SANAQATIIT
CONSTRUCTION LTD.

Operation and Maintenance Manual

Section A – Architectural
Section B – Mechanical
Section C – Electrical

Potable Water System Phase 1
Cambridge Bay, NU

Project Number: 11-4002
Contract Number: 12-3000
Community and Government Services
Government of Nunavut

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A

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Section A – Architectural

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Potable Water System Phase 1
Cambridge Bay, NU
Architectural O&M

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SANAQATIIT
CONSTRUCTION LTD.

CONTACTS

Contacts

Contractor
SANAQATIIT CONSTRUCTION LTD
PO Box 1769
1560 Federal Road
Iqaluit, NU X0A 0H0
TEL: (867) 979-1109
FAX: (867) 979-1415
E-MAIL: info@sanaqatiit.ca

Electrical Subcontractor
RYFAN KITIKMEOT LTD
Box 297
1 Oligona Drive
Kugluktuk, NU X0E 0E0
TEL: (867) 873-6158
FAX: (867) 873-6159
E-MAIL: jmailloux@ryfan.ca

Mechanical Subcontractor
CENTRAL MECHANICAL SYSTEMS LTD.
345 Old Airport Road
Yellowknife, NT X1A 3T4
TEL: (867) 873-3003
FAX: (867) 873-6633
E-MAIL: Yellowknife@cmsnisku.com

Consultant
STANTEC
4910 53 Street
PO Box 1777
Yellowknife, NT X1A 2P3
TEL: (867) 920-2882
FAX: (867) 920-4319
E-MAIL: arlen.foster@stantec.com

SANAQATIIT
CONSTRUCTION LTD.

SUPPLIERS

Suppliers

Reinforcing Steel
HARRIS REBAR
6613 44 Street
Leduc, AB T9E 7E5
TEL: (780) 986-7055
FAX: (780) 986-9011
E-MAIL: edmonton@harrisrebar.com

Steel Structure, Skid, and Grating
WHITEMUD IRONWORKS LTD
7727 18 Street
Edmonton, AB T6P 1N9
TEL: (780) 465-5888
FAX: (780) 465-1722
E-MAIL: info@wiworks.ca

Steel Vault
SCHENDEL MECHANICAL CONTRACTING LTD.
20310 107 Ave
Edmonton, AB T5S 1W9
TEL: (780) 447-3400
FAX: (780) 447-4313
E-MAIL: schendek@schendel.ca

Insulated Metal Panels – Walls, Roof
VICWEST
1296 South Service Rd. W
Oakville, ON L6L 5T7
TEL: (800) 265-8653
FAX: (905) 825-2272
E-MAIL: sales@awipanels.com

HDPE Pipe
WOLSELEY ENGINEERED PIPE GROUP
34 Roy Roche Dr.
Winnipeg, MB R3C 2E6
TEL: (204) 633-7213
FAX: (204) 694-7228
WEBSITE: wolseleyindustrial.ca

Doors, Frames, Hardware
CP DISTRIBUTORS
4715 Eleniak Rd
Edmonton, AB T6B 2N1
TEL: (780) 468-6754
FAX: (780) 465-3278
E-MAIL: sales@cpdist.ca

SANAQATIIT
CONSTRUCTION LTD.

WARRANTIES

SANAQATIIT
CONSTRUCTION LTD.

April 27, 2015

Community and Government Services
Government of Nunavut
15 Omingmak Street
Cambridge Bay, NU X0B 0C0

Via email: mazmal@gov.nu.ca

Att: **Mustafa Azmal**

RE: **Potable Water System Phase 1**
Letter of Warranty

Dear Sir,

In accordance with the requirements for project 11-4002 under contract 12-3000, for the construction of the Potable Water System Phase 1, specifically GC 31 – Warranty and Rectification of Defects in the Work, and as our standard policy, we advise as follows:

Sanaqatiit Construction Ltd agrees to correct promptly, at our expense, defects or deficiencies in the work which appear prior to and during the period of one (1) year from **March 11, 2015**, the date of substantial performance of the work, or such longer periods as may be specified in the contract documents for certain products.

Without specific limitations, this warranty will cover the proper performance of the work only to the extent that the design and specifications permit such performance, and is limited to the workmanship and materials supplied and installed as per the contract documents.

Sincerely,

Ron Jordan
Senior Project Manager
Sanaqatiit Construction Ltd

Head Office
1560 Federal Road
Box 1769
Iqaluit , NU X0A 0H0
Phone: (867) 979-4028
Fax: (867) 979-1415

McKinney
ASSA ABLOY

ASSA ABLOY, the global leader in door opening solutions

To Whom It May Concern:

McKinney products are guaranteed to be free of defects in both workmanship and materials for a period of one year. Any bending, defacing or modification of our product after leaving the factory will void the warranty. Liability shall be limited to the replacement of product or component determined to be defective and shall not include costs arising from removal or reinstallation of product. Cost of replacement shall not exceed original purchase price.

Written notice of damages must occur within the warranty period. A factory generated Return Goods Authorization will be provided as no goods will be accepted without prior approval. These defective goods must be returned to our factory in Berlin, CT, unless specified otherwise. Freight charges must be pre-paid unless noted otherwise.

This guarantee is only valid if the products are specified, applied and adjusted in accordance with the instructions contained in the General Information Section of the McKinney catalog and on frames and doors that are plumb and square.

Please be advised that we do not have operation and maintenance manuals or MSDS Sheets for our products.

The McKinney Products Company

McKinney Products Company
225 Episcopal Road
Berlin, CT 06037 U.S.A.

Phone: (800) 346-7707
www.mckinneyhinge.com

SARGENT
ASSA ABLOY

LIMITED WARRANTY

Canadian Price Book I February 1, 2014

ASSA ABLOY reserves the right to review Approved Reseller's usage of ASSA ABLOY at any time and may:

(a) require changes to the use of ASSA ABLOY Marks at any time in its sole discretion, which changes must be implemented within 30 days of written notice to Approved Reseller;
(b) condition the use of ASSA ABLOY Marks on ASSA ABLOY's prior approval use, which approval may be withheld in its sole discretion;
(c) revoke permission to use ASSA ABLOY Marks at any time for any or no reason days prior written notice to Approved Reseller; and
(d) revoke permission to use ASSA ABLOY Marks immediately upon notice to Reseller in the event Approved Reseller is in violation of this Policy, or of any agreement with ASSA ABLOY or any Group Company.

Approved Reseller's right to use ASSA ABLOY Marks in no way conveys to Approved any proprietary or economic interest in any ASSA ABLOY Marks.

Use of ASSA ABLOY Marks in violation of this Policy may result in severe civil and liabilities. ASSA ABLOY will vigorously enforce this Policy by seeking all appropriate remedies, including, but not limited to, pecuniary damages and injunctive relief.

TECHNICAL INFORMATION AND ADVICE:

(a) All designs, data and specifications provided by company are proprietary and will not be disclosed or reused by customer without the prior written consent of Company;
(b) Company assumes no obligation or liability for any advice given by Company, the results obtained, or damages incurred, and all such advice is given and accepted at Customer risk.

LIMITED WARRANTY:

SARGENT® warrants that its products sold under the "SARGENT" trade name in the United States of America are free from defects in workmanship and materials under normal use and service.

This warranty does not cover defects or damage arising from improper installation, lack of or improper maintenance, improper storage, shipping and handling, corrosion, erosion, ordinary wear and tear, misuse, abuse, accident, unauthorized service, or use with unauthorized non-SARGENT products or parts.

This warranty is void if any modification is made to the warranty product, regardless of whether the modification causes or contributes to the alleged defect. All modifications are made at the risk of the party making the modification.

The only liability of SARGENT®, in tort or contract whether under this warranty or otherwise, shall be limited to the repair or replacement of any product or component part which shall prove defective as covered by this warranty, within the stated time period listed below, after delivery to the original purchaser.

• T-Zone (11-Line) Bored-In Lever Lock	10 years
• 281, 351, 1431, 1331 Series Closer Body	25 years
• 1130 Series Closer Body	15 years
• 268, 269, 278, 421 Series Closer Body	10 years
• 9200/8200/7800 Mortise Lock	10 years
• FM6100, FM7100, 10L Bored-In Lever Lock	7 years
• 7000 Vertical Rod Lock, 7900 Mortise Lock	5 years
• 80/90 Series Exit Device, 56- Electric Latch Retraction Option	5 years
• Overhead Holders & Stops	5 years
• 7L Bored-In Lever Lock	5 years
• 8 Line Bored-In Knob Lock	3 years
• 20/30 and P Series Exit Device or Trim	3 years
• 1700 Series Overhead Holder & Stops, all Electromechanical and Electronic Products	2 years
• All other SARGENT products	1 year

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SARGENT®

ASSA ABLOY

LIMITED WARRANTY

Canadian Price Book | February 1, 2014

Warranty for Cylinders Factory or Field Combinated:
Cylinders shall be periodically lubricated depending on environmental conditions. Dry graphite, molybdenum disulfide or Polylube(trademark) are recommended. Petroleum based liquid lubricants should only be used in cylinders in harsh or corrosive environments and should not be mixed with dry lubricants.

SARGENT® cylinders and/or core warranty will be voided if used in non-SARGENT® locking devices.

Warranty for Cylinders Field Combinated:
1. Keys shall be cut to the SARGENT® key bitting specifications required for the particular keyway and depth system.
2. All pin lengths shall be selected according to prevailing factory standards.
3. Original SARGENT® cylinder components, including pin tumblers and key blanks, shall be used.
4. We reserve the right to void the warranty if we deem that a malfunction is a result of non-original components which do not conform to SARGENT® standards.

Keying Systems:
All bittings shall be originated by the SARGENT® Key Systems Department to be compatible with one another in a specific type of cylinder (conventional, security, high security, interchangeable core, removable core) and within a particular keying system.

SARGENT® will not pay for the cost of repair performed other than in accordance with this warranty.

SARGENT® will not be held responsible in any way for any field generated bitting systems.

Refer to our Returned Goods Policy regarding the return of a product or component part believed to be defective as covered by this warranty. A brief description of the defect will be required. Product will be examined upon return.In the event such examination reveals a defect covered by this warranty, the product will be repaired or replaced.

THIS WARRANTY IS IN LIEU OF ALL OTHER EXPRESS WARRANTIES. TO THE EXTENT PERMITTED BY LAW, ALL IMPLIED WARRANTIES ARE LIMITED TO THE DURATION OF THIS WARRANTY. SARGENT® MANUFACTURING COMPANY SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES. NO AGENT, SALES REPRESENTATIVE OR DEALER HAS THE AUTHORITY TO INCREASE OR ALTER THE OBLIGATIONS OF THIS WARRANTY.

SOME STATE DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS OR THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU.

THIS WARRANTY GIVE YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

SARGENT® Manufacturing Company

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Norton

ASSA ABLOY

Limited Warranty

Yale Security Inc. (the "Company") warrants that its products sold under the Norton® trade name in the United States of America are free from defects in workmanship and materials under normal use and service

This warranty does not cover defects or damage arising from improper installation, lack of or improper maintenance, improper storage, shipping and handling, ordinary wear and tear, misuse, abuse, accident, unauthorized service, use with unauthorized non-Norton products or parts, or the effects of erosion, or corrosion on the finish. This warranty is void if any modification is made to the product, regardless of whether the modification causes or contributes to the alleged defect. All modifications are made at the risk of the party making modification.

The only liability of the Company in tort or contract whether under this warranty or otherwise shall be limited to the repair or replacement of any product or component part which shall prove defective as covered by this warranty. This warranty does not cover, and the Company is not responsible for, any labor charges or others costs and expenses associated with removal and reinstallation of products, or maintenance or other adjustments to the products. The warranty period after delivery to the original purchaser in all cases is as follows:

Norton Door Controls:

9500, 7500, 7700 (Discontinued Jan. 2015), 8000 Series	25 years*
1600 Series	15 years*
78B/F, 2800ST, 7900, 210 Series	10 years
1700, 9300BC, 160 Series	5 years
7100SZ SafeZone®, 7200 Electromechanical, 7700 PowerTrack®, 6000 Series, 5900 Series, 5700 Series	2 years
5600 Series	1 year
Aluminum shells of all NORTON door controls (in the building in which originally installed)	Life of Building

The Company will not pay for the cost of repair performed other than in accordance with this warranty

Written notice of a product or component part believed to be defective as covered by this warranty should be sent to Yale Security Inc., 1902 Airport Road, Monroe, North Carolina 28110, and should include your name and address, an identification of the product or component part and a brief description of the defect. Upon receipt of such notice, the Company will inform you where to ship such product or component part, shipping charges prepaid, for examination and, in the event such examination reveals a defect covered by this warranty, the product will be repaired or replaced.

This warranty is in lieu of all other express warranties. To the extent permitted by law, all implied warranties are limited to the duration of this warranty. Yale Security Inc. shall not be liable for any incidental or consequential damages.

SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS OR THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

For more specific warranty information, please contact us at.
Norton Door Controls • 1902 Airport Road • Monroe, NC 28110 USA • Tel: 800-438-1951, Fax: 800-338-0965 • www.nortondoorcontrols.com

** Product must be manufactured after August 1, 2012.*

ASSA ABLOY, the global leader in door opening solutions

35 Year Limited Fluropon® Coating Warranty

Vicwest, a division of Vicwest Inc. ("VICWEST"), hereby warrants to the purchaser of roll-formed steel panels coated with Fluropon® (containing Kynar 500® or Hylar 5000® resins) (the "Product"), or in the event that the purchaser is in the business of reselling the Product, to the end user or the original owner of any structure on which the Product is used (herein collectively referred to as the "Customer") that the Product shall perform as follows :

1. *Loss of Adhesion*

   Will not crack, flake or peel (loss of adhesion) for a period of thirty-five (35) years following the date of shipment of the Product. Cracking is defined as breaks in the flat coating as opposed to cracking or breaks in the film caused by metal forming which is accepted as standard;

2. *Chalk Rating*

   Will not chalk in excess of a number eight (8) rating as determined by ASTM D4214 Method D659 at any time for a period of thirty (30) years from the date of shipment when the Product is properly maintained as may be described herein;

3. *Fade Rating*

   Will not change color more than five (5.0) Hunter ΔE units as determined by ASTM Method D-2244 at any time for a period of thirty (30) years from the date of shipment when the Product is properly maintained as may be described herein. Color change shall be measured on an exposed painted surface that has been cleaned of surface soils and chalk, and the corresponding values measured on the original or unexposed painted surface. It is understood that fading or colour changes may not be uniform if the surfaces are not equally exposed to the sun and elements and Vicwest does not warrant that color changes will be uniform.

This warranty only applies when the Product is used within Canada or the U.S.A. (excluding Alaska and Hawaii) under Normal Conditions (as described below). Vicwest's sole responsibility under this Limited Warranty is to repaint, refinish, repair or replace the Product that fails to meet the conditions of this Warranty and it is at the discretion of Vicwest as to what measures shall be taken to rectify any failure.

The Customer shall inspect the Product prior to installation so as to mitigate expenses involved in repairing, refinishing, repainting or replacing defective Products. VICWEST'S liability under this Limited Warranty shall not exceed the Customer's liability, if any, and is strictly limited to the direct cost of repairing, refinishing, repainting or replacing the failed Product. The liability of VICWEST for Product replacement excludes all installation and other associated material costs. Repairing, refinishing, repainting or replacing of failed Product shall be performed by a qualified contractor using standard practices and materials and VICWEST reserves the right to select, approve and negotiate all repairing, refinishing,

repainting or replacement contracts. VICWEST, or a qualified third party selected by VICWEST, will, in all instances, be the sole judge as to whether repairing, refinishing, repainting or supply of new material for failed areas is required to fulfill the obligations of VICWEST under this Limited Warranty. The responsibility for selection of suitable long-lasting fasteners for attachment of the Product in exposed fastener applications rests solely with the Customer.

The Limited Warranty period shall not be extended by any repairing, refinishing, repainting or replacement of the Product, but the remaining warranty period shall continue in effect and be applicable to the repaired, refinished, repainted or replaced areas under the terms and conditions of this Limited Warranty.

This Limited Warranty constitutes the exclusive remedy of the Customer for any defects or deficiencies in the Product. Except for this Limited Warranty, VICWEST makes NO WARRANTIES, GUARANTEES, REPRESENTATIONS OR CONDITIONS, EXPRESS OR IMPLIED, ORAL OR WRITTEN, WITH RESPECT TO THE PRODUCT WHETHER UNDER COMMON LAW, STATUTE OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY GENERAL OR PARTICULAR PURPOSE, ALL OF WHICH ARE HEREBY EXPRESSLY DISCLAIMED BY VICWEST TO THE FULLEST EXTENT PERMITTED BY LAW. The liability of VICWEST arising out of the sale or supply of the Product or its installation or use, whether based on warranty, contract, tort or otherwise and whether or not arising as a result of negligence or gross negligence of VICWEST shall not exceed the then current purchase price for that portion of the Product which is being repaired, refinished, repainted or replaced. In no event shall VICWEST be liable for any indirect, incidental, consequential or special damages sustained by the Customer or any other person in connection with the purchase, installation or use of the Product.

Claims under this Limited Warranty must be presented to VICWEST in writing during the warranty period and within thirty (30) days after the Customer becomes aware that any warranted condition has occurred. Time is of the essence and failure to give notice within the specified time shall discharge VICWEST from all warranty obligations. The Customer shall include in all warranty claims adequate identification of materials involved in the claim, including the original invoice, original shipping document or such other sufficient documentation as may be reasonably required by VICWEST. VICWEST, and any agent, employee, representative or contractor of VICWEST, must be given reasonable opportunity to conduct an on-site inspection in order to determine the cause of the Product failure, if any, and the corrective action to be taken, if any.

This Limited Warranty is extended to the Customer alone, is non-transferable and non-assignable and may not be modified or enlarged in its scope by any representative, salesman, agent, or other employee of VICWEST, the Customer or any other person whatsoever. The Customer shall not permit anyone to claim or imply that this Limited Warranty extends to anyone other than the Customer. These conditions are material terms of this Limited Warranty and any violation by the Customer or its agents or representatives shall release VICWEST from its obligations hereunder. This Limited Warranty shall be governed by and interpreted

in accordance with the laws of the Province of Ontario and the laws of Canada applicable therein and the laws of the U.S.A.

NORMAL CONDITIONS

This Limited Warranty applies to the Product exposed to normal atmospheric conditions and excludes corrosive or aggressive atmospheres such as contamination due to chemical fumes or salt spray, standing water, contact by or exposure to animals or animal waste, or poorly ventilated applications. Defects, damage or failure due to exposed/cut edge corrosion or substrate corrosion is specifically excluded. This Limited Warranty does not apply where Product defect, damage or failure is the result of physical damage from fabrication or embossing operations, snow/ice removal, acts of God, falling objects, fire, explosions, vandalism, any negligent acts of the Customer, including but not limited to, improper packaging, storage, shipping, transit, processing, or installation which prohibits proper drainage of standing water or results in condensation, or other such occurrences whatsoever beyond the control of VICWEST. Defects or damage to the pre-painted finish of the Product after delivery to the Customer resulting from handling, improper storage or installation, alteration or modification of the Product in a manner not originally intended, prolonged moisture contact or contact with corrosives and/or similar materials are not covered by this Limited Warranty. Damage to the Product caused directly or indirectly by contact with fasteners or caused by steel shavings or minute particles from sawing sparks that come into contact with the Product's finish is not covered by this Limited Warranty.

Fluropon® is a registered trademark of The Valspar Corporation

2011.07.25

40 Year Limited WeatherX™ Coating Warranty

Vicwest, a division of Vicwest Corporation ("VICWEST"), hereby warrants to the purchaser of the roll-formed steel panels coated with WeatherX™ (the "Product"), or in the event that the purchaser is in the business of reselling the Product, to the end user or the owner of any structure in which the Product is used (herein collectively referred to as the "Customer") that the Product shall be free from all defects of workmanship caused in the course of manufacturing. VICWEST also warrants to the Customer that when the Product is used within Canada or the U.S.A (excluding Alaska and Hawaii) under Normal Conditions (as described below), the Product shall perform as follows :

i. **For all WeatherX™ colors except Bright Red (QC16080) or Orange (QC16063)**

The Product will not chip, crack, peel or otherwise lose adhesion for a period of forty (40) years following the original date of purchase of the Product. VICWEST also warrants to the Customer that when the Product is used within Canada or the U.S.A (excluding Alaska and Hawaii) under Normal Conditions (as described below), in both vertical and non-vertical applications, that for a period of thirty (30) years from installation or thirty and one-half (30.5) years following the original date of purchase of the Product the degree of colour fade and surface chalk of the Product shall be in accordance with the Performance Criteria (as described below).

ii. **For WeatherX™ colors Bright Red (QC16080) and Orange (QC16063)**

The Product will not chip, crack, peel or otherwise lose adhesion for a period of twenty-five (25) years following the original date of purchase of the Product. VICWEST also warrants to the Customer that when the Product is used within Canada or the U.S.A (excluding Alaska and Hawaii) under Normal Conditions (as described below), in both vertical and non-vertical applications, that for a period of twenty-five (25) years from installation or twenty-five and one half (25.5) years following the original date of purchase of the Product the degree of colour fade and surface chalk of the Product shall be in accordance with the Performance Criteria (as described below).

The Customer shall inspect the Product prior to installation so as to mitigate expenses involved in repairing, refinishing, repainting or replacing defective Products. VICWEST'S liability under this Limited Warranty shall not exceed the Customer's liability, if any, and is strictly limited to the direct cost of repairing, refinishing, repainting or replacing the failed Product. The liability of VICWEST for Product replacement excludes all installation and other associated material costs. Repairing, refinishing, repainting or replacing of failed Product shall be performed by a qualified contractor using standard practices and materials and VICWEST reserves the right to select, approve and negotiate all repairing, refinishing, repainting or replacement contracts. VICWEST, or a qualified third

party selected by VICWEST, will, in all instances, be the sole judge as to whether repairing, refinishing, repainting or supply of new material for failed areas is required to fulfill the obligations of VICWEST under this Limited Warranty. The responsibility for selection of suitable long-lasting fasteners for attachment of the Product in exposed fastener applications rests solely with the Customer.

The Limited Warranty period shall not be extended by any repairing, refinishing, repainting or replacement of the Product, but the remaining warranty period shall continue in effect and be applicable to the repaired, refinished, repainted or replaced areas under the terms and conditions of this Limited Warranty.



This Limited Warranty constitutes the exclusive remedy of the Customer for any defects or deficiencies in the Product. Except for this Limited Warranty, VICWEST makes NO WARRANTIES, GUARANTEES, REPRESENTATIONS OR CONDITIONS, EXPRESS OR IMPLIED, ORAL OR WRITTEN, WITH RESPECT TO THE PRODUCT WHETHER UNDER COMMON LAW, STATUTE OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY GENERAL OR PARTICULAR PURPOSE, ALL OF WHICH ARE HEREBY EXPRESSLY DISCLAIMED BY VICWEST TO THE FULLEST EXTENT PERMITTED BY LAW. The liability of VICWEST arising out of the sale or supply of the Product or its installation or use, whether based on warranty, contract, tort or otherwise and whether or not arising as a result of negligence or gross negligence of VICWEST shall not exceed the then current purchase price for that portion of the Product which is being repaired, refinished, repainted or replaced. In no event shall VICWEST be liable for any indirect, incidental, consequential or special damages sustained by the Customer or any other person in connection with the purchase, installation or use of the Product.

Claims under this Limited Warranty must be presented to VICWEST in writing during the warranty period and within thirty (30) days after the Customer becomes aware that any warranted condition has occurred. Time is of the essence and failure to give notice within the specified time shall discharge VICWEST from all warranty obligations. The Customer shall include in all warranty claims adequate identification of materials involved in the claim, including the original invoice, original shipping document or such other sufficient documentation as may be reasonably required by VICWEST. VICWEST, and any agent, employee, representative or contractor of VICWEST, must be given reasonable opportunity to conduct an on-site inspection in order to determine the cause of the Product failure, if any, and the corrective action to be taken, if any.

This Limited Warranty is extended to the Customer alone, is non-transferable and non-assignable and may not be modified or enlarged in its scope by any representative, salesman, agent, or other employee of VICWEST, the Customer or any other person whatsoever. The Customer shall not permit anyone to claim or imply that this Limited Warranty extends to anyone other than the Customer. These conditions are material terms of this Limited

40 Year Limited WeatherX™ Coating Warranty

Warranty and any violation by the Customer or its agents or representatives shall release VICWEST from its obligations hereunder. This Limited Warranty shall be governed by and interpreted in accordance with the laws of the Province of Ontario and the laws of Canada applicable therein and the laws of the U.S.A.

PERFORMANCE CRITERIA

All WeatherX™ colors except Bright Red (QC16080) or Orange (QC16063)

SIDEWALL PANELS (for 30 years from installation or 30.5 years from application)

a. WILL NOT chalk in excess of number eight (8) rating as determined by ASTM D4214 Method D659 at any time for a period of thirty (30) years.

b. WILL NOT change colour more than five (5.0) Hunter ΔE units as determined by ASTM Method D-2244. Colour change shall be measured on an exposed painted surface that has been cleaned of surface soils and chalk, and the corresponding values measured on the original or unexposed painted surface. It is understood that fading or colour changes may not be uniform if the surfaces are not equally exposed to the sun and elements.

ROOFING PANELS (for 30 years from installation or 30.5 years from application)

a. WILL NOT chalk in excess of number six (6) rating as determined by ASTM D4214 Method D659.

b. WILL NOT change colour more than eight (8.0) Hunter ΔE units as determined by ASTM D-2244-93. Colour change shall be measured on an exposed painted surface that has been cleaned of surface soils and chalk, and the corresponding values measured on the original or unexposed painted surface. It is understood that fading or colour changes may not be uniform if the surfaces are not equally exposed to the sun and elements.

WeatherX™ colors Bright Red (QC16080) and Orange (QC16063)

SIDEWALL PANELS (for 25 years from installation or 25.5 years from application)

a. WILL NOT chalk in excess of number eight (8) rating as determined by ASTM D4214 Method D659 at any time for a period of twenty-five (25) years.

b. WILL NOT change colour more than five (5.0) Hunter ΔE units as determined by ASTM Method D-2244. Colour change shall be measured on an exposed painted surface that has been cleaned of surface soils and chalk, and the corresponding values measured on the

original or unexposed painted surface. It is understood that fading or colour changes may not be uniform if the surfaces are not equally exposed to the sun and elements.

ROOFING PANELS (for 25 years from installation or 25.5 years from application)

a. WILL NOT chalk in excess of number six (6) rating as determined by ASTM D4214 Method D659.

b. WILL NOT change colour more than eight (8.0) Hunter ΔE units as determined by ASTM D-2244-93. Colour change shall be measured on an exposed painted surface that has been cleaned of surface soils and chalk, and the corresponding values measured on the original or unexposed painted surface. It is understood that fading or colour changes may not be uniform if the surfaces are not equally exposed to the sun and elements.



NORMAL CONDITIONS

This Limited Warranty applies to the Product exposed to normal atmospheric conditions and excludes corrosive or aggressive atmospheres such as contamination due to chemical fumes or salt spray, standing water, contact by or exposure to animals or animal waste, or poorly ventilated applications. Defects, damage or failure due to exposed/cut edge corrosion or substrate corrosion is specifically excluded. This Limited Warranty does not apply where Product defect, damage or failure is the result of physical damage from fabrication or embossing operations, snow/ice removal, acts of God, falling objects, fire, explosions, vandalism, any negligent acts of the Customer, including but not limited to, improper packaging, storage, shipping, transit, processing, or installation which prohibits proper drainage of standing water or results in condensation, or other such occurrences whatsoever beyond the control of VICWEST. Defects or damage to the pre-painted finish of the Product after delivery to the Customer resulting from handling, improper storage or installation, alteration or modification of the Product in a manner not originally intended, prolonged moisture contact or contact with corrosives and/or similar materials are not covered by this Limited Warranty. Damage to the Product caused directly or indirectly by contact with fasteners or caused by steel shavings or minute particles from sawing sparks that come into contact with the Product's finish is not covered by this Limited Warranty.

2010.10.28

SANAQATIIT
CONSTRUCTION LTD.

STRUCTURAL STEEL BUILDING ON SKID

SANAQATIIT
CONSTRUCTION LTD.

Shop Drawing Transmittal

Project Name: Potable Water System – Phase I

Sanaqatiit Project Number: 12-505 **Submittal Number:** 12-505-01

Owner Project Number: 11-4002

Product Description: Supply labour and material to construct new potable water intake pump-house and twin intake lines.

Specification Number: 05 12 23

Total Pages: 32 including cover

Submitted by: Sarah Fox

To: Walter Orr, Stantec

Via: Electronic Submission **Date:** **January 11, 2013**

Notes:

Attached pages are structural steel fabrication drawings

Stantec

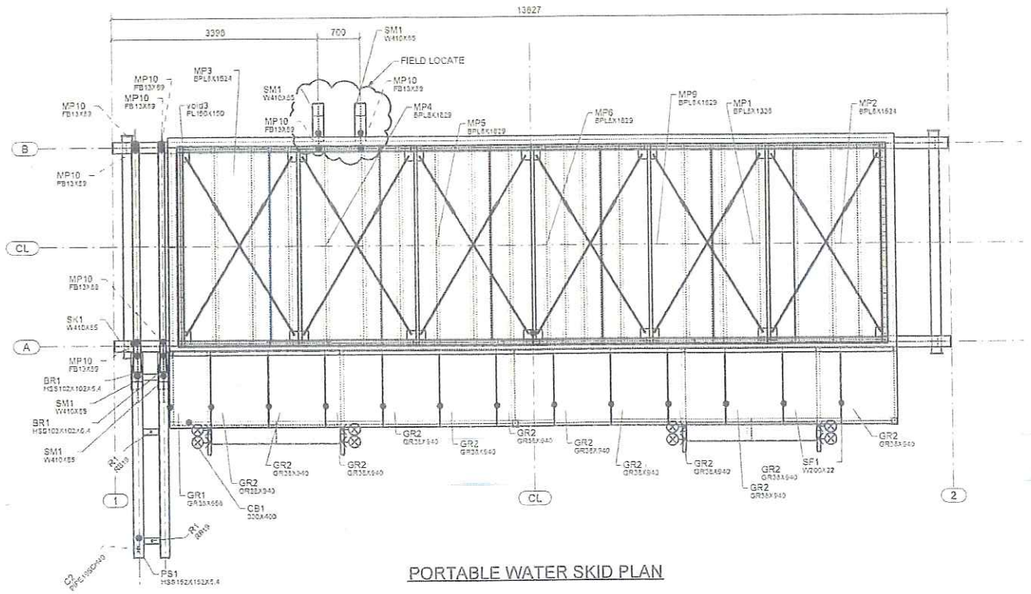
- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

January 16, 2013

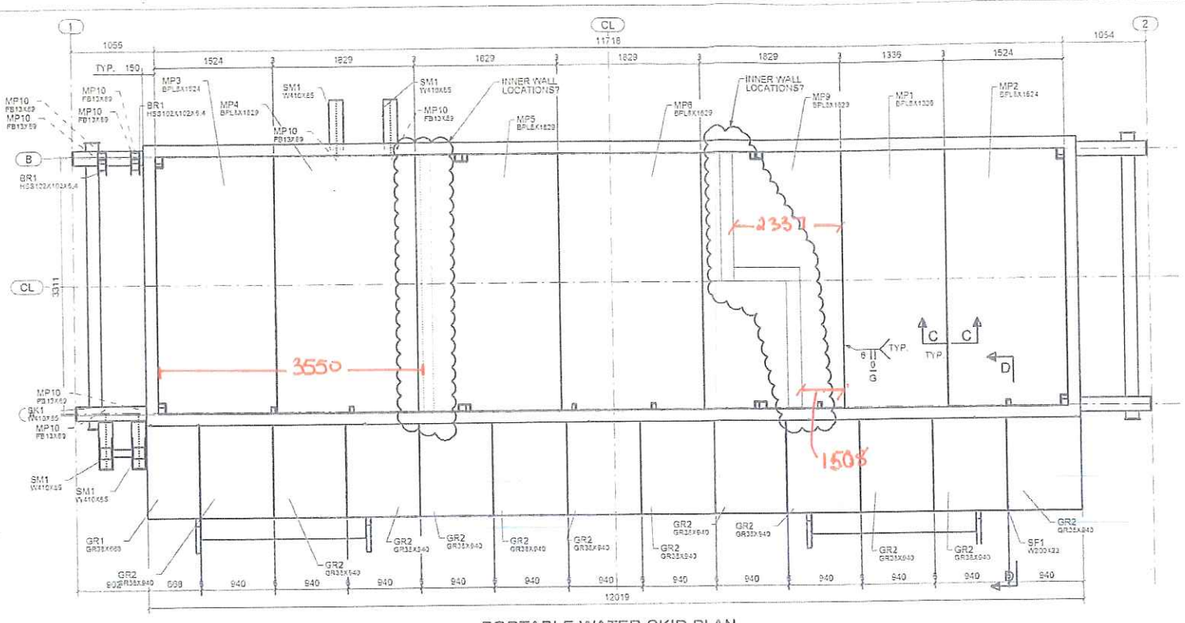
By: Arlen Foster, EIT

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STANTEC ARCHITECTURE LTD. (PC-1449)

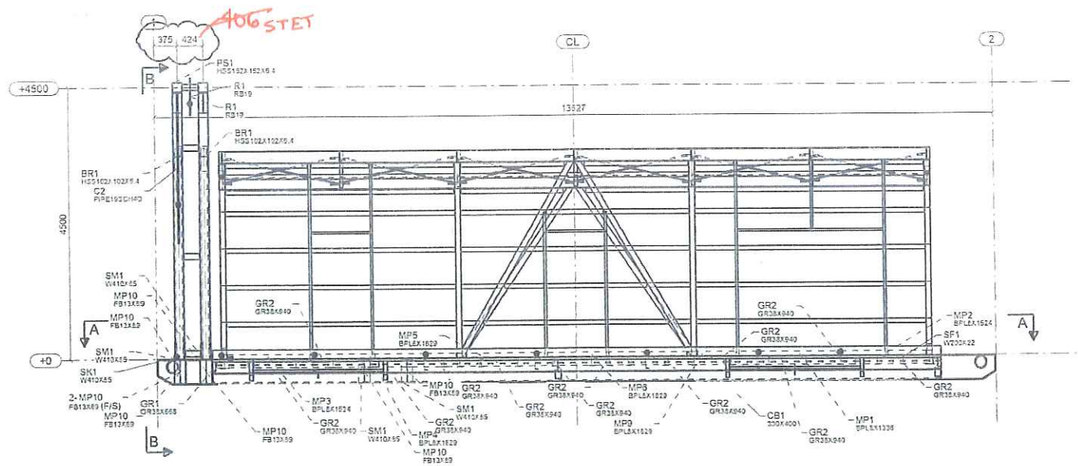


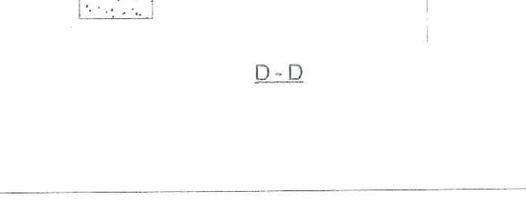
PORTABLE WATER SKID PLAN



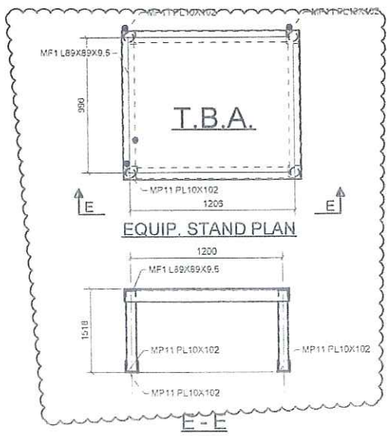
PORTABLE WATER SKID PLAN

GRATING/ DIAMOND PLATE LAYOUT

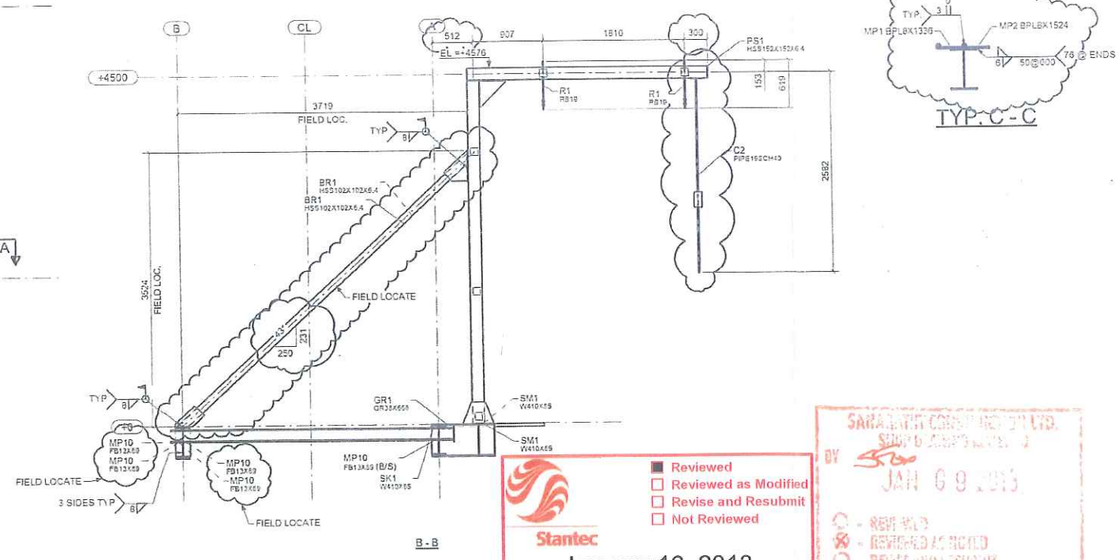




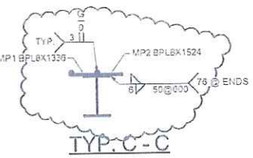
D - D



E - E



B - B



TYP. C - C

Stantec

- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

January 16, 2013

By: Arlen Foster, EIT

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STANTEC ARCHITECTURE LTD. (PC-1449)

SASKATCHEWAN CONTRACTING (1977) LTD. STRUCTURAL ENGINEERING DEPT.
BY
JAN 09 2013
G - REVIEWED
R - REVIEWED AS NOTED
O - REVISE AND RESUBMIT

REV	DATE	REMARKS	ISS.NO
A	JAN.04/13	ISSUED FOR APPROVAL IFA1	IFA1

WHITEMUD IRONWORKS LIMITED

CUSTOMER: ArCan

PROJECT: Portable Water System Skid

DWG. TITLE: PORTABLE SKID LAYOUT

DRAWN BY	CHECKED	JOB NUMBER	DRAWING NO.
RS		62-125	E-001
DATE: 01.04.2013	DATE:		

Stantec

- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

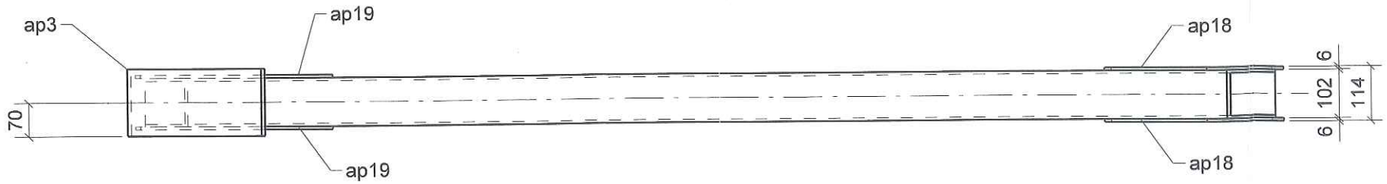
January 16, 2013

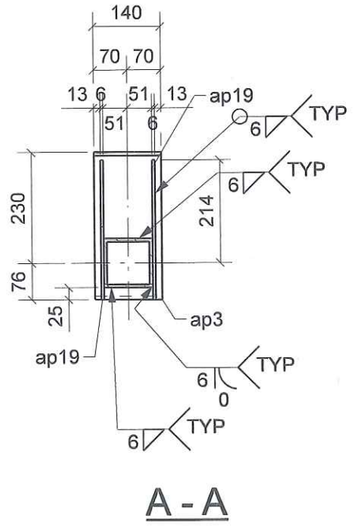
By: Arlen Foster, EIT

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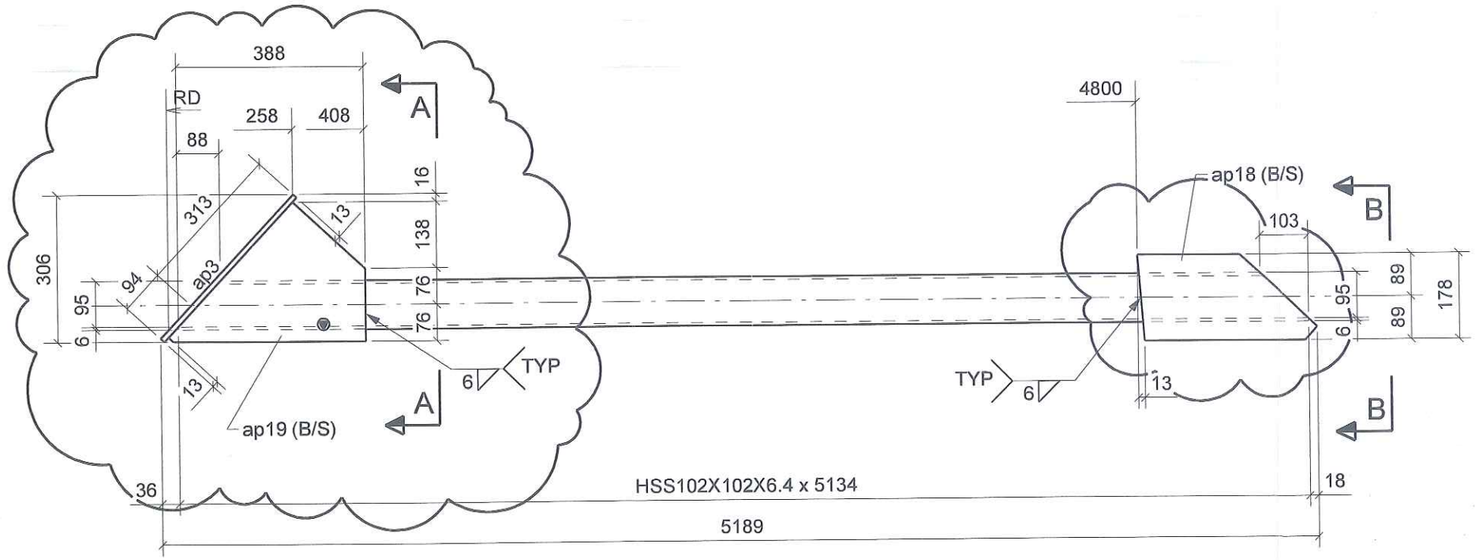
STANTEC ARCHITECTURE LTD. (PC-1449)

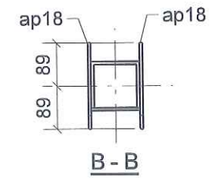
UNIT QTY	FIELD BOLTS	LENGTH





A - A





B - B

2 - BRACE SUPPORTS REQ'D - BR1

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
2		BR1	BRACE SUPPORTS			236		
2	1	BR1	HSS102X102X6.4	5134	94	187	350W	
2	1	ap3	PL10X140	407	4	9	300W	
4	2	ap18	PL6X264	376	5	19	300W	
4	2	ap19	PL6X290	408	6	22	300W	

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF:

MATERIAL: 350W U/NOTED

HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N

WELDS: E49XX BOLTS: 19 Ø U/N

SURF. PREP: SP3

PAINT NOTE: BLACK SELF-PRIMING

Prepared on 3D-TeklaStructures

ALL WELDS 6mm U/NOTED

62-125

WHITEMUD IRONWORKS LIMITED
7727 - 18TH STREET
EDMONTON ALBERTA T6P 1N9
PHONE (780) 465-5888 FAX. (780) 465-1722

CUSTOMER: ArCan

PROJECT: Poratable Water System Skid

DWG. TITLE: BRACE SUPPORT

DRAWN BY:	CHKD BY:	JOB NUMBER	DWG NUMBER	
DATE: 12/19/2012	DATE:	62-125	BR1	A

Stantec

- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

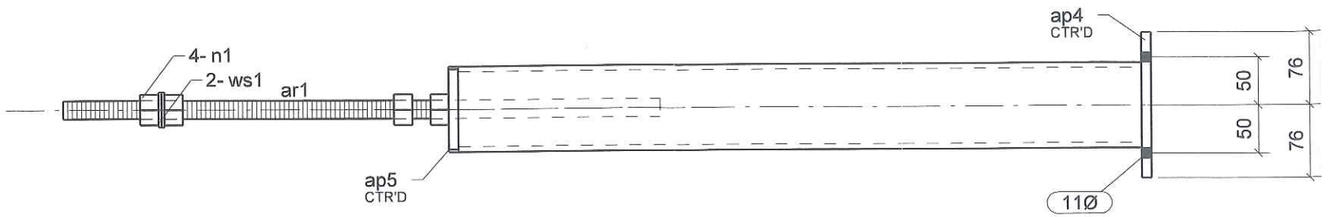
January 16, 2013

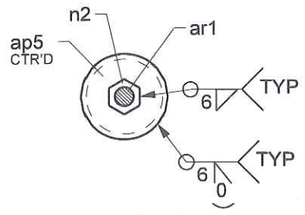
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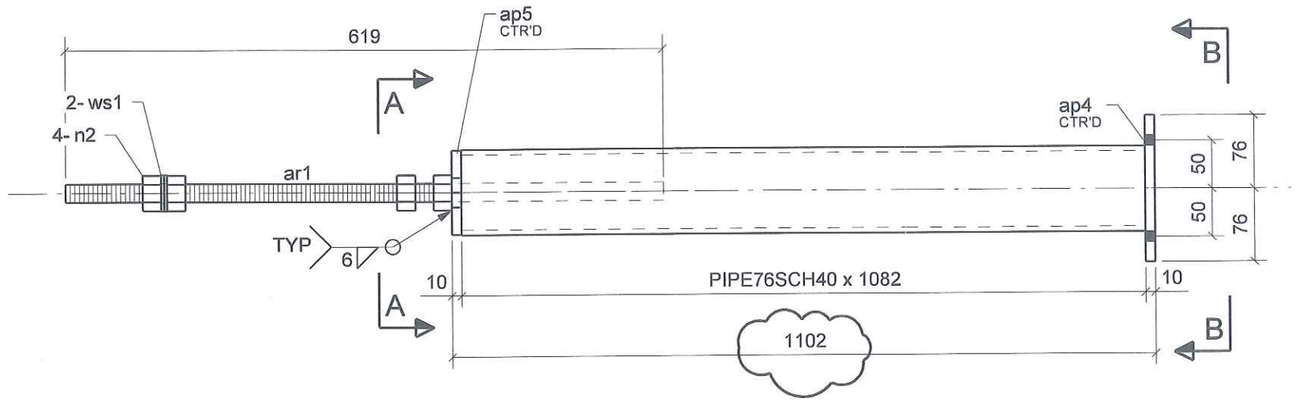
STANTEC ARCHITECTURE LTD. (PC-1449)

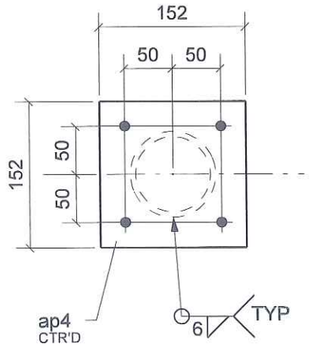
UNIT QTY	FIELD BOLTS	LENGTH





A - A





B - B

ONE - BEAM REQ'D - C1

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
ONE		C1	BEAM			15		
1	1	C1	PIPE76SCH40	1082	12	12	350W	Height?
1	1	ap4	FB10X152	152	2	2	300W	
1	1	ap5	FB10X89	89	1	1	300W	
1	1	ar1	RB19	619	1	1	300W	GALVANIZED
1	1	n1	19NUT	19	0	0	300W	
3	3	n2	19NUT	19	0	0	300W	GALVANIZED
2	2	ws1	19FW	3	0	0	300W	GALVANIZED

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF:

MATERIAL: 350W U/NOTED

HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N

WELDS: E49XX BOLTS: 19 Ø U/N

SURF. PREP: SP3

PAINT NOTE: BLACK SELF-PRIMING

Prepared on 3D-TeklaStructures

ALL WELDS 6mm U/NOTED

62-125

WHITEMUD IRONWORKS LIMITED
7727 - 18TH STREET
EDMONTON ALBERTA T6P 1N9
PHONE (780) 465-5888 FAX (780) 465-1722

CUSTOMER: ArCan

PROJECT: Poratable Water System Skid

DWG. TITLE: BEAM

DRAWN BY:	CHKD BY:	JOB NUMBER	DWG NUMBER	
DATE: 01/03/2013	DATE:	62-125	C1	A

Stantec

- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

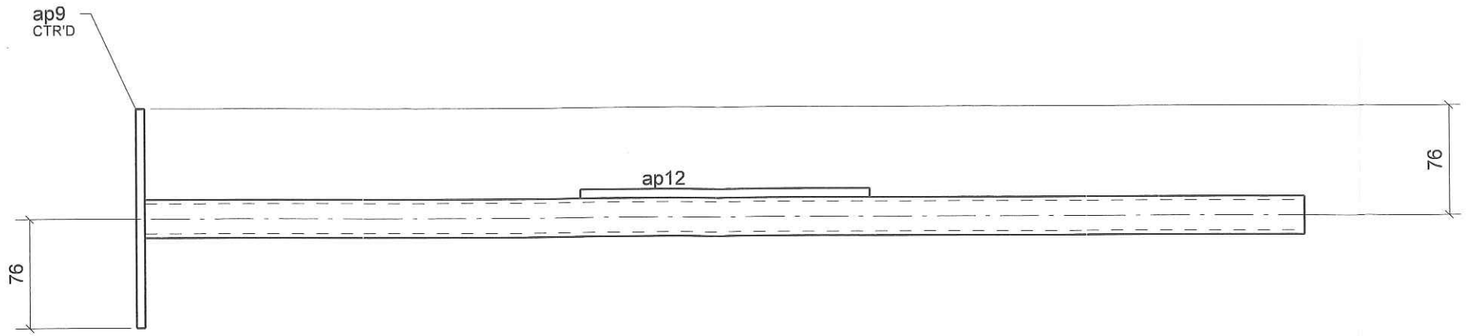
January 16, 2013

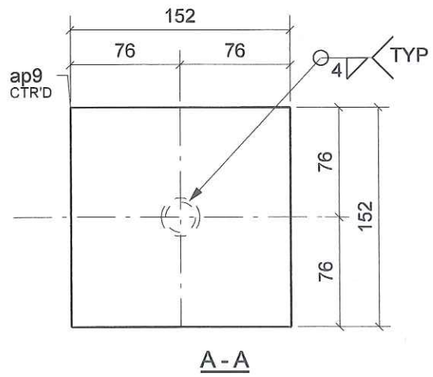
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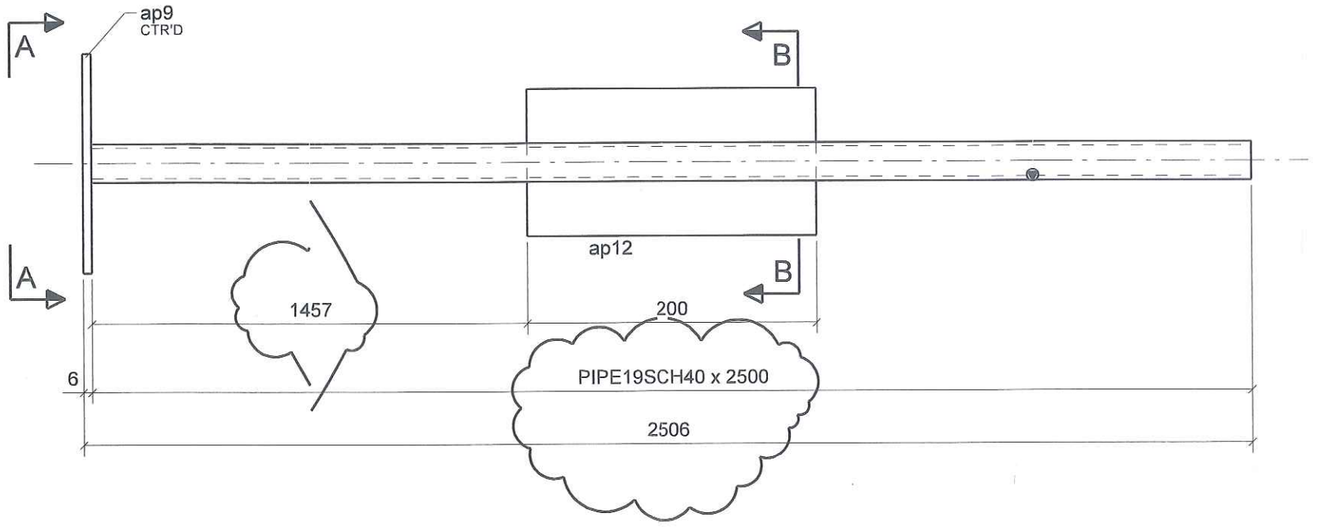
STANTEC ARCHITECTURE LTD. (PC-1449)

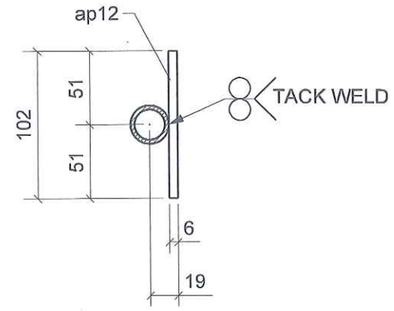
UNIT QTY	FIELD BOLTS	LENGTH





A - A





B - B

ONE - SWITCH MOUNT REQ'D - C2

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
ONE		C2	SWITCH MOUNT			6		
1	1	C2	PIPE19SCH40	2500	4	4	300W	
1	1	ap9	FB6X152	152	1	1	300W	
1	1	ap12	FB6X102	200	1	1	300W	

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF:

MATERIAL: 350W U/NOTED

HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N

WELDS: E49XX BOLTS: 19 Ø U/N

SURF. PREP: SP3

PAINT NOTE: BLACK SELF-PRIMING

Prepared on 3D-TeklaStructures

ALL WELDS 6mm U/NOTED

62-125

WHITEMUD IRONWORKS LIMITED
7727 - 18TH STREET
EDMONTON ALBERTA T6P 1N9
PHONE: (780) 465-5888 FAX (780) 465-1722

CUSTOMER: ArCan

PROJECT: Poratable Water System Skid

DWG. TITLE: SWITCH MOUNT

DRAWN BY:	CHKD BY:	JOB NUMBER	DWG NUMBER	
DATE: 01/03/2013	DATE:	62-125	C2	A

Stantec

- [x] Reviewed
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- [ ] Not Reviewed

January 16, 2013

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STANTEC ARCHITECTURE LTD. (PC-1449)

UNIT QTY	FIELD BOLTS	LENGTH



GALVANIZED

ONE - GRATING REQ'D - GR1

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
ONE		GR1	GRATING			45		
1	1	GR1	GR38X668	1256	43	43	GR_38X4.8	GALVANIZED
2	2	ap25	FB6X38	668	1	2	300W	

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF:

MATERIAL: 350W U/NOTED

HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N

WELDS: E49XX BOLTS: 19 Ø U/N

SURF. PREP: SP3

PAINT NOTE: GALVANIZED

Prepared on 3D-TeklaStructures

ALL WELDS 6mm U/NOTED

62-125

WHITEMUD IRONWORKS LIMITED
7727 - 18TH STREET
EDMONTON ALBERTA T6P 1N9
PHONE (780) 465-5888 FAX (780) 465-1722

CUSTOMER: ArCan

PROJECT: Poratable Water System Skid

DWG. TITLE: GRATING

DRAWN BY:	CHKD BY:	JOB NUMBER	DWG NUMBER	
DATE: 12/19/2012	DATE:	62-125	GR1	A

Stantec

- [x] Reviewed
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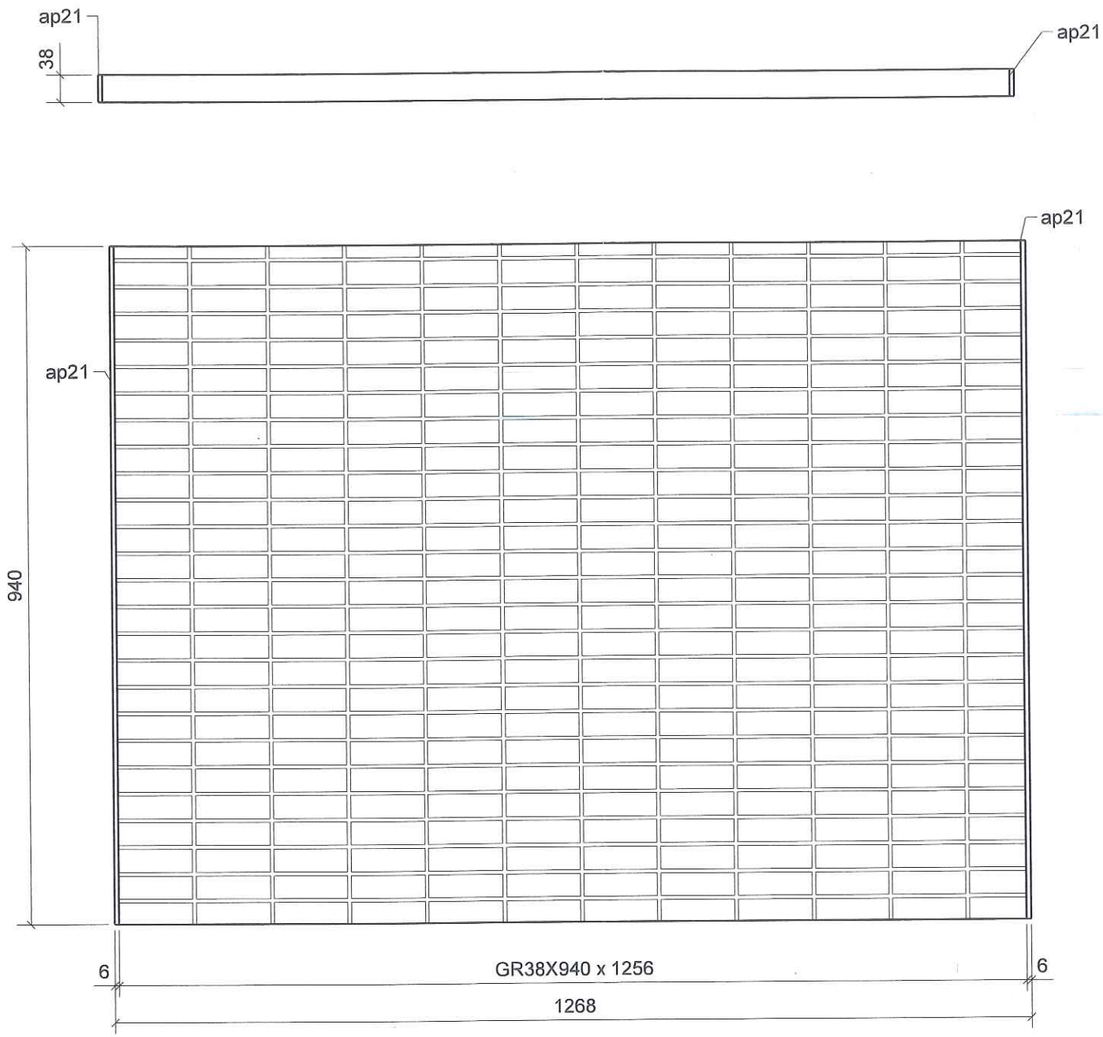
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STANTEC ARCHITECTURE LTD. (PC-1449)

UNIT QTY	FIELD BOLTS	LENGTH



GALVANIZED

12 - GRATINGS REQ'D - GR2

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
12		GR2	GRATINGS			766		
12	1	GR2	GR38X940	1256	61	727	GR_38X4.8	GALVANIZED
24	2	ap21	FB6X38	940	2	40	300W	

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF:

MATERIAL: 350W U/NOTED

HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N

WELDS: E49XX BOLTS: 19 Ø U/N

SURF. PREP: SP3

PAINT NOTE: GALVANIZED

Prepared on 3D-TeklaStructures

ALL WELDS 6mm U/NOTED

62-125

WHITEMUD IRONWORKS LIMITED
7727 - 18TH STREET
EDMONTON ALBERTA T6P 1N9
PHONE (780) 465-5888 FAX (780) 465-1722

CUSTOMER: ArCan

PROJECT: Poratable Water System Skid

DWG. TITLE: GRATING

DRAWN BY:	CHKD BY:	JOB NUMBER	DWG NUMBER	
DATE: 01/03/2013	DATE:	62-125	GR2	A

Stantec

- [x] Reviewed
- [ ] Reviewed as Modified
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- [ ] Not Reviewed

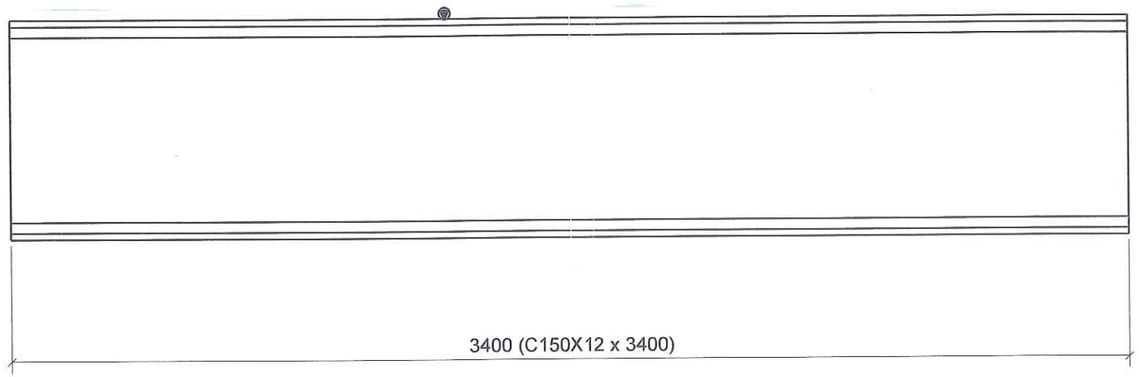
January 16, 2013

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STANTEC ARCHITECTURE LTD. (PC-1449)

UNIT QTY	FIELD BOLTS	LENGTH



4 - PIPE HANGERS REQ'D - MB1

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
4		MB1	PIPE HANGERS			164		
4	1	MB1	C150X12	3400	41	164	300W	

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF:

MATERIAL: 350W U/NOTED

HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N

WELDS: E49XX BOLTS: 19 Ø U/N

SURF. PREP: SP3

PAINT NOTE: BLACK SELF-PRIMING

Prepared on 3D-TeklaStructures

ALL WELDS 6mm U/NOTED

62-125

WHITEMUD IRONWORKS LIMITED
7727 - 18TH STREET
EDMONTON ALBERTA T6P 1N9
PHONE (780) 465-5888 FAX (780) 465-1722

CUSTOMER: ArCan

PROJECT: Poratable Water System Skid

DWG. TITLE: PIPE HANGER

DRAWN BY:	CHKD BY:	JOB NUMBER	DWG NUMBER	
DATE: 01/04/2013	DATE:	62-125	MB1	A

Stantec

January 16, 2013

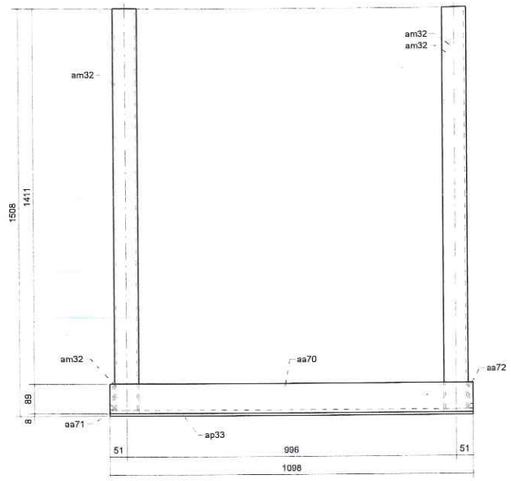
By Arlen Foster, EIT

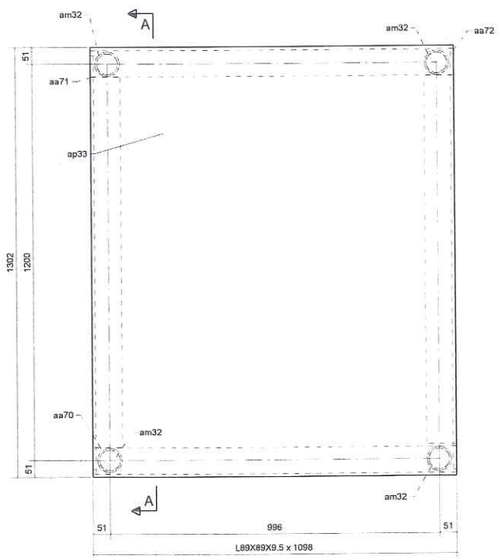
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not relieve that Stantec Architecture Ltd. approve the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or schedules. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all subtrades.

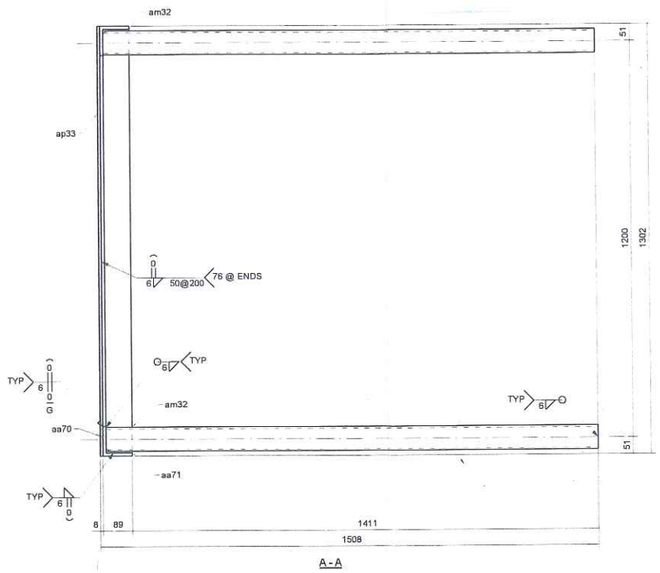
STANTEC ARCHITECTURE LTD.

■ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
3		MF1	MECH FRAMES			598		
3	1	MF1	L89X89X9.5	1098	14	41	300W	
3	1	aa70	L89X89X9.5	1098	14	41	300W	
3	1	aa71	L89X89X9.5	1280	16	48	300W	
3	1	aa72	L89X89X9.5	1273	16	48	300W	
12	4	am32	PIPE64SCH40	1490	13	150	300W	Height?
3	1	ap33	PL8X1098	1302	90	269	300W	







A - A

T.B.D.

3 - MECH FRAMES REQ'D - MF1

UNIT QTY	FIELD BOLTS	LENGTH

DW	GRID LOC.	ELEV
1	<1/B>	+1.518

APPROVER:
PLEASE VERIFY ALL CLOUDED AREAS AND DIMS.

62-125

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

WHITEMUD IRONWORKS LIMITED
7717 - 16TH STREET
EDMONTON (ALBERT) T6P 1S5
PHONE (780) 465-5591 FAX (780) 465-5733

REF
MATERIAL 350W U/NOTED
HOLES 20.6 Ø U/N EDGE DIST 38mm U/N
WELDS E49XX BOLTS 19 Ø U/N
SURF. PREP SP3
PAINT NOTE BLACK SELF-PRIMING
ALL WELDS 6mm U/NOTED

CUSTOMER ArCan
PROJECT Poratable Water System Skid
DWG. TITLE MECH FRAME

DRAWN BY	CHKD BY	JOB NUMBER	DWG NUMBER
DATE 01/02/2013	DATE	62-125	MF1

Stantec

- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Review and Resubmit
- [ ] Not Reviewed

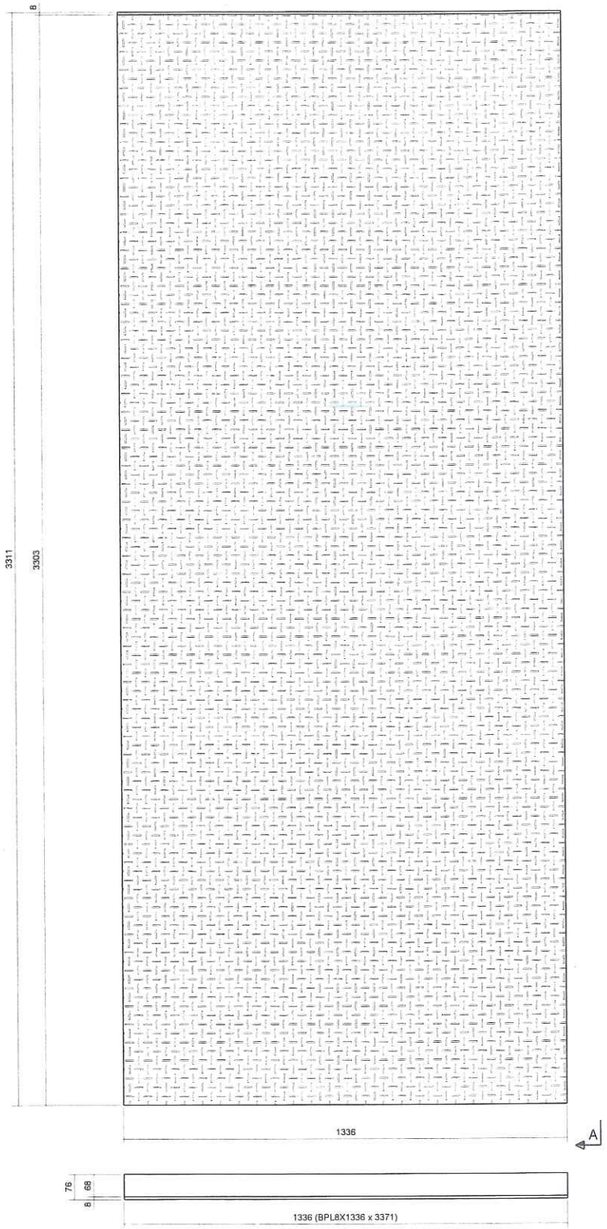
January 16, 2013

By: Artem Foster, EIT

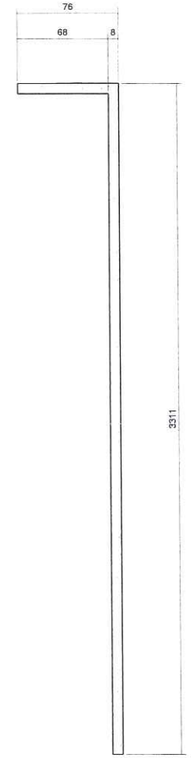
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TOTAL QTY.	UNIT QTY.	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
ONE		MP1	SS DIAMOND GRIP			283		
1	1	MP1	BPL8X1336	3371	284	284	304	STAINLESS STEEL



ONE - SS DIAMOND GRIP REQ'D - MP1



A - A

DIV	GRID LOC.	ELEV
161	CL-2/A-B	+0.076

UNIT QTY	FIELD BOLTS	LENGTH

62-125

REV	DATE	REMARKS	ISS.NO.
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF

MATERIAL 350W U/NOTED

HOLES 20.6 Ø U/N EDGE DIST 38mm U/N

WELDS E49XX BOLTS 19 Ø U/N

SURF. PREP SP3

PAINT NOTE NONE

ALL WELDS 6mm U/NOTED

WHITEMUD IRONWORKS LIMITED

CUSTOMER ArCan

PROJECT Poratable Water System Skid

DWG. TITLE SS DIAMOND GRIP

DRAWN BY	CHKD BY	JOB NUMBER	DWG NUMBER
DATE 01/03/2013	DATE	62-125	MP1

Stantec

Reviewed
Reviewed as Modified
Revise and Resubmit
Not Reviewed

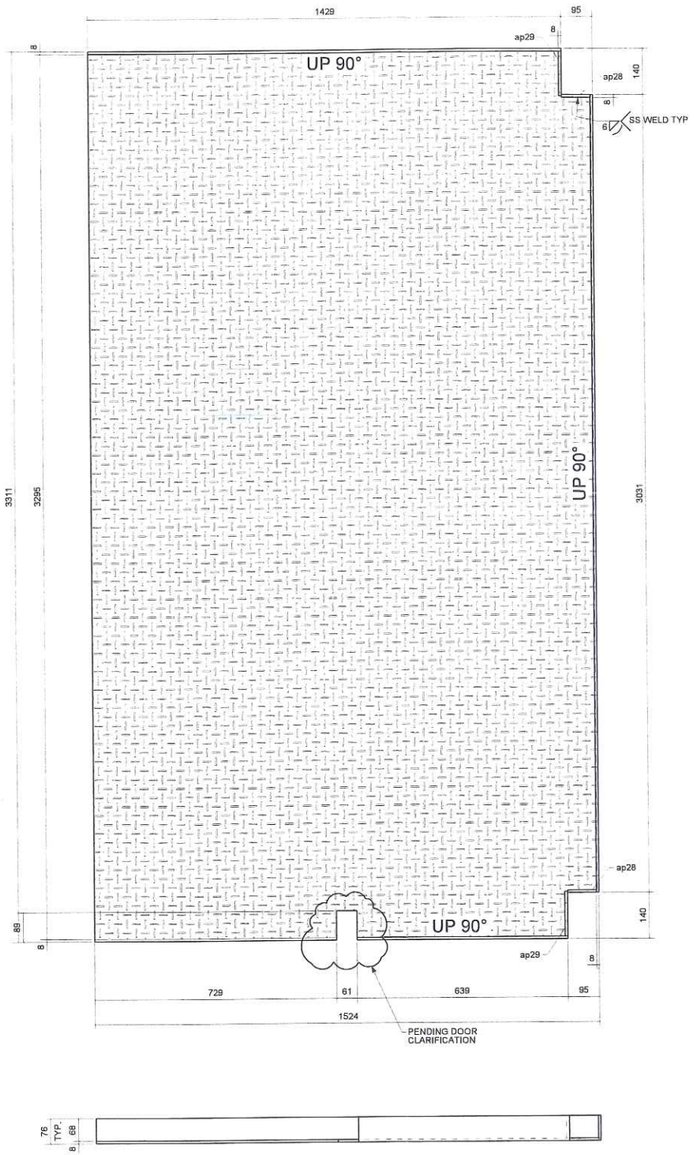
January 16, 2013

By Arlen Foster, EIT

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not relieve that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings; responsibility for which shall remain with the Contractor named herein. Stantec Architecture Ltd. shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and coordinated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all subtrades.

STANTEC ARCHITECTURE LTD.

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
ONE		MP2	SS DIAMOND GRIP			326		
1	1	MP2	BPL8X1524	3395	325	325	304	STAINLESS STEEL
2	2	ap28	PL8X68	87	0	1	304	STAINLESS STEEL
2	2	ap29	PL8X68	136	1	1	304	STAINLESS STEEL



ONE - SS DIAMOND GRIP REQ'D - MP2

UNIT QTY	FIELD BOLTS	LENGTH

DIV	GRID LOC.	ELEV.
101	CL-2/A-B	+0.076

REV	DATE	REMARKS	ISS NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

62-125

WHITEMUD IRONWORKS LIMITED
7727 - 14TH STREET
EDMONTON, ALBERTA T6P 1X3
PHONE (780) 955-7838 FAX (780) 955-7733

REF
MATERIAL 350W U/NOTED
HOLES 20.6 Ø U/N EDGE DIST 38mm U/N
WELDS E49XX BOLTS 19 Ø U/N
SURF. PREP SP3
PAINT NOTE NONE
ALL WELDS 6mm U/NOTED

CUSTOMER ArCan
PROJECT: Poratable Water System Skid
DWG. TITLE: SS DIAMOND GRIP

DRAWN BY	CHKD BY	JOB NUMBER	DWG NUMBER
DATE 01/03/2013	DATE	62-125	MP2

Stantec

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

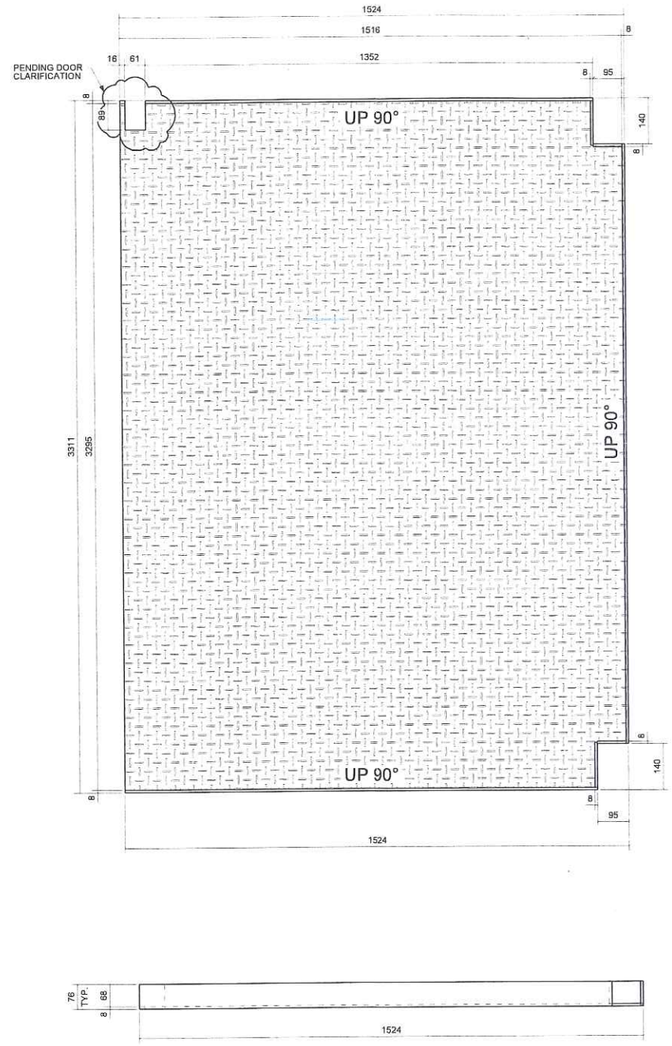
January 16, 2013

By: Arlen Foster, EIT

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not relieve that Stantec Architecture Ltd. approves the detail design of items shown on this shop drawings; responsibility for which shall remain with the Contractor submitting same; and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all subtrades.

STANTEC ARCHITECTURE LTD.

TOTAL QTY.	UNIT QTY.	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
ONE		MP3	SS DIAMOND GRIP			333		
1	1	MP3	BPL8X1524	3463	331	331	304	STAINLESS STEEL
2	2	ap2ii	PL8X68	87	0	1	304	STAINLESS STEEL
2	2	ap2ii	PL8X68	136	1	1	304	STAINLESS STEEL



ONE - SS DIAMOND GRIP REQ'D - MP3

UNIT QTY	FIELD BOLTS	LENGTH

DIV	GRID LOC.	ELEV
101	1-C/J-A-B	+0.076

62-125

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF:
MATERIAL: 350W U/NOTED
HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N
WELDS: E49XX BOLTS: 19 Ø U/N
SURF. PREP: SP3
PAINT NOTE: NONE
ALL WELDS 6mm U/NOTED

WHITEMUD IRONWORKS LIMITED
7521 - 14TH STREET
EDMONTON ALBERTA T6P 1X6
PHONE (780) 955-9191 FAX (780) 955-9733

CUSTOMER: ArCan
PROJECT: Poratable Water System Skid
DWG. TITLE: SS DIAMOND GRIP

DRAWN BY	CHKD BY	JOB NUMBER	DWG NUMBER
DATE: 01/03/2013	DATE:	62-125	MP3

Reviewed
Reviewed as Modified
Revise and Resubmit
Not Reviewed

Stantec

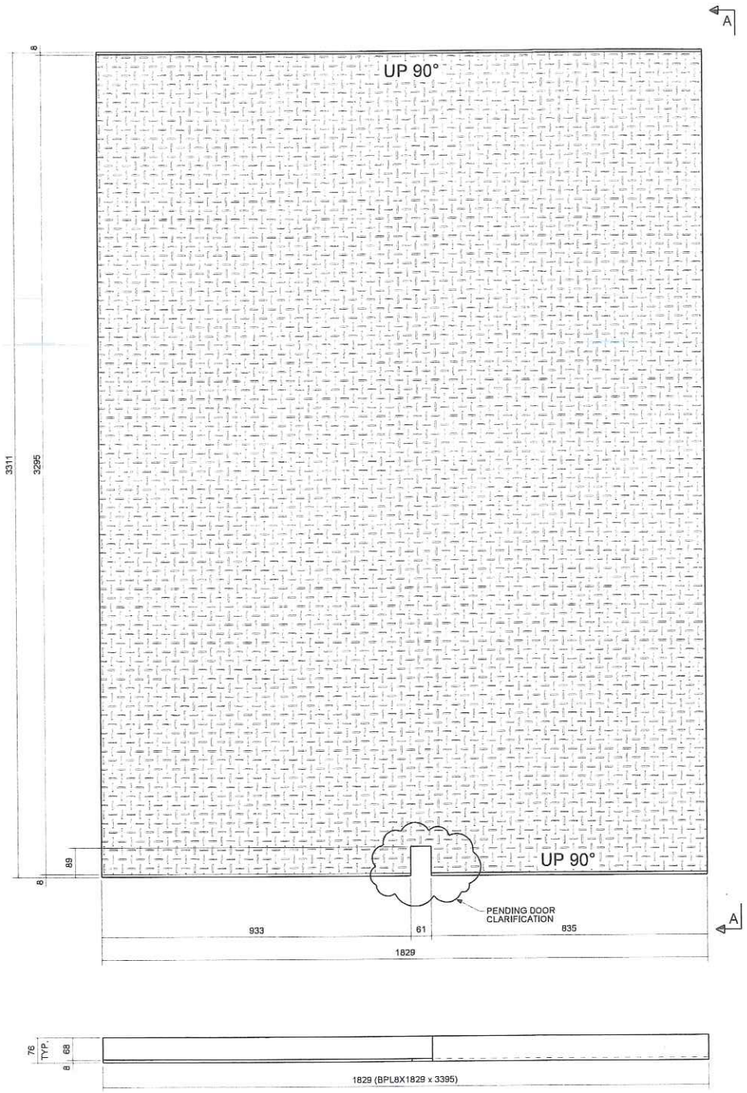
January 16, 2013

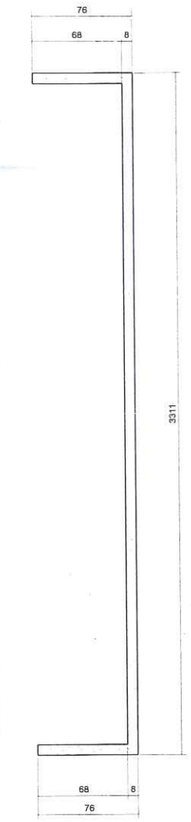
By Arlen Foster, EIT

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STANTEC ARCHITECTURE LTD.

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
ONE		MP4	SS DIAMOND GRIP			389		
1	1	MP4	BPL8X1829	3395	390	390	304	STAINLESS STEEL





A - A

ONE - SS DIAMOND GRIP REQ'D - MP4

UNIT QTY	FIELD BOLTS	LENGTH

DIV	GRID LOC	ELEV
101	I-CL/A-B	+0.076

62-125

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

WHITEMUD IRONWORKS LIMITED
7527 - 14TH STREET
EDMONTON, ALBERTA T6P 1X9
PHONE (780) 463-5930 FAX (780) 463-4733

REF.
MATERIAL 350W U/NOTED
HOLES 20.6 Ø U/N EDGE DIST 38mm U/N
WELDS E49XX BOLTS 19 Ø U/N
SURF. PREP. SP3
PAINT NOTE NONE
ALL WELDS 6mm U/NOTED

CUSTOMER ArCan
PROJECT Poratable Water System Skid
DWG. TITLE SS DIAMOND GRIP

DRAWN BY	CHKD BY	JOB NUMBER	DWG NUMBER
DATE 01/03/2013	DATE	62-125	MP4

Stantec

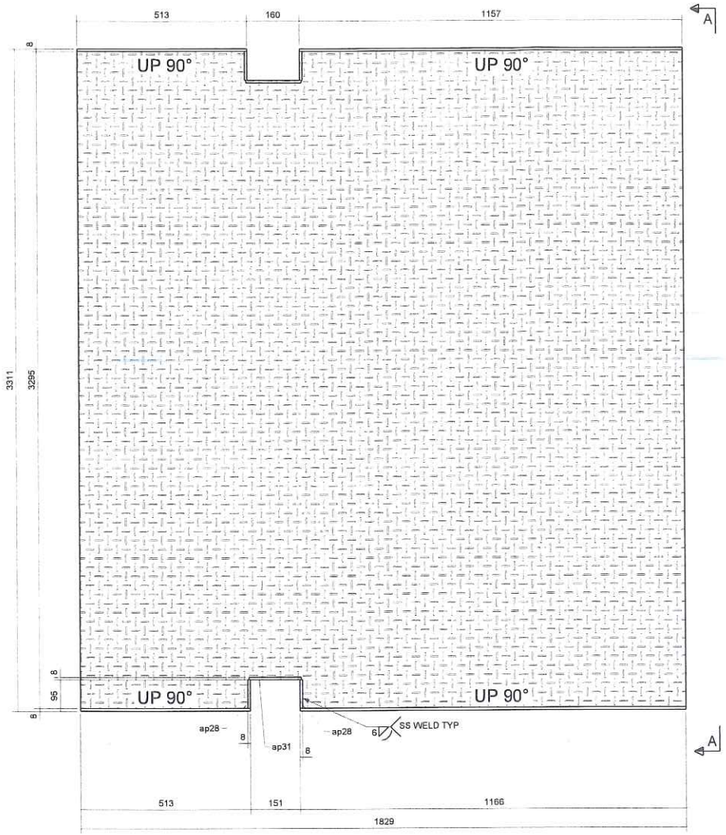
January 16, 2013

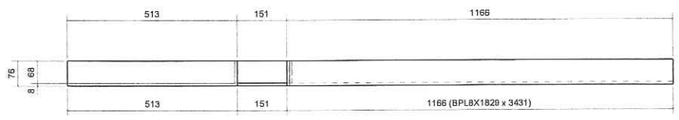
By: Arlen Foster, EIT

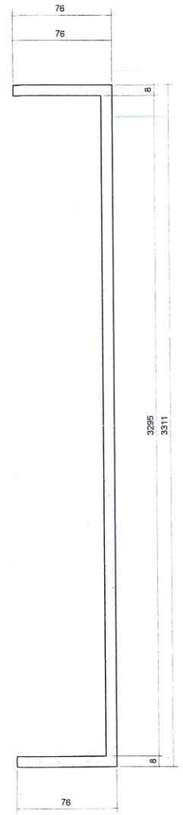
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STANTEC ARCHITECTURE LTD.

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
ONE		MP5	SS DIAMOND GRIP			398		
1	1	MP5	BPL8X1829	3431	396	396	304	STAINLESS STEEL
4	4	ap28	PL8X68	87	0	1	304	STAINLESS STEEL
1	1	ap31	PL8X68	159	1	1	304	STAINLESS STEEL
1	1	ap32	PL8X68	168	1	1	304	STAINLESS STEEL







A-A

ONE - SS DIAMOND GRIP REQ'D - MP5

UNIT QTY	FIELD BOLTS	LENGTH

DIV	GRID LOC	ELEV
101	1-CLIA-B	+9.076

62-125

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

WHITEMUD IRONWORKS LIMITED
7717 - 143N STREET
EDMONTON ALBERTA T5P 1N5
PHONE (780) 944-5855 FAX (780) 465-5773

REF
MATERIAL 350W U/NOTED
HOLES 20.6 Ø U/N EDGE DIST 38mm U/N
WELDS E49XX BOLTS 19 Ø U/N
SURF. PREP SP3
PAINT NOTE NONE
ALL WELDS 6mm U/NOTED

CUSTOMER ArCan
PROJECT Poratable Water System Skid
DWG. TITLE SS DIAMOND GRIP

DRAWN BY	CHKD BY	JOB NUMBER	DWG NUMBER
DATE 01/03/2013	DATE	62-125	MP5

Reviewed
Reviewed as Modified
Revise and Resubmit
Not Reviewed

Stantec

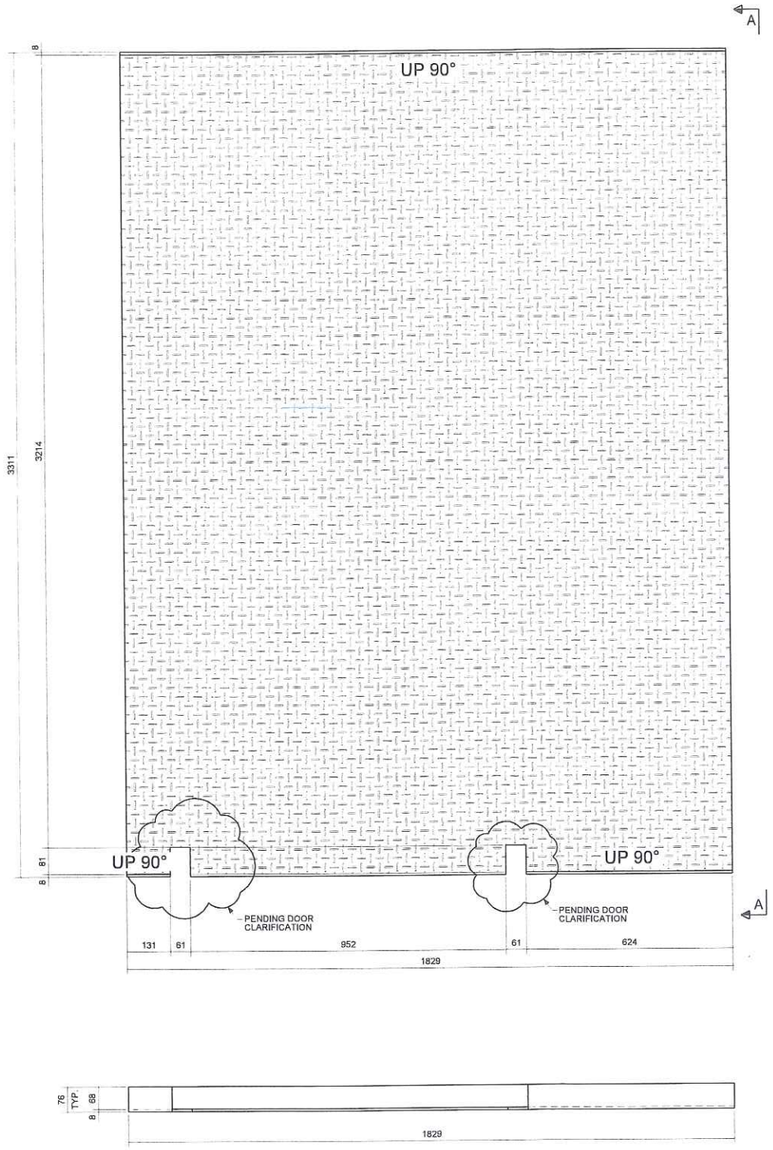
January 16, 2013

By Arlen Foster, EIT

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STANTEC ARCHITECTURE LTD.

TOTAL QTY.	UNIT QTY.	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
ONE		MP6	SS DIAMOND GRIP			395		
1	1	MP6	BPL8X1829	3431	396	396	304	STAINLESS STEEL





A-A

ONE - SS DIAMOND GRIP REQ'D - MP6

DIV	GRID LOC.	ELEV.
101	1-2/A-B	+0.076

UNIT QTY	FIELD BOLTS	LENGTH

62-125

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF

MATERIAL 350W U/NOTED

HOLES. 20.6 Ø U/N EDGE DIST 38mm U/N

WELDS E49XX BOLTS 19 Ø U/N

SURF. PREP SP3

PAINT NOTE NONE

ALL WELDS 6mm U/NOTED

WHITEMUD IRONWORKS LIMITED
7727 - 34th STREET
EDMONTON, ALBERTA T6P 1N9
PHONE (780) 465-5881 FAX (780) 465-5733

CUSTOMER ArCan

PROJECT Poratable Water System Skid

DWG. TITLE SS DIAMOND GRIP

DRAWN BY	CHKD BY	JOB NUMBER	DWG NUMBER
DATE 01/03/2013	DATE	62-125	MP6

Stantec

- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

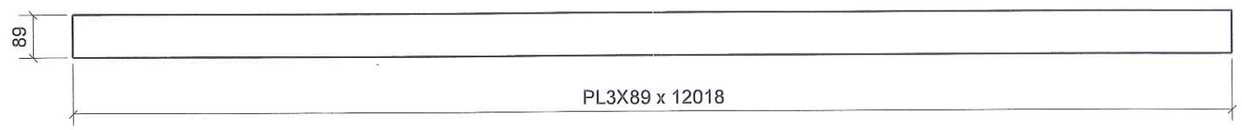
January 16, 2013

By: Arlen Foster, EIT

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STANTEC ARCHITECTURE LTD. (PC-1449)

UNIT QTY	FIELD BOLTS	LENGTH



2 - PLATES REQ'D - MP7

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
2		MP7	PLATES			50		
2	1	MP7	PL3X89	12018	25	50	300W	

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF:

MATERIAL: 350W U/NOTED

HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N

WELDS: E49XX BOLTS: 19 Ø U/N

SURF. PREP: SP3

PAINT NOTE: BLACK SELF-PRIMING

Prepared on 3D-TeklaStructures

ALL WELDS 6mm U/NOTED

62-125

WHITEMUD IRONWORKS LIMITED
7727 - 18TH STREET
EDMONTON ALBERTA T6P 1N9
PHONE (780) 465-5888 FAX (780) 465-1722

CUSTOMER: ArCan

PROJECT: Poratable Water System Skid

DWG. TITLE: PLATE

DRAWN BY:	CHKD BY:	JOB NUMBER	DWG NUMBER	
DATE: 01/03/2013	DATE:	62-125	MP7	A

Stantec

- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

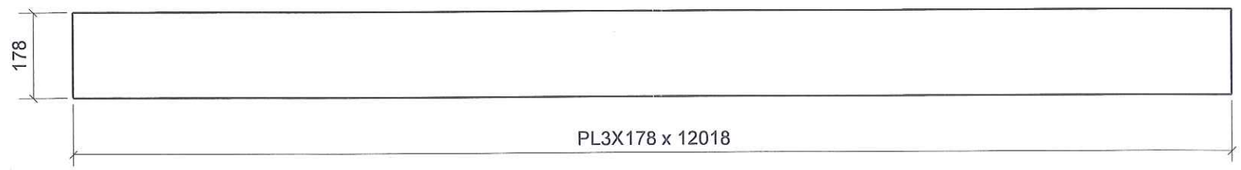
January 16, 2013

By: Arlen Foster, EIT

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STANTEC ARCHITECTURE LTD. (PC-1449)

UNIT QTY	FIELD BOLTS	LENGTH



2 - PLATES REQ'D - MP8

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
2		MP8	PLATES			100		
2	1	MP8	PL3X178	12018	50	101	300W	

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF:

MATERIAL: 350W U/NOTED

HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N

WELDS: E49XX BOLTS: 19 Ø U/N

SURF. PREP: SP3

PAINT NOTE: BLACK SELF-PRIMING

Prepared on 3D-TeklaStructures

ALL WELDS 6mm U/NOTED

62-125

WHITEMUD IRONWORKS LIMITED
7727 - 18TH STREET
EDMONTON ALBERTA T6P 1N9
PHONE (780) 465-5888 FAX (780) 465-1722

CUSTOMER: ArCan

PROJECT: Poratable Water System Skid

DWG. TITLE: PLATE

DRAWN BY:	CHKD BY:	JOB NUMBER	DWG NUMBER	
DATE: 01/03/2013	DATE:	62-125	MP8	A

Stantec

January 16, 2013

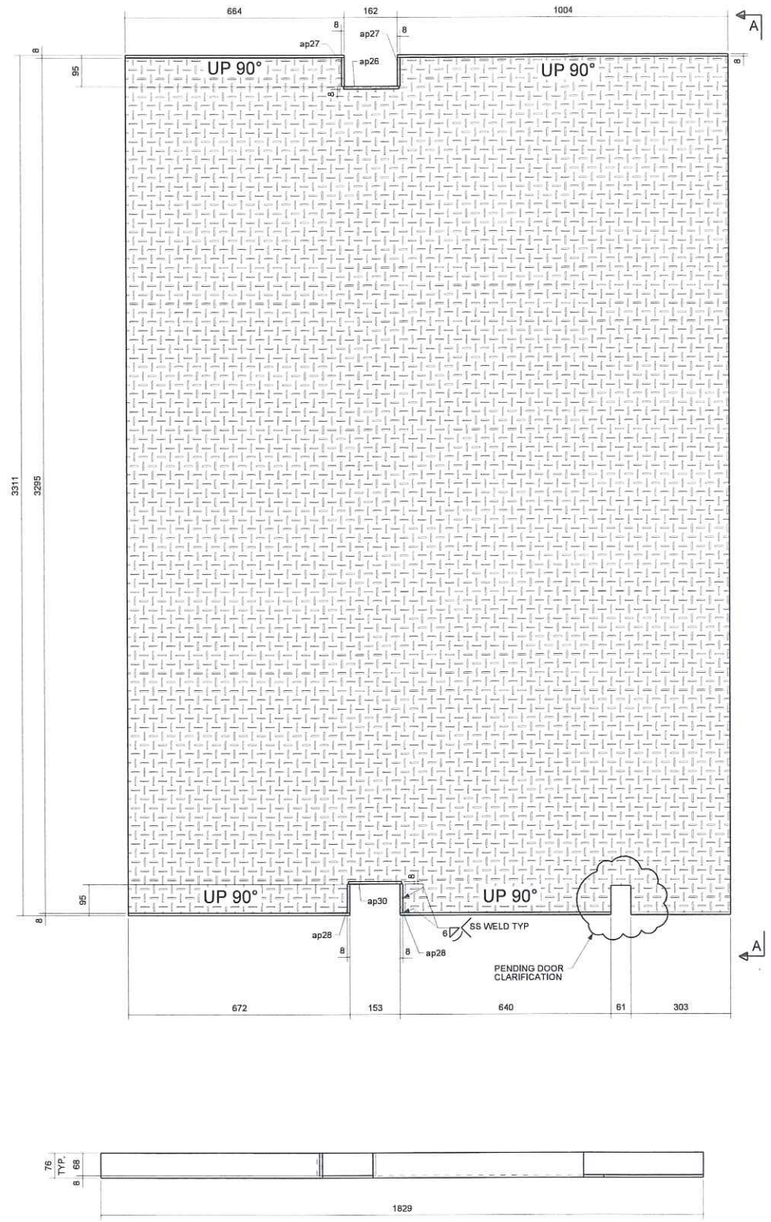
by Arlen Foster, EIT

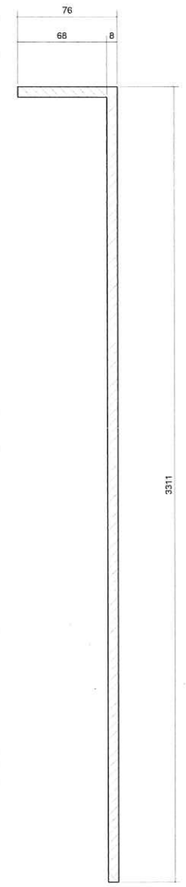
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STANTEC ARCHITECTURE LTD.

- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
ONE		MP9	SS DIAMOND GRIP			398		
1	1	MP3	BPL8X1829	3431	396	396	304	STAINLESS STEEL
1	1	ap26	PL8X68	168	1	1	304	STAINLESS STEEL
2	2	ap27	PL8X68	87	0	1	304	STAINLESS STEEL
2	2	ap28	PL8X68	87	0	1	304	STAINLESS STEEL
1	1	ap30	PL6X68	161	1	1	304	STAINLESS STEEL





A - A

ONE - SS DIAMOND GRIP REQ'D - MP9

UNIT QTY	FIELD BOLTS	LENGTH

DIV	GRID LOC.	ELEV.
101	CL-2/A-B	+0.076

REV	DATE	REMARKS	ISS NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

62-125

REF:

MATERIAL: 350W U/NOTED

HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N

WELDS: E49XX BOLTS: 19 Ø U/N

SURF. PREP: SP3

PAINT NOTE: NONE

Painter Schedule: ALL WELDS 6mm U/NOTED

WHITEMUD IRONWORKS LIMITED
7727 - 18TH STREET
EDMONTON, ALBERTA T6P 1N3
PHONE (780) 465-5995 FAX (780) 465-1725

CUSTOMER: ArCan

PROJECT: Poratable Water System Skid

DWG. TITLE: SS DIAMOND GRIP

DRAWN BY	CHKD BY	JOB NUMBER	DWG NUMBER
DATE: 01/03/2013	DATE	62-125	MP9

Stantec

- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

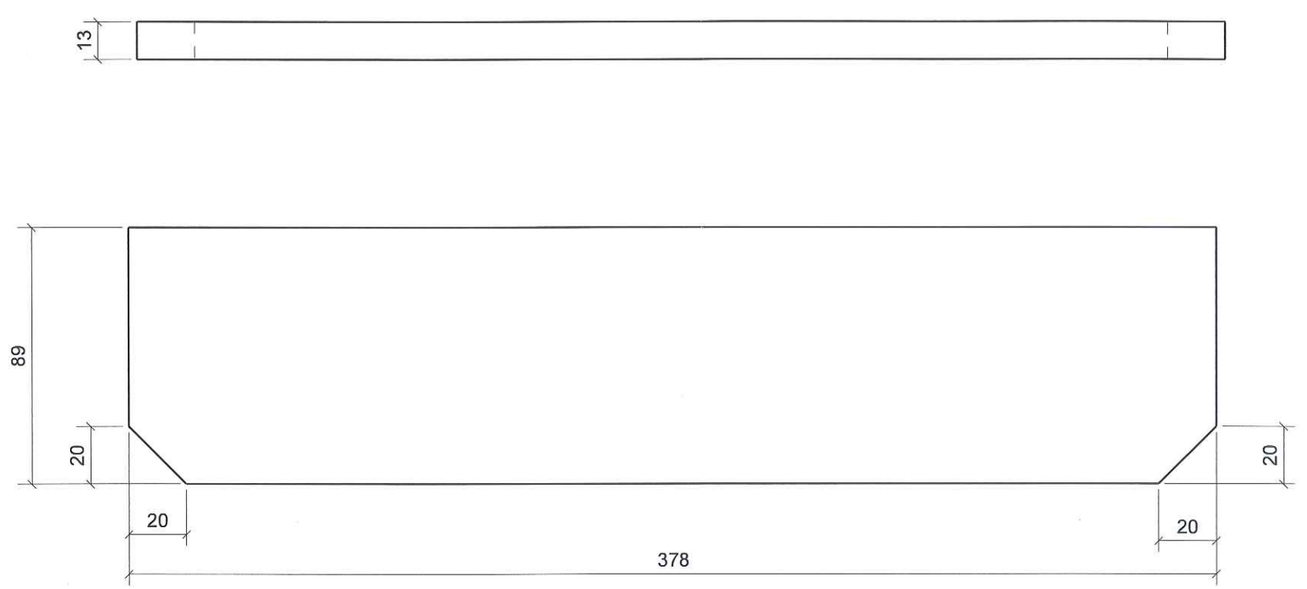
January 16, 2013

By: Arlen Foster, EIT

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STANTEC ARCHITECTURE LTD. (PC-1449)

UNIT QTY	FIELD BOLTS	LENGTH



8 - PLATES REQ'D - MP10

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
8		MP10	PLATES			27		
8	1	MP10	FB13X89	378	3	27	300W	

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF:

MATERIAL: 350W U/NOTED

HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N

WELDS: E49XX BOLTS: 19 Ø U/N

SURF. PREP: SP3

PAINT NOTE: BLACK SELF-PRIMING

Prepared on 3D-TeklaStructures

ALL WELDS 6mm U/NOTED

62-125

WHITEMUD IRONWORKS LIMITED
7727 - 18TH STREET
EDMONTON ALBERTA T6P 1N9
PHONE: (780) 465-5888 FAX: (780) 465-1722

CUSTOMER: ArCan

PROJECT: Poratable Water System Skid

DWG. TITLE: PLATE

DRAWN BY:	CHKD BY:	JOB NUMBER	DWG NUMBER	
DATE: 01/04/2013	DATE:	62-125	MP10	A

Stantec

- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

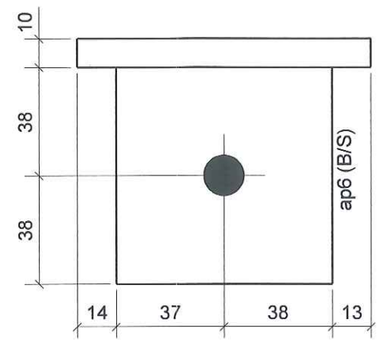
January 16, 2013

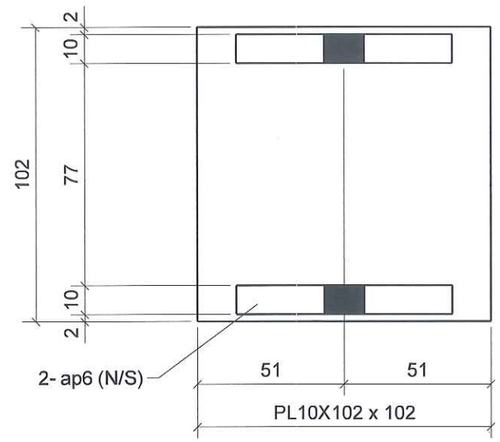
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STANTEC ARCHITECTURE LTD. (PC-1449)

UNIT QTY	FIELD BOLTS	LENGTH





12 - BASE PLATES REQ'D - MP11

S.S.

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
12		MP11	BASE PLATES			20		
12	1	MP11	PL10X102	102	1	10	304	STAINLESS STEEL
24	2	ap6	PL10X75	75	0	11	304	STAINLESS STEEL

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF:

MATERIAL: 350W U/NOTED

HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N

WELDS: E49XX BOLTS: 19 Ø U/N

SURF. PREP: SP3

PAINT NOTE: BLACK SELF-PRIMING

Prepared on 3D-TeklaStructures

ALL WELDS 6mm U/NOTED

62-125

WHITEMUD IRONWORKS LIMITED
7727 - 18TH STREET
EDMONTON ALBERTA T6P 1N9
PHONE: (780) 465-5888 FAX: (780) 465-1722

CUSTOMER: ArCan

PROJECT: Poratable Water System Skid

DWG. TITLE: BASE PLATE

DRAWN BY:	CHKD BY:	JOB NUMBER	DWG NUMBER	
DATE: 01/04/2013	DATE:	62-125	MP11	A

UNIT QTY	FIELD BOLTS	LENGTH

Stantec

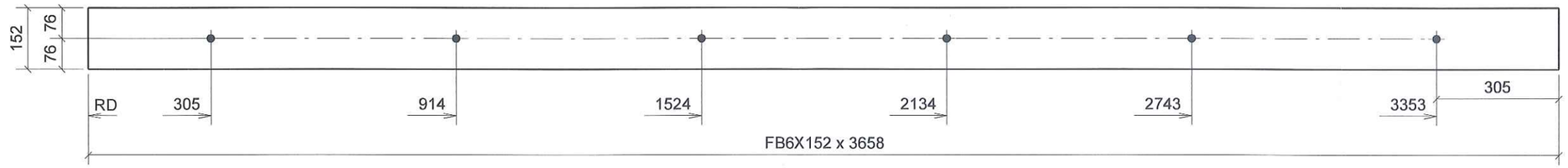
- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

January 16, 2013

By: Arlen Foster, EIT

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STANTEC ARCHITECTURE LTD. (PC-1449)



6 - SS PLATES REQ'D - MP12

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
6		MP12	SS PLATES			157		
6	1	MP12	FB6X152	3658	26	157	300W	STAINLESS STEEL

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF:

MATERIAL: 350W U/NOTED

HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N

WELDS: E49XX BOLTS: 19 Ø U/N

SURF. PREP: SP3

PAINT NOTE: NONE

Prepared on 3D-TeklaStructures

ALL WELDS 6mm U/NOTED

62-125

WHITEMUD IRONWORKS LIMITED
7727 - 18TH STREET
EDMONTON ALBERTA T6P 1N9
PHONE: (780) 465-5888 FAX: (780) 465-1722

CUSTOMER: ArCan

PROJECT: Poratable Water System Skid

DWG. TITLE: SS PLATE

DRAWN BY:	CHKD BY:	JOB NUMBER	DWG NUMBER	
DATE: 01/03/2013	DATE:	62-125	MP12	A

Stantec

■ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

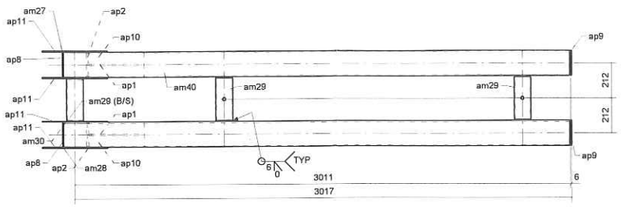
January 16, 2013

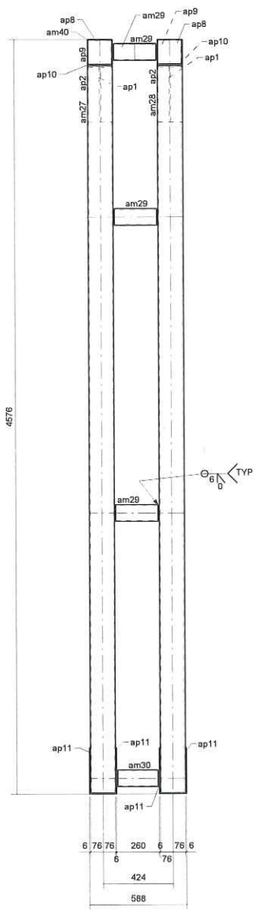
By: Aries Foster, EIT

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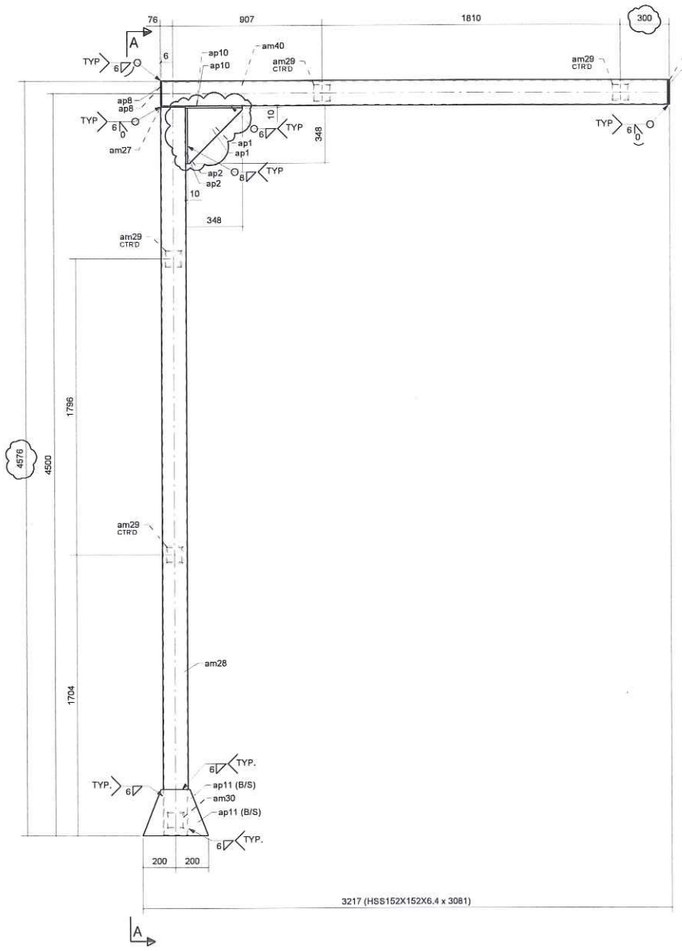
STANTEC ARCHITECTURE LTD.

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
ONE		PS1	BEAM			509		
1	1	PS1	HSS152X152X6.4	3081	87	87	350W	
1	1	am27	HSS152X152X6.4	4424	125	125	350W	
1	1	am28	HSS152X152X6.4	4424	125	125	350W	
4	4	am29	HSS102X102X6.4	269	5	20	350W	
1	1	am30	HSS102X102X6.4	257	5	5	350W	
1	1	am40	HSS152X152X6.4	3081	87	87	350W	
2	2	ap1	PL10X338	338	9	18	300W	
2	2	ap2	FB10X152	338	4	8	300W	
2	2	ap8	PL6X146	146	1	2	300W	
2	2	ap9	FB6X152	152	1	2	300W	
2	2	ap10	FB10X152	348	4	8	300W	
4	4	ap11	PL6X280	400	5	21	300W	





A - A



ONE - BEAM REQ'D - PS1

DIV	GRID LOC.	ELEV.
1	1/A-A	+4.576

UNIT QTY	FIELD BOLTS	LENGTH

APPROVER:
PLEASE VERIFY ALL CLOUDED AREAS AND DIMS.

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

62-125

WHITEMUD IRONWORKS LIMITED
7519 - 68th STREET
EDMONTON, ALBERTA, T6P 1N9
PHONE (780) 465-5444 FAX (780) 465-5722

REF:
MATERIAL: 350W U/NOTED
HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N
WELDS: E49XX BOLTS: 19 Ø U/N
SURF. PREP: SP3
PAINT NOTE: BLACK SELF-PRIMING
ALL WELDS 6mm U/NOTED

CUSTOMER: ArCan
PROJECT: Poratable Water System Skid
DWG. TITLE: BEAM

DRAWN BY:	CHKD BY	JOB NUMBER	DWG NUMBER	
DATE: 01/03/2013	DATE:	62-125	PS1	A

Stantec

- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

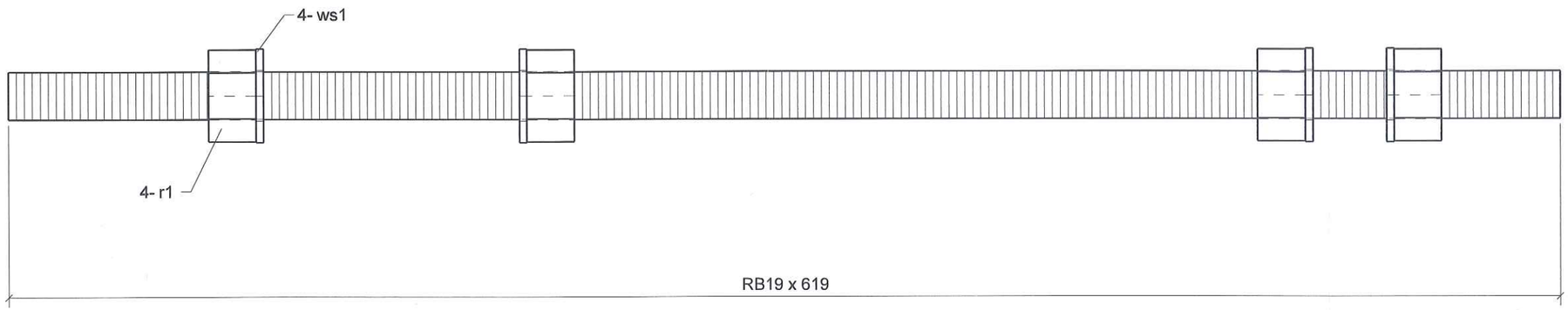
January 16, 2013

By: Arlen Foster, EIT

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STANTEC ARCHITECTURE LTD. (PC-1449)

UNIT QTY	FIELD BOLTS	LENGTH



2 - RODS REQ'D - R1

GALVANIZED

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
2		R1	RODS			3		
2	1	R1	RB19	619	1	2	300W	
8	4	r1	19NUT	19	0	1	300W	
8	4	ws1	19FW	3	0	0	300W	

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF:

MATERIAL: 350W U/NOTED

HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N

WELDS: E49XX BOLTS: 19 Ø U/N

SURF. PREP: SP3

PAINT NOTE: GALVANIZED

Prepared on 3D-TeklaStructures

ALL WELDS 6mm U/NOTED

62-125

WHITEMUD IRONWORKS LIMITED
7727 - 18TH STREET
EDMONTON ALBERTA T6P 1N9
PHONE: (780) 465-5888 FAX: (780) 465-1722

CUSTOMER: ArCan

PROJECT: Poratable Water System Skid

DWG. TITLE: ROD

DRAWN BY:	CHKD BY:	JOB NUMBER	DWG NUMBER	
DATE: 12/19/2012	DATE:	62-125	R1	A

Stantec

January 16, 2013

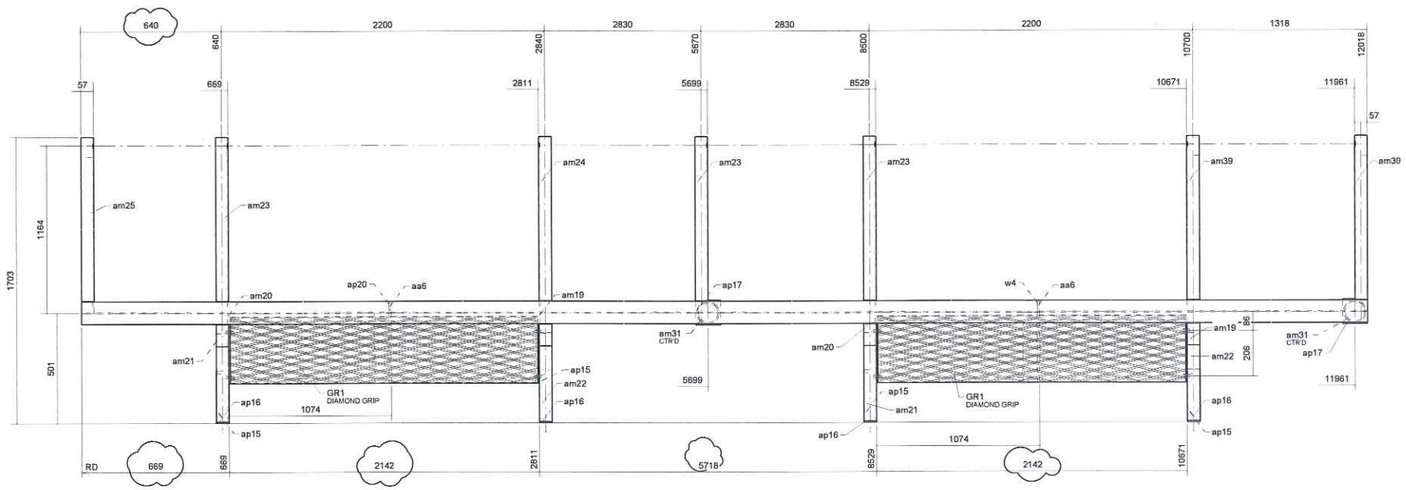
By Arlen Foster, EIT

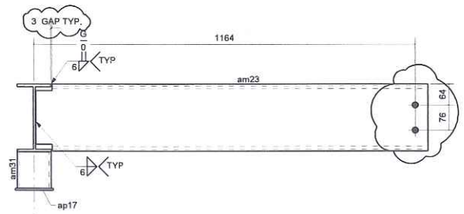
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STANTEC ARCHITECTURE LTD.

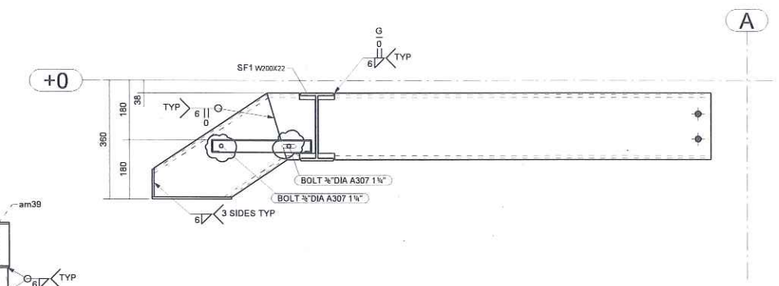
■ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
ONE		SF1	BEAM			571		
2	2	GR1	BPL3X991	2130	50	99	350W	DIAMOND GRIP
1	1	SF1	W200X22	12018	270	270	350W	
2	2	aa6	L102X76X9.5	372	5	9	300W	
2	2	am19	C200X17	148	3	5	300W	
2	2	am20	C200X17	148	3	5	300W	
2	2	am21	C200X17	460	8	16	300W	
2	2	am22	C200X17	460	8	16	300W	
3	3	am23	C200X17	1197	20	61	300W	
1	1	am24	C200X17	1197	20	20	300W	
1	1	am25	C200X17	1197	20	20	300W	
2	2	am31	PIPE89SCH40	110	1	3	300W	
2	2	am39	C200X17	1197	20	41	300W	
4	4	ap15	PL6X58	240	1	3	300W	
4	4	ap16	PL6X58	84	0	1	300W	
2	2	ap17	PL6X114	114	1	1	300W	
1	1	ap20	PL9X44	187	1	1	300W	
1	1	w4	PL9X44	187	1	1	300W	

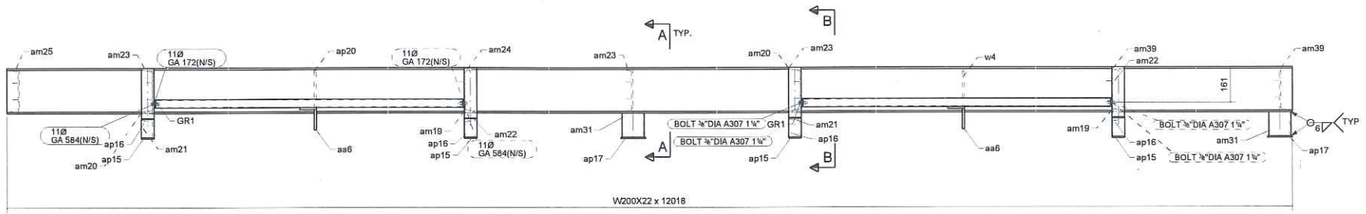




A - A



B - B



UNIT QTY	FIELD BOLTS	LENGTH
8	9 DIA BOLT-A307	32

ONE - BEAM REQ'D - SF1

DIV	GRID LOC.	ELEV.
1	1-2/<A	-0.038

APPROVER:
PLEASE VERIFY ALL CLOUDED AREAS AND DIMS.

REV	DATE	REMARKS	ISS.NO.
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF:
MATERIAL: 350W U/NOTED
HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N
WELDS: E49XX BOLTS: 19 Ø U/N
SURF. PREP: SP3
PAINT NOTE: BLACK SELF-PRIMING
ALL WELDS 6mm U/NOTED

62-125

WHITEMUD IRONWORKS LIMITED
7737 - 30TH STREET
EDMONTON, ALBERTA T6P 1N3
PHONE (780) 465-5466 FAX (780) 465-1733

CUSTOMER: ArCan
PROJECT: Poratable Water System Skid
DWG. TITLE: BEAM

DRAWN BY	CHKD BY	JOB NUMBER	DWG NUMBER	
DATE 01/03/2013	DATE	62-125	SF1	A

Reviewed
Reviewed as Modified
Revise and Resubmit
Not Reviewed

Stantec

January 16, 2013

By: Arlen Foster, EIT

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STANTEC ARCHITECTURE LTD. (PC-1449)

UNIT QTY	FIELD BOLTS	LENGTH

SEE DWGS. SK1, SK1A, SK1B, SK1C, SK1D, SK1E

ONE - SKID REQ'D - SK1

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
ONE		SK1	SKID			7688		

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF:

MATERIAL: 350W U/NOTED

HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N

WELDS: E49XX BOLTS: 19 Ø U/N

SURF. PREP: SP3

PAINT NOTE: BLACK SELF-PRIMING

Prepared on 3D-TeklaStructures

ALL WELDS 6mm U/NOTED

62-125

WHITEMUD IRONWORKS LIMITED
7727 - 18TH STREET
EDMONTON ALBERTA T6P 1N9
PHONE: (780) 465-5888 FAX: (780) 465-1722

CUSTOMER: ArCan

PROJECT: Poratable Water System Skid

DWG. TITLE: SKID

DRAWN BY:	CHKD BY:	JOB NUMBER	DWG NUMBER	
DATE: 01/02/2013	DATE:	62-125	SK1	A

Stantec

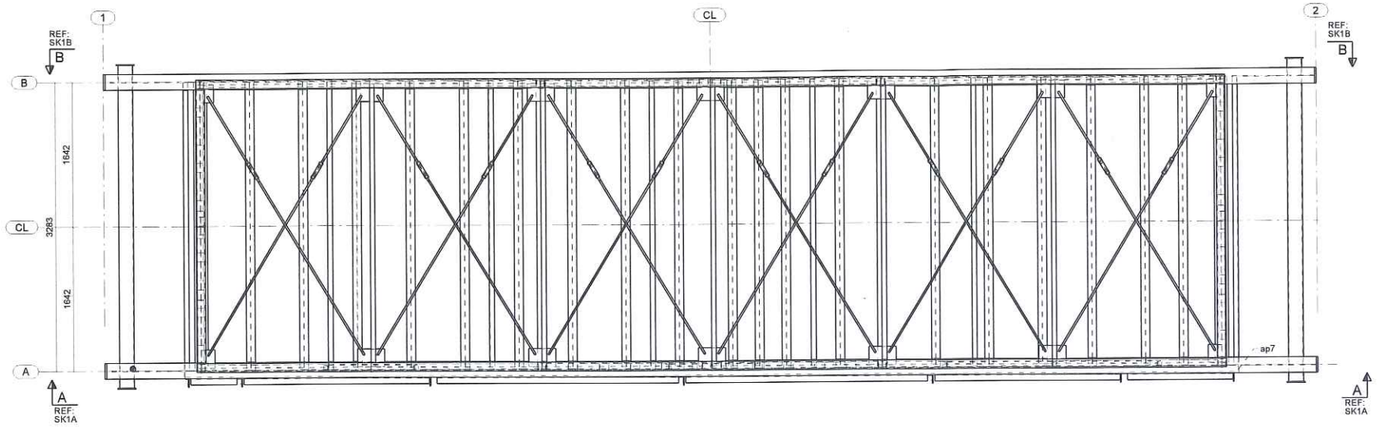
- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

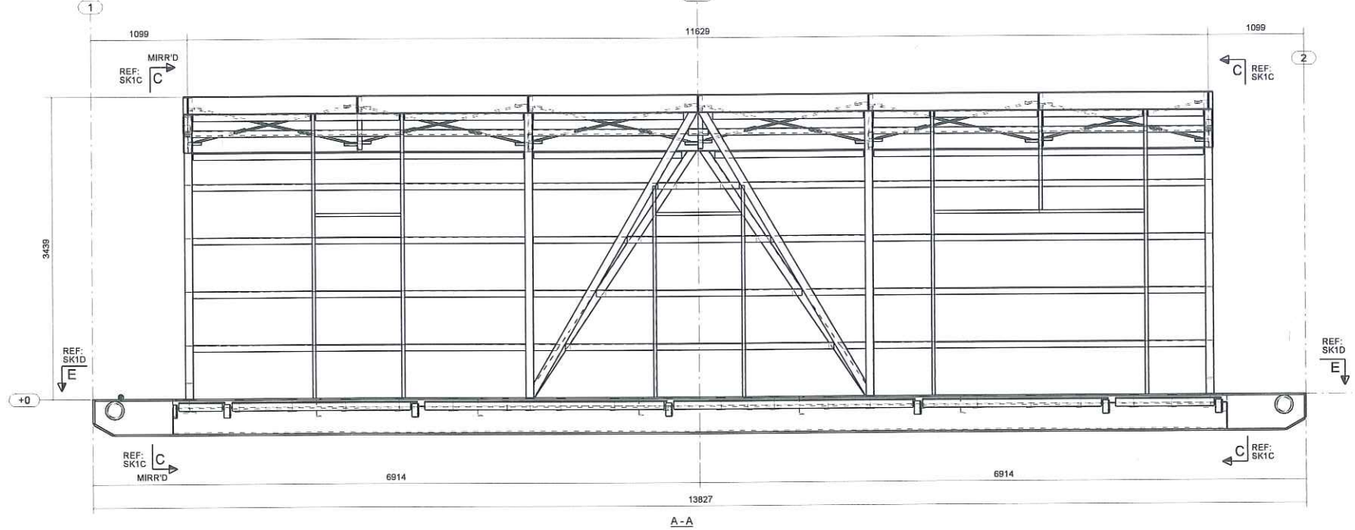
January 16, 2013

By Arlen Foster, EIT

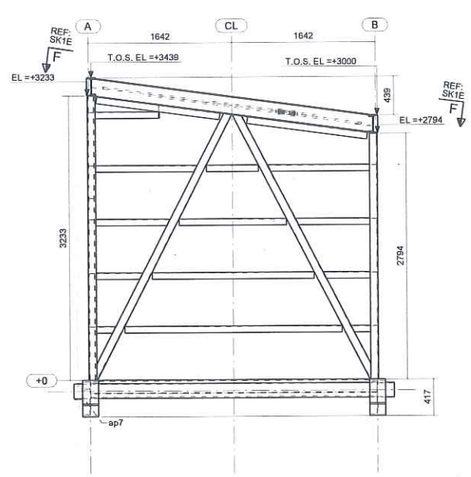
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and review by us shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the construction contract. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all subtrades.

© STANTEC ARCHITECTURE LTD.





A - A



REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

WHITEMUD IRONWORKS LIMITED
7727 - 44TH STREET
EDMONTON, ALBERTA T6P 1N5
PHONE (780) 465-5995 FAX (780) 465-5725

CUSTOMER: ArCan

PROJECT: Poratable Water System Skid

DWG. TITLE: SK1 SKID

DRAWN BY: RS	CHKD BY	JOB NUMBER	DWG NUMBER
DATE: 01/03/2013	DATE	62-125	SK1

Stantec

- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

January 16, 2013

By Arlen Foster, EIT

The review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not relieve that the Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and corrected at the job site. For information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all sub-trades.

STANTEC ARCHITECTURE LTD.

A - A

CL

RD 1080 | 1451 | 978 | 1449 | 1937 | 1939 | 738 | 1200 | 1200 | 738

1080 2531 3508 4958 6895 8334 9572 10772 11972 12709

3878 3876 3876

RD 57 | 1464 | 2477 | 3935 | 5981 | 7811 | 8505 | 9740 | 10940

T.O.S. EL =+3439

DET. D TYP.

W.P.

SPACING TYP. 13

DET. B TYP.

DET. B MIRR.

DET. C TYP.

DOOR CLARIFICATION REQ'D

DET. A

DET. A MIRR.

T.O.S. EL =-38

+0

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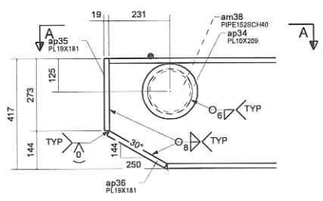
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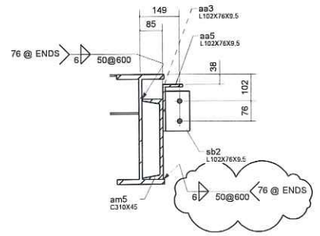
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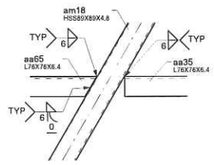
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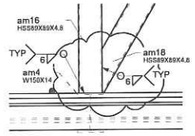
DETAIL A



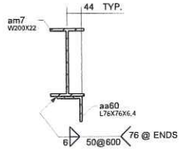
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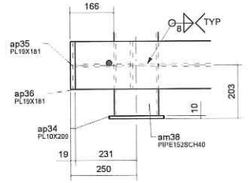
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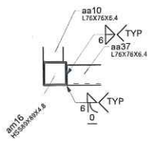
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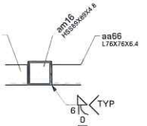
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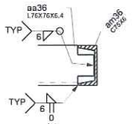
A - A



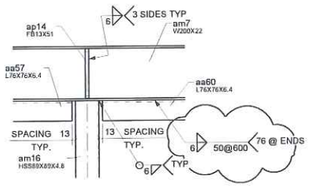
TYP. C - C



TYP. D - D



TYP. E - E



DETAIL D TYP.

APPROVER:
PLEASE VERIFY ALL CLOUDED AREAS AND DIMS.

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

WHITEMUD IRONWORKS LIMITED
7727 - 18TH STREET
EDMONTON ALBERTA T6P 1N6
PHONE (780) 465-8888 FAX (780) 465-5725

CUSTOMER:	ArCan
PROJECT:	Poratable Water System Skid
DWG. TITLE:	SK1A SKID

DRAWN BY: RS	CHKD BY	JOB NUMBER	DWG NUMBER	
DATE 01/03/2013	DATE	62-125	SK1A	1

Stantec

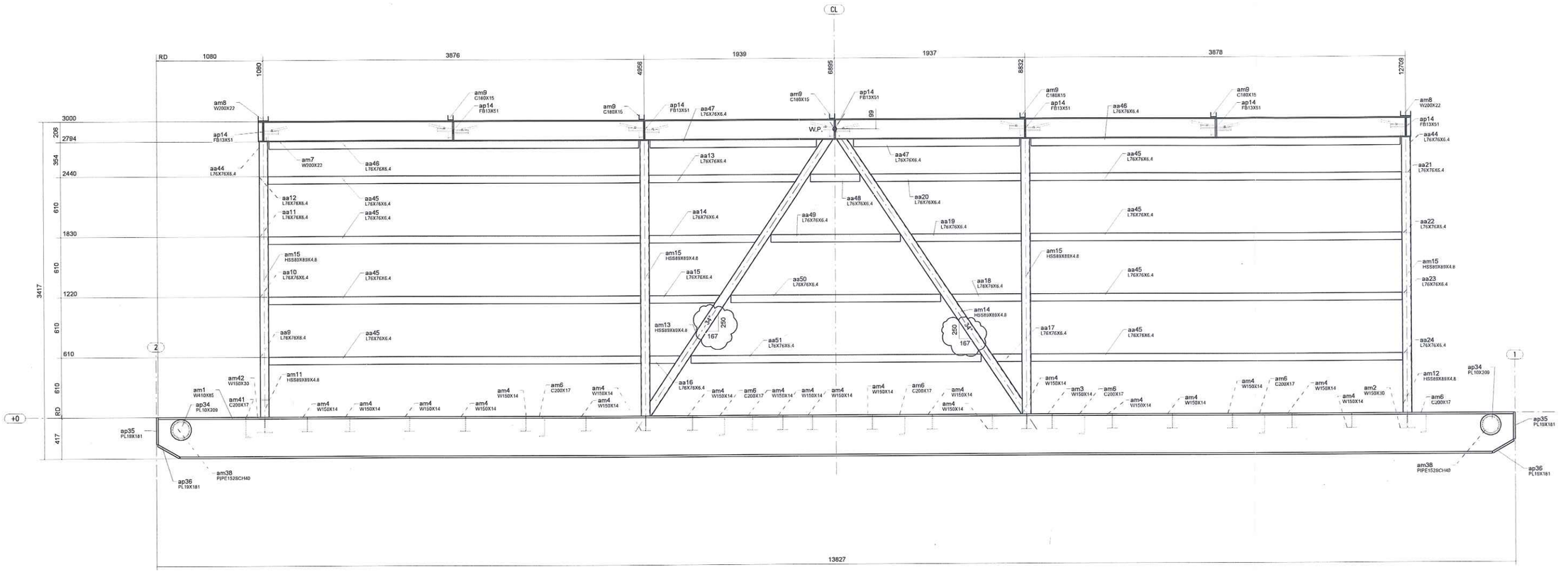
- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

January 16, 2013

By: Arlen Foster, EIT

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not relieve that Stantec Architecture Ltd. appears the detail design inherent in the shop drawings, fabrication drawings, and erection drawings of the Contractor subcontractors, and shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all subtrades.

STANTEC ARCHITECTURE LTD.



B - B

NOTE:
-REF: DWG. SK1 SKID
-TYP DETAILS FOUND ON DWG SK1A

APPROVER:
PLEASE VERIFY ALL CLOUDED AREAS AND DIMS.

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

WHITEMUD IRONWORKS LIMITED
7727 - 14TH STREET SOUTHEAST, CALGARY, ALBERTA T2C 1W2
PHONE (780) 615-5999 FAX (780) 615-1722

CUSTOMER: ArCan
PROJECT: Poratable Water System Skid
DWG. TITLE: SK1B SKID

DRAWN BY	CHKD BY	JOB NUMBER	DWG NUMBER
RS		62-125	SK1B
DATE 01/03/2013	DATE		

Stantec

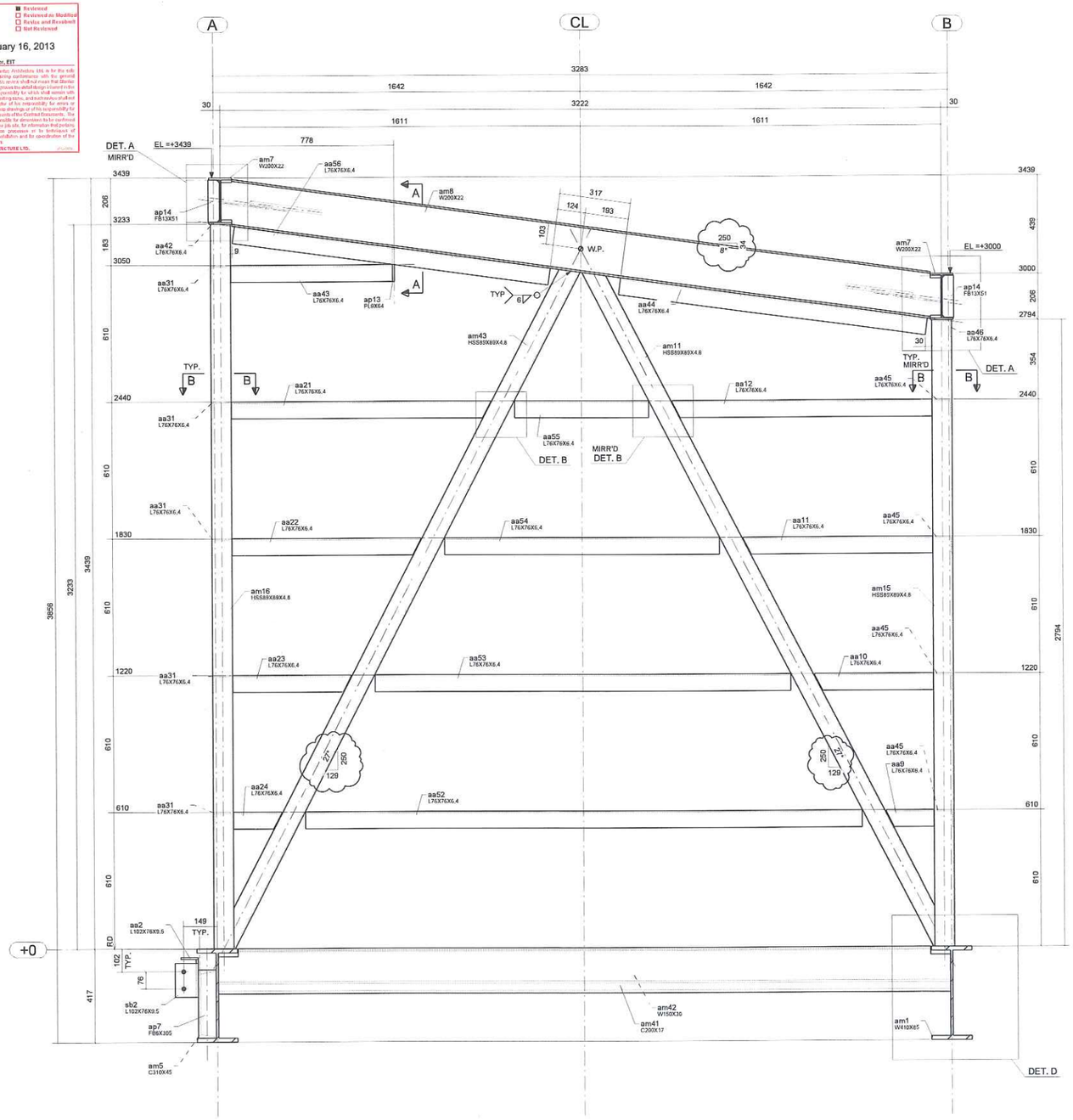
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- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

January 16, 2013

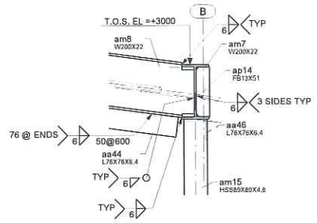
By Arlen Foster, EIT

This review by Stantec Architecture Ltd. is for the sole purpose of monitoring conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and he/she/they shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. This review shall not include review of the accuracy or adequacy of the design, construction or safety at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all subtrades.

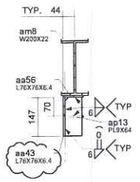
STANTEC ARCHITECTURE LTD.



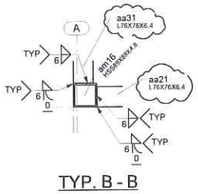
C - C



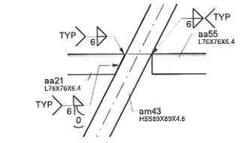
TYP DETAIL A



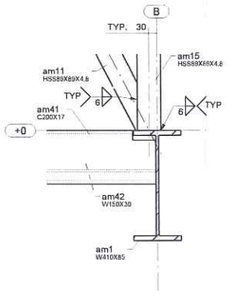
A - A



TYP. B - B



TYP DETAIL B



TYP DETAIL D

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

WHITEMUD IRONWORKS LIMITED
7727 - 43RD STREET
EDMONTON ALBERTA T6P 1N5
PHONE (780) 465-5888 FAX (780) 465-3722

CUSTOMER:	ArCan
PROJECT:	Poratable Water System Skid
DWG. TITLE:	SK1C SKID

DRAWN BY: RS	CHKD BY	JOB NUMBER	DWG NUMBER	
DATE 01/03/2013	DATE	62-125	SK1C	A

Stantec

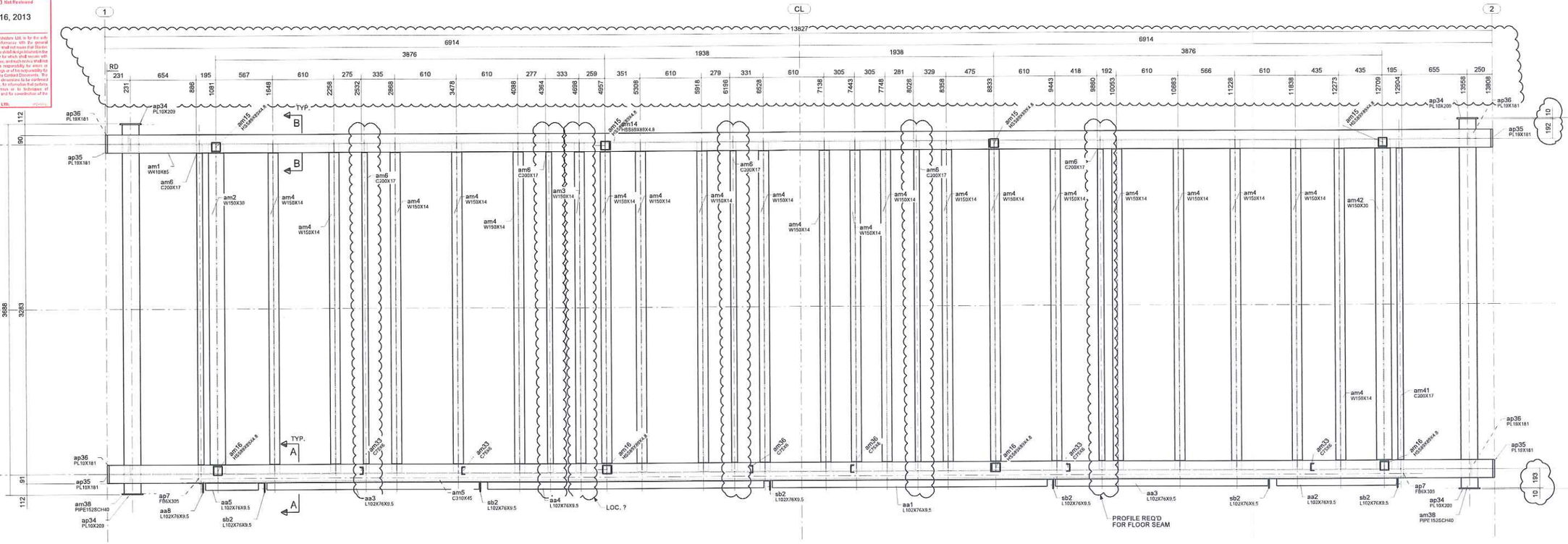
January 16, 2013

By Arlen Foster, EIT

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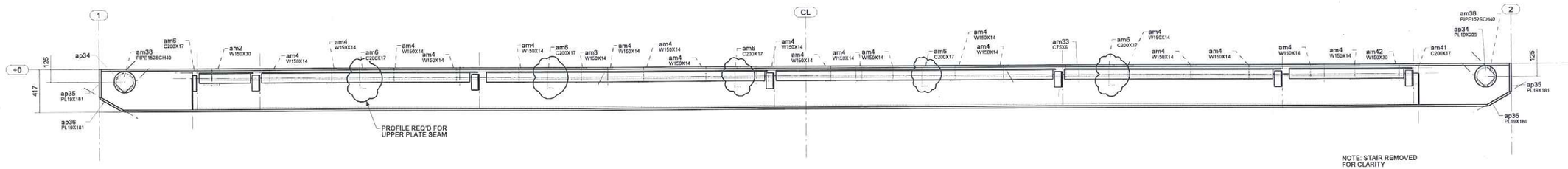
STANTEC ARCHITECTURE LTD.

- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

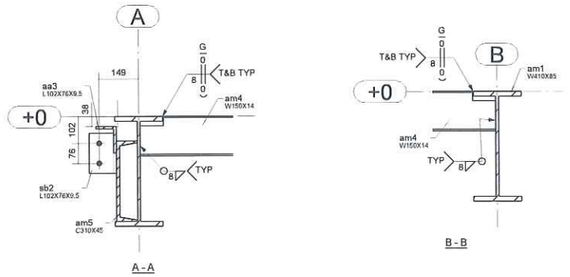


FLOOR LAYOUT

E - E



A - A



A - A

B - B

APPROVER:
PLEASE VERIFY ALL CLOUDED AREAS AND DIMS.

REV	DATE	REMARKS	ISS.NO
A	JAN.04/13	ISSUED FOR APPROVAL IFA1	IFA1

WHITEMUD IRONWORKS LIMITED
7727 - 44TH STREET EDMONTON ALBERTA T6P 1N9
PHONE (780) 465-6916 FAX (780) 465-1733

CUSTOMER: ArCan			
PROJECT: Poratable Water System Skid			
DWG. TITLE: SK1D SKID			
DRAWN BY: RS	CHKD BY:	JOB NUMBER: 62-125	DWG NUMBER: SK1D
DATE 01/03/2013	DATE:		

Stantec

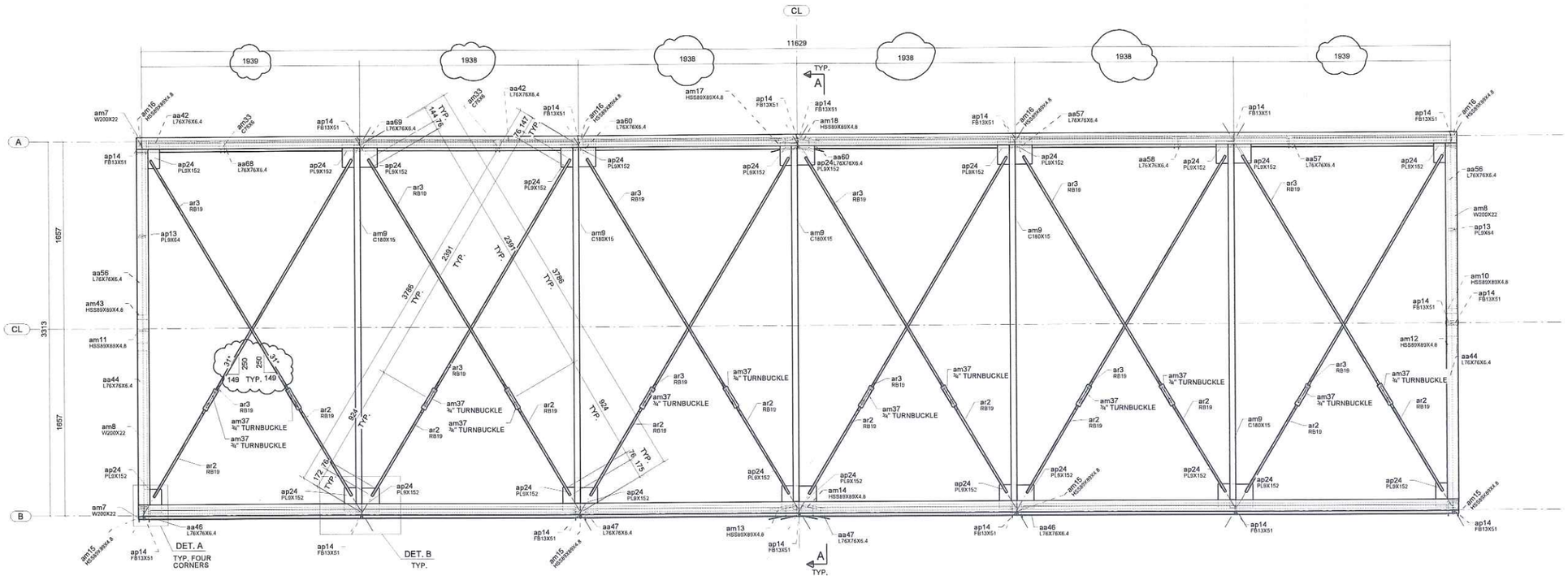
- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

January 16, 2013

By Arlen Foster, EIT

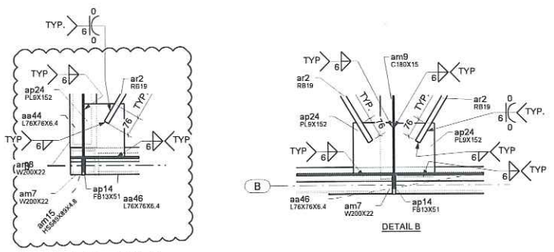
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STANTEC ARCHITECTURE LTD.



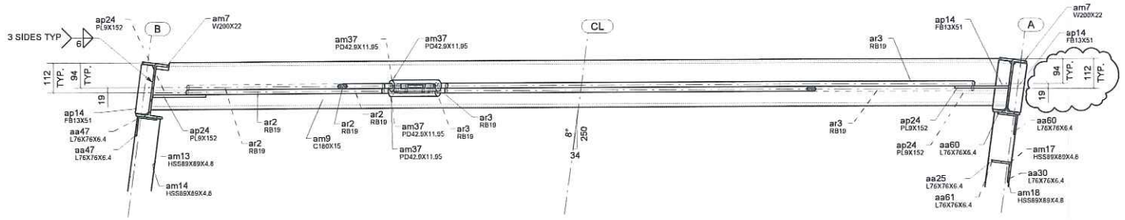
ROOF LAYOUT

F - F



TYP. DETAIL A

DETAIL B



A - A

APPROVER:
PLEASE VERIFY ALL CLOUDED AREAS AND DIMS.

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

WHITEMUD IRONWORKS LIMITED
7727 - 14TH STREET
EDMONTON, ALBERTA T6P 1N5
PHONE (780) 465-5668 FAX (780) 465-1733

CUSTOMER: ArCan			
PROJECT: Poratable Water System Skid			
DWG. TITLE: SK1E SKID			
DRAWN BY: RS	CHKD BY	JOB NUMBER: 62-125	DWG NUMBER: SK1E
DATE: 01/03/2013	DATE:		

Stantec

- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

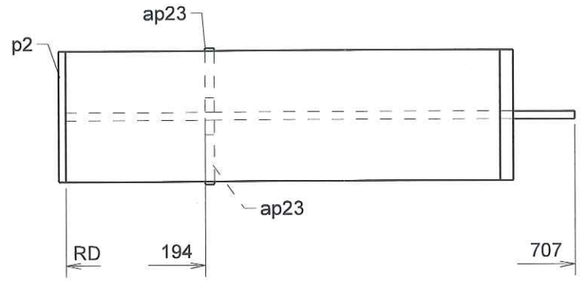
January 16, 2013

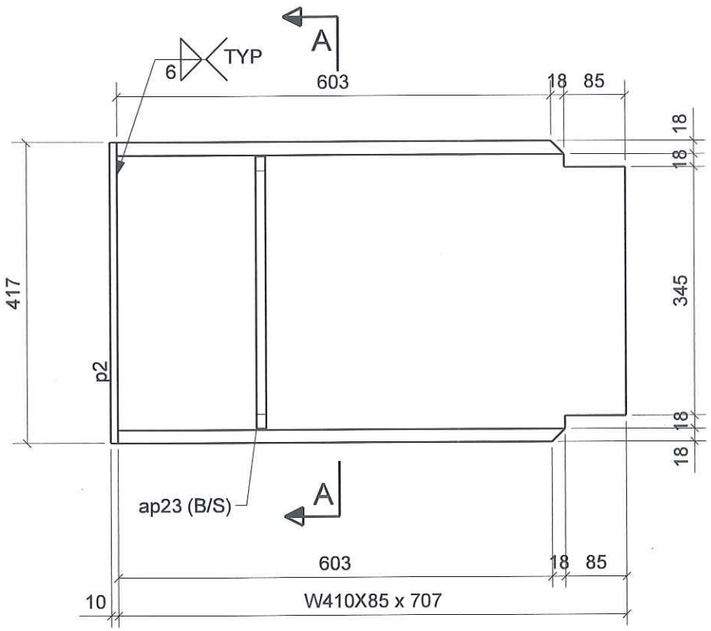
By: Arlen Foster, EIT

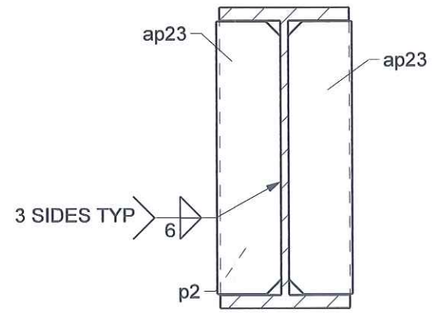
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STANTEC ARCHITECTURE LTD. (PC-1449)

UNIT QTY	FIELD BOLTS	LENGTH







A - A

4 - STUB BEAMS REQ'D - SM1

TOTAL QTY	UNIT QTY	MARK	DESCRIPTION	LENGTH	UNIT WT.	TOTAL	GRADE	REMARKS
4		SM1	STUB BEAMS			290		
4	1	SM1	W410X85	707	60	240	350W	
8	2	ap23	FB13X89	378	3	27	300W	
4	1	p2	PL10X181	417	6	24	300W	

REV	DATE	REMARKS	ISS.NO
A	JAN 04/13	ISSUED FOR APPROVAL IFA1	IFA1

REF:

MATERIAL: 350W U/NOTED

HOLES: 20.6 Ø U/N EDGE DIST: 38mm U/N

WELDS: E49XX BOLTS: 19 Ø U/N

SURF. PREP: SP3

PAINT NOTE: BLACK SELF-PRIMING

Prepared on 3D-TekleStructures

ALL WELDS 6mm U/NOTED

62-125

WHITEMUD IRONWORKS LIMITED
7727 - 18TH STREET
EDMONTON ALBERTA T6P 1N9
PHONE: (780) 465-5888 FAX: (780) 465-1722

CUSTOMER: ArCan

PROJECT: Poratable Water System Skid

DWG. TITLE: STUB BEAM

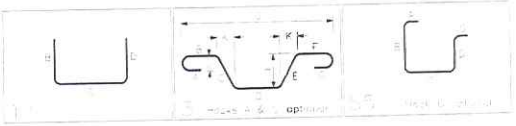
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DATE: 12/19/2012	DATE:	62-125	SM1	A

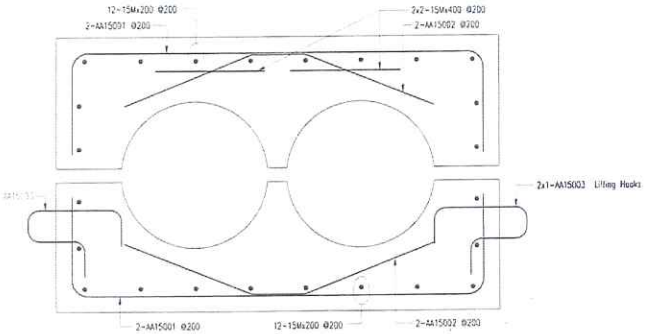
SANAQATIIT
CONSTRUCTION LTD.

REBAR FOR CONCRETE ANCHOR

Release# R6983-01 Release Description:

Bar Mark	Qty	Size	Total Length	Type	'A'	'B'	'C'	'D'	'E'	'F'	'G'	'H'	'J'	'K'	'O'	'R'
AA15001	148	15M	2250	17		375	1500	375								
AA15002	148	15M	1200	3			500	200	500			200		460	1120	
AA15003	74	15M	980	S5	140	350	130	220			140					





INTAKE CONCRETE ANCHOR

(37 Req'd. 1 Shown)

Stantec

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

By _____

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STANTEC ARCHITECTURE LTD. (PC 1449)

SANAARTIT CONST
SHOP DRAWING REVIEWED
BY
JUN 21, 2012
☑ REVIEWED
☐ REVIEWED AS NOTED
☐ REVISE AND RESUBMIT

No.	Description	Date	By
1	Revised as Per Reviewed Drawing	06/20/2012	EYC

Revisions and Issue Record

The full intent and purpose of this drawing is the placing of reinforcing steel bars ONLY. It is NOT to be used as a means of communication between the Architect, Engineer, Contractor or any other Sub-trades.

THIS DRAWING IS NOT TO BE SCALED.

Harris Steel Services Limited
6513 44TH STREET LLOYDMINSTER AB T9V 2E8
TEL. (780)-808-7000 FAX. (780)-808-8011

Project: Pipe Anchors Nunavut

Drawing: INTAKE LINES
Concrete Anchors

Customer: ARCAN Artic Canada Construction Ltd.

Contractor:

Refer to Release:

Date	Drawn	Chkd.	JOB No.	Dwg. No.
06/19/12	EYC		513R6983	R6983-001

C:\DRAWINGS\2012 Field Jobs\513R6983 (Pipe Anchors Nunavut)\R6983-001 (Pipe Anchors).dwg

SANAQATIIT
CONSTRUCTION LTD.

UTILITY VAULT

SANAQATIIT CONSTRUCTION LTD.

Shop Drawing Transmittal

Project Name: Potable Water System – Phase I

Sanaqatiit Project Number: 12-505 **Submittal Number:** 12-505-19

Owner Project Number: 11-4002

Product Description: Utility Vault

Specification Number:

Total Pages: 9 including cover

Submitted by: Sarah Fox

To: Warren McLeod, Stantec **CC:** Arlen Foster, Stantec

Via: Electronic Submission **Date:** May 7 2013

Notes:

The attached pages include the submittal for the underground utility vault

Stantec

☐ Reviewed
■ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

May 7, 2013

By. Arlen Foster, EIT

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STANTEC ARCHITECTURE LTD. (PC-1449)

REVIEWED
By Sarah Fox at 9:40 am, May 07, 2013

Stantec

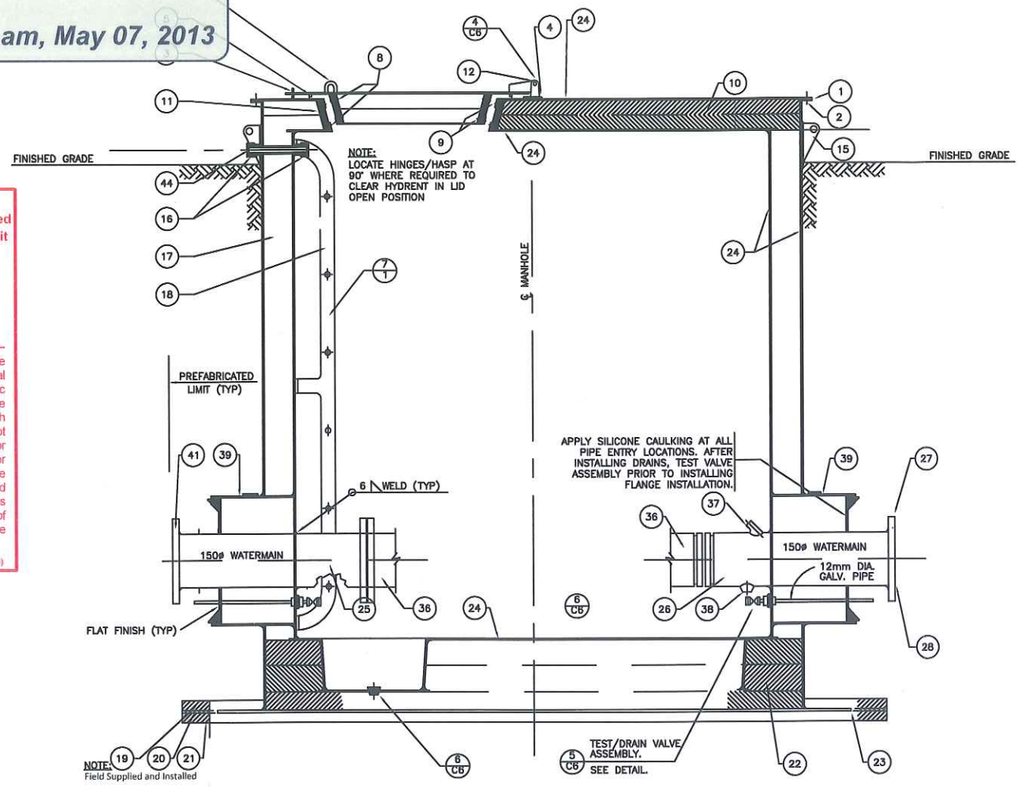
- ☐ Reviewed
- ■ Reviewed as Modified
- ☐ Revise and Resubmit
- ☐ Not Reviewed

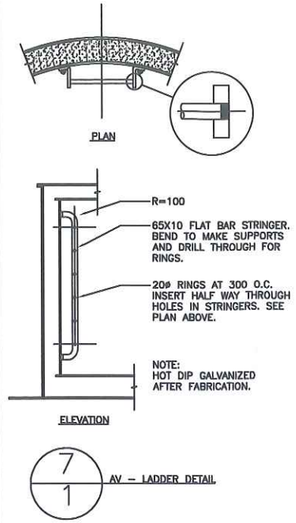
May 7, 2013

By: Arlen Foster, EIT

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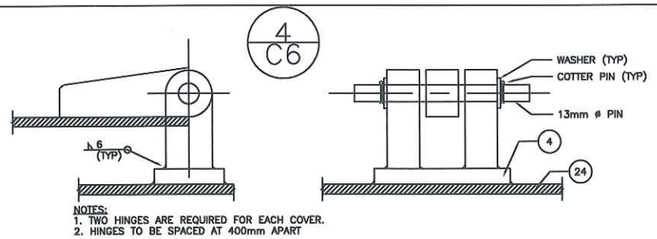
STANTEC ARCHITECTURE LTD. (PC-1449)

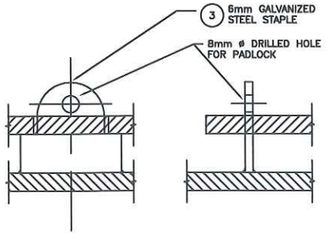


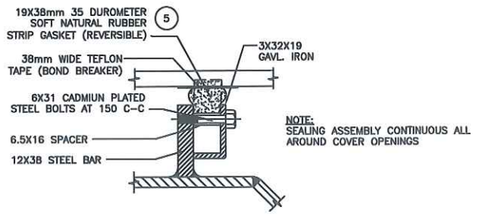


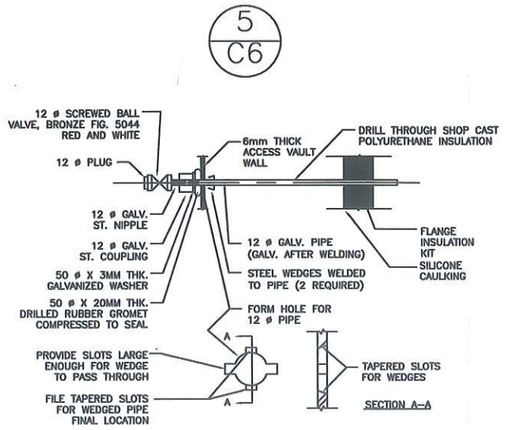
KEY NOTES:

1. GASKET 50mm X 3mm , COMPRESSIBLE NEOPRENE RUBBER
2. 12 GALVANIZED STEEL BOLTS, NUTS AND WASHERS 210mm EQUAL SPACING
3. HASP ASSEMBLY (DETAIL 5)
4. 5Omm X 60mm X 12mm STEEL HINGE BASE PLATE WELDED TO ACCESS VAULT TOP
5. 19mm X 38mm 35 DUROMETER SOFT NATURAL RUBBER STRIP (REVERSIBLE) GASKET TO ACHIVE AIRTIGHT & WATERPROOF SEAL ALL AROUND
6. 5Omm X 4mm STEEL BAR WELDED TO LID
7. LIFTING EYE 12mm0 STEEL X 40mm INSIDE LOOP
8. 6mm GALV. STEEL BOLT, NUT, WASHER@ 100mm CENTERS
9. #12-30 PAN HEAD METAL SCREWS@ 100mm CENTERS
10. POLYURETHANE SHEET INUSLATION, 240 kPa CUT TO SIZE
11. 20mm THICK HIGH DENSITY POLYETHYLENE
12. HINGES SPACED @ 400mm APPART.
15. Lifting Lugs
16. 65mm THREADED STEEL HALF NIPPLE CONDUIT SLEEVE (FOR EXTENSION CORD / SUMP PUMP DISCHARGE) IN APPROPRIATE LOCATION, C/W THR. GALV. STEEL CAPS
17. SPRAYED POLYURETHANE INSULATION 240kPa.
18. LADDER, LENGTH AS REQURIED. 450mm WIDE MADE FROM 65mm X 12mm FLAT BAR VERTICALS & SUPPORTS WITH 20mm0 RUNGS. WELDED CONSTRUCTION THROUGHOUT ALL EDGES TO BE GROUND SMOOTH GALVANIZED AFTER FABRICATION. DOW CHEMICAL HI60,410 kPa COMPRESSIVE STRENGTH.
20. FILLER PIECE 10mm THICK STYROFOAM HI60
21. 38mm THICK X 2.438 X 2438 STYROFOAM HI 60
22. POLYURETHANE SHEET INSULATION CUT TO SIZE,240kPa
23. 10mm THICK X2438 X 2438 SQUARE STEEL BASE PLATE
24. 6mm THICK STEEL PLATE ACCESS VAULT CONSTRUCTION
25. MAY OR MAY NOT BE PART OF VAULT, SANITARY SEWER ENTRY, SCHEDULE 80 STEEL PIPE TRANSITION PIECE, DIAMETER AS REQUIRED
26. 6mm THICK STEEL PLATE ACCESS VAULT CONSTRUCTION DIAMETER AS REQUIRED
27. WELDED STEEL SLIP-ON FLANGE, SIZE AS REQUIRED.
28. WATER MAIN STUB END, H.D.P.E. DRII,ASA 125# CAST IRON (DUCTILE) METAL BACKUP FLANGE,STUB END GASKET, CADMIUM PLATED NUTS, BOLTS & WASHERS
36. HOT DIPPED GALVANIZED STEEL PIPING
37. 5Omm LATROLET
38. 25mm THREADOLET
39. STEEL RING SECTION WELDED TO ACCESS VAULT OUTER WALL, 6mm THICK. OD TO MATCH FRPI ISULATION KIT OUTER DIAMETER.
41. WELDED STEEL SLIP-QN FLANGE,SIZE TO SUIT MAIN
44. POLYETHYLENE LINER TUBE, PACK WITH STYROFOAM INSULATION.





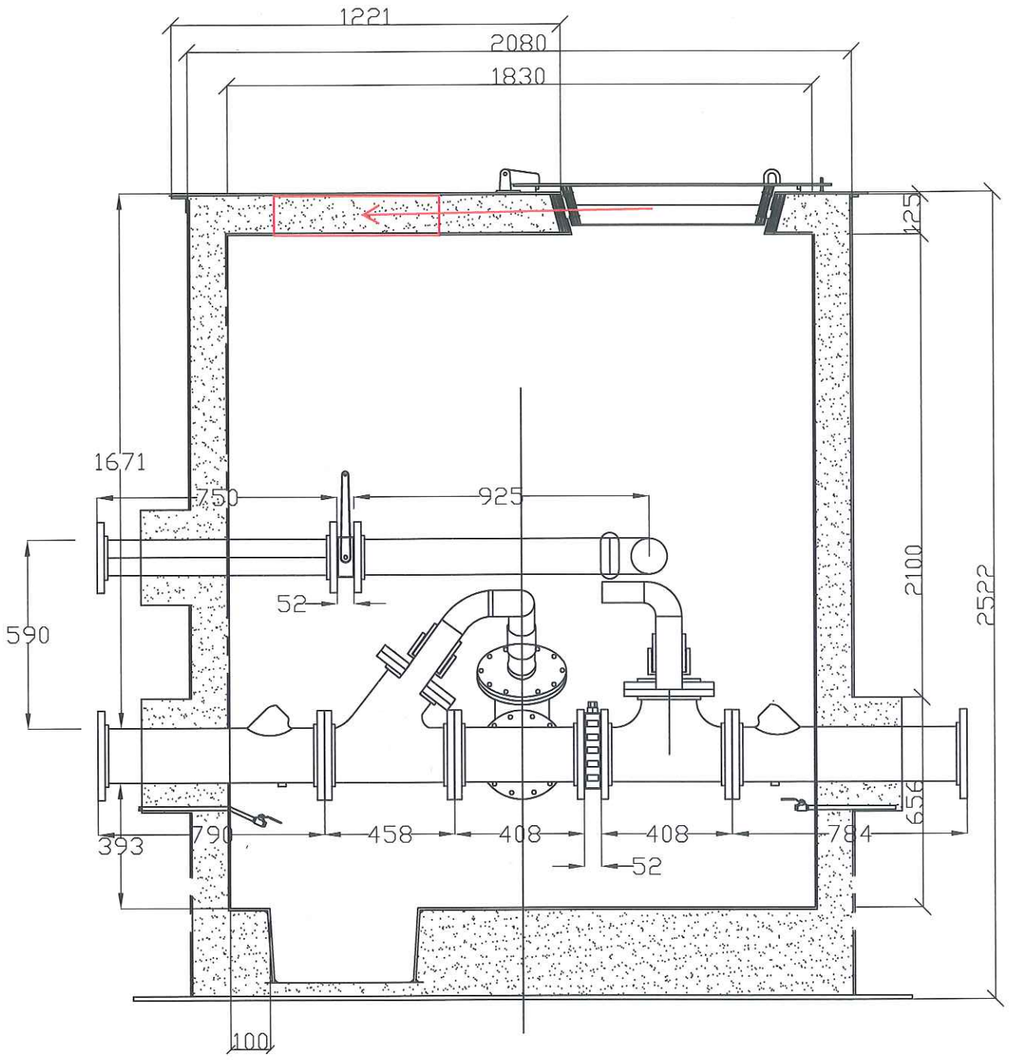


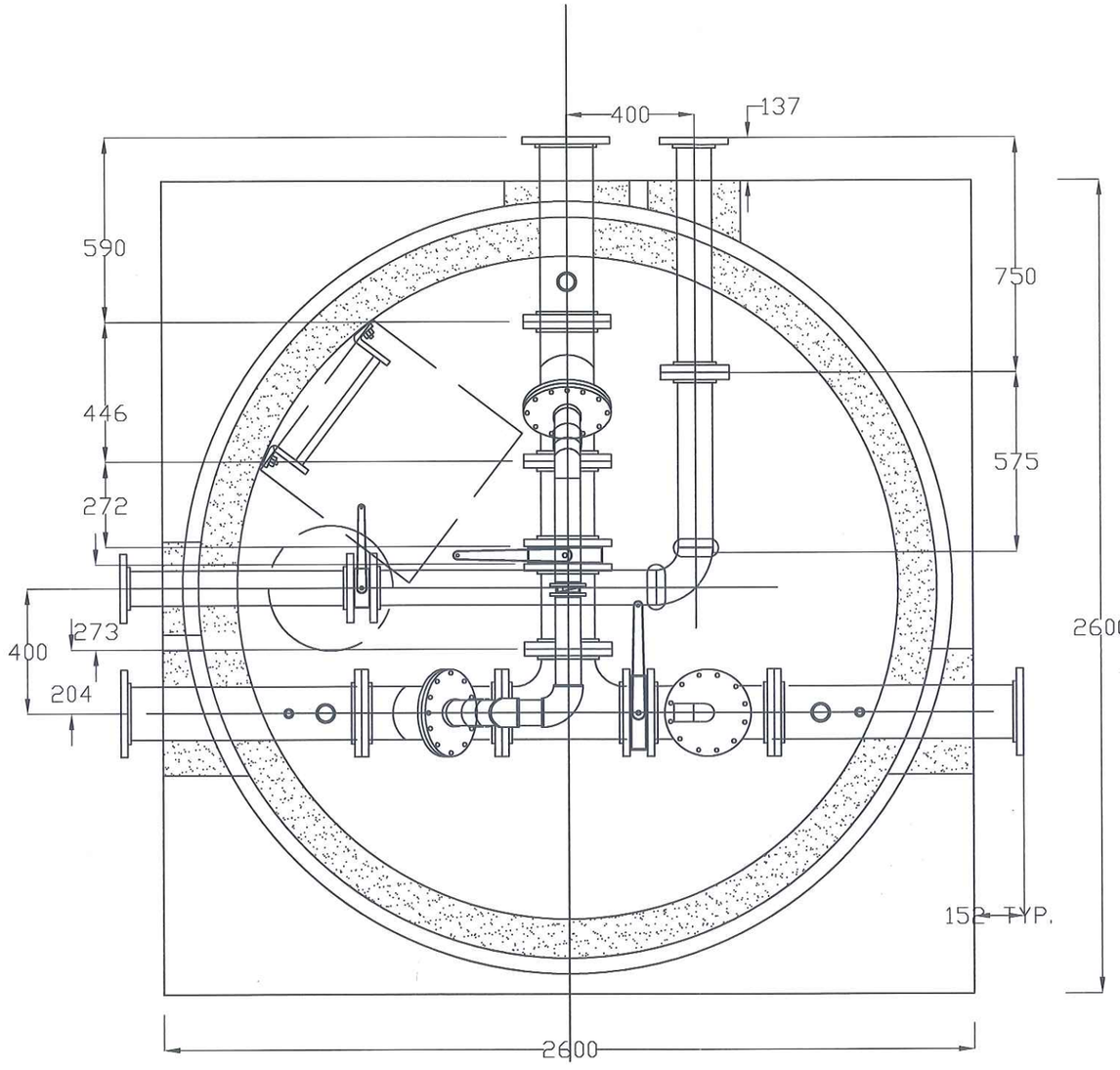


SCHENDEL MECHANICAL CONTRACTING LTD.

PROJECT:	CAMBRIDGE BAY
PROJECT:	Steel Vaults, C-504
DATE:	FEB 12, 2013
DWG. #	1
SCALE:	NONE

Access hatch should be shown on the opposite side to match that shown in the plan view.





Stantec

- ☐ Reviewed
- ■ Reviewed as Modified
- ☐ Revise and Resubmit
- ☐ Not Reviewed

May 7, 2013

By: Arlen Foster, EIT

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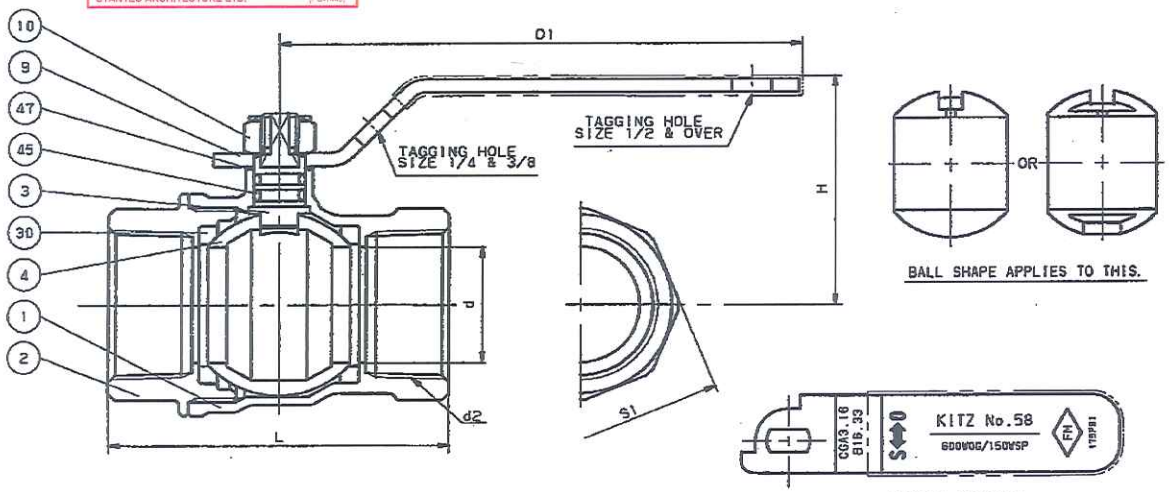
STANTEC ARCHITECTURE LTD. (PC-1449)

As Builds

SCHENDEL MECHANICAL CONTRACTING LTD.

PROJECT:	CAMBRIDGE BAY
PROJECT:	Steel Vaults, C-504
DATE:	FEB 12, 2013
DWG. #	2
SCALE:	NONE

Stantec
☐ Reviewed
■ Reviewed as Modified
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☐ Not Reviewed
May 7, 2013
By: Arlen Foster, EIT
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STANTEC ARCHITECTURE LTD. (PC-1449)



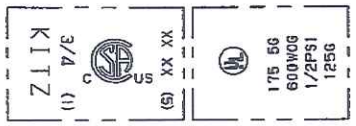
BALL SHAPE APPLIES TO THIS.

HANDLE MARKING

DIMENSIONS UNIT: mm

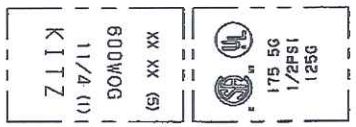
NOMINAL SIZE	d	d2	H	D1	L	S1		
1/4	10	NPT1/4	37	70	42	20		
3/8	10	NPT3/8	37	70	42	22		
1/2	15	NPT1/2	40	80	53	26		
3/4	20	NPT3/4	43	80	60	32		
1	25	NPT 1	50	110	72	39		
1.1/4	32	NPT1.1/4	55	110	84	48		
1.1/2	40	NPT1.1/2	65	150	92	55		
2	50	NPT 2	72	150	110	68		

NOTE (1) VALVE SIZE IDENTIFICATION.
(2) Cr PLATING.
(3) ZINC DICHROMATE PLATED AND PLASTIC COVERING.
(4) Ni PLATEING.
(5) DATE CODE MARKING.



ONE SIDE THE OTHER SIDE

SIZE 1/4-1



ONE SIDE THE OTHER SIDE

SIZE 11/4-2

MARKING ON THE BODY

NO	NAME OF PARTS	QTY	MATERIALS	SPECIFICATIONS
				ASTM SPEC.
1	BODY	1	FORGED BRASS	B283 NO. C37700
2	BODY CAP	1	FORGED BRASS	B283 NO. C37700
3	STEM	1	BRASS ROD (4)	B16
4	BALL	1	FORGED BRASS (2)	B283 NO. C37700
9	HANDLE	1	CARBON STEEL (3)	
10	HANDLE NUT	1	CARBON STEEL	
30	BALL SEAT	2	PTFE	
45	O RING	2	FPM	
47	THRUST WASHER	1	PBT	

TEST PRESSURE		SHELL	SEAT
	HYDROSTATIC	900 psi	psi
	AIR	psi	80 psi

STANDARD		
	FACE TO FACE OR END TO END	KITZ STANDARD
	END CONNECTION	ANSI/ASME B1.20.1
	WALL THICKNESS	KITZ STANDARD
	FIGURE	AKSZA/MODEL NO.58

TYPE 600 FORGED BRASS BALL VALVES

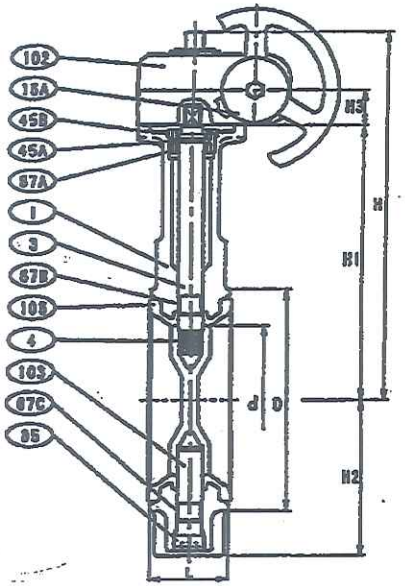
DATE APPD	APR.23.04	DRAWING NO	
APPD BY	S. NAITO	925-C60069	
CHKD BY	Y. HASHIOKA	REV-00	
DSGND BY	T. AIKAWA		
DRAWD BY	M. HORIGOME		

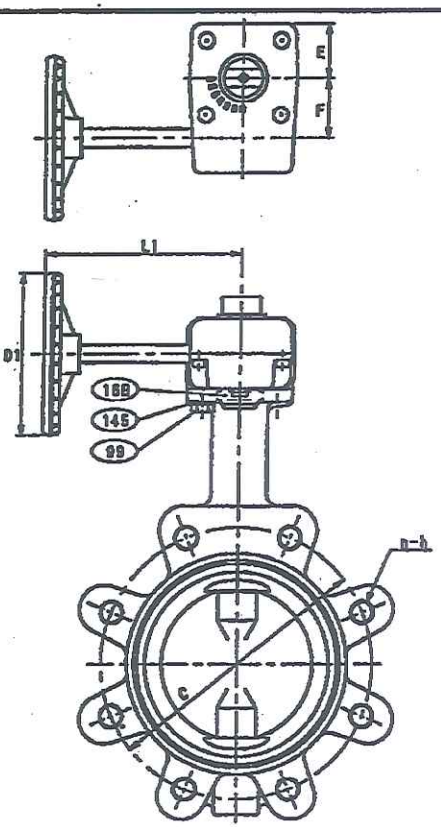
MARK	DATE	BY

KITZ CORPORATION

KITZ

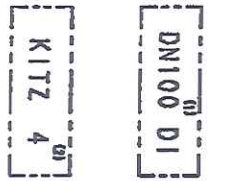
Stantec
Reviewed
Reviewed as Modified
Revise and Resubmit
☐ Not Reviewed
May 7, 2013
By: Arlen Foster, EIT
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STANTEC ARCHITECTURE LTD. (PC-1449)







GEAR TYPE:No. 0



ONE SIDE THE OTHER SIDE

MARKING ON THE BODY

NO.	NAME OF PARTS	QTY	MATERIALS	SPECIFICATION EQUIV. ASTM	EQUIV. ASTM
1	BODY	1	DUCTILE IRON	A536	
3	STEM	1	STAINLESS STEEL	A276 TYPE410	
4	DISC	1	ALUMINUM-BRONZE		
18A	NAME PLATE	1	ALUMINUM		
18B	NAME PLATE	1	ALUMINUM		
45A	O RING	1		NBR	EPDM
45B	O RING	1		NBR	EPDM
87A	BEARING	1	POLYACETAL		
87B	STEM BEARING	1	G/F PTFE		
87C	STEM BEARING	1	G/F PTFE		
85	PLUG	1	ZINC DIE-CAST (3)		
99	SET BOLT	4	CARBON STEEL		
102	GEAR UNIT	1			
103	BOTTOM STEM	1	STAINLESS STEEL	A276 TYPE410	
108	SEAT RUBBER (4)	1		NBR	EPDM
145	SPRING WASHER	4	CARBON STEEL		

FIGURE		☐ G-200DJLA	☐ G-200DJLAE
HAS MODEL No.		S122BG	S122EG
TEST PRESSURE	SHELL	SEAT	
HYDROSTATIC	300 lb/in² 2.07 MPa	220 lb/in² 1.52 MPa	
AIR	lb/in² MPa	85 lb/in² 0.59 MPa	
STANDARD	FACE TO FACE OR END TO END	MSS SP67	
	END CONNECTION	LUG TYPE (ASME B 16.5 CL.150)	
	WALL THICKNESS	KITZ STANDARD	

DIMENSIONS. UNIT:mm

NOMINAL SIZE									END CONNECTION							GEAR UNIT TYPE		
In.	mm	d	H	H1	H2	H3	L	D	C	h	n	D1	L1	E	F			
2	50	50	184	147	87	18.5	42.8	90	120.5	5/8-11UNC	4	80	121.5	29	28	NO. 0		
2.1/2	65	65	202	155	75	18.5	46	104	139.6	5/8-11UNC	4	80	121.5	29	28	NO. 0		
~~3~~	~~80~~	~~80~~	~~230~~	~~173~~	~~91~~	~~24~~	~~46~~	~~124~~	~~152.5~~	~~5/8-11UNC~~	~~4~~	~~110~~	~~135~~	~~36.5~~	~~40.5~~	~~NO.1~~		
4	100	100	246	183	104	24	52.3	146	190.5	5/8-11UNC	8	110	135	36.5	40.5	NO. 1		
~~5~~	~~125~~	~~125~~	~~274~~	~~211~~	~~127~~	~~24~~	~~55.6~~	~~178~~	~~216~~	~~3/4-10UNC~~	~~8~~	~~110~~	~~150~~	~~36.5~~	~~40.5~~	~~NO.1~~		
6	150	150	286	223	139	24	55.6	206	241.5	3/4-10UNC	8	110	150	36.5	40.5	NO. 1		
~~8~~	~~200~~	~~197~~	~~325~~	~~248~~	~~168~~	~~31~~	~~60.5~~	~~257~~	~~298.5~~	~~3/4-10UNC~~	~~8~~	~~170~~	~~180~~	~~51~~	~~63~~	~~NO.2~~		

NOTE (1) VALVE SIZE(mm) IDENTIFICATION.
(2) VALVE SIZE(Inch) IDENTIFICATION.
(3) CHROMATE COATING.
(4) VULCANIZED TO THE BODY.
(5) THE VALVES ARE RATED FOR DEAD END SERVICE WITH THE DOWN STREAM FLANGED REMOVE AT 200PSI 2°-8°.
(6) THE LINE PAINTED ON TOP OF THE STEM INDICATES THE DISC DIRECTION.

KITZ

CLASS 200 DUCTILE IRON BUTTERFLY VALVES

GEAR OPERATED.

DATE APPD	APR. 21'03	DRAWING NO	
APPD BY	Y. SATO	947-B10107	
CHKD BY	K. SAKYU	REV-00	
DSGND BY	H. NAKAGAWA		
DRAWD BY	K. KOIKE		

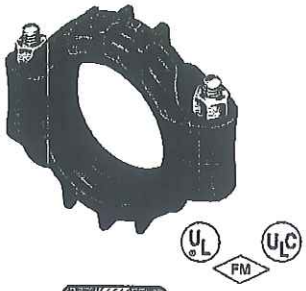
MARK	DATE	BY

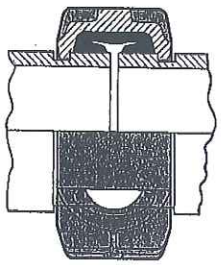
KITZ CORPORATION

Victaulic®
An ISO 9001 certified company

Style 77 Standard Flexible Coupling

PRODUCT DESCRIPTION





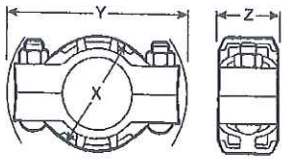
Style 77 couplings are designed with cross-ribbed construction to provide a strong component for pressure piping systems. Sizes ¾ -12" (26.7 - 323.9 mm) are two-piece housings. Sizes 14 - 22" (355.6 - 559.0 mm) are cast in four identical segments, with larger sizes cast in six segments. This eases handling and assures concentricity.

All sizes are provided with plated bolts and nuts. Galvanized and stainless steel housings are also available.

Independent testing has shown the Style 77 coupling to be an effective stress relief and vibration attenuation device providing performance superior to braided steel and elastomeric arch-type connectors when used in close proximity to the source of vibration. Refer to 26.04 for vibration information.

Independent testing has shown that Victaulic Style 77 and 75 flexible couplings and Style 07 Zero-Flex® rigid couplings provide exceptional functionality during and after earthquake conditions. Refer to 26.05 for further information.

DIMENSIONS



¾ - 12" Sizes

Stantec

☐ Reviewed
■ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

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STANTEC ARCHITECTURE LTD. (PC-1449)

06.04-1B

SIZE Nominal Inches Actual mm	Max. Work Pres. PSI* kPa	Max. End Load Lbs.* N	Allow. Pipe End † Sep. In./mm	Deflect. Fr. C_L † Per Cplg. Deg.	Deflect. Fr. C_L † Pipe In./Ft. mm/m	@ Bolt/Nut No. - Size Inches mm	Dimensions Inches/millimeters X	Y	Z	Aprx. Wgt. Each Lbs. kg
¾ 26.7	1,000 6900	865 3850	0 - 0.06 0 - 1.6	3° – 24′	0.72 60	2 - ⅜ × 2	2.13 54	4.00 102	1.75 44	1.1 0.5
1 33.4	1,000 6900	1,360 6050	0 - 0.06 0 - 1.6	2° – 43′	0.57 48	2 - ⅜ × 2	2.38	4.12 105	1.75 44	1.2 0.5
1¼ 42.2	1,000 6900	2,160 9610	0 - 0.06 0 - 1.6	2° – 10′	0.45 38	2 - ½ × 2½	2.65 67	5.00 127	1.88 48	2.0 0.9
1½ 48.3	1,000 6900	2,835 12615	0 - 0.06 0 - 1.6	1° – 56′	0.40 33	2 - ½ × 2½	3.13 79	5.38 137	1.88 48	2.1 1.0
2 60.3	1,000 6900	4,430 19715	0 - 0.06 0 - 1.6	1° – 31′	0.32 26	2 - ½ × 2½	3.63 92	5.88 149	1.88 48	2.6 1.2
2½ 73.0	1,000 6900	6,490 28880	0 - 0.06 0 - 1.6	1° – 15′	0.26 22	2 - ½ × 2¾	4.25 108	6.50 165	1.88 48	3.1 1.4
3 O.D. 76.1	1,000 6900	7,070 31460	0 - 0.06 0 - 1.6	1° – 12′	0.26 22	2 - ½ × 2¾	4.38 111	6.63 168	1.88 48	3.2 1.5
3 88.9	1,000 6900	9,620 46810	0 - 0.06 0 - 1.6	1° – 2′	0.22 18	2 - ½ × 2¾	5.00 127	7.13 181	1.88 48	3.7 1.7
3½ 101.6	1,000 6900	12,565 55915	0 - 0.06 0 - 1.6	0° – 34′	0.19 16	2 - ⅝ × 3¼	5.63 143	8.25 210	1.88 48	5.6 2.5
4 114.3	1,000 6900	15,900 70755	0 - 0.13 0 - 3.2	1° – 36′	0.34 28	2 - ⅝ × 3¼	6.13 156	8.88 226	2.13 54	6.7 3.0
4½ O.D. 108.0	1,000 6900	14,190 63100	0 - 0.13 0 - 3.2	1° – 41′	0.35 29	2 - 16 × 82.5	6.00 152	8.63 219	2.13 54	11.0 5.0
5 141.3	1,000 6900	24,300 108135	0 - 0.13 0 - 3.2	1° – 18′	0.27 23	2 - ¾ × 4¼	7.75 197	10.65 270	2.13 54	10.6 4.8
5¼ O.D. 133.0	1,000 6900	21,635 96275	0 - 0.13 0 - 3.2	1° – 21′	0.28 24	2 - 20 × 108	7.63 194	10.38 264	2.13 54	10.0 4.5
5½ O.D. 139.7	1,000 6900	23,745 105665	0 - 0.13 0 - 3.2	1° – 18′	0.28 24	2 - 20 × 108	8.63 219	10.65 270	2.13 54	10.0 4.5
6 168.3	1,000 6900	34,470 153390	0 - 0.13 0 - 3.2	1° – 5′	0.23 18	2 - ¾ × 4¼	8.63 219	11.88 302	2.13 54	12.0 5.4
6¼ O.D. 159.0	1,000 6900	30,665 136460	0 - 0.13 0 - 3.2	1° – 9′	0.24 20	2 - 20 × 108	8.63 219	11.50 292	2.13 54	13.2 6.0
6½ O.D. 165.1	1,000 6900	33,185 147660	0 - 0.13 0 - 3.2	1° – 6′	0.23 19	2 - ¾ × 4¼	8.88 226	11.63 295	2.13 54	13.2 6.0
8 § 219.1	800 5500	46,740 207995	0 - 0.13 0 - 3.2	0° – 50′	0.18 14	2 - ⅞ × 5	11.00 279	14.75 375	2.50 63	20.8 9.4

Table continued on page 2.

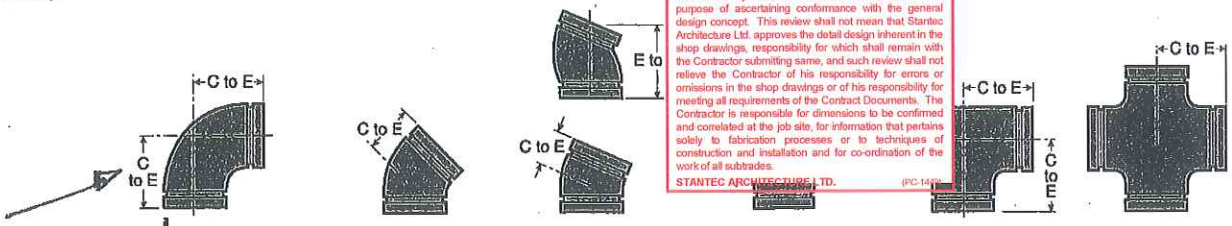
*†@ Refer to notes on page 2.

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Stantec
☐ Reviewed
■ Reviewed as Modified
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☐ Not Reviewed
May 7, 2013
By: Arlen Foster, EIT
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STANTEC ARCHITECTURE LTD. (PC-14)

Fittings

(Ductile iron)



07.01-2D

SIZE Nominal Inches Actual mm	No. 10 90° Elbow C to E Inches mm	No. 10 90° Elbow Aprx. Wgt. Ea. Lbs. kg	No. 11 45° Elbow C to E Inches mm	No. 11 45° Elbow Aprx. Wgt. Ea. Lbs. kg	No. 12 22½° Elbow C to E Inches mm	No. 12 22½° Elbow Aprx. Wgt. Ea. Lbs. kg	No. 13 11¼° Elbow C to E Inches mm	No. 13 11¼° Elbow Approx. Wgt. Ea. Lbs. kg	No. 20 Tee C to E Inches mm	No. 20 Tee Aprx. Wgt. Ea. Lbs. kg	No. 35 Cross (sw) C to E Inches mm	No. 35 Cross (sw) Aprx. Wgt. Ea. Lbs. kg
¾ 26.7	2.25 57	0.5 0.2	1.50 38	0.5 0.2	1.63 sw 41	– –	1.38 sw 35	– –	2.25 57	0.6 0.3	2.25 57	0.9 0.4
1 33.4	2.25 57	0.6 0.3	1.75 44	0.6 0.3	3.25 @ 83	0.6 0.3	1.38 sw 35	0.3 0.1	2.25 57	1.0 0.5	2.25 57	1.3 0.6
1¼ 42.2	2.75 70	1.0 0.5	1.75 44	0.9 0.4	1.75 44	0.8 0.4	1.38 sw 35	0.5 0.2	2.75 70	1.5 0.7	2.75 1.0	2.1 1.0
1½ 48.3	2.75 70	1.2 0.5	1.75 44	0.9 0.4	1.75 44	0.8 0.4	1.38 sw 35	0.5 0.2	2.75 70	2.0 0.9	2.75 70	2.5 1.1
2 60.3	3.25 83	1.8 0.8	2.00 51	1.3 0.6	3.75 @ 95	1.4 0.6	1.38 35	1.0 0.5	3.25 83	3.0 1.4	3.25 83	3.8 1.7
2½ 73.0	3.75 95	3.2 1.5	2.25 57	2.2 1.0	4.00 @ 102	2.3 1.0	1.50 38	1.1 0.5	3.75 95	4.3 2.0	3.75 95	6.1 2.8
3 O.D. 76.1	3.75 95	3.7 1.7	2.25 57	3.4 1.5	– –	– –	– –	– –	3.75 95	5.2 2.4	– –	– –
3 88.9	4.25 108	4.5 2.0	2.50 64	3.1 1.4	4.50 @ 114	3.1 1.4	1.50 38	2.1 1.0	4.25 108	6.8 3.0	4.25 108	10.5 4.8
3½ 101.6	4.50 114	5.6 2.5	2.75 70	4.3 2.0	2.50 sw 64	4.0 1.8	1.75 sw 44	2.7 1.2	4.50 sw 114	7.9 3.6	4.50 114	11.5 5.2
4 114.3	5.00 127	7.1 3.2	3.00 76	5.6 2.5	2.88 73	5.6 2.5	1.75 44	3.6 1.6	5.00 127	11.9 5.4	5.00 127	15.8 7.2
4¼ O.D. 108.0	5.00 127	11.0 5.0	3.00 76	5.6 2.5	– –	– –	– –	– –	5.00 127	15.5 7.0	– –	– –
4½ 127.0	5.25 sw 133	10.0 4.5	3.13 sw 79	6.0 2.7	3.50 89	6.6 3.0	1.88 sw 48	4.2 1.9	5.25 sw 133	15.0 6.8	5.25 133	18.5 8.4
5 141.3	5.50 140	11.7 5.3	3.25 83	8.3 3.8	2.88 sw 73	7.8 3.5	2.00 sw 51	5.0 2.2	5.50 140	17.8 8.1	5.50 140	20.0 9.1
5¼ O.D. 133.0	5.50 140	11.7 5.3	3.25 83	8.3 3.8	– –	– –	– –	– –	5.50 140	17.8 8.1	– –	– –
5½ O.D. 139.7	5.50 140	11.7 5.3	3.25 83	8.3 3.8	– –	– –	– –	– –	5.50 140	17.8 8.1	– –	– –
6 168.3	6.50 165	17.2 7.8	3.50 89	10.8 4.9	6.25 @ 159	12.2 5.5	2.00 51	7.0 3.2	6.50 165	25.7 1.7	6.50 165	28.0 12.7
6¼ O.D. 159.0	6.50 165	18.6 8.4	3.50 89	10.8 4.9	– –	– –	– –	– –	6.50 165	27.1 12.3	– –	– –
6½ O.D. 165.1	6.50 165	15.5 7.0	3.50 89	9.8 4.4	3.13 79	11.4 5.2	2.00 51	7.4 3.4	6.50 165	22.0 10.0	6.50 165	28.0 12.7
8 219.1	7.75 197	29.9 13.6	4.25 108	20.4 9.3	7.75 @ 197	20.0 9.1	2.00 51	10.1 4.6	7.75 197	47.6 21.6	7.75 197	48.0 21.8
10 273.0	9.00 229	63.3 28.7	4.75 121	37.5 17.0	4.38 sw 111	30.0 13.6	2.13 sw 54	11.8 5.3	9.00 229	99.0 44.9	9.00 229	121.5 55.1
12 323.9	10.00 254	74.0 33.6	5.25 133	66.7 30.3	4.88 sw 124	40.0 18.1	2.25 sw 57	29.3 13.3	10.00 254	133.0 60.3	10.00 254	110.0 49.9
14 # 355.6	21.00 533	164.0 74.4	8.75 222	82.0 37.2	5.00 sw 127	46.0 20.9	3.50 sw 89	32.0 14.5	11.00 sw* 279	151.0 68.5	11.00 279	198.0 89.8
16 # 406.4	24.00 610	210.0 95.3	10.00 254	100.0 45.4	5.00 sw 127	58.0 26.3	4.00 sw 102	42.0 19.1	12.00 sw* 305	188.0 85.3	12.00 305	250.0 113.4
18 # 457.2	27.00 686	273.0 123.8	11.25 286	135.0 61.2	5.50 sw 140	65.0 29.5	4.50 sw 114	53.2 24.1	15.50 sw* 394	263.0 119.3	15.50 394	350.0 158.8
20 # 508.0	30.00 762	343.0 155.6	12.50 318	174.0 78.9	6.00 sw 152	78.6 36.0	5.00 sw 127	65.0 29.5	17.25 sw* 438	339.0 153.8	17.25 438	452.0 205.0
24 # 609.6	36.00 914	516.0 234.1	15.00 381	251.0 113.9	7.00 sw 178	140.0 63.5	6.00 sw 152	60.0 27.2	20.00 sw* 508	473.0 214.5	20.00 508	795.0 360.6

14", 16", 18", 20", 24" (355.6 - 609.6 mm) elbows (90°, 45°) are 1½ D long radius forged steel elbows No. 100 and No. 110. See page 5.
For 1D radius elbows contact Victaulic.
(sw) Segmentally welded steel
@ Gooseneck design, end-to-end dimension
*Cast ductile iron fittings available, contact Victaulic for details.

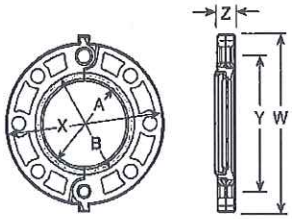
Victaulic®
An ISO 9001 certified company

METRIC CARBON STEEL PIPE GROOVED SYSTEM **06.07**

Style 741 (Metric) Vic-Flange® Adapter PN10 and PN16

PRODUCT DESCRIPTION





Note: Gray area of mating face must be free from gouges, undulations or deformities of any type for effective sealing.

Style 741 PN10/16 Vic-Flange adapters are designed for directly incorporating flanged components with PN10 or PN16. Bolt hole patterns into a grooved pipe system. Sizes 50 - 300 mm are hinged for easy handling with integral end tabs which facilitate assembly.

The design incorporates small teeth inside the key shoulder I.D. to prevent rotation. These teeth should be removed when Vic-Flange adapter is utilized with a Victaulic Series 700 grooved end butterfly valve, Schedule 5 pipe or plastic pipe.

Vic-Flange adapter Style 741 may only be used on one side of Victaulic Series 700 butterfly valves, sizes 50 - 100 mm fitted with standard or lever-lock handles. Vic-Flange adapter must be assembled so it does not interfere with handle operation.

Vic-Flange adapters may only be used on Vic-300 butterfly valves on one side in 2 - 8" (50 - 200 mm) sizes. They are not recommended for 10 and 12" sizes.

Because of the outside flange dimension, Vic-Flange should not be used within 90° of one another on a standard fitting. When wafer or lug-type valves are used adjoining a Victaulic fitting, check disc dimensions to assure proper clearance.

Vic-Flange adapters should not be used as anchor points for tie-rods across nonrestrained joints. Mating rubber faced flanges, valves, etc., require the use of a Vic-Flange washer.

Vic-Flange gaskets must always be assembled with the color coded lip on the pipe and the other lip facing the

Stantec
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☐ Not Reviewed
May 7, 2013
By: Arlen Foster, EIT
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STANTEC ARCHITECTURE LTD. (PC-1449)

DIMENSIONS

Pipe mm/inches		Max. Work Pres.	Max. End Load	Bolts†		Max. Work Pres.	Max. End Load	Bolts†		Sealing Surface mm/inches		Flange D Millimeters/inches				Wgt. Ea.
Nom. Size	Actual Size	Bars* PSI	N* lbs.	No. Req'd.	Size mm	Bars* PSI	N* lbs.	No. Req'd.	Size mm	"A" Max.	"B" Min.	W	X	Y	Z	kg lbs.
50 2	60.3 2.38	10 145	2850 640	4	16	16 230	4561 1025	4	16	60 2.38	87 3.41	185 7.28	165 6.50	125 4.92	20 0.79	1.4 3.1
65 2½	76.1 3.00	10 145	4540 1020	4	16	16 230	7275 1635	4	16	76 3.00	103 4.05	207 8.15	185 7.28	145 5.71	20 0.79	2.1 4.7
80 3	88.9 3.50	10 145	6210 1395	8	16	16 230	9925 2230	8	16	89 3.50	115 4.53	216 8.50	200 7.87	160 6.30	22 0.87	2.4 5.4
100 4	114.3 4.50	10 145	10260 2305	8	16	16 230	16420 3690	8	16	114 4.50	141 5.55	252 9.94	229 9.00	180 7.09	24 0.94	3.5 7.7
150 6	168.3 6.63	10 145	22250 5000	8	20	16 230	35600 8000	8	20	168 6.63	198 7.78	303 11.93	278 10.94	240 9.45	25 100	4.5 10.0
165.1	165.1 6.50	10 145	21400 4811	8	20	16 230	34236 7632	8	20	165 6.50	195 7.68	303 11.93	280 11.00	240 9.45	25 100	4.5 10.0
200 8	219.1 8.63	10 145	37690 8470	8	20	16 230	60320 13555	12	20	219 8.63	252 9.94	369# 14.53	344# 13.54	296# 11.65	30# 1.19	7.5 16.6
250 10	273.0 10.75	10 145	58560 13160	12	20	16 230	93695 21055	12	24	273 10.75	313 12.31	402§ 15.83	382§ 15.04	350§ 13.78	30§ 1.19	11.0 24.2
300 12	323.9 12.75	10 145	82370 18510	12	20	16 230	131810 29620	12	24	324 12.75	365 14.31	461 18.15	444 17.48	410 15.75	32 1.26	17.4 38.4

* Refer to notes on Page 2.
# PN16 dimensions (mm): W = 360; X = 340; Y = 295; Z = 30. § PN16 dimensions (mm); W = 432; X = 406; Y = 362; Z = 30.
† Total bolts required, to be supplied by installer. Bolt sizes for conventional flange-to-flange connection.
Longer bolts required when flange utilized with wafer-type valves.
IMPORTANT NOTES: Style 741 Vic-Flange adapters provide rigid joints when used on pipe with standard cut or roll groove dimensions and consequently allow no linear or angular movement at the joint. When used with Victaulic Series 700 butterfly valves, plastic pipe or light wall metallic pipe, small teeth in I.D. of key section should be removed and may only be used on one side of the valve. Contact Victaulic for information on AS2129 - Table E; ISO 2084 (PN10); DIN 2532 (PN10) and JIS B-2210 (10k) flanges.

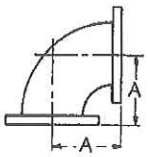
This product shall be manufactured by Victaulic Company. All products shall be installed in accordance with current Victaulic installation/assembly instructions.
Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

Victaulic International • P.O. Box 31, Easton, PA 18044-0031 • 4901 Kesslersville Rd., Easton, PA 18040 USA • 610/559-3300 • FAX: 610/559-3608

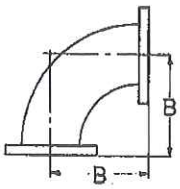
1658 Rev.A 10/96 ® Registered Trademark Victaulic Company of America © Copyright 1996 Victaulic Company of America Printed in U.S.A.

125-POUND CAST IRON FLANGED FITTINGS—Faced and Drilled

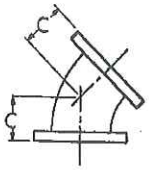
Manufactured to ASA Specifications B 16.1-1960. Available in sizes 2" to 30" inclusive.



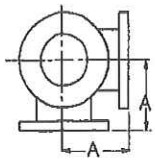
90° Elbow
No. 316



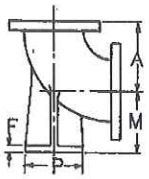
90° Long Radius
Elbow
No. 317



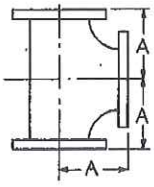
45° Elbow
No. 318



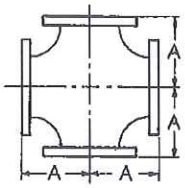
Side Outlet
Elbow
No. 319



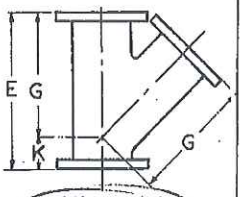
90° Base
Elbow
No. 321



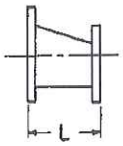
Double Sweep
Tee
No. 324



Cross
No. 326



45° Lateral
No. 327



Eccentric Reducer
No. 335

Stantec

☐ Reviewed
■ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

May 7, 2013

By: Arlen Foster, EIT

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STANTEC ARCHITECTURE LTD. (PC-1449)

DIMENSIONAL CHART IN INCHES

Size	A	B	C	AA	E	G	L	F	M	P	K
2	4½	6½	2½	9	10½	8	5	½	4⅛	4⅝	2½
3	5½	7¾	3	11	13	10	6	9/16	4⅞	5	3
4	6½	9	4	13	15	12	7	⅝	5½	6	3
5	7½	10¼	4½	15	17	13½	8	11/16	6¼	7	3½
6	8	11½	5	16	18	14½	9	11/16	7	7	3½
8	9	14	5½	18	22	17½	11	15/16	8⅛	9	4½
10	11	16½	6½	22	25½	20½	12	15/16	9¾	9	5
12	12	19	7½	24	30	24½	14	1	11¼	11	5½

Reducing Elbows, Tees, Crosses and Laterals are the same as straight fittings corresponding to the sizes of the largest outlet.

125-POUND CAST IRON FLANGES—Faced and Drilled



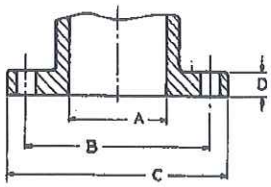
Blind Flange
No. 301



Screwed Flange
No. 302



Reducing Flange
No. 303



DESCRIPTION AND SPECIFICATIONS

Size	FLANGE				BOLTS	
	A	B	C	D	No.	Dia.
2	2	4¾	6	⅝	4	⅝
3	3	6	7½	¾	4	⅝
4	4	7½	9	15/16	8	⅝
5	5	8½	10	15/16	8	¾
6	6	9½	11	1	8	¾
8	8	11¾	13½	1⅛	8	¾
10	10	14¼	16	1 3/16	12	⅞
12	12	17	19	1¼	12	⅞

When ordering reducing flanges, the screwed or reduced size should be designated first, and then the outside diameter of the flange.
For example: a 125-pound flange to connect a 6-inch pipe to a 12-inch fitting should be ordered 6" x 19" Reducing Flange.

SANAQATIIT
CONSTRUCTION LTD.

HDPE PIPE

Tender Name: CAMBRIDGE BAY **Quotation:** 35502

QTY		Product Code	Description
			******INTAKE LINE OUTER CASING******
10.00	EA		16"DR17 X 50 C/W 2" INSULATION **ABOVE TO C/W WITH FLANGED ENDS** **OVERALL LENGTH WITH FUSED ENDS APPROXIMATELY 52' LONG**
10	EA	FF.16.17.50S.F2	16"DR17 HDPE SPOOL X 50' C/W FLANGE BOTH ENDS **PIPE ABOVE TO COME IN THE FOLLOWING LENGTHS** - 8 X 52'FLANGE TO FLANGE - 1 X 39'8" FLANGE TO FLANGE - 1 X 40'10" FLANGE TO FLANGE
2.00	EA	**	16" GALVANIZED BLIND FLANGE
2.00	EA	**	16"X16"X12" SCH30 GAVL FLG TEE
2	EA	FF.12.17.05S.F2	12"DR17 HDPE SPOOL X 5'C/W FLANGE BOTH ENDS
2.00	EA	**	12" JOHNSONITE INTAKE SCREENS
320.00	EA	**	1"X9-1/2" GALV HEX BOLTS
64.00	EA	**	1"X 7" GALV HEX BOLTS
384	EA	NT.01.GAL	1"NUT GALVANIZED
768	EA	FW.01.GAL	1"FLAT WASHER GALVANIZED
48	EA	BT.78.0550.GAL	BOLT 7/8"X5-1/2"GALVANIZED

WOLSELEY is not responsible for this take-off nor for errors or omissions in estimated quantities. All quantities should be verified correct by the contractor prior to bidding.

Tender Name: CAMBRIDGE BAY **Quotation:** 35502

QTY		Product Code	Description
48	EA	NT.78.GAL	7/8"NUT GALVANIZED
96	EA	FW.78.GAL	7/8"FLAT WASHER GALVANIZED
12.00	EA	**	16" FLANGE ASSEMBLY 2" THICK POLYMER COATED URRETHAN FOAM INSULATION KIT C/W STAINLESS STRAPPING, BANDIT CLIPS, SILICONE CAULKING AND HEAT SHRINK WRAP WITH CLOSURE SEAL
			******INTAKE LINE INNER PIPING 4"****** . .
1120	FT	PB.04.017.040	4"DR17 HDPE IPS PIPE X 40' LENGTHS
1200	FT	PC.01.TYPE.K.100	1"TYPE K COPPER PIPE X 100' COIL
600.00	EA	**	5" SS CLIPS
300.00	EA	**	NEOPRENE WRAP X 6"
20.00	EA	**	1" COPPER SOLDER COUPLINGS
200.000	FT	PB.06.017.050	6"DR17 HDPE IPS PIPE X 50' LENGTHS
160	FT	PB.02.017.040	2"DR17 HDPE IPS PIPE X 40 ' LENGTHS
9	EA	SF.06.017	6"DR17 HDPE IPS FLANGE ADAPTER
6	EA	BU.06.EPX	6"DR7 IPS D.I. BACK UP RING C/W EPOXY COATING
3	EA	BU.06.GAL	6"IPS D.I. BACK UP RING C/W GALVANIZE COATING

WOLSELEY is not responsible for this take-off nor for errors or omissions in estimated quantities. All quantities should be verified correct by the contractor prior to bidding.

Tender Name: CAMBRIDGE BAY **Quotation:** 35502

QTY		Product Code	Description
			ITEM IS SPECIAL ORDER AND THEREFORE NOT RETURNABLE
6	EA	UK.FA.06.2	2"INSUL KIT FOR 6"FL.ASSEMBLY C/W POLY OJ,SS STRAP,CAULKING
6	EA	BT.SS.06.PEXPE	6"BOLT-PAC 304SS POLY X POLY 8 3/4"X5-1/2"BOLT, NUT, GASKET
			*****MISC..MATERIALS*******
1.00	EA	**	LEAD FREE SOLDER & FLUX
1	EA	UR.PF.200	200 PORTA FOAM 15 CU. FT.
1.00	EA	**	20L MASTIC PAIL
100	FT	HS.30M.24	BULK HEAT SHRINK WRAP 24"X 100 FEET
7.00	EA	OPEN.CRATE	OPEN CRATE FOR PIPE
6.00	EA	CLOSE.CRATE	CLOSED CRATE FOR FITTINGS

FOB PORT OF ST.CATHERINE
ALL TAXES EXTRA
PRICES FIRM FOR 10 DAYS
DELIVERY: 3-4 WEEKS ARO

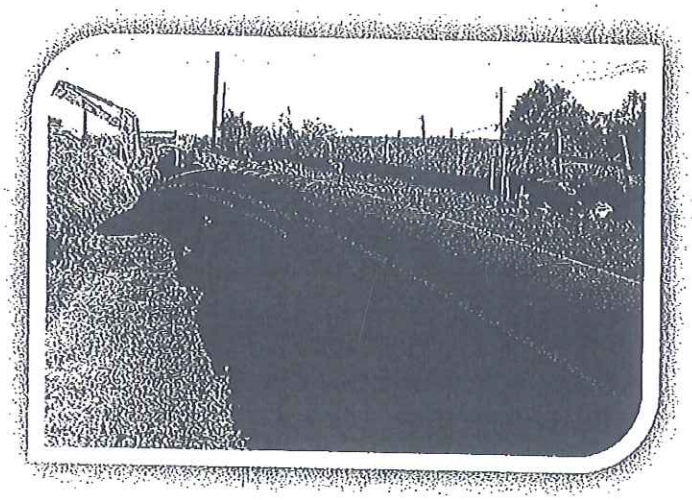
WEIGHTS AND DIMENSIONS:

6 CLOSED CRATES 4' X 4' X 8' = 700LBS/EACH
7 OPEN CRATES 4 X 4 X 50' = 3500LBS/EACH

SARAQATIT CONSTRUCTION LTD.
SHOP DRAWING REVIEWED
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MAY 14 2013
- REVIEWED
- REVIEWED AS NOTED
- REVISE AND RESUBMIT

PERFORMANCE PIPE
A Division of Chevron Phillips Chemical Company LP

DRISCOPLEX® 4000/4100 Series
Municipal and Industrial HDPE Pipe



DRISCOPLEX® HDPE Pipe is available to meet your needs in compliance with ASTM D3035/AWWA C901 or ASTM F714/AWWA C906 and NSF/ANSI 61 product standards. Factory Mutual FM1613 product standard is also available.

Produced from only the highest rated HDPE pipe material, DRISCOPLEX® 4000/4100 Series Pipe is manufactured from PE4710 resin as listed in PPI-TR4.

DRISCOPLEX® HDPE Pipe Advantages:

- ✓ Durable
- ✓ Leak Tight
- ✓ Excellent Flow
- ✓ Low Surge
- ✓ Fatigue Free
- ✓ Impact Resistant
- ✓ Trenchless Install
- ✓ Bend Radius
- ✓ Chemical Resistant
- ✓ UV Protection
- ✓ Flexibility
- ✓ Environmental

Optional Color Stripes to Identify the Application	
Color	Application
Blue	Potable Water
Green	Wastewater
Purple	Treated Effluent, Reclaimed Water
Red	Factory Mutual, Underground Fire Main
White – Gray – Brown	Customer Specified

Standard product is solid black with no stripes. IPS – 4 single stripes / DIPS – 3 sets of dual stripes.
Factory Mutual FM1613 pipe available as DriscoPlex® 4000/4100 FM.
Available in DR 9 (PC 200 psi) and DR 11 (PC 150 psi) sizes.

NSF FM Approvals

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Performance Pipe, a division of Chevron Phillips Chemical Company LP | 5085 W. Park Blvd | Suite 500 | Plano, TX 75093 | Phone: 800-527-0662 | Fax: 972-599-7329

PERFORMANCE PIPE
A Division of Chevron Phillips Chemical Company LP

DRISCOPLEX® 4000/4100 Series

DriscoPlex® Series Pipe Material Physical Properties		
Property	**Standard**	**Typical Value†**
Material Designation	ASTM F714	PE4170
Cell Classification	ASTM D3350	445574C (black)
Density [4]	ASTM D1505	0.960 g/cc (black)
Melt Index [4]	ASTM D1238	0.08 g/10 min
Flexural Modulus [5]	ASTM D790	>120,000 psi
Tensile Strength [5]	ASTM D638 Type IV	>3500 psi
SCG (PENT) [7]	ASTM F1473	>500 hours
HDB at 73°F (23°C) [4]	ASTM D2837	1600 psi
Color; UV stabilizer [C] [E]	ASTM D3350	Black Color with UV Stabilizer

This is not a product specification and does not guarantee or establish specific minimum or maximum values or manufacturing tolerance for material or piping products to be supplied. Values obtained from tests of specimens taken from piping product may vary from these typical values.

Additional Sizes and DR available. Contact Performance Pipe or visit www.performancepipe.com

Selected Dimension Ratios for DriscoPlex® 4000 DIPS Pipe (Additional Sizes and DR's available. Contact Performance Pipe)

DIPS ASTM F714 PR AWWA C906 PC		DR 17 PR = 125 psi PC = 100 psi			DR 11 PR = 200 psi PC = 160 psi		
Pipe Size, in.	OD, in.	Min Wall in.	Avg. ID in.	Wgt. lbs/ft	Min Wall in.	Avg. ID in.	Wgt. lbs/ft
4	4.80	0.282	4.201	3.76	0.436	3.876	2.62
6	6.90	0.406	6.040	7.64	0.627	6.671	5.42
8	9.05	0.532	7.921	6.26	0.823	7.305	9.33
10	11.10	0.653	9.716	9.42	1.009	8.961	14.03
12	13.20	0.776	11.554	13.32	1.200	10.656	19.84
14	15.30	0.900	13.392	17.59	1.391	12.351	26.65
16	17.40	1.024	15.230	23.14	1.582	14.046	34.47
18	19.50	1.147	17.068	29.07	1.773	15.741	43.30
20	21.60	1.270	18.906	35.66	1.964	17.436	53.13
24	25.80	1.518	22.583	50.88	2.345	20.828	76.77
30	32.00	1.882	28.009	78.29	2.909	25.833	116.58
36	38.30	2.253	33.524	112.13	3.482	30.918	167.02
42	44.50	2.618	38.951	151.37			

Selected Dimension Ratios for DriscoPlex® 4100 IPS Pipe (Additional Sizes and DR's available. Contact Performance Pipe)

IPS ASTM F714 PR AWWA C906 PC		DR 17 PR = 125 psi PC = 100 psi			DR 11 PR = 200 psi PC = 160 psi		
Pipe Size, in.	OD, in.	Min Wall in.	Avg. ID in.	Wgt. lbs/ft	Min Wall in.	Avg. ID in.	Wgt. lbs/ft
2	2.375	0.140	2.078	0.43	0.216	1.917	0.64
3	3.50	0.206	3.063	0.94	0.318	2.826	1.39
4	4.50	0.265	3.938	1.65	0.409	3.633	2.31
6	6.63	0.390	5.798	3.62	0.602	5.349	5.00
8	8.63	0.507	7.550	5.89	0.784	6.963	8.47
10	10.75	0.632	9.410	8.83	0.977	8.679	13.16
12	12.75	0.750	11.160	12.43	1.159	10.293	18.51
14	14.00	0.824	12.263	14.99	1.273	11.301	22.32
16	16.00	0.941	14.005	19.07	1.455	12.916	29.15
18	18.00	1.059	15.755	24.77	1.636	14.532	36.89
20	20.00	1.176	17.507	30.68	1.818	16.146	45.54
22	22.00	1.294	19.257	37.00	2.000	17.760	55.10
24	24.00	1.412	21.007	44.03	2.182	19.374	65.58
26	26.00	1.529	22.759	51.67	2.364	20.988	76.99
28	28.00	1.647	24.509	59.93	2.545	22.605	89.26
30	30.00	1.765	26.259	68.80	2.727	24.219	102.47
32	32.00	1.882	28.010	78.28	2.909	25.833	116.58
34	34.00	2.000	29.760	88.37	3.091	27.447	131.61
36	36.00	2.118	31.510	99.07	3.273	29.061	147.55
42	42.00	2.471	36.762	134.64	3.818	33.905	200.84
48	48.00	2.824	42.013	176.12			
54	54.00	3.176	47.264	222.90			

This product flyer is intended for reference purposes. It should not be used in place of the advice from a licensed Professional Engineer. Pressure Ratings and Pressure Class are based on operating temperature up to 80°F. Pressure class is based on a 0.5 Design Factor for water application from AWWA white Pressure Rating is based on a 0.63 Design Factor per PPI TR-41. Average inside diameter is calculated using Nominal OD and Minimum Wall plus 6% for use in estimating fluid flow. Actual ID will vary. When designing components to fit the pipe ID, refer to pipe dimensions and tolerances in the applicable pipe manufacturing specification. Additional information available at www.performancepipe.com

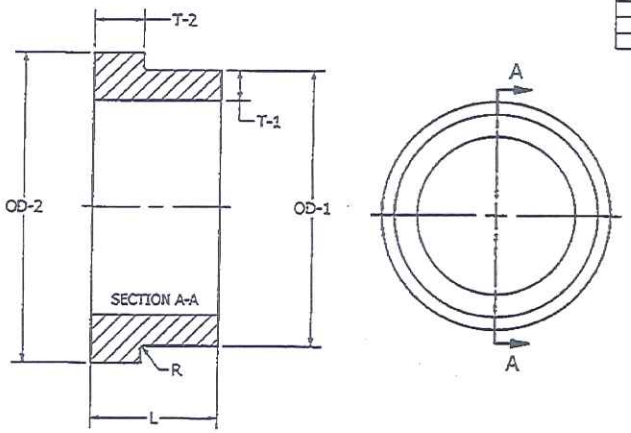
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Performance Pipe, a division of Chevron Phillips Chemical Company LP | 5085 W. Park Blvd | Suite 500 | Plano, TX 75093 | Phone: 800-527-0662 | Fax: 972-599-7329

Material: PE 4710

REVISION HISTORY		
REV	DESCRIPTION	DATE
1	VALID - ORIGINAL DWG	05/19/11
2	EDIT L COLUMN	07/27/12
3	EDIT T-2 DIMENSIONS	09/02/11

SANAQATIIT CONSTRUCTION LTD.
SHOP DRAWING REVIEWED
BY
MAY 14 2013
- REVIEWED
- REVIEWED AS NOTED
- REVISE AND RESUBMIT

	Wall Thickness and Hub Height (2" - 16")							
	SDR's							
	7		9		11		17	
Size	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2
2	0.339	0.450	0.264	0.400	0.247	0.402	0.138	0.402
3	0.500	0.600	0.389	0.598	0.319	0.598	0.205	0.598
4	0.642	1.000	0.500	0.866	0.469	0.800	0.264	0.800
6	0.945	1.200	0.736	0.920	0.602	0.799	0.390	0.799
8	1.232	1.598	0.958	1.200	0.783	0.799	0.508	0.799
10	1.535	1.900	1.194	1.490	0.976	1.299	0.634	0.902
12	1.823	2.299	1.417	1.770	1.157	1.500	0.752	1.000
14	2.000	2.598	1.556	1.950	1.272	1.701	0.823	1.098
16	2.287	3.000	1.778	2.220	1.453	1.902	0.941	1.201



	Wall Thickness and Hub Height (18" - 63")																			
	SDR's																			
	7		9		11		13.5		15.5		17		19		21		26		32.5	
Size	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2
18	2.571	3.858	2.000	2.500	1.638	2.100	1.333	2.100	1.161	2.100	1.059	1.400	0.947	1.250	0.857	1.250	0.692	1.250	0.554	1.250
20	2.857	3.630	2.222	3.490	1.819	2.300	1.481	2.300	1.290	2.300	1.177	1.500	1.053	1.390	0.952	1.390	0.769	1.390	0.615	1.390
22	3.143	3.920	2.444	3.920	2.000	2.500	1.630	2.500	1.419	2.500	1.295	1.600	1.158	1.520	1.048	1.520	0.846	1.520	0.677	1.520
24	3.429	4.360	2.667	4.360	2.181	2.900	1.778	2.900	1.548	2.900	1.413	1.800	1.263	1.667	1.143	1.667	0.923	1.667	0.738	1.667
26	3.714	4.643	2.889	4.643	2.364	2.955	1.926	2.955	1.677	2.955	1.529	2.955	1.368	1.711	1.238	1.711	1.000	1.711	0.800	1.711
28			3.111	5.000	2.545	3.182	2.074	3.182	1.806	3.182	1.647	3.182	1.474	1.842	1.333	1.842	1.077	1.842	0.862	1.842
30			3.333	5.357	2.727	3.409	2.222	3.409	1.935	3.409	1.765	3.409	1.579	1.974	1.429	1.974	1.154	1.974	0.923	1.974
32			3.556	5.714	2.909	3.636	2.370	3.636	2.065	3.636	1.882	3.636	1.684	2.105	1.524	2.105	1.231	2.105	0.985	2.105
34			3.778	6.071	3.091	3.864	2.519	3.864	2.194	3.864	2.000	3.864	1.789	2.237	1.619	2.237	1.308	2.237	1.046	2.237
36			4.000	6.429	3.273	4.091	2.667	4.091	2.323	4.091	2.118	4.091	1.895	2.368	1.714	2.368	1.385	2.368	1.108	2.368
42					3.818	4.773	3.111	4.773	2.710	4.773	2.471	4.773	2.211	2.763	2.000	2.763	1.615	2.763	1.292	2.763
48					4.364	5.455	3.556	5.455	3.097	5.455	2.824	5.455	2.526	3.158	2.286	3.158	1.846	3.158	1.477	3.158
54															2.571	3.553	2.077	3.553	1.662	3.553
63															3.000	4.145	2.423	4.145	1.938	4.145

Flange Adapter Dimensions					
Size	Type	OD-1	OD-2	L	R
2	IPS	2.375	4.000	5.984	0.354
3	IPS	3.500	5.000	5.984	0.354
4	IPS	4.500	6.598	5.984	0.433
6	IPS	6.625	8.500	7.992	0.433
8	IPS	8.625	10.598	9.016	0.433
10	IPS	10.750	12.799	11.000	0.433
12	IPS	12.750	15.252	11.000	0.433
14	IPS	14.000	17.500	11.000	0.433
16	IPS	16.000	20.000	12.000	0.433
18	IPS	18.000	21.098	12.000	0.500
20	IPS	20.000	23.500	12.000	0.500
22	IPS	22.000	25.600	12.000	0.500
24	IPS	24.000	27.900	14.000	0.500
26	IPS	26.000	29.750	14.000	0.500
28	IPS	28.000	32.000	14.000	0.500
30	IPS	30.000	34.000	14.000	0.500
32	IPS	32.000	36.125	14.000	0.500
34	IPS	34.000	38.125	14.000	0.500
36	IPS	36.000	40.500	14.000	0.500
42	IPS	42.000	47.125	21.000	0.500
48	IPS	48.000	53.500	21.000	0.500
54	IPS	54.000	59.625	21.000	0.500
63	IPS	63.000	66.790	21.000	0.500

*Length is 16.500" for 36" SDR9 only.





Ongoing engineering design efforts may affect the technical information listed in our publications.

Notes
2" - 24" meet requirements of ASTM D2513, Certified to NSF / ANSI 61*
2" - 48" meet requirements of ASTM D3261
4" - 63" meet requirements of AWWA C906
*NSF / ANSI certification obtained on IPPSH plant

DRAWN	
Matt Graff	5/19/2011
ENG	
Ellis Clark	9/1/2011
QA	
Adil Nasir	5/19/2011
VPOP	
Duncan Schlicht	9/1/2011

UNLESS OTHERWISE NOTED, ALL DIMENSIONS IN INCHES

IMPROVED PIPING PRODUCTS, INC.

TITLE: IPS Flange Adapter Submittal

SIZE	PART NO	SALES NO
C	IPS Flange Adapter Submittal	

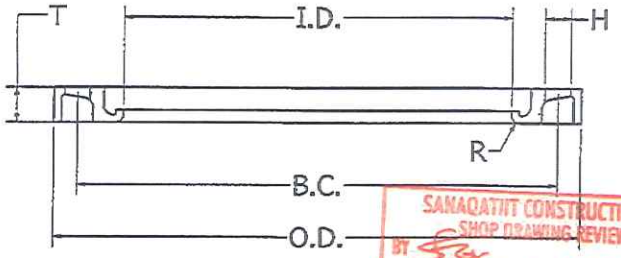
SCALE | REV 3 | SHEET 1 OF 1

Material: Ductile Iron, ASTM A536, 65/45/12

REVISION HISTORY		
REV	DESCRIPTION	DATE
1	VALID	07/29/11
2	ADD 42" SDR11	09/07/11
3	ADD 20", 22", 24" SDR7	10/14/11
4	EDIT SDR COLUMN	06/28/12

Dimensions										
Pipe Diameter (in)	SDR	O.D.	T	I.D.	Bolt Count	Bolt Hole Size (H)	Bolt Hole Circle (BC)	R	Weight (lbs)	Operating Pressure (psi)
1/2"	7	3.500	0.500	0.900	4	0.625	2.380	0.130	1.0	267
3/4"	7	3.880	0.500	1.110	4	0.625	2.750	0.130	1.0	267
1"	7	4.250	0.560	1.380	4	0.625	3.130	0.130	1.0	267
1 1/4"	7	4.630	0.630	1.720	4	0.625	3.500	0.190	2.0	267
1 1/2"	7	5.000	0.690	1.970	4	0.625	3.880	0.250	2.0	267
2"	7	6.000	0.750	2.460	4	0.750	4.750	0.310	3.0	267
2"	11	6.000	0.500	2.630	4	0.750	4.750	0.200	1.5	160
2 1/2"	7	7.000	0.880	2.970	4	0.750	5.500	0.310	4.0	267
2 1/2"	11	7.000	0.640	2.970	4	0.750	5.500	0.200	2.5	160
3"	7	7.500	0.940	3.600	4	0.750	6.000	0.400	4.0	267
3"	11	7.500	0.530	3.750	4	0.750	6.000	0.280	2.5	160
4"	7	9.000	0.940	4.600	8	0.750	7.500	0.400	5.5	267
4"	11	9.000	0.550	4.750	8	0.750	7.500	0.280	3.5	160
5"	7	10.000	0.940	5.690	8	0.875	8.500	0.440	6.0	267
6"	7	11.000	1.000	6.750	8	0.875	9.500	0.400	7.0	267
6"	11	11.060	0.630	6.880	8	0.875	9.500	0.280	4.5	160
8"	7	13.500	1.120	8.750	8	0.875	11.750	0.400	11.0	267
8"	11	13.560	0.850	8.880	8	0.875	11.750	0.280	8.0	160
10"	7	16.000	1.190	10.920	12	1.000	14.250	0.400	16.0	267
10"	11	16.000	0.980	11.000	12	1.000	14.250	0.310	12.0	160
12"	7	19.000	1.500	12.920	12	1.000	17.000	0.400	23.0	267
12"	11	19.000	1.250	13.130	12	1.000	17.000	0.280	20.0	160
14"	7	21.000	1.630	14.180	12	1.125	18.750	0.400	37.0	267
14"	11	21.000	1.380	14.380	12	1.125	18.750	0.310	30.0	160
16"	7	23.500	1.880	16.190	16	1.125	21.250	0.400	49.0	267
16"	11	23.500	1.650	16.380	16	1.125	21.250	0.350	40.0	160
18"	7	25.000	1.800	18.200	16	1.250	22.750	0.400	48.0	267
18"	9	25.000	1.750	18.200	16	1.250	22.750	0.400	48.0	200
18"	11	25.000	1.670	18.375	16	1.250	22.750	0.350	45.0	160
20"	7	27.500	2.125	20.375	20	1.250	25.000	0.310	66.5	267
20"	9	27.500	2.060	20.375	20	1.250	25.000	0.310	61.0	200
20"	11	27.500	1.810	20.375	20	1.250	25.000	0.400	55.0	160
22"	7	29.500	2.300	22.375	20	1.375	27.250	0.310	83.0	267
22"	9	29.500	2.150	22.375	20	1.375	27.250	0.310	720	200
22"	11	29.500	2.000	22.375	20	1.375	27.250	0.370	65.0	160





SANAQAUIT CONSTRUCTION LTD.
SHOP DRAWING REVIEWED
BY
MAY 14 2013
- REVIEWED
- REVIEWED AS NOTED
- REVISE AND RESUBMIT

Ongoing engineering design efforts may affect the technical information listed in our publications.

Notes
Finish: Red oxide primed, Hot dip galvanized or Epoxy coated
Mate with all 150 lb flanges, ANSI B16.5, B16.47, B16.1, AWWA C207

DRAWN	Matt Graff	7/29/2011
ENG	Ellis Clark	7/29/2011
QA	Adil Nasir	7/29/2011
VPOP	Duncan Schlicht	7/29/2011

UNLESS OTHERWISE NOTED, ALL DIMENSIONS IN INCHES

IMPROVED PIPING PRODUCTS, INC.

TITLE: BUP-SDR Convoluted Flange / Backup Ring Submittal Sheet

SIZE: C | PART NO: BUP-SDR submittal | SALES NO:

SCALE: | REV 4 | SHEET 1 OF 2

URECON U.I.P.® INSULATION SPECIFICATION FOR HDPE PIPE

1. General

The pipes shall be insulated by the Urecon U.I.P.® void free insulation process, with an integral conduit for electrical heat trace cable (if required) and a 1,27 mm *(50 mils)* thick polyethylene outer jacket. The outer jacket shall be UV inhibited. Polymer coated, form fitting insulation kits shall be used to insulate elbows, tees, saddles and other fittings, according to the manufacturer's recommendations (except thrust blocked fittings).

2. Pipe Preparation

Pipes are to be cleaned of surface dust or dirt and treated, if necessary, to assure a positive bond of the foam to the entire pipe surface.

3. Heat Tracing Conduits (if required)

Heat tracing conduits shall consist of an extruded plastic molding applied to the pipe prior to the application of the insulation. The conduit will be securely fastened to the pipe and sealed to prevent the ingress of foam during the insulation process. Each conduit shall be checked after insulating to ensure they are not blocked. The ends shall be sealed prior to shipping to prevent foreign materials from entering the conduit during transport or installation.

4. U.I.P.® insulation

- Material : Rigid polyurethane foam, factory applied.
- Insulation thickness 50 mm *(2 in)* for freeze protection, 40 mm *(1½ in)* for chilled water, other thickness available upon request.
- Density : (ASTM D1622) 35 to 48 kg/m^3 *(2.2 to 3.0 lbs/ft^3)*.
- Water absorption : (ASTM D2842) 4% by volume.
- Closed cell content : (ASTM D2856) 90% minimum.
- System compressive strength : (modified ASTM D1621) 414 to 552 kPa *(60 to 80 lbs/in^2)*.
- Thermal conductivity : (ASTM C518) 0,020 to 0,026 W/m °C *(0.14 to 0.17 Btu•in/ft^2•hr•°F)*.
- Service temperature range : -45 °C to 85 °C *(-49 °F to 185 °F)*. Please contact Urecon if your application is for other than freeze protection or chilled water so that we may assist you in calculating expansion forces.

5. Outer jacket on pipe insulation

- The pipe shall be factory jacketed with UV inhibited polyethylene, specially formulated for cold weather resistance.
- Sealant : Butyl rubber and resin.
- Thickness : 1,27 mm *(50 mils)*.

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SHOP DRAWING REVIEWED
BY
MAY 14 2013
REVIEWED AS NOTED
REVISE AND RESUBMIT

- Minimum elongation : (ASTM D1000) 300 %, 6 month test.
- Minimum temperature : Service : -45 °C *(-49 °F)*
  Installation : -34 °C *(-30 °F)*.
- Tensile strength : (ASTM D1000) 6.8 kg/cm wide *(38 lbs/in wide)*.

Note: Urecon's standard jacket is suitable for H-20 highway loading at 600 mm *(24 in)* bury. Live H-20 load transferred to the insulation at 600 mm *(24 in)* depth of bury is 38 kPa *(5.51 lbs/in²)*. Our system is rated 414 kPa *(60 lbs/in²)*.

6. Insulated Pipe Joints

- Pre-formed urethane halfshells with heat shrink sleeves shall be used at butt fused joints.
- All exposed ends of insulation shall be coated with an approved waterproofing sealant, as recommended by the supplier, after field cutting or trimming has been carried out.

7. Insulation Kits for fittings

Insulation kits for fittings shall consist of rigid polyurethane foam with a fully bonded polymer protective coating on all exterior surfaces, including ends. Kits to be supplied complete with silicone caulking for seams, stainless steel attachment straps, clips and heat shrink sleeves or joint tape to seal between pipe and kits.

Insulation
- Rigid polyisocyanurate or polyurethane foam.
- Density: (ASTM D1622) 27 to 32 kg / m³ *(1.7 to 2 lbs/ft³)*.
- Compressive strength: (ASTM D1621) 131 to 158 kPa *(19 to 23 lbs/in²)*.
- Closed cell content: (ASTM D2856) 90% minimum.
- Water absorption: (ASTM D2842) 4% by volume.
- Thermal Conductivity: (ASTM C518) 0,027 W/m°C *(0.19 Btu • in/ft² • hr • °F)*.
- Thickness, to match pipe insulation thickness.

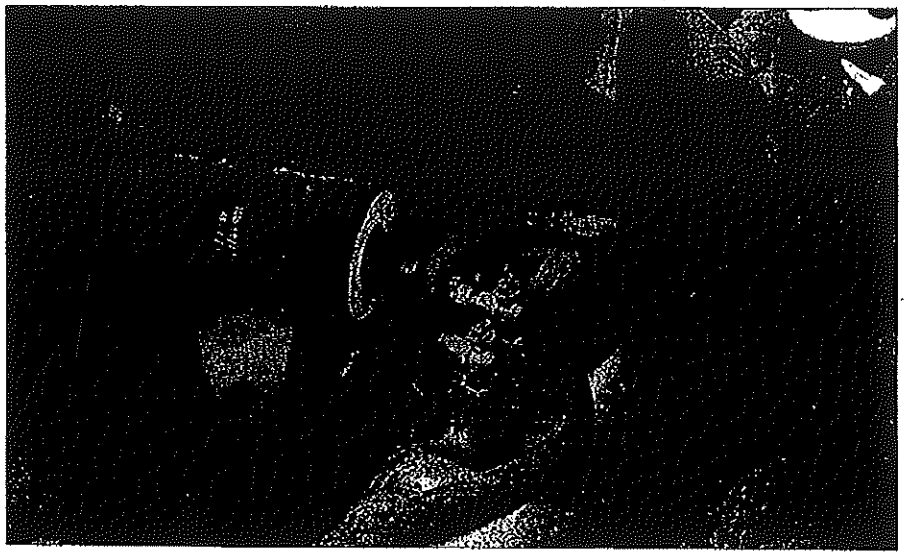
Polymer coating
- Two component high density polyurethane coating, black in color.
- Density: 1170 kg/m³ *(73 lbs/ft³)*.
- Durometer D scale 60.
- Tensile strength: 11,100 kPa *(1610 lbs/in²)*.
- Tear strength: 26,5 N/mm *(151 lbs/in.)*.
- Thickness: 1,9 mm *(75 mils)* outside surfaces.
  0,51 mm *(20 mils)* inside surfaces.
- Urecon BL-75-20EP.

8. Insulation - Foamed in Place (Portafoam® Specifications)

- Material to be a two component polyurethane foam supplied in a portable, disp pressurized container.
- Density: (ASTM D1622) 35 to 39 kg/m³ *(2.18 to 2.43 lbs/ft³).*
- Closed cell content: (ASTM D2856) 90% minimum.
- Thermal conductivity: (ASTM C518) 0,020 to 0,028 W/m°C *(0. 14 to 0.20 Btu • in/ft² • hr • °F).*
- Compressive strength: (ASTM D1621) 103 to 172 kPa *(15 to 25 lbs/in².).*
- Portafoam® or approved equivalent.

PRE-INSULATED SERVICES

Services may be protected in one of two ways: either by insulation of the service pipe, or by the insertion of the service pipe into a pre-insulated HDPE duct. In both cases, insulation kits are available for the insulation of mainstops, curb stops, etc. Consult the URECON pre-insulated service brochure for complete servicing methods and details.



Installing a typical NWT design re-circulating HDPE service connection at Iqaluit, NU.

ELECTRIC HEAT TRACING

Urecon pre-insulated pipe can be designed and manufactured for use with our CSA approved THERMOCABLE® heat trace system. Consult the URECON electric heat tracing brochure for complete heat tracing information.

JOINT TYPES AVAILABLE

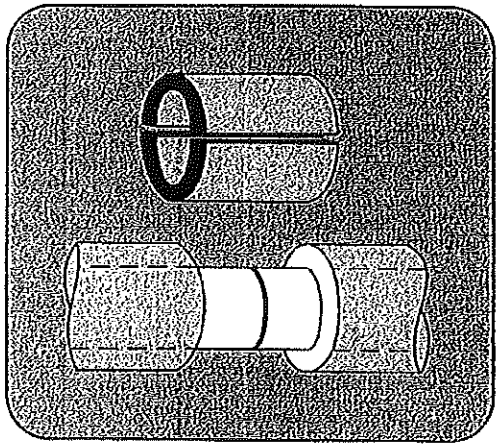
Urecon "U.I.P."® pre-insulated HDPE pipe may be joined by any of the following methods:

- Compression couplings: 19 to 50 mm *(¾ to 2 in)* CTS and IPS sizes.
- Socket fusion: 25 mm *(1 in)* CTS size.
  19 to 100 mm *(¾ to 4 in)* IPS sizes.
- Hugger® couplings: 50 to 350 mm *(2 to 14 in)* IPS sizes.
- Flange assembly: 40 to 500 mm *(1½ to 20 in)* IPS sizes.
  75 to 500 mm *(3 to 20 in)* metric sizes.
- Thermal butt fusion: all sizes.
- Electrofusion: 19 to 500 mm *(¾ to 20 in)* CTS and IPS sizes.

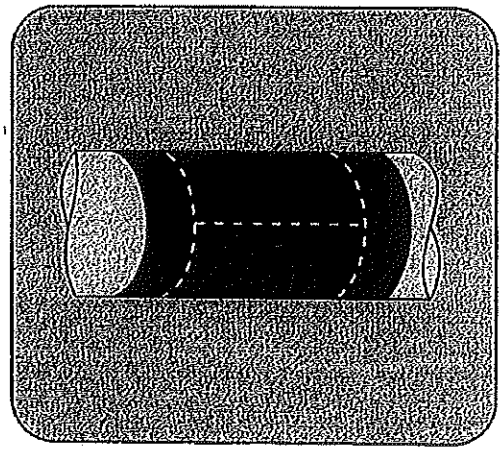
Note: Stainless steel inserts must be used in conjunction with compression couplings.

The thermal butt fusion technique generally utilized in the joining of pre-insulated HDPE pipe systems provides excellent joint integrity. Butt fused joints require no external couplings and joint strength is compatible with the inherent performance of the pipe. Urecon can arrange for the purchase or rental of modern butt fusion equipment. In addition, we have access to several pipe fusion contractors located across Canada and the United States who can contract for the fusion of your polyethylene piping system. Using the latest machines and techniques, the specialized contractor can save valuable time in the field, and minimize costs.

BUTT FUSED JOINT INSULATION DETAIL



Trim halfshells to fit the cutback area, install and hold temporarily in place with masking tape.



Apply wrap around heat shrink sleeve, being sure to overlap the factory insulation by at least 75 mm *(3 in)* on either side of the joint.

TABLE 3

TIME TO FREEZE AND HEAT LOSS FOR U.I.P.® DR 11 PRE-INSULATED HDPE PIPE

NOMINAL PIPE DIAMETER		PIPE AMBIENT -18 °C (0 °F) TIME TO FREEZE HRS.		HEAT LOSS (watts/m)	PIPE AMBIENT -34 °C (-30 °F) TIME TO FREEZE HRS.		HEAT LOSS (watts/m)
mm	in	NO INSULATION	50 mm (2 in) U.I.P.®		NO INSULATION	50 mm (2 in) U.I.P.®	
19	¾	< 1	13	1.6	< 1	7	2.9
25	1	< 1	20	1.8	< 1	10	3.3
30	1¼	< 1	34	2.2	< 1	18	4.1
40	1½	< 1	42	2.3	< 1	22	4.4
50	2	1	57	2.7	< 1	29	5.0
75	3	3	107	3.4	1	55	6.5
100	4	4	149	4.1	2	77	7.7
150	6	9	241	5.4	5	125	10.2
200	8	16	333	6.6	8	172	12.4
250	10	24	433	7.8	12	224	14.7
300	12	34	530	8.9	17	274	16.8
350	14	41	592	9.6	21	305	18.0
400	16	53	692	10.6	27	357	20.0
450	18	65	775	11.9	34	410	21.9
500	20	80	876	12.9	42	464	23.8

NOTE:
- No safety factor included; results are nominal; assumes initial water temperature of 1,11°C *(34 °F)*.
- To convert watts to BTU, multiply by 3.414.
- To convert meters to feet, multiply by 3.28.
- To convert w/m to w/ft divide by 3.28.

PRE-INSULATED HDPE PIPE IN HOT CLIMATES

Urecon U.I.P.® pre-insulated HDPE pipe substantially reduces the heat gain of central chilled water distribution systems installed in tropical and sub-tropical climates. This results in considerable energy savings for the end user.

TABLE 4
HEAT GAIN CHART EXPRESSED IN BTU / HR - FT

Heat Gain Based on ΔT of 16.7 °C *(30 °F)*

Pipe Size		Insulation Thickness				
mm	in	25 mm (1 in)	40 mm (1½ in)	50 mm (2 in)	63 mm (2½ in)	75 mm (3 in)
13	½	2.41	1.98	1.73	1.57	1.46
19	¾	2.74	2.21	1.92	1.74	1.61
25	1	3.14	2.50	2.16	1.93	1.78
30	1¼	3.64	2.87	2.45	2.18	1.99
40	1½	3.98	3.11	2.64	2.34	2.13
50	2	4.64	3.58	3.01	2.65	2.40
63	2½	5.32	4.07	3.40	2.97	2.68
75	3	6.15	4.67	3.87	3.36	3.01
100	4	7.45	5.60	4.60	3.97	3.53
150	6	10.12	7.52	6.11	5.22	4.60
200	8	12.56	9.29	7.50	6.37	5.58
250	10	N/A	11.14	8.96	7.57	6.61
300	12	N/A	12.85	10.31	8.69	7.57
350	14	N/A	13.92	11.15	9.39	8.16
400	16	N/A	N/A	12.49	10.50	9.11
450	18	N/A	N/A	13.83	11.60	10.05
500	20	N/A	N/A	15.17	12.71	11.00

NOTES: 1) No safety factor included; results are nominal.
2) To convert BTU to watts, divide by 3.414.

PIPE SPECIFICATIONS

URECON pre-insulated HDPE pipe is manufactured from type III, Category 5, Class C, Grade P34 in ASTM D-1248 high density polyethylene resin. This material shall have a long term hydrostatic design stress of 800 psi for PE 3408 materials. HDPE core pipe shall conform to AWWA standard C906-90, ASTM F-714, ASTM D-3035, CSA B137.1 and CGSB 41GP-25M. The core pipe shall be continuously printed or spaced at intervals not exceeding 1,5 m *(5 ft)* with the following information: Name and / or trademark of pipe manufacturer, nominal pipe size, dimensional ratio, polyethylene grade, hydrostatic design basis, standard reference, production code (date and place of manufacture). Urecon pre-insulated HDPE pipe is available in a number of pressure ratings.

STANDARDS AND APPROVALS

ASTM	American Society for Testing Materials (Canada & U.S.A.)
AWWA	American Water Works Association (Canada & U.S.A.)
CSA	Canadian Standards Association (Canada)
NSF	National Sanitation Foundation (U.S.A.)
FM	Factory Mutual (DR11 only, Canada & U.S.A.)

TABLE 8

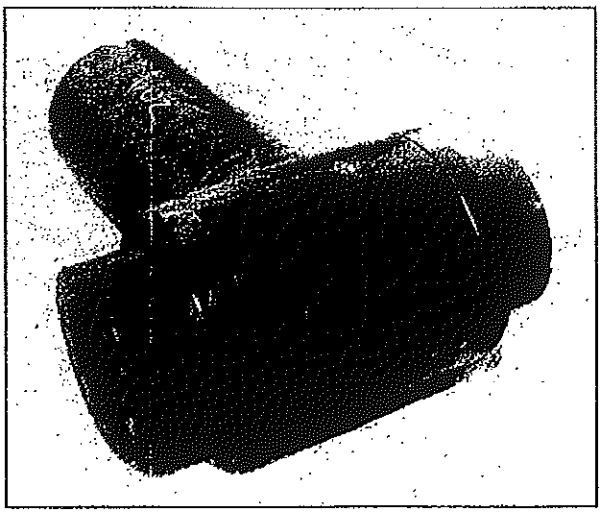
URECON PRE-INSULATED HDPE CORE PIPE DR 17

Dimensions 19 mm to 500 mm *(3/4 in to 20 in)*

NOMINAL PIPE SIZE		OUTSIDE PIPE DIA.		INSULATION O.D.				DR 17, 690 kPa *(100 psi)*					
				INSULATION THICKNESS				AVERAGE PIPE I.D.		MIN WALL THICKNESS		TOTAL WEIGHT	
mm	*in*	mm	*in*	40 mm	*1.5 in*	50 mm	*2 in*	mm	*in*	mm	*in*	kg/m	*lbs/ft*
19 CTS	*3/4 CTS*	SEE DR-11											
25 CTS	*1 CTS*	SEE DR-11											
40	*1 1/2*	48	*1.90*	139	*5.50*	155	*6.13*	42,16	*1.66*	2,79	*0.11*	1,10	*0.74*
50	*2*	60	*2.375*	155	*6.13*	165	*6.50*	52,83	*2.08*	3,55	*0.14*	1,34	*0.90*
75	*3*	88	*3.50*	171	*6.75*	196	*7.75*	77,72	*3.06*	5,33	*0.21*	2,35	*1.58*
100	*4*	114	*4.50*	196	*7.75*	228	*9.00*	100,07	*3.94*	6,86	*0.27*	3,53	*2.37*
150	*6*	168	*6.625*	247	*9.75*	279	*11.00*	147,32	*5.80*	9,91	*0.39*	6,52	*4.38*
200	*8*	219	*8.625*	304	*12.00*	336	*13.25*	191,77	*7.55*	12,95	*0.51*	10,46	*7.03*
250	*10*	273	*10.75*	355	*14.00*	393	*15.50*	239,01	*9.41*	16,00	*0.63*	15,58	*10.47*
300	*12*	324	*12.75*	406	*16.00*	438	*17.50*	283,46	*11.16*	19,05	*0.75*	21,28	*14.30*
350	*14*	355	*14.00*	438	*17.25*	476	*18.75*	318,26	*12.53*	20,83	*0.82*	30,38	*20.41*
400	*16*	406	*16.00*	N/A	*N/A*	527	*20.75*	355,85	*14.01*	23,88	*0.94*	38,43	*25.82*
450	*18*	457	*18.00*	N/A	*N/A*	597	*23.50*	400,30	*15.76*	26,92	*1.06*	46,26	*31.08*
500	*20*	508	*20.00*	N/A	*N/A*	635	*25.00*	444,75	*17.51*	29,97	*1.18*	54,17	*36.40*

1. Other sizes and metric dimensional pipe available on request.
2. Insulation thickness for freeze protection 50 mm *(2 in)* minimum; other thicknesses available on request.
3. Insulation thickness for chilled water 40 mm *(1.5 in)* minimum; other thicknesses available on request.
4. Jacketing 1,27 mm *(50 mils)* thick polyethylene; other types and thicknesses available on request.
5. Pressure rating of DR 17 is 690 kPa *(100 psi)* at 23 °C *(73.4 °F)*.
6. Insulated pipe available in standard industry lengths of 12.19 m *(40 ft)* and 15.24 m *(50 ft)*; other lengths available on request.
7. Insulation cut back for standard butt fused joint is 230 mm *(9 in)*; other cut backs available on request. Call your Urecon representative to discuss your application requirements.
8. Each pipe length shipped with suitable insulation kit for butt fused joint (unless advised otherwise).
9. Data may vary slightly from one pipe manufacturer to another.
10. Reference specifications (core pipe): see pipe specifications.

7.2 Field installed Insulation Kits for Fittings



A typical polymer coated, form fitting insulation kit.

This is the most popular method of insulating all fittings other than those that need to be thrust blocked. All insulation kits are custom fabricated and adaptable to all types of fittings and all types of core pipes. Extension legs are provided to automatically insulate the cut-back area on the pre-insulated pipe after the butt fusion, welding or coupling operation has taken place. All polymer coated insulation kits are shipped complete with form fitting insulation covers, silicone caulking, stainless steel strapping and joint tape (or heat shrink sleeves) to seal between the insulation kit and the pre-insulated pipe. Urecon insulation kits are economical, easy to install and have a proven record of dependability. In addition, they are ideally suited to traced systems as the THERMOCABLE® can be pulled in and placed, then the insulation kit installed.

Specification:

Insulation kits for fittings shall consist of rigid polyurethane foam with a fully bonded polymer protective coating on all exterior surfaces, including ends. Kits to be supplied complete with silicone caulking for seams, stainless steel attachment straps, clips and heat shrink sleeves or joint tape to seal between pipe and kits.

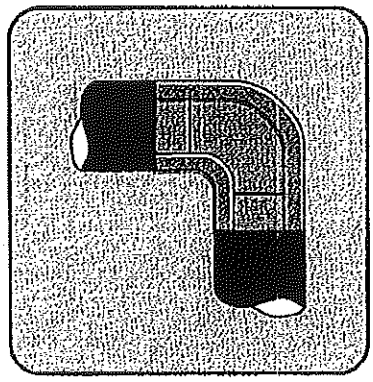
Insulation

- Rigid polyisocyanurate or polyurethane foam.
- Density: (ASTM D1622) 27 to 32 kg / m^3 *(1.7 to 2 lbs/ft³).*
- Compressive strength: (ASTM D1621) 131 to 158 kPa *(19 to 23 lbs/in²).*
- Closed cell content: (ASTM D2856) 90% minimum.
- Water absorption: (ASTM D2842) 4% by volume.
- Thermal conductivity: (ASTM C518) 0,027 W/m°C *(0.19 Btu • in/ft² • hr • °F).*
- Thickness to match pipe insulation thickness.

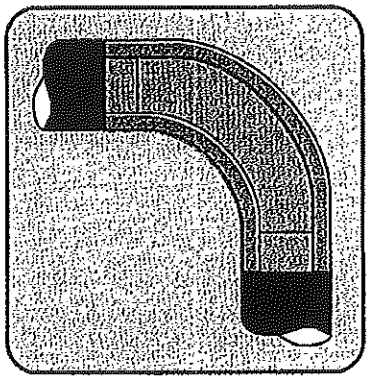
Polymer coating

- Two component high density polyurethane coating, black in color.
- Density: 1170 kg/m³ *(73 lbs/ft³).*
- Durometer D scale 60.
  Tensile strength: 11,100 kPa *(1610 lbs/in².).*
- Tear strength: 26,5 N/mm *(151 lbs/in.).*
- Thickness: 1,9 mm *(75 mils)* outside surfaces, 0,51 mm *(20 mils)* inside surfaces.
- Urecon BL-75-20EP.

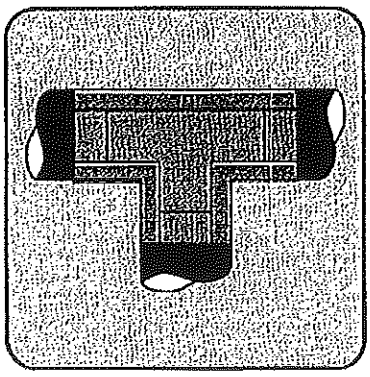
SOME OF THE MORE POPULAR INSULATION KITS



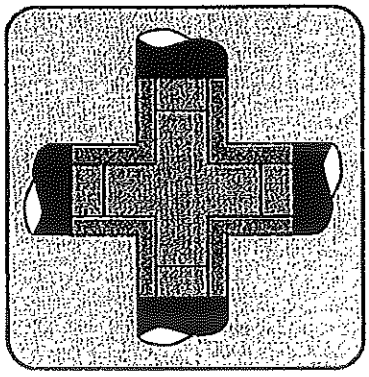
SHORT RADIUS ELBOW



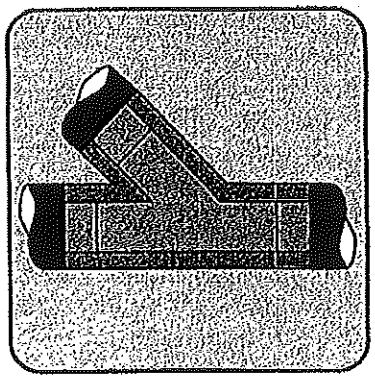
LONG RADIUS ELBOW



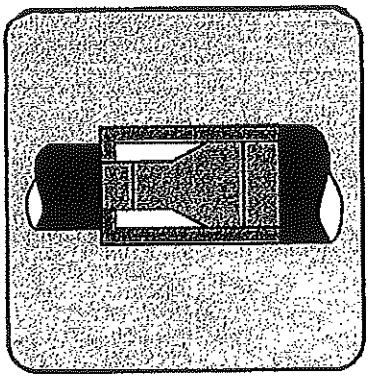
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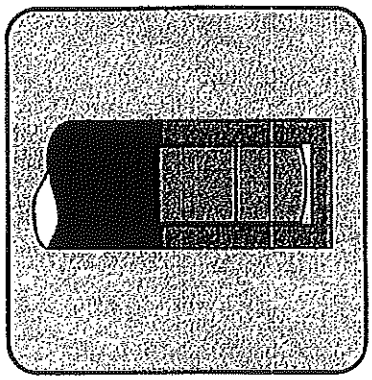
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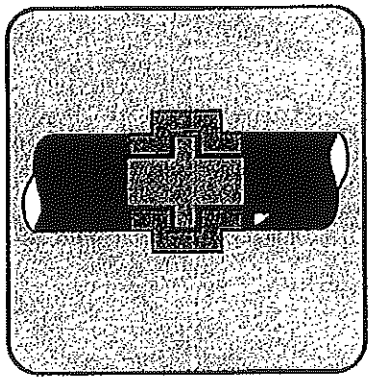
45° LATERAL



REDUCER



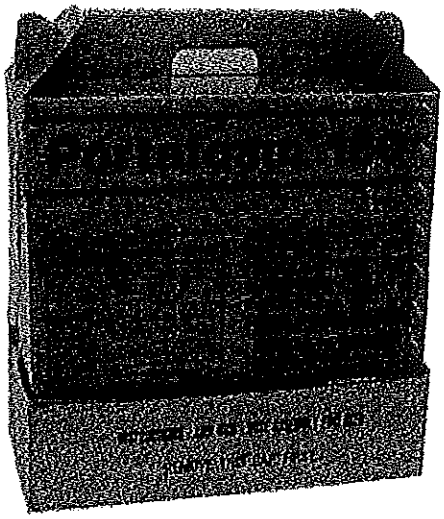
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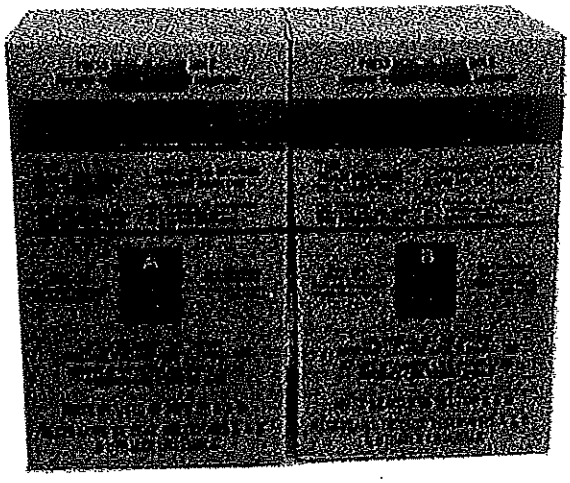


FLANGE ASSEMBLY

7.3. Insulation, foamed in place (PORTAFOAM® Specification)

The PORTAFOAM® kit is a self contained, factory pressurized system designed to precisely meter, mix and dispense specially formulated chemical systems for 'in the ditch' production of urethane foam. PORTAFOAM® kits are available in two sizes, each complete with all required chemical components, gun hose assembly, 10 disposable mixing nozzles and instructions. All components are contained in specially waxed cartons, suitable for outdoor use. The PORTAFOAM® system may be applied at virtually any ambient temperature provided the kit itself has been heated to 24°C *(75°F)* prior to use. Kits may be kept in the truck cab, with the heater on between applications to ensure their proper operation in cold ambient temperatures.





- Material to be a two component polyurethane foam supplied in a portable, disposable, pressurized container.
- Density: (ASTM D1622) 35 to 39 kg/m³ *(2.18 to 2.43 lbs/ft³).*
- Closed cell content: (ASTM D2856) 90% minimum.
- Thermal conductivity: (ASTM C518) 0,020 to 0,028 W/m°C *(0.14 to 0.20 Btu • in/ft² • hr • °F).*
- Compressive strength: (ASTM D1621) 103 to 172 kPa *(15 to 25 lbs/in².).*
- PORTAFOAM® or approved equivalent.

PORTAFOAM® kits are available in the following sizes:

#160 - 0,37 m³ *(13 ft³)*
#520 - 1,21 m³ *(43 ft³)*

ACCESSORIES AND COMPONENTS

1. Wrap Around Heat Shrink Sleeves

Wrap around heat shrink sleeves are supplied in kit form with a pressure sensitive closure strip to hold the sleeve temporarily until heat shrinking has taken place. The sleeve consists of a radiation-crosslinked polyolefin backing, pre-coated with a high strength adhesive. All sleeves are black and are available both for above ground and buried applications.

Once the insulated pipe or insulation kit jacket has been cleaned, the sleeve is wrapped around and the pressure sensitive closure installed to form a tube. Upon heating the sleeve, the backing shrinks, forcing the now melted adhesive to flow and form a permanent seal between the sleeve and outer jacket of the pre-insulated pipe.

Wrap around heat shrink sleeves are readily available in the following widths:

150 mm *(6 in)*
300 mm *(12 in)*
450 mm *(18 in)*
600 mm *(24 in)*

SANAQATIIT
CONSTRUCTION LTD.

INSULATED METAL PANELS

ALL WEATHER INSULATED PANELS

A Vicwest Company

Technical Bulletin #73

4/13

Cleaning and Maintenance of IMPs

Cleaning and Maintenance

Proper installation and maintenance are extremely important to obtain the best performance and appearance from the insulated panel.

Dirt, oil, grease, fingerprints or any other kind of contaminant must be completely removed when the installation is finished to maximize coating performance.

The building will require periodic maintenance according to conditions at the site: ultraviolet rays, dirt, smoke, corrosive atmosphere, etc. If further assistance is required, please consult the AWIP's technical services department.

If touch-up paint is required, AWIP can provide color chips to get paints matched at a local paint store.

Removing Oxidation and Stains

The recommended method to remove mild oxidation and stains is to use a household cleaner recommended for use with porcelain sinks and tubs. Thorough rinsing of the panels with water after cleaning is suggested. Wire brushing or scrubbing with any abrasive material may damage the painted surface and should not be used.

Cleaning the Painted Surface

Dirt pickup may cause apparent discoloration of the paint when it has been exposed to dirt-laden atmospheres for long periods of time. Slight chalking may cause some change in appearance in areas of strong sunlight. A good cleaning will often restore the appearance of these buildings.

In many cases, simply pressure-washing the building with water will be adequate. In areas of heavy dirt deposits, a solution of water and detergent may be used. Use a rag or sponge to clean. Rinse with water afterward.

Exposure to Heat or Flame

Although AWIP urethane core panels are acceptable for use in non-combustible building assemblies in accordance with the IBC and have been exhaustively tested for fire resistivity based on their end use, they are not "fire rated" panels per ASTM E119. Panels shall not be exposed to extreme temperatures or direct flame at any time. In simple terms, do not use a welding torch on or near insulated panels more than you would on a wood building. This may compromise the paint finish and structural capabilities of the foam core. Please consult with AWIP's technical services department for further information.

ALL WEATHER INSULATED PANELS

A Vicwest Company

Technical Bulletin #72

4/11

Field Touch-up or Repainting of Metal Panels

All Weather Insulated Panels can provide color chips to get touch-up paints matched at a local paint store. We recommend damaged areas to be repainted using a high-quality, field applied acrylic lacquer that has been color and gloss matched to the existing finish. Small variations between the color and gloss of the touch-up paint and the original coating can be expected. For small areas, any difference between the repaired area and the original panel finish should be difficult to discern. Use small brushes and small amounts of touch-up paint as needed to cover the scratch or abrasion. However, for large areas, we suggest the entire section be refinished professionally. Please feel free to contact us directly for recommendations of metal building refinishing services.

929 Aldridge Road · Vacaville, CA 95688 · 707.359.2280 · Fax 707.359.2286 · www.awipanels.com

ALL WEATHER INSULATED PANELS

A Vicwest Company

Technical Bulletin #63

5/09

Recommended Methods of Panel Repair

Repair to field damaged areas of All Weather Insulated Panels can usually be performed in one of three ways:

1. Filling and re-texturing the area with automotive putty (Small area)
2. Re-skinning the panel facing (Medium area)
3. Replacement of the panel or section of the panel (Large area)

These methods of repair are also shown in the order of magnitude of the repair: smallest to largest.

Note: It is important to note that any repair of insulated panels, short of replacing them completely, may leave a noticeable area where the repair was performed.

Filling with Automotive Putty

Repair to small areas of a damaged panel (dings and scratches, etc.) can be effectively done with automotive putty(Bondo®, or similar). The sheet metal exterior and interior skins can be repaired in a manner similar to fixing a ding on an automobile. The area can be prepared, filled, textured and re-painted.

The texture in the putty can be replicated by pressing a piece of identically profiled flat stock or trim into the putty while it is still malleable.

Retouching of the repair area should be performed with a good quality, color-matched exterior grade acrylic base paint. The paint manufacturer may recommend a specific primer or undercoat preparation.

Small dings may also be repaired with an auto body "suction kit".

Re-skinning the Panel Facing

Repair to medium sized areas of a damaged panel (larger creases, dents, etc.) may be achieved by covering the damaged area with a matching panel skin. The skin is adhered with an industrial adhesive or a two sided acrylic tape in combination with paint matching 1/8" pop rivets.

Replacing or re-covering the panel skin is best done with a full width piece that covers the panel from joint to joint. The replaced skin will create a noticeable line across the panel, so the repair should be accomplished with this in mind. Carefully seal the topside horizontal line with a clear or color matching acrylic to inhibit water intrusion behind the "patch".

Replacement of a Complete Panel or Section of a Panel

Damage to large areas (vehicles, forklifts, etc.) can be performed by a method known as "folding in a panel". This repair method is performed by exposing and drilling out the fasteners of the damaged panel(s) and the panel to the immediate right or left. The damaged panels are removed and the replacement panels are "folded" back into the wall by aligning the joinery on both sides of the panels and pressing them flush against the structural framing with adequate force to allow full engagement. The panels are then back-fastened using expansion fasteners (Fab-lok or similar).

Metal Construction Association

Metal Panel Field Repainting

The factory applied coating on metal siding and roof panels is a baked-on finish designed to provide trouble free performance for many years with minimum service required. When repainting metal siding and roof panels care must be taken to prepare the factory applied finish and to assess the adhesion between this surface and the coating to be used to repaint the panels.

Polyester factory-applied coatings are standard technology and present the least difficulty in repainting. Polyvinylidene fluoride (PVDF) and plastisol factory applied coatings require special precautions.

SURFACE PREPARATION

Before any repainting process can begin the following procedures should be followed:

DIRT, LOOSE CHALK AND MILDEW MUST BE REMOVED

a. ***Polyester coatings*** should be washed with a mild solution of detergent or household ammonia. Use a solution of one cup of common detergent, containing less than 0.5% phosphate (example "Tide"), dissolved into five gallons of warm water. A solution containing one cup of household ammonia dissolved into 5 gallons of water (at room temperature) will also aid in the cleaning of dirt, mildew and chalking. Solvent containing cleaners (examples "Fantastic" or "Formula 409") and detergents with greater than 0.5% Phosphate may be used if mildew or other fungal growth resists the milder treatments.

b. ***PVDF and Plastisol*** coatings should be washed as above with the exception that solvent containing cleaners should generally not be used. If solvent containing cleaners are used, a small area should be tested before general application; contact should be limited to ***five minutes***

Following the above cleaning process, the metal panel surface must be thoroughly flushed with water to remove any residual cleaning agents. Any cleaning agents left on the metal panel surface will damage the adhesion of the newly applied paint system.

SURFACE IMPERFECTIONS

Minor scratches, which have not exposed the substrate, may be lightly sanded or buffed to create a smooth surface for repainting. Care must be taken not to expose the substrate. If the substrate becomes exposed, refer to paragraph 3.

EXPOSED METAL AND RUST

Exposed metal must be treated to prevent rust from developing. A light sanding of the exposed, unrusted area should be followed by application of a high quality primer. Special care must be exercised to avoid the possibility that solvents (example - NMP or acetone types) in some primers may delaminate the factory applied PVDF and plastisol finishes.

If either red or white rust is evident, it should be totally removed by scraping or brushing followed by a light sanding and the application of a high quality primer. Care must be taken not to destroy the metal coating on the steel substrate.

TESTING FOR ADEQUATE INTERCOAT ADHESION

Repainting should not be done until after the intercoat adhesion is known to be acceptable. Unacceptable intercoat adhesion could result in delamination after long term exposure.

The following test can be used to determine the intercoat adhesion of a repaint material to a well prepared factory applied coating.

Equipment:

- Sharp utility knife
- Scotch #610 Cellophane Tape

Procedure:

Step 1 After properly cleaning and preparing the surface to be repainted, repaint a 4" x 4" area with the repaint material according to the manufacturer's instructions. Allow to dry completely before proceeding.

Step 2 Use a utility knife to cut a two inch "X" into the repaint coating.

Step 3 Place a three inch strip of Scotch #610 tape over the "X" and rub with heavy pressure, leaving one half inch of tape free for easy removal.

Step 4 Pull the tape back over itself at a 180 degree angle.

Step 5 Examine the tape and the panel for signs of paint removal.

REPAINTING

Evaluation of Test Results

If the tape removes more than 1/16" of the repaint material from the "X" cut, or if any material is removed from the face of the panel, the intercoat adhesion is inadequate for repainting. Do not proceed to repaint the panels since long term adhesion failure would be likely. Determination that acceptable intercoat adhesion has been achieved is the responsibility of the repainting contractor.

ADDITIONAL SURFACE PREPARATION METHODS

A layer of factory applied wax is often applied to protect the metal panels during forming and transit. Failure to remove this wax layer will result in poor intercoat adhesion and the probable peeling or flaking of a new coating. After washing the metal panel, the wax can be removed by wiping the surface with a clean cloth saturated with an industrial solvent (example - Xylene). An industrial solvent will facilitate the removal of the wax layer and assure maximum intercoat adhesion. After solvent cleaning, the acceptability of the intercoat adhesion of the cleaned metal panel must again be determined.

If intercoat adhesion is still unacceptable, it will be necessary to 'rough-up' the panel surface by light sanding (#400 grit sandpaper is recommended) or power washing. Care must be exercised so that the factory applied finish is not removed during this process. Building panels must be repainted within 24 hours after the surface preparation is completed.

MIXING AND REDUCTION

The paint must be thoroughly mixed before using. Mechanical mixing is recommended to assure that no settlement remains in the bottom of the container. Paint can be reduced for spraying by adding a solvent (example - xylene) to the paint and mixing thoroughly. The recommendation of the paint supplier concerning the use of specific solvents should be followed. The use of more, or less of the solvent recommended may be required depending upon the temperature conditions at the job site and application equipment used.

APPLICATION

The metal panel surface should be completely dry before starting to paint. Painting should not be done in the early morning and should not be done at job site temperatures less than 50 degrees Fahrenheit. Paint application should be at the rate recommended by the paint manufacturer. Excessive or heavy film application thickness can result in cracking or wrinkling.

COVERAGE

The application of paint at the rate of 1.0 mil dry film should result in approximately 400-500 square feet of coverage per gallon. This assumes minimum application losses. Some spray equipment and application methods can result in significant losses (up to 50%) which should be considered in estimating paint requirements.

CLEAN UP

The solvent recommended by the paint manufacturer should be used to clean all equipment.

This technical bulletin has been distributed, prior to publication, for review and comment by those organizations believed to have a direct interest in and knowledge of the subject matter.

Metal Construction Association

ISSUED 7-97

115 LaSalle St. ■ Suite 1400 ● Chicago, IL 60603
(312) 201-0193 ▲ Fax (312) 201-0214
or P.O. Box 687 Chicago, IL 60690-0687

TB 105.1

SANAQATIIT
CONSTRUCTION LTD.

Shop Drawing Transmittal

Project Name: Potable Water System – Phase I

Sanaqatiit Project Number: 12-505 **Submittal Number:** 12-505-02

Owner Project Number: 11-4002

Product Description: Supply labour and material to clad new potable water intake pump-house.

Specification Number: 13 34 19

Total Pages: 6 including cover

Submitted by: Sarah Fox

To: Walter Orr, Stantec

Via: Electronic Submission **Date:** **January 21, 2013**

Notes:

Attached pages are related to Insulated Wall and Roof panels and Metal soffit.

Stantec

- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

January 24, 2013

By: Arlen Foster, EIT

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.

STANTEC ARCHITECTURE LTD. (PC-1449)

Stantec

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- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

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STANTEC ARCHITECTURE LTD. (PC-1449)

Sarah Fox

From: David Kinch
Sent: Monday, January 21, 2013 8:39 AM
To: Sarah Fox
Subject: FW: Attached Image
Attachments: 3385_001.pdf; 3414_001.pdf; 3413_001.pdf

Sarah,
See attached Vicwest Color Chart and product information sheets.....
Below are the different panel profile and gauge options available which closely match the specifications.
Note: The exterior face of Alternate 1 is only available in 26ga Striated.

Insulated Metal Wall Panels

1500 sqft - 6" Mesa (DM40) 10 -12 weeks delivery
Interior: 26ga Stucco Embossed Mesa Imperial White
Exterior: 22ga Stucco Embossed Mesa with Standard In-Stock PDVF Color

Wall Panel Alternate 1:
1500 sqft - 6" Mesa (DM40)
Interior: 26ga Stucco Embossed Mesa Imperial White
Exterior: 26ga Stucco Embossed Striated with Standard In-Stock PDVF Color

Wall Panel Alternate 2:
1500 sqft - 6" Mesa (DM40)
Interior: 26ga Stucco Embossed Mesa Imperial White
Exterior: 24ga Stucco Embossed Mesa with Standard In-Stock PDVF Color

In REGAL BLUE

Insulated Metal Roof Panels

500 sqft - 6" HR5 10-12 weeks delivery
Interior: 26ga Stucco Embossed Mesa Imperial White
Exterior: 22ga Stucco Embossed with Standard In-Stock PDVF Color

Roof Panel Alternate 1:
500 sqft - 6" HR5
Interior: 26ga Stucco Embossed Mesa Imperial White
Exterior: 24ga Stucco Embossed with Standard In-Stock PDVF Color

In PEARL GREY

Metal Soffit Cladding

500 sqft - 24ga Diamond Rib Wall Cladding (White, Bone White, Galvalume, Galvanized) 3 -4 weeks delivery

In WHITE

Dave Kinch

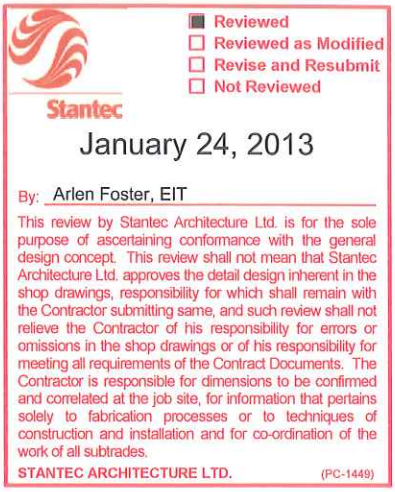


Arcan Roofing and Cladding Ltd.
Web Site: www.arcan.nt.ca
Email: dkinch@arcan.nt.ca

209 – 40 Elizabeth Street
Okotoks, Alberta T1S 1B1

Office: (403) 938 3131
Direct: (403) 9955015
Cell: (403) 404 7307
Fax: (403) 938 3188

From: OKCopier@arcan.ca [mailto:OKCopier@arcan.ca]
Sent: Thursday, January 17, 2013 8:44 AM
To: David Kinch
Subject: Attached Image



vicwest.com

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AWIP

ALL WEATHER INSULATED PANELS

VICW

Stantec

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☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

January 24, 2013

By: Arlen Foster, EIT

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STANTEC ARCHITECTURE LTD. (PC-1449)

Insulated Metal Panels

Color Availability Char

The colors shown here are representative only and not necessarily true reproductions of actual coating colors. Coil coat color chips are available on request.

For information regarding USDA and CFIA approved colors please contact your Vicwest / AWIP sales representative.



PVDF In-stock Colors

Sandstone

Surrey Beige

Regal White

Regal Blue

Natural Green

Pearl Gray

SMP In-stock Colors

Imperial White

Sandstone

Surrey Beige

Available PVDF Non-stock Colors

Warm White

Slate Gray

Evergreen

Slate Blue

Colonial Red

Weathered Copper

Interior Colors

Imperial White

Hi Rib Roof Panels

Stantec
Reviewed
Reviewed as Modified
Revise and Resubmit
Not Reviewed
January 24, 2013
By: Arlen Foster, EIT
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STANTEC ARCHITECTURE LTD. (PC-1449)

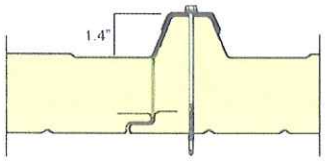
HR3 and HR5

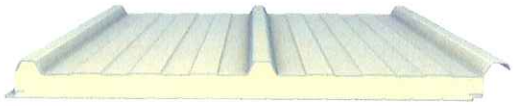
The HR3 (three rib) high rib panel is an economical solution to roofing. This product installs quickly and easily by through fas into supporting structural members.

The HR5 (5 rib) high rib panel was developed for long span and/ conditions. Fastening is identical to the HR3 panel.

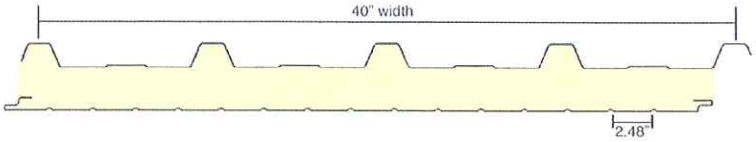
Standard thickness (inches): 2.5, 4, 5, 6

HR Roof Joint





HR3





HR5

HR roof specifications:

Standard exterior facing: 26 gauge G-90 galvanized steel
Standard interior facing: 26 gauge G-90 galvanized steel, Imperial White polyester
Other available steel facings: 24, 22
Module lengths: 8' to 60'
Joinery: Overlapping (HR series), Preformed snap-on cap (CR series)
R-Values: 2.5"=20, 4"=32, 5"=41, 6"=49
Core: Continuously foamed-in-place urethane with nominal 2.2 to 2.5 pcf density



Stantec

- [x] Reviewed
- [ ] Reviewed as Modified
- [ ] Revise and Resubmit
- [ ] Not Reviewed

January 24, 2013

By: Arlen Foster, EIT

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STANTEC ARCHITECTURE LTD. (SC-1449)

Product Information Sheet

Innovative
Adaptable
Energy Ef



DM40 Mesa Wall Panels

TESTED & APPROVED

AWIP / Vicwest insulated metal panels have been extensively tested under a variety of North American standards:

FM 4880: Class 1 Fire Rating

FM 4881: Class 1 Exterior Wall System

FM 4471: Class 1 Roof Assembly

CAN/ULC S102: Flame Spread

CAN/ULC S101: Fire Endurance

CAN/ULC S138: Fire Endurance

CAN/ULC S127: Flammability

CAN/ULC S126: Flame Spread (Roof)

ASTM C518/C1363: Thermal Transmission

ASTM E283: Air Infiltration

ASTM E1680: Air Infiltration

ASTM E331: Water Infiltration

ASTM E1646: Water Infiltration

ASTM E72: Structural Strength

ASTM E84: Flame Spread

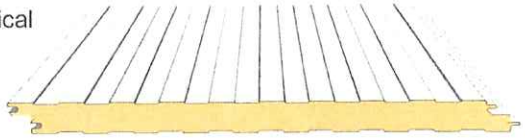
ASTM E119: Fire Endurance

AAMA 501.1: Air/Water Infiltration

CAN/ULC S134: Fire Test of Exterior Wall Assemblies

FM APPROVED

Our Mesa profile panel is the perfect economical choice for exterior / interior wall and ceiling applications on industrial and cold storage buildings.



FEATURES AND BENEFITS

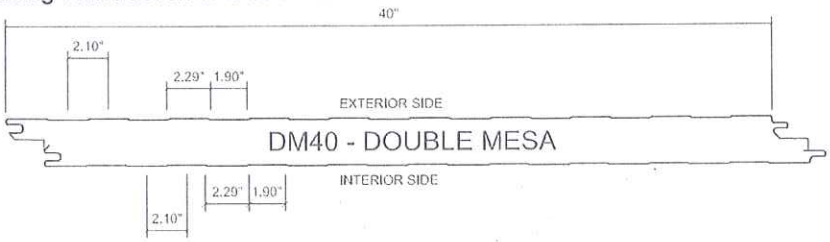
The low profile linear exterior surface simplifies flashing connections designed to inhibit moisture vapor transmission compared with other deep fluted products on the market.

The additional mesa profile on the interior face makes this panel particularly suited for thicker, long-length walls.

The panel's overlapping joint is self-aligning and allows for easy sealant application at the panel joinery.

The standard metal surface is 26ga G-90 galvanized steel with standard PVDF and SMP exterior coatings (other coatings may be available).

The panel arrives on site in one piece and requires a simple one step installation reducing construction time and costs.



PRODUCT PARAMETERS

Panel Thickness:	2"	2.5"	3"	4"	5"	6"
Insulating Values (R):	16	20	24	32	40	48
Panel Width:	40"					
Panel Length:	from 8' to 50' maximum					
Insulation Material:	CFC-free foamed-in-place isocyanurate foam 2.2 to 2.5 pcf density					
Joint Configuration:	offset tongue and groove with concealed fastener					
Metal facings:	26ga galvanized steel (22ga, 24ga available)					
Coatings:	PVDF & SMP (other coatings available)					
Accessories:	fasteners, concealed fastener clips, sealants, brake formed flashings					

U.S.A
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awipanels.com

AWIP
ALL WEATHER INSULATED PANELS

vicwest

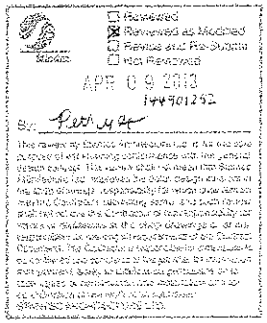
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vicwest.com

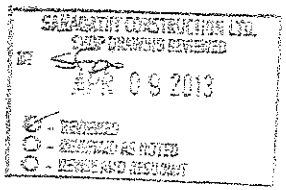
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CAMBRIDGE BAY POTABLE WATER SYSTEM
INSULATED METAL PANEL
SHOP DRAWINGS

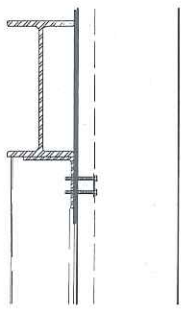
ISSUED FOR CLIENT REVIEW MARCH 22, 2013

REVISED FOR CLIENT REVIEW APRIL 5, 2013





W1 VICWEST 6" DM40 INSULATED WALL PANELS

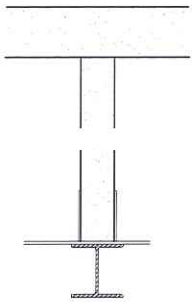


VICWEST 6" DM40 INSULATED FOAM PANELS.
INTERIOR: 26ga STUCCO EMBOSSED IMPERIAL WHITE
EXTERIOR: 24ga STUCCO EMBOSSED REGAL BLUE

FASTENED TO 76x76x6.4 HORIZONTAL STRUCTURAL ANGLE @ 610 o.c. USING 2–¼"–14x6" TEK 5 FASTENERS c/w PANEL CLIP

EXTERIOR WALL FLASHINGS TO MATCH

W2 VICWEST 4" DM40 INSULATED WALL PANELS

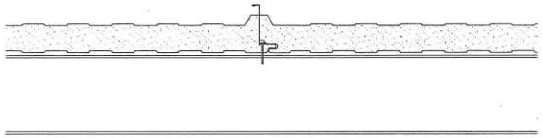


26ga STUCCO EMBOSSED IMPERIAL WHITE BOTH SIDES

FASTENED TO CEILING AS PER DETAIL D021
FASTENED TO FLOOR AS PER DETAIL D020

INTERIOR FLASHINGS TO MATCH

R1 VICWEST 6" SR2 INSULATED ROOF PANELS

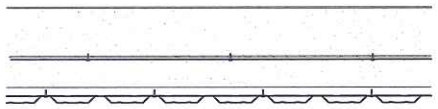


VICWEST 6" SR2 INSULATED ROOF PANELS.
INTERIOR: 26ga STUCCO EMBOSSED IMPERIAL WHITE
EXTERIOR: 24ga PEARL GREY

FASTENED TO THE TOP FLANGE OF A W200x22 STRUCTURAL BEAM USING 2–¼"–14x6" TEK 5 FASTENERS @ EACH END c/w PANEL CLIP

GABLE AND EAVE FLASHINGS TO MATCH

S1 VICWEST 24ga DIAMOND RIB SOFFIT CLADDING



24ga VICWEST DIAMOND RIB SOFFIT PANEL. COLOR WHITE. FASTENED TO 18ga Z–GIRTS USING #12x1" TEK SCREWS COLOR @ 12" o.c. c/w NEOPRENE WASHERS. COLOR TO MATCH CLADDING.

TYVEK BUILDING WRAP AS PER MANUFACTURERS RECOMMENDATIONS

18ga GALVANIZED Z–GIRTS @ 24" o.c. DEPTH VARIES (REFER TO DETAIL D004) FOR LOCATIONS AND ORIENTATION. FASTENED TO STRUCTURAL STEEL USING #14x1" TEK5 FASTENERS @ 16" o.c.

230mm SPRAY FOAM INSULATION

STRUCTURAL STEEL

SOFFIT FLASHINGS TO MATCH

ARCAN
ARCTIC CANADA CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

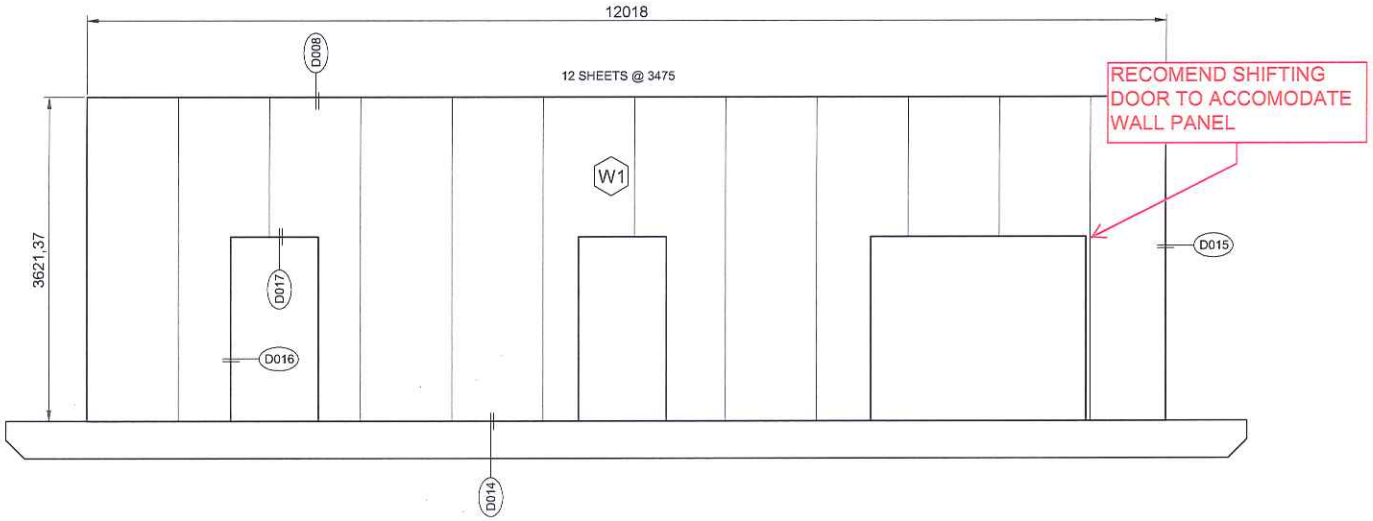
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
MATERIALS LEGEND AND SPECIFICATIONS

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12–505

Drawing No.	Rev.:
D001	2



FRONT ELEVATION

ARCAN
ARCTIC CANADA
CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

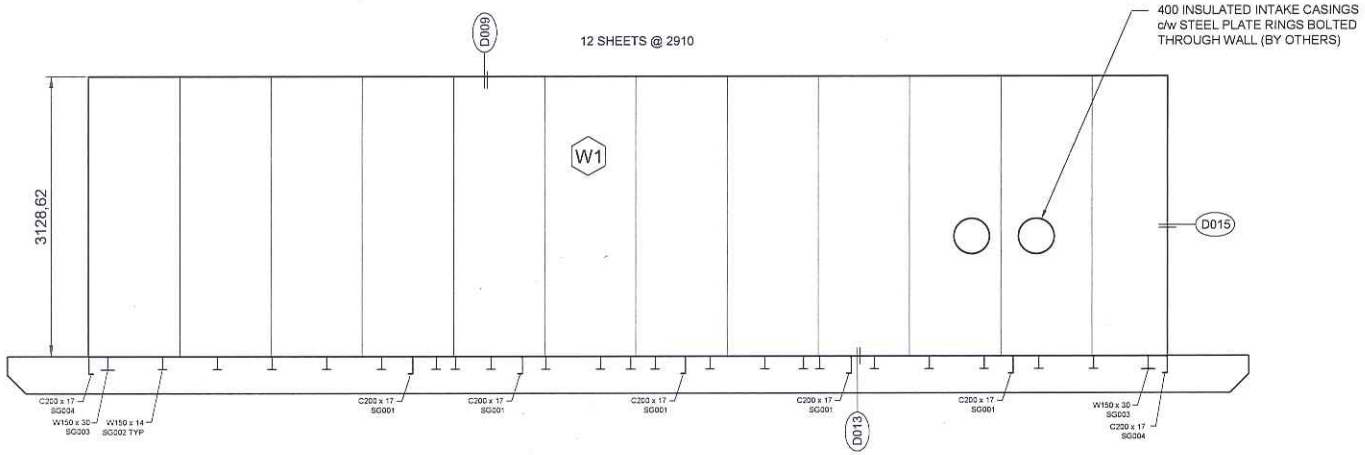
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
FRONT ELEVATION

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No. D002 | Rev.: 2



REAR ELEVATION

REFER TO D011 & D012
FOR SUBGIRT DETAILS

ARCAN
ARCTIC CANADA
CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR15/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

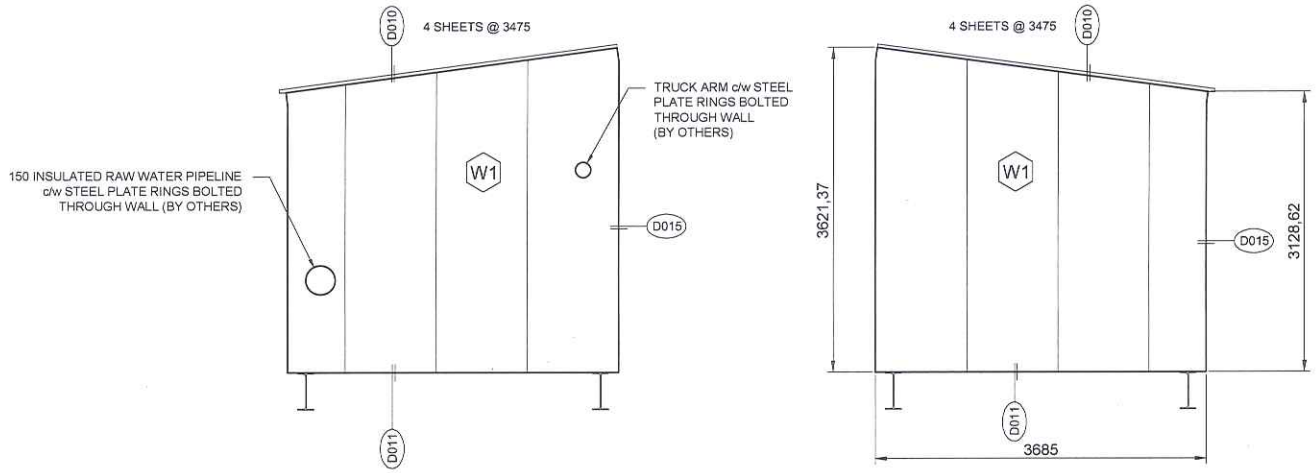
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
REAR ELEVATION

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No. D003 | Rev.: 2



SIDE ELEVATION

ARCAN
ARCTIC CANADA CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

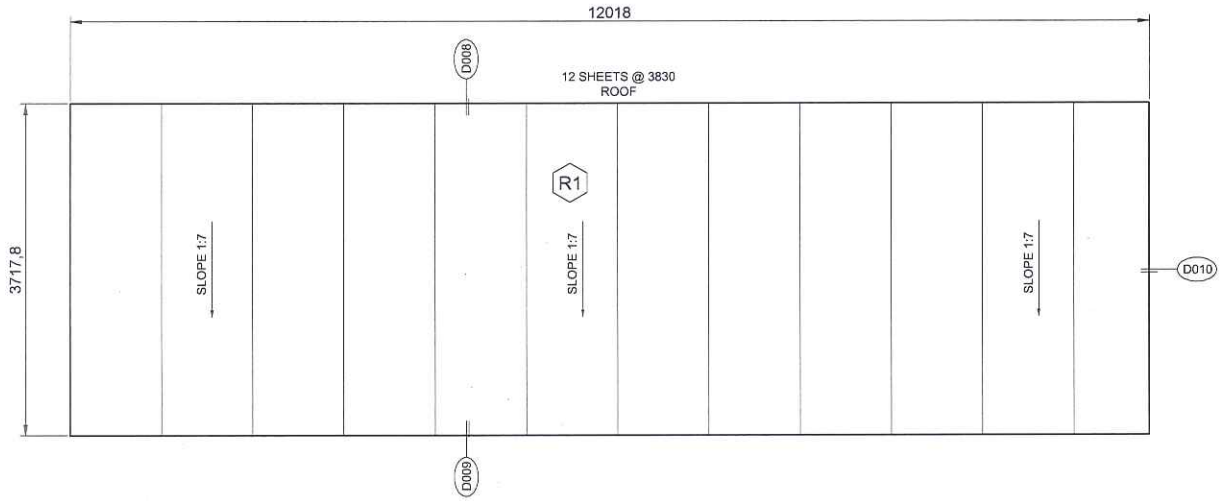
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
SIDE ELEVATIONS

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-805

Drawing No. D004 | Rev.: 2



ROOF PLAN

ARCAN
ARCTIC CANADA
CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

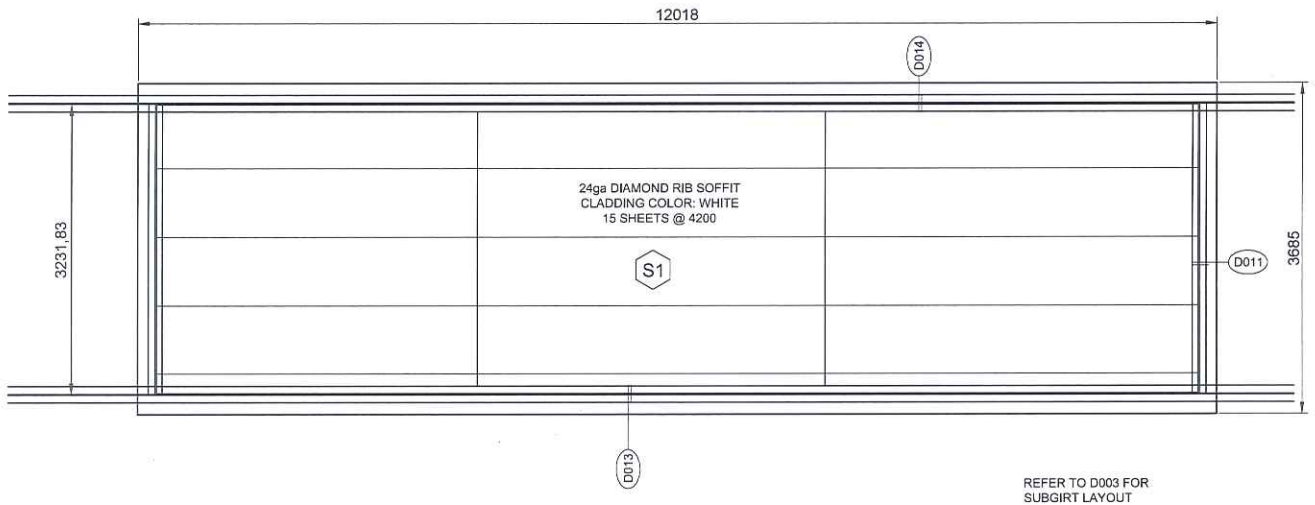
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
ROOF PLAN

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No. D005 | Rev.: 2



REFER TO D003 FOR SUBGIRT LAYOUT

REFLECTED SOFFIT PLAN

ARCAN
ARCTIC CANADA CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

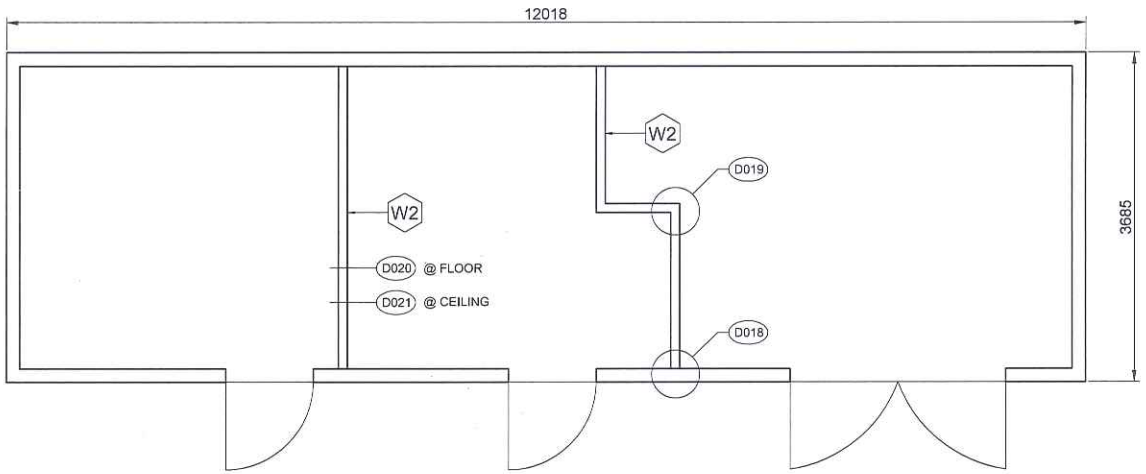
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
REFLECTED SOFFIT PLAN

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No. D006 | Rev.: 2



INTERIOR WALLS

ARCAN
ARCTIC CANADA
CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

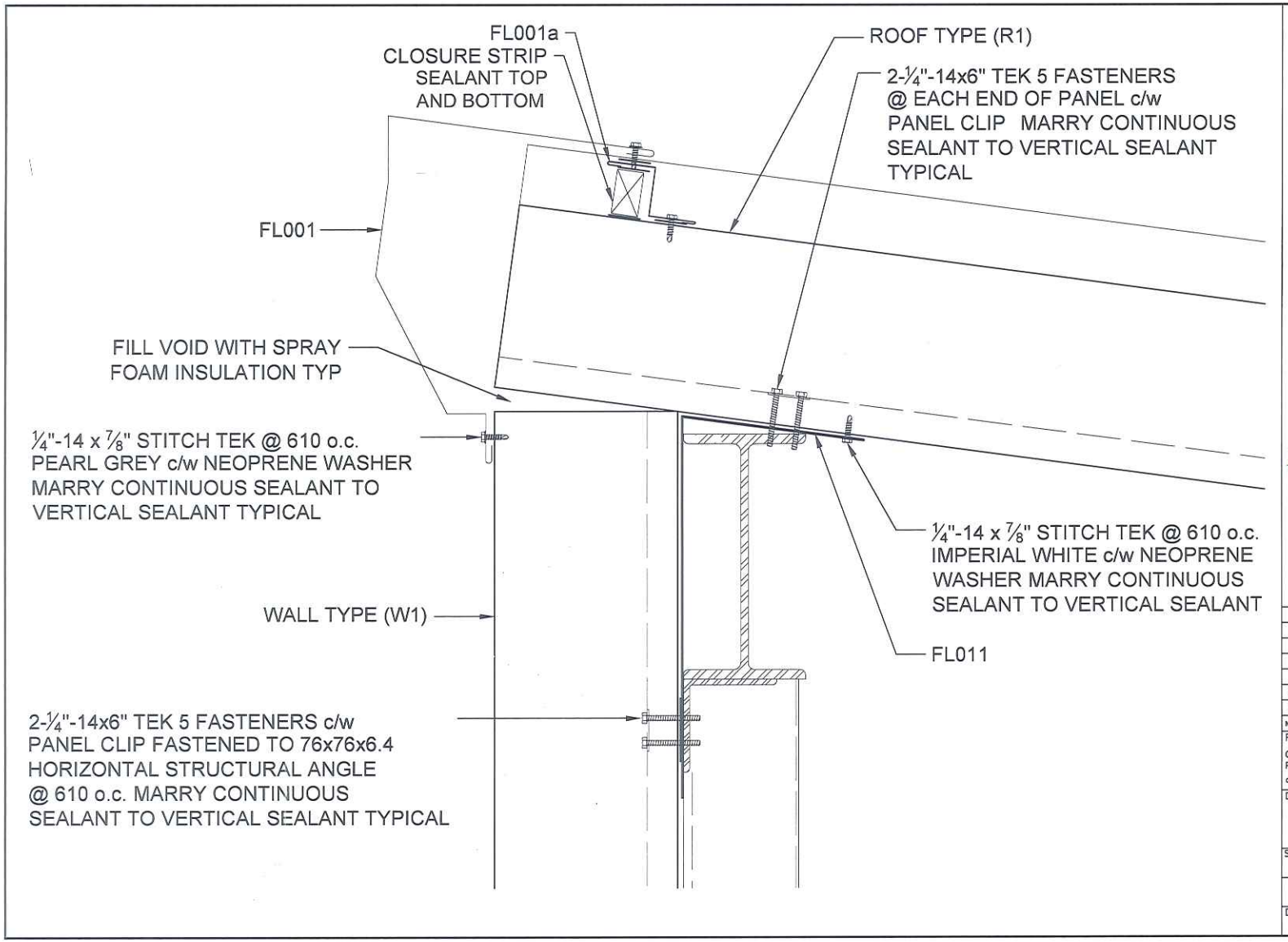
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
INTERIOR FLOOR PLAN

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No.	Rev.:
D007	2



ARCAN
ARCTIC CANADA
CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

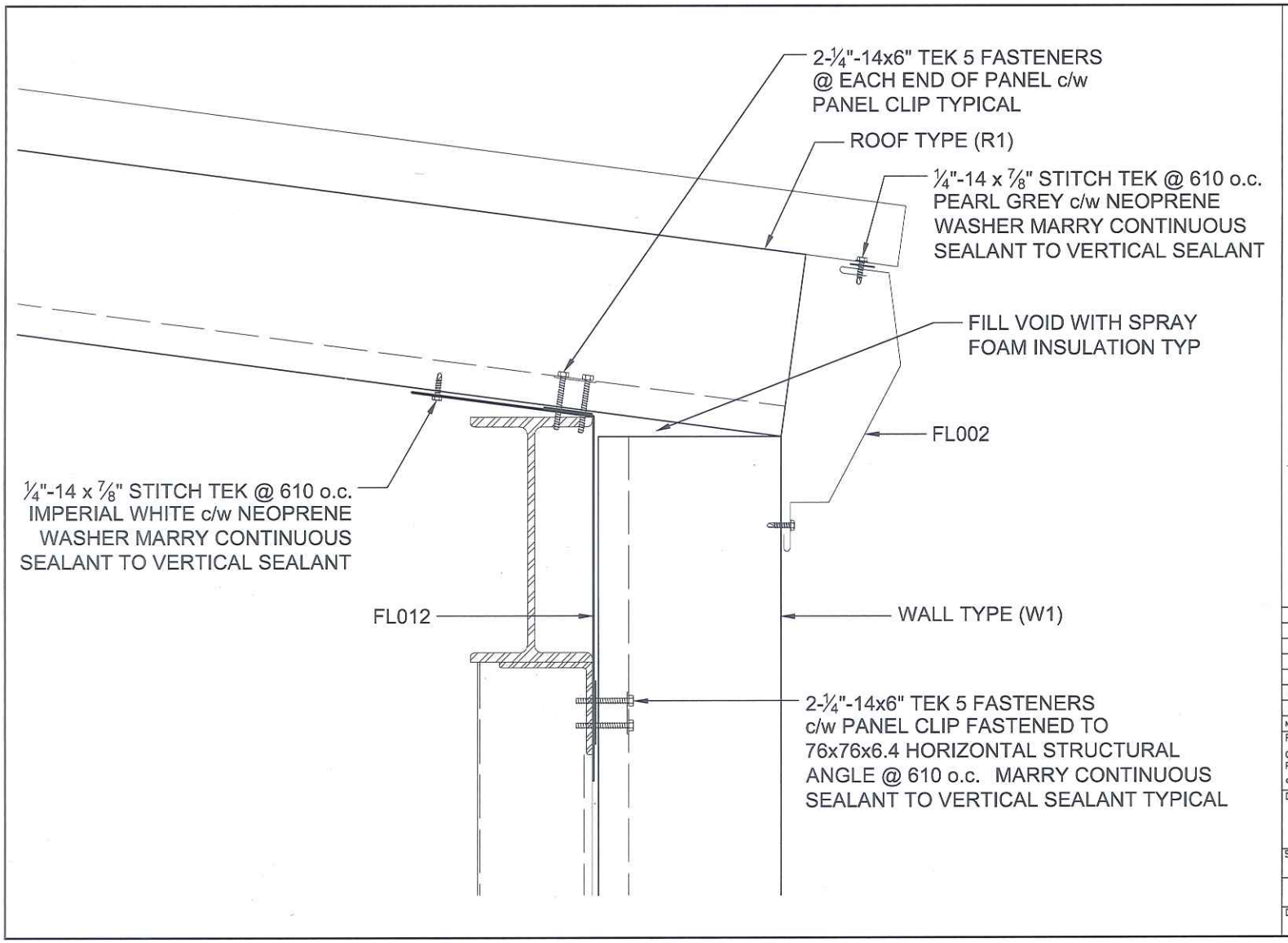
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
RIDGE DETAIL

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No. D008 | Rev.: 2



ARCAN
ARCTIC CANADA
CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

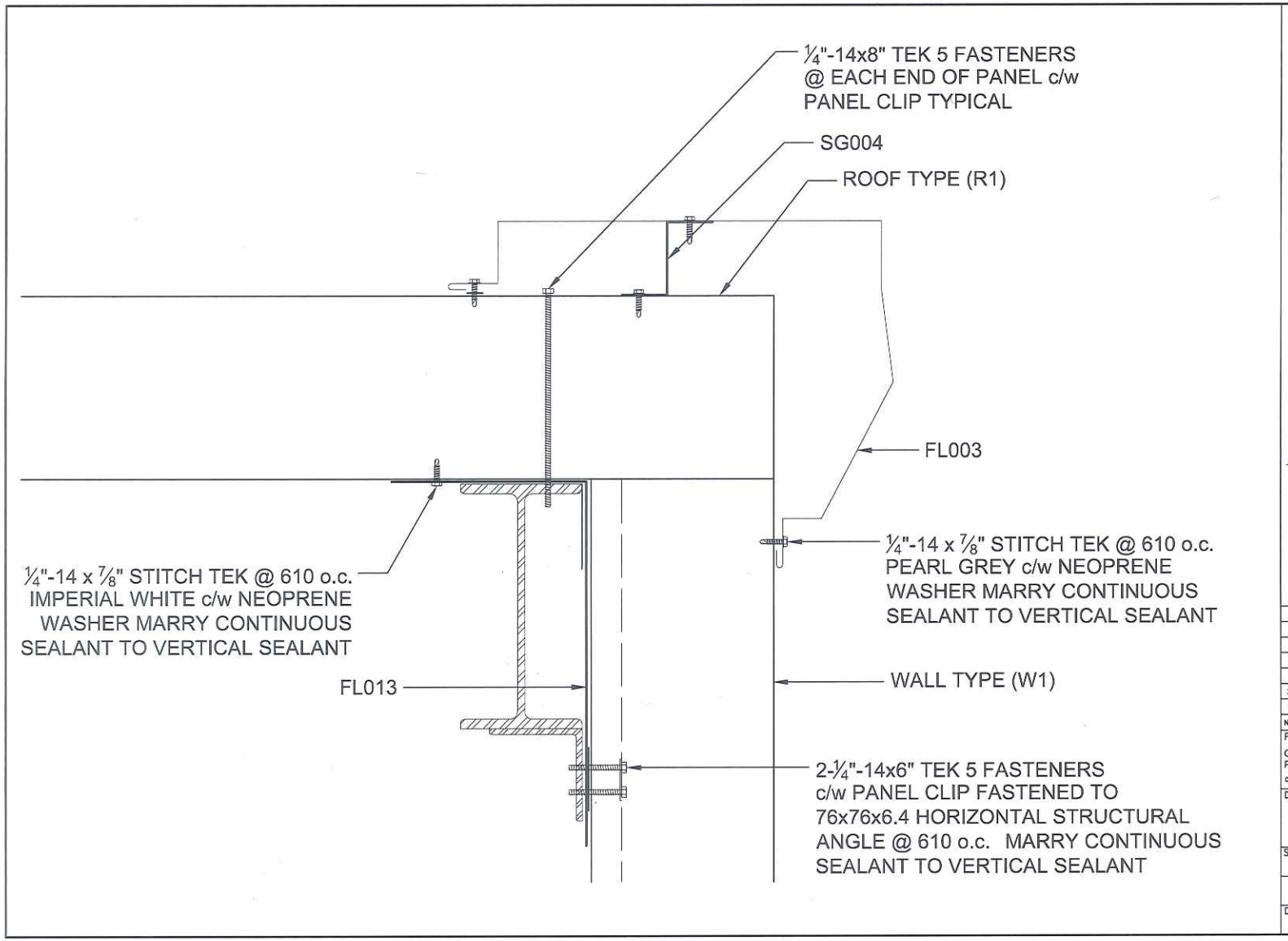
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
EAVE DETAIL

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No. D009 | Rev.: 2



ARCAN
ARCTIC CANADA
CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

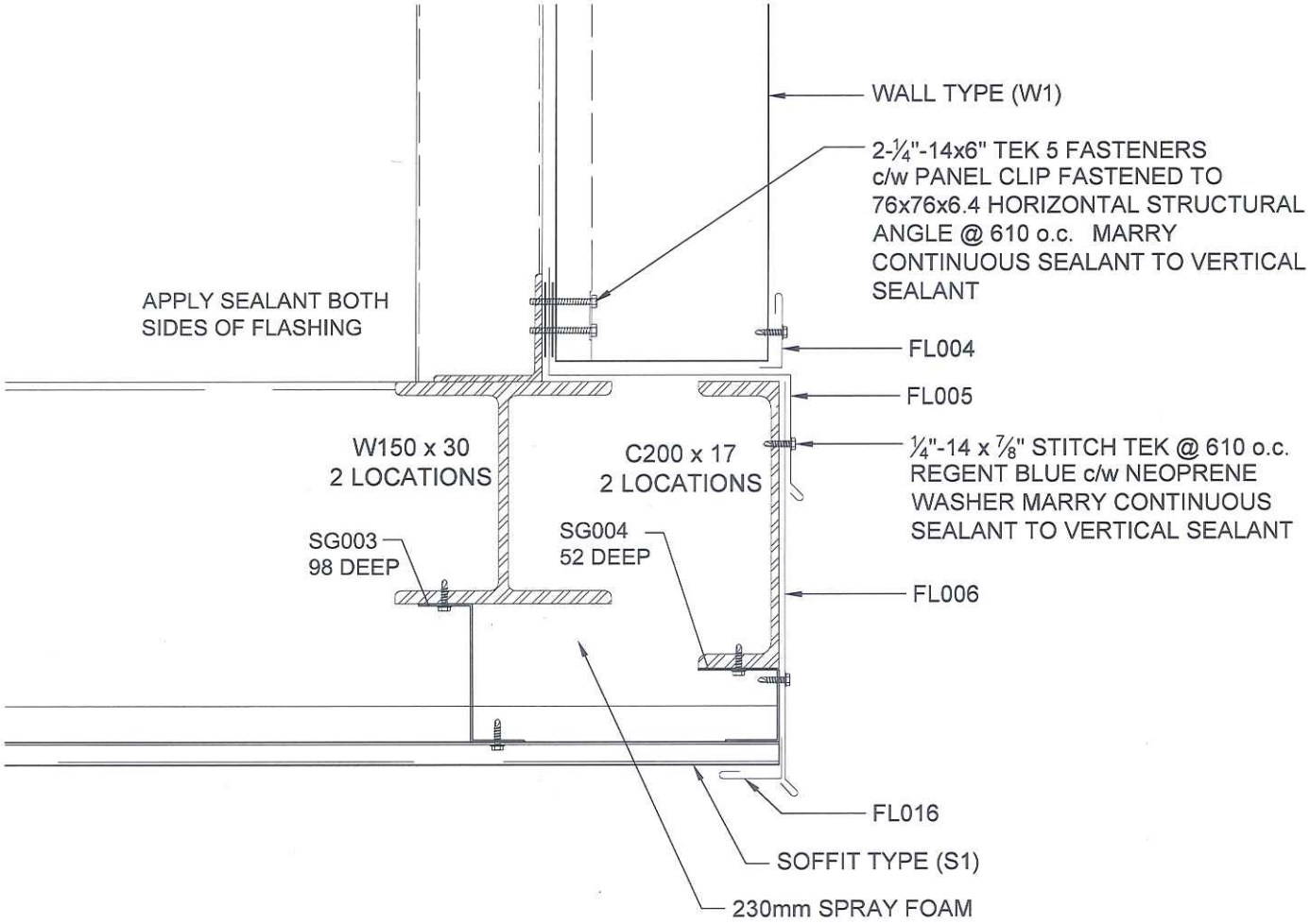
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
GABLE END DETAIL

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No. D010 | Rev.: 2



ARCAN
ARCTIC CANADA CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

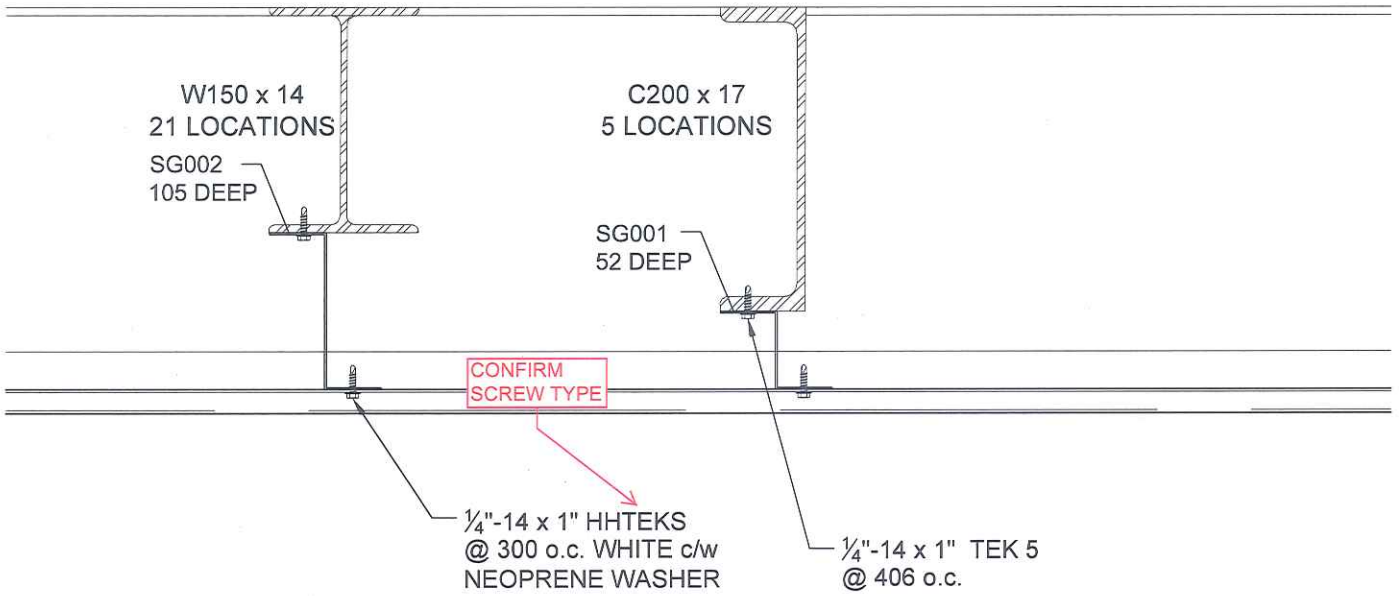
Drawing Title:
BASE DETAIL

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No. D011 | Rev.: 2

REFER TO D003 FOR
SUBGIRT LAYOUT



ARCAN
ARCTIC CANADA
CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

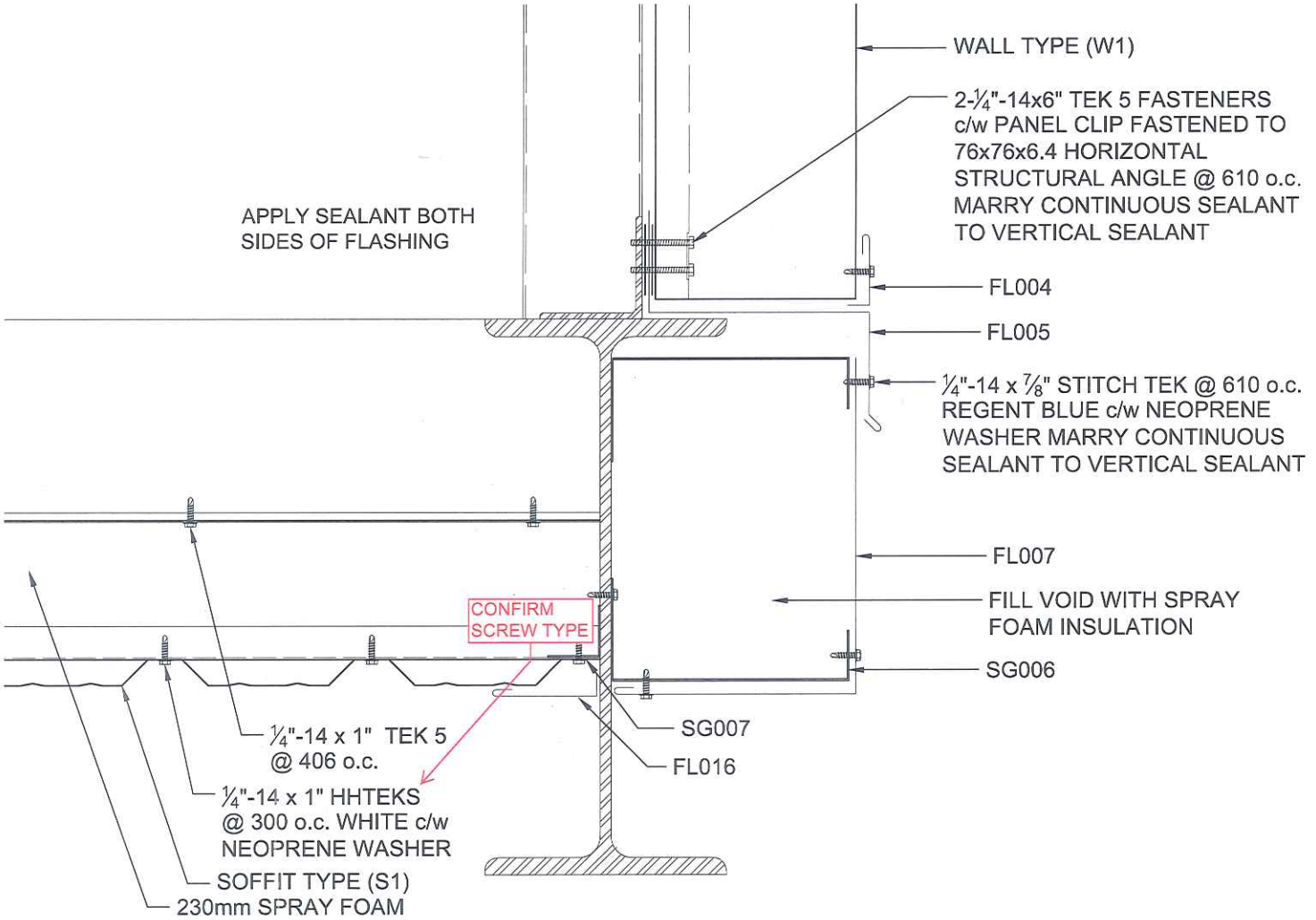
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
FLOOR DETAIL

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No.	Rev.:
D012	2



ARCAN
ARCTIC CANADA CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

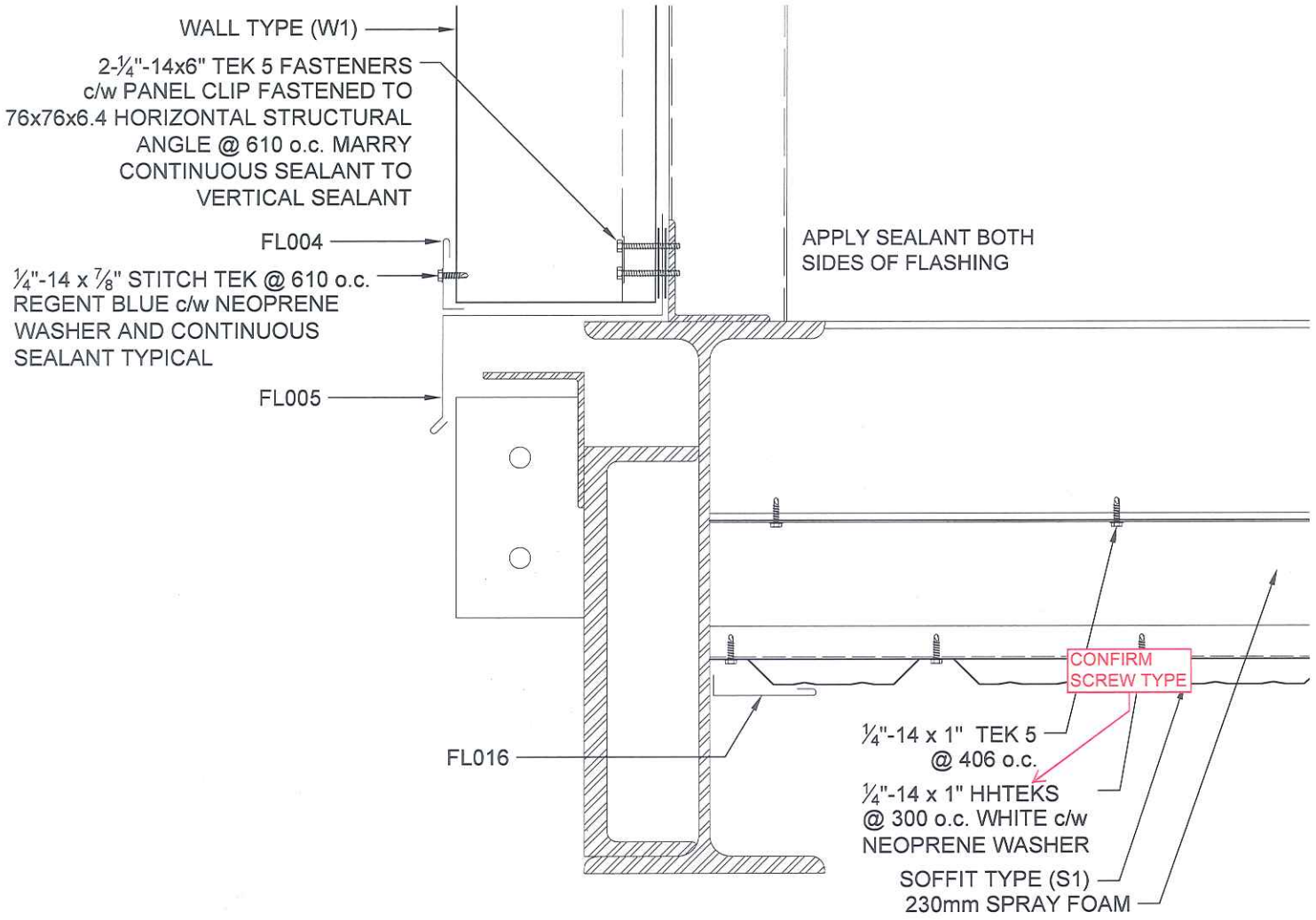
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
BASE DETAIL

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No. D013 | Rev.: 2



ARCAN
ARCTIC CANADA CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

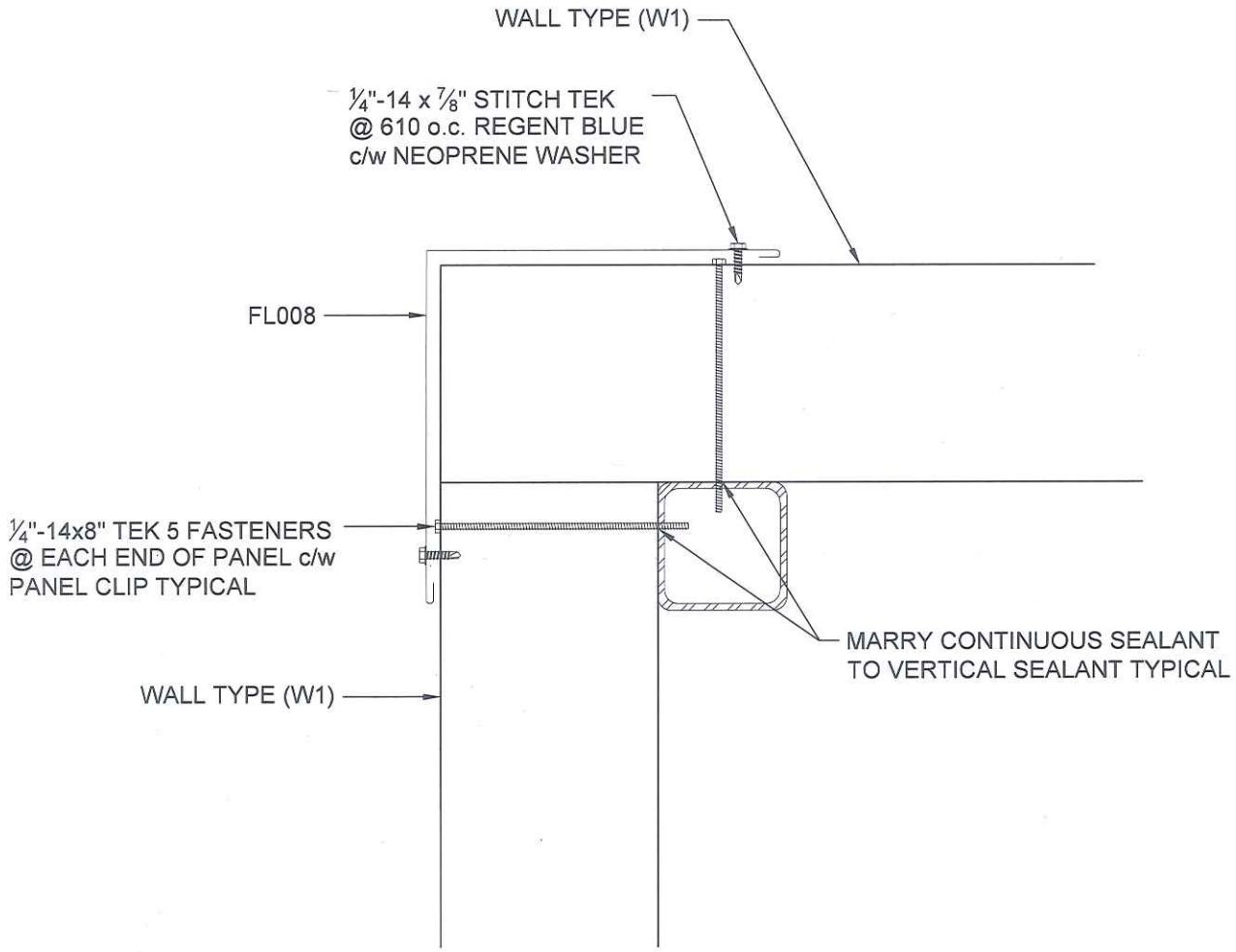
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
BASE DETAIL

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No. D014 | Rev.: 2



ARCAN
ARCTIC CANADA
CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

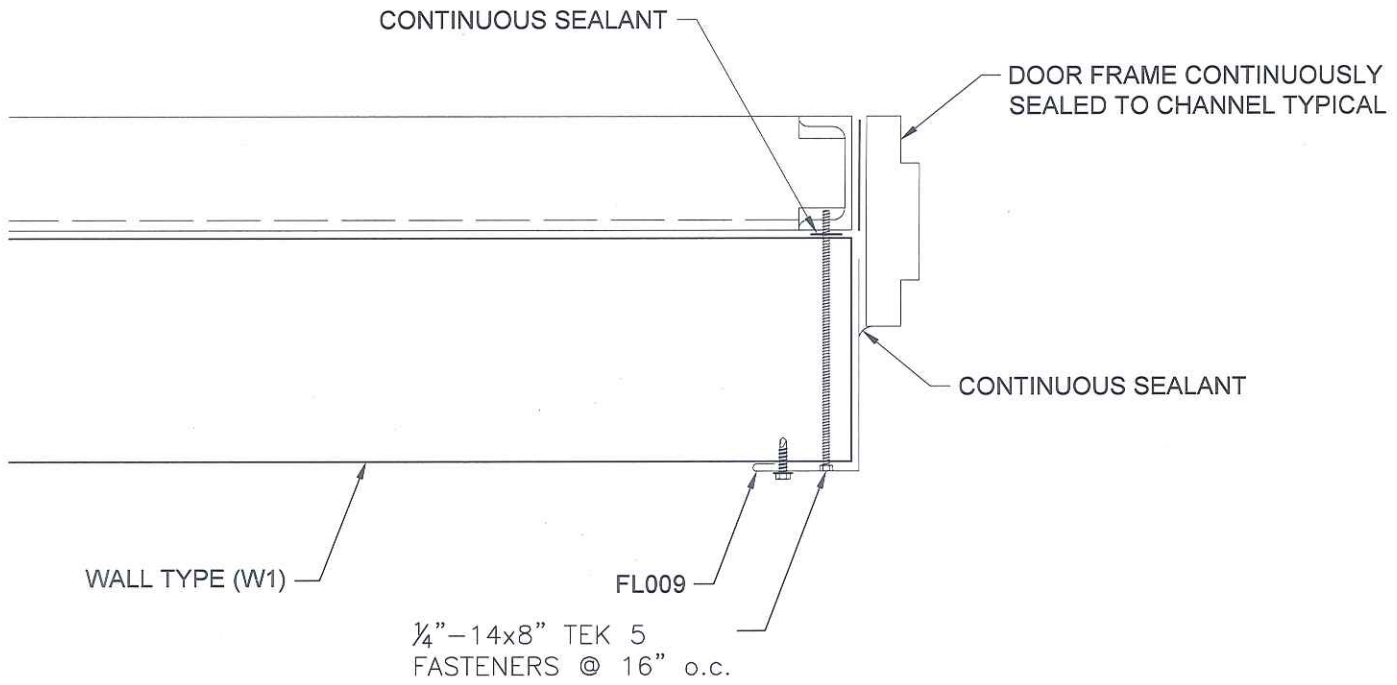
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
CORNER DETAIL

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No. D015 | Rev.: 2



ARCAN
ARCTIC CANADA CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

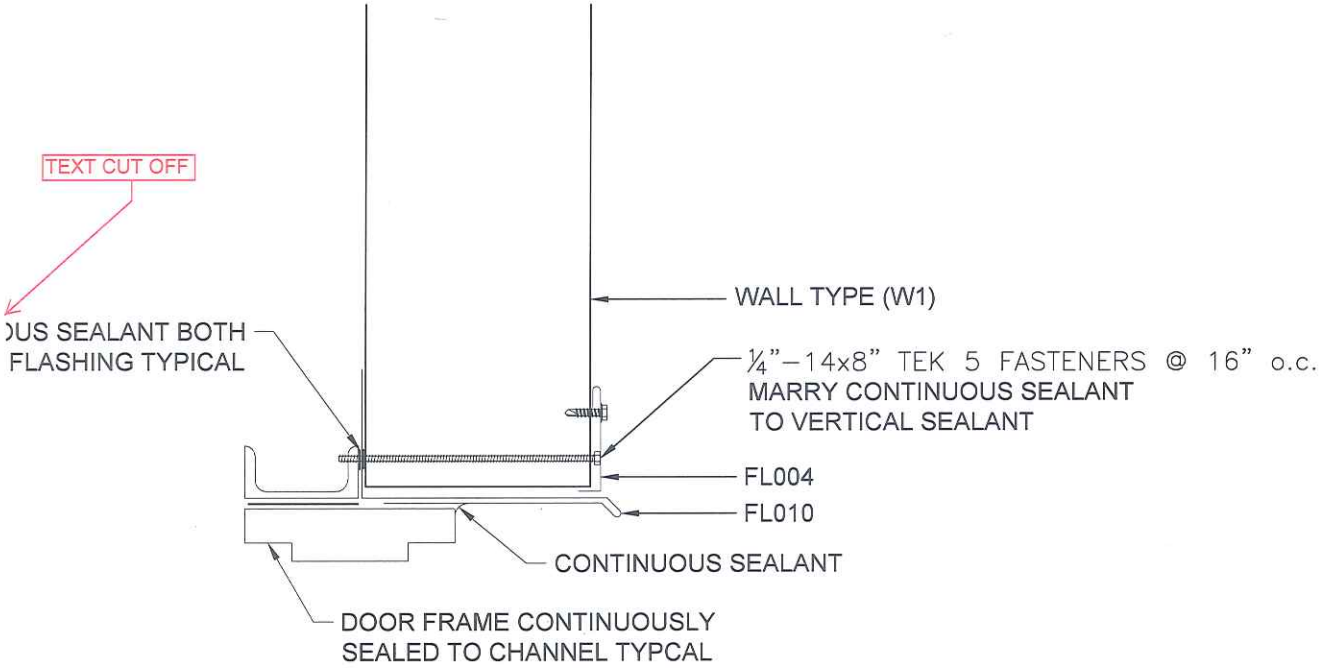
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
DOOR JAMB DETAIL

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12–505

Drawing No.	Rev.:
D016	2



ARCAN
ARCTIC CANADA
CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

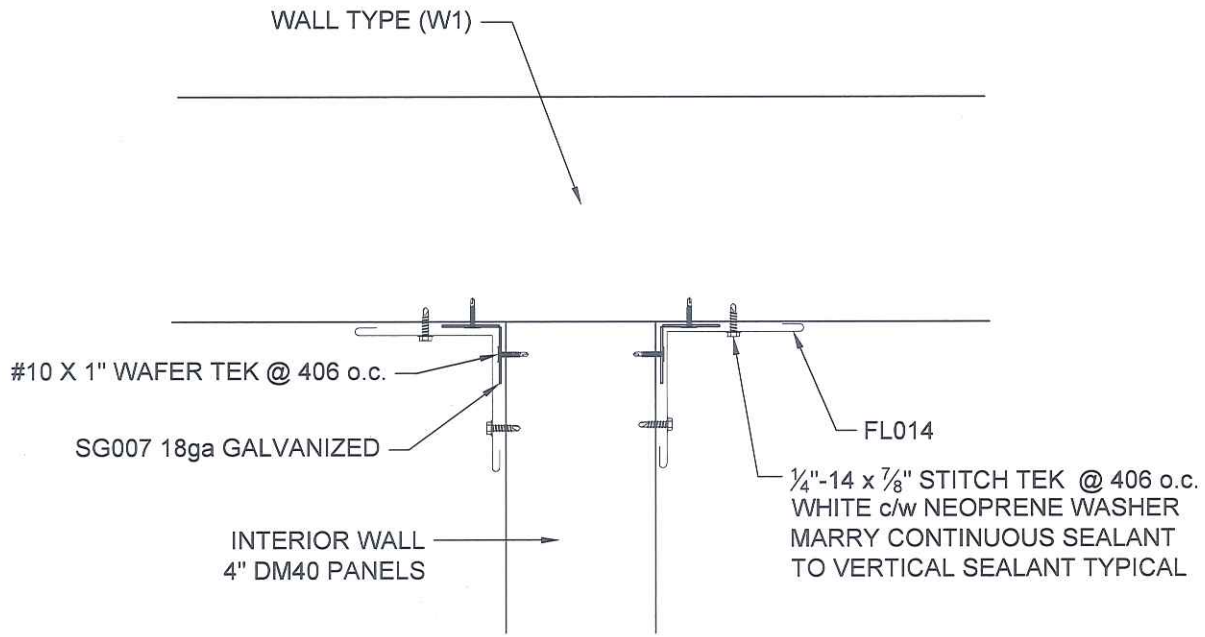
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
DOOR HEAD DETAIL

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12–505

Drawing No.	Rev.:
D017	2



ARCAN
ARCTIC CANADA CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

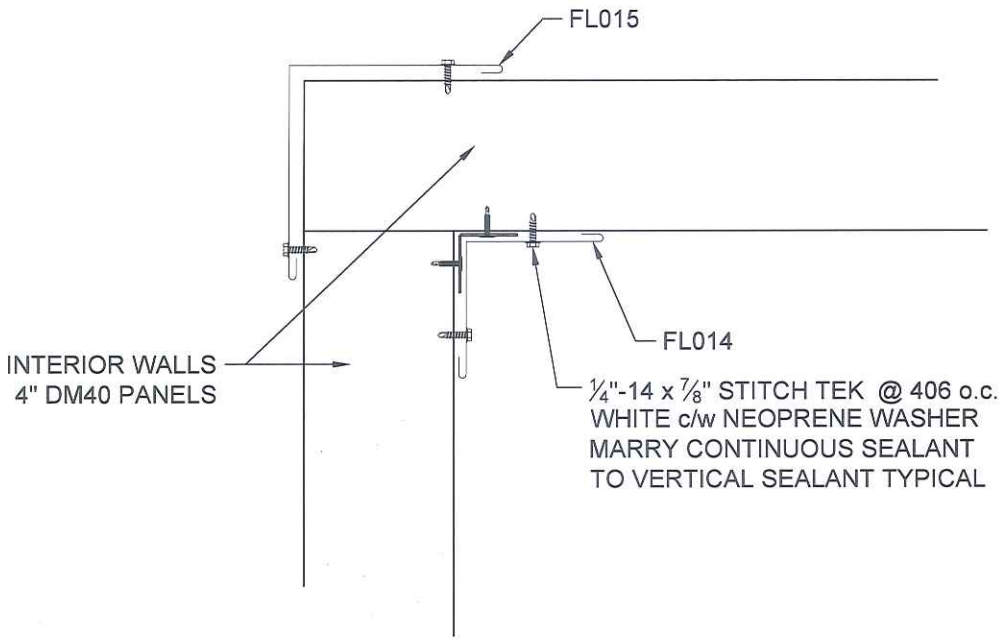
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
INTERIOR WALL/EXTERIOR WALL CONNECTION DETAIL

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No. D018 | Rev.: 2



ARCAN
ARCTIC CANADA
CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

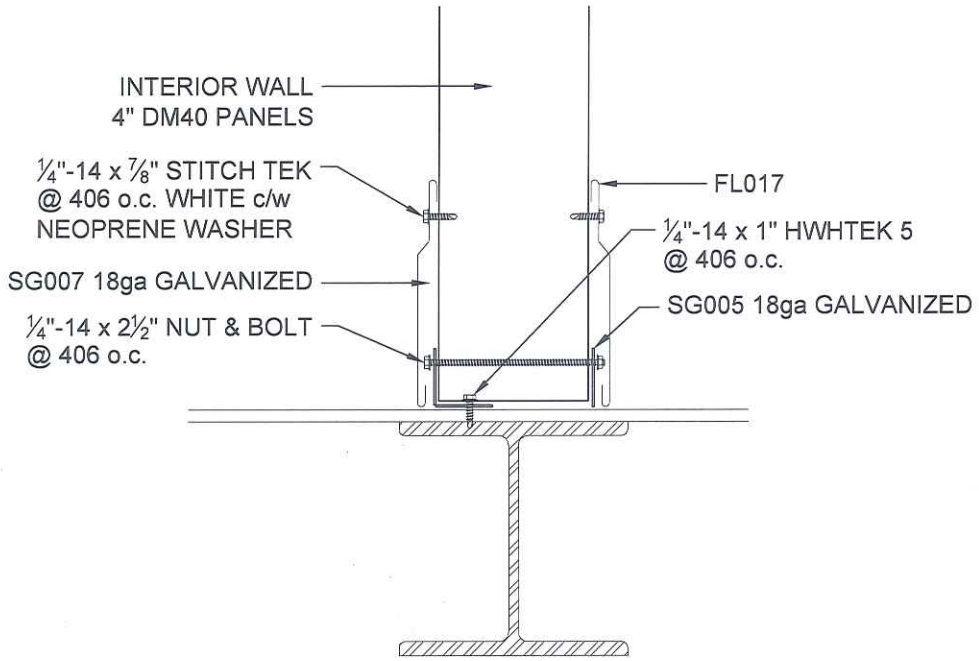
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
INTERIOR CORNER DETAIL

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No. D019 | Rev.: 2



ARCAN
ARCTIC CANADA
CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

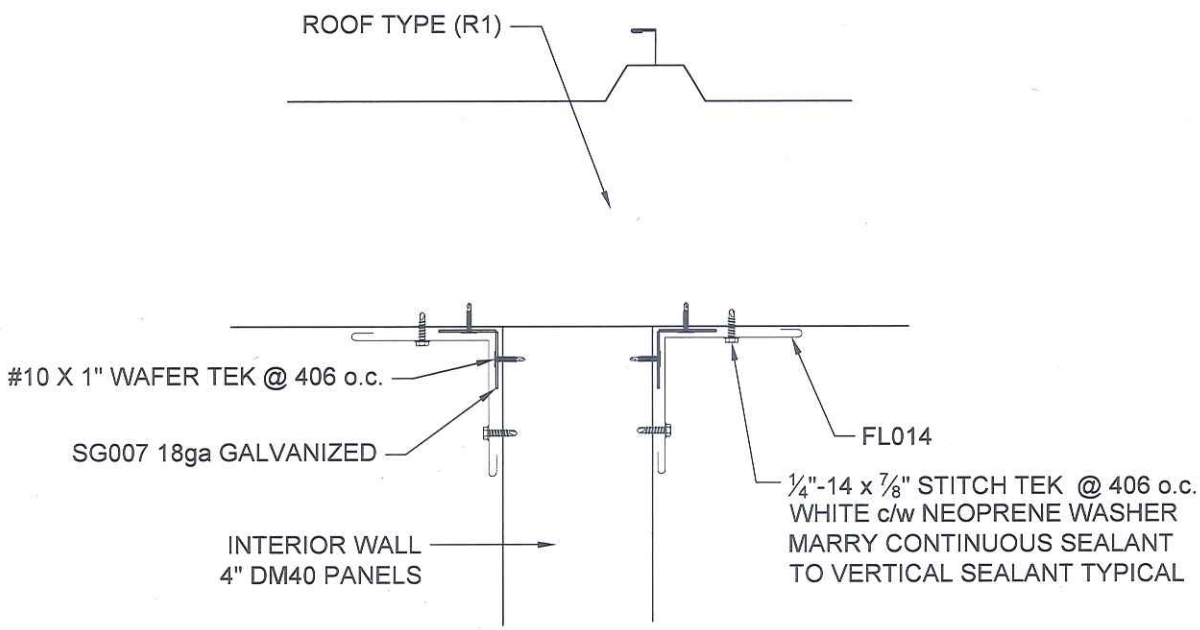
Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
INTERIOR WALL TO FLOOR DETAIL

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No. D020 | Rev.: 2



ARCAN
ARCTIC CANADA
CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR15/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

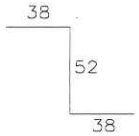
Drawing Title:
INTERIOR WALL TO CEILING DETAIL

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No. D021 | Rev.: 2

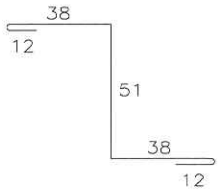
SG001



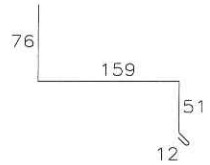
SG005



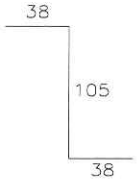
FL001a



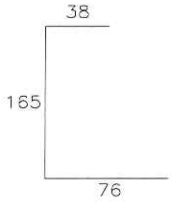
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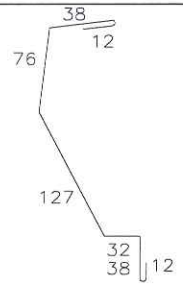
SG002



SG006



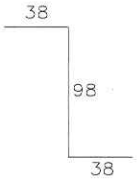
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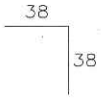
FL006



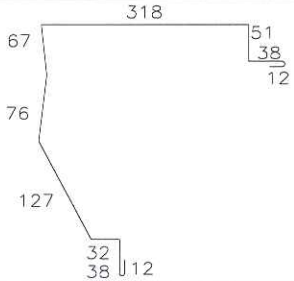
SG003



SG007



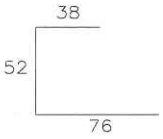
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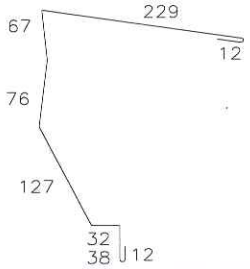
FL007



SG004



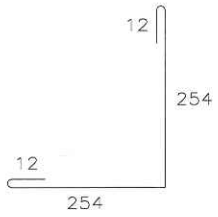
FL001



FL004



FL008



ARCAN
ARCTIC CANADA
CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

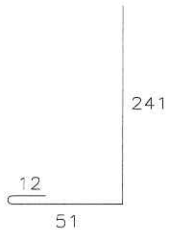
Drawing Title:
FLASHINGS & GIRTS

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

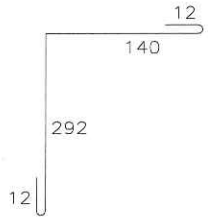
JOB# 12-505

Drawing No. D022 | Rev.: 2

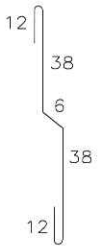
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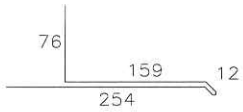
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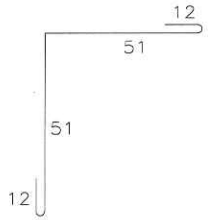
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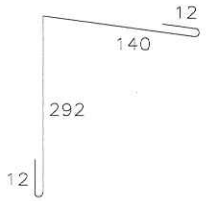
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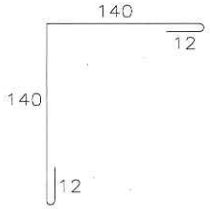
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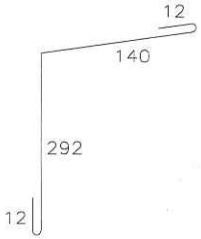
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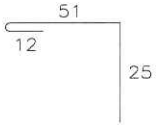
FL015



FL012



FL016



ARCAN
ARCTIC CANADA
CONSTRUCTION LTD.

No.	Revision Description	Date
2	REVISED FOR CLIENT REVIEW	APR5/13
1	ISSUED FOR CLIENT REVIEW	MAR22/13

Project Title:
CAMBRIDGE BAY
POTABLE WATER SYSTEM SKID
CAMBRIDGE BAY, NU

Drawing Title:
FLASHINGS & GIRTS

Scale:	Date:	Drawn by:
NTS	MARCH 20, 2012	DKINCH

JOB# 12-505

Drawing No. D023 | Rev.: 2

SANAQATIIT
CONSTRUCTION LTD.

DOORS, FRAMES, HARDWARE

CP DISTRIBUTORS
YOUR BUILDING CONNECTION

Maintenance Instructions & Warranty

Project Name:	Edmonton OTC
Project Number:	EOTC
Supplier:	CP Distributors Ltd. 4715 Eleniak Road Edmonton, AB T6B 2N1 Phone (780) 468-6754 Fax (780) 465-3278 sales.edmonton@cpdist.ca www.cpdist.ca
Materials:	Hollow Metal Doors & Pressed Steel Frames
Manufacturer:	Fleming Ltd.
Maintenance:	It shall be the responsibility of the General Contractor to see that any scratches or disfigurement caused in shipping or handling of the doors and frames is promptly cleaned and touched up with the rust inhibitive primer. All exposed surfaces of the metal doors and frames should be painted according to the architectural specifications. After installation and painting of the metal frames and doors, all hardware used in the installation should be kept in good working order to prevent damage to the frames or doors.
Cleaning:	Cleaning shall be carried out according to the instructions provided by the Painting Contractors.
Warranty:	Standard ONE YEAR Construction Warranty by Manufacturer covering defective materials.

CP DISTRIBUTORS
YOUR BUILDING CONNECTION

Maintenance Instructions & Warranty

Project Name:	Edmonton OTC
Project Number:	EOTC
Supplier:	CP Distributors Ltd. 4715 Eleniak Road Edmonton, AB T6B 2N1 Phone (780) 468-6754 Fax (780) 465-3278 sales.edmonton@cpdist.ca www.cpdist.ca
Materials:	Finish Hardware
Manufacturer:	Sargent-Locks Norton-Closers
Maintenance:	Insure all hardware is installed with strict compliance to installation instructions and templates. Periodic adjustments are required on mechanical hardware.
Cleaning:	Use diluted standard commercial cleaners to remove dirt and other materials as required. Do not use abrasive cleaners as they may damage the plated finishes
Warranty:	Sargent: Locksets- 1 Year Norton: Closers- 10 Years

SANAQATIIT
CONSTRUCTION LTD.

Shop Drawing Transmittal

Project Name: Potable Water System – Phase I

Sanaqatiit Project Number: 12-505 **Submittal Number:** 12-505-26

Owner Project Number: 11-4002

Product Description: Doors, frames, and hardware

Specification Number: 08 11 14 & 08 71 10

Total Pages: 18 including cover

Submitted by: Sarah Fox

To: Warren McLeod, Stantec **CC:** Arlen Foster, Stantec

Via: Electronic Submission **Date:** June 5th, 2013

Please see attached shop drawing submittal for metal doors, thermally broken frames, and door hardware.

CP DISTRIBUTORS
YOUR BUILDING CONNECTION

TRANSMITTAL

To: **Arctic Canada Construction Ltd.**
Box 322 11-2 Tuglig Street
Rankin Inlet, NU X0C 0G0
Attn: Sarah Fox
sfox@arcan.nt.ca
Re: Potable Water System
Cambridge Bay, NU

File #: **Quote # 41482-310 N.S.**
Date: **June 5th 2013**
Phone 1-867-645-3116
Fax 1-867-645-3735

We enclose copies of the following:

x Shop Drawings	_____ Hardware Schedule
_____ Plans and Specifications	_____ Colour Charts
_____ Contracts	_____ Templates
_____ Statutory Declaration	_____ Progress Billing
_____ Product Information	_____ O & M Data

_____

_____

_____

_____

_____

X For Approval	_____ As Requested
_____ Resubmitted For Approval	x For Your Information
x For Your Signature	_____ Other

Please Return 1 Copy by your earliest convenience.

SANAQATIIT CONSTRUCTION LTD.
SHOP DRAWING REVIEWED
BY: _____
DATE: 06/05/2013
☑ REVIEWED
☐ REVIEWED AS NOTED
☐ REVISE AND RESUBMIT

C P DISTRIBUTORS LTD.
Tim Walterhouse
Project Coordinator

CP DISTRIBUTORS
YOUR BUILDING CONNECTION

SHOP & DETAIL DRAWINGS

for

PSF's / HMD's

Project Name : Potable Water System

Project Number : Quote # 41482-310 N.S.

Architect : Stantec

General Contractor : Arctic Canada Construction Ltd.

Date Required : 20 July 2013 (to Hay River)
(Please Indicate Delivery Requirement Here)

Prepared By: Tim Walterhouse
Project Leader: N/A

Submitted for Approval: June 5, 2013

Our Purpose

To optimize our customers' success by providing them with the best value in quality construction products and service.

CP DISTRIBUTORS
YOUR BUILDING CONNECTION

Project Name : **Potable Water System**

Project Number : Quote # 41482-310 N.S.

Materials : **PSF's/HMD's/Finish Hardware**

Please note that it is the responsibility of the person receiving the materials to check quantities against the bill of lading and to check for damage at the time that the goods are received. If cartons or crates are damaged, please sign the bill of lading "DAMAGE NOTED". This will give the person receiving the goods 24 hours to check for any concealed damage and report the same to the carrier and request an inspection. If cartons are missing, please note, this as well on the bill of lading.

CP Distributors will not be responsible for replacing materials that have been damaged in transit or have missing pieces should the contractor or his representative fail to follow the above procedure.

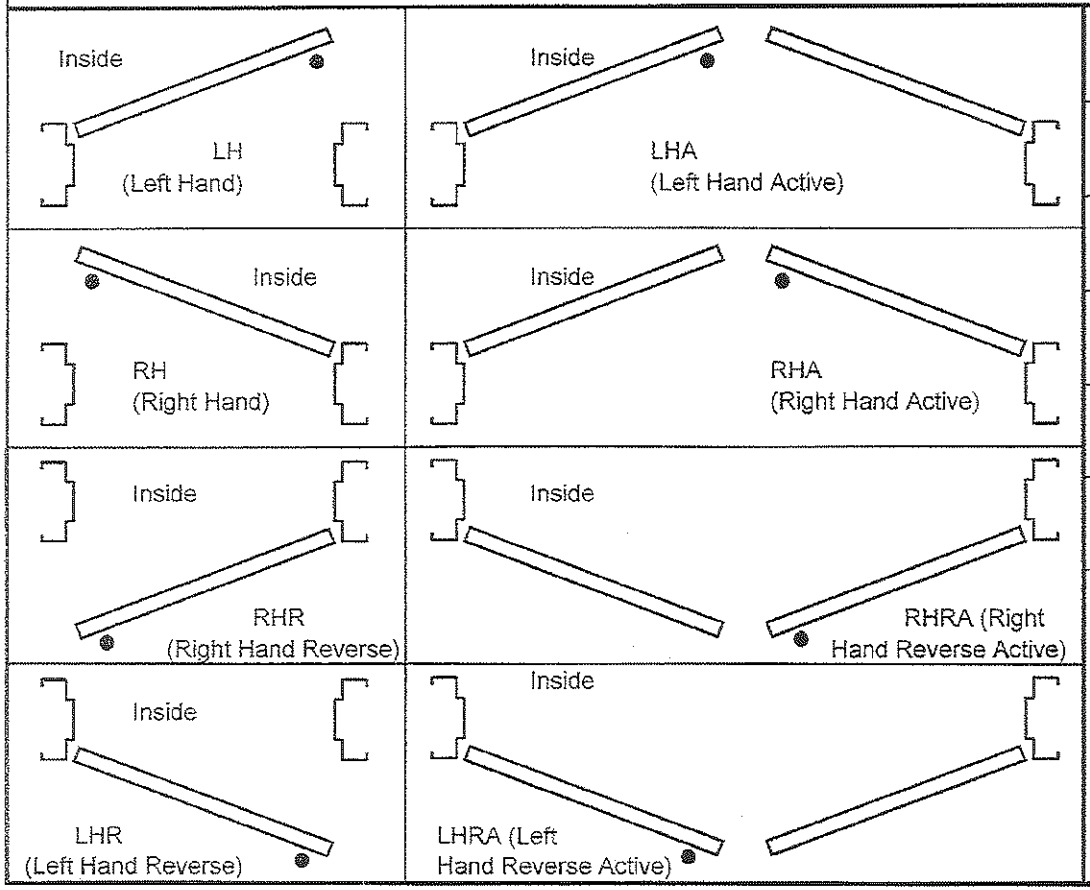
It is the responsibility of the contractor and / or his representative to claim for damage or lost pieces to the transport company.

If all cartons are received in good condition but shortage is discovered, please notify CP Distributors immediately. Notification of missing items must be made within 72 hours after materials have arrived at the jobsite.

The contractor shall be responsible for providing all site dimensions on supply only items and supply and install items where noted on our quotation. Site dimensions must be provided in writing to CP Distributors as soon as they are available and should be recorded on the shop drawings or accompanying form provided by CP Distributors.

CP DISTRIBUTORS
YOUR BUILDING CONNECTION

HOLLOW METAL DOORS & PRESSED STEEL FRAMES



Job #: Quote # 41482-310 N.S.

Project: **Potable Water Station**

Location: Cambridge Bay, NU

Consultant: **Stantec**

Contractor: **Arctic Canada Construction Ltd.**

Drawn By: **Tim Walterhouse**

Date: June 5th 2013

Comments:

General Notes

1. Material shown on these drawings will be fabricated ONLY after formal approval of it by the architect and the receipt of the hardware schedule and all necessary hardware templates.
2. Doors and frames will be reinforced for surface mounted hardware as required. Drilling and tapping for attaching of surface mounted hardware by others. Doors and frames will be prepared and reinforced for mortise hardware. Holes for this hardware will be drilled and tapped at the factory except for trim mounting holes.
3. All doors and frames will be manufactured from wipe coat paintable galvanneal steel, unless noted otherwise.
4. All frames will be supplied with jamb and base anchors as shown and detailed.
5. All frames will be prepared for three rubber bumpers/strike jamb for single frames or two/head for double frames.
6. Installation of glass and glazing by others, unless noted otherwise.
7. The dimensions given on these drawings are NOT accurate enough to order glass from, and we assume no responsibility for such orders, please contact us for further details if needed.
8. All frames in masonry construction to be filled with grout by others.
9. The hardware columns of the door and frame schedule sheets are for future shop fabrication purposes only and are determined ONLY after receipt of the approved hardware schedule furnished by the hardware contractor.
10. The hardware locations indicated on the door and frame elevation are our standard location for "standard type" hardware only. Other hardware such as deadlocks will be located at our standard locations for that specific hardware. Panic exit devices will be located per the paper templates or hardware schedules received.
11. When hollow metal is used in conjunction with aluminum or structural steel products, it will be the responsibility of the general Contractor to coordinate hardware locations and notify us of those desired locations.
12. The rough openings for welded frames should be 108mm (4.25") wider and 54mm (2.125") higher than rebate opening size. (See Schedule)
13. All doors, frames and materials are products of Fleming Steel Doors and Frames unless noted otherwise.
14. High gloss paint is not recommended by CSDMA, SDI–ANSI, or HMMA. We will not be held responsible for any extra finishing work required to prepare metal surfaces to accept a high gloss finish.

Legend

Frames

FS =	Single Frame
FD =	Double Frame
TB =	Thermal Broken Frame
DW =	Drywall Frame
KD =	Knock Down Frame
WF =	Window Frame
SL =	Sidelight Frame
TR =	Transom Frame

Doors

D =	Lockseam Series
H =	Steel Stiffened Series
E =	Panel Embossed Series
HC =	Honeycomb Core
PS =	Polystyrene Core
PI =	Polyisocyanurate Core
SDG =	Sealed Double Glazed
SS =	Steel Stiffened

Misc.

NIC =	Not in Contract
DA =	Double Acting
CS =	Contra Swing
SUA =	Set up and Arc Weld
ABO =	Aluminum by Others
WBO =	Wood by Others
DE =	Double Egress
CO =	Cased Open
T & F =	Tack & Fill

CP DISTRIBUTORS
YOUR BUILDING CONNECTION

General Notes and Legends

Drawn By A. N.

Schedule

Architect				Frame Data										Door Data																				
							Rebate																												
From	To	Opening #	Rating	Quantity	Series/Gauge	Jamb Depth	Width	Height	Handing	Anchor Type	Elevation	Jamb Section	Issue	Quantity	Series	Gauge/Species	Core	Type	Head Detail	Sill Detail	Door Swing	Issue	Heading #	Hinges	Weight	Strike	Lock	Closer	FB	OH	P/P	Remarks			
Exterior	Pump House	101.1		1	TB FD14	5 3/4"	6'0" (2 x 3'0")	6'8"	RHR LHR	3	B	17 22		2	D16		PI	M	3	2	RHR LHR		101.1	4 1/2"	H W	ASA/ NL ASA	DL 161	TJ/ PA				c/w ASA/NL strike installed			
Exterior	Mechanical Room	102.1		1	TB FS14	5 3/4"	3'0"	6'8"	LHR	3	A	17		1	D16		PI	M	3	2	LHR		102.1	4 1/2"	H W	ASA/ NL ASA	DL 161	TJ/ PA				The door, frame and hardware schedule shows RHR but the floor plan shows LHR, please confirm swing.			
Exterior	Electrical / Generator Room	103.1		1	TB FS14	5 3/4"	3'0"	6'8"	LHR	3	A	17		1	D16		PI	M	3	2	LHR		102.1	4 1/2"	H W	ASA/ NL ASA	DL 161	TJ/ PA				The door, frame and hardware schedule shows RHR but the floor plan shows LHR, please confirm swing.			

Stantec

☐ Reviewed
☒ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

Jun. 05, 2013

Stantec Project #: 144901025_08-12

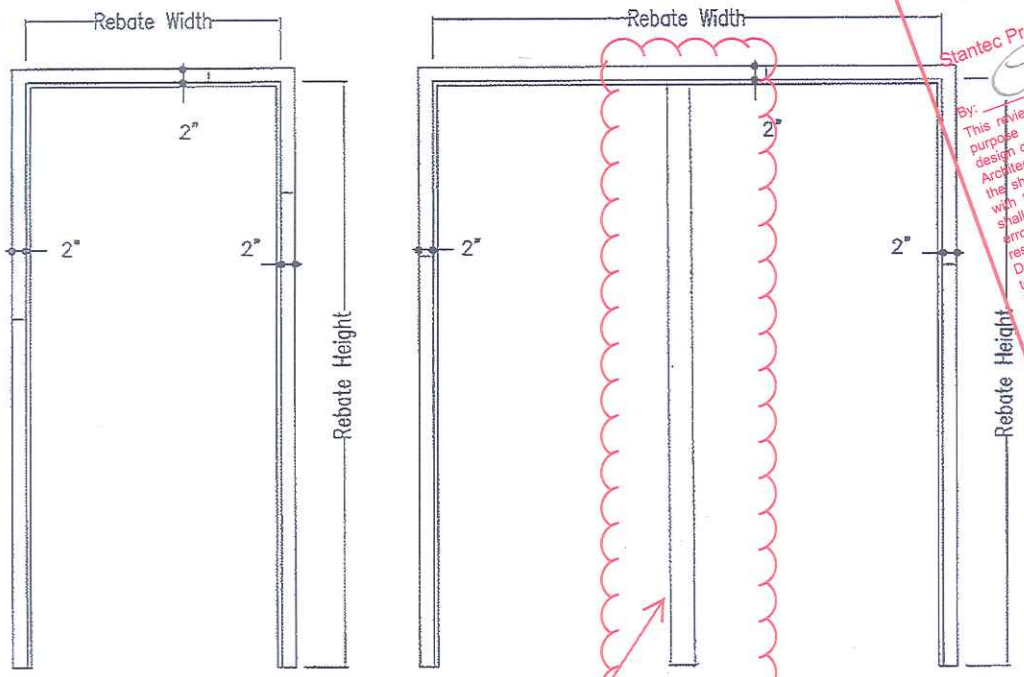
By: Chris Edwards

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contact Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.
STANTEC ARCHITECTURE LTD.

change to 103.1

Use LHR for both Dr. 102.1 & 103.1.
See attached redmarked A101 & A201

Standard Frame Elevations



Elev. A

Elev. B

Center mullion is to be removable

Stantec

☐ Reviewed
☒ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

Jun. 05, 2013

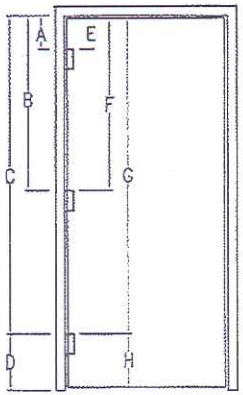
Stantec Project #: 144901025_08-12

By: Chris Edwards

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Standard Fabrication Details

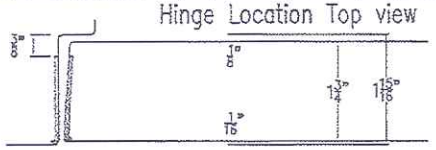


This is the standard hinge pitch we use for 6'8" and 7'0" frames and doors using standard 4 1/2" hinges only.

For any other options please contact us.

	On Frame			On Door	
	6'8"	7'0"		6'8"	7'0"
A	7 1/2"	7 1/2"	E	7 3/8"	7 3/8"
B	37 7/16"	39 7/16"	F	37 5/16"	39 5/16"
C	67 3/8"	71 3/8"	G	67 1/4"	71 1/4"
D	12 5/8"	12 5/8"	H	11 7/8"	11 7/8"

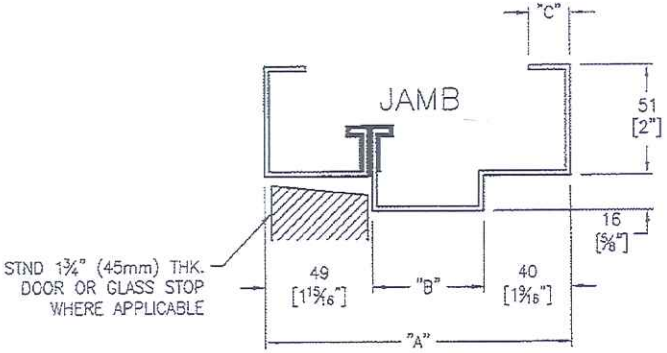
Hinge Location Top view

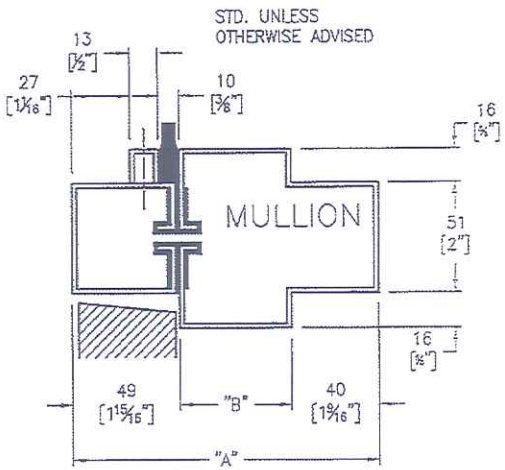


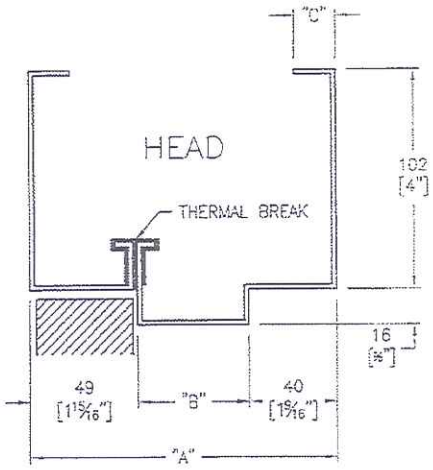
CP DISTRIBUTORS
YOUR BUILDING CONNECTION

Standard Frame Elevation/Details

Drawn By A. N.







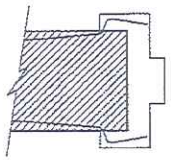
SEC.	"A"	"B"	"C"
16	4¾" 121mm	1¼" 32mm	½" 13mm
17	5¾" 146mm	2¼" 57mm	7/16" 11mm
18	6¾" 172mm	3¼" 83mm	½" 13mm
19	7¾" 197mm	4¼" 108mm	½" 13mm
20	8¾" 222mm	5¼" 133mm	½" 13mm

SEC.	"A"	"B"
21	4¾" 121mm	1¼" 32mm
22	5¾" 146mm	2¼" 57mm
23	6¾" 172mm	3¼" 83mm
24	7¾" 197mm	4¼" 108mm
25	8¾" 222mm	5¼" 133mm

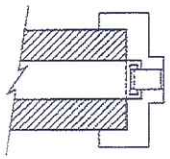
SEC.	"A"	"B"	"C"
26	4¾" 121mm	1¼" 32mm	½" 13mm
27	5¾" 146mm	2¼" 57mm	7/16" 11mm
28	6¾" 172mm	3¼" 83mm	½" 13mm
29	7¾" 197mm	4¼" 108mm	½" 13mm
30	8¾" 222mm	5¼" 133mm	½" 13mm

ANCHOR DETAILS

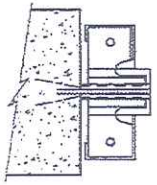
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2 ADJUSTABLE MASONRY ANCHOR (A.M.A.)



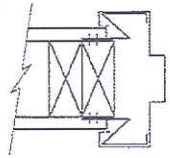
3 EXISTING WALL ANCHOR (E.W.A.)



4



7 DRYWALL BASE ANCHOR



Stantec

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

Jun. 05, 2013

Stantec Project #: 144901025_08-12

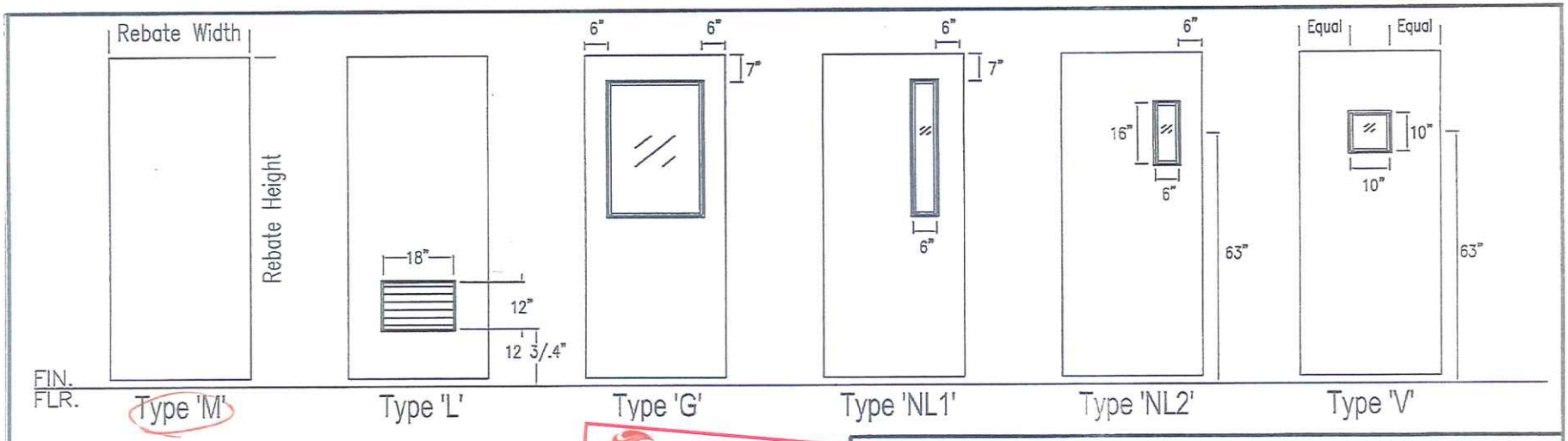
By: Chris Edwards

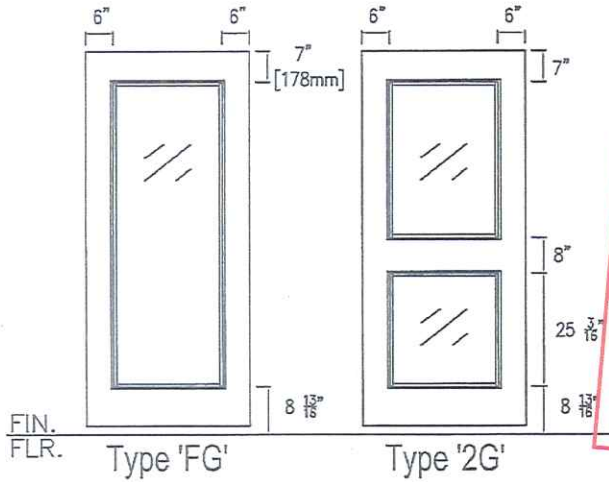
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STANTEC ARCHITECTURE LTD.

CP Distributors Ltd.
MANUFACTURERS & DISTRIBUTORS OF QUALITY CONSTRUCTION PRODUCTS

THERMALLY BROKEN PRESSED STEEL FRAME

DRAWN BY	DATE	PG OF





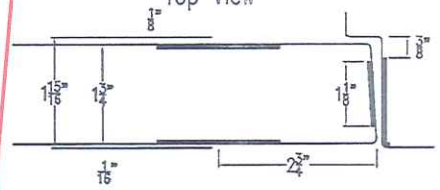
Stantec
☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
Jun. 05, 2013
Stantec Project #: 144901025_08-12
By:
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STANTEC ARCHITECTURE LTD.

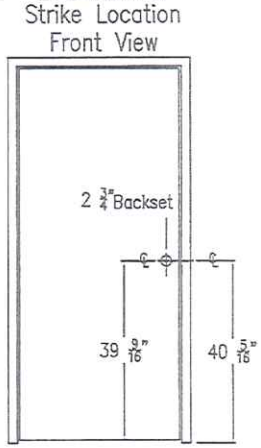
Standard Fabrication Details

All Standard Doors are undersized as follows:

1/8" [3mm] on the Top
3/32" [2mm] on Each Side
3/4" [19mm] on the Bottom

Standard Clearance Between these leaves is 3/16" or 5mm





Head & Sill Details



CP DISTRIBUTORS
YOUR BUILDING CONNECTION

Standard Door Elevation/Details

Drawn By A. N.

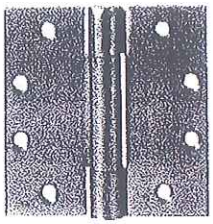
McKinney ASSA ABLOY | 1-800-346-7707 www.mckinneyhinge.com

Three Knuckle Heavy Weight Series

Recommended for use on high frequency and/or heavy wood or metal doors in schools, hospitals or other public buildings where heavy traffic is experienced.

- Heavy weight hinges should be used on all extra heavy doors or those exposed to high frequency use
- Use for the common flush door/frame/wall application
- Beveled Edge - where doors are beveled on hinge side specify TA5386 or TA5786
- For available finishes see page 29

→ TA386
TA786



No.	ANSI Cross Reference	Base Material	Weight
TA386	A5111	Stainless	STD
TA386	A211*	Brass	STD
TA786	A8111	Steel	STD

← NON RUSTING

non-removable pins required

Application



Specifications

Inches	mm	Gauge	No. of Holes	Fasteners Machine	Fasteners Wood
4½ x 4	114.3 x 101.6	.180	8	½ x 12-24	#14 x 12
4½ x 4½	114.3 x 114.3	.180	8	½ x 12-24	#14 x 12
5 x 4½	127 x 114.3	.190	8	½ x 12-24	#14 x 12
5 x 5*	127 x 127	.190	8	½ x 12-24	#14 x 12
6 x 5*	152.4 x 127	.203	10	½ x ¼-20	#12 x 14
6 x 6*	152.4 x 152.4	.203	10	½ x ¼-20	#12 x 14
8 x 6**	203.2 x 152.4	.225	16	½ x ¼-20	#12 x 14

* Not available in Brass Base material
** 8 x 6 furnished in Steel only (hole pattern differs from photo shown)

Options:

Code	Description
NRP	Non-Removable Pin
ET	Exposed Tip
RC	Round Corner - ¼" radius furnished unless specified otherwise
HT	Hospital Tip
SSF	Safety Stud Feature
QC	ElectroLynx® Hinge - 2, 4, 6, 8, 10 or 12 wire available
CC	Concealed Circuit - 2, 4, 6, 8, 10 or 12 wire available
CC-18	Concealed Circuit - 2, 4, 6, 8 or 10 wire available (2-18AWG wires and the remainder 28AWG wires)
MM	Magnetic Monitoring

Stantec
☐ Reviewed
☒ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
Jun. 05, 2013
Stantec Project #: 144901025_08-12
By: Chris Edwards
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STANTEC ARCHITECTURE LTD.

ASSA ABLOY, the global leader in door opening solutions

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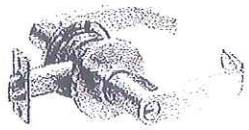
Features, Benefits & Applications

11 Line Bored Lock

SARGENT
ASSA ABLOY

The SARGENT 11 Line* sets a higher standard for Grade 1 bored-in locks. The unique, T-Zone construction provides unequalled strength and durability for the most demanding applications such as schools and hospitals. This is accomplished by true interlocking between the lockbody and the latchbolt.

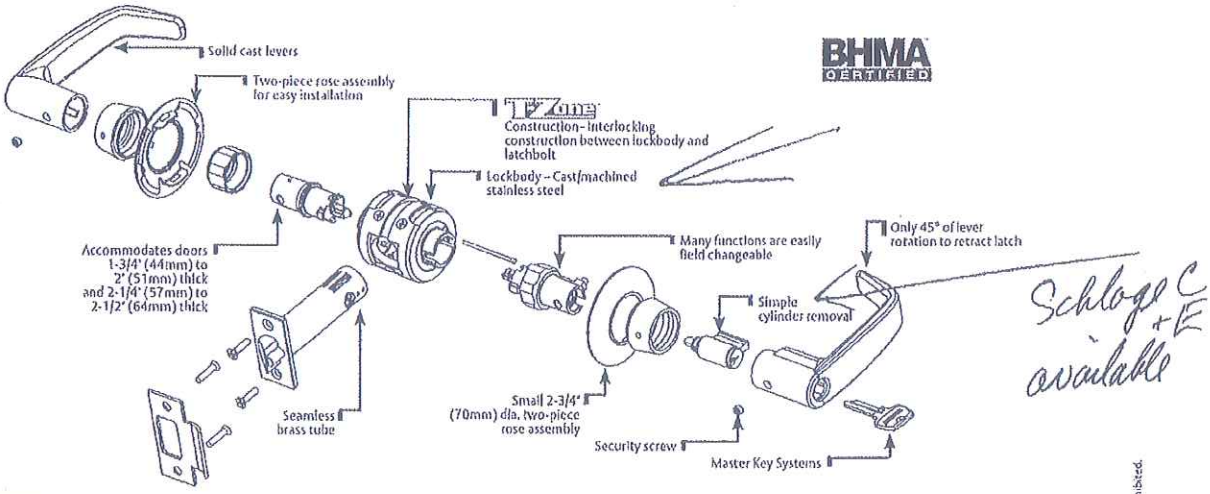
Specify the SARGENT 11 Line when you need the ultimate in strength and durability in a bored-in lock. Accept no substitute. There is no equal!



*U.S. Patent No. 6,626,018

T-Zone Construction – There is no equal!

Direct linkage with fixed alignment between the hub and the latchbolt is the best construction for quietly and effectively operating the latchbolt. For this reason, SARGENT has developed the interlocking aligning and latch tubes, which form a rugged torque resistant "T" in the critical twist area. This "T-Zone" construction, combined with long lasting components, makes 11 Line bored locks outstanding!



Schlage C + E available

Maximum Strength & Durability

- True interlocking between the cast/ machined stainless steel lockbody and latchbolt. Provides unequalled strength and durability
- Independent Testing proves:
  - Exceeds 12 TIMES ANSI/ BHMA A156.2 Grade 1 standard for cycle testing. Over 10,000,000 MILLION cycles!
  - Withstands 3 TIMES ANSI/ BHMA A156.2 Grade 1 torque force on a locked lever. Over 3000 in/lbs!
  - Virtually no lever sag ever
- In a class of its own! This lock raises the bar and sets new standards!
- 10 Year limited warranty. No service required to maintain warranty

BHMA CERTIFIED

Maximum Convenience

- Two-piece rose assembly goes quickly into place
- "Out of the box and onto the door" packaging organizes the parts, has simpl d even a small tool kit
- Fits any 161 prep; Does not fit 160 door prep
- Two piece rose & collar for easier installation
- Only 45° of lever rotation required to retract latchbolt
- 18 functions. Many functions are easily field changeable
- 4 ADA lever designs and 4 roses available to cover a wide variety of door preps and design requirements
- Simple cylinder removal. Easy change outs
- 11 Architectural grade finishes
- SARGENT uses engineered solutions and flexible manufacturing processes to acc applications

Security

- The only bored lock on the market available with security lever catch feature for high vandalism application
- Resists vandalism
- Torx® and spanner screws
- Classroom security function available
- Security key systems available (Signature, Keso F1, XC)

Applications

- High traffic areas - offices, public buildings, hospitals
- High abuse areas - institutions, schools, retail
- Anywhere that requires the contemporary look of a small rose and durability that exceeds Grade 1 standards

Innovation

- Patented "11 Line" construction with true interlocking between the lockbody and the latchbolt Provides unequalled strength and durability for the most demanding applications
- Revolutionary MicroShield® available, technology, containing the Agion™ antimicrobial compound, that suppresses the growth of destructive bacteria.

MicroShield™

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480 Series
Grade 1 Deadbolts
Auxiliary Locks

Stantec
☒ Reviewed
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☐ Revise and Resubmit
☐ Not Reviewed
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STANTEC ARCHITECTURE LTD.

SARGENT
ASSA ABLOY

Specifications

For Doors	1-3/8" (35mm) to 1-3/4" (44mm) thick standard. For doors over 1-3/4" (44mm) consult factory (2-1/4" thick door max)
Door Prep	Fits 161 (standard) cut outs and Fits 160 with 2-3/8" (60mm) backset with 1" at (25mm) front and for 1-3/8" (35mm) thick door
Backsets	2-3/4" (70mm) standard. 2-3/8" (60mm) optional (20 option)
Strike	Wrought brass, bronze or stainless steel
Bolt	Solid steel with hardened steel pin insert and nickel silver plating 7/8" (22mm) x 5/8" (16mm) x 1" (25mm) throw
Cylinder	Brass, 6-pin. 2 nickel silver keys
Masterkeying	Can be masterkeyed. Construction key system available
Front	Wrought brass, bronze or stainless steel 2-1/4" (57mm) x 1-1/8" (29mm) with fixed bevel 1/8" (3mm) in 2" (51mm) furnished standard
Hand	Non handed, field reversible
Turn Lever	Non-ferrous
Housing	Non-ferrous, reinforced, one piece 2-1/2" (64mm) diameter LFIC options: housing brass & zinc, two piece Concealed screws on double cylinder function
Specification	Meets ANSI A156.5 Grade 1 requirements with 408 or 488 strike
UL/cUL Listed	UL listed to U.S. and Canadian safety standards
Positive Pressure	Conforms to standards UL 10C and UBC 7-2 (1997)
Mechanical Options	Cylinder Options see page 10 16- 400 "T" shaped strike with strike box 20- 2-3/8" (60mm) backset, 2-3/4" (70mm) x 1" (25mm) wide front 28- 408 Flat lip strike ANSI A115.2 36- 6-Lobe security Head Screw 37- Spanner Head Screw 48- 488 Reinforced strike with 4 mounting screws and strike box
Finishes	03, 04, 10, 10B, 26, 26D For other finishes consult factory

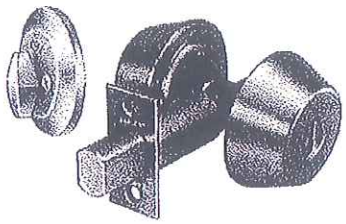
Any retrofit or other field modification to a fire rated opening can potentially impact the fire rating of the opening, and Sargent Manufacturing Company makes no representations or warranties concerning what such impact may be in any specific situation. When retrofitting any portion of an existing fire rated opening, or specifying and installing a new fire-rated opening, please consult with a code specialist or local code official (Authority Having Jurisdiction) to ensure compliance with all applicable codes and ratings.

How To Order

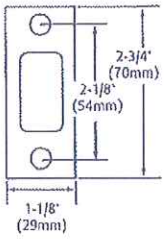
10-28-	487	26D
Options	Series x Function	Finish
Mechanical Options this page	484	03, 04, 10, 10B, 26 & 26D
	485	
Cylinder Options page 10	486	
	487	
	489	

480 Series Deadbolt

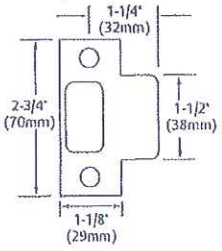
Inside Turn Lever



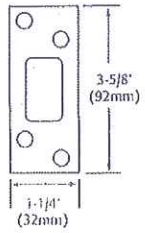
404 Strike (Standard)



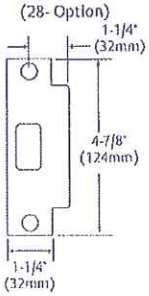
400 T-Shaped Strike (16- Option)



488 Reinforced Strike (48- Option)



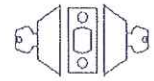
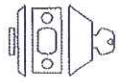
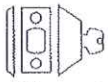
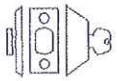
408 Flat Lip Strike (28- Option)



Packaging — 480 Series

Approximate Shipping Weights	
2 lbs. (.9 kg)/Box	10 Boxes/Case

Functions

484 Double Cylinder	485 Single Cylinder	486 Single Cylinder	487 Classroom	489 Exit
				
• Key from either side operates deadbolt • ANSI E0141	• Key outside operates deadbolt • Thumb turn inside operates deadbolt • ANSI E0151	• Key outside operates deadbolt • Blank plate by exposed screws inside. Minimum 1" (25mm) required between doors • ANSI E0161	• Key outside operates deadbolt • Thumb turn inside retracts deadbolt, but will not project the deadbolt • ANSI E0161	• Thumb turn inside operates deadbolt • Blank outside plate

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Norton®

7500/7700 Series Door Closers

Stantec
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STANTEC ARCHITECTURE LTD.

SPECIAL FUNCTION DOOR CLOSER

7700 Special Function Door Closers

Telephone Booth Operation
Closer holds the door to the telephone booth open at 5° from the closed position. This prevents the light switch from being activated and allows the booth to be ventilated. It also indicates to users that the booth is unoccupied. Available in size 2 only for regular arm or top jamb application only.

Coupon Booth Hold Open
Most commonly used on doors to safe deposit box inspection cubicles. Closer holds the door to the booth open at 15° to indicate that the booth is available for use by a safe-deposit-box renter. When the door is opened, the closer will close the door and engage the lock, providing the occupant with the desired privacy. Available in sizes 2 and 3 only for regular arm, top jamb or parallel arm application. Specify hand.

Hospital Hold Open
Closer will hold door open at approximately 15° for ventilation, 45° for observation and beyond 90° for full access.

Closer is supplied with a standard hold open arm for the beyond 90° hold open position. Available in sizes 3 and 4 only for regular arm, top jamb or parallel arm application. Specify hand.

SUGGESTED SPECIFICATIONS

7500 Series
Closers for interior and exterior doors shall be full rack-and-pinion type with cast aluminum alloy body. Closers shall be surface mounted and shall project no more that 2-1/8" from the surface of the door. Closers shall be non-handed to permit installation on doors of either hand. Closer fluid shall contain lubricity and anti-oxidation agents. Closer fluid shall maintain stable viscosity to allow door closer to perform in temperatures ranging from extremely high to as low as -40°F. Closers shall have multi-size spring power adjustment to permit setting of spring from (BF)1 through 6 with additional spring power available. Closers shall have two non-critical valves, hex key adjusted, to independently regulate sweep and latch speed. Closers shall have backcheck cushioning controlled by a hex key adjusted valve. Closers shall have backcheck position controlled by a hex key adjusted value.

[Closers shall have adjustable delayed-action closing controlled by a hex key adjustable valve.]

[Closers shall be highly corrosion resistant and shall have all external body components of aluminum, zinc alloy or stainless steel material and all fasteners of stainless steel.]

Regular arm and top jamb closers shall have a non-hold open shoe permitting 15% (+/ – 7-1/2%) power adjustment.**Closers shall be enclosed in a [molded resin cover] [plated or sprayed metal cover]. Closers to be *Norton* [7500] [7500M] [7500SS] [7500SSM].

**For special arms insert the appropriate specification from column three on this page.

7700 Series
Closers for interior and exterior doors shall be full rack-and-pinion type with cast aluminum alloy shell. Closers shall be surface mounted and shall project no more that 2-1/8" from the surface of the door. Closers shall be non-handed to permit installation of doors of either hand. Closer fluid shall contain lubricity and anti-oxidation agents. Closer fluid shall maintain stable viscosity to allow door closer to perform in temperatures ranging from extremely high to as low as -40°F. Closers shall have power adjustment to permit a 50% increase in power over the minimum closing force for each size. Closers shall have two non-critical valves, hex key adjusted, to independently regulate sweep and latch speed. Closers shall have backcheck cushioning controlled by a hex key adjusted valve. Closers shall have backcheck position controlled by a hex key adjusted value.

[Closers shall have adjustable delayed action closing controlled by a hex key adjustable valve.]

Regular arm and top jamb closers shall have a non-hold open shoe permitting 15% (+/ – 7-1/2%) power adjustment.** Closers shall be enclosed in a [molded resin cover] [plated or sprayed metal cover]. Closers to be *Norton* [7700] [7700M].

**For special arms insert that specification here (see column three on this page)

**Unitrol® Arm
Door closers shall have built-in door stop [and holder] effective at one point selected at installation, from 90° - 115° in five-degree increments. Door stop shall be cushioned by a shock-absorbing heavy-duty spring action effective at the [soffit plate] [arm shoe] pivot. [Closers shall be provided for parallel arm installation using rigid steel main arm and secondary arm lengths proportional to the door width.] [Closers shall be provided for top jamb installation using steel, rigid main arm and telescoping secondary arm adequate for the frame reveal of the openings.]

**CloserPlus® Arm
Door closers shall have built-in door stop [and holder] effective at one point selected at installation, from 85° - 110° in five-degree increments. Door stop mechanism shall be non-handed and attach to soffit plate. [Hold open mechanism shall have engage/disengage selection actuated by thumbturn]. Closers shall be provided for parallel arm installation using rigid steel main and secondary arm.

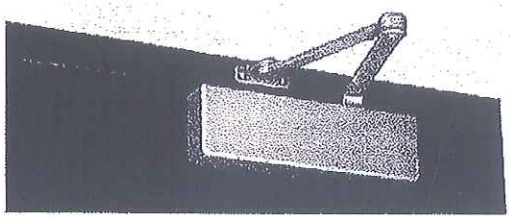
**CloserPlus Spring™ Arm
Door closers shall have built in door stop [and holder] effective at one point selected at installation, from 85° - 110° in five-degree increments. Door stop mechanism shall have a buffer spring that engages prior to the dead stop feature, reducing shock loads to the door and frame assemble. Door stop mechanism shall be non-handed and attached to soffit plate. [Hold open mechanism shall have engage/disengage selection actuated by thumbturn]. Closers shall be provided for parallel installation using rigid steel main and secondary arm.

In USA: 1.800.438.1951 or www.nortondoorcontrols.com In Canada: 1.800.461.3007 or www.yalecorbin.on.ca 2/05

Norton

7500/7700 Series Door Closers

APPLICATIONS

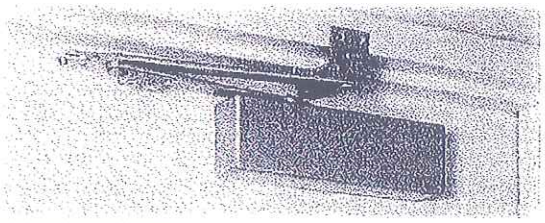


Non Hold Open Arm

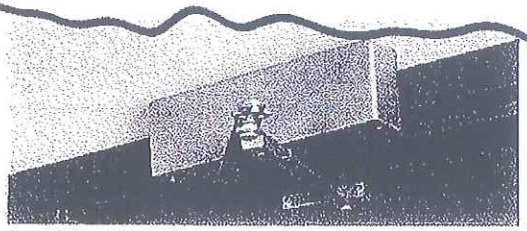
Regular Rigid Heavy-Duty Arm

This double lever arm features a non-adjustable secondary arm. Orbitally riveted joints prevent tampering or disassembly. The rigid heavy-duty arm is standard with the security closers featuring a regular arm (7570 or 7770) but is also available with standard product. Prefix "R" to model number.

Available non hold open only.



Unitrol® Parallel Arm

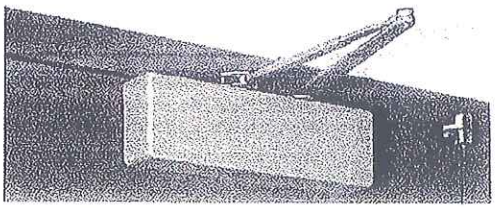


Unitrol® Top Jamb

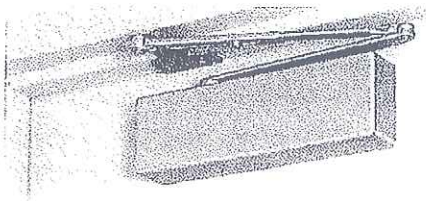
Unitrol® Arm

Can be used for either parallel arm or top jamb applications. *Unitrol* arms combine the features of a double lever arm overhead door stop/holder with the backcheck feature of the door closer to reduce door stopping shock loads to a minimum. They use a compression spring buffer at the soffit plate/arm shoe that will absorb 30 lbs. of force, 5° prior to the door's dead stop. Coupled with the door closer's backcheck feature, the Unitrol® Arm offers the most controlled stop available with a surface door closer.

For parallel arm applications there are three different length arm assemblies. Each length is designed for a specific range of door widths to provide precise door control. This further lessens the dead stop impact on the door's hinges/pivots.



Low Profile-Regular Arm



Low Profile-Parallel Arm

Low Profile Arm

...7700 Series door closers for non-hold open ...ave a reduced height elbow joint and a straight main arm. This allows the door closer to be installed in less vertical space.

Regular Arm allows closer to be installed where there is as little as 1" (25mm) of frame face or ceiling clearance.

Parallel Arm allows closer to be installed 1/2" (13mm) higher up on door than standard parallel arm application.

Stantec
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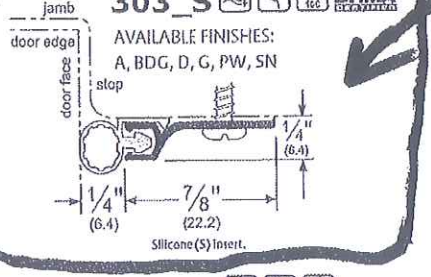
PERIMETER GASKETING

Standard Perimeter Gasketing

- Rigid jamb weatherstrip shown mounted on openings with 1/16" gaps; however, each weatherstrip can seal gaps up to the depth of its seal. Seal depth provided on each illustration (example: the 303 has a 1/4" seal; therefore, it can seal up to a 1/4" gap).
- Punched on 6" centers with slotted holes for adjustment.
- Stainless steel fasteners are standard on all except 292 and 299.
- Other fasteners are available.
- Models 297 and 303 are available with self-adhesive two-sided tape (TST) and tek screws (3 slotted holes per part) for easy installation. To obtain this option, add "TST" to the end of the part when ordering (example: 303AVTST).

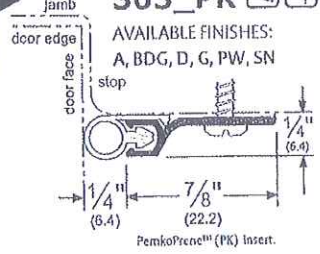
303AS

303_S



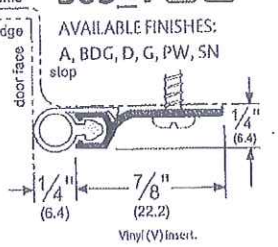
AVAILABLE FINISHES:
A, BDG, D, G, PW, SN

303_PK



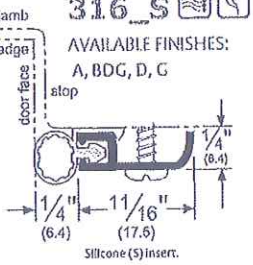
AVAILABLE FINISHES:
A, BDG, D, G, PW, SN

303_V



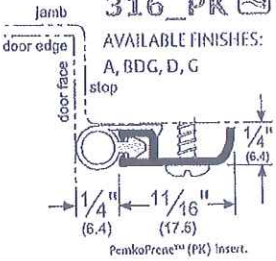
AVAILABLE FINISHES:
A, BDG, D, G, PW, SN

316_S



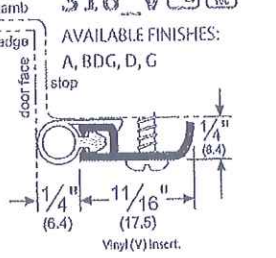
AVAILABLE FINISHES:
A, BDG, D, G

316_PK



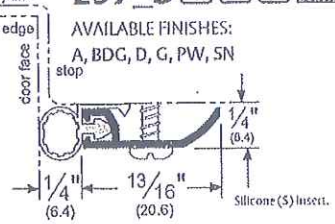
AVAILABLE FINISHES:
A, BDG, D, G

316_V



AVAILABLE FINISHES:
A, BDG, D, G

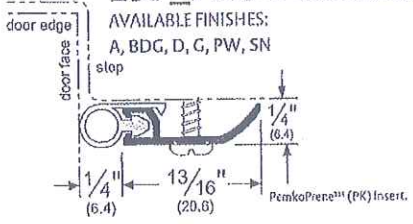
297_S



AVAILABLE FINISHES:
A, BDG, D, G, PW, SN

Satin Nickel finished product supplied with *BLACK* insert. *GRAY* available upon request.

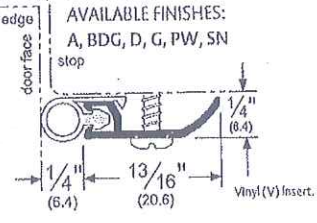
297_PK



AVAILABLE FINISHES:
A, BDG, D, G, PW, SN

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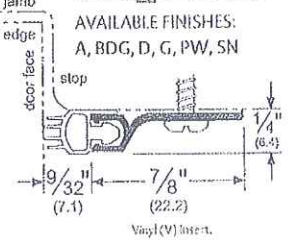
297_V



AVAILABLE FINISHES:
A, BDG, D, G, PW, SN

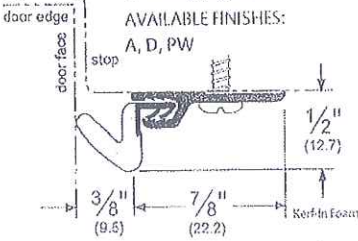
Satin Nickel finished product supplied with *BLACK* insert. *GRAY* available upon request.

306_V



AVAILABLE FINISHES:
A, BDG, D, G, PW, SN

306_Q



AVAILABLE FINISHES:
A, D, PW

Minimum space between the door face and the stop is 3/16"; maximum space is 5/16".

Stantec
☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
Jun. 05, 2013
Stantec Project #: 144901025_08-12
By: Chris Edwards
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contact Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.
STANTEC ARCHITECTURE LTD.

⚠ AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart.)

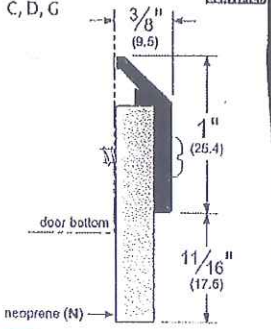
A (Mill Finish Aluminum) • BDG (Bright Dip Gold Anodized) • D (Dark Bronze Anodized) • G (Gold Anodized) • PW (Painted White) • SN (Satin Nickel Anodized)

PEMKO ASSA ABLOY
VENTURA, CA USA PH. 800.283.9988
MEMPHIS, TN USA PH. 800.824.3018
VANCOUVER, BC CANADA PH. 877.535.7888
TORONTO, ON CANADA PH. 866.243.9816

Door Bottom Sweeps

368_N

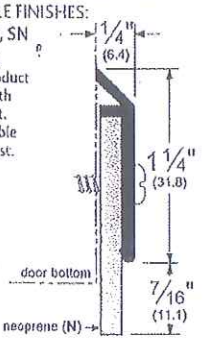
AVAILABLE FINISHES: C, D, G



315_N

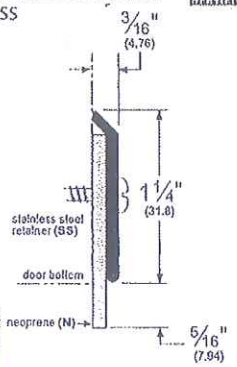
AVAILABLE FINISHES: B, C, D, G, SN

Satin Nickel finished product supplied with BLACK insert. GRAY available upon request.



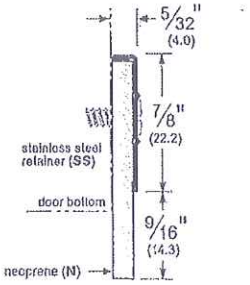
315SSN

AVAILABLE FINISHES: SS



321SSN

AVAILABLE FINISHES: SS



Stantec

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

Jan. 05, 2013

Stantec Project #: 14490[illegible]025 08-12

By:

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STANTEC ARCHITECTURE LTD.

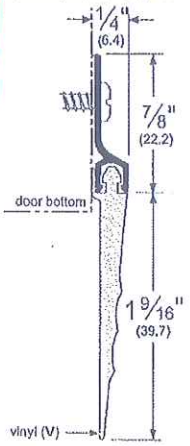
21_N

AVAILABLE FINISHES: C, D, G



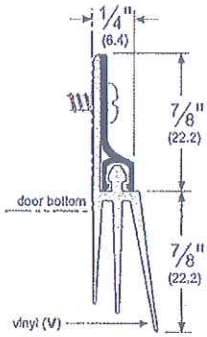
56_V

AVAILABLE FINISHES: A, BDG, D, G, PW, SN



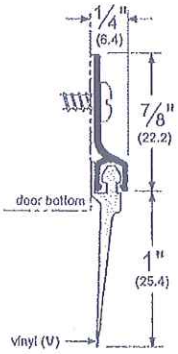
57_V

AVAILABLE FINISHES: A, BDG, D, G, PW, SN



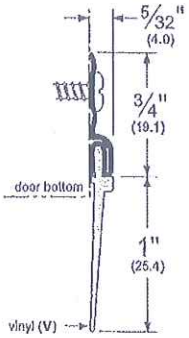
307_V

AVAILABLE FINISHES: A, BDG, D, G, PW, SN



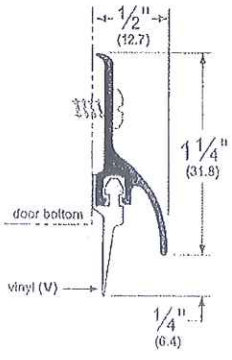
99_V

AVAILABLE FINISHES: PA, PD, PG, PW



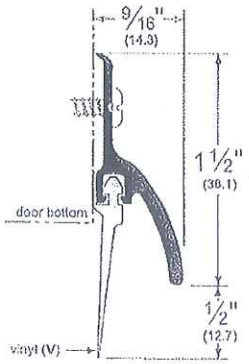
3452_V

AVAILABLE FINISHES: A, BDG, D, G, PW, SN



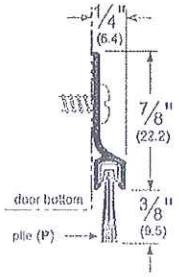
345_V

AVAILABLE FINISHES: A, B, BDG, D, G, PW



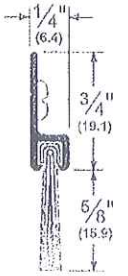
309_P

AVAILABLE FINISHES: A, BDG, D, G, PW, SN



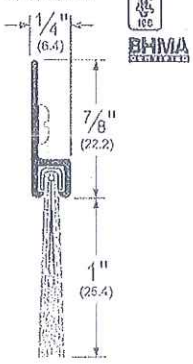
18061_NB

AVAILABLE FINISHES: C, D, G, SN



18100_NB

AVAILABLE FINISHES: C, D, G, PW



⚠ AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)

A (Mill Finish Aluminum) • B (Mill Finish Extruded Bronze[Brass]) • BDG (Bright Dip Gold Anodized) • C (Clear Anodized) • D (Dark Bronze Anodized) • G (Gold Anodized)
PA (Painted Aluminum) • PD (Painted Dark Bronze) • PG (Painted Gold) • PW (Painted White) • SN (Satin Nickel Anodized) • SS (Stainless Steel)

COMMERCIAL THRESHOLDS

Thermal Barrier Saddles

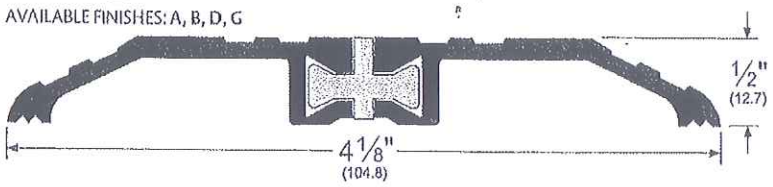
- Black rigid vinyl key between extrusions provides a thermal barrier (designated by "FG" Frost Guard following finish code).

ALL PRODUCTS ON THIS PAGE ARE TESTED TO OR ARE APPROVED UNDER: BHMA CERTIFIED

Stantec
☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
Jun. 05, 2013
Stantec Project #: 144901025_08-12
By: Chris Edwards
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contact Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.
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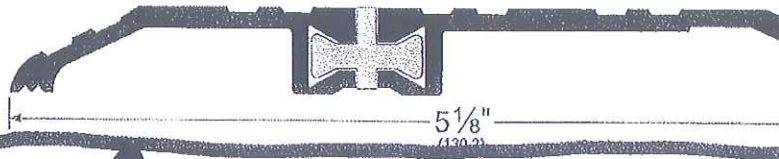
252X2_FG

AVAILABLE FINISHES: A, B, D, G



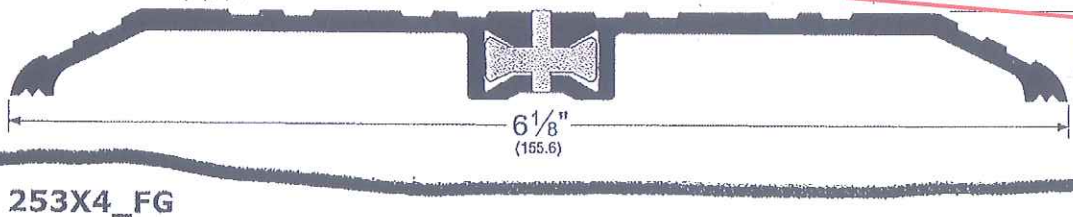
252X3_FG

AVAILABLE FINISHES: A, B, D, G



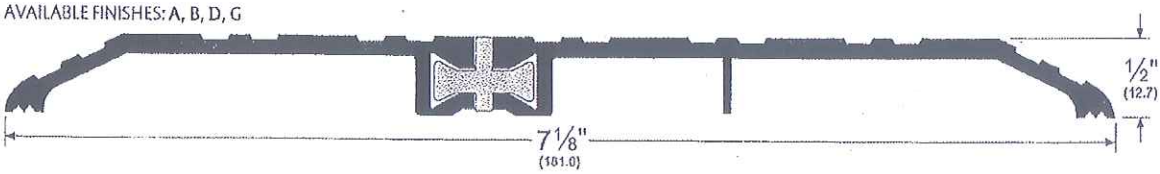
253X3_FG

AVAILABLE FINISHES: A, B, D, G



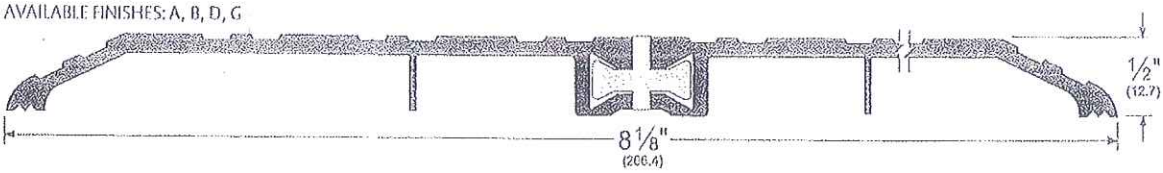
253X4_FG

AVAILABLE FINISHES: A, B, D, G



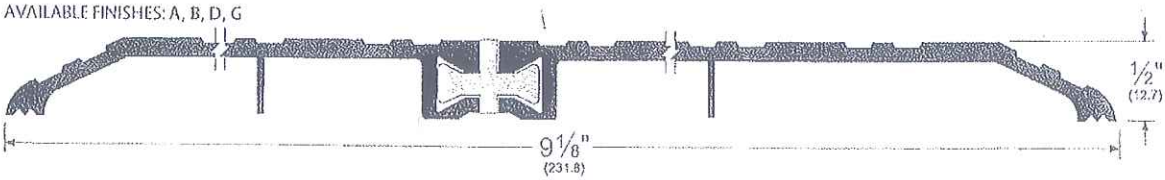
254X4_FG

AVAILABLE FINISHES: A, B, D, G



254X5_FG

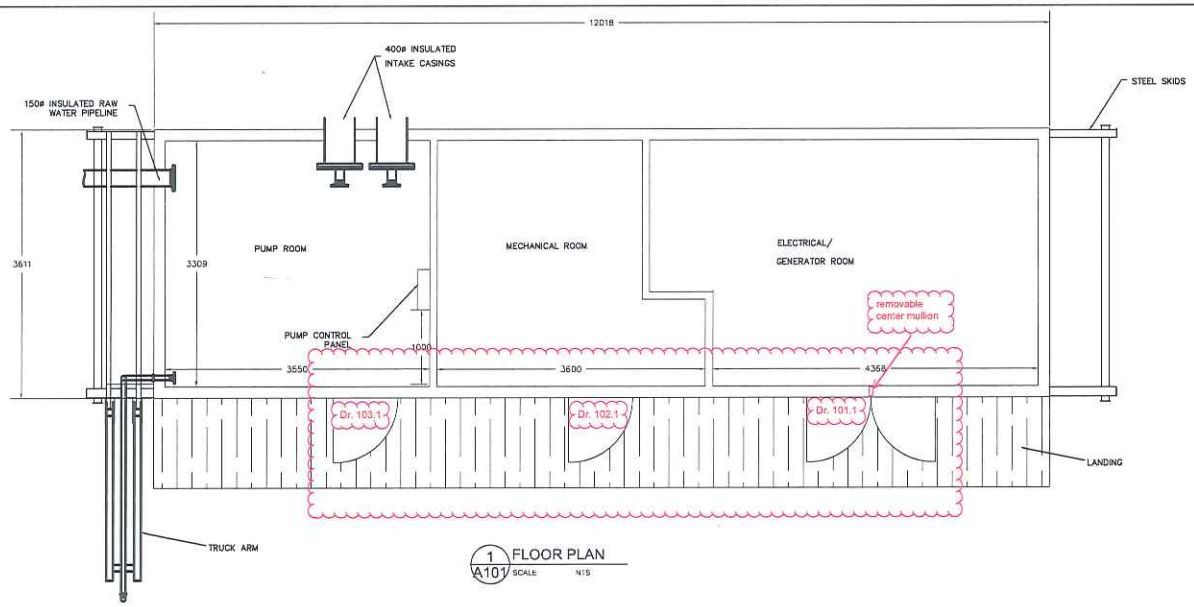
AVAILABLE FINISHES: A, B, D, G



NOTE: Products shown in this section may not be drawn to scale.

⚠ AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)

A (Mill Finish Aluminum) • B (Mill Finish Extruded Bronze [Brass]) • D (Dark Bronze Anodized) • G (Gold Anodized)



1 A101 FLOOR PLAN
SCALE: NTS

ROOF CONSTRUCTION ASSEMBLIES

R1 **ROOF** (152 MM. RSI 8.13 / R-46)
152 MM THICK PRE-FINISHED INSULATED METAL ROOF PANEL. PROFILE & CONFIGURATION AS PER EXTERIOR ELEVATIONS. COLOUR: AS PER OWNER MECHANICAL FASTENERS AS PER MANUFACTURER'S SPECIFICATIONS TO STEEL SUPPORT FRAMES AS PER STRUCTURAL DRAWINGS

EXTERIOR WALL CONSTRUCTION ASSEMBLIES

EW1 **EXTERIOR WALL** (152 MM. RSI 8.13 / R-46)
152 MM THICK PRE-FINISHED INSULATED METAL WALL PANEL. PROFILE & CONFIGURATION AS PER EXTERIOR ELEVATIONS. COLOUR: AS PER OWNER MECHANICAL FASTENERS AS PER MANUFACTURER'S SPECIFICATIONS TO STEEL SUPPORT FRAMES AS PER STRUCTURAL DRAWINGS

FLOOR CONSTRUCTION ASSEMBLIES

F1 **MAIN FLOOR - NONCOMBUSTIBLE CONSTRUCTION** (230 MM. RSI 3.45 / R-46)
6 MM STAINLESS STEEL SLIP RESISTANT FLOOR PLATE, ALL SEAMS WELDED W150x JOISTS @ 610 MM O.C. WELDED TO STEEL BEAMS AS PER STRUCTURAL DRAWINGS.
203 MM POLYURETHANE SPRAY FOAMED REQUIRED FOR TOTAL FLOOR SYSTEM. DEPTH OF 230mm
SPUN OLEFIN WEATHER BARRIER
19 MM PRE-FINISHED METAL CLADDING SOFFIT LINER PANEL. MECHANICAL FASTENED AS PER MANUFACTURER

INTERIOR WALL CONSTRUCTION ASSEMBLIES

1. REFER TO FLOOR PLANS FOR PARTITION LOCATIONS.
2. ALL STEEL STUD PARTITIONS TO HAVE MID-HEIGHT CONTINUOUS BRIDGING CHANNEL C/W BRIDGING ANGLE CLIP.
3. LOCATE CONTROL JOINTS AT 10M O.C. ON 1500 MODULE OR ABOVE DOOR FRAME CORNER WHEREVER POSSIBLE.
4. PARTITIONS NOT SPECIFICALLY DESIGNATED SHALL BE CONSIDERED TO BE CONSTRUCTED AS A GW1 WALL ASSEMBLY AND EXTEND 150 MM ABOVE FINISHED CEILING.
5. ACOUSICALLY SEAL PERIPHERY OF WALL AND ALL PENETRATIONS AIRTIGHT.

INTERIOR WALL CONSTRUCTION ASSEMBLIES

GW1 (89 MM)
89mm THICK PRE-FINISHED PRE-INSULATED METAL WALL PANEL. COLOUR WHITE. MECHANICAL FASTENERS AS PER MANUFACTURER'S SPECIFICATIONS TO STEEL SUPPORT FRAMES AS PER STRUCTURAL DRAWINGS.

Stantec
4910 53rd Street
Yellowknife, NT
X1A 2P4
Tel. (867) 920-2882
Fax. (867) 920-4319
www.stantec.com

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Consultants

Legend

Notes

Revision	By	Appd.	YY.MM.DD
ISSUED FOR CONSTRUCTION	AF	WD	12.06.06
ISSUED FOR TENDER	AF	WD	12.03.30
90% SUBMISSION			12.03.02
50% SUBMISSION	JG	WD	12.01.16

Issued

File Name:

Dwn.	Chk'd	Dsgn.	YY.MM.DD

Permit-Seal

PERMIT TO PRACTICE
STANTEC ARCHITECTURE LTD.
Signature
Date 6 SEPT 2012
PERMIT NUMBER: P 800
NT/NU Association of Professional Engineers and Geoscientists

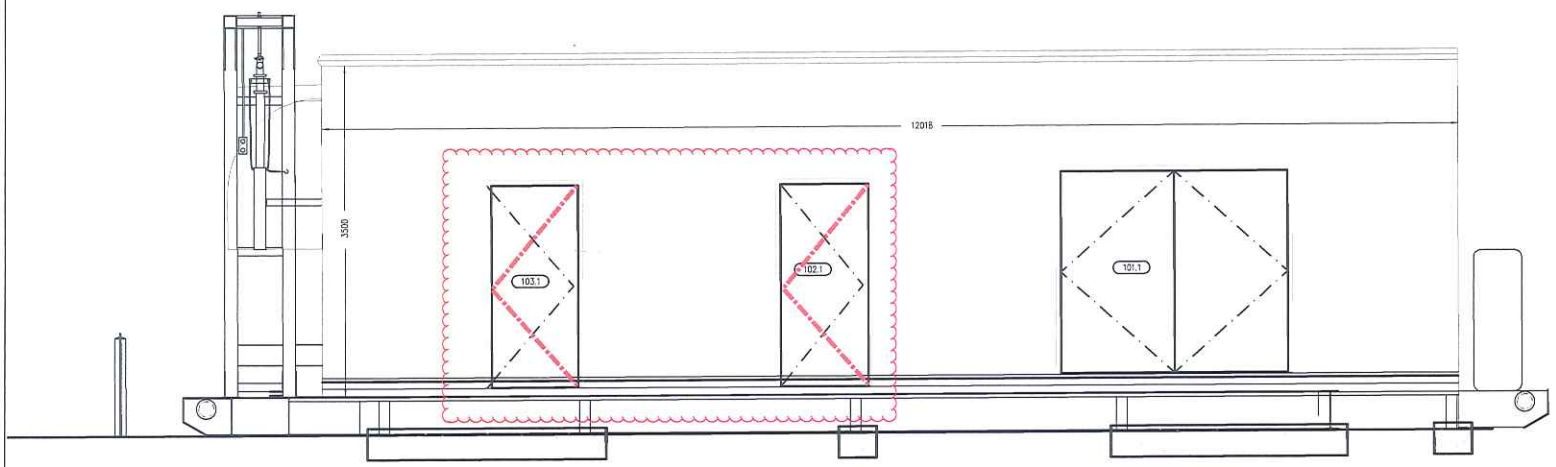
Client/Project
GOVERNMENT OF NUNAVUT

POTABLE WATER SYSTEM
PHASE I
Cambridge Bay, NU

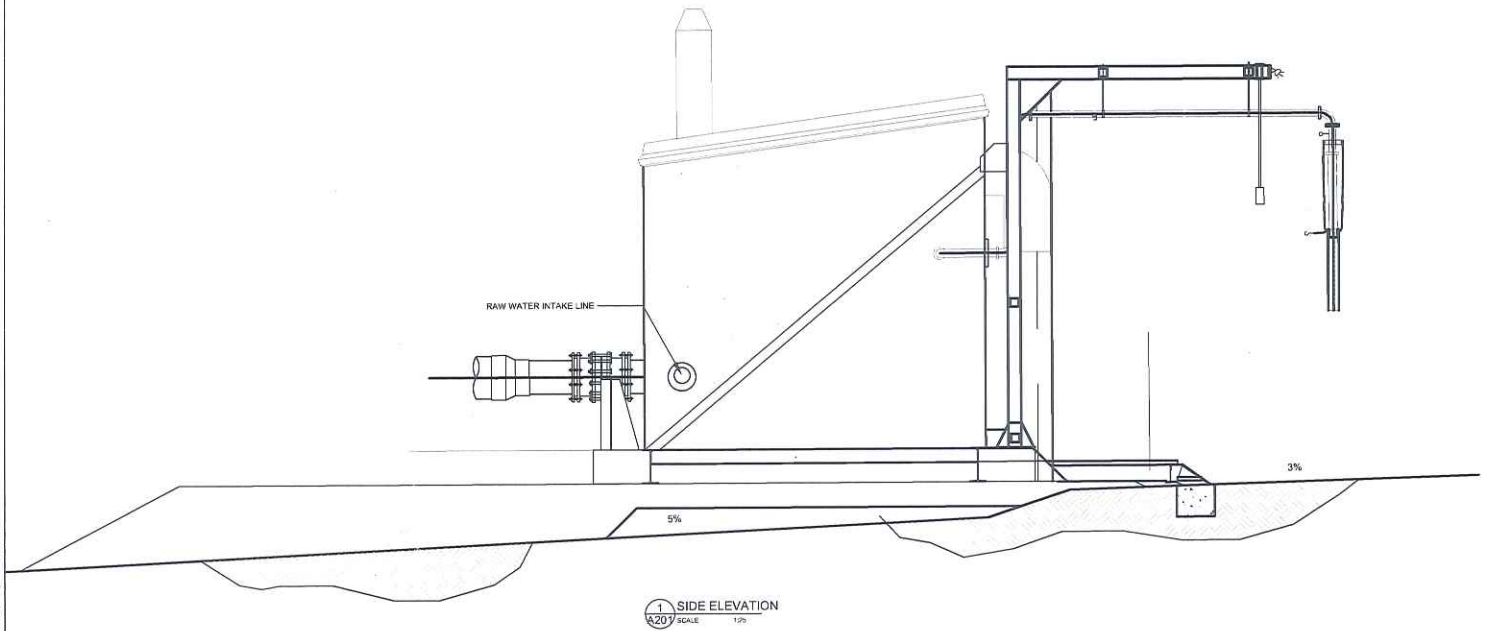
Title
FLOOR PLAN, ASSEMBLIES, AND SCHEDULES

Project No.	Scale	
1449-01252	NTS	
Drawing No.	Sheet	Revision
A-101	1 of 3	0

V:\1449\Active\1449\252\000_cw\Nb_dwg\pt\Nb-01 Issued For Construction\Phase 1\101254-101.dwg
2012/09/07 11:14 AM By: Richard, Mark
ORIGINAL SHEET - ANSI D



1 A201 FRONT ELEVATION
SCALE 1:25



1 A201 SIDE ELEVATION
SCALE 1:25

Stantec
4910 53rd Street
Yellowknife, NT
X1A 2P4
Tel. (867) 920-2882
Fax. (867) 920-4319
www.stantec.com

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Consultants

Legend

Notes

Revision	By	Appd.	YY.MM.DD
ISSUED FOR CONSTRUCTION	AF	WG	12.09.06
ISSUED FOR TENDER	AF	WG	12.03.30
95% SUBMISSION			12.03.02
50% SUBMISSION	JD	WG	12.01.18

Issued	By	Appd.	YY.MM.DD

File Name: Dwn. Chkd. Dsgn. YY.MM.DD

Permit-Seal

PERMIT TO PRACTICE
STANTEC ARCHITECTURE LTD.
Signature
Date 6 SEPT 2012
PERMIT NUMBER: P 800
NT/NU Association of Professional Engineers and Geoscientists

Client/Project
GOVERNMENT OF NUNAVUT

POTABLE WATER SYSTEM
PHASE I
Cambridge Bay, NU

Title
BUILDING ELEVATIONS

Project No.	Scale
1449-01252	AS SHOWN

Drawing No.	Sheet	Revision
A-201	2 of 3	0

ORIGINAL SHEET – ANSI D

B

SANAQATIIT
CONSTRUCTION LTD.

Operation and Maintenance Manual

Section B – Mechanical

Potable Water System Phase 1
Cambridge Bay, NU

Project Number: 11-4002
Contract Number: 12-3000
Community and Government Services
Government of Nunavut

MECHANICAL SYSTEMS
OPERATING & MAINTENANCE
MANUAL

CAMBRIDGE BAY POTABLE WATER SYSTEM PHASE #1

CAMBRIDGE BAY, NU

Prepared For:
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CMS PROJECT NO: 12-569
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MECHANICAL OPERATION & MAINTENANCE MANUAL
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CONTRACTOR INFORMATION

1. Mechanical Contractor:

Central Mechanical Systems Ltd.
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Nisku, AB T9E 7S1
Ph: 780-955-7161
Fx: 780-955-2785

2. Controls Contractor:

Siemens Canada
Building Technologies Division
P.O. Box 4219, Stat. A
Toronto, ON M5W-5N1
Ph: 780-486-1234
Fx: 780-486-1817

SUPPLIER INFORMATION

1. **Bartle and Gibson** - **Fuel Oil Day Tanks (TK-1.1, 1.2)**
   13475 Fort Rd
   Edmonton, AB T5A 1C6
   Ph: 780-472-2850
   Fx: 780-476-6686

2. **EH Price** - **Heat Recovery Ventilator (HRV-1)**
   12944 -148th St. - **Exhaust Fan (CF-1)**
   Edmonton, AB T5L 2H8 - **Grilles (S-1, R-1)**
   Ph: 780-477-9231
   Fx: 870-477-3701

3. **Independent Pump and Motor Company** - **Raw Water Pumps (RWP-1, 2)**
   18916 - 111th Ave
   Edmonton, AB T5S 0B6
   Ph: 780-496-9753
   Fx: 780-496-9947

4. **Pace Chemicals Ltd.** - **Chemical Injection Pump & Tank (P-P2)**
   8321 Williard St
   Burnaby, BC V3N 2X3
   Ph: 604-520-6211
   Fx: 604-521-5927

5. **Summit Valve & Controls Inc.** - **Process Piping Valves**
   5304 – 68 Ave
   Edmonton, AB T6B 3M4
   Ph: 1-780-468-6900
   Fx: 1-780-468-1400

6. **Tundra Process Solutions Ltd.** - **Electromagnetic Flowmeters (FM-1,2)**
   7523 Flint Rd SE
   Calgary, AB T2H 1G3
   Ph: 1-403-255-5222
   Fx: 1-403-253-4448

Central Mechanical Systems Ltd.
345 Old Airport Road
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Central Mechanical Systems Ltd.
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WARRANTY CERTIFICATE

CENTRAL MECHANICAL SYSTEMS LTD. WARRANTIES THE MECHANICAL SYSTEM AND CORRESPONDING EQUIPMENT SUPPLIED & INSTALLED AT THE POTABLE WATER INTAKE PUMPHOUSE AS PART OF THE PHASE #1 UPGRADES, LOCATED IN THE TOWN OF CAMBRIDGE BAY, NUNAVUT, CANADA; TO BE FREE OF DEFICIENCIES FOR A ONE (1) YEAR PERIOD EFFECTIVE FROM THE DATE OF SUBSTANTIAL COMPLETION, WHICH TOOK PLACE ON THE 11TH DAY OF MARCH, 2015.

CENTRAL MECHANICAL SYSTEMS WARRANTY IS LIMITED TO PARTS & WORKMANSHIP ONLY; AS THE EQUIPMENT ITSELF IS WARRANTED BY THE MANUFACTURER FOR A PERIOD AS SPECIFIED IN THE MANUAL.

IN THE EVENT THAT SUCH DEFICIENCIES DO TAKE PLACE, CENTRAL MECHANICAL SYSTEMS LTD. GUARANTEES TO REPAIR AND/OR REPLACE PARTS TO ENSURE ALL COMPONENTS OF THE MECHANICAL SYSTEM TOUCHED IN THIS UPGRADE ARE FUNCTIONING AS THEY WERE DESIGNED TO.

CENTRAL MECHANICAL SYSTEMS LTD.
DIRECTOR, LORNE GANSKE

APRIL 2 - 2015
DATE
(DAY/MONTH/YEAR)

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

Warranty statement for

AE/AS, BCF, BDF, BSQ, CBF, CUBE, CUE, CW, CWB, DF, ERD, ESRMD, ESRMDF, G, GB, INLINE CENTRIFUGAL GREASE FAN, LB, LBP, LD, LDP, MS-1P, MSSC, MSAC, NYB,NYD, R-2, RB-1, RB-2, RB-3, RBC-3, RBCF-3, RBF-1, RBF-2, RBF-3, RBUMO, RC-3, RBU, RDU, RPBR, RPDR, RPBRF, RPDRF, RSF, RSFP, S1, S2, SAF, SB-1, SB-2, SB-3, SBCR, SC-3, SFB, SFD, SQ, SWD, SWB SERIES 100, SWB SERIES 200, TAUB, TAUB-CA, TAUD, TCB, TCBRU, TCBRS, TCB UL762, TCF, USGF

Greenheck warrants this equipment to be free from defects in material and workmanship for a period of one year from the shipment date. Any units or parts which prove defective during the warranty period will be replaced at our option when returned to our factory, transportation prepaid.

Motors are warranted by the motor manufacturer for a period of one year. Should motors furnished by Greenheck prove defective during this period, they should be returned to the nearest authorized motor service station. Greenheck will not be responsible for any removal or installation costs.

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

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LIMITED WARRANTY

Products manufactured by (GRUNDFOS) GRUNDFOS PUMPS CORPORATION are warranted to the original user only to be free of defects in material and workmanship for a period of 24 months from date of installation, but not more than 30 months from date of manufacture. GRUNDFOS' liability under this warranty shall be limited to repairing or replacing at GRUNDFOS' option, without charge, F.O.B. GRUNDFOS' factory or authorized service station, any product of GRUNDFOS' manufacture. GRUNDFOS will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by GRUNDFOS are subject to the warranty provided by the manufacturer of said products and not by GRUNDFOS' warranty. GRUNDFOS will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with GRUNDFOS' printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of GRUNDFOS' products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact GRUNDFOS or an authorized service station for instructions. Any defective product to be returned to GRUNDFOS or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limitations on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

ISO 9001 CERTIFIED

L-CP-TL-003 12/05 (US)
Subject to alterations

GRUNDFOS Pumps Corporation
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GRUNDFOS Canada Inc.
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Oakville, Ontario L6H 6C9 Canada
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Boulevard TLC #15, Parque Stiva Aeropuerto
Apodaca, N.L. 66600 Mexico
Telephone: 52 81 8144 4000
Fax: 52 81 8144 4010

GRUNDFOS

Additional Information

Defrost Mode - During cold weather, the HRV automatically cycles through its defrost mode when temperatures drop below freezing to avoid frost build up in the core.

HRV - a Heat Recovery Ventilator (HRV) is designed to provide fresh air into a building while exhausting an equal amount of stale air. During the winter months, heat recovered from the stale air, before it is exhausted to the outdoors, warms the incoming cold fresh air. During the summer months, when the indoor space is air conditioned, the HRV helps to cool the incoming fresh air with the cool exhausted stale air.

Self-Test - Each time the HRV is powered/energized, the self-test function automatically initiates. The HRV cycles through the available speeds and tests the damper motor operation. The HRV resumes operation at the selected mode and speed. (Approximately 60 seconds in duration.)

Standby (Speed 0) - The HRV is on but fans are not running waiting for ventilation to be initiated by either an external control (i.e. timer) or the dehumidistat. Set the main control to speed 0 to set the HRV in standby.

Timers - These optional controls may be installed at specific exhaust locations (bathrooms etc.) to initiate high speed ventilation.

Additional information can be found at www.lifebreath.com.

Warranty

Lifebreath RNC Series Heat Recovery Ventilators carry a Lifetime Warranty on the heat recovery core and a 5 year replacement parts warranty.

Register for your warranty:

www.lifebreath.com or phone 1-855-247-4200 (toll free)

Note: Airia will require the HRV Model and serial number(s) for the registration of your HRV.

VIKING PUMP

WARRANTY

Viking warrants all products manufactured by it to be free from defects in workmanship or material for a period of one (1) year from date of startup, provided that in no event shall this warranty extend more than eighteen (18) months from the date of shipment from Viking. If, during said warranty period, any products sold by Viking prove to be defective in workmanship or material under normal use and service, and if such products are returned to Viking's factory at Cedar Falls, Iowa, transportation charges prepaid, and if the products are found by Viking to be defective in workmanship or material, they will be replaced or repaired free of charge, FOB. Cedar Falls, Iowa.

Viking assumes no liability for consequential damages of any kind and the purchaser by acceptance of delivery assumes all liability for the consequences of the use or misuse of Viking products by the purchaser, his employees or others. Viking will assume no field expense for service or parts unless authorized by it in advance.

Equipment and accessories purchased by Viking from outside sources which are incorporated into any Viking product are warranted only to the extent of and by the original manufacturer's warranty or guarantee, if any.

THIS IS VIKING'S SOLE WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, WHICH ARE HEREBY EXCLUDED, INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. No officer or employee of IDEX Corporation or Viking Pump, Inc. is authorized to alter this warranty.

IDEX

VIKING PUMP INC. •
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Weil-McLain® Cast Iron Oil Boiler
Models WGO, WTGO, and UO

Limited Warranty for Commercial Use

F. What Is Not Covered Under This Limited Warranty?

This Limited Warranty does not cover any Product that has been moved from its original installation site; any components that are not supplied by Weil-McLain; and any burner supplied by Weil-McLain. (Burners supplied by Weil-McLain are covered by a separate manufacturer's warranty.)

Additionally, this Limited Warranty does not cover claims you make if the failure, malfunction, or unsatisfactory performance of, or damage to, your Product resulted from or is attributable to:

(1) Inaccurate or incomplete information or data supplied or approved by any party other than Weil-McLain;
(2) The failure to properly size the Product for its use;
(3) Installation not done in accordance with manufacturer's instructions;
(4) Services provided by and workmanship of the installer of the Product;
(5) Components that are not supplied by Weil-McLain;
(6) Improper or negligent operation, adjustment, control settings, repair, care, or maintenance of the Products, or the failure to adjust, set the controls of, repair, care for, or maintain the Products;
(7) Operation with combustion air contaminated by chemical vapors, with improper fuel additives, or with water conditions that have caused deterioration or unusual deposits in the heat exchanger; and
(8) Freezing, accident, fire, flood, or other acts of God; abuse or misuse; unauthorized alteration; or power surges or failures.

Changes to your Product due to normal wear and tear that do not cause the failure, malfunction, or unsatisfactory performance of your Product are not covered by this Limited Warranty.

WEIL-McLAIN'S MAXIMUM LIABILITY SHALL NOT EXCEED THE ACTUAL PURCHASE PRICE PAID BY YOU FOR YOUR PRODUCT. IN NO EVENT SHALL WEIL-McLAIN BE RESPONSIBLE FOR INDIRECT, INCIDENTAL, CONSEQUENTIAL (INCLUDING WITHOUT LIMITATION DAMAGE TO OR LOSS OF OTHER PROPERTY), OR PUNITIVE DAMAGES, WHETHER SUCH CLAIM OR ACTION IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, STRICT LIABILITY, OR ANY OTHER LEGAL THEORY. ALL IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE DISCLAIMED IN THEIR ENTIRETY.

G. How Do You Get Service?

To commence a warranty claim under this Limited Warranty, please contact a qualified heating or plumbing contractor of your choice. Your contractor will notify the authorized Weil-McLain distributor from which your Product was purchased. If your warranty claim is not resolved, please contact the **Weil-McLain Commercial Relations Department, 500 Blaine Street, Michigan City, Indiana 46360**, and explain the difficulty you are encountering in resolving your warranty claim. Weil-McLain may require the return of the Product or parts thereof that are the subject of your warranty claim for the purpose of inspection to determine the cause of failure.

H. How Can You Register Your Purchase?

Please register your purchase at Weil-McLain's website at www.weil-mclain.com. Registration is not required to activate your warranty, but you should retain proof of date of purchase and installation.

* * *

If you have any questions about your coverage under this Limited Warranty, please contact Weil-McLain using the contact information provided above.

550-141-058 (1011)

WESTEEL LIMITED WARRANTY

Petroleum Storage Products

Westeel Division of Vicwest Corporation ("Westeel") warrants products that it has manufactured and/or that are branded with its name or that of Northern Steel Industries (the "goods") subject to the following terms and limitations, (the "warranty").

Note: The warranty does not apply to products manufactured by Westeel under license (the "licensed products"). The licensed products are solely subject to warranty terms as they may be set from time to time by the licensing body. The licensed products include but are not necessarily limited to: FLAME SHIELD, Fireguard, F921, stiP3, AquaSweep and Glasteel. For information on warranty terms applicable to the licensed products, or to determine whether a product is a licensed product, please consult the Westeel website and/or contact Westeel www.westeel.com or 1-800-665-2099.

1. **Duration of Warranty.** The duration of the warranty is limited as follows.

   i. External Corrosion – 2 years.

   ii. Internal Corrosion – 2 years.

   iii. Structural Defect – 5 years, except in the case of Mobile Tanks in which case it is 1 year.

   iv. Tank Accessories – 1 year;

   v. Loss of Vacuum – 2 years, except in the case of Underground Tanks in which case it is 30 days from date of delivery to the purchaser.

   The duration of the warranty will run from the date of purchase from a dealer or distributor authorized by Westeel, unless otherwise stated (the "warranty period").

2. **Limitation of Remedies Replacement.** Within the warranty period, Westeel will replace the goods and/or original manufactured components thereof which are found, to Westeel's satisfaction, to be defective. Westeel is not responsible for direct, indirect, special, consequential, or any other damages of any kind, including personal injury to any individual, howsoever caused, including caused by transportation of the goods for repair or replacement.

3. **Procedure for Obtaining Service.** In the event of a warranty claim, the purchaser must complete any and all information required by Westeel in order to properly assess or investigate the claim. Westeel will not be responsible for the removal of any of the goods found to be defective, or transportation charges to and from Westeel's authorized dealer or distributor, or for installation of any replacement goods and/or parts furnished under the warranty.

4. **Limitations as to Scope of Warranty.** The warranty does not extend to defects or damage caused, in whole or in part, by:

   i. use of a kind and/or to a degree not reasonably expected to be made of the goods;

   ii. improper storage of the goods both prior to and after purchase;

DISCLAIMERS

External Corrosion

The warranty does not apply if:

I. Foreign materials have contacted painted surfaces or stainless steel surfaces causing damage and/or allowing for corrosion and/or rust.

II. The goods have been primed and/or painted by someone other than Westeel.

III. Threaded material has been scraped or scratched in a manner causing damage and/or allowing for corrosion and/or rust (eg. pipe caps or pumps).

Internal Corrosion

The warranty does not apply if:

I. The goods are not used solely for the containment of petroleum products, unless otherwise stated in writing and signed off by an authorized representative of Westeel.

II. All maintenance procedures are not strictly followed. This includes but is not limited to a regular inspection for internal moisture and debris, dents, punctures, leaks and loose or damaged fittings a minimum of once every twelve (12) months.

Loss of Vacuum

The warranty does not apply if:

I. The purchaser fails to contact Westeel immediately for instructions when vacuum appears to have been lost.

II. The vacuum has not been checked immediately after transporting to installation site.

III. The Installation Checklist is not strictly followed and completed, signed and returned to Westeel within fourteen (14) calendar days of the date of delivery.

(Please see additional notes on "Vacuum Monitoring System Maintenance")

Underground Tanks

The warranty does not apply if:

I. The Installation Checklist is not strictly followed and completed, signed and returned to Westeel within thirty (30) calendar days of the date of installation or ninety (90) calendar days of the date of shipment to the purchaser, whichever occurs first.

General

The following disclaimers apply to the goods in all circumstances:

I. The goods must be installed by a certified installer recognized by local authorities, where applicable, and strictly in accordance with Westeel's Installation Instructions as well as all applicable installation and building codes and accepted trade practices. Without limiting the generality of the foregoing, proper foundation assembly, installation and use solely for the purposes intended as specified in Westeel's published product literature is essential. As well, tank venting for both normal and emergency situations must be installed properly and kept unobstructed at all times.

Vacuum Monitoring System Maintenance

Long term vacuum monitoring of the double-walled portion of a tank can be used to evaluate the integrity of the primary or secondary walls of the tank system. However, it should be noted that the vacuum filled interstice created by the two walls, essentially acts as a large barometer, and thus the Vacuum recorded on the mechanical gauge factory installed on each tank, will vary with ambient temperature as well as atmospheric or internal tank pressure.

Recorded vacuum gauge readings that vary with temperature or pressure would be considered normal. However, a steady drop in vacuum readings over time, regardless of ambient conditions, may indicate the vacuum system requires either maintenance or remedial action. Please contact Westeel immediately should you notice any consistent drops in vacuum readings.

3. Mechanical Component Details/Descriptions

3.1 Heating System

3.2 Ventilation System

3.3 Process Piping System

3.4 Controls System

SECTION 3.1 ~ Heating System

COMPONENTS:

TK-1.1	454 L Westeel Fuel Oil Tank (Generator Day Tank)
TK-1.2	680 L Westeel Fuel Oil Tank (Boiler Room Day Tank)
P-2.1 & 2.2	Duplex Viking FH-432 Fuel Oil Pump Skid Mounted System c/w Torna Tech Duplex Oil Pump Controller
B-1, 2	Weil McLain P-WGO-2 Boilers c/w Riello Burners c/w McDonnell & Miller Low Water Cutoffs (PS-851-120)
EX-1	Flexcon SXHT-40 Hydronic Expansion Tank
P-3.5	Axiom MF-200 Pressure Pal Mini Glycol Feeder System c/w Alarm Panel (Model: RIA10-1-SAA)
UH-1 & 3	Rosemex H-24 Hydronic Unit Heaters
UH-2	Rosemex H-24-AG Hydronic Unit Heater
HC-1	Rosemex WBH 12" x 12" Heating Coil
P-3.1, 3.2	Grundfos UP 15-58FC Primary Hydronic Circulation Pumps
P-3.3, 3.4	Grundfos UPS 26-99FC Secondary Hydronic Circulation Pumps

This section has been provided to supply a written description of the heating system installed and is supplemented by the information provided in the manufacturer's equipment data sheets.

FUEL OIL SYSTEM

Fuel oil is pumped from the main exterior tank to the two days tanks by means of a duplex pump system which is designed for P-2.1 to be the main pump and P-2.2 to be the standby pump. The two days tanks consist of one 454 Litre double walled steel indoor fuel oil tank (TK-1.1) which serves the generator and one 680 Litre double walled steel indoor fuel oil tank (TK-1.2) which serves the boilers. Each day tank is equipped with a 3-point electronic level switch which allows each day tank to be monitored and filled independently. When the level switch calls for fuel at 30% volume level, a solenoid valve is opened and the fuel pump starts. When the level switch senses the tank is 80% full, the system is designed to stop the pump and close the solenoid valve.

A tank full light will also be energized for a period of 30 minutes and de-energized. If the pump does not start when called for at the 30% level and the fuel level diminishes to a 10% volume level within the tank, the system is designed to alarm to an autodialer.

BOILERS

Two Weil McLain oil fired boilers (B-1 & B-2) situated in the mechanical room are intended to provide heat generation for the fluid heat transfer within the building. The boiler temperature controller, normally situated on the face of the boiler will energize the burner circuit if a call for heating is sensed.

The burner circuit will sequentially energize the boiler draft fan, the oil supply solenoid valve and will energize the igniter; thus allowing the boiler to fire. In the event of a failure by any one of these burner circuit components or if the boiler does not ignite within a prescribed time period, the burner ignition cycle must be checked and tested. In the event of a flame outage, the boiler flame rod safety control will de-energize the burner circuit.

As all components are interlocked, it is advisable to have the operation of this burner circuit checked periodically by qualified personnel. Additional information may be found in the shop drawings within this manual.

SEQUENCE OF OPERATION

The boiler operating controls will cycle the burners on a call for heat. The system is designed to be a lead/lag configuration. The Siemens control system alternates the lead boiler after 168hrs of operation.

EMERGENCY SHUT DOWN

An emergency shut-off button has been installed to allow for manual shut down of the boilers if an emergency occurs.

The boiler control and safety limits are as explained below:

A) High Limit Safety Control

A temperature controller located on the face of the boiler is set at 85°C.
Should the boiler water temperature rise above this set point (generally indicating loss of flow or water volume) the controller will shut off the boiler.
This control must be manually reset.

B) Auxiliary High Limit

A temperature controller, generally mounted on the face of the boiler is set at 93°C.
If for any reason the high limit safety control should fail to function properly, this control will shut off the boiler on high temperature. This control must be manually reset.

C) High Pressure Safety Valve

This is a mechanical device sitting on the boiler to sense the pressure of the water being circulated. If the system pressure rises above the setting shown on the valve tag, the valve will blow the excess water into the glycol/water storage tank until such a time as the pressure drops to three (3) psi below the safety valve setting.

D) Low Water Cutoff Safety Control

The low water cutoff safety control is mounted on the supply to the boiler. This is a float type low water cutoff which is connected to a mercury switch. When the boiler water drops, the float activates the mercury switch and breaks the electrical circuit to the burner. This will need to be manually reset in order to become operational again.

HEATING FLUID

The heating fluid for this building is a 50/50, water/propylene glycol mixture. This heating fluid is heated by means of the two packaged boilers. The heating system is set to maintain a HWS temperature of 82°C in the primary heating loop. Each boiler is equipped with a circulating pump (P-3.1 & P-3.2) that activates to circulate Glycol through the primary loop when a boiler is running. Two secondary pumps (P-3.4 & P-3.5) operate as lead and standby. One of these pumps runs continuously to maintain the temperature set point in the heating loop until the outside

temperature reaches 16°C. The secondary pumps are controlled by a pump sequencer which alternates the lead pump every 168 hrs of operation. In the event of a lead pump failure as sensed by the current sensor, the system will alarm a lead pump failure at the pump sequencer and a mechanical alarm strobe and the standby pump will be energized. In the event of a standby pump failure, the system will alarm to an autodialer.

GLYCOL FILL TANK

The heating fluid circulates within a closed loop hydronic system and therefore has been designed with a glycol make-up system which feeds and pressurizes the system on an as and when basis. This mini feeder system consists of a 25 Litre storage/mixing tank with a level gauge and alarm panel which will sound and close a set of dry contacts if it senses a low level within the tank. The level in this tank should not fluctuate dramatically once the system is up and running. If the level does drop it most likely indicates a leak somewhere within the heating piping.

EXPANSION TANK

A hot water expansion tank located in the mechanical room is installed to allow for the expansion of the circulated water when it is heated. This system must remain under positive pressure at all times and therefore the space above the water level in the expansion tank is filled with air. The air pressure must be the same as the systems water pressure at the tank.

UNIT HEATERS & HEATING COIL

The three unit heaters and heating coil are the primary source of heat for this pump house. Glycol is circulated through the three unit heaters continuously. The fans on the unit heaters are controlled by wall mounted line voltage room thermostats to maintain room temperature. The initial set point of the unit heaters is 15°C.

SECTION 3.2 ~ Ventilation System

COMPONENTS:

HRV-1	Lifebreath RNC 95 Heat Recover Unit
CF-1	Greenheck SQ-70-E Inline Exhaust Fan
S-1	Round Supply Air Grille – EH Price RSG
R-1	Round Perforated Return Air Grille – EH Price RPG

This section has been provided to supply a written description of the ventilation system provided and is supplemented by the information provided in the manufacturer's equipment data sheets.

BUILDING VENTILATION

The ventilation system is intended to provide tempered heat and fresh air to the building. The initial set point for the building is 25°C. Fresh air is introduced and tempered through the HRV unit and exhausted or relieved by the independent exhaust fan CF-1.

HRV-1 is designed to start and stop through an integral control. When the HRV is OFF, the internal defrost damper is closed to prohibit outside air from entering through the unit. When the HRV is ON, the internal damper is open to allow the mixture of fresh outdoor air and exchange it with the air being circulated within the building. HRV-1 is installed with a reheat coil which modulates through a 3-way control valve and remote sensor to maintain a discharge air temperature of 18°C.

In the event of high temperature reading in the mechanical room, the cooling thermostat will energize exhaust fan CF-1. Upon confirmation of CF-1 operation, the current sensor will modulate the operation of the normally closed outdoor air damper and the normally open return air damper to cool the room to a temperature of 20°C and then the control dampers will return to their normal position.

In the event of low temperature reading (10°C) in the mechanical room, CF-1 will be disabled and the control dampers will return to their normal positions. This low temperature reading will alarm a mechanical room fan trouble.

3.3

SECTION 3.3 ~ Process Piping System

COMPONENTS:

RWP-1, 2	8" Raw Water Submersible Pumps c/w 6" Encapsulated 15 HP/ 230V /3 PH Submersible Franklin Electric Motor
P-P1	Grundfos TP 50-240/2 Potable Water Recirculation Pump
P-P2	Grundfos DDA 7.5-16 Chlorine Injection Pump
	205 Litre Chlorine Injection Polyethylene Holding Tank
FM-1	6" Water Master Electromagnetic Flowmeter
FM-2	2" Water Master Electromagnetic Flowmeter
DVA-1, 2	6" J&S Series 9200 Ball Check Valves
	1" Valmatic 101VB Vacuum Breaker Valve
	1" Valmatic 201C.2SV Combination Air Valves
	2" Valmatic 7800LW Swing Check Valve
	6" Valmatic 7800LW Swing Check Valve
	2" Bray Series 31 Trim, 108 Butterfly Valve
	3" Bray Series 31 Trim, 119 Butterfly Valve
	6" Bray Series 31 Trim, 119 Butterfly Valve

This section has been provided to supply a written description of the process piping system installed and is supplemented by the information provided in the manufacturer's equipment data sheets. All process components are monitored and/or controlled by Siemens PXC system.

NORMAL OPERATIONS – RAW WATER SUPPLY TO TOWN

1. Operator manually opens valve BUV-0A and 0B on the 150mm (6") line of both the intake lines. These valves are prior to the Series 9200 Check Valves.
2. Operator sets Raw Water Delivery (HAND/OFF/AUTO) selector on the Plant Control Panel to AUTO.
3. Operator switches raw water pumps RWP-1 and RWP-2 to ON.
4. Specific pump to run is chosen by the Siemens PXC controls system on an alternate 'lead/lag' run basis.
5. If it is desired to utilize a specific pump, either RWP-1 or RWP-2 as desired, operator sets (HAND/OFF/AUTO) Raw Water Pump selector switch on Plant Control Panel PP1 to HAND, and switches the chosen pump to ON and the other pump to OFF.
6. Upon receiving a signal from the Siemens PXC, the selected pump will start and run until it receives a signal from the Siemens PXC system to stop.

TRUCK FILL – MANUALLY DELIVERING A DESIRED QUANTITY OF WATER

1. Operator parks the vehicle under the Truck Fill Arm #1 and positions the fill pipe in the truck hatch.
2. With both water pumps off, operator sets Raw Water Delivery (HAND/OFF/AUTO) selector on Plant Control Panel to HAND.
3. Operator manually opens valve BUV-0G to the truck fill arm and closes valve BUV-0F on the 150mm (6") raw water pipeline.
4. Operator switches the chosen raw water pump RWP-1 or RWP-2 to ON and the other pump to OFF to start delivery of water into the truck.
5. The chlorine injection pump is interlocked with the submersible pump to deliver aqueous hypochlorite solution to the truck fill arm whenever the submersible pump is running.
6. When desired amount of water is delivered, operator switches the chosen pump to OFF.

OPERATION OF 50MM (2") INTERNAL RECIRCULATION LINE

NOTICE: The proper operation of the 50mm internal recirculation line is essential for the water delivery pipeline to the community to operate without freeze up in the winter. As such, monitoring and regular checking of both the flow in the line and of the retained pressure in the line is essential.

The circulation line MUST operate whenever the ground temperature is below freezing. As it is not possible to check and confirm the ground temperature, in general the recirculation line should be operated continuously whenever the raw water pipeline is in use. If the raw water is not in use, this line should be drained and blown out with air.

1. Circulation Pump P-P1 shall be switched ON when raw water pipelines are operating.
2. Flow Control Valve FCV-1 is to be set to retain a minimum 50 PSI pressure differential to atmosphere in the 50mm recirculation line. This pressure is to be supplied to the 50mm recirculation line largely by the high head recirculation pump in the pumphouse.
3. If circulation stops for more than 1 minute in the recirculation line as shown by the flow sensor (FM-1, FM-2), the Siemens PXC monitoring system is set to alarm at the pumphouse control panel to notify the operator.

BACKWASHING INTAKE CASINGS

1. Operator manually opens backwash valves BUV-0P or BUV-0O (and 0M or 0N) on the 50mm line of the intake being backwashed, and manually closes valve BUV-0C on the primary raw water line. These valves are adjacent to the DVA-1 and DVA-2 Valves.
2. With both raw water pumps off, operator sets (HAND/OFF/AUTO) selector on Plant Control Panel P-P1 to HAND.
3. Ensure bypass valve BUV-0D on the 150mm raw water pipeline is closed.
4. Operator switches the raw water pump (either RWP-1 or RWP-2) on the line that's NOT being backwashed to ON and the other pump to OFF to start the backwash.
5. Backwash for the required length of time and shut off the chosen raw water pump.
6. Reverse the valve and pump settings in above steps to backwash the other pump line.
7. Following the completion of backwashing the intake lines, return all valves to their normal settings as per the valve schedule.

3.4 Controls System

***see Controls Section under 6.4 As-Builts**

4. Mechanical Certification and Testing

4.1 Hydronic Balancing Report

4.2 Inspection Certificates

4.3 Pressure Test Reports

4.4 Start-Up Reports

CIRCUIT SETTER REPORT

PROJECT: Potable water upgrade

SYSTEM: Hydronic Heating

		DESIGN						ACTUAL						ΔP	
	AIR	FLOW	EWT	LWT	EAT	LAT	AIR	EWT	LWT	EAT	LAT	VALVE		
	FLOW	l/s	c	c	c		FLOW	c	c	c		SET		
	l/s						l/s							
UH 1		.08½					.08					3.5	.4	PSI
UH 2		.08					.08					4	.4	PSI
UH 3		.08					.08					3.7	.46	PSI
Heating coil		.15					.15					3.7	.5	PSI
Pres Diff Valve		.15					.15					2.6	.72	PSI
6														
7														
8														
9														
10														
11														
12														
13														
14														
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32														
33														
34														
35														

EQUIPMENT TEST REPORT

PUMP REPORT

PROJECT: Potable water upgrade.

SYSTEM: Hydronic Heating

DESIGN											ACTUAL						
#	PUMP MODEL	PUMP S/N	MTR MFG	MTR S/N	HP kw	FLOW l/s	HEAD m	RPM	VOLTS	AMPS	pa IN	pa OUT	HEAD m	FLOW l/s	AMPS	CIRCUIT SET SIZE/SET/HEAD/FLOW	ΔP
3.1								3450	115		17PSI	18PSI		.53		1¼"/1.9/.53	2PSI
3.2								3450	115		18PSI	18PSI		.53		1¼"/1.9/.53	2PSI
3.3								3450	115		18PSI	28PSI		.53		1"/1.4/.53	7PSI
3.4								3450	115		18PSI	28PSI		.53		1"/1.4/.53	7PSI

Government of Nunavut

Community and Government Services
Safety Section

23-Jul-2014

Baffin Region	Kivalliq Region	Kitikmeot Region
P.O. Box 1000 Station 610	Bag 002	Bag 200
Iqaluit, NU	Rankin Inlet, NU	Cambridge Bay, NU
X0A 0H0	X0C 0G0	X0B 0C0
Phone: (867) 975-5423	Phone: (867) 645-8179	Phone: (867) 983-4157
Fax: (867) 975-5453	Fax: (867) 645-8196	Fax: (867) 983-4152

BOILER PERMIT

PERMIT # 28538

LOCATION

Community: Cambridge Bay

Building: Cambridge Bay Water Treatment Plant

OWNER

Name: Gov of Nunavut - Kitikmeot Region

Address: Bag 200
Cambridge Bay
X0B0C0

Contact:

Phone:

DEVICE

Type Heating
Manufacturer Weil McLain
Serial Number 1305769
CRN K7916.5123467NOTY
Year Built

MAWP: 207 kPa
Maximum Input: 33.41 KW
Heating Surface: M2
Dimensions:

	SV1	SV2
Size:	.75	
Pressure:		
Capacity:	33.41 KW	

INSTALLATION

Name: Jason Langer
Firm: Central Mechanical Systems Ltd.
Address: 345 Old Airport Road, Yellowknife, NT X1A 3T4

Telephone: (867) 873-3003

Certificate of Qualification: OBM # 44-5001

Cost of Installation (Includes labour, travel, room board)	
Permit Fee	$20.00

Issued By MUHAMMAD WANI
CHIEF BOILER INSPECTOR

July 23, 2014
Issue Date

INSPECTOR'S REPORT

BOILERS AND PRESSURE VESSELS ACT

DATE - D/M/Y: 03/12/2014

GN #: 28538

OWNER NAME	GN			
ADDRESS	WATER LAKE, CAMBRIDGE BAY WATER TREATMENT PLANT NU			
LOCATION	CAMBRIDGE BAY			
TYPE: C15	MGF.: WEIL Mc LAIN		MAWP: 207 kPa	
S.V.(s): 1	PRESS.: 30 PSI kPa	SIZE: 0.75 IN	CAPACITY: 114000 BTU/HR	
SER. #: 1305769	CRN #: K7916.5123467	NOTY	FEE: —	
FEDERAL: ☐ Ext. ☐ Int.	TERRITORIAL: ☑ Ext. ☐ Int.	DIMENSION: —	kW: 33.41	

D/M/Y

REPAIRS ORDERED. To be completed by .....

Inspected Safety Valve function, working of burner, conducted blow down. Everything was found to be normal. The Boiler permit was not available in the Boiler room which should be there alongwith the inspection report.

INSPECTOR ~~SHEIKH~~ ILYAS

BOILER + GAS INSPECTOR, CAMBRIDGE BAY

CANARY COPY MUST BE SIGNED AND FORWARDED TO:

Department of Public Works and Services
Gov't of Nunavut, Bag 1000, Iqaluit, NU X0A 0H0

I, (Print Name) .....

DECLARE THAT THE ABOVE ORDERED REPAIRS HAVE BEEN COMPLETED.

Date ..... Signed .....

GN 2368/1199

WHITE–POST WITH VESSEL CANARY–SAFETY DIVISION PINK–INSPECTOR'S COPY

Government of Nunavut

Community and Government Services
Safety Section

23-Jul-2014

Baffin Region	Kivalliq Region	Kitikmeot Region
P.O. Box 1000 Station 610	Bag 002	Bag 200
Iqaluit, NU	Rankin Inlet, NU	Cambridge Bay, NU
X0A 0H0	X0C 0G0	X0B 0C0
Phone: (867) 975-5423	Phone: (867) 645-8179	Phone: (867) 983-4157
Fax: (867) 975-5453	Fax: (867) 645-8196	Fax: (867) 983-4152

BOILER PERMIT

PERMIT # 28539

LOCATION

Community: Cambridge Bay

Building: Cambridge Bay Water Treatment Plant

OWNER

Name: Gov of Nunavut - Kitikmeot Region

Address: Bag 200
Cambridge Bay
X0B0C0

Contact:

Phone:

DEVICE

Type Heating
Manufacturer Weil McLain
Serial Number 1305770
CRN K7916.5123467NOTY
Year Built

MAWP: 207 kPa
Maximum Input: 33.41 KW
Heating Surface: M2
Dimensions:

	SV1	SV2
Size:	.75	
Pressure:		
Capacity:	33.41 KW	

INSTALLATION

Name: Jason Langer
Firm: Central Mechanical Systems Ltd.
Address: 345 Old Airport Road, Yellowknife, NT X1A 3T4

Telephone: (867) 873-3003

Certificate of Qualification: OBM # 44-5001

Cost of Installation (Includes labour, travel, room, board)	
Permit Fee	$20.00

Issued By MUHAMMAD WANI
CHIEF BOILER INSPECTOR

July 23, 2014
Issue Date

INSPECTOR'S REPORT

BOILERS AND PRESSURE VESSELS ACT

Nunavut

DATE - D/M/Y: 03/12/2014

GN #: 28539

OWNER NAME: GN				
ADDRESS: WATER LAKE, CAMBRIDGE BAY, WATER TREATMENT PLANT NU				
LOCATION: CAMBRIDGE BAY				
TYPE: C IS	MGF.: WEIL Mc LAIN		MAWP: 207 kPa	
S.V.(s): 1	PRESS.: 30 psi kPa	SIZE: 0.75 IN	CAPACITY: 114000 BTU/Hr	
SER. #: 1305770	CRN #: K7916.5123467	NOTY	FEE: —	
FEDERAL: ☐ Ext. ☐ Int.	TERRITORIAL: ☑ Ext. ☐ Int.	DIMENSION: —	kW: 33.41	

D/M/Y

REPAIRS ORDERED. To be completed by .....

Inspected & every thing found to be normal. The Boiler permit was not available in the Boiler room which should be there alongwith the inspection report.

INSPECTOR SHEIKH ILYAS

BOILER & GAS INSPECTOR, CAMBRIDGE BAY

CANARY COPY MUST BE SIGNED AND FORWARDED TO:

Department of Public Works and Services
Gov't of Nunavut, Bag 1000, Iqaluit, NU X0A 0H0

I, (Print Name) .....

DECLARE THAT THE ABOVE ORDERED REPAIRS HAVE BEEN COMPLETED.

Date ..... Signed .....

GN 2368/1199

WHITE–POST WITH VESSEL CANARY–SAFETY DIVISION PINK–INSPECTOR'S COPY

4.3

CMS
Central Mechanical Systems

345 Old Airport Road Yellowknife, NT X1A 3T4 Phone: 867-873-3003 Fax: 867-873-6633
1505-6th Street Nisku, AB T9E 7R8 Phone:780-955-7161 Fax: 780-955-2785

Hydronic System Piping Pressure Test

Project Name:	Cam Bay Potable water Upgrade.
Project #:	569
Community:	Cambridge Bay NU
Spec Section:	N/A ~ As per CMS

System Tested:	Hydronic System
Type of Test:	Air Test
Length of Test:	Twelve (12) Hours
Test Pressure:	100 PSI (690 kPa)
Date:	June 4. - 2014

Comments:

Tested By: Gord Gotda **Company:** Central Mechanical Systems Ltd.

Witnessed By: Nick Vaughan **Company:** CMS.

CMS
Central Mechanical Systems

345 Old Airport Road Yellowknife, NT X1A 3T4 Phone: 867-873-3003 Fax: 867-873-6633
1505-6th Street Nisku, AB T9E 7R8 Phone:780-955-7161 Fax: 780-955-2785

Fuel Oil Piping Pressure Test

Project Name:	Cambridge Bay Potable Water Upgrade.
Project #:	569
Community:	Cambridge Bay N/U.
Spec Section:	N/A ~ As per CMS

System Tested:	Fuel Oil Piping
Type of Test:	Air Test
Length of Test:	Twelve (12) Hours
Test Pressure:	100 PSI (690 kPa)
Date:	June 6 - 2014

Comments:

Tested By: Gord Gorda **Company:** Central Mechanical Systems Ltd.

Witnessed By: Nick Vaughan **Company:** CMS.

CMS
Central Mechanical Systems

345 Old Airport Road Yellowknife, NT X1A 3T4 Phone: 867-873-3003 Fax: 867-873-6633
1505-6th Street Nisku, AB T9E 7R8 Phone:780-955-7161 Fax: 780-955-2785

Hydronic Systems Piping
Flushing & Degreasing Report

Project Name:	Cambridge Bay Potable water System Upgrade ps I
Project #:	569
Community:	Cambridge Bay.
Spec Section:	N/A ~ As per CMS

Cleaning Solution ~ As per Specifications ~	
OR – If not specified (Purgex L24) Containing:	
1.	Tri-sodium phosphate: 0.40 kg per 100 L water in system
2.	Sodium carbonate: 0.40 kg per 100 L water in system
3.	Low-foaming detergent: 0.01 kg per 100 L water in system

	Pre-Cleaning Checklist
☑	1. Hydronic systems are fully operational.
☑	2. Hydronic systems have been hydrostatically tested.
☑	3. All hydronic system safety devices have been installed.
☑	4. Systems are to be completely drained.
☑	5. Systems are free from construction debris, dirt or other foreign material.
☑	6. Control valves are operational and fully open to ensure that terminal units can be cleaned properly.

CMS
Central Mechanical Systems

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1505-6th Street Nisku, AB T9E 7R8 Phone:780-955-7161 Fax: 780-955-2785

	Cleaning Hydronic Systems
☐	1. Test PH level of local water. _____ PH
☑	2. Fill system with water, ensure air is vented from system.
☑	3. Bring system to design temperature 160 °F and design pressure 18 PSI.
☑	4. Circulate all parts of the system.
☑	5. Add cleaning chemicals as per manufacturer's instructions.
☑	6. Circulate system with a return temperature of 140 °F for a period of 24 hrs.
☑	7. Shut down system and drain from all low points.
☑	8. Refill system with water.
☑	9. Bring system back up to design temperature and pressure.
☑	10. While maintaining design temperature and pressure, flush from various points in the system, adding fresh water as required.
☑	11. Flush for a minimum of 8 hrs.
☐	12. Test PH level of water of hydronic system. _____ PH
☐	12. Confirm PH is at an acceptable level between 7 and 8 &/or the same as the PH level recorded in step #1 above.
☑	13. Shut system down and drain completely.
☑	14. Clean out strainers and drain all heating coils in the system.
☑	15. Fill system with medium as per specification.
☐	16. Take a sample of the medium, labeling the date and location where sample was taken. Send to office for testing.

Comments:

Date: June 08/2014

Performed By: Scott Cordy **Company:** Central Mechanical Systems Ltd.

Witnessed By: [signature] **Company:** C.M.S.

4.4

CMS
Central Mechanical Systems

345 Old Airport Road Yellowknife, NT X1A 3T4 Phone: 867-873-3003 Fax: 867-873-6633
1505-6th Street Nisku, AB T9E 7R8 Phone:780-955-7161 Fax: 780-955-2785

Hydronic Systems Piping
Start-Up Report

Project Name:	Cam Bay Potable water System Upgrade Ph I
Project #:	589
Community:	Cambridge Bay
Spec Section:	N/A ~ As per CMS

	Pre Start-Up Checklist
☑	1. Cleaning of hydronic system piping is complete.
☑	2. Hydronic system piping has been filled with medium as specified.

	Start-Up Checklist
☑	1. Establish circulation and expansion tank level.
☑	2. Confirm diaphragm expansion tank is set up as per manufacturer's recommended pressure. 12 PSI.
☑	3. Set pressure controls.
☑	4. Ensure air is removed from system.
☑	5. Check pumps to be free of air, debris, possibility of cavitation when system is at design temperature.
☑	6. Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.
☑	7. Bring system to design temperature and pressure slowly.
☐	8. Confirm TAB has been performed.
☑	9. Adjust pipe supports, hangers, springs as necessary.
☑	10. Monitor pipe movement, performance of expansion joints, loops, guides, anchors.
☑	11. Check operation of drain valves.
☑	12. Adjust valve stem packings as systems settle down.
☑	13. Fully open balancing valves (except those that are factory set).

Comments: _____

Date: June 9/2014

Performed By: Gord Gorda **Company:** Central Mechanical Systems Ltd.

Witnessed By: Nick Vaughan **Company:** C.M.S.

CMS
Central Mechanical Systems

345 Old Airport Road Yellowknife, NT X1A 3T4 Phone: 867-873-3003 Fax: 867-873-6633
1505-6th Street Nisku, AB T9E 7R8 Phone:780-955-7161 Fax: 780-955-2785

Fuel Oil Piping Pressure Test

Project Name:	Cambridge Bay Potable Water Upgrade.
Project #:	569
Community:	Cambridge Bay NU.
Spec Section:	N/A ~ As per CMS

System Tested:	Fuel Oil Piping
Type of Test:	Air Test
Length of Test:	Twelve (12) Hours
Test Pressure:	100 PSI (690 kPa)
Date:	June 6 - 2014

Comments:

Tested By: Gord Gorda **Company:** Central Mechanical Systems Ltd.

Witnessed By: Mick Vaughan **Company:** CMS.

CMS
Central Mechanical Systems

345 Old Airport Road Yellowknife, NT X1A 3T4 Phone: 867-873-3003 Fax: 867-873-6633
1505-6th Street Nisku, AB T9E 7R8 Phone:780-955-7161 Fax: 780-955-2785

Hydronic Pump Start-Up Report

Project Name:	Cam Bay Potable water Upgrade
Project #:	569
Community:	Cam Bay
Spec Section:	N/A ~ As per CMS

Pump Information						
System Tag:	P-3,1		**Type of System:**	Hydronic/Glycol		
Service Area:	Boiler Rm.		**Fluid Media:**	Glycol		
Manufacturer:	Grundfos.		**Pressure (kPa):**	18 PSI		
Model Number:	UPS15-58FC		**Serial Number:**	59896341 P1		
Power:	115 Volts	1 PH	60 Hz	**Motor RPM:**	3450 RPM	
Frame Size:						

	Installation Checklist
☑	1. Equipment is installed as per manufacturer's instructions & specifications.
☑	2. Equipment label is permanently affixed.
☑	3. Pumps turn freely – Check pump rotation.
☑	4. Drive guard or shield is properly installed.
☑	5. Pump is level within manufacturer's tolerances.
☑	6. Pump is in place and properly anchored.
☑	7. Seismic anchoring is installed and functional where applicable.
☑	8. Piping installed supports pump.
☑	9. Pump isolation valves and piping specialties have been installed.
☑	10. Pump detail has been checked against the drawings and all devices, sensors and gauges have been installed.
☑	11. Clean pump strainers.
☑	12. Confirm pump has a power supply.
☑	13. Confirm power disconnects are labeled and located within site of the pump it controls.
☑	14. Confirm all control devices to operate pump are installed & wiring is complete.

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1505-6th Street Nisku, AB T9E 7R8 Phone:780-955-7161 Fax: 780-955-2785

	Start-Up Checklist
☑	1. Start pumps.
☑	2. Check impeller rotation.
☑	3. Check for safe and proper operation.
☑	4. Check settings, operation of unit, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.
☑	5. Test operation of hands off auto switch.
☑	6. Test operation of alternator.
☑	7. Verify operation of protective devices under low and no-flow conditions.
☑	8. Eliminate air from scroll casings.
☑	9. Adjust leakage through water-cooled bearings.
☑	10. Adjust shaft stuffing boxes.
☑	11. Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.
☑	12. Check pump base for free-floating and confirm there are no obstructions under base.
☑	13. Run pumps for 12 continuous hrs. (Ensure parallel pumps are equally balanced).
☑	14. Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
☑	15. Adjust alignment of piping and conduit to ensure full flexibility.
☑	16. Eliminate causes of cavitation, flashing or air entrainment.
☑	17. Measure and record pressure drop across strainer when clean and with flow rates as finally set. _____ PSI
☑	18. Clean strainer if pressure drop from one side to the other is greater than 5 PSI.
☑	19. Re-measure and record pressure drop across strainer. _____ PSI
☑	20. Verify lubricating oil levels.

Comments:

_____

_____

_____

Date: June 7/14

Performed By: Coord Cotzla **Company:** Central Mechanical Systems Ltd.

Witnessed By: _____ **Company:** _____

CMS
Central Mechanical Systems

345 Old Airport Road Yellowknife, NT X1A 3T4 Phone: 867-873-3003 Fax: 867-873-6633
1505-6th Street Nisku, AB T9E 7R8 Phone:780-955-7161 Fax: 780-955-2785

Hydronic Pump Start-Up Report

Project Name:	Cam Bay Potable water Upgrade.
Project #:	569
Community:	Cam Bay.
Spec Section:	N/A ~ As per CMS

Pump Information						
System Tag:	P-3-2.		**Type of System:**	Hydronic		
Service Area:	Boiler Rm.		**Fluid Media:**	Glycol		
Manufacturer:	Grunfos.		**Pressure (kPa):**	18 PSI		
Model Number:	UPS 15-58FC		**Serial Number:**	59896341 P1		
Power:	115 Volts	1 PH	60 Hz	**Motor RPM:**	3450 RPM	
Frame Size:						

Installation Checklist	
☑	1. Equipment is installed as per manufacturer's instructions & specifications.
☑	2. Equipment label is permanently affixed.
☑	3. Pumps turn freely – Check pump rotation.
☑	4. Drive guard or shield is properly installed.
☑	5. Pump is level within manufacturer's tolerances.
☑	6. Pump is in place and properly anchored.
☑	7. Seismic anchoring is installed and functional where applicable.
☑	8. Piping installed supports pump.
☑	9. Pump isolation valves and piping specialties have been installed.
☑	10. Pump detail has been checked against the drawings and all devices, sensors and gauges have been installed.
☑	11. Clean pump strainers.
☑	12. Confirm pump has a power supply.
☑	13. Confirm power disconnects are labeled and located within site of the pump it controls.
☑	14. Confirm all control devices to operate pump are installed & wiring is complete.

CMS
Central Mechanical Systems

345 Old Airport Road Yellowknife, NT X1A 3T4 Phone: 867-873-3003 Fax: 867-873-6633
1505-6th Street Nisku, AB T9E 7R8 Phone:780-955-7161 Fax: 780-955-2785

	Start-Up Checklist
☑	1. Start pumps.
☑	2. Check impeller rotation.
☑	3. Check for safe and proper operation.
☑	4. Check settings, operation of unit, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.
☑	5. Test operation of hands off auto switch.
☑	6. Test operation of alternator.
☑	7. Verify operation of protective devices under low and no-flow conditions.
☑	8. Eliminate air from scroll casings.
☑	9. Adjust leakage through water-cooled bearings.
☑	10. Adjust shaft stuffing boxes.
☑	11. Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.
☑	12. Check pump base for free-floating and confirm there are no obstructions under base.
☑	13. Run pumps for 12 continuous hrs. (Ensure parallel pumps are equally balanced).
☑	14. Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
☑	15. Adjust alignment of piping and conduit to ensure full flexibility.
☑	16. Eliminate causes of cavitation, flashing or air entrainment.
☑	17. Measure and record pressure drop across strainer when clean and with flow rates as finally set. _____ PSI
☑	18. Clean strainer if pressure drop from one side to the other is greater than 5 PSI.
☑	19. Re-measure and record pressure drop across strainer. _____ PSI
☑	20. Verify lubricating oil levels.

Comments:

_____

_____

_____

Date: June 7/14

Performed By: Gord Gorda **Company:** Central Mechanical Systems Ltd.

Witnessed By: _____ **Company:** _____

CMS
Central Mechanical Systems

345 Old Airport Road Yellowknife, NT X1A 3T4 Phone: 867-873-3003 Fax: 867-873-6633
1505-6th Street Nisku, AB T9E 7R8 Phone:780-955-7161 Fax: 780-955-2785

Hydronic Pump Start-Up Report

Project Name:	Cam Bay Potable Water Upgrades.
Project #:	569
Community:	Cam Bay.
Spec Section:	N/A ~ As per CMS

Pump Information						
System Tag:	P-3.3		**Type of System:**	Hydronic		
Service Area:	Boiler Rm.		**Fluid Media:**	Glycol		
Manufacturer:	Grundfos.		**Pressure (kPa):**	18 PSI		
Model Number:	UPS26-99FC		**Serial Number:**	52722512 P1		
Power:	115 Volts	60 PH	1 Hz	**Motor RPM:**	3450 RPM	
Frame Size:						

	Installation Checklist
☑	1. Equipment is installed as per manufacturer's instructions & specifications.
☑	2. Equipment label is permanently affixed.
☑	3. Pumps turn freely – Check pump rotation.
☑	4. Drive guard or shield is properly installed.
☑	5. Pump is level within manufacturer's tolerances.
☑	6. Pump is in place and properly anchored.
☑	7. Seismic anchoring is installed and functional where applicable.
☑	8. Piping installed supports pump.
☑	9. Pump isolation valves and piping specialties have been installed.
☑	10. Pump detail has been checked against the drawings and all devices, sensors and gauges have been installed.
☑	11. Clean pump strainers.
☑	12. Confirm pump has a power supply.
☑	13. Confirm power disconnects are labeled and located within site of the pump it controls.
☑	14. Confirm all control devices to operate pump are installed & wiring is complete.

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Central Mechanical Systems

345 Old Airport Road Yellowknife, NT X1A 3T4 Phone: 867-873-3003 Fax: 867-873-6633
1505-6th Street Nisku, AB T9E 7R8 Phone:780-955-7161 Fax: 780-955-2785

	Start-Up Checklist
☑	1. Start pumps.
☑	2. Check impeller rotation.
☑	3. Check for safe and proper operation.
☑	4. Check settings, operation of unit, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.
☑	5. Test operation of hands off auto switch.
☑	6. Test operation of alternator.
☑	7. Verify operation of protective devices under low and no-flow conditions.
☑	8. Eliminate air from scroll casings.
☑	9. Adjust leakage through water-cooled bearings.
☑	10. Adjust shaft stuffing boxes.
☑	11. Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.
☑	12. Check pump base for free-floating and confirm there are no obstructions under base.
☑	13. Run pumps for 12 continuous hrs. (Ensure parallel pumps are equally balanced).
☑	14. Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
☑	15. Adjust alignment of piping and conduit to ensure full flexibility.
☑	16. Eliminate causes of cavitation, flashing or air entrainment.
☑	17. Measure and record pressure drop across strainer when clean and with flow rates as finally set. _____ PSI
☑	18. Clean strainer if pressure drop from one side to the other is greater than 5 PSI.
☑	19. Re-measure and record pressure drop across strainer. _____ PSI
☑	20. Verify lubricating oil levels.

Comments:

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Date: June 7/14

Performed By: Gord Gorda. **Company:** Central Mechanical Systems Ltd.

Witnessed By: _____ **Company:** _____

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Hydronic Pump Start-Up Report

Project Name:	Cam Bay Potable Water UPGrade
Project #:	569
Community:	Cam Bay
Spec Section:	N/A ~ As per CMS

Pump Information						
System Tag:	P-3.4		**Type of System:**	Hydronic		
Service Area:	Boiler Rm.		**Fluid Media:**	Glycol		
Manufacturer:	Grundfos		**Pressure (kPa):**	18 PSI		
Model Number:	UPS 26-99 FC		**Serial Number:**	52722512 P1		
Power:	115 Volts	1 PH	60 Hz	**Motor RPM:**	3450 RPM	
Frame Size:						

	Installation Checklist
☑	1. Equipment is installed as per manufacturer's instructions & specifications.
☑	2. Equipment label is permanently affixed.
☑	3. Pumps turn freely – Check pump rotation.
☑	4. Drive guard or shield is properly installed.
☑	5. Pump is level within manufacturer's tolerances.
☑	6. Pump is in place and properly anchored.
☑	7. Seismic anchoring is installed and functional where applicable.
☑	8. Piping installed supports pump.
☑	9. Pump isolation valves and piping specialties have been installed.
☑	10. Pump detail has been checked against the drawings and all devices, sensors and gauges have been installed.
☑	11. Clean pump strainers.
☑	12. Confirm pump has a power supply.
☑	13. Confirm power disconnects are labeled and located within site of the pump it controls.
☑	14. Confirm all control devices to operate pump are installed & wiring is complete.

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	Start-Up Checklist
☑	1. Start pumps.
☑	2. Check impeller rotation.
☑	3. Check for safe and proper operation.
☑	4. Check settings, operation of unit, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.
☑	5. Test operation of hands off auto switch.
☑	6. Test operation of alternator.
☑	7. Verify operation of protective devices under low and no-flow conditions.
☑	8. Eliminate air from scroll casings.
☑	9. Adjust leakage through water-cooled bearings.
☑	10. Adjust shaft stuffing boxes.
☑	11. Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.
☑	12. Check pump base for free-floating and confirm there are no obstructions under base.
☑	13. Run pumps for 12 continuous hrs. (Ensure parallel pumps are equally balanced).
☑	14. Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
☑	15. Adjust alignment of piping and conduit to ensure full flexibility.
☑	16. Eliminate causes of cavitation, flashing or air entrainment.
☑	17. Measure and record pressure drop across strainer when clean and with flow rates as finally set. _____ PSI
☐	18. Clean strainer if pressure drop from one side to the other is greater than 5 PSI.
☑	19. Re-measure and record pressure drop across strainer. _____ PSI
☑	20. Verify lubricating oil levels.

Comments:

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Date: June 7

Performed By: Gord Gorda **Company:** Central Mechanical Systems Ltd.

Witnessed By: _____ **Company:** _____

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Hydronic Pump Start-Up Report

Project Name:	Cam Bay Potable Water Upgrade
Project #:	569
Community:	Cam Bay
Spec Section:	N/A ~ As per CMS

Pump Information						
System Tag:	P-3.5		**Type of System:**	Hydronic		
Service Area:	Boiler Room		**Fluid Media:**	Glycol		
Manufacturer:	Axiom		**Pressure (kPa):**	Max 20 PSI		
Model Number:	MF 200		**Serial Number:**			
Power:	115 Volts	1 PH	60 Hz	**Motor RPM:**	2930 RPM	
Frame Size:						

	Installation Checklist
☑	1. Equipment is installed as per manufacturer's instructions & specifications.
☑	2. Equipment label is permanently affixed.
☑	3. Pumps turn freely – Check pump rotation.
☑	4. Drive guard or shield is properly installed.
☑	5. Pump is level within manufacturer's tolerances.
☑	6. Pump is in place and properly anchored.
☑	7. Seismic anchoring is installed and functional where applicable.
☑	8. Piping installed supports pump.
☑	9. Pump isolation valves and piping specialties have been installed.
☑	10. Pump detail has been checked against the drawings and all devices, sensors and gauges have been installed.
☑	11. Clean pump strainers.
☑	12. Confirm pump has a power supply.
☑	13. Confirm power disconnects are labeled and located within site of the pump it controls.
☑	14. Confirm all control devices to operate pump are installed & wiring is complete.

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	Start-Up Checklist
☑	1. Start pumps.
☑	2. Check impeller rotation.
☑	3. Check for safe and proper operation.
☑	4. Check settings, operation of unit, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.
☑	5. Test operation of hands off auto switch.
☑	6. Test operation of alternator.
☑	7. Verify operation of protective devices under low and no-flow conditions.
☑	8. Eliminate air from scroll casings.
☑	9. Adjust leakage through water-cooled bearings.
☑	10. Adjust shaft stuffing boxes.
☑	11. Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.
☑	12. Check pump base for free-floating and confirm there are no obstructions under base.
☑	13. Run pumps for 12 continuous hrs. (Ensure parallel pumps are equally balanced).
☑	14. Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
☑	15. Adjust alignment of piping and conduit to ensure full flexibility.
☑	16. Eliminate causes of cavitation, flashing or air entrainment.
☑	17. Measure and record pressure drop across strainer when clean and with flow rates as finally set. _____ PSI
☑	18. Clean strainer if pressure drop from one side to the other is greater than 5 PSI.
☑	19. Re-measure and record pressure drop across strainer. _____ PSI
☑	20. Verify lubricating oil levels.

Comments:

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Date: JUNE 7/14

Performed By: Gord Cordua **Company:** Central Mechanical Systems Ltd.

Witnessed By: _____ **Company:** _____

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Central Mechanical Systems

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Unit Heater /Furnace
(Hydronic)
Start-Up Report

Project Name:	Cam Bay Potable water upgrade.
Project #:	569
Community:	Cam Bay
Spec Section:	N/A ~ As per CMS

Unit Heater Information					
System Tag:	UH-1			**Service Area:**	Boiler Room
Manufacturer:	Rosemex			**Serial Number:**	NEBD022113013147
Model Number:	RMC-95			**Capacity (BTU's):**	N.A.
Power:	120 Volts	1/20 PH	60 Hz		
Fuel Pressure:	N.A.	**RPM:**	1550		

	Installation Checklist
☑	1. Ensure unit has been hung/mounted as designed or as specified.
☑	2. Confirm if isolation is required.
☑	3. Ensure there is power to unit.
☑	4. Confirm controls (zone valves & thermostat) have been installed and wired to unit.
☑	5. Confirm fan in unit turns freely – no obstructions.
☑ ☑ ☑	6. Confirm all hydronic equipment has been installed: - Isolation Valves - Air Bleed Valve - Drain Valve
☑	7. Ensure all valves have been properly identified.
☑	8. Ensure the unit has been proper identified.

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	Start-Up Checklist
☑	1. Confirm all isolation valves are closed.
☑	2. Manually open control valve.
☑	3. Open supply isolation valve.
☑	4. Open air bleed until no air is present.
☑	5. Close supply isolation valve.
☑	6. Open return isolation valve.
☑	7. Open air bleed until no air present.
☑	8. Open supply isolation valve.
☑	9. Turn power on to unit.
☑	10. Ensure fan runs smoothly and quietly.
☑ ☑	11. Test to see the controls operate properly. - Confirm that the thermostat calling for heat opens the control valve and the unit emits heat until the desired temperature is reached. - Confirm that the control valve closes when the desired temperature is reached.
☑	12. Check the coil and all piping for any sign of leaks.
☑	13. If leaks are present, turn off unit, close the zone valves – make the repairs and repeat all of the above steps.

Comments:

Date: Oct 24/14

Performed By: Gord Gorda **Company:** Central Mechanical Systems Ltd.

Witnessed By: _____ **Company:** _____

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Unit Heater /Furnace
(Hydronic)
Start-Up Report

Project Name:	Cam Bay Potable water Upgrade
Project #:	569
Community:	Cam Bay
Spec Section:	N/A ~ As per CMS

Unit Heater Information				
System Tag:	UH-2		**Service Area:**	Process Room
Manufacturer:	Rosemex		**Serial Number:**	NEBD 022113013148
Model Number:	RNC-95		**Capacity (BTU's):**	N.A.
Power:	120 Volts	1/60 PH	60 Hz	
Fuel Pressure:	N.A.	**RPM:**	1550	

	Installation Checklist
☑	1. Ensure unit has been hung/mounted as designed or as specified.
☑	2. Confirm if isolation is required.
☑	3. Ensure there is power to unit.
☑	4. Confirm controls (zone valves & thermostat) have been installed and wired to unit.
☑	5. Confirm fan in unit turns freely – no obstructions.
☑ ☑ ☑	6. Confirm all hydronic equipment has been installed: - Isolation Valves - Air Bleed Valve - Drain Valve
☑	7. Ensure all valves have been properly identified.
☑	8. Ensure the unit has been proper identified.

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	Start-Up Checklist
☑	1. Confirm all isolation valves are closed.
☑	2. Manually open control valve.
☑	3. Open supply isolation valve.
☑	4. Open air bleed until no air is present.
☑	5. Close supply isolation valve.
☑	6. Open return isolation valve.
☑	7. Open air bleed until no air present.
☑	8. Open supply isolation valve.
☑	9. Turn power on to unit.
☑	10. Ensure fan runs smoothly and quietly.
☑ ☑	11. Test to see the controls operate properly. - Confirm that the thermostat calling for heat opens the control valve and the unit emits heat until the desired temperature is reached. - Confirm that the control valve closes when the desired temperature is reached.
☑	12. Check the coil and all piping for any sign of leaks.
☑	13. If leaks are present, turn off unit, close the zone valves – make the repairs and repeat all of the above steps.

Comments:

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Date: Oct 24/14

Performed By: Good Gorda **Company:** Central Mechanical Systems Ltd.

Witnessed By: _____ **Company:** _____

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Unit Heater /Furnace
(Hydronic)
Start-Up Report

Project Name:	Cam Bay Potable water Upgrade
Project #:	569
Community:	Cam Bay
Spec Section:	N/A ~ As per CMS

Unit Heater Information				
System Tag:	UH-3		**Service Area:**	Generator Rm
Manufacturer:	Rosemex		**Serial Number:**	NEB0022113013149
Model Number:	RNC-95		**Capacity (BTU's):**	N.A.
Power:	120 Volts	1/20 PH	60 Hz	
Fuel Pressure:	N.A.	**RPM:**	1550	

	Installation Checklist
☑	1. Ensure unit has been hung/mounted as designed or as specified.
☑	2. Confirm if isolation is required.
☑	3. Ensure there is power to unit.
☑	4. Confirm controls (zone valves & thermostat) have been installed and wired to unit.
☑	5. Confirm fan in unit turns freely – no obstructions.
☑	6. Confirm all hydronic equipment has been installed: - Isolation Valves - Air Bleed Valve - Drain Valve
☑	7. Ensure all valves have been properly identified.
☑	8. Ensure the unit has been proper identified.

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	Start-Up Checklist
☑	1. Confirm all isolation valves are closed.
☑	2. Manually open control valve.
☑	3. Open supply isolation valve.
☑	4. Open air bleed until no air is present.
☑	5. Close supply isolation valve.
☑	6. Open return isolation valve.
☑	7. Open air bleed until no air present.
☑	8. Open supply isolation valve.
☑	9. Turn power on to unit.
☑	10. Ensure fan runs smoothly and quietly.
☑ ☑	11. Test to see the controls operate properly. - Confirm that the thermostat calling for heat opens the control valve and the unit emits heat until the desired temperature is reached. - Confirm that the control valve closes when the desired temperature is reached.
☑	12. Check the coil and all piping for any sign of leaks.
☑	13. If leaks are present, turn off unit, close the zone valves – make the repairs and repeat all of the above steps.

Comments:

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Date: Oct 24/14

Performed By: Gord Gorda. **Company:** Central Mechanical Systems Ltd.

Witnessed By: _____ **Company:** _____

Fuel Pump . Start-Up Report

Project Name: Cam Bay Potable water Upgrade
Project #: 569
Community: Cam Bay
Spec Section: N/A ~ As per CMS

Pump Information

System Tag: P.2.2 **Type of System:** Fuel Supply

Service Area: Generator Rm. **Fluid Media:** Fuel Oil

Manufacturer: Viking **Pressure (kPa):**

Model Number: MEO1CO x0x0006300734 **Serial Number:** 10022075

Power: 208 V olts 1 P H 60 H z **Motor RPM:** 1750 R PM

Frame Size:

Installation Checklist

FORMCHECKBOX ✓	1. Equipment is installed as per manufacturer's instructions & specifications.
FORMCHECKBOX ✓	2. Equipment label is permanently affixed.
FORMCHECKBOX ✓	3. Pumps turn freely – Check pump rotation.
FORMCHECKBOX ✓	4. Drive guard or shield is properly installed.
FORMCHECKBOX ✓	5. Pump is level within manufacturer's tolerances.
FORMCHECKBOX ✓	6. Pump is in place and properly anchored.
FORMCHECKBOX ✓	7. Seismic anchoring is installed and functional where applicable.
FORMCHECKBOX ✓	8. Piping installed supports pump.
FORMCHECKBOX ✓	9. Pump isolation valves and piping specialties have been installed.
FORMCHECKBOX ✓	10. Pump detail has been checked against the drawings and all devices, sensors and gauges have been installed.
FORMCHECKBOX ✓	11. Clean pump strainers.
FORMCHECKBOX ✓	12. Confirm pump has a power supply.
FORMCHECKBOX ✓	13. Confirm power disconnects are labeled and located within site of the pump it controls.
FORMCHECKBOX ✓	14. Confirm all control devices to operate pump are installed & wiring is complete.

Start-Up Checklist

FORMCHECKBOX	1. Start pumps.
FORMCHECKBOX	2. Check impeller rotation.
FORMCHECKBOX	3. Check for safe and proper operation.

FORMCHECKBOX	4. Check settings, operation of unit, limit, safety controls, over-temperature, audible/ visual alarms, other protective devices.
FORMCHECKBOX	5. Test operation of hands off auto switch.
FORMCHECKBOX	6. Test operation of alternator.
FORMCHECKBOX	7. Verify operation of protective devices under low and no-flow conditions.
FORMCHECKBOX	8. Eliminate air from scroll casings.
FORMCHECKBOX	9. Adjust leakage through water-cooled bearings.
FORMCHECKBOX	10. Adjust shaft stuffing boxes.
FORMCHECKBOX	11. Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.
FORMCHECKBOX	12. Check pump base for free-floating and confirm there are no obstructions under base.
FORMCHECKBOX	13. Run pumps for 12 continuous hrs. (Ensure parallel pumps are equally balanced).
FORMCHECKBOX	14. Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
FORMCHECKBOX	15. Adjust alignment of piping and conduit to ensure full flexibility.
FORMCHECKBOX	16. Eliminate causes of cavitation, flashing or air entrainment.
FORMCHECKBOX	17. Measure and record pressure drop across strainer when clean and with flow rates as finally set. _____ PSI
FORMCHECKBOX	18. Clean strainer if pressure drop from one side to the other is greater than 5 PSI.
FORMCHECKBOX	19. Re-measure and record pressure drop across strainer. _____ PSI
FORMCHECKBOX	20. Verify lubricating oil levels.

Comments:

Date: June 12/14

Performed By: Gord Gorda. **Company:** Central Mechanical

Witnessed By: _____ **Company:**

Fuel Pump · Start-Up Report

Project Name: Cam Bay Potable water upgrade
Project #: 569
Community: Nr. Cam Bay
Spec Section: N/A ~ As per CMS

Pump Information

System Tag: P-2.1 **Type of System:** Fuel Supply
Service Area: Generator Rm **Fluid Media:** Fuel Oil
Manufacturer: Viking **Pressure (kPa):**
Model Number: MJE01C0X0X0000300734 **Serial Number:** 10022074
Power: 208 Volts V 1 PH P 60 Hz H **Motor RPM:** 1750 PM R
Frame Size: B56

Installation Checklist

FORMCHECKBOX	✓	1. Equipment is installed as per manufacturer's instructions & specifications.
FORMCHECKBOX	✓	2. Equipment label is permanently affixed.
FORMCHECKBOX	✓	3. Pumps turn freely – Check pump rotation.
FORMCHECKBOX	✓	4. Drive guard or shield is properly installed.
FORMCHECKBOX	✓	5. Pump is level within manufacturer's tolerances.
FORMCHECKBOX	✓	6. Pump is in place and properly anchored.
FORMCHECKBOX	✓	7. Seismic anchoring is installed and functional where applicable.
FORMCHECKBOX	✓	8. Piping installed supports pump.
FORMCHECKBOX	✓	9. Pump isolation valves and piping specialties have been installed.
FORMCHECKBOX	✓	10. Pump detail has been checked against the drawings and all devices, sensors and gauges have been installed.
FORMCHECKBOX	✓	11. Clean pump strainers.
FORMCHECKBOX	✓	12. Confirm pump has a power supply.
FORMCHECKBOX	✓	13. Confirm power disconnects are labeled and located within site of the pump it controls.
FORMCHECKBOX	✓	14. Confirm all control devices to operate pump are installed & wiring is complete.

Start-Up Checklist

FORMCHECKBOX	1. Start pumps.
FORMCHECKBOX	2. Check impeller rotation.
FORMCHECKBOX	3. Check for safe and proper operation.

FORMCHECKBOX	4. Check settings, operation of unit, limit, safety controls, over-temperature, audible/ visual alarms, other protective devices.
FORMCHECKBOX	5. Test operation of hands off auto switch.
FORMCHECKBOX	6. Test operation of alternator.
FORMCHECKBOX	7. Verify operation of protective devices under low and no-flow conditions.
FORMCHECKBOX	8. Eliminate air from scroll casings.
FORMCHECKBOX	9. Adjust leakage through water-cooled bearings.
FORMCHECKBOX	10. Adjust shaft stuffing boxes.
FORMCHECKBOX	11. Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.
FORMCHECKBOX	12. Check pump base for free-floating and confirm there are no obstructions under base.
FORMCHECKBOX	13. Run pumps for 12 continuous hrs. (Ensure parallel pumps are equally balanced).
FORMCHECKBOX	14. Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
FORMCHECKBOX	15. Adjust alignment of piping and conduit to ensure full flexibility.
FORMCHECKBOX	16. Eliminate causes of cavitation, flashing or air entrainment.
FORMCHECKBOX	17. Measure and record pressure drop across strainer when clean and with flow rates as finally set. _____ PSI
FORMCHECKBOX	18. Clean strainer if pressure drop from one side to the other is greater than 5 PSI.
FORMCHECKBOX	19. Re-measure and record pressure drop across strainer. _____ PSI
FORMCHECKBOX	20. Verify lubricating oil levels.

Comments:

Date: June 12/14

Performed By: Gord Gorda. **Company:** Central Mechanical

Witnessed By: _____ **Company:**

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Boiler Combustion Efficiency Report

Project Name:	Cam Bay Potable Water Upgrade.
Project #:	569
Community:	Cam Bay.
Spec Section:	N/A ~ As per CMS

Pre-Combustion Efficiency Test Checklist	
☑	1. Verify boiler has been pressure tested.
☑	2. Verify the hydronic system piping has been pressure tested.
☑	3. Verify hydronic system has been filled with medium as specified.
☑	4. Verify chimney & breeching has been properly installed on boiler.

Boiler Manufacturer:	Weil Mclean.
Boiler Model #:	P-WGO-2
Boiler Serial #:	1305770
Boiler CRN #	K7916.5123467NOTY

Draft:	.03
Carbon Monoxide:	25.9
Smoke:	1
Gross Stack Temp:	410 F
Net Stack Temp:	280 F
Combustion Efficiency:	78.9
Oil Pressure:	

Comments:

Date: APRIL 10 / 15

Performed By: J.P. ZANKL Company: Central Mechanical Systems Ltd.

Witnessed By: Company: CMS

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Boiler Combustion Efficiency Report

Project Name:	Cam Bay Potable Water Upgrade.
Project #:	569
Community:	Cam Bay
Spec Section:	N/A ~ As per CMS

Pre-Combustion Efficiency Test Checklist	
☑	1. Verify boiler has been pressure tested.
☑	2. Verify the hydronic system piping has been pressure tested.
☑	3. Verify hydronic system has been filled with medium as specified.
☑	4. Verify chimney & breeching has been properly installed on boiler.

Boiler Manufacturer:	Weil Mclean.
Boiler Model #:	PWGO-2.
Boiler Serial #:	1305769
Boiler CRN #	K7916.5123467 NOTY

Draft:	.02
Carbon Monoxide:	14.1
Smoke:	1
Gross Stack Temp:	412°F
Net Stack Temp:	230°F
Combustion Efficiency:	74.1
Oil Pressure:	

Comments:

Date: April 10/15

Performed By: J.P ZANKI

Witnessed By: [signature]

Company: Central Mechanical Systems Ltd.

Company: CMS

HRV - Start-Up Report

Project Name: Cam Bay Potable water Upgrade
Project #: 569
Community: Cambridge Bay
Spec Section: N/A ~ As per CMS

Fan Information

System Tag: HRV-1 **Service Area:** Process Room
Manufacturer: LifeBreath. **Serial Number:** NEBD022113013 48
Model Number: RNC-95 **Capacity (L/s):** 34/L/S
Power: 120 V (Volts) 1.25 P (H) 60 H (z) **RPM:**

Installation Checklist

FORMCHECKBOX	/	1. Equipment is installed as per manufacturer's instructions & specifications.
FORMCHECKBOX	/	2. Equipment label is permanently affixed.
FORMCHECKBOX	/	3. Unit casing is in good condition w/ door gaskets installed. No dents or leaks.
FORMCHECKBOX	/	4. Access doors close tightly – No leaks.
FORMCHECKBOX	/	5. Connection between duct and unit are air tight and in good condition.
FORMCHECKBOX	/	6. Vibration isolation equipment is installed.
FORMCHECKBOX	/	7. Shipping locks on unit have been removed.
FORMCHECKBOX	/	8. Maintenance access is adequate for unit and it's components.
FORMCHECKBOX	/	9. Sound attenuation has been installed.
FORMCHECKBOX	/	10. Thermal insulation has been properly installed and is according to specifications.
FORMCHECKBOX	/	11. Instrumentation has been properly installed and is according to specifications. (Thermometers, Pressure Gauges, Flow Meters, Temperature Sensors, etc.)
FORMCHECKBOX	/	12. Equipment has been cleaned as per specifications.
FORMCHECKBOX	/	13. Fan and motor are aligned.
FORMCHECKBOX	/	14. Fan belt tension is correct and in good condition.
FORMCHECKBOX	/	15. Protective shrouds for belts are in place and secure.
FORMCHECKBOX	/	16. Fan area is clean.
FORMCHECKBOX	/	17. Fan and motor have been properly lubricated.
FORMCHECKBOX	/	18. Fan filters are clean and fight tightly.

FORMCHECKBOX	/	19. All dampers (balancing, control, fire) close tightly.
FORMCHECKBOX	/	20. All damper actuators have been installed.
FORMCHECKBOX	/	21. Sound attenuators have been installed.
FORMCHECKBOX	/	22. All duct joints have been properly sealed with duct sealer.
FORMCHECKBOX	/	23. There are no apparent/severe duct restrictions.
FORMCHECKBOX	/	24. All square elbows installed have turning vanes in them to direct airflow as per specifications.
FORMCHECKBOX	/	25. All branch ducts have operable balancing &/or controls dampers as per specifications.
FORMCHECKBOX	/	26. All outside air (fresh air) intakes are located away from pollutant sources and exhaust air outlets.
FORMCHECKBOX	/	27. All power disconnects are properly labeled and within site of the Fan it controls.
FORMCHECKBOX	/	28. All safety's installed are operational.
FORMCHECKBOX	/	29. Control systems interlocks are connected and functional. – See Controls Commissioning Checklist.

Start-Up Checklist

FORMCHECKBOX	/	1. Start Fan.
FORMCHECKBOX	/	2. Check fan rotation is correct.
FORMCHECKBOX	/	3. Confirm noise and vibration of the fan is normal.
FORMCHECKBOX	/	4. Confirm inlet vanes are aligned in housing and actuators spanned modulate smoothly and proportional to input signal and EMS readout.
FORMCHECKBOX	/	5. Confirm all dampers (OSA, RA, EA, etc.) stroke fully without binding and operate with EMS system.
FORMCHECKBOX	/	6. Check settings, operation of unit, limit, safety controls, over-temperature, audible/ visual alarms, other protective devices.
FORMCHECKBOX	/	7. Confirm point to point checks have been completed by controls contractor.

Comments:

Date: Sept 15/14

Performed By: Gord Gorda Company: Central Mechanical Systems Ltd.

5. Manufacturer's Data and Service Information

5.1 Heating System

5.1.1 Fuel Oil Day Tanks

5.1.2 Fuel Oil Pump with Controller

5.1.3 Boilers

5.1.4 Hydronic Expansion Tank

5.1.5 Glycol Feeder System

5.1.6 Unit Heaters

5.1.7 Circulation Pumps

5.2 Ventilation System

5.2.1 Heat Recovery Unit (HRV)

5.2.2 Inline Exhaust Fan

5.2.3 Air Grilles

5.3 Process Piping System

5.3.1 Submersible Pumps

5.3.2 Potable Water Recirculation Pump

5.3.3 Chlorine Injection Pump

5.3.4 Electromagnetic Flowmeters

5.3.5 Valves

5.4 Control System

SECTION 5.1 ~ Heating System Components & Manufacturer Info

TK-1.1	454 L Westeel Fuel Oil Tank (Generator Day Tank) c/w Ktech 4-Point Level Switch
TK-1.2	680 L Westeel Fuel Oil Tank (Boiler Room Day Tank) c/w Ktech 4-Point Level Switch
P-2.1 & 2.2	Duplex Viking FH-432 Fuel Oil Pump Skid Mounted System c/w Torna Tech Duplex Oil Pump Controller
B-1, 2	Weil McLain P-WGO-2 Boilers c/w Riello Burners c/w McDonnell & Miller Low Water Cutoffs (PS-851-120)
EX-1	Flexcon SXHT-40 Hydronic Expansion Tank
P-3.5	Axiom MF-200 Pressure Pal Mini Glycol Feeder System c/w Alarm Panel (Model: RIA10-1-SAA)
UH-1 & 3	Rosemex H-24 Hydronic Unit Heaters
UH-2	Rosemex H-24-AG Hydronic Unit Heater
HC-1	Rosemex WBH 12" x 12" Heating Coil
P-3.1, 3.2	Grundfos UPS 15-58FC Hydronic Circulation Pumps
P-3.3, 3.4	Grundfos UPS 26-99FC Hydronic Circulation Pumps

Division 23

TK-1.1
Generator Fuel Oil Day Tank
c/w Ktech 4-Point Level Switch

Make:	Westeel
Model:	N/A
Capacity:	454 L
Serial #:	

Division 23

TK-1.2
Boiler Room Fuel Oil Day Tank
c/w Ktech 4-Point Level Switch

Make:	Westeel
Model:	N/A
Capacity:	680 L
Serial #:	

bartle & gibson co. ltd.

Plumbing, Heating, & Electrical Supplies

SERVING ALBERTA, B.C. & NORTHWEST TERRITORIES

ALBERTA BRANCHES

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LETHBRIDGE

LLOYDMINSTER

MEDICINE HAT

PEACE RIVER

SPRUCE GROVE

WETASKIWIN

YELLOWKNIFE, N.T.

BRITISH COLUMBIA BRANCHES

CHILLIWACK

COURTENAY

KELOWNA

MAPLE RIDGE

NANAIMO

PORT COQUITLAM

PRINCE GEORGE

SAANICH

SURREY

VANCOUVER

VICTORIA

WHISTLER

SPECIFICATION

Date

April 18, 2013

Job Title

Cambridge Bay Intake Pumphouse

Type of Building

Architect

Consulting Engineer

CMS Comfort Solutions

Shop Drawing Review

18-Apr-13

General Contractor

By: DO

☐ Original Submision

☑ Resubmission

Section:

Mechanical Consultant

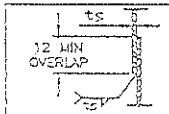
Central Mechanical – Nisku

PO #569-885-003

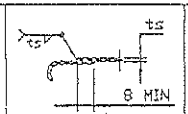
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Brad Gurba

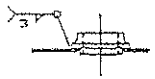
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April 23, 2013



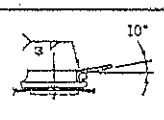
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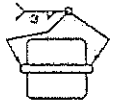
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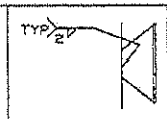
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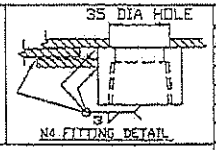
LOCKING LUG DETAIL



HANDLE DETAIL



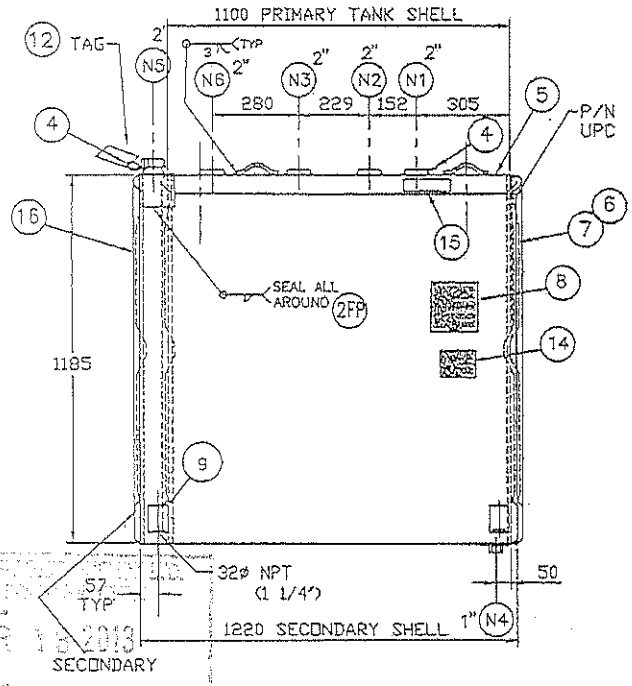
NP BRKT DETAIL



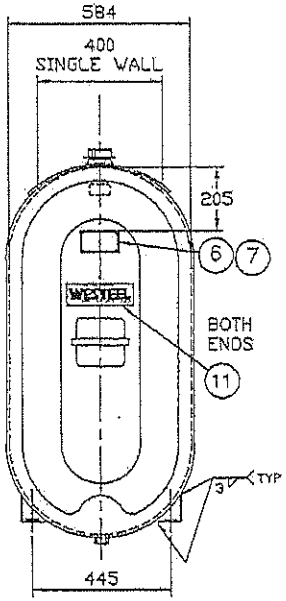
N4 FITTING DETAIL

BILL OF MATERIALS					
MK	QTY	PART No	DESCRIPTION	MATL	REMARKS
1P	2	235076	END 2.6THK OBROUND 584Wx1181H	A1011	PRIM HEADS
2P	1	105189	HR SHT 2.6THKx1100Wx3073 LG	A1011	PRIM SHELL
1S	2	235076	END 2.6THK OBROUND 584Wx1181H	A1011	SECD HEADS
2S	1	105074	HR SHT 2.6THKx1220Wx2625 LG	A1011	SECD SHELL
2FP	1	INCL	HR SHT 2.6THKx180Wx500 LG	A1011	FILLER PC-SHELL
3	2	235002	HANDLE	STL	
4	2	272211	LOCK LUG	STL	
5	1	198870	DECAL "SERIAL No"	VINYL	
6	1	272030	NAME PLATE HOLDER	STL	
	4		CW RIVET DR DRIVE SCREW	STL	
7	1	272130	NAME PLATE S602 CONTAINED	BRASS	
8	1	272811	DECAL "IMPORTANT TANK INFO"	VINYL	
9	4	272251	PIPE LEG BRACKET (1 1/4" NPT)	STL	
10	2	264225	LIFT LUG	STL	-
11	2	264428S	DECAL "WESTEEL"	VINYL	
12	1	272430	TAG "DO NOT REMOVE.."	PLSTC	
13	AR	178136	PAINT - SILVER		
14	1	272815	DECAL "WARRANTY"	VINYL	
15	2	272808	DECAL "D WALL TANK EMPTY WGHT"		
16	1	280195	DECAL "STOP DO NOT FILL.."		

NOZZLE SCHEDULE							
MK No	QTY	PART No.	SIZE	RATING	DESCRIPTION	MATL	REMARKS
N1	1	271327	50ø (2")		TANK FLANGE x NPT	A181	FILL
	1	264144	(2")		c/w VENTED PLUG NPT	POLY	
N2	1	271327	50ø (2")		TANK FLANGE x NPT	A181	PUMP
	1	264144	(2")		c/w PLUG NPT	POLY	
N3	1	271327	50ø (2")		TANK FLANGE x NPT	A181	GAUGE
	1	264144	(2")		c/w PLUG NPT	POLY	
N4	1	271525	25ø (1")	(3000#)	HALF COUPLING x NPT	A105	OUTLET
	1	CUTTING	-		HR SHT 2.5THKx100 DIA	A1011	CLOSURE PLT
	1	272529	(1")		c/w PLUG NPT	C.I.	
N5	1	271327	50ø (2")		TANK FLANGE x NPT	A181	EV. INSPECTION
	1	264139	(2")		c/w PV VENT CAP	CAST	
N6	1	271327	50ø (2")		TANK FLANGE x NPT	A181	SPARE
	1	264144	(2")		c/w PLUG NPT	POLY	



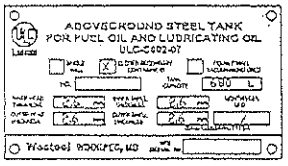
SIDE VIEW



END VIEW

NOTES:
1. AIR/SOAP TEST PRIMARY TANK: 35 kPa (5 PSI) MAX.
   AIR TEST SECONDARY WHEN COMPLETED AT 35 kPa MAX
   IMPORTANT! PRIMARY MUST BE UNDER PRESSURE
   BEFORE DOING THIS TEST. (SEE ENG STD ES1323)
2. CLEAN AREA BEFORE APPLYING SERIAL DECAL.
3. FINISH
   INTERIOR: CLEAN OF LOOSE DEBRIS
   EXTERIOR: PHOSPHATE WASH AND DRY
   APPLY ONE COAT OF SILVER PAINT
   CAULK UNDERSIDE OF NP BRACKET
4. SHIPPING WEIGHT: 213 KGS (470 POUNDS).
5. SEAL ALL OPENINGS AFTER TESTING.
6. SECONDARY VOLUME: PER PAR 4.1.2 OF CODE

APR 15 2013
SECONDARY



ULC LABEL INFO

DOUBLE WALL TANK
EMPTY WEIGHT
213 KG (470 LBS)
MK15 INFO

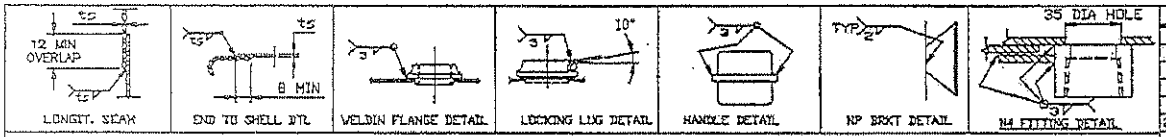
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NO.	DATE	REVISION	E.C.R.	BY	CHK.
9	08-11-20	UPDATE TO S602-07	A0149P	SBK	JH
8	07-05-01	MOVE LEG BRACKET	A0103C	AG	SBK

METRIC

MATERIAL: SEE BOM
BLANK SIZE: -
WEIGHT (LBS): -
DRAWN: SBK
CHK'D: GD
APP'D: SBK
WESTEEL
THIS DRAWING IS THE EXCLUSIVE PROPERTY OF WESTEEL AND ALL RIGHTS ARE RESERVED. NO PART OF THIS DRAWING MAY BE USED OR REPRODUCED BY ANY MANNER WHATSOEVER WITHOUT WRITTEN PERMISSION FROM Westeel-United
SI UNITS ARE SHOWN, IMPERIAL UNITS ARE SHOWN IN ( )
SCALE: N.T.S.
DWN. (Y/M/D): 01-11-19
LOCATION: VPG
I.O. -
E.P. NO. -
V.O. -
DRAWING TITLE: 680 L FUEL OIL TANK. S602 c/w CLOSED SECONDARY CONTAINMENT
CUSTOMER: DESIGN STANDARD
ORDER NO: -
SIZE: B
DRAWING NO: 264014-SC
REV. NO: 9

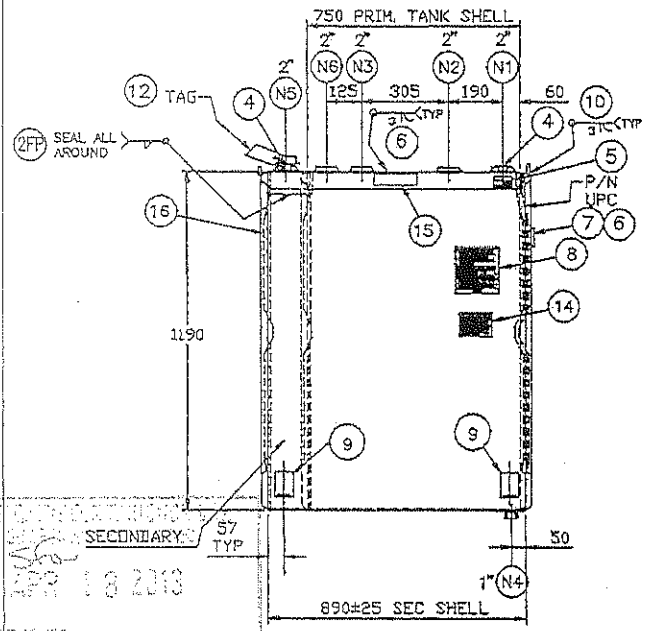
Reviewed
Reviewed as Noted
Revise and Resubmit
Not Reviewed
April 23, 2013



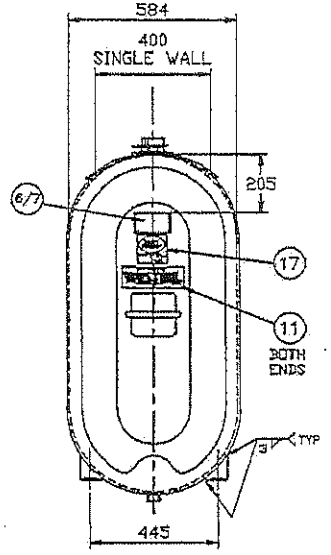
BILL OF MATERIALS					
MK	QTY	PART No.	DESCRIPTION	MATL	REMARKS
1P	2	235076	END 2.6THK OBROUND 584Wx1181H	A1011	PRIM HEADS
2P	1	(S)105078	HR SHT 2.6THKx750Wx3873 LG	A1011	PRIM SHELL
1S	2	235076	END 2.6THK OBROUND 584Wx1181H	A1011	SECD HEADS
2S	1	(S)105293	HR SHT 2.3THKx915Wx2625 LG	A1011	SECD SHELL
2FP	1	INCL	HR SHT 2.3THKx150Wx500 LG	A1011	FILLER PC-INCL
3	2	235002	HANDLE	STL	
4	2	272211	LOCK LUG	STL	
5	1	198370	DECAL "SERIAL No"	VINYL	
6	1	272030	NAME PLATE HOLDER	STL	
	4		CW RIVET OR DRIVE SCREW	STL	
7	1	272130	NAME PLATE S602 CONTAINED	BRASS	
8	1	272811	DECAL "IMPORTANT TANK INFO"	VINYL	
9	4	272291	PIPE LEG BRACKET Q.3/4" NPT)	STL	
10	2	264225	LIFT LUG	STL	
11	2	264428S	DECAL "WESTEEL"	VINYL	
12	1	272430	TAG "DO NOT REMOVE.."	PLSTC	
13	AR	178136	PAINT - SILVER		
14	1	272815	DECAL "WARRANTY"	VINYL	
15	1	272808	DECAL "D WALL TANK EMPTY WGHT"		
16	1	281195	DECAL "STOP DO NOT FILL.."		
17	1	272800	DECAL "DONT FORGETL.."	VINYL	

NOZZLE SCHEDULE

MK No	QTY	PART No.	SIZE	RATING	DESCRIPTION	MAT'L	REMARKS
N1	1	271327	50ø (2")		TANK FLANGE x NPT	A181	FILL
	1	264144	(2")		c/w VENTED PLUG NPT	POLY	
N2	1	271327	50ø (2")		TANK FLANGE x NPT	A181	PUMP
	1	264144	(2")		c/w PLUG NPT	POLY	
N3	1	271327	50ø (2")		TANK FLANGE x NPT	A181	GAUGE
	1	264144	(2")		c/w PLUG NPT	POLY	
N4	1	271525	25ø (1")	(3000#)	HALF COUPLING x NPT	A105	OUTLET
	1	CUTTING	-		HR SHT 2.6THKx100 DIA	A1011	CLOSURE PLT
	1	272529	(1")		c/w PLUG NPT	C.I.	
N5	1	271327	50ø (2")		TANK FLANGE x NPT	A181	PV, INSPECTION
	1	264139	(2")		c/w PV VENT CAP	CAST	
N6	1	271327	50ø (2")		TANK FLANGE x NPT	A181	SPARE
	1	264144	(2")		c/w PLUG NPT	POLY	



SIDE VIEW

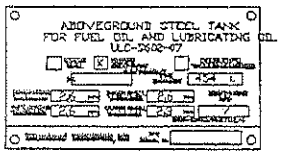


END VIEW

NOTES:
1. AIR/SOAP TEST PRIMARY TANK@ 35 kPa (5 PSI) MAX.
   AIR TEST SECONDARY WHEN COMPLETED AT 35 kPa MAX
   IMPORTANT! PRIMARY MUST BE UNDER PRESSURE
   BEFORE DOING THIS TEST. (SEE ENG STD ES15323)
2. CLEAN AREA BEFORE APPLYING SERIAL DECAL.
3. FINISH
   INTERIOR: CLEAN OF LOOSE DEBRIS
   EXTERIOR: PHOSPHATE WASH AND DRY
   APPLY ONE COAT OF SILVER PAINT
   CAULK UNDERSIDE OF NP BRACKET
4. SHIPPING WEIGHT: 159 KGS (350) POUNDS).
5. SEAL ALL OPENINGS AFTER TESTING.
6. SECONDARY VOLUME PER PAR 4.12 OF CODE

METRIC

APR 18 2013



ULC LABEL INFO

DOUBLE WALL TANK
EMPTY WEIGHT
159 KG (350 LBS)

MK15 INFO

Tag : Tk-1.2

NO.	DATE	REVISION	E.C.N.	BY	CH.
10	10-01-14	ADD MK 17 DECAL	A0166C	SBK	JH
9	09-11-20	UPDATE TO S602-07	A0149P	SBK	JH
8	07-10-14	2P WAS 756 WIDE	A0125C	NK	AG

MATERIAL: SEE BOM | BLANK SIZE: - | WEIGHT (LBS): -

DESIGN: - | WESTEEL | SCALE: N.T.S. | DWN. (Y-M-D): 03-03-24 | LOCATION: VPG

DWN: SBK | I.D.: - | EXP. NO.: - | V.O.: -

CHKD: GD

APPD: SBK | CUSTOMER: DESIGN STANDARD | DRAWING TITLE: 454 L FUEL OIL TANK S602 c/w CLOSED SECONDARY CONTAINMENT | DRAWING NO.: 264008-SC | SIZE: B | REV. NO.: 10

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ST. UNITS ARE (SI/CAN) IMPERIAL UNITS ARE (METRIC IN ( ))

Ktech INDUSTRIAL PRODUCTS INC.

Model FS301 Overfill Protection Device Installation Instructions

Part No.: FS301E-4

Construction: Brass stem, buna-n float 1.88"dia. , 2" NPT bushing, explosion proof J-box.
Switch set-point distances are measured from the underside of the 2" NPT bushing to the centre of the float at the level where the switch is activated. Switch set-point distances are not field adjustable. They are factory-set as specified on the purchase order. The contact arrangement may be changed from normally open (NO) to normally closed (NC) and vice versa. Turn over the float and return the stop collars to their original positions. If the contact arrangement is altered, use an ohmmeter to test that the switch operates correctly. Screw the float switch into the 2" NPT opening on the top of the tank. The conductors are colour coded to identify each switch. The switch must be connected in series with a load.

DO NOT CONNECT THE SWITCH DIRECTLY ACROSS THE POWER SUPPLY.
The voltage / current product must not exceed the power rating.

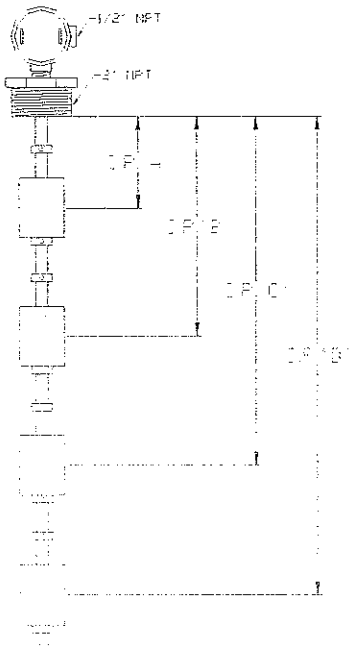
Electrical Specifications

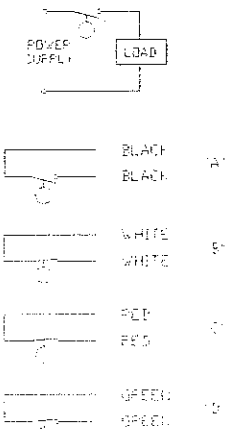
Maximum Switching Voltage VOLTS DC/AC	240
Maximum Switching Current AMPS DC/AC	1.0
Maximum Switching Power WATTS DC/AC	100
Max. Operating Temperature	90°C 194°F

9700099

Meets Standards:
Class 1 Division 1, Groups B,C,D
CSA C22.2 No. 1010-1 and ANSI /I SA S82-03
CSA C22.2 No. 30 and UL1203

MINIMUM SETPOINT DISTANCE FROM TOP IS 2"
MINIMUM SETPOINT DISTANCE BETWEEN CONTACTS IS 3"
MINIMUM SETPOINT DISTANCE FROM BOTTOM IS 2 1/2"





Ktech Industrial Products, 20 Regan Road, Unit 11, Brampton, Ontario. L7A 1C3 Phone (905) 840-7106 Fax (905) 840-6172

DIMENSIONAL DRAWING FH-432 DUPLEX UNIT

REVIEWED
By Sarah Fox at 1:30 pm, May 08, 2013

Reviewed
Reviewed as Modified
Revise and Resubmit
Not Reviewed

May 8, 2013

Stantec

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review does not relieve the Stantec Architecture Ltd. supervises the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site for coordination that pertains to fabrication processes or to techniques of construction and installation and for coordination of the work of all subtrades.

STANTEC ARCHITECTURE LTD.

CMS

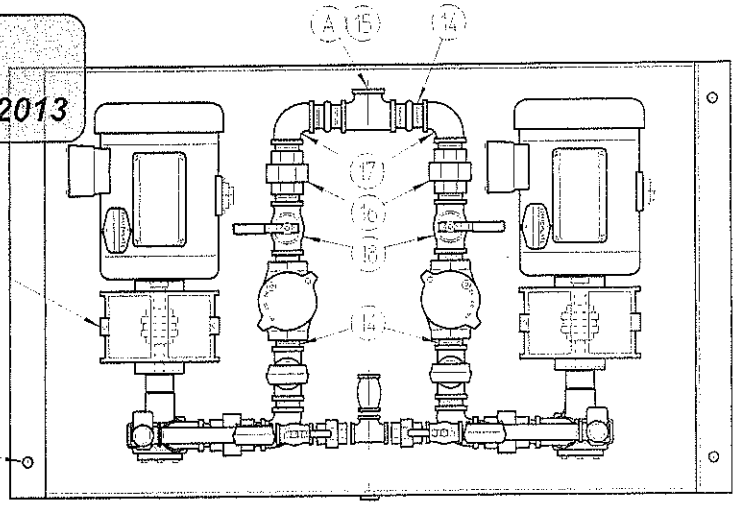
Shop Drawing Review
6-May-13

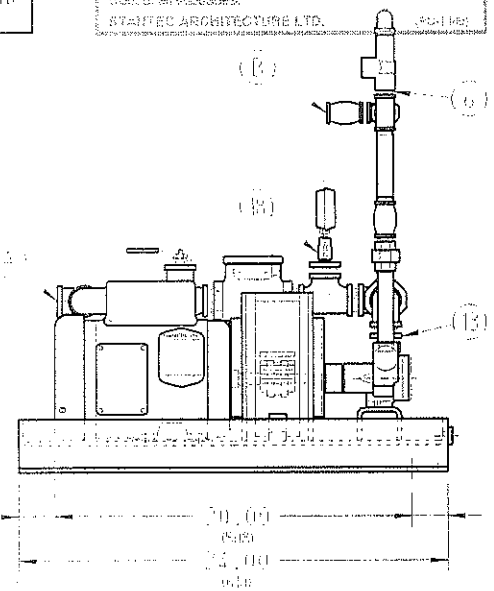
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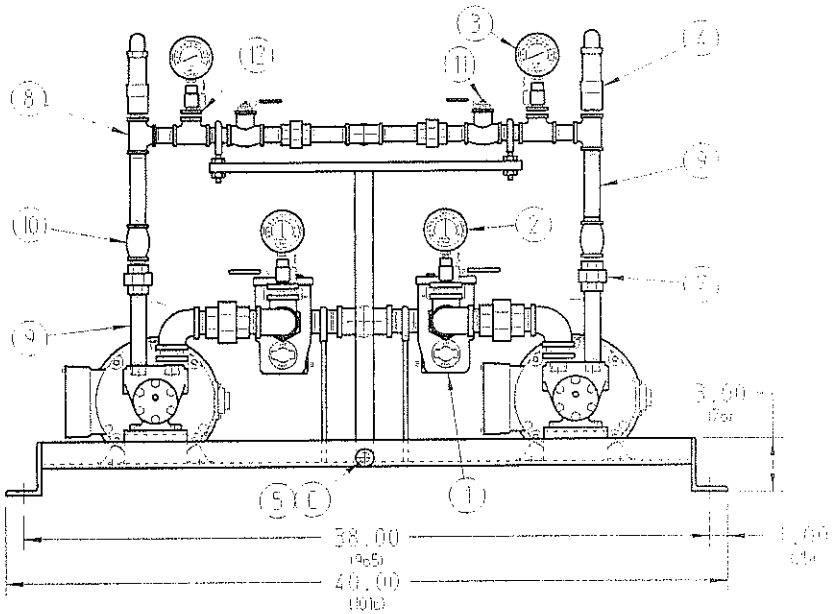
☐ Original Submision
☑ Resubmission

Section:

REV	C.N. NO.	DATE







CUSTOMER: WOLSELEY INC.
CUSTOMER P.O. #: 36373
MODEL FH-432 PUMP DUPLEX ASSEMBLY
THIS PRINT IS PRELIMINARY
VIKING SALES ORDER #:
DRAWN BY: ROBERT F
DATE: MAY 03/13
APPROVED BY: ROBERT F
DATE: MAY 03/13

* BRACKETED DIMENSIONS ARE IN MILLIMETERS *

PUMP DESIGN DATA			MOTOR DESIGN DATA	
PUMP MODEL: FH-432	SIZE: 50 NPT	LIQUID: #2 FUEL OIL	H.P.: 50	R.P.M.: 1750
CAPACITY: 30 USGPM		TEMP.: 70° F	FRAME: 56	ENCLOSURE: TEFC
P.S.I.A.: 144 psig	S.G.: 0.85	VISC.: 38 ssu	VOLTS: 115	CYCLE: 60 PHASE: 1

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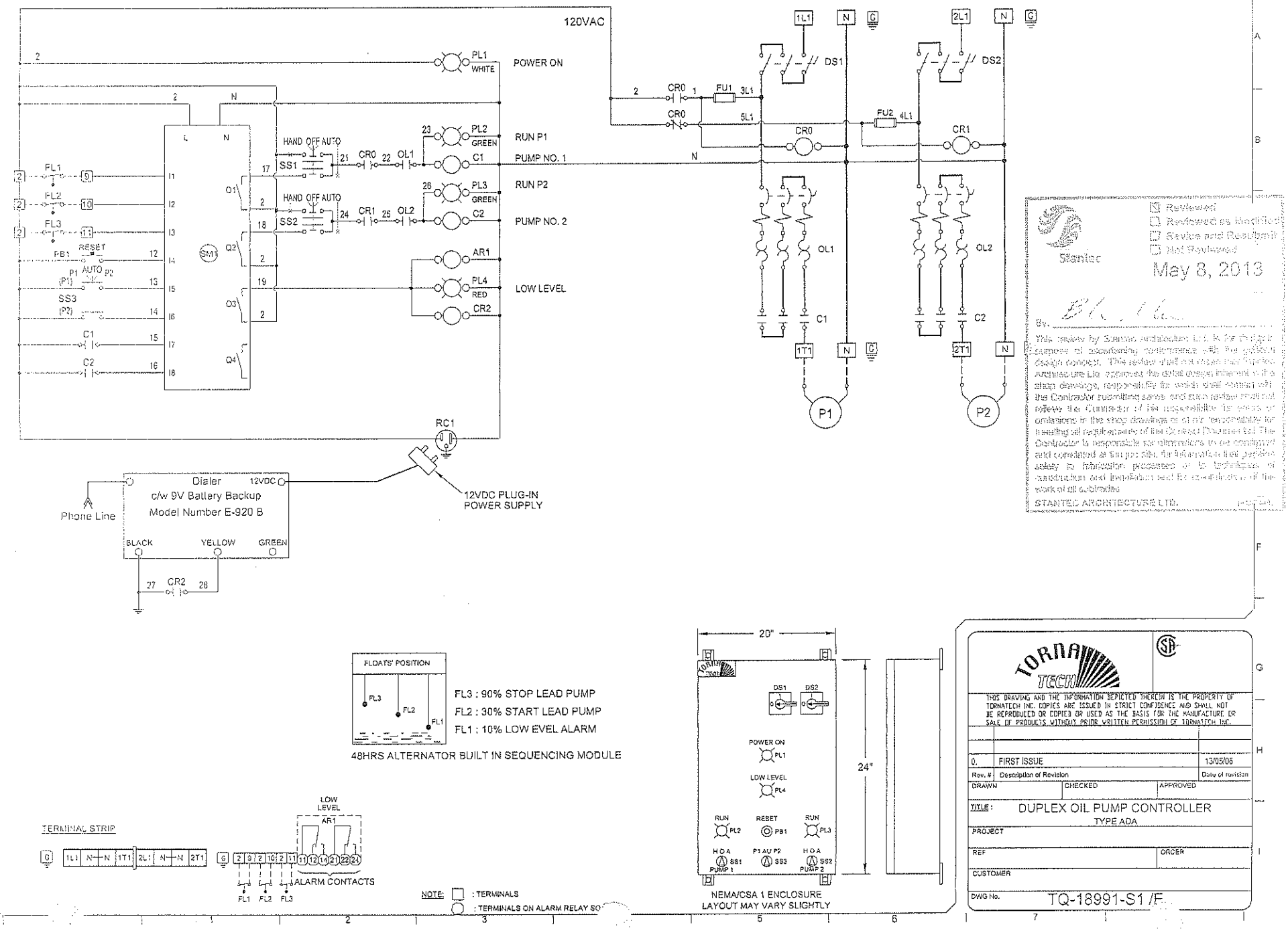
VIKING PUMP
VIKING PUMP OF CANADA INC.
A Unit of IDEX Corporation
Windsor, Ontario N9A 6N9
CANADA

DIMENSIONAL DRAWING FOR DUPLEX ASSEMBLY C/W FH-432 PUMPS, 56 FRAME MOTORS, FLEXIBLE COUPLINGS & ORANGE PEEL CHA GUARD

APP. DRAWING

DRAWING NUMBER 6001-BPH50(PE3-3)373

SHEET 1



Reviewed
Reviewed as Modified
Revise and Resubmit
Not Reviewed

Stantec

May 8, 2013

By

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the jobsite, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all subtrades.

STANTEC ARCHITECTURE LTD.

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Rev. #	Description of Revision	Date of revision
0.	FIRST ISSUE	13/05/06

DRAWN | CHECKED | APPROVED

TITLE: DUPLEX OIL PUMP CONTROLLER
TYPE ADA

PROJECT

REF | ORDER

CUSTOMER

DWG No. TQ-18991-S1 /E

TECHNICAL SERVICE MANUAL

VIKING PUMP

GENERAL PURPOSE PUMPS
SERIES 32 and 432
SIZES C - F - FH

CONTENTS

Introduction	1
Special Information	1
Maintenance	2
Disassembly	3
Assembly	5
Pressure Relief Valve Instructions	5

INTRODUCTION

The illustrations used in this maintenance bulletin are for identification purposes only and *should not be used for ordering parts*. Secure a parts list from the factory or a Viking representative. Always give complete name of part, part number and material with the model and serial number of the pump when ordering repair parts.

UNMOUNTED PUMP		UNITS
PACKED	MECH. SEAL	Units are designed by the un-mounted pump model numbers followed by a letter indicating drive style. D = Direct Drive V = V-belt
C32	C432	
F32	F432	
FH32	FH432	

This bulletin deals exclusively with Pump Models C, F, FH32 and C, F, FH432 General Purpose Pumps. Refer to Figures 1, 2, 4, and 7 for general configuration and nomenclature used in this bulletin.

All pumps can be furnished with either a mechanical seal or packing. Packed pumps are furnished with suitable packing for the liquid pumped. A seal pump can be changed to a packed pump by removing the mechanical seal and inserting the packing spring, inner packing gland, packing and outer packing gland. The mechanical seal pump is dimensionally interchangeable with the packed pump.

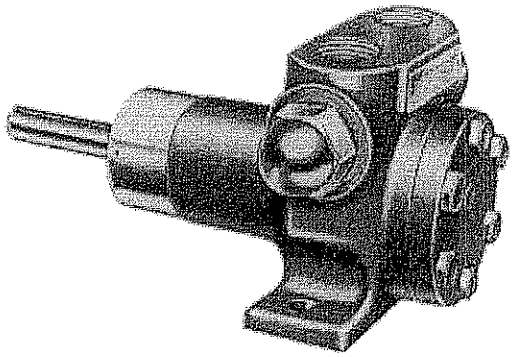


FIGURE 1
SERIES 32 and 432 Pump
3 GPM Size Shown. Packed
or Mechanical Seal type.
Valve on casing – clockwise rotation

SPECIAL INFORMATION

DANGER

BEFORE OPENING ANY VIKING PUMP LIQUID CHAMBER (PUMPING CHAMBER, RESERVOIR, RELIEF VALVE ADJUSTING CAP FITTING ETC.) BE SURE:

1. THAT ANY PRESSURE IN CHAMBER HAS BEEN COMPLETELY VENTED THROUGH SUCTION OR DISCHARGE LINES OR OTHER APPROPRIATE OPENINGS OR CONNECTIONS.
2. THAT THE DRIVING MEANS (MOTOR, TURBINE, ENGINE, ETC.) HAS BEEN "LOCKED OUT" OR MADE NON-OPERATIONAL SO THAT IT CANNOT BE STARTED WHILE WORK IS BEING DONE ON PUMP.
3. THAT YOU KNOW WHAT LIQUID THE PUMP HAS BEEN HANDLING AND THE PRECAUTIONS NECESSARY TO SAFELY HANDLE THE LIQUID. OBTAIN A MATERIAL SAFETY DATA SHEET (MSDS) FOR THE LIQUID TO BE SURE THESE PRECAUTIONS ARE UNDERSTOOD.

FAILURE TO FOLLOW ABOVE LISTED PRECAUTIONARY MEASURES MAY RESULT IN SERIOUS INJURY OR DEATH.

SPECIAL INFORMATION

ROTATION: Viking pumps operate equally well in a clockwise or counterclockwise rotation. Shaft rotation determines which port is suction and which is discharge. Port in area where pumping elements (gear teeth) come out of mesh is suction port.

PRESSURE RELIEF VALVES:

1. Viking pumps are positive displacement pumps and must be provided with some sort of pressure protection. This may be a relief valve mounted directly on the pump, an inline pressure relief valve, a torque limiting device or a rupture disk.
2. This series of pumps may be equipped with an integral pressure relief valve. Standard configuration is for clockwise rotation (suction on the right viewing the shaft end of the pump) but it also may be ordered for counterclockwise rotation. The valve cannot be reversed for opposite rotation.
3. If pump rotation is reversed during operation, pressure protection must be provided on *both* sides of pump.
4. Relief valve adjusting screw cap must *always* point towards suction side of pump.
5. Pressure relief valves cannot be used to control pump flow or regulate discharge pressure.

For additional information on pressure relief valves, refer to Technical Service Manual TSM000 and Engineering Service Bulletin ESB-31.

MAINTENANCE

The Series 32 and 432 pumps are designed for long trouble free life under a wide variety of application conditions with minimum maintenance, however, the following should be considered.

1. *LUBRICATION* – External lubrication not required for this series of pumps. The liquid being pumped lubricates the internal bearings in the pump.
2. *PACKING ADJUSTMENT* – These pumps are designed with a packing spring to maintain a constant load on the packing; no external adjustment is possible. When leakage becomes excessive the packing must be replaced. Refer to re-assembly instruction for proper installation of packing.
3. *END CLEARANCE ADJUSTMENT* – After long term operation it is sometimes possible to improve the performance of the pump, without major repair, by adjusting the end clearance. Refer to instructions under re-assembly of the pump for information regarding this procedure.
4. *SAFETY RELIEF VALVE* – If your pump is equipped with a safety relief valve, adjustment can be made as follows. Remove the adjusting screw cap, turn in the adjusting screw to increase the pressure and turn-out to decrease the pressure. If the pump is not producing the rated capacity adjustment of the safety relief valve may be necessary. Be sure adjusting screw cap is re-installed before pump is started.

MAINTENANCE

5. *CLEANING THE PUMP* - It is good practice to keep the pump as clean as possible. This will facilitate inspection, adjustment and repair work.
6. *STORAGE* - If the pump is to be stored or not used for any appreciable length of time it should be drained and a light coat of lubricating and preservative oil should be applied to the internal parts

SUGGESTED REPAIR TOOLS: The following tools must be available to properly repair Series 32 and 432 pumps. These tools are in addition to standard mechanics' tools such as open end wrenches, pliers, screw drivers, etc. Most of the items can be obtained from an industrial supply house.

1. Soft Headed hammer
2. Allen wrenches (some mechanical seals and set collars)
3. Packing hooks, flexible (packed pumps)
4. Mechanical seal installation sleeve
5. Bearing locknut spanner wrench
   (Source: #472 J. H. Williams & Co. or equal)
6. Spanner wrench, adjustable pin type for use on double end caps (Source: #482 J. H. Williams & Co. or equal)
7. Brass bar
8. Arbor press

DISASSEMBLY

DANGER

BEFORE OPENING ANY VIKING PUMP LIQUID CHAMBER (PUMPING CHAMBER, RESERVOIR, RELIEF VALVE ADJUSTING CAP FITTING ETC.) BE SURE:

1. THAT ANY PRESSURE IN CHAMBER HAS BEEN COMPLETELY VENTED THROUGH SUCTION OR DISCHARGE LINES OR OTHER APPROPRIATE OPENINGS OR CONNECTIONS.
2. THAT THE DRIVING MEANS (MOTOR, TURBINE, ENGINE, ETC.) HAS BEEN "LOCKED OUT" OR MADE NON-OPERATIONAL SO THAT IT CANNOT BE STARTED WHILE WORK IS BEING DONE ON PUMP.
3. THAT YOU KNOW WHAT LIQUID THE PUMP HAS BEEN HANDLING AND THE PRECAUTIONS NECESSARY TO SAFELY HANDLE THE LIQUID. OBTAIN A MATERIAL SAFETY DATA SHEET (MSDS) FOR THE LIQUID TO BE SURE THESE PRECAUTIONS ARE UNDERSTOOD.

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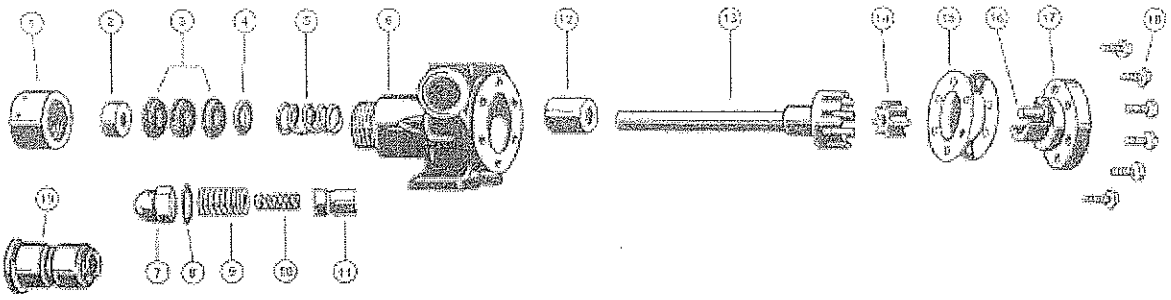


FIGURE 2
EXPLODED VIEW SERIES 32 and 432

ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Packing Nut	8	Gasket for Cap	15	Head Gaskets
2	Outer Packing Gland (Series 32 only)	9	Adjusting Screw	16	Idler Pin
3	Packing (Series 32 only)	10	Spring	17	Head
4	Inner Packing Gland (Series 32 only)	11	Poppet	18	Capscrews
5	Packing Spring (Series32 only)	12	Casing Bushing	19	Mechanical Seal (Series 432 only)
6	Casing	13	Rotor and Shaft		
7	Adjusting Screw Cap	14	Idler		

DISASSEMBLY

1. Remove the capscrews and the head from the pump. It may be necessary to apply a slight pressure on the drive end of the rotor shaft to free the head from the casing. DO NOT PRY the head from the casing as this may damage and mar the gasket surfaces.
   CAUTION: The rotor and shaft is made of two pieces and the shaft can move in the rotor if tapped too hard. Carefully check Rotor & Shaft Assembly before re-assembling the pump.
2. Remove idler from idler pin. If the idler pin is worn, both the head and idler pin, and idler should be replaced.
3. Next, completely remove the rotor and shaft from the casing by exerting pressure on the drive end of the shaft.
4. Remove the packing nut.
5. The pump is now ready for removal of packing or mechanical seal. Refer to Figure 3 or 5 for example. It is recommended a new mechanical seal or packing be used every time a pump is completely disassembled.

All parts should be examined for wear before the pump is put together. When making major repairs, such as replacing a rotor and shaft, it is usually considered advisable to also install a new casing bushing.

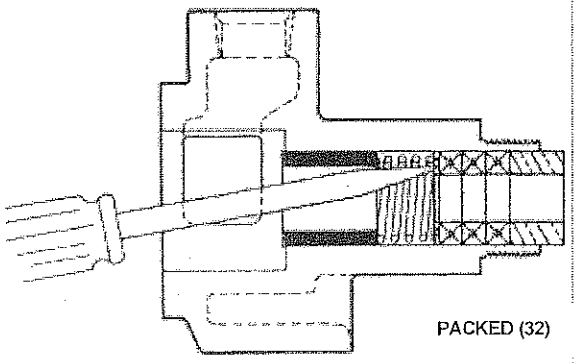


FIGURE 3

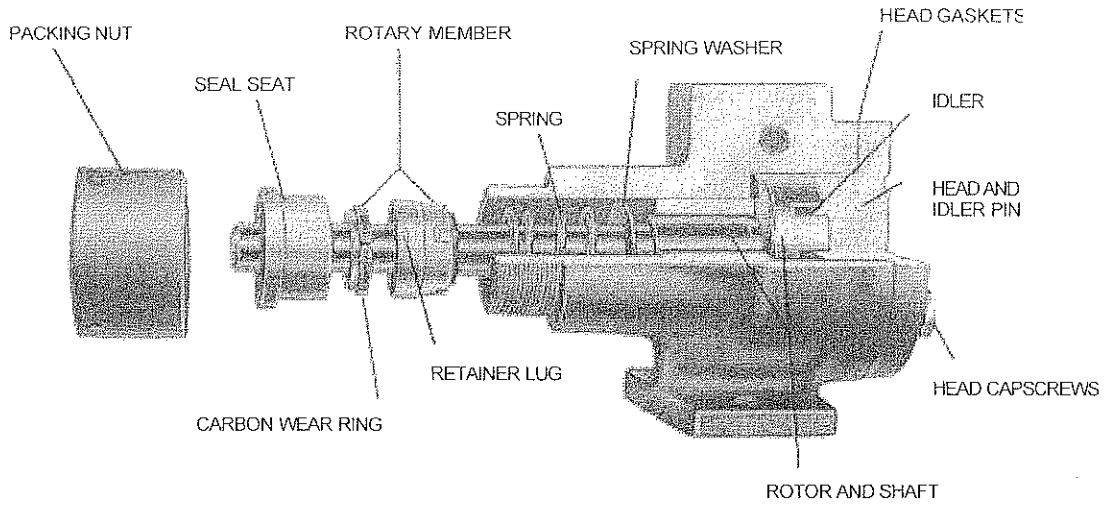


FIGURE 4

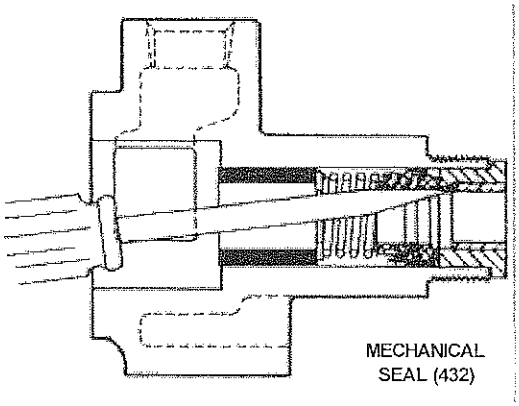


FIGURE 5

Pump Size	"A" Dimension
C	0.88" to 0.94"
F&FH	1.19" to 1.25"

The end clearance within the pump is governed by the location of the casing bushing as well as the number of head gaskets. To correctly position the casing bushing in the casing, see note in step 3 of "RE-ASSEMBLY".

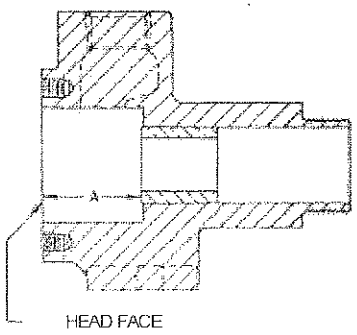


FIGURE 6

INSTALLING CASING BUSHING

The casing bushing can be replaced in the following manner: Insert a bar approximately 0.94" diameter and at least 3.5" long in the packing or seal end of the casing and press the bushing out of the casing.

When installing a new carbon graphite bushing, extreme care should be taken to prevent breakage as carbon graphite is a brittle material and easily cracked. When cracked the bushing may quickly disintegrate in operation. An arbor press should always be used and the bushing should be installed in one even uninterrupted stroke of the press. Dip the bushing in lube oil and start the bushing in the head end of the casing. Press until located to the "A" dimension in Figure 6.

REASSEMBLY

1. Clean all parts thoroughly.
2. Place the rotor and shaft in the casing.
3. Put the head gaskets on the head and the idler on the idler pin projecting from the head. Replace the head in the casing; tighten cap screws.

NOTE: If a new casing bushing has been installed in the casing, use only one .002" head gasket on the head and tighten the capscrews evenly and securely. This will correctly position the bushing in the casing. Remove the head, add one .002" head gasket and replace the capscrews and tighten securely.

NOTE: Turn the rotor shaft by hand to be certain it turns freely.

4. When reassembling a mechanical seal pump, place the spring washer and spring on the shaft, see Fig. 4, Page 4. Coat the shaft and the inside of the rubber bellows of the seal rotary member with light oil. Slide the rotary member part way down the shaft.

NOTE: The lapped face of the carbon wear ring must face toward the shaft end of the pump. Be sure the notches on the edge of the carbon wear ring mate with the retainer lugs in the rotary member.

Oil the lapped faces of the rotary member and the seal seat. Slide the seal seat on the shaft until it contacts the rotary member and then push the complete seal into the casing. Replace the packing nut and tighten.

Your pump is now completely assembled. Once again turn the pump shaft by hand to be sure it turns freely. Start the pump with a supply of liquid in the suction line, since the pump should not be run dry.

5. If the pump has packing rather than a mechanical seal, place the spring and inner packing gland on the shaft and slide into the pump. Next install the packing. Stagger the joints in the packing a half turn and add lube oil between each ring of packing. Push the outer packing gland in the casing, and replace the packing nut and tighten.

DANGER

BEFORE STARTING PUMP, BE SURE ALL DRIVE EQUIPMENT GUARDS ARE IN PLACE.

FAILURE TO PROPERLY MOUNT GUARDS MAY RESULT IN SERIOUS INJURY OR DEATH.

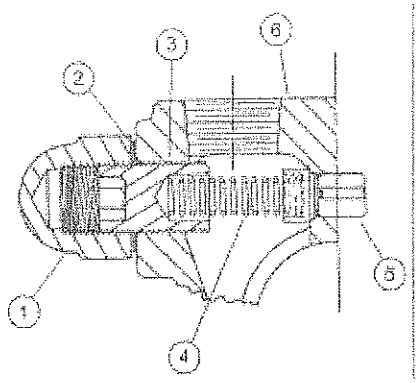


FIGURE 7
SAFETY RELIEF VALVE C, F, FH Size

LIST OF PARTS	
1	Adjusting Screw Cap
2	Gasket for Cap
3	Adjusting Screw
4	Spring
5	Poppet
6	Casing

SAFETY RELIEF VALVE

The relief valve is a safety device to protect the pump and motor against excessive pressure. A pump without a properly set safety relief valve operating against a closed discharge line could build up enough pressure to damage the pump or motor.
The pressure setting is increased by turning the adjusting screw in and decreased by turning the adjusting screw out.

SPECIAL PUMP DESIGNS

Pumps furnished with a Teflon Mechanical seal require a special rotor and shaft with drive pin installed for positive drive of the rotating member. All other assembly and disassembly instructions are the same.

TECHNICAL SERVICE MANUAL

VIKING PUMP

GENERAL PURPOSE PUMPS
SERIES 32 and 432
SIZES C - F - FH

SECTION TSM 310.1
PAGE 6
ISSUE B

VIKING PUMP

WARRANTY

Viking warrants all products manufactured by it to be free from defects in workmanship or material for a period of one (1) year from date of startup, provided that in no event shall this warranty extend more than eighteen (18) months from the date of shipment from Viking. If, during said warranty period, any products sold by Viking prove to be defective in workmanship or material under normal use and service, and if such products are returned to Viking's factory at Cedar Falls, Iowa, transportation charges prepaid, and if the products are found by Viking to be defective in workmanship or material, they will be replaced or repaired free of charge, FOB Cedar Falls, Iowa.

Viking assumes no liability for consequential damages of any kind and the purchaser by acceptance of delivery assumes all liability for the consequences of the use or misuse of Viking products by the purchaser, his employees or others. Viking will assume no field expense for service or parts unless authorized by it in advance.

Equipment and accessories purchased by Viking from outside sources which are incorporated into any Viking product are warranted only to the extent of and by the original manufacturer's warranty or guarantee, if any.

THIS IS VIKING'S SOLE WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, WHICH ARE HEREBY EXCLUDED, INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. No officer or employee of IDEX Corporation or Viking Pump, Inc. is authorized to alter this warranty.

IDEX

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ISO 9001

OIL PUMP CONTROLLERS

OIL PUMP CONTROLLERS
SIMPLEX - DUPLEX

Oil pump controllers are installed to automatically start and stop pump motor(s) in order to fill fuel day tanks for generators. Automatic level control is provided by start and stop float switch. A lead pump failure pilot light and a manual or automatic alternation selector switch is standard on the duplex units.

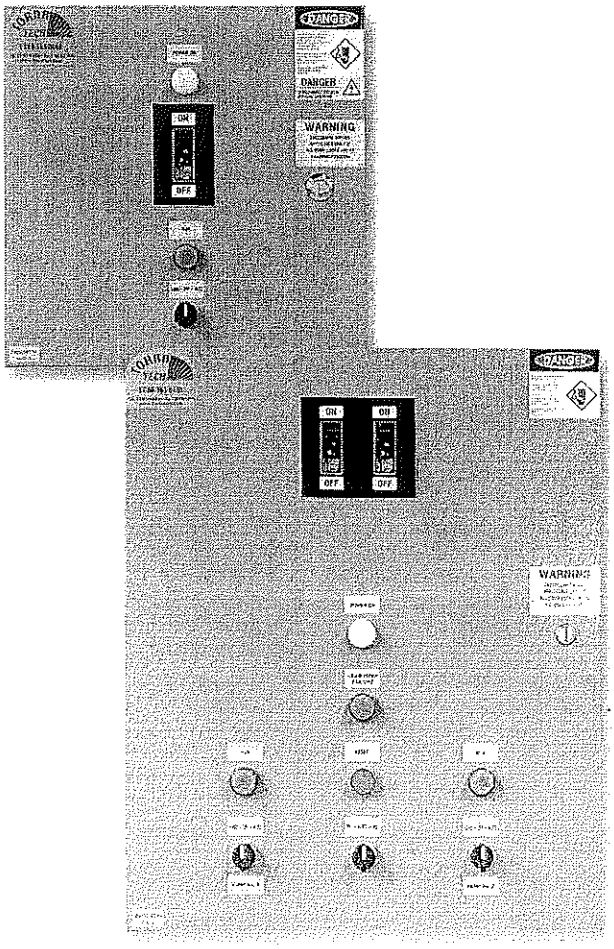
The completely assembled and wired controllers are factory tested before shipping. All components used in Tornatech oil pump controllers are CSA listed and UL approved.

Tornatech favors fuseless motor protection for easy field maintenance.

STANDARD FEATURES included in SIMPLEX and DUPLEX OIL PUMP CONTROLLERS:

STANDARD FEATURES	SIMPLEX	DUPLEX
NEMA/CSA 1 enclosure ASA 61 grey	1	1
Single pole circuit breaker(s) c/w through the door operation *	1	2
Overload relay(s)*	1	2
Across-the-line contactor(s) (HP rated)	1	2
Controler fuse (1 phase)*	1	1
"Power On" white pilot light	1	1
"Run" green pilot light(s)	1	2
"Hand-Off-Auto" selector switch(es)	1	2
Provision to connect float switches (float swiches not included)	2	3
Lead pump failure pilot light, manual reset and lag pump start	N/A	1
P1-Auto-P2 alternation selector switch	N/A	1

* Replaced by individual disconnect switch(es), thermomagnetic motor protector(s) and control transformer c/w secondary fuse (3 phase)



OIL
PUMP CONTROLLERS

OIL PUMP CONTROLLERS

SIMPLEX - DUPLEX

OPTIONAL FEATURES AVAILABLE
(Contact factory for details.):

- Low and High level indications
- Various types of enclosure: NEMA/CSA 3R, NEMA/CSA 4...
- Pilot lights, buzzer and alarm contacts for different conditions such as overload, low level, high level...
- Momentary test button
- Heat sensor cut-out
- Provision for pump start by generator

Start-up instructions:

- Check name plate rating of oil pump controller and compare with incoming voltage and motor(s) rating(s).
- Adjust overload relay setting to full motor current rating.
- Check that motor protector push actuator(s) is(are) in start position.
- Check that float switches are adjusted to the desired levels.
- Check that controller is properly connected to pump motor(s).
- Turn Hand-Off-Auto selector switch(es) to Off position. Switch main disconnect switch to On position.
- Turn Hand-Off-Auto selector switch(es) to Hand position. Pump motor(s) should start. Check motor(s) for proper rotation.
- If all above checks out correctly, turn Hand-Off-Auto selector switch(es) to Auto position. Activate float switches manually and test if pump(s) start and stop are at the desired level.

SEQUENCE OF OPERATION

SIMPLEX OIL pump controller

- Once the level falls below the start pump level float switch, the pump motor is energized and the pump starts pumping fuel into the tank.
- Once the level reaches the high level float switch, the pump motor is de-energized and the pump stops.

DUPLEX OIL pump controller

- Once the level falls below the start lead pump level float switch, the pump motor is energized and the lead pump starts pumping fuel into the tank.
- If the lead pump has failed and the level falls below the start lag pump level float switch, the "Lead pump failure" pilot light is turned on and the lag pump motor is energized so that the lag pump keeps pumping fuel into the fuel tank. In order to turn off the pilot light, the manual reset pushbutton must be pressed.
- Once the level reaches the stop all pumps level float switch, the pump motor(s) is(are) de-energized and the pump(s) stop(s).
- If the alternation selector switch is in the automatic position, the stop all pump level switch triggers the alternator and reverse the order of the lead and lag pumps.

HOW TO ORDER: **AB -** V / C x HP / Ph / Hz

Ex.: **ADA3 -** 480 / 2 x 7.5 / 3 / 60

A =	ASA simplex ADA duplex	B =	1 single phase(120V) 2 single phase(240V) 3 three phase	V =	120 208 240 380 415 416 480 600	C =	1 one pump 2 two pumps	HP =	anything between .25 and 30	Ph =	1 single phase(120V) 2 single phase(240V) 3 three phase	Hz =	50 60

For dimensions or other voltages and HP, please contact factory.

Tornatech inc., 7075, Place Robert-Joncas, # 132, Montreal, Quebec, Canada H4M 2Z2

Tel.: 1 514 334 0523 1 800 363 8448 (Canada & U.S.A.) Fax: 1 514 334 5448
E-mail: tornatech@tornatech.com www.tornatech.com

9BRO905.OIL PUMP Rev.0
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5.1.3

Division 23

B-1, B-2
Weil McLain Oil Fired Hot Water Boilers
c/w Riello F-5 Burners &
c/w McDonnell & Miller Low Water Cutoffs (PS-851-120)

Make:	Weil McLain
Model:	P-WGO-2
Capacity:	33.41kW, 114,000 BTU/Hr
B-1 - Serial #:	1305769
B-2 – Serial #:	1305770

WEIL-McLAIN CANADA

SUBMITTAL DRAWINGS

QUOTE #:	NCA-12-0715-WM
JOB NAME:	Cambridge Bay Potable Water System
ENGINEER:	
WHOLESALER:	Wolseley Edmonton
DATE SUBMITTED:	April 3, 2013
NUMBER OF COPIES:	1
MECH. CONTRACTER:	
PREPARED BY:	W.R. Sheppard

Stantec

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

April 23, 2013

By:

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.

STANTEC ARCHITECTURE LTD. (PC-14-99)

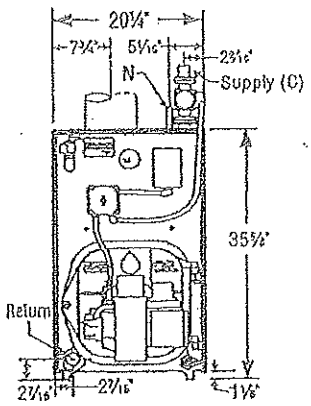
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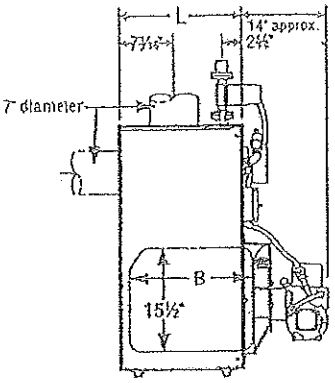
4390 PALETTA COURT, BURLINGTON, ONTARIO L7L 5R2 TEL: 905-456-8300 FAX: 905-456-8582 E-MAIL: info@weil-mclain.ca

WGO BOILER SUBMITTAL

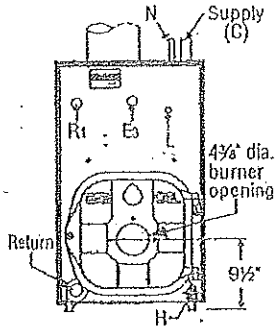
Boiler: (2) P-WGO-2
Job: NCA-12-0715-WM



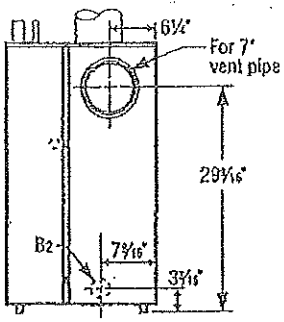
P-WGO Front



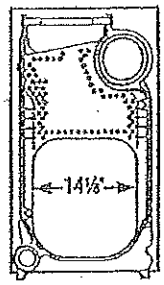
Side



A-WGO Front



Back



Intermediate

Tapping Location	Size (inches)	Control
B2	11/2"	Alternate return - "A" units only
E3	1/2"	Pressure/temperature gauge
H	3/4"	Drain valve
L	3/4"	High limit/circular control
N	1/2"	Piping to expansion tank or automatic air vent
R1	3/4"	Relief valve

B=R BURNER CAPACITY (GPH)	NET I=B=R RATINGS	DRAFT LOSS THROUGH BOILER	MINIMUM I=B=R CHIMNEY SIZE
0.70	75	0.10	8 x 8 or 6" x 15'

DIMENSIONS IN INCHES		
B	L	WEIGHT (LBS)
10.5	13 1/4	540

SUBMITTAL NO:
DATE: April 3, 2013
PAGE:

WGO Series 3
SUBMITTAL DATA

TO: Wolseley
ADDRESS: ____
CITY: ____
PROVINCE: Edmonton

REF. JOB: Cambridge Bay Potable Water Sys.
ADDRESS: ____
CITY: ____
PROVINCE: ____

We hereby submit for approval on the above job, the following Weil McLain Cast Iron Sectional Fired Boiler(s) to be furnished with the following equipment:

Boiler (s) No. (2) P-WGO-2
Input ( ) 0.70

Gross Output BTUH 86 MBH

STANDARD EQUIPMENT

- Drain valve
- Factory Tested
- Two vent pipe brackets
- Balanced draft damper
- Pressure/temperature gauge
- 30 PSI ASME PRV - 50 psi w.p.
- Electrical junction box with wiring harness
- Limited lifetime warranty on boiler sections
- High limit control with circulator relay outlet
- Junction box cover plate with service switch
- Circulator (Taco 007) supplied with "P" units only
- Factory assembled sections w/ following Installed (Jacket and collector hood not assembled on 7-9 units)
  * Insulated steel jacket
  * Swing away burner mounting door
  * Refractory blanket and target wall in combustion a
  * Aluminized steel flue collector hood w/ flue cap on top

ADDITIONAL EQUIPMENT

- High efficiency flame-retention oil burner
  - ☐ Beckett AFG
  - ☐ Carlin EZ
  - ☐ Riello
- Three piece circulators
  - ☐ Taco 110
  - ☐ B & G 100
- Weil-McLain Homeowner Protection Plan
  - ☐ 5 Year
  - ☐ 10 Year
- Weil-McLain indirect fired water heater
  - ☐ Gold Plus 30
  - ☐ Gold Plus 40
  - ☐ Gold Plus 60
  - ☐ Gold Plus 80
  - ☐ Plus 100
  - ☐ Plus 120

(2) P-WGO-2, Oil Fired, Balanced Draft, Hot Water Boiler complete with all standard equipment. Relief Valve set at 30PSI. 3 1/2 Pressure Gauge with 1/4 Shut-Off Cock, 5-Inch Thermometer & M.M. PS851-120 Probe Type L.W.C.O. Riello F-5, Oil Fired Burner with 530/SEC Flame Safeguard. On/Off Mode Of Operation. Nozzle.

CONTRACTOR: ____
ADDRESS: ____
CITY: ____
PROVINCE: ____

SIGNATURE:

DATE: April 3, 2013

Low Water Cut-Offs – Electronic For Hot Water Boilers

New and Improved

Series PS-850

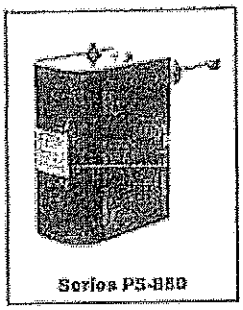
Low Water Cut-Offs

NOW WITH SELF-CLEANING PROBE!

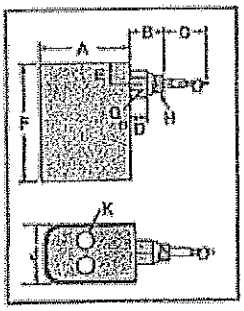
- For residential, commercial and industrial applications
- Electronic operation

New Features:

- User-friendly diagnostics
  - Red low water and shorted probe LED
  - Green power and test LED
- Higher probe sensitivity: 7,000 ohms
- No lock out with loss of power if probe is in water
- No blow down of control required when mounted directly into boiler tappings
- Test button standard on all models
- Options available include
  - Manual reset
  - Extended barrel, remote and short probe models
  - 120 volt and 24 volt models (24 volt models meet ANSI specification Z21.13a)
- Power consumption 1.7 VA
- Provisions to add alarm
- Maximum ambient temperature 120°F (49°C)
- Maximum water pressure 160 psi (11.2 kg/cm²)
- Maximum water temperature 250°F (121°C)



Series PS-850



Boiler Controls

Ordering Information

Model Number	Part Number	Description	Weight lbs (kg)
PS-851-120	153895	Low water cut-off 120V	2.7 (1.2)
PS-851-U-120	153897	PS-851-120 w/extended barrel	2.7 (1.2)
PS-851-M-120	153898	PS-851-120 w/manual reset	2.7 (1.2)
PS-851-M-U-120	153894	PS-851-120 w/extended barrel & manual reset	2.7 (1.2)
PS-851-RX2-120	158421	PS-851-120 w/remote probe	2.7 (1.2)
PS-851-M-RX2-120	153901	PS-851-120 w/remote probe & manual reset	2.7 (1.2)
PS-851-SP-120	153920	PS-851-120 w/short probe	2.7 (1.2)
PS-851-SP-M-120	153921	PS-851-120 w/short probe & manual reset	2.7 (1.2)
PS-852-24	153919	Low water cut-off 24V	2.7 (1.2)
PS-852-M-24	153918	PS-852-24 w/manual reset	2.7 (1.2)
PS-852-SP-24	153922	PS-852-24 w/short probe	2.7 (1.2)
PS-852-SP-M-24	153923	PS-852-24 w/short probe & manual reset	2.7 (1.2)

Electrical Ratings

Model	Voltage	Switch Rating (Amperes) Full Load	Locked Rotor	Pilot Duty
24 VAC	24 VAC	—	—	50 VA at 24 VAC
120 VAC	120 VAC	7.6	43.2	125 VA at 120 or 240 VAC 50 or 60 Hz
	240 VAC	3.75	21.6	

Dimensions, in. (mm)

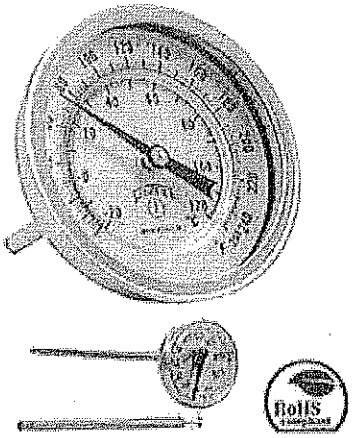
A	B		C				D	E	F	G	H		J	K
	All	U	Std	SP	RX2	U					All	RX		
4⅛ (105)	1⅜ (40)	3⅛ (78)	2⅛ (54)	1⅜ (35)	2⅛ (54)	1⅜ (40)	¾ (20)	⅞ (21)	5⅞ (146)	1⅜ (35)	¾ (20)	⅛ (25)	2⅞ (73)	¾ (22)

⚠ CAUTION

Do not use "manual reset" models with electric automatic water feeders.
Failure to follow this caution can cause flooding and property damage.

Reviewed
Reviewed as Modified
Revise and Resubmit
Not Reviewed
April 23, 2013

Bi-Metal Thermometer | TBM



Description & Features:

- A general purpose, versatile 1" (25mm) to 6" (150mm) dial, 304 stainless steel thermometer
- Bi-metallic sensing element for reliable readings
- Back, bottom or adjustable angle connection
- Welded stem length from 2.5" (63mm) and up
- ±1% accuracy
- Anti-parallax dial that reduces operator reading errors
- Re-zero adjustment screws are standard on the 2" (50mm) to 6" (150mm) dials
- 5 year warranty

Applications:

- Industrial process, food processing and wastewater

Specifications	
Dial	1" (25mm), 2" (50mm), 3" (75mm), 4" (100mm), 5" (125mm), 6" (150mm) aluminum with black markings, dish-shaped
Case	AISI 304 SS
Stem	AISI 304 SS welded to socket, centre back, bottom or adjustable angle configurations (316 SS optional*) 2" (50mm): centre back connection only
Recalibrator	Standard**
Lens	1" (25mm): Acrylic Others: Glass standard, hermetically sealed
Ring	AISI 304 SS
Connection	1" (25mm): None 2" (50mm): ¼" NPT standard 3" (75mm), 4" (100mm), 5" (125mm), 6" (150mm): ½" NPT standard
Sensing Element	Bi-metallic coil
Pointer	Aluminum, painted black
Maximum Operating Pressure	125 psi (861 kPa)
Operating Temperature	75% of full scale value (recommended maximum)
Ambient Temperature	-58°F to 248°F (-50°C to 120°C)
Accuracy	±1%
Enclosure Rating	IP68

Stantec

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

April 23, 2013

By

23 05 21

APR 15 2013

*Contact Winters for 316 SS requirements
**Not available on 1" pocket and 3" laboratory thermometer
Note: The use of a thermowell is recommended to protect the thermometer in corrosive or pressure applications, as well as to maintain a closed system during its removal from the process

TBM Bi-Metal Thermometer

Order Codes (products in bold are normally in stock)

To order, specify the code for each dial/stem length and the range; i.e. TBM20025 - B26

Dial Size	Stem Length	Back Connection	Bottom	Adjustable Angle
1" (25mm) pocket thermometer	5" (125mm)	TBM10050	-	-
2" (50mm) lab thermometer	8" (200mm)	TBM20080	-	-
2" (50mm)	2.5" (63mm)	TBM20025	-	-
	4" (100mm)	TBM20040	-	-
	6" (150mm)	TBM20060	-	-
	9" (225mm)	TBM20090	-	-
	12" (300mm)	TBM20120	-	-
3" (75mm)	2.5" (63mm)	TBM30025	TBM31025	TBM32025
	4" (100mm)	TBM30040	TBM31040	TBM32040
	6" (150mm)	TBM30060	TBM31060	TBM32060
	9" (225mm)	TBM30090	TBM31090	TBM32090
	12" (300mm)	TBM30120	TBM31120	TBM32120
4" (100mm)	2.5" (63mm)	TBM40025	TBM41025	TBM42025
	4" (100mm)	TBM40040	TBM41040	TBM42040
	6" (150mm)	TBM40060	TBM41060	TBM42060
	9" (225mm)	TBM40090	TBM41090	TBM42090
	12" (300mm)	TBM40120	TBM41120	TBM42120
5" (125mm)	2.5" (63mm)	TBM50025	TBM51025	TBM52025
	4" (100mm)	TBM50040	TBM51040	TBM52040
	6" (150mm)	TBM50060	TBM51060	TBM52060
	9" (225mm)	TBM50090	TBM51090	TBM52090
	12" (300mm)	TBM50120	TBM51120	TBM52120
6" (150mm)	2.5" (63mm)	TBM60025	TBM61025	TBM62025
	4" (100mm)	TBM60040	TBM61040	TBM62040
	6" (150mm)	TBM60060	TBM61060	TBM62060
	9" (225mm)	TBM60090	TBM61090	TBM62090
	12" (300mm)	TBM60120	TBM61120	TBM62120

Available Ranges					
°F & °C (Dual)	Code	°F Only	Code	°C Only	Code
-100°F to 150°F & -70°C to 70°C	B1	-40°F to 120°F	B14	-80°C to 50°C	B26
-40°F to 120°F & -40°C to 50°C	B2	-40°F to 160°F	B15	-50°C to 50°C	B27
0°F to 140°F & -20°C to 60°C	B3	0°F to 140°F	B16	0°C to 50°C	B28
-40°F to 160°F & -40°C to 70°C	B4	0°F to 200°F	B17	-50°C to 100°C	B29
25°F to 125°F & - 5°C to 50°C	B5	20°F to 240°F	B18	0°C to 100°C	B30
0°F to 200°F & -20°C to 90°C	B6	0°F to 250°F	B19	-20°C to 120°C	B31
20°F to 240°F & - 5°C to 115°C	B7	50°F to 300°F	B20	0°C to 150°C	B32
0°F to 250°F & -20°C to 120°C	B8	50°F to 400°F	B21	0°C to 200°C	B33
50°F to 300°F & 10°C to 150°C	B9	50°F to 550°F	B22	0°C to 300°C	B34
50°F to 400°F & 10°C to 200°C	B10	150°F to 750°F	B23	0°C to 450°C	B35
50°F to 500°F & 10°C to 260°C	B11	0°F to 800°F	B24	100°C to 550°C	B36
150°F to 750°F & 100°C to 400°C	B12	200°F to 1,000°F	B25	-	-
200°F to 1,000°F & 100°C to 540°C	B13	-	-	-	-

Other ranges, stem lengths and connection sizes available upon request. Flat dial on 6" model available. For glycerin fill, maximum temperature limit is 300°F (150°C). Silicone fill available.

Option suffix:

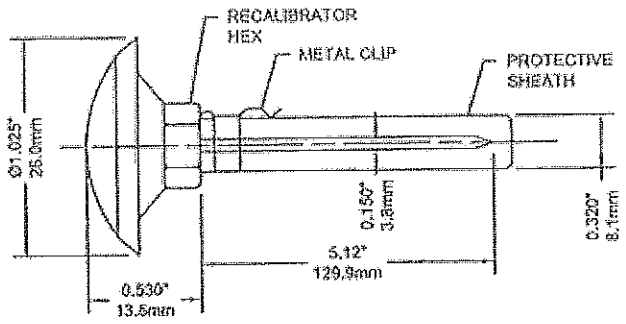
AP3 = 3" acrylic lens
AP4 = 4" acrylic lens
AP5 = 5" acrylic lens
AP6 = 6" acrylic lens

BG3 = 3" glycerin filling
BG4 = 4" glycerin filling
BG5 = 5" glycerin filling
BG6 = 6" glycerin filling

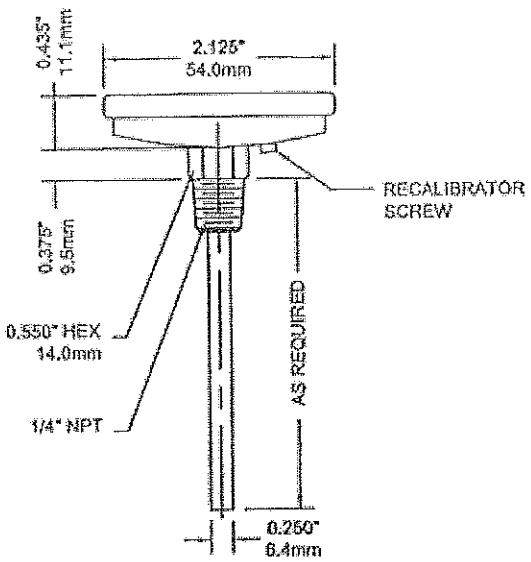
DUCT = Aluminum duct flange
SCK = Socket conversion kit
SPG3 = 3" Shatterproof glass lens
SPG5 = 5" Shatterproof glass lens

Note: The use of a thermowell is recommended to protect the thermometer from corrosive or damaging environments, as well as to maintain a closed system during its removal from the process

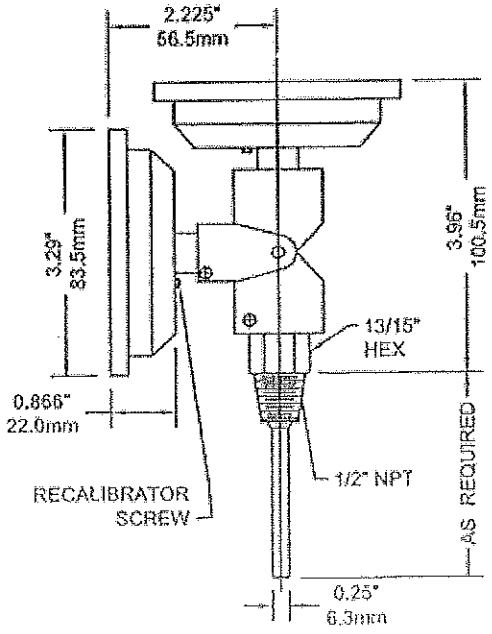
1" Back Connection



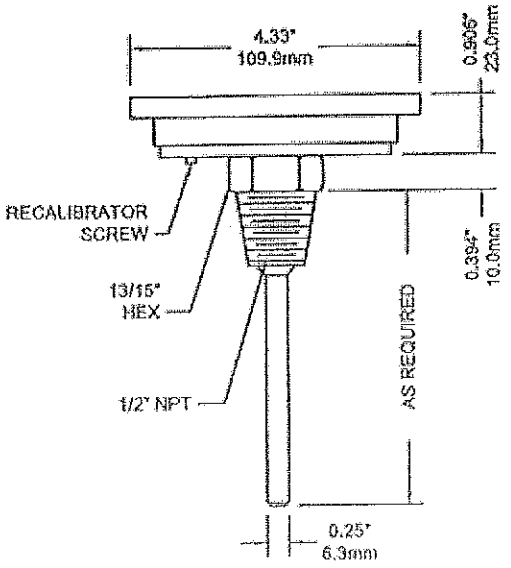
2" Back Connection



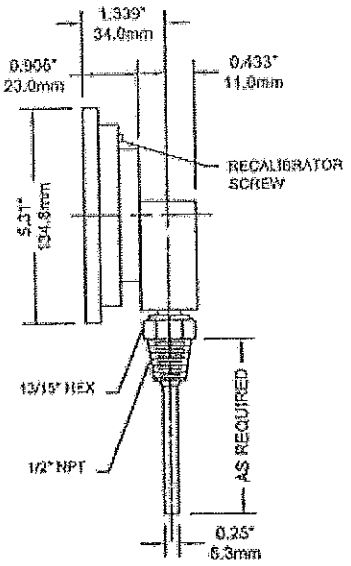
3" Adjustable Angle Connection



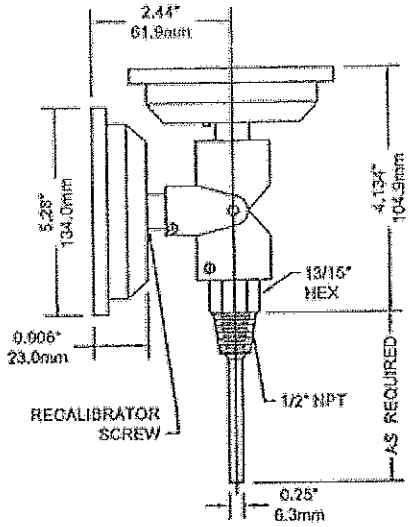
4" Back Connection



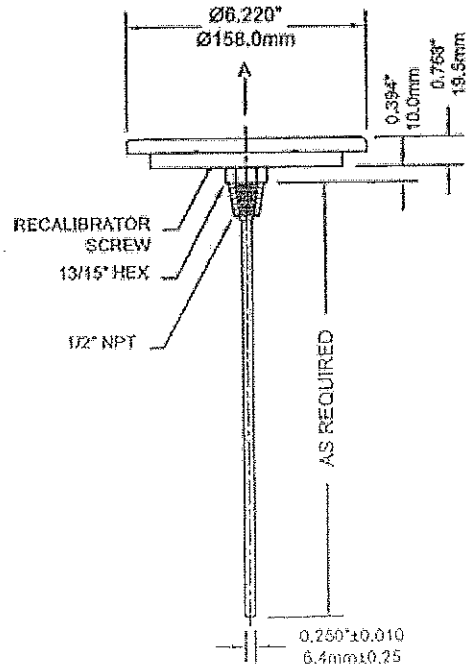
5" Bottom Connection



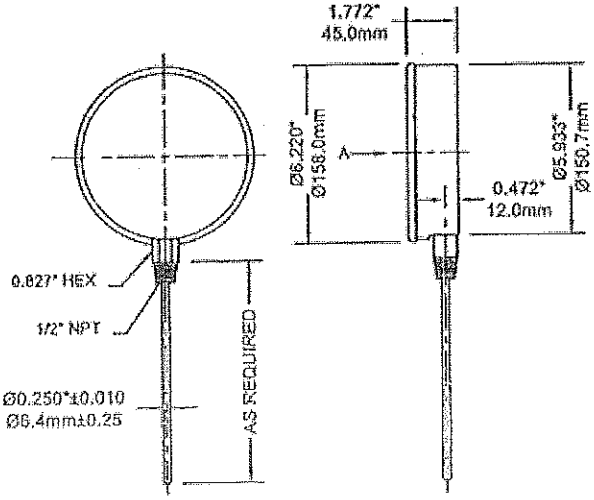
5" Adjustable Angle Connection



6" Back Connection



6" Bottom Connection



WEIL-McLAIN®

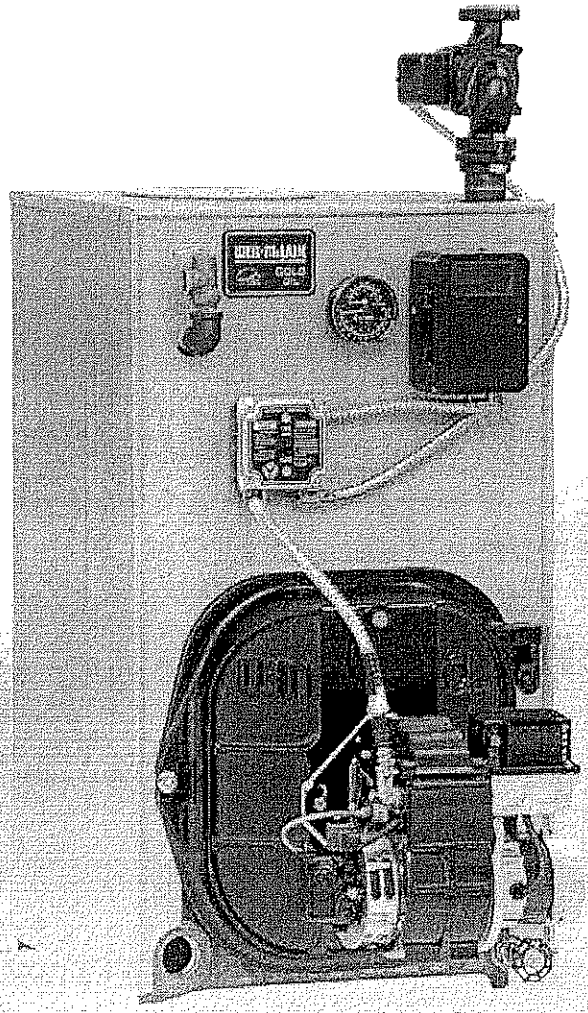
C SA® US

WGO
GOLD SERIES-OIL BOILER

Oil-Fired Water Boilers

Boiler Manual

- Installation
- Maintenance
- Startup
- Parts



Mobile Product Library

⚠WARNING This manual must only be used by a qualified heating installer/service technician. BEFORE installing, read all instructions in this manual and all other information shipped with the boiler. Perform steps in the order given. Failure to comply could result in severe personal injury, death or substantial property damage.

Part number 550-141-326/12-15

Using this manual

Homeowner —

Read and follow all information on pages 1 through 7 ONLY.

Service technician —

Read and follow ALL information in the entire manual.

WARNING Failure to follow all instructions in proper order can cause severe personal injury, death or substantial property damage.

When calling or writing about the boiler

Please have boiler model number and series from boiler rating label and CP number(s) from boiler jacket, burner and controls. On page 28 of this manual is space to list CP number(s).

Packaged and non-packaged boilers

Packaged boilers, available only in sizes 2 through 6, are factory assembled, complete with block, jacket and controls. Burner is shipped separately.

Non-packaged boilers, available in all sizes, 2 through 9, are shipped with block assembled, with jacket. Controls, trim and burner shipped separately for field assembly.

Hazard definitions

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels or to important information concerning the life of the product.

DANGER Indicates presence of hazards that will cause severe personal injury, death or substantial property damage.

WARNING Indicates presence of hazards that can cause severe personal injury, death or substantial property damage.

CAUTION Indicates presence of hazards that will or can cause minor personal injury or property damage.

NOTICE Indicates special instructions on installation, operation or maintenance that are important but not related to personal injury or property damage.

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Please read before proceeding

Homeowner —

- For homeowner or person responsible for simple start-up and routine maintenance of the system
- Instructions on page 1 through page 7 must be followed to assure proper operation of your boiler. See page 7 for lists common problems and possible corrections. In addition, it is your responsibility to:
  - Have boiler and burner installed by a qualified installer.
  - Have boiler and burner serviced annually by a qualified service technician.
  - Review and understand start-up and routine maintenance procedures with qualified service technician.
  - Perform routine maintenance as described on page 5.

Service technician —

- For a qualified service technician who has the necessary equipment to check the boiler and system performance, and is responsible for start-up and service of boiler and system.
- All instructions in this manual must be followed to assure proper operation of this boiler.
- Annually service boiler and burner to assure proper operation. See page 29 for service record.
- Review and explain start-up and routine maintenance procedures with homeowner.

⚠DANGER Follow instructions below to prevent severe personal injury, death or substantial property damage:

- Do not use crankcase drainings or any oil containing gasoline. See burner manual for proper fuel oil.
- Do not attempt to start burner when excess oil has accumulated in combustion chamber, when unit is full of vapor, or when combustion chamber is very hot.
- Do not start burner unless collector hood, flue cap, jacket cap, breeching and burner mounting door are secured in place.
- Never burn garbage or paper in the boiler. Never leave combustible material around boiler.
- DO NOT TAMPER WITH UNIT OR CONTROLS. Always follow specific instructions when starting up boiler or performing routine maintenance or service.

⚠WARNING Follow instructions below to prevent severe personal injury, death or substantial property damage:

- To avoid electric shock, disconnect electrical supply to burner service switch and additional external switches before performing service.
- To avoid severe burns, allow boiler to cool before performing service.
- Do not block flow of combustion or ventilation air to boiler.
- Boiler must be connected to a flue with sufficient draft at all times to assure proper operation.
- Do not use this boiler if any part has been under water. Electrical and mechanical failures may cause electric shock and fire risks. Immediately call a qualified service technician to inspect chimney or vent, boiler and burner. Have the boiler flueways cleaned and have the following replaced:
  - all electrical and mechanical controls
  - electrical wiring
  - oil burner and controls
  - insulation and chamber lining

Tips for water systems —

- Check boiler and system piping for leaks. Continual makeup water will reduce boiler life. Minerals can build up in sections, reducing heat transfer and causing cast iron to overheat, resulting in section failure.

⚠CAUTION Failure to maintain recommended pH and repair leaks can cause section iron corrosion, leading to section failure and leaks. Do not use petroleum-based sealing or stop-leak compounds in boiler systems. Damage to system components can result, causing property damage.

- Boiler water pH 7.0 to 8.5 is recommended. For pH conditions outside 7.0 to 8.5 range or unusually hard water areas (above 7 grains hardness), consult local water treatment company.
- When using antifreeze:
  - ❑ Use antifreeze especially made for hydronic systems. Inhibited propylene glycol is recommended.

⚠WARNING Do not use automotive, ethylene glycol, undiluted or petroleum-based antifreeze. Severe personal injury, death or substantial property damage can result.

  - ❑ 50% solution provides protection to about –30°F.
  - ❑ Local codes may require back-flow preventer or actual disconnect from city water supply.
  - ❑ Determine quantity according to system water content. Boiler water content is listed on back cover of Boiler Manual.
  - ❑ Percent of solution will affect sizing of heat distribution units, circulator and expansion tank.
  - ❑ Follow antifreeze manufacturer's instructions.
  - ❑ Do not add cold water to hot boiler. Thermal shock can cause sections to crack.

Routine maintenance schedule

Beginning **each heating season**	❑ Call a qualified service technician to perform annual service.
Daily **during heating season**	❑ Check that boiler area is free from combustible materials, gasoline and other flammable vapors and liquids.
Weekly **during heating season**	❑ Check for and remove any obstructions to flow of combustion or ventilation air to boiler. ❑ Check that breeching is attached between boiler and chimney. If breeching is loose or damaged, immediately turn off switch on boiler and call service technician to repair. ❑ Check for oil leaks in oil piping and around burner. If found, immediately call qualified service technician to correct situation. ❑ Check for water leaks in boiler and piping; also check for leaks around tankless heater plate, if installed. If found, immediately call service technician to repair.
End **of heating season**	❑ If tankless heater is installed, boiler will continue to operate. Check for the following: • All daily and weekly instructions listed on this page must be followed. • Burner motor may have to be oiled. Some motors are permanently lubricated and do not need additional oil. Check for oiling instructions on burner or motor.
Boiler **shutdown**	❑ Do not drain boiler unless exposure to freezing temperatures will occur. ❑ Always keep manual fuel supply shut off if burner is shut down for an extended period of time. • Turn off switch at boiler and any external switch to boiler. • Close fuel valves. • Turn off water feed valve. • Cover burner to protect from dust and dampness.

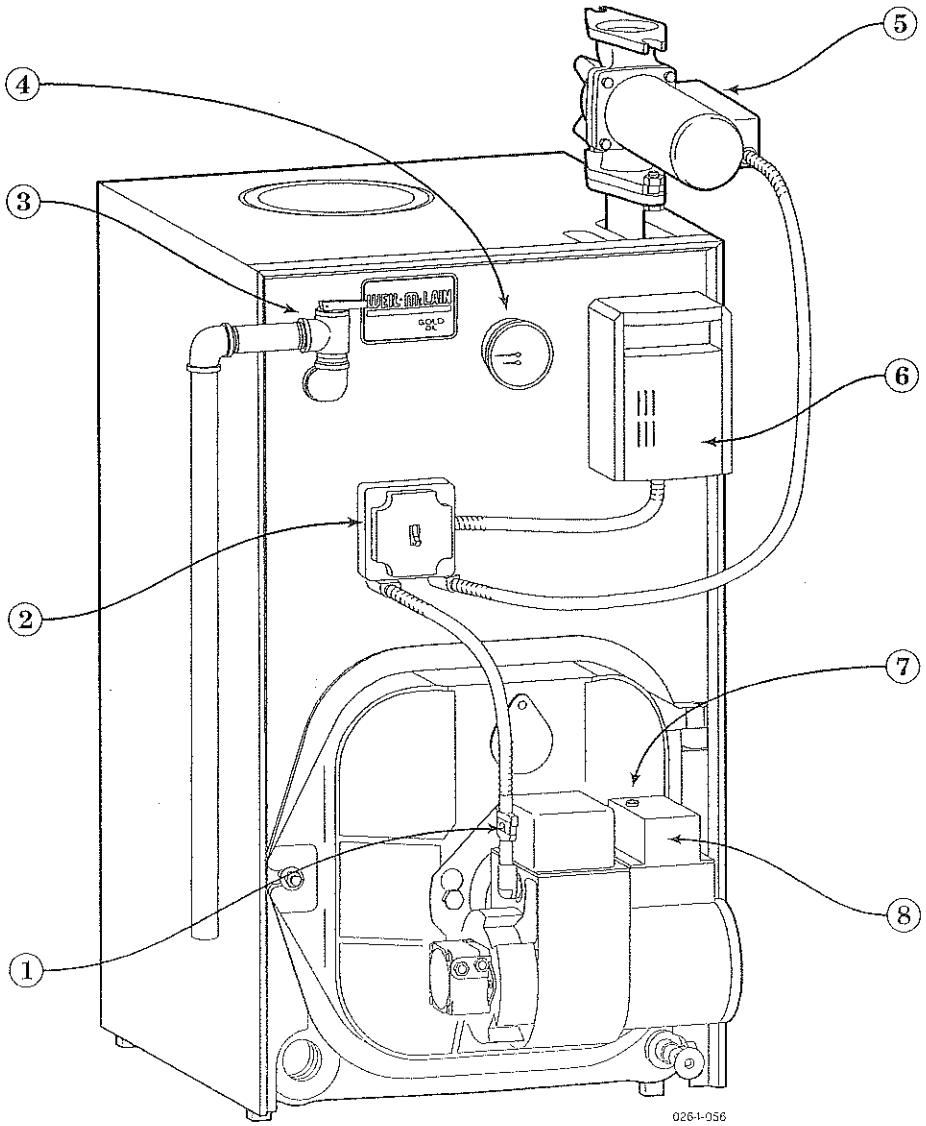
Operation

WGO (see Figure 1)

1. If burner does not fire, check for:
   - Service switch on boiler or additional switches turned off.
   - Fuses or breaker switch tripped.
   - Thermostat set below room temperature.
   - Fuel valves turned off.
   - Not enough oil in tank to supply burner.
2. Correct problems found in step #1. If burner does not fire, press reset button on burner primary control only once. Repeated presses will deposit oil in combustion chamber.

   DANGER Burner must never be fired when oil is in combustion chamber. Immediately call qualified service technician.
3. If burner still does not fire, call qualified service technician.

Figure 1 WGO Boilers



1 Burner disconnect plug

2 Service switch on boiler

3 Water relief valve

4 Temperature-pressure gauge

5 Circulator

6 Limit control / low water cut-off

7 Reset button on burner primary control

8 Burner primary control

Troubleshooting

WARNING Homeowners — The problems and corrections below represent common situations that can occur. There may be others not listed below. It is important always to contact a qualified service technician if you have any questions about the operation of your boiler or system.

Common Problems	Common Causes	Possible Corrections
Rapid cycling — burner turns on and off frequently.	Thermostat installed where drafts or heat affect reading.	Locate thermostat on inner wall away from heat sources or cool drafts.
	Heat anticipator in thermostat adjusted incorrectly.	Adjust heat anticipator to match current draw. Refer to boiler wiring diagram.
	Incorrect limit setting.	Have qualified service technician increase limit setting to decrease cycling. Maximum setting 220° F.
Need to frequently add makeup water.	Leaks in boiler or piping.	Have qualified service technician repair leaks at once to avoid constant use of makeup water.
Popping or percolating noise heard in boiler.	Mineral deposits in sections due to constant use of makeup water, or incorrect pH.	Have qualified service technician de-lime boiler, repair leaks at once to avoid constant use of makeup water and check pH (between 7.0 and 8.5).
Black water condition.	Oxygen corrosion due to leaks in piping.	Have qualified service technician repair leaks at once to avoid constant use of makeup water and check pH (between 7.0 and 8.5).
Frequent release of water through relief valve.	Expansion tank sized too small or water-logged.	Have qualified service technician check expansion tank operation.
Metal flakes found in flueway.	Contaminated combustion air supply.	Remove sources of hydrocarbons in or near boiler area. (Bleaches, cleaners, chemicals, sprays, fabric softeners, paint remover, etc.)
	Condensation of combustion gases.	Have qualified service technician check boiler operation.
Some radiators or baseboard units do not heat or are noisy.	Air in system.	Bleed air from system through air vents in radiators or baseboard units.
	Low system pressure.	Have qualified service technician check for leaks in boiler or piping at once.
	High limit set too low.	Have qualified service technician adjust limit to higher setting.
Domestic water from tankless heater is hot then suddenly turns cold. OR Domestic water from tankless heater is always lukewarm.	Mineral deposits insulate internal waterways of heater.	Have qualified service technician delime or replace coil.
	Boiler stop-leak compound has been added to boiler water and is insulating outside of coil.	Have qualified service technician remove and clean coil and drain, and flush boiler to remove stop-leak.
	Incorrect mixing valve setting for tankless heater.	Have qualified service technician adjust mixing valve setting.
	Domestic flow rate too high.	Have qualified service technician install flow check valve set to rating of tankless heater.
	Incorrect setting on tankless heater control.	Have qualified service technician raise tankless control setting. Adjust differential on tankless control to lower setting.

Before installing boiler

DANGER **Homeowner — STOP!** The procedures and information on this and following pages are intended only for a qualified service technician who has the necessary equipment to inspect and adjust boiler and burner. A homeowner should never attempt these procedures. The service technician must also read pages 1 through 7 before proceeding.

Installations must comply with

- United States
  - State and local plumbing, heating and electrical codes.
  - National codes where applicable.
- Canada
  - Canadian Standards Association, CSA B139, Installation Code for Oil-Burning Equipment.
  - CSA C22.1 Canadian Electrical Code Part One.
  - Applicable local or provincial codes.

Before selecting boiler location

Check for nearby connections to:

- System water piping.
- Chimney. See page 16. Boiler can be top or back vented.
- Combustion and ventilation air supply. See page 9.
- Oil supply. See page 26 for oil line routing.
- Electrical power.

- Check area around boiler. Remove any combustible materials, gasoline and other flammable liquids.

Provide clearances around boiler (see Figure 2)

NOTICE Jacket cap must be in place on boiler to avoid requiring an 9" minimum clearance from back or top of boiler to combustible material.

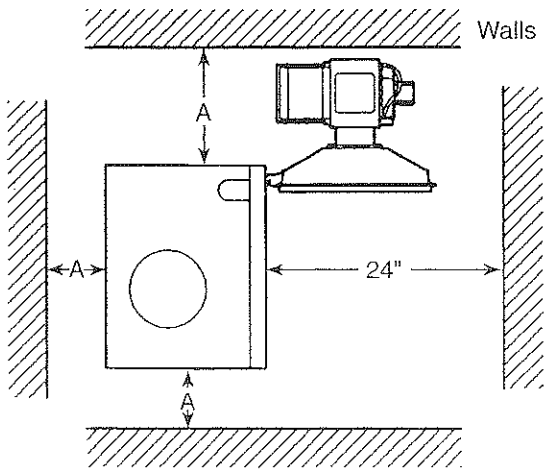
- MINIMUM clearances from vent pipe to combustible material
  - 6 inches — Type "L" double-wall vent*
  - 9 inches — Single-wall vent*

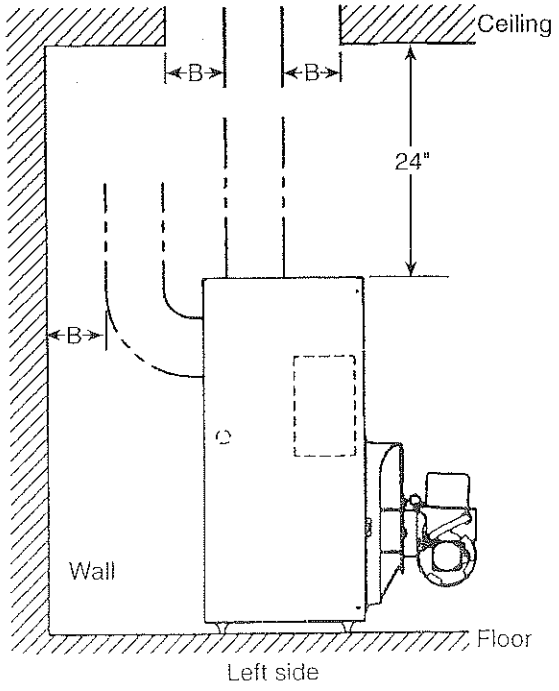
NOTICE Flue pipe clearances must take precedence over jacket clearances.

- Recommended SERVICE clearances
  - 24 inches — Front and top
  - 6 inches — Left side, back and right side
  - 12 inches — Right side for burner door swing radius
- Special close clearances (alcove, closet, under counters, etc.) — see Appendix, page 32.

WARNING Failure to keep boiler area clear and free of combustible materials, gasoline and other flammable liquids and vapors can result in severe personal injury, death or substantial property damage.

Figure 2 Recommended service clearances





A Provide 6" minimum clearance for service, provide 12" minimum clearance for burner door swing.
B Minimum clearance from vent pipe to combustible material: 6" for type "L" double-wall vent, 9" for single-wall vent.

Before installing boiler (continued)

Provide air for combustion and ventilation

WARNING Do not install exhaust fan in boiler room.

Adequate combustion and ventilation air:

- Assures proper combustion.
- Reduces risk of severe personal injury or death from possible flue gas leakage and carbon monoxide emissions.

Older buildings with single-pane windows, minimal weather-stripping and no vapor barrier often provide enough natural infiltration and ventilation without dedicated openings.

New construction or remodeled buildings are most often built tighter. Windows and doors are weather-stripped, vapor barriers are used and openings in walls are caulked. As a result, such tight construction is unlikely to allow proper natural air infiltration and ventilation.

Follow state, provincial or local codes when sizing adequate combustion and ventilation air openings. In absence of codes, use the following guidelines when boiler is in a confined room (defined by NFPA 31 as as less than 7200 cubic feet per 1 GPH input of all appliances in area. A room 8 ft. high x 33.5 ft. x 33.5 ft. is 7200 cu. ft.).

Permanent Openings

Provide two permanent openings, one within 12 inches of ceiling, one within 12 inches of floor. Minimum height or length dimension of each rectangular opening should be at least 3 inches.

Inside air

When inside air is used, each opening must freely connect with areas having adequate infiltration from outside. Each opening should be at least 140 sq. in. per 1 GPH input (1 sq. in. per 1000 Btu input) of all fuel-burning appliances plus requirements for any equipment that can pull air from room (including clothes dryer and fireplace).

Outside air

When outside air is used, connect each opening directly or by ducts to the outdoors or to crawl or attic space that freely connects with outdoors. Size per below:

- Through outside wall or vertical ducts — at least 35 sq. in. per 1 GPH input (1 sq. in. per 4000 Btu input) of all fuel-burning appliances plus requirements for equipment that can pull air from room (including clothes dryer and fireplace).
- Through horizontal ducts — at least 70 sq. in. per 1 GPH boiler input (1 sq. in. per 2000 Btu input) of all fuel-burning appliances plus requirements for any equipment that can pull air from room (including clothes dryer and fireplace).

Where ducts are used, they should have same cross-sectional area as free area of openings to which they connect. Compensate for louver, grille or screen blockage when calculating free air openings. Refer to their manufacturer's instructions for details. If unknown, use:

- Wood louvers, which provide 20-25% free air.
- Metal louvers or grilles, which provide 60-75% free air.

Lock louvers in open position or interlock with equipment to prove open before boiler operation.

Foundation

Lay a foundation, if needed. Boiler may be installed on non-carpeted combustible flooring. Solid concrete blocks can be used to create a pad.

For residential garage installation, install boiler so burner is at least 18 inches above floor to avoid contact with gasoline fumes.

A level concrete or masonry foundation is required when:

- Floor could possibly become flooded.
- Non-level conditions exist.

Table 1 Boiler foundation sizes

Boiler model	Length inches	Width inches	Min. height inches
WGO-2	14	22	2
WGO-3	17	22	2
WGO-4	17	22	2
WGO-5	20	22	2
WGO-6	23	22	2
WGO-7	26	22	2
WGO-8	29	22	2
WGO-9	32	22	2

Installation instructions:
Packaged boiler — Continued on page 10
Non-packaged boiler — Continued on page 12

Install boiler — packaged boilers only

Place boiler

1. Remove circulator strapped to pallet.

NOTICE Circulator will be damaged if not removed before boiler is lifted from pallet.

2. Remove boiler from pallet.

NOTICE Do not drop boiler or bump jacket on floor or pallet. Damage to boiler can result.

CAUTION Smaller sized boilers may be top heavy. Use caution when handling to avoid minor personal injury or property damage.

3. Boiler is shipped for back flue outlet. To change to top flue outlet (see Figure 3, page 11):
   a. Remove jacket cap on top of boiler.
   b. Loosen two screws holding flue cap strap to collector hood. Remove strap and flue cap from opening. Re-tighten screws.
   c. Check rope placement inside flue cap.

(Read WARNING under step #6 below).

   d. Loosen two screws on back flue outlet. Set flue cap on outlet. Install strap by engaging slots in screws. Tighten screws. Make sure cap is securely installed.
   e. Snap jacket cap in back outlet opening.

NOTICE Jacket cap must be in place on boiler to avoid requiring an 18" minimum clearance from back or top of boiler to combustible material.

4. Check level. Shim legs, if needed.
5. Check for secure placement of insulation on target wall, chamber floor and burner door.
6. Visually check:
   a. Flue collector hood seal.
   b. Burner mounting door seal.

WARNING Obtain gas-tight seal to prevent possible flue gas leakage and carbon monoxide emissions, which can lead to severe personal injury or death.

Perform hydrostatic pressure test

1. Remove relief valve installed in boiler.
2. Install air vent in "N" tapping on top boiler.
3. Plug supply and return tappings.
4. Drain valve is already factory-installed.
5. Fill boiler. Vent all air. Pressure test boiler at 1½ times working pressure.

WARNING Do not leave boiler unattended. Cold water fill can expand and damage cast iron, resulting in severe personal injury, death or substantial property damage.

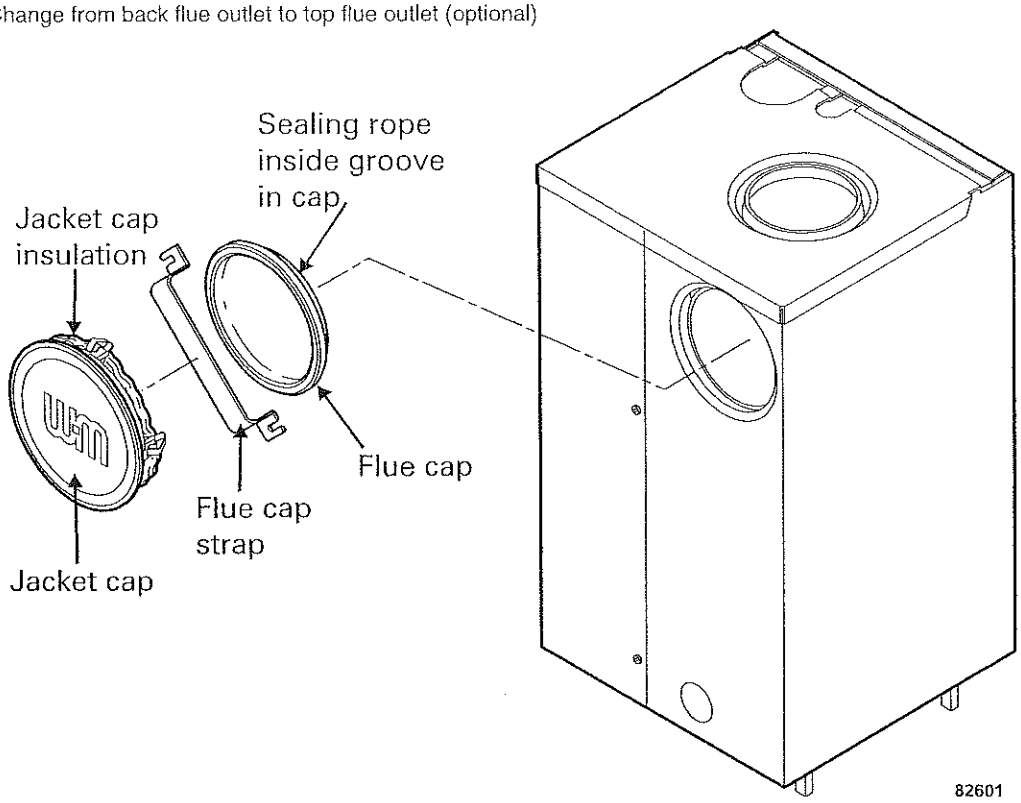
6. Check for maintained gauge pressure for more than 10 minutes. Visually check for leaks if gauge pressure drops.
7. Drain boiler. Repair leaks if found.

CAUTION Do not use petroleum-based sealing compounds to repair leaks. Damage to system components can result, causing property damage.

8. Retest boiler after repairing leaks.
9. Remove air vent and plugs. Reinstall relief valve.

Install boiler — packaged boilers only (continued)

Figure 3 Change from back flue outlet to top flue outlet (optional)



Instructions for packaged boilers continued on page 15.

Install boiler — non-packaged boilers only

WARNING Fiberglass wool and ceramic fiber materials are possible cancer hazards. See warning on page 31.

Place boiler

Non-Packaged WGO-2 through 6 — position on site

CAUTION Smaller sized boilers may be top heavy. Use caution when handling to avoid minor personal injury or property damage.

Boiler is shipped for back flue outlet. To change to top flue outlet (see Figure 3):

1. Loosen two screws holding flue cap strap to collector hood. Remove strap and flue cap from opening. Re-tighten screws.
2. Check rope placement inside flue cap.

   (Read **WARNING** under Step #3 on page 13.)
3. Loosen two screws on back flue outlet. Set flue cap on outlet. Install strap by engaging slots in screws. Tighten screws. Make sure cap is securely installed.

Non-Packaged WGO-7, 8 & 9 — split the assembled block for easier handling (see Figure 4, page 13)

1. Open burner mounting door and, using utility knife, slit floor insulation at joint to be separated.
2. Remove 5½" draw rod and the longest draw rod from each side. Pull block apart. Save draw rods, nuts, washers and sealing rings for reassembly.
3. Move divided block to location.
4. Clean port openings with clean rag.

CAUTION Do not use petroleum-based compounds to clean openings. Damage to system components can result, causing property damage.

5. Place rings in port openings. If ring slips out of groove, stretch ring gently for several seconds, then place in groove.
6. Position sections so aligning lugs fit into sockets of next section. Make sure sealing rope is in good condition and in position.
7. Oil threads on draw rods. Install washer and nut on end to be tightened. Use nut only on other end.
8. With wrench at washer/nut end, uniformly tighten nuts starting with 5½" rod at large port, 5½" rod at small port, bottom long rod and finally top long rod.
9. Torque on both 5½" rods and bottom long rod should be 50-60 ft. lbs; long top rod should be 20-25 ft. lbs. Do not back-off nuts.
10. Metal-to-metal contact should be made around port openings. If gap does exist, it should be less than .020". Check with feeler gauge.
11. If gap around port openings exceeds .020", check for dirt on port openings, sockets or misaligned lugs. If corrections are made and gap still exists, contact your Weil-McLain distributor or sales office before continuing installation.

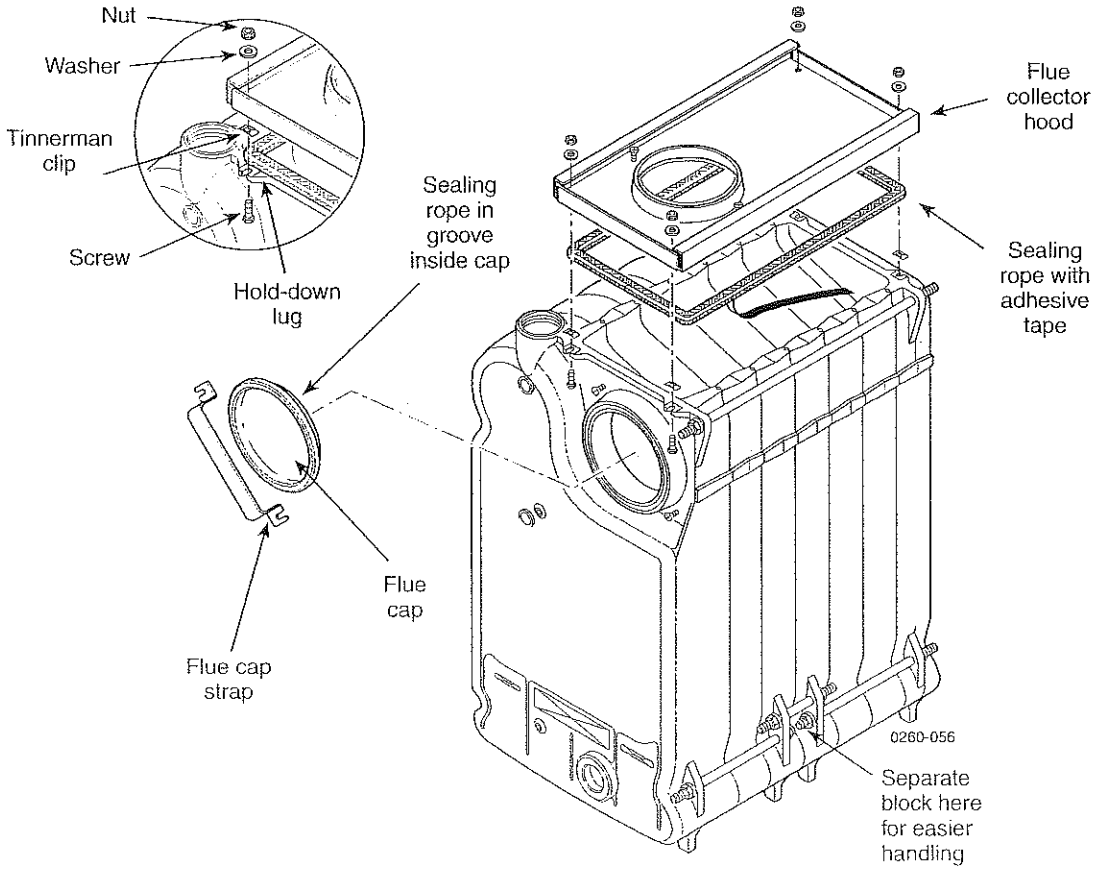
Install boiler — non-packaged boilers only (continued)

Non-Packaged WGO-7, 8 & 9 — install flue collector hood (see Figure 4)

⚠WARNING Obtain gas-tight seal to prevent possible flue gas leakage and carbon monoxide emissions, leading to severe personal injury or death.

1. Thread tinnerman clip on screw so that clip fits snugly in notch of hold-down lug. Screw must not turn.
2. Remove paper on sealing rope. Starting at back section near flue collar, position sealing rope around top of block with adhesive side to sections. Do not stretch rope. Make sure rope ends meet. Trim excess rope.
3. Position flue collector hood on top of boiler sections and over screws and clips as shown in Figure 4.
4. Install washers and nuts. Tighten nuts until collector hood makes contact with tinnerman clip.
5. Flue Cap
   - Back flue outlet boiler — Position flue cap and strap over opening in flue collector hood. Make sure rope in cap is in place and in good condition. Tighten strap to hood with screws provided.
   - Top flue outlet boiler — Position flue cap and strap over opening in back section. Make sure rope in cap is in place and in good condition. Tighten strap to boiler with screws provided in section. Install remaining screws in holes in flue collector hood.
6. Check level. Shim legs, if needed.

Figure 4 Change from back flue outlet to top flue outlet (optional)



Install boiler — non-packaged boilers only (continued)

Perform hydrostatic pressure test

1. See Figure 5 and Control Tapping table to install:
   a. Boiler drain.
   b. Water pressure gauge (test only). Be sure gauge can handle test pressure.
   c. Air vent in upper "N" tapping.
   d. Plugs in remaining tappings.
2. Fill boiler. Vent all air. Pressure test boiler at 1 times working pressure. For boilers split and reassembled, test between 75 and 85 psig.

WARNING Do not leave boiler unattended. Cold water fill could expand and damage cast iron, resulting in severe personal injury, death or substantial property damage.

3. Check for maintained gauge pressure for more than 10 minutes. Visually check for leaks if gauge pressure drops.
4. Drain boiler. Repair leaks if found.

CAUTION Do not use petroleum-based compounds to repair leaks. Damage to system components can result, causing property damage.

5. Re-test boiler after repairing leaks.
6. Remove pressure gauge, air vent and plugs from tappings used for controls.
7. Visually check:
   a. Sealing rope placement.
   b. Metal-to-metal contact around port openings.
   c. Flue collector hood seal.
   d. Burner mounting door seal.

WARNING Obtain gas-tight seal to prevent possible flue gas leakage and carbon monoxide emissions, which can lead to severe personal injury or death.

Install jacket

(sizes 7 through 9 only)

Before installing jacket, remove burner mounting door. See jacket instructions for details.

Install boiler controls

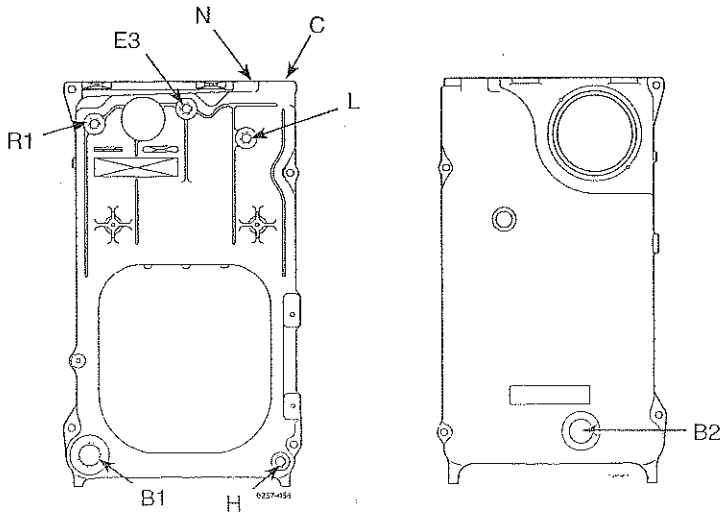
See Control Tapping Table and Figure 5 and Figure 6, page 15 to install controls.

1. Install limit control. If not furnished, use high limit with maximum 220°F setting.
2. Affix CP number label(s) on jacket front panel.

Table 2 Control tappings

Location	Size	Function
B1	1½"	Return piping
B2	1½"	Alternate return piping for A/B WGO
C	1½"	Supply piping
E3	¼"	Pressure-temperature gauge
H	¾"	Drain valve
L	¾"	High limit control
N	½"	Air vent or expansion tank piping
R1	¾"	Relief valve

Figure 5 Control tapping locations



Front section

Back section

Install burner — all boilers

Install burner

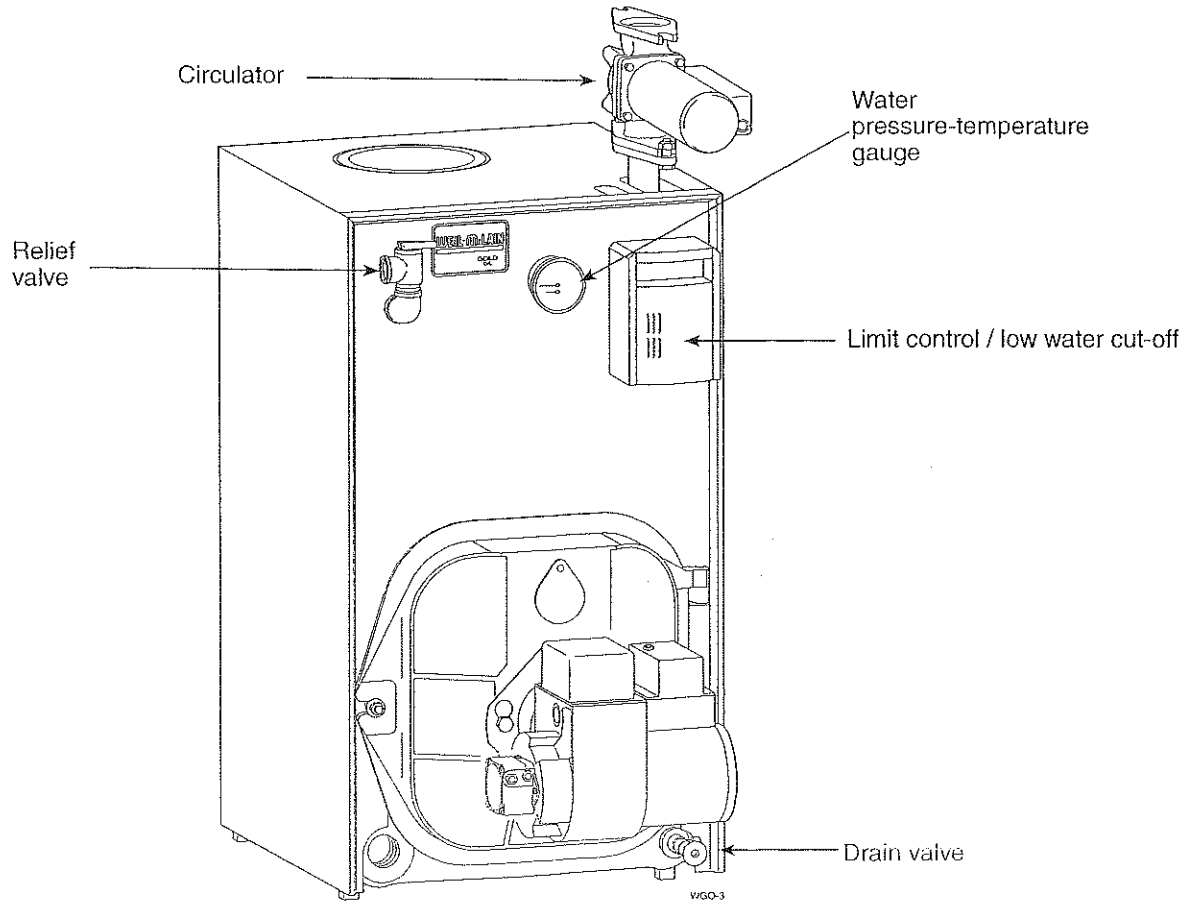
(also refer to instructions packed with burner)

NOTICE Use only burners specified for use on Weil-McLain GOLD oil boilers. DO NOT use burners specified for use on Weil-McLain Model 68 boilers. Contact individual burner manufacturers for proper burner selections.

For P-WGO and A-WGO boiler:

1. Secure universal mounting flange and gasket to burner mounting door. Use three bolts provided.
2. Secure burner on flange with three bolts.
3. Position burner so end of air tube is level to 1½° tilt downward. Open door to verify burner position. End of air tube should be flush to ¼" recessed from inside wall of burner door refractory. Check for secure placement of insulation on target wall, chamber floor and burner mounting door. Securely close door with nut.

Figure 6 Water boiler controls



Connect breeching

General chimney requirements

- Designed for natural draft firing. Connect boiler to vertical chimney.
- Insufficient draft can cause flue gas leakage and carbon monoxide emissions, which will lead to severe personal injury or death.
- Use vent material approved by local codes for oil-fired burners. In their absence, refer to:
  - NFPA 31, Installation of Oil-Burning Equipment.
  - NFPA 211, Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances.
  - In Canada, refer to CSA B139, Installation Code for Oil-Burning Equipment.
- NFPA 211 requires chimney to be lined before connected to boiler.
- Inspect existing chimney before installing new boiler. Failure to do any of the following will result in severe personal injury or death:
- Clean chimney, including removal of blockage.
- Repair or replace damaged pipe or liner.
- Repair mortar and joints.
- To prevent downdrafts, extend chimney at least 3 feet above highest point where it passes through roof and 2 feet higher than any portion of building within 10 feet. Increase chimney cross-sectional area and height at least 4% per 1,000 feet above sea level.
- Minimum clearances from vent pipe to combustible material:
  - 6 inches — Type "L" double-wall vent
  - 9 inches — Single-wall vent
- Minimum chimney sizes should be used.

NOTICE Oversized chimneys, outside masonry chimneys and/or derated inputs can result in condensation in chimney.

Table 3 Minimum chimney sizes

Boiler model number	Minimum breeching diameter (note 3)	Minimum I=B=R chimney size		Minimum chimney height
		Rect.	Round	
WGO-2	5"	8" x 8" (note 1)	6"	15'
WGO-3				
WGO-4	6"			
WGO-5	6"	8" x 8" (note 1)	7"	15'
WGO-6	7"			
WGO-7				
WGO-8	7"	8" x 12" (note 2)	7"	20'
WGO-9				
Note 1	6¾" x 6¾" inside liner			
Note 2	6½" x 10½" inside liner			
Note 3	Flue collar on boiler is 7" diameter			

Connect breeching:

WARNING Long horizontal breechings, excessive number of tees and elbows or other obstructions restricting combustion gas flow can result in possibility of condensation, flue gas leakage and carbon monoxide emissions, which can lead to severe personal injury or death.

1. Install 2 flue pipe brackets.
2. Connect full-sized breeching when possible. See Minimum Chimney Size Table.
   - Back outlet — see Figure 7, page 17.
   - Top outlet — see Figure 8, page 17.
3. Connection must be made above bottom of chimney to avoid blockage. Breeching must not enter chimney far enough to cause obstruction. Use thimble or slip joint where breeching enters chimney to allow removal for cleaning.
4. When burner and boiler are properly installed, draft overfire will be approximately -0.01" to -0.02" W.C. Install barometric control in breeching, per control manufacturer's instructions, when excess draft needs to be relieved or to comply with applicable codes and regulations. Use draft gauge to adjust proper opening.
5. An induced draft fan for the chimney may be necessary if:
   - Excessive resistance to flow of combustion gases can be expected.
   - Cross-sectional area of chimney is smaller than minimum recommended.
   - Chimney height is less than recommended.

WARNING Seal all vent joints. Interlock burner with fan operation.

Connect breeching (continued)

Figure 7 Back outlet breeching connection

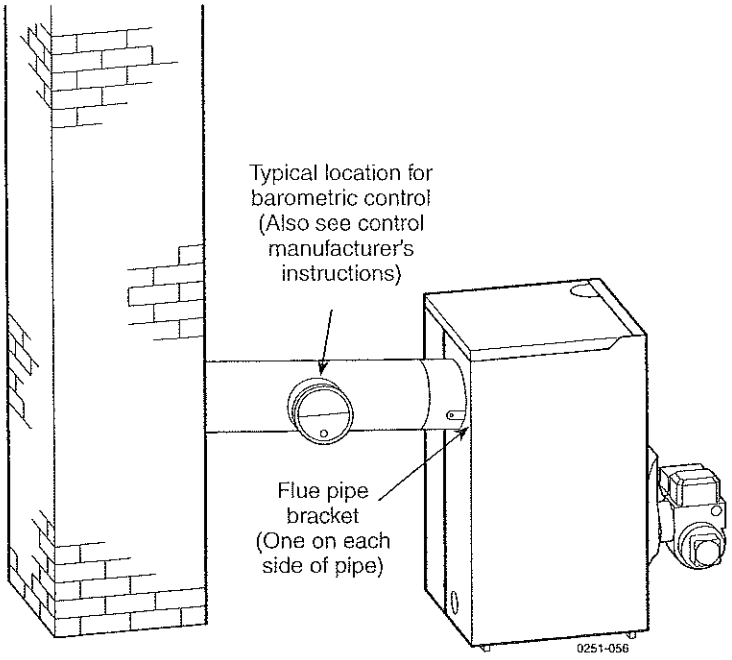
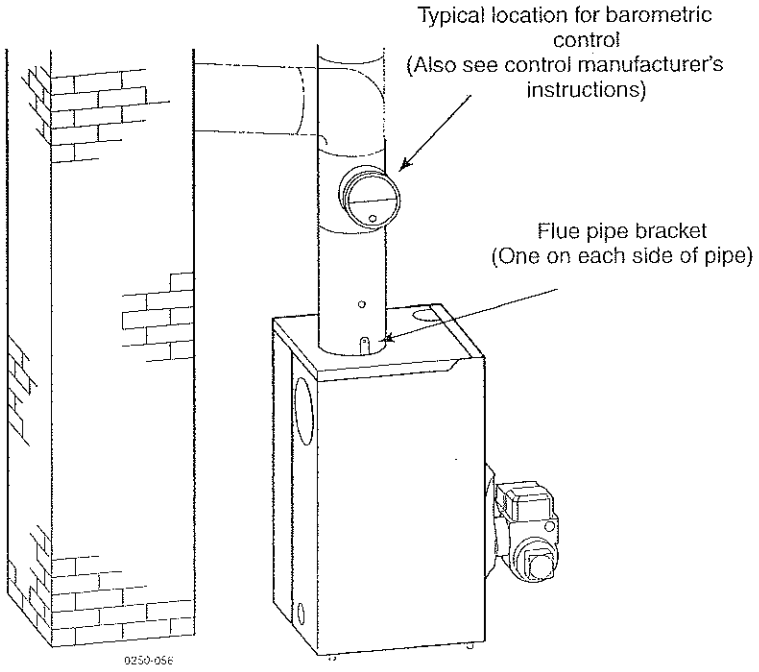


Figure 8 Top outlet breeching connection



Connect water piping

General piping information

- All packaged WGO boilers are shipped with an installed combination temperature limit control/low water cut-off.
- If installation is to comply with ASME or Canadian requirements, an additional high temperature limit is needed. Install control in supply piping between boiler and isolation valve. Set control to a minimum of 20°F above set point of combination control. Maximum allowable set point is 220°F. Wire control as shown on wiring diagram.
- Use backflow check valve in cold water supply as required by local codes.

Install piping

- See Figure 9 or Figure 10, page 19, and Table 4, page 18 for near-boiler piping and single-zone piping. See page 20 to complete multiple-zone piping or page 21 to complete piping for systems operating below 140°F.
- For multiple-boiler piping, refer to Weil-McLain's "Primary/Secondary Piping Guide" and "M-WGO Multiple Boiler Manual."
- Install relief valve vertically in "R1" tapping on front of boiler. See Figure 9 or Figure 10 and also refer to tag attached to relief valve for manufacturer's instructions.

⚠WARNING Pipe relief valve discharge line near floor close to floor drain to eliminate potential of severe burns. Do not pipe to any area where freezing could occur. Do not plug, valve or place any obstruction in discharge line.

DIAPHRAGM expansion tank

(Figure 9, page 19)

- Make sure expansion tank size will handle boiler and system water volume and temperature. Tank must be located near boiler before inlet to circulator. See tank manufacturer's instructions for details.
- Undersized expansion tanks cause system water to be lost from relief valve and makeup water added through fill valve. Eventual section failure can result.
- Install automatic air vent in "N" tapping as shown in Figure 9.

CLOSED expansion tank

(Figure 10, page 19)

- Ensure expansion tank size will handle boiler and system water volume and temperature.

⚠WARNING Undersized expansion tanks cause system water to be lost from relief valve and makeup water added through fill valve. Eventual section failure can result.

- Connect tank from "N" tapping shown in Figure 9 to expansion tank. Use ½" N.P.T. piping. Pitch any horizontal piping up towards tank 1 inch per 5 feet of piping.

To connect WGO boilers to indirect-fired water heaters

Install and wire per water heater manual provided with water heater.

Table 4 Water piping sizes

Boiler model number	To system	From system
WGO-2	1"	1"
WGO-3	1¼"	1¼"
WGO-4	1¼"	1¼"
WGO-5	1½"	1½"
WGO-6	1½"	1½"
WGO-7	1½"	1½"
WGO-8	2"	2"
WGO-9	2"	2"

* All piping sizes based on 20°F temperature rise through boiler.

Connect water piping (continued)

Figure 9 Piping with DIAPHRAGM expansion tank

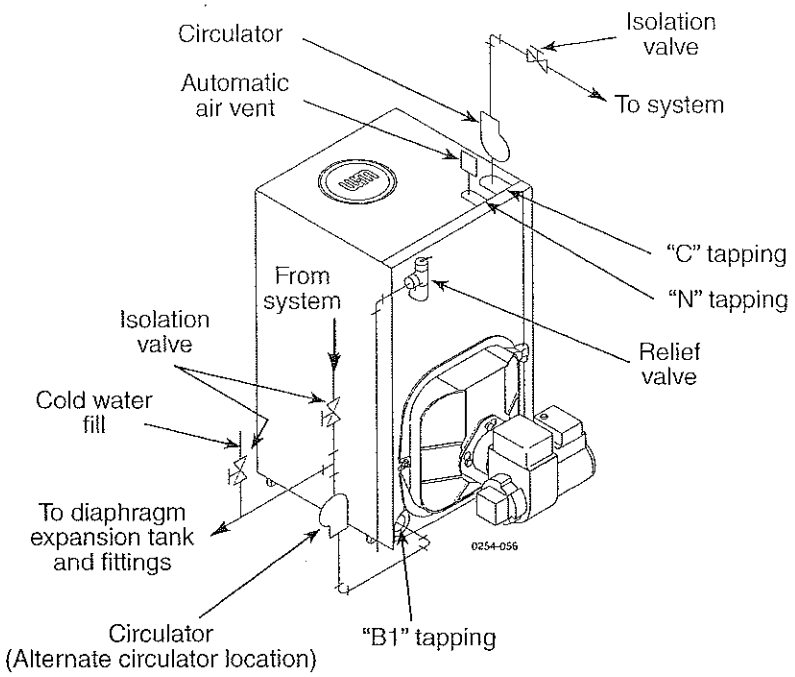
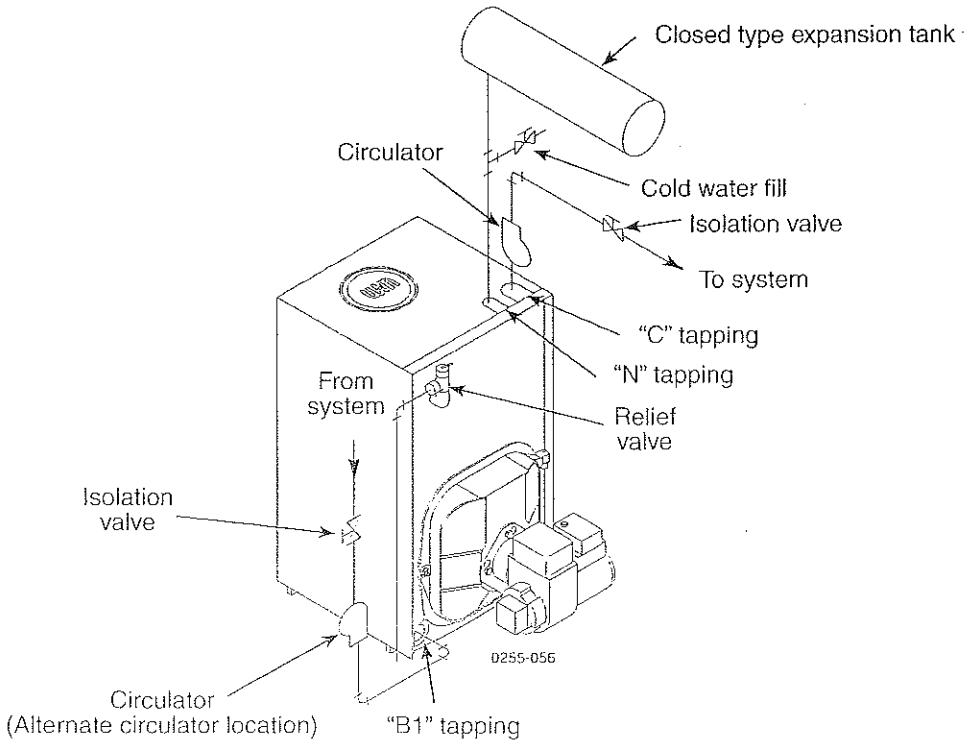


Figure 10 Piping with CLOSED expansion tank

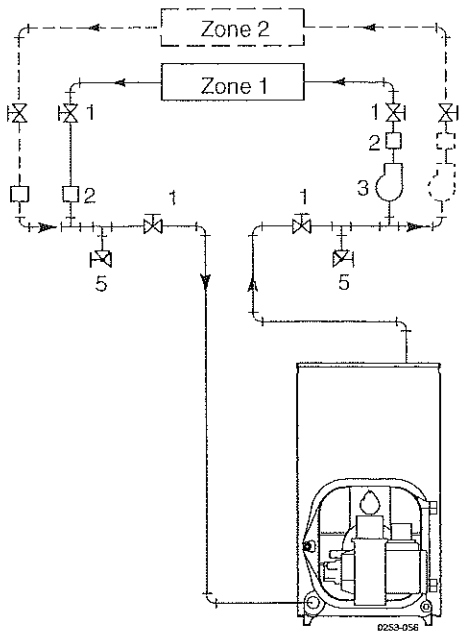


Connect water piping (continued)

Piping MULTIPLE ZONES

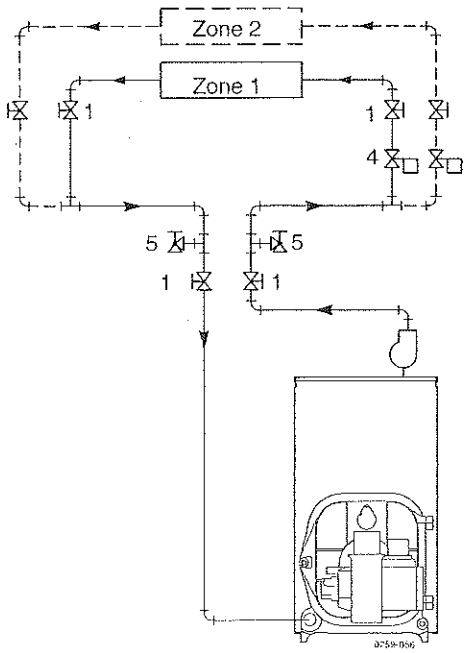
1. Follow instructions on page 18 and page 19 to install piping near boiler.
2. See Figure 11 or Figure 12 to complete installation
3. Zoning with circulators:
   a. Size each circulator to individual circuit requirements.
   b. Remove circulator (when furnished as standard equipment).
   c. Install balancing valves to adjust flow to distribute heat to all zones.
   d. Separate relay is required for each circulator.
4. Zoning with zone valves:
   a. Install balancing valves to adjust flow to distribute heat to all zones.
   b. Separate transformer is required to power zone valves. Refer to "Weil-McLain Zone Valve Wiring Guide" for details.

Figure 11 Multiple zoning with CIRCULATORS



Legend			
1	Isolation valve	3	Circulator
2	Flow control valve	4	Zone valve
		5	Drain valve

Figure 12 Multiple zoning with ZONE VALVES



Connect water piping (continued)

Piping for systems requiring temperatures below 140°F

In most systems, this type of piping is not required. If system water temperature requirements are less than 140°F, such as radiant panels or converted gravity systems, use piping as shown in Figure 13 or Figure 14. If system piping is plastic without an oxygen barrier, a heat exchanger must be used.

Figure 13 Piping with CIRCULATORS

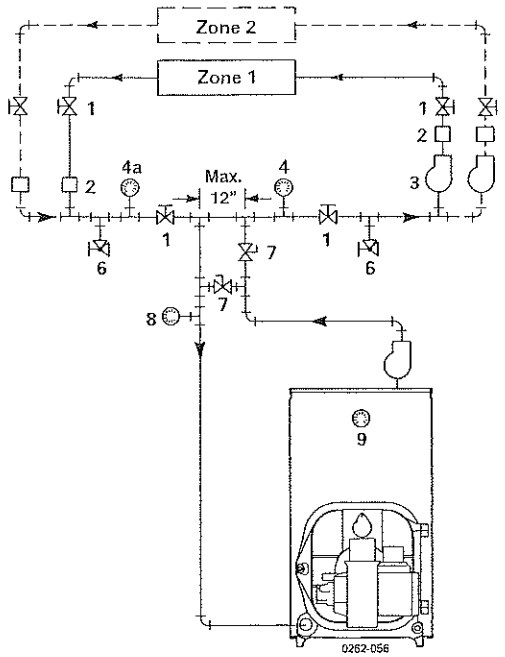
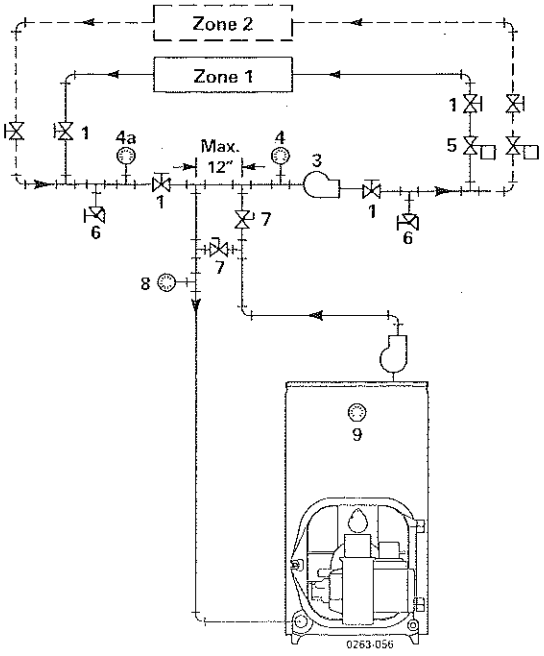


Figure 14 Piping with ZONE VALVES



Legend

1 Isolation valve
2 Flow control valve
3 Circulator
4 System temperature gauge
5 Zone valve
6 Drain valve
7 System temperature valves
Adjust valves so that:
- the temperature at gauge 8 is at least 140°F
- the temperature at gauge 9 is at least 160°F
8 Blend temperature gauge
9 Boiler temperature gauge

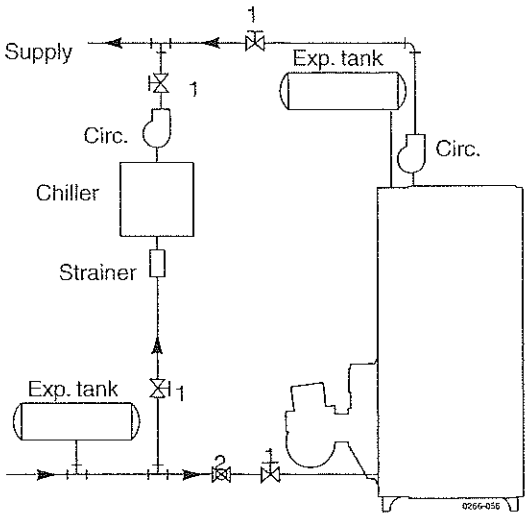
Connect water piping

(continued)

Use with refrigeration systems

- Install boiler so that chilled medium is piped in parallel with heating boiler. Use appropriate valves to prevent chilled medium from entering boiler. Consult I=B=R Installation and Piping Guides.
- If boiler is connected to heating coils located in air handling units where they can be exposed to refrigerated air, use flow control valves or other automatic means to prevent gravity circulation during cooling cycle.

Figure 15 Use with refrigeration system



1 Isolation valve 2 Balancing valve

Connect wiring

General wiring requirements

WARNING Electric shock hazard. Can cause severe personal injury or death if power source, including service switch on boiler, is not disconnected before installing or servicing.

- Installations must follow these codes:
  - National Electrical Code, ANSI/NFPA 70, latest edition and any additional national, state or local codes.
  - In Canada, CSA C22.1 Canadian Electrical Code Part 1 and any local codes.
- Wiring must be N.E.C. Class 1. If original wire as supplied with boiler must be replaced, type 105°C wire or equivalent must be used. Supply wiring to boiler and additional control wiring must be 14 ga. or heavier.
- Provide electrical ground at boiler as required by codes.

Thermostat wiring

- Install thermostat on inside wall away from influences of drafts, hot or cold water pipes, lighting fixtures, television, sun rays or fireplaces.
- Follow instructions with thermostat. If it has a heat anticipator, set heat anticipator in thermostat to match power requirements of equipment connected to it. Boiler wiring diagrams give setting for standard equipment.

Zone Valve Wiring

CAUTION **DO NOT connect directly from 3-wire zone valves to the T-T terminals on the boiler.** When using 3-wire zone valves, install an isolation relay. Connect the zone valve end switch wires to the isolation relay coil. Connect the isolation relay contact across the boiler T-T terminals. Failure to comply can result in damage to boiler components or cause unreliable operation, resulting in possible severe property damage.

4- wire zone valves may be connected directly to the boiler control.

Connect wiring (continued)

Junction box (furnished)

- Junction box houses electrical connections for all boiler components.
- "P" boilers have harnesses furnished.
- "A" boilers are furnished with burner and limit harnesses.
- All field-provided high voltage wiring must be sheathed in flexible metal conduit.
- Connect incoming line voltage "HOT" wire to service switch, and neutral wire to white wire. Field-install equipment ground wire to green wire with wire nut.
- Service switch (15 amp) is provided with boiler. "A" boilers — install switch as shown.
- Some local codes may require an emergency shut-off switch installed at a location away from boiler. Follow local codes.

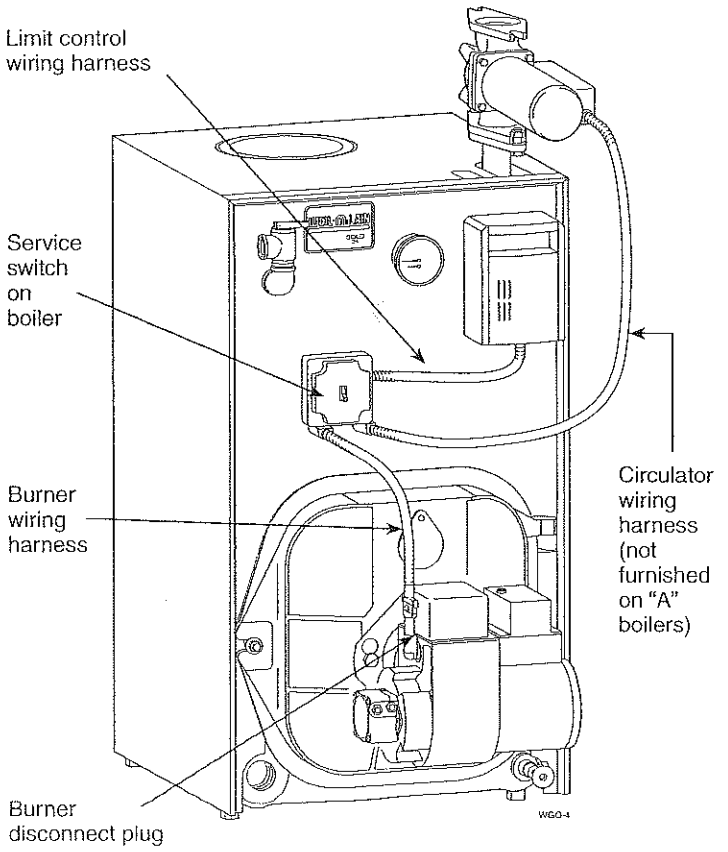
Burner wiring

- Burner harness incorporates a disconnect plug, providing a convenient way to disconnect wiring when burner mounting door is opened.
- All "P" boilers have a power disconnect plug installed on burner.
- On "A" boilers, mount the plug (provided in water trim carton) on the burner housing as shown in Figure 16. For Carlin burners, screw burner plug into threaded conduit coupling, then mount this assembly to the burner housing using the chase nipple. Route wires through housing and make connections in burner junction box as shown in boiler wiring diagram.

High temperature limit

- To comply with ASME, UL 726 or Canadian requirements, an additional high temperature limit is needed.
- Install the secondary control in the supply piping between boiler and isolation valve.
- Set the control to a minimum of 20°F above the set point of the combination control.
- The maximum allowable set point is 220°F.
- Wire the control as shown on page 24.

Figure 16 Boiler wiring for forced hot water



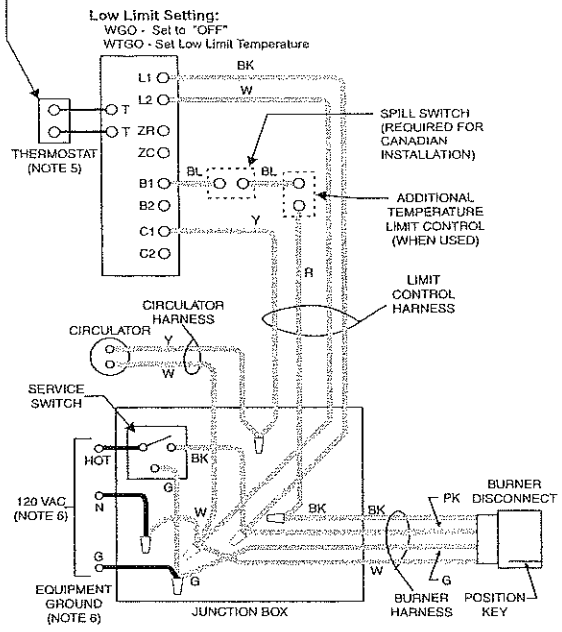
Connect wiring (continued)

Figure 17 Wiring diagram

Boiler Wiring

WARNING Electrical shock hazard — can cause severe injury or death. Disconnect power before installing or servicing.

CAUTION ***DO NOT connect directly from 3-wire zone valves to the T-T terminals on the boiler.*** When using 3-wire zone valves, install an isolation relay. Connect the zone valve end switch wires to the isolation relay coil. Connect the isolation relay contact across the boiler T-T terminals. Failure to comply can result in damage to boiler components or cause unreliable operation, resulting in possible severe property damage.



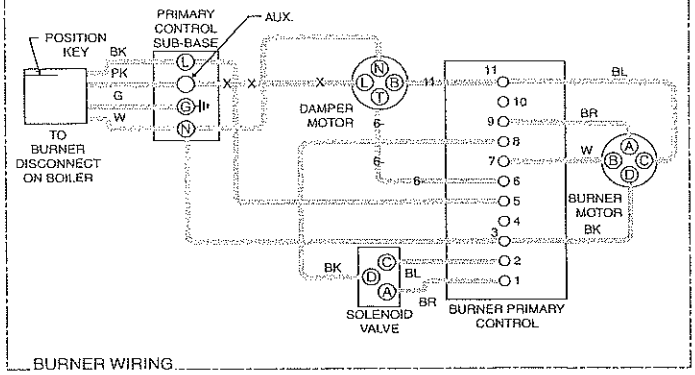
NOTICE Burners with Beckett Clean Cut Pump must be used with a primary control that has a valve-on delay (pre-purge). Controls shown have valve on delay (see control manufacturer's instructions for timings.)

NOTES:

1. All wiring must be installed in accordance with N.E.C. and any other national, state, or local code requirements. For Canadian installations, all wiring must comply with the Canadian Electrical Code.
2. All wiring must be N.E.C. Class 1.
3. Refer to control component instructions packed with the boiler for application information.
4. If any of the original wire as supplied with the appliance must be replaced, use minimum 105 °C wire or equivalent.
5. Set thermostat heat anticipator as per control manufacturer's recommendations.
6. Connect incoming line voltage "HOT" wire to service switch and neutral wire to white wire. Connect ground wire to green wire with wire nut.

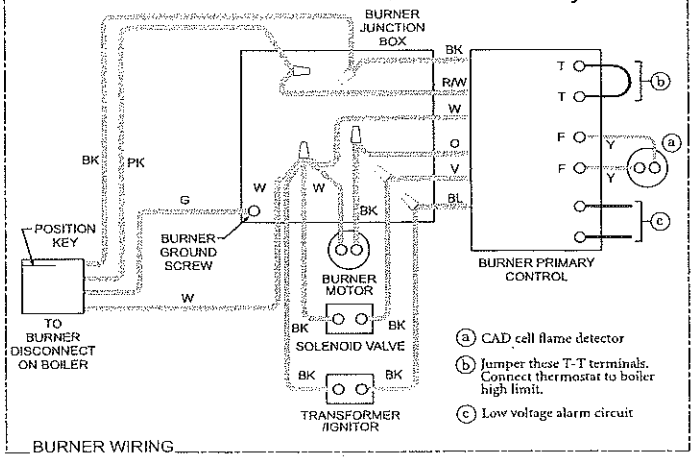
120 VAC FIELD WIRING
LOW VOLTAGE FIELD WIRING
120 VAC FACTORY WIRING
LOW VOLTAGE FACTORY WIRING
<< 1/4" QUICK CONNECT TERMINAL

Riello 530 SE/C Primary Control



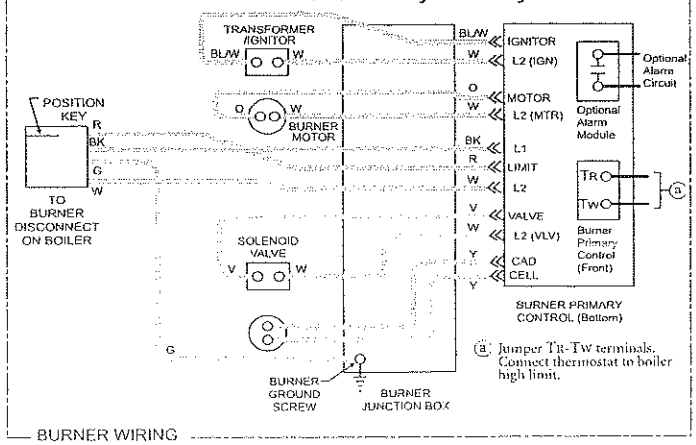
BURNER WIRING

Carlin 60200 Primary Control



BURNER WIRING

Beckett GeniSys Primary Control 7505



BURNER WIRING

WGO	WTGO
2 thru 9	3 thru 9

WGO
- Water without tankless heater

WTGO
- Water with tankless heater

WEIL-McLAIN
Weil-McLain • 500 Blaine St. • Michigan City, IN 46360-2388
PART NUMBER 550-200-018/1211

Connect wiring — blocked vent shutoff switch option

Blocked vent shutoff switch

NOTICE In Canada, blocked vent shutoff switch kit (see parts list page 34) must be installed. See Figure 18. The wiring diagram in Figure 19 shows boiler wiring only up to the burner disconnect. For additional information, refer to manufacturer's instructions.

WARNING Electric shock hazard. Turn off electrical power supply at service entrance panel before making any electrical connections to avoid possible electric shock hazard. Failure to do so can cause severe personal injury or death.

After installing BVSS switch, proceed as follows:

1. Disconnect power.
2. Install Spill Switch (BVSS) Wiring Harness (P/N 591-391-942) as follows:
   a. Remove cover from BVSS Box.
   b. Install straight fitting end of the harness on the BVSS Box. Install elbow (90°) end fitting on the Boiler Junction Box (see Figure 18).
   c. Install both the fork ends to the screw terminals on the BVSS Switch as per the wiring diagram, (see Figure 19).
   d. Replace BVSS box cover.
   e. Locate Combination Control, remove cover, and disconnect red wire from "B1" terminal.
   f. If red wire from Step "e" has uninsulated female end, replace it with insulated female end as supplied in kit.
   g. Connect female end of Spill Switch BVSS Harness (blue wire) to "B1" terminal.
   h. Connect male end of Spill Switch BVSS Harness to the red wire removed in Step "e".
   i. Replace Combination Control Cover.
3. Turn on power and verify safe operation of the appliance.
4. Restore boiler to normal operation.

Figure 18 Blocked vent shutoff switch installation

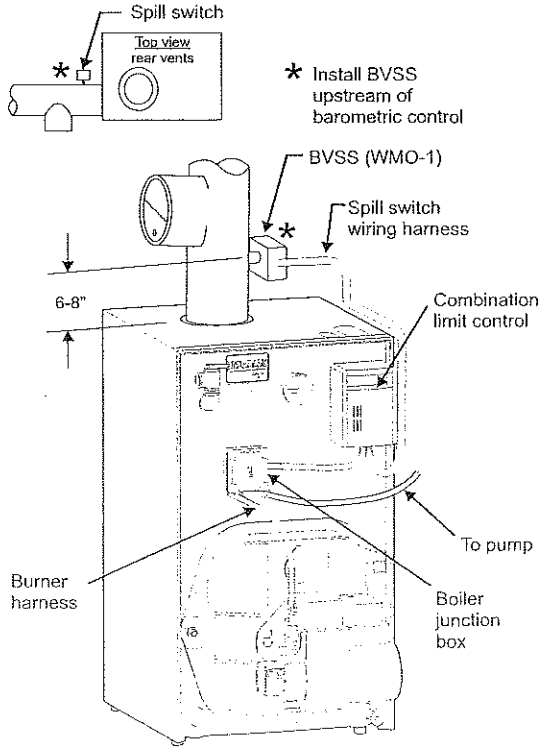
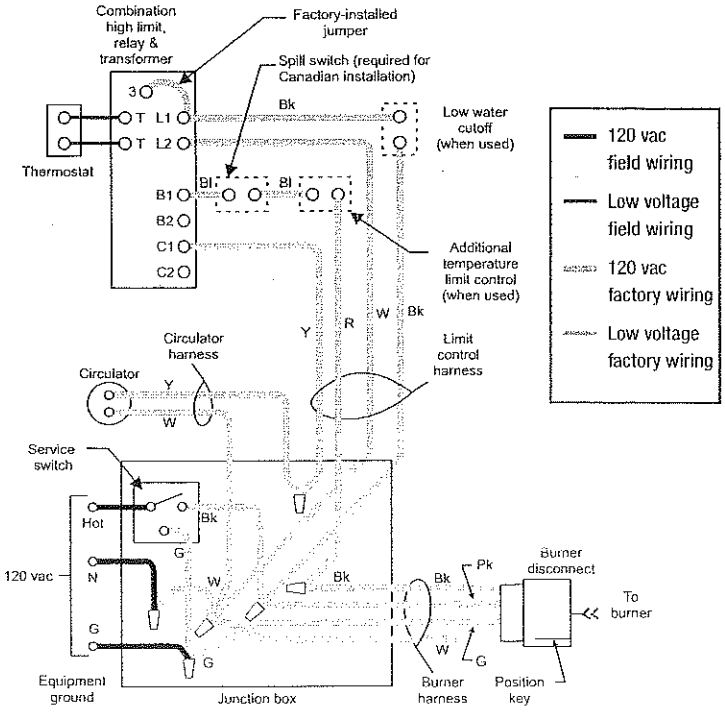


Figure 19 BVSS wiring diagram



Connect oil piping

General oil piping requirements

- Location and installation of oil tanks, oil piping and burners must follow:
  - NFPA 31, Standard for the Installation of Oil-Burning Equipment.
  - In Canada, CSA B139, Installation of Oil-Burning Equipment.
  - Local codes and regulations.
  - Information provided with burner and fuel pump.
- If any part of fuel oil tank is above level of burner, installation of an anti-siphon device is highly recommended to be used to prevent flow of oil in case of oil line break.
- Support oil lines as required by codes.
- Make tank connections with swing joints or copper tubing to prevent breaking in case the tank settles. Make swing joints so they will tighten as tank settles. Non-hardening pipe joint compounds should be used on all threads.

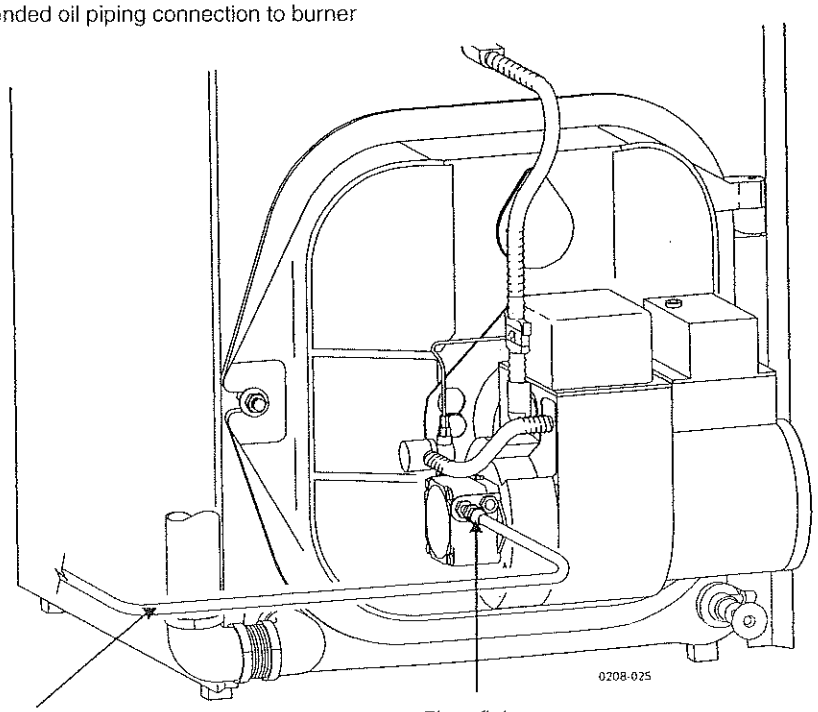
WARNING Do not use Teflon tape as an oil pipe sealant. It can cause valves to fail, creating hazards. Do not use compression fittings.

- Underground pipe must be run in a casing to prevent oil leaking into ground or under floor. Check local codes for information.

Oil piping connection at burner

See Figure 20 for recommended connection at burner, allowing burner mounting door to swing open completely for servicing.

Figure 20 Recommended oil piping connection to burner



Start-up

Fill the system

1. Close manual and automatic air vents and boiler drain cock.
2. Fill to correct system pressure. Correct pressure will vary with each installation. Normal cold water fill pressure for residential systems is 12 psig. Boiler water pH 7.0 to 8.5 is recommended.

NOTICE Failure to maintain recommended pH level can cause section failure and leaks.

3. Open automatic air vent one turn.
4. Open other vents.
   a. Starting on the lowest floor, open air vents one at a time until water squirts out. Close vent.
   b. Repeat with remaining vents.
5. Refill to correct pressure.

When using antifreeze

WARNING Do not use automotive, ethylene glycol, undiluted or petroleum-based antifreeze. Severe personal injury, death or substantial property damage can result.

- Use antifreeze especially made for hydronic systems. Inhibited propylene glycol is recommended.
- 50% solution provides protection to about -30°F. Do not exceed 50% mixture.
- Local codes may require back-flow preventer or actual disconnect from city water supply.
- Determine quantity according to system water content. Boiler water content is listed on back cover of manual. Percent of solution will affect sizing of heat distribution units, circulator and expansion tank.
- Follow antifreeze manufacturer's instructions.
- Do not add cold water to hot boiler. Thermal shock can cause sections to crack.

To place in operation

1. Verify boiler is filled with water.
2. Open burner mounting door and verify rear target wall, floor and burner door insulations are in proper position.
3. Verify burner mounting door is closed tightly and burner wiring harness is connected to junction box.
4. Factory burner adjustment and settings may not be suitable for specific job conditions. See Appendix, page 32.

NOTICE Make final burner adjustments using combustion test equipment to assure proper operation. Do not fire boiler without water. Sections will overheat, damaging boiler and resulting in substantial property damage.

5. Vent air from system. Repeat steps 4 and 5 under "Fill the system." Air in system can interfere with water circulation and cause improper heat distribution.
6. Check boiler and system piping for leaks. See "Tips for water systems" on page 4.
7. Inspect breeching and venting for proper operation.

Check-out procedure

Check off steps as completed

- ❑ Boiler and heat distribution units filled with water?
- ❑ Automatic air vent, if used, opened one full turn?
- ❑ Air purged from system? Piping checked for leaks?
- ❑ Air purged from oil piping? Piping checked for leaks?
- ❑ Flue cap in place and tightened? Burner door closed, sealed and nut tight? Burner plugged in and service switch on?

⚠WARNING Obtain gas-tight seal to prevent possible flue gas leakage and carbon monoxide emissions, leading to severe personal injury or death.

- ❑ Proper draft and burner flame? Final adjustment made with combustion test equipment?
- ❑ Test limit control: While burner is operating, move indicator on limit control below actual boiler water temperature. Burner should go off while circulator continues to operate. Raise setting on limit control above water temperature and burner should re-ignite.
- ❑ Test additional field-installed controls: If boiler has a low water cutoff, additional high limit or other controls, test operation as outlined by the manufacturer. Burner should be operating and should go off when controls are tested. When controls are restored, burner should re-ignite.
- ❑ Limit control set to system temperature requirements (max. 220°F)?
- ❑ For multiple zones, flow adjusted to distribute heat in all zones?
- ❑ Thermostat heat anticipator setting (if available) set properly? Refer to "Connect wiring," page 22.
- ❑ Boiler cycled with thermostat? Raise to highest setting and verify boiler goes through normal start-up cycle. Lower to lowest setting and verify boiler goes off.
- ❑ Observed several operating cycles for proper operation?
- ❑ Set room thermostat(s) to desired room temperature?
- ❑ Completed Installation and Service Certificate below?
- ❑ Reviewed pages 1–7 with owner or maintenance person and instructed person to keep for future reference?
- ❑ Returned all instructions provided with boiler to its envelope and placed with boiler for future reference?

Installation and service certificate

Date Installed: _____

Boiler Model Number: _____ Series: _____

CP Number(s): _____

Measured Btu or GPH Input: _____

- ❑ Installation instructions have been followed.
- ❑ Check-out procedure has been performed.
- ❑ Above information is certified to be correct.
- ❑ Information received and left with owner/maintenance person.

Installer: _____

(Company) (Address) (Phone)

_____

(Installer's Signature)

Annual service check list

	Annual Service Call Checklist (follow in order listed below)	Dates										Comments
1	Check that boiler area is free from combustible materials, gasoline and other flammable vapors and liquids.											
2	Check for and remove any obstruction to combustion and ventilation air flow to boiler.											
3	Check breeching and chimney or vent for obstructions, damage, etc. Repair or replace as necessary.											
4	Clean boiler flueways. See Figure 21, page 30.											
5	Perform service on relief valve and circulator. See page 30.											
6	Check boiler and piping for leaks and repair if found. Check for leaks at tankless heater plate. Tighten nuts only if leaks are found (for WGO torque to 20-25 ft.lbs.).											
7	Inspect and adjust burner. See burner manual and: • change nozzle. • check ignition electrode settings. • clean blower housing and wheel. • make sure blower wheel turns freely. • oil burner motor if required. • clean air inlet. • clean or change fuel filter and strainer.											
8	Make sure boiler is filled with water.											
9	Start unit and verify combustion settings with combustion test equipment. See page 28.											
10	Verify operation of all controls on boiler. See page 28.											
	Any parts of the boiler furnished by Weil-McLain must be replaced by parts listed in Weil-McLain Boiler and Repair Parts Book.											

Controls requiring annual service

Water Relief Valve

Check operation of water relief valve. Follow instructions on label fastened to relief valve.

DANGER Scald potential. Do not check operation of relief valve unless discharge piping has been installed according to Boiler Manual. If piping is not in place, a qualified service technician must properly install piping.

Circulator

Follow oil-lubricating instructions on circulator. Over-oiling will damage circulator.

Water-lubricated circulators do not need oiling.

Detailed service procedures

Cleaning boiler flueways

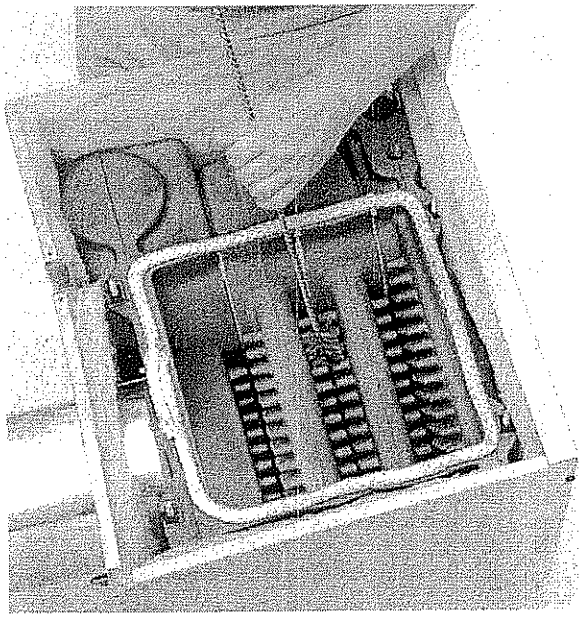
DANGER Make sure all electrical connections to boiler are turned off and wait until boiler is warm, not hot, before cleaning. Failure to do so will result in severe personal injury, death or substantial property damage.

1. **Top flue boilers** -remove breeching and jacket top panel.
   Rear flue boilers - remove jacket top panel.
2. Remove flue collector hood, saving hardware for reassembly.
3. Shut off oil valves. Arrange drip pans under the areas of oil piping that will be disconnected. Disconnect oil line at burner so that you can swing open the door completely.
4. Line combustion chamber floor with newspaper to catch any soot that will be loosened in the cleaning process.
5. Starting at the top of the boiler, use a wire flue brush to thoroughly clean between all pins at all angles. Be careful not to damage side walls of rear refractory.
6. Move to the bottom of the flueways and clean up between the sections to reach pins left uncleaned in step #5.
7. Once the flueways are cleaned, carefully remove the paper from the floor of the combustion chamber.
8. Verify sealing rope around flue area is intact. Visually check condition and position of insulation in combustion chamber floor, and the refractories at the rear of boiler and in the burner mounting door. Replace any parts as necessary.
9. Close burner mounting door and tighten nut securely. Place flue collector hood on top of boiler. Secure with hardware from step #2.

WARNING Maintain a gas-tight seal to avoid possible flue gas leakage and carbon monoxide emissions, which can lead to severe personal injury or death.

10. Check breeching for sooting and clean if necessary. Install jacket top panel and breeching.
11. Reconnect oil line and all electrical connections.

Figure 21 Thoroughly clean flueways between all pins at all angles. Start on top of boiler, finish from the bottom.



General description of control operation

Automatic air vent

Air is released when cap is unscrewed one turn. If air vent leaks, remove small cap on top of vent, push in stem of valve and then release to clean valve seat. Screw cap completely on, then unscrew one turn.

Temperature limit control

If high boiler water temperature occurs, control shuts down burner, but allows circulator to run as long as there is a call for heat. Limit should be set higher than temperature needed for the system.

Maximum limit setting is 220°F.

Water relief valve

Provides discharge if boiler pressure exceeds 30 psig.

Circulator

Circulator provides forced water circulation through boiler and piping system.

Pressure-temperature gauge

Provides reading of boiler pressure and temperature. Maximum boiler pressure is 50 psig, maximum water temperature is 220°F. Temperature will vary according to system and daily heating demands. The range will be from room temperature up to limit control setting.

Handling ceramic fiber and fiberglass materials

REMOVAL OF COMBUSTION CHAMBER LINING OR BASE PANELS

WARNING The combustion chamber lining or base insulation panels in this product contain ceramic fiber materials. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1).":

Precautionary measures

- ❑ Avoid breathing fiberglass dust and contact with skin or eyes.
  - Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for fiberglass wool at the time this document was written. Other types of respirators may be needed depending on the job site conditions. Current NIOSH recommendations can be found on the NIOSH web site at http://www.cdc.gov/niosh/homepage.html. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this web site.
  - Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- ❑ Apply enough water to the combustion chamber lining or base insulation to prevent airborne dust.
- ❑ Remove combustion chamber lining or base insulation from the boiler and place it in a plastic bag for disposal.
- ❑ Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

NIOSH stated First Aid

- ❑ Eye: Irrigate immediately
- ❑ Breathing: Fresh air

REMOVAL OF FIBERGLASS WOOL

or

INSTALLATION OF FIBERGLASS WOOL OR BASE PANELS:

WARNING This product contains fiberglass jacket insulation and ceramic fiber materials in combustion chamber lining or base panels in gas fired products. Airborne fibers from these materials have been listed by the State of California as a possible cause of cancer through inhalation.

Precautionary measures

- ❑ Avoid breathing fiberglass dust and contact with skin or eyes.
  - Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for fiberglass wool at the time this document was written. Other types of respirators may be needed depending on the job site conditions. Current NIOSH recommendations can be found on the NIOSH web site at http://www.cdc.gov/niosh/homepage.html. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this web site.
  - Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- ❑ Operations such as sawing, blowing, tear out, and spraying may generate airborne fiber concentration requiring additional protection.
- ❑ Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

NIOSH stated First Aid

- ❑ Eye: Irrigate immediately
- ❑ Breathing: Fresh air

Close clearance installation

⚠WARNING To provide close clearances as described on pages 26 and 27:

Obtain the Close Clearance Kit, Weil-McLain Part No. 386-500-050. Install the kit as described below. Failure to use kit or install as described can result in a fire hazard, causing severe personal injury, death or substantial property damage.

Close clearance installation

Substitute these instructions for corresponding material in manual. All other procedures and practices must remain the same.

Recommended service and minimum clearances shown on page 8 should be used where possible. Where closer clearances are required:

- Top of boiler — If less than 24" available, provide removable surface to allow for cleaning boiler flueways.
- Right or left side — Minimum 2 inches.
- Front — Minimum 2 inches from burner.
- Double-wall flue pipe to combustible surface — as listed in Table 5, page 33 and Figure 24 through Figure 26, page 33.

NOTICE Jacket cap must be in place on boiler to avoid requiring an 9" minimum clearance from back or top of boiler to combustible material. Flue pipe clearances must take precedence over jacket clearances.

1. Install boiler using clearances described at left.
2. Install barometric control 18-20 inches from boiler in breeching.
3. Attach manual reset temperature switch near upper surface of enclosed area. See Figure 22.
4. Wire switch in series with thermostat. See Figure 23.
5. Provide two combustion/ventilation openings when installing in confined space. Size opening 140 sq. in. (1000 Btu) per 1 GPH input. Locate openings near top and bottom of enclosed space.

Burner adjustments for packaged and non-packaged boilers

⚠WARNING Final burner adjustments must be made using combustion test equipment to assure proper operation. Do not fire boiler without water or sections will overheat.

1. Refer to burner manual for start-up.
2. Allow boiler to heat to design condition.
3. Using combustion test equipment, adjust burner for:
   a. CO2 between 11% and 12% and 0 smoke.
   b. -0.01" to -0.02" W.C. draft in combustion chamber.

Figure 22 Manual reset temperature switch location

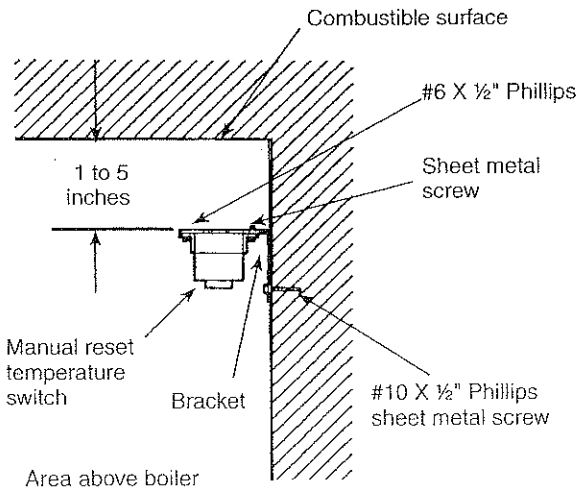
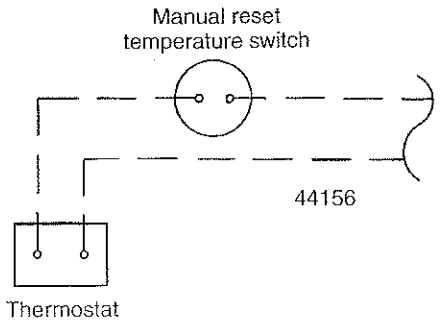


Figure 23 Manual reset temperature switch wiring



Close clearance installation (continued)

Figure 24 Flue pipe clearances

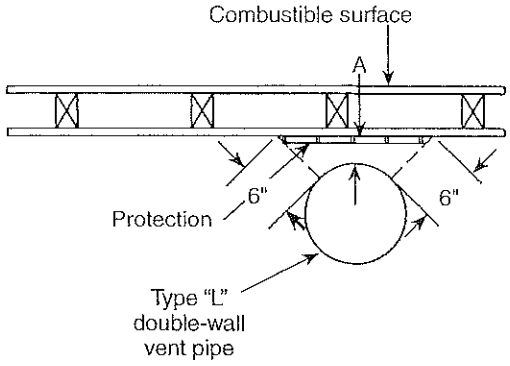


Table 5 Protection required for clearances less than 6 inches from doublewall vent pipe*

Dimension A When desired minimum clearance from Type "L" double-wall vent pipe to combustible surface is:	Use the following protection**:
3"	½" thick insulation board *** over one-inch glass fiber or mineral wool batts+
2"	24 gauge sheet metal with one-inch ventilated air space
3"	½" thick insulation board *** with one-inch ventilated air space

* All clearances measured from outer surface of equipment to combustible surface, not to the protection used.

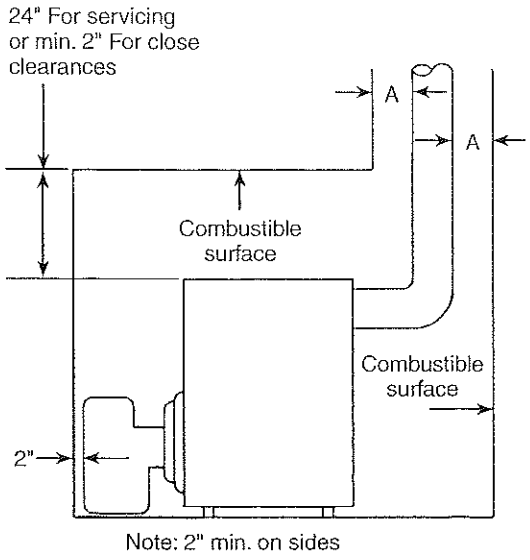
** Apply to combustible surface unless otherwise noted. Cover all surfaces as specified in Table and Figure 24. Thicknesses are minimum.

*** Factory-fabricated board made of non-combustible materials, normally fibers, having thermal conductivity in range of one (Btu-inch)/(hr./sq. ft./°F) or less.

\+ Mineral wool batts (blanket or board), having min. density of 8 lb/ft3 and a min. melting point of 1500°F.

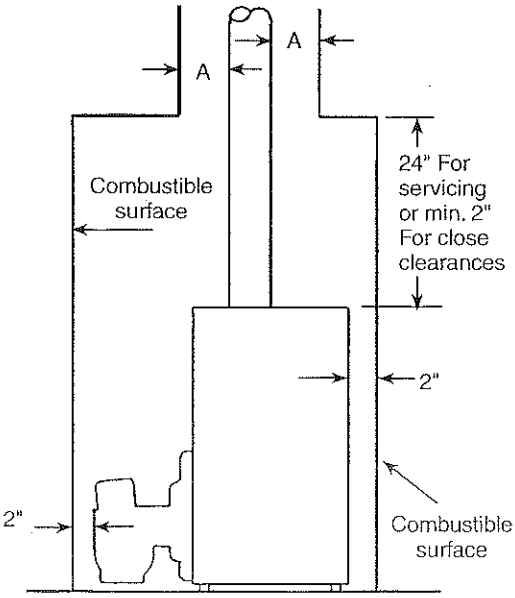
Other dimensions available. Refer to NFPA-31.

Figure 25 Back vent clearances



Note: 2" min. on sides

Figure 26 Top vent clearances



Note: 2" min. on sides

Replacement parts

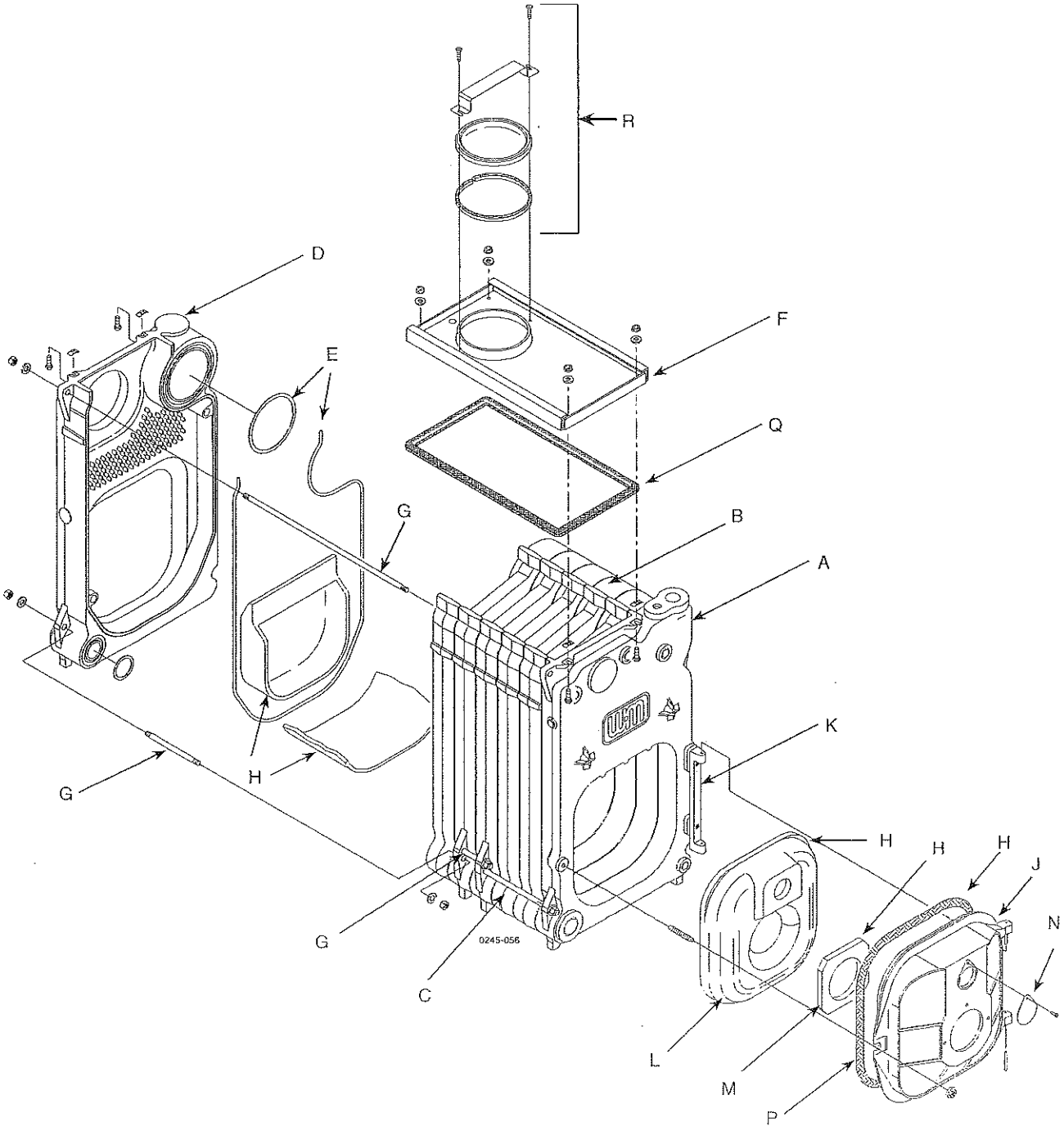
Table 6 Series 3 section and flue collector parts

Item	Description	Part no.
A	Regular front section 7022	316-700-215
B	Wide intermediate section (WGO-3) 7010	316-700-075
B	Narrow intermediate section 7015	316-700-065
C	Intermediate section w/draw rod lugs 7016	316-700-070
D	Back section w/7" flue, supply & 2" return 7027	316-700-235
E	Section replacement kit (for 1 joint, includes seals, rope, adhesive and collector hood hardware) front or back section	386-700-852
	Section replacement kit (for 2 joints, includes seals, rope and adhesive) intermediate section	386-700-851
	Section assembly complete, for WGO-2	386-700-650
	Section assembly complete, for WGO-3	386-700-651
	Section assembly complete, for WGO-4	386-700-652
	Section assembly complete, for WGO-5	386-700-653
	Section assembly complete, for WGO-6	386-700-654
	Section assembly complete, for WGO-7	386-700-655
	Section assembly complete, for WGO-8	386-700-656
	Section assembly complete, for WGO-9	386-700-657
F	Collector hood kit for WGO-2*	386-700-336
F	Collector hood kit for WGO-3*	386-700-337
F	Collector hood kit for WGO-4*	386-700-337
F	Collector hood kit for WGO-5*	386-700-338
F	Collector hood kit for WGO-6*	386-700-339

Item	Description	Part no.
F	Collector hood kit for WGO-7*	450-020-188
F	Collector hood kit for WGO-8*	450-020-189
F	Collector hood kit for WGO-9*	450-020-190
G	Tie rod ½ x 5½ (WGO-7, 8, 9)	560-234-464
G	Tie rod ½ x 10¾ (WGO-2 & 7)	560-234-491
G	Tie rod ½ x 12 (WGO-7)	560-234-492
G	Tie rod ½ x 14 (WGO-3, 4, 8, 9)	560-234-470
G	Tie rod ½ x 15 (WGO-9)	560-234-495
G	Tie rod ½ x 17 (WGO-5)	560-234-472
G	Tie rod ½ x 20 (WGO-6)	560-234-534
G	Tie rod ½ x 23¼ (WGO-7)	560-234-538
G	Tie rod ½ x 26⅜ (WGO-8)	560-234-542
G	Tie rod ½ x 29½ (WGO-9)	560-234-497
H	Combustion chamber kit (rear & frt. ref., door ref. blanket, rope, blanket & water glass)	386-700-355
	Burner mounting door assembly (door, obs. port, rope, ins. & pins)	386-700-358
J	Burner mounting door 7070	330-054-302
K	Door hinge 7054	330-054-300
L	Door refractory	386-700-359
M	Door refractory blanket	591-222-115
N	Observation port shutter	460-039-867
P	Door seal rope 5'	590-735-104
Q	⅜" Glass rope for collector hood (7' for largest size hood)	590-735-109
R	Flue cap assembly (cap, strap, rope & screws)	386-700-344
	Flue brush 123D	591-706-214
	Blocked vent shutoff switch (Canada only)	511-624-650
*	Includes flue cap assembly, rope and hardware for installation.	

Replacement parts (continued)

Figure 27 Parts drawing



NOTICE Repair parts must be purchased through Weil-McLain for the specific boiler as indicated in the list below. Results from using modified or other manufactured parts will not be covered by warranty and may damage boiler or impair operation.

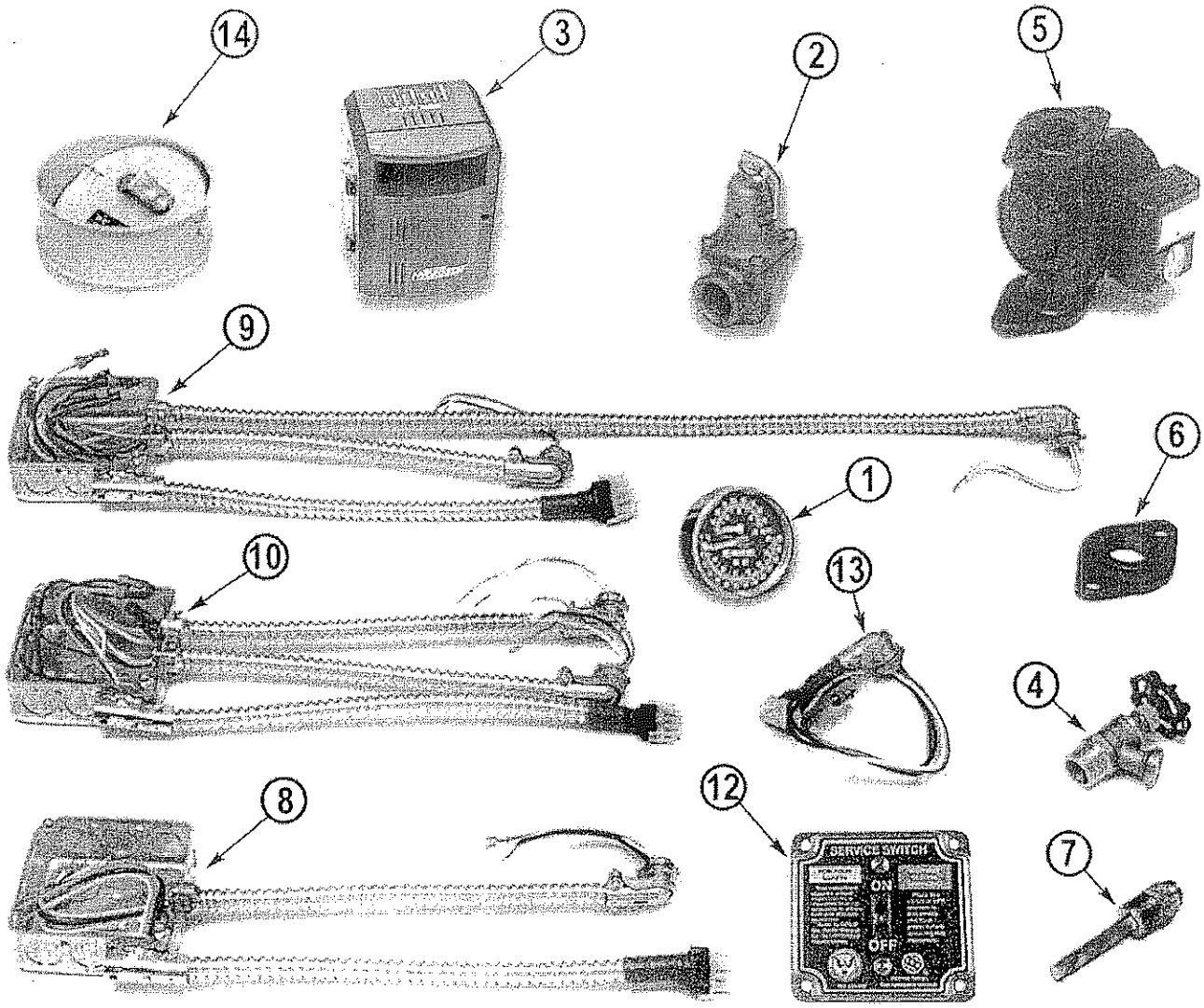
Replacement parts (continued)

Table 7 Series 3 trim parts

Fig. No.	Part no.	Description	Mfr.	Mfr. part no.
1	380-000-000	Combination pressure-temperature gauge kit, 60° – 360° F., 0 - 75 psi, 3⅛" dia., ¼" NPT, short shank, with ¼" x ½" reducing bushing	Weil-McLain	
2	511-546-920	ASME pressure relief valve, set to relieve at 30 PSIG, ¾" male inlet, ¾" female outlet	Conbraco	M330
3	381-300-000	Electronic aquastat, high limit or combination high/low limit, with LWCO, high limit 100° – 220°, low limit 110° - 200°, circulator amps: 5.8 FLA, anticipator: 0.2 amps	Hydrolevel	3250
4	511-210-423	Drain cock, ¾", 1½" shank	Conbraco	31-606-01
	511-246-392	Drain cock, ¾"	Hammond	710
		Drain cock, ¾"	Watts	BD2C
		Drain cock, ¾"	Matco-Norca	
		Drain cock, ¾"	Nibco	#74
5	511-405-113	Circulator, 1/25 HP, 120/60/1 motor, 175 RPM, 0.75 amps	Taco	W007F
6	381-354-526	Circulator universal hardware kit 1¼" (Includes: (1) Flange, (1) Gasket, (2) Screws and (2) nuts) for sizes 2, 3 & 4 only	Weil-McLain	
	381-354-531	Circulator universal hardware kit 1½" (Includes: (1) Flange, (1) Gasket, (2) Screws and (2) nuts) for sizes 5 & 6 only	Weil-McLain	
7	592-300-026	¾" NPT well, 4.25" long	Hydrolevel	
8	591-391-846	Junction box - wiring harness assembly (series 1 A & B only)	Weil-McLain	
9	591-391-856	Junction box - wiring harness assembly (series 1 only - large pump)	Weil-McLain	
10	591-391-836	Junction box - wiring harness assembly (series 2 & 3 packaged only)	Weil-McLain	
11	591-391-837	(Not shown) Junction box - wiring harness assembly (series 2 & 3 A & B only)	Weil-McLain	
12	591-391-854	Junction box cover assembly with service switch	Weil-McLain	
13	591-391-850	Burner harness assembly	Weil-McLain	
14	510-512-267	Barometric damper	Weil-McLain	
15	426-700-268	(Not shown) Flue pipe brackets (set of 2)		

Replacement parts (continued)

Figure 28 Series 3 trim



Replacement parts (continued)

Table 8 Weil-McLain part numbers

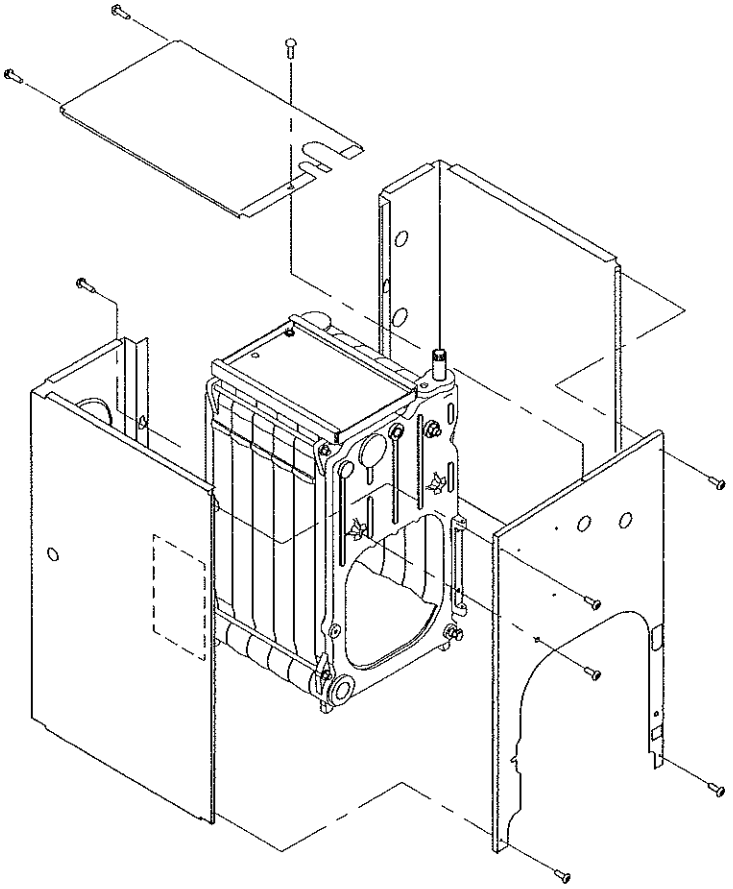
Model	1		2			3
	Jacket panel with insulation — front		Left side and rear		Right side and rear	Top panel with cap
	UL	Non-UL	UL	Non-UL		
WGO-2	381-355-494	381-355-593	381-355-495	381-355-496	426-700-250	381-355-497
WGO-3	381-355-494	381-355-593	381-355-498	381-355-499	426-700-252	381-355-500
WGO-4	381-355-494	381-355-593	381-355-501	381-355-502	426-700-252	381-355-771
WGO-5	381-355-494	381-355-593	381-355-503	381-355-504	426-700-254	381-355-505
WGO-6	381-355-494	381-355-593	381-355-506	381-355-507	426-700-256	381-355-508

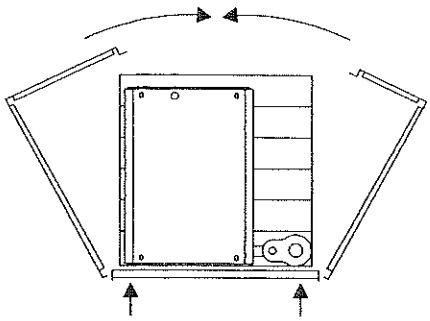
Complete Jacket cartons		
	UL	Non-UL
7 section	416-700-170	416-700-171
8 section	416-700-172	416-700-173
9 section	416-700-174	416-700-175

Common jacket parts for all boilers	
Plastic flue cap cover w/insulation	560-907-687
Jacket hardware kit	386-700-853
Touch up paint, gold spray can	592-000-000

Replacement parts (continued)

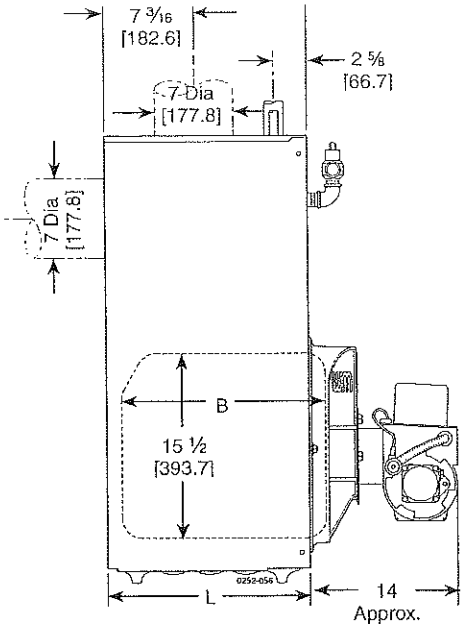
Figure 29 Boiler jacket



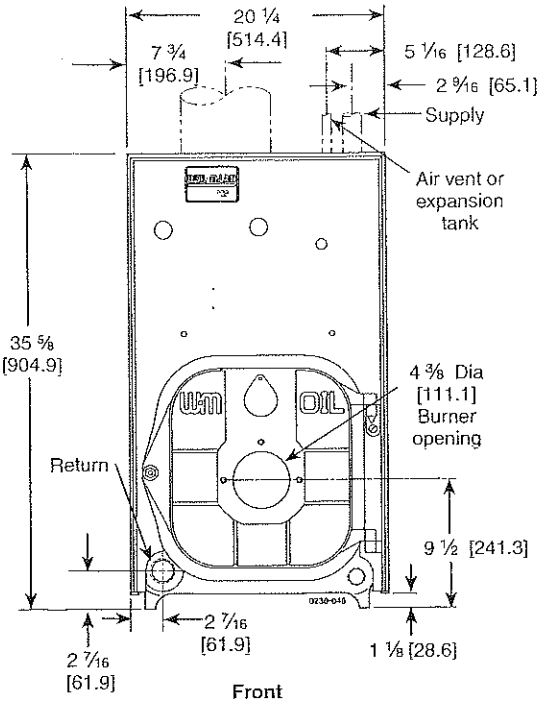


Dimensions

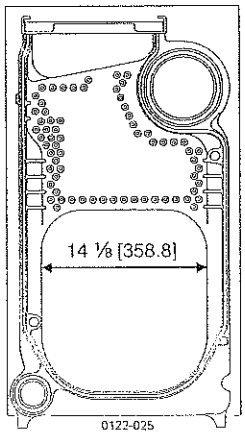
Figure 30 WGO dimensions — inches (mm) — see Table 9, page 41



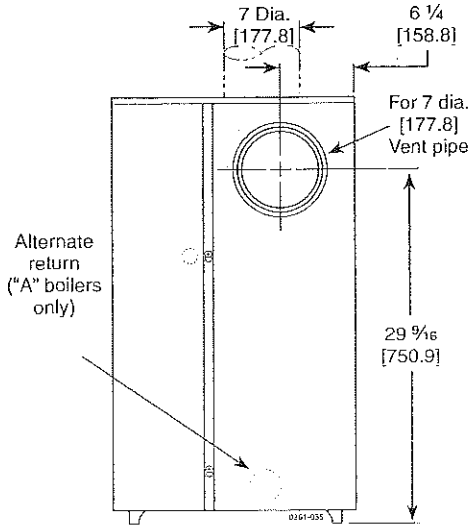
Left side



Front



Intermediate



Back

Dimensions (continued)

Table 9 Dimensions

BOILER MODEL NUMBER	B		L	
	Inches	mm.	Inches	mm.
WGO-2	10 ½	266.7	13 ¾	349.2
WGO-3	13 ½	342.9	16 ⅞	428.7
WGO-4	13 ⅝	345.9	16 ⅞	428.7
WGO-5	16 ⅞	428.7	20	508.0
WGO-6	20	508	23 ⅛	587.2
WGO-7	23 ⅛	587.2	26 ¼	666.7
WGO-8	26 ¼	666.7	29 31/32	746.2
WGO-9	29 ⅜	746.2	32 ½	825.5

Ratings

Table 10 GOLD WGO oil water boiler ratings

Boiler Model Number (9)	I=B=R Burner Capacity GPH (3)	DOE Heating Capacity MBH (4) (2)	Net I=B=R Ratings (5) MBH (2)	DOE Seasonal Efficiency % Afue	Minimum I=B=R Chimney			Round Flue Outlet Size In (7)	Boiler Water Content Gallons	Draft Loss Thru Boiler In W.C. (8)
					Rect In	Round In	Height Ft			
*WGO-2	0.70	86	75	86.4	8 x 8	6	15	7	11.0	0.010
*WGO-2PLUS	0.95	114	99	85.3						0.010
*WGO-3R	0.80	98	85	86.2	8 x 8	6	15	7	14.9	0.020
*WGO-3	0.95	115	100	85.3						0.020
*WGO-4R	1.00	122	106	86.2	8 x 8	6	15	7	13.4	0.010
*WGO-4	1.20	145	126	85.0						0.010
*WGO-5R	1.20	147	128	86.1	8 x 8	7	15	7	15.9	0.015
*WGO-5	1.45	175	152	85.0						0.015
*WGO-6R	1.40	171	149	86.1	8 x 8	7	15	7	18.4	0.015
*WGO-6	1.75	212	184	85.0						0.015
*WGO-7R	1.60	196	170	86.0	8 x 8	8	15	7	20.8	0.015
*WGO-7	2.00	242	210	85.0						0.015
**WGO-8	2.30	266 (6)	231	-	8 x 12	8	20	7	23.3	0.025
**WGO-9	2.55	295 (6)	257	-					25.8	0.030

* Substitute "P" for completely assembled packaged boiler without burner (WGO-3 through WGO-6 only). Substitute "A" for boiler only for use with approved burners as listed with I=B=R.

** Available only as an "A" unit.

(1) WGO boiler designed with convertible vertical and horizontal flue outlet.

(2) MBH refers to thousands of Btu per hour.

(3) Based on 140,000 Btu/gal.

(4) Based on standard test procedures prescribed by the United States Department of Energy at combustion condition of 13.5% CO_2 and -0.02" W.C. draft overfire.

(5) Net I=B=R ratings are based on net installed radiation of sufficient quantity for the requirements of the building and nothing need be added for normal piping and pick-up. Water ratings are based on a piping and pick-up allowance of 1.15. An additional allowance should be made for unusual piping and pick-up loads. Consult local Weil-McLain Sales Office.

(6) I=B=R gross output

(7) See page 12 for minimum breeching diameter.

(8) Listed draft losses are for factory-shipped settings.

(9) Boiler model suffixes: "R" designates a reduced input version. NOTE: A burner nozzle change is required — refer to the burner instructions or boiler's rating label for correct selection.

Notes

GOLD WGO OIL-FIRED NATURAL DRAFT WATER BOILER – SERIES 3 – Boiler Manual

WEIL-McLAIN®

Weil-McLain
500 Blaine Street
Michigan City, IN 46360-2886
http://www.weil-mclain.com

Part Number 550-141-526/1215

Division 23

EX-1
Flexcon Hydronic Expansion Tank

Make:	Flexcon
Model:	SXHT 40
Capacity:	20 Gallons
Serial #:	N/A

Specifications

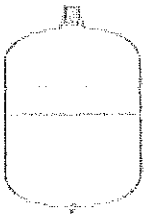
HTX & SXHT Series
Hydronic Expansion Tanks

Dimensions and Capacities

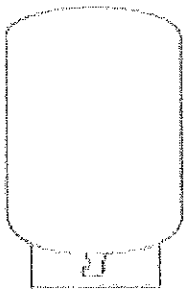
Model	Capacity Gallons	Maximum Acceptance Volume	System Connection	Dimensions (inches) Diameter	Height	Weight (lbs)
HTX 15	2.1	1.0	1/2" MNPT	8.0	12.5	5.5
HTX 30	4.5	2.5	1/2" MNPT	11.0	14.0	10.0
HTX 60	6.0	3.0	1/2" MNPT	11.4	17.2	11.5
HTX 90	15.0	6.0	3/4" MNPT	16.0	20.8	28.0
SXHT 30	15.0	6.0	1" FNPT	16.0	21.7	32.0
SXHT 40	20.0	8.0 11.0	1" FNPT	16.0	28.8	39.0
SXHT 60	33.0	13.3	1" FNPT	16.0	42.8	57.0
SXHT 90	44.0	17.7	1 1/4" FNPT	21.0	36.2	72.0
SXHT 110	62.0	24.9	1 1/4" FNPT	21.0	47.9	112.0
SXHT 160	81.0	32.6	1 1/4" FNPT	21.0	62.0	123.0

Maximum Working Pressure 100 PSI • Factory Pre-Charge 12 PSI • Maximum working Temperature 220°F

HTX Series

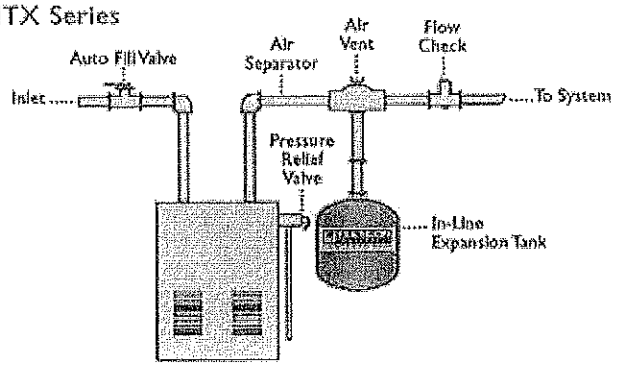


SXHT Series

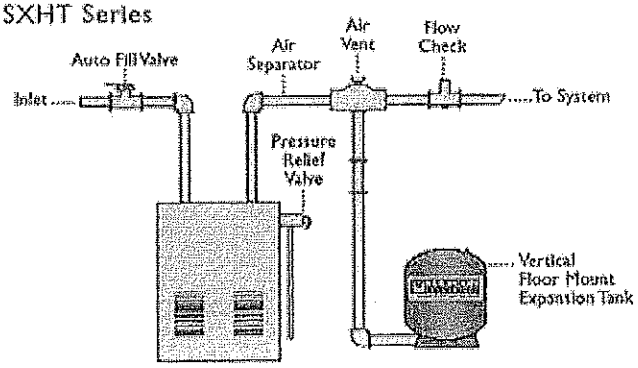


Typical Installations

HTX Series



SXHT Series



Quick Sizing Guide

Boiler Output 1000's BTU	Finned Tube Baseboard (Copper)	Type of Radiation: Convectors & Unit Htrs	Cast Iron: Radiators	Cast Iron: Baseboard
25	HTX 15	HTX 15	HTX 15	HTX 15
50	HTX 15	HTX 30	HTX 30	HTX 30
75	HTX 30	HTX 30	HTX 60	HTX 60
100	HTX 30	HTX 30	HTX 60	HTX 60
125	HTX 30	HTX 60	HTX 60	HTX 60
150	HTX 30	HTX 60	HTX 90	HTX 90
175	HTX 60	HTX 60	HTX 90	HTX 90
200	HTX 60	HTX 60	HTX 90	HTX 90
250	SXHT 30	SXHT 30	SXHT 40	SXHT 30
300	SXHT 30	SXHT 40	SXHT 40	SXHT 30
350	SXHT 30	SXHT 40	SXHT 60	SXHT 40
400	SXHT 30	SXHT 60	SXHT 90	SXHT 40
500	SXHT 40	SXHT 60	SXHT 90	SXHT 40
600	SXHT 40	SXHT 90	SXHT 90	SXHT 60
700	SXHT 60	SXHT 90	SXHT 90	SXHT 60
800	SXHT 60	SXHT 110	SXHT 110	SXHT 90
900	SXHT 60	SXHT 110	SXHT 110	SXHT 90
1000	SXHT 90	SXHT 110	SXHT 110	SXHT 90

23 21 14

SARAMANDIT CONSTRUCTION LTD.
SHOP DRAWING REVIEWED
BY
APR 15 2013

Stantec

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

April 23, 2013

By:

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all subtrades.

STANTEC ARCHITECTURE LTD.

FLEXCON INDUSTRIES
ING & HEATING DIVISION

Flexcon Industries
300 Pond Street
Randolph, Massachusetts 02368

For More Information
Call 1.781.986.2424
Fax 1.781.986.2029
www.flexconind.com

Division 23

P-3.5
Axiom Pressure Pal Mini Glycol Feeder System c/w Alarm Panel (Model: RIA10-1-SAA)

Make:	Axiom
Model:	MF-200
Capacity:	6.0 US Gallons
Serial #:	N/A

AXIOM INDUSTRIES LIMITED

MODEL MF200 'PRESSURE PAL' MINI SYSTEM FEEDER

The 'PRESSURE PAL' is ideal for feeding and pressurizing closed hydronic systems that do not require cold static fill pressures higher than 18 psig. It is compatible with both water and glycol/water solutions. Perfect for small boiler/chiller systems, snow/ice melt circuits, outside air heating/cooling glycol coils, solar heating systems.

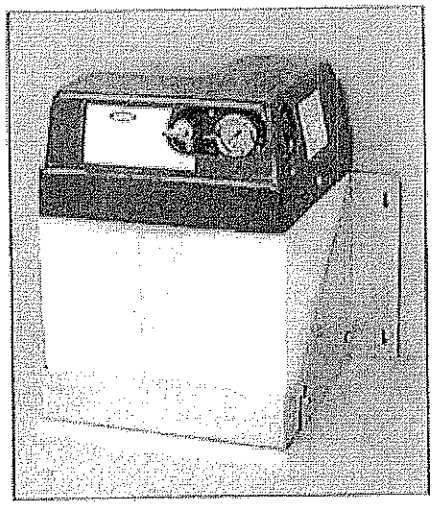


Fig. 1: Shown with Optional Tank Shelf

FEATURES and BENEFITS

- *6.0 US gallon (22.7 liter) tank for storage and mixing*
- *Power supply plugs into any standard 115 VAC outlet*
- *Diaphragm pump can run dry without damage*
- *No direct connection to potable water supply eliminates need for backflow prevention*
- *Make-up fluid stored in the feeder tank can be pre-treated*
- *Diverter valve allows easy purging of air on initial start-up, and manual agitation of solution*
- *Prevents major floods - in the event of system rupture, only the contents of the tank will be pumped into the system*
- *Provides leak detection - dropping fluid level provides immediate notice that the system has developed a leak*
- *Fluid drained for service can easily be put back into the system*
- *Fluid level switch shuts the pump off if the storage tank level gets too low*
- *Auxiliary dry contact included for remote low pressure alarm (alarm optional or by others)*

Represented By:

Stantec

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

April 23, 2013

By: _____

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design intent. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all subtrades.

STANTEC ARCHITECTURE LTD.

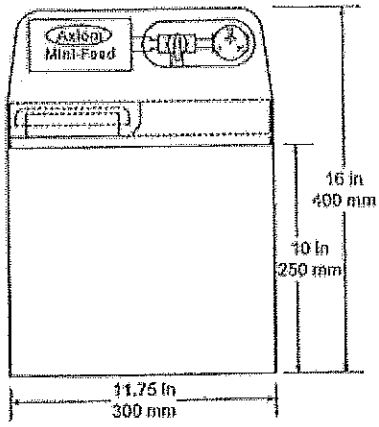
APR 15 2013

SLS-04-0302

AXIOM INDUSTRIES LIMITED

MF200 HYDRONIC SYSTEM FEEDER TECHNICAL INFORMATION

WEIGHT - 7 lbs., 3.2 kg



Depth - 11.75 in 300 mm
Clearances - Sides and Top - 12 in 305 mm
Weight When Full 60 lbs/27 kg.
Discharge 1/4" FPT

ELECTRICAL

Power supply adapter
115/60/1 to 24 VDC
Rated 50 watts AC

PUMP PERFORMANCE

0.04 l/s (0.7 gpm) @ free flow
Self-priming up to 1.2 m (4 feet)

SPECIFICATION

Hydronic system feeder shall be AXIOM INDUSTRIES LTD. model MF200. System shall include 25 litre (6.6 U.S. gallon) storage/mixing tank with molded-in level gauge, 125 mm (5") fill/access opening and cover; pump suction hose with inlet strainer and check valve; pressure pump with fuse protection; low fluid level pump cut-out float switch; manual diverter valve for purging air and agitating contents of storage tank; pressure switch with snubber and two sets of SPST contacts, each individually adjustable from 55 kPa (8 psig) to 125 kPa (18 psig) cut-out pressure; and liquid filled pressure gauge. Unit to be c/w power supply adapter, 115/60/1 to 24 VDC 50 watts AC, supplied loose for field installation.

Feeder shall be compatible with glycol solutions of up to 50% concentration. Pump shall be capable of running dry without damage. The second set of contacts in the pressure switch shall be wired to a terminal strip for use as low pressure alarm contacts for remote alarm circuit supplied by others. Unit shall be completely assembled.

OPTIONS

☐ SMW003 – Tank Mounting Shelf
☐ RIA10-1-SAA – Low Level Alarm Panel c/w Remote Monitoring Dry Contacts and Selectable Audible Alarm

LIMITED WARRANTY

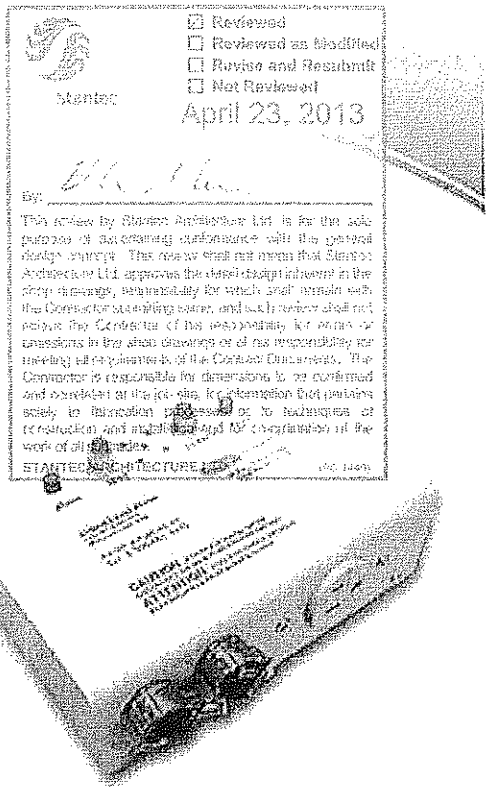
The MF200 is warranted against defects in materials and workmanship for one year.

Project _____ Location _____

Consultant _____ Contractor _____

Unit Tag _____ Sales Agent _____

AXIOM INDUSTRIES LTD.



Optional Accessories:

Alarm Panel (Model RIA10-1-SAA)

DESCRIPTION:
Alarm panel shall incorporate a power supply cord, pump/alarm relay, power on and alarm indicating lights, alarm buzzer, test switch, silence/off switch, float switch and receptacle for SF100 power supply cord. On a low-level condition the SF100 will be disabled, the alarm will sound and a set of dry contacts will close. (For remote indication if connected to a DCS.) The alarm buzzer may be disconnected by removing a jumper in the alarm circuit.

SPECIFICATIONS:

Electrical Rating Motors: ¼ hp at 115 Volts/230 Volts

Cable: Neoprene, Type SJOW No. 16/2 (7.6 mm Dia.)

Temperature: 140° F (60° C)

Panel Dimensions: 153mm (6 in) x 120mm (4.75 in) x 55mm (2.25 in)

AXIOM INDUSTRIES LIMITED 2615 WENTZ AVENUE SASKATOON, SK S7K 5J1
TOLL FREE : (877) 651-1615 PHONE : (306) 651-1615 FAX : (306) 242-3373
www.axiomind.com

AXIOM INDUSTRIES LIMITED

Installation, Operation & Maintenance Instructions for MF Series Solution Feeders

En Français Page 12

Startup Procedure

1) Close isolation valve between feeder and system connection point
2) Fill reservoir, turn valve on feeder to mix/purge and plug in
3) Ensure pump is cycling fluid through reservoir (primed)
4) Turn valve to run and open isolation valve to system

2615 Wentz Avenue, Saskatoon, SK S7K 5J1 Ph: (306) 651-1815 Fax: (306) 651-2293
email: sales@axiomind.com website: www.axiomind.com

AXIOM INDUSTRIES LIMITED

MF200 and MF300 HYDRONIC SYSTEM FEEDER

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

The System Feeder is used to maintain a minimum system pressure within a hydronic heating or cooling system. It should be used to pressurize the system while system temperature is at it's lowest.

Installation Instructions

1. Set System Feeder on a secure and level base or in the optional tank shelf.
2. Connect the unit to the system using copper or plastic tubing. Ensure that there is a system isolation valve installed to allow for isolation of the unit. **DO NOT INSTALL A CHECK VALVE OR PRESSURE REGULATOR BETWEEN SYSTEM FEEDER AND SYSTEM.**
3. Mount power supply and secure with mounting bracket. Do not power up System Feeder until a system connection is made, isolation valve is closed and Feeder valve is set to mix.
4. If the System Feeder will be connected to an alarm system connect alarm circuit to terminals below discharge connection.
5. Install proper water/glycol mix in the tank to a level above minimum level indication on tank scale. A 30-50% Polypropylene Glycol is Recommended.
6. **Close system isolation valve, turn feeder valve to vertical position (mix position).**
7. Insert DC plug into the System Feeder first, and then plug power supply into 120v outlet. The red LED in the power supply cord should light up. If it does not, check the fuse and power receptacle.
8. Once the pump is primed, turn the feeder valve handle to horizontal position (run position), open system isolation valve and allow pump to pressurize system. If system pressure is below pressure switch setting (18 psi), the pump will start. The System Feeder will run until system is pressurized to approximately 18 psi. and shut-off. It may cycle rapidly a number of times while system pressure stabilizes and while air is removed from the system. The cycling will stop once system pressure rises above 18 psi due to thermal expansion.
9. If a higher fill pressure is required (up to 25 psi) the internal pressure switch may be adjusted by turning the center adjusting screw clockwise to increase pressure. Access to the pressure switch can be gained by lifting the left side of the top cover.
10. The MF200 is shipped with a small amount of 50% propylene glycol (non-toxic) in the discharge tubing between the pump and the check valve. This is to aid in priming.

Please note that the pressure gauge supplied with the unit may read differently from another gauge, which may be installed elsewhere in the system. This may be due to gauge calibration or differences in elevation within the system and should not be a concern.

The System Feeder does not require any scheduled maintenance. Should you wish to test pump operation, turn mix/purge valve to vertical position to start pump. Turning mix/purge valve handle to horizontal position will stop pump.

COLD STATIC FILL PRESSURE

The cold static fill pressure (CSFP) in a closed hydronic system has to be high enough to accomplish three things.

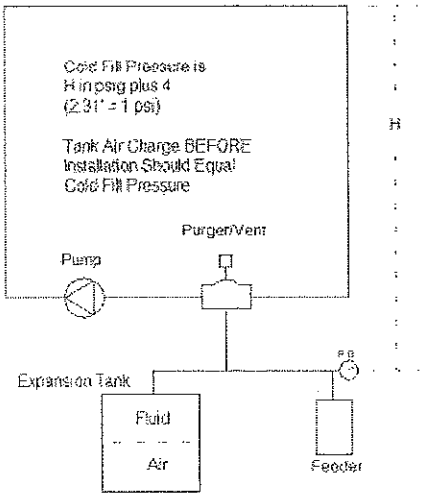
1) Overcome the static head (height) between the fill point and the highest point in the system.

2) Provide adequate pressure (minimum 4 psig) at the top of the system for proper air venting.

3) Maintain adequate pressure at the inlet of the system pumps to prevent cavitation.

The formula for calculating the required CSFP to satisfy points 1 & 2 is:

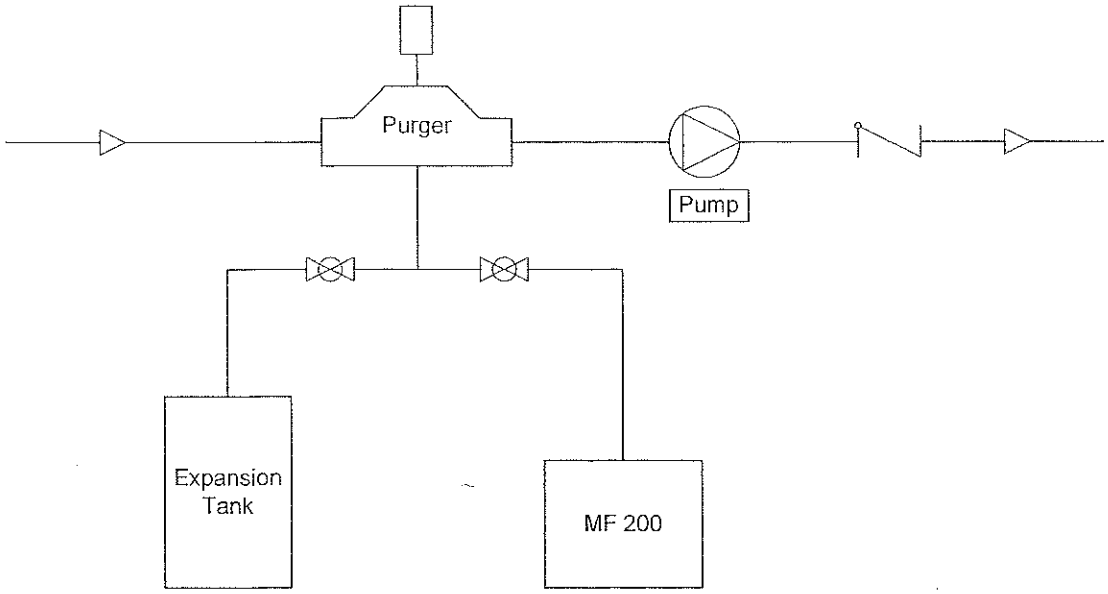
(Static height in feet/2.31) + 4 = CSFP in psig.



As an example, the CSFP for a system with a static height above the fill point of 40 feet would be: (40/2.31) + 4 = 21.3 psig.

For most closed hydronic systems operating below about 210 F, maintaining the minimum top-of-system pressure at 4 psig will be adequate to prevent pump cavitation even if the pumps are at or near the top of the system as well.

IMPORTANT NOTE – For air-charged diaphragm or bladder tanks, the air charge in the tank must be adjusted to equal the cold static fill pressure before it is connected to the system.

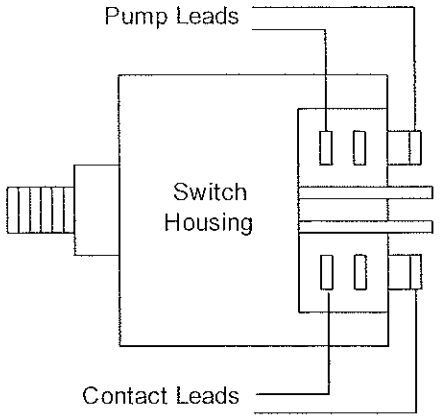


Connection Schematic – MF 200 Packaged System Feeder

Connecting the Alarm Contacts in the MF Series to Other Alarm Systems

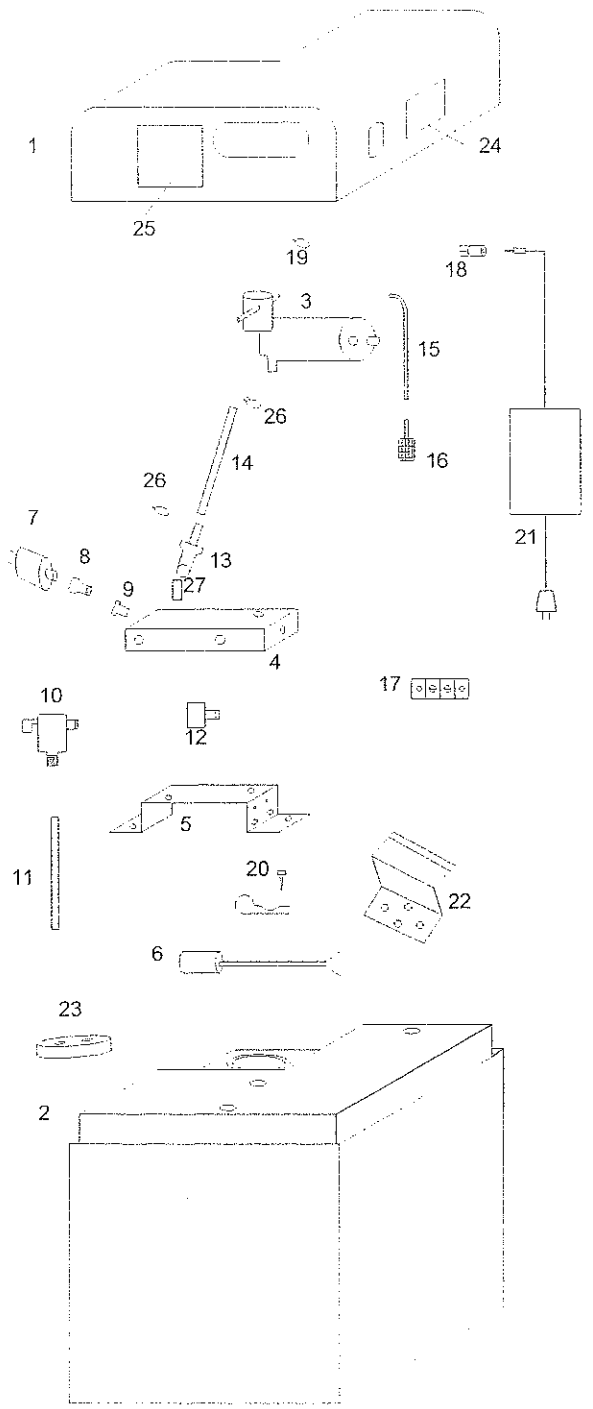
The alarm switch contacts in the MF series are factory wired to be OPEN on LOW PRESSURE. The switch is SPDT, so if some other alarm system is connected to this alarm contact and can not be configured to work with an open contact, the wiring on the low-pressure micro-switch can be changed to provide a closed contact on low pressure.

Remove the screws fastening the top cover to the unit and lift the cover to get access to the pressure switch. Disconnect the power before doing this.



Wiring MF200 Pressure Switch For Closed Contact on Low Pressure

The upper micro-switch controls the pump. The lower micro-switch is used for a low-pressure warning. Move the wire from the middle terminal on the lower micro-switch to the rear-most terminal as shown in the diagram above to get an open circuit on low pressure. You should now have a closed alarm circuit at low pressure.



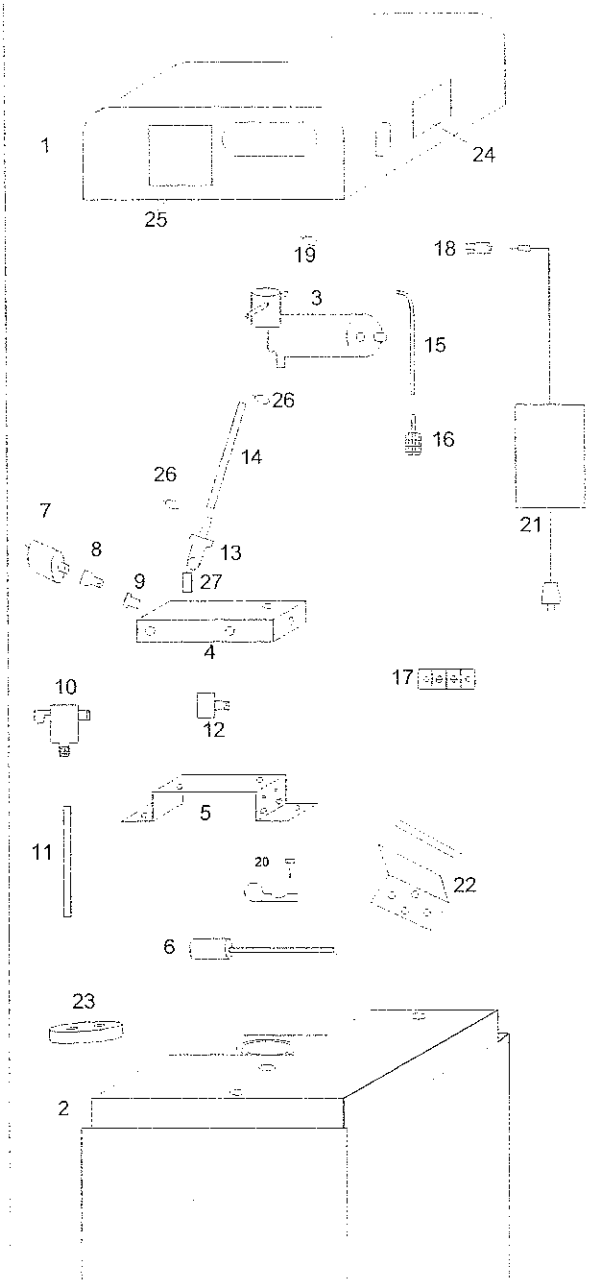
LEGEND

ITEM #	PART #	DESCRIPTION
1	MF200-1600	tank lid
2	MF200-1000	tank
3	MF200-1300	pump & motor assembly
4	MF200-1400	fluid diverter block
5	MF200-1410	diverter mounting bracket
6	MF200-0800	in-tank float
7	MF200-0200	adjustable pressure switch
8	MF200-0400	pressure snubber
9	MF200-0900	brass reducer
10	MF200-1200	¼" angle ball valve
11	MF200-0930	3/8" plastic hose
12	MF200-0700	pressure gauge
13	MF200-0940	¼" hose adapter
14	MF200-0950	½" OD clear hose
15	MF200-0960	½" OD plastic tubing
16	MF200-0910	foot valve strainer
17	MF200-0310	alarm hook up terminal block
18	MF200-0110	power adapter plug-in
19	MF200-1520	½" plastc clamp
20	MF200-0970	cable clamp
21	MF200-0101	120V to 24DCV power adapter
22	MF200-1420	power adapter bracket
23	MF200-0500	tank bung
24	MF200-0110	side decal
25	MF200-1100	s/n decal
26	MF200-0970	5/8" plastic clamp
27	MF200-0980	¼" check valve

PROJECT MF-200 (EXPLODE)

CUSTOMER AXIOM INDUSTRIES

DRWG. NO.	EQUIP. NO.	JOB NO.	DATE
TLL-MF200-1005 PARTS LIST			13 OCTOBER 2005



LEGEND

ITEM #	PART #	DESCRIPTION
1	MF200-1600	tank lid
2	MF200-1001	tank
3	MF200-1300	pump & motor assembly
4	MF200-1400	fluid diverter block
5	MF200-1410	diverter mounting bracket
6	MF200-0810	in-tank float
7	MF200-0200	adjustable pressure switch
8	MF200-0400	pressure snubber
9	MF200-0900	brass reducer
10	MF200-1200	¼" angle ball valve
11	MF200-0930	3/8" plastic hose
12	MF200-0700	pressure gauge
13	MF200-0940	¼" hose adapter
14	MF200-0950	½" OD clear hose
15	MF200-0960	½" OD plastic tubing
16	MF200-0910	foot valve strainer
17	MF200-0310	alarm hook up terminal block
18	MF200-0110	power adapter plug-in
19	MF200-1520	½" plastc clamp
20	MF200-0970	cable clamp
21	MF200-0101	120V to 24DCV power adapter
22	MF200-1420	power adapter bracket
23	MF200-0500	tank bung
24	MF200-0110	side decal
25	MF200-1100	s/n decal
26	MF200-0970	5/8" plastic clamp
27	MF200-0980	¼" check valve

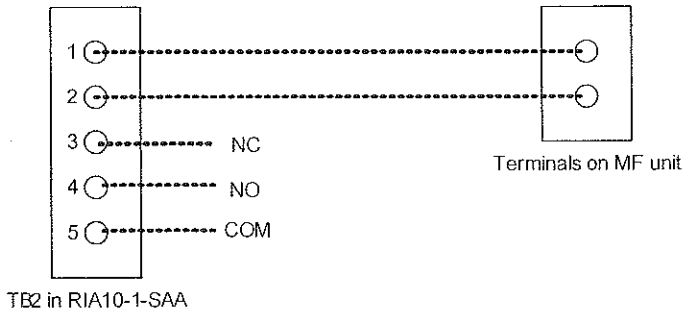
PROJECT MF-300 (EXPLODE)

CUSTOMER AXIOM INDUSTRIES

DRWG. NO.	EQUIP. NO.	JOB NO.	DATE
TLL-MF300-1005 PARTS LIST			13 OCTOBER 2005

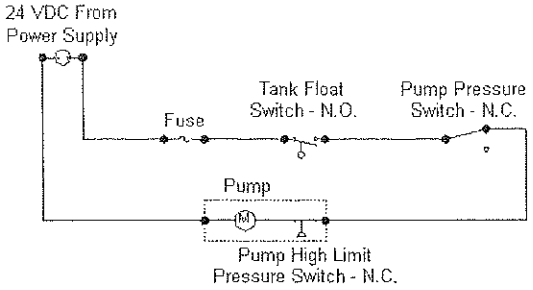
Installation Instructions for the RIA10-1-SAA Control Panel for use with MF200 & MF300 Feeders

The MF series alarm dry contacts are factory wired to provide an OPEN contact on LOW PRESSURE. This is compatible with the alarm circuit in the RIA10-1-SAA panel. Connect terminals 1 and 2 from terminal block TB2 in the panel to the contact terminals located beside the power plug on the MF unit.



To disable the audible alarm in the RIA10-1-SAA panel, remove the jumper from the control board of the RIA10-1-SAA.

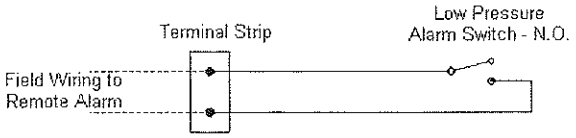
Note - the switch positions shown in this document are for the unit as it comes out of the box, with no fluid in the tank and no pressure in the system.



MF200 Power Wiring

The high limit pressure switch is integral to the pump and will open if the pressure reaches approx. 25 psig. *NOTE - this switch is only found in units with the new style pump, serial number 03-1215 and higher.*

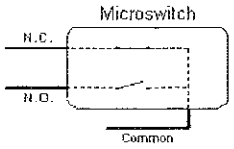
The pump pressure switch is factory set to shut off the pump at about 12 psig. It can be field adjusted to a maximum of about 18 psig.



MF200 Low Pressure Dry Contact

The low limit pressure switch is factory wired to OPEN on low system pressure. It can, however, be re-wired to CLOSE on low pressure if necessary.

The pressure control switch in the MF200 has two microswitches. The upper switch controls the pump, and the lower switch provides the low pressure dry contacts. Switching action at low pressure is shown in the diagram below.



Troubleshooting Chart

Symptom	Possible Cause	Resolution
Pump will not start	Fluid level in tank is low	Add correct fluid. Check for cause of system fluid loss
	Blown fuse	Check LED indicator light on power cord, check fuse and replace if needed (2.5 Amps)
	Power supply or Breaker	Check LED indicator light on power cord, flip breaker or obtain power supply from reseller and replace
	Power supply unplugged or loose electrical connections	Plug in power supply or correct faulty electrical connection
	Pressure switch out of adjustment	Adjust pressure switch according to the manufacturers recommendations
	Faulty pressure switch	First obtain snubber from reseller and replace. If problem continues obtain pressure switch from reseller then replace
	Pump failure	Obtain pump from reseller and replace
Pump will not shut off	Air lock in pump	Turn purge/mixing valve to prime pump
	Leak in system or pump	Inspect system and repair leak
	Faulty pressure switch	Obtain pressure switch and snubber from reseller then replace
Pump will not prime	Check valve stuck	Tap check valve lightly
	Fluid level in tank is low	Add correct fluid. Check for cause of system fluid loss
	Strainer on inlet hose is blocked	Clean strainer
	Product in tank is too thick or Congealed glycol	Clean strainer and check concentration of glycol mixture
	Inlet tubing leak is drawing air	Replace tubing and repair leak
	Inlet/Outlet tube severely restricted (Kinked)	Replace tubing

Noisy / Rough operation

Pump is overloaded and pump pressure switch not cutting out	Obtain Replacement pump from reseller and install
Loose pump head or drive screws	Tighten screws
Feeder is plumbed with rigid pipe causing noise to transmit	Plumb with PEX or plastic pipe

Feeder Leaking

Manifold block over tightened and cracked	Obtain replacement manifold block from reseller and install
Loose fittings	Tighten fittings
Pump has punctured diaphragm	Obtain Replacement pump from reseller and install

System pressure low

Fluid level in tank is low	Add correct fluid. Check for cause of system fluid loss
Blown fuse	Check LED indicator light on power cord, check fuse and replace if needed
Power supply or Breaker	Check LED indicator light on power cord, flip breaker or obtain power supply from reseller and replace
Pressure switch out of adjustment	Adjust pressure switch according to the manufacturers recommendations
Snubber on pressure switch is plugged	Obtain snubber from reseller and replace
Faulty pressure switch	Obtain pressure switch and snubber from reseller then replace
Power supply unplugged or loose electrical connections	Plug in power supply or correct faulty electrical connection
Pump failure	Obtain pump from reseller and install

System pressure to high

Pressure switch not adjusted to proper setpoint	Adjust pressure switch, refer to maintenance manual for instructions
Snubber on pressure switch is plugged	Obtain snubber from reseller and replace. Ensure fluid in tank is clean.
Faulty pressure switch	Obtain pressure switch and snubber from reseller then replace

Pump Cycles Continually	Air is being removed from system and pump is only making up fluid	No action required
	Leak in system	Inspect system and repair leak
	Check valve or Regulator installed between System Feeder and system	Remove check valve or regulator

Division 23

UH-2
Rosemex Hydronic Unit Heater

Make:	Rosemex
Model:	H-24-AG
Capacity:	13.51 MBH
Serial #:	N/A

Division 23

HC-1
Rosemex Heating Coil

Make:	Rosemex
Model:	WBH, 12" x 12"
Capacity:	17.5 MBH, 5.1 kW
Serial #:	N/A

C&G HATCH ASSOCIATES LTD.

4525 – 101 Street, Edmonton , Alberta T6E 5C6
Phone (780) 988 6997 Fax (780) 988 8411
Email: cghatch@telusplanet.net

Date:	April 11, 2013
Project Name:	CAMBRIDGE BAY POTABLE WATER SYSTEM CAMBRIDGE, NU
Engineer:	STANTEC ENGINEERING.
Purchaser:	WOLSELEY INC.
Order No.:	LPO-59-36372

Submittal Summary Page

UNIT HEATERS (3), TAGGED: UH-1 TO UH-3

HEAT COIL, (1) TAGGED: HC-1

(2) ROSEMEX COLOR SAMPLES

23 82 39
SASKATCHEWAN CONSTRUCTION LTD.
SHOP DRAWINGS REVIEWED
BY
APR 15 2013
✓ - REVIEWED
O - REVISE AS NOTED
O - REVISE & RESUBMIT

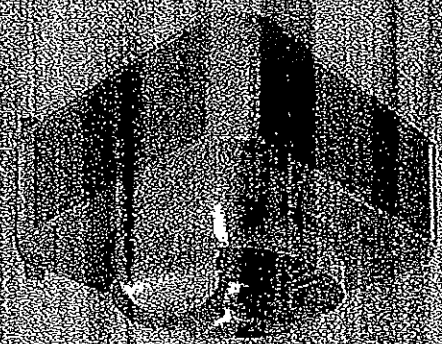
CAMBRIDGE BAY POTABLE WATER SYSTEM
CAMBRIDGE BAY, NU

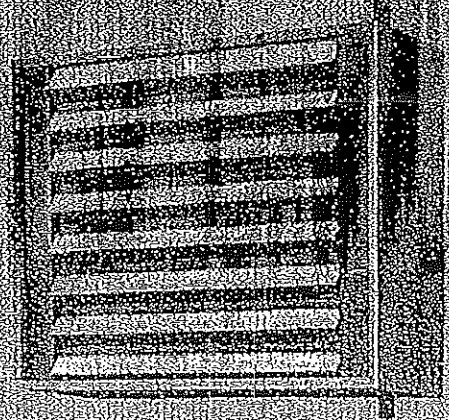
Rosemex Products 01 2009 HEATING

ROSEMEX

UNIT HEATERS

FOR STEAM OR HOT WATER





Date: April 11, 2013

PROJECT: CAMBRIDGE BAY POTABLE WATER SYSTEM

LOCATION: CAMBRIDGE BAY, NU

CONSULTANT: STANTEC ENGINEERING

CONTRACTOR: WOLSELEY INC.

P.O. NUMBER: LPO-59-36372

UNIT HEATER DATA SHEET

TAG	LOCATION	MODEL	AIR VOLUME		MOTOR		CAPACITY		WATER		W.P.D.		REMARKS
			CFM	L/S	HP	WATTS	MBH	kW	GPM	L/S	FT	kPa	
UH-1		H-24	680	321	1/20	37	22.1	6.5	2.30	0.15	1.5	4.5	copper headers
UH-3		H-24	680	321	1/20	37	22.1	6.5	2.30	0.15	1.5	4.5	copper headers
**UH-2		H-24-AG											REFER TO SEPARATE SHOP DRAWING

NOTES:

1) Capacity Based on 82.2 C (180 F) EWT, 15.6 C (60 F) EAT, and 11 C (20 F) WTD

2) Motors are 115V/1Ph/60Hz

3) Casings are to be enamel painted, Architect to choose color, with the exception of UH-2 which is stainless steel.

4) Remote wall mounted, line voltage thermostats supplied by others.

Stantec

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

April 23, 2013

By:

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STANTEC ARCHITECTURE LTD.

FEATURES

BROAD RANGE OF APPLICATION

- Hot water or steam ROSEMEX unit heaters provide economical "space comfort" for industrial, commercial and institutional applications.
- Horizontal models H and HS in 13 sizes; up to 492 MBH.
- Vertical models V and VS in 13 sizes; up to 685 MBH.
- Greater throw with "low outlet temperature» HS and VS units (with high pressure steam).
- Maximum flexibility of air distribution with optional diffuser arrangements.
- Units with special coil available on request: copper fins on copper tubes, steel fins on either steel, Bundyweld steel (copper plated steel), copper or red brass tubes.

APPEARANCE

- Compact and attractive. Modern design enhanced by aluminium semi-gloss finish.

HIGH PERFORMANCE

- More CFM for lower outlet air temperature.
- Quieter operation with lower RPM motors.
- Greater air throw and circulation.
- Top opening on V models helps recover warm air at ceiling.
- Suitable for higher temperature drops.
- HS and VS units have wider fin spacing allowing for higher CFM and higher outlet velocities for even greater throw.
- Accurately rated in accordance with AMCA bulletins # 20 and 22.
- Guaranteed to be free from defects in material or workmanship for a period of one year from date of purchase.

RUGGED "LONG-LIFE" CONSTRUCTION

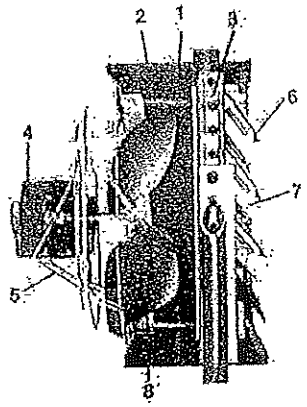
- Casing: die formed, reinforced steel.
- Finish: sheet metal chemically degreased, phosphatized and etched. Semi-gloss "grey" paint finish.
- Coil: steel pipe headers, copper tubes, ribbed aluminum plate fins. Red brass tubes, heavy 0.035" wall is standard on HS and VS models, optional on all other models, and recommended for steam over 5 PSIG. All coils tested with 200 PSIG air pressure under water.
- Motors: specially selected and tested; thermally protected; permanently lubricated for a minimum of 20,000 hours on H and HS models, and 20,000 hours on V and VS models. Motors totally enclosed on H and HS models.
- Motor mounts: rugged, corrosion resistant. All motors or supports resiliently mounted.
- Fans: aluminum blades; sturdy, balanced, efficient and quiet.

EASY MAINTENANCE

- All parts fully accessible for maintenance, service or replacement.
- Motors readily accessible on model H units, and easily removable through fan opening on model V units.

CUTAWAY VIEWS

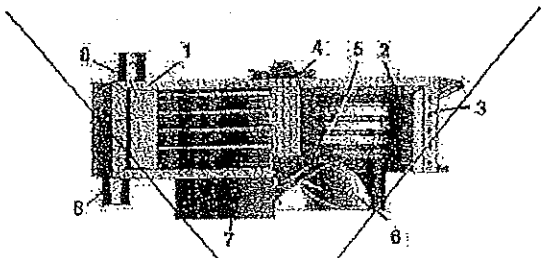
FIGURE 1



MODEL H

1. Heavy gauge steel cabinet
2. Speed grip nut for solid easy hanging of unit
3. One-row coil with single connecting header on one side for half circuit
4. Heavy duty motor designed for longer life, permanently lubricated for a minimum of 20,000 hours
5. Rugged protective motor-mounts
6. Adjustable louvers
7. Louver fin diffusers
8. Sturdy balanced fan blade

FIGURE 2



MODEL V

1. Heavy gauge steel cabinet
2. Speed grip nut for solid easy hanging of unit
3. One-row coil with full header at each end for a full circuit
4. Heavy duty motor designed for longer life, permanently lubricated for a minimum of 20,000 hours
5. Steel plate, rubber mounted motor support
6. Factory balanced quiet operating aluminum fan blades
7. Deep fan opening collar which encircles full depth of fan blade for protection against damage and also for better air distribution
8. Header brazed to copper tubes

GENERAL SELECTION

HEAT LOSSES

Should be calculated according to ASHRAE Guide or other reliable source.

MODEL SELECTION

The model selected should be suitable for the type of building or area to be served. Model H units are generally used with low ceilings (see Table 2 for mounting height and spread). Model V units are recommended with high ceilings. They are particularly efficient in plants, warehouses or similar applications where they recover warm air which stratifies near ceilings (see Table 3 for mounting height and spread). Model V unit heaters with louver cone diffusers can also be used with higher ceilings.

NUMBER OF UNITS

Select required number of units to handle the heat losses, and also for proper air motion, adequate coverage of the occupied space, and operation within permissible sound levels. For instance, although one large unit may be sufficient for a certain area, two smaller units may be specified at a lower RPM for quieter operation, and to provide better heat distribution and circulation.

SPOT HEATING

It is usually more effective to discharge air across, instead of into, an open door. The throw shown in the performance tables applies to draft-free buildings with relatively stable temperatures. When heating only a small area within a cold environment, experience shows that the published throw may be reduced by as much as 50%.

UNIT LOCATION

Unit Heaters should be spotted to aim the discharge towards the source of heat loss, but precautions should be taken to avoid blasting people with the warm air mass. Model H units should be located to achieve maximum air rotation in the same direction at the outside walls.

ECONOMY AND COMFORT

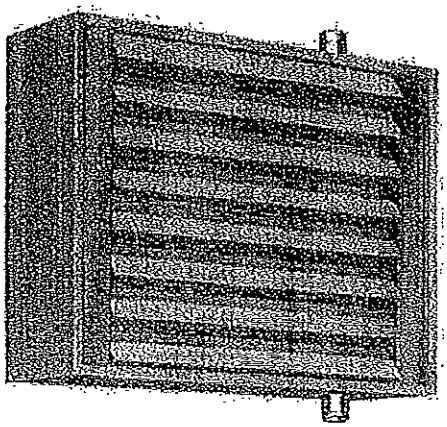
Where individual comfort is not an important factor, the prime consideration is to design the most economical system which will satisfy overall heating requirements. Larger units requiring less piping are recommended. Where the physical comfort of the occupants is important, several smaller units will provide quieter operation, better heat distribution, and more even temperatures.

PIPING

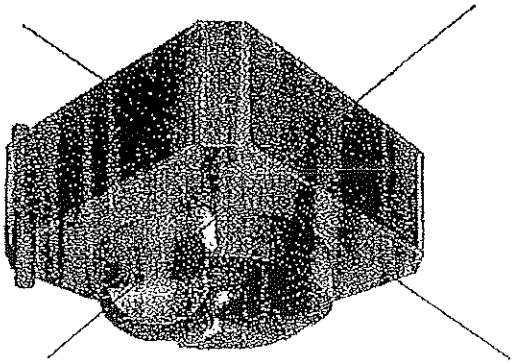
For unit heater piping connections, see AMCA Bulletin No. 15.

NOTE:

Although the cone diffuser can be mounted on Model V as shown throughout this literature, it is recommended that the cone diffuser be mounted approximately four inches below the fan collar using fourbrackets (not shown) to provide optimum heat dispersion.



MODEL H



MODEL V

UNIT HEATER MOTOR SPEEDS & SWITCHES

TABLE 11

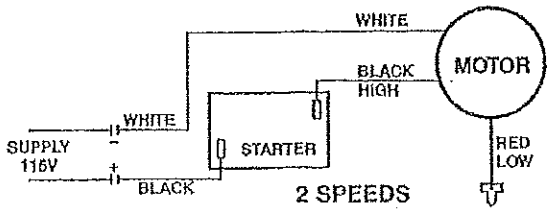
UH-1 & 3

HORIZONTAL UNIT		VERTICAL UNIT		MOTOR (115/1/60) HP	A	NOMINAL RPM
		V-30, V-40	VS-47, VS-55	1/30	1.15	1550
H-18, H-24 H-26, H-36	HS-25, HS-31 HS-39, HS-47			1/20	0.94	1550
H-32, H-40 H-44, H-58	HS-43, HS-51	V-38, V-48	VS-57, VS-67	1/12	1.60	1550
H-50, H-60, H-70 H-82	HS-73, HS-95	V-70, V-84*	VS-89, VS-103*	1/6	2.60	1075
H-80, H-98*	HS-97, HS-113*			1/4	3.60	1100
H-96, H-114 H-102, H-122* H-136, H-166*	HS-117, HS-137*	V-50*, V-80* V-90, V-106* V-108, V-130*	VS-137, VS-157*	1/4	3.60	1075
		V-66*, V-96*		1/3	2.80	1725
H-144, H-174* H-194, H-234*	HS-175, HS-205*			1/3	4.90	1100
H-250	HS-265			0.6	6.70	1075
		V-124, V-140* V-144, V-180* V-170, V-200*	VS-171, VS-197*	3/4	10.30	1100
		V-204, V-252 V-300, V-370	VS-247, VS-279 VS-361, VS-413	1	14.00	1075
		V-520	VS-595	2**		
H-400	HS-420			2***		1140

* Available with "Explosion Proof" motor.
** 575/3/60.
*** 460/200-230/3/60
575/3/60
NOTE: Applies to Standard Motors only, when Special Motors are needed (TEFC, Explosion Proof...) Please contact our Engineering Department.

FIGURE 9

TYPICAL WIRING DIAGRAM



2 SPEEDS
High: Black
Low: Red

Note: Refer to unit for current wiring diagram.

TABLE 12

UH-1& 3

MOTOR CHARACTERISTICS

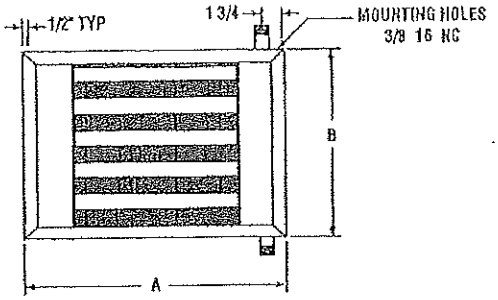
UNIT	HP	1/30	1/20	1/12	1/6		1/4	1/3	1/2	0.6		3/4	1	2
MODEL H	VOLTS		115	115	115		115		115	115				
	AMP.		0.94	1.6	2.60		3.6		4.9	6.7				
	RPM		1000 1550	1000 1550	820 1075		820 1075		820 1100	1075				
MODEL V	VOLTS	120		115	115		115	115				115	115	575
	AMP.	1.15		1.60	2.60		3.69	2.90				10.30	14.00	2.70
	RPM	1000 1300 1550		1000 1550	820 1075		820 1075	1725				1100	1100	1100

All motors operate on 60 cycles, 1Ø, except 2 HP motors 575/3/60.

DIMENSIONS

HORIZONTAL PROJECTION — MODEL H

FIGURE 4



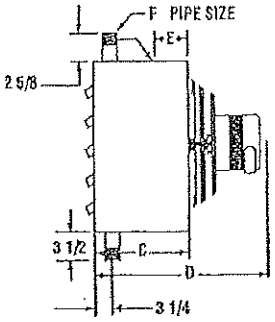


TABLE 13 — UH-1 & 3

CATALOGUE NO. STANDARD	CATALOGUE NO. LOW OUT. TEMP.	FAN DIAM.	A	B	C	D	E	F	WEIGHT
H-18, H-24	HS-25, HS-31	10	19	12 3/4	9	17	3	1 1/4	39
H-26, H-36	HS-39, HS-47	14	22	15 3/4	9	16 1/2	3	1 1/4	53
H-32, H-40	HS-43, HS-51					17 1/2			
H-44, H-58		14	25	18 3/4	9	16 1/2	3	1 1/4	64
H-50, H-60	HS-73	16							
H-70, H-82	HS-95	16	29	21 3/4	9	16 1/2	3	1 1/2	82
H-80, H-98	HS-97, HS-113	18				18			
H-96, H-114		20	32	24 3/4	12	19 1/2	4 1/8	1 1/2	122
H-102, H-122	HS-117, HS-137					21			
H-136, H-166		20	37	30 3/4	12	21	4 1/8	1 1/2	166
H-144, H-174	HS-175, HS-205	24				23 1/2			
H-194, H-234		26	46	30 3/4	12	23 1/2	4 1/8	1 1/2	184
H-250	HS-265								
H-400	HS-420	26	55	30 3/4	12	26	4 1/8	1 1/2	230

VERTICAL PROJECTION — MODEL V

FIGURE 5

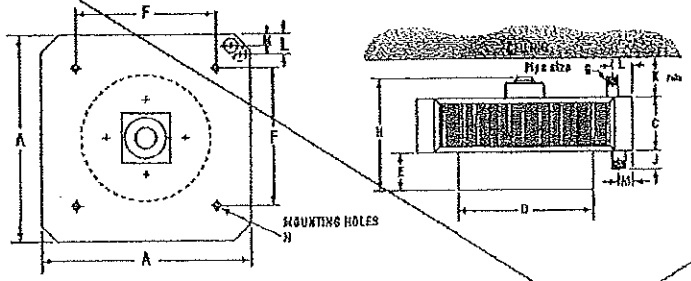


FIGURE 6

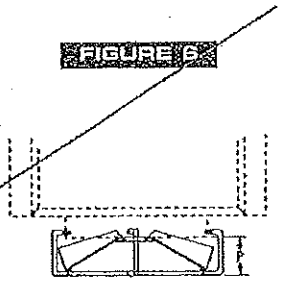


TABLE 14

CATALOGUE NO. STANDARD	CATALOGUE NO. LOW OUT. TEMP.	FAN DIAM.	A	C	D	E	F	G	H	J	K	L	M	N	P	WEIGHT
V-30, 40	VS-47, 55	12	21	6	12 3/8	2 1/2	11	1 1/2	8 1/2	2 3/4	6	3 1/16	1 3/4	3/8 - 16 NC	4 1/4	30
V-36, 48	VS-57, 67	14			14 7/16	4			12							36
V-50, 66									13 1/2							36
V-70, 84	VS-89, 103	16	26 1/2		16 7/16		16		12						5	64
V-80, 96									13 1/2							64
V-90, 106		18	34 1/4		18 1/2		22	2	12		7	5 5/16	2 1/4	1/2 - 13 NC	5 3/4	72
V-108, 130	VS-137, 157								12							89
V-124, 140		20			20 1/2				16 1/2							98
V-144, 180	VS-171, 197	24	37 3/4	7 1/2	24 5/8	5	24		15 1/2						6 3/4	98
V-170, 200									16 1/2							106
V-204, 252	VS-247, 279								17 1/2							125
V-300, 370	VS-361, 413	30	43 5/8	9	30 3/4	6	30	2 1/2	18	3	8	4 5/16			8	162
V-520	VS-595			13 1/2					19 1/2							230

GUIDE SPECIFICATIONS

The mechanical contractor shall supply and install Rosemex unit heaters in models and sizes as shown on plans and described in specifications.

CASING

Shall be of high quality, die formed, cold rolled steel, degreased, phosphatized, etched and finished in aluminium semi-gloss finish.

COIL

Shall consist of aluminum plate fins on mechanically expanded copper tubes, welded to steel headers and tested with 200 PSIG air pressure under water.
Low outlet temperature units shall have 0,035" wall red brass tubes.

MOTORS

With permenant split capacitor and shall be thermally protected and permanently lubricated for a minimum of 20,000 hours. They shall be totally enclosed on H and HS models. Motors or supports shall be resiliently mounted. Motors on H and HS units shall be mounted on formed, welded and plated heavy gauge wire support. On V and VS units, motors and blades shall be removable through fan opening.

FANS

Fan blades shall be aluminum and balanced for quietness.

DIFFUSERS

Louver fin (model H) and louver cone (model V) diffusers shall have individually adjustable blades for maximum air distribution flexibility.

SPECIFICATIONS

Shall specify:

- Cat. No.
- Volts
- Phase
- Optional
  - Louver fin or louver cone diffusers
  - Protective grille
  - Motor speed.

Controls and optional motors are supplied at additional cost (contact factory).

For information about your nearest branch or agent, contact Head Office.

In the interest of product improvement, we reserve the right to make product and specification changes without notice.

Printed in Canada

SCHEDULE FOR UNIT HEATERS

PROJECT:	Cambridge Bay Potable Water System, Cambridge Bay, NU
ENG.:	Stantec Engineering
JOB:	Wolseley LPO-59-36372
DATE:	April 11, 2013

LOCATION	QTY	TYPE ON PLAN	CAT. No	HEATING							AIR	MOTOR				SPEED CONT.*	STARTER*	THERMOSTAT*	NOTES
				ENT. AIR TEMP. F	LVG. AIR TEMP. F	ENTER WATER TEMP. F	LVG. WATER TEMP. F	WATER USGPM	WATER PRESS. DROP FT.H2O	CAP. MBH	CFM	HP	RPM	AMP.	VOLTS				
UH-2	1		H-24-AG	60	81	180	160	1.59	0.02	35351	680	1/20	1550	0.94	115/1/60	N	N	N	
TOTAL:																			

NOTES:

ACCESSORY
* N = NOT APPL.
* U = UNIT MT'D.
* W = WALL MT'D
* ST = STANDARD

ROSEMEX PRODUCTS

SHEET: 1

ROSEMEX AIR COIL SELECTION

Project H-24- AG
System No
Coil Type WH

Data

Elevation:	0 ft.	EDB:	60.0 °F	Air Flow:	680.0 ft³/min.	Fins (Mat./Thk):	AL/0.0085
Height:	12 In.	EWB:	-	Face Velocity:	680.0 ft/min.	Tub. (Mat./Thk):	CU/0.0200
Length:	12 In.	EWT:	180.0 °F	Fluid:	Water	Turbulator:	No

No	*	NR	FP (I	CP	APD (IN.WG)	TH (MBH)	SH (MBH)	LDB (°F)	LWB (°F)	FLOW (USGPM	LWT (°F)	WPD (FT.H2O)	WV (FPS)	HD
1	3	1	9	0.5	0.24	16.617	16.617	81.0	-	1.69	160.0	0.02	0.45	SE

UH-2

DIMENSIONS

HORIZONTAL PROJECTION — MODEL H

FIGURE 2

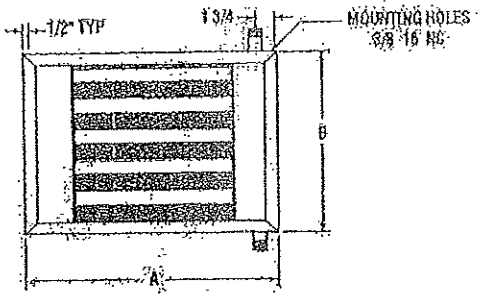


TABLE 1

CATALOGUE NO. STANDARD	CATALOGUE NO. LOW OUT. TEMP.	FAN DIAM.	A	B	C	D	E	F	WEIGHT
H-18, H-24	HS-25, HS-31	10	18	12 3/4	9	17	3	1 1/4	38
H-26, H-36	HS-39, HS-47	14	22	16 3/4	9	16 1/2 17 1/2	3	1 1/4	53
H-32, H-40	HS-43, HS-51								
H-44, H-58		14	25	18 3/4	9	16 1/2	3	1 1/4	64
H-60, H-80	HS-73	16							
H-70, H-82	HS-85	16	29	21 3/4	9	16 1/2 18	3	1 1/2	82
H-80, H-99	HS-97, HS-113	18							
H-98, H-114		20	32	24 3/4	12	19 1/2 21	4 1/8	1 1/2	122
H-102, H-122	HS-117, HS-137								
H-136, H-166		20	37	30 3/4	12	21 23 1/2	4 1/8	1 1/2	166
H-144, H-174	HS-175, HS-205	24							
H-194, H-234		26	46	30 3/4	12	23 1/2	4 1/8	1 1/2	184
H-250	HS-295								
H-400	HS-420	26	55	30 3/4	12	28	4 1/8	1 1/2	230

VERTICAL PROJECTION — MODEL V

FIGURE 3

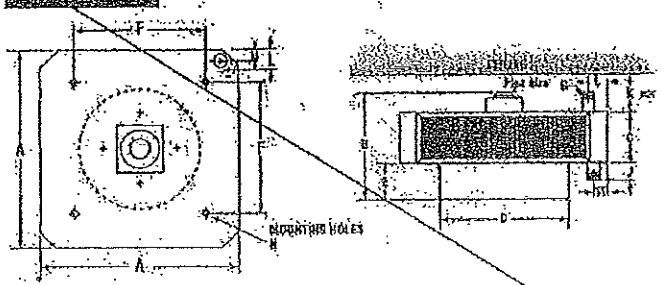


FIGURE 4

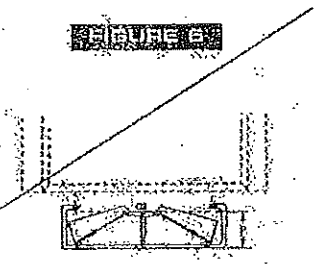
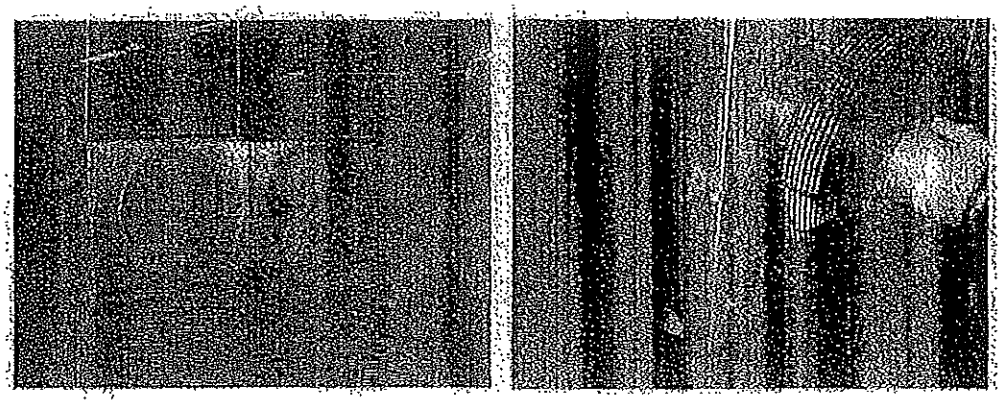


TABLE 2

CATALOGUE NO. STANDARD	CATALOGUE NO. LOW OUT. TEMP.	FAN DIAM.	A	C	D	E	F	G	H	J	K	L	M	N	P	WEIGHT
V-30, 40	VS-47, 55	12	21	6	12 3/8	2 1/2	11	1 1/2	8 1/2	2 3/4	6	3 1/16	1 3/4	3/8 - 16 NC	6 1/4	30
V-36, 48	VS-67, 67	14			14 7/16	4			11 2							36
V-50, 66									13 1/2							56
V-70, 84	VS-89, 103	16	28 1/2		16 7/16		16		12						6	64
V-80, 96									13 1/2							64
V-90, 106		16	34 1/4		18 1/2		22	2	12		7	5 5/16	2 1/4	1/2 - 13 NC	6 3/4	72
V-108, 130	VS-137, 157								12							89
V-124, 140		20			20 1/2				16 1/2							98
V-144, 180	VS-171, 197	24	37 3/4	7 1/2	24 5/8	5	24		15 1/2						8	88
V-170, 200									16 1/2							106
V-204, 252	VS-247, 279								17 1/2							125
V-300, 370	VS-361, 413	30	49 5/8	9	30 3/4	6	30	2 1/2	18	3	8	4 5/16			8	162
V-520	VS-595			13 1/2					19 1/2							250

Re: Agriculture unit heater . Heavy duty type with :

1. *– Coil should be Copper Tube / Aluminum fins with Heresite baked Phenolic Coatings will withstand exposure to practically all corrosive atmospheres.*
2. *- Fins spacing 9 FPI*
3. *- Unit casing should be Stainless Steel 416 . 16 ga. That can withstand hi levels of ammonia .*
4. *- The Motor & Fan assembly should be hinged with easy close & open penture made with 14 ga. Stainless Steel 416 for regular cleaning with high pressure washing.*
5. *– Heresite coated on fan & motor .*



CAMBRIDGE BAY POTABLE WATER SYSTEM
CAMBRIDGE BAY, NU

Rosemex Products 4/99 VENTILATION

ROSEMEX

Type WH & WHT

HOT WATER COILS

SERPENTINS À EAU CHAUDE

Date: April 11, 2013

PROJECT: CAMBRIDGE BAY POTABLE WATER SYSTEM

LOCATION: CAMBRIDGE BAY, NU

CONSULTANT: STANTEC

CONTRACTOR: WOLSELEY INC.

P.O. NUMBER: LPO-59-36372

TAG		HC-1							
SERVICE									
		IMPERIAL		METRIC					
GENERAL	TYPE	WBH							
	HEIGHT	12	in	305	mm				
	WIDTH	12	in	305	mm				
	ROWS	1							
	CIRCUITS	1							
	FIN SPACING	12	fpi	472	f/m				
	FACE AREA	1.00	sq ft	0.09	sq m				
AIR	AIR VOLUME	106	CFM	50	L/S				
	FACE VELOCITY	106	fpm	0.54	m/s				
	APD	0.02	in wg	5.0	Pa				
	CAPACITY	17.5	MBH	5.1	kW				
	EDB	-47.2	F	-44.0	C				
	LDB	74.7	F	23.7	C				
WATER	WATER FLOW	1.90	gpm	0.12	l/s				
	EWT	170.0	F	76.7	C				
	LWT	150.0	F	65.6	C				
	WPD	1.1	ft	3.3	kPa				
	CONNECTION	5/8	in	16	mm				
	CONNECTION SIDE	LH							
	PERCENT GLYCOL	40%							

NOTE: L or R CONNECTIONS ARE DETERMINED BY FACING AIRSTREAM.

Stantec

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

April 23, 2013

By:

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.

STANTEC ARCHITECTURE LTD. (PC-1449)

23 82 16

SAMUEL WESTBURY CONSTRUCTION LTD.
SHOP DRAWINGS REVIEWED

BY

APR 15 2013

☒ - REVIEWED
☐ - REVISED AS NOTED
☐ - REVISE AND RESUBMIT

MAIN FEATURES

FINS
New design for uniform air turbulence over fin surface assuring higher heat transfer performance. Fins are aluminum plate type, 6, 9 or 12 fins per inch, mechanically bonded to tubes; available in 1 and 2 rows.
Optional : Copper fins.

TUBES
Copper, 5/8" O.D. staggered from row to row for optimum air turbulence over fins and around tubes where heat transfer is at its maximum. Tubes are brazed to headers and silver soldered to return bends. Suitable for 200 PSIG.

CASING
Ruggedly constructed of galvanized steel with reinforcing plats on longer lengths. Fastening holes provided.

SIZES
Type WH: Finned **heights** from 12" to 48" in 3" increments.
Finned **lengths** from 24" to 144" in 1" increments.
Type WBH: Finned **heights** from 6" to 18" in 3" increments.
Finned **lengths** from 6" to 42" in 1" increments.

HEADERS
Type WH: Male threaded steel pipes, coated with zinc chromate red oxyde for corrosion protection, plugs for air vent and drain. 2" or 2 1/2" nominal diameter. Coils are drainable.
Type WBH: Copper tube: 5/8" O.D. for single circuit and 7/8" I.D. for two circuits. Sweat connection.

CIRCUITS
Type WH: **Half, full or double** circuits available.
Type WBH: **One or two** circuits available.

CAPACITIES
Capacities are established in accordance with ARI Code No. 470-91.

GUARANTEE
One year regular manufacturer's warranty against material or manufacturing defects.

CARACTÉRISTIQUES PRINCIPALES

AILETTES
Nouvelle conception de formes pour assurer une turbulence d'air uniforme sur toute la surface ailetée en vue d'un meilleur transfert de chaleur. En aluminium, 6, 9 ou 12 ailettes au pouce, fixées mécaniquement aux tubes, et assemblées en 1 et 2 rangées.
Facultatif : Ailettes de cuivre.

TUBES
En cuivre 5/8" diamètre extérieur décalés d'un rang à l'autre pour obtenir une turbulence d'air optimum sur les ailettes et autour des tubes où le transfert de chaleur est à son maximum. Une brasure joint les tubes aux collecteurs et une soudure à l'argent joint les tubes aux coudes de retour. Peuvent supporter 200 lb/po ca.

CHÂSSIS
Fabrication rigide en acier galvanisé, avec trous de fixation. Renforts sur les grands serpentins.

DIMENSIONS
Type WH : **Hauteurs** d'ailettes de 12" à 48" en multiples de 3". **Longueurs** d'ailettes de 24" à 144" en multiples de 1".
Type WBH : **Hauteurs** d'ailettes de 6" à 18" en multiples de 3". **Longueurs** d'ailettes de 6" à 42" en multiples de 1".

COLLECTEURS
Type WH : En acier, et recouverts d'une couche de chromate de zinc rouge oxyde contre la corrosion. Diamètres de 2" ou 2 1/2", raccords mâles filetés. Bouchons pour purgeur d'air et vidange. Les serpentins peuvent être vidangés.
Type WBH : En cuivre : 5/8" O.D. pour un circuit et 7/8" I.D. pour deux circuits. Pour raccords soudés.

CIRCUITS
Type WH : Ces serpentins sont fabriqués avec **demi, plein ou double** circuit.
Type WBH : Ces serpentins sont fabriqués avec **un ou deux** circuits.

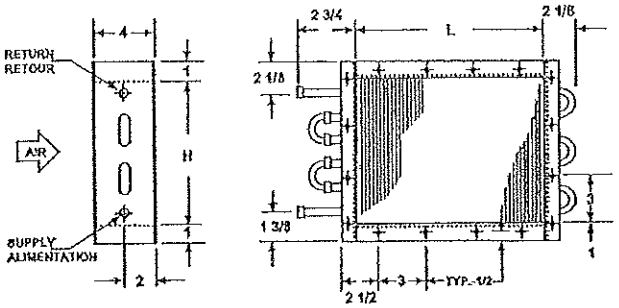
PUISSANCES
Les puissances ont été déterminées en conformité avec le code ARI no. 470-91.

GARANTIE
Tout serpentin porte la garantie normale d'un an du manufacturier contre tout défaut de matériel ou de fabrication.

DIMENSIONS

1 ROW - 1 CIRCUIT - 1 RANGÉE

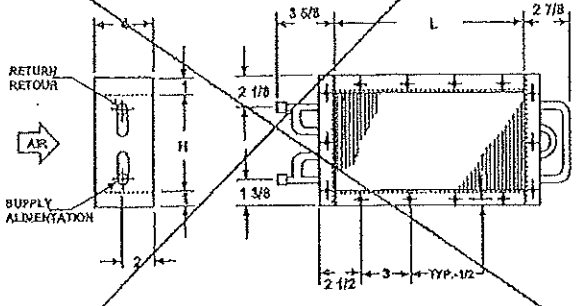
LEFT HAND CONNECTIONS SHOWN
RACCORDS À GAUCHE MONTRÉS



H						CONN. RACCORD
6	9	12	15	18		5/8 O.D.

DIMENSIONS

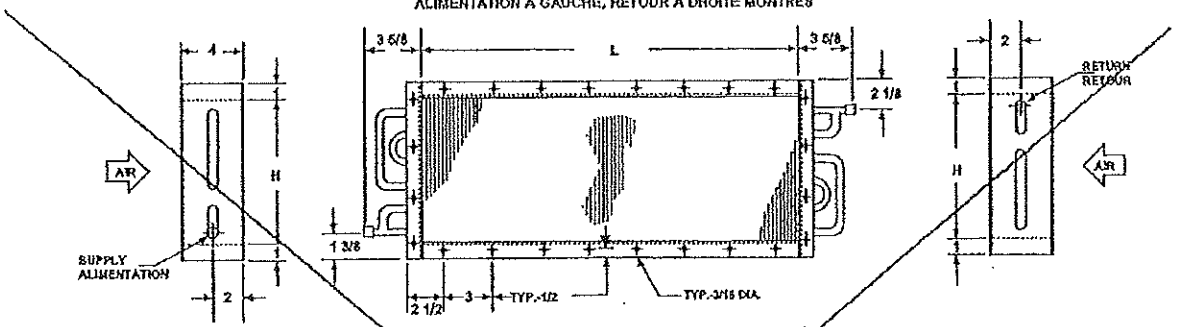
1 ROW - 2 CIRCUITS - 1 RANGÉE



H			CONN. RACCORD
6	12	18	7/8 I.D.

1 ROW - 2 CIRCUITS - 1 RANGÉE

LEFT HAND SUPPLY, RIGHT HAND RETURN SHOWN
ALIMENTATION À GAUCHE, RETOUR À DROITE MONTRÉS

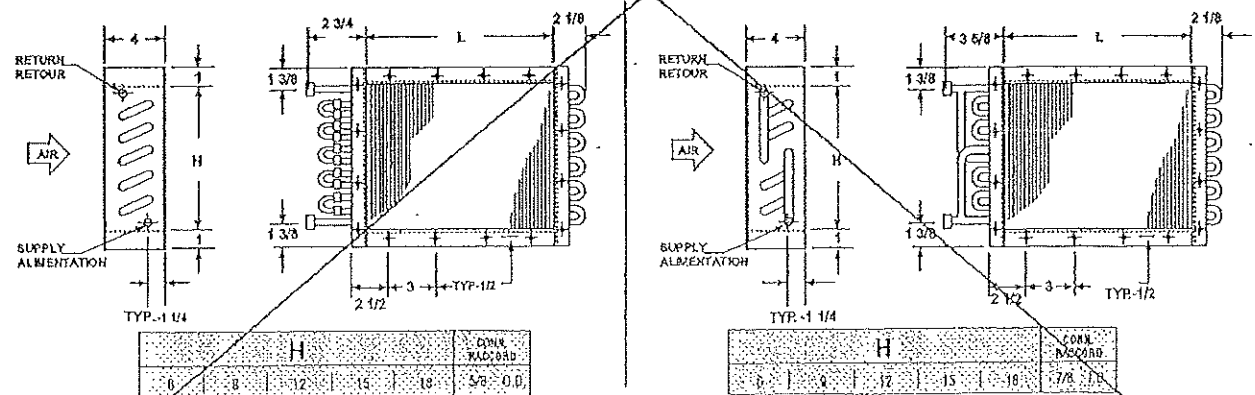


H		CONN. RACC.
9	15	7/8 I.D.

2 ROWS - 1 CIRCUIT - 2 RANGÉES

2 ROWS - 2 CIRCUITS - 2 RANGÉES

LEFT HAND CONNECTIONS SHOWN
RACCORDS À GAUCHE MONTRÉS



H						CONN. RACCORD
6	9	12	15	18		5/8 O.D.

H						CONN. RACCORD
6	9	12	15	18		7/8 I.D.

L - STD FIN LENGTHS

FROM 6" TO 42", IN 1" INCREMENTS

L - LONGUEURS STD DES AILETTES

DE 6" À 42", EN MULTIPLES DE 1"

GENERAL SPECIFICATIONS

CASING
Casing shall be constructed of first quality galvanized steel.
Type WH
Top and bottom of casing shall be 16 gauge for coils up to 84" finned length and 14 gauge for coils from 90" to 144" finned length. Casing sides shall be 16 gauge. Coils 48" and over in length shall be provided with a brace in centre of length. Fastening holes, 5/16" diameter shall be provided around frame, on 6" centres.
Type WBH
All casing shall be 16 gauge. Fastening holes, 1/4" diameter shall be provided around frame, on 6" centres.

FINS
Fins shall be aluminum, or copper (optional) and shall be 6, 9 or 12 fins per inch, in 1 or 2 rows.

TUBES
Tubes shall be copper, 5/8" O.D. and 0.020 inch thick. Mechanical bond shall be insured by ball expansion process.

HEADERS
Type WH
Headers shall be steel, **pipe threaded**, and coated with zinc chromate red oxyde against corrosion. Threaded plugs for air vent and drain shall be provided. Coils shall be drainable.
Type WBH
Copper fitting for **sweat connections**.

CIRCUITS
Type WH
Shall be **half, full, double** circuit.
Type WBH
Shall be **one, two** circuits.

WELDING
Type WH
Tubes shall be brazed to headers and silver soldered to return bends.
Type WBH
All silver soldered.
Coils shall be tested for 200 PSIG operation.

COIL IDENTIFICATION
Example 1: WH-2472-2R6-HC-L

WH	=	Water cooling coil
2472	=	24" finned height x 72 finned length
2R	=	2 row coil
6	=	6 fins/inch
HC	=	Half circuit (FC-full, DC double)
L	=	Left hand supply

Example 2: WBH-918-1R12-2C-L

WBH	=	Hot water booster coils
918	=	9" finned height x 18" finned length
1R	=	1-row coil
12	=	12 fins/inch
2C	=	Two circuits (1C, one circuit)
L	=	Left hand supply

Note
L or R connections are determined by facing airstream.

DEVIS TYPE

CHÂSSIS
Le châssis sera fabriqué en acier galvanisé.
Type WH
Le dessus et le dessous des serpentins jusqu'à 84" de longueur ailetée seront en acier de calibre 16 et ceux des serpentins de 90" à 144" seront en acier de calibre 14. Les côtés du châssis seront de calibre 16. Les serpentins de 48" et plus de longueur seront munis d'un renfort au centre de la longueur. Des trous de fixation de 5/16" de diamètre seront percés à 6" centre en centre autour du châssis.
Type WBH
Tout le châssis est de calibre 16, avec des trous de fixation de 1/4" de diamètre percés à 6" centre en centre.

AILETTES
Les ailettes seront en aluminium, ou en cuivre (facultatif), et seront de 6, 9 ou 12 ailettes au pouce et en 1 ou 2 rangées.

TUBES
Les tubes seront en cuivre de 5/8" de diamètre extérieur et de 0.020 pouce d'épaisseur. Le contact parfait et permanent entre le tube et l'ailette sera assuré par le procédé de dilatation à bille.

COLLECTEURS
Type WH
Les collecteurs seront en acier, pour **raccord fileté** et munis de bouchons pour purgeur d'air et vidange. Ils seront recouverts d'une couche de chromate de zinc rouge oxyde. Les serpentins pourront être vidangés.
Type WBH
Les raccords seront en cuivre, pour **soudure.**

CIRCUITS
Type WH
Sera à **demi, à plein ou à double** circuit.
Type WBH
Sera à **un ou à deux** circuits.

SOUDURE
Type WH
Une brasure joindra les tubes aux collecteurs, et une soudure à l'argent joindra les tubes aux coudes de retour.
Type WBH
Toutes les soudures seront à l'argent.
Les serpentins seront soumis à un essai pour fonctionner à 200 lb/ po ca au manomètre.

IDENTIFICATION DES SERPENTINS
Exemple 1 : WH-2472-2R6-HC-L

WH	=	Serpentin de chauffage
2472	=	24" hauteur d'ailettes x 72" longueur d'ailettes
2R	=	2 rangées
6	=	6 ailettes/po
HC	=	Demi-circuit (FC-plein, DC-double)
L	=	Alimentation à gauche

Exemple 2 : WBH-918-1R12-2C-L

WBH	=	Serpentin de préchauffage
918	=	9" hauteur d'ailettes x 18" longueur d'ailettes
1R	=	1 rangée
12	=	12 ailettes/po
2C	=	Deux circuits (1C, un circuit)
L	=	Alimentation à gauche

Note
Les raccords L ou R sont déterminés en faisant face à la sortie d'air.

5.1.7

Division 23

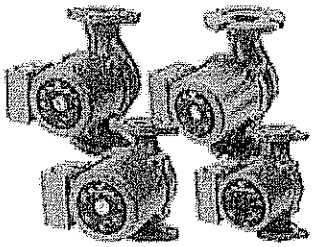
P-3.1 & P-3.2
Grundfos Hydronic Circ Pump

Make:	Grundfos
Model:	UPS 15-58 FC
Capacity:	0.5662 l/s
Serial #:	N/A

GRUNDFOS

Submittal Data

PROJECT:	Cambridge Bay Truckfill	UNIT TAG:	P-3.1/3.2	QUANTITY:	
		TYPE OF SERVICE:			
REPRESENTATIVE:		SUBMITTED BY:		DATE:	
ENGINEER:		APPROVED BY:		DATE:	
CONTRACTOR:		ORDER NO.:		DATE:	



Product photo could vary from the actual product

UPS 15-58 FC

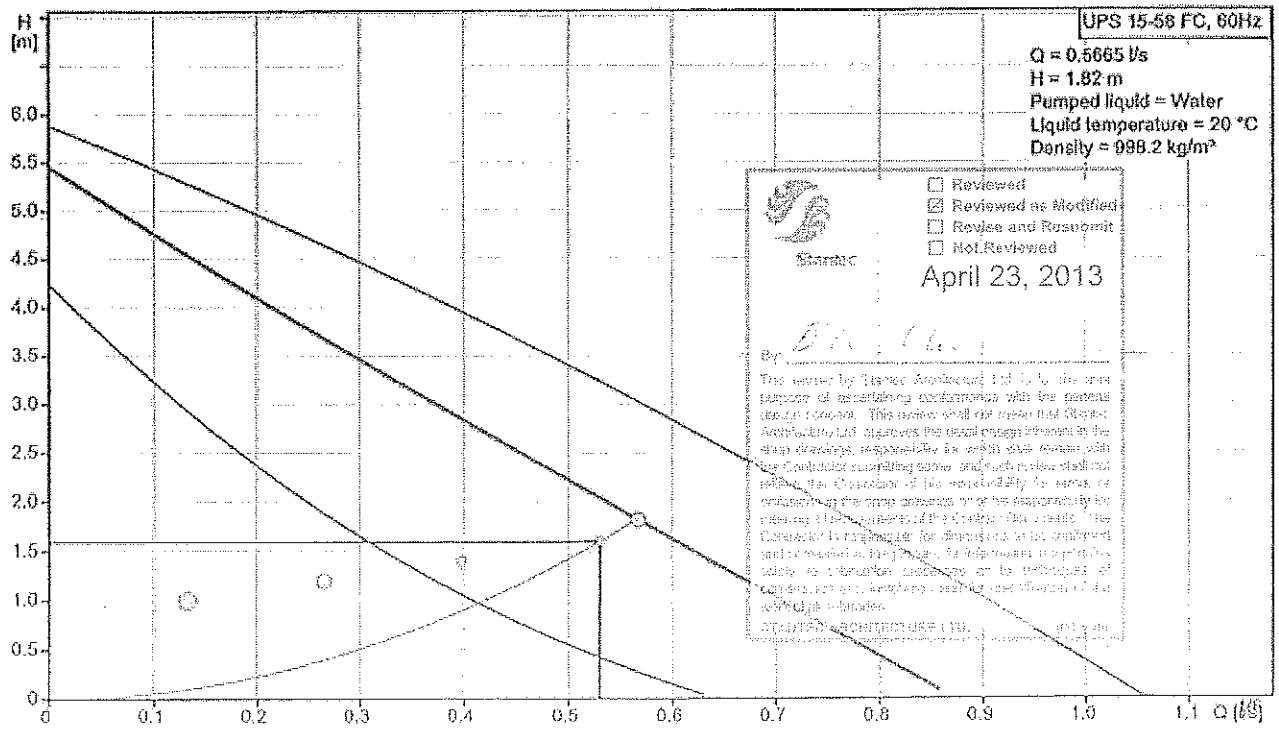
Circulator pumps

23 01 23
SARGENT CONTRACTING LTD.
Shop Drawings Reviewed
APR 16 2013

Conditions of Service	
Flow:	0.5662 l/s
Head:	1.82 m
Efficiency:	11.6 %
Liquid:	Water
Temperature:	20 °C
NPSH required:	10 m
Viscosity:	1 mm²/s
Specific Gravity:	1.000

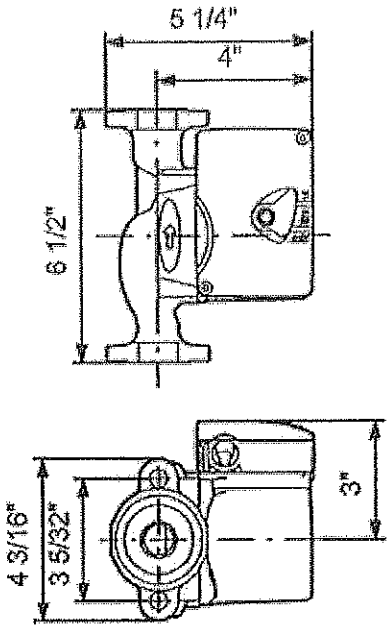
Pump Data	
Maximum operating pressure:	10 bar
Liquid temperature range:	2 .. 110 °C
Maximum ambient temperature:	40 °C
Approvals:	UL, CSA
Type of connection:	C.I. Flange
Flange standard:	USA Oval
Pipe connection:	2 - Bolt Flange
Product number:	59896341

Motor Data	
Max. power input:	87 W
Rated power - P2:	0.03 kW
Rated voltage:	115 V
Main frequency:	60 Hz
Insulation class:	F
Motor protection:	Contact
Thermal protection:	Internal



GRUNDFOS

Submittal Data



Materials:

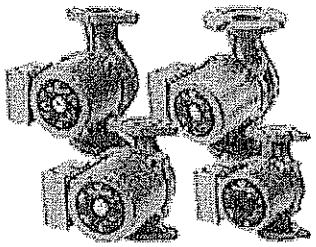
Pump housing:	Cast iron EN-JL1030 ASTM 30 B
Impeller:	Composite, PES

GRUNDFOS

Company name:	Grundfos Canada Inc
Created by:	Graham Scott
Phone:	780-418-8853
Fax:	780-418-4487
Date:	-

Project:	U of A Fume Hood	Client:	-
Reference number:	-	Client number:	-
		Contact:	-

Position	Count	Description
	1	**UPS 15-58 FC**



wtp truck fill

Product photo could vary from the actual product

Product No.: 59896341
The pump is of the canned rotor type, i.e. pump and motor form an integral unit without shaft seal and with only two gaskets for sealing.
The bearings are lubricated by the pumped liquid.
The pump is characterized by:

- Ceramic shaft and radial bearings.
- Carbon axial bearing.
- Stainless steel rotor can and bearing plate.
- Corrosion-resistant impeller, Composite, PES.
- Cast iron pump housing.

The motor is a 1-phase motor.
No additional motor protection is required.

Liquid:

Pumped liquid:	Water
Liquid temperature range:	2 .. 110 °C
Liquid temp:	20 °C
Density:	998.2 kg/m³
Kinematic viscosity:	1 mm²/s

Technical:

Actual calculated flow:	0.5665 l/s
Resulting head of the pump:	1.82 m
Approvals on nameplate:	UL, CSA

Materials:

Pump housing:	Cast iron EN-JL1030 ASTM 30 B
Impeller:	Composite, PES

Installation:

Maximum ambient temperature:	40 °C
Ambient max at 176°F liquid:	80 °C

GRUNDFOS

Company name:	Grundfos Canada Inc
Created by:	Graham Scott
Phone:	780-418-8853
Fax:	780-418-4487
Date:	-

Project:	U of A Fume Hood	Client:	-
Reference number:	-	Client number:	-
		Contact:	-

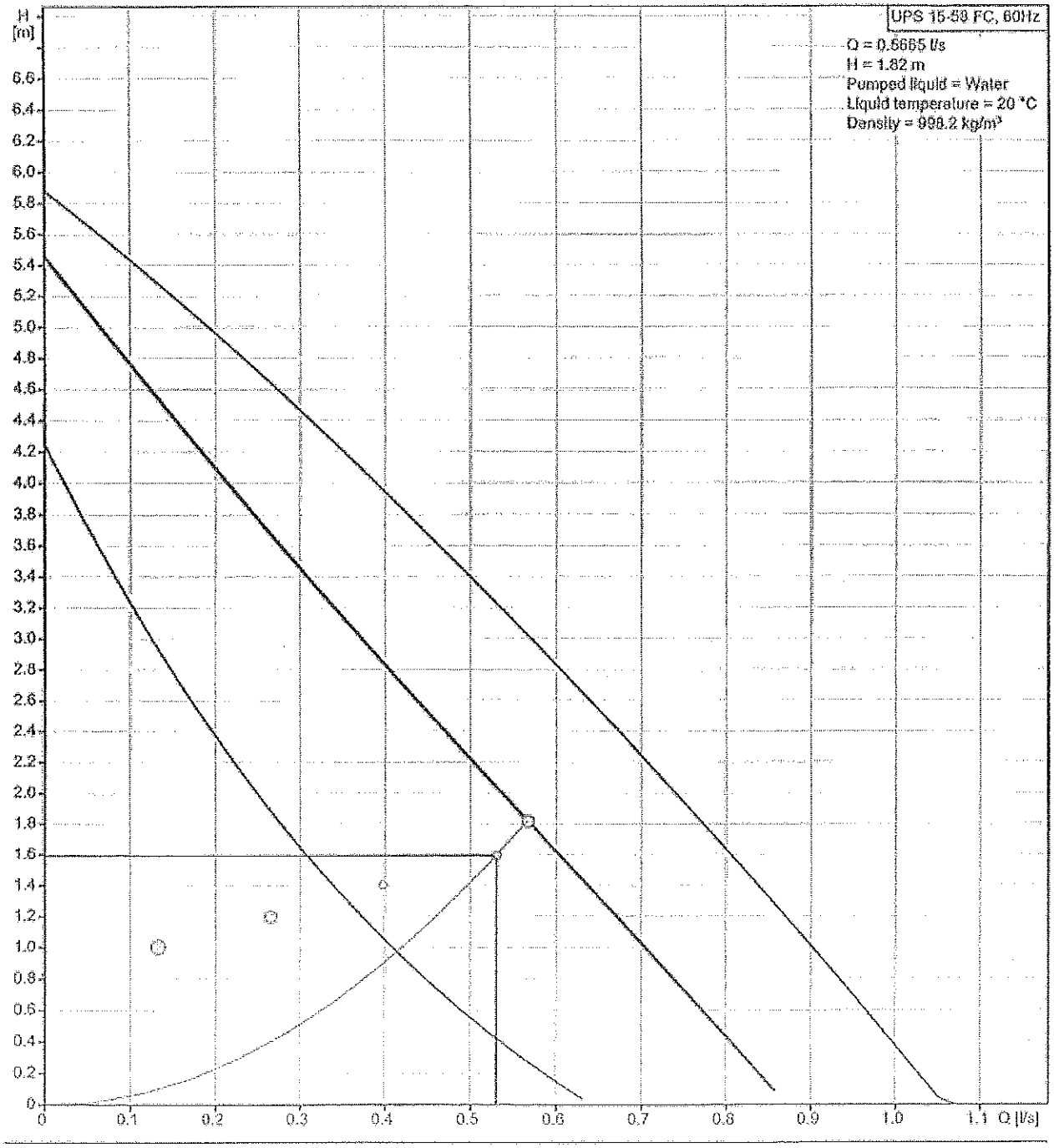
Position	Count	Description	
		Maximum operating pressure:	10 bar
		Flange standard:	USA Oval
		Type of connection:	C.I. Flange
		Pipe connection:	2 - Bolt Flange
		Pressure stage:	10
		Port-to-port length:	165 mm
		Electrical data:	
		Number of poles:	2
		Power input in speed 1:	60 W
		Power input in speed 2:	80 W
		Max. power input:	87 W
		Rated power - P2:	0.03 kW
		Main frequency:	60 Hz
		Rated voltage:	1 x 115 V
		Current in speed 1:	0.55 A
		Current in speed 2:	0.66 A
		Current in speed 3:	0.75 A
		Capacitor size - run:	10 muF/180 V
		Insulation class (IEC 85):	F
		Others:	
		Gross weight:	3.29 kg

GRUNDFOS

Company name:	Grundfos Canada Inc
Created by:	Graham Scott
Phone:	780-416-8853
Fax:	780-418-4487
Date:	-

Project:	U of A Fume Hood	Client:	-
Reference number:	-	Client number:	-
		Contact:	-

59896341 UPS 15-58 FC 60 Hz

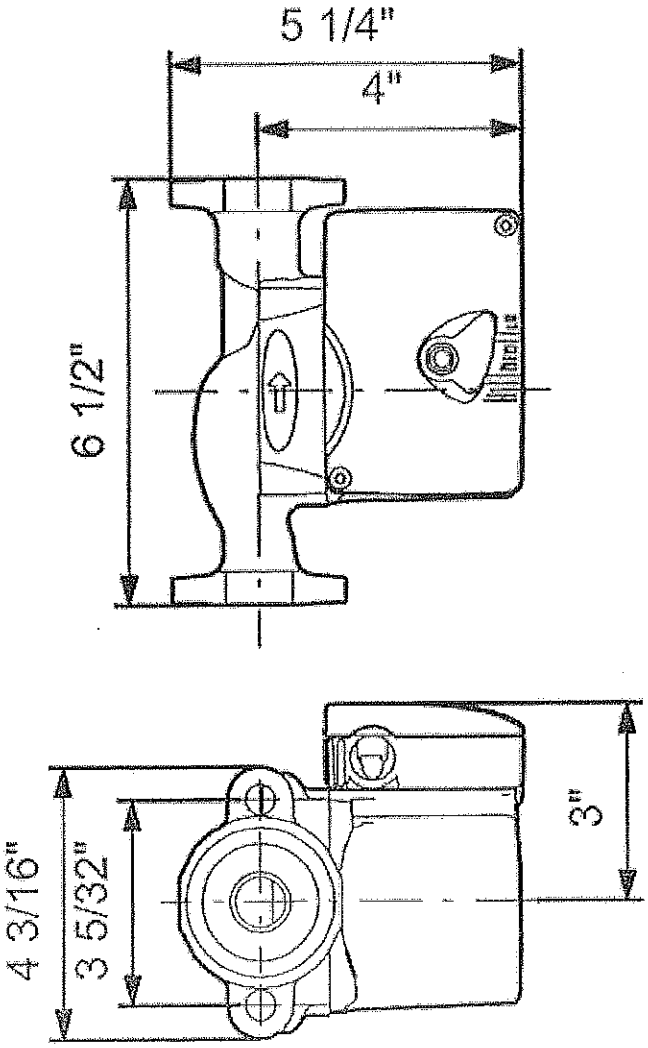


GRUNDFOS

Company name:	Grundfos Canada Inc
Created by:	Graham Scott
Phone:	780-418-8853
Fax:	780-418-4487
Date:	-

Project:	U of A Fume Hood	Client:	-
Reference number:	-	Client number:	-
		Contact:	-

59896341 UPS 15-58 FC 60 Hz



Note! All units are in [mm] unless others are stated.
Disclaimer: This simplified dimensional drawing does not show all details.

Division 23

P-3.4 & P-3.5
Grundfos Hydronic Circ Pump

Make:	Grundfos
Model:	UPS 26-99 FC
Capacity:	0.5354 l/s
Serial #:	N/A

GRUNDFOS

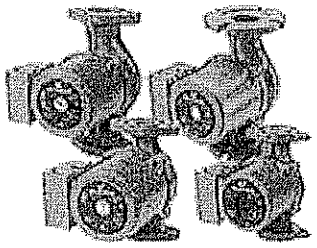
Submittal Data

PROJECT:	Cambridge Bay Truckfill	UNIT TAG:	P-3.3/3.4	QUANTITY:	
		TYPE OF SERVICE:			
REPRESENTATIVE:		SUBMITTED BY:		DATE:	
ENGINEER:		APPROVED BY:		DATE:	
CONTRACTOR:		ORDER NO.:		DATE:	

UPS 26-99 FC

Circulator pumps

23 04 23
SANIMARTIN CONSTRUCTION LTD.
SHOP DRAWING REVIEW
BY
APR 16 2013
- REVIEWED
- REVIEWED AS NOTED
- REVISE AND RESUBMIT

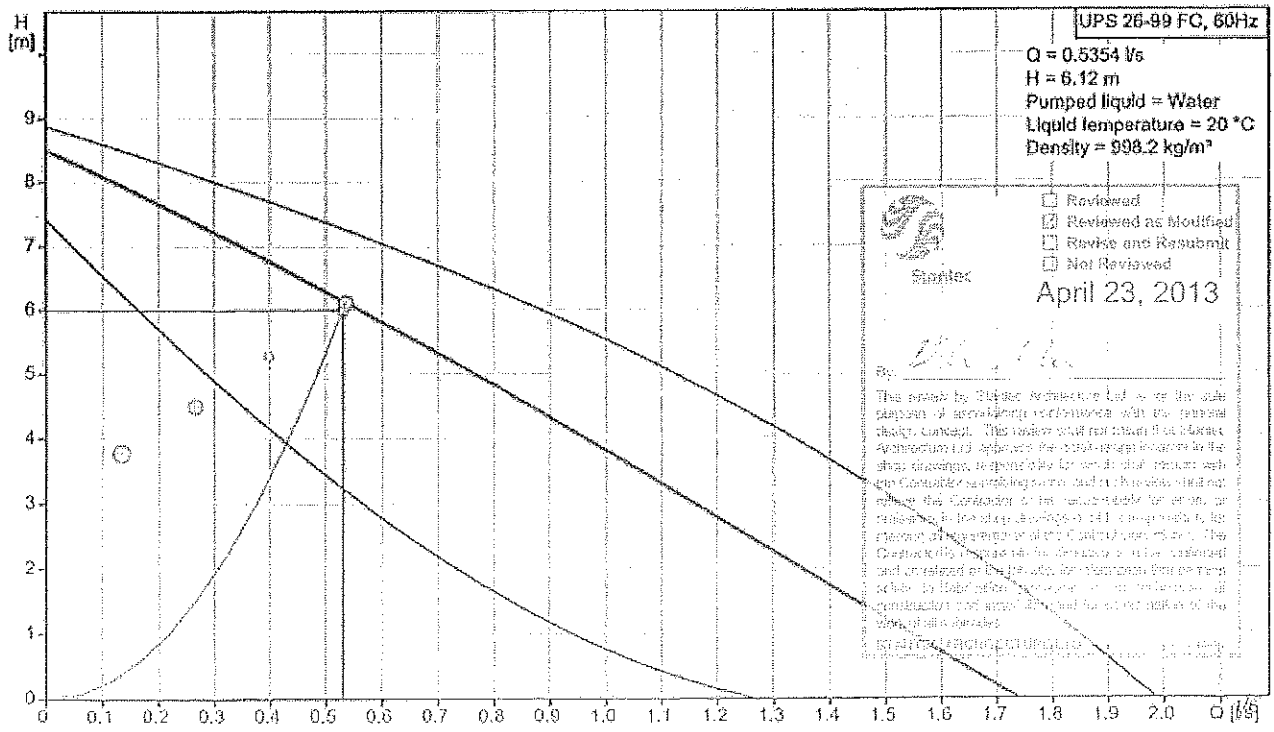


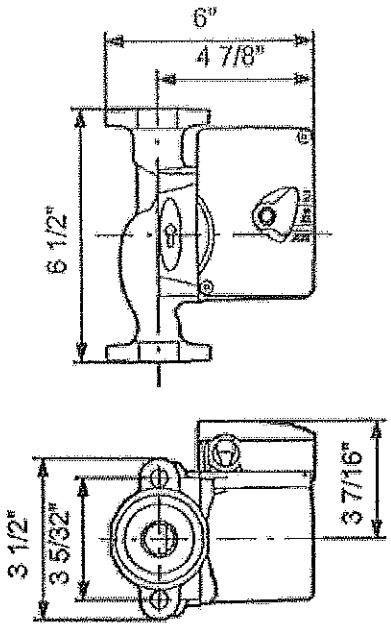
Product photo could vary from the actual product

Conditions of Service	
Flow:	0.5354 l/s
Head:	6.12 m
Efficiency:	16.3 %
Liquid:	Water
Temperature:	20 °C
NPSH required:	10 m
Viscosity:	1 mm²/s
Specific Gravity:	1.000

Pump Data	
Maximum operating pressure:	10 bar
Liquid temperature range:	2 .. 110 °C
Maximum ambient temperature:	40 °C
Approvals:	UL, CSA
Type of connection:	C.I. Flange
Flange standard:	USA Oval
Pipe connection:	2 - Bolt Flange
Product number:	52722512

Motor Data	
Max. power input:	197 W
Rated power - P2:	0.12 kW
Rated voltage:	115 V
Main frequency:	60 Hz
Insulation class:	F
Motor protection:	Contact
Thermal protection:	Internal





Materials:

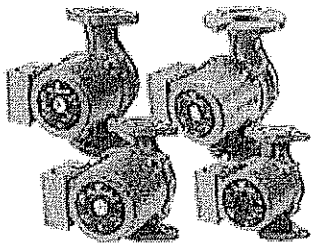
Pump housing:	Cast iron EN-JL1030 ASTM 30 B
Impeller:	Composite, PES

GRUNDFOS

Company name:	Grundfos Canada Inc
Created by:	Graham Scott
Phone:	780-418-8853
Fax:	780-418-4487
Date:	-

Project:	U of A Fume Hood	Client:	-
Reference number:	-	Client number:	-
		Contact:	-

Position	Count	Description
	1	UPS 26-99 FC



truck fill

Product photo could vary from the actual product

Product No.: 52722512
The pump is of the canned rotor type, i.e. pump and motor form an integral unit without shaft seal and with only two gaskets for sealing.
The bearings are lubricated by the pumped liquid.
The pump is characterized by:

- Ceramic shaft and radial bearings.
- Carbon axial bearing.
- Stainless steel rotor can and bearing plate.
- Corrosion-resistant impeller, Composite, PES.
- Cast iron pump housing.

The motor is a 1-phase motor.
No additional motor protection is required.

Liquid:

Pumped liquid:	Water
Liquid temperature range:	2 .. 110 °C
Liquid temp:	20 °C
Density:	998.2 kg/m³
Kinematic viscosity:	1 mm²/s

Technical:

Actual calculated flow:	0.5354 l/s
Resulting head of the pump:	6.12 m
Approvals on nameplate:	UL, CSA

Materials:

Pump housing:	Cast iron EN-JL1030 ASTM 30 B
Impeller:	Composite, PES

Installation:

Maximum ambient temperature:	40 °C
Ambient max at 176°F liquid:	80 °C

GRUNDFOS

Company name:	Grundfos Canada Inc
Created by:	Graham Scott
Phone:	780-418-8853
Fax:	780-418-4487
Date:	-

Project:	U of A Fume Hood	Client:	-
Reference number:	-	Client number:	-
		Contact:	-

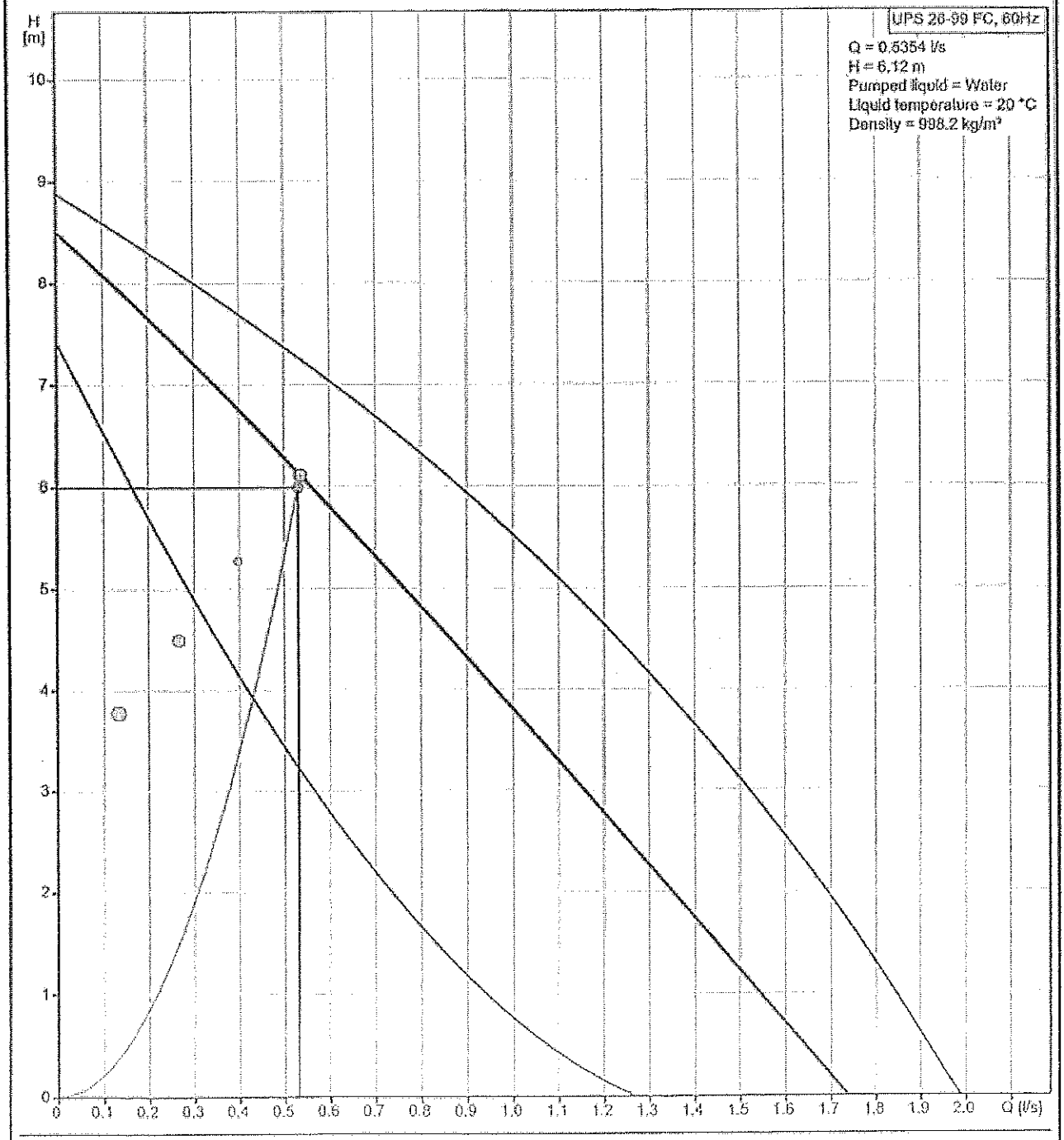
Position	Count	Description	
		Maximum operating pressure:	10 bar
		Flange standard:	USA Oval
		Type of connection:	C.I. Flange
		Pipe connection:	2 - Bolt Flange
		Pressure stage:	10
		Port-to-port length:	165 mm
		Electrical data:	
		Number of poles:	2
		Power input in speed 1:	150 W
		Power input in speed 2:	179 W
		Max. power input:	197 W
		Rated power - P2:	0.12 kW
		Main frequency:	60 Hz
		Rated voltage:	1 x 115 V
		Current in speed 1:	1.3 A
		Current in speed 2:	1.5 A
		Current in speed 3:	1.8 A
		Capacitor size - run:	20 muF/180 V
		Insulation class (IEC 85):	F
		Others:	
		Gross weight:	4.67 kg

GRUNDFOS

Company name:	Grundfos Canada Inc
Created by:	Graham Scott
Phone:	780-418-8853
Fax:	780-418-4487
Date:	-

Project:	U of A Fume Hood	Client:	-
Reference number:	-	Client number:	-
		Contact:	-

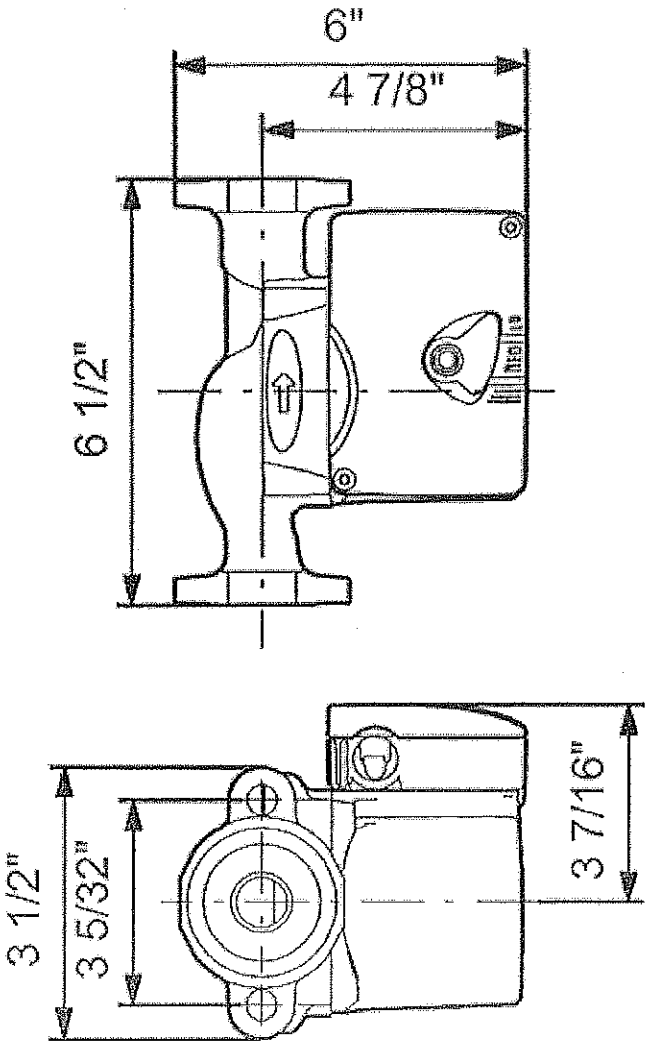
52722512 UPS 26-99 FC 60 Hz



GRUNDFOS

		Company name:	Grundfos Canada Inc
		Created by:	Graham Scott
		Phone:	780-418-8853
		Fax:	780-418-4487
		Date:	-
Project:	U of A Fume Hood	Client:	-
Reference number:	-	Client number:	-
		Contact:	-

52722512 UPS 26-99 FC 60 Hz



Note! All units are in [mm] unless others are stated.
Disclaimer: This simplified dimensional drawing does not show all details.

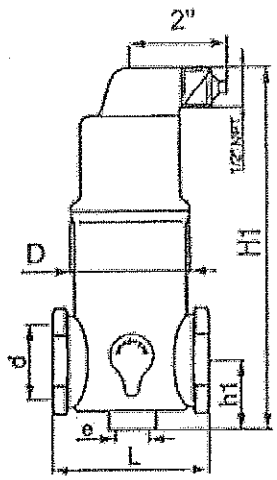
SPIROTHERM®

Submittal Data
VJR-1B

Spirovent® Junior Microbubble™ Eliminator

Job Name:
Engineer:
Contractor:
Representative: WOLSELEY

Tag	Model	Flow	Size	Location



Specifications:

Body	Brass
Vent Head	Brass
Float	Non-Ferrous
Seal	Viton
O Ring	Viton
Coalescing Medium	Copper
Max. Working Pressure	150 psig (160psi (1100kpa))
Max. Operating Temperature	270°F (350°F (177°C))

Notes: --unit is capable of removing up to 100% of the free air, as well as the entrained air, and up to 99.6% of the dissolved air in the system (23.83.16.46.2.9.2.9.6)
--warrantied for up to 2 years after installation date (23.83.16.46.1.4.9)

d (Pipe Size NPT)		3/4"	1"	1 ¼"	1 ½"	2"
D	(inches)	2.6	2.6	2.6	2.6	4.0
H1	(inches)	6.0	7.0	7.8	9.1	10.8
h1	(inches)	0.8	1.4	1.5	1.6	2.3
L	(inches)	3.4	3.5	3.5	3.5	6.2
e	(inches)	N/A	½	¼	½	½
Weight	(lbs)	3.0	3.5	4.0	4.5	8.5
Rec. Flow	(gpm)	6	10	15	30	40
Model No.	VJR-	075FT	100TM	125TM	150TM	200TM

(Dimensions for reference only)

SASKATCHEWAN CONSTRUCTION TECH LTD. WORK APPROVED
BY
APR 16 2013
REVIEWED
REVIEWED NOTED
Reviewed
Reviewed as Modified
Revise and Resubmit
Not Reviewed
April 23, 2013

© 2005 Spirotherm, Inc., 25 North Brandon Drive, Glendale Heights, IL 60139

SECTION 5.2 ~ Ventilation System Components & Manufacturer Info

HRV-1	Lifebreath RNC 95 Heat Recover Unit
CF-1	Greenheck SQ-70-E Inline Exhaust Fan
S-1	Round Supply Air Grille – EH Price RSG
R-1	Round Perforated Return Air Grille – EH Price RPG

Division 23

HRV-1
Heat Recovery Ventilator
c/w Lifebreath Lifestyle Timer Model 99-20M01

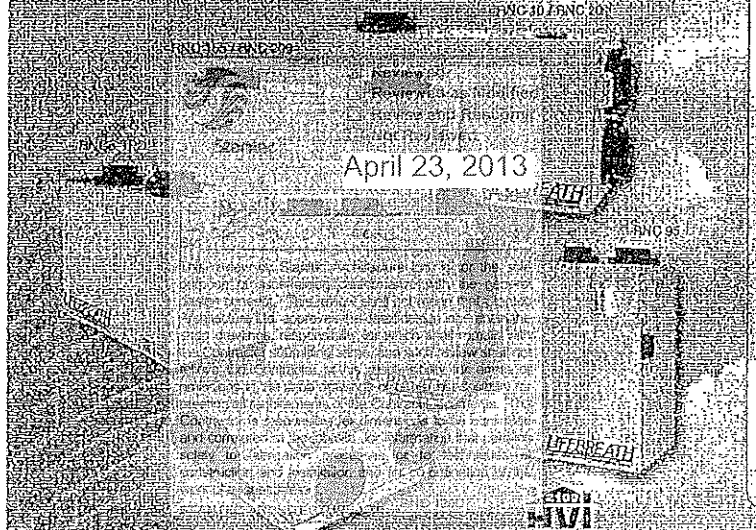
Make:	Lifebreath
Model:	RNC 95
Capacity:	76 L/s
Serial #:	NEBD02211301348

LIFEBREATH
INDOOR AIR SYSTEMS

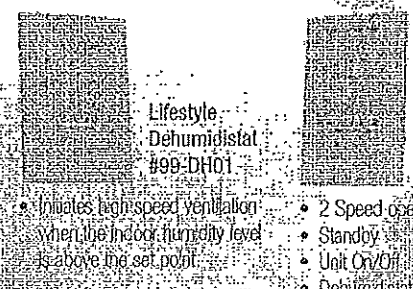
RNC SERIES
HEAT RECOVERY VENTILATORS

Model Selection

Model	Description: H x W x D (inches)	Airflow cfm (L/s) 1 (25 Pa)	2 (50 Pa)	3 (75 Pa)	4 (100 Pa)	5 (125 Pa)	Effectiveness @ 0°C (32°F)	Performance Highlights
RNC 95*	Recirculating Defrost 24.5 x 18.5 x 16	76 (36)	73 (34)	70 (33)	66 (31)	60 (29)	88%	Top ported, compact unit. Ideally suited to narrow installations.
RNC5-TPD*	Recirculating Defrost 18.75 x 27 x 15	156 (74)	146 (69)	134 (63)	124 (59)	116 (54)	74%	Compact unit with door port balancing. Adjustable high speed (3) settings.
RNC 120D	Recirculating Defrost 22 x 22.13 x 9.13	142 (67)	137 (64)	131 (62)	128 (60)	123 (58)	68%	Only 9 inches tall. Can be mounted horizontally or vertically for maximum installation flexibility.
RNC 155	Recirculating Defrost 19 x 33.62 x 14.75	144 (68)	134 (63)	125 (59)	113 (53)	97 (46)	73%	Horizontal model with door port balancing. One of our most popular units.
RNC 200*	Recirculating Defrost 19 x 33.62 x 14.75	207 (97)	200 (94)	184 (87)	171 (80)	152 (71)	74%	Horizontal model, with door port balancing. Same design as RNC 155 with greater airflow.
RNC 10	Damper Defrost 19 x 33.62 x 14.75	177 (83)	164 (77)	156 (73)	143 (67)	125 (59)	76%	Horizontal model with 5 ports and damper defrost. Best value for new construction.
RNC 20	Damper Defrost 19 x 33.62 x 14.75	214 (101)	206 (97)	193 (91)	184 (87)	170 (80)	67%	Same design as RNC 10. Ideally suited to larger applications.



Control Options



Lifestyle Dehumidistat #99-DH01
- Initiates high speed ventilation when the indoor humidity level is above the set point.

Lifestyle RNC Ventilation Control #99-RC01
- 2 Speed operation
- Standby
- Unit On/Off
- Dehumidistat

Lifestyle RNC Digital Control #99-DX01
- 4 selectable operational modes
- 2 speed operation on each mode
- Adjustable dehumidistat function
- Dehumidistat disable

Timers

Lifestyle 20/40/60 Minute Timer #99-DT01
- Initiates high speed operation for 20, 40 or 60 minutes.

Lifestyle 20 Minute Timer #99-20M01
- Initiates high speed operation for 20 minutes.

Accessories

- Weatherhoods - 5", 6" or 7"
- Kitchen Grille - 6" x 10"
- Teen Grilles - 4", 5", 6" or 8"

Project: Cambridge Bay Potable Water System
Customer: Central Mechanical Systems Ltd.
Engineer: Stantec Consulting Ltd.
Distributor: E.H. Price
Date: 4/16/2013

APR 16 2013

LIFEBREATH
THE ULTIMATE AIR EXCHANGER

Model RNC95

THERMALLY CONDUCTIVE, PATENTED ALUMINUM CORE
The cross-flow heat recovery core transfers heat between the two airstreams. It is easily removed for cleaning or service.

MOTORS AND BLOWERS
Each air stream has one centrifugal blower driven by a common PSC motor. 2 speed fan operation.

FILTERS
Washable air filters in exhaust and supply air streams.

MOUNTING THE HRV
Four threaded inserts at corners of the cabinet designed to accept the "S" hooks and hanging straps supplied with the unit.

DEFROST
Recirculating defrost system.

CASE
Twenty gauge prepainted galvanized steel (G60) for superior corrosion resistance. Insulated to prevent exterior condensation. Drain connections 2 - 1/2" (12 mm) OD.

WEIGHT 52 lbs. (23.6 kg) SHIPPING WEIGHT 56 lbs (25.4 kg)

CONTROLS AND ELECTRONICS
99-BC-01 Lifestyle RNC Ventilation Control - (included with unit)
Can be wall mounted in a central location of the home (3 wire) 20 gauge 100 ft. length.
- 2 Speed Fan setting (Low/High)
- Adjustable Dehumidistat function built into main wall control
- Built-in Relay for interlocking the unit to furnace.

OPTIONAL CONTROLS
99-DX-01 Lifestyle RNC Digital Control
- 2 Speed Operation on each mode - 4 user selectable operational modes: Continuous Ventilation, 20 ON/40 OFF, 20 ON/40 Recirculation, Continuous Recirculation
- Adjustable Dehumidistat function built into the main wall control
- Connect to 3 wire 20 gauge low voltage wire.

OPTIONAL TIMERS
99-DET01 Lifestyle 20/40/60 Minute Timer - Initiates high speed ventilation for 20, 40, or 60 minutes, (3 wire) 20 gauge wire (min.) 100' length
99-20M01 Lifestyle 20 Minute Timer - Initiates high speed ventilation for 20 minutes, (3 wire) 20 gauge wire (min.) 100' length.
99-101 Mechanical Timer - Initiates High speed ventilation for up to 60 minutes, (2 wire) 20 gauge wire (min.) 100' length

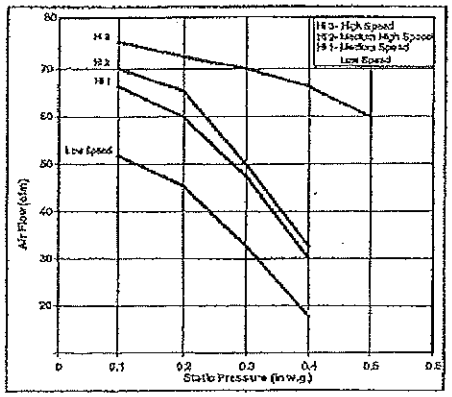
OPTIONAL ACCESSORIES
99-DH-01 Lifestyle Dehumidistat - Initiates high speed ventilation when the indoor humidity level is above the set point. (3 wire) 20 gauge wire (min.) 100' length
99-163 Duct Heater w/ Electronic SCR Thermostat, 1 Kw, 6" (152 mm)
99-185 Weatherhoods, Two - 5" (125 mm) c/w 1/4" (6 mm) mesh screen

Performance (HVI certified)
Net supply air flow in cfm (L/s) against external static pressure

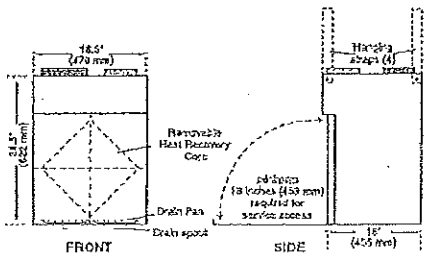
E.S.P (external static pressure)	[cfm (L/s)]
@ 0.1" (25 Pa)	76 (36)
@ 0.2" (50 Pa)	73 (34)
@ 0.3" (75 Pa)	70 (33)
@ 0.4" (100 Pa)	66 (31)
@ 0.5" (125 Pa)	60 (28)

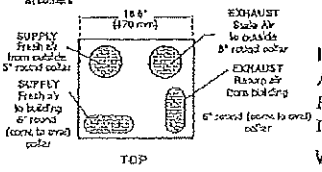
Max. Temperature Recovery		88%
Sensible Effectiveness @ 60 cfm (28 L/s)	32°F (0°C)	88%
*Sensible Efficiency @ 60 cfm (28 L/s)	32°F (0°C)	75%
*Sensible Efficiency @ 61 cfm (29 L/s)	-13°F (-25°C)	68%
VAC @ 60HZ		120
WATTS / Low speed.		59
WATTS / High speed		150
Amp rating		0.9

*Sensible Efficiency – thermal **Latent Efficiency – moisture
Note: Effectiveness - based on temp. difference between the 2 airstreams
Efficiency – taken into account all power inputs



DIMENSIONS RNC95 *Inches (mm)*





All units conform to CSA and UL standards.

Installer Selectable High Speed Settings
Adjustable DIPswitches are located on the circuit board. Hi3 is the factory setting. Refer to the Operation and Installation manual for the adjustment instructions.

WARRANTY
Units carry a LIFETIME warranty on the heat recovery core and a 5 year replacement parts warranty.

Project: Cambridge Bay Potable Water System
Customer: Central Mechanical Systems Ltd.
Engineer: Stantec Consulting Ltd.
Distributor: E.H. Price
Date: 4/16/2013

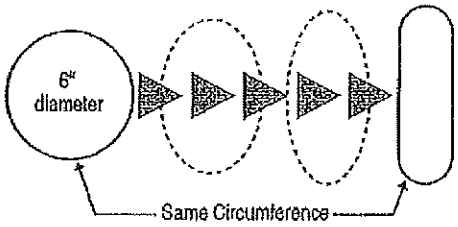
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Email: info@lifebreath.com

270 Regency Ridge, Suite 210
Dayton, Ohio 45459
T (937) 439-6676
F (937) 439-6585
Website: www.lifebreath.com

ISO 9001 REGISTERED

In order to make the RNC95 as space efficient as possible, the INDOOR supply and return ports are converted from round to oval shape. Overall size of the port remains the same. Simply bend a standard duct fitting to the correct shape, and attach to the oval port using the same method as for a round port.



Round port bent to oval

LIFEBREATH®
INDOOR AIR SYSTEMS

RNC Series
Homeowners Guide

Setting a new standard for
energy efficient, clean air homes

AIRIA BRANDS INC.
511 McCormick Blvd
London, Ontario Canada N5W 4C8
519.457.1904
ORDER INFORMATION: 1.855.247.4200
ORDER DESK FAX: 1.800.494.4185
www.lifebreath.com

69-RNC-Owners Sep-13

LIFEBREATH
INDOOR AIR SYSTEMS

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Troubleshooting 11
Additional Information 12
Warranty 12

Homeowner Information

Model_____

Serial Number_____

Dealer / Contractor Information

Dealer_____

Installer_____

Telephone/Contact_____

Installation Date_____

Register your HRV for warranty at www.lifebreath.com

For any warranty information, please contact Airia Brands

511 McCormick Blvd. London ON N5W 4C8

T 1-855-247-4200 F 1-800-494-4185

ISO 9001 REGISTERED

CSA C US

HVI CERTIFIED

A2000

HRAI MEMBER COMPANY

CHBA Member

Selecting the Ventilation Rate That is Right for You

The modes of operation and speeds are used to adjust your indoor ventilation rate. Experiment with the ventilation levels in your home to evaluate the ideal amount of ventilation to suit your home and personal preferences.

I. **Continuous Ventilation**
This mode of operation provides continuous ventilation within the home. You may, for example, select Continuous Ventilation at low speed for normal operation and increase to high speed during increased activity levels, such as cooking and showering, etc.

II. **20 Minutes On, 40 Minutes Standby**
This mode of operation provides 20 minutes of ventilation each hour. You can use this ventilation mode at low speed for low household activity levels or when the home is unoccupied.

III. **20 Minutes On, 40 Minutes Recirculation**
Ventilates for 20 minutes and recirculates the household air every 40 minutes each hour. This mode is not applicable if your HRV is connected to a forced air system.

IV. **Continuous Recirculation**
Continuously recirculate your household air (no ventilation). This mode is not applicable if your HRV is connected to a forced air system.

Recirculation

Recirculates existing household air without introducing fresh air. Recirculation modes (III and IV) are not applicable if your HRV is connected to a forced air system, since your forced air system already circulates the household air. Recirculation modes are unavailable on some models.

⚠ Note

- Due to ongoing research and product development, specifications, ratings, and dimensions are subject to change without notice.

⚠ Warning

- Disconnect the power from the unit before cleaning or servicing.
- To prevent electrical shock, it is extremely important to confirm the polarity of the power line that is switched by the safety (disconnect) switch. The hot line (black) is the proper line for switching. Use either a voltmeter or test lamp to confirm the absence of a voltage between the disconnect switch and ground (on the cabinet) while the door is open. This procedure must be followed, as dwellings are occasionally wired improperly. Always ensure the proper grounding of the unit.

How the Dehumidistat Works

High indoor humidity levels, during the heating season, have become a problem in many well insulated, tight homes, excessive condensation on the window is a visual sign of high indoor humidity levels. High indoor humidity levels can result in mold and mildew and the eventual degradation of the building structure itself.

Your HRV reduces indoor humidity levels when the outdoor air is drier than the indoor air. These conditions usually occur during the heating season when outdoor temperatures are less than 15°C (59°F). During the heating season, the operation of the HRV may reduce indoor humidity levels sufficiently to eliminate the need for further dehumidification. If your home requires further dehumidification, use the dehumidistat feature located on the main control. This feature aggressively addresses high indoor humidity levels by initiating high speed ventilation when the indoor humidity levels rise above the adjustable set point on the control. Refer to the Main Control instructions located in the Installation Guide for instructions on how to set the dehumidistat. The dehumidistat function should be set to off for all seasons except the heating season because a dehumidifying effect occurs only when the outdoor air is dryer than the indoor air. (Refer to the Control Instructions for information on how to set the dehumidistat).

Your **Lifestyle RNC Digital Control** has an adjustable dehumidistat which can be set to achieve a further dehumidification effect from your HRV. High speed ventilation will be initiated upon exceeding the dehumidistat set point regardless of the mode and speed of operation. Once the humidity in the house is reduced, the HRV will revert back to its previous setting.

We suggest operating the HRV for the first few days without use of the dehumidistat function to observe if a further dehumidification effect will be required. The dehumidistat operates in % of RH (relative humidity) with 80 being high and 20 being low. Set the dehumidistat to 80% to disable. If after a few days, further dehumidification is required (the house is still too humid), set the humidity level to a lower amount.

The average person is comfortable between 30% and 50% RH. The dehumidistat should be set to off for all seasons except the heating season. Off is achieved by setting the dehumidistat to 80.

Dehumidistat Notes

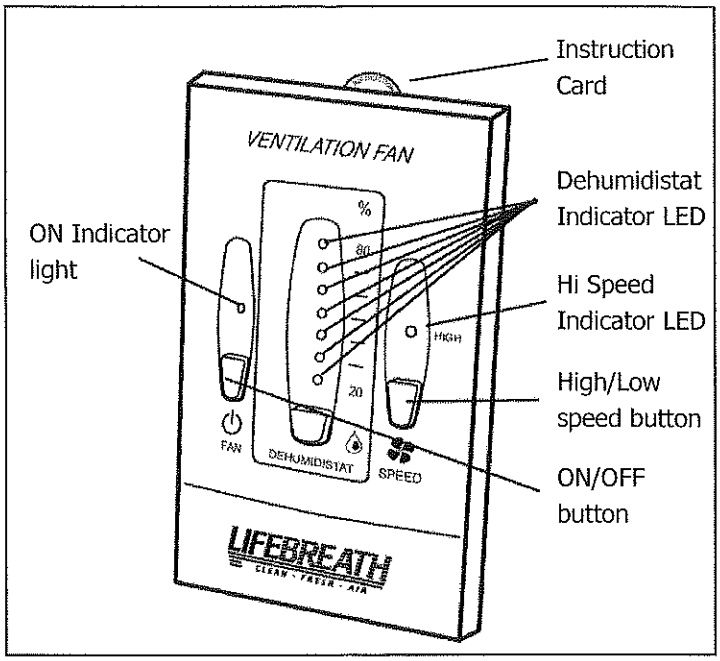
- **Dehumidistat Disable** automatically disables the dehumidistat function on the main control when outdoor temperatures exceed 15°C (59°F) for a full 24 hour period. All other HRV features and functions operate normally while the dehumidistat function is disabled.
- **Dehumidistat Re-Enable** automatically re-enables the dehumidistat function if either the outdoor temperature drops below 15°C (59°F) for a full 24 hour period or if the HRV is reset (unplugged for 30 seconds).

The Lifestyle RNC Ventilation Control 99-BC01 (Included) (Not included with RNC120F Model)

The **Lifestyle RNC Ventilation Control** offers ON/OFF, high speed/low speed plus and electronic dehumidistat.

Key Features

- 2 speed fan setting
- Electronic dehumidistat
- Instruction card inserted in the control
- Slim-line design
- Connect to 3 wire 20 gauge low voltage wire



Turning on the Control

Press and release the ON/OFF button. The "ON indicator light" will illuminate.

Adjusting the Ventilation Speed

The unit will normally operate at low speed. Press and release the SPEED button to initiate high speed ventilation. The "High Speed Indicator LED" will illuminate.

Humidity Control

Your unit will produce a dehumidifying effect when outdoor humidity levels are lower than indoor humidity levels. Never use the dehumidistat feature when outdoor temperatures are above 59°F (15°C).

Setting the Dehumidistat

Press and release the DEHUMIDISTAT button until the dehumidistat LED is at the desired setting. After 5 seconds the dehumidistat light will either flash or be on continuous.

A flashing light indicates the humidity level is higher than the setting and the unit is operating on high speed ventilation. A continuous light indicates the humidity level is lower than the setting. Refer to manual for instructions on "How the Dehumidistat Works."

⚠ Attention

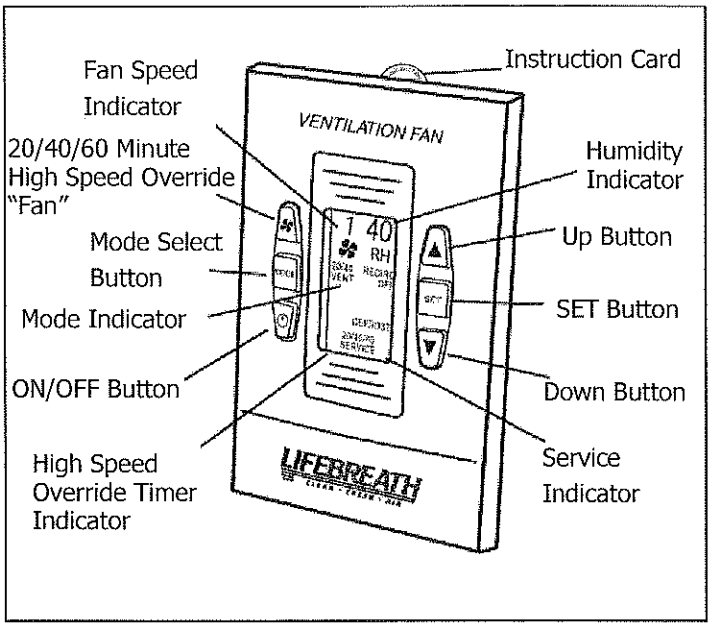
- Only one main control can be installed on your system.
- Recirculation is not available on all models.
- Timers will not function when mode of operation is set to "OFF", unless specifically installed for that function. (See Installation Guide for other options.)
- Install a jumper between 2 (ON) and 3 (RED) on the HRV terminal block to configure the ON/OFF button to ON/STANDBY. Refer to "Setting Standby when using a Main Control" in this manual.

The Lifestyle RNC Digital Control 99-DX01 (Optional)
(Included with DX Models)

The **Lifestyle RNC Digital Control** offers advanced features to control your home's ventilation.

Key Features

- 2 speed fan setting (low-1/high-2)
- Standby setting (fan speed 0)
- Electronic dehumidistat
- Four selectable modes of operation
    - 20 min. ON/40 min. OFF
    - 20 min. ON/40 min. recirculation
    - Continuous ventilation
    - Continuous recirculation
- 20/40/60 high speed override button
- Instruction card is inserted in the control
- Easy to read backlit LCD screen
- Slim-line design
- Connect to 3 wire 20 gauge low voltage wire



Setting the Control

1. Refresh the screen: use the ON/OFF button to turn the control off and on.
2. Press the SET button.
3. The "FAN" symbol flashes. Scroll (using Up/Down buttons) to select desired fan speed. Press the SET button.
4. Scroll to select the desired operational mode (VENT, 20/40, 20/40 RECIRC, RECIRC, or OFF). Press the SET button. Refer to manual for explanation of operational modes.

20/40/60 Minute High Speed Timer

This function temporarily initiates high speed ventilation for 20, 40, or 60 minutes.

1. Refresh the screen: use the ON/OFF button to turn the control off and on.
2. Press FAN button once for 20, twice for 40, three times for 60 minutes and four times to cancel the timer.

Setting the Dehumidistat

Refer to "How the Dehumidistat Works" in this manual before setting the dehumidistat.

1. Refresh the screen: use the ON/OFF button to turn the control off and on.
2. Press and release MODE until "RH" number flashes.
3. Scroll to desired "RH" number. Press the MODE button.

⚠ Attention

- Only one main control can be installed on your system.
- Recirculation is not available on all models.
- Timers will not function when mode of operation is set to "OFF", unless specifically installed for that function. (See Installation Guide for other options.)

99-DX01 Continued

The Lifestyle RNC Digital Control Gives you 4 Mode Selection

The Lifestyle RNC Digital Control has 4 operational modes and 2 speeds on each mode to adjust indoor ventilation levels.

Experiment with the ventilation levels in your home to evaluate the best amount of ventilation to suit your home and preferences.

I. **Continuous Ventilation Mode**
This is the most popular mode since it provides continuous ventilation within the home. You may, for example, select Continuous Ventilation at high speed for high household activity levels or Continuous Ventilation for lower activity levels.

II. **20 minutes On, 40 minutes OFF Mode**
This operational mode will provide 20 minutes of ventilation each hour. You may wish to use this ventilation mode in low speed for low household activity levels or if the home is unoccupied.

III. **20 minutes On, 40 minutes Recirculation Mode**
The operational mode provides 20 minutes of ventilation (fresh air) and 40 minutes of recirculate air. Use this mode only if your HRV is not connected to a forced air system (the forced air system has already circulated household air).

IV. **Continuous Recirculation Mode**
This operational mode recirculates your household air (no ventilation). Use this mode only if your HRV is not connected to a forced air system.

How to Synchronize the Humidity Setting

The Lifestyle RNC Digital wall control has a feature that will allow it to be synchronized with other humidity instruments in your home.

1. Turn off the control with the ON/OFF button.
2. Simultaneously press and release the ON/OFF button and the 20/40/60 minute high speed override button.
3. Use the Up/Down buttons to adjust the humidity indicator on the display screen to the number of degrees difference between your humidity measuring device. Minus is indicated by flashing.
4. Press the MODE button.

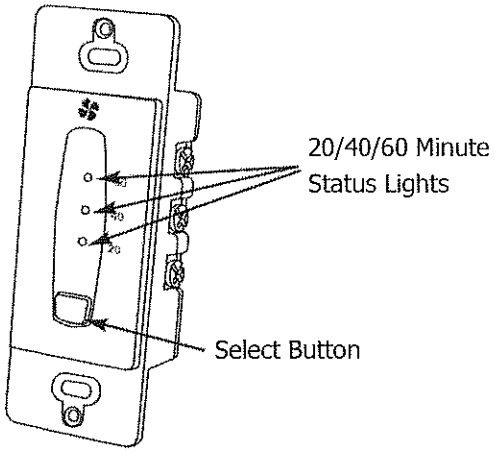
⚠ Attention

- Only one main control can be installed on your system.
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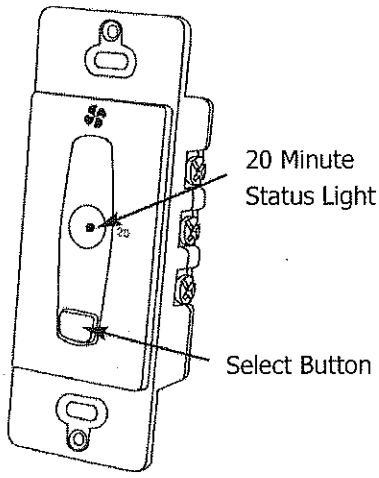
Timers

Depending on the type of HRV installation, you may have timers in areas such as restrooms. The timer will override the operational mode (regardless of the setting) and initiate high speed ventilation. Upon completion of the timer cycle, the HRV will return to your selected operational mode and speed setting.

Lifestyle 20/40/60 Minute Timer 99-DET01
Initiates high speed ventilation for 20, 40 or 60 minutes. The 20/40/60 minute status lights indicate high speed operation. Lockout mode is useful if you wish to disable the timer. Set lockout by holding the select button for 5 seconds. Unlock by holding for 5 seconds.

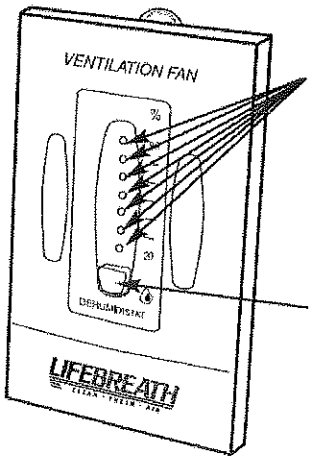


Lifestyle 20 Minute Timer 99-20M01
Initiates high speed ventilation for 20 minutes. The 20 minute status light indicates high speed operation. Lockout mode is useful if you wish to disable the timer. Set lockout by holding the select button for 5 seconds. Unlock by holding for 5 seconds.



Dehumidistat

Lifestyle Dehumidistat 99-DH01
Initiates high speed ventilation when the moisture level in the home exceeds the set point on the control. Once the humidity in the house is reduced, the HRV will revert back to its previous setting. The dehumidistat should be set to OFF for all seasons except the heating season. Refer to "How the Dehumidistat Works" in this manual before setting the dehumidistat.



Dehumidistat LEDs
Set to the desired humidity level. High speed ventilation will initiate when the indoor moisture level exceeds the set point on the control

Dehumidistat Adjust Button

Maintenance Routine

1. Inspect Exterior Hoods at Least Once a Month

Make sure exhaust and fresh air supply hoods are not blocked or restricted by leaves, grass, or snow. In winter, it is especially important to make sure snow is not blocking the hoods or that frost has not built up on the wire mesh (bird screen).

2. Clean Air Filters (Clean Twice a Year)

The standard filters equipped with your HRV are removable and washable.

a) Open access door and slide core out.
b) Remove filter clips if present.
c) Once clips are removed, filters can be taken off the core to be rinsed with water or a combination of mild soap and water. Do not clean in the dishwasher.
d) To re-assemble, place clean filter(s) (wet or dry) back into their positions against the core and return clips to their original positions.
e) Slide core back into its original position.

3. Clean Core Twice a Year

a) Open access door.
b) Carefully grip ends of core and pull evenly outward. Core may be snug, but will slide out of the cabinet.
c) Once removed from the cabinet remove filters.
d) Install the clean filters.
e) Install clean core in the cabinet.

Note: Core installation label on the outer end of the core.

To Install the Clean Core:

a) To reinstall the core first position the bottom of the core on the bottom support in the cabinet.
b) Carefully align the core with the other 3 supports and fully insert the core.
c) Push on sides of core, do not push on the center.

Note: Core may appear to stick out from the cabinet approximately 1/8 in (3 mm). This is designed this way so that the access door will fit tight against the core.

⚠ Attention/Warning

- Do not use cleaning solutions for the HRV core
- Soak and rinse the HRV core in warm soapy water
- Do not use bleach or chlorine
- Do not use a pressure washer on the HRV core
- Do not place the HRV core in a dishwasher

Warning:

- Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power unit off at disconnect switch(es). Unit may have multiple power supplies.
- Blockage of hoods may cause an imbalance

Maintenance Routine Continued

4. Motors — Maintenance Free

5. Drain (condensate) Line - Clean Once a Year

Inspect drain line, drain spout and "P" trap for blockage, mold or kinks. Flush with warm soapy water and replace if worn, bent or unable to clean.

6. Clean Duct Work if Required

The duct work running to and from the HRV may accumulate dirt. Wipe and vacuum the duct once every year. You may wish to contact a heating/ventilation company to do this.

7. General Maintenance - Twice a Year

Wipe down the inside of the cabinet with a damp cloth to remove dirt, bugs and debris that may be present.

Troubleshooting

SYMPTOM	CAUSE	SOLUTION
Poor airflows	• 1/4 in (6 mm) mesh on outside hood is plugged • Filters plugged • Core obstructed • House grills closed or blocked • Dampers are closed if installed • Poor power supply at site • Ductwork is restricting HRV • Improper speed control setting • HRV airflow improperly balanced	• Clean exterior hoods or vents • Remove and clean filter • Remove and clean core • Check and open grilles • Open and adjust dampers • Have electrician check supply voltage • Check duct installation • Increase the speed of the HRV • Have contractor balance HRV
Supply air feels cold	• Outdoor temperature extremely cold	• Turn down the HRV supply speed • Placement of furniture or closed doors is restricting the movement of air in the home • If supply air is ducted into furnace return, the furnace fan may need to run continuously to distribute ventilation air comfortably
Dehumidistat in not operating	• Outdoor temperature is above 15°C (59°F) • Check dehumidistat setting it may be on OFF	• Dehumidistat is functioning normally (see Auto Dehumidistat Disable in this manual) • Set the dehumidistat at the desired setting
Humidity levels are too high condensation is appearing on the windows	• Dehumidistat is set too high • HRV is not sized to handle a hot tub, indoor pool etc. • Lifestyle of the occupants • Moisture coming into the home from an unvented or unheated crawl space • Moisture is remaining in the washroom and kitchen areas • Condensation seems to form in the spring and fall • HRV is set at too low a speed	• Set dehumidistat lower • Cover pools, hot tubs when they are not in use • Avoid hanging clothes to dry, storing wood and venting clothes dryer inside. Fire wood may have to be moved outside • Vent crawl space and place a vapor barrier on the floor of the crawl space • On humid days, as the seasons change, some condensation may appear but the homes air quality will remain high with some HRV use • Increase speed of the HRV
Humidity levels are too low	• Dehumidistat control set too low • Blower speed of HRV is too high • Lifestyle of occupants • HRV airflows may be improperly balanced	• Set dehumidistat higher • Decrease HRV blower speed • Humidity may have to be added through the use of humidifiers • Have contractor balance HRV airflows
HRV and/or ducts frosting up	• HRV airflows are improperly balanced • Malfunction of the HRV defrost system	• Note: minimal frost build-up is expected on cores before unit initiates defrost cycle functions • Have HVAC contractor balance the HRV
Condensation or ice build up in insulated duct to the outside	• Incomplete vapor barrier around insulated duct • A hole or tear in outer duct covering	• Tape and seal all joints • Tape any holes or tears made in the outer duct covering, ensure that the vapor barrier is completely sealed
Excess water in the bottom of the HRV	• Drain pans plugged • Improper connection of HRV's drain lines • HRV is not level • Drain lines are obstructed • HRV heat exchange core is not properly installed	• Look for obstructions in the drain line • Look for kinks in the drain line
Excessive vibration	• Dirt on fan wheels	• Have a contractor service HRV

Additional Information

Defrost Mode - During cold weather, the HRV automatically cycles through its defrost mode when temperatures drop below freezing to avoid frost build up in the core.

HRV - a Heat Recovery Ventilator (HRV) is designed to provide fresh air into a building while exhausting an equal amount of stale air. During the winter months, heat recovered from the stale air, before it is exhausted to the outdoors, warms the incoming cold fresh air. During the summer months, when the indoor space is air conditioned, the HRV helps to cool the incoming fresh air with the cool exhausted stale air.

Self-Test - Each time the HRV is powered/energized, the self-test function automatically initiates. The HRV cycles through the available speeds and tests the damper motor operation. The HRV resumes operation at the selected mode and speed. (Approximately 60 seconds in duration.)

Standby (Speed 0) - The HRV is on but fans are not running waiting for ventilation to be initiated by either an external control (i.e. timer) or the dehumidistat. Set the main control to speed 0 to set the HRV in standby.

Timers - These optional controls may be installed at specific exhaust locations (bathrooms etc.) to initiate high speed ventilation.

Additional information can be found at www.lifebreath.com.

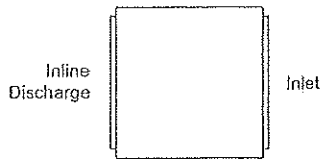
Warranty

Lifebreath RNC Series Heat Recovery Ventilators carry a Lifetime Warranty on the heat recovery core and a 5 year replacement parts warranty.

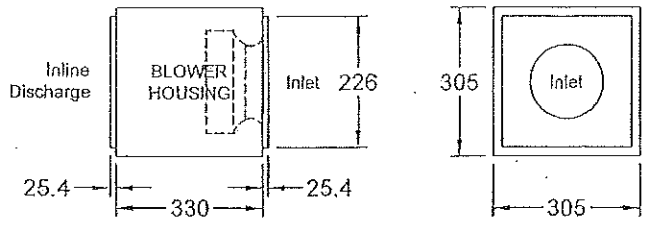
Register for your warranty:

www.lifebreath.com or phone 1-855-247-4200 (toll free)

Note: Airia will require the HRV Model and serial number(s) for the registration of your HRV.



PLAN VIEW



ELEVATION VIEW END VIEW

Model: SQ-70-E

Direct Drive Centrifugal Inline Fan

Standard Construction Features:

- Galvanized steel housing - Backward inclined aluminum wheel - Two bolted access panels - Integral duct connection flanges - Ball bearing motors (sizes 100-160), sleeve bearing motors (sizes 60-95) - Corrosion resistant fasteners

Options & Accessories:

Motor with CSA Approval
UL/cUL 705 Listed - "Power Ventilators"
Switch, NEMA-1, Toggle, Junction Box Mounted & Wired
Damper, Inline, WD-330-PB-9X9, Gravity Operated (Loose), Not Coated
Insulated Housing - 25 mm Thick: Fan Housing
Isolators & Brackets, Spring Hanging (1 Kit(s): Qty 4, PN: 850343) (Shipped Loose)
Solid State Speed Control, (PN: SWSSC) Shipped Loose

Reviewed
Reviewed as Modified
Reviewed as Modified and Resubmit
Not Reviewed
Stantec April 23, 2013
By:
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible to review all drawings in detail and to coordinate the work of all trades. Stantec does not assume responsibility for site conditions or the job site for information that pertains solely to the fabrication processes or to techniques of construction and installation and for the coordination of the work of all trades.
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Dimensional

Qty	Weight w/o Accessories (kg)	Weight with Accessories (kg)	Optional Damper (mm)
1	12	19	229 x 229

Performance

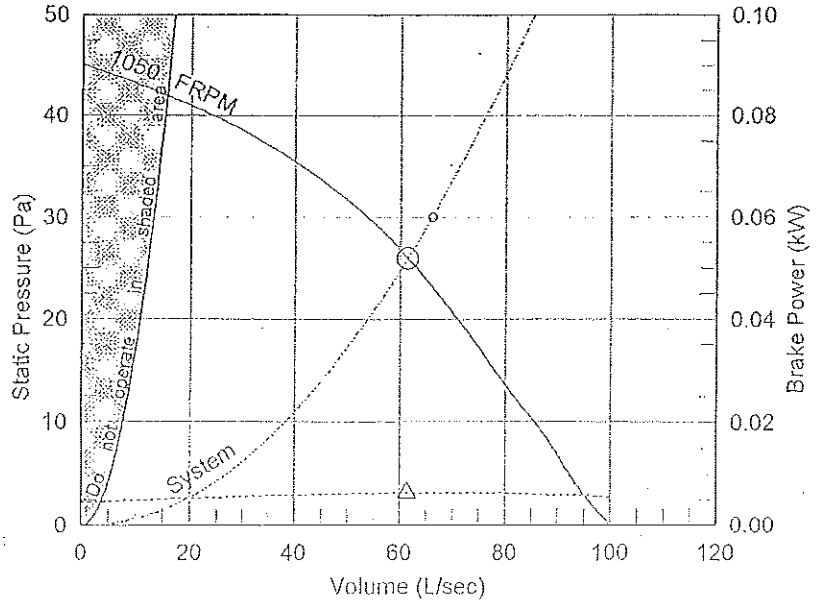
Requested Volume (L/sec)	Actual Volume (L/sec)	External SP (Pa)	Total SP (Pa)	Fan RPM	Operating Power (kW)	Elevation (m)	Airstream Temperature (C)
66	61	30	25.9	1050	0.01	676	25

Motor

Motor Mounted	Size (hp)	V/C/P	Encl.	Motor RPM	Windings	NEC FLA* (Amps)
Yes	1/100	115/60/1	TEAO	1050	1	NA

Sound Power by Octave Band

Sound Data	62.5	125	250	500	1000	2000	4000	8000	LwA	dBA	Sones
Inlet	62	58	49	39	35	32	24	23	46	35	1.5
Radiated	61	53	39	29	24	13	5	10	40	29	0.7



△ Operating BkW point
○ Operating point at Total SP
◦ Operating point at External SP
——— Fan curve
·····System curve
- - - - - - Brake kilowatts curve

External SP	30	Pa
Direct Drive Rpm Adjustment	-4.1	Pa
Total SP	25.9	Pa

SABADATH CONSTRUCTION LTD.
SHOP DRAWING REVIEWED
APR 16 2013
REVIEWED
REVIEWED AS NOTED
REVISE AND RESUBMIT

amca CERTIFIED RATINGS SOUND AIR

Notes:
All dimensions shown are in units of mm.
*FLA - based on tables 150 or 148 of National Electrical Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.
LwA - A weighted sound power level, based on ANSI S1.4
dBA - A weighed sound pressure level, based on 11.5 dB attenuation per Octave band at 1.5 m - dBA levels are not licensed by AMCA International
Sones - calculated using AMCA 301 at 1.5 m

Disconnect Switch

Enclosure Rating: NEMA-1

Standard Construction Features:

Enclosure constructed for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment and to provide a degree of protection against falling dust. This enclosure meets the rod entry and the indoor corrosion protection design tests. The rod entry test is intended to simulate incidental contact with enclosure equipment. Enclosure is equipped with provision to lockout in the off position with customer supplied lock.

Disconnect Switch Configuration

Type:	Toggle	Motor Size:	1/100 hp	Voltage:	115	UL Listed:	Yes
Manufacturer:	Pass and Seymour	Cycle:	60	Amperage:	15	CSA Approved:	Yes
Overload Protection:	None	Phase:	1	Switch Pole(s):	1	Rating:	1/2 hp
Mounting:	Mounted and Wired	RPM:	1050	Wiring (Exp. Resist.):	None		

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☐ Revise and Resubmit
☐ Not Reviewed

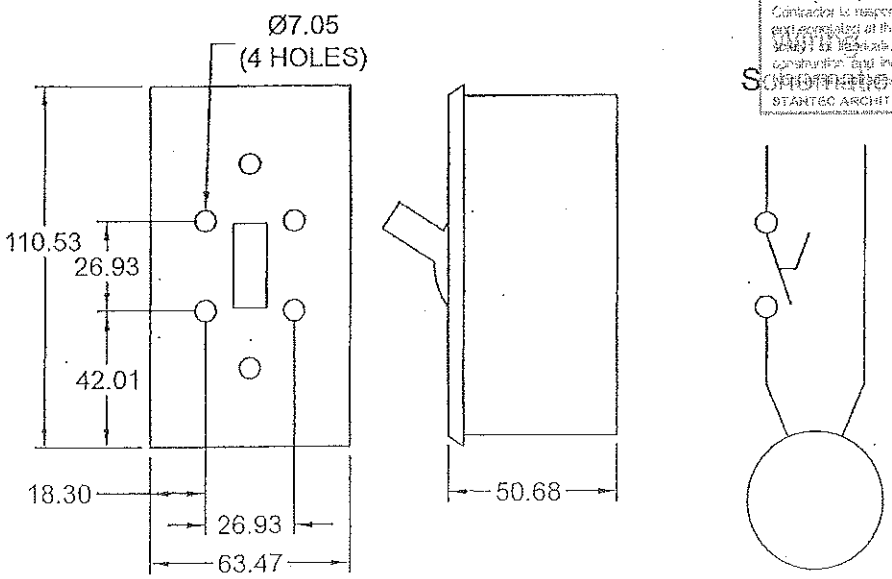
April 23, 2013

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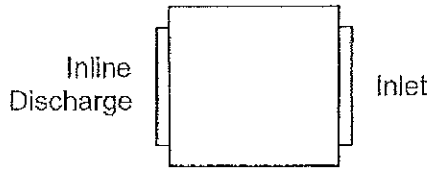
Electrical Drawing Details



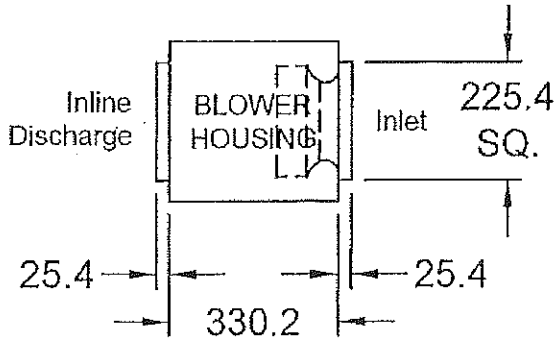
Notes: All dimensions shown are in units of mm

Assembly Drawing

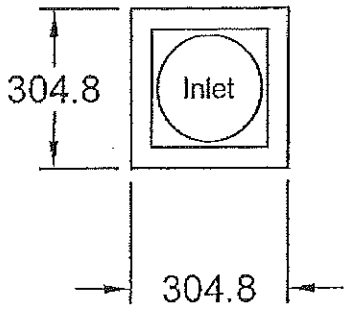
Type: Direct Drive Centrifugal Inline Fan



PLAN VIEW



ELEVATION VIEW



END VIEW

Notes: All dimensions shown are in units of mm.

Vertical Mount Exhaust Damper

Model: WD-330

Standard Construction Features:

- Model WD-330 is a vertical mount exhaust damper and is constructed of galvanized steel with pre-punched mounting holes - Damper blades are 1 mm roll formed aluminum with vinyl seals on the closing edge - Steel axles are 5 mm diameter zinc plated steel - Synthetic sleeve type bushings

Accessory Configuration

Actuator Type:	Gravity
End Switch:	No

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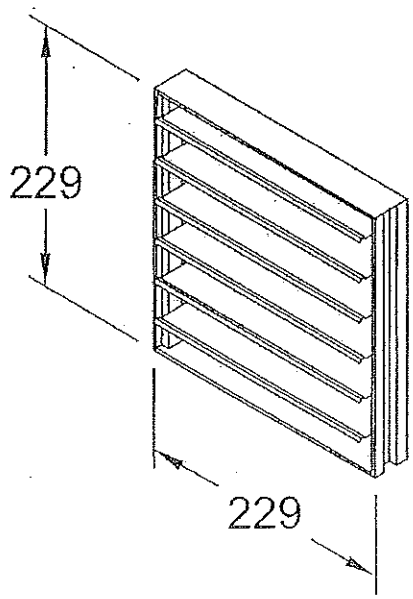
☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

April 23, 2013

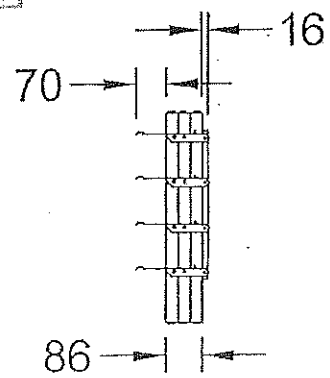
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DAMPER - INLINE DISCHARGE



TYP. SECTION VIEW

23 33 15
SAHTU DAVIES CONSTRUCTION LTD.
SHOP DRAWINGS REVIEWED
BY
APR 16 2013

Notes: All dimensions shown are in units of mm
Width And height furnished approximately 3 mm undersize

Isolator

Type: Spring Hanging

Standard Construction Features:

The spring hanging isolator is designed to reduce the transmission of vibration and noise produced by suspended equipment and piping. To assure stability, the spring element has a minimum lateral stiffness of 1.0 times the rated vertical stiffness. The hanger will allow a support rod misalignment through a 30 degree arc and the isolation brackets will carry a 500% overload without failure. The isolator has an epoxy powder coated bracket and spring coil which is color coded according to the load capacity and has a noise isolation pad, all which is assembled into a stamped or welded hanger bracket.

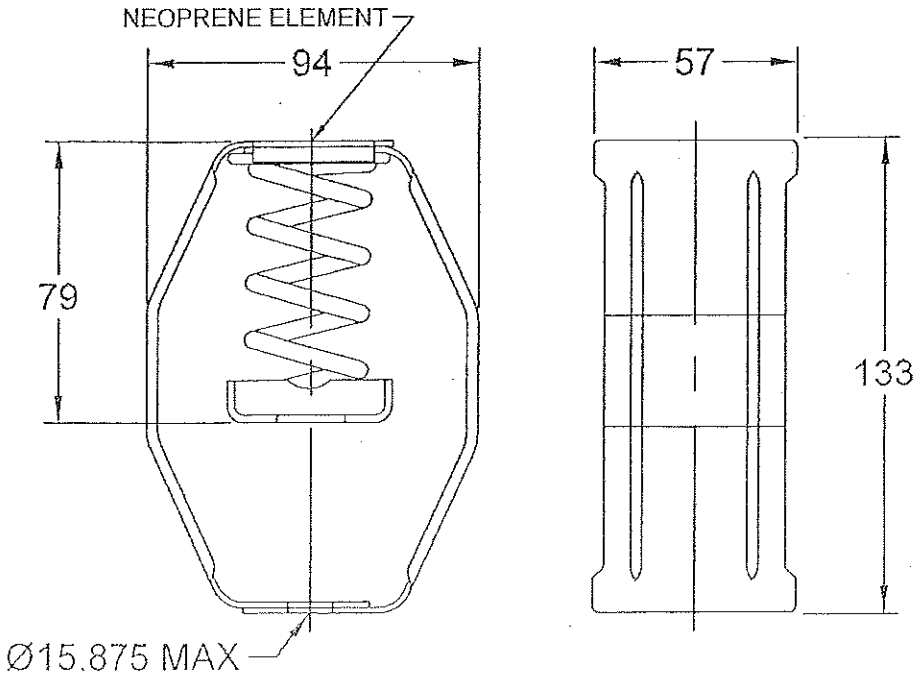
This part number includes 4 isolators.

Isolator Configuration

Description:	SH-1-35	Color:	Blue
Manufacturer:	Kinetics Noise Control	Mounting:	Hanging
Load Capacity:	16 kg	Kit Part Number:	850343
Deflection:	39 mm		

Stantec
☑ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
April 23, 2013
By.
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STANTEC ARCHITECTURE LTD

Spring Hanging - Vibration Isolator



Notes: All dimensions shown are in units of mm

23.05.18
CAMBRIDGE BAY POTABLE WATER SYSTEM
BY
APR 16 2013
2 - REVISED

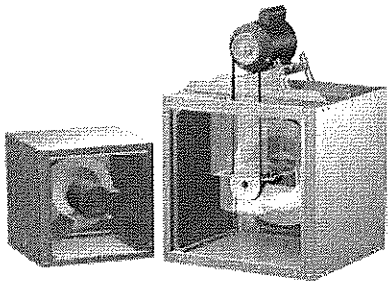
GREENHECK
Building Value in Air.

Document 472058
Models SQ and BSQ
Centrifugal Inline Fans

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage!

Model SQ Direct Drive



Model SQ is a direct drive centrifugal inline exhaust fan. These fans are specifically designed for inline applications. Performance capabilities range up to 5,000 cfm *(8,500 m^3/hr)* and up to 2.0 in. wg *(498 Pa)* of static pressure. SQ fans are available in thirteen sizes with nominal wheel diameter ranging from 6 to 16 inches *(152 to 406 mm)* (060 - 160 unit sizes). Each fan shall bear a permanently affixed manufacturers engraved metal nameplate containing the model number and individual serial number.

Model BSQ Belt Drive

Model BSQ is a belt drive centrifugal inline exhaust fan. These fans are specifically designed for inline applications. Performance capabilities range up to 27,200 cfm *(46,200 m^3/hr)* and up to 4.0 in. wg *(996 Pa)* of static pressure. BSQ fans are available in fourteen sizes with nominal wheel diameter ranging from 7 to 42 inches *(178 to 1067 mm)* (070 - 420 unit sizes). Each fan shall bear a permanently affixed manufacturers engraved metal nameplate containing the model number and individual serial number.

General Safety Information

Only qualified personnel should install this fan. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if seismic activity is present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electric Code (CEC) in Canada.
2. The rotation of the wheel is critical. It must be free to rotate without striking or rubbing any stationary objects.
3. Motor must be securely and adequately grounded.
4. Do not spin fan wheel faster than max cataloged fan RPM. Adjustments to fan speed significantly effects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces or chemicals. Replace cord immediately if damaged.
6. Verify that the power source is compatible with the equipment.
7. Never open access doors to a duct while the fan is running.

DANGER
Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.
CAUTION
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.
CAUTION
Precaution should be taken in explosive atmospheres.

DANGER
Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.
ATTENTION
Lors de toute intervention sur la soufflante, le moteur peut être suffisamment chaud pour provoquer une douleur voire une blessure. Laisser le moteur refroidir avant toute maintenance.
ATTENTION
Faire preuve de précaution dans les atmosphères explosives.

Receiving

Upon receiving the product check to ensure all items are accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make a notation of damage (or shortage of items) on the delivery receipt and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your Greenheck Representative. Any physical damage to the unit after acceptance is not the responsibility of Greenheck Fan Corporation.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Handling

Move fan to desired location and determine position of access panels, discharge and motor. Make sure the inlet and outlet have at least 2½ times the wheel diameter (duct diameter) before any obstructions like an elbow or transition. Attach the fan to a suitable framework as specified; hanging or base vibration isolators are recommended. See the SQ & BSQ Fan Dimensions table on page 3 for physical dimensions, utilizing Figures 1 and 2. Mounting dimensions and vibration isolator centerline information is provided on pages 4 and 5. The motor's amperage and voltage ratings must be checked for compatibility to supply voltage prior to final electrical connection. Electrical lead-in wires are then connected to the factory supplied safety disconnect switch. All wiring must conform to local and national codes.

Fan Storage

Fans are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the fan and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

Indoor Storage

The ideal environment for the storage of fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain or snow. Temperatures should be evenly maintained between 30° to 110°F *(-1° to 43°C)* (wide temperature swings may cause condensation and "sweating" of metal parts). All accessories must be stored indoors in a clean, dry atmosphere.

Remove any accumulations of dirt, water, ice or snow and wipe dry before moving to indoor storage. To avoid "sweating" of metal parts allow cold parts to reach room temperature. To dry parts and packages use a portable electric heater to get rid of any moisture buildup. Leave coverings loose to permit air circulation and to allow for periodic inspection.

The unit should be stored at least 3½ in. *(89 mm)* off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

Outdoor Storage

Fans designed for outdoor applications may be stored outdoors, if absolutely necessary. Roads or aisles for portable cranes and hauling equipment are needed.

The fan should be placed on a level surface to prevent water from leaking into the fan. The fan should be elevated on an adequate number of wooden blocks so that it is above water and snow levels and has enough blocking to prevent it from settling into soft ground. Locate parts far enough apart to permit air circulation, sunlight and space for periodic inspection. To minimize water accumulation, place all fan parts on blocking supports so that rain water will run off.

Do not cover parts with plastic film or tarps as these cause condensation of moisture from the air passing through heating and cooling cycles.

Fan wheels should be blocked to prevent spinning caused by strong winds.

Inspection and Maintenance During Storage

While in storage, inspect fans once per month. Keep a record of inspection and maintenance performed.

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate the wheel by hand ten to fifteen revolutions to distribute lubricant on motor. If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Thoroughly wipe clean with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive, WD-40® or the equivalent.

Removing From Storage

As fans are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion until the fan equipment goes into operation.

SQ & BSQ Fan Dimensions

Model	A	B	C	*D	E	*F	*G	*H	Damper	SQ Weight^	BSQ Weight^
SQ 60-75	12 (305)	13 (330)	12 (305)	8⅞ (225)	1 (25)	-	-	-	9 (229)	26 (12)	-
SQ 80-95	15 (381)	16 (406)	15 (381)	11⅞ (302)	1 (25)	-	-	-	12 (305)	41 (19)	-
BSQ 70-80	15 (381)	21 (533)	15 (381)	11⅞ (302)	1 (25)	15½ (394)	14 (356)	12½ (318)	12 (305)	-	76 (34)
BSQ 90	15 (381)	21 (533)	15 (381)	11⅞ (302)	1 (25)	15½ (394)	14 (356)	12½ (318)	12 (305)	-	84 (38)
SQ-BSQ 100	17 (432)	21 (533)	17 (432)	13⅞ (352)	1 (25)	15½ (394)	14 (356)	12½ (318)	14 (356)	56 (25)	83 (38)
SQ-BSQ 120	19 (483)	21 (533)	19 (483)	15⅞ (403)	1 (25)	17⅞ (454)	16 (406)	12½ (318)	16 (406)	67 (30)	97 (44)
SQ-BSQ 130 (HP)	21 (533)	21 (533)	21 (533)	17⅞ (454)	1 (25)	17⅞ (454)	16 (406)	12½ (318)	18 (457)	67 (35)	97 (44)
SQ-BSQ 140 (HP)	23 (584)	22 (559)	23 (584)	19⅞ (505)	1 (25)	17⅞ (454)	16 (406)	12½ (318)	20 (508)	104 (47)	111 (50)
SQ-BSQ 160 (HP)	26 (660)	26 (660)	26 (660)	22⅞ (581)	1 (25)	20½ (521)	17 (432)	13⅜ (340)	23 (584)	160 (73)	208 (94)
BSQ 180 (HP)	28 (711)	28 (711)	28 (711)	23⅞ (606)	1½ (38)	24⅜ (619)	18 (457)	13¾ (349)	24 (610)	26 (12)	245 (111)
BSQ 200 (HP)	32 (813)	32 (813)	32 (813)	27⅞ (708)	1½ (38)	28 (711)	20 (508)	16 (406)	28 (711)	26 (12)	314 (142
BSQ 240 (HP)	39 (991)	34 (864)	39 (991)	34⅞ (886)	1½ (38)	32⅞ (835)	22 (559)	19 (483)	35 (889)	26 (12)	415 (188)
BSQ 300 (HP)	46 (1168)	38 (965)	46 (1168)	41⅞ (1064)	1½ (38)	34 (864)	22 (559)	18 (457)	42 (1067)	26 (12)	537 (244)
BSQ 360 (HP)	52 (1321)	42 (1067)	52 (1321)	47⅞ (1216)	1½ (38)	34 (864)	22 (559)	18 (457)	48 (1219)	26 (12)	686 (311)
BSQ 420 (HP)	58 (1473)	50 (1270)	58 (1473)	53⅞ (1368)	1½ (38)	34 (864)	22 (559)	18 (457)	54 (1372)	26 (12)	789 (358)

All dimensions in inches (millimeters) and weight is shown in pounds (kilograms). *May be greater depending on motor.
^Weight shown is largest cataloged Open Drip Proof motor.

Filter Option Dimensions

Model	A	B	C	D	WT.	Filter Size	Filter Quantity
SQ 60-75	22⅛ (562)	12 (305)	8⅞ (225)	1 (25)	40 (18)	10 x 12 (254 x 305)	1
SQ 80-95	45⅝ (1159)	15 (381)	11⅞ (302)	1 (25)	74 (34)	14 x 25 (356 x 635)	1
SQ 100	47¼ (1200)	17 (432)	13⅞ (352)	1 (25)	88 (40)	16 x 20 (406 x 508)	2
SQ 120	52⅜₁₆ (1326)	19 (483)	15⅞ (403)	1 (25)	114 (52)	16 x 25 (406 x 635)	2
SQ 130	46⅜ (1178)	21 (533)	17⅞ (454)	1 (25)	120 (54)	20 x 20 (508 x 508)	2
SQ 140	52⅜ (1330)	23 (584)	19⅞ (505)	1 (25)	174 (79)	20 x 25 (508 x 635)	2
SQ 160	51⅜ (1305)	26 (660)	22⅞ (581)	1 (25)	246 (112)	20 x 20 (508 x 508)	4
BSQ 70-80-90	50⅝ (1286)	15 (381)	11⅞ (302)	1 (25)	117 (53)	14 x 25 (356 x 635)	1
BSQ 100	47¼ (1200)	17 (432)	13⅞ (352)	1 (25)	120 (54)	16 x 20 (406 x 508)	2
BSQ 120	52⅜₁₆ (1326)	19 (483)	15⅞ (403)	1 (25)	144 (79)	16 x 25 (406 x 635)	2
BSQ 130 (HP)	46⅜ (1178)	21 (533)	17⅞ (454)	1 (25)	140 (64)	20 x 20 (508 x 508)	2
BSQ 140 (HP)	52⅜ (1330)	23 (584)	19⅞ (505)	1 (25)	181 (82)	20 x 25 (508 x 635)	2
BSQ 160 (HP)	51⅜ (1305)	26 (660)	22⅞ (581)	1 (25)	294 (133)	20 x 20 (508 x 508)	4
BSQ 180 (HP)	55¹⁄₁₆ (1399)	28 (711)	23⅞ (606)	1½ (38)	344 (156)	20 x 25 (508 x 635)	4
BSQ 200 (HP)	66¹¹⁄₁₆ (1694)	32 (813)	27⅞ (708)	1½ (38)	441 (200)	12 x 25 (305 x 635)	3
						16 x 25 (406 x 635)	3
BSQ 240 (HP)	68⅞ (1749)	39 (991)	34⅞ (886)	1½ (38)	573 (260)	20 x 25 (508 x 635)	4
						16 x 25 (406 x 635)	4
BSQ 300 (HP)	72⅛ (1832)	46 (1168)	41⅞ (1064)	1½ (38)	759 (344)	20 x 25 (508 x 635)	8
BSQ 360 (HP)	79¼ (2013)	52 (1321)	47⅞ (1216)	1½ (38)	957 (434)	16 x 25 (406 x 635)	10
						20 x 25 (508 x 635)	5
BSQ 420	93⅛ (2365)	58 (1473)	53⅞ (1368)	1½ (38)	1185 (538)	16 x 25 (406 x 635)	5
						20 x 25 (508 x 635)	10

Note: 24-inch side clearance is recommended for accessing and removing filters. All dimensions in inches (millimeters) and weight (WT.) in pounds (kilograms).

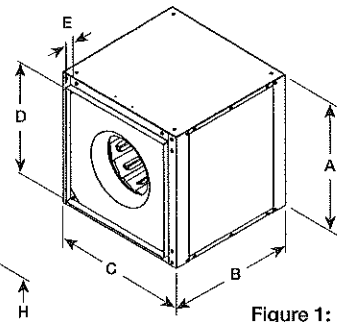


Figure 1: SQ Dimensions

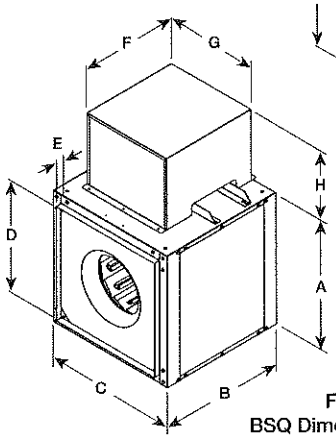


Figure 2: BSQ Dimensions

Figure 3: Model SQ - Filter Options

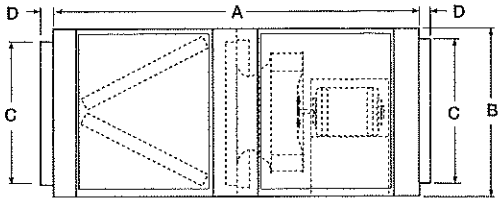
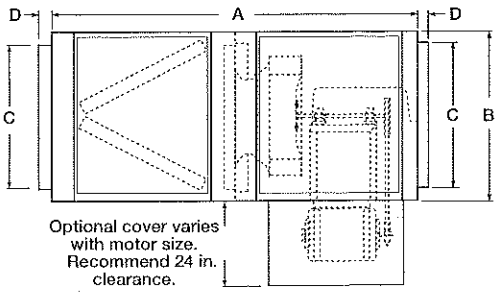


Figure 4: Model BSQ - Filter Options



Mounting: SQ /BSQ

All SQ and BSQ fan models can be mounted horizontally, vertically or at an angle. For ease of installation, knockouts are provided at each location where mounting brackets are shown in Figures 5, 6 and 7. Optional brackets are universally adjustable to mount in any of these locations.

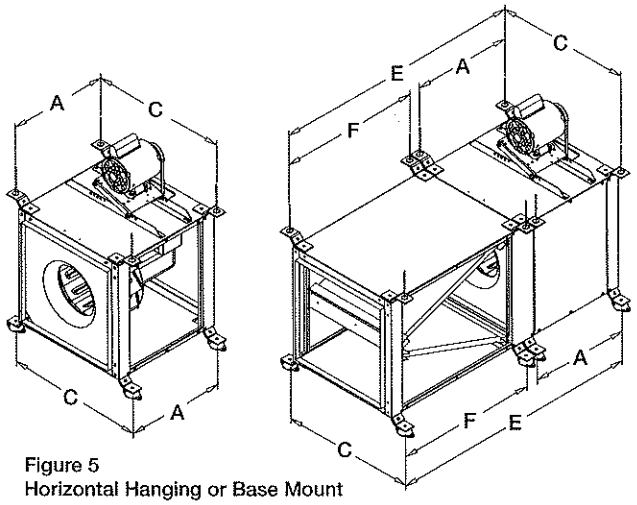


Figure 5
Horizontal Hanging or Base Mount

With either a hanging or base mount the motor may be located on either side. The base mount allows top access panels only.

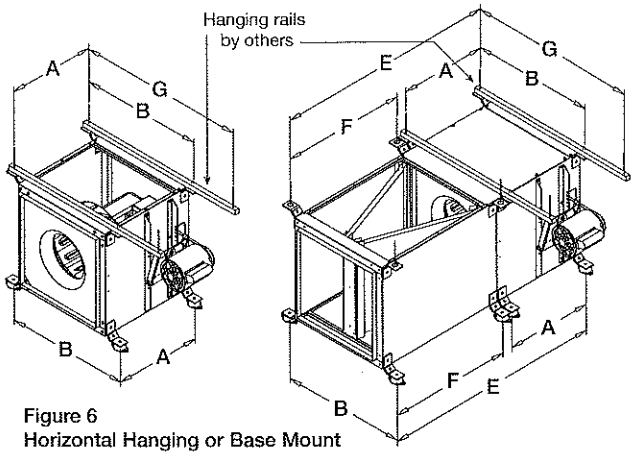


Figure 6
Horizontal Hanging or Base Mount

With a hanging mount, the motor may be located on either top or bottom. The base mount allows top motor location only. Both options provide access panels on two sides.

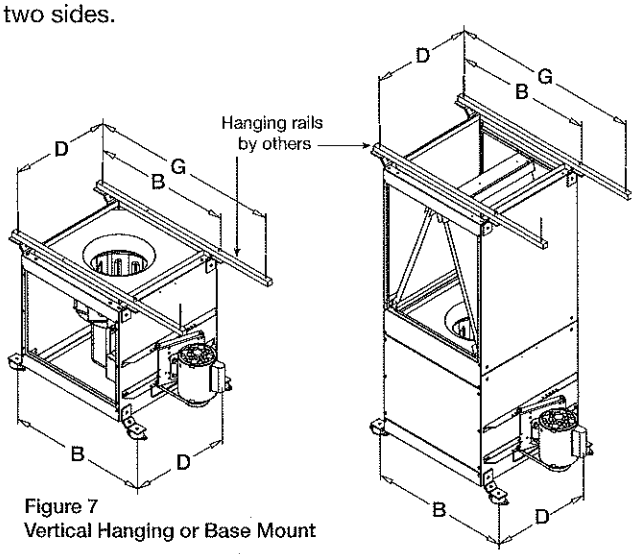


Figure 7
Vertical Hanging or Base Mount

Mounting brackets are turned 90° for vertical mounting. Access panels are located on the two sides adjacent to the motor.

Mounting Dimensional Data

Model	A	B	C	D	E	F	G
SQ 60-75	10⅝ *(270)*	17 *(432)*	15¾ *(400)*	8⅞ *(225)*	19¾ *(502)*	7 *(178)*	Hanging rails not included. Supplied by others.
SQ 80-95	13¼ *(337)*	20 *(508)*	18¾ *(476)*	11⅞ *(302)*	43 *(1092)*	27⅜ *(695)*	
BSQ 70-90	18⅝ *(473)*	20⅛ *(511)*	18¾ *(476)*	11⅞ *(302)*	48⅛ *(1227)*	27⅜ *(695)*	
SQ-BSQ 100	18⅝ *(473)*	22⅛ *(562)*	20¾ *(527)*	13⅞ *(352)*	44⅞ *(1140)*	24 *(610)*	
SQ-BSQ 120	18⅝ *(473)*	24 *(610)*	22¾ *(578)*	16 *(406)*	49⅜ *(1254)*	28⅛ *(714)*	
SQ-BSQ 130	18⅝ *(473)*	26⅛ *(664)*	24¾ *(629)*	17⅞ *(454)*	44 *(1118)*	23 *(584)*	
SQ-BSQ 140	19⅝ *(498)*	28⅛ *(714)*	26¾ *(679)*	19⅞ *(505)*	50 1/16 *(1272)*	28 *(711)*	
SQ-BSQ 160	23½ *(597)*	31 *(787)*	29¾ *(756)*	22⅞ *(581)*	49⅝ *(1260)*	23⅝ *(600)*	Hanging rails not included. Supplied by others.
BSQ 180	25½ *(648)*	33½ *(851)*	29 9/16 *(751)*	22¾ *(578)*	52 9/16 *(1335)*	24½ *(622)*	
BSQ 200	29⅛ *(740)*	37 *(940)*	33¾ *(857)*	26¾ *(679)*	64 9/16 *(1630)*	32¼ *(819)*	
BSQ 240	31⅝ *(803)*	44¼ *(1124)*	40¾ *(1035)*	33⅞ *(860)*	66½ *(1689)*	32⅛ *(816)*	
BSQ 300	35 *(889)*	51 *(1295)*	47¾ *(1213)*	40⅞ *(1038)*	69⅛ *(1756)*	31⅜ *(797)*	
BSQ 360	38¾ *(974)*	57¼ *(1454)*	53½ *(1359)*	46¾ *(1187)*	76 *(1930)*	34 1/16 *(881)*	
BSQ 420	47⅛ *(1197)*	63 *(1600)*	59⅞ *(1521)*	59⅞ *(1521)*	90½ *(2299)*	40½ *(1029)*	

All dimensions in inches (millimeters).

Duct Length: The inlet and outlet duct length should be approximately two to three wheel diameters long before and after the fan to achieve cataloged performance.

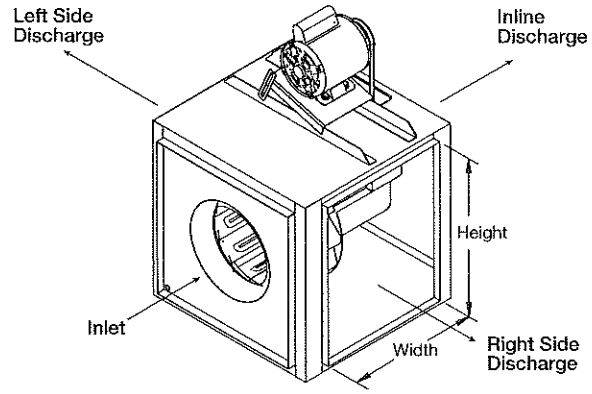


Figure 8

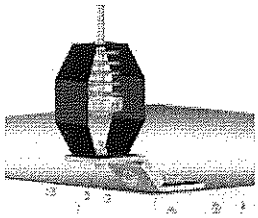
Side Discharge: Make sure discharge is orientated in the same direction as originally ordered, performance will change with different discharge positions. Refer to Figure 8 for proper side discharge definition and the Side Discharge chart for dimensions. Refer to the CAPS program or consult factory for performance corrections.

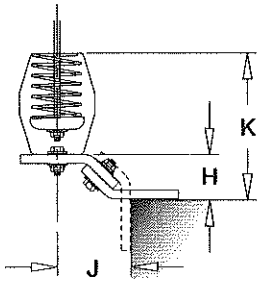
Side Discharge Duct Openings

Unit Size	Width	Height
BSQ 70-80-90	11⅞ *(302)*	11⅞ *(302)*
SQ 60-75	9⅞ *(251)*	8⅞ *(225)*
SQ 80-95	12⅞ *(327)*	11⅞ *(302)*
SQ 100/BSQ 100	13⅞ *(352)*	13⅞ *(352)*
SQ 120/BSQ 120	15⅞ *(403)*	15⅞ *(403)*
SQ 130/BSQ 130 (HP)	17⅞ *(454)*	17⅞ *(454)*
SQ 140/BSQ 140 (HP)	19⅞ *(505)*	19⅞ *(505)*
SQ 160/BSQ 160 (HP)	22⅛ *(581)*	22⅞ *(581)*
BSQ 180 (HP)	23⅞ *(606)*	23⅞ *(606)*
BSQ 200 (HP)	27⅞ *(708)*	27⅞ *(708)*
BSQ 240 (HP)	28⅞ *(733)*	34⅞ *(886)*
BSQ 300 (HP)	31⅞ *(810)*	41⅞ *(1064)*
BSQ 360 (HP)	32⅞ *(835)*	37⅞ *(962)*
BSQ 420	34⅞ *(886)*	43⅞ *(1114)*

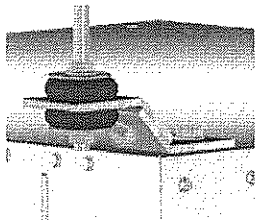
All dimensions in inches (millimeters).

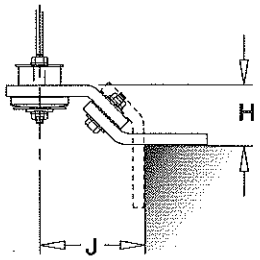
Hanging Spring Isolator



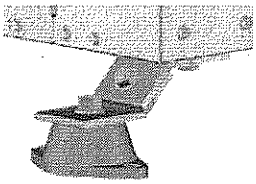


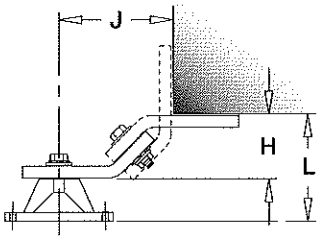
Hanging Neoprene Isolator



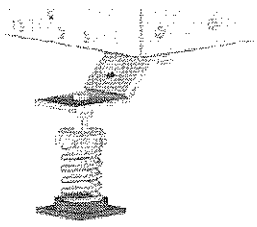


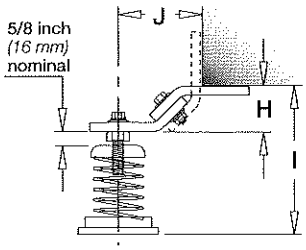
Standing Neoprene Isolator





Standing Spring Isolator





Isolator Dimensional Data

Model	H	I	J	K	L
SQ 60-75 SQ 80-95 BSQ 70-90 SQ-BSQ 100 SQ-BSQ 120 SQ-BSQ 130 SQ-BSQ 140	1⅜ *(35)*	5½ *(140)*	2 *(51)*	6¾ *(171)*	2⁵⁄₁₆ *(59)*
SQ-BSQ 160 BSQ 180 BSQ 200 BSQ 240 BSQ 300 BSQ 360 BSQ 420	1⅜ *(35)*	5½ *(140)*	2 *(51)*	6¾ *(171)*	2⅝ *(67)*

All dimensions in inches (millimeters).

Pre Start-Up Checks

1. Check all fasteners for tightness. The wheel should rotate freely and be aligned as shown in Figure 9. Wheel position is preset and the unit is tested at the factory. Movement may occur during shipment, and realignment may be necessary. Centering can be accomplished by loosening the bolts holding the inlet (venturi) panel and repositioning. Wheel and inlet cone overlap can be adjusted by loosening the setscrews in the wheel and moving the wheel to the desired position.

Wheel Overlap Dimensions

Model	G - Overlap in. *(mm)*	H - Gap in. *(mm)*
SQ 60-95	-	1/8 *(3)*
SQ 100-160	1/4 *(6)*	-
BSQ 70-160	1/4 *(6)*	-
BSQ 180-240	3/8 *(10)*	-
BSQ 300-420	1/2 *(13)*	-

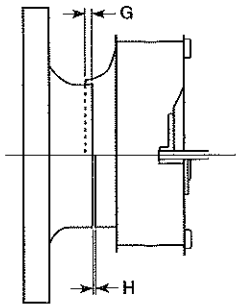


Figure 9

2. **Wheel Rotation:** Direction of wheel rotation is critical. Reversed rotation will result in poor air performance, motor overloading and possible burnout. Check wheel rotation by momentarily energizing the unit (all SQ and BSQ fans have clockwise wheel rotation when viewed from top of fan). Rotation should be clockwise as shown in Figure 10 and correspond to the rotation decal on the unit.

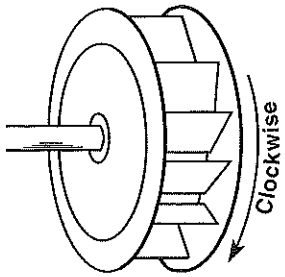


Figure 10

WARNING
Correct direction of wheel rotation is critical. Reversed rotation will result in poor air performance, motor overloading and possible burnout.
AVERTISSEMENT
La turbine doit impérativement tourner dans le bon sens. Une rotation en sens inverse entraînerait de mauvaises performances de soufflage, une surcharge du moteur voire un grillage du moteur.

3. **Vibration Isolators:** After fan is moved to desired location, punch out the four knockout holes which are located on the unit top and bottom panels. Assemble the brackets to the unit according to the appropriate drawings on page 5 and refer to respective parts list on page 11. Make certain all connectors are tight and that all washers are in.
4. **For BSQ Fans:** If adjustments are made, it is very important to check the pulleys for proper alignment. Misaligned pulleys lead to excessive belt wear, vibration, noise, and power loss. (see Figure 11).

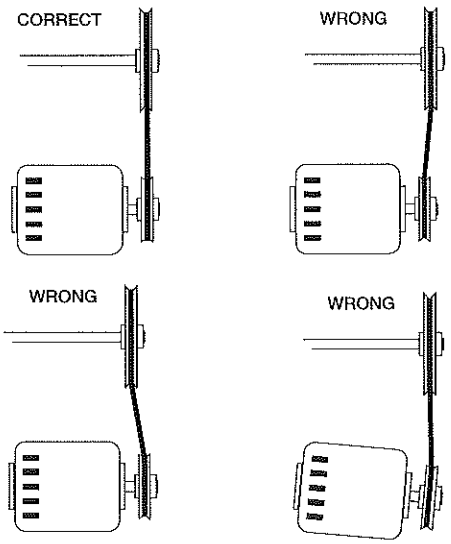
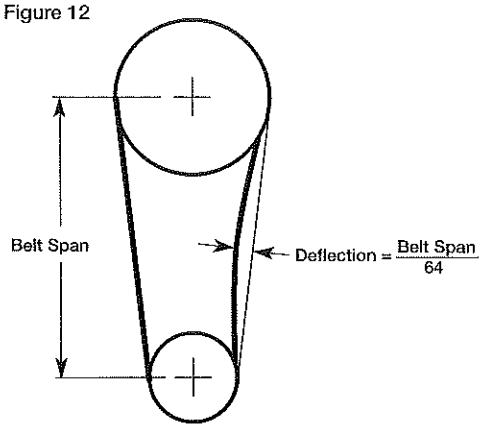
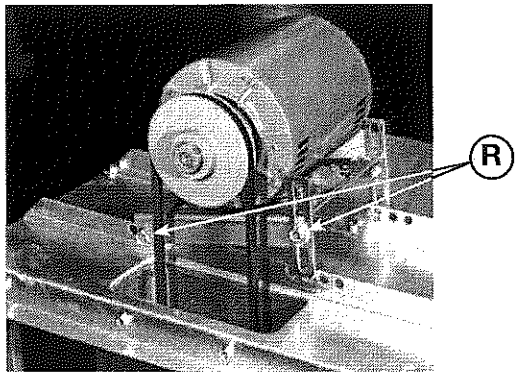


Figure 11

5. **For BSQ Fans:** Belt tension can be adjusted by loosening four fasteners marked "R" on the drive frame. (refer to Figure 13 on page 7). The motor plate slides on the slotted adjusting arms. Belt tension should be adjusted to allow 1/64 inch of deflection per inch of belt span. For example, a 15 inch belt span should have 15/64 inch (or about 1/4 inch) of deflection with moderate thumb pressure at mid-point between pulleys (see Figure 12). Over-tightening will cause excessive bearing wear and noise. Too little tension will cause slippage at start-up and uneven wear.

Figure 12





NOTE: Identical fasteners on opposing side must also be loosened.

Figure 13

6. The adjustable motor pulley is factory set for the RPM specified. Speed can be increased by closing or decreased by opening the adjustable motor sheave. Two groove variable pitch pulleys must be adjusted an equal number of turns open or closed. Any increase in speed represents a substantial increase in the horsepower required by a unit. Motor amperage should always be checked to avoid serious damage to the motor when speed is varied.

IMPORTANT

The fan has been checked for mechanical noises at the factory prior to shipment. If mechanical noise should develop, suggested corrective actions are offered in the Troubleshooting section.

IMPORTANT

Over-tightening will cause excessive bearing wear and noise. Too little tension will cause slippage at start-up and uneven wear.

IMPORTANT

Adjust (tighten) belt tension after the first 24-48 hours of operation.

Operation: SQ / BSQ

1. Before starting up or operating fan, check all fasteners for tightness. In particular, check the setscrews in wheel hub (and pulleys, if applicable).
2. While in the OFF position or before connecting the fan to power, turn the fan wheel by hand to be sure it is not striking the venturi or any obstacle.
3. Start the fan and shut it off immediately to check rotation of the wheel with directional arrow in the motor compartment, see Figure 10.
4. When the fan is started, observe the operation and check for any unusual noises.
5. With the system in full operation and all ductwork attached, measure current input to the motor and compare with the nameplate rating to determine if the motor is operating under safe load conditions.
6. Keep inlets and approaches to fan clean and free from obstruction.

Inspection: SQ / BSQ

Inspection of the fan should be conducted at the first 30 minute and 24 hour intervals of satisfactory operation.

30 Minute Interval

Inspect bolts, setscrews and motor mounting bolts. Adjust and tighten as necessary.

24 Hour Interval

Check all internal components. On BSQ unit only, inspect belt alignment and tension. Adjust and tighten as necessary.

Maintenance: SQ / BSQ

Installation and maintenance are to be performed only by qualified personnel who are familiar with local codes and regulations and who are experienced with this type of equipment.

Motor maintenance is generally limited to cleaning and lubrication (where applicable). Cleaning should be limited to exterior surfaces only. Removing dust buildup on motor housing ensures proper motor cooling.

Greasing of motors is only intended when fittings are provided. Many fractional horsepower motors are permanently lubricated and should not be lubricated after installation. Motors supplied with grease fittings should be greased in accordance with manufacturers' recommendations. Where motor temperatures do not exceed 104°F *(40°C)*, the grease should be replaced after 2,000 hours of running time as a general rule.

Wheels require very little attention when moving clean air. Occasionally, oil and dust may accumulate causing imbalance. When this occurs the wheel and housing should be cleaned to ensure smooth and safe operation.

All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting unit.

A proper maintenance program will help these units deliver years of dependable service.

WARNING

Always disconnect, lock and tag power source before servicing. Failure to disconnect power source can result in fire, shock or serious injury.

WARNING

Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.

IMPORTANT

Uneven cleaning of the wheel will produce an out of balance condition that will cause vibration in the fan.

WARNING

This unit should be made non-functional when cleaning the wheel or housing (fuses removed, disconnect locked off).

WARNING

L'appareil doit être rendu non opérationnel lors du nettoyage de la turbine ou du caisson (fusibles retirés, sectionneur verrouillé).

Belt/Bearing Maintenance BSQ Unit

1. Belts tend to stretch after a period of time. They should be checked periodically for wear and tightness. When replacing belts, use the same type as supplied with the unit.
2. Matched belts should always be used on units with multi-groove pulleys.
3. For belt replacement, loosen the tensioning device enough to allow removal of the belt by hand. Do not force belts on or off. This may cause cords to break, leading to premature belt failure.
4. Once installed, adjust belts as shown in "Pre-Start-Up Checks."
5. Shaft bearings can be classified in two groups: relubricating and non-relubricating. All bearings on standard model BSQ fans are factory lubricated and require no further lubrication under normal use (between -20°F and 180°F in a relatively clean environment).
6. Units installed in hot, humid or dirty locations should be equipped with special bearings. These bearings will require frequent lubrication. Caution should be employed to prevent overpacking or contamination.
7. Grease fittings should be wiped clean. The unit should be in operation while lubricating. Extreme care should be used around moving parts.
8. Grease should be pumped in very slowly until a slight bead forms around the seal. A high grade lithium base grease should be used.

Recommended Relubrication Frequency in Months

NOTE: If unusual environment conditions exist (extreme temperature, moisture or contaminants) more frequent lubrication is required.

A good quality lithium base grease, conforming to NLGI Grade 2 consistency, such as those listed here may be used.

Suggested Fan Bearing Greasing Intervals	
Interval (months)	**Type of Service**
1 to 3	Heavy duty in dirty, dusty locations; high ambient temperatures; moisture laden atmosphere; vibration.
3 to 6	12 to 24 hours per day, heavy duty, or if moisture is present
6 to 12	8 to 16 hours per day in clean, relatively dry atmosphere
12 to 18	Infrequent operation or light duty in clean atmosphere

Grease Manufacturers	
Manufacturer	**Grease (NLGI #2)**
U.S. Electric Motors	Grease No. 83343
Chevron U.S.A. Inc	Chevron SRI Grease #2
Mobil Oil Corporation	Mobilith
	Mobil 532
Texaco, Inc.	Premium BRB #2
	Texaco Multifak #2
Amoco Oil Co.	Rykon Premium #2
Exxon	Unirex N2
Shell	B Shell Alvania #2

Maintenance Documentation

Job Information

Job Name: _____
Address: _____
City: _____
State: _____ Zip: _____
Phone: _____
Contact Person: _____

Service Organization: _____
Address: _____
City: _____
State: _____ Zip: _____
Phone: _____
Work Done By: _____

Nameplate Information

Model: _____
Volts: _____ Hertz: _____ Phase: _____
Amps: _____ Mark: _____
Supply hp: _____ Exhaust hp: _____
Serial Number: _____
Model Voltage: _____
Motor Amperage: _____
Fan RPM: _____

Field Start-Up Documentation

Actual Voltage: _____ Hertz: _____ Phase: _____
Actual Amperage: _____
Blower Rotation: _____
Air Volume: Design cfm: _____
Actual cfm: _____
Level of fan (L or H): _____
Fan RPM Range (min.) _____ (max.) _____

Maintenance Log

Date _____ Time _____ AM/PM
Notes: _____

Date _____ Time _____ AM/PM
Notes: _____

Date _____ Time _____ AM/PM
Notes: _____

Date _____ Time _____ AM/PM
Notes: _____

Date _____ Time _____ AM/PM
Notes: _____

Date _____ Time _____ AM/PM
Notes: _____

Date _____ Time _____ AM/PM
Notes: _____

Date _____ Time _____ AM/PM
Notes: _____

Parts List

Each fan bears a manufacturer's nameplate with model number and serial number embossed. This information will assist the local Greenheck representative and the factory in providing service and replacement parts. Before taking any corrective action, make certain unit is not capable of operation during repairs.

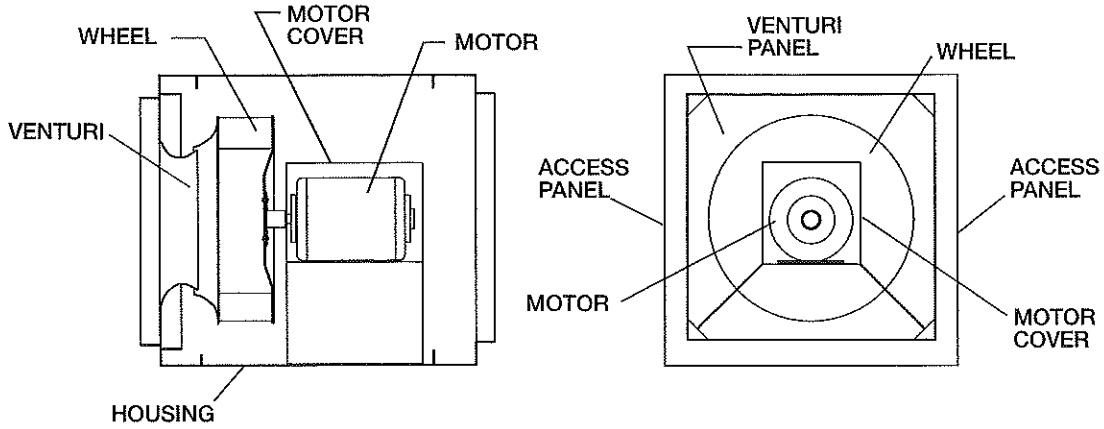
CAUTION

A fan manufactured with an explosion resistant motor does not certify the entire unit to be explosion proof. Refer to UL Listing Mark for the fans approved usage.

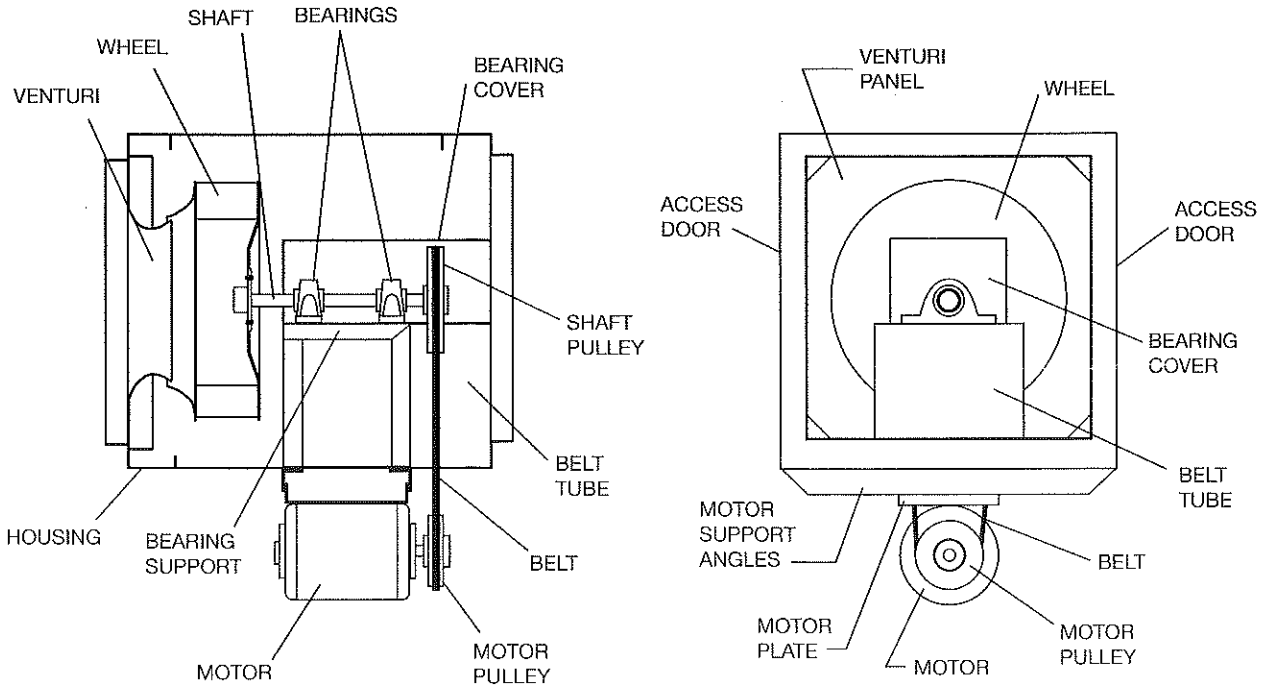
CAUTION

La présence d'un moteur antidéflagrant sur un ventilateur ne garantit pas que tout l'appareil est antidéflagrant. Pour connaître les emplois autorisés de l'appareil, voir son marquage de conformité UL.

SQ Direct Drive Centrifugal Inline Exhaust Fan

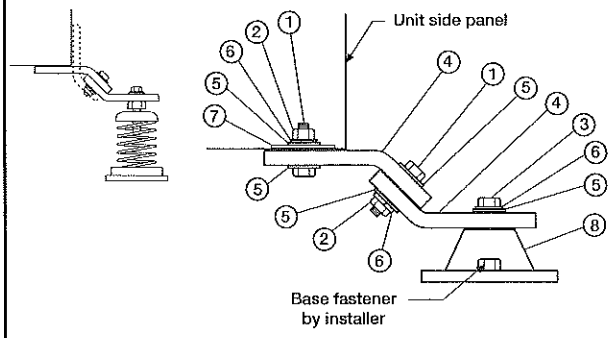


BSQ Belt Drive Centrifugal Inline Exhaust Fan

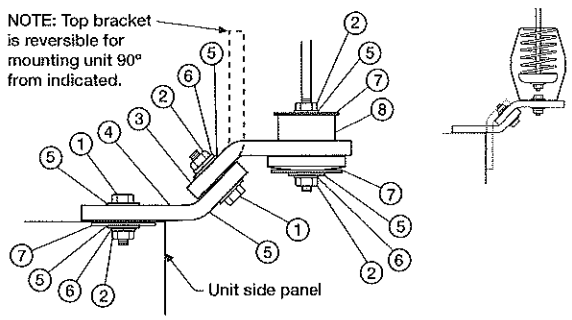


Isolator Parts List

STANDING SUPPORT ISOLATOR



HANGING SUPPORT ISOLATOR



No.	Qty.	Description	SQ-60 thru 140 BSQ-100 thru 140	SQ-160 BSQ-160 thru 420
1	8	Cadium plated hex head bolts	3/8 in. - 16 x 1 in.	3/8 in.-16 x 1 1/4 in.
2	8	Cadium plated hex nuts	3/8 in. - 16	3/8 in. - 16
3	4	Cadium plated hex head bolts	5/16 in. - 18 x 1 in.	3/8 in. - 16 x 1 in.
4	8	Std. mount bracket with (2) 7/16 in. holes	3/16 in.	1/4 in.
5	20	Cadium plated washer	7/8 in. O.D. x 3/8 in. I.D. x 1/16 in.	7/8 in. O.D. x 3/8 in. I.D. x 1/16 in.
6	12	Cadium plated lock washer	3/8 in.	3/8 in.
7	4	Cadium plated washer	1 3/8 in. O.D. x 9/16 in. I.D. x 3/32 in.	1 3/8 in. O.D. x 9/16 in. I.D. x 3/32 in.
8	4	Neoprene or Spring Isolator	Reference appropriate table below for replacement Isolator(s)	

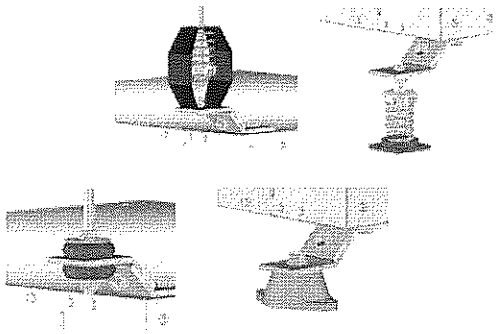
No.	Qty.	Description	SQ-60 thru 140 BSQ-100 thru 140	SQ-160 BSQ-160 thru 420
1	8	Cadium plated hex head bolts	3/8 in. - 16 x 1 in.	3/8 in.-16 x 1 1/4 in.
2	16	Cadium plated hex nuts	3/8 in. - 16	3/8 in. - 16
3	4	Std. mount bracket with (1) 1/4 in. hole	3/16 in.	1/4 in.
4	4	Std. mount bracket with (2) 7/16 in. holes	3/16 in.	1/4 in.
5	24	Cadium plated washer	7/8 in. O.D. x 3/8 in. I.D. x 1/16 in.	7/8 in. O.D. x 3/8 in. I.D. x 1/16 in.
6	12	Cadium plated lock washer	3/8 in.	3/8 in.
7	12	Cadium plated washer	1 3/8 in. O.D. x 9/16 in. I.D. x 3/32 in.	1 3/8 in. O.D. x 9/16 in. I.D. x 3/32 in.
8	4	Neoprene or Spring Isolator	Reference appropriate table below for replacement Isolator(s)	

REPLACEMENT SPRING ISOLATOR(S)

MODEL	FAN SIZES					
BSQ	-----	70-130	140-180	200	240-300	360-420
SQ	60-100	120-140	160	-----	----	----
BASE MOUNT	FDS-1-35 BLUE	FDS-1-70 GREEN	FDS 1-120 GRAY	FDS 1-120 GRAY	FDS-1-220 BROWN	FDS-1-370 ORANGE
HANGING	SH-1-35 BLUE	SH-1-70 GREEN	SH-1-125 GRAY	SH-1-245 BROWN	SH-1-245 BROWN	SH-1-370 ORANGE

REPLACEMENT NEOPRENE ISOLATOR(S)

MODEL	FAN SIZE		
BSQ	70-140	160-200	240-420
SQ	60-140	160	----
BASE MOUNT	R-1 GREEN	R-2 BLACK	R-2 RED
HANGING	40DUR BLACK	50DUR BLACK	50DUR BLACK



Troubleshooting

WARNING
Before taking any corrective action, make certain unit is not capable of operation during repairs.

AVERTISSEMENT
Avant d'entreprendre toute action corrective, s'assurer que l'appareil ne pourra pas fonctionner durant les réparations.

PROBLEM	CAUSE	CORRECTIVE ACTION
Excessive noise or vibration	Wheel unbalance	Clean all dirt off wheel. Check wheel balance, rebalance in place if necessary.
	Bad bearings	Replace.
	Belts too tight or too loose	Adjust tension, see Figure 12.
	Wheel improperly aligned and rubbing	Center wheel on inlet, see Figure 9.
	Loose drive or motor pulleys	Align and tighten. See "Pre Start-Up Checks", see page 6-7.
	Foreign objects in wheel or housing	Remove objects, check for damage or unbalance.
Reduced airflow	System resistance too high	Check system: Proper operation of backdraft or control dampers, obstruction in ductwork, clean dirty filters.
	Unit running backwards	Correct as shown in Figure 10.
	Excessive dirt buildup on wheels	Clean wheel.
	Improper wheel alignment	Center wheel on inlets, see Pre Start-Up Checks and Figure 9.

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.

Greenheck's Centrifugal Inline Fans catalog, Models SQ and BSQ provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

GREENHECK
Building Value in Air.

Phone: 715.359.6171 • Fax: 715.355.2399 • Parts: 800.355.5354 • E-mail: gfcinfo@greenheck.com • Website: www.greenheck.com

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Division 23

R-1
Return Air Grilles

Make:	Price
Model:	Round RPG
Size:	6"
Serial #:	N/A

Price All-In-One
Detailed Submittal Schedule
Grilles/Registers/Diffusers

Sorted By Item Tag

Job Name:	Cambridge Bay potable Water System	**Date:**	04/15/2013
Job Number:	QP00014216	**Contractor:**	
Entered By:	Connie Keller	**Engineer:**	Stantec Consulting Ltd
Reps Job No:		**SDA No.:**	
Location:	Cambridge Bay		

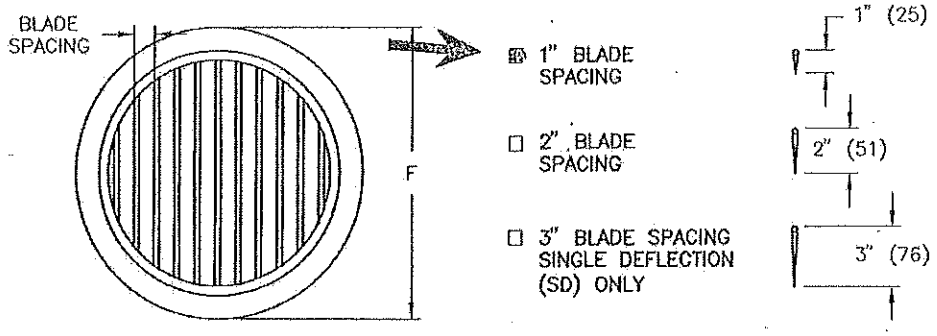
Item Tag	Model	Line No	Loc	Qty	Inlet Sz L x W	Border	Pattern	Finish	Accessories 1 2 3	Submittal	Building	Floor	Room
Return Grille	RPG	2		1	6	RD		B12		255293			
Supply Grille	RSG	1		1	6	RD		B12		255291			

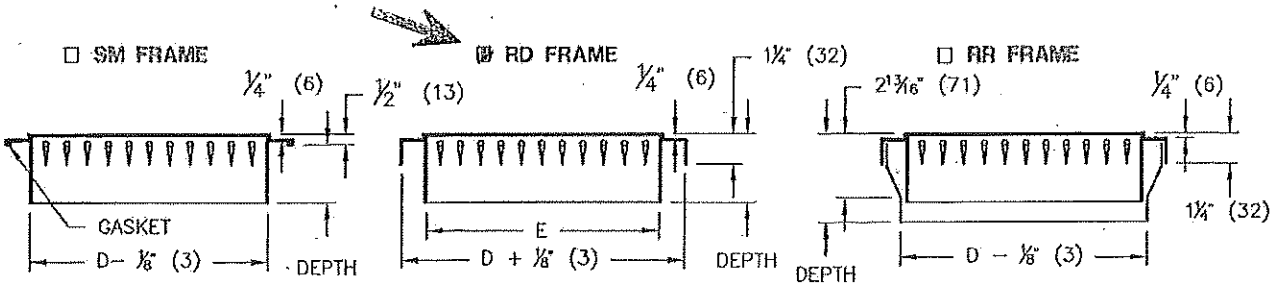
The order and sale are made pursuant to the terms of the Sales Agreement and the Sales Policies set out in the latest Customer Service Handbook.
See Section AA in price lists.

price®

Submittal Sheet

RSG - ROUND SUPPLY GRILLE





SIZE	D	F
*,** 6	6	8¼
* 8	8	10¼
* 10	10	12¼
* 12	12	14¼
* 14	14	16¼
16	16	18¼
18	18	20¼
20	20	22¼
22	22	24¼
24	24	26¼
***30	30	32¼

* SIZES 6 TO 14 NOT AVAILABLE IN SD 3"
** SIZE 6 NOT AVAILABLE IN SD AND DD 2"
*** SIZE 30 NOT AVAILABLE IN SD 1"

DEPTH
DD MODEL WITH 2" BLADE SPACING IS 4⁹⁄₁₆" DEEP
ALL OTHERS ARE 2⅜" DEEP

SIZE	D	E	F
*,** 6	8	6	8¼
* 8	10	8	10¼
* 10	12	10	12¼
* 12	14	12	14¼
* 14	16	14	16¼
16	18	16	18¼
18	20	18	20¼
20	22	20	22¼
22	24	22	24¼
24	26	24	26¼
***30	32	30	32¼

* SIZES 6 TO 14 NOT AVAILABLE IN SD 3"
** SIZE 6 NOT AVAILABLE IN SD AND DD 2"
*** SIZE 30 NOT AVAILABLE IN SD 1"

DEPTH
DD MODEL WITH 2" BLADE SPACING IS 4⁹⁄₁₆" DEEP
ALL OTHERS ARE 3 ⁵⁄₁₆" DEEP

SIZE	D	F
*,** 6	6	8¼
* 8	8	10¼
* 10	10	12¼
* 12	12	14¼
* 14	14	16¼
16	16	18¼
18	18	20¼
20	20	22¼
22	22	24¼
24	24	26¼

* SIZES 6 TO 14 NOT AVAILABLE IN SD 3"
** SIZE 6 NOT AVAILABLE IN SD AND DD 2"

DEPTH
DD MODEL WITH 2" BLADE SPACING IS 4⁹⁄₁₆" DEEP
ALL OTHERS ARE 3 ¹³⁄₁₆" DEEP

MATERIAL :
- ALUMINUM CONSTRUCTION

FINISH :
- DURABLE POWDER COAT FINISH (STANDARD) (OPTIONAL FINISHES AVAILABLE)

NOTES:
- INDIVIDUALLY ADJUSTABLE BLADES.
- AVAILABLE SIZES : MIN. 6", MAX. 24", 2" INCREMENTS.
- FACTORY TOLERANCE ± 1⁄16" (2)

OPTION:
- ☐ SM FRAME – WALL MOUNTING
- ☒ RD FRAME – EXPOSED MOUNTING
- ☐ RR FRAME – ROUND REDUCER
- ☐ SINGLE DEFLECTION (SD) (AVAILABLE WITH 1", 2" BLADE SPACING)
- ☐ DOUBLE DEFLECTION (DD) (AVAILABLE WITH 1" BLADE SPACING)

ALL METRIC DIMENSIONS ( ) ARE SOFT CONVERTED. IMPERIAL DIMENSIONS ARE CONVERTED TO METRIC AND ROUNDED TO THE NEAREST MILLIMETRE.

Stantec
☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
April 23, 2013
By:
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general concept of the project. This review shall not mean that Stantec Architecture Ltd. has the detail design inherent in the contract documents, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains only to the means, methods, techniques of construction and installation and for co-ordination of the work of all sub-trades.

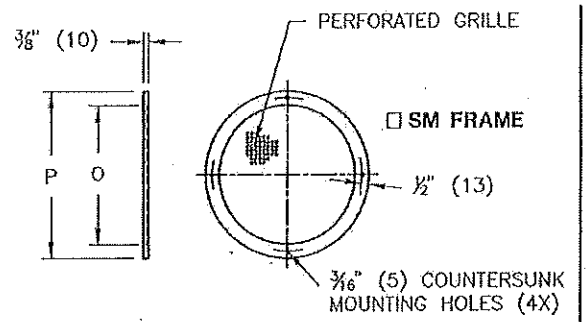
PROJECT:	Cambridge Bay potable Water System	price®
ENGINEER:	Stantec Consulting Ltd	**RSG** ROUND SUPPLY GRILLE
CUSTOMER:	Central Mechanical Systems Ltd.	255291
SUBMITTAL DATE: 4/15/2013	**SPEC. SYMBOL:**	2010/08/19

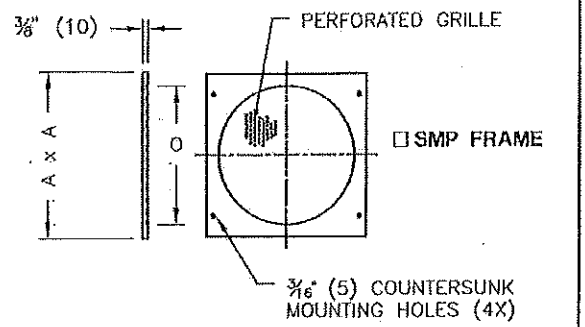
d3 37 13
SARGENT EARTHWORK (1989) LTD. SHOP DRAWING REVIEWED
BY
APR 16 2013

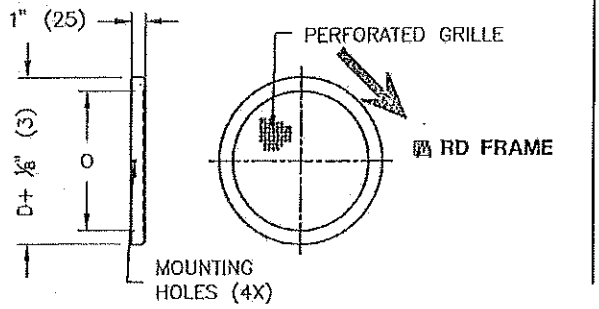
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Submittal Sheet

RPG - ROUND PERFORATED GRILLE







SIZE	SM Frame Opening Size O	SM Frame Duct Size D	SM Frame Panel Size P	SMP Frame Duct Size DxD	SMP Frame Panel Size AxA	RD Frame Opening Size O	RD Frame Duct Size D
4	4	4	6	4x4	6x6	4	6
5	5	5	8	5x5	8x8	5	6
6	6	6	8	6x6	8x8	6	8
8	8	8	10	8x8	10x10	8	10
10	10	10	12	10x10	12x12	10	12
12	12	12	14	12x12	14x14	12	14
14	14	14	16	14x14	16x16	14	16
16	16	16	18	16x16	18x18	16	18

Stantec
☑ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
April 23, 2013
By
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MATERIAL :

- ALUMINUM CONSTRUCTION

NOTES:

- CAN BE USED AS SUPPLY, RETURN OR EXHAUST GRILLE.
- AVAILABLE SIZES : 4", 5", 6", 8", 10", 12", 14" & 16".
- 3 MOUNTING FRAMES
- FACTORY TOLERANCE ±1/16" (2)

OPTION:

- ☐ SM FRAME - WALL / CEILING MOUNT
- ☐ SMP FRAME - WALL / CEILING MOUNT
- ☒ RD FRAME - SURFACE ROUND DUCT

FINISH :

- B12 WHITE (STANDARD)

(OPTIONAL FINISHES AVAILABLE)

ALL METRIC DIMENSIONS ( ) ARE SOFT CONVERTED. IMPERIAL DIMENSIONS ARE CONVERTED TO METRIC AND ROUNDED TO THE NEAREST MILLIMETER.

PROJECT:	Cambridge Bay potable Water System		
ENGINEER:	Stantec Consulting Ltd		**RPG** ROUND PERFORATED GRILLE
CUSTOMER:	Central Mechanical Systems Ltd.	255293	
SUBMITTAL DATE: 4/15/2013	**SPEC. SYMBOL:**	2010/08/20	

23 37 13
SAUNDATHIT CONSTRUCTION LTD
SHOP DRAWING REVIEWED
BY
APR 16 2013

R - REVIEWED
O - REVISE AND RESUBMIT

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5.3

NORMAL OPERATIONS – RAW WATER SUPPLY TO TOWN

1. Operator manually opens valve BUV-0A and 0B on the 150mm (6") line of both the intake lines. These valves are prior to the Series 9200 Check Valves.
2. Operator sets Raw Water Delivery (HAND/OFF/AUTO) selector on the Plant Control Panel to AUTO.
3. Operator switches raw water pumps RWP-1 and RWP-2 to ON.
4. Specific pump to run is chosen by the Siemens PXC controls system on an alternate 'lead/lag' run basis.
5. If it is desired to utilize a specific pump, either RWP-1 or RWP-2 as desired, operator sets (HAND/OFF/AUTO) Raw Water Pump selector switch on Plant Control Panel PP1 to HAND, and switches the chosen pump to ON and the other pump to OFF.
6. Upon receiving a signal from the Siemens PXC, the selected pump will start and run until it receives a signal from the Siemens PXC system to stop.

TRUCK FILL – MANUALLY DELIVERING A DESIRED QUANTITY OF WATER

1. Operator parks the vehicle under the Truck Fill Arm #1 and positions the fill pipe in the truck hatch.
2. With both water pumps off, operator sets Raw Water Delivery (HAND/OFF/AUTO) selector on Plant Control Panel to HAND.
3. Operator manually opens valve BUV-0G to the truck fill arm and closes valve BUV-0F on the 150mm (6") raw water pipeline.
4. Operator switches the chosen raw water pump RWP-1 or RWP-2 to ON and the other pump to OFF to start delivery of water into the truck.
5. The chlorine injection pump is interlocked with the submersible pump to deliver aqueous hypochlorite solution to the truck fill arm whenever the submersible pump is running.
6. When desired amount of water is delivered, operator switches the chosen pump to OFF.

OPERATION OF 50MM (2") INTERNAL RECIRCULATION LINE

NOTICE: The proper operation of the 50mm internal recirculation line is essential for the water delivery pipeline to the community to operate without freeze up in the winter. As such, monitoring and regular checking of both the flow in the line and of the retained pressure in the line is essential.

The circulation line MUST operate whenever the ground temperature is below freezing. As it is not possible to check and confirm the ground temperature, in general the recirculation line should be operated continuously whenever the raw water pipeline is in use. If the raw water is not in use, this line should be drained and blown out with air.

1. Circulation Pump P-P1 shall be switched ON when raw water pipelines are operating.
2. Flow Control Valve FCV-1 is to be set to retain a minimum 50 PSI pressure differential to atmosphere in the 50mm recirculation line. This pressure is to be supplied to the 50mm recirculation line largely by the high head recirculation pump in the pumphouse.
3. If circulation stops for more than 1 minute in the recirculation line as shown by the flow sensor (FM-1, FM-2), the Siemens PXC monitoring system is set to alarm at the pumphouse control panel to notify the operator.

BACKWASHING INTAKE CASINGS

1. Operator manually opens backwash valves BUV-0P or BUV-0O (and 0M or 0N) on the 50mm line of the intake being backwashed, and manually closes valve BUV-0C on the primary raw water line. These valves are adjacent to the DVA-1 and DVA-2 Valves.
2. With both raw water pumps off, operator sets (HAND/OFF/AUTO) selector on Plant Control Panel P-P1 to HAND.
3. Ensure bypass valve BUV-0D on the 150mm raw water pipeline is closed.
4. Operator switches the raw water pump (either RWP-1 or RWP-2) on the line that's NOT being backwashed to ON and the other pump to OFF to start the backwash.
5. Backwash for the required length of time and shut off the chosen raw water pump.
6. Reverse the valve and pump settings in above steps to backwash the other pump line.
7. Following the completion of backwashing the intake lines, return all valves to their normal settings as per the valve schedule.

SAMADATHY CONSTRUCTION LTD.
SHOP DRAWING REVIEWED
BY
MAY 15 2013
- REVIEWED
- REVIEWED AS NOTED
- REVISE AND RESUBMIT

RWP-1, RWP-2

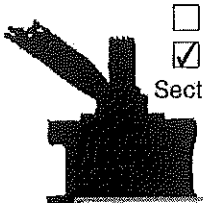
6" ENCAPSULATED SUBMERSIBLE MOTORS

Single-Phase 5-15 hp & Three-Phase 5-40 hp
200-575 volts 60 & 50 Hz

Motors
Drives
Controls

CMS Pro-Flo Control Solutions

Shop Drawing Review
15-May-13
By: DO
☐ Original Submision
☑ Resubmission
Section:



Application Data:

These motors are built for dependable operation in 6-inch diameter or larger water wells. Temperature and time ratings are continuous in 86 °F (30 °C) water at 1/2 ft./sec. flow past the motor. Rotation: single-phase, CCW facing shaft end; three-phase, electrically reversible.

Basic Features:

- Full 3450 RPM design point
- Maximum temperature winding wire NEMA class 200
- Anti-track self-healing resin system
- Hermetically-sealed windings
- Removable Water-Bloc™ lead
- Double flange design
- Stainless steel shell
- Kingsbury-type water lubricated thrust bearing
- Pressure equalizing diaphragm
- Sand slinger
- 3-lead & 6-lead (Wye Delta) configurations for 3-phase
- Copper bar rotor

Special Features:

- **316 Stainless Steel:** Special construction option for acid, low pH, and seawater applications. All 316 SS motors include a Subtrol-Plus heat sensor.
- **Sand Fighter™** models available for sandy wells. All Sand Fighter models include Subtrol-Plus heat sensor.

SUBMONITOR® OVERLOAD OPTION FOR THREE-PHASE MOTORS
A field proven and contractor friendly premium motor protection system. It protects the motor against overload, underload, excessive winding temperature and rapid cycling. It also extends the motor warranty to a full three years.* The motor must be manufactured with a Subtrol-Plus® heat sensor.

*Contact factory for warranty details.

Stantec
■ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
May 15, 2013
By: Arlen Foster, EIT
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.
STANTEC ARCHITECTURE LTD. (PC-1449)

System Solutions

Franklin Electric

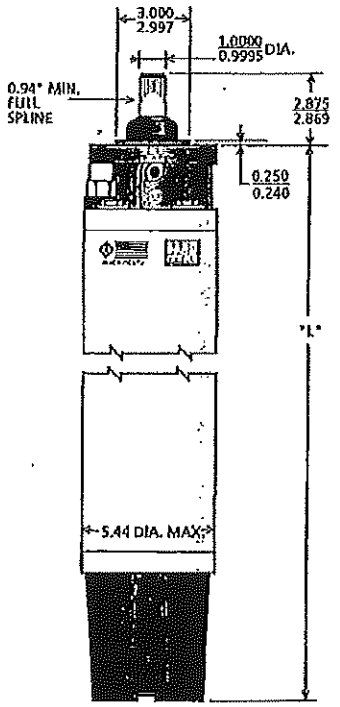
Three-Phase

HP	KW	"L" Dim		316 SS "L" Dim		Shipping Weight	
		IN	CM	IN	CM	LBS	KG
5	3.7	22.9	58.1	22.5	57.1	103	47
7.5	5.5	24.2	61.4	23.8	60.4	110	50
10	7.5	25.4	64.6	25.0	63.6	118	54
15	11.0	28.0	71.1	27.6	70.1	131	60
20	15.0	30.6	77.6	30.2	76.6	147	67
25	18.5	33.1	84.2	32.7	83.1	158	72
30	22.0	35.7	90.7	35.3	89.6	176	80
40	30.0	40.8	103.7	40.4	102.6	206	94

Note: 60 Hz - 3,450 RPM 50 Hz - 2,875 RPM

Three-Phase, 60 Hz - 3450 RPM

HP	KW	DOWNWARD THRUST	VOLTS	HZ	SERVICE FACTOR
5	3.7	3500 lbs. 15500 N	200	60	1.15
			230	60	1.15
			380	60	1.15
			460	60	1.15
			575	60	1.15
7.5	5.5	3500 lbs. 15500 N	200	60	1.15
			230	60	1.15
			380	60	1.15
			460	60	1.15
			575	60	1.15
10	7.5	3500 lbs. 15500 N	200	60	1.15
			230	60	1.15
			380	60	1.15
			460	60	1.15
			575	60	1.15
15	11	3500 lbs. 15500 N	200	60	1.15
			230	60	1.15
			380	60	1.15
			460	60	1.15
			575	60	1.15
20	15	3500 lbs. 15500 N	200	60	1.15
			230	60	1.15
			380	60	1.15
			460	60	1.15
			575	60	1.15
25	18.5	3500 lbs. 15500 N	200	60	1.15
			230	60	1.15
			380	60	1.15
			460	60	1.15
			575	60	1.15
30	22	3500 lbs. 15500 N	200	60	1.15
			230	60	1.15
			380	60	1.15
			460	60	1.15
			575	60	1.15
40	30	6000 lbs. 27500 N	380	60	1.15
			460	60	1.15
			575	60	1.15



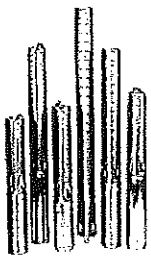
Construction Materials

Component	Material
1 Castings	Gray Iron
2 Stator Shell	301 SS
3 Stator Ends	Low Carbon Steel
4 Shaft Extension	303 SS, Except 17-4 SS on 40-60 hp
5 Fasteners	300 & 400 Series SS
6 Seal Cover	304 SS & Sintered Bronze
7 Seal	Sand Fighter™ SiC/SiC Mech Seal
8 Diaphragm	Nitrile Rubber
9 Diaphragm Plate	304 SS
10 Diaphragm Spring	302 SS
11 Slinger	Nitrile Rubber
12 Lead Wire (or Cable)	XLPE
13 Lead Potting	Epoxy
14 Filter	Delrin & Polyester

Specifications subject to change without notice.
Contact Franklin Electric if current material types are required for bid specifications.

Franklin Electric
400 East Spring Street, Bluffton, Indiana 46714 • Tel: 260.824.2900 Fax: 260.824.2909 • www.franklin-electric.com

Position	Count	Description
	1	385S150-2



Product photo could vary from the actual product

Product No.: 16B70002
Multi-stage submersible pump for raw water supply, groundwater lowering and pressure boosting. The pump is suitable for pumping clean, thin, non-agressive liquids without solid particles or fibers.

The pump is made entirely of Stainless steel DIN W.-Nr. DIN W.-Nr. 1.4301 and suitable for horizontal and vertical installation.
The pump is fitted with a built-in non-return valve.

Liquid:

Pumped liquid:	Water
Maximum liquid temperature:	104 °F
Liquid temp:	68 °F
Density:	62.29 lb/ft³
Kinematic viscosity:	0.0388 ft²/h

Technical:

Speed for pump data:	3450 rpm
Rated flow:	383 US gpm
Curve tolerance:	ISO 9906:2012 Grade 3B

Materials:

Pump:	Stainless steel DIN W.-Nr. 1.4301 AISI 304
Impeller:	Stainless steel DIN W.-Nr. 1.4301 AISI 304

Installation:

Pump outlet:	4" NPT
Motor diameter:	6 inch
Minimum borehole diameter:	8" mm

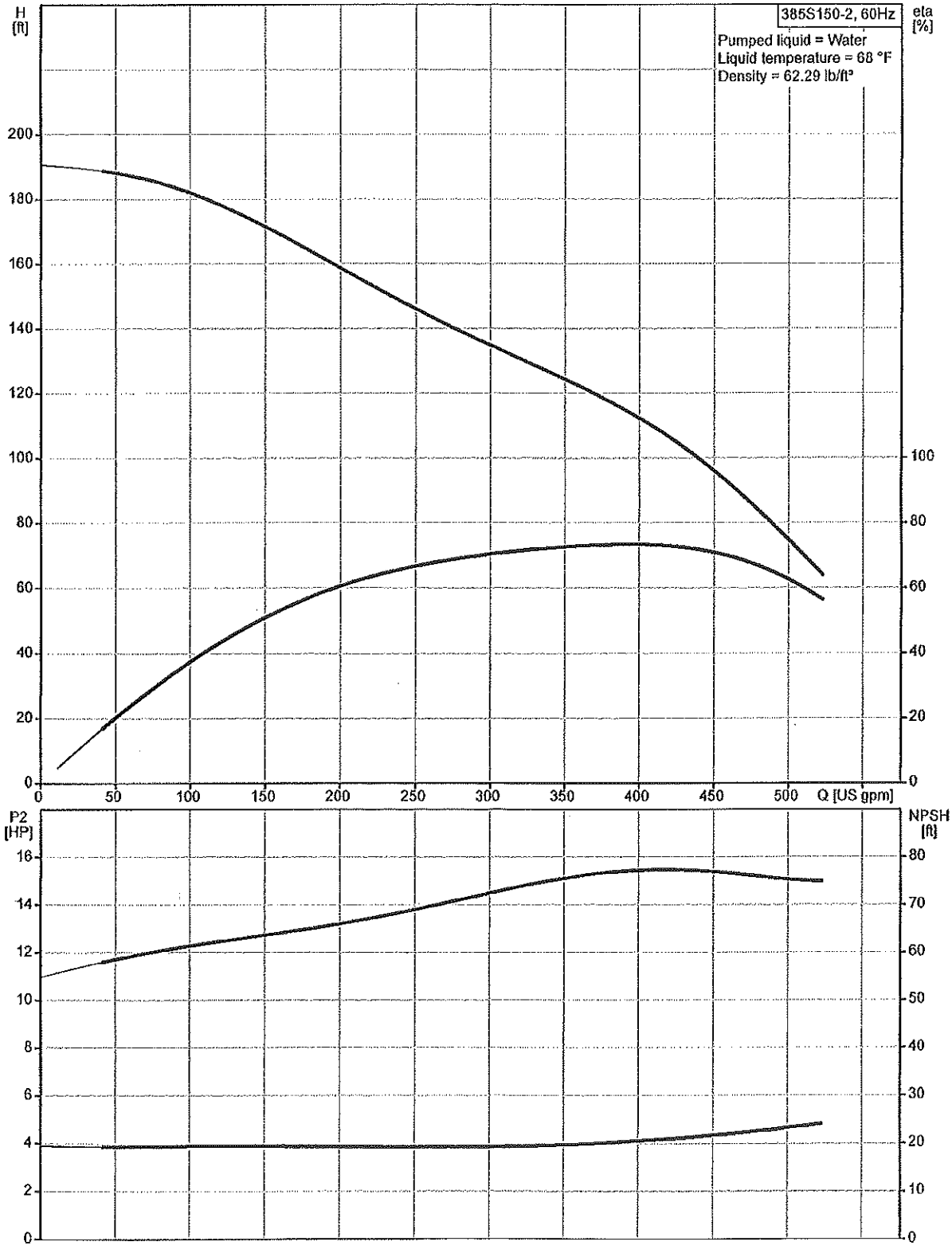
Electrical data:

Power (P2) required by pump:	15 HP

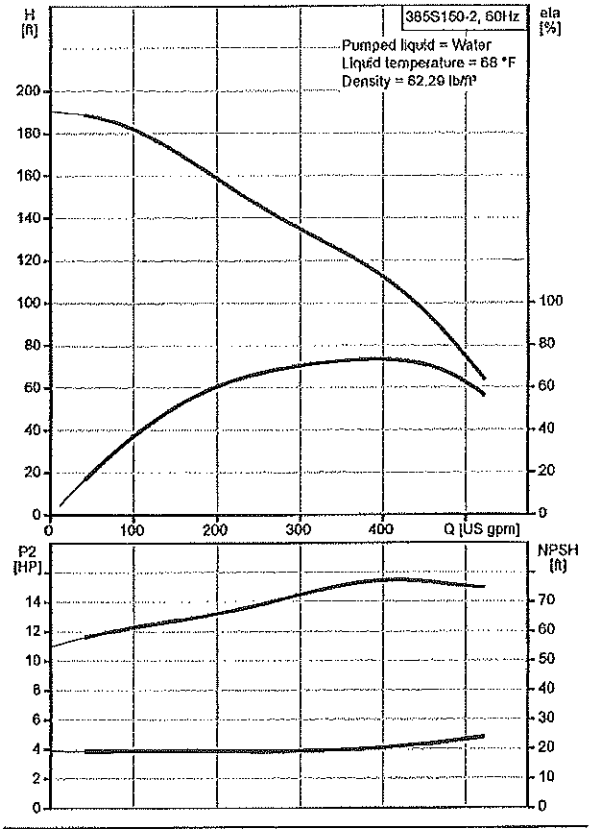
Others:

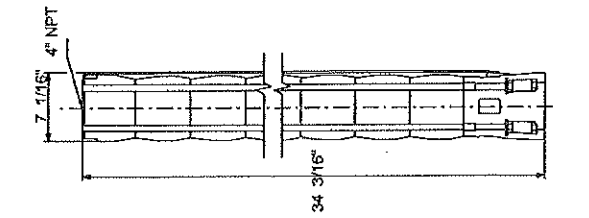
Net weight:	59.5 lb
Gross weight:	110 lb

16B70002 385S150-2 60 Hz

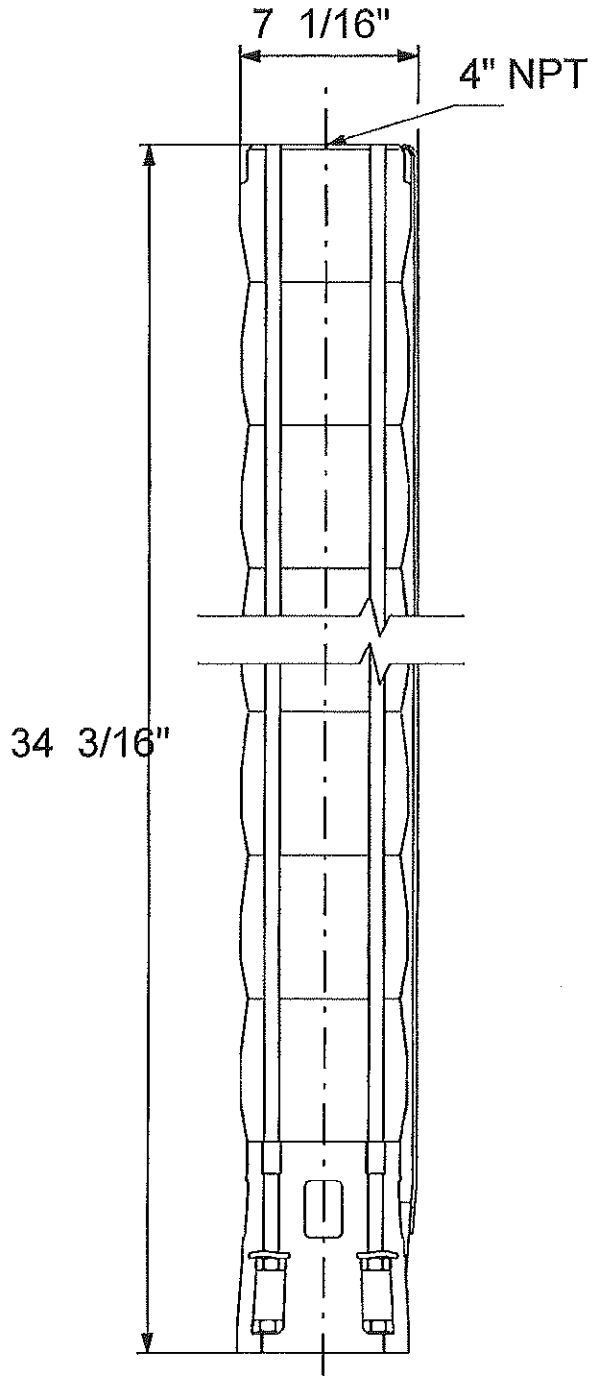


Description	Value
Product name:	385S150-2
Product Number:	16B70002
EAN number:	5700391532580
Technical:	
Speed for pump data:	3450 rpm
Rated flow:	383 US gpm
Flow range:	52.8 .. 441 US gpm
Max flow:	441 US gpm
Curve tolerance:	ISO 9906:2012 Grade 3B
Stages:	2
Model:	C
Valve:	pump with built-in non-return valve
Materials:	
Pump:	Stainless steel DIN W.-Nr. 1.4301 AISI 304
Impeller:	Stainless steel DIN W.-Nr. 1.4301 AISI 304
Installation:	
Pump outlet:	4" NPT
Motor diameter:	6 inch
Minimum borehole diameter:	8" mm
Liquid:	
Pumped liquid:	Water
Maximum liquid temperature:	104 °F
Liquid temp:	68 °F
Density:	62.29 lb/ft³
Kinematic viscosity:	0.0388 ft²/h
Electrical data:	
Power (P2) required by pump:	15 HP
Others:	
Net weight:	59.5 lb
Gross weight:	110 lb
Sales region:	Namreg

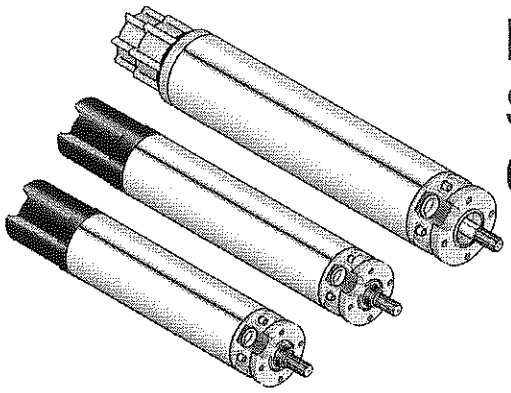




16B70002 385S150-2 60 Hz



Note! All units are in [mm] unless others are stated.
Disclaimer: This simplified dimensional drawing does not show all details.



Encapsulated Submersible Motors, 6" and 8"

GB

Assembly and operating instructions

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Franklin Electric

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Doc.-Nb.: 308 018 418
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Changes due to technical developments reserved.

Franklin Electric

EC Declaration of Conformity

Manufacturer:	Franklin Electric Europa GmbH Rudolf-Diesel-Strasse 20 D-54516 Wittlich/Germany
Product:	6-Inch and 8-Inch Encapsulated Submersible Motors
Type Designations:	226..., 236..., 239..., 276...

The above products are in conformity with the following European Directives:

2006/95/EC (Low Voltage Directive)

and

2004/108/EC (EMC Directive)

Applied harmonized standards:	**EN 60034-1: 2010**
Applied national standards:	**NEMA MG 1-2009: 18.170, 18.181**

J. A. Weber
Manager, Engineering Services
3 December 2013

1 With this document

These assembly and operating instructions form an integral part of the submersible motor and describe its safe, intended use in all operating phases.

Storage and handing over

⇨ Keep the assembly and operating instructions in the immediate vicinity of the motor.

⇨ Hand the assembly and operating instructions over to every subsequent user of the motor.

Application

These assembly and operating instructions only apply to the motors described here.

1.1 Warning notices and warning symbols

Warning notices point out special dangers and indicate the measures that can be taken to avoid the danger. Warning notices come in three levels:

Warning word	Meaning
DANGER	Immediate danger to life and health
WARNING	Possible danger to life and health
CAUTION	Possible danger of slight injury or material damage

Warning notices are built up as follows:



Warning word

Type and source of danger as well as the possible consequences of measures not being observed!

⊘ *Forbidden actions.*

⇨ *Measures to avoid the danger.*

1.2 Instructions and highlights

In these assembly and operating instructions we use the following symbols and, for improved legibility and uniform identification, highlights:

Insulation measuring unit	(this indicates a listing)
☑ Instructions ... observed	(this indicates a condition)
⇨ Switch off the motor.	(this indicates an instruction to take action)
Motor has stopped.	(this indicates the result of the action)
Immediately switch off the motor...	(you can see a highlight in bold here)



Note

Specifically important information is given here. You should observe this information to ensure correct and safe operation of the motor.

2 Safety

This section describes the safety rules which you have to observe for the safe use of submersible motors. Possible sources of danger and the relevant safety measures are listed here.

2.1 Intended use

Franklin Electric submersible motors are only intended for integration with a machine in order to drive the relevant machine under water. They must only be put into use if the machine fulfils the provisions of the applicable directives and statutory provisions.

Installation location: Vertical (Mandatory mounting position: vertical, shaft up. Only one diameter step allowed, i.e. 6" motor on 8" pump). Horizontal (only allowed if the pump size is identical to the motor size, e.g. 6" motor with 6" pump). The pump has to sufficient "Down Thrust" transmit to the motor.

The submersible motors must only be used in clean, highly fluid media, such as drinking or process water.

The following media are not allowed: air, highly flammable, explosive media and wastewater.

Loss of guarantee and exclusion of liability

Franklin Electric shall not be liable for the damage resulting from any further, non-intended use. The risk of such use rests solely with the user.

2.2 Target group

The electrical system must only be installed by professional staff (qualified electrical engineers or electrical machine technicians).

2.3 General safety instructions

The following safety measures must be observed prior to putting the motor into use:

- Do not carry out any other work on the motor than described in these instructions.
- Only use the motor under water (the motor and the short motor cable must be fully submersed).
- Do not implement any changes or conversions to the motor or its electrical connections.
- Never open the motor.
- Never use the motor in combination with damaged pump units or parts.
- Only work on the motor when it is switched off. No work or checks require the motor to be running.
- Switch off the power supply to the motor before carrying out any work on it.
- Make sure that nobody can switch on the voltage unexpectedly while work is being carried out on the motor.
- Never work on electrical systems during a thunderstorm.
- Make sure immediately after ending the work that all protective and safety devices have been fitted again and are operational.
- Before switching on the motor, make sure that all electrical connections and safety devices have been checked and that all fuses and safeties have been set correctly.
- Make sure that no danger zones are freely accessible (e.g. rotating parts, suction locations, pressure output locations, electrical connections).
- Observe the pump manufacturer's commissioning instructions.
- If motors or pump units have been used in contaminated media they must be marked as such before handing them over to a third party (e.g. when submitting them for repair). Pay attention to possible residues in "Dead spaces" (diaphragm cover).
- Contaminated motors or pump units must be marked as such before handing them over to a third party (e.g. when submitting them for repair).
- Repairs must only be carried out by authorized professional workshops. Use only original Franklin Electric spare parts.

3 Storage, transport, disposal

Storage

⇨ Store the motor in its original packaging until the time of installing it.

⇨ If the motor is stored standing up, make sure that it cannot topple over (shaft always pointing up!).

⇨ Do not store the motor in direct sunlight or within the reach of other heat sources.

⇨ Observe the storage temperature (–15 - +60 °C, see Technical specifications).

Transport



DANGER

Falling loads may cause lethal injuries or may crush parts of the body!

⦸ *Nobody is allowed to be located under suspended loads.*

⇨ *Only use approved hoisting gear.*

⇨ *Select the hoisting gear on the basis of the total weight to be transported.*

Unpacking

⇨ After unpacking the motor check it for possible damage, e.g. damage to the diaphragm cover, housing, endbell, connection and motor cable.

⇨ Immediately inform the supplier of any damage found.



DANGER

Danger to life due to electrocution if the motor cable is damaged!

⦸ *Do **not** install the motor and do **not** put it into operation.*

Disposal

In order to avoid environmental damage:

- Avoid contamination by lubricants, detergents etc.
- Dispose of the motor and the packaging material in a proper, environmentally sound manner.
- Observe local regulations.

4 Technical specifications

Description	Value
Performance/model number	6": 4 - 45 kW (HighTemp90 up to 30 kW) models 236 ... (276 ...) 8": 30 - 150 kW (HighTemp75 up to 110 kW) models 239 ... (279 ...)
Voltage range	220 V ... 690 V, 3~ 50/60 Hz
Frequency tolerance	± 2%
Voltage tolerance (on the motor terminals)	50Hz : –10 / +6 % of U_N, i.e. at a nominal voltage of 380-415 V: 380V –10 % = 342V / 415V + 6 % = 440 V 60Hz : +/- 10% of U_N
Speed	approx. 2900 rpm at 50 Hz
Start alternatives	Direct starting, wye-delta-starting
Switching frequency	Max. 20 switching actions per hour with a minimum off time of 90 s
Protection	IP 68 according to IEC 60529
Insulation class	F (155°C)
Submersion depth	max. 350 m

Description	Value
Installation location	Vertical (Mandatory mounting position: vertical, shaft up. Only one diameter step allowed, i.e. 6" motor on 8" pump). Horizontal (only allowed if the pump size is identical to the motor size, e.g. 6" motor with 6" pump). The pump has to sufficient "Down Thrust" transmit to the motor. No general warranty when built-in in booster systems.
Operating temperature	≥ –3 °C
Sound pressure level	≤ 70 dB(A)
Maximum axial thrust towards the motor	6": 4 - 22 kW 15.5 kN (optional High Thrust Version: 45kN) 30 kW 27.5 kN (optional High Thrust Version: 45kN) (HighTemp90 – 18,5kW) 37 / 45 kW 45 kN (HighTemp90 – 22 / 30kW) 8": all motors 45.0 kN
Maximum axial thrust away from the motor (only for a short-time load of max. 3 minutes; independent of performance rating)	6": 1400 N 8" 30 - 75 kW 1400 N 93 - 150 kW 3400 N
Material	The person placing the order is responsible for selecting the correct material, specifically as regards its resistance in the medium to be transported. 304SS/Cast Iron Version: Stator 304, powder-coated castings 304SS: Stator and castings in 316SS 316SS: Stator and castings in 316SS
Motor fluid	FES 91 (approved, water-based emulsion) (FES92 for HighTemp 75/90)
Weight	Technical data sheets (see appendix)
Storage temperature	–15 °C to +60 °C
Short motor cable	KTW and VDE- tested (HighTemp Motors with cable without KTW approval) 6": Motor cable 4.0 m length 8": Motor cable 8.0 m length
Connection flange	6", 8": NEMA flange (see appendix)
Temperature monitoring	PT100 temperature sensor for retrofitting Subtrol temperature sensor + SubMonitor tripping device PTC temperature sensor (only for 6" 4 - 30 kW, sensor with cable)
Medium temperature	6" Standard: 4-30kW Nominal 30°C; 37/45kW Nominal 50°C 6" HighTemp90: Nominal 90°C 8" Standard: Nominal 30°C 8" HighTemp75: Nominal 75°C
Coolant flow speed (is the speed of the medium flowing along the motor casing during normal operation)	Nominal 0.16 m/sec In the event of higher media temperatures operation is only allowed if you • reduce the performance (De-Rating) • increase the coolant flow speed

5 Putting the motor into use

5.1 Checking the motor prior to installing it

If a leak is visible or if the motor is more than one year old (e.g. in the event of re-use or after long storage):

⇨ Check the fluid level in the motor prior to installing it.

Tools You need the following tools for assembly and inspection work:

- Insulation measuring unit: 500 VDC testing
- Filling Kit 308 726 103

⇨ Determine the age of the motor by checking the type plate (see Figure 5-1).

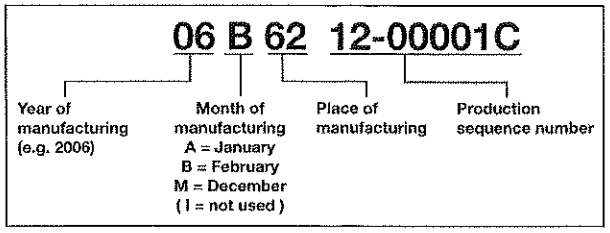


Figure 5-1: Type plate with date of manufacture

5.1.1 Checking the motor fluid

CAUTION

Motor damage due to being insufficiently filled!

⇨ *Fill the motor with sufficient motor fluid*

⇨ *Wear safety goggles and gloves when filling and draining the motor.*

⇨ Top up using original motor fluid from Franklin Electric (5 litres concentrate Id. no. 308 353 941)
Never use distilled water!

Filling volumes

- 6":max. 1.5 liter
- 8":max. 3.5 liter

Venting the motor

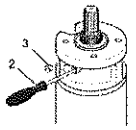


Figure 5-2: Venting the motor

⇨ Place the motor horizontally so that the filling valve is located at the highest position.

⇨ Remove the plug (3) from the filling valve.

Carefully push the test pin (2) into the filling valve until air and some fluid escape from it.

Checking the motor

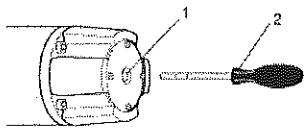


Figure 5-3: Checking the motor fluid

⇨ Feed the test pin (2) through the opening (1) in the diaphragm housing until you can feel resistance.

⇨ Measure the actual diaphragm distance to the side of the opening in the diaphragm cover.
If the measured result is not identical to the target value:
59 mm ± 2 mm (6"- motor-Cast iron/304SS / 4-30kW)
25 mm ± 2 mm (6"- motor-304SS and 316SS / 4-30kW)
47 mm ± 2 mm (6"- motor-304SS/316SS - 37/45kW)
47 mm ± 2 mm (6"- HighTemp90)
44 mm ± 2 mm (6"- 45kN Version)
37 mm ± 2 mm (8"- motors all)

Topping up the motor

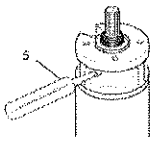


Figure 5-4: Topping up the motor fluid

- ⇨ Top up or drain motor fluid.
- ⇨ Apply the filling syringe (5) to the filling valve.
- ⇨ Top up the motor filling fluid until the value of the diaphragm position is lower than the target value.

Adjusting the motor

- ⇨ Adjust the diaphragm position by draining (see Venting) or topping up motor fluid until the target value is reached.
- ⇨ Fit the plug (3) again.

5.2 Motor and pump assembly

Note
These assembly and operating instructions only describe action steps related to the motor. You should also observe the pump unit manufacturer's instructions in all events.

Preparation

- ☑ Short motor cable fitted (see 5.3.1)
- ☑ Shaft protector removed
- ☑ Motor shaft rotated manually before assembly – runs freely after overcoming static friction
- ☑ Surfaces of parts to be connected are free from dust and dirt
- ☑ Coupling attached to the pump shaft, slides on the motor shaft

Assembly

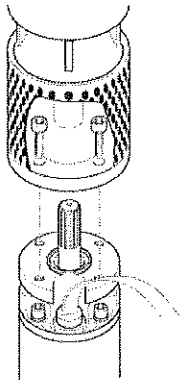


Figure 5-5: Pump assembly

- ⇨ Apply water-resistant, acid-free grease (e.g. Mobil FM 102, Texaco, Cygnus 2661, Gleitmo 746) to the inner part of the coupling to the pump unit.
- ⇨ Make sure that the splined section is encased by an O-ring when the motor and the pump unit are assembled together.
- ⇨ Align the pump unit and motor shaft to each other, connect the pump unit and the motor.
- ⇨ Screw the motor to the pump unit, tighten the fixing screws crosswise as instructed.
  6": ½"-20 UNF-2B
  8": Bore Ø 17.5 mm
- ⇨ Protect the coupling location against contact.

5.3 Motor cable

CAUTION

Motor damage due to damaged motor cable!

- ⇨ *Make sure that the motor cable is not in contact with any sharp edges.*
- ⇨ *Protect the cable against damage using the cable guard.*

5.3.1 Connecting the short motor cable

Note

⇨ *Always a <u>new</u> cable must be used*

Tools and Torques

You need to use the following tools and torques for assembly and inspection work:

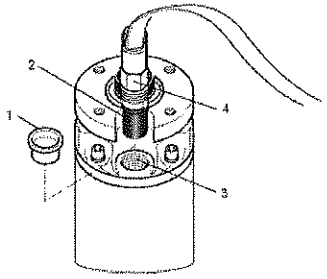
- 6" Motors (all Ratings) 60 N/m ±6 N/m; Wrench 1 3/16" (30,2 mm)
- 8" Motors (30 – 93kW) 74 N/m ±7 N/m; Wrench 1 3/16" (30,2,) oder 1 5/8" (42mm)
- 8" Motors (110 – 150kW) 9,0 N/m ±1 N/m, Allen Key 3/16" (4,7mm)

Preparation

☑ Remove the sealing plug (1)

☑ Clean and dry the surfaces of the plug (2) and the socket (3)

Assembly



⇨ Pull back the jam nut (4) until the plug (2) is free

⇨ Apply silicone paste or vaseline to the rubber casing surfaces

⇨ Apply acid-free grease to the thread of the union nut

⇨ Insert the plug (4) in the socket (3)

Figure 5-5: Connection of the short motor cable

5.3.2 Extending the motor cable

☑ The unit manufacturer's instructions regarding the cable connection have been observed

☑ Only extension cable and insulating material used which are suitable for the specific use (specifically drinking water) and which are approved for the temperatures occurring in the relevant medium

☑ Cable cross-sections: The tables in the appendix only serve as recommended suggestions. The fitter is responsible for the correct selection and dimensioning of the cable

⇨ Lay the cable along the pump.

⇨ Connect the ground conductor correctly (motors or integrated ground conductors are prepared for external grounding).

⇨ Protect the cable connection location against water penetration (shrink hoses, compounds or ready cable sets).

⇨ Make sure that the short motor cable is always fully surrounded by transport medium for proper cooling during operation.

5.4 Measuring the insulation resistance

This measurement is to be carried out using an insulation measuring unit (500 VDC) before and while submersing the fully assembled unit at the place of use.

⇨ Before submersing the unit, connect a measuring cable to the ground conductor.

⇨ Make sure that the contact points are clean.

⇨ Connect the other measuring cable to every core of the connected motor cable in succession. The insulation resistance is shown on the insulation measuring unit.

For your information

Minimum insulation resistance (500 VDC; 1 min.; 20°C) **with extension cable**:

- for a new motor > 4 MΩ
- for a used motor > 1 MΩ

Minimum insulation resistance (500 VDC; 1 min.; 20°C) **without extension cable**:

- for a new motor > 400 MΩ
- for a used motor > 20 MΩ

5.5 Making the electrical motor connection

DANGER

Danger to life due to electrocution!

⇨ *Prior to making the electrical motor connection make sure that there is no more voltage on the entire plant and that nobody can accidentally switch on the voltage again while the work is being carried out.*

Observe the instructions on the motor type plate and dimension the electrical system accordingly. The connection examples in this chapter concern the actual motor and do not serve as recommendation for the upstream control elements.

☑ All action steps of the previous chapter have been carried out properly

Energy supply by generator

Note

We urgently recommend that you discuss the plant dimensions with the generator manufacturer.

The voltage tolerance –10 % to +6 % -50Hz and +/-10% - 60Hz motors (on the motor terminals) and the deviation of a motor current from the mean value of all three currents must not be more than 5 %.

☑ Generator selected on the basis of the motor start behaviour, i.e. starting current with a mean cos φ of 0.5

☑ Sufficient continuous generator power available

☑ Voltage at start at least 55 % of the nominal voltage

⇨ You must follow the following switch-on sequences unconditionally:
first switch on the generator and then the motor.
first switch off the motor and then the generator.

Fusing and motor protection

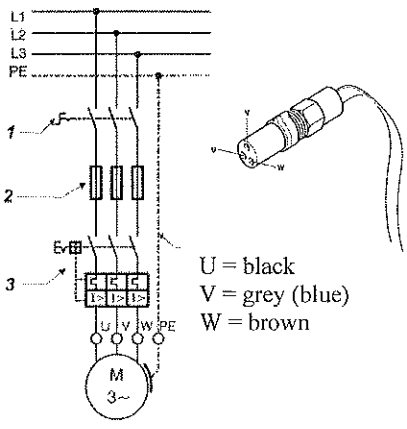


Figure 5-10: Fusing and motor protection

⇨ Provide an external mains switch (1) enabling the voltage to be removed from the system.

⇨ Provide fuses (2) for every single phase on site.

⇨ Provide a motor starting and protection switch (3) (see connection alternatives)

⇨ Provide an emergency stop system, if required for your specific application.

⇨ Ground the motor (4)
(exterior grounding possible with all motors)

Surge voltage protection

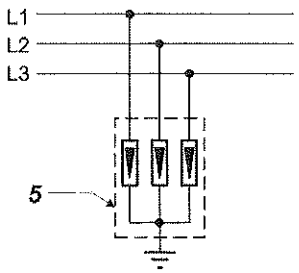


Figure 5-12: Surge voltage protection

⇨ Integrate an overload protector in accordance with IEC 60099 in the power supply (lightning safety (5)).

Connection alternatives

The motors can be used for clockwise and anti-clockwise rotation. The connection example shows the usual circuit with a right-hand field and an anti-clockwise direction of rotation:

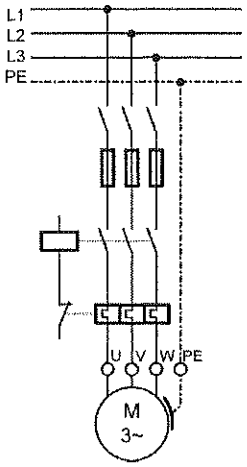


Figure 5-13: Direct starting

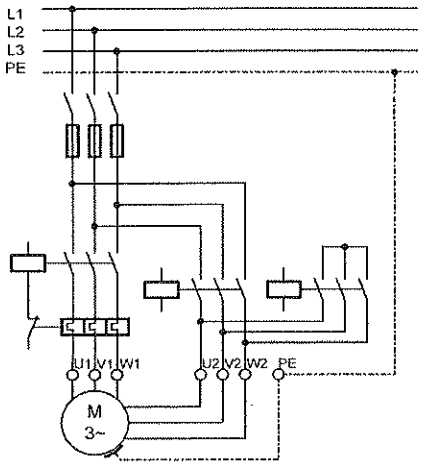


Figure 5-14: Wye-delta-starting

Motor safety switch

A motor safety switch (overload relay) is absolutely necessary!

Only use thermal trips of tripping categories 10A or 10, with

⇨ tripping time < 10 s at 500 % I_N (nominal current),

⇨ phase sensitivity,

⇨ temperature compensation from 20 to 40 °C.

⇨ Set the motor protection unit to the value of the operating current measured without exceeding the rated motor current I_N (as indicated on the type plate).

6 Motor operation

6.1 Making sure that the motor is cooled sufficiently

Caution

Damage to the motor and the motor cable due to overheating

⇨ *Make sure that the coolant flow speed along the motor is sufficient.*

⇨ *Make sure that the short motor cable is always fully surrounded by transport medium for proper cooling.*



Figure 6-1: Cooling tube

If the required minimum coolant flow speed cannot be reached (e.g. if the inlet opening of the well is located above the motor or if using large-diameter wells):

⇨ Fit a cooling tube (see figure 6-1).

⇨ Make sure that the cooling tube encases the entire motor and the pump water inlet opening.

The motor is force-cooled.

6.2 Providing a check valve and a level sensor

⇨ Provide one spring-loaded check valve in the production tube in case no such check valve has been fitted in the pump.

⇨ Ensure that the first check valve is no further than 7 m (metres) away from the pump.

⇨ Install a level sensor for wells with a highly varying water inflow.

6.3 Switching on the motor

☑ All action steps of the previous chapter have been carried out properly

⇨ Switch on the motor using the mains switch in the control cabinet.

⇨ Measure the following values after switching on:

Motor operating current in every phase
Mains voltage when motor is running
Level of the medium to be transported

⇨ **Immediately switch off the motor if**:

- the nominal current as specified on the type plate is exceeded,
- voltage tolerances of more than -10 % / +6 % to 50Hz and +/- 10% to 60Hz, relative to the nominal voltage are measured on the motor,
- there is a risk of the motor running dry,
- a motor current deviates from the mean value of all three currents by more than 5 %.

6.4 Operating a motor with a frequency converter

Note

When operating a motor with a frequency converter, the relevant operating manual must be observed!

⇨ Make sure that the motor current in all operating levels of the regulating range does not exceed the nominal motor current indicated on the type plate.

⇨ Adjust the frequency converter so that the limit values for the nominal motor frequency of min. 30 Hz and max. the value of the nominal motor frequency (50 or 60 Hz) are observed.

⇨ Limit any voltage peaks on the motor when using a frequency converter to the following values: max. voltage rise 500 V/µs, max. voltage peak 1000V.

⇨ Make sure that the running up time from 0 to 30 Hz and the deceleration time from 30 to 0 Hz is maximum one second.

⇨ Dimension the cable such that power loss due to additional filters is taken into consideration.

⇨ Make sure that the required coolant flow speed along the motor is also observed with frequency converter operation.

6.5 Operating a motor with a soft starter

Note
When operating a motor with a soft starter, the relevant operating manual must be observed!

⇨ Set the starting voltage of the soft starter to 55 % of the nominal voltage and set the running up and delay times to max. three seconds.

⇨ Bridge the soft starter after running up, using a contactor.

7 Maintenance and service

The motor is maintenance-free, no maintenance or service activities are necessary.

8 Troubleshooting

Fault	Remedy
Unusual noises, problems with the true running of the pump or the pump switching on and off too frequently.	⇨ Try to find the cause of the fault on the pump unit.
The pump repeatedly switches off	⇨ Have the insulation resistance checked by a professional (see chapter 5.4). ⇨ If no cause can be found in the motor or the motor cable: Have the electrical system checked.

9 Service

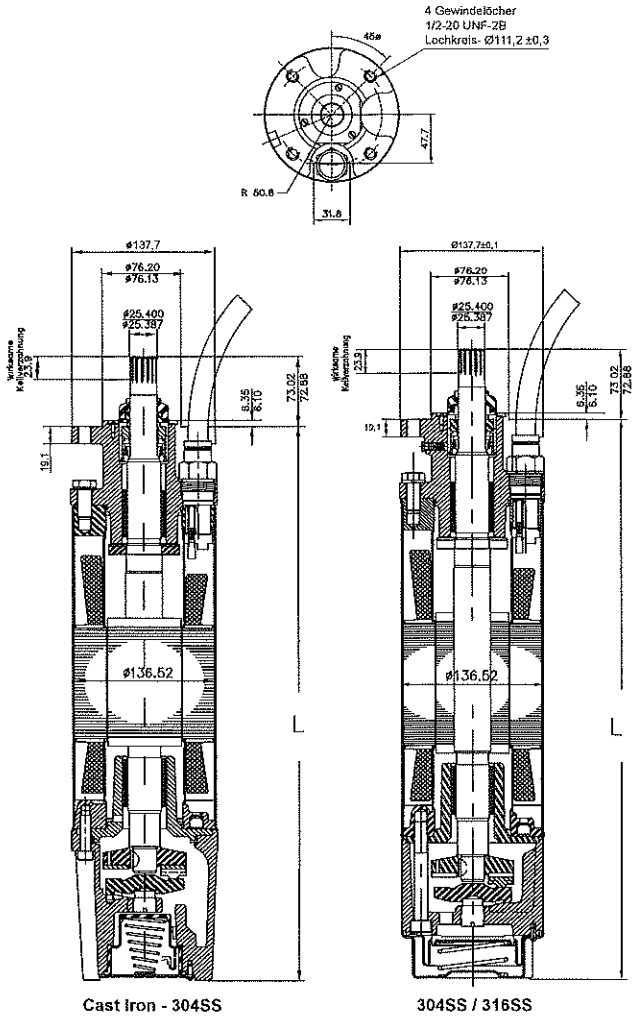
Repairs must only be carried out by authorised professional workshops (only use original Franklin Electric spare parts).

If you have any questions or problems, please contact your dealer or contact Franklin Electric via Internet or mail to field-service@franklin-electric.de.

10 Appendix

Page	Explanation
Page A	Outline drawings 6" / 8" Standard Motors
Page B	Outline drawings HiTemp 75/90 Motors
Page C	Motor Test Report (MTR)
Page D	Cable cross-sections DOL and YD

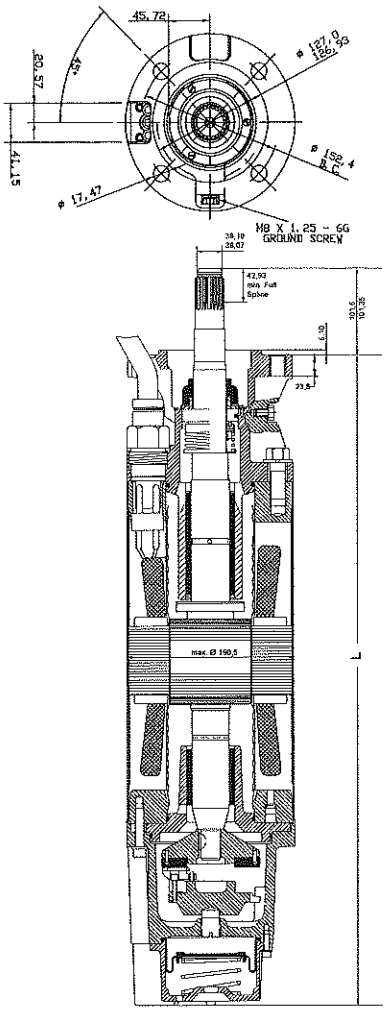
6" Encapsulated



Cast Iron - 304SS

304SS / 316SS

8" Encapsulated

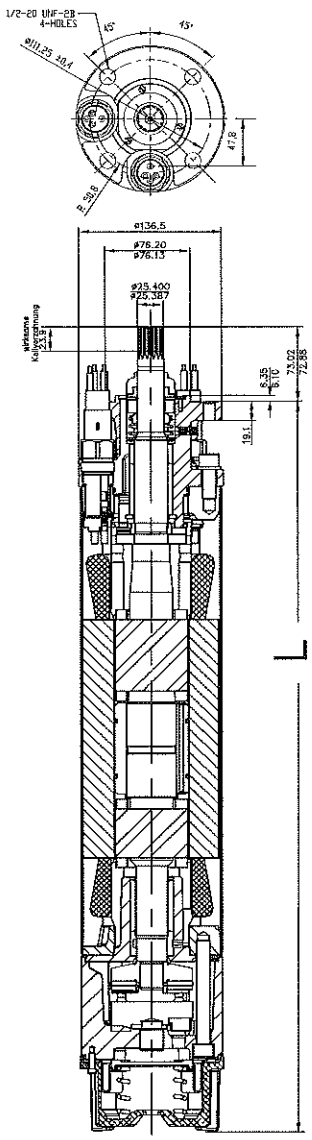


P_N [kW]	Cast Iron - 304SS L [mm]	304SS* L [mm]	316SS** L [mm]	Motor Package Size [mm]	Shipping Weight [kg]***	
					DOL	YΔ
4	581,2	570,7	570,7	155 x 212 x 800	41,3	40,3
5,5	614,4	604,0	604,0	155 x 212 x 800	44,9	43,9
7,5	646,2	635,8	635,8	155 x 212 x 800	49,0	48,0
9,3	678,7	668,3	668,3	155 x 212 x 1070	51,3	50,3
11	711,2	700,8	700,8	155 x 212 x 1070	54,7	53,7
15	776,2	765,8	765,8	155 x 212 x 1070	60,5	59,5
18,5	841,5	831,1	831,1	155 x 212 x 1070	67,1	66,1
22	906,5	896,1	896,1	155 x 212 x 1070	73,1	72,1
30	1036,6	1026,2	1026,2	155 x 212 x 1200	87,7	87,7
37		1476,7	1476,7	223 x 267 x 1823	136	
45		1629,2	1629,2	223 x 267 x 1823	156	

* HighThrust Version + ~60mm
** HighThrust Version + ~70mm
*** HighThrust Version + ~4Kg

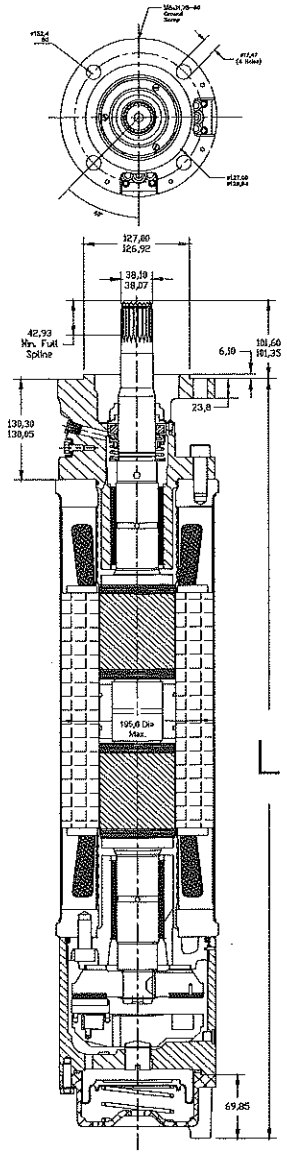
P_N [kW]	304/316 L [mm]	Motor Package Size [mm]	Shipping Weight [kg]
30	920,5	432 x 235 x 1295	145
37	1000,0	432 x 235 x 1295	157
45	1070,7	432 x 235 x 1295	172
55	1390,4	432 x 235 x 1626	202
75	1490,6	432 x 235 x 1626	240
93	1740,8	432 x 235 x 2007	318
110	1970,6	432 x 235 x 2438	381
130	2170,9	432 x 235 x 2438	420
150	2400,8	432 x 235 x 2743	494

6" Encapsulated HighTemp 90°C



P_N [kW]	L [mm]	Motor Package Size [mm]	Shipping Weight [kg]
3.7	716	190,5 x 273,5 x 876,3	55
5.5	752	190,5 x 273,5 x 876,3	61
7.5	780	190,5 x 273,5 x 939,8	68
11	846	190,5 x 273,5 x 1073,2	73
15	909	190,5 x 273,5 x 1073,2	81
18.5	1041	190,5 x 273,5 x 1200,2	94
22	1410	222,2 x 273,5 x 1822,4	138
30	1562	222,2 x 273,5 x 1822,4	152

8" Encapsulated HighTemp 75°C



P_N [kW]	L [mm]	Motor Package Size [mm]	Shipping Weight [kg]
30	1138	432 x 245 x 1295	182
37	1265	432 x 245 x 1626	207
45	1455	432 x 245 x 1626	252
55	1747	432 x 245 x 2007	318
75	1976	432 x 245 x 2438	382
93	2179	432 x 245 x 2438	421
110	2408	432 x 245 x 2743	473

Franklin Electric

FEE – NO: _____
VISIT DATE: _____

Motor Test Report

Additional comments under „Remarks"

1. CUSTOMER / USER

Company: _____ Country: _____ Town: _____

Talked To: _____ Tel.: _____

2. MOTOR

Type: _____ Modell: _____ KW: _____ Volts: _____ Hz: _____

Date Code: _____ Sequenz-Nr: _____ Stator Nr: _____ Assembler: _____ Material _____

Built in: _____ Equipped for: _____ Worked with _____

Worked for: ☐ Months _____ ☐ Days _____ ☐ Hours _____ Date Inst.: _____ Date Failed: _____

3. INSTALLATION

☐ Vertical _____ ☐ Horizontal Pump Make: _____ Type: _____

Well depth /[m]: _____ Well diameter /[cm]: _____ Pump at /[m]: _____ Water inlet at /[m]: _____

Cable length /[m]: _____ Cable square /[mm²]: _____ Protection Make: _____ Type: _____

Water: _____ Temperature: _____ PH-Value: _____ Setting /[A]: _____

4. EXTERNAL

Shaft Height: _____ Upper End Bell: _____ Shaft Rotation: _____ Slinger: _____

Stator Shell: _____ Lower End Bell: _____ Deposits: _____ Valve: _____

Splines: _____ Diaphragm Pos.: _____ Cable / Lead Insu.: _____ Connector _____

Nameplate: _____ Leakage: _____ Snap Ring: _____

5. ELECTRICAL MEASUREMENTS

Phase 1: _____ Ω Normal Value: _____ Ω Main Phase: _____ Ω

Phase2: _____ Ω Normal Value: _____ Ω Start Phase: _____ Ω

Phase3: _____ Ω Normal Value: _____ Ω Insulation Resistance: _____ MΩ

6. TEARDOWN

Thrust Bearing: _____ _____ Lower Radial Bearing: _____ Diaphragm: _____

Segments: _____ Upper Radial Bearing: _____ Liner: _____

Filling Liquid: _____ _____ Sleeve Upper Shaft End _____ Shaft Seal: _____

Water Entry: _____ cm^3 Sleeve Lower Shaft End _____ Windings: _____

Up-thrust Washer _____ Prong: _____

7. CONTROL BOX

Relay: _____ Type: _____ Capacitor: _____ Wiring: _____

Subrol: _____ CP-Water: _____

8. REMARKS

Tech. Warranty: _____ Com. Warranty: _____ ☐ Repair ☐ Scrap Defect: _____ Cause: _____

Signature: _____ Date: _____ Entered into EDP: _____ Date: _____

maximum lengths in meters for 400V / 50Hz and 5% voltage drop at 30°C ambient Jacketed Cable Ampacity, IEC Publication 364-5-523 (1983 edition), Table 52-B1, Installation Methods C & G																	
DOL start																	
rating		cable size mm², copper wire - 70°C rated insulation															
KW	HP	2,5	4	6	10	16	25	35	50	70	95	120	150	185	240	300	400
4	5,5	180	290	430	710												
5,5	7,5	130	210	320	530	830											
7,5	10	90	150	230	390	610	940										
9,3	12,5	80	130	190	320	510	770										
11	15	60	100	160	270	430	650	890									
13	17,5		90	140	230	370	560	770									
15	20		80	120	200	320	490	680	920								
18,5	25			100	160	260	400	540	740	980							
22	30				140	220	340	470	630	840							
26	35				120	190	290	390	540	720	920						
30	40					160	250	340	470	620	790	940					
37	50					130*	200	280	380	500	640	760	890	1020			
45	60						170	240	330	440	570	690	810	940			
52	70						150*	210	290	390	500	600	710	820	980		
55	75						140*	190	270	360	470	560	660	770	910		
60	80							180	250	340	440	530	630	730	870	1010	
67	90							160*	220	300	390	460	550	630	750	860	1000
75	100								200*	270	350	420	490	570	680	780	910
83	111								180*	250	320	390	450	530	630	730	850
85	114									230	290	350	410	480	570	650	750
93	125									220*	280	340	390	460	550	620	720
110	150										220	270	310	360	420	480	550
130	175										200*	240	280	330	390	440	520
150	200											200*	240	280	330	380	440
185	250													210*	250	280	330

Wye - Delta																	
rating		cable size mm², copper wire - 70°C rated insulation															
KW	HP	2,5	4	6	10	16	25	35	50	70	95	120	150	185	240	300	400
4	5,5	270	430	640													
5,5	7,5	190	310	480	790												
7,5	10	130	220	340	580	910											
9,3	12,5	120	190	280	480	760											
11	15	90	150	240	400	640	970										
13	17,5	70	130	210	340	560	840										
15	20	70	120	180	300	480	730	1020									
18,5	25	60	90	150	240	390	600	810									
22	30		70	120	210	330	510	700	940								
26	35		60*	100	180	280	430	580	810								
30	40			90	150	240	370	510	700	930							
37	50				120	190	300	420	570	750	960						
45	60				100	160	250	360	490	660	850						
52	70				90*	150	220	310	430	580	750	900					
55	75					130	210	280	400	540	700	840	990				
60	80					120	190	270	370	510	660	790	940				
67	90					100	180	240	330	450	580	690	820	940			
75	100					90*	150	210	300	400	520	630	730	850	1020		
83	111						130	190	270	370	480	580	670	790	940		
85	114						130*	180	250	340	430	520	610	720	850	970	
93	125						120*	160	240	330	420	510	580	690	820	930	
110	150							130*	190	250	330	400	460	540	630	720	820
130	175								160*	220	300	360	420	490	580	660	780
150	200								150*	190	250	300	360	420	490	570	660
185	250										190*	240	270	310	370	420	490

* only for individual conductor cable

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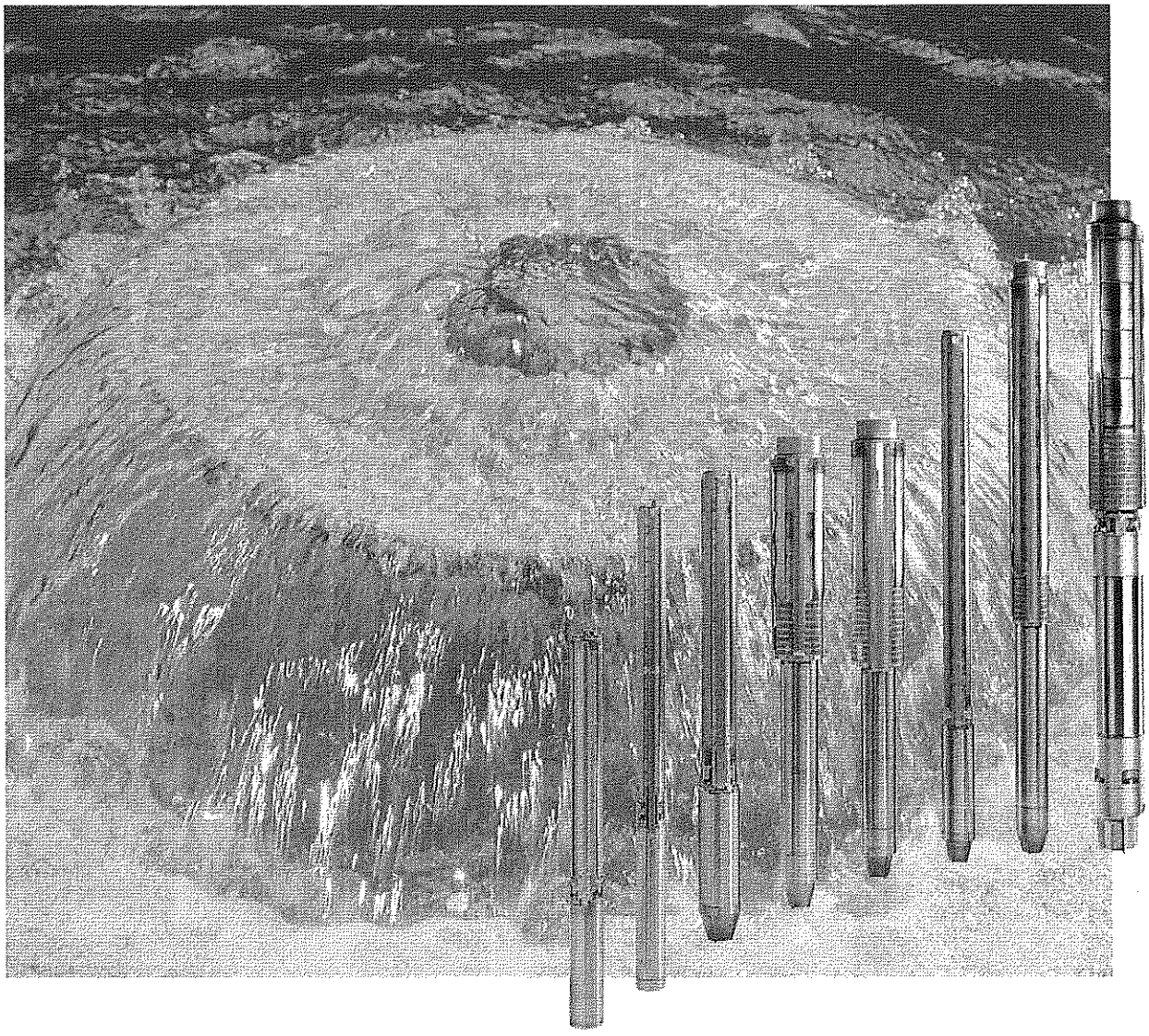
QUALITY IN THE WELL

Doc.: 308 018 418
January 2014

GRUNDFOS **PRODUCT GUIDE**

SP

Submersible pumps, motors, and accessories
60 Hz



BE › THINK › INNOVATE ›

GRUNDFOS

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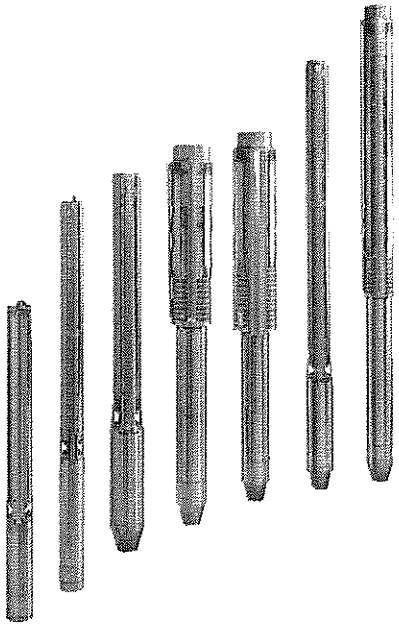
1. Product introduction

Introduction

The Grundfos SP range of submersible pumps is renowned for high efficiency and reliability. Made entirely of corrosion resistant stainless steel, SP pumps are ideal for a wide variety of applications.

Grundfos SP pumps represent state-of-the-art hydraulic design. Built to deliver optimum efficiency during periods of high demand, SP pumps provide low long-term costs and high operating reliability regardless of the application.

The SP range offers high efficiency, high resistance to sand and other abrasives, motor burnout protection, and easy maintenance. A complete monitoring and control system is available for constant optimization of the pumping system.



TM05 0051 0611

Fig. 1 Grundfos SP pumps

Applications

Grundfos Large SP submersible pumps are suitable for:

- Groundwater supply to waterworks
- Irrigation in horticulture and agriculture
- Groundwater lowering (dewatering)
- Pressure boosting
- Industrial applications
- Domestic water supply.

Pumped liquids

Grundfos SP pumps are suitable for pumping clean, thin, non-aggressive liquids without solid particles or fibers.

SP offers stainless steel construction which ensures good wear resistance and a reduced risk of corrosion where the water has minor chloride content.

Optional, upgraded stainless steel construction is available for pumping more aggressive liquids:

A complete range of zinc anodes for cathodic protection is available; see p. 97 for applications (for example, sea water applications).

For slightly polluted liquids (for example, containing oil), Grundfos offers a complete range of stainless steel SP NE pumps with all rubber parts made of FKM.

Features and benefits

Grundfos SP submersible pumps offer these features and benefits:

- State-of-the-art hydraulics provide high efficiency and low operating costs
- 100 % stainless steel components inside and outside for long service life
- Sand resistant
- Resistant to aggressive water
- Motor burnout protection via CU 301
- Dry-running protection
- Monitoring, protection and communication via protection unit MP204, and remote control, R100.

A wide pump range

Grundfos offers energy-efficient SP submersible pumps with a performance range of up to 1,400 gpm and 2,100 ft of head.

The pump range consists of many pump sizes, and each pump size is available with an optional number of stages to match any duty point.

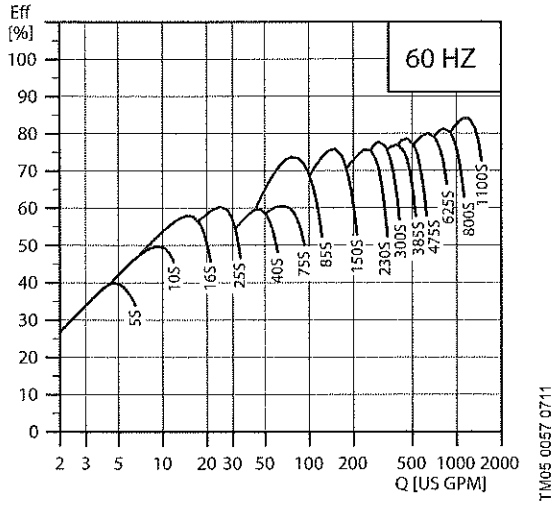
High pump efficiency

Often pump efficiency is given less consideration than the price of a pump; however, owners who choose efficiency will find substantial savings in energy costs over time. See fig. 2 for an illustration of SP efficiencies in relation to flow.

Example

For example, a pump and motor with a 10 % higher efficiency than a cheaper, less efficient pump, can save its owner more than $80,000.00 over 10 years*.

* If producing 880 gpm at 325 ft of head for 10 years @ 13.8 cents per kWh. U.S. kWh costs range from 6 cents to more than 20 cents, depending on region.



TM05 0057 0711

Fig. 2 SP pump/motor efficiencies in relation to flow

Pump design

Grundfos SP submersible pumps feature components that contribute to the superior performance and durability of the range.

Lower installation costs

Stainless steel means low weight for ease in the handling of pumps, resulting in lower equipment costs and reduced installation and service time.

Bearings with sand channels

All bearings are water-lubricated and have a squared shape enabling sand particles, if any, to leave the pump together with the pumped liquid.



TM00 7301 1096

Fig. 3 Bearing

Inlet strainer

The inlet strainer prevents particles over a certain size from entering the pump.



TM00 7302 1096

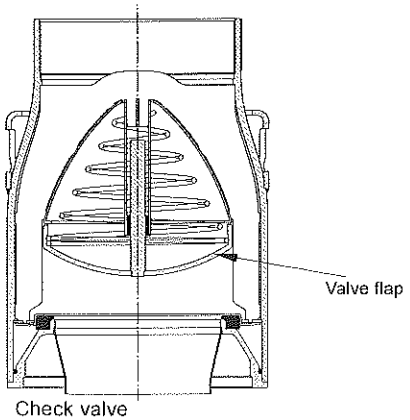
Fig. 4 Fig. Inlet strainer

Non-return valve

All pumps are equipped with a reliable check valve in the valve casing preventing back flow in connection with pump stoppage.

Furthermore, the short closing time of the check valve means that the risk of destructive water hammer is reduced to a minimum.

The valve casing is designed for optimum hydraulic properties to minimize the pressure loss across the valve and thus to contribute to the high efficiency of the pump.



TM01 2499 1798

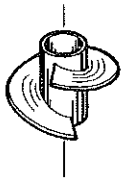
Fig. 5 Check valve

Priming screw

All Grundfos 4" pumps are fitted with a priming screw. Consequently, dry running is prevented, because the priming screw will make sure that pump bearings are always lubricated.

Due to the semi-axial impellers of large SP pumps this priming is provided automatically.

However, it applies to all pump types that if the water table is lowered to a level below the pump inlet neither pump nor motor will be protected against dry running.



TM00 7304 1096

Fig. 6 Priming screw

Stop ring

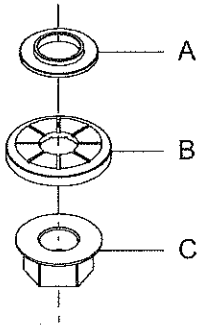
The stop ring prevents damage to the pump during transport and in case of up-thrust in connection with start-up.

The stop ring, which is designed as a thrust bearing, limits axial movements of the pump shaft.

Example: SP 385S

The stationary part of the stop ring (A) is secured in the upper intermediate chamber.

The rotating part (B) is fitted above the split cone (C).



TM01 3327 0412

Fig. 7 Stop ring (rotating and stationary part) and the split cone

Grundfos submersible motors

A complete motor range

Grundfos offers a complete submersible motor range in different voltages. For an overview of motor types, sizes and voltages, see page 85.

MS 402 is designed for the domestic ground water market and covers outputs. The MS 4000 and MS6 series are designed for use in a variety of applications in water supply. When equipped with features like oversized motor, temperature measurement, cooling jacket, and SiC/SiC mechanical shaft seals, these motors are suitable for heavy-duty industrial applications such as dewatering operations.

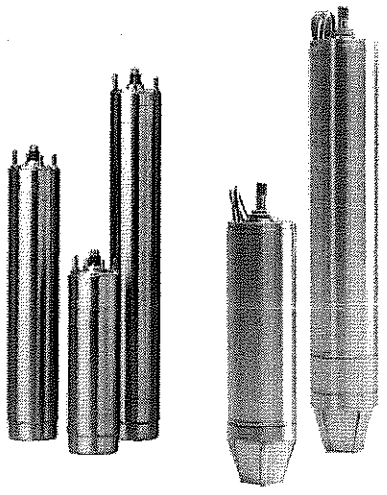
As a standard, all external surfaces of the Grundfos MS motors in contact with water are made of AISI 304 stainless steel. For aggressive water, such as seawater or brackish water, R-versions made of AISI 904 are available.

Grundfos rewindable MMS motor range

Grundfos MMS motors are suitable for any submersible installation, including heavy-duty industrial applications and dewatering operations (when equipped with temperature control, oversized motor, cooling jacket, and SiC/ SiC mechanical shaft seals).

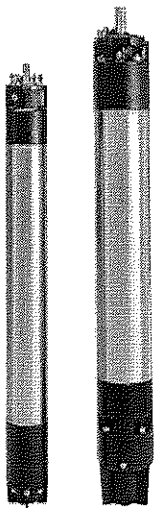
As a standard the MMS motors are supplied with black cast-iron end-bells. Optionally, the range is available in all-stainless steel AISI 316 or AISI 904 versions.

The 2-pole Grundfos MMS submersible motors are all easy to rewind. The windings of the stator are made of a special water-proof wire of pure electrolytic copper sheathed with special non-hydroscopic thermoplastic material. The fine dielectric properties of this material allow direct contact between the windings and the liquid for efficient cooling of the windings.



TM00 7305 1096 - GrA4011 - GrA4013

Fig. 8 Grundfos MS motors



TM01 7873 4799

Fig. 9 Grundfos MMS motors

Industrial submersible motors and MS6 T60-versions

For heavy-duty applications Grundfos offers a complete motor range of industrial motors with up to 5 % higher efficiency than that of Grundfos' standard motors. The industrial motors are available in sizes as from 3 Hp up to 30 Hp.

The cooling of the motor is very efficient due to the large motor surface. The efficient cooling makes it possible to increase the liquid temperature to 140 °F (60 °C) at a minimum flow of 0.49 ft/s (0.15 m/s) past the motor.

The industrial motors are for customers who value low operating costs and long life higher than price.

Grundfos industrial motors are developed for difficult operating conditions. These motors will stand a higher thermal load than standard motors and thus have a longer life when subjected to high load. This applies whether the high load is caused by bad power supply, hot water, bad cooling conditions, high pump load etc.

Please note that heavy duty motors are longer than motors for standard conditions.

Overtemperature protection

Accessories for protection against overtemperature are available for both Grundfos MS and MMS submersible motors. When the temperature becomes too high, the protection device will cut out and damage to the pump and motor be avoided.

Restart of the motor after cut-out can be achieved in two ways:

- manual restart
- automatic restart.

Automatic restart means that the MP 204 attempts to restart the motor after 15 minutes. If the first attempt is not successful, restarting will be reattempted at 30-minute intervals.

MS

The Grundfos MS submersible motors (with the exception of MS 402) are available with a built-in Tempcon temperature transmitter for protection against overtemperature. By means of the transmitter, it is possible to read out and/or monitor the motor temperature via an MP 204 or a PR 5714 relay.

The Grundfos MS6 submersible motors can be fitted with a Pt100. The Pt100 is fitted in the motor and connected directly to the MP 204 or monitored by the PR 5714 relay.

MMS

For the protection of the Grundfos MMS submersible motors against overtemperature Grundfos offers the Pt100 temperature sensor as an optional extra.

The Pt100 is fitted in the motor and connected directly to the MP 204 or monitored by the PR 5714 relay.

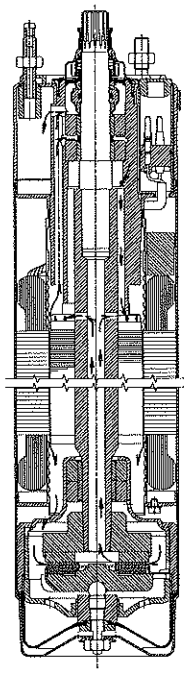
Protection against upthrust

In case of a very low counter pressure in connection with start-up there is a risk that the entire chamber stack may rise. This is called upthrust. Upthrust may damage both pump and motor. Both Grundfos pumps and motors are protected against upthrust as standard, preventing upthrust from occurring during the critical start-up phase. The protection consists of either a built-in stop ring or hydraulic balancing.

Built-in cooling chambers

In all Grundfos MS submersible motors, efficient cooling is ensured by cooling chambers at the top and at the bottom of the motor, and by an internal circulation of motor liquid.

See fig. 10. As long as the required flow velocity past the motor is maintained, cooling of the motor will be efficient.



TM00 5698 0996

Fig. 10 MS 4000

Lightning protection

The smallest Grundfos submersible motors, such as the MS 402, are all insulated in order to minimize the risk of motor burnout caused by lightning strike.

Reduced risk of short-circuit

The embedded stator winding in the Grundfos MS submersible motor is hermetically enclosed in stainless steel. The result is high mechanical stability and optimum cooling. Also, this eliminates the risk of short-circuit of the windings caused by water condensation.

Shaft seal

MS 402

The shaft seal is of the lip seal type characterized by low friction against the rotor shaft.

The rubber material offers good wear resistance, good elasticity and resistance to particles, and it is approved for use in drinking water.

MS 4000, MS6

The material is ceramic/tungsten carbide providing optimum sealing, optimum wear resistance and long life.

The spring loaded shaft seal is designed with a large surface and a sand shield. The result is a minimum exchange of pumped and motor liquids and no penetration of particles.

Motors, version R, are supplied with a SiC/SiC shaft seal. Other combinations are available request. See fig. 11 and fig. 12 for an illustration of shaft seal components and configuration.

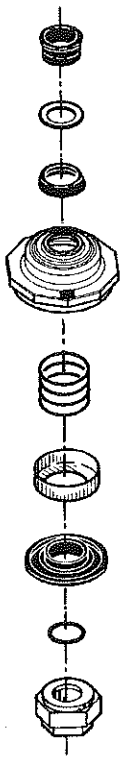
MMS rewindable motors

The standard shaft seal is a ceramic/carbon mechanical shaft seal. The shaft seal is replaceable.

The material features good wear resistance and resistance to particles.

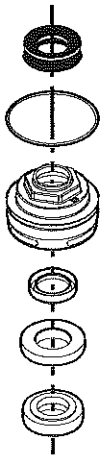
Together with the shaft seal housing, the sand shield forms a labyrinth seal, which during normal operating conditions prevents penetration of sand particles into the shaft seal.

On request, motors can be supplied with a SiC/SiC seal.



TM00 7306 0412

Fig. 11 Shaft seal, MS 4000



TM03 9225 3607

Fig. 12 Shaft seal, MS6

Identification

Type key, SP pumps

Example	475	S	500	-	5	-	A	B

- 475: Rated flow rate in gpm
- S: Type range
  Stainless steel parts of material
  S= AISI 304
  N= AISI 316
  R= AISI 904L
- 500: Hp of motor
- 5: Number of impellers
- A: First reduced-diameter impeller (A, B or C)
- B: Second reduced-diameter impeller (A, B or C)

Type key, MS 4000 motors

Example	MS	4	000	R

- MS: Motor submersible
- 4: Min. borehole diameter in inches
- 000: Generation
- R: Material
  - = Stainless steel AISI 304
  R = Stainless steel AISI 904L
  I = Stainless steel AISI 304 + De-rated
  RE = Stainless steel AISI 904 L + FKM
  EI = Stainless steel AISI 304 + De-rated + FKM

Type key, MS 402 motors

Example	MS	4	02

- MS: Motor submersible
- 4: Min. borehole diameter in inches
- 02: Generation
- -: Material
  - = Stainless steel AISI 304

Type key, MMS motors

Example	MMS	6	000	N

- MMS: Type range
- 6: Min. borehole diameter in inches
- 000: Generation
- N: Material:
  = Cast iron EN-JL1040
  N = DIN/EN 1.4401 (AISI 316)

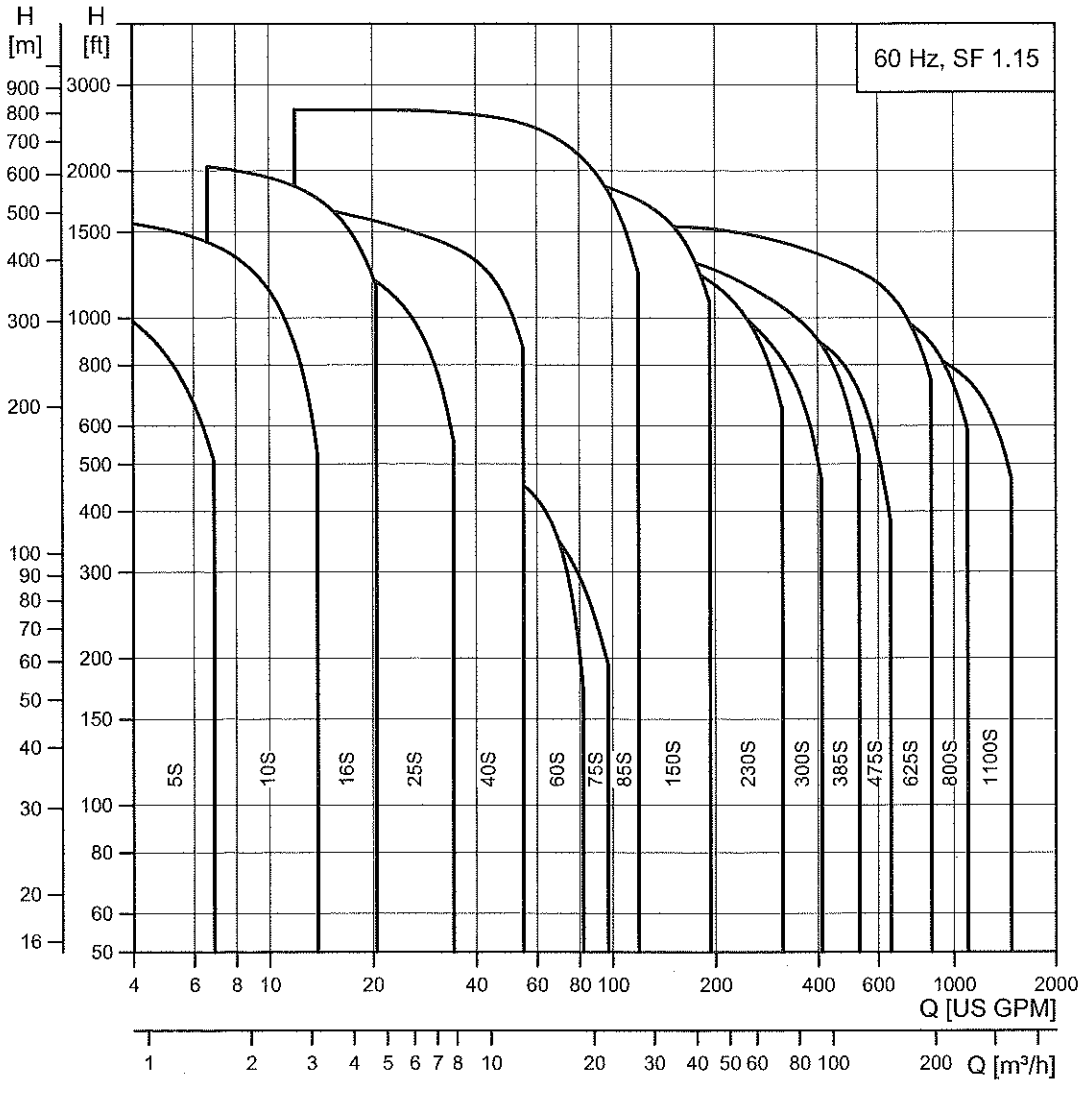
Type key, MS6 motors

Example	MS	6	R	E	S	W	D	T60

- MS: Type range
  (Motor Submersible)
- 6: **Motor diameter in inches**
- R: **Material**
  - Blank = stainless steel EN 1.4301 (AISI 304)
  - R = stainless steel EN 1.4539 (AISI 904L)
- E: **Rubber parts**
  - Blank = NBR
  - E = FKM
- S: **Shaft seal**
  - Blank = ceramics/carbon
  - S = SiC/SiC
- W: **Radial bearings**
  - Blank = carbon/stainless steel
  - W = SiC/tungsten carbide
- D: **Motor liquid**
  - Blank = SML-3
  - D = demineralized water
- T60: **Maximum liquid temperature**
  - T30 = 86 °F (30 °C)
  - T60 = 140 °F (60 °C)

2. Product overview

Performance range 60 Hz



TM05 0056 0112

Pump range

Type		5S	10S	16S	25S	40S	60S	75S	85S	150S	230S	300S	385S	475S	625S	800S	1100S
AISI 304 stainless steel		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
AISI 316 stainless steel				●	●	●		●	●	●	●	●	●	●	●	●	●
AISI 904L stainless steel					●	●			●	●	●	●	●	●	●	●	●
Connection ★	NPT	1"	1.25"	1.25"	1.5"	2"	2"	2"	(3")	(3")	3" (4")	3" 4"	5"	5"	6"	6"	6"
Flange connection: Grundfos flange													5"	5"	6"	6"	6"

★ Figures in brackets ( ) indicate connection for pumps with sleeve.

Motor range

Motor output [hp]	0.5	0.75	1.0	1.5	1.5	3.0	5.0	7.5	10.0	15	20	25	30	40	50	60	75	100	125	150	175	200	250
Single-phase	●	●	●	●	●	●																	
Three-phase	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Industrial motor and MS6 T60-versions						●	●	●	●	●	●	●	●										
Rewindable motor							●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Steel: AISI 304	●	●	●	●	●	●	●	●	●	●	●	●	●	●									
Steel: AISI 304 and cast iron							●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Steel: AISI 316							●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Steel: AISI 904L			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●				
Built-in temperature transmitter in motor			●	●	●	●	●	●	●	●	●	●	●	●									

Direct-on-line starting is recommended up to 100 hp.
Soft starter or autotransformer is recommended above 100 hp.
Motors with star/delta are available from 7.5 hp.

Motor protection and controllers

Motor output [hp]	0.5	0.75	1.0	1.5	1.5	3.0	5.0	7.5	10.0	15	20	25	30	40	50	60	75	100	125	150	175	200	250
MP 204	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Pt100							●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Zinc anode				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Vertical flow sleeve	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Horizontal flow sleeve	●	●	●	●	●	●		●	●	●	●	●	●	●									
SA-SPM	●	●	●	●	●	●	●																
R100	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
RS-485 communication module	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
G100	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Motor protection of single-phase motors, see page 85.

3. Construction

Sectional drawing, SP pump, 4"

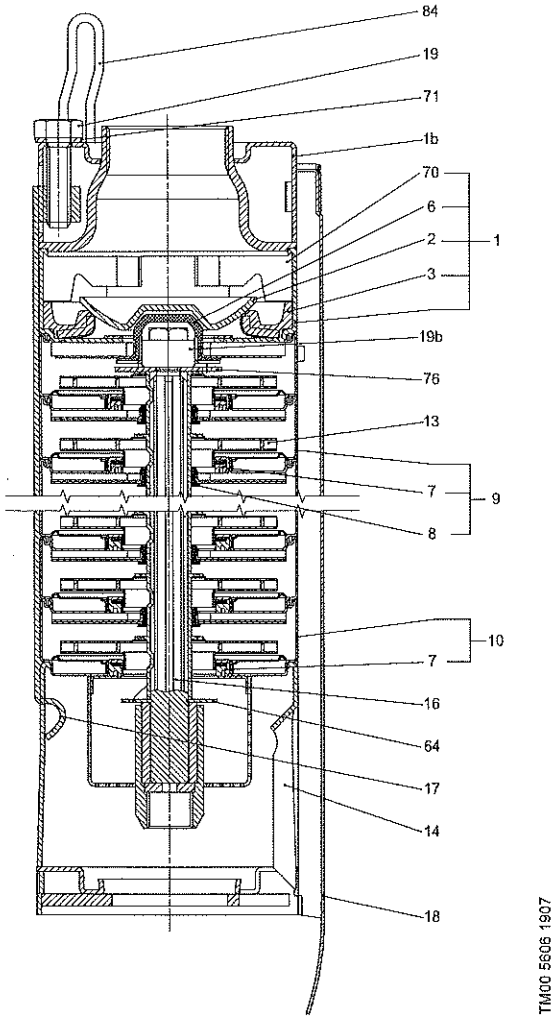


Fig. 13 SP pump, 4"

Material specification, SP pump, 4"

Pos.	Component	Materials	Standard
			AISI
1	Valve casing	Stainless steel	304
1b	Discharge piece	Stainless steel	304
2	Valve cup	Stainless steel	304
3	Valve seat	Stainless steel/NBR	304
6	Top bearing	NBR	
7	Neck ring	NBR/PBT	
8	Intermediate ring	NBR	
9	Intermediate chamber	Stainless steel	304
10	Bottom intermediate chamber	Stainless steel	304
13	Impeller	Stainless steel	304
14	Suction interconnector	Stainless steel	304
16	Shaft	Stainless steel	304
17	Strap	Stainless steel	304
18	Cable guard	Stainless steel	304
19	Hexagon screw	Stainless steel	304
19a	Nut	Stainless steel	316
19b	Nut	Stainless steel	304
20	Motor cable		
64	Priming disc	Stainless steel	304
70	Valve guide	Stainless steel	304
71	Washer for pos. 19	Stainless steel	316
76	Washer	Stainless steel	304
78	Nameplate	Stainless steel	316
84	Hook	Stainless steel	304

Sectional drawing, SP pump, 6"

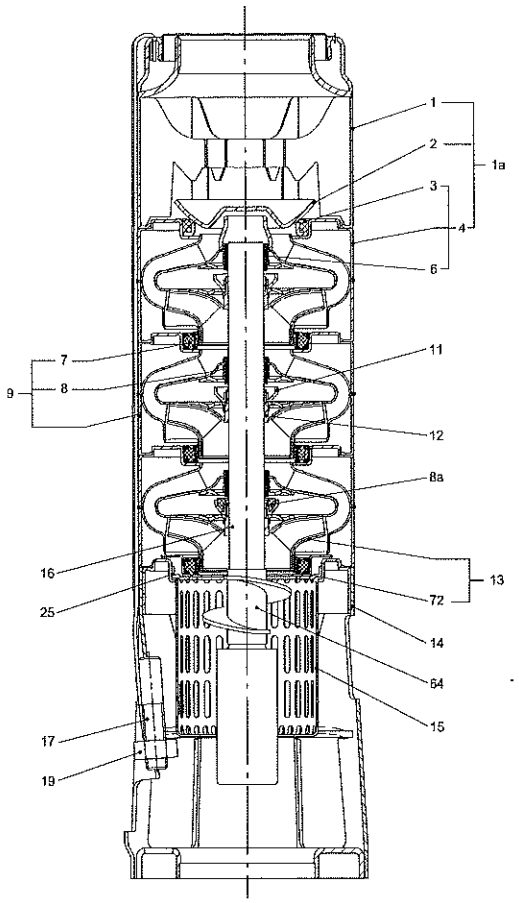


Fig. 14 SP pump, 6"

Material specification, SP pump, 6"

Pos.	Component	Materials	Standard	N-version	R-version
				AISI	
		Valve casing			
1	Valve casing	Stainless steel	304	316	904 L
2	Valve cup	Stainless steel	304	316	904 L
3	Valve seat	Stainless steel	304	316	904 L
4	Top chamber	Stainless steel	304	316	904 L
		Chamber stack			
7	Neck ring	NBR/PPS			
8	Bearing	NBR			
8a	Spacing washer	Carbon/ graphite HY22 in PTFE mass			
9	Chamber	Stainless steel	304	316	904 L
11	Nut for split cone	Stainless steel	304	316	904 L
12	Split cone	Stainless steel	304	316	904 L
13	Impeller	Stainless steel	304	316	904 L
16	Shaft with coupling	Stainless steel	431	329	Si 31 803
18	Cable guard	Stainless steel	304	316	904 L
23	Rubber guard	NBR			
25	Neck ring retainer	Stainless steel	304	316	904 L
64	Priming screw	Stainless steel	304	316	904 L
72	Wear ring	Stainless steel	304	316	904 L
		Suction interconnector			
14	Suction interconnector	Stainless steel	304	316	904 L
	Intermediate piece for 6" motor over 40 Hp	Stainless steel	316	316	316
15	Strainer	Stainless steel	304	316	904 L
17	Strap	Stainless steel	304	316	904 L
19	Nut for strap	Stainless steel	304	316	904 L
19a	Nut	Stainless steel	316	316	316
20	Motor cable				
78	Nameplate	Stainless steel	316	316	316
		Pumps in sleeve			
	Clamping flange (counter)	Stainless steel	304	316	904 L
	Clamping flange	Stainless steel	304	316	904 L
	Connecting piece	Stainless steel	304	316	904 L
	Sleeve	Stainless steel	304	316	904 L
	Stay bolt	Stainless steel	304	316	904 L
	Hexagon socket head screw	Stainless steel	304	316	904 L

Sectional drawing, SP pump, 8"

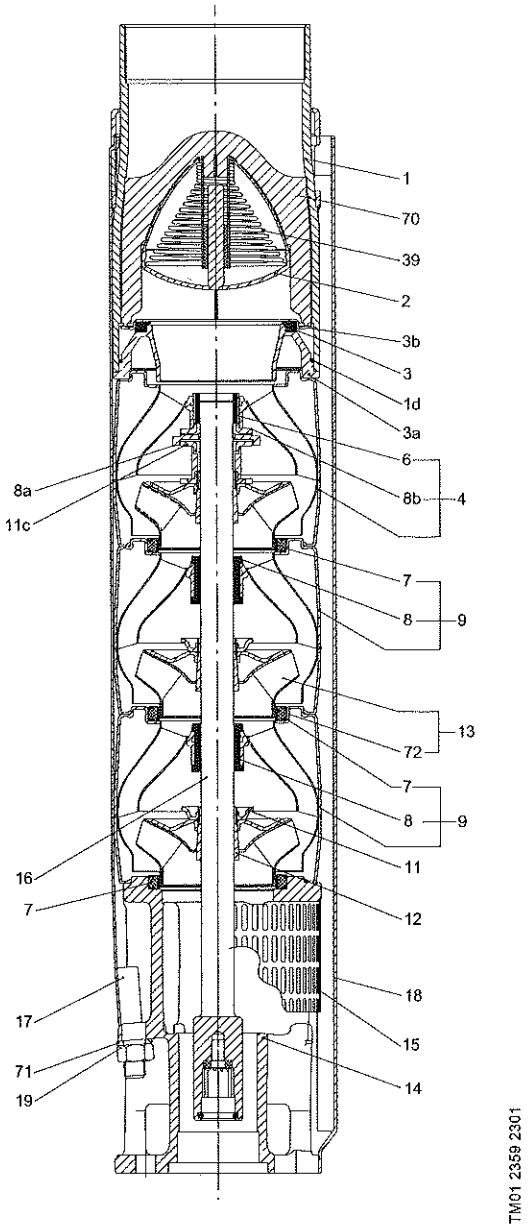
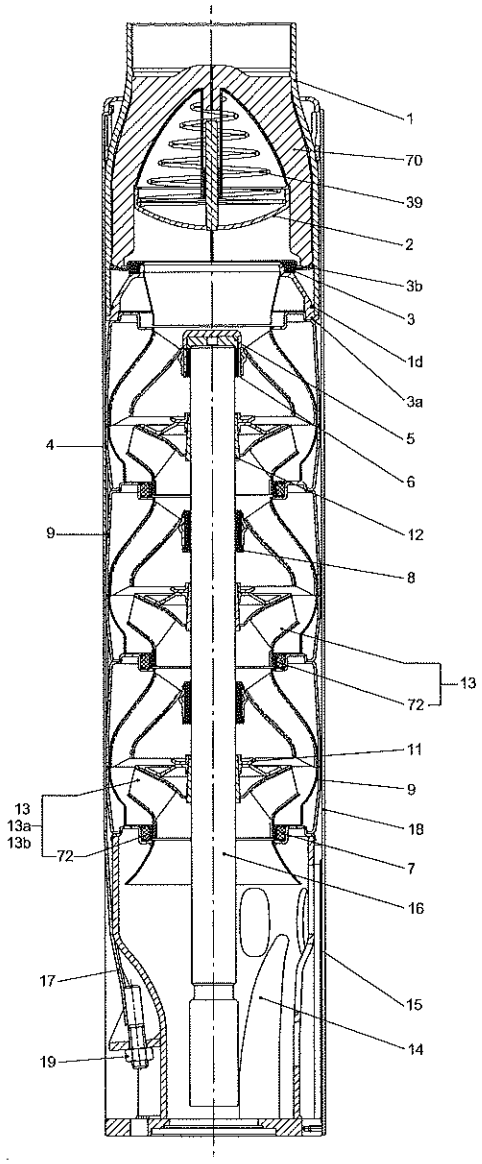


Fig. 15 SP pump, 8"

Material specification, SP pump, 8"

Pos.	Component	Materials	Standard	N-version	R-version
				AISI	
1	Valve casing	Stainless steel	304	316	904L
1d	O-ring	NBR			
2	Valve cup	Stainless steel	304	316	904L
3	Valve seat	Standard/ N- version: NBR R-version: FKM			
3a	Lower valve seat retainer	Stainless steel	316	316	(DIN 1.4517)
3b	Upper valve seat retainer	Stainless steel	304	316	904L
4	Top chamber	Stainless steel	304	316	904L
6	Upper bearing	Stainless steel/NBR	304	316	904L
7	Neck ring	NBR/PPS			
8	Bearing	NBR			
8a	Washer for stop ring	Carbon/ graphite HY22 in PTFE mass			
8b	Stop ring	Stainless steel	316	316	904L
9	Chamber	Stainless steel	304	316	904L
11	Split cone nut	Stainless steel	304	316	904L
11c	Nut for stop ring	Stainless steel	316	316	904L
12	Split cone	Stainless steel	304	316	904L
13	Impeller	Stainless steel	304	316	904L
14	Suction inter-connector	Stainless steel	CF8M	A744 CD4-MCu	(DIN 1.4517)
15	Strainer	Stainless steel	304	316	904L
16	Shaft complete	Stainless steel	431	329	329
17	Strap	Stainless steel	304	316	904L
18	Cable guard	Stainless steel	304	316	904L
19	Nut for strap	Stainless steel	304	316	904L
39	Spring for valve cup	Stainless steel	304	316	SAF 2205
70	Valve guide	Stainless steel	304	316	904L
71	Washer	Stainless steel	316	316	904L
72	Wear ring	Stainless steel	304	316	904L

Sectional drawing, SP pump, 10"



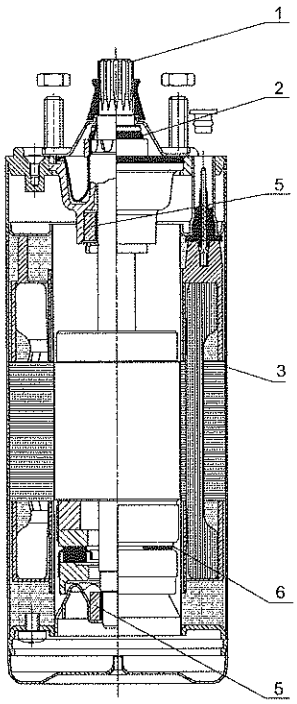
TM01 2363 2701

Fig. 16 SP pump, 10"

Material specification, SP pump, 10"

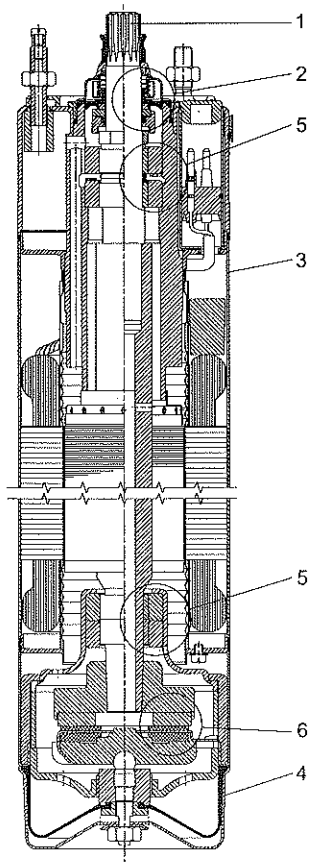
Pos.	Description	Material	Standard	N version
			AISI	
		Valve casing		
1	Valve casing	Stainless steel	304	316
1d	O-ring	NBR		
2	Valve cup	Stainless steel	304	316
3	Valve seat	Stainless steel	304	316
3a	Lower valve seat retainer	Stainless steel	304	316
3b	Upper valve seat retainer	Stainless steel	304	316
39	Spring for valve cup	Stainless steel	301	316
70	Valve guide	Stainless steel	304	316
78	Nameplate	Stainless steel	304	316
79	Rivet	Stainless steel	304	316
63	Connecting piece	Stainless steel	304	316
		Chamber stack		
4	Top chamber	Stainless steel	304	316
5	Upthrust disc	Carbon/ graphite HY22 in PTFE mass		
6	Top bearing	Stainless steel/ NBR	304	316
7	Neck ring	NBR/PPS		
8	Bearing	NBR		
9	Chamber	Stainless steel	304	316
11	Nut for split cone	Stainless steel	304	316
12	Split cone	Stainless steel	304	316
13	Impeller	Stainless steel	304	316
16	Shaft with coupling	Stainless steel	431	329
18	Cable guard	Stainless steel	304	316
18a, 18b	Screw for cable guard	Stainless steel	304	316
23	Rubber guard	NBR		
72	Wear ring	Stainless steel	304	316
		Suction interconnector		
14	Suction interconnector	Stainless steel	304	316
15	Strainer	Stainless steel	304	316
17	Strap	Stainless steel	304	316
19	Nut for strap	Stainless steel	304	316
19a	Nut	Stainless steel	316	316
20	Motor cable			
22	Bolts	Stainless steel	316	316
28, 28a	Lock for strainer	Stainless steel	329	329

Sectional drawing - MS motors



TM00 4736 0412

Fig. 17 MS 402 motor



TM00 7865 2196

Fig. 18 MS 4000 motor

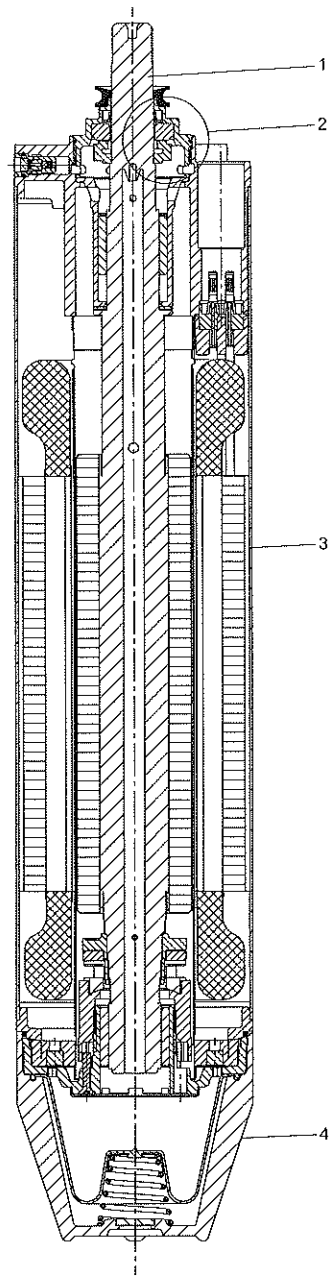
Material specification, MS 402 and MS 4000 motors

Pos.	Part	MS 402	MS 4000
		AISI	
1	Shaft	431	431
2	Shaft seal	NBR	Tungsten carbide/ ceramic
3	Motor sleeve	304	304
4	Motor end shield		304
5	Radial bearing	Ceramic	Ceramic/ tungsten carbide
6	Axial bearing	Ceramic/carbon	Ceramic/carbon
	Rubber parts	NBR	NBR

R-version motor

Pos.	Part	MS 4000
1	Shaft	316 LN
2	Shaft seal	NBR/ceramic
3	Motor sleeve	904L
4	Motor end shield	904L
5	Radial bearing	Ceramic/tungsten carbide
6	Thrust bearing	Ceramic/carbon
	Rubber parts	NBR

Sectional drawing - MS6 motors



TM03 9226 3607

Fig. 19 MS6 motor

Material specification - MS6 motors

Pos.	Part	MS6
202	Shaft with rotor	318LN
2	Shaft seal	Ceramic/carbon
3	Motor sleeve	304
4	Motor end cover	304
	Rubber parts	NBR/FKM

R-version motor

Pos.	Part	MS6
1	Shaft	318LN
2	Shaft seal	SiC/SiC
3	Motor sleeve	904L
4	Motor end cover	(DIN 1.4517)
	Rubber parts	FKM

Sectional drawing - MMS motors

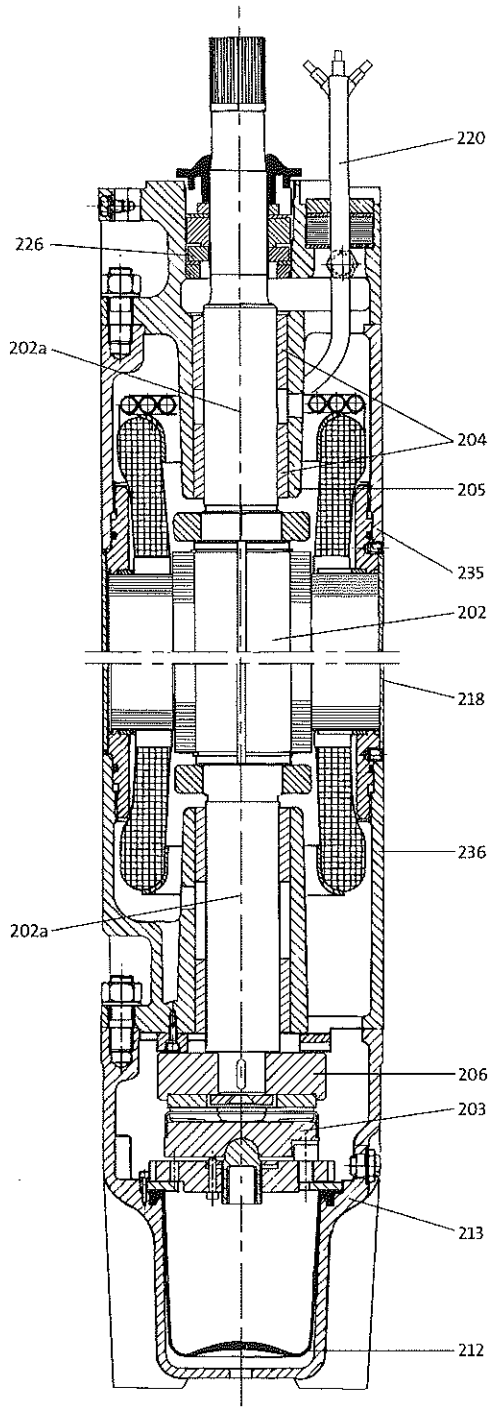


Fig. 20 MMS 10000

Material specification

MMS motors, submersible rewindable versions

Pos.	Component		Material	AISI
202	Shaft		Steel	(EN 1.0533)
202a	Shaft ends		Stainless steel	316/329
203/206	Thrust bearing Stationary/ rotating part	6", 0.5 - 20 Hp	Hardened steel/ EPDM	
		6", 25 - 50 Hp	Ceramic/ carbon	
		8" - 10"		
204	Bearing bush	6" - 10"	Carbon	
205	Bearing housing, upper		Cast iron	A126 Class B
212	Diaphragm		CR	
213	Motor end shield		Cast iron	A126 Class B
218	Motor sleeve		Stainless steel	304
220	Motor cable		EPDM	
226	Shaft seal		Ceramic/ carbon	
235	Intermediate housing		Cast iron	A126 Class B
236	Bearing housing, lower		Cast iron	A126 Class B

MMS motors, N- and R-versions

Pos.	Component		Material	Version	
				N	R*
				AISI	
202	Shaft		Steel	(EN 1.0533)	(EN 1.0533)
202a	Shaft ends		Stainless steel	316/329	318LN
203/206	Thrust bearing Stationary/ rotating part	6", 0.5 - 20 Hp	Hardened steel/EPDM		
		6", 25 - 50 Hp	Ceramic/ carbon		
		8"-10"			
204	Bearing bush	6"-10"	Carbon		
205	Bearing housing, upper		Stainless steel	316	904L
212	Diaphragm		CR		
213	Motor end shield		Stainless steel	316	904L
218	Motor sleeve		Stainless steel	316	904L
220	Motor cable		EPDM		
226	Shaft seal		Ceramic/ carbon		
235	Intermediate housing		Stainless steel	316	904L
236	Bearing housing, lower		Stainless steel	316	904L

* Only MMS 6000 and MMS 8000 are available in R-versions

4. Operating conditions

Operating conditions

Flow rate, Q: 0.44 - 1475 gpm (0.1-335 m^3/h).

Head, H: Maximum 2657 ft (810 m).

Maximum liquid temperature

Motor	Installation		
	Flow velocity past motor	Vertical [°F (°C)]	Horizontal [°F (°C)]
Grundfos MS 4"and MS6 T30-versions	0.49 ft/s (0.15 m/s)	86 (30)	86 (30)
Grundfos 4" MS industry versions	0.49 ft/s (0.15 m/s)	140 (60)	140 (60)
Grundfos MS6 T60-versions	3.28 ft/s (1.0 m/s)	140 (60)	140 (60)
Grundfos MMS 6" to 12" rewindable with PVC in the windings	0.49 ft/s (0.15 m/s)	77 (25)	77 (25)
	1.64 ft/s (0.50 m/s)	86 (30)	86 (30)
Grundfos MMS 6" to 12" rewindable with PE/PA in the windings	0.49 ft/s (0.15 m/s)	104 (40)	104 (40)
	1.64 ft/s (0.50 m/s)	113 (45)	113 (45)

Note: Note: For MMS 6000, 0.5 hp; MMS 8000, 150 hp; the maximum liquid temperature is 9 °F (5 °C) lower than the values stated in the table. For MMS 10000, 250 hp, the temperature is 18 °F (10 °C) lower.

Operating pressure

Motor	Maximum operating pressure
Grundfos MS 4" and 6"	870 psi (6 Mpa) (60 bar)
Grundfos MMS 6" to 10" rewindable	

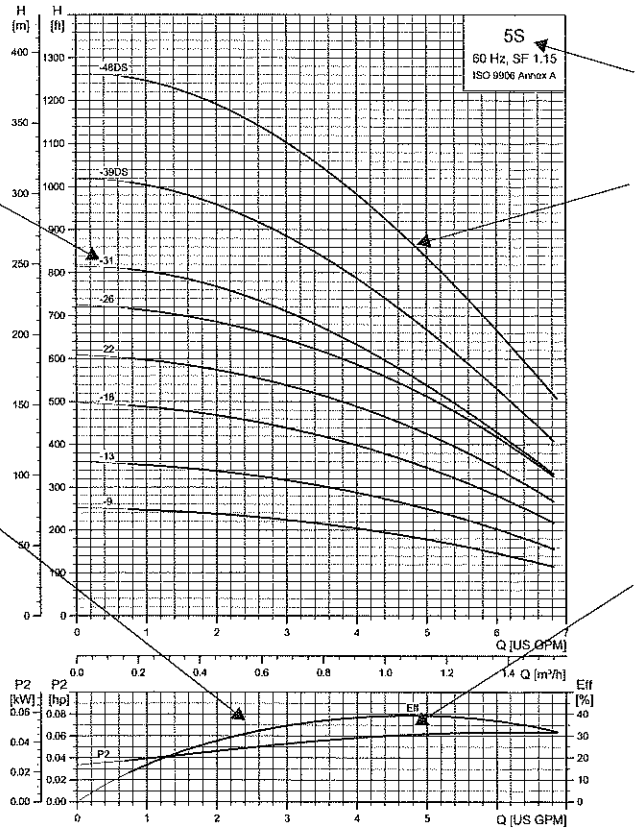
Curve conditions

The conditions below apply to the curves shown on pages 20 - 84:

General

- Curve tolerances according to ISO 9906, Annex A.
- The performance curves show pump performance at actual speed, cf. standard motor range.
  The speeds of the motors are approximately these:
  4" motors: n = 3470 min^{-1}
  6" motors: n = 3460 min^{-1}
  8" to 10" motors: n = 3525 min^{-1}
- The measurements were made with airless water at a temperature of 68 °F (20 °C). The curves apply to a kinematic viscosity of 1 mm^2/s (1 cSt). When pumping liquids with a density higher than that of water, use motors with correspondingly higher outputs.
- The **bold** curves indicate the recommended performance range.
- The performance curves are inclusive of possible losses such as non-return valve loss.
- **Q/H:** The curves are inclusive of valve and inlet losses at the actual speed.
  Operation without non-return valve will increase the actual head at rated performance by 0.5 to 1.0 m.
- **NPSH:** The curve is inclusive of pressure loss in the suction interconnector and shows required inlet pressure.
- **Power curve:** P_2 shows pump power input at the actual speed of each individual pump size.
- **Efficiency curve:** Eta shows pump stage efficiency. If Eta for the actual pump size is needed, please consult WinCAPS or WebCAPS.

5. How to read the curve charts



Pump type, number of poles and frequency.

Number of stages.
First figure: number of stages; second figure: number of reduced-diameter impellers.

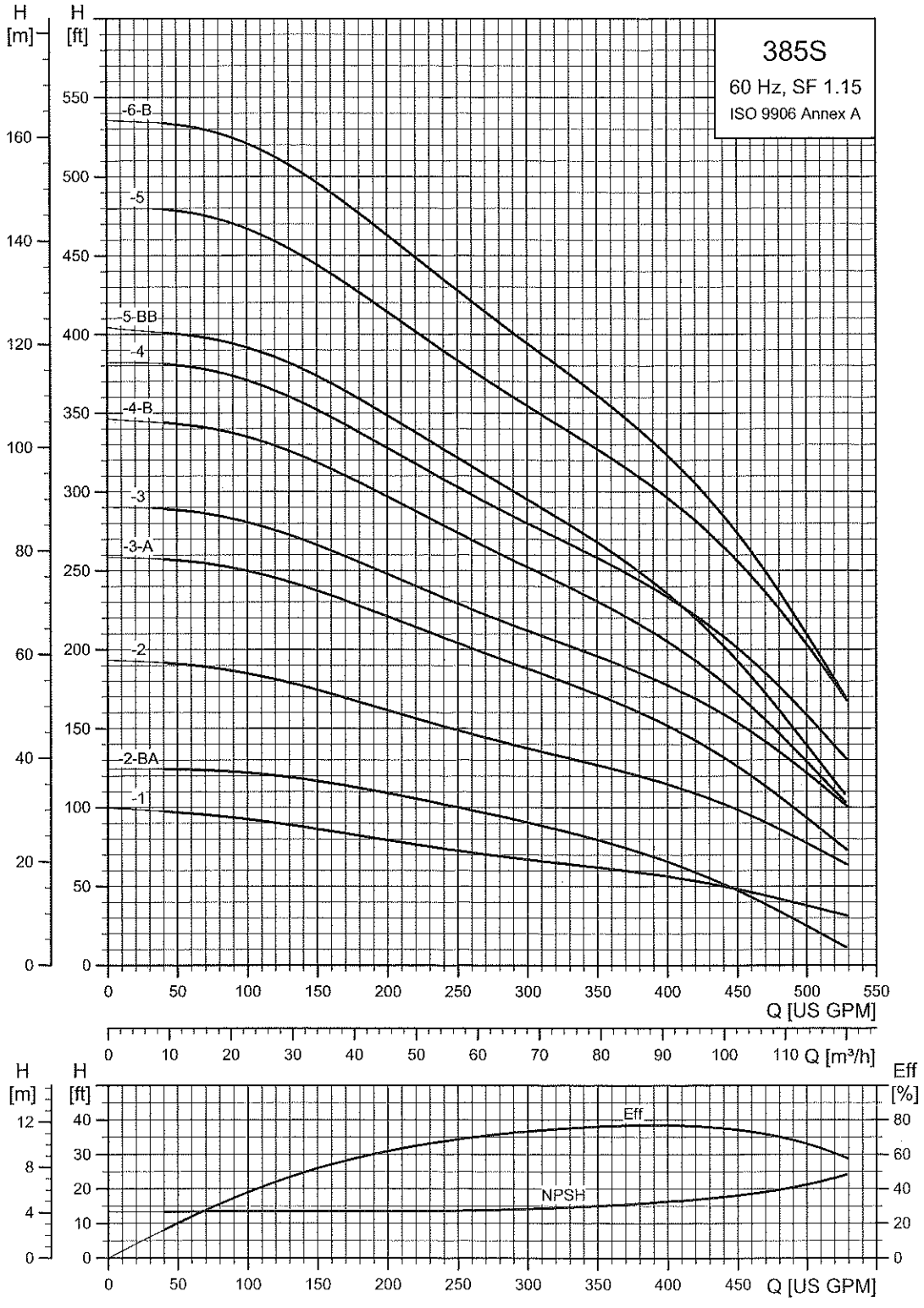
QH curve for the individual pump. The **bold** curves indicate the **recommended** performance range for best efficiency.

The efficiency curve shows the efficiency of the pump. The efficiency curve is an average curve of all the pump types shown in the chart. The efficiency of pumps with reduced-diameter impellers is approx. 2 % lower than the efficiency curve shown in the chart.

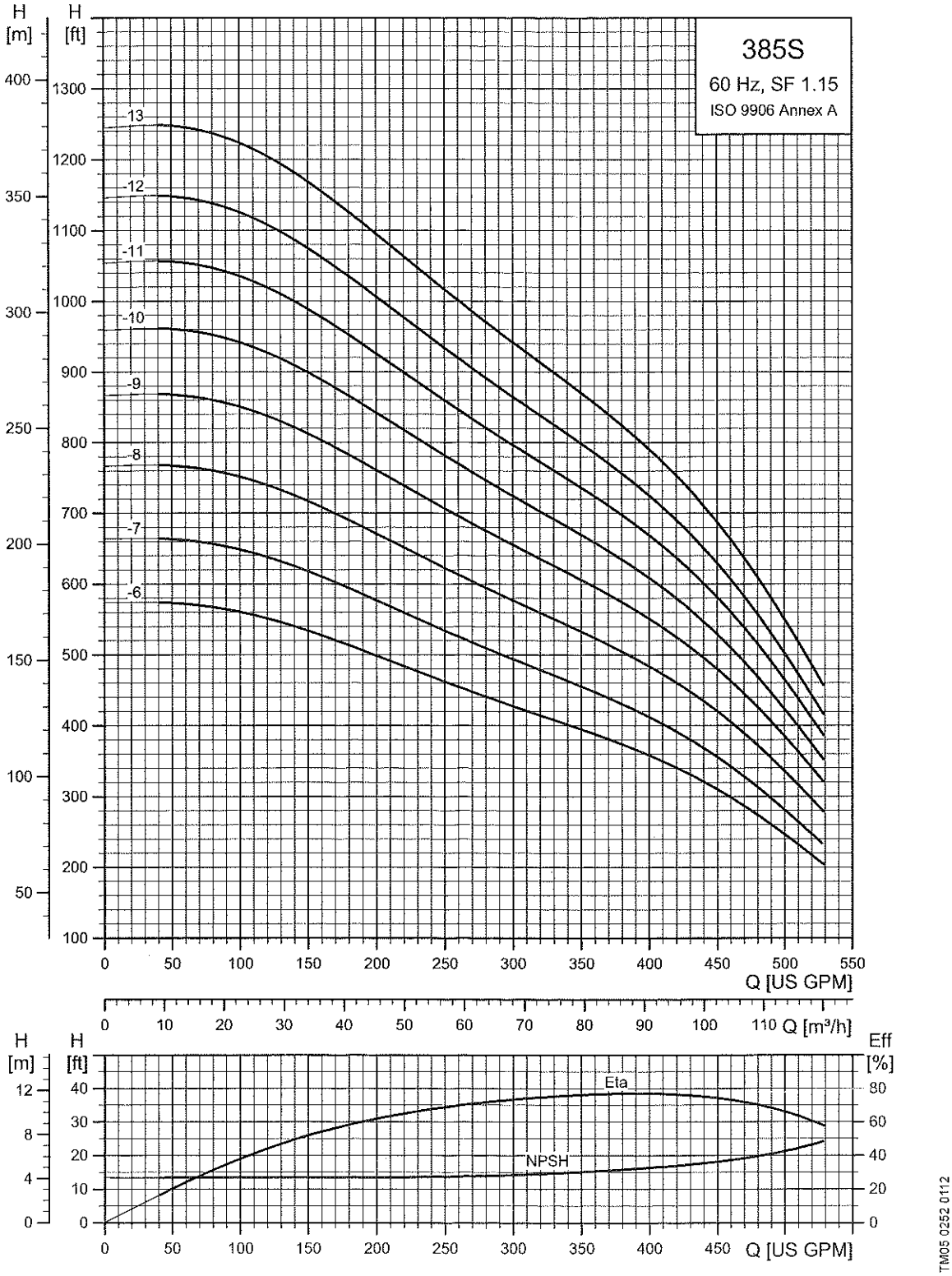
The power curves indicate pump input power **per stage**. Curves are shown for complete (1/1) and for reduced-diameter (2/3) impellers.

TM05 0229 10112

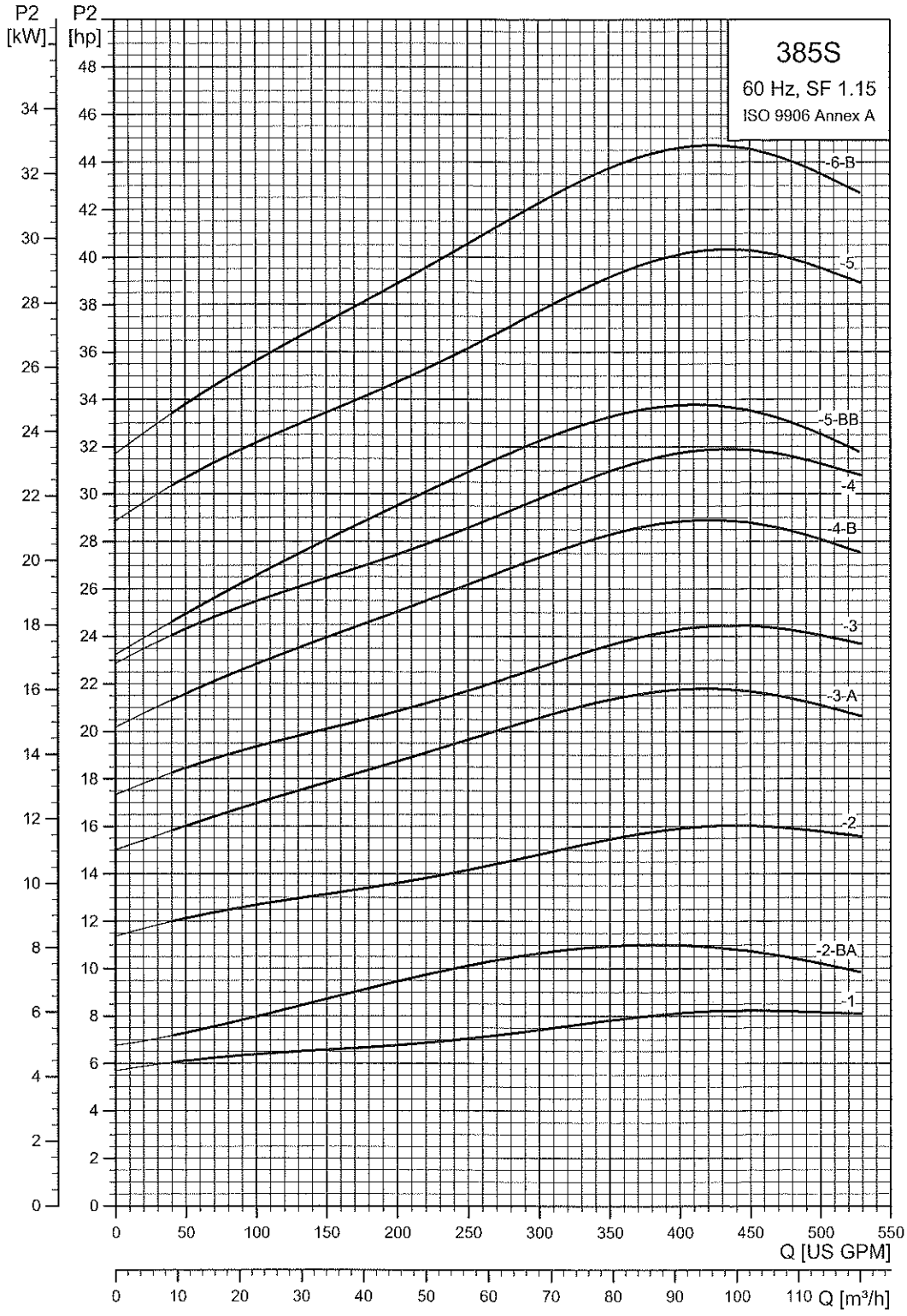
385S (385 gpm)


385S
60 Hz, SF 1.15
ISO 9906 Annex A
H [m]
H [ft]
-6-B
-5
-5-BB
-4
-4-B
-3
-3-A
-2
-2-BA
-1
Q [US GPM]
Q [m³/h]
Eff [%]
Eff
NPSH
TM05 0251 0112

385S (385 gpm)

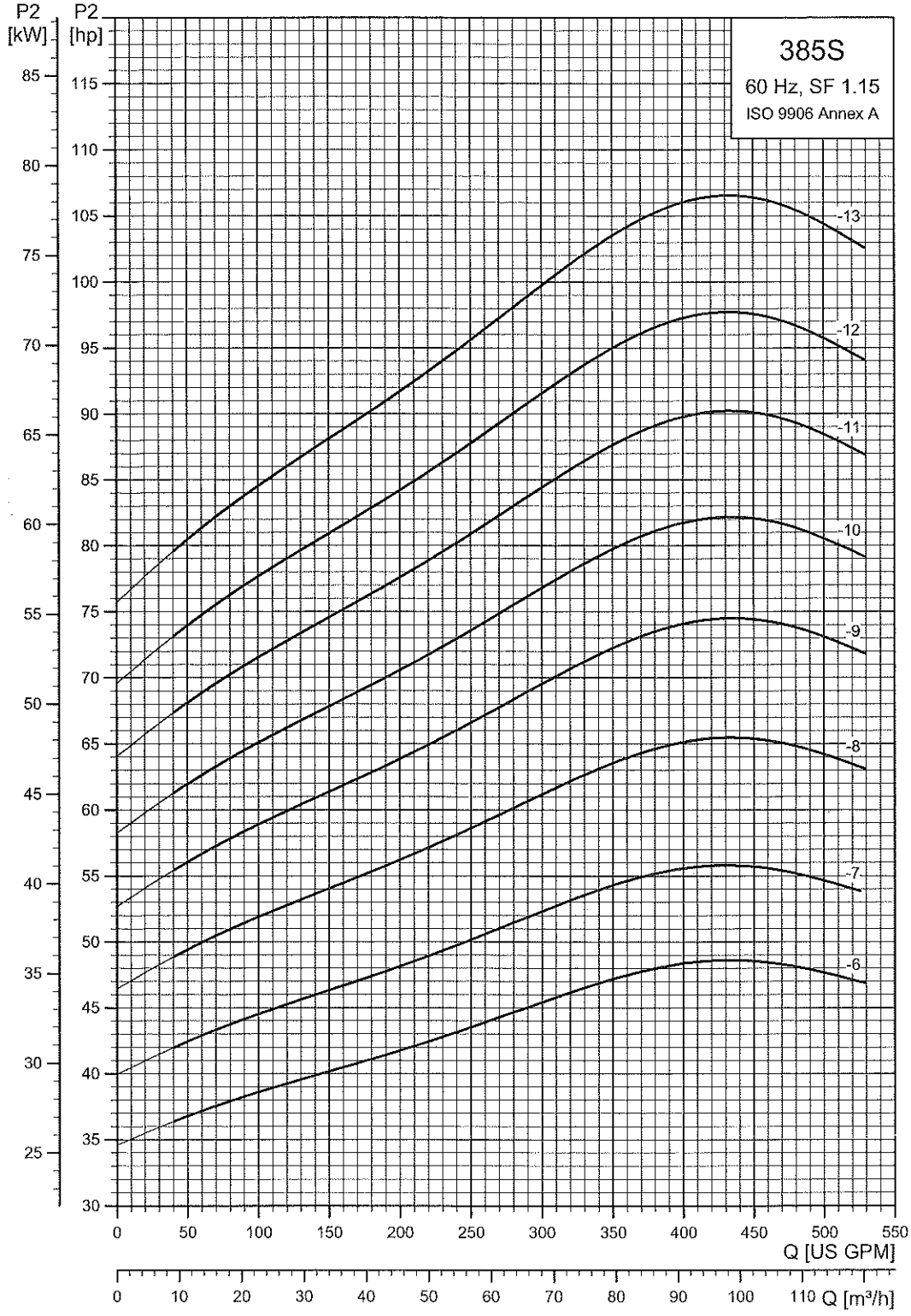

385S
60 Hz, SF 1.15
ISO 9906 Annex A
H [m]
H [ft]
-13
-12
-11
-10
-9
-8
-7
-6
Q [US GPM]
Q [m³/h]
H [m]
H [ft]
Eff [%]
Eta
NPSH
Q [US GPM]
TM05 0252 0112

385S (385 gpm) pump power requirement (P2)



TM05 0253 0112

385S (385 gpm) pump power requirement (P2)



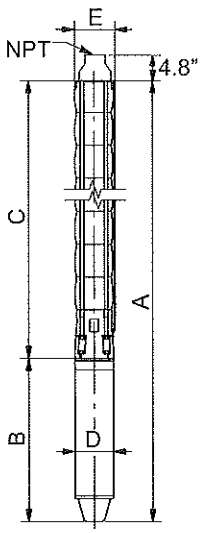
TM05 0254 0112

385S (385 gpm)

Pump model	Nom. head [ft]	Ph	Volts [V]	Motor [Hp]		Dimensions A [in (mm)]	B [in (mm)]	C [in (mm)]	D [in (mm)]	E [in (mm)]	Net weight (complete) [lb]
385S - Motor dia. 6 inch, 3 wire motor, 60 Hz, rated flow 385 gpm (4" NPT)											
385S75-1	57	3	230	7.5	▲	46.58 (1183)	22.25 (565)	24.34 (618)	5.63 (143)	7.01 (178)	135.9
		3	460	7.5	▲	46.58 (1183)	22.25 (565)	24.34 (618)	5.63 (143)	7.01 (178)	135.9
385S100-2BA	69	3	230	10	▲	52.6 (1336)	23.23 (590)	29.38 (746)	5.63 (143)	7.01 (178)	169.2
		3	460	10	▲	52.6 (1336)	23.23 (590)	29.38 (746)	5.63 (143)	7.01 (178)	169.2
385S150-2	117	3	230	18	▲	57.25 (1454)	27.88 (708)	29.38 (746)	5.63 (143)	7.01 (178)	169.2
		3	460	18	▲	57.25 (1454)	27.88 (708)	29.38 (746)	5.63 (143)	7.01 (178)	169.2
385S200-3A	155	3	230	20	▲	65.24 (1657)	30.83 (783)	34.41 (874)	5.63 (143)	7.01 (178)	188.1
		3	460	20	▲	65.24 (1657)	30.83 (783)	34.41 (874)	5.63 (143)	7.01 (178)	188.1
385S250-3	177	3	230	25	▲	67.41 (1712)	33.00 (838)	34.41 (874)	5.63 (143)	7.01 (178)	188.1
		3	460	25	▲	67.41 (1712)	33.00 (838)	34.41 (874)	5.63 (143)	7.01 (178)	188.1
385S250-4B	210	3	230	25	▲	72.45 (1840)	33.00 (838)	39.45 (1002)	5.63 (143)	7.01 (178)	239.4
		3	460	25	▲	72.45 (1840)	33.00 (838)	39.45 (1002)	5.63 (143)	7.01 (178)	239.4
385S300-4	237	3	230	30	▲	75.00 (1905)	35.56 (903)	39.45 (1002)	5.63 (143)	7.01 (178)	239.4
		3	460	30	▲	75.00 (1905)	35.56 (903)	39.45 (1002)	5.63 (143)	7.01 (178)	239.4
385S300-5BB	343	3	230	30	▲	80.04 (2033)	35.56 (903)	44.49 (1130)	5.63 (143)	7.01 (178)	247.5
		3	460	30	▲	80.04 (2033)	35.56 (903)	44.49 (1130)	5.63 (143)	7.01 (178)	247.5
385S400-5	297	3	460	40	▲	84.77 (2153)	40.28 (1023)	44.49 (1130)	5.63 (143)	7.01 (178)	247.5
385S400-6B	330	3	460	40	▲	89.81 (2281)	40.28 (1023)	49.53 (1258)	5.63 (143)	7.01 (178)	252.0
385S500-6	357	3	460	50	☼	110.99 (2825)	56.11 (1425)	54.88 (1394)	5.67 (144)	7.88 (200)	—
385S500-7A	400	3	460	50	☼	110.99 (2825)	56.11 (1425)	54.88 (1394)	5.67 (144)	7.88 (200)	—
385S600-7	416	3	460	60	♦	—	—	55.12 (1400)	—	7.88 (200)	—
385S600-8	476	3	460	60	♦	—	—	55.12 (1400)	—	7.88 (200)	—
385S - Motor dia. 8 inch, 3 wire motor, 60 Hz, rated flow 385 gpm (4" NPT)											
385S400-6B	330	3	460	40	*	93.78 (2382)	43.71 (1110)	50.08 (1272)	7.56 (192)	7.88 (200)	428.3
385S500-6	357	3	460	50	*	95.75 (2432)	45.67 (1160)	50.08 (1272)	7.56 (192)	7.88 (200)	451.2
385S500-7A	400	3	460	50	*	100.79 (2560)	45.67 (1160)	55.12 (1400)	7.56 (192)	7.88 (200)	461.1
385S600-7	416	3	460	60	*	105.12 (2670)	50.00 (1270)	55.12 (1400)	7.56 (192)	7.88 (200)	507.3
385S600-8	476	3	460	60	*	110.16 (2798)	50.00 (1270)	60.16 (1528)	7.56 (192)	7.88 (200)	517.2
385S750-9	536	3	460	75	*	118.35 (3006)	53.15 (1350)	65.2 (1656)	7.56 (192)	7.88 (200)	558.7
385S750-10	596	3	460	75	*	123.39 (3134)	53.15 (1350)	70.24 (1784)	7.56 (192)	7.88 (200)	568.6
385S1000-11	656	3	460	100	*	137.88 (3502)	62.60 (1590)	75.28 (1912)	7.56 (192)	7.88 (200)	677.5
385S1000-12	716	3	460	100	*	142.92 (3630)	62.60 (1590)	80.32 (2040)	7.56 (192)	7.88 (200)	687.4
385S1000-13	776	3	460	100	*	147.96 (3758)	62.60 (1590)	85.36 (2168)	7.56 (192)	7.88 (200)	697.3

Notes:
Control box is required for 3-wire, single-phase applications. Data does not include control box.
- ■ MS402 motor.
- ● MS4000 motor.
- ▲ MS6 motor.
- ∧ MMS6000 motor.
- ★ MMS8000 motor.
- ♦ Takes MS6 motor; not available as complete.
- ☼ Takes MMS6000 motor; not available as complete.
- * Takes MMS8000 motor; not available as complete.
- † Takes MMS10000 motor; not available as complete.

385S



TM05 2530 0212

E = Maximum diameter of pump including cable guard and motor.

Electrical data

Grundfos submersible pump motors - 60 Hz

Grundfos submersible pump motors - 60 Hz												
Hp	Ph	Volt [V]	S.F.	Circuit breaker or fuses		Amperage		Full load		Max. thrust [lbs]	Nameplate number	Product number
				Std.	Delay	Start [A]	Max. [A]	Eff. [%]	Power factor [%]			
4-inch, single-phase, 2-wire motors (control box not required)												
.5	1	115	1.60	35	15	55.0	12.0	62	76	900	79922102	96465574
.5	1	230	1.60	15	7	34.5	6.0	62	76	750	79952102	96465616
.75	1	230	1.50	20	9	40.5	8.4	62	75	750	79952103	96465618
1	1	230	1.40	25	12	48.4	9.8	63	82	750	79952104	96465620
1.5	1	230	1.30	35	15	62.0	13.1	64	85	750	79952105	96465622
4-inch, single-phase, 3-wire motors												
.5	1	115	1.60	35	15	42.5	12.0	61	76	900	79423102	96023039
.5	1	230	1.60	15	7	21.5	6.0	62	76	750	79453102	96465606
.75	1	230	1.50	20	9	31.4	8.4	62	75	750	79453103	96465608
1	1	230	1.40	25	12	37.0	9.8	63	82	750	79453104	9646510
1.5	1	230	1.30	35	15	45.9	11.6	69	89	750	79453105	96465612
4-inch, three-phase, 3-wire motors												
1.5	3	230	1.30	15	8	40.3	7.3	75	72	750	79302005	96465629
		460	1.30	10	4	20.1	3.7	75	72	750	79362005	96465651
		575	1.30	10	4	16.1	2.9	75	72	750	79392005	96785912
2	3	230	1.25	20	10	48	8.7	76	75	750	79302006	96465630
		460	1.25	10	5	24	4.4	76	75	750	79362006	96465652
		575	1.25	10	4	19.2	3.5	76	75	750	79392006	96785917
3	3	230	1.15	30	15	56	12.2	77	75	1000	79304507	96405801
		460	1.15	15	7	28	6.1	77	75	1000	79354507	96405810
		575	1.15	15	6	22	4.8	77	75	1000	79394507	96405815
5	3	230	1.15	40	25	108	19.8	80	82	1000	79304509	96405802
		460	1.15	20	12	54	9.9	80	82	1000	79354509	96405811
		575	1.15	15	9	54	7.9	80	82	1000	79394509	96405816
7.5	3	230	1.15	60	30	130	25.0	81	82	1000	79305511	96405805
		460	1.15	35	15	67	13.2	81	82	1000	79355511	96405814
		575	1.15	30	15	67	10.6	81	82	1000	79395511	96405819
6-inch, three-phase, 3-wire motors												
7.5	3	230	1.15	60	35	119	26.4	80.5	76	1000	78305511	96405781
		460	1.15	30	15	59	13.2	80.5	76	1000	78355511	96405794
10	3	230	1.15	80	45	156	34.0	82.5	79	1000	78305512	96405782
		460	1.15	40	20	78	17.0	82.0	79	1000	78355512	96405795
15	3	230	1.15	150	80	343	66.0	84.0	81	4400	78305516	96405784
		460	1.15	60	30	115	24.5	82.5	82	4400	78305514	96405796
20	3	230	1.15	150	80	343	66.0	84	81	4400	78305516	96405784
		460	1.15	80	40	172	33.0	84	82	4400	78355516	96405797
25	3	460	1.15	100	50	217	41.0	84.5	80	4400	78355517	96405798
30	3	460	1.15	110	60	237	46.5	85	83	4400	78355518	96405799
40	3	460	1.15	150	80	320	64.0	85	82	4400	78355520	96405800
50	3	460	1.15	225	125	470	68.7	84	83	13000	96476890	96023200
8-inch, three-phase, 3-wire motors												
40	3	460	1.15	175	100	380	55.7	83	85	13000	96530180	96023204
50	3	460	1.15	225	125	550	67.8	84	85	13000	96530182	96023205
60	3	460	1.15	250	150	640	80.4	86	85	13000	96476891	96023206
75	3	460	1.15	300	175	580	97.4	86	86	13000	96476892	96023207
100	3	460	1.15	400	225	570	130.4	87	86	13000	96476893	96023208
125	3	460	1.15	500	300	600	160.0	87	87	13000	96476894	96023209
150	3	460	1.15	600	350	580	191.3	86	87	13000	96511375	96023210
10-inch, three-phase, 3-wire motors												
175	3	460	1.15	700	400	570	230.4	88	85	13000	96521619	96937300
200	3	460	1.15	800	500	620	265.2	87	82	13000	96540302	96937302
250	3	460	1.15	1100	600	610	352.2	87	79	13000	96463669	96937316

Other motor manufacturers

- Hitachi motors: Refer to the Hitachi submersible motors application maintenance manual.
- Franklin motors: Refer to the Franklin submersible motors application maintenance manual.

7. Accessories

MP 204

The MP 204 is an electronic motor protector, designed for the protection of an asynchronous motor or a pump.

The motor protector consists of:

- a cabinet incorporating transformers and electronics
- a control panel with operating buttons and display for reading of data.

The MP 204 operates with two sets of limits:

- a set of warning limits and
- a set of trip limits.

If one or more of the warning limits are exceeded, the motor continues to run, but the warnings will appear in the MP 204 display.

Some values only have a warning limit.

The warning can also be read out by means of the Grundfos R100 remote control.

If one of the trip limits is exceeded, the trip relay will stop the motor. At the same time, the signal relay is operating to indicate that the limit has been exceeded.

Applications

The MP 204 can be used as a stand-alone motor protector.

The MP 204 can be monitored via a Grundfos GENIbus.

The power supply to the MP 204 is in parallel with the supply to the motor. Motor currents up to 120 A are passed directly through the MP 204. The MP 204 protects the motor primarily by measuring the motor current by means of a true RMS measurement. The MP 204 disconnects the contactor if, for example, the current exceeds the preset value.

Secondarily, the motor is protected via temperature measuring by a Tempcon sensor, a Pt100/Pt1000 sensor and a PTC sensor/thermal switch.

The MP 204 is designed for single- and three-phase motors. In single-phase motors, the starting and run capacitors are also measured. Cos φ is measured in both single- and three-phase systems.

Benefits

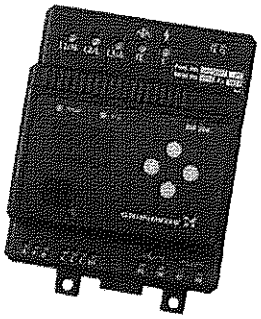
The MP 204 offers these benefits:

- Suitable for both single- and three-phase motors
- Dry-running protection
- Overload protection
- Very high accuracy
- Made for submersible pumps.

Many monitoring options

The MP 204 monitors the following parameters:

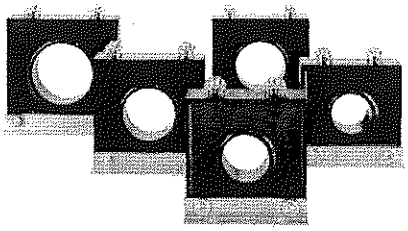
- Insulation resistance before start-up
- Temperature (Tempcon, Pt sensor and PTC/thermal switch)
- Overload/underload
- Overvoltage/undervoltage
- Phase sequence
- Phase failure
- Power factor
- Power consumption
- Harmonic distortion
- Operating hours and number of starts.



TM03 1471 2205

Fig. 21 MP 204

Five sizes of single-turn transformers, 120-999 A.
Note: Monitoring of motor temperature is not possible when single-turn transformers are used.



TM03 2033 3505

Fig. 22 Single-turn transformers

Product numbers

Product	Product number
MP 204	96079927
R100	625333

Functions

- Phase-sequence monitoring
- Indication of current or temperature (user selection)
- Indication of temperature in °F or °C (user selection)
- 4-digit, 7-segment display
- Setting and status reading with the R100
- Setting and status reading via the GENIbus.

Tripping conditions

- Overload
- Underload (dry running)
- Temperature (Tempcon sensor, PTC/thermal switch and Pt sensor)
- Phase failure
- Phase sequence
- Overvoltage
- Undervoltage
- Power factor (cos φ)
- Current unbalance.

Warnings

- Overload
- Underload
- Temperature (Tempcon and Pt sensor)
- Overvoltage
- Undervoltage
- Power factor (cos φ)
  Note: In connection with single- and three-phase connection.
- Run capacitor (single-phase operation)
- Starting capacitor (single-phase operation)
- Loss of communication in network
- Harmonic distortion.

Learning function

- Phase sequence (three-phase operation)
- Run capacitor (single-phase operation)
- Starting capacitor (single-phase operation)
- Identification and measurement of Pt100/Pt1000 sensor circuit.

External current transformers

When fitted with external current transformers, the MP 204 unit can handle currents from 120 to 999 A. Grundfos can supply approved current transformers from stock (200/5A, 300/5A, 500/5A, 750/5A, 1000/5A).

Remote control R100

The R100 remote control from Grundfos allows for wireless infrared remote control of your MP 204 unit.

With the R100, you get access to a full range of options such as factory setting adjustment, service and fault finding.

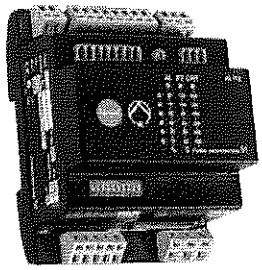
Ready for bus communication

The MP 204 allows for monitoring and communication via GENIbus — a Grundfos-designed bus for exchange of pump data, alarms, status information, and setpoints. This enables users to connect the MP 204 to, for instance, SCADA systems.

Technical data - MP 204

Enclosure class	IP 20
Ambient temperature	–4 °F to +140 °F (–20 °C to +60 °C)
Relative air humidity	99%
Voltage range	100-480 VAC
Current range	3-999 A
Frequency	50 to 60 Hz
IEC trip class	1-45
Special Grundfos trip class	0.1 to 30 s
Voltage variation	–25 %/+15 % of nominal voltage
Approvals	EN 60947, EN 60335, UL/CSA 508
Marking	CE, cUL, C-tick
Consumption	Max. 5 W
Plastic type	Black PC / ABS

	Measuring range	Accuracy	Resolution
Current without external current transformers	3-120 A	±1 %	0.1 A
Current with external current transformers	120-999 A	±1 %	1 A
Phase-to-phase voltage	80-610 VAC	±1 %	1 V
Frequency	47-63 Hz	±1 %	0.5 Hz
Power	0-1 MW	±2 %	1 W
Power factor	0-0.99	±2 %	0.01
Energy consumption	0-4x10^9 kWh	±5 %	1 kWh

IO 112	Description	Product number
	The IO 112 is a measuring module and a 1-channel protection unit for use in connection with the MP 204 motor protection unit. The module can be used for protection of pump against other factors than the electrical conditions, for instance dry-running. it can also be used as a stand-alone protection module. The IO 112 interface has three inputs for measured values one potentiometer for setting of limits indicator lights indicating the • measured value of the input • value of the limit set • alarm source • pump status. **Electrical data:** • Supply voltage: 24 VAC ±10% 50/60 Hz or 24 VDC ±10% • Supply current: Min. 2.4 A; max. 8 A • Power consumption:Max. 5 W Ambient temperature: –13 °F to+149 °F (–25 °C to +65 °C) • Enclosure class: IP 20	96651601

Control functions

This table describes the protection provided by MP 204.

Control parameters	Function	Problem	Advantages
Temperature	**MS** The motor temperature is measured by means of the built-in Tempcon temperature transmitter and a signal is sent to MP 204 via the phase leads. In MP 204 the measured temperature is compared with the factory-set value (167 °F (75 °C)). **MMS** The motor temperature is measured by means of the Pt100. The signal is sent to the MP 204 where the measured temperature is compared with the factory-set value. Temperature protection requires a submersible motor with a Pt100. The motor temperature must be monitored during frequency converter operation.	Overload, frequent starts/stops, operation against blocked discharge pipe, insufficient flow velocity past the motor.	Longer motor life, safe operating conditions, service indication.
Overvoltage/ undervoltage	If the set trip value is exceeded, the motor will stop.	The installation is close to a transformer. The mains do not absorb load variations.	Important installation parameter, possibility of improving operating conditions.
Overload	The motor power input is measured on each of the three phases. The registered power input is an average of these three values. If the factory-set value is exceeded, the motor will stop.	Incorrect sizing of pump/motor, voltage supply failure, defective cable, blocking, wear or corrosion.	Longer pump life, safe operating conditions, service indication.
Underload (dry running)	The motor power input is measured on each of the three phases. The registered power input is an average of these three values. If the average value is lower than the factory-set value, the motor will stop.	Pump exposed to dry running or underload, for example caused by wear.	Traditional dry-running protection is no longer necessary, no extra cables.
Current unbalance	The power input of the motor is measured on each of the three phases.	Mains load is uneven, incipient motor defect, phase voltages diverging.	Motor protection against overload, service indication.
Phase sequence	MP 204 and motor are installed so that the phase sequence corresponds to correct direction of rotation. MP 204 monitors changes in the phase sequence.	Two phases are wrongly connected.	Ensures correct pump performance.
Phase failure	MP 204 checks the phases connected, phase failure will cause an alarm.	Phase failure	Indication of phase failure, and alarm.

R100 menus

0. GENERAL

See the operating instructions for the R100.

1. OPERATION

- Operating mode
- Actual trip
- Actual warning 1
- Actual warning 2
- Alarm log 1
- Alarm log 2
- Alarm log 3
- Alarm log 4
- Alarm log 5.

2. STATUS

Display of

- Supply overview
- Average current
- Average voltage
- Tempcon sensor
- Pt100/Pt1000 sensor
- *Power input and energy consumption* (described in the following)
- Energy trip counter
- Phase sequence
- Current unbalance
- Operating hours and number of starts
- Trip counter of hours and starts
- Starting capacitor
- Run capacitor
- Insulation resistance
- Cos φ
- Harmonic distortion.

3. LIMITS

Display and setting of warning and trip limits.

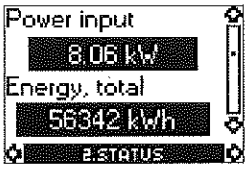
- Tempcon sensor
- Pt sensor
- Tripping current
- Current warning
- Nominal voltage
- Voltage limits
- Current unbalance
- Starting capacitor
- Run capacitor
- Insulation resistance
- Cos φ trip
- Cos φ warning.

4. INSTALLATION

Setting and display of

- Supply mains
- Trip class (described in the following)
- Trip delay
- External current transformers
- Power-on delay
- Restarting (described in the following)
- Automatic restarting (described in the following)
- Tempcon sensor
- Pt sensor
- Insulation resistance measurement
- PTC/thermal switch
- Resetting of trip counters
- Service interval
- Number of automatic restarts
- Units/display
- MP 204 display
- GENIbus ID number
- Learning function.

Power input and energy consumption



Actual input power and motor energy consumption.

The energy consumption is an accumulated value which cannot be reset.

The power is calculated like this:

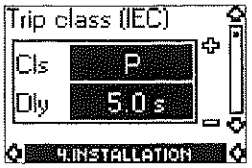
$$U_{average} = \frac{U_{L1-L2} + U_{L2-L3} + U_{L3-L1}}{3}[V]$$

$$I_{average} = \frac{I_{L1} + I_{L2} + I_{L3}}{3}[A]$$

$$\cos\varphi_{average} = \frac{\cos\varphi_{L1} + \cos\varphi_{L2} + \cos\varphi_{L3}}{3}[-]$$

$$P = (U_{average} \times I_{average} \times \sqrt{3} \times \cos\varphi_{average})[W]$$

Trip class



Line 1: Select IEC trip class (1 to 45).

If manual indication of trip delay in the case of overload is required, select trip class "P".

Factory setting:

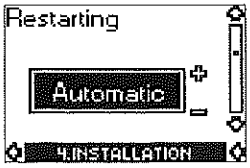
- Cls (trip class): P.

Line 2: Select trip delay.

Factory setting:

- Dly (trip delay): 10 s.

Restarting



Set whether restarting after tripping is to be

- *Automatic* (factory setting)
- *Manual.*

Setting of time, see section "Automatic restarting".

Automatic restarting



Set the time after which the MP 204 is to attempt automatic restarting of motor after cut-out.

The time runs from the moment when the value which triggered the fault has returned to normal.

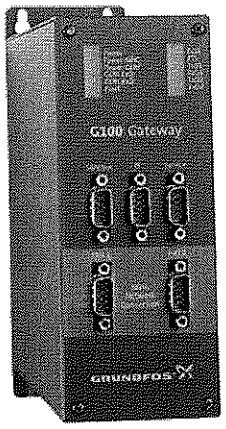
Factory setting:

- 300 s.

G100 gateway for communication with Grundfos products

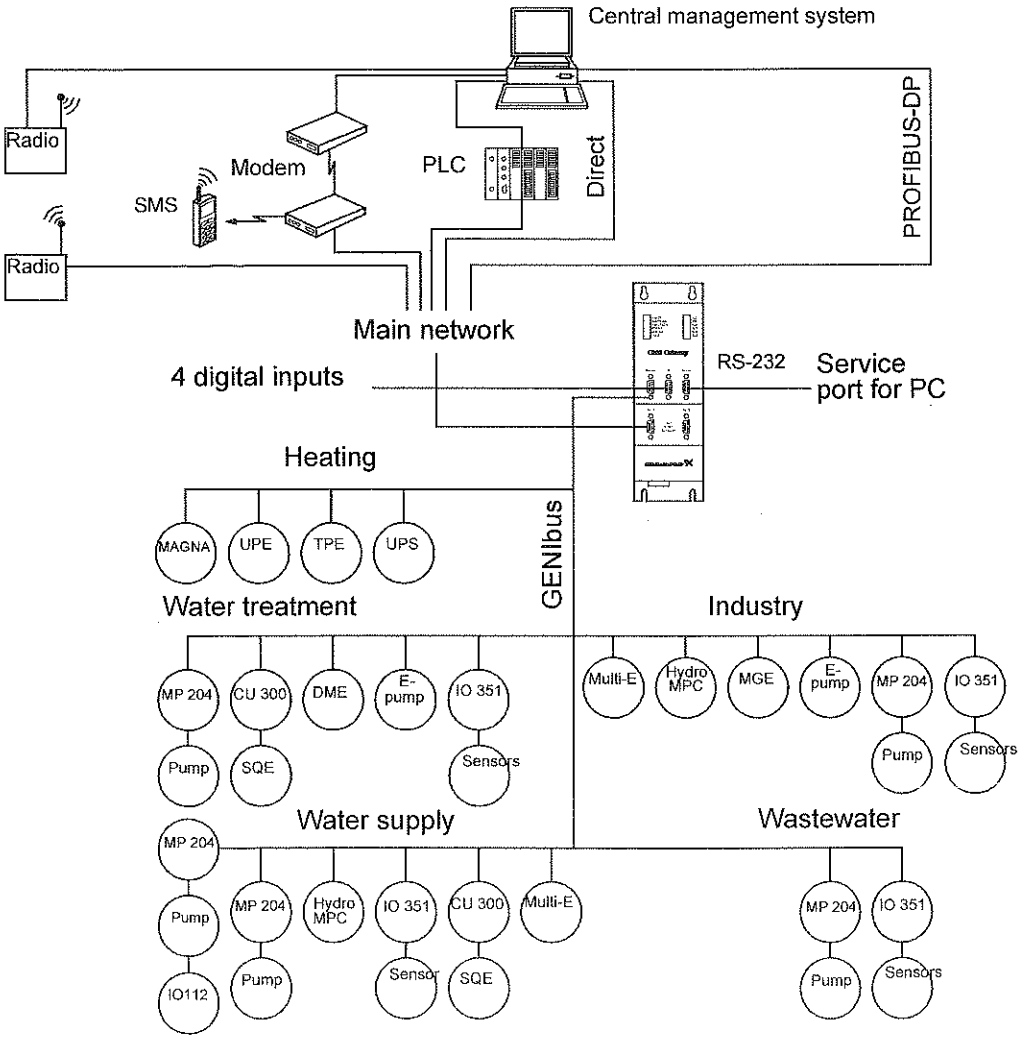
The G100 offers a wide selection of options for integration of Grundfos products provided with GENIbus interface into main control and monitoring systems.

The G100 enables a pump installation to meet future demands for optimum pump operation in terms of reliability, operating costs, centralization and automation.



GR5940

Fig. 23 G100



TM03 9224 3607

Fig. 24 Examples of G100 applications

Product description

The G100 Gateway enables communication of operating data, such as measured values and setpoints, between Grundfos products with GENIbus interface and a main network for control and monitoring.

As indicated in the illustration on page 92, the G100 is suitable for use in applications such as water supply, water treatment, wastewater, building automation and industry.

Common to above applications is that downtime is usually costly, and extra investments are therefore often made to achieve maximum reliability by monitoring selected operating variables.

The day-to-day operation, such as starting and stopping of pumps and changing of setpoints, can also be effected from the main system by communication with the G100. In addition, the G100 can be set up to send event-controlled status indications such as alarms via the SMS to mobile phones, and to make automatic alarm call-backs to a central management system.

Data logging

Besides the possibility of data communication, the G100 offers logging of up to 350,000 time-stamped data. The logged data can be transmitted to the main system or a PC for further analysis in a spreadsheet or similar program.

For the data logging, the "PC Tool G100 Data Log" software tool is used. The tool is part of the PC Tool G100 package, which is supplied with the G100.

Other features

- Four digital inputs.
- Stop of all pumps in case of failing communication with the management system (optional).
- Access code for modem communication (optional).
- Alarm log.

Installation

Installation of the G100 is effected by the system integrator. The G100 is connected to the GENIbus as well as to the main network. All units on the GENIbus can thus be controlled from a central management system on the main network.

The "G100 Support Files" CD-ROM supplied with the G100 contains examples of programs to be used when the G100 is connected to the various main network systems. Included is also a description of the data points available in Grundfos products with GENIbus interface.

The "PC Tool G100" software tool included can be used for the installation and use of G100.

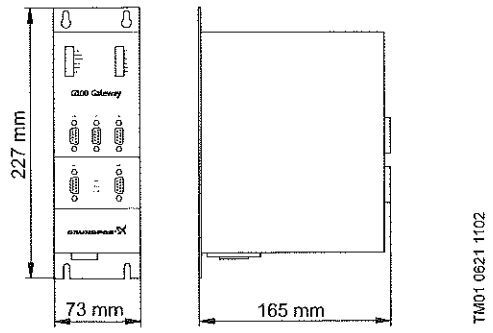


Fig. 25 Dimensional sketch

Technical data

Overview of protocols

Main system	Software protocol
PROFIBUS-DP	DP
Radio	Satt Control COMLI/Modbus
Modem	Satt Control COMLI/Modbus
PLC	Satt Control COMLI/Modbus
GSM mobile phone	SMS, UCP

Other possible connections

GENIbus RS-485:	Connection of up to 32 units.
Service port RS-232:	For direct connection to a PC or via radio modem.
Digital inputs:	4.
Voltage supply:	1 x 110-240 V, 50/60 Hz.
Ambient temperature:	In operation: –4 °F to +140 °F (–20 °C to +60 °C).
Enclosure class:	IP 20.
Weight:	1.8 kg.

Accessories

- PC Tool G100 package (supplied with the product)
- G100 Support Files CD-ROM (supplied with product)

Product numbers

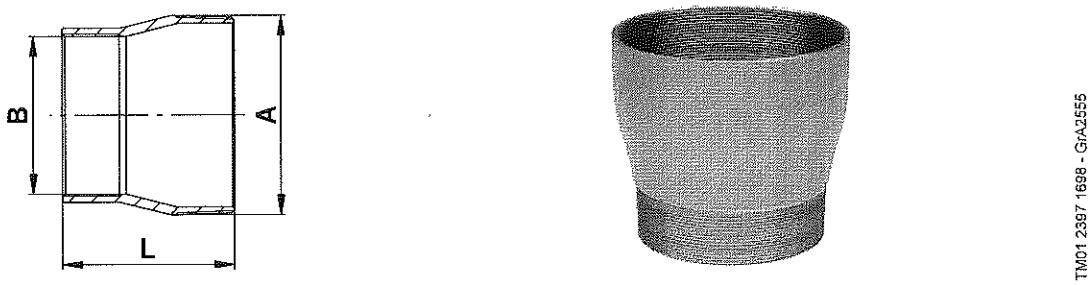
Product	Product number
G100 with Profibus-DP expansion board*	96411135
G100 with Radio/Modem/PLC expansion board*	96411136
G100 Basic Version*	96411137
PC Tool G100 package	96415783

* CD-ROM with G100 Support Files included.

Connecting pieces

The tables below show the range of connecting pieces for connection of thread-to-flange and thread-to-thread.

Thread-to- thread



TM01 2397 1698 - GrA2555

Fig. 26 Dimensional sketch and photo of connecting piece thread-to-thread

Type	Connecting piece	Dimensions			Product number	
		Thread-to-thread		L [in (mm)]		
		A	B		304 stainless steel	316 stainless steel
385S 475S	NPT 5→ NPT 4	NPT 5	NPT 4	4.76 (121)	190064	190586
	NPT 5→ NPT 6	NPT 5	NPT 6	5.91 (150)	190070	190592
625S 800S 1100S	NPT 6→ NPT 5	NPT 6	NPT 5	5.91 (150)	200135	200645

Zinc anodes

Application

Cathodic protection by means of zinc can be used for corrosion protection of SP pumps in chloride-containing liquids such as brackish water and seawater.

Sacrificial anodes are placed on the outside of the pump and motor as protection against corrosion.

The number of anodes required depends on the pump and motor in question.

Please contact Grundfos for further details.

Liquid temperatures

- Seawater:
  Up to 95 °F (35 °C).
- Brackish water (min. 1500 ppm (g/m^3) chloride):
  Up to 95 °F (35 °C).

Anode life

The zinc anodes have a life of one to four years, depending on operating conditions (temperature, flow and chloride content).

Product numbers of zinc anodes

Zinc anodes for pumps										
	Used for pump type									
Product number	SP 5S to 75S	85S	150S	230S	300S	385S	475S	625S	800S	1100S
96421444	●	-	-	-	-	-	-	-	-	-
96421445	-	●	●	●	●	-	-	-	-	-
96421447	-	-	-	-	-	●	●	-	-	-
96421448	-	-	-	-	-	-	●	-	-	-
96421449	-	-	-	-	-	-	-	●	-	-
96421450	-	-	-	-	-	-	-	●	●	●

Zinc anodes for motors			
4" motors	6" motors	8" motors	10" motors
96421444	96421446	96421450	96564808

SA-SPM 5 control boxes

Application

SA-SPM 5 control boxes are used as starting units for single-phase, 3-wire motors, types MS 402B with power input lower than or equal to 1.5 hp (1.1 kW).

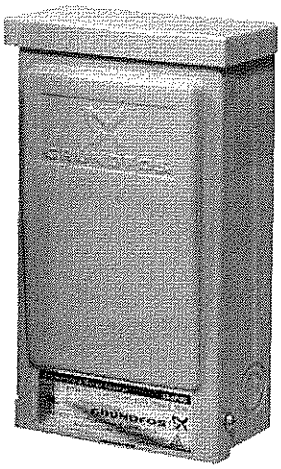
SA-SPM 5 is available in two versions, standard and DeLuxe. The standard version incorporates a motor -protective circuit breaker and thus protects the motor against overload. The DeLuxe version is identical to the standard version with the following addition a motor contactor is included for connection and disconnection of the power supply.

Technical data

Enclosure class: IP 42.

Ambient temperature: –4 °F to +140 °F (–20 °C to +60 °C).

Relative humidity: Maximum 95 %, normal non-aggressive atmosphere.



TM03 8150 0607

Fig. 27 SA-SPM 5 control box

Product numbers

Product	Description					Product number
	1 x 220-230 V	1.5 hp	2.0 hp	3.0 hp	5.0 hp	
SA-SPM 5 (Standard version)	●	●	-	-	-	91126212
SA-SPM 5 (DeLuxe version)	●	●	-	-	-	91126213
SA-SPM 5 (Standard version)	●	-	●	-	-	91126214
SA-SPM 5 (DeLuxe version)	●	-	●	-	-	91126215
SA-SPM 5 (Standard version)	●	-	-	●	-	91126216
SA-SPM 5 (DeLuxe version)	●	-	-	●	-	91126217
SA-SPM 5 (Standard version)	●	-	-	-	●	91126218
SA-SPM 5 (DeLuxe version)	●	-	-	-	●	91126219

Pt100

The Pt100 sensor offers these features:

- Continuous monitoring of the motor temperature
- Protection against too high motor temperature.

Protecting the motor against too high motor temperature is the simplest and cheapest way of avoiding that motor lifetime is reduced. Pt100 ensures that operating conditions are not exceeded and indicates when it is time for service of the motor.

Monitoring and protection by means of Pt100 require the following parts:

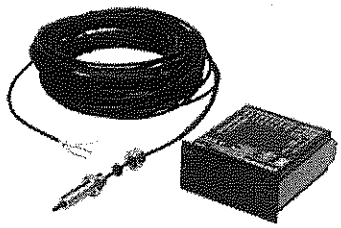
- Pt100 sensor
- Relay, type PR 5714
- Cable.

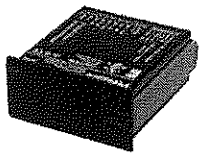
The PR 5714 relay is fitted with a Pt100 module. For both relays the following temperature limits are preset on delivery:

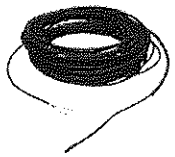
- +60 °C (+140 °F) warning limit
- +75 °C (+167 °F) stop limit.

Technical data

	Relay type
	PR 5714
Enclosure class	IP 65 (mounted in a control panel)
Ambient temperature	–4 °F to +140 °F (–20 °C to +60 °C)
Relative humidity	95 % (condensating)
Voltage variation	• 1 x 24-230 VAC ±10 %, 50 - 60 Hz. • 24-250 VDC ±20 %.
Approvals	UL, DNV
Mark	CE

Pt100 sensor with/without PR 5714 relay and cable	Cable length [ft (m)]	PR 5714	Product number		
			MS6	MMS 6000, MMS 8000	MMS 10000, MMS 12000
	65.6 (20)	Yes	96408953	96494596	96437287
	131.2 (40)	Yes	96408681	96494597	96437288
	196.9 (60)	Yes	96408954	96494598	96437289
	262.5 (80)	Yes	96408955	96494599	96437290
	328.1 (100)	Yes	96408956	96494610	96437291
	65.6 (20)	No	96658626	96658629	96658633
	131.2 (40)	No	96658627	96658630	96658634
	196.9 (60)	No	96658628	96658631	96658635
	262.5 (80)	No	96658637	96658632	96658636
	328.1 (100)	No	96658638	96658639	96658640

PR 5714 relay	Voltage	Product number
	24-230 VAC, 50/60 Hz / 24-250 VDC	96621274

Pt100 sensor including cable	Cable length [ft (m)]	Product number	
		MS6, MMS 6000, MMS 8000	MMS 10000 MMS 12000
	65.6 (20)	96408957	96437784
	131.2 (40)	96408684	96437785
	196.9 (60)	96408958	96437786
	262.5 (80)	96408959	96437787
	328.1 (100)	96408960	96437788

Staybolts for Pt100	Description	Product number
	Bolt KIT for Pt100 (for MS6)	96611899

8. Energy consumption

Energy consumption of submersible pumps

The percentage distribution of service life costs of a submersible pump for water supply is:

5 % initial costs (pump)
85 % operating costs / energy consumption
10 % maintenance costs.

It is obvious that the highest savings can be achieved within energy consumption!

The annual energy consumption, E, of a submersible pump can be calculated as follows:

$E = c \times h \times P_1$ (EURO)

c = specific energy price (EURO/kWh)

h = operating hours/year (hours)

P_1 = power input of the submersible pump (kW).

Example: Calculation of the annual energy consumption of the submersible pump, type 625S-3.

625S-3 with MS 8000, 45 kW, 3 x 460 V, 60 Hz.

Duty point:
Flow rate: $Q = 120\ m^3/h$

Total head: $H = 102$ m

Specific energy price: c = EURO 0.1/kWh
(consisting of day and night rate)

Operating hours/year: h = 3200.

$$P_1 = \frac{Q \times H \times \rho}{367 \times \eta_{pump} \times \eta_{motor}} \text{ in kW}$$

Q = m^3/h

H = m

Density ρ = kg/dm^3 (assumed 1)

367 = conversion factor

η_{motor} = (example 84.5 %, in equation 0.845)

η_{pump} = (not to be confused with the stage efficiency curve).

By showing the P_2/Q curve we make it easier for you to calculate the energy consumption.

$$P_1 = \frac{P_2}{\eta_{motor}}$$

P_2 = 26 kW (power requirement of 625S-3 pump at 20 m^3/h, from curve P_2 / Q on page 72).

Calculation of motor efficiency at duty point
As standard the SP 625S-3 is equipped with a 45 kW MS6 motor.

At duty point (Q = 120 m^3/h) the pump requires 44 kW, thus:

a motor load of 87 % (44 kW / 45 kW) and a power reserve of 2 %.

From the table on page 72 the motor efficiency can be read as:

84.6 % at a load of 75 %. ($\eta_{75\,\%}$)
85.6 % at a load of 100 %. ($\eta_{100\,\%}$)
The interpolated value in this example is
η_{motor} = 85.1 %, η_{motor} = 0.851.

$$P_1 = \frac{44}{0.851} = 51.7 \text{ kW}$$

E = 0.1 EURO/kWh x 3200 h x 51.7 kW.
The annual energy costs amount to EURO 16544.

The pay-off time, A, (months) is calculated as follows:

$$A = \frac{\text{Purchase price of energy} - \text{efficiency pump}}{\text{Energy savings/year}} \times 12$$

Cable sizing
In order to obtain an economical duty of the pump the voltage drop should be low.

Today large water works already size cables for a maximum voltage drop of 1 %).

The hydraulic resistance in the discharge pipe should be as low as possible.

9. Cables

Grundfos offers submersible drop cables for all applications: 3-core cable, 4-core cable, single leads.

Cables for Grundfos 4" submersible motors are available with or without plugs. The submersible drop cable is chosen according to application and type of installation.

Standard version: Max. liquid temperature +140 °F +60 °C).

Hot water version: Max. liquid temperature +158 °F (+70 °C), for short periods up to 194 °F (+90 °C) (for MS only).

Tables indicating cable dimension in borehole

The tables indicate the maximum length of drop cables in meters from motor starter to pump at direct-on-line starting at different cable dimensions.

If star/delta starting is used the current will be reduced by $\sqrt{3}$ (I x 0.58), meaning that the cable length may be $\sqrt{3}$ longer (L x 1.73) than indicated in the tables.

If for example the operating current is 10 % lower than the full-load current, the cable may be 10 % longer than indicated in the tables.

The calculation of the cable length is based on a maximum voltage drop of 1 % to 3 % of the rated voltage and a water temperature of maximum +86 °F (30 °C).

In order to minimize operating losses the cable cross section may be increased compared to what is indicated in the tables. This is economical only if the borehole provides the necessary space, and if the operational time of the pump is long, especially if the operating voltage is below the rated voltage.

The table values are calculated on the basis of the formula:

Max. cable length of a single-phase submersible pump:

$$L = \frac{U \times \Delta U}{I \times 2 \times 100 \times \left(\cos\varphi \times \frac{\rho}{q} + \sin\varphi \times X_L\right)} [m]$$

Max. cable length of a three-phase submersible pump:

$$L = \frac{U \times \Delta U}{I \times 1.73 \times 100 \times \left(\cos\varphi \times \frac{\rho}{q} + \sin\varphi \times X_L\right)} [m]$$

where

U = Rated voltage [V]

ΔU = Voltage drop [%]

I = Rated current of the motor [A]

q = Cross-section of submersible drop cable [mm^2]

X_L = Inductive resistance: 0.078 x 10^{-3} [Ω/m]

$\cos\varphi$= Power factor

$\sin\varphi = \sqrt{1 - \cos^2\varphi}$

ρ = Specific resistance: 0.02 [Ω mm^2/m]

Example

Motor size: 30 kW, MMS 8000

Rated current: 64.0 A

Rated voltage: 3 x 460 V, 60 Hz

Starting method: Direct-on-line

Power factor: $\cos\varphi$ = 0.85

Voltage drop: 3 %

Cross-section: 16 mm^2

$\sin\varphi$: 0.53

$$L = \frac{460 \times 3}{64.0 \times 1.73 \times 100 \times \left(0.85 \times \frac{0.02}{16} + 0.53 \times 0.078 \times 10^{-3}\right)}$$

L = 113 m

Cable dimensions at 1 x 220 V, 60 Hz

Motor	kW	I_n [A]	1.5 mm^2	2.5 mm^2	4 mm^2	6 mm^2	10 mm^2
4"	0.25	3.3	96	159	254	379	624
	0.37	4.4	73	121	192	286	472
	0.55	6.6	48	80	127	189	311
	0.75	7.7	37	62	98	147	243
	1.1	9.0	30	50	79	118	196

Maximum cable length in meters from motor starter to pump.

Cable sizing chart

1 phase, 60 Hz

Motor rating		Copper wire size												
Volts	Hp	14	12	10	8	6	4	2	0	00	000	0000	250	300
		Maximum motor cable length (motor service to entrance) [ft/m]												
115	0.33	130 (40)	210 (64)	340 (104)	540 (165)	840 (256)	1300 (396)	1960 (597)	2910 (887)					
	0.5	100 (30)	160 (49)	250 (76)	390 (119)	620 (189)	960 (293)	1460 (445)	2160 (658)					
	0.33	550 (168)	880 (268)	1390 (424)	2190 (668)	3400 (1036)	5250 (1600)	7960 (2426)						
	0.5	400 (122)	650 (198)	1020 (311)	1610 (491)	2510 (765)	3880 (1183)	5880 (1792)						
	0.75	300 (91)	480 (146)	760 (232)	1200 (366)	1870 (570)	2890 (881)	4370 (1332)	6470 (1972)					
	1	250 (76)	400 (122)	630 (192)	990 (302)	1540 (469)	2380 (725)	3610 (1100)	5360 (1634)	6520 (1987)				
	1.5	190 (58)	310 (94)	480 (146)	770 (235)	1200 (366)	1870 (570)	2850 (869)	4280 (1305)	5240 (1597)				
	2	150 (46)	250 (76)	390 (119)	620 (189)	970 (296)	1530 (466)	2360 (719)	3620 (1103)	4480 (1366)				
	3	120 (37)	190 (58)	300 (91)	470 (143)	750 (229)	1190 (363)	1850 (564)	2890 (881)	3610 (1100)				
	5			180 (55)	280 (85)	450 (137)	710 (216)	1110 (338)	1740 (530)	2170 (661)				
	7.5				200 (61)	310 (94)	490 (149)	750 (229)	1140 (347)	1410 (430)				
	10					250 (76)	390 (119)	600 (183)	930 (283)	1160 (354)				

3 phase, 60 Hz

Motor rating		Copper wire size												
Volts	Hp	14	12	10	8	6	4	2	0	00	000	0000	250	300
		Maximum motor cable length (motor service to entrance) [ft/m]												
208	1.5	310 (94)	500 (152)	790 (241)	1260 (384)									
	2	240 (73)	390 (119)	610 (186)	970 (296)	1520 (463)								
	3	180 (55)	290 (88)	470 (143)	740 (226)	1160 (354)	1810 (552)							
	5		170 (52)	280 (85)	440 (134)	690 (210)	1080 (329)	1660 (506)						
	7.5			200 (61)	310 (94)	490 (149)	770 (235)	1180 (360)	1770 (539)					
	10				230 (70)	370 (113)	570 (174)	880 (268)	1330 (405)	1640 (500)				
	15					250 (76)	390 (119)	600 (183)	910 (277)	1110 (338)	1340 (408)			
	20						300 (91)	460 (140)	700 (213)	860 (262)	1050 (320)	1270 (387)		
	25							370 (113)	570 (174)	700 (213)	840 (256)	1030 (314)	1170 (357)	
	30							310 (94)	470 (143)	580 (177)	700 (213)	850 (259)	970 (296)	1110 (338)
230	1.5	360 (110)	580 (177)	920 (280)	1450 (442)									
	2	280 (85)	450 (137)	700 (213)	1110 (338)	1740 (530)								
	3	210 (64)	340 (104)	540 (165)	860 (262)	1340 (408)	2080 (634)							
	5		200 (61)	320 (98)	510 (155)	800 (244)	1240 (378)	1900 (579)						
	7.5			230 (70)	360 (110)	570 (174)	890 (271)	1350 (411)	2030 (619)					
	10				270 (82)	420 (128)	660 (201)	1010 (308)	1520 (463)	1870 (570)				
	15					290 (88)	450 (137)	690 (210)	1040 (317)	1280 (390)	1540 (469)			
	20						350 (107)	530 (162)	810 (247)	990 (302)	1200 (366)	1450 (442)		
	25						280 (85)	430 (131)	650 (198)	800 (244)	970 (296)	1170 (357)	1340 (408)	
	30							350 (107)	540 (165)	660 (201)	800 (244)	970 (296)	1110 (338)	1270 (387)
460	1.5	1700 (518)												
	2	1300 (396)	2070 (631)											
	3	1000 (305)	1600 (488)	2520 (768)										
	5	590 (180)	950 (290)	1500 (457)	2360 (719)									
	7.5	420 (128)	680 (207)	1070 (326)	1690 (515)	2640 (805)								
	10	310 (94)	500 (152)	790 (241)	1250 (381)	1960 (597)	3050 (930)							
	15			540 (165)	850 (259)	1340 (408)	2090 (637)	3200 (975)						
	20			410 (125)	650 (198)	1030 (314)	1610 (491)	2470 (753)	3730 (1137)					
	25				530 (162)	830 (253)	1300 (396)	1990 (607)	3010 (917)	3700 (1128)				
	30				430 (131)	680 (207)	1070 (326)	1640 (500)	2490 (759)	3060 (933)	3700 (1128)			
	40						790 (241)	1210 (369)	1830 (558)	2250 (686)	2710 (826)	3290 (1003)		
	50						640 (195)	980 (299)	1480 (451)	1810 (552)	2190 (668)	2650 (808)	3010 (917)	
	60							830 (253)	1250 (381)	1540 (469)	1850 (564)	2240 (683)	2540 (774)	2890 (881)
	75								1030 (314)	1260 (384)	1520 (463)	1850 (564)	2100 (640)	2400 (732)
	100									940 (287)	1130 (344)	1380 (421)	1560 (475)	1790 (546)
	125											1080 (329)	1220 (372)	1390 (424)
	150												1050 (320)	1190 (363)
	200												1060 (329)	1300 (396)
	250													1080 (329)

3 phase, 60 Hz													
Motor rating		Copper wire size											
Volts	Hp	14	12	10	8	6	4	2	0	00	000	0000	250	300
		Maximum motor cable length (motor service to entrance) [ft/m]												
575	1.5	2620 (799)												
	2	2030 (619)												
	3	1580 (482)	2530 (771)											
	5	920 (280)	1480 (451)	2330 (710)										
	7.5	660 (201)	1060 (323)	1680 (512)	2650 (808)									
	10	490 (149)	780 (238)	1240 (378)	1950 (594)									
	15		530 (162)	850 (259)	1340 (408)	2090 (637)								
	20			650 (198)	1030 (314)	1610 (491)	2520 (768)							
	25			520 (158)	830 (253)	1300 (396)	2030 (619)	3110 (948)						
	30				680 (207)	1070 (326)	1670 (509)	2560 (780)	3880 (1183)					
	40					790 (241)	1240 (378)	1900 (579)	2860 (872)	3510 (1070)				
	50						1000 (305)	1540 (469)	2310 (704)	2840 (866)	3420 (1042)			
	60						850 (259)	1300 (396)	1960 (597)	2400 (732)	2890 (881)	3500 (1067)		
	75							1060 (323)	1600 (488)	1970 (600)	2380 (725)	2890 (881)	3290 (1003)	

CAUTION: Use of wire size smaller than listed will void warranty.
Notes:
1. If aluminum conductor is used, multiply lengths by 0.5 Maximum allowable length of aluminum is considerably shorter than copper wire of same size.
2. The portion of the total cable which is between the service entrance and a 3ø motor starter should not exceed 25% of the total maximum length to assure reliable starter operation. Single-phase control boxes may be connected at any point of the total cable length.
3. Cables #14 to #0000 are AWG sizes, and 250 to 300 are MCM sizes.

10. Friction loss tables

Friction loss table - SCH 40 steel pipe										
U.S. gpm	U.S. gph	.5"	.75"	1"	1.25"	1.5"	2"	2.5"	3"	4"
		ID 0.622"	ID 0.824"	ID 1.049"	ID 1.380"	ID 1.610"	ID 2.067"	ID 2.469"	ID 3.068"	ID 4.026"
		Friction loss in feet of head per 100 feet of pipe								
2	120	4.8								
3	180	10.0	2.5							
4	240	17.1	4.2							
5	300	25.8	6.3	1.9						
6	360	36.5	8.9	2.7						
7	420	48.7	11.8	3.6						
8	480	62.7	15.0	4.5						
9	540	78.3	18.8	5.7						
10	600	95.9	23.0	6.9						
12	720		32.6	9.6	2.5	1.2				
14	840		43.5	12.8	3.3	1.5				
16	960		56.3	16.5	4.2	2.0				
20	1,200		86.1	25.1	6.3	2.9				
25	1,500			38.7	9.6	4.5	1.3			
30	1,800			54.6	13.6	6.3	1.8			
35	2,100			73.3	18.2	8.4	2.4			
40	2,400			95.0	23.5	10.8	3.1	1.3		
45	2,700				29.4	13.5	3.9	1.6		
50	3,000				36.0	16.4	4.7	1.9		
60	3,600				51.0	23.2	6.6	2.7		
70	4,200				68.8	31.3	8.9	3.6	1.2	
80	4,800				89.2	40.5	11.4	4.6	1.6	
90	5,400					51.0	14.2	5.8	2.0	
100	6,000					62.2	17.4	7.1	2.4	
120	7,200						24.7	10.1	3.4	
140	8,400						33.2	13.5	4.5	1.2
160	9,600						43.0	17.5	5.8	1.5
200	12,000						66.3	27.0	8.9	2.3
260	15,600							45.0	14.8	3.7
300	18,000							59.6	19.5	4.9

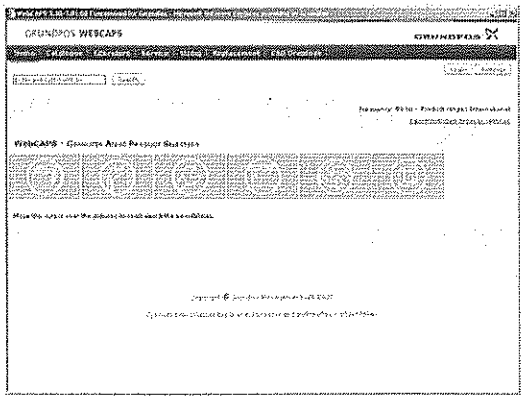
Friction loss table - SCH 40 PVC pipe										
		.5"	.75"	1"	1.25"	1.5"	2"	2.5"	3"	4"
U.S. gpm	U.S. gph	ID 0.622"	ID 0.824"	ID 1.049"	ID 1.380"	ID 1.610"	ID 2.067"	ID 2.469"	ID 3.068"	ID 4.026"
		Friction loss in feet of head per 100 feet of pipe								
2	120	4.1								
3	180	8.7	2.2							
4	240	14.8	3.7							
5	300	22.2	5.7	1.8						
6	360	31.2	8.0	2.5						
7	420	41.5	10.6	3.3						
8	480	53.0	13.5	4.2						
9	540	66.0	16.8	5.2						
10	600	80.5	20.4	6.3	1.7					
12	720		28.6	8.9	2.3	1.1				
14	840		38.0	11.8	3.1	1.4				
16	960		48.6	15.1	4.0	1.9				
20	1,200		60.5	22.8	6.0	2.8				
25	1,500			38.7	9.1	4.3	1.3			
30	1,800				12.7	6.0	1.8			
35	2,100				16.9	8.0	2.4			
40	2,400				21.6	10.2	3.0	1.1		
45	2,700				28.0	12.5	3.8	1.4		
50	3,000					15.4	4.6	1.7		
60	3,600					21.6	6.4	2.3		
70	4,200					28.7	8.5	3.0	1.2	
80	4,800					36.8	10.9	3.8	1.4	
90	5,400					45.7	13.6	4.8	1.8	
100	6,000					56.6	16.5	5.7	2.2	
120	7,200						23.1	8.0	3.0	
140	8,400						30.6	10.5	4.0	1.1
160	9,600						39.3	13.4	5.0	1.4
200	12,000						66.3	20.1	7.6	2.1
260	15,600							32.4	12.2	3.4
300	18,000							42.1	15.8	4.4

Type of fitting and application	Pipe and fitting	Nominal size of fitting and pipe						
		1/2"	3/4"	1"	1.25"	1.5"	2"	2.5"
		Friction loss in equivalent length of straight pipe in feet						
Insert coupling	Plastic	3	3	3	3	3	3	3
Threaded adapter (plastic to thread)	Plastic	3	3	3	3	3	3	3
90° standard elbow	Steel	2	2	3	4	4	5	6
	Plastic	2	2	3	4	4	5	6
Standard tee (flow through run)	Steel	1	2	2	3	3	4	4
	Plastic	1	2	2	3	3	4	4
Standard tee (flow through side)	Steel	4	5	6	7	8	11	13
	Plastic	4	5	6	7	8	11	13
Gate valve[1]	Steel	1	1	1	1	2	2	2
Swing check valve[1]	Steel	5	7	9	12	13	17	21

Notes:
Based on Schedule 40 steel and plastic fittings
[1]Friction loss figures are for screwed valves and are based on equivalent lengths of steel pipe.

11. Further product documentation

WebCAPS

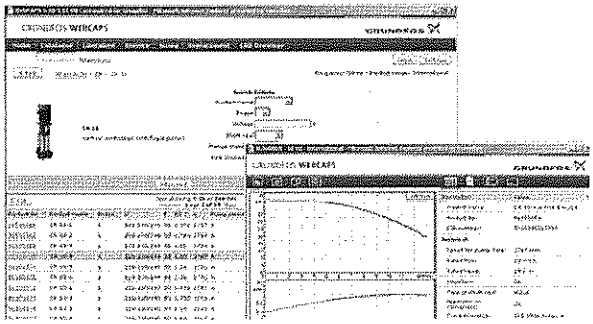


WebCAPS is a **Web**-based **C**omputer **A**ided **P**roduct **S**election program available on www.grundfos.com.

WebCAPS contains detailed information on more than 185,000 Grundfos products in more than 20 languages.

In WebCAPS, all information is divided into 6 sections:

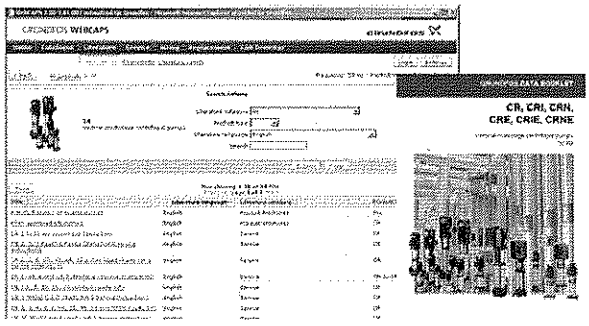
- Catalog
- Literature
- Service
- Sizing
- Replacement
- CAD drawings.



Catalog

This section is based on fields of application and pump types, and contains

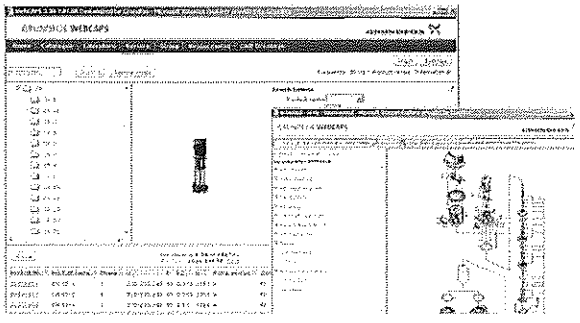
- technical data
- curves (QH, Eta, P1, P2, etc) which can be adapted to the density and viscosity of the pumped liquid and show the number of pumps in operation
- product photos
- dimensional drawings
- wiring diagrams
- quotation texts, etc.



Literature

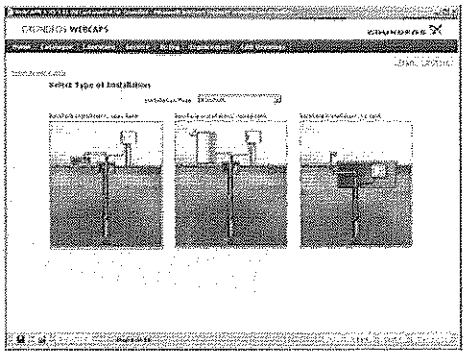
In this section you can access all the latest documents of a given pump, such as

- product guides
- installation and operating instructions
- service documentation, such as Service kit catalog and Service kit instructions
- quick guides
- product brochures, etc.



Service

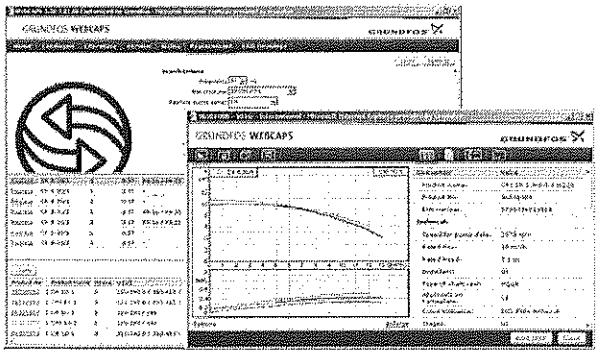
This section contains an easy-to-use interactive service catalog. Here you can find and identify service parts of both existing and discontinued Grundfos pumps.
Furthermore, this section contains service videos showing you how to replace service parts.



Sizing

This section is based on different fields of application and installation examples, and gives easy step-by-step instructions in how to

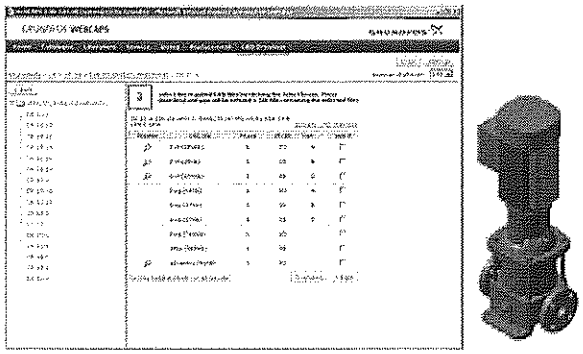
- select the most suitable and efficient pump for your installation
- carry out advanced calculations based on energy consumption, payback periods, load profiles, life cycle costs, etc.
- analyse your selected pump via the built-in life cycle cost tool
- determine the flow velocity in wastewater applications, etc.



Replacement

In this section you find a guide to selecting and comparing replacement data of an installed pump in order to replace the pump with a more efficient Grundfos pump.
The section contains replacement data of a wide range of pumps produced by other manufacturers than Grundfos.

Based on an easy step-by-step guide, you can compare Grundfos pumps with the one you have installed on your site. When you have specified the installed pump, the guide will suggest a number of Grundfos pumps which can improve both comfort and efficiency.



CAD drawings

In this section it is possible to download 2-dimensional (2D) and 3-dimensional (3D) CAD drawings of most Grundfos pumps.

These formats are available in WebCAPS:

2-dimensional drawings:
- .dxf, wireframe drawings
- .dwg, wireframe drawings.

3-dimensional drawings:
- .dwg, wireframe drawings (without surfaces)
- .stp, solid drawings (with surfaces)
- .eprt, E-drawings.

WinCAPS



Fig. 28 WinCAPS CD-ROM

WinCAPS is a **Win**dows-based **C**omputer **A**ided **P**roduct **S**election program containing detailed information on more than 185,000 Grundfos products in more than 20 languages.

The program contains the same features and functions as WebCAPS, but is an ideal solution if no Internet connection is available.

WinCAPS is available on CD-ROM and updated once a year.

BE > THINK > INNOVATE >

Being responsible is our foundation
Thinking ahead makes it possible
Innovation is the essence

L-SP-PG-001 0212

Repl. L-SP-PG-001 Rev. 0206 US

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GRUNDFOS

P-1

P-P1

LINE CIRCULATOR

1. Product introduction

Introduction

Grundfos TP circulator pumps are designed for circulation of liquids in heating and air-conditioning systems. Pumps with bronze pump housings are suitable for circulation in domestic hot water systems.

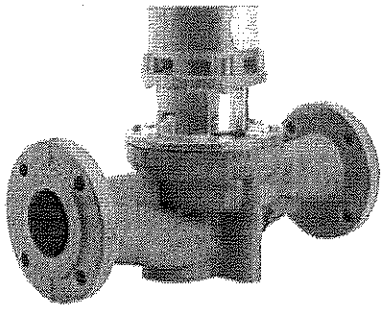
Grundfos TP pumps are vertical single-stage in-line centrifugal pumps of the close-coupled type.

The TP is highly reliable and efficient. TP pumps are electrocoated to ensure a high corrosion resistance.

Applications

General examples of systems in which TP pumps are suitable are:

- boiler/hydronic heating
- chilled water
- air conditioning systems
- cooling towers
- domestic hot water
- radiant floor heat
- solar
- snow melt systems.



TM03 6159

Fig. 1 Grundfos TP circulator pump

Cross reference guide: B&G, Taco and Armstrong to Grundfos

B&G Series 60&80	Hp	Port to port length [in]	Flange size	Taco Series 1600	Hp	Port to port length [in]	Flange size	Arm-strong	Hp	Port to port length [in]	Flange size	Grundfos Model TP	Hp	Port to port length [in]	Flange size
								H-32	.17	8.5	1.25"	32-40	.33	11.0	1.25"
6011	.25	11.0	1.25"	1600	.25	10.25	1.5"	H-52	.33	11.5	1.25"	32-80	.5	11.0	1.25"
6016	.75	13.5	1.5"	1614	.75	13.5	1.5"	H-64	.75	13.5	1.5"	32-160	.75	13.5	1.5"
								H-52	.33	11.5	.25"	40-40	.33	13.5	1.5"
								H-53	.5	11.5	1.5"		.5	13.5	1.5"
6013	.5	11.5	1.5"	1612	.5	13.5	1.5"	H-53	.5	11.5	1.5"	40-80	.75	13.5	1.5"
6015	.5	13.5	1.5"	1612	.5	13.5	1.5"	H-63	.5	13.5	1.5"	40-80	.75	13.5	1.5"
								H-67	1	14.0	2"	40-160	.75	11.5	1.5"
6017	1	13.5	1.5"	1616	1.5	14.5	2"	H-65	1	13.5	1.5"	40-240	1.5	13.5	1.5"
								H-53	.5	11.5	1.5"	50-40	.33	14.0	2"
								H-54	.75	11.5	2"		.75	11.5	2"
6014	.75	11.5	2"	1632	.75	13.5	2"	H-54	.75	11.5	2"	50-80	.75	11.5	2"
6019	1	14.0	2"	1634	1	13.5	2"	H-67	1	14.0	2"	50-160	1.5	14.0	2"
6020	1.5	14.0	2"	1634	1	13.5	2"	H-68	1.5	14.0	2"	50-160	1.5	14.0	2"
6021	2	14.0	2"					10603D	3	18.0	3"	50-240	2	14.0	2"
								105028	.5	11.5	2"	80-40	.5	19.0	3" ANSI
801	1.5	19.0	3" ANSI					10603D	1.5	18.0	3"	80-80	1.5	19.0	3" ANSI
802	3	19.0	3" ANSI					10603D	3	18.0	3"	80-160	3	19.0	3" ANSI
803	3	19.0	3" ANSI					10603D	3	18.0	3"	80-240	3	19.0	3" ANSI
								10603D	1	18.0	3"	100-40	1	21.0	4" ANSI
806	2	21.0	4" ANSI					10603D	2	18.0	3"	100-80	2	21.0	4" ANSI
807	3	21.0	4" ANSI					10603D	3	18.0	3"	100-160	3	21.0	4" ANSI

Features and benefits

Motor

The motor is a totally enclosed, fan-cooled standard motor with main dimensions to NEMA standards.

Mounting designation:	NEMA C FACE
Enclosure class:	TEFC; (ODP) optional
Insulation class:	F, B
Ambient temperature:	Max. 104 °F (40 °C).

Pump

In-line cast iron or bronze spiral pump housing.

Flange dimensions for USA are according to Industry and/or ANSI Standard.

The flanges have ¼" NPT pressure gauge tappings.

Tapped holes are provided on the underside of the pumps. These holes can be used for fitting the pump to a base plate, bracket or the like by means of hexagon screws. The pump housing is provided with a replaceable stainless steel/Teflon neck ring. The ring reduces to a minimum the amount of liquid running from the discharge side of the impeller to the suction side.

Surface treatment

The pump housing and the motor stool are electrocoated.
The treatment includes:

1. Alkaline cleaning.
2. Pre-treatment with zinc phosphate coating.
3. Cathodic electrocoating (epoxy).
   Coating thickness: 15-20 µm.
4. Curing of paint film at 392 - 482 °F (200-250 °C).

Motor stool

The motor stool forms connection between the pump housing and the motor, and is equipped with a manual air vent screw for venting of the pump housing and the shaft seal chamber. The sealing between motor stool and pump housing is either an O-ring or a flat gasket.

The central part of the motor stool is provided with guards for protection against shaft and coupling.

The dimensions of the motor side flange of the motor stool are according to NEMA.

Pump shaft

The shaft is a cylindrical Ø16 mm stainless steel shaft. The coupling end of the shaft has a hole for the coupling shaft pin.

Coupling

The coupling is a two-piece, inelastic sintered metal coupling secured with four hexagon socket head screws.

Impeller

The impeller is made of stainless steel, AISI 304 SS.

As the impeller is made of stainless steel sheet, it can be pressed into the correct hydraulic form.

Shaft seal

The pumps are fitted as standard with a single, unbalanced tungsten carbide/carbon rubber bellows shaft seal in a 16 mm diameter size with EPDM elastomer (BUBE). The tungsten carbide/carbon shaft seal has a wide range of applications and is especially suitable where there is a risk of dry running and in case of high temperatures.

The tungsten carbide/carbon shaft seal is not suitable for liquids containing abrasive particles, as the carbon parts will be worn down. In that case a tungsten carbide/ tungsten carbide seal is recommended.

Optional shaft seals available:

- unbalanced tungsten carbide/tungsten carbide O-ring shaft seal with EPDM elastomer (AUUE).

And for glycol/water mixtures:

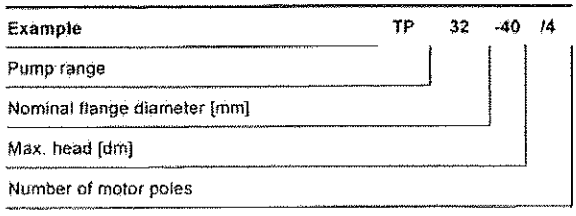


Unbalanced reduced face tungsten carbide/tungsten carbide O-ring shaft seal with EPDM elastomers (RUUE).

The circulation of liquid through the duct of the air vent screw ensures lubrication and cooling of the shaft seal.

Identification

Type key, TP



2. Product overview

Performance range, TP

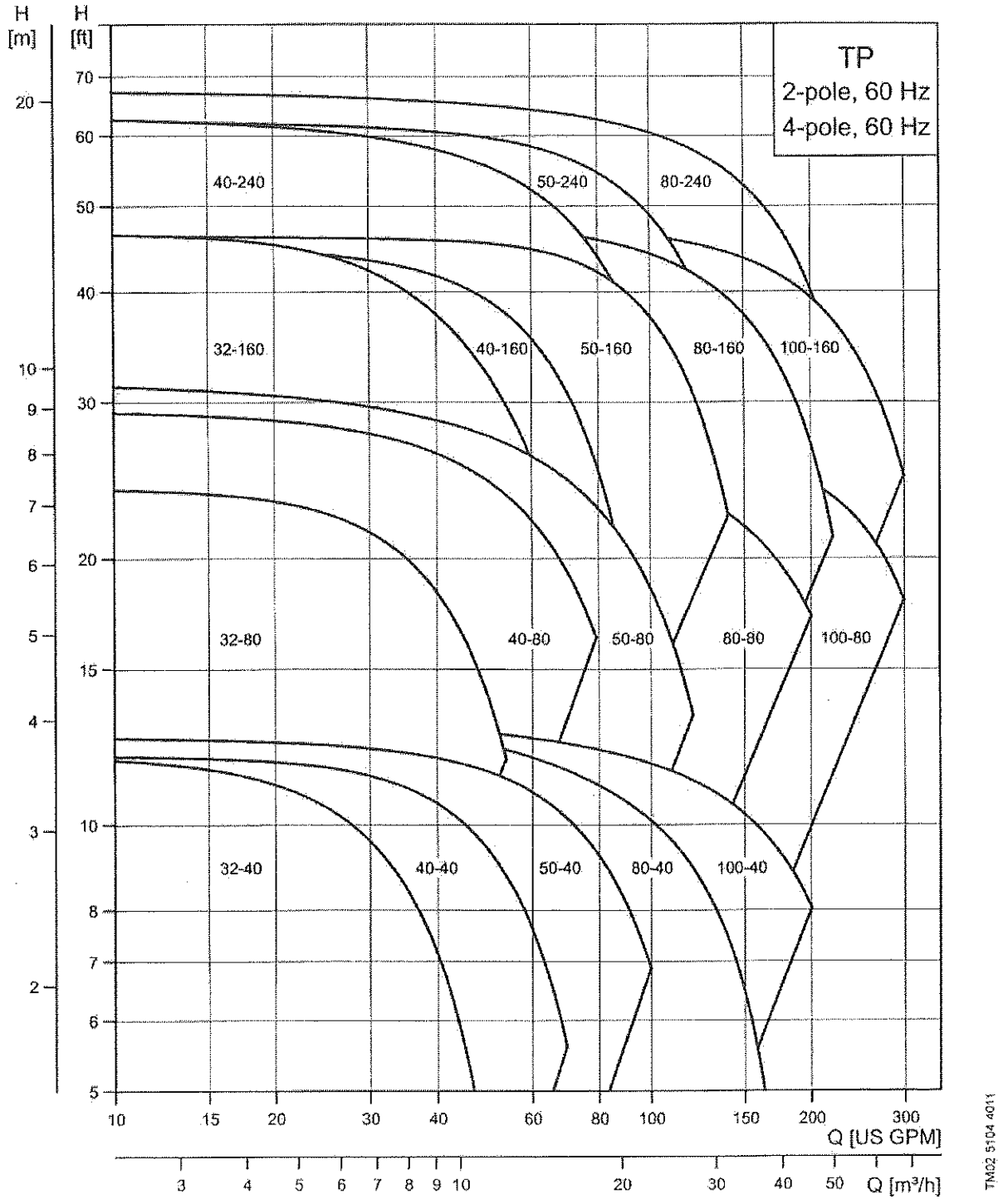


Fig. 2 Performance range, TP

Product range, TP

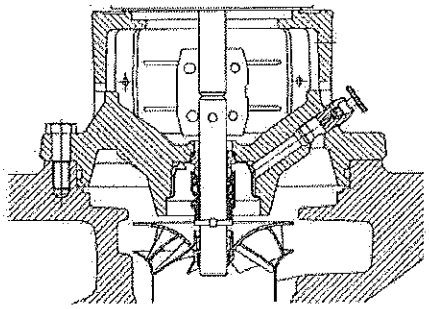
Pump type	Flow [gpm]	Head [ft]	Ph	Hp	Flange	Page
TP 32-40/4	8-50	3.5-12	1, 3	.33	1.25", 2 bolt, with .63" hole	14
TP 32-80/2	8-55	11-24	1, 3	.5	1.25", 2 bolt, with .63" hole	14
TP 32-160/2	8-70	18-47	1, 3	.75	1.5", 2 bolt, with .63" hole	14
TP 40-40/4	8-70	5-12	1, 3	.33	1.5", 2 bolt, with .63" hole	16
TP 40-80/2	8-80	16-29	1, 3	.75	1.5", 2 bolt, with .63" hole	16
TP 40-160/2	8-85	22-46	1, 3	.75	1.5", 2 bolt, with .63" hole	16
TP 40-240/2	8-100	33-63	1, 3	1.5	1.5", 2 bolt, with .63" hole	16
TP 50-40/4	8-100	7-13	1, 3	.33	2", 4 bolt with .56" hole	18
TP 50-80/2	8-120	14-32	1, 3	.75	2", 4 bolt with .56" hole	18
TP 50-160/2	8-140	22-47	1, 3	1.5	2", 4 bolt with .56" hole	18
TP 50-240/2	8-150	27-63	1, 3	2	2", 4 bolt with .56" hole	18
TP 80-40/4	12-170	4-14	1, 3	.5	3" ANSI 125lb RF	20
TP 80-80/4	12-200	17-28	1, 3	1.5	3" ANSI 125lb RF	20
TP 80-160/2	12-220	22-48	1, 3	3	3" ANSI 125lb RF	20
TP 80-240/2	12-240	26-67.5	1, 3	3	3" ANSI 125lb RF	20
TP 100-40/4	25-200	8-13.5	1, 3	1	4" ANSI 125lb RF	22
TP 100-80/4	25-300	18-28	1, 3	2	4" ANSI 125lb RF	22
TP 100-160/2	25-300	25-49	1, 3	3	4" ANSI 125lb RF	22

3. Construction

Construction, TP

The TP pump is a single-stage, in-line centrifugal pump with standard motor and mechanical shaft seal.

The pumps are of the top-pull-out design, i.e. pump head (motor, motor stool and impeller) can be removed without interfering with the pipework on either side of the pump housing. Consequently, service work on even the biggest pumps can be performed by a single person.



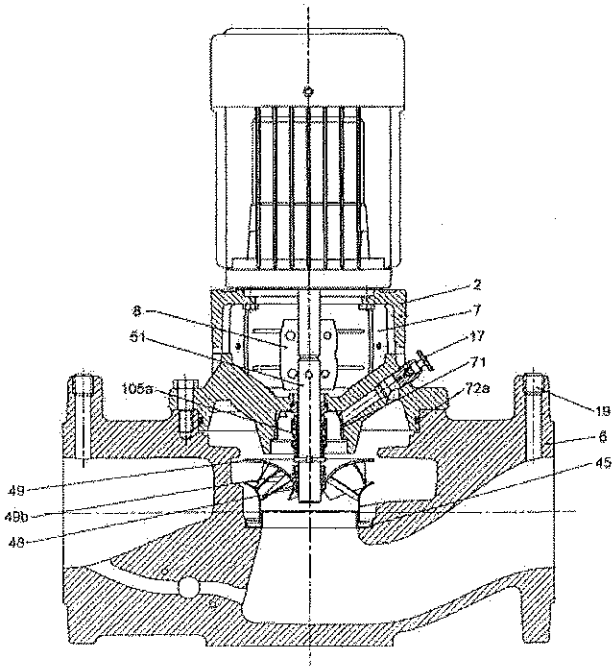
TM00 2265 4696

Fig. 3 Internal cross section, TP shaft and shaft seal

Material specification, TP

Pos.	Description	Materials	AISI, ASTM
2	Motor stool	Cast iron	
6	Pump housing	Cast iron	
7	Coupling guard	Stainless steel	304
8	Coupling	Sintered metal HPX PNC45	
17	Vent screw	Brass	
19	Pipe plug	Stainless steel	303
45	Neck ring	Stainless steel/ Teflon	
48	Split cone nut	Stainless steel	430F
49	Impeller	Stainless steel	304
49b	Split cone	Stainless steel	304
51	Shaft	Stainless steel	431
71	Distributing cup	Stainless steel	304
72a	O-ring/flat gasket	EPDM rubber	
105a	Shaft seal		

Sectional drawing, TP



TM01 0175 0697

Fig. 4 Sectional drawing, TP

4. Operating conditions

Operating conditions

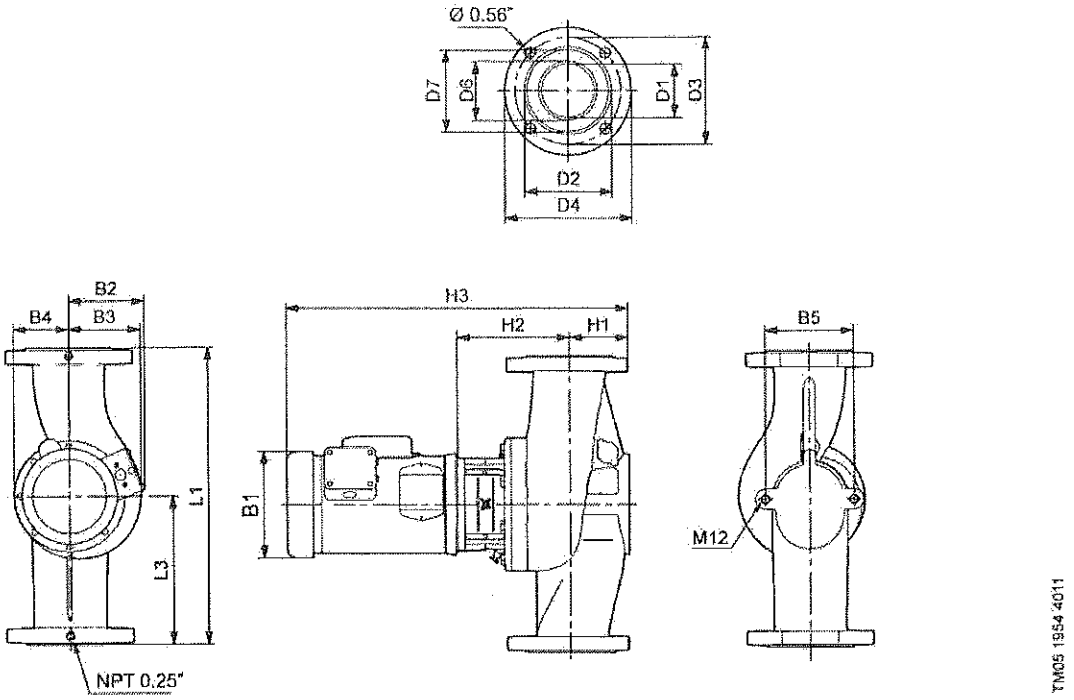
Relative humidity: Max. 95 %.
Max. working pressure: 145 psi (10 bar).

Liquid temperature

Liquid temperature:
–13 °F to +284 °F (–25 °C to +140 °C)

Please note that shaft seals operating close to their maximum temperature will require regular maintenance, i.e. replacement.

Pump type	Shaft seal	Temperature
TP	BUBE	32 °F to +284 °F (0 °C to +140 °C)
	AUUE	32 °F to +194 °F (0 °C to 90 °C)
	RUUE	–13 °F to +194 °F (–25 °C to +90 °C)



Dimensions and weights TP 50-XX

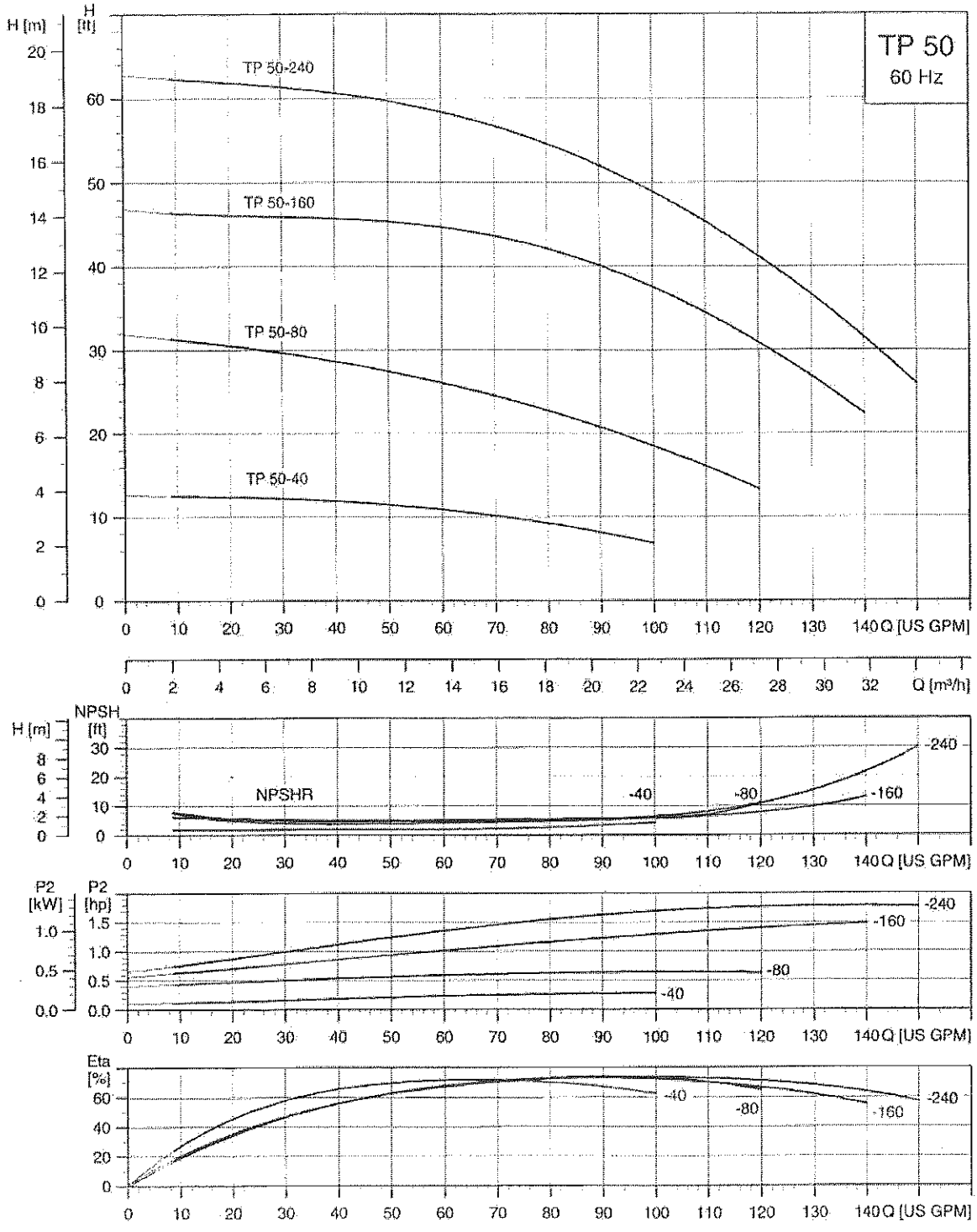
Pump type	Hp	Ph	Dimensions [inches (mm)]																Net weight [lbs]
			L1	L3	B1	B2	B3	B4	B5	H1	H2	H3	D1	D2	D3	D4	D6	D7	
TP 50-40/4	0.33	1	14 (356)	7 (178)	6.19 (157)	5.19 (132)	3.55 (90)	3 (76)	4.72 (120)	3.23 (82)	6.20 (157)	18.72 (475)	2.09 (53)	3.39 (86)	4.06 (103)	5.25 (133)	2.5 (64)	3.06 (78)	54
	0.33	3	14 (356)	7 (178)	6.19 (157)	5.19 (132)	3.56 (90)	3 (76)	4.72 (120)	3.23 (82)	6.20 (157)	18.72 (475)	2.09 (53)	3.39 (86)	4.06 (103)	5.25 (133)	2.5 (64)	3.06 (78)	53
TP 50-80/2	0.75	1	11.5 (292)	5.75 (146)	6.19 (157)	5.19 (132)	3.75 (95)	3 (76)	4.72 (120)	2.95 (75)	6.26 (159)	18.50 (470)	2.09 (53)	3.46 (88)	4.06 (103)	5.25 (133)	2.5 (64)	3.06 (78)	58
	0.75	3	11.5 (292)	5.75 (146)	5.55 (141)	4.57 (116)	3.75 (95)	3 (76)	4.72 (120)	2.95 (75)	6.26 (159)	16.65 (423)	2.09 (53)	3.46 (88)	4.06 (103)	5.25 (133)	2.5 (64)	3.06 (78)	57
TP 50-160/2	1.5	1	14 (356)	7 (178)	7.19 (183)	5.74 (146)	4 (102)	4 (102)	4.72 (120)	2.95 (75)	5.83 (148)	20.46 (520)	2.09 (53)	3.46 (88)	4.06 (103)	5.25 (133)	2.5 (64)	3.06 (78)	67
	1.5	3	14 (356)	7 (178)	5.55 (141)	4.57 (116)	4 (102)	4 (102)	4.72 (120)	2.95 (75)	5.83 (148)	17.40 (442)	2.09 (53)	3.46 (88)	4.06 (103)	5.25 (133)	2.5 (64)	3.06 (78)	66
TP 50-240/2	2	1	14 (356)	7 (178)	7.19 (183)	5.74 (146)	4 (102)	4 (102)	4.72 (120)	2.95 (75)	5.83 (148)	21.34 (542)	2.09 (53)	3.46 (88)	4.06 (103)	5.25 (133)	2.5 (64)	3.06 (78)	71
	2	3	14 (356)	7 (178)	7.01 (178)	4.33 (110)	4 (102)	4 (102)	4.72 (120)	2.95 (75)	5.83 (148)	20.00 (508)	2.09 (53)	3.46 (88)	4.06 (103)	5.25 (133)	2.5 (64)	3.06 (78)	70

Note: For information about motor data, see page 25.

Technical data

Flow range:	8-150 U.S. gpm
Head range:	7-63 ft
Maximum working pressure:	145 psi (10 bar)
Temperature range:	5 °F (–15 °C) to 284 °F (140 °C)
Max ambient air temperature:	104 °F (40 °C)
Motors:	TEFC-Standard, ODP-Optional
Flanges:	2" 4 bolt with (4) .56" dia. holes

TP 50-XX



TK00 9227 1697

CHLORINE INJECTION PUMP

SMART Digital

DDA, DDC, DDE

DIGITAL DOSING

pumps and accessories



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1. General data

Performance range

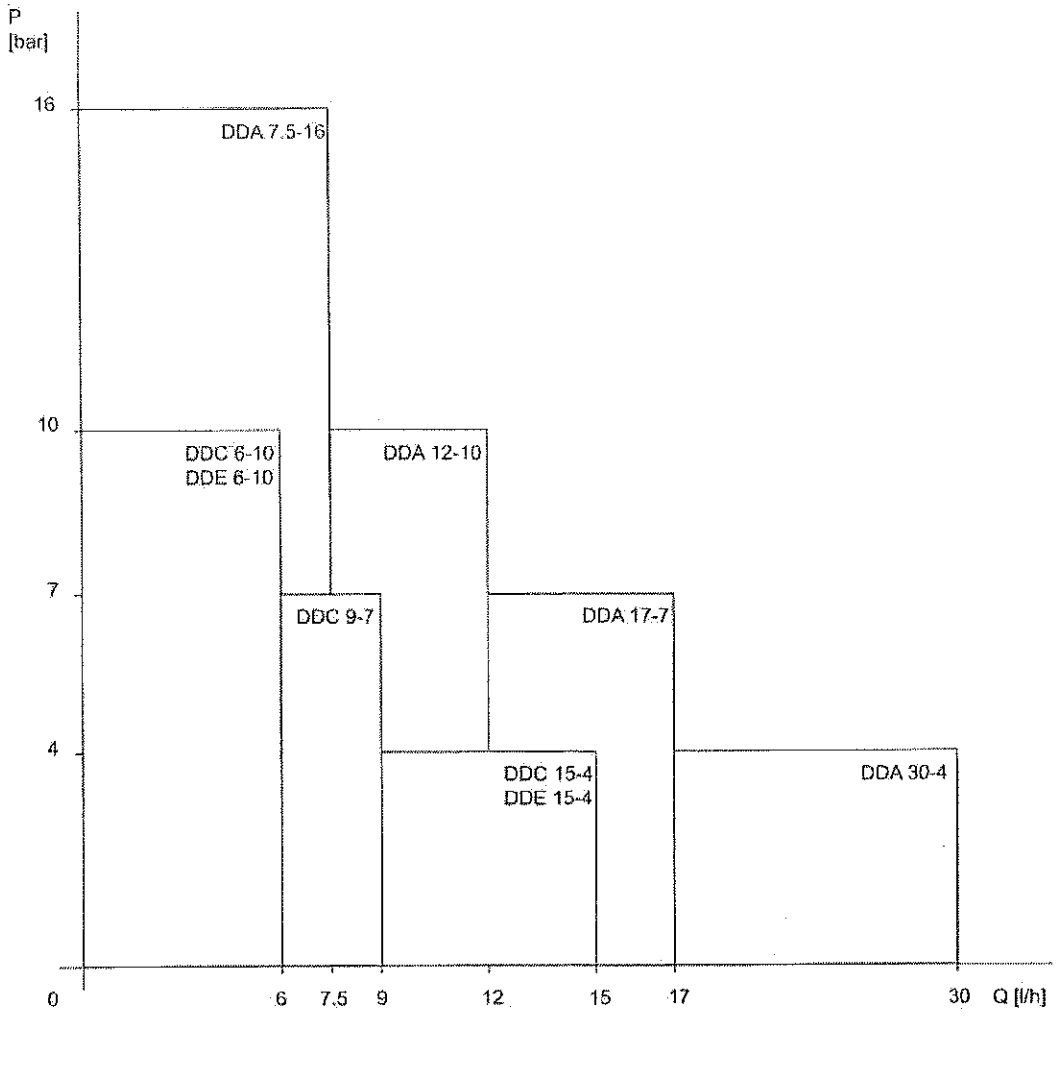
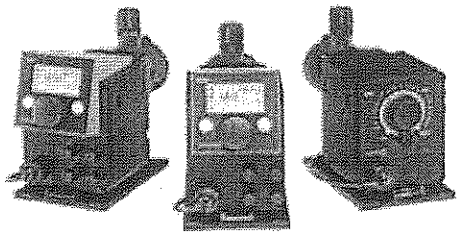


Fig. 1 Performance range

Features at a glance



TM04 1635 2110

Fig. 2 DDA, DDC, DDE

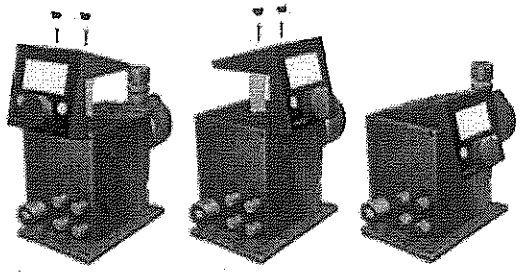
Digital Dosing™

The SMART Digital generation DDA, DDC and DDE with powerful variable-speed stepper motor brings state-of-the-art technology to perfection.
Combined expert knowledge and the new patented solutions set future standards. Traditional technologies such as stroke length / stroke frequency adjustment with synchronous motor or solenoid drive become a thing of the past.

Unique flexibility with only a few variants

The included click-stop mounting plate makes the new pump more flexible. Three different positions are possible without using any additional accessories, such as wall brackets. Service and pump exchange can now be done easily and fast just by clicking the pump in and out of the mounting plate.

The control cube on the DDA and DDC pump can be lifted and turned easily into three different positions: front, left or right.



TM04 1652 2610

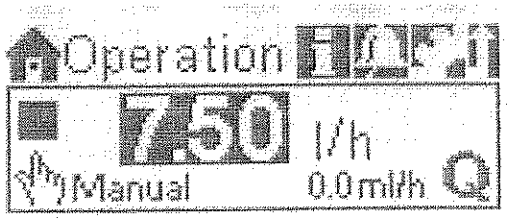
Fig. 3 Modularity of the control cube

A turn-down ratio of up to 1:3000, a wide supply voltage range (100-240 V; 50/60 Hz), combined connection sets and other features reduce the models and variants to a minimum.

Precise and easy setting / usability and interaction

The operator can easily install the pump and set it to discharge exactly the quantity of dosing liquid required for the application. In the display, the setting of the pump is read out directly, the flow is shown in ml/h, l/h, or gph.

The click wheel (turn-and-push knob) and the graphical LC display with plain-text menu in more than 20 languages make commissioning and operation intuitive. As the LCD is backlit in different colours, the pump status can be seen from a distance (traffic-light concept).



TM04 1651 2610

Fig. 4 Display DDA, DDC

Thanks to a variety of operation modes, signal inputs and outputs, the pump can easily be integrated into every process.

Advanced process reliability

An intelligent drive and microprocessor control ensures that dosing is performed precisely and with low pulsation, even if the pump is dosing high-viscosity or degassing liquids. Malfunctions, caused e.g. by air bubbles, are detected quickly by the maintenance-free FlowControl system and then displayed in the alarm menu. The AutoFlowAdapt function automatically adjusts the pump according to the process conditions, e.g. varying backpressure. The integrated flow measurement makes additional monitoring and control equipment redundant.

Designed to save costs

In general, the investment for a dosing pump installation is low compared to its life cycle costs including the cost of the chemicals. The following features make the SMART Digital DDA, DDC and DDE pumps contribute to low life cycle costs:

- No underdosing or overdosing due to high dosing accuracy and FlowControl
- Longer maintenance intervals thanks to the universal chemical resistance of the full-PTFE diaphragm
- Reduced energy consumption thanks to state-of-the-art drive technology.

Three application-oriented type ranges

DDA: High-end pump range for extended flow and pressure ranges with sensor-based FlowControl and measurement functions for challenging industrial applications, e.g.

- Process water
- Food and beverage
- Ultrafiltration and reverse osmosis
- Pulp and paper
- Boiler feed water
- CIP (Clean-In-Place).

DDC: User-friendly pump range with standard inputs and outputs for common applications, e.g.

- Drinking water
- Waste water
- Swimming pool water
- Cooling tower
- Chemical industry.

DDE: Low-budget pump range with basic functions including manual operation or control via PLC for OEM applications, e.g.

- Car wash
- Irrigation.

2. Identification

Type key

Example: DDA 7.5- 16 AR- PP /V /C -F -3 1 U2U2 F G

Type range

DDE
DDC
DDA

Maximum flow [l/h]

Maximum pressure [bar]

Control variant

B	Basic (DDE)
P	B with pulse mode (DDE)
A	Standard (DDC)
AR	A with alarm relay and analog input
FC	AR with FlowControl (DDA)
FCM	FC with flow measurement (DDA)

Dosing head variant

PP	Polypropylene
PVC	Polyvinyl chloride**
PV	PVDF (polyvinylidene fluoride)
SS	Stainless steel 1.4401

Gasket material

E	EPDM
V	FKM
T	PTFE

Valve ball material

C	Ceramic
SS	Stainless steel 1.4401

Control cube position

F	Front-mounted (change to left and right possible)
X	No control cube (DDE)

Supply voltage

3	1 x 100-240 V, 50/60 Hz
1	24-48 VDC (DDC)***

Valve type

1	Standard
2	Spring-loaded 0.1 bar suction opening pressure 0.1 bar discharge opening pressure

Installation set*

I001	Hose 4/6 mm (up to 7.5 l/h, 13 bar)
I002	Hose 9/12 mm (up to 60 l/h, 9 bar)
I003	Hose 0.17" x 1/4" (up to 7.5 l/h, 13 bar)
I004	Hose 3/8" x 1/2" (up to 60 l/h, 10 bar)

Connection, suction/discharge

U2U2	Hose 4/6 mm, 6/9 mm, 6/12 mm, 9/12 mm
U7U7	Hose 0.17" x 1/4"; 1/4" x 3/8"; 3/8" x 1/2"
AA	Threaded, Rp 1/4", female (SS)
VV	Threaded, NPT 1/4", female (SS)
XX	No connection

Mains plug

F	EU
B	USA, Canada
G	UK
I	Australia, New Zealand, Taiwan
E	Switzerland
J	Japan
L	Argentina
X	No plug (only 24-48 VDC)***

Design

G	Grundfos Alldos

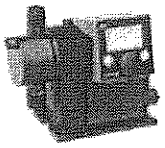
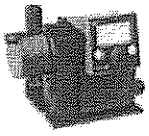
* Including 2 pump connections, foot valve, injection unit, 6 m PE discharge hose, 2 m PVC suction hose, 2 m PVC deaeration hose (4/6 mm)

** PVC dosing heads only up to 10 bar

*** Planned for 09/2011

3. Functions

Overview of functions

	DDA			DDC		DDE	
	 TM04 1636 2110			 TM04 1637 2110		 TM04 1638 2110	
Control variant:	**FCM**	**FC**	**AR**	**AR**	**A**	**P**	**B**
General							
Digital Dosing: Internal stroke speed and frequency control	●	●	●	●	●	●	●
Mounting plate (basic/wall mounting)	●	●	●	●	●	●	●
Control panel, see page 9							
Control cube mountable in three positions: front, left, right	●	●	●	●	●		
Control panel position: front-fitted						●	●
Transparent protective cover for control elements	●	●	●	●	●		
Capacity setting in millilitres, litres or US-gallons	●	●	●	●	●		
Graphical display with background light in four colours for status indication: white, green, yellow, red	●	●	●	●	●		
Plain-text menu in different languages	●	●	●	●	●		
Turn-and-push knob (click wheel) for easy navigation	●	●	●	●	●		
Capacity adjustment knob (0.1 - 100 %)						●	●
Start/Stop key	●	●	●	●	●		
100 % key (deaeration)	●	●	●	●	●	●	
Operation mode switch (manual/pulse)						●	
Operation modes, see page 11							
Manual speed control	●	●	●	●	●	●	●
Pulse control in ml/pulse	●	●	●	●	●		
Pulse control (1:n)						●	
Analog control 0/4-20 mA	●	●	●	●			
Batch control (pulse-based)	●	●	●				
Dosing timer cycle	●	●	●				
Dosing timer week	●	●	●				
Fieldbus control	●	●	●				
Functions, see page 13							
Auto deaeration also during pump standby	●	●	●				
FlowControl system with selective fault diagnosis	●	●					
Pressure monitoring (min/max)	●	●					
Flow measurement	●						
AutoFlowAdapt	●						
SlowMode (anti-cavitation)	●	●	●	●	●		
Calibration mode	●	●	●	●	●		
Scaling of analog input	●	●	●				
Service information display	●	●	●	●	●		
Relay setting: alarm, warning, stroke signal, pump dosing	●	●	●	●			
Relay setting (additionally): timer cycle, timer week	●	●	●				
Inputs/outputs, see page 14							
Input for external stop	●	●	●	●	●	●	
Input for pulse control	●	●	●	●	●	●	
Input for analog 0/4-20 mA control	●	●	●	●			
Input for low-level signal	●	●	●	●	●		
Input for empty tank signal	●	●	●	●	●	●	
Output relay (2 relays)	●	●	●	●			
Output analog 0/4-20 mA	●	●	●				
Input/Output for GeniBus*	●	●	●				
Input/Output for E-box (Profibus DP or additional alarm relays)*	●	●	●				

* Planned for 09/2011

Functional description

The electronically controlled variable-speed motor (stepper motor) of the DDA, DDC and DDE pumps provides optimum control of the stroke speed. The duration of each discharge stroke varies according to the capacity set, resulting in optimum discharge flow in any operating situation, while the duration of each suction stroke is constant (see figure below).

The advantages are as follows:

- The pump always operates at full stroke length, irrespective of the capacity set; this ensures optimum accuracy, priming and suction.
- A capacity range of up to 1:3000 (turndown ratio) reduces variants and spare parts.
- Smooth and continuous dosing ensuring an optimum mixing ratio at the injection point without needing static mixers.
- Significant reduction of pressure peaks, preventing mechanical stress on wearing parts such as diaphragm, tubes, connections, resulting in extended maintenance intervals.
- The installation is less affected by long suction and discharge lines.
- Easier dosing of high-viscosity and degassing liquids (SlowMode).

The optimum dosing control shown below takes place in any operation mode.

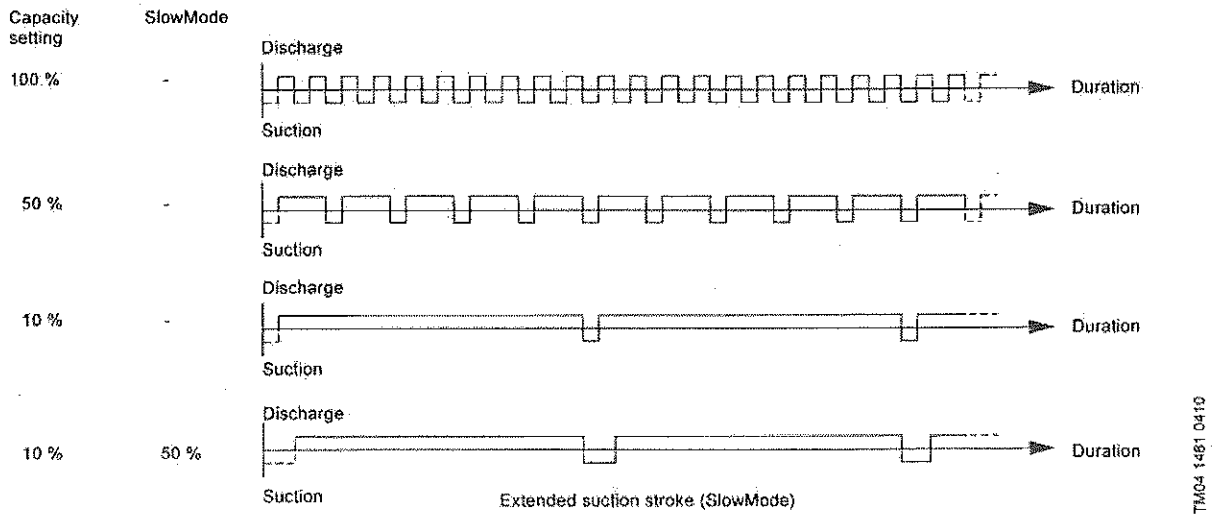
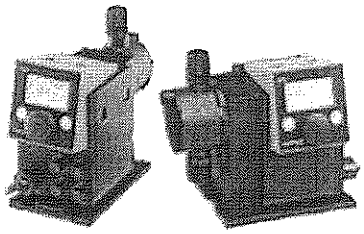


Fig. 5 Relation between stroke-frequency adjustment and capacity

Control cube DDA and DDC

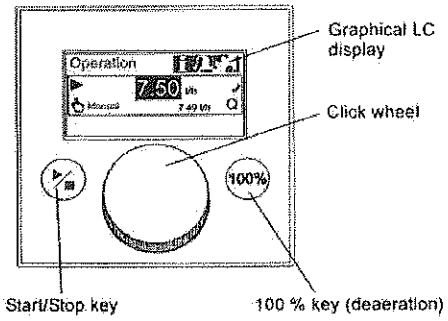
DDA and DDC pumps are supplied with front-mounted control cube. The position of the control cube can easily be changed by unfastening 2 screws, lifting the cube, turning it to the left or to the right and fastening both screws again.



TM04 1639 2110

Fig. 6 Two of three possible control cube positions: at the front or at the left or at the right of the pump

Operating elements DDA and DDC



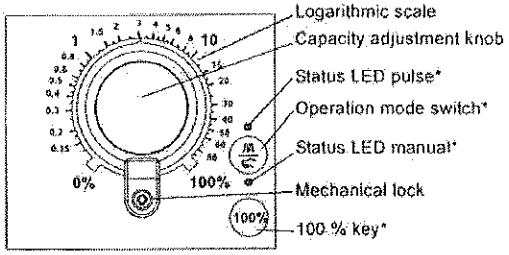
TM04 1104 2010

Fig. 7 Operating elements DDA and DDC

The click wheel guides the user quickly and easily through the plain-text menu.

If the maximum capacity is required over a short period of time, for example during start-up, press the 100 % key. To set the pump to run for a specific number of seconds at maximum capacity, press the 100 % key and turn the click wheel clockwise simultaneously.

Operating elements DDE



TM04 1530 0910

Fig. 8 Operating elements DDE

With the capacity adjustment knob the capacity of the pump can easily be adjusted in % of the maximum flow.

** Applies to DDE-P*

When holding down the operation mode switch, the pump changes from manual operation to pulse mode or vice versa.

If the maximum capacity is required over a short period of time, for example during start-up, press the 100 % key.

Depending on the selected operation mode, the respective status LED (pulse or manual) is activated according to the following table:

LED colour	Pump status
Green (flashing)	Stopped
Green	Running
Yellow	External Stopped
Red	Empty tank (alarm)
Red (flashing)	Motor blocked (alarm)

Menu

The DDA and DDC dosing pumps feature a user-friendly plain-text menu. The menu consists of 4 tabs: Operation; Info; Alarm; Setup. During initial start-up, all menu text appears in the English language. The menu can be set to display other languages.

This example applies to DDA pumps:

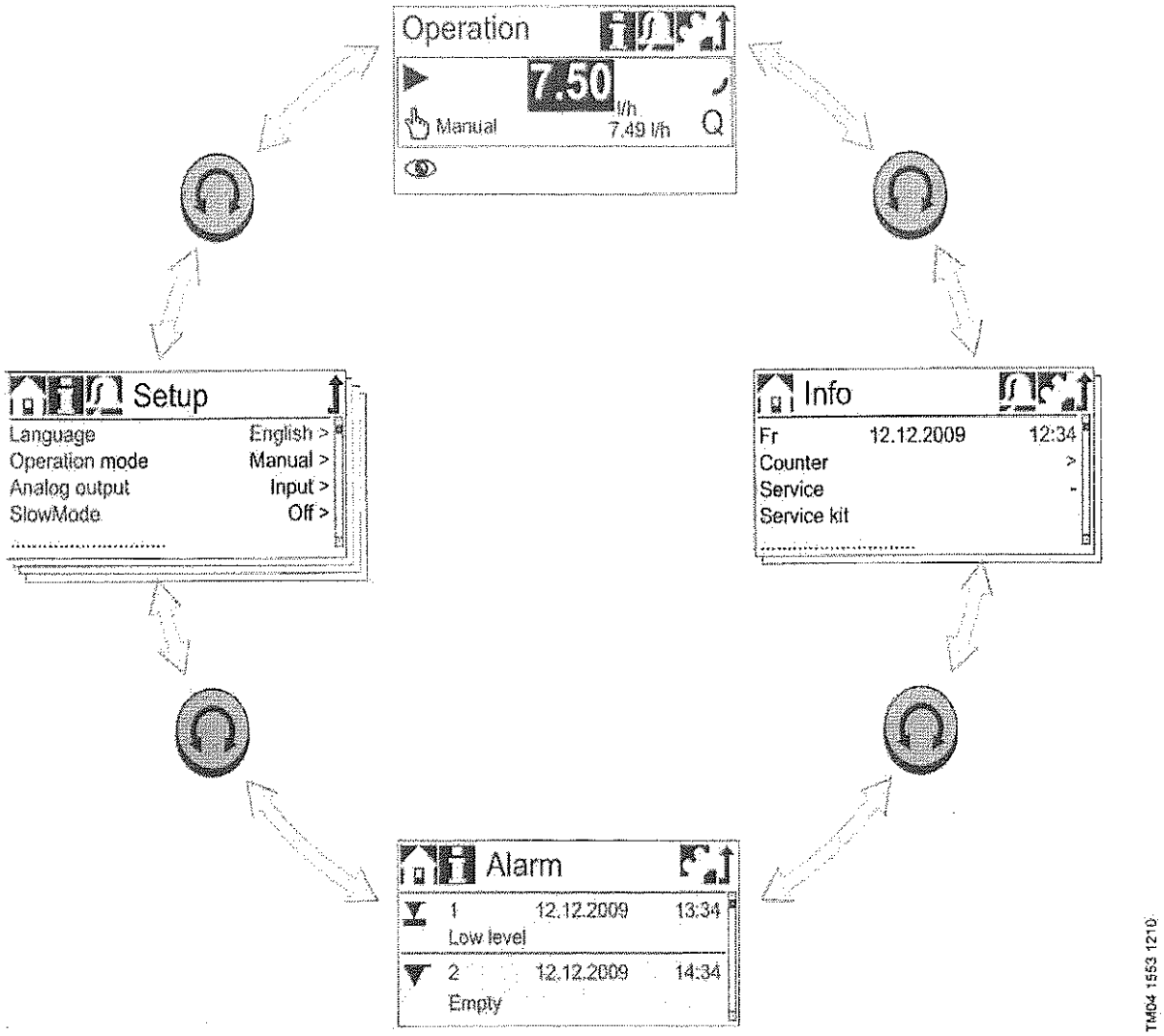


Fig. 9 Menu overview (example of main menus)

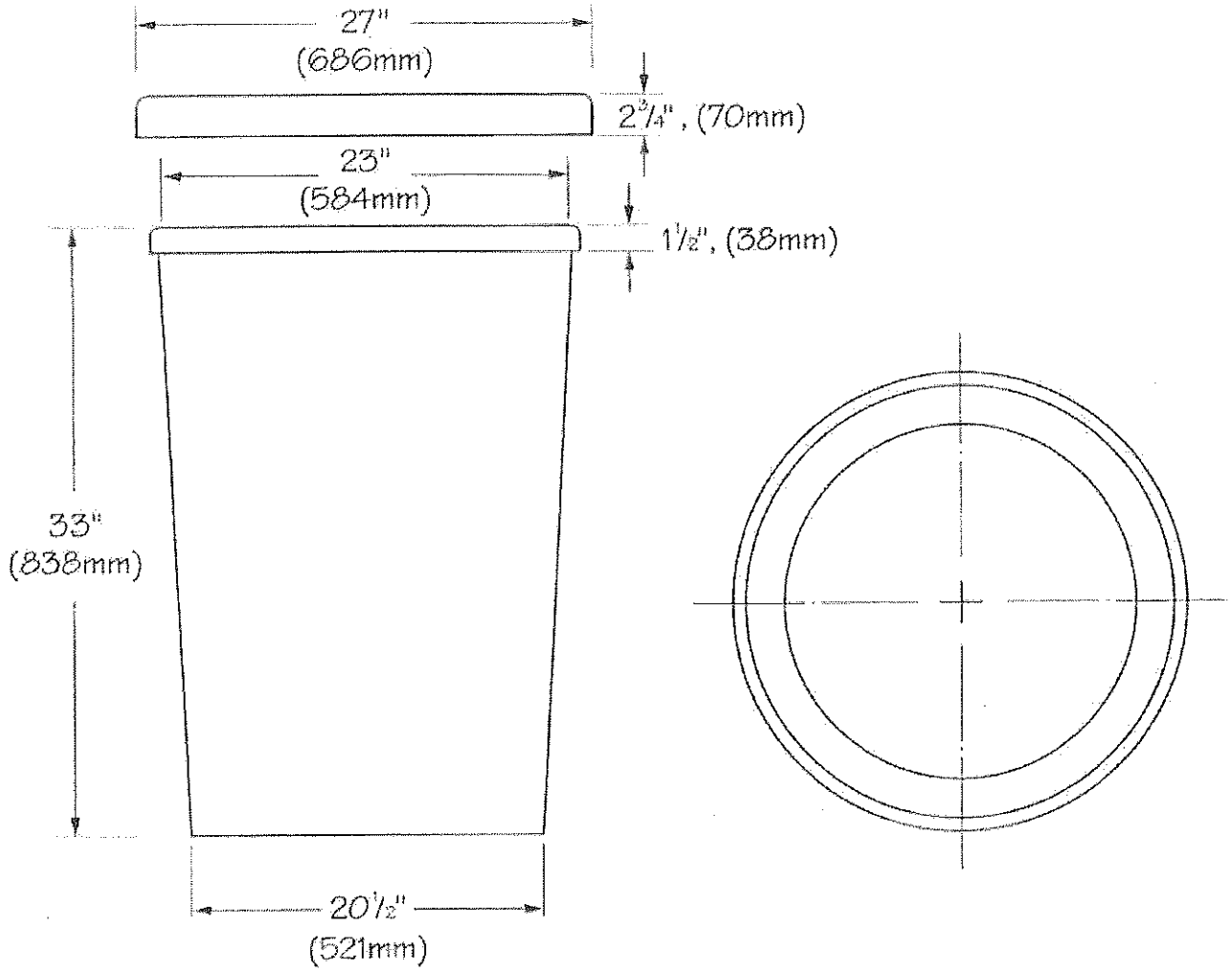
The menu text appears in up to 29 languages on a big graphical display, backlit in four different colours according to the traffic light concept.

Display	Fault	Pump status
White	-	Stop ■ Standby ‖
Green	-	Running ▶
Yellow	Warning	Stop ■ Standby ‖ Running ▶
Red	Alarm	Stop ■ Standby ‖

Division 23

Chlorine Injection Tank

Make:	Pace Chemicals
Model:	Polyethylene
Capacity:	205 Litre
Serial #:	N/A



©1996 PACE CHEMICALS LTD.

Material of Construction:

Virgin, Medium Density Polyethylene.

Note: *Dimensions may differ by up to ¼", (6mm) depending on shrinkage during production.*

POLYETHYLENE TANK, 205 LITRE
- SPECIFICATIONS

Date: June 28, 1996 Version:

Scale: N.T.S. Drawn by: JM

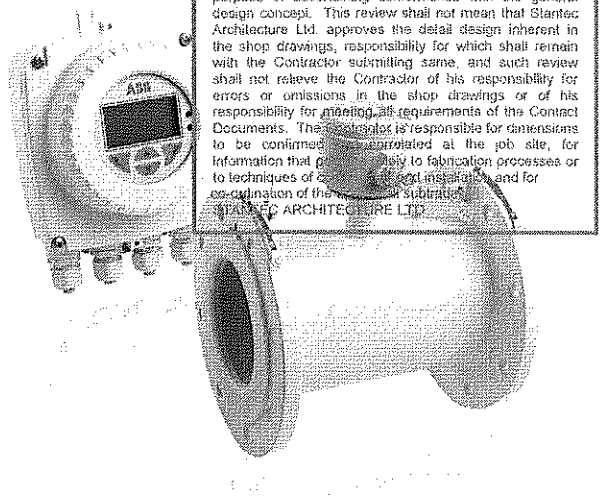
PACE CHEMICALS LTD., Burnaby, B.C.

Data sheet DS/WM-EN Rev. K

WaterMaster
Electromagnetic flowmeter

Stantec
☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
Jul. 31, 2014
Stantec Project #: 144901252_08-12
By: _____
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for co-ordination of the work of all subtrades.
STANTEC ARCHITECTURE LTD.

The perfect fit for all water industry applications



CMS
Central Mechanical Systems
Shop Drawing Review
July 30th, 2014

By: JM
☑ Original Submission
☐ Resubmission
Section: 13 50 10

The most stable transmitter in the world
— self-calibrating transmitter and ultra-low temperature coefficient for highest accuracy

One solution for all your needs
— designed for use in all water and waste water applications, from sewage plants to distribution networks

Quick transmitter exchange
— revolutionary data storage enables transmitter interchange and commissioning without the need for reconfiguration

Advanced infrared service port
— supports simultaneous and parallel operation of HART, remote HMI, cyclic data output and parameter dump

OIML R49 and MID Approved
— Type approved to OIML R49 to accuracy Class 1 and Class 2, for any pipe orientation and bidirectional flow

Compatible with ABB's full range of industry-leading flow sensors
— reduced-bore FER series for high turn-down applications, for example, leakage detection
— full-bore FEF series for general-purpose water metering applications
— optimized (virtual) full-bore FEV series for optimum turndown / low pressure-drop, irrigation applications
— all sensors are buriable, eliminating the need for costly chamber construction – a significant site preparation saving

OIML R49 permanent self-checking
— Type P approved
— continuous self checking of the sensor and transmitter to ensure the highest accuracy and long term performance

VeriMaster in situ verification software option
— allows the customer to perform in situ verification at the flowmeter

Flexible bus options
— Profibus DP and MODBUS for full system and PLC integration

REVIEWED
By Sarah Fox at 7:30 am, Jul 31, 2014

Power and productivity for a better world™ ABB

The Company

ABB is an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a world leader in process automation technology our worldwide presence, comprehensive service and application-oriented know-how make ABB a leading supplier of flow measurement products.

Introduction

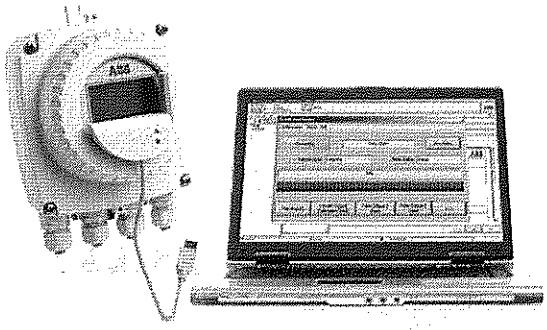
Setting the standard for the Water Industry

The WaterMaster range, available in sizes 10 to 2400 mm (3/8 to 96 in.), is designed specifically for use on the many diverse applications encountered in the Water and Waste-water industry. The modular design concept offers flexibility, cost-saving operation and reliability while providing a long service life and exceptionally low maintenance.

Integration into ABB asset management systems and use of the self-monitoring and diagnostic functions increase the plant availability and reduce downtimes.

VeriMaster – the verification tool

An easy-to-use utility, available through the infra red service port, it uses the advanced self-calibration and diagnostic capability of WaterMaster, coupled with fingerprinting technology, to determine the accuracy status of the WaterMaster flowmeter to within ±1 % of its original factory calibration. VeriMaster also supports printing of calibration verification records for regulatory compliance.



Diagnostic functions

Using its diagnostic functions, the flowmeter monitors both its own operability and the process. Limit values for the diagnostic parameters can be set locally. When these limits are exceeded, an alarm is tripped. In the event of an error, diagnostic-dependent help text appears on the display and this considerably simplifies and accelerates the troubleshooting procedure.

In accordance with NAMUR NE107, alarms and warnings are classified with the status of 'Maintenance Required', 'Check Function', 'Failure' and 'Out of Specification'.

Flow performance

Utilizing its advanced filtering methods, the WaterMaster improves accuracy even under difficult conditions. WaterMaster has an operating flow range with ±0.4 % accuracy as standard (±0.2 % optional) in both forward and reverse flow directions.

Easy and quick commissioning

'Fit-and-Flow' data storage inside WaterMaster eliminates the need to match sensor and transmitter in the field. On initial installation, the self-configuration sequence automatically replicates into the transmitter all calibration factors, meter size and serial numbers, as well as customer site-specific settings, eliminating the potential for error.

Intuitive, convenient navigation

The 'Easy Setup' function reliably guides unpracticed users through the menu step by step. The smart key based functionality makes handling a breeze – it's just like using a cell phone. During configuration, the permissible range of each parameter is indicated on the display and invalid entries are rejected.

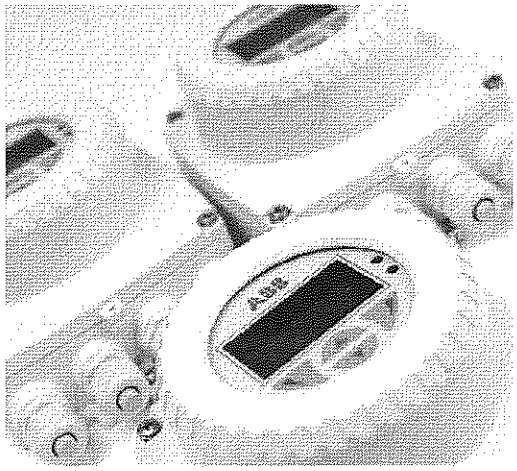
Universal transmitter – powerful and flexible

The backlit display can be rotated easily without the need for tools. The contrast is adjustable and the display fully-configurable. The character size, number of lines and display resolution (number of decimal points) can be set as required. In multiplex mode, several different display options can be pre-configured and invoked one after the other.

The smart modular design of the transmitter unit enables easy disassembly without the need to unscrew cables or unplug connectors. HART is used as the standard communications protocol. Optionally, the transmitter is available with PROFIBUS DP or MODBUS communication.

Assured quality

WaterMaster is designed and manufactured in accordance with international quality procedures (ISO 9001) and all flowmeters are calibrated on nationally-traceable calibration rigs to provide the end-user with complete assurance of both quality and performance of the flowmeter.



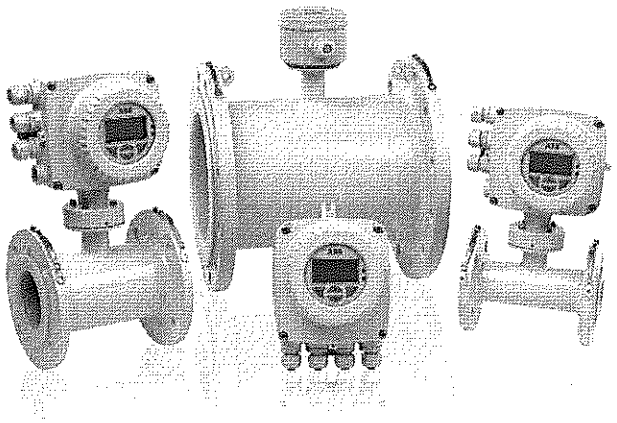
WaterMaster – always the first choice

WaterMaster sets the standard for the water industry. The specification, features and user benefits offered by this range are based on ABB's worldwide experience in this industry and they are all targeted specifically to the industry's requirements.

Submersible and buriable

WaterMaster sensors have a rugged, robust construction to ensure a long, maintenance-free life under the arduous conditions experienced in the Water and Waste Industry. The sensors are, as standard, inherently submersible (IP68, NEMA 6P), thus ensuring suitability for installation in chambers and metering pits that are susceptible to flooding.

A unique feature of the WaterMaster sensors is that sizes DN40 to DN2400 (1½ to 96 in. NB) are buriable; installation simply involves excavating to the underground pipe, fitting the sensor, cabling back to the transmitter and then backfilling the hole.

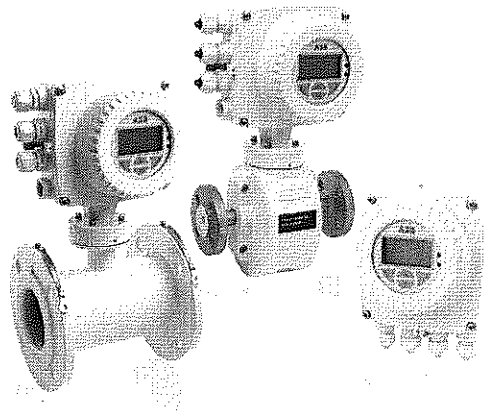


The WaterMaster family

Overview of the WaterMaster

A wide range of features and user benefits are built into WaterMaster as standard:

- bi-directional flow
- unique self-calibrating transmitter (patented) for the ultimate in stability and repeatability
- OIML-type continuous self-checking, with alarms, ensures both sensor and transmitter accuracy
- true electrode and coil impedance measurement
- comprehensive simulation mode
- universal switch-mode power supply (options are available for AC and DC supplies)
- comprehensive self-diagnostics compliant with NAMUR NE107
- programmable multiple-alarm capability
- bus options: HART (4 to 20 mA), PROFIBUS DP (RS485), MODBUS (RS485)
- 3 configurable pulse / frequency and alarm outputs
- advanced infrared service port supports remote HMI, HART, cyclic data out and parameter download
- VeriMaster in situ verification software available as option
- read-only switch and ultra-secure service password for total security



OIML / MID approved

WaterMaster has been type tested and internationally approved to the highest accuracy class 1 and 2 for cold and hot potable water meters – OIML R49-1 (Organisation Internationale de Métrologie Légale). For full details, OIML R49 is available to download from www.oiml.org. Its requirements are very similar to other International standards, such as EN14154 and ISO4064.

WaterMaster has been assessed by type approval at the National Measurement Office (NMO) to OIML R49 and passed to the very highest accuracy designations for sizes DN40 to DN200 (1½ to 8 in. NB).

The approval is for:

- Class 1 and Class 2 accuracy (calibration option)
- Environmental class T50 for water temperatures of 0.1 to 50 °C (32.18 to 122 °F)
- Electromagnetic Environment E2 (10 V/m)
- Any pipe orientation
- 5 Diameters upstream pipe
- 0 Diameters downstream pipe
- Pressure Loss Class <0.25 bar (3.62 psi)
- Integral or remote transmitter (<200 m [<656 ft.] cable)
- DN40 to DN200 (1½ to 8 in. NB), bi-directional flow

A major advance in WaterMaster is the self-checking capabilities that meet and exceed the R49 requirements and is the first electromagnetic flowmeter to be approved to OIML Type P permanent self checking during normal operation (not just at startup) and alarm indication for:

- transmitter and sensor status, with an accuracy alarm
- program ROM and RAM status
- double, independent storage of totalizer values, in both the sensor and transmitter non-volatile memories
- display test

The OIML R49-1 certificate of conformity is available from:

http://www.abb.com/product/seitp330/b42ec2377d3293cdc12573de003db93b.aspx

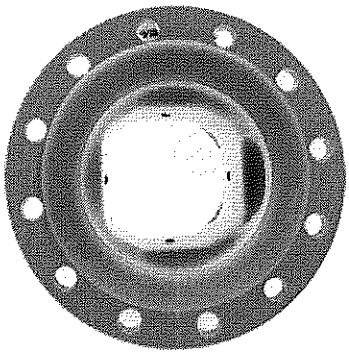
WaterMaster is also approved under the EU Measuring Instruments Directive (MID) 2004/22/EC, that covers putting into use water flowmeters for certain applications. MID WaterMaster is secured against tamping and is available as an option, along with fingerprinting for ABB VeriMaster in situ verification product, with certificate printout to ±1 % accuracy.

WaterMaster certificates of EC type-examination of a measuring instrument are available from:

http://www.abb.com/product/seitp330/b42ec2377d3293cdc12573de003db93b.aspx

Superior control through advanced sensor design

The innovative, patented octagonal sensor design improves flow profile and reduces up- and down-stream piping requirements for the most commonly used sizes of 40 to 200 mm (1½ to 8 in.). This optimized full bore meter provides impressive results in the most difficult of installation requirements.

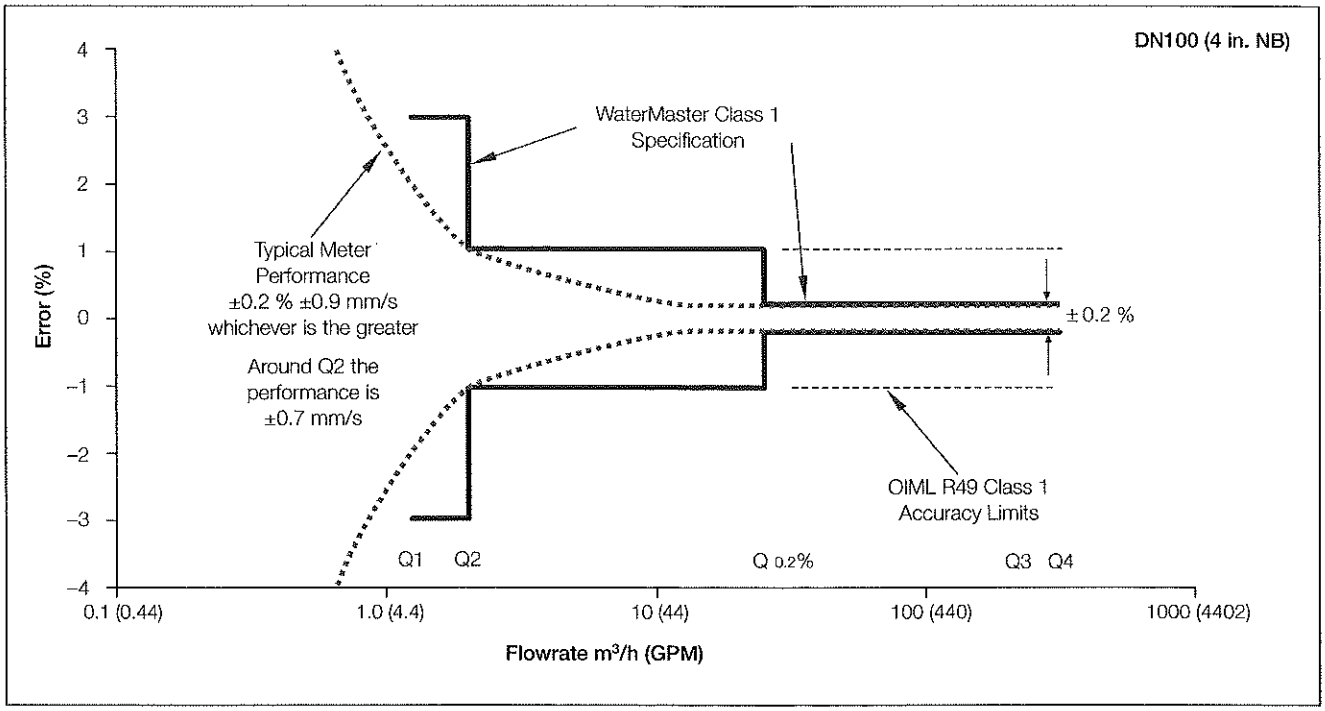


WaterMaster sensors are also available in reduced-bore geometries giving the ultimate in low-flow performance with a very high turn-down range.

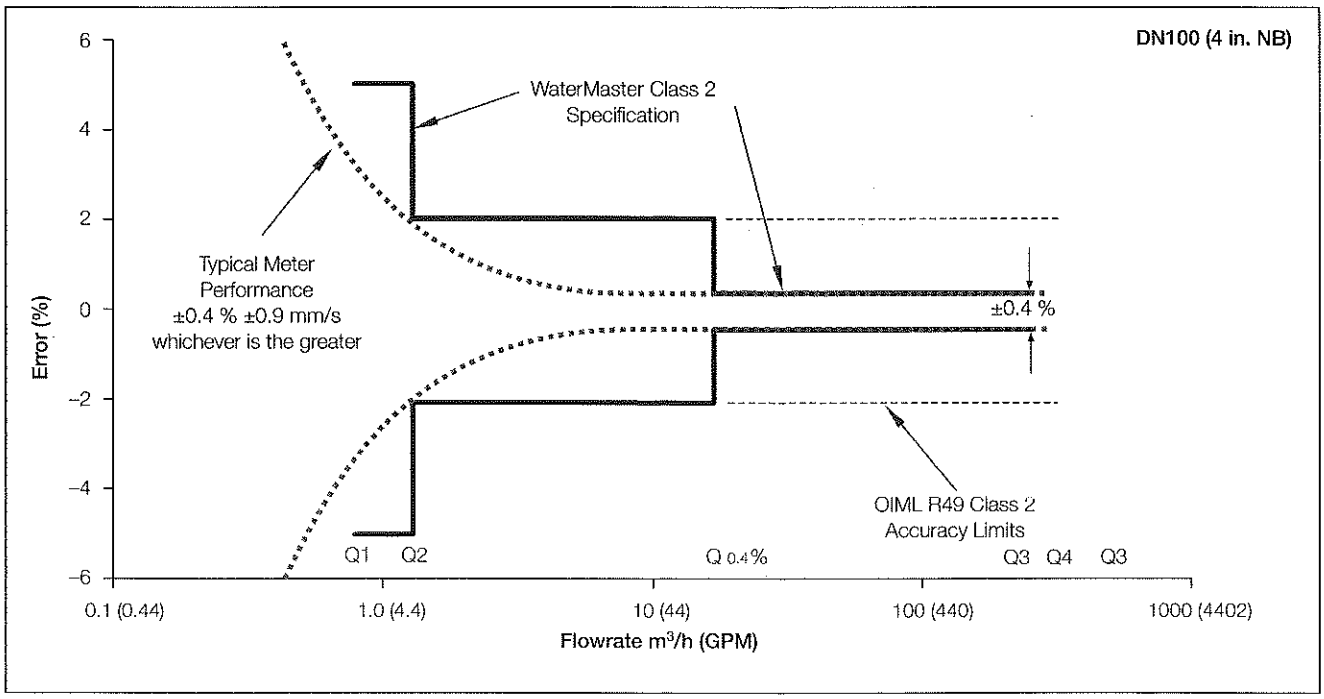
The unique design of the reduced-bore sensor conditions the flow profile in the measuring section so that distortions in the flow profile, either upstream or downstream, are flattened. The result is excellent in situ flowmeter performance, even with very bad hydraulic installation conditions.

Specification

WaterMaster specification to OIML R49 Class 1



WaterMaster specification to OIML R49 Class 2



Although OIML R49 does not define the flow accuracy below Q1, WaterMaster continues to measure flow at lower flow rates down to a cutoff velocity of ±5 mm/s (±0.2 in./s). The accuracy between cutoff and Q1 is typically ±0.9 mm/s (±0.04. in./s).

WaterMaster optimized full-bore meter (FEV) / full-bore meters (FEF, FEW) flow performance – m^3/h

			Standard Calibration – 0.4 % Class 2			High Accuracy Calibration – 0.2 % Class 1		
DN	Q4	Q3	$Q_{0.4\%}$	Q2	Q1	$Q_{0.2\%}$	Q2	Q1
10	3.1	2.5	0.167	0.013	0.008	0.31	0.02	0.012
15	7.88	6.3	0.42	0.032	0.02	0.79	0.05	0.03
20	12.5	10	0.67	0.05	0.032	1.25	0.08	0.05
25	20	16	1.1	0.08	0.05	2	0.13	0.08
32	31.25	25	1.67	0.13	0.08	3	0.20	0.13
40*	50	40	4.2	0.2	0.13	6	0.32	0.2
50*	79	63	4.2	0.32	0.20	7.9	0.5	0.32
65*	125	100	6.7	0.5	0.32	12.5	0.8	0.5
80*	200	160	10.7	0.81	0.51	16	1.3	0.8
100*	313	250	16.7	1.3	0.79	25	2	1.25
125*	313	250	16.7	1.3	0.79	25	2	1.25
150*	788	630	42	3.2	2.0	63	5	3.2
200*	1,250	1,000	67	5.1	3.2	100	8	5
250	2,000	1,600	107	8.1	5.1	160	13	8
300	3,125	2,500	167	12.7	7.9	250	20	12.5
350	5,000	4,000	267	20.3	12.7	400	32	20
400	5,000	4,000	267	20.3	12.7	400	32	20
450	7,875	6,300	420	32	20	630	50	32
500	7,875	6,300	420	32	20	630	50	32
600	12,500	10,000	667	51	32	1000	80	50
700	20,000	16,000	1600	102	64	1600	160	100
750	20,000	16,000	1600	102	64	1600	160	100
30 in (760)	20,000	16,000	1600	102	64	1600	160	100
800	20,000	16,000	1600	102	64	1600	160	100
900	31,250	25,000	2500	160	100	2500	250	156
1000	31,250	25,000	2500	160	100	2500	250	156
42 in	31,250	25,000	2500	160	100	2500	250	156
1100	31,250	25,000	2500	160	100	2500	250	156
1200	50,000	40,000	4000	256	160	4000	400	250
1350	78,750	63,000	6300	403	252	6300	630	394
1400	78,750	63,000	6300	403	252	6300	630	394
1500	78,750	63,000	6300	403	252	6300	630	394
60 in (1500)	78,750	63,000	6300	403	252	6300	630	394
1600	78,750	63,000	6300	403	252	6300	630	394
1650	78,750	63,000	6300	403	252	6300	630	394
1800	125,000	100,000	10000	640	400	10000	1000	625
1950	125,000	100,000	10000	640	400	10000	1000	625
2000	125,000	100,000	10000	640	400	10000	1000	625
2200	200,000	160,000	16000	1024	640	16000	1600	1000
2400	200,000	160,000	16000	1024	640	16000	1600	1000

* OIML R49 Certificate of Conformance to Class 1 and Class 2, with OIML R49 and MID versions available.

Note. OIML R49–1 allow Class 1 only for meters with $Q_3 \geq 100\ m^3/h$. Meters outside this range have been tested and conform to Class 1.

WaterMaster optimized full-bore meter (FEV) / full-bore meters (FEF, FEW) flow performance – gal/min

			Standard Calibration 0.4 % Class 2			High Accuracy Calibration 0.2 % Class 1		
NPS/NB (DN)	Q4	Q3	$Q_{0.4\%}$	Q2	Q1	$Q_{0.2\%}$	Q2	Q1
3/8 (10)	13.8	11	0.73	0.06	0.035	1.38	0.09	0.053
1/2 (15)	34.7	27.7	1.85	0.14	0.09	3.48	0.22	0.14
3/4 (20)	55	44	2.94	0.22	0.14	5.5	0.35	0.22
1 (25)	88	70.4	4.7	0.35	0.22	8.8	0.57	0.35
1 1/4 (32)	137.6	110	7.3	0.57	0.35	13.2	0.88	0.57
1 1/2 (40)	220	176	18.5	0.89	0.56	26.4	1.41	0.88
2 (50)	347	277	18.5	1.41	0.88	34.7	2.22	1.39
2 1/2 (65)	550	440	29.4	2.24	1.40	55.0	3.52	2.20
3 (80)	881	704	47.0	3.58	2.24	70.4	5.64	3.52
4 (100)	1,376	1,101	73.4	5.59	3.49	110	8.81	5.50
5 (125)	1,376	1,101	73.4	5.59	3.49	110	8.81	5.50
6 (150)	3,467	2,774	185	14.1	8.81	277	22.2	13.9
8 (200)	5,504	4,403	294	22.4	14.0	440	35.2	22.0
10 (250)	8,806	7,045	470	35.8	22.4	704	56.4	35.2
12 (300)	13,759	11,007	734	55.9	34.9	1,101	88.1	55.0
14 (350)	22,014	17,611	1,174	89.5	55.9	1,761	141	88.1
16 (400)	22,014	17,611	1,174	89.5	55.9	1,761	141	88.1
18 (450)	34,673	27,738	1,849	141	88.1	2,774	222	139
20 (500)	34,673	27,738	1,849	141	88.1	2,774	222	139
24 (600)	55,036	44,029	2,935	224	140	4,403	352	220
27/28* (700)	88,057	70,446	7,045	451	282	7,045	704	440
29 (750)	88,057	70,446	7,045	451	282	7,045	704	440
30 (760)	88,057	70,446	7,045	451	282	7,045	704	440
32 (800)	88,057	70,446	7,045	451	282	7,045	704	440
36 (900)	137,590	110,072	11,007	704	440	11,007	1,100	688
39/40* (1000)	137,590	110,072	11,007	704	440	11,007	1,100	688
42 (1050)	137,590	110,072	11,007	704	440	11,007	1,100	688
44 (1100)	137,590	110,072	11,007	704	440	11,007	1,100	688
48 (1200)	220,143	176,115	17,611	1,127	704	17,611	1,761	1,101
52 (1350)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
54 (1400)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
60 (1500)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
66 (1600)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
68 (1650)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
77 (1800)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
77 (1950)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
78 (2000)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
78 (2000)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
84 (2200)	880,573	704,459	70,446	4,509	2,818	70,446	7,045	4,403
96 (2400)	880,573	704,459	70,446	4,509	2,818	70,446	7,045	4,403

*Size is dependent on flange specification

WaterMaster reduced-bore meter (FER) flow performance – m^3/h (gal/min)

				Class 2 specification				Class 1 specification			
Size		Q_4	Q_3	$Q_{0.4\%}$	Q_2	Q_1	R	$Q_{0.2\%}$	Q_2	Q_1	R
mm	in.	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)		m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	
40	1 1/2	31 (138)	25 (110)	0.83 (1.05)	0.063 (0.28)	0.04 (0.18)	630	1.7 (7.48)	0.1 (0.44)	0.063 (0.28)	400
50	2	50 (220)	40 (176)	1.0 (4.40)	0.1 (0.44)	0.063 (0.28)	630	2.0 (8.8)	0.16 (0.7)	0.1 (0.44)	400
65	2 1/2	79 (347)	63 (277)	1.6 (7.04)	0.16 (0.7)	0.1 (0.44)	630	3.2 (10.56)	0.25 (1.1)	0.16 (0.7)	400
80	3	125 (550)	100 (440)	2.0 (8.80)	0.25 (1.1)	0.16 (0.7)	630	4.0 (17.6)	0.4 (1.76)	0.25 (1.1)	400
100	4	200 (880)	160 (704)	3.2 (10.56)	0.41 (1.8)	0.25 (1.1)	630	6.4 (28)	0.64 (2.8)	0.4 (1.76)	400
125	5	200 (880)	160 (704)	3.2 (10.56)	0.41 (1.8)	0.25 (1.1)	630	6.4 (28)	0.64 (2.8)	0.4 (1.76)	400
150	6	500 (2200)	400 (1760)	8.0 (35.20)	1.0 (4.4)	0.63 (2.77)	630	16 (70.4)	1.6 (7)	1.0 (4.4)	400
200	8	788 (3470)	630 (2770)	13.0 (57.2)	1.6 (7.04)	1.0 (4.4)	630	25 (110)	2.5 (11)	1.6 (7)	400
250	10	1250 (5500)	1000 (4400)	20 (88)	2.5 (11.01)	1.6 (7)	630	40 (176)	4.0 (17.6)	2.5 (11)	400
300	12	2000 (8810)	1600 (7045)	32 (140.8)	4.1 (18.05)	2.5 (11)	630	64 (281.6)	6.4 (28)	4.0 (17.6)	200
350	14	2000 (8810)	1600 (7045)	32 (140.8)	6.4 (28.18)	4.0 (17.6)	400	64 (281.6)	12.8 (56)	8.0 (35.2)	200
375	15	2000 (8810)	1600 (7045)	32 (140.8)	6.4 (28.18)	4.0 (17.6)	400	64 (281.6)	12.8 (56)	8.0 (35.2)	200
400	16	3125 (13760)	2500 (11007)	50 (220)	10 (44)	6.3 (27.7)	400	100 (440)	20 (88)	12.5 (55)	200
450	18	3125 (13760)	2500 (11007)	50 (220)	10 (44)	6.3 (27.7)	400	100 (440)	20 (88)	12.5 (55)	200
500	20	5000 (22014)	4000 (17610)	80 (352)	16 (70.45)	10 (44)	400	160 (70.4)	32 (141)	20 (88)	200
600	24	7875 (34670)	6300 (27740)	126 (554.4)	25.2 (110.9)	15.8 (70)	400	252 (1108)	50.4 (222)	31.5 (138.7)	200

Specification – sensor

Functional specification

Pressure limitations

As per flange rating – non approved
PN16 for OIML R49, MID Approved

Pressure equipment directive 97/23/EC

This product is applicable in networks for the supply, distribution and discharge of water and associated equipment and is therefore exempt.

Temperature limitations

Ambient temperature
Remote transmitter –20 to 70 °C (–4 to 158 °F)
Integral transmitter –20 to 60 °C (–4 to 140 °F)

Process temperature See table below.
0.1 to 50 °C (32.2 to 122 °F) – OIML R49 T50 Approved

			Medium temperature °C (°F)	
Code	Lining	Flange material	Minimum	Maximum
FEF, FEW3	Hard rubber	Carbon steel	–10 (14)	90 (194)
		Stainless steel	–10 (14)	90 (194)
FEW1	PTFE	Carbon steel	–10 (14)	130 (266)
		Stainless steel	–25 (–13)	130 (266)
FEW3	PTFE	Carbon steel	–10 (14)	130 (266)
		Stainless steel	–10 (14)	130 (266)
FEW3	Elastomer	Carbon steel	–5 (23)	80 (176)
		Stainless steel	–5 (23)	80 (176)
FEF, FER	Elastomer	Carbon steel	–6 (21)	70 (158)
FEV	Polypropylene		–6 (21)	70 (158)

IP rating

IP68 (NEMA 6) to 7 m (20 ft.) depth
Note. Not sizes DN10 to DN32 (3/8 – 1 1/4 in. NB)

IP67 (NEMA 4X) – DN10 to DN32 (3/8 – 1 1/4 in. NB)

Buriable (sensor only)

FEV, FEF and FEW – DN450 to 2400 (18 to 96 in. NB) to 5 m (16 ft.) depth

Conductivity

>5µS cm^{-1}

Transmitter mounting

Integral (not FEF) or remote

Electrical connections

20 mm glands

1/2 in. NPT
20 mm armored glands

Sensor cable

ABB WaterMaster cable available in two forms – standard and armored
Maximum length 200 m (660 ft.)

Physical specification

Wetted parts

Electrode material

Stainless steel 316 L / 316 Ti

Super-austenitic steel

Hastelloy® C-22 and Hastelloy C4

(other electrode materials available on request)

Potential equalizing rings

Minimum of 1 recommended

Lining material / potable water approvals

			Potable Water Approvals					
Code	Size Range	Liner	WRAS	WRAS 60°C	ACS	DVGW	NSF	AZ/ NZS 4020
FEW1	DN10 – 32 (3/8 – 1 1/4 in. NB)	PTFE	✔					
FEW3	DN10 – 600 (3/8 – 24 in. NB)	PTFE						
FEW3	DN40 – 2400 (1 1/2 – 96 in. NB)	Elastomer	✔					✔
FEW3	DN40 – 2400 (1 1/2 – 96 in. NB)	Hard rubber	✔	✔		✔	NSF approved material	
FEV	DN40 – 200 (1 1/2 – 8 in. NB)	Poly-propylene	✔		✔	✔	NSF-61	✔
FEF	DN250 – 600 (10 – 24 in. NB)	Elastomer	✔		✔	✔	NSF-61	✔
FEF	DN250 – 600 (10 – 24 in. NB)	Hard rubber	✔	✔		✔	NSF approved material	
FER	DN40 – 600 (1 1/2 – 24 in. NB)	Elastomer	✔		✔	✔		✔

*Size is dependent on flange specification

Lining protection plates

Not required

Installation conditions (recommended)

	Straight pipe requirements	
	Upstream	Downstream
FEW / FEF	5 x DN	2 x DN
FEV	5x DN	0 x DN
FER	0 x DN	0 x DN

Pressure loss

Negligible at Q3	All full bore meters
<0.25 bar (<3.62 psi) at Q3	FEV (DN40 to 200 [1 1/2 to 8 in. NB])
<0.63 bar (<9.13 psi) at Q3	FER (DN40 to 600 [1 1/2 to 24in. NB])

Non-wetted parts

Flange material

Carbon steel	DN20 to DN2400 (3/4 to 96 in. NB)
Stainless steel	DN10 to DN2400 (3/8 to 96 in. NB)
SG iron	FEV – DN40 to DN150 [1 1/2 to 6 in. NB)
	FER – DN40 to DN150 [1 1/2 to 6 in. NB)

Housing material

Carbon steel	FEV – DN40 to 200 (1 1/2 to 8 in. NB)
	FEW – DN450 to 2400 (18 to 96 in. NB)
Plastic	FEF – DN250 to 600 (10 to 24 in. NB)
Aluminium	FEW – DN10 to 400 (3/8 to 16 in. NB)

Terminal box material
Polycarbonate

Cable gland material
Plastic, brass

Paint specification
Paint coat ≥70 µm thick RAL 9002 (light grey)

Specification – transmitter

Functional specification

Power supply

Mains	85 to 265 V AC @ <7 VA
Low voltage	24 V AC +10 % /–30 % @ <7 VA
DC	24 V ±30 % @ <0.4 A

Supply voltage fluctuations within the specified range have no effect on accuracy

Digital Outputs (3)

Rating 30 V @ 220 mA, open collector, galvanically isolated *

Maximum output frequency 5250 Hz

1 off dedicated to Alarm / Logic, programmable function

2 off configurable to either Pulse / Frequency or Alarm/Logic function

Current output – HART FEX100 variant

4 to 20 mA or 4 to 12/20 mA, galvanically isolated *

Maximum loop resistance 750 Ω

HART protocol Version 5.7 (HART registered)

Signal levels compliant with NAMUR NE 43 (3.8 to 20.5 mA)

Low alarm 3.6 mA, High alarm 21.8 mA

Additional accuracy

±0.1 % of reading

Temperature coefficient: typically <±20 ppm/°C

RS485 Communications – PROFIBUS FEX100-DP variant

Registered name: FEX100-DP

RS485 (9.6kbps to 1.5Mbps), galvanically isolated

DPV0, DPV1

PA Profile 3.01

Standard idents: 9700, 9740, 9741

FEX100-DP specific ident: 3431

3 Concurrent MS2 master connections

RS485 Communications – MODBUS FEX100-MB variant

MODBUS RTU protocol

RS485 (9.6kbps to 115.2kbps), galvanically isolated

Electrical connections

20 mm glands ½ in. NPT, 20 mm armored glands

Temperature limitations

Ambient temperature	–20 to 60 °C (–4 to 140 °F)
Temperature coefficient	Typically <±10 ppm/°C @ Vel ≥0.5 m/s

Environmental protection

Humidity: 0 to 100 %

Rating: IP67 (NEMA 4X) to 1m (3.3 ft.) depth

Tamper-proof security

Write access prevented by internal switch combined with external security seals for MID applications

Languages

English, French, German, Italian, Spanish, Polish

Infrared service port

USB adapter (accessory), USB 1.1. and 2.0 compatible

Driver software for Windows 2000, XP, 7 (32-bit) and Vista

Housing material

Powder-coated aluminium with glass window

Paint specification

Paint coat ≥70 µm thick RAL 9002 (light grey)

Transmitter vibration testing

Vibration level: 7 m/s^2

Frequency range: 20 to 150 Hz

No. of sweeps in 3 orthogonal planes: 20

Undetectable shift in transmitter span or zero performance

Hazardous approvals (HART variant only)

FM & FMc Class 1 Div 2

(FM listing NI / 1 / 2 / ABCD / T4, S / II, III / 2 / FG /T4,
Ta=60C; Type 4X, IP67 – for transmitter and integral mounting
Ta=70C, Type 6P, IP68 – for remote sensor type,
IP67 on DN10 to 32 [⅜ to 1¼ in.NB])

(FMc listing NI / 1 / 2 / ABCD / T4, DIP / II, III / 2 / FG /T4,
Ta=60C; Type 4X, IP67 – for transmitter and integral mounting
Ta=70C, Type 6P, IP68 – for remote sensor type, IP67 on
DN10 to 32 [⅜ to 1¼ in.NB])

FET, FEV, FEW and FEF DN700 to 2200 (27/28* to 84 in. NB) only

*Size is dependent on flange specification

ATEX* Zone 2, 21 & 22

II 3 G Ex nA IIC T5 Gc
II 2 D Ex tb IIIC T100°C Db
TA = –20°C to +60°C (integral transmitter)
TA = –20°C to +70°C (remote sensor)

IECEx* Zone 2, 21 & 22

Ex tb IIIC T100°C Db
Ex nA IIC T5 Gc
TA = –20°C to +60°C (integral transmitter)
TA = –20°C to +70°C (remote sensor)

*FEW, FEV, FET and FEF ≥700 (27/28 in. NB) only

Declaration of Conformance

Copies of CE certification will be available on request.

WaterMaster has OIML R49 Certificate of Conformity to accuracy class 1 and 2 (FEV DN40 to 200 [1½ to 8 in.NB]). Copies of accuracy certification are available on request.

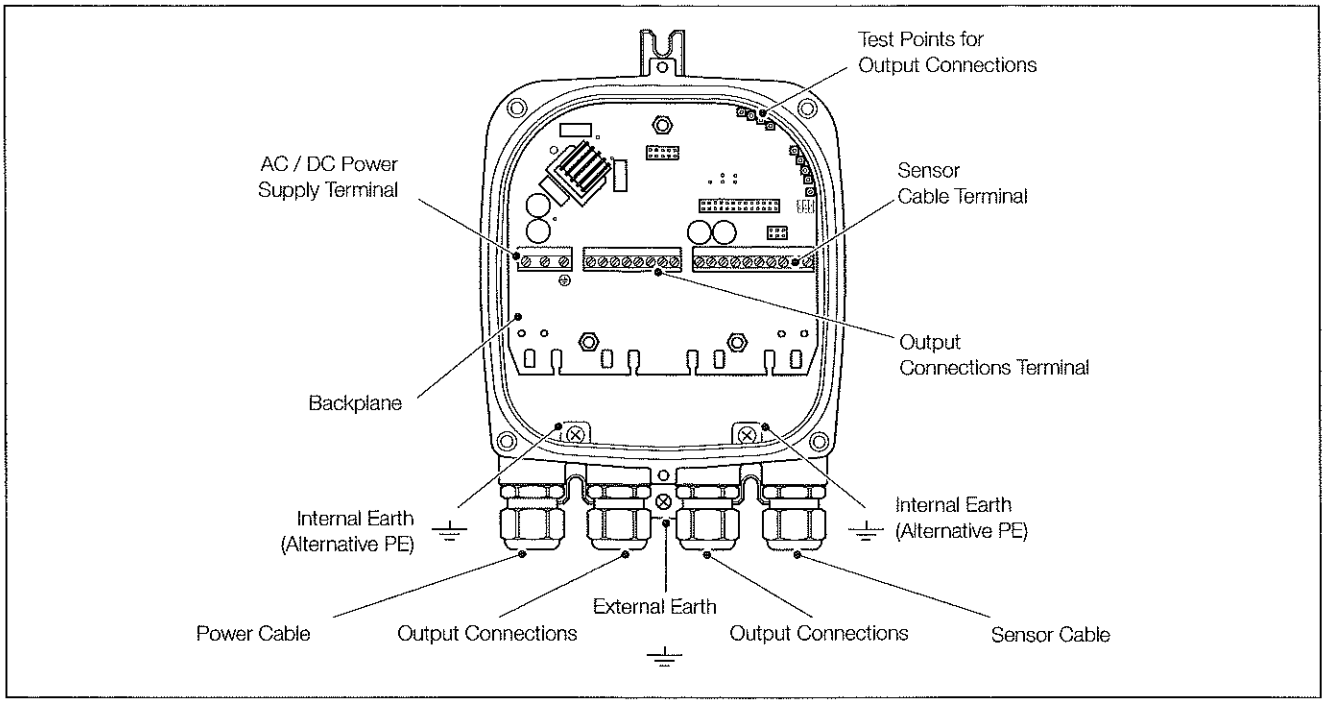
WaterMaster (FEV DN40 to 200 [1½ to 8 in.NB]) has been type examined under directive MID 2004/22/EC, Annex MI-001. Copies of this certificate are available on request.

* When installed, do not leave galvanically isolated circuits (pulse and current) floating.

Transmitter connections

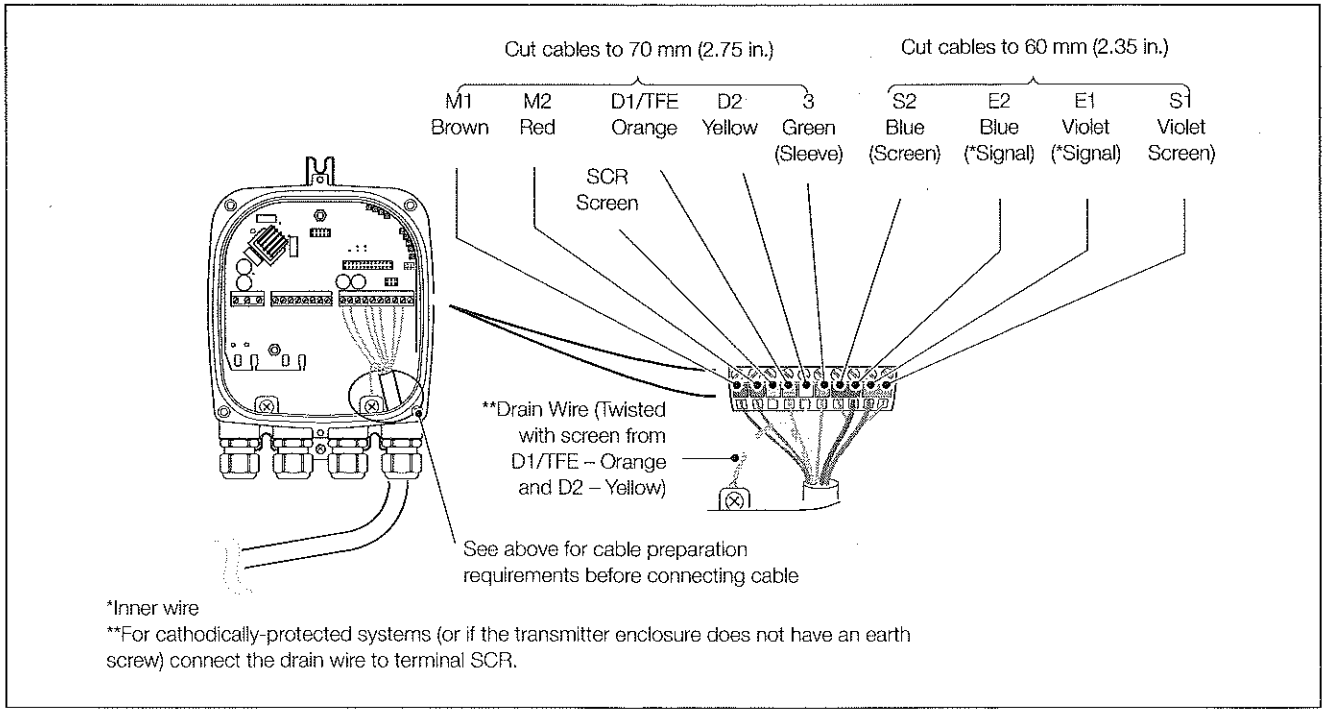
Transmitter terminal connections overview

This section is intended to give an overview of installation of a flowmeter. For Installation requirements, technical information and Health and safety precautions – refer to the User Guide OI/FET100–EN.



Cable gland / conduit entry (Remote transmitter shown)

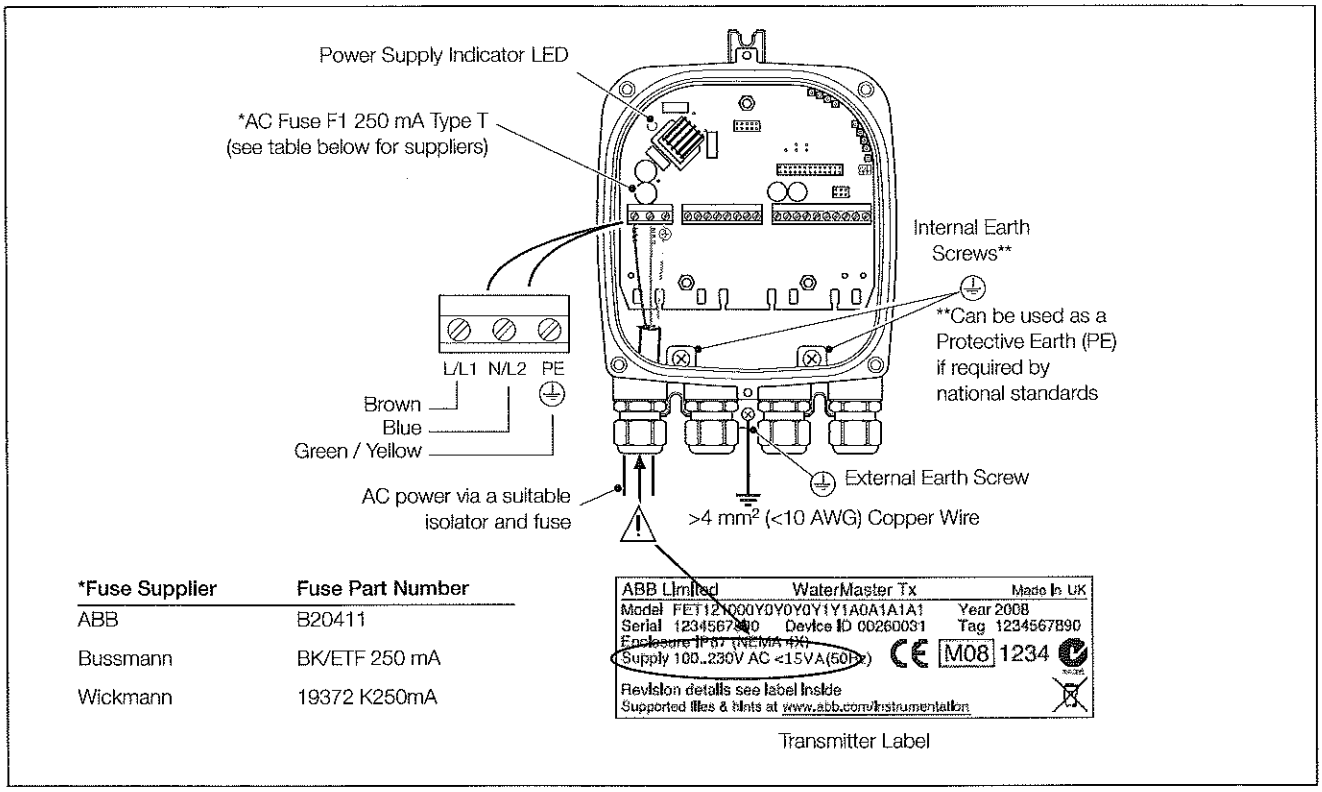
Sensor cable terminal connections and recommended cable lengths



Sensor cable connections at transmitter terminal block – remote transmitter

Power supply connections

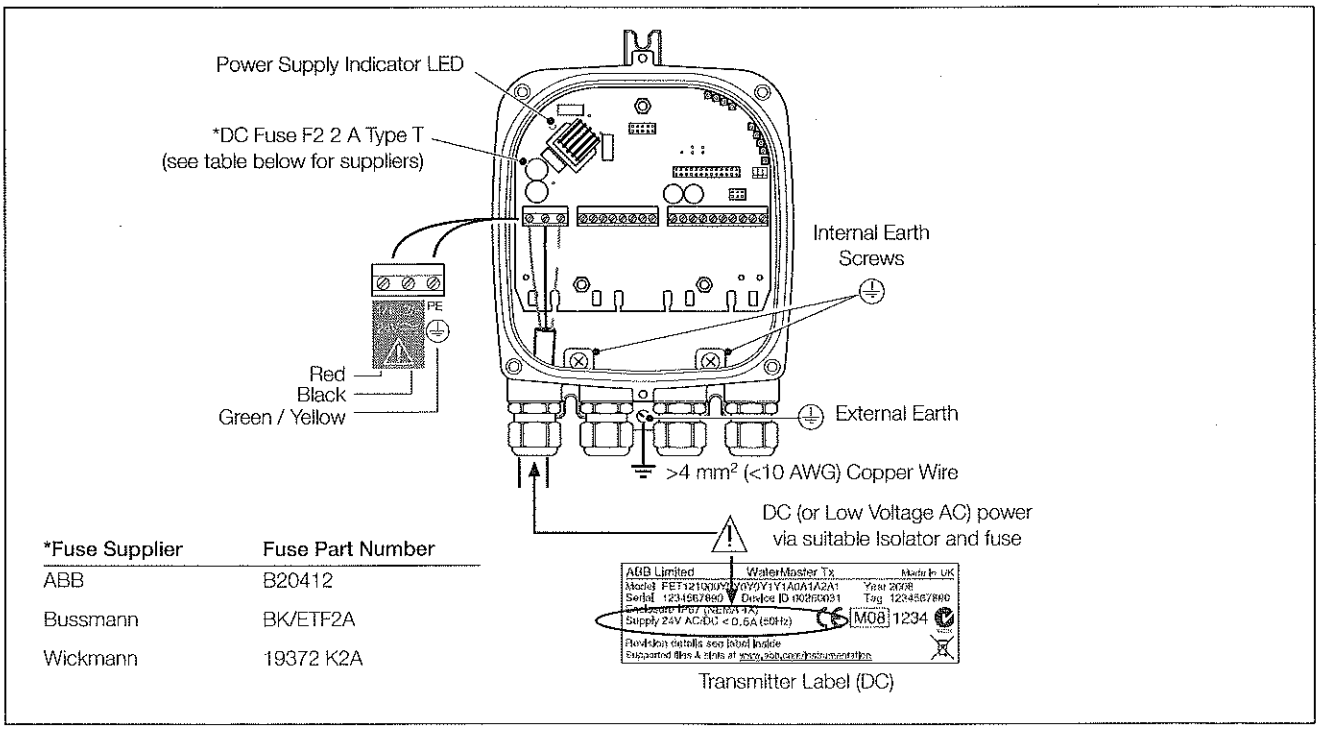
AC power supply



*Fuse Supplier	Fuse Part Number
ABB	B20411
Bussmann	BK/ETF 250 mA
Wickmann	19372 K250mA

AC power supply connections

DC (and low voltage AC) power supply



*Fuse Supplier	Fuse Part Number
ABB	B20412
Bussmann	BK/ETF2A
Wickmann	19372 K2A

DC (and low voltage AC) power supply connections

Configuration DIP switches

Three configuration DIP switches are mounted on the transmitter backplane board.

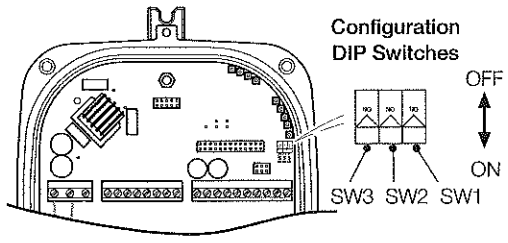
These are factory-set as follows:

- Remote transmitter – all OFF
- Integral transmitter – SW3 ON

For MID-compliant flowmeters the read-only / MID protection switch is set to 'ON' to ensure the meter is secure from tampering.

For HART software versions prior to 01.02.XX, this switch (set after commissioning) prevents login via the keypad or bus at any security level.

From HART software version 01.03.XX onwards and for all PROFIBUS software versions, on MID meters, all metrological-related parameters are locked and inaccessible at the Service level. Standard and Advanced user level parameters can still be modified via the HMI or bus.



DIP Switch Functions

SW1 – Read-only / MID Protection

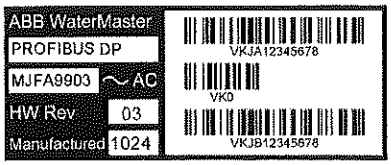
SW2 – (Future Product)

SW3 – Internal Sensor Memory

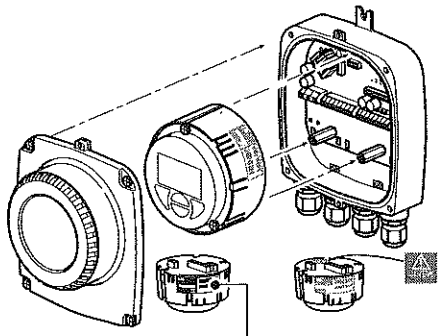
Configuration DIP switches

Transmitter module identification

Note. The communications bus type is HART FEX100 if not specified on the transmitter module label. An example of the PROFIBUS FEX100-DP variant transmitter module label is shown below.



PROFIBUS FEX-100P Label



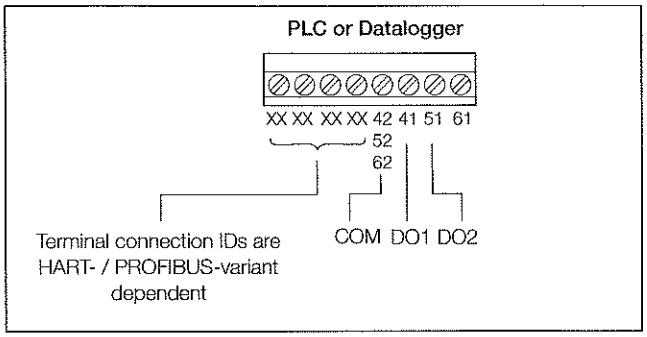
Red Label on DC
(and Low Voltage AC)
Converter Module

Black Label on AC Converter Module

Transmitter module identification

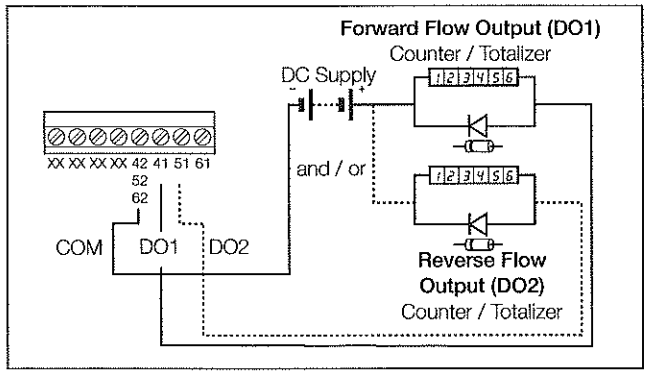
Output connections

Frequency outputs

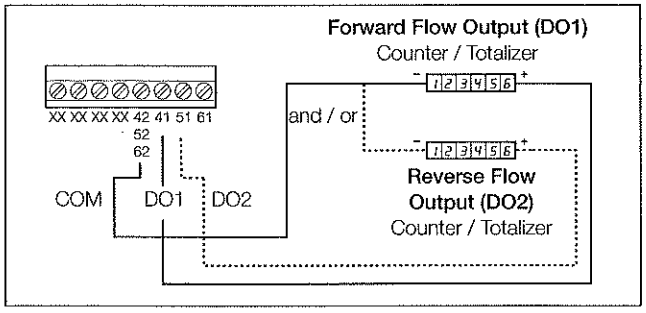


PLC / Datalogger connections

Note. Digital outputs DO1 and DO2 are polarity sensitive. The common (negative) connection for these outputs is designated 'COM'.

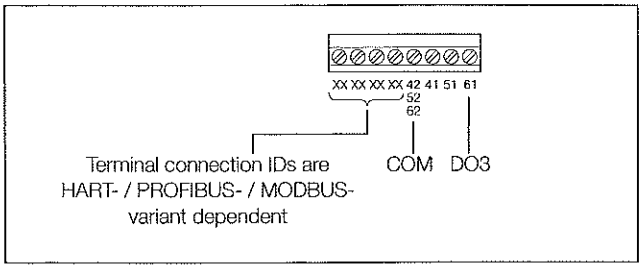


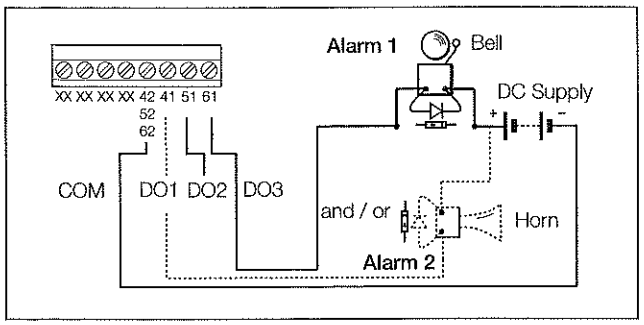
Electromechanical connections



Telemetry / Electronic counters connections

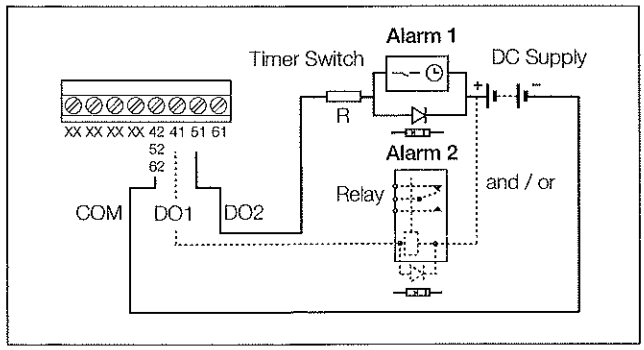
Alarm outputs





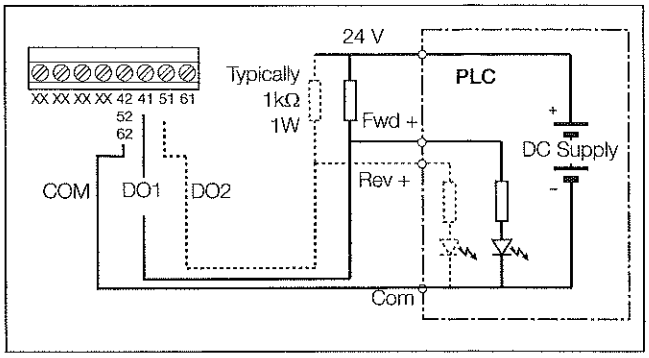
Note.

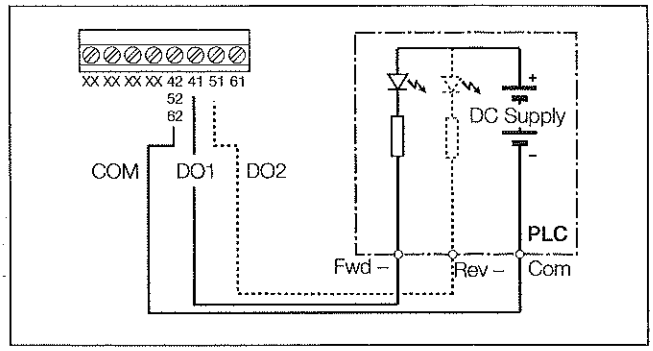
- Normal alarm / logic output is from DO3 (terminal 61). DO1 (41) and DO2 (51) can also be configured as alarms if required but are then NOT available as frequency / pulse outputs as shown in *Electromechanical connections* and *Telemetry / Electronic counters connections*, opposite.
- Bell and horn shown for example only. Any suitable alarm device may be used (for example, lamp, siren, buzzer etc.).



Note. Relay and timer switch shown for example only.

PLC interface

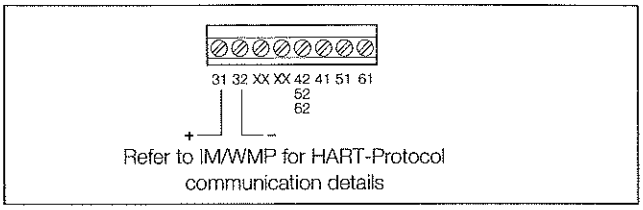




Note.

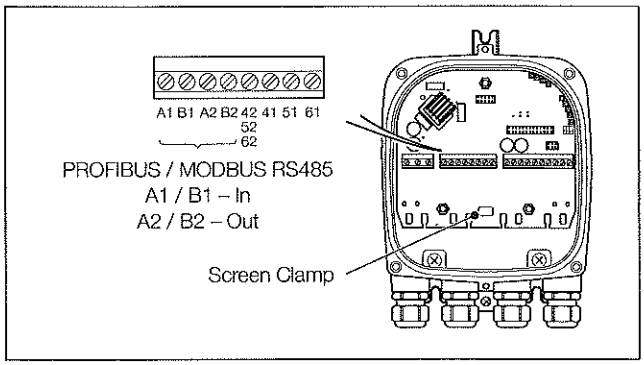
- WaterMaster digital outputs are NPN optocoupled transistors used as switches.
- Maximum allowed voltage at collector is 30 V DC
- Maximum allowed current across transistor is 220 mA.

Current output (4 to 20 ma) – HART (FEX100) variant



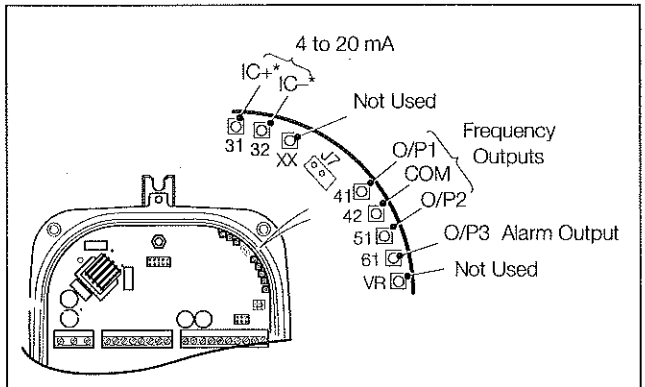
Current output (4 to 20 mA) – HART (FEX100) variant

RS485 communications – PROFIBUS (FEX100-DP) and MODBUS (FEX100-MB) variants



Test point access

Note. A typical DVM probe can access (fit) the PCB's test holes.



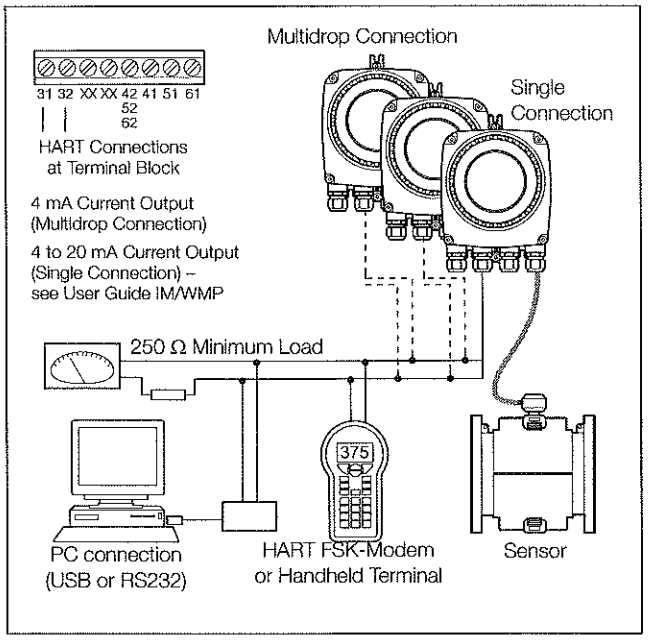
*These 2 test points are connected on the HART FEX100 backplane only (they are present on the PROFIBUS FEX100-DP / MODBUS FEX100-MB backplane but not connected)

Digital communication

The transmitter has the following options for digital communication.

HART protocol

The unit is registered with HART Communication Foundation.



HART protocol	
Configuration	Directly on the Device Software Asset Vision Basic (+ HART -DTM)
Transmission	Install a HART modem (FSK [Frequency Shift Keyed]-Modem) for HART-Communication when connecting to a PC. The HART-Modem converts the analog 4 to 20 mA signal into a digital output signal (Bell Standard 202) and connects to the PC using a USB (or RS232C) connector
Max. signal amplitude	1.2 mA
Current output load	Min. 250Ω, max. = 560Ω
Cable	AWG 24 twisted
Max. cable length	1500 m (4921 ft.)
Baud rate	1.200 baud

System integration

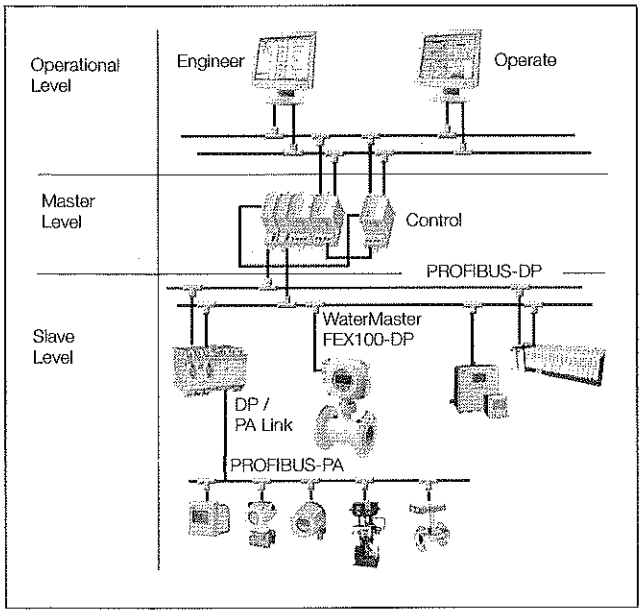
WaterMaster can be integrated into control systems and configuration devices using any Frame application, such as ABB AssetVision or similar third-party applications. ABB Device Type Managers (DTMs) for WaterMaster provide a unified structure for accessing device parameters, configuring and operating the devices and diagnosing problems. FDT (Field Device Tool) technology standardizes the communication and configuration interface between all field devices and host systems.

PROFIBUS DP protocol

PROFIBUS is a manufacturer-independent, open Fieldbus standard for a wide range of applications in manufacturing, process and building automation. Manufacturer independence and openness are ensured by the international standard EN 50170.

PROFIBUS DP ID no.	0x3431
Alternative standard ID no.	0x9701 or 0x9741
Configuration	Directly on the device Software Asset Vision Basic (+PROFIBUS DP-DTM)
Transmission signal	Accuracy to IEC 61158-2
Cable	Shielded, twisted cable (accurate to IEC 61158-2, types A or B)

All devices are connected in a bus structure ('line') as shown in below. Up to 32 stations (master or slaves) can be linked to create one 'segment', although it is recommended not to install more than 16 devices on a single segment. Each end of a segment must be terminated by an active bus terminating resistor. Both bus terminators must always be powered to ensure fault-free operation, therefore it is strongly recommended that they are connected to a back-up power supply. The use of bus amplifiers (repeaters) and segment couplers can be used to extend the network.



System integration

The GSD file for WaterMasters specifies the device-specific Ident No. 3431. It conforms to the PROFIBUS standard, providing a clear and comprehensive description of each instrument in a precisely defined format.

This enables the system configuration tool to use the information automatically when configuring a PROFIBUS bus system.

The ABB GSD file (Ident No. 3431) is divided into 2 sections:

- General specifications

  Identification of the device, together with hardware and software versions, baud rates supported and the possible time intervals for monitoring times.

- DP slave-related specifications

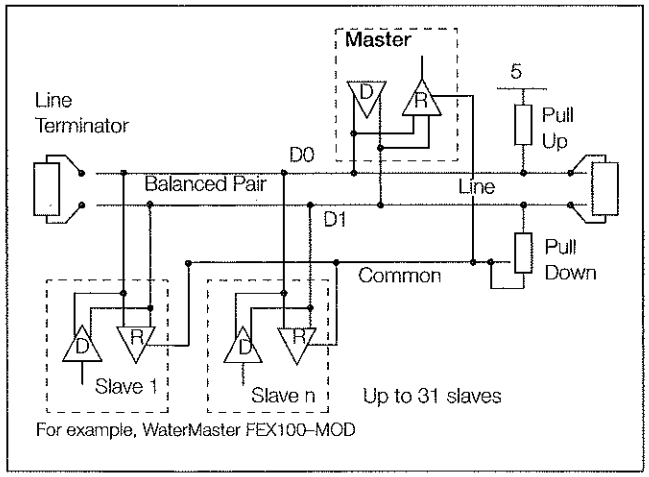
  Information about the user parameter block for device-specific configuration and modules containing details of the input and output data that can be exchanged cyclically with a PROFIBUS master.

The WaterMaster GSD file (ABB_3431.gsd) is available for download from the ABB website at: www.abb.com/fieldbus (follow the link for PROFIBUS DP field devices).

MODBUS protocol

MODBUS is an open standard that is owned and administered by an independent group of device manufacturers called the Modbus Organization (www.modbus.org).

Using the MODBUS protocol, devices from different manufacturers exchange information on the same communications bus without the need for special interface equipment. WaterMaster FEX100-MB follows the specification for Modbus Over Serial Line V1.02, using 2-wire TIA/EIA-485 (RS485) physical layer.



For example, WaterMaster FEX100-MOD

Cable Properties

The end-to-end length of the trunk cable must be limited. The maximum length depends on the Baud rate, the cable (gauge, capacitance or characteristic impedance), the number of loads on the daisy chain and the network configuration (2-wire or 4-wire).

For 9600 Baud rate and AWG26 (or wider) gauge, the maximum length is 1000 m (3280 ft.). Where 4-wire cabling is used as a 2-wire cabling system the maximum length must be divided by 2. The tap cables must be short, never more than 20 m (65.6 ft.). If a multi-port tap is used with n derivations, each one must have a maximum length of 40 m (131 ft.) divided by n.

The maximum serial data transmission line length for RS485 systems is 1200 m (3937 ft.). The lengths of cable that can be used are determined by the cable type, typically:

- Up to 6 m (19.7 ft.) – standard screened or twisted pair cable.
- Up to 300 m (984 ft.) – twin twisted pair with overall foil screen and an integral drain wire – for example, Belden 9502 or equivalent.
- Up to 1200 m (3937 ft.) – twin twisted pair with separate foil screens and integral drain wires – for example, Belden 9729 or equivalent.

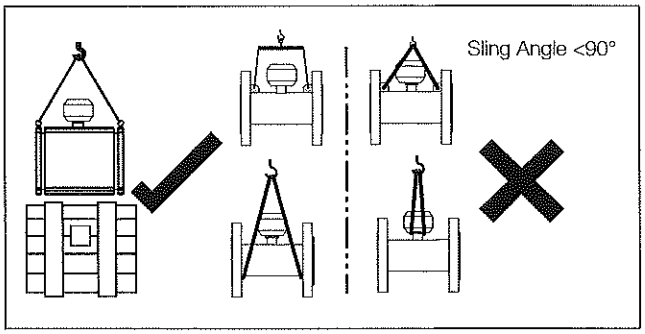
Category 5 cables may be used for RS485-MODBUS to a maximum length of 600 m (1968 ft.). For the balanced pairs used in an RS485-system, a characteristic impedance with value higher than 100Ω is preferred especially for 19200 and higher Baud rates.

Installation requirements

This section is intended to give an overview of installation of a flowmeter. For Installation requirements, technical information and Health and Safety precautions refer to User Guide OI/FEF/FEV/FEW–EN.

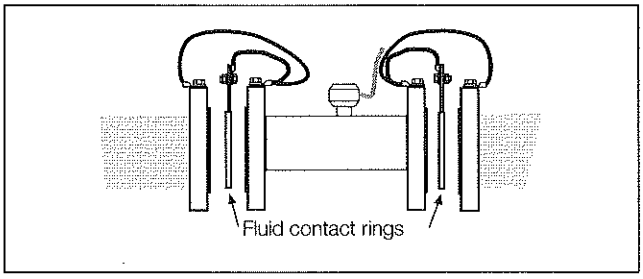
Unpacking the flowmeter

Care must be taken when lifting the flowmeter to use the lifting hooks provided or sling under the body of the meter. Never lift using the terminal connection box of the sensor cable as this will cause damage and invalidate warranty.



Grounding

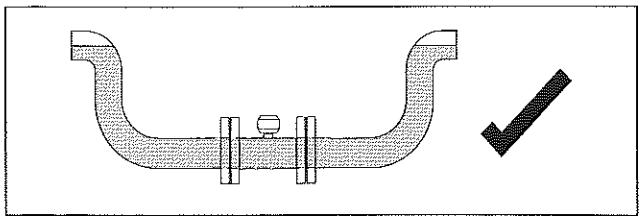
The flowmeter sensor must be cross-bonded to the upstream and downstream pipes and fluid. For technical reasons, this potential should be identical to the potential of the metering fluid. For plastic or insulated lined pipelines, the fluid is grounded by installing a minimum of 1 earthing rings. When there are stray potentials present in the pipeline, an earthing ring is recommended on both ends of the meter sensor.



Mounting

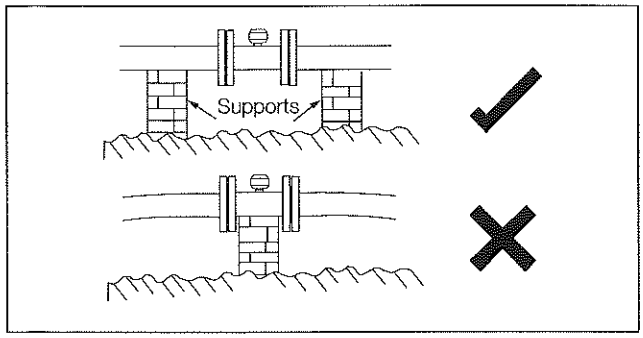
The installation conditions shown below must be observed to achieve the best operational results.

The sensor tube must always be completely full.

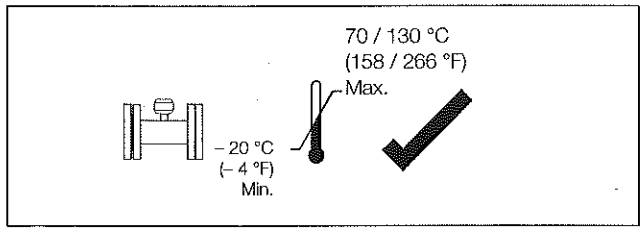


The flow direction must correspond to the identification plate. The device measures the flowrate in both directions. Forward flow is the factory setting.

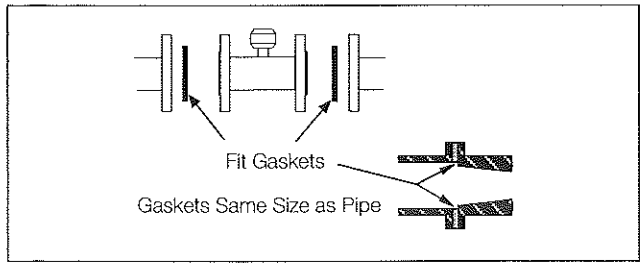
The devices must be installed without mechanical tension (torsion, bending). If required support the pipeline.



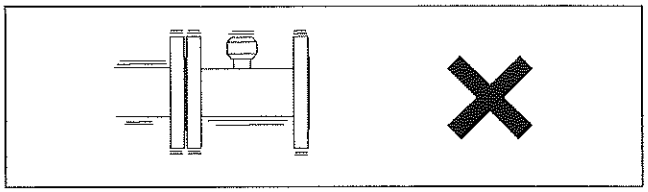
The flange seals must be made from a compatible material for the fluid and fluid temperatures if required.



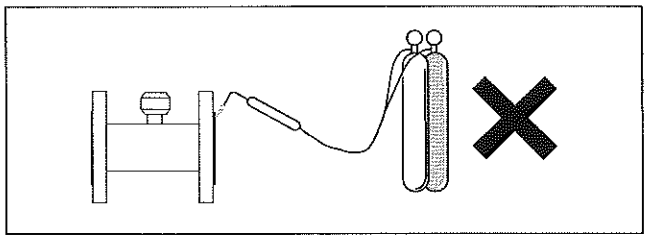
Seals must not extend into the flow area since possible turbulence could influence the device accuracy.



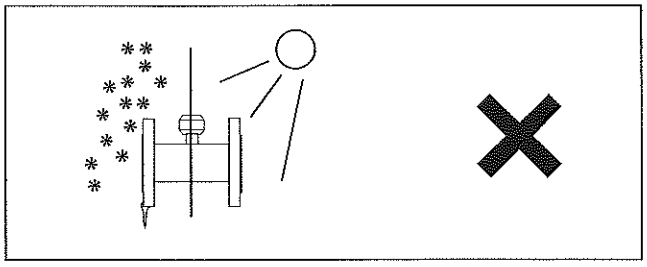
The pipeline may not exert any unallowable forces and torques on the device, such as vibration.



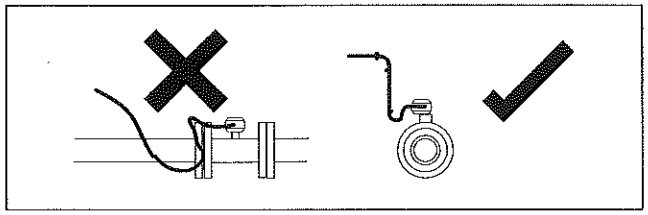
The flowmeter must not be submitted to any localized heat during installation; take care to remember this is a measuring instrument.



The flowmeter must not be exposed to direct sunlight or provide for appropriate sun protection where necessary.

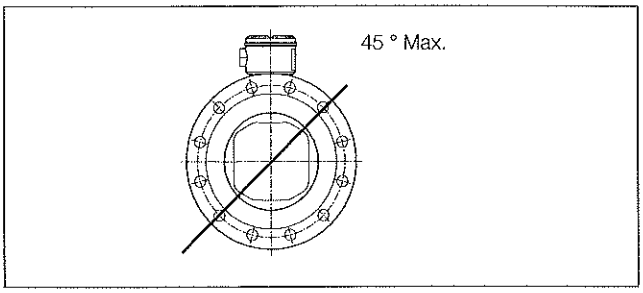


The cable to the flowmeter should be installed neatly or within a conduit, both loose or conduit should have a u shape below the terminal connection box height to allow any water run off to avoid any capillary action into the flowmeter sensor.



Electrode axis

Electrode axis should be horizontal if at all possible or no more than 45° from horizontal.



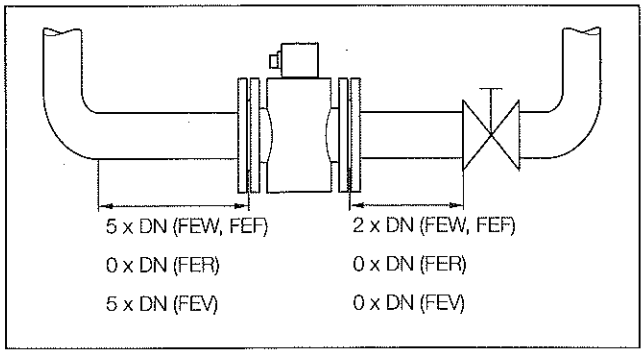
Upstream and Downstream pipe sections

The metering principle is tolerant of the flow profile.

- Wherever possible do not install fittings (for example, manifolds, valves) directly in front of the flowmeter sensor.
- Butterfly valves should be installed so that the valve plate does not extend into the flowmeter sensor.
- Valves or other turn-off components should be installed in the Downstream pipe section.

Experience has shown that, in most installations, straight upstream sections 3 x DN long and straight downstream sections 2 x DN long are normally sufficient. We would recommend conditions of 5 x DN straight upstream and 2 x DN straight downstream where possible.

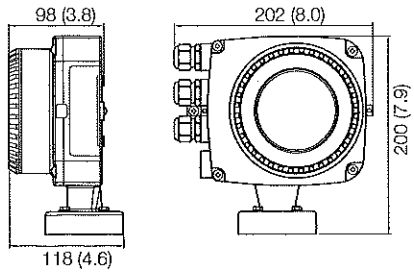
For reduced-bore meters (FER), these straight pipe sections are often not necessary.



Transmitter dimensions

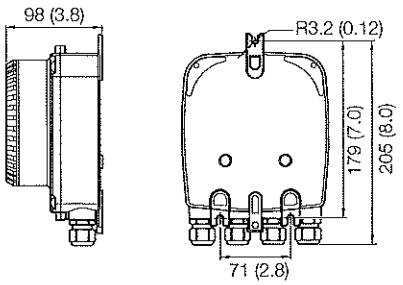
Integral transmitter

Dimensions in mm (in.)



Remote transmitter

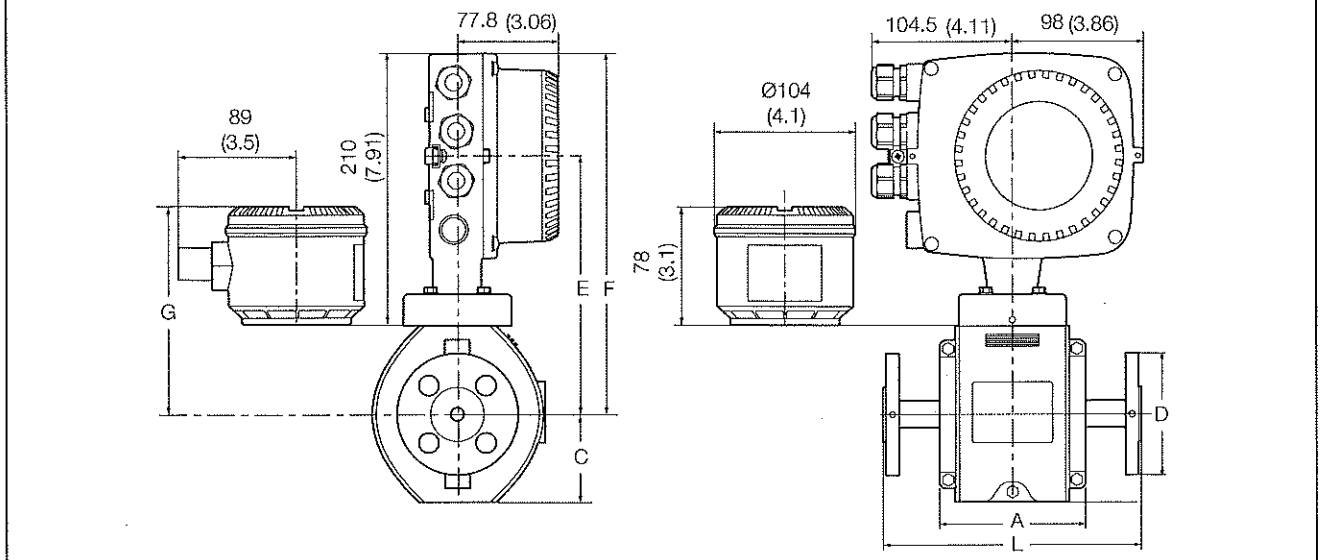
Dimensions in mm (in.)



Sensor dimensions

FEW – DN10 to 125 (3/8 to 5 in. NB)

Dimensions in mm (in.)



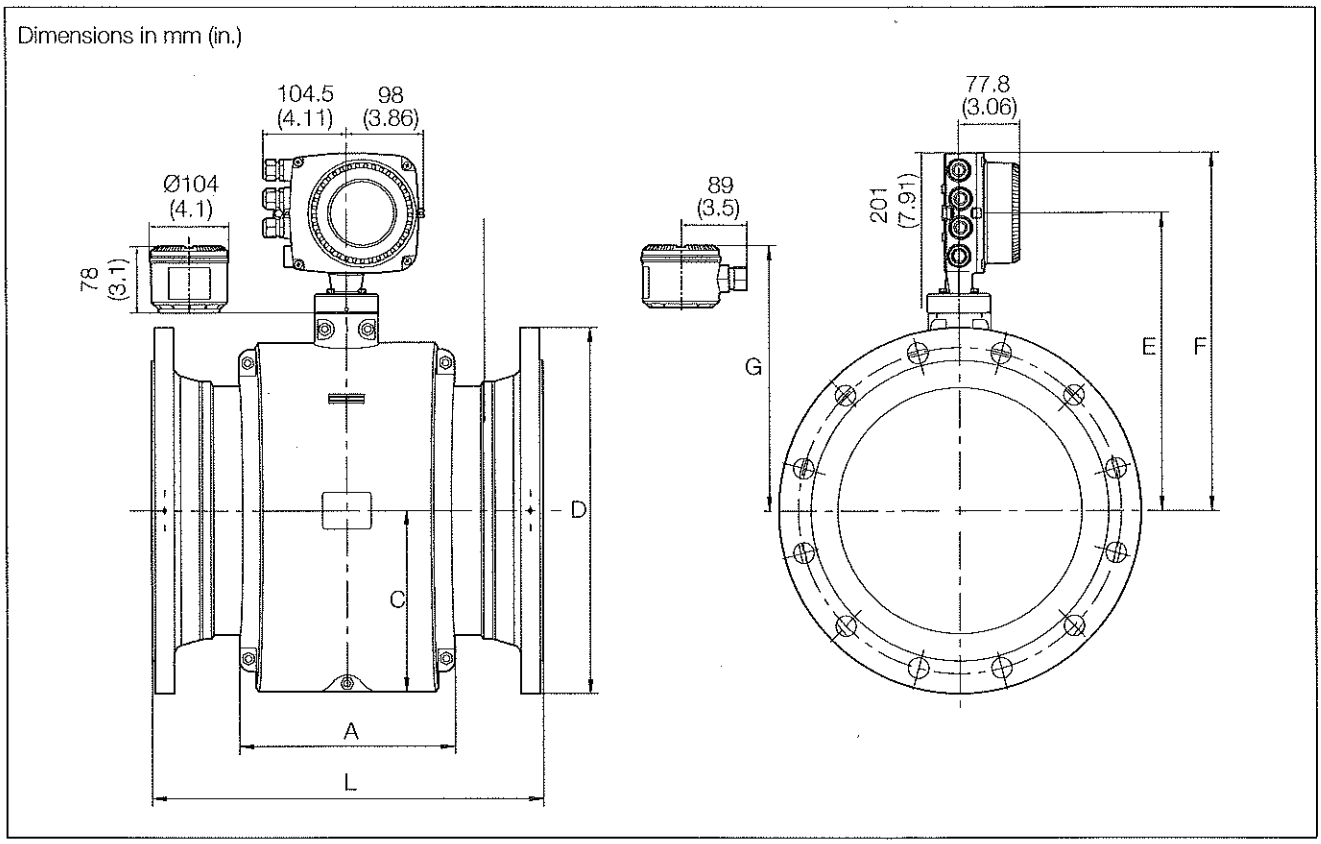
DN10 to 125 (3/8 to 5 in. NB) (FEW)

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Process connection type	D	L	F	C	E	G	A	Integral	Remote
DN10 (3/8 in.)	JIS10K	90 (3.54)	200 (7.87)	268 (10.55)	82 (3.23)	193 (7.6)	148 (5.83)	113 (4.45)	6 (13)	4 (9)
	PN10 to 40	90 (3.54)								
	ASME B16.5 CL150	90 (3.54)								
	ASME B16.5 CL300	96 (3.78)								
DN15 (1/2 in.)	PN10 to 40	95 (3.74)								
	JIS5K	80 (3.15)								
	JIS10K	95 (3.74)								
	ASME B16.5 CL300	95 (3.74)								
	ASME B16.5 CL150	90 (3.54)								
DN20 (3/4 in.)	PN10 to 40	105 (4.13)							8 (18)	6 (13)
	JIS5K	85 (3.35)								
	JIS10K	100 (3.94)								
	ASME B16.5 CL300	115 (4.53)								
	ASME B16.5 CL150	98 (3.86)								
DN25 (1 in.)	PN10 to 40	115 (4.53)	200 (7.87)	268 (10.55)	82 (3.23)	193 (7.6)	148 (5.83)	113 (4.45)	9 (20)	7 (15)
	JIS5K	95 (3.74)								
	JIS10K	125 (4.88)								
	ASME B16.5 CL300	125 (4.88)								
	ASME B16.5 CL150	108 (4.25)								
DN32 (1 1/4 in.)	PN10 to 40	140 (5.51)		275 (10.83)	92 (3.62)	200 (7.87)	155 (6.10)	113 (4.45)	10 (22)	8 (18)
	JIS5K	115 (4.53)								
	JIS10K	135 (5.31)								
	ASME B16.5 CL300	135 (5.31)								
	ASME B16.5 CL150	117 (4.61)								
DN40 (1 1/2 in.)	PN10 to 40	150 (5.91)							11 (24)	9 (20)
	JIS5K	120 (4.72)								
	JIS10K	140 (5.51)								
	ASME B16.5 CL300	155 (6.10)								
	ASME B16.5 CL150	127 (5.00)								
DN50 (2 in.)	PN10 to 40	165 (6.5)		281 (11.06)	97 (3.82)	206 (8.11)	161 (6.34)	115 (4.53)	12 (26)	10 (22)
	JIS5K	130 (5.12)								
	JIS10K	155 (6.10)								
	AS4087 PN16	150 (5.91)								
	AS4087 PN35	165 (6.50)								
	ASME B16.5 CL150	152 (5.98)								
	ASME B16.5 CL300	165 (6.50)								
DN65 (2 1/2 in.)	PN10 to 40	185 (7.28)		292 (11.50)	108 (4.25)	217 (8.54)	172 (6.77)	104 (4.09)	13 (29)	11 (24)
	JIS5K	155 (6.10)								
	JIS10K	175 (6.89)								
	AS4087 PN16	165 (6.50)								
	AS4087 PN35	185 (7.28)								
	ASME B16.5 CL150	178 (7.01)								
	ASME B16.5 CL300	190 (7.48)							15 (33)	13 (29)
DN80 (3 in.)	PN10 to 40	200 (7.87)		292 (11.5)	108 (4.25)	217 (8.54)	172 (6.77)	104 (4.09)	17 (37)	15 (33)
	JIS5K	180 (7.09)								
	JIS10K	185 (7.28)								
	AS4087 PN16	185 (7.28)								
	AS4087 PN35	205 (8.07)								
	ASME B16.5 CL150	190 (7.48)								
	ASME B16.5 CL300	210 (8.28)							19 (42)	17 (37)
DN100 (4 in.)	PN10 to 16	220 (8.66)	250 (9.84)	314 (12.36)	122 (4.8)	239 (9.41)	194 (7.64)	125 (4.92)	19 (42)	17 (37)
	PN25 to 40	235 (9.25)							23 (51)	21 (46)
	JIS5K	200 (7.87)							19 (42)	17 (37)
	JIS10K	210 (8.27)								
	AS4087 PN16	215 (8.46)								
	AS4087 PN35	230 (9.06)							23 (51)	21 (46)
	ASME B16.5 CL300	255 (1.04)							30 (66)	28 (62)
	ASME B16.5 CL150	229 (9.00)							21 (51)	19 (42)
DN125 (5 in.)	PN10 to 16	250 (9.84)		324 (12.76)	130 (5.12)	249 (9.8)	204 (8.03)	125 (4.92)	22 (48)	20 (44)
	PN25 to 40	270 (10.63)							29 (64)	27 (59)
	JIS5K	235 (9.25)							22 (48)	20 (44)
	JIS10K	250 (9.84)								
	ASME B16.5 CL150	254 (10.00)								
	ASME B16.5 CL300	280 (11.02)							35 (77)	33 (73)

DN10 to 125 (3/8 to 5 in. NB) (FEW) dimensions / weights

FEW – DN150 to 400 (6 to 16 in. NB) FM-1

Dimensions in mm (in.)



DN150 to 400 (6 to 16 in. NB) (FEW)

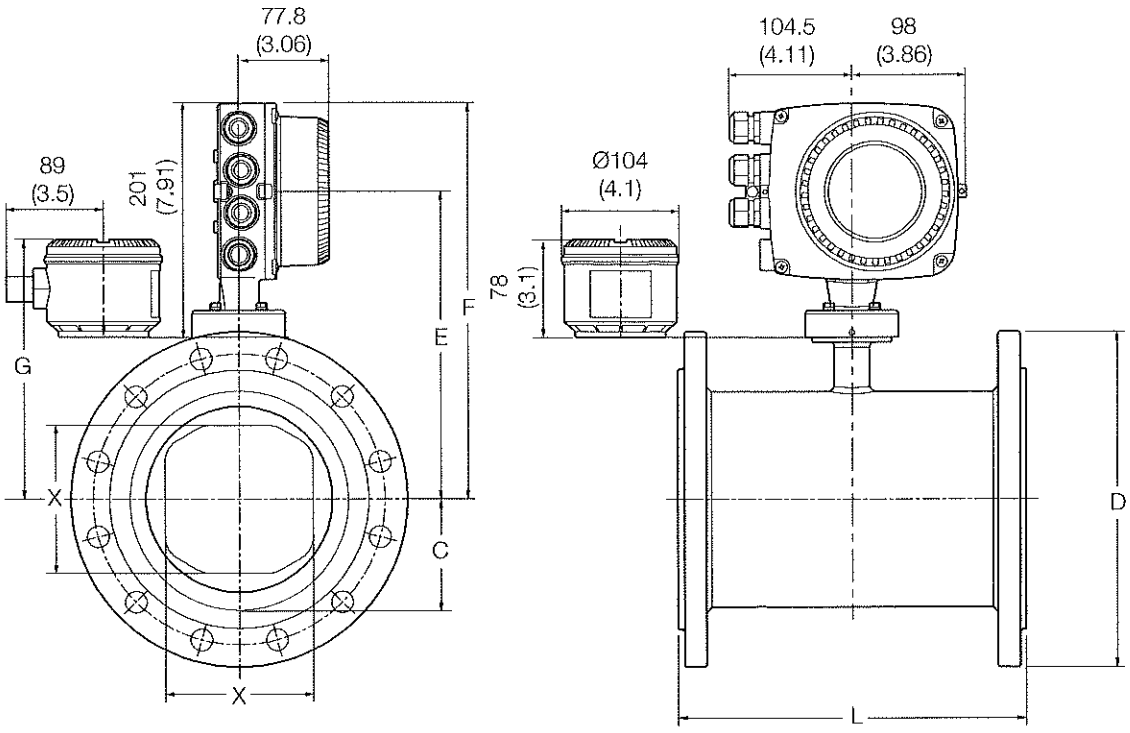
M-1

DN	Process connection type	Dimensions in mm (in.)							Approx. weight in kg (lb)	
		D	L	F	C	E	G	A	Integral	Remote
DN150 (6 in.)	PN10 to 16	285 (11.22)	300 (11.81)	371 (14.61)	146 (9.88)	296 (11.65)	251 (9.88)	166 (6.54)	33 (73)	31 (68)
	PN25 to 40	300 (11.81)							39 (86)	37 (81)
	JIS5K	265 (10.43)							33 (73)	31 (68)
	JIS10K	280 (11.02)								
	AS4087 PN16	280 (11.02)								
	AS4087 PN35	305 (11.81)							39 (86)	37 (81)
	ASME B16.5 CL300	320 (12.60)							47 (103)	45 (99)
	ASME B16.5 CL150	279 (10.98)							33 (73)	31 (68)
DN200 (8 in.)	PN10	340 (13.39)	350 (13.78)	411 (16.18)	170 (6.69)	336 (13.23)	291 (11.46)	200 (7.87)	41 (90)	39 (86)
	PN16	340 (13.39)								
	PN25	360 (14.17)							55 (121)	53 (117)
	PN40	375 (14.76)							65 (143)	63 (139)
	AS4087 PN16	335 (13.19)							41 (90)	39 (86)
	AS4087 PN35	370 (14.57)							65 (143)	63 (139)
	JIS5K	320 (12.60)							41 (90)	39 (86)
	JIS10K	330 (12.99)								
	ASME B16.5 CL300	380 (14.96)							72 (158)	70 (154)
	ASME B16.5 CL150	345 (13.58)							50 (110)	48 (106)
DN250 (10 in.)	PN10	395 (15.55)	450 (17.72)	426 (16.77)	198 (7.80)	351 (13.82)	306 (12.05)	235 (9.62)	61 (134)	59 (130)
	PN16	405 (15.94)							65 (143)	63 (139)
	PN25	425 (16.73)							84 (185)	82 (180)
	PN40	450 (17.72)							95 (209)	93 (205)
	AS4087 PN16	405 (15.94)							65 (143)	63 (139)
	AS4087 PN35	430 (16.93)							95 (209)	93 (205)
	JIS5K	385 (15.16)							65 (143)	63 (139)
	JIS10K	400 (15.75)								
	ASME B16.5 CL300	445 (17.52)							105 (231)	103 (227)
	ASME B16.5 CL150	405 (15.94)							70 (154)	68 (150)
DN300 (12 in.)	PN10	445 (17.52)	500 (19.69)	449 (17.68)	449 (17.68)	449 (17.68)	449 (17.68)	449 (17.68)	74 (163)	72 (158)
	PN16	460 (18.11)							80 (176)	78 (172)
	PN25	485 (19.09)							100 (220)	98 (216)
	JIS5K	430 (16.93)							80 (176)	78 (172)
	JIS10K	445 (17.52)								
	AS4087 PN16	455 (17.91)								
	AS4087 PN35	490 (19.29)							130 (286)	128 (282)
	ASME B16.5 CL300	520 (20.47)							150 (330)	148 (326)
	ASME B16.5 CL150	485 (19.09)							105 (231)	103 (227)
	PN40	515 (20.28)	600 (23.62)						130 (286)	128 (282)
DN350 (14 in.)	PN10	505 (19.88)	550 (21.65)	464 (18.27)	265 (10.43)	389 (15.31)	344 (13.54)	322 (12.68)	95 (209)	93 (205)
	PN16	520 (20.47)							110 (242)	108 (238)
	PN25	555 (21.85)							145 (319)	143 (315)
	JIS5K	480 (18.90)							95 (209)	93 (205)
	JIS10K	490 (19.29)								
	AS4087 PN16	525 (20.67)							130 (286)	128 (282)
	AS4087 PN35	550 (21.65)							185 (407)	183 (403)
	ASME B16.5 CL300	585 (23.03)							140 (308)	138 (304)
	ASME B16.5 CL150	535 (21.06)							105 (231)	103 (227)
	PN40	580 (22.83)	650 (25.59)						195 (429)	193 (425)
DN400 (16 in.)	PN10	565 (22.24)	600 (23.62)	506 (19.92)	265 (10.43)	431 (16.97)	386 (15.20)	322 (12.68)	103 (227)	101 (222)
	PN16	580 (22.83)							126 (277)	124 (273)
	PN25	620 (24.41)							170 (374)	168 (370)
	JIS5K	540 (21.26)							103 (227)	101 (223)
	JIS10K	560 (22.05)							116 (255)	114 (251)
	AS4087 PN16	580 (22.83)							154 (339)	152 (335)
	AS4087 PN35	610 (24.02)							302 (664)	300 (660)
	ASME B16.5 CL300	650 (25.59)							265 (583)	263 (578)
	ASME B16.5 CL150	600 (23.62)							175 (385)	173 (381)
	PN40	660 (25.98)	650 (25.59)						258 (568)	256 (564)

DN150 to 400 (6 to 5 in. NB) (FEW) dimensions / weights

FEV – DN40 to 200 (1½ to 8 in. NB) FM-2

Dimensions in mm (in.)



DN40 to 200 (1½ to 8 in. NB) (FEV)

DN	Process connection type	Dimensions in mm (in.) D	L	F	E	G	X	Approx. weight in kg (lb) Integral	Remote
DN40 (1½ in.)	EN1092-1 PN10, 16, 25, 40	150 (5.91)	190 (7.48)	260 (10.24)	185 (7.28)	137 (5.39)	30 (1.18)	12.8 (28.16)	11.8 (25.96)
	ASME B16.5 CLASS 150								
	AS2129 TABLE D, E, F								
DN50 (2 in.)	EN1092-1 PN10, 16, 25, 40	165 (6.50)	190.5 (7.5)	261 (10.28)	186 (7.32)	138 (5.43)	38 (1.5)	13.75 (30.25)	12.75 (28.05)
	ASME B16.5 CLASS 150								
DN80 (3 in.)	EN1092-1 PN10, 16, 25, 40	200 (7.87)	190.5 (7.5)	280 (11.04)	205.5 (8.09)	157.5 (6.2)	61 (2.4)	17.2 (37.84)	16.2 (35.64)
	ASME B16.5 CLASS 150								
	AS4087 PN16, 21								
	AS2129 TABLE D, E, F								
DN100 (4 in.)	EN1092-1 PN10, 16, 25, 40	225 (8.86)	240.5 (9.47)	300.5 (11.83)	225.5 (8.88)	177.5 (6.98)	70 (2.76)	19.3 (42.5)	18.3 (40.3)
	ASME B16.5 CLASS 150								
	AS4087 PN16								
DN150 (6 in.)	EN1092-1 PN10, 16, 25, 40	300 (11.81)	290.5 (11.44)	333.5 (13.13)	258.5 (10.18)	210.5 (8.29)	103 (4.06)	35.1 (77.2)	34.1 (75)
	ASME B16.5 CLASS 150								
	AS4087 PN16								
DN200 (8 in.)	EN1092-1 PN10, 16	375 (11.76)	340.5 (13.4)	358.7 (14.12)	283.7 (11.17)	235.7 (9.28)	150 (5.91)	67 (147.4)	66 (145.2)
	ASME B16.5 CLASS 150								
	AS2129 TABLE C, D, E, F								
	AS4087 PN14, 16, 21								

WaterMaster integral / remote FEV – DN40 to 200 (1½ to 8 in.) cast iron sensor dimensions / weights

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Process connection type	D	L	F	C	E	G	X	Integral	Remote
DN40 (1½ in.)	EN1092-1 PN10, PN40	150 (5.91)	200 (7.87)	260 (10.24)	30.4 (1.20)	185 (7.28)	138 (5.43)	30 (1.18)	12 (27)	11 (24)
	ASME B16.5 CLASS 150	127 (5.00)								
	JIS 10K	140 (5.51)								
	AS2129 TABLE F	140 (5.51)								
	AS2129 TABLE C D E	135 (5.31)								
	AS4087 PN14	135 (5.31)								
DN50 (2 in.)	EN1092-1 PN10, PN16	165 (6.50)	200 (7.87)	270 (10.63)	38.3 (1.51)	195 (7.68)	146 (5.75)	38 (1.50)	13 (29)	12 (27)
	ASME B16.5 CLASS 150	152.4 (6.00)								
	JIS 10K	155 (6.10)								
	AS4087 PN21	165 (6.50)								
	AS2129 TABLE F	165 (6.50)								
	AS2129 TABLE C D E	150 (5.91)								
	AS4087 PN14, PN16	150 (5.91)								
DN65 (2½ in.)	AS4087 PN14, PN16	165 (6.50)	200 (7.87)	275 (10.83)	45.2 (1.78)	200 (7.87)	152 (5.98)	48 (1.89)	15 (33)	14 (31)
	AS2129 TABLE C D E	165 (6.50)								
	EN1092-1 PN10	185 (7.28)								
	EN1092-1 PN16	185 (7.28)								
DN80 (3 in.)	EN1092-1 PN10, PN16	200 (7.87)	200 (7.87)	280 (11.02)	51.5 (2.03)	205 (8.07)	156 (6.14)	61 (2.40)	16 (36)	15 (33)
	ASME B16.5 CLASS 150	190 (7.48)								
	JIS 7.5K	211 (8.31)								
	JIS 10K	185 (7.28)								
	AS2129 TABLE C D E	185 (7.28)								
	AS4087 PN14, PN16	185 (7.28)								
	AS2129 TABLE F	205 (8.07)								
	AS4087 PN21	205 (8.07)								
DN100 (4 in.)	EN1092-1 PN10, PN16	220 (8.66)	250 (9.84)	320 (12.60)	63.75 (2.51)	245 (9.65)	196.8 (7.75)	70 (2.76)	19 (42)	18 (40)
	ASME B16.5 CLASS 150	228.6 (9.00)								
	JIS 7.5K	238 (9.37)								
	JIS 10K	210 (8.27)								
	AS2129 TABLE C D	215 (8.46)								
	AS4087 PN14, PN16	215 (8.46)								
	AS2129 TABLE E	215 (8.46)								
	AS4087 PN21	230 (9.06)								
	AS2129 TABLE F	230 (9.06)								
DN125 (5 in.)	EN1092-1 PN10, PN16	250 (9.84)	250 (9.84)	320 (12.60)	63.75 (2.51)	245 (9.65)	197 (7.76)	70 (2.76)	20 (44)	19 (42)
	ASME B16.5 CLASS 150	254 (10.00)								
	JIS 10K	250 (9.84)								
	AS2129 TABLE C D E	255 (10.04)								
	AS2129 TABLE F	280 (11.02)								
DN150 (6 in.)	EN1092 PN10, PN16	285 (11.22)	300 (11.81)	340 (13.39)	84.4 (3.32)	265 (10.43)	217 (8.54)	103 (4.06)	32 (70)	31 (68)
	ASME B16.5 CLASS 150	279 (10.98)								
	JIS 7.5k	290 (11.42)								
	JIS 10K	280 (11.02)								
	AS2129 TABLE C D	280 (11.02)								
	AS4087 PN14, PN16	280 (11.02)								
	AS2129 TABLE E	280 (11.02)								
	AS2129 TABLE F	305 (12.01)								
	AS4087 PN21	305 (12.01)								
DN200 (8 in.)	EN1092-1 PN10	340 (13.39)	350 (13.78)	365 (14.37)	109.8 (4.32)	290 (11.42)	243 (9.57)	150 (5.91)	49 (108)	48 (105)
	EN1092-1 PN16	340 (13.39)								
	ASME B16.5 CLASS 150	345 (13.58)								
	JIS 7.5K	342 (13.46)								
	JIS 10K	330 (12.99)								
	AS2129 TABLE C D	335 (13.19)								
	AS4087 PN14, PN 16	335 (13.19)								
	AS2129 TABLE E	335 (13.19)								
	AS2129 TABLE F	370 (14.57)								
	AS4087 PN21	370 (14.57)								

DN40 to 200 (1½ to 8 in. NB) (FEV) dimensions / weights

Electromagnetic flowmeter WaterMaster FEV11, FEV12 and FEV18

Product coding field number	1 ... 5	6	7 ... 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system, optimized full bore, integral mount	FEV11																				
Flowmeter system, optimized full bore, remote mount	FEV12	X	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	
Optimized full bore sensor only, for use with WaterMaster transmitter / remote	FEV18																				
Design																					
Non-hazardous areas		1																			
Hazardous areas		5																			
Bore diameter																					
DN40 (1 1/2 in.)			040																		
DN50 (2 in.)			050																		
DN65 (2 1/2 in.)			065																		
DN80 (3 in.)			080																		
DN100 (4 in.)			100																		
DN125 (5 in.)			125																		
DN150 (6 in.)			150																		
DN200 (8 in.)			200																		
Liner material																					
Polypropylene – DN40 to 200 (1 1/2 to 8 in. NB)				V																	
Electrode design																					
Standard					1																
Measuring electrodes material																					
Stainless steel 316						S															
Hastelloy® C-22						C															
Super-austenitic steel						U															
Grounding accessories																					
Standard							1														
One potential equalizing ring (stainless steel)							3														
Two potential equalizing rings (stainless steel)							4														
Process connection type (refer to pages 29 and 28)																					
Flanges ASME B16.5 class 150								A1													
Flanges AS 4087 PN21 (≥ DN50 [2 in. NB])								E0													
Flanges AS 4087 PN16 (≥ DN50 [2 in. NB])								E1													
Flanges AS 4087 PN14								E2													
Flanges AS 2129 Table F								E3													
Flanges AS 2129 Table E								E4													
Flanges AS 2129 Table D								E5													
Flanges AS 2129 Table C								E6													
Flanges JIS G5527 7.5K (≤ DN100 [4 in. NB])								J0													
Flanges JIS B2220 10K								J1													
ISO/EN PN10								S1													
ISO / EN PN16 (≥ DN50 [2 in. NB])								S2													
ISO / EN PN40 (DN40 [1 1/2 in. NB] only) 16 bar rated								S4													
Process connection material																					
Carbon steel flanges									B												
Usage certifications																					
Standard										1											
Calibration type																					
Class 2 Calibration – standard accuracy 0.4 %											A										
Class 1 Calibration – high accuracy 0.2 %											B										
Extended range, class 1 calibration – high accuracy 0.2 %											N										
Extended range, class 2 calibration – standard accuracy 0.4 %											P										

Continued on next page...

Product coding field number	1 ... 5	6	7 ... 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system, optimized full bore, integral mount	FEV11	X	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	
Flowmeter system, optimized full bore, remote mount	FEV12																				
Optimized full bore sensor only, for use with WaterMaster transmitter / remote	FEV18																				
Temperature range installation / ambient temperature range																					
Standard design / –20 ... 60 °C (–4 ... 140 °F)												1									
Nameplate																					
Adhesive													A								
Signal cable length and type*																					
Without signal cable														0							
5 m (15 ft.) cable														1							
10 m (30 ft.) cable														2							
20 m (60 ft.) cable														3							
30 m (100 ft.) cable														4							
50 m (165 ft.) cable														5							
80 m (260 ft.) cable														6							
100 m (325 ft.) cable														7							
150 m (490 ft.) cable														8							
Special length > 150 m (> 490 ft.)														9							
Explosion protection certification															A						
General purpose (non-Ex design)															G						
FM Class 1 Div. 2															P						
usFMc Class 1 Div. 2															M						
ATEX / IECEx Zone 2, 21 & 22																					
Protection class transmitter / protection class sensor																1					
IP67 (NEMA 4X) / IP67 (NEMA 4X) – integral																2					
IP67 (NEMA 4X) / IP68 (NEMA 6P) – cable not fitted and not potted																3					
IP67 (NEMA 4X) / IP68 (NEMA 6P) – cable fitted and potted																					
Cable conduits *																	A				
M20 x 1.5 (plastic)																	B				
NPT ½ in. (blanked when cable not fitted)																	D				
M20 SWA (armored)																	F				
M20 SWA sensor, M20 x 1.5 (plastic) power / output																	Y				
Without																					
Power supply																		0			
Without																		1			
100... 230 V AC, 50 Hz																		2			
24 V AC or 24 V DC, 50 Hz																		3			
100... 230 V AC, 60 Hz																		4			
24 V AC or 24 V DC, 60 Hz																		9			
Others																					
Input and output signal type																			A		
HART + 20 mA + pulse + contact output																			G		
PROFIBUS DP RS485 physical layer + pulse + contact output (general-purpose design only)																			M		
MODBUS RTU RS485 physical layer + pulse + contact output (general-purpose design only)																			Y		
Without																					
Configuration type / diagnostics type																				0	
Without																				1	
Factory defaults / standard diagnostics																					

Continued on next page...

* The type of signal cable supplied (standard or armored) depends on the type of cable conduit (variant digit number 24) ordered.
For FM or FMC Approved versions, NPT only permitted.

Product coding field number	1 ... 5	6	7 ... 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system, optimized full bore, integral mount	FEV11	X	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	
Flowmeter system, optimized full bore, remote mount	FEV12																				
Optimized full bore sensor only, for use with WaterMaster transmitter / remote	FEV18																				

Options**

Accessories

Configuration lead	AC

Documentation language

German	M1	Chinese	M6
Italian	M2	Swedish	M7
Spanish	M3	Finnish	M8
French	M4	Portuguese	MA
English	M5 (default)	Danish	MF
		Norwegian	MN

Other usage certifications

Measuring Instruments Directive (MID)	CM1
OIML R49 Calibration	CM2

Verification type

Without fingerprint	V0
VeriMaster	V3

Potable water approval

WRAS cold water approval	CWA
NSF 61 meter approval	CWC
DVGW	CWD
ACS	CWF
Without	CWY

Power supply frequency (sensor FEV18 only)

50 Hz	F5
60 Hz	F6

Number of testpoints

1 Point	T1
3 Points	T3

**Add codes for options.

Electromagnetic flowmeter WaterMaster – FEW31, FEW32 and FEW38

Product coding field number	1 ... 5	6	7 ... 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system – full bore, integral mount	FEW31																				
Flowmeter system – full bore, remote mount	FEW32	X	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	
Full bore sensor only – for use with WaterMaster transmitter / remote	FEW38																				
Design																					
Non-hazardous areas		1																			
Hazardous areas		5																			
Bore diameter																					
DN10 (3/8 in.)			010																		
DN15 (1/2 in.)			015																		
DN20 (3/4 in.)			020																		
DN25 (1 in.)			025																		
DN32 (1 1/4 in.)			032																		
DN40 (1 1/2 in.)			040																		
DN50 (2 in.)			050																		
DN65 (2 1/2 in.)			065																		
DN80 (3 in.)			080																		
DN100 (4 in.)			100																		
DN125 (5 in.)			125																		
DN150 (6 in.)			150																		
DN200 (8 in.)			200																		
DN250 (10 in.)			250																		
DN300 (12 in.)			300																		
DN350 (14 in.)			350																		
DN400 (16 in.)			400																		
DN450 (18 in.)			450																		
DN500 (20 in.)			500																		
DN600 (24 in.)			600																		
DN700 (28 in.)			700																		
DN750 (29 in.)			750																		
DN760 (30 in.)			760																		
DN800 (32 in.)			800																		
DN900 (36 in.)			900																		
DN1000 (40 in.)			001																		
DN1050 (42 in.)			051																		
DN1100 (44 in.)			101																		
DN1200 (48 in.)			201																		
DN1350 (54 in.)			351																		
DN1400 (56 in.)			401																		
DN1500 (60 in.)			501																		
DN1600 (64 in.)			601																		
DN1650 (66 in.)			651																		
DN1800 (72 in.)			801																		
DN1950 (78 in.)			951																		
DN2000 (80 in.)			002																		
DN2100 (84 in.)			102																		
DN2200 (88 in.)			202																		
DN2400 (96 in.)			402																		
Others			999																		
Liner material																					
PTFE – DN10 to 600 (3/8 to 24 in. NB)				A																	
Hard rubber – DN40 to 2400 (1 1/2 to 96 in. NB)				H																	
Elastomer – DN40 to 2400 (1 1/2 to 96 in. NB)				K																	
Electrode design																					
Standard					1																
Other					9																
Measuring electrodes material																					
Hastelloy® C-4 (2.4610)						D															
Stainless steel 316Ti/316L						S															
Hastelloy C-22						C															
Grounding accessories																					
Not required							0														
Standard							1														
One potential equalizing ring (stainless steel)							3														
Two potential equalizing rings (stainless steel)							4														

Continued on next page...

Product coding field number	1 ... 5	6	7 ... 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system – full bore, integral mount	FEW31																				
Flowmeter system – full bore, remote mount	FEW32	X	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	
Full bore sensor only – for use with WaterMaster transmitter / remote	FEW38																				
Process connection type (refer to pages 21 to 26)																					
Flanges ASME B16.47 series B / B16.5 Class 150								A1													
Flanges ASME B16.47 series B / B16.5 Class 300								A3													
Flanges ASME B16.47 series A Class 150								B1													
Flanges ASME B16.47 series A Class 300								B3													
Flanges AWWA C207 Class B								C1													
Flanges AWWA C207 Class D								C2													
Flanges AWWA C207 Class E								C3													
Flanges AWWA C207 Class F								C4													
Flanges JIS 10K								J1													
Flanges JIS 5K								J2													
Flanges AS 4087 PN 16								E1													
Flanges AS 2129 Table E								E4													
Flanges AS 2129 Table D								E5													
Flanges AS 4087 PN 35								E8													
ISO 7005, DIN, EN 1092-1 PN6								S0													
ISO 7005, DIN, EN 1092-1 PN10								S1													
ISO 7005, DIN, EN 1092-1 PN16								S2													
ISO 7005, DIN, EN 1092-1 PN25								S3													
ISO 7005, DIN, EN 1092-1 PN40								S4													
Process connection material																					
Carbon steel flanges									B												
Stainless steel flange									D												
Usage certifications																					
Standard (without PED)										1											
Calibration type																					
Class 2 calibration – standard accuracy 0.4 %											A										
Class 1 calibration – high accuracy 0.2 %											B										
Temperature range installation / ambient temperature range																					
Standard design/ –20 ... 60 °C (–4 ... 140 °F)												1									
Nameplate																					
Adhesive													A								
Signal cable length and type																					
Without signal cable														0							
5 m (15 ft.) cable														1							
10 m (30 ft.) cable														2							
20 m (60 ft.) cable														3							
30 m (100 ft.) cable														4							
50 m (165 ft.) cable														5							
80 m (260 ft.) cable														6							
100 m (325 ft.) cable														7							
150 m (490 ft.) cable														8							
Special length or cable type														9							
Explosion protection certification*																					
General purpose (non-Ex design)															A						
FM Class 1 Div. 2															G						
usFMc Class 1 Div. 2															P						
ATEX / IECEx Zone 2, 21 & 22															M						

Continued on next page...

Product coding field number	1 ... 5	6	7 ... 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system – full bore, integral mount	FEW31	X	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	
Flowmeter system – full bore, remote mount	FEW32																				
Full bore sensor only – for use with WaterMaster transmitter / remote	FEW38																				

Protection class transmitter / protection class sensor

IP67 (NEMA 4X) / IP67 (NEMA 4X) – cable not fitted and not potted to sensor	1
IP 67 (NEMA 4x) / IP68 (NEMA 6P) – cable not fitted and not potted to sensor	2
IP 67 (NEMA 4x) / IP68 (NEMA 6P) – cable fitted and potted to sensor	3

Cable conduits **

M20 x 1.5 (plastic)	A
NPT ½ in. (blanked when cable not fitted)	B
M20 SWA (armored)	D
M20 SWA sensor, M20 x 1.5 (plastic) power / output	F
Without	Y

Power supply

Without	0
108.. 230 V AC, 50 Hz	1
24 V AC or 24 V DC, 50 Hz	2
100 ... 230 V AC, 60 Hz	3
24 V AC or 24 V DC, 60 Hz	4

Input and output signal type

HART + 20 mA + pulse + contact output	A
PROFIBUS DP RS485 physical layer + pulse + contact output (general-purpose design only)	G
MODBUS RTU RS485 physical layer + pulse + contact output (general-purpose design only)	M
Without	Y

Configuration type / diagnostics type

Not required	0
Factory default / Standard	1

Options***

Accessories

Configuration lead	AC

Documentation language

German	M1	Chinese	M6
Italian	M2	Swedish	M7
Spanish	M3	Finnish	M8
French	M4	Portuguese	MA
English	M5 (default)	Danish	MF
		Norwegian	MN

Lay length

Isolength – DN10 to 600 (⅜ to 24 in.) and 1.25D DN1800 to 2400 (72 to 96 in.)	JB
1.3D DN700 to 2400 (28 to 96 in.)	JK
1.0D DN700 to 1650 (28 to 66 in.)	JH

Verification type

Without fingerprint	V0
VeriMaster	V3

Potable water approval

WRAS cold water approval	CWA
DVGW	CWD
WRAS 60 °C (140 °F) water approval	CWK
NSF material approval	CWM
Without	CWY

Power supply frequency (sensor FEW38 only)

50 Hz	F5
60 Hz	F6

* FM approval in process. FEF product still available with full FM approval

** The type of signal cable supplied (standard or armored) depends on the type of cable conduit (variant digit number 24) ordered. For FM or FMC Approved versions, NPT only permitted.

*** Add codes for options.

Common accessories

Accessory	Item Number
WaterMaster AC Fuse F1 Type T 250 mA A/S TR5	B20411
WaterMaster DC Fuse F2 Type T 2 A A/S TR5	B20412
WaterMaster Infra Red Comms Pack	MJBX9932
WaterMaster Backplane PCB Board (STD)	WATX2505
WaterMaster Sensor PCB Board	WATX2506
WaterMaster Comms Cable	WEBC2500
Signal cable for remote WaterMaster transmitter	
5 m (15 ft.)	STT4500/05
10 m (30 ft.)	STT4500/10
20 m (60 ft.)	STT4500/20
30 m (100 ft.)	STT4500/30
50 m (165 ft.)	STT4500/50
80 m (260 ft.)	STT4500/80
100 m (325 ft.)	STT4500/100
150 m (490 ft.)	STT4500/150
500 m (1650 ft.)	STT4500/500
Armored signal cable for remote WaterMaster transmitter	
5 m (15 ft.)	STT4501/05
10 m (30 ft.)	STT4501/10
20 m (60 ft.)	STT4501/20
30 m (100 ft.)	STT4501/30
50 m (165 ft.)	STT4501/50
80 m (260 ft.)	STT4501/80
100 m (325 ft.)	STT4501/100
150 m (490 ft.)	STT4501/150
500 m (1650 ft.)	STT4501/500

Acknowledgements

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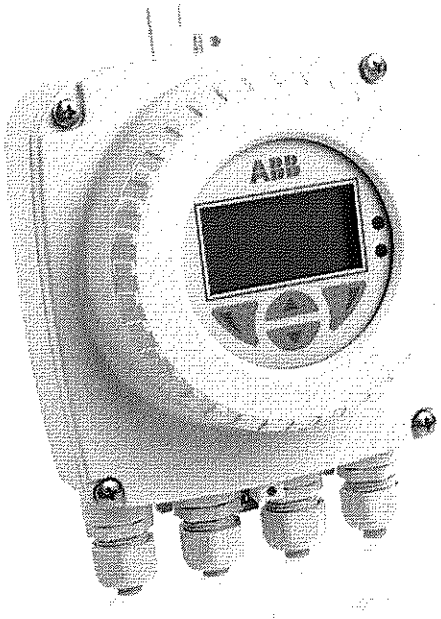
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User Guide OI/FET100-EN Rev. F

WaterMaster FET100 Electromagnetic flowmeter Transmitter

The perfect fit for all water industry applications



Introduction

WaterMaster™ is a range of high performance electromagnetic flowmeters for the measurement of electrically-conductive fluids and systems are normally supplied factory-configured and calibrated.

This User Guide provides installation, connection, security, start-up and basic setup details. For programming and configuration information refer to the Programming Guide – IM/WMP.

For a comprehensive overview of publications available for the WaterMaster transmitter, refer to the inside cover of this publication. Web links, QR code and reference numbers are also included.

Power and productivity for a better world™

The Company

We are an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

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Quality Control

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UKAS CALIBRATION
0255

UKAS Calibration Laboratory No. 0255

For more information...

Further publications for the WaterMaster transmitter are available for free download from www.abb.com/flow (see links and reference numbers below) or by scanning this code:

	search for or click on:
Programming Guide	IM/WMP
User Guide Supplement, PROFIBUS RS485 Physical Layer (FEX100–DP)	IM/WMPBS–EN
User Guide Supplement, PROFIBUS FEX100-DP Parameter Tables	IM/WMPBST–EN
User Guide Supplement, MODBUS RS485 Physical Layer (FEX100–MB)	COI/FEX100/MOD–EN
User Guide Supplement, MODBUS Tables	COI/FEX100/MOD/TBL–EN

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1 Safety

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of the Technical Publications Department.

1.1 Electrical Safety

This equipment follows, obeys the requirements of CEI/IEC 61010-1:2001-2 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use' and follows, obeys NIST and OSHA.

If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

1.2 Symbols

One or more of the following symbols may appear on the equipment labeling:

	**Warning** – Refer to the manual for instructions
	**Caution** – Risk of electric shock
	Protective earth (ground) terminal
	Earth (ground) terminal

	Direct current supply only
	Alternating current supply only
	Both direct and alternating current supply
	The equipment is protected through double insulation

1.3 Health & Safety

Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

- The safety requirements of this equipment, any associated equipment and the local environment must be taken into consideration during installation.
- Install and use this equipment and any associated equipment in accordance with the relevant national and local standards.
- The relevant sections of these instructions must be read carefully before proceeding.
- Warning labels on containers and packages must be observed.
- Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
- Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and / or temperature.
- Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
- When disposing of chemicals ensure that no two chemicals are mixed.
- Product liability – advice and assistance provided without charge is given in good faith but without liability.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

Warning.

- System configuration must be carried out only by users or personnel with approved access rights (user privileges).
- Read all relevant sections of this guide before configuring the system or modifying system parameters.
- Install and use associated equipment in accordance with the relevant national and local standards.

1.4 Waste Electrical and Electronic Equipment (WEEE)

WEEE EU Directives 2002/96/EC and 2003/108/EC cover disposal and recycling of electronic equipment at the end of life for reasons of environmental protection. Not all products are covered by the categories in this directive.

For Industrial installations, portable equipment is included, hence when the WaterMaster transmitter is used with a portable AquaProbe sensor, it is included in directive's scope and therefore has the WEEE symbol ()on its data label.

Therefore, at the end of life, contact the supplier for specialist waste recycling. It should not be disposed of as municipal waste.

Permanent Industrial installations are not designated within this directive for recycling. At the point of supply the intended use is not always known, so the WEEE symbol is included on all remote forms of the WaterMaster transmitter.

2 Mechanical Installation

2.1 Installation Conditions

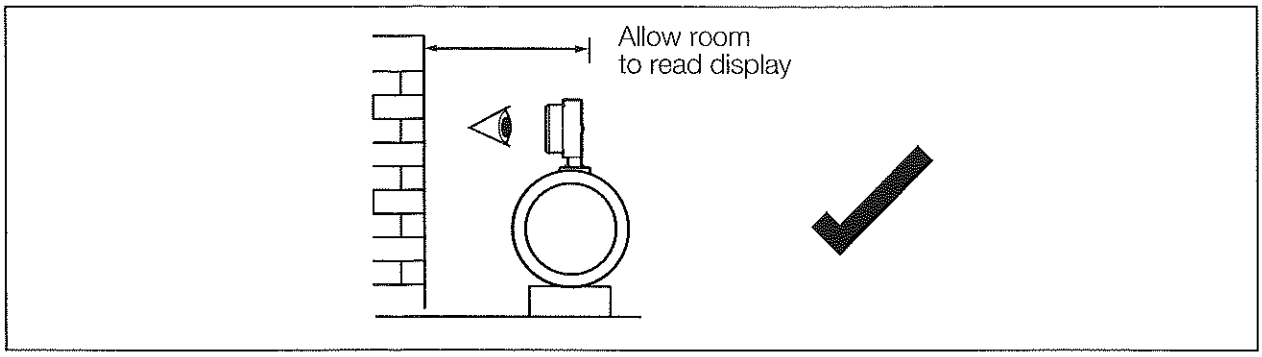


Fig. 2.1 Siting

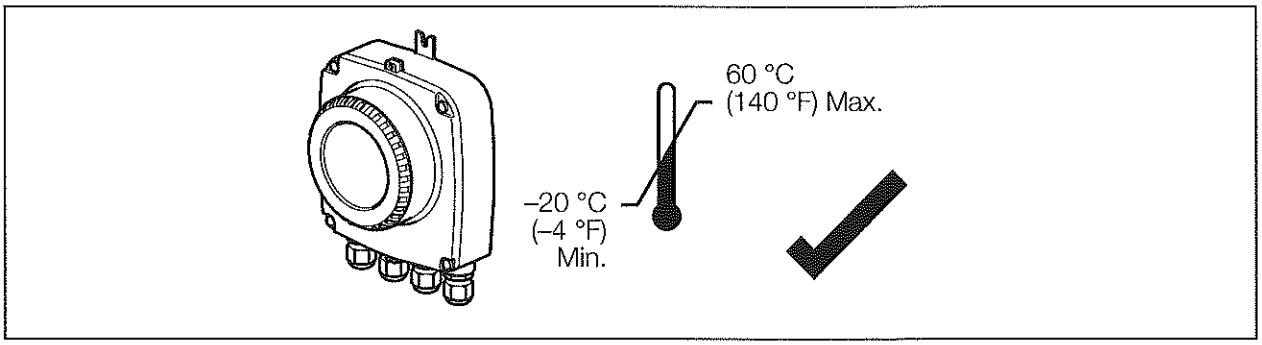


Fig. 2.2 Within Temperature Limits

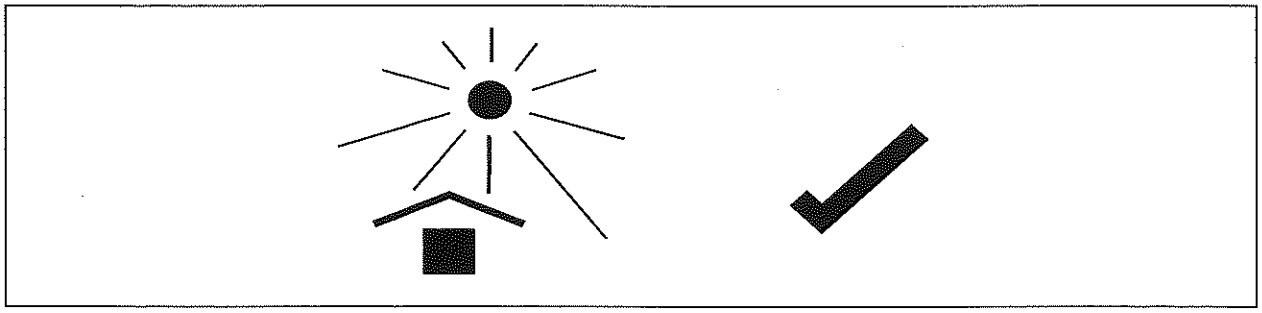


Fig. 2.3 Shade

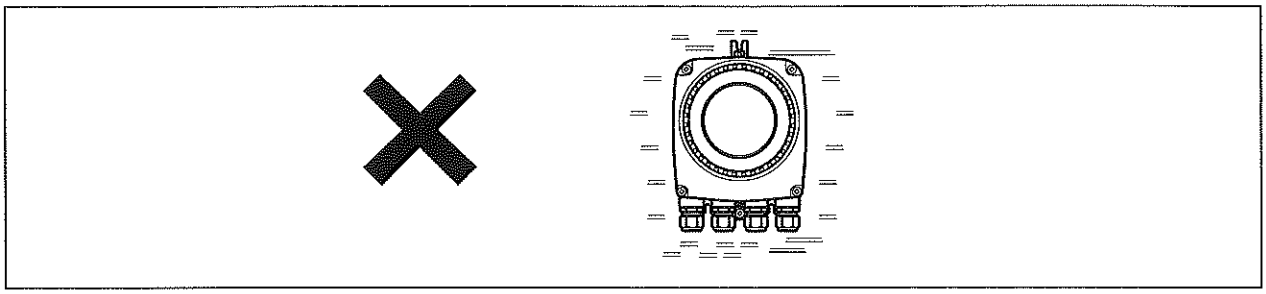


Fig. 2.4 Vibration

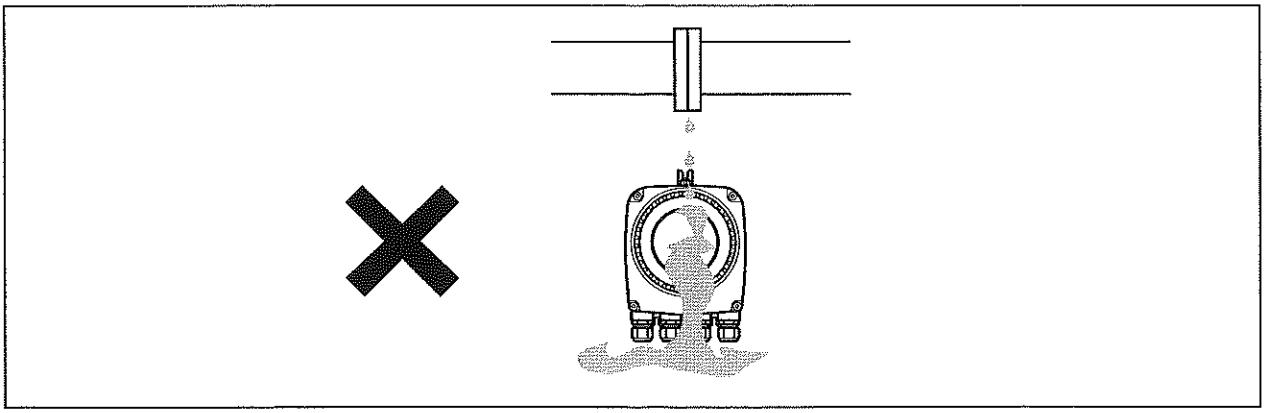


Fig. 2.5 Spillage

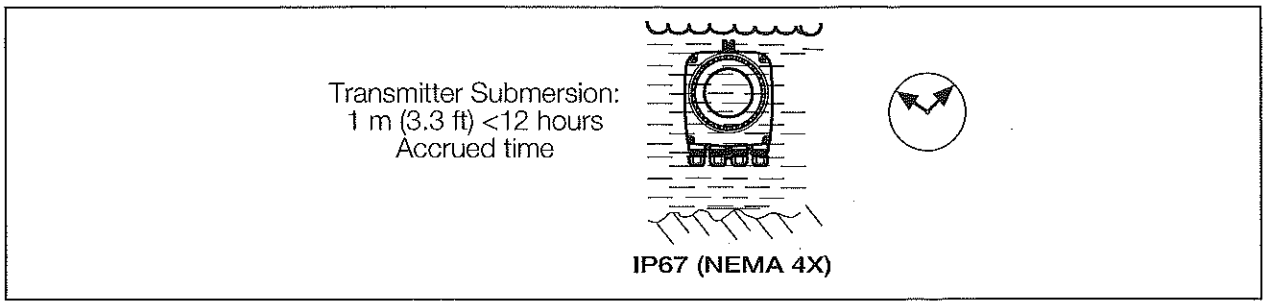


Fig. 2.6 Within Environmental Rating

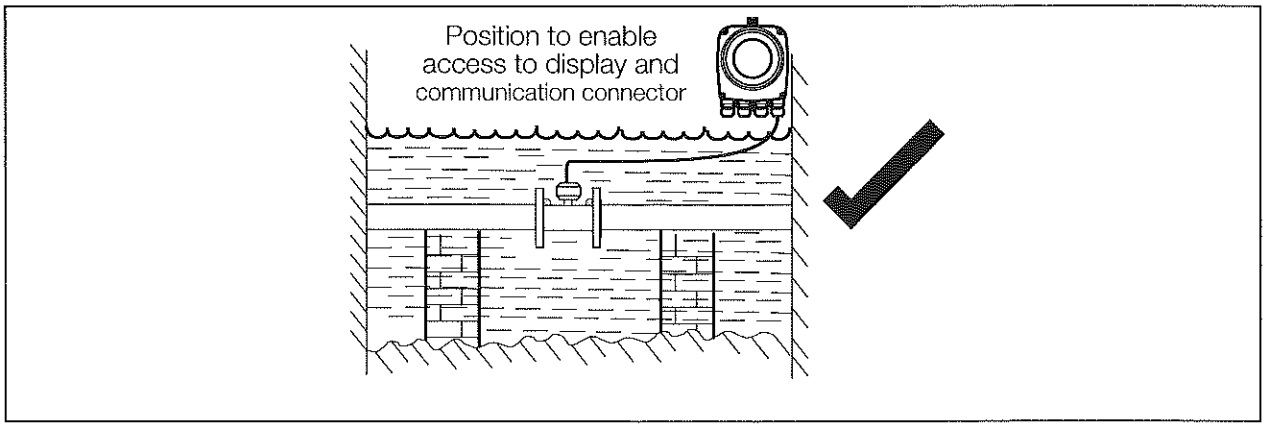


Fig. 2.7 Access to Transmitter

2.2 Dimensions

Dimensions in mm (in).

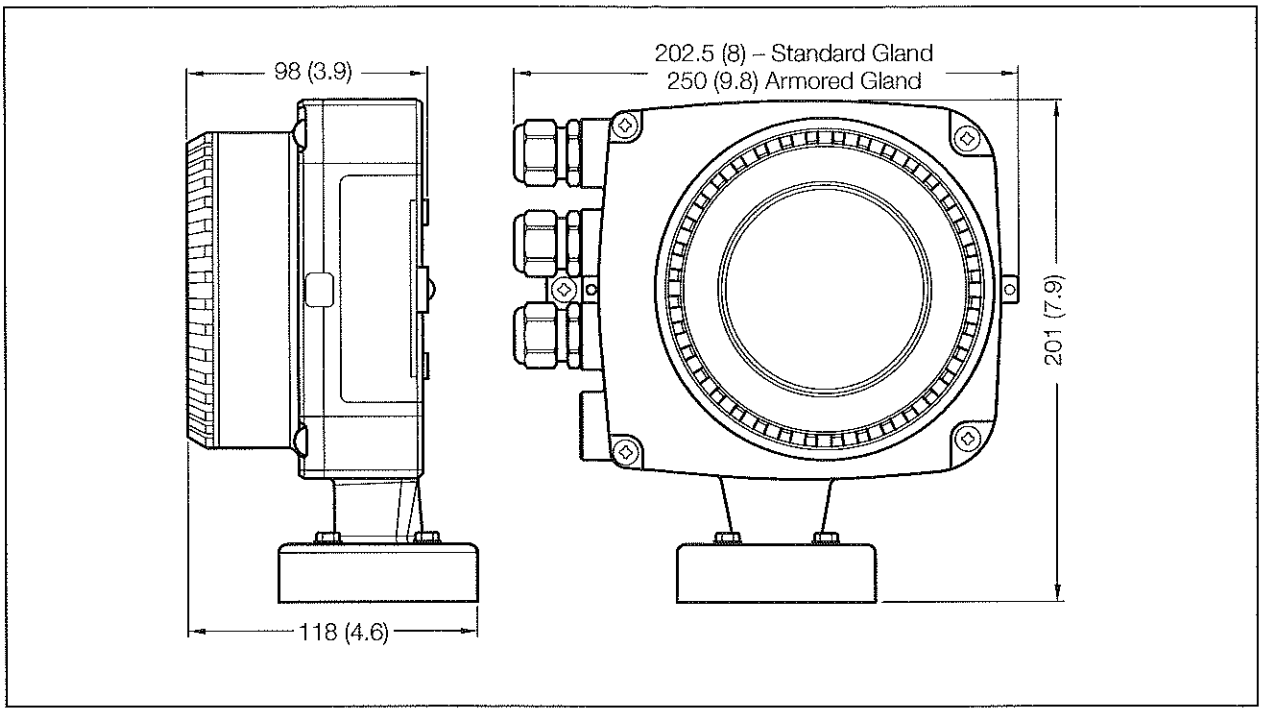


Fig. 2.8 Integral Transmitter Dimensions (Standard Gland Shown)

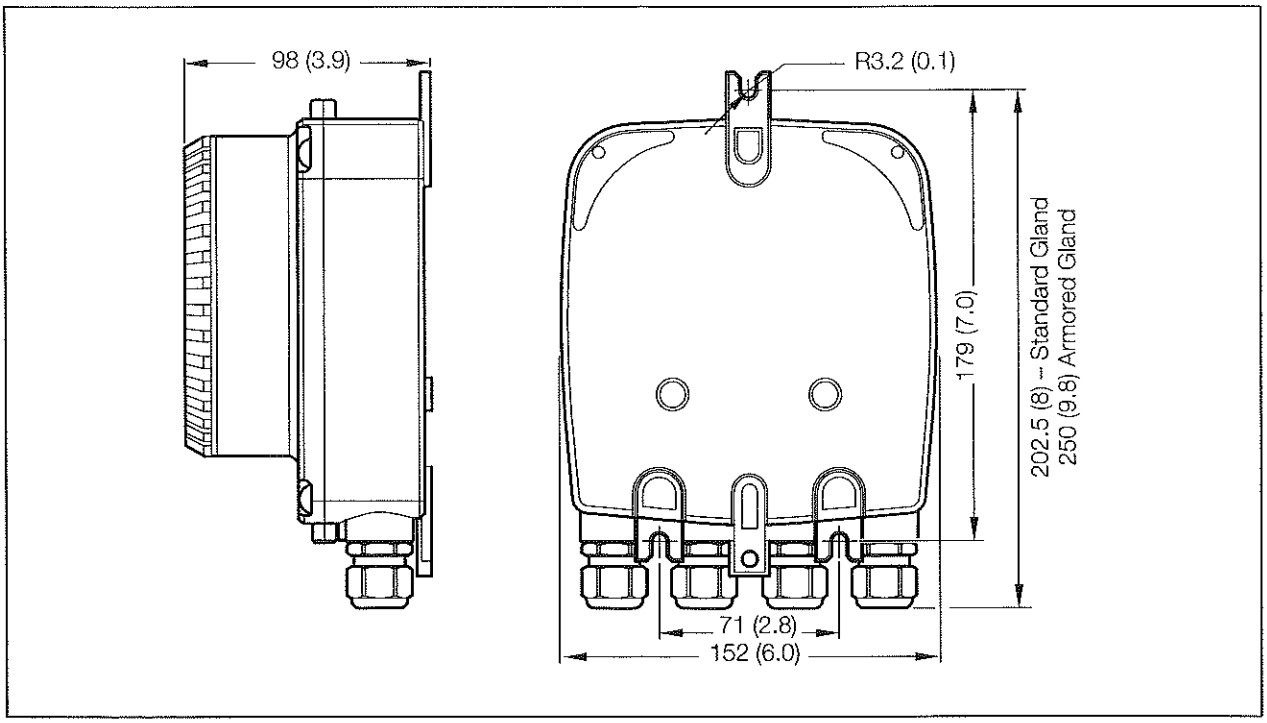


Fig. 2.9 Remote Transmitter Dimensions (Standard Gland Shown)

Note. Fix remote transmitter to a secure surface using 3 x M5 screws (not supplied).

3 Electrical Installation

3.1 Remote Transmitter / Sensor Arrangement

Note. For bonding connections use ≥ 4mm² (< 10AWG) cable.

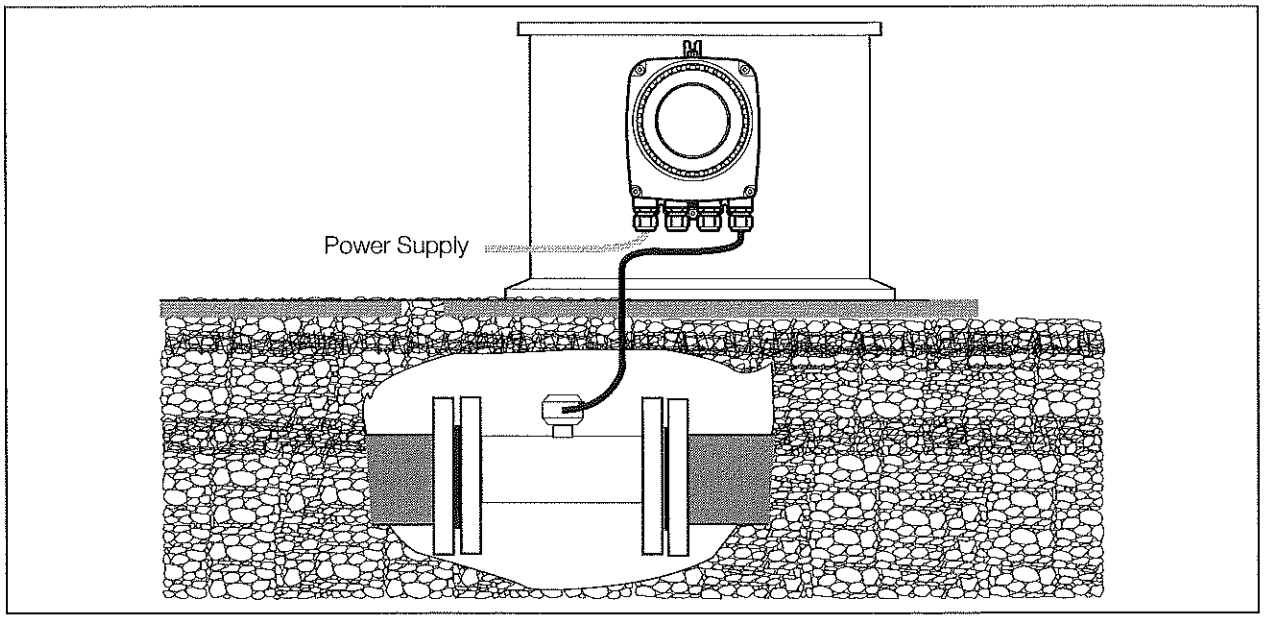


Fig. 3.1 Remote Transmitter in Roadside Cabinet – Flanged Sensor

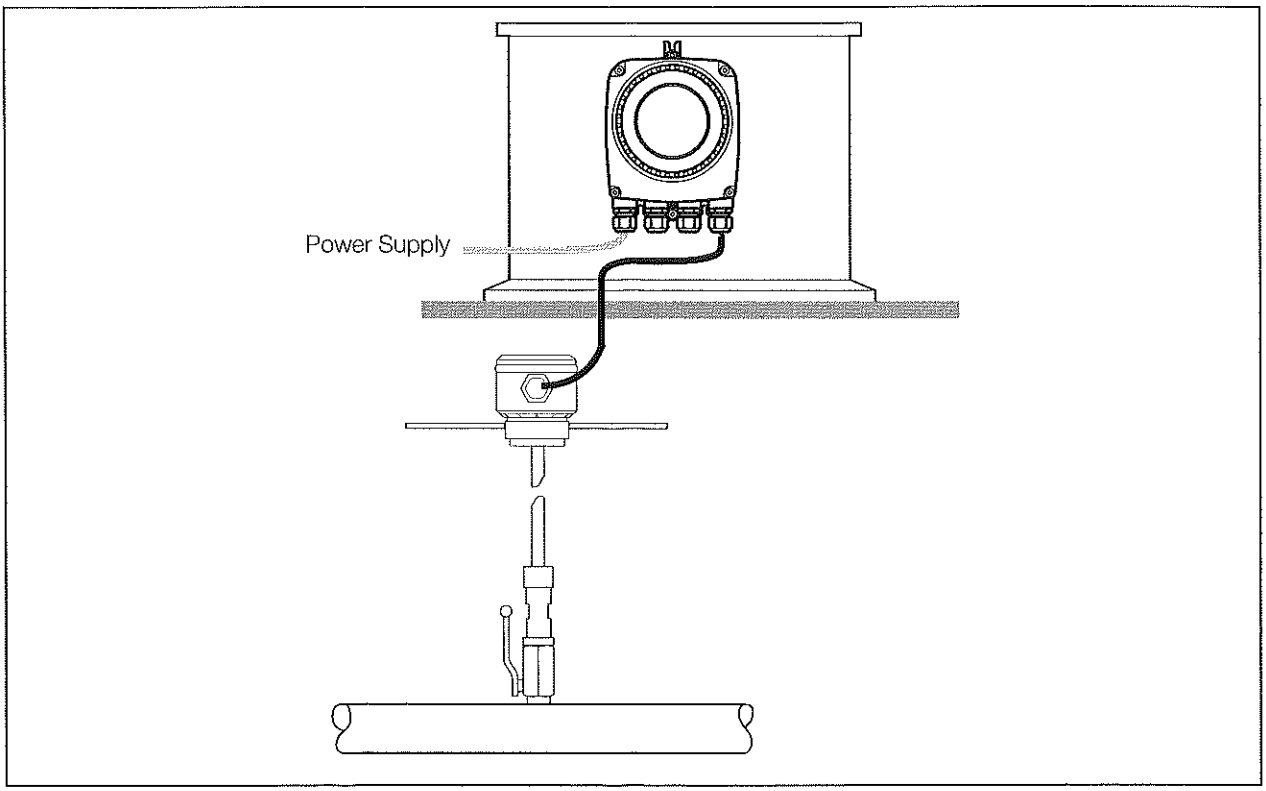


Fig. 3.2 Remote Transmitter in Roadside Cabinet – Probe Sensor

3.2 Transmitter Terminal Connections

Warning. Isolate the transmitter from power supplies before removing the cover.

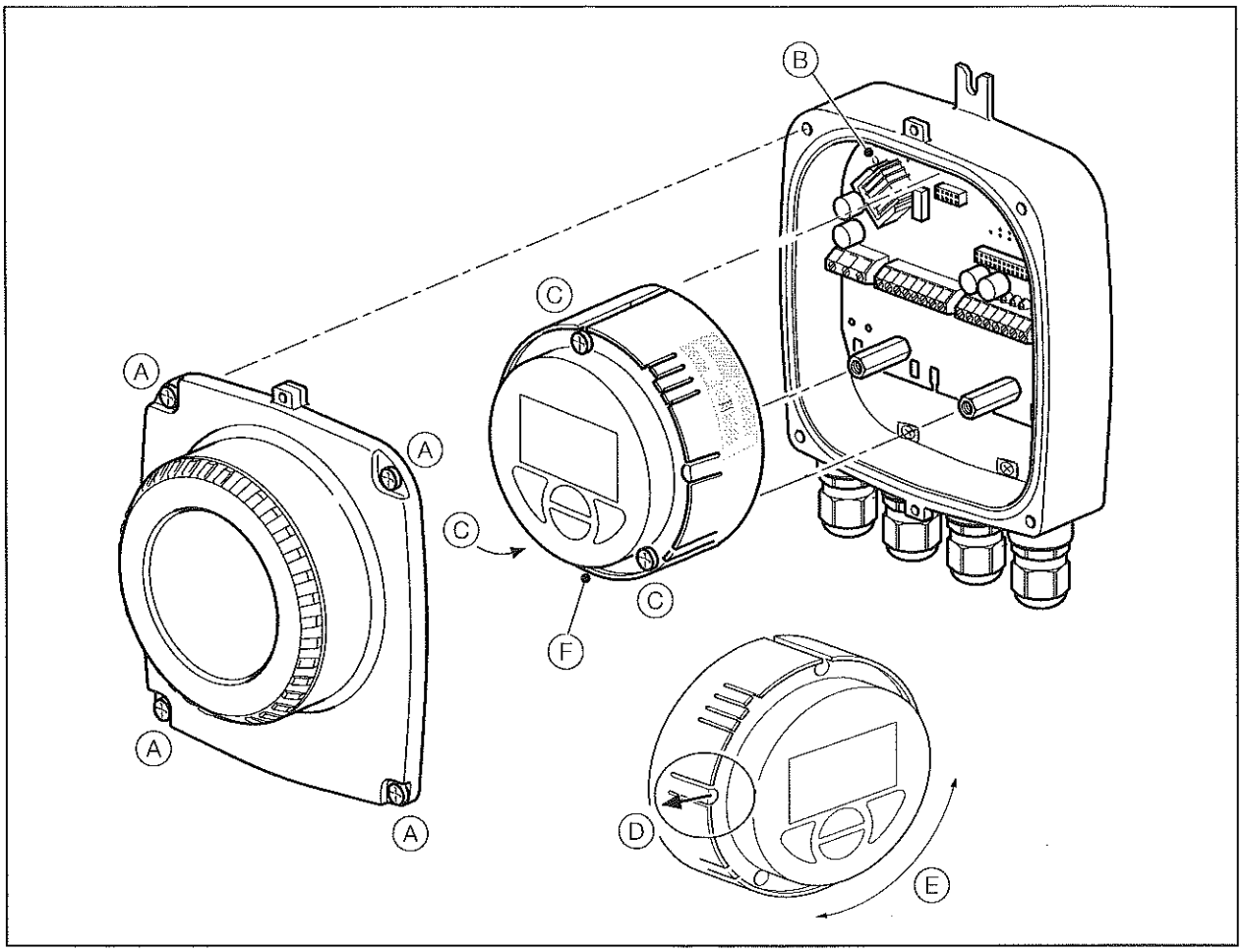


Fig. 3.3 Accessing the Transmitter Terminals

Referring to Fig. 3.3:

1. Slacken (but do not remove) the four transmitter cover screws (A).
2. Remove the transmitter cover.
3. Check that the power indicator LED (B) on the backplane is **not** lit.

   Warning. If the power indicator LED (B) is lit, the transmitter is still powered up. Before continuing, isolate the transmitter power supply.

4. If screws (C) are not visible, access them by gently pulling the rotation lock (D) back and rotating the cartridge (E) until the cartridge screw access holes align with the cartridge screw heads.
5. Slacken the three cartridge screws and lift the cartridge (F) away from the housing.

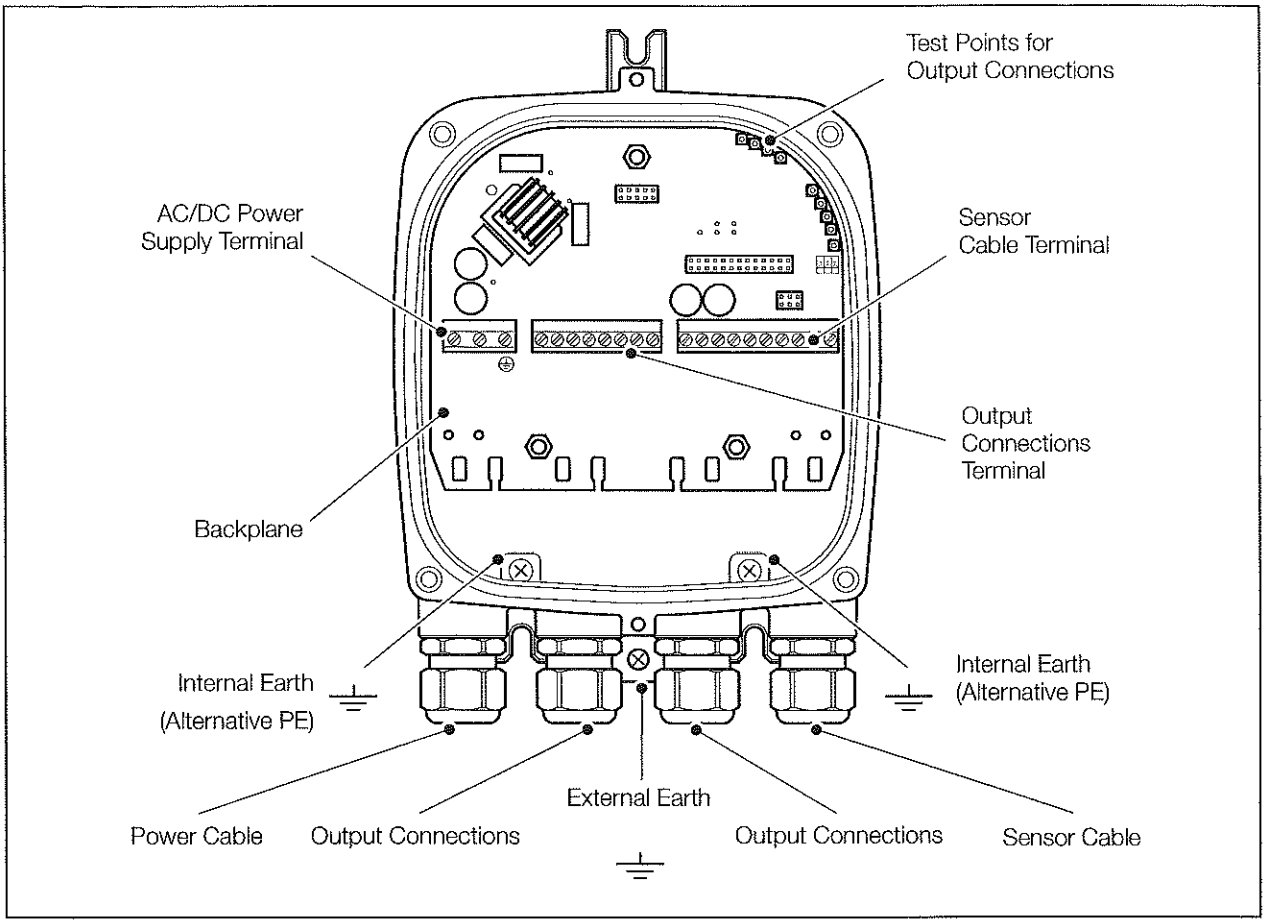


Fig. 3.4 Cable Gland / Conduit Entry (Remote Transmitter Shown)

3.3 Cable Preparation (Remote Systems Only)

To prepare the cable for connection at the transmitter and sensor terminal blocks:

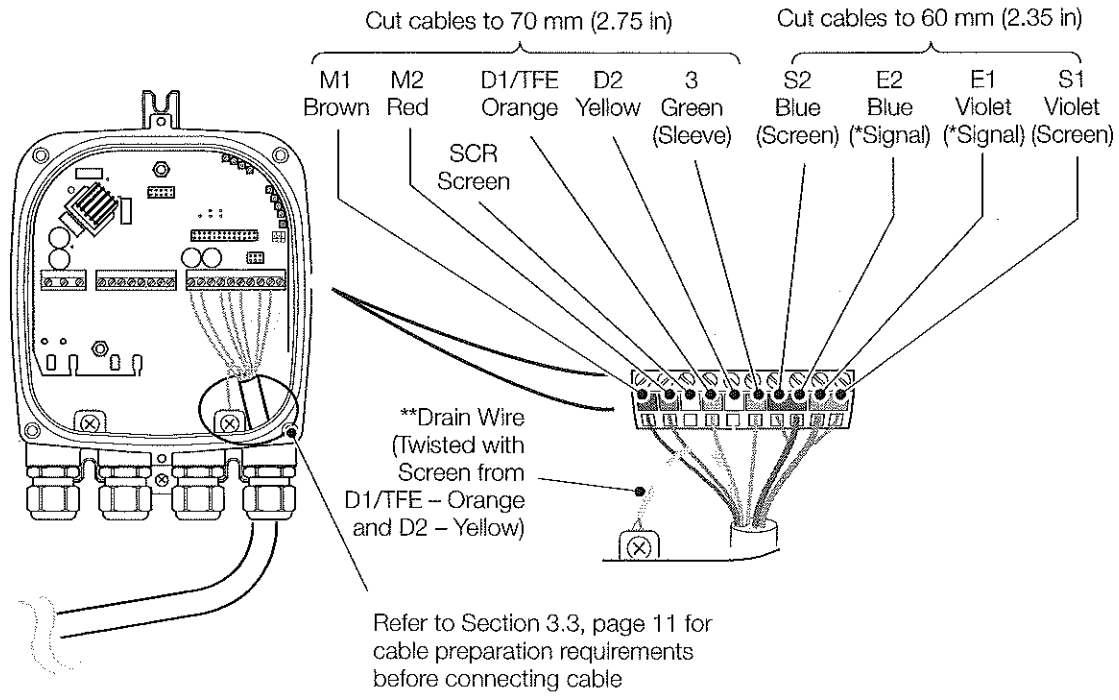
1. Remove the outer cable insulation and Mylar® wrap.
2. Ensure the drain wire is sleeved.
3. Cut the cable connection wires to the lengths shown in Fig 3.5, page 12.

3.4 Transmitter / Sensor Cable Connections

Caution.

- Make connections only as shown.
- Twist the screen wire of D1 / TFE + D2 with the outer screen drain wire and sleeve them.
- For standard (non-cathodically protected) systems, connect the drain wire to the earth screw.
- For cathodically protected systems, connect the drain wire to terminal SCR, ensuring no braid or wires touch the exposed copper areas within the transmitter sensor cable wiring area.
- If an earth screw is not available at the transmitter enclosure, connect the drain wire to terminal SCR.
- Ensure the seal and mating surfaces are clean to maintain environmental rating.
- Conduit connections must provide cable entry sealing.
- Ensure cable glands are tightened after wiring. Do not overtighten the plastic cable glands to avoid destroying their sealing properties. Initially, tighten finger-tight, then a further 1/2 to 3/4 turn using a suitable spanner or wrench.
- Fit blanking plugs where required.

3.4.1 Sensor Cable Terminal Connections and Recommended Cable Lengths



*Inner wire
**For cathodically protected systems (or if the transmitter enclosure does not have an earth screw) connect the drain wire to terminal SCR.

Fig. 3.5 Sensor Cable Connections at Transmitter Terminal Block – Standard System

3.5 Output Connections

Caution.

- Inductive loads must be suppressed or clamped to limit voltage swings.
- Operation of outputs is programmable.
- External isolators are not normally required as the pulse and alarm circuit is electrically separated from all other WaterMaster connections.

3.5.1 Frequency Outputs

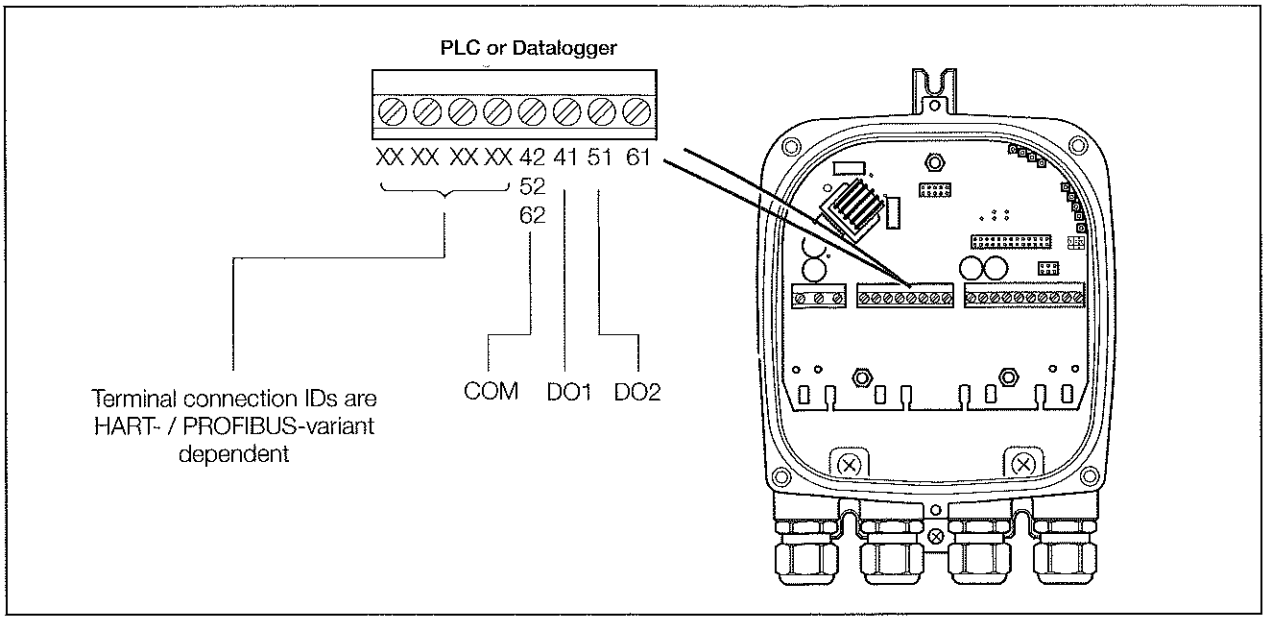


Fig. 3.6 PLC / Datalogger Connections

Note. Digital outputs DO1 and DO2 are polarity sensitive. The common (negative) connection for these outputs is designated 'COM'.

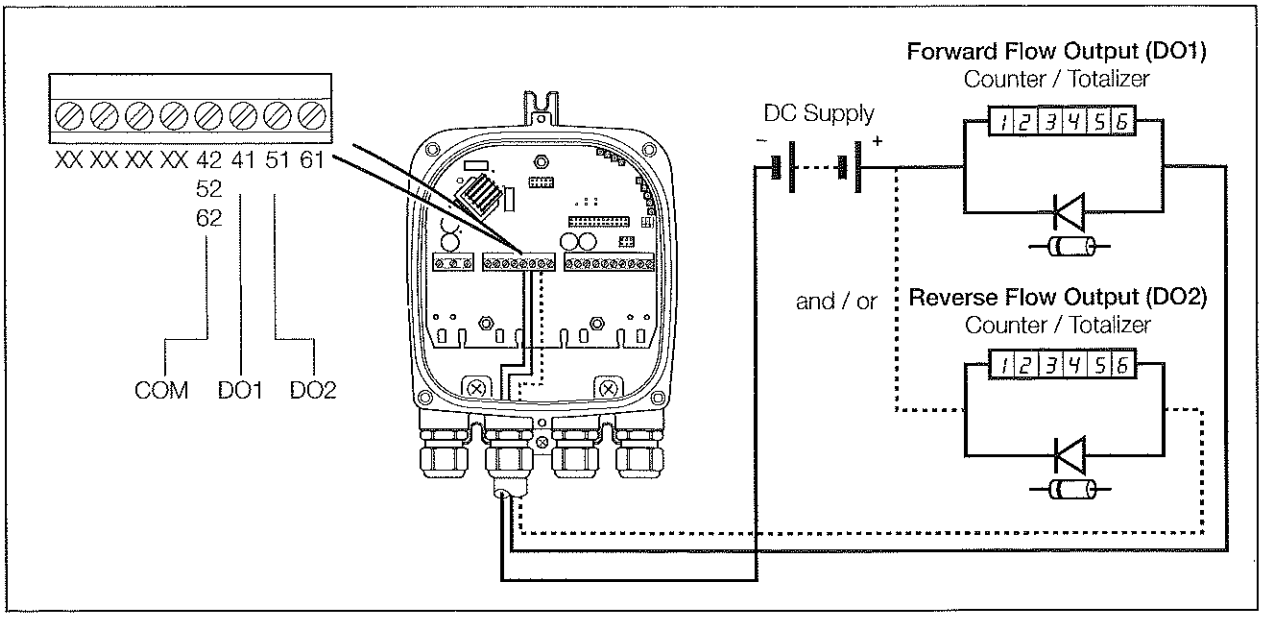


Fig. 3.7 Electromechanical Connections

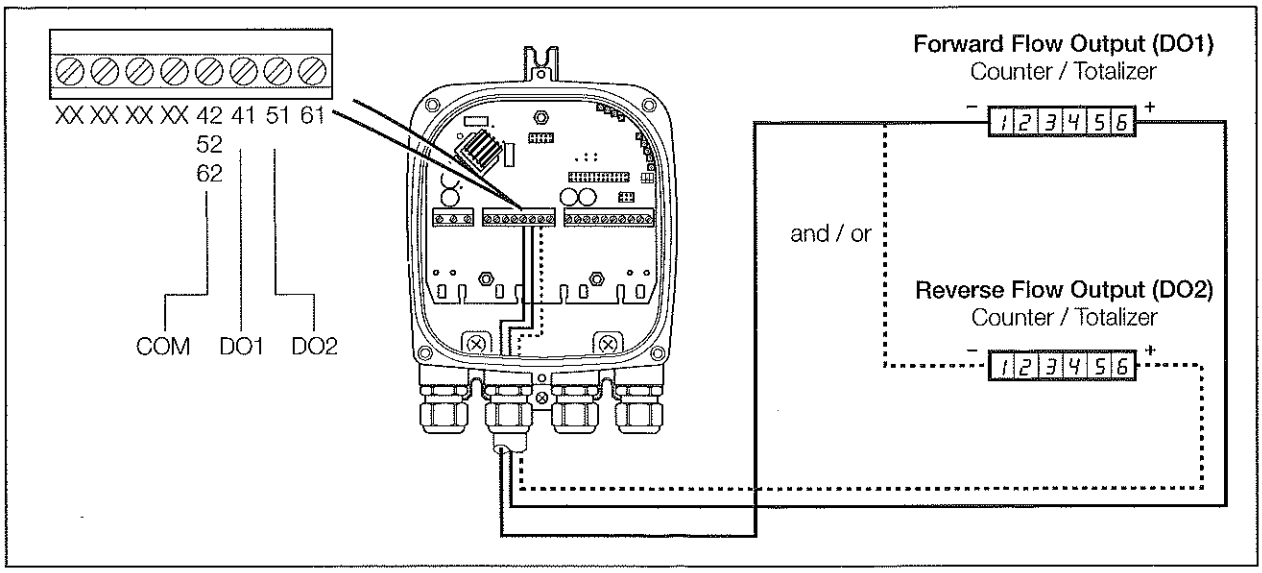


Fig. 3.8 Telemetry / Electronic Counters (etc.) Connections

3.5.2 Alarm Outputs

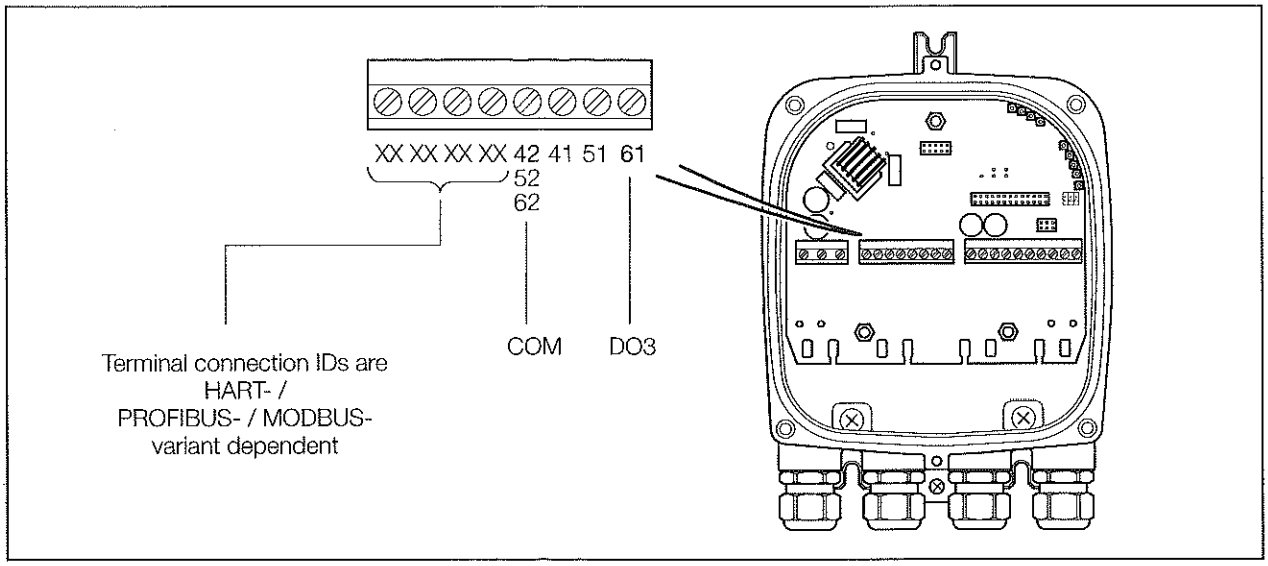


Fig. 3.9 Alarm Output Connections

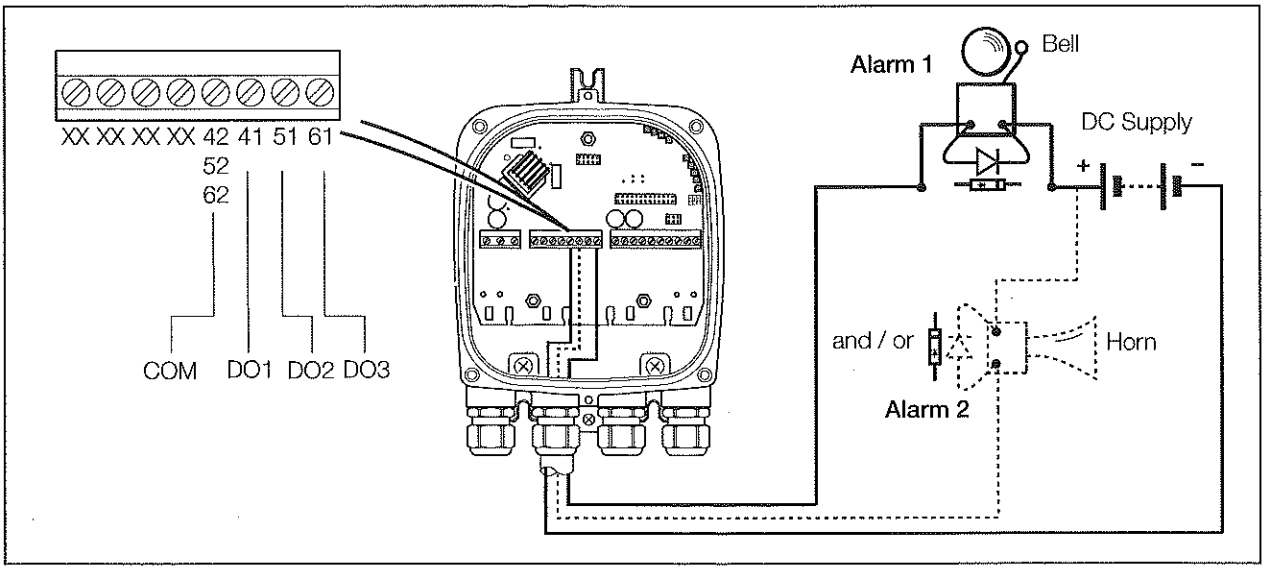


Fig. 3.10 Alarm Output Connections

Note.

- Normal alarm / logic output is from DO3 (terminal 61). DO1 (41) and DO2 (51) can also be configured as alarms if required but are then NOT available as frequency / pulse outputs as shown in Figs 3.7 and 3.8).
- Bell and horn shown for example only. Any suitable alarm device may be used (for example, lamp, siren, buzzer etc.).

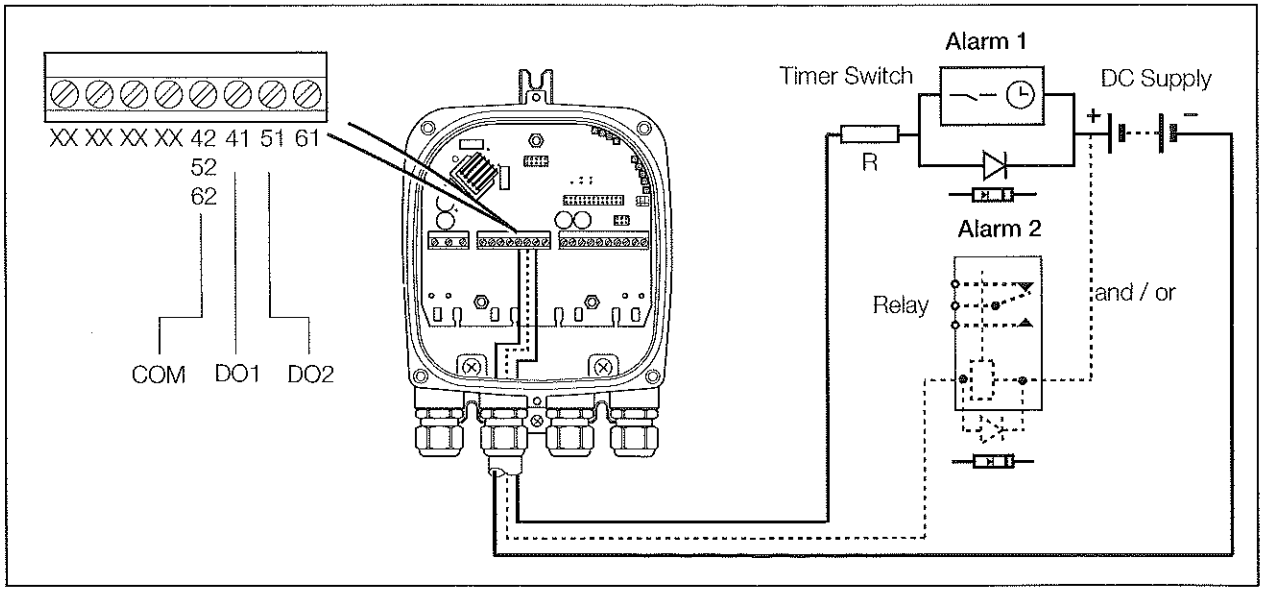


Fig. 3.11 Relay and Timers Output Connections

Note. Relay and timer switch shown for example only. Connect as required.

3.5.3 Contact Input

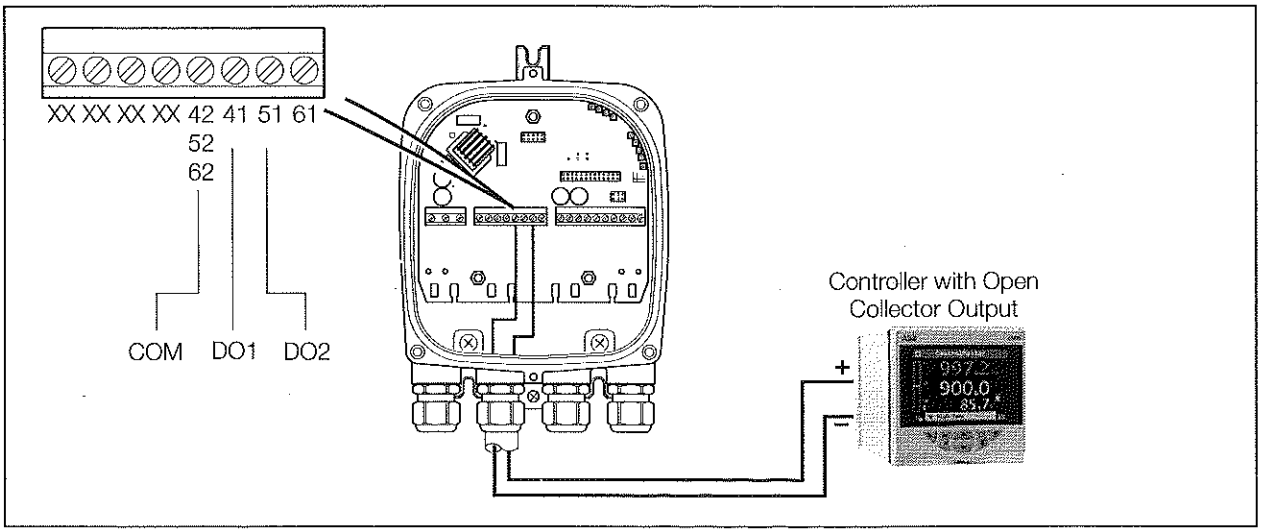


Fig. 3.12 Open Collector (or Grounded Contact) Connections

3.5.4 PLC Interface

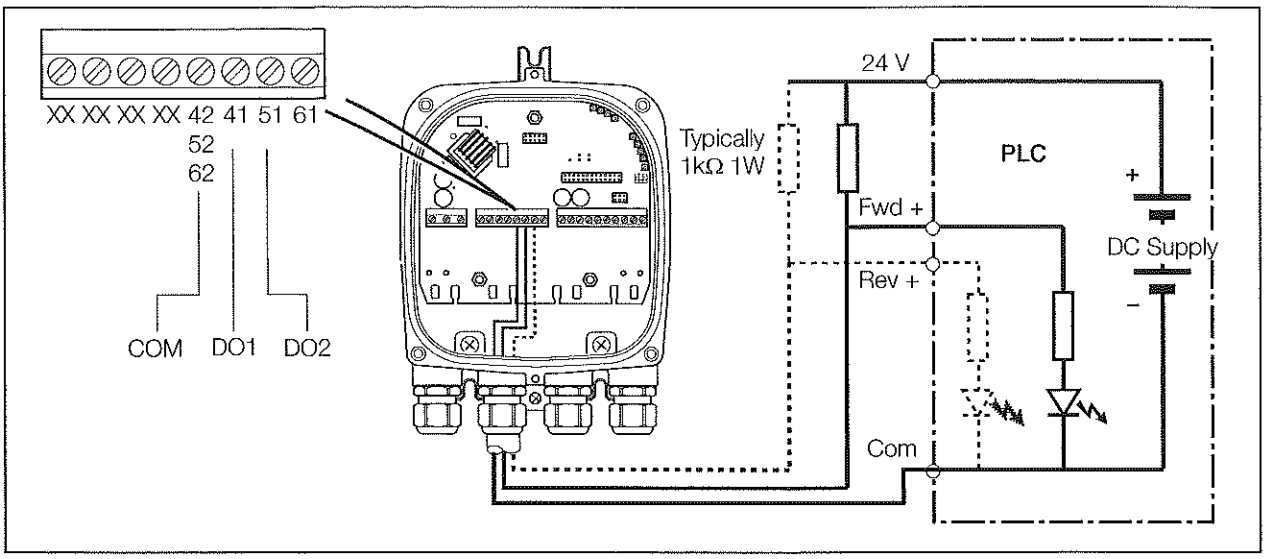


Fig. 3.13 PLC – Common –ve Connections

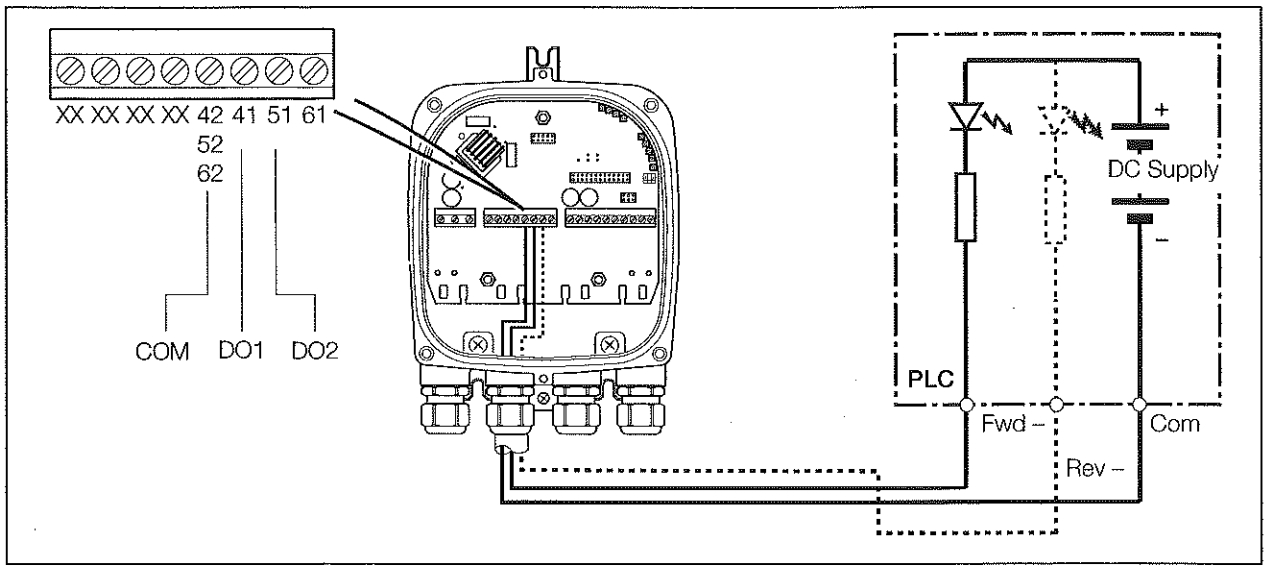


Fig. 3.14 PLC – Common +ve Connections

Note.

- WaterMaster digital outputs are NPN optocoupled transistors used as switches.
- Maximum allowed voltage at collector is 30 V DC
- Maximum allowed current across transistor is 220 mA.

3.5.5 Current Output (4 to 20 mA) – HART (FEX100) Variant

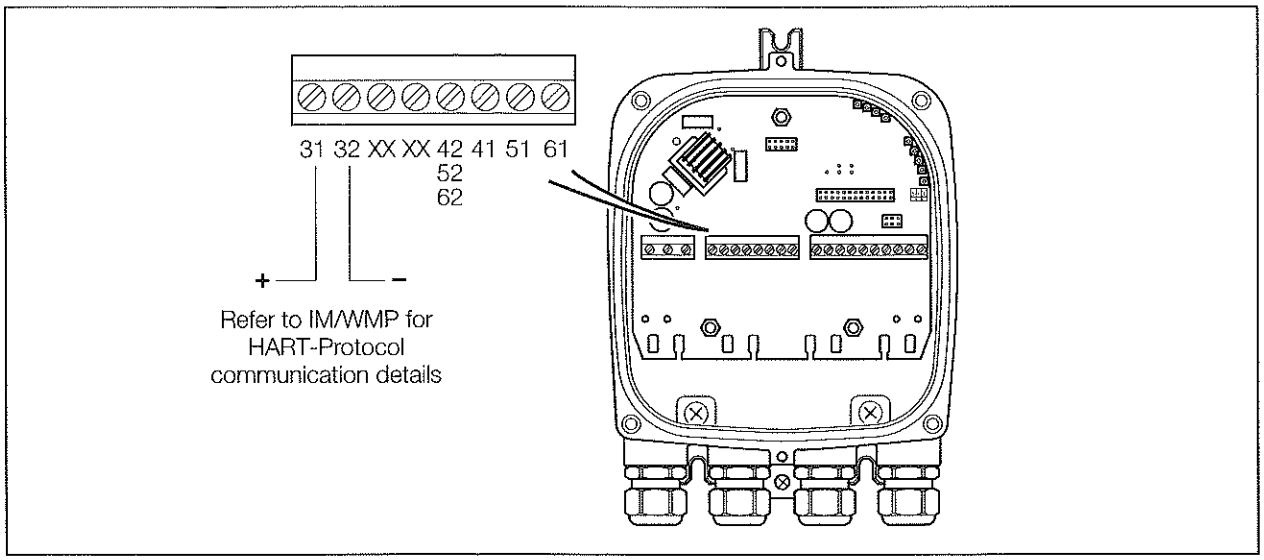


Fig. 3.15 Current Output (4 to 20 mA) – HART (FEX100) Variant

3.5.6 RS485 Communications – PROFIBUS (FEX100-DP) and MODBUS (FEX100-MB) Variants

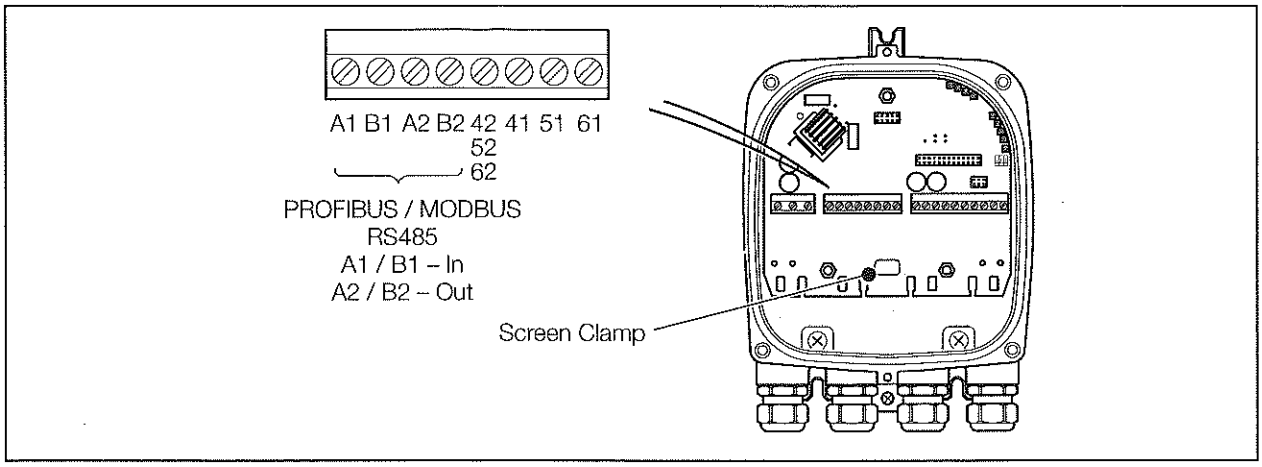
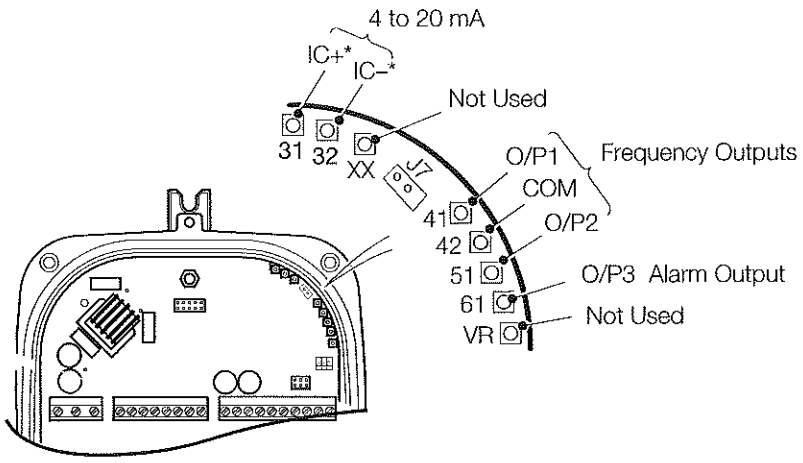


Fig. 3.16 WaterMaster RS485 Backplane Connections to PROFIBUS / MODBUS Networks

3.5.7 Test Point Access

Note. A typical DVM probe can access (fit) the PCB's test holes.



*These 2 test points are connected on the HART FEX100 backplane only
(they are present on the PROFIBUS FEX100-DP / MODBUS FEX100-MB backplane but are not connected)

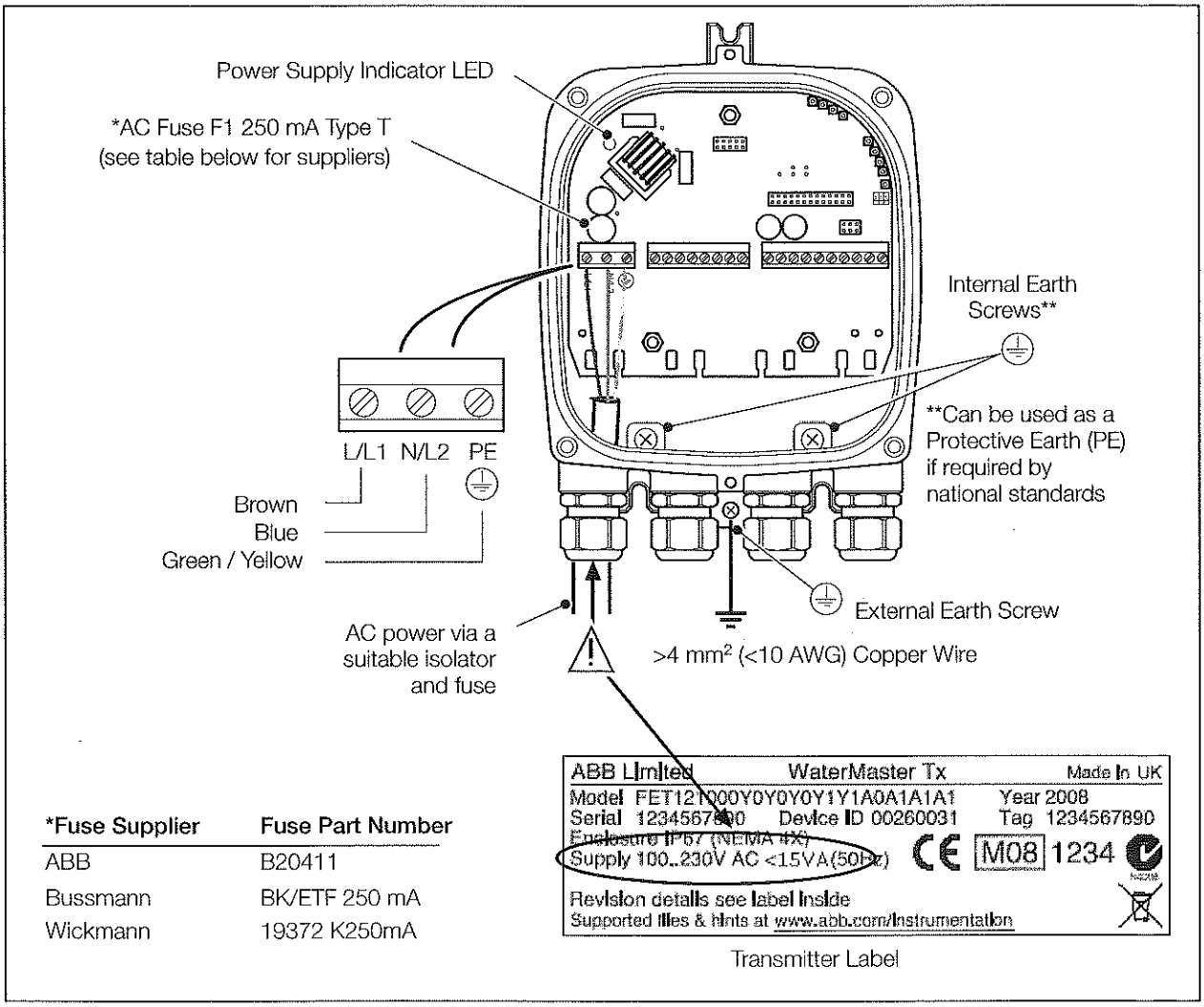
Fig. 3.17 Transmitter PCB Board Test Point Access

3.6 Power Supply Connections

Warning.

- Electrical installation and earthing (grounding) must be in accordance with relevant national and local standards.
- Power must be connected via a suitable isolator and fused in accordance with relevant standards.
- When changing fuses F1 or F2, isolate the power supply and wait 20 seconds before opening the enclosure.
- Replace fuses with the correct part – see Fig 3.18 (AC power) and 3.19, page 21 (DC power).

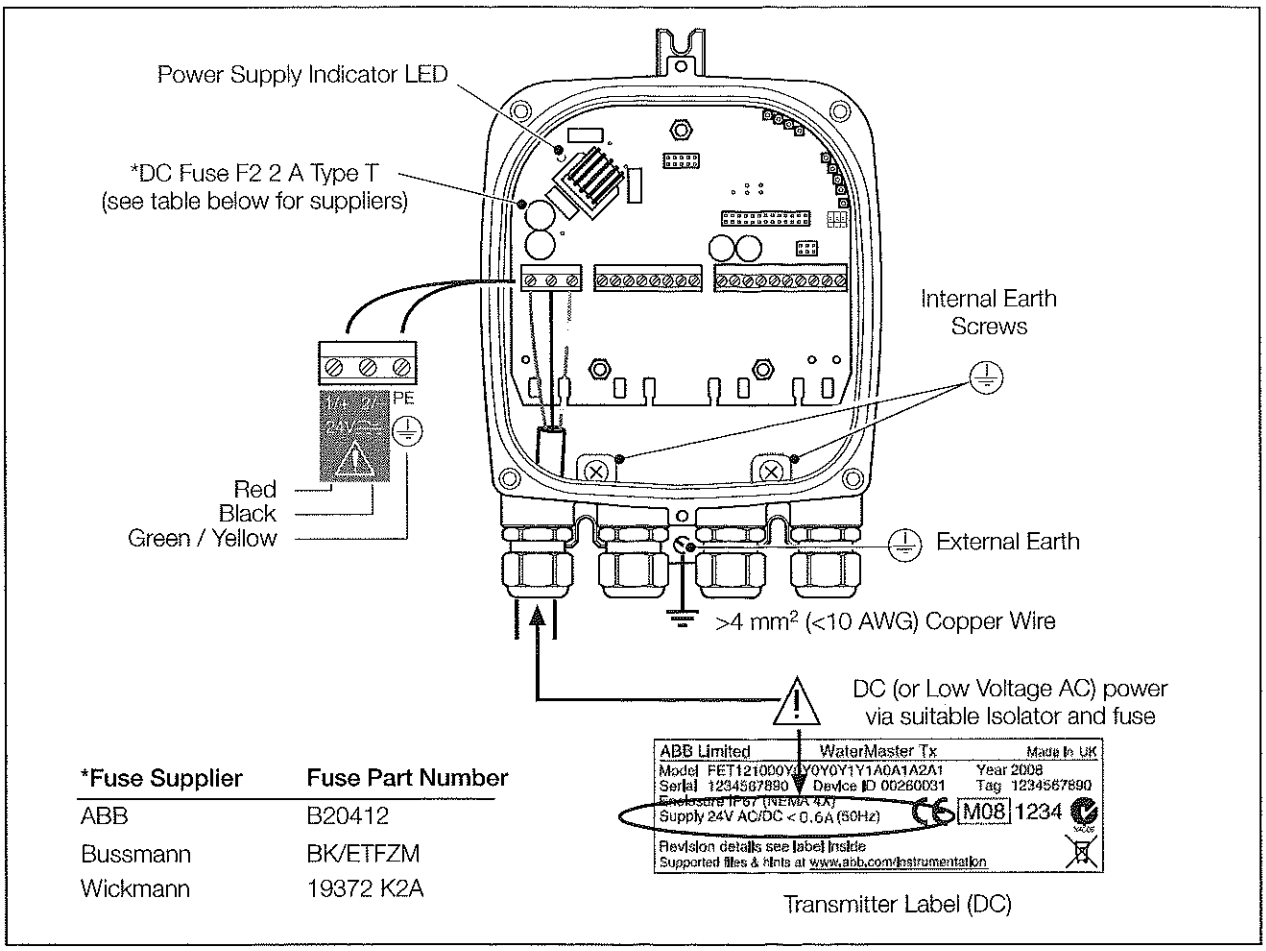
3.6.1 AC Power Supply



*Fuse Supplier	Fuse Part Number
ABB	B20411
Bussmann	BK/ETF 250 mA
Wickmann	19372 K250mA

Fig. 3.18 AC Power Supply Connections

3.6.2 DC (and Low Voltage AC) Power Supply



*Fuse Supplier	Fuse Part Number
ABB	B20412
Bussmann	BK/ETFZM
Wickmann	19372 K2A

Fig. 3.19 DC (and Low Voltage AC) Power Supply Connections

3.6.3 Configuration DIP Switches

Three configuration DIP switches are mounted on the transmitter backplane board.

These are factory-set as follows:

- Remote transmitter – all OFF
- Integral transmitter – SW3 ON

For MID-compliant flowmeters set the read-only / MID protection switch to 'ON' to ensure the meter is secure from tampering.

For HART software versions prior to 01.02.XX, this switch (set after commissioning) prevents login via the keypad or bus at any security level.

From HART software version 01.03.XX onwards and for all PROFIBUS software versions, on MID meters, all metrological-related parameters are locked and inaccessible at the Service level. Standard and Advanced user level parameters can still be modified via the HMI or bus.

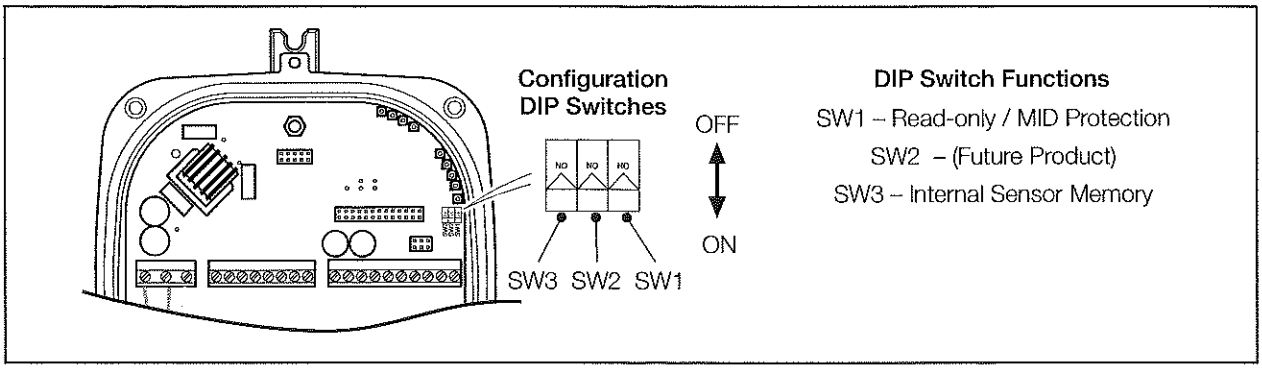


Fig. 3.20 Configuration DIP Switches

3.7 Refitting the Cartridge and Cover

Warning. Ensure the transmitter is isolated from power supplies before refitting the cover.

Caution.

- The communications bus type is HART FEX100 if not specified on the cartridge label. An example of the PROFIBUS FEX100-DP variant cartridge label is shown on the right.
- The cartridge communications type must match the communications type of the transmitter backplane PCB.
- To avoid damaging the cartridge during refitting, do not overtighten the cartridge screws.



PROFIBUS variant cartridge label

Referring to Fig. 3.21:

1. Confirm that the cartridge to be fitted is of the correct power supply and for the correct communications bus type (HART, PROFIBUS OR MODBUS) by checking the label (A) on the side of the cartridge:
   - AC cartridges have one **black** label on the cartridge side.
   - DC (and low voltage AC) cartridges have two **red** DC labels – one on the cartridge side and one on the cartridge rear plate.
2. Align the three cartridge screws (B) with the cartridge housing pillars and tighten the screws carefully until the cartridge is held in position.
3. If necessary, rotate the cartridge to the required orientation before refitting the cover – see Fig. 3.3, page 10 for details.
4. For high integrity / security installations, set DIP switch SW1 to the 'ON' (Read-only) position – see Fig. 3.20, page 22.
5. Align the transmitter cover with the housing and tighten the four cover screws (C) carefully.
6. For high integrity / security installations or where MID is required, fit anti-tamper seals to the security fixtures (D).

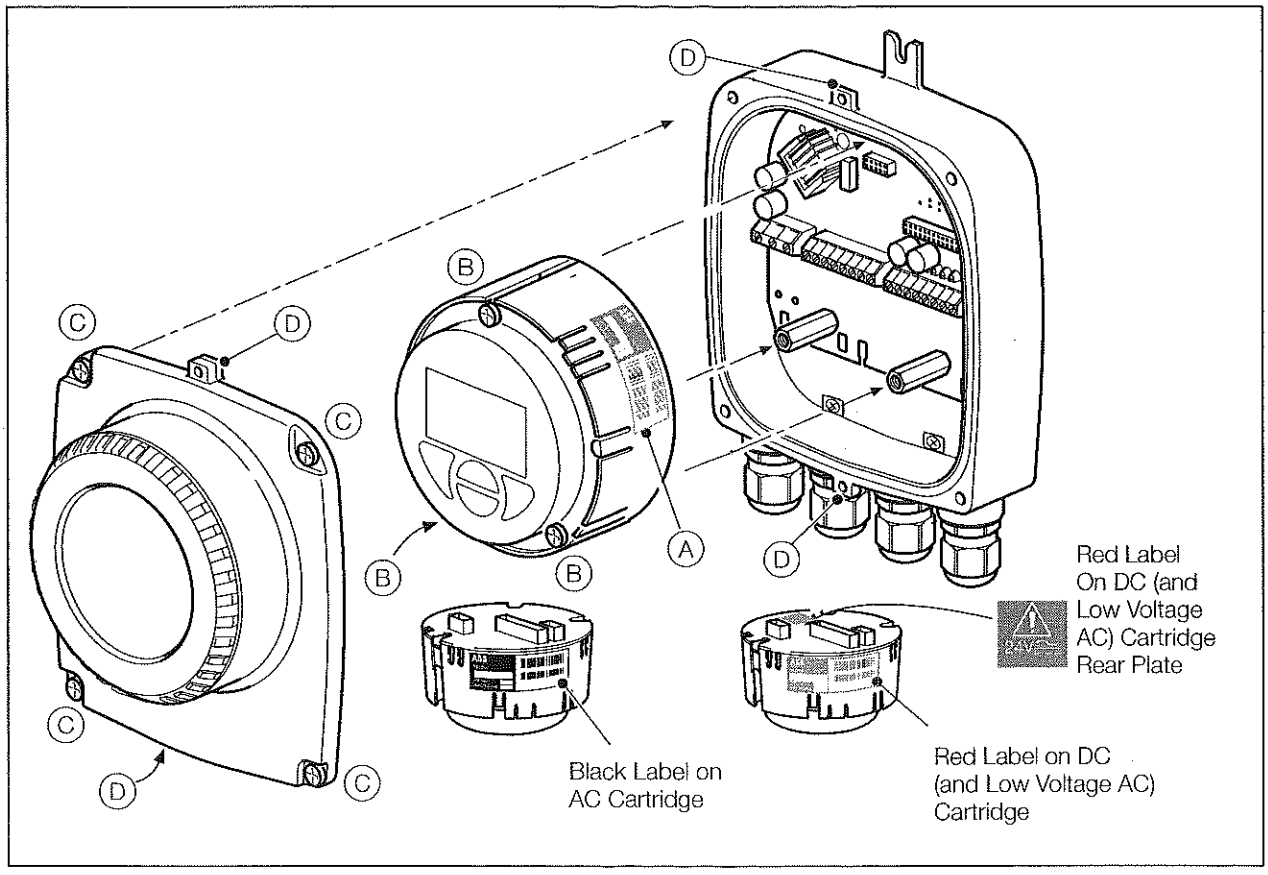


Fig. 3.21 Refitting the Cartridge and Cover

4 Start-up and Operation

Note. This section describes the options available at the 'Easy Setup' menu. Refer to the Programming Manual (IM/WMP) for comprehensive details of all end-user menus and operating levels.

4.1 Navigating the Menus and Parameters

The four keys below the display are used to navigate through the menus and to execute all system commands and selections.

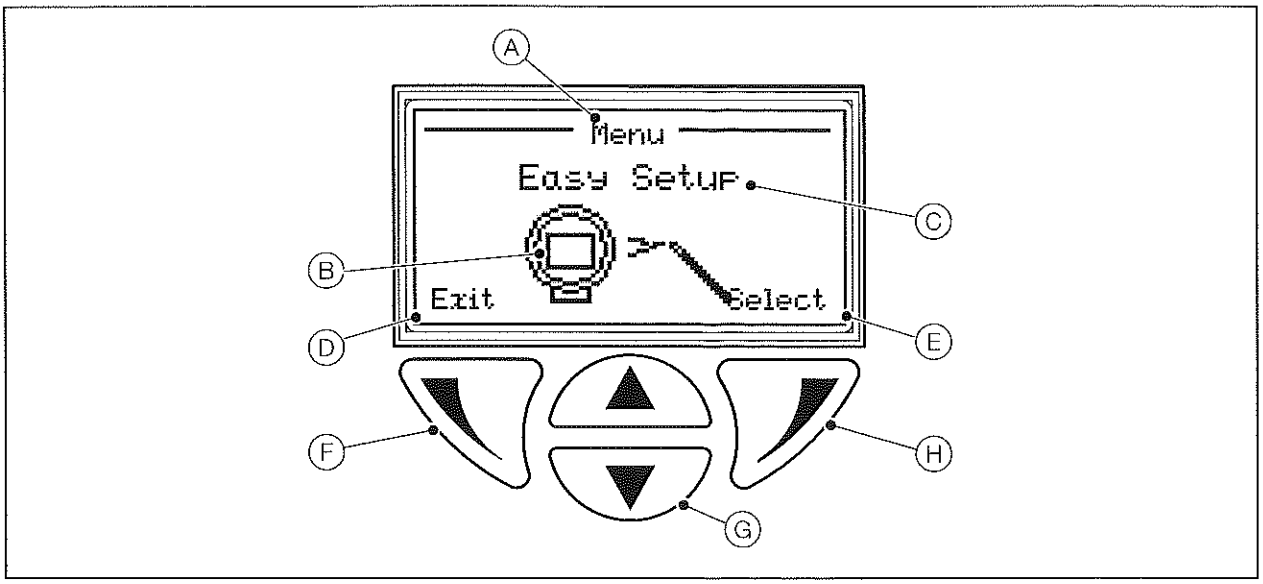


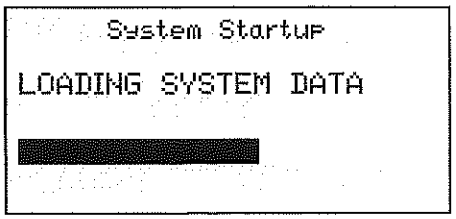
Fig. 4.1 Display and Keys

Item	Description
A	Screen title at the current level / parameter
B	Main level icon
C	Menu level title
D	Prompt executed by pressing the ◁ key
E	Prompt executed by pressing the ▷ key
F	Left key – used for parameter navigation and to enter editable parameters
G	Up / Down keys – used to scroll through menu options and to increase / decrease values in editable parameters
H	Right key – used to accept / select parameter values / selections and exit sub-levels

4.2 Start-up Screens

At start-up, the type of screen displayed indicates the status of the system.

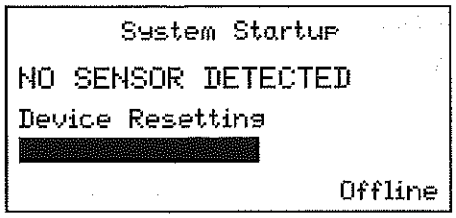
There are four common start-up screen types as follows:



System Start-up

At system start-up, a progress bar is displayed for the duration of the start-up period.

After this period, one of the four following screens is displayed according to the current status of the system.



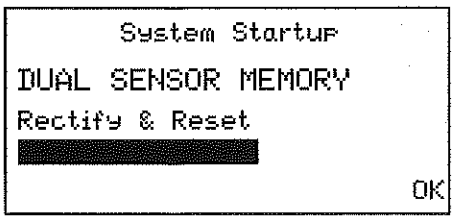
No Sensor Connected

If no sensor is detected during start-up, an auto-recovery routine is run to look for the sensor. If no sensor is detected, this routine continues until it is stopped manually.

If 'Offline' is selected during auto-recovery (by pressing the ▽ key) the transmitter ceases to operate as a flowmeter and the following conditions apply at the transmitter:

- Plant and transmitter data can be configured.
- Sensor data cannot be configured.

Note. If this screen is displayed on an integral transmitter, check that DIP switch SW3 is in the 'ON' position (refer to Fig. 3.20, page 22).

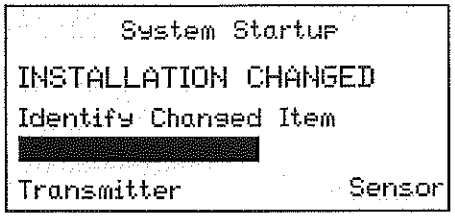


Dual Sensor Memory

Integral and retrofit systems have the sensor memory mounted on the transmitter backplane board.

If two sensor memory types (integral and remote) are detected at start-up, the warning 'DUAL SENSOR MEMORY' is displayed.

To correct this condition, set DIP switch SW3 to the 'OFF' position (refer to Fig. 3.20, page 22).



Installation Changed

If the sensor data stored in the transmitter memory does not match the data of the connected sensor, the warning 'INSTALLATION CHANGED' is displayed.

The changed item(s) (transmitter or sensor) can be identified and data copied as follows:

Transmitter

Selecting this option copies plant and stack data from the sensor memory to the transmitter memory and loads the totalizer from the sensor memory.

It is used to make the following changes:

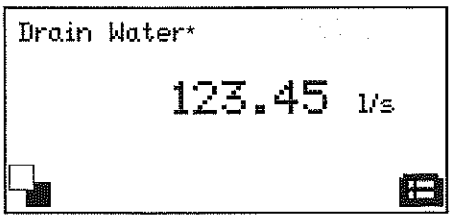
- Remote or integral cartridge change
- Remote Tx change
- New installation

Sensor

Selecting this option copies data from the transmitter memory to the sensor and loads the totalizer from the sensor memory.

It is used to make the following changes:

- Integral backplane change
- Sensor change
- Integral transmitter change



Example legend only

Process Display (Operator Page)

When the 'Process Display' (Operator Page) is displayed, normal operation is assumed.

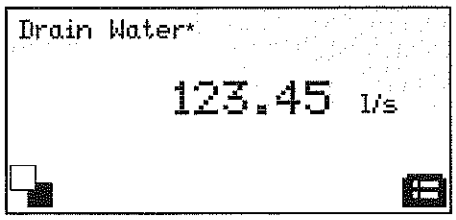
To access menus at a permitted access level, press the ▽ key to display the 'Access Level' screen – see Section 4.3, page 27.

4.3 Security Levels and Password Access

At power-up, the 'Start-up Display' and 'Process Display' screens are activated in sequence.

Note.

- Passwords at 'Standard' and 'Advanced' level can be set and changed by end-users.
- Access to the 'Service' level is reserved for factory-only personnel and not available to end-users.
- To navigate from the 'Operator Page(s)' directly back to the menus, accept the default access level selection at the 'Access Level' screen and press the ▽ key.

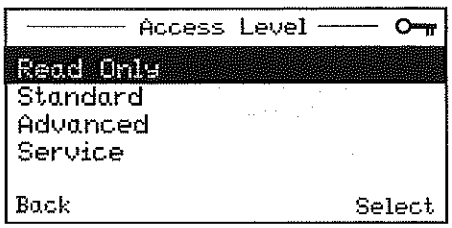


Example legend only

Operator Pages (Process Display)

When the start-up routine is completed, and if no changes have occurred since last start-up, the 'Process Display' (Operator Page) screen is displayed.

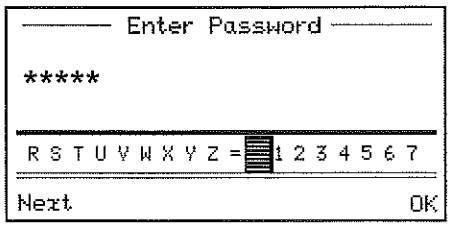
Press the ▽ key to display the 'Access Level' screen where the level of user access is selected.



Access Level

Passwords are required for 'Standard' and 'Advanced' level access. Passwords are not required for 'Read Only' access.

Select the permitted level of access and press the ▽ key to display the 'Enter Password' screen (the 'Enter Password' screen is bypassed if 'Read Only' is selected).



Enter Password

Enter the password and press the ▽ key to display menus available at the permitted access level.

Note. If a time-out occurs (5 minutes of no activity), enter the password again to access the menus.

4.3.1 Default Passwords

The WaterMaster transmitter is supplied with default passwords for access to 'Standard' and 'Advanced' level menus.

The two passwords are:

- 'Standard' access password: 2 or blank
- 'Advanced' access password: 3 or blank

Passwords can contain up to 5 characters and are not case sensitive.

To prevent unauthorized access ABB recommend the default passwords are changed on commissioning.

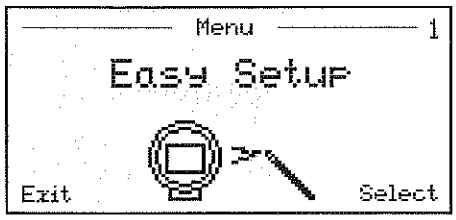
Note. When allocating passwords, record a copy of each password and store in a safe location. It is not possible to interrogate the transmitter to 'recover' passwords once they have been set.

4.3.2 Entering Passwords

To select password characters and enter passwords:

1. Scroll to the 'Access Level' screen and select the required access level. Press the key to display the 'Enter Password' screen.
2. Use the and keys to scroll to and highlight the first password character to be selected.
3. Press the key to select the highlighted character (add it to the password set).
4. Use the and keys to highlight the next password character to be selected.
5. Repeat steps 2 to 4 until all characters have been added to the password.
6. Press the key to accept the password and display menus available at the requested access level.

4.4 Easy Setup



Easy Setup

The 'Easy Setup' level is used to set the system up quickly and contains a series of options for users with 'Standard' and 'Advanced' access permission. Users with 'Read Only' access cannot make selections at this level.

To navigate the 'Easy Setup' parameters:

- Enter 'Easy Setup' by pressing the key at the 'Select' prompt.
- View and edit a parameter by pressing the key at the 'Edit' prompt.
- Scroll parameter options by pressing the and keys (press and retain contact to scroll multiple options consecutively).
- Edit parameters by pressing the key at the 'Next' prompt to enter the text field and press the and keys to increase or decrease the value. Press the key at the 'OK' prompt to accept the new value.
- Accept a highlighted parameter by pressing the key at the 'OK' prompt.
- Exit the current parameter without changing the setting by pressing the key at the 'Cancel' prompt.
- Move to the next parameter by pressing the key at the 'Next' prompt.
- Exit 'Easy Setup' level by pressing the key at the 'Exit' prompt on the 'Easy Setup' main level screen.

Parameter	Range	[Default] *Note*
Language	English, Deutsch, Français, Español, Italiano, Polski, Portuguese	[English] Selectable
Q (Flowrate) Unit	m^3/s, m^3/min, m^3/h, m^3/d, ft^3/s, ft^3/min, ft^3/h, ft^3/d, ugal/s, ugal/min, ugal/h, ugal/d, Mugal/d, igal/s, igal/min, igal/h, igal/d, bls/s, bls/min, bls/h, bls/d, hl/h, ml/s, ml/min, l/s, l/min, l/h, Ml/d,	[m^3/h] Selectable
Qmax	Dependent on sensor size	[Factory set]
Volume & Pulse Unit	m^3, l, ml, ft^3, hl, igal, ugal, bls, Ml, Mugal	Selectable*
Pulse Width	0.09 to 2000.00 ms	[0.09 ms] Editable
Pulses / Unit	0.000010 to 10,000,000 pulses / unit	[1.0] Editable (Only shown when Pulse Mode is Pulse / Unit)
Fullscale Frequency	0.250000 to 10,000,000 Hz	[5,000.000] Editable (Only shown when Pulse Mode is Fullscale Frequency)
Damping	0.02 to 60 s	[3.00 s] Editable
Mains Frequency	50 or 60 Hz	[50 Hz] Selectable

* For OIML and MID flowmeters, only m^3 must be used.

5 Specification

Functional Specification

Power supply

Mains	85 to 265 V AC @ <7 VA
Low voltage	24 V AC +10 %/–30 % @ <7 VA
DC	24 V ±30 % @ <0.4 A

Supply voltage fluctuations within the specified range have no effect on accuracy

Digital outputs (3 off)

Rating 30 V @ 220 mA, open collector, galvanically isolated

Maximum output frequency 5250 Hz

1 off dedicated to Alarm / Logic, programmable function

2 off configurable to either Pulse / Frequency or Alarm/Logic function

Current output – HART FEX100 variant

4 to 20 mA or 4 to 12/20 mA, galvanically isolated (when installed, do not leave galvanically isolated circuits [pulse and current] floating)

Maximum loop resistance 750 Ω

HART protocol Version 5.7 (HART registered)

Signal levels compliant with NAMUR NE 43 (3.8 to 20.5 mA)

Low alarm 3.6 mA, High alarm 21.8 mA

Additional accuracy

±0.1 % of reading

Temperature coefficient: typically <±20 ppm/°C

RS485 communications – PROFIBUS FEX100-DP variant

Registered name: FEX100-DP

RS485 (9.6kbps to 1.5Mbps), galvanically isolated

DPV0, DPV1

PA Profile 3.01

Standard idents: 9700, 9740, 9741

FEX100-DP specific ident: 3431

3 Concurrent MS2 master connections

RS485 communications – MODBUS FEX100-MB variant

MODBUS RTU protocol

RS485 (9.6kbps to 115.2kbps), galvanically isolated

Electrical connections

20 mm glands, ½ in NPT, 20 mm armored glands

Temperature limitations

Ambient temperature	–20 to 60 °C (–4 to 140 °F)
Temperature coefficient	Typically <±10 ppm/°C @ Vel ≥0.5 mls

Environmental protection

Humidity: 0 to 100 %

Rating: IP67 (NEMA 4X) to 1m (3.3 ft) depth

Tamper-proof security

Write access prevented by internal switch combined with external security seals for MID applications

Languages

English, French, German, Italian, Spanish, Polish

Infrared service port

USB adapter (accessory), USB 1.1. and 2.0 compatible

Driver software for Windows 2000, XP, 7 (32-bit) and Vista

Housing material

Powder-coated aluminium with glass window

Paint specification

Paint coat ≥70 µm thick RAL 9002 (light grey)

Transmitter vibration testing

Vibration level: 7 m/s^2

Frequency range: 20 to 150 Hz

No. of sweeps in 3 orthogonal planes: 20

Undetectable shift in transmitter span or zero performance

Hazardous approvals (HART variant only)

FM & FMc Class 1 Div 2

(FM listing NI / 1 / 2 / ABCD / T4, S / II, III / 2 / FG /T4,
Ta=60C; Type 4X, IP67 – for transmitter and integral mounting
Ta=70C, Type 6P, IP68 – for remote sensor type,
IP67 on DN10 to 32)

(FMc listing NI / 1 / 2 / ABCD / T4, DIP / II, III / 2 / FG /T4,
Ta=60C; Type 4X, IP67 – for transmitter and integral mounting
Ta=70C, Type 6P, IP68 – for remote sensor type, IP67 on DN10 to 32)

FET, FEV, FEW and FEF DN700 to 2200 (27/28* to 84) only – size is dependent on flange specification

ATEX* Zone 2, 21 & 22

II 3 G Ex nA IIC T5 Gc
II 2 D Ex tb IIIC T100°C Db
TA = –20°C to +60°C (integral transmitter)
TA = –20°C to +70°C (remote sensor)

IECEx* Zone 2, 21 & 22

Ex tb IIIC T100°C Db
Ex nA IIC T5 Gc
TA = –20°C to +60°C (integral transmitter)
TA = –20°C to +70°C (remote sensor)

*FEW, FEV, FET and FEF ≥700 (27/28 in. NB) only

Declaration of Conformance

Copies of CE and PED certification will be available on request.

WaterMaster has OIML R49 Certificate of Conformity to accuracy class 1 and 2 (FEV DN40 to 200).
Copies of accuracy certification are available on request.

WaterMaster (FEV DN40 to 200) has been type examined under directive MID 2004/22/EC, Annex MI-001.
Copies of this certificate are available on request.

DS/WM-EN Rev. U

Products and customer support

Automation Systems
For the following industries:
- Chemical & Pharmaceutical
- Food & Beverage
- Manufacturing
- Metals and Minerals
- Oil, Gas & Petrochemical
- Pulp and Paper

Drives and Motors
- AC and 6 Drives, AC and DC Machines, AC Motors to 1kV
- Drive Systems
- Force Measurement
- Servo Drives

Controllers & Recorders
- Single and Multi-loop Controllers
- Circular Chart and Strip Chart Recorders
- Paperless Recorders
- Process Indicators

Flexible Automation
- Industrial Robots and Robot Systems

Flow Measurement
- Electromagnetic Flowmeters
- Mass Flowmeters
- Turbine Flowmeters
- Wedge Flow Elements

Marine Systems & Turbochargers
- Electrical Systems
- Marine Equipment
- Offshore Retrofit and Refurbishment

Process Analytics
- Process Gas Analysis
- Systems Integration

Transmitters
- Pressure
- Temperature
- Level
- Interface Modules

Valves, Actuators and Positioners
- Control Valves
- Actuators
- Positioners

Water, Gas & Industrial Analytics Instrumentation
- pH, Conductivity and Dissolved Oxygen Transmitters and Sensors
- Ammonia, Nitrate, Phosphate, Silica, Sodium, Chloride, Fluoride, Dissolved Oxygen and Hydrazine Analyzers
- Zirconia Oxygen Analyzers, Katharometers, Hydrogen Purity and Purge-gas Monitors, Thermal Conductivity

Customer support
We provide a comprehensive after sales service via a Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

UK
ABB Limited
Tel: +44 (0)1453 826661
Fax: +44 (0)1453 829671

USA
ABB Inc.
Tel: +1 215 674 6000
Fax: +1 215 674 7183

Client Warranty
Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification.
Periodic checks must be made on the equipment's condition. In the event of a failure under warranty, the following documentation must be provided as substantiation:
- A listing evidencing process operation and alarm logs at time of failure.
- Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.

Contact us

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Fax: +1 215 674 7183

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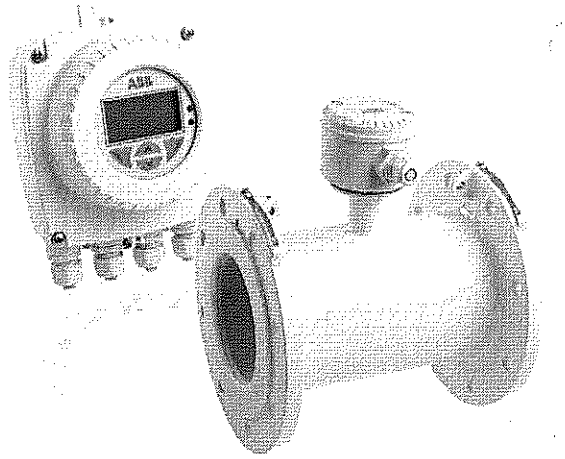
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OI/FET100-EN Rev. F 07.2014

Power and productivity
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User Guide Supplement – PROFIBUS RS485 Physical Layer (FEX100-DP) IM/WMPBS–EN

WaterMaster
Electromagnetic flowmeter



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The Company

We are an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

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1 Introduction

This publication contains information specific to the PROFIBUS®-enabled WaterMaster with RS485 physical layer (PNO registered model FEX100-DP). It must be read in conjunction with IM/WMP and IM/WMPST-EN. The PROFIBUS model name FEX100-DP is applicable to several variants of the WaterMaster flowmeter system (for example, FEV1xx, FEF1xx, FET1xx). Refer to data sheet DS/WM-EN for details of specific order codes.

1.1 PROFIBUS

PROFIBUS is a manufacturer-independent, open Fieldbus standard for a wide range of applications in manufacturing, process and building automation. Manufacturer independence and openness are ensured by the international standard EN 50170.

Using the PROFIBUS protocol, devices from different manufacturers exchange information on the same communications bus without the need for special interface equipment.

Further information on PROFIBUS can be found at www.profibus.com.

1.1.1 PROFIBUS DP

PROFIBUS DP is designed for high-speed data exchange and is commonly used by complex or externally-powered devices. The central controller or 'master' device (for example, PLC or PC) utilizes PROFIBUS DP as a fast serial connection with distributed (slave) field devices such as PROFIBUS-enabled WaterMasters.

The master device reads the input information cyclically in a defined, recurring order from the slave(s). When configuring the bus system, the user assigns an address in the range 0 to 125 to each slave device and also defines which of the slaves are to be included in, or excluded from, the data acquisition cycle.

1.1.2 PROFIBUS PA

PROFIBUS-PA is designed to accommodate process automation field devices and specifies an application profile that characterizes device behavior and parameters in a standard way making integration with a controller easier.

PROFIBUS-PA supports several physical layer options including RS485 and the IEC61168-2 current-loop based bus that can power low-power devices from the bus and is ideal for intrinsic safety in hazardous areas.

1.2 PROFIBUS and ABB Products

WaterMaster utilizes PROFIBUS DP as this protocol is optimized for high speed and low connection costs (see www.abb.com/fieldbus and follow the PROFIBUS link).

The WaterMaster FEX100-DP variant has an RS485 physical layer so, while it benefits from the well-defined PROFIBUS PA application profile (version 3.01), it can also be connected directly to a traditional PROFIBUS-DP RS485 network.

1.3 PROFIBUS DP Transmission Technology

The most common transfer method of PROFIBUS-DP is RS485 – a proven technology. A twisted, shielded, 2-wire copper cable is used as the transfer medium.

The bus structure enables addition and removal of stations or step-by-step commissioning of the system without affecting other stations. Later expansion has no influence on stations already in operation.

Transmission speeds from 9.6 kbps up to 1.5 Mbps are supported. One uniform transmission speed is selected for all devices on the bus when the system is commissioned.

1.4 Acronyms and Abbreviations

AI	Analog Output Function Block
AO	Analog Output Function Block
FB	PROFIBUS-PA Function Block
Input	Data passed into a Master device (for example, from a Slave device)
I&M	PROFIBUS Identification and Maintenance function
MS1	Class 1 Master-Slave acyclic transaction
MS2	Class 2 Master-Slave acyclic transaction
Output	Data passed out of a Master device (for example, to a Slave device)
PA	PROFIBUS-PA application profile
PB	PROFIBUS-PA Physical Block
PCS/DCS	Process control system / distributed control system
PI/PNO	PROFIBUS International / PROFIBUS User Organization (www.profibus.com)
TB	PROFIBUS-PA Transducer Block
TOT	Totalizer Function Block

Table 1.1 Acronyms and Abbreviations

1.5 PROFIBUS Interface

Physical layer	RS485
Supported baud rates	9.6 kbps to 1.5 Mbps
Supported DP Protocol services	DPV0, DPV1
Concurrent MS2 connections	3
Device stub length	250 mm (9.8 in.)
Application profile	PA version 3.01
Master components available	GSD, DTM, EDD

Table 1.2 PROFIBUS Interface

2 Installation

2.1 Installation Overview

All devices are connected in a bus structure ('line') as shown in Fig 2.1. Up to 32 stations (master or slaves) can be linked to create one 'segment', although it is recommended not to install more than 16 devices on a single segment.

Each end of a segment must be terminated by an active bus terminating resistor. Both bus terminators must always be powered to ensure fault-free operation, therefore it is strongly recommended that they are connected to a back-up power supply. The use of bus amplifiers (repeaters) and segment couplers can be used to extend the network.

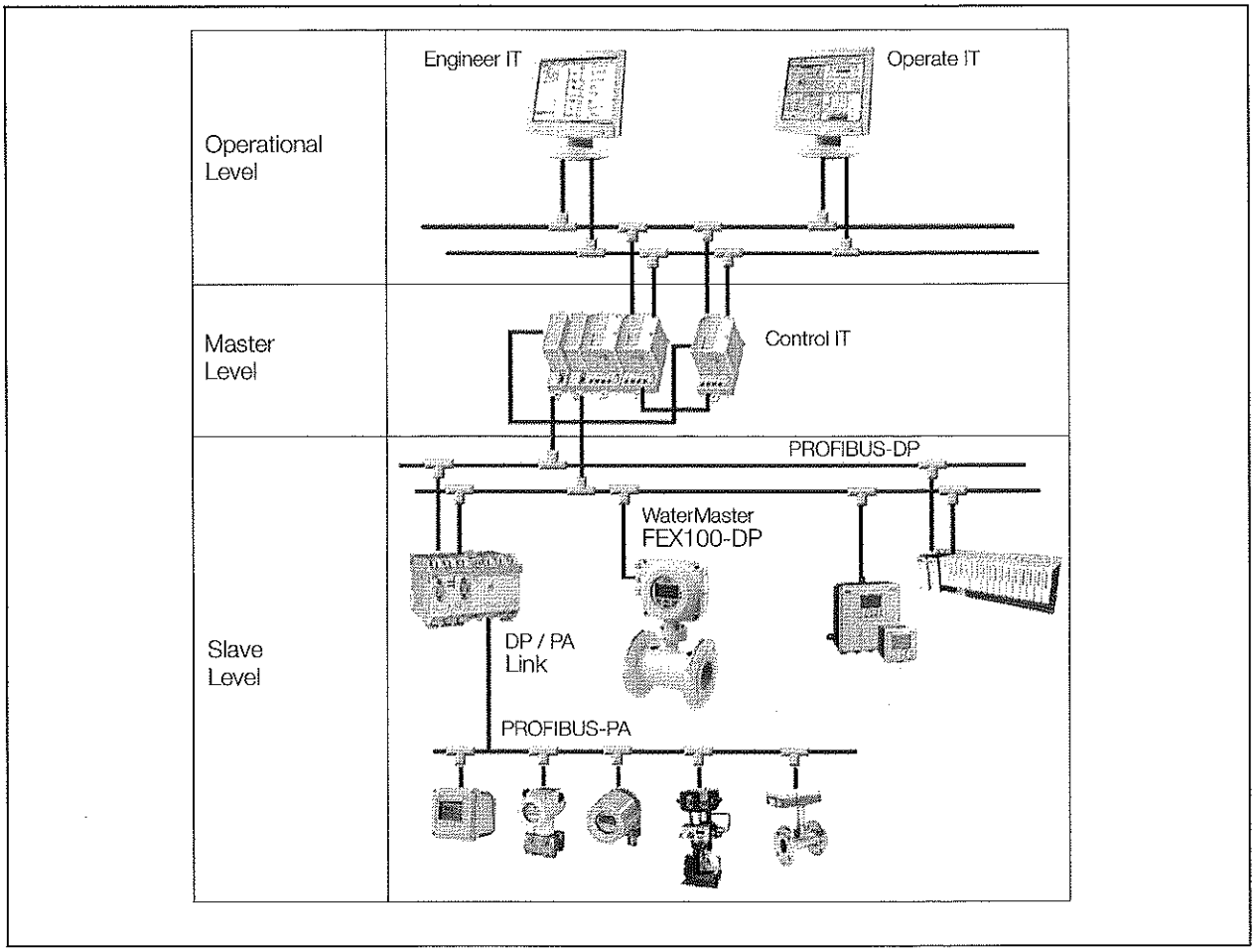


Fig. 2.1 Typical PROFIBUS Network

2.2 Cable Length

The maximum cable length of a segment is determined by the transmission speed (see Table 2.1). The cable length specified can be extended using repeaters, but it is recommended that no more than 3 repeaters are connected in series.

Transmission Rate (bits / second)	Maximum Segment Length (m [ft.])	Maximum Total Network Length (m [ft.])
9.6 to 93.75 kbps	1200 (3937)	4800 (15748)
187.5 kbps	1000 (3280)	4000 (13123)
500 kbps	400 (1312)	1600 (5249)
1.5 Mbps	200 (656)	800 (2624)
3 to 12 Mbps	100 (328)	400 (1312)

Table 2.1 Cable Length

2.3 Cable Specification

The cable lengths in Table 2.1 refer to the following cable type:

Characteristic impedance	135 to 165 Ω
Capacitance per unit length	<30 pf/m
Loop resistance	110 Ω/km
Core diameter	0.64 mm
Core cross section	>0.34 mm^2

Table 2.2 Cable Specification

Suitable PROFIBUS cable (part numbers PCA010, PCA011 and PCA012) can be obtained from ABB. Refer to Data Sheet 10/63-6.46 EN.

3 Network Connection

Caution.

When connecting a WaterMaster to a PROFIBUS-DP RS485 network:

- Refer to the WaterMaster User Guide (IM/WM) before making electrical connections.
- Refer to IM/WM for all other installation and connection details.
- Use cable that meets PROFIBUS specifications for reliable RS485 communications.
- Ensure RS485 signals are not reversed.
- Ensure a PROFIBUS active terminator is fitted each end of the RS485 bus segment.
- Route data lines clear of the source of any strong electrical and magnetic fields.

3.1 Network Connections

PROFIBUS network connections are made to the terminal blocks on the WaterMaster backplane PCB located below the cartridge assembly (refer to Fig 3.1). Refer to IM/WM to remove the cartridge assembly and access these terminals and to replace the cartridge before powering up the transmitter.

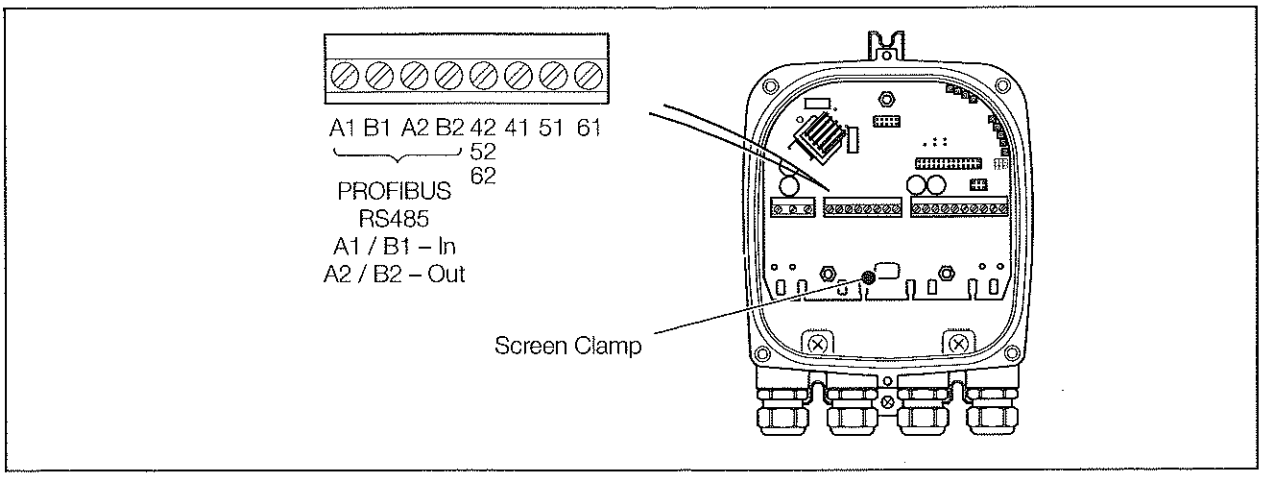


Fig. 3.1 WaterMaster RS485 Backplane Connections to PROFIBUS Network

Data Signal	Cable Color	Description
A	Green	Negative (–) data line: connect to pin 8 on PROFIBUS DP equipment with 9-way D-type connectors.
B	Red	Positive (+) data line: connect to pin 3 on PROFIBUS DP equipment with 9-way D-type connectors.
Braided screen	N / A	Cable screen – usually connected to the D-type shell or pin 1 on PROFIBUS DP equipment with 9-way D-type connectors.

Table 3.1 PROFIBUS DP Data Cable Signals

4 Configuration

4.1 Setting the PROFIBUS Station Address

The PROFIBUS Station Address for a WaterMaster can be set set locally via the keypad and menus or remotely by a master using the SET_SLAVE_ADDRESS service.

When the PROFIBUS Master sets the transmitter's Station Address, the address is stored and overwrites the address value previously held in the the instrument.

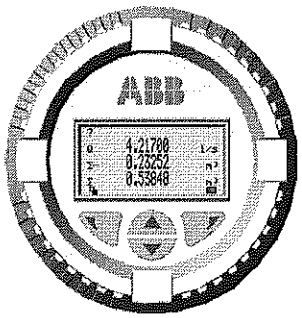
> **Warning.** The WaterMaster reboots after its PROFIBUS Station Address parameter is changed. During this period it is not visible to any PROFIBUS masters.

To change the Station Address:

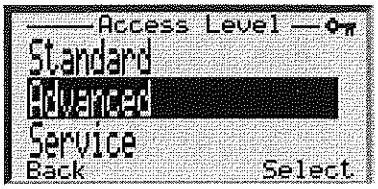
1 From the *Operator* page, press ▽ (the key beneath the ■ icon).

The *Access Level* is displayed.

Note. Values displayed on the *Operator* page are determined by the transmitter's configuration – refer to IM/WMP for configuration details.



2 Use the △ and ▽ keys to scroll to the *Advanced* menu and press ▽ to display the *Enter Password* page.



3 Use the △ and ▽ keys to move to and highlight the first password character.

Press ▽ to select the character.

Navigate to and select any additional password characters.

Press ▽ to accept the password and log in to the *Operator* level menus.

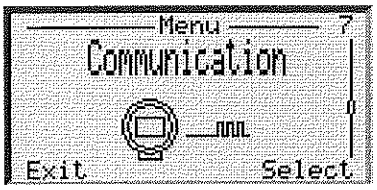
Note. The factory default password for *Advanced* level access is null or no password (this can be changed in the *Device Setup* pages).

If an invalid password is entered, the *Advanced* level menus cannot be accessed and the *Operator* page is displayed.



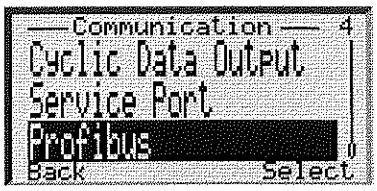
4 Use the ▲ and ▼ keys to move to the *Communication* page.

Press ✓ to enter the *Communication* level.



5 Use the ▲ and ▼ keys to move to and highlight the *PROFIBUS* menu.

Press ✓ to enter the *PROFIBUS* level.



6 If the *Station Address* menu is not already highlighted, use the ▲ and ▼ keys to move to and highlight the *Station Address* menu.

Press ✓ to enter the PROFIBUS / *Station Address* page.



7 The current *Station Address* setting (for example 70) is displayed.

To edit this value, press ✓ to enter the *Station Address* edit page.

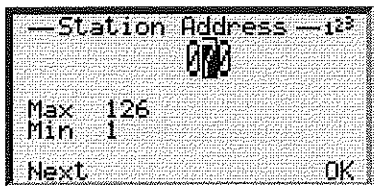
Note. To exit the page without changing the setting and return to the *Operator* page, press ✗ 4 times.



8 Use the ✗ key to move between editable numbers and use the ▲ and ▼ keys to increment / decrement each number.

Press ✓ to accept the new value and exit the *Station Address* edit page.

Note. Press ✗ 4 times to return to the *Operator* page.



4.2 Integration using GSD

PROFIBUS devices differ with respect to available functionality and parameters for each device type and manufacturer. In order to obtain 'Plug-and-Play' configuration for PROFIBUS, characteristic device communication features such as manufacturer name, device name, hardware / software versions, baud rate and the number and nature of inputs / outputs are defined in an electronic device data sheet known as a GSD (Generic Station Description) file.

A GSD file is readable ASCII text file that contains both general and device-specific specifications for communication. Each of the entries describes a feature supported by a device. By using keywords, a configuration tool reads the device identification, the adjustable parameters, the corresponding data type and the permitted limit values for the configuration of the device from the GSD. Some keywords are mandatory, for example, Vendor_Name; others are optional, for example, Sync_Mode_supported.

The GSD file for WaterMasters specifies the device-specific Ident No. 3431. It conforms to the PROFIBUS standard, providing a clear and comprehensive description of each instrument in a precisely defined format. This enables the system configuration tool to use the information automatically when configuring a PROFIBUS bus system.

The ABB GSD file (Ident No. 3431) is divided into 2 sections:

- **General Specifications**

  Identification of the device, together with hardware and software versions, baud rates supported and the possible time intervals for monitoring times.

- **DP Slave-Related Specifications**

  Information about the user parameter block for device-specific configuration and modules containing details of the input and output data that can be exchanged cyclically with a PROFIBUS master.

The WaterMaster GSD file (ABB_3431.gsd) is available for download from the ABB website at: www.abb.com/fieldbus (follow the link for PROFIBUS DP field devices).

4.2.1 Condensed Diagnostic Status

WaterMaster supports enabling / disabling of condensed diagnostic status (as the PROFIBUS PA version 3.01 profile specification) via the PRM_COND bit of the profile-specific Prm_Structure that can be included by the SET_PRM service, depending on the settings in the GSD file.

Values for the Prm_Structure octets sent in the SET_PRM service are defined in the WaterMaster-specific GSD file.

Condensed status / diagnostics are disabled by default, if the Prm_Structure is not sent in the SET_PRM service.

Octet	Description
0	Structure length – fixed to 5
1	Structure type – fixed to 65 (profile-specific)
2	Slot number – fixed to 0 (settings in Prm_Structure apply to whole device)
3	Reserved – fixed to 0
4	Options: Bit0 PRM_COND: 1 = condensed status enabled 0 = condensed status disabled Bit1 to Bit7 Reserved – fixed to 0

Table 4.1 Profile-specific Prm_Structure

4.2.2 Cyclic Data Exchange Modules

Modules are defined for the following functions (see Table 4.2). Their formats are in accordance with PROFIBUS PA version 3.01 Function Block specifications – see Appendix A for details of the structure of these blocks.

Module	Data Type
1	Empty Module (for slot not used)
2	Analog Input OUT (input) value
3	Totalizer TOTAL (input) value
4	Totalizer SET_TOT (output) and TOTAL (input) values
5	Totalizer SET_TOT (output), MODE_TOT (output) and TOTAL (input) values
6	Analog Output SP (output) value

Table 4.2 GSD File Module Definitions (Ident No. 3431)

Selection of modules operates for the following slots:

Slot	Slot Name (see Table for Slot Descriptions)	Module Options	
		Default	Option(s)
1	AI1 Volume Flowrate (Q)	2	1,2
2	TOT1 Totalizer 1	3	1, 3, 4, 5
3	TOT2 Totalizer 2	3	1, 3, 4, 5
4	AI2 Internal Volume (FWD)	2	1, 2
5	AI3 Internal Volume (REV)	2	1, 2
6	AI4 Diagnostics	2	1, 2
7	AO1 Display Value	6	1, 6

Table 4.3 GSD file slot definitions

Slot Name	Description
AI1 Volume Flowrate (Q)	The meter's primary process measurement value.
TOT1 Totalizer 1	PROFIBUS PA totalizer for volumetric flow. Operation is determined by the MODE setting. Factory set to forward flow totalization.
TOT2 Totalizer 2	PROFIBUS PA totalizer for volumetric flow. Operation is determined by the MODE setting. Factory set to reverse flow totalization.
AI2 Internal Volume (FWD)	The meter's internal forward volumetric flow totalizer (as shown on the local display).
AI3 Internal Volume (REV)	The meter's internal reverse volumetric flow totalizer (as shown on the local display).
AI4 Diagnostics	To read system diagnostic measurements such as coil current etc. The AI CHANNEL number determines the source.
AO1 Display Value	A process value from another instrument to be shown on the WaterMaster's local display in addition to its own process values.

Table 4.4 GSD File Slot Name Descriptions

4.3 Configuration from the WaterMaster Display



PROFIBUS-related parameters are configured from the WaterMaster's *Communication / PROFIBUS* page.

PROFIBUS parameters are readable at all access levels. Write access to secure (writable) parameters is possible only at 'Advanced' access level. Refer to Section 4.1, page 9 and the WaterMaster User Guide (IM/WMP) for details of *Access Level* page parameters.

PROFIBUS parameters options are described in Table 4.5.

Parameter	Description
Station Address	Sets the PROFIBUS *Station Address* value – see page 10.
Ident Select	Selected profile ident number. Options are the specific WaterMaster ident number (3431) and supported profile specific ident numbers.
Data Exchange State	Indicates if the transmitter is in cyclic data exchange with a PROFIBUS master (read only parameter). *Active* *Inactive*
Baud Rate	Indicates the baud rate (in kbps) the transmitter has locked on to (read only parameter).

Table 4.5 PROFIBUS Parameter Descriptions

4.4 Configuration using Device Type Manager (DTM) Software

The WaterMaster DTM can be used for acyclic parameter configuration and monitoring of measurement values using a suitable PC-based FDT 1.2/1.2.1 frame application tool (such as ABB AssetVision Basic) and a Class 2 PROFIBUS master (with its corresponding Communication DTM).

Downloads and Bundles:

- AssetVision Basic – available as a download from the ABB website at www.abb.com/fieldbus (follow the link for Scalable Device Management Tools).
- WaterMaster DTM – available as a download from the ABB website at www.abb.com/fieldbus (follow the link for DTM Bundle) or supplied in the ABB DTM500 Bundle – contact ABB sales for details.

An example dialog from the WaterMaster PROFIBUS FEX100-DP DTM is shown in Fig. 4.1.

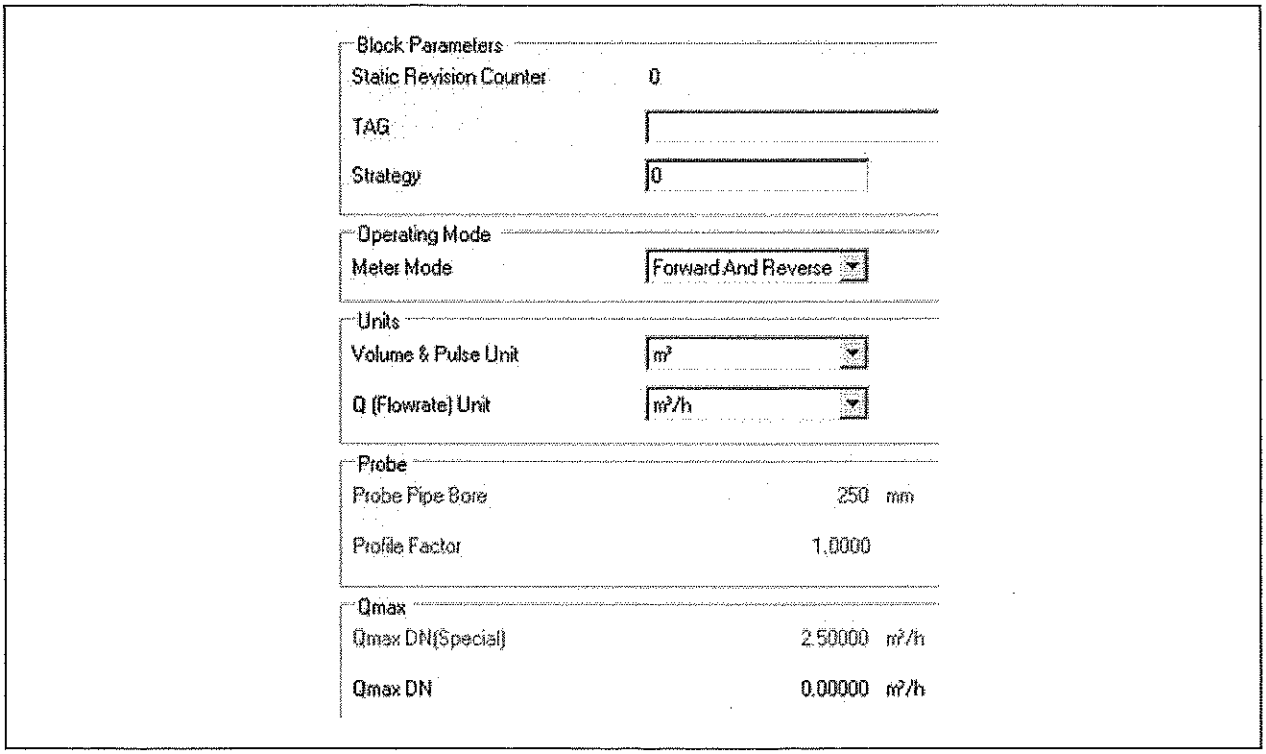


Fig. 4.1 Example Dialog – Extract from WaterMaster FEX100-DP DTM

4.5 Configuration using an EDD

Similar to the use of a DTM, configuration of WaterMaster parameters and monitoring of measurement values is possible using an EDD interpreter application with the WaterMaster EDD file.

This EDD file is available for download from the ABB website at www.abb.com/fieldbus (follow link for PROFIBUS DP field devices).

5 PROFIBUS Block Parameters

WaterMaster parameters are arranged in blocks that are formatted in accordance with PROFIBUS-PA specifications that define 3 categories of blocks: Physical Block, Transducer Block and Function Block.

Analog Input, Totalizer and Analog Output Function Blocks are used by WaterMaster – see Appendix A for PROFIBUS PA block structure diagrams.

PROFIBUS-PA blocks described in Table 5.1 are defined for WaterMaster – Fig. 5.1, page 18 shows the relationship between WaterMaster Transducer Blocks and Function Blocks.

Note.

- TOT blocks are defined by the PROFIBUS PA specification and are not the same as the WaterMaster's own internal totalizers.
- WaterMaster's own internal totalizers (AI2, AI3) should be used instead of PROFIBUS totalizer blocks (TOT1, TOT2) for custody transfer and fiscal metering applications.
- The locally displayed totalizer values have a much higher resolution and range than the internal totalizer values expressed via AI blocks. This means that the lower significance digits should be the same, allowing for limitation of floating point value accuracy, but higher significance digits may be cut off on the AI totalizer value.
- Refer to IM/WMPBST-EN for full details of PROFIBUS Block Parameters Slots 0 to 12. This manual can be downloaded from www.abb.com.

Slot	Block	Description
0	Physical Block (PB)	Standard PROFIBUS PA Physical Block parameters plus settings for profile selection, alarms and alarm history.
1	AI1 Volume Flowrate (Q)	Volumetric flow rate, that is the primary process value for the instrument.
2	TOT1 Totalizer 1	Volume totalizer. Factory-set to accumulate in the forward flow direction, but mode can be changed to suit user requirements.
3	TOT2 Totalizer 2	Volume totalizer. Factory-set to accumulate in the reverse flow direction, but mode can be changed to suit user requirements.
4	AI2 Internal Volume (FWD)	WaterMaster's internal forward flow volume totalizer. This is the same as the totalizer value displayed on the *Operator* page.
5	AI3 Internal Volume (REV)	WaterMaster's internal reverse flow volume totalizer. This is the same as the totalizer value displayed on the *Operator* page.

Table 5.1 PROFIBUS Block Parameters – Slots 0 to 12

Slot	Block	Description
6	AI4 Diagnostic Signal	Value of certain measurements used for diagnostics purposes such as electromagnetic coil resistance. The block's channel number defines the actual measurement source.
7	AO1 Display Value	Allows the master to send a process value from another instrument to be shown on the local display in addition to the WaterMaster's own process values (for example, if the remote instrument did not have its own local display).
8	TB1 Flow	Block for signal processing of process measurements. Holds similar configuration items to the *Device Setup* menu pages.
9	TB2 Device Info	Unique information about a particular instrument such as serial numbers. Holds similar configuration items to the *Device Info* menu pages.
10	TB3 Special Function	Holds similar configuration items to the *Totalizer* and *Input / Output* menu pages.
11	TB4 Display	Holds similar configuration items to the menu pages displayed on the WaterMaster.
12	TB5 Diagnostics	Block for processing of diagnostic signal measurements. Holds similar configuration items to the *Diagnostic* menu pages.

Table 5.1 PROFIBUS Block Parameters – Slots 0 to 12 (Continued)

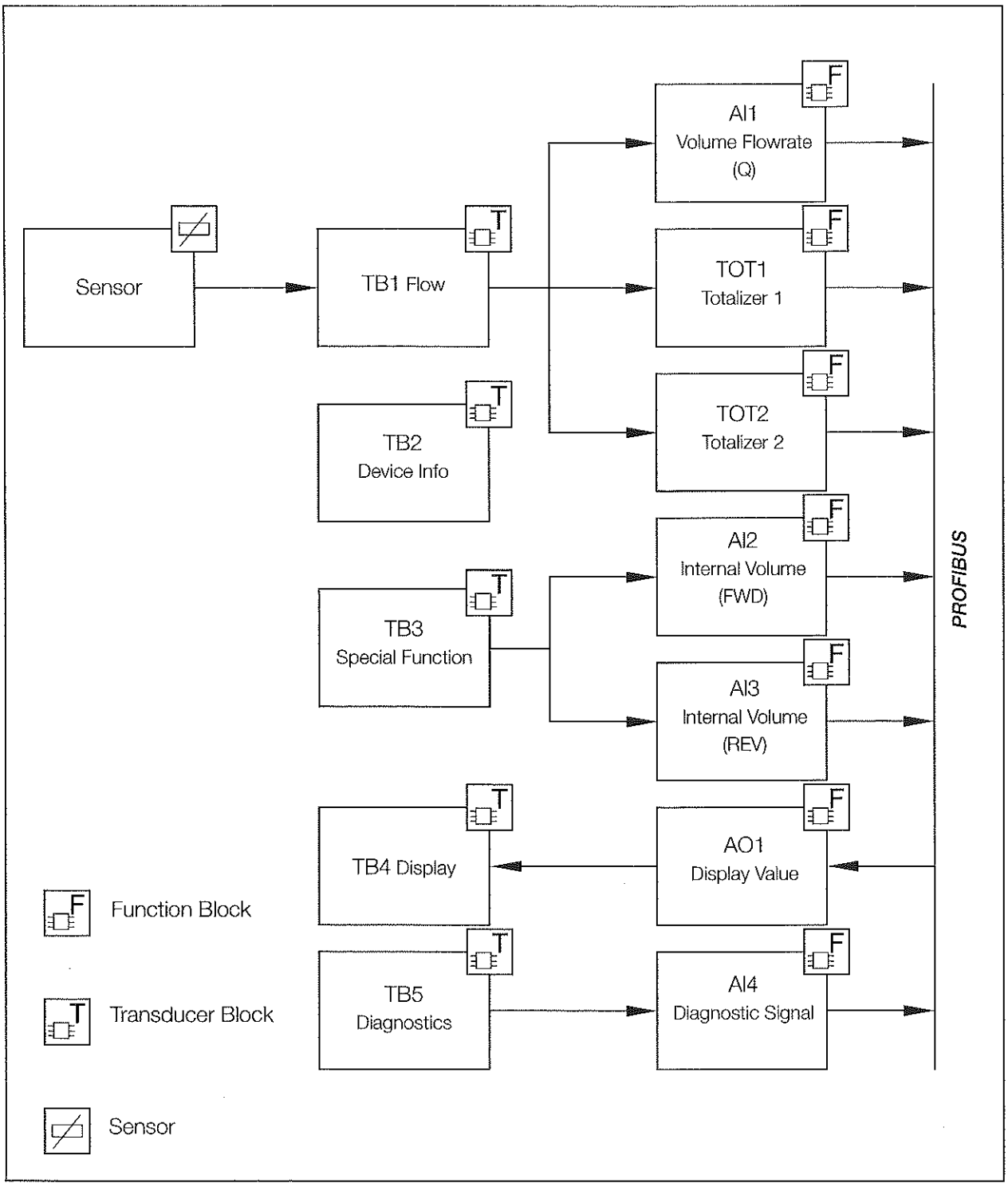


Fig. 5.1 WaterMaster Transducer and Function Block Relationships

	Supported PA Ident Numbers			
	0x3431 FEX100-DP	**0x9741 Profile-specific (2AI + 1TOT)**	**0x9740 Profile-specific (1AI + 1TOT)**	**0x9700 Profile-specific (1AI)**
Physical Block (PB)	Slot 0	Slot 0	Slot 0	Slot 0
AI1 Volume Flowrate (Q)	Slot 1	Slot 1	Slot 1	Slot 1
TOT1 Totalizer 1	Slot 2	Slot 2	Slot 2	–
TOT2 Totalizer 2	Slot 3	–	–	–
AI2 Internal Volume (FWD)	Slot 4	Slot 4	–	–
AI3 Internal Volume (REV)	Slot 5	–	–	–
AI4 Diagnostics	Slot 6	–	–	–
AO1 Display Value	Slot 7	–	–	–
TB1 Flow	Slot 8	Slot 8	Slot 8	Slot 8
TB2 Device Info	Slot 9	Slot 9	Slot 9	Slot 9
TB3 Special Function	Slot 10	Slot 10	Slot 10	Slot 10
TB4 Display	Slot 11	Slot 11	Slot 11	Slot 11
TB5 Diagnostics	Slot 12	Slot 12	Slot 12	Slot 12

Table 5.2 Slots used for Supported PA Ident numbers

6 Error and Warning Handling

6.1 Device Alarms

WaterMaster has two instrument-specific alarm registers: one for current alarms, the other for alarm history (latch of alarm bits that have been set since last being cleared).

These alarms are a combination of errors and warnings (as defined in IM/WMP) and are located in the *Physical Block*. The alarm history can be cleared by writing to the *Clear Alarm History* parameter of the *Physical Block*. In addition to instrument-specific alarms, each Function Block has separate error and warning registers. For testing, it is possible to simulate device-specific error and warning alarms, although the alarm history does not show simulated alarms.

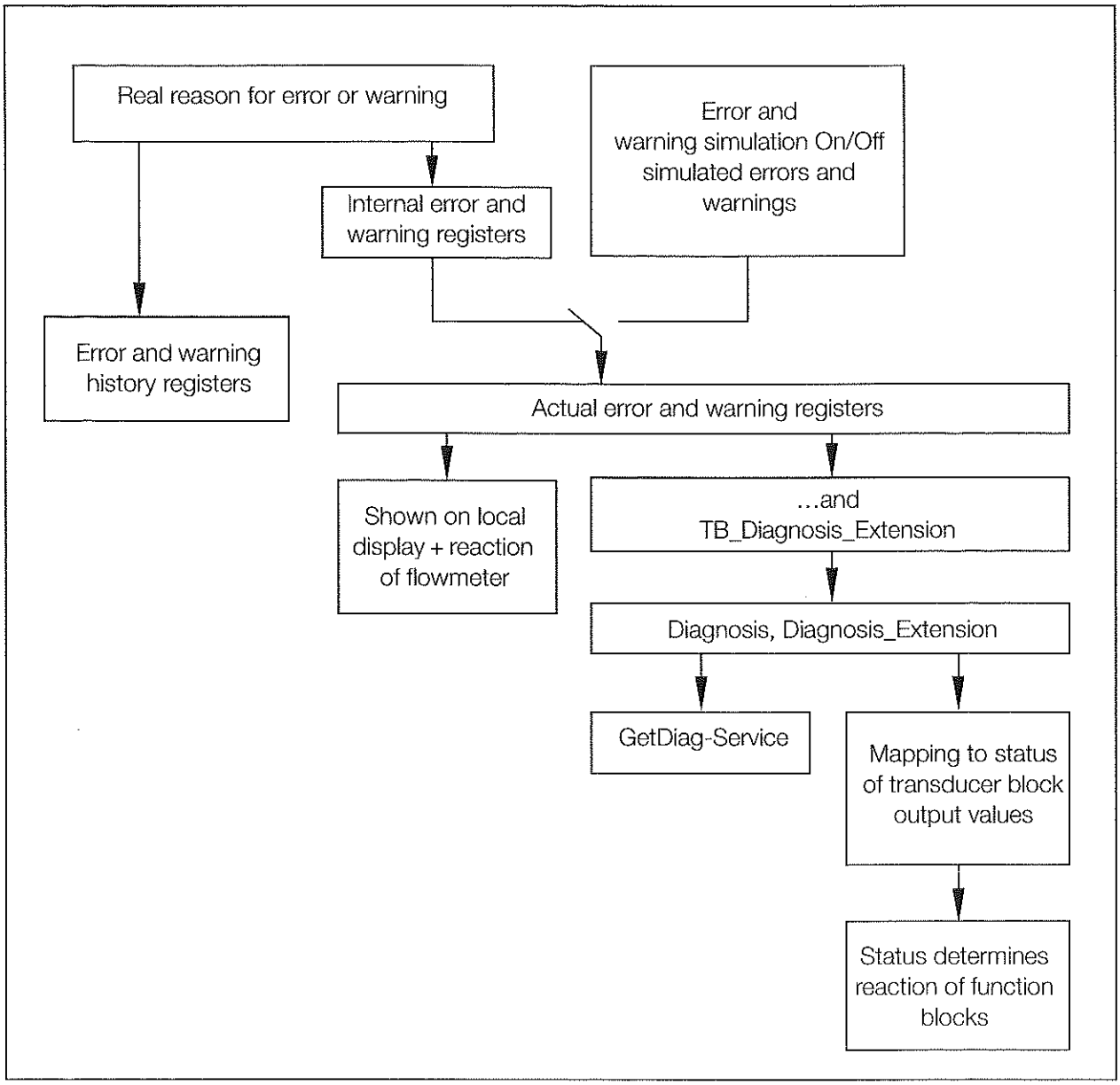


Fig. 6.1 WaterMaster Error and Warning Activities

6.2 Diagnostic Message Formats

The WaterMaster responds to diagnostics requests from the PROFIBUS master in 1 of 2 formats:

- **Short format**

  The short format is sent if there are no extended diagnostic alarms that need to be signalled (when the diagnostic response Ext_Diag bit is not set). This format is the standard PROFIBUS diagnostic response of 6 bytes without extended diagnostics information.

- **Long format**

  The long format is sent if extended diagnostic alarms need to be signalled (when the diagnostic response Ext_Diag bit is set). This format is the standard diagnostics information plus DPV1 extended diagnostics information.

6.3 Extended Diagnostics

The following PROFIBUS DPV1 extended diagnostic information is available, this information is always located after the standard diagnostic information (that occupies bytes 0 to 5 inclusive):

Byte	Description
6	The length of the DPV1 status message (including this byte)
7	DPV1 status type
8	Slot number (of Physical Block)
9	Specifier. The value of Bit0 and Bit1 indicate the change condition: 1 = status appears 2 = status disappears
10 to 13	4 octets DIAGNOSIS
14 to 19	6 octets DIAGNOSIS_EXTENSION

Table 6.1 PROFIBUS Parameter Descriptions

Note. Bytes 6 to 9 inclusive are defined by the DPV1 diagnostic model specification.

6.3.1 DIAGNOSIS Parameter

The DIAGNOSIS parameter is at relative index 13 of the Physical Block. The meaning of bits within the DIAGNOSIS value are defined or reserved by the application profile PROFIBUS PA version 3.01 and depend on whether extended or condensed status is enabled. Alarm status is maintained for the duration of the alarm condition, with the exception of *Warm Start* and *Cold Start* indications that reset after 10 seconds.

Extended Status

The PROFIBUS PA application profile defines a standard set of alarm status bits and is used when condensed diagnostic status is disabled. The instrument's diagnostic response Ext_Diag bit is set when any of these alarm bits are set.

Octet	Bit	Unit Diag Bit (GSD)	Description (When Bit Set)
1	0	24	Hardware failure of the electronics
	1	25	Hardware failure mechanics
	2	26	Motor temperature too high
	3	27	Electronic temperature too high
	4	28	Memory error
	5	29	Failure in measurement
	6	30	Device not initialized (no self-calibration)
	7	31	Self-calibration failed
2	0	32	Zero point error (limit position)
	1	33	Power supply failed (electrical, pneumatic)
	2	34	Configuration not valid
	3	35	Warm Start performed
	4	36	Cold Start performed
	5	37	Maintenance required
	6	38	Characterization invalid
	7	39	Ident_Number of the running cyclic data transfer and the value of Physical Block IDENT_NUMBER_SELECTOR parameter are different.
3	0 to 7	40 to 47	Reserved by PNO, fixed to 0
4	0 to 6	48 to 54	Reserved by PNO, fixed to 0
	7	55	More diagnosis information is available in DIAGNOSIS_EXTENSION

Table 6.2 DIAGNOSIS Bit Descriptions (Extended)

Condensed Status

The PROFIBUS PA application profile defines condensed status and diagnostics to:

- make diagnostic events clearer with reference to the usage in the PCS / DCS and the Maintenance Station
- indicate the need of maintenance in a graduated way
- add new required status information

When condensed diagnostic status is enabled, the instrument's diagnostic response Ext_Diag bit is set only when a failure alarm bit is set.

The following table shows condensed alarm bits as defined by the PROFIBUS PA application profile.

Octet	Bit	Unit Diag Bit (GSD)	Description (When Bit Set)
1	0 to 7	24 to 31	Reserved by PNO, fixed to 0
2	0 to 2	32 to 34	Reserved by PNO, fixed to 0
	3	35	*Warm Start* performed
	4	36	*Cold Start* performed
	5	37	Maintenance required
	6	38	Reserved by PNO, fixed to 0
	7	39	Ident_Number of the running cyclic data transfer and the value of Physical Block IDENT_NUMBER_SELECTOR parameter are different
3	0	40	Device failure. Causes Ext_Diag bit to be set
	1	41	Maintenance demanded
	2	42	Device is in function check mode or in simulation or under local control (for example, maintenance)
	3	43	The process conditions prevent return to valid values – the value has the following quality status definitions: Uncertain, process related Uncertain, no maintenance Bad, process related Bad, no maintenance
	4 to 7	44 to 47	Reserved by PNO, fixed to 0
4	0 to 6	48 to 54	Reserved by PNO, fixed to 0
	7	55	More diagnosis information is available in DIAGNOSIS_EXTENSION

Table 6.3 DIAGNOSIS Bit Descriptions (Extended)

6.3.2 DIAGNOSIS_EXTENSION Parameter

The DIAGNOSIS_EXTENSION parameter is at relative index 14 of the Physical Block.

WaterMaster's map device-specific diagnostic error and warning messages into bits of the DIAGNOSIS_EXTENSION. Because the standard profile Ident Numbers do not support these device-specific alarms, they are available only when the WaterMaster-specific Ident Number (3431) is used.

Octet	Bit	Unit Diag Bit (GSD)	Description (When Bit Set)
1	0	56	Unused
	1	57	Logic simulation selected on OP1
	2	58	Pulse simulation selected on OP1
	3	59	Logic simulation selected on OP1
	4	60	Pulse simulation selected on OP2
	5	61	Logic simulation selected on OP3
	6	62	Low flow alarm
	7	63	High flow alarm
2	0	64	Q > 103% Qmax
	1	65	Simulation mode on
	2	66	Tx. simulator / calibrator mode
	3	67	At Qmax, volume display overrun <1600 hours
	4	68	Totalizer reset
	5	69	Intermittent sensor comms
	6	70	Unused
	7	71	Tx. memory fault detected
3	0	72	Sensor memory not detected
	1	73	Tx. measurement suspended
	2	74	Empty pipe
	3	75	Unused
	4	76	Unused
	5	77	Open circuit electrode
	6	78	Short circuit electrode
	7	79	Unused

Table 6.4 DIAGNOSIS Bit Descriptions – Extended

Octet	Bit	Unit Diag Bit (GSD)	Description (When Bit Set)
4	0	80	Installation fault / condition
	1	81	Open circuit coil / wiring
	2	82	Short circuit coil / wiring
	3	83	Check cable + coil resistance
	4	84	Transmitter hardware fault
	5	85	Bad flow data
	6	86	Accuracy warning
	7	87	OIML self-check limits exceeded
5	0	88	Measurement starting
	1	89	Unused
	2	90	Sensor setup not complete
	3	91	Incompatible sensor
	4	92	Tx. code memory fault
	5	93	Tx. data memory fault
	6	94	Unused
	7	95	Alarm simulation active
6	0	96	Non-volatile summary alarm
	1 to 7	97 to 103	Unused

Table 6.4 DIAGNOSIS Bit Descriptions – Extended (Continued)

6.4 Mapping Alarms to Transducer Block Status

Transducer Blocks deliver measurement values to their corresponding Function Blocks in a data structure (PROFIBUS data type structure 101) containing the measurement value plus a status code to indicate the quality of the measurement value.

WaterMasters have three diagnostic groups that affect the measurement value status of the associated Transducer Block channels and the Function Blocks connected to them when error or warning bits are set – these are defined in Table 6.5.

Diagnostic Group	TB Channels Affected	FBs Affected
0	VOLUME_FLOWRATE	AI1, TOT1, TOT2
1	VOLUME_FORWARD,VOLUME_REVERSE	AI2, AI3
2	ELECTRODE_1_RESISTANCE ELECTRODE_2_RESISTANCE BACK_OFF_VOLTAGE COIL_AND_CABLE_RESISTANCE COIL_INDUCTANCE SENSOR_INDUCTANCE_SHIFT TRANSMITTER_AVERAGE_GAIN_SHIFT	AI4

Table 6.5 Diagnostic Group TB Channels

6.4.1 Extended Status Tables

The following tables define how set alarm bits affect the measurement status of the corresponding Transducer Block channels for extended status (refer to the PROFIBUS PA application profile specification for more details on these definitions).

Octet	Bit	Unit Diag Bit (GSD)	Description (When Bit Set)	Diagnostic Group 0	Diagnostic Group 1	Diagnostic Group 2
1	0	56	Unused			
	1	57	Logic simulation selected on OP1	GOOD(NC)	GOOD(NC)	GOOD(NC)
	2	58	Pulse simulation selected on OP1	GOOD(NC)	GOOD(NC)	GOOD(NC)
	3	59	Logic simulation selected on OP1	GOOD(NC)	GOOD(NC)	GOOD(NC)
	4	60	Pulse simulation selected on OP2	GOOD(NC)	GOOD(NC)	GOOD(NC)
	5	61	Logic simulation selected on OP3	GOOD(NC)	GOOD(NC)	GOOD(NC)
	6	62	Low flow alarm	GOOD(NC), low limited	GOOD(NC), low limited	GOOD(NC), low limited
	7	63	High flow alarm	GOOD(NC), high limited	GOOD(NC), high limited	GOOD(NC), high limited
2	0	64	Q > 103% Qmax	GOOD(NC), high limited	GOOD(NC), high limited	GOOD(NC), high limited

Table 6.6 Alarm Mapping for Extended Status

Octet	Bit	Unit Diag Bit (GSD)	Description (When Bit Set)	Diagnostic Group 0	Diagnostic Group 1	Diagnostic Group 2
	1	65	Simulation mode on	UNCERTAIN, simulated value	UNCERTAIN, simulated value	GOOD(NC)
	2	66	Tx. simulator / calibrator mode	UNCERTAIN, simulated value	UNCERTAIN, simulated value	GOOD(NC)
	3	67	At Qmax, volume display overrun <1600 hours	GOOD(NC)	GOOD(NC)	GOOD(NC)
	4	68	Totalizer reset	GOOD(NC)	GOOD(NC)	GOOD(NC)
	5	69	Intermittent sensor comms	GOOD(NC), maintenance required	GOOD(NC), maintenance required	GOOD(NC), maintenance required
	6	70	Unused			
	7	71	Tx. memory fault detected	BAD, device failure	BAD, device failure	BAD, device failure
3	0	72	Sensor memory not detected	BAD, device failure	BAD, device failure	BAD, device failure
	1	73	Tx. measurement suspended	BAD, device failure	BAD, device failure	BAD, device failure
	2	74	Empty pipe	UNCERTAIN, non-specific	UNCERTAIN, non-specific	UNCERTAIN, non-specific
	3	75	Unused			
	4	76	Unused			
	5	77	Open circuit electrode	UNCERTAIN, non-specific	UNCERTAIN, non-specific	UNCERTAIN, non-specific
	6	78	Short circuit electrode	UNCERTAIN, non-specific	UNCERTAIN, non-specific	UNCERTAIN, non-specific
	7	79	Unused			

Table 6.6 Alarm Mapping for Extended Status (Continued)

Octet	Bit	Unit Diag Bit (GSD)	Description (When Bit Set)	Diagnostic Group 0	Diagnostic Group 1	Diagnostic Group 2
4	0	80	Installation fault / condition	BAD, device failure	BAD, device failure	BAD, device failure
	1	81	Open circuit coil / wiring	BAD, device failure	BAD, device failure	BAD, device failure
	2	82	Short circuit coil / wiring	BAD, device failure	BAD, device failure	BAD, device failure
	3	83	Check cable and coil resistance	BAD, device failure	BAD, device failure	BAD, device failure
	4	84	Transmitter hardware fault	BAD, device failure	BAD, device failure	BAD, device failure
	5	85	Bad flow data	BAD, device failure	BAD, device failure	BAD, device failure
	6	86	Accuracy warning	UNCERTAIN, non-specific	UNCERTAIN, non-specific	UNCERTAIN, non-specific
	7	87	OIML self-check limits exceeded	GOOD(NC), maintenance required	GOOD(NC), maintenance required	GOOD(NC), maintenance required
5	0	88	Measurement starting	UNCERTAIN, non-specific	UNCERTAIN, non-specific	UNCERTAIN, non-specific
	1	89	Unused			
	2	90	Sensor setup not complete	UNCERTAIN, non specific	UNCERTAIN, non specific	UNCERTAIN, non specific
	3	91	Incompatible sensor	BAD, device failure	BAD, device failure	BAD, device failure
	4	92	Tx. code memory fault	BAD, device failure	BAD, device failure	BAD, device failure
	5	93	Tx. data memory fault	BAD, device failure	BAD, device failure	BAD, device failure
	6	94	Unused			
	7	95	Alarm simulation active	GOOD(NC)	GOOD(NC)	GOOD(NC)
6	0	96	Non-volatile summary alarm	BAD, device failure	BAD, device failure	BAD, device failure
	1 to 7	97 to 103	Unused			

Table 6.6 Alarm Mapping for Extended Status (Continued)

For extended status, the status value is formatted into several fields and is defined in Table 6.7:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Quality		Quality Sub Status				Limits	

Table 6.7 Status Value Field Formats

0	BAD – the value is not useful.
1	UNCERTAIN – the quality of the value is less than normal, but the value may still be useful.
2	GOOD (non-cascade / NC) – the quality of the value is good. Possible alarm conditions may be indicated by the sub-status.
3	GOOD (cascade / C) – the value can be used in control.

Table 6.8 Quality

0	Non-specific
1	Configuration error
2	Not connected
3	Device failure
4	Sensor failure
5	No communication (last usable value)
6	No communication (no usable value)
7	Out-of-service

Table 6.9 Quality Sub Status for BAD

0:	Non specific
1:	Last usable value (LUV)
2	Substitute value
3	Initial value
4	Sensor conversion not accurate
5	Engineering unit violation
6	Sub normal
7	Configuration error
8	Simulated value
9	Sensor calibration

Table 6.10 Quality Sub Status for UNCERTAIN

0	OK
1	Update event
2	Active advisory alarm
3	Active critical alarm
4	Unacknowledged update event
5	Unacknowledged advisory alarm
6	Unacknowledged critical alarm
7	–
8	Initiate fail-safe
9	Maintenance required

Table 6.11 Quality Sub Status for GOOD (Non-cascade)

0	OK
1	Initialisation acknowledged
2	Initialisation request
3	Not invited
4	Reserved
5	Do not select
6	Local override

Table 6.12 Quality Sub Status for GOOD (Cascade)

0	OK
1	Low limited
2	High limited
3	Constant

Table 6.13 Limits

6.4.2 Condensed Status Tables

Tables to 6.14 to 6.20 (page 37)define how set alarm bits affect the measurement status of the corresponding Transducer Block channels for condensed status (refer to the PROFIBUS PA application profile specification for more details on these definitions).

Octet	Bit	Unit Diag Bit (GSD)	Description (When Bit Set)	Diagnostic Group 0	Diagnostic Group 1	Diagnostic Group 2
1	0	56	Unused			
	1	57	Logic simulation selected on OP1	GOOD(G)	GOOD(G)	GOOD(G)
	2	58	Pulse simulation selected on OP1	GOOD(G)	GOOD(G)	GOOD(G)
	3	59	Logic simulation selected on OP1	GOOD(G)	GOOD(G)	GOOD(G)
	4	60	Pulse simulation selected on OP2	GOOD(G)	GOOD(G)	GOOD(G)
	5	61	Logic simulation selected on OP3	GOOD(G)	GOOD(G)	GOOD(G)
	6	62	Low flow alarm	GOOD critical alarm, low limit	GOOD critical alarm, low limit	GOOD critical alarm, low limit
	7	63	High flow alarm	GOOD-critical alarm, high limit	GOOD-critical alarm, high limit	GOOD-critical alarm, high limit
2	0	64	Q > 103% Qmax	GOOD-critical alarm, high limit	GOOD-critical alarm, high limit	GOOD-critical alarm, high limit
	1	65	Simulation mode on	Check(C)	Check(C)	Good(G)
	2	66	Tx. simulator / calibrator mode	Check(C)	Check(C)	Good(G)
	3	67	At Qmax, volume display overrun <1600 hours	GOOD(G)	GOOD(G)	GOOD(G)
	4	68	Totalizer reset	GOOD(G)	GOOD(G)	GOOD(G)
	5	69	Intermittent sensor comms	Maintenance(M)	Maintenance(M)	Maintenance(M)
	6	70	Unused			
	7	71	Tx. memory fault detected	Failure(F)	Failure(F)	Failure(F)

Table 6.14 Alarm Mapping for Extended Status

Octet	Bit	Unit Diag Bit (GSD)	Description (When Bit Set)	Diagnostic Group 0	Diagnostic Group 1	Diagnostic Group 2
3	0	72	Sensor memory not detected	Failure(F)	Failure(F)	Failure(F)
	1	73	Tx. measurement suspended	Failure(F)	Failure(F)	Failure(F)
	2	74	Empty pipe	Out of Specification(S)	Out of Specification(S)	Out of Specification(S)
	3	75	Unused			
	4	76	Unused			
	5	77	Open circuit electrode	Out of Specification(S)	Out of Specification(S)	Out of Specification(S)
	6	78	Short circuit electrode	Out of Specification(S)	Out of Specification(S)	Out of Specification(S)
	7	79	Unused			
4	0	80	Installation fault / condition	Failure(F)	Failure(F)	Failure(F)
	1	81	Open circuit coil / wiring	Failure(F)	Failure(F)	Failure(F)
	2	82	Short circuit coil / wiring	Failure(F)	Failure(F)	Failure(F)
	3	83	Check cable + coil resistance	Failure(F)	Failure(F)	Failure(F)
	4	84	Transmitter hardware fault	Failure(F)	Failure(F)	Failure(F)
	5	85	Bad flow data	Failure(F)	Failure(F)	Failure(F)
	6	86	Accuracy warning	Out of Specification(S)	Out of Specification(S)	Out of Specification(S)
	7	87	OIML self-check limits exceeded	Maintenance(M)	Maintenance(M)	Maintenance(M)

Table 6.14 Alarm Mapping for Extended Status (Continued)

Octet	Bit	Unit Diag Bit (GSD)	Description (When Bit Set)	Diagnostic Group 0	Diagnostic Group 1	Diagnostic Group 2
5	0	88	Measurement starting	Out of Specification(S)	Out of Specification(S)	Out of Specification(S)
	1	89	Unused			
	2	90	Sensor setup not complete	Out of Specification(S)	Out of Specification(S)	Out of Specification(S)
	3	91	Incompatible sensor	Failure(F)	Failure(F)	Failure(F)
	4	92	Tx. code memory fault	Failure(F)	Failure(F)	Failure(F)
	5	93	Tx. data memory fault	Failure(F)	Failure(F)	Failure(F)
	6	94	Unused			
	7	95	Alarm simulation active	Good(G)	Good(G)	Good(G)
6	0	96	Non-volatile summary alarm	Failure(F)	Failure(F)	Failure(F)
	1 to 7	97 to 103	Unused			

Table 6.14 Alarm Mapping for Extended Status (Continued)

Condensed status values are formatted into several fields defined and is defined in Table 6.15:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Quality		Quality Sub-status				Limits	

Table 6.15 Status Value Field Formats

NE107 Meaning	PCS / DCS usage	Coding				PROFIBUS-PA meaning
		Quality	Sub Status	Limits		
Failure(F)	Failure	0 0	1 0 0 1	X X	0x24 to 0x27	BAD maintenance alarm, more diagnosis available
Check(C)	Failure	0 0	1 1 1 1	X X	0x3C to 0x3F	BAD function check / local override
Out of specification(S)	Uncertain	0 1	1 1 1 0	X X	0x78 to 0x7B	UNCERTAIN process related, no maintenance
Maintenance(M)	Good	1 0	1 0 0 1 1 0 1 0	X X	0xA4 to 0xAB	GOOD maintenance required / demanded

Table 6.16 Coding of the Condensed Status Restricted to NE107

NE107 Meaning	PCS / DCS usage	Coding				PROFIBUS-PA meaning
		Quality	Sub Status	Limits		
Good(G)	Good	1 0	0 0 0 0	0 0	0x80	GOOD ok
Good(G)	Good	1 0	0 0 0 1	X X	0x84 to 0x87	GOOD update event
Good(G)	Good	1 0	0 0 1 0	0 1	0x89	GOOD advisory alarm, low limit
Good(G)	Good	1 0	0 0 1 0	1 0	0x8A	GOOD advisory alarm, high limit
Good(G)	Good	1 0	0 0 1 1	0 1	0x8D	GOOD critical alarm, low limit
Good(G)	Good	1 0	0 0 1 1	1 0	0x8E	GOOD critical alarm, high limit

Table 6.17 Coding of Limit Checks / Update Events for Quality GOOD

NE107 Meaning	PCS / DCS usage	Maintenance Station Usage	Coding				PROFIBUS-PA meaning
			Quality	Sub Status	Limits		
Failure(F)	Failure	Failure	0 0	0 0 0 0	0 0	0x00	BAD non-specific
Failure(F)	Passivated	Good	0 0	1 0 0 0	1 1	0x23	BAD passivated (diagnostic alerts inhibited)
Failure(F)	Failure	Maintenance alarm	0 0	1 0 0 1	X X	0x24 to 0x27	BAD maintenance alarm, more diagnosis available
Failure(F)	Failure	Good	0 0	1 0 1 0	X X	0x28 to 0x2B	BAD process related, no maintenance
Check(C)	Function check	Function check	0 0	1 1 1 1	X X	0x3C to 0x3F	BAD function check / local override, value not usable

Table 6.18 Detailed Coding of the Condensed Status – Quality BAD

NE107 Meaning	PCS / DCS usage	Maintenance Station Usage	Coding				PROFIBUS-PA meaning
			Quality	Sub Status	Limits		
Failure(F)	Uncertain	Maintenance alarm	0 1	0 0 1 0	1 1	0x4B	UNCERTAIN substitute set
Failure(F)	Uncertain	Good	0 1	0 0 1 1	1 1	0x4F	UNCERTAIN initial value
Maintenance(M)	Uncertain	Maintenance demanded	0 1	1 0 1 0	X X	0x68 to 0x6B	UNCERTAIN maintenance demanded
Check(C)	Uncertain	Function check	0 1	1 1 0 0	1 1	0x73	UNCERTAIN simulated value, start
Check(C)	Uncertain	Good	0 1	1 1 0 1	X X	0x74 to 0x77	UNCERTAIN simulated value, end
Out of specification(S)	Uncertain	Good	0 1	1 1 1 0	X X	0x78 to 0x7B	UNCERTAIN process related, no maintenance

Table 6.19 Detailed Coding of the Condensed Status – Quality UNCERTAIN

NE107 Meaning	PCS / DCS usage	Maintenance Station Usage	Coding				PROFIBUS-PA meaning
			Quality	Sub Status	Limits		
Good(G)	Good	Good	1 0	0 0 X X	X X	0x80 to 0x8E	GOOD
Good(G)	Good	Good	1 0	1 0 0 0	X X	0xA0 to 0xA3	GOOD initiate fail safe
Maintenance(M)	Good	Maintenance required	1 0	1 0 0 1	X X	0xA4 to 0xA7	GOOD maintenance required
Maintenance(M)	Good	Maintenance demanded	1 0	1 0 1 0	X X	0xA8 to 0xAB	GOOD maintenance demanded
Good(G)	Good	Function check	1 0	1 1 1 1	X X	0xBC to 0xBF	GOOD function check

Table 6.20 Detailed Coding of the Condensed Status – Quality GOOD

7 Identification and Maintenance

PROFIBUS DPV1 specifies functionality for Identification and Maintenance services (I&M) that allow information about an instrument to be requested via bus in a standard format.

WaterMaster flowmeters support the following standard I&M functions (as the mandatory requirements of PROFIBUS PA application profile version 3.01):

- I&M0
- I&M1
- I&M2
- I&M3
- profile-specific function PA_I&M0

All of these functions are available with read-only access from parameter slot 0. I&M functions are not available for the other parameter slots.

Note. Unless otherwise stated, reserved parameters have their data value set to 0x00 for numerical values or all characters set to ASCII 0x20 (space) for text values.

Parameter		Description
0	HEADER	Reserved.
1	MANUFACTURER_ID	PROFIBUS manufacturer code for ABB (0x1A – as DEVICE_MAN_ID parameter in PB).
2	ORDER_ID	Fixed to '9AAC133129' that is the ABB catalogue ID for WaterMaster flowmeters. This can be used to create a web query for locating information about the device on the ABB website: www.abb.com
3	SERIAL_NUMBER	Serial number of the device – as DEVICE_SER_NUM parameter in PB.
4	HARDWARE_REVISION	Fixed to 0xFF, 0xFF (to indicate profile-specific information).
5	SOFTWARE_REVISION	Fixed to 'V', 0xFF, 0xFF, 0xFF (to indicate profile-specific information).
6	REV_COUNTER	Incremental change count for any static data in any block (PB, TB or FB).

Table 7.1 Function: I&M0

Parameter		Description
7	PROFILE_ID	Fixed to 0x9700, indicating device supporting PROFIBUS PA profile.
8	PROFILE_SPECFIC_TYPE	Byte 0 – BlockObject type code for the block of slot being accessed (PB gives value 0x01). Byte 1 – ParentClass type code for the block of slot being accessed (PB gives value 0x01 [transmitter]).
9	IM_VERSION	Fixed to 0x01, 0x01 (indicating I&M version 1.1).
10	IM_SUPPORTED	Fixed to 0x00, 0x0F (indicating I&M0 to I&M3 supported).

Table 7.1 Function: I&M0 (Continued)

Parameter		Description
0	HEADER	Reserved.
1	TAG_FUNCTION	Same as the TAG parameter in PB.
2	TAG_FUNCTION	Filled with ASCII 0x20 (space) characters.

Table 7.2 Function: I&M1

Parameter		Description
0	HEADER	Reserved.
1	DATE	Same as the DEVICE_INSTALL_DATE parameter in PB.
2	Reserved	Reserved.

Table 7.3 Function: I&M2

Parameter		Description
0	HEADER	Reserved.
1	DESCRIPTOR	Same as the DESCRIPTOR parameter in PB.

Table 7.4 Function: I&M3

Parameter		Description
0	HEADER	Reserved.
1	PA_IM_VERSION	Fixed to 0x01, 0x00 (version 1.0)
2	HARDWARE_REVISION	Same as HARDWARE_REVISION in PB.
3	SOFTWARE_REVISION	Same as SOFTWARE_REVISION in PB.
4	Reserved	Reserved.
5	PA_IM_SUPPORTED	Fixed to 0x00, 0x00 (no manufacturer-specific I&M data).

Table 7.5 Function: PA_I&M0

Note.

- In the event of a WaterMaster transmitter electronics fault, most problems can be fixed by replacing the cartridge with a new one. For other transmitter faults contact ABB customer support.
- Parameter data held in the sensor (such as the internal totalizer values and sensor calibration settings) are uploaded into the new cartridge at next power-up.
- The PROFIBUS Totalizer Block totals (TOT1.TOTAL and TOT2.TOTAL) are held only in the cartridge. These need to be re-written back into the WaterMaster via the bus after the new cartridge has been fitted.

Appendix A – PROFIBUS-PA Block Structure Diagrams

The following diagrams illustrate the relationship and data flow in PROFIBUS PA Function Blocks and Flow Transducer Block used in WaterMaster.

A.1 Analog Input Function Block

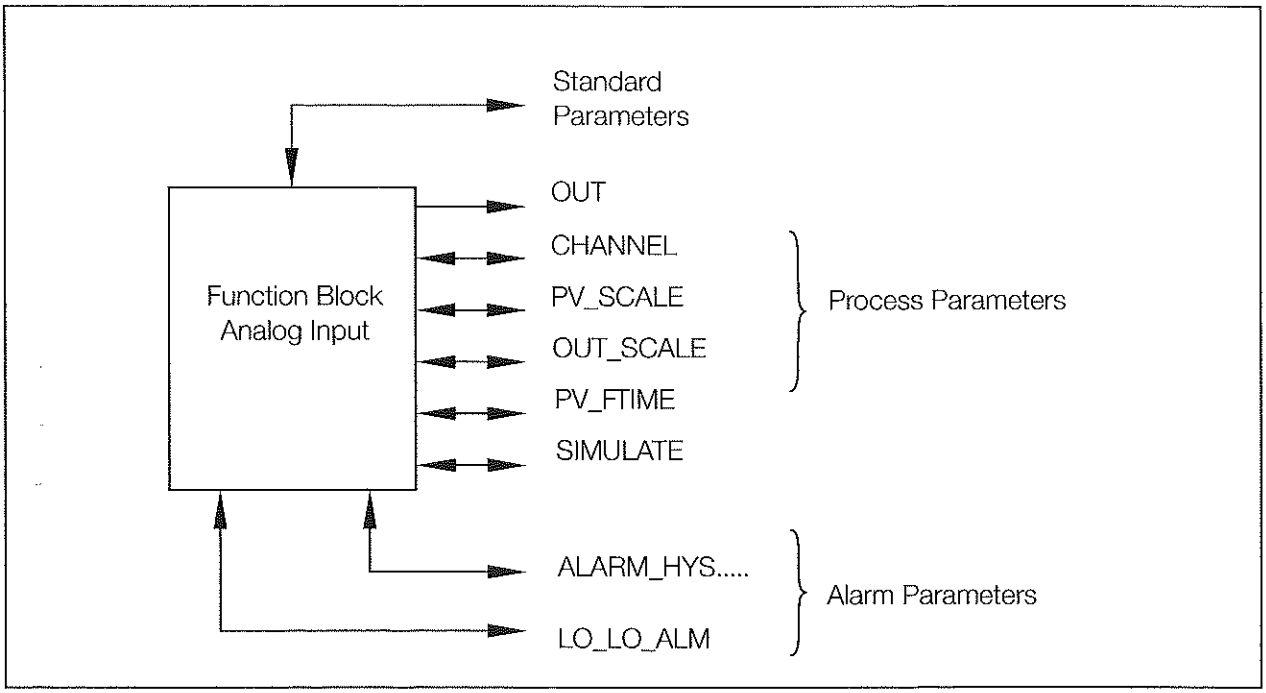


Fig. A.1 AI Block Summary

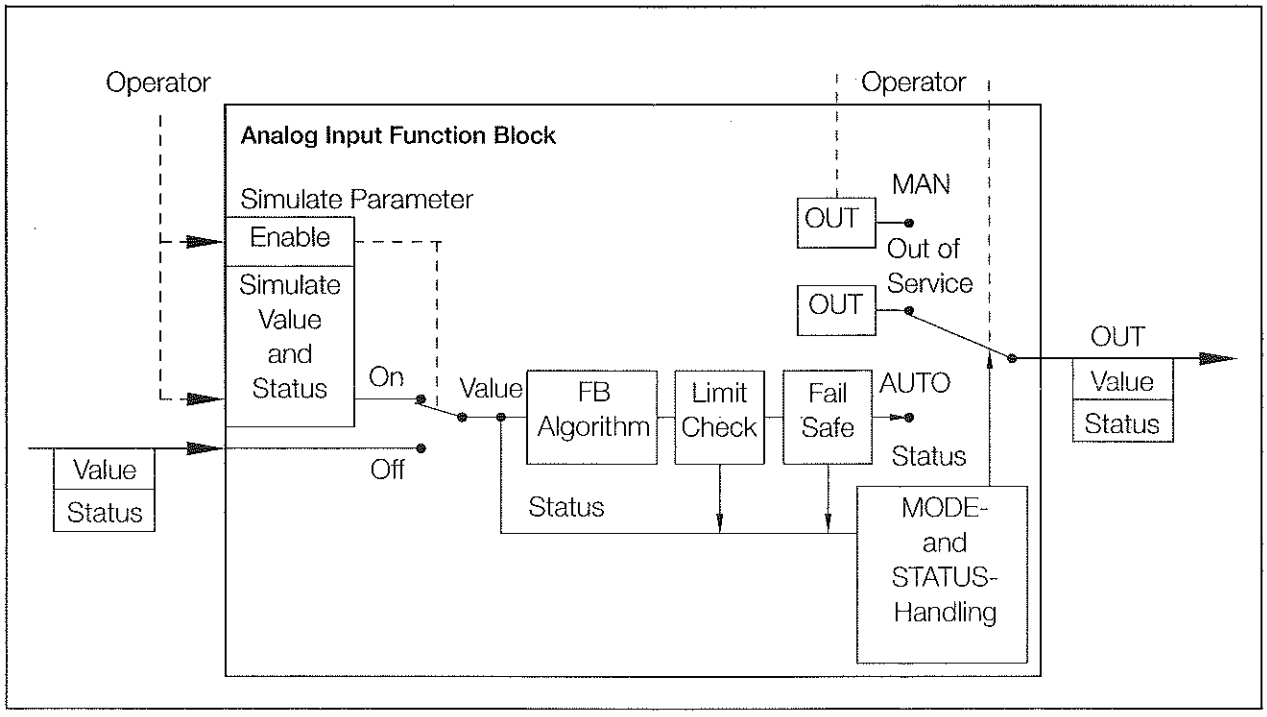


Fig. A.2 AI Block Structure

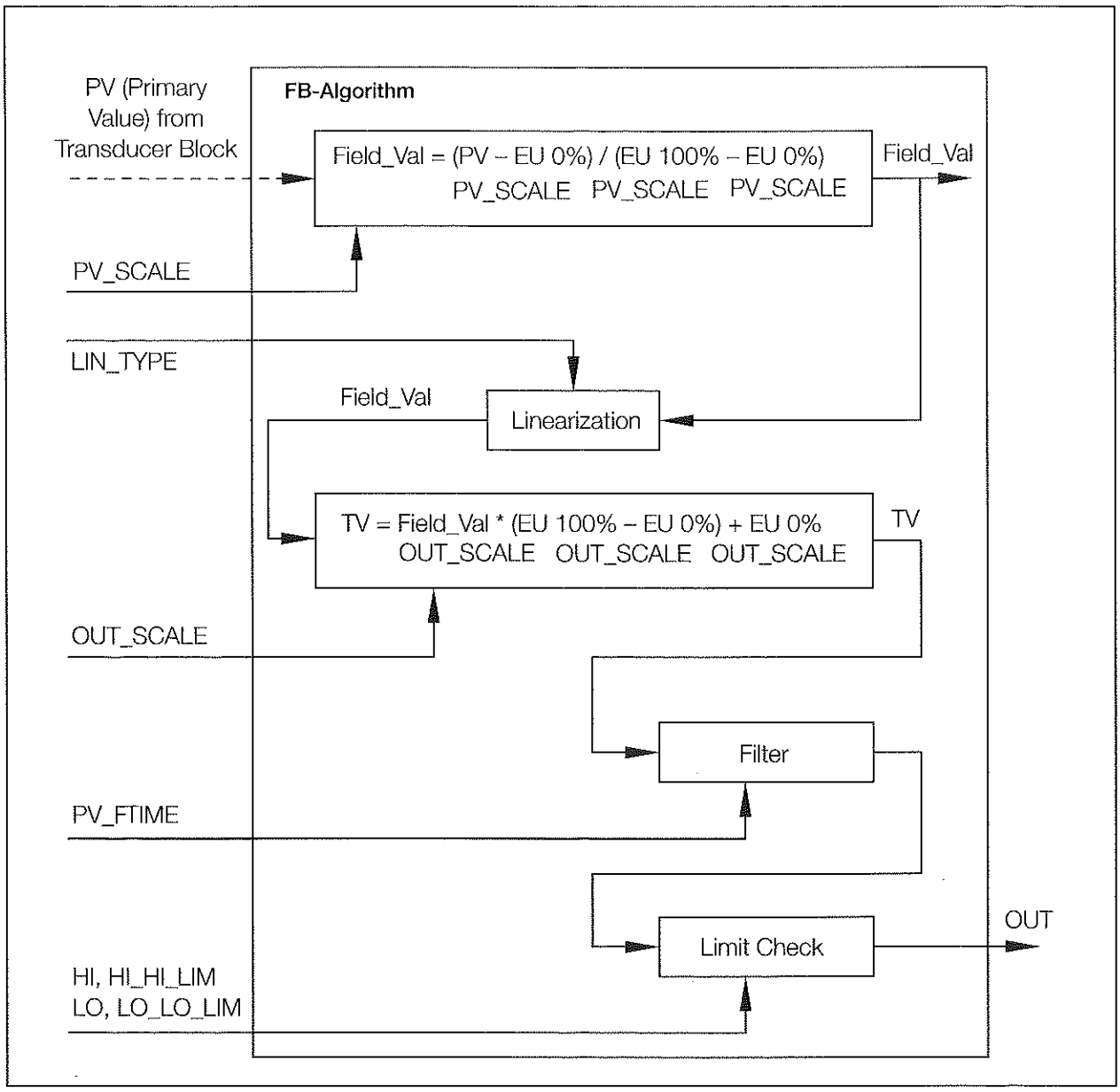


Fig. A.3 AI Block Algorithm

A.2 Totalizer Function Block

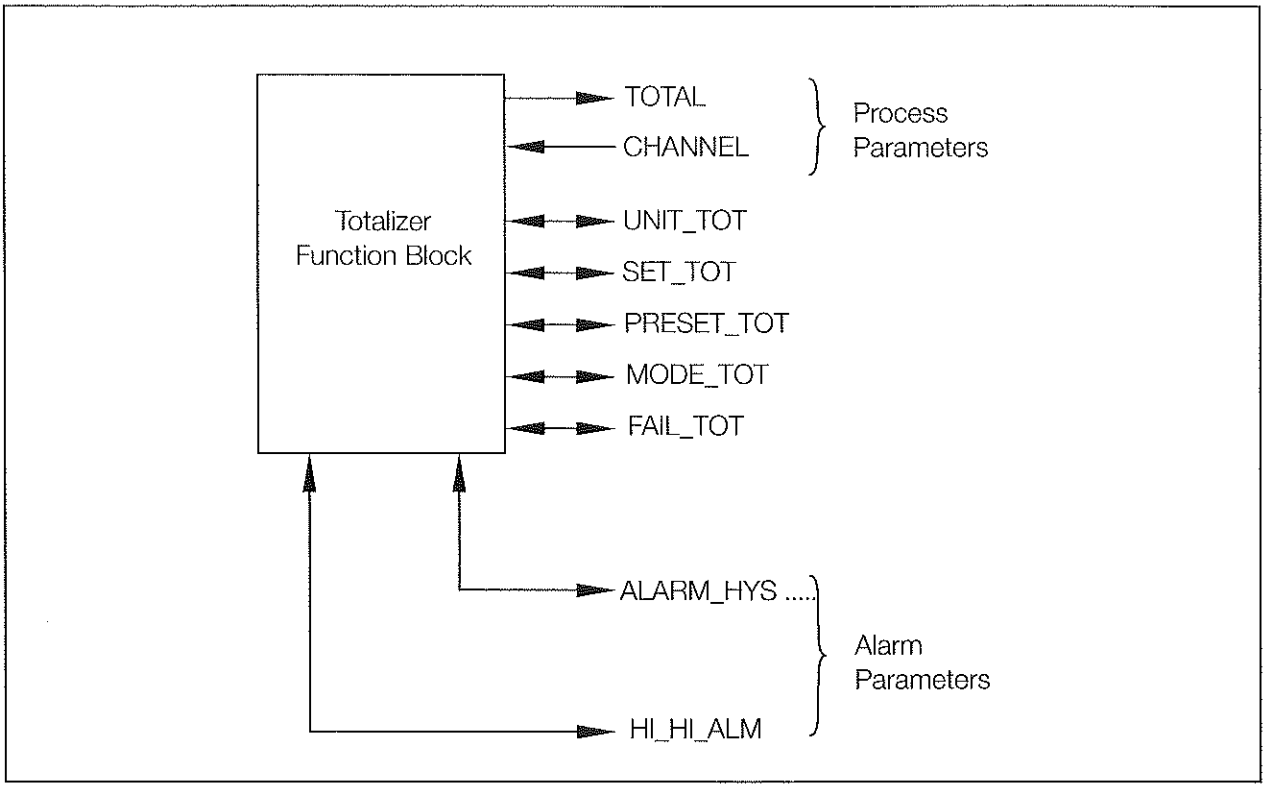


Fig. A.4 TOT Block Summary

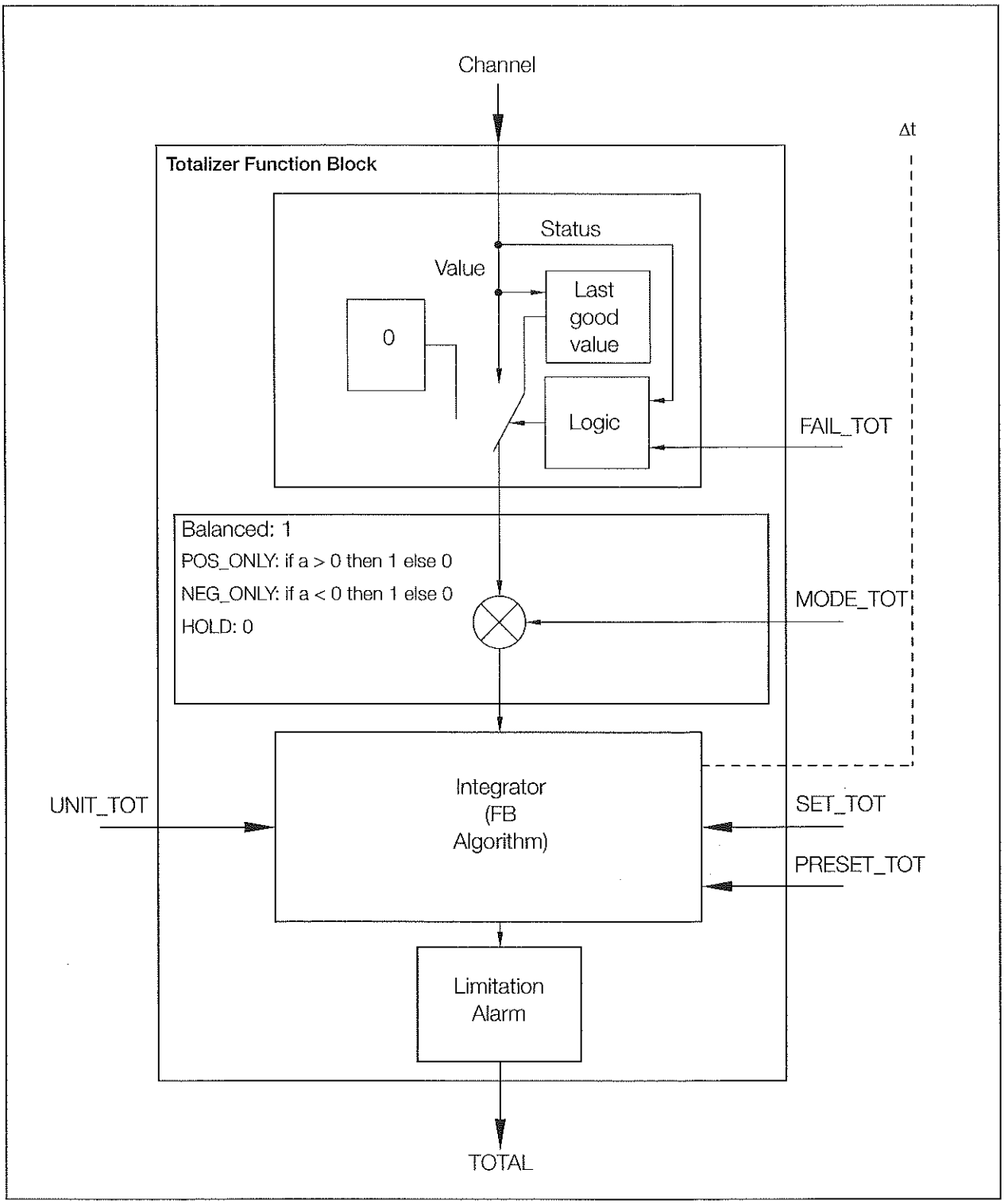


Fig. A.5 TOT Block Structure

A.3 Analog Output Function Block

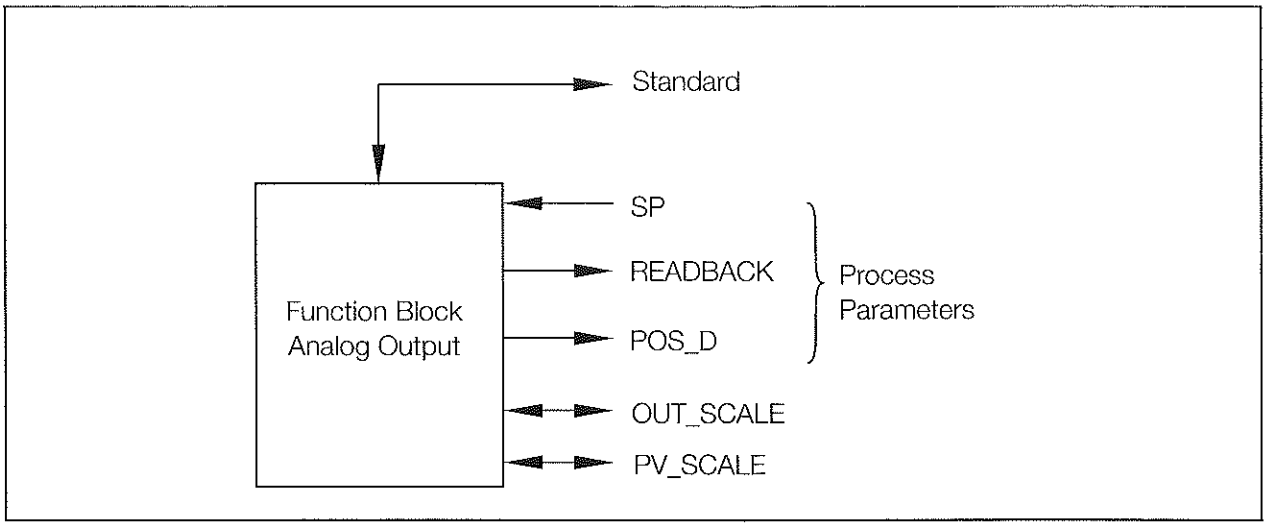


Fig. A.6 AO Block Summary

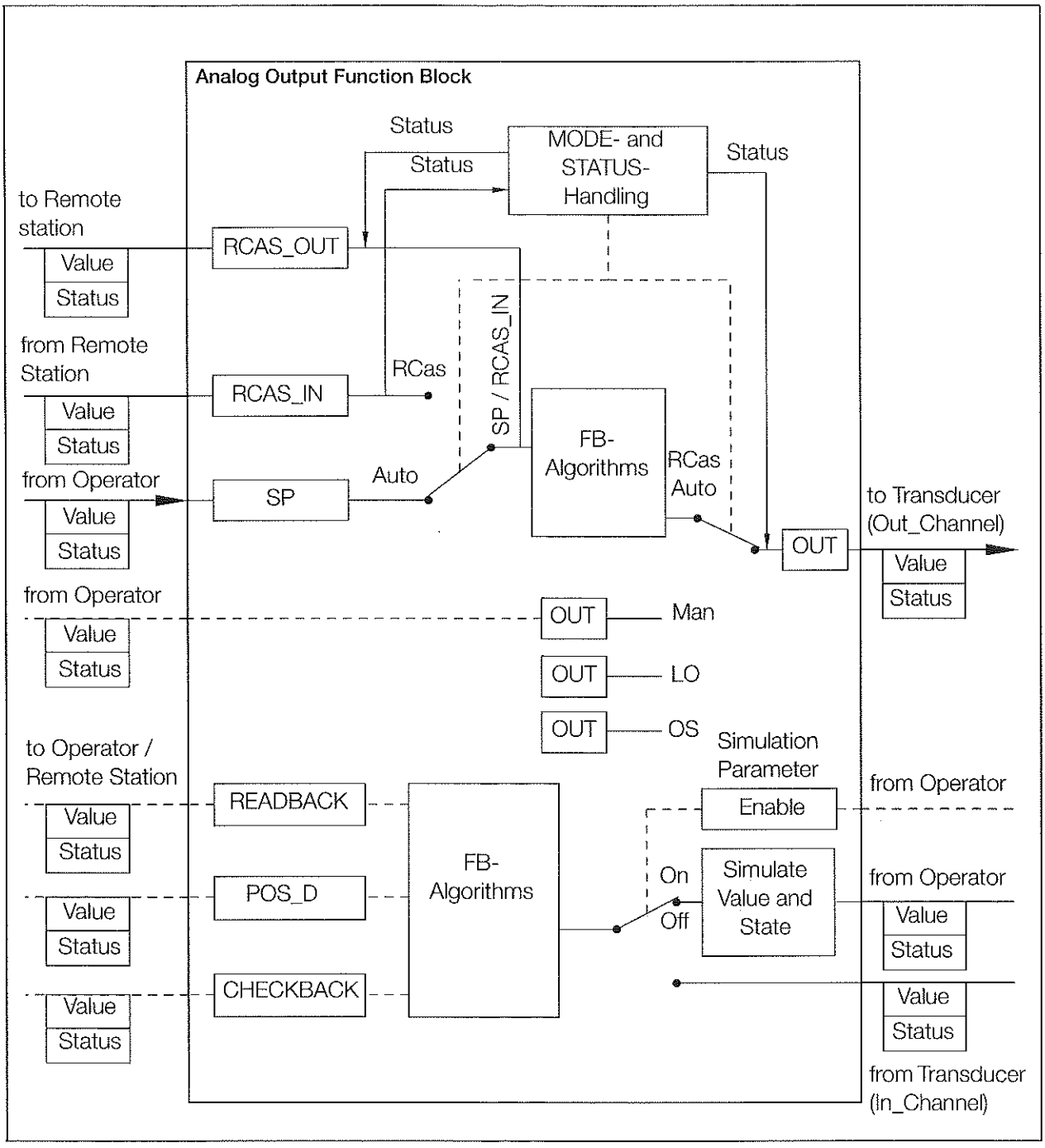


Fig. A.7 AO Block Structure

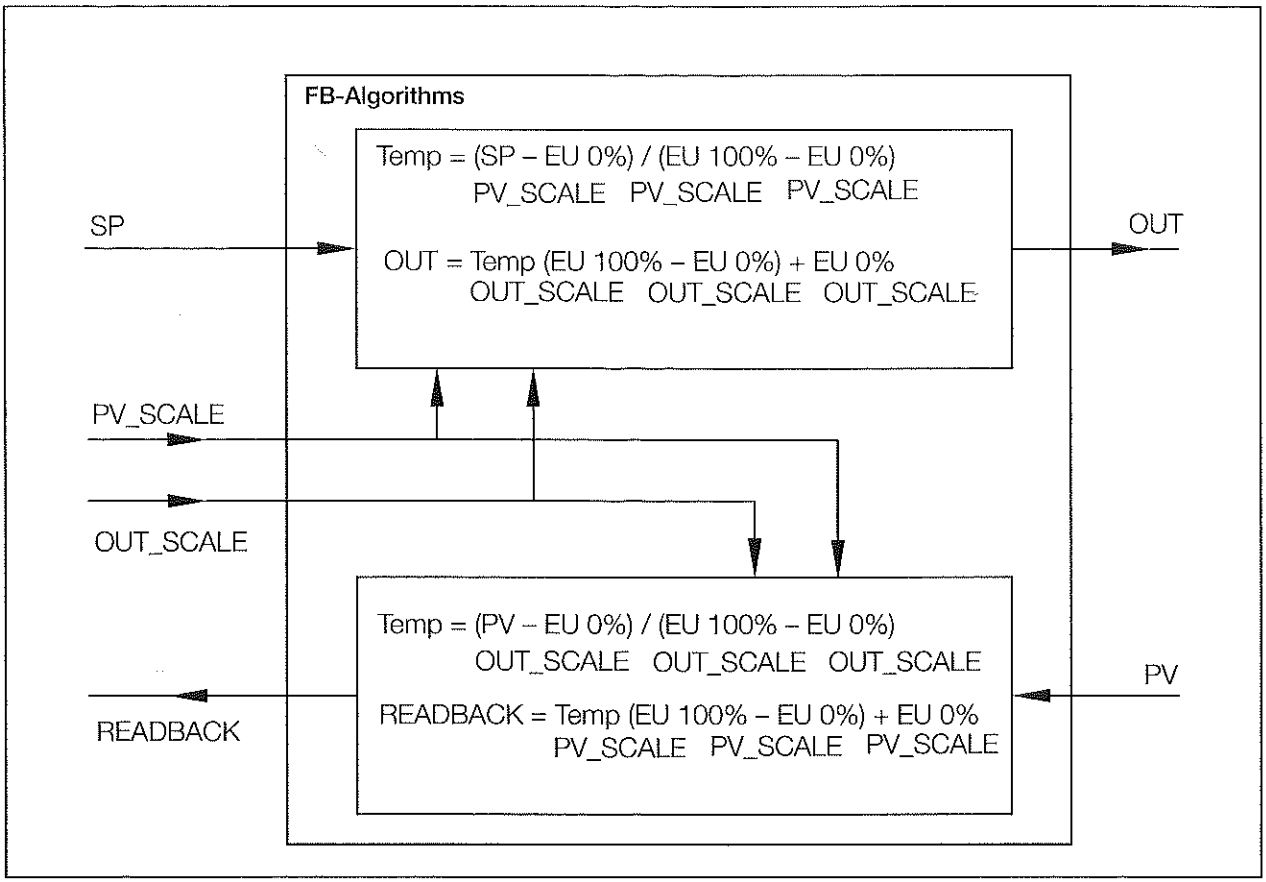


Fig. A.8 AO Block Algorithm

A.4 Flow Transducer Block

The Flow Transducer Block describes the basic set of parameters for flow devices.

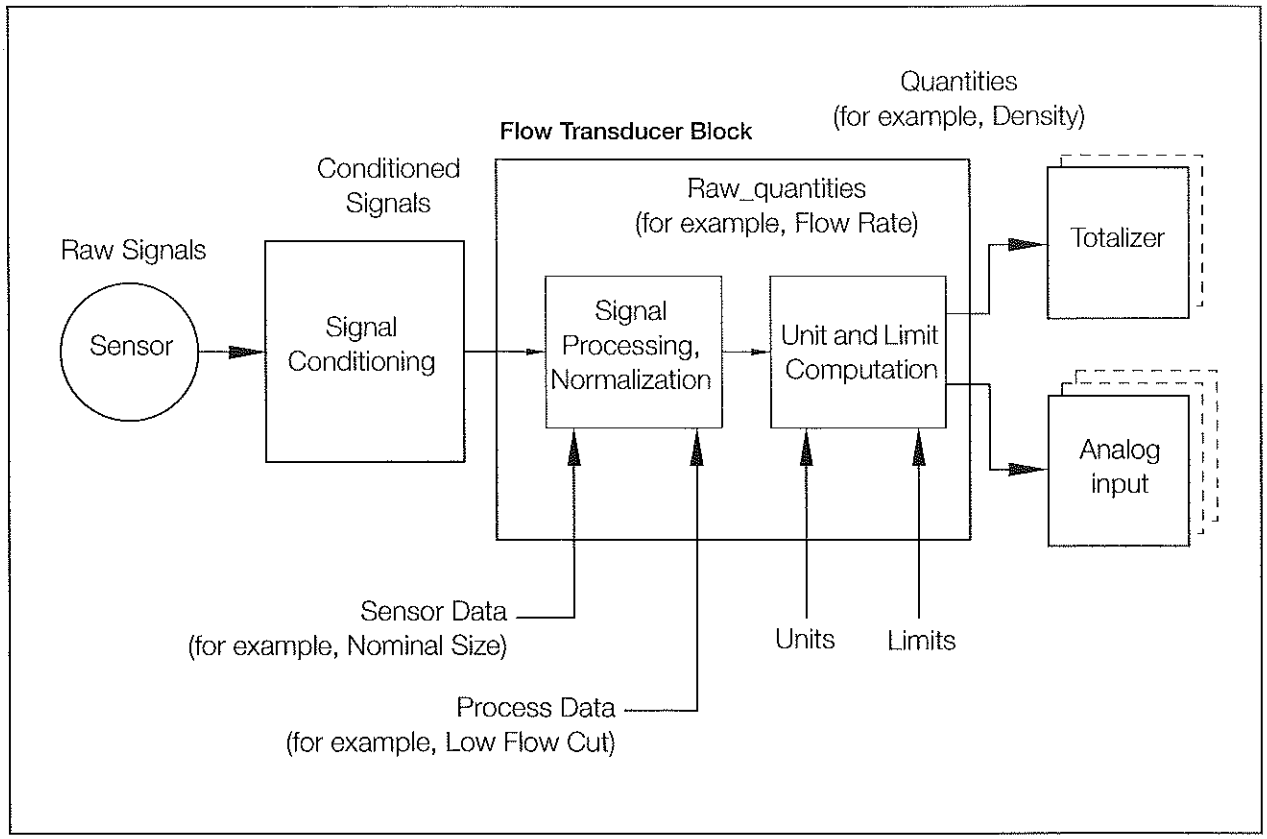


Fig. A.9 TB Flow Functional Diagram

Appendix B – PROFIBUS Data Structures

The following PROFIBUS and WaterMaster specific data structures are used in the WaterMaster blocks.

E	Element Name	Data Type	Size
1	Reserved	Unsigned8	1
2	Block_Object	Unsigned8	1
3	Parent_Class	Unsigned8	1
4	Class	Unsigned8	1
5	DD_Reference	Unsigned32	4
6	DD_Revision	Unsigned16	2
7	Profile	OctetString	2
8	Profile_Revision	Unsigned8	1
9	Execution_Time	Unsigned16	2
10	Number_of_Parameters	Unsigned16	2
11	Address_of_View_1	Unsigned16	2
12	Number_of_Views	Unsigned8	1

Table B.1 DS-32 Block Structure

E	Element Name	Data Type	Size
1	Value	Float	4
2	Status	Unsigned8	1

Table B.2 101 (Value and Status Float Structure)

E	Element Name	Data Type	Size
1	EU_at_100%	Float	4
2	EU_at 0%	Float	4
3	Units_Index	Unsigned16	2
4	Decimal_Point	Unsigned8	1

Table B.3 DS-36 (Scaling Structure)

E	Element Name	Data Type	Size
1	Actual	Unsigned8	1
2	Permitted	Unsigned8	1
3	Normal	Unsigned8	1

Table B.4 DS-37 (Mode Structure)

E	Element Name	Data Type	Size
1	Unacknowledged	Unsigned8	1
2	Alarm_State	Unsigned8	1
3	Time_Stamp	TimeValue	8
4	Subcode	Unsigned16	1
5	Value	Float	4

Table B.5 DS-39 (Alarm Float Structure)

E	Element Name	Data Type	Size
1	Current	OctetString	2
2	Unacknowledged	OctetString	2
3	Unreported	OctetString	2
4	Disabled	OctetString	2

Table B.6 DS-42 (Alarm Summary Structure)

E	Element Name	Data Type	Size
1	Simulate_Status	Unsigned8	1
2	Simulate_Value	Float	4
3	Simulate_Enabled	Unsigned8	1

Table B.7 DS-50 (Simulation Float Structure)

E	Element Name	Data Type	Size
1	Batch_ID	Unsigned32	4
2	Rup	Unsigned16	2
3	Operation	Unsigned16	2
4	Phase	Unsigned16	2

Table B.8 DS-67 (Batch Structure)

E	Element Name	Data Type	Size
1	Supported	OctetString	4
2	Enabled	OctetString	4

Table B.9 DS-68 (Feature Structure)

E	Element Name	Data Type	Size
1	Alarm_Counter	Unsigned16	2
2	Alarm_Time_Counter_Msec	Unsigned32	4
3	Alarm_Time_Counter_Day	Unsigned16	2
4	Time_Stamp_Last_Alarm_Msec	Unsigned32	4
5	Time_Stamp_Last_Alarm_Day	Unsigned16	2

Table B.10 WaterMaster Diagnosis Information Structure

Appendix C – FEX100-DP PROFIBUS Datasheet

Item	Detail
PROFIBUS device name	FEX100-DP
Applicable standards	IEC61158 (Type 3) IEC61784 (CPF3/1)
Protocols supported	PROFIBUS-DP (DPV0) PROFIBUS-DP extensions (DPV1)
Application profile	Process Control Devices version 3.01 (PROFIBUS-PA)
Profile ident support	Standard: 9700, 9740, 9741 Device specific: 3431 (4xAI, 2xTOT, 1xAO)
PROFIBUS unit type	PROFIBUS DPV1 Slave
PROFIBUS media type	RS485 (EIA-485), galvanically isolated
PROFIBUS bus connection	Wiring terminals A1/B1 (in) and A2/B2 (out)
Bus address range	1 to 126 via local display interface 1 to 125 via Set_Slave_Addr service
Baud rates supported	9.6 kbps 19.2 kbps 45.45 kbps 93.75 kbps 187.5 kbps 500 kbps 1.5 Mbps
Master Class 1 – Slave cyclic services (MS0)	Set_Prm Chk_Cfg Set_Slave_Addr Data_Exchange Get_Diag Global-Control (SYNC / UNSYNC, FREEZE / UNFREEZE, CLEAR) Get_Cfg Rd_Inp Rd_Outp
Master Class 1 – Slave acyclic services (MS1)	MS1_Read MS1_Write

Table C.1 PROFIBUS Datasheet

Item	Detail
Master Class 2 – Slave acyclic services (MS2)	3 concurrent MS2 connections MS2_Initiate MS2_Read MS2_Write MS2_Abort MS2_DataTransport MS2_Idle
Device-specific GSD file	ABB_3431.gsd
Configuration support	EDD, DTM, local display interface

Table C.1 PROFIBUS Datasheet (Continued)

Appendix D – Declaration of PROFIBUS Conformance

FEX100-DP is the PNO registered model name for PROFIBUS-enabled WaterMaster flowmeters (RS485 physical layer) approved by an independent authorized certification laboratory for connection and use in PROFIBUS networks.

Certification of PROFIBUS specification conformance covers the following areas:

- RS485 bus interface electrical characteristics.
- DPV0 and DPV1 protocol services.
- Process Control Devices Profile version 3.01 (also known as the PA Profile).
- FEX100-DP device specific GSD file.

A copy of the conformance certificate is available for download from the WaterMaster product pages of the ABB website www.abb.com.

Products and customer support

Automation Systems
For the following industries:
- Chemical & Pharmaceutical
- Food & Beverage
- Manufacturing
- Metals and Minerals
- Oil, Gas & Petrochemical
- Pulp and Paper

Drives and Motors
- AC and 6 Drives, AC and DC Machines, AC Motors to 1kV
- Drive Systems
- Force Measurement
- Servo Drives

Controllers & Recorders
- Single and Multi-loop Controllers
- Circular Chart and Strip Chart Recorders
- Paperless Recorders
- Process Indicators

Flexible Automation
- Industrial Robots and Robot Systems

Flow Measurement
- Electromagnetic Flowmeters
- Mass Flowmeters
- Turbine Flowmeters
- Wedge Flow Elements

Marine Systems & Turbochargers
- Electrical Systems
- Marine Equipment
- Offshore Retrofit and Refurbishment

Process Analytics
- Process Gas Analysis
- Systems Integration

Transmitters
- Pressure
- Temperature
- Level
- Interface Modules

Valves, Actuators and Positioners
- Control Valves
- Actuators
- Positioners

Water, Gas & Industrial Analytics Instrumentation
- pH, Conductivity and Dissolved Oxygen Transmitters and Sensors
- Ammonia, Nitrate, Phosphate, Silica, Sodium, Chloride, Fluoride, Dissolved Oxygen and Hydrazine Analyzers
- Zirconia Oxygen Analyzers, Katharometers, Hydrogen Purity and Purge-gas Monitors, Thermal Conductivity

Customer support
We provide a comprehensive after sales service via a Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

UK
ABB Limited
Tel: +44 (0)1453 826661
Fax: +44 (0)1453 829671

USA
ABB Inc.
Tel: +1 215 674 6000
Fax: +1 215 674 7183

Client Warranty
Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification.
Periodic checks must be made on the equipment's condition. In the event of a failure under warranty, the following documentation must be provided as substantiation:
- A listing evidencing process operation and alarm logs at time of failure.
- Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.

Contact us

ABB Limited
Process Automation
Oldends Lane
Stonehouse
Gloucestershire GL10 3TA
UK
Tel: +44 1453 826 661
Fax: +44 1453 829 671

ABB Inc.
Process Automation
125 E. County Line Road
Warminster
PA 18974
USA
Tel: +1 215 674 6000
Fax: +1 215 674 7183

www.abb.com

Note
We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

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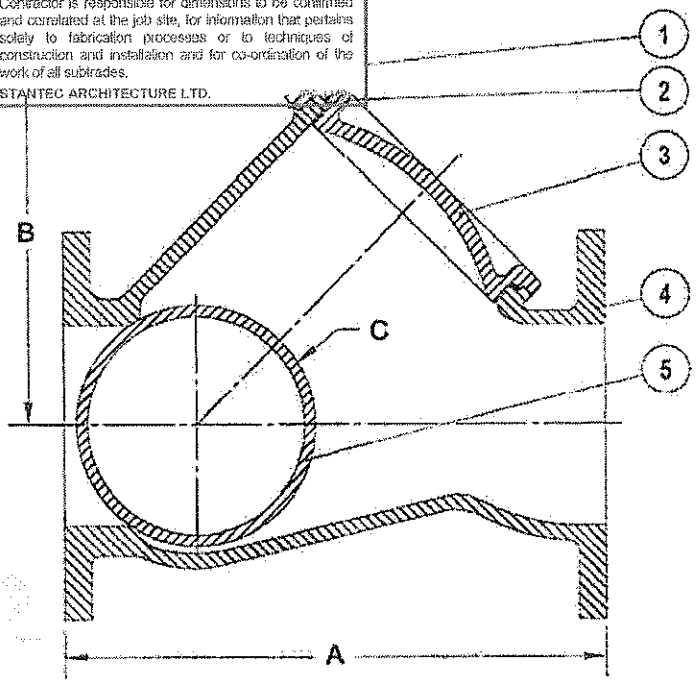
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IM/WMPBS-EN 11.2010

Power and productivity
for a better world™

Stantec
■ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
May 6, 2013
By: Arlen Foster, EIT
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.
STANTEC ARCHITECTURE LTD.

Ball Check Valve
Series 9200
FL X FL Type ▪ Sizes 1.5" - 14"



No.	Part Name	Materials
1	Bolt	304 Stainless Steel
2	Gasket	EPDM
3	Cover	Ductile Iron A536 65-45-12
4	Body	Ductile Iron A536 65-45-12
5	Ball	Aluminum EPDM Coated

Standard Features:

- Design and Materials Exceed AWWA C508
- ANSI B 16.1 Class 125 Flanges
- Working Temperature –14°F to 248°F

Dimensions:

Size	1.5"	2"	2.5"	3"	4"	6"	8"	10"	12"	14"
Model	9215	9202	9225	9203	9204	9206	9208	9210	9212	9214
A	7"	8"	9.4"	10.2"	11.8"	15.7"	19.6"	23.6"	27.5"	31.4"
B	3.9"	4.9"	5.5	7"	8"	11"	13.9"	16.5"	18.8"	22.8"
C	2"	2.4"	3"	3.7"	5"	7"	10"	12.5"	14.5"	16.2"
LBS	17.6	19.8	24	28.5	44	92.5	163	304	440	683.4

2323 1st Street ▪ Huffman, TX 77336 ▪ Phone: 281.324.3990
Fax: 281.324.6879 ▪ Email: sales@JandSValve.com ▪ JandSValve.com

Design and Materials Subject to Change Without Notice. Call for Any Updated Drawings

VALVES

SUMMIT

SUMMIT VALVE AND CONTROLS INC.

DOCUMENT TRANSMITTAL

Package #:	1
Customer:	Central Mechanical Systems
Attention:	Mark Tribiger
Customer purchase order number:	Cambridge Bay
Manufacturer:	Valmatic Valve and Manufacturing Corp.
Tag #:	
Drawing description:	1" Valmatic Model 101VB Vacuum Breaker Valve, Air Intake Type - Pressure rating 300psi - Cast iron body - 316 stainless steel trim - Buna-N seat - NSF/ANSI 372 certified
Submitted for:	For Your Record Only
NO. of copies submitted to customer:	(1) Electronic Copy

Drawings included:	Description or remarks:
VM-100VB	Valmatic Vacuum Breaker Air Valve Dimensional Drawing

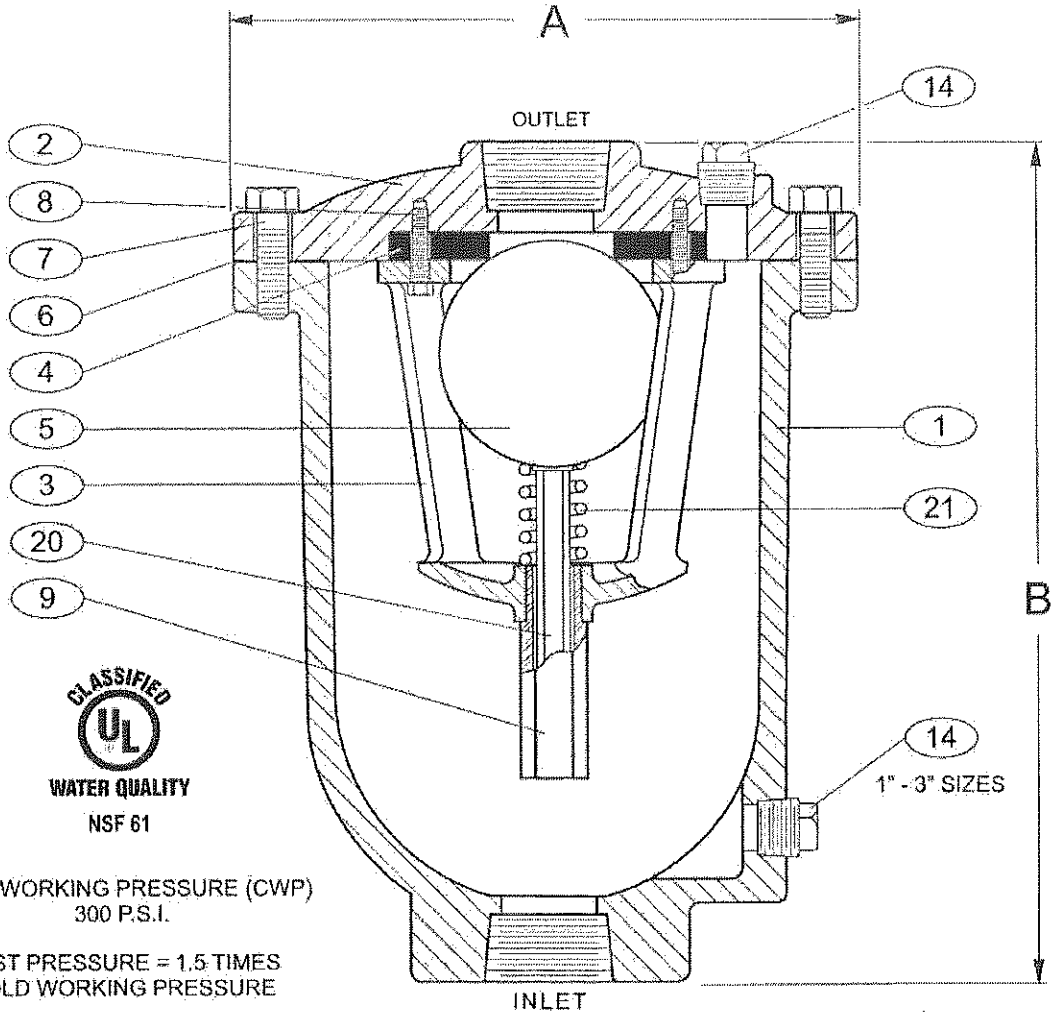
Summit Valve. Representative:	Keith Kierulf
Date:	March 11, 2014

ISO 9001

569

CAMB BAY

PUMP HOUSE



CLASSIFIED UL WATER QUALITY NSF 61

COLD WORKING PRESSURE (CWP)
300 P.S.I.

TEST PRESSURE = 1.5 TIMES
COLD WORKING PRESSURE

SEE DRAWING NO. VM-100VB -M FOR STANDARD MATERIALS OF CONSTRUCTION.

VALVE SIZE	MODEL NO.*	A	B	INLET SIZE	OUTLET SIZE
1"	101VB	7.00	9.50	1" N.P.T.	1" N.P.T.

1	BODY	7	COVER BOLT
2	COVER	8	RETAINING SCREW
3	BAFFLE	9	GUIDE BUSHING
4	SEAT	14	PIPE PLUG
5	FLOAT	20	GUIDE SHAFT
6	GASKET	21	SPRING

Revised 11-18-11

VACUUM BREAKER AIR VALVES

DATE 9-18-84

VAL-MATIC® VALVE AND MANUFACTURING CORP.

DRWG. NO. VM-100VB

VACUUM BREAKER AIR VALVE

1/2" to 3" SERIES NO. 100VB

STANDARD MATERIALS OF CONSTRUCTION

PART NO.	PART NAME	MATERIAL
1	BODY	CAST IRON ASTM A126, CLASS B
2	COVER	CAST IRON ASTM A126, CLASS B
3	BAFFLE	DUCTILE IRON ASTM A536, GRADE 65-45-12
4	SEAT	BUNA-N
5	FLOAT	STAINLESS STEEL T316, ASTM A240
6	GASKET	COMPRESSED NON-ASBESTOS FIBER
7	COVER BOLT	ALLOY STEEL SAE, GRADE 5
8	RETAINING SCREW	STAINLESS STEEL T316, ASTM F593
9	GUIDE BUSHING	STAINLESS STEEL T316, ASTM A582
14	PIPE PLUG	STEEL
20	GUIDE SHAFT	STAINLESS STEEL T316, ASTM A582
21	SPRING	STAINLESS STEEL T316, ASTM A313

NOTE: ALL SPECIFICATIONS AS LAST REVISED.

Revised 11-18-11

MATERIALS OF CONSTRUCTION	DATE 5/14/98
VAL-MATIC® VALVE AND MANUFACTURING CORP.	DRWG. NO. VM-100VB-M

SUMMIT

SUMMIT VALVE AND CONTROLS INC.

DOCUMENT TRANSMITTAL

Package #:	2
Customer:	Central Mechanical Systems
Attention:	
Customer purchase order number:	Cambridge Bay
Manufacturer:	Valmatic Valve and Manufacturing Corp.
Tag #:	
Drawing description:	1" Valmatic Model 201C.2SV Combination Air Valves - Threaded NPT inlet & outlet - Pressure rating 300psi CWP - Cast iron body - 316 stainless steel trim - EPDM seat - Fusion bonded epoxy coating with Holiday Testing - Stainless steel bolts and pipe plugs - NSF/ANSI 372 certified
Submitted for:	For Your Record Only
NO. of copies submitted to customer:	(1) Electronic Copy

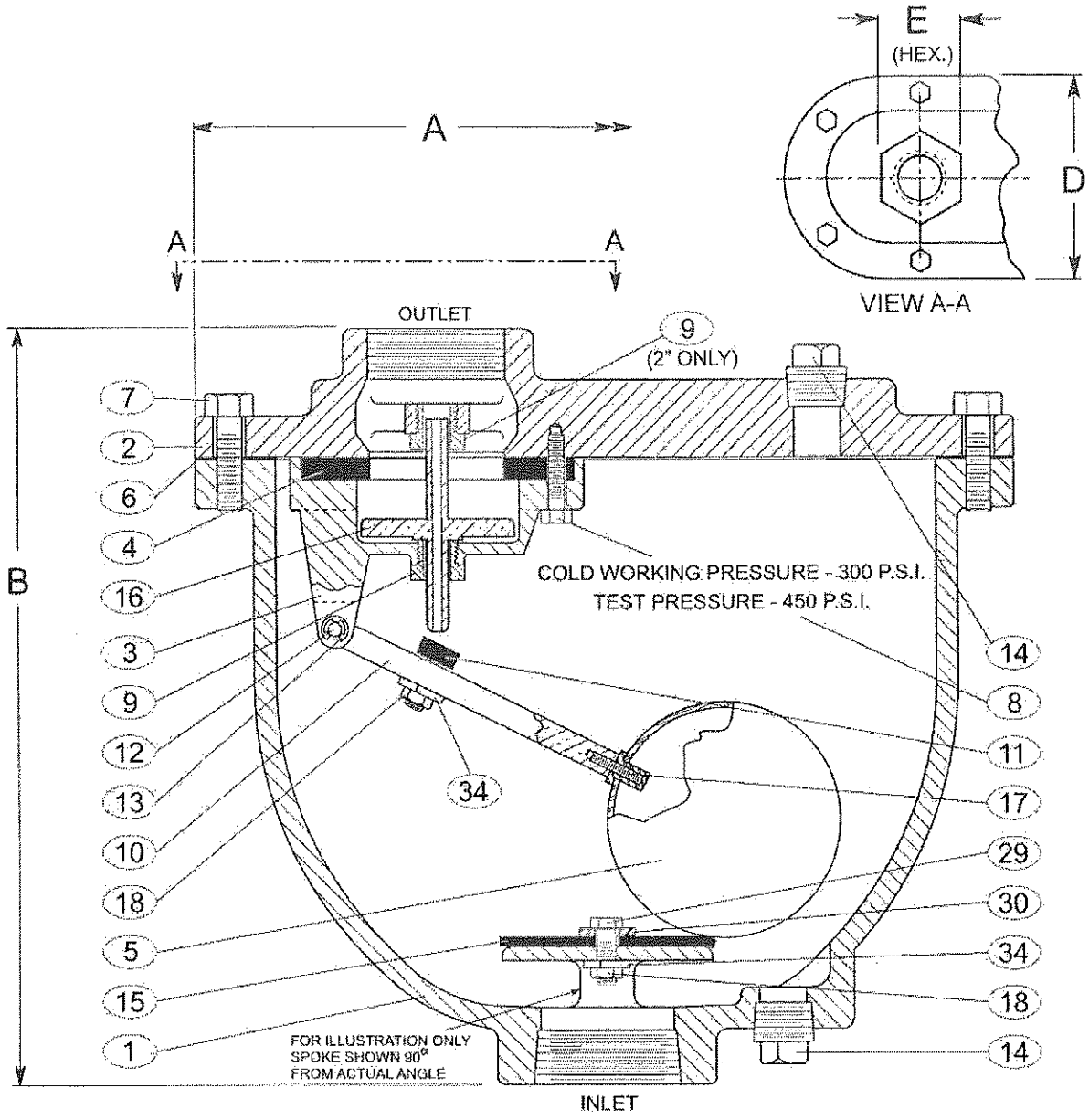
Drawings included:	Description or remarks:
VM-201C	Valmatic Combination Air Valve Dimensional Drawing

Summit Valve. Representative:	Keith Kierulf
Date:	March 11, 2014

Certified System

ISO 9001

QMI-SAI Global



CLASSIFIED UL WATER QUALITY NSF 61

SEE DRAWING NO. VM-201C-M FOR STANDARD MATERIALS OF CONSTRUCTION.

VALVE SIZE	MODEL NO.	A	B	D	E	INLET SIZE	OUTLET SIZE	ORIFICE SIZE
1"	201C.2	11.38	10.50	6.38	2.00	1" N.P.T.	1" N.P.T.	5/64"

1 BODY
2 COVER
3 BAFFLE
4 SEAT
5 FLOAT
6 GASKET
7 COVER BOLTS
8 RETAINING SCREWS
9 BUSHING
10 FLOAT ARM
11 ORIFICE BUTTON
12 PIVOT PIN
13 RETAINING RING
14 PIPE PLUG
15 CUSHION
16 PLUG
17 FLOAT RETAINER
18 LOCK NUT
29 CUSHION RETAINER
30 WASHER
34 LOCK WASHER

Revised 2-27-09

COMBINATION AIR VALVE (SINGLE BODY TYPE)

DATE 2-2-69

VAL-MATIC® VALVE AND MANUFACTURING CORP.

DRWG. NO. VM-201C

COMBINATION AIR VALVES (SINGLE BODY TYPE)

MODEL NOS. 201C.2SV - 202C.2SV - 203C.2SV - 204C.2SV

STANDARD MATERIALS OF CONSTRUCTION

PART NO.	PART NAME	MATERIAL
1	BODY	CAST IRON ASTM A126, CLASS B (INTERIOR / EXTERIOR FUSION BONDED EPOXY)
2	COVER	CAST IRON ASTM A126, CLASS B (INTERIOR / EXTERIOR FUSION BONDED EPOXY)
3	BAFFLE	CAST IRON ASTM A126, CLASS B (INTERIOR / EXTERIOR FUSION BONDED EPOXY)
4	SEAT	EPDM
5	FLOAT	STAINLESS STEEL T316, ASTM A240
6	GASKET	COMPRESSED NON-ASBESTOS FIBER
7	COVER BOLT	STAINLESS STEEL T316, ASTM F593
8	RETAINING SCREWS	STAINLESS STEEL T316, ASTM F593
9	GUIDE BUSHING	STAINLESS STEEL T316, ASTM A240
10	FLOAT ARM	STAINLESS STEEL T316, ASTM A240
11	ORIFICE BUTTON	STAINLESS STEEL & EPDM
12	PIVOT PIN	STAINLESS STEEL T316, ASTM A276
13	RETAINING RING	STAINLESS STEEL PH 15-7 MO
14	PIPE PLUG	STAINLESS STEEL
15	CUSHION	BUNA-N
16	PLUG	STAINLESS STEEL T316, ASTM A276
17	FLOAT RETAINER	STAINLESS STEEL T316, ASTM F880
18	LOCK NUT	STAINLESS STEEL T316, ASTM F594
29	CUSHION RETAINER	STAINLESS STEEL T316, ASTM F593
30	WASHER	STAINLESS STEEL T316, ASTM A240
34	LOCK WASHER	STAINLESS STEEL T316, ASTM A240

NOTE: ALL SPECIFICATIONS AS LAST REVISED.

SUMMIT

SUMMIT VALVE AND CONTROLS INC.

DOCUMENT TRANSMITTAL

Package #:	3
Customer:	Central Mechanical Systems
Attention:	
Customer purchase order number:	Cambridge Bay
Manufacturer:	Valmatic Valve and Manufacturing Corp
Tag #:	
Drawing description:	2"/6" Valmatic Model 7800LW Swing Check Valve - ANSI Class 150 - Pressure rating 250psi - Ductile iron body - Ductile iron disc - Fusion bonded epoxy coating Complete with lever and weight
Submitted for:	For Your Record Only
NO. of copies submitted to customer:	(1) Electronic Copy

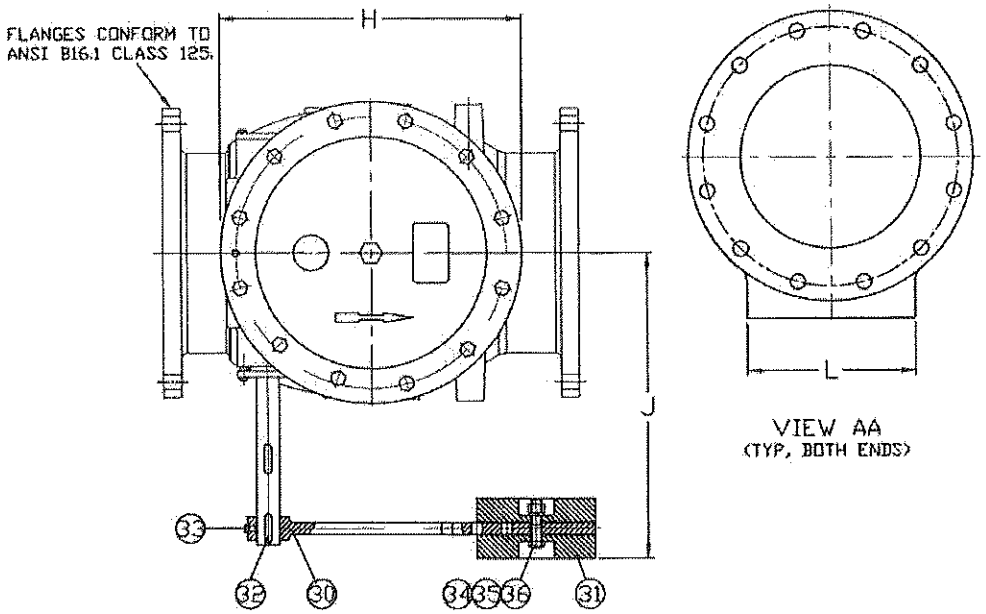
Drawings included:	Description or remarks:
VMC-7802LW	Valmatic Swing Check Valve with Lever and Weight Dimensional Drawing

Summit Valve. Representative:	Keith Kierulf
Date:	March 11, 2014

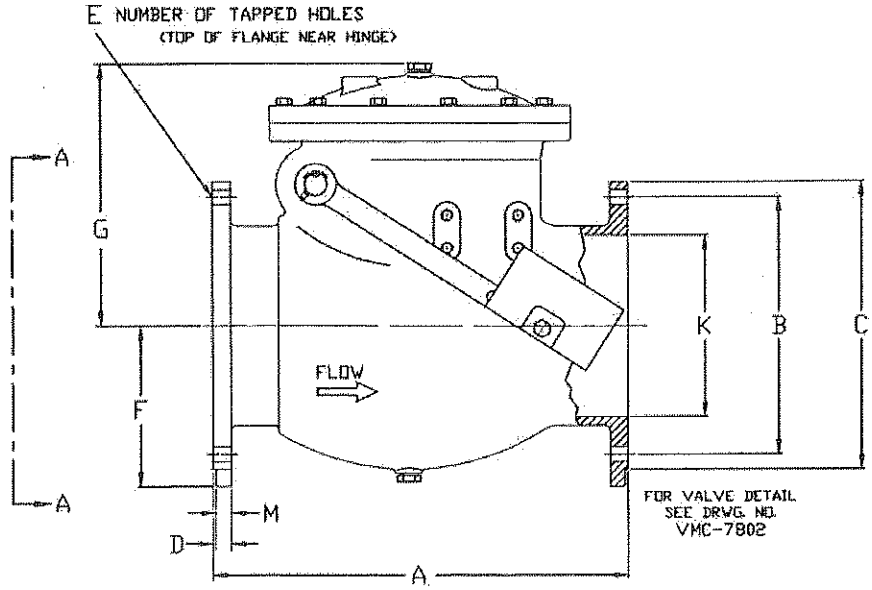
Certified System

ISO 9001

QMI-SAI Global



VIEW AA
(TYP, BOTH ENDS)



DRAWING DEPICTS 12" VALVE SIZE TO SCALE.
SEE DRAWING NO. VM-7802LW-M FOR STANDARD MATERIALS OF CONSTRUCTION.

Revised 11-12-13

SWING CHECK VALVE WITH LEVER AND WEIGHT	DATE 10-13-11
VAL-MATIC VALVE AND MANUFACTURING CORP.	DRWG. NO. VMC-7802LW SHEET 1 OF 2

TABLE OF DIMENSIONS

FLANGE DIMENSIONS, INCHES

VALVE SIZE	MODEL NO.	CWP (PSI)	A	B	C	D	E	F	G	H	J	K	L	M	SHPG. WT.
2	7802LW	250	8.00	4.75	6.00	0.63	0	—	4.34	5.39	4.38	2.00	3.15	0.50	28
6	7806LW	250	14.00	9.50	11.00	0.75	0	6.69	10.53	12.60	12.50	6.00	6.29	0.59	185

Revised 11-12-13

SWING CHECK VALVE WITH LEVER AND WEIGHT

DATE 10-13-11

VAL-MATIC VALVE AND MANUFACTURING CORP.

DRWG. NO. VMC-7802LW

SWING CHECK VALVE WITH LEVER AND WEIGHT

2" - 48" SERIES NO. 7800LW

STANDARD MATERIALS OF CONSTRUCTION

PART NO.	PART NAME	MATERIAL
30	WEIGHT LEVER	DUCTILE IRON ASTM A536, GRADE 65-45-12
31	WEIGHT	DUCTILE IRON ASTM A536, GRADE 65-45-12
32	KEY	STEEL
33	BOLT	PLATED STEEL
34	BOLT	PLATED STEEL
35	NUT	PLATED STEEL
36	WASHER	PLATED STEEL

NOTE: ALL SPECIFICATIONS AS LAST REVISED.

MATERIALS OF CONSTRUCTION	DATE 10/13/11
VAL-MATIC® VALVE AND MANUFACTURING CORP.	DRWG. NO. VM-7802LW-M

SUMMIT

SUMMIT VALVE AND CONTROLS INC.

DOCUMENT TRANSMITTAL

Package #:	4
Customer:	Central Mechanical Systems
Attention:	
Customer purchase order number:	Cambridge Bay
Manufacturer:	Bray Controls Inc.
Tag #:	
Drawing description:	2" Bray Series 31 trim 108 Butterfly Valve, Lugged Style - Suitable for installation between 125/150 flanges - Full pressure rating 175psi - Cast iron body - Nylon 11 coated ductile iron disc - 316 stainless steel stem - EPDM seat Complete with lever operator and notch plate
Submitted for:	For Your Record Only
NO. of copies submitted to customer:	(1) Electronic Copy

Drawings included:	Description or remarks:
ES11A-0256	Bray Butterfly Valve, Lugged Style Dimensional Drawing

Summit Valve. Representative:	Keith Kierulf
Date:	March 11, 2014

Certified System

ISO 9001

QMI-SAI Global

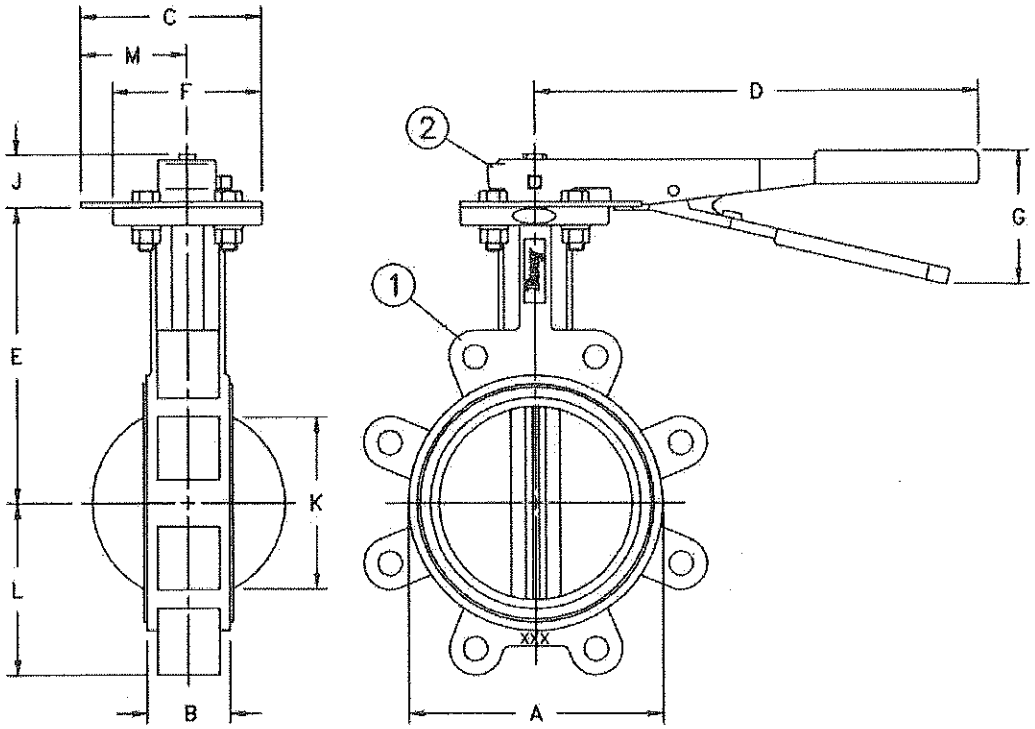
"ATTENTION"

THIS DOCUMENT IS VALID IF AND ONLY IF YOU PERSONALLY DOWNLOADED IT FROM WWW.BRAY.COM
IF YOU RECEIVED THIS DOCUMENT FROM ANY OTHER SOURCE, PLEASE TAKE INTO CONSIDERATION THAT ALTERATIONS COULD HAVE BEEN MADE. FOR AN ORIGINAL COPY, PLEASE CONTACT BRAY VALVE AT 281-894-5454

SERIES 31
ES11A-0256
Date: JULY 1996

Valve Size	A	B	C	D	E	F	G	J	K	L	M
2"	3.69	1.62	4.32	10.62	5.50	3.54	3.16	1.25	1.32	2.30	2.55

Note: K dim is disc chordal dimension at valve face.



ITEM No.	NAME	No. REQUIRED	SERIES/PART No.	MATERIAL	SPECIFICATION/REMARKS
2	HANDLE KIT	1			
1	VALVE	1			

The High Performance Company

BRAY VALVE & CONTROLS

A Subsidiary of BRAY INTERNATIONAL, Inc.

DIMENSIONAL DRAWING (inches)
SERIES 31, SIZES 2" THRU 12" BUTTERFLY VALVES
WITH SERIES 01 HANDLE KIT

Series	Size	Part No.	Material Trim Code	Drawing No.
				ES11A-0256

Bray

REV. RFP / ERN-2442

ESNUMBER

SUMMIT

SUMMIT VALVE AND CONTROLS INC.

DOCUMENT TRANSMITTAL

Package #:	5
Customer:	Central Mechanical Systems
Attention:	
Customer purchase order number:	Cambridge Bay
Manufacturer:	Bray Controls Inc.
Tag #:	
Drawing description:	3"/6" Bray Series 31 trim 119 Butterfly Valve, Lugged Style - Suitable for installation between 125/150 flanges - Pressure rating 175psi - Cast iron body - Nylon 11 coated ductile iron disc - EPDM seat - 416 stainless steel stem Complete with lever operator and notch plate
Submitted for:	For Your Record Only
NO. of copies submitted to customer:	(1) Electronic Copy

Drawings included:	Description or remarks:
ES11A-0256	Bray Butterfly Valve, Lugged Style Dimensional Drawing

Summit Valve. Representative:	Keith Kierulf
Date:	March 11, 2014

Certified System

ISO 9001

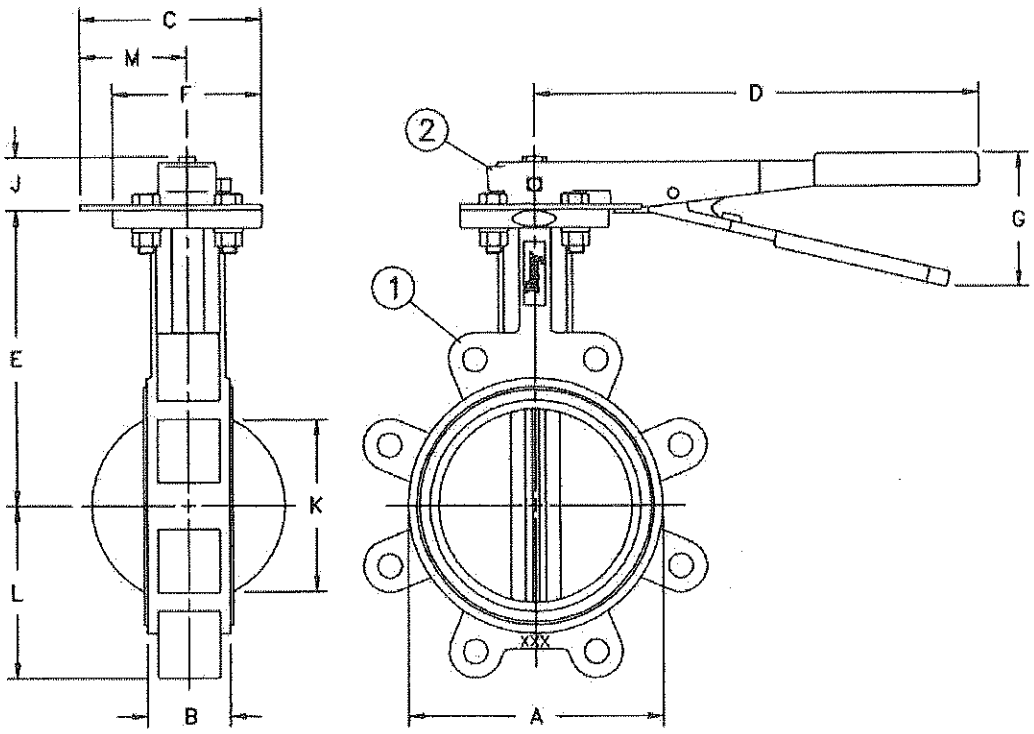
QMI-SAI Global

"ATTENTION"
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IF YOU RECEIVED THIS DOCUMENT FROM ANY OTHER SOURCE, PLEASE TAKE INTO CONSIDERATION THAT ALTERATIONS COULD HAVE BEEN MADE. FOR AN ORIGINAL COPY, PLEASE CONTACT BRAY VALVE AT 281-894-5454

SERIES 31
ES11A-0256
Date: JULY 1996

Valve Size	A	B	C	D	E	F	G	J	K	L	M
3"	4.88	1.75	4.32	10.62	6.25	3.54	3.16	1.25	2.55	2.81	2.55
6"	8.12	2.12	4.32	10.62	8.00	3.54	3.16	1.25	5.45	5.06	2.55

Note: K dim is disc chordal dimension at valve face.



ITEM No.	NAME	No. REQUIRED	SERIES/PART No.	MATERIAL	SPECIFICATION/REMARKS
2	HANDLE KIT	1			
1	VALVE	1			

The High Performance Company

BRAY VALVE & CONTROLS
A Subsidiary of BRAY INTERNATIONAL, Inc.

DIMENSIONAL DRAWING (inches)
SERIES 31, SIZES 2" THRU 12" BUTTERFLY VALVES
WITH SERIES 01 HANDLE KIT

Series	Size	Part No.	Material Trim Code	Drawing No.
				ES11A-0256

Bray

REV. RFP / ERN-2442

ESNUMBER

5.4

SANAQATIIT CONSTRUCTION LTD.

Shop Drawing Transmittal

Project Name: Potable Water System – Phase I

Sanaqatiit Project Number: 12-505 **Submittal Number:** 12-505-27

Owner Project Number: 11-4002

Product Description: Doors, frames, and hardware

Specification Number: 23 09 33

Total Pages: 141 including cover

Submitted by: Sarah Fox

To: Warren McLeod, Stantec **CC:** Arlen Foster, Stantec

Via: Electronic Submission **Date:** June 10th, 2013

Please see attached shop drawing submittal for the electric and electronic control system for the HVAC

Stantec

☐ Reviewed
☐ Reviewed as Modified
■ Revise and Resubmit
☐ Not Reviewed

June 18, 2013

By: Arlen Foster, EIT

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.

STANTEC ARCHITECTURE LTD. (PC-1449)

Only the Process Drawing 601 requires revision and resubmission as per attached Stantec Drawing D-401.

SANAQATIIT CONSTRUCTION LTD.

Shop Drawing Transmittal

Project Name: Potable Water System – Phase I

Sanaqatiit Project Number: 12-505 **Submittal Number:** 12-505-32 R1

Owner Project Number: 11-4002

Product Description: Process Control panel

Specification Number: 13 50 30

Total Pages: 4 including cover

Submitted by: Sarah Fox

To: Warren McLeod, Stantec **CC:** Arlen Foster, Stantec

Via: Electronic Submission **Date:** November 28, 2014

Notes:

The attached pages include the re-submittal for Siemans controls

Stantec

☒ Reviewed
☐ ~~Reviewed as Modified~~
☐ Revise and Resubmit
☐ Not Reviewed

Nov 28, 2014

Stantec Project # 144901252_08-12

By: _____

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contact Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.
STANTEC ARCHITECTURE LTD.

REVIEWED
Sfox - 15:48:51 - 28/11/2014

CMS
Central Mechanical Systems

345 Old Airport Road Yellowknife, NT X1A 3T4 Phone: 867-873-3003 Fax: 867-873-6633
1505-6th Street Nisku, AB T9E 7R8 Phone:780-955-7161 Fax: 780-955-2785

SHOP DRAWING SUBMITTAL

SUBMITTED TO: Sanaqatiit	DATE:	**11/28/2014**
ATTN: Sarah Fox		
EMAIL: sfox@sanaqatiit.ca	SUBMITTAL #:	002

RE: **12-569 Cambridge Bay Potable Water System**	SUBMITTED BY:	John
	EMAIL:	john@cmsnisku.com

NOTES: Process Panel Submittal

QTY	SPEC. SECTION	ITEM #	DESCRIPTION	TAG	SUPPLIER
1	13 50 30		Process Control Panel		Siemens

Stantec
☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Re-submit
☐ Not Reviewed
Nov 28, 2014
Stantec Project #: 144901252_08-12
By:
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains only to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.
STANTEC ARCHITECTURE LTD.

S

Building Technologies

TRANSMITTAL CONFIRMATION

To: **Central Mechanical**	Date: **11/28/2014** SBT Project No.: **B-52-B-0382**
Attn: **Lorne Ganske**	Project Name: **Cambride Bay Pump House** Your Order No.
WBS #(S): Transmittal No.	

WE ARE SENDING YOU

- ☑ UNDER SEPARATE COVER THE FOLLOWING ITEMS:
- ☐ MATERIAL SPECIFICATIONS FOR REVIEW & APPROVAL
- ☐ DESIGN SUBMITTALS
- ☐ AS-BUILT SUBMITTALS FOR YOUR USE
- ☐ MARKED PLANS & SPECIFICATIONS
- ☐ ENGINEERING COMMENTS
- ☐ LETTER
- ☐ CHANGE ORDER REQUEST(S)
- ☐ CHANGE ORDER SUPPORT DOCUMENTATION
- ☐ INVOICE
- ☑ OTHER: 1 **Process Panel**
  2
  3

THESE ARE SUBMITTED

- ☑ FOR APPROVAL
- ☐ VOR CORRECTION
- ☐ FOR PERMIT SUBMISSION
- ☐ FOR YOUR RECORDS
- ☐ PLEASE RETURN ___APPROVED COPY(S) FOR
- ☐ ORIGINAL RECORD USE

DESCRIPTION: Attached are the following:

MaterialCut Sheets and Bill of Meterials

Please review and approve the attachments provided in this transmittal. Please call me if you have any questions.

IN ORDER TO PROCURE DOCUMENTS, WE NEED THE FOLLOWING INFORMATION, AS CHECKED BELOW

- ☐ ARCHITECTURAL PLANS
- ☑ MECHANICAL PLANS
- ☐ ELECTRICAL PLANS
- ☐ MECHANICAL SPECIFICATIONS
- ☐ ELECTRICAL SPECIFICATIONS
- ☐ _____ COMPLETE SET(S) OF PLANS & SPECS
- ☐ Addendum #2
- ☐ ELECTRICAL HEATING COIL WIRING
- ☐ UNIT VENTILATOR ORIGINAL DRAWINGS
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

PLEASE BE ADVISED THAT WE MUST HAVE THIS INFORMATION ***BEFORE*** *WORK CAN PROCEED WITH THE WORK AS INDICATED.*

Please contact me if you have any questions and thank you for your ongoing cooperation.

Stantec
- ☑ Reviewed
- ☐ Reviewed as Modified
- ☐ Revise and Resubmit
- ☐ Not Reviewed

Nov 28, 2014

Stantec Project #: 144901252_08-12

By: _____

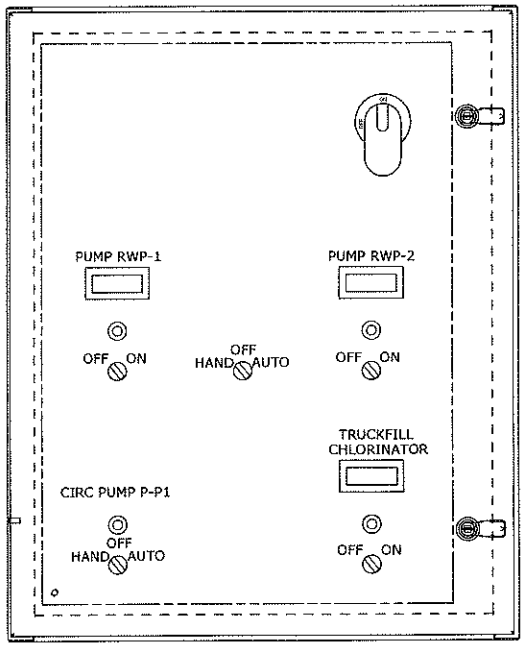
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contact Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all subtrades.

STANTEC ARCHITECTURE LTD

REMARKS:

1. Process Panel Submittal
2. Flow rate meters provided by others and not included in the panel

Please address your remarks to:	Transmittal Accepted By:
SIEMENS CANADA LTD. - Building Technologies	
Attn: Adeel Choudhry, P.Eng.	Date:
Tel.(780) 486-1234	Transmitted By:
Fax.(780) 486-1817	Date:



CMS
Central Mechanical Systems
Shop Drawing Review
November 28, 2014

By: JM

☐ Original Submission
☑ Resubmission
Section: 13 60 30

Stantec
☐ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
Nov 28, 2014
Stantec Project #: 144001252_03-12
By:

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review does not extend to the means, methods, techniques, sequences or procedures of construction or to safety precautions and programs in connection with the work. The contractor remains responsible for dimensions to be confirmed and correlated at the job site. For construction in or adjacent to any existing structure, shop drawings should be reviewed only after responsibility for field measurements, existing conditions and construction procedures has been undertaken by the appropriate parties. This review does not relieve the contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating his work with that of all other trades and performing his work in a safe and satisfactory manner.

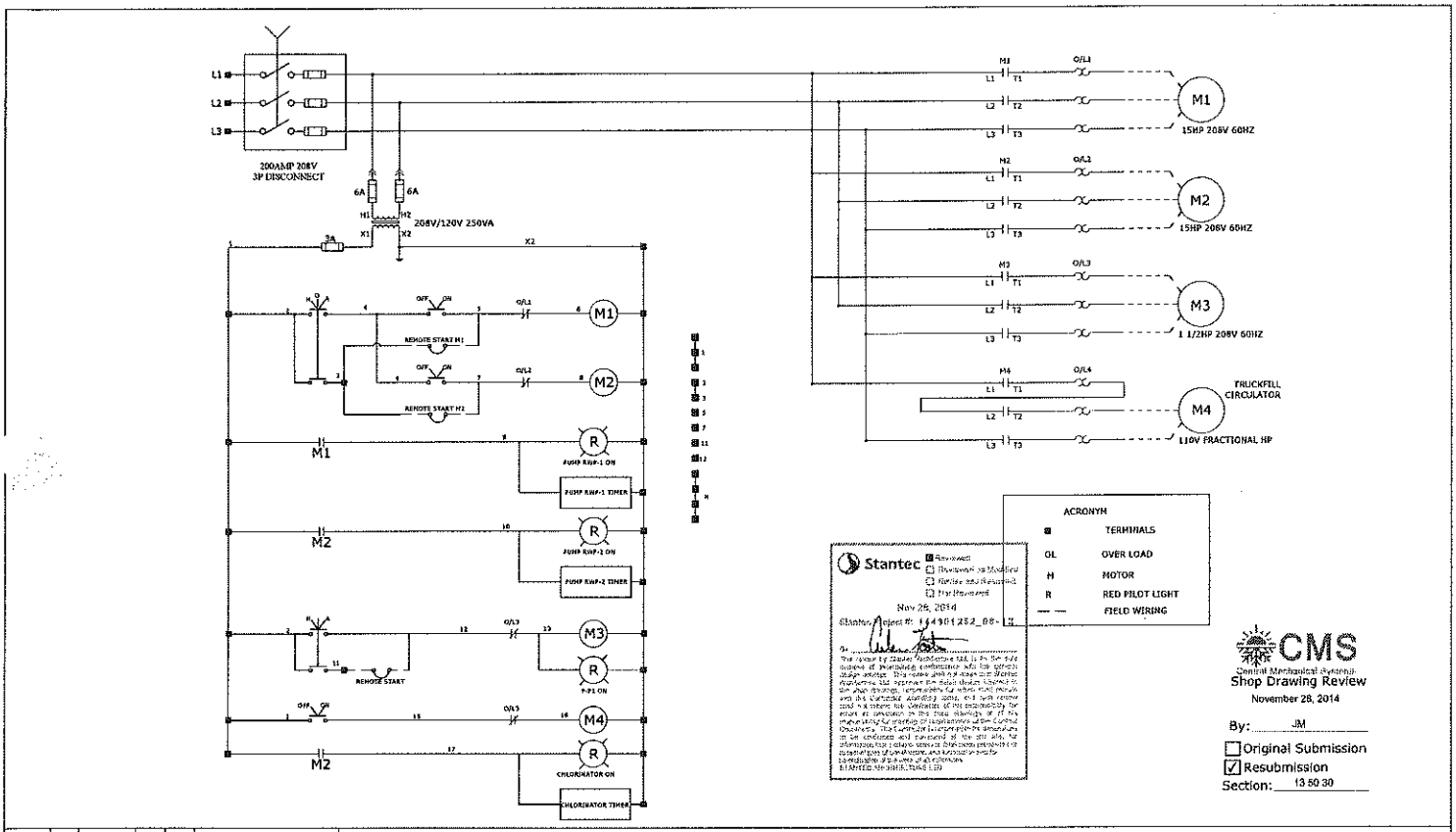
	BY:	DATE:	REV	BY:	DATE:
DRAWN:	MS	06/10/14	R1	MS	28/11/14
CHKD:	JM		R2		
APPRVD:			R3		

SOLUTION CONTROL SYSTEMS INC.
info@solutioncontrols.ca
www.solutioncontrols.ca

Title - TRUCKFILL STARTERS

DRAWING NO.: S3000-061014-1

REV 1



ACRONYM	
■	TERMINALS
OL	OVER LOAD
M	MOTOR
R	RED PILOT LIGHT
— —	FIELD WIRING

Stantec

Reviewed
Reviewed as Modified
Revise and Resubmit
For Reference

Nov 26, 2014

Stantec Project #: 144901252_08-1.2

The review by Stantec Architecture Ltd. is for the purpose of determining compliance with the general design concept. This review does not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to the fabrication processes or techniques of construction and assembly and for coordination of the work of all trades.

CMS
Central Mechanical Systems
Shop Drawing Review
November 26, 2014

By: JM

☐ Original Submission
☑ Resubmission
Section: 13 50 30

	BY:	DATE:	REV	BY:	DATE:
DRAWN:	MS	30/04/14	R1	MS	28/11/14
CHKD:	JM		R2		
APPRVD:			R3		

SOLUTION CONTROL SYSTEMS INC.
info@solutioncontrols.ca
www.solutioncontrols.ca

Title - TRUCKFILL STARTERS

DRAWING NO.: S3000-061014-S

REV 1

SIEMENS

Siemens Canada Limited
Building Technologies Division

6652 - 50th Street N.W.
Edmonton, AB T6B2N7
Canada

PHONE: 780- 486-1234
FAX: 780-486-1817

SUBMITTAL PACKAGE

ISSUED ON: MAY 09, 2013

CMS

Shop Drawing Review
24-May-13

By: DO

☑ Original Submision
☐ Resubmission

Section:

04/24/13

FOR INFORMATION CONTACT
Jason Dale

ENGINEERING DATA FOR
Camb

NANAVUT CONSTRUCTION LTD.
SHOP DRAWING REVIEWED
BY
JUN 10 2013
- REVIEWED
- REVIEWED AS NOTED
- REVISE AND RESUBMIT

Project Name: Cambridge Bay Pumphouse
Project Number: B-52-B-0382

Bill of Material

9/26/2014

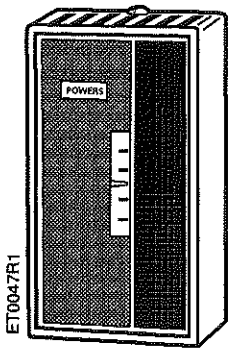
Product Number	DocumentNum	Description	Manufacturer
134-1084	155 017	T'STAT,H/C,LINE VOLT CON/EXP	SIEMENS
141-570	155723	THERMOSTAT GUARD, CLEAR LOCKABLE	SIEMENS
298-03006	155 304	2WNO,SS,LN,FXF,1.25/16 +GCA161	SIEMENS
298-03020	155 304	2WNC,SS,LN,FXF,0.5/2.5 +GCA161	SIEMENS
298-03146	155 304	3WMX,SS,=%,FXF, .50/2.5+GCA161	SIEMENS
544-339-18	149261	DCT PT SNSR, PT 1K OHM, (375), 18" PROBE	SIEMENS
544-577-25	149261	IMMWELL SNSR, PT 1K OHM, (375),2.5" LGTH	SIEMENS
544-578	149 261	O/AIR TEMP SENS (-40/240F)	SIEMENS
544-973	149 971	1000 OHM PLATINUM FLUSHMOUNT ROOM SENSOR	SIEMENS
567-351	155 272	#1 PNEU PANEL 19X16X5.7	SIEMENS
GMA126.1P	154004	ACT, 2P ,SR,PLENUM	SIEMENS
GMA161.1P	154004	MOD SR 24V,62LBIN,PLM	SIEMENS
PXA-ENC34	149475	ENCLOSURE ASSY 34	SIEMENS
PXA-SB115V192VA	149478	SERVICE BOX 115V, 24VAC, 192VA	SIEMENS
PXA-USBMODEMKIT	149265	USB MODEM WITH SURGE SUPPRESSOR & CABLE	SIEMENS
PXC100-PE96.A	149478	PXC MOD, P2, TX-I/O, 96 NODE, APOGEE	SIEMENS
PXC36-PE.A	149454	APOGEE 36PT, P2 RS485/IP ALN	SIEMENS
TXA1.K24	149476	ADDRESS KEY 1-24	SIEMENS
TXM1.16D	149476	16 DIGITAL INPUT MODULE	SIEMENS
TXM1.6R-M	149476	6 RELAY OUTPUT MODULE W/OVD	SIEMENS
TXM1.8U	149476	8 UNIVERSAL I/O MODULE	SIEMENS
TXM1.8U-ML	149476	8 UNIV I/O MODULE W/ OVD&LCD	SIEMENS
TXM1.8X	149476	8 UNIV I/O MODULE W/ 4-20MA	SIEMENS
TXS1.12F4	149476	24VDC SUPPLY 1200MA, 4 A FUSE	SIEMENS
TXS1.EF4	149476	BUS CONNECTION MODULE, 4A FUSE	SIEMENS
QFA2000.WU	149479	RM RH 5%, VDC, NODSP, WHT, SL	SIEMENS
SMT750	SMT750	APC SMARTUPS 750VA	APC
70-459-1	70-459	SOCKET,RELAY 8PIN 2.65"X1.18"	MAGNECRAFT
70-463-1	70-463	SOCKET,RELAY 11PIN 3.0"X1.70"	MAGNECRAFT
70-464-1	70-464	SOCKET,RELAY 8PIN 2.02"X1.60"	MAGNECRAFT
782XBXM4L-24A	782	RELAY SQR 8PIN DPDT 24V W LED	MAGNECRAFT
788XCXM4L-24A	788	RELAY SQR 11IN 3PDT 24V W LED	MAGNECRAFT
W211ACPSOX-60	211	TIME DELAY RELAY 60-900SEC ON	MAGNECRAFT
W211ACPSRX-8	211	TIME DELAY RELAY 2-300SEC OFF	MAGNECRAFT
FS4-3	FS4-3	FLOW SWITCH	McDonnell & Miller
2091100PG2M1102	209	PRES TRANS,100PSI,4-20MA,2'CBL	SETRA
2301050PD3V11B	230	DP TRAN,WET,50PSI,4-20MA,W/MAN	SETRA
H300	H300	H300 MICRO-SPLITCORE GO/NO GO .15-60Amps	VERIS INDU
LVK-121	LVK	LEVEL SWITCH STARTER KIT	OMEGA

SIEMENS

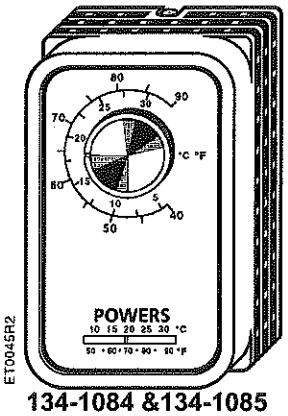
Technical Instructions
Document No. 155-017P25
ET 134-55
April 1, 2005

Powers™ Controls

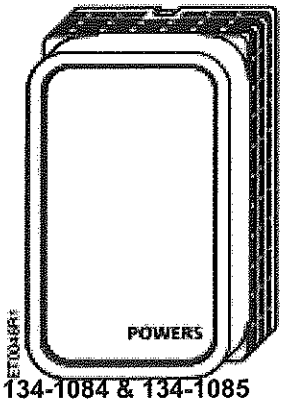
ET 134 Line Voltage Room Thermostats



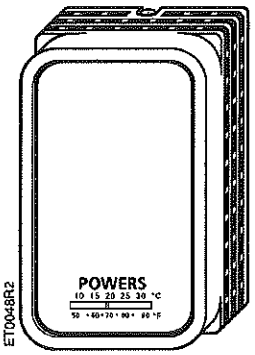
134-1083



134-1084 &134-1085
Exposed Knobs



134-1084 & 134-1085
Concealed Adjustment



134-1086

Description

The ET 134 line voltage room thermostat is a wall mounted instrument available with exposed or concealed set point adjustment. Models are available with Single-Pole, Single-Throw (SPST) or Single-Pole, Double-Throw (SPDT) contact action and for standard-duty (nominal 1/4 hp; 10 amps, non-inductive) or heavy-duty (nominal 1 hp; 22 amps, non-inductive) applications.

Features

134-1083

- Locking cover with Allen screws.
- Concealed auto-off-fan selector switch.
- Adjustable high range stop.

134-1084, 134-1085, 134-1086

- Dual Fahrenheit and Celsius scale thermometers.
- Separable mounting plate for mounting and wiring without removing cover.
- Locking cover with Allen screws.
- Concealed, adjustable low and high range stops.
- Large, exposed set point knob (134-1084 and 134-1085)
- Internal, dual Celsius and Fahrenheit scale.
- Optional blank faceplate included (134-1084 and 134-1085).

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
Stantec
June 17, 2013
Brandon Morris
By:
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.
STANTEC ARCHITECTURE LTD. (PC-14-0)

Warning/Caution Notations

WARNING	⚠	Personal injury/loss of life may occur if a procedure is not performed as specified.
CAUTION	⚠	Equipment damage may occur if the user does not follow a procedure as specified.

Application

These line voltage thermostats control heating, cooling or year-round air conditioning units in commercial, industrial or residential installations. Typical uses are for unit heaters, fan coils, blast coils, refrigerated storage rooms, electric heat, duct furnaces, greenhouses, etc.



WARNING:

These thermostats are designed for use only as an operating control. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

Product Numbers

Table 1. Product Numbers and Specifications.

Product Number	Set Point Adjustment	Dual Set Point Range °F (°C)	Diff °F (°C)	Switch Action	Motor Rating (Full Load Amps)		Resistive Rating (Amps)		Weight lbs. (kg)
					120 Vac	240 Vac	120 Vac	277 Vac	
134-1083	Concealed	40 to 90 (5 to 30)	1.8 (1)	SPST with "AUTO-OFF FAN" Switch	6.0	3.0	—	—	1.3 (0.6)
134-1084	*Exposed Knob, or Concealed		1.8 (1) Htg. 2.3 (1.3) Clg.	SPDT Heating/Cooling	6.0	3.0	10.0	10.0	1.0 (0.45)
134-1085			3 (1.7) Htg. 3.5 (2) Clg.		16.0 Htg. 8.0 Clg.	8.0 Htg. 8.0 Clg	22.0 Htg.	22.0 Htg.	
134-1086	Concealed		1.8 (1)	SPST open on Temperature rise Heating only	6.0	3.0	—	—	1.0 (0.45)
134-117	Aluminum Thermostat Guard and Baseplate								1.3 (0.6)
134-034	Concealed Adjustment Faceplate								0.03 (0.02)

NOTE: Approval UL File E35198
*Each thermostat is shipped with a blank faceplate for use when concealed adjustment is desired.

Mounting

The proper location of a heavy-duty room thermostat is very important to ensure good performance.

- Make sure the thermostat is in a place where air circulates around it freely.
- Never install the thermostat on or near an outside wall.
- Keep the thermostat away from windows and doors.
- Do not locate the thermostat too close to a strong light or any other false source of heat such as direct sunlight, steam lines, etc.
- Mount the thermostat on a post or partitioning wall, but make sure that there are no pipes or duct work in that wall or in the other side of the wall.
- Mount in a vertical position.

Wiring

WARNING:

Disconnect the power supply before wiring connections are made to avoid possible electrical shock or equipment damage.

Make all wiring connections using copper conductors only and in accordance with the National Electrical Code and local regulations. Loads exceeding the rating of the thermostat should be handled by means of a relay or motor starter.

- Install an electrical conduit box for the thermostat.
- Pull the required wires to this box.

CAUTION:

Use terminal screws furnished (No. 8-32 × 1/4-inch binder head screw). Substitution of other screws can cause problems in making proper connections.

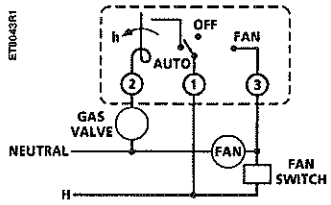
Service

There is no servicing of the thermostat. Replace if inoperative.

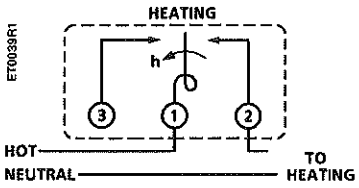
Installation of 134-1083

Read the *Mounting and Wiring* sections.

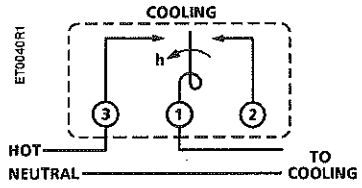
1. Make the wiring connections to the numbered terminals on the back of the thermostat. Figure 1 shows typical wiring diagrams.



Typical Auto-Off-Fan application for 134-1083 thermostat.



Typical heating application for 134-1084, 134-1085, 134-1086 thermostats.



Typical cooling application for 134-1084, and 134–1085 thermostats.

Figure 1. Wiring Diagrams.

2. Remove the thermostat cover by loosening the Allen screws at the top and bottom of the thermostat. The Allen wrench is included with the thermostat.
3. Mount the thermostat to the box using the two keyhole openings in the thermostat base.
4. Set the high temperature cut-out stop.
   a. Turn the thermostat dial so the desired high temperature setting minus one degree is at the pointer. See Figure 2.
   b. Loosen the stop screw and slide the screw toward the back of the dial against the step behind the dial.
   c. Tighten the stop screw.

Installation of 134-1083, Continued

5. Set the desired temperature. Turn the dial to the pointer located at the nine o'clock position. See Figure 2.
6. Turn the selector switch so that desired AUTO, OFF, or FAN reads vertically. See Figure 2.
7. Replace the thermostat cover. Tighten the screws on the bottom and top of the thermostat.

The installation is now complete.

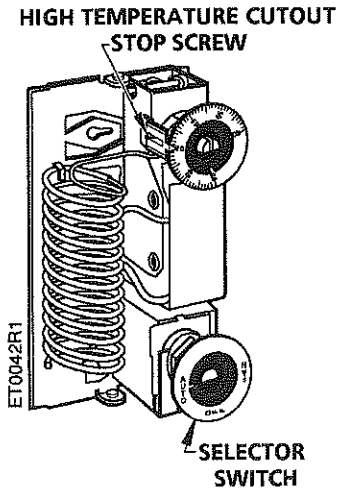


Figure 2. Interior View of the 134-1083.

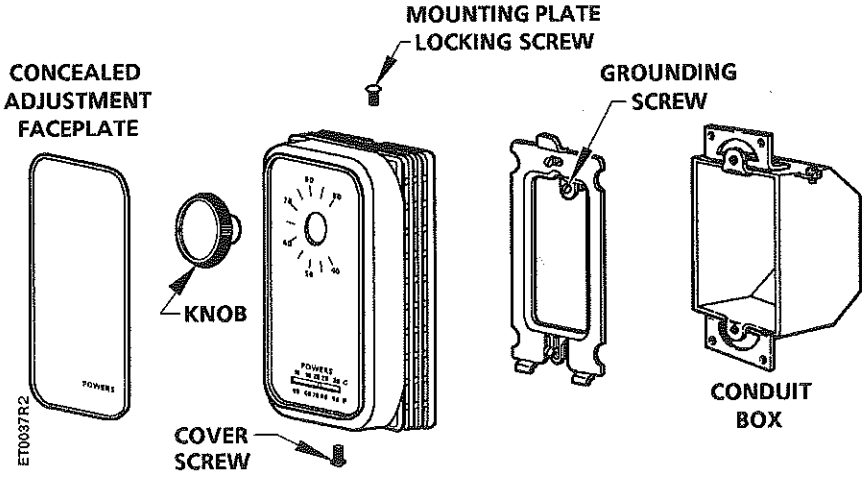


Figure 3. Mounting a 134-1084, 134-1085 or 134-1086 Thermostat to a Conduit Box.

Installation of 134-1084, 134-1085, 134-1086

Read the *Mounting and Wiring* sections.

1. Do not remove the thermostat cover to install.
2. Remove the mounting plate from the back of the thermostat by unscrewing the mounting plate locking screw (see Figure 3) with the Allen wrench provided.
3. Fasten the plate to the conduit box with the screws provided on the mounting plate.
4. Make the wiring connections to the terminals on the back of the thermostat. Terminal number 1 identification is stamped on the terminal block. See Figure 1 for typical wiring diagrams.
5. Hook the two slots in the back of the thermostat over the prongs of the mounting plate. Swing the thermostat into position on the plate.
6. Tighten the mounting plate locking screw.

The installation is now complete.

Adjustments

To remove the thermostat cover

1. Pull off the knob.
2. Loosen the thermostat cover screw with the Allen wrench provided.

To convert to concealed adjustment

1. Remove the thermostat cover by loosening the Allen screws at the top and bottom of the thermostat. The Allen wrench is included with the thermostat.
2. Peel off the backing from the enclosed faceplate.
3. Position the new faceplate over the factory-installed faceplate.
4. Press firmly onto the cover.
5. Set the thermostat dial by lining up the desired set point at the nine o'clock position.
6. Replace the cover and tighten the thermostat cover screw.

To set high and low range stops

See Figure 4

1. Before the cover is removed, set the dial to the maximum stop setting.
2. Pull off the knob.
3. Hold the dial firmly, press tab "A", and rotate the tab clockwise until it stops against stop "C".
4. Release the tab and be sure it snaps into the desired notch.
5. Set the dial at the lowest temperature stop setting desired.
6. Hold the dial firmly, press tab "B" and rotate it counter clockwise until it stops against stop "C".
7. Release the tab and be sure it snaps into the desired notch.
8. Replace the cover, tighten the cover screw, and push on the knob.
9. Rotate the knob to the desired setting.

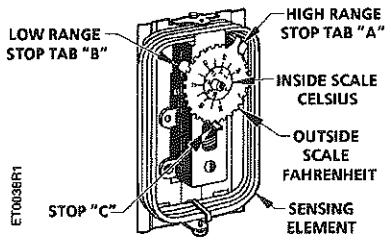


Figure 4. Interior of 134-1084, 134-1085 and 134-1086 Thermostats with High

and Low Adjustment Stops.

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Dimensions

Dimensions in Inches
(Millimeters)

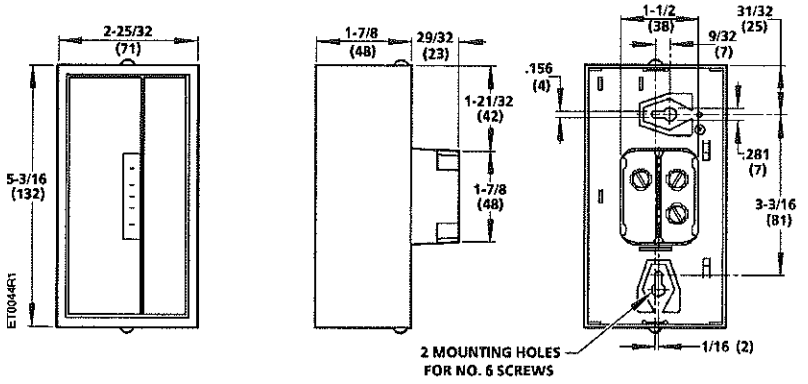


Figure 5. Dimensions of the 134-1083 Thermostat.

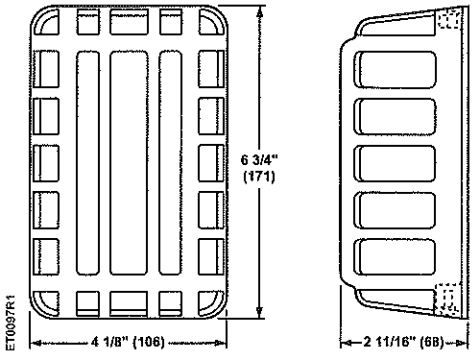


Figure 6. Dimensions of the 134-117 Thermostat Guard.

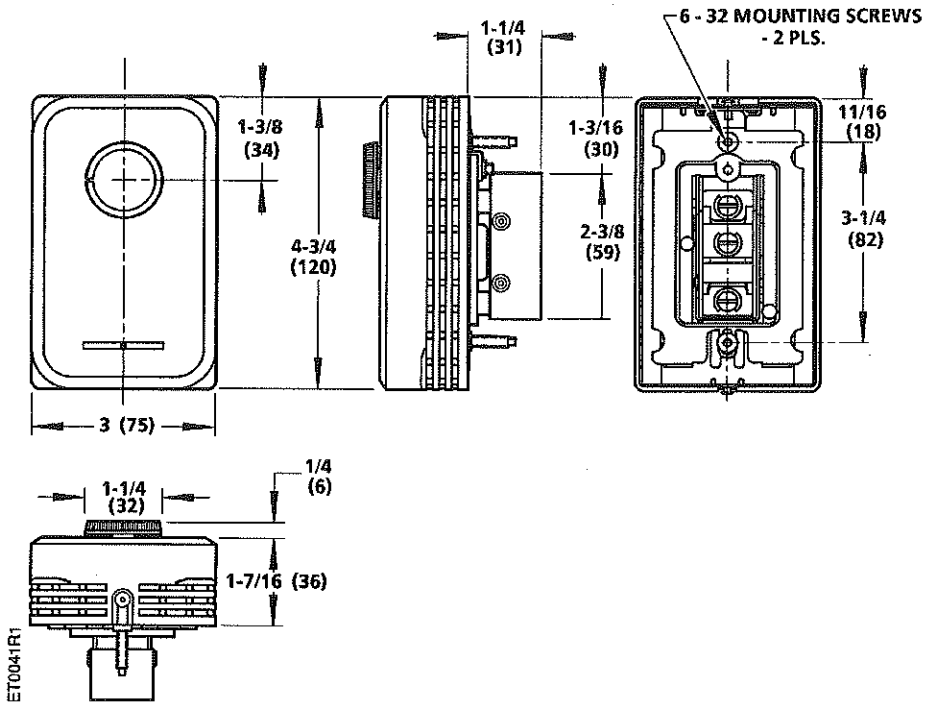


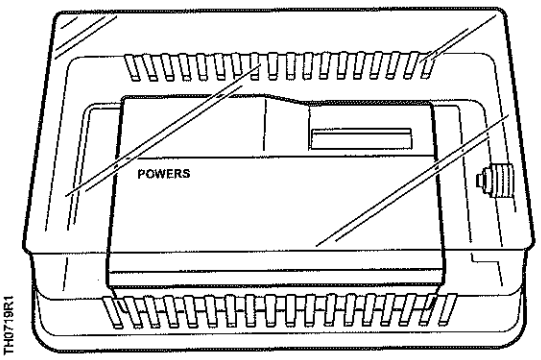
Figure 7. Dimensions of 134-1084, 134-1085 and 134-1086 Thermostats.

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SIEMENS

Technical Instructions
Document No. 155-723
November 21, 2002

Lockable Thermostat Guard



Description

A two-piece, plastic shield designed to prevent unauthorized adjustment or physical damage to a wall-mounted thermostat. A lockset secures the guard to the wall plate.

Features

- Two styles of wall plates are included to accommodate new installations or retrofit jobs.
- Clear, 1/8-inch thick, plastic surface provides unrestricted viewing of thermostat settings.
- Lock and two keys.
- Ventilated louvers on all four sides allow accurate temperature sensing.

Specifications

Guard cover	1/8-inch, clear plastic
Mounting plates	
Retrofit installation	Clear plastic
New installation	Desert beige plastic
Dimensions	10 × 6-1/4 × 3-3/4 inches (254 × 158.75 × 95.25 mm)
Weight	1.25 lbs (0.57 kg)

Application

The Lockable Thermostat Guard provides protection from physical damage and unauthorized adjustment of settings. The lockset makes this unit truly vandal-proof. This guard will protect any Siemens Building Technologies electric or pneumatic wall-mounted thermostat.

The mounting plate designed for new installations has a small, back entry hole to accommodate electrical wires or pneumatic tubing connected to the thermostat. The retrofit mounting plate is a large frame with four mounting screw holes to allow installation over any existing Siemens thermostat.

141-570

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
Stantec
June 17, 2013
Brandon Morris
By
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STANTEC ARCHITECTURE LTD.

Mounting

This guard can be used with all types of wall surfaces including plaster, brick, tile, cement block, and drywall. It can be mounted either vertically or horizontally.

Required Tools

- Medium, flat-blade screwdriver (all installations)
- Drill and 3/16-inch drill bit (new installations only)

Installation

For new installations (desert beige mounting plate – Item 6):

- Mount plate before installing thermostat.
- When installing to a 2" × 4" wall box:
  - Punch or drill out mounting holes in the plate at the proper locations.
  - Use two No. 6-32 × 1-inch long screws for mounting (Item 5).
- When installing directly to drywall, use four No. 6-18 self-tapping screws (Item 2).

For retrofit installations (clear plastic mounting ring – Item 3), use four No. 6-18 self-tapping screws (Item 2).

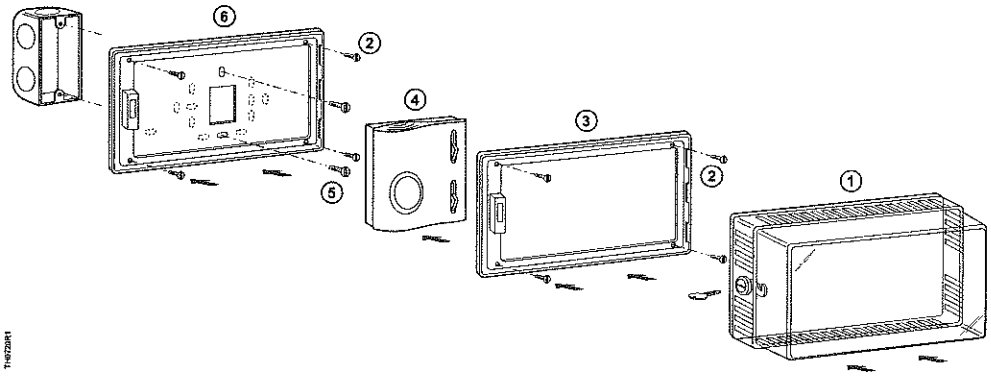


Figure 1. Installing the Lockable Thermostat Guard.

Table 1. Lockable Thermostat Guard Components.

Item	Description	Quantity	Material
1	Cover	1	Plastic
2	No. 6-18 × 1-1/4 inch self-tapping screws	4	Steel
3	Mounting Plate, clear (retrofit installation)	1	Plastic
4	Thermostat (not included)	1	—
5	No. 6-32 × 1-inch screw	2	Steel
6	Mounting Plate, desert beige (new installation)	1	Plastic
	Keys	2	—

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SIEMENS

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Flowrite™ 599 Series

Valve and Actuator Assembly Selection

Description

This Technical Bulletin will aid in the selection of a Flowrite 599 Series valve and actuator assembly. Begin with the graph of water capacity and the chart of close-off pressures to select a valve and actuator according to specifications. Use Tables 1 through 7 to identify product numbers.

These tables show all the possible combinations of the Flowrite 599 Series valves and compatible actuators that can be ordered as complete valve assemblies from the factory.

The dimensions of all valves and the service envelope required for each actuator are included in Tables 8 through 12.

How to Use the Selection Graphs

Use Figure 1, the water capacity graph, to select a valve. Locate the specified flow rate on the vertical axis. Follow across on the horizontal line to the point of intersection with the specified pressure drop. Choose the valve size from the heavy diagonal lines across the graph.

Use Figures 2 and 3, the close-off pressure graphs, to select an actuator. First locate the graph for the valve action and actuator power source specified. Locate the bar that represents the valve line size. The top of the bar indicates the maximum close-off pressure for tight close-off. Use the legend at the bottom of the graph to identify the actuator.

How To Use The Valve Tables

Tables have been organized to help select a valve and actuator combination using additional specifications.

Moving from left to right, identify the valve assembly needed. Continue to the right to match the valve to a desired actuator.

A valve and actuator assembly part number is determined by combining the actuator prefix code with the suffix of the valve product number.

NOTES:

1. No valve will combine with all actuators.
2. The symbol "—" indicates a combination that is a special order.
3. A shaded space with the symbol "X" indicates an inappropriate combination.

Stantec
☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
June 17, 2013
Brandon Morris
By:
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.
STANTEC ARCHITECTURE LTD. (PC-1449)

Valve Tables

1/2 to 2-inch Valves	
Two-Way, NC, Linear characteristic	Table 1
Two-Way, NC, Equal % characteristic	Table 2
Two-Way, NO, Linear characteristic	Table 3
Two-Way, NO, Equal % characteristic	Table 4
Three-Way, Mixing, Equal % characteristic	Table 5
2-1/2 to 6-inch Valves	
ANSI 125, Two-Way and Three-Way	Table 6
ANSI 250, Two-Way and Three-Way	Table 7

Selection Example

Specification

Select a two-way normally closed valve and actuator assembly for an ANSI 125 piping system that will deliver 500 gpm (113 m^3/h) chilled water with an equal percentage flow characteristic with no more than 5 psi (35 kPa) pressure drop across the fully open valve.

The valve shall be operated by a 24 Vac powered, 0 to 10 Vdc control signal, spring return electronic actuator, and must close off tightly against a pump head pressure of 15 psi (1 bar).

Valve Sizing

Use Figure 1, the water capacity graph, to begin valve sizing.

1. Locate 500 gpm (113 m^3/h) on the vertical axis to find the required flow.
2. Read across the horizontal axis to find 5 psi (35 kPa), the maximum allowable pressure drop across the open valve.
3. Select a 5-inch (125 mm) 250 Cv (214 Kvs) line size valve because the point of intersection falls close to the 5-inch line.

Actuator selection

Use Figures 2 and 3, the close-off pressure graphs, to choose an actuator.

1. Locate the graph for electronic actuators for NC valves in the upper left side of the figure.
2. Locate the bar for 5-inch valves. The black bar represents an SKB/C actuator.
3. Notice that the SKB/C has the sufficient force to provide tight close-off against more than 20 psi (1.4 bar) differential. For a 5-inch valve, select a SKC actuator with a 40 mm stroke.

Product Number Selection

Use Table 6 for ANSI Class 125 valves. Begin at the left and select the specifications necessary.

1. Select a two-way, normally closed, equal percentage flow characteristic according to the specifications.

Selection Example, Continued

2. Select bronze trim for the low pressure water application and standard packing for chilled water.

3. Select the 5-inch line size determined from the sizing example above. Note the 40 mm stroke of the valve. The valve part number is 599-05993.

4. Read across the top of the table to Electronic-hydraulic, 40 mm, and 24 Vac, 0-10 Vdc control signal.
   The actuator part number is SKC62.
   The actuator code number is 294.

5. Read down the column to determine the valve and actuator assembly product number is 294-05993.

NOTE: The valve and actuator can be ordered separately by using the part numbers from Steps 3 and 4.

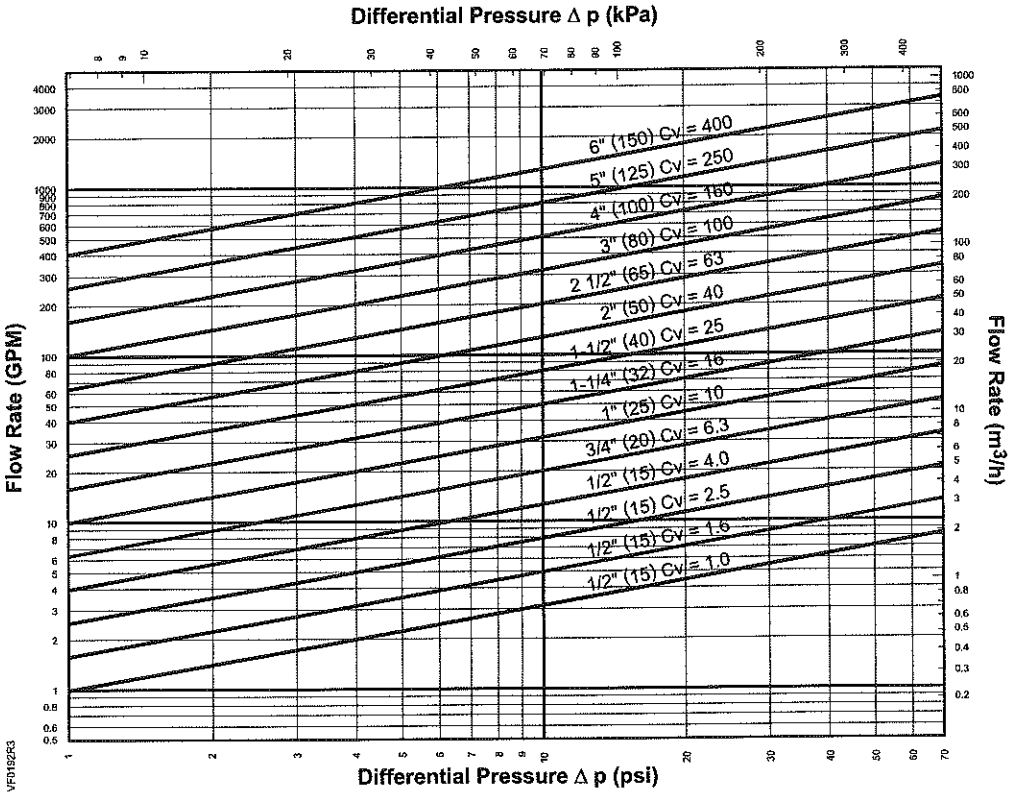


Figure 1. Water Capacity Graph.

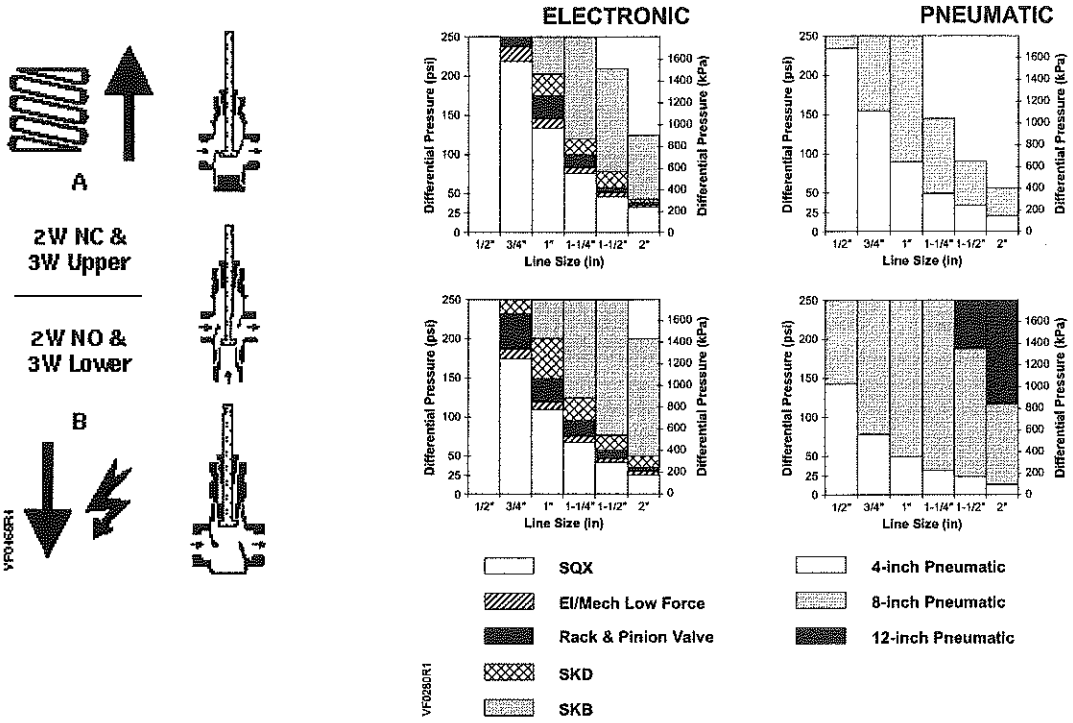


Figure 2. Close-off Pressures for 1/2 through 2-Inch Valves.

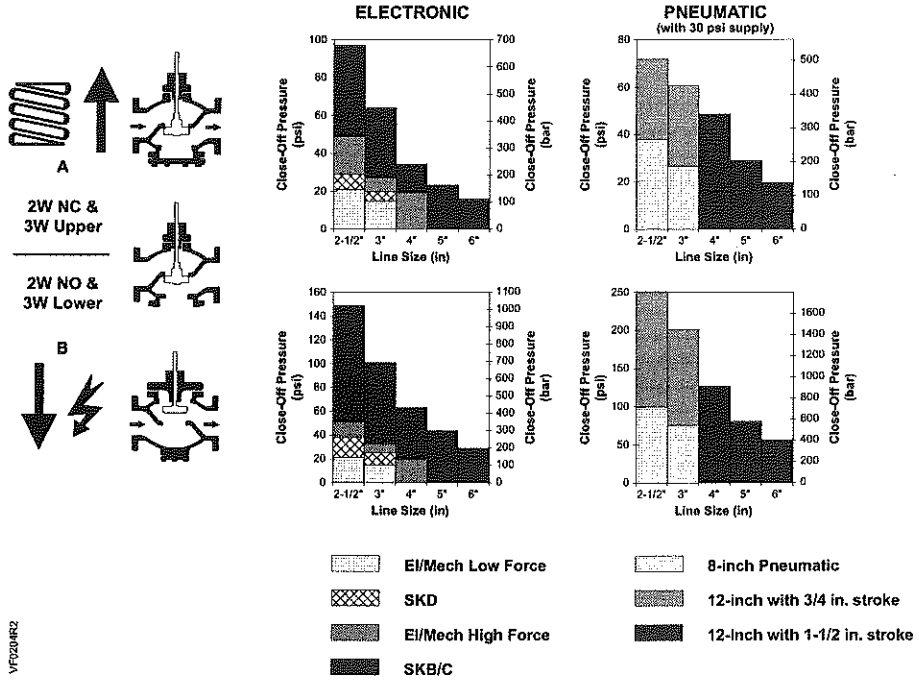


Figure 3. Close-off Pressures for 2-1/2 through 6-Inch Valves.

Table 1. 1/2 to 2-Inch, Two-Way, Normally Closed (NC), Linear Valves (Technical Instructions 155-184P25).

Trim	Packing	Connection *	Flow Rate		Line Size		Stroke	Type	Pneumatic						Pneumatic with Factory Mounted Position Relay		
								Description	4-inch 3-8 psi (21-55 kPa)	4-inch 5-10 psi (34-69 kPa)	4-inch 10-15 psi (69-103 kPa)	8-inch	8-inch Hi-Temp	12-inch	8-inch	8-inch Hi-Temp	12-inch with Positioner
								Technical Instructions	155-183P25	155-183P25	155-183P25	155-161P25	155-161P25	155-162P25	155-161P25	155-161P25	155-162P25
								Actuator Assembly	599-01081	599-01082	599-01083	599-01050	599-01051	599-01010	599-01050	599-01051	599-01010
			Cv	Kvs	In	mm		Valve Assembly	Actuator Code 268	Actuator Code 269	Actuator Code 270	Actuator Code 277	Actuator Code 278	Actuator Code 279	Actuator Code 283	Actuator Code 284	Actuator Code 285
Stainless Steel	Standard	FxF	1	0.9	0.5	15	20	599-03018	—	—	270-03018	277-03018	—	—	283-03018	—	—
			1.6	1.4	0.5	15	20	599-03019	—	—	270-03019	277-03019	—	—	283-03019	—	—
			2.5	2.2	0.5	15	20	599-03020	—	—	270-03020	277-03020	—	—	283-03020	—	—
			4	3.4	0.5	15	20	599-03021	—	—	270-03021	277-03021	—	—	283-03021	—	—
			6.3	5.4	0.75	20	20	599-03022	—	—	270-03022	277-03022	—	—	283-03022	—	—
			10	8.6	1	25	20	599-03023	—	—	270-03023	277-03023	—	279-03023	283-03023	—	285-03023
			16	14	1.25	32	20	599-03024	—	—	270-03024	277-03024	—	279-03024	283-03024	—	285-03024
			25	22	1.5	40	20	599-03025	—	—	270-03025	277-03025	—	279-03025	283-03025	—	285-03025
			40	34	2	50	20	599-03026	—	—	270-03026	277-03026	—	279-03026	283-03026	—	285-03026
		FxUF	1	0.9	0.5	15	20	599-03027	—	—	270-03027	277-03027	—	—	283-03027	—	—
			1.6	1.4	0.5	15	20	599-03028	—	—	270-03028	277-03028	—	—	283-03028	—	—
			2.5	2.2	0.5	15	20	599-03029	—	—	270-03029	277-03029	—	—	283-03029	—	—
			4	3.4	0.5	15	20	599-03030	—	—	270-03030	277-03030	—	—	283-03030	—	—
			6.3	5.4	0.75	20	20	599-03031	—	—	270-03031	277-03031	—	—	283-03031	—	—
			10	8.6	1	25	20	599-03032	—	—	270-03032	277-03032	—	279-03032	283-03032	—	285-03032
		FxUM	1	0.9	0.5	15	20	599-03225	—	—	270-03225	277-03225	—	—	283-03225	—	—
			1.6	1.4	0.5	15	20	599-03226	—	—	270-03226	277-03226	—	—	283-03226	—	—
			2.5	2.2	0.5	15	20	599-03227	—	—	270-03227	277-03227	—	—	283-03227	—	—
			4	3.4	0.5	15	20	599-03228	—	—	270-03228	277-03228	—	—	283-03228	—	—
			6.3	5.4	0.75	20	20	599-03229	—	—	270-03229	277-03229	—	—	283-03229	—	—
			10	8.6	1	25	20	599-03230	—	—	270-03230	277-03230	—	279-03230	283-03230	—	285-03230
		UFxUF	16	14	1.25	32	20	599-03033	—	—	270-03033	277-03033	—	279-03033	283-03033	—	285-03033
			25	22	1.5	40	20	599-03034	—	—	270-03034	277-03034	—	279-03034	283-03034	—	285-03034
			40	34	2	50	20	599-03035	—	—	270-03035	277-03035	—	279-03035	283-03035	—	285-03035
	Hi-Temp	FxF	1	0.9	0.5	15	20	599-03072	—	—	270-03072	277-03072	278-03072	—	283-03072	284-03072	—
			1.6	1.4	0.5	15	20	599-03073	—	—	270-03073	277-03073	278-03073	—	283-03073	284-03073	—
			2.5	2.2	0.5	15	20	599-03074	—	—	270-03074	277-03074	278-03074	—	283-03074	284-03074	—
			4	3.4	0.5	15	20	599-03075	—	—	270-03075	277-03075	278-03075	—	283-03075	284-03075	—
			6.3	5.4	0.75	20	20	599-03076	—	—	270-03076	277-03076	278-03076	—	283-03076	284-03076	—
			10	8.6	1	25	20	599-03077	—	—	270-03077	277-03077	278-03077	279-03077	283-03077	284-03077	285-03077
			16	14	1.25	32	20	599-03078	—	—	270-03078	277-03078	278-03078	279-03078	283-03078	284-03078	285-03078
			25	22	1.5	40	20	599-03079	—	—	270-03079	277-03079	278-03079	279-03079	283-03079	284-03079	285-03079
			40	34	2	50	20	599-03080	—	—	270-03080	277-03080	278-03080	279-03080	283-03080	284-03080	285-03080
		FxUF	1	0.9	0.5	15	20	599-03081	—	—	270-03081	277-03081	278-03081	—	283-03081	284-03081	—
			1.6	1.4	0.5	15	20	599-03082	—	—	270-03082	277-03082	278-03082	—	283-03082	284-03082	—
			2.5	2.2	0.5	15	20	599-03083	—	—	270-03083	277-03083	278-03083	—	283-03083	284-03083	—
			4	3.4	0.5	15	20	599-03084	—	—	270-03084	277-03084	278-03084	—	283-03084	284-03084	—
			6.3	5.4	0.75	20	20	599-03085	—	—	270-03085	277-03085	278-03085	—	283-03085	284-03085	—
			10	8.6	1	25	20	599-03086	—	—	270-03086	277-03086	278-03086	279-03086	283-03086	284-03086	285-03086
		FxsUM	1	0.9	0.5	15	20	599-03243	—	—	270-03243	277-03243	278-03243	—	283-03243	284-03243	—
			1.6	1.4	0.5	15	20	599-03244	—	—	270-03244	277-03244	278-03244	—	283-03244	284-03244	—
			2.5	2.2	0.5	15	20	599-03245	—	—	270-03245	277-03245	278-03245	—	283-03245	284-03245	—
			4	3.4	0.5	15	20	599-03246	—	—	270-03246	277-03246	278-03246	—	283-03246	284-03246	—
			6.3	5.4	0.75	20	20	599-03247	—	—	270-03247	277-03247	278-03247	—	283-03247	284-03247	—
			10	8.6	1	25	20	599-03248	—	—	270-03248	277-03248	278-03248	279-03248	283-03248	284-03248	285-03248
		UFxUF	16	14	1.25	32	20	599-03087	—	—	270-03087	277-03087	278-03087	279-03087	283-03087	284-03087	285-03087
			25	22	1.5	40	20	599-03088	—	—	270-03088	277-03088	278-03088	279-03088	283-03088	284-03088	285-03088
			40	34	2	50	20	599-03089	—	—	270-03089	277-03089	278-03089	279-03089	283-03089	284-03089	285-03089

* F = Female NPT, UF = Union Female, UM = Union Male connection, — = Special Order, X = Inappropriate combination.

Table 1a. 1/2 to 2-Inch, Two-Way, Normally Closed (NC), Linear Valves (Technical Instructions 155-184P25), Continued.

Trim	Packing	Connection*	Flow Rate		Line Size		Stroke	Type	Electro-Hydraulic					
									24 Vac					
								Description	0-10V 4-20mA SR	3-Pos NSR	3-Pos SR	3-Pos SR	3-Pos SR	0-10V 4-20mA SR
								Technical Instructions	155-180P25	155-181P25	155-181P25	155-171P25	155-171P25	155-163P25
								Actuator Assembly	SKD62U	SKD82.50U	SKD82.51U	SKB82.51U	SKB82.50U	SKB62U
			Cv	Kvs	In	mm		Valve Assembly	Actuator Code 274	Actuator Code 275	Actuator Code 276	Actuator Code 289	Actuator Code 290	Actuator Code 291
Stainless Steel	Standard	FxF	1	0.9	0.5	15	20	599-03018	274-03018	275-03018	276-03018	—	—	—
			1.6	1.4	0.5	15	20	599-03019	274-03019	275-03019	276-03019	—	—	—
			2.5	2.2	0.5	15	20	599-03020	274-03020	275-03020	276-03020	—	—	—
			4	3.4	0.5	15	20	599-03021	274-03021	275-03021	276-03021	—	—	—
			6.3	5.4	0.75	20	20	599-03022	274-03022	275-03022	276-03022	—	—	—
			10	8.6	1	25	20	599-03023	274-03023	275-03023	276-03023	289-03023	290-03023	291-03023
			16	14	1.25	32	20	599-03024	274-03024	275-03024	276-03024	289-03024	290-03024	291-03024
			25	22	1.5	40	20	599-03025	274-03025	275-03025	276-03025	289-03025	290-03025	2903025
			40	34	2	50	20	599-03026	274-03026	275-03026	276-03026	290-03026	290-03026	291-03026
		FxUF	1	0.9	0.5	15	20	599-03027	274-03027	275-03027	276-03027	—	—	—
			1.6	1.4	0.5	15	20	599-03028	274-03028	275-03028	276-03028	—	—	—
			2.5	2.2	0.5	15	20	599-03029	274-03029	275-03029	276-03029	—	—	—
			4	3.4	0.5	15	20	599-03030	274-03030	275-03030	276-03030	—	—	—
			6.3	5.4	0.75	20	20	599-03031	274-03031	275-03031	276-03031	—	—	—
			10	8.6	1	25	20	599-03032	274-03032	275-03032	276-03032	289-03032	290-03032	291-03032
		FxUM	1	0.9	0.5	15	20	599-03225	274-03225	275-03225	276-03225	—	—	—
			1.6	1.4	0.5	15	20	599-03226	274-03226	275-03226	276-03226	—	—	—
			2.5	2.2	0.5	15	20	599-03227	274-03227	275-03227	276-03227	—	—	—
			4	3.4	0.5	15	20	599-03228	274-03228	275-03228	276-03228	—	—	—
			6.3	5.4	0.75	20	20	599-03229	274-03229	275-03229	276-03229	—	—	—
			10	8.6	1	25	20	599-03230	274-03230	275-03230	276-03230	289-03230	290-03230	291-03230
		UFxUF	16	14	1.25	32	20	599-03033	274-03033	275-03033	276-03033	289-03033	290-03033	291-03033
			25	22	1.5	40	20	599-03034	274-03034	275-03034	276-03034	289-03034	290-03034	291-03034
			40	34	2	50	20	599-03035	274-03035	275-03035	276-03035	289-03035	290-03035	291-03035
	Hi-Temp	FxF	1	0.9	0.5	15	20	599-03072	274-03072	275-03072	276-03072	—	—	—
			1.6	1.4	0.5	15	20	599-03073	274-03073	275-03073	276-03073	—	—	—
			2.5	2.2	0.5	15	20	599-03074	274-03074	275-03074	276-03074	—	—	—
			4	3.4	0.5	15	20	599-03075	274-03075	275-03075	276-03075	—	—	—
			6.3	5.4	0.75	20	20	599-03076	274-03076	275-03076	276-03076	—	—	—
			10	8.6	1	25	20	599-03077	274-03077	275-03077	276-03077	289-03077	290-03077	291-03077
			16	14	1.25	32	20	599-03078	274-03078	275-03078	276-03078	289-03078	290-03078	291-03078
			25	22	1.5	40	20	599-03079	274-03079	275-03079	276-03079	298-03079	290-03079	291-03079
			40	34	2	50	20	599-03080	274-03080	275-03080	276-03080	298-03080	290-03080	291-03080
		FxUF	1	0.9	0.5	15	20	599-03081	274-03081	275-03081	276-03081	—	—	—
			1.6	1.4	0.5	15	20	599-03082	274-03082	275-03082	276-03082	—	—	—
			2.5	2.2	0.5	15	20	599-03083	274-03083	275-03083	276-03083	—	—	—
			4	3.4	0.5	15	20	599-03084	274-03084	275-03084	276-03084	—	—	—
			6.3	5.4	0.75	20	20	599-03085	274-03085	275-03085	276-03085	—	—	—
			10	8.6	1	25	20	599-03086	274-03086	275-03086	276-03086	289-03086	290-03086	291-03086
		FxsUM	1	0.9	0.5	15	20	599-03243	274-03243	275-03243	276-03243	—	—	—
			1.6	1.4	0.5	15	20	599-03244	274-03244	275-03244	276-03244	—	—	—
			2.5	2.2	0.5	15	20	599-03245	274-03245	275-03245	276-03245	—	—	—
			4	3.4	0.5	15	20	599-03246	274-03246	275-03246	276-03246	—	—	—
			6.3	5.4	0.75	20	20	599-03247	274-03247	275-03247	276-03247	—	—	—
			10	8.6	1	25	20	599-03248	274-03248	275-03248	276-03248	289-03248	290-03248	291-03248
		UFxUF	16	14	1.25	32	20	599-03087	274-03087	275-03087	276-03087	289-03087	290-03087	291-03087
			25	22	1.5	40	20	599-03088	274-03088	275-03088	276-03088	289-03088	290-03088	291-03088
			40	34	2	50	20	599-03089	274-03089	275-03089	276-03089	289-03089	290-03089	291-03089

* F = Female NPT, UF = Union Female, UM = Union Male connection, — = Special Order, X = Inappropriate combination.

Table 1b. 1/2 to 2-Inch, Two-Way, Normally Closed (NC), Linear Valves (Technical Instructions 155-184P25), Continued.

Trim	Packing	Connection *	Flow Rate		Line Size		Stroke	Type	Electro-Mechanical						
									24 Vac						
								Description	0-10V 4-20 mA NSR	3-Pos, 120 sec, NSR	3-Pos, 30 sec, NSR	0-10V, Lo, NSR	0-10V, Lo, SR	0-10V, SR	2-Pos, SR
								Technical Instructions	155-182P25	155-186P25	155-186P25	155-172P25	155-172P25	155-541P25	155-541P25
								Actuator Assembly	SQX62U	SQX82.00U	SQX82.03U	599-10021	599-10022	599-03609	599-03611
			Cv	Kvs	In	mm		Valve Assembly	Actuator Code 271	Actuator Code 272	Actuator Code 273	Actuator Code 295	Actuator Code 296	Actuator Code 298	Actuator Code 299
Stainless Steel	Standard	FxF	1	0.9	0.5	15	20	599-03018	271-03018	272-03018	273-03018	295-03018	296-03018	298-03018	299-03018
			1.6	1.4	0.5	15	20	599-03019	271-03019	272-03019	273-03019	295-03019	296-03019	298-03019	299-03019
			2.5	2.2	0.5	15	20	599-03020	271-03020	272-03020	273-03020	295-03020	296-03020	298-03020	299-03020
			4	3.4	0.5	15	20	599-03021	271-03021	272-03021	273-03021	295-03021	296-03021	298-03021	299-03021
			6.3	5.4	0.75	20	20	599-03022	271-03022	272-03022	273-03022	295-03022	296-03022	298-03022	299-03022
			10	8.6	1	25	20	599-03023	271-03023	272-03023	273-03023	295-03023	296-03023	298-03023	299-03023
			16	14	1.25	32	20	599-03024	271-03024	272-03024	273-03024	295-03024	296-03024	298-03024	299-03024
			25	22	1.5	40	20	599-03025	271-03025	272-03025	273-03025	295-03025	296-03025	298-03025	299-03025
			40	34	2	50	20	599-03026	271-03026	272-03026	273-03026	295-03026	296-03026	298-03026	299-03026
		FxUF	1	0.9	0.5	15	20	599-03027	271-03027	272-03027	273-03027	295-03027	296-03027	298-03027	299-03027
			1.6	1.4	0.5	15	20	599-03028	271-03028	272-03028	273-03028	295-03028	296-03028	298-03028	299-03028
			2.5	2.2	0.5	15	20	599-03029	271-03029	272-03029	273-03029	295-03029	296-03029	298-03029	299-03029
			4	3.4	0.5	15	20	599-03030	271-03030	272-03030	273-03030	295-03030	296-03030	298-03030	299-03030
			6.3	5.4	0.75	20	20	599-03031	271-03031	272-03031	273-03031	295-03031	296-03031	298-03031	299-03031
			10	8.6	1	25	20	599-03032	271-03032	272-03032	273-03032	295-03032	296-03032	298-03032	299-03032
		FxUM	1	0.9	0.5	15	20	599-03225	271-03225	272-03225	273-03225	295-03225	296-03225	298-03225	299-03225
			1.6	1.4	0.5	15	20	599-03226	271-03226	272-03226	273-03226	295-03226	296-03226	298-03226	299-03226
			2.5	2.2	0.5	15	20	599-03227	271-03227	272-03227	273-03227	295-03227	296-03227	298-03227	299-03227
			4	3.4	0.5	15	20	599-03228	271-03228	272-03228	273-03228	295-03228	296-03228	298-03228	299-03228
			6.3	5.4	0.75	20	20	599-03229	271-03229	272-03229	273-03229	295-03229	296-03229	298-03229	299-03229
			10	8.6	1	25	20	599-03230	271-03230	272-03230	273-03230	295-03230	296-03230	298-03230	299-03230
		UFxUF	16	14	1.25	32	20	599-03033	271-03033	272-03033	273-03033	295-03033	296-03033	298-03033	299-03033
			25	22	1.5	40	20	599-03034	271-03034	272-03034	273-03034	295-03034	296-03034	298-03034	299-03034
			40	34	2	50	20	599-03035	271-03035	272-03035	273-03035	295-03035	296-03035	298-03035	299-03035
	Hi-Temp	FxF	1	0.9	0.5	15	20	599-03072	271-03072	272-03072	273-03072	295-03072	296-03072	298-03072	299-03072
			1.6	1.4	0.5	15	20	599-03073	271-03073	272-03073	273-03073	295-03073	296-03073	298-03073	299-03073
			2.5	2.2	0.5	15	20	599-03074	271-03074	272-03074	273-03074	295-03074	296-03074	298-03074	299-03074
			4	3.4	0.5	15	20	599-03075	271-03075	272-03075	273-03075	295-03075	296-03075	298-03075	299-03075
			6.3	5.4	0.75	20	20	599-03076	271-03076	272-03076	273-03076	295-03076	296-03076	298-03076	299-03076
			10	8.6	1	25	20	599-03077	271-03077	272-03077	273-03077	295-03077	296-03077	298-03077	299-03077
			16	14	1.25	32	20	599-03078	271-03078	272-03078	273-03078	295-03078	296-03078	298-03078	299-03078
			25	22	1.5	40	20	599-03079	271-03079	272-03079	273-03079	295-03079	296-03079	298-03079	299-03079
			40	34	2	50	20	599-03080	271-03080	272-03080	273-03080	295-03080	296-03080	298-03080	299-03080
		FxUF	1	0.9	0.5	15	20	599-03081	271-03081	272-03081	273-03081	295-03081	296-03081	298-03081	299-03081
			1.6	1.4	0.5	15	20	599-03082	271-03082	272-03082	273-03082	295-03082	296-03082	298-03082	299-03082
			2.5	2.2	0.5	15	20	599-03083	271-03083	272-03083	273-03083	295-03083	296-03083	298-03083	299-03083
			4	3.4	0.5	15	20	599-03084	271-03084	272-03084	273-03084	295-03084	296-03084	298-03084	299-03084
			6.3	5.4	0.75	20	20	599-03085	271-03085	272-03085	273-03085	295-03085	296-03085	298-03085	299-03085
			10	8.6	1	25	20	599-03086	271-03086	272-03086	273-03086	295-03086	296-03066	298-03086	299-03086
		FxsUM	1	0.9	0.5	15	20	599-03243	271-03243	272-03243	273-03243	295-03243	296-03243	298-03243	299-03243
			1.6	1.4	0.5	15	20	599-03244	271-03244	272-03244	273-03244	295-03244	296-03244	298-03244	299-03244
			2.5	2.2	0.5	15	20	599-03245	271-03245	272-03245	273-03245	295-03245	296-03245	298-03245	299-03245
			4	3.4	0.5	15	20	599-03246	271-03246	272-03246	273-03246	295-03246	296-03246	298-03246	299-03246
			6.3	5.4	0.75	20	20	599-03247	271-03247	272-03247	273-03247	295-03247	296-03247	298-03247	299-03247
			10	8.6	1	25	20	599-03248	271-03248	272-03248	273-03248	295-03248	296-03248	298-03248	299-03248
		UFxUF	16	14	1.25	32	20	599-03087	271-03087	272-03087	273-03087	295-03087	296-03087	298-03087	299-03087
			25	22	1.5	40	20	599-03088	271-03088	272-03088	273-03088	295-03088	296-03088	298-03088	299-03088
			40	34	2	50	20	599-03089	271-03089	272-03089	273-03089	295-03089	296-03089	298-03089	299-03089

CV-2

* F = Female NPT, UF = Union Female, UM = Union Male connection, — = Special Order, X = Inappropriate combination.

Table 2. 1/2 to 2-Inch, Two-Way, Normally Closed (NC), Equal Percentage Valves (Technical Instructions 155-184P25).

Trim	Packing	Connection *	Flow Rate		Line Size		Stroke	Type	Pneumatic						Pneumatic with Factory Mounted Position Relay		
								Description	4-inch 3-8 psi (21-55 kPa)	4-inch 5-10 psi (34-69 kPa)	4-inch 10-15 psi (69-103 kPa)	8-inch	8-inch Hi-Temp	12-inch	8-inch	8-inch Hi-Temp	12-inch with Positioner
								Technical Instructions	155-183P25			155-161P25		155-162P25	155-161P25		155-162P25
								Actuator Assembly	599-01081	599-01082	599-01083	599-01050	599-01051	599-01010	599-01050	599-01051	599-01010
			Cv	Kvs	In	mm		Valve Assembly	Actuator Code 268	Actuator Code 269	Actuator Code 270	Actuator Code 277	Actuator Code 278	Actuator Code 279	Actuator Code 283	Actuator Code 284	Actuator Code 285
Bronze	Standard	FxF	1	0.9	0.5	15	20	599-03180	—	—	270-03180	277-03180	—		283-03180	—	
			1.6	1.4	0.5	15	20	599-03181	—	—	270-03181	277-03181	—		283-03181	—	
			2.5	2.2	0.5	15	20	599-03182	—	—	270-03182	277-03182	—		283-03182	—	
			4	3.4	0.5	15	20	599-03183	—	—	270-03183	277-03183	—		283-03183	—	
			6.3	5.4	0.75	20	20	599-03184	—	—	270-03184	277-03184	—		283-03184	—	
			10	8.6	1	25	20	599-03185	—	—	270-03185	277-03185	—	279-03185	283-03185	—	285-03185
			16	14	1.25	32	20	599-03186	—	—	270-03186	277-03186	—	279-03186	283-03186	—	285-03186
			25	22	1.5	40	20	599-03187	—	—	270-03187	277-03187	—	279-03187	283-03187	—	285-03187
			40	34	2	50	20	599-03188	—	—	270-03188	277-03188	—	279-03188	283-03188	—	285-03188
		FxUF	1	0.9	0.5	15	20	599-03189	—	—	270-03189	277-03189	—		283-03189	—	
			1.6	1.4	0.5	15	20	599-03190	—	—	270-03190	277-03190	—		283-03190	—	
			2.5	2.2	0.5	15	20	599-03191	—	—	270-03191	277-03191	—		283-03191	—	
			4	3.4	0.5	15	20	599-03192	—	—	270-03192	277-03192	—		283-03192	—	
			6.3	5.4	0.75	20	20	599-03193	—	—	270-03193	277-03193	—		283-03193	—	
			10	8.6	1	25	20	599-03194	—	—	270-03194	277-03194	—	279-03194	283-03194	—	285-03194
		FxUM	1	0.9	0.5	15	20	599-03279	—	—	270-03279	277-03279	—		283-03279	—	
			1.6	1.4	0.5	15	20	599-03280	—	—	270-03280	277-03280	—		283-03280	—	
			2.5	2.2	0.5	15	20	599-03281	—	—	270-03281	277-03281	—		283-03281	—	
			4	3.4	0.5	15	20	599-03282	—	—	270-03282	277-03282	—		283-03282	—	
			6.3	5.4	0.75	20	20	599-03283	—	—	270-03283	277-03283	—		283-03283	—	
			10	8.6	1	25	20	599-03284	—	—	270-03284	277-03284	—	279-03284	283-03284	—	285-03284
		UFxUF	16	14	1.25	32	20	599-03195	—	—	270-03195	277-03195	—	279-03195	283-03195	—	285-03195
			25	22	1.5	40	20	599-03196	—	—	270-03196	277-03196	—	279-03196	283-03196	—	285-03196
			40	34	2	50	20	599-03197	—	—	270-03197	277-03197	—	279-03197	283-03197	—	285-03197
Stainless Steel		FxF	1	0.9	0.5	15	20	599-03126	—	—	270-03126	277-03126	—		283-03126	—	
			1.6	1.4	0.5	15	20	599-03127	—	—	270-03127	277-03127	—		283-03127	—	
			2.5	2.2	0.5	15	20	599-03128	—	—	270-03128	277-03128	—		283-03128	—	
			4	3.4	0.5	15	20	599-03129	—	—	270-03129	277-03129	—		283-03129	—	
			6.3	5.4	0.75	20	20	599-03130	—	—	270-03130	277-03130	—		283-03130	—	
			10	8.6	1	25	20	599-03131	—	—	270-03131	277-03131	—	279-03131	283-03131	—	285-03131
			16	14	1.25	32	20	599-03132	—	—	270-03132	277-03132	—	279-03132	283-03132	—	285-03132
			25	22	1.5	40	20	599-03133	—	—	270-03133	277-03133	—	279-03133	283-03133	—	285-03133
			40	34	2	50	20	599-03134	—	—	270-03134	277-03134	—	279-03134	283-03134	—	283-03134
		FxUF	1	0.9	0.5	15	20	599-03135	—	—	270-03135	277-03135	—		283-03135	—	
			1.6	1.4	0.5	15	20	599-03136	—	—	270-03136	277-03136	—		283-03136	—	
			2.5	2.2	0.5	15	20	599-03137	—	—	270-03137	277-03137	—		283-03137	—	
			4	3.4	0.5	15	20	599-03138	—	—	270-03138	277-03138	—		283-03138	—	
			6.3	5.4	0.75	20	20	599-03139	—	—	270-03139	277-03139	—		283-03139	—	
			10	8.6	1	25	20	599-03140	—	—	270-03140	277-03140	—	279-03140	283-03140	—	285-03140
		FxsUM	1	0.9	0.5	15	20	599-03261	—	—	270-03261	277-03261	—		283-03261	—	
			1.6	1.4	0.5	15	20	599-03262	—	—	270-03262	277-03262	—		283-03262	—	
			2.5	2.2	0.5	15	20	599-03263	—	—	270-03263	277-03263	—		283-03263	—	
			4	3.4	0.5	15	20	599-03264	—	—	270-03264	277-03264	—		283-03264	—	
			6.3	5.4	0.75	20	20	599-03265	—	—	270-03265	277-03265	—		283-03265	—	
			10	8.6	1	25	20	599-03266	—	—	270-03266	277-03266	—	279-03266	283-03266	—	285-03266
		UFxUF	16	14	1.25	32	20	599-03141	—	—	270-03141	277-03141	—	279-03141	283-03141	—	285-03141
			25	22	1.5	40	20	599-03142	—	—	270-03142	277-03142	—	279-03142	283-03142	—	283-03142
			40	34	2	50	20	599-03143	—	—	270-03143	277-03143	—	279-03143	283-03143	—	285-03143

* = Female NPT, UF = Union Female, UM = Union Male connection, — = Special Order, X = Inappropriate combination.

Table 2a. 1/2 to 2-Inch, Two-Way, Normally Closed (NC), Equal Percentage Valves (Technical Instructions 155-184P25), Continued.

Trim	Packing	Connection *	Flow Rate Cv	Flow Rate Kvs	Line Size In	Line Size mm	Stroke	Type	Electro-Hydraulic 24 Vac					
								Description	0-10V 4-20 mA SR	3-Pos NSR	3-Pos, SR	3-Pos SR	3-Pos SR	0-10V 4-20 mA SR
								Technical Instructions	155-180P25	155-181P25	155-181P25	155-171P25	155-171P25	155-163P25
								Actuator Assembly	SKD62U	SKD82.50 U	SKD82.51 U	SKB82.51 U	SKB82.50 U	SKB62U
								Valve Assembly	Actuator Code 274	Actuator Code 275	Actuator Code 276	289	290	291
Bronze	Standard	FxF	1	0.9	0.5	15	20	599-03180	274-03180	275-03180	276-03180	—	—	—
			1.6	1.4	0.5	15	20	599-03181	274-03181	275-03181	276-03181	—	—	—
			2.5	2.2	0.5	15	20	599-03182	274-03182	275-03182	276-03182	—	—	—
			4	3.4	0.5	15	20	599-03183	274-03183	275-03183	276-03183	—	—	—
			6.3	5.4	0.75	20	20	599-03184	274-03184	275-03184	276-03184	—	—	—
			10	8.6	1	25	20	599-03185	274-03185	275-03185	276-03185	289-03185	290-03185	291-03185
			16	14	1.25	32	20	599-03186	274-03186	275-03186	276-03186	289-03186	290-03186	291-03186
			25	22	1.5	40	20	599-03187	274-03187	275-03187	276-03187	289-03187	290-03187	291-03187
			40	34	2	50	20	599-03188	274-03188	275-03188	276-03188	289-03188	290-03188	291-03188
		FxUF	1	0.9	0.5	15	20	599-03189	274-03189	275-03189	276-03189	—	—	—
			1.6	1.4	0.5	15	20	599-03190	274-03190	275-03190	276-03190	—	—	—
			2.5	2.2	0.5	15	20	599-03191	274-03191	275-03191	276-03191	—	—	—
			4	3.4	0.5	15	20	599-03192	274-03192	275-03192	276-03192	—	—	—
			6.3	5.4	0.75	20	20	599-03193	274-03193	275-03193	276-03193	—	—	—
			10	8.6	1	25	20	599-03194	274-03194	275-03194	276-03194	289-03194	290-03194	291-03194
		FxUM	1	0.9	0.5	15	20	599-03279	274-03279	275-03279	276-03279	—	—	—
			1.6	1.4	0.5	15	20	599-03280	274-03280	275-03280	276-03280	—	—	—
			2.5	2.2	0.5	15	20	599-03281	274-03281	275-03281	276-03281	—	—	—
			4	3.4	0.5	15	20	599-03282	274-03282	275-03282	276-03282	—	—	—
			6.3	5.4	0.75	20	20	599-03283	274-03283	275-03283	276-03283	—	—	—
			10	8.6	1	25	20	599-03284	274-03284	275-03284	276-03284	289-03284	290-03284	291-03284
		UFxUF	16	14	1.25	32	20	599-03195	274-03195	275-03195	276-03195	289-03195	290-03195	291-03195
			25	22	1.5	40	20	599-03196	274-03196	275-03196	276-03196	289-03196	290-03196	291-03196
			40	34	2	50	20	599-03197	274-03197	275-03197	276-03197	289-03197	290-03197	291-03197
Stainless Steel		FxF	1	0.9	0.5	15	20	599-03126	274-03126	275-03126	276-03126	—	—	—
			1.6	1.4	0.5	15	20	599-03127	274-03127	275-03127	276-03127	—	—	—
			2.5	2.2	0.5	15	20	599-03128	274-03128	275-03128	276-03128	—	—	—
			4	3.4	0.5	15	20	599-03129	274-03129	275-03129	276-03129	—	—	—
			6.3	5.4	0.75	20	20	599-03130	274-03130	275-03130	276-03130	—	—	—
			10	8.6	1	25	20	599-03131	274-03131	275-03131	276-03131	289-03131	290-03131	291-03131
			16	14	1.25	32	20	599-03132	274-03132	275-03132	276-03132	289-03132	290-03132	291-03132
			25	22	1.5	40	20	599-03133	274-03133	275-03133	276-03133	289-03133	290-03133	291-03133
			40	34	2	50	20	599-03134	274-03134	275-03134	276-03134	289-03134	290-03134	291-03134
		FxUF	1	0.9	0.5	15	20	599-03135	276-03135	275-03135	276-03135	—	—	—
			1.6	1.4	0.5	15	20	599-03136	276-03136	275-03136	276-03136	—	—	—
			2.5	2.2	0.5	15	20	599-03137	276-03137	275-03137	276-03137	—	—	—
			4	3.4	0.5	15	20	599-03138	276-03138	275-03138	276-03138	—	—	—
			6.3	5.4	0.75	20	20	599-03139	276-03139	275-03139	276-03139	—	—	—
			10	8.6	1	25	20	599-03140	276-03140	275-03140	276-03140	289-03140	290-03140	291-03140
		FxsUM	1	0.9	0.5	15	20	599-03261	276-03261	275-03261	276-03261	—	—	—
			1.6	1.4	0.5	15	20	599-03262	276-03262	275-03262	276-03262	—	—	—
			2.5	2.2	0.5	15	20	599-03263	276-03263	275-03263	276-03263	—	—	—
			4	3.4	0.5	15	20	599-03264	276-03264	275-03264	276-03264	—	—	—
			6.3	5.4	0.75	20	20	599-03265	276-03265	275-03265	276-03265	—	—	—
			10	8.6	1	25	20	599-03266	276-03266	275-03266	276-03266	289-03266	290-03266	291-03266
		UFxU	16	14	1.25	32	20	599-03141	276-03141	275-03141	276-03141	289-03141	290-03141	291-03141
			25	22	1.5	40	20	599-03142	276-03142	275-03142	276-03142	289-03142	290-03142	291-03142
			40	34	2	50	20	599-03143	276-03143	275-03143	276-03143	289-03143	290-03143	291-03143

* F = Female NPT, UF = Union Female, UM = Union Male connection. — = Special Order, X = Inappropriate combination.

Table 2b. 1/2 to 2-Inch, Two-Way, Normally Closed (NC), Equal Percentage Valves (Technical Instructions 155-184P25), Continued.

Trim	Packing	Connection *	Flow Rate		Line Size		Stroke	Type	Electro-Mechanical						
									24 Vac						
								Description	0-10V 4-20 mA NSR	3-Pos, 120 sec, NSR	3-Pos, 30 sec, NSR	0-10V, Lo, NSR	0-10V, Lo, SR	0-10V, SR	2 2P, SR
								Technical Instructions	155-182P25	155-186P25	155-186P25	155-172P25	155-172P25	155-541P25	155-541P25
								Actuator Assembly	SQX62U	SQX82.00U	SQX82.03U	599-10021	599-10022	599-03609	599--03611
			Cv	Kvs	In	mm		Valve Assembly	Actuator Code 271	Actuator Code 272	Actuator Code 273	Actuator Code 295	Actuator Code 296	Actuator Code 298	Actuator Code 299
Bronze	Standard	FxF	1	0.9	0.5	15	20	599-03180	271-03180	272-03180	273-03180	295-03180	296-03180	298-03180	299-03180
			1.6	1.4	0.5	15	20	599-03181	271-03181	272-03181	273-03181	295-03181	296-03181	298-03181	299-03181
			2.5	2.2	0.5	15	20	599-03182	271-03182	272-03182	273-03182	295-03182	296-03182	298-03182	299-03182
			4	3.4	0.5	15	20	599-03183	271-03183	272-03183	273-03183	295-03183	296-03183	298-03183	299-03183
			6.3	5.4	0.75	20	20	599-03184	271-03184	272-03184	273-03184	295-03184	296-03184	298-03184	299-03184
			10	8.6	1	25	20	599-03185	271-03185	272-03185	273-03185	295-03185	296-03185	298-03185	299-03185
			16	14	1.25	32	20	599-03186	271-03186	272-03186	273-03186	295-03186	296-03186	298-03186	299-03186
			25	22	1.5	40	20	599-03187	271-03187	272-03187	273-03187	295-03187	296-03187	298-03187	299-03187
			40	34	2	50	20	599-03188	271-03188	272-03188	273-03188	295-03188	296-03188	298-03188	299-03188
		FxUF	1	0.9	0.5	15	20	599-03189	271-03189	272-03189	273-03189	295-03189	296-03189	298-03189	299-03189
			1.6	1.4	0.5	15	20	599-03190	271-03190	272-03190	273-03190	295-03190	296-03190	298-03190	299-03190
			2.5	2.2	0.5	15	20	599-03191	271-03191	272-03191	273-03191	295-03191	296-03191	298-03191	299-03191
			4	3.4	0.5	15	20	599-03192	271-03192	272-03192	273-03192	295-03192	296-03192	298-03192	299-03192
			6.3	5.4	0.75	20	20	599-03193	271-03193	272-03193	273-03193	295-03193	296-03193	298-03193	299-03193
			10	8.6	1	25	20	599-03194	271-03194	272-03194	273-03194	295-03194	296-03194	298-03194	299-03194
		FxUM	1	0.9	0.5	15	20	599-03279	271-03279	272-03279	273-03279	295-03279	296-03279	298-03279	299-03279
			1.6	1.4	0.5	15	20	599-03280	271-03280	272-03280	273-03280	295-03280	296-03280	298-03280	299-03280
			2.5	2.2	0.5	15	20	599-03281	271-03281	272-03281	273-03281	295-03281	296-03281	298-03281	299-03281
			4	3.4	0.5	15	20	599-03282	271-03282	272-03282	273-03282	295-03282	296-03282	298-03282	299-03282
			6.3	5.4	0.75	20	20	599-03283	271-03283	272-03283	273-03283	295-03283	296-03283	298-03283	299-03283
			10	8.6	1	25	20	599-03284	271-03284	272-03284	273-03284	295-03284	296-03284	298-03284	299-03284
		UFxUF	16	14	1.25	32	20	599-03195	271-03195	272-03195	273-03195	295-03195	296-03195	298-03195	299-03195
			25	22	1.5	40	20	599-03196	271-03196	272-03196	273-03196	295-03196	296-03196	298-03196	299-03196
			40	34	2	50	20	599-03197	271-03197	272-03197	273-03197	295-03197	296-03197	298-03197	299-03197
Stainless Steel		FxF	1	0.9	0.5	15	20	599-03126	271-03126	272-03126	273-03126	295-03126	296-03126	298-03126	299-03126
			1.6	1.4	0.5	15	20	599-03127	271-03127	272-03127	273-03127	295-03127	296-03127	298-03127	299-03127
			2.5	2.2	0.5	15	20	599-03128	271-03128	272-03128	273-03128	295-03128	296-03128	298-03128	299-03128
			4	3.4	0.5	15	20	599-03129	271-03129	272-03129	273-03129	295-03129	296-03129	298-03129	299-03129
			6.3	5.4	0.75	20	20	599-03130	271-03130	272-03130	273-03130	295-03130	296-03130	298-03130	299-03130
			10	8.6	1	25	20	599-03131	271-03131	272-03131	273-03131	295-03131	296-03131	298-03131	299-03131
			16	14	1.25	32	20	599-03132	271-03132	272-03132	273-03132	295-03132	296-03132	298-03132	299-03132
			25	22	1.5	40	20	599-03133	271-03133	272-03133	273-03133	295-03133	296-03133	298-03133	299-03133
			40	34	2	50	20	599-03134	271-03134	272-03134	273-03134	295-03134	296-03134	298-03134	299-03134
		FxUF	1	0.9	0.5	15	20	599-03135	271-03135	272-03135	273-03135	295-03135	296-03135	298-03135	299-03135
			1.6	1.4	0.5	15	20	599-03136	271-03136	272-03136	273-03136	295-03136	296-03136	298-03136	299-03136
			2.5	2.2	0.5	15	20	599-03137	271-03137	272-03137	273-03137	295-03137	296-03137	298-03137	299-03137
			4	3.4	0.5	15	20	599-03138	271-03138	272-03138	273-03138	295-03138	296-03138	298-03138	299-03138
			6.3	5.4	0.75	20	20	599-03139	271-03139	272-03139	273-03139	295-03139	296-03139	298-03139	299-03139
			10	8.6	1	25	20	599-03140	271-03140	272-03140	273-03140	295-03140	296-03140	298-03140	299-03140
		FxsUM	1	0.9	0.5	15	20	599-03261	271-03261	272-03261	273-03261	295-03261	296-03261	298-03261	299-03261
			1.6	1.4	0.5	15	20	599-03262	271-03262	272-03262	273-03262	295-03262	296-03262	298-03262	299-03262
			2.5	2.2	0.5	15	20	599-03263	271-03263	272-03263	273-03263	295-03263	296-03263	298-03263	299-03263
			4	3.4	0.5	15	20	599-03264	271-03264	272-03264	273-03264	295-03264	296-03264	298-03264	299-03264
			6.3	5.4	0.75	20	20	599-03265	271-03265	272-03265	273-03265	295-03265	296-03265	298-03265	299-03265
			10	8.6	1	25	20	599-03266	271-03266	272-03266	273-03266	295-03266	296-03266	298-03266	299-03266
		UFxU	16	14	1.25	32	20	599-03141	271-03141	272-03141	273-03141	295-03141	296-03141	298-03141	299-03141
			25	22	1.5	40	20	599-03142	271-03142	272-03142	273-03142	295-03142	296-03142	298-03142	299-03142
			40	34	2	50	20	599-03143	271-03143	272-03143	273-03143	295-03143	296-03143	298-03143	299-03143

* F = Female NPT, UF = Union Female, UM = Union Male connection. — = Special Order, X = Inappropriate combination.

Table 3. 1/2 to 2-Inch, Two-Way, Normally Open (NO), Linear Valves (Technical Instructions 155-184P25).

Trim	Packing	Connection *	Flow Rate		Line Size		Stroke	Type	Pneumatic						Pneumatic with Factory Mounted Position Relay		
									4-Inch			8-Inch					
								Description	3-8 psi (21-55 kPa)	5-10 psi (34-69 kPa)	10-15 psi (69-103 kPa)	Standard	8-inch Hi-Temp	12-Inch	8-inch	8-inch Hi-Temp	12-inch with Positioner
								Technical Instructions	155-183P25	155-183P25	155-183P25	155-161P25	155-161P25	155-162P25	155-161P25	155-161P25	155-162P25
								Actuator Assembly	599-01081	599-01082	599-01083	599-01050	599-01051	599-01010	599-01050 and 599-00426	599-01051 and 599-00426	599-01010
			Cv	Kvs	In	mm		Valve Assembly	Actuator Code 268	Actuator Code 269	Actuator Code 270	Actuator Code 277	Actuator Code 278	Actuator Code 279	Actuator Code 283	Actuator Code 284	Actuator Code 285
Stainless Steel	Standard	FxF	1	0.9	0.5	15	20	599-03000	268-03000	—	—	277-03000	—	—	283-03000	—	—
			1.6	1.4	0.5	15	20	599-03001	268-03001	—	—	277-03001	—	—	283-03001	—	—
			2.5	2.2	0.5	15	20	599-03002	268-03002	—	—	277-03002	—	—	283-03002	—	—
			4	3.4	0.5	15	20	599-03003	268-03003	—	—	277-03003	—	—	283-03003	—	—
			6.3	5.4	0.75	20	20	599-03004	268-03004	—	—	277-03004	—	—	283-03004	—	—
			10	8.6	1	25	20	599-03005	268-03005	—	—	277-03005	—	279-03005	283-03005	—	285-03005
			16	14	1.25	32	20	599-03006	268-03006	—	—	277-03006	—	279-03006	283-03006	—	285-03006
			25	22	1.5	40	20	599-03007	268-03007	—	—	277-03007	—	279-03007	283-03007	—	285-03007
			40	34	2	50	20	599-03008	268-03008	—	—	277-03008	—	279-03008	283-03008	—	285-03008
		FxUF	1	0.9	0.5	15	20	599-03009	268-03009	—	—	277-03009	—	—	283-03009	—	—
			1.6	1.4	0.5	15	20	599-03010	268-03010	—	—	277-03010	—	—	283-03010	—	—
			2.5	2.2	0.5	15	20	599-03011	268-03011	—	—	277-03011	—	—	283-03011	—	—
			4	3.4	0.5	15	20	599-03012	268-03012	—	—	277-03012	—	—	283-03012	—	—
			6.3	5.4	0.75	20	20	599-03013	268-03013	—	—	277-03013	—	—	283-03013	—	—
			10	8.6	1	25	20	599-03014	268-03014	—	—	277-03014	—	279-03014	283-03014	—	285-03014
		FxUM	1	0.9	0.5	15	20	599-03216	268-03216	—	—	277-03216	—	—	283-03216	—	—
			1.6	1.4	0.5	15	20	599-03217	268-03217	—	—	277-03217	—	—	283-03217	—	—
			2.5	2.2	0.5	15	20	599-03218	268-03218	—	—	277-03218	—	—	283-03218	—	—
			4	3.4	0.5	15	20	599-03219	268-03219	—	—	277-03219	—	—	283-03219	—	—
			6.3	5.4	0.75	20	20	599-03220	268-03220	—	—	277-03220	—	—	283-03220	—	—
			10	8.6	1	25	20	599-03221	268-03221	—	—	277-03221	—	279-03221	283-03221	—	285-03221
		UFxUF	16	14	1.25	32	20	599-03015	268-03015	—	—	277-03015	—	279-03015	283-03015	—	285-3015
			25	22	1.5	40	20	599-03016	268-03016	—	—	277-03016	—	279-03016	283-03016	—	285-03016
			40	34	2	50	20	599-03017	268-03017	—	—	277-03017	—	279-03017	283-03017	—	285-03017
	Hi-Temp	FxF	1	0.9	0.5	15	20	599-03054	268-03054	—	—	277-03054	278-03054	—	283-03054	284-03054	—
			1.6	1.4	0.5	15	20	599-03055	268-03055	—	—	277-03055	278-03055	—	283-03055	284-03055	—
			2.5	2.2	0.5	15	20	599-03056	268-03056	—	—	277-03056	278-03056	—	283-03056	284-03056	—
			4	3.4	0.5	15	20	599-03057	268-03057	—	—	277-03057	278-03057	—	283-03057	284-03057	—
			6.3	5.4	0.75	20	20	599-03058	268-03058	—	—	277-03058	278-03058	—	283-03058	284-03058	—
			10	8.6	1	25	20	599-03059	268-03059	—	—	277-03059	278-03059	279-03059	283-03059	284-03059	285-03059
			16	14	1.25	32	20	599-03060	268-03060	—	—	277-03060	278-03060	279-03060	283-03060	284-03060	285-03060
			25	22	1.5	40	20	599-03061	268-03061	—	—	277-03061	278-03061	279-03061	283-03061	284-03061	285-03061
			40	34	2	50	20	599-03062	268-03062	—	—	277-03062	278-03062	279-03062	283-03062	284-03062	285-03062
		FxUF	1	0.9	0.5	15	20	599-03063	268-03063	—	—	277-03063	278-03063	—	283-03063	284-03063	—
			1.6	1.4	0.5	15	20	599-03064	268-03064	—	—	277-03064	278-03064	—	283-03064	284-03064	—
			2.5	2.2	0.5	15	20	599-03065	268-03065	—	—	277-03065	278-03065	—	283-03065	284-03065	—
			4	3.4	0.5	15	20	599-03066	268-03066	—	—	277-03066	278-03066	—	283-03066	284-03066	—
			6.3	5.4	0.75	20	20	599-03067	268-03067	—	—	277-03067	278-03067	—	283-03067	284-03067	—
			10	8.6	1	25	20	599-03068	268-03068	—	—	277-03068	278-03068	279-03068	283-03068	284-03068	285-03068
		FxsUM	1	0.9	0.5	15	20	599-03234	268-03234	—	—	277-03234	278-03234	—	283-03234	284-03234	—
			1.6	1.4	0.5	15	20	599-03235	268-03235	—	—	277-03235	278-03235	—	283-03235	284-03235	—
			2.5	2.2	0.5	15	20	599-03236	268-03236	—	—	277-03236	278-03236	—	283-03236	284-03236	—
			4	3.4	0.5	15	20	599-03237	268-03237	—	—	277-03237	278-03237	—	283-03237	284-03237	—
			6.3	5.4	0.75	20	20	599-03238	268-03238	—	—	277-03238	278-03238	—	283-03238	284-03238	—
			10	8.6	1	25	20	599-03239	268-03239	—	—	277-03239	278-03239	279-03239	283-03239	284-03239	285-03239
		UFxUF	16	14	1.25	32	20	599-03069	268-03069	—	—	277-03069	278-03069	279-03069	283-03069	284-03069	285-03069
			25	22	1.5	40	20	599-03070	268-03070	—	—	277-03070	278-03070	279-03070	283-03070	284-03070	285-03070
			40	34	2	50	20	599-03071	268-03071	—	—	277-03071	278-03071	279-03071	283-03071	284-03071	285-03071

* F = Female NPT, UF = Union Female, UM = Union Male connection. = Special Order, X = Inappropriate combination.

Table 3a. 1/2 to 2-Inch, Two-Way, Normally Open (NO), Linear Valves (Technical Instructions 155-184P25), Continued.

Trim	Packing	Connection *	Flow Rate		Line Size		Stroke	Type	Electro-Hydraulic					
									24 Vac					
								Description	0-10V 4-20 mA SR	3-Pos NSR	3-Pos, SR	3-Pos, SR	3-Pos SR	0-10V 4-20 mA SR
								Technical Instructions	155-180P25	155-181P25	155-181P25	155--171P25	155-171P25	155-163P25
								Actuator Assembly	SKD62U	SKD82.50 U	SKD82.51 U	SKB82.51U	SKB82.50U	SKB62U
			Cv	Kvs	in	mm		Valve Assembly	Actuator Code 274	Actuator Code 275	Actuator Code 276	Actuator Code 289	Actuator Code 290	Actuator 291
Stainless Steel	Standard	FxF	1	0.9	0.5	15	20	599-03000	274-03000	275-03000	276-03000	—	—	—
			1.6	1.4	0.5	15	20	599-03001	274-03001	275-03001	276-03001	—	—	—
			2.5	2.2	0.5	15	20	599-03002	274-03002	275-03002	276-03002	—	—	—
			4	3.4	0.5	15	20	599-03003	274-03003	275-03003	276-03003	—	—	—
			6.3	5.4	0.75	20	20	599-03004	274-03004	275-03004	276-03004	—	—	—
			10	8.6	1	25	20	599-03005	274-03005	275-03005	276-03005	289-03005	290-03005	291-03005
			16	14	1.25	32	20	599-03006	274-03006	275-03006	276-03006	289-03006	290-03005	291-03005
			25	22	1.5	40	20	599-03007	274-03007	275-03007	276-03007	289-03007	290-03007	291-03007
			40	34	2	50	20	599-03008	274-03008	275-03008	276-03008	289-03008	290-03008	291-03008
		FxUF	1	0.9	0.5	15	20	599-03009	274-03009	275-03009	276-03009	—	—	—
			1.6	1.4	0.5	15	20	599-03010	274-03010	275-03010	276-03010	—	—	—
			2.5	2.2	0.5	15	20	599-03011	274-03011	275-03011	276-03011	—	—	—
			4	3.4	0.5	15	20	599-03012	274-03012	275-03012	276-03012	—	—	—
			6.3	5.4	0.75	20	20	599-03013	274-03013	275-03013	276-03013	—	—	—
			10	8.6	1	25	20	599-03014	274-03014	275-03014	276-03014	289-03014	290-03014	290-03014
		FxUM	1	0.9	0.5	15	20	599-03216	274-03216	275-03216	276-03216	—	—	—
			1.6	1.4	0.5	15	20	599-03217	274-03217	275-03217	276-03217	—	—	—
			2.5	2.2	0.5	15	20	599-03218	274-03218	275-03218	276-03218	—	—	—
			4	3.4	0.5	15	20	599-03219	274-03219	275-03219	276-03219	—	—	—
			6.3	5.4	0.75	20	20	599-03220	274-03220	275-03220	276-03220	—	—	—
			10	8.6	1	25	20	599-03221	274-03221	275-03221	276-03221	289-03221	290-03221	291-03221
		UFxUF	16	14	1.25	32	20	599-03015	274-03015	275-03015	276-03015	289-03015	290-03015	291-03015
			25	22	1.5	40	20	599-03016	274-03016	275-03016	276-03016	289-03016	290-03016	291-03016
			40	34	2	50	20	599-03017	274-03017	275-03017	276-03017	289-03017	290-03017	291-03017
	Hi-Temp	FxF	1	0.9	0.5	15	20	599-03054	274-03054	275-03054	276-03054	—	—	—
			1.6	1.4	0.5	15	20	599-03055	274-03055	275-03055	276-03055	—	—	—
			2.5	2.2	0.5	15	20	599-03056	274-03056	275-03056	276-03056	—	—	—
			4	3.4	0.5	15	20	599-03057	274-03057	275-03057	276-03057	—	—	—
			6.3	5.4	0.75	20	20	599-03058	274-03058	275-03058	276-03058	—	—	—
			10	8.6	1	25	20	599-03059	274-03059	275-03059	276-03059	289-03059	290-03059	291-03059
			16	14	1.25	32	20	599-03060	274-03060	275-03060	276-03060	289-03060	290-03060	291-03060
			25	22	1.5	40	20	599-03061	274-03061	275-03061	276-03061	289-03061	290-03061	291-03061
			40	34	2	50	20	599-03062	274-03062	275-03062	276-03062	289-06062	290-03062	291-03062
		FxUF	1	0.9	0.5	15	20	599-03063	274-03063	275-03063	276-03063	—	—	—
			1.6	1.4	0.5	15	20	599-03064	274-03064	275-03064	276-03064	—	—	—
			2.5	2.2	0.5	15	20	599-03065	274-03065	275-03065	276-03065	—	—	—
			4	3.4	0.5	15	20	599-03066	274-03066	275-03066	276-03066	—	—	—
			6.3	5.4	0.75	20	20	599-03067	274-03067	275-03067	276-03067	—	—	—
			10	8.6	1	25	20	599-03068	274-03068	275-03068	276-03068	289-03068	290-03068	291-03068
		FxsUM	1	0.9	0.5	15	20	599-03234	274-03234	275-03234	276-03234	—	—	—
			1.6	1.4	0.5	15	20	599-03235	274-03235	275-03235	276-03235	—	—	—
			2.5	2.2	0.5	15	20	599-03236	274-03236	275-03236	276-03236	—	—	—
			4	3.4	0.5	15	20	599-03237	274-03237	275-03237	276-03237	—	—	—
			6.3	5.4	0.75	20	20	599-03238	274-03238	275-03238	276-03238	—	—	—
			10	8.6	1	25	20	599-03239	274-03239	275-03239	276-03239	289-03239	290-03239	291-03239
		UFxU	16	14	1.25	32	20	599-03069	274-03069	275-03069	276-03069	289-03069	290-03069	291-03069
			25	22	1.5	40	20	599-03070	274-03070	275-03070	276-03070	289-03070	290-03070	291-03070
			40	34	2	50	20	599-03071	274-03071	275-03071	276-03071	289-03070	290-03070	291-03070

* F = Female NPT, UF = Union Female, UM = Union Male connection. — = Special Order, X = Inappropriate combination.

Table 3b. 1/2 to 2-Inch, Two-Way, Normally Open (NO), Linear Valves (Technical Instructions 155-184P25), Continued.

Trim	Packing	Connection *	Flow Rate		Line Size		Stroke	Type	Electro-Mechanical						
									24 Vac						
								Description	0-10V 4-20 mA NSR	3-Pos, 120 sec, NSR	3-Pos, 30 sec, NSR	0-10V, Lo, NSR	0-10V, Lo, SR	0-10V, SR	2-Pos, SR
								Technical Instructions	155-182P25	155-186P25	155-186P25	155-172P25	155-172P25	155-541P25	155-541P25
								Actuator Assembly	SQX62U	SQX82.00U	SQX82.03U	599-10021	599-10022	599-03609	599-03611
			Cv	Kvs	In	mm		Valve Assembly	Actuator Code 271	Actuator Code 272	Actuator Code 273	Actuator Code 295	Actuator Code 296	Actuator Code 298	Actuator Code 299
Stainless Steel	Standard	FxF	1	0.9	0.5	15	20	599-03000	271-03000	272-03000	273-03000	295-03000	296-03000	298-03000	299-03000
			1.6	1.4	0.5	15	20	599-03001	271-03001	272-03001	273-03001	295-03001	296-03001	298-03001	299-03001
			2.5	2.2	0.5	15	20	599-03002	271-03002	272-03002	273-03002	295-03002	296-03002	298-03002	299-03002
			4	3.4	0.5	15	20	599-03003	271-03003	272-03003	273-03003	295-03003	296-03003	298-03003	299-03003
			6.3	5.4	0.75	20	20	599-03004	271-03004	272-03004	273-03004	295-03004	296-03004	298-03004	299-03004
			10	8.6	1	25	20	599-03005	271-03005	272-03005	273-03005	295-03005	296-03005	298-03005	299-03005
			16	14	1.25	32	20	599-03006	271-03006	272-03006	273-03006	295-03006	296-03006	298-03006	299-03006
			25	22	1.5	40	20	599-03007	271-03007	272-03007	273-03007	295-03007	296-03007	298-03007	299-03007
			40	34	2	50	20	599-03008	271-03008	272-03008	273-03008	295-03008	296-03008	298-03008	299-03008
		FxUF	1	0.9	0.5	15	20	599-03009	271-03009	272-03009	273-03009	295-03009	296-03009	298-03009	299-03009
			1.6	1.4	0.5	15	20	599-03010	271-03010	272-03010	273-03010	295-03010	296-03010	298-03010	299-03010
			2.5	2.2	0.5	15	20	599-03011	271-03011	272-03011	273-03011	295-03011	296-03011	298-03011	299-03011
			4	3.4	0.5	15	20	599-03012	271-03012	272-03012	273-03012	295-03012	296-03012	298-03012	299-03012
			6.3	5.4	0.75	20	20	599-03013	271-03013	272-03013	273-03013	295-03013	296-03013	298-03013	299-03013
			10	8.6	1	25	20	599-03014	271-03014	272-03014	273-03014	295-03014	296-03014	298-03014	299-03014
		FxUM	1	0.9	0.5	15	20	599-03216	271-03216	272-03216	273-03216	295-03216	296-03216	298-03216	299-03216
			1.6	1.4	0.5	15	20	599-03217	271-03217	272-03217	273-03217	295-03217	296-03217	298-03217	299-03217
			2.5	2.2	0.5	15	20	599-03218	271-03218	272-03218	273-03218	295-03218	296-03218	298-03218	299-03218
			4	3.4	0.5	15	20	599-03219	271-03219	272-03219	273-03219	295-03219	296-03219	298-03219	299-03219
			6.3	5.4	0.75	20	20	599-03220	271-03220	272-03220	273-03220	295-03220	296-03220	298-03220	299-03220
			10	8.6	1	25	20	599-03221	271-03221	272-03221	273-03221	295-03221	296-03221	298-03221	299-03221
		UFxUF	16	14	1.25	32	20	599-03015	271-03015	272-03015	273-03015	295-03015	296-03015	298-03015	299-03015
			25	22	1.5	40	20	599-03016	271-03016	272-03016	273-03016	295-03016	296-03016	298-03016	299-03016
			40	34	2	50	20	599-03017	271-03017	272-03017	273-03017	295-03017	296-03017	298-03017	299-03017
	Hi-Temp	FxF	1	0.9	0.5	15	20	599-03054	271-03054	272-03054	273-03054	295-03054	296-03054	298-03054	299-03054
			1.6	1.4	0.5	15	20	599-03055	271-03055	272-03055	273-03055	295-03055	296-03055	298-03055	299-03055
			2.5	2.2	0.5	15	20	599-03056	271-03056	272-03056	273-03056	295-03056	296-03056	298-03056	299-03056
			4	3.4	0.5	15	20	599-03057	271-03057	272-03057	273-03057	295-03057	296-03057	298-03057	299-03057
			6.3	5.4	0.75	20	20	599-03058	271-03058	272-03058	273-03058	295-03058	296-03058	298-03058	299-03058
			10	8.6	1	25	20	599-03059	271-03059	272-03059	273-03059	295-03059	296-03059	298-03059	299-03059
			16	14	1.25	32	20	599-03060	271-03060	272-03060	273-03060	295-03060	296-03060	298-03060	299-03060
			25	22	1.5	40	20	599-03061	271-03061	272-03061	273-03061	295-03061	296-03061	298-03061	299-03061
			40	34	2	50	20	599-03062	271-03062	272-03062	273-03062	295-03062	296-03062	298-03062	299-03062
		FxUF	1	0.9	0.5	15	20	599-03063	271-03063	272-03063	273-03063	295-03063	296-03063	298-03063	299-03063
			1.6	1.4	0.5	15	20	599-03064	271-03064	272-03064	273-03064	295-03064	296-03064	298-03064	299-03064
			2.5	2.2	0.5	15	20	599-03065	271-03065	272-03065	273-03065	295-03065	296-03065	298-03065	299-03065
			4	3.4	0.5	15	20	599-03066	271-03066	272-03066	273-03066	295-03066	296-03066	298-03066	299-03066
			6.3	5.4	0.75	20	20	599-03067	271-03067	272-03067	273-03067	295-03067	296-03067	298-03067	299-03067
			10	8.6	1	25	20	599-03068	271-03068	272-03068	273-03068	295-03068	296-03068	298-03068	299-03068
		FxsUM	1	0.9	0.5	15	20	599-03234	271-03234	272-03234	273-03234	295-03234	296-03234	298-03234	299-03234
			1.6	1.4	0.5	15	20	599-03235	271-03235	272-03235	273-03235	295-03235	296-03235	298-03235	299-03235
			2.5	2.2	0.5	15	20	599-03236	271-03236	272-03236	273-03236	295-03236	296-03236	298-03236	299-03236
			4	3.4	0.5	15	20	599-03237	271-03237	272-03237	273-03237	295-03237	296-03237	298-03237	299-03237
			6.3	5.4	0.75	20	20	599-03238	271-03238	272-03238	273-03238	295-03238	296-03238	298-03238	299-03238
			10	8.6	1	25	20	599-03239	271-03239	272-03239	273-03239	295-03239	296-03239	298-03239	299-03239
		UFxU	16	14	1.25	32	20	599-03069	271-03069	272-03069	273-03069	295-03069	296-03069	298-03069	299-03069
			25	22	1.5	40	20	599-03070	271-03070	272-03070	273-03070	295-03070	296-03070	298-03070	299-03070
			40	34	2	50	20	599-03071	271-03071	272-03071	273-03071	295-03071	296-03071	298-03071	299-03071

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* F = Female NPT, UF = Union Female, UM = Union Male connection. — = Special Order, X = Inappropriate combination.

Table 4. 1/2 to 2-Inch, Two-Way, Normally Open (NO), Equal Percentage Valves (Technical Instructions 155-184P25).

Trim	Packing	Connection *	Flow Rate		Line Size		Stroke	Type	Pneumatic						Pneumatic with Factory Mounted Position Relay		
								Description	4-inch 3-8 psi (21-55 kPa)	4-inch 5-10 psi (34-69 kPa)	4-inch 10-15 psi (69-103 kPa)	8-inch	8-inch Hi-Temp	12-inch	8-inch	8-inch HI-Temp	12-inch with Positioner
								Technical Instructions	155-183P25	155-183P25	155-183P25	155-161P25	155-161P25	144-162P25	155-161P25	155-161P25	155-162P25
								Actuator Assembly	599-01081	599-01082	599-01083	599-01050	599-01051	599-01010	599-01050	599-01051	599-01010
			Cv	Kvs	In	mm		Valve Assembly	Actuator Code 268	Actuator Code 269	Actuator Code 270	Actuator Code 277	Actuator Code 278	Actuator Code 279	Actuator Code 283	Actuator Code 284	Actuator Code 285
Bronze	Standard	FxF	1	0.9	0.5	15	20	599-03162	268-03162	—	—	277-03162	—		—	283-03162	—
			1.6	1.4	0.5	15	20	599-03163	268-03163	—	—	277-03163	—		—	283-03163	—
			2.5	2.2	0.5	15	20	599-03164	268-03164	—	—	277-03164	—		—	283-03164	—
			4	3.4	0.5	15	20	599-03165	268-03165	—	—	277-03165	—		—	283-03165	—
			6.3	5.4	0.75	20	20	599-03166	268-03166	—	—	277-03166	—		—	283-03166	—
			10	8.6	1	25	20	599-03167	268-03167	—	—	277-03167	—	279-03167	—	283-03167	285-03167
			16	14	1.25	32	20	599-03168	268-03168	—	—	277-03168	—	279-03168	—	283-03168	285-03168
			25	22	1.5	40	20	599-03169	268-03169	—	—	277-03169	—	279-03169	—	283-03169	285-03169
			40	34	2	50	20	599-03170	268-03170	—	—	277-03170	—	279-03170	—	283-03170	285-03170
		FxUF	1	0.9	0.5	15	20	599-03171	268-03171	—	—	277-03171	—	—	—	283-03171	—
			1.6	1.4	0.5	15	20	599-03172	268-03172	—	—	277-03172	—	—	—	283-03172	—
			2.5	2.2	0.5	15	20	599-03173	268-03173	—	—	277-03173	—	—	—	283-03173	—
			4	3.4	0.5	15	20	599-03174	268-03174	—	—	277-03174	—	—	—	283-03174	—
			6.3	5.4	0.75	20	20	599-03175	268-03175	—	—	277-03175	—	—	—	283-03175	—
			10	8.6	1	25	20	599-03176	268-03176	—	—	277-03176	—	279-03176	—	283-03176	285-03176
		FxUM	1	0.9	0.5	15	20	599-03270	268-03270	—	—	277-03270	—	—	—	283-03270	—
			1.6	1.4	0.5	15	20	599-03271	268-03271	—	—	277-03271	—	—	—	283-03271	—
			2.5	2.2	0.5	15	20	599-03272	268-03272	—	—	277-03272	—	—	—	283-03272	—
			4	3.4	0.5	15	20	599-03273	268-03273	—	—	277-03273	—	—	—	283-03273	—
			6.3	5.4	0.75	20	20	599-03274	268-03274	—	—	277-03274	—	—	—	283-03274	—
			10	8.6	1	25	20	599-03275	268-03275	—	—	277-03275	—	279-03275	—	283-03275	285-03275
			16	13.8	1.25	32	20	599-03276	268-03276	—	—	277-03276	—	279-03276	—	283-03276	285-03276
		UFxU	16	14	1.25	32	20	599-03177	268-03177	—	—	277-03177	—	279-03177	—	283-03177	285-03177
			25	22	1.5	40	20	599-03178	268-03178	—	—	277-03178	—	279-03178	—	283-03178	285-03178
			40	34	2	50	20	599-03179	268-03179	—	—	277-03179	—	279-03179	—	283-03179	285-03179
Stainless Steel		FxF	1	0.9	0.5	15	20	599-03108	268-03108	—	—	277-03108	—	—	—	283-03108	—
			1.6	1.4	0.5	15	20	599-03109	268-03109	—	—	277-03109	—	—	—	283-03109	—
			2.5	2.2	0.5	15	20	599-03110	268-03110	—	—	277-03110	—	—	—	283-03110	—
			4	3.4	0.5	15	20	599-03111	268-03111	—	—	277-03111	—	—	—	283-03111	—
			6.3	5.4	0.75	20	20	599-03112	268-03112	—	—	277-03112	—	—	—	283-03112	—
			10	8.6	1	25	20	599-03113	268-03113	—	—	277-03113	—	279-03113	—	283-03113	285-03113
			16	14	1.25	32	20	599-03114	268-03114	—	—	277-03114	—	279-03114	—	283-03114	285-03114
			25	22	1.5	40	20	599-03115	268-03115	—	—	277-03115	—	279-03115	—	283-03115	285-03115
			40	34	2	50	20	599-03116	268-03116	—	—	277-03116	—	279-03116	—	283-03116	285-03116
		FxUF	1	0.9	0.5	15	20	599-03117	268-03117	—	—	277-03117	—	—	—	283-03117	—
			1.6	1.4	0.5	15	20	599-03118	268-03118	—	—	277-03118	—	—	—	283-03118	—
			2.5	2.2	0.5	15	20	599-03119	268-03119	—	—	277-03119	—	—	—	283-03119	—
			4	3.4	0.5	15	20	599-03120	268-03120	—	—	277-03120	—	—	—	283-03120	—
			6.3	5.4	0.75	20	20	599-03121	268-03121	—	—	277-03121	—	—	—	283-03121	—
			10	8.6	1	25	20	599-03122	268-03122	—	—	277-03122	—	279-03122	—	283-03122	285-03122
		FxsUM	1	0.9	0.5	15	20	599-03252	268-03252	—	—	277-03252	—	—	—	283-03252	—
			1.6	1.4	0.5	15	20	599-03253	268-03253	—	—	277-03253	—	—	—	283-03253	—
			2.5	2.2	0.5	15	20	599-03254	268-03254	—	—	277-03254	—	—	—	283-03254	—
			4	3.4	0.5	15	20	599-03255	268-03255	—	—	277-03255	—	—	—	283-03255	—
			6.3	5.4	0.75	20	20	599-03256	268-03256	—	—	277-03256	—	—	—	283-03256	—
			10	8.6	1	25	20	599-03257	268-03257	—	—	277-03257	—	279-03257	—	283-03257	285-03257
		UFxU	16	14	1.25	32	20	599-03123	268-03123	—	—	277-03123	—	279-03123	—	283-03123	285-03123
			25	22	1.5	40	20	599-03124	268-03124	—	—	277-03124	—	279-03124	—	283-03124	285-03124
			40	34	2	50	20	599-03125	268-03125	—	—	277-03125	—	279-03125	—	283-03125	285-03125

* F = Female NPT, UF = Union Female, UM = Union Male connection. — = Special Order, X = Inappropriate combination.

Table 4a. 1/2 to 2-Inch, Two-Way, Normally Open (NO), Equal Percentage Valves (Technical Instructions 155-184P25), Continued. Bronze Stainless

Packing	Connection *	Flow Rate		Line Size		Stroke	Type	Electro-Hydraulic			Electro-Mechanical						
							Description	24V, 0-10V 4-20 mA SR	24V, 3P NSR	24V, 3P, SR	24V, 0-10V 4-20mA NSR	24V, 3P, 120 sec., NSR	24V, 3P, 30 sec, NSR	24V, 0-10V, Lo, NSR	24V, 0-10V, Lo, SR	24V, 0-10V, SR	24V, 2P, SR
							Technical Instructions	155-180P25	155-181P25	155-181P25	155-182P25	155-186P25	155-186P25	155-172P25	155-172P25	155-541P25	155-541P25
							Actuator Assembly	SKD62U	SKD82.50 U	SKD82.51 U	SQX62U	SQX82.00U	SQX82.03U	599-10021	599-10022	599-03609	599--03611
		Cv	Kvs	In	mm		Valve Assembly	Actuator Code 274	Actuator Code 275	Actuator Code 276	Actuator Code 271	Actuator Code 272	Actuator Code 273	Actuator Code 295	Actuator Code 296	Actuator Code 298	Actuator Code 299
Standard	FxF	1	0.9	0.5	15	20	599-03162	274-03162	275-03162	276-03162	271-03162	272-03162	273-03162	295-03162	296-03162	298-03162	299-03162
		1.6	1.4	0.5	15	20	599-03163	274-03163	275-03163	276-03163	271-03163	272-03163	273-03163	295-03163	296-03163	298-03163	299-03163
		2.5	2.2	0.5	15	20	599-03164	274-03164	275-03164	276-03164	271-03164	272-03164	273-03164	295-03164	296-03164	298-03164	299-03164
		4	3.4	0.5	15	20	599-03165	274-03165	275-03165	276-03165	271-03165	272-03165	273-03165	295-03165	296-03165	298-03165	299-03165
		6.3	5.4	0.75	20	20	599-03166	274-03166	275-03166	276-03166	271-03166	272-03166	273-03166	295-03166	296-03166	298-03166	299-03166
		10	8.6	1	25	20	599-03167	274-03167	275-03167	276-03167	271-03167	272-03167	273-03167	295-03167	296-03167	298-03167	299-03167
		16	14	1.25	32	20	599-03168	274-03168	275-03168	276-03168	271-03168	272-03168	273-03168	295-03168	296-03168	298-03168	299-03168
		25	22	1.5	40	20	599-03169	274-03169	275-03169	276-03169	271-03169	272-03169	273-03169	295-03169	296-03169	298-03169	299-03169
		40	34	2	50	20	599-03170	274-03170	275-03170	276-03170	271-03170	272-03170	273-03170	295-03170	296-03170	298-03170	299-03170
	FxUF	1	0.9	0.5	15	20	599-03171	274-03171	275-03171	276-03171	271-03171	272-03171	273-03171	295-03171	296-03171	298-03171	299-03171
		1.6	1.4	0.5	15	20	599-03172	274-03172	275-03172	276-03172	271-03172	272-03172	273-03172	295-03172	296-03172	298-03172	299-03172
		2.5	2.2	0.5	15	20	599-03173	274-03173	275-03173	276-03173	271-03173	272-03173	273-03173	295-03173	296-03173	298-03173	299-03173
		4	3.4	0.5	15	20	599-03174	274-03174	275-03174	276-03174	271-03174	272-03174	273-03174	295-03174	296-03174	298-03174	299-03174
		6.3	5.4	0.75	20	20	599-03175	274-03175	275-03175	276-03175	271-03175	272-03175	273-03175	295-03175	296-03175	298-03175	299-03175
		10	8.6	1	25	20	599-03176	274-03176	275-03176	276-03176	271-03176	272-03176	273-03176	295-03176	296-03176	298-03176	299-03176
	FxUM	1	0.9	0.5	15	20	599-03270	274-03270	275-03270	276-03270	271-03270	272-03270	273-03270	295-03270	296-03270	298-03270	299-03270
		1.6	1.4	0.5	15	20	599-03271	274-03271	275-03271	276-03271	271-03271	272-03271	273-03271	295-03271	296-03271	298-03271	299-03271
		2.5	2.2	0.5	15	20	599-03272	274-03272	275-03272	276-03272	271-03272	272-03272	273-03272	295-03272	296-03272	298-03272	299-03272
		4	3.4	0.5	15	20	599-03273	274-03273	275-03273	276-03273	271-03273	272-03273	273-03273	295-03273	296-03273	298-03273	299-03273
		6.3	5.4	0.75	20	20	599-03274	274-03274	275-03274	276-03274	271-03274	272-03274	273-03274	295-03274	296-03274	298-03274	299-03274
		10	8.6	1	25	20	599-03275	274-03275	275-03275	276-03275	271-03275	272-03275	273-03275	295-03275	296-03275	298-03275	299-03275
		16	13.8	1.25	32	20	599-03276	274-03276	275-03276	276-03276	271-03276	272-03276	273-03276	295-03276	296-03276	298-03276	299-03276
	UFxUF	16	14	1.25	32	20	599-03177	274-03177	275-03177	276-03177	271-03177	272-03177	273-03177	295-03177	296-03177	298-03177	299-03177
		25	22	1.5	40	20	599-03178	274-03178	275-03178	276-03178	271-03178	272-03178	273-03178	295-03178	296-03178	298-03178	299-03178
		40	34	2	50	20	599-03179	274-03179	275-03179	276-03179	271-03179	272-03179	273-03179	295-03179	296-03179	298-03179	299-03179
	FxF	1	0.9	0.5	15	20	599-03108	274-03108	275-03108	276-03108	271-03108	272-03108	273-03108	295-03108	296-03108	298-03108	299-03108
		1.6	1.4	0.5	15	20	599-03109	274-03109	275-03109	276-03109	271-03109	272-03109	273-03109	295-03109	296-03109	298-03109	299-03109
		2.5	2.2	0.5	15	20	599-03110	274-03110	275-03110	276-03110	271-03110	272-03110	273-03110	295-03110	296-03110	298-03110	299-03110
		4	3.4	0.5	15	20	599-03111	274-03111	275-03111	276-03111	271-03111	272-03111	273-03111	295-03111	296-03111	298-03111	299-03111
		6.3	5.4	0.75	20	20	599-03112	274-03112	275-03112	276-03112	271-03112	272-03112	273-03112	295-03112	296-03112	298-03112	299-03112
		10	8.6	1	25	20	599-03113	274-03113	275-03113	276-03113	271-03113	272-03113	273-03113	295-03113	296-03113	298-03113	299-03113
		16	14	1.25	32	20	599-03114	274-03114	275-03114	276-03114	271-03114	272-03114	273-03114	295-03114	296-03114	298-03114	299-03114
		25	22	1.5	40	20	599-03115	274-03115	275-03115	276-03115	271-03115	272-03115	273-03115	295-03115	296-03115	298-03115	299-03115
		40	34	2	50	20	599-03116	274-03116	275-03116	276-03116	271-03116	272-03116	273-03116	295-03116	296-03116	298-03116	299-03116
	FxUF	1	0.9	0.5	15	20	599-03117	274-03117	275-03117	276-03117	271-03117	272-03117	273-03117	295-03117	296-03117	298-03117	299-03117
		1.6	1.4	0.5	15	20	599-03118	274-03118	275-03118	276-03118	271-03118	272-03118	273-03118	295-03118	296-03118	298-03118	299-03118
		2.5	2.2	0.5	15	20	599-03119	274-03119	275-03119	276-03119	271-03119	272-03119	273-03119	295-03119	296-03119	298-03119	299-03119
		4	3.4	0.5	15	20	599-03120	274-03120	275-03120	276-03120	271-03120	272-03120	273-03120	295-03120	296-03120	298-03120	299-03120
		6.3	5.4	0.75	20	20	599-03121	274-03121	275-03121	276-03121	271-03121	272-03121	273-03121	295-03121	296-03121	298-03121	299-03121
		10	8.6	1	25	20	599-03122	274-03122	275-03122	276-03122	271-03122	272-03122	273-03122	295-03122	296-03122	298-03122	299-03122
	FxUM	1	0.9	0.5	15	20	599-03252	274-03252	275-03252	276-03252	271-03252	272-03252	273-03252	295-03252	296-03252	298-03252	299-03252
		1.6	1.4	0.5	15	20	599-03253	274-03253	275-03253	276-03253	271-03253	272-03253	273-03253	295-03253	296-03253	298-03253	299-03253
		2.5	2.2	0.5	15	20	599-03254	274-03254	275-03254	276-03254	271-03254	272-03254	273-03254	295-03254	296-03254	298-03254	299-03254
		4	3.4	0.5	15	20	599-03255	274-03255	275-03255	276-03255	271-03255	272-03255	273-03255	295-03255	296-03255	298-03255	299-03255
		6.3	5.4	0.75	20	20	599-03256	274-03256	275-03256	276-03256	271-03256	272-03256	273-03256	295-03256	296-03256	298-03256	299-03256
		10	8.6	1	25	20	599-03257	274-03257	275-03257	276-03257	271-03257	272-03257	273-03257	295-03257	296-03257	298-03257	299-03257
	UFxUF	16	14	1.25	32	20	599-03123	274-03123	275-03123	276-03123	271-03123	272-03123	273-03123	295-03123	296-03123	298-03123	299-03123
		25	22	1.5	40	20	599-03124	274-03124	275-03124	276-03124	271-03124	272-03124	273-03124	295-03124	296-03124	298-03124	299-03124
		40	34	2	50	20	599-03125	274-03125	275-03125	276-03125	271-03125	272-03125	273-03125	295-03125	296-03125	298-03125	299-03125

* F = Female NPT, UF = Union Female, UM = Union Male connection. — = Special Order, X = Inappropriate combination.

Table 5. 1/2 to 2-Inch Three-Way Valves (Equal Percentage NC/Linear NO) (Technical Instructions 155-185P25).

Trim	Packing	Connection *	Flow Rate		Line Size		Stroke	Type	Pneumatic					Pneumatic with Factory Mounted Position Relay	
								Description	4-inch 3-8 psi (21-55 kPa)	4-inch 5-10 psi (34-69 kPa)	4-inch 10-15 psi (69-103 kPa)	8-inch	8-inch Hi-Temp	8-inch	8-inch Hi-Temp
								Technical Instructions	155-183P25	155-183P25	155-183P25	155-161P25	155-161P25	155-161P25	155-161P25
								Actuator Assembly	599-01081	599-01082	599-01083	599-01050	599-01051	599-01050	599-01051
			Cv	Kvs	In	mm		Valve Assembly	Actuator Code 268	Actuator Code 269	Actuator Code 270	Actuator Code 277	Actuator Code 278	Actuator Code 283	Actuator Code 284
Bronze	Standard	FxF	1	0.9	0.5	15	20	599-03198	268-03198	269-03198	270-03198	277-03198	—	283-03198	—
			1.6	1.4	0.5	15	20	599-03199	268-03199	269-03199	270-03199	277-03199	—	283-03199	—
			2.5	2.2	0.5	15	20	599-03200	268-03200	269-03200	270-03200	277-03200	—	283-03200	—
			4	3.4	0.5	15	20	599-03201	268-03201	269-03201	270-03201	277-03201	—	283-03201	—
			6.3	5.4	0.75	20	20	599-03202	268-03202	269-03202	270-03202	277-03202	—	283-03202	—
			10	8.6	1	25	20	599-03203	268-03203	269-03203	270-03203	277-03203	—	283-03203	—
			16	14	1.25	32	20	599-03204	268-03204	269-03204	270-03204	277-03204	—	283-03204	—
			25	22	1.5	40	20	599-03205	268-03205	269-03205	270-03205	277-03205	—	283-03205	—
			40	34	2	50	20	599-03206	268-03206	269-03206	270-03206	277-03206	—	283-03206	—
		UFxUF	1	0.9	0.5	15	20	599-03207	268-03207	269-03207	270-03207	277-03207	—	283-03207	—
			1.6	1.4	0.5	15	20	599-03208	268-03208	269-03208	270-03208	277-03208	—	283-03208	—
			2.5	2.2	0.5	15	20	599-03209	268-03209	269-03209	270-03209	277-03209	—	283-03209	—
			4	3.4	0.5	15	20	599-03210	268-03210	269-03210	270-03210	277-03210	—	283-03210	—
			6.3	5.4	0.75	20	20	599-03211	268-03211	269-03211	270-03211	277-03211	—	283-03211	—
			10	8.6	1	25	20	599-03212	268-03212	269-03212	270-03212	277-03212	—	283-03212	—
			16	14	1.25	32	20	599-03213	268-03213	269-03213	270-03213	277-03213	—	283-03213	—
			25	22	1.5	40	20	599-03214	268-03214	269-03214	270-03214	277-03214	—	283-03214	—
			40	34	2	50	20	599-03215	268-03215	269-03215	270-03215	277-03215	—	283-03215	—
Stainless Steel		FxF	1	0.9	0.5	15	20	599-03144	268-03144	269-03144	270-03144	277-03144	—	283-03144	—
			1.6	1.4	0.5	15	20	599-03145	268-03145	269-03145	270-03145	277-03145	—	283-03145	—
			2.5	2.2	0.5	15	20	599-03146	268-03146	269-03146	270-03146	277-03146	—	283-03146	—
			4	3.4	0.5	15	20	599-03147	268-03147	269-03147	270-03147	277-03147	—	283-03147	—
			6.3	5.4	0.75	20	20	599-03148	268-03148	269-03148	270-03148	277-03148	—	283-03148	—
			10	8.6	1	25	20	599-03149	268-03149	269-03149	270-03149	277-03149	—	283-03149	—
			16	14	1.25	32	20	599-03150	268-03150	269-03150	270-03150	277-03150	—	283-03150	—
			25	22	1.5	40	20	599-03151	268-03151	269-03151	270-03151	277-03151	—	283-03151	—
			40	34	2	50	20	599-03152	268-03152	269-03152	270-03152	277-03152	—	283-03152	—
		UFxUF	1	0.9	0.5	15	20	599-03153	268-03153	269-03153	270-03153	277-03153	—	283-03153	—
			1.6	1.4	0.5	15	20	599-03154	268-03154	269-03154	270-03154	277-03154	—	283-03154	—
			2.5	2.2	0.5	15	20	599-03155	268-03155	269-03155	270-03155	277-03155	—	283-03155	—
			4	3.4	0.5	15	20	599-03156	268-03156	269-03156	270-03156	277-03156	—	283-03156	—
			6.3	5.4	0.75	20	20	599-03157	268-03157	269-03157	270-03157	277-03157	—	283-03157	—
			10	8.6	1	25	20	599-03158	268-03158	269-03158	270-03158	277-03158	—	283-03158	—
			16	14	1.25	32	20	599-03159	268-03159	269-03159	270-03159	277-03159	—	283-03159	—
			25	22	1.5	40	20	599-03160	268-03160	269-03160	270-03160	277-03160	—	283-03160	—
			40	34	2	50	20	599-03161	268-03161	269-03161	270-03161	277-03161	—	283-03161	—

* F = Female NPT, UF = Union Female, UM = Union Male connection, — = Special Order, X = Inappropriate combination.

Table 5a. 1/2 to 2-Inch Three-Way Valves (Equal Percentage NC/Linear NO) (Technical Instructions 155-185P25), Continued.

Trim	Packing	Connection *	Flow Rate		Line Size		Stroke	Type	Electro-Hydraulic			Electro-Mechanical						
								Description	24V, 0-10V 4-20mA SR	24V, 3P NSR	24V, 3P, SR	24V, 0-10V 4-20mA NSR	24V, 3P, 120 sec., NSR	24V, 3P, 30 sec, NSR	24V, 0-10V, Lo, NSR	24V, 0-10V, Lo, SR	24V, 0-10V, SR	24V, 2P, SR
								Technical Instructions	155-180P25	155-181P25	155-181P25	155-182P25	155-186P25	155-186P25	155-172P25	155-172P25	155-541P25	155-541P25
								Actuator Assembly	SKD62U	SKD82.50 U	SKD82.51 U	SQX62U	SQX82.00U	SQX82.03U	599-10021	599-10022	599-03609	599--03611
			Cv	Kvs	In	mm		Valve Assembly	Actuator Code 274	Actuator Code 275	Actuator Code 276	Actuator Code 271	Actuator Code 272	Actuator Code 273	Actuator Code 295	Actuator Code 296	Actuator Code 298	Actuator Code 299
Bronze	Standard	FxF	1	0.9	0.5	15	20	599-03198	274-03198	275-03198	276-03198	271-03198	272-03198	273-03198	295-03198	296-03198	298-03198	299-03198
			1.6	1.4	0.5	15	20	599-03199	274-03199	275-03199	276-03199	271-03199	272-03199	273-03199	295-03199	296-03199	298-03199	299-03199
			2.5	2.2	0.5	15	20	599-03200	274-03200	275-03200	276-03200	271-03200	272-03200	273-03200	295-03200	296-03200	298-03200	299-03200
			4	3.4	0.5	15	20	599-03201	274-03201	275-03201	276-03201	271-03201	272-03201	273-03201	295-03201	296-03201	298-03201	299-03201
			6.3	5.4	0.75	20	20	599-03202	274-03202	275-03202	276-03202	271-03202	272-03202	273-03202	295-03202	296-03202	298-03202	299-03202
			10	8.6	1	25	20	599-03203	274-03203	275-03203	276-03203	271-03203	272-03203	273-03203	295-03203	296-03203	298-03203	299-03203
			16	14	1.25	32	20	599-03204	274-03204	275-03204	276-03204	271-03204	272-03204	273-03204	295-03204	296-03204	298-03204	299-03204
			25	22	1.5	40	20	599-03205	274-03205	275-03205	276-03205	271-03205	272-03205	273-03205	295-03205	296-03205	298-03205	299-03205
			40	34	2	50	20	599-03206	274-03206	275-03206	276-03206	271-03206	272-03206	273-03206	295-03206	296-03206	298-03206	299-03206
		UFxUF	1	0.9	0.5	15	20	599-03207	274-03207	275-03207	276-03207	271-03207	272-03207	273-03207	295-03207	296-03207	298-03207	299-03207
			1.6	1.4	0.5	15	20	599-03208	274-03208	275-03208	276-03208	271-03208	272-03208	273-03208	295-03208	296-03208	298-03208	299-03208
			2.5	2.2	0.5	15	20	599-03209	274-03209	275-03209	276-03209	271-03209	272-03209	273-03209	295-03209	296-03209	298-03209	299-03209
			4	3.4	0.5	15	20	599-03210	274-03210	275-03210	276-03210	271-03210	272-03210	273-03210	295-03210	296-03210	298-03210	299-03210
			6.3	5.4	0.75	20	20	599-03211	274-03211	275-03211	276-03211	271-03211	272-03211	273-03211	295-03211	296-03211	298-03211	299-03211
			10	8.6	1	25	20	599-03212	274-03212	275-03212	276-03212	271-03212	272-03212	273-03212	295-03212	296-03212	298-03212	299-03212
			16	14	1.25	32	20	599-03213	274-03213	275-03213	276-03213	271-03213	272-03213	273-03213	295-03213	296-03213	298-03213	299-03213
			25	22	1.5	40	20	599-03214	274-03214	275-03214	276-03214	271-03214	272-03214	273-03214	295-03214	296-03214	298-03214	299-03214
			40	34	2	50	20	599-03215	274-03215	275-03215	276-03215	271-03215	272-03215	273-03215	295-03215	296-03215	298-03215	299-03215
Stainless Steel		FxF	1	0.9	0.5	15	20	599-03144	274-03144	275-03144	276-03144	271-03144	272-03144	273-03144	295-03144	296-03144	298-03144	299-03144
			1.6	1.4	0.5	15	20	599-03145	274-03145	275-03145	276-03145	271-03145	272-03145	273-03145	295-03145	296-03145	298-03145	299-03145
			2.5	2.2	0.5	15	20	599-03146	274-03146	275-03146	276-03146	271-03146	272-03146	273-03146	295-03146	296-03146	298-03146	299-03146
			4	3.4	0.5	15	20	599-03147	274-03147	275-03147	276-03147	271-03147	272-03147	273-03147	295-03147	296-03147	298-03147	299-03147
			6.3	5.4	0.75	20	20	599-03148	274-03148	275-03148	276-03148	271-03148	272-03148	273-03148	295-03148	296-03148	298-03148	299-03148
			10	8.6	1	25	20	599-03149	274-03149	275-03149	276-03149	271-03149	272-03149	273-03149	295-03149	296-03149	298-03149	299-03149
			16	14	1.25	32	20	599-03150	274-03150	275-03150	276-03150	271-03150	272-03150	273-03150	295-03150	296-03150	298-03150	299-03150
			25	22	1.5	40	20	599-03151	274-03151	275-03151	276-03151	271-03151	272-03151	273-03151	295-03151	296-03151	298-03151	299-03151
			40	34	2	50	20	599-03152	274-03152	275-03152	276-03152	271-03152	272-03152	273-03152	295-03152	296-03152	298-03152	299-03152
		UFxUF	1	0.9	0.5	15	20	599-03153	274-03153	275-03153	276-03153	271-03153	272-03153	273-03153	295-03153	296-03153	298-03153	299-03153
			1.6	1.4	0.5	15	20	599-03154	274-03154	275-03154	276-03154	271-03154	272-03154	273-03154	295-03154	296-03154	298-03154	299-03154
			2.5	2.2	0.5	15	20	599-03155	274-03155	275-03155	276-03155	271-03155	272-03155	273-03155	295-03155	296-03155	298-03155	299-03155
			4	3.4	0.5	15	20	599-03156	274-03156	275-03156	276-03156	271-03156	272-03156	273-03156	295-03156	296-03156	298-03156	299-03156
			6.3	5.4	0.75	20	20	599-03157	274-03157	275-03157	276-03157	271-03157	272-03157	273-03157	295-03157	296-03157	298-03157	299-03157
			10	8.6	1	25	20	599-03158	274-03158	275-03158	276-03158	271-03158	272-03158	273-03158	295-03158	296-03158	298-03158	299-03158
			16	14	1.25	32	20	599-03159	274-03159	275-03159	276-03159	271-03159	272-03159	273-03159	295-03159	296-03159	298-03159	299-03159
			25	22	1.5	40	20	599-03160	274-03160	275-03160	276-03160	271-03160	272-03160	273-03160	295-03160	296-03160	298-03160	299-03160
			40	34	2	50	20	599-03161	274-03161	275-03161	276-03161	271-03161	272-03161	273-03161	295-03161	296-03161	298-03161	299-03161

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* F = Female NPT, UF = Union Female, UM = Union Male connection, — = Special Order, X = Inappropriate combination.

Table 6. 2-1/2 to 6-Inch Flanged Valves, ANSI Class 125.

Port	Action	Characteristic	Trim	Packing	Flow Rate Cv	Flow Rate Kvs	Line Size in	Line Size mm	Stroke	Type	Pneumatic				Pneumatic with Factory Mounted Position Relay			
										Stroke	20 mm			40 mm	20 mm			40 mm
										Description	8-inch	8-inch Hi-Temp	12-inch	12-inch	8-inch	8-inch Hi-Temp	12-inch	12-inch
										Technical Instructions	155-161P25	155-161P25	155-162P25	155-162P25	155-161P25	155-161P25	155-162P25	155-162P25
										Actuator Assembly	599-01050	599-01051	599-01010	599-01000	599-01050 and 599-00426	599-01051 and 599-00425	599-01010 and 599-00423	599-01000 and 599-00423
										Valve Assembly	Actuator Code 277	Actuator Code 278	Actuator Code 279	Actuator Code 281	Actuator Code 283	Actuator Code 284	Actuator Code 285	Actuator Code 287
2-Way Tech. Instr. 155-159P25	Normally Closed (NC)	Equal Percentage	Stainless Steel	Standard	63	54	2.5	65	20	599-05970	277-05970	—	279-05970	X	283-05970	—	285-05970	X
					100	86	3	80	20	599-05971	277-05971	—	279-05971	X	283-05971	—	285-05971	X
					160	140	4	100	40	599-05972	X	X	X	281-05972	X	X	X	287-05972
					250	215	5	125	40	599-05973	X	X	X	281-05973	X	X	X	287-05973
					400	340	6	150	40	599-05974	X	X	X	281-05974	X	X	X	287-05974
			Bronze		63	54	2.5	65	20	599-05990	277-05990	—	279-05990	X	283-05990	—	285-05990	X
					100	86	3	80	20	599-05991	277-05991	—	279-05991	X	283-05991	—	285-05991	X
					160	140	4	100	40	599-05992	X	X	X	281-05992	X	X	X	287-05992
					250	215	5	125	40	599-05993	X	X	X	281-05993	X	X	X	287-05993
					400	340	6	150	40	599-05994	X	X	X	281-05994	X	X	X	287-05994
		Linear	Stainless Steel		63	54	2.5	65	20	599-06070	277-06070	—	279-06070	X	283-06070	—	285-06070	X
					100	86	3	80	20	599-06071	277-06071	—	279-06071	X	283-06071	—	285-06071	X
					160	140	4	100	40	599-06072	X	X	X	281-06072	X	X	X	287-06072
					250	215	5	125	40	599-06073	X	X	X	281-06073	X	X	X	287-06073
					400	340	6	150	40	599-06074	X	X	X	281-06074	X	X	X	287-06074
				Hi-Temp	63	54	2.5	65	20	599-06050	277-06050	278-06050	279-06050	X	283-06050	284-06050	285-06050	X
					100	86	3	80	20	599-06051	277-06051	278-06051	279-06051	X	283-06051	284-06051	285-06051	X
					160	140	4	100	40	599-06052	X	X	X	281-06052	X	X	X	287-06052
					250	215	5	125	40	599-06053	X	X	X	281-06053	X	X	X	287-06053
					400	340	6	150	40	599-06054	X	X	X	281-06054	X	X	X	287-06054
	Normally Open (NO)	Equal Percentage	Stainless Steel	Standard	63	54	2.5	65	20	599-05960	277-05960	—	279-05960	X	283-05960	—	285-05960	X
					100	86	3	80	20	599-05961	277-05961	—	279-05961	X	283-05961	—	285-05961	X
					160	140	4	100	40	599-05962	X	X	X	281-05962	X	X	X	287-05962
					250	215	5	125	40	599-05963	X	X	X	281-05963	X	X	X	287-05963
					400	340	6	150	40	599-05964	X	X	X	281-05964	X	X	X	287-05964
			Bronze		63	54	2.5	65	20	599-05980	277-05980	—	279-05980	X	283-05980	—	285-05980	X
					100	86	3	80	20	599-05981	277-05981	—	279-05981	X	283-05981	—	285-05981	X
					160	140	4	100	40	599-05982	X	X	X	281-05982	X	X	X	287-05982
					250	215	5	125	40	599-05983	X	X	X	281-05983	X	X	X	287-05983
					400	340	6	150	40	599-05984	X	X	X	281-05984	X	X	X	287-05984
		Linear	Stainless		63	54	2.5	65	20	599-06060	277-06060	—	279-06060	X	283-06060	—	285-06060	X
					100	86	3	80	20	599-06061	277-06061	—	279-06061	X	283-06061	—	285-06061	X
					160	140	4	100	40	599-06062	X	X	X	281-06062	X	X	X	287-06062
					250	215	5	125	40	599-06063	X	X	X	281-06063	X	X	X	287-06063
					400	340	6	150	40	599-06064	X	X	X	281-06064	X	X	X	287-06064
				Hi-Temp	63	54	2.5	65	20	599-06040	277-06040	278-06040	279-06040	X	283-06040	284-06040	285-06040	X
					100	86	3	80	20	599-06041	277-06041	278-06041	279-06041	X	283-06041	284-06041	285-06041	X
					160	140	4	100	40	599-06042	X	X	X	281-06042	X	X	X	287-06042
					250	215	5	125	40	599-06043	X	X	X	281-06043	X	X	X	287-06043
					400	340	6	150	40	599-06044	X	X	X	281-06044	X	X	X	287-06044
3-Way Tech. Instr. 155-160P25	Mixing	Linear	Stainless	Standard	63	54	2.5	65	20	599-06165	277-06165	—	279-06165	X	283-06165	—	285-06165	X
					100	86	3	80	20	599-06166	277-06166	—	279-06166	X	283-06166	—	285-06166	X
					160	140	4	100	40	599-06167	X	X	X	281-06167	X	X	X	287-06167
					250	215	5	125	40	599-06168	X	X	X	281-06168	X	X	X	287-06168
					400	340	6	150	40	599-06169	X	X	X	281-06169	X	X	X	287-06169
			Bronze		63	54	2.5	65	20	599-06160	277-06160	—	279-06160	X	283-06160	—	285-06160	X
					100	86	3	80	20	599-06161	277-06161	—	279-06161	X	283-06161	—	285-06161	X
					160	140	4	100	40	599-06162	X	X	X	281-06162	X	X	X	287-06162
					250	215	5	125	40	599-06163	X	X	X	281-06163	X	X	X	287-06163
					400	340	6	150	40	599-06164	X	X	X	281-06164	X	X	X	287-06164

ıring start point for valve assemblies with pneumatic actuators: NO = 3 to 8 psi (21 to 55 kPa), NC = 10 to 15 psi (69 to 103 kPa), 3-Way = 8 to 13 psi (55 to 90 kPa),
= Special Order, X = Inappropriate combination.

Table 6a. 2-1/2 to 6-Inch Flanged Valves, ANSI Class 125, Continued.

Port	Action	Characteristic	Trim	Packing	Flow aRate Cv	Flow aRate Kvs	Line Size In	Line Size mm	Stroke	Type	Electronic-Hydraulic					
										Stroke	20 mm					
										Description	24V, 3-Pos, SR	24V, 3-Pos, NSR	24V, 0-10V, 4-20mA, SR	24V, 3-Pos, SR	24V, 3-Pos, NSR	24V, 0-10V, 4-20mA, SR
										Technical Instructions	155-181P25	155-181P25	155-180P25	155-171P25	155-171P25	155-16325
										Actuator Assembly	SKD82.51U	SKD82.50U	SKD62U	SKB82.51U	SKB82.50U	SKB62U
										Valve Assembly	Actuator Code 276	Actuator Code 275	Actuator Code 274	Actuator Code 289	Actuator Code 290	Actuator Code 291
2-Way Tech. Instr. 155-159P25	Normally Closed (NC)	Equal Percentage	Stainless Steel	Standard	63	54	2.5	65	20	599-05970	276-05970	275-05970	274-05970	289-05970	290-05970	291-05970
					100	86	3	80	20	599-05971	276-05971	275-05971	274-05971	289-05971	290-05971	291-05971
					160	140	4	100	40	599-05972	X	X	X	X	X	X
					250	215	5	125	40	599-05973	X	X	X	X	X	X
					400	340	6	150	40	599-05974	X	X	X	X	X	X
			Bronze		63	54	2.5	65	20	599-05990	276-05990	275-05990	274-05990	289-05990	290-05990	291-05990
					100	86	3	80	20	599-05991	276-05991	275-05991	274-05991	289-05991	290-05991	291-05991
					160	140	4	100	40	599-05992	X	X	X	X	X	X
					250	215	5	125	40	599-05993	X	X	X	X	X	X
					400	340	6	150	40	599-05994	X	X	X	X	X	X
		Linear	Stainless Steel		63	54	2.5	65	20	599-06070	276-06070	275-06070	274-06070	289-06070	290-06070	291-06070
					100	86	3	80	20	599-06071	276-06071	275-06071	274-06071	289-06071	290-06071	291-06071
					160	140	4	100	40	599-06072	X	X	X	X	X	X
					250	215	5	125	40	599-06073	X	X	X	X	X	X
					400	340	6	150	40	599-06074	X	X	X	X	X	X
				Hi-Temp	63	54	2.5	65	20	599-06050	276-06050	275-06050	274-06050	289-06050	290-06050	291-06050
					100	86	3	80	20	599-06051	276-06051	275-06051	274-06051	289-06051	290-06051	291-06051
					160	140	4	100	40	599-06052	X	X	X	X	X	X
					250	215	5	125	40	599-06053	X	X	X	X	X	X
					400	340	6	150	40	599-06054	X	X	X	X	X	X
	Normally Open (NC)	Equal Percentage	Stainless Steel	Standard	63	54	2.5	65	20	599-05960	276-05960	275-05960	274-05960	289-05960	290-05960	291-05960
					100	86	3	80	20	599-05961	276-05961	275-05961	274-05961	289-05961	290-05961	291-05961
					160	140	4	100	40	599-05962	X	X	X	X	X	X
					250	215	5	125	40	599-05963	X	X	X	X	X	X
					400	340	6	150	40	599-05964	X	X	X	X	X	X
			Bronze		63	54	2.5	65	20	599-05980	276-05980	275-05980	274-05980	289-05980	290-05980	291-05980
					100	86	3	80	20	599-05981	276-05981	275-05981	274-05981	289-05981	290-05981	291-05981
					160	140	4	100	40	599-05982	X	X	X	X	X	X
					250	215	5	125	40	599-05983	X	X	X	X	X	X
					400	340	6	150	40	599-05984	X	X	X	X	X	X
		Linear	Stainless		63	54	2.5	65	20	599-06060	276-06060	275-06060	274-06060	289-06060	290-06060	291-06060
					100	86	3	80	20	599-06061	276-06061	275-06061	274-06061	289-06061	290-06061	291-06061
					160	140	4	100	40	599-06062	X	X	X	X	X	X
					250	215	5	125	40	599-06063	X	X	X	X	X	X
					400	340	6	150	40	599-06064	X	X	X	X	X	X
				Hi-Temp	63	54	2.5	65	20	599-06040	276-06040	275-06040	274-06040	289-06040	290-06040	291-06040
					100	86	3	80	20	599-06041	276-06041	275-06041	274-06041	289-06041	290-06041	291-06041
					160	140	4	100	40	599-06042	X	X	X	X	X	X
					250	215	5	125	40	599-06043	X	X	X	X	X	X
					400	340	6	150	40	599-06044	X	X	X	X	X	X
3-Way Tech. Instr. 155-160P25	Mixing	Linear	Stainless	Standard	63	54	2.5	65	20	599-06165	276-06165	275-06165	274-06165	289-06165	290-06165	291-06165
					100	86	3	80	20	599-06166	276-06166	275-06166	274-06166	289-06166	290-06166	291-06166
					160	140	4	100	40	599-06167	X	X	X	X	X	X
					250	215	5	125	40	599-06168	X	X	X	X	X	X
					400	340	6	150	40	599-06169	X	X	X	X	X	X
			Bronze		63	54	2.5	65	20	599-06160	276-06160	275-06160	274-06160	289-06160	290-06160	291-06160
					100	86	3	80	20	599-06161	276-06161	275-06161	274-06161	289-06161	290-06161	291-06161
					160	140	4	100	40	599-06162	X	X	X	X	X	X
					250	215	5	125	40	599-06163	X	X	X	X	X	X
					400	340	6	150	40	599-06164	X	X	X	X	X	X

— = Special Order, X = Inappropriate combination.

Table 6b. 2-1/2 to 6-Inch Flanged Valves, ANSI Class 125, Continued.

Port	Action	Characteristic	Trim	Packing	Flow Rate Cv	Flow Rate Kvs	Line Size In	Line Size mm	Stroke	Type	Electronic-Hydraulic			Electronic-Mechanical		
										Stroke	40 mm			20 mm		40 mm
										Description	24V, 3-Pos, SR	24V, 3-Pos, NSR	24V, 0-10V, 4-20mA, SR	24V, 0-10V	24V, 0-10V	24V, 0-10V
										Technical Instructions	155-171P25	155-171P25	155-163P25	155-172P25	155-172P25	155-172P25
										Actuator Assembly	SKC82.61U	SKC82.60U	SKC62U	Lo NSR 599-10021	Lo NSR 599-10022	Hi NSR 599-10023
										Valve Assembly	Actuator Code 292	Actuator Code 293	Actuator Code 294	Actuator Code 295	Actuator Code 296	Actuator Code 297
2-Way Tech. Instr. 155-159P25	Normally Closed (NC)	Equal Percentage	Stainless Steel	Standard	63	54	2.5	65	20	599-05970	X	X	X	295-05970	296-05970	X
					100	86	3	80	20	599-05971	X	X	X	295-05971	296-05971	X
					160	140	4	100	40	599-05972	292-05972	293-05972	294-05972	X	X	297-05972
					250	215	5	125	40	599-05973	292-05973	293-05973	294-05973	X	X	X
					400	340	6	150	40	599-05974	292-05974	293-05974	294-05974	X	X	X
			Bronze		63	54	2.5	65	20	599-05990	X	X	X	295-05990	296-05990	X
					100	86	3	80	20	599-05991	X	X	X	295-05991	296-05991	X
					160	140	4	100	40	599-05992	292-05992	293-05992	294-05992	X	X	297-05992
					250	215	5	125	40	599-05993	292-05993	293-05993	294-05993	X	X	X
					400	340	6	150	40	599-05994	292-05994	293-05994	294-05994	X	X	X
		Linear	Stainless Steel		63	54	2.5	65	20	599-06070	X	X	X	295-06070	296-06070	X
					100	86	3	80	20	599-06071	X	X	X	295-06071	296-06071	X
					160	140	4	100	40	599-06072	292-06072	293-06072	294-06072	X	X	297-06072
					250	215	5	125	40	599-06073	292-06073	293-06073	294-06073	X	X	X
					400	340	6	150	40	599-06074	292-06074	293-06074	294-06074	X	X	X
				Hi-Temp	63	54	2.5	65	20	599-06050	X	X	X	295-06050	296-06050	X
					100	86	3	80	20	599-06051	X	X	X	295-06051	296-06051	X
					160	140	4	100	40	599-06052	292-06052	293-06052	294-06052	X	X	297-06052
					250	215	5	125	40	599-06053	292-06053	293-06053	294-06053	X	X	X
					400	340	6	150	40	599-06054	292-06054	293-06054	294-06054	X	X	X
	Normally Open (NO)	Equal Percentage	Stainless Steel	Standard	63	54	2.5	65	20	599-05960	X	X	X	295-05960	296-05960	X
					100	86	3	80	20	599-05961	X	X	X	295-05961	296-05961	X
					160	140	4	100	40	599-05962	292-05962	293-05962	294-05962	X	X	297-05962
					250	215	5	125	40	599-05963	292-05963	293-05963	294-05963	X	X	X
					400	340	6	150	40	599-05964	292-05964	293-05964	294-05964	X	X	X
			Bronze		63	54	2.5	65	20	599-05980	X	X	X	295-05980	296-05980	X
					100	86	3	80	20	599-05981	X	X	X	295-05981	296-05981	X
					160	140	4	100	40	599-05982	292-05982	293-05982	294-05982	X	X	297-05982
					250	215	5	125	40	599-05983	292-05983	293-05983	294-05983	X	X	X
					400	340	6	150	40	599-05984	292-05984	293-05984	294-05984	X	X	X
		Linear	Stainless		63	54	2.5	65	20	599-06060	X	X	X	295-06060	296-06060	X
					100	86	3	80	20	599-06061	X	X	X	295-06061	296-06061	X
					160	140	4	100	40	599-06062	292-06062	293-06062	294-06062	X	X	297-06062
					250	215	5	125	40	599-06063	292-06063	293-06063	294-06063	X	X	X
					400	340	6	150	40	599-06064	292-06064	293-06064	294-06064	X	X	X
				Hi-Temp	63	54	2.5	65	20	599-06040	X	X	X	295-06040	296-06040	X
					100	86	3	80	20	599-06041	X	X	X	295-06041	296-06041	X
					160	140	4	100	40	599-06042	292-06042	293-06042	294-06042	X	X	297-06042
					250	215	5	125	40	599-06043	292-06043	293-06043	294-06043	X	X	X
					400	340	6	150	40	599-06044	292-06044	293-06044	294-06044	X	X	X
3-Way Tech. Instr. 155-160P25	Mixing	Linear	Stainless	Standard	63	54	2.5	65	20	599-06165	X	X	X	295-06165	296-06165	X
					100	86	3	80	20	599-06166	X	X	X	295-06166	296-06166	X
					160	140	4	100	40	599-06167	292-06167	293-06167	294-06167	X	X	297-06167
					250	215	5	125	40	599-06168	292-06168	293-06168	294-06168	X	X	X
					400	340	6	150	40	599-06169	292-06169	293-06169	294-06169	X	X	X
			Bronze		63	54	2.5	65	20	599-06160	X	X	X	295-06160	296-06160	X
					100	86	3	80	20	599-06161	X	X	X	295-06161	296-06161	X
					160	140	4	100	40	599-06162	292-06162	293-06162	294-06162	X	X	297-06162
					250	215	5	125	40	599-06163	292-06163	293-06163	294-06163	X	X	X
					400	340	6	150	40	599-06164	292-06164	293-06164	294-06164	X	X	X

— = Special Order, X = Inappropriate combination.

Table 7. 2-1/2 to 6-Inch Flanged Valves, ANSI Class 250.

Port	Action	Characteristic	Trim	Packing	Flow Rate Cv	Flow Rate Kvs	Line Size In	Line Size mm	Stroke	Type	Pneumatic				Pneumatic with Factory Mounted Position Relay			
										Stroke	20 mm			40 mm	20 mm			40 mm
										Description	8-Inch	8-Inch Hi-Temp	12-Inch	12-Inch	8-Inch	8-Inch Hi-Temp	12-Inch	12-Inch
										Technical Instructions	155-161P25	155-161P25	155-162P25	155-162P25	155-161P25	155-161P25	155-162P25	155-162P25
										Actuator Assembly	599-01050	599-01051	599-01010	599-01000	599-01050 & 599-00426	599-01051 & 599-00425	599-01010 & 599-00423	599-01000 & 599-00423
										Valve Assembly	Actuator Code 277	Actuator Code 278	Actuator Code 279	Actuator Code 281	Actuator Code 283	Actuator Code 284	Actuator Code 285	Actuator Code 287
2-Way Tech. Instr. 155-159P25	Normally Closed (NC)	Equal Percentage	Stainless Steel	Standard	63	54	2.5	65	20	599-05930	277-05930	—	279-05930	X	283-05930	—	285-05930	X
					100	86	3	80	20	599-05931	277-05931	—	279-05931	X	283-05931	—	285-05931	X
					160	140	4	100	40	599-05932	X	X	X	281-05932	X	X	X	287-05932
					250	215	5	125	40	599-05933	X	X	X	281-05933	X	X	X	287-05933
					400	340	6	150	40	599-05934	X	X	X	281-05934	X	X	X	287-05934
			Bronze		63	54	2.5	65	20	599-05950	277-05950	—	279-05950	X	283-05950	—	285-05950	X
					100	86	3	80	20	599-05951	277-05951	—	279-05951	X	283-05951	—	285-05951	X
					160	140	4	100	40	599-05952	X	X	X	281-05952	X	X	X	287-05952
					250	215	5	125	40	599-05953	X	X	X	281-05953	X	X	X	287-05953
					400	340	6	150	40	599-05954	X	X	X	281-05954	X	X	X	287-05954
		Linear	Stainless Steel		63	54	2.5	65	20	599-06150	277-06150	—	279-06150	X	283-06150	—	285-06150	X
					100	86	3	80	20	599-06151	277-06151	—	279-06151	X	283-06151	—	285-06151	X
					160	140	4	100	40	599-06152	X	X	X	281-06152	X	X	X	287-06152
					250	215	5	125	40	599-06153	X	X	X	281-06153	X	X	X	287-06153
					400	340	6	150	40	599-06154	X	X	X	281-06154	X	X	X	287-06154
				Hi-Temp	63	54	2.5	65	20	599-06130	277-06130	278-06130	279-06130	X	283-06130	284-06130	285-06130	X
					100	86	3	80	20	599-06131	277-06131	278-06131	279-06131	X	283-06131	284-06131	285-06131	X
					160	140	4	100	40	599-06132	X	X	X	281-06132	X	X	X	287-06132
					250	215	5	125	40	599-06133	X	X	X	281-06133	X	X	X	287-06133
					400	340	6	150	40	599-06134	X	X	X	281-06134	X	X	X	287-06134
	Normally Open (NO)	Equal Percentage	Stainless Steel	Standard	63	54	2.5	65	20	599-05920	277-05920	—	279-05920	X	283-05920	—	285-05920	X
					100	86	3	80	20	599-05921	277-05921	—	279-05921	X	283-05921	—	285-05921	X
					160	140	4	100	40	599-05922	X	X	X	281-05922	X	X	X	287-05922
					250	215	5	125	40	599-05923	X	X	X	281-05923	X	X	X	287-05923
					400	340	6	150	40	599-05924	X	X	X	281-05924	X	X	X	287-05924
			Bronze		63	54	2.5	65	20	599-05940	277-05940	—	279-05940	X	283-05940	—	285-05940	X
					100	86	3	80	20	599-05941	277-05941	—	279-05941	X	283-05941	—	285-05941	X
					160	140	4	100	40	599-05942	X	X	X	281-05942	X	X	X	287-05942
					250	215	5	125	40	599-05943	X	X	X	281-05943	X	X	X	287-05943
					400	340	6	150	40	599-05944	X	X	X	281-05944	X	X	X	287-05944
		Linear	Stainless		63	54	2.5	65	20	599-06140	277-06140	—	279-06140	X	283-06140	—	285-06140	X
					100	86	3	80	20	599-06141	277-06141	—	279-06141	X	283-06141	—	285-06141	X
					160	140	4	100	40	599-06142	X	X	X	281-06142	X	X	X	287-06142
					250	215	5	125	40	599-06143	X	X	X	281-06143	X	X	X	287-06143
					400	340	6	150	40	599-06144	X	X	X	281-06144	X	X	X	287-06144
				Hi-Temp	63	54	2.5	65	20	599-06120	277-06120	278-06120	279-06120	X	283-06120	284-06120	285-06120	X
					100	86	3	80	20	599-06121	277-06121	278-06121	279-06121	X	283-06121	284-06121	285-06121	X
					160	140	4	100	40	599-06122	X	X	X	281-06122	X	X	X	287-06122
					250	215	5	125	40	599-06123	X	X	X	281-06123	X	X	X	287-06123
					400	340	6	150	40	599-06124	X	X	X	281-06124	X	X	X	287-06124
3-Way Tech. Instr. 155-160P25	Mixing	Linear	Stainless	Standard	63	54	2.5	65	20	599-06175	277-06175	—	279-06175	X	283-06175	—	285-06175	X
					100	86	3	80	20	599-06176	277-06176	—	279-06176	X	283-06176	—	285-06176	X
					160	140	4	100	40	599-06177	X	X	X	281-06177	X	X	X	287-06177
					250	215	5	125	40	599-06178	X	X	X	281-06178	X	X	X	287-06178
					400	340	6	150	40	599-06179	X	X	X	281-06179	X	X	X	287-06179
			Bronze		63	54	2.5	65	20	599-06170	277-06170	—	279-06170	X	283-06170	—	285-06170	X
					100	86	3	80	20	599-06171	277-06171	—	279-06171	X	283-06171	—	285-06171	X
					160	140	4	100	40	599-06172	X	X	X	281-06172	X	X	X	287-06172
					250	215	5	125	40	599-06173	X	X	X	281-06173	X	X	X	287-06173
					400	340	6	150	40	599-06174	X	X	X	281-06174	X	X	X	287-06174

Spring start point for valve assemblies with pneumatic actuators: NO = 3 to 8 psi (21 to 55 kPa), NC = 10 to 15 psi (69 to 103 kPa), 3-Way = 8 to 13 psi (55 to 90 kPa), — = Special Order, X = Inappropriate combination.

Table 7a. 2-1/2 to 6-Inch Flanged Valves, ANSI Class 250, Continued.

Port	Action	Characteristic	Trim	Packing	Flow Rate Cv	Flow Rate Kvs	Line Size In	Line Size mm	Stroke	Type	Electronic-Hydraulic					
										Stroke	20 mm					
										Description	24V, 3-Pos, SR	24V, 3-Pos, NSR	24V, 0-10V, 4-20 mA, SR	24V, 3-Pos, SR	24V, 3-Pos, NSR	24V, 0-10V, 4-20 mA, SR
										Technical Instructions	155-181P25	155-181P25	155-180P25	155-171P25	155-171P25	155-16325
										Actuator Assembly	SKD82.51U	SKD82.50U	SKD62U	SKB82.51U	SKB82.50U	SKB62U
										Valve Assembly	Actuator Code 276	Actuator Code 275	Actuator Code 274	Actuator Code 289	Actuator Code 290	Actuator Code 291
2-Way Tech. Instr. 155-159P25	Normally Closed (NC)	Equal Percentage	Stainless Steel	Standard	63	54	2.5	65	20	599-05930	276-05930	275-05930	274-05930	289-05930	290-05930	291-05930
					100	86	3	80	20	599-05931	276-05931	275-05931	274-05931	289-05931	290-05931	291-05931
					160	140	4	100	40	599-05932	X	X	X	X	X	X
					250	215	5	125	40	599-05933	X	X	X	X	X	X
					400	340	6	150	40	599-05934	X	X	X	X	X	X
			Bronze		63	54	2.5	65	20	599-05950	276-05950	275-05950	274-05950	289-05950	290-05950	291-05950
					100	86	3	80	20	599-05951	276-05951	275-05951	274-05951	289-05951	290-05951	291-05951
					160	140	4	100	40	599-05952	X	X	X	X	X	X
					250	215	5	125	40	599-05953	X	X	X	X	X	X
					400	340	6	150	40	599-05954	X	X	X	X	X	X
		Linear	Stainless Steel		63	54	2.5	65	20	599-06150	276-06150	275-06150	274-06150	289-06150	290-06150	291-06150
					100	86	3	80	20	599-06151	276-06151	275-06151	274-06151	289-06151	290-06151	291-06151
					160	140	4	100	40	599-06152	X	X	X	X	X	X
					250	215	5	125	40	599-06153	X	X	X	X	X	X
					400	340	6	150	40	599-06154	X	X	X	X	X	X
				Hi-Temp	63	54	2.5	65	20	599-06130	276-06130	275-06130	274-06130	289-06130	290-06130	291-06130
					100	86	3	80	20	599-06131	276-06131	275-06131	274-06131	289-06131	290-06131	291-06131
					160	140	4	100	40	599-06132	X	X	X	X	X	X
					250	215	5	125	40	599-06133	X	X	X	X	X	X
					400	340	6	150	40	599-06134	X	X	X	X	X	X
	Normally Open (NO)	Equal Percentage	Stainless Steel	Standard	63	54	2.5	65	20	599-05920	276-05920	275-05920	274-05920	289-05920	290-05920	291-05920
					100	86	3	80	20	599-05921	276-05921	275-05921	274-05921	289-05921	290-05921	291-05921
					160	140	4	100	40	599-05922	X	X	X	X	X	X
					250	215	5	125	40	599-05923	X	X	X	X	X	X
					400	340	6	150	40	599-05924	X	X	X	X	X	X
			Bronze		63	54	2.5	65	20	599-05940	276-05940	275-05940	274-05940	289-05940	290-05940	291-05940
					100	86	3	80	20	599-05941	276-05941	275-05941	274-05941	289-05941	290-05941	291-05941
					160	140	4	100	40	599-05942	X	X	X	X	X	X
					250	215	5	125	40	599-05943	X	X	X	X	X	X
					400	340	6	150	40	599-05944	X	X	X	X	X	X
		Linear	Stainless		63	54	2.5	65	20	599-06140	276-06140	275-06140	274-06140	289-06140	290-06140	291-06140
					100	86	3	80	20	599-06141	276-06141	275-06141	274-06141	289-06141	290-06141	291-06141
					160	140	4	100	40	599-06142	X	X	X	X	X	X
					250	215	5	125	40	599-06143	X	X	X	X	X	X
					400	340	6	150	40	599-06144	X	X	X	X	X	X
				Hi-Temp	63	54	2.5	65	20	599-06120	276-06120	275-06120	274-06120	289-06120	290-06120	291-06120
					100	86	3	80	20	599-06121	276-06121	275-06121	274-06121	289-06121	290-06121	291-06121
					160	140	4	100	40	599-06122	X	X	X	X	X	X
					250	215	5	125	40	599-06123	X	X	X	X	X	X
					400	340	6	150	40	599-06124	X	X	X	X	X	X
3-Way Tech. Instr. 155-160P25	Mixing	Linear	Stainless	Standard	63	54	2.5	65	20	599-06175	276-06175	275-06175	274-06175	289-06175	290-06175	291-06175
					100	86	3	80	20	599-06176	276-06176	275-06176	274-06176	289-06176	290-06176	291-06176
					160	140	4	100	40	599-06177	X	X	X	X	X	X
					250	215	5	125	40	599-06178	X	X	X	X	X	X
					400	340	6	150	40	599-06179	X	X	X	X	X	X
			Bronze		63	54	2.5	65	20	599-06170	276-06170	275-06170	274-06170	289-06170	290-06170	291-06170
					100	86	3	80	20	599-06171	276-06171	275-06171	274-06171	289-06171	290-06171	291-06171
					160	140	4	100	40	599-06172	X	X	X	X	X	X
					250	215	5	125	40	599-06173	X	X	X	X	X	X
					400	340	6	150	40	599-06174	X	X	X	X	X	X

— = Special Order, X = Inappropriate combination.

Table 7b. 2-1/2 to 6-Inch Flanged Valves, ANSI Class 250, Continued.

Port	Action	Characteristic	Trim	Packing	Flow Rate Cv	Flow Rate Kvs	Line Size In	Line Size mm	Stroke	Type	Electronic-Hydraulic			Electronic-Mechanical		
										Stroke	40 mm			20 mm		40 mm
										Description	24V, 3-Pos, SR	24V, 3-Pos, NSR	24V, 0-10V, 4-20 mA, SR	24V, 0-10V	24V, 0-10V	24V, 0-10V
										Technical Instructions	155-171P25	155-171P25	155-163P25	155-172P25	155-172P25	155-172P25
										Actuator Assembly	SKC82.61U	SKC82.60U	SKC62U	Lo NSR 599-10021	Lo NSR 599-10022	HI NSR 599-10023
										Valve Assembly	Actuator Code 292	Actuator Code 293	Actuator Code 294	Actuator Code 295	Actuator Code 296	Actuator Code 297
2-Way Tech. Instr. 155-159P25	Normally Closed (NC)	Equal Percentage	Stainless Steel	Standard	63	54	2.5	65	20	599-05930	X	X	X	295-05930	296-05930	X
					100	86	3	80	20	599-05931	X	X	X	295-05931	296-05931	X
					160	140	4	100	40	599-05932	292-05932	293-05932	294-05932	X	X	297-05932
					250	215	5	125	40	599-05933	292-05933	293-05933	294-05933	X	X	X
					400	340	6	150	40	599-05934	292-05934	293-05934	294-05934	X	X	X
			Bronze		63	54	2.5	65	20	599-05950	X	X	X	295-05950	296-05950	X
					100	86	3	80	20	599-05951	X	X	X	295-05951	296-05951	X
					160	140	4	100	40	599-05952	292-05952	293-05952	294-05952	X	X	297-05952
					250	215	5	125	40	599-05953	292-05953	293-05953	294-05953	X	X	X
					400	340	6	150	40	599-05954	292-05954	293-05954	294-05954	X	X	X
		Linear	Stainless Steel		63	54	2.5	65	20	599-06150	X	X	X	295-06150	296-06150	X
					100	86	3	80	20	599-06151	X	X	X	295-06151	296-06151	X
					160	140	4	100	40	599-06152	292-06152	293-06152	294-06152	X	X	297-06152
					250	215	5	125	40	599-06153	292-06153	293-06153	294-06153	X	X	X
					400	340	6	150	40	599-06154	292-06154	293-06154	294-06154	X	X	X
				Hi-Temp	63	54	2.5	65	20	599-06130	X	X	X	295-06130	296-06130	X
					100	86	3	80	20	599-06131	X	X	X	295-06131	296-06131	X
					160	140	4	100	40	599-06132	292-06132	293-06132	294-06132	X	X	297-06132
					250	215	5	125	40	599-06133	292-06133	293-06133	294-06133	X	X	X
					400	340	6	150	40	599-06134	292-06134	293-06134	294-06134	X	X	X
	Normally Open (NO)	Equal Percentage	Stainless Steel	Standard	63	54	2.5	65	20	599-05920	X	X	X	295-05920	296-05920	X
					100	86	3	80	20	599-05921	X	X	X	295-05921	296-05921	X
					160	140	4	100	40	599-05922	292-05922	293-05922	294-05922	X	X	297-05922
					250	215	5	125	40	599-05923	292-05923	293-05923	294-05923	X	X	X
					400	340	6	150	40	599-05924	292-05924	293-05924	294-05924	X	X	X
			Bronze		63	54	2.5	65	20	599-05940	X	X	X	295-05940	296-05940	X
					100	86	3	80	20	599-05941	X	X	X	295-05941	296-05941	X
					160	140	4	100	40	599-05942	292-05942	293-05942	294-05942	X	X	297-05942
					250	215	5	125	40	599-05943	292-05943	293-05943	294-05943	X	X	X
					400	340	6	150	40	599-05944	292-05944	293-05944	294-05944	X	X	X
		Linear	Stainless		63	54	2.5	65	20	599-06140	X	X	X	295-06140	296-06140	X
					100	86	3	80	20	599-06141	X	X	X	295-06141	296-06141	X
					160	140	4	100	40	599-06142	292-06142	293-06142	294-06142	X	X	297-06142
					250	215	5	125	40	599-06143	292-06143	293-06143	294-06143	X	X	X
					400	340	6	150	40	599-06144	292-06144	293-06144	294-06144	X	X	X
				Hi-Temp	63	54	2.5	65	20	599-06120	X	X	X	295-06120	296-06120	X
					100	86	3	80	20	599-06121	X	X	X	295-06121	296-06121	X
					160	140	4	100	40	599-06122	292-06122	293-06122	294-06122	X	X	297-06122
					250	215	5	125	40	599-06123	292-06123	293-06123	294-06123	X	X	X
					400	340	6	150	40	599-06124	292-06124	293-06124	294-06124	X	X	X
3-Way Tech. Instr. 155-160P25	Mixing	Linear	Stainless	Standard	63	54	2.5	65	20	599-06175	X	X	X	295-06175	296-06175	X
					100	86	3	80	20	599-06176	X	X	X	295-06176	296-06176	X
					160	140	4	100	40	599-06177	292-06177	293-06177	294-06177	X	X	297-06177
					250	215	5	125	40	599-06178	292-06178	293-06178	294-06178	X	X	X
					400	340	6	150	40	599-06179	292-06179	293-06179	294-06179	X	X	X
			Bronze		63	54	2.5	65	20	599-06170	X	X	X	295-06170	296-06170	X
					100	86	3	80	20	599-06171	X	X	X	295-06171	296-06171	X
					160	140	4	100	40	599-06172	292-06172	293-06172	294-06172	X	X	297-06172
					250	215	5	125	40	599-06173	292-06173	293-06173	294-06173	X	X	X
					400	340	6	150	40	599-06174	292-06174	293-06174	294-06174	X	X	X

— = Special Order, X = Inappropriate combination.

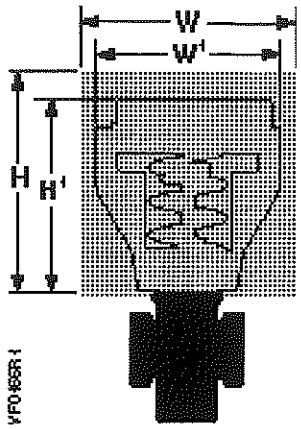
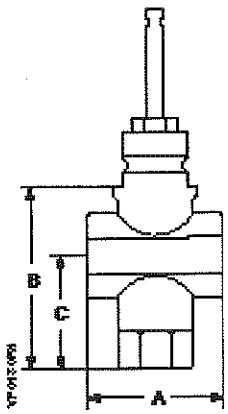


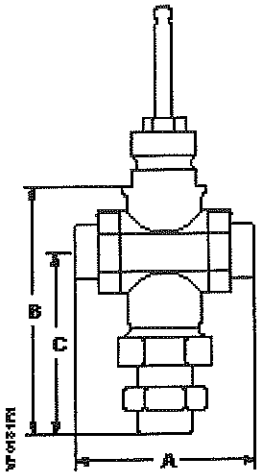
Figure 4. Actuator Dimensions. See Table 8.

Table 8. Dimensions of the Actuator and Recommended Service Envelope. Dimensions in Inches (Millimeters).

Actuator	Actuator Prefix Code	Actual Height of Actuator H1	Service Height H	Actual Width or Diameter of Actuator W1	Service Width W
4-inch Pneumatic	268, 269, 270	5-3/4 (146)	14 (350)	5-1/2 (137) diameter	18 (450)
8-inch' Pneumatic	277, 278, 283, 284	14-1/8 (359)	26 (660)	8-3/4 (222) diameter	21 (533)
12-inch Pneumatic	279, 281, 285, 287	17-7/8 (454)	30 (762)	15-1/8 (384) diameter	27 (686)
SKB/C with handle closed	289, 290, 291, 292, 293, 294	14-3/4 (375)	22-3/4 (578)	7 (178) width × 8-15/16 (226) depth	25 (635)
SKD	274, 275, 276	11-13/16 (300)	19-3/4 (500)	5 (127) width × 6-5/8 (169) depth	14-1/2 (360)
SQX	271, 272, 273	8-7/8 (226)	17 (430)	5-17/32 (140) width × 4-3/8 (111) depth	13-1/2 (340)
El/Mech with linkage	295, 296, 297	11 (280)	22 (559)	5-3/4 (144) width × 8-7/8 (225) depth	25-3/4 (654)



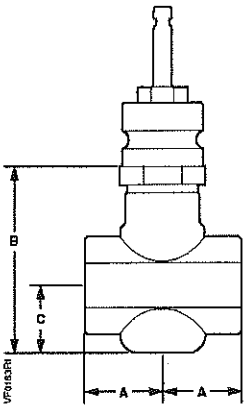
F×F
Female NPT × Female NPT



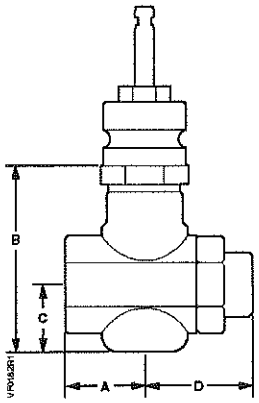
UF×UF
Union Female × Union Female

Table 9. 1/2 to 2-Inch Three-Way Valve Dimensions.

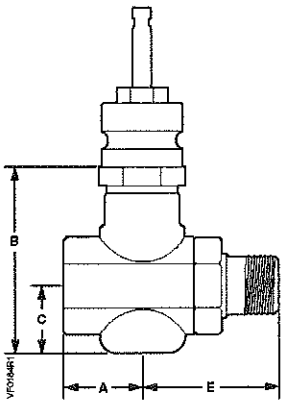
Valve	Valve Size Inches (mm)	Dimensions in Inches (mm)						Weight lb (kg)	
		F×F NPT × NPT			UF×UF Female Union × Female Union				
		A	B	C	A	B	C	F×F	UF×UF
3-Way	1/2 (15)	2-7/8 (72)	4-5/16 (110)	2-11/16 (68)	4-11/16 (119)	6-1/4 (159)	4-5/8 (117)	3 (1.4)	4 (1.8)
	3/4 (20)	3-3/8 (85)	4-5/16 (110)	2-3/4 (69)	6-3/8 (163)	6-15/16 (176)	5-1/4 (134)	4 (1.8)	6 (2.7)
	1 (25)	3-15/16 (100)	4-1/2 (114)	2-7/8 (72)	7-1/16 (180)	7 (178)	5-3/8 (136)	5 (2.3)	7 (3.2)
	1-1/4 (32)	4-15/16 (125)	4-5/8 (116)	2-15/16 (74)	7-1/2 (190)	6-3/4 (170)	5-1/16 (129)	7 (3.2)	11 (5)
	1-1/2 (40)	5-1/8 (130)	4-5/8 (117)	3 (76)	7-13/16 (199)	6-15/16 (176)	5-5/16 (135)	9 (4.1)	13 (5.9)
	2 (50)	6-1/4 (158)	4-3/4 (121)	3-3/16 (81)	9-1/16 (231)	7-3/16 (182)	5-9/16 (141)	13 (5.9)	19 (8.6)



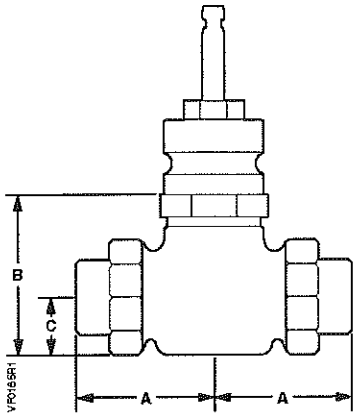
F×F
Female NPT × Female NPT



F×UF
Female NPT × Union Female



F×UM
Female NPT × Union Male



UF×UF
Union Female × Union Female

Table 10. 1/2 to 2-Inch Two-Way Valve Dimensions.

Valve Action	Valve Size inch (mm)	A		B	C	D	E	Weight lb (kg)			
		F×F, F×UF, and F×UM	UF×UF			F×UF	F×UM	F×F	F×UF	F×UM	UF×UF
Normally Closed	1/2 (15)	1-7/16 (36)	— —	3-13/16 (97)	2-3/16 (55)	2-5/16 (59)	2-7/8 (73)	3 (1.4)	4 (1.8)	4 (1.8)	— —
	3/4 (20)	1-11/16 (43)	— —	3-13/16 (97)	2-3/16 (55)	2-5/8 (67)	3-3/16 (81)	4 (1.8)	4 (1.8)	5 (2.3)	— —
	1 (25)	2 (50)	— —	3-13/16 (97)	2-3/16 (55)	3 (76)	3-1/2 (89)	5 (2.3)	5 (2.3)	5 (2.3)	— —
	1-1/4 (32)	2-1/2 (62)	3-3/4 (95)	3-13/16 (97)	2-3/16 (55)	— —	— —	7 (3.2)	— —	— —	9 (4.1)
	1-1/2 (40)	2-9/16 (65)	3-15/16 (99)	3-7/8 (99)	2-1/4 (58)	— —	— —	8 (3.6)	— —	— —	11 (5)
	2 (50)	3-1/8 (79)	4-9/16 (115)	4-3/16 (106)	2-9/16 (65)	— —	— —	16 (7.3)	— —	— —	16 (7.3)
Normally Open	1/2 (15)	1-1/16 (36)	— —	2-15/16 (74)	1-1/4 (31)	2-5/16 (59)	2-7/8 (73)	3 (1.4)	3 (1.4)	3 (1.4)	— —
	3/4 (20)	1-11/16 (43)	— —	3-15/16 (99)	1-7/16 (36)	2-5/8 (67)	3-3/16 (81)	4 (1.8)	4 (1.8)	5 (2.3)	— —
	1 (25)	2 (50)	— —	3-3/4 (96)	1-1/4 (32)	3 (76)	3-1/2 (89)	5 (2.3)	6 (2.7)	6 (2.7)	— —
	1-1/4 (32)	2-1/2 (62)	3-3/4 (95)	4-1/8 * (104)	1-5/8* (40)	— —	4-3/8 (111)	7 (3.2)	— —	8 (3.6)	9 (4.1)
	1-1/2 (40)	2-9/16 (65)	3-15/16 (99)	4-1/4* (109)*	1-3/4* (44)*	— —	— —	9 (4.1)	— —	— —	11 (5)
	2 (50)	3-1/8 (79)	4-9/16 (115)	4-9/16* (116)*	2* (51)*	— —	— —	13 (5.9)	— —	— —	16 (7.3)

* This dimension is determined by the union nut.

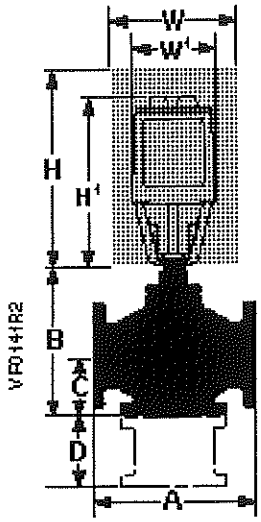


Figure 5. 2-1/2 through 6-inch Dimensions. See Tables 8, 11, and 12.

Table 11. 2-1/2 through 6-Inch Three-Way Valve Dimensions.

Nominal Valve Size Inches (mm)	Dimensions in Inches (Millimeters)					Weight lb (kg)	
	A		B	C	D		
	ANSI Class 125	ANSI Class 250			Service Flange	ANSI Class 125	ANSI Class 250
2-1/2 (65)	10-7/8 (276.4)	11-1/2 (292)	9-3/8 (239.2)	3-3/4 (95)	6-1/2 (165)	104 (47)	117 (53)
3 (80)	11-3/4 (298.5)	12-1/2 (318)	10-3/4 (272)	4-3/8 (111)	7 (178)	114 (52)	132 (60)
4 (100)	13-7/8 (352.4)	14-1/2 (368)	12-1/2 (317.6)	5-1/8 (131.6)	7-1/2 (191)	146 (66)	174 (79)
5 (125)	15-3/4 (400)	16-5/8 (422)	13-3/4 (349.2)	5-3/4 (146.2)	8-1/2 (216)	170 (77)	215 (99)
6 (150)	17-3/4 (451)	18-5/8 (473)	15-1/2 (393)	6-5/8 (167)	9-1/2 (241)	199 (90)	261 (119)

Table 12. 2-1/2 through 6-Inch Two-Way Valve Dimensions.

Valve Action	Nominal Valve Size Inches (mm)	ANSI Class 125				ANSI Class 250			
		Dimensions in Inches (mm)			Weight lb (kg)	Dimensions in Inches (mm)			Weight lb (kg)
		A	B	C		A	B	C	
Normally Closed	2-1/2 (65)	10-7/8 (276)	10-5/8 (269)	4-7/8 (125)	107 (48)	11-1/2 (292)	11 (279)	5-3/8 (135)	120 (55)
	3 (80)	11-3/4 (299)	11-15/16 (303)	5-5/8 (142)	117 (53)	12-1/2 (318)	12-7/16 (315)	6 (154)	136 (62)
	4 (100)	13-7/8 (352)	13-15/16 (354)	6-5/8 (168)	154 (70)	14-1/2 (368)	14-3/8 (364)	7 (178)	184 (84)
	5 (125)	15-3/4 (400)	15-1/4 (388)	7-1/2 (185)	175 (79)	16-5/8 (422)	15-3/4 (399)	7-3/4 (196)	221 (101)
	6 (150)	17-3/4 (451)	171/16 (433)	8-3/16 (207)	210 (95)	18-5/8 (473)	17-1/2 (444)	8-5/8 (218)	275 (125)
Normally Open	2-1/2 (65)	10-7/8 (276)	11 (281)	4-7/8 (123)	107 (49)	11-1/2 (292)	11 (281)	4-7/8 (123)	121 (55)
	3 (80)	11-3/4 (299)	12-1/4 (312)	5-5/16 (135)	118 (53)	12-1/2 (318)	12-1/4 (312)	5-5/16 (135)	139 (63)
	4 (100)	13-7/8 (352)	13-9/16 (345)	6-5/16 (160)	153 (70)	14-1/2 (368)	13-5/8 (344.7)	6-5/16 (160)	183 (83)
	5 (125)	15-3/4 (400)	15-3/16 (385)	7 (177)	176 (80)	16-5/8 (422)	15-3/16 (385)	7 (177)	222 (101)
	6 (150)	17-3/4 (451)	16-3/4 (426)	7-7/8 (200)	211 (96)	18-5/8 (473)	16-3/4 (426)	7-7/8 (200)	277 (126)

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SIEMENS

Technical Specification Sheet
Document No. 149-261P25
February 26, 2009

Stantec
☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
June 17, 2013
Brandon Morris
By:
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.
STANTEC ARCHITECTURE LTD. PC-1449

Analog Sensors—1000 Ω Platinum RTD

Description

1000 Ohm Platinum (375 α) RTD sensors provide input for cost-effective, accurate temperature sensing (detecting) via a 20 AWG twisted, shielded cable pair. The sensor resistance varies according to the temperature being measured. Several models are available for specific mounting and sensing applications.

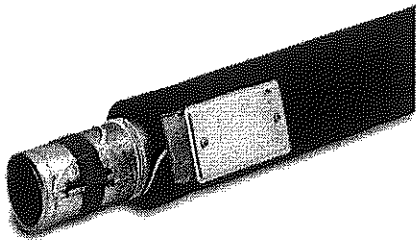


Figure 1. Surface Mounted Temperature Sensor.

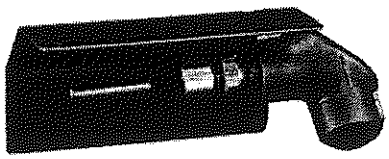


Figure 2. Outside Air Temperature Sensor.

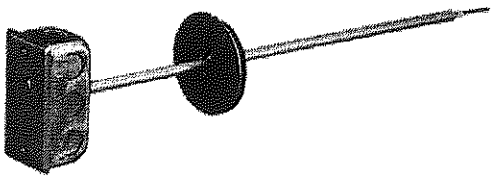


Figure 3. Duct (Single Point) Temperature Sensor (544-339-18 Shown with AQM2000 Accessory).

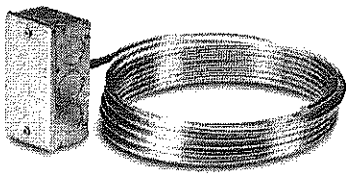


Figure 4. Duct (Averaging) Flexible Temperature Sensor.

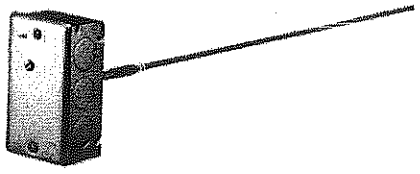


Figure 5. Duct (Averaging) Rigid Temperature Sensor.

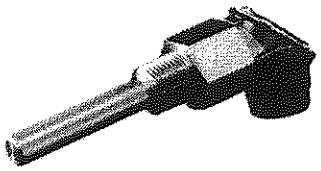


Figure 6. Liquid Immersion Temperature Sensor.

Specifications

Temperature Monitoring Ranges	See *Sensor Specifications*
Output Signal	Changing resistance
Elements	Platinum (or equivalent) wire resistance type
Accuracy	See *Sensor Specifications*
Reference Resistance at 32°F (0°C)	1000 Ohm

Sensor Specifications

Sensor Applications	Temperature Range (See Tolerance Formula at Bottom of Table)	Element Package	Part Number
Surface Mount - Pipe	-40°F to 240°F (-40°C to 116°C)	2-inch × 4-inch metal box with clamps	544-089
Outdoor Air		Through-the-wall	544-578
Duct - Single Point		4-inch (10 cm) 8-inch (20 cm) 18-inch (45 cm)	544-339-4 544-339-8 544-339-18
Duct - Averaging, Rigid	20°F to 120°F (-7°C to 49°C) Special Tolerances: 20°F ±2.3°F 70°F ±1.0°F 120°F ±2.8°F	18-inch (46 cm) 24-inch (60 cm) 36-inch (91 cm) 48-inch (122 cm)	544-343-18 544-343-24 544-343-36 544-343-48
Duct - Averaging, Flexible		8-foot(2.4 m) 16-foot (4.9 m) 24-foot (7.3 m)	544-342-8 544-342-16 544-342-24
Liquid Immersion	-40°F to 240°F (-40°C to 116°C)	2.5-inch (5 cm) 4-inch (10 cm) 6-inch (15 cm) Stainless steel wells NEMA 4/IP56 (immersion heads only)	544-577-25 544-577-40 544-577-60

Tolerance Formula: $\pm(0.54°F+(0.005 \times |T_{°F}-32|)$ [$\pm(0.3°C+(0.005 \times |T_{°C}|)$]
where $T_{°F}$ ($T_{°C}$) is the operating temperature point within the transmitter's range
(Example: For a sensor operating at 100°F; Tol = $\pm(0.54°F+(0.005 \times |100°F-32°F|)$ or ±0.88°F)

Accessories

AQM2000	Flange Gasket Kit (order separately if an adjustable depth is required for 544-339-18 duct point temperature sensors.)
544-577-RK	Immersion Repair Kit

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SIEMENS

Technical Specification Sheet
Document No. 149-971
August 16, 2006

Metal Flush Mount Room Temperature Sensor

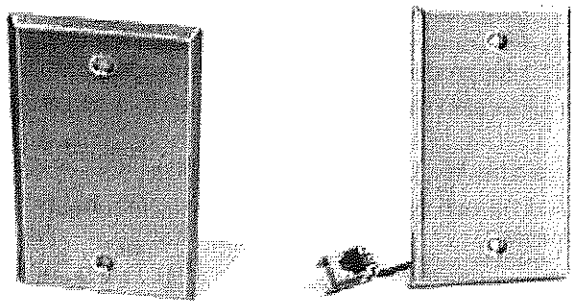


Figure 1. Metal Flush Mount Room Temperature Sensors.

Description

The Flush Mount Room Temperature Sensor from Siemens Building Technologies, Inc. provides sensing of room temperature to the Siemens room controller products. The sensor's resistance varies proportionally to the actual room temperature being measured.

The sensor connects to the controller via a two-wire pigtail connection. The Metal Flush Mount Room Temperature Sensor incorporates a temperature-sensing element (10K ohm thermistor, 100K ohm thermistor, or 1000 ohm RTD) behind a blank, stainless steel switch cover plate.

This room sensor is designed for those applications in which a conventional temperature sensor is not acceptable.

The tamper-proof screw is used to install the sensor to protect the sensor from removal by unauthorized personnel. The sensor may be painted after installation.

The Flush Mount Room Temperature Sensor is designed for mounting to a standard 4 electrical box. Sensors have a brushed stainless steel finish.

Specifications

Dimensions	4-1/2" H × 2-3/4" W × 1-1/36" D (114 mm × 70 mm × 27 mm)
Output Signal	Changing Resistance
Operating Temperature Range*	-40°F to 257°F (-40°C to 120°C)
10k Ohm Thermistor	
Calibration Point Factory Setting	77°F (25°C)
Accuracy @ Resistance Value	±0.5°F (±0.3°C) 10K ohm
100K Ohm Thermistor	
Calibration Point	77°F (25°C)
Accuracy @ Resistance Value	±0.5°F (±0.3°C) 100K ohm
1000 Ohm RTD	
Calibration Point	32°F (0°C)
Accuracy @ Resistance Value	±0.54°F (±0.3°C) 1K ohm

*Functional range for AI Input is controller-dependent.

Table 1. Metal Flush Mount Room Temperature Sensors.

Sensor Type	Blank Cover
10K ohm (Staefa compatible)	540-984
10K ohm (TEC compatible with RJ-11 jack)	540-995
100K ohm	536-984
1000 ohm	544-973

NOTE: The **540-984** sensor is not compatible with APOGEE controllers and is not intended for use with the Terminal Equipment Controller (TEC). This sensor does not have an RJ-11 jack. Any attempt to fit an RJ-11 jack to this sensor and connect it to a TEC will result in an inaccurate reading or no reading at all.

Reviewed
Revise and Resubmit
Not Reviewed
Stantec
June 17, 2013
Brandon Thompson
By:
This review is for general conformance with the design concept and general compliance with information given in the Contract Documents. Stantec Architecture Ltd. assumes no responsibility for errors, omissions, or deficiencies in the shop drawings or other submissions prepared by others, nor for the dimensions, which shall be confirmed and correlated at the job site. For information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.
STANTEC ARCHITECTURE LTD.
(PC-1-44e)

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SIEMENS

Technical Instructions
Document No. 155-272P25
CP 567-7
November 12, 2007

Powers™ Controls

CP 567 Control Cabinets

Description

CP 567 Control Cabinets are designed to conveniently group control system components (Figure 1). Control components can be mounted on the door or mounted within the cabinet enclosure using the perforated mounting plate. Cabinets are available in four Sizes: 1, 2, 3 and 4. See Table 1 for product numbers and dimensions.

- The cabinet enclosure, door, and perforated mounting plate for Sizes 1, 3 and 4 may be ordered separately.
- The Size 1 cabinet enclosure is available in a flush mount version.
- Size 3 and 4 cabinets are available in 6-inch depth (for electronic installations) or 9-inch depth (for pneumatic installations).

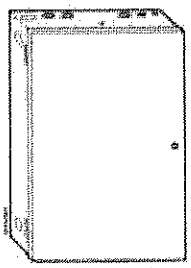


Figure 1. CP 567 Control Cabinet.

Stantec

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

June 17, 2013
Brandon Morris

By: _____

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STANTEC ARCHITECTURE LTD. (20-14-49)

Table 1. Product Numbers.

Description			Product Numbers	Dimensions Inches (mm) H × W × D
	Size	Installation		
Cabinet Assembly	1	Pneumatic	567-351	19-1/2 (495) × 16-3/8 (416) × 5-3/4 (146)
	2	Electronic	567-454	20 (508) × 20 (508) × 6 (152)
	3	Pneumatic	567-352	24-5/16 (617) × 24-3/8 (619) × 9-3/8 (238)
	3	Electronic	567-452	24-5/16 (617) × 24-3/8 (619) × 6 (152)
	4	Pneumatic	567-353	36-1/2 (927) × 24-3/8 (619) × 9-3/8 (238)
	4	Electronic	567-453	36-1/2 (927) × 24-3/8 (619) × 6 (152)
Cabinet Door	1	Pneumatic	567-361	See Figure 4
	3	Either	567-362	
	4	Either	567-363	
Cabinet Enclosure	1	Pneumatic	567-371	See Figures 4 and 5
	3	Either	567-372	See Figures 4 and 5
	4	Either	567-373	
Flush Mount Cabinet	1	Pneumatic	567-391	See Figure 7
Flush Mount Door Kit	1	Pneumatic	567-390	See Figure 8
Perforated Mounting Plate	1	Pneumatic	567-381	–
	3	Either	567-382	
	4	Either	567-383	

Application

CP 567 Control Cabinets provide a convenient central location for equipment mounting, termination of piping, adjustment, and calibration.

The door and mounting plate can be separated from the cabinet enclosure. The empty cabinet enclosure can be installed at the job to permit early rough-in of conduit.

Controls may be mounted to the door and mounting plate either at the job site or at the office and attached to the cabinet enclosure at your convenience. After reassembly, final connections are made.

Cabinets may be used with pneumatic systems employing either copper or polyethylene tubing for transmission lines, with wired electric/electronic systems, or with a combination of both.

Pneumatic tubing within the cabinet enclosure should be polyethylene for a flexible connection to hinged door components and for easy installation and arrangement.

Features

- Cabinets are symmetrical; therefore, they can be mounted with the door hinge on the left or right hand side.
- Door is removable.
- Attractive gray finish permits use in occupied areas.
- Removable perforated mounting plate permits mounting controls inside the cabinet without drilling holes.
- All cabinets can be wall or floor mounted.
- Support kits are available for floor mounting (medium and large cabinets only).
- Knockouts are provided for electrical or pneumatic piping.
- Cabinets are listed under UL 508 Industrial Control Panel Enclosures.
- CSA approved file LR84214.
- NEMA TYPE 1 style of enclosure.
- Height and width dimensions and cabinet color are the same for automation and pneumatic cabinets for a uniform look and mounting.

Specifications

Cabinet Sizes	See Table 1
Dimensions:	
Cabinet, Door, Subpanel	See Figures 4 through 8 and Tables 6 and 7
Supports	See Figure 6
Mounting:	
Wall	See Figure 4 and Table 6
Floor	See Figure 5
Flush (in wall)	See Figures 7 and 8 and Table 7

Specifications, Continued

Knockouts-Electrical Conduit Size:	
Size 1 and Flush Mount Cabinets	
Top	(3) 1-1/4 or 1-1/2, (1) 3/4 or 1, (2) 1/2 or 3/4, (1) 7/16
Bottom	(3) 1-1/4 or 1-1/2, (1) 3/4 or 1, (2) 1/2 or 3/4, (1) 7/16
Right Side	(2) 2
Left Side	(2) 2
Size 2, Size 3 and Size 4 Cabinets	
Top	(1) 2, (3) 1-1/4 or 1-1/2, (1) 3/4 or 1, (1) 1/2 or 3/4, (1) 7/16
Bottom	(1) 2, (3) 1-1/4 or 1-1/2, (1) 3/4 or 1, (1) 1/2 or 3/4, (1) 7/16
Right Side	(2) 2
Left Side	(2) 2
Material (Steel):	
Cabinet (Size 1, 2, 3 and Flush Mount)	16 gauge 0.0598 (1.5 mm)
Door (Size 1, 2, 3 and Flush Mount)	16 gauge 0.0598 (1.5 mm)
Cabinet (Size 4)	14 gauge 0.0747 (1.9 mm)
Door (Size 4)	14 gauge 0.0747 (1.9 mm)
Mounting Plate	16 gauge 0.0598 (1.5 mm)
Supports	14 gauge 0.0747 (1.9 mm)
Finish	Gray
Weight:	
Size 1 Cabinet Assembly	20 lb (9 kg)
Size 2 Cabinet Assembly	28 lb (13 kg)
Size 3 Cabinet Assembly	39 lb (18 kg)
Size 4 Cabinet Assembly	72 lb (33 kg)
Flush Mount Enclosure	20 lb (9 kg)
Flush Mount Kit	8 lb (3.6 kg)
Support Legs	See Table 2

Accessories

Replacement Door Lock and Key Assembly	567-225
Floor Mount Support Kit (2 supports, hardware)	See Table 2
Touch-up Spray Paint, 16 oz Can	
Gray	544-459
Blue	534-500
Cabinet Light	See I.D. Number 3296 in the Field Purchasing Guide

Table 2. Floor Mount Support Kit.

Cabinet Size to be Supported	Support Size		Order Number
	Height	Weight	
Size 3	49 inches (1245 mm)	40 lb (18 kg)	567-335
Size 4	37 inches (940 mm)	30 lb (14 kg)	567-334

NOTE: The six-inch deep cabinets do not have floor mount support kits.

Door Layout

NOTE: Controls cannot be mounted to the door of the flush mount cabinet.

Perform the following steps when preparing to lay out a cabinet door:

1. Determine controls to be mounted on the door.
2. Determine if the controls mounted in the door will clear the mounting plate when tubing or wires are attached. See Figure 3 and Table 5 for dimensions. Table 4 provides the approximate space requirements for controls frequently mounted in the door.
3. Determine if the total weight of the controls, (see Table 4) to be mounted on the door are within the maximum weight limitations shown in Table 3. If weight limitations are exceeded, the door might sag and prevent proper closure.

Table 3. Weight Limitations.

Cabinet Size	Maximum Weight of Controls That Can Be Mounted on Door lb (Kg)	Maximum Number of Selector Switches That Can Be Mounted on Door
Size 1	21 (9.5)	14
Size 2	24 (11)	16
Size 3	30 (14)	20
Size 4	93 (42)	62

Cabinet Installation (Non-flush mount)

1. There are four keyhole mounting holes in the back surface of the cabinet. Their sizes and locations are shown in Figure 5. Use wall anchors that are suitable to support the weight of the cabinet and its contents.
2. If more than one cabinet is to be mounted in the same location, allow at least 2 inches (51 mm) between cabinets to provide space for doors to open properly.
3. The cabinets are symmetrical before cutouts have been made, so the door can be mounted with the hinge on the left or right side.
4. Determine the size of the knockouts required for the number and size of pneumatic tubes and wires to be brought into the cabinet.
5. If more than one knockout is required, divide the tubes and wires for easy connection to the controls.
6. If a cabinet light is required, order per instructions under accessories. The recommended mini work light has a 2-inch diameter by 4-inchlong (51 mm × 102 mm) bulb holder on a 15-inch (381 mm) long flexible metal arm.
   a. Remove the plug and mounting bracket from the light.
   b. Punch out the 7/16-inch (11 mm) diameter knockout in the center of the top of the cabinet.
   c. Attach the light using the nut and washer provided with it.
   d. Wire the light cord in compliance with local electrical codes.

Controls Installation

NOTE: It might be easier to remove the door from the cabinet and then mount the controls onto the door or the mounting plate.

1. The space required for the controls mounted in the door or the mounting plate is shown in Table 4. Space available between the door and the mounting plate is shown in Figure 4, Table 5, and Table 6.

2. Arrange the controls on the mounting plate to avoid interference with the controls on the door. Arrange the controls in logical groupings for easy access to fitting and wiring terminals. Table 4 shows the approximate space required for controls frequently mounted on the mounting plate in the cabinet.

3. In some cases it might be easier to remove the mounting plate to mount the controls.

4. Mount the controls to the perforated mounting plate with standard sheet metal screws.

5. When routing tubing or wires from the controls mounted on the door, allow sufficient slack to prevent excessive stress.

6. Bundle and tie tubing and wires separately.

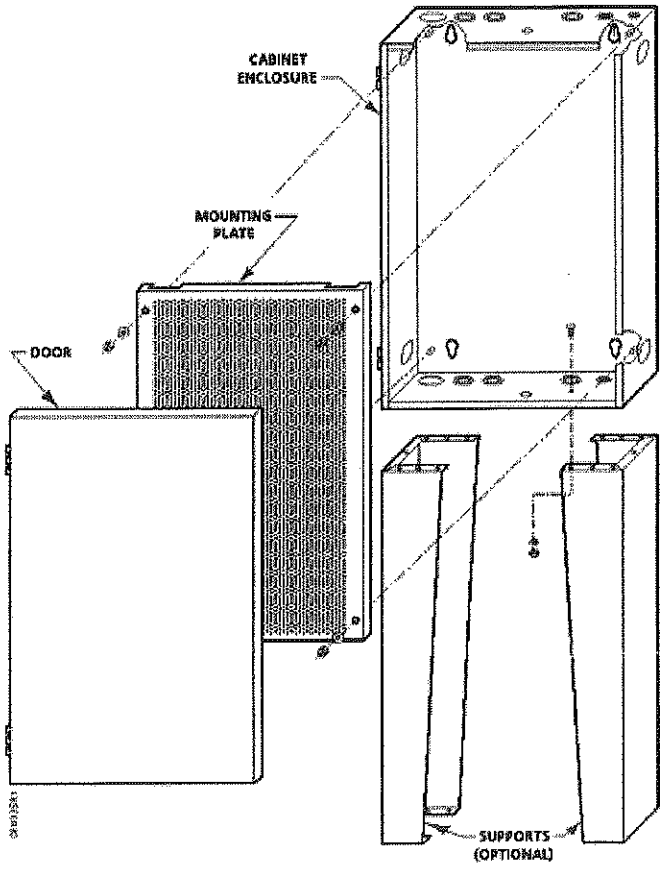


Figure 2. Wall Mount Cabinet Components.

Cabinet Installation (Flush Mount)

1. Mount the cabinet in a wall at least 6 inches (15.2 cm) deep. There are four keyhole mounting holes in the back surface of the cabinet. Their sizes and locations are shown in Figure 5. Use wall anchors that are suitable to support the weight of the cabinet and its contents.

2. Determine the size of the knockouts required for the number and size of pneumatic tubes and wires to be brought into the cabinet.

3. The cabinets are symmetrical before cutouts have been made, so the door can be mounted with the hinge on the left or right side.

4. If more than one knockout is required, divide the tubes and wires for easy connection to the controls.

5. If a cabinet light is required, order per instructions under accessories. The recommended mini work light has a 2-inch diameter by 4-inch long (51 mm × 102 mm) bulb holder on a 15-inch (381 mm) long flexible metal arm.

   a. Remove the plug and mounting bracket from the light.

   b. Punch out the 7/16-inch (11 mm) diameter knockout in the center of the top of the cabinet.

   c. Attach the light using the nut and washer provided with it.

   d. Wire the light cord in compliance with local electrical codes.

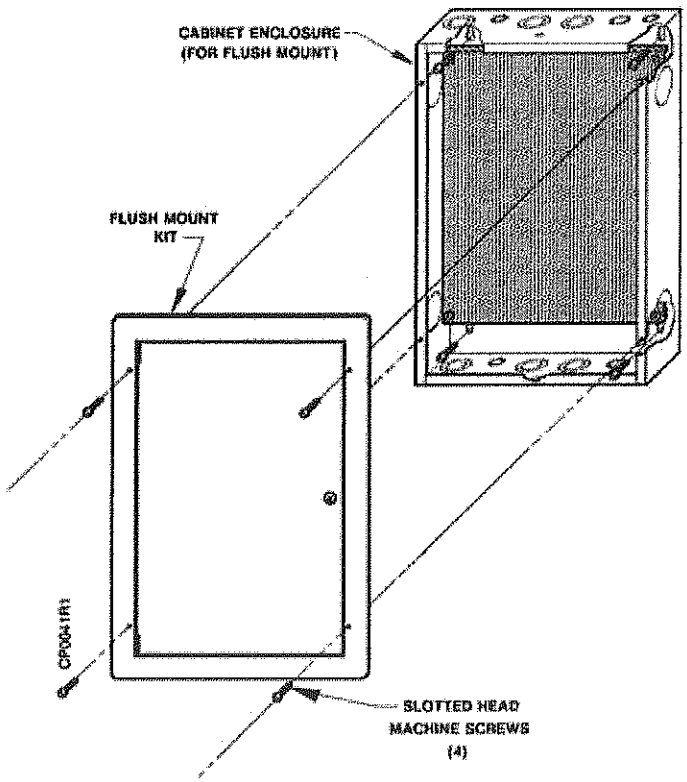


Figure 3. Flush Mount Cabinet Components.

Table 4. Approximate Panel Space Requirements (Includes Fitting and Clearances).

Equipment	Door Mounting Depth Inches (mm)	Equipment Weight Pounds (kg) (See Note 3)	Mounting Plate Depth Inches (mm)	Inside Area Required Inches^2 (cm^2)
6 Input Sig. Selector	–	–	4 (102)	12 (77)
656 Pilot Valve	–	–	3 (76)	100 (645)
ARG 61.00 Wall Mount Case	–	–	8.52 (216.4)	13.10 (84.5)
ARG 61.01 Panel Mount Case	7.52 (191)	1.65 (0.750)	–	11.28 (72.8)
D.P. Switch	–	–	3 (76)	45 (290)
Diff. Press. Reg.	–	–	3 (76)	35 (226) (See *Note 1*)
E.P.	–	–	1-1/4 (32)	30 (194)
Electric Relay	–	–	4 (102)	30 (194)
Enthalpy Comparator	–	–	3-1/2 (89)	30 (194)
FZA 21 Remote Setting Unit	0.87 (22)	0.11 (0.05)	–	1.98 (12.76)
FZA 61 Remote Setting Unit	1.10 (28)	0.15 (0.07)	–	3.00 (19.36)
Gauges 1-1/2"	2 (51)	0.2 (0.09)	1-1/2 (38)	4 (26) (See *Note 2*)
Gauges 2-1/2"	2-1/2 (64)	0.5 (0.22)	–	–
Gauges 3-1/2"	2-1/2 (64)	0.6 (0.27)	–	–
Min (PRV)	3 (76)	0.5 (0.22)	2 (51)	10 (65)
MP, BR, Analog Relays	4-1/2 (114)	2 (0.91)	2-1/2 or 5 (64 or 127)	42 (271)
P.E. (Single)	–	–	3-1/2 (89)	28 (181)
Positioning/Selector Switch	3 (76)	2 (0.91)	5 (127)	10 (65) (See *Note 2*)
PRV (Powers)	–	–	5-1/2 (140)	100 (645)
RC 195	–	–	3-1/2 (89)	6 0(387)
Static Pressure Reg.	–	–	4 (102)	30 (194)
Switching Relay	–	–	2-1/2 (64)	65 (419)

NOTES: 1. Normally not mounted inside of the cabinet.
2. If mounted inside of the cabinet.
3. Weights are given for door mounted devices only.

Table 5. Usability.

Product Numbers	Cabinet Enclosure	Inside Depth Door to Mounting Plate Inches (mm)	Maximum Usable Area Inches^2 (cm^2)	Maximum Number of RC-195 Per Cabinet
567-351	Size 1	5 (127)	172 (1109)	3
567-391	Flush Mount	4-5/8 (117)	172 (1109)	3
567-454	Size 2	5-1/2 (140)	227 (1465)	4
567-352 567-452	Size 3	8-1/2 (216) 5-1/2 (140)	380 (2451)	6
567-353 567-453	Size 4	8-1/2 (216) 5-1/2 (140)	615 (3967)	10

Dimensions

Dual Knockouts		
Type	Nominal Conduit Size Inches (mm)	Knockout Diameter Inches (mm)
1	1/2 & 3/4 (13 & 19)	0.875 & 1.109 (22 &28)
2	3/4 & 1 (19 & 25)	1.109 & 1.375 (28 & 35)
3	1-1/4 & 1-1/2 (32 & 38)	1.734 & 1.984 (44 & 50)
4	2 (51)	2.469 (63)
5	–	0.437 (11)

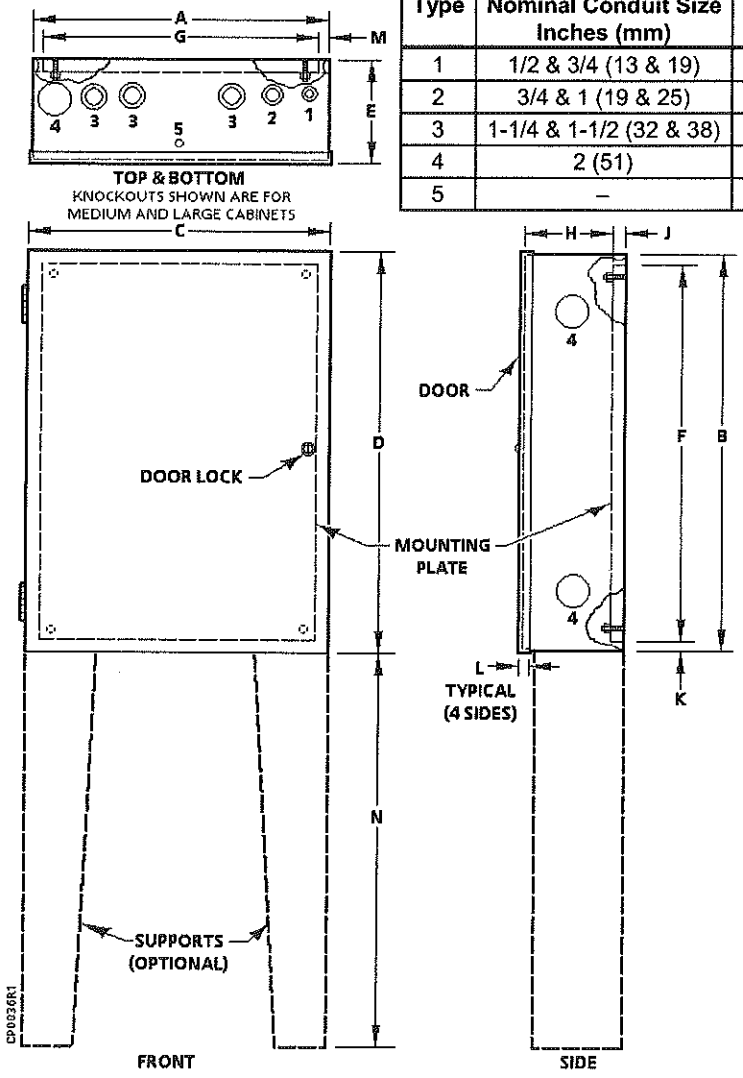


Figure 4. Cabinet and Support Dimensions (See Table 5 and Figure 9).

Dimensions, Continued

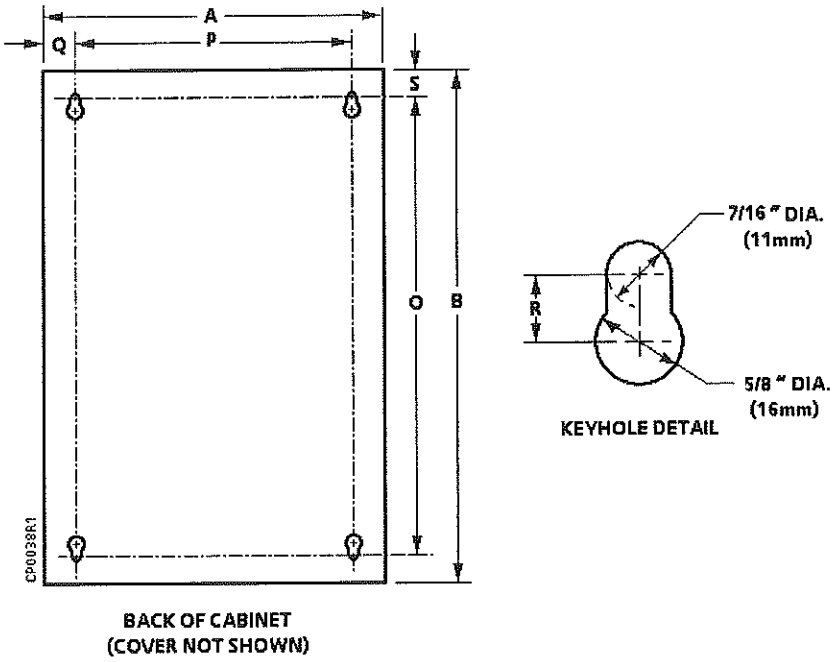


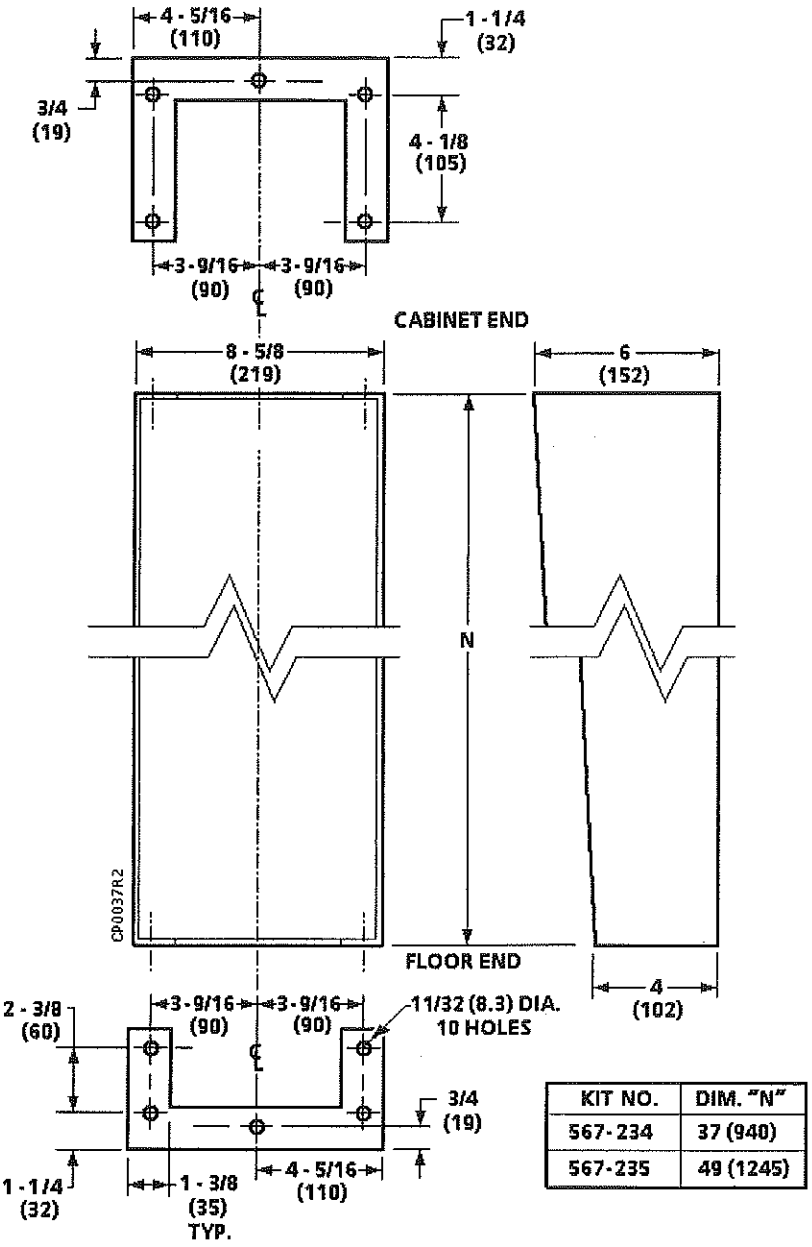
Figure 5. Rear View of Cabinet (See Table 6).

Table 6. Cabinet Assembly Dimensions (See Figures 4, 5, and 6).

Cabinet Assembly		Dimensions Inches (mm)									
Product Number	Size	A	B	C	D	E	F	G	H	I	J
567-351	Size 1	16 (406)	19 (483)	16-3/8 (416)	19-1/2 (495)	5-3/4 (146)	14-1/2 (368)	14-3/4 (375)	5 (127)	5-11/16 (145)	1/2 (13)
567-454	Size 2	20 (508)	20 (508)	20-5/16 (516)	20-5/16 (516)	6 (152)	19 (483)	15.25 (387)	5-3/8 (137)	5-7/8 (149)	1/2 (13)
567-352 [567-452]	Size 3	24 (610)	24 (610)	24-3/8 (619)	24-5/16 (617)	9-3/8(238) [6 (152)]	19-1/4 (489)	23 (584)	8-1/2 (216)	9-1/4(235) [5-7/8 (149)]	1/2 (13)
567-353 [567-453]	Size 4	24 (610)	36 (914)	24-3/8 (619)	36-1/2 (927)	9-3/8(238) [6 (152)]	31-1/2 (800)	22 (559)	8-1/2 (216)	9-1/4(235) [5-7/8 (149)]	1/2 (13)
Product Number	**Size**	**K**	**L**	**M**	**N**	**O**	**P**	**Q**	**R**	**S**	–
567-351	Size 1	2-1/4 (57)	3/4 (19)	5/8 (16)	*	16-1/2 (419)	13-1/2 (343)	1-1/4 (32)	1/2 (13)	1-1/4 (32)	–
567-454	Size 2	2-1/4 (57)	3/4 (19)	1/2 (13)	-	17.5 (445)	12 (305)	4 (102)	1/2 (13)	1-1/4 (32)	–
567-352 [567-452]	Size 3	2-1/4 (57)	3/4 (19)	1/2 (13)	49 (1245)	21 (533)	16 (406)	4 (102)	1/2 (13)	1-1/2 (38)	–
567-353 [567-453]	Size 4	2-1/4 (57)	3/4 (19)	1 (25)	37 (940)	33-1/2 (851)	16-314 (425)	3-5/8 (92)	1/2 (13)	1-1/4 (32)	–

* See Figure 6 for dimensions of "N"

Dimensions, Continued



KIT NO.	DIM. "N"
567-234	37 (940)
567-235	49 (1245)

Figure 6. Floor Mount Support Legs Kit. Dimensions in Inches (mm).

Dimensions, Continued

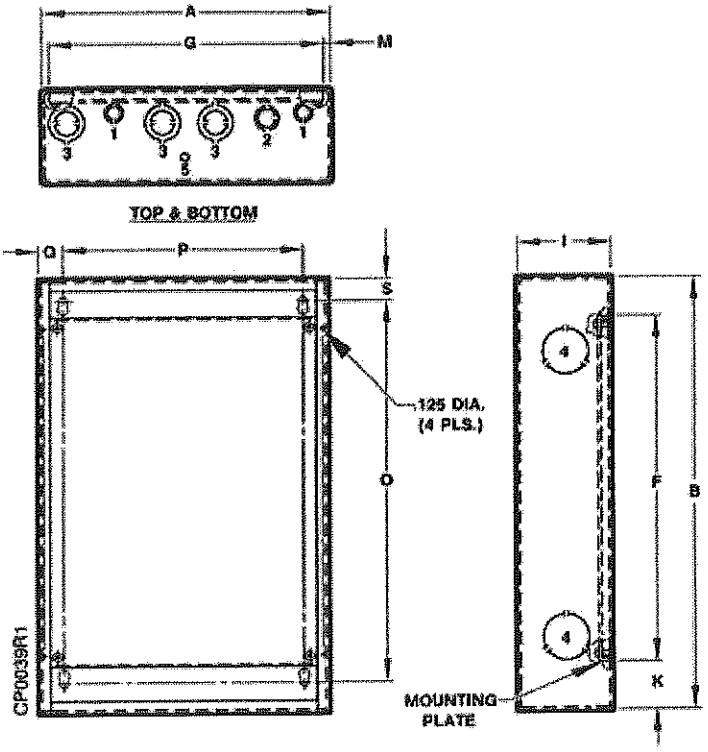


Figure 7. Flush Mount Cabinet Dimensions (See Table 7).

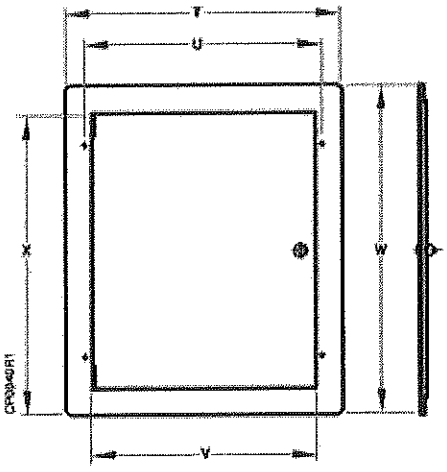


Figure 8. Flush Mount Door Dimensions (See Table 7).

Table 7. Flush Mount Cabinet and Door Dimensions.

Dimensions in Inches (mm)							
A*	B*	F	G	I	K	M	O
16-1/8 (410)	19-1/2 (495)	13-1/2 (343)	14-3/4 (375)	5-1/8 (130)	1-1/2 (38)	1-11/16 (43)	16-1/2 (419)
P	Q	S	T*	U	V	W*	X
13-1/2 (343)	1-1/4 (32)	1-1/4 (32)	18 (457)	15-7/16 (392)	14-3/4 (375)	21-3/8 (543)	18-1/8 (460)

* Cutout dimensions; make cutout at least the size of dimensions A and B (cabinet size) but no larger than T & W (door size).

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Submittal Sheet
Document No. 154-004P25
January 25, 2011

OpenAir™ GMA Series, Spring Return, 24 Vac/dc and 120 Vac, 62 lb-in, Direct-Coupled Electronic Damper Actuators

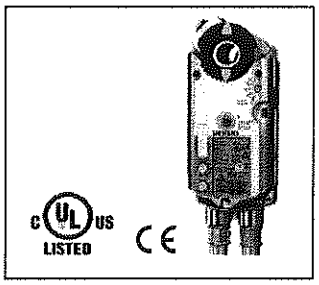
Product Number	Operating Voltage		Control				Cables		Built-In Control Options				
	24 Vac ±20% 24 Vdc ±15%	120 Vac ±10%	Modulating 0 to 10 Vdc	Modulating 2 to 10 Vdc	Floating	2-position	Standard	Plenum	Position Feedback	Dual Auxiliary Switches	Offset 0 to 5 Vdc Span 2 to 30 Vdc	Input Signal Inversion (Direct or Inverse Acting)	Feedback Signal Inversion
GMA121.1U	•					•	•						
GMA121.1P/B	•					•		•					
GMA121.1P	•					•		•					
GMA126.1U	•					•	•			•			
GMA126.1P	•					•		•		•			
GMA221.1U		•				•	•						
GMA226.1U		•				•	•			•			
GMA131.1U	•				•		•						
GMA131.1P	•				•			•					
GMA132.1U	•				•		•		•				
GMA136.1U	•				•		•			•			
GMA151.1U	•			•			•		•			•	•
GMA151.1P	•			•				•	•			•	•
GMA156.1U	•			•			•		•	•		•	•
GMA156.1P	•			•				•	•	•		•	•
GMA161.1U	•		•				•		•				
GMA161.1P	•		•					•	•				
GMA163.1U	•		•				•		•		•		
GMA163.1P	•		•					•	•		•		
GMA164.1U	•		•				•		•	•	•		
GMA166.1U	•		•				•		•	•			
GMA166.1P	•		•					•	•	•			

Technical Data

Runtime for 90°:	90 sec. operating
Spring Return:	15 sec. typical (<60 seconds max. at –25°F (–32°C))
Frequency:	50/60 Hz
Power consumption: 24 Vac/dc	
Running:	5 VA/3.5W
Holding:	4 VA/3W
Power Consumption: 120 Vac	
Running and holding:	≤7 VA/5W
Equipment rating (24V):	Class 2 per UL/CSA
Angle of rotation:	90° nominal, 95° max.
Shaft dimensions:	1/4 to 3/4-in. (6.4 to 20.5 mm) dia., 1/4 to 1/2-in. (6.4 to 13 mm) sq., 1-in. (25.4 mm) min. length
Operating temperature:	-25°F to 130°F (-32°C to 55°C)
Storage temperature:	-40°F to 158°F (-40°C to 70°C)
Ambient humidity:	95% rh (non-condensing)

Description

The OpenAir direct-coupled, spring return electronic damper actuators provide modulating, two-position and three-position control of building HVAC dampers.



Features

- Brushless motor technology
- Bi-directional fail-safe spring return
- Unique self-centering shaft coupling
- Models available with dual, independently adjustable auxiliary switches
- Floating control models available with feedback potentiometer
- All modulating control types include built-in feedback capability
- All metal housing
- Manual override
- Mechanical range adjustment capability
- Easily visible position indicator
- Precabled
- UL60730 (to replace UL873) and cUL (C22.2 No. 24-93) listed CE conformance
- Small actuator footprint with 62 lb-in of torque
- 24 Vac/dc and 120 Vac models

Stantec

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

June 17, 2013
Brandon Morris

By:

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.

STANTEC ARCHITECTURE LTD.

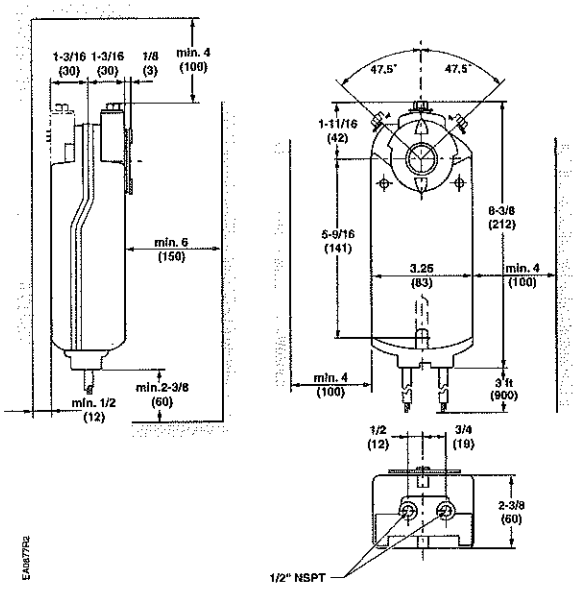
Technical Data, continued

Enclosure:	NEMA 1
Precabled connection:	18 AWG, 3 ft (0.9 m) long
Agency listings:	UL60730 (to replace UL873) C-UL C22.2 No. 24-93
Material:	Die cast aluminum alloy
Gear lubrication:	Silicone free
Dimensions:	8-3/8" H × 3-1/4" W × 2-2/3" D (212 mm H x 83 mm W x 68 mm D)
Weight:	2.9 lb (1.3 kg)
Country of Origin	USA

Typical Specifications

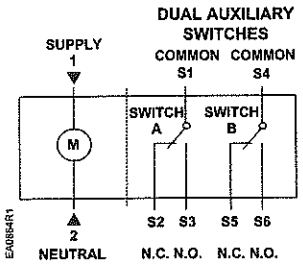
Spring-return damper actuators shall be the direct-coupled type that requires no connecting linkages. These spring return actuators shall have a self-centering damper shaft coupling that assures concentric alignment of the actuator's output coupling with the damper shaft for <60 lb-in torque and be capable of direct mounting to a shaft up to a 3/4-inch in diameter. Actuators shall provide stall protection throughout the full range of rotation. All spring return actuators shall be capable of both clockwise and counterclockwise spring return fail-safe operation using a continuously engaged mechanical return spring that returns the actuator to a fail-safe position in <15 seconds in response to a loss of power. All actuators shall provide a means of manually positioning the output coupling in the absence of power. Dual, independently adjustable auxiliary switches are available for these actuators. All actuators must be precabled and provide an easily readable high contrast yellow on black position indicator. All actuators shall be CE conforming; UL60730 (to replace UL873) and CSA22.2 listed and manufactured under ISO 9002 and ISO 14000 procedures. Actuators shall be as manufactured by Siemens Industry, Inc.

Dimensions in Inches (Millimeters)

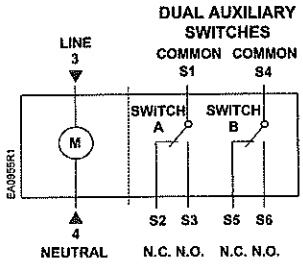


Wiring Diagrams

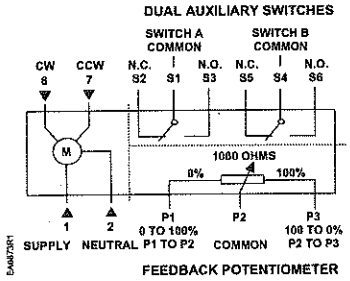
GMA12x, 2-Position, 24 Vac/dc:



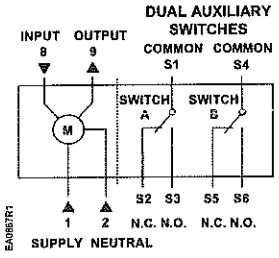
GMA22x, 2-Position, 120 Vac:



GMA13x, Floating, 24 Vac/dc:



GMA16x, GMA15x; Modulating; 24 Vac/dc:



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SIEMENS

Technical Specification Sheet
Document No. 149-475
February 2009

Stantec
☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
June 17, 2013
Brandon Morris
By:
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.
STANTEC ARCHITECTURE LTD. (PC-14-16)

PX Series Enclosures and Accesso

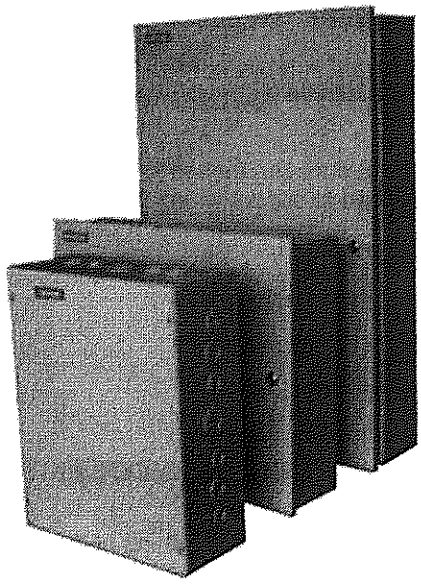


Figure 1. New PX Series Enclosures.

Enclosures

Description

PX series enclosures house both electronic and pneumatic components. The enclosures include a perforated backplane for mounting of the PXC series controllers, Power Modular Equipment Controllers, Point Expansion Modules or other electronic or pneumatic components.

Features

- Three sizes available to match installation needs.
- Sturdy construction accommodates secure conduit fittings and protects components against incidental contact and falling dirt.
- Multiple knockouts along top, sides and bottom.
- Perforated backplane extends wall-to-wall for mounting of additional equipment.
- DIN rail(s) for mounting of components.
- Spacious interior for easy routing and termination of wiring.
- Hinged door, key lock, wire tie bars, PXA series service boxes
- UL Smoke Control Listing is available on the 19" and 34" models.
- UL 916 rating is available on the 18' enclosure
- 18" enclosure pull-box type, utility cabinet for low cost installations (see Figure 2).

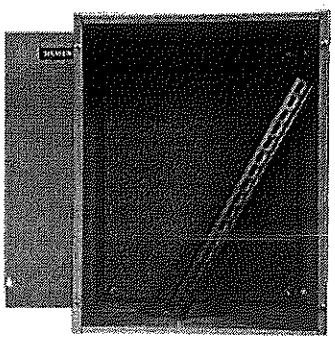


Figure 2. Complete 18" Enclosure Assembly.

Accessories

Service Boxes

Description

PXA series service boxes include all of the parts necessary for installation inside a 19 inch or 34 inch PX Series Enclosure Assemblies. The 192VA service box can also be used within existing MEC enclosures. The 384VA service box may only be installed in the 34 inch PX Series Enclosure.

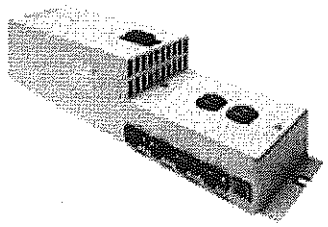


Figure 3. SB115V384VA service box .

Features

- Four service boxes are available to step-down line voltage to 24Vac for use by electronic components.
- Service boxes are sized for:
  - 115V to 24V at 192VA
  - 115V to 24V at 384VA
  - 230V to 24V at 192VA
  - 230V to 24V at 384VA
- 384VA models mount inside the 34" enclosures.
- 192VA models mount inside the 19" and 34" enclosures.
- Two sidewall kits cover exposed circuits for use in other NEMA Type 1 enclosures such as motor control cabinets.
- Each service box includes an on/off circuit breaker for the transformer, transient protection on both primary and secondary sides, two NEC Class 1 power limited terminations for components inside the enclosure and one NEC Class 2 termination for external components such as TX-I/O Bus expansion or actuators.
- The 115V models provide an un-switched duplex outlet to power peripheral devices such as modems, trunk interfaces and Portable Operator's Terminals.
- UL864 Smoke Control rated when used in PXA Series Enclosure 19" or 34" or within existing MEC enclosures.

DIN Replacement Kit (PXA-DIN16KIT)

The DIN Replacement Kit can be used when additional 16" DIN rail is required.

This kit contains:

- Four 16" (406 mm) DIN rails for use when extra rails are needed
- Twelve Screws

Wire Tie Bar Kit (PXA-TIEBARKIT)

The Wire Tie Bar kit can be used when addition tie bars are needed to secure wiring within the enclosure.

This kit contains:

- Four 4.5" (114 mm) tie bars
- Four 9.5" (241 mm) tie bars
- Screws and cable ties

USB Modem Kit (PXA-USBMODEMKIT)

USB Modem kit contains everything needed for dial up modem connection using the USB Host port of the PXC Modular controller.

This kit contains:

- Sportsters Modem 56k BPS Dialup
- USB to RS232 Adapter
- Surge Suppressor Analog Telephone Line
- DB25M/F Right-Angle Adapter
- IBM 6' PC Cable DB9F to DB25M

USB to RS232 Adapter (PXA-USBADAPTER)

USB to RS232 Adapter converts USB Host signals (Type A male connector) to RS232 signals (DB9 male connector).

This adapter may be used for connection to a RS232 printer. It is part of the PXA-USBMODEMKIT.

Specifications

Specifications	PXA-ENC18	PXA-ENC19	PXA-ENC34
UL Listed NEMA Type 1 Enclosure	X	X	X
Pull-box style	X		
Hinged Door with lock		X	X

Ambient Operating Environment			
+32°F to +120°F (0°C to +49°C) 93% RH (Non-condensing)	X	X	X

Agency Listing			
UL864 UUKL		X	X
ULC-C100 UUKL7		X	X
UL 916 PAZX		X	X
UL 508A	X		

Agency Compliance			
FCC Compliance	X	X	X
Australian EMC Framework	X	X	X
European EMC Directive (CE)	X	X	X
European Low Voltage Directive (LVD)	X	X	X
Dimensions	18"H × 14"W × 6"D (457.2 mm × 355.6 mm × 152.4 mm)	19"H × 22"W × 5.75"D (482.6 mm × 558.8 mm × 146.05 mm)	34"H × 22"W × 5.75"D (863.6 mm ×558.8 mm × 146.05 mm)

Mounting Surface			
Building Wall	X	X	X
Structural Member	X	X	X

Input Power Requirement	**115V Service Boxes**	**230V Service Boxes**
Voltage	115Vac +/- 15% @ 60 Hz +/- 5%, from 15 or 20A circuit breaker	230Vac +/- 15% @ 50/60 Hz +/- 5%, from 10A circuit breaker
Current	2A for 192VA, 4A for 384VA, 2A for 115Vac Service Outlets	1A for 192VA, 2A for 384VA

Ordering Information

Enclosure Range

Description	Product Number
18" PX Series Enclosure	PXA-ENC18
19" PX Series Enclosure	PXA-ENC19
34" PX Series Enclosure	PXA-ENC34

Accessories

Service Box 115V, 24 Vac, 192 VA	PXA-SB115V192VA
Service Box 230V, 24 Vac, 192 VA	PXA-SB230V192VA
Service Box 115V, 24 Vac, 384 VA	PXA-SB115V384VA
Service Box 230V, 24 Vac, 384 VA	PXA-SB230V384VA
Service Box Sidewall Kit, 192 VA	PXA-SW192VA
Service Box Sidewall Kit, 384 VA	PXA-SW384VA
Replacement door for 19" PX series enclosure	PXA-ENC19.REPL.DR
Replacement door for 34" PX series enclosure	PXA-ENC34.REPL.DR

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SIEMENS

Technical Specification Sheet
Document No. 149-265P25
June 2, 2012

Sportster 56000 Modem



Features

The U.S. Sportster 56000 bps modem is a high speed modem for use in intermittent network communications over public telephone lines. The modem is a desk top unit which can also be mounted in an APOGEE® Automation System field panels such as the PXC Modular, PXC Compact 36, Modular Building Controller (MBC), Remote Building Controller (RBC), or Floor Level Network (FLN) Controller. It can also be used in modem applications with Insight® Auto-Dial. It can also be used for virtually all on-line service applications such as remote terminal or alarm printer (except leased-line).

The UL and cUL listed Dial-up Modem Smoke Control Kit contains the modem, transient suppressor and associated cable(s) intended for use in field panels that require S1 Smoke Control ratings. Order individual components where a kit has been discontinued.

The Sportster 56000 Modem specific features include:

- High speed operation provides 56000, 19200, and 9600 baud rate transmission.
- Automatic answer, Auto-dial.
- Full duplex on a 2-wire switched network.
- Programmable dial-up, service and remote printer modes. Modem factory-configured for dial-up.
- FCC/DOC approved for direct connection to an analog phone line.
- UL and ULC listed for Information Technology equipment.
- Support of AT basic and extended command sets.
- End-to-end compatible with all Bell, CCITT and ITU-T protocols from 300 to 56000 bps.
- Automatic transmission speed adjustment guarantees highest speed under wide range of conditions.
- Compatible with Group III Fax modem software.
- Supports data compression, error control and dial security.
- Comprehensive User's Manual is provided with the modem.
- Maximum usable by Insight Auto-Dial is 19200 baud other supported data rates are 9600, 4800, 2400, and 1200 baud.
- The Dial-up Modem Smoke Control Kit specific features include:
- UL and cUL listed for Smoke Control equipment.
- UL and cUL listed as suitable for use as Energy Management equipment, Signal System unit and Process Management equipment.
- Installation of modem kit maintains a field panel S1 smoke control rating by providing secondary telephone line transient suppression, which protects both the modem and the field panel from damage due to electronic disturbances such as lightning strikes.

Description

The Sportster 56000 modem is easy to operate. The front panel contains status LEDs (light-emitting diodes) and an ON/OFF switch. The rear panel contains the necessary connections for an optional telephone, the telephone line, the power connector and the computer or terminal interface. DIP switches located on the rear panel of the modem and "AT" commands stored in programmable nonvolatile random access memory (NVRAM) are used to specify a wide variety of applications. However, the modem is preset for the Dial-up Application (setup sheet is included). The volume control is located on the side panel. The

modem comes with a 120 Vac plug-in power pack, 7-foot phone cord, connectivity software, and user documentation.

The Dial-up Modem Smoke Control Kit includes an EDCO FAS-TEL-200T telephone transient surge suppressor which uses a silicon break-over device and solid state resettable fuses to limit over voltage and fault currents. Through the use of the transient surge suppressor, telephone line transients are reduced to levels that do not damage the modem or field panel controller. The devices are tested together by UL for smoke control compliance. The kit also includes an RJ11 to modem cable for use in a field panel dial-up network or for service only.

Specifications

Sportster Specifications	
RS-232 Data Rate	300 – 115.2K bps asynchronous
Operation	Full duplex on 2-wire Public Switched Telephone Network (PSTN)
Operating mode	Auto Call/Auto Answer/ Dumb
Compatibility	
Modem Compatibility	ITU-T V.92, V.90, V.80, V.34+, V.34, V.32ter, V.32bis, V.32, V.25, V.22/Bell 212A,
Fax Compatibility	V.21/Bell 103 V.29, V.27ter, V.21, V.17,
Error Correction	Group III, EIA 578 Class 1, EIA 592 Class 2.0
Data Compression	V.42
	V.44, V.42bis
TELCO and TELSET jack	6-pin RJ11 modular jack
Digital Interface	25-pin EIA RS-232 female jack
AC Power Pack	UL and CSA approved, 120VAC
Environmental (Operating)	32°F to 104°F (0°C to 40°C) 90% RH, non-condensing
Ringer Equivalence	0.4B
Certification	FCC Approved Part 15 Class B/Part 68, IC (formerly DOC) Approved, UL and CSA Approved
	* 53.3K bps limit

Product meets OSHPD Special Seismic Preapproval certification (OSH-0217-10) under California Building Code 2010 (CBC2010) and International Building Code 2009 (IBC2009) when installed as directed within Siemens enclosure part numbers; PXA-ENC18, PXA-ENC19 or PXA-ENC34.

Suppressor Specifications	
Maximum Peak Signal	220V working voltage
Maximum Signal Load	150 mA continuous current
Nominal Breakdown	300V
Surge Current	200A
Break-over voltage	10V
Certification	UL 497A listed
Kit Specifications	
Certification	UL 864 UUKL, UDTZ QVAX, UL 916 PAZX, ULC/ORD-C100-1992
Controls and Indicators	
Operator Controls and Switches Power Volume	Turns power to modem ON or OFF Raises or lowers volume of built-in speaker
Nonvolatile Random Access Memory (NVRAM)	Allows modem to be configured for a variety of applications using "AT" command set.
Dip Switches	8 binary switches configure modem for a variety of applications
Status Indicators	7 indicating LEDs on front panel

Ordering Information

Description	Product Number
USB Modem Smoke Control Kit (includes Modem, USB Adapter, Suppressor, DB-9F to DB-25M Cable, and Right Angle Adapter) for use with USB Host Port	PXA-USBMODEMKIT
Service Modem Smoke Control Kit (includes Modem, Suppressor, and Service Modem Cable) for use with HMI RJ11 or center 6-pins of RJ45 Dial-in only	538-915
Dial-up Modem Sportster 56000 bps (includes power pack & 7 ft. phone cord)	538-859
Telephone Transient Suppressor Kit (recommended for all field panel modems, any off the shelf phone line suppressor may be used with PC)	538-600
Adapter, USB Host to DB-9M for data translation from USB to RS-232 for use with PXC Modular and PXC Compact 36	PXA-USBADAPTER
Cable,DB-25M Dial-up Modem to RJ11 (7 ft.) for Open Processor, SCUV5 and FLNC	538-858
Cable, DB-25M Service Modem to RJ11 (7 ft. 3-wire) for all field panel HMI (MMI) Dial-in only, also connects to center 6-pins of RJ-45	538-914
Cable, DB25M Dial-up Modem to RJ45 (7 ft.) for Power Open Processor, MEC 3xx, or 13xx	549-510
Cable, DB-25M Modem to DB-9F (6 ft.) for PC or USB to RS-232 Adapter	536-004

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SIEMENS

Technical Specification Sheet
Document No.149-478
April 30, 2012

PXC Modular Series

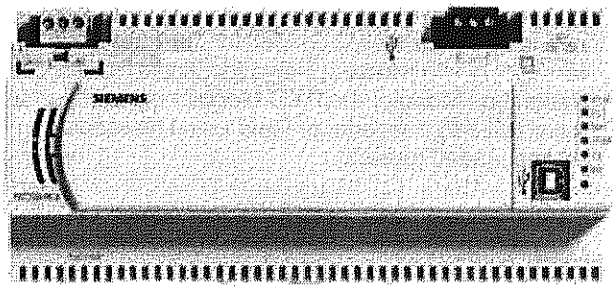


Figure 1. PXC Modular.

Description

The PXC Modular (Programmable Controller - Modular) is an integral part of the APOGEE® Automation System. It is a high performance, modular Direct Digital Control (DDC) supervisory field panel.

The field panel operates stand-alone or networked to perform complex control, monitoring, and energy management functions without relying on a higher level processor.

- Up to 100 modular field panels communicate on a peer-to-peer network.
- With the addition of TX-I/O modules and a TX-I/O Power Supply on a self-forming bus, the PXC Modular can directly control up to 500 points.

With the addition of an Expansion Module, the PXC Modular also provides central monitoring and control for distributed Field Level Network (FLN) devices.

Features

- Modular hardware components match initial control requirements while providing for future expansion.
- DIN rail mounting and removable terminal blocks simplify installation and servicing.
- Proven program sequences to match equipment control applications.
- Sophisticated Adaptive Control, a closed loop control algorithm that auto-adjusts to compensate for load/seasonal changes.
- Built-in energy management applications and DDC programs for complete facility management.
- Comprehensive alarm management, historical data trend collection, operator control and monitoring functions.
- Support for peer-to-peer communications over Industry standard 10/100Base-T TCP/IP networks.

Stantec

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

June 17, 2013
Brandon Morris

By. _____

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.

STANTEC ARCHITECTURE LTD. (PC-1449)

Hardware

PXC Modular

- The PXC Modular is a microprocessor-based multi-tasking platform for program execution and communication with other field panels. It scans field data, optimizes control parameters, and manages operator requests for data in seconds.
- The program and database information stored in the PXC Modular memory is battery-backed. This eliminates the need for time-consuming program and database re-entry in the event of an extended power failure. When battery replacement is necessary, the PXC Modular illuminates a "battery low" status LED and can send an alarm message to selected printers or terminals.
- The PXC Modular firmware, including the operating system, is stored in non-volatile flash memory.
- The PXC Modular provides both an Ethernet port as well as an RS-485 port for communication on Automation Level Networks using either TCP/IP or RS-485.
- An HMI RS-232 port is provided as a connection to a laptop computer for local operation and engineering.
- LEDs provide instant visual indication of overall operation, network communication, and low battery warning.
- Two self-forming buses are an integral part of the flexibility of the PXC Modular. A self-forming bus to the right of the controller supports up to 500 points through TX-I/O™ modules. Another self-forming bus to the left of the controller supports hardware connection to subsystems through Expansion Modules.

TX-I/O Modules

TX-I/O Modules are modular expansion I/O consisting of an electronics module and terminal base. The electronics modules perform A/D or D/A conversion, signal processing, and point monitoring and command output through communication with the PXC Modular. The terminal bases provide for termination of field wiring and connection of a self-forming bus. For more information, see *TX-I/O* (149-476).

The TX-I/O Power Supply provides power for TX-I/O modules and peripheral devices. Multiple Power Modules can be used in parallel to meet the power needs of large concentrations of I/O points (Figure 2 and Figure 3). For more information, see *TX-I/O Power Supplies* (149-476).

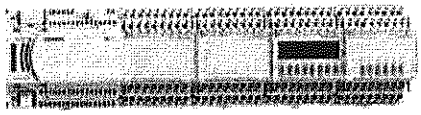


Figure 2. TX-I/O Power Supply and TX-I/O Modules.

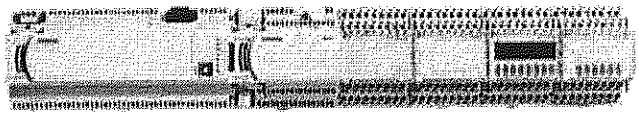


Figure 3. PXC Modular, TX-I/O Power Supply, and TX-I/O Modules.

PXC Modular Expansion Module

The PXC Modular Expansion Module (see Figure 4) provides the hardware connection for Field Level Network (FLN) devices. Using the Triple RS-485 Expansion Module, the PXC Modular supports up to three RS-485 networks of Field Level Network devices (see Figure 5).

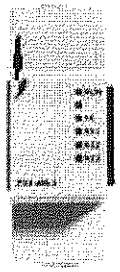


Figure 4. RS-485 Expansion Module.

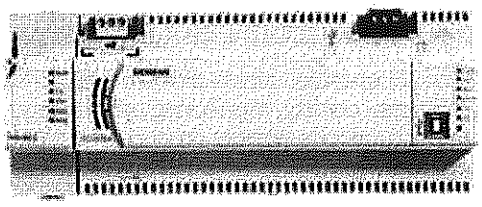


Figure 5. RS-485 Expansion Module and PXC Modular.

Modular Control Panels with Application Flexibility

The PXC Modular is a high performance controller with extensive flexibility to customize each field panel with the exact hardware and program for the application. As a result, the user only purchases what is needed.

For example, in monitoring applications, the control panel can be customized with the number and type of points to match the sensor devices. For monitoring and controlling a large number of (on-off) fans or

motors, more digital points can be added (see Figure 6).



Figure 6. PXC Modular, TX-I/O Power Supply, and TX-I/O Modules.

Alternately, if no local point control is required, the PXC Modular can be used to monitor and control Field Level Network devices using the Expansion Modules (see Figure 7).

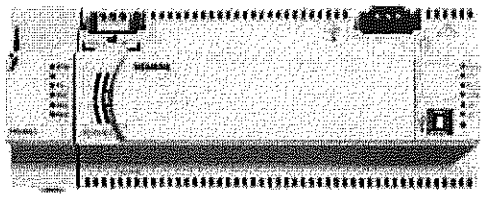


Figure 7. RS-485 Expansion Module and PXC Modular.

Of course, the PXC Modular can be used for both direct point monitoring and control **and** as a system controller for Field Level Network devices (see Figure 8).



Figure 8. RS-485 Expansion Module, PXC Modular, TX-I/O Power Supply, and TX-I/O Modules.

The control program for each field panel is customized to exactly match the application. Proven Powers Process Control Language (PPCL), a "BASIC" type programming language, provides direct digital control and energy management sequences to precisely control equipment and optimize energy usage.

In a stand-alone configuration, the PXC Modular can fulfill all requirements of a supervisory network coordinator by managing operation schedules and alarms and communicating for the connected devices.

Global Information Access

Each PXC Modular is equipped with an RS-232 port. This port supports the connection of a computer. Devices connected to the terminal port gain global information access.

Multiple Operator Access

Multiple operators can access the network simultaneously. When using the Ethernet ALN option, multiple operators may access the controller through concurrent Telnet sessions and/or local operator terminal ports.

Menu Prompted, English Language Operator Interface

The PXC Modular field panel includes a simple, yet powerful menu driven English Language Operator Interface that provides, among other things:

- Point monitoring and display
- Point commanding
- Historical trend collection and display for multiple points
- Equipment scheduling
- Program editing and modification via Powers Process Control Language (PPCL)
- Alarm reporting and acknowledgment
- Continual display of dynamic information

Built-in Direct Digital Control Routines

The PXC Modular provides stand-alone Direct Digital Control (DDC) to deliver precise HVAC control and comprehensive information about system operation. It receives information from sensors in the building, processes the information, and directly controls the equipment. The following functions are available in the PXC Modular:

- Adaptive Control, an auto-adjusting closed loop control algorithm. Provides more efficient, adaptive, robust, fast, and stable control than the traditional PID control algorithm. Superior in terms of response time, holding steady state, and minimizing error, oscillations, and actuator repositioning.
- Closed Loop Proportional, Integral and Derivative (PID) control.
- Logical sequencing.
- Alarm detection and reporting.
- Reset schedules.

Built-in Energy Management Applications

The following applications are programmed in the PXC Modular and require simple parameter input for implementation:

- Peak demand limiting
- Start-Stop time optimization
- Equipment scheduling, optimization and sequencing
- Duty cycling
- Economizer control

Licensable Options

The following features are available on the PXC Modular P2 controllers and require a license for implementation:

- Field Panel GO
- Virtual AEM

Specifications

Dimensions

PXC Modular Series	7.56" L × 3.54" W × 2.76" D (192 mm L × 90 mm W × 70 mm D)
Expansion Module with three P1 RS-485 FLN connections	1.26" L × 3.54" W × 2.76" D (32 mm L × 90 mm W × 70 mm D)

Electrical, Processor, Battery, and Memory

Power Consumption	24 VA @ 24 Vac
Processor	MPC885 (PowerPC®)
Processor Clock Speed	133 MHz
Memory	72 MB (64 MB SDRAM, 8 MB Flash ROM)
Secure Digital Input/Output (SDIO) card	Expandable or removable non-volatile memory
Battery backup of SDRAM	30 days (accumulated) AA (LR6) 1.5 Volt Alkaline (non-rechargeable)
Battery backup of Real Time Clock	12 months (accumulated) Cell coin 3 Volt lithium

Communication

Ethernet Automation Level Network (EALN) port BACnet I/P Ethernet Automation Level Network port	10Base-T or 100Base-TX compilant
RS-485 Automation Level Network (ALN) port	1200 bps to 115.2 Kbps
Expansion Bus for support of sub-system networks	1200 bps to 115.2 Kbps
TX-I/O Self forming bus connection	115.2 Kbps
Human-Machine Interface (HMI) port	RS-232 compliant
USB Device Port	Standard 1.1 and 2.0 USB device port, full speed 12 Mbps, low speed 1.5 Mbps, Type B connector
USB Host port	Standard 1.1 and 2.0 USB host port, full speed 12 Mbps, low speed 1.5 Mbps, Type A connector

Electrical Rating

AC Power	NEC Class 2
Communication	NEC Class 2

Operating Environment

Ambient operating temperature	32°F to 122°F (0°C to 50°C), <95% rh, non-condensing
Ambient operating environment	Operate in a dry location, which is protected from exposure to salt spray or other corrosive elements. Exposure to flammable or explosive vapors must be prevented.
Shipping and Storage environment	-40°F to +185°F (-40°C to +85°C) <95% rh, non-condensing
Shipping environment	-13°F to 158°F (-25°C to 70°C), 5% to 95% rh, non-condensing
Mounting Surface	Building wall or structural member

Agency Listings

UL	UL 864 UUKL Smoke Control Equipment UL 864 UUKL7 Smoke Control Equipment CAN/ULC-S527-M8 UL 916 PAZX UL 916 PAZX7
Agency Compliance	FCC Compliance Australian EMC Framework European EMC Directive (CE) – with enclosure

Product Ordering Information

Description	Product Number
PXC MOD, P2, 96 NODE, APOGEE	PXC00-PE96.A
PXC MOD, P2, TX-I/O, 96 NODE, APOGEE	PXC100-PE96.A
PXC MOD, BACnet, 96 NODE, APOGEE	PXC00-E96.A
PXC MOD, BACnet, TX-I/O, 96 NODE, APOGEE	PXC100-E96.A
Add support for TX-I/O	PXF-TXIO.A
Virtual AEM License	LSM-VAEM
Field Panel GO License	LSM-FPGO
Expansion Module, three RS-485 connections	PXX-485.3

Document Ordering Information

Description	Document Number
PXC Modular Series Owner's Manual	125-3582
Powers Process Control Language (PPCL) User's Manual	125-1896

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SIEMENS

Technical Specification Sheet
Document No. 149-454
April 15, 2013

PXC Compact Series

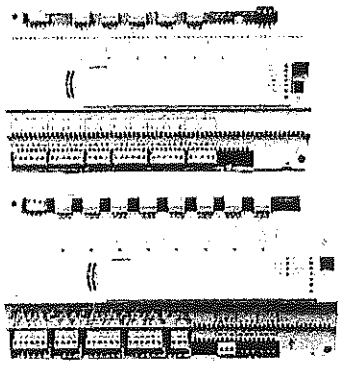


Figure 1. PXC Compact Series Controllers (PXC-24 and PXC-36 shown.)

Description

The PXC Compact Series (Programmable Controller–Compact) is a high-performance Direct Digital Control (DDC) supervisory equipment controller, which is an integral part of the APOGEE® Automation System.

The PXC Compact Series offers integrated I/O based on state-of-the-art TX-I/O™ Technology, which provides superior flexibility of point and signal types, and makes it an optimal solution for Air Handling Unit (AHU) control. The PXC Compact operates stand-alone or networked to perform complex control, monitoring, and energy management functions without relying on a higher-level processor.

The PXC Compact Series communicates with other field panels or workstations on a peer-to-peer Automation Level Network (ALN) and supports the following communication options:

- Ethernet TCP/IP
- P2 RS-485

The PXC Compact is available with 16, 24, or 36 point terminations. Selected models in the Compact Series provide the following options:

- Support for FLN devices.
- An extended temperature range for the control of rooftop devices.
- Support for Island Bus, which uses TX I/O modules to expand the number of point terminations.

Features

- DIN rail mounted device with removable terminal blocks simplifies installation and servicing.
- Proven program sequences to match equipment control applications.
- Built-in energy management applications and DDC programs for complete facility management.
- Comprehensive alarm management, historical data trend collection, operator control, and monitoring functions.
- Sophisticated Adaptive Control, a closed loop control algorithm that auto-adjusts to compensate for load/seasonal changes.
- Message control for terminals, printers, pagers, and workstations.
- Highly configurable I/O using Siemens state-of-the-art TX-I/O™ Technology.
- HMI RS-232 port, which provides laptop connectivity for local operation and engineering.
- Extended battery backup of Real Time Clock.
- Persistent database backup and restore within the controller.
- Optional HOA (Hand/Off/Auto) module for swappable and configurable HOA capability.

- Optional extended temperature range for rooftop installation.
- Optional peer-to-peer communications over industry-standard 10Base-T/100Base-TX Ethernet networks.
- Optional support for FLN devices.
- Optional support for P1 Wireless FLN.
- Optional operation as a P1 FLN device with default applications.
- Optional support for Virtual AEM.
- PXM10T and PXM10S support: Optional LCD Local user interface with HOA (Hand-off-auto) capability and point commanding and monitoring features.

The Compact Series

In addition to building and system management functions, the Compact Series includes several styles of controllers that flexibly meet application needs.

PXC-16

The PXC-16 provides control of 16 points, including 8 software-configurable universal points.

Point count includes: 3 Universal Input (UI), 5 Universal I/O (U), 2 Digital Input (DI), 3 Analog Output (AOV), and 3 Digital Output (DO).

PXC-24

The PXC-24 provides control of 24 points, including 16 software-configurable universal points.

Point count includes: 3 Universal Input (UI), 9 Universal I/O (U), 4 Super Universal I/O (X), 3 Analog Output (AOV), 5 Digital Output (DO).

PXC-36

The PXC-36 provides control of 36 local points, including 24 software-configurable universal points.

Point count includes: 18 Universal I/O (U), 6 Super Universal I/O (X), 4 Digital Input (DI), and 8 Digital Output (DO).

The PXC-36 offers the flexibility of expanding the total point count through a self-forming island bus. With the addition of a TX-I/O Power Supply, up to 4 TX-I/O modules can be supported. For more information, see the *TX-I/O Product Range Technical Specification Sheet* (149-476).

Available Options

The following options are available to match the application:

Ethernet or RS-485 ALN

Support for APOGEE P2 ALN through TCP/IP or RS-485 networks.

FLN Support

- The PXC-24 "F32" models support up to 32 P1 FLN devices when the ALN is connected to TCP/IP.
- The PXC-24 "F" models with an FLN license support up to 32 P1 FLN devices when the ALN is connected to TCP/IP.
- The PXC-36 with an FLN license supports up to 96 P1 FLN devices when the ALN is connected to RS-485 or TCP/IP.
- A Wireless FLN may also be used to replace the traditional P1 FLN cabling with wireless communication links that form a wireless mesh network. Additional hardware is required to implement the Wireless FLN.

For more information about FLN support, contact your local Siemens Industry representative.

P1 FLN Operation

The PXC-16 and PXC-24 can be configured as a programmable P1 FLN device. In the P1 FLN mode, the PXC Compact functions as an equipment controller with customized programming and default applications.

Virtual AEM Support

The Virtual AEM license allows the PXC Compact to connect an RS-485 APOGEE Automation Level Network or individual field panels to a P2 Ethernet network without additional hardware.

Extended Temperature Operation

The "R" models of the PXC Compact Series support extended temperature operation, allowing for rooftop installations.

Field Panel GO

The PXC-36 supports Field Panel GO.

The Field Panel GO license provides a Web-based user interface for your APOGEE® Building Automation System. It is an ideal solution for small or remote facilities with field panels on an Ethernet Automation Level Network (ALN).

Hardware

The PXC Compact Series consists of the following major components:

- Input/Output Points
- Power Supply
- Controller Processor

Input/Output Points

- The PXC Compact input/output points perform A/D or D/A conversion, signal processing, point command output, and communication with the controller processor. The terminal blocks are removable for easy termination of field wiring.
- The Universal and Super Universal points leverage TX-I/O™ Technology from Siemens Industry to configure an extensive variety of point types.
- Universal Input (UI) and Universal Input/Output (U) points are software-selectable to be:
  - 0-10V input
  - 4-20 mA input
  - Digital Input
  - Pulse Accumulator inputs
  - 1K Ni RTD @ 32°F (Siemens, Johnson Controls, DIN Standard)
  - 1K Pt RTD (375 or 385 alpha) @ 32°F
  - 10K NTC Thermistor (Type 2 and Type 3) @ 77°F
  - 100K NTC Thermistor (Type 2) @ 77°F
  - 0-10V Analog Output (Universal Input/Output (U) points only)
- Super Universal (X) points (PXC-24 and PXC-36 only) are software-selectable to be:
  - 0-10V input
  - 4-20 mA input
  - Digital Input
  - Pulse Accumulator inputs
  - 1K Ni RTD @ 32°F (Siemens, Johnson Controls, DIN Standard)
  - 1K Pt RTD (375 or 385 alpha) @ 32°F
  - 10K NTC Thermistor (Type 2 and Type 3) @ 77°F
  - 100K NTC Thermistor (Type 2) @ 77°F
  - 0-10V Analog Output
  - 4-20 mA Analog Output
  - Digital Output (using external relay)
- Dedicated Digital Input (DI) points (PXC-16 and PXC-36 only) are dry contact status sensing.
- Digital Output (DO) points are 110/220V 4 Amp (resistive) Form C relays; LEDs indicate the status of each point.
- All PXC Compact Series models support 0-10 Vdc Voltage Analog Output circuits.
- On PXC-24 and PXC-36 models, the Super Universal circuits may be defined as 4-20 mA current AO.

Power Supply

- The 24 volt DC power supply provides regulated power to the input/output points and active sensors. The power supply is internal to the PXC Compact housing, eliminating the need for external power supply and simplifying installation and troubleshooting.
- The power supply works with the processor to ensure smooth power up and power down sequences for the equipment controlled by the I/O points, even through brownout conditions.

Controller Processor

- The PXC Compact Series includes a microprocessor-based multi-tasking platform for program execution and communications with the I/O points and with other PXC Compacts and field panels over the ALN.
- A Human Machine Interface (HMI) port, with a quick-connect phone jack (RJ-45), uses RS-232 protocol to support operator devices (such as a local user interface or simple CRT terminal), and a phone modem for dial-in service capability.
- A USB Device port supports a generic serial interface for an HMI or Tool connection.
- The program and database information stored in the PXC Compact RAM memory is battery-backed. This eliminates the need for time-consuming program and database re-entry in the event of an extended power failure.
- The firmware, which includes the operating system, is stored in non-volatile flash ROM memory; this enables firmware upgrades in the field.
- Brownout protection and power recovery circuitry protect the controller board from power fluctuations.
- LEDs provide instant visual indication of overall operation, network communication, and low battery warning.

Programmable Control with Application Flexibility

The PXC Compact Series of high performance controllers provides complete flexibility, which allows the owner to customize each controller with the exact program for the application.

The control program for each PXC Compact is customized to exactly match the application. Proven Powers Process Control Language (PPCL), a text-based programming structure like BASIC, provides direct digital control and energy management sequences to precisely control equipment and optimize energy usage.

Global Information Access

The HMI port supports operator devices, such as a local user interface or simple CRT terminal, and a phone modem for dial-in service capability. Devices connected to the operator terminal port gain global information access.

Multiple Operator Access

Multiple operators can access the network simultaneously. Multiple operator access ensures that alarms are reported to an alarm printer while an operator accesses information from a local terminal. When using the Ethernet TCP/IP ALN option, multiple operators may also access the controller through concurrent Telnet sessions and/or local operator terminal ports.

Menu Prompted, English Language Operator Interface

The PXC Compact field panel includes a simple, yet powerful, menu-driven English Language Operator Interface that provides, among other things:

- Point monitoring and display
- Point commanding
- Historical trend collection and display for multiple points
- Event scheduling
- Program editing and modification via Powers Process Control Language (PPCL)
- Alarm reporting and acknowledgment
- Continual display of dynamic information

Built-in Direct Digital Control Routines

The PXC Compact provides stand-alone Direct Digital Control (DDC) to deliver precise HVAC control and comprehensive information about system operation. The controller receives information from sensors in the building, processes the information, and directly controls the equipment. The following functions are available:

- Adaptive Control, an auto-adjusting closed loop control algorithm, which provides more efficient, adaptive, robust, fast, and stable control than the traditional PID control algorithm. It is superior in terms of response time and holding steady state, and at minimizing error, oscillations, and actuator repositioning.
- Closed Loop Proportional, Integral and Derivative (PID) control.
- Logical sequencing.
- Alarm detection and reporting.
- Reset schedules.

Built-in Energy Management Applications

The following applications are programmed in the PXC Compact Series and require simple parameter input for implementation:

- Automatic Daylight Saving Time switchover
- Calendar-based scheduling
- Duty cycling
- Economizer control
- Equipment scheduling, optimization and sequencing
- Event scheduling
- Holiday scheduling
- Night setback control
- Peak Demand Limiting (PDL)
- Start-Stop Time Optimization (SSTO)
- Temperature-compensated duty cycling
- Temporary schedule override

Specifications

Dimensions (L × W × D)

PXC-16 and PXC-24	10.7 in. × 5.9 in. × 2.45 in. (272 mm × 150 mm × 62 mm)
PXC-36	11.5 in. × 5.9 in. × 3.0 in. (293 mm × 150 mm × 77 mm)

Processor, Battery, and Memory

Processor and Clock Speed	*PXC-16 and PXC-24:* Motorola MPC852T, 100 MHz *PXC-36:* Motorola MPC885, 133 MHz
Memory	*PXC-16 and PXC-24:* 24 MB (16 MB SDRAM, 8 MB Flash ROM) *PXC-16 and PXC-24 "F" and "F32":* 40 MB (32 MB SDRAM, 8 MB Flash ROM) *PXC-36:* 80 MB (64 MB SDRAM, 16 MB Flash ROM)
Battery backup of Synchronous Dynamic (SD) RAM (field replaceable)	*Non-rooftop Models:* 60 days (accumulated), AA (LR6) 1.5 Volt Alkaline (non-rechargeable) *Rooftop (Extended Temperature) Models:* 90 days (accumulated), AA (LR6) 3.6 Volt Lithium (non-rechargeable)
Battery backup of Real Time Clock	*Non-rooftop Models:* 10 years *Rooftop (Extended Temperature) Models:* 18 months

Communication

A/D Resolution (analog in)	16 bits
D/A Resolution (analog out)	10 bits
Ethernet/IP Automation Level Network (ALN)	10Base-T or 100Base-TX compliant
RS-485 Automation Level Network (ALN)	1200 bps to 115.2 Kbps
RS-485 P1 Field Level Network (FLN) *on selected models, license required*	4800 bps to 38.4 Kbps
Human-Machine Interface (HMI)	RS-232 compliant, 1200 bps to 115.2 Kbps
USB Device port (for non-smoke control applications only)	Standard 1.1 and 2.0 USB device port, Type B female connector.
USB Host port *on selected models* (for ancillary smoke control applications only)	Standard 1.1 and 2.0 USB host port, Type A female connector.

Electrical

Power Requirements	24 Vac ±20% input @ 50/60 Hz
Power Consumption (Maximum)	*PXC-16:* 18 VA @ 24 Vac *PXC-24:* 20 VA @ 24 Vac *PXC-36:* 35 VA @ 24 Vac

AC Power and Digital Outputs	NEC Class 1 Power Limited
Communication and all other I/O	NEC Class 2
Digital Input	Contact Closure Sensing Dry Contact/Potential Free inputs only Does not support counter inputs
Digital Output	Class 1 Relay
Analog Output	0 to 10 Vdc
Universal Input (UI) and Universal Input/Output (U)	**Analog Input** Voltage (0-10 Vdc) Current (4-20 mA) 1K Ni RTD @ 32°F 1K Pt RTD (375 or 385 alpha) @ 32°F 10K NTC Type 2 or Type 3 Thermistor @ 77°F 100K NTC Type 2 Thermistor @ 77°F **Digital Input** Pulse Accumulator Contact Closure Sensing Dry Contact/Potential Free inputs only Supports counter inputs up to 20 Hz **Analog Output (Universal Input/Output (U) points only)** Voltage (0-10 Vdc)
Super Universal (X)	**Analog Input** Voltage (0-10 Vdc) Current (4-20 mA) 1K Ni RTD @ 32°F 1K Pt RTD (375 or 385 alpha) @ 32°F 10K NTC Type 2 or Type 3 Thermistor @ 77°F 100K NTC Type 2 Thermistor @ 77°F **Digital Input** Pulse Accumulator Contact Closure Sensing Dry Contact/Potential Free inputs only Supports counter inputs up to 20 Hz **Analog Output** Voltage (0-10 Vdc) Current (4-20 mA) **Digital Output (requires an external relay)** 0 to 24 Vdc, 22 mA max.

Operating Environment

Ambient operating temperature	32°F to 122°F (0°C to 50°C)
Ambient operating temperature with rooftop (extended temperature) option	-40°F to 158°F (-40°C to 70°C)
Relative Humidity	*PXC-16 and PXC-24:* 5% to 95%, non-condensing *PXC-36:* 5% to 95%, non-condensing

Mounting Surface	*PXC-16 and PXC-24:* Direct equipment mount, building wall, or structural member *PXC-36:* Building wall or a secure structure

Agency Listings

UL	UL864 UUKL (except rooftop models) UL864 UUKL7 (except rooftop models) CAN/ULC-S527-M8 (except rooftop models) UL916 PAZX (all models) UL916 PAZX7 (all models)
Agency Compliance	FCC Compliance Australian EMC Framework European EMC Directive (CE) European Low Voltage Directive (LVD)
OSHPD Seismic Certification	Product meets OSHPD Special Seismic Preapproval certification (OSH-0217-10) under California Building Code 2010 (CBC2010) and International Building Code 2009 (IBC2009) when installed within the following Siemens enclosure part numbers: PXA-ENC18, PXA-ENC19, or PXA-ENC34.

Ordering Information

PXC Compact Series

Product Number	Description
PXC16.2-P.A	PXC Compact, 16 point, RS-485 ALN
PXC16.2-PE.A	PXC Compact, 16 point, Ethernet/IP ALN
PXC24.2-P.A	PXC Compact, 24 point, RS-485 ALN
PXC24.2-PE.A	PXC Compact, 24 point, Ethernet/IP ALN
PXC24.2-PR.A	PXC Compact, 24 point, RS-485 ALN, rooftop option
PXC24.2-PER.A	PXC Compact, 24 point, Ethernet/IP ALN, rooftop option
PXC24.2-PEF.A	PXC Compact, 24 point, Ethernet/IP or RS-485 ALN. P1 FLN or Remote Ethernet/IP (Virtual AEM) option.
PXC24.2-PEF32.A	PXC Compact, 24 point, Ethernet/IP or RS-485 ALN. P1 FLN enabled
PXC24.2-PERF.A	PXC Compact, 24 point, Ethernet/IP or RS-485 ALN, rooftop option. P1 FLN or Remote Ethernet/IP (Virtual AEM) option.
PXC36-PE.A	PXC Compact, 36 point, Ethernet/IP or RS-485 ALN.
PXC36-PEF.A	PXC Compact, 36 point, Ethernet/IP or RS-485 ALN, Island Bus, P1 FLN.

Optional Licenses

Product Number	Description
LSM-FLN	License to enable FLN support on PXC-16 or PXC-24 "F" models
LSM-VAEM	License to enable Virtual AEM support when the ALN is connected to RS-485
LSM-FLN36.A	License to enable FLN support on model PXC36-PE.A
LSM-FPGO	License to enable Field Panel GO on models PXC36-PE.A and PXC36-PEF.A
LSM-IB36.A	License to enable the Island Bus on model PXC36-PE.A
LSM-36.A	License to enable both FLN and Island Bus support on model PXC36-PE.A

Accessories

Product Number	Description
PXM10S	Controller mounted Operator Display module with point monitor and optional blue backlight
PXM10T	Controller mounted Operator Display module
PXA8-M	8-switch HOA (UL864)
PXA16-M	16-switch HOA (UL864)
PXA16-MR	16-switch HOA (extended temp, UL 916) with HMI cable
PXA-HMI.CABLEP5	Serial cable required for HOA or PXM10T/S connection to non-rooftop variants of the 16-point and 24-point Compact Series (pack of 5)
TXA1.LLT-P100	Labels for HOA and TX-I/O Modules, pack of 100, letter format

Service Boxes and Enclosures

Product Number	Description
PXA-SB115V192VA	PX Series Service Box —115V, 24 Vac, 50/60 Hz, 192 VA
PXA-SB115V384VA	PX Series Service Box— 115V, 24 Vac, 50/60 Hz, 384 VA
PXA-SB230V192VA	PX Series Service Box— 230V, 24 Vac, 50/60 Hz, 192 VA
PXA-SB230V384VA	PX Series Service Box —230V, 24 Vac, 50/60 Hz, 384 VA
PXA-ENC18	18" Enclosure (Utility Cabinet) (UL Listed NEMA Type 1 Enclosure)
PXA-ENC19	19" Enclosure (UL Listed NEMA Type 1 Enclosure)
PXA-ENC34	34" Enclosure (UL Listed NEMA Type 1 Enclosure)

Documentation

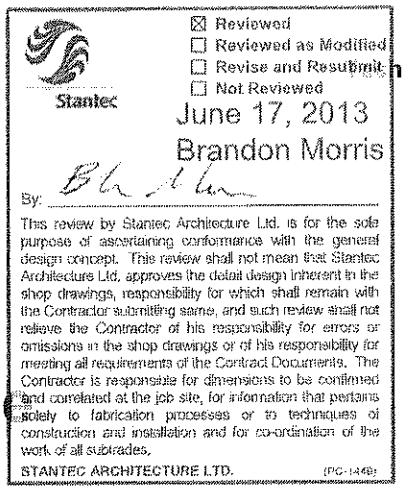
Product Number	Description
553-104	PXC Compact Series Owner's Manual
125-1896	Powers Process Control Language (PPCL) User's Manual

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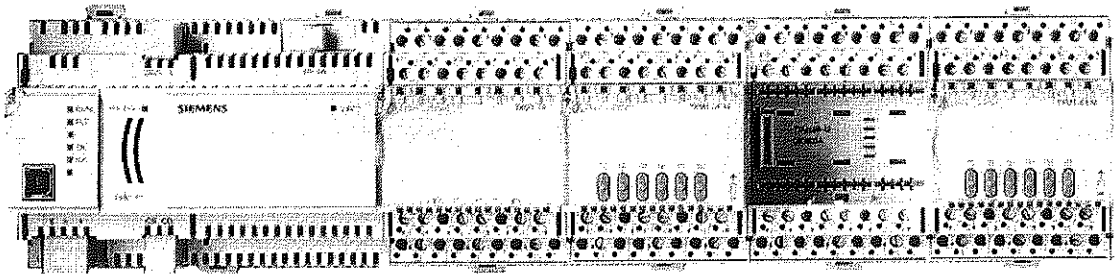
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SIEMENS



nical Specification Sheet
Document No. 149-476
April 18, 2013

TX-I/O Product Rang



Description

TX-I/O™ is a range of I/O modules, with associated power and communication modules, for use within the APOGEE system. The TX-I/O product range includes the following:

- Eight types of I/O modules, which act as signal converters. The I/O modules communicate between the PXC Modular or the PXC-36 and the related devices in the building services plant.
- TX-I/O Power Supply for the TX-I/O modules.
- TX-I/O Bus Connection Module, which bridges communication and power from one DIN rail to another.
- TX-I/O Island Bus Expansion (IBE) module, which bridges communication between the primary field panel and expansion field panels.
- P1 Bus Interface Module (BIM), which connects TX-I/O modules to the P1 FLN. The P1 BIM provides power for TX-I/O modules, but it does not contain applications or perform control; the control database for the TX-I/O points resides in a field panel.

TX-I/O Modules provide I/O points for APOGEE based upon TX-I/O Technology. TX-I/O Technology provides flexibility of point types, tremendous flexibility of signal types and support for manual operation.

There are eight types of TX-I/O modules:

- 8 point DI module (TXM1.8D)
- 16 point DI module (TXM1.16D)
- 6 point DO with Relay module (TXM1.6R)
- 6 point DO with Relay and Manual Override module (TXM1.6R-M)
- 8 point Universal module (TXM1.8U)
- 8 point Universal with local override/identification device (LOID) module (TXM1.8U-ML)
- 8 point Super Universal module (TXM1.8X)
- 8 point Super Universal with LOID module (TXM1.8X-ML)

Features

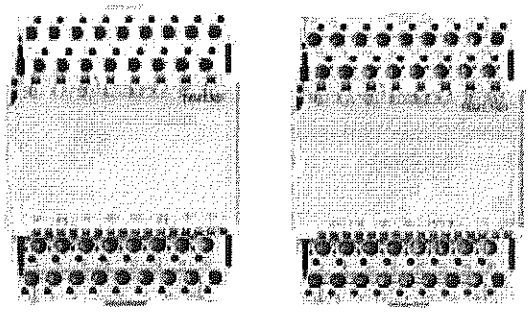
- The *self-forming TX-I/O island bus* transmits power as well as communication signals.
  - The TX-I/O island bus can be extended a maximum of 164 feet (50 meters).
  - Adding an Island Bus Expansion (IBE) module expands communication data up to an additional maximum of 200 feet (61 m) in two directions.
- *Hot-swappable electronic components* allow powered electronics to be disconnected and replaced without removing terminal wiring or disturbing the self-forming bus.

All TX-I/O modules include the following features:

- DIN rail mounting.
- High density (point count to physical dimensions).
- Hardware addressed with address keys.
- Removable label holder that allows for customized point labels.
- LEDs that provide status indication and diagnostic information for the I/O module, as well as for each point on the module.
- Separable into terminal base and plug-in I/O module electronics for:
  - Improved installation workflow, allowing field wiring to be terminated prior to installation of electronics.
  - Optimum diagnostics—connected peripheral devices can be measured without affecting or being affected by the I/O module.
  - Quick replacement of electronics for service.

Module Introduction

Digital Input Modules (TXM1.8D and TXM1.16D)

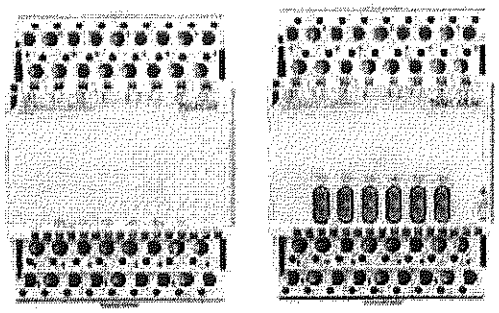


The TXM1.8D and TXM1.16D are dedicated to monitoring, respectively, 8 and 16 digital input points.

- They monitor status signals from normally open (NO) or normally closed (NC), latched voltage free/dry contacts.
- All 8 points on the TXM1.8D module, as well as 8 of the 16 points on the TXM1.16D module, may be used as pulse counters up to 10 Hz.
- Each input point has a green LED for status indication.

NOTE: No potential (dry contact) for all points.

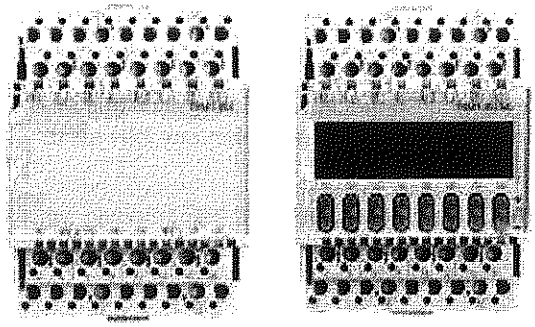
Digital Output Modules (TXM1.6R and TXM1.6R-M)



The TXM1.6R and TXM1.6R-M Digital Output Modules provide six NO or NC (form C), maintained or pulsed, voltage free/dry contacts.

- The contacts are rated for a maximum of 250 Vac at 4A.
- Each I/O point has a green LED for status indication.
- The TXM1.6R-M module is also equipped with manual override switches. An orange LED per override switch indicates override status individually per point.

Universal Modules (TXM1.8U and TXM1.8U-ML)



The TXM1.8U and TXM1.8U-ML Universal I/O modules provide 8 points, which can be individually software configured as digital input, analog input, or analog output to best meet the specific application needs.

All Universal I/O modules provide:

- Class 2 AC distribution voltage for peripheral devices, such as valves and actuators.

- Green LED status per I/O point that varies in intensity according to the voltage and current (directly proportional).

Digital input support includes:

- Voltage free/dry contacts
- Pulse counters up to 25 Hz

Analog input sensor support includes:

- 1K Nickel – Landis & Gyr curve
- 1K Platinum – 375 and 385 coefficient
- 10K and 100K Thermistor – Type II Curve

Active input and output support includes:

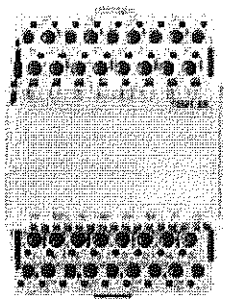
- Analog input voltage 0-10 Vdc
- Analog output voltage 0-10 Vdc

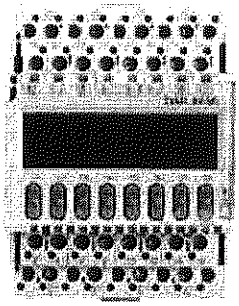
TXM1.8U-ML modules are also equipped with a local override/identification device (LOID), which includes an LCD signal display. The LCD displays the following information for each I/O point:

- Configured signal type
- Symbolic display of process value
- Notification of faulty operation, short circuit, or sensor open circuit

Orange LEDs indicate override status individually per point.

Super Universal Modules (TXM1.8X and TXM1.8X-ML)

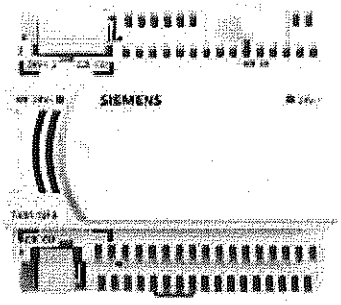




The TXM1.8X and TXM1.8X-ML Super Universal modules share all of the Universal module features, and also provide:

- Analog input current 4-20 mA
- Analog output current 4-20 mA (four current outputs maximum per module on Points 5 through 8)
- 24 Vdc distribution from power supply for sensors at a maximum of 200 mA per module

TX-I/O Power Supply (TXS1.12F4)



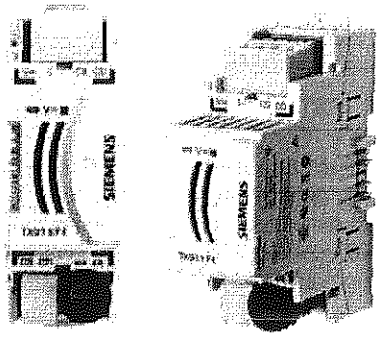
The TX-I/O Power Supply generates 24 Vdc at 1.2A to power TX-I/O modules and peripheral devices.

- Up to 4 TX-I/O Power Supplies can be operated in parallel, with a maximum of two per DIN rail.
- It can be located within a row of TX-I/O modules or at the beginning of a new DIN rail.

The TX-I/O Power Supply performs the following functions:

- Transfers 24 Vac at 4A to power TX-I/O modules and peripheral devices.
- Routes CS (+24 Vdc Communication Supply) and CD (Communication Data signal) between DIN rails.
- Provides an input point for 24 Vac to power additional peripheral devices.
- Isolates the 24 Vac peripheral device supply in case of overload or short-circuit with Class 2 distribution. The replaceable AC fuse can be accessed from an installed module.
- Indicates the AC fuse status (via LED) for easy diagnostics.

TX-I/O Bus Connection Module (TXS1.EF4)



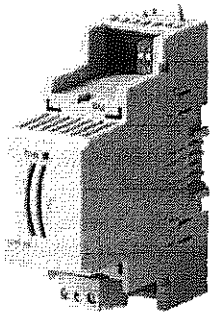
The Bus Connection Module transfers DC power for TX-I/O modules and peripheral devices and transfers AC power for peripheral devices.

- It can be located within a row of TX-I/O modules or at the beginning of a new DIN rail.

The TX-I/O Bus Connection Module performs the following functions:

- Routes CS (+24 Vdc Communication Supply) and CD (Communication Data Signal) between DIN rails.
- Provides an input point for 24 Vac to power additional peripheral devices.
- Isolates the 24 Vac peripheral device supply in case of overload or short-circuit with Class 2 distribution. The replaceable AC fuse can be accessed from an installed module.
- Indicates the AC fuse status (via LED) for easy diagnostics.

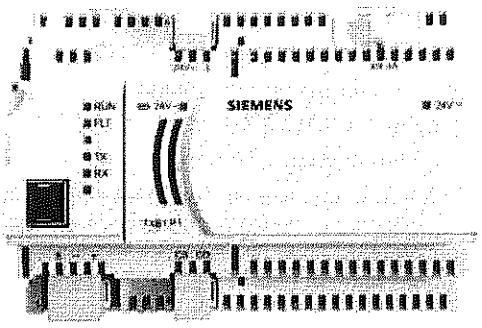
TX-I/O Island Bus Expansion Module (TXA1.IBE)



The TX-I/O Island Bus Expansion (IBE) module increases the distance between the primary field panel and expansion field panels without affecting the TX-I/O island bus maximum distance.

- An LED provides an indication of island bus communication.
- The IBE converts the TX-I/O island bus signal on the self-forming rail to an RS-485 signal level on the connector.
  - Each IBE module supports a maximum of two RS-485 segments.
  - Each segment may extend up to 200 ft (61 m) from the primary enclosure.
  - The island bus length extended from the primary field panel is added to island bus length extended from any expansion panel. RS-485 segment length between the IBEs does not add to the island bus length.
- The IBE does not transfer power over the RS-485 segment.
- Switches set the IBE as the TX-I/O island bus master (BM) or an RS-485 end-of-line terminator.
- A programming tool is not required.
- A maximum of 5 IBEs may be installed on the island bus: one IBE in the primary enclosure plus one in each expansion enclosure (maximum of 4).
- Only one Island Bus Expansion (IBE) module per enclosure is permitted.
- Expansion enclosures must be supplied using a separate TX-I/O Power Supply. Loss of this power does not affect the primary enclosure.

P1 Bus Interface Module (TXB1.P1 and TXB1.P1-4)



The P1 Bus Interface Module (P1 BIM) provides P1 FLN communication and power for TX-I/O modules. It does not contain application or control for the TX-I/O modules.

The P1 BIM provides the following features:

- Communication on the P1 FLN or MEC Expansion Bus.
- 24 Vac input.
- Generation of 24 Vdc at 600 mA to power TX-I/O modules and peripheral devices.
- Plug-in screw terminals.
- Isolates the peripheral device supply in case of overload or short-circuit with Class 2 distribution. The replaceable AC fuse can be accessed from an installed module.
- Separate LEDs for module operation, FLN communication activity, 24 Vdc present on the TX-I/O island bus, and monitoring of the 24 Vac fuse.

TXB1.P1

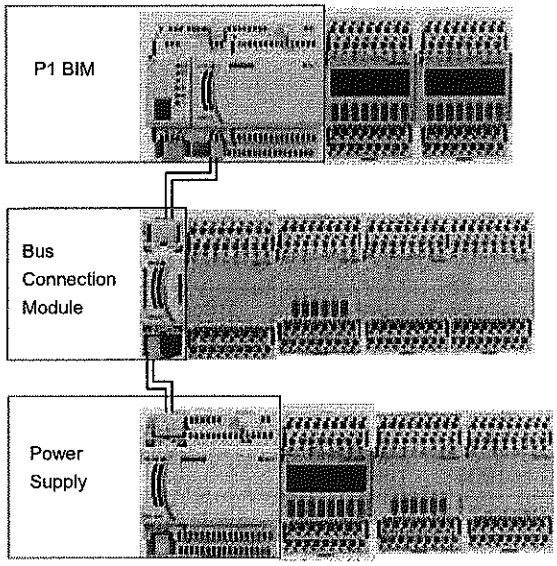
- Support for 80 TX-I/O points.
- Support for up to 10 I/O modules.
- Transfer of 24 Vac at a maximum of 4A to power peripheral devices.
- Up to three TX-I/O Power Supplies can be operated in parallel, max of 2 per DIN.

TXB1.P1-4

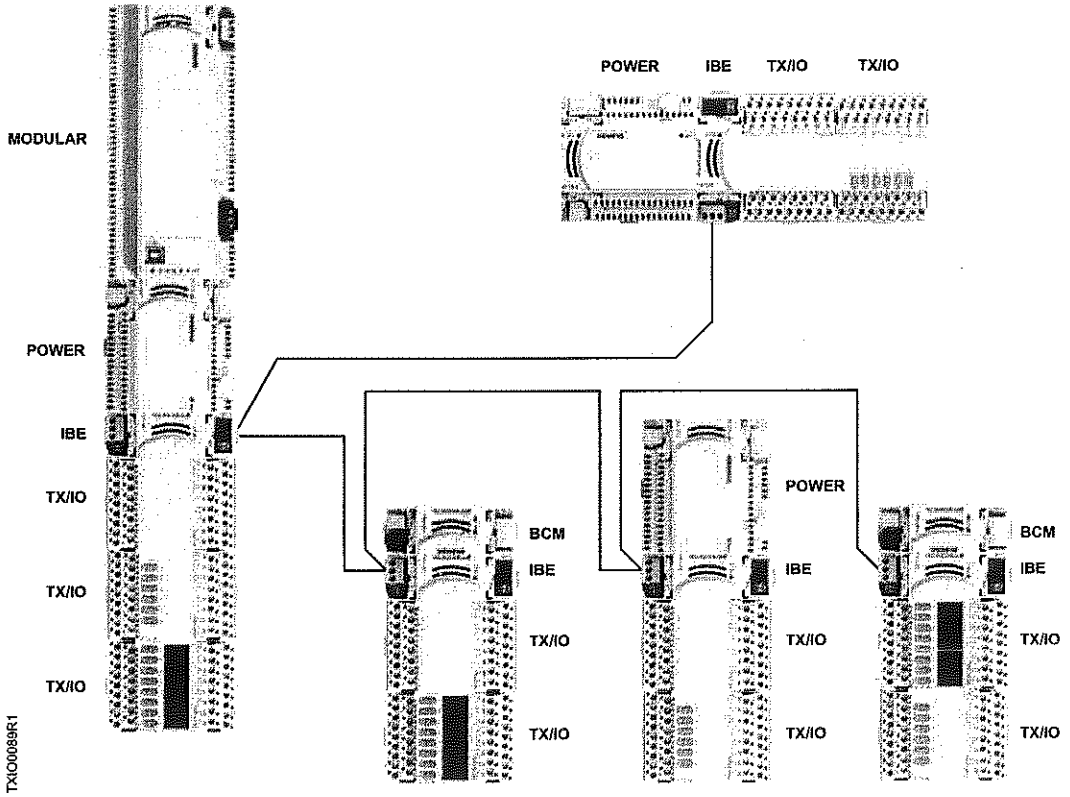
- Support for 64 TX-I/O points.
- Support for up to 4 I/O modules.
- One TX-I/O Power Supplies can be operated.

TX-I/O island bus Extension

The following picture shows the TX-I/O island bus extended using a Bus Connection Module and TX-I/O Power Supply. This configuration allows the TX-I/O island bus to extend a maximum of 164 feet (50 meters), and may extend outside an enclosure.



The following picture shows the TX-I/O island bus expanded using five Island Bus Expansion modules.



I/O Functions by Module

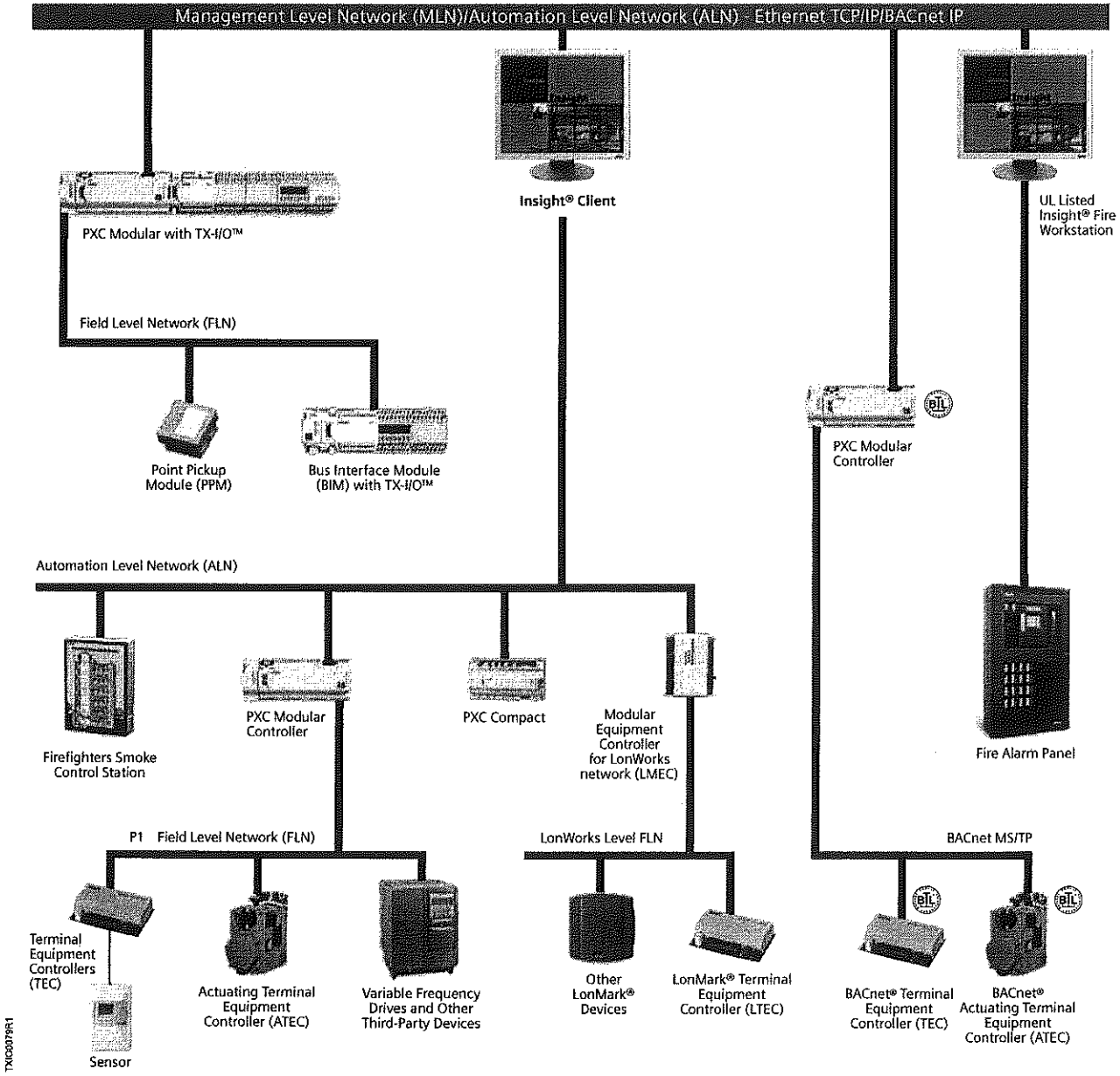
TX-I/O™ function	Description	Module type							
		TXM1.8D	TXM1.16D	TXM1.8U	TXM1.8U-ML	TXM1.8X	TXM1.8X-ML	TXM1.6R	TXM1.6R-M
		Maximum number of functions per module							
Digital inputs									
Binary Input	Status indication, voltage-free/dry contact	8	16	8	8	8	8		
Counter	Count/accumulator, voltage-free/dry pulse contact	8	8	8	8	8	8		
Analog Inputs									
	Temperature LG-Ni1000			8	8	8	8		
	Temperature Pt 1000 375			8	8	8	8		
	Temperature Pt 1000 385			8	8	8	8		
	Temperature (NTC) 10 K			8	8	8	8		
	Temperature (NTC) 100 K			8	8	8	8		
	Voltage, DC 0 ... 10V *			8	8	8	8		
	Current DC 4... 20 mA *					8	8		
Digital outputs									
BO OnOff	Latched contact, AC/DC 250V, 4A							6	6
BO Pulse	Pulse							6	6
Analog Outputs									
	DC 0..10 V *			8	8	8	8		
	DC 4 ... 20 mA *					4	4		

* Active inputs and active outputs (0-10V and 4-20 mA) must be located on different modules if sensors are externally powered.

TX-I/O Network Architecture Example

The following architecture picture shows TX-I/O modules connected to:

- A P1 BIM located on the Field Level Network.
- A PXC Modular on Ethernet TCP/IP.



Specifications:

Dimensions (L × W × D)	
TX-I/O Modules	2.52" × 3.54" × 2.75" (64 mm × 90 mm × 70 mm)
TX-I/O P1 BIM	5" × 3.54" × 2.75" (128 mm × 90 mm × 70 mm)
TX-I/O Power Supply	3.78" × 3.54" × 2.75" (96 mm × 90 mm × 70 mm)
TX-I/O Bus Connection Module	1.26" × 3.54" × 2.75" (32 mm × 90 mm × 70 mm)
TX-I/O Island Bus Expansion (IBE) Module	1.26" × 3.54" × 2.75" (32 mm × 90 mm × 70 mm)
Electrical	
Power Requirements	24 Vac +/-20% input @ 50 or 60 Hz
Power Consumption	
Power Supply	35 VA with 96 VA pass-thru
Bus Connection Module	0 VA with 96 VA pass-thru
TX-I/O P1 BIM	20 VA with 96 VA pass-thru
With the above power consumption, the Power Supply produces 28.8 W (1.2A at 24 Vdc) and the P1 BIM provides 14.4 W (0.6A at 24 Vdc) to be used by the following:	
TXM1.8D	1.1 W
TXM1.16D	1.4 W
TXM1.8U	1.5 W
TXM1.8U-ML	1.8 W
TXM1.8X	2.2 W
TXM1.8X-ML	2.3 W
TXM1.6R	1.7 W
TXM1.6R-M	1.9 W
Island Bus Expansion Module	1.2 W
Terminations	
I/O Terminals	20-12 AWG Solid 20-14 AWG Stranded
Power Supply, BCM, P1 BIM, and IBE	2-, 3-, or 4-position screw terminal pluggable blocks
Operating Environment	32°F to 122°F (0°C to 50°C), 5 to 95% rh, non-condensing
Agency Listings	UL 864 UUKL Smoke Control Equipment ULC/ORD-C100-1992 UUKL7 Smoke Control Equipment UL 916 PAZX CSA 22.2 No. 205 PAZX7
Agency Compliance	FCC Compliance Australian EMC Framework (C-Tick) European EMC Directive (CE) European Low Voltage Directive (LVD)

Ordering Information

TX-I/O I/O Modules

Product Number	Description
TXM1.8D	TX-I/O Module, 8 DI points
TXM1.16D	TX-I/O Module, 16 DI points
TXM1.8U	TX-I/O Module, 8 Universal points
TXM1.8U-ML	TX-I/O Module, 8 Universal points with LOID
TXM1.8X	TX-I/O Module, 8 Super Universal points
TXM1.8X-ML	TX-I/O Module, 8 Super Universal points with LOID
TXM1.6R	TX-I/O Module, 6 DO with Relay points
TXM1.6R-M	TX-I/O Module, 6 DO with Relay points with manual override

TX-I/O Power Supply and Bus Modules

Product Number	Description
TXS1.12F4	TX-I/O Power Supply, 1.2 A, 4A Fuse
TXS1.EF4	TX-I/O Bus Connection Module, 4A Fuse
TXA1.IBE	TX-I/O Island Bus Expansion Module with RS-485 connection.
TXB1.P1	TX-I/O Bus Interface Module, P1, 10-module
TXB1.P1-4	TX-I/O Bus Interface Module, P1, 4-module

Accessories

Product Number	Description
TXA1.K12	One set of address keys, numbers 1-12
TXA1.K24	One set of address keys, numbers 1-24
TXA1.K-48	One set of address keys, numbers 25-48
TXA1.K-72	One set of address keys, numbers 49-72
TXA1.LLT-P100	Labels for TX-I/O 100 sheets/pack Letter format
TXA1.LH	Replacement label holders

Regions where this Product is Sold

(US, Asia Pacific, Canada, Latin America, UK)

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Printed in the USA

SIEMENS

Technical Specification Sheet
Document No. 149-479
February 20, 2013

Q-Series Room Relative Humidity and Relative Humidity & Temperature Sensors

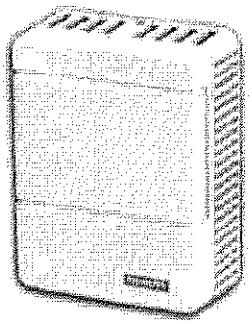


Figure 1. Q-Series Room Relative Humidity and Relative Humidity & Temperature Sensor.

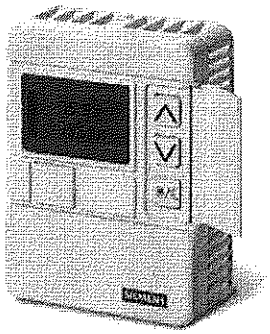
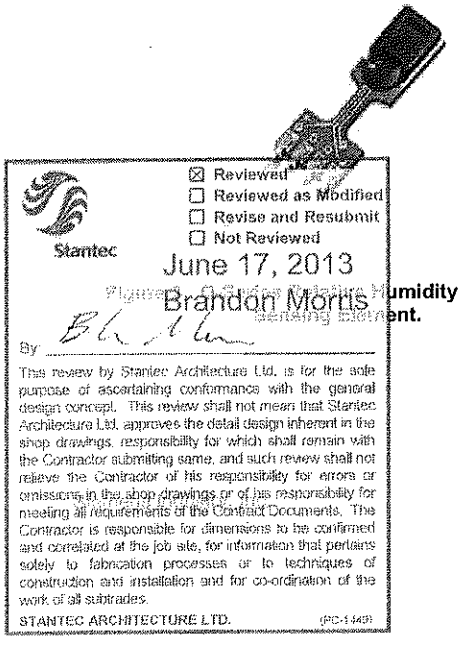


Figure 2. Q-Series Room Relative Humidity and Relative Humidity & Temperature Sensor.



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Description

The Q-Series Room Relative Humidity and Relative Humidity & Temperature Sensors monitor and transmit changes in humidity and temperature to the building control systems. These units are especially suited for applications where precise, stable humidity sensing is required.

The new Q-Series sensors use the same housing as their Series 1000 predecessors, but with a totally new internal circuit design and sensing element.

Several models are available: humidity only versions (with ±5% or ±2% accuracy) and humidity and temperature sensing versions (also with ±5% or ±2% accuracy).

The humidity only units have either a 4 to 20 mA or 0 to 10 Vdc output signal.

The combination humidity and temperature units have a current or voltage humidity output, with the temperature output being a matching current or voltage signal.

Sensing models (with display or full-featured) are also available. The full-featured models offer a wide range of features and functionality that can be used with a variety of building control systems:

Liquid Crystal Display (LCD): A two-line alphanumeric LCD allows simultaneous display of room temperature and relative humidity in degrees Fahrenheit or Celsius.

NOTE: Sensing models with display (QFAxxxx.Dxxx) show degrees Fahrenheit only. To show degrees Celsius, order the full-featured model (QFAxxxx.Fxxx).

Digital Temperature Setpoint Adjustment: The sensor's keypad allows error-free digital temperature setpoint adjustments in 0.5°F (0.2°C) increments. Setpoint values momentarily display as adjustments are made. The setpoint uses a matching current or voltage output signal.

Override Button: Allows an occupant to change to an unoccupied control schedule during the unoccupied cycle for a predetermined time period.

All 2% versions allow the sensing element to be removed and replaced if needed. Siemens sensors with replaceable elements are ideal for applications where measurement accuracy is critical and sensor replacement is not an option. Replaceable sensing elements eliminate the need for accuracy adjustment.

Specifications – Humidity Output

Measurement range	0 to 100% rh
Accuracy of 5% rated sensors at room temperature @ 73°F	±5% rh for 0% ≤ rh <30% or 70% ≤ rh <95% ±3% rh for 30% ≤ rh <70%
Accuracy of 2% rated sensors at room temperature @ 73°F	±2% 0% to 100% rh
Temperature effect	Less than 0.1% per degree C
Sensing element	Capacitive polymer sensing element
Output signal	4 to 20 mA or 0 to 10 Vdc, 0 to 100% linear, proportional
Polarity protection	None

Specifications–Temperature Output (for combination RH/T units only)

Temperature output range	32°F to 122°F (0°C to 50°C)
Time constant at 0 to 50°C and 10 to 80% rh	Approximately 20 seconds in moving air
Accuracy	±1.8°F (±1°C)
Temperature output signal	Active: 4 to 20 mA or 0 to 10 Vdc
Calibration adjustments	None
Temperature setpoint output range	63°F to 83°F (17°C to 28°C)
Temperature setpoint output signal:	Active: 4 to 20 mA or 0 to 10 Vdc

General Specifications

Operating conditions Relative humidity Temperature	 0 to 100% 32°F to 122°F (0°C to 50°C)
Installation	18 AWG cable length shared in conduit with other sensor wiring 750 ft (229 m) maximum
Connections	Screw terminals
Housing Dimensions	3-11/32" H × 2-1/2" W × 1-1/2" D (85 mm × 63 mm × 38 mm)
Power requirements: 0 to 10V outputs	20 to 30 Vdc, max. 25 mA
Power requirements: 4 to 20 mA outputs	20 to 30 Vdc, max. 25 mA + 20 mA * outputs QFAx001.x = max. 45 mA QFAx071.W/B/Dx = max. 65 mA QFAx071.Fx = max. 85 mA
Material Type	Polycarbonate plastic
Color	Desert beige or white
CE and UL–listed	UL 873 standard for temperature indicating and regulating equipment

Ordering Information

Product Number	Room Sensor Description
QFA3000.BU	RH 2%, 0 to 10V Signal, Beige, Siemens Logo
QFA3000.WU	RH 2%, 0 to 10V Signal, White, Siemens Logo
QFA3000.DBU	RH 2%, 0 to 10V Signal, Display, Beige, Siemens Logo
QFA3000.DWU	RH 2%, 0 to 10V Signal, Display, White, Siemens Logo

Ordering Information, Continued

Product Number	Room Sensor Description
QFA3000.WTU	RH 2%, 0 to 10V Signal, White, TALON Logo
QFA3001.BU	RH 2%, 4 to 20 mA Signal, Beige, Siemens Logo
QFA3001.WTU	RH 2%, 4 to 20 mA Signal, White, TALON Logo
QFA3001.WU	RH 2%, 4 to 20 mA Signal, White, Siemens Logo
QFA3001.WU-2WIRE	RH 5%, 4 to 20 mA Signal, White, Siemens Logo, 2-wire
QFA3060.BU	RHT 2%, 0 to 10V Signals, Beige, Siemens Logo
QFA3060.FBU	RHT 2%, 0 to 10V Signals, Display, Temp Setpoint, Override, Beige, Siemens Logo
QFA3060.FWTU	RHT 2%, 0 to 10V RH and Temp Signals, Display, Temp Setpoint, Override, White, TALON Logo
QFA3060.FWU	RHT 2%, 0 to 10V Signals, Display, Temp Setpoint, Override, White, Siemens Logo
QFA3060.WTU	RHT 2%, 0 to 10V RH and Temp Signals, White, TALON Logo
QFA3060.WU	RHT 2%, 0 to 10V Signals, White, Siemens Logo
QFA3071.BU	RHT 2%, 4 to 20 mA Signals, Beige, Siemens Logo
QFA3071.FBU	RHT 2%, 4 to 20 mA Signals, Display, Temp Setpoint, Override, Beige, Siemens Logo
QFA3071.FWU	RHT 2%, 4 to 20 mA Signals, Display, Temp Setpoint, Override, White, Siemens Logo
QFA3071.WU	RHT 2%, 4 to 20 mA Signals, White, Siemens Logo

Accessories	Description
544-480A	Occupancy Override Button, 25-pack (Beige)
544-480B	Occupancy Override Button, 25-pack (White)
544-481A	Setpoint Door, 25-pack (Beige)
544-481B	Setpoint Door, 25-pack (White)
544-482A	Blank Bezel, 25-pack (Beige)
544-482B	Blank Bezel, 25-pack (White)
544-484A	Blanking Override Button, 25-pack (Beige)
544-484B	Blanking Override Button, 25-pack (White)
544-782A	Single Adapter Base Kit (Beige)
544-782B	Single Adapter Base Kit (White)
544-783A	Double Adapter Base Kit (Beige)
544-783B	Double Adapter Base Kit (White)
544-784	Non-Conduit Rough-In Kit
544-785A	Extender Ring Kit (Beige)
544-785B	Extender Ring Kit (White)
AQF3051	Replaceable Sensing Element (2% versions only)

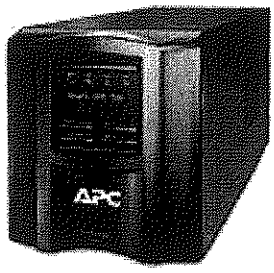
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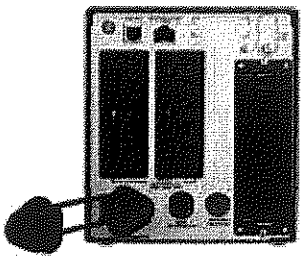
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Stantec
☑ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
June 17, 2013
Brandon Morris
By
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.
STANTEC ARCHITECTURE LTD. (PC-1449)





APC Smart-UPS 750VA LCD 120V
Part Number: SMT750

Output

Output Power Capacity	500 Watts / 750 VA
Max Configurable Power	500 Watts / 750 VA
Nominal Output Voltage	120V
Output Voltage Distortion	Less than 5% at full load
Output Frequency (sync to mains)	47 - 53 Hz for 50 Hz nominal,57 - 63 Hz for 60 Hz nominal
Waveform Type	Sine wave
Output Connections	(6) NEMA 5-15R



Input

Nominal Input Voltage	120V
Input Frequency	50/60 Hz +/- 3 Hz (auto sensing)
Input Connections	NEMA 5-15P
Cord Length	1.83 meters
Input voltage range for main operations	82 - 144V
Input voltage adjustable range for mains operation	75 - 154V

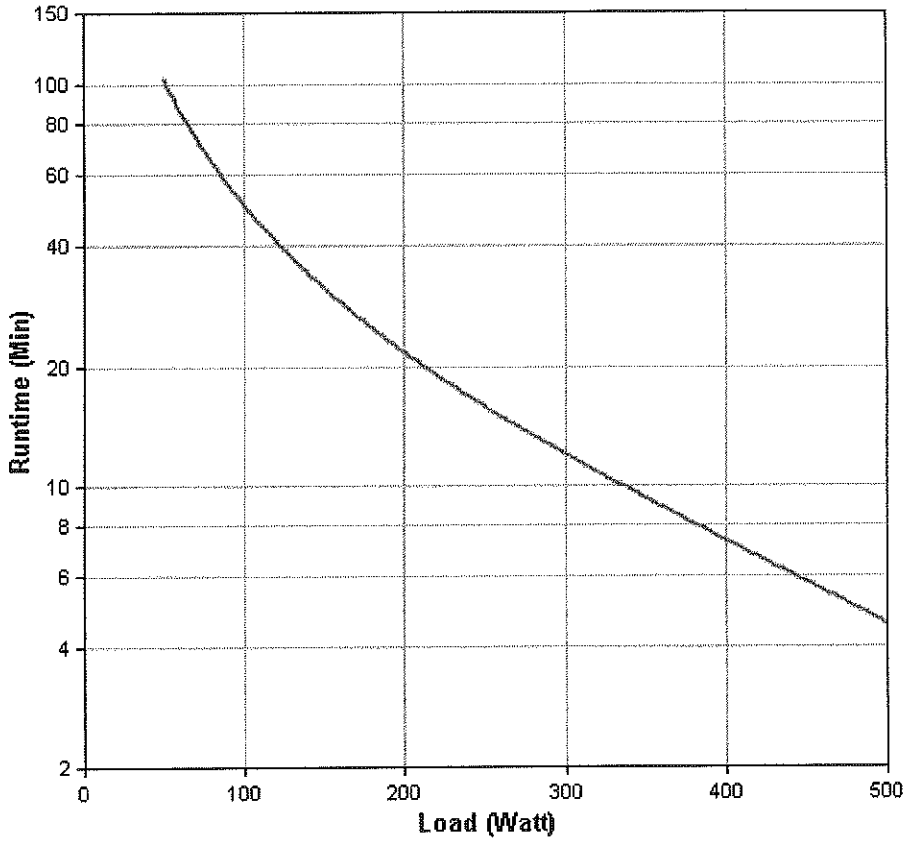


Batteries & Runtime

Battery Type	Maintenance-free sealed Lead-Acid battery with suspended electrolyte : leakproof
Typical recharge time	3 hour(s)
Replacement Battery	RBC48

RBC™ Quantity 1

Runtime Graph

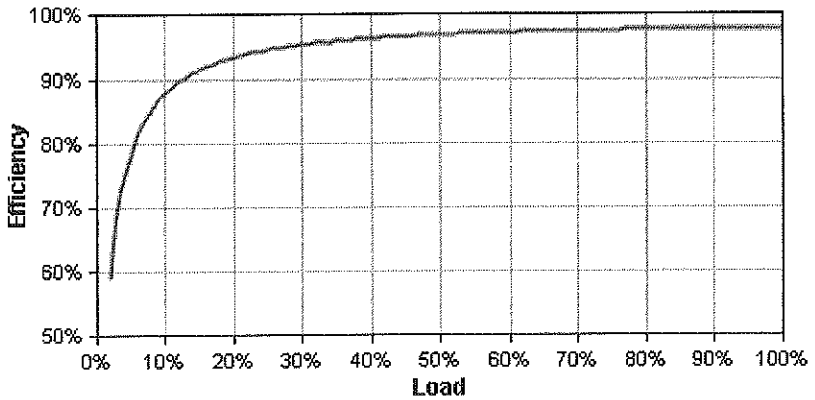


Hover over the line on the graph above to view the runtime at any desired load

Curve fit to measured runtime data. All measurements taken with new, fully charged batteries, at typical environmental conditions, with no electrical input and balanced resistive load (PF = 1.0) output.

View Enlarged Graph View Runtime Chart

Energy Use/Efficiency



Hover over the line on the graph above to view the efficiency at any desired load

Curve fit to measured efficiency data. All measurements taken in normal operating mode,

at typical environmental conditions, with nominal electrical input and balanced resistive load (PF = 1.0) output.

View Enlarged Chart

Communications & Management

Interface Port(s)	Smart-Slot
Available SmartSlot™ Interface Quantity	1
Control panel	Multi-function LCD status and control console
Audible Alarm	Alarm when on battery : distinctive low battery alarm : configurable delays
Emergency Power Off (EPO)	Optional

Surge Protection and Filtering

Surge energy rating	540 Joules
Filtering	Full time multi-pole noise filtering : 0.3% IEEE surge let-through : zero clamping response time : meets UL 1449

Physical

Maximum Height	161.00 mm
Maximum Width	138.00 mm
Maximum Depth	363.00 mm
N[illegible] Weight	13.18 KG
S[illegible]ing Weight	14.23 KG
Shipping Height	301.00 mm
Shipping Width	278.00 mm
Shipping Depth	499.00 mm
Color	Black
Units per Pallet	40.00

Environmental

Operating Environment	0 - 40 °C
Operating Relative Humidity	0 - 95%
Operating Elevation	0-3000 meters
Storage Temperature	-15 - 45 °C
Storage Relative Humidity	0 - 95%
Storage Elevation	0-15000 meters
Audible noise at 1 meter from surface of unit	55.00 dBA
Online Thermal Dissipation	90.00 BTU/hr

Conformance

I[illegible]latory Approvals	UL 1778
Sta[illegible]ard Warranty	3 years repair or replace (excluding battery) and 2 year for battery

Environmental Compliance	RoHS 7b Exemption,REACH: Contains No SVHCs

**The time to recharge to 90% of full battery capacity following a discharge to shutdown using a load rated for 1/2 the full load rating of the UPS.

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CLASS 70-459-

8 PIN MINIATURE DIN/PANEL MOUNT SOCKET

10 AMPS, 300 VOLTS

FEATURES	BENEFITS
HEAVY DUTY 1 PIECE BLOCK AND CONTACT SYSTEM:	ALLOWS FOR GREATER HEAT DISSIPATION AND LOWER CONTACT RESISTANCE AT THE RELAY TERMINALS.
IMPROVED CONTACT DESIGN:	ALLOWS FOR MORE AREA OF CONTACT ON RELAY TERMINALS, RESULTING IN LOWER CONTACT RESISTANCE AT RELAY TERMINALS.
STANDARD DIN RAIL MOUNTING:	FITS ALL STANDARD 35 MILLIMETER DIN TRACKS.

c UL us
UL Recognized
File No. E70500

97899

LISTED 367G
IND. CONT. EQ.
c UL us
WHEN USED
WITH RELAYS
78 OR 782

CE

COMPLIES WITH REQUIREMENTS OF

* IEC STANDARDS 947-4-1 AND 947-5-1 LOW VOLTAGE DIRECTIVE
* IEC = INTERNATIONAL ELECTROTECHNICAL COMMISSION
* CE TESTING AND EVALUATION PERFORMED BY THE UNDERWRITERS LABORATORIES AS A THIRD PARTY PARTICIPANT

DESIGNED FOR PANEL OR DIN MOUNT.

GENERAL SPECIFICATIONS

Electrical Rating:	10 amps, 300 volts
Dielectric Strength:	2000 V rms between all electrical elements of opposite polarity. 2000 V rms between all elements to metal mounting plate

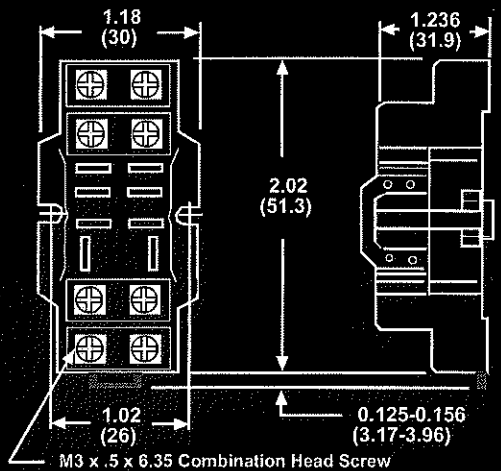
CONSTRUCTION

Contacts and Internal Metal Tracks:	Plated copper alloy
Screws and Clamping Plates:	Steel, yellow zinc plated
Screw Style and Size:	Combination head, M3 x .5 x 6.35
Screw and Clamping Plate Torque:	8 Inch - Lbs
Internal Metal Tracks, Contacts and Screw Terminals:	One piece construction

MISCELLANEOUS

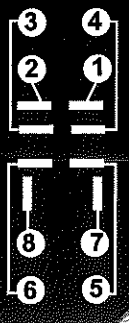
Hook-up Wire Range:	AWG #12 to #22 solid or stranded
Molded Material:	UL recognized break resistant electrical grade thermoplastic
Socket Mounting Torque:	7 to 8 Inch - Lbs
Body Color:	Gray
DIN Locking Clip Color:	Red
Weight:	49.8 grams approx.

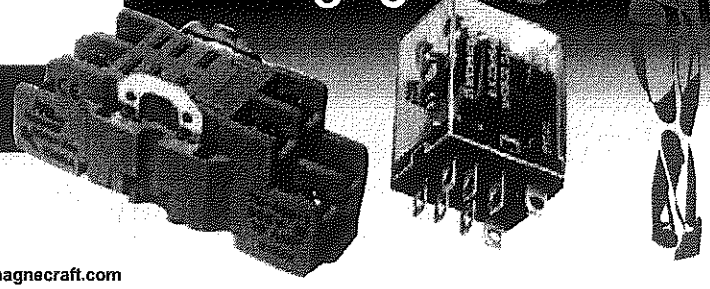
OUTLINE DIMENSIONS
DIMENSIONS SHOWN IN INCHES & (MILLIMETERS).
TOLERANCES : ± 0.010 (± 0.25)
UNLESS OTHERWISE SHOWN



16-1197 HOLD DOWN CLIP ORDERED SEPARATELY

WIRING DIAGRAM
TOP VIEW





Stantec
☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
June 17, 2013
Brandon Morris
By:

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all subtrades.

STANTEC ARCHITECTURE LTD. (PC-1449)

DESCRIPTION

8 PIN SOCKET **DIN / PANEL MOUNT,**
WITH SCREW **TERMINALS & CLAMPING PLATES.**

PHONE: (843) 393-5778 FAX: (843) 393-4123 EMAIL: info@magnecraft.com

CLASS 70-463- UP TO 3PDT 11 PIN SCREW TERMINAL SOCKET

15 AMPS 300 VOLTS

FEATURES	BENEFITS
HEAVY DUTY 1 PIECE TRACK AND CONTACT SYSTEM:	ALLOWS FOR GREATER HEAT DISSIPATION AND LOWER CONTACT RESISTANCE AT THE RELAY TERMINALS.
STANDARD DIN RAIL MOUNTING:	FITS ALL STANDARD 35 MILLIMETER DIN TRACKS.

c UL us
UL Recognized
File No. E70500

97899

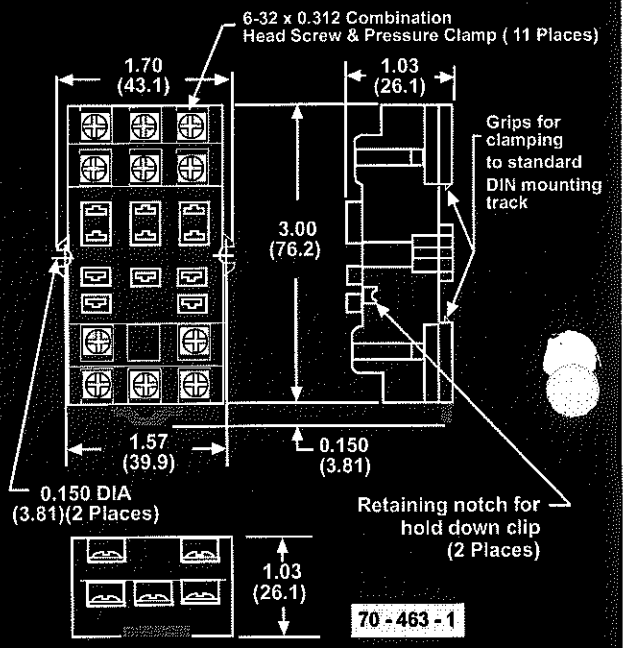
CE

LISTED 367G
IND. CONT. EQ.
C US
WHEN USED
WITH RELAYS
388 OR 788

COMPLIES WITH REQUIREMENTS OF

* IEC STANDARDS 947-4-1 AND 947-5-1 LOW VOLTAGE DIRECTIVE
*IEC = INTERNATIONAL ELECTROTECHNICAL COMMISSION
*CE TESTING AND EVALUATION PERFORMED BY THE UNDERWRITERS LABORATORIES AS A THIRD PARTY PARTICIPANT

OUTLINE DIMENSIONS
DIMENSIONS SHOWN IN INCHES & (MILLIMETERS).
TOLERANCES : ± 0.010 (± 0.25)
UNLESS OTHERWISE SHOWN



16-1278 HOLD DOWN CLIP FITS 388 / A283 RELAYS
16-1325 HOLD DOWN CLIP FITS 788 RELAYS
16-1340 UNIVERSAL HOLD DOWN CLIP FITS RELAY HEIGHTS FROM 1.90 " TO 2.15"
16-1239 HOLD DOWN CLIP FITS 388 TDR LONG BODY RELAYS
HOLD DOWN CLIPS ORDERED SEPARATELY

DESIGNED FOR PANEL OR DIN MOUNT.

GENERAL SPECIFICATIONS

Electrical Rating:	15 amps, 300 volts
Dielectric Strength:	2000 V rms between all electrical elements of opposite polarity 2000 V rms between all elements to metal mounting plate

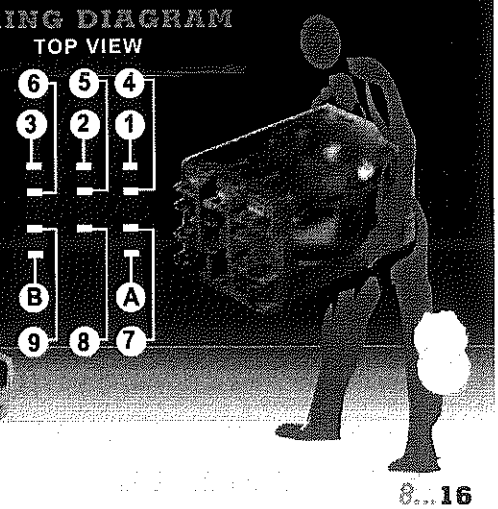
CONSTRUCTION

Contacts and Internal Metal Tracks:	Plated copper alloy
Screws and Clamping Plates:	Steel, yellow zinc plated
Screw Style and Size:	Combination head, M3 x 0.5 x 6.35
Screw and Clamping Plate Torque:	9 Inch - Lbs
Internal Metal Tracks, Contacts and Screw Terminal:	One piece construction

MISCELLANEOUS

Hook-up Wire Range:	AWG #12 to #22 solid or stranded.
Molded Material:	UL recognized break resistant electrical grade thermoplastic
Socket Mounting Torque:	8 to 10 Inch - Lbs.
Body Color:	Gray
DIN Locking Clip Color:	Red
Weight:	50.6 grams approx.

WIRING DIAGRAM
TOP VIEW



STANDARD PART NUMBERS	DESCRIPTION
70 - 463 - 1	11 PIN SOCKET, DIN/PANEL MOUNT, WITH SCREW TERMINALS & CLAMPING PLATES.

PHONE: (843) 393-5778 FAX: (843) 393-4123 EMAIL: info@magnecraft.com

CLASS 70-464- 8 PIN OCTAL SOCKET, DIN/PANEL MOUNTABLE

10 AMPS, 600 VOLTS
15 AMPS, 300 VOLTS

FEATURES	BENEFITS
PLETE ISOLATION OF ALL INTERNAL METAL TRACKS AND CONTACTS:	IDEAL FOR APPLICATIONS THAT REQUIRE UP TO 600 VOLTS.
SCREWS & CLAMPING PLATES DESIGNED WITH MAXIMUM SET BACK:	ELIMINATES ARCING BETWEEN TERMINALS AND THE NEED FOR WIRE TERMINALS.
EXTENDED PANEL MOUNTING SCREW SLOTS:	ALLOWS FOR HOLE CENTERS FROM 1.29" UP 1.4". IDEAL REPLACEMENT IN MANY EXISTING SOCKET MOUNTING APPLICATIONS.
HEAVY DUTY 1 PIECE TRACK AND CONTACT SYSTEM:	ALLOWS FOR GREATER HEAT DISSIPATION AND LOWER CONTACT RESISTANCE AT THE RELAY TERMINALS.
STANDARD DIN RAIL MOUNTING:	FITS ALL STANDARD 35 MILLIMETER DIN TRACKS

c UL us 97899
UL Recognized
File No. E70500

CE

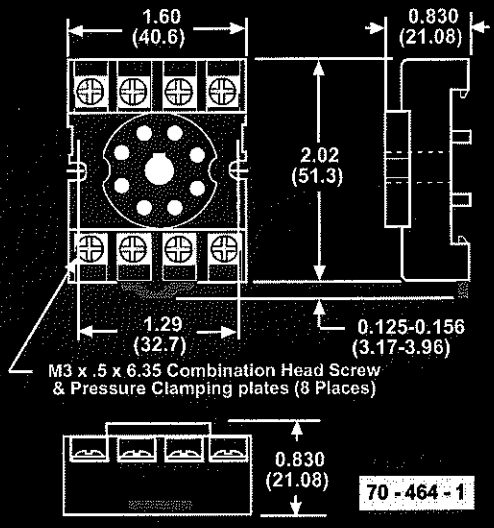
UL LISTED 367G
IND. CONT. EQ.
C US
WHEN USED
WITH RELAYS
250, 314, 211
OR 750

COMPLIES WITH REQUIREMENTS OF

* IEC STANDARDS 947-4-1 AND 947-5-1 LOW VOLTAGE DIRECTIVE
*IEC = INTERNATIONAL ELECTROTECHNICAL COMMISSION
*CE TESTING AND EVALUATION PERFORMED BY THE UNDERWRITERS LABORATORIES AS A THIRD PARTY PARTICIPANT

DESIGNED FOR PANEL OR DIN MOUNT.

OUTLINE DIMENSIONS
DIMENSIONS SHOWN IN INCHES & (MILLIMETERS).
TOLERANCES : ± 0.010 (± 0.25)
UNLESS OTHERWISE SHOWN



70 - 464 - 1

GENERAL SPECIFICATIONS

Electrical Rating:	10 amps, 600 volts, 15 amps, 300 volts
Dielectric Strength:	2500 V rms between all electrical elements of opposite polarity. 2500 V rms between all elements to metal mounting plate

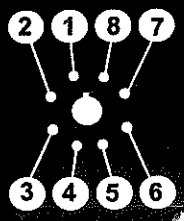
CONSTRUCTION

Contacts and Internal Metal Tracks:	Plated copper alloy
Screws and Clamping Plates:	Steel, yellow zinc plated
Screw Style and Size:	Combination head, M3 x .5 x 6.35
Screw and Clamping Plate Torque:	9 Inch - Lbs
Internal Metal Tracks, Contacts and Screw Terminals:	One piece construction

MISCELLANEOUS

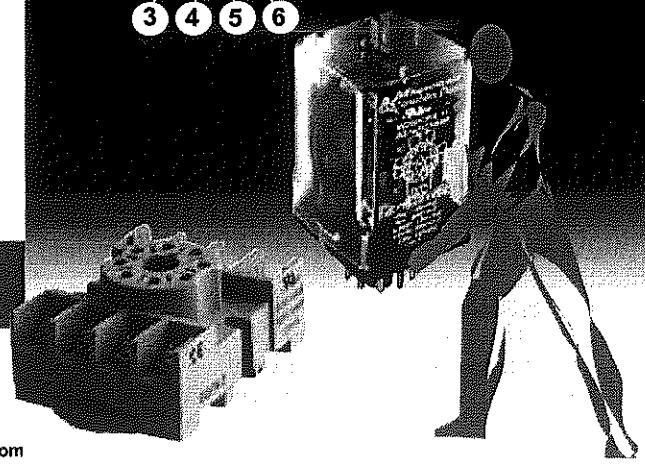
Hook-up Wire Range:	AWG #12 to #22 solid or stranded
Molded Material:	UL recognized break resistant electrical grade thermoplastic
Socket Mounting Torque:	8 to 10 Inch - Lbs
Body Color:	Gray
DIN Locking Clip Color:	Red
Weight:	40 grams, approx.

WIRING DIAGRAM
TOP VIEW



70-464- ACCEPTS ALL STANDARD 8 PIN OCTAL PLUG RELAYS

STANDARD PART NUMBERS	DESCRIPTION
70 - 464 - 1	8 PIN OCTAL SOCKET, DIN / PANEL MOUNT, WITH SCREW TERMINALS & CLAMPING PLATES.



PHONE: (843) 393-5778 FAX: (843) 393-4123 EMAIL: info@magnecraft.com

CLASS **782** FULL FEATURED

ICE CUBE STYLE POWER RELAY

DPDT & 4PDT
3, 10 & 15 AMP

FEATURES	BENEFITS
FLAG INDICATOR:	SHOWS RELAY STATUS IN MANUAL OR POWERED CONDITION.
BI - POLAR L.E.D. STATUS LAMP:	SHOWS COIL "ON" OR "OFF" STATUS. IDEAL IN LOW LIGHT CONDITIONS.
PUSH BUTTON:	ALLOWS FOR MANUAL OPERATION OF RELAY WITHOUT THE NEED FOR COIL POWER. IDEAL FOR FIELD SERVICE PERSONNEL TO TEST CONTROL CIRCUITS.
LOCK-DOWN DOOR:	WHEN ACTIVATED, HOLDS PUSH BUTTON AND CONTACTS IN THE OPERATE POSITION. EXCELLENT FOR ANALYZING CIRCUIT PROBLEMS.
FINGER-GRIP COVER:	ALLOWS OPERATOR TO REMOVE RELAYS FROM SOCKETS MORE EASILY THAN CONVENTIONAL RELAYS.
I.D. TAG/WRITE LABEL:	USED FOR IDENTIFICATION OF RELAYS IN MULTI-RELAY CIRCUITS.
COVER ADAPTERS:	DIN RAIL FLANGE ADAPTER OR TOP/BOTTOM FLANGE ADAPTER, ALLOWS THE 782 RELAY TO BE DIRECT MOUNTED TO A DIN RAIL OR PANEL.

c UL us
UL Recognized
File No. E43641

c UL us **LISTED 367G IND. CONT. EQ.**

WHEN USED WITH SOCKETS **70-782D-1, 70-459-1** OR **70-461-1**

CURRENT LIMITED TO RATING OF RELAY OR SOCKET WHICHEVER IS LESS

MANUFACTURED UNDER ISO 9002 & QS 9000

GENERAL SPECIFICATIONS

COIL

Pull-in Voltage:	75% of nominal voltage or less for DC coils, 80% of nominal voltage or less for AC coils
Dropout Voltage:	DC-10% min. AC-30% min. Of nominal voltage or more
Max. Voltage:	110%
Resistance:	±15% measured @ 25°C
Coil Power:	0.9 watts DC, 1.2 VAC (60Hz) AC @ 25°C
Insulation System:	Class "B" (130°C per UL standard 1446)
Max. Coil Dissipation:	2.3 watts DC, 2.55 VAC (60Hz) AC @ 25°C
Duty:	Continuous

CONTACTS

Contact Material:	3 amps bifurcated silver gold plated. 3 amps silver gold flashed 10 & 15 amps, silver alloy, gold flashed
Contact Rating:	**DPDT, 4PDT-** Bifurcated 3 amps @120/240 VAC 30 VDC. 1/16Hp (2.8 amp FLA),120 VAC. Pilot duty - 5 amps make, 1/2 amp break, 3 amps continuous,120 VAC **DPDT, 4PDT-** 3 amps @ 120/240 VAC, 30 VDC, 1/6 Hp 120/240 VAC, C300 pilot duty. **DPDT, 4PDT-** 10 amps @ 110/120 VAC, 8 amps @ 220/277 VAC. 8 amps @ 28 VDC, 1/3 Hp 250 VAC, B300 pilot duty. **DPDT-** 15 amps @ 110/120 VAC, 12 amps @ 220/277 VAC (20 amps max.) 12 amps 28 VDC, 1/2 Hp, 120 VAC. 1 Hp 250 VAC, B300 pilot duty

DIELECTRIC STRENGTH

Coil To Frame:	1500 V rms
Across Open Contacts:	1000 V rms
Contacts To Frame:	1500 V rms
Insulation Resistance:	100 megohms @ 500 VDC

TEMPERATURE

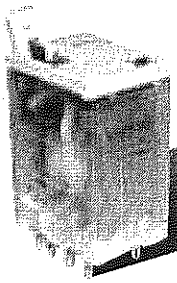
Operating:	-40°C to +70°C
Storage:	-40°C to +105°C

LIFE EXPECTANCY

Electrical:	200,000 operations @ rated resistive load
Mechanical:	10,000,000 operations @ no load

MISCELLANEOUS

Operating Position:	Any
Insulation Material	Molded plastic
Enclosure:	Polycarbonate dust cover
Weight:	36 grams approx



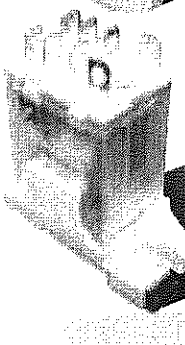
STANDARD COVER



STANDARD COVER WITH FLANGE ADAPTER 16-782 ON TOP



STANDARD COVER WITH FLANGE ADAPTER 16-782C1 ON BOTTOM



STANDARD COVER WITH DIN ADAPTER 16-782C



Mating Sockets
70-782D-1, 70-461-1, 70-459-1: SCREW/DIN
70-379-1, 70-378-1: SOLDER
70-401-1, 70-402-1: PRINTED CIRCUIT

See section 8, page 13, 14, 15

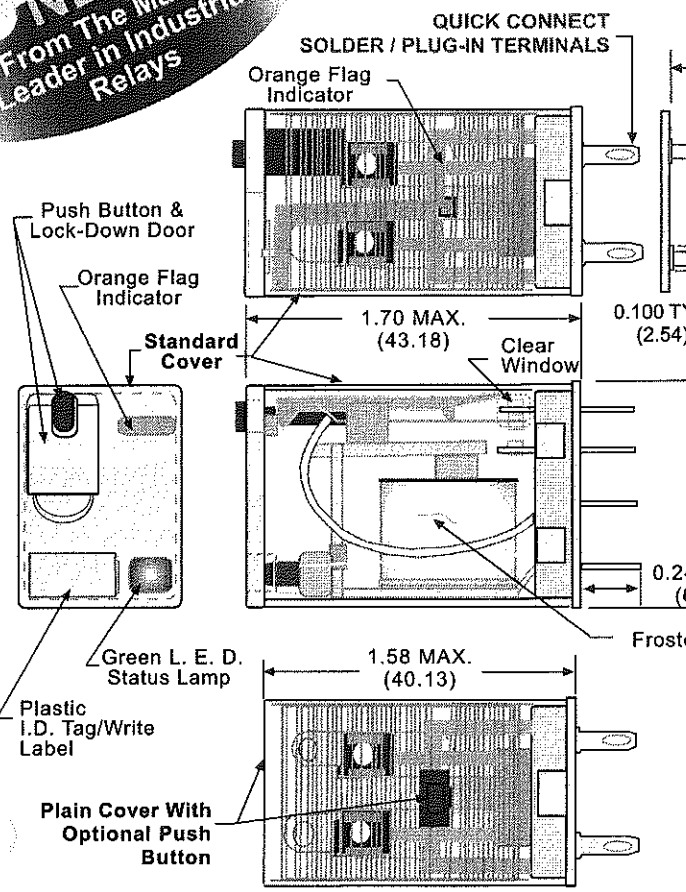
PHONE: (843) 393-5778 FAX: (843) 393-4123 EMAIL: info@magnecraft.com

ICE CUBE STYLE POWER RELAY

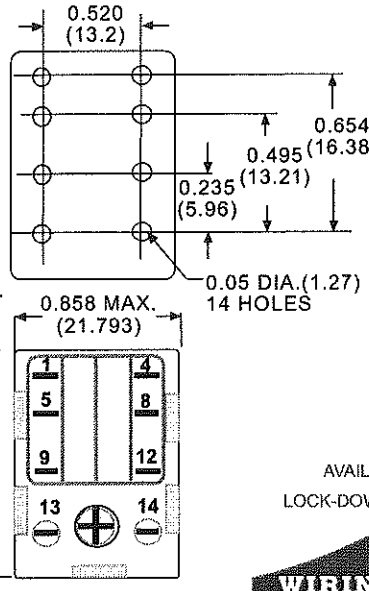
DPDT, 3 & 10 AMPS

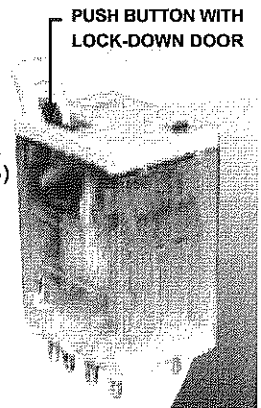
NEW From The Market Leader in Industrial Relays

OUTLINE DIMENSIONS
DIMENSIONS SHOWN IN INCHES & (MILLIMETERS).



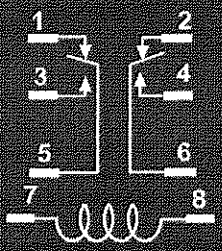
PRINTED CIRCUIT MOUNTING HOLE LAYOUT
(BOTTOM VIEW)





AVAILABLE WITHOUT LOCK-DOWN DOOR: CODE "M"

WIRING DIAGRAM
(VIEWED FROM PIN END)





BI - POLAR L.E.D. STATUS LAMP ALLOWS FOR REVERSE POLARITY APPLICATIONS

ORDERING CODE FOR RELAYS

782 XBX M4L -120A

CLASS: 782

CONTACT CONFIGURATION: XBX
DPDT: **XBX**

TERMINAL STYLE:
QUICK CONNECTSOLDER/ PLUG-IN TERMINALS: **NO CODE**
PRINTED CIRCUIT TERMINALS: **CODE T**

CONTACT RATING:
3 AMP: **CODE 1**
10 AMP: **CODE 2**
3 AMP BIFURCATED CONTACT: **CODE 3**

OPTIONAL PLAIN COVER: M4L
CODE C

STANDARD COVER FEATURES:
PUSH BUTTON & LOCK-DOWN DOOR: **CODE M4**
BI - POLAR L.E.D. STATUS LAMP: **CODE L**

OPTIONAL STANDARD COVER DELETION:
PUSH BUTTON AND BI - POLAR L.E.D.WITHOUT LOCK-DOWN DOOR: **CODE ML**

OPTIONAL PLAIN COVER FEATURES:
PUSH BUTTON WITHOUT LOCK-DOWN DOOR: **CODE M**
BI - POLAR L.E.D. STATUS LAMP: **CODE L**

COIL VOLTAGE: -120A
6, 12, 24, 120, 220/230, 240 **ADD "A" FOR AC COILS**
6, 12, 24, 110 **ADD "D" FOR DC COILS**

COIL MEASURED @ 25°C

STANDARD PART NUMBERS DPDT	NOMINAL INPUT VOLTAGE	NOMINAL RESISTANCE (OHMS)
AC OPERATED - SOLDER/PLUG-IN, 10 AMP		
782XBX2M4L-24A	24 VAC, 50/60Hz	72 Ω
782XBX2M4L-120A	120 VAC, 50/60Hz	1,700 Ω
782XBX2M4L-240A	240 VAC, 50/60HZ	9,100 Ω
DC OPERATED - SOLDER/PLUG-IN, 10 AMP		
782XBX2M4L-12D	12 VDC	120 Ω
782XBX2M4L-24D	24 VDC	470 Ω
782XBX2M4L-110D	110 VDC	10,000 Ω
AC OPERATED - SOLDER/PLUG-IN, 3 AMP, BIFURCATED		
782XBX3M4L-24A	24 VAC, 50/60Hz	72 Ω
782XBX3M4L-120A	120 VAC, 50/60Hz	1,700 Ω
782XBX3M4L-240A	240 VAC, 50/60HZ	9,100 Ω
DC OPERATED - SOLDER/PLUG-IN, 3 AMP, BIFURCATED		
782XBX3M4L-12D	12 VDC	120 Ω
782XBX3M4L-24D	24 VDC	470 Ω
782XBX3M4L-110D	110 VDC	10,000 Ω

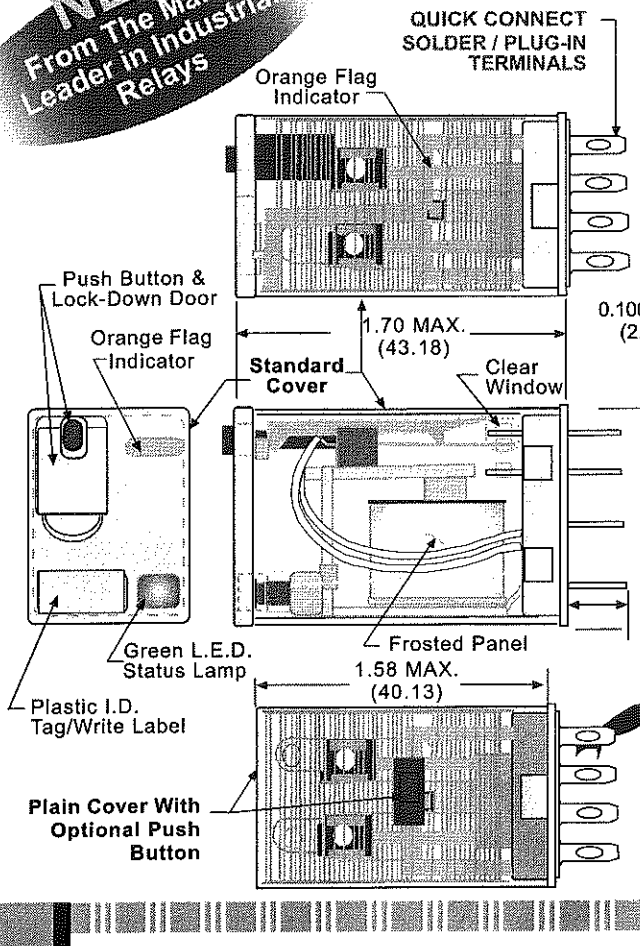
RETROFITS SCHRACK PT.
SEE END OF SECTION 1 FOR CROSS REFERENCE
CADMIUM-FREE CONTACTS AVAILABLE, CONTACT FACTORY FOR DETAILS

ICE CUBE STYLE POWER RELAY

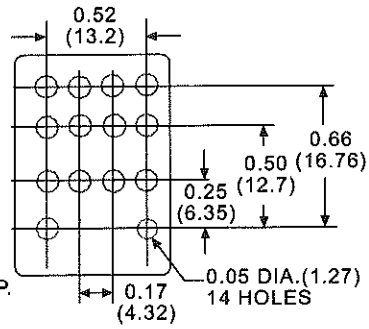
4PDT, 3 & 10 AMPS

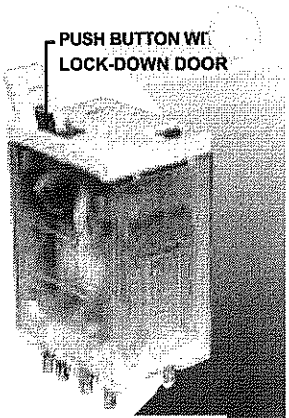
NEW From The Market Leader in Industrial Relays

OUTLINE DIMENSIONS
DIMENSIONS SHOWN IN INCHES & (MILLIMETERS).

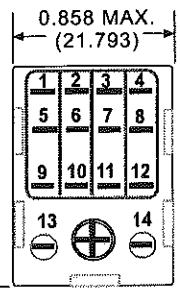


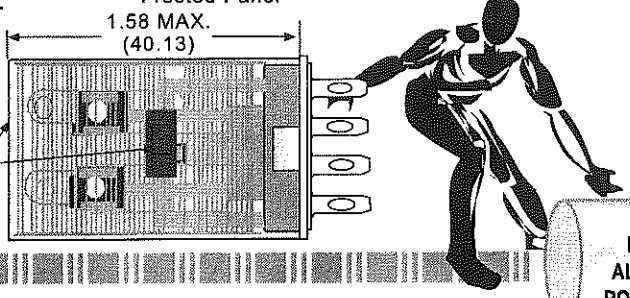
PRINTED CIRCUIT MOUNTING HOLE LAYOUT
(BOTTOM VIEW)





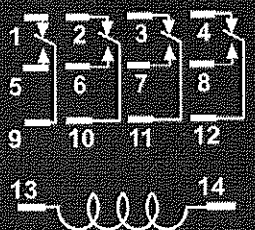
AVAILABLE WITHOUT LOCK-DOWN DOOR: CODE "M"





BI - POLAR L.E.D. STATUS LAMP ALLOWS FOR REVERSE POLARITY APPLICATIONS

WIRING DIAGRAM
(VIEWED FROM PIN END)



ALL 4 POLE RELAYS HAVE OPP POLARITY ARC BARRIERS AS A STANDARD FEATURE TO PROVIDE GREATER VOLTAGE PROTECTION BETWEEN ADJACENT POLES

ORDERING CODE FOR RELAYS

782 XDX M4L -120A

CLASS:

CONTACT CONFIGURATION:
4PDT: **XDX**

TERMINAL STYLE:
QUICK CONNECTSOLDER/ PLUG-IN TERMINALS: **NO CODE**
PRINTED CIRCUIT TERMINALS: **CODE T**

CONTACT RATING:
3 AMP: **CODE 1**
10 AMP: **CODE 2**
3 AMP BIFURCATED CONTACT: **CODE 3**

OPTIONAL PLAIN COVER:
CODE C

STANDARD COVER FEATURES:
PUSH BUTTON & LOCK-DOWN DOOR: **CODE M4**
BI - POLAR L.E.D. STATUS LAMP: **CODE L**

OPTIONAL STANDARD COVER DELETION:
PUSH BUTTON AND BI - POLAR L.E.D.WITHOUT LOCK-DOWN DOOR: **CODE ML**

OPTIONAL PLAIN COVER FEATURES:
PUSH BUTTON WITHOUT LOCK-DOWN DOOR: **CODE M**
BI - POLAR L.E.D. STATUS LAMP: **CODE L**

COIL VOLTAGE:
6, 12, 24, 120, 220/230, 240 **ADD "A" FOR AC COILS**
6, 12, 24, 48, 110 **ADD "D" FOR DC COILS**

COIL MEASURED @ 25°C

STANDARD PART NUMBERS 4PDT	NOMINAL INPUT VOLTAGE	NOMINAL RESISTANCE (OHMS)
AC OPERATED - QUICK CONNECT SOLDER/PLUG-IN, 3 AMP		
782XDX1M4L-24A	24 VAC, 50/60Hz	72 Ω
782XDX1M4L-120A	120 VAC, 50/60Hz	1,700 Ω
782XDX1M4L-240A	240 VAC, 50/60HZ	9,100 Ω
DC OPERATED - QUICK CONNECT SOLDER/PLUG-IN, 3 AMP		
782XDX1M4L-12D	12 VDC	120 Ω
782XDX1M4L-24D	24 VDC	470 Ω
782XDX1M4L-110D	110 VDC	10,000 Ω
AC OPERATED - SOLDER/PLUG-IN, 10 AMP		
782XDX2M4L-24A	24 VAC, 50/60Hz	72 Ω
782XDX2M4L-120A	120 VAC, 50/60Hz	1,700 Ω
782XDX2M4L-240A	240 VAC, 50/60HZ	9,100 Ω
DC OPERATED - SOLDER/PLUG-IN, 10 AMP		
782XDX2M4L-12D	12 VDC	120 Ω
782XDX2M4L-24D	24 VDC	470 Ω
782XDX2M4L-110D	110 VDC	10,000 Ω
AC OPERATED - SOLDER/PLUG-IN, 3 AMP, BIFURCATED		
782XDX3M4L-24A	24 VAC, 50/60Hz	72 Ω
782XDX3M4L-120A	120 VAC, 50/60Hz	1,700 Ω
782XDX3M4L-240A	240 VAC, 50/60HZ	9,100 Ω
DC OPERATED - SOLDER/PLUG-IN, 3 AMP, BIFURCATED		
782XDX3M4L-12D	12 VDC	120 Ω
782XDX3M4L-24D	24 VDC	470 Ω
782XDX3M4L-110D	110 VDC	10,000 Ω

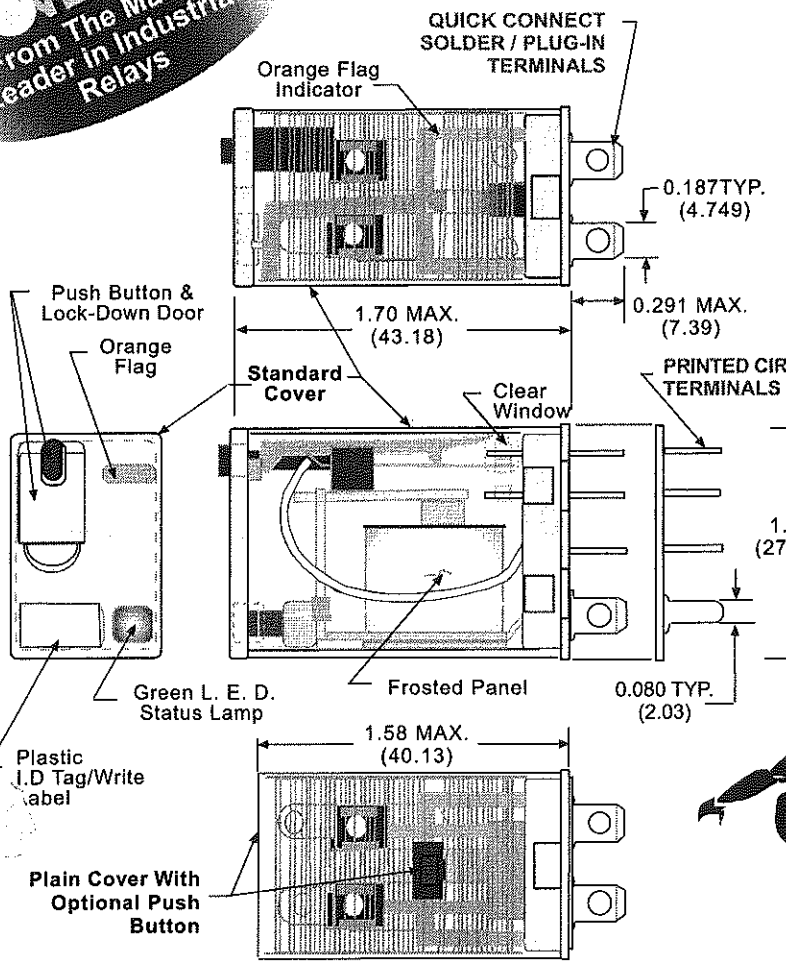
RETROFITS SCHRACK PT.
SEE END OF SECTION 1 FOR CROSS REFERENCE

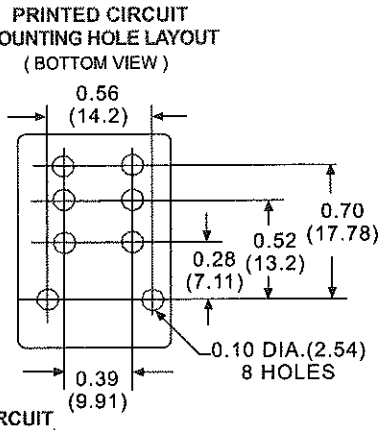
FULL FEATURED ICE CUBE STYLE POWER RELAY

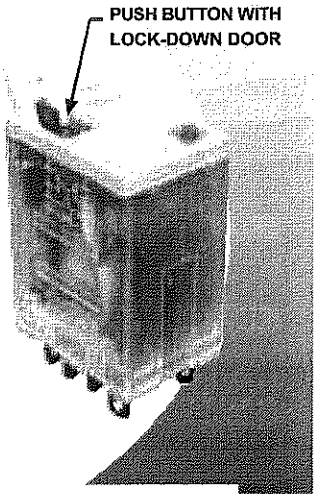
DPDT , 15 AMPS

NEW From The Market Leader in Industrial Relays

OUTLINE DIMENSIONS
DIMENSIONS SHOWN IN INCHES & (MILLIMETERS).







AVAILABLE WITHOUT LOCK-DOWN DOOR: CODE "M"



BI - POLAR L.E.D. STATUS LAMP ALLOWS FOR REVERSE POLARITY APPLICATIONS

ORDERING CODE FOR RELAYS

782 XBX M4L -120A

CLASS:

CONTACT CONFIGURATION:
DPDT: **XBX**

TERMINAL STYLE:
QUICK CONNECTSOLDER/
PLUG-IN TERMINALS: **NO CODE**
PRINTED CIRCUIT TERMINALS: **CODE T**

OPTIONAL PLAIN COVER:
CODE C

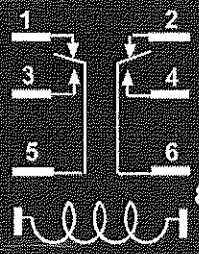
STANDARD COVER FEATURES:
PUSH BUTTON & LOCK-DOWN DOOR: **CODE M4**
BI - POLAR L.E.D. STATUS LAMP: **CODE L**

OPTIONAL STANDARD COVER DELETION:
PUSH BUTTON AND BI - POLAR L.E.D.WITHOUT LOCK-DOWN DOOR: **CODE ML**

OPTIONAL PLAIN COVER FEATURES:
PUSH BUTTON WITHOUT LOCK-DOWN DOOR: **CODE M**
BI - POLAR L.E.D. STATUS LAMP: **CODE L**

COIL VOLTAGE:
6, 12, 24, 120, 220/230, 240 **ADD "A" FOR AC COILS**
6, 12, 24 ,48, 110 **ADD "D" FOR DC COILS**

WIRING DIAGRAM
(VIEWED FROM PIN END)



COIL MEASURED @ 25°C

STANDARD PART NUMBERS DPDT	NOMINAL INPUT VOLTAGE	NOMINAL RESISTANCE (OHMS)
AC OPERATED - SOLDER/PLUG-IN, 15 AMP		
782XBXM4L-24A	24 VAC, 50/60Hz	72 Ω
782XBXM4L-120A	120 VAC, 50/60Hz	1,700 Ω
782XBXM4L-240A	240 VAC, 50/60HZ	9,100 Ω
DC OPERATED - SOLDER/PLUG-IN, 15 AMP		
782XBXM4L-12D	12 VDC	120 Ω
782XBXM4L-24D	24 VDC	470 Ω
782XBXM4L-110D	110 VDC	10,000 Ω

RETROFITS SCHRACK PT.

SEE END OF SECTION 1 FOR CROSS REFERENCE

CLASS **788** FULL FEATURED **PLUG-IN POWER RELAY**

DPDT & 3PDT, 12 AMPS

FEATURES	BENEFITS
FLAG INDICATOR:	SHOWS RELAY STATUS IN MANUAL OR POWERED CONDITION.
BI - POLAR L.E.D. STATUS LAMP:	SHOWS COIL "ON" OR "OFF" STATUS. IDEAL IN LOW LIGHT CONDITIONS.
PUSHBUTTON:	ALLOWS FOR MANUAL OPERATION OF RELAY WITHOUT THE NEED FOR COIL POWER. IDEAL FOR FIELD SERVICE PERSONNEL TO TEST CONTROL CIRCUITS.
LOCK-DOWN DOOR:	WHEN ACTIVATED, HOLDS PUSH BUTTON AND CONTACTS IN THE OPERATE POSITION. EXCELLENT FOR ANALYZING CIRCUIT PROBLEMS.
FINGER-GRIP COVER:	ALLOWS OPERATOR TO REMOVE RELAYS FROM SOCKETS MORE EASILY THAN CONVENTIONAL RELAYS.
I.D. TAG/WRITE LABEL:	USED FOR IDENTIFICATION OF RELAYS IN MULTI - RELAY CIRCUITS.

c UL us — UL Recognized File No. E43641

LR40787

UL LISTED 367G IND. CONT. EQ. C US — WHEN USED WITH SOCKET **70-463-1**

CURRENT LIMITED TO RATING OF RELAY OR SOCKET WHICHEVER IS LESS

CE — COMPLIES WITH REQUIREMENTS OF

* IEC STANDARDS 947-4-1 AND 947-5-1 LOW VOLTAGE DIRECTIVE

*IEC = INTERNATIONAL ELECTROTECHNICAL COMMISSION

*CE TESTING AND EVALUATION PERFORMED BY THE UNDERWRITERS LABORATORIES AS A THIRD PARTY PARTICIPANT

MANUFACTURED UNDER ISO 9002 & QS 9000

GENERAL SPECIFICATIONS

COIL

Pull-in Voltage:	80% of nominal voltage or less for DCcoils, 85% of nominal voltage or less for AC Coils
Dropout Voltage:	DC-10% min. AC-30% min. Of nominal voltage or more
Max. Voltage:	110%
Resistance:	±10% measured @ 25°C
Coil Power:	1.4 watts DC., 2 VA to 3.55 VA (60Hz) AC @ 25°C
Insulation System:	Class "B" (130°C per UL standard 1446)
Max. Coil Dissipation:	3.0 watts DC. 3.4 VA (60Hz) AC. @ 25°C
Duty:	Continuous

CONTACTS

Contact Material:	Silver alloy, gold flashed
Contact Rating:	12 amps, 120/240 VAC 50/60Hz, 12 amps, 28 VDC 1/3Hp 120 VAC, 1/2Hp 240 VAC.
Contact Resistance:	50 milliohms max. @ 10 amps, 120 VAC or 24 VDC contacts conditioned for 50 make and break operations @ 1 second "ON" & 1 second "OFF"

DIELECTRIC STRENGTH

Contacts to Coil:	2500 V rms
Across Open Contacts:	1500 V rms
Pole to Pole:	2500 V rms
Contacts to Frame:	2500 V rms
Insulation Resistance:	100 megohms @ 500 VDC

TEMPERATURE

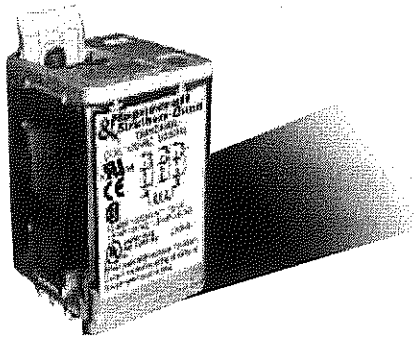
Operating:	-40°C to +50°C. (AC), -40°C +65°C. (DC)
Storage:	-40°C to +100°C

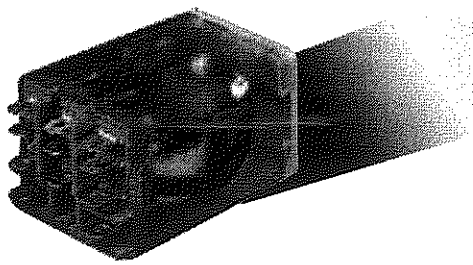
LIFE EXPECTANCY

Electrical:	200,000 operations @ rated resistive load
Mechanical:	5,000,000 operations @ no load

MISCELLANEOUS

Operating Position:	Any
Insulation Material:	Molded plastic
Enclosure:	Polycarbonate dust cover
Weight:	88 grams approx.







Mating Sockets
70-463-1: SCREW/DIN
70-124-1: SOLDER
70-178-1, 70-178-2: PRINTED CIRCUIT
70-124-2: QUICK CONNECT
See section 8, page 16, 17

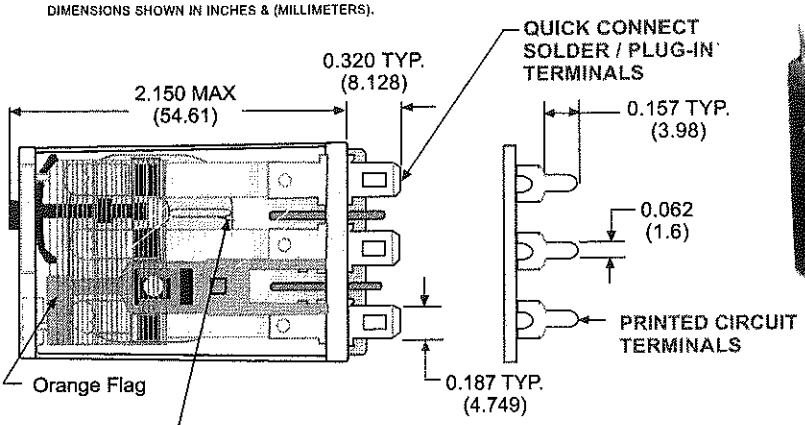
PHONE: (843) 393-5778 FAX: (843) 393-4123 EMAIL: Info@magnecraft.com

FULL FEATURED PLUG-IN POWER RELAY

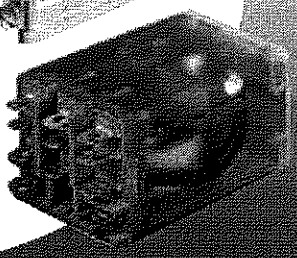
DPDT & 3PDT, 12 AMPS

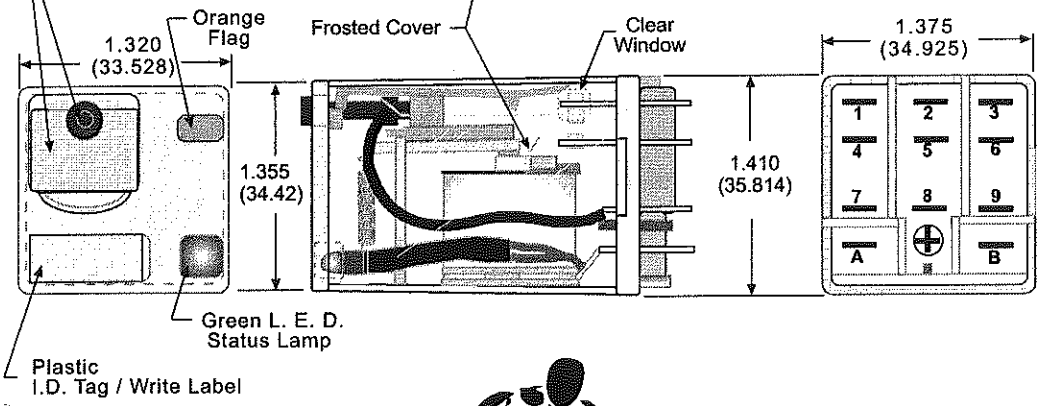
NEW From The Market Leader in Industrial Relays

OUTLINE DIMENSIONS
DIMENSIONS SHOWN IN INCHES & (MILLIMETERS).





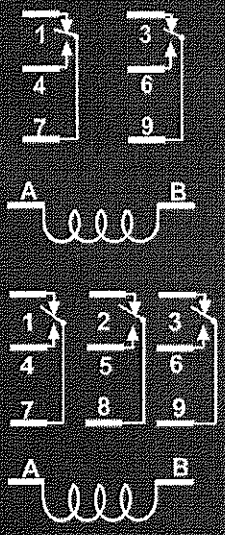






BI - POLAR L.E.D. STATUS LAMP ALLOWS FOR REVERSE POLARITY APPLICATIONS

WIRING DIAGRAMS
(VIEWED FROM PIN END)



ORDERING CODE FOR RELAYS

788 XBX M4L - 120A

CLASS:

CONTACT CONFIGURATION:
DPDT: **XBX**
3PDT: **XCX**

TERMINAL STYLE:
SOLDER PLUG-IN TERMINALS: **NO CODE**
PRINTED CIRCUIT TERMINALS: **CODE T**

STANDARD FEATURES:
PUSH BUTTON & LOCK DOWN DOOR: **CODE M4**
BI - POLAR L.E.D. STATUS LAMP: **CODE L**

OPTIONAL FEATURES:
PUSH BUTTON WITHOUT LOCK DOWN DOOR: **CODE M**

COIL VOLTAGE:
6, 12, 24,120, 220 / 230, 240 **ADD "A" FOR AC COILS**
6, 12, 24, 48,110 **ADD "D" FOR DC COILS**

STANDARD PART NUMBERS	CONTACT CONFIGURATION	COIL MEASURED @ 25°C NOMINAL INPUT VOLTAGE	NOMINAL RESISTANCE (OHMS)
AC OPERATED - SOLDER/PLUG-IN, 12 AMP			
788XBXM4L-24A	DPDT	24 VAC, 50/60Hz	72 Ω
788XBXM4L-120A	DPDT	120 VAC, 50/60Hz	1,700 Ω
788XBXM4L-240A	DPDT	240 VAC, 50/60Hz	9,100 Ω
DC OPERATED - SOLDER/PLUG-IN, 12 AMP			
788XBXM4L-12D	DPDT	12 VDC	120 Ω
788XBXM4L-24D	DPDT	24 VDC	470 Ω
788XBXM4L-110D	DPDT	110 VDC	10,000 Ω
AC OPERATED - SOLDER/PLUG-IN, 12 AMP			
788XCXM4L-24A	3PDT	24 VAC, 50/60Hz	72 Ω
788XCXM4L-120A	3PDT	120 VAC, 50/60Hz	1,700 Ω
788XCXM4L-240A	3PDT	240 VAC, 50/60Hz	9,100 Ω
DC OPERATED - SOLDER/PLUG-IN, 12 AMP			
788XCXM4L-12D	3PDT	12 VDC	120 Ω
788XCXM4L-24D	3PDT	24 VDC	470 Ω
788XCXM4L-110D	3PDT	110 VDC	10,000 Ω

CADMIUM-FREE CONTACTS AVAILABLE, CONTACT FACTORY FOR DETAILS

CLASS **211**

OCTAL 8 & 11 PIN TIME DELAY RELAY

DPDT, 10 AMPS

THE CLASS 211 TIME DELAY RELAY MAKES USE OF HYBRID CIRCUITRY, COMBINING INTEGRATED CIRCUITS FOR A MULTITUDE OF TIMING FUNCTIONS, AND THE RELIABILITY OF RELAY TECHNOLOGY.

c UL us
UL Recognized
File No. E43641

UL LISTED 367G

WHEN USED WITH SOCKETS
70-464-1 (8 PIN)
70-465-1 (11 PIN)

COMPLIES WITH REQUIREMENTS OF

* IEC STANDARDS 947-4-1 AND 947-5-1 LOW VOLTAGE DIRECTIVE
* IEC = INTERNATIONAL ELECTROTECHNICAL COMMISSION
* CE TESTING AND EVALUATION PERFORMED BY THE UNDERWRITERS LABORATORIES AS A THIRD PARTY PARTICIPANT

GENERAL SPECIFICATIONS

TIMING

Operating Modes Available:	On delay, off delay, Interval, one shot
Timing Adjustments Available:	0.1 to 120 minutes
Repeatability (Repeat Accuracy when Stabilized):	±0.1% max. or ±33 mS AC min. or± 10 mS DC. min. @ constant voltage & temperature
Timing Change Over Temperature and Voltage Range:	± 10%
Timing Tolerance High End:	- 0 to + 40%
Timing Tolerance Low End :	+ 0 to - 40%
Reset Time:	100 milliseconds max.

CONTACTS

Contact Rating:	10 amps @ 120VAC / 30VDC resistive load, 1/2 Hp @ 240 VAC, 1/3 Hp @120 VAC, NEMA B300 pilot duty
Contact Life:	200,000 operations @ 120VAC, 10 amps resistive load 1,000,000 operations @ 120 VAC, 5 amps resistive load 2,000,000 operations @ 120VAC, 2 amps resistive load
Mechanical Life:	10,000,000 operations

INPUT

Operating Voltage Range:	AC: 85 % to 110 %, DC: 80 % to 110 % of nominal
Temperature range (Operate):	- 30 ˚C to + 55˚C
Temperature range (Storage):	- 55˚C to + 85˚C
Steady State Input Current:	80 mA @ 24 VAC, 20 mA @ 120 VAC, 15 mA @ 230 VAC, 80 mA @ 12 VDC, 50 mA @ 28 VDC, 30 mA @ 48 VDC

PROTECTION

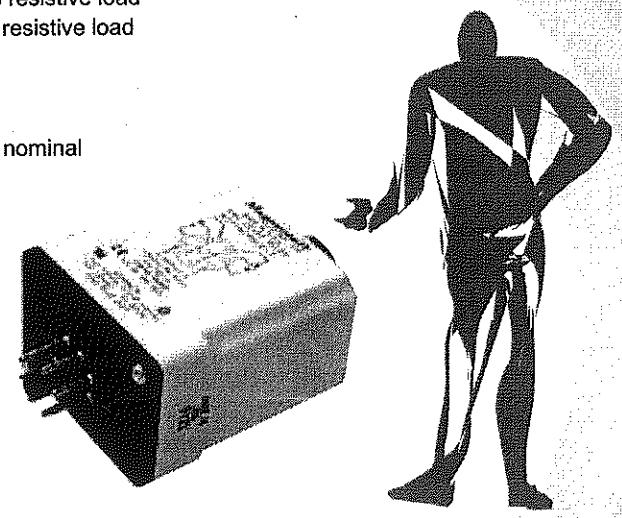
Reverse Polarity:	Yes - DC
Transient:	UL 508 surge test: 5000V for 50 uS
Noise Immunity:	NEMA ICS2-230 2500 VAC

DIELECTRIC STRENGTH

Coil to Contacts:	1500 V rms
Across Open Contacts:	1000 V rms

MECHANICAL

Operating Position:	Any
Enclosure:	Polycarbonate dust cover
Mounting:	Standard 8 or 11 pin octal
Weight:	115 grams approx



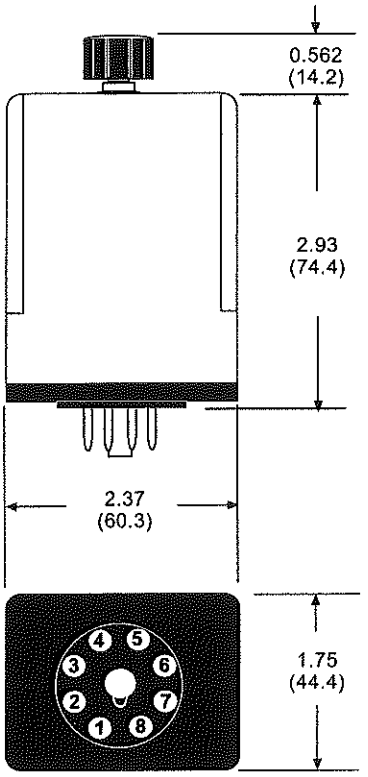
Mating Sockets
70-750D8-1, 70-750D11-1,
70-464-1, 70-465-1: SCREW/DIN
70-169-1, 70-170-1: SCREW/PANEL
See section 8, page 7 - 12

PHONE: (843) 393-5778 FAX: (843) 393-4123 EMAIL: Info@magnecraft.com

OCTAL 8 & 11 PIN TIME DELAY RELAY

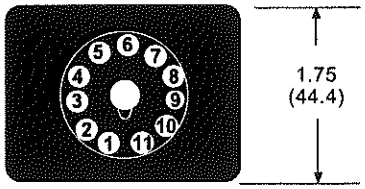
DPDT, 10 AMPS

OUTLINE DIMENSIONS
DIMENSIONS SHOWN IN INCHES & (MILLIMETERS).



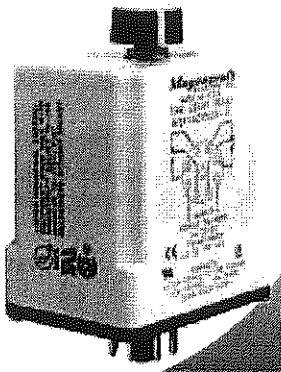
ON-DELAY

8 PIN OCTAL

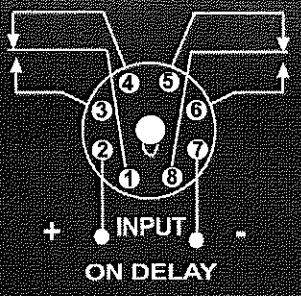


OFF-DELAY

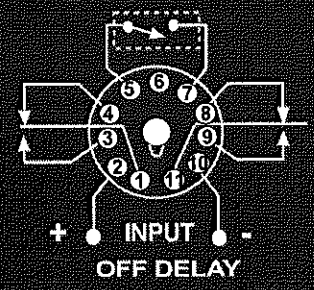
11 PIN OCTAL



WIRING DIAGRAMS



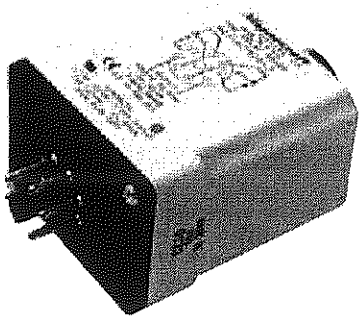
EXTERNALCONTROL SWITCH



EXTERNAL SWITCH SHALL NOT BE CONNECTED TO ANY EXTERNAL LOAD OR VOLTAGE. DAMAGE TO INTERNAL COMPONENTS CAN OCCUR.

STANDARD PART NUMBERS	NOMINAL INPUT VOLTAGE	TIMING RANGE
ON DELAY		
W211ACPSOX-18	120 VAC	0.1 TO 1.0 SECONDS
W211ACPSOX-5	120 VAC	0.1 TO 10 SECONDS
W211ACPSOX-7	120 VAC	1.0 TO 180 SECONDS
W211ACPSOX-8	120 VAC	2.0 TO 300 SECONDS
W211ACPSOX-60	120 VAC	1.0 TO 15 MINUTES
W211ACPSOX-61	120 VAC	2.0 TO 30 MINUTES
W211ACPSOX-62	120 VAC	4.0 TO 60 MINUTES
W211ACPSOX-63	120 VAC	8.0 TO 120 MINUTES
W211CPSOX-1	24 VDC	0.1 TO 10 SECONDS
W211CPSOX-3	24 VDC	1.0 TO 180 SECONDS
OFF DELAY		
W211ACPSRX-5	120 VAC	0.1 TO 10 SECONDS
W211ACPSRX-7	120 VAC	1.0 TO 180 SECONDS
W211ACPSRX-8	120 VAC	2.0 TO 300 SECONDS
W211ACPSRX-60	120 VAC	1.0 TO 15 MINUTES
W211CPSRX-1	24 VDC	0.1 TO 10 SECONDS
W211CPSRX-3	24 VDC	1.0 TO 180 SECONDS





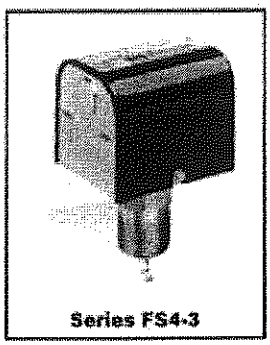
CALL FACTORY FOR OTHER VOLTAGES, TIME AND FUNCTIONS

Flow Switches – Liquid

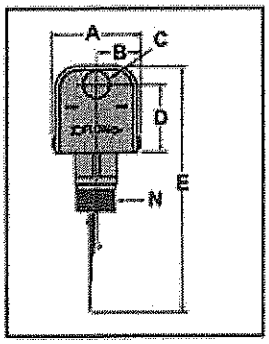
Series FS4-3

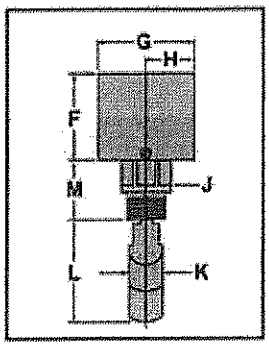
General Purpose Liquid Flow Switches

- Universal design serves the widest variety of applications
- For starting or stopping electrically operated equipment such as signal lights, alarms, motors, automatic burners, metering devices and others
- Replacement for Johnson Controls flow switch Model F61KB-11
- 1" (25mm) NPT
- Two electrical knock-outs allows connection from either end
- Sensitivity adjusting screw makes flow adjustment easy
- Single pole, double throw snap switch
- Hardened stainless steel bearings minimize friction
- Sealed Monel bellows
- Four Monel paddles included-1", 2" , 3" & 6" (25, 50, 80, & 150mm) NPT
- Optional features
  - Time delay (5 or 20 seconds)
  - Two SPDT switches to make or break two separate circuits
  - Reinforced paddles
  - Materials of construction suitable for corrosive liquids
  - Sprinkler service (UL & ULC listed)-Model FS4-3F
  - BSPT threads
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 300°F (149°C)
- Maximum pressure 150 psi (10.5 kg/cm²)



Series FS4-3





Stantec

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

June 17, 2013
Brandon Morris

By _____

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.

STANTEC ARCHITECTURE LTD. (PC-1449)

Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C	D	E	F	G
3 (76)	1½ (38)	⅞ (22)	2 7/32 (56)	8 7/16 (211)	2 15/16 (75)	3⅜ (86)

H	J	K	L	M	N NPT
1 11/16 (43)	1 7/16 (37)	1⅛ (29)	3 1/16 (87)	2 1/16 (52)	1 (25)

Flow Switches – Liquid (continued)

Series FS4-3 (continued)
General Purpose Liquid Flow Switches

Flow Rates

Pipe Size NPT in. (mm)	Settings	Mode of Operation: Flow gpm (lpm)	Mode of Operation: No Flow gpm (lpm)	Max. Flow Rate (GPM) w/o Paddle Damage
1 (25)	Factory or Minimum	6 (22.7)	3.6 (13.6)	27
	Maximum	10.2 (38.6)	9.2 (34.8)	
1¼ (32)	Factory or Minimum	9.8 (37.1)	5.6 (21.2)	47
	Maximum	16.8 (63.6)	15 (56.8)	
1½ (40)	Factory or Minimum	12.7 (48.1)	7 (26.5)	63
	Maximum	23 (87.1)	19.5 (73.8)	
2 (50)	Factory or Minimum	18.8 (71.2)	9.4 (35.6)	105
	Maximum	32.8 (124.1)	24 (90.8)	
2½ (65)	Factory or Minimum	24.3 (92)	11.8 (43.9)	149
	Maximum	42.4 (160.5)	37.5 (141.9)	
3 (80)	Factory or Minimum	30 (113.6)	12 (45.4)	230
	Maximum	52.1 (197.2)	46.1 (174.5)	
4 (100)	Factory or Minimum	39.7 (150.3)	19.8 (74.9)	397
	Maximum	73.5 (278.2)	64.2 (242)	
5 (125)	Factory or Minimum	58.7 (222.2)	29.3 (110.9)	654
	Maximum	115 (435.3)	92 (348.2)	
6 (150)	Factory or Minimum	79.2 (300)	39.6 (150)	900
	Maximum	166 (628.3)	123 (465.6)	

Values are ± 10%

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS4-3	114400	Liquid flow switch	2.3 (1.0)
FS4-3D	114550	FS4-3 w/2 SPDT switches	3.3 (1.5)
FS4-3F	114625	FS4-3 for sprinkler service	2.3 (1.0)
FS4-3J	114610	FS4-3 w/BSPT threads	2.0 (0.9)
FS4-3S	114641	FS4-3 w/SS/monel construction	2.3 (1.0)
FS4-3DS	114642	FS4-3 w/SS/monel & w SPDT switches	3.3 (1.5)
FS4-3RP	114650	FS4-3 w/reinforced paddle	2.3 (1.0)
FS4-3-5R	114405	FS4-3 w/5 second delay on break	2.3 (1.5)
FS4-3-20	114425	FS4-3 w/20 second delay on make	2.3 (1.5)

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

For Model FS4-3F & FS4-3DF

NPT Pipe Size in. (mm)	Paddle to use Length	TEE Size
1" (25)	1 11/32" as furnished	1" x 1" x 1" NPT Tee
1¼" (32)	Trim 1½" pipe size paddle with template furnished	1¼" x 1¼" x 1" NPT Tee (Paddle must be bowed for insertion into 1¼" tee)
1½" (40)	2 1/16" as furnished	1½" x 1½" x 1" NPT Tee (Paddle must be bowed for insertion into 1½" tee)

NOTE: ONLY LISTED PIPE SIZES MEET UL REQUIREMENTS FOR FIRE SPRINKLER SYSTEMS.

Model 209

Pressure Transducer



Applications

- Industrial OEM Equipment
- Hydraulic Systems
- Compressor Control
- HVAC/R Equipment
- Industrial Engines
- Process and Containerized Refrigeration Systems

Benefits

- Unparalleled Price/ Performance
- Rugged Design Survives Harsh Environments
- Operates Over a Wide Temperature Band
- Compatible with Wide Range of Gases and Liquids
- Operates on Low Cost Unregulated DC Power
- Suitable for High Shock and Vibration Applications
- No Seals or "O" Rings to Cause Leakage
- No Brazed Joints Susceptible to Corrosion Problems
- 3 to 5 Day Shipment for Small Quantities, Standard Configurations

Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed
Stantec
June 17, 2013
Brandon Morris
By:
This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all subtrades.

setra

800-257-3872

Model 209 Specifications

Performance Data

Accuracy RSS* (at constant temperature)	±0.25% FS
Non-Linearity (BFSL)	±0.22% FS
Hysteresis	0.10% FS
Non-Repeatability	0.05% FS
Thermal Effects	
Compensated Range °F(°C)	-4 to +176 (-20 to +80)
Zero Shift %FS/100°F(%FS/50°C)	2.0 (±1.8)
Span Shift %FS/100°F(%FS/50°C)	1.5 (±1.3)
Warm-up Shift	±0.1% FS total
Response Time	5 milliseconds
Stability	0.5% FS/Year

*RSS of Non-Linearity, Non-Repeatability and Hysteresis.

Electrical Data (Voltage)

Circuit	3-Wire (Com, Out, Exc)
Excitation	9 to 30 VDC
Output*	0.5 to 5.5 VDC**
Output Impedance	10 ohms

*Calibrated into a 50K ohm load, operable into a 5000 ohm load or greater.

**Zero output factory set to within ±50mV.

**Span (Full Scale) output factory set to within ±50mV.

Note: Other outputs are available with 9 to 30 VDC excitation.

An output of 0.5 to 4.5 VDC output is available with 5 VDC excitation.

Electrical Data (Current)

Circuit	2-Wire
Output*	4 to 20 mA**
External Load	0 to 800 ohms

Minimum supply voltage (VDC) = 9 + 0.02 x (Resistance of receiver plus line).

Maximum supply voltage (VDC) = 30 + 0.004 x (Resistance of receiver plus line).

*Calibrated at factory with a 24 VDC loop supply voltage and a 250 ohm load.

**Zero output factory set to within ±0.16mA.

**Span (Full Scale) output factory set to within ±0.16mA.

Environmental Data

Temperature	
Operating °F (°C)	-40 to +260 (-40 to +127)
Storage °F (°C)	-40 to +260 (-40 to +127)
Vibration*	20g
Shock**	200g
Environmental Protection	Weather Resistant

*MIL-STD 202, Method 204, Cond. C

**MIL-STD 202, Method 213B, Cond. C

Physical Description

Case	Stainless Steel & Valox
Sensor	17-4 PH Stainless Steel
Electrical Connection	2 ft. multi-conductor cable
Pressure Fitting*	1/4" -18 NPT external, 17-4 PH Stainless Steel
Vent	Through cable
Weight (approx.)	2.3 ounces (65 grams)

*See ordering information for other fittings available (minimum quantities apply).

Pressure Media

Liquids or gases compatible with 17-4 PH Stainless Steel*.

*Note: Hydrogen not recommended for use with 17-4 PH Stainless Steel.

Specifications are subject to change without notice.
NOTE: Setra quality standards are based on ANSI-Z540-1.
The calibration of this product is NIST traceable.
U.S. Patent Nos. 409315, and other Patents Pending.

Gauge and Compound Pressure Ranges

(Sealed ranges available on 200 PSI and above)

Full Scale Range PSI	Proof Pressure PSI	Burst Pressure PSI
1	2	250
2	4	250
5	10	250
10	20	500
25	50	500
50	100	750
100	200	1000
200	400	2000
250	500	2000
500	1000	3000
1000	2000	5000
2000	3000	6500
3000	4500	7500
5000	7500	10,000
10,000	12,500	20,000

Gauge Pressure: Pressure measured relative to ambient atmospheric pressure. Referred to as pounds per square inch (gauge) or psig.
Proof Pressure: The maximum pressure that may be applied without changing performance beyond specifications (±0.5% FS zero shift).
Burst Pressure: The maximum pressure that may be applied to the positive pressure port without rupturing the sensing element.

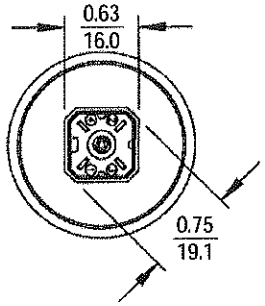
Setra Systems 209 pressure transducers have been designed specifically for industrial applications with demanding price and performance requirements. The 209 offers exceptional reliability in typical industrial grade environments. Standard features tailor the Model 209 for applications with more extreme environmental conditions or more stringent performance needs. The Model 209 offers unparalleled performance in a configurable transducer designed specifically for the budget conscious OEM.

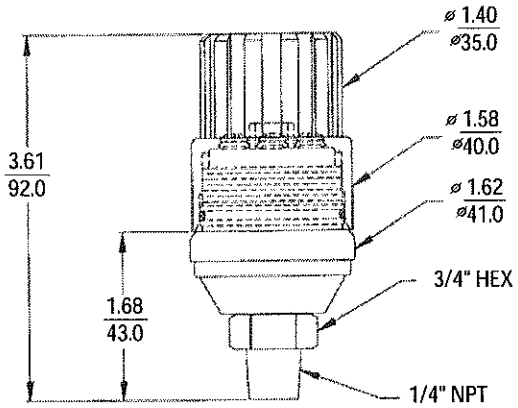
Setra's proven center mount electrode configuration is the heart of this simple, yet industrialized, design. A 17-4 PH stainless steel sensor and a rigid stainless steel electrode form the variable capacitor.

Setra 209 transducers are packaged in rugged stainless steel/Valox housings, which are small and lightweight for optimum compatibility with system designs. As a totally self - contained electronic package, the 209 stainless steel capacitance sensing element, coupled with a high level output IC-based circuit, assures excellent accuracy and long term stability.

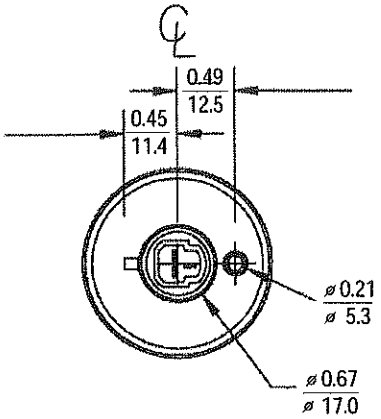
When it comes to a product to rely on - choose the Model 209. When it comes to a company to trust - choose Setra - an ESOP (Employee Owned) company.

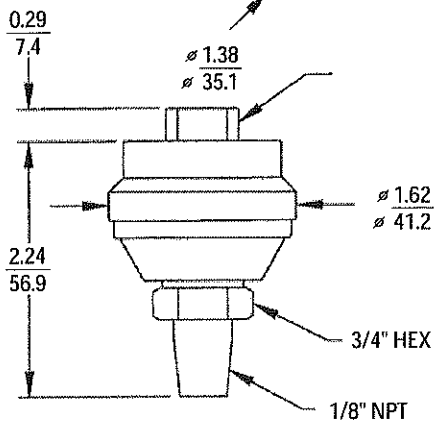
Outline Drawings





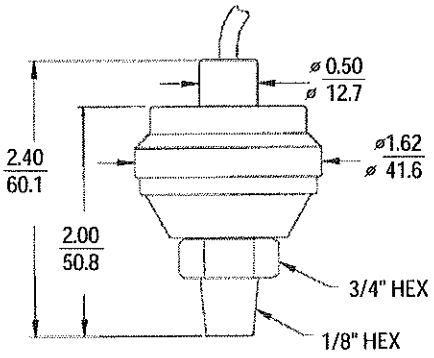
CONDUIT VERSION



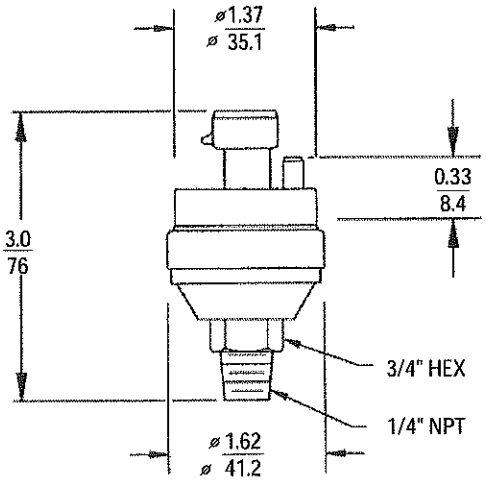


OPTIONAL P1 (3-Pin) HIRSCHMANN CONNECTOR Type: G4A1M #931807-106
Mating Connector Hirschmann G4WIF MFR. P/N 932157-106, not provided by Setra Systems unless ordered separately as Option 590.

IN
MM



CABLE ANCHOR



OPTIONAL PACKARD CONNECTOR
Type: P2S Series 150
Mating Packard Connector #12065287, 3 terminals #12103881, not provided by Setra Systems, unless ordered separately as Option 854.

SSP208 Rev.C 11/01/99

ORDERING INFORMATION
Model 209 Pressure Transducer

Code all blocks in table.

Example: Part No. 2091050PG2M1102 for a 209 Transducer 0 to 50 PSIG Range, 1/4" NPT Male Pressure Fitting, 4 to 20 mA Output, and 2 Feet of Cable.

2 0 9 1 — [ ][ ][ ][ ] — [ ] — [ ][ ] — [ ][ ] — [ ][ ]

Model	Pressure Ranges in. W.C.	Type	Pressure Fitting	Output	Electrical Termination
2091 = 209	001P = 0 to 1 PSI 002P = 0 to 2 PSI 005P = 0 to 5 PSI 010P = 0 to 10 PSI 025P = 0 to 25 PSI 050P = 0 to 50 PSI 100P = 0 to 100 PSI 200P = 0 to 200 PSI 250P = 0 to 250 PSI 500P = 0 to 500 PSI 10CP = 0 to 1000 PSI 20CP = 0 to 2000 PSI 30CP = 0 to 3000 PSI 50CP = 0 to 5000 PSI 10KP = 0 to 10000 PSI	G = Gauge C = Compound S = Sealed (Sealed version available in 200 PSI Ranges & Above)	2M = 1/4" NPT Male J7 = 7/16" SAE Male 1M = 1/8" NPT Male	11 = 4 to 20 mA 24 = 0.5 to 5.5 VDC 28 = 1 to 6 VDC 45 = 0.5 to 4.5 VDC (5 VDC Excitation)	XX = Cable length in feet (i.e., 2 feet = 02) P1 = Packard (3-Pin) P3 = Packard (4-Pin) H2 = Hirschmann, ("Mini") T1 = Terminal Block A1 = 1/2" Conduit

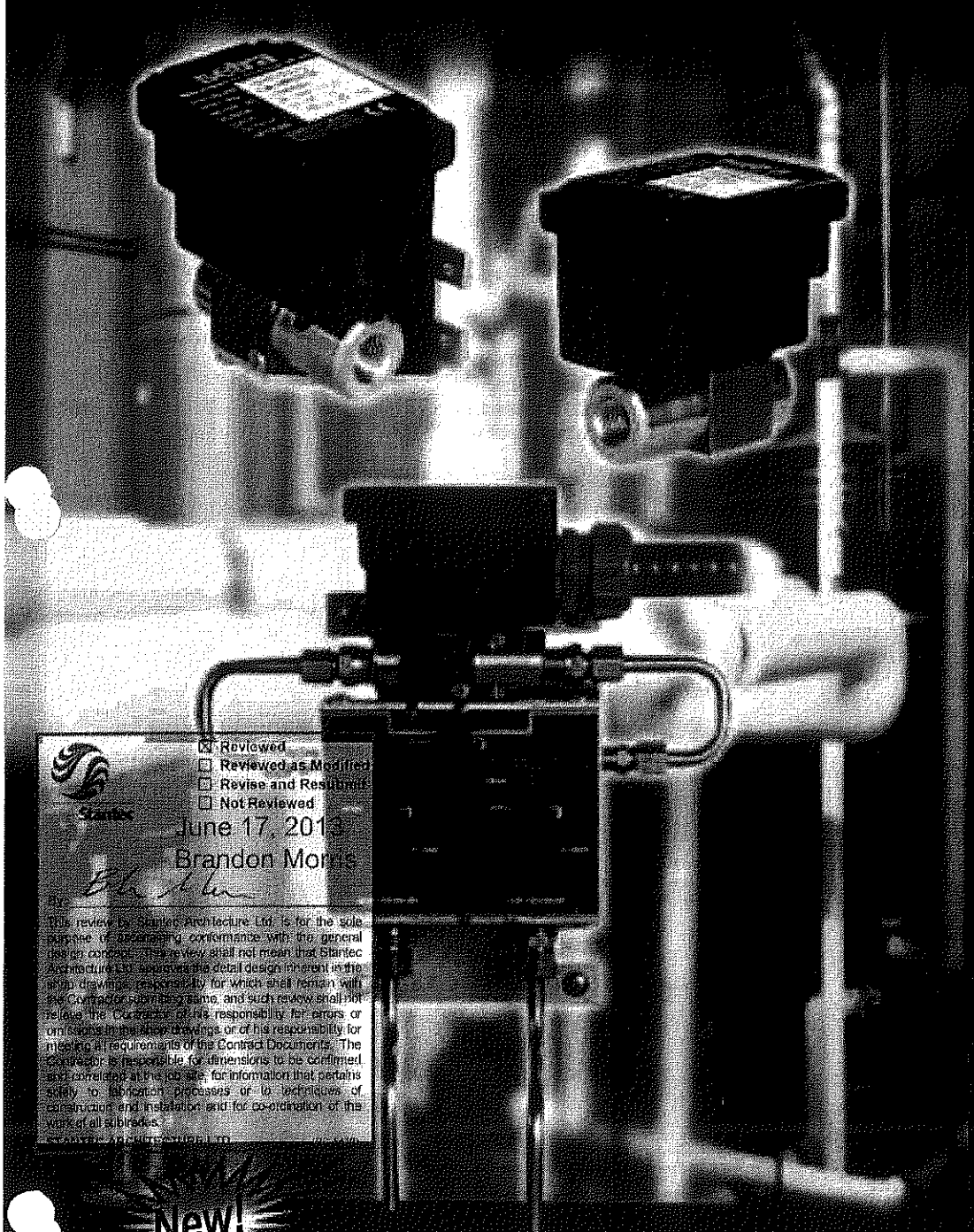
Standard configuration consists of: PSI Range, 1/4" NPT Fitting and 2 feet of cable. Minimum quantities apply for all other configurations. Consult a Setra Applications Engineer for assistance.

While we provide application assistance on all Setra products, both personally and through our literature, it is up to the customer to determine the suitability of the product in the application.

159 Swanson Road, Boxborough, Massachusetts 01719/Tel: 800-257-3872;
Fax: 978-264-0292; Email: sales@setra.com; Web: www.setra.com

Model 230

Wet/Wet Pressure Transducer



Setra Systems Model 230 is a high output, low differential pressure transducer designed for wet to wet differential pressure measurements of liquids or gases. A fast-response capacitance sensor and signal conditioned electronic circuitry provide a highly accurate, linear analog output proportional to pressure. Both unidirectional and bidirectional pressure ranges are available for applications with line pressure up to 250 psig.

A unique isolation system transmits the motion of the differential pressure sensing diaphragm from the high line pressure environment(e.g. corrosive liquids) to the dry (air) enclosure where it moves one of a pair of capacitance plates proportionally to the diaphragm movement. All parts exposed to the pressure media are stainless steel and elastomer seals. The 230 has a NEMA 4/IP65 rated package to withstand environmentaleffects.Thissystem responds to pressure changes approximately 20 times faster than conventional fluid-filled transducers. The electronic circuit linearizes output vs. pressure and compensates for thermal effects of the sensor.

New! 3-VALVE MANIFOLD

The Model 230 can be supplied with an optional 3-valve manifold assembly for ease of installation and maintenance. The 3-valve manifold is a machined brass body requiring no internal pipe connections, thereby, eliminating the risk of internal leaks. The manifold's rugged, yet compact, construction requires minimum space for installation and use . The 230 bleed ports allow for total elimination of air in the line and pressure cavities. If the Model 230 is ordered with the 3-valve manifold, the system is shipped completely assembled and ready for wall or pipe mounting. (Order as Pressure Fitting Code 3V.)

ISO 9001 Certified

Visit Setra Online:
http://www.setra.com

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800-257-3872

New! Optional 3-Valve Manifold Assembly

Stantec

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

June 17, 2013

Brandon Morris

By

This review by Stantec Architecture Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Stantec Architecture Ltd. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.

Stantec Architecture Ltd.

Model 230 Specifications

Performance Data

Accuracy RSS* (at constant temp)	±0.25% FS
Non-Linearity, BFSL	±0.20% FS
Hysteresis	0.10% FS
Non-Repeatability	0.05% FS
Thermal Effects**	
Compensated Range °F(°C)	+30 to +150 (-1 to +65)
Zero shift %FS/100°F(%FS/50°C)	2.0 (1.8)
Span Shift %FS/100°F(%FS/50°C)	2.0 (1.8)
Line Pressure Effect	Zero shift ±0.004% FS/psig line pressure
Resolution	Infinite, limited only by output noise level (0.02%FS)
Static Acceleration Effect	2%FS/g (most sensitive axis)
Natural Frequency	500 Hz (gaseous media)
Warm-up Shift	±0.1% FS total
Response Time	30 to 50 milliseconds
Long Term Stability	0.5%FS/1 YR
Maximum Working Pressure	250 psig

*RSS of Non-Linearity, Non-Repeatability and Hysteresis.

**Units calibrated at nomial 70°F. Maximum thermal error computed from this datum

Environmental Data

Temperature	
Operating* °F (°C)	0 to +175 (-18 to +80)
Storage °F (°C)	-65 to +250 (-54 to +121)
Vibration	5 g from 5 Hz to 500 Hz
Acceleration	10 g
Shock	50 g

*Operating temperature limits of the electronics only.

Pressure media temperatures may be considerably higher or lower.

Physical Description (Model 230)

Case	Stainless Steel/Aluminum
Electrical Connection	Barrier strip terminal block with conduit enclosure & 0.875 DIA conduit opening.
Pressure Fittings	1/4" -18 NPT internal
Weight (approx.)	14.4 oz
Sensor Cavity Volume	0.27 in^3 Positive Port, 0.08 in^3 Negative Port

(With 1/4" NPT external fittings installed - does not include cavity volume of 1/4" NPT external fittings.)

Physical Description (3-Valve Manifold Assembly)

Manifold Block	Brass
Valves (3)*	V1 for connection to + port V2 for connection to - port V3 for equalizing pressure
Valve Type	90° On/Off
Process Connections	1/4"-18 NPT Internal Thread
Dimensions	7.05"W x 6.25"H x 2.16"D
Weight	<2.5 lbs.

*Refer to drawing on back page.

Electrical Data (Current)

Circuit	2-Wire
Output*	4 to 20 mA**
External Load	0 to 1000 ohms

Minimum loop supply voltage (VDC) = 9 + 0.02 x (Resistance of receiver plus line).

Maximum loop supply voltage (VDC) = 30 + 0.004 x (Resistance of receiver plus line).

*Calibrated at factory with a 24 VDC loop supply voltage and a 250 ohm load.

**Zero output factory set to within 4mA (±0.08mA)

**Span output factory set to within 20mA (±0.08mA)

Pressure Media

For the Model 230

Gases or liquids compatible with 17-4 PH Stainless Steel, 300 Series Stainless Steel, Viton and Silicone O-Rings.

Note: Hydrogen not recommended for use with 17-4 PH stainless steel.

Optional Buna-N O'rings are recommended for hydrocarbon applications.

For the 3 Valve Manifold

Gases or liquids compatible with 360 brass, Copper 122, Acetal plug valves and Nitrile O-rings.

Specifications are subject to change without notice.

Pressure Ranges

UNIDIRECTIONAL		
Pressure Range PSID	Proof Pressure High Side* PSI	Proof Pressure Low Side* PSI
0 to 1	20	2.5
0 to 2	40	5
0 to 5	100	12.5
0 to 10	100	25
0 to 25	250	62.5
0 to 50	250	125
0 to 100	250	250

BIDIRECTIONAL		
Pressure Range PSID	Proof Pressure High Side* PSI	Proof Pressure Low Side* PSI
0 to ±0.5	20	1.25
0 to ±1	40	2.5
0 to ±2.5	100	6.25
0 to ±5	100	12.5
0 to ±10	200	25
0 to ±25	250	62.5
0 to ±50	250	125

*The zero will shift slightly when high differential overpressure is applied. The shift may be as much as ±10% FS with overpressure applied to the low pressure port. Other parameters (sensitivity, linearity, etc) will not shift. If the overpressure is normally only in one direction, the user may apply this overpressure to preset the sensor. Subsequent overload of less magnitude will not cause additional shift. The unit is pre-zeroed at the factory after application of maximum overload pressure to the high pressure port.

NOTE: Setra quality standards including ISO 9001 are based on ANSI-Z540-1.
The calibration of this product is NIST traceable.
U.S. Patent nos. 4054833

Applications

- Energy Management Systems
- Process Control Systems
- Flow Measurement of Various Gases or Liquids
- Liquid Level Measurement of Pressurized Vessels
- Pressure Drop Across Filters

Features

- NEMA 4/IP65 Rating
- No Liquid Fill Diaphragm
- Available with 3-Valve Manifold Assembly Option
- Low Line Pressure Effect
- Low Cost
- Fast Response
- Gas and Liquid Compatible
- Low Differential Ranges

When it comes to a product to rely on - choose the Model 230. When it comes to a company to trust - choose Setra.

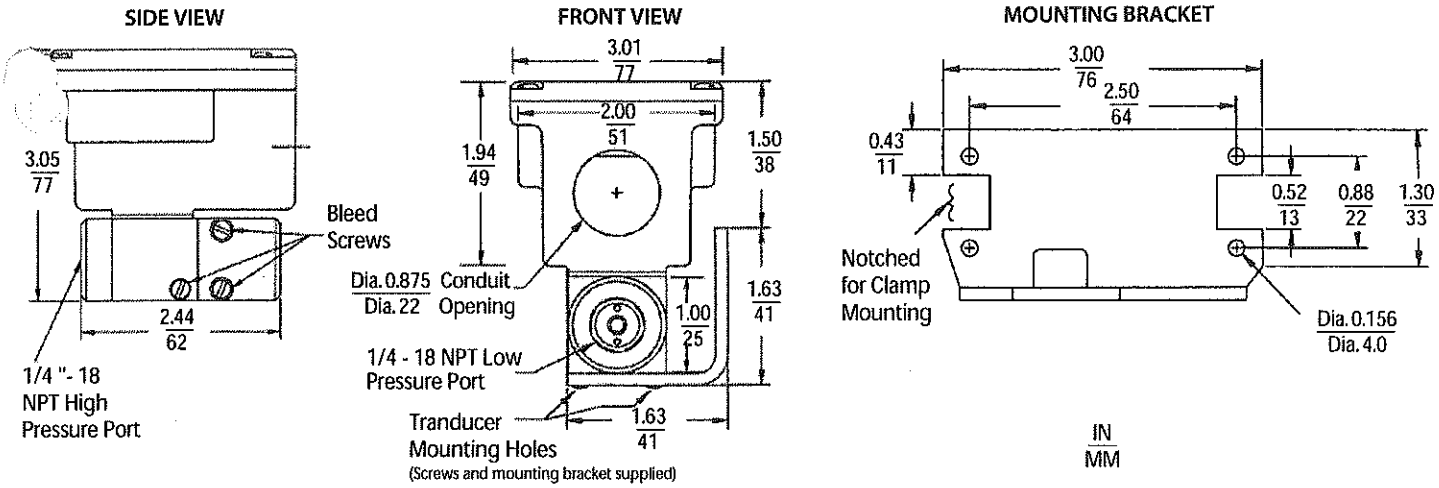
ISO 9001 Certified

Visit Setra Online:
http://www.setra.com

setra

800-257-3872

Outline Drawings – Model 230 Transducer



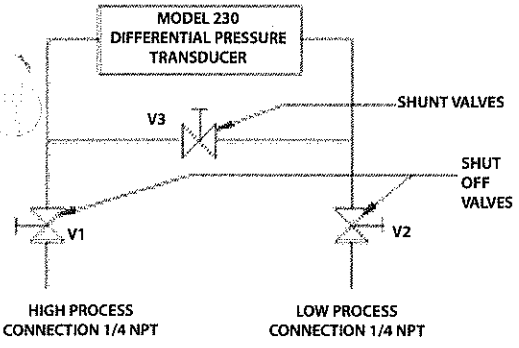
Outline Drawing – Model 230 Transducer with 3-Valve Manifold Assembly

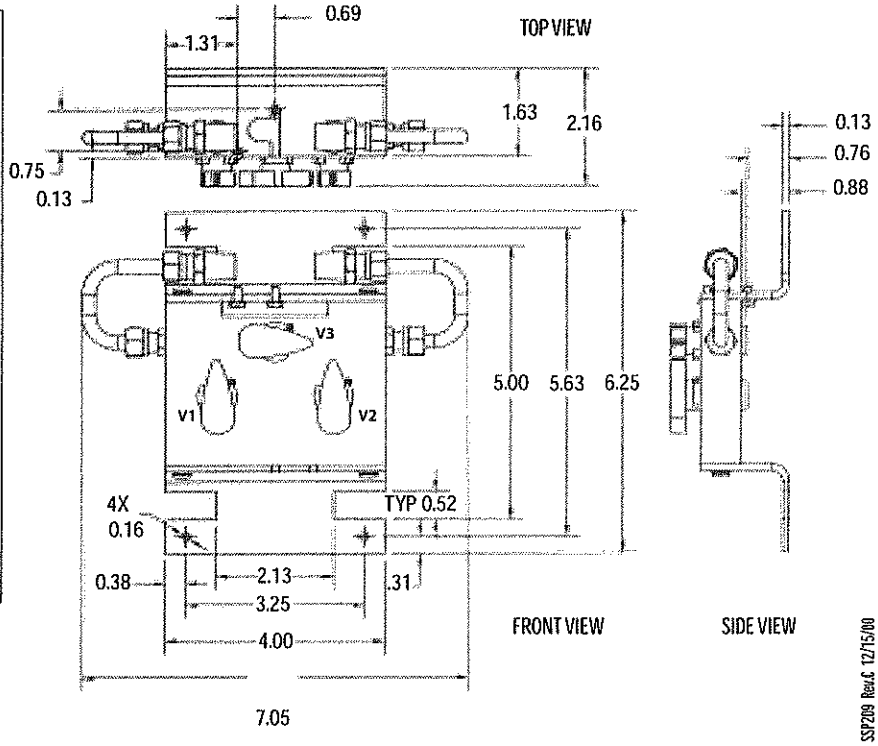


3-Valve Manifold Assembly Description

(Order as Pressure Code Fitting "3V". See Table below.)

Manifold Block	Brass
Valves (3)	V1 for connection to + port V2 for connection to - port V3 for equalizing pressure
Valve type	90 Degree On/Off
Process Connections	1/4" -18 NPT Internal Thread





SSP209 Rev.A 12/15/00

ORDERING INFORMATION

Model 230 Pressure Transducer

UNIDIRECTIONAL PSID	Product Code	BIDIRECTIONAL PSID	Product Code
0 to 1	2301001PD2F11B	-0.5 to +0.5	23010R5PB2F11B
0 to 2	2301002PD2F11B	-1 to +1	2301001PB2F11B
0 to 5	2301005PD2F11B	-2.5 to +2.5	23012R5PB2F11B
0 to 10	2301010PD2F11B	-5 to +5	2301005PB2F11B
0 to 25	2301025PD2F11B	-10 to +10	2301010PB2F11B
0 to 50	2301050PD2F11B	-25 to +25	2301025PB2F11B
0 to 100	2301100PD2F11B	-50 to +50	2301050PB2F11B

Model 230 with 3 Valve Manifold

UNIDIRECTIONAL PSID	Product Code	BIDIRECTIONAL PSID	Product Code
0 to 1	2301001PD3V11B	-0.5 to +0.5	23010R5PB3V11B
0 to 2	2301002PD3V11B	-1 to +1	2301001PB3V11B
0 to 5	2301005PD3V11B	-2.5 to +2.5	23012R5PB3V11B
0 to 10	2301010PD3V11B	-5 to +5	2301005PB3V11B
0 to 25	2301025PD3V11B	-10 to +10	2301010PB3V11B
0 to 50	2301050PD3V11B	-25 to +25	2301025PB3V11B
0 to 100	2301100PD3V11B	-50 to +50	2301050PB3V11B

Please contact factory for versions not shown.

While we provide application assistance on all Setra products, both personally and through our literature, it is up to the customer to determine the suitability of the product in the application.

159 Swanson Road, Boxborough, Massachusetts 01719/Tel: 800-257-3872;
Fax: 978-264-0292; Email: sales@setra.com; Web: www.setra.com

Current Switches: Fixed Trip Point

0.15 A TURN-ON!

Split-Core & Solid-Core On/Off Status Current Switches



DESCRIPTION

Hawkeye x00 on/off current switches provide a cost-effective solution for monitoring status on unit vents, exhaust fans, recirculation pumps, and other fixed loads where belt loss is not a concern.

Veris has applied new technology to the H300, H600, and H800 models to achieve impressive improvement in turn-on levels. The Hawkeye H300 and H600 now have the lowest turn-on current in the industry at a mere 150mA!

APPLICATIONS

- Monitoring status of electrical loads
- Monitoring direct-drive units, exhaust fans, pumps, process motors, and other fixed loads
- Verifying lighting run times

CURRENT SENSING THE ULTIMATE PROOF OF FLOW

Maximize Reliability
Minimize Installed Cost

FEATURES

- More reliable for status than relays across auxiliary contacts
- Ideal for direct-drive units, unit vents, fan coil units, exhaust fans, and other fixed loads
- Great for lighting status–less expensive than 277V relays
- Low 0.15 A turn-on (H300 and H600)...ideal for small exhaust fans (not intended to detect belt loss)
- Removable mounting bracket provides installation flexibility
- Bracket on H900 can be installed in three different configurations...installer convenience
- Split-core H300, H600, and H900 for fast retrofit installation
- Mini solid-core H800 and micro split-core H300 fit in tight enclosures... saves valuable panel space
- 100% solid-state, no moving parts to fail
- Polarity insensitive output
- 5-year warranty

Stantec

☒ Reviewed
☐ Reviewed as Modified
☐ Revise and Resubmit
☐ Not Reviewed

June 17, 2013
Brandon Morris

By:

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STANTEC ARCHITECTURE LTD. (PC-1449)

SPECIFICATIONS

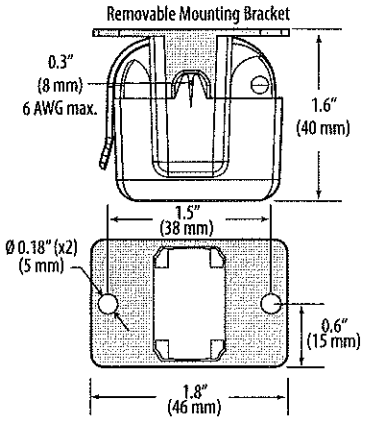
5 Year Warranty

Sensor Power (N.O. Models)	Induced from monitored current
Insulation Class	600VAC RMS (UL), 300VAC RMS (CE)
Frequency Range	50/60 Hz
Temperature Range	H800, H800NC, H300, H900: -15° to 60°C (5° to 140°F) H600: -15° to 40°C (5° to 104°F) (to 200A); -15° to 60°C (5° to 140°F) (to 150A) H800HV: -40° to 50°C (-40° to 122°F) (to 200A); -40° to 75°C (-40° to 167°F) (to 100A, & 0.25A status output)
Humidity Range	10-90% RH non-condensing
Sensor Power (N.C. Models)	5-30VDC, permanently connected
Off State Leakage (N.C. Models)	34µA@5VDC, 200µA@30VDC
On State Voltage Drop (N.C. Models)	1.9VDC (max.) @0.1A
Terminal Block Maximum Wire Size	14 AWG (16 AWG for H300)
Terminal Block Torque (nominal)	4 in-lbs (7 in-lbs for H300)
Agency Approvals	UL 508 open device listing; CE:EN61010-1:2001-02, CAT III, deg. 2, basic insulation

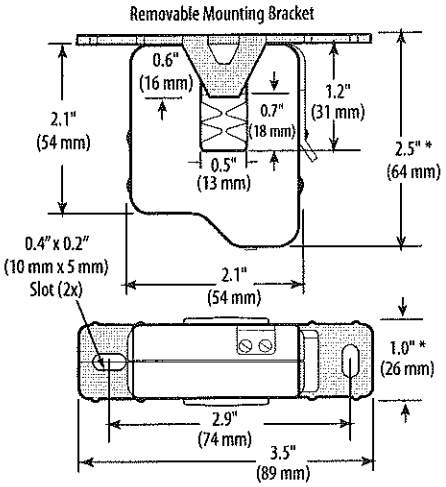
Do not use the LED status indicators as evidence of applied voltage.

DIMENSIONAL DRAWINGS

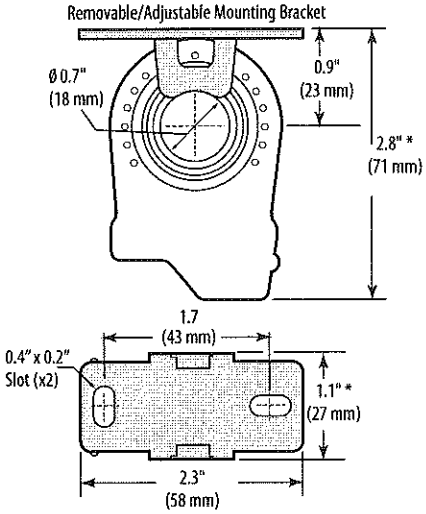
H300



H600

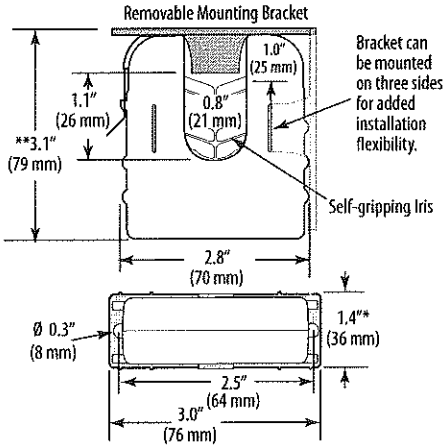


H800, H800HV, H800NC



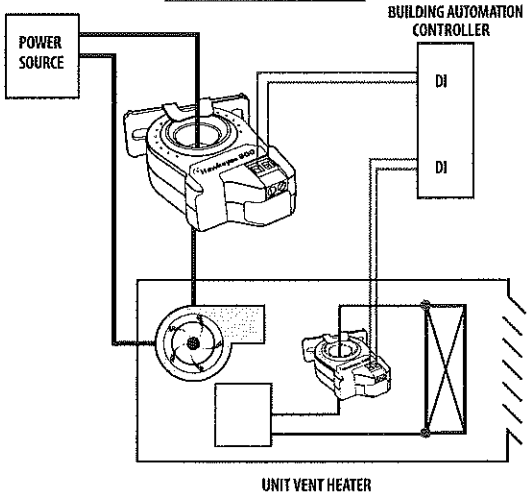
** Terminal block may extend up to 1/8" over the height dimensions shown.*

H900



APPLICATION/WIRING DIAGRAM

Unit Vent Heater Control



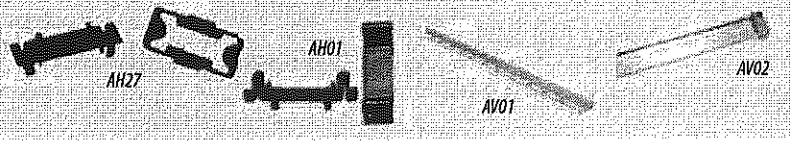
ORDERING INFORMATION

MODEL	AMPERAGE RANGE	STATUS OUTPUT (max.)	TRIP POINT	HOUSING	UL	CE	RoHS
H300	0.15 - 60A	N.O. 1.0A@30VAC/DC	0.15A or less	Split-core	●	●[2]	●
H600	0.15 - 200A	N.O. 1.0A@30VAC/DC	0.15A or less	Split-core	●[1]	●	●
H800	0.25 -200A	N.O. 1.0A@30VAC/DC	0.25A or less	Solid-core	●[1]	●	●
H800NC	0.5 - 200A	N.C. 0.1A@30VDC	0.5A or less	Solid-core	●[1]		●
H800HV	0.75 - 200A	N.O. 0.5A@250VAC/DC	0.75A or less	Solid-core	●[3]		
H900	1.5 - 200A	N.O. 1.0A@30VAC/DC	1.5A or less	Split-core	●	●	

[1] *Listed for use on 75°C insulated conductors.*
[2] *Product provides functional insulation only.*
[3] *Listed for use on 90°C insulated conductors.*

ACCESSORIES

DIN Rail Clip Set (AH01, AH27)
DIN Rail (AV01) and DIN Stop Clip (AV02)



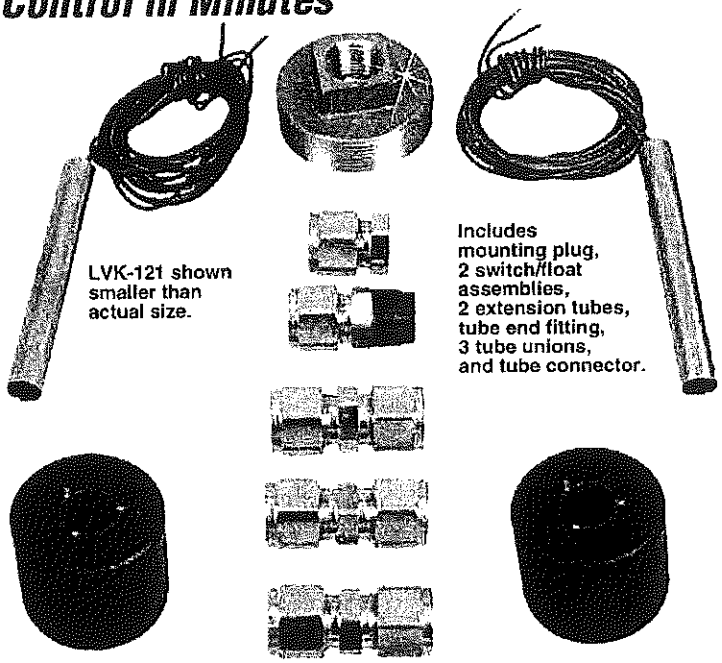
CURRENT MONITORING

CUSTOM-LEVEL SWITCH STARTER KIT

Assemble a Custom-Level Control in Minutes

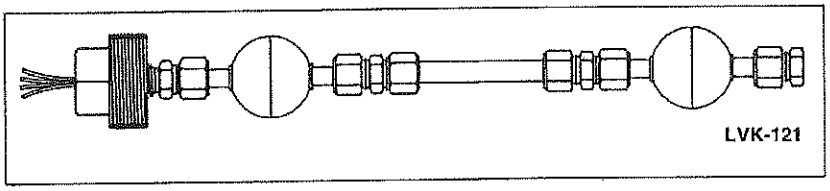
LVK-120

1 YEAR WARRANTY CE RoHS



- **Starter Kit is Expandable Up to 6 Level Stations**
- **Customized for Individual Applications**
- **Features a Normally Open or Normally Closed SPST 20 VA Switch**

To determine fluid specific gravity, add 0.1 to float specific gravity for clean liquids and 0.3 to float specific gravity for dirty or viscous liquids. The LVK-120 Series OMEGA® starter kit can be assembled and installed vertically in your tank in minutes. Each kit contains all the components for complete assembly of a 1- or 2-station level switch for pipe-plug mounting. Additional level stations may be added (see accessories)



SPECIFICATIONS

Temperature Range:
LVK-120: 1 to 82°C (34 to 180°F) in water, 0 to 106°C (0 to 225°F) in oil
LVK-121: 0 to 149°C (0 to 300°F)
Pressure Rating: 150 psi for LVK-120 or 500 psi for LVK-121
Float Diameter:
LVR-120: 47.7 mm (1.8")
LVR-121: 53.3 mm (2.1")
Mounting: 2 NPT
Tube/Fitting Size:
12.7 mm (½") OD tube
Mounting Attitude: Vertical up to 30°
Lead Wire: 152.4 mm (60"), 20 AWG, insulated
Fittings: Coated with zinc gold chromate
Maximum Assembly Length: Approximately 760 mm (30")

To Order		
Model No.	Stem/Float	Float Specific Gravity
LVK-120	Brass/Buna	0.45
LVK-121	316 SS	0.63

OMEGA® Starter Kit Replacement Parts

Model No.	Description
LVK-125	Brass/Buna float station
LVK-126	316 SS float station
BRK-U-12	½" tube union, brass
SSK-U-12	½" tube union, 316 SS
BRK-12-10-0	½" OD tubing, 12" length, brass
SSK-12-10-0	½" OD tubing, 12" length, 316 SS

Comes complete with 1 mounting plug, 2 switch/float assemblies, two 30.5 cm (12") extension tubes, 1 tube end fitting, 3 tube unions, 1 tube connector and operator's manual.
***Ordering Examples: LVK-120,** brass/Buna level switch kit.*
***LVK-121,** 316 SS brass/Buna level switch kit.*

CMS
Central Mechanical Systems

PROJECT NAME:	**Cam Bay Potable Water System Phase I Upgrades**
PROJECT NUMBER:	**12-569 / CT 12-3000**

VALVE TAG LIST

Tag #	Location	Description/Service	Type	Position
31	**Boiler Room**	UH-1 Balance	Armstrong CBV	Set
32	**Process Room**	UH-2 Supply Isolation	Ball Valve	N.O.
33	**Process Room**	UH-2 Return Isolation	Ball Valve	N.O.
34	**Process Room**	UH-2 Drain	Ball Valve	N.C.
35	**Process Room**	UH-2 Balance	Armstrong CBV	Set
36	**Generator Room**	UH-3 Supply Isolation	Ball Valve	N.O.
37	**Generator Room**	UH-3 Return Isolation	Ball Valve	N.O.
38	**Generator Room**	UH-3 Drain	Ball Valve	N.O.
39	**Generator Room**	UH-3 Balance	Armstrong CBV	Set
40	**Process Room**	HRV-1 Heat Coil Supply	Ball Valve	N.O.
41	**Process Room**	HRV-1 Heat Coil Return Isolation	Ball Valve	N.O.
42	**Process Room**	HRV-1 Heat Coil Drain	Ball Valve	N.C.
43	**Process Room**	HRV-1 Heat Coil Balance	Armstrong CBV	Set
44	**Generator Room**	Main Fuel Supply Isolation	Ball Valve	N.O.
45	**Generator Room**	Main Fuel Filter Isolation	Ball Valve	N.O.O.
46	**Generator Room**	Fuel Pump 2.1 Isolation	Ball Valve	N.O.
47	**Generator Room**	Fuel Pump 2.1 Isolation	Ball Valve	N.O.
48	**Generator Room**	Fuel Pump 2.2 Isolation	Ball Valve	N.O.
49	**Generator Room**	Fuel Pump 2.2 Isolation	Ball Valve	N.O.
50	**Generator Room**	Day Tank 1.1 Solenoid Isolation	Ball Valve	N.O.
51	**Generator Room**	Day Tank 1.1 Solenoid Isolation	Ball Valve	N.O.
52	**Generator Room**	Day Tank 1.2 Solenoid Isolation	Ball Valve	N.O.
53	**Generator Room**	Day Tank 1.2 Solenoid Isolation	Ball Valve	N.O.
54	**Generator Room**	Day Tank 1.1 Outlet Isolation	Ball Valve	N.O.
55	**Generator Room**	Day Tank 1.1 Drain	Ball Valve	N.C.
56	**Generator Room**	Genset Supply Isolation	Ball Valve	N.O.
57	**Boiler Room**	Day Tank 1.2 Outlet Isolation	Ball Valve	N.O.
58	**Boiler Room**	Day Tank 1.2 Drain	Ball Valve	N.C.
59	**Boiler Room**	Boiler 1 Fuel Supply Isolation	Ball Valve	N.O.
60	**Boiler Room**	Boiler 2 Fuel Supply Isolation	Ball Valve	N.O.

CMS
Central Mechanical Systems

PROJECT NAME:	Cam Bay Potable Water System Phase I Upgrades
PROJECT NUMBER:	12-569 / CT 12-3000

VALVE TAG LIST

Tag #	Location	Description/Service	Type	Position
61	Process Room	Intake Pump 1 Isolation	Butterfly Valve	N.O.
62	Process Room	Intake Pump 2 Isolation	Butterfly Valve	N.O.
63	Process Room	Intake Pump 1 Back Wash	Butterfly Valve	N.C.
64	Process Room	Intake Pump 1 Back Wash	Butterfly Valve	N.C.
65	Process Room	Intake Pump 2 Back Wash	Butterfly Valve	N.C.
66	Process Room	Intake Pump 2 Back Wash	Butterfly Valve	N.C.
67	Process Room	Raw Water Flow Meter Isolation	Butterfly Valve	N.O.
68	Process Room	Raw Water Flow Meter Isolation	Butterfly Valve	N.O.
69	Process Room	Raw Water Flow Meter Bypass	Butterfly Valve	N.C.
70	Process Room	Raw Water Outlet To Service Iso.	Butterfly Valve	N.O.
71	Process Room	Truck Fill Isolation	Butterfly Valve	N.C.
72	Process Room	Truck Fill Drain	Ball Valve	N.C.
73	Process Room	Raw Water Drain	Ball Valve	N.C.
74	Process Room	Recirc. Inlet Isolation	Butterfly Valve	N.O.
75	Process Room	Recirc. Flow Meter Isolation	Butterfly Valve	N.O.
76	Process Room	Recirc. Flow Meter Isolation	Butterfly Valve	N.O.
77	Process Room	Recirc. Flow Meter Bypass	Butterfly Valve	N.C.
78	Process Room	Recirc. Pump Isolation	Butterfly Valve	N.O.
79	Process Room	Recirc. Pump Isolation	Butterfly Valve	N.O.
80	Process Room	Recirc. Isolation	Butterfly Valve	N.O.
81	Process Room	Recirc. Drain	Butterfly Valve	N.C.

CMS
Central Mechanical Systems

	HYDRONIC HEATING SYSTEMS:			
6.	Oil Burner Assembly for Boiler	Riello F-5 Burner c/w 530/sec Flame Safeguard	1	
7.	Pre-Mixed Heating Water Media	Arcan Has Stored. Dowfrost HD Propylene Glycol	One 20L Drum	
	INSTRUMENTATION & CONTROLS:			
8.	Flow Switch	McDonnel Miller FS-4-3	1	
9.	Flow Switch Paddles	Various Sizes	3	

Sign Off/Acceptance:

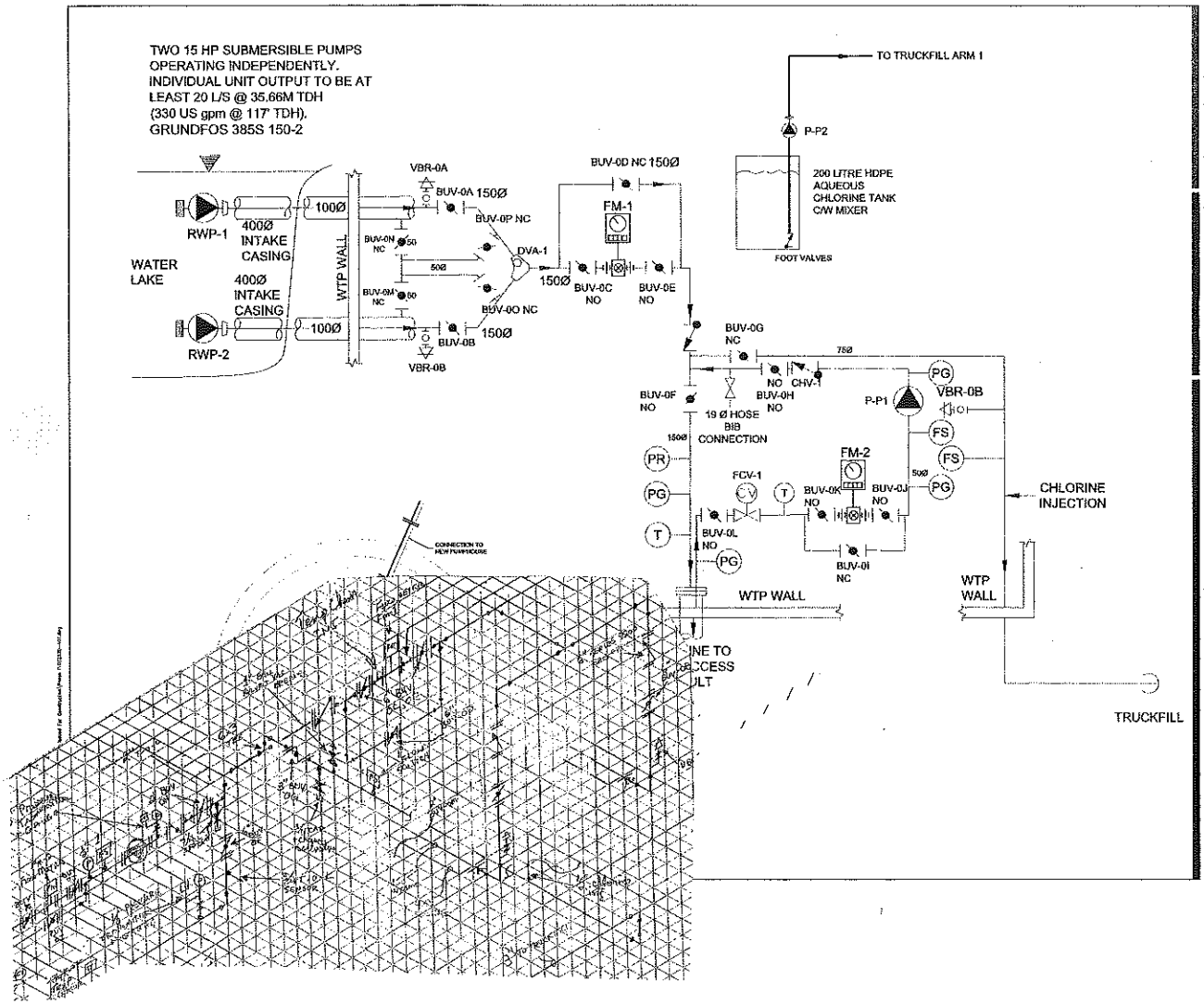
Date: Nov 25/2014

Delivered By: Gord Gordon (Print Name) (Signature)

Company: **Central Mechanical Systems Ltd.**

Received By: Darren Herber (Print Name) (Signature)

Company: CGS



Stantec
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Yellowknife, NT
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www.stantec.com

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Consultants

Legend

Notes

No.	Revision	By	Appd.	YY.MM.DD
1	ISSUED FOR CONSTRUCTION	JP	RD	12.09.04
0	ISSUED FOR TENDER	JP	RD	12.03.30
	IFA SUBMISSION			12.03.02
	50% SUBMISSION	JP	RD	12.01.19

Issued

No.	Name	Date	Chkd.	Dsgn.	YY.MM.DD

Permit/Seal

PERMIT TO PRACTICE
Stantec Architecture Ltd.
Signature
Date 12.SEP.2012
PERMIT NUMBER: P 800
NT/NU Association of Professional Engineers and Geoscientists

Client/Project
GOVERNMENT OF NUNAVUT

POTABLE WATER SYSTEM
PHASE I
Cambridge Bay, NU

Title
TRUCKFILL & VAULT
SCHEMATIC DIAGRAMS

Project No.	Scale	
1449-01252	NTS	
Drawing No.	Sheet	Revision
D-401	1 of 3	0

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AS-BUILT

ISSUED ON: NOV. 17TH, 2014

REVISED DRAWINGS AS PER CONSULTANT'S COMMENTS DATED ON JUNE 18TH, 2013

17/11/2014

FOR INFORMATION CONTACT
Jason Dale

ENGINEERING DATA FOR
Cambridge Bay Pumphouse

Cambridge Bay, NV

B-52-B-0382

ARCHITECT

Stantec
ENGINEER

Central Mechanical Systems
CONTRACTOR

DWG	DESCRIPTION
	GENERAL
CS	Cover Sheet
TTRM1	TX-I/O Termination Spec.
TTRM2	TX-I/O Termination Spec. 2
	CONTROL DRAWINGS
001	TABLE OF CONTENTS, LEGEND
001A	WIRING DETAILS
005	BUILDING RISER
005A	BUILDING RISER PXCM-05 DETAILS
201	HRV-1 CONTROL SYSTEM
202	MECHANICAL ROOM COOLING FAN CF-1
203	GENERATOR ROOM VENTILATION
401	HEATING SYSTEM
501	HW UNIT HEATER CONTROL
601	POTABLE WATER PROCESS
602	FUREL OIL SYSTEM
603	BLDG LOW TEMPERATURE ALARM
	DDC PANEL LAYOUTS
104	PXCC-4 PANEL LAYOUT
105	IPH.PXCM.05
105A	IPH.PXCM.05p002
105B	IPH.PXCM.05p003
105C	IPH.PXCM.05p004
	PANEL POINT LIST
	PROGRAM LIST
	TECHNICAL DATA SHEETS

REVISION HISTORY

1	16/11/2014	OA	B-52-B-0382/AS-BUILT

SIEMENS

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Cambridge Bay Pumphouse
Cambridge Bay, NV

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	OA	RQ	11/17/14	11/16/14

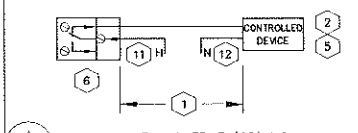
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B52B0382

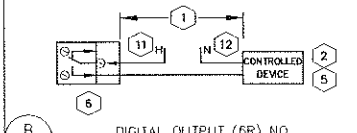
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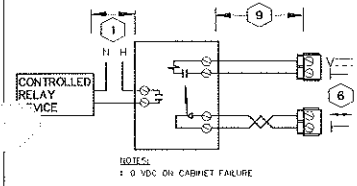
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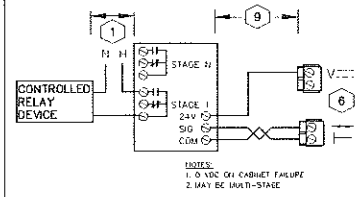
A / 00 — DIGITAL OUTPUT (6R) NC
PULSED OR LATCHED



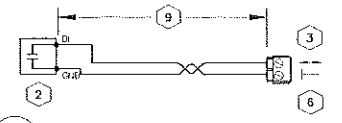
B / 00 — DIGITAL OUTPUT (6R) NO
PULSED OR LATCHED



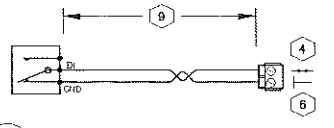
C / 00 — DIGITAL OUTPUT (8U,8X) Latched
VOLTAGE TO SOLID STATE RELAY



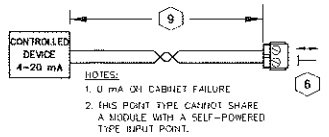
D / 00 — DIGITAL OUTPUT (8U,8X) Sequenced
VOLTAGE TO SEQUENCING MODULE



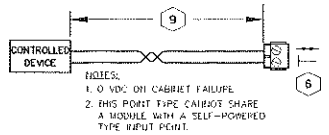
E / 00 — DIGITAL INPUT (8D,16D,8U,8x)
DRY CONTACT



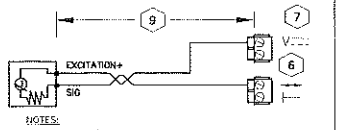
F / 00 — DIGITAL INPUT (8D,16D,8U,8X)
PULSE ACCUMULATOR



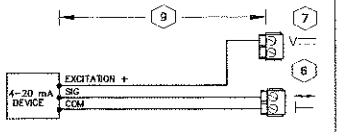
H / 00 — ANALOG OUTPUT (8X) 4-20 mA



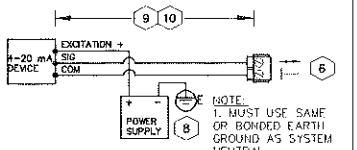
I / 00 — ANALOG OUTPUT (8U,8X) 0-10VDC



M / 00 — ANALOG INPUT (8X) 4-20 mA
2-WIRE INTERNAL POWERED



N / 00 — ANALOG INPUT (8X) 4-20mA
3-WIRE INTERNAL POWERED



O / 00 — ANALOG INPUT (8X) 4-20mA
3-WIRE EXTERNAL POWERED

NOTES:

1. MAXIMUM WIRE RUN LENGTHS ARE BASED ON THE CURRENT DRAW AND WIRE GAGE. SEE DRAWING TWIR.
2. SEE CONTROL DRAWINGS FOR NORMAL DE-ENERGIZED CONTACT STATE
3. MAXIMUM CONTACT CLOSURE RATE IS 10 PER SECOND
   8D, 16d EXCITATION = 24VDC, 8mA
   8U, 8X EXCITATION = 24VDC, 8mA, 20ms, 100mA
4. 8D, 16D MAXIMUM PULSE RATE = 10Hz (50ms PER STATE, 100ms PER PULSE)
   8U, 8X MAXIMUM PULSE RATE = 20Hz (25ms PER STATE, 50ms PER PULSE)
5. PXC MODULAR DO CONTACT RATINGS
   AC OPERATION:
   4A @ 240VAC (RESISTIVE)
   3A @ 240VAC (INDUCTIVE)
   SIZE 4 MOTOR STARTER
   DC OPERATION:
   40W @ < 50VDC
   20W @ > 50VDC
6. REFER TO PXC MODULAR PANEL FOR ACTUAL POINT ADDRESSES. REFER TO TXMI TERMINATION TABLES FOR ACTUAL TERMINALS FOR EACH PANEL ADDRESS. COMMON TERMINAL MAY BE SHARED BY 2 POINTS.
7. REFER TO DRAWING P1 ON TWIR FOR MAXIMUM CURRENT PROVIDED BY THE 24VDC SENSOR SUPPLY ON P1 BIM OR BUS POWER SUPPLY
8. EXTERNAL POWER SUPPLY CAN EITHER BE A 24VDC POWER SUPPLY OR A 24VAC TRANSFORMER DEPENDING ON THE SENSOR SELECTED. IF NOT AN ISOLATED NC CLASS 2 CIRCUIT THEN POWER SOURCE, NEUTRAL AND PXC MODULAR COMMON MUST BE BOTH CONNECTED TO THE SAME OR BONDED BUILDING APPROVED EARTH GROUND. FOR FURTHER DETAILS SEE EARTH GROUNDING RULES (125-3002) APOGEE WIRING GUIDELINES FOR FIELD PANELS AND EQUIPMENT CONTROLLERS.
9. 50mA OR LESS - 750ft/230m
   50mA TO 100mA - 375ft/115m
10. 100mA TO 150mA - 250ft/76m
    150mA TO 200mA - 187ft/57m
    200mA TO 250mA - 150ft/46m
11. WHERE H TERMINAL IS NOT A NEC CLASS 2 CIRCUIT, RELAY COMMON TERMINAL BRANCH CURRENT MUST BE EXTERNALLY LIMITED TO 10A MAXIMUM BY AN NEC APPROVED MEANS. NOT A FUSE.
12. WHERE REQUIRED, N TERMINAL BRANCH CURRENT MUST BE EXTERNALLY LIMITED BY AN NEC APPROVED MEANS.

REVISION HISTORY

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Cambridge Bay Pumphouse
Cambridge Bay, NV

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	SF	RQ		05/08/13

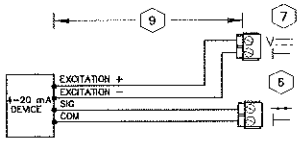
TX-I/O Termination Spec.

B-53-B-0382

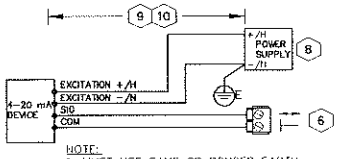
TTRM1

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J:\JOBS_NEW\BRANCH_52-EDMONTON_INFO&JOBS\8952_JOBS\B-52-B-0382 CAMBRIDGE BAY PUMPHOUSE_UTILOWNWATER\13_DESIGN\MISC\TTRM1.dwg

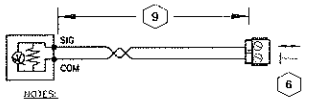


P 00 — ANALOG INPUT (8X) 4–20mA
4–WIRE INTERNAL POWERED



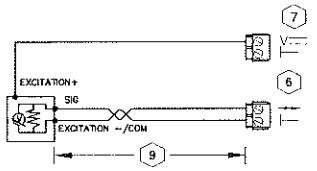
NOTE:
1. MUST USE SAME OR BONDED EARTH GROUND AS SYSTEM NEUTRAL

Q 00 — ANALOG INPUT (8X) 4–20mA
4–WIRE EXTERNAL POWERED

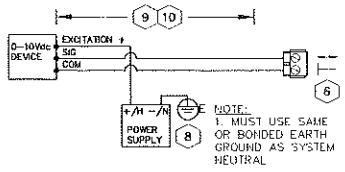


NOTES:
1. TRANSDUCER POWERED FROM ISOLATED INPUT
2. TRANSDUCER OUTPUT VOLTAGE

R 00 — ANALOG INPUT (8U,8X) 0–10 Vdc
SELF POWERED TRANSDUCER

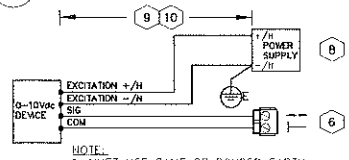


S 00 — ANALOG INPUT (8U,8X) 0–10VDC
3–WIRE INTERNAL POWERED



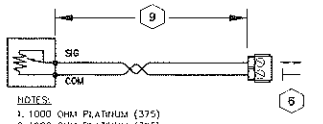
NOTE:
1. MUST USE SAME OR BONDED EARTH GROUND AS SYSTEM NEUTRAL

T 00 — ANALOG INPUT (8U,8X) 0–10VDC
3–WIRE EXTERNAL POWERED



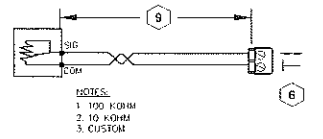
NOTE:
1. MUST USE SAME OR BONDED EARTH GROUND AS SYSTEM NEUTRAL

U 00 — ANALOG INPUT (8U,8X) 0–10VDC
4–WIRE EXTERNAL POWERED



NOTES:
1. 1000 OHM PLATINUM (375)
2. 1000 OHM PLATINUM (385)
3. 1000 OHM NICKEL
4. CUSTOM

V 00 — ANALOG INPUT (8X,8U) RTD



NOTES:
1. 100 KOHM
2. 10 KOHM
3. CUSTOM

W 00 — ANALOG INPUT (8X,8U) THERMISTOR

TXM1 TERMINATION TABLES

1. ALL TXM1 TERMINALS (MEASURING, NEUTRAL, RELAY, SUPPLY) ARE CONNECTED IN THE PLUG–IN I/O MODULE, NOT IN THE TERMINAL BUS.

		TXM1.8D, TXM1.16D							
I/O POINT		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SYSTEM NEUTRAL[1]	⊥ (–)	1	5	5	7	9	11	13	15
DIGITAL INPUT	⏐ (+)	2	4	6	8	10	12	14	16

1. NEUTRAL CAN BE CONNECTED TO ANY NEUTRAL TERMINAL ON SAME MODULE AND SEVERAL CAN SHARE SAME NEUTRAL TERMINAL.

		TXM1.16D							
I/O POINT		(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
SYSTEM NEUTRAL	⊥ (–)	18	20	22	24	26	28	30	32
DIGITAL INPUT[1]	⏐ (+)	19	21	23	25	27	29	31	33

1. NO PULSE ACCUMULATOR

		TXM1.8U, TXM1.8U–ML							
I/O POINT		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SYSTEM NEUTRAL	⊥ (–)	2	6	10	14	19	23	27	31
UNIVERSAL I/O	⏐ (+)	4	8	12	16	21	25	29	33
24V AC/DC ACTUATOR SUPPLY[1]	≂		7		15		24		32

1. 24V DC ONLY AVAILABLE WITH BUS CONNECTOR MODULE (BCM) POWERED EXTERNALLY BY DC SUPPLY.

		TXM1.8X, TXM1.8X–ML							
I/O POINT		(1)	(2)	(3)	(4)	(5)[3]	(6)[3]	(7)[3]	(8)[3]
SYSTEM NEUTRAL	⊥ (–)	2	6	10	14	19	23	27	31
UNIVERSAL I/O	⏐ (+)	4	8	12	16	21	25	29	33
24V AC/DC ACTUATOR SUPPLY[2]	≂		7		15		24		32
24V DC SENSOR SUPPLY[3]	⎓	3		11		20		28	

1. 4–20 mA OUTPUT AVAILABLE ON POINTS 5–8 ONLY.

2. 24V DC ONLY AVAILABLE WITH BUS CONNECTOR MODULE (BCM) POWERED EXTERNALLY BY DC SUPPLY.

3. MAY POWER EXTERNAL SENSORS 0.6w (25mA) OR 1.2w (50mA) PER TERMINATION UP TO 2.4w (100mA) MAXIMUM FOR ALL TERMINATIONS.

		TXM1.6R, TXM1.6R–M					
I/O POINT		(1)	(2)	(3)	(4)	(5)	(6)
COMMON[1]	⏐ (C)	3	9	15	20	26	32
NORMALLY CLOSED	⌐ (NC)	4	10	16	19	25	31
NORMALLY OPEN	⌊ (NO)	2	8	14	21	27	33

1. COMMONS ARE NOT INTERNALLY CONNECTED.

NOTE: REFER TO TERMINATION SHEET #1 FOR INSTALLATION DETAILS.

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Cambridge Bay, NV

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST ENT DATE
SF	SF	RG		05/08/13

TX-I/O Termination Spec. 2

B-53-B-0382

TTRM2

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P:\JOBS_NEW\EDMONTON_52-EDMONTON_INFO\JOBS\8652_JOBS\B-53-B-0382 CAMBRIDGE BAY PUMPHOUSE_YELLOWKNIFE\14.DESIGN\HOT\TXTERM2.dwg

GENERAL NOTES:

1) PNEUMATIC TUBING SHALL BE HARD DRAWN OR SOFT COPPER OR F.R. POLYETHYLENE.
2) COPPER TUBING SHALL BE USED IN THE FOLLOWING LOCATIONS:
   A) INACCESSIBLE AREAS.
   B) WHERE SINGLE LINES TRAVEL FROM A JUNCTION BOX TO INSTRUMENTS.
   C) AREAS OF HEAT ABOVE 82°C (180°F).
   D) MECHANICAL ROOMS WHERE SUBJECT TO DAMAGE.
   E) ADJACENT TO HEATING PIPES PASSING THRU A COMMON SLEEVE.
   F) PASSING THRU FIRE RATED PARTITIONS OR FLOOR SLABS.
   G) LIFE SAFETY RISER SYSTEMS.
3) F.R. POLY TUBING SHALL BE USED IN ALL OTHER INSTALLATIONS. WHERE LARGE QTYS OF POLY TUBES RUN TOGETHER TO THE SAME LOCATION, AN E.M.T. CONDUIT CARRIER SYSTEM SHALL BE USED. CARRIER SYSTEMS SHALL TERMINATE AT JUNCTION BOXES.
4) FIELD WIRING SCHEMATICS, AS PRESENTED IN THESE CONTROL DRAWINGS, WERE PREPARED USING THE EQUIPMENT MFGR'S SUBMITTED SHOP DRAWINGS. FOR EXACT WIRING TERMINATIONS, REFER TO THE MFGR'S WIRING DIAGRAMS ACCOMPANYING THE EQUIPMENT.
5) CONTROL WIRING SHALL BE INSTALLED IN E.M.T. CONDUIT OR FT-4 RATED PLENUM CABLE.
6) CONTROL WIRING SHALL BE INSTALLED IN E.M.T. CONDUIT IN THE FOLLOWING LOCATIONS:
   A) INACCESSIBLE AREAS.
   B) AREAS OF HEAT ABOVE 82°C (180°F).
   C) MECHANICAL ROOMS WHERE SUBJECT TO DAMAGE.
   D) ADJACENT TO HEATING PIPES PASSING THRU A COMMON SLEEVE.
   E) PASSING THRU FIRE RATED PARTITIONS OR FLOOR SLABS.
   F) BLN COMMUNICATION RISERS.
7) FT-4 RATED CABLE SHALL BE USED IN ALL OTHER INSTALLATIONS.
8) COUPLINGS AND CONNECTORS SHALL BE DIE CAST TYPE.
9) CONTROL WIRE GAUGE SIZES SHALL BE AS FOLLOWS:
   A) #24 STRANDED (TSP) LOW CAP. FOR BMS PMD & LAN COMMUNICATION TRUNKS.
   B) #20 STRANDED (TP) FOR BMS SENSOR AND STATUS INPUT POINTS.
   C) #14 TO #18 STRANDED (TEW) FOR MAGNETIC STARTER START & STOP CIRCUITS.
   D) #14 STRANDED, 3 WIRE FOR T.E.C. POWER TRUNKS.
   E) #18 STRANDED, 3 WIRE, SHIELDED FOR TERMINAL & PRINTER COMMUNICATION.
10) THE FOLLOWING IS CONSIDERED TO BE OUTSIDE THE SCOPE OF THIS CONTRACT.
   A) INSTALLATION ON CONTROL VALVES, TEMPERATURE WELLS, & PRESSURE TAPPINGS.
   B) INSTALLTION OF CONTROL DAMPERS.
   C) SUPPLY AND INSTALLTION OF LOCAL DISCONNECT SWITCHES OR STARTERS.
   D) WIRING ASSOCIATED WITH FIRE SHUTDOWN OR SMOKE EVACUATION SYSTEMS.

INDEX OF DRAWINGS

000 SERIES GENERAL

001 INDEX, GENERAL NOTES, LEGEND, TITLE PAGE
002 CONTROL VALVE SCHEDULE
003 CONTROL DAMPER SCHEDULE
005 BUILDING RISER

100 SERIES PANEL LAYOUTS

104 PXCC-04 PANEL LAYOUTS
105 PXCM-05 PANEL LAYOUTS

200 SERIES VENTILATION SYSTEMS

201 HRV-1 CONTROL SYSTEM
202 MECHANICAL ROOM COOLING FAN CF-1
203 GENERATOR ROOM VENTILATION

400 SERIES HEATING PLANT SYSTEMS

401 HEATING SYSTEM

500 SERIES ROOM CONTROL SYSTEMS

501 HW UNIT HEATER CONTROL

600 SERIES MISCELLANEOUS SYSTEMS

601 POTABLE WATER PROCESS CONTROL
602 FUREL OIL SYSTEM
603 BLDG LOW TEMPERATURE ALARM

LEGEND

*CS-NNN EXISTING EQUIPMENT TO BE REMOVED.

+CS-NNN EXISTING EQUIPMENT TO BE REUSED.

④ PNEUMATIC TERMINAL TAG

[5] ELECTRIC TERMINAL TAG

⬡1 INSTALLATION NOTES

⚠ REVISION TAGS

— — — BLN WIRING SYMBOL

—— - —— FLN1 WIRING SYMBOL

…… - —— FLN2 WIRING SYMBOL

— - - - - FLN3 WIRING SYMBOL

(PA) INSTRUMENT AIR SUPPLY AND SYSTEM PRESSURE

LOGICAL POINT NAME → PTNAME [T.CC.L.DD.PP]

TRUNK No.

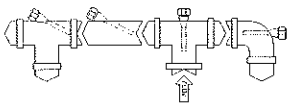
CABINET No. 00-99

LAN TRUNK No.
1) TX-I/O POINTS: 0
2) XSLAND BUS: 0
3) FLN TRUNKS: 1, 2, 3

DROP No.
1) TX-I/O MODULE No.s: 1-64 (500 POINT MAX)
2) MEC PANELS No.s: 0-8
3) FLN CABINET No.s: 0-99

POINT No.
1) TX-I/O POINTS:
BB / BP-M
DO 1-6
SO / SBP
DI 1-8
DI 1-16
BV / BV-MV
AI/AO 1-8
SV / BV-MV
AI/AO 1-8
AO 5-8 (4-20 mA)
2) MEC POINTS
UNIT PANEL
DI 1-8
AO 9-16
AI 17-24
DO 25-32
3) MEC POINTS
EXPANSION PANEL:
DI/AI 1-4
DO/AO 5-8

THERMAL WELL INSTALLATION INSTRUCTIONS



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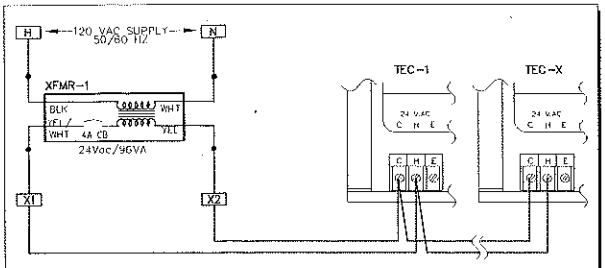
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ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	SF	RQ	04/24/13	11/16/14

TABLE OF CONTENTS, LEGEND

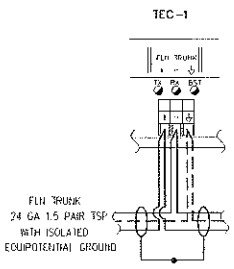
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1 / 001A TRANSFORMER-TEC 3-WIRE POWER

SERVES: NEW TEC PLATFORM (2012)



2 / 001A 1.5 PAIR FLN WIRING

SERVES: NEW TEC PLATFORM (2012)

1. ALL TXM1 TERMINALS (MEASURING, NEUTRAL, RELAY, SUPPLY) ARE CONNECTED IN THE PLUG-IN I/O MODULE, NOT IN THE TERMINAL BUS.

	TXM1.8D, TXM1.16D							
I/O POINT	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SYSTEM NEUTRAL[1] ⊥ (−)	1	3	5	7	9	11	13	15
DIGITAL INPUT ⏐ (+)	2	4	6	8	10	12	14	16

1. NEUTRAL CAN BE CONNECTED TO ANY NEUTRAL TERMINAL ON SAME MODULE AND SEVERAL CAN SHARE SAME NEUTRAL TERMINAL.

	TXM1.16D							
I/O POINT	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
SYSTEM NEUTRAL ⊥ (−)	18	20	22	24	26	28	30	32
DIGITAL INPUT[1] ⏐ (+)	19	21	23	25	27	29	31	33

1. NO PULSE ACCUMULATOR

	TXM1.8U, TXM1.8U-ML							
I/O POINT	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SYSTEM NEUTRAL ⊥ (−)	2	6	10	14	19	23	27	31
UNIVERSAL I/O ⏐ (+)	4	8	12	16	21	25	29	33
24V AC/DC ACT SUPPLY[1] ~		7		15		24		32

1. 24V DC ONLY AVAILABLE WITH BUS CONNECTOR MODULE (BCM) POWERED EXTERNALLY BY DC SUPPLY.

	TXM1.8X, TXM1.8X-ML							
I/O POINT	(1)	(2)	(3)	(4)	(5)[1]	(6)	(7)	(8)[1]
SYSTEM NEUTRAL ⊥ (−)	2	6	10	14	19	23	27	31
UNIVERSAL I/O ⏐ (+)	4	8	12	16	21	25	29	33
24V AC/DC ACT SUPPLY[2] ~		7		15		24		32
24V DC SENSOR SUPPLY[3] ⎓	3		11		20		28	

1. 4-20 mA OUTPUT AVAILABLE ON POINTS 5-8 ONLY.

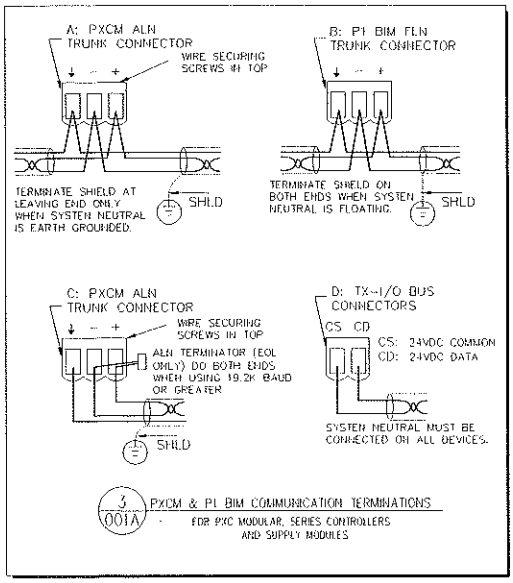
2. 24V DC ONLY AVAILABLE WITH BUS CONNECTOR MODULE (BCM) POWERED EXTERNALLY BY DC SUPPLY.

3. MAX POWER EXTERNAL SENSORS 0.6w (25mA) OR 1.2w (50mA) PER TERMINATION UP TO 2.4w (100mA) MAXIMUM FOR ALL TERMINATIONS.

	TXM1.6R, TXM1.6R-M					
I/O POINT	(1)	(2)	(3)	(4)	(5)	(6)
COMMON[1] ⏐ (C)	3	9	15	20	26	32
NORMALLY CLOSED ⊓ (NC)	4	10	16	19	25	31
NORMALLY OPEN ⏐ (NO)	2	8	14	21	27	33

1. COMMONS ARE NOT INTERNALLY CONNECTED.

5 / 001A IX-I/O TERMINATION TABLES

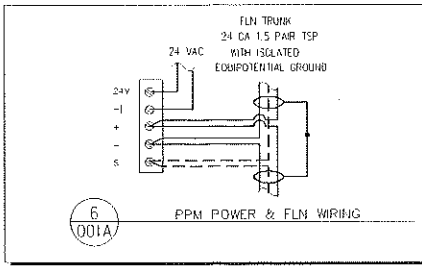


3 / 001A PXCM & PL BIM COMMUNICATION TERMINATIONS

FOR PXC MODULAR, SERIES CONTROLLERS AND SUPPLY MODULES

PXCM FAMILY VA RATINGS & SENSOR SUPPLY			
PRODUCT	24VDC (W)	24VAC INPUT VA	24VAC OUTPUT VA
PXC00-X	0	24	0
PXC100-X	0	24	0
TXB1.P1	14.4	125	96
TXS1.12F4	28.8	150	96
TXS1.EF4	0	96	96
TX-I/O MODULE	24VDC LOAD (W)		
TXM1.8D	1.1		
TXM1.16D	1.4		
TXM1.8U	1.5		
TXM1.8U-ML	1.8		
TXM1.8X	2.2		
TXM1.8X-ML	2.5		
TXM1.6R	1.7		
TXM1.6R-M	1.9		

4 / 001A PXCM POWER WIRING



6 / 001A PPM POWER & FLN WIRING

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SF	SF	RQ	04/24/13	11/18/14

WIRING DETAILS

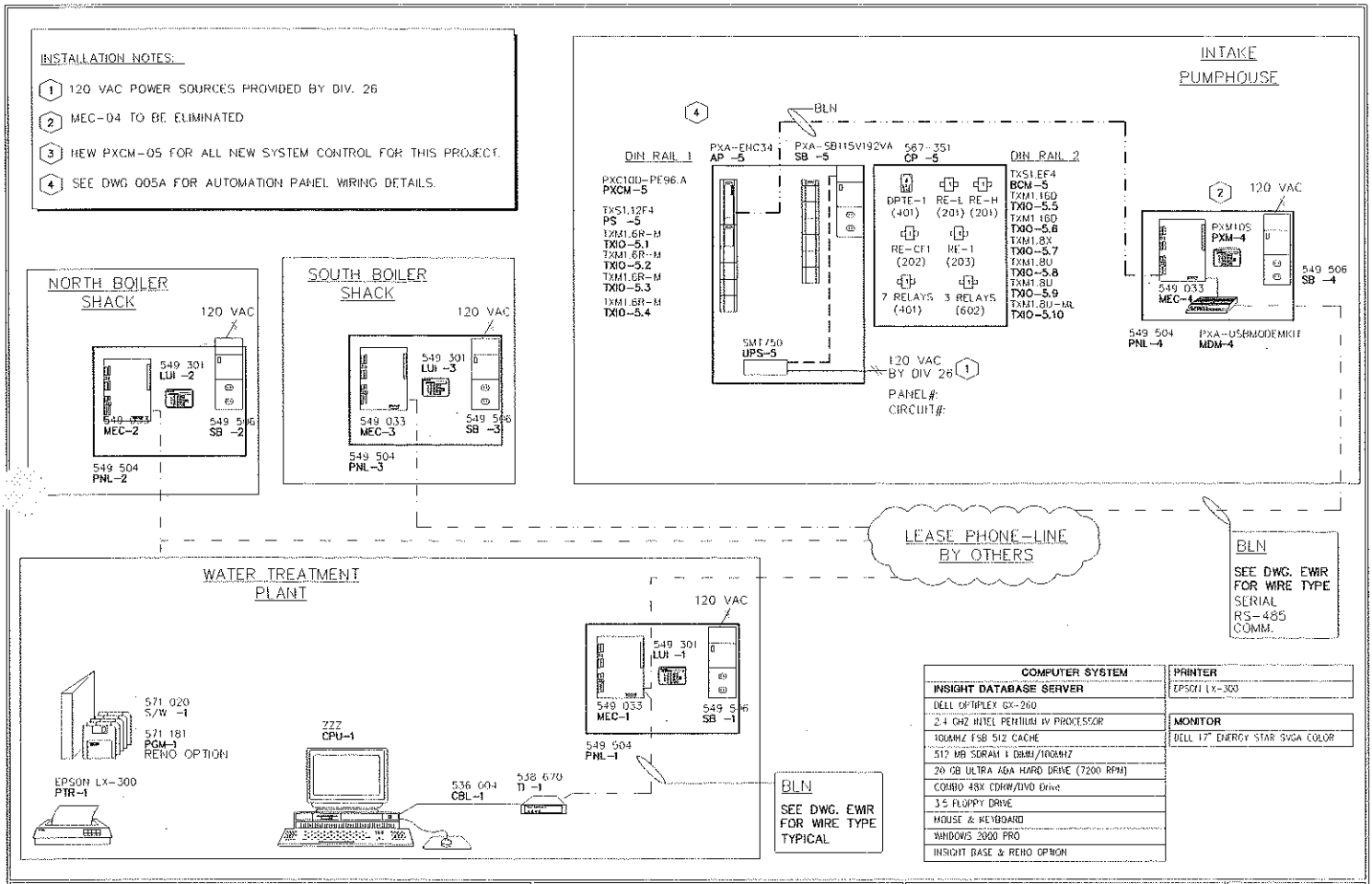
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INSTALLATION NOTES:

1. 120 VAC POWER SOURCES PROVIDED BY DIV. 26
2. MEC-04 TO BE ELIMINATED
3. NEW PXCM-05 FOR ALL NEW SYSTEM CONTROL FOR THIS PROJECT.
4. SEE DWG 005A FOR AUTOMATION PANEL WIRING DETAILS.



COMPUTER SYSTEM
INSIGHT DATABASE SERVER
DELL OPTIPLEX GX-260
2.4 GHZ INTEL PENTIUM IV PROCESSOR
100MHZ FSB 512 CACHE
512 MB SDRAM 1 DIMM/100MHZ
20 GB ULTRA ADA HARD DRIVE (7200 RPM)
COMBO 48X CDRW/DVD Drive
3.5 FLOPPY DRIVE
MOUSE & KEYBOARD
WINDOWS 2000 PRO
INSIGHT BASE & RENO OPTION

PRINTER
EPSON LX-300
MONITOR
DELL 17" ENERGY STAR SVGA COLOR

REVISION HISTORY

3	16/11/2014	OA	B-52-B-0382/AS-BUILT
2	5/29/2013	SF	ADDED NEW PXCM-5 AND UPGRADED MEC-4 TO PXCC.
1	06/09/2007	PJJ	RECORD DRAWING

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SF	SF	RQ	04/24/13	11/18/14

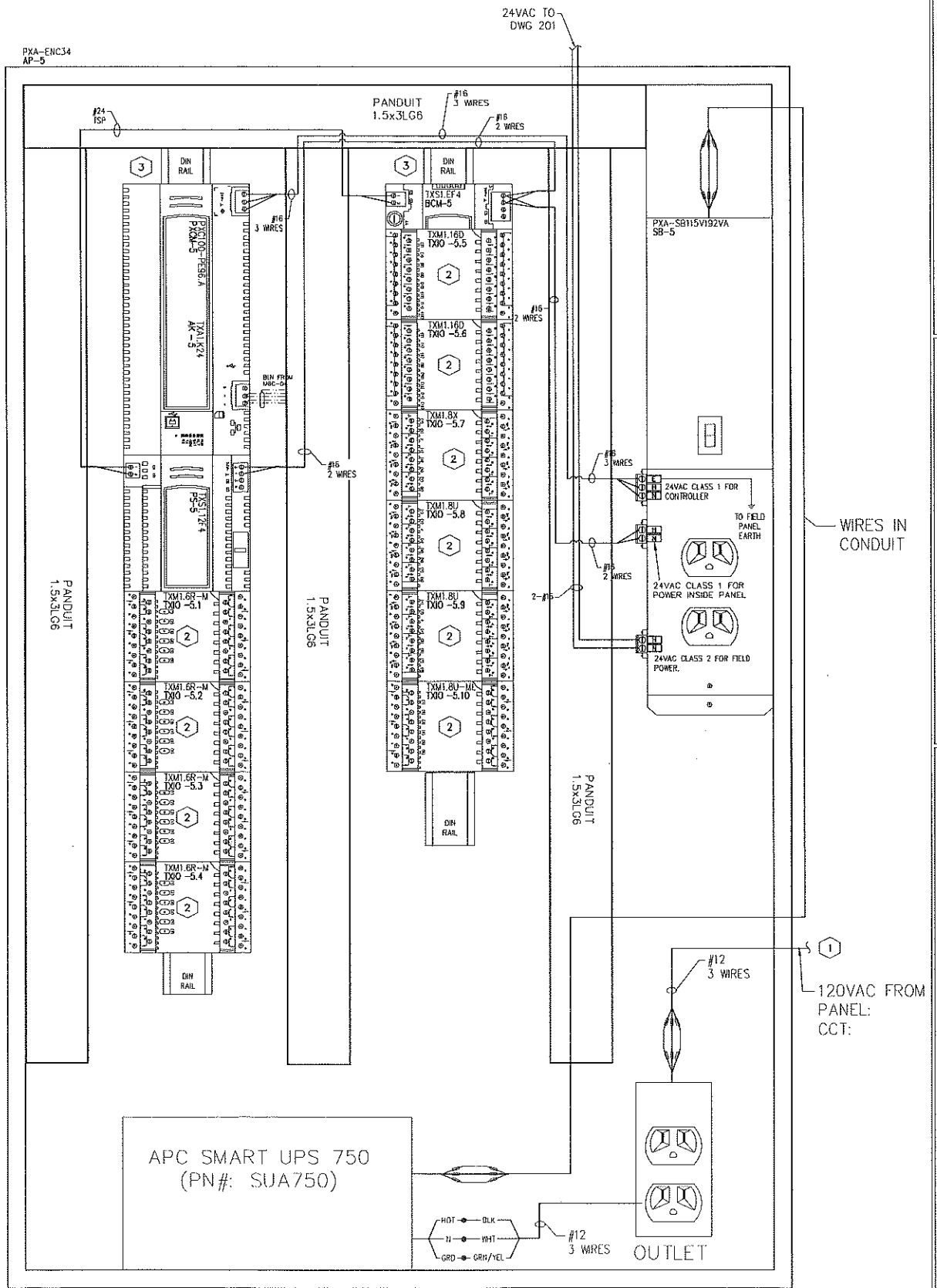
BUILDING RISER

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INSTALLATION NOTES:

1. COORDINATE 120 VAC POWER WITH DIVISION 26. UPDATE PANEL ID & CCT AS REQUIRED.
2. REFER TO PANEL LAYOUT (DWG SERIE 101) FOR TERMINATION ON TX/IO MODULE.



REVISION HISTORY			
1	16/11/2014	OA	B-52-B-0382/AS-BUILT

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Cambridge Bay Pumphouse Cambridge Bay, NV			
ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE / LAST EDIT DATE
SF	OA	RQ	04/24/13 / 11/16/14

BUILDING RISER PXCM-05 DETAILS

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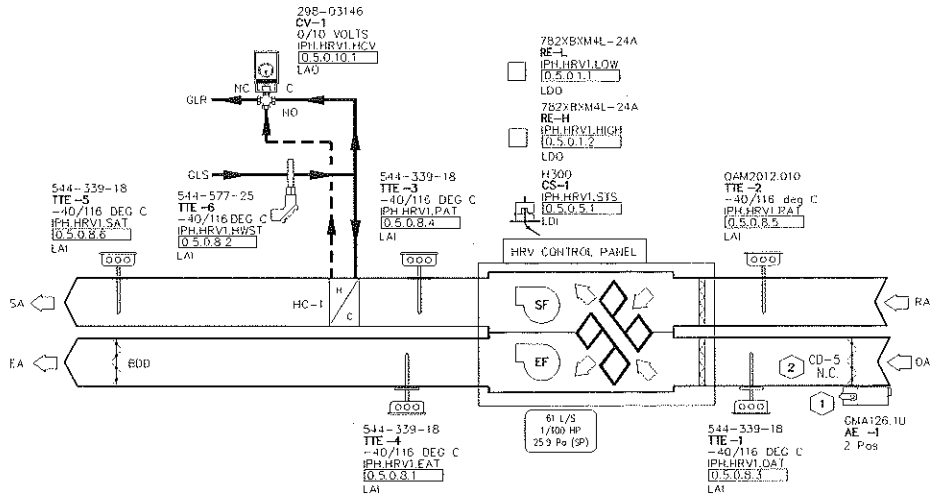
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C:\USERS\ALI-D\DESKTOP\JOB LOCAL\EDMONTON\B-382\MDT\005A1SERA.DWG

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INSTALLATION NOTES:

1. OA DAMPER ACTUATOR HARDWIRE INTERLOCKED WITH HRV-1 UNIT.
2. DAMPER C/W UNIT IF IT IS APPLICABLE.
3. ROOM RH SENSOR APPLICABILITY TO BE CONFIRMED.



1/201 Heat Recovery Unit HRV-1

LOCATION: PUMP ROOM
SERVES: PUMP ROOM

3 544-973
TTE-7
-40/120DEG C
IPH,HRV1,2AT
0.5.0.7.6
LAI

REVISION HISTORY			
1	16/11/2014	OA	B-52-B-0382/AS-BUILT

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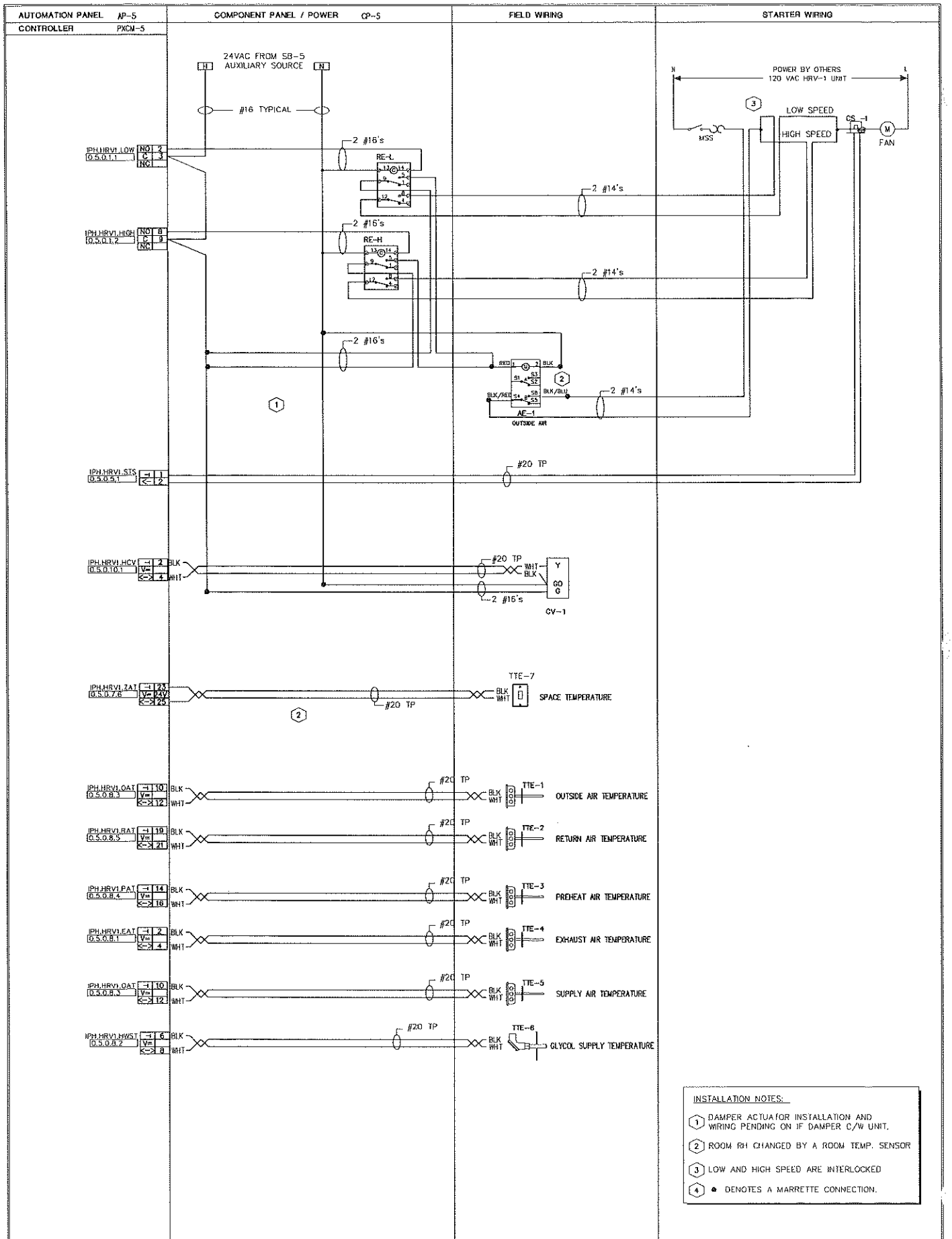
ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	OA	RQ	11/17/14	11/16/14

HRV-1 CONTROL SYSTEM

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REVISION HISTORY			
1	15/11/2014	OA	B-52-B-0382/AS-BUILT

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Fax 780-486-1817

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HRV-1 CONTROL SYSTEM WIRING

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Control Device		Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices						
AE	1	1	QMA126.1U	SIEMENS	154004	2PT SR 24V,62LBIN/S/PLU
CS	1	1	H300	VERIS INDU	N/A	H300 MICRO-SPLITCORE CO/HO CO .15-60A
CV	1	1	298-03146	SIEMENS	155 304	3WMX,SS,+%FXF, .50/2.5+0CA161
RE	H	1	782XBXM4L-24A	MAGNECRAFT	1202cur1055	RELAY SQR 8PIN DPDT 24V W LED
		1	70-459-1	MAGNECRAFT	1202cur1064	SOCKET,RELAY 8PIN 2.65"X1.18"
RE	L	1	782XBXM4L-24A	MAGNECRAFT	1202cur1055	RELAY SQR 8PIN DPDT 24V W LED
		1	70-459-1	MAGNECRAFT	1202cur1064	SOCKET,RELAY 8PIN 2.65"X1.18"
TE	1	1	544-339-18	SIEMENS	149261	DCT PT SNSR, PT 1K OHM, (375), 18" PROBE
TE	2	1	QAM2012.010	SIEMENS	149915	DUCT PT SNSR, PT 1K OHM, (385), 4 IN LG
TE	3-5	3	544-339-18	SIEMENS	149261	DCT PT SNSR, PT 1K OHM, (375), 18" PROBE
TE	6	1	544-577-25	SIEMENS	149261	IMMWELL SNSR, PT 1K OHM, (375),2.5" LGTH
TE	7	1	544-973	SIEMENS	149 971	1000OHM PLATINUM FLUSHMOUNT SENSOR

Sequence of Operation - HRV-1

1. HRV to start/stop through BMS.
2. Outdoor damper (if applicable, to be confirmed on site.) hardwire interlocked with HRV unit. The fan will only start when the damper is fully open and hits the end-switch.
3. The HRV normally operates the fan on low speed. It will only operate at high speed if the heating demand is at 0% and if the room temperature is higher than the given set point by 1 deg C.
4. The reheat coil modulates at all times to maintain a discharge air temperature of 20 deg C through the 3-way control valve.

REVISION HISTORY		
1	16/11/2014	OA
		B-52-B-0382/AS-BUILT

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SF	OA	RQ	11/17/14	11/16/14

HRV-1 CONTROL SYSTEM

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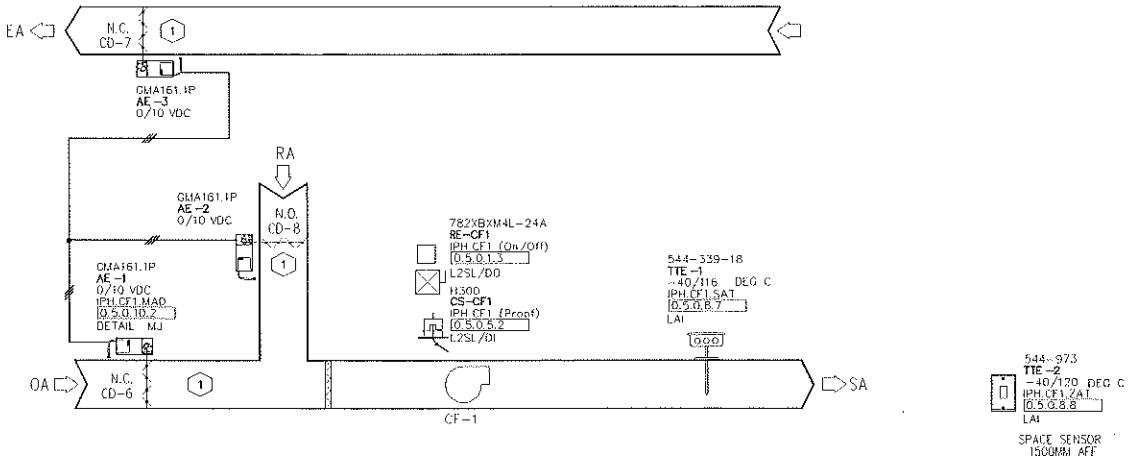
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INSTALLATION NOTES:

(1) DAMPER SUPPLIED BY OTHERS.



1/202 MECHANICAL ROOM COOLING FAN CF-1

LOCATION:MECHANICAL ROOM
SERVES:MECHANICAL ROOM

REVISION HISTORY			
1	16/11/2014	OA	B-52-B-0382/AS-BUILT

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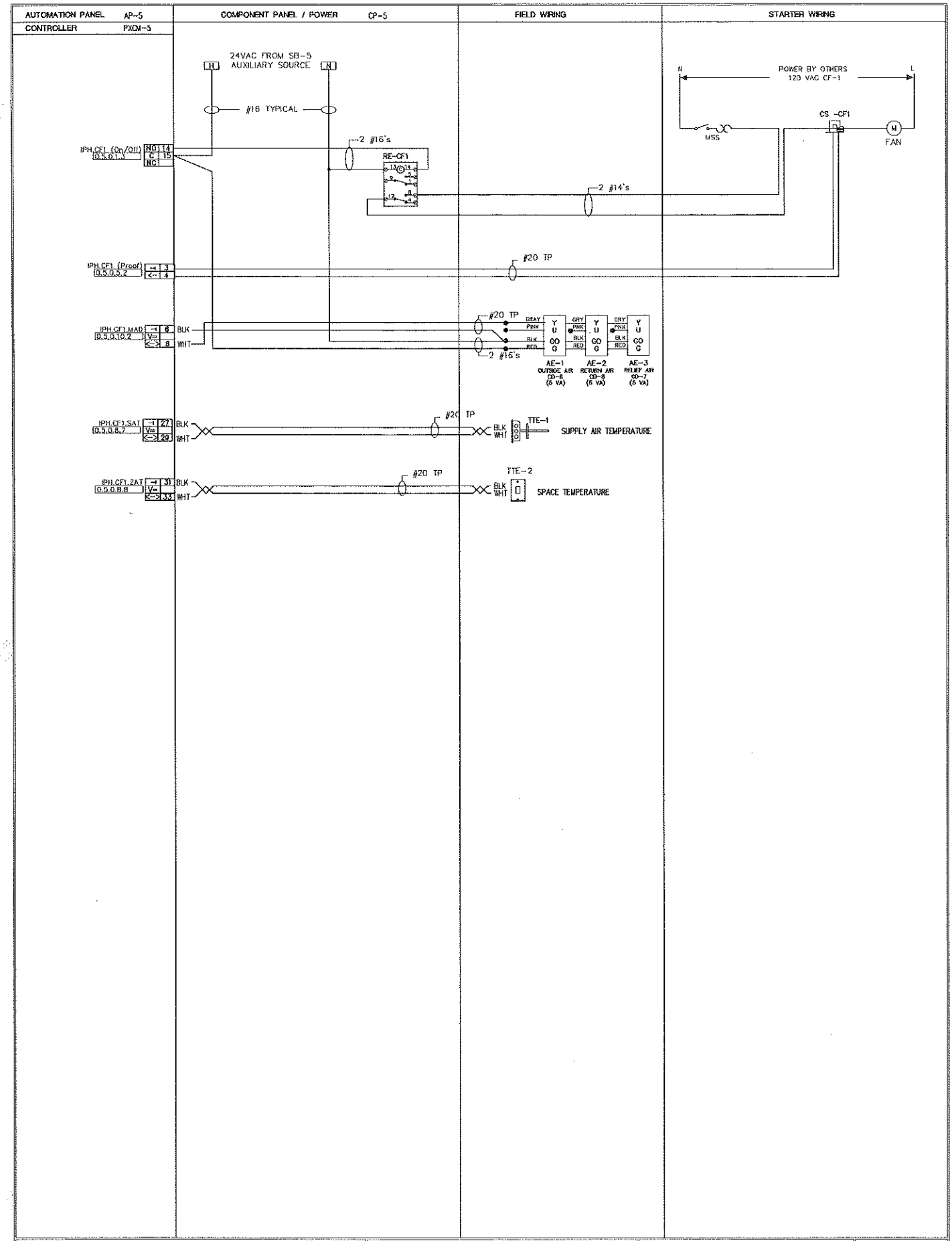
ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	OA	RQ	11/17/14	11/16/14

MECHANICAL ROOM COOLING FAN CF-1

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202

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1	16/11/2014	OA	B-52-0-0382/AS-BUILT

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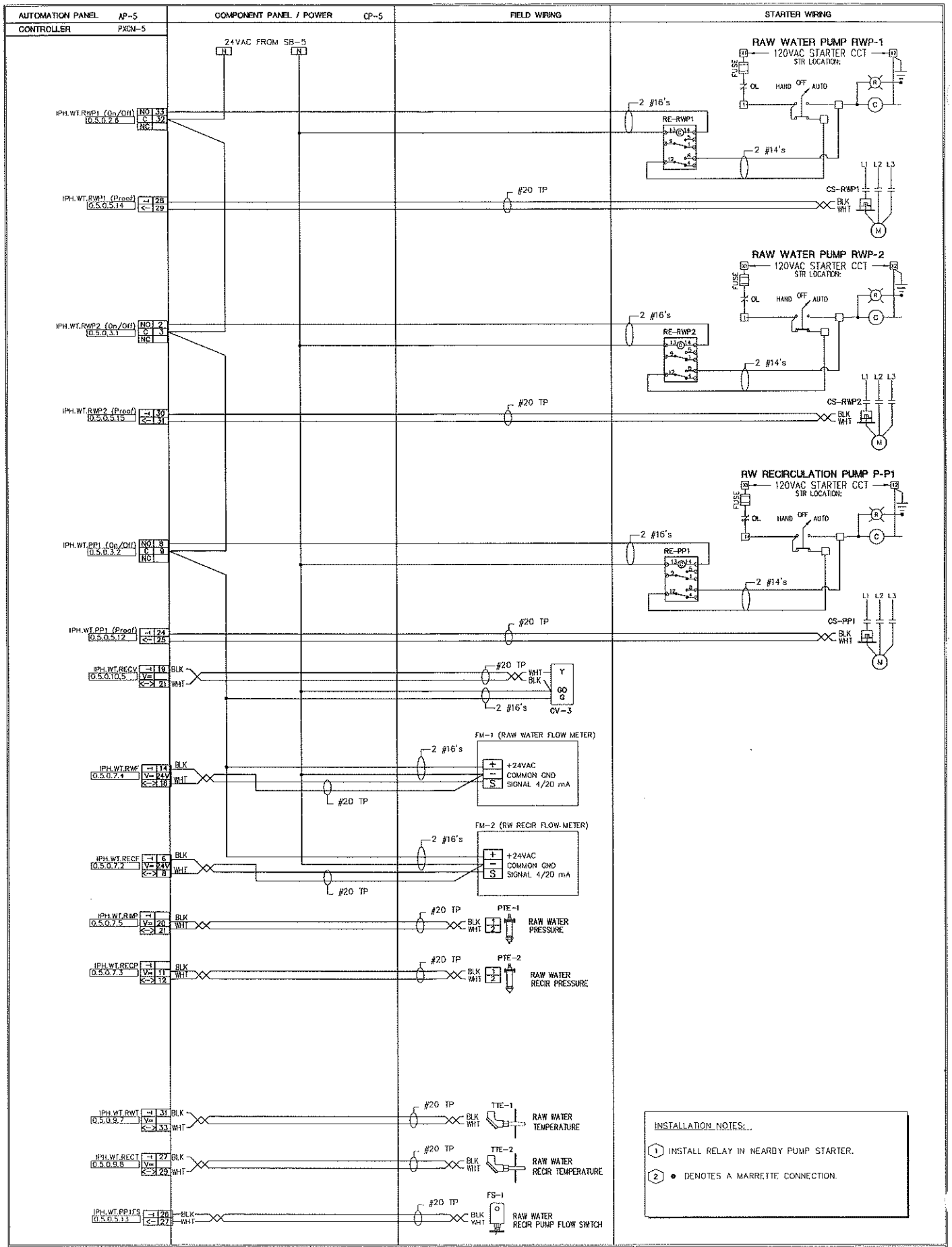
ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	OA	RQ	11/17/14	11/18/14

MECHANICAL ROOM CF-1 WIRING

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REVISION HISTORY			
2	15/11/2014	OA	B-52-B-0382/AS-BUILT
1	6/24/2013	SF	ADD 2 MORE PRESSURE SENSOR AS PER CONSULTANT'S COMMENTS.

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SF	OA	RQ	11/17/14	11/18/14

POTABLE WATER PROCESS WIRING

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601A

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Control Device		Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices						
AE	1-3	3	GUA161.1P	SIEMENS	154004	MOD SR 24V,62LBIN,PLN
CS	CF1	1	H300	VERIS INDU	H300	H300 MICRO-SPLITCORE 60/NO 60 .15-60A
RE	CF1	1	/82XBXH4L-24A	MAGNECRAFT	1202cul055	RELAY SOR 8PIN DPDT 24V W LED
RE	P3.3	1	70-459-1	MAGNECRAFT	1202cul064	SOCKET,RELAY 8PIN 2.65"X1.38"
TTE	1	1	544-339-18	SIEMENS	149261	DCT PT SNSR, PT 1K OHM, (375), 18" PROBE
TTE	2	1	544-973	SIEMENS	149 971	1000 OHM PLATINUM FLUSHMOUNT SENSOR

Sequence of Operation - Mechanical Room Ventilation

1. In the event of high temperature in mechanical room (initial set point = 25 deg C), cooling thermostat in mechanical room to energize cooling fan CF-1.
2. On confirmation of CF-1 operation by current sensor, modulate NC outdoor air damper and NO return air damper to satisfy supply air temperature controller (initial set point = 20 deg C).
3. In the event of low supply air temperature (initial set point = 10 deg C), disable CF-1, control dampers return to normal position. Alarm Mechanical room cooling fan trouble to BMS workstation

REVISION HISTORY			
1	16/11/2014	OA	B-52-B-0382/AS-BUIL1

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ENGINEER	DRAWN BY	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	SF	RQ		05/13/13

MECHANICAL ROOM CF-1 - BOM

B-52-B-0382

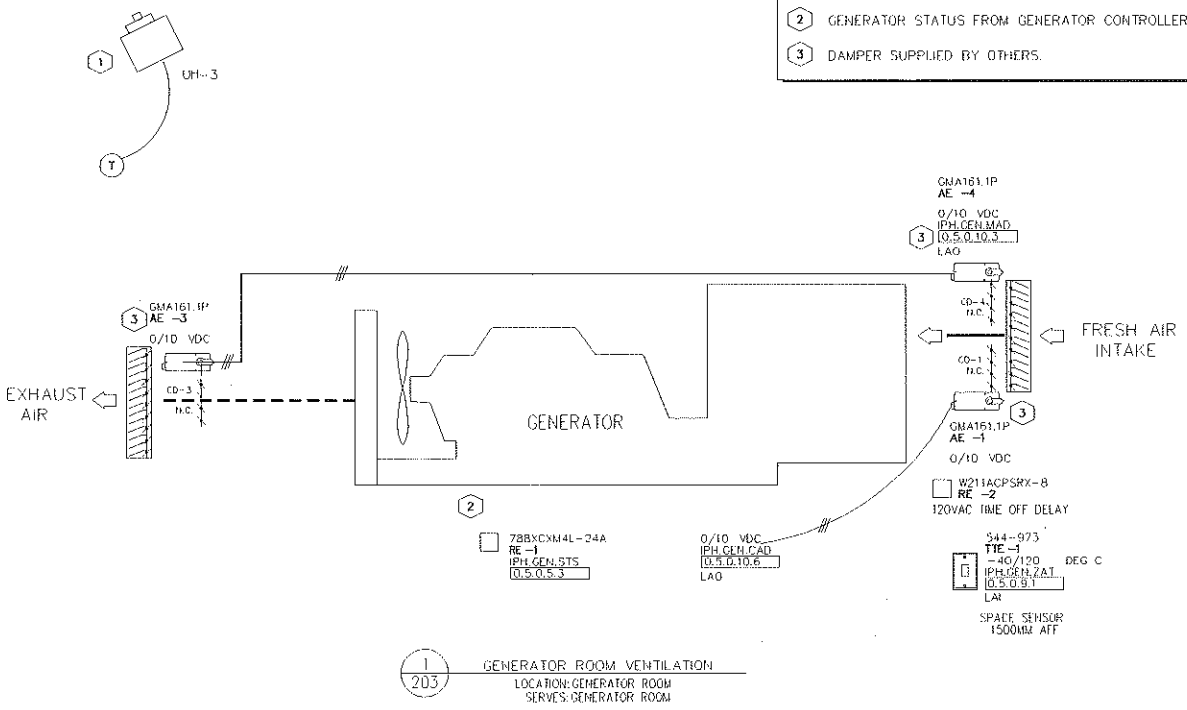
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INSTALLATION NOTES:

1. REFER TO S01 FOR UNIT HEATER WIRING DETAILS.
2. GENERATOR STATUS FROM GENERATOR CONTROLLER.
3. DAMPER SUPPLIED BY OTHERS.



1/203 GENERATOR ROOM VENTILATION

LOCATION: GENERATOR ROOM
SERVES: GENERATOR ROOM

REVISION HISTORY			
1	16/11/2014	OA	B-52-B-6382/AS-BUILT

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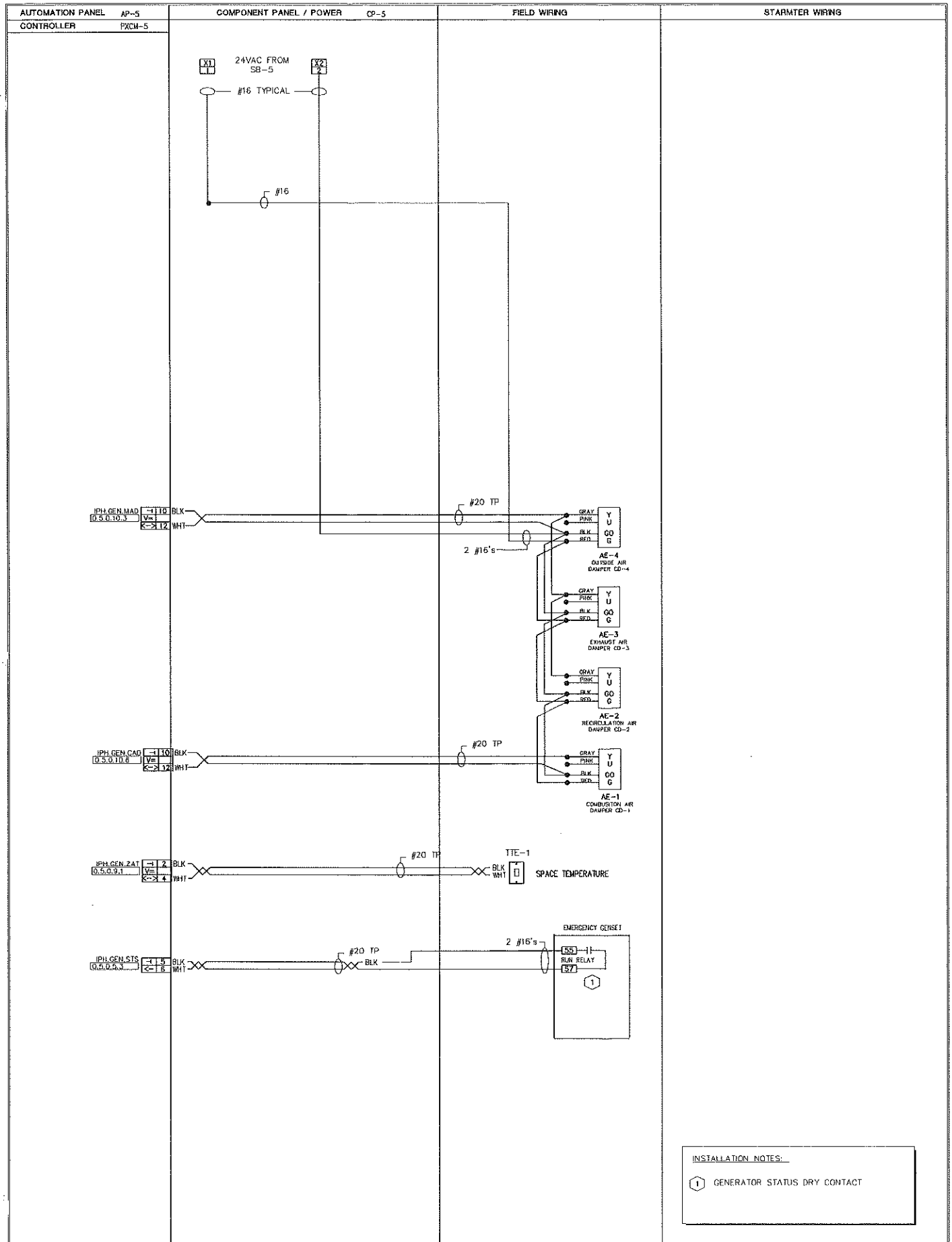
ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST ISSUE DATE
SF	OA	RQ	11/17/14	11/16/14

GENERATOR ROOM VENTILATION

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203

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INSTALLATION NOTES:

(1) GENERATOR STATUS DRY CONTACT

REVISION HISTORY			
1	10/11/2014	DA	B-52-B-0382/AS-BUILT

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SF	DA	RQ	11/17/14	11/10/14

GENERATOR VENTILATION WIRING

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Control Device		Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices						
AE	1-4	4	QMA161.1P	SIEMENS	154084	400 SR 24V,62LBIN,PLM
TE	1	1	544-973	SIEMENS	149 971	1000 OHM PLATINUM FLUSHMOUNT SENSOR

Sequence of Operation - Generator Room Ventilation

1. On a RUN status from the generator, open combustion damper CD-01 and energize free cooling dampers.
2. If the generator status is off, combustion damper closes after 2 minutes (Adjustable).

3 BMS modulates control dampers CD-02, 03 and 04 to maintain room thermostat at set point Initial set point = 20 degC.(Adjustable)

REVISION HISTORY

1	16/11/2014	OA	B-52-B-0382/AS-BUILT

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SF	OA	RQ	11/17/14	11/16/14

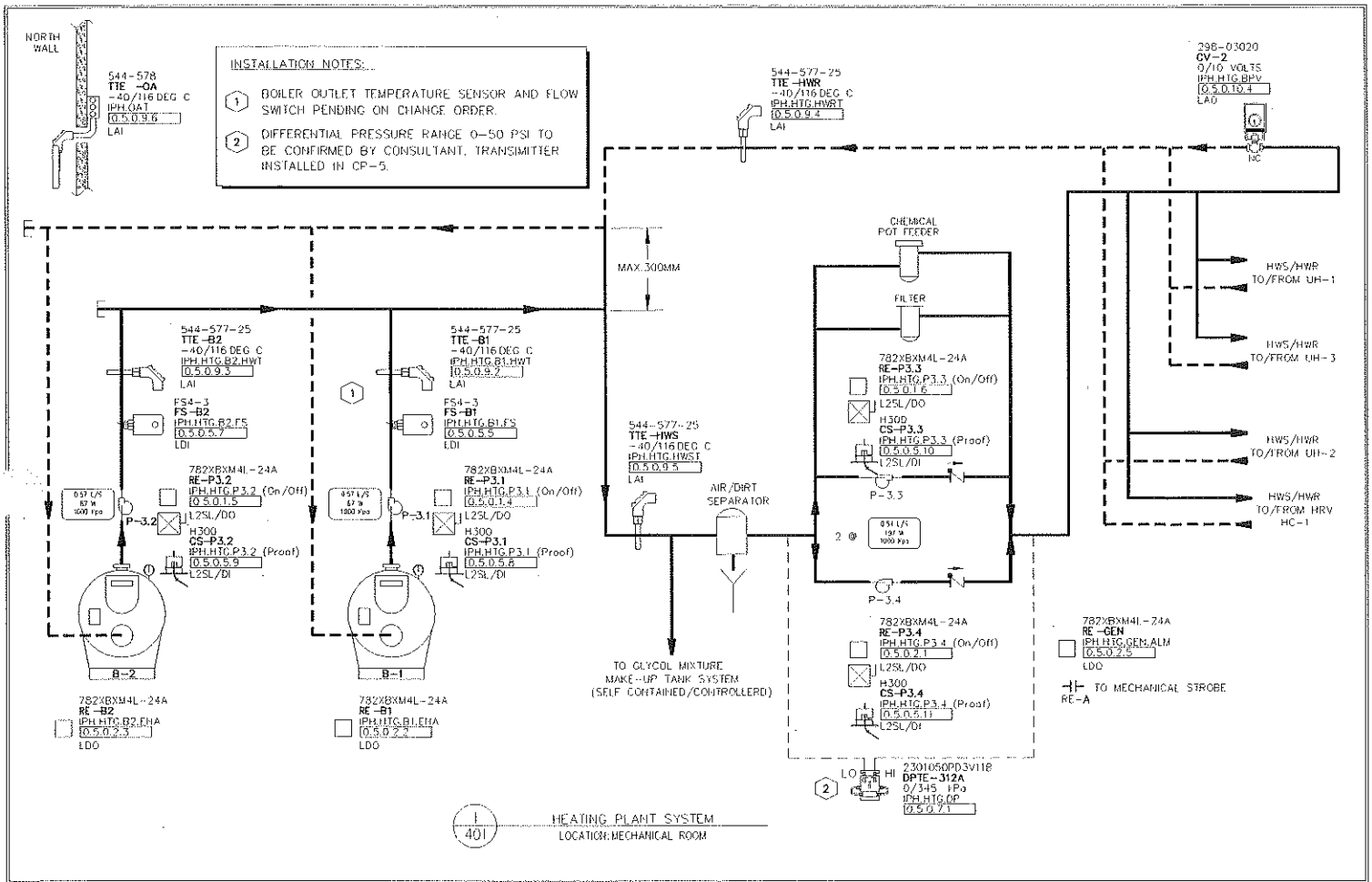
GENERATOR ROOM VENTILATION

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203B

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1	16/11/2014	OA	B-52-B-0382/AS-BUILT

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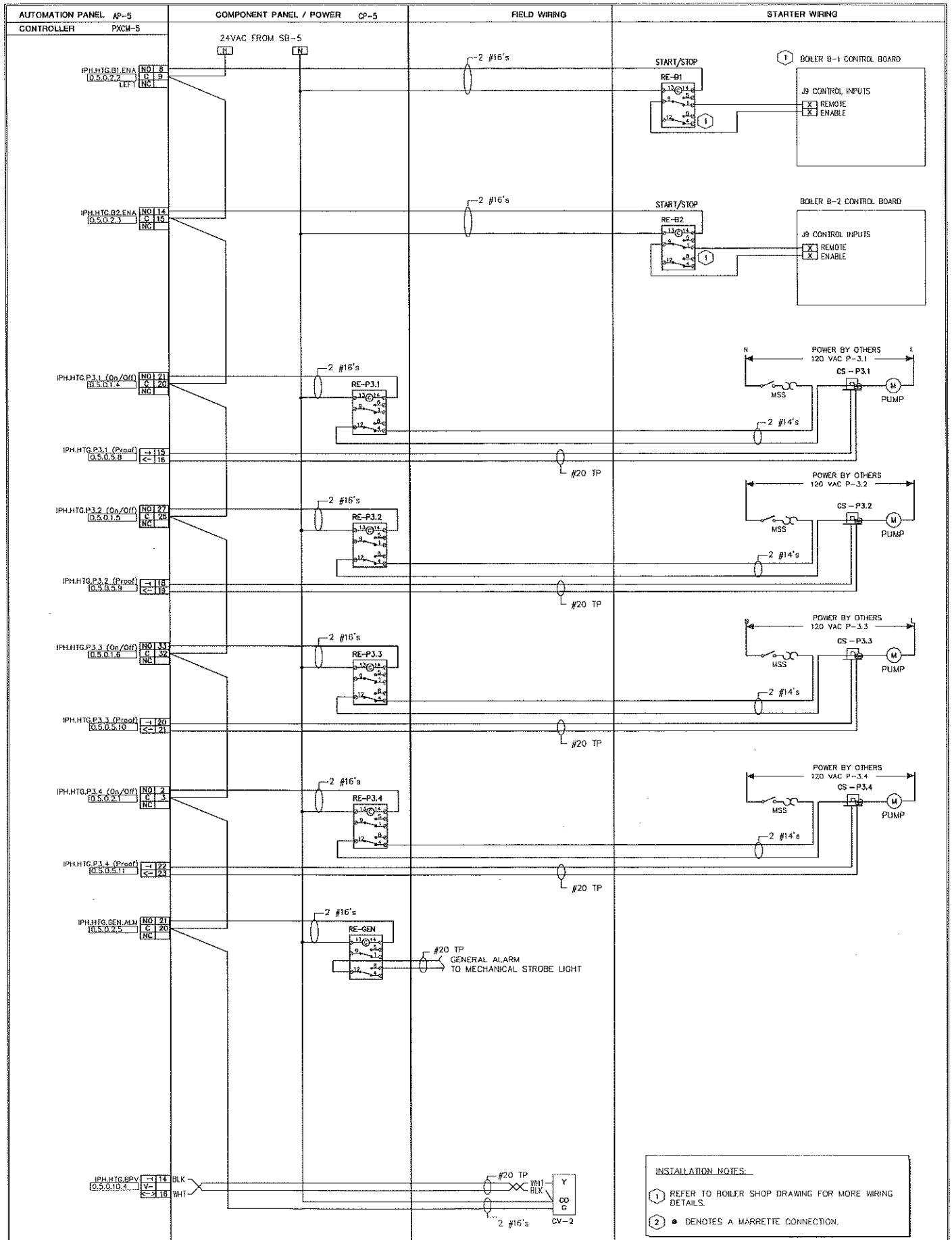
ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST CONT DATE
SF	OA	RQ	11/17/14	11/18/14

HEATING SYSTEM

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REVISION HISTORY			
1	16/11/2014	OA	B-52-B-0382/AS-BUILT

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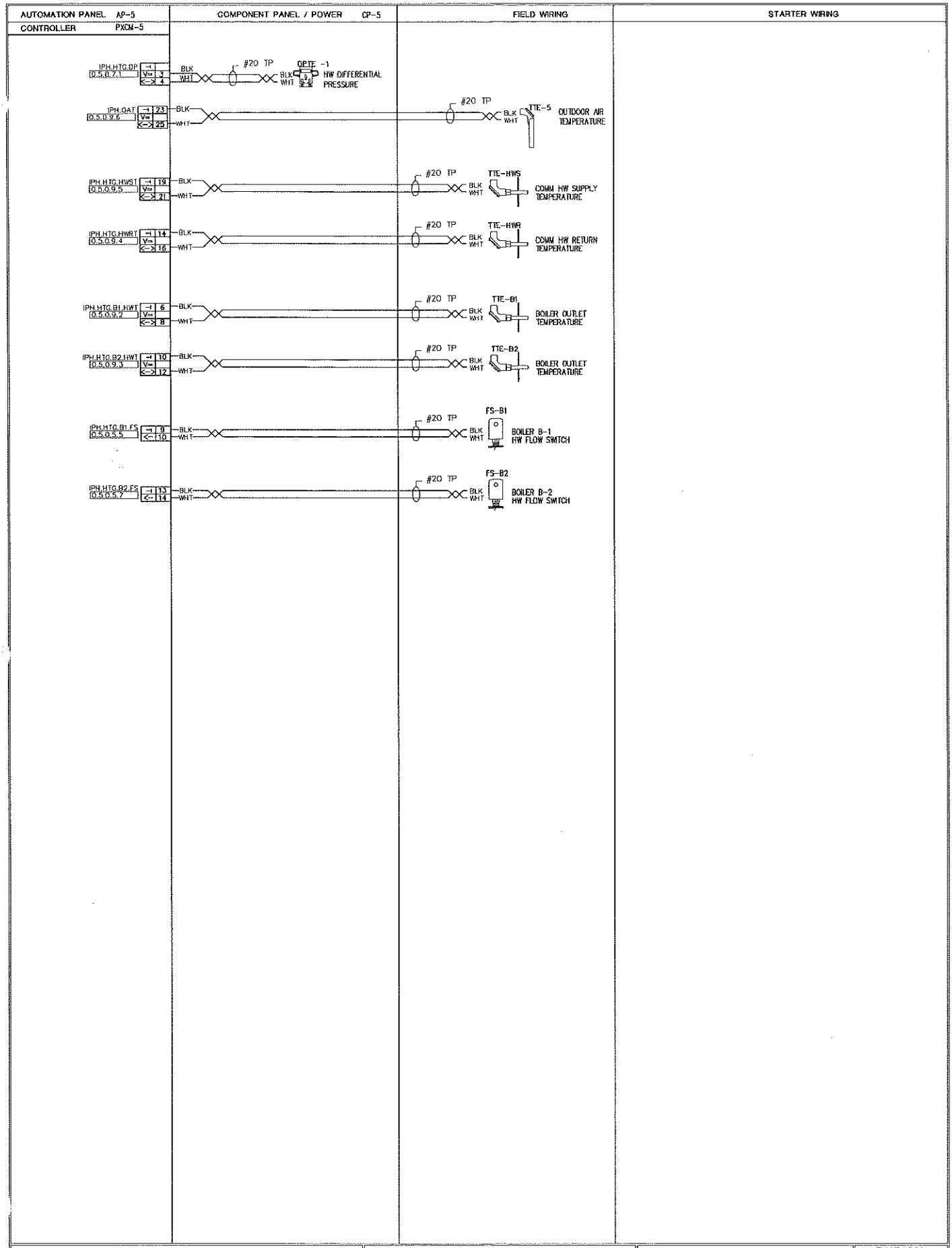
ENGINEER	DRAFTER	CHECKED BY	ORIGINAL RELEASE	LAST EDIT DATE
SF	OA	RQ	11/17/14	11/16/14

HEATING SYSTEM WIRING 1

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REVISION HISTORY			
1	16/11/2014	OA	B-52-B-0382/AS-BUILT

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HEATING SYSTEM WIRING 2

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Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
CS P3.1-P3.4	4	H300	VERIS INDU	N/A	H300 MICRO-SPLITCORE CO/NO CO .15-60A
CV 2	1	298-03020	SIEMENS	155 304	2WNC,3S,LN,FXF,0.5/2.5 +QCA161
DPTE 312A	1	2.301050PD3V1IB	SETRA	0608cu1002	DP TRAN,WET,50PSI,4-20MA,W/MAN
FS B1-B2	2	FS4-3	N/A	N/A	N/A
RE B1	1	782XBXM4L-24A	MAGNECRAFT	1202cu1055	RELAY SOR 8PIN DPDT 24V W LED
	1	70-459-1	MAGNECRAFT	1202cu1064	SOCKET,RELAY 8PIN 2.65"X1.18"
RE B2	1	782XBXM4L-24A	MAGNECRAFT	1202cu1055	RELAY SOR 8PIN DPDT 24V W LED
	1	70-459-1	MAGNECRAFT	1202cu1064	SOCKET,RELAY 8PIN 2.65"X1.18"
RE GEN	1	782XBXM4L-24A	MAGNECRAFT	1202cu1055	RELAY SOR 8PIN DPDT 24V W LED
	1	70-459-1	MAGNECRAFT	1202cu1064	SOCKET,RELAY 8PIN 2.65"X1.18"
RE P3.1	1	782XBXM4L-24A	MAGNECRAFT	1202cu1055	RELAY SOR 8PIN DPDT 24V W LED
	1	70-459-1	MAGNECRAFT	1202cu1064	SOCKET,RELAY 8PIN 2.65"X1.18"
RE P3.2	1	782XBXM4L-24A	MAGNECRAFT	1202cu1055	RELAY SOR 8PIN DPDT 24V W LED
	1	70-459-1	MAGNECRAFT	1202cu1064	SOCKET,RELAY 8PIN 2.65"X1.18"
RE P3.3	1	782XBXM4L-24A	MAGNECRAFT	1202cu1055	RELAY SOR 8PIN DPDT 24V W LED
	1	70-459-1	MAGNECRAFT	1202cu1064	SOCKET,RELAY 8PIN 2.65"X1.18"
RE P3.4	1	782XBXM4L-24A	MAGNECRAFT	1202cu1055	RELAY SOR 8PIN DPDT 24V W LED
	1	70-459-1	MAGNECRAFT	1202cu1064	SOCKET,RELAY 8PIN 2.65"X1.18"
TTE B1-B2	2	544-577-25	SIEMENS	149261	IMMSELL SNSR, PT 1K OHM, (375),2.5" LGTH
TTE OA	1	544-578	SIEMENS	149 261	O/AIR TEMP SENS (-40/240F)
TTE HWR-HWS	2	544-577-25	SIEMENS	149261	IMMWELL SNSR, PT 1K OHM, (375),2.5" LGTH

Sequence of Operation - Heating System

Boilers:

1. Boilers are controlled by BMS and cycle burners to satisfy hot water supply temperature at set point.
2. BMS to cycle lead boiler based on runtime and to provide outdoor reset HWS temperature reset schedule.
3. HWS reset schedule initial setpoints:
   - Design HWS = 82°C
   - Max HWS = 85°C
   - Min HWS = 60°C
   - Design OAT = -25°C
4. BMS to cycle lead boiler based on runtime. Lead boiler switches after 168 hrs run time. Sequence as follows:
   .1 After 168hr runtime on lead boiler, change lead boiler to next in line.
5. When lead boiler energized, associated boiler circulation pump energized (B1.1/P-3.1, B1.2/P-3.2). Current Sensor to enable burner activation on proof of boiler circulation pump operation. In event of no HW flow, disable burner, alarm boiler failure to auto dialer.
6. Low water cutoff (LWCO) to disable boiler in event of low heating water level.
7. High limit controller with manual reset to disable boiler in event of high heating water temperature. Setpoint = 93 deg C.

Secondary Recirculation Pumps P-3.3, P-3.4

1. Secondary pumps operate as lead/standby.
2. Pump sequencer alternates lead pump every 168 hours of operation.
3. In event of lead pump failure as sensed by current sensor, alarm lead pump failure at BMS workstation and at mechanical alarm strobe and energize stand-by pump. On stand-by pump failure alarm to autodialer.
4. Pumps run continuous until outdoor air temperature greater than 16 deg C. Minimum deadband = 3 deg C.

REVISION HISTORY			
1	10/11/2014	OA	B-52-B-0382/AS-BUILT

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HEATING SYSTEM

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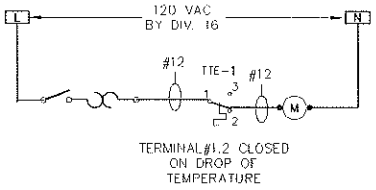
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INSTALLATION NOTES:

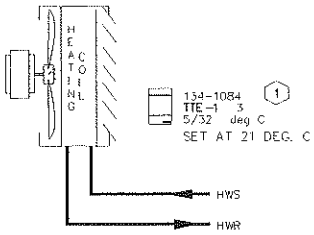
1. MOUNT ROOM THERMOSTAT 1.5M A.F.F. AS PER MECHANICAL SET POINT TO BE ADJUSTABLE.
2. THERMOSTAT TO BE SUPPLIED BY SIEMENS & WIRED BY DIVISION 16.
3. UNIT HEATER TABLE

UNIT HEATER TAG#	LOCATION
UH-1	MECHANICAL ROOM
UH-2	PUMP ROOM
UH-3	GENERATOR ROOM



TERMINAL#1,2 CLOSED ON DROP OF TEMPERATURE

2/501 UNIT HEATER WIRING



1/501 UNIT HEATER CONTROL

LOCATION: REFER TO UNIT HEATER TABLE
SERVES: REFER TO UNIT HEATER TABLE

REVISION HISTORY			
1	16/11/2014	OA	B-52-B-0382/AS-BUILT

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ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST ISSUE DATE
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HW UNIT HEATER CONTROL

B-52-B-0382
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501

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Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
TTE 1	3	134-1084	SIEMENS	155 017	T'STAT,H/C,LINE VOLT CON/EXP

Sequence of Operation - Unit Heater

1. Line voltage thermostat cycles blower to satisfy set point.
2. Initial set point = 20 deg C.

REVISION HISTORY			
1	18/11/2014	OA	B-52-B-0382/AS-BUILT

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ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	SF	RQ		05/13/13

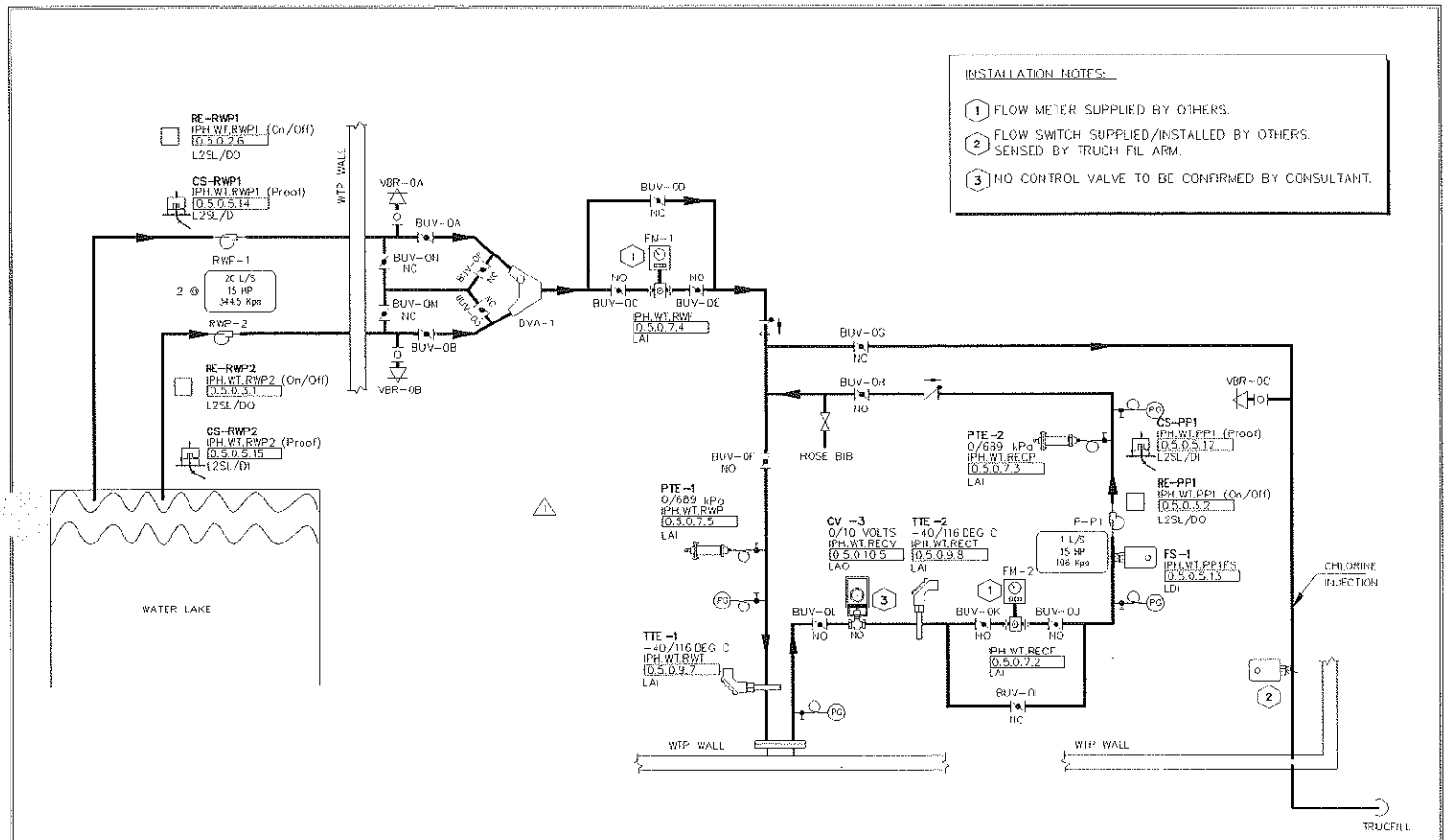
HW UNIT HEATER CONTROL - BOM

B-52-B-0382

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REVISION HISTORY

2	16/11/2014	OA	B-52-B-0382/AS-BUILT
1	9/26/2014	SF	REVISED AS PER CONSULTANTS COMMENTS

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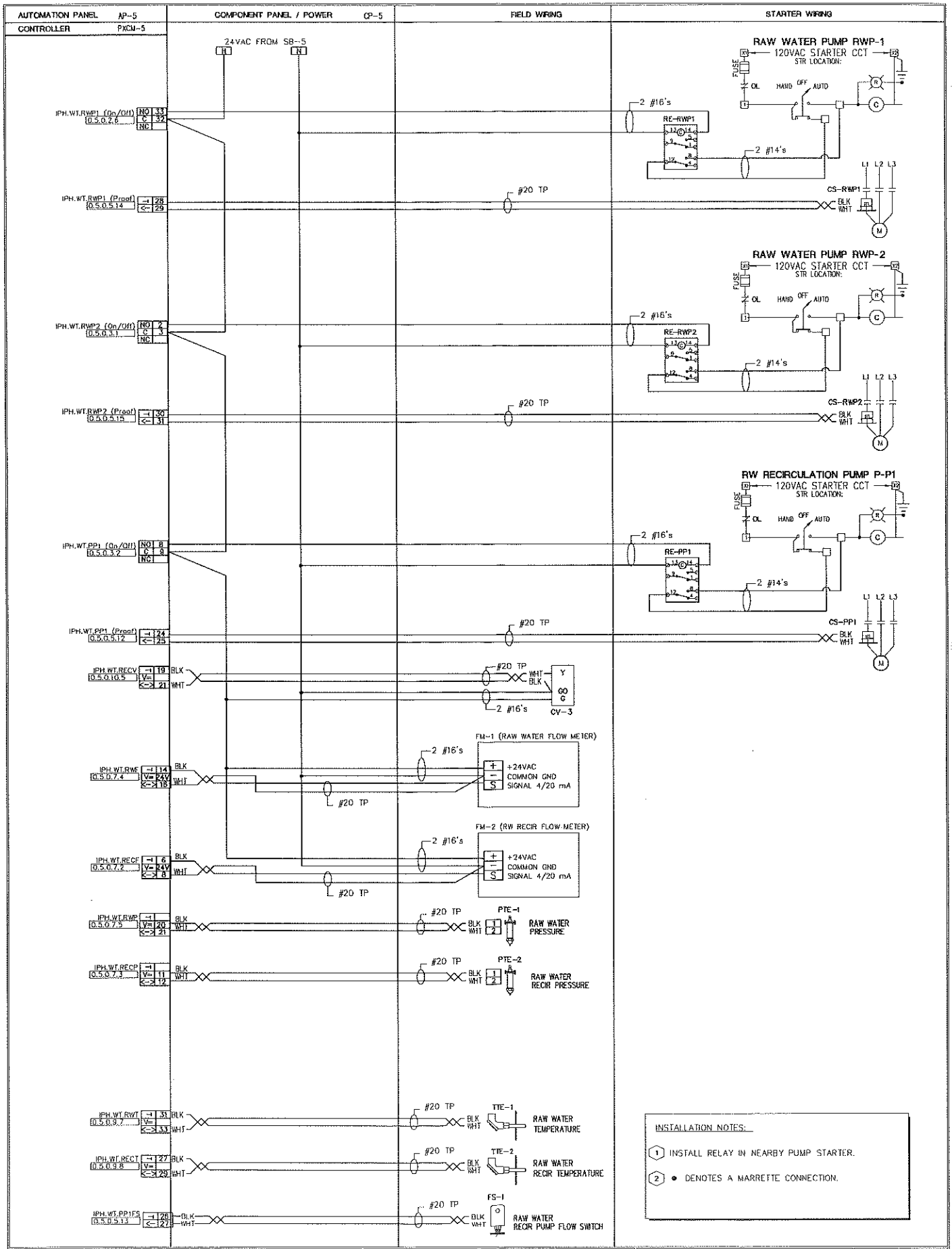
ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	OA	RQ	11/17/14	11/18/14

POTABLE WATER PROCESS

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601

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INSTALLATION NOTES:

1. INSTALL RELAY IN NEARBY PUMP STARTER.
2. • DENOTES A MARRETTE CONNECTION.

REVISION HISTORY			
2	16/11/2014	OA	B-52-B-0382/AS-BUILT
1	6/24/2013	SF	ADD 2 MORE PRESSURE SENSOR AS PER CONSULTANT'S COMMENTS.

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ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	OA	RQ	11/17/14	11/18/14

POTABLE WATER PROCESS WIRING

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Control Device		Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices						
CS	PP1	1	H300	VERIS INDU	N/A	H300 MICRO-SPLITCORE CO/NO CO ,15-60A
CS	RWP1-RWP2	2	H300	VERIS INDU	N/A	H300 MICRO-SPLITCORE CO/NO CO 15-60A
CV	3	1	298-03006	SIEMENS	155 304	2WNO,SS,1/4,FXF,1.25/16 +6CA161
FS	1	1	FS4-3	N/A	N/A	N/A
PTE	1-2	2	2091100PG2M1102	SETRA	0808cut004	PRES TRANS,100PSI,4-20MA,2'CBL
RE	PP1	1	782XBXM4L-24A	MAGNECRAFT	1202cut055	RELAY 5OR 8PIN DPDT 24V W LED
RE	RWP1-RWP2	2	782XBXM4L-24A	MAGNECRAFT	1202cut055	RELAY 5OR 8PIN DPDT 24V W LED
TTE	1-2	2	544-577-25	SIEMENS	149261	JAMWELL SNSR, PT IR OHM, (375),2.5" LGTH

Sequence of Operation - Potable Water System Process

NORMAL OPERATIONS - RAW WATER SUPPLY TO TOWN

1. Operator manually opens valve BUV-0A and 0B on the 150 mm diameter line at both intake lines. These valves are prior to the Tech – Taylor 'Y' valve.
2. Operator sets Raw Water Delivery (HAND/OFF/AUTO) selector on Plant Control Panel to AUTO.
3. Operator switches raw water pump RWP-1 and RWP-2 to ON.
4. Specific pump to run is chosen by the owner supplied Siemens PXC control system on a alternate 'lead / lag' run basis.
5. If it is desired to utilize a specific pump, either Pump RWP-1 or RWP-2 as desired, operator sets (HAND/OFF/AUTO) Raw Water Pump selector switch on Plant Control Panel PP1 to HAND, and switchs the chosen pump to ON and the other pump to OFF.
6. Upon receiving a signal from the owner supplied Siemens PXC, the selected pump will start, and run until a signal from the owner supplied Siemens PXC system to stop.

OPERATIONS OF 50 MM INTERNAL RECIRCULATION LINE

NOTICE: The proper operation of the 50 mm internal recirculation line is essential for the water delivery pipeline to the community to operate without freeze up in the winter. As such, monitoring and regular checking of both the flow in the line and of the retained pressure in the line is essential.

The circulation line must operate whenever the ground temperature is below freezing. As it is not possible to check and confirm that ground temperature, in general, the recirculation line should be operated continuously all year, whenever the raw water pipeline is in use

1. Circulation Pump P-P1 shall be switched ON when raw water pipelines are operating.
2. Flow Control Valve FCV-1 is to be set to retain a minimum 50 PSI pressure differential to atmosphere in the 50 mm recirculation line. This pressure is to be supplied to the 50 mm recirculation line largely by the high head recirculation pump in the in town pumphouse.
3. If circulation stops for more than 1 minute in 50 mm circulation line as shown by the FS, the owner supplied Siemens PXC monitoring system is to set alarm condition to notify operator control panel in town pumphouse.

REVISION HISTORY			
1	16/11/2014	OA	B-52-B-0382/AS-BUILT

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ENGINEER	DRAFTSMAN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	OA	RQ	11/17/14	11/18/14

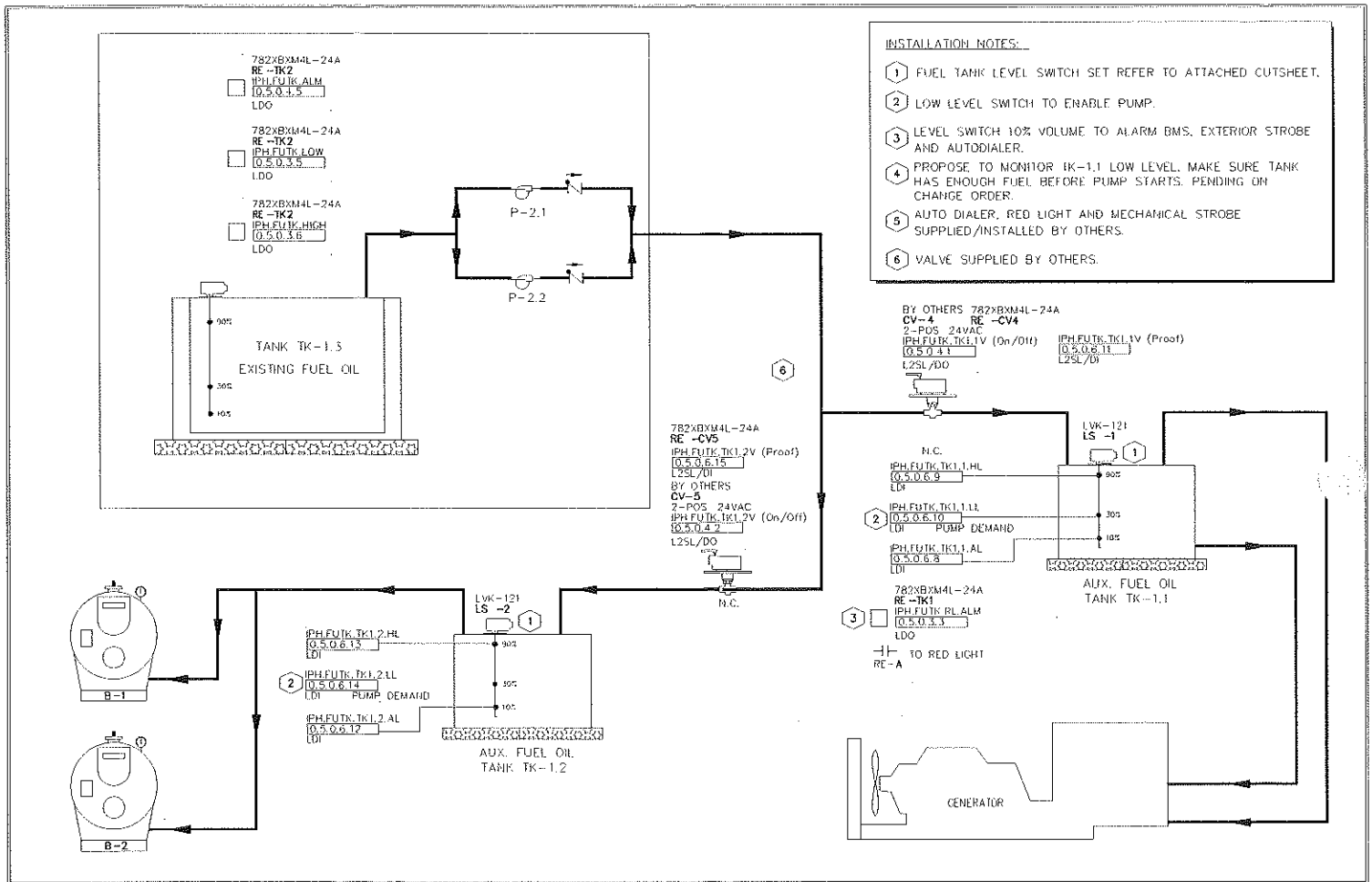
POTABLE WATER PROCESS

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REVISION HISTORY

2	10/11/2014	OA	B-52-B-0382/AS-BUILT
1	09/26/2014	SF	REVISED AS PER CONSULTANT'S COMMENTS.

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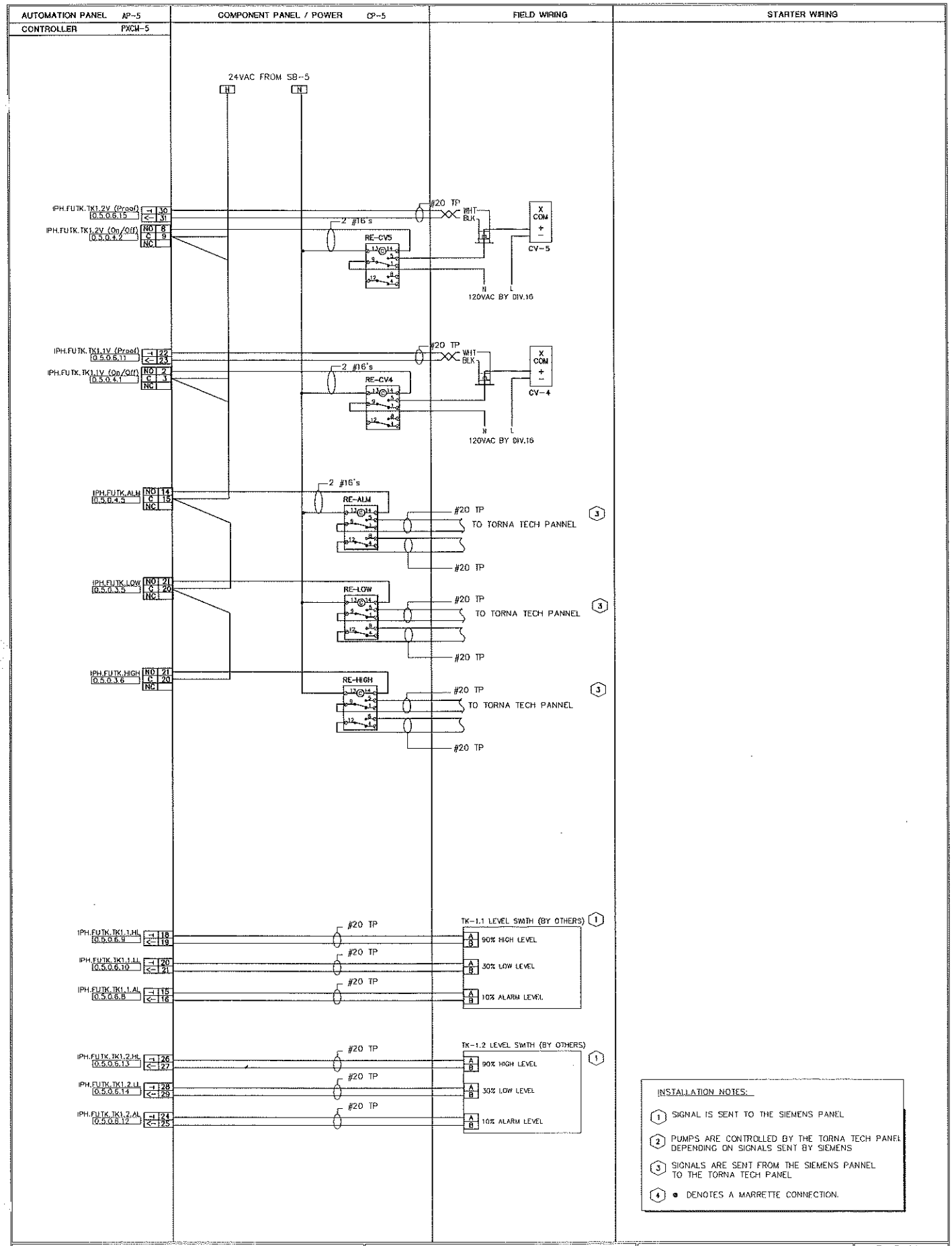
ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	OA	RQ	11/17/14	11/16/14

FUREL OIL SYSTEM

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602

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REVISION HISTORY			
1	16/11/2014	OA	B-52-B-0382/AS-BUILT

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ENGINEER	DRAWN BY	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	OA	RQ	11/17/14	11/18/14

FUREL OIL SYSTEM WIRING

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Control Device		Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices						
CS	CV4-CV5	2	H300	VERIS INDU	N/A	H300 MICRO-SPLITCORE CO/NO CO .15-60A
LS	1-2	2	LWK-121	N/A	N/A	N/A
RE	ALM	1	782XBXM4L-24A	MAGNECRAFT	1202cut055	RELAY SOR 8PIN DPDT 24V W LED
		1	70-459-1	MAGNECRAFT	1202cut064	SOCKET,RELAY 8PIN 2.65"X1.18"
RE	CV4	1	782XBXM4L-24A	MAGNECRAFT	1202cut055	RELAY SOR 8PIN DPDT 24V W LED
		1	70-459-1	MAGNECRAFT	1202cut064	SOCKET,RELAY 8PIN 2.65"X1.18"
RE	CV5	1	782XBXM4L-24A	MAGNECRAFT	1202cut055	RELAY SOR 8PIN DPDT 24V W LED
		1	70-459-1	MAGNECRAFT	1202cut064	SOCKET,RELAY 8PIN 2.65"X1.18"
RE	LOW	1	782XBXM4L-24A	MAGNECRAFT	1202cut055	RELAY SOR 8PIN DPDT 24V W LED
		1	70-459-1	MAGNECRAFT	1202cut064	SOCKET,RELAY 8PIN 2.65"X1.18"
RE	HIGH	1	782XBXM4L-24A	MAGNECRAFT	1202cut055	RELAY SOR 8PIN DPDT 24V W LED
		1	70-459-1	MAGNECRAFT	1202cut064	SOCKET,RELAY 8PIN 2.65"X1.18"

Sequence of Operation - Fuel Oil System

1. Three point level float switch in generator, boiler fuel supply tank.
2. If generator or boiler fuel tank Level hits the 30% volume switches then the corresponding solenoid valve gets energized and a signal is sent to the Tornq Tech panel.
3. If generator or boiler fuel tank Level hits the 90% volume switches then the corresponding solenoid valve gets de-energized and a signal is sent to the Tornq Tech panel.
4. Generator or boiler fuel tank level switch 10% volume to Alarm to control system, exterior red light gets lit and the Auto-Dialer sends out alarm trough the phone communication to the operator..
5. Lead pump to switch after 48 hours of total run time (depending on how the Tornq Tech panel has been configured).

REVISION HISTORY

1	16/11/2014	OA	B-52-B-0382/AS-BUILT

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ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	OA	RQ	11/17/14	11/16/14

FUREL OIL SYSTEM

B52B0382

602B

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INSTALLATION NOTES:

1. QTY. AND LOCATION AS PER MECHANICAL DRAWING M-502. TO BE CONFIRMED BY CONSULTANT.
2. QTY. AND LOCATION AS PER ADDENDUM 5. TO BE CONFIRMED BY CONSULTANT.
3. MECHANICAL STROBE SUPPLIED/INSTALLED BY OTHERS.

1 — 141-570 CV-2 (4); 134-1084 LTDE-2 (4) 5/32 deg C

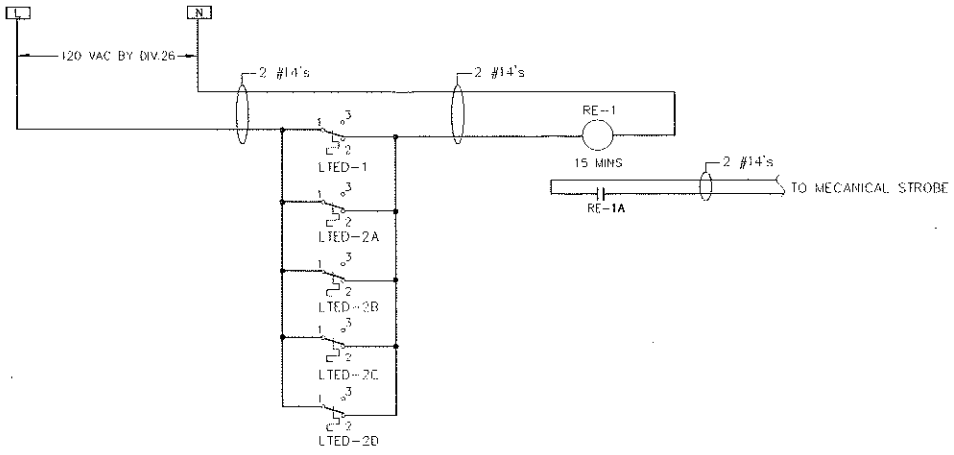
LOCATED IN CORRIDOR OF EACH WING. AFF 1500MM

2 — 141-570 CV-1; 134-1084 LTDE-1 5/32 deg C

LOCATED IN PROCESS ROOM AFF 1500MM

3 — W211ACPS0x-60 RE-1 15 MIN TIME DELAY RELAY; RE-A TO MECHANICAL STROBE WHICH LOCATED OUTSIDE FRONT OF BUILDING, AMBER IN COLOUR.

LOW BUILDING TEMPERATURE ALARM
INITIAL SETPOINT = 10 DEGREE C



REVISION HISTORY			
1	16/11/2014	OA	B-52-B-0382/AS-BUILT

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ENGINEER	DRAFTER	ENGINEER BYT	INITIAL RELEASE	LAST EDIT DATE
SF	SF	RQ	04/24/13	05/27/13

BLDG LOW TEMPERATURE ALARM

B-52-B-0382
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603

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Control Device		Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices						
CV	1-2	5	141-570	SIEMENS	155723	THERMOSTAT GUARD, CLEAR LOCKABLE
ETOE	1-2	5	134-1084	SIEMENS	155 017	T'STAT,N/C,LINE VOLT COM/EXP
RE	1	1	W211ACPSOX-80	MAGNECRAFT	1202cut062	TIME DELAY RELAY 60-900SEC ON
		1	70-464-1	MAGNECRAFT	1202cut066	SOCKET,RELAY 8PIN 2.02"X1.60"

Sequence of Operation - Low building temperature Alarm

1. In event of low building temperature as sensed by temperature sensor and 15 minute time delay, energize mechanical alarm strobe (by Div 26).
2. Initial setpoint = 10 deg C
3. Strobe to be located outside front of building, amber in color
4. Low temperature sensors located in process room and corridors in 4 wings. Located in pump room, mechanical room and generator room, long distance from exterior door.

REVISION HISTORY			
2	16/11/2014	QA	B-52-B-0382/AS-BUILT
1	9/26/2014	SF	Revised as per consultant's comments

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ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	SF	RQ		09/26/14

BLDG LOW TEMP ALARM - BOM

B-52-B-0382

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REVISION HISTORY

1	16/11/2014	OA	B-52-B-0382/AS-BUILT

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ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	OA	RQ	04/24/13	11/16/14

B52B0382

105

PXCM-005000 PXC100-PE96.A

PXC MODULAR

Module 1 / Rail 1

TXIO-00500X TXS1.12F4

POWER SUPPLY 24 Volt 4A

Module 2 / Rail 1

TXIO-005001 TXM1.6R-M

RE L 201HRV	2	(1)	IPH.HRV1.LOW 0.5.0.1.1 LDO ON/OFF HRV-1 LOW SPEED	IPH.HTG.P3.1 0.5.0.1.4 L2SL ON/OFF PUMP CONTROL	(4)	19 20 21	RE P3.1 401HTG
RE H 201HRV	8 9 10	(2)	IPH.HRV1.HIGH 0.5.0.1.2 LDO ON/OFF HRV-1 HIGH SPEED	IPH.HTG.P3.2 0.5.0.1.5 L2SL ON/OFF PUMP CONTROL	(5)	25 26 27	RE P3.2 401HTG
RE CF1 202MECHRM	14 15 16	(3)	IPH.CF1 0.5.0.1.3 L2SL ON/OFF CF-1 CONTROL	IPH.HTG.P3.3 0.5.0.1.6 L2SL ON/OFF PUMP CONTROL	(6)	31 32 33	RE P3.3 401HTG

Module 3 / Rail 1

TXIO-005002 TXM1.6R-M

RE P3.4 401HTG	2	(1)	IPH.HTG.P3.4 0.5.0.2.1 L2SL ON/OFF PUMP CONTROL	0.5.0.2.4 LDO	(4)	19 20 21	
RE B1 401HTG	8 9 10	(2)	IPH.HTG.B1.ENA 0.5.0.2.2 LDO ON/OFF BLR B-1 ENABLE	IPH.GEN.ALM 0.5.0.2.5 LDO ON/OFF GEN ALARM STROBE	(5)	25 26 27	RE BLR 401HTG
RE B2 401HTG	14 15 16	(3)	IPH.HTG.B2.ENA 0.5.0.2.3 LDO ON/OFF BLR B-2 ENABLE	IPH.WT.RWP1 0.5.0.2.6 L2SL ON/OFF PUMP CONTROL	(6)	31 32 33	RE RWP1 601WATER TREATMENT

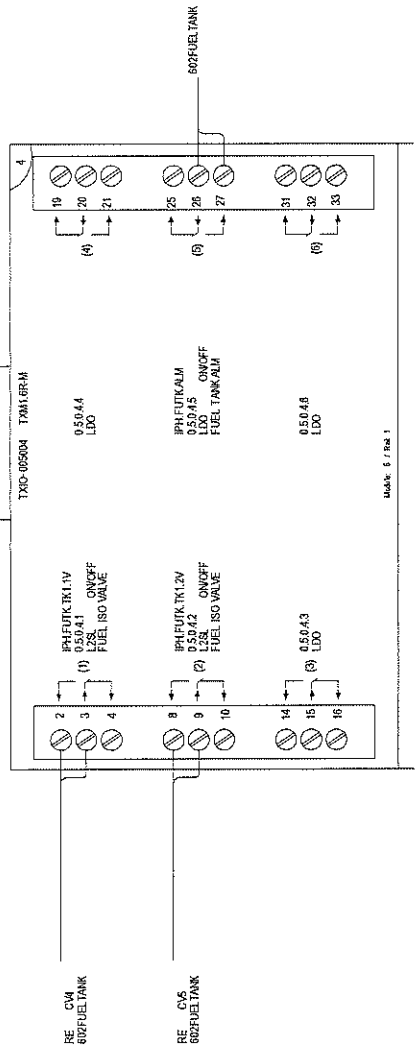
Module 4 / Rail 1

TXIO-005003 TXM1.6R-M

RE RWP2 601WATER TREATMENT	2	(1)	IPH.WT.RWP2 0.5.0.3.1 L2SL ON/OFF PUMP CONTROL	0.5.0.3.4 LDO	(4)	19 20 21	
RE PP1 601WATER TREATMENT	8 9 10	(2)	IPH.WT.PP1 0.5.0.3.2 L2SL ON/OFF PUMP CONTROL	IPH.FUTK.LOW 0.5.0.3.5 LDO ON/OFF FUEL TANK LOW	(5)	25 26 27	602FUELTANK
602FUELTANK	14 15 16	(3)	IPH.FUTK.RLALM 0.5.0.3.3 LDO ON/OFF RED LIGHT ALARM	IPH.FUTK.HIGH 0.5.0.3.6 LDO ON/OFF FUEL TANK HIGH	(6)	31 32 33	602FUELTANK

Module 5 / Rail 1

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REVISION HISTORY			
1	16/11/2014	OA	B-52-B-0382/AS-BUILT

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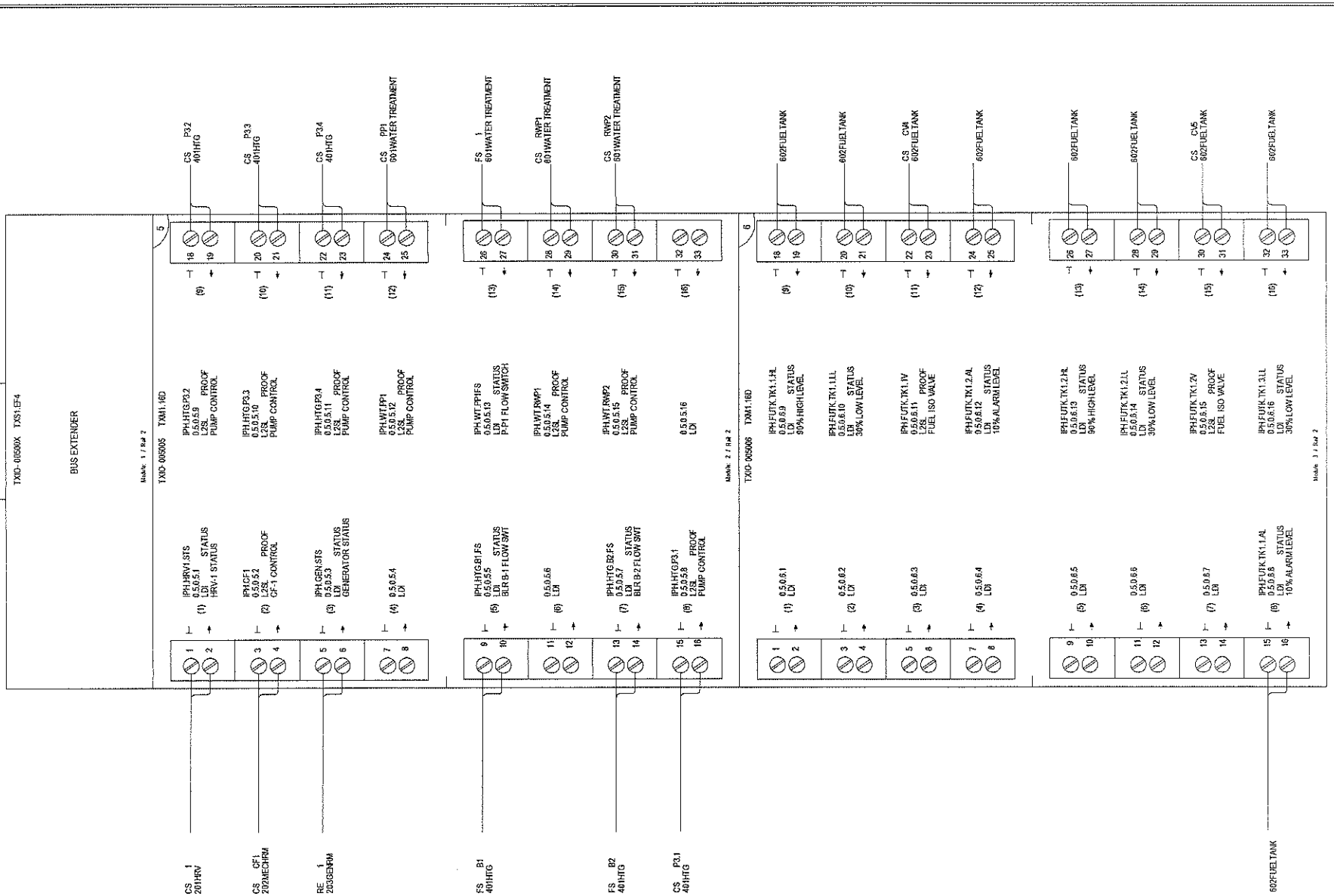
ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	OA	RQ	11/17/14	11/16/14

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REVISION HISTORY			
1	16/11/2014	OA	B-52-B-0382AS-BUILT

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ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SF	OA	RQ	11/17/14	11/16/14

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REVISION HISTORY

1	16/11/2014	CA	B--S2--B--0382/AS--BUILT

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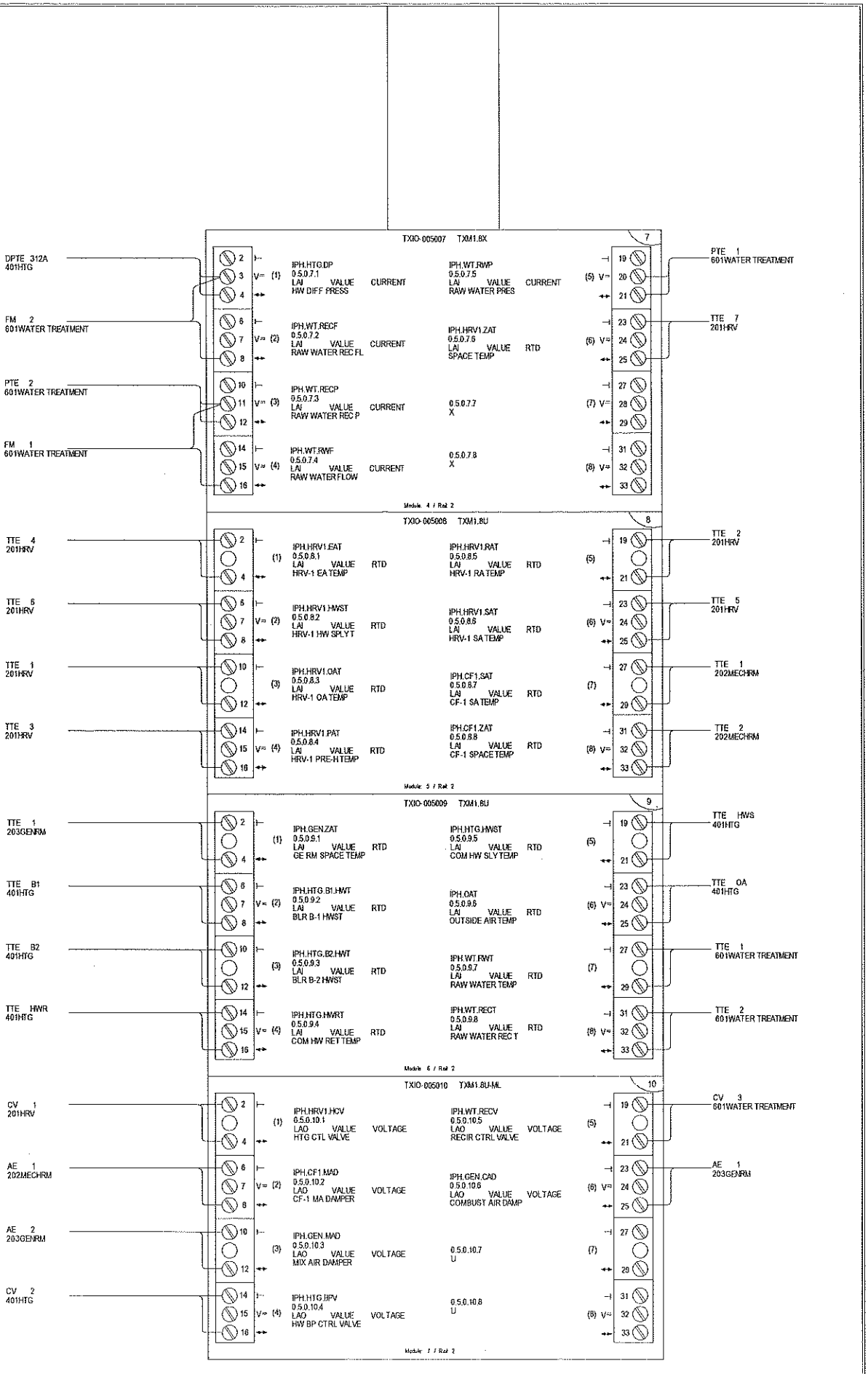
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SF	OA	RQ	11/17/14	11/16/14

IPH.PXCM.05p004

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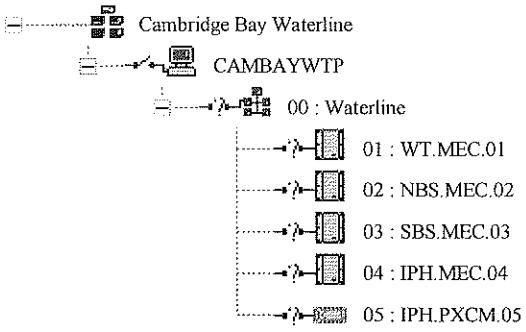
Siemens Canada
Edmonton

Pannel Point Report

Cambridge Bay
B-52-B-0382

Name	Type	Description	Function	Address	Alarms
IPH.HRV1.LOW	LDO	HRV-1 LOW SPEED	On/Off	0.5.0.1.1	No
IPH.HRV1.HIGH	LDO	HRV-1 HIGH SPEED	On/Off	0.5.0.1.2	No
IPH.CF1	L2SL	CF-1 CONTROL	On/Off	0.5.0.1.3	Std
IPH.HTG.P3.1	L2SL	PUMP CONTROL	On/Off	0.5.0.1.4	Std
IPH.HTG.P3.2	L2SL	PUMP CONTROL	On/Off	0.5.0.1.5	Std
IPH.HTG.P3.3	L2SL	PUMP CONTROL	On/Off	0.5.0.1.6	Std
IPH.HTG.P3.4	L2SL	PUMP CONTROL	On/Off	0.5.0.2.1	Std
IPH.HTG.B1.ENA	LDO	BLR B-1 ENABLE	On/Off	0.5.0.2.2	No
IPH.HTG.B2.ENA	LDO	BLR B-2 ENABLE	On/Off	0.5.0.2.3	No
IPH.GEN.ALM	LDO	GEN ALARM STROBE	On/Off	0.5.0.2.5	Std
IPH.WT.RWP1	L2SL	PUMP CONTROL	On/Off	0.5.0.2.6	Std
IPH.WT.RWP2	L2SL	PUMP CONTROL	On/Off	0.5.0.3.1	Std
IPH.WT.PP1	L2SL	PUMP CONTROL	On/Off	0.5.0.3.2	Std
IPH.FUTK.RL.ALM	LDO	RED LIGHT ALARM	On/Off	0.5.0.3.3	No
IPH.FUTK.LOW	LDO	FUEL TANK LOW	On/Off	0.5.0.3.5	Std
IPH.FUTK.HIGH	LDO	FUEL TANK HIGH	On/Off	0.5.0.3.6	No
IPH.FUTK.TK1.1V	L2SL	FUEL ISO VALVE	On/Off	0.5.0.4.1	Std
IPH.FUTK.TK1.2V	L2SL	FUEL ISO VALVE	On/Off	0.5.0.4.2	Std
IPH.FUTK.ALM	LDO	FUEL TANK ALM	On/Off	0.5.0.4.5	Std
IPH.HRV1.STS	LDI	HRV-1 STATUS	Status	0.5.0.5.1	No
IPH.CF1	L2SL	CF-1 CONTROL	Proof	0.5.0.5.2	Std
IPH.GEN.STS	LDI	GENERATOR STATUS	Status	0.5.0.5.3	Std
IPH.HTG.B1.FS	LDI	BLR B-1 FLOW SWT	Status	0.5.0.5.5	No
IPH.HTG.B2.FS	LDI	BLR B-2 FLOW SWT	Status	0.5.0.5.7	No
IPH.HTG.P3.1	L2SL	PUMP CONTROL	Proof	0.5.0.5.8	Std
IPH.HTG.P3.2	L2SL	PUMP CONTROL	Proof	0.5.0.5.9	Std
IPH.HTG.P3.3	L2SL	PUMP CONTROL	Proof	0.5.0.5.10	Std
IPH.HTG.P3.4	L2SL	PUMP CONTROL	Proof	0.5.0.5.11	Std
IPH.WT.PP1	L2SL	PUMP CONTROL	Proof	0.5.0.5.12	Std
IPH.WT.PP1FS	LDI	P-P1 FLOW SWITCH	Status	0.5.0.5.13	No
IPH.WT.RWP1	L2SL	PUMP CONTROL	Proof	0.5.0.5.14	Std
IPH.WT.RWP2	L2SL	PUMP CONTROL	Proof	0.5.0.5.15	Std
IPH.FUTK.TK1.1.AL	LDI	10% ALARM LEVEL	Status	0.5.0.6.8	Std
IPH.FUTK.TK1.1.HL	LDI	90% HIGH LEVEL	Status	0.5.0.6.9	Std
IPH.FUTK.TK1.1.LL	LDI	30% LOW LEVEL	Status	0.5.0.6.10	Std
IPH.FUTK.TK1.1V	L2SL	FUEL ISO VALVE	Proof	0.5.0.6.11	Std
IPH.FUTK.TK1.2.AL	LDI	10% ALARM LEVEL	Status	0.5.0.6.12	Std
IPH.FUTK.TK1.2.HL	LDI	90% HIGH LEVEL	Status	0.5.0.6.13	Std
IPH.FUTK.TK1.2.LL	LDI	30% LOW LEVEL	Status	0.5.0.6.14	Std
IPH.FUTK.TK1.2V	L2SL	FUEL ISO VALVE	Proof	0.5.0.6.15	Std
IPH.HTG.DP	LAI	HW DIFF PRESS	Value	0.5.0.7.1	No
IPH.WT.RECF	LAI	RAW WATER REC FL	Value	0.5.0.7.2	No
IPH.WT.RECP	LAI	RAW WATER REC P	Value	0.5.0.7.3	No
IPH.WT.RWF	LAI	RAW WATER FLOW	Value	0.5.0.7.4	No
IPH.WT.RWP	LAI	RAW WATER PRES	Value	0.5.0.7.5	No
IPH.HRV1.ZAT	LAI	SPACE TEMP	Value	0.5.0.7.6	Std
IPH.HRV1.EAT	LAI	HRV-1 EA TEMP	Value	0.5.0.8.1	No
IPH.HRV1.HWST	LAI	HRV-1 HW SPLY T	Value	0.5.0.8.2	No
IPH.HRV1.OAT	LAI	HRV-1 OA TEMP	Value	0.5.0.8.3	No
IPH.HRV1.PAT	LAI	HRV-1 PRE-H TEMP	Value	0.5.0.8.4	No
IPH.HRV1.RAT	LAI	HRV-1 RA TEMP	Value	0.5.0.8.5	No
IPH.HRV1.SAT	LAI	HRV-1 SA TEMP	Value	0.5.0.8.6	No
IPH.CF1.SAT	LAI	CF-1 SA TEMP	Value	0.5.0.8.7	Std
IPH.CF1.ZAT	LAI	CF-1 SPACE TEMP	Value	0.5.0.8.8	Std
IPH.GEN.ZAT	LAI	GE RM SPACE TEMP	Value	0.5.0.9.1	Std
IPH.HTG.B1.HWT	LAI	BLR B-1 HWST	Value	0.5.0.9.2	No
IPH.HTG.B2.HWT	LAI	BLR B-2 HWST	Value	0.5.0.9.3	No

IPH.HTG.HWRT	LAI	COM HW RET TEMP	Value	0.5.0.9.4	No
IPH.HTG.HWST	LAI	COM HW SLY TEMP	Value	0.5.0.9.5	No
IPH.OAT	LAI	OUTSIDE AIR TEMP	Value	0.5.0.9.6	No
IPH.WT.RWT	LAI	RAW WATER TEMP	Value	0.5.0.9.7	Std
IPH.WT.RECT	LAI	RAW WATER REC T	Value	0.5.0.9.8	Std
IPH.HRV1.HCV	LAO	HTG CTL VALVE	Value	0.5.0.10.1	No
IPH.CF1.MAD	LAO	CF-1 MA DAMPER	Value	0.5.0.10.2	No
IPH.GEN.MAD	LAO	MIX AIR DAMPER	Value	0.5.0.10.3	No
IPH.HTG.BPV	LAO	HW BP CTRL VALVE	Value	0.5.0.10.4	No
IPH.WT.RECV	LAO	RECIR CTRL VALVE	Value	0.5.0.10.5	No
IPH.GEN.CAD	LAO	COMBUST AIR DAMP	Value	0.5.0.10.6	No


Cambridge Bay Waterline
CAMBAYWTP
00 : Waterline
01 : WT.MEC.01
02 : NBS.MEC.02
03 : SBS.MEC.03
04 : IPH.MEC.04
05 : IPH.PXCM.05

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00010    C ****************************************************
00020    C ****** CAMBRIDGE BAY - PORTABLE WATER SYSTEM ******
00030    C ********* STANTEC PROJET # : 144901252 *************
00040    C ************* GN PROJECT # : 11-4002 ***************
00050    C ****************************************************
00060    C ******** SIEMENS PROJECT # : B-52-B-0382 ***********
00070    C ********* PROJECT DESIGNER : SALLY FENG ************
00080    C *********** PRJECT MANAGER : ADEEL CHOUDHRY ********
00090    C *************** TECHNICIAN : OMAR ALI ***************
00100    C ****************************************************
00110    C ************** PORTABLE WATER PROCESS **************
00120    C ********** CONTROL DRAWING : 601 *******************
00130    C ****************************************************
00140    C *************** CONTROLLER : PXCM-05 ***************
00150    C ********** CONTROL PROGRAM : PPCL_PWP **************
00160    C ******** REV.# ******** DATE ******** INIT. ********
00170    C ********* 1.0 ******* 03/10/14 ******* OA *********
00180    C ********* X.X ******* XX/XX/XX ******* XX *********
00190    C ********* X.X ******* XX/XX/XX ******* XX *********
00200    C ****************************************************
00210    C
00220    C POWER LOSS/REBOOT
00230    ONPWRT(530)
00240    C
00250    C RAW WATER PUMP RUNTIME TIMERS AND ALARMS
00260    SAMPLE(60)IF("IPH.WT.RWP1" .EQ. PRFON) THEN "IPH.WT.RWP1.RTT" =
         "IPH.WT.RWP1.RTT" + 1
00270    SAMPLE(60)IF("IPH.WT.RWP2" .EQ. PRFON) THEN "IPH.WT.RWP2.RTT" =
         "IPH.WT.RWP2.RTT" + 1
00271    IF("IPH.WT.RWP1" .EQ. ALARM) THEN ON("IPH.WT.RWP1.ALM")
00272    IF("IPH.WT.RWP1" .EQ. PRFON .AND. "IPH.WT.RWP1" .EQ. ON) THEN
         OFF("IPH.WT.RWP1.ALM")
00275    IF("IPH.WT.RWP2" .EQ. ALARM) THEN ON("IPH.WT.RWP2.ALM")
00276    IF("IPH.WT.RWP2" .EQ. PRFON .AND. "IPH.WT.RWP2" .EQ. ON) THEN
         OFF("IPH.WT.RWP2.ALM")
00280    C
00290    C RAW WATER PUMP LEAD CYCLING AT 168 RUNTIME HOURS WITH ALARM
         PRIORITISING
00330    IF("IPH.WT.RWP2" .EQ. ALARM .OR. "IPH.WT.RWP2.RTT" .GE. 10080) THEN
         GOTO 340 ELSE GOTO 360
00340    SET(1,"IPH.WT.RWPL")
00350    SET(0,"IPH.WT.RWP2.RTT")
00360    IF("IPH.WT.RWP1" .EQ. ALARM .OR. "IPH.WT.RWP1.RTT" .GE. 10080) THEN
         GOTO 370 ELSE GOTO 420
00370    SET(2,"IPH.WT.RWPL")
00380    SET(0,"IPH.WT.RWP1.RTT")
00390    C
00400    C NORMAL SEQUENCE
00420    IF("IPH.WT.RWPL" .EQ. 1) THEN ON("IPH.WT.RWP1") ELSE OFF("IPH.WT.RWP1")
00430    IF("IPH.WT.RWPL" .EQ. 2) THEN ON("IPH.WT.RWP2") ELSE OFF("IPH.WT.RWP2")
00440    IF("IPH.WT.RWP1" .EQ. PRFON .OR. "IPH.WT.RWP2" .EQ. PRFON) THEN
         ON("IPH.WT.PP1") ELSE OFF("IPH.WT.PP1")
00445    IF("IPH.WT.PP1" .NE. PRFON) THEN GOTO 540
00450    C
00460    C 50mm INTERNAL RECIRCULATION LINE CONTROLLED AT 350kPA BY
         RECIRCULATING VALVE
00470    LOOP (0, "IPH.WT.RECP", "IPH.WT.RECV", 350, 1000, 25, 0, 1, 50, 0,
         100, 0)
00480    C
00490    C END OF SEQUENCE
00500    GOTO 570
00510    C
00520    C POWER LOSS/REBOOT SEQUENCE
00530    OFF("IPH.WT.RWP1","IPH.WT.RWP2","IPH.WT.PP1")
00540    SET(100,"IPH.WT.RECV")
00550    C
00560    C END OF POWER LOSS/REBOOT SEQUENCE
00570    GOTO 260
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00010    C ****************************************************
00020    C ****** CAMBRIDGE BAY - PORTABLE WATER SYSTEM ******
00030    C ********* STANTEC PROJET # : 144901252 ************
00040    C ************ GN PROJECT # : 11-4002 **************
00050    C ****************************************************
00060    C ******** SIEMENS PROJECT # : B-52-B-0382 ***********
00070    C ********* PROJECT DESIGNER : SALLY FENG ************
00080    C *********** PRJECT MANAGER : ADEEL CHOUDHRY *******
00090    C *************** TECHNICIAN : OMAR ALI *************
00100    C ****************************************************
00110    C ***************** HEAT RECOVERY UNIT ***************
00120    C ********** CONTROL DRAWING : 201 ******************
00130    C ****************************************************
00140    C *************** CONTROLLER : PXCM-05 ***************
00150    C ********** CONTROL PROGRAM : PPCL_HRV-1 ************
00160    C ******** REV.# ******** DATE ******** INIT. ********
00170    C ********* 1.0 ******* 03/10/14 ******* OA *********
00180    C ********* X.X ******* XX/XX/XX ******* XX *********
00190    C ********* X.X ******* XX/XX/XX ******* XX *********
00200    C ****************************************************
00210    C
00220    C POWER LOSS/REBOOT SEQUENCE
00230    ONPWRT(370)
00231    C
00232    C ALARM SEQUENCE
00233    IF("IPH.HRV1.HIGH" .EQ. OFF .OR. "IPH.HRV1.LOW" .EQ. OFF) THEN
         SET(0,SECND1)
00234    IF("IPH.HRV1.HIGH" .EQ. ON .OR. "IPH.HRV1.LOW" .EQ. ON .AND.
         "IPH.HRV1.STS" .EQ. OFF .AND. SECND1 .GE. 120) THEN ON("IPH.HRV1.ALM")
         ELSE OFF("IPH.HRV1.ALM")
00240    C
00250    C TEMPERATURE CTRL FROM THE ZONE AIR SENSOR
00260    LOOP(128,"IPH.HRV1.SAT","IPH.HRV1.HCV","IPH.HRV1.TCS",1000,25,0,1,50,0,
         100,0)
00270    C
00280    C LOW/HIGH FAN SPEED ADJUSTMENT BY THE ROOM TEMPERATURE SENSOR AND
         SETPOINT
00285    "IPH.HRV1.HTS" = "IPH.HRV1.TCS" + 1
00290    DBSWIT(0, "IPH.HRV1.ZAT", "IPH.HRV1.TCS", "IPH.HRV1.HTS",
         "IPH.HRV1.FCS")
00300    SAMPLE(1)IF("IPH.HRV1.FCS" .AND. "IPH.HRV1.HCV" .LE. 5) THEN
         ON("IPH.HRV1.HIGH") ELSE OFF("IPH.HRV1.HIGH")
00310    SAMPLE(1)IF("IPH.HRV1.FCS" .AND. "IPH.HRV1.HCV" .GT. 5) THEN
         OFF("IPH.HRV1.LOW") ELSE ON("IPH.HRV1.LOW")
00320    C
00330    C END OF NORMAL SEQUENCE
00340    GOTO 410
00350    C
00360    C POWER LOSS/REBOOT SEQUENCE
00370    OFF("IPH.HRV1.LOW","IPH.HRV1.HIGH")
00380    SET(0,"IPH.HRV1.HCV")
00390    C
00400    C END OF LOSS/REBOOT SEQUENCE
00410    GOTO 260
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00010    C ****************************************************
00020    C ****** CAMBRIDGE BAY - PORTABLE WATER SYSTEM ******
00030    C ********* STANTEC PROJET # : 144901252 *************
00040    C ************* GN PROJECT # : 11-4002 ***************
00050    C ****************************************************
00060    C ******** SIEMENS PROJECT # : B-52-B-0382 **********
00070    C ********* PROJECT DESIGNER : SALLY FENG ************
00080    C *********** PRJECT MANAGER : ADEEL CHOUDHRY *******
00090    C *************** TECHNICIAN : OMAR ALI **************
00100    C ****************************************************
00110    C ***************** HEATING PLANT SYSTEM *************
00120    C ********** CONTROL DRAWING : 401 ******************
00130    C ****************************************************
00140    C *************** CONTROLLER : PXCM-05 ***************
00150    C ********** CONTROL PROGRAM : PPCL_HPS **************
00160    C ******** REV.# ******** DATE ******** INIT. *******
00170    C ********* 1.0 ******* 03/10/14 ******* OA **********
00180    C ********* X.X ******* XX/XX/XX ******* XX **********
00190    C ********* X.X ******* XX/XX/XX ******* XX **********
00200    C ****************************************************
00210    C
00220    C POWER LOSS/REBOOT
00230    ONPWRT(800)
00240    C
00250    C BOILER & PUMP RUNTIME TIMERS
00260    SAMPLE(60)IF("IPH.HTG.B1.ENA") THEN "IPH.HTG.B1.RTT" =
         "IPH.HTG.B1.RTT" + 1
00270    SAMPLE(60)IF("IPH.HTG.B2.ENA") THEN "IPH.HTG.B2.RTT" =
         "IPH.HTG.B2.RTT" + 1
00280    SAMPLE(60)IF("IPH.HTG.P3.3" .EQ. PRFON) THEN "IPH.HTG.P3.3.RTT" =
         "IPH.HTG.P3.3.RTT" + 1
00290    SAMPLE(60)IF("IPH.HTG.P3.4" .EQ. PRFON) THEN "IPH.HTG.P3.4.RTT" =
         "IPH.HTG.P3.4.RTT" + 1
00291    IF("IPH.HTG.B1.ENA" .EQ. OFF) THEN SET(0,SECND1)
00292    IF("IPH.HTG.B2.ENA" .EQ. OFF) THEN SET(0,SECND2)
00300    C
00310    C ALARM SETTINGS & ATTRIBUTIONS
00320    C IF("IPH.HTG.P3.1" .EQ. PRFON .AND. "IPH.HTG.B1.FS" .EQ. OFF) THEN
         ON("IPH.HTG.B1.FSA") ELSE OFF("IPH.HTG.B1.FSA")
00330    C IF("IPH.HTG.P3.2" .EQ. PRFON .AND. "IPH.HTG.B2.FS" .EQ. OFF) THEN
         ON("IPH.HTG.B2.FSA") ELSE OFF("IPH.HTG.B2.FSA")
00340    IF("IPH.HTG.P3.1" .EQ. ALARM .OR. (SECND1 .GT. 300 .AND.
         "IPH.HTG.B1.HWT" .LT. 60)) THEN ON("IPH.HTG.B1A") ELSE
         OFF("IPH.HTG.B1A")
00341    IF("IPH.HTG.B1A") THEN ON("IPH.HTG.B1.ALM")
00345    IF("IPH.HTG.P3.1" .EQ. PRFON .AND. "IPH.HTG.P3.1" .EQ. ON) THEN
         OFF("IPH.HTG.B1.ALM")
00350    IF("IPH.HTG.P3.2" .EQ. ALARM .OR. (SECND2 .GT. 300 .AND.
         "IPH.HTG.B2.HWT" .LT. 60)) THEN ON("IPH.HTG.B2A") ELSE
         OFF("IPH.HTG.B2A")
00351    IF("IPH.HTG.B2A") THEN ON("IPH.HTG.B2.ALM")
00355    IF("IPH.HTG.P3.2" .EQ. PRFON .AND. "IPH.HTG.P3.2" .EQ. ON) THEN
         OFF("IPH.HTG.B2.ALM")
00356    IF("IPH.HTG.P3.3" .EQ. ALARM) THEN ON("IPH.HTG.P3.3A")
00357    IF("IPH.HTG.P3.3" .EQ. PRFON .AND. "IPH.HTG.P3.3" .EQ. ON) THEN
         OFF("IPH.HTG.P3.3A")
00358    IF("IPH.HTG.P3.4" .EQ. ALARM) THEN ON("IPH.HTG.P3.4A")
00359    IF("IPH.HTG.P3.4" .EQ. PRFON .AND. "IPH.HTG.P3.4" .EQ. ON) THEN
         OFF("IPH.HTG.P3.4A")
00360    C
00365    C GENERAL ALARM FOR PWP AND HPS SYSTEM
00370    IF("IPH.HTG.HWST" .LT. 60 .OR. "IPH.WT.RWT" .LT. 1 .OR. "IPH.WT.RECT"
         .LT. 1) THEN ON("IPH.GEN.ALM") ELSE OFF("IPH.GEN.ALM")
00390    C
00400    C PUMP LEAD CYCLING AT 168 RUNTIME HOURS WITH ALARM PRIORITISING
00410    IF("IPH.HTG.B1.ALM" .AND. "IPH.HTG.B2.ALM") THEN SET(0,"IPH.HTG.P3L")
         ELSE GOTO 440
00420    GOTO 550
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00440    IF("IPH.HTG.P3.4" .EQ. ALARM .OR. "IPH.HTG.P3.4.RTT" .GE. 10080) THEN
         GOTO 450 ELSE GOTO 470
00450    SET(1,"IPH.HTG.P3L")
00460    SET(0,"IPH.HTG.P3.4.RTT")
00470    IF("IPH.HTG.P3.3" .EQ. ALARM .OR. "IPH.HTG.P3.3.RTT" .GE. 10080) THEN
         GOTO 480 ELSE GOTO 550
00480    SET(2,"IPH.HTG.P3L")
00490    SET(0,"IPH.HTG.P3.3.RTT")
00500    C
00510    C BOILER LEAD CYCLING AT 168 RUNTIME HOURS WITH ALARM PRIORITISING
00550    IF("IPH.HTG.B2A" .EQ. ON .OR. "IPH.HTG.B2.RTT" .GE. 10080) THEN GOTO
         560 ELSE GOTO 580
00560    SET(1,"IPH.HTG.BL")
00570    SET(0,"IPH.HTG.B2.RTT")
00580    IF("IPH.HTG.B1A" .EQ. ON .OR. "IPH.HTG.B1.RTT" .GE. 10080) THEN GOTO
         590 ELSE GOTO 630
00590    SET(2,"IPH.HTG.BL")
00600    SET(0,"IPH.HTG.B1.RTT")
00610    C
00620    C NORMAL SEQUENCE
00630    DBSWIT (1, "IPH.OAT", 13, 16, "IPH.HTG.P3.TRA")
00635    DBSWIT (1, "IPH.HTG.HWST", 80, 85, "IPH.HTG.B.ENA")
00640    IF("IPH.HTG.P3L" .EQ. 0) THEN OFF("IPH.HTG.P3.3","IPH.HTG.P3.4")
00650    IF("IPH.HTG.P3L" .EQ. 1 .AND. "IPH.HTG.P3.TRA" .EQ. ON) THEN
         ON("IPH.HTG.P3.3") ELSE OFF("IPH.HTG.P3.3")
00660    IF("IPH.HTG.P3L" .EQ. 2 .AND. "IPH.HTG.P3.TRA" .EQ. ON) THEN
         ON("IPH.HTG.P3.4") ELSE OFF("IPH.HTG.P3.4")
00680    IF("IPH.HTG.BL" .EQ. 1) THEN ON("IPH.HTG.P3.1") ELSE
         OFF("IPH.HTG.P3.1")
00690    IF("IPH.HTG.BL" .EQ. 2) THEN ON("IPH.HTG.P3.2") ELSE
         OFF("IPH.HTG.P3.2")
00700    IF("IPH.HTG.P3.1" .EQ. PRFON .AND. "IPH.HTG.P3.1" .EQ. ON .AND.
         "IPH.HTG.B.ENA" .EQ. ON) THEN ON("IPH.HTG.B1.ENA") ELSE
         OFF("IPH.HTG.B1.ENA")
00710    IF("IPH.HTG.P3.2" .EQ. PRFON .AND. "IPH.HTG.P3.2" .EQ. ON .AND.
         "IPH.HTG.B.ENA" .EQ. ON) THEN ON("IPH.HTG.B2.ENA") ELSE
         OFF("IPH.HTG.B2.ENA")
00720    C
00730    C HOT WATER PRESSURE CTRL WITH BYPASS VALVE
00740    LOOP (0, "IPH.HTG.DP", "IPH.HTG.BPV", "IPH.HTG.DPS", 1000, 25, 0, 1,
         50, 0, 100, 0)
00750    C
00760    C END OF SEQUENCE
00770    GOTO 830
00780    C
00790    C POWER LOSS/REBOOT SEQUENCE
00800    OFF("IPH.HTG.B1.ENA","IPH.HTG.B2.ENA","IPH.HTG.P3.1","IPH.HTG.P3.2","IP
         H.HTG.P3.3","IPH.HTG.P3.4")
00810    C
00820    C END OF POWER LOSS/REBOOT SEQUENCE
00830    GOTO 260
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00010    C ***************************************************
00020    C ****** CAMBRIDGE BAY - PORTABLE WATER SYSTEM ******
00030    C ********* STANTEC PROJET # : 144901252 ************
00040    C ************ GN PROJECT # : 11-4002 **************
00050    C ***************************************************
00060    C ******** SIEMENS PROJECT # : B-52-B-0382 **********
00070    C ********* PROJECT DESIGNER : SALLY FENG ************
00080    C *********** PRJECT MANAGER : ADEEL CHOUDHRY *******
00090    C *************** TECHNICIAN : OMAR ALI **************
00100    C ***************************************************
00110    C ************ GENERATOR ROOM VENTILATOR *************
00120    C ********** CONTROL DRAWING : 203 ******************
00130    C ***************************************************
00140    C *************** CONTROLLER : PXCM-05 ***************
00150    C ********** CONTROL PROGRAM : PPCL_GRV **************
00160    C ******** REV.# ******** DATE ******** INIT. *******
00170    C ********* 1.0 ******* 03/10/14 ******* OA *********
00180    C ********* X.X ******* XX/XX/XX ******* XX *********
00190    C ********* X.X ******* XX/XX/XX ******* XX *********
00200    C ***************************************************
00210    C
00220    C POWER LOSS/REBOOT SEQUENCE
00230    ONPWRT(405)
00240    C
00250    C GENERATOR OFF TIMER
00260    IF("IPH.GEN.STS") THEN SET(0,SECND1)
00270    C
00310    C MODULATES DAMPERS WHEN GENERATOR IS ON
00320    LOOP (0, "IPH.GEN.ZAT", "IPH.GEN.MAD", "IPH.GEN.TCS", 1000, 25, 0, 1,
         50, 0, 100, 0)
00330    IF(SECND1 .LT. "IPH.GEN.CAT") THEN SET(100,"IPH.GEN.CAD") ELSE
         SET(0,"IPH.GEN.CAD")
00350    C
00360    C END OF NORMAL SEQUENCE
00390    GOTO 410
00395    C
00400    C C POWER LOSS/REBOOT SEQUENCE
00405    SET(0,"IPH.GEN.MAD","IPH.GEN.CAD")
00410    GOTO 260
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00010    C ***************************************************
00020    C ****** CAMBRIDGE BAY - PORTABLE WATER SYSTEM ******
00030    C ********* STANTEC PROJET # : 144901252 ************
00040    C ************ GN PROJECT # : 11-4002 **************
00050    C ***************************************************
00060    C ******** SIEMENS PROJECT # : B-52-B-0382 **********
00070    C ********* PROJECT DESIGNER : SALLY FENG ************
00080    C *********** PRJECT MANAGER : ADEEL CHOUDHRY ********
00090    C *************** TECHNICIAN : OMAR ALI ***************
00100    C ***************************************************
00110    C ****************** FUEL OIL SYSTEM ****************
00120    C ********** CONTROL DRAWING : 602 ******************
00130    C ***************************************************
00140    C *************** CONTROLLER : PXCM-05 ***************
00150    C ********** CONTROL PROGRAM : PPCL_FOS **************
00160    C ******** REV.# ******** DATE ******** INIT. ********
00170    C ********* 1.0 ******* 03/10/14 ******* OA *********
00180    C ********* X.X ******* XX/XX/XX ******* XX *********
00190    C ********* X.X ******* XX/XX/XX ******* XX *********
00200    C ***************************************************
00210    C
00220    C ALARM TRANFSER TO TORNA TECH PANNEL
00230    IF("IPH.FUTK.TK1.1.LL" .EQ. ON .OR. "IPH.FUTK.TK1.2.LL" .EQ. ON) THEN
         ON("IPH.FUTK.LOW") ELSE OFF("IPH.FUTK.LOW")
00240    IF("IPH.FUTK.TK1.1.HL" .EQ. ON .AND. "IPH.FUTK.TK1.2.HL" .EQ. ON) THEN
         OFF("IPH.FUTK.HIGH") ELSE ON("IPH.FUTK.HIGH")
00250    IF("IPH.FUTK.TK1.1.AL" .EQ. ON .OR. "IPH.FUTK.TK1.2.AL" .EQ. ON) THEN
         ON("IPH.FUTK.ALM","IPH.FUTK.RL.ALM") ELSE OFF("IPH.FUTK.ALM",
         "IPH.FUTK.RL.ALM")
00260    C
00270    C DETERMINES WHEN THE SOLENOID VALVES OPENS AND CLOSES
00280    IF("IPH.FUTK.TK1.1.LL" .EQ. ON .OR. "IPH.FUTK.TK1.1.AL" .EQ. ON) THEN
         ON("IPH.FUTK.TK1.1V")
00290    IF("IPH.FUTK.TK1.1.HL" .EQ. ON) THEN OFF("IPH.FUTK.TK1.1V")
00300    IF("IPH.FUTK.TK1.2.LL" .EQ. ON .OR. "IPH.FUTK.TK1.2.AL" .EQ. ON) THEN
         ON("IPH.FUTK.TK1.2V")
00310    IF("IPH.FUTK.TK1.2.HL" .EQ. ON) THEN OFF("IPH.FUTK.TK1.2V")
00320    C
00330    C END OF SEQUENCE
00340    GOTO 230
```

```
00010    C ****************************************************
00020    C ****** CAMBRIDGE BAY - PORTABLE WATER SYSTEM ******
00030    C ********* STANTEC PROJET # : 144901252 ************
00040    C ************ GN PROJECT # : 11-4002 **************
00050    C ****************************************************
00060    C ******** SIEMENS PROJECT # : B-52-B-0382 **********
00070    C ********* PROJECT DESIGNER : SALLY FENG ************
00080    C *********** PRJECT MANAGER : ADEEL CHOUDHRY ********
00090    C *************** TECHNICIAN : OMAR ALI **************
00100    C ****************************************************
00110    C ************* MECHANICAL ROOM COOL FAN *************
00120    C ********** CONTROL DRAWING : 202 *******************
00130    C ****************************************************
00140    C *************** CONTROLLER : PXCM-05 ***************
00150    C ********** CONTROL PROGRAM : PPCL_CF-1 *************
00160    C ******** REV.# ******** DATE ******** INIT. ********
00170    C ********* 1.0 ******* 03/10/14 ******* OA *********
00180    C ********* X.X ******* XX/XX/XX ******* XX *********
00190    C ********* X.X ******* XX/XX/XX ******* XX *********
00200    C ****************************************************
00210    C
00220    C POWER LOSS/REBOOT SEQUENCE
00230    ONPWRT(400)
00240    C
00250    C STOPS THE SYSTEM IF SUPPLY TEMPERATURE SENSOR GOES BELOW 10°C
00260    IF("IPH.CF1.SAT" .EQ. ALARM) THEN GOTO 400
00270    C
00280    C ACTIVATES THE SYSTEM IF ROOM TEMPERATURE SENSOR GOES ABOVE 25°C,
         DEACTIVATES WHEN GOES BELLOW 22°C
00290    DBSWIT (0, "IPH.CF1.ZAT", 22, 25, "IPH.CF1")
00300    C
00310    C MODULATES MIX AIR DAMPERS FOR TEMPERATURE CTRL FROM THE SUPPLY AIR
         TEMPERATURE SENSOR
00320    IF("IPH.CF1" .EQ. PRFON) THEN GOTO 340 ELSE SET(0,"IPH.CF1.MAD")
00330    GOTO 440
00340    LOOP (0, "IPH.CF1.SAT", "IPH.CF1.MAD", 20, 1000, 25, 0, 1, 50, 0, 100,
         0)
00350    C
00360    C END OF NORMAL SEQUENCE
00370    GOTO 440
00380    C
00390    C POWER LOSS/REBOOT OR ALARM SEQUENCE
00400    SET(0,"IPH.CF1.MAD")
00410    OFF("IPH.CF1")
00420    C
00430    C END OF POWER LOSS/REBOOT OR ALARM SEQUENCE
00440    GOTO 260
```

C

POTABLE WATER SYSTEM – PHASE 1

CAMBRIDGE BAY, NU

ELECTRICAL OPERATION AND MAINTENANCE MANUAL

JULY 2014

Ryfan Kitikmeot Ltd.
Box 297, Kugluktuk, NU X0E 0E0
Email: dfraser@ryfan.ca

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1.0 General

2.0 Power System

3.0 Lighting

4.0 Exit & Emergency Lighting

5.0 Generator

6.0 Record Drawings

7.0 Certifications & Warranties

Electrical Contractor Contact Information

Ryfan Electric Ltd.

P.O. Box 4204

485 South Avenue

Spruce Grove, AB

T7X 3B4

Ph: (780)960-3601

Fx: (780)962-3266

Contact: Darren Fraser

Electrical Consultant Contact Information

Stantec Architecture Ltd.

4910 – 53rd Street

Yellowknife, NT

X1A 2P4

Ph: (867)920-2882

Fx: (867)920-4319

Contact: Kosta Gavrikov

Power System Materials

Wesco Distribution
#14760 – 116th Avenue
Edmonton, AB
T5M 3G1
Ph. (780)452-7920
Fax (780)451-2195
Contact: Jeff Shemely

Heat Trace Materials

Eecol Electric
16021 – 121A Avenue
Edmonton, AB
T5V 1H1
Ph. (780) 451-6481
Fax (780)453-2524
Contact: Ken Lukinuk

Lighting (*including* Exit & Emergency)

Wesco Distribution
#14760 – 116th Avenue
Edmonton, AB
T5M 3G1
Ph. (780)452-7920
Fax (780)451-2195
Contact: Jeff Shemely

Generator

Wajax Power Systems
#10025 – 51st Ave.
Edmonton, AB
T6E 0A8
Ph. (780)989-4965
Fax (780)437-6864
Contact: Bilal Abukhodair

Section 26 60 00 – Spare Parts

The following spare parts were turned over at the end of the project;

LIGHTING

.1 Lamps:
  .1 Furnish 10 percent spare lamps for each size and type installed.
.2 Ballasts:
  .1 Furnish 5 percent spare ballasts for each size and type.

MOTOR STARTERS

.1 Three (3) spare fuses of each type and size used.
.2 One (1) set of each type of adjustable thermal overload device.
.3 One (1) spare coil of each starter size.
.4 Two (2) spare control transformers.
.5 One spare time delay device of each type used.

GENERATOR

.1 Six (6) fuel filter replacement elements
.2 Six (6) oil filter elements
.3 Six (6) air cleaner replacement elements
.4 Two (2) fuses of each type used in control panel
.5 Two (2) accessory belts of each type used on engine
.6 Special; tools for servicing

Ryfan representative

Owners representative

Date

2.0 Power Systems

Section 2.0 - Power Systems

Overview

The power system includes a meter, service entrance board, transfer switches, central distribution panels, a generator, and branch panelboards. The panels have all been labeled with lamacoids and the panel directories for all the sub panels are located inside the door of each panel. The breaker for the circuit powering the fire alarm panel has been painted red. For specific details on the equipment used see the shop drawings in this section.

Maintenance

Generally, the breakers and distribution equipment are maintenance free however, annual interior/ exterior cleaning of all distribution equipment is recommended. This should be performed by a qualified electrician. The only problem that might be experienced is in the event a circuit becomes overloaded it will open or "trip". Should this happen, remove the load from the circuit, and then locate the tripped breaker in the panel. Push the breaker handle all the way to the off position. This resets the breaker and you should be able to feel and hear an audible click. After resetting the breaker push it all the way to the on position. Power should now be restored to the circuit. If the breaker will not reset, confirm that everything connected to the circuit has been disconnected. If it still will not reset, call a qualified electrician to correct the problem.

WARNING: When resetting a breaker, make sure that you stand back and to the side and shield your eyes before turning the breaker back on to prevent injury in case of catastrophic failure of the breaker.

Grounding

The grounding system for the facility is done with the installation of a grounded cable sized appropriately for the system. A lead is attached to the neutral bar in the main switchgear. No maintenance is required on the wire; however care must be taken when working around the building so as not to inadvertently damage the conductor. Should the ground conductor become damaged do not attempt to repair it yourself. A repair to this part of the installation must be done by a qualified electrician.

Wiring devices

All wiring devices used in this facility are high quality "specification grade". Replacement devices should be of the same quality and manufacturer as those being replaced. Refer to the particular shop drawings for these devices.

Motor Starters and control

As a result of the horse power rating of some of the electric motors, a relay c/w with a manual motor starter and hand/off/auto selector switch is used to start and stop the motor. The control devices operated by the operator actually control the magnetic coil of the relay and this in turn switches the power to the motor. Located inside the enclosures are devices

called "heaters". These measure the amount of electrical current the motor is using. If the motor is using too much current then the heaters will interrupt the control circuit and disconnect the power to the motor. This prevents the motor from overheating and eventually burning up. To reset the power to the contactor after it has tripped, wait 5 minutes for the heaters to cool down then turn off the switch on the front of the enclosure. You should hear and feel it click. The motor is now ready to restart. If the tripping continues have the motor and / or contactor serviced by a qualified service man. The manual motor starters located throughout the building operate the same way.

WARNING: Do not attempt to reset the heaters with the enclosure door open. The enclosure is designed to contain equipment failure when the door is closed and all the screws are tight, thus assuring operator safety.

SANAQATIIT CONSTRUCTION LTD.

Shop Drawing Transmittal

Project Name:	Potable Water System – Phase I		
Sanaqatiit Project Number:	12-505	**Submittal Number:**	12-505-05
Owner Project Number:	11-4002		
Product Description:	Transfer switch	**Specification Number:**	26 36 23
Total Pages:	21 including cover	**Submitted by:**	Sarah Fox
To:	Warren McLeod, Stantec	**CC:**	Arlen Foster, Stantec Walter Orr, Stantec
Via:	Electronic Submission	**Date:**	February 6, 2013

SHOP DRAWINGS ARE REVIEWED UNLESS NOTED OTHERWISE

REVIEWED AS MODIFIED

REVISE & RESUBMIT

SEAL & SIGNATURES REQUIRED

Stantec

DATE Feb 11/2013

SIGNATURE

REVIEW BY STANTEC IS FOR THE SOLE PURPOSE OF ASCERTAINING GENERAL CONFORMITY WITH DESIGN. CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS, FABRICATION AND CONSTRUCTION METHODS. COORDINATION OF SUB-TRADES, DETAIL DESIGN OF COMPONENTS, AND ERRORS OR OMISSIONS ON SHOP DRAWINGS.

SANAQATIIT CONSTRUCTION LTD.
SHOP DRAWING REVIEWED
BY
FEB 06 2013

- REVIEWED
- REVIEWED AS NOTED
- REVISE AND RESUBMIT

SHOP DRAWING REVIEW

Project: Cambridge Bay Potable Water System

Location: Cambridge Bay, NU

General Contractor: Sanaqatiit Construction Ltd.

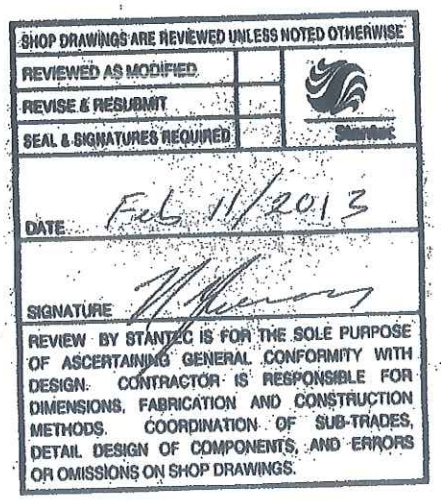
Engineer: Stantec

Section 26 36 23 Automatic Transfer Switch

Reviewed by: Darren Fraser

APPROVED
By Darren Fraser at 11:07 am, Feb 01, 2013

Ryfan Kitikmeot Ltd.
Box 297, Kugluktuk, NU X0E 0E0
Email: dfraser@ryfan.ca

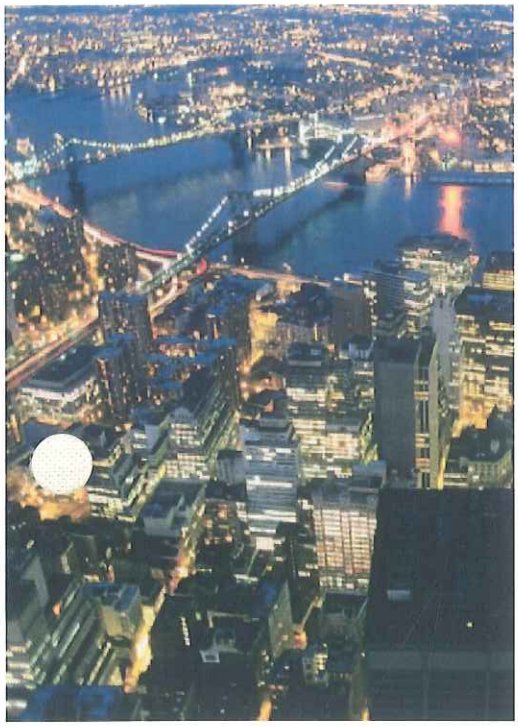


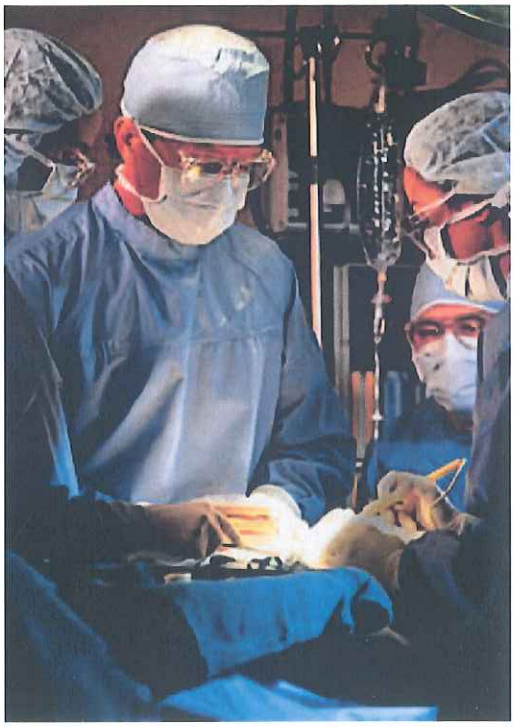
Business-Critical Continuity

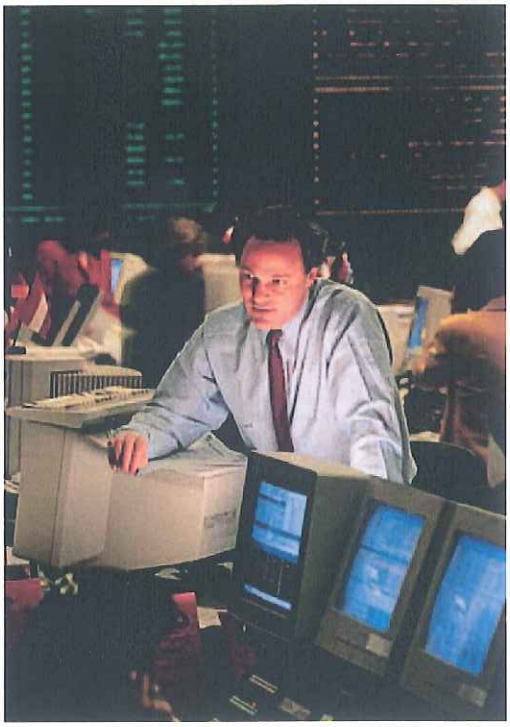
Non- Bypass Automatic Transfer Switch

APPROVED
By Darren Fraser at 11:07 am, Feb 01, 2013

ASCO 7000 SERIES Power Transfer Switches



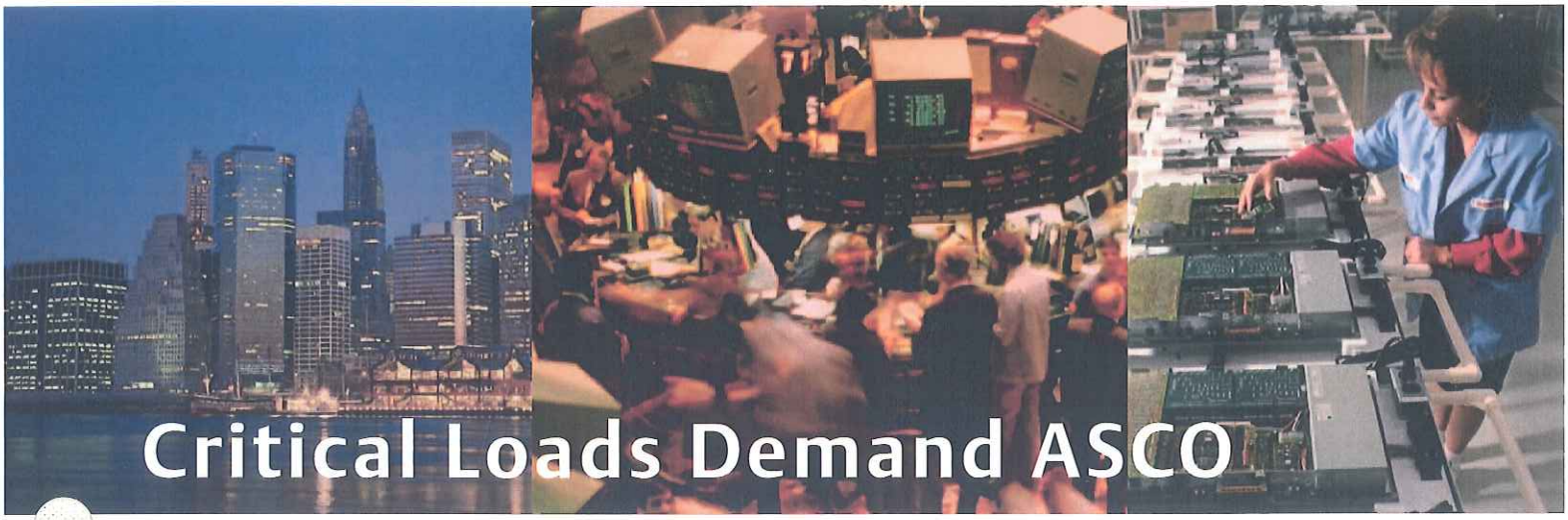




ASCO Power Technologies®

EMERSON Network Power

ASCO® 7000 Series



- **Healthcare Facilities**
- **Commercial Buildings / Industrial Buildings**
- **Web Hosting, Internet Data Centers**
- **Telecom Central Offices**
- **Process Manufacturing / Wafer Fabrication Plants /**
- **Distributed Power / Load Management**

As we become more dependent on the quality and reliability of electrical power, interruption or complete loss of power can create serious and even crippling financial losses, or impose dangers to life and safety.

ASCO Power Technologies (ASCO) provides the solutions to handle the transfer of critical loads to emergency sources reliably and with state of the art products. Using ASCO products can mean the difference between a minor inconvenience and a major catastrophe. You'll find ASCO Power Transfer Switches wherever there is a critical load to be protected.

When flexibility in power switching is a must, ASCO offers a variety of product solutions to meet virtually every application requirement, including distributed generation applications. That's why the 7000 Series is available in open, delayed, closed and closed soft load configurations. Additionally, switched or overlapping neutral options provide for reliable operation of ground fault protection systems and reduction of voltage transients from unbalanced load switching.
ASCO Power Transfer Switches are the first CE Marked, IEC 60947-6-1 compliant Transfer Switches in the world.

ASCO® The Recognized Leader in Power Transfer Switch Technology Offers the Most Advanced Transfer Switches in the World.

7000 Series

ASCO Power Transfer Switches are the standard of the industry. High speed transfer of loads between alternate sources of power, regardless of ampacity size, is achieved by a reliable, field proven solenoid operating mechanism. When combined with a programmable microprocessor controller with keypad and LCD display, they offer the most advanced method of transferring all types of loads, such as motors, electronic drives, UPSs and microprocessor based systems. 7000 Series Power Transfer Switches are available open or enclosed, in ampacity sizes from 30 through 4000 amperes with the largest selection of optional accessories offered anywhere. All switching configurations are available with an integrally mounted bypass-isolation switch and/or rated for use in service entrance applications.

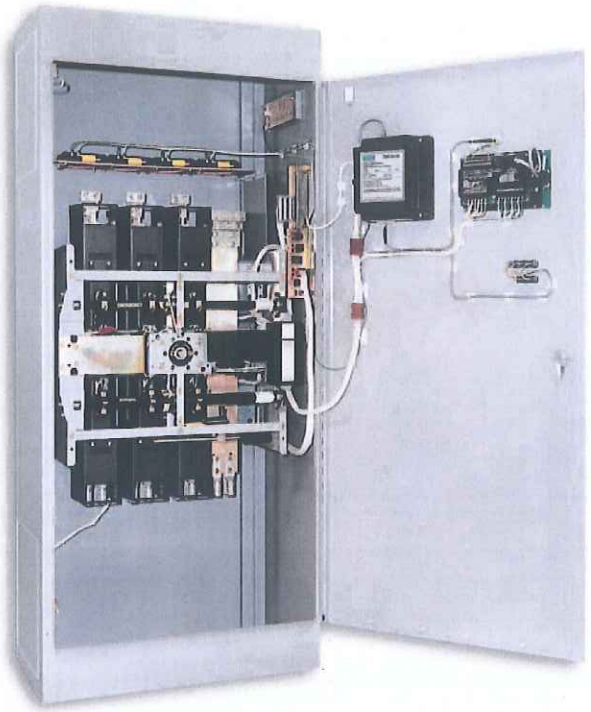


Fig. 1: Three Pole 7000 Series Automatic Transfer Switch rated 1600 amperes (shown with optional front connected terminals and Power Manager).

7000 Series Power Transfer Switches Product Features

- Conventional two-position transfer configuration, plus closed and delayed transition modes of operation. All configurations available with either automatic or non-automatic control.
- UL listed to 1008 Transfer Switch Equipment & CSA certified to CSA 22.2 No.178-1978 Automatic Transfer Switches.
- Qualified and certified to IEC 60947-6-1, CE marked (optional). (Limited to certain accessories.)
- Rated up to 600 VAC, 30 through 4000 amperes.
- Reliable and field proven solenoid operating mechanism.
- High withstand and close-on ratings including short time withstand current rating for optimum flexibility in circuit breaker coordination (600-4000 amperes).
- Solid, switched, or overlapping neutral conductor options.
- Front replaceable main and arcing contacts (800-4000 amperes).
- Programmable microprocessor controller with keypad and LCD display.
- Centrally located terminal block for customer control connections (260-4000 amperes).
- 16mm, industrial grade control switches and indicating lights.
- Switch position LED indicators and source acceptability lights.
- Standard ground conductor connections.
- Four auxiliary contacts, two contacts closed when switch is in normal position and two contacts closed when switch is in emergency position.
- Local/remote communications capability for interfacing with ASCO Power*Quest*® or *Site*Web® communication products.

ASCO® 7000 Series Microprocessor Controller



Fig. 11: 7000 Series Microprocessor Controller.

The 7000 Series Microprocessor Based Controller is used with all sizes of Power Transfer Switches from 30 through 4000 amperes. It represents the most advanced digital controller in the industry and includes, as standard, all of the voltage, frequency, control, timing and diagnostic functions required for most emergency and standby power applications.

Because of severe voltage transients frequently encountered with industrial distribution systems, the microprocessor logic board is separated and isolated from the power board as shown below. This improves electrical noise immunity performance and helps assure compliance with the rigorous transient suppression standards highlighted below.

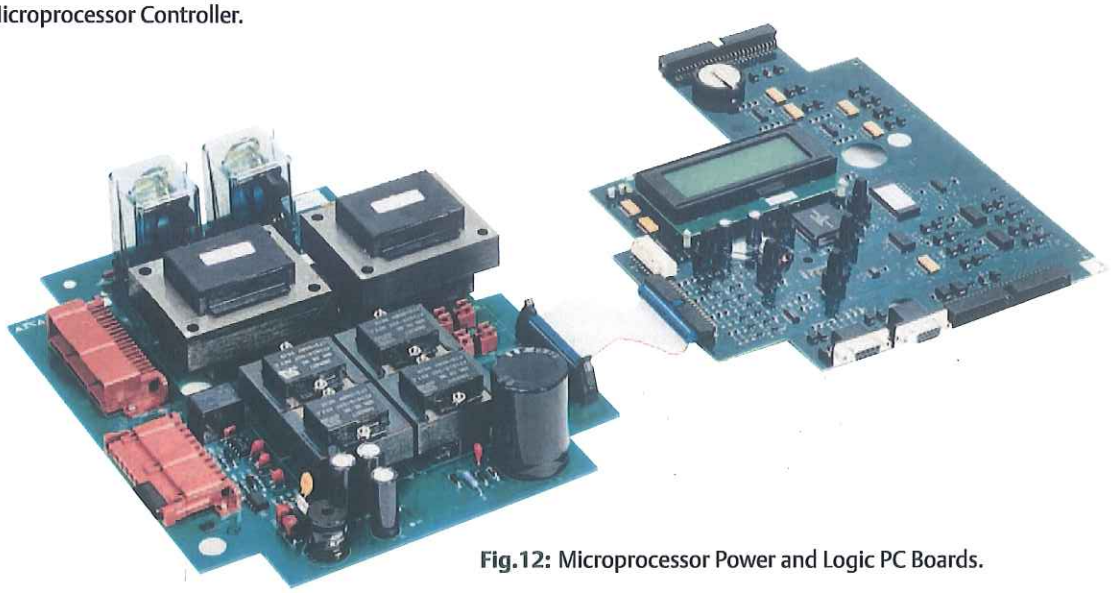


Fig.12: Microprocessor Power and Logic PC Boards.

7000 Series Microprocessor Based Controller

Emission Standard - Group 1, Class A	EN 55011:1991
Generic Immunity Standard, from which:	EN 50082-2:1995
Electrostatic Discharge (ESD) Immunity	EN 61000-4-2:1995
Radiated Electromagnetic Field Immunity	ENV 50140:1993
Electrical Fast Transient (EFT) Immunity	EN 61000-4-4:1995
Surge Transient Immunity	EN 61000-4-5:1995
Conducted Radio-Frequency Field Immunity	EN 61000-4-6:1996
Voltage Dips, Interruptions and Variations Immunity	EN 61000-4-11:1994

ASCO® 7000 Series Microprocessor Controller

Features

- Digital microprocessor.
- Touch pad programming of features and settings without the need for meters, or variable power supplies.
- Sixteen (16) selectable operating voltages available in a single Controller.
- On-board diagnostics provide control panel and ATS status information to analyze system performance.
- Displays and counts down active timing functions.
- Selectable multi-language display (English, German, Portuguese, Spanish, or French. For others contact ASCO).
- Password protection to prevent unauthorized tampering of settings.
- Remote monitoring and control with ASCO Power*Quest*® and *Site*Web™ communications products. Specify optional accessory 72A or 72E.
- Load shed option for SYNCHROPOWER® bus optimization applications. Specify optional accessory 30B.
- Historical event log
- Statistical ATS systems monitoring information

Voltage and Frequency Sensing

- 3-Phase under and over voltage settings on normal and emergency sources.
- Under and over frequency settings on normal and emergency.
- True RMS Voltage Sensing with +/- 1% accuracy; Frequency Sensing Accuracy is +/- 0.2%.
- Selectable settings: single or three phase voltage sensing on normal and emergency; 50 or 60Hz.
- Phase sequence sensing for phase sensitive loads.
- Voltage unbalance detection between phases.

Status and Control Features

- Output contact (N/O or N/C) for engine-start signals.
- Selection between "commit/no-commit" on transfer to emergency after engine start and normal restores before transfer.
- Advanced inphase algorithm which automatically measures the frequency difference between the two sources and initiates transfer at appropriate phase angles to minimize disturbances when transferring motor loads.
- Event log displays 99 logged events with the time and date of the event, event type and event reason.
- Output signals for remote indication of normal and emergency source acceptability
- Statistical ATS/System monitoring data screens which provide:
  - Total number of ATS transfers.
  - Number of ATS transfers caused by power source failure.
  - Total number of days ATS has been in operation.
  - Total number of hours that the normal and emergency sources have been available.

Time Delays

- Engine start time delay - delays engine starting signal to override momentary normal source outages - adjustable 0 to 6 seconds.
- Transfer to emergency time delay - adjustable 0 to 60 minutes.
- Emergency source stabilization time delay to ignore momentary transients during initial generator set loading - adjustable 0 to 6 seconds.
- Retransfer to normal time delay with two settings:
  - Power failure mode - 0 to 60 minutes.
  - Test mode - 0 to 60 minutes.
- Unloaded running time delay for engine cooldown - adjustable 0 to 60 minutes.
- Pre and post transfer signal time delay for selective load disconnect with a programmable bypass on source failures - adjustable 0 to 5 minutes. This signal can be used to drive a customer furnished relay, or for (2) sets of double throw contacts rated 3 amps at 480 volts AC, specify ASCO optional accessory 31Z.
- Fully programmable engine exerciser with seven independent routines to exercise the engine generator, with or without loads, on a daily, weekly, bi-weekly or monthly basis.
- Contains all alarm signals, logic and time delays for use with closed transition switches.
  - Insynch time delay - 0 to 3 seconds.
  - Failure to synchronize - 1 to 5 minutes.
  - Extended parallel - 0.1 to 1.0 seconds.
- Delayed transition load disconnect time delay - adjustable 0 to 5 minutes.

ASCO® 7000 Series User Controls and Indicators

Control Switches and Indicating Lights for Conventional 2-Position Switches

- Switch position indicating lights (16 mm, industrial grade LEDs).
- Source acceptability indicating lights with true indication of the acceptability of each source, as determined by the voltage, frequency, voltage unbalance, and phase sequence settings of the control panel (16mm, industrial grade LEDs).
- Three position (16mm, industrial grade type) selector switch:
- Automatic: Normal maintained position.
- Test: Momentary position to simulate normal source failure for system test function.
- Reset Delay Bypass: Momentary position to bypass transfer and re-transfer time delay.

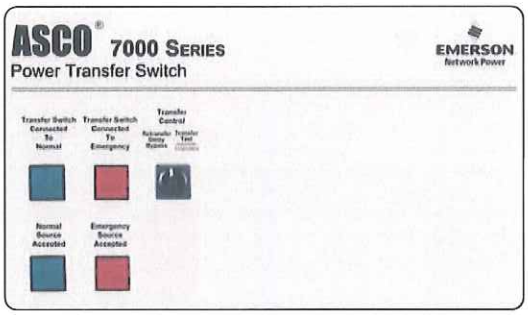


Fig. 13: 7000 Series User Controls and Indicators.

Control Switches and Indicating Lights for Closed Transition Switches

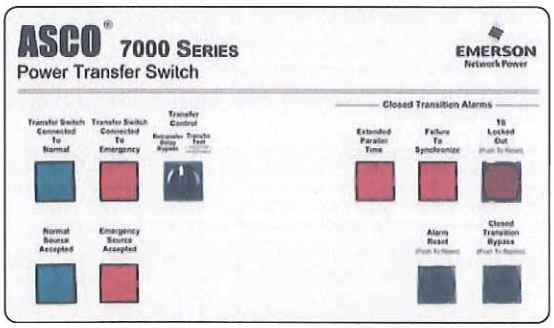


Fig. 14: 7000 Series User Controls and Indicators.

- Extended Parallel Time - Provides visual indication when the pre-set extended parallel time has been exceeded. The controls automatically open the emergency or normal main contacts. Separate contact also available to shunt trip external breaker.
- Failure To Synchronize - Visually displays a failure to synchronize alarm if the time delay settings is exceeded, during closed transition transfer operation.
- TS Locked Out - Prevents transfer in either direction if the extended parallel time is exceeded.
- Alarm Reset - Resets extended parallel and failure to synchronize alarms.
- Closed Transition Bypass - Pushbutton allows transfer between sources in an open transition mode.

7000 Series Power Control Center



Fig. 15: 7000 Series
Power Control Center.

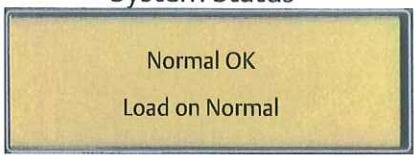
The 7000 Series microprocessor controller is a Power Control Center which allows the user to easily access detailed information on: system status; power source parameters; voltage, frequency and time delay settings; optional feature settings; historical event log; and system diagnostics. A four line, (20) character LCD has a backlit display which enables easy viewing under all conditions. The user can navigate through all screens using only six buttons, which also allows selection of: (18) different source parameter settings; (16) standard time delays; (12) standard feature settings; up to seven independent engine exercise routines; and even the language (English, German, Spanish, French, etc.) which appears on the display.

Since the Power Control Center must be visible and operable through the enclosure door, it has been qualified for use in industrial and outdoor applications. This includes installation in Type 3R (outdoor/rainproof), 4 (weatherproof) and 12 (indoor/industrial) enclosures.

ASCO® 7000 Series Power Control Center Screens

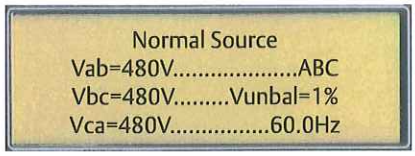
Status

System Status



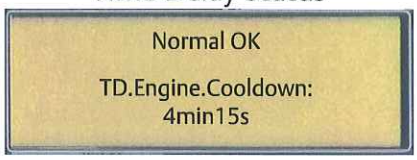
Displays system status in clear, concise language. Message shown indicates normal source is acceptable and the load is connected to the normal source.

Source Status



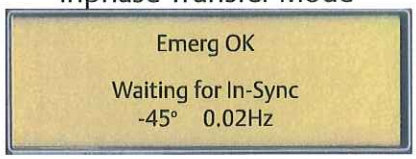
Displays voltage for each phase, frequency, phase rotation and voltage unbalance for both normal and emergency sources.

Time Delay Status



Active time delay status displays time remaining until next control event.

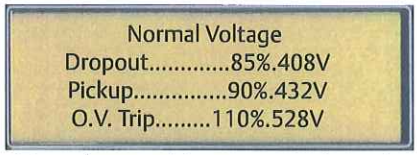
Inphase Transfer Mode



Displays the relative phase angle between sources and frequency differential to indicate the controller is awaiting an inphase condition.

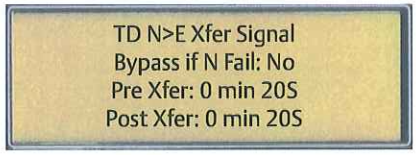
Settings

Voltage and Frequency Settings



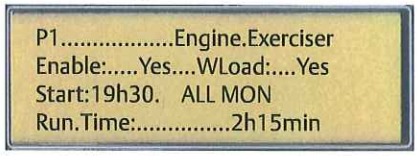
Provides voltage and frequency setting values for normal and emergency sources. Voltage pick-up, dropout and trip settings are set in percentage of nominal voltage and are also displayed in rms voltage values.

Time Delay Settings



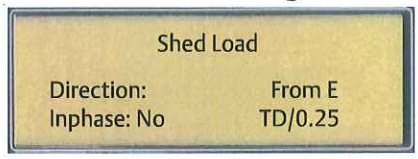
Provides direct reading display for setting time delays.

Engine Exerciser



Seven independent programs, load/no load selection, flexible run times and daily, weekly, bi-weekly and monthly exercise routines.

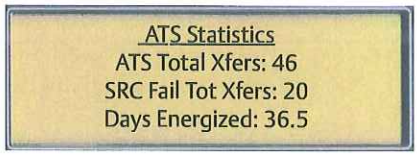
Feature Settings



Standard features can be activated with the keypad. As an example, when enabled, the "shed load" option causes the transfer switch to transfer the load off of the specified source. If desired, the load shed transfer can be made inphase.

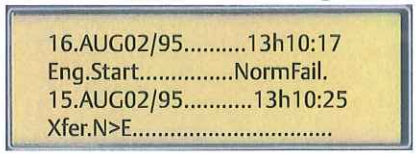
Data Logging

ATS Statistics



Instant availability of statistical information on total number of ATS transfers, number of transfers caused by power failures and total days controller has been energized, plus more.

Historical Event Log



Displays detailed information for last 99 events, including time of occurrence, length of event, date and reason for event.

ASCO® 7000 Series Optional Accessories

Time Delays

2C Provides an extended time delay on engine starting. The standard feature one time delay is adjustable from zero to six seconds. Accessory 2C allows this time delay to be adjustable from zero to sixty minutes in one second intervals factory set at five minutes.

1G Similar to accessory 2C except using 24 volt DC external input signal. 7000 Series controller remains active when both power sources are de-energized

Manual Controls for Automatic Transfer Switches

6C Reset switch for manual retransfer to normal with automatic retransfer in the event of emergency source failure.

6D Selector switch for automatic/manual retransfer to normal. Automatic bypass if emergency fails.

Engine Generator Controls and Accessories

12 Three position engine control selector switch. Positions: 1-Stop 2-Automatic 3-Engine Test

Note: Switches with accessory 12 must be labeled as a non-automatic transfer switch according to UL 1008.

Engine controls containing "engine stop" positions should be located at the engine generator. (Consult ASCO for application assistance.)

Indicators

14A/14B Additional auxiliary contact sets to indicate switch position. Two sets are standard. Specify total number of sets if more are required.

18B Two-pole, double-throw contacts operate when emergency source voltage is present at transfer switch terminals.

18G Two-pole, double-throw contacts operate when normal source voltage is present at transfer switch terminals.

99 "Push-to-Test" feature on all pilot light indicators.

Customer Control Circuits

30A Load-shedding circuit initiated by opening of a customer-supplied contact.

30B* Load-shedding circuit initiated by removal of customer-supplied control voltage. *(Specify voltage).

31Z Selective load disconnect control contacts (two provided) which operate with time delay prior to and/or after load transfer and retransfer.

43R Terminal block for all customer control connections on 30-150 amp only (standard on all other sizes).

Note: An externally operable quick-make, quick-break (QMQB), manual handle is available on some 7000 Series product configurations. (Consult ASCO for guidance.)

Neutral Conductor Options

- Solid neutral, with fully-rated terminals. (AL-CU) UL Listed.
- Conventional neutral switching pole.
- Overlapping neutral transfer contacts. Allows for proper ground-fault sensing and avoids generator voltage transients during transfer.

Note: Specify neutral option in catalog number, see page 21 for instructions.

Extension Harness

37B Six foot (6') extension harness to increase distance between transfer switch and control panel on open-type units.

Analog Load Metering Options

23B Three phase ammeter with selector switch (with current transformers and shorting blocks).

24B Three phase voltmeter with selector switch.

Note: Refer to ASCO 5200 Series Power Manager on page 15 which provides voltage, frequency and power monitoring.

Serial Communications

72A Serial communication module for remote communications to ASCO Power*Quest*® products.

72E Connectivity module for remote communications using ethernet TCP/IP networks

Surge Protection

ASCO Pulsar 450 rated 40KA

73AC1 Normal source protection. (3Ø, 4wire WYE)
73AC2 Emergency source protection. (3Ø, 4wire WYE)
73AC3 Load side protection. (3Ø, 4wire WYE)

Note: Other distribution voltages available (Contact ASCO).

Special Applications

111A Generator - to - Generator for Standby Applications
111B Generator - to - Generator for Prime Power Applications

Bypass Isolation Switch Options

14A1 Auy contact to close in "Bypass to Normal" position.

14B1 Auxiliary contact to close in "Bypass to Emergency" position.

14T Auxiliary contact to close when transfer switch is in "Automatic" position.

14U Auxiliary contact to close when transfer switch is in "Isolate" position.

14V Auxiliary; contact to close when transfer switch is in "Test" position.

82B Lifting yoke for transition switch removal on 600-3000 amp.*

82C Automatic shutters for bus isolation when transfer switch is withdrawn.*

* see page 6 for details

ASCO® 5200 Series Power Manager

The ASCO 5200 Series Power Manager is a microprocessor based metering device that provides real-time measurements of single and three phase power systems. The Power Manager uses digital signal processing technology to measure voltage and current per phase; real, reactive and apparent power, and bi-directional energy. All measurements can be viewed locally with a backlit liquid crystal display and/or displayed remotely with ASCO Power*Quest*® or *Site*Web® products.

Direct voltage input for systems up to 600 Volts AC can be monitored without the use of external potential transformers (PTs). Measures three phase currents and a fourth current input is available for measuring current in the neutral conductor. The Power Manager includes one discrete input for transfer switch position, eight general purpose discrete inputs, and four relay outputs for monitoring and controlling external devices.

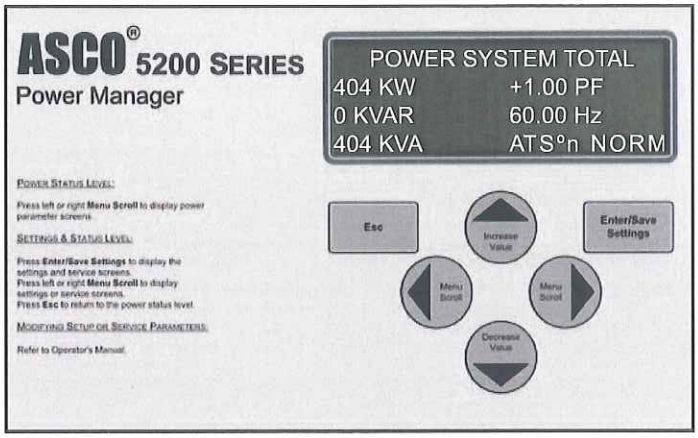


Fig. 16: ASCO 5200 Series Power Manager.

Power Metering

- Voltage:
  Line - Line: VAB, VBC, VCA, VAVERAGE
  Line - Neutral: VAN, VBN, VCN, VAVERAGE
- Frequency: 45.0 to 66.0 Hertz
- Current: IA, IB, IC, IAVERAGE
- Unbalance %: Voltage, Amps
- Real Power: KWA, KWB, KWC, KWNET
- Reactive Power: KVARA, KVARB, KVARC, KVARNET
- Apparent Power: KVAA, KVAB, KVAC, KVANET
- Real Energy: KWHIMPORT, KWHEXPORT, KWHNET
- Reactive Energy: KVARHIMPORT, KVARHEXPORT, KVARHNET
- Power Factor: PFA, PFB, PFC, PFNET

Data Access

- Eight digital inputs, four relay outputs.
- Input/Output 15-character, user definable screen display for identification of input/output signals.

Communications

- RS485 (2) or (4) wire serial capability.
- Includes Modbus RTU.
- Ethernet compatible when combined with 5150 Connectivity Module (72E).

Configurable Designations

- Local - A four line, 20 character LCD backlit display.
- Remote - Integrated 4 wire RS485 port; optional 5110 Serial Module (72A) or 5150 Communications Module (72E) and power manager monitoring systems.
- Provides user programmable setpoints based on twelve metering and I/O parameters. Each setpoint allows the user to select the parameter, the trip & reset levels, the trip & reset time delays and the alarm type or relay output to trigger. This can be used for protective relaying and peak shaving applications.
- 100 event data logging feature.

Integrated ATS Features

When configured on load of ATS:

- Displays ATS position.
- Displays power data as a function of ATS position (normal/emergency).
- Accumulates energy data separately for normal and emergency sources.

Optional Configurations and Connection Arrangements

Connected To:	With Display	Without Display
Load	Acc. 85L	Acc. 75L
Normal	Acc. 85N	Acc. 75N
Emergency	Acc. 85M	Acc. 75M
Load (BPS only)	Acc. 85R*	Acc. 75R*

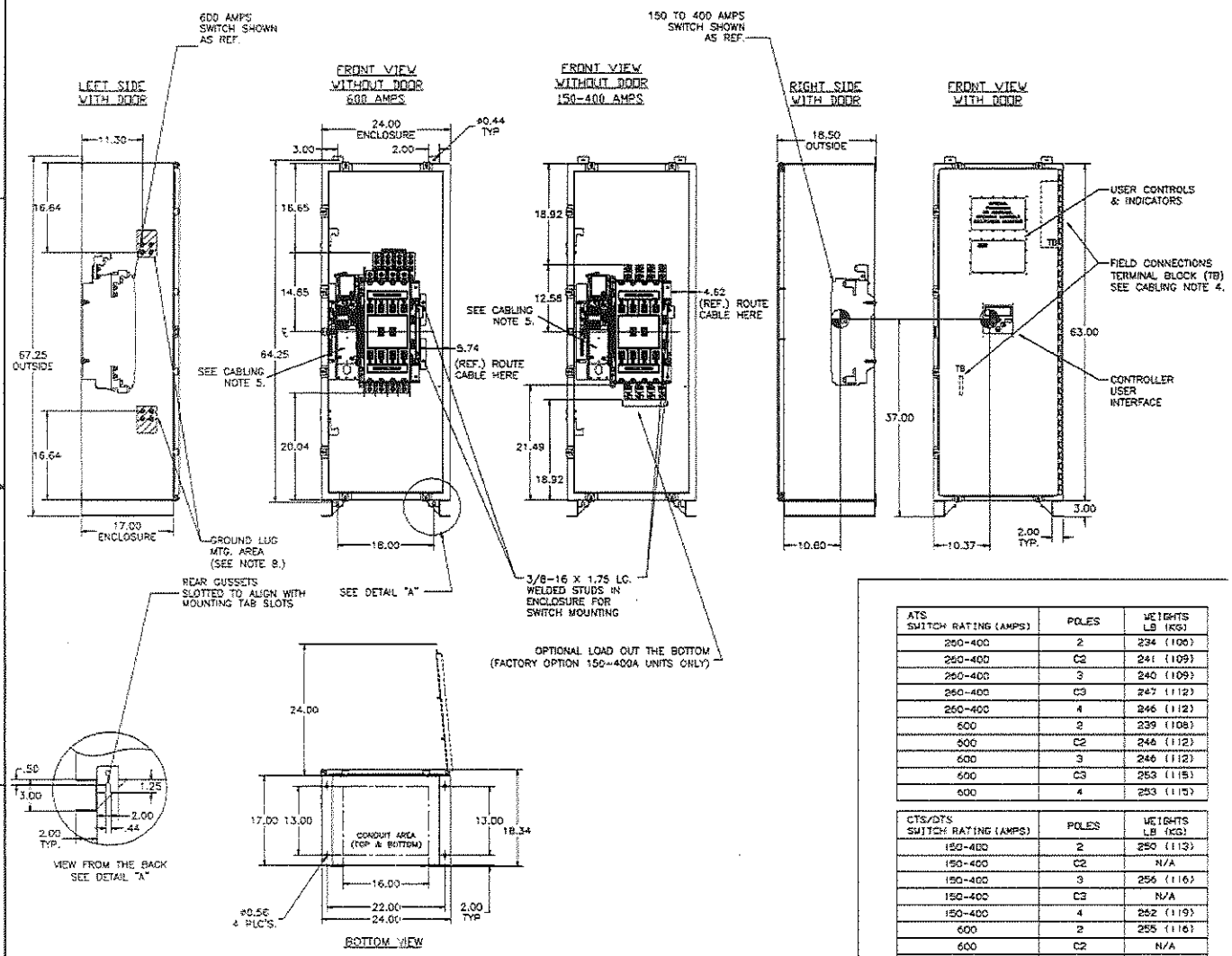
Add suffix "A" to above designations if neutral conductor monitoring is required.

Note: Accessory 75 and 85 includes component mounting, CTs, shorting blocks and all necessary interwiring.

**Bypass & isolation switch contacts wired to discrete Power Manager inputs.*

Note: The ASCO Power Manager is also available as a separate unit for monitoring electrical parameters anywhere in the power distribution system.

OUTLINE FOR ASCO® 4000 & 7000 SERIES 150-600 AMPERE "J" FRAME (ATS,ACTS,ADTS) FRONT CONNECTED TRANSFER SWITCHES TYPE 4/4X ENCLOSURE



GENERAL NOTES

1. TYPE 4/4X ENCLOSURE, FREE STANDING, FLOOR OR WALL MOUNTABLE, 14 GAUGE CONSTRUCTION.
2. FINISH: TYPE 4: ANSI 61 GRAY POLYESTER SEMI GLOSS ELECTROSTATIC POWDER.
   OTHER ANSI COLORS AVAILABLE CONSULT FACTORY. UL RECOGNIZED.
   FINISH TYPE 4X: ENCLOSURE BODY AND DOOR - SMOOTH BRUSHED #3.
3. RECOMMENDED CLEARANCES:
   FRONT: 24 INCHES.
4. A 20% RATED GROUND BUS IS PROVIDED.
5. UNIT IS DESIGNED FOR COMBINATION TOP AND BOTTOM CABLE ENTRY. THE STANDARD SWITCH CONFIGURATION IS FOR TOP LUGS EMERGENCY AND LOAD AND BOTTOM LUGS NORMAL, OPTIONALLY, THE SWITCH MAY BE SUPPLIED WITH REVERSE NORMAL & EMERGENCY LUGS. (REFER TO THE WIRING DIAGRAM FURNISHED WITH EACH TRANSFER SWITCH TO DETERMINE TERMINATION POSITIONS).
6. A FULL RATED NEUTRAL CONNECTION FOR EACH SOURCE AND THE LOAD IS OPTIONAL WHEN PROVIDED IT IS IN ONE OF THE FOLLOWING FORMATS AS SPECIFIED BY THE CATALOG NO. NEUTRAL TYPE;
   A. SOLID (COPPER BUS) NEUTRAL
   B. SWITCHED NEUTRAL POLE
   C. OVERLAPPING NEUTRAL POLE (NOT AVAILABLE ON 7ACTS/ADTS UNITS)
7. CENTER OF GRAVITY.
8. WHEN INSTALLING GROUND LUGS TO TYPE 4 ENCLOSURE, REMOVE HARDWARE FROM STUDS AND REMOVE MASKING PLATES TO EXPOSE UNPAINTED SURFACE.

CABLING NOTES

1. ALL SIZES SUPPLIED STANDARD WITH MECHANICAL (SCREW TYPE) LUGS. (SEE AMP SIZE BELOW)
   A. LUG MATERIAL: ALUMINUM ALLOY 6061-T6 WITH ELECTRO TIN PLATED FINISH.
   B. SCREW MATERIAL: ALUMINUM ALLOY 6262-T9 WITH ELECTRO TIN PLATED FINISH.
   C. UL LISTED, CSA CERTIFIED.
   D. LUG SCREW TIGHTENING TORQUE PER UL 486B: 19 FT-LBS.
   E. SUITABLE WIRE BENDING SPACE IS PROVIDED. (SEE AMP SIZE BELOW)
2. CONSULT FACTORY FOR OTHER TERMINATION REQUIREMENTS.
3. GROUND LUGS ARE PROVIDED STANDARD AS FOLLOWS. (SEE AMP SIZE BELOW)
4. CUSTOMER TERMINAL BLOCKS:
   FOR ALL 7000 SERIES AND 4000 SERIES ACTS, ADTS, NCTS, & NDTS UNITS THE TB WILL BE MOUNTED ON THE UPPER RIGHT INSIDE OF ENCLOSURE.
   FOR 4000 SERIES ATS AND NTS UNITS TB WILL BE MOUNTED ON THE TRANSFER SWITCH FRAME AS INDICATED.

NOTES 150-400 AMP SWITCHES

1. SUPPLIED WITH STANDARD MECHANICAL (SCREW TYPE) LUGS ON THE NORMAL, EMERGENCY & LOAD BUS STABS. ONE (1) LUG PER PHASE AND NEUTRAL EACH SUITABLE FOR CONNECTION OF TWO (2) 1/0 -250MCM CU/AL CABLES OR ONE (1) #4 -600MCM CU/AL CABLE.
   A. SUITABLE WIRE BENDING SPACE IS PROVIDED FOR UP TO ONE (1) 600MCM CABLE PER TERMINAL PER NEC.
2. OPTIONAL COPPER CRIMP LUGS MAY BE SUPPLIED. UP TO ONE (1) TWO HOLE, LONG BARREL CU CRIMP LUGS RATED FOR UP TO 500MCM. (REFER TO CRIMP LUG INSTALLATION DATA PROVIDED WITH UNIT FOR FULL INSTALLATION DETAILS). NOTE: USE OF CRIMP LUGS ON THE 400 AMP UNITS DE-RATES THE SWITCH TO 360 AMPS.
   A. SUITABLE WIRE BENDING SPACE IS PROVIDED FOR UP TO ONE (1) 500MCM CABLE PER TERMINAL PER NEC.
3. GROUND LUGS ARE PROVIDED STANDARD AS FOLLOWS:
   SIX (6) 1/0 -250MCM CU/AL CABLES OR THREE (3) #4 -600MCM CU/AL CABLE CONNECTIONS.

NOTES 600 AMP SWITCHES

1. SUPPLIED WITH STANDARD MECHANICAL (SCREW TYPE) LUGS ON THE NORMAL, EMERGENCY & LOAD BUS STABS. ONE (1) LUG PER PHASE AND NEUTRAL EACH SUITABLE FOR CONNECTION OF TWO (2) #2 -600MCM CU/AL CABLES.
   A. SUITABLE WIRE BENDING SPACE IS PROVIDED FOR UP TO TWO (2) 600MCM CABLE PER TERMINAL PER NEC.
2. GROUND LUGS ARE PROVIDED STANDARD AS FOLLOWS:
   SIX (6) #2 -600MCM CU/AL CABLE CONNECTIONS.

ATS SWITCH RATING (AMPS)	POLES	WEIGHTS LB (KG)
260-400	2	234 (106)
260-400	C2	241 (109)
260-400	3	240 (109)
260-400	C3	247 (112)
260-400	4	246 (112)
600	2	239 (108)
600	C2	246 (112)
600	3	246 (112)
600	C3	253 (115)
600	4	253 (115)

CTS/DTS SWITCH RATING (AMPS)	POLES	WEIGHTS LB (KG)
150-400	2	250 (113)
150-400	C2	N/A
150-400	3	256 (116)
150-400	C3	N/A
150-400	4	262 (119)
600	2	255 (116)
600	C2	N/A
600	3	262 (119)
600	C3	N/A
600	4	269 (122)

SERIES	CATALOG PREFIX
4000	4ATS
	4NTS
	4ACTS
	4NCTS
	4ADTS
	4NDTS
7000	7ATS
	7NTS
	7ACTS
	7NCTS
	7ADTS
	7NDTS

APPROVED
By Darren Fraser at 11:07 am, Feb 01, 2013

REV			
B	218867	WK	01/25/13
A	209620	MK	06/23/06
—	208113	TK	03/30/06

ISSUED

PROJECT ASCO

COMPOSITE — OUTLINE

7000 SERIES TO "J"

150-600 AMP TYPE 4/4X

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN	DJS	03/30/06
CHECKED	RK	03/30/06
PROJECT APPROVAL	WK	03/30/06
TECH. PUBLICATIONS		

MANUFACTURED TO BE IN ACCORDANCE WITH ASME Y14.5M-1994. NON CRITICAL DIMENSIONS PER MACHINED PARTS REC. 97-1-002

MATERIAL SPEC NO.

COMPUTER GENERATED DRAWING

SCALE: 1:1 SIZE: DS

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ASCO® ASCO POWER TECHNOLOGIES, LP FLORHAM PARK, NEW JERSEY 07932 U.S.A.

DRAWING NO. 780149

DRAWING SIZE B — ECN NO. 218867 — SHEET NO. 1 OF 1

SANAQATIIT
CONSTRUCTION LTD.

Shop Drawing Transmittal

Project Name: Potable Water System – Phase I

Sanaqatiit Project Number: 12-505 **Submittal Number:** 12-505-09

Owner Project Number: 11-4002

Product Description: Panel Boards, Breaker Type.

Specification Number: 26 24 17

Total Pages: 23 including cover

Submitted by: Sarah Fox

To: Warren McLeod, Stantec **CC:** Arlen Foster, Stantec

Via: Electronic Submission **Date:** **February 21, 2013**

Notes:

Attached pages are related to the panel board breaker type.

SHOP DRAWING REVIEW

Project: Cambridge Bay Potable Water System

Location: Cambridge Bay, NU

General Contractor: Sanaqatiit Construction Ltd.

Engineer: Stantec

Section 26 24 17 – Panel boards Breaker Type

Reviewed by: Darren Fraser

APPROVED
By Darren Fraser at 11:21 am, Feb 21, 2013

SHOP DRAWINGS ARE REVIEWED UNLESS NOTED OTHERWISE

REVIEWED AS MODIFIED		Stantec
REVISE & RESUBMIT		
SEAL & SIGNATURES REQUIRED		

DATE March 6/2013

SIGNATURE

REVIEW BY STANTEC IS FOR THE SOLE PURPOSE OF ASCERTAINING GENERAL CONFORMITY WITH DESIGN. CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS, FABRICATION AND CONSTRUCTION METHODS, COORDINATION OF SUB-TRADES, DETAIL DESIGN OF COMPONENTS, AND ERRORS OR OMISSIONS ON SHOP DRAWINGS.

Ryfan Kitikmeot Ltd.
Box 297, Kugluktuk, NU X0E 0E0
Email: dfraser@ryfan.ca

Powering Business Worldwide

Panelboards

APPROVED
By Darren Fraser at 11:21 am, Feb 21, 2013

Neg# ENIF0508D202 Alt# C001 02/08/13
11:31:42

Customer Bill of Material

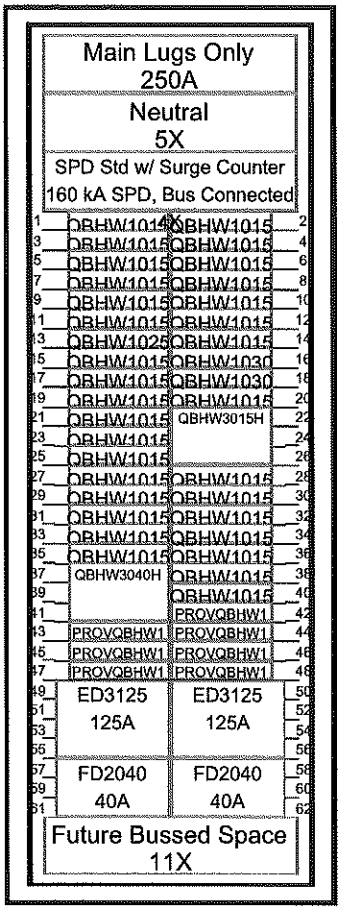
1 Pow-R-Line3a

250A, Fully Rated, 208Y/120V 3Ph 4W, Silver Plated Copper Bus, 22k AIC,250A, Main Lugs Only[Top Fed], Surface Mounted, Surge Protective Device, 160 kA SPD Series - Standard w/ Surge Counter
Used X-Space: 28X, Remaining X-Space: 11X, Max X-Space for Branch Devices: 39X

1	Panelboard PRL3a - Surface Mounted
4	Shunt Trip (48-127Vac)
2	Padlockable Lockoff Device
2	40A, 2P FD Branch Breaker
2	30A, 1P QBHW Branch Breaker
1	25A, 1P QBHW Branch Breaker
2	125A, 3P ED Branch Breaker
1	40A, 3P QBHW-H Branch Breaker
7	1P Branch Provision Only
1	15A, 3P QBHW-H Branch Breaker
32	15A, 1P QBHW Branch Breaker
1	Surge Protective Device, 160 kA SPD Series - Standard w/ Surge Counter
1	Copper Main Bus, 250 Amps
1	Bolted + Insul / Iso Aluminum (Al/Cu Cable)
1	SPRINKLERPROOF Enclosure:EZB2090RCSP
2	Ground fault relay in NEMA 1 enclosure (FD2040 breaker)
2	ED breakers to be 110A instead of 125A

Designations: A

All orders must be released for manufacture within 90 days of date of order entry. If approval drawings are required, drawings must be returned approved for release within 60 days of mailing. If drawings are not returned accordingly, and/or if shipment is delayed by the customer, the price of the order will increase by 1.0% per month.



General Information **(Section 1 of 1)**

Service Voltage:	208Y/120V 3Ph 4W	**Enclosure:**	SPRINKLER
Bus Rating & Type:	250A Silver Plated Copper	**Neutral Rating:**	250A
Ground Bar:	Bolted + Insul / Iso Aluminum, Al or Cu cable		
S.C. Rating:	22k A.I.C.Fully Rated		

Main Device Type: Main Lugs Only - Top Cable Entry
Main Terminals: Mechanical - (1) #6-350 kcmil (Cu/Al)
Neutral Terminals: Mechanical - (1) #6-350 kcmil (Cu/Al)
Box Catalog No.: EZB2090RCSP
Trim: EZ Trim, Door in Door, Concealed Hardware (EZT2090S)

Surface Mounted

Box Dimensions: 90." [2286.0mm]H x 20" [508.0mm]W x 5.75" [146.0mm]D
Consult factory to confirm actual enclosure size.
Min. Gutter Size: Top = 5.5" [139.7mm] Bottom = 5.5" [139.7mm]
Left = 4" [101.6mm] Right = 4" [101.6mm]

Panel ID Nameplate:
Type: No Nameplate

CSA

Trim Lock:Standard Lock & Key (Keyed WEM2)
Circuit Directory:Plastic Sleeve with Card
Entry Plate:No Plate

Device Modifications:

Ref #	Description
1256C41G05	Padlockable Lockoff
Ckt #10, 11	
SNT1RP08K	Shunt Trip (48-127Vac)
Ckt #49, 50, 57, 58	

Branch Devices

Qty	Poles	Trip	Frame	Amps	KAIC
32	1	15	QBHW	100	22
2	3	125	ED	225	22
1	1	25	QBHW	100	22
2	1	30	QBHW	100	22
2	2	40	FD	100	22
1	3	40	QBHW	100	22
1	3	15	QBHW	100	22
7	1		PROVQBHW1		

Notes:
Ground fault relay in NEMA 1 enclosure (FD2040 breaker)
ED breakers to be 110A instead of 125A

The information on this document is created by Eaton Corporation. It is disclosed in confidence and it is only to be used for the purpose in which it is supplied.

PREPARED BY: LonnyWilson	DATE: 02/08/13	**Eaton Corporation**			
APPROVED BY:	DATE: 02/08/13	JOB NAME: CSCI044220-TP39658 - Cambridge bay	DESIGNATION: A		
VERSION: 7.9		TYPE: PRL3a		DRAWING TYPE: Customer Approval	
NEG-ALT NUMBER: ENIF0508D202-C001	REVISION:	DWG SIZE: A	G.O.: CSCI044220	ITEM: 0081	SHEET: 1 OF 1

Submittal specification for 160 kA SPD Series sidemount versions

Eaton's SPD Series Surge Protective Devices (SPD) are used to protect equipment from damage caused by surge events. This submittal specification represents sidemount versions of the SPD Series units with a catalog number beginning with "SPD160." These versions are designed to be mounted external to electrical distribution assemblies and interfaced via conduit and wires.

Table 1. Surge Current Capacity

Configuration	Per Phase	L-N Mode	L-G Mode	N-G Mode	L-L Mode
Single split phase (3W+G)	160	80	80	80	—
Three-phase wye (4W+G)	160	80	80	80	—
Three-phase delta (3W+G)	160	—	80	—	80
Three-phase high-leg delta (4W+G)	160	80	80	80	—

Table 2. Catalog Numbering System

SPD160 240S 1 K

Voltage Code
- ☐ **240S** = 120/240 single split-phase
- ☐ **208Y** = 120/208 wye (4W+G)
- ☐ **220Y** = 127/220 wye (4W+G)
- ☐ **400Y** = 230/400 wye (4W+G)
- ☐ **480Y** = 277/480 wye (4W+G)
- ☐ **600Y** = 347/600 wye (4W+G)
- ☐ **240D** = 240 delta (3W+G)
- ☐ **480D** = 480 delta (3W+G)
- ☐ **600D** = 600 delta (4W+G)
- ☐ **240H** = 240 high-leg delta (4W+G) on 'B' phase

Feature Package
- ☐ **1** = Basic ①②
- ☐ **2** = Standard ①②③
- ☐ **3** = Standard + surge counter ①②③④

Enclosure Options
- ☐ **K** = NEMA® 1 enclosure
- ☐ **L** = NEMA 1 flushmount enclosure
- ☐ **M** = NEMA 1 with internal disconnect
- ☐ **N** = NEMA 4
- ☐ **O** = NEMA 4 with internal disconnect
- ☐ **P** = NEMA 4X
- ☐ **Q** = NEMA 4X with internal disconnect

① Dual-colored LED per phase to indicate protection status.

② Dual-colored LED to indicate protection status of the N-G mode on units with a neutral wire.

③ Audible alarm with silence button, Form C relay contact, EMI/RFI filtering providing up to 50 dB of noise attenuation from 10 kHz to 100 MHz.

④ Surge counter with Reset button.

Performance Specifications and Features

A. ANSI/UL® 1449 3rd Edition Voltage Protection Rating (VPR)

   a. VPR for units without an internal disconnect (catalog number ends in K, L, N, or P)

Table 3. Voltage Code and VPR

Voltage Code	VPR for Each Protection Mode			
	L-N	L-G	N-G	L-L
240S	TBD	TBD	TBD	TBD
208Y and 220Y	TBD	TBD	TBD	TBD
400Y and 480Y	TBD	TBD	TBD	TBD
600Y	TBD	TBD	TBD	TBD
240D	TBD	TBD	TBD	TBD
480D	TBD	TBD	TBD	TBD
600D	TBD	TBD	TBD	TBD
240H	TBD	TBD	TBD	TBD

Powering Business Worldwide

b. VPR for units with an internal disconnect (catalog number ends in M, O, or Q)

Table 4. Voltage Code and VPR

Voltage Code	VPR for Each Protection Mode			
	L-N	L-G	N-G	L-L
240S	TBD	TBD	TBD	TBD
208Y and 220Y	TBD	TBD	TBD	TBD
400Y and 480Y	TBD	TBD	TBD	TBD
600Y	TBD	TBD	TBD	TBD
240D	TBD	TBD	TBD	TBD
480D	TBD	TBD	TBD	TBD
600D	TBD	TBD	TBD	TBD
240H	TBD	TBD	TBD	TBD

B. Internal overcurrent protection
   a. All units contain thermally protected metal-oxide varistors. Each of these devices is internally fused by a thermal element that safely removes them from the circuit under abnormal conditions, such as temporary overvoltage or high fault current conditions.

C. Monitoring and features (refer to **Table 2** for a listing of the individual features contained in each feature package)

D. General features
   a. Units with catalog numbers ending in K, L, or M contain a factory-installed ¾-inch trade size chase nipple
   b. Units with catalog numbers ending in N, O, P, or Q contain a factory-installed ¾-inch trade size hub connector
   c. All units are prewired at the factory. Phase, neutral, and ground connections are made via 10 AWG wires. Form C relay contact connections are made via 14 AWG wires ①
   d. All units are factory sealed. No user intervention or internal connections are required
   e. Units with an internal disconnect (catalog numbers ending in M, O, or Q) contain a three-pole, 30A thermal-magnetic circuit breaker
   f. NEMA 1 and NEMA 4 enclosures are constructed of powder-coated steel
   g. NEMA 4X enclosures are constructed of stainless steel

E. Enclosure dimensions and weights
   a. NEMA 1 (catalog number ends with K): 10.50L x 7.50W x 3.50D inches, 6.8 lbs
   b. NEMA 1 flushmount (catalog number ends with L): 10.50L x 7.50W x 3.50D inches, 6.8 lbs; flushmount plate dimensions are 14.00L x 11.00W inches
   c. NEMA 1 with disconnect (catalog number ends with M): 10.70L x 11.10W x 5.80D inches, 14.7 lbs
   d. NEMA 4 and 4X (catalog number ends with N or P): 11.30L x 8.70W x 5.40D inches, 14.6 lbs
   e. NEMA 4 and 4X with disconnect (catalog number ends with O or Q): 12.30L x 12.50W x 7.70D inches, 27.5 lbs

Table 5. Specifications

Description	Specification
Surge capacity ratings available	50, 80, 100, 120, 160, 200, 250, 300, 400 kA per phase
Nominal discharge current (I_n)	20 kA
Short circuit current rating (SCCR)	200 kA
SPD type	Basic feature package = Type 1 (can also be used in Type 2 applications) Standard and Standard with Surge Counter feature packages = Type 2
Single split phase voltages available	120/240
Three-phase wye system voltages available	120/208, 127/220, 230/400, 277/480, 347/600
Three-phase delta system voltages available	240, 480, 600
Input power frequency	50/60 Hz
Power consumption (basic units)—voltage codes 208Y, 220Y, 240S, 240D, and 240H 400Y, 480Y, and 480D 600Y and 600D	 0.5W 1.1W 1.3W
Power consumption—voltage codes ① 208Y, 220Y, 240S, 240D, and 240H 400Y, 480Y, and 480D basic 600Y and 600D	 0.6W 1.7W 2.1W
Protection modes	Single split phase . . . . . L-N, L-G, N-G, L-L Three-phase wye . . . . . L-N, L-G, N-G, L-L Three-phase delta. . . . . L-G, L-L Three-phase high-leg delta. . . . L-N, L-G, N-G, L-L
Maximum continuous operating voltage (MCOV) 240S, 208Y, 220Y, and 240H 400Y and 480Y 600Y 240D 480D 600D	 150 L-N, 150 L-G, 150 N-G, 300 L-L 320 L-N, 320 L-G, 320 N-G, 640 L-L 420 L-N, 420 L-G, 420 N-G, 840 L-L 320 L-G, 320 L-L 640 L-G, 640 L-L 840 L-G, 840 L-L
Ports	1
Operating temperature	–20°C–50°C (–4°F–122°F)
Operating humidity	5%–95%, noncondensing
Operating altitude	Up to 16,000 ft (5000m)
Seismic withstand capability	Meets or exceeds the requirements specified in IBC® 2006, CBC 2007, and UBC® Zone 4
Form C relay contact ratings	150 Vdc or 125 Vac, 1A maximum
Form C relay contact logic	Power ON, normal state—NO contact = open, NC contact = closed Power OFF or fault state—NO contact = closed, NC contact = open
EMI/RFI filtering attenuation ①	Up to 50 dB from 10 kHz–100 MHz
Pending agency certifications and approvals	UL 1449 3rd Edition listed, CSA®, UL 1283 (Type 2 SPDs only)
Warranty	10 years

① Standard and standard with surge counter units.

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F-Frame



Typical F-Frame Breaker



F-Frame Breaker with Electronic Trip Unit

Product Description

- All Eaton's Cutler-Hammer F-Frame Circuit Breakers by are HACR rated.
- All circuit breakers 10 through 30 amperes are suitable for HID (high intensity discharge) use.
- All F-Frame circuit breakers are suitable for reverse feed use

Technical Data and Specifications

Table 12-148. UL 489 Interrupting Capacity Ratings

Circuit Breaker Type	Number of Poles	Interrupting Capacity (kA Symmetrical Amperes)					
		Volts ac (50/60 Hz)				Volts dc ①	
		240	277	480	600	125	250 ②③
EDB	2, 3	22	—	—	—	10	—
EDS	2, 3	42	—	—	—	10	—
ED	2, 3	65	—	—	—	10	—
EDH	2, 3	100	—	—	—	10	—
EDC	2, 3	200	—	—	—	10	—
EHD	1	—	4	—	—	10	—
	2, 3	18	—	14	—	—	10
FDB	2, 3, 4	18	—	14	14	—	10
FD, FDE ④	1	—	35	—	—	10	—
	2, 3, 4	65	—	35	18	—	10
HFD, HFDE ④	1	—	65	—	—	10	—
	2, 3, 4	100	—	65	25	—	22
FDC ⑤, FDCE ④⑤⑥	2, 3, 4	200	—	100	25	—	22

① dc ratings apply to substantially non-inductive circuits.
② 2-pole circuit breaker, or two poles of 3-pole circuit breaker.
③ Time constant is 3 milliseconds minimum at 10 kA and 8 milliseconds minimum at 22 kA.
④ Electronics available on 3-pole only, no dc rating for FDE, HFDE, FDCE.
⑤ Current limiting.
⑥ Check with Eaton for availability.

Table 12-149. IEC 157-1 (P1) Interrupting Capacity Ratings (P1)

Circuit Breaker Type	Number of Poles	Interrupting Capacity (kA Symmetrical Amperes)					
		Volts ac (50/60 Hz)				Volts dc ⑦	
		220, 240	380, 415	440	500	125	250 ⑧⑨
EDB	2, 3	22	—	—	—	10	—
EDS	2, 3	42	—	—	—	10	—
ED	2, 3	65	—	—	—	10	—
EDH	2, 3	100	—	—	—	10	—
EDC	2, 3	200	—	—	—	10	—
EHD	1	—	14	—	—	10	—
	2, 3	18	—	14	—	—	10
FDB	2, 3, 4	18	14	14	14	—	10
FD	1	35	—	—	—	10	—
	2, 3, 4	65	35	35	18	—	10
HFD	1	65	—	—	—	10	—
	2, 3, 4	100	65	65	25	—	22
FDC	2, 3, 4	200	100	100	35	—	22

⑦ dc ratings apply to substantially non-inductive circuits.
⑧ 2-pole circuit breaker, or two poles of 3-pole circuit breaker.
⑨ Time constant is 3 milliseconds minimum at 10 kA and 8 milliseconds minimum at 22 kA.

Table 12-150. Digitrip Electronic Trip Units

Circuit Breaker Type	Frame	Ratings
FDE, HFDE, FDCE	225	100, 110, 125, 150, 160, 175, 200, 225
FDE, HFDE, FDCE	160	60, 70, 80, 90, 100, 125, 150, 160
FDE, HFDE, FDCE	80	15, 20, 30, 40, 50, 60, 70, 80

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Table 12-151. F-Frame Digitrip Specifications

Trip Unit Type	Digitrip RMS 310+	
rms Sensing	Yes	
Breaker Type		
Frame Ampere Range Interrupting Rating at 480 V	FDE 15 – 225 A 35, 65, 100 (kA)	
Protection		
Ordering Options	LS LSG	LSI LSIG
Fixed Rated Plug (I_n) Overtemperature Trip	No Yes	
Long Delay Protection (L)		
Adjustable Rating Plug (I_n) Long Delay Pickup Long Delay Time I^2t	No 40 – 100% Frame 2 – 24 Seconds	
Long Delay Time I^4t Long Delay Thermal Memory High Load Alarm	No Yes Yes	
Short Delay Protection (S)		
Short Delay Pickup	200 – 1000% x (I_r)	
Short Delay Time I^2t Short Delay Time Flat	Yes No	No Inst – 300 ms
Short Delay Time Z.S.I.	Yes ①	
Instantaneous Protection (I)		
Instantaneous Pickup Discriminator Instantaneous Override	No No Yes	
Ground Fault Protection (G)		
Ground Fault Alarm Ground Fault Pickup Ground Fault Delay I^2t	No 20 – 100% Frame No	
Ground Fault Delay Flat Ground Fault Z.S.I. Ground Fault Thermal Memory	Inst – 300 ms Yes ① Yes	
System Diagnostics		
Cause of Trip LEDs Magnitude of Trip Information Remote Signal Contacts	No No No	
System Monitoring		
Digital Display Current Voltage	No No No	
Power and Energy Power Quality Harmonics Power Factor	No No No	
Communications		
PowerNet	No	
Testing		
Testing Method	Test Kit	

① ZSI (Zone Selective Interlocking) is optional. Must order with ZSI. Standard 310+ does not come with ZSI.

Legend: I_n = Rating Plug
I_r = Long Delay Pickup Setting x I_n

Dimensions/Weights

Table 12-152. Dimensions in Inches (mm)

Number of Poles	Width	Height	Depth
1	1.38 (35.1)	6.00 (152.4)	3.38 (86.0)
2	2.75 (70.0)	6.00 (152.4)	3.38 (86.0)
3	4.13 (105.0)	6.00 (152.4)	3.38 (86.0)
4	5.50 (139.7)	6.00 (152.4)	3.38 (86.0)

Table 12-153. Approximate Shipping Weight, Lbs. (kg)

Breaker Type	Number of Poles			
	1	2	3	4
ED, EDB, EDS, EDH, EDC	—	3 (1.4)	4.5 (2.0)	—
EHD, FDB, FD, HFD, FDC	2 (.9)	3 (1.4)	4.5 (2.0)	6 (2.7)
FDE, HFDE, FDCE	—	—	4.5 (2.0)	—

Product Selection

This information is presented only as an aid to understanding Catalog Numbers. It is not to be used to build Catalog Numbers for circuit breakers or trip units.

Table 12-154. Circuit Breaker Catalog Numbering System

FDC 3 100 L

Circuit Breaker Type	Number of Poles	Trip Amperes	Suffix
EHD FDB FD HFD FDC	1 = 1 Pole 2 = 2 Poles 3 = 3 Poles 4 = 4 Poles	010 015 020 025 030 035 040 045 050 060 070 080 090 100 110 125 150 175 (FD, HFD, FDC, 2-, 3-, 4-Pole Only) 200 (FD, HFD, FDC, 2-, 3-, 4-Pole Only) 225 (FD, HFD, FDC, 2-, 3-, 4-Pole Only)	E = 100% Protected (4-Pole only) Neutral Pole EH = 50% Protected (4-Pole only) K = High Magnetic Molded Case Switch L = Line and Load Terminals S = Stainless Steel Terminals V = 50°C Calibration W = Without Terminals Y = Line Terminals Only Z = Aluminum Terminals (≤ 100 Amperes)

EDC 3 200 L

Circuit Breaker Type	Number of Poles	Trip Amperes	Suffix
EDB EDS ED EDH EDC	2 = 2 Poles 3 = 3 Poles	100 125 150 175 200 225	L = Line and Load Terminals W = Without Terminals Y = Line Terminals Only Z = Aluminum Terminals (100 Amperes)

FDE 3 225 32 _ W

Circuit Breaker Type	Number of Poles	Trip Amperes	Trip Unit	Suffix	Suffix
FDE HFDE FDCE	3 = 3 Poles	80 160 225	33 = LS 32 = LSI 35 = LSG 36 = LSIG	ZG = Zone Selective Interlocking	W = Without Terminals L = Line and Load Terminals — = Load Side Terminals only

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Table 12-158. Type FD Thermal-Magnetic Circuit Breakers with Non-Interchangeable Trip Units

Max. Cont. Ampere Rating at 40°C	600 Vac Maximum, 250 Vdc						277 Vac Maximum, 125 Vdc		600 Vac Maximum, 250 Vdc					
	14 kAIC at 600 Vac						35 kAIC at 277 Vac		35 kAIC at 480 Vac					
	Type FDB (Includes Terminals on Load End Only)						Type FD (Includes Terminals on Load End Only)							
	2-Pole		3-Pole		4-Pole		1-Pole		2-Pole		3-Pole		4-Pole	
	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $
10 ①	FDB2010		FDB3010		FDB4010		FD1010		—		—		—	
15	FDB2015		FDB3015		FDB4015		FD1015 ②		FD2015		FD3015		FD4015	
20	FDB2020		FDB3020		FDB4020		FD1020 ②		FD2020		FD3020		FD4020	
25	FDB2025		FDB3025		FDB4025		FD1025		FD2025		FD3025		FD4025	
30	FDB2030		FDB3030		FDB4030		FD1030		FD2030		FD3030		FD4030	
35	FDB2035		FDB3035		FDB4035		FD1035		FD2035		FD3035		FD4035	
40	FDB2040		FDB3040		FDB4040		FD1040		FD2040		FD3040		FD4040	
45	FDB2045		FDB3045		FDB4045		FD1045		FD2045		FD3045		FD4045	
50	FDB2050		FDB3050		FDB4050		FD1050		FD2050		FD3050		FD4050	
60	FDB2060		FDB3060		FDB4060		FD1060		FD2060		FD3060		FD4060	
70	FDB2070		FDB3070		FDB4070		FD1070		FD2070		FD3070		FD4070	
80	FDB2080		FDB3080		FDB4080		FD1080		FD2080		FD3080		FD4080	
90	FDB2090		FDB3090		FDB4090		FD1090		FD2090		FD3090		FD4090	
100	FDB2100		FDB3100		FDB4100		FD1100		FD2100		FD3100		FD4100	
110	FDB2110		FDB3110		FDB4110		FD1110		FD2110		FD3110		FD4110	
125	FDB2125		FDB3125		FDB4125		FD1125		FD2125		FD3125		FD4125	
150	FDB2150		FDB3150		FDB4150		FD1150		FD2150		FD3150		FD4150	
175	—		—		—		—		FD2175		FD3175		FD4175	
200	—		—		—		—		FD2200		FD3200		FD4200	
225	—		—		—		—		FD2225		FD3225		FD4225	

① Not UL listed. 5 kAIC interrupting rating.
② UL listed for SWD applications, see NEC Article 240-83(d).

Table 12-159. Types HFD and FDC Thermal-Magnetic Circuit Breakers with Non-Interchangeable Trip Units

Max. Cont. Ampere Rating at 40°C	277 Vac Maximum, 125 Vdc		600 Vac Maximum, 250 Vdc						600 Vac Maximum, 250 Vdc					
	65 kAIC at 277 Vac		65 kAIC at 480 Vac						100 kAIC at 480 Vac					
	Type HFD (Includes Terminals on Load End Only)								Type FDC Current Limiting (Includes Terminals on Load End Only)					
	1-Pole		2-Pole		3-Pole		4-Pole		2-Pole		3-Pole		4-Pole	
	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $
15	HFD1015 ③		HFD2015		HFD3015		HFD4015		FDC2015		FDC3015		FDC4015	
20	HFD1020 ③		HFD2020		HFD3020		HFD4020		FDC2020		FDC3020		FDC4020	
25	HFD1025		HFD2025		HFD3025		HFD4025		FDC2025		FDC3025		FDC4025	
30	HFD1030		HFD2030		HFD3030		HFD4030		FDC2030		FDC3030		FDC4030	
35	HFD1035		HFD2035		HFD3035		HFD4035		FDC2035		FDC3035		FDC4035	
40	HFD1040		HFD2040		HFD3040		HFD4040		FDC2040		FDC3040		FDC4040	
45	HFD1045		HFD2045		HFD3045		HFD4045		FDC2045		FDC3045		FDC4045	
50	HFD1050		HFD2050		HFD3050		HFD4050		FDC2050		FDC3050		FDC4050	
60	HFD1060		HFD2060		HFD3060		HFD4060		FDC2060		FDC3060		FDC4060	
70	HFD1070		HFD2070		HFD3070		HFD4070		FDC2070		FDC3070		FDC4070	
80	HFD1080		HFD2080		HFD3080		HFD4080		FDC2080		FDC3080		FDC4080	
90	HFD1090		HFD2090		HFD3090		HFD4090		FDC2090		FDC3090		FDC4090	
100	HFD1100		HFD2100		HFD3100		HFD4100		FDC2100		FDC3100		FDC4100	
110	HFD1110		HFD2110		HFD3110		HFD4110		FDC2110		FDC3110		FDC4110	
125	HFD1125		HFD2125		HFD3125		HFD4125		FDC2125		FDC3125		FDC4125	
150	HFD1150		HFD2150		HFD3150		HFD4150		FDC2150		FDC3150		FDC4150	
175	—		HFD2175		HFD3175		HFD4175		FDC2175		FDC3175		FDC4175	
200	—		HFD2200		HFD3200		HFD4200		FDC2200		FDC3200		FDC4200	
225	—		HFD2225		HFD3225		HFD4225		FDC2225		FDC3225		FDC4225	

③ UL listed for SWD applications, see NEC Article 240-83(d).

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Discount Symbol CB-2

Line and Load Terminals (Continued)

Table 12-164. Line and Load Terminals

Maximum Breaker Amperes	Terminal Body Material	Wire Type	AWG Wire Range	Metric Wire Range mm²	Package of 3 Terminals	
					Catalog Number	Price U.S. $
Standard Pressure Type Terminals						
20 (EHD)	Steel	Cu/Al	14 – 10	2.5 – 4	**3T20FB** ①	
100	Steel	Cu/Al	14 – 1/0	2.5 – 50	**3T100FB**	
225	Aluminum	Cu/Al	4 – 4/0	25 – 95	**3TA225FD**	
Optional Pressure Terminals						
50	Aluminum	Cu/Al	14 – 4	2.5 – 25	**3TA50FB** ①	
100	Aluminum	Cu/Al	14 – 1/0	2.5 – 50	**3TA100FD**	
200	Stainless Steel	Cu	4 – 4/0	25 – 95	**3T150FB**	
225	Copper	Cu	4 – 4/0	25 – 95	**3T225FD**	
225	Aluminum	Cu/Al	6 – 300 kcmil	16 – 150	**3TA225FDK** ②	

① Not for use with ED, EDH, EDC breakers.
② Includes terminal shield kit. Adds approximately 3 inches (76.2) to breaker height. Available for use on 3-pole breaker only.

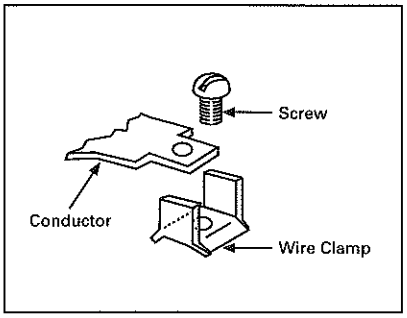


Figure 12-15. 3T20FB
Assemble wire clamp to bottom of conductor as shown.

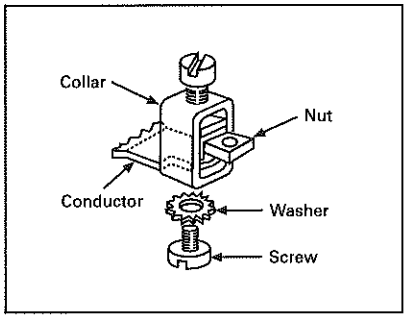


Figure 12-16. 3T100FB, 3T150FB
Insert collar enclosing conductor as shown. Locate nut on top of conductor and tighten securely with screw and washer. **Caution:** Collar must surround conductor.

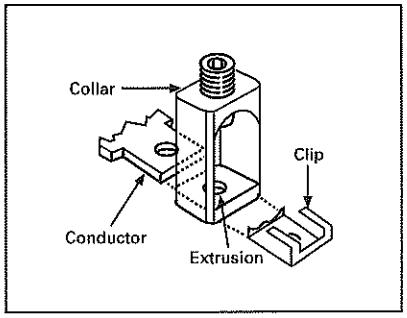


Figure 12-17. 3TA225FD
Insert collar enclosing conductor and center on extrusion on collar. Install clip with legs on top of conductor and snap end around bottom of collar.

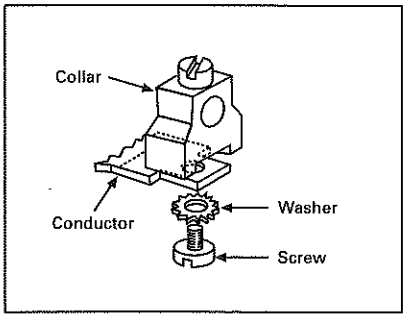


Figure 12-18. 3TA50FB
Assemble collar on top of conductor as shown. Tighten securely with screw and washer.

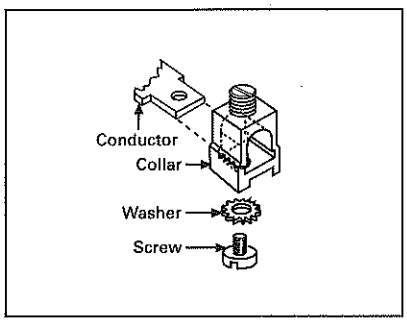


Figure 12-19. 3TA100FD
Collar slides onto conductor and is held in position by a screw and lockwasher.

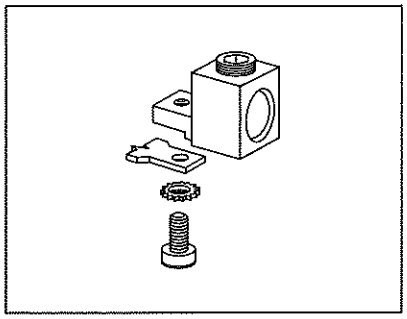


Figure 12-20. 3TA225FDK (Up to 150 mm²)
Assemble collar on top of conductor as shown. Tighten securely with screw and washer. Terminal shield must be used with this collar.

Note: For 185 mm², use **3TA225FDK1.**

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Discount Symbol **CB-2**

Allowable Accessory Combinations

Different combinations of accessories can be supplied, depending on the types of accessories and the number of poles in the circuit breaker.

Table 12-165. Accessories

Description	Reference Page	1-Pole	2-Pole		3-Pole ①			4-Pole			
		Center	Left	Right	Left	Center	Right	Left	Center	Right	Neutral
Internal Accessories (Only one internal accessory per pole)											
Alarm Lockout Switch (Make Only)	12-217	■									
Alarm Lockout (Make/Break)	12-217			■	❑		❑	■			
Alarm Lockout (2Make/2Break)	12-217			■	❑		❑	■			
Auxiliary Switch (1A, 1B)	12-220			■	■		■	■			■
Auxiliary Switch (2A, 2B)	12-220			■	■		■	■			■
Auxiliary Switch and Alarm Switch Combination	12-223			■	❑		❑	■			
Shunt Trip — Standard	12-226			■	■		■	■			■
Shunt Trip — Low Energy	12-231			■	■		■	■			
Undervoltage Release Mechanism	12-232			■	■		■	■			
External Accessories											
End Cap Kit	12-243		●			●				●	
Keeper Nut	12-243	●	●			●				●	
Control Wire Terminal Kit	12-244	●	●			●				●	
Multiwire Connectors	12-245	●	●			●				●	
Base Mounting Hardware	12-246	●	●			●				●	
Terminal Shields	12-248	●	●			●				●	
Terminal End Covers	12-249					●					
Interphase Barriers	12-249		●			●				●	
Non-Padlockable Handle Block	12-251	■	■			■			■		
Snap-on Padlockable Handle Lock Hasp	12-251	■	■			■			■		
Padlockable Handle Lock Hasp	12-252			■	❑		❑	❑		❑	
Cylinder Lock	12-252				■						
Key Interlock Kit	12-253			■	❑		❑	❑		❑	
Sliding Bar Interlock — Requires Two Breakers	12-254					●					
Walking Beam Interlock — Requires Two Breakers	12-254					●				●	
Electrical (Solenoid and Motor) Operators	12-255					●				●	
Plug-in Adapters	12-257		●			●				●	
Rear Connecting Studs	12-258	●	●			●				●	
Panelboard Connecting Straps	12-261	●	●			●				●	
Handle Mechanisms	12-262					●					
LFD Current Limiter	12-268					●					
IQ Energy Sentinel	12-268		●			●					
Modifications (Refer to Eaton)											
Special Calibration	—	●	●			●				●	
Moisture Fungus Treatment	12-73	●	●			●				●	
Freeze-Tested Circuit Breakers	—	●	●			●				●	
Marine Application	—	●	●			●				●	

■ Applicable in indicated pole position ❑ May be mounted on left or right pole — not both ● Accessory available/Modification available

① Internal accessories are listed with Underwriters Laboratories (UL) for factory installation. They are not listed with UL for field installation. Any one internal accessory may be mounted in the left pole. Only a specialty built 1A/1B auxiliary switch may be mounted in the right pole. Factory reference part number for the 1A/1B auxiliary switch is A1X1RPKFDE.

Shunt Trip

F-Frame and HMCP (F)

Electrical Rating Data ①②③

50/60 Hz			Dc		
Supply Voltage	Minimum Operating Voltage	VA	Supply Voltage	Minimum Operating Voltage	VA
12 24	6.75	75 300	12 24	9	100 400
48 60 110 120 127	36	92 140 480 570 640	48 60	36	100 160
208 220 240 380	156	180 200 240 610	110 120 125 127	77	55 66 71 72
415 440 480 525 550 600	300	130 330 380 450 530 590 –	220 250 – – – – –	– – – – – – –	110 140 – – – – –

Shunt Trip

Voltage Rating (Ac Frequency = 50/60 Hz)	Factory Mounted					Shunt Trip Kits ④	
	Connection Type and Location						
	18-Inch Pigtail Leads ⑤				Terminal Block	Pigtail Leads	Terminal Block
	Same Side	Rear ⑥	Opposite Side	Same Side			
	Suffix Number					Catalogue Number	
Left-Pole Mounting Ac/Dc Ratings							
12-24 Vac or Vdc 48-127 Vac or 48-60 Vdc ⑦ 208-380 Vac or 110-127 Vdc 415-600 Vac or 220-250 Vdc	S01 S05 S09 S13	S02 S06 S10 S14	S03 S07 S11 S15	S04 S08 S12 S16		SNT1LP03K SNT1LP08K SNT1LP12K SNT1LP18K	SNT1LT03K SNT1LT08K SNT1LT12K SNT1LT18K
Right- or Neutral-Pole Mounting Ac/Dc Ratings ⑧							
12-24 Vac or Vdc 48-127 Vac or 48-60 Vdc⑦ 208-380 Vac or 110-127 Vdc 415-600 Vac or 220-250 Vdc	S17 S21 S25 S29	S18 S22 S26 S30	S19 S23 S27 S31	S20 S24 S28 S32		SNT1RP03K SNT1RP08K SNT1RP12K SNT1RP18K	SNT1RT03K ⑨ SNT1RT08K ⑨ SNT1RT12K ⑨ SNT1RT18K ⑨

Instruction Leaflet Number 29C140

Note: F-Frame circuit breakers are factory sealed. CSA and UL requires that internal accessories be installed at the factory. Internal accessories are CSA and UL listed for factory installation.

J-Frame and HMCP (J)

Electrical Rating Data ①②⑩

50/60 Hz			Dc		
Supply Voltage	Minimum Operating Voltage	VA	Supply Voltage	Minimum Operating Voltage	VA
12 24	9	31 173	12 24	8.4	50 247
48 60	36	686 1014	48 60	33.6	1094 1698
110 ⑪ 120 ⑪ 127 ⑪ 208 ⑪ 220 ⑪ 240 ⑪	60.5	66 84 102 354 396 432	110 120 125 – – –	77 – –	112 138 150 – – –
380 400 415 440	285	180 200 240 610	110 120 125 127	154	40 58 – –
480 525 550 600	360	34 42 50 60	– – – –	– – – –	– – – –

Shunt Trip

Voltage Rating (Ac Frequency = 50/60 Hz)	Factory Mounted					Field Mounted	
	Connection Type and Location					Field Installation Kits ⑫	
	18-Inch Pigtail Leads ⑤				Terminal Block	Pigtail Leads	Terminal Block
	Same Side	Rear ⑬	Opposite Side	Same Side			
	Suffix Number					Catalogue Number	
Left-Pole Mounting Ac/Dc Ratings ⑬							
12-24 Vac or Vdc 48-60 Vac or Vdc 110-240 Vac or 110-125 Vdc ⑭ 380-440 Vac or 220-250 Vdc 480-600 Vac	S41 S49 S09 S33 S17	S42 S50 S10 S34 S18	S43 S51 S11 S35 S19	S44 S52 S12 S36 S20		SNT2P04K SNT2P06K SNT2P11K SNT2P14K SNT2P18K	SNT2T04K SNT2T06K SNT2T11K SNT2T14K SNT2T18K
Right-Pole Mounting Ac/Dc Ratings							
12-24 Vac or Vdc 48-60 Vac or Vdc 110-240 Vac or 110-125 Vdc ⑭ 380-440 Vac or 220-250 Vdc 480-600 Vac	S45 S53 S29 S33 S37	S46 S54 S30 S34 S38	S47 S55 S31 S35 S39	S48 S56 S32 S36 S40		SNT2P04K SNT2P06K SNT2P11K SNT2P14K SNT2P18K	SNT2T04K⑨ SNT2T06K⑨ SNT2T11K⑨ SNT2T14K⑨ SNT2T18K⑨

Instruction Leaflet Number 29C142

① Average unlatching time: 6 milliseconds.
② Average circuit breaker contact total opening time: 18 milliseconds.
③ Endurance: 4000 electrical operations plus 4000 mechanical operations.
④ Not listed with CSA and UL for field installation.
⑤ Pigtail wire size: No. 18 AWG (0.82 mm²).
⑥ Standard pigtail lead exit location.
⑦ 120 Vac marked suitable for ground fault protection devices.
⑧ Standard mounting location.
⑨ Not for use on 4-pole circuit breakers.
⑩ Endurance – 6000 electrical operations plus 2000 mechanical operations.
⑪ Supply voltages suitable for use with Class 1 GFP devices. Marking label included with accessory kits.
⑫ Listed with CSA and UL for field installation.
⑬ Standard mounting location – leads exit rear of breaker.
⑭ Suitable for use with Class 1 ground fault sensing element.

Quick Reference (Continued)

Tables 11-1. Eaton's Cutler-Hammer QUICKLAG Industrial Circuit Breakers ① Plug-In, Bolt-On, Cable-In/Cable-Out (Continued)

Circuit Breaker Type	Circuit Breaker Type Code	Continuous Ampere Rating at 40°C	Number of Poles	Volts		Federal Spec. W-C-375b	Interrupting Ratings rms Symmetrical Amperes						Page Number
				ac	dc		ac Ratings Volts			dc ②			
							120	120/240	240	24-48	62.5	80	
BAB	B	10 – 70	1	120/240	24, 48, 62.5	10a, 11a, 12a	—	10,000	—	5,000	③	—	11-6
BAB		10 – 125	2	120/240	24, 48, 80	10a, 12a	—	10,000	—	5,000	5,000	5,000	11-6
BAB		10 – 100	2, 3	240	—	10b, 11b, 12b	—	—	10,000	—	—	—	11-6
BABRP	B	15 – 30	1	120	—	—	10,000	—	—	—	—	—	11-13
BABRP		15 – 30	2	120/240	—	—	—	10,000	—	—	—	—	11-13
QBAF	B, AF	15 – 20	1, 2	120/240	—	—	—	10,000	—	—	—	—	11-7
QBAG	B, AF, GF	15 – 20	1, 2	120/240	—	—	—	10,000	—	—	—	—	11-7
QBHW	B	15 – 70	1	120/240	24, 48, 62.5	14a	—	22,000	—	5,000	③	—	11-6
QBHW		15 – 125	2	120/240	24, 48, 80	14a	—	22,000	—	5,000	5,000	5,000	11-6
QBHW		15 – 100	2, 3	240	—	14b	—	—	22,000	—	—	—	11-6
HBAX	B	15 – 70	1	120/240	24, 48, 62.5	—	—	42,000	—	5,000	③	—	11-6
HBAX		15 – 100	2	120/240	24, 48, 80	—	—	42,000	—	5,000	5,000	5,000	11-6
HBAX		15 – 100	3	240		—	—	—	42,000	—	—	—	11-6
HBAW	B	15 – 30	1	120/240	24, 48, 62.5	15a	—	65,000	—	5,000	③	—	11-6
HBAW		15 – 30	2	120/240	24, 48, 80	15a	—	65,000	—	5,000	5,000	5,000	11-6
HBAW		15 – 20	3	240	—	15b	—	—	65,000	—	—	—	11-6
QBGF	B, GF	15 – 40	1	120	—	10a, 11a, 12a	10,000	—	—	—	—	—	11-8
QBGF		15 – 50	2	120/240	—	10a, 11a, 12a	—	10,000	—	—	—	—	11-8
QBHGF	B, GF	15 – 30	1	120	—	10a, 11a, 12a	22,000	—	—	—	—	—	11-8
QBHGF		15 – 30	2	120/240	—	10a, 11a, 12a	—	22,000	—	—	—	—	11-8
QBGFEP	B, GFEP	15 – 40	1	120	—	—	10,000	—	—	—	—	—	11-8
QBGFEP		15 – 50	2	120/240	—	—	—	10,000	—	—	—	—	11-8
QBHGFEP	B, GFEP	15 – 30	1	120	—	—	22,000	—	—	—	—	—	11-8
QBHGFEP		15 – 30	2	120/240	—	—	22,000	22,000	—	—	—	—	11-8
QC	C	10 – 70	1	120/240	24, 48, 62.5	10a, 11a, 12a	—	10,000	—	5,000	③	—	11-10
QC		10 – 100	2	120/240	24, 48, 80	10a, 12a	—	10,000	—	5,000	5,000	5,000	11-10
QC		10 – 100	2, 3, 4	240	—	10b, 11b, 12b	—	—	10,000	—	—	—	11-10
QCD	C (DIN-Rail Mount)	10 – 100	1	120/240	—	—	10,000	—	—	—	—	—	11-11
			2	120/240	—	—	10,000	—	—	—	—	—	11-11
			3	240	—	—	—	10,000	10,000	—	—	—	11-11
QCF	C	10 – 60	1, 2	120/240	24, 48, 62.5	—	10,000	10,000	—	3,000	3,000	—	11-12
QCF		15 – 20	1, 2	120/240	24, 48, 62.5	—	22,000	—	—	3,000	3,000	—	11-12
QCF		15 – 30	2, 3	240	24, 48, 62.5	—	—	10,000	—	3,000	3,000	—	11-12
QCR		10 – 60	1, 2	120/240	24, 48, 62.5	—	10,000	10,000	—	3,000	3,000	—	11-12
QCR		15 – 20	1, 2	120/240	24, 48, 62.5	—	22,000	—	—	3,000	3,000	—	11-12
QCR		15 – 30	2, 3	240	24, 48, 62.5	—	—	10,000	—	3,000	3,000	—	11-12
QCHW	C	15 – 70	1	120/240	24, 48, 62.5	14a	—	22,000	—	5,000	③	—	11-10
QCHW		15 – 100	2	120/240	24, 48, 80	14a	—	22,000	—	5,000	5,000	5,000	11-10
QCHW		15 – 100	2, 3	240	—	14b	—	—	22,000	—	—	—	11-10
QHCX	C	15 – 70	1	120/240	24, 48, 62.5	—	—	42,000	—	5,000	③	—	11-10
QHCX		15 – 100	2	120/240	24, 48, 80	—	—	42,000	—	5,000	5,000	5,000	11-10
QHCX		15 – 100	3	240	—	—	—	—	42,000	—	—	—	11-10
QHCW	C	15 – 30	1	120/240	24, 48, 62.5	15a	—	65,000	—	5,000	③	—	11-10
QHCW		15 – 30	2	120/240	24, 48, 80	15a	—	65,000	—	5,000	5,000	5,000	11-10
QHCW		15 – 20	3	240	—	15b	—	—	65,000	—	—	—	11-10
QCGF	C, GF	15 – 40	1	120	—	—	10,000	—	—	—	—	—	11-15
QCGF		15 – 50	2	120/240	—	—	—	10,000	—	—	—	—	11-15
QCHGF	C, GF	15 – 30	1	120	—	—	22,000	—	—	—	—	—	11-15
QCHGF		15 – 30	2	120/240	—	—	—	22,000	—	—	—	—	11-15
QCGFEP	C, GFEP	15 – 40	1	120	—	—	10,000	—	—	—	—	—	11-15
QCGFEP		15 – 50	2	120/240	—	—	—	10,000	—	—	—	—	11-15
QCHGFEP	C, GFEP	15 – 30	1	120	—	—	22,000	—	—	—	—	—	11-15
QCHGFEP		15 – 30	2	120/240	—	—	—	22,000	—	—	—	—	11-15

① QUICKLAG circuit breakers are suitable for application in relative humidity 0 – 95% noncondensing.
② Two-pole dc interrupting ratings based on 2 poles connected in series. Not UL listed.
③ 62.5 Vac interrupting rating is 3800 AIC 10 – 50 amperes and 2500 AIC 55 – 100 amperes continuous.

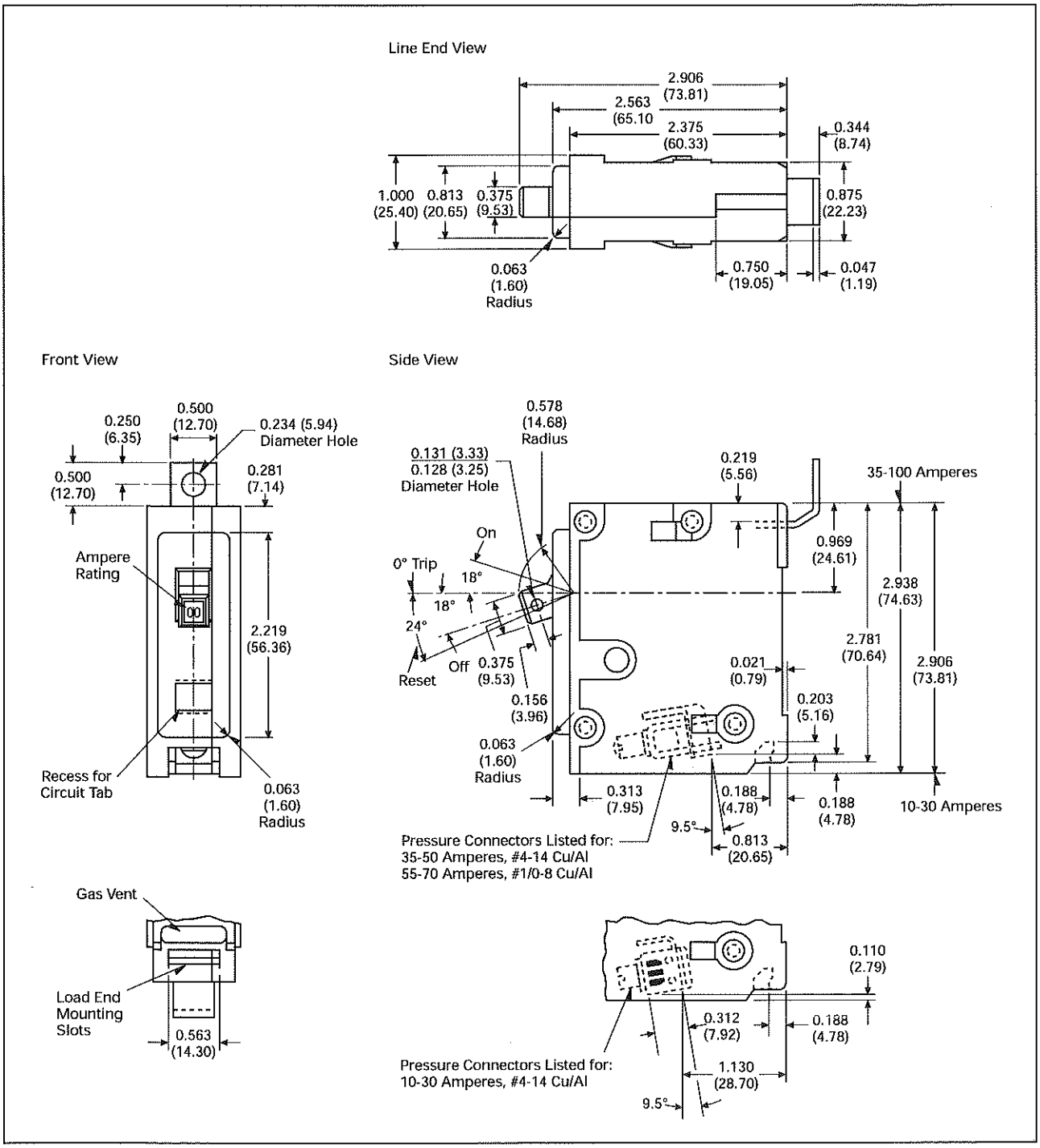
Note: Circuit Breaker Type Codes: **P** Plug-In; **B** Bolt-On; **C** Cable-In/Cable-Out; **GF** Ground Fault, 5 mA; **GFEP** Ground Fault, 30 mA; **AF** Arc Fault.

Note: For Types GHBS, GBHS and GHQRSP Solenoid-Operated, Remote-Controlled Circuit Breakers, see **Pages 11-16 – 11-19.**

Note: For Type WMT Circuit Breakers, see **Pages 11-27 – 11-36.**

Note: For Types WMS and SPHM Supplementary Protectors, see **Pages 11-37 – 11-50.**

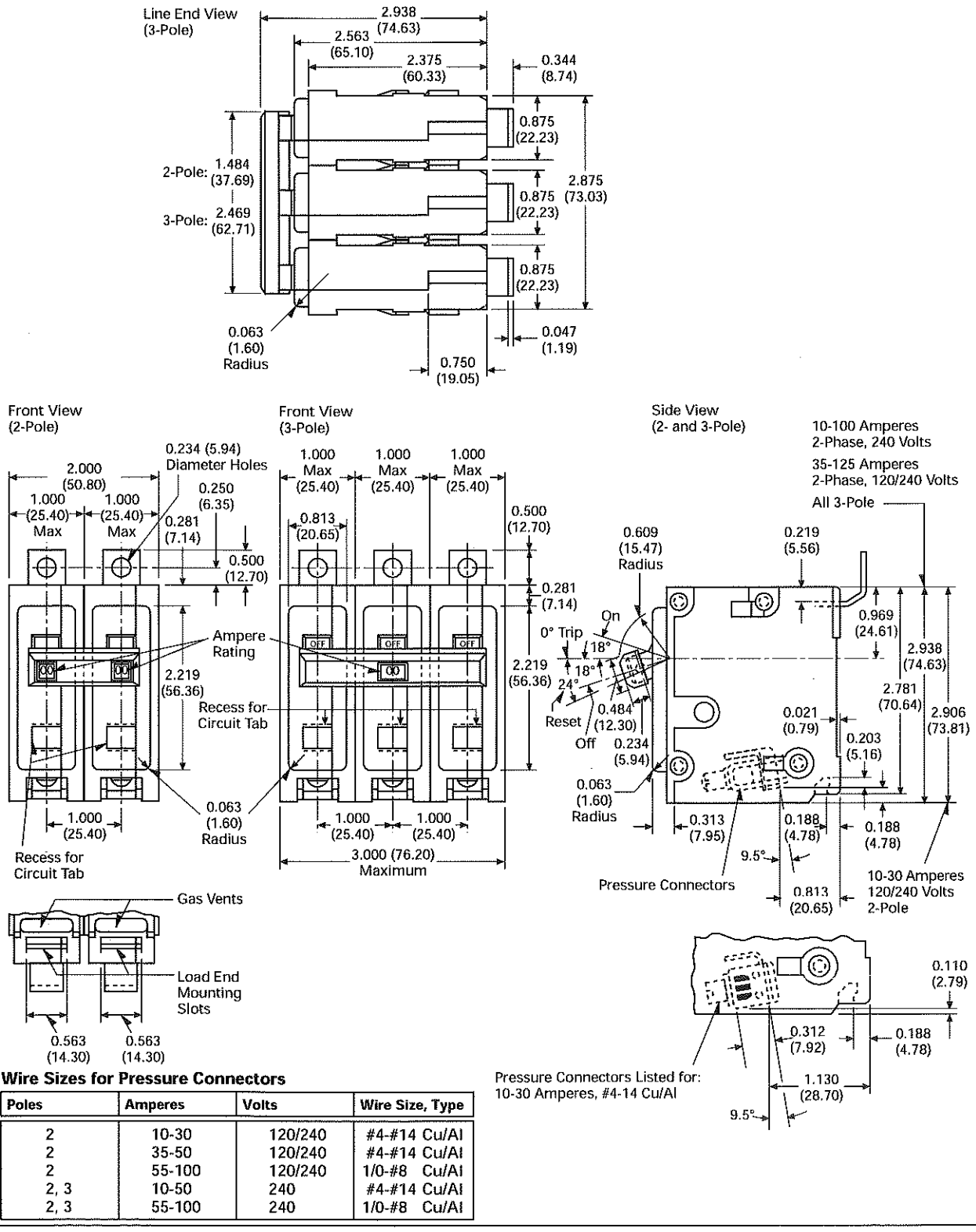
Types BAB, QBHW, HBAX, and HBAW Single-Pole Breakers



Reproduced from Drawings 1251C91, 1253C38.

Dimensions in parentheses in millimeters.

Types BAB, QBHW, HBAX, and HBAW Two- and Three-Pole Breakers



Wire Sizes for Pressure Connectors

Poles	Amperes	Volts	Wire Size, Type
2	10-30	120/240	#4-#14 Cu/Al
2	35-50	120/240	#4-#14 Cu/Al
2	55-100	120/240	1/0-#8 Cu/Al
2, 3	10-50	240	#4-#14 Cu/Al
2, 3	55-100	240	1/0-#8 Cu/Al

Dimensions in parentheses in millimeters. ***Reproduced from Drawings 1251C92, 1253C40, 2612C62.***

2 blank boxes to the right of the LCD display window are marked "A" and "kA". Use a permanent marker to check the appropriate box as follows:

"A" – when using the built-in CT, a 500:1 ratio C311CT external CT, or a 500:5 ratio interposing CT

"kA" – when using a 5000:5 ratio interposing CT

A current exceeding the maximum range of the system displays as 'OUt'. (This means the measured ground fault current is higher than the measuring range of the D64RPB100.)

Refer to Figure 5 for dimensions, door cutout and mounting provision. A bracket and two #10-24 (M5) bolts are supplied with each D64D1.

4.2 D64D2 REMOTE INDICATOR UNIT

The D64D2 Remote Indicator Unit is connected to the D64RPB100 by up to 30 feet/10m of low cost 4-wire telephone type cable. It provides the following remote indications and functions:

Green RUN LED	Flashing:	Okay
	Off:	No control voltage, control voltage too low, or D64RPB100 defective
	Steady on:	Control voltage too low or D64RPB100 defective
Red TRIP LED	Off:	No trip
	Steady on:	Trip

RESET: To reset relay and LED after a trip.

TEST: (See 2.6 Ground Fault Test for a description of the test procedure).

The RESET button must be held pressed before the TEST is pressed to invoke the test procedure. The function of this button can be enabled/disabled by inserting the interconnecting cable from the D64RPB100 relay into one of two sockets, TEST ON or TEST OFF, on the right side of the display. If the feature is disabled and the RESET and TEST buttons are pressed, the test will not take place and the red 'G/F TRIP' LED on the display flashes twice.

VERIFY: By pushing the VERIFY button on the Remote Display the D64D2 will show if the D64RPB100 to which it is connected tripped due to a ground fault prior to loss of its control voltage by lighting the red TRIP LED. If there was no ground fault trip prior to loss of control voltage the green RUN LED will light. This feature is especially useful when pulse tripping a breaker that also supplies control voltage to the D64RPB100. This indication will remain available for at least ten hours. The D64D2 will reset automatically when control voltage is restored.

5. CATALOG NUMBERS

D64RPB100	Series B1 Ground Fault Relay with built-in 1.81" (46mm) CT, 24 - 240 Volt ac or dc control voltage, for use on 660 Volts maximum, 50/60 Hz power system. Terminal blocks for external CT and remote Test/Reset pushbutton
D64D1	Digital Display Unit with LCD display and 1 meter interconnecting cable, for use with D64RPB100
D64D2	Remote Indicator Unit with1 meter interconnecting cable, for use with D64RPB100

Zero Sequence Current Transformers with 500:1 ratio:

C311CT1	1.81" (46 mm) inside diameter, Toroidal
C311CT2	3.54" (90 mm) inside diameter, Toroidal
C311CT3	5.9" x 6.7" (150 x 170 mm) rectangular, Split Core
C311CT4	3.94" x 13.78" (100 x 350 mm) rectangular, Split Core
C311CT5	5.7" (145 mm) inside diameter, Toroidal
C311CT6	9.45" (240 mm) inside diameter, Toroidal
C311CT7	11.8" x 11.8" (300 x 300 mm) square, Split core
C311CT8	1.1" (28 mm) inside diameter, Toroidal
C311CT9	2.56" (65 mm) inside diameter, Toroidal
C311CT28	1.1" (28 mm) inside diameter, Toroidal – with wire leads

For mounting dimensions and additional information on C311CT current transformers refer to the current Eaton's Cutler-Hammer catalog.

6. TECHNICAL SPECIFICATION

Control Voltage ..... 24 – 240 Volts ac or dc
0.6 VA @ 24 Vac
0.8 VA @ 120 Vac
1.1 VA @ 240 Vac
0.5 Watts @ dc Voltages

- Operating voltage tolerance ..... 80% to 110% of rated voltage 24 -32 V ac
  55% to 110% of rated voltage 32 – 240 V ac
  80% to 110% of rated voltage 24 – 240 V dc
- Isolation voltage ..... 400V rms. 50-60 Hz 1min, 2.5 kV impulse
- Under voltage tolerance (no impaired operation):

DC voltage ≥ 38V:	withstands loss of supply up to 50 ms
DC voltage ≥ 80V:	withstands loss of supply up to 180 ms
DC voltage ≥ 138V:	withstands loss of supply up to 400 ms
AC voltage ≥ 38V:	withstands loss of supply up to 70 ms
AC voltage ≥ 80V:	withstands loss of supply up to 250 ms
AC voltage ≥ 138V:	withstands loss of supply up to 600 ms

- Power Up Time ..... 500 milliseconds

Maximum System Voltage & Frequency ..... 660 Volts ac, 45 to 450 Hz

The D64RPB100 may be applied on higher voltage circuits providing the power conductors are insulated for the system voltage.

Output Relay:

Contacts: Maximum UL rating:
5 A @ 125 and 250 V ac, general use
5 A @ 30 V dc, resistive
1/6 hp, 125 and 250 V ac
3 A, 360 VA, @ 120 V ac, pilot duty
1.5 A, 360 VA, @ 240 V ac, pilot duty

EN 60947-5-1 rating:
5 A @ 250 Vac, Utilization category AC-12
4 A @ 250 Vac, Utilization category AC-13
3 A @ 250 Vac, Utilization category AC-14, AC15

(Continued on next page)

Output Relay (cont'd):

Contacts: EN 60947-5-1 rating: 5 A @ 30 Vdc, Utilization category DC-12
3 A @ 24 Vdc, Utilization category DC-13

Maximum fusing under EN 60947-5-1: ..... 13 A

Isolation voltage ..... 3 kV rms, 50-60 Hz, 1 min.
Between open contacts ..... 1 kV rms, 50-60 Hz, 1 min.
Between contact sets ..... 2 kV rms, 50-60 Hz, 1 min.

Configuration ..... Voltage free form "Z" 1 N.O. and 1 N.C. (4 terminals)

Operating Mode (Selected on DIPswitches 9 & 10) ..... Non-Failsafe

Failsafe

Pulsed Auto Reset

Functional Test:

A simulated current equal to the trip current set on the Trip Level DIPswitches replaces the measured current. This tests all internal electronics and secondary winding of the built-in current transformer. No external power supply or additional wiring is required.

Local Test ..... Double click RESET button on front of relay

Remote Test ..... Double click button connected to terminals R1 and R2
Or via D64D1 or D64D2

Reset ..... RESET button on front of relay

Remote Reset ..... Single push of button connected to terminals R1 and R2
Or via D64D1 or D64D2

Reset mode ..... Manual or Pulsed Auto Reset

Ground Fault Circuit:

Ground Fault Trip Time Delay ..... 20 milliseconds - 5.00 Seconds

Setting within Range ..... DIPswitches 6, 7, & 8 on front of relay

Ground Fault Trip Time Delay Accuracy:

Trip Current Level Set between 0.030 – 2.5 Amps (3 – 250 A, 0.030 – 2.5 kA)

Trip delay setpoint	@ 1.2 x Ground Fault setpoint	@ 2 x Ground Fault setpoint	@ 4 x Ground Fault setpoint	@ ≥6 x Ground Fault setpoint
20 ms	57 – 90 ms	34 – 53 ms	23 – 40 ms	17 – 34 ms
50 ms	87 – 120 ms	64 – 83 ms	53 – 70 ms	47 – 64 ms
100 ms	137 – 170 ms	114 – 133 ms	103 – 120 ms	97 – 114 ms
200 ms	237 – 270 ms	214 – 233 ms	203 – 220 ms	197 – 214 ms
500 ms	531 – 581 ms	507 – 544 ms	497 – 531 ms	491 – 525 ms
1.0 s	1031 – 1081 ms	1007 – 1044 ms	997 – 1031 ms	991 – 1025 ms
2.0 s	2031 – 2081 ms	2007 – 2044 ms	1997 – 2031 ms	1991 – 2025 ms
5.0 s	4890 – 5081 ms	4867 – 5044 ms	4856 – 5031 ms	4850 – 5025 ms

Ground Fault Trip Time Delay Accuracy (cont'd):

Trip Current Level set at 4 Amps (400 A, 4 kA)

Trip delay setpoint	@ 1.2 x Ground Fault setpoint	@ 2 x Ground Fault setpoint	@ ≥3.7 x Ground Fault setpoint
20 ms	57 – 90 ms	34 – 53 ms	20 – 37 ms
50 ms	87 – 120 ms	64 – 83 ms	50 – 67 ms
100 ms	137 – 170 ms	114 – 133 ms	100 – 117 ms
200 ms	237 – 270 ms	214 – 233 ms	200 – 217 ms
500 ms	531 – 581 ms	507 – 544 ms	494 – 528 ms
1.0 s	1031 – 1081 ms	1007 – 1044 ms	994 – 1028 ms
2.0 s	2031 – 2081 ms	2007 – 2044 ms	1994 – 2028 ms
5.0 s	4890 – 5081 ms	4867 – 5044 ms	4853 – 5028 ms

Trip Current Level set at 6 Amps (600 A, 6 kA)

Trip delay setpoint	@ 1.2 x Ground Fault setpoint	@ 2 x Ground Fault setpoint	@ ≥2.5 x Ground Fault setpoint
20 ms	57 – 90 ms	34 – 53 ms	24 – 46 ms
50 ms	87 – 120 ms	64 – 83 ms	54 – 76 ms
100 ms	137 – 170 ms	114 – 133 ms	104 – 126 ms
200 ms	237 – 270 ms	214 – 233 ms	204 – 226 ms
500 ms	531 – 581 ms	507 – 544 ms	498 – 537 ms
1.0 s	1031 – 1081 ms	1007 – 1044 ms	998 – 1037 ms
2.0 s	2031 – 2081 ms	2007 – 2044 ms	1998 – 2037 ms
5.0 s	4890 – 5081 ms	4867 – 5044 ms	4857 – 5037 ms

Trip Current Level set at 9 Amps (900 A, 9 kA)

Trip delay setpoint	@ 1.2 x Ground Fault setpoint	@ 1.7 x Ground Fault setpoint
20 ms	57 – 90 ms	33 – 55 ms
50 ms	87 – 120 ms	63 – 85 ms
100 ms	137 – 170 ms	113 – 135 ms
200 ms	237 – 270 ms	213 – 235 ms
500 ms	531 – 581 ms	507 – 546 ms
1.0 s	1031 – 1081 ms	1007 – 1046 ms
2.0 s	2031 – 2081 ms	2007 – 2046 ms
5.0 s	4890 – 5081 ms	4866 – 5046 ms

Output Relay (cont'd):

Contacts: EN 60947-5-1 rating: 5 A @ 30 Vdc, Utilization category DC-12
3 A @ 24 Vdc, Utilization category DC-13

Maximum fusing under EN 60947-5-1: ..... 13 A

Isolation voltage ..... 3 kV rms, 50-60 Hz, 1 min.
Between open contacts ..... 1 kV rms, 50-60 Hz, 1 min.
Between contact sets ..... 2 kV rms, 50-60 Hz, 1 min.

Configuration ..... Voltage free form "Z" 1 N.O. and 1 N.C. (4 terminals)

Operating Mode (Selected on DIPswitches 9 & 10) ..... Non-Failsafe

Failsafe

Pulsed Auto Reset

Functional Test:

A simulated current equal to the trip current set on the Trip Level DIPswitches replaces the measured current. This tests all internal electronics and secondary winding of the built-in current transformer. No external power supply or additional wiring is required.

Local Test ..... Double click RESET button on front of relay

Remote Test ..... Double click button connected to terminals R1 and R2
Or via D64D1 or D64D2

Reset ..... RESET button on front of relay

Remote Reset ..... Single push of button connected to terminals R1 and R2
Or via D64D1 or D64D2

Reset mode ..... Manual or Pulsed Auto Reset

Ground Fault Circuit:

Ground Fault Trip Time Delay ..... 20 milliseconds - 5.00 Seconds

Setting within Range ..... DIPswitches 6, 7, & 8 on front of relay

Ground Fault Trip Time Delay Accuracy:

Trip Current Level Set between 0.030 – 2.5 Amps (3 – 250 A, 0.030 – 2.5 kA)

Trip delay setpoint	@ 1.2 x Ground Fault setpoint	@ 2 x Ground Fault setpoint	@ 4 x Ground Fault setpoint	@ ≥6 x Ground Fault setpoint
20 ms	57 – 90 ms	34 – 53 ms	23 – 40 ms	17 – 34 ms
50 ms	87 – 120 ms	64 – 83 ms	53 – 70 ms	47 – 64 ms
100 ms	137 – 170 ms	114 – 133 ms	103 – 120 ms	97 – 114 ms
200 ms	237 – 270 ms	214 – 233 ms	203 – 220 ms	197 – 214 ms
500 ms	531 – 581 ms	507 – 544 ms	497 – 531 ms	491 – 525 ms
1.0 s	1031 – 1081 ms	1007 – 1044 ms	997 – 1031 ms	991 – 1025 ms
2.0 s	2031 – 2081 ms	2007 – 2044 ms	1997 – 2031 ms	1991 – 2025 ms
5.0 s	4890 – 5081 ms	4867 – 5044 ms	4856 – 5031 ms	4850 – 5025 ms

Ground Fault Trip Time Delay Accuracy (cont'd):

Trip Current Level set at 4 Amps (400 A, 4 kA)

Trip delay setpoint	@ 1.2 x Ground Fault setpoint	@ 2 x Ground Fault setpoint	@ ≥3.7 x Ground Fault setpoint
20 ms	57 – 90 ms	34 – 53 ms	20 – 37 ms
50 ms	87 – 120 ms	64 – 83 ms	50 – 67 ms
100 ms	137 – 170 ms	114 – 133 ms	100 – 117 ms
200 ms	237 – 270 ms	214 – 233 ms	200 – 217 ms
500 ms	531 – 581 ms	507 – 544 ms	494 – 528 ms
1.0 s	1031 – 1081 ms	1007 – 1044 ms	994 – 1028 ms
2.0 s	2031 – 2081 ms	2007 – 2044 ms	1994 – 2028 ms
5.0 s	4890 – 5081 ms	4867 – 5044 ms	4853 – 5028 ms

Trip Current Level set at 6 Amps (600 A, 6 kA)

Trip delay setpoint	@ 1.2 x Ground Fault setpoint	@ 2 x Ground Fault setpoint	@ ≥2.5 x Ground Fault setpoint
20 ms	57 – 90 ms	34 – 53 ms	24 – 46 ms
50 ms	87 – 120 ms	64 – 83 ms	54 – 76 ms
100 ms	137 – 170 ms	114 – 133 ms	104 – 126 ms
200 ms	237 – 270 ms	214 – 233 ms	204 – 226 ms
500 ms	531 – 581 ms	507 – 544 ms	498 – 537 ms
1.0 s	1031 – 1081 ms	1007 – 1044 ms	998 – 1037 ms
2.0 s	2031 – 2081 ms	2007 – 2044 ms	1998 – 2037 ms
5.0 s	4890 – 5081 ms	4867 – 5044 ms	4857 – 5037 ms

Trip Current Level set at 9 Amps (900 A, 9 kA)

Trip delay setpoint	@ 1.2 x Ground Fault setpoint	@ 1.7 x Ground Fault setpoint
20 ms	57 – 90 ms	33 – 55 ms
50 ms	87 – 120 ms	63 – 85 ms
100 ms	137 – 170 ms	113 – 135 ms
200 ms	237 – 270 ms	213 – 235 ms
500 ms	531 – 581 ms	507 – 546 ms
1.0 s	1031 – 1081 ms	1007 – 1046 ms
2.0 s	2031 – 2081 ms	2007 – 2046 ms
5.0 s	4890 – 5081 ms	4866 – 5046 ms

SANAQATIIT
CONSTRUCTION LTD.

Shop Drawing Transmittal

Project Name: Potable Water System – Phase I

Sanaqatiit Project Number: 12-505 **Submittal Number:** 12-505-10

Owner Project Number: 11-4002

Product Description: Motor Starters.

Specification Number: 26 29 10

Total Pages: 10 including cover

Submitted by: Sarah Fox

To: Warren McLeod, Stantec **CC:** Arlen Foster, Stantec

Via: Electronic Submission **Date:** **February 21, 2013**

Notes:

Attached pages are related to the electric motor starters.

SHOP DRAWING REVIEW

Project: Cambridge Bay Potable Water System

Location: Cambridge Bay, NU

General Contractor: Sanaqatiit Construction Ltd.

Engineer: Stantec

Section 26 29 10 – Motor Starters

Reviewed by: Darren Fraser

APPROVED
By Darren Fraser at 11:23 am, Feb 21, 2013

SHOP DRAWINGS ARE REVIEWED UNLESS NOTED OTHERWISE		
REVIEWED AS MODIFIED		Stantec
REVISE & RESUBMIT		
SEAL & SIGNATURES REQUIRED		
DATE March 6/2013		
SIGNATURE		
REVIEW BY STANTEC IS FOR THE SOLE PURPOSE OF ASCERTAINING GENERAL CONFORMITY WITH DESIGN. CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS, FABRICATION AND CONSTRUCTION METHODS. COORDINATION OF SUB-TRADES, DETAIL DESIGN OF COMPONENTS, AND ERRORS OR OMISSIONS ON SHOP DRAWINGS.		

Ryfan Kitikmeot Ltd.
Box 297, Kugluktuk, NU X0E 0E0
Email: dfraser@ryfan.ca



Powering Business Worldwide

Enclosed Control (NEMA)

APPROVED
By Darren Fraser at 11:23 am, Feb 21, 2013

REVISION	01

ITEM	CUSTOMER REFERENCE	CATOLOGUE OR DEVICE No.	H.P.	CEMA SIZE	MOTOR NAMEPLATE F.L.A.	CIRCUIT BREAKER OR INTERUPTER OR DISCONNECT SWITCH AMPS	CIRCUIT BREAKER OR INTERUPTER OR DISCONNECT SWITCH FRAME OR FUSE TYPE	NO. OF POLES	O/L HEATER	SELECTOR SWITCH OR PUSHBUTTONS	PILOT LIGHT RED	PILOT LIGHT GRN	PILOT LIGHT AMBER	EXTRA ELECT. CONTACT N.O.	EXTRA ELECT. CONTACT N.C.	CONTROL TRANSFORMER VA	ENCLOSURE PAGE #	* NOTES
A		SNED3200LS				200	ED	3										1
B	RWP-1	ECN2439EJG-A30A31G1	15	3		100	HMCP	3		HOA	1			2	2	150	5	2
C	RWP-2	ECN2439EJG-A30A31G1	15	3		100	HMCP	3		HOA	1			2	2	150	5	2
D	AB	ECN2419EJE-H5/D10A30A31G1	3	1		30	HMCP	3	H2010	HOA	1			2	2	150	6	2
E	P-P1	ECN2419EJC-H5/D7A30A31G1	1/2	1		7	HMCP	3	H2007	HOA	1			2	2	150	6	2
F	FUEL	ECN2419EJE-A30A31G1	5	1		30	HMCP	3		HOA	1			2	2	150	6	2
G		ECN2419EJE-A30A31G1	5	1		30	HMCP	3		HOA	1			2	2	150	6	2
H		MMP/R/HOA/PL/N4	TBA	FR				1		HOA	1						7	3
I		MMP/R/HOA/PL/N4	TBA	FR				1		HOA	1						7	3
J		MMP/R/HOA/PL/N4	TBA	FR				1		HOA	1						7	3
K		MMP/R/HOA/PL/N4	TBA	FR				1		HOA	1						7	3
L		MMP/R/HOA/PL/N4	TBA	FR				1		HOA	1						7	3
M		MMP/R/HOA/PL/N4	TBA	FR				1		HOA	1						7	3
N		MMP/R/HOA/PL/N4	TBA	FR				1		HOA	1						7	3
O		MMP/R/HOA/PL/N4	TBA	FR				1		HOA	1						7	3
P		MMP/R/HOA/PL/N4	TBA	FR				1		HOA	1						7	3
Q		MMP/R/HOA/PL/N4	TBA	FR				1		HOA	1						7	3
R		MMP/R/HOA/PL/N4	TBA	FR				1		HOA	1						7	3
S		MMP/R/HOA/PL/N4	TBA	FR				1		HOA	1						7	3
T		MMP/R/HOA/PL/N4	TBA	FR				1		HOA	1						7	3
U																		

*NOTES

1. ENCLOSED CIRCUIT BREAKER, SEE PAGE 2.
2. WIRE PER PAGE 3, CODE C, EEMAC 4X ENCLOSED, BOX C, 208V
3. WIRE PER PAGE 3, CODE C, EEMAC 4X ENCLOSED, BOX B, 208V
4. WIRE PER PAGE 4, EEMAC 4 ENCLOSED 120V
5.
6.

SUPPLY		CONTROL	
VOLTS	208/120	VOLTS	120
PHASE	3/1	PHASE	1
HERTZ	60	HERTZ	60

CUSTOMER RYFAN ELECTRIC

DISTRIBUTOR WESCO

PROJECT CAMBRIDGE BAY POTABLE WATER

CONSULTANT

CUSTOMER #

DISTRIBUTOR # 2510-913418

Issued For Approval

The information on this document is intended to convey and document that the contract specification has been accurately interpreted and may not be accurate for construction purposes.

THE INFORMATION ON THIS DOCUMENT WAS CREATED BY EATON CORP. IT WAS DISCLOSED IN CONFIDENCE AND IS ONLY TO BE USED FOR THE PURPOSE IN WHICH IT WAS SUPPLIED.

DFTR	DATE
D.SIMARD	07/05/12
APPD	DATE
.	.
S.O.	05-105543

EATON EDMONTON SATELLITE

TITLE STANDARD CONTROL MOTOR STARTERS AND ABI

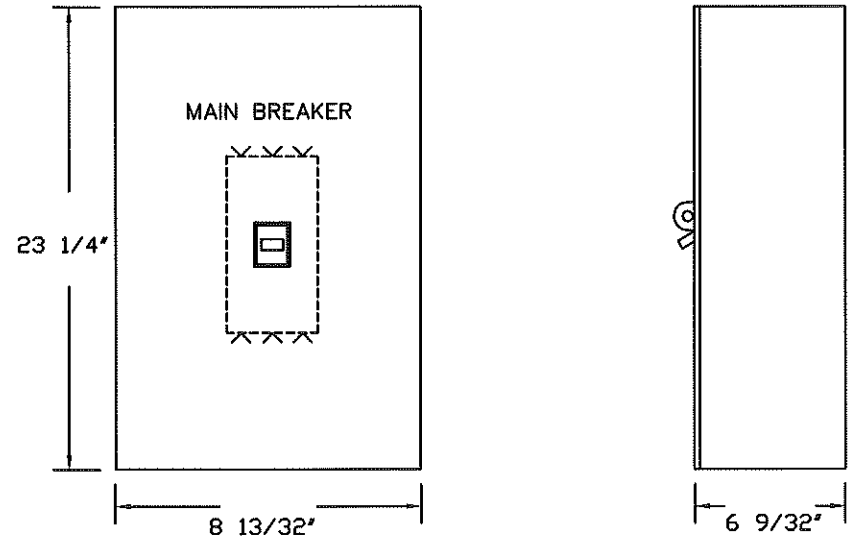
TYPE STANDARD CONTROL — INFORMATION

FEDERAL ID NO.	PRODUCT CODE	REVISION		G.O.	DWG	SHEET
88725	410	01		CSCI044220	DFORM	1 OF 7

REVISION
01

BREAKER
TYPE ED3200 POLES 3
FRAME RATING 225 AMPERES
TRIP RATING 200 AMPERES
BREAKER TERMINALS PER DRAWING # C04A312
SERVICE
240 VOLTS 3 ø 3 W
CABLE
#14 to 1/0 (per) ø & N

ENCLOSURE
EEMAC 1
STOCK # SFDN225
FINISH
BOX ASA-61
TRIM ASA-61
MAXIMUM AMPERES 225



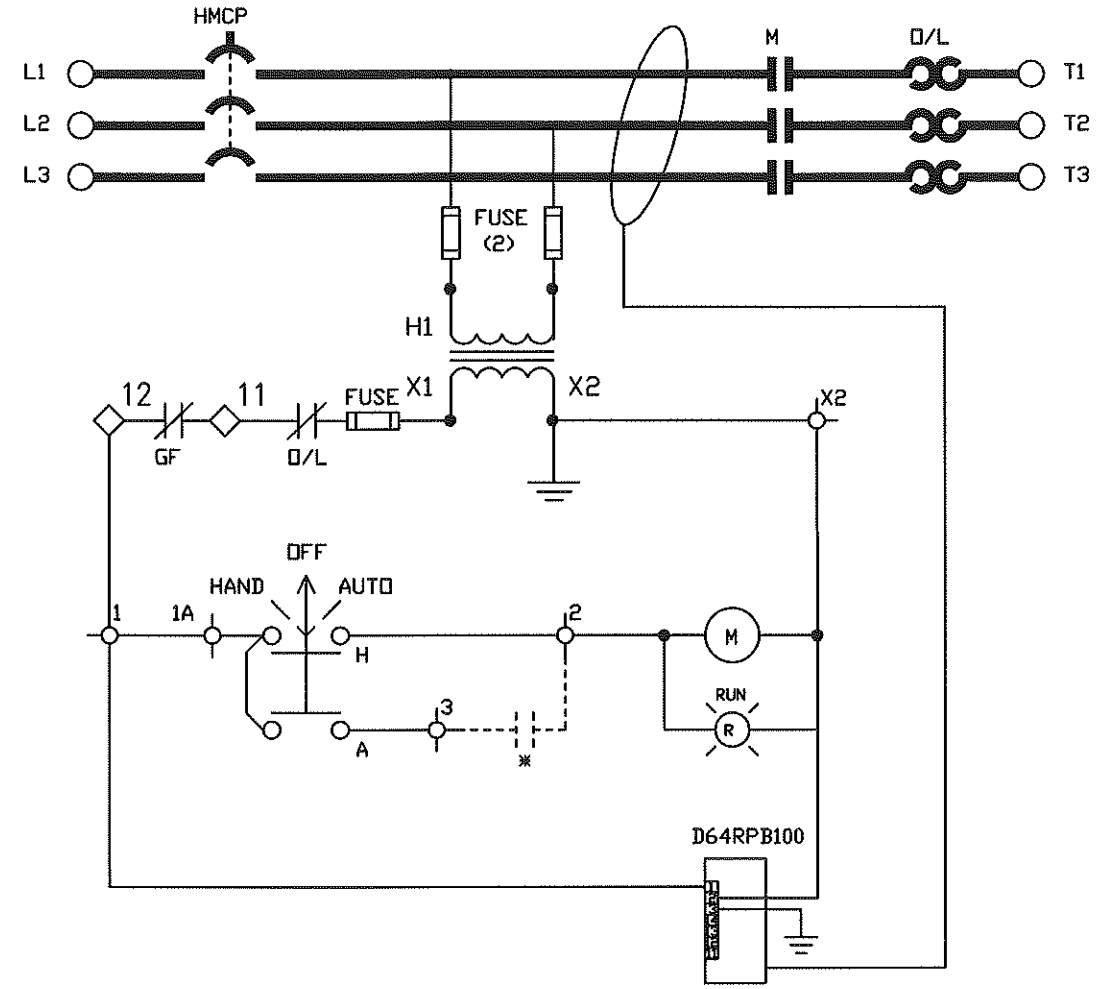
NOTES:

ENCLOSURE OF CODE GUAGE STEEL, CEMA 1
HANDLE PADLOCKABLE

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DFTR	DATE	EATON	EDMONTON SATELLITE
D.SIMARD	02/06/13		
APPD	DATE	TITLE	ABI ENCLOSED CIRCUIT BREAKER
.	.		
S.O.		TYPE	BREAKER LAYOUT
05-105543		ENCLOSED CIRCUIT BREAKER	
FEDERAL ID NO.	PRODUCT CODE	REVISION	G.O. / DWG / SHEET
88725	210	01	CSCI044220 / AB1BLANKEDM / 2 OF 7

01
REVISION



LEGEND:

M - MAGNETIC STARTER.
HMCP - MOTOR CIRCUIT INTERRUPTER.
CCT - CONTROL CIRCUIT TRANSFORMER,SIZED PER ORDER SPECIFICATIONS.
FUSE - PRIMARY AND SECONDARY FUSES SIZED PER CONTROL CIRCUIT TRANSFOMER.
* - REMOTE DEVICE

XX - TERMINAL BLOCK

XX - D64 TERMINAL

X2
1
1A
2
3
4
5

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DFTR	DATE
DLS	02/06/13
APPD	DATE
.	.
S.O.	05-105543

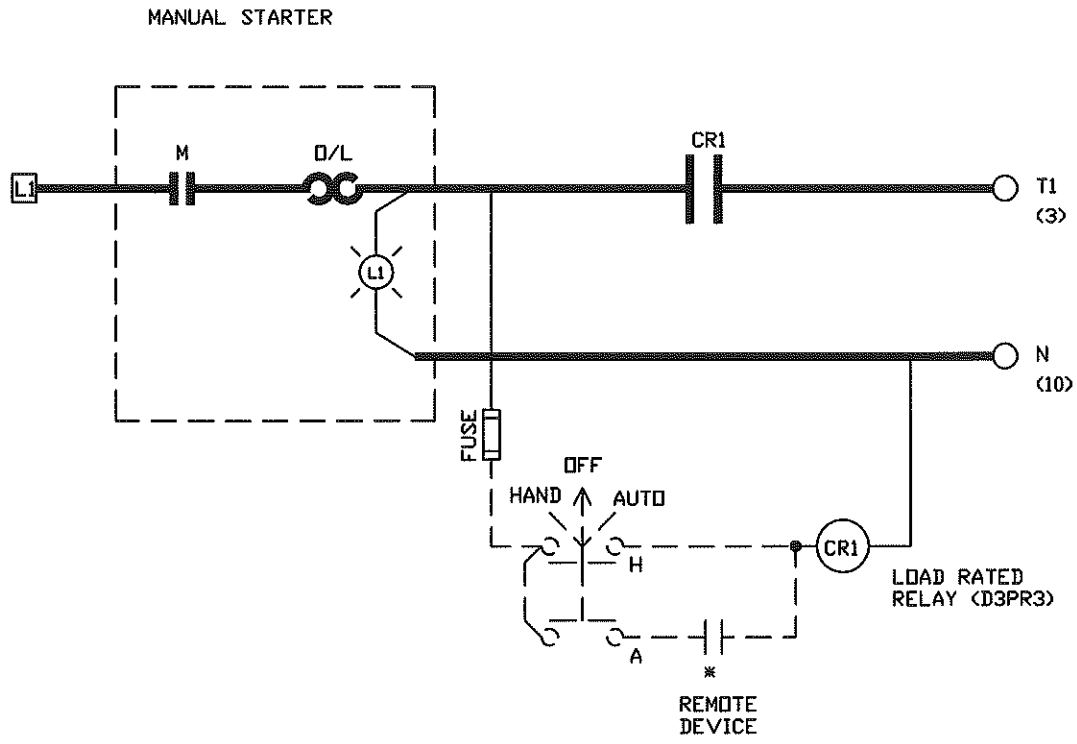
EATON EDMONTON SATELLITE

TITLE: STANDARD DIAGRAM FVNR SZ 1 TO 6 STARTER HOA, CONTROL TRANSFORMER, PRIMARY FUSED, GF RELAY

TYPE: STANDARD CONTROL — INFORMATION

FEDERAL ID NO.	PRODUCT CODE	REVISION	G.O.	DWG	SHEET
88725	410	01	CSCI044220	ECN GF	3 OF 7

REVISION
01



NOTES:
L1 - TERMINAL ON BACK PAN.
T1(3) AND N(10) TERMINAL ON RELAY BASE..

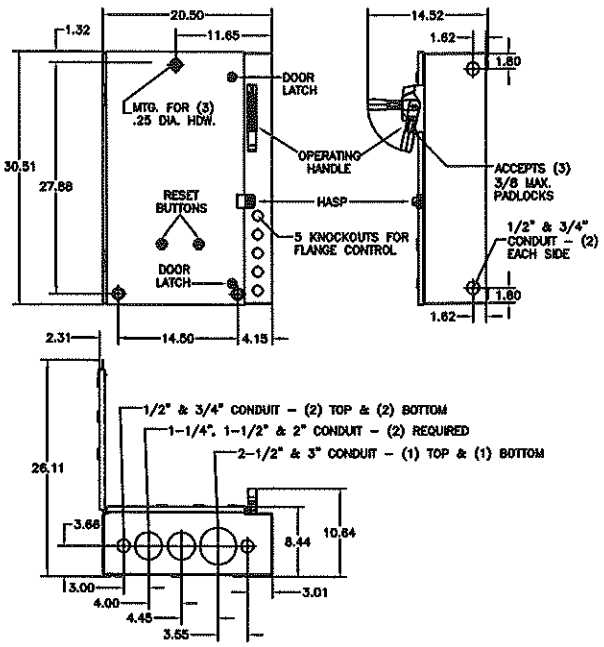
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DFTR D.SIMARD	DATE 07/22/04	EATON	EDMONTON SATELLITE
APPD .	DATE .	TITLE STANDARD CONTROL MANUAL MOTOR STARTERS	
S.O. 05-105543		TYPE STANDARD CONTROL	INFORMATION
FEDERAL ID NO. 88725	PRODUCT CODE 410	REVISION 01	G.O. CSCI044220
DWG MMPR1PH	SHEET 4 OF 7		

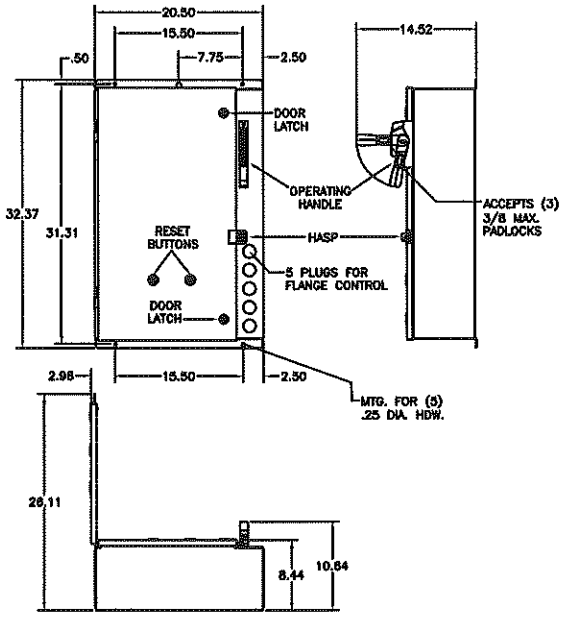
REVISION	01

ENCLOSURE DIMENSIONS - BOX C

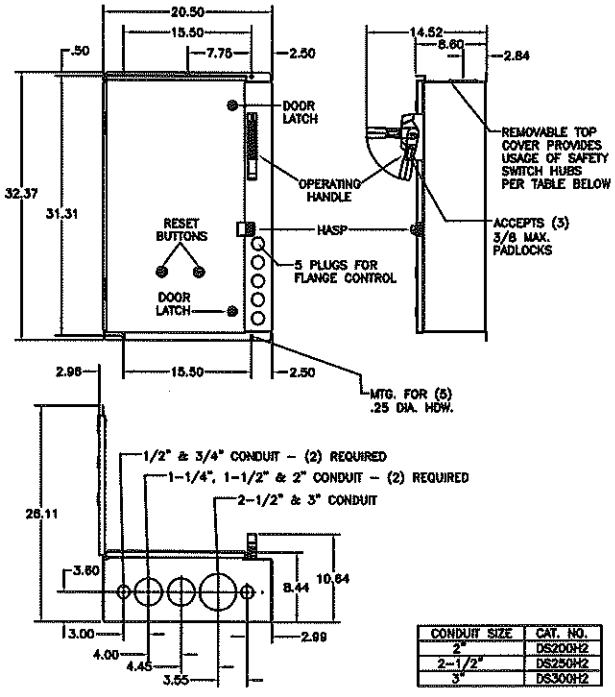
BOX C, EEMAC 1



BOX C, EEMAC 12

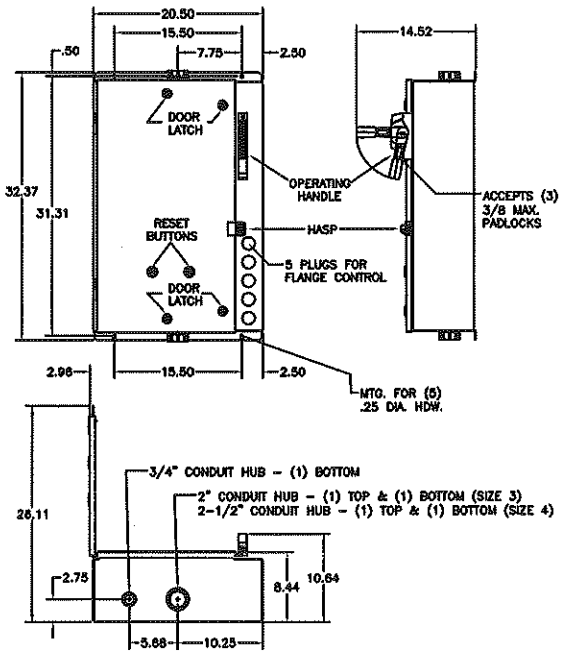


BOX C, EEMAC 3R



CONDUIT SIZE	CAT. NO.
2"	DS200H2
2-1/2"	DS250H2
3"	DS300H2

BOX C, EEMAC 4/4X



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DFTR	DATE
D.SIMARD	11/24/03
APPD	DATE
.	.
S.O.	05–105543

EATON EDMONTON SATELLITE

TITLE: ENCLOSURE DIMENSIONS BOX C

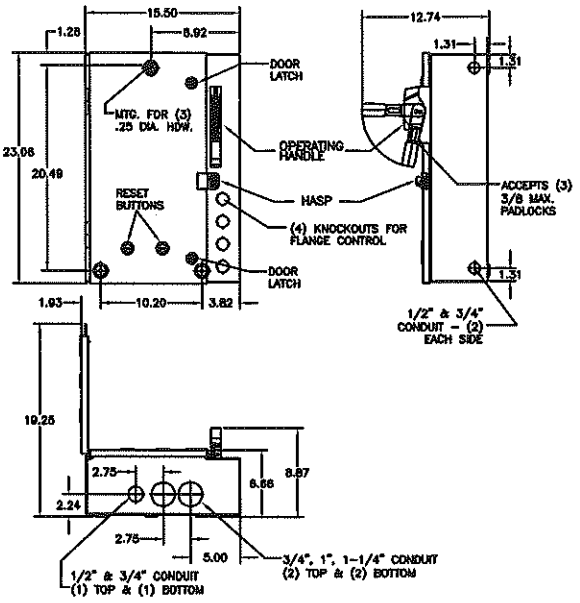
TYPE: STANDARD CONTROL — LAYOUT

FEDERAL ID NO.	PRODUCT CODE	REVISION		G.O.	DWG	SHEET
88725	410	01		CSCI044220	BOX(C)	5 OF 7

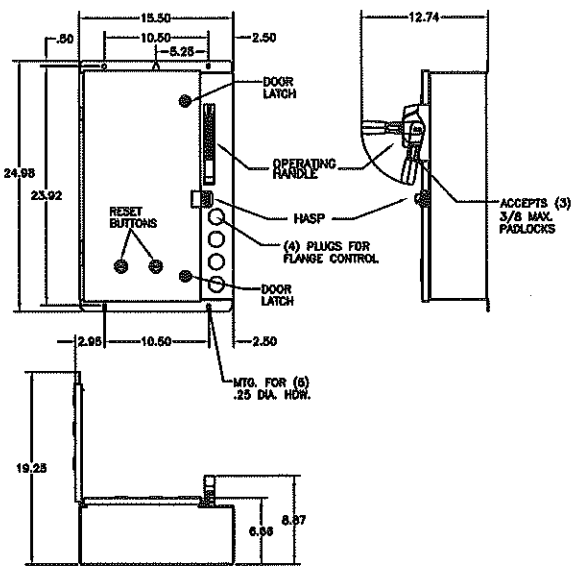
REVISION
01

ENCLOSURE DIMENSIONS - BOX B

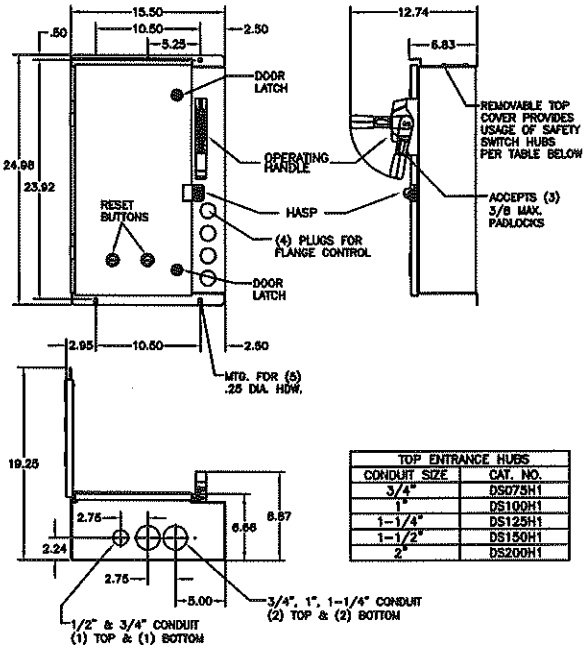
BOX B, EEMAC 1



BOX B, EEMAC 12

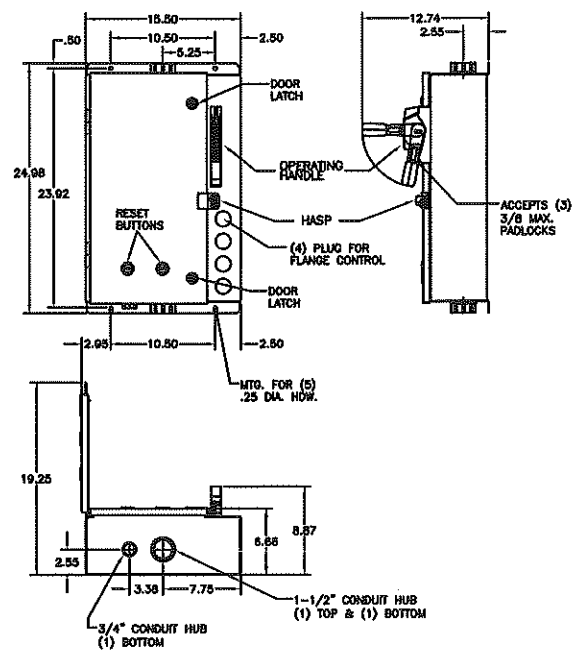


BOX B, EEMAC 3R



TOP ENTRANCE HUBS	
CONDUIT SIZE	CAT. NO.
3/4"	DS075H1
1"	DS100H1
1-1/4"	DS125H1
1-1/2"	DS150H1
2"	DS200H1

BOX B, EEMAC 4/4X



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DFTR	DATE
D.SIMARD	11/24/03
APPD	DATE
.	.
S.O.	
05-105543	

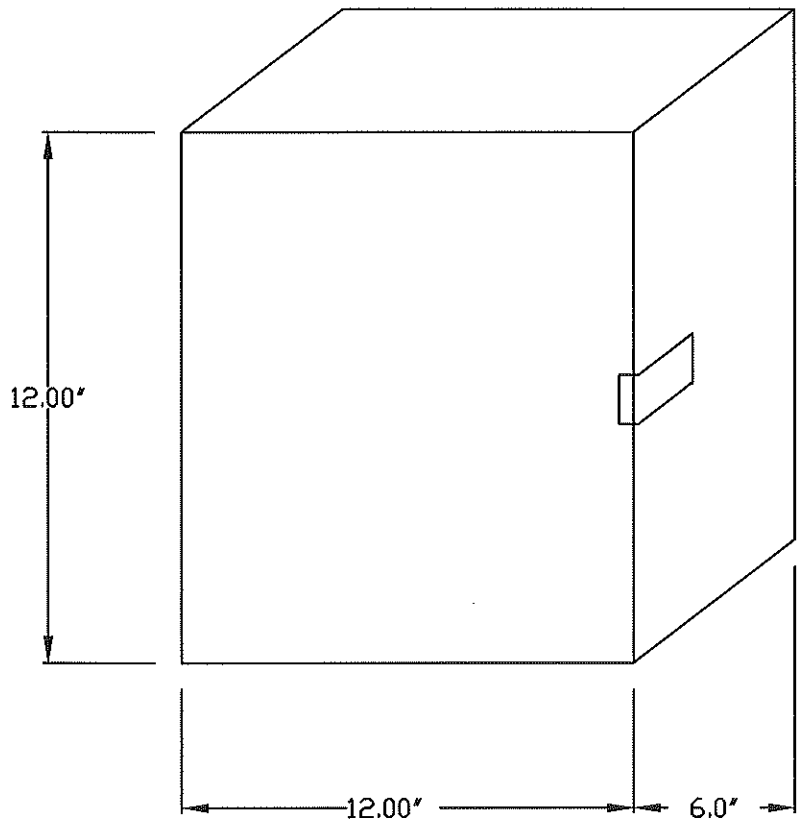
EATON — EDMONTON SATELLITE

TITLE: ENCLOSURE DIMENSIONS BOX B

TYPE: STANDARD CONTROL — LAYOUT

FEDERAL ID NO.	PRODUCT CODE	REVISION		G.O.	DWG	SHEET
88725	410	01		CSCI044220	BOX(B)	6 OF 7

REVISION	01



NOTES:
-DIMENSIONS NOT TO BE USED FOR CONSTRUCTION PURPOSES UNLESS APPROVED.
-ALL DIMENSIONS IN INCHES.

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DFTR: D.SIMARD	DATE: 11/24/03	EATON EDMONTON SATELLITE	
APPD: .	DATE: .	TITLE: SZ 1, 2 NON COMB CUSTOM ENCLOSURE 12X12X6	
S.O.: 05-105543		TYPE: STANDARD CONTROL	WIRING
FEDERAL ID NO.: 88725	PRODUCT CODE: 410	REVISION: 01	G.O.: CSCI044220
DWG: 12X12X6	SHEET: 7 OF 7		

SANAQATIIT
CONSTRUCTION LTD.

Shop Drawing Transmittal

Project Name: Potable Water System – Phase I

Sanaqatiit Project Number: 12-505 **Submittal Number:** 12-505-08

Owner Project Number: 11-4002

Product Description: Molded Case Breakers.

Specification Number: 26 28 21

Total Pages: 8 including cover

Submitted by: Sarah Fox

To: Warren McLeod, Stantec **CC:** Arlen Foster, Stantec

Via: Electronic Submission **Date:** **February 21, 2013**

Notes:

Attached pages are related to the molded case circuit breaker.

SHOP DRAWING REVIEW

Project: Cambridge Bay Potable Water System

Location: Cambridge Bay, NU

General Contractor: Sanaqatiit Construction Ltd.

Engineer: Stantec

Section 26 28 21 – Molded Case breakers

Reviewed by: Darren Fraser

APPROVED
By Darren Fraser at 11:22 am, Feb 21, 2013

SHOP DRAWINGS ARE REVIEWED UNLESS NOTED OTHERWISE
REVIEWED AS MODIFIED
REVISE & RESUBMIT
SEAL & SIGNATURES REQUIRED
Stantec
DATE March 6/2013
SIGNATURE
REVIEW BY STANTEC IS FOR THE SOLE PURPOSE OF ASCERTAINING GENERAL CONFORMITY WITH DESIGN. CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS, FABRICATION AND CONSTRUCTION METHODS. COORDINATION OF SUB-TRADES, DETAIL DESIGN OF COMPONENTS, AND ERRORS OR OMISSIONS ON SHOP DRAWINGS.

Ryfan Kitikmeot Ltd.
Box 297, Kugluktuk, NU X0E 0E0
Email: dfraser@ryfan.ca

Powering Business Worldwide

Enclosed Circuit Breakers

APPROVED
By Darren Fraser at 11:22 am, Feb 21, 2013

Neg# ENIF0508D202 Alt# C001 02/08/13
11:32:02

Customer Bill of Material

1 Enclosed Breakers
Factory Assembled Enclosed Circuit Breaker
Catalog Number SNED3200LS
240Volts, 200Amps, 3 Pole, 65 KAIC

1 Factory Assembled Enclosed Thermal Magnetic Circuit Breaker - SNED3200LS
1 Molded Case Circuit Breaker with Standard Terminals - ED3200L
1 Circuit Breaker Load Terminals - 14AWG-4/0 - 3T150FB
1 Circuit Breaker Enclosure - Nema 1 Surface Mounted - SFDN225
1 Enclosure Neutral Kit - N250
Designations:

All orders must be released for manufacture within 90 days of date of order entry. If approval drawings are required, drawings must be returned approved for release within 60 days of mailing. If drawings are not returned accordingly, and/or if shipment is delayed by the customer, the price of the order will increase by 1.0% per month.



Typical F-Frame Breaker

Technical Data and Specifications

CSA C22.2 No. 5.1 and UL489 Interrupting Capacity Ratings

Circuit Breaker Type	Number of Poles	Interrupting Capacity (Symmetrical Amperes) (kA)							Page Number
		Volts Ac (50/60 Hz)					Volts Dc①		
		240	277	347	480	600	125	250②③	
ED	2, 3	65	–	–	–	–	10	–	F-3
EDH	2, 3	100	–	–	–	–	10	–	F-3
EDC	2, 3	200	–	–	–	–	10	–	F-3
EHD	1	–	14	–	–	–	10	–	F-3
	2, 3	18	–	–	14	–	–	10	F-3
FDB	1	–	–	14④	–	–	10④	–	F-3
	2, 3, 4	18	–	–	14	14	–	10	F-3
FD	1	–	25	18	–	–	10	–	F-3
	2, 3, 4	65	–	–	25	18	–	10	F-3
HFD	1	–	65	25④	–	–	10	–	F-4
	2, 3, 4	100	–	–	65	25	–	22	F-4
FDC	1	–	–	30④			10④		F-4
	2, 3, 4	200	–	–	100	35	–	22	F-4

Product Description

- All F-frame circuit breakers are HACR rated. UL listed only.
- All circuit breakers 10 through 50 amperes are suitable for HID (high intensity discharge) use. 480 VAC max.
- All F-frame circuit breakers are suitable for reverse feed use.

IEC 157-1 (P1) Interrupting Capacity Ratings (P1)

Circuit Breaker Type	Number of Poles	Interrupting Capacity (Symmetrical Amperes) (kA)						Page Number
		Volts Ac (50/60 Hz)				Volts Dc①		
		220, 240	380, 415	440	500	125	250②③	
ED	2, 3	65	–	–	–	10	–	F-3
EDH	2, 3	100	–	–	–	10	–	F-3
EDC	2, 3	200	–	–	–	10	–	F-3
FDB	2, 3, 4	18	14	14	14	–	10	F-3
FD	1	25	–	–	–	10	–	F-3
	2, 3, 4	65	35	35	18	–	10	F-3
HFD	1	65	–	–	–	10	–	F-4
	2, 3, 4	100	65	65	25	–	22	F-4
FDC	2, 3, 4	200	100	100	35	–	22	F-4

① Dc ratings apply to substantially non-inductive circuits.
② 2-pole circuit breaker, or two poles of 3-pole circuit breaker.
③ Time constant is 3 milliseconds minimum at 10 kA and 8 milliseconds minimum at 22 kA.
④ CSA listed only.

Types ED, EDH, and EDC Thermal-Magnetic Circuit Breakers with Non-Interchangeable Trip Units

Maximum Continuous Ampere Rating @ 40°C	240 Vac Maximum, 125 Vdc					
	65 kAIC @ 240 Vac		100 kAIC @ 240 Vac		200 kAIC @ 240 Vac	
	Type ED ③		Type EDH ③		Type EDC Current Limiting ③	
	2-Pole	3-Pole	2-Pole	3-Pole	2-Pole	3-Pole
	Catalogue Number (Includes Terminals on Load End Only)					
100	ED2100	ED3100	EDH2100	EDH3100	EDC2100	EDC3100
125	ED2125	ED3125	EDH2125	EDH3125	EDC2125	EDC3125
150	ED2150	ED3150	EDH2150	EDH3150	EDC2150	EDC3150
175	ED2175	ED3175	EDH2175	EDH3175	EDC2175	EDC3175
200	ED2200	ED3200	EDH2200	EDH3200	EDC2200	EDC3200
225	ED2225	ED3225	EDH2225	EDH3225	EDC2225	EDC3225

Instruction Leaflet/FRED Number 29C101

Type EHD Thermal-Magnetic Circuit Breakers with Non-Interchangeable Trip Units

Maximum Continuous Ampere Rating @ 40°C	277 Vac Maximum, 125 Vdc	480 Vac Maximum, 250 Vdc	
	14 kAIC @ 277 Vac	14 kAIC @ 480 Vac	
	Type EHD ③		
	1-Pole	2-Pole	3-Pole
	Catalogue Number (Includes Terminals on Load End Only)		
10①	EHD1010	EHD2010	EHD3010
15	EHD1015②	EHD2015	EHD3015
20	EHD1020②	EHD2020	EHD3020
25	EHD1025	EHD2025	EHD3025
30	EHD1030	EHD2030	EHD3030
35	EHD1035	EHD2035	EHD3035
40	EHD1040	EHD2040	EHD3040
45	EHD1045	EHD2045	EHD3045
50	EHD1050	EHD2050	EHD3050
60	EHD1060	EHD2060	EHD3060
70	EHD1070	EHD2070	EHD3070
80	EHD1080	EHD2080	EHD3080
90	EHD1090	EHD2090	EHD3090
100	EHD1100	EHD2100	EHD3100

Instruction Leaflet/FRED Number 29C101

Type FDB and FD Thermal-Magnetic Circuit Breakers with Non-Interchangeable Trip Units

Maximum Continuous Ampere Rating @ 40°C	600 Vac Maximum, 250 Vdc 14 kAIC @ 600 Vac Type FDB ③				600 Vac Maximum, 250 Vdc 18 kAIC @ 347 & 600 Vac Type FD ③			
	1-Pole	2-Pole	3-Pole	4-Pole	1-Pole	2-Pole	3-Pole	4-Pole
	Catalogue Number (Includes Terminals on Load End Only)							
10①	FDB1010	FDB2010	FDB3010	FDB4010	–	–	–	–
15	FDB1015②	FDB2015	FDB3015	FDB4015	FD1015②	FD2015	FD3015	FD4015
20	FDB1020②	FDB2020	FDB3020	FDB4020	FD1020②	FD2020	FD3020	FD4020
25	FDB1025	FDB2025	FDB3025	FDB4025	FD1025	FD2025	FD3025	FD4025
30	FDB1030	FDB2030	FDB3030	FDB4030	FD1030	FD2030	FD3030	FD4030
35	FDB1035	FDB2035	FDB3035	FDB4035	FD1035	FD2035	FD3035	FD4035
40	FDB1040	FDB2040	FDB3040	FDB4040	FD1040	FD2040	FD3040	FD4040
45	FDB1045	FDB2045	FDB3045	FDB4045	FD1045	FD2045	FD3045	FD4045
50	FDB1050	FDB2050	FDB3050	FDB4050	FD1050	FD2050	FD3050	FD4050
60	FDB1060	FDB2060	FDB3060	FDB4060	FD1060	FD2060	FD3060	FD4060
70	FDB1070	FDB2070	FDB3070	FDB4070	FD1070	FD2070	FD3070	FD4070
80	FDB1080	FDB2080	FDB3080	FDB4080	FD1080	FD2080	FD3080	FD4080
90	FDB1090	FDB2090	FDB3090	FDB4090	FD1090	FD2090	FD3090	FD4090
100	FDB1100	FDB2100	FDB3100	FDB4100	FD1100	FD2100	FD3100	FD4100
110	FDB1110	FDB2110	FDB3110	FDB4110	FD1110	FD2110	FD3110	FD4110
125	FDB1125	FDB2125	FDB3125	FDB4125	FD1125	FD2125	FD3125	FD4125
150	FDB1150	FDB2150	FDB3150	FDB4150	FD1150	FD2150	FD3150	FD4150
175	–	FDB2175	FDB3175	FDB4175	–	FD2175	FD3175	FD4175
200	–	FDB2200	FDB3200	FDB4200	–	FD2200	FD3200	FD4200
225	–	FDB2225	FDB3225	FDB4225	–	FD2225	FD3225	FD4225

Instruction Leaflet/FRED Number 29C101

① CSA listed under C22.2 No. 235 Supplementary Protectors. 5KAIC interrupting rating. Not UL listed.
② CSA and UL listed for SWD applications.
③ When a "VISA" type breaker is required, add suffix 'S' to circuit breaker catalogue number, i.e., FD3150S. Available for 1-,2-,3-pole breakers.

Line and Load Terminals

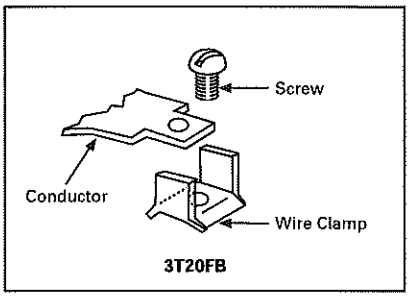
Line and load terminals provide wire connecting capabilities for specific ranges of continuous current ratings and wire types. Except as noted, terminals comply with Canadian Standard Association and UL standard UL486A and UL486B. Unless otherwise specified, F-frame circuit breakers are factory equipped with load terminals only.

Ordering Information

F-frame circuit breakers and Moulded case switches have load terminals only as standard equipment. When standard line-end terminals (same as standard load-end terminals) are required, add suffix L to the circuit breaker Catalogue number. When non-standard or optional line and/or load terminals are required, order by style number. Specify if factory installation is required.

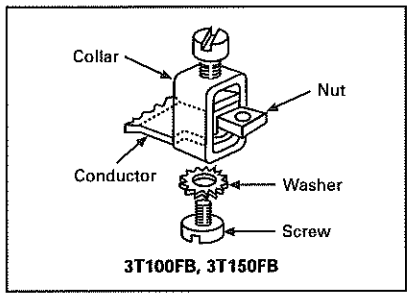
Line and Load Terminals

Maximum Breaker Amperes	Terminal Body Material	Wire Type	AWG Wire Range	Metric Wire Range mm^2	Package of 3 Terminals Catalogue Number
Standard Pressure Type Terminals					
20 (EHD)	Steel	Cu/Al	#14-#10	2.5-4	**3T20FB①**
100	Steel	Cu/Al	#14-1/0	2.5-50	**3T100FB**
150	Aluminum	Cu/Al	#4 - 4/0	25 - 95	**3TA150FB**
225	Aluminum	Cu/Al	#4-4/0	25-95	**3TA225FD**
Optional Pressure Terminals					
50	Aluminum	Cu/Al	#14-#4	2.5-25	**3TA50FB①**
100	Aluminum	Cu/Al	#14-1/0	2.5-50	**3TA100FD**
150	Stainless Steel	Cu	#4-4/0	25-95	**3T150FB**
225	Aluminum	Cu/Al	#6-300 kcmil	16-150	**3TA225FDK②**



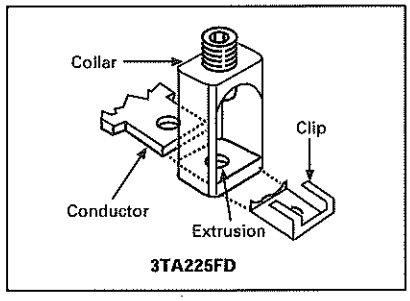
3T20FB

Assemble wire clamp to bottom of conductor as shown.



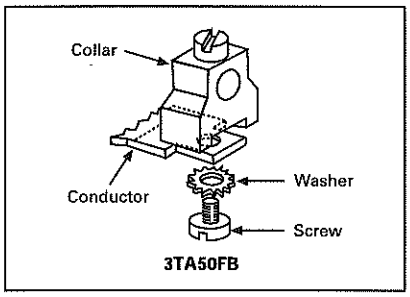
3T100FB, 3T150FB

Insert collar enclosing conductor as shown. Locate nut on top of conductor and tighten securely with screw and washer. Caution: Collar must surround conductor.



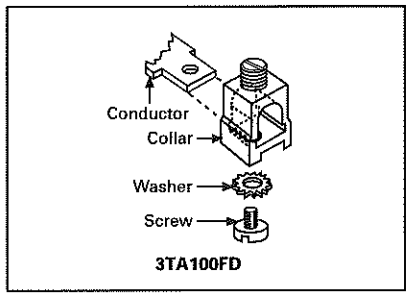
3TA225FD

Insert collar enclosing conductor and center on extrusion on collar. Install clip with legs on top of conductor and snap end around bottom of collar.



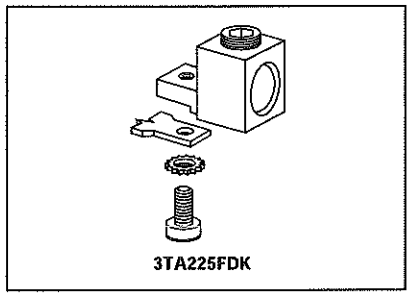
3TA50FB

Assemble collar on top of conductor as shown. Tighten securely with screw and washer.



3TA100FD

Collar slides onto conductor and is held in position by a screw and lockwasher.



3TA225FDK

Assemble collar on top of conductor as shown. Tighten securely with screw and washer. Terminal shield must be used with this collar.

① Not for use with ED, EDH, EDC breakers.
② Includes terminal shield kit. Adds approximately 3 inches to breaker height. Available for use on 3-pole breaker only. Not for use on line side of F frame breaker rated 150A or less.

Allowable Accessory Combinations

Different combinations of accessories can be supplied, depending on the types of accessories and the number of poles in the circuit breaker.

	Refer-ence Page	1-Pole		2-Pole			3-Pole				4-Pole			
		Center		Left	Right		Left	Center	Right		Left	Center	Right	Neu.
Internal Accessories (Only One Internal Accessory Per Pole)														
Alarm Lockout Switch (Make Only)	INTA-2	■												
Alarm Lockout (Make/Break)	INTA-2				■		❑		❑		■			
Alarm Lockout (2Make/2Break)	INTA-2				■		❑		❑		■			
Auxiliary Switch (1A, 1B)	INTA-5				■		■		■		■			■
Auxiliary Switch (2A, 2B)	INTA-5				■		■		■		■			■
Auxiliary Switch and Alarm Switch Combination	INTA-8				■		❑		❑		■			
Shunt Trip – Standard	INTA-11				■		■		■		■			■
Shunt Trip – Low Energy	INTA-15				■		■		■		■			
Undervoltage Release Mechanism	INTA-17				■		■		■		■			
External Accessories														
End Cap Kit	EXTA-1			●			●				●			
Keeper Nut	EXTA-1	●		●			●				●			
Control Wire Terminal Kit	EXTA-2	●		●			●				●			
Multiwire Connectors	EXTA-3	●		●			●				●			
Base Mounting Hardware	EXTA-4	●		●			●				●			
Terminal Shields	EXTA-6	●		●			●				●			
Terminal End Covers	EXTA-7						●							
Interphase Barriers	EXTA-7			●			●				●			
Non-Padlockable Handle Block	EXTA-9	■		■				■				■		
Snap-on Padlockable Handle Lock Hasp	EXTA-9	■		■				■				■		
Padlockable Handle Lock Hasp	EXTA-10				■		❑		❑		❑		❑	
Cylinder Lock	EXTA-10						■							
Key Interlock Kit	EXTA-11				■		❑		❑		❑		❑	
Sliding Bar Interlock – Requires Two Breakers	EXTA-12						●							
Walking Beam Interlock – Requires Two Breakers	EXTA-12						●				●			
Electrical (Solenoid)/(Motor) Operator	EXTA-13						●				●			
Plug-in Adapters	EXTA-15			●			●				●			
Rear Connecting Studs	EXTA-16	●		●			●				●			
Panelboard Connecting Straps	EXTA-19	●		●			●				●			
Handle Mechanisms	EXTA-20						●							
LFD Current Limiter	EXTA-27						●							
IQ Energy Sentinel	EXTA-27			●			●							
Modifications (Refer to Cutler-Hammer)														
Special Calibration	2	●		●			●				●			
Moisture Fungus Treatment	2	●		●			●				●			
Freeze-Tested Circuit Breakers	2	●		●			●				●			
Marine Application	2	●		●			●				●			

■ Applicable in indicated pole position

❑ May be mounted on left or right pole – not both

● Accessory available/Modification available

MIQ20E3H2S155.00MD41

PRODUCT SPECIFICATIONS

MIQ™ MINERAL INSULATED CABLE

APPLICATION

MIQ high performance mineral insulated heating cables are used extensively for high temperature maintenance, high temperature exposure and/or high watt density applications which exceed the limitations of thermoplastic insulated cables. The resistance configurations available can provide tracing for pipes up to 1 mile (1.6 km) long from a single power supply point.

Thermon's MIQ mineral insulated cables are manufactured using Alloy 825, a high nickel/chromium alloy ideally suited for high temperature service that offers exceptional resistance to stress corrosion in chloride, acid, salt and alkaline environments.

MIQ cables are approved for use in ordinary (nonclassified) areas and hazardous (classified) areas.

RATINGS

Rated voltage [1] ..... 300 and 600 Vac
Max. maintenance temperature [2] ..... 932°F (500°C)
Max. continuous exposure temperature
Power-off ..... 1,112°F (600°C)
Max. watt density [2] ..... up to 80 w/ft (262 w/m)
Minimum installation temperature ..... -76°F (-60°C)
Minimum bend radius ..... 6 x cable O.D.

MIQ CATALOG REFERENCE NUMBER

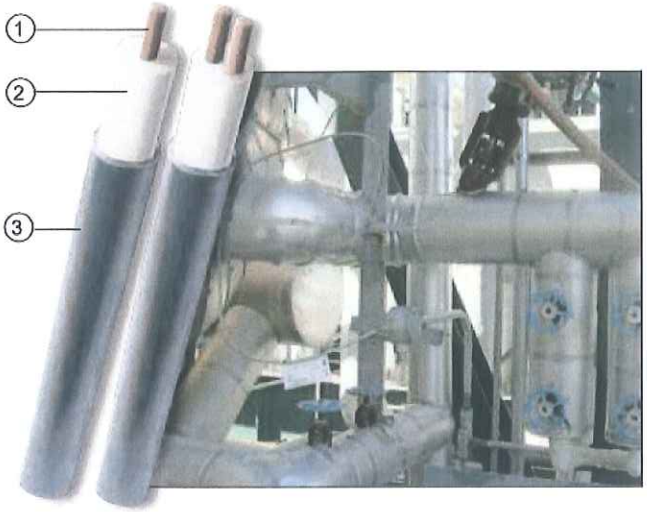
A complete catalogue reference number includes the following components:

D / MIQ-50E3H-2S / 200 / 1404 / 120 / 4 / 12 / 6 / 1

- Design (A,B,D,E)
- Cable Reference
- Length (metric lengths followed by "M")
- Watts
- Volts
- Cold Lead Length (metric lengths followed by "M")
- Cold Lead size (AWG)
- Cold Lead Voltage Rating
- Hazardous (Classified) Location Rating [4]

Notes

1. Definition as stated in IEEE Standard 515. Specific voltage depends on circuit length and design conditions.
2. Watt density limitations are correlated to maintain temperatures.
3. Contact Thermon for gland size information.
4. If the field is blank, then the heating cable set is intended for ordinary (non-classified) locations or Division 2 locations, or for use with AEx de, or Ex e enclosures. If the value in the field is "1", then the heating cable set is intended for Division 1 locations, or for use with AEx d, or Ex d enclosures.



CONSTRUCTION

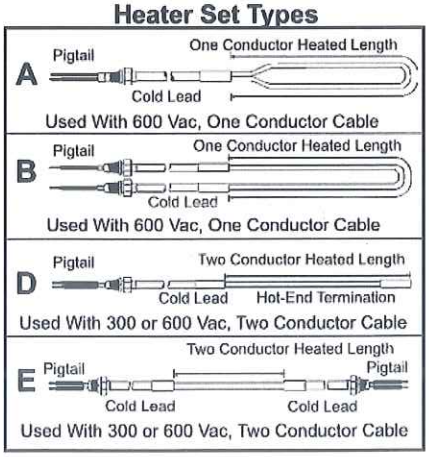
1 Solid alloy or copper conductor(s)
2 Compacted magnesium oxide insulation
3 Seamless alloy 825 sheath

MIQ HEATER SETS

Thermon MIQ cable sets are available in four factory fabricated configurations: Type A, B, D or E. The standard assemblies consist of a predetermined length of heating cable joined to a standard 4' (1.2 m) or 7' (2.1 m) nonheating cold lead with 12" (305 mm) long thermoplastic insulated pigtails.

The nonheating section of the unit is sealed and fitted with a high pressure, liquid-tight 1/2" or 3/4" NPT stainless steel gland [3] for connection into the supply junction box.

Heater Set Types



THERMON **The Heat Tracing Specialists®**

ISO 9001 REGISTERED Corporate Headquarters:100 Thermon Dr • PO Box 609 San Marcos, TX 78667-0609 • Phone: 512-396-5801 • 1-800-820-4328
For the Thermon office nearest you visit us at . . . www.thermon.com

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MIQ™
Mineral Insulated Cable

Available MIQ Cables[1] . . .

600 Vac Cable—Two Conductor—Heater Set Type D or E

Catalog Number	Resistance[2]		Nominal Diameter	
	ohms/ft	ohms/m	in	mm
MIQ-11EOH-2S	11.0	36.1	0.220	5.59
MIQ-90E1H-2S	9.0	29.5	0.225	5.72
MIQ-60E1H-2S	6.0	19.7	0.230	5.84
MIQ-40E1H-2S	4.0	13.1	0.240	6.10
MIQ-20E1H-2S	2.0	6.56	0.255	6.48
MIQ-10E1H-2S	1.0	3.28	0.255	6.48
MIQ-70E2H-2S	0.70	2.30	0.265	6.73
MIQ-50E2H-2S	0.50	1.64	0.280	7.11
MIQ-30E2H-2S	0.30	0.98	0.300	7.62
MIQ-20E2H-2S	0.20	0.66	0.255	6.48
MIQ-15E2H-2S	0.15	0.49	0.265	6.73
MIQ-10E2H-2S	0.10	0.33	0.280	7.11
MIQ-70E3H-2S	0.070	0.23	0.295	7.49
MIQ-50E3H-2S	0.050	0.16	0.310	7.87
MIQ-40E3H-2S	0.040	0.13	0.325	8.26
MIQ-30E3H-2S	0.030	0.098	0.345	8.76
MIQ-20E3H-2S	0.020	0.066	0.270	6.86
MIQ-16E3H-2S	0.016	0.052	0.280	7.11
MIQ-13E3H-2S	0.013	0.043	0.290	7.37
MIQ-10E3H-2S	0.0104	0.0341	0.300	7.62
MIQ-81E4H-2S	0.00818	0.02684	0.300	7.62

600 Vac Cable—One Conductor—Heater Set Type A or B

Catalog Number	Resistance[2]		Nominal Diameter	
	ohms/ft	ohms/m	in	mm
MIQ-20E1H-1S	2.0	6.56	0.170	4.32
MIQ-16E1H-1S	1.6	5.25	0.170	4.32
MIQ-13E1H-1S	1.3	4.26	0.170	4.32
MIQ-10E1H-1S	1.0	3.28	0.170	4.32
MIQ-85E2H-1S	0.85	2.79	0.170	4.32
MIQ-70E2H-1S	0.70	2.30	0.170	4.32
MIQ-50E2H-1S	0.50	1.64	0.170	4.32
MIQ-38E2H-1S	0.38	1.25	0.170	4.32
MIQ-30E2H-1S	0.30	0.98	0.170	4.32
MIQ-25E2H-1S	0.25	0.82	0.170	4.32
MIQ-20E2H-1S	0.20	0.66	0.175	4.45
MIQ-17E2H-1S	0.17	0.56	0.180	4.57
MIQ-15E2H-1S	0.15	0.49	0.170	4.32
MIQ-10E2H-1S	0.10	0.33	0.170	4.32
MIQ-80E3H-1S	0.080	0.26	0.170	4.32
MIQ-70E3H-1S	0.070	0.23	0.170	4.32
MIQ-60E3H-1S	0.060	0.20	0.170	4.32
MIQ-40E3H-1S	0.040	0.13	0.175	4.45
MIQ-30E3H-1S	0.030	0.098	0.185	4.70
MIQ-20E3H-1S	0.020	0.066	0.200	5.08
MIQ-10E3H-1S	0.010	0.03395	0.170	4.32
MIQ-65E4H-1S	0.00651	0.02135	0.180	4.57
MIQ-40E4H-1S	0.00409	0.01342	0.190	4.83
MIQ-25E4H-1S	0.00258	0.00846	0.210	5.33
MIQ-16E4H-1S	0.00162	0.00531	0.225	5.72

300 Vac Cable—Two Conductor—Heater Set Type D or E

Catalog Number	Resistance[2]		Nominal Diameter	
	ohms/ft	ohms/m	in	mm
MIQ-11EOL-2S	11.0	36.1	0.160	4.06
MIQ-90E1L-2S	9.0	29.5	0.160	4.06
MIQ-75E1L-2S	7.5	24.6	0.160	4.06
MIQ-60E1L-2S	6.0	19.7	0.160	4.06
MIQ-50E1L-2S	5.0	16.4	0.160	4.06
MIQ-40E1L-2S	4.0	13.1	0.160	4.06
MIQ-32E1L-2S	3.20	10.5	0.160	4.06
MIQ-27E1L-2S	2.75	9.02	0.160	4.06
MIQ-25E1L-2S	2.50	8.20	0.160	4.06
MIQ-20E1L-2S	2.00	6.56	0.160	4.06
MIQ-17E1L-2S	1.70	5.58	0.160	4.06
MIQ-14E1L-2S	1.40	4.59	0.160	4.06
MIQ-10E1L-2S	1.00	3.28	0.165	4.19
MIQ-70E2L-2S	0.70	2.30	0.180	4.57
MIQ-50E2L-2S	0.50	1.64	0.190	4.83
MIQ-30E2L-2S	0.30	0.98	0.170	4.32
MIQ-25E2L-2S	0.25	0.82	0.170	4.32
MIQ-20E2L-2S	0.20	0.66	0.170	4.32
MIQ-15E2L-2S	0.15	0.49	0.175	4.45
MIQ-10E2L-2S	0.10	0.33	0.190	4.83
MIQ-70E3L-2S	0.070	0.23	0.205	5.21
MIQ-50E3L-2S	0.050	0.16	0.225	5.72

Circuit Breaker Sizing and Type . . .

Breaker sizing should be based on the National Electrical Code, Canadian Electrical Code or any other applicable code.

The National Electrical Code and Canadian Electrical Code require ground-fault protection of equipment for each branch circuit supplying electric heating equipment. Check local codes for ground-fault protection requirements.

Certifications/Approvals . . .

FM Approved

Factory Mutual Research
Ordinary Locations
Hazardous (Classified) Locations
- Class I, Division 1 Groups B, C and D[3]
- Class I, Division 2, Groups A, B, C and D
- Class II, Divisions 1 and 2 Groups E, F and G
- Class III, Divisions 1 and 2

Canadian Standards Association
Ordinary Locations
Hazardous (Classified) Locations
- Class I, Division 1 Groups B, C and D[3]
- Class I, Division 2, Groups A, B, C and D
- Class II, Divisions 1 and 2, Groups E, F and G
- Class IIII, Divisions 1 and 2

Notes . . .
1. Other resistances are available. Contact Thermon for design assistance.
2. All resistances shown are per length of cable at 68°F (20°C) and are subject to a ±10% manufacturing tolerance.
3. Flameproof system must be specified, contact factory.

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PRODUCTS INFORMATION GUIDE & ACCESSORIES

POWER CONNECTION KITS



Terminator DP and ZP nonmetallic kits are designed to fabricate power connections of an electric heat trace circuit.



Terminator DL and ZL nonmetallic kits are designed to fabricate power connections and provide visual indication of an energized heat trace circuit.

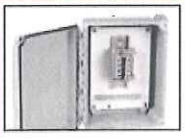


ECA-1 metallic kits are designed to fabricate power connections of an electric heat trace circuit.

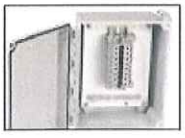


PCA nonmetallic kits are designed to fabricate power connections of an electric heat trace circuit.

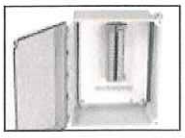
MIQ CONNECTION KITS



MIQ-PJBFG-TB4-DRM0-S Type 4X junction box with 4-point terminal block.



MIQ-PJBFG-TB8-DRM0-S Type 4X junction box with 8-point terminal block.



MIQ-PJBFG-TB12-DRM0-S Type 4X junction box with 12-point terminal block.

IN-LINE SPLICE KITS



Terminator DS/DE and ZS/ZE nonmetallic kits are designed to fabricate in-line splices of an electric heat trace circuit.



ECA-1 metallic kits are designed for splicing two electric heat trace cables together.

END TERMINATION KITS



Terminator DS/DE and ZS/ZE nonmetallic kits are designed to fabricate an end termination of an electric heat trace circuit.



Terminator DE-B and ZE-B nonmetallic kits are designed to provide visual indication of an energized heat trace circuit.

- Terminator "D" kits Division 2 and Zone 2 Areas
- Terminator "Z" kits Zone 1 Areas.
- D1 Kits available, contact factory.

T-SPLICE KITS



Terminator DP and ZP nonmetallic kits are designed to fabricate T-splice connections of an electric heat trace circuit.



ECT-2 metallic kits are designed for splicing three electric heat trace cables together.



PCA nonmetallic kits are designed to fabricate T-splice connections of an electric heat trace circuit.

MISCELLANEOUS



PETK power and end termination kits are required for use with all Thermon parallel heating cable connection kits.

SCTK Splice connection kits are required when preparing splices with all Thermon parallel heating cable connection kits.



FT-1L, FT-1H fixing tapes for attaching heating cable to piping every 12" (30 cm) or as required by code or specification.



AL-20L, AL-20H, AL-30L, AL-30H aluminum tape for continuous (longitudinal) covering.

CONTROL AND MONITORING

MECHANICAL THERMOSTATS



B4X-15140 and B7-15140 are designed to provide ambient sensing control of electric heat trace circuits.



E4X-25325 and E7-25325 are designed to provide pipewall or tankwall sensing control of electric heat trace circuits.

TEMPERATURE SENSORS



RTD-100 is designed for use as control input for electric heat trace circuits requiring pipewall or tankwall temperature sensing.



RTD-100-S is designed for use as control input for freeze protection and temperature maintenance applications requiring pipewall or tankwall temperature sensing.



RTD-MI-120-HT is designed for use as control input for freeze protection and temperature maintenance applications requiring pipewall or tankwall temperature sensing.

ELECTRONIC THERMOSTATS



Terminator ECM is an electronic control module specifically designed for controlling electric heat trace circuits. Serves as both the temperature control as well as the sensor and power connection for a heat trace circuit.

ELECTRONIC CONTROLLERS



TraceNet TN Series provides control and monitoring for up to 180 electric heat trace circuits.



TraceNet TC Series provides control and monitoring for up to 18 electric heat trace circuits.



TC 1818a provides control and monitoring for up to 18 electric heat trace circuits.



TC 202a provides control and monitoring for two electric heat trace circuits with input from two RTDs.



TC 201a provides control and monitoring for one electric heat trace circuit with input from two RTDs.



TC 101a provides control and monitoring for one electric heat trace circuit with input from one RTD.

PRODUCT SPECIFICATIONS

TC 201a

CONTROL AND MONITORING MODULE

APPLICATION

The TC 201a is a microprocessor-based temperature control and monitoring module developed specifically for heat tracing. The unit provides control and monitoring capabilities via digital information display for one heat tracing circuit with input from two RTDs. Each RTD can provide independent sensing of the heated surface and, as a safety feature, can activate a high temperature alarm and shut down the heater.

RATINGS

Control and monitoring capacity ..... 1 heat tracing circuit
Module supply voltages ..... 110-120 or 208-240 Vac
Controlled output voltages ..... 110-480 Vac
Power consumption ..... 6 watts
Operating ambient [1] ..... -40°F to 140°F (-40°C to 60°C)
Maximum storage ambient ..... 158°F (70°C)
Data retention ..... nonvolatile EEPROM
Power clamp function . programmable from 20% to 100%
Temperature input ..... two 3-wire platinum 100 Ω RTDs
Temperature control range ..... -40°F to 932°F (-40°C to 500°C)
Control band .... programmable in increments of 1 degree
Module dimensions (HxWxD) ..... 8.25" x 5.125" x 2.625" (222 x 130 x 67 mm)
High operating current alarm ..... 1.0 to 30.0 amps
Low operating current alarm ..... 0.0 to 30.0 amps
Ground leakage alarm/trip ..... 30 to 150 mA (in 1 mA increments)
Alarm relay ..... AC only, rated @ 1-amp resistive (110-120 or 208-240 Vac)
Self-test frequency ..... programmable from 2 to 99 hours
Communication ..... Modbus ASCII via RS 485 port

Notes
1. LCD display heater is recommended for ambients below -4°F (-20°C).

Refer to **HOW TO SPECIFY** on reverse to specify module type.



TC 201a
(shown mounted in
NEMA-4X fiberglass enclosure)

PRODUCT FEATURES

Real time data for:
- Temperature
- Heater current
- Ground leakage current

Stored data for:
- Highest temperature encountered
- Lowest temperature encountered

Alarm information for:
- Low temperature
- High temperature
- Low heater current
- High heater current
- Ground leakage current
- Damaged RTD sensor

CERTIFICATIONS/APPROVALS

When housed in a NEMA 4X enclosure and equipped with solid-state relays, the TC 201a is approved for use in ordinary (non-classified) and hazardous (classified) areas.

FM Approved
FM Approvals
Ordinary Locations
Hazardous (Classified) Locations
Class I, Division 2, Groups A, B, C and D

UL LISTED
Underwriters Laboratories Inc.
Ordinary Locations

CSA
Canadian Standards Association
Ordinary Locations
Hazardous (Classified) Locations
Class I, Division 2, Groups A, B, C and D

THERMON **The Heat Tracing Specialists®**
ISO 9001 REGISTERED
Corporate Headquarters:100 Thermon Dr • PO Box 609 San Marcos, TX 78667-0609 • Phone: 512-396-5801 • 1-800-820-4328
For the Thermon office nearest you visit us at . . . www.thermon.com

Form TEP0024-0814 • © Thermon Manufacturing Co. • Printed in U.S.A. • Information subject to change.

PRODUCT SPECIFICATIONS

TC 201a

CONTROL AND MONITORING MODULE

TC201A-SSR30A-24D - C - P3



CONTROL METHODS

Heat tracing circuits are controlled with the TC 201a via zero crossing solid-state relays that allows four different modes of operation:

- **On-Off Control**—User input for maintain temperature and control band provides the on-off limits for the controlled heater.
- **On-Off Control with Soft Start**—Adds a three-minute 0% to 100% ramp-up feature to the on-off control function to minimize the effects of start-up power.
- **Proportional**—Adjusts the amount of heat generated through time sequencing of the heater. Reduces energy consumption for ambient-controlled systems and provides precise control of temperatures when line sensing control is used.
- **Self-adjust**—The user inputs the setpoint and the control band (maximum on temperature); the controller adjusts the heat generated to stay within the limits imposed.

The ambient conditions and heat sink style determine the amperage rating of a solid-state relay. The chart indicates the amperage ratings (at the temperatures indicated) using the standard enclosures and heat sinks. The 40°F (4°C) ratings should be used with freeze protection applications as the controlled circuit would not be energized above this temperature.

HOW TO SPECIFY

TC 201A - SSR30B - 120 - F - P3

Module Type

Relay
SSR30A[1] = Solid State Relay Single Pole
SSR15A[1] = Solid State Relay Double Pole
SSR30B= Solid State Relay Single Pole
SSR15B = Solid State Relay Double Pole

Voltage
120 = 120 Vac controller, 120 Vac heater
240 = 240/208 Vac controller, 240/208 Vac heater
277 = 120 Vac controller, 277 Vac heater

Operating Units
F = Farenheit
C = Celsius

Enclosure
P3 = Fiberglass, NEMA 4X 14" x 16" x 6" (356 x 406 x 152 mm)
SS3 = Stainless Steel, NEMA 4X 14" x 16" x 6" (356 x 406 x 152 mm)

Relay	Configuration	Operating Ambient	Heat Sink Style	Amperage Ratings
SSR30A[1]	Internal Heat Sink (single pole relay)	40°F (4°C)	A	30 amps
		104°F (40°C)	A	24 amps
SSR15A	Internal Heat Sink (double pole relay)	40°F (4°C)	A	24 amps
		104°F (40°C)	A	12 amps
SSR30B[1]	External Heat Sink (single pole relay)	40°F (4°C)	B	30 amps
		104°F (40°C)	B	30 amps
SSR15B	External Heat Sink (double pole relay)	40°F (4°C)	B	24 amps
		104°F (40°C)	B	24 amps

Note

1. When phase-to-phase heaters are controlled and qualified personnel are not maintaining the system, 2-pole relays or a 2-pole EPD circuit breaker is recommended."

ENCLOSURES

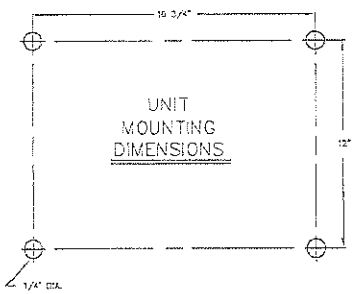
Thermon offers both metallic and nonmetallic enclosures to meet a variety of application environments. The standard size is 14" x 16" x 6" (356 x 406 x 152 mm). Each enclosure includes a 3" x 3" (76 x 76 mm) clear polycarbonate viewing window.

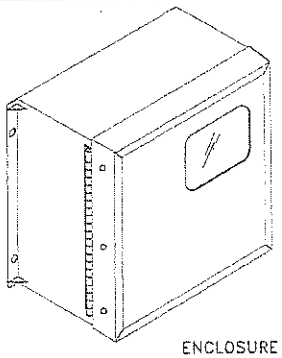
Metallic: NEMA 4X stainless steel with a hinged cover held in place by screw closures. A quick release latch option is available.

Nonmetallic: NEMA 4X fiberglass reinforced polyester with a hinged cover held in place with quick release latches.

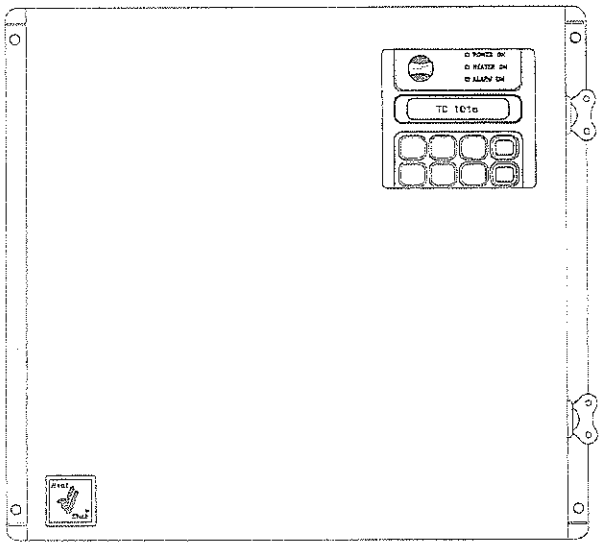
Control and Monitoring Unit

- TC-201a-SSRXA-XXX-X-P3-2R-LCDHX

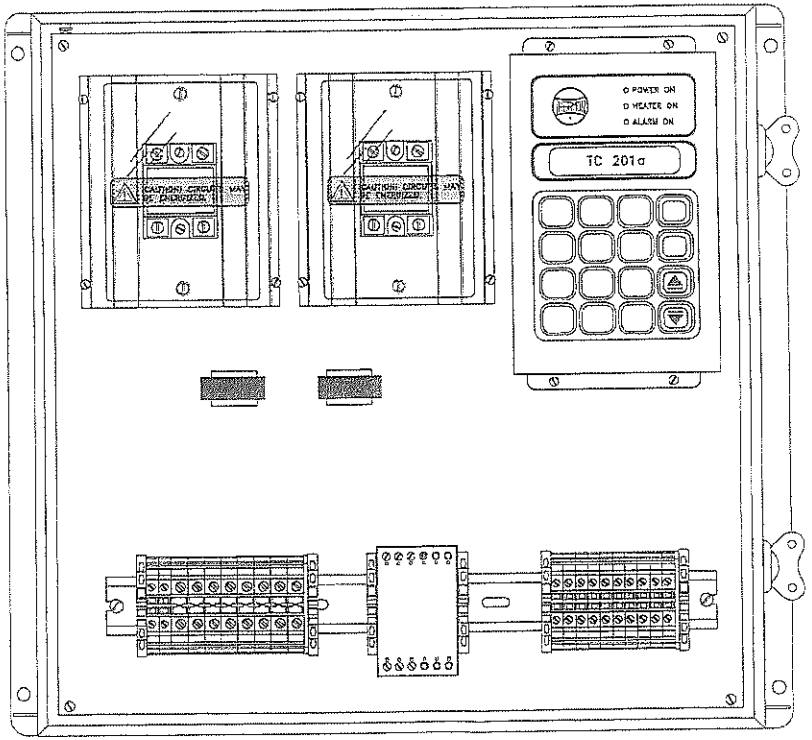




ENCLOSURE
EXTERIOR VIEW



PANEL FRONT VIEW



BACK PANEL LAYOUT

REV	DATE	DESCRIPTION OF REVISION	DRAWN	DESIGNED	REVIEWED	APPROVED
0	10/23/13	ISSUED FOR FABRICATION	TA	RD	RR	JWJ

HEATCHEK™ CONTROL UNIT LAYOUT FOR SSRXA AND P3 ENCLOSURES

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ISO 9001 CERTIFIED COMPANY

THERMON PROJECT NUMBER

THERMON MANUFACTURING COMPANY
THE HEAT TRACING SPECIALISTS®

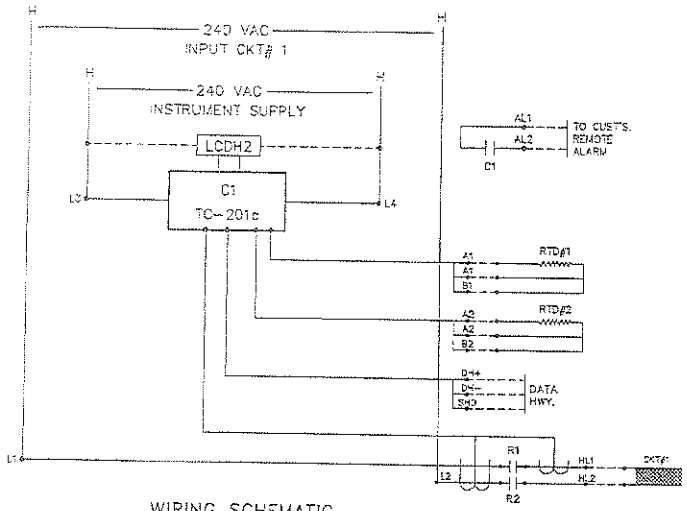
THERMON DWG. NO. 44B043

SHT. 11 REV. 0

BORDER2.DWT 06/06/00 JHD

Control and Monitoring Unit

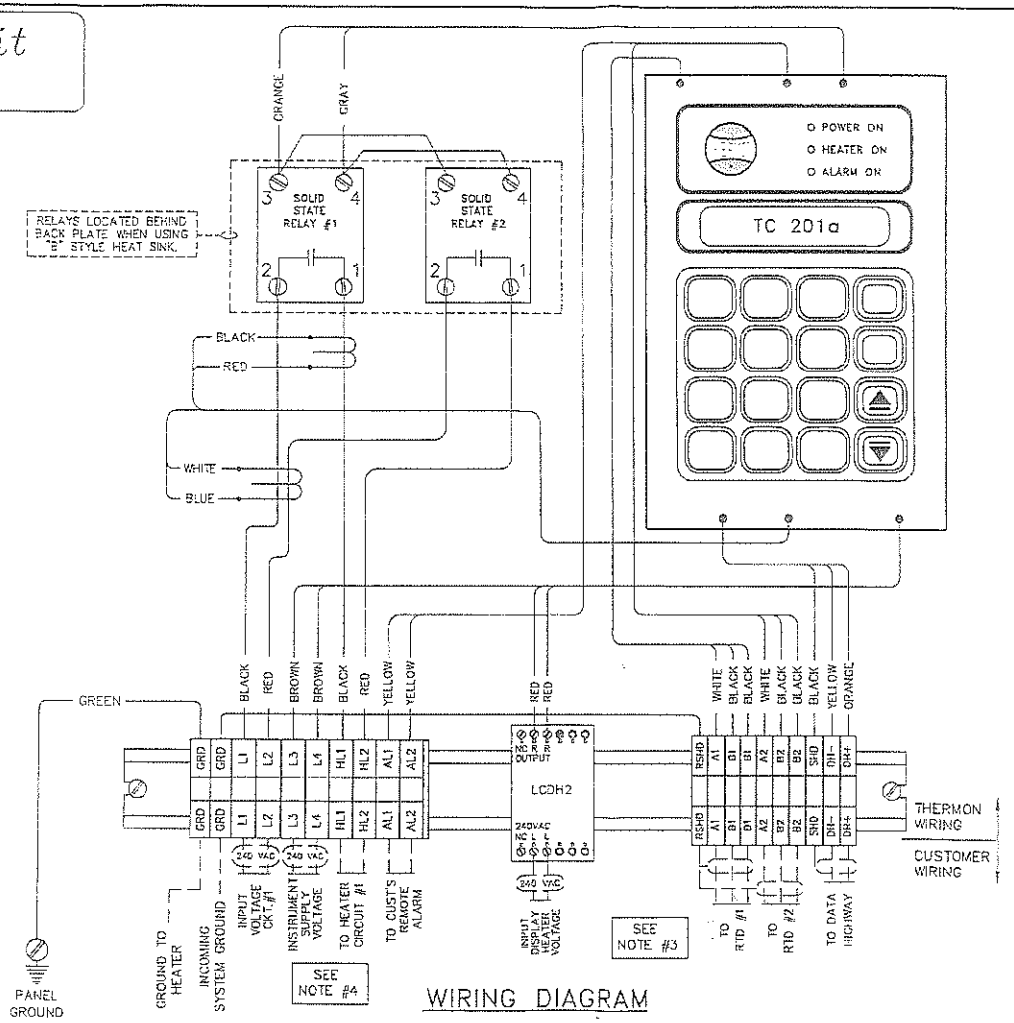
• TC-201a-SSR30X-240-X-XXX-LCDH2-2R



WIRING SCHEMATIC

NOTES:

1. THIS OUTPUT CONTACT IS OPEN IN THE NO ALARM STATE (INVERSE OPERATION IS ALSO AVAILABLE ON REQUEST). ALARM CONTACT RELAY IS A SOLID STATE ALARM RELAY. OUTPUT IS RATED AT 1a at 240VAC WHEN DRIVING A RESISTIVE LOAD.
2. CAUTION – DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF TO THIS UNIT, AND PROPER LOCKOUT/ TAGOUT PROCEDURES HAVE OCCURRED.
3. RTD SHIELDS TO BE GROUNDED AT RTD SHIELD TERMINAL IN THIS CONTROLLER.
4. THIS UNIT IS WIRED TO ALLOW SEPARATE INSTRUMENT POWER SUPPLY TO THE CONTROL MODULE. THIS ENSURES CONTINUOUS OPERATION OF THE CONTROL MODULE SHOULD THE HEAT TRACING CIRCUIT BREAKER BE TURNED OFF.



WIRING DIAGRAM

REV	DATE	DESCRIPTION OF REVISION	DRAWN	DESIGNED	REVIEWED	APPROVED
0	10/23/13	ISSUED FOR FABRICATION	TA	RD	CL	DNJ

HEATCHEK™ CONTROL UNIT
LAYOUT AND WIRING
240 VAC SERVICE
CONTROLLER
240 VAC SERVICE
HEATER

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ISO 9001 CERTIFIED COMPANY

THERMON PROJECT NUMBER

THERMON MANUFACTURING COMPANY
THE HEAT TRACING SPECIALISTS®

THERMON DWG. NO. 44B002

SHT. 4 REV. 0

BORDER32.DWT 05/05/00 JNO

AutoCAD 2005 (MS Icon) — F:\DGN\Thermon\44B002\44B002SH.dwg 10-23-2013 8:32:22 am

3.0 Lighting

Section 3.0 - Lighting System

Interior

The interior lighting system is comprised of various different fixtures. Refer to the particular shop drawing enclosed in this manual for the appropriate lamp replacement.

Exterior

These fixtures are controlled by a photocell and can be overridden by a programmable time clock. The outdoor lights will automatically come on at dark and go off at dawn. Refer to the particular shop drawing enclosed in this manual for the appropriate lamp replacement.

SHOP DRAWING REVIEW

Project: Cambridge Bay Potable Water System

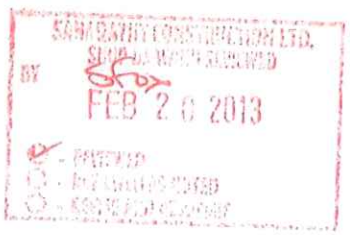
Location: Cambridge Bay, NU

General Contractor: Sanaqatiit Construction Ltd.

Engineer: Stantec

Section 26 50 00 – Lighting

Reviewed by: Darren Fraser



Ryfan Kitikmeot Ltd.
Box 297, Kugluktuk, NU X0E 0E0
Email: dfraser@ryfan.ca

Submitted by Prolux Lighting Edmonton Ltd.Sharlene Howg			
PROLUX LIGHTING	**Job Name:** Cambridge Bay Water Plant	**Catalog Number:** STW-232-120V-ER81-U WG/STW-4FT-B Notes:	**Type:** 200 PLE12-5121

COOPER LIGHTING - METALUX®

DESCRIPTION

The STW Series is a functional and multi-purpose extra wide, heavy duty, strip family, that incorporates premium performance and construction durability. The performance and application versatility of this series can be increased by incorporating symmetrical or asymmetrical reflectors. The STW Series can be installed using various mounting methods and numerous options and accessories are available.

The STW Series can be the illumination solution in commercial, industrial, retail and residential applications. Fixtures can be used in storage/utility areas, shops, task and general area lighting.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

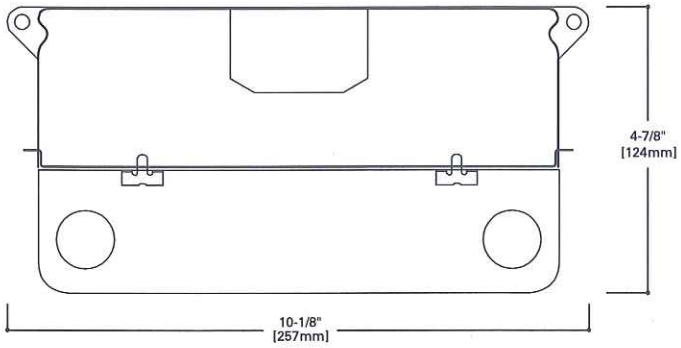
Construction
Channel die formed code gauge prime cold rolled steel. Numerous KOs for ease of installation. Deep V-Groove for tong hanger. Die formed channel connector, sleeve type, assures straight rows and continuity of ground through set screws. Lampholder bracket easily installed with snap-in action. Channel/wireway cover secured with quarter-turn fasteners.

Channel/Wireway Cover
Die formed heavy gauge steel. Tight fit for ease of maintenance. Easily removed without use of tools. Optional reflector available incorporating silver technology enhancements. (SilverLining) Consult Pre Sales Technical Support.

Electrical*
Ballasts are CBM/ETL Class "P" and are positively secured by mounting bolts. Pressure lock lampholders. UL/CUL listed. Suitable for damp locations.

Finish
Multistage, iron phosphate pretreatment ensures maximum bonding and rust inhibitor. Lighting grade, baked white enamel finish.



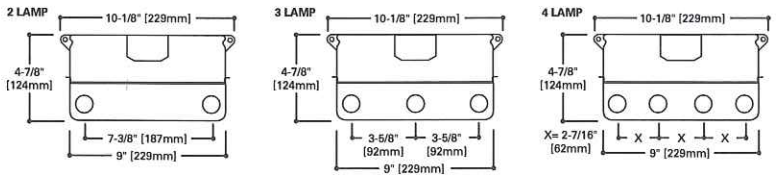


STW
240
232
340
332
440
432

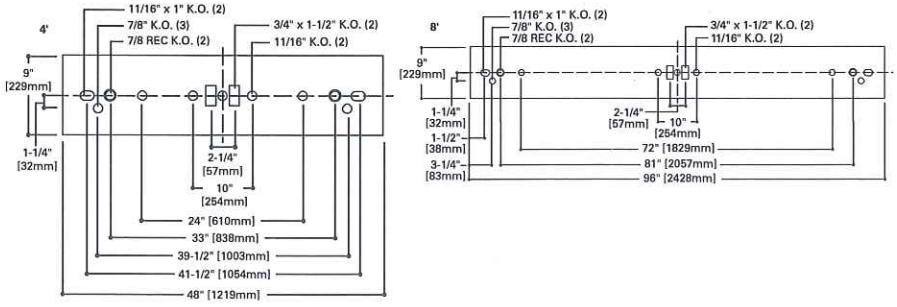
4' STRIP
2, 3 OR 4 LAMP

Wide-Body Striplight

LAMP CONFIGURATIONS



MOUNTING DATA



ENERGY DATA

Input Watts:

EB Ballast & STD Lamps
240 (72)
232 (61)
340 (110)
332 (91)
440 (144)
432 (122)

ES Ballast & STD Lamps
240 (86)
232 (71)
340 (136)
332 (108)
440 (172)
432 (142)

Luminaire Efficacy Rating
LER = FS-89
Catalog Number: STW-432
Yearly Cost of 1000 lumens, 3000 hrs at .08 KWH = $2.70

*Reference the lamp/ballast data in the Technical Section for specific lamp/ballast requirements.

LAMPS CONTAIN MERCURY. DISPOSE ACCORDING TO LOCAL, STATE OR FEDERAL LAWS

LINEAR DISCONNECT
Safe and convenient means of disconnecting power.

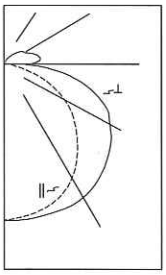
COOPER Lighting
www.cooperlighting.com

Specifications and dimensions subject to change without notice.
Consult your representative for additional options and finishes.

ADF020697
2010-03-03 17:11:56

Submitted by Prolux Lighting Edmonton Ltd.Sharlene Howg			
PROLUX LIGHTING	**Job Name:** Cambridge Bay Water Plant	**Catalog Number:** STW-232-120V-ER81-U WG/STW-4FT-B Notes:	**Type:** 200 PLE12-5121

PHOTOMETRICS



STW-432
Electronic Ballast

F32T8-SPX35 Lamps 2950Lumens

Spacing criterion: (||) 1.3 x mounting height, (⊥) 1.5 x mounting height

Efficiency 97.1%

Test Report: STW432.IES

LER = FS-89

Yearly Cost of 1000 lumens, 3000 hrs at .08 KWH = $2.70

Coefficients of Utilization

Effective floor cavity reflectance 20%

rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	113	113	113	113	109	109	109	109	102	102	102	96	96	96	90	90	90	87
1	101	96	91	86	97	92	88	84	86	83	79	81	78	75	75	73	71	68
2	91	82	74	68	87	79	72	66	74	68	63	69	64	60	65	61	57	55
3	82	71	62	55	79	68	60	54	64	57	52	60	54	49	56	51	47	45
4	75	62	53	46	72	60	52	45	56	49	43	53	46	41	49	44	40	37
5	68	55	46	39	65	53	45	38	50	42	37	47	40	35	44	38	34	32
6	63	49	40	33	60	48	39	33	45	37	32	42	36	31	40	34	30	27
7	58	44	35	29	56	43	35	29	41	33	28	38	32	27	36	30	26	24
8	54	40	32	26	52	39	31	25	37	30	25	35	28	24	33	27	23	21
9	50	37	28	23	48	36	28	23	34	27	22	32	26	21	30	25	21	19
10	47	34	26	21	45	33	25	20	31	24	20	30	23	19	28	23	19	17

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
0-30	2153	18.2	18.8
0-40	3649	30.9	31.8
0-60	7007	59.4	61.1
0-90	10238	86.8	89.3
90-180	1225	10.4	10.7
0-180	11464	97.1	100.0

Candela

Angle	Along ||	45°	Across⊥
0	2632	2632	2632
10	2604	2625	2637
20	2469	2570	2651
30	2251	2475	2642
40	1962	2327	2530
50	1589	2077	2322
60	1160	1744	2081
70	682	1417	1726
80	249	901	1112
90	0	264	407
100	0	383	616
110	0	284	513
120	0	228	410
130	0	149	303
140	0	75	189
150	0	15	82
160	0	4	6
170	0	2	2
180	0	0	0

SHOP DRAWINGS ARE REVIEWED UNLESS NOTED OTHERWISE

REVIEWED AS MODIFIED	
REVISE & RESUBMIT	
SEAL & SIGNATURES REQUIRED	

Stantec

DATE Feb 19/2013

SIGNATURE

REVIEW BY STANTEC IS FOR THE SOLE PURPOSE OF ASCERTAINING GENERAL CONFORMITY WITH DESIGN. CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS, FABRICATION AND CONSTRUCTION METHODS. COORDINATION OF SUB-TRADES, DETAIL DESIGN OF COMPONENTS, AND ERRORS OR OMISSIONS ON SHOP DRAWINGS.

Submitted by Prolux Lighting Edmonton Ltd.Sharlene Howg			
PROLUX LIGHTING	**Job Name:** Cambridge Bay Water Plant	**Catalog Number:** STW-232-120V-ER81-U WG/STW-4FT-B Notes:	**Type:** 200 PLE12-5121

ORDERING INFORMATION STW

Sample Number: STW-232-120V-EB81-U

Tandem
Blank=4' Length
8T=8' Length

Series [1]
STW=Commercial Extra Wide Striplite

Number of Lamps
2 Lamps (Not Included)
3 Lamps (Not Included)
4 Lamps (Not Included)

Wattage
32=32W T8 (48")
40=40W T12 (48")

Voltage [2]
120V: 120 Volt
277V: 277 Volt
347V: 347 Volt
UNV: Universal Voltage[3] 120-277

Options
GL: Single Element Fuse
GM: Double Element Fuse
EL: Emergency Installed

Ballast Type [2]
EB=Electronic Instant Start
ER=T8 Electronic Program Rapid Start. Total Harmonic Distortion < 10%
DLS=Digital Lighting System Dimming

Lamp Size
2: T12
8: T8

Number of Ballasts
1: 1 Ballast
2: 2 Ballast

Options
PLUS=Higher Ballast Factor > 1.13. Total Harmonic Distortion < 20%
RLS=Rotor Lock Socket (T8 Lamp only)
RIF1=Radio Interference Suppressor
515P=Cord & Plug (120V)
715P=Cord & Plug (277V)
TILW: Tandem In Line Wiring Option (Consult TILW Option Catalog Page)
PI/CPI: Plug-In Option

Packaging
U=Unit Pack

WG/STW-4FT-B = 4' Wire Guard

Notes: 1 For Silver Lining reflector add SS in catalog number, Example: STW-SS-SYM-4FT
2 Products also available in non-US voltage and frequencies for international markets
3 Not Available when specifying emergencies, voltage must be specific

APPROVED
By Darren Fraser at 4:00 pm, Jan 18, 2013

SHIPPING DATA

Catalog No.	Wt.
STW-232	18 lbs.
STW-332	22 lbs.
STW-432	22 lbs.

Submitted by Prolux Lighting Edmonton Ltd.Sharlene Howg			
PROLUX LIGHTING	**Job Name:** Cambridge Bay Water Plant	**Catalog Number:** VT2-232LEX-UNV-ER81-WL-U Notes:	**Type:** 201 PLE12-5121

COOPER LIGHTING - METALUX®

DESCRIPTION

The VT2 Series is an energy efficient industrial Vaportite fixture that features rugged and durable construction. The VT2 incorporates a full metal fixture liner inside a reinforced fiberglass housing with a high impact diffuser. This Vaportite series is suitable for interior and exterior applications and can be surface or chain mounted.

The VT2 Series has been designed for maximum operation in commercial institutional and industrial environments where weathering, high temperature, humidity and dust or corrosive fumes are present.

		Type
Catalog #		
Project		
Comments		Date
Prepared by		

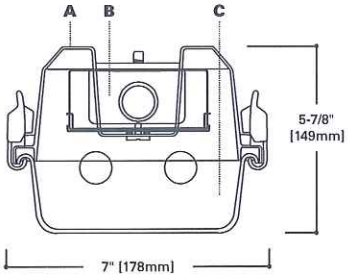
SPECIFICATION FEATURES

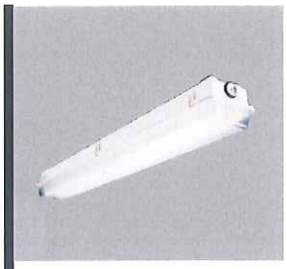
A ... Construction
Fiberglass housing is reinforced polyester and self-extinguishing (ASTM-D635-74) plastic of a permanent pearl gray color. Top of housing has nine embossments (4' unit) and thirteen embossments (8' unit), providing mounting flexibility on uneven surfaces. A watertight hub for 1/2" conduit entry is provided at each end of housing (standard) for continuous feed. Polyurethane gasketing is formed in the housing providing a continuous seamless seal for the diffuser. Six sturdy cam latches (4' unit) and twelve (8' and tandem unit) clamp diffuser tightly for a positive seal between housing, gasketing and diffuser.

B ... Electrical*
Unit has full metal liner (channel) secured by brass internal/external mounting studs for positive grounding, maximum protection and rigidity. Ballasts are CBM/ETL Class "P" certified suitable to plus 50°F. Spring loaded lampholders. Electrical components and fixtures are UL/CUL listed for Wet Locations.**
IP65 approved (4' only).

C ... Lens
"DR" - Clear low brightness pattern acrylic with 15% high impact additive.
"DR-100" - Clear low brightness pattern acrylic with 100% high impact additive.
Example: VT2-296DR-100
"LEX" - High impact clear low brightness pattern polycarbonate. LEXAN
Example: VT2-296LEX.

D ... Reflectors
Optional die formed finished or 95% specular miro reflector.



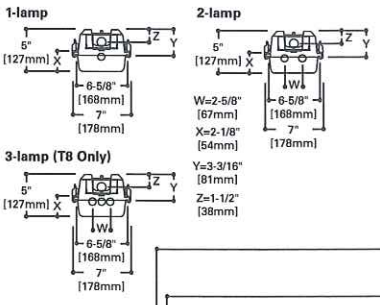


VT2
132
232
332
154T5
254T5

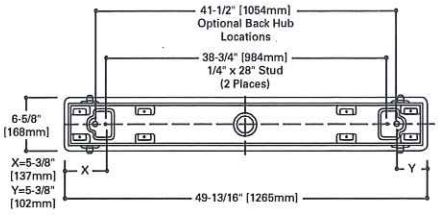
4' OR 8' INDUSTRIAL
1, 2 OR 3 LAMP T8
1 OR 2 LAMP T5HO

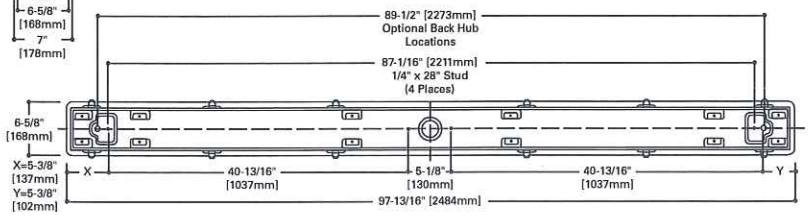
Vaportight Industrial

LAMP CONFIGURATIONS



MOUNTING DATA





ENERGY DATA

Input Watts:
EB Ballast & STD Lamps
132 (36), 232 (57), 332 (82)
EB Ballast & T5HO Lamps
254T5 (121), 8T254T5 (242)
EB Ballast & T5HO Lamps
154T5 (62), 254T5 (117)
EB Plus Ballast & STD Lamps
132 (46), 232 (73), 332 (108)
Luminaire Efficacy Rating
LER = FI-73
Catalog Number: VT-232DR
Yearly Cost of 1000 lumens, 3000 hrs at .08 KWH = $3.29

*Reference the lamp/ballast data in the Technical Section for specific lamp/ballast requirements.

**Not Suitable for Wet Locations if EL4 Option is added. Consult Pre Sales Technical Support.

LAMPS CONTAIN MERCURY. DISPOSE ACCORDING TO LOCAL, STATE OR FEDERAL LAWS

LINEAR DISCONNECT
Safe and convenient means of disconnecting power

INSTALLATION DATA



MOUNTING BRACKETS
Furnished
Two per 2' and 4' Unit
Four per 8' Unit



OPTIONAL CHAIN HANGING SET
(VT2-CHAIN/SET-U)
Includes 6 ft. of chain, 4 large S-Hooks and 4 small S-Hooks
Order One (1) Kit for each 2' or 4' Fixture
Two (2) Kits Recommended For 8' Fixture

COOPER Lighting
www.cooperlighting.com

Specifications and Dimensions subject to change without notice.
Consult your representative for additional options and finishes.

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09/29/2008 10:06:07 AM

Submitted by Prolux Lighting Edmonton Ltd.Sharlene Howg

PROLUX LIGHTING

Job Name: Cambridge Bay Water Plant

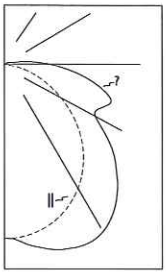
Catalog Number: VT2-232LEX-UNV-ER81-WL-U

Notes:

Type: 201

PLE12-5121

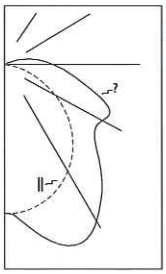
PHOTOMETRICS



VT2-254DR-UNV-EB81-WL-M4-U
Electronic Ballast
(2) F54/T5/835 Lamps
4460 Lumens each
Spacing criterion: (II) 1.2 x mounting height, (⊥) 1.6 x mounting height
Efficiency 74.3%
Test Report: 127P111
LER = FI57
Yearly Cost of 1000 lumens, 3000 hrs at .08 KWH = $4.24

Candlepower

Angle	Along II	45°	Across ⊥
0	1615	1615	1615
5	1613	1632	1648
10	1592	1673	1723
15	1556	1704	1781
20	1504	1717	1820
25	1438	1712	1839
30	1357	1683	1815
35	1262	1625	1743
40	1154	1532	1635
45	1033	1412	1499
50	902	1263	1355
55	762	1101	1180
60	621	944	994
65	485	775	988
70	362	667	1051
75	253	677	992
80	158	612	827
85	74	455	647
90	26	297	463



SHOP DRAWINGS ARE REVIEWED UNLESS NOTED OTHERWISE
REVIEWED AS MODIFIED
REVISE & RESUBMIT
SEAL & SIGNATURES REQUIRED
Stantec
DATE Feb 19/2013
SIGNATURE
REVIEW BY STANTEC IS FOR THE SOLE PURPOSE OF ASCERTAINING GENERAL CONFORMITY WITH DESIGN. CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS, FABRICATION AND CONSTRUCTION METHODS. COORDINATION OF SUB-TRADES, DETAIL DESIGN OF COMPONENTS, AND ERRORS OR OMISSIONS ON SHOP DRAWINGS.

Coefficients of Utilization

Effective floor cavity reflectance 20%

rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	87	87	87	87	85	85	85	85	80	80	80	76	76	76	72	72	72	70
1	78	73	70	68	75	71	68	65	67	64	62	64	61	59	60	59	57	55
2	70	63	57	52	68	61	56	51	58	53	50	55	51	48	52	49	46	44
3	64	55	48	43	61	53	47	42	51	45	41	48	43	40	45	42	39	37
4	58	48	41	36	56	47	40	35	45	39	34	42	38	34	40	36	33	31
5	53	43	36	31	51	42	35	30	40	34	30	38	33	29	36	32	28	26
6	49	39	32	27	47	38	31	26	36	30	26	34	29	25	33	28	25	23
7	45	35	28	23	44	34	28	23	32	27	23	31	26	22	30	25	22	20
8	42	32	25	21	41	31	25	20	30	24	20	28	23	20	27	23	19	18
9	39	29	23	18	38	28	22	18	27	22	18	26	21	18	25	21	17	16
10	37	27	21	17	36	26	20	16	25	20	16	24	19	16	23	19	16	14

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
0-30	1411	15.8	21.3
0-40	2397	26.9	36.2
0-60	4380	49.1	66.2
0-90	6268	70.3	94.8
0-180	6614	74.2	100.0

Luminance Data

Angle in Deg	Average 0-Deg cd/sm	Average 45-Deg cd/sm	Average 90-Deg cd/sm
45	7779	10632	11288
55	7074	10221	10954
65	6110	9764	12196
75	5205	13928	20408
85	4251	27797	39527

Coefficients of Util

Effective floor cavity

rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	96	96	96	96	93	93	93	93	87	87	87	82	82	82	78	78	78	76
1	86	81	77	73	83	78	74	71	74	70	68	69	67	64	65	63	61	59
2	77	69	63	58	74	67	61	57	63	58	54	60	56	52	56	53	50	48
3	70	60	53	47	67	59	52	46	55	49	45	52	47	43	49	45	42	40
4	64	53	45	40	61	52	44	39	49	43	38	46	41	37	44	39	35	33
5	58	47	39	34	56	46	39	33	44	37	32	41	36	31	39	34	31	29
6	54	42	35	29	52	41	34	29	39	33	28	37	32	27	35	30	27	25
7	50	38	31	26	48	37	30	25	35	29	25	34	28	24	32	27	24	22
8	46	35	28	23	45	34	27	22	32	26	22	31	25	21	29	25	21	19
9	43	32	25	20	42	31	25	20	30	24	20	28	23	19	27	22	19	17
10	40	29	23	18	39	29	22	18	27	22	18	26	21	17	25	20	17	15

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
0-30	985	17.3	21.1
0-40	1675	29.4	36.0
0-60	2999	52.6	64.4
0-90	4316	75.7	92.7
0-180	4658	81.7	100.0

Luminance Data

Angle in Deg	Average 0-Deg cd/sm	Average 45-Deg cd/sm	Average 90-Deg cd/sm
45	4874	6095	5343
55	4392	5171	4906
65	3669	4791	5995
75	2853	5921	5721
85	1868	5874	5512

ORDERING INFORMATION

SAMPLE NUMBER: 8TVT2-254DR-UNV-EB82-M4-U

Width
Blank=4' Length
8T=8' Length

Series
VT2=Vapor-Tite

Number of Lamps[3]
1=1 lamp (T5 or T8)
2=2 lamps (T5 or T8)
3=3 lamps (T8 only)
(Lamps not included)

Lamp Type
32=32WT8 Lamp (4' Long)
54T5=54W T5HO Lamp (4' Long)

Lens
DR=Internal Prismatic Lens/15% DR High Impact Additive (Standard)
DR-100%=100% High Impact Additive
LEX=High Impact Clear Polycarbonate LEXAN Lens/Low Brightness Pattern

Voltage [1]
120V=120 Volt
277V=277 Volt
347V=347 Volt
480V=480 Volt
UNV=Universal Voltage 120/277V
UNC=Universal Voltage 347/480V (T5 Linear Only)

Fusing
GL=Single Element Fuse
GM=Double Element Fuse
Emergency=EM Installed, see EM options table[3][4]

ER81

Ballast Type [1]
T8 Systems
EB8_=T8 Electronic Instant Start.[4] Total Harmonic Distortion < 20%
No. of Ballast 1 or 2
EB8_/PLUS=T8 Electronic Instant Start. High Ballast Factor >1.13. Total Harmonic Distortion < 20%
No. of Ballast 1 or 2
ER8_=T8 Electronic Program Rapid Start. Total Harmonic Distortion < 10%
No. of Ballast 1 or 2
ER8_/PLUS=T8 Electronic Program Start. High Ballast Factor >1.13. Total Harmonic Distortion < 10%
No. of Ballast 1 or 2
EB8_/L=T8 Electronic Instant Start w/0.80 Ballast Factor.
No. of Ballast 1 or 2
T5 Systems
EBT_=T5HO Electronic Program Start.
No. of Ballast 1 or 2

WL=Wet Location Label

Options
RIF1=Radio Interference Suppressor
TH=(2) Top Watertite Hubs
TEH=(2) Top & (2) End Watertite Hubs (all Watertite Hubs have 1/2" Conduit Entry)
TILW=Tandem In-Line Wiring Option (Consult TILW Option Catalog Page)
PI/CPI=Plug-In Option
DD=Deep Diffuser (4' Length) (Available for 4' Fixture Length) To Complement Deep Diffuser Depth of 8' Fixture
M4=Specular Reflector
SSL=Stainless Steel Latches

Packaging
U=Unit Pack
PALC=Job Pack in Carton

NOTES: [1]Ballast type used only if ballast & voltage is chosen [2]Not available when specifying emergencies, voltage must be specific. [3]T5HO is only available in 1 or 2-lamp versions only. [4]Emergency option in 3 lamp version must use remote mount test switch.

ACCESSORIES

Accessories (order separately)
VT2-Chain/Set-U=Chain Hanging Set
Includes 6 ft. of chain, 4 large S-Hooks and 4 small S-Hooks
Order One (1) Kit for each 2' or 4' Fixture
Two (2) Kits Recommended For 8' Fixture
VT2-SS-MBK=Stainless Steel Mounting Bracket



SHIPPING DATA

Catalog No.	Wt.
VT2-132DR-WL	35 lbs.
VT2-232DR-WL	35 lbs.

APPROVED
By Darren Fraser at 4:00 pm, Jan 18, 2013

Submitted by Prolux Lighting Edmonton Ltd.Sharlene Howg			
PROLUX LIGHTING	**Job Name:** Cambridge Bay Water Plant	**Catalog Number:** LS70C WY/FC/CO Notes:	**Type:** 300 PLE12-5121

COOPER LIGHTING - LUMARK®

DESCRIPTION

Lumark's Cutoff Wally is a cutoff classified wall luminaire. Combining compact and aerodynamic styling with higher wattage performance, it is ideal for areas where spill light and glare control must be managed effectively. U.L. Listed for wet locations.

		Type
Catalog #		
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

Construction
HOUSING: Die-cast aluminum housing finished standard bronze polyester powder coat. DOOR: Special one-piece door design held in place with slot-head captive screws, provides lowglare cutoff lighting. Silicone gasketing seals out dirt and contaminants.

Electrical
SOCKET: HID: 4Kv medium-base socket.

Optical
LAMP: HID: Medium-base lamp included and available, up to 150W High Pressure Sodium or 100W Pulse Start Metal Halide. LENS: Patterned tempered glass lens minimizes direct lamp imaging.

Mounting
Ships completely prewired and preassembled. Easily mounts to J-box wall for quick installation. (3) 1/2" NPS conduit taps available.



WALLY CUTOFF

50 - 150W
High Pressure Sodium
70 - 100W
Pulse Start Metal Halide

WALL MOUNT LUMINAIRE

SHOP DRAWINGS ARE REVIEWED UNLESS NOTED OTHERWISE

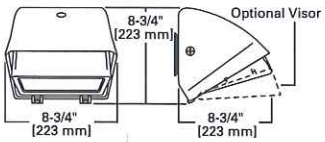
REVIEWED AS MODIFIED		Stantec
REVISE & RESUBMIT		
SEAL & SIGNATURES REQUIRED		

DATE Feb 19/2013

SIGNATURE

REVIEW BY STANTEC IS FOR THE SOLE PURPOSE OF ASCERTAINING GENERAL CONFORMITY WITH DESIGN. CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS, FABRICATION AND CONSTRUCTION METHODS. COORDINATION OF SUB-TRADES, DETAIL DESIGN OF COMPONENTS, AND ERRORS OR OMISSIONS ON SHOP DRAWINGS.

DIMENSIONS



DARK SKY COMPLIANT CO Cutoff

ORDERING INFORMATION

SAMPLE NUMBER: LS50C

Catalog Number	Lamp Type	Lamp Wattage	Voltage	Net Wt Color
High Pressure Sodium				
LS50C	ED17	50	120V	Bronze
LS70C	ED17	70	120V	Bronze
LS10C	ED17	100	120V	Bronze
LS15C	ED17	150	120V	Bronze
Pulse Start Metal Halide				
LP70C	ED17	70	120-277V	Bronze
LP10C	ED17	100	120-277V	Bronze

NOTE: Add "W" to the end of catalog number for white finish. Add "WHT" to the end of accessory for white finish. (Example: WY/CO-WHT).

Accessories (order separately)
WY/CO=Cutoff Replacement Door (Bronze)
WY/FC/CO=Full Cutoff Visor for Cutoff (Bronze)

TECHNICAL DATA
U.L. Wet Location Listed
CSA Certified

ENERGY DATA
Reactor Ballast Input Watts
50W HPS NPF (58 Watts)
70W HPS NPF (82 Watts)
100W HPS NPF (118 Watts)
150W HPS NPF (175 Watts)
High Reactance Ballast Input Watts
70W MP NPF (92 Watts)
100W MP NPF (128 Watts)

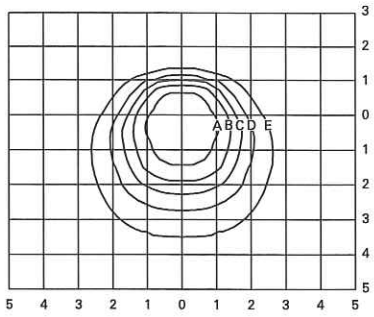
SHIPPING DATA
Approximate Net Weight:
HID: 11 lbs. (5kgs.)

COOPER Lighting
www.cooperlighting.com

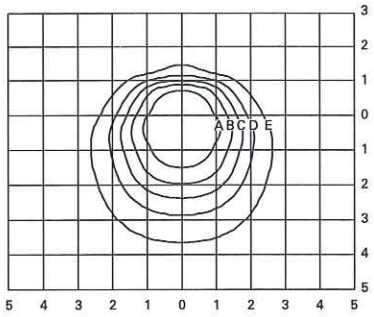
Submitted by Prolux Lighting Edmonton Ltd.Sharlene Howg	Catalog Number:	Type:
PROLUX LIGHTING **Job Name:** Cambridge Bay Water Plant	LS70C WY/FC/CO Notes:	300 PLE12-5121

WALLY CUTOFF

PHOTOMETRICS



LP10C
100-Watt MP
9,300-Lumen Clear ED-17 Lamp



LS15C
150-Watt HPS
16,000-Lumen Clear ED-17 Lamp

Footcandle Table

Select mounting height and read across for footcandle values of each isofootcandle line. Distance in units of mounting height.

Mounting Height	Footcandle Values for Isofootcandle Lines				
	A	B	C	D	E
10'	2.00	1.00	0.50	0.20	0.10
12'	1.38	0.69	0.34	0.13	0.06
15'	0.88	0.44	0.22	0.08	0.04

APPROVED
By Darren Fraser at 4:01 pm, Jan 18, 2013

Submitted by Prolux Lighting Edmonton Ltd.Sharlene Howg			
PROLUX LIGHTING	**Job Name:** Cambridge Bay Water Plant	**Catalog Number:** HPSF-K-50H-TT-LL SF/TR SF/VS Notes:	**Type:** 301 PLE12-5121

COOPER LIGHTING - LUMARK®

DESCRIPTION

The Lumark Falcon is a stylish and rugged luminaire that combines value and performance with a soft, architecturally appealing form. This soft rounded corner, die-cast construction is excellent for applications that have a high visibility and where a uniform beam distribution is desired. The Falcon floodlight can be wall or pole mounted, making it ideal for all commercial, industrial and residential low wattage floodlighting applications.

		Type
Catalog #		
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

Construction
DOOR + LATCH: Tempered glass lens is impact and thermal shock resistant. Easily released die-cast aluminum doorframe with stainless steel toolless latch allows easy access for re-lamping. Enclosure latch can be secured with a single point stainless steel screw, provided, or with optional vandal resistant head. HOUSING: Die-cast aluminum housing is finished in weather and abrasion resistant dark bronze polyester powder paint. Optional colors are available. GASKET: Full-circumference silicone gasket seals out external contaminants.

Electrical
SOCKET: Pulse rated, 4KV, medium-base porcelain lamp socket standard for HID. Electronic compact 4-pin fluorescent sockets standard for CF lamp options.

Optical
REFLECTOR: Formed aluminum hammered reflector optimized beam efficiency and control.

Mounting
Adjustable ANSI 1G rated stem mounting arm fits 1/2" NPS outlet box cover. (RBC round outlet box cover not included, order separately). Optional heavy-gauge steel adjustable trunnion mounting provides additional durability when required.

THE FALCON

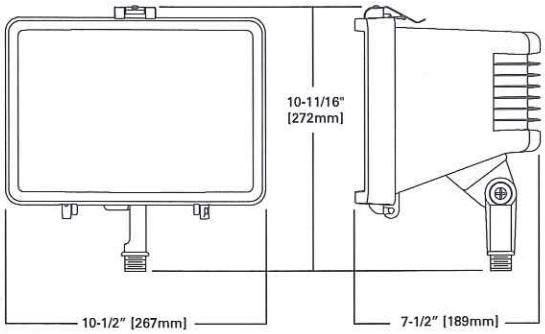


SF
FALCON

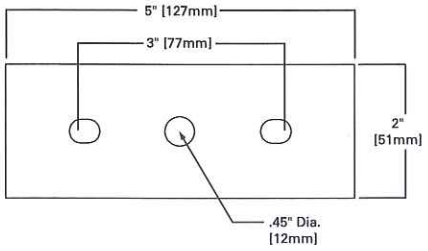
35 - 150W
Pulse Start Metal Halide
Metal Halide
High Pressure Sodium
26 - 70W
Compact Fluorescent

LOW WATTAGE FLOODLIGHT

DIMENSIONS



TRUNNION-MOUNT DRILLING DIMENSIONS



LAMP TYPE	WATTAGE
Pulse Start Metal Halide (MP)	150W
Metal Halide (MH)	50, 70, 100, 175W
High Pressure Sodium (HP)	35, 50, 70, 100, 150W
Compact Fluorescent (CF)	(1) 26, (1) 32, (1) 42, (2) 26, (1) 57, (1) 60 (2) 32, (1) 70W

TECHNICAL DATA

U.L. Wet Location Listed
25°C Maximum Ambient Temperature
External Supply Wiring 60°C Minimum

ENERGY DATA

Reactor Ballast Input Watts
35W HPS NPF (46 Watts)
50W HPS NPF (58 Watts)
70W HPS NPF (82 Watts)
100W HPS NPF (115 Watts)
150W HPS NPF (175 Watts)
High Reactance Ballast Input Watts
50W HPS HPF (66 Watts)
50W MP HPF (72 Watts)
70W HPS HPF (95 Watts)
70W MP HPF (90 Watts)
100W HPS HPF (130 Watts)
100W MP HPF (129 Watts)
150W HPS HPF (190 Watts)
150W MP HPF (185 Watts)
CWA Ballast Input Watts
175W MH HPF (210 Watts)
Electronic Ballast Input Watts
26W CF HPF (29 Watts)
32W CF HPF (36 Watts)
42W CF HPF (46 Watts)
52W CF HPF (54 Watts)
57W CF HPF (59 Watts)
60W CF HPF (70 Watts)
64W CF HPF (68 Watts)
70W CF HPF (75 Watts)

SHIPPING DATA

Approximate Net Weight:
18 lbs. (8 kgs.)

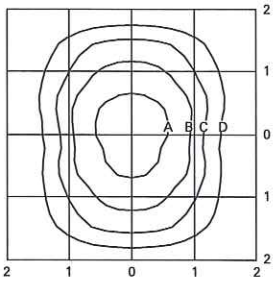
ISHI CERTIFIED

COOPER Lighting
www.cooperlighting.com

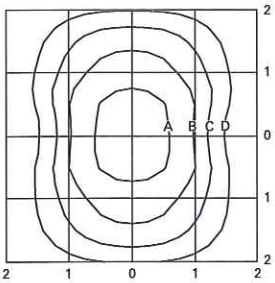
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2010-09-15 13:04:13

Submitted by Prolux Lighting Edmonton Ltd.Sharlene Howg			
PROLUX LIGHTING	**Job Name:** Cambridge Bay Water Plant	**Catalog Number:** HPSF-K-50H-TT-LL SF/TR SF/VS Notes:	**Type:** 301 PLE12-5121

PHOTOMETRICS



MPSF-X-150
150—Watt MP
14,000—Lumen Clear Lamp

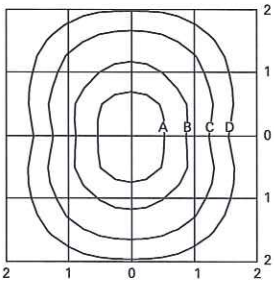


HPSF-X-150
150—Watt HP
16,000—Lumen Clear Lamp

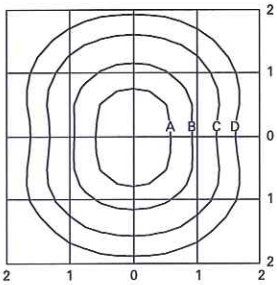
Footcandle Table
Select mounting height and read across for footcandle values of each isofootcandle line. Distance in units of mounting height.

Mounting Height	Footcandle Values for Isofootcandle Lines			
	A	B	C	D
MPSF-X-150 / HPSF-X-150				
10'	20.00	8.00	4.00	2.00
15'	9.00	3.60	1.80	0.90
20'	5.00	2.00	1.00	0.50

Vertical Aiming=0°



CFSF-X-42
42—Watt CF (42W Triple Tube)
3,200—Lumen Lamp



CFSF-X-60
60—Watt CF (60W Triple Tube)
4,000—Lumen Lamp

Footcandle Table
Select mounting height and read across for footcandle values of each isofootcandle line. Distance in units of mounting height.

Mounting Height	Footcandle Values for Isofootcandle Lines			
	A	B	C	D
CFSF-X-42 / CFSF-X-60				
10'	4.00	2.00	0.80	0.40
15'	1.80	0.90	0.36	0.18
20'	1.00	0.50	0.20	0.10

Vertical Aiming=0°

APPROVED
By Darren Fraser at 4:01 pm, Jan 18, 2013

SHOP DRAWINGS ARE REVIEWED UNLESS NOTED OTHERWISE

REVIEWED AS MODIFIED	
REVISE & RESUBMIT	
SEAL & SIGNATURES REQUIRED	

Stantec

DATE Feb 19/2013

SIGNATURE

REVIEW BY STANTEC IS FOR THE SOLE PURPOSE OF ASCERTAINING GENERAL CONFORMITY WITH DESIGN. CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS, FABRICATION AND CONSTRUCTION METHODS. COORDINATION OF SUB-TRADES, DETAIL DESIGN OF COMPONENTS, AND ERRORS OR OMISSIONS ON SHOP DRAWINGS.

Submitted by Prolux Lighting Edmonton Ltd.Sharlene Howg	Catalog Number:	Type:
PROLUX LIGHTING	Job Name: Cambridge Bay Water Plant	HPSF-K-50H-TT-LL SF/TR SF/VS Notes:	301 PLE12-5121

ORDERING INFORMATION

Sample Number: MPSF-T-70H-120V

Lamp Type
- **MP**=Pulse Start Metal Halide
- **MH**=Metal Halide[1]
- **HP**=High Pressure Sodium
- **CF**: Compact Fluorescent

Series
- **SF**: Falcon

Mounting
- **T**=Trunnion
- **K**=Knuckle

Lamp Wattage [1]

MP
- **50**=50W

70=70W
100=100W
150: 150W[2]

MH
- **175**: 175W[1]

HP
- **35**: 35W[3, 4]
- **50**: 50W
- **70**: 70W
- **100**: 100W
- **150**: 150W

CF
- **26**: (1) 26W
- **32**: (1) 32W
- **42**: (1) 42W
- **52**: (2) 26W
- **57**: (1) 57W
- **60**=(1) 60W
- **64**=(2) 32W
- **70**=(1) 70W

Ballast
- **H**=High Power Factor[2]
- __=Normal Power Factor

Voltage [5]
- **120V**: 120V[6]
- **208V**: 208V[7]
- **240V**: 240V[7]
- **277V**: 277V
- **347V**: 347V[8]
- **480V**: 480V
- **DT**: Dual-Tap
- **MT**: Multi-Tap, wired 277V
- **TT**: Triple-Tap, wired[8] 347V
- **E**: Electronic (120-277V)[9]

Options
- **LL**=Lamp Included (Must Specify Wattage with Fluorescent)
- **TR**=Tamper Resistant Screws
- **PE**: Internal Photocontrol (Specify Voltage)
- **PC**: Button Type Photocontrol
- **F**: Single Fuse (120, 277 or[10] 347V. Specify Voltage)
- **FF**: Double Fuse (208, 240 or[10] 480V. Specify Voltage)

Accessories [11]
- **TYS-XX**=Trunnion or Yoke Slipfitter for 2 3/8", 3", or 3 1/2" O.D. Tenon
- **FA5-XX**=2" Slipfitter for Trunnion Fixture
- **RAB-XX**=Right Angle Pipe Bracket for Slipfitter
- **SAB-XX**: Steel Angle Bracket for Trunnion
- **PE/MT**: Field Installed Photocontrol
- **RBC-XX**: Round Outlet Box Cover
- **SF/VS**: Vandal Shield
- **TRSD-6/32**: Tamper-Resistant Screwdriver
- **SF/TR**: Tamper-Resistant Screw
- **SF/V-XX**: Visor
- **SPK**: Landscape Post (Standard Color Dark Grey)

Notes:
1. All HID lamps are medium base. 175W MH is available for non U.S. markets only.
2. 150W Pulse Start Metal Halide available in High Power Factor Ballast only. High Power Factor Ballast is required on all MP and MH and CF products.
3. High Pressure Sodium only.
4. 120V Only.
5. Products also available in non-US voltages and 50HZ for international markets.
6. Reactor ballasts used for HP lamps when specified.
7. Not available in Canada.
8. Canada only.
9. Compact Fluorescent lamps only. In cold temperatures, compact fluorescent lamps produce lower illumination levels.
10. 100W Metal Halide maximum.
11. Order separately, replace XX with color designation.

VOLTAGE CHART	
DT=Dual-Tap	120/277 (wired 277V)
MT=Multi-Tap	120/208/240/277 (wired 277V)
TT=Triple-Tap	120/277/347 (wired 347V)
E=Electronic Ballast (CF only)	120-277V (wired 277V) (50/60 HZ)

STOCK SAMPLE NUMBER (LAMP INCLUDED): HIGH PRESSURE SODIUM AND PULSE START METAL HALIDE

SAMPLE NUMBER: MPSF10K-MT

Lamp Type
- **HP**=High Pressure Sodium
- **MP**=Pulse Start Metal Halide

Series
- **SF**=Falcon

Lamp Options
- **35**=35W[2,3]
- **50**=50W
- **70**=70W
- **10**=100W
- **15**=150W[4]

Mounting
- **K**=Knuckle
- **T**=Trunnion

Wiring Options
- __=Standard
- **MT**=Multi-Tap

Note:
Refer to In-Stock Guide for availability.

STOCK SAMPLE NUMBER (LAMP INCLUDED): COMPACT FLUORESCENT

SAMPLE NUMBER: CFSF-K-42-E-LL

Lamp Type/Series
- **CFSF**=Compact Fluorescent Falcon

Mounting
- **K**=Knuckle

Lamp Option
- **42**=42W

Wiring Option
- **E**=Electronic Ballast

Lamp Included
- **LL**=Lamp Included

NOTES [stock]: Options not available with stock products. Order Accessories as separate items for field installation. Refer to standard ordering information to add options and accessories. Refer to In-Stock Guide for availabilty.

4.0 Exit & Emergency Lighting

Section 4.0 - Exit & Emergency Lighting

Exit Lighting

The exit lights for the facility are Light Emitting Diode type that require next to no maintenance. The fixtures are designed to operate for 10 years plus with no lamp replacement. Should one become damaged replace it, or its parts, with one that matches.

Emergency Lighting

In the event of an interruption of power to a lighting circuit, the battery lights pertaining to the affected area will come on automatically. They remain lit until the power is restored or until the batteries die. When power is restored to the facility they shut off and the automatic charging unit brings the batteries up to full charge. The unit should be checked monthly by disconnecting power to the unit. When power is restored to the unit the lights should go out and the unit should go into the high rate charge to bring the batteries up to full power. The pack should provide power for a minimum of 30 minutes. If the lights do not remain on for the full 30 minutes then a qualified maintenance person should be called in to do a battery test and replace the batteries if necessary.

SHOP DRAWING REVIEW

Project: Cambridge Bay Potable Water System

Location: Cambridge Bay, NU

General Contractor: Sanaqatiit Construction Ltd.

Engineer: Stantec

Section 26 52 01 – Emergency Lighting

Reviewed by: Darren Fraser

SHOP DRAWINGS ARE REVIEWED UNLESS NOTED OTHERWISE

REVIEWED AS MODIFIED		Stantec
REVISE & RESUBMIT		
SEAL & SIGNATURES REQUIRED		

DATE Feb 19/2013

SIGNATURE

REVIEW BY STANTEC IS FOR THE SOLE PURPOSE OF ASCERTAINING GENERAL CONFORMITY WITH DESIGN. CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS, FABRICATION AND CONSTRUCTION METHODS. COORDINATION OF SUB-TRADES, DETAIL DESIGN OF COMPONENTS, AND ERRORS OR OMISSIONS ON SHOP DRAWINGS.

SANAQATIIT CONSTRUCTION LTD.
SHOP DRAWING REVIEWED
BY
FEB 20 2013
- REVIEWED
- REVIEWED AS NOTED
- REVISE AND RESUBMIT

Ryfan Kitikmeot Ltd.
Box 297, Kugluktuk, NU X0E 0E0
Email: dfraser@ryfan.ca

Submitted by Prolux Lighting Edmonton Ltd.Sharlene Howg			
PROLUX LIGHTING	**Job Name:** Cambridge Bay Water Plant	**Catalog Number:** EBST24720-2MD20MR16-WHT-ATD-FS4-VLT-AMP-DCT-ACT-MTS Notes:	**Type:** BP PLE12-5121

EBST

Project:

Contractor:

STEEL BATTERY UNIT

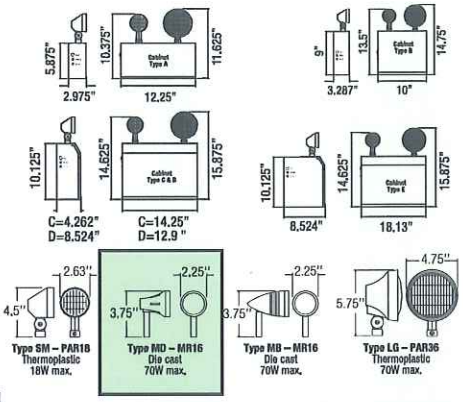
6V, 12V or 24V Models

18-720 Watt Capacities

Steel Construction

120/347VAC Input





Approvals:
CSA Certified to
C22.2 #141, C860

DESCRIPTION

The EBST series of commercial steel battery units are designed to provide efficient and reliable emergency lighting. Utilizing a sturdy, all steel housing, the EBST presents a modern and unobtrusive design. On higher capacity models, the cabinet front is sloped to allow better internal access and superior low angle light distribution. The EBST series is available in 6VDC, 12VDC and 24VDC versions in a range of wattage capacities between 18 and 720 watts, for 30 minutes duration. Units are typically supplied with two top mounted PAR18 or PAR36 type heads, however a wide range of head type, number and placement are available including MR16 type. The EBST can also accommodate a wide variety of options, including auto-testing self-diagnostics and remote testing.

MECHANICAL

- 120VAC line cord supplied standard
- Universal spider knockout pattern and keyhole mounting slots stamped into back of cabinet
- Multiple conduit entry knockouts
- White powder coat finish standard, other finishes and colours optional
- Lamp heads include PAR18 small style, PAR36 large style and die cast metal MR16 type
- Top head mounting is standard, side mount is optional

ELECTRICAL

- 120/347VAC 60Hz Input, field selectable
- High efficiency, rapid recovery, precision control charging system
- 6VDC, 12VDC or 24VDC emergency power output versions (as specified)
- Wattage capacities from 18 to 720 watts
- 30 Minutes emergency power duration standard
- Momentary push button test switch
- Diagnostic/pilot LEDs for AC ON and CHARGE
- Fully automatic, current limited charger
- Line latched, low voltage protection
- Solid state design and construction
- Brownout and short circuit protection
- Temperature compensated
- Large magnum terminal screw type connectors for remote load connection
- Complete battery recharge in 24 hours
- Maintenance free, sealed lead acid battery
- Optional automatic-testing, self-diagnostic charger board:
  - Continuously monitors the operational status of the battery unit
  - Automatically performs battery and lamp load testing at preset intervals
  - Indicates any component malfunctions or automated test failures

ORDERING GUIDE

Series	Voltage	Capacity	Heads & Lamps		Lamp	Colour	Options
EBST	06 - 6VDC 12 - 12VDC **24 - 24VDC**	See model rating below **720**	0 - No Heads 1SM - One PAR18 2SM - Two PAR18 1LG - One PAR36 2LG - Two PAR36	1MD - One MR16 **2MD - Two MR16** 1MB - One MR16 2MB - Two MR16	See lamp list below **MR16Q20**	**WHT - White (standard)** BLK - Black GRY - Grey WST - Whistle CUS - Custom colour (specify))	**ATD, TDL, LPD, BTD, VLT, AMP, ACT, DCT, FS4, RDS*, NLC, TLP, CAB, VDR, MTS, WRG, IRT, IRC** * Specify AC voltage

Lamp Selection

	6 Volts	12 Volts	24V
PAR18 - Small heads			
Quartz halogen	08Q, 10Q, 12Q	08Q, 10Q, 12Q	12Q
Tungsten	5.4T, 7.2T, 09T	5.4T, 09T, 12T, 18T	09T, 18T
MR16 - Small Heads c/w MR16 Lamp			
Quartz halogen	08Q, 10Q, 12Q, 20Q, 35Q, 50Q	08Q, 10Q, 12Q, 20Q, 35Q, 50Q	10Q, 12Q, 20Q, 35Q, 50Q, 70Q
LED	N/A	3.7L, 5.7L	N/A
PAR36 - Large heads			
Quartz halogen	08Q, 10Q, 12Q, 20Q	08Q, 10Q, 12Q, 20Q, 35Q	12Q, 20Q
Tungsten	5.4T, 7.2T, 09T, 18T, 25T	5.4T, 09T, 18T, 25T	09T, 18T, 25T
Quartz sealed beam	08SBQ, 10SBQ, 12SBQ, 20SBQ	08SBQ, 12SBQ, 20SBQ, 35SBQ, 55SBQ	55SBQ, 70SBQ
Tungsten sealed beam	09SBT, 18SBT	25SBT	N/D

NOTE: Due to cabinet/space limitations, not all options are available for all models in any given combination. Please consult with your factory representative regarding specific options and exact cabinet dimension information

Model Ratings

		Wattage capacities				
Model	Voltage	30 min.	60 min.	90 min.	120 min.	Cabinet
EBST-06018	6V	18	9	N/A	N/A	A
EBST-06036	6V	36	18	12	9	A
EBST-06050	6V	50	25	16	12	A
EBST-06072	6V	72	36	24	18	B
EBST-06100	6V	100	50	33	25	B
EBST-06160	6V	160	80	53	40	C
EBST-06180	6V	180	90	60	45	C
EBST-12036	12V	36	18	12	9	A
EBST-12050	12V	50	25	16	12	A
EBST-12072	12V	72	36	24	18	A
EBST-12100	12V	100	50	33	25	B
EBST-12160	12V	160	80	53	40	C
EBST-12200	12V	200	100	66	50	C
EBST-12250	12V	250	125	83	62	D
EBST-12360	12V	360	180	120	90	D
EBST-24144	24V	144	72	48	36	C
EBST-24200	24V	200	100	66	50	C
EBST-24320	24V	320	160	106	80	D
EBST-24350	24V	350	175	116	87	E
EBST-24550	24V	550	275	183	137	E
EBST-24720	24V	720	360	240	180	E

Submitted by Prolux Lighting Edmonton Ltd.Sharlene Howg			
PROLUX LIGHTING	**Job Name:** Cambridge Bay Water Plant	**Catalog Number:** EBST24720-2MD20MR16-WHT-ATD-FS4-VLT-AMP-DCT-ACT-MTS Notes:	**Type:** BP PLE12-5121

OPTIONS

Project:

Contractor:

EMERGENCY LIGHTING

APPROVED
By Darren Fraser at 4:02 pm, Jan 18, 2013

Family	Description
ACT	AC Terminal Block
ALM	Aluminum Frame (for Tritium sign only)
AMP	Ammeter
ATD	Automatic test Self-diagnostic
BKO	Black Out Option
BNO	White Out Option
BTD	Battery Disconnect
CAB	Remote Load Cab tire Set
CCWH	White end caps & canopy kit (RPEL only)
CPS	Constant Power Supply
DCT	DC Terminal Block
DL	Damp Location Rated
FAFL	Fire Alarm Flasher
FLA	Flasher and Audible Alarm
FLH	Flasher (specify Voltage)
FS2	2 Circuit Fused Internal Distribution
FS3	3 Circuit Fused Internal Distribution
FS4	4 Circuit Fused Internal Distribution
FS5	5 Circuit Fused Internal Distribution
FS6	6 Circuit Fused Internal Distribution
HTR	Internal thermostatically controlled battery heater (specify voltage)
RMT	Infrared Remote Test (specify AC voltage)
K5	1/2" Knockout for pendant mount
LCP	Less Canopy
LGD	Die Cast Lens Guard
LNC	120VAC line cord
LPD	Lamp Disconnect (internal)
LXG	Lexan Guard (separate order)
LXS	Vandal resistant wraparound shield (separate order)

Family	Description
LZT	Remote Laser Test (contact factory)
MC	Metal Canopy
MTS	Mounting Shelf (separate order)
NLC	Octagon Box Mount (no line cord)
RDS	Radio Frequency Suppression (specify AC voltage)
SMH	Side Mounted Heads
SPW	Special Wording
TDL	Time Delay (specify AC voltage)
TFC	Teflon Coated Lens
TLP	Twist Lock Plug (specify AC voltage)
TSFN	Transfer Panel for AC & DC Exits
TSW	External Push Button Test Switch
VCC	Heavy-duty full width ceiling mount canopy
VCE	Heavy-duty full width end mount canopy
VDR	Tamper Proof Screws
VLT	Voltmeter
VTX	Tamper Proof Torx Screw (Vandal Resistant Sign only)
VRF	Vandal Resistant Frame (Tritium sign)
WRG	Wireguard (separate order)

Submitted by Prolux Lighting Edmonton Ltd.Sharlene Howg			
PROLUX LIGHTING	**Job Name:** Cambridge Bay Water Plant	**Catalog Number:** EBST24144-0-WHT-ATD-FS4-VLT-AMP-DCT-ACT-MTS Notes: Required to maintain 120 minute operating time;	**Type:** BP PLE12-5121

EBST

Project:

Contractor:

STEEL BATTERY UNIT

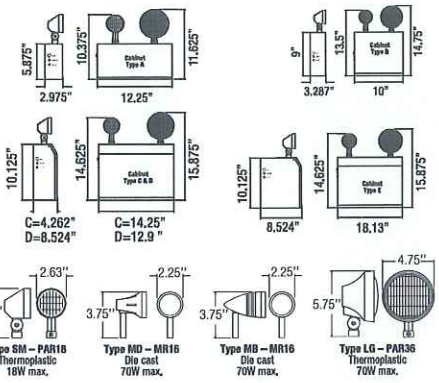
6V, 12V or 24V Models

18-720 Watt Capacities

Steel Construction

120/347VAC Input





Type SM – PAR18 Thermoplastic 18W max.

Type MD – MR16 Die cast 70W max.

Type MB – MR16 Die cast 70W max.

Type LG – PAR36 Thermoplastic 70W max.

Approvals:
CSA Certified to C22.2 #141, C860

DESCRIPTION

The EBST series of commercial steel battery units are designed to provide efficient and reliable emergency lighting. Utilizing a sturdy, all steel housing, the EBST presents a modern and unobtrusive design. On higher capacity models, the cabinet front is sloped to allow better internal access and superior low angle light distribution. The EBST series is available in 6VDC, 12VDC and 24VDC versions in a range of wattage capacities between 18 and 720 watts, for 30 minutes duration. Units are typically supplied with two top mounted PAR18 or PAR36 type heads, however a wide range of head type, number and placement are available including MR16 type. The EBST can also accommodate a wide variety of options, including auto-testing self-diagnostics and remote testing.

MECHANICAL

- 120VAC line cord supplied standard
- Universal spider knockout pattern and keyhole mounting slots stamped into back of cabinet
- Multiple conduit entry knockouts
- White powder coat finish standard, other finishes and colours optional
- Lamp heads include PAR18 small style, PAR36 large style and die cast metal MR16 type
- Top head mounting is standard, side mount is optional

ELECTRICAL

- 120/347VAC 60Hz Input, field selectable
- High efficiency, rapid recovery, precision control charging system
- 6VDC, 12VDC or 24VDC emergency power output versions (as specified)
- Wattage capacities from 18 to 720 watts
- 30 Minutes emergency power duration standard
- Momentary push button test switch
- Diagnostic/pilot LEDs for AC ON and CHARGE
- Fully automatic, current limited charger
- Line latched, low voltage protection
- Solid state design and construction
- Brownout and short circuit protection
- Temperature compensated
- Large magnum terminal screw type connectors for remote load connection
- Complete battery recharge in 24 hours
- Maintenance free, sealed lead acid battery
- Optional automatic-testing, self-diagnostic charger board:
  - Continuously monitors the operational status of the battery unit
  - Automatically performs battery and lamp load testing at preset intervals
  - Indicates any component malfunctions or automated test failures

ORDERING GUIDE

Series	Voltage	Capacity	Heads & Lamps		Lamp	Colour	Options
EBST	06 - 6VDC 12 - 12VDC 24 - 24VDC	See model rating below 144	0 - No Heads 1SM - One PAR18 2SM - Two PAR18 1LG - One PAR36 2LG - Two PAR36	1MD - One MR16 2MD - Two MR16 1MB - One MR16 2MB - Two MR16	See lamp list below	WHT - White (standard) BLK - Black GRY - Grey WST - Whistle CUS - Custom colour (specify))	ATD, TDL, LPD, BTD, VLT, AMP, ACT, DCT, FS4, RDS*, NLC, TLP, CAB, VDR, MTS, WRG, IRT, IRC * Specify AC voltage

Lamp Selection

	6 Volts	12 Volts	24V
PAR18 - Small heads			
Quartz halogen	08Q, 10Q, 12Q	08Q, 10Q, 12Q	12Q
Tungsten	5.4T, 7.2T, 09T	5.4T, 09T, 12T, 18T	09T, 18T
MR16 - Small Heads c/w MR16 Lamp			
Quartz halogen	08Q, 10Q, 12Q, 20Q, 35Q, 50Q	08Q, 10Q, 12Q, 20Q, 35Q, 50Q	10Q, 12Q, 20Q, 35Q, 50Q, 70Q
LED	N/A	3.7L, 5.7L	N/A
PAR36 - Large heads			
Quartz halogen	08Q, 10Q, 12Q, 20Q	08Q, 10Q, 12Q, 20Q, 35Q	12Q, 20Q
Tungsten	5.4T, 7.2T, 09T, 18T, 25T	5.4T, 09T, 18T, 25T	09T, 18T, 25T
Quartz sealed beam	08SBQ, 10SBQ, 12SBQ, 20SBQ	08SBQ, 12SBQ, 20SBQ, 35SBQ, 55SBQ	55SBQ, 70SBQ
Tungsten sealed beam	09SBT, 18SBT	25SBT	N/D

NOTE: Due to cabinet/space limitations, not all options are available for all models in any given combination. Please consult with your factory representative regarding specific options and exact cabinet dimension information.

Model Ratings

		Wattage capacities				
Model	Voltage	30 min.	60 min.	90 min.	120 min.	Cabinet
EBST-06018	6V	18	9	N/A	N/A	A
EBST-06036	6V	36	18	12	9	A
EBST-06050	6V	50	25	16	12	A
EBST-06072	6V	72	36	24	18	B
EBST-06100	6V	100	50	33	25	B
EBST-06160	6V	160	80	53	40	C
EBST-06180	6V	180	90	60	45	C
EBST-12036	12V	36	18	12	9	A
EBST-12050	12V	50	25	16	12	A
EBST-12072	12V	72	36	24	18	A
EBST-12100	12V	100	50	33	25	B
EBST-12160	12V	160	80	53	40	C
EBST-12200	12V	200	100	66	50	C
EBST-12250	12V	250	125	83	62	D
EBST-12360	12V	360	180	120	90	D
EBST-24144	24V	144	72	48	36	C
EBST-24200	24V	200	100	66	50	C
EBST-24320	24V	320	160	106	80	D
EBST-24350	24V	350	175	116	87	E
EBST-24550	24V	550	275	183	137	E
EBST-24720	24V	720	360	240	180	E

Submitted by Prolux Lighting Edmonton Ltd.Sharlene Howg			
PROLUX LIGHTING	**Job Name:** Cambridge Bay Water Plant	**Catalog Number:** EBST24144-0-WHT-ATD-FS4-VLT-AMP-DCT-ACT-MTS Notes: Required to maintain 120 minute operating time;	**Type:** BP PLE12-5121

OPTIONS

Project:

Contractor:

EMERGENCY LIGHTING

APPROVED
By Darren Fraser at 4:02 pm, Jan 18, 2013

Family	Description
ACT	AC Terminal Block
ALM	Aluminum Frame (for Tritium sign only)
AMP	Ammeter
ATD	Automatic test Self-diagnostic
BKO	Black Out Option
BNO	White Out Option
BTD	Battery Disconnect
CAB	Remote Load Cab tire Set
CCWH	White end caps & canopy kit (RPEL only)
CPS	Constant Power Supply
DCT	DC Terminal Block
DL	Damp Location Rated
FAFL	Fire Alarm Flasher
FLA	Flasher and Audible Alarm
FLH	Flasher (specify Voltage)
FS2	2 Circuit Fused Internal Distribution
FS3	3 Circuit Fused Internal Distribution
FS4	4 Circuit Fused Internal Distribution
FS5	5 Circuit Fused Internal Distribution
FS6	6 Circuit Fused Internal Distribution
HTR	Internal thermostatically controlled battery heater (specify voltage)
RMT	Infrared Remote Test (specify AC voltage)
K5	1/2" Knockout for pendant mount
LCP	Less Canopy
LGD	Die Cast Lens Guard
LNC	120VAC line cord
LPD	Lamp Disconnect (internal)
LXG	Lexan Guard (separate order)
LXS	Vandal resistant wraparound shield (separate order)

Family	Description
LZT	Remote Laser Test (contact factory)
MC	Metal Canopy
MTS	Mounting Shelf (separate order)
NLC	Octagon Box Mount (no line cord)
RDS	Radio Frequency Suppression (specify AC voltage)
SMH	Side Mounted Heads
SPW	Special Wording
TDL	Time Delay (specify AC voltage)
TFC	Teflon Coated Lens
TLP	Twist Lock Plug (specify AC voltage)
TSFN	Transfer Panel for AC & DC Exits
TSW	External Push Button Test Switch
VCC	Heavy-duty full width ceiling mount canopy
VCE	Heavy-duty full width end mount canopy
VDR	Tamper Proof Screws
VLT	Voltmeter
VTX	Tamper Proof Torx Screw (Vandal Resistant Sign only)
VRF	Vandal Resistant Frame (Tritium sign)
WRG	Wireguard (separate order)

Submitted by Prolux Lighting Edmonton Ltd.Sharlene Howg			
PROLUX LIGHTING	**Job Name:** Cambridge Bay Water Plant	**Catalog Number:** RMMD2-24V20MR16WHT Notes:	**Type:** DRH PLE12-5121

RMMD

APPROVED
By Darren Fraser at 4:04 pm, Jan 18, 2013

Contractor:

COMPACT REMOTE

- MR16 Surface Mount
- Compact Design
- Single, Double or Triple
- 6V, 12V, & 24V Lamps



Approvals:
CSA Certified to
C22.2 #141

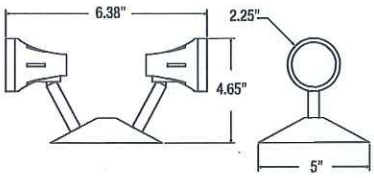
DESCRIPTION

The RMMD series of commercial MR16 remotes provide exceptional light output in a compact, traditional design. The die cast, all metal housing is fully adjustable with a friction lock tilt and swivel that can be locked in place with a rear mounted set screw. The canopy is designed to mount directly to typical electrical junction boxes. Available in 6V, 12V and 24V models, all utilizing low glare, MR16 quartz halogen or LED lamps.

MECHANICAL

- Die cast, solid metal housing with die cast, twist lock lamp collar
- Complete adjustablity - both tilt and swivel
- 5" diameter canopy standard
- Two canopy mounting holes designed to match standard electrical junction boxes
- White paint finish is standard, black color is optional
- MR16 lamp designed with low glare reflector and available in 6V, 12V or 24V

DIMENSIONS



ORDERING GUIDE

Series	Number of heads	Voltage	Lampe type	Colour	Options
RMMD	1 - Single head 2 - Double head 3 - Triple head 4 - Quad head (require 12" dia. canopy)	06 - 6VDC 12 - 12VDC 24 - 24VDC	See lamp selection above MR16Q20	WHT - White (standard) BLK - Black	LCP, VDR, WRG, LXG

LAMP SELECTION

	6 Volts	12 Volts	24 Volts
MR16 - Small Heads c/w MR16 Lamp			
Quartz halogen	08Q, 10Q, 12Q, 20Q, 35Q, 50Q	08Q, 10Q, 12Q, 20Q, 35Q, 50Q	10Q, 12Q, 20Q, 35Q, 50Q
LED	N/A	3,7L, 5,7L	N/A

SHOP DRAWING REVIEW

Project: Cambridge Bay Potable Water System

Location: Cambridge Bay, NU

General Contractor: Sanaqatiit Construction Ltd.

Engineer: Stantec

Section 26 53 00 – Exit Signs

Reviewed by: Darren Fraser

SHOP DRAWINGS ARE REVIEWED UNLESS NOTED OTHERWISE

REVIEWED AS MODIFIED		Stantec
REVISE & RESUBMIT		
SEAL & SIGNATURES REQUIRED		

DATE Feb 19/2013

SIGNATURE

REVIEW BY STANTEC IS FOR THE SOLE PURPOSE OF ASCERTAINING GENERAL CONFORMITY WITH DESIGN. CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS, FABRICATION AND CONSTRUCTION METHODS. COORDINATION OF SUB-TRADES, DETAIL DESIGN OF COMPONENTS, AND ERRORS OR OMISSIONS ON SHOP DRAWINGS.

SANAQATIIT CONSTRUCTION LTD.
SHOP DRAWING REVIEWED
BY
FEB 2 0 2013
Ø - REVIEWED
O - REVIEWED AS NOTED
O - REVISE AND RESUBMIT

Ryfan Kitikmeot Ltd.
Box 297, Kugluktuk, NU X0E 0E0
Email: dfraser@ryfan.ca

Submitted by Prolux Lighting Edmonton Ltd.Sharlene Howg			
PROLUX LIGHTING	**Job Name:** Cambridge Bay Water Plant	**Catalog Number:** RPSTUMWHTUNVDC Notes:	**Type:** EXIT PLE12-5121

AimLite

Project:
Contractor:

RPST
STEEL



- NEW NBC2010 compliant
- Meets C22.2 #141 specifications

Approvals:
CSA Certified to C22.2 #141

DESCRIPTION

The clean lines of the series RPST of commercial steel signs present a fully modern appearance. The steel provides for a rigid, durable and light-weight sign. Available in AC only, AC/DC and internally Self-Powered versions.

ELECTRICAL - AC & AC/DC

- LED Ultra-bright light source
- 120/347VAC Input, field selectable
- 1.8 Watt power consumption single or double face
- Emergency DC wattages as follows:

6VDC = 0.9W / 12VDC = 0.9W / 24VDC=0.9W

ELECTRICAL - SELF-POWERED

- LED Ultra-bright light source
- 120/347VAC Input, field selectable
- 1.8 Watt power consumption single or double face
- High-performance, Ni-Cad battery
- 90 or 120 Minutes emergency duration
- Solid state transfer and battery charger

APPROVALS

- New NBC2010 compliant
- Meets C22.2 #141 specifications

APPROVED
By Darren Fraser at 4:05 pm, Jan 18, 2013

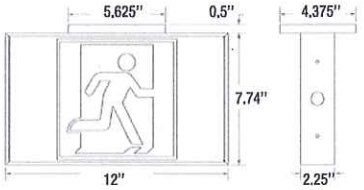
SPECIFICATIONS

Supply and Install Aimlite Steel LED Running Man sign in accordance with NBC2010, C22.2 No. 141. The equipment shall operate with universal AC input of 120/347V at less than 1.8 watts and universal DC input voltage from 6V to 24V. The housing shall be constructed of rugged steel and have a maximum depth of 2-1/4''. The faceplates shall be open face type with an steel contour. The light source shall be high performing light emitting diodes (LED) and the LED lamps shall provide illumination in normal and emergency operation and shall be mounted inside the Running Man housing. A white LED sensitive diffuser shall be used to provide an evenly illuminated green and white legend.

The Running Man in a self powered configuration shall be equipped with a nickel cadmium battery and shall stay illuminated during emergency operation for at least 90 minutes upon AC fail

The unit shall be Aimlite model number RPSTUMWH

DIMENSIONS





Come standard with three pictogram legends for direction selection.

ORDERING GUIDE

/

Series	Face #	Mounting	Colour	DC output	Options
RPST	U - Universal faces	M - Universal mounting	WHT - White (standard) BLK - Black GRY - Grey CUS - Custom colour (please specify)	NDC - No DC UNVDC - Universal DC backup voltage 6 to 24VDC selectable BAT - Self-powered for 90 minutes BAT1 - Self-powered for 120 minutes	WRG - Steel Wireguard (specify mounting) VDR - Vandal resistant screws PM - Pendant kit PG - Polycarbonate lens guard SPW - Special wording BKO - Blank out (white out) BNO - Black out

5.0 Generator

Section 5.0 - Generator System

Overview

In the event of a power failure, the generator will turn on and power supply will be transferred from the utility power to the back-up generator. See the following pages for shop drawings providing information on the generator provided for this project.

Maintenance

We recommend that the performance of the generator be tested semi-annually by use of a load bank. Being a diesel motor, the generator should also be serviced by a qualified technician annually or more frequently if recommended by the manufacturer.

Serial Number:	Part Number:	Part Description:
MX187094	78190	GENERATOR 361/1602 SPECIAL SAE 4 FLYWHEEL 10 12W NAFTA
PE5030L117226	86789	ENGINE 5030HF285 T3 12V LESS RAD SAE 4 FLYWHEEL 10
357123-1-1-0213	XFG848044-357123-1	DS00060D6S-AK0574 (ENHANCED)

For inspection and maintenance please refer to the following pages of the Generator O&M manual:

25-2, 25-3 and 25-4.

SANAQATIIT CONSTRUCTION LTD.

Shop Drawing Transmittal

Project Name:	Potable Water System – Phase I		
Sanaqatiit Project Number:	12-505	**Submittal Number:**	12-505-04
Owner Project Number:	11-4002		
Product Description:	Power Generation Diesel	**Specification Number:**	26 32 14
Total Pages:	21 including cover		
Submitted by:	Sarah Fox		
To:	Warren McLeod	**CC:**	Arlen Foster Walter Orr, Stantec
Via:	Electronic Submission	**Date:**	February 6, 2013

Notes:

Attached pages are related to Diesel Power Generation. When asked, the contractor made the comment that a generator of this small are not made with 24V battery systems, as is requested in the specification.

SANAQATIIT CONSTRUCTION LTD.
SHOP DRAWING REVIEWED
BY
FEB 06 2013
⊗ - REVIEWED
○ - REVIEWED AS NOTED
○ - REVISE AND RESUBMIT

SHOP DRAWINGS ARE REVIEWED UNLESS NOTED OTHERWISE
REVIEWED AS MODIFIED
REVISE & RESUBMIT
SEAL & SIGNATURES REQUIRED
Stantec
DATE Feb 11/2013
SIGNATURE
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SHOP DRAWING REVIEW

Project: Cambridge Bay Potable Water System

Location: Cambridge Bay, NU

General Contractor: Sanaqatiit Construction Ltd.

Engineer: Stantec

Section 26 32 14 Power Generation Diesel

Reviewed by: Darren Fraser

APPROVED
By Darren Fraser at 11:08 am, Feb 01, 2013

SANAQATIIT CONSTRUCTION LTD.
SHOP DRAWING REVIEWED
BY
FEB 01 2013
○ - REVIEWED
○ - REVIEWED AS NOTED
✓ - REVISE AND RESUBMIT

Ryfan Kitikmeot Ltd.
Box 297, Kugluktuk, NU X0E 0E0
Email: dfraser@ryfan.ca

SHOP DRAWINGS ARE REVIEWED UNLESS NOTED OTHERWISE	
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SEAL & SIGNATURES REQUIRED	
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Serial Number:	Part Number:	Part Description:
MX187094	78190	GENERATOR 361/1602 SPECIAL SAE 4 FLYWHEEL 10 12W NAFTA
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357123-1-1-0213	XFG848044-357123-1	DS00060D6S-AK0574 (ENHANCED)

For Inspections and Maintenance please refer to the following pages of the Operation and Maintenance manual: Pages 25-2, 25-3 and 25.4.

DIESEL ENGINE-GENERATOR SET
AIR CHARGE-AIR COOLING

60 kWe / 60 Hz / Standby
208 - 600V

APPROVED
By Darren Fraser at 11:08 am, Feb 01, 2013

(Reference DP51D6S for Prime Rating Technical Data)

mtu onsite energy

SYSTEM RATINGS

Standby	DS60D6SGA	DS60D6SDA	DS60D6SPA	DS60D6SJA	DS60D6SRA	DS60D6SNA
Voltage (L-L)	240V**	240V**	208V**	240V**	480V**	600V**
Phase	1	1	3	3	3	3
PF	1.0	1.0	0.8	0.8	0.8	0.8
Hz	60	60	60	60	60	60
kW	60	60	60	60	60	60
kVA	60	60	75	75	75	75
AMPS	250	250	208	180	90	72
skVA@30% Voltage Dip	119	130	150	150	198	136
Generator Model	362CSL1604	361CSL1613	361CSL1602	361CSL1602	361CSL1602	361PSL1633
Temp Rise	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C
Connection	12 LEAD ZIG-ZAG	4 LEAD	12 LEAD LOW WYE	12 LEAD HI DELTA	12 LEAD HI WYE	4 LEAD WYE

** UL 2200 Offered

CERTIFICATIONS AND STANDARDS

// **Emissions –** EPA Tier 3 Certified

// **Engine-generator set is designed and manufactured in facilities certified to standards ISO 9001:2008 and ISO 14001:2004**

// **Seismic Certification – Optional**
- IBC Certification
- OSHPD Pre-Approval

// **UL 2200 / CSA – Optional**
- UL 2200 Listed
- CSA Certified

// **Performance Assurance Certification (PAC)**
- Engine-Generator Set Tested to ISO 8528-5 for Transient Response
- Verified product design, quality and performance integrity
- All engine systems are prototype and factory tested

// **Power Rating**
- Accepts Rated Load in One Step Per NFPA 110

STANDARD FEATURES*

// MTU Onsite Energy is a single source supplier
// Global Product Support
// 2 Year Standard Warranty
// 5030HF285 Diesel Engine
- 3.0 Liter Displacement
- Electronic Unit Pump Injection
- 4-Cycle

// Engine-generator resilient mounted
// Complete Range of Accessories
// Generator
- Brushless, Rotating Field Generator
- 2/3 Pitch Windings
- 300% Short Circuit Capability with Optional PMG

// Digital Control Panel(s)
- UL Recognized, CSA Certified, NFPA 110
- Complete System Metering
- LCD Display

// Cooling System
- Integral Set-Mounted
- Engine Driven Fan

STANDARD EQUIPMENT*

// Engine

Air Cleaner
Oil Pump
Oil Drain Extension & S/O Valve
Full Flow Oil Filter
Fuel Filter with Water Separator
Jacket Water Pump
Thermostat
Blower Fan & Fan Drive
Radiator - Unit Mounted
Electric Starting Motor - 12V
Governor – Electronic Isochronous
Base - Formed Steel
SAE Flywheel & Bell Housing
Charging Alternator - 12V
Battery Box & Cables
Flexible Fuel Connectors
Flexible Exhaust Connection
EPA Certified Engine

// Generator

NEMA MG1, IEEE and ANSI standards compliance for temperature rise and motor starting
Self-Ventilated and Drip-Proof
Superior Voltage Waveform
Solid State, Volts-per-Hertz Regulator
±1% Voltage Regulation No Load to Full Load
Brushless Alternator with Brushless Pilot Exciter
4 Pole, Rotating Field
130 °C Maximum Standby Temperature Rise
1 Bearing, Sealed
Flexible Coupling
Full Amortisseur Windings
125% Rotor Balancing
3-Phase Voltage Sensing
100% of Rated Load - One Step
3% Maximum Harmonic Content

// Digital Control Panel(s)

Digital Metering
Engine Parameters
Generator Protection Functions
Engine Protection
SAE J1939 Engine ECU Communications
Windows-Based Software
Multilingual Capability
Remote Communications to RDP-110 Remote Annunciator
16 Programmable Contact Inputs
Up to 11 Contact Outputs
UL Recognized, CSA Certified, CE Approved
Event Recording
IP 54 Front Panel Rating with Integrated Gasket
NFPA110 Compatible

* Represents standard product only. Consult Factory/MTU Onsite Energy Distributor for additional configurations.

APPLICATION DATA

// Engine

Manufacturer	John Deere
Model	5030HF285
Type	4-Cycle
Arrangement	5-Inline
Displacement: L (in³)	3.05 (186)
Bore: cm (in)	8.6 (3.4)
Stroke: cm (in)	10.5 (4.1)
Compression Ratio	18.2:1
Rated RPM	1,800
Engine Governor	JDEC
Maximum Power: kWm (bhp)	72 (96)
Speed Regulation	±0.25%
Air Cleaner	Dry

// Liquid Capacity (Lubrication)

Total Oil System: L (gal)	11.2 (2.96)
Engine Jacket Water Capacity: L (gal)	2.9 (0.78)
System Coolant Capacity: L (gal)	15.4 (4.08)

// Electrical

Electric Volts DC	12
Cold Cranking Amps Under -17.8 °C (0 °F)	750

// Fuel System

Fuel Supply Connection Size	3/8" NPT
Fuel Return Connection Size	3/8" NPT
Maximum Fuel Lift: m (ft)	3 (10)
Recommended Fuel	Diesel #2
Total Fuel Flow: L/hr (gal/hr)	82 (21.7)

// Fuel Consumption

	STANDBY
At 100% of Power Rating: L/hr (gal/hr)	18.9 (5)
At 75% of Power Rating: L/hr (gal/hr)	14.4 (3.8)
At 50% of Power Rating: L/hr (gal/hr)	9.5 (2.5)

// Cooling - Radiator System

	STANDBY
Ambient Capacity of Radiator: °C (°F)	50 (122)
Maximum Allowable Static Pressure on Rad. Exhaust: kPa (in. H_2O)	0.12 (0.5)
Water Pump Capacity: L/min (gpm)	100 (26)
Heat Rejection to Coolant: kW (BTUM)	45.5 (2,590)
Heat Rejection to Air to Air: kW (BTUM)	12.7 (723)
Heat Radiated to Ambient: kW (BTUM)	12.8 (728)

// Air Requirements

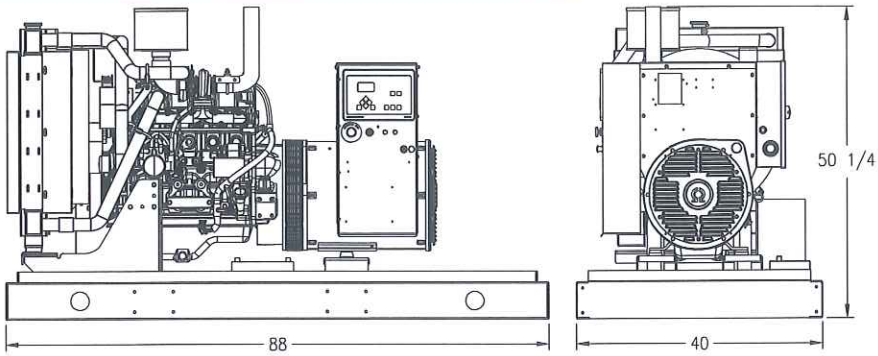
	STANDBY
Aspirating: *m³/min (SCFM)	5.3 (186)
Air Flow Required for Rad. Cooled Unit: *m³/min (SCFM)	158 (5,570)
Remote Cooled Applications; Air Flow Required for Dissipation of Radiated Gen-set Heat for a Max of 25 °F Rise: *m³/min (SCFM)	47 (1,642)

* Air density = 1.184 kg/m³ (0.0739 lbm/ft³)

// Exhaust System

	STANDBY
Gas Temp. (Stack): °C (°F)	522 (972)
Gas Volume at Stack Temp: m³/min (CFM)	13.7 (484)
Maximum Allowable Back Pressure: kPa (in. H_2O)	7.5 (30)
Minimum Allowable Back Pressure: kPa (in. H_2O)	4 (16)

WEIGHTS AND DIMENSIONS



Drawing above for illustration purposes only, based on standard open power 480 volt engine-generator set. Lengths may vary with other voltages. Do not use for installation design. See website for unit specific template drawings.

System	Dimensions (L x W x H)	Weight (dry/less tank)
Open Power Unit (OPU)	2,235 x 1,016 x 1,276 mm (88 x 40 x 50.25 in)	883 kg (1,947 lb)

Weights and dimensions are based on open power units and are estimates only. Consult the factory for accurate weights and dimensions for your specific engine-generator set.

SOUND DATA

Unit Type	Standby Full Load
Level 0: Open Power Unit (dBA)	79.2

Sound data is provided at 7 m (23 ft). Engine-generator set tested in accordance with ISO 8528-10 and with infinite exhaust.

APPROVED
By Darren Fraser at 11:08 am, Feb 01, 2013

EMISSIONS DATA

NO_x + NMHC	CO	PM
3.4	0.8	0.15

All units are in g/hp-hr and are EPA D2 cycle values. Emission levels of the engine may vary as a function of ambient temperature, barometric pressure, humidity, fuel type and quality, installation parameters, measuring instrumentation, etc. The data provided are laboratory results from one engine representing this rating. The data was obtained under controlled environmental conditions with calibrated instrumentation traceable to the United States National Bureau of Standards and in compliance with US EPA regulations found within 40 CFR Part 89. The weighted cycle value from each engine is guaranteed to be below the US EPA Standards at the US EPA defined conditions.

RATING DEFINITIONS AND CONDITIONS

// Standby ratings apply to installations served by a reliable utility source. The standby rating is applicable to varying loads for the duration of a power outage. No overload capability for this rating. Ratings are in accordance with ISO 3046-1, BS 5514, AS 2789, and DIN 6271.

// Deration Factor:
Altitude: Consult your local MTU Onsite Energy Power Generation Distributor for altitude derations.
Temperature: Consult your local MTU Onsite Energy Power Generation Distributor for temperature derations.

© MTU Onsite Energy. Subject to alteration due to technological advances. OE 23 460 (77 3E) 2012-06

Materials and specifications subject to change without notice.
C/F = Consult Factory/MTU Onsite Energy Distributor

// **Tognum Group Companies: Europe / Middle East / Africa** / MTU Onsite Energy / 88040 Friedrichshafen / Germany / Phone + 49 7541 90 7060 / Fax +49 7541 90 7084 / powergenregion1@mtu-online.com // **Asia / Australia / Pacific** / MTU Onsite Energy / 1, Benoi Place / Singapore 629923 / Republic of Singapore / Phone + 65 6861 5922 / Fax + 65 6861 3615 / powergenregion2@mtu-online.com // **USA / Canada / Latin America / Mexico** / MTU Onsite Energy Corporation / 100 Power Drive / Mankato, Minnesota 56001 / USA / Phone + 1 507 625 7973 / Fax + 1 507 625 2968 / powergenregion3@mtu-online.com

Product Data Sheet

JDL36200C

Molded Case Circuit Breaker (J-Frame) 200A, 3-Pole, 600 Vac/250 Vdc, 100% Rated



SQUARE D

by Schneider Electric

List Price $3,276.00 USD

Availability **Non-Stock Item: This item is not normally stocked in our distribution facility.**

APPROVED
By Darren Fraser at 11:08 am, Feb 01, 2013

Technical Characteristics

Adjustable Magnetic Trip	Low: 1000A - High: 2000A
Weight	5 Pounds
Ampere Rating	200A
For Use With	Industrial Enclosures and Switchboards
Frame Type	J-Frame
HACR Rated	Yes
Interrupting Rating	25kA@240VAC - 18kA@480VAC - 14kA@600VAC - 20kA@250VDC
Marketing Trade Name	Powerpact
Circuit Breaker Rating	100% Rated
General Application	Provides overload and short circuit protection
Voltage Rating	600VAC/250VDC
Number of Poles	3-Pole
Approvals	UL Listed - CSA Certified - IEC Rated
Circuit Breaker Type	Standard
Mounting Type	Unit Mount
Terminal Type	Line: Lug - Load: Lug
Wire Size	#3/0 to 350 AWG/kcmil(Al/Cu)
Depth	5.00 Inches
Height	7.52 Inches
Width	4.12 Inches

Shipping and Ordering

Category	01110 -
Discount Schedule	DE2
GTIN	00785901671367
Package Quantity	1
Weight	4.5 lbs.
Availability Code	Non-Stock Item: This item is not normally stocked in our distribution facility.
Returnability	Y
Country of Origin	US

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

Generated: 09/20/2012 12:37:19

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Schneider Electric

Battery Charger

2608

HIGHLIGHTS

- Recharge and extend the life of your battery
- "3-stage" electronic battery charger
- Rainproof, lightweight, silent, and automatic
- Uses less AC current than older chargers



APPROVED

By Darren Fraser at 11:08 am, Feb 01, 2013

DESCRIPTION

The Battery Charger model 2608 is designed to both recharge your battery and extend your battery's life in applications where it is stored for long periods of time. The 2608 is a "3-stage" electronic battery charger. Rainproof, lightweight, silent, and completely automatic, it produces 12 Volts DC at full 6 Amps, while using much less AC current than older chargers. Unlike automotive "trickle" chargers, the 2608 will not boil off the electrolyte in a lead-acid battery when left unattended. When the 2608 is attached to your battery and plugged into a standard 115 volt / 60 Hz AC outlet, the red and green LEDs let you know the unit is recharging and maintaining your battery.

SPECIFICATIONS

Output:

Charging:	12 Volts DC (min) at 6 Amps
Maintaining:	13.30 Volts DC at 0.1 Amps

Input:

Rated AC Voltage:	100-130 VAC, 50/60 Hz
Current Draw:	1.6 Amps at full output

Physical Dimensions:

Height:	3.5 in. (8.9 cm.)
Width:	6.4 in. (16.3 cm.)
Depth:	2.1 in. (5.3 cm.)

ENGINE PREHEATER TANK STYLE



Simple to install and very lightweight, the HOTSTART TPS engine preheater features a built-in thermostat and heats engines up to 12L displacement. Thermosiphon circulation of the coolant delivers heat throughout the entire engine.

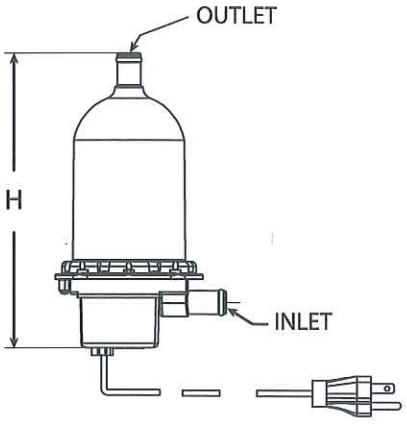
APPLICATION

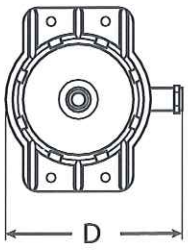
The TPS engine preheater is designed to preheat diesel and gas engines in genset, heavy duty mobile equipment, marine and industrial applications.

APPROVED
By Darren Fraser at 11:08 am, Feb 01, 2013

SPECIFICATIONS

- Heating Fluid: Engine coolant (50% glycol/50% water)
- Power: 0.5, 1, 1.5, 1.8 and 2 kW*
- Rated Voltage: 1 Phase 120 and 240 VAC
- Tank Material: Polyphenylensulfid PPS
- Heating Element: Incoloy 800
- Enclosure: IP41
- Fluid Capacity: 0.11gl (416 cm3)
- Max Pressure: 90PSI (6.2 bar)
- Inlet /Outlet: 0.625" (15.9mm)





* 2kW available at 240V only

Dimensions & Weight			
Height (H)	In (mm)	7.9	(200)
Depth (D)	In (mm)	4.6	(117)
Weight	lbs (g)	1.7	(771)

FEATURES

- UL-C/US listed
- CE compliant
- Various temperature settings available, including adjustable thermostat 90° - 130°F (32° - 54°C)
- Can be delivered with UL marked 120 or 240V NEMA plug or CE marked 240V Schuko plug

HOTSTART® ENGINE HEATING

Small Tank Heaters

TPS Series
Single Phase

500-2000 Watts
120V & 240V

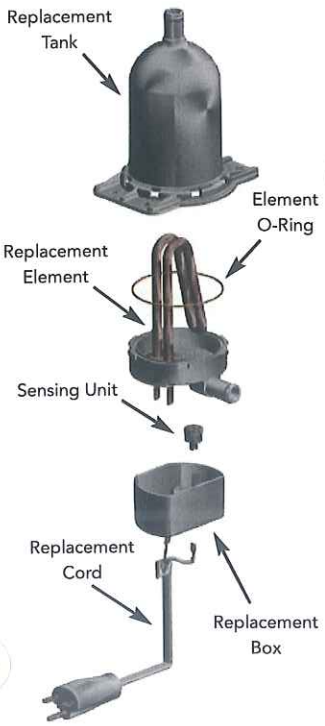


Engine Displacement	Model Number	Volts	Watts	Phase	Amps	Thermostat Range On	Thermostat Range Off
150cid 2.5L	TPS051GT8-000	120	500	1	4.2	80°F (27C)	100°F (38C)
	TPS051GT10-000	120	500	1	4.2	100°F (38C)	120°F (49C)
	TPS051GT12-000	120	500	1	4.2	120°F (49C)	140°F (60C)
	TPS052GT8-000	240	500	1	2.1	80°F (27C)	100°F (38C)
	TPS052GT10-000	240	500	1	2.1	100°F (38C)	120°F (49C)
	TPS052GT12-000	240	500	1	2.1	120°F (49C)	140°F (60C)
350cid 5.7L	TPS101GT8-000	120	1000	1	8.4	80°F (27C)	100°F (38C)
	TPS101GT10-000	120	1000	1	8.4	100°F (38C)	120°F (49C)
	TPS101GT12-000	120	1000	1	8.4	120°F (49C)	140°F (60C)
	TPS102GT8-000	240	1000	1	4.2	80°F (27C)	100°F (38C)
	TPS102GT10-000	240	1000	1	4.2	100°F (38C)	120°F (49C)
	TPS102GT12-000	240	1000	1	4.2	120°F (49C)	140°F (60C)
350 - 500cid 5.7 - 8.2L	TPS151GT8-000	120	1500	1	12.5	80°F (27C)	100°F (38C)
	TPS151GT10-000	120	1500	1	12.5	100°F (38C)	120°F (49C)
	TPS151GT12-000	120	1500	1	12.5	120°F (49C)	140°F (60C)
	TPS152GT8-000	240	1500	1	6.3	80°F (27C)	100°F (38C)
	TPS152GT10-000	240	1500	1	6.3	100°F (38C)	120°F (49C)
	TPS152GT12-000	240	1500	1	6.3	120°F (49C)	140°F (60C)
500 - 700cid 8.2 - 11.5L	TPS181GT8-000	120	1800	1	15	80°F (27C)	100°F (38C)
	TPS181GT10-000	120	1800	1	15	100°F (38C)	120°F (49C)
	TPS181GT12-000	120	1800	1	15	120°F (49C)	140°F (60C)
	TPS202GT8-000	240	2000	1	8.3	80°F (27C)	100°F (38C)
	TPS202GT10-000	240	2000	1	8.3	100°F (38C)	120°F (49C)
	TPS202GT12-000	240	2000	1	8.3	120°F (49C)	140°F (60C)

HOTSTART TPS tank heaters are constructed from a durable, high-impact plastic. Every heater is assembled with a built-in thermostat and 4–foot power cord.

Replacement Parts

For TPS Model heaters



Model Number	Volts	Watts	Replacement Parts: Sensing Unit	Element	Tank	Box	Power Cord	Element O-ring
TPS051GT8-000	120	500	LSU-8	REPS051T8	TPS-T	CPS-1	11P48UU	TPS-BOR
TPS051GT10-000	120	500	LSU-10	REPS051T10	TPS-T	CPS-1	11P48UU	TPS-BOR
TPS051GT12-000	120	500	LSU-12	REPS051T12	TPS-T	CPS-1	11P48UU	TPS-BOR
TPS052GT8-000	240	500	LSU-8	REPS052T8	TPS-T	CPS-1	21P48UU	TPS-BOR
TPS052GT10-000	240	500	LSU-10	REPS052T10	TPS-T	CPS-1	21P48UU	TPS-BOR
TPS052GT12-000	240	500	LSU-12	REPS052T12	TPS-T	CPS-1	21P48UU	TPS-BOR
TPS101GT8-000	120	1000	LSU-8	REPS101T8	TPS-T	CPS-1	11P48UU	TPS-BOR
TPS101GT10-000	120	1000	LSU-10	REPS101T10	TPS-T	CPS-1	11P48UU	TPS-BOR
TPS101GT12-000	120	1000	LSU-12	REPS101T12	TPS-T	CPS-1	11P48UU	TPS-BOR
TPS102GT8-000	240	1000	LSU-8	REPS102T8	TPS-T	CPS-1	21P48UU	TPS-BOR
TPS102GT10-000	240	1000	LSU-10	REPS102T10	TPS-T	CPS-1	21P48UU	TPS-BOR
TPS102GT12-000	240	1000	LSU-12	REPS102T12	TPS-T	CPS-1	21P48UU	TPS-BOR
TPS151GT8-000	120	1500	LSU-8	REPS151T8	TPS-T	CPS-1	11P48UU	TPS-BOR
TPS151GT10-000	120	1500	LSU-10	REPS151T10	TPS-T	CPS-1	11P48UU	TPS-BOR
TPS151GT12-000	120	1500	LSU-12	REPS151T12	TPS-T	CPS-1	11P48UU	TPS-BOR
TPS152GT8-000	240	1500	LSU-8	REPS152T8	TPS-T	CPS-1	21P48UU	TPS-BOR
TPS152GT10-000	240	1500	LSU-10	REPS152T10	TPS-T	CPS-1	21P48UU	TPS-BOR
TPS152GT12-000	240	1500	LSU-12	REPS152T12	TPS-T	CPS-1	21P48UU	TPS-BOR
TPS181GT8-000	120	1800	LSU-8	REPS181T8	TPS-T	CPS-1	12P16H48UU	TPS-BOR
TPS181GT10-000	120	1800	LSU-10	REPS181T10	TPS-T	CPS-1	12P16H48UU	TPS-BOR
TPS181GT12-000	120	1800	LSU-12	REPS181T12	TPS-T	CPS-1	12P16H48UU	TPS-BOR
TPS202GT8-000	240	2000	LSU-8	REPS202T8	TPS-T	CPS-1	21P48UU	TPS-BOR
TPS202GT10-000	240	2000	LSU-10	REPS202T10	TPS-T	CPS-1	21P48UU	TPS-BOR
TPS202GT12-000	240	2000	LSU-12	REPS202T12	TPS-T	CPS-1	21P48UU	TPS-BOR

Small Tank Heaters

TPS Series w/in-line adjustable and remote thread-in fixed thermostat
Single Phase

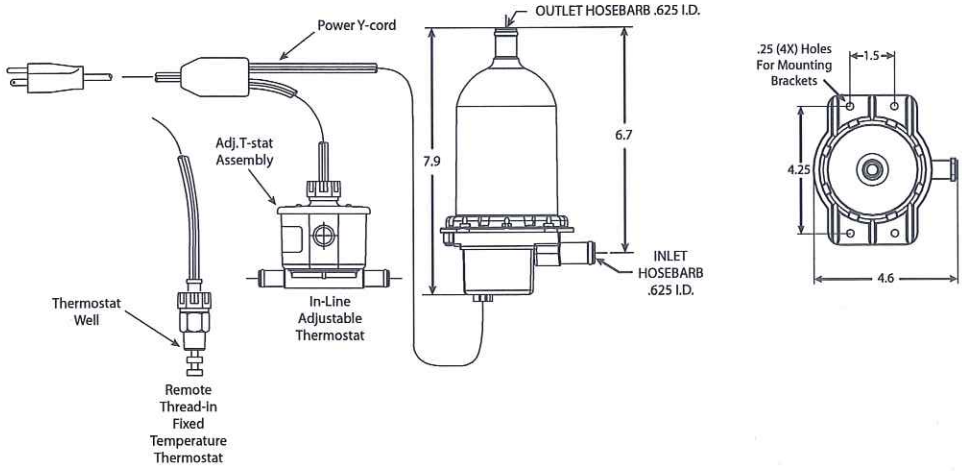
500-2000 Watts
120V & 240V

Engine Displacement	Model Number	Volts	Watts	Phase	Amps	Thermostat Range On	Thermostat Range Off
150cid 2.5L	TPS051GT12-001*	120	500	1	4.2	100°F (38C)	120°F (49C)
	TPS051GT12-A00	120	500	1	4.2	ADJUSTABLE	
	TPS052GT12-001*	240	500	1	2.1	100°F (38C)	120°F (49C)
	TPS052GT12-A00	240	500	1	2.1	ADJUSTABLE	
350cid 5.7L	TPS101GT12-001*	120	1000	1	8.4	100°F (38C)	120°F (49C)
	TPS101GT12-A00	120	1000	1	8.4	ADJUSTABLE	
	TPS102GT12-001*	240	1000	1	4.2	100°F (38C)	120°F (49C)
	TPS102GT12-A00	240	1000	1	4.2	ADJUSTABLE	
350 - 500cid 5.7 - 8.2L	TPS151GT12-001*	120	1500	1	12.5	100°F (38C)	120°F (49C)
	TPS151GT12-A00	120	1500	1	12.5	ADJUSTABLE	
	TPS152GT12-001*	240	1500	1	6.3	100°F (38C)	120°F (49C)
	TPS152GT12-A00	240	1500	1	6.3	ADJUSTABLE	
500 - 700cid 8.2 - 11.5L	TPS181GT12-001*	120	1800	1	15	100°F (38C)	120°F (49C)
	TPS181GT12-A00	120	1800	1	15	ADJUSTABLE	
	TPS202GT12-001*	240	2000	1	8.3	100°F (38C)	120°F (49C)
	TPS202GT12-A00	240	2000	1	8.3	ADJUSTABLE	

* Remote thread-in fixed temperature thermostat

ADJUSTABLE 90-130°F (32-54°C)
On differential – 20°F (-7°C)

In-line thermostat options:



Replacement Parts

For TPS Model heaters w/in-line adjustable and remote thread-in fixed thermostat
Single Phase

Model Number	Volts	Watts	Replacement Parts: Sensing Unit	Element	Power Y-cord	Thermostat Well
TPS051GT12-001*	120	500	LSU-10	REPS051T12	TPS-YC1	TW2374-1
TPS051GT12-A00	120	500	RSU90-130	REPS051T12	#	#
TPS052GT12-001*	240	500	LSU-10	REPS052T12	TPS-YC2	TW2374-1
TPS052GT12-A00	240	500	RSU90-130	REPS052T12	#	#
TPS101GT12-001*	120	1000	LSU-10	REPS101T12	TPS-YC1	TW2374-1
TPS101GT12-A00	120	1000	RSU90-130	REPS101T12	#	#
TPS102GT12-001*	240	1000	LSU-10	REPS102T12	TPS-YC2	TW2374-1
TPS102GT12-A00	240	1000	RSU90-130	REPS102T12	#	#
TPS151GT12-001*	120	1500	LSU-10	REPS151T12	TPS-YC1	TW2374-1
TPS151GT12-A00	120	1500	RSU90-130	REPS151T12	#	#
TPS152GT12-001*	240	1500	LSU-10	REPS152T12	TPS-YC2	TW2374-1
TPS152GT12-A00	240	1500	RSU90-130	REPS152T12	#	#
TPS181GT12-001*	120	1800	LSU-10	REPS181T12	12P16H54S54X10UU	TW2374-1
TPS181GT12-A00	120	1800	RSU90-130	REPS181T12	#	#
TPS202GT12-001*	240	2000	LSU-10	REPS202T12	TPS-YC2	TW2374-1
TPS202GT12-A00	240	2000	RSU90-130	REPS202T12	#	#

* Remote thread-in fixed temperature thermostat

Call Factory

Common replacement parts for all TPS Model heaters:
— Tank
— Box
— Element O-ring

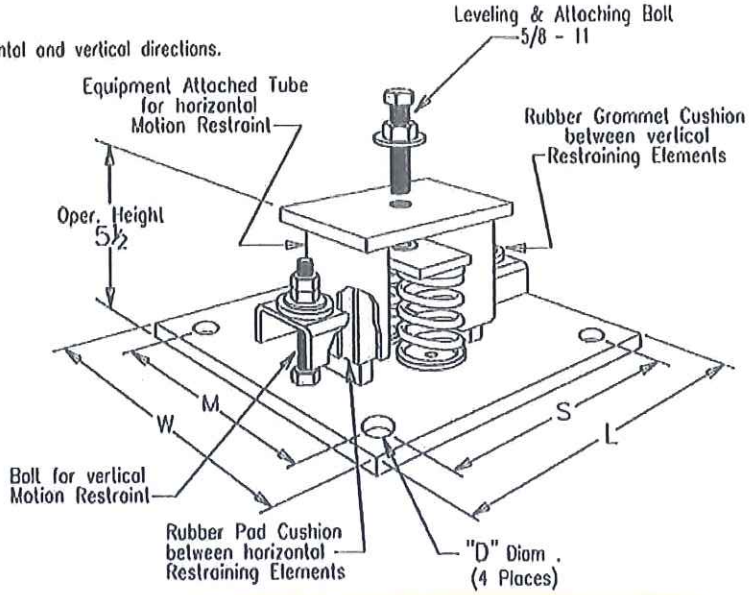
See previous page

RESTRAINT PERFORMANCE

Equipment motion is limited in all horizontal and vertical directions.

PROTECTION FOR

- Earthquakes
- Windloads
- Marine installations
- Mobile installations
- Equipment weight change due to drainage
- Unstable installations due to high equipment center of gravity



RESTRAINT CHARACTERISTICS	
Ratings	(Lbs)
Up restraint	5856
End restraint	5600
Side restraint	3666

Restraint ratings determined by independent laboratory test.

VIBRATION ISOLATION CHARACTERISTICS			
Type	Max. Load (lbs)	Max. Defl. (in)	Spring Rate (lbs/in)
RJSD	42K	1.13	36
RJSD	110K	1.13	98
RJSD	158K	1.13	140
RJSD	212K	1.13	188
RJSD	240K	2.30	104
RJSD	310K	2.00	155
RJSD	402K	1.70	236
RJSD	488K	1.13	432
RJSD	592K	1.60	370
RJSD	636K	1.13	562
RJSD	790K	1.80	440
RJSD	1022K	1.50	682
RJSD	1430K	1.30	1100
RJSD	1602K	1.00	1602
RJSD	2120K	1.00	2120
RJSD	3040K	.78	3900
RJSD	3920K	.78	5030

7854 10 8½ 6 4½ 5/8

BASE PLATE DESIGNATION	DIMENSION (inches)				
	L	S	W	M	D
7855	10	8½	7½	6	5/8
7856	10	8½	9	7½	¾
7857	12	10	10½	9	⅞
BASE PLATE DESIGNATION MUST BE INCLUDED IN CALLOUT					

TYPICAL CALLOUTS

RJSD 1022K 7855
(Minimum base size for use with 1/2 inch anchors).

RJSD 3040K 7857
(Maximum base size to accomodate 3/4 inch anchors).

This rugged spring isolator provides excellent vibration protection for medium & high speed machines installed on grade. Earthquake protection is also provided by means of cushioned, rugged, motion restraining elements manufactured with ideal clearances for maximum vibration isolation efficiency and earthquake protection.

APPROVED
By Darren Fraser at 11:08 am, Feb 01, 2013

CALDYN
CALIFORNIA DYNAMICS CORP.
5572 ALHAMBRA AVENUE,
LOS ANGELES, CA 90032
PH (323) 223 3882 FX (323) 223 7581
"CALL US - TO SET THINGS RIGHT"
Assoc Member VISCMA

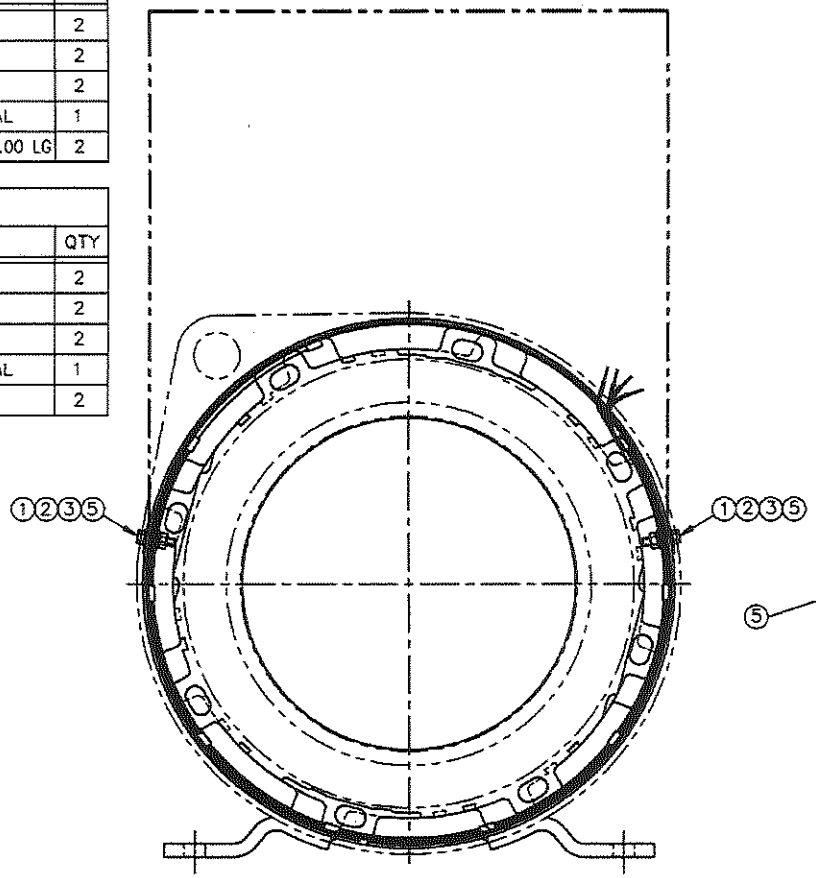
JOB:	DWG No.		TYPE RJSD ISOLATOR/ RESTRAINT PERFORMANCE RATED
CUST:	PREP BY:	Date:	
TAG:	CHKD:	Date:	
SHEET OF REV.			REV 0

779658-0A

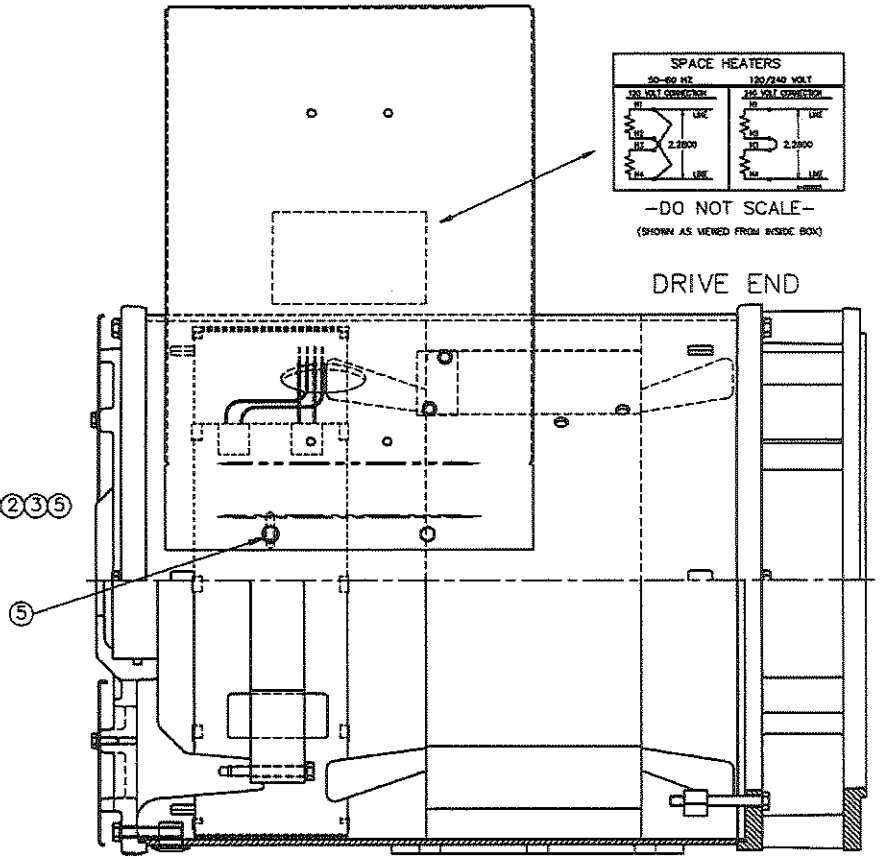
) MAGNAPLUS SHOWN

360 PLS		
ITEM	DESCRIPTION	QTY
1	FLAT WASHER 1/4	2
2	SPLIT LOCKWASHER 1/4	2
3	HEX NUT 1/4-20	2
4	SPACE HEATER CONNECTION DECAL	1
5	HEX HD WHIZLOCK SCREW 1/4-20 x 1.00 LG	2

280JV PLS		
ITEM	DESCRIPTION	QTY
1	FLAT WASHER 6MM	2
2	SPLIT LOCKWASHER 6MM	2
3	HEX NUT M6 X 1	2
4	SPACE HEATER CONNECTION DECAL	1
5	HEX HD FLG LOCK M6 X 1 X 20 LG	2



OPPOSITE DRIVE END (O.D.E.)
(BRACKET & EXCITER REMOVED)



-DO NOT SCALE-
(SHOWN AS VIEWED FROM INSIDE BOX)

DRIVE END

APPROVED
By Darren Fraser at 11:09 am, Feb 01, 2013

ASSEMBLY INSTRUCTIONS:

1- REMOVE O.D.E. BRACKET WITH EXCITER STATOR.

2- SLIDE SPACE HEATER INSIDE OF FRAME SUCH THAT SPACE HEATER LEADS ARE NEXT TO THE FRAME LEAD EXIT HOLE. REMOVE THE (2) O.D.E. CONDUIT BOX MTG SCREWS. FASTEN HEATER INSIDE FRAME USING A SCREW, FLAT WASHER, LOCKWASHER AND HEX NUT (2 PL).

3- ROUTE SPACE HEATER LEADS THRU LEAD EXIT HOLE.

4- INSTALL O.D.E. BRACKET WITH EXCITER STATOR.

5- AFFIX SPACE HEATER CONNECTION DECAL (A-510663) INSIDE BOX.

6- STAMP SPACE HEATER PLATE (A-94326) PER SALES ORDER & SECURE TO FRAME PER NAMEPLATE ASSY 778692-0A.

NO.	REVISION	BY & DATE	CHK
3	ADDED 280JV PLS OPTION GM81293	MRB 01/07/2004	
2	ITEM 1, 2, 3 WERE 6MM; ADDED ITEM 5 CN 9898	TM 01-10-2003	
1	NEW DRAWING CN 9413	TM 12-21-2000	

TOLERANCES UNLESS SPECIFIED: DEC. .X ± -, .XX ± -, .XXX ± -, .XXXX ± -, ANG ± -; INCHES

REGAL-BELOIT Motor Technologies Group

TITLE SPACE HEATER ASSEMBLY
360PLS / 280JV PLS (115/230V)

MATL
FINISH

DRAWN TM 12-21-2000
CHK ML 12-21-2000
APPD GK 12-21-2000
SCALE 1=4
REF 779649-0A
FMF
PREV

RFP
CAD FILE 7796580a
DIST LM

SIZE B | DRAWING NO. 779658-0A | PAGE OF | REV. 3

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THIS IS AN ELECTRONICALLY GENERATED DOCUMENT - DO NOT SCALE THIS PRINT

APPROVED
By Darren Fraser at 11:09 am, Feb 01, 2013

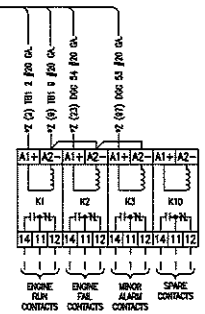
LEGEND:

AEM	ANALOG EXPANSION MODULE
BPS	BACK PLATE STUD
CEM	CONTACT EXPANSION MODULE
DGC	DGC-2020 MICROPROCESSOR
DGS	DOOR GROUND STUD
K1	ENGINE RUN RELAY
K2	ENGINE FAIL RELAY
K3	MINOR ALARM RELAY
K10	SPARE RELAY
K9	LOUVER MOTOR RELAY
MCC	MODBUS/ETHERNET CONVERTER
R1	RESISTOR 120 OHM ¼ W
TB1	TERMINAL BLOCK 1

TO: PANEL FRONT

TO: GENERATOR

TO: ENGINE



*2 (888) DGC #14 GA

TB2

BPS

STANDARD DRAWING OPTIONS

AC ACCESSORIES:	☐ LOUVER MOTORS
RTD:	☐ WIRED TO AEM
BREAKER OPTIONS:	☐ AUXILIARY SWITCH ☐ BELL ALARM TO TB2 ☐ SHUNT TRIP
DC ACCESSORIES:	☐ DC HOUSING LIGHTS ☒ FOUR RELAY OPTION ☐ MODBUS
MODULES	☐ CONTACT EXPANSION MODULE ☐ ANNALOG EXPANSION MODULE

NOTES:
1. WIRE NUMBERS ARE IN PARENTHESIS.
2. SHORT DASHED LINES (- - - -) INDICATE CUSTOMER CONNECTION OR OPTIONAL EQUIPMENT.

*X (X) XXX X	
*X	DESTINATION
(X)	WIRE NUMBER
XXX	DESTINATION
X	DESTINATION TERMINAL

REV	REVISION DESCRIPTION	DATE	BY

onsite energy

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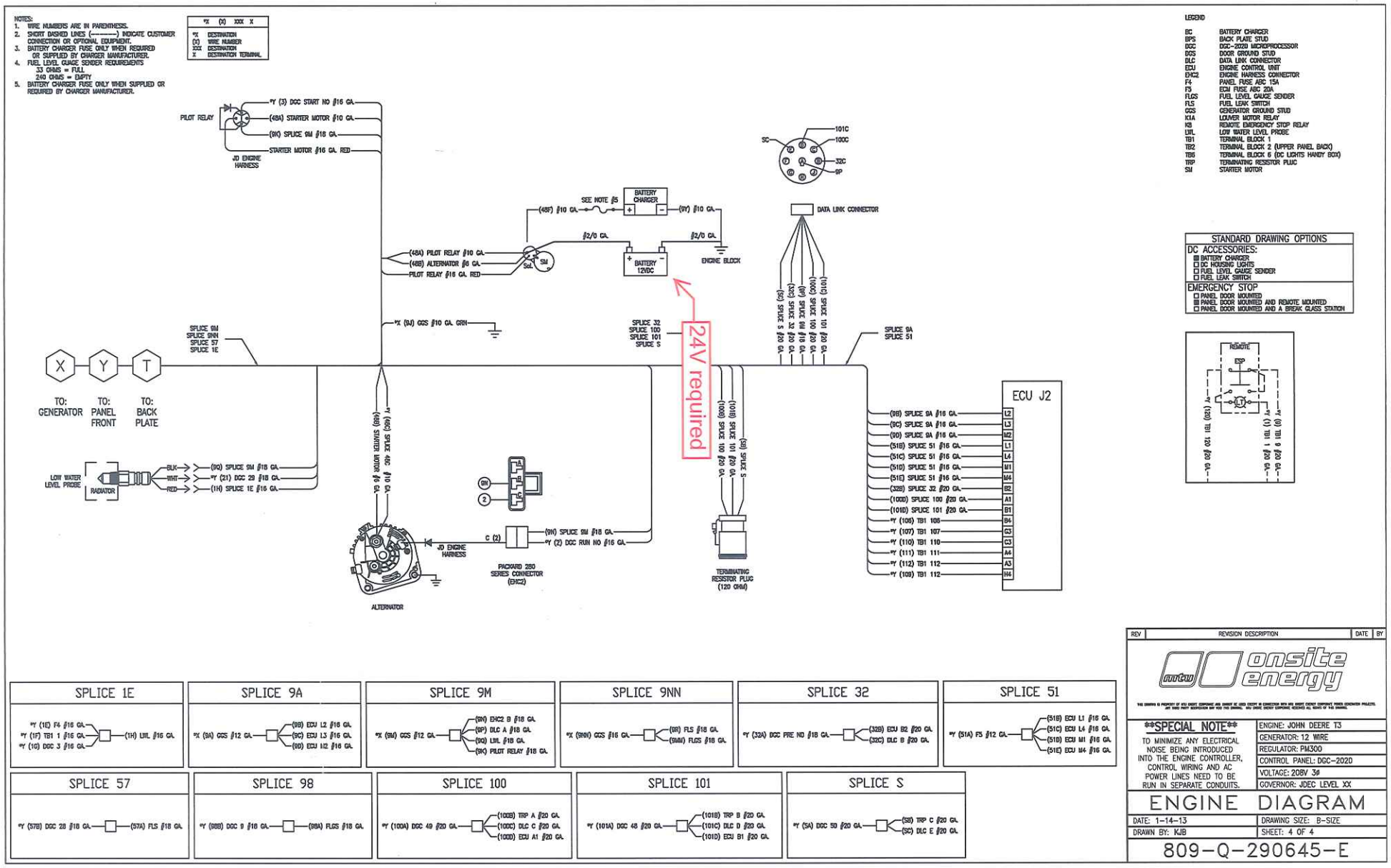
****SPECIAL NOTE****
TO MINIMIZE ANY ELECTRICAL NOISE BEING INTRODUCED INTO THE ENGINE CONTROLLER, CONTROL WIRING AND AC POWER LINES NEED TO BE RUN IN SEPARATE CONDUITS.

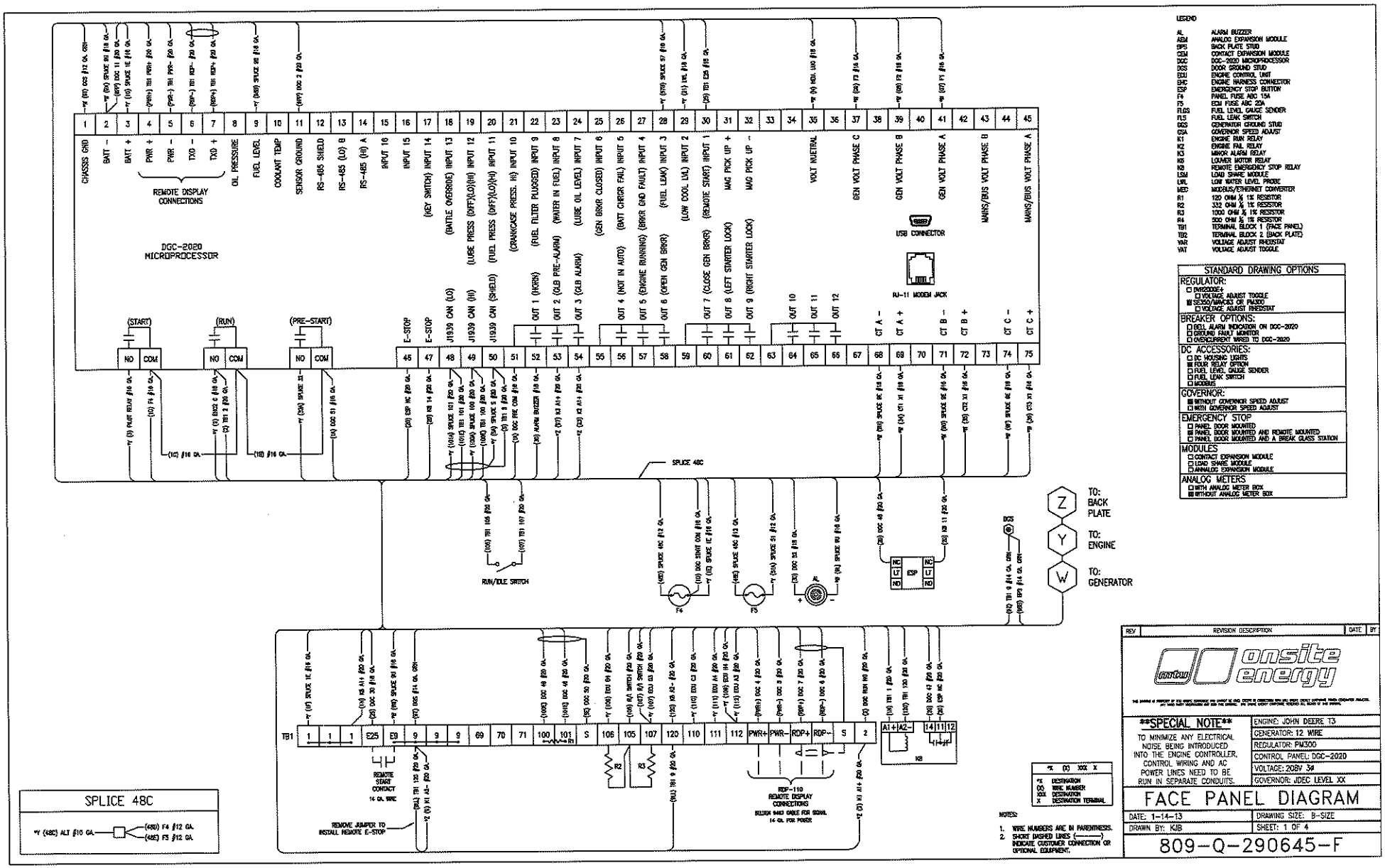
ENGINE: JOHN DEERE T3
GENERATOR: 12 WIRE
REGULATOR: PM300
CONTROL PANEL: DGC-2020
VOLTAGE: 208V 3Ø
GOgovernor: JDEC LEVEL XX

BACK PLATE DIAGRAM

DATE: 1-14-13	DRAWING SIZE: B-SIZE
DRAWN BY: KJB	SHEET: 2 OF 4

809-Q-290645-B


NOTES:
1. WIRE NUMBERS ARE IN PARENTHESES.
2. SHORT DASHED LINES (- - - - - -) INDICATE CUSTOMER CONNECTION OR OPTIONAL EQUIPMENT.
3. BATTERY CHARGER FUSE ONLY WHEN REQUIRED OR SUPPLIED BY CHARGER MANUFACTURER.
4. FUEL LEVEL GAUGE SENDER REQUIREMENTS
33 OHMS = FULL
240 OHMS = EMPTY
5. BATTERY CHARGER FUSE ONLY WHEN SUPPLIED OR REQUIRED BY CHARGER MANUFACTURER.
*X (X) XXX X
*X DESTINATION
(X) WIRE NUMBER
XXX DESTINATION
X DESTINATION TERMINAL
LEGEND
BC BATTERY CHARGER
BPS BACK PLATE STUD
DGC DGC-2020 MICROPROCESSOR
DGS DOOR GROUND STUD
DLC DATA LINK CONNECTOR
ECU ENGINE CONTROL UNIT
ENC2 ENGINE HARNESS CONNECTOR
F4 PANEL FUSE ABC 15A
F5 ECM FUSE ABC 20A
FLGS FUEL LEVEL GAUGE SENDER
FLS FUEL LEAK SWITCH
GGS GENERATOR GROUND STUD
K1A LOUVER MOTOR RELAY
K9 REMOTE EMERGENCY STOP RELAY
LWL LOW WATER LEVEL PROBE
TB1 TERMINAL BLOCK 1
TB2 TERMINAL BLOCK 2 (UPPER PANEL BACK)
TB6 TERMINAL BLOCK 6 (DC LIGHTS HANDY BOX)
TRP TERMINATING RESISTOR PLUG
SM STARTER MOTOR
STANDARD DRAWING OPTIONS
DC ACCESSORIES:
BATTERY CHARGER
DC HOUSING LIGHTS
FUEL LEVEL GAUGE SENDER
FUEL LEAK SWITCH
EMERGENCY STOP
PANEL DOOR MOUNTED
PANEL DOOR MOUNTED AND REMOTE MOUNTED
PANEL DOOR MOUNTED AND A BREAK GLASS STATION
REMOTE
ESP
PILOT RELAY
*Y (3) DGC START NO #16 GA.
(48A) STARTER MOTOR #10 GA.
(9K) SPLICE 9M #18 GA.
STARTER MOTOR #16 GA. RED
JD ENGINE HARNESS
SEE NOTE #5
BATTERY CHARGER
(48F) #10 GA.
(9Y) #10 GA.
#2/0 GA.
(48A) PILOT RELAY #10 GA.
(48B) ALTERNATOR #6 GA.
PILOT RELAY #16 GA. RED
SOL
SM
BATTERY 12VDC
ENGINE BLOCK
SC
101C
100C
32C
9P
DATA LINK CONNECTOR
(SC) SPLICE S #20 GA.
(32C) SPLICE 32 #20 GA.
(9P) SPLICE 9M #16 GA.
(100C) SPLICE 100 #20 GA.
(101C) SPLICE 101 #20 GA.
SPLICE 9M
SPLICE 9NN
SPLICE 57
SPLICE 1E
*X (9J) GGS #10 GA. GRN
SPLICE 32
SPLICE 100
SPLICE 101
SPLICE S
24V required
SPLICE 9A
SPLICE 51
X
Y
T
TO: GENERATOR
TO: PANEL FRONT
TO: BACK PLATE
LOW WATER LEVEL PROBE
RADIATOR
BLK
WHT
RED
(9Q) SPLICE 9M #18 GA.
*Y (21) DGC 29 #18 GA.
(1H) SPLICE 1E #16 GA.
*Y (48C) SPLICE 48C #10 GA.
STARTER MOTOR #6 GA.
(9N)
(2)
C (2)
(9N) SPLICE 9M #18 GA.
*Y (2) DGC RUN NO #16 GA.
JD ENGINE HARNESS
PACKARD 280 SERIES CONNECTOR (ENC2)
ALTERNATOR
(100B) SPLICE 100 #20 GA.
(101B) SPLICE 101 #20 GA.
(S9) SPLICE S
TERMINATING RESISTOR PLUG (120 OHM)
ECU J2
(9B) SPLICE 9A #16 GA. J3
(9C) SPLICE 9A #16 GA. J3
(9D) SPLICE 9A #16 GA. M2
(51B) SPLICE 51 #16 GA. L1
(51C) SPLICE 51 #16 GA. L4
(51D) SPLICE 51 #16 GA. M1
(51E) SPLICE 51 #16 GA. M4
(32B) SPLICE 32 #20 GA. B2
(100B) SPLICE 100 #20 GA. A1
(101B) SPLICE 101 #20 GA. B1
*Y (105) TB1 105 B4
*Y (107) TB1 107 C3
*Y (110) TB1 110 C1
*Y (111) TB1 111 A4
*Y (112) TB1 112 A3
*Y (109) TB1 112 M4
*Y (120) TB1 120 #20 GA.
*Y (1) TB1 1 #20 GA.
*Y (9) TB1 9 #20 GA.
SPLICE 1E
*Y (1E) F4 #16 GA.
*Y (1F) TB1 1 #16 GA.
*Y (1G) DGC 3 #16 GA.
(1H) LWL #16 GA.
SPLICE 9A
*X (9A) GGS #12 GA.
(9B) ECU L2 #16 GA.
(9C) ECU L3 #16 GA.
(9D) ECU M2 #16 GA.
SPLICE 9M
*X (9M) GGS #12 GA.
(9N) ENC2 B #18 GA.
(9P) DLC A #18 GA.
(9Q) LWL #18 GA.
(9K) PILOT RELAY #18 GA.
SPLICE 9NN
*X (9NN) GGS #16 GA.
(9R) FLS #18 GA.
(9MM) FLGS #18 GA.
SPLICE 32
*Y (32A) DGC PRE NO #18 GA.
(32B) ECU B2 #20 GA.
(32C) DLC B #20 GA.
SPLICE 51
*Y (51A) F5 #12 GA.
(51B) ECU L1 #16 GA.
(51C) ECU L4 #16 GA.
(51D) ECU M1 #16 GA.
(51E) ECU M4 #16 GA.
SPLICE 57
*Y (57B) DGC 28 #18 GA.
(57A) FLS #18 GA.
SPLICE 98
*Y (98B) DGC 9 #18 GA.
(98A) FLGS #18 GA.
SPLICE 100
*Y (100A) DGC 49 #20 GA.
(100B) TRP A #20 GA.
(100C) DLC C #20 GA.
(100D) ECU A1 #20 GA.
SPLICE 101
*Y (101A) DGC 48 #20 GA.
(101B) TRP B #20 GA.
(101C) DLC D #20 GA.
(101D) ECU B1 #20 GA.
SPLICE S
*Y (SA) DGC 50 #20 GA.
(SB) TRP C #20 GA.
(SC) DLC E #20 GA.
REV
REVISION DESCRIPTION
DATE
BY
onsite energy
SPECIAL NOTE
TO MINIMIZE ANY ELECTRICAL NOISE BEING INTRODUCED INTO THE ENGINE CONTROLLER, CONTROL WIRING AND AC POWER LINES NEED TO BE RUN IN SEPARATE CONDUITS.
ENGINE: JOHN DEERE T3
GENERATOR: 12 WIRE
REGULATOR: PM300
CONTROL PANEL: DGC-2020
VOLTAGE: 208V 3#
GOVERNOR: JDEC LEVEL XX
ENGINE DIAGRAM
DATE: 1-14-13
DRAWING SIZE: B-SIZE
DRAWN BY: KJB
SHEET: 4 OF 4
809-Q-290645-E



LEGEND

AL	ALARM BUZZER
AEM	ANALOG EXPANSION MODULE
BPS	BACK PLATE STUD
CEM	CONTACT EXPANSION MODULE
DGC	DGC-2020 MICROPROCESSOR
DGS	DOOR GROUND STUD
ECU	ENGINE CONTROL UNIT
EHC	ENGINE HARNESS CONNECTOR
ESP	EMERGENCY STOP BUTTON
F*	PANEL FUSE ABC 15A
F3	ECM FUSE ABC 20A
FLGS	FUEL LEVEL GAUGE SENDER
FLS	FUEL LEAK SWITCH
GGS	GENERATOR GROUND STUD
GSA	GOVERNOR SPEED ADJUST
K1	ENGINE RUN RELAY
K2	ENGINE FAIL RELAY
K3	MINOR ALARM RELAY
K6	LOUVER MOTOR RELAY
K8	REMOTE EMERGENCY STOP RELAY
LSM	LOAD SHARE MODULE
LWL	LOW WATER LEVEL PROBE
MBE	MODBUS/ETHERNET CONVERTER
R1	100 OHM ¼ 1% RESISTOR
R2	332 OHM ¼ 1% RESISTOR
R3	1000 OHM ¼ 1% RESISTOR
R4	200 OHM ¼ 1% RESISTOR
TB1	TERMINAL BLOCK 1 (FACE PANEL)
TB2	TERMINAL BLOCK 2 (BACK PLATE)
VAR	VOLTAGE ADJUST RHEOSTAT
VAT	VOLTAGE ADJUST TOGGLE

STANDARD DRAWING OPTIONS
REGULATOR: ☐ PM2000E+; ☐ VOLTAGE ADJUST TOGGLE; ☒ SE350/MARK3S OR PM300; ☐ VOLTAGE ADJUST RHEOSTAT
BREAKER OPTIONS: ☐ BG1 ALARM INDICATION ON DGC-2020; ☐ GROUND FAULT MONITOR; ☐ OVERCURRENT WIRED TO DGC-2020
DC ACCESSORIES: ☐ DC HOUSING LIGHTS; ☒ FOUR RELAY OPTION; ☐ FUEL LEVEL GAUGE SENDER; ☐ FUEL LEAK SWITCH; ☐ MODBUS
GOVERNOR: ☒ WITHOUT GOVERNOR SPEED ADJUST; ☐ WITH GOVERNOR SPEED ADJUST
EMERGENCY STOP: ☐ PANEL DOOR MOUNTED; ☒ PANEL DOOR MOUNTED AND REMOTE MOUNTED; ☐ PANEL DOOR MOUNTED AND A BREAK GLASS STATION
MODULES: ☐ CONTACT EXPANSION MODULE; ☐ LOAD SHARE MODULE; ☐ ANNALOG EXPANSION MODULE
ANALOG METERS: ☐ WITH ANALOG METER BOX; ☒ WITHOUT ANALOG METER BOX

SPLICE 48C

*Y (48C) ALT #16 GA. — (480) F4 #12 GA. / (485) F5 #12 GA.

*% (00) XXX X
% = DESTINATION WIRE NUMBER
(00) = DESTINATION
X = DESTINATION TERMINAL

NOTES:
1. WIRE NUMBERS ARE IN PARENTHESIS.
2. SHORT DASHED LINES ( ) INDICATE CUSTOMER CONNECTION OR OPTIONAL EQUIPMENT.

REV	REVISION DESCRIPTION	DATE	BY

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SPECIAL NOTE

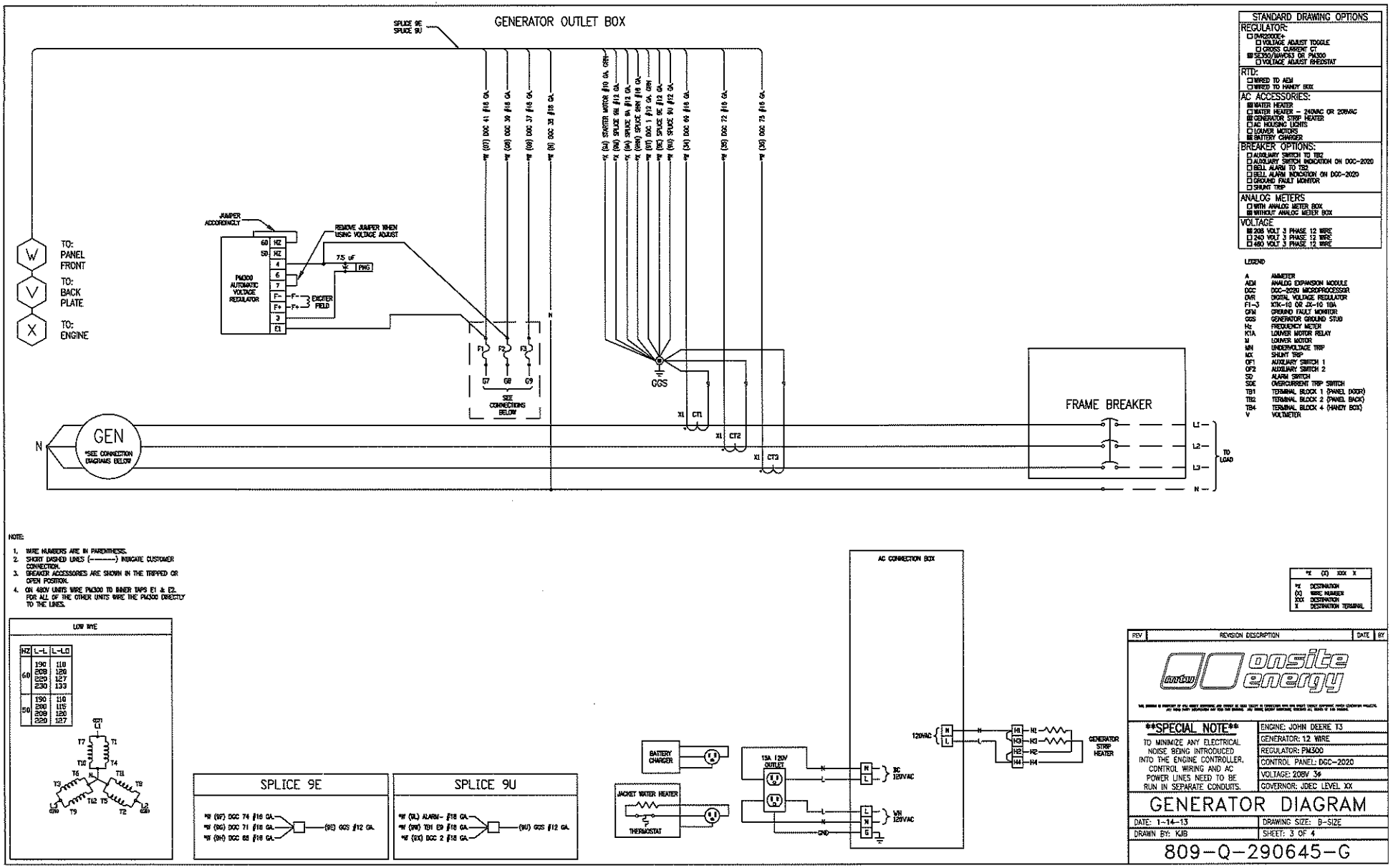
TO MINIMIZE ANY ELECTRICAL NOISE BEING INTRODUCED INTO THE ENGINE CONTROLLER, CONTROL WIRING AND AC POWER LINES NEED TO BE RUN IN SEPARATE CONDUITS.

ENGINE:	JOHN DEERE T3
GENERATOR:	12 WIRE
REGULATOR:	PM300
CONTROL PANEL:	DGC-2020
VOLTAGE:	208V 3ø
GOVERNOR:	JDEC LEVEL XX

FACE PANEL DIAGRAM

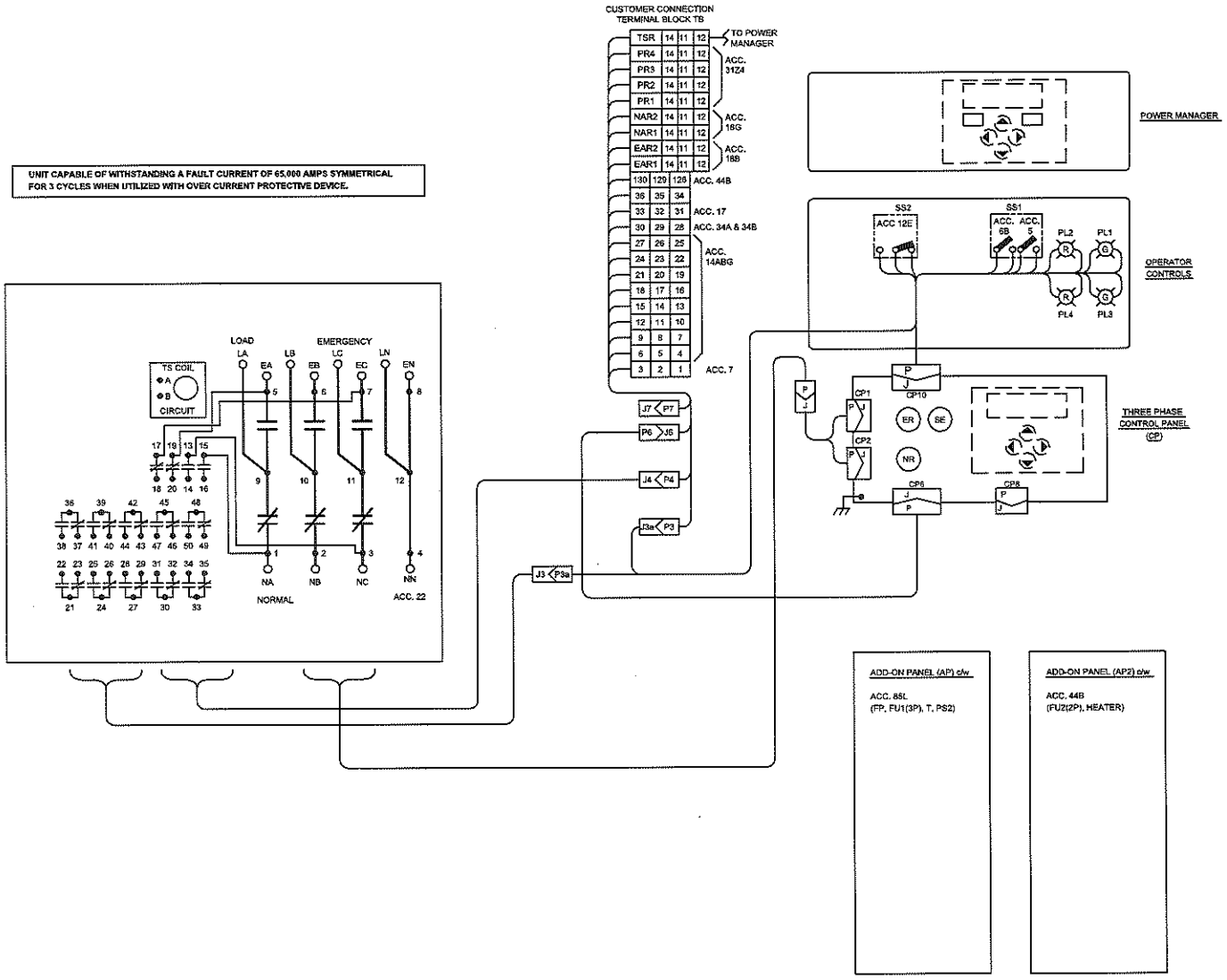
DATE: 1-14-13	DRAWING SIZE: B-SIZE
DRAWN BY: KJB	SHEET: 1 OF 4

809-Q-290645-F


GENERATOR OUTLET BOX
SPLICE 9E
SPLICE 9U
TO: PANEL FRONT
TO: BACK PLATE
TO: ENGINE
JUMPER ACCORDINGLY
REMOVE JUMPER WHEN USING VOLTAGE ADJUST
PM300 AUTOMATIC VOLTAGE REGULATOR
7.5 uF
EXCITER FIELD
F1
F2
F3
G7
G8
G9
SEE CONNECTIONS BELOW
GGS
CT1
CT2
CT3
GEN
*SEE CONNECTION DIAGRAMS BELOW
FRAME BREAKER
L1
L2
L3
N
TO LOAD
STANDARD DRAWING OPTIONS
REGULATOR:
DVR2000E+
VOLTAGE ADJUST TOGGLE
CROSS CURRENT CT
SE350/MAC04 OR PM300
VOLTAGE ADJUST RHEOSTAT
RTD:
WIRED TO AEM
WIRED TO HANDY BOX
AC ACCESSORIES:
WATER HEATER
WATER HEATER - 240VAC OR 208VAC
GENERATOR STRIP HEATER
AC HOUSING LIGHTS
LOUVER MOTORS
BATTERY CHARGER
BREAKER OPTIONS:
AUXILIARY SWITCH TO TB2
AUXILIARY SWITCH INDICATION ON DGC-2020
BELL ALARM TO TB2
BELL ALARM INDICATION ON DGC-2020
GROUND FAULT MONITOR
SHUNT TRIP
ANALOG METERS
WITH ANALOG METER BOX
WITHOUT ANALOG METER BOX
VOLTAGE
208 VOLT 3 PHASE 12 WIRE
240 VOLT 3 PHASE 12 WIRE
480 VOLT 3 PHASE 12 WIRE
LEGEND
A AMMETER
AEM ANALOG EXPANSION MODULE
DGC DGC-2020 MICROPROCESSOR
DVR DIGITAL VOLTAGE REGULATOR
F1-3 10K-10 OR 2K-10 10A
GFM GROUND FAULT MONITOR
GGS GENERATOR GROUND STUD
Hz FREQUENCY METER
K1A LOUVER MOTOR RELAY
M LOUVER MOTOR
MN UNDERVOLTAGE TRIP
MX SHUNT TRIP
OP1 AUXILIARY SWITCH 1
OP2 AUXILIARY SWITCH 2
SD ALARM SWITCH
SOE OVERCURRENT TRIP SWITCH
TB1 TERMINAL BLOCK 1 (PANEL DOOR)
TB2 TERMINAL BLOCK 2 (PANEL BACK)
TB4 TERMINAL BLOCK 4 (HANDY BOX)
V VOLTMETER
*# (X) XXX X
*# DESTINATION
(X) WIRE NUMBER
XXX DESTINATION
X DESTINATION TERMINAL
NOTE:
1. WIRE NUMBERS ARE IN PARENTHESIS.
2. SHORT DASHED LINES (- - - - -) INDICATE CUSTOMER CONNECTION.
3. BREAKER ACCESSORIES ARE SHOWN IN THE TRIPPED OR OPEN POSITION.
4. ON 480V UNITS WIRE PM300 TO INNER TAPS E1 & E2. FOR ALL OF THE OTHER UNITS WIRE THE PM300 DIRECTLY TO THE LINES.
LOW WYE
HZ L-L L-LG
60 190 110
208 120
220 127
230 133
50 190 110
200 115
208 120
220 127
SPLICE 9E
SPLICE 9U
BATTERY CHARGER
JACKET WATER HEATER
THERMOSTAT
15A 120V OUTLET
AC CONNECTION BOX
120VAC
GENERATOR STRIP HEATER
REV REVISION DESCRIPTION DATE BY
onsite energy
SPECIAL NOTE
TO MINIMIZE ANY ELECTRICAL NOISE BEING INTRODUCED INTO THE ENGINE CONTROLLER, CONTROL WIRING AND AC POWER LINES NEED TO BE RUN IN SEPARATE CONDUITS.
ENGINE: JOHN DEERE T3
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REGULATOR: PM300
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GENERATOR DIAGRAM
DATE: 1-14-13
DRAWING SIZE: B-SIZE
DRAWN BY: KJB
SHEET: 3 OF 4
809-Q-290645-G

7000 SERIES

UNIT CAPABLE OF WITHSTANDING A FAULT CURRENT OF 65,000 AMPS SYMMETRICAL FOR 3 CYCLES WHEN UTILIZED WITH OVER CURRENT PROTECTIVE DEVICE.



STANDARD FACTORY VOLTAGE & FREQUENCY SENSING SETTINGS

	NORMAL SOURCE	EMERGENCY SOURCE
NOMINAL VOLTAGE	208Y/120V, 60Hz, 3Ø 4W	208Y/120V, 60Hz, 3Ø 4W
VOLTAGE PICKUP	187V (90%)	187V (90%)
VOLTAGE DROPOUT	177V (85%)	160V (77%)
OVERVOLTAGE TRIP	AS SPECIFIED	AS SPECIFIED
FREQUENCY PICKUP	57.0Hz (95%)	57.0Hz (95%)
FREQUENCY DROPOUT	54.0Hz (90%)	54.0Hz (90%)
OVER FREQ. TRIP	AS SPECIFIED	AS SPECIFIED

STANDARD TIME DELAYS

-TIME DELAY ON ENGINE START TO OVERRIDE MOMENTARY NORMAL SOURCE OUTAGES, RANGE: 0 to 6 SECONDS, ACCESSORY 1.
-TIME DELAY ON TRANSFER TO EMERGENCY, RANGE: 0 SECONDS TO 61 MINUTES, ACCESSORY 2B.
-TIME DELAY ON RETRANSFER TO NORMAL SOURCE, ACCESSORY 3A.
NORMAL FAILURE MODE- RANGE: 0 SECONDS TO 61 MINUTES.
TRANSFER TEST MODE- RANGE: 0 SECONDS TO 61 MINUTES.
-TIME DELAY ENGINE COOLDOWN, RANGE: 0 SECONDS TO 61 MINUTES, ACCESSORY 2E.

INDICATING LIGHTS

PL1 -GREEN, INDICATES TRANSFER SWITCH CONNECTED TO NORMAL. ACC. 9A
PL2 -RED, INDICATES TRANSFER SWITCH CONNECTED TO EMERGENCY. ACC. 9B
PL3 -GREEN , INDICATES NORMAL SOURCE ACCEPTED. ACC. 9C
PL4 -RED, INDICATES EMERGENCY SOURCE ACCEPTED. ACC. 9D

ACCESSORY REFERENCE DESCRIPTIONS

ACC. 5 -TRANSFER TEST SWITCH, MOMENTARY TYPE.
ACC. 6B -RETRANSFER TO NORMAL TIME DELAY (ACC. 3A) BYPASS SWITCH.
ACC. 7 -ENGINE START CONTACT, CLOSES TO START ENGINE.
ACC. 11C -ENGINE PLANT EXERCISER(LOAD/NO LOAD).
ACC. 12E -THREE POSITION ENGINE MODE SELECTOR SWITCH, MANUAL / AUTO / ENGINE START
ACC. 14ABG -QTY. 8 AUXILARY FORM-C CONTACTS THAT INDICATE ATS POSITION, CLOSED ON NORMAL SOURCE(14A) AND CLOSED ON EMERGENCY SOURCE (14B).
ACC. 17 -CUSTOMER CONTACT CLOSES TO TRANSFER LOAD TO EMERGENCY.
ACC. 18B -QTY 2 FORM-C CONTACTS, INDICATE EMERGENCY AVAILABLE.
ACC. 18G -QTY 2 FORM-C CONTACTS, INDICATE NORMAL AVAILABLE.
ACC. 22 -SOLID NEUTRAL BLOCK.
ACC. 27 -INPHASE MONITOR FOR TRANSFER OF MOTOR LOADS
ACC. 31Z4 -QTY 4 PRE/POST TRANSFER FORM-C CONTACTS, FACTORY SET AT 0 SECONDS..
ACC. 34A -REMOTE CUSTOMER CONTACT OPENS TO INHIBIT TRANSFER TO NORMAL.
ACC. 34B -REMOTE CUSTOMER CONTACT OPENS TO INHIBIT TRANSFER TO EMERGENCY
ACC. 44B -ENCLOSURE HEATER WITH THERMOSTAT AND CIRCUIT BREAKER.

REFER TO SHEET 3 FOR POWER MANAGER (ACC. 85L) CONNECTIONS.

TYPE 4 ENCLOSURE OUTLINE DRAWING DS 780149

GENERAL NOTES

1. SWITCH SHOWN DE-ENERGIZED, CONNECTED TO NORMAL SOURCE.
2. ALL WIRES ARE NO. 16 A.W.G. STRANDED COPPER UNLESS OTHERWISE SPECIFIED.
3. ○ INDICATES CUSTOMER CONNECTIONS.
4. ● INDICATES FACTORY CONNECTIONS.
5. CONNECTION POINTS THAT HAVE BOTH FACTORY AND CUSTOMER CONNECTIONS ARE SHOWN AS CUSTOMER CONNECTIONS.
6. ⁄ INDICATES WIRE NUMBER OF ADDITIONAL WIRES TO HARNESSES.
7. —⊟— INDICATES INLINE HARNESS DISCONNECT PLUG.
8. MATING PLUG & JACK TERMINAL NUMBERS MATCH WHEN PLUGGED TOGETHER.
9. OPERATOR'S MANUAL IS SUPPLIED WITH EACH AUTOMATIC TRANSFER SWITCH. REFER TO THIS MANUAL PRIOR TO INSTALLATION AND OPERATION OF THIS SWITCH.

PHYSICAL WIRING DIAGRAM, 7000 SERIES
3 POLE 200 AMP AUTOMATIC TRANSFER SWITCH
CATALOG NO. J07ATSA30200C5

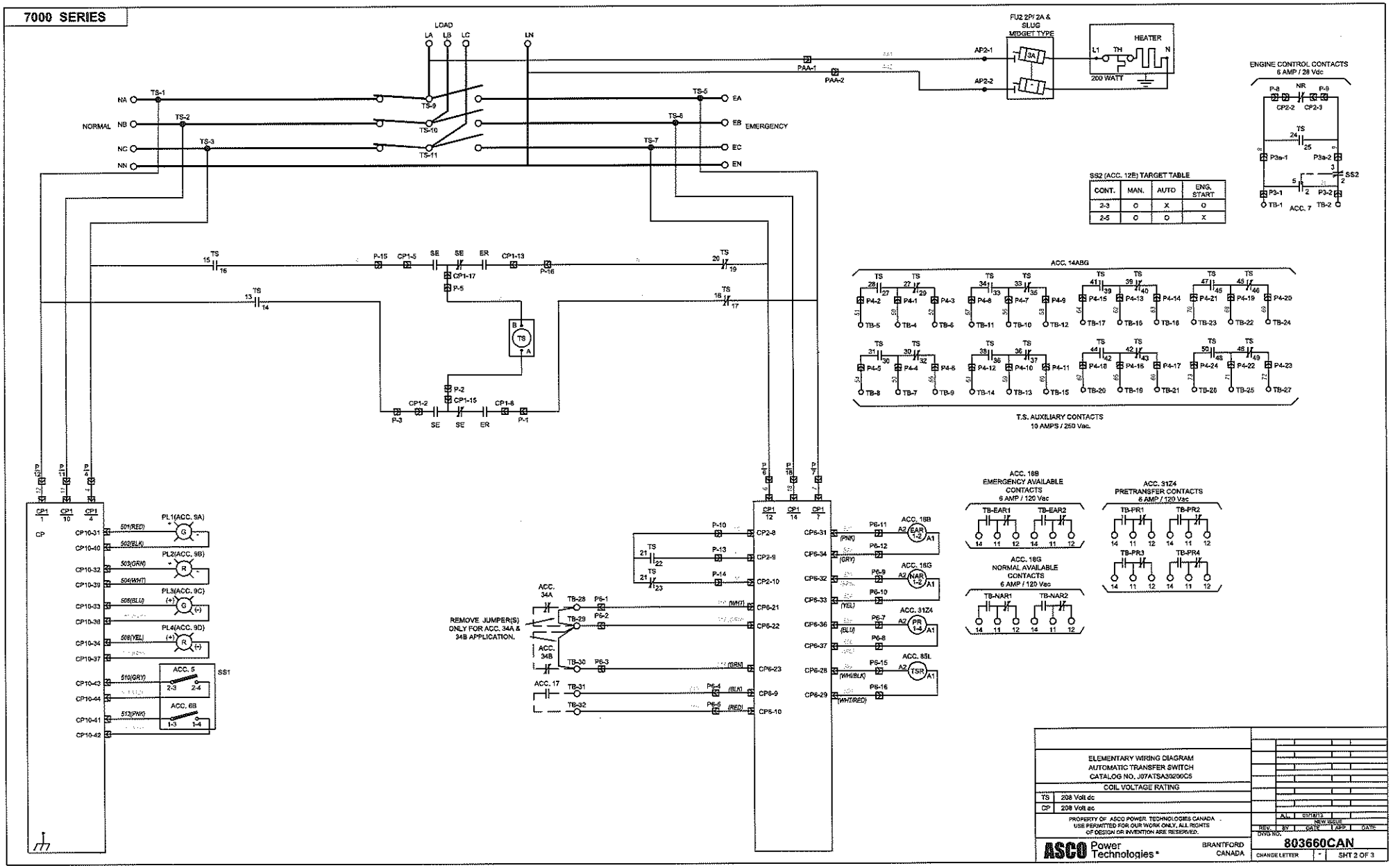
AUTOMATED DRAWING PROGRAM

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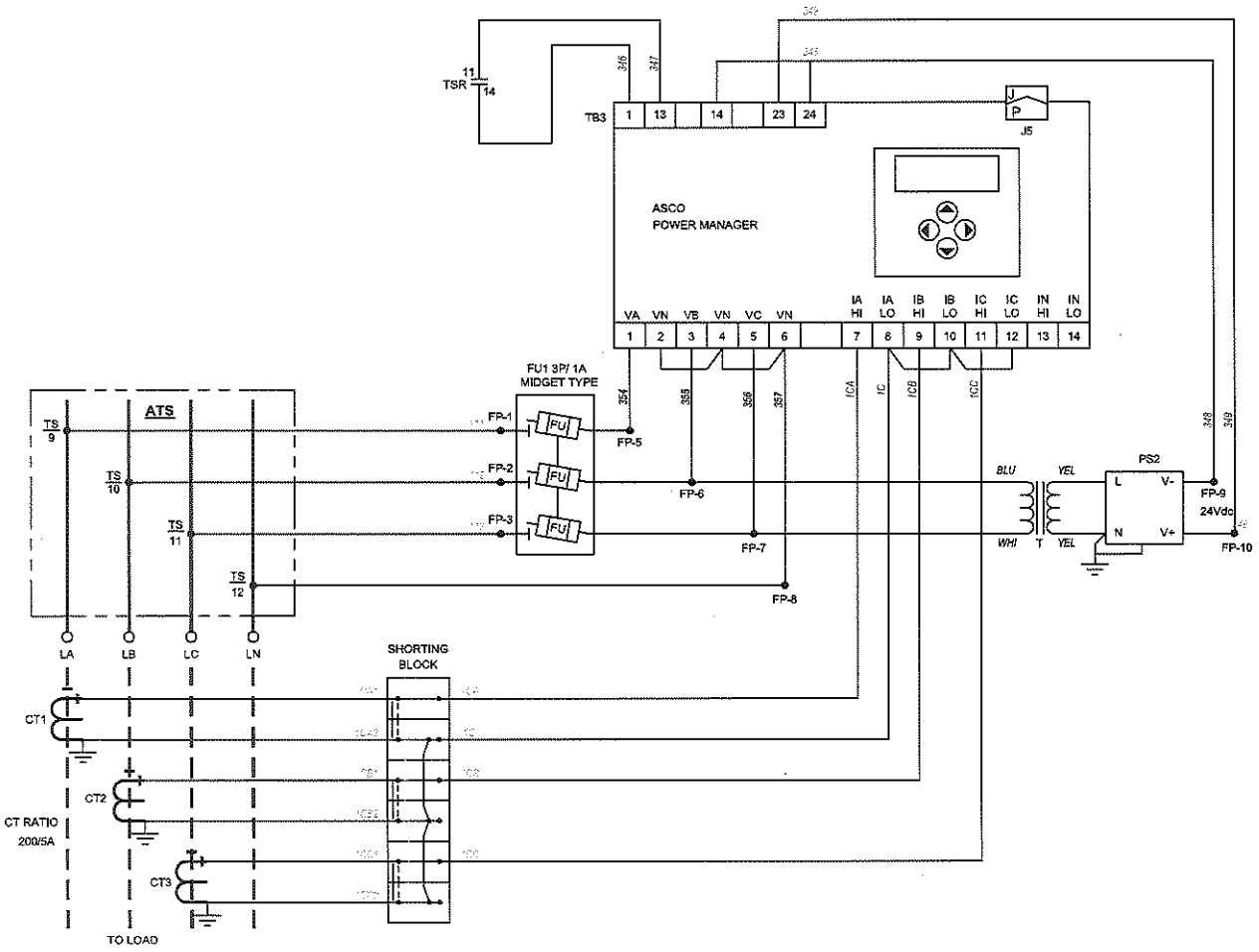
ASCO Power Technologies* BRANTFORD CANADA
ENTERED BY: A.L. DATE 01/18/13

REV.	BY	DATE	APP.	DATE
-			DYMO3 NEW ISSUE	

DWG NO. 803660CAN
CHANGE LETTER - SHT 1 OF 3


7000 SERIES
LOAD
LA LB LC LN
NA NB NC NN
NORMAL
TS-1 TS-2 TS-3
TS-9 TS-10 TS-11
TS-5 TS-6 TS-7
EA EB EC EN
EMERGENCY
PAA-1 PAA-2
AP2-1 AP2-2
FU2 2P/ 2A & SLUG MIDGET TYPE
3A
HEATER
L1 TH N
200 WATT
ENGINE CONTROL CONTACTS
6 AMP / 28 Vdc
P-8 NR P-9
CP2-2 CP2-3
TS
24 25
P3a-1 P3a-2
3 SS2 2
5 1
P3-1 P3-2
TB-1 TB-2
ACC. 7
SS2 (ACC. 12E) TARGET TABLE
CONT. | MAN. | AUTO | ENG. START
2-3 | O | X | O
2-5 | O | O | X
TS 15 16
P-15 CP1-5 SE SE ER CP1-13
CP1-17
P-16
TS 20 19
P-5
TS 13 14
TS 18 17
B TS A
P-2
CP1-15
CP1-2 CP1-8
P-3 P-1
SE SE ER
ACC. 14ABG
TS 28 27 TS 29 P4-2 P4-1 P4-3 TB-5 TB-4 TB-6
TS 34 33 TS 35 P4-8 P4-7 P4-9 TB-11 TB-10 TB-12
TS 41 39 TS 40 P4-15 P4-13 P4-14 TB-17 TB-16 TB-18
TS 47 45 TS 46 P4-21 P4-19 P4-20 TB-23 TB-22 TB-24
TS 31 30 TS 32 P4-5 P4-4 P4-6 TB-8 TB-7 TB-9
TS 38 36 TS 37 P4-12 P4-10 P4-11 TB-14 TB-13 TB-15
TS 44 42 TS 43 P4-18 P4-16 P4-17 TB-20 TB-19 TB-21
TS 50 48 TS 49 P4-24 P4-22 P4-23 TB-26 TB-25 TB-27
T.S. AUXILIARY CONTACTS
10 AMPS / 250 Vac.
CP1 1 CP1 10 CP1 4
CP
CP10-31 CP10-40 CP10-32 CP10-39 CP10-33 CP10-38 CP10-34 CP10-37 CP10-43 CP10-44 CP10-41 CP10-42
PL1(ACC. 9A) 501(RED)
PL2(ACC. 9B) 503(GRN) 504(WHT)
PL3(ACC. 9C) 506(BLU)
PL4(ACC. 9D) 508(YEL)
510(GRY)
512(PNK)
ACC. 5 2-3 2-4
ACC. 6B 1-3 1-4
SS1
CP1 12 CP1 14 CP1 7
CP2-8 CP2-9 CP2-10 CP2-21 CP2-22 CP2-23 CP2-9 CP2-10
P-10 P-13 P-14
TS 21 22 TS 21 23
ACC. 34A ACC. 34B
TB-28 P6-1 TB-29 P6-2 TB-30 P6-3
(WHT) (GRN)
ACC. 17 TB-31 TB-32
P6-4 (BLK) P6-5 (RED)
REMOVE JUMPER(S) ONLY FOR ACC. 34A & 34B APPLICATION.
CP6-31 CP6-34 CP6-32 CP6-33 CP6-36 CP6-37 CP6-28 CP6-29
P6-11 (PNK) P6-12 (GRY) P6-9 P6-10 (YEL) P6-7 (BLU) P6-8 P6-15 (WHI/BLK) P6-16 (WHT/RED)
ACC. 18B A2 EAR 1-2 A1
ACC. 18G A2 NAR 1-2 A1
ACC. 31Z4 A2 PR 1-4 A1
ACC. 85L A2 TSR A1
ACC. 18B EMERGENCY AVAILABLE CONTACTS 6 AMP / 120 Vac
TB-EAR1 TB-EAR2
ACC. 18G NORMAL AVAILABLE CONTACTS 6 AMP / 120 Vac
TB-NAR1 TB-NAR2
ACC. 31Z4 PRETRANSFER CONTACTS 6 AMP / 120 Vac
TB-PR1 TB-PR2 TB-PR3 TB-PR4
14 11 12
ELEMENTARY WIRING DIAGRAM
AUTOMATIC TRANSFER SWITCH
CATALOG NO. J07ATSA30200C5
COIL VOLTAGE RATING
TS 208 Volt dc
CP 208 Volt ac
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ASCO Power Technologies
BRANTFORD CANADA
AL 01/16/13
REC BY NEW ISSUE DATE APP DATE
DWG NO. 803660CAN
CHANGE LETTER - SHT 2 OF 3

7000 SERIES



ACCESSORY REFERENCE DESCRIPTIONS

ACC. 85L -POWER MANAGER, POWER METER MONITORING THE LOAD
VOLTAGE: Vab, Vbc, Vca, Van, Vbn, Vcn, V AVERAGE.
FREQUENCY: 45.0 TO 66.0 HZ
CURRENT: Ia, Ib, Ic, I AVERAGE
UNBALANCE % VOLTAGE, AMPS
REAL POWER: KWa, KWb, KWc, KW NET
REACTIVE POWER: KVARa, KVARb, KVARc, KVAR NET
APPARENT POWER: KVAa, KVAb, KVAc, KVA NET
REAL ENERGY: KWH IMPORT, KWH EXPORT, KWH NET.
REACTIVE ENERGY: KVARH IMPORT, KVARH EXPORT, KVARH NET.
POWER FACTOR: PFa, PFb, PFc, PF AVERAGE

ELEMENTARY WIRING DIAGRAM
AUTOMATIC TRANSFER SWITCH
CATALOG NO. J07ATSA30200C5

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ASCO Power Technologies® BRANTFORD CANADA

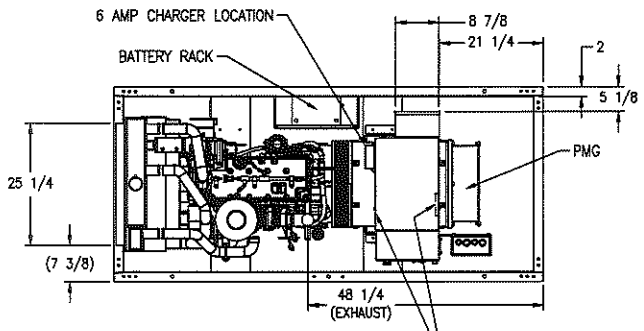
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A	L	01/18/13	NEW ISSUE	

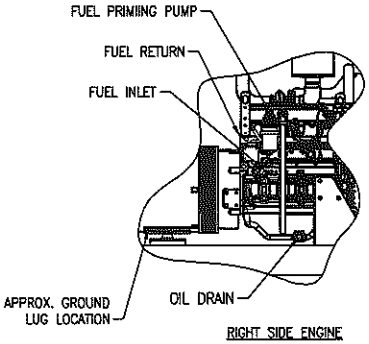
DWG NO. 803660CAN

CHANGE LETTER - SHT 3 OF 3

APPROVED
By Darren Fraser at 11:09 am, Feb 01, 2013

DWG. #: DS60D6SPA(5030HF)LO-MD-162

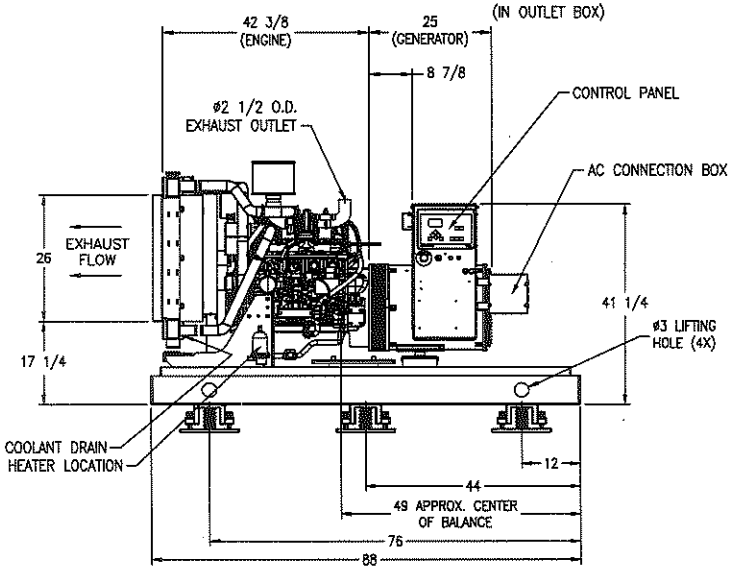


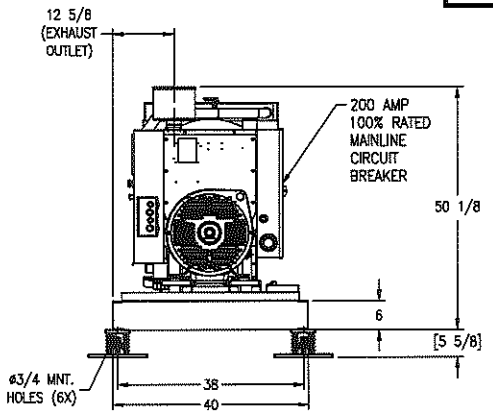


RIGHT SIDE ENGINE

NOTES:
1. SUB-BASE FUEL TANK INFORMATION:
   OVERALL HEIGHT OF UNIT WILL INCREASE WITH USE OF OPTIONAL SUB-BASE FUEL TANK. REFERENCE SALES CATALOG FOR TANK HEIGHT AND GALLON CAPACITY INFORMATION.
2. FUEL SYSTEM CONNECTIONS:
   (FOR UNITS WITHOUT SUB-BASE FUEL TANKS)
   INLET: 3/8 NPT OUTLET: 3/8 NPT
3 APPROX. UNIT WEIGHTS: (WET) 2,600# LESS FUEL

THIS PRINT CERTIFIED FOR
Wajax Power Systems – West
MTU/OE QUOTE NO.: 290645
DATE: 01-14-13 CERTIFIED BY: JTG
ENGINEERING DEPT.
MTU ONSITE ENERGY





DRAWING TOLERANCES: ±1/4"
EXCEPT BASE MTG. HOLES: ±1/8"

REVISION	DATE	REVISION DESCRIPTION	INITIALS
A	01-14-13	INITIAL RELEASE TO SALES AND ENGINEERING	JTG

onsite energy

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GEN-SET INFORMATION

ENGINE: 5030HF285	ENCLOSURE: NA
GENERATOR: 361 W/ PMG	BREAKER: 200 AMP
RADIATOR: 86880(DR-2853)	TANK: NA
RADIATOR AMBIENT: 50C	MUFFLER: NA
DUCT FLANGE: 84014	TRAILER: NA
CONTROL PANEL: DGC-2020	ISOLATORS: RJSD-488
BASE: 95825	

DIMENSIONAL LAYOUT

DRAWN TO SCALE ALL DIMENSIONS ARE IN INCHES	MODEL: DS60D6SPA
DATE: 01-14-13	DRAWN BY: JTG
DWG. #: DS60D6SPA(5030HF)LO-MD-162	

WAJAX POWER SYSTEMS

Load Test Form

Length of Load test: 4 **Interval of Reads:** 15 **Minutes**

Date: **April 03, 2013**

Generator Information
Engine Model: JD 5030HF285
Engine Serial#: PE5030L117226
Gen-Set Serial #: 357123-1-1-0213
Genset Model: DS00060D6S-AK0574
Generator: MX187094
Generator Serial#:MX187094
Rated KW: 60
Voltage: 208

Project #: 10452
Test Date: April 03, 2013
Customer Ryfan Electric
Customer PO#:9052-00002
Project Name: Cambridge Bay Potable Water System
Location: Calgary
Province Alberta
Data Recorded By: Thorne Thompson

Load Test Data:

Time of Read	7:46:17 AM	8:01:29 AM	8:16:27 AM	8:31:28 AM	8:46:27 AM	9:01:28 AM	9:16:29 AM	9:31:28 AM
Session Run Time	0 h 5 min	0 h 20 min	0 h 35 min	0 h 50 min	1 h 5 min	1 h 20 min	1 h 35 min	1 h 50 min
Engine Information:								
Engine Speed	1802	1802	1803	1802	1799	1799	1799	1801
Coolant Temperature	187 F	201 F	201 F	201 F	199 F	201 F	201 F	201 F
Oil Pressure	52 psi	43 psi	44 psi	43 psi	44 psi	44 psi	43 psi	43 psi
Fuel Rate	4.40 g/H	4.62 g/H	4.62 g/H	4.60 g/H	4.57 g/H	4.58 g/H	4.57 g/H	4.56 g/H
Fuel Pressure	26.1 psi	26.7 psi	25.5 psi	23.8 psi	23.2 psi	23.2 psi	23.2 psi	22.6 psi
Intake Temperature	77.0 F	100.4 F	100.4 F	100.4 F	98.6 F	100.4 F	102.2 F	100.4 F
Intake Pressure	NA	NA	NA	NA	NA	NA	NA	NA
ECU Temperature	NA	NA	NA	NA	NA	NA	NA	NA
Battery Voltage	14.6 V	14.6 V	14.6 V	14.6 V	14.6 V	14.6 V	14.6 V	14.6 V
Engine Load	98%	98%	99%	99%	98%	98%	99%	98%
Winding A1	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Winding A2	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Winding B1	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Winding B2	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Winding C1	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Winding C2	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Bearing DE	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
RTD 8	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Exhaust Gas Left	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Exhasit Gas Right	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Power Information:								
Voltage A & B	210 V	211 V	211 V	211 V	210 V	210 V	211 V	210 V
Voltage B & C	210 V	211 V	211 V	211 V	210 V	210 V	211 V	211 V
Voltage C & A	210 V	211 V	211 V	211 V	210 V	210 V	210 V	211 V
Voltage A & N	121 V	122 V	122 V	122 V	122 V	122 V	122 V	122 V
Voltage B & N	121 V	121 V	122 V	122 V	121 V	122 V	122 V	121 V
Voltage C & N	121 V	122 V	122 V	122 V	122 V	121 V	121 V	122 V
Amps Phase A	162 A	162 A	162 A	162 A	162 A	162 A	162 A	162 A
Amps Phase B	162 A	162 A	162 A	162 A	162 A	162 A	162 A	162 A
Amps Phase C	162 A	162 A	162 A	162 A	162 A	162 A	162 A	162 A
Generator Frequency	60.1 Hz	60.1 Hz	60.1 Hz	60.1 Hz	60.0 Hz	60.0 Hz	60.0 Hz	60.0 Hz
Phase A Killowatts	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW
Phase B Killowatts	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW
Phace C Killowatts	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW
Total Killowatts	58 kW	59 kW	59 kW	59 kW	59 kW	59 kW	59 kW	59 kW
Power Factor	1.00 LEAD	1.00 LEAD	1.00 LEAD	1.00 LEAD	1.00 LEAD	1.00 LEAD	1.00 LEAD	1.00 LEAD
Phase A KVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA
Phase B KVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA
Phase C KVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA
Total KVA	58 kVA	59 kVA	59 kVA	59 kVA	59 kVA	59 kVA	59 kVA	59 kVA

WAJAX POWER SYSTEMS

Load Test Form

Load Test Data:								
Time of Read	9:46:29 AM	10:01:29 AM	10:16:26 AM	10:31:27 AM	10:46:28 AM	11:01:27 AM	11:16:25 AM	11:31:26 AM
Session Run Time	2 h 5 min	2 h 20 min	2 h 35 min	2 h 50 min	3 h 5 min	3 h 20 min	3 h 35 min	3 h 50 min
Engine Information:								
Engine Speed	1799	1800	1798	1801	1798	1802	1798	1799
Coolant Temperature	199 F	199 F	199 F	199 F	201 F	199 F	199 F	199 F
Oil Pressure	43 psi	43 psi	44 psi	44 psi	43 psi	43 psi	44 psi	43 psi
Fuel Rate	4.58 g/H	4.62 g/H	4.57 g/H	4.62 g/H	4.58 g/H	4.60 g/H	4.58 g/H	4.60 g/H
Fuel Pressure	23.2 psi	22.6 psi	23.2 psi	23.2 psi	22.6 psi	23.2 psi	23.2 psi	23.2 psi
Intake Temperature	100.4 F	104.0 F	102.2 F	104.0 F	102.2 F	104.0 F	104.0 F	104.0 F
Intake Pressure	NA	NA	NA	NA	NA	NA	NA	NA
ECU Temperature	NA	NA	NA	NA	NA	NA	NA	NA
Battery Voltage	14.6 V	14.6 V	14.5 V	14.5 V	14.5 V	14.6 V	14.6 V	14.6 V
Engine Load	98%	98%	98%	98%	98%	98%	98%	98%
Winding A1	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Winding A2	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Winding B1	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Winding B2	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Winding C1	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Winding C2	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Bearing DE	N/C	N/C	0 F	N/C	N/C	N/C	N/C	N/C
RTD 8	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Exhaust Gas Left	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Exhasit Gas Right	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Power Information:								
Voltage A & B	210 V	210 V	211 V	210 V	210 V	210 V	211 V	210 V
Voltage B & C	210 V	210 V	211 V	211 V	210 V	211 V	210 V	211 V
Voltage C & A	210 V	211 V	211 V	211 V	211 V	211 V	211 V	211 V
Voltage A & N	122 V	122 V	122 V	122 V	122 V	122 V	122 V	122 V
Voltage B & N	121 V	121 V	121 V	121 V	121 V	122 V	122 V	121 V
Voltage C & N	122 V	122 V	122 V	122 V	122 V	122 V	121 V	122 V
Amps Phase A	162 A	162 A	162 A	162 A	162 A	162 A	162 A	162 A
Amps Phase B	162 A	162 A	162 A	162 A	162 A	162 A	162 A	162 A
Amps Phase C	162 A	162 A	162 A	162 A	162 A	162 A	162 A	162 A
Generator Frequency	60.0 Hz	60.0 Hz	60.0 Hz	60.0 Hz	60.0 Hz	60.0 Hz	60.0 Hz	60.0 Hz
Phase A Killowatts	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW
Phase B Killowatts	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW
Phace C Killowatts	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW	19 kW
Total Killowatts	59 kW	59 kW	59 kW	59 kW	59 kW	59 kW	59 kW	59 kW
Power Factor	1.00 LEAD	1.00 LEAD	1.00 LEAD	1.00 LEAD	1.00 LEAD	1.00 LEAD	1.00 LEAD	1.00 LEAD
Phase A KVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA
Phase B KVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA
Phase C KVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA	19 kVA
Total KVA	59 kVA	59 kVA	59 kVA	59 kVA	59 kVA	59 kVA	59 kVA	59 kVA

WAJAX POWER SYSTEMS

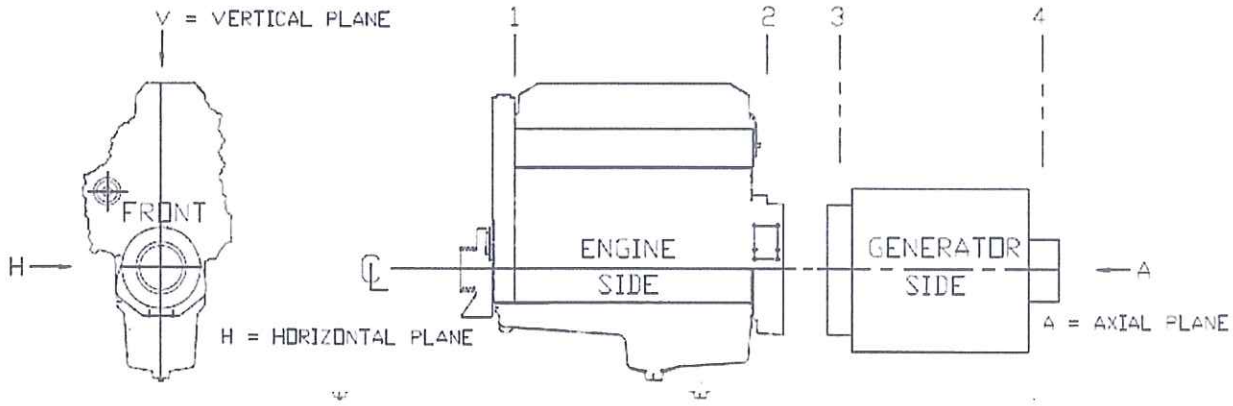
Load Test Form

Load Test Data:								
Time of Read	11:46:27 AM							
Session Run Time	4 h 5 min							
Engine Information:								
Engine Speed	1799							
Coolant Temperature	201 F							
Oil Pressure	43 psi							
Fuel Rate	4.58 g/H							
Fuel Pressure	23.2 psi							
Intake Temperature	105.8 F							
Intake Pressure	NA							
ECU Temperature	NA							
Battery Voltage	14.5 V							
Engine Load	99%							
Winding A1	N/C							
Winding A2	N/C							
Winding B1	N/C							
Winding B2	N/C							
Winding C1	N/C							
Winding C2	N/C							
Bearing DE	N/C							
RTD 8	N/C							
Exhaust Gas Left	N/C							
Exhasit Gas Right	N/C							
Power Information:								
Voltage A & B	211 V							
Voltage B & C	211 V							
Voltage C & A	211 V							
Voltage A & N	122 V							
Voltage B & N	122 V							
Voltage C & N	122 V							
Amps Phase A	162 A							
Amps Phase B	162 A							
Amps Phase C	162 A							
Generator Frequency	60.0 Hz							
Phase A Killowatts	19 kW							
Phase B Killowatts	19 kW							
Phace C Killowatts	19 kW							
Total Killowatts	59 kW							
Power Factor	1.00 LEAD							
Phase A KVA	19 kVA							
Phase B KVA	19 kVA							
Phase C KVA	19 kVA							
Total KVA	59 kVA							

WAJAX POWER SYSTEMS

Generator Vibration Test

		TEST LOCATION											
Load (KW)		**V1**	**H1**	**A1**	**V2**	**H2**	**A2**	**V3**	**H3**	**A3**	**V4**	**H4**	**A3**
50%	**30**	**0.987**	**1.95**	**0.906**	**0.942**	**0.889**	**0.307**	**-**	**-**	**-**	**1.90**	**0.820**	**0.480**
75%	**45**	**1.15**	**2.03**	**0.732**	**1.02**	**1.04**	**0.432**				**1.55**	**1.31**	**0.522**
100%	**58.9**	**1.39**	**2.38**	**0.981**	**1.15**	**1.28**	**0.472**				**1.68**	**0.919**	**0.523**
110%													
No Load	**0**	**0.930**	**1.06**	**0.342**	**0.866**	**0.741**	**0.247**				**1.40**	**0.880**	**0.379**



Notes:

Record data in Displacement (mils) versus Frequency (Hz)
Shop standard for new builds is: .005" (5 mils) displacement max.
Recordings at Planes 2 & 3 may be combined for closed coupled generators
Recordings at Planes V & H to be on crank centerline where possible AND test points marked on machines
Planes 1 through 4 to be aligned with bearing supports where possible and machined or smooth surfaces used for attaching accelerometer
Make notes on data recording sheet in cases of poor access to test points on machine being tested

PowerTech™ E 4024HF285/HF295 and 5030HF285 OEM Diesel Engines

OPERATOR'S MANUAL
PowerTech™ E OEM Diesel Engines

OMRG37673 Issue 13Aug08 (ENGLISH)

CALIFORNIA
Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

If this product contains a gasoline engine:

⚠ WARNING

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

The State of California requires the above two warnings.

John Deere Power Systems
LITHO IN U.S.A.

Introduction

Foreword

READ THIS MANUAL carefully to learn how to operate and service your engine correctly. Failure to do so could result in personal injury or equipment damage.

THIS MANUAL SHOULD BE CONSIDERED a permanent part of your engine and should remain with the engine when you sell it.

MEASUREMENTS IN THIS MANUAL are given in both metric and customary U.S. unit equivalents. Use only correct replacement parts and fasteners. Metric and inch fasteners may require a specific metric or inch wrench.

RIGHT-HAND AND LEFT-HAND sides are determined by standing at the drive or flywheel end (rear) of the engine and facing toward the front of the engine.

WRITE ENGINE SERIAL NUMBERS and option codes in the spaces indicated in the Record Keeping Section. Accurately record all the numbers. Your dealer also needs these numbers when you order parts. File the identification numbers in a secure place off the engine.

SETTING FUEL DELIVERY outside the published factory specifications or otherwise modifying or tampering with the engine fuel system settings including ECU software parameters may subject the user to civil fines and penalties. Such actions will also be taken into consideration if claims are made under the provisions of John Deere's engine warranty.

CERTAIN ENGINE ACCESSORIES such as radiator, air cleaner, and instruments are optional equipment on John Deere OEM Engines. These accessories may be provided by the equipment manufacturer instead of John Deere. This operator's manual applies only to the engine and those options available through the John Deere distribution network.

NOTE: This operator's manual covers PowerTech™ E 2.4 L and 3.0 L engine models 4024HF285, 4024HF295 and 5030HF285 . The 4024HF285 and 5030HF285 engines meet emission standards for EPA Tier 3 in the United States, and Stage III A in the European Union. The 4024HF295 engines meet emission standards for EPA Interim Tier 4 in the United States, and Stage III A in the European Union. For earlier 2.4 L and 3.0 L engines, refer to OMRG34851.

This manual covers only engines provided to OEM (Outside Equipment Manufacturers). For engines in Deere machines, refer to the machine operators manual.

PowerTech is a trademark of Deere & Company

OUOD006,00000AC –19–29JUL08–1/1

Engine Owner

John Deere Engine Owner:

Don't wait until you need warranty or other service to meet your local John Deere Engine Distributor or Service Dealer. To register your engine for warranty via the Internet, use the following URL:
http://www.johndeere.com/enginewarranty

Learn who your dealer is and where he is. At your first convenience, go meet him. He'll want to get to know you and to learn what your needs might be.

Aux Utilisateurs De Moteurs John Deere:

N'attendez pas d'être obligé d'avoir recours à votre concessionnaire John Deere ou au point de service le plus proche pour vous adresser à lui. Pour enregistrer votre moteur pour la garantie via Internet, utilisez l'adresse suivante:
http://www.johndeere.com/enginewarranty

Renseignez-vous dès que possible pour l'identifier et le localiser. A la première occasion, prenez contact avec lui et faites-vous connaître. Il sera lui aussi heureux de faire votre connaissance et de vous proposer ses services le moment venu.

An Den Besitzer Des John Deere Motors:

Warten Sie nicht auf einen evt. Reparaturfall, um den nächstgelegenen John Deere Händler kennen zu lernen. Zur Registrierung Ihres Motors für die Garantie dient folgende Internet-Adresse:
http://www.johndeere.com/enginewarranty

Machen Sie sich bei ihm bekannt und nutzen Sie sein "Service Angebot".

Proprietario del motore John Deere:

Non aspetti fino al momento di far valere la garanzia o di chiedere assistenza per fare la conoscenza del distributore dei motori John Deere o del concessionario che fornisce l'assistenza tecnica. Per registrare via Internet la garanzia del suo motore, si colleghi al seguente sito URL:
http://www.johndeere.com/enginewarranty

Lo identifichi e si informi sulla sua ubicazione. Alla prima occasione utile lo contatti. Egli desidera fare la sua conoscenza e capire quali potrebbero essere le sue necessità.

Propietario De Equipo John Deere:

No espere hasta necesitar servicio de garantía o de otro tipo para conocer a su Distribuidor de Motores John Deere o al Concesionario de Servicio. Registre su motor para la garantía en la siguiente dirección de internet: http://www.johndeere.com/enginewarranty

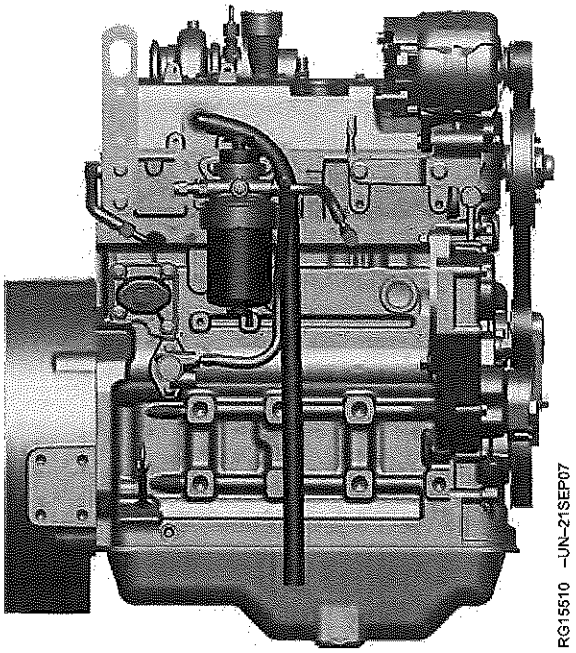
Aprenda quién es su distribuidor y donde él está situado. Cuando tenga un momento, vaya a visitarlo. A él le gustará conocerlo, y saber cuáles podrían ser sus necesidades.

Till ägare av John Deere motorer:

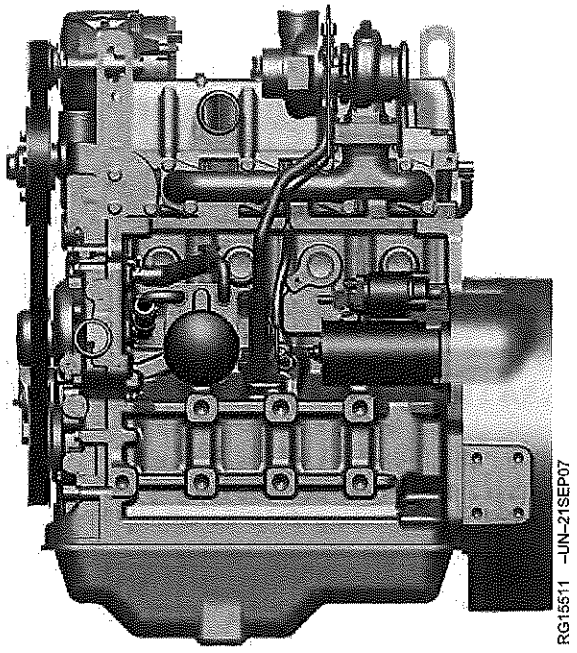
Ta reda på vem din återförsäljare är och besök honom så snart tillfälle ges. Vänta inte tills det är dags för service eller eventuellt garantiarbete. Din motor garantiregistrerar Du via Internet på
http://www.johndeere.com/enginewarranty

Din återförsäljare vill mycket gärna träffa dig för att lära känna dina behov och hur bäst han kan hjälpa dig.

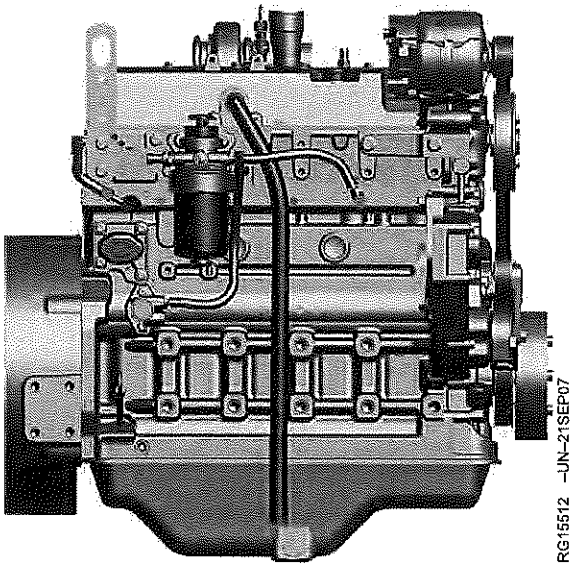
PowerTech™ E 2.4L and 3.0L Diesel Engines



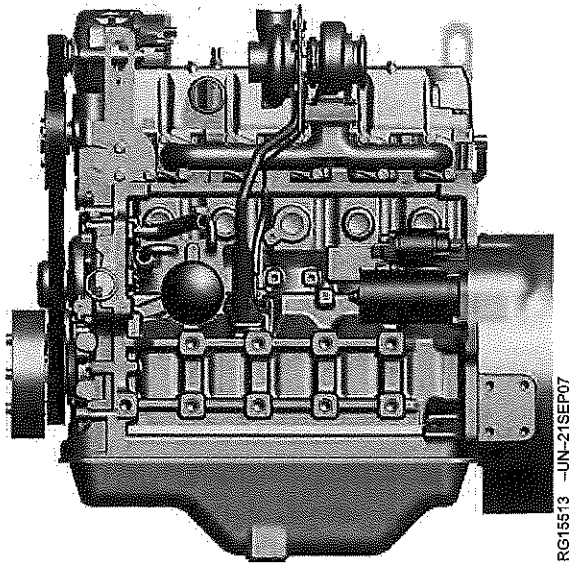
2.4 L Right Side View



2.4 L Left Side View



3.0 L Right Side View



3.0 L Left Side View

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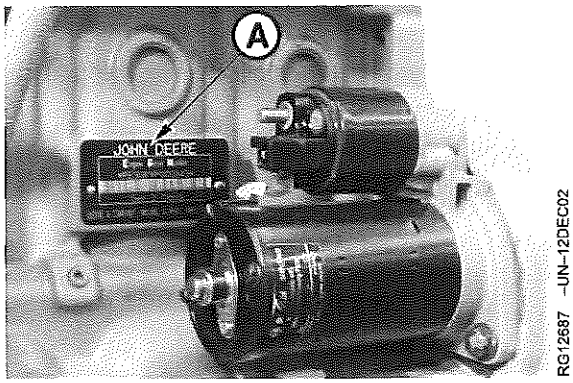
Record Keeping

Engine Serial Number Plate

Each engine has a 13-digit John Deere engine serial number. The first two digits identify the factory that produced the engine.

- "PE" indicates the engine was built in Torreon, Mexico

Your engine's serial number plate (A) is located on the left-hand side of cylinder block behind the starter motor.



RG12687 –UN–12DEC02

13-Digit Engine Serial Number Plate

RG41183,0000025 –19–11DEC02–1/1

Record Engine Serial Number

Record all of the numbers and letters found on your engine serial number plate in the spaces provided below.

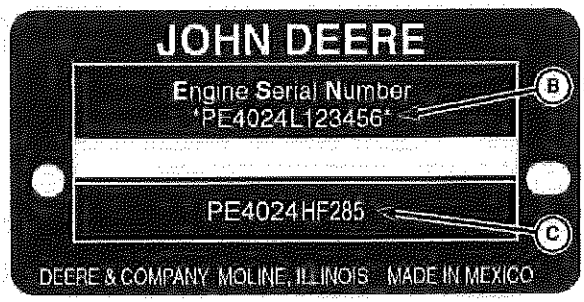
This information is very important for repair parts or warranty information.

Engine Serial Number (B)

_____

Engine Model Number (C)

_____

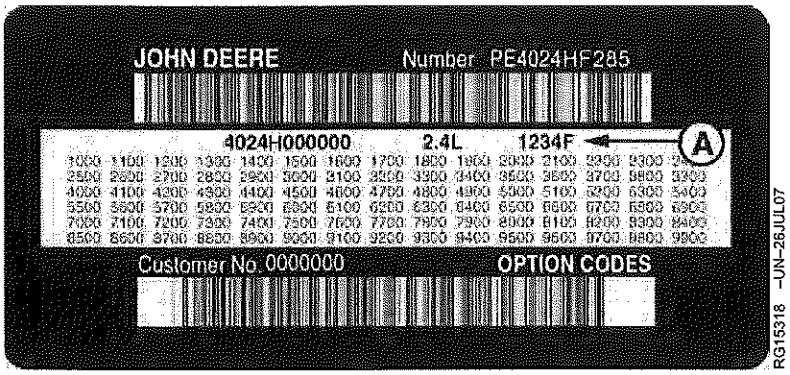


RG15317 –UN–26JUL07

Engine Serial Number Plate

OUOD006,00000AF –19–29JUN07–1/1

Engine Option Codes



Engine Option Codes

In addition to the serial number plate, OEM engines have an engine option code label affixed to the rocker arm cover. These codes indicate which of the engine options were installed on your engine at the factory. When in need of parts or service, furnish your authorized servicing dealer or engine distributor with these numbers.

The engine option code label includes an engine base code (A). This base code must also be recorded along with the option codes.

The first two digits of each code identify a specific group, such as alternators. The last two digits of each code identify one specific option provided on your engine, such as a 12-volt, 70-amp alternator.

NOTE: These option codes are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

If an engine is ordered without a particular component, the last two digits of that functional group option code will be 99, 00, or XX. The list on the next page shows only the first two digits of the code numbers. For future reference such as ordering repair parts, it is important to have these code numbers available. To ensure this availability, enter the third and fourth digits shown on your engine option code label in the spaces provided on the following page.

Continued on next page

NOTE: Your engine option code label may not contain all option codes if an option has been added after the engine left the producing factory.

If option code label is lost or destroyed, consult your servicing dealer or engine distributor selling the engine for a replacement.

An additional option code label may also be delivered with the engine. Place this sticker or tag, for reference, either on this page or in the engine owner's warranty booklet under OPTION CODES title.

Option Codes	Description
11	Rocker Arm Cover
12	Oil Filler
13	Crankshaft Pulley
14	Flywheel Housing
15	Flywheel
16	Fuel Injection System
17	Air Inlet
18	Air Cleaner
19	Oil Pan
20	Coolant Pump
21	Thermostat Cover
22	Thermostat
23	Fan Drive
24	Fan Belt
25	Fan
26	Engine Coolant Heater
27	Radiator
28	Exhaust Manifold
29	Crankcase Vent System
30	Starter Motor
31	Alternator
32	Instrument Panel
33	Tachometer
35	Fuel Filter
36	Front Plate
37	Fuel Transfer Pump
39	Thermostat Housing
40	Oil Dipstick
41	Belt-Driven Front Auxiliary Drive
43	Starting Aids
44	Timing Gear Cover
45	Balancer Shafts
46	Cylinder Block and Camshaft
47	Crankshaft and Bearings
48	Connecting Rods and Pistons
49	Valve Actuating Mechanism
50	Oil Pump

Option Codes	Description
51	Cylinder Head With Valves
52	Auxiliary Gear Drive
53	Fuel Heater
54	Air Intake for Turbocharger
55	Shipping Stand
56	Paint Option
57	Coolant Pump Inlet
59	Oil Cooler
60	Alternator Fan Drive Pulley
62	Alternator Mounting
63	Low Pressure Fuel Line
64	Exhaust Elbow
65	Turbocharger
66	Coolant Temperature Switch
67	Speed Sensor
68	Crankshaft Rear Damper
69	Engine Serial Number Plate
71	Engine Oil Bypass Filter
72	ECU Electronic Software Option
74	Air Conditioning (Freon) Compressor
75	Air Restriction Indicator
76	Oil Pressure Switch
77	Timing Gear Cover
78	Air Compressor
79	Engine Certification
81	Primary Fuel Filter and Water Separator
83	Electronic Software (Vehicle Option)
84	Electrical Wiring Harness
86	Fan Pulley
87	Belt Tensioner
88	Oil Filter
92	Test Certificate
95	Special Equipment (Factory Installed)
96	Engine Installation Kit
97	Special Equipment (Field Installed)
98	Lift Straps for Engine
99	Service Only Parts and Kits

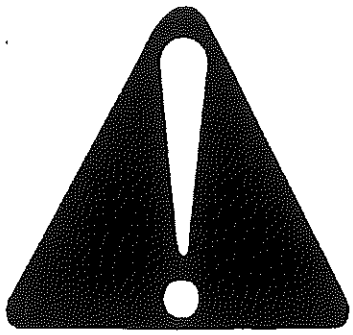
_____ **Engine Base Code**

Safety

Recognize Safety Information

This is a safety-alert symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.

Follow recommended precautions and safe operating practices.



T81389 –UN–07DEC88

DX,ALERT –19–29SEP98–1/1

Understand Signal Words

A signal word—DANGER, WARNING, or CAUTION—is used with the safety-alert symbol. DANGER identifies the most serious hazards.

DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.



TS187 –19–30SEP88

DX,SIGNAL –19–03MAR93–1/1

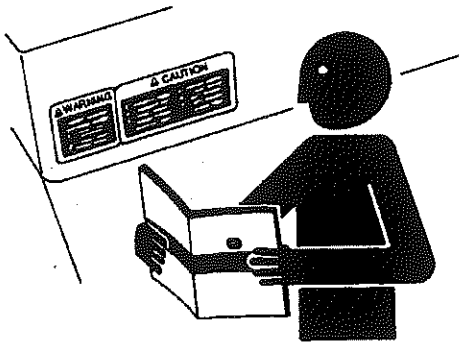
Follow Safety Instructions

Carefully read all safety messages in this manual and on your machine safety signs. Keep safety signs in good condition. Replace missing or damaged safety signs. Be sure new equipment components and repair parts include the current safety signs. Replacement safety signs are available from your John Deere dealer.

Learn how to operate the machine and how to use controls properly. Do not let anyone operate without instruction.

Keep your machine in proper working condition. Unauthorized modifications to the machine may impair the function and/or safety and affect machine life.

If you do not understand any part of this manual and need assistance, contact your John Deere dealer.

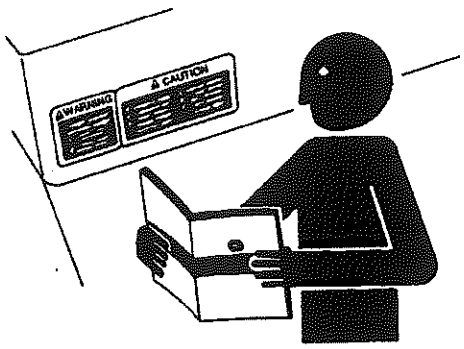


TS201 –UN–23AUG88

DX,READ –19–03MAR93–1/1

Replace Safety Signs

.eplace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.



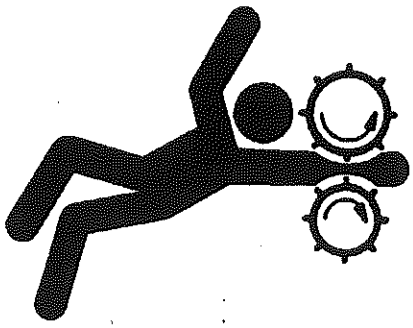
TS201 –UN–23AUG88

DX,SIGNS1 –19–04JUN90–1/1

Service Machines Safely

Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



TS228 –UN–23AUG88

DX,LOOSE –19–04JUN90–1/1

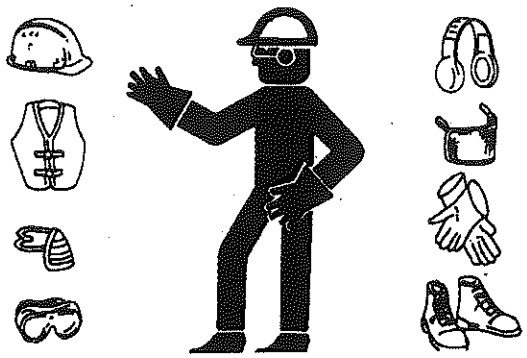
/ear Protective Clothing

Wear close fitting clothing and safety equipment appropriate to the job.

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.



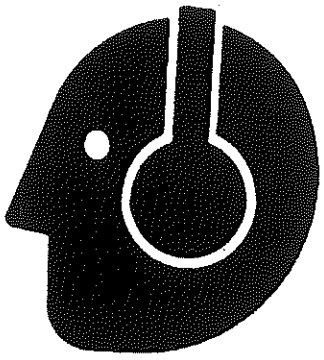
TS206 –UN–23AUG88

DX,WEAR –19–10SEP90–1/1

Protect Against Noise

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



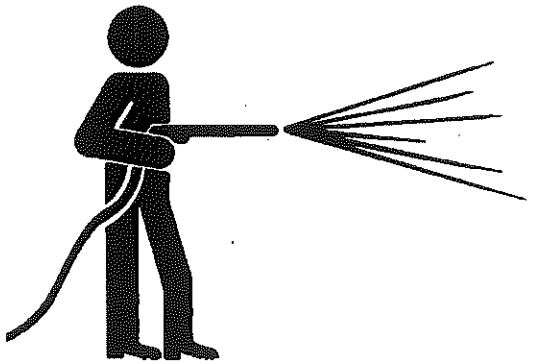
TS207 –UN–23AUG88

DX,NOISE –19–03MAR93–1/1

Work in Clean Area

Before starting a job:

- Clean work area and machine.
- Make sure you have all necessary tools to do your job.
- Have the right parts on hand.
- Read all instructions thoroughly; do not attempt shortcuts.



T6642EJ –UN–18OCT88

DX,CLEAN –19–04JUN90–1/1

Practice Safe Maintenance

nderstand service procedure before doing work. Keep area clean and dry.

Never lubricate, service, or adjust machine while it is moving. Keep hands, feet , and clothing from power-driven parts. Disengage all power and operate controls to relieve pressure. Lower equipment to the ground. Stop the engine. Remove the key. Allow machine to cool.

Securely support any machine elements that must be raised for service work.

Keep all parts in good condition and properly installed. Fix damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris.

On self-propelled equipment, disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

On towed implements, disconnect wiring harnesses from tractor before servicing electrical system components or welding on machine.



TS218 –UN–23AUG88

DX,SERV –19–17FEB99–1/1

Illuminate Work Area Safely

Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.



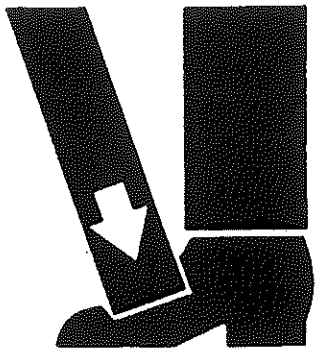
TS223 –UN–23AUG88

DX,LIGHT –19–04JUN90–1/1

Use Proper Lifting Equipment

Lifting heavy components incorrectly can cause severe injury or machine damage.

Follow recommended procedure for removal and installation of components in the manual.



TS226 –UN–23AUG88

DX,LIFT –19–04JUN90–1/1

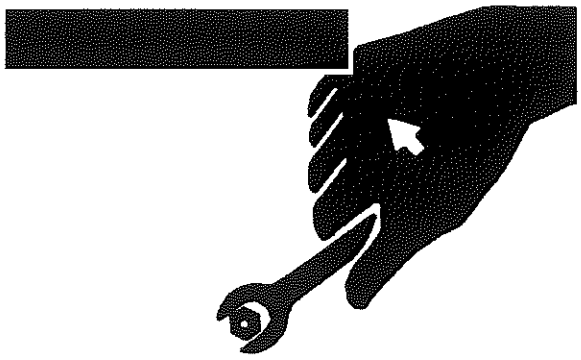
Use Proper Tools

Use tools appropriate to the work. Makeshift tools and procedures can create safety hazards.

Use power tools only to loosen threaded parts and fasteners.

For loosening and tightening hardware, use the correct size tools. DO NOT use U.S. measurement tools on metric fasteners. Avoid bodily injury caused by slipping wrenches.

Use only service parts meeting John Deere specifications.



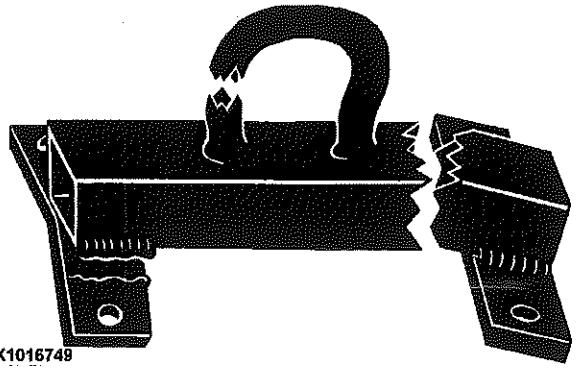
TS779 –UN–08NOV89

DX,REPAIR –19–17FEB99–1/1

Construct Dealer-Made Tools Safely

Faulty or broken tools can result in serious injury. When constructing tools, use proper, quality materials, and good workmanship.

Do not weld tools unless you have the proper equipment and experience to perform the job.



LX1016749

LX1016749 –UN–01JUL97

DX,SAFE,TOOLS –19–10OCT97–1/1

Prevent Machine Runaway

.void possible injury or death from machinery runaway.

Do not start engine by shorting across starter terminals. Machine will start in gear if normal circuitry is bypassed.

NEVER start engine while standing on ground. Start engine only from operator's seat, with transmission in neutral or park.



TS177 –UN–11JAN89

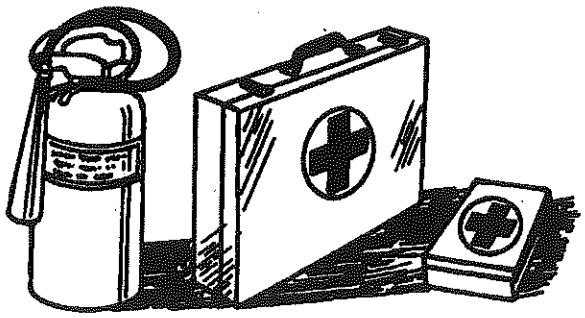
DX,BYPAS1 –19–29SEP98–1/1

Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



TS291 –UN–23AUG88

DX,FIRE2 –19–03MAR93–1/1

andle Fuel Safely—Avoid Fires

Handle fuel with care: it is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks.

Always stop engine before refueling machine. Fill fuel tank outdoors.

Prevent fires by keeping machine clean of accumulated trash, grease, and debris. Always clean up spilled fuel.



TS202 –UN–23AUG88

DX,FIRE1 –19–03MAR93–1/1

DO NOT USE Starting Fluids

DO NOT USE any starting fluids with these glow plug - equipped engines as they could cause an extreme explosion with possible personal injury.

OUOD006,0000076 –19–15FEB07–1/1

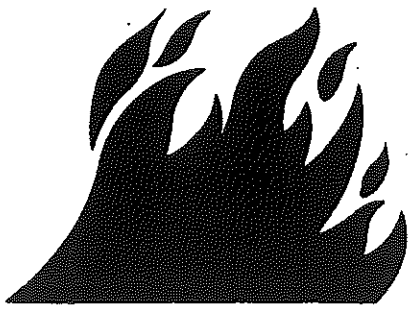
Handle Fluids Safely—Avoid Fires

When you work around fuel, do not smoke or work near heaters or other fire hazards.

Store flammable fluids away from fire hazards. Do not incinerate or puncture pressurized containers.

Make sure machine is clean of trash, grease, and debris.

Do not store oily rags; they can ignite and burn spontaneously.



TS227 –UN–23AUG88

DX,FLAME –19–29SEP98–1/1

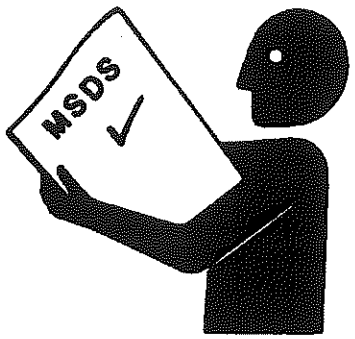
Handle Chemical Products Safely

Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with John Deere equipment include such items as lubricants, coolants, paints, and adhesives.

A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.

Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

(See your John Deere dealer for MSDS's on chemical products used with John Deere equipment.)



TS1132 –UN–26NOV90

DX,MSDS,NA –19–03MAR93–1/1

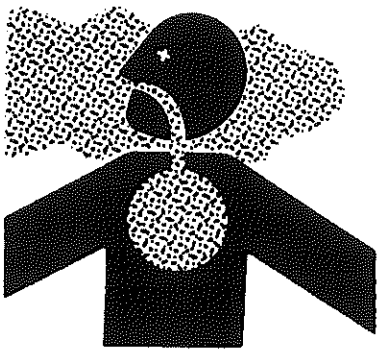
Handle Agricultural Chemicals Safely

Chemicals used in agricultural applications such as fungicides, herbicides, insecticides, pesticides, rodenticides, and fertilizers can be harmful to your health or the environment if not used carefully.

Always follow all label directions for effective, safe, and legal use of agricultural chemicals.

Reduce risk of exposure and injury:

- Wear appropriate personal protective equipment as recommended by the manufacturer. In the absence of manufacturer's instructions, follow these general guidelines:
  - Chemicals labeled **'Danger'**: Most toxic. Generally require use of goggles, respirator, gloves, and skin protection.
  - Chemicals labeled **'Warning'**: Less toxic. Generally require use of goggles, gloves, and skin protections.
  - Chemicals labeled **'Caution'**: Least toxic. Generally require use of gloves and skin protection.
- Avoid inhaling spray or dusts.
- Always have soap, water, and towel available when working with chemicals. If chemical contacts skin, hands, or face, wash immediately with soap and water. If chemical gets into eyes, flush immediately with water.
- Wash hands and face after using chemicals and before eating, drinking, smoking, or urination.
- Do not smoke or eat while applying chemicals.
- After handling chemicals, always bathe or shower and change clothes. Wash clothing before wearing again.
- Seek medical attention immediately if illness occurs during or shortly after use of chemicals.
- Keep chemicals in original containers. Do not transfer chemicals to unmarked containers or to containers used for food or drink.
- Store chemicals in a secure, locked area way from human or livestock food. Keep children away.
- Always dispose of containers properly. Triple rinse empty containers and puncture or crush containers and dispose of properly.



TS220 –UN–23AUG88



A34471

A34471 –UN–11OCT88

DX,WW,CHEM01 –19–05APR04–1/1

Stay Clear of Rotating Drivelines

ntanglement in rotating driveline can cause serious injury or death.

Keep master shield and driveline shields in place at all times. Make sure rotating shields turn freely.

Wear close-fitting clothing. Stop the engine and be sure PTO driveline is stopped before making adjustments, connections, or performing any type of service on the engine or PTO-driven equipment.



TS1644 –UN–22AUG95

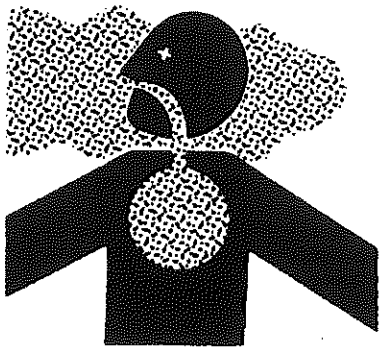
Rotating Drivelines

OUO1004,0000BD8 –19–15OCT07–1/1

Work In Ventilated Area

Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

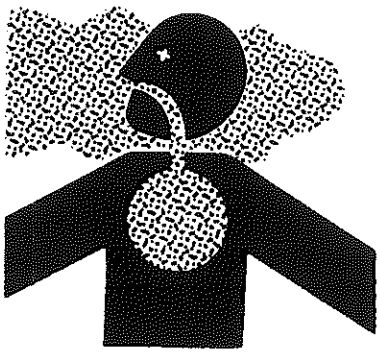
you do not have an exhaust pipe extension, open the doors and get outside air into the area.



TS220 –UN–23AUG88

DX,AIR –19–17FEB99–1/1

Avoid Harmful Asbestos Dust



TS220 –UN–23AUG88

Avoid breathing dust that may be generated when handling components containing asbestos fibers. Inhaled asbestos fibers may cause lung cancer.

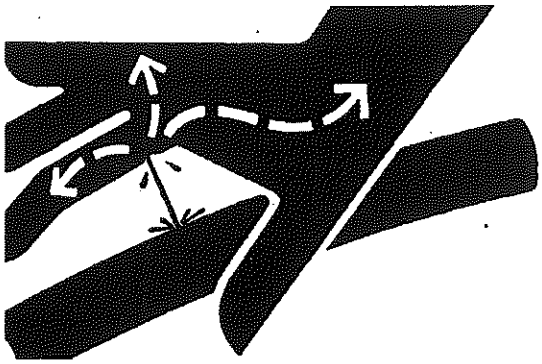
Components in products that may contain asbestos fibers are brake pads, brake band and lining assemblies, clutch plates, and some gaskets. The asbestos used in these components is usually found in a resin or sealed in some way. Normal handling is not hazardous as long as airborne dust containing asbestos is not generated.

Avoid creating dust. Never use compressed air for cleaning. Avoid brushing or grinding material containing asbestos. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If not available, apply a mist of oil or water on the material containing asbestos.

Keep bystanders away from the area.

DX,DUST –19–15MAR91–1/1

Avoid High-Pressure Fluids



X9811 –UN–23AUG88

Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical Department in Moline, Illinois, U.S.A.

DX,FLUID –19–03MAR93–1/1

Protect Against High Pressure Spray

Spray from high pressure nozzles can penetrate the skin and cause serious injury. Keep spray from contacting hands or body.

If an accident occurs, see a doctor immediately. Any high pressure spray injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical Department in Moline, Illinois, U.S.A.



TS1343 –UN–18MAR92

DX,SPRAY –19–16APR92–1/1

Avoid Heating Near Pressurized Fluid Lines

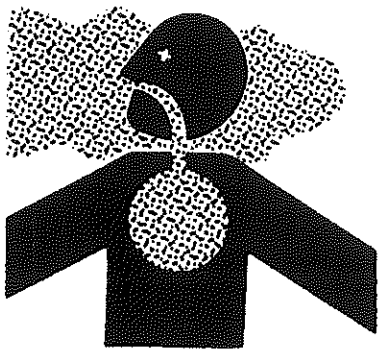
Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can accidentally burst when heat goes beyond the immediate flame area.



TS953 –UN–15MAY90

DX,TORCH –19–10DEC04–1/1

Remove Paint Before Welding or Heating



TS220 –UN–23AUG88

Avoid potentially toxic fumes and dust.

Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Remove paint before heating:

- Remove paint a minimum of 100 mm (4 in.) from area to be affected by heating. If paint cannot be removed, wear an approved respirator before heating or welding.
- If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

Do not use a chlorinated solvent in areas where welding will take place.

Do all work in an area that is well ventilated to carry toxic fumes and dust away.

Dispose of paint and solvent properly.

DX,PAINT –19–24JUL02–1/1

Service Cooling System Safely



TS281 –UN–23AUG88

Explosive release of fluids from pressurized cooling system can cause serious burns.

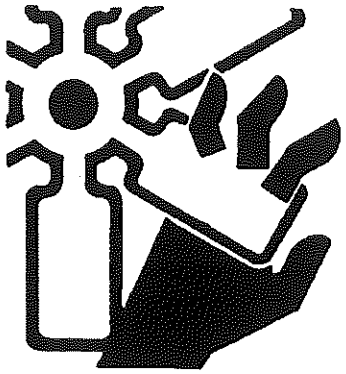
Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

DX,RCAP –19–04JUN90–1/1

Install Fan Guards

.otating cooling system fans can cause serious injury.

Keep fan guards in place at all times during engine operation. Wear close fitting clothes. Stop the engine and be sure fan is stopped before making adjustments or connections, or cleaning near the front of the engine.



Rotating Fan

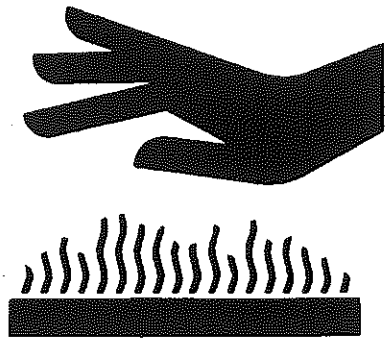
TS677 –UN–21SEP89

OUOD006,000009D –19–15MAY08–1/1

Avoid Hot Parts

Avoid skin contact with exhaust manifolds, turbochargers and mufflers. Keep flammable materials clear of the turbocharger.

External dry exhaust parts become very hot during operation. Turbochargers and exhaust manifolds may reach temperatures as high as 600°C (1112°F) under full load. This may ignite paper, cloth or wooden materials. Parts on engines that have been at full load and reduced to no load idle will maintain approximately 150°C (302°F).



Hot Surface

TS271 –UN–23AUG88

OURGP12,0000135 –19–15OCT07–1/1

Prevent Battery Explosions

Keep sparks, lighted matches, and open flame away from the top of battery. Battery gas can explode.

Never check battery charge by placing a metal object across the posts. Use a volt-meter or hydrometer.

Do not charge a frozen battery; it may explode. Warm battery to 16°C (60°F).



TS204 –UN–23AUG88

DX,SPARKS –19–03MAR93–1/1

Handling Batteries Safely

CAUTION: Battery gas can explode. Keep sparks and flames away from batteries. Use a flashlight to check battery electrolyte level.

Never check battery charge by placing a metal object across the posts. Use a voltmeter or hydrometer.

Always remove grounded (—) battery clamp first and replace it last.



TS204 –UN–23AUG88

Explosion

CAUTION: Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid the hazard by:

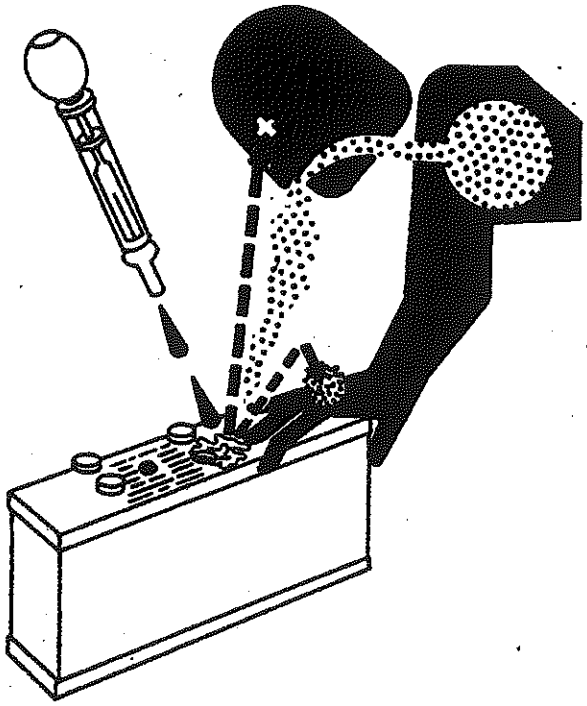
1. **Filling batteries in a well-ventilated area.**
2. **Wearing eye protection and rubber gloves.**
3. **Avoiding breathing fumes when electrolyte is added.**
4. **Avoiding spilling or dripping electrolyte.**
5. **Using proper jump start procedure.**

If you spill acid on yourself:

1. **Flush your skin with water.**
2. **Apply baking soda or lime to help neutralize the acid.**
3. **Flush your eyes with water for 15—30 minutes. Get medical attention immediately.**

If acid is swallowed:

1. **Do not induce vomiting.**
2. **Drink large amounts of water or milk, but do not exceed 2 L (2 qt.).**
3. **Get medical attention immediately.**



TS203 –UN–23AUG88

Acid

WARNING: Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. **Wash hands after handling.**

DPSG,OUO1004,2758 –19–15OCT07–1/1

Dispose of Waste Properly

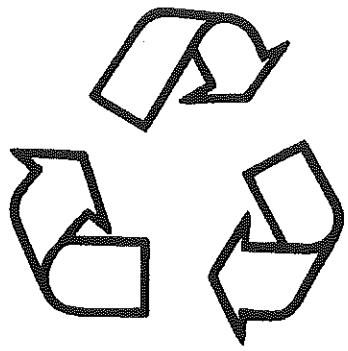
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

Do not pour waste onto the ground, down a drain, or into any water source.

Air conditioning refrigerants escaping into the air can damage the Earth's atmosphere. Government regulations may require a certified air conditioning service center to recover and recycle used air conditioning refrigerants.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.



TS1133 –UN–26NOV90

DX,DRAIN –19–03MAR93–1/1

Diesel Fuel

Consult your local fuel distributor for properties of the diesel fuel available in your area.

In general, diesel fuels are blended to satisfy the low temperature requirements of the geographical area in which they are marketed.

Diesel fuels specified to EN 590 or ASTM D975 are recommended. Renewable diesel is basically identical to petroleum diesel fuel that is created by Hydrotreating fats and oils. Renewable diesel that meets EN 590 or ASTM D975 is acceptable for use at all percentage mixture levels.

Required fuel properties

In all cases, the fuel shall meet the following properties:

Cetane number of 45 minimum. Cetane number greater than 50 is preferred, especially for temperatures below –20°C (–4°F) or elevations above 1500 m (5000 ft).

Cold Filter Plugging Point (CFPP) should be at least 5°C (9°F) below the expected lowest temperature or **Cloud Point** below the expected lowest ambient temperature.

Fuel lubricity should pass a maximum scar diameter of 0.45 mm as measured by ASTM D6079 or ISO 12156-1.

Sulfur content:

- Diesel fuel quality and fuel sulfur content must comply with all existing emissions regulations for the area in which the engine operates.
- Use of diesel fuel with sulfur content less than 0.10% (1000 ppm) is STRONGLY recommended.
- Use of diesel fuel with sulfur content 0.10% (1000 ppm) to 0.50% (5000 ppm) may result in REDUCED oil and filter change intervals as shown in the table.
- BEFORE using diesel fuel with sulfur content greater than 0.50% (5000 ppm), contact your John Deere dealer.

IMPORTANT: Do not mix used diesel engine oil or any other type of lubricating oil with diesel fuel.

IMPORTANT: Improper fuel additive usage may cause damage on fuel injection equipment of diesel engines.

DX,FUEL1 –19–05OCT07–1/1

Lubricity of Diesel Fuel

Most diesel fuels manufactured in the United States, Canada, and the European Union have adequate lubricity to ensure proper operation and durability of fuel injection system components. However, diesel fuels manufactured in some areas of the world may lack the necessary lubricity.

IMPORTANT: Make sure the diesel fuel used in your machine demonstrates good lubricity characteristics.

Fuel lubricity should pass a maximum scar diameter of 0.45 mm as measured by ASTM D6079 or ISO 12156-1.

If fuel of low or unknown lubricity is used, add John Deere PREMIUM DIESEL FUEL CONDITIONER (or equivalent) at the specified concentration.

Lubricity of Biodiesel Fuel

Significant improvement in lubricity can occur with biodiesel blends up to B20. The gain in lubricity above a 20% blend is limited.

DX,FUEL5 –19–05OCT07–1/1

Handling and Storing Diesel Fuel

CAUTION: Handle fuel carefully. Do not fill the fuel tank when engine is running.

DO NOT smoke while you fill the fuel tank or service the fuel system.

Fill the fuel tank at the end of each day's operation to prevent water condensation and freezing during cold weather.

Keep all storage tanks as full as practicable to minimize condensation.

Ensure that all fuel tank caps and covers are installed properly to prevent moisture from entering.

Monitor water content of the fuel regularly.

When using bio-diesel fuel, the fuel filter may require more frequent replacement due to premature plugging.

Check engine oil level daily prior to starting engine. A rising oil level may indicate fuel dilution of the engine oil.

IMPORTANT: The fuel tank is vented through the filler cap. If a new filler cap is required, always replace it with an original vented cap.

When fuel is stored for an extended period or if there is a slow turnover of fuel, add a fuel conditioner to stabilize the fuel and prevent water condensation. Contact your fuel supplier for recommendations.

DX,FUEL4 –19–19DEC03–1/1

Testing Diesel Fuel

DIESELSCAN™ is a John Deere fuel analysis program that can be used to monitor the quality of your fuel. The DIESELSCAN analysis verifies fuel type, cleanliness, water content, suitability for cold weather operation, and whether the fuel meets specifications.

Check with your John Deere dealer for availability of DIESELSCAN kits.

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DX,FUEL6 –19–14NOV05–1/1

Biodiesel Fuel

Biodiesel is a fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats. Biodiesel blends are biodiesel mixed with petroleum diesel fuel on a volume basis.

Biodiesel users in the U.S. are strongly encouraged to purchase biodiesel blends from a BQ-9000 Certified Marketer and sourced from a BQ-9000 Accredited Producer (as certified by the National Biodiesel Board). Certified Marketers and Accredited Producers can be found at the following website: http://www.bq-9000.org.

While 5% blends are preferred (B5), biodiesel concentrations up to a 20% blend (B20) in petroleum diesel fuel can be used in all John Deere engines. Biodiesel blends up to B20 can be used ONLY if the biodiesel (100% biodiesel or B100) meets ASTM D6751 (US), EN 14214 (EU), or equivalent specification. Expect a 2% reduction in power and a 3% reduction in fuel economy when using B20.

John Deere approved fuel conditioners containing detergent/dispersant additives are recommended when using lower biodiesel blends, but are required when using blends of B20 or greater.

John Deere engines can also operate on biodiesel blends above B20 (up to 100% biodiesel) ONLY if the biodiesel meets the EN 14214 specification (primarily available in Europe). Engines operating on biodiesel blends above B20 may not fully comply with all applicable emissions regulations. Expect up to a 12% reduction in power and an 18% reduction in fuel economy when using 100% biodiesel. John Deere approved fuel conditioners containing detergent/dispersant additives are required.

The petroleum diesel portion of biodiesel blends must meet the requirements of ASTM D975 (US) or EN 590 (EU) commercial standards.

Biodiesel blends up to B20 must be used within 90 days of the date of biodiesel manufacture. Biodiesel blends from B21 to B100 must be used within 45 days of the date of biodiesel manufacture.

Request a certificate of analysis from your fuel distributor to ensure that the fuel is compliant with the above specifications.

Consult your John Deere dealer for approved biodiesel fuel conditioners to improve storage and performance with biodiesel fuels.

When using biodiesel fuel, the engine oil level must be checked daily. If oil becomes diluted with fuel, shorten oil change intervals. Refer to Diesel Engine Oil and Filter Service Intervals for more details regarding biodiesel and engine oil change intervals.

The following must be considered when using biodiesel blends up to B20:

- Cold weather flow degradation
- Stability and storage issues (moisture absorption, oxidation, microbial growth)
- Possible filter restriction and plugging (usually a problem when first switching to biodiesel on used engines.)
- Possible fuel leakage through seals and hoses
- Possible reduction of service life of engine components

The following must also be considered when using biodiesel blends above B20.

- Possible coking and/or blocked injector nozzles, resulting in power loss and engine misfire if John Deere approved fuel conditioners containing detergent/dispersant additives are not used
- Possible crankcase oil dilution, requiring more frequent oil changes
- Possible corrosion of fuel injection equipment
- Possible lacquering and/or seizure of internal components
- Possible formation of sludge and sediments
- Possible thermal oxidation of fuel at elevated temperatures
- Possible elastomer seal and gasket material degradation (primarily an issue with older engines)

Continued on next page

- Possible compatibility issues with other materials (including copper, lead, zinc, tin, brass, and bronze) used in fuel systems and fuel handling equipment
- Possible reduction in water separator efficiency
- Potential high acid levels within fuel system
- Possible damage to paint if exposed to biodiesel

IMPORTANT: Raw pressed vegetable oils are NOT acceptable for use as fuel in any concentration in John Deere engines. Their use could cause engine failure.

DX,FUEL7 –19–04OCT07–2/2

Aviation (Jet) Fuels

Aviation (jet) fuels may be used with the following restrictions.

Type	Comments
Jet A	Lower viscosity and density than base No. 2-D diesel fuel. Power loss up to 10% can be expected.
Jet A-1	Lower viscosity and density than base No. 2-D diesel fuel. Power loss up to 10% can be expected.
Jet B	**Not Recommended.**Lower density and extremely low viscosity compared to base No. 2-D diesel fuel. Power loss up to 14% can be expected.
JP-4	**Not Recommended.**Lower density and extremely low viscosity compared to base No. 2-D diesel fuel. Power loss up to 12% can be expected.
JP-5	Lower viscosity and density than base No. 2-D diesel fuel. Power loss up to 9% can be expected.
JP-7	Lower viscosity and density than base No. 2-D diesel fuel. Power loss up to 10% can be expected.
JP-8	Lower viscosity and density than base No. 2-D diesel fuel. Power loss up to 10% can be expected.

OURGP12,000003F –19–07JUL04–1/1

Burner Fuels

urner fuels, like kerosene, may be used with the following restrictions.

Type	Comments
No.2	Higher density and specific gravity than base No. 2-D diesel fuel. Power increase up to 3% can be expected.
No.1	Lower viscosity than base No. 2-D diesel fuel. Power loss up to 2% can be expected.

OURGP12,0000040 –19–07JUL04–1/1

Minimizing the Effect of Cold Weather on Diesel Engines

John Deere diesel engines are designed to operate effectively in cold weather.

However, for effective starting and cold weather operation, a little extra care is necessary. The information below outlines steps that can minimize the effect that cold weather may have on starting and operation of your engine. See your John Deere dealer for additional information and local availability of cold weather aids.

Use Winter Blend Diesel Fuel

When temperatures fall below -10°C (14°F), winter blend diesel fuel is best suited for cold weather operation. Winter blend diesel fuel has a lower cloud point and a lower pour point.

Cloud point is the temperature at which wax will begin to form in the fuel and this wax causes fuel filters to plug. **Pour point** is the lowest temperature at which movement of the fuel is observed.

NOTE: On an average, winter blend diesel fuel has a lower BTU (heat content) rating. Using winter blend diesel fuel may reduce power and fuel efficiency, but should not cause any other engine performance effects. Check the grade of fuel being used before troubleshooting for low power complaints in cold weather operation.

CAUTION: Do not use ether when starting these engines. They are equipped with glow plugs.

Coolant Heater

An engine block heater (coolant heater) is an available option to aid cold weather starting.

Seasonal Viscosity Oil and Proper Coolant Concentration

Use seasonal grade viscosity engine oil based on the expected air temperature range between oil changes and a proper concentration of low silicate antifreeze as recommended. (See DIESEL ENGINE OIL and ENGINE COOLANT requirements this section.)

Diesel Fuel Flow Additive

Use John Deere Premium Diesel Fuel Conditioner (winter formula) which contains anti-gel chemistry, or equivalent to treat Grade No.2-D fuel during the cold weather season. This generally extends operability about 10°C (18°F) below its Cloud Point. For operability at temperatures further below, winter grade fuel (a blend of No.2-D and No.1-D, or straight No.1-D fuel) is best suited for cold weather operation.

IMPORTANT: Treat fuel when outside temperature drops below 0°C (32°F). For best results, use with untreated fuel. Follow all recommended instructions on label.

Biodiesel

When running with BIODIESEL blends wax formation can generate at warmer temperatures. Begin to use John Deere Premium Biodiesel Conditioner (winter) at 5°C (40°F) to treat biodiesel fuels during the cold weather season. Below 0°C (32°F) John Deere requires the use of B5 or lower blends. Below -10°C (14°F) John Deere requires the use of winter blend diesel fuel.

Winterfronts

Use of fabric, cardboard, or solid winterfronts is not recommended with any John Deere engine. Their use can result in excessive engine coolant, oil, and charge air temperatures. This can lead to reduced engine life, loss of power and poor fuel economy. Winterfronts may also put abnormal stress on fan and fan drive components potentially causing premature failures.

Continued on next page

If winterfronts are used, they should never totally close off the grill frontal area. Approximately 25% area in the center of the grill should remain open at all times. At no time should the air blockage device be applied directly to the radiator core.

Radiator Shutters

If equipped with a thermostatically controlled radiator shutter system, this system should be regulated in such a way that the shutters are completely open by the time the coolant reaches 93°C (200°F) to prevent excessive intake manifold temperatures. Manually controlled systems are not recommended.

If air-to-air aftercooling is used, the shutters must be completely open by the time the intake manifold air temperature reaches the maximum allowable temperature out of the charge air cooler.

For more information, see your John Deere dealer.

OUOD006,000011E –19–26OCT07–2/2

Diesel Engine Oil

Use oil viscosity based on the expected air temperature range during the period between oil changes.

IMPORTANT: In weather applications:

- **Above 0° C and for continued high load applications 15W-40 oil is recommended**
- **Below 0° C 10W-30 oil is STRONGLY recommended**
- **Below -10° C 10W-30 oil is REQUIRED**

John Deere PLUS-50™ is the preferred premium oil. (John Deere TORQ-GARD SUPREME™ is an acceptable alternative which is also available in 10W-30.)

Oils meeting one of the following specifications are also recommended:

- ACEA Oil Sequence E7
- ACEA Oil Sequence E6

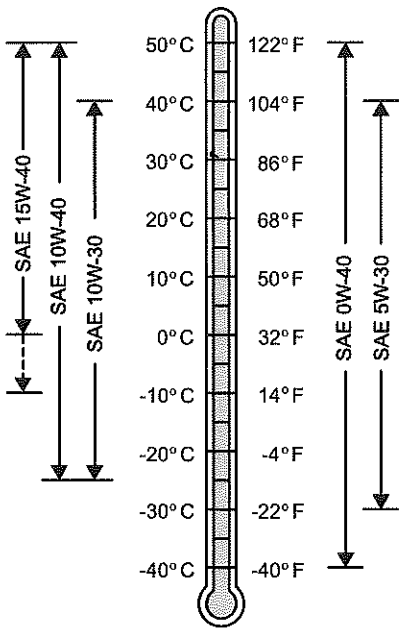
Extended service intervals may apply when John Deere PLUS-50™, ACEA E7, or ACEA E6 engine oils are used. Consult your John Deere dealer for more information.

Other oils may be used if they meet one or more of the following:

- John Deere TORQ-GARD SUPREME™
- API Service Category CJ-4
- API Service Category CI-4 PLUS
- API Service Category CI-4
- ACEA Oil Sequence E5
- ACEA Oil Sequence E4

Multi-viscosity diesel engine oils are preferred.

Diesel fuel quality and fuel sulfur content must comply with all existing emissions regulations for the area in which the engine operates.



Oil Viscosities for Air Temperature Ranges

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TORQ-GARD SUPREME is a trademark of Deere & Company

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DO NOT use diesel fuel with sulfur content greater than
.0% (10 000 ppm).

BK34394,00000DF –19–06MAR08–2/2

Diesel Engine Oil and Filter Service Intervals

The oil and filter service intervals in the table below should be used as guidelines. Actual service intervals also depend on operation and maintenance practices. It is suggested to use oil analysis to determine the actual useful life of the oil and to aid in selection of the proper oil and filter service interval.

Oil and filter service intervals are based on a combination of oil pan capacity, type of engine oil and filter used, and sulfur content of the diesel fuel.

Diesel fuel sulfur level will affect engine oil and filter service intervals. Higher fuel sulfur levels reduce oil and filter service intervals as shown in the table.

- Use of diesel fuel with sulfur content less than 0.10% (1000 ppm) is strongly recommended.
- Use of diesel fuel with sulfur content 0.10% (1000 ppm) to 0.50% (5000 ppm) may result in REDUCED oil and filter change intervals as shown in the table.
- BEFORE using diesel fuel with sulfur content greater than 0.50% (5000 ppm), contact your John Deere dealer.
- DO NOT use diesel fuel with sulfur content greater than 1.00% (10 000 ppm).

IMPORTANT: If using BIODIESEL blends greater than B20, shorten oil change interval to half the recommended service interval or monitor engine oil using OILSCAN to ensure that fuel dilution does not exceed 5%.

Oil types (premium or standard) in the table include:

- "Premium Oils" include John Deere PLUS-50™, ACEA E7, or ACEA E6 oils.
- "Standard Oils" include John Deere TORQ-GARD SUPREME™, API CJ-4, API CI-4 PLUS, API CI-4, ACEA E5, or ACEA E4 oils.

Use of lower specification oils in Tier 3 engines may result in premature engine failure.

NOTE: The 500 hour extended oil and filter change interval is only allowed if all of the following conditions are met:

- *Engine equipped with an extended drain interval oil pan*
- *Use of diesel fuel with sulfur content less than 0.50% (5000 ppm)*
- *Use of premium oil: John Deere PLUS-50, ACEA E7, or ACEA E6*
- *Perform engine oil analysis to determine the actual extended service life of ACEA E7 and ACEA E6 oils*
- *Use of an approved John Deere oil filter*

Refer to the following charts to find the proper oil and filter service interval for your engine.

Using Charts to Find Oil and Filter Service Interval

1. Determine your engine power rating and find it in the left column of chart.
2. Locate your engine oil pan option code (19__) on engine label.
3. In the chart column under your oil pan code, select whether you use premium oil (PLUS-50™, ACEA 7 or ACEA 6) or standard grade oil.
4. Determine the sulfur content of your diesel fuel.
5. Now you can find the proper oil and filter change interval by lining up your power level and fuel sulfur content with oil pan/oil type column. The number indicates how frequently your oil and filter should be changed.

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Example:

Engine Power - 60 kW (80 hp)

- Oil Pan Code - 1902
- Oil Type - Premium
- Oil Filter - John Deere approved
- Fuel Sulfur Level - 0.10-0.20 (1000-2000 ppm)

In the left column of the chart, find 60 kW Power Rating, and select the line for 0.10-0.20 "Fuel Sulfur Content". Move across to column for 1902 "oil pan option code", select "Prem Oil" and read **500** hour oil change interval.

Engine Oil and Filter Service Intervals in Hours of Operation

		Oil Pan Option Codes					
Power Rating	**Fuel Sulfur Content**	**2.4L Engines 1901, 1909, 1911, 1912**		**2.4L Engines 1921, 1924, 1925, 1925**		**3.0L Engines 1902, 1910, 1913, 1914**	
		Interval		**Interval**		**Interval**	
kW (hp)		**Std Oil**	**Prem Oil**	**Std Oil**	**Prem Oil**	**Std Oil**	**Prem Oil**
68-74 (91-99)	Less Than 0.10% (1000 ppm)	250	375	250	375	250	500
	0.10% - 0.20% (1000 - 2000 ppm)	200	300	200	300	250	500
	0.20% - 0.50% (2000 - 5000 ppm)	150	275	150	275	250	500
	0.50% - 1.00% (5000 - 10,000 ppm)	125	187	125	187	125	250
60-65 (80-87)	Less Than 0.10% (1000 ppm)	250	500	250	500	250	500
	0.10% - 0.20% (1000 - 2000 ppm)	200	400	200	400	250	500
	0.20% - 0.50% (2000 - 5000 ppm)	175	350	175	350	250	500
	0.50% - 1.00% (5000 - 10,000 ppm)	125	250	125	250	125	250
45-57 (60-76)	Less Than 0.10% (1000 ppm)	250	500	250	500	250	500
	0.10% - 0.20% (1000 - 2000 ppm)	250	500	250	500	250	500
	0.20% - 0.50% (2000 - 5000 ppm)	250	500	250	500	250	500
	0.50% - 1.00% (5000 - 10,000 ppm)	125	250	125	250	125	250
Use of premium oil also requires use of an approved John Deere oil filter.							

OUOD006,00000FE –19–04OCT07–2/2

Mixing of Lubricants

In general, avoid mixing different brands or types of oil. Oil manufacturers blend additives in their oils to meet certain specifications and performance requirements.

Mixing different oils can interfere with the proper functioning of these additives and degrade lubricant performance.

Consult your John Deere dealer to obtain specific information and recommendations.

DX,LUBMIX –19–18MAR96–1/1

Oil Filters

Filtration of oils is critical to proper operation and lubrication.

Always change filters regularly as specified in this manual.

Use filters meeting John Deere performance specifications.

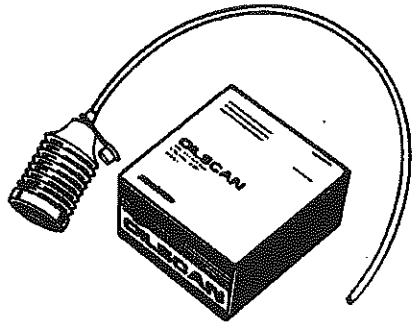
DX,FILT –19–18MAR96–1/1

OILSCAN™ and COOLSCAN™

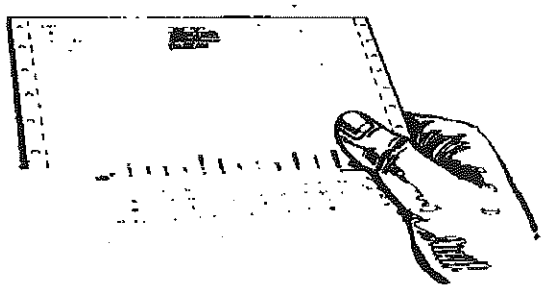
OILSCAN™ and COOLSCAN™ are John Deere sampling programs to help you monitor machine performance and identify potential problems before they cause serious damage.

Oil and coolant samples should be taken from each system prior to its recommended change interval.

Check with your John Deere dealer for the availability of OILSCAN™ and COOLSCAN™ kits.



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T6829AB –UN–18OCT88

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COOLSCAN is a trademark of Deere & Company.

DX,OILSCAN –19–02DEC02–1/1

Alternative and Synthetic Lubricants

Conditions in certain geographical areas may require lubricant recommendations different from those printed in this manual.

Some John Deere brand coolants and lubricants may not be available in your location.

Consult your John Deere dealer to obtain information and recommendations.

Synthetic lubricants may be used if they meet the performance requirements as shown in this manual.

The temperature limits and service intervals shown in this manual apply to both conventional and synthetic oils.

Re-refined base stock products may be used if the finished lubricant meets the performance requirements.

DX,ALTER -19-15JUN00-1/1

Lubricant Storage

Your equipment can operate at top efficiency only when clean lubricants are used.

Use clean containers to handle all lubricants.

Whenever possible, store lubricants and containers in an area protected from dust, moisture, and other contamination. Store containers on their side to avoid water and dirt accumulation.

Make certain that all containers are properly marked to identify their contents.

Properly dispose of all old containers and any residual lubricant they may contain.

DX,LUBST -19-18MAR96-1/1

Grease

Use grease based on NLGI consistency numbers and the expected air temperature range during the service interval.

John Deere SD POLYUREA GREASE is preferred.

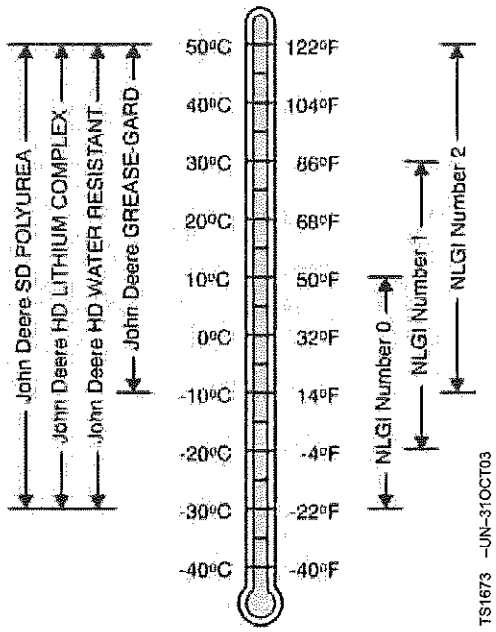
The following greases are also recommended

- John Deere HD LITHIUM COMPLEX GREASE
- John Deere HD WATER RESISTANT GREASE
- John Deere GREASE-GARD™

Other greases may be used if they meet the following:

NLGI Performance Classification GC-LB

IMPORTANT: Some types of grease thickeners are not compatible with others. Consult your grease supplier before mixing different types of grease.



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DX,GREA1 –19–07NOV03–1/1

Diesel Engine Coolant

he engine cooling system is filled to provide year-round protection against corrosion and cylinder liner pitting, and winter freeze protection to -37°C (-34°F). If protection at lower temperatures is required, consult your John Deere dealer for recommendations.

John Deere COOL-GARD™ Prediluted Coolant is preferred for service.

John Deere COOL-GARD Prediluted Coolant is available in a concentration of either 50% ethylene glycol or 55% propylene glycol.

Additional recommended coolants

The following engine coolant is also recommended:

- John Deere COOL-GARD Coolant Concentrate in a 40% to 60% mixture of concentrate with quality water.

John Deere COOL-GARD coolants do not require use of supplemental coolant additives, except for periodic replenishment of additives during the drain interval.

Other fully formulated coolants

Other fully formulated low silicate ethylene or propylene glycol base coolants for heavy-duty engines may be used if they meet one of the following specifications:

- ASTM D6210 prediluted (50%) coolant
- ASTM D6210 coolant concentrate in a 40% to 60% mixture of concentrate with quality water

Coolants meeting ASTM D6210 do not require use of supplemental coolant additives, except for periodic replenishment of additives during the drain interval.

Coolants requiring supplemental coolant additives

Other low silicate ethylene glycol base coolants for heavy-duty engines may also be used if they meet one of the following specifications:

- ASTM D4985 ethylene glycol base prediluted (50%) coolant
- ASTM D4985 ethylene glycol base coolant concentrate in a 40% to 60% mixture of concentrate with quality water

Coolants meeting ASTM D4985 require an initial charge of supplemental coolant additives, formulated for protection of heavy duty diesel engines against corrosion and cylinder liner erosion and pitting. They also require periodic replenishment of additives during the drain interval.

Other coolants

It is possible that neither John Deere COOL-GARD nor coolants meeting one of the coolant standards listed above is available in the geographical area where service is performed. If these coolants are unavailable, use a coolant concentrate or prediluted coolant with a quality additive package that provides cylinder liner cavitation protection and protects the cooling system metals (cast iron, aluminum alloys, and copper alloys such as brass) from corrosion.

The additive package must be part of one of the following coolant mixtures:

- ethylene glycol or propylene glycol base prediluted (40% to 60%) coolant
- ethylene glycol or propylene glycol base coolant concentrate in a 40% to 60% mixture of concentrate with quality water

Water quality

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Continued on next page

Water quality is important to the performance of the cooling system. Distilled, deionized, or demineralized water is recommended for mixing with ethylene glycol and propylene glycol base engine coolant concentrate.

IMPORTANT: Do not use cooling system sealing additives or antifreeze that contains sealing additives.

IMPORTANT: Do not mix ethylene glycol and propylene glycol base coolants.

DX,COOL3 –19–27OCT05–2/2

Drain Intervals for Diesel Engine Coolant

Drain the factory fill engine coolant, flush the cooling system, and refill with new coolant after the first 3 years or 3000 hours of operation.

Subsequent drain intervals are determined by the coolant used for service. At each interval, drain the coolant, flush the cooling system, and refill with new coolant.

When John Deere COOL-GARD™ is used, the drain interval may be extended to 5 years or 5000 hours of operation, provided that the coolant is tested annually AND additives are replenished, as needed, by adding a supplemental coolant additive.

If John Deere COOL-GARD is used but the coolant is not tested OR additives are not replenished by adding a supplemental coolant additive, the drain interval is 3 years or 3000 hours of operation

If COOL-GARD is not used, the drain interval is reduced to 2 years or 2000 hours of operation.

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DX,COOL11 –19–19DEC03–1/1

Additional Information About Diesel Engine Coolants and Supplemental Coolant Additives

Engine coolants are a combination of three chemical components: ethylene glycol or propylene glycol antifreeze, inhibiting coolant additives, and quality water.

Coolant specifications

Some products, including John Deere COOL-GARD™ Prediluted Coolant, are fully formulated coolants that contain all three components in their correct concentrations. Do not add an initial charge of supplemental coolant additives to these fully formulated products.

Coolants meeting ASTM D6210 do not require an initial charge of supplemental coolant additives.

Some coolant concentrates, including John Deere COOL-GARD Coolant Concentrate, contain both glycol antifreeze and inhibiting coolant additives. Mix these products with quality water, but do not add an initial charge of supplemental coolant additives.

Coolants meeting ASTM D4985 require an initial charge of supplemental coolant additives.

Replenish coolant additives

The concentration of coolant additives is gradually depleted during engine operation. Periodic replenishment of inhibitors is required, even when John Deere COOL-GARD or another fully formulated coolant is used. Follow the recommendations in this manual for the use of supplemental coolant additives.

Why use supplemental coolant additives?

Operating without proper coolant additives will result in increased corrosion, cylinder liner erosion and pitting, and other damage to the engine and cooling system. A simple mixture of ethylene glycol or propylene glycol and water will not give adequate protection.

Use of supplemental coolant additives reduces corrosion, erosion, and pitting. These chemicals reduce the number of vapor bubbles in the coolant and help form a protective film on cylinder liner surfaces. This film acts as a barrier against the harmful effects of collapsing vapor bubbles.

Avoid automotive-type coolants

Never use automotive-type coolants (such as those meeting ASTM D3306). These coolants do not contain the correct additives to protect heavy-duty diesel engines. They often contain a high concentration of silicates and may damage the engine or cooling system.

Water quality

Water quality is important to the performance of the cooling system. Distilled, deionized, or demineralized water is recommended for mixing with ethylene glycol and propylene glycol base engine coolant concentrate. All water used in the cooling system should meet the following minimum specifications for quality:

Chlorides	<40 mg/L
Sulfates	<100 mg/L
Total dissolved solids	<340 mg/L
Total hardness	<170 mg/L
pH	5.5 to 9.0

Freeze protection

The relative concentrations of glycol and water in the engine coolant determine its freeze protection limit.

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Continued on next page

Ethylene Glycol	Freeze Protection Limit
40%	-24°C (-12°F)
50%	-37°C (-34°F)
60%	-52°C (-62°F)
Propylene Glycol	**Freeze Protection Limit**
40%	-21°C (-6°F)
50%	-33°C (-27°F)
60%	-49°C (-56°F)

DO NOT use a coolant-water mixture greater than 60% ethylene glycol or 60% propylene glycol.

DX,COOL7 –19–19DEC03–2/2

Supplemental Coolant Additives

The concentration of coolant additives is gradually depleted during engine operation. For all recommended coolants, replenish additives between drain intervals by adding a supplemental coolant additive every 12 months or as determined necessary by coolant testing.

John Deere COOLANT CONDITIONER is recommended as a supplemental coolant additive in John Deere engines.

IMPORTANT: Do not add a supplemental coolant additive when the cooling system is drained and refilled with John DeereCOOL-GARD™.

If other coolants are used, consult the coolant supplier and follow the manufacturer's recommendation for use of supplemental coolant additives.

The use of non-recommended supplemental coolant additives may result in additive drop-out and gelation of the coolant.

Add the manufacturer's recommended concentration of supplemental coolant additive. DO NOT add more than the recommended amount.

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DX,COOL4 –19–07NOV03–1/1

Testing Diesel Engine Coolant

esting Diesel Engine Coolant

Maintaining adequate concentrations of glycol and inhibiting additives in the coolant is critical to protect the engine and cooling system against freezing, corrosion, and cylinder liner erosion and pitting.

Test the coolant solution at intervals of 12 months or less and whenever excessive coolant is lost through leaks or overheating.

Coolant test strips

Coolant test strips are available from your John Deere dealer. These test strips provide a simple, effective method to check the freeze point and additive levels of your engine coolant.

Compare the results to the supplemental coolant additive (SCA) chart to determine the amount of inhibiting additives in your coolant and whether more John Deere COOLANT CONDITIONER should be added.

COOLSCAN™ and COOLSCAN PLUS™

For a more thorough evaluation of your coolant, perform a COOLSCAN or COOLSCAN PLUS analysis, where available. See your John Deere dealer for information.

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COOLSCAN PLUS is a trademark of Deere & Company

DX,COOL9 –19–19DEC03–1/1

perating in Warm Temperature Climates

John Deere engines are designed to operate using glycol base engine coolants.

Always use a recommended glycol base engine coolant, even when operating in geographical areas where freeze protection is not required.

IMPORTANT: Water may be used as coolant *in emergency situations only.*

Foaming, hot surface aluminum and iron corrosion, scaling, and cavitation will occur when water is used as the coolant, even when coolant conditioners are added.

Drain cooling system and refill with recommended glycol base engine coolant as soon as possible.

DX,COOL6 –19–18MAR96–1/1

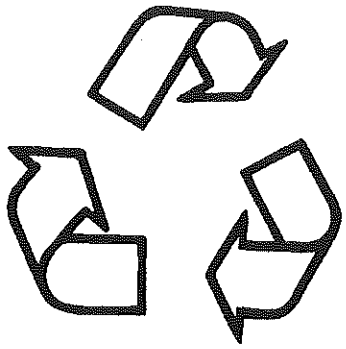
Disposing of Coolant

Improperly disposing of engine coolant can threaten the environment and ecology.

Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

Do not pour waste onto the ground, down a drain, or into any water source.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere engine distributor or servicing dealer.

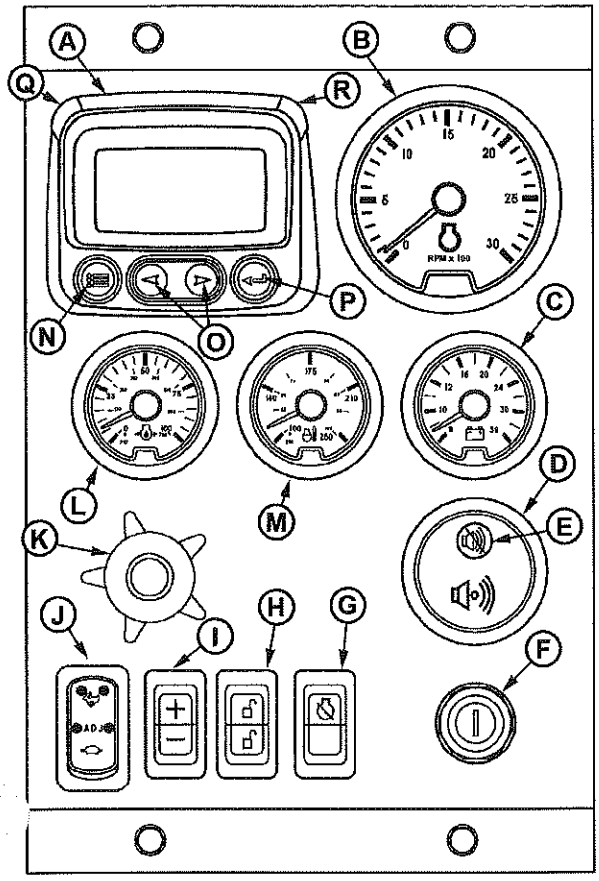


TS1133 –UN–26NOV90

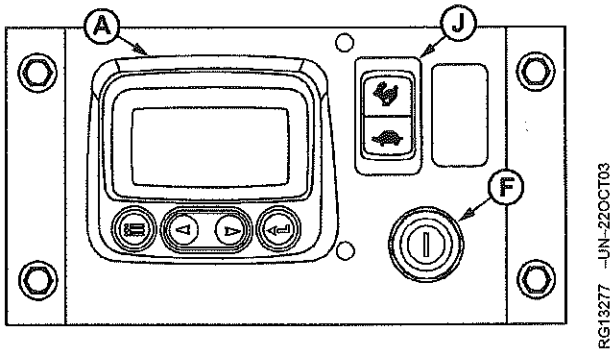
Recycle Waste

RG,RG34710,7543 –19–09JAN07–1/1

Instrument Panels



Full-Featured Instrument Panel



Basic Instrument Panel

A—Diagnostic Gauge/Hour Meter
B—Tachometer
C—Voltmeter (Optional)
D—Audible Alarm (Optional)
E—Audible Alarm Override Button
F—Key Switch
G—Override Shutdown Rocker Switch
H—Bump Enable Rocker Switch
I—Speed Select Rocker Switch
J—High-Low Speed Select Rocker Switch
K—Analog Throttle Control (Optional)
L—Oil Pressure Gauge
M—Coolant Temperature Gauge
N—Menu Key
O—Arrow Keys
P—Enter Key
Q—Amber "WARNING" Indicator Light
R—Red "STOP ENGINE" Indicator Light

John Deere ***POWERTECH***™ OEM Engines have an electronic control system, which has the following controls and gauges as shown. The following information applies only to those controls and gauges supplied by John Deere. Refer to your engine application manual for specific guidelines if John Deere-sourced controls and instrumentation are not used.

Following is a brief description of the available optional electronic controls and gauges found on John Deere provided instrument panels. Refer to manufacturer's literature for information on controls not provided by Deere.

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Continued on next page

Instrument Panel (Continued)

A—Diagnostic Gauge/Hour Meter

The diagnostic gauge (A) displays diagnostic trouble codes (DTCs) as they are accessed. Other information on the engine can be accessed using the touch keys (N, O and P). The hour meter feature shows the operating hours of the engine and should be used as a guide for scheduling periodic maintenance. If the diagnostic gauge receives a trouble code from an engine control unit, the current display will switch to a warning or shutdown (depending on the severity of the code) screen that will display the trouble code number, the description of the code and the corrective action needed.

B—Tachometer

The tachometer (B) indicates engine speed in hundreds of revolutions per minute (rpm).

C—Voltmeter (Optional)

The voltmeter (C) indicates system battery voltage. The amber "Warning" light (Q) will illuminate when battery voltage is too low for proper operation of the fuel injection system.

D—Audible Alarm (Optional)

The audible alarm (D) will sound whenever low oil pressure, high coolant temperature, or water-in-fuel conditions exist. This includes all signals that light up the amber "warning" indicator (intermittent alarm) or the red "stop engine" indicator (steady alarm).

E—Audible Alarm Override Button

The optional audible alarm has an override button (E) that silences the audible alarm for approximately two minutes when pressed.

F—Key Start Switch

The three-position key start switch (F) controls the engine electrical system. When the key switch is turned clockwise to "START", the engine will crank. When the engine starts, the key is released and returns to the "ON" (RUN) position.

G—Override Shutdown Rocker Switch

Switch will be present, but may not be active, depending on engine controller (ECU) options originally selected. If switch is active, pressing the upper half of the override shutdown switch (G) will override an engine shutdown signal. The switch must be pressed within 30 seconds to prevent undesired shutdown of engine. Pressing this switch will override the engine shutdown for 30 seconds at a time to move vehicle to a safe location.

H—Bump Speed Enable Rocker Switch

This is a three-position switch (H) with the center position as "OFF" (locked). With this switch in the "OFF" position, the speed select switch (I) is also locked, to prevent accidental changes in operating speed. Pressing upper or lower half of switch (H) will unlock or enable the bump speed switch to take effect using speed select switch (I).

I—Speed Select Rocker Switch

The speed select switch (I) is used to bump engine speed up (+) or down (-) in small increments during operation. This switch must be used with the bump speed enable switch (H) in the unlocked position (top or bottom half of button depressed).

J—High-Low Speed Select Rocker Switch

The high-low speed select switch (J) is used to set the engine operating speeds at slow (turtle) or fast (rabbit). Factory preset idle speeds can also be adjusted using bump speed enable switch (H) with speed select switch (I).

The basic instrument panel will have the high-low speed select switch only. Press and hold up (+) or down (-) to adjust engine speed as desired. The engine speed selected will not be held in the memory. To adjust engine speeds, See Changing Engine Speeds in Section 20.

Continued on next page

How To Select Preset Operating Speeds (Bump Speeds)

First select Turtle (Slow) or Adj by pressing speed select switch (J) to "Turtle" (slow) or "Adj"(center). Then you can press either the upper or lower portion of the bump speed enable switch (H) to unlock the setting. The bump speed enable must be held down as the speed select switch (J) is used to change the setting by pressing (+) to increase speed or (-) to decrease speed.

Once the slow idle speed has been set, the bump speed enable **switch must be pressed and released three times within two seconds to commit the new operating speed to memory.** If not done, the engine's new speed will only be effective until the key switch is shut off. Then the speed will revert back to the previous setting.

The fast idle speed is not adjustable. It will always go back to the factory preset fast idle speed.

K—Analog Throttle Control (Optional)

The throttle control (K) is used to control engine speed. This control is available only on engines with analog throttle.

L—Engine Oil Pressure Gauge

The oil pressure gauge (L) indicates engine oil pressure. An audible alarm (D) warns the operator if engine oil pressure falls below a safe operating pressure.

M—Engine Coolant Temperature Gauge

The engine coolant temperature gauge (M) indicates engine coolant temperature. An audible alarm (D) warns the operator if coolant temperature rises above the preset safe operating temperature.

N—Menu Key

The menu key is pressed to either enter or exit the menu screens on the diagnostic gauge.

O—Arrow Keys

Use the arrow keys (O) to change the display on the window of the diagnostic gauge and to access engine performance data.

Pressing the left arrow to scroll to the left or upward or the right arrow to scroll to the right or downward. This will allow you to view various engine parameters and any diagnostic trouble codes that occur.

Refer to the following story for accessing engine information on the diagnostic gauge using the touch keys.

P—Enter Key

The enter key is pressed to select the parameter that is highlighted on the screen.

Q—Amber "WARNING" Indicator Light

When light comes on, an abnormal condition exists. It is not necessary to shutdown engine immediately, but problem should be corrected as soon as possible.

R—Red "STOP ENGINE" Indicator Light

When light comes on, stop engine immediately or as soon as safely possible to prevent engine damage. Correct problem before restarting.

Using Diagnostic Gauge to Access Engine Information

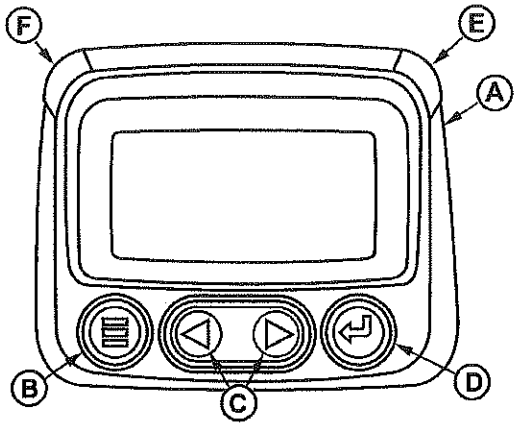
The diagnostic gauge (A) allows the operator to view many readouts of engine functions and trouble codes (DTCs). The gauge is linked to the electronic control system and its sensors. This allows the operator to monitor engine functions and to troubleshoot the engine systems when needed.

Press the menu key (B) to access the various engine functions in sequence. The displays can be selected as either customary English or metric units. The following menu of engine parameters can be displayed on the diagnostic gauge window:

- Engine hours
- Engine rpm
- System voltage
- Percent engine load at the current rpm
- Coolant temperature
- Oil pressure
- Throttle position
- Intake manifold temperature
- Current fuel consumption
- Active service (diagnostic) codes
- Stored service (diagnostic) codes from the engine
- Set the units for display
- View the engine configuration parameters

NOTE: Engine parameters which can be accessed will vary with the engine application. Six languages for readouts are available and can be selected during setup of gauge.

The diagnostic gauge includes a graphical backlit Liquid Crystal Display (LCD) screen. The display can show either a single parameter or a quadrant display showing four parameters simultaneously. The diagnostic gauge uses two arrow keys (C) for scrolling through the engine parameter list and viewing the menu list and an enter key (D) for selecting highlighted items. The red (E) and amber (F) lights are used to signal active trouble code received by the diagnostic gauge.



RG13132 –UN–09SEP03

Diagnostic Gauge (Later Engines)

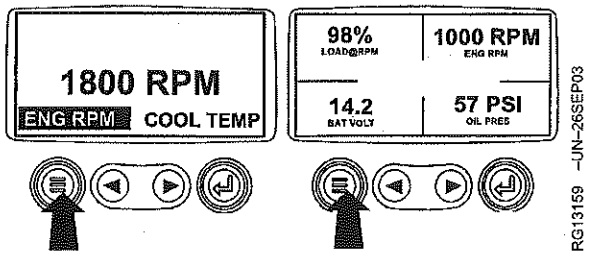
A—Diagnostic Gauge
B—Menu Key
C—Arrow Keys
D—Enter Key
E—Red "STOP ENGINE" Indicator Light
F—Amber "WARNING" Indicator Light

OURGP11,0000074 –19–31JAN06–1/1

Main Menu Navigation

OTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

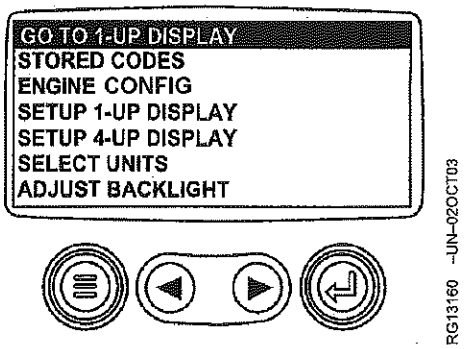
1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.



Menu Key

OURGP11,00000A9 –19–03SEP03–1/5

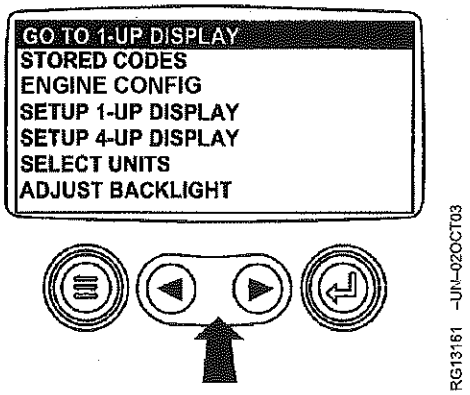
2. The first seven items of the "Main Menu" will be displayed.



Menu Display

OURGP11,00000A9 –19–03SEP03–2/5

3. Pressing the "Arrow" keys will scroll through the menu selections.

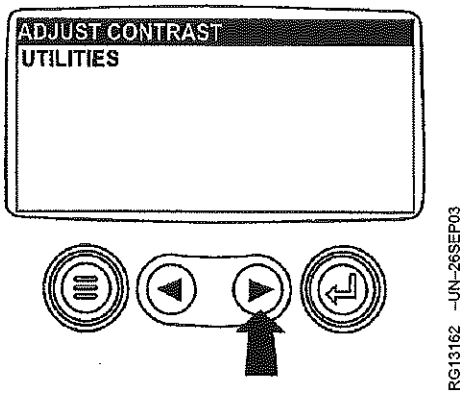


Main Menu Items

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OURGP11,00000A9 –19–03SEP03–3/5

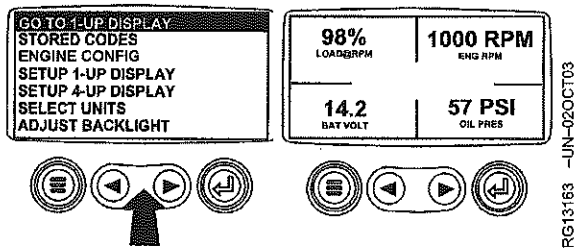
4. Pressing the right arrow key will scroll down to reveal the last items of "Main Menu" screen, highlighting the next item down.



Last Items On Main Menu

OURGP11,00000A9 –19–03SEP03–4/5

5. Use the arrow keys to scroll to the desired menu item or press the "Menu Button" to exit the main menu and return to the engine parameter display.



Use Arrow Buttons To Scroll / Quadrant Display

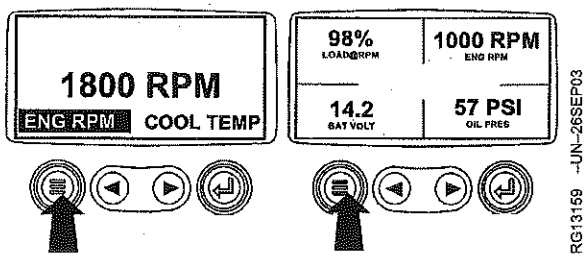
OURGP11,00000A9 –19–03SEP03–5/5

Engine Configuration Data

NOTE: The engine configuration data is a read only function.

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

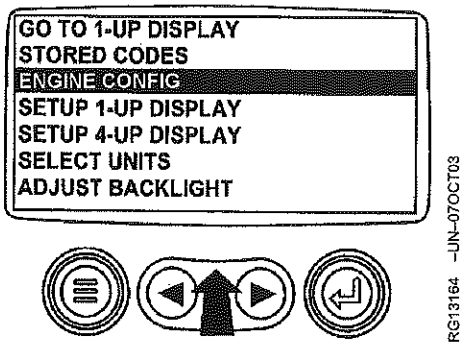


Menu Key

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OURGP11,00000AB –19–03SEP03–1/6

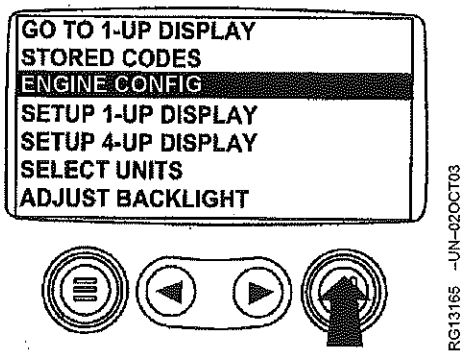
2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Engine Config" is highlighted.



Select Engine Configuration

OURGP11,00000AB –19–03SEP03–2/6

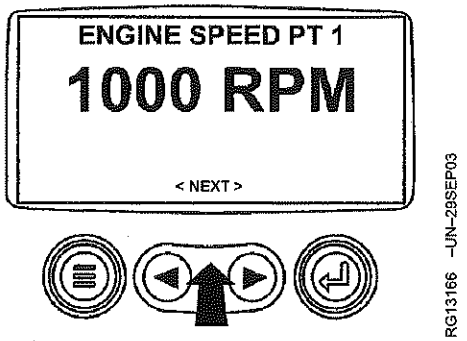
3. Once "Engine Config" menu item has been highlighted, press the "Enter" key to view the engine configuration data.



Enter Key

OURGP11,00000AB –19–03SEP03–3/6

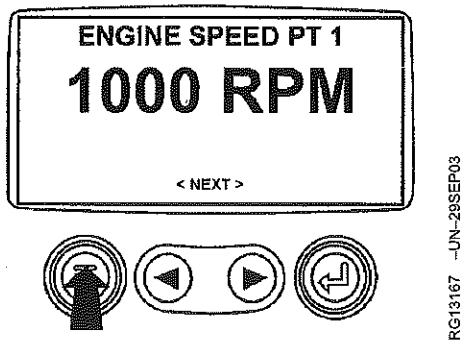
Use the "Arrow" keys to scroll through the engine configuration data.



Use Arrow Keys To Scroll

OURGP11,00000AB –19–03SEP03–4/6

5. Press the "Menu" key to return to the main menu.

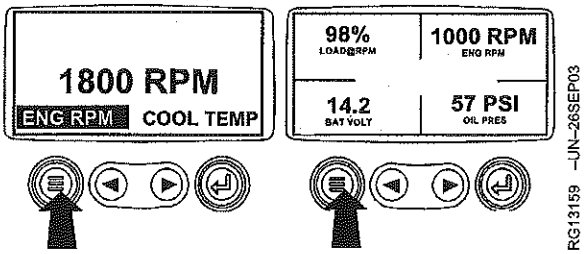


Return To Main Menu

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OURGP11,00000AB –19–03SEP03–5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.



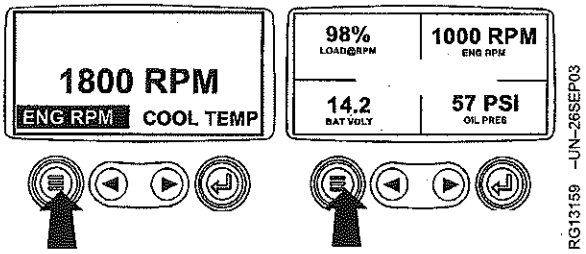
Exit Main Menu

OURGP11,00000AB –19–03SEP03–6/6

Accessing Stored Trouble Codes

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

For description of trouble codes, see chart in Troubleshooting Section.

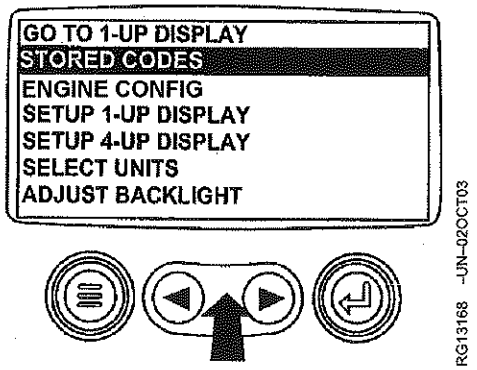


Menu Key

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

OURGP11,00000AC –19–03SEP03–1/6

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Stored Codes" is highlighted.

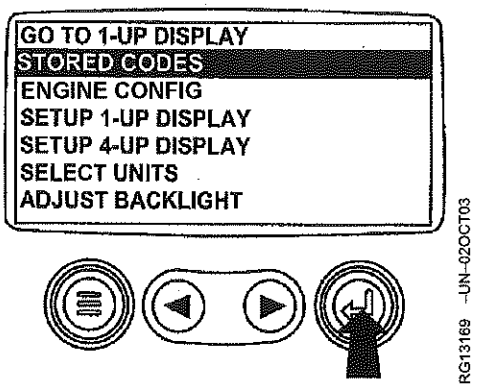


Select Stored Codes

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OURGP11,00000AC –19–03SEP03–2/6

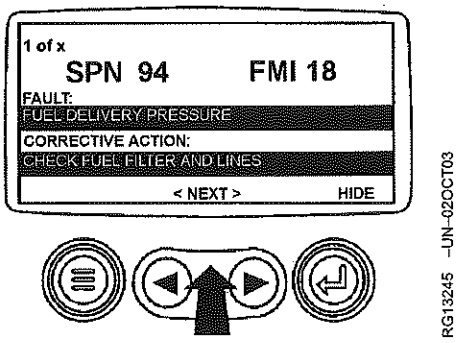
3. Once the "Stored Codes" menu item has been highlighted press the "Enter" key to view the stored codes.



Enter Key

OURGP11,00000AC –19–03SEP03–3/6

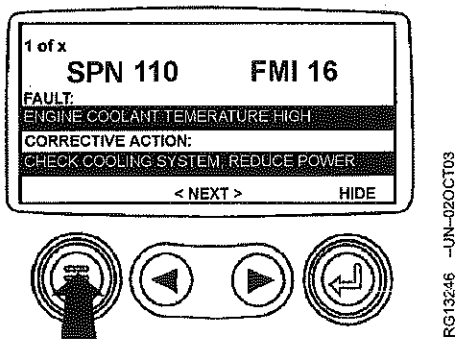
4. If the word "Next" appears above the "Arrow" keys, there are more stored codes that may be viewed. Use the "Arrow" key to scroll to the next stored code.



Use Arrow Keys To Scroll

OURGP11,00000AC –19–03SEP03–4/6

5. Press the "Menu" key to return to the main menu.

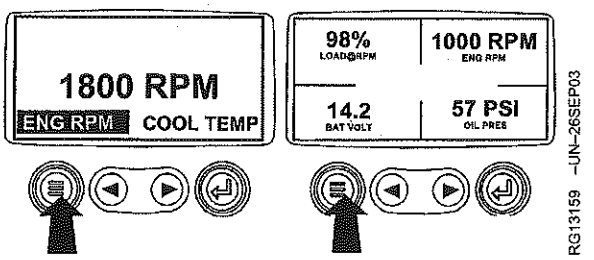


Return To Main Menu

Continued on next page

OURGP11,00000AC –19–03SEP03–5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.



Exit Main Menu

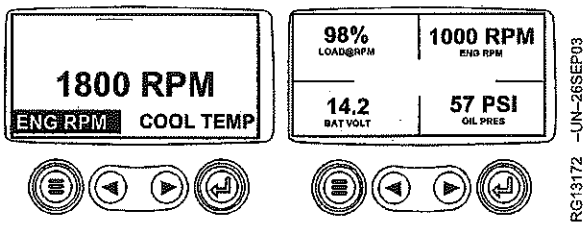
OURGP11,00000AC –19–03SEP03–6/6

Accessing Active Trouble Codes

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

For description of trouble codes, see chart in Troubleshooting Section.

1. During normal operation the single or four parameter screen will be displayed.

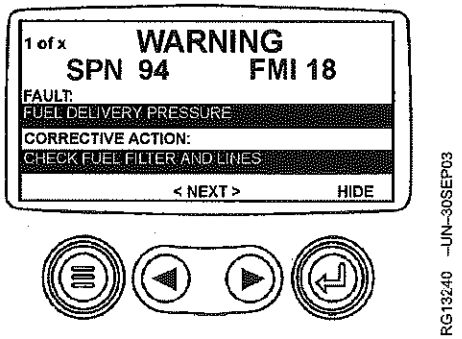


Normal Operation

OURGP11,00000AD –19–03SEP03–1/7

2. When the diagnostic gauge receives a trouble code from an engine control unit, the single or four parameter screen will be replaced with the "Warning" message. The SPN and FMI number will be displayed along with a description of the problem and the corrective action needed.

IMPORTANT: Ignoring active trouble codes can result in severe engine damage.

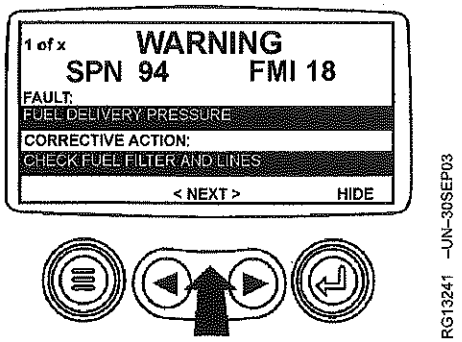


Active Trouble Codes Displayed

Continued on next page

OURGP11,00000AD –19–03SEP03–2/7

3. If the word "Next" appears above the arrow keys, there are more trouble codes that can be viewed by using the arrow keys to scroll to the next trouble code.

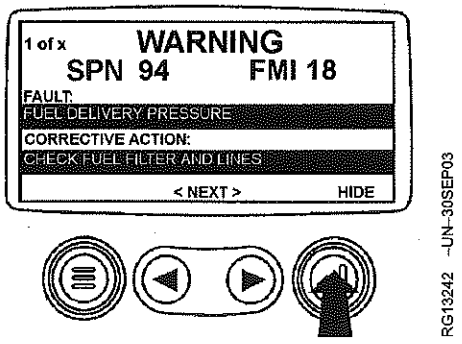


Use Arrow Keys To Scroll

OURGP11,00000AD –19–03SEP03–3/7

IMPORTANT: Ignoring active trouble codes can result in severe engine damage.

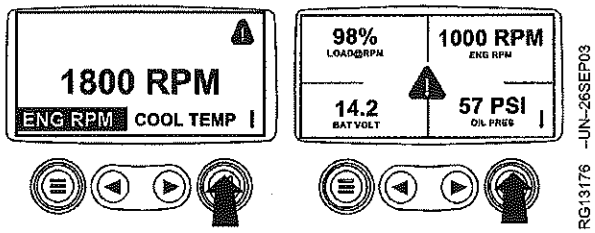
4. To acknowledge and hide the code and return to the single or four parameter display, press the "Enter" Key.



Hide Trouble Codes

OURGP11,00000AD –19–03SEP03–4/7

The display will return to the single or four parameter display, but the display will contain the warning icon. Pressing the "Enter" key will redisplay the hidden trouble code.

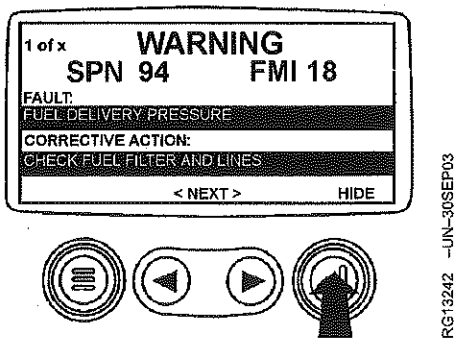


Active Trouble Code Icon

OURGP11,00000AD –19–03SEP03–5/7

IMPORTANT: Ignoring active trouble codes can result in severe engine damage.

6. Pressing the "Enter" key once again will hide the trouble code and return the screen to the single or four parameter display.

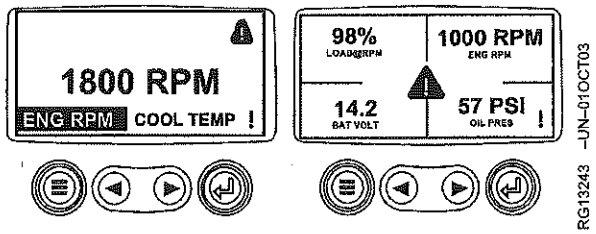


Enter Key

Continued on next page

OURGP11,00000AD –19–03SEP03–6/7

7. The single or four parameter screen will display the warning icon until the trouble code condition is corrected.

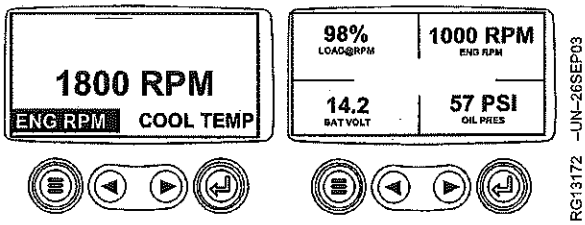


Active Trouble Code Condition

OURGP11,00000AD –19–03SEP03–7/7

Engine Shutdown Codes

1. During normal operation the single or four parameter screen will be displayed.

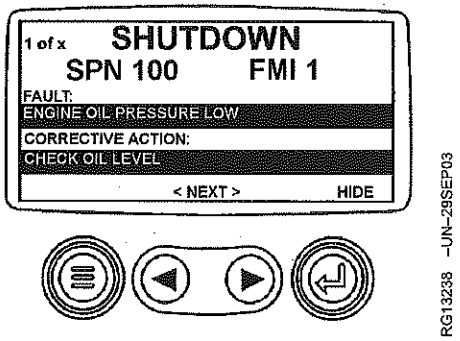


Normal Operation

OURGP11,00000AE –19–03SEP03–1/6

2. When the diagnostic gauge receives a severe trouble code from an engine control unit, the single or four parameter screen will be replaced with the "Shutdown" message. The SPN and FMI number will be displayed along with a description of the problem and the corrective action needed.

   If the word "Next" appears above the arrow keys, there are more trouble codes that can be viewed by using the arrow keys to scroll to the next trouble code.

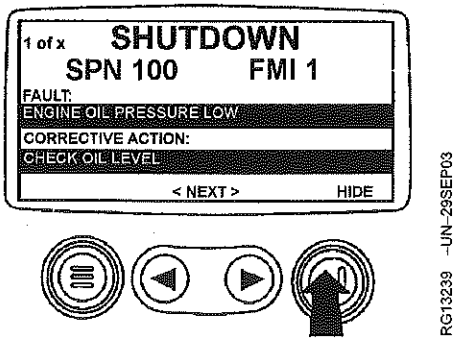


Shutdown Message

OURGP11,00000AE –19–03SEP03–2/6

3. To acknowledge and hide the trouble code and return to the single or four parameter display, press the "Enter" key".

IMPORTANT: Ignoring the shutdown message can result in severe engine damage.



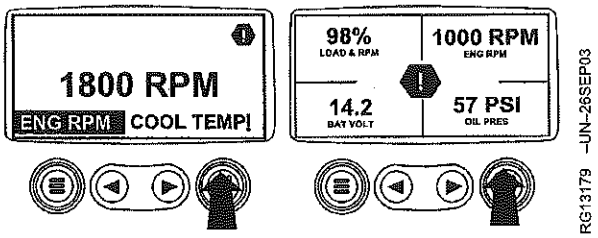
Hide Trouble Code

Continued on next page

OURGP11,00000AE –19–03SEP03–3/6

4. The display will return to the single or four parameter display, but the display will contain the "Shutdown" icon. Pressing the "Enter" key will redisplay the hidden trouble code.

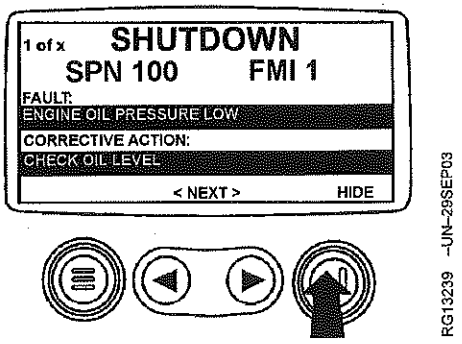
IMPORTANT: Ignoring the shutdown message can result in severe engine damage.



Flashing Shutdown Icon

OURGP11,00000AE –19–03SEP03–4/6

5. Pressing the "Enter" key once again will hide the trouble code and return the screen to the single or four parameter display.

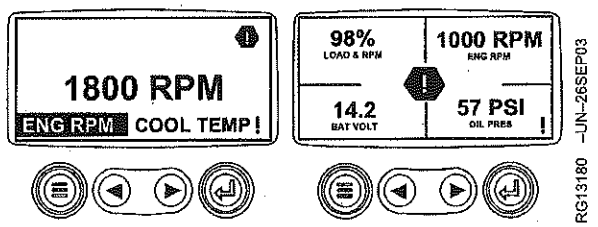


Redisplay Trouble Code

OURGP11,00000AE –19–03SEP03–5/6

The single or four parameter screen will display the shutdown icon until the trouble code condition is corrected.

IMPORTANT: Ignoring the shutdown message can result in severe engine damage.

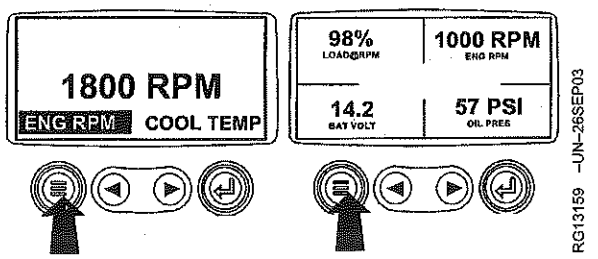


Shutdown Icon

OURGP11,00000AE –19–03SEP03–6/6

Adjusting Backlighting

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

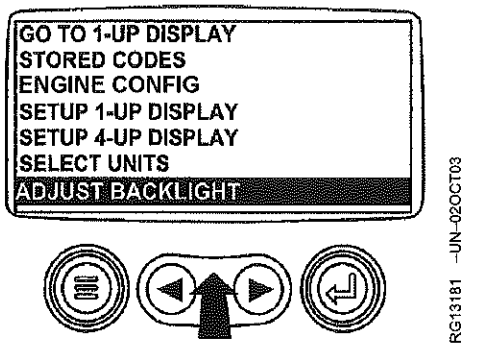


Menu Key

Continued on next page

OURGP11,0000237 –19–21OCT03–1/6

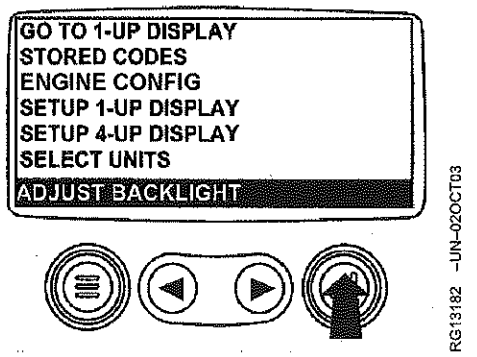
2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Adjust Backlight" is highlighted.



Select Adjust Backlight

OURGP11,0000237 –19–21OCT03–2/6

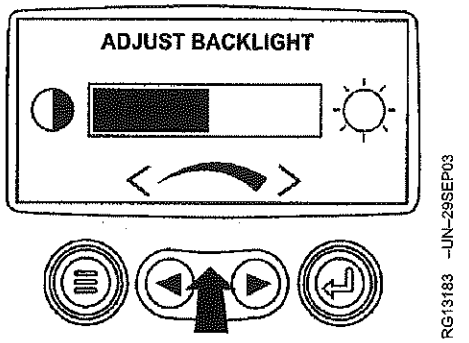
3. Once the "Adjust Backlight" menu item has been highlighted, press the "Enter" key to activate the "Adjust Backlight" function.



Press Enter Key

OURGP11,0000237 –19–21OCT03–3/6

4. Use the "Arrow" keys to select the desired backlight intensity.

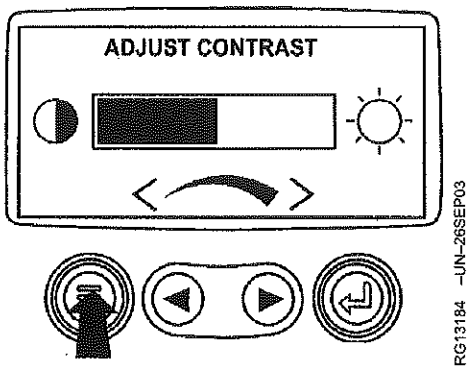


Adjust Backlight Intensity

Continued on next page

OURGP11,0000237 –19–21OCT03–4/6

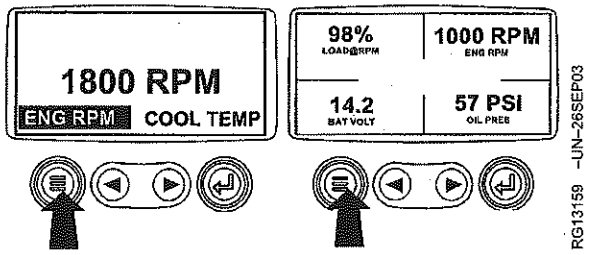
5. Press the "Menu" key to return to the main menu.



Return To Main Menu

OURGP11,0000237 –19–21OCT03–5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.

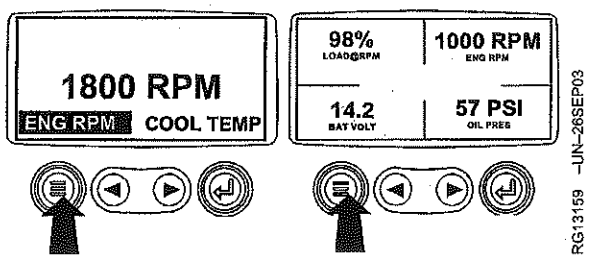


Exit Main Menu

OURGP11,0000237 –19–21OCT03–6/6

Adjusting Contrast

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display press the "Menu" key.

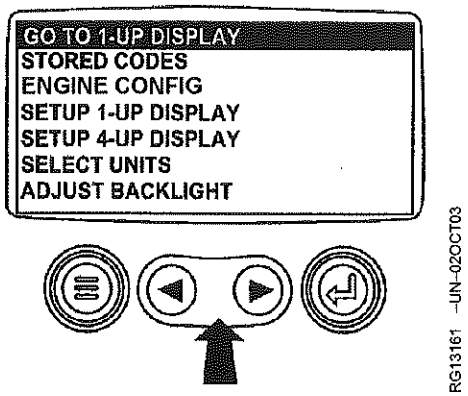


Menu Key

Continued on next page

OURGP11,00000AF –19–03SEP03–1/6

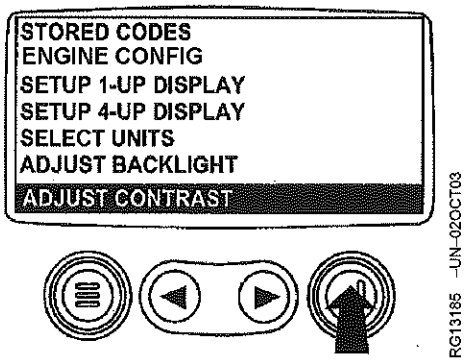
2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Adjust Contrast" is highlighted.



Select Adjust Contrast

OURGP11,00000AF –19–03SEP03–2/6

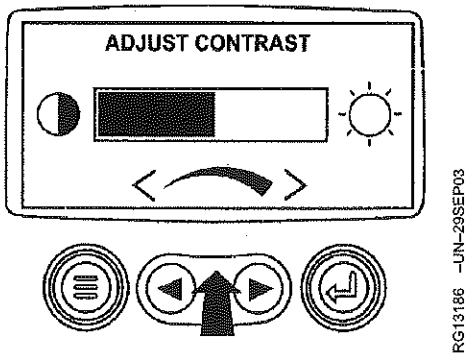
3. Once the "Adjust Contrast" menu item has been highlighted, press the "Enter" key to activate the "Adjust Contrast" function.



Press Enter Key

OURGP11,00000AF –19–03SEP03–3/6

4. Use the "Arrow" keys to select the desired contrast intensity.

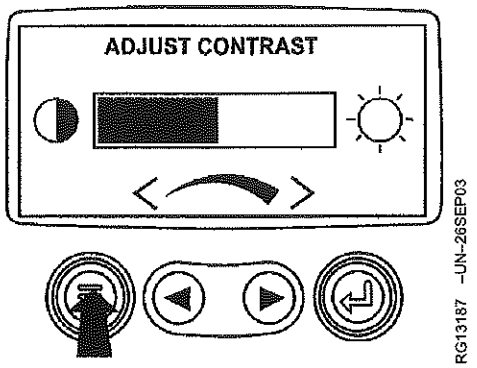


Adjust Contrast Intensity

Continued on next page

OURGP11,00000AF –19–03SEP03–4/6

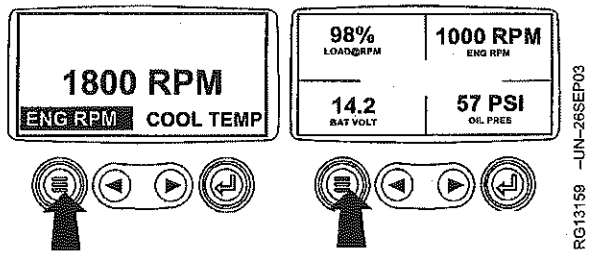
5. Press the "Menu" key to return to the main menu.



Return To Main Menu

OURGP11,00000AF –19–03SEP03–5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.

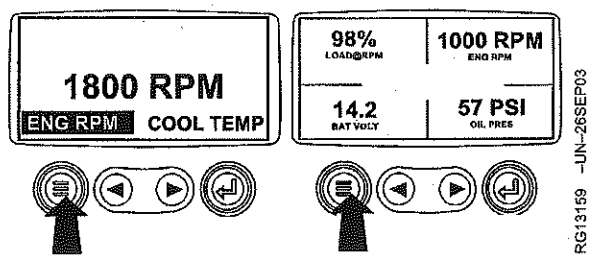


Exit Main Menu

OURGP11,00000AF –19–03SEP03–6/6

Selecting Units Of Measurement

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

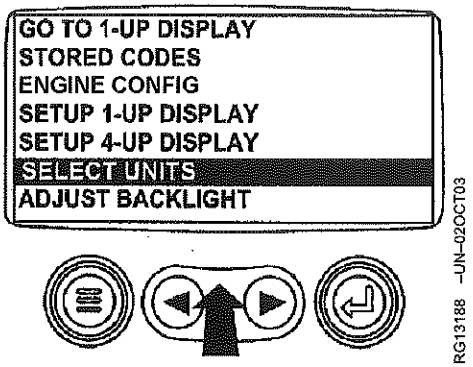


Menu Key

Continued on next page

OURGP11,00000B0 –19–03SEP03–1/7

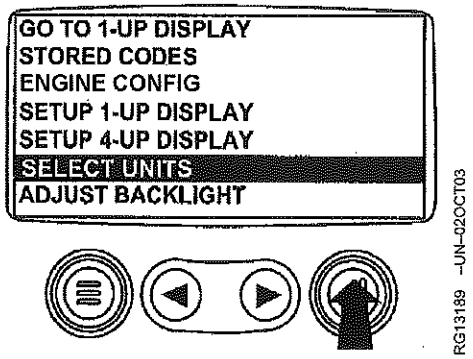
2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Select Units" is highlighted.



Select Units

OURGP11,00000B0 –19–03SEP03–2/7

3. Once the "Select Units" menu item has been highlighted press the "Enter" key to access the "Select Units" function.



Press Enter Key

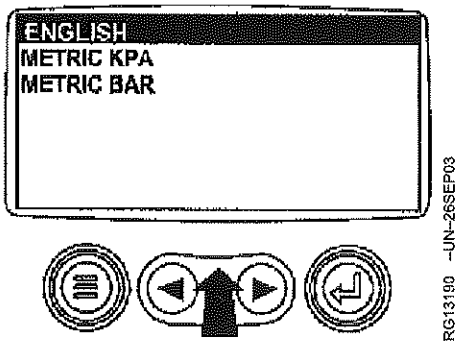
OURGP11,00000B0 –19–03SEP03–3/7

4. There are three choices for units of measurement, English, Metric kPa or Metric Bar.

   English is for Imperial units, with pressures displayed in PSI and temperatures in °F.

   Metric kPa and Metric bar are for IS units, with pressures displayed in kPa and bar respectively, and temperatures in °C.

   Use the "Arrow" keys to highlight the desired units of measurement.

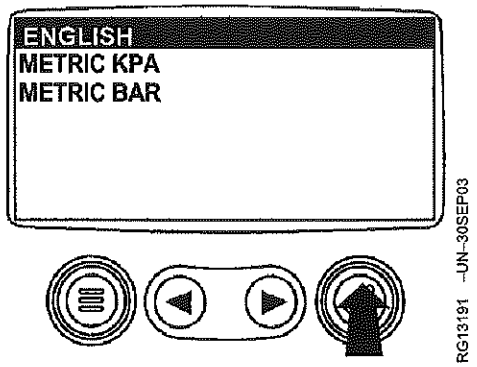


Select Desired Units

Continued on next page

OURGP11,00000B0 –19–03SEP03–4/7

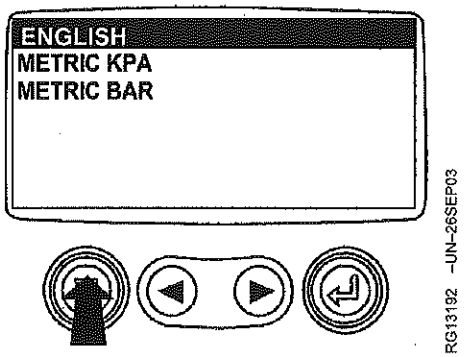
5. Press the "Enter" key to select the highlighted units.



Press Enter Key to Select

OURGP11,00000B0 –19–03SEP03–5/7

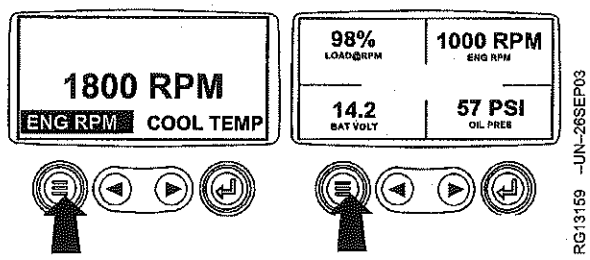
6. Press the "Menu" key to return to the main menu.



Return To Main Menu

OURGP11,00000B0 –19–03SEP03–6/7

7. Press the "Menu" key to return to the engine parameter display.

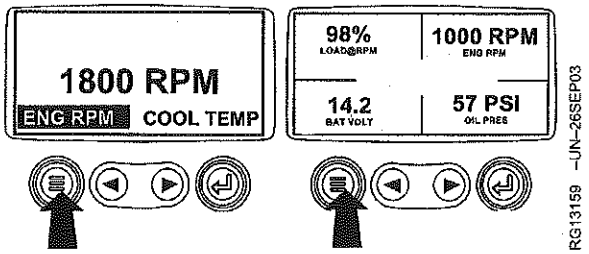


Press Menu Key

OURGP11,00000B0 –19–03SEP03–7/7

Setup 1-Up Display

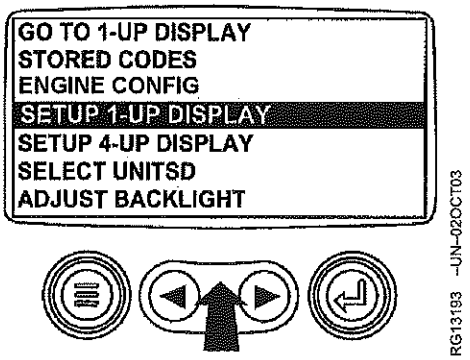
1. Turn the key switch to the ON position. Starting at the single engine parameter display, press the "Menu" key.



Menu Key

OURGP11,00000B1 –19–03SEP03–1/18

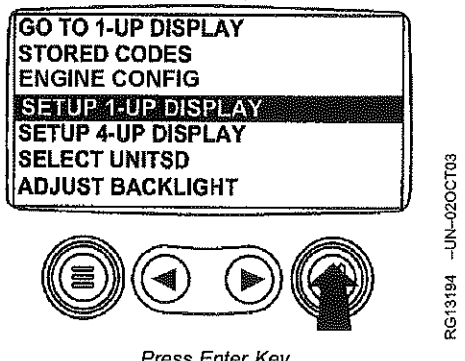
2. Use the "Arrow" keys to scroll through the menu until "Setup 1-Up Display" is highlighted.



Setup 1-Up Display

OURGP11,00000B1 –19–03SEP03–2/18

3. Once "Setup 1-Up Display" menu item has been highlighted press the "Enter" key to access the "Setup 1-Up Display" function.



Press Enter Key

Continued on next page

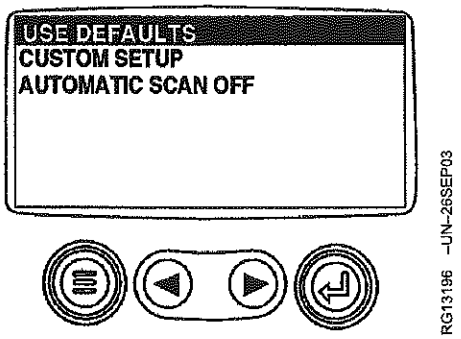
OURGP11,00000B1 –19–03SEP03–3/18

4. Three options are available for modification of the 1-Up Display.

   a. **Use Defaults** – This option contains the following engine parameters for display: Engine Hours, Engine Speed, Battery Voltage, % Load, Coolant Temperature and Oil Pressure.

   b. **Custom Setup** – This option contains a list of engine parameters. Engine parameters from this list can be selected to replace any or all of the default parameters. This option can be used to add parameters available for scrolling in the 1-Up Display.

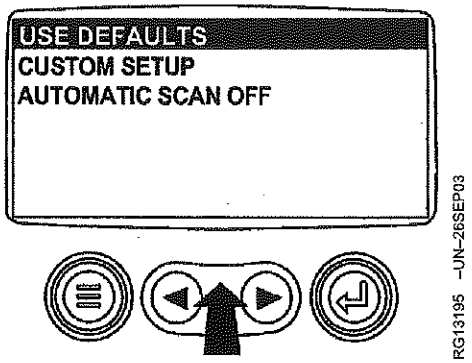
   c. **Automatic Scan** – Selecting the scan function will allow the 1-Up Display to scroll through the selected set of parameters one at a time, momentarily pausing at each.



1-Up Display Options

OURGP11,00000B1 –19–03SEP03–4/18

Use Defaults - To select "Use Defaults" use the Arrow keys to scroll to and highlight "Use Defaults" in the menu display.

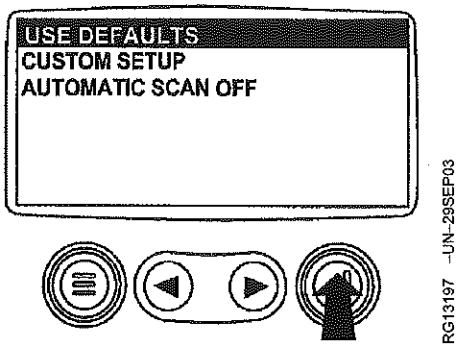


Select Defaults

Continued on next page

OURGP11,00000B1 –19–03SEP03–5/18

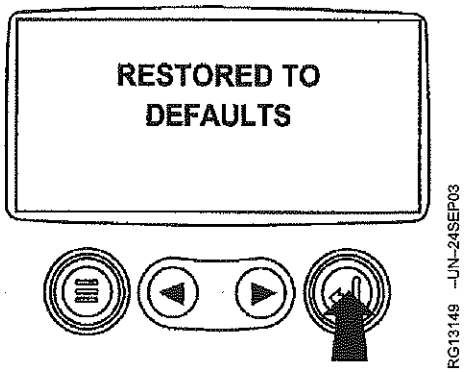
6. Press the "Enter" key to activate the "Use Defaults" function.



Defaults Selected

OURGP11,00000B1 –19–03SEP03–6/18

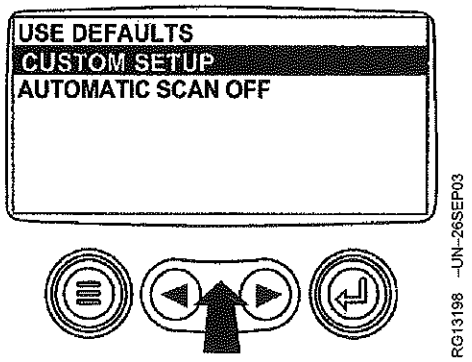
7. The display parameters are reset to the factory defaults, then the display will return to the "Setup 1-Up Display" menu.



Restored To Defaults

OURGP11,00000B1 –19–03SEP03–7/18

8. **Custom Setup** - To perform a custom setup of the 1-Up Display, use the arrow buttons to scroll to and highlight "Custom Setup" on the display.

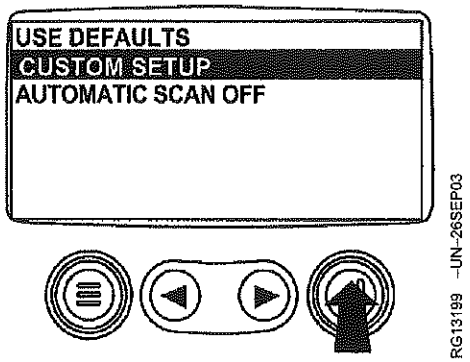


Select Custom Setup

Continued on next page

OURGP11,00000B1 –19–03SEP03–8/18

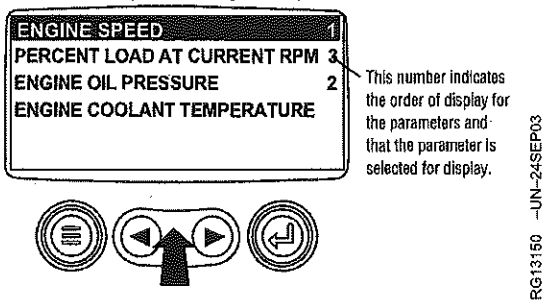
9. Press the "Enter" key to display a list of engine parameters.



Engine Parameters

OURGP11,00000B1 –19–03SEP03–9/18

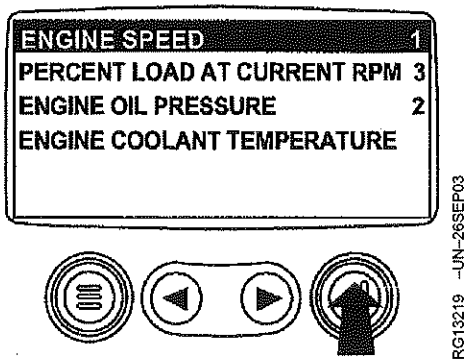
10. Use the "Arrow" keys to scroll to and highlight a selected parameter (parameter with a number to right of it).



Select Parameters

OURGP11,00000B1 –19–03SEP03–10/18

11. Press the "Enter" key to deselect the selected parameter, removing it from the list of parameters being displayed on the 1-Up Display.

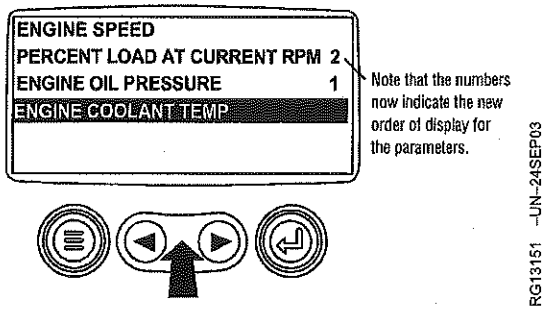


Deselect Parameters

Continued on next page

OURGP11,00000B1 –19–03SEP03–11/18

12. Use the "Arrow" keys to scroll and highlight the desired parameter that has not been selected for display (parameter without a number to right of it).

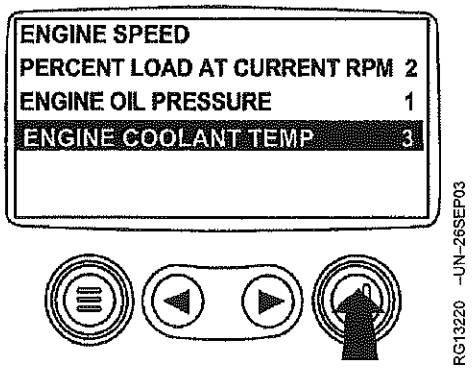


Select Desired Parameters

OURGP11,00000B1 –19–03SEP03–12/18

13. Press the "Enter" key to select the parameter for inclusion in the Single Engine Parameter Display.

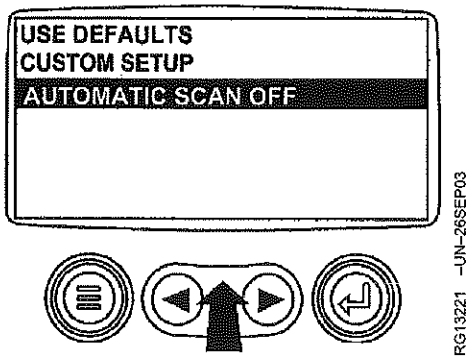
14. Continue to scroll through and select additional parameters for the custom 1-Up Display. Press the "Menu" key at any time to return to the "Custom Setup" menu.



Select Parameters For Display

OURGP11,00000B1 –19–03SEP03–13/18

15. **Automatic Scan** - Selecting the scan function will allow the 1- Up Display to scroll through the selected set of parameters one at a time. Use the "Arrow" keys to scroll to the "Automatic Scan" function.

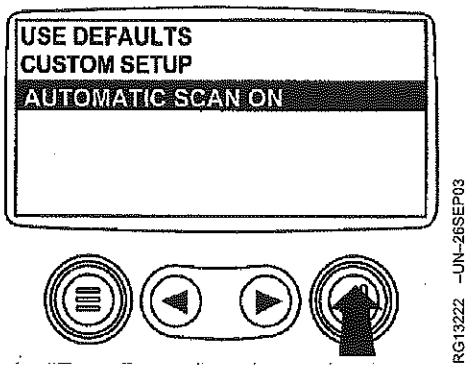


Automatic Scan Off

Continued on next page

OURGP11,00000B1 –19–03SEP03–14/18

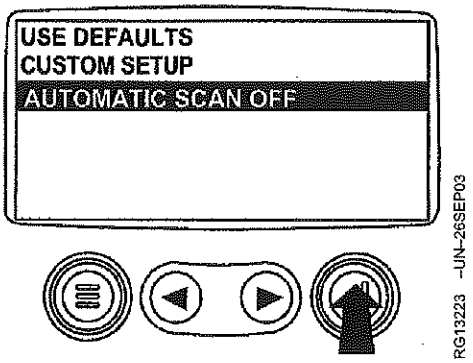
16. Press the "Enter" key to toggle the "Automatic Scan" function on.



Automatic Scan On

OURGP11,00000B1 –19–03SEP03–15/18

17. Press the "Enter" key again to toggle the "Automatic Scan" function off.

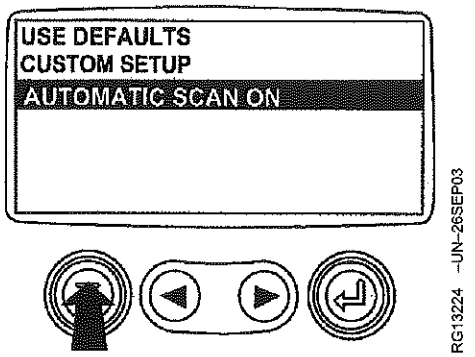


Automatic Scan Off

Continued on next page

OURGP11,00000B1 –19–03SEP03–16/18

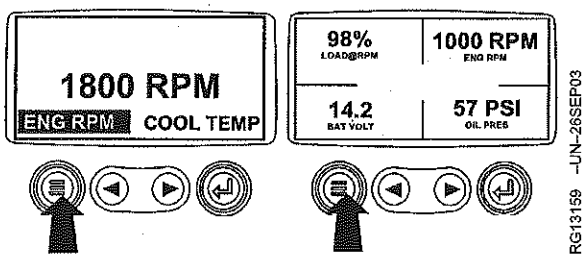
18. Once the "Use Defaults", "Custom Setup" and "Automatic Scan" functions have been set, press the "Menu" key to return to the main menu.



Menu Key

OURGP11,00000B1 –19–03SEP03–17/18

19. Press the "Menu" key to exit the main menu and return to the engine parameter display.

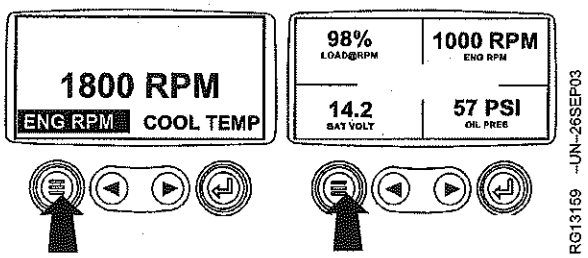


Exit Main Menu

OURGP11,00000B1 –19–03SEP03–18/18

Setup 4-Up Display

1. Turn the key switch to the ON position. From the single or four engine parameter display, press the "Menu" key.

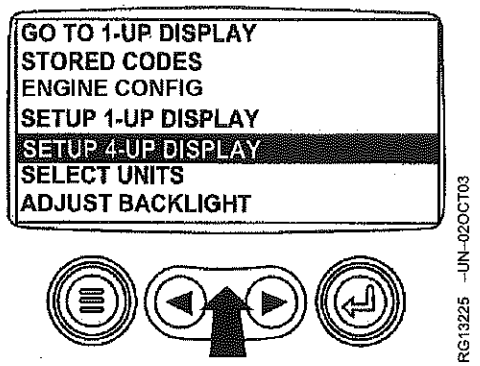


Menu Key

Continued on next page

OURGP11,00000B2 –19–03SEP03–1/14

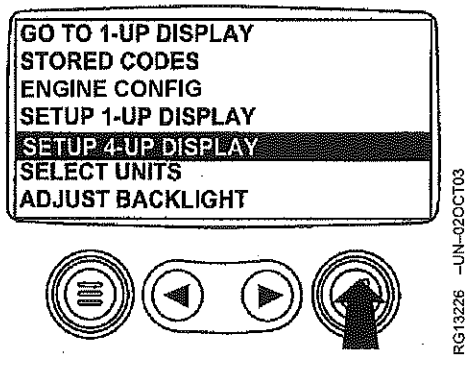
2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Setup 4-Up Display" is highlighted.



Select Setup 4-Up Display

OURGP11,00000B2 –19–03SEP03–2/14

3. Once the "Setup 4-Up Display" menu item has been highlighted, press the "Enter" key to activate the "Setup 4-Up Display" menu.



Press Enter Key

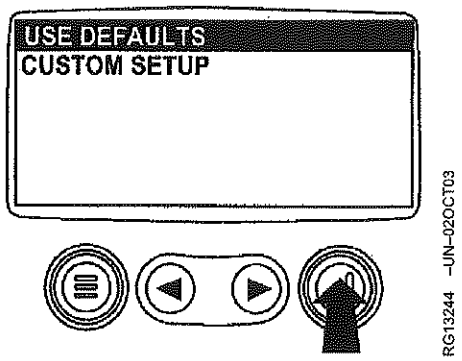
Continued on next page

OURGP11,00000B2 –19–03SEP03–3/14

4. Two options are available for the 4-Up Display.

   a. **Use Defaults** – This option contains the following engine parameters for display: Engine Speed, Battery Voltage, Coolant Temperature and Oil Pressure.

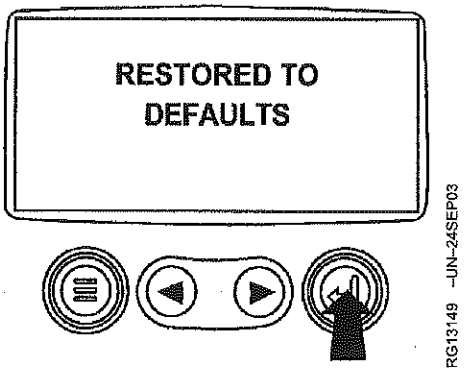
   b. **Custom Setup** – This option contains a list of engine parameters. Engine parameters from this list can be selected to replace any or all of the default parameters.



Select Factory Defaults

OURGP11,00000B2 –19–03SEP03–4/14

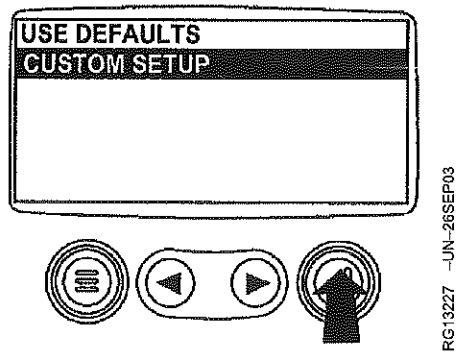
5. To reset the display parameters to the factory defaults, scroll to and highlight "Use Defaults". Press the "Enter" key to activate the "Use Defaults" function. A message indicating the display parameters are reset to the factory defaults will be displayed, then the display will return to the "Setup 4-Up Display" menu.



Restored To Defaults

OURGP11,00000B2 –19–03SEP03–5/14

6. **Custom Setup** - To perform a custom setup of the 4-Up Display, use the arrow buttons to scroll to and highlight "Custom Setup" on the display.

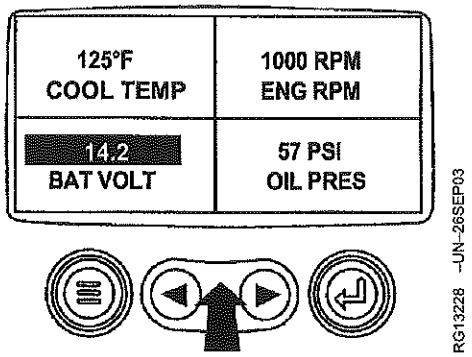


Custom Setup

Continued on next page

OURGP11,00000B2 –19–03SEP03–6/14

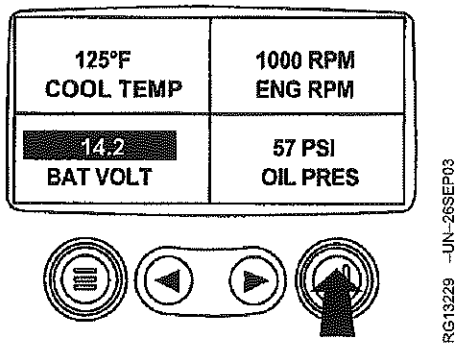
7. The quadrant with the highlighted parameter value is the current selected parameter. Use the "Arrow" keys to highlight the value in the quadrant you wish to change to a new parameter.



Select Parameters

OURGP11,00000B2 –19–03SEP03–7/14

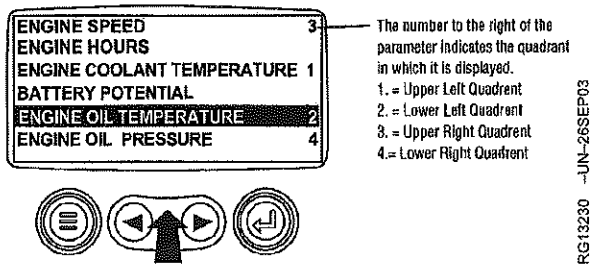
8. Press the "Enter" key and a list of engine parameters will be displayed.



List Of Engine Parameters

OURGP11,00000B2 –19–03SEP03–8/14

9. The parameter that is highlighted is the selected parameter for the screen. Use the "arrow" keys to highlight the new parameter to be placed in the "4-Up Display"..

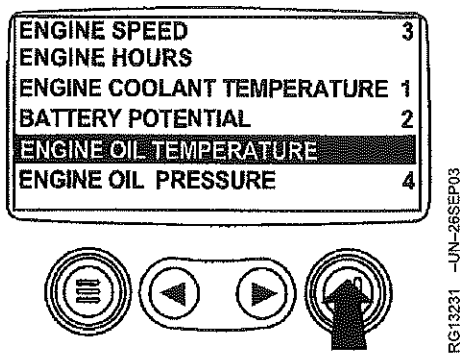


Select Desired Engine Parameter

Continued on next page

OURGP11,00000B2 –19–03SEP03–9/14

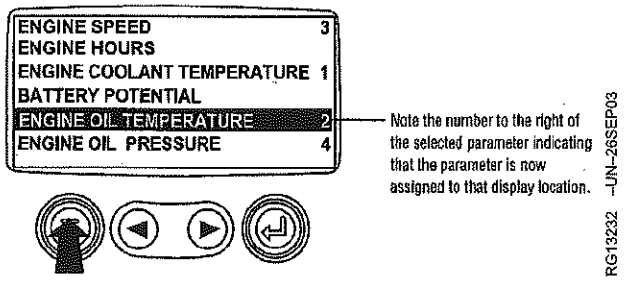
10. Press the "Enter" key to change the selected parameter in the quadrant to the new parameter.



Enter Selected Parameter

OURGP11,00000B2 –19–03SEP03–10/14

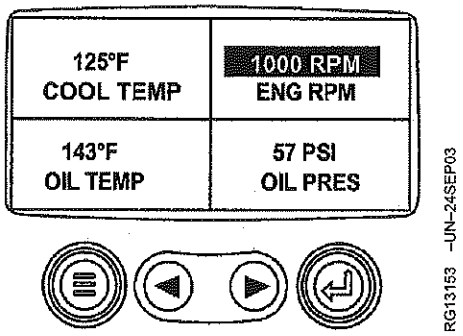
11. Use the "Menu" keys to return to the "4-Up Custom Setup" screen.



Return To 4-Up Custom Setup

OURGP11,00000B2 –19–03SEP03–11/14

12. The selected quadrant has now changed to the new selected parameter.

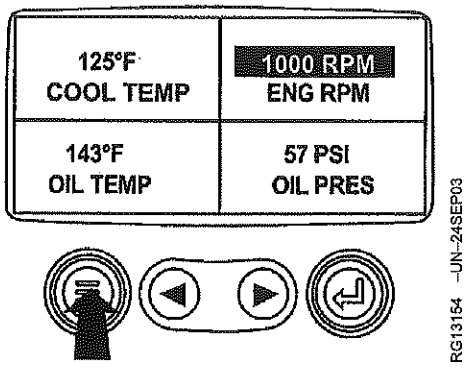


4-Up Display

Continued on next page

OURGP11,00000B2 –19–03SEP03–12/14

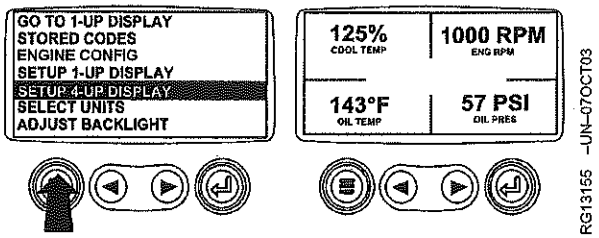
13. Repeat the parameter selection process until all spaces are as desired.
14. Press the "Menu" key to return to the main menu.



Return To Main Menu

OURGP11,00000B2 –19–03SEP03–13/14

15. Press the "Menu" key to exit the main menu and return to the engine parameter display.



Select Remaining Parameters

OURGP11,00000B2 –19–03SEP03–14/14

Break-In Service

IMPORTANT: This engine is normally factory-filled with John Deere PLUS-50™ 10W-30 oil, but can be shipped without oil to comply with certain legislations. In this case, fill engine with John Deere PLUS-50™ 10W-30 oil.

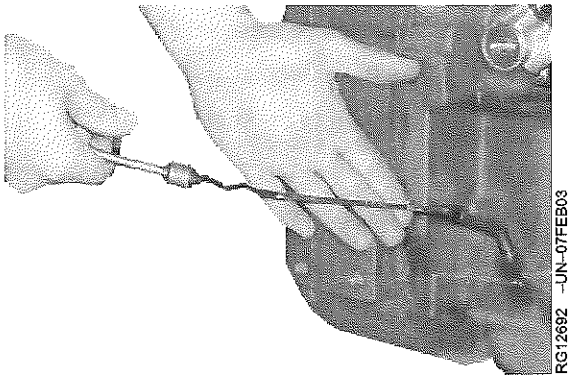
NOTE: The use of BREAK-IN oils is not required for this engine. Perform the following steps to break-in your engine properly during the first 100 hours. Factory-fill oil and filter are suitable for extended 500-hour drain interval, provided diesel fuel sulfur content is less than 0.10% (1000 ppm).

Before starting, fill engine with seasonal viscosity grade oil and with coolant meeting specifications. (See DIESEL ENGINE OIL and DIESEL ENGINE COOLANT SPECIFICATIONS in Fuels, Lubricants, and Coolant Section.)

1. During the first 20 hours, avoid prolonged periods of engine idling or sustained maximum load operation. Warm-up engine carefully and operate at normal loads. If engine will idle longer than 5 minutes, stop engine.

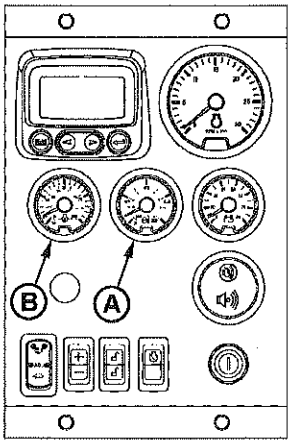
2. Check oil level daily or every 10 hours during engine break-in period. If oil must be added during this period, use John Deere PLUS-50™ 10W-30 oil. (See DIESEL ENGINE OIL in Fuels, Lubricants, and Coolant section.)

3. Watch oil pressure (A) and coolant temperature (B) closely during break-in period. Also check coolant level daily or every 10 hours and check for leaks.



RG12692 –UN–07FEB03

Check Engine Oil Level Daily



RG13720 –UN–11NOV04

Oil Pressure and Coolant Temperature Gauges

A—Oil Pressure
B—Coolant Temperature

PLUS-50 is a trademark of Deere & Company.

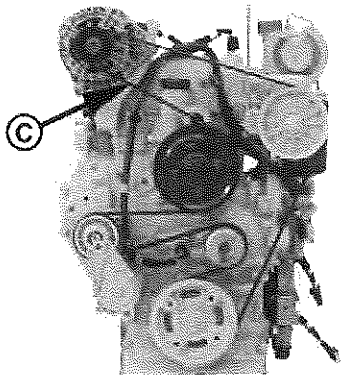
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4. Check poly-vee belt (C) for proper alignment and seating in pulley grooves.

5. Change oil and oil filter (D) after first 500 hours/12 months. (See CHANGE ENGINE OIL AND FILTER in Lubrication and Maintenance/500 Hour Section.) Fill crankcase with seasonal viscosity grade oil. (See DIESEL ENGINE OIL, in Fuels, Lubricants, and Coolant Section.)

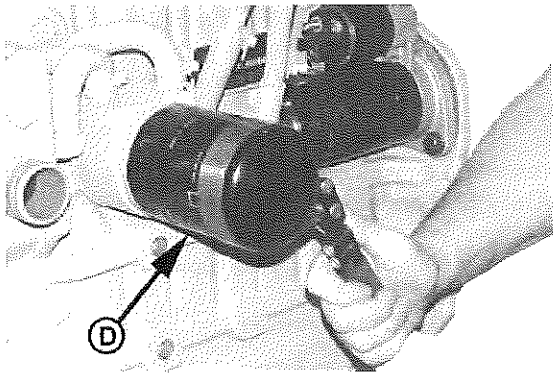
IMPORTANT: DO NOT operate engine when oil level is below ADD mark on dipstick. Check oil level before starting engine for the first time.

C—Poly-Vee Belt
D—Oil Filter



RG15340 –UN–04OCT07

Poly-Vee Belt



RG15341 –UN–04OCT07

Engine Oil Filter

OUOD006,00000C6 –19–10AUG07–2/2

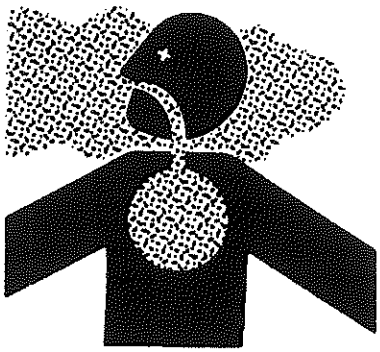
Starting the Engine

The following instructions apply to the optional controls and instruments available through the John Deere Parts Distribution Network. The controls and instruments for your engine may be different from those shown here; always follow manufacturer's instructions.

CAUTION: Before starting engine in a confined building, install proper outlet exhaust ventilation equipment. Always use safety approved fuel storage and piping.

NOTE: If temperature is below 0°C (32°F), it may be necessary to use cold weather starting aids (See COLD WEATHER OPERATION, later in this section).

1. Perform all prestarting checks outlined in Lubrication & Maintenance/Daily Section later in this manual.
2. Open the fuel supply shut-off valve, if equipped.
3. Disengage clutch (if equipped) controlling any engine drivelines.



TS220 –UN–23AUG88

Use Proper Ventilation

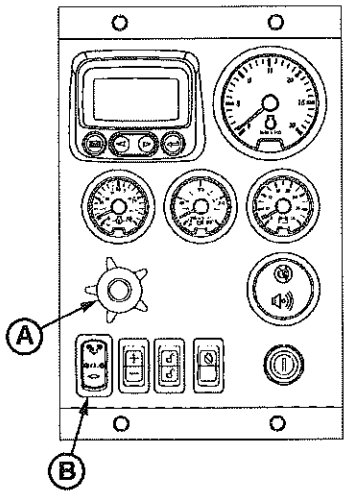
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4. Set slow idle as follows:

   Panels with high-low speed select rocker switch (B) only: Set slow speed by pressing lower half of switch.

   Panels with optional analog throttle(s) (A) : Set high-low speed select rocker switch to slow (turtle), then push in on analog throttle handle or turn full counterclockwise to set analog throttle(s) to slow speed.

IMPORTANT: Do not operate the starter for more than 30 seconds at a time. To do so may overheat the starter. If the engine does not start the first time, wait at least 2 minutes before trying again. If engine does not start after four attempts, see Troubleshooting section.



RG13722 –UN–11NOV04

Analog Throttle Control and Speed Select Switch On Panel

A—Analog Throttle Control (Optional)
B—Speed Select Rocker Switch

Continued on next page

5. Turn the key start switch (A) clockwise to crank the engine. When the engine starts, release the key switch so that it returns to the "ON" position.

IMPORTANT: If the key switch is released before the engine starts, wait until the starter and the engine stop turning before trying again. This will prevent possible damage to the starter and/or flywheel.

6. After engine starts, idle engine at not more than 1200 rpm until warm. (See WARMING ENGINE later in this section).

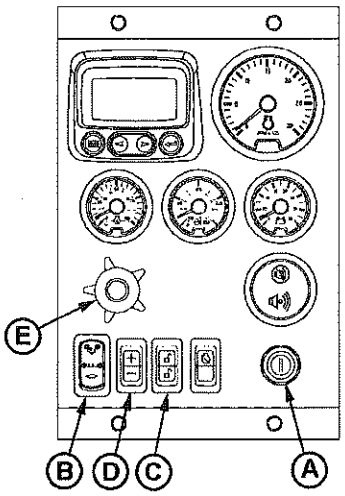
   Panels with high-low speed select rocker switch (B) only: Set rpm using bump speed enable switch (C) with speed select rocker switch (D).

   Panels with optional analog throttle (E): Set either high-low speed select switch (B) or analog throttle (E) to slow speed, and set desired speed with remaining control.

NOTE: Engine control unit (ECU) reads the higher of the high-low speed select rocker switch or the analog throttle speed settings.

7. Check all gauges for normal engine operation. If operation is not normal, stop the engine and determine the cause. (For normal gauge pressures and temperatures, see BREAK-IN SERVICE earlier in this section.)

NOTE: Hand throttle may have an analog potentiometer (E) for changing engine speeds (See "Changing Engine Speeds" later in this section).



RG13723 –UN–11NOV04

Start And Idle Engine Controls On Panel

A—Key Start Switch
B—High-Low Speed Select Rocker Switch
C—Bump Speed Enable Rocker Switch
D—Speed Select Rocker Switch
E—Analog Throttle Control (Optional)

OURGP12,00001C9 –19–14MAR06–3/3

Normal Engine Operation

efore starting, fill engine with oil and coolant meeting specifications. (See DIESEL ENGINE OIL and DIESEL ENGINE COOLANT SPECIFICATIONS in Fuels, Lubricants, and Coolant section.)

- Observe engine coolant temperature and engine oil pressure. Temperatures and pressures will vary between engines and with changing operating conditions, temperatures, and loads. Refer to GENERAL OEM ENGINE SPECIFICATIONS in the Specifications section.
- If coolant temperature rises above Maximum Coolant Temperature (see Specifications section), reduce load on engine. Unless temperature drops quickly, stop engine and determine cause before resuming operation.
- Operate the engine under a lighter load and at slower than normal speed for first 15 minutes after start-up. DO NOT run engine at slow idle.
- Stop engine immediately if there are any signs of part failure. Symptoms that may be early signs of engine problems are:
  - Sudden drop in oil pressure
  - Abnormal coolant temperatures
  - Unusual noise or vibration
  - Sudden loss of power
  - Excessive black exhaust
  - Excessive fuel consumption
  - Excessive oil consumption
  - Fluid leaks

OUOD006,00000C5 –19–04OCT07–1/1

Warming Engine

IMPORTANT: To assure proper lubrication, operate engine at or below 1200 rpm with no load for 1–2 minutes. Extend this period 2–4 minutes when operating at temperatures below freezing.

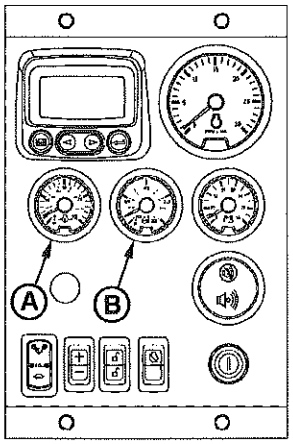
1. Refer to GENERAL OEM ENGINE SPECIFICATIONS in the Specifications section for oil pressure and coolant temperature specifications.

2. Check oil pressure gauge (A) as soon as engine starts. If gauge needle does not rise above the minimum oil pressure specification within 5 seconds, stop the engine and determine the cause. Normal engine oil pressure (see Specifications section) can vary within pressure ranges provided.

NOTE: On certain engines, the oil pressure and coolant temperature gauges are replaced by indicator warning lights. The lights must be "OFF" when engine is running.

3. Watch coolant temperature gauge (B). Do not place engine under full load until it is properly warmed up. See Specifications section for normal engine coolant temperature range.

NOTE: It is a good practice to operate the engine under a lighter load and at lower speeds than normal for the first few minutes after start-up.



RG13724 –UN–11NOV04

Oil Pressure and Coolant Temperature Gauges

A—Oil Pressure
B—Coolant Temperature

OUOD006,00000C8 –19–09OCT07–1/1

Cold Weather Starting

When outside temperatures fall below 0°C (32° F) it may be necessary to consider using cold weather starting aids. Engines are equipped with standard glow plugs, and may also be fitted with a block heater. An increased capacity battery and/or lower viscosity oil may also need to be used.

IMPORTANT: In weather applications:

- **Above 0° C and for continued high load applications 15W-40 oil is recommended**
- **Below 0° C 10W-30 oil is STRONGLY recommended**
- **Below -10° C 10W-30 oil is REQUIRED**

For further information, see DIESEL ENGINE OIL in Fuels, Lubricants, and Coolant section.

CAUTION: NEVER USE ANY STARTING FLUID as a starting aid with these glow plug-equipped engines as it could cause an explosion and possible personal injury.

1. Follow steps 1—4 as listed under STARTING THE ENGINE earlier in this section, then proceed as follows according to the instrument (gauge) panel on your engine.

IMPORTANT: Do not operate the starter for more than 30 seconds at a time. To do so may overheat the starter. If the engine does not start the first time, wait at least 2 minutes before trying again. If engine does not start after four attempts, see Troubleshooting Section.

NOTE: Glow plugs operate automatically through the ECU. The light, located above the diagnostic gauge, should illuminate when the glow plugs are activated. In warm weather, the light illuminates briefly as a light check. In cold weather, the light remains on during the automatic operation of the glow plugs. Operating time depends on temperature. Do not crank the engine until light turns off.

2. Follow remaining 5—6 as listed earlier in this section.

Additional information on cold weather operation is available from your authorized servicing dealer.

OUOD006,00000C7 –19–05MAR08–1/1

Using a Booster Battery or Charger

A 12-volt booster battery can be connected in parallel with battery (ies) on the unit to aid in cold weather starting. ALWAYS use heavy duty jumper cables.

CAUTION: Gas given off by battery is explosive. Keep sparks and flames away from battery. Before connecting or disconnecting a battery charger, turn charger off. Make last connection and first disconnection at a point away from battery. Always connect NEGATIVE (–) cable last and disconnect this cable first.

WARNING: Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. **Wash hands after handling.**

IMPORTANT: Be sure polarity is correct before making connections. Reversed polarity will damage electrical system. Always connect positive to positive and negative to ground. Always use 12-volt booster battery for 12-volt electrical systems and 24-volt booster battery (ies) for 24-volt electrical systems.

1. Connect booster battery or batteries to produce the required system voltage for your engine application.

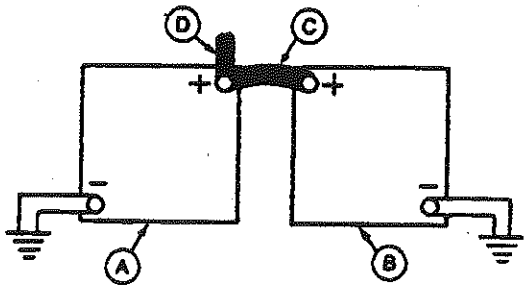
NOTE: To avoid sparks, DO NOT allow the free ends of jumper cables to touch the engine.

2. Connect one end of jumper cable to the POSITIVE (+) post of the booster battery.
3. Connect the other end of the jumper cable to the POSITIVE (+) post of battery connected to starter.
4. Connect one end of the other jumper cable to the NEGATIVE (–) post of the booster battery.
5. ALWAYS complete the hookup by making the last connection of the NEGATIVE (–) cable to a good ground on the engine frame and away from the battery (ies).



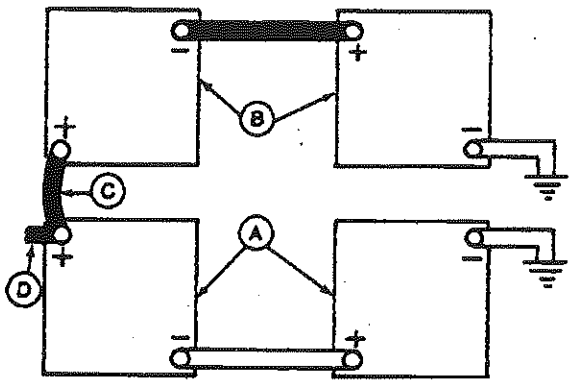
TS204 –UN–23AUG88

Exploding Battery



RG4678 –UN–14DEC88

12-Volt System



RG4698 –UN–14DEC88

24-Volt System

A—12-Volt Machine Battery (ies)
B—12-Volt Booster Battery (ies)
C—Booster Cable
D—Cable to Starting Motor

Continued on next page

6. Start the engine. Disconnect jumper cables immediately after engine starts. Disconnect NEGATIVE (–) cable first.

RG,RG34710,5564 –19–27JUL06–2/2

Avoid Excessive Engine Idling

Avoid excessive engine idling. Prolonged idling may cause the engine coolant temperature to fall below its normal range. This, in turn, causes crankcase oil dilution, due to incomplete fuel combustion, and permits formation of gummy deposits on valves, pistons, and piston rings. It also promotes rapid accumulation of engine sludge and unburned fuel in the exhaust system.

Once an engine is warmed to normal operating temperatures, engine should be idled at slow idle speed. (See ENGINE POWER RATING AND SPEED SPECIFICATIONS in the Specifications Section for slow idle speed information.) If an engine will be idling for more than 5 minutes, stop and restart later.

OURGP12,00000FC –19–04OCT07–1/1

Changing Engine Speed

Changing from slow to fast speed using Standard High-Low Speed Select Rocker Switch (A) (If equipped):

- For slow speed, press lower half of switch (indicated by turtle symbol).
- For fast speed, press upper half of switch (indicated by rabbit symbol).

NOTE: To adjust preset fast or slow speeds for High-Low Speed Select Rocker Switch:

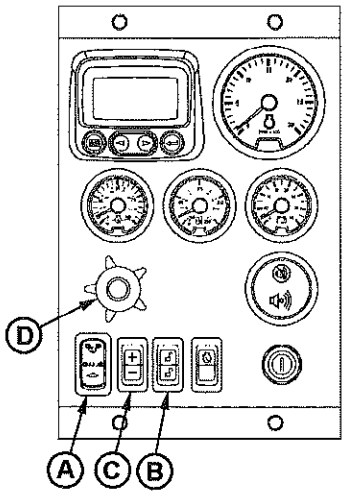
1. *Select fast (rabbit) or slow (turtle) position on High-Low Speed Select Rocker Switch (A).*
2. *Press and hold top or bottom half of Bump Speed Enable Rocker Switch (B) while using Speed Select Rocker Switch (C).*
3. *Use Speed Select Rocker Switch (C) to bump engine speed up (+) or down (-).*

NOTE: Once the speed has been set, the Bump Speed Enable Switch (B) must be pressed and released three times within two seconds to commit the new slow or fast speed to memory. If not done, the engine's new slow or fast speed will only be effective until the key switch is shut off. Then the speed will revert to its previous setting.

Changing from slow to fast speed using Adjustable High-Low Speed Select Rocker Switch (A) (If equipped):

Adjustable **three-position** rocker switch (A) that can be used to select slow idle, fast idle, or an adjustable ("ADJ") intermediate speed.

- For slow speed, press lower half of rocker switch (indicated by turtle symbol).
- For fast speed, press upper half of rocker switch (indicated by rabbit symbol).



RG13725 –UN–11NOV04

Changing Engine Speed On Panel

A—High-Low Speed Select Rocker Switch
B—Bump Speed Enable Rocker Switch
C—Speed Select Rocker Switch
D—Analog Throttle Control (Optional)

Continued on next page

NOTE: To adjust preset fast or slow speeds with adjustable High-Low Speed Select Rocker Switch:

1. *Select middle position (ADJ) or slow (turtle) position on the optional Adjustable Three-State Speed Select Rocker Switch (A).*
2. *Press and hold top or bottom half of Bump Speed Enable Rocker Switch (B) while using Speed Select Rocker Switch (C).*
3. *Use Speed Select Rocker Switch (C) to bump engine speed up (+) or down (-).*

NOTE: Slow (turtle) position is factory preset at low engine idle, while middle (ADJ) position is factory set at high engine idle.

NOTE: Once the speed has been set, the Bump Speed Enable Switch (B) must be pressed and released three times within two seconds to commit the new slow or fast speed to memory. If not done, the engine's new slow or fast speed will only be effective until the key is shut off. Then the speed will revert to its previous setting.

Changing engine speed using optional analog potentiometer throttle (D)

NOTE: Pushing in on analog potentiometer will immediately take engine to slow idle speed.

1. Set High-Low Speed Select Rocker Switch (A) to low speed position.

2. Turn potentiometer throttle clockwise to increase speed or counterclockwise to decrease speed.

NOTE: Engine Control Unit (ECU) reads the higher of the High-Low Speed Select Rocker Switch or the Analog Throttle(s) Speed Settings. With High-Low switch at low speed, Analog Throttle(s) will control speed higher than low idle setting.

Continued on next page

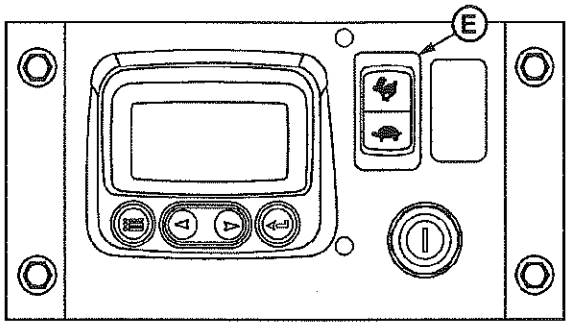
Changing engine speeds on engines equipped with the Basic Instrument Panel

The basic instrument panel has a "ramp" throttle switch (E) with a spring loaded return to the center rest position (Off).

To increase the engine speed, press and hold upper half of rocker switch (E) (indicated by rabbit symbol) to increase or ramp up the engine speed to desired speed. Release the rocker switch.

Press lower half of rocker switch (indicated by turtle symbol) to decrease or ramp down the engine speed to desired speed. Release the rocker switch.

The settings will not be stored.



Changing Engine Speed With Basic Panel

E—High-Low Speed Select Rocker Switch

OURGP12,00001CD –19–14MAR06–3/3

Stopping The Engine

. Disengage clutch, if equipped, controlling engine power driveline.

IMPORTANT: Before stopping an engine that has been operating at working load, idle engine at least 2 minutes at 1000—1200 rpm to cool hot engine parts.

Engines in generator set applications where the ECU is locked at a specified speed and no slow idle function is available, run engine for at least 2 minutes at fast idle and no load.

2. Run engine at 1000—1200 rpm for at least 2 minutes to cool.

Panels with High-Low Speed Select Rocker Switch (B) only: Set rpm using Bump Speed Enable Switch (C) with Speed Select Rocker Switch (D).

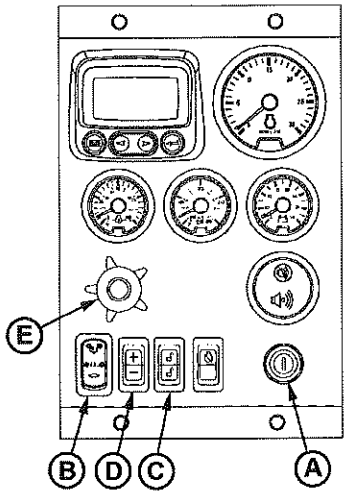
Panels with optional Analog Throttle (E): Set either High-Low Speed Select Switch (B) or Analog Throttle (E) to low idle, and set desired speed with remaining control.

NOTE: Engine Control Unit (ECU) reads the higher of the High-Low Speed Select Rocker Switch or the Analog Throttle(s) Speed settings.

3. Push in on analog throttle potentiometer handle (if equipped) so that engine goes to slow idle, or set slow speed with High-Low Speed Select Rocker Switch.

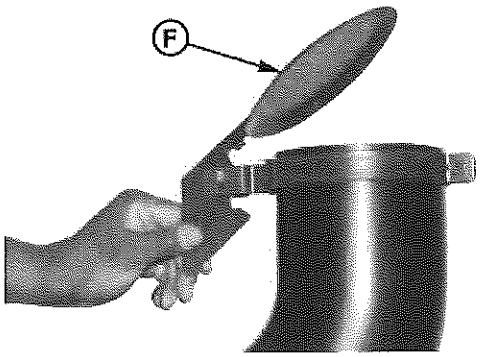
4. Turn key switch (A) to "OFF" position to stop the engine. Remove ignition key.

IMPORTANT: Make sure that exhaust stack rain cap (F) is installed when engine is not running. This will prevent water and dirt from entering engine.



RG13723 –UN–11NOV04

Stopping the Engine Controls



RG9933 –UN–18NOV99

Exhaust Stack Rain Cap

A—Key Switch
B—High-Low Speed Select Rocker Switch
C—Bump Speed Enable Switch
D—Speed Select Rocker Switch
E—Analog Throttle (Optional)
F—Exhaust Stack Rain Cap

Auxiliary Gear Drive Limitations

IMPORTANT: When attaching an air compressor, hydraulic pump, or other accessory to be driven by the auxiliary gear drive (A) (engine timing gear train at front of engine), power requirements of the accessory must be limited to values listed below:

- 21kW (28 hp) Continuous Operation at 2800 rpm
- 26kW (35 hp) Intermittent Operation at 2800 rpm

OUOD006,00000F6 –19–04OCT07–1/1

Generator Set (Standby) Applications

To assure that your engine will deliver efficient standby operation when needed, start engine and run at rated speed (with 50%—70% load) for 30 minutes every 2 weeks. DO NOT allow engine to run extended period of time with no load.

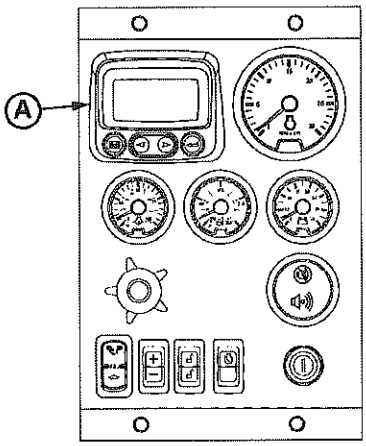
RG,RG34710,5556 –19–27JUL06–1/1

Observe Service Intervals

sing hour meter (A) on diagnostic gauge as a guide, perform all services at the hourly intervals indicated on following pages. At each scheduled maintenance interval, perform all previous maintenance operations in addition to the ones specified. Keep a record of hourly intervals and services performed, using charts provided in Lubrication and Maintenance Records section.

IMPORTANT: Recommended service intervals are for normal operating conditions. Service MORE OFTEN if engine is operated under adverse conditions. Neglecting maintenance can result in failures or permanent damage to the engine.

A—Hour Meter



Hour Meter On Panel

RG13728 –UN–11NOV04

OURGP12,00001D0 –19–14MAR06–1/1

se Correct Fuels, Lubricants, and Coolant

IMPORTANT: Use only fuels, lubricants, and coolants meeting specifications outlined in Fuels, Lubricants, and Coolant Section when servicing your John Deere Engine.

Consult your John Deere engine distributor, servicing dealer or your nearest John Deere Parts Network for recommended fuels, lubricants, and coolant. Also available are necessary additives for use when operating engines in tropical, arctic, or any other adverse conditions.



TS100 –UN–23AUG88

DPSG,OUOE003,20 –19–09OCT07–1/1

Lubrication and Maintenance Service Interval Chart—Standard Industrial Engines

NOTE: The service intervals below are for standard industrial engines. Match service items below to titles in Lubrication and Maintenance Sections for procedures.

Item	Lubrication and Maintenance Service Intervals			
	Daily	500 Hour/ 12 Month	2000 Hour/ 24 Month	As Required
Check Engine Oil and Coolant Level	•			
Check Fuel Filter	•			
Check Air Cleaner Dust Unloader Valve & Indicator[a]	•			
Perform Visual Walkaround Inspection	•			
Changing Engine Oil And Replacing Oil Filter[b]		•		
Replacing Fuel Filter Element		•		
Cleaning Crankcase Vent Tube		•		
Checking Air Intake System		•		
Checking Engine Speeds		•		
Checking Belt Tensioner Spring Tension and Belt Wear		•		
Checking Engine Electrical Ground Connection		•		
Servicing Fire Extinguisher		•		
Checking Engine Mounts		•		
Servicing Battery		•		
Checking Cooling System		•		
Replenishing SCAs as Required		•		
Testing Diesel Engine Coolant		•		
Pressure Testing Cooling System		•		
Checking Crankshaft Vibration Damper (If Equipped)[c]			•	
Flushing Cooling System[d]			•	
Testing Thermostats			•	
Adding Coolant				•
Replacing Air Cleaner Elements				•
Replacing Poly-Vee Belt				•
Checking Fuses				•

[a]Replace primary air cleaner element when restriction indicator shows a vacuum of 625 mm (25 in.) H2O.

[b]If PLUS-50 or ACEA - E4/E5/E6/E7 oil is NOT used along with a John Deere oil filter, the oil change interval is reduced to every 250 hours.

[c]Replace crankshaft damper every 4500 hours or 60 months, whichever occurs first.

[d]If John Deere COOL-GARD is used, the flushing interval may be extended to 3000 hours or 36 months. If John Deere COOL-GARD is used and the coolant is tested annually AND additives are replenished as needed by adding a supplemental coolant additive, the flushing interval may be extended to 5000 hours or 60 months, whichever occurs first.

Continued on next page

Item	Lubrication and Maintenance Service Intervals			
	Daily	500 Hour/ 12 Month	2000 Hour/ 24 Month	As Required
Checking Air Compressor (If Equipped)				•
Bleeding Fuel System				•

OURGP12,00000FD –19–10AUG07–2/2

Lubrication and Maintenance Service Interval Chart—Generator (Standby) Applications

NOTE: Use service intervals listed below for generator (standby) applications. Match service items below to titles in Lubrication and Maintenance Sections for procedures.

Item	Lubrication and Maintenance Service Intervals			
	Every 2 Weeks	500 Hours or 12 Months	2000 Hours or 24 Months	As Required
Operate Engine at Rated Speed and 50%–70% Load a Minimum of 30 Minutes	•			
Check Engine Oil and Coolant Level	•			
Check Fuel Filter	•			
Check Air Cleaner Dust Unloader Valve & Indicator [a]	•			
Perform Visual Walkaround Inspection	•			
Changing Engine Oil And Replacing Oil Filter[b]		•		
Replacing Fuel Filter Element		•		
Cleaning Crankcase Vent Tube		•		
Checking Air Intake System		•		
Checking Engine Speeds		•		
Checking Belt Tensioner Spring Tension and Belt Wear		•		
Checking Engine Electrical Ground Connection		•		
Servicing Fire Extinguisher		•		
Checking Engine Mounts		•		
Servicing Battery		•		
Checking Cooling System		•		
Replenishing SCAs as Required		•		
Testing Diesel Engine Coolant		•		
Pressure Testing Cooling System		•		
Checking Crankshaft Vibration Damper [c]			•	
Flushing Cooling System[d]			•	
Testing Thermostats			•	
Adding Coolant				•
Replacing Air Cleaner Elements				•
Replacing Poly-Vee Belt				•
Checking Fuses				•
Checking Air Compressor (If Equipped)				•

[a]Replace primary air cleaner element when restriction indicator shows a vacuum of 625 mm (25 in.) H2O.

[b]If PLUS-50 or ACEA - E4/E5/E6/E7 oil is NOT used along with a John Deere oil filter, the oil change interval is reduced to every 250 hours.

[c]Replace crankshaft damper every 4500 hours or 60 months, whichever occurs first.

[d]If John Deere COOL-GARD is used, the flushing interval may be extended to 3000 hours or 36 months. If John Deere COOL-GARD is used and the coolant is tested annually AND additives are replenished as needed by adding a supplemental coolant additive, the flushing interval may be extended to 5000 hours or 60 months, whichever occurs first.

Continued on next page

Item	Lubrication and Maintenance Service Intervals			
	Every 2 Weeks	500 Hours or 12 Months	2000 Hours or 24 Months	As Required
Adjusting Speed Gain				•
Bleeding Fuel System				•

OURGP12,00002B5 –19–02JAN07–2/2

Daily Prestarting Checks

Do the following BEFORE STARTING THE ENGINE for the first time each day:

IMPORTANT: DO NOT add makeup oil until the oil level is BELOW the "ADD" mark on dipstick. Do not use break-in oil in this engine.

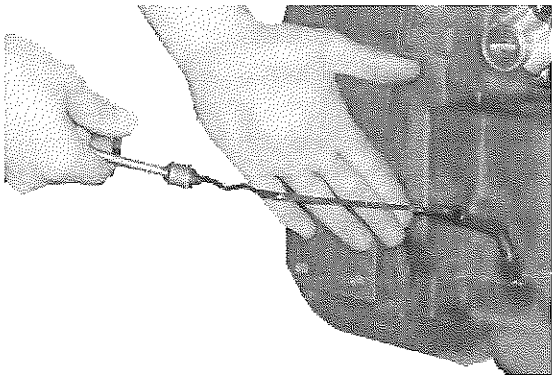
1. Check engine oil level on dipstick. Add as required, using seasonal viscosity grade oil. (See DIESEL ENGINE OIL in Fuels, Lubricants, and Coolant Section for oil specifications.)

   Depending on application, oil may be added at left side (A) or rocker arm cover filler cap (B) locations.

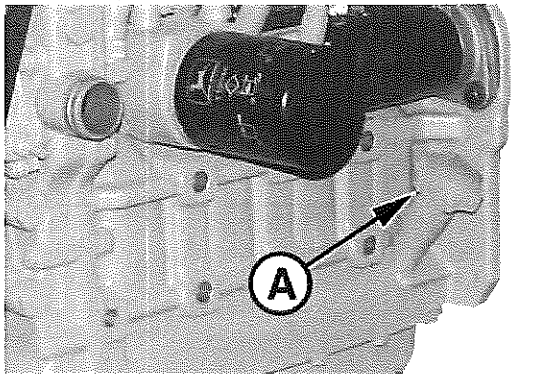
   After checking oil, hand tighten dipstick used on left-hand oil fillers.

IMPORTANT: DO NOT fill above the top mark on the dipstick. Oil levels anywhere within the crosshatch (C) are considered in the acceptable operating range.

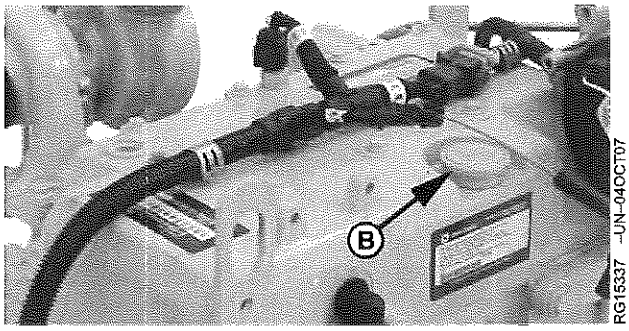
A—Left Side Oil Filler Cap
B—Rocker Arm Cover Oil Filler Cap
C—Crosshatch on Dipstick



Engine Oil Dipstick

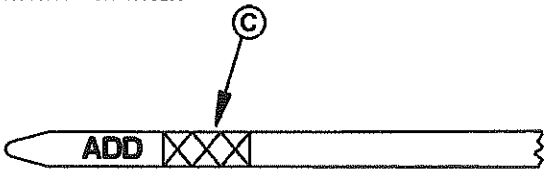


Left Side Oil Filler Cap and Dipstick



Rocker Arm Cover Filler Cap

RG14931 –UN–13JUL06



Crosshatch on Dipstick

Continued on next page

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Only remove filler cap when engine is cold or when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

2. Check the coolant level when engine is cold. Coolant level should be at bottom of filler neck. Fill radiator (A) with proper coolant solution if level is low. (See ADDING COOLANT in Service As Required Section.) Check overall cooling system for leaks.

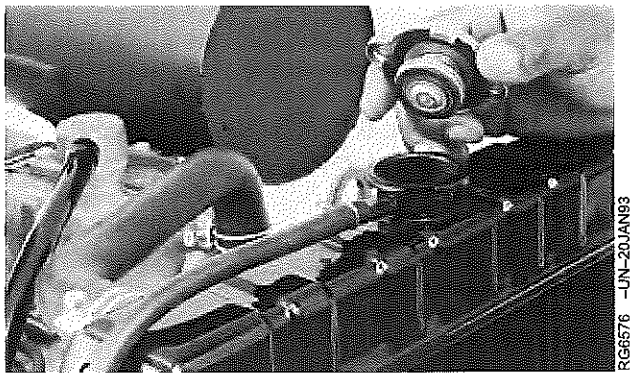
NOTE: Refer to your vehicle's operator's manual for recommendations for non-John Deere supplied accessories.

A—Fill Radiator



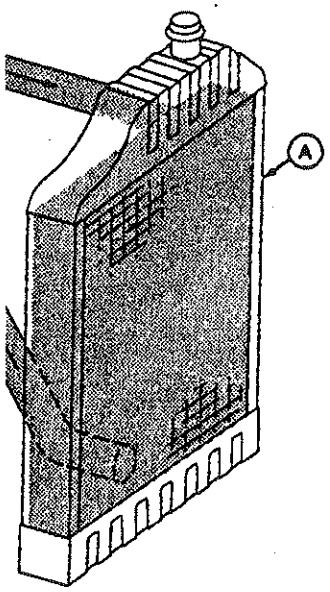
TS281 –UN–23AUG88

High-Pressure Fluids



RG6576 –UN–20JAN93

Check Coolant Level in Radiator



RG4675 –UN–14DEC88

Fill Radiator

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IMPORTANT: Drain water from filter bowl daily to avoid premature failure of unit injection pump.

When using BIODIESEL blends, monitor water quantity in fuel filter element more closely. Water in the separator may need to be drained more frequently.

3. Check the fuel filter (A) for water or debris. If filter is fitted with a see-through bowl, drain as needed based on a daily visual inspection.

IMPORTANT: Drain water into a suitable container and dispose of properly.

a. Loosen drain plug (B) at bottom of fuel filter or bowl, if equipped, two or three turns.

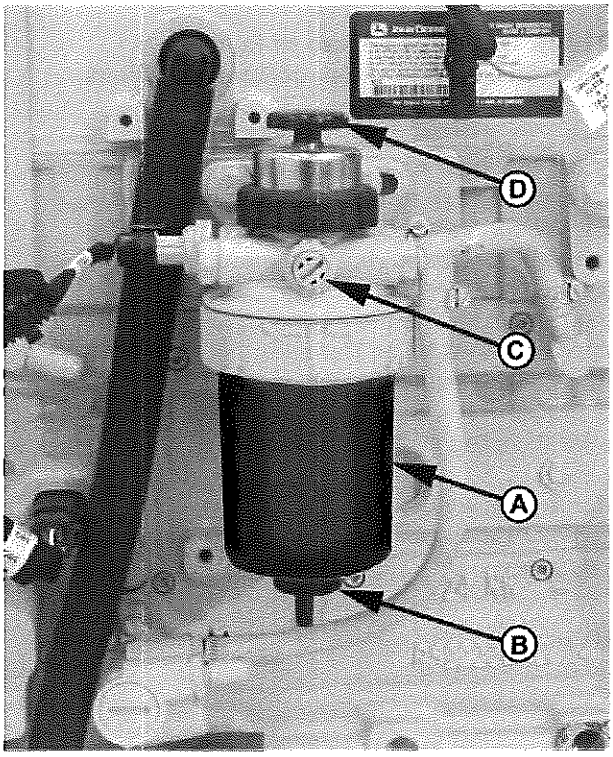
b. Loosen air bleed plug (C) two full turns on fuel filter mounting and drain water from bottom until fuel starts to drain out.

c. When fuel starts to drain out, tighten drain plug securely.

After draining water from the fuel filter, the filter must be primed. Once the filter has been primed, fuel system will purge itself when starter is cranked.

a. Operate hand primer (D) on the fuel filter header until fuel flow is free from air bubbles.

b. Tighten bleed plug securely.



Fuel Transfer Pump and Filter

A—Fuel Filter
B—Drain Plug
C—Air Bleed Plug
D—Hand Primer

Continued on next page

4. If the air cleaner has an automatic dust unloader valve (A), squeeze the unloader valve on air cleaner assembly to clear away any dust buildup.

   If equipped with air intake restriction indicator gauge (B), check gauge to determine if air cleaner needs to be serviced.

IMPORTANT: Maximum air intake restriction is 6.25 kPa (0.06 bar) (1.0 psi) (25 in. H_2O). A clogged air cleaner element will cause excessive intake restriction and a reduced air supply to the engine.

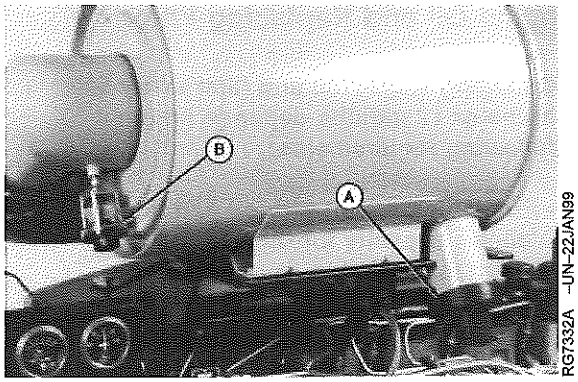
5. Make a thorough inspection of the engine compartment. Look for oil or coolant leaks, worn fan and accessory drive belts, loose connections and trash build-up. Remove trash buildup and have repairs made as needed if leaks are found.

NOTE: Wipe all fittings, caps, and plugs before performing any maintenance to reduce the chance of system contamination.

Inspect:

- Radiator for leaks and trash build-up.
- Air intake system hoses and connections for cracks and loose clamps.
- Fan, alternator, and accessory drive belts for cracks, breaks or other damage.
- Coolant pump for coolant leaks.

NOTE: It is normal for a small amount of leakage to occur as the engine cools down and parts contract. Excessive coolant leakage may indicate the need to replace the coolant pump. Contact your engine distributor or servicing dealer for repairs.



Dust Unloader Valve and Indicator Gauge

A—Dust Unloader Valve
B—Air Restriction Indicator

OUOD006,00000C2 –19–03AUG07–4/4

Changing Engine Oil and Replacing Filter

IMPORTANT: Changing engine oil and filter every 500 hours or 12 months depends on the following requirements:

- **Engine equipped with oil pan that allows capacity for this extended drain interval.**
- **Use of premium oil: John Deere PLUS-50™, ACEA E7 or ACEA E6.**
- **Perform engine oil analysis to determine actual extended service life of ACEA E7 and ACEA E6 oils.**
- **Use of approved John Deere oil filter.**
- **Use of diesel fuel with sulfur content less than 0.50% (5000 ppm).**

The oil and filter change interval is reduced if ANY of the above listed requirements are not followed.

IMPORTANT: If using BIODIESEL blends greater than B20, reduce oil change interval to half the recommended service interval, or monitor engine oil using OILSCAN to ensure fuel dilution does not exceed 5%.

NOTE: During break-in, change engine oil and filter for the first time before 100 hours of operation maximum .

NOTE: Service intervals depend on sulfur content of the diesel fuel, oil pan capacity, and the oil and filter used. (See DIESEL ENGINE OIL and DIESEL ENGINE OIL AND FILTER SERVICE INTERVALS in the "Fuels, Lubricants, and Coolant" section.

OILSCAN™ or OILSCAN PLUS™ is a John Deere sampling program to help you monitor machine performance and identify potential problems before they cause serious damage. OILSCAN™ and OILSCAN PLUS™ kits are available from your John Deere engine distributor or servicing dealer. Oil samples should be taken prior to the oil change. Refer to instructions provided with kit.

PLUS-50 is a trademark of Deere & Company.
OILSCAN is a trademark of Deere & Company.
OILSCAN PLUS is a trademark of Deere & Company.

Continued on next page

CAUTION: Metal surfaces of oil pan and drain plug maybe hot to the touch. Use care to prevent burns.

To change engine oil and oil filter:

1. Run engine approximately 5 minutes to warm up oil. Shut engine off.
2. Remove oil pan drain plug (arrow).
3. Drain crankcase oil from engine while warm.
4. Turn filter element (A) counterclockwise using a suitable filter wrench to remove. Discard oil filter element.

NOTE: Depending on engine application, oil filter may have either a vertical or horizontal mounting.

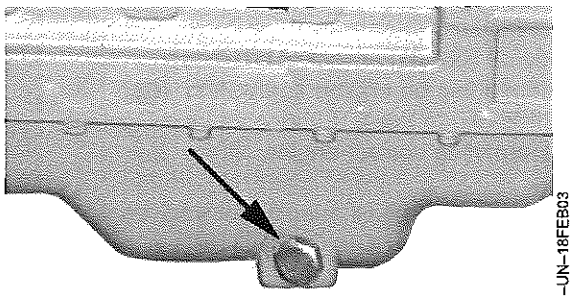
5. Remove oil filter packing and clean filter mounting pad.

IMPORTANT: Filtration of oils is critical to proper lubrication. Always change filter regularly. Use filter meeting John Deere performance specifications.

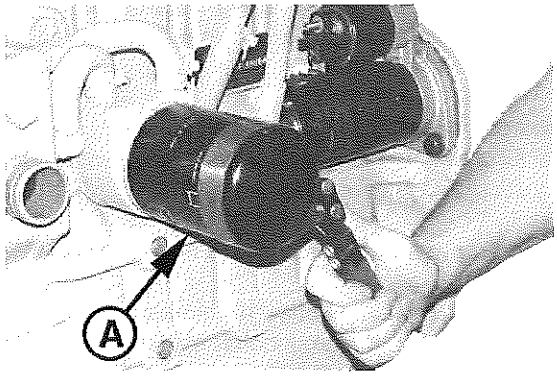
NOTE: Apply a thin coat of engine oil to the entire filter packing. DO NOT use grease.

6. Oil new packing and install new filter element. Hand tighten element according to values printed on filter element. If values are not provided, tighten element by hand approximately 3/4 — 1-1/4 turn after packing contacts filter housing. DO NOT overtighten filter element. If a filter wrench is used, be sure it is padded to avoid damaging element.
7. Install oil pan drain plug with O-ring. If O-ring is damaged, replace it.
8. Tighten drain plug to specifications.

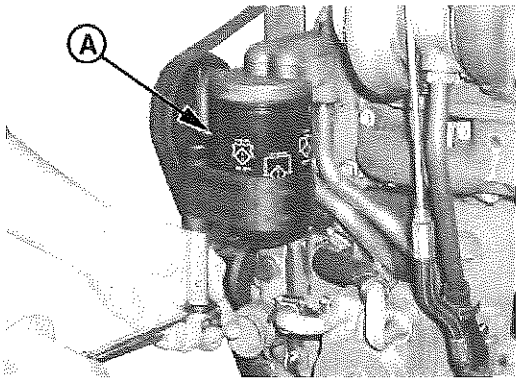
Specification	
Oil Pan Drain Plug With O-Ring— Torque	35 N•m (26 lb ft)



Oil Pan Drain Plug



Removing Horizontal Oil Filter Element



Removing Optional Vertical Oil Filter Element

A—Oil Filter Element

Continued on next page

9. Fill engine crankcase with correct John Deere engine oil through side oil filler (B) or rocker arm cover opening (C) depending on engine application. (See DIESEL ENGINE OIL in Fuels, Lubricants, and Coolant Section for determining correct engine oil.)

   To determine the correct oil fill quantity for your engine, see ENGINE CRANKCASE OIL CAPACITIES in the Specifications Section of this manual.

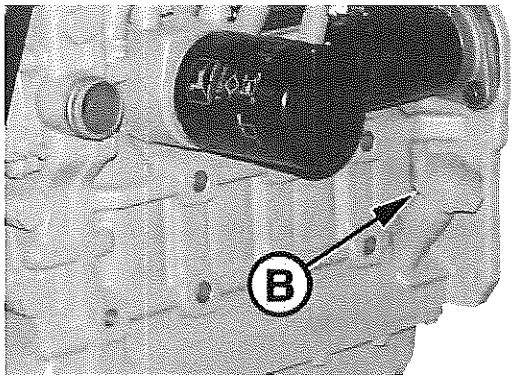
IMPORTANT: Immediately after completing any oil change, crank engine for 30 seconds without permitting engine to start. This will help insure adequate lubrication to engine components before engine starts.

NOTE: Crankcase oil capacity may vary slightly. ALWAYS fill crankcase to within crosshatch marks (D) on dipstick. DO NOT overfill.

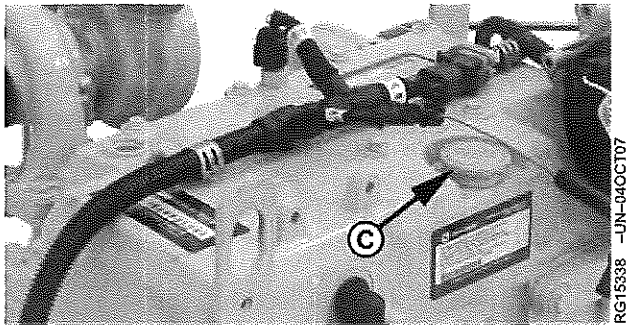
10. Start engine and run to check for possible leaks.

11. Stop engine and check oil level after 10 minutes. Oil level reading should be within crosshatch marks (D) on dipstick.

B—Optional Side Oil Fill
C—Rocker Arm Cover Oil Fill
D—Crosshatch Marks on Dipstick

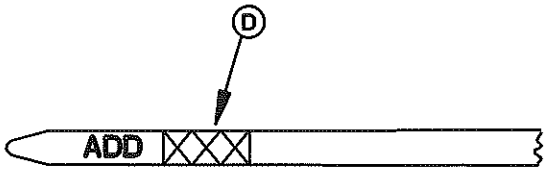


Optional Side Oil Fill



Rocker Arm Cover Oil Fill

RG12781 –UN–17FEB03



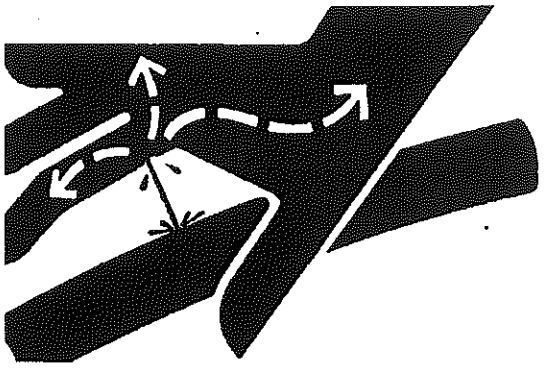
Crosshatch Marks on Dipstick

OUOD006,00000C9 –19–10AUG07–3/3

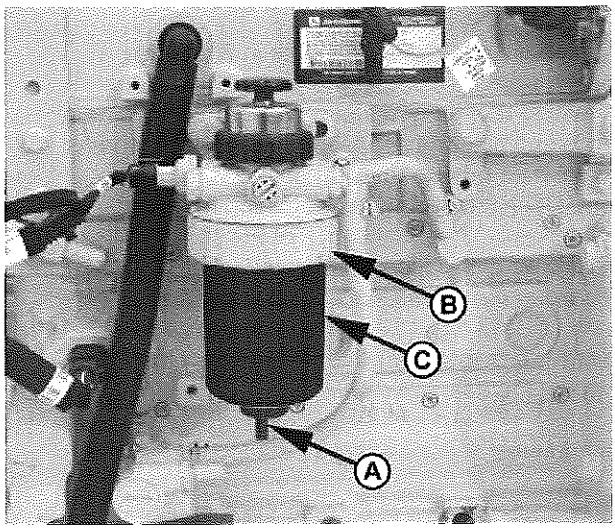
Replacing Fuel Filter Element

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If any fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.



High-Pressure Fluids



Fuel Filter

A—Drain Plug
B—Retaining Ring
C—Filter Element

1. Close fuel shut-off valve, if equipped.
2. Thoroughly clean fuel filter assembly and surrounding area.
3. Disconnect water sensor wiring (if equipped).
4. Loosen drain plug (A) and drain fuel into a suitable container.

NOTE: Lifting up on retaining ring while rotating the ring helps in clearing raised locators.

5. Firmly grasp retaining ring (B) and rotate it counterclockwise 1/4 turn (as viewed from top). Remove ring with filter element (C).
6. Inspect filter mounting base for cleanliness. Clean as required.

Continued on next page

NOTE: Raised locators on fuel filter canisters must be indexed properly with slots in mounting base for correct installation.

7. Install new filter element onto mounting base. Be sure element is properly indexed and firmly seated on base. It may be necessary to rotate filter for correct alignment.

   If equipped with water separator bowl, remove filter element from separator bowl. Drain and clean separator bowl. Dry with compressed air. Install bowl onto new element. Tighten securely.

8. Align keys on filter element with slots in filter base.

9. Install retaining ring onto mounting base making certain dust seal is in place on filter base. Hand tighten ring counterclockwise (about 1/3 turn) until it "snaps" into the detent. DO NOT overtighten retaining ring.

NOTE: The proper installation is indicated when a "click" is heard and a release of the retaining ring is felt.

A plug is provided with the new element for plugging the used element.

10. Reconnect water sensor wiring (if equipped).

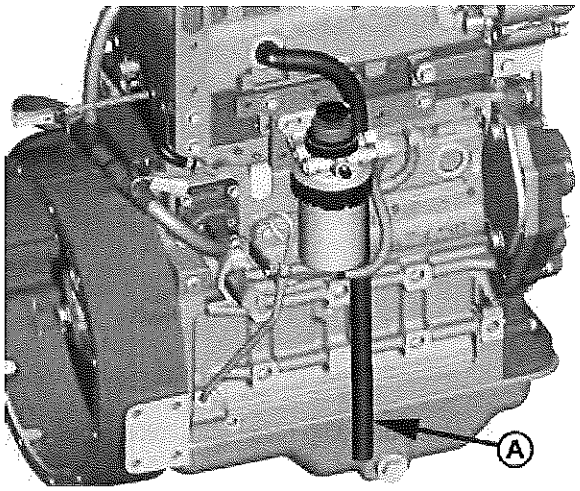
11. Open fuel shut-off valve and prime the fuel filter. (See PRIMING THE FUEL FILTER in Service As Required Section.)

OUOD006,00000C3 –19–17OCT07–2/2

Cleaning Crankcase Vent Tube

you operate the engine in dusty conditions, clean the tube at shorter intervals.

1. Remove and clean crankcase vent tube (A).
2. Install the vent tube.



RG15634 –UN–19OCT07

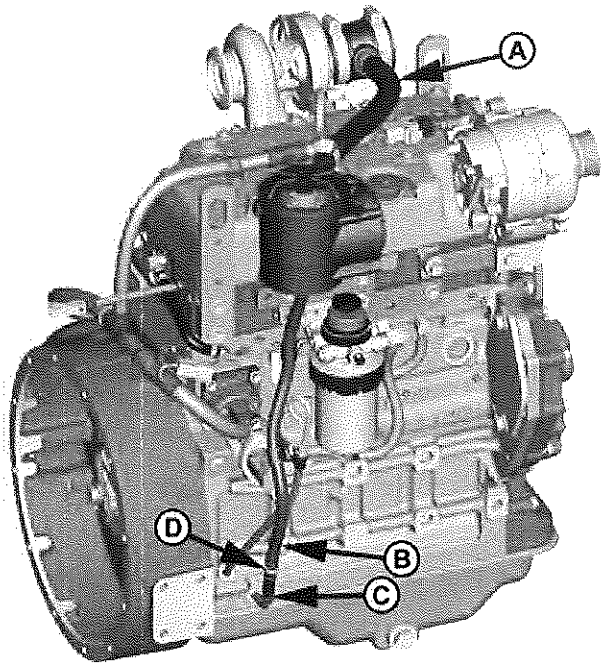
Crankcase Vent Tube

OUOD006,00000CA –19–10AUG07–1/1

Checking Closed Crankcase Vent System (If Equipped)

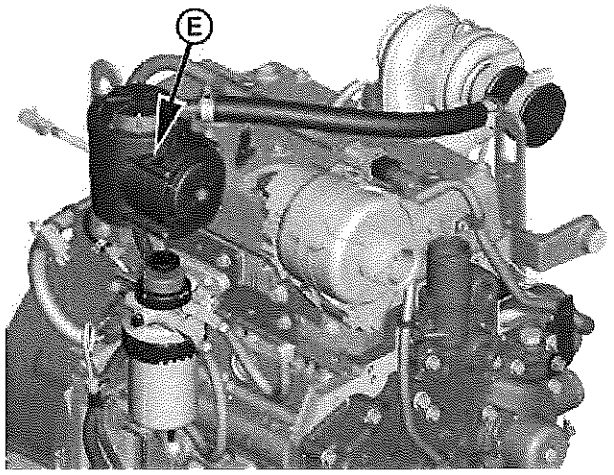
1. Inspect hoses (A) and (B) and oil drain tube assembly (C) for kinks, blockage, or other damage.
2. Inspect check valve (D) for damage.
3. Verify that the crankcase vent system bypass port (E) is not plugged.
4. Inspect CCV unit for cracks or other damage.
5. Inspect turbo compressor coupling for cracks, blockage or other damage.

A—Hose, Compressor to Filter Housing
B—Oil Drain Hose
C—Oil Drain Tube Assembly
D—Check Valve
E—Crankcase Vent System Bypass Port



RG15633 –UN–19OCT07

Closed Crankcase Vent System



RG15632 –UN–19OCT07

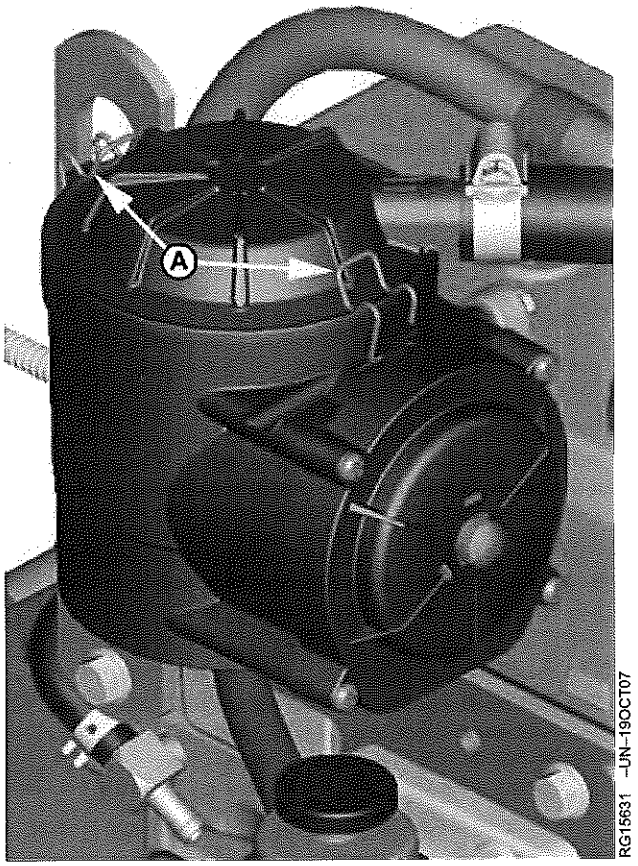
Crankcase Vent System Bypass Port

OUOD006,000011B –19–19OCT07–1/1

Replace Crankcase Vent Filter (If Equipped)

1. Open clips (A) and remove the crankcase vent lid.
2. Remove old filter and discard.
3. Install new filter into crankcase vent housing and snap into place.
4. Install lid and lock down clips.

A—Clips



Replace Crankcase Vent Filter

OUOD006,000011C —19—19OCT07—1/1

Checking Air Intake System

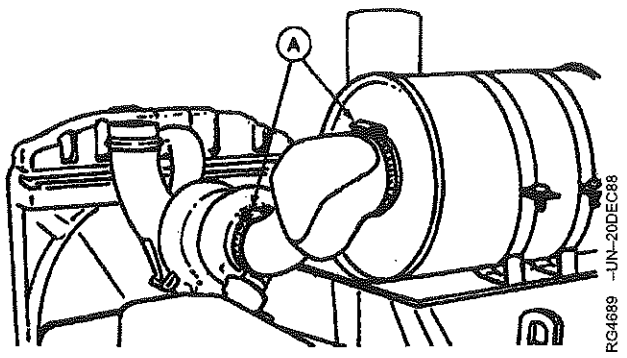
IMPORTANT: The air intake system must not leak. Any leak, no matter how small, may result in internal engine damage due to abrasive dirt and dust entering the intake system.

1. Inspect all intake hoses (piping) for cracks. Replace as necessary.
2. Check clamps (A) on piping which connect the air cleaner, engine and, if present, turbocharger. Tighten clamps as necessary. This will help prevent dirt from entering the air intake system through loose connections causing internal engine damage.
3. If engine has a rubber dust unloader valve (B), inspect the valve on bottom of air cleaner for cracks or plugging. Replace as necessary.

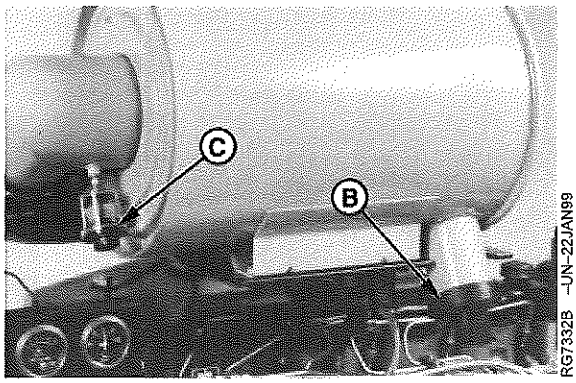
IMPORTANT: ALWAYS REPLACE primary air cleaner element when air restriction indicator shows a vacuum of 625 mm (25 in. H_2O), is torn, or visibly dirty. See REPLACING AIR CLEANER ELEMENT later in Service As Required section.

4. Test air restriction indicator (C) for proper operation. Replace indicator as necessary.

IMPORTANT: If not equipped with air restriction indicator, replace air cleaner elements at 500 Hours or 12 Months, whichever occurs first.



Check Clamps



Unloader Valve and Air Restriction Indicator

A—Clamps
B—Dust Unloader Valve
C—Air Restriction Indicator

RG41183,000003D –19–31JAN07–1/1

Check Engine Speeds

Observe tachometer reading (if equipped) and check speeds per specification (See correct speeds listed in ENGINE POWER RATINGS). If speeds require adjustment, contact your John Deere dealer or distributor.

RG41183,000003E –19–31JAN07–1/1

Checking Belt Tensioner Spring Tension and Belt Wear

Belt drive systems equipped with an automatic (spring) belt tensioner cannot be adjusted or repaired. The automatic belt tensioner is designed to maintain proper belt tension over the life of the belt. If tensioner spring tension is not within specification, replace tensioner assembly.

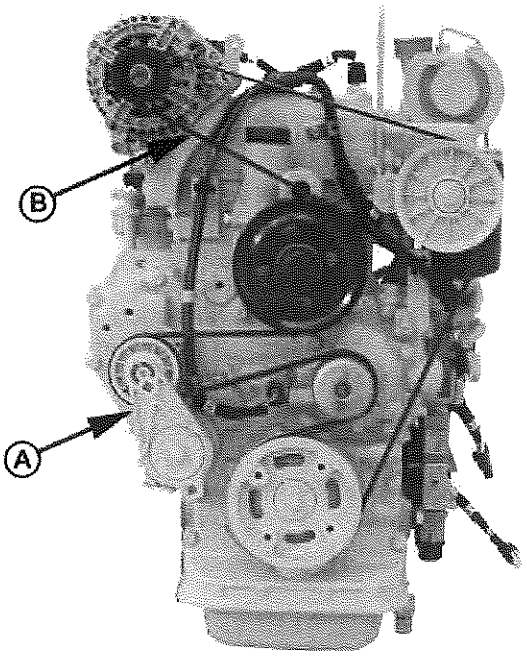
OUOD006,000010E –19–10OCT07–1/3

Checking Belt Wear

The belt tensioner (A) is designed to operate within the limit of arm movement when correct belt length and geometry is used.

Visually inspect poly-vee belt (B) for excessive wear and cracks. See Replacing Fan and Alternator Belt in Section 45.

A—Belt Tensioner
B—Poly-Vee Belt



RG15339 –UN–04OCT07

Belt Wear Inspection

Continued on next page

OUOD006,000010E –19–10OCT07–2/3

Checking Tensioner Spring Tension

A belt tension gauge will not give an accurate measure of the belt tension when automatic spring tensioner is used. Measure tensioner spring tension using a torque wrench and procedure outlined below:

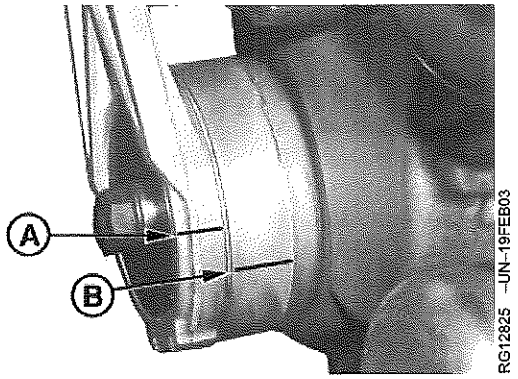
1. Release tension on belt using a breaker bar and socket on tension arm. Remove belt from pulleys.
2. Release tension on tension arm and remove breaker bar.
3. Put a mark (A) on swing arm of tensioner as shown.
4. Measure 21 mm (0.83 in.) from (A) and put a mark (B) on tensioner mounting base.
5. Install torque wrench (C) so that it is aligned with center of pulley and tensioner. Rotate the swing arm with the torque wrench until marks (A and B) are aligned.
6. Record torque wrench measurement and compare with specification below. Replace tensioner assembly as required.

Specification

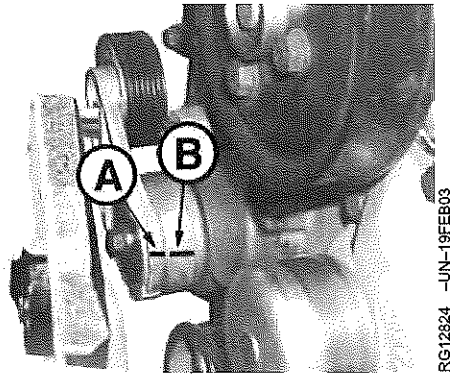
Spring Tension—Torque ..... 18-22 N•m (13-16 lb-ft)

NOTE: Threads on belt tensioner roller cap screw are LEFT-HAND threads

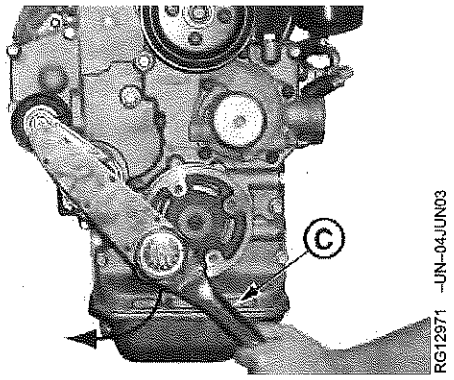
A—Mark On Swing Arm
B—Mark On Tensioner Mounting Base
C—Torque Wrench



Marks on Tensioner



Align Marks



Align Torque Wrench With Pulley And Tensioner

OUOD006,000010E –19–10OCT07–3/3

Checking Engine Electrical Ground Connections

Keep all engine ground connections clean and tight to prevent electrical arcing which can damage electrical components.

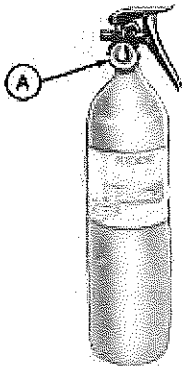
RG41183,0000049 –19–08JAN03–1/1

Servicing Fire Extinguisher

A fire extinguisher (A) is available from your authorized servicing dealer or engine distributor.

Read and follow the instructions which are packaged with it. The extinguisher should be inspected at least every 500 hours of engine operation or once a month. Once extinguisher is operated, no matter how long, it must be recharged. Keep record of inspections on the tag which comes with the extinguisher instruction booklet.

A—Fire Extinguisher



Fire Extinguisher

RW4918 –UN–15DEC88

RG,RG34710,5567 –19–02JAN07–1/1

Checking Engine Mounts

Engine mounting is the responsibility of the vehicle or generator manufacturer. Follow manufacturer's guidelines for mounting specifications.

IMPORTANT: Use only Grade SAE 8 or higher grade of hardware for engine mounting.

1. Check the engine mounting bracket, vibration isolators, and mounting bolts on support frame and engine block for tightness. Tighten as necessary.

2. Inspect overall condition of vibration isolators, if equipped. Replace isolators if rubber has deteriorated or mounts have collapsed, as necessary.

DPSG,RG34710,111 –19–07JAN02–1/1

Servicing Battery

CAUTION: Battery gas can explode. Keep sparks and flames away from batteries. Use a flashlight to check battery electrolyte level.

Never check battery charge by placing a metal object across the posts. Use a voltmeter or hydrometer.

Always remove grounded NEGATIVE (–) battery clamp first and replace it last.



TS204 –UN–23AUG88

Exploding Battery

WARNING: Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. **Wash hands after handling.**

1. On regular batteries, check electrolyte level. Fill each cell to bottom of filler neck with distilled water.

NOTE: Low-maintenance or maintenance-free batteries should require little additional service. However, electrolyte level can be checked by cutting the center section of decal on dash-line, and removing cell plugs. If necessary, add clean, soft water to bring level to bottom of filler neck.

2. Keep batteries clean by wiping them with a damp cloth. Keep all connections clean and tight. Remove any corrosion, and wash terminals with a solution of 1 part baking soda and 4 parts water. Tighten all connections securely.

NOTE: Coat battery terminals and connectors with a mixture of petroleum jelly and baking soda to retard corrosion.

3. Keep battery fully charged, especially during cold weather. If a battery charger is used, turn charger off before connecting charger to battery(ies). Attach POSITIVE (+) battery charger lead to POSITIVE (+) battery post. Then attach NEGATIVE (–) battery charger lead to a good ground.

Continued on next page

CAUTION: Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid the hazard by:

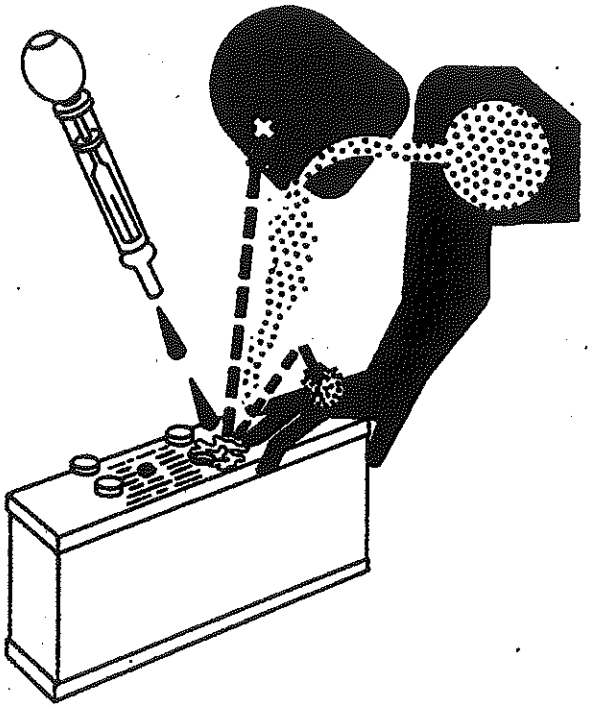
1. **Filling batteries in a well-ventilated area.**
2. **Wearing eye protection and rubber gloves.**
3. **Avoiding breathing fumes when electrolyte is added.**
4. **Avoiding spilling or dripping electrolyte.**
5. **Use proper jump start procedure.**

If you spill acid on yourself:

1. **Flush your skin with water.**
2. **Apply baking soda or lime to help neutralize the acid.**
3. **Flush your eyes with water for 10–15 minutes. Get medical attention immediately.**

If acid is swallowed:

1. **Drink large amounts of water or milk.**
2. **Then drink milk of magnesia, beaten eggs, or vegetable oil.**
3. **Get medical attention immediately.**



TS203 –UN–23AUG88

Sulfuric Acid

In freezing weather, run engine at least 30 minutes to assure thorough mixing after adding water to battery.

If necessary to replace battery(ies), replacements must meet or exceed the following recommended capacities at -18°C (0°F):

Specification	
12 Volt Standard Duty Starter—Cold Cranking Amps	640
12 Volt Heavy Duty Starter—Cold Cranking Amps	800
24 Volt Standard Duty Starter—Cold Cranking Amps	570

RG,RG34710,5568 –19–20MAY96–2/2

Checking Cooling System

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

IMPORTANT: Air must be expelled from cooling system when system is refilled. Loosen temperature sending unit fitting at rear of cylinder head or plug in thermostat housing to allow air to escape when filling system. Retighten fitting or plug when all the air has been expelled.

1. Visually check entire cooling system for leaks. Tighten all clamps securely.

2. Thoroughly inspect all cooling system hoses for hard, flimsy, or cracked condition. Replace hoses if any of the above conditions are found.



High-Pressure Fluids

TS281 –UN–23AUG88

RG,RG34710,5580 –19–20MAY96–1/1

Replenishing Supplemental Coolant Additives (SCAs) Between Coolant Changes

IMPORTANT: Do not add supplemental coolant additives when the cooling system is drained and refilled with John Deere COOL-GARD™

NOTE: If system is to be filled with coolant that does not contain SCAs, the coolant must be precharged. Determine the total system capacity and premix with 3% John Deere Coolant Conditioner.

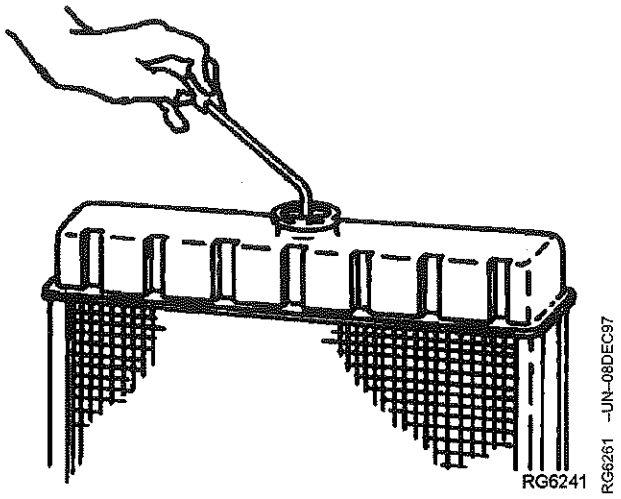
Through time and use, the concentration of coolant additives is gradually depleted during engine operation. Periodic replenishment of inhibitors is required, even when John Deere COOL-GARD™ is used. The cooling system must be recharged with additional supplemental coolant additives available in the form of liquid coolant conditioner.

Maintaining the correct coolant conditioner concentration (SCAs) and freeze point is essential in your cooling system to protect against rust, liner pitting and corrosion, and freeze-ups due to incorrect coolant dilution.

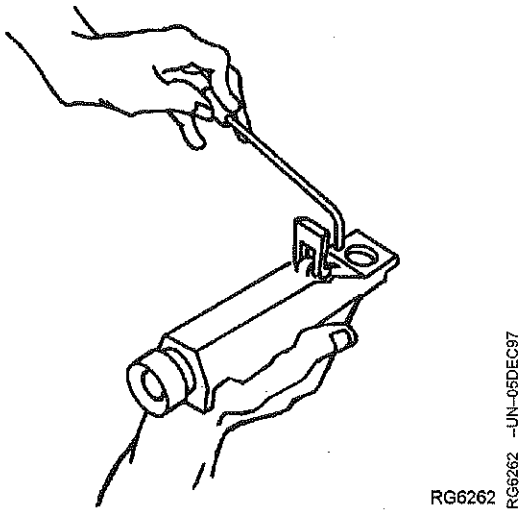
John Deere LIQUID COOLANT CONDITIONER is recommended as a supplemental coolant additive in John Deere engines.

DO NOT mix one brand of SCA with a different brand.

Test the coolant solution at 500 hours or 12 months of operation using either John Deere coolant test strips or a COOLSCAN™ or COOLSCAN PLUS™ analysis. If a COOLSCAN™ or COOLSCAN PLUS™ analysis is not available, recharge the system per instructions printed on label of John Deere Liquid Coolant Conditioner.



Radiator Coolant Check



JT07298 Coolant/Battery Tester

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COOLSCAN is a trademark of Deere & Company
COOLSCAN PLUS is a trademark of Deere & Company

Continued on next page

IMPORTANT: ALWAYS maintain coolant at correct level and concentration. DO NOT operate engine without coolant even for a few minutes.

If frequent coolant makeup is required, the glycol concentration should be checked with JT07298 Coolant/Battery Tester to ensure that the desired freeze point is maintained. Follow manufacturer's instructions provided with Coolant/Battery Tester.

Add the manufacturer's recommended concentration of supplemental coolant additive. DO NOT add more than the recommended amount.

The use of non-recommended supplemental coolant additives may result in additive drop-out and gelation of the coolant.

If other coolants are used, consult the coolant supplier and follow the manufacturer's recommendation for use of supplemental coolant additives.

See DIESEL ENGINE COOLANTS AND SUPPLEMENTAL ADDITIVE INFORMATION for proper mixing of coolant ingredients before adding to the cooling system.

DPSG,OUOD002,1921 –19–27JUL06–2/2

Testing Diesel Engine Coolant

esting Diesel Engine Coolant

Maintaining adequate concentrations of glycol and inhibiting additives in the coolant is critical to protect the engine and cooling system against freezing, corrosion, and cylinder liner erosion and pitting.

Test the coolant solution at intervals of 12 months or less and whenever excessive coolant is lost through leaks or overheating.

Coolant test strips

Coolant test strips are available from your John Deere dealer. These test strips provide a simple, effective method to check the freeze point and additive levels of your engine coolant.

Compare the results to the supplemental coolant additive (SCA) chart to determine the amount of inhibiting additives in your coolant and whether more John Deere COOLANT CONDITIONER should be added.

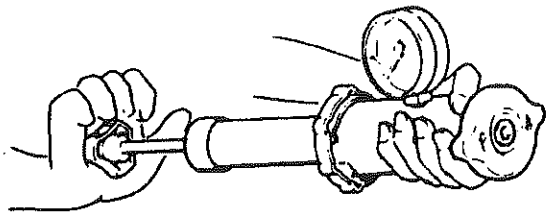
COOLSCAN™ and COOLSCAN PLUS™

For a more thorough evaluation of your coolant, perform a COOLSCAN or COOLSCAN PLUS analysis, where available. See your John Deere dealer for information.

COOLSCAN is a trademark of Deere & Company
COOLSCAN PLUS is a trademark of Deere & Company

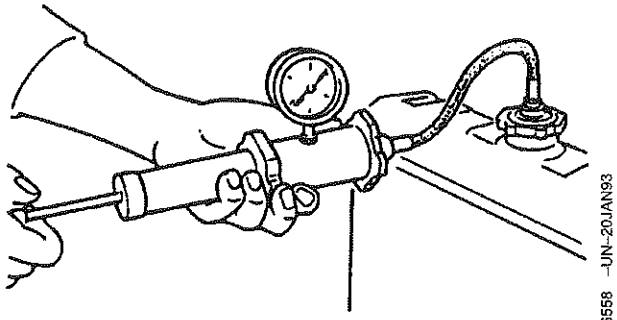
DX,COOL9 –19–19DEC03–1/1

Pressure Testing Cooling System



RG6557 –UN–20JAN93

Test Radiator Cap



RG6558 –UN–20JAN93

Test Cooling System

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

Test Radiator Cap

1. Remove radiator cap and attach to D05104ST Tester as shown.
2. Pressurize cap to specification listed. Gauge should hold pressure for 10 seconds within the normal range if cap is acceptable.

   If gauge does not hold pressure, replace radiator cap.

Specification	
Radiator Cap Holding Pressure (Not Opening For 10 Seconds)—Pressure	70 kPa (0.7 bar) (10 psi) minimum

3. Remove the cap from gauge, turn it 180°, and retest cap. This will verify that the first measurement was accurate.

Test Cooling System

NOTE: Engine should be warmed up to test overall cooling system.

1. Allow engine to cool, then carefully remove radiator cap.
2. Fill radiator with coolant to the normal operating level.

IMPORTANT: DO NOT apply excessive pressure to cooling system, doing so may damage radiator and hoses.

3. Connect gauge and adapter to radiator filler neck. Pressurize cooling system to specification listed for radiator cap.
4. With pressure applied, check all cooling system hose connections, radiator, and overall engine for leaks.

   If leakage is detected, correct as necessary and pressure test system again.

   If no leakage is detected, but the gauge indicated a drop in pressure, coolant may be leaking internally within the system or at the block-to-head gasket. Have your engine distributor or servicing dealer correct this problem immediately.

RG,RG34710,5586 –19–07JAN02–1/1

Checking Crankshaft Vibration Damper (If Equipped)

1. Grasp vibration damper with both hands and attempt to turn it in both directions. If rotation is felt, damper is defective and should be replaced.

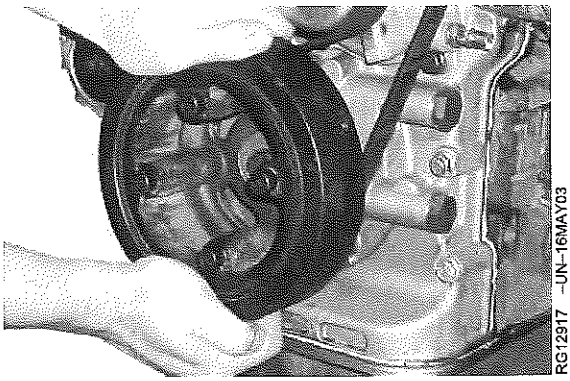
IMPORTANT: The vibration damper assembly is not repairable and should be replaced every 4500 hours or 60 months, whichever occurs first.

2. Check vibration damper radial runout by positioning a dial indicator so probe contacts damper outer diameter.
3. Remove starter motor.
4. Rotate crankshaft using JDG1704 or JDG10221 Flywheel Turning Tool as shown. This tool is available from your John Deere dealer or distributor.
5. Note dial indicator reading. If runout exceeds specifications given below, replace vibration damper.

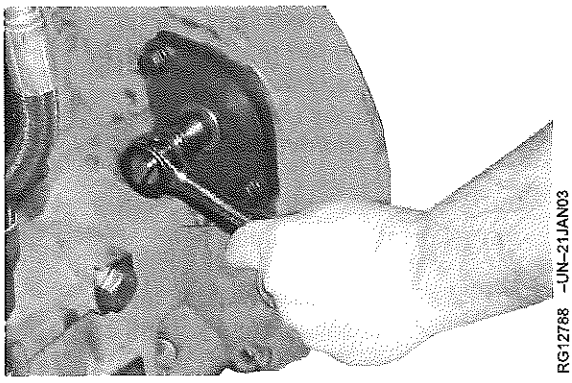
Specification	
Vibration Damper—Maximum Radial Runout	1.00 mm (0.040 in.)

6. Remove tool and reinstall starter motor. Connect wiring and tighten mounting cap screws to specifications.

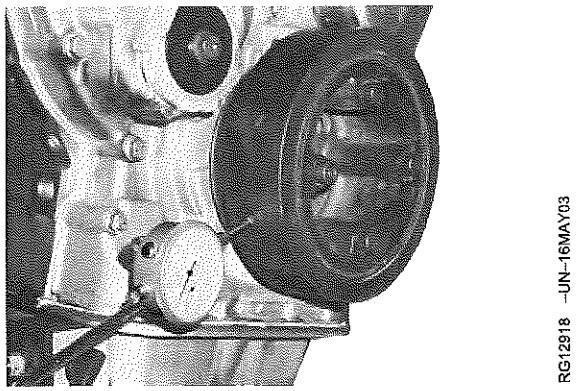
Specification	
Starter Motor Mounting Cap Screws—Torque	80 N•m (59 lb-ft)



Vibration Damper



Rotating Crankshaft Using JDG1704



Vibration Damper Radial (Concentricity)

OUOD006,000006E –19–02JAN07–1/1

Flushing and Refilling Cooling System

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

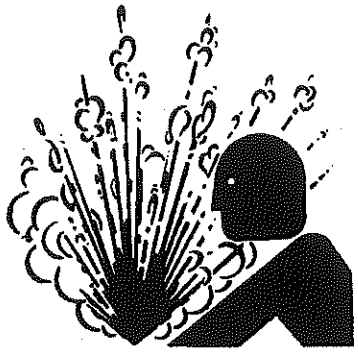
Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

NOTE: When John Deere COOL-GARD is used, the drain interval is 3000 hours or 36 months. The drain interval may be extended to 5000 hours or 60 months of operation, ***provided that the coolant is tested annually AND additives are replenished, as needed, by adding a supplemental coolant additive (SCA).***

If COOL-GARD is not used, the flushing interval is 2000 hours or 24 months of operation.

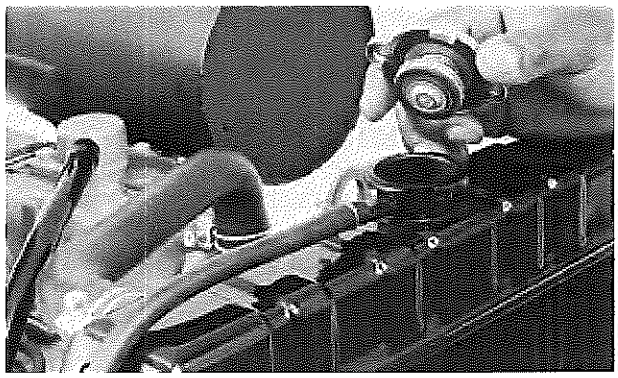
Drain old coolant, flush the entire cooling system, test thermostats, and fill with recommended clean coolant as follows:

1. Pressure test entire cooling system and pressure cap if not previously done. (See PRESSURE TESTING COOLING SYSTEM, in the Lubrication and Maintenance/500 Hour/12 Month Section.)
2. Slowly open the engine cooling system filler cap or radiator cap to relieve pressure and allow coolant to drain faster.
3. Open engine block drain valve (A) on right side of coolant pump on engine front cover. Drain all coolant from engine block.
4. Open radiator drain valve. Drain all coolant from radiator.
5. Remove coolant hose and thermostat at this time, if not previously done. (See TESTING THERMOSTATS OPENING TEMPERATURE later in this section.)
6. Close all drain valves after coolant has drained.



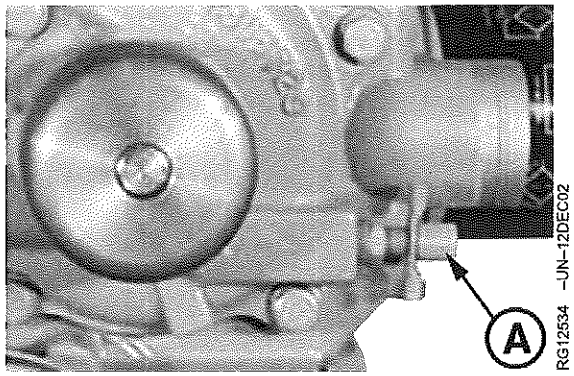
TS281 –UN–23AUG88

High-Pressure Fluids



RG6576 –UN–20JAN93

Cooling System Filler Cap



RG12534 –UN–12DEC02

Engine Coolant Drain Valve

A—Engine Coolant Drain Valve

Continued on next page

CAUTION: Do not run engine longer than 10 minutes. Doing so may cause engine to overheat which may cause burns when radiator water is draining.

7. Fill the cooling system with clean water. Run the engine about 10 minutes to stir up possible rust or sediment.

8. Stop engine, pull off lower radiator hose and remove radiator cap. Immediately drain the water from system before rust and sediment settle.

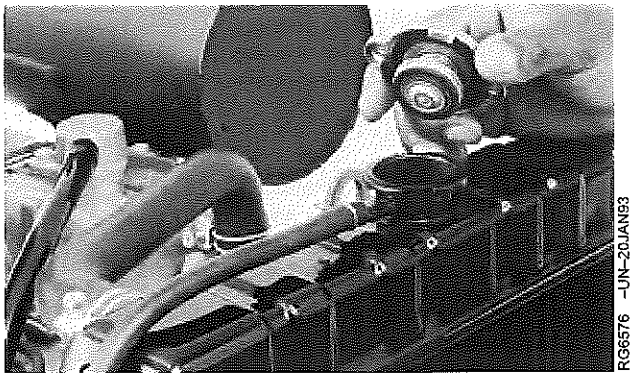
9. After draining water, close drain valves. Reinstall radiator cap and radiator hose and clamp. Fill the cooling system with clean water and a heavy duty cooling system cleaner such as Fleetguard® RESTORE™ and RESTORE PLUS™. These products may be available from your John Deere dealer. Follow manufacturer's directions on label.

10. After cleaning the cooling system, drain cleaner and fill with water to flush the system. Run the engine about 10 minutes, remove radiator cap and pull off lower radiator hose to drain out flushing water.

11. Close all drain valves on coolant pump and radiator. Install thermostat. Reinstall radiator hose and tighten clamps securely.

IMPORTANT: Air must be expelled from cooling system when system is refilled. Loosen temperature sending unit fitting at rear of cylinder head or plug in thermostat housing to allow air to escape when filling system. Retighten fitting or plug after filling cooling system.

12. Refill system with fresh coolant at radiator until coolant touches bottom of filler neck. See specification for capacity. (See ADDING COOLANT in Service As Required Section.) Install radiator cap.



Radiator Cap

Fleetguard is a trademark of Cummins Engine Company, Inc.
RESTORE is a trademark of Fleetguard.
RESTORE PLUS is a trademark of Fleetguard.

Continued on next page

Specification	
2.4 L and 3.0 L Industrial Engine— Coolant Capacity	2.6 L (2.7 qt)
2.4 L and 3.0 L Gen Set Engine—Coolant Capacity	2.9 L (3.1 qt)

13. Run engine until it reaches operating temperature. This mixes the solution uniformly and circulates it through the entire system. See GENERAL ENGINE SPECIFICATIONS in Specification Section for normal coolant temperature specification for your engine.

14. After running engine, check coolant level and entire cooling system for leaks.

OURGP12,00002B8 –19–03AUG07–3/3

Testing Thermostats Opening Temperature

o Remove Thermostat

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns. DO NOT drain coolant until it has cooled below operating temperature. Always loosen radiator pressure cap or drain valve slowly to relieve pressure.

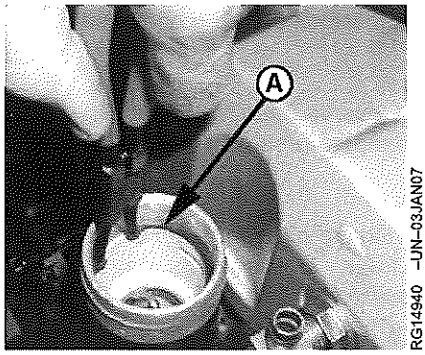
1. Visually inspect area around thermostat housing on top of engine timing gear cover for leaks.
2. Remove radiator pressure cap and partially drain cooling system.
3. Remove coolant hose (shown removed) from thermostat housing.
4. Remove snap ring (A) from thermostat housing.
5. Remove thermostat (B) from thermostat housing.
6. Clean and check thermostat housing for cracks or damage.

A—Snap Ring
B—Thermostat



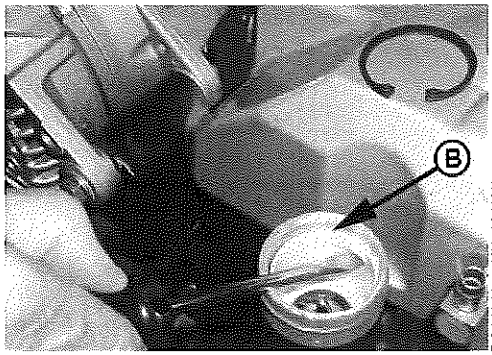
TS281 –UN–23AUG88

High Pressure Fluids



RG14940 –UN–03JAN07

Remove Snap Ring



RG14941 –UN–03JAN07

Remove Thermostat

Continued on next page

Testing Thermostats Opening Temperature

1. Remove thermostat(s).

2. Visually inspect thermostat(s) for corrosion or damage. If dual thermostats, replace as a matched set as necessary.

CAUTION: DO NOT allow thermostat or thermometer to rest against the side or bottom of container when heating water. Either may rupture if overheated.

3. Suspend thermostat and a thermometer in a container of water.

4. Stir the water as it heats. Observe opening action of thermostat and compare temperatures with the specification below.

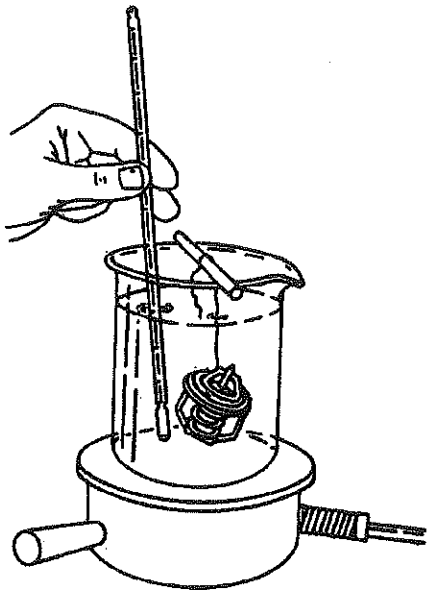
NOTE: Due to varying tolerances of different suppliers, initial opening and full open temperatures may vary slightly from specified temperatures.

THERMOSTAT TEST SPECIFICATIONS

Rating	Initial Opening (Range)	Full Open (Nominal)
71°C (160°F)	69—72°C (156—162°F)	84°C (182°F)
77°C (170°F)	74—78°C (166—172°F)	89°C (192°F)
82°C (180°F)	80—84°C (175—182°F)	94°C (202°F)
89°C (192°F)	86—90°C (187—194°F)	101°C (214°F)
90°C (195°F)	89—93°C (192—199°F)	103°C (218°F)
92°C (197°F)	89—93°C (193—200°F)	105°C (221°F)
96°C (205°F)	94—97°C (201—207°F)	100°C (213°F)
99°C (210°F)	96—100°C (205—212°F)	111°C (232°F)

5. Remove thermostat and observe its closing action as it cools. In ambient air the thermostat should close completely. Closing action should be smooth and slow.

6. Replace any defective thermostat.



RG5971 –UN–23NOV97

Testing Thermostat Opening Temperature

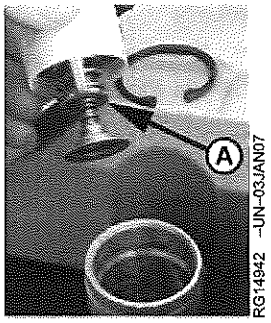
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To Install Thermostats

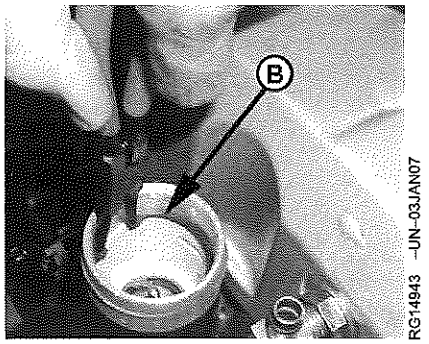
1. Insert thermostat (A) in housing.
2. Install snap ring (B) in groove.
3. Install coolant hose to thermostat cover. Tighten clamp.
4. If not already done, fill cooling system and check for leaks.

IMPORTANT: Air must be expelled from cooling system when filling. Loosen temperature sending unit fitting at rear of cylinder head or plug in thermostat housing to allow air to escape when filling system. Tighten fitting or plug when all air has been expelled.

A—Thermostat
B—Snap Ring



Install Thermostat



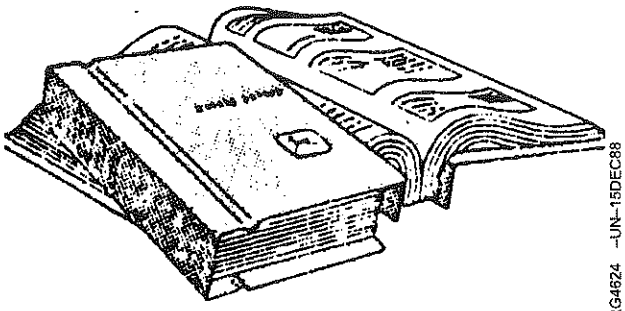
Install Snap Ring

OUOD006,00000C1 —19—03AUG07—3/3

Service as Required

Additional Service Information

This is not a detailed service manual. If you want more detailed service information, contact your John Deere dealer or engine distributor.



RG4624 –UN–15DEC88

Component Technical Manuals

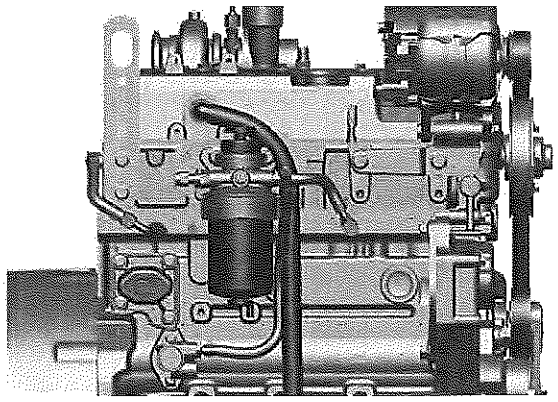
OURGP11,0000048 –19–11OCT06–1/1

Do Not Modify Fuel System

IMPORTANT: Modification or alteration of the fuel injection system, the injection timing, or the fuel injectors in ways not recommended by the manufacturer will terminate the warranty obligation to the purchaser.

In addition, tampering with fuel system which alters emission-related equipment on engines may result in fines or other penalties, per EPA regulations or other local emission laws.

Do not attempt to service fuel injectors yourself. Special training and special tools are required. (See your authorized servicing dealer or engine distributor.)



RG15478 –UN–19OCT07

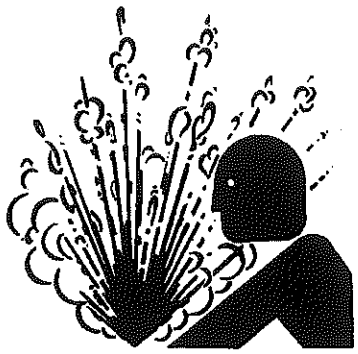
Fuel System

OUOD006,000011D –19–19OCT07–1/1

Adding Coolant

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.



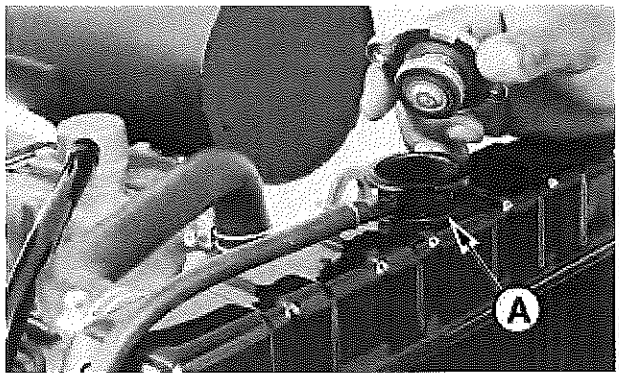
TS281 –UN–23AUG88

High-Pressure Fluids

IMPORTANT: Never pour cold liquid into a hot engine, as it may crack cylinder head or block. DO NOT operate engine without coolant for even a few minutes.

John Deere Cooling System Sealer may be added to the radiator to stop leaks on a temporary or emergency basis only. DO NOT use any other stop-leak additives in the system. Leaks should be permanently repaired as soon as possible.

Air must be expelled from cooling system when coolant is added.



RG6576A –UN–04JUN03

Radiator Filler Neck

1. Loosen temperature sending unit fitting at rear of cylinder head or plug in side of thermostat housing to allow air to escape when filling system.

IMPORTANT: When adding coolant to the system, use the appropriate coolant solution. (See ENGINE COOLANT SPECIFICATIONS in Fuels, Lubricants, and Coolant Section for mixing of coolant ingredients before adding to cooling system.)

Do not overfill cooling system. A pressurized system needs space for heat expansion without overflowing at top of radiator.

2. Remove radiator cap and fill until coolant level touches bottom of radiator filler neck (A).

Continued on next page

3. Tighten plugs and fittings when air has been expelled from system.

4. Run engine until it reaches operating temperature.

OUOD006,0000070 –19–03JAN07–2/2

Replacing Single Stage Air Cleaner Element

IMPORTANT: ALWAYS REPLACE air cleaner when air restriction indicator shows a vacuum greater than 625 mm (25 in.) H_2O, is torn, or visibly dirty.

NOTE: Refer to manufacturers' instructions for servicing air cleaners not supplied by John Deere. If engine is NOT equipped with an air restriction indicator, replace air filter element every 500 hours of operation or every 12 months, whichever occurs first.

1. If equipped, loosen body clamp.
2. Loosen clamp around outlet neck (A).
3. Remove air cleaner.
4. Install new filter so that overlap (B) of air cleaner outlet neck and engine intake pipe is to specification below.

Specification	
Air Cleaner Neck to Engine Intake—Overlap	38 mm (1.5 in)

5. Tighten neck clamp (A) to specification below.

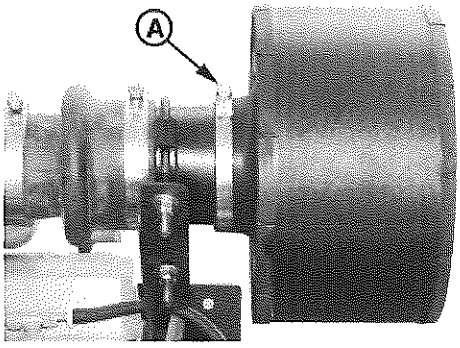
Specification	
Air Cleaner Neck Clamp—Torque	6.8 N•m (60 lb-in.)

IMPORTANT: Do NOT overtighten body clamp. Overtightening may cause crushing of air cleaner body. Tighten body clamp only until snug.

6. If equipped, tighten body clamp until snug.

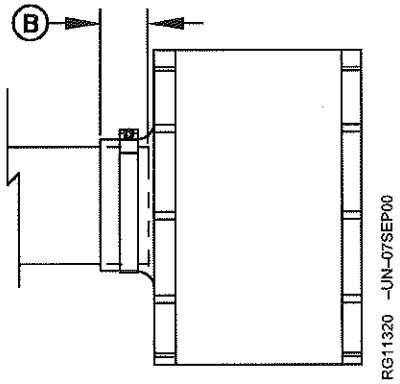
IMPORTANT: Whenever the air cleaner has been serviced or removed, ALWAYS fully depress the air restriction indicator reset button (if equipped) to assure accurate readings.

7. If equipped, fully depress air restriction indicator reset button and release to reset indicator.



RG11319A –UN–06SEP00

Single Stage Air Filter



RG11320 –UN–07SEP00

Installation of Single Stage Air Cleaner

A—Outlet Neck Clamp
B—Filter to Engine Overlap

Replacing Axial Seal Air Cleaner Filter Element

IMPORTANT: ALWAYS REPLACE primary air cleaner element when air restriction indicator shows a vacuum greater than 625 mm (25 in.) H_2O, is torn, or visibly dirty.

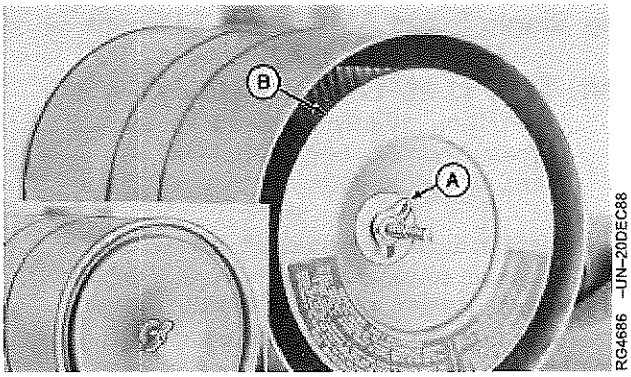
NOTE: Refer to manufacturers' instructions for servicing air cleaners not supplied by John Deere. If engine is NOT equipped with an air restriction indicator, replace air filter element every 500 hours of operation or every 12 months, whichever occurs first.

1. Remove wing nut and remove canister cover shown in small illustration inset.
2. Remove wing nut (A) and remove primary element (B) from canister.
3. Thoroughly clean all dirt from inside canister.

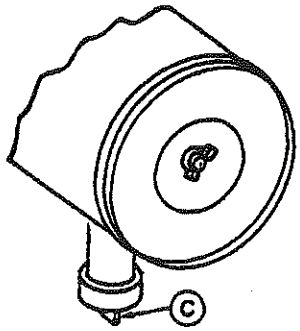
NOTE: Some engines may have a dust unloader valve (C) on the air cleaner. If equipped, squeeze valve tip to release any trapped dirt particles.

IMPORTANT: Remove secondary (safety) element (E) ONLY for replacement. DO NOT attempt to clean, wash, or reuse secondary element. Replacement of secondary element is usually necessary ONLY when primary element has a hole in it.

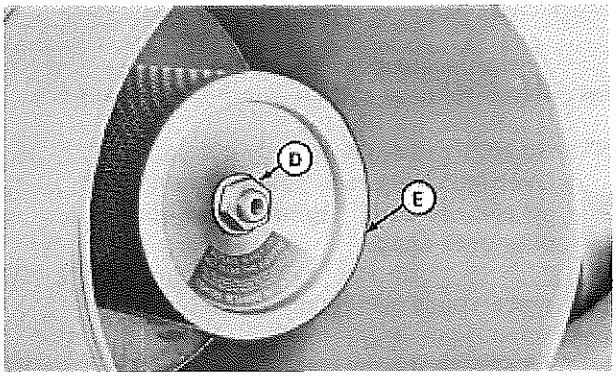
4. To replace secondary element, remove retaining nut (D) and secondary element (E). Immediately replace secondary element with new element to prevent dust from entering air intake system.
5. Install new primary element and tighten wing nut securely. Install cover assembly and tighten retaining wing nut securely.



Wing Nut and Primary Element



Dust Unloader Valve



Retaining Nut and Secondary Element

A—Wing Nut
B—Primary Element
C—Dust Unloader Valve
D—Retaining Nut
E—Secondary Element

Continued on next page

IMPORTANT: Whenever the air cleaner has been serviced or had cover removed, ALWAYS fully depress the air restriction indicator reset button (if equipped) to assure accurate readings.

6. If equipped, fully depress air restriction indicator reset button and release to reset indicator.

RG41183,0000054 –19–03JAN07–2/2

Replacing Radial Seal Air Cleaner Filter Element

IMPORTANT: ALWAYS REPLACE primary air cleaner element when air restriction indicator shows a vacuum greater than 625 mm (25 in.) H_2O, is torn, or visibly dirty.

NOTE: Refer to manufacturers' instructions for servicing air cleaners not supplied by John Deere. If engine is NOT equipped with an air restriction indicator, replace air filter element every 500 hours of operation or every 12 months, whichever occurs first.

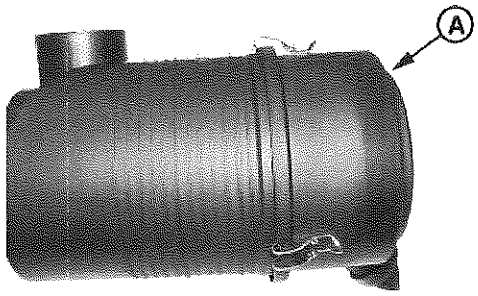
1. Unlatch and remove dust cup/cover (A) of air cleaner.
2. Move end of filter (B) back and forth gently to break seal.
3. Pull filter (B) off outlet tube and out of housing.
4. Thoroughly clean all dirt from inside housing and from outlet bore.

IMPORTANT: Remove secondary (safety) element (C) ONLY for replacement. DO NOT attempt to clean, wash, or reuse secondary element. Replacement of secondary element is usually necessary ONLY when primary element has a hole in it.

5. To replace secondary element (C), pull filter element out gently. Immediately replace secondary element with new element to prevent dust from entering air intake system.
6. Install new primary filter element. Apply pressure by hand at outer rim of filter.

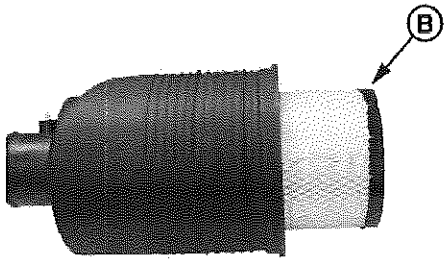
IMPORTANT: Do NOT use latches on cover to force filter into air cleaner. Using cover to force filter will damage cleaner housing.

7. Close housing with dust unloader valve aimed down and latch latches.



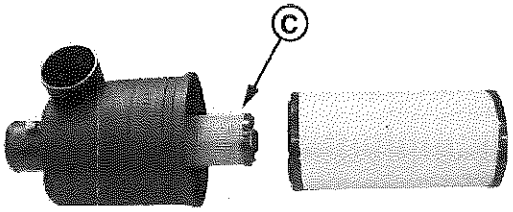
RG11321A –UN–08SEP00

Dust Cup/Cover



RG11322A –UN–08SEP00

Primary Filter Element



RG11327A –UN–08SEP00

Secondary Filter Element

A—Dust Cap/Cover
B—Primary Filter Element
C—Secondary Filter Element

Continued on next page

IMPORTANT: Whenever the air cleaner has been serviced or cover has been removed, ALWAYS fully depress the air restriction indicator reset button (if equipped) to assure accurate readings.

8. If equipped, fully depress air restriction indicator reset button and release to reset indicator.

RG41183,0000055 –19–03JAN07–2/2

Replacing Fan and Alternator Belt

Refer to CHECKING BELT TENSIONER SPRING TENSION AND BELT WEAR in Lubrication and Maintenance/500 Hour/12 Month Section for additional information on the belt tensioner.

1. Inspect belts for cracks, fraying, or stretched out areas. Replace if necessary.

2. To replace belt, release tension on belt using a 3/8-inch drive arm (B) on tension arm.

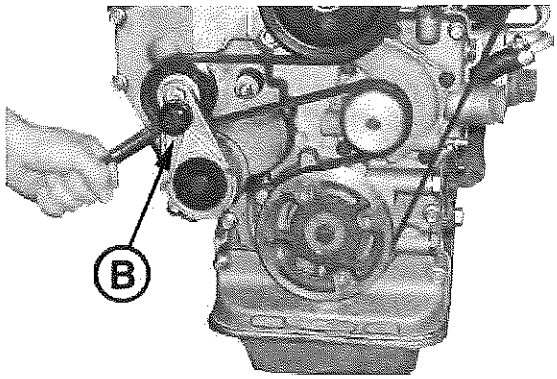
3. Remove poly-vee belt from pulleys and discard belt.

4. Install new belt, making sure belt is correctly seated in all pulley grooves. Refer to belt routing at right for your application.

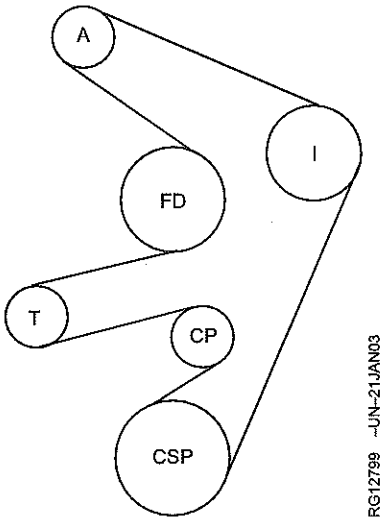
5. Best method to install belt is:
Back-wrap it around the fan pulley (FD), route it over the alternator (A), over top of the idler pulley (I), then down and around the crankshaft pulley (CSP). Finally, use a 3/8-inch drive arm to rotate the tensioner (T) to the tensioned position and slip the belt (back-wrap) over the coolant pump pulley (CP), then release the tensioner.

6. Apply tension to belt with tensioner. Remove drive arm.

7. Start engine and check belt alignment.



Replacing Belt



Belt Routing

A—Alternator
CSP—Crankshaft Pulley
FD—Fan Drive
I—Idler Pulley
T—Tensioner
CP—Coolant Pump

RG41183,0000056 –19–03JAN07–1/1

Checking Fuses

Check fuses for electrical system and replace if defective. Refer to manufactures instructions and wiring diagrams for location and types of fuses.

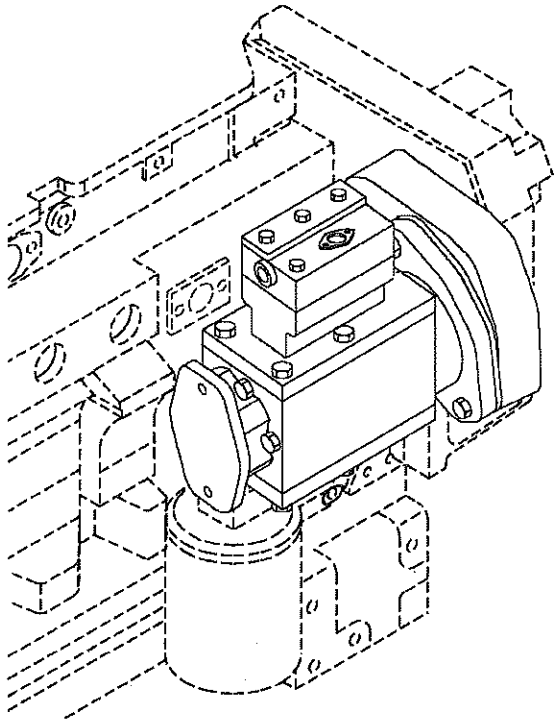
OUOD006,0000111 –19–11OCT07–1/1

Checking Air Compressors (If Equipped)

Air compressors are offered as options with John Deere OEM engines to provide compressed air to operate air-powered devices like vehicle air brakes.

Air compressors are engine-driven piston types. They are either air cooled or cooled with engine coolant. The compressors are lubricated with engine oil. The compressor runs continuously as gear or spline driven by the auxiliary drive of the engine but has "loaded" and "unloaded" operating modes. This is controlled by the vehicle's air system (refer to vehicle technical manual for complete air system checks and services).

See your John Deere engine distributor or servicing dealer for diagnostic and troubleshooting information. If diagnosis leads to an internal fault in the compressor, replace the complete compressor as a new or remanufactured unit.

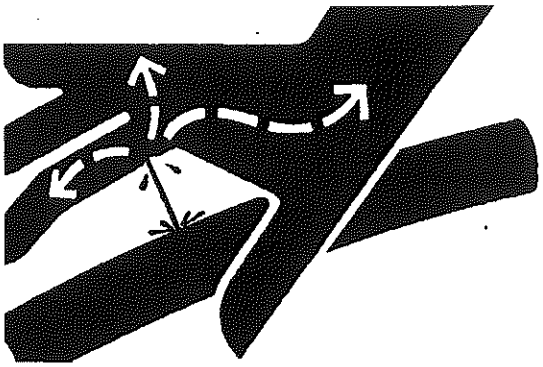


RG12836 –UN–27FEB03

Air Compressor (Optional)

OURGP12,00001E0 –19–26FEB03–1/1

Priming the Fuel Filter



X9811 –UN–23AUG88

High Pressure Fluids

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid hazards by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

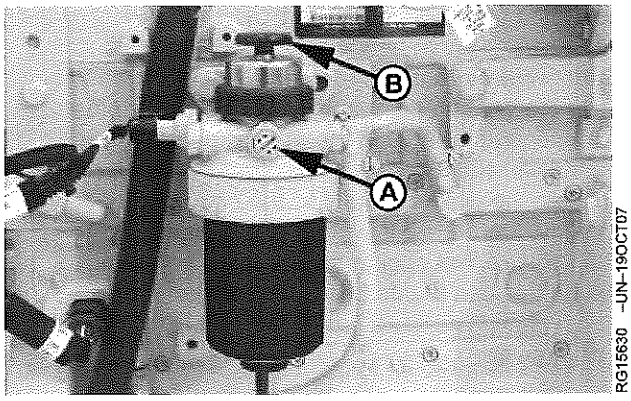
If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

Any time the fuel system has been opened up for service (lines disconnected or filter removed), it will be necessary to prime the fuel filter. Once the fuel filter has been primed, the fuel system will purge itself while cranking the starter.

OUOD006,00000C4 –19–19OCT07–1/2

1. Open air bleed plug (A) two full turns by hand.
2. Pump the hand primer (B) on filter mounting base, or (if equipped) the hand primer on fuel transfer pump, until a noticeable amount of fuel and air comes out of vent opening. Continue pumping and close vent screw when fuel starts to flow.

A—Air Bleed Plug
B—Hand Primer



RG15630 –UN–19OCT07

Fuel Filter Air Bleed Plug and Hand Primer

OUOD006,00000C4 –19–19OCT07–2/2

Troubleshooting

General Troubleshooting Information

The following pages provide a list of possible engine problems that may be encountered accompanied by possible causes and corrections. The troubleshooting information is of a general nature; final design of the overall system for your engine application may be different. See your engine distributor or servicing dealer if you are in doubt.

A reliable program for troubleshooting engine problems should include the following basic diagnostic thought process:

- Know the engine and all related systems.
- Study the problem thoroughly.
- Relate the symptoms to your knowledge of engine and systems.
- Diagnose the problem starting with the easiest things first.
- Double-check before beginning the disassembly.
- Determine cause and make a thorough repair.
- After making repairs, operate the engine under normal conditions to verify that the problem and cause was corrected.

OUOD006,00000EA –19–31AUG07–1/1

Precautions For Welding

IMPORTANT: Welding on an engine is not recommended. If welding must be performed, follow the following precautions.

IMPORTANT: ALWAYS disconnect Electronic Control Unit (ECU) connectors before welding on engine or machine. High currents or electro-static discharge in electronic components from welding may cause permanent damage.



TS953 –UN–15MAY90

1. Disconnect the connectors from the ECU.

2. Connect the welder ground to the same engine component as the welding point and be sure ECU or other electronic components are not in the ground path.

3. Never connect the welder ground to the crankshaft damper or pulley, the engine flywheel, or any driveline components. Be sure that engine bearings are not in the ground path, as this can create bearing damage.

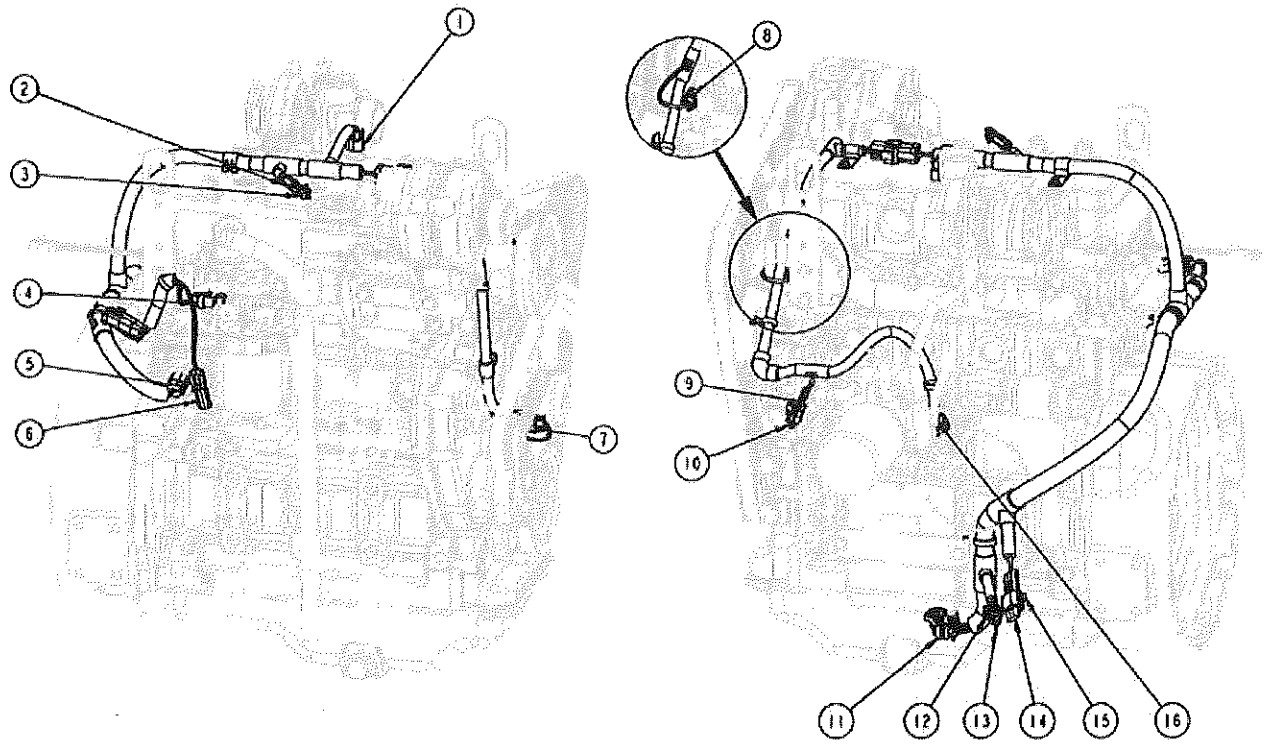
OUOD002,000016B –19–24JUN08–1/1

Precautions for Electrical System When Steam Cleaning Engine

IMPORTANT: Do not steam clean any electrical or electronic components while steam cleaning the engine as it could damage sensitive parts.

OURGP11,000012A –19–11OCT06–1/1

Wiring Harness Layout

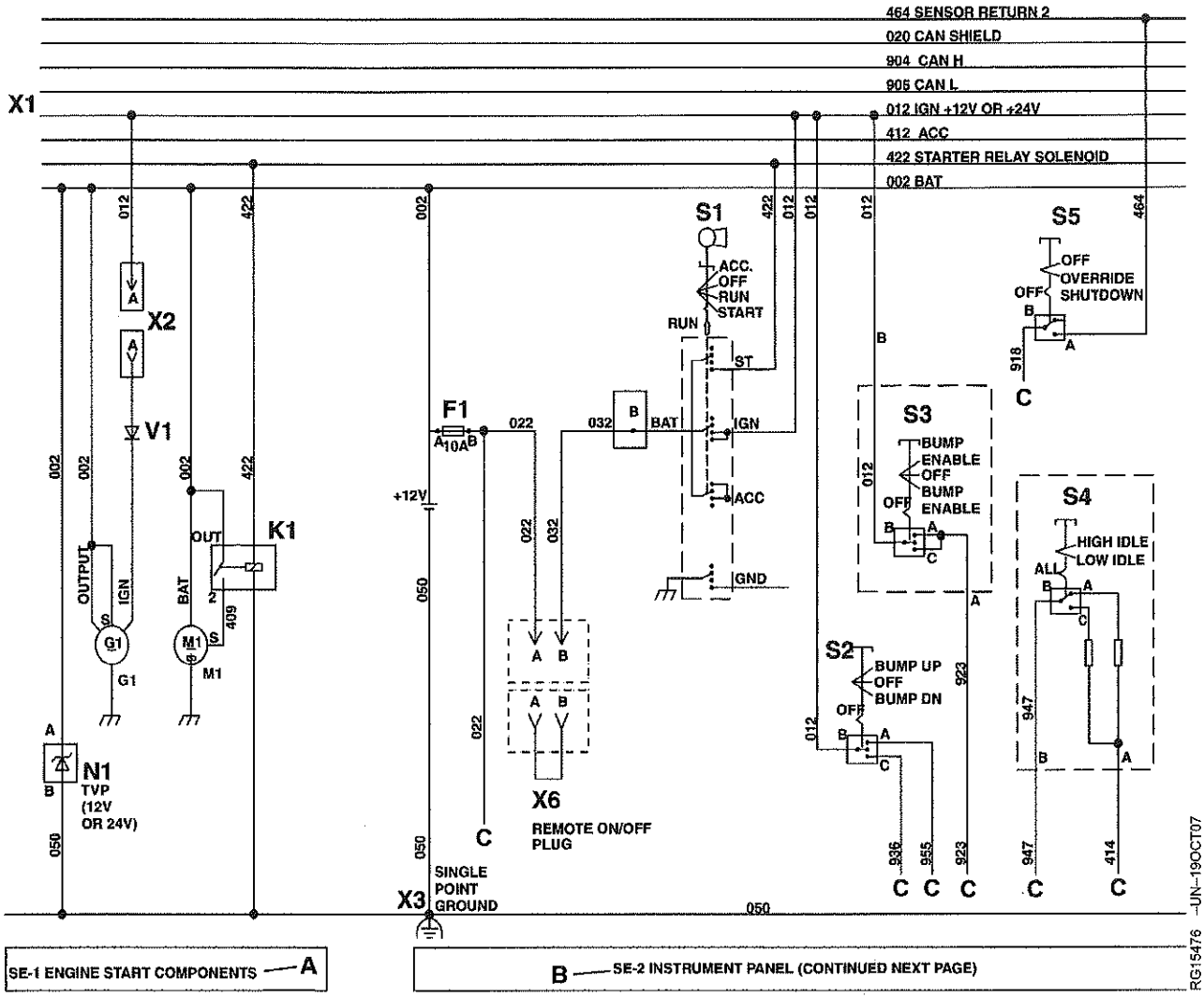


RG15319 –UN–26JUL07

1—Manifold Air Temperature
2—Alternator Excitation
3—Alternator Excitation Dust Cap
4—Fuel Pressure
5—Fuel Injection
6—Water In Fuel Sensor
7—Cam Sensor
8—Coolant Temperature
9—Oil Pressure
10—Oil Pressure Dust Cap
11—ECU Engine Connector
12—Glow Plug
13—Glow Plug Dust Cap
14—Auxiliary Power Dust Cap
15—Auxiliary Power Connector
16—Engine Crank Sensor

OUOD006,00000B5 –19–04OCT07–1/1

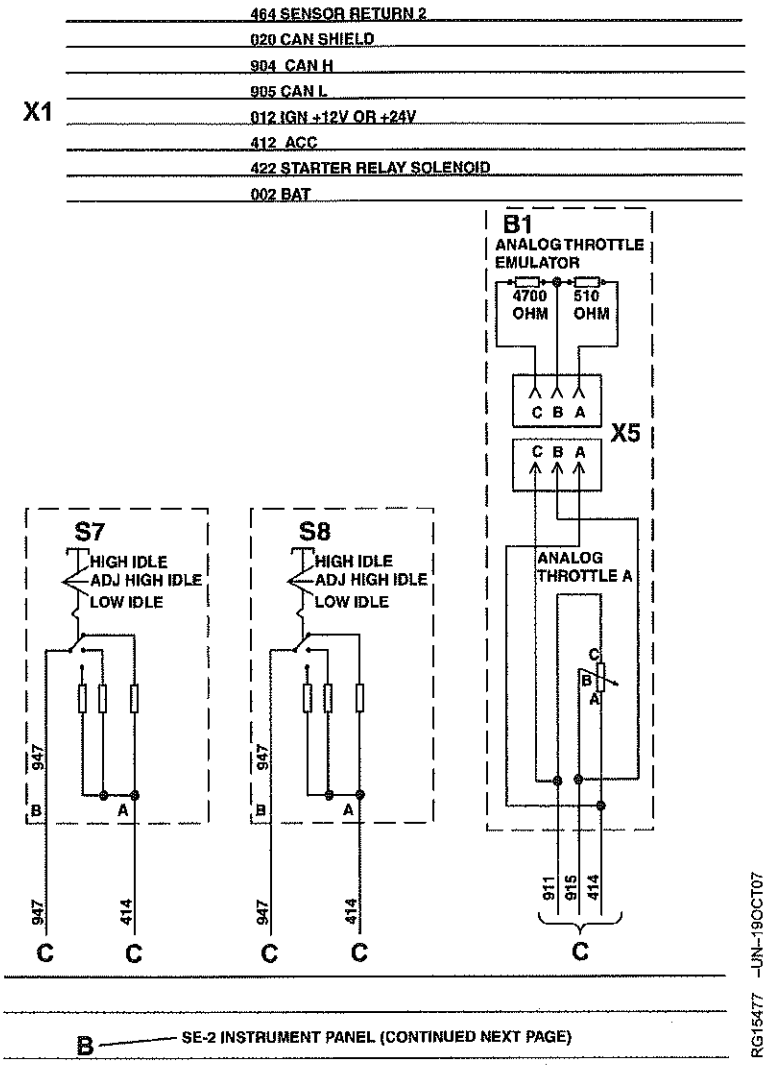
Wiring Diagram - Instrument Panel Components



A—SE-1 Engine Start Components
B—SE-2 Instrument Panel (Continued Next Page)
C—To ECU
F1—Fuse (10 Amp)
G1—Alternator
K1—Starter Relay
M1—Starter Motor
N1—Transient Voltage Protector
S1—Ignition Key Switch
S2—Speed Select Switch (Momentary)
S3—Bump Enable Switch (Momentary)
S4—Dual State Throttle Switch
S5—Override Shutdown Switch (Momentary)
V1—Diode
X1—Vehicle Harness Connector
X2—Alternator Harness Connector
X3—Single Point Ground
X6—Remote On/Off Plug
002—BAT
012—IGN +12V or + 24V
020—CAN Shield
412—ACC
422—Starter Relay Solenoid
464—Sensor Return 2
904—CAN H
905—CAN L

OUOD006,000010B –19–10OCT07–1/1

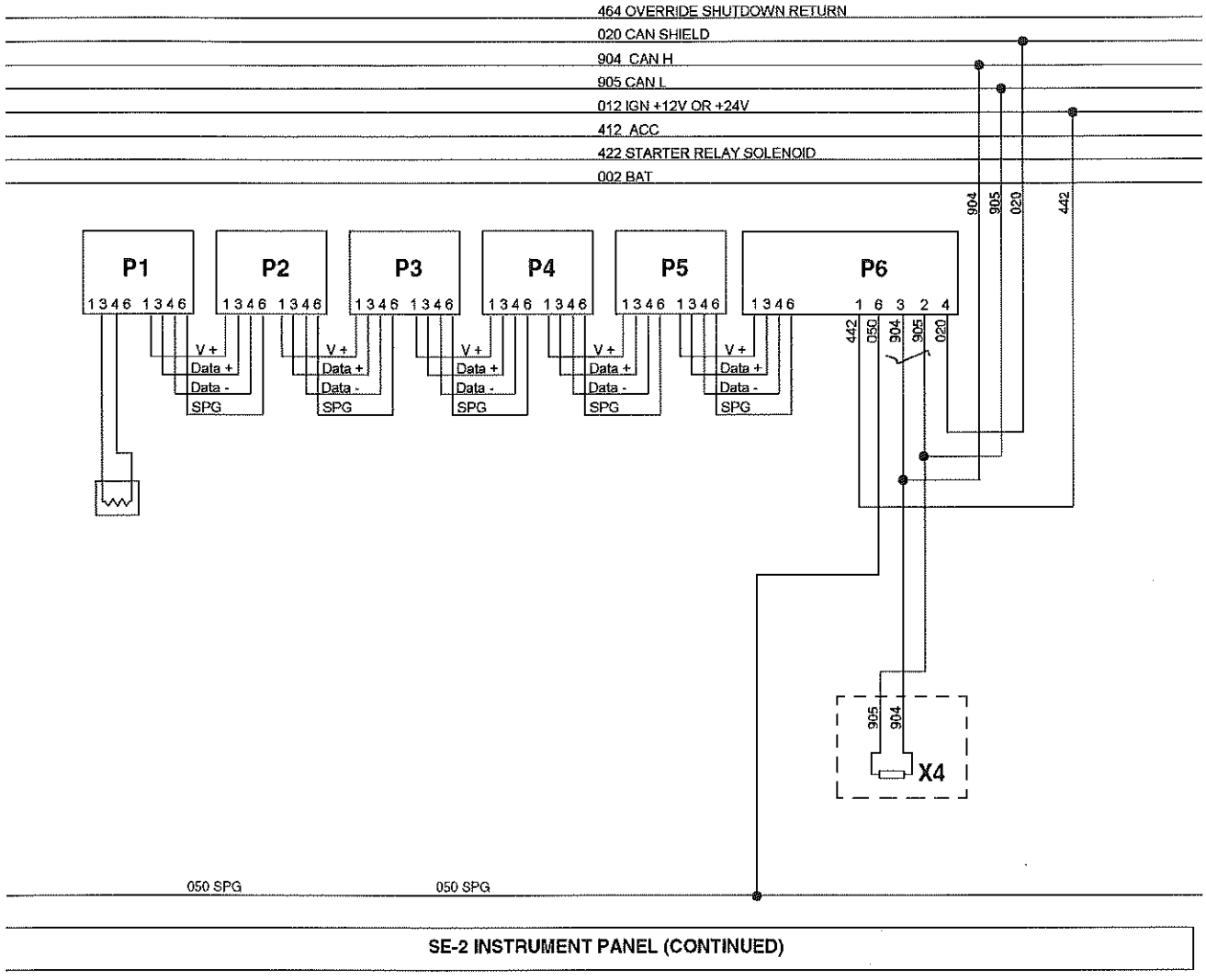
Wiring Diagram - Instrument Panel Components (Continued)



B—SE-2 Instrument Panel (Continued Next Page)
B1—Analog Throttle Emulator
C—To ECU
S7—Tri-state Throttle Switch
S8—Ramp Throttle Switch
X1—Vehicle Harness Connector
X5—Analog Throttle Connector
002—BAT
012—IGN +12V or + 24V
020—CAN Shield
412—ACC
422—Starter Relay Solenoid
464—Sensor Return 2
904—CAN H
905—CAN L

OUOD006,000010C –19–10OCT07–1/1

Wiring Diagram - Instrument Panel Components (Continued)



P1—Optional Gauge
P2—Optional Gauge
P3—Oil Pressure Gauge
P4—Coolant Temperature Gauge
P5—Tachometer Display
P6—Hourmeter/ Diagnostic Meter
X4—CAN Terminator
002—BAT
012—IGN +12V or + 24V
020—CAN Shield
412—ACC
422—Starter Relay Solenoid
464—Sensor Return 2
904—CAN H
905—CAN L

OUOD006,000010D –19–10OCT07–1/1

Engine Troubleshooting

ymptom	Problem	Solution
NOTE: If using BIODIESEL blends above B20, the possibility of some of the symptoms listed below, such as power loss, could increase.	Incorrect starting procedure.	Verify correct starting procedure.
Engine cranks but will not start		
	No fuel.	Check fuel in tank and manual shut-off valve.
	Exhaust restricted.	Check and correct exhaust restriction.
	Fuel filter plugged or full of water.	Replace fuel filter or drain water from filter.
	Unit injection pumps not getting fuel /or air in fuel system.	Check fuel flow at transfer pump or bleed fuel system.
	Faulty injection pumps or nozzles.	Consult authorized diesel repair station for repair or replacement.

Continued on next page

Symptom	Problem	Solution
Engine hard to start or will not start	Engine starting under load.	Disengage driveline.
	Improper starting procedure.	Review starting procedure.
	No fuel.	Check fuel tank.
	Air in fuel line.	Bleed fuel line.
	Cold weather.	Activate glow plugs.
	Slow starter speed.	See "Starter Cranks Slowly".
	Crankcase oil too heavy.	Use oil of proper viscosity.
	Improper type of fuel.	Consult fuel supplier; use proper type fuel for operating conditions.
	Water, dirt, or air in fuel system.	Drain, flush, fill, and bleed system.
	Clogged fuel filter.	Replace filter element.
	Dirty or faulty injection nozzles.	Have authorized servicing dealer or engine distributor check injectors.
	Injection shut-off not reset.	Turn key switch to "OFF" then to "ON".
Engine overspeeds at startup (Generator set engines)	Low gain on electronic governor.	Increase governor speed gain.
Sluggish response to load changes (Generator set engines)	Low gain on electronic governor.	Increase governor speed gain.
Engine knocks	Low engine oil level.	Add oil to engine crankcase.
	Unit injection pumps out of time.	See your authorized servicing dealer or engine distributor.
	Hydraulic valve lifters.	See your authorized servicing dealer or engine distributor.
	Low coolant temperature.	Remove and check thermostat.
	Engine overheating.	See "Engine Overheats".

Continued on next page

Symptom	Problem	Solution
Engine runs irregularly or stalls frequently	Low coolant temperature.	Remove and check thermostat.
	Clogged fuel filter.	Replace fuel filter element.
	Water, dirt, or air in fuel system.	Drain, flush, fill, and bleed system.
	Dirty or faulty injectors.	Have authorized servicing dealer or engine distributor check injectors.
Below normal engine temperature	Defective thermostat.	Remove and check thermostat.
	Defective temperature gauge or sender.	Check gauge, sender, and connections.

Continued on next page

Symptom	Problem	Solution
Lack of power	Engine overloaded.	Reduce load.
	Intake air restriction.	Service air cleaner.
	Clogged fuel filter.	Replace filter elements.
	Improper type of fuel.	Use proper fuel.
	Overheated engine.	See "Engine Overheats".
	Below normal engine temperature.	Remove and check thermostat.
	Improper valve clearance.	See your authorized servicing dealer or engine distributor.
	Dirty or faulty injectors.	Have authorized servicing dealer or engine distributor check injectors.
	Injector tip deposits.	Use John Deere approved biodiesel fuel conditioners containing detergents.
	Unit injection pumps out of time	See your authorized servicing dealer or engine distributor.
	Turbocharger not functioning.	See your authorized servicing dealer or engine distributor.
	Leaking exhaust manifold gasket.	See your authorized servicing dealer or engine distributor.
	Restricted fuel hose.	Clean or replace fuel hose.
	Low fast idle speed.	See your authorized servicing dealer or engine distributor.
Low oil pressure	Low oil level.	Add oil.
	Improper type of oil.	Drain, fill crankcase with oil of proper viscosity and quality.

Continued on next page

Symptom	Problem	Solution
igh oil consumption	Crankcase oil too light.	Use proper viscosity oil.
	Oil leaks.	Check for leaks in lines, gaskets, and drain plug.
	Restricted crankcase vent tube.	Clean vent tube.
	Defective turbocharger.	See your authorized servicing dealer or engine distributor.
Engine emits white smoke	Improper type of fuel.	Use proper fuel.
	Low engine temperature.	Warm up engine to normal operating temperature.
	Defective thermostat.	Remove and check thermostat.
	Defective fuel injectors.	See your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
Engine emits black or gray exhaust smoke	Improper type of fuel.	Use proper fuel.
	Clogged or dirty air cleaner.	Service air cleaner.
	Engine overloaded.	Reduce load.
	Fuel injectors dirty.	Use John Deere approved Biodiesel or diesel fuel conditioners. If no improvement is seen, see your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
	Turbocharger not functioning.	See your authorized servicing dealer or engine distributor.

Continued on next page

Symptom	Problem	Solution
Engine overheats	Engine overloaded.	Reduce load.
	Low coolant level.	Fill radiator to proper level, check radiator and hoses for loose connections or leaks.
	Faulty radiator cap.	Have serviceman check.
	Stretched poly-vee belt or defective belt tensioner.	Check automatic belt tensioner and check belts for stretching. Replace as required.
	Low engine oil level.	Check oil level. Add oil as required.
	Cooling system needs flushing.	Flush cooling system.
	Defective thermostat.	Remove and check thermostat.
	Defective temperature gauge or sender.	Check water temperature with thermometer and replace, if necessary.
	Incorrect grade of fuel.	Use correct grade of fuel.
High fuel consumption	Improper type of fuel.	Use proper type of fuel.
	Clogged or dirty air cleaner.	Service air cleaner.
	Engine overloaded.	Reduce load.
	Improper valve clearance.	See your authorized servicing dealer or engine distributor.
	Injector tip deposits.	Use John Deere approved biodiesel fuel conditioners containing detergents.
	Fuel injectors dirty.	See your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
	Defective turbocharger.	See your authorized servicing dealer or engine distributor.
	Low engine temperature.	Check thermostat.

Continued on next page

Symptom	Problem	Solution
Undercharged electrical system	Excessive electrical load from added accessories.	Remove accessories or install higher output alternator.
	Excessive engine idling.	Increase engine rpm when heavy electrical load is used.
	Poor electrical connections on battery, ground strap, starter, or alternator.	Inspect and clean or tighten connections as necessary.
	Defective battery.	Test battery.
	Defective alternator.	Test charging system.
Battery uses too much water	Cracked battery case.	Check for moisture and replace as necessary.
	Defective battery.	Test battery.
	Battery charging rate too high.	Test charging system.
Batteries will not charge	Loose or corroded connections.	Clean and tighten connections.
	Sulfated or worn-out batteries.	See your authorized servicing dealer or engine distributor.
	Stretched poly-vee belt or defective belt tensioner.	Adjust belt tension or replace belts.
Starter will not crank	Engine driveline engaged.	Disengage engine driveline.
	Loose or corroded connections.	Clean and tighten loose connections.
	Low battery output voltage.	See your authorized servicing dealer or engine distributor.
	Faulty start circuit relay.	See your authorized servicing dealer or engine distributor.
	Blown main system fuse.	Replace electrical system fuse.
Starter cranks slowly	Low battery output.	See your authorized servicing dealer or engine distributor.
	Crankcase oil too heavy.	Use proper viscosity oil.
	Loose or corroded connections.	Clean and tighten loose connections.

Continued on next page

Symptom	Problem	Solution
Entire electrical system does not function	Faulty battery connection.	Clean and tighten connections.
	Sulfated or worn-out batteries.	See your authorized servicing dealer or engine distributor.
	Blown main system fuse.	Replace electrical system fuse.

OUOD006,00000CB –19–19OCT07–8/8

Instrument Panel Method for Retrieving Diagnostic Trouble Codes

IMPORTANT: Care should be used during diagnostic procedures to avoid damaging the terminals of connectors, sensors, and actuators. Probes should not be poked into or around the terminals or damage will result. Probes should only be touched against the terminals to make measurements.

Diagnosis of the Deere electronic control system on engines with Deere electronic instrument panel should be performed as follows:

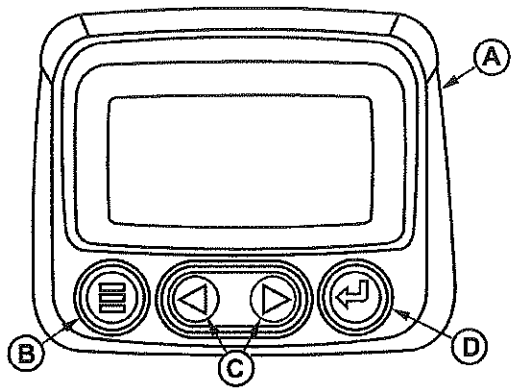
1. Make sure all engine mechanical and other systems not related to the electronic control system are operating properly. (See ENGINE TROUBLESHOOTING later in this section.)

NOTE: Diagnostic gauge (A) uses the menu key (B) to access various engine functions, two arrow keys (C) to scroll through the engine parameter list and view the menu list, and an enter key (D) for selecting highlighted items.

2. Read and record DTC(s) displayed on LCD of diagnostic gauge (A). For procedure to access diagnostic trouble codes, refer to "Using Diagnostic Gauge to Access Engine Information", earlier in this manual.

3. Go to the LISTING OF DIAGNOSTIC TROUBLE CODES (DTCs) later in this section, to interpret to the DTC(s) present.

4. Contact your nearest engine distributor or servicing dealer with a list of DTC(s) so that necessary repairs can be made.



RG13740 –UN–11NOV04

Trouble Code Display On Instrument Panel

A—Diagnostic Gauge
B—Menu Key
C—Arrow Keys
D—Enter Key

OURGP11,0000063 –19–08DEC05–1/1

Displaying Of Diagnostic Trouble Codes (DTCs)

SPN/FMI CODES

Stored and active diagnostic trouble codes are output on the diagnostic gauge on the Deere electronic instrument panel according to the J1939 standard as a two-part code as shown on the tables on the following pages.

The first part is a Suspect Parameter Number (SPN) followed by a Failure Mode Identifier (FMI) code. In order to determine the exact failure, both parts (SPN and FMI) of the code are needed.

The SPN identifies the system or the component that has the failure; for example SPN 000110 indicates a failure in the engine coolant temperature circuit.

The FMI identifies the type of failure that has occurred; for example FMI 03 indicates value above normal. Combining SPN 000110 with FMI 03 yields a fault code "engine coolant temperature input voltage too high". A corrective action will also be displayed, "check sensor and wiring". If this check does not solve the engine fault, contact your servicing dealer.

Always contact your servicing dealer for help in correcting unsolved diagnostic trouble codes which are displayed for your engine.

OURGP12,00000F0 –19–11OCT06–1/1

Listing of Diagnostic Trouble Codes (DTCs)

NOTE: Not all of these codes are used on all OEM engine applications

Trouble Codes

DTC's Listing in Ascending SPN/FMI Codes

—SPN	FMI	Description of Fault	Corrective Action
000029	03	Throttle #2 Signal Out of Range High	Check Sensor and Wiring
	04	Throttle #2 Signal Out of Range Low	Check Sensor and Wiring
000091	03	Throttle #1 Signal Out of Range High	Check Switch and Wiring
	04	Throttle #1 Signal Out of Range Low	Check Switch and Wiring
	07	Throttle #1 Not Responding	Contact Servicing Dealer
	13	Throttle Voltage Out of Range	Check Sensor and Wiring
000094	03	Low Pressure Fuel Signal Out of Range High	Check Sensor and Wiring
	04	Low Pressure Fuel Signal Out of Range Low	Check Sensor and Wiring
	17	High Pressure Fuel System- Pressure Slightly Low	Contact Servicing Dealer
000100	01	Engine Oil Pressure Signal Extremely Low	Check Oil Level
	04	Engine Oil Pressure Signal Out of Range Low	Check Sensor and Wiring
000105	00	Intake Manifold Air Temperature Signal Extremely High	Check Air Cleaner, Aftercooler, or Room Temperature
	03	Intake Manifold Air Temperature Signal Out of Range High	Check Sensor and Wiring
	04	Intake Manifold Air Temperature Signal Out of Range Low	Check Sensor and Wiring
	15	Intake Manifold Air Temperature Signal Slightly High	Check Air Cleaner, Aftercooler, or Room Temperature
	16	Intake Manifold Air Temperature Signal Moderately High	Check Air Cleaner, Aftercooler, or Room Temperature
000108	02	Barometric Pressure Signal Invalid	Contact Servicing Dealer
000110	00	Engine Coolant Temperature Signal Extremely High	Check Cooling System, Reduce Power
	03	Engine Coolant Temperature Signal Out of Range High	Check Sensor and Wiring
	04	Engine Coolant Temperature Signal Out of Range Low	Check Sensor and Wiring
	15	Engine Coolant Temperature Signal Slightly High	Check Cooling System, Reduce Power
	16	Engine Coolant Temperature Signal Moderately High	Check Cooling System, Reduce Power
000158	17	ECU Power Down Error (Internal ECU Problem)	Contact Servicing Dealer
000174	03	Fuel Temperature Signal Out of Range High	Check Sensor and Wiring
	04	Fuel Temperature Signal Out of Range Low	Check Sensor and Wiring
000189	00	Engine Speed Derate Condition Exists	Check Fault Codes or Contact Servicing Dealer
000569	03	Rear Axle Differential Lock Signal Out of Range High	Contact Servicing Dealer
	04	Rear Axle Differential Lock Signal Out of Range Low	Contact Servicing Dealer
000611	03	Injector Shorted to Power	Check Wiring
	04	Injector Shorted to Ground	Check Wiring
000627	01	All Injector Currents Are Low	Check Battery Voltage and Wiring
	18	Battery Voltage Moderately Low	Contact Service Dealer
000629	12	ECU EEPROM Error	Contact Service Dealer
	13	ECU Programming Error	Contact Service Dealer
000636	02	Camshaft Sensor Signal Unreliable	Check Sensor and Wiring
	05	Camshaft Sensor Circuit Has High Resistance	Contact Service Dealer
	06	Camshaft Sensor Circuit Has Low Resistance	Contact Service Dealer
	08	Camshaft Sensor Signal Missing	Check Sensor and Wiring
	10	Camshaft Sensor Signal Rate of Change Abnormal	Check Sensor and Wiring
000637	02	Engine Timing Sensor Signal Unreliable	Check Sensor and Wiring
	05	Engine Position Sensor Circuit Has High Resistance	Contact Service Dealer
	06	Engine Position Sensor Circuit Has Low Resistance	Contact Service Dealer
	07	Engine Timing and Position Sensors Out of Sync	Check Sensor and Wiring
	08	Engine Timing Sensor Signal Missing	Check Sensor and Wiring
	10	Engine Timing Signal Rate of Change Abnormal	Check Sensor and Wiring

Continued on next page

—SPN	FMI	Description of Fault	Corrective Action
000651	05	Injector Number 1 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 1 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	13	Injector Number 1 Calibration Fault	Contact Service Dealer
000652	05	Injector Number 2 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 2 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	13	Injector Number 21 Calibration Fault	Contact Service Dealer
000653	05	Injector Number 3 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 3 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	13	Injector Number 3 Calibration Fault	Contact Service Dealer
000654	05	Injector Number 4 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 4 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	13	Injector Number 4 Calibration Fault	Contact Service Dealer
000655	05	Injector Number 5 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 5 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	13	Injector Number 5 Calibration Fault	Contact Service Dealer
000676	03	Glow Plug Signal Received When Not Expected	Contact Service Dealer
	05	Glow Plug Signal Not Received When Expected	Contact Service Dealer
001136	00	ECU Temperature High-Most Severe	Contact Service Dealer
	16	ECU Temperature High-Moderately Severe	Contact Service Dealer
001569	31	Engine in Derate Condition	Check Fault Codes
002003	09	No CAN Message Received from Source Address 17 Within Time Out Period	Contact Service Dealer
002023	09	Message ETCP1 From ICC Timed Out	Contact Service Dealer
003509	03	Sensor Supply Voltage out of Range High	Contact Service Dealer
	04	Sensor Supply Voltage out of Range Low	Contact Service Dealer
003510	03	Sensor Supply Voltage out of Range High	Contact Service Dealer
	04	Sensor Supply Voltage out of Range Low	Contact Service Dealer
003511	03	Sensor Supply Voltage out of Range High	Contact Service Dealer
	04	Sensor Supply Voltage out of Range Low	Contact Service Dealer
003597	01	Injector Power Supply Voltage Extremely Low	Contact Service Dealer
	18	Injector Power Supply Voltage Moderately Low	Contact Service Dealer
524037	02	MFWD Switch Circuit Fault	Contact Service Dealer
524223	03	Rear Axle Differential Lock Circuit	Contact Service Dealer
524225	31	Engine Start Protection Bypass Detected	Contact Service Dealer
524235	03	MWFD Solenoid Circuit Voltage High	Contact Service Dealer
	04	MWFD Solenoid Circuit Voltage Low	Contact Service Dealer

OUOD006,000011A –19–08JUL08–2/2

Intermittent Fault Diagnostics (With Electronic Controls)

Intermittent faults are problems that periodically "go away". A problem such as a terminal that intermittently doesn't make contact can cause an intermittent fault. Other intermittent may be set only under certain operating conditions such as heavy load, extended idle, etc. When diagnosing intermittent faults, take special note of the condition of wiring and connectors, since a high percentage of intermittent problems originate here. Check for loose, dirty or disconnected connectors. Inspect the wiring routing, looking for possible shorts caused by contact with external parts (for example, rubbing against sharp sheet metal edges). Inspect the connector vicinity, looking for wires that have pulled out of connectors, poorly positioned terminals, damaged connectors and corroded or damaged splices and terminals. Look for broken wires, damaged splices, and wire-to-wire shorts. Use good judgement if component replacement is thought to be required.

NOTE: The engine control unit (ECU) is the component LEAST likely to fail.

Suggestions for diagnosing intermittent faults:

- If the problem is intermittent, try to reproduce the operating conditions that were present when the diagnostic trouble code (DTC) set.
- If a faulty connection or wire is suspected to be the cause of the intermittent problem: clear DTCs, then check the connection or wire by wiggling it while watching the diagnostic gauge to see if the fault resets.

Possible causes of intermittent faults:

- Faulty connection between sensor or actuator harness.
- Faulty contact between terminals in connector.
- Faulty terminal/wire connection.
- Electromagnetic interference (EMI) from an improperly installed 2-way radio, etc., can cause faulty signals to be sent to the ECU.

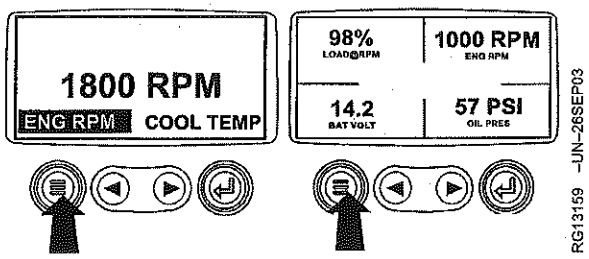
NOTE: Refer to wiring diagrams earlier in this section as a guide to connection and wiring.

OUOD007,0000036 –19–27JUL06–1/1

Displaying Diagnostic Gauge Software

NOTE: The following steps can be used to display the software version of the diagnostic gauge if needed by your dealer for troubleshooting. This is a read only function.

1. Starting at the single or four engine parameter display, press the "Menu" key.

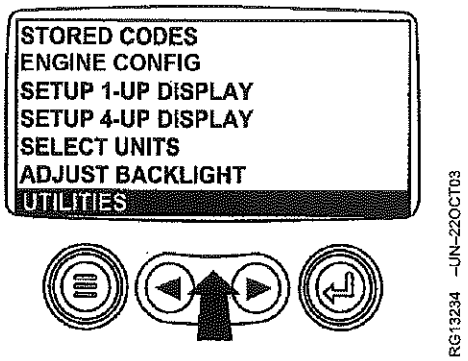


Menu Key

Continued on next page

OURGP12,00001E3 –19–15MAR06–1/4

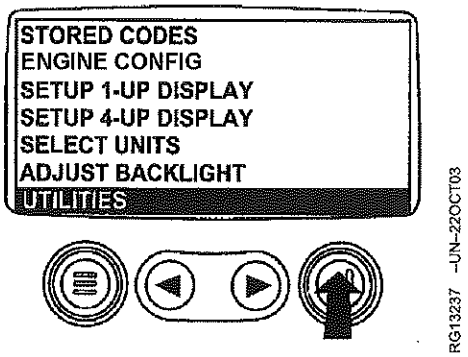
2. The main menu will be displayed. Use the "Arrow" key to scroll through the menu until "Utilities" is highlighted.



Select Utilities

OURGP12,00001E3 –19–15MAR06–2/4

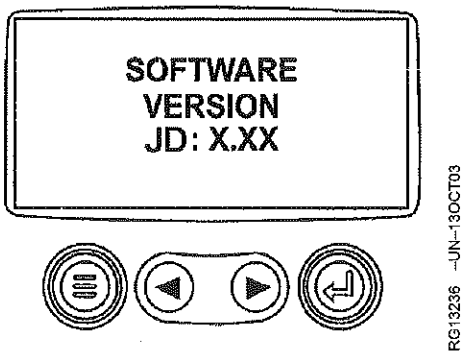
3. Once "Utilities" is highlighted, press "Enter" to activate the utilities function.



Select Utilities

OURGP12,00001E3 –19–15MAR06–3/4

4. Scroll to the "Software Version". Press "Enter" to view the software version. Press the menu button twice to return to the main menu.



Software Version

OURGP12,00001E3 –19–15MAR06–4/4

Storage

Engine Storage Guidelines

1. John Deere engines can be stored outside for up to three (3) months with no long term preparation IF COVERED BY WATERPROOF COVERING. No outside storage is recommended without a waterproof covering.
2. John Deere engines can be stored in a standard overseas shipping container for up to three (3) months with no long term preparation.
3. John Deere engines can be stored inside for up to six (6) months with no long term preparation.
4. John Deere engines expected to be stored more than six (6) months MUST have long term storage preparation. (See PREPARING ENGINE FOR LONG TERM STORAGE, later in this section.)
5. Long term storage includes the use of a stabilized rust preventive oil to protect internal metal components of the engine. This oil should be an SAE 10 oil with 1-4 percent morpholine or equivalent vapor corrosion inhibitor. These rust preventive oils are available from area distributors.

OURGP12,00000DF –19–11OCT06–1/1

Preparing Engine for Long Term Storage

The following storage preparations are used for long term engine storage up to one year. After that, the engine should be started, warmed up, and retreated for an extended storage period.

IMPORTANT: Any time your engine will not be used for over six (6) months, the following recommendations for storing it and removing it from storage will help to minimize corrosion and deterioration.

IMPORTANT: DO NOT USE BIODIESEL DURING MACHINE STORAGE. When using biodiesel blends, switch to petroleum diesel for long term storage. Before storage, operate engine on at least one complete tank of petroleum diesel fuel to purge the fuel system. Follow normal storage procedures once the fuel system has been purged.

1. Change engine oil and replace filter. (See CHANGE ENGINE OIL AND FILTER in Lubrication and Maintenance/500 Hour Section.) Used oil will not give adequate protection. Add one (1) ounce of rust preventive oil to the engine crankcase for every quart of oil. This rust preventive oil should be an SAE 10 oil with 1-4 percent morpholine or equivalent vapor corrosion inhibitor.
2. Ensure the machine fuel tank is filled with high quality petroleum diesel fuel. Filling the tank completely will ensure that water does not build up due to condensation. For storage of more than one year, use John Deere PREMIUM DIESEL FUEL CONDITIONER (or equivalent) at the specified concentration.
3. Service air cleaner. (See REPLACING AIR CLEANER FILTER ELEMENTS in Service As Required Section.)
4. Draining and flushing of cooling system is not necessary if engine is to be stored only for several months. However, for extended storage periods of a year or longer, it is recommended that the cooling system be drained, flushed, and refilled. Refill with appropriate coolant. (See RECOMMENDED ENGINE COOLANT in Fuels, Lubricants, and Coolant Section and ADDING COOLANT in Service As Required Section.)
5. Pour three (3) ounces of rust preventive oil into the turbocharger intake. (It may be necessary to temporarily install a short intake elbow on the turbocharger inlet to receive the oil.)
6. Prepare a tank with a solution of diesel fuel and rust preventive oil, at ten (10) ounces of rust preventive oil per gallon of diesel fuel.
7. Remove existing lines/plugs as required, and run a temporary line from the tank to the engine fuel intake, and another temporary line from the fuel return manifold to the tank, so rust preventive oil solution is circulated through the injection system during cranking.
8. Crank the engine several revolutions with starter (do not allow the engine to start). This will allow rust preventive oil solution to circulate.
9. Remove temporary lines installed in Step 6 above, and replace any lines/plugs previously removed.

Continued on next page

NOTE: One gallon of fuel/oil solution can be used to treat 100 engines; two gallons to treat 200 engines, etc. The oil could then be replenished by adding an additional five (5) ounces of rust preventive oil per gallon of solution. However, starting over with a new solution is recommended to dispose of any water or other impurities.

10. Loosen, or remove and store, fan/alternator poly-vee belt.
11. Remove and clean batteries. Store them in a cool, dry place and keep them fully charged.
12. Disengage the clutch for any driveline.
13. Clean the exterior of the engine with salt-free water and touch up any scratched or chipped painted surfaces with a good quality paint.
14. Coat all exposed (machined) metal surfaces with grease or corrosion inhibitor if not feasible to paint.
15. Seal all openings on engine with plastic bags and tape.
16. Store the engine in a dry protected place. If engine must be stored outside, cover it with a waterproof canvas or other suitable protective material and use a strong waterproof tape.

OUOD006,00000FC –19–04OCT07–2/2

Removing Engine from Long Term Storage

Refer to the appropriate section for detailed services listed below or have your authorized servicing dealer or engine distributor perform services that you may not be familiar with.

Remove all protective coverings from engine. Unseal all openings in engine and remove covering from electrical systems.

2. Remove the batteries from storage. Install batteries (fully charged) and connect the terminals.
3. Install fan/alternator poly-vee belt if removed.
4. Fill fuel tank.
5. Perform all appropriate prestarting checks. (See DAILY PRESTARTING CHECKS in Lubrication and Maintenance/Daily Section.)

IMPORTANT: DO NOT operate starter more than 30 seconds at a time. Wait at least 2 minutes for starter to cool before trying again.

6. Crank engine for 20 seconds with starter (do not allow the engine to start). Wait 2 minutes and crank engine an additional 20 seconds to assure bearing surfaces are adequately lubricated.
7. Start engine and run at low idle and no load for several minutes. Warm up carefully and check all gauges before placing engine under load.
8. On the first day of operation after storage, check overall engine for leaks and check all gauges for correct operation.

NOTE: If using BIODIESEL blends after long term storage, frequency of fuel filter plugging may increase initially.

OUOD006,00000FD –19–02OCT07–1/1

General OEM Engine Specifications

ITEM	UNIT OF MEASURE	4024HF	5030HF
Number of Cylinders	—	4	5
Bore	mm (in.)	86 (3.39)	86 (3.39)
Stroke	mm (in.)	105 (4.13)	105 (4.13)
Displacement	L (cu. in.)	2.44 (149)	3.05 (186)
Compression Ratio[a]	—	18.2:1	18.2:1
Max. Crank Pressure	kPa (in. H_2O)	0.5 (2)	0.5 (2)
Oil Pressure At Rated Speed - 2800 rpm - Gen (Prime) - Gen (Standby) - HF295, 2400 rpm - 2800 rpm, 62 kW (82 hp) - 2800 rpm, 74 kW (99 hp) - 2400 rpm, 57 kW (76 hp) - 2400 rpm, 62 kW (82 hp) - 2400 rpm, 68 kW (91 hp)	kPa (psi)	 380 (55) 273 (40) 273 (40) 320 (46)	 273 (40) 276 (40) 340 (49) 360 (52) 320 (46) 320 (46) 325 (47)
Oil Pressure At Low Idle	kPa (psi)	250 (36)	250 (36)
Coolant Temperature- Range - Industrial - Gen	°C (°F)	 82—94 (180—201) 82—94 (180—201)	 89—100 (192—212) 82—94 (180—201)
Coolant Temperature- Maximum - Industrial - Gen	°C (°F)	 105 (221) 110 (230)	 110 (230) 110 (230)
Cooling System Capacity	L (qt)	2.6 (2.7)	2.9 (3.1)
Length	mm (in.)	662 (26.1)	799 (31.5)
Width	mm (in.)	566 (22.3)	566 (22.3)
Height	mm (in.)	772 (30.4)	800 (31.5)
Weight	kg (lb)	251 (554)	287 (633)
NOTE: Engines with suffix "H" are turbocharged and aftercooled.			
[a]Piston compression ratio may vary based on production date.			

OUOD006,00000B0 –19–08JUL08–1/1

Engine Power Rating and Speed Specifications

NOTE: *Specifications are subject to change without notice.*

Engine speeds listed are as preset to factory specification. In some cases, slow idle speed will be reset depending upon specific vehicle application requirements. Refer to your machine technical manual for engine speeds that are different from those preset at the factory.

Power ratings specify flywheel power for a bare engine without the drag effect of a cooling fan or other accessories like an air compressor.

POWER RATINGS ON DYNAMOMETER FOR OEM ENGINES

Engine Model	Fuel System Option Code or Hz Rating	Engine Application	Slow Idle (rpm)	Fast Idle (rpm)	Rated Speed at Full Load (rpm)	Power Rating kW (HP)[a]
4024HF285	1645	Industrial	900	3000	2800	60 (80)
4024HF285	60 Hz	Gen Set (Prime)	1150	-	1800	55 (74)
		Gen Set (Standby)	1150	-	1800	60 (80)
4024HF295	1662	Industrial	900	3000	2800	46 (61)
4024HF295		Industrial	900	3000	2800	49 (66)
4024HF295		Industrial	900	2600	2400	45 (60)
4024HF295		Industrial	900	2600	2400	49 (66)
5030HF285	1644	Industrial	900	3000	2800	62 (82)
5030HF285		Industrial	900	3000	2800	74 (99)
5030HF285		Industrial	900	2600	2400	57 (76)
5030HF285		Industrial	900	2600	2400	62 (82)
5030HF285		Industrial	900	2600	2400	68 (91)
5030HF285	60 Hz	Gen Set (Prime)	1150	-	1800	65 (87)
5030HF285	60 Hz	Gen Set (Standby)	1150	-	1800	72 (96)

[a]Power rating is under full load and at rated speed listed.

OUOD006,00000B1 –19–15AUG07–1/1

Engine Crankcase Oil Capacities

To determine the option code for the oil fill quantity of your engine, refer to the engine option code label affixed to the rocker arm cover. The first two digits of the code (19) identify the oil pan option group. The last two digits of each code identify the specific oil pan on your engine.

The following table lists approximate engine crankcase oil capacities for each "19__" option code for these engines.

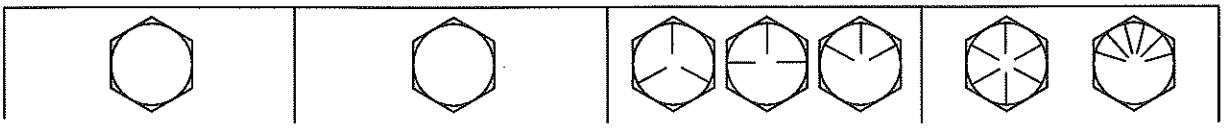
NOTE: Crankcase oil capacity may vary slightly. ALWAYS fill crankcase to within crosshatch marks on dipstick. DO NOT overfill.

Engine Model	Option Code	Crankcase Oil Capacity L (qt)
4024	1901	8 (8.5)
4024	1909	8 (8.5)
4024	1911	8 (8.5)
4024	1912	8 (8.5)
4024	1921	8 (8.5)
4024	1924	8 (8.5)
4024	1925	8 (8.5)
4024	1926	8 (8.5)
5030	1902	11 (11.5)
5030	1910	11 (11.5)
5030	1913	11 (11.5)
5030	1914	11 (11.5)

OUOD006,00000B2 –19–03AUG07–1/1

Unified Inch Bolt and Screw Torque Values

TS1671 –UN–01MAY03



Bolt or	SAE Grade 1				SAE Grade 2[a]				SAE Grade 5, 5.1 or 5.2				SAE Grade 8 or 8.2			
Screw	Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]	
Size	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in
1/4	3.7	33	4.7	42	6	53	7.5	66	9.5	84	12	106	13.5	120	17	150
													N•m	lb-ft	N•m	lb-ft
5/16	7.7	68	9.8	86	12	106	15.5	137	19.5	172	25	221	28	20.5	35	26
									N•m	lb-ft	N•m	lb-ft				
3/8	13.5	120	17.5	155	22	194	27	240	35	26	44	32.5	49	36	63	46
			N•m	lb-ft	N•m	lb-ft	N•m	lb-ft								
7/16	22	194	28	20.5	35	26	44	32.5	56	41	70	52	80	59	100	74
	N•m	lb-ft														
1/2	34	25	42	31	53	39	67	49	85	63	110	80	120	88	155	115
9/16	48	35.5	60	45	76	56	95	70	125	92	155	115	175	130	220	165
5/8	67	49	85	63	105	77	135	100	170	125	215	160	240	175	305	225
3/4	120	88	150	110	190	140	240	175	300	220	380	280	425	315	540	400
7/8	190	140	240	175	190	140	240	175	490	360	615	455	690	510	870	640
1	285	210	360	265	285	210	360	265	730	540	920	680	1030	760	1300	960
1-1/8	400	300	510	375	400	300	510	375	910	670	1150	850	1450	1075	1850	1350
1-1/4	570	420	725	535	570	420	725	535	1280	945	1630	1200	2050	1500	2600	1920
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2140	1580	2700	2000	3400	2500
1-1/2	990	730	1250	930	990	730	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For plastic insert or crimped steel type lock nuts, for stainless steel fasteners, or for nuts on U-bolts, see the tightening instructions for the specific application. Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Replace fasteners with the same or higher grade. If higher grade fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

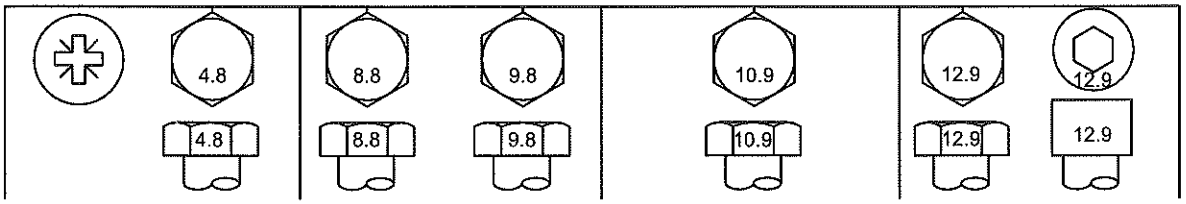
[a]Grade 2 applies for hex cap screws (not hex bolts) up to 6. in (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types of bolts and screws of any length.

[b]"Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or 7/8 in. and larger fasteners with JDM F13C zinc flake coating.

[c]"Dry" means plain or zinc plated without any lubrication, or 1/4 to 3/4 in. fasteners with JDM F13B zinc flake coating.

DX,TORQ1 –19–24APR03–1/1

Metric Bolt and Screw Torque Values



TS1670 –UN–01MAY03

Bolt or	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
Screw	Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]	
Size	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in
M6	4.7	42	6	53	8.9	79	11.3	100	13	115	16.5	146	15.5	137	19.5	172
									N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft
M8	11.5	102	14.5	128	22	194	27.5	243	32	23.5	40	29.5	37	27.5	47	35
			N•m	lb-ft	N•m	lb-ft	N•m	lb-ft								
M10	23	204	29	21	43	32	55	40	63	46	80	59	75	55	95	70
	N•m	lb-ft														
M12	40	29.5	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	46	80	59	120	88	150	110	175	130	220	165	205	150	260	190
M16	100	74	125	92	190	140	240	175	275	200	350	255	320	235	400	300
M18	135	100	170	125	265	195	330	245	375	275	475	350	440	325	560	410
M20	190	140	245	180	375	275	475	350	530	390	675	500	625	460	790	580
M22	265	195	330	245	510	375	650	480	725	535	920	680	850	625	1080	800
M24	330	245	425	315	650	480	820	600	920	680	1150	850	1080	800	1350	1000
M27	490	360	625	460	950	700	1200	885	1350	1000	1700	1250	1580	1160	2000	1475
M30	660	490	850	625	1290	950	1630	1200	1850	1350	2300	1700	2140	1580	2700	2000
M33	900	665	1150	850	1750	1300	2200	1625	2500	1850	3150	2325	2900	2150	3700	2730
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2770	4750	3500

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For stainless steel fasteners or for nuts on U-bolts, see the tightening instructions for the specific application. Tighten plastic insert or crimped steel type lock nuts by turning the nut to the dry torque shown in the chart, unless different instructions are given for the specific application.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class. Replace fasteners with the same or higher property class. If higher property class fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

[a] "Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or M20 and larger fasteners with JDM F13C zinc flake coating.

[b] "Dry" means plain or zinc plated without any lubrication, or M6 to M18 fasteners with JDM F13B zinc flake coating.

DX,TORQ2 –19–24APR03–1/1

Lubrication and Maintenance Records

Using Lubrication and Maintenance Records

.efer to specific Lubrication and Maintenance Section for detailed service procedures.

1. Keep a record of the number of hours you operate your engine by regular observation of hour meter.
2. Check your record regularly to learn when your engine needs service.
3. DO ALL the services within an interval section. Write the number of hours (from your service records) and the date in the spaces provided. For a complete listing of all items to be performed and the service intervals required, refer to the quick-reference chart near the front of the Lubrication and Maintenance Section.

IMPORTANT: The service recommendations covered in this manual are for the accessories that are provided by John Deere. Follow manufacturer's service recommendations for servicing engine-driven equipment or other accessories not supplied by Deere.

RG,RG34710,5620 –19–20MAY96–1/1

Daily (Prestarting) Service

- Check engine oil level.
- Check coolant level.

IMPORTANT: Drain water by loosening drain plug on fuel/water separator bowl. Premature unit injection pump failure may occur if water is not drained daily.

- Check fuel filter/water separator bowl.
- Check air cleaner dust unloader valve and air restriction indicator, if equipped.
- Visual walkaround inspection.

RG41183,000006B –19–21JAN03–1/1

500 Hour/12 Month Service

- Change engine oil and filter.[1]
- Replace fuel filter element.
- Clean crankcase vent tube.
- Check air intake system.
- Check engine speeds
- Check belt tensioner and belt wear.
- Check engine electrical ground connection.
- Service fire extinguisher.
- Check engine mounts.
- Service battery.
- Check cooling system.
- Replenish SCAs as needed.
- Test diesel engine coolant.
- Pressure test cooling system.

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[1]If John Deere PLUS-50 or ACEA - E4/E5/E6/E7 oil is NOT used along with a John Deere oil filter, the oil and filter change interval is reduced by 50 percent to every 250 hours.

OUOD006,0000072 –19–03JAN07–1/1

2000 Hour/24 Month Service

Check crankshaft vibration damper (If equipped). (5030 Engines only).

- Flush cooling system.[1]
- Test thermostats.

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[1]If John Deere COOL-GARD is used, the flushing interval may be extended to 3000 hours, or 36 months. If John Deere COOL-GARD is used and the coolant is tested annually AND additives are replenished as needed by adding a supplemental coolant additive, the flushing interval may be extended to 5000 hours or 60 months, whichever occurs first.

RG41183,000006D –19–21JAN03–1/1

Service as Required

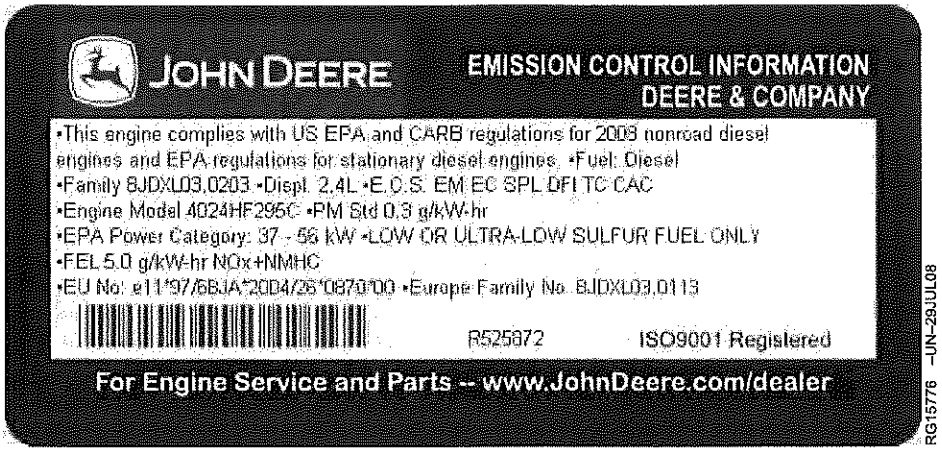
- Add coolant
- Replace air cleaner.
- Replace poly-vee belt.
- Check fuses
- Check air compressor (if equipped)
- Adjust speed gain (Generator sets)
- Bleed fuel system

Hours									
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OURGP12,00000FE –19–18MAY04–1/1

Emission System Warranty

Emissions Control System Certification Label



Emissions Label

CAUTION: Statutes providing severe penalties for tampering with emissions controls may apply to the user or dealer.

The emissions warranty described below applies only to those engines marketed by John Deere that have been certified by the United States Environmental Protection Agency (EPA) and/or California Air Resources Board (CARB), and used in the United States and Canada. The presence of an emissions label like the one shown signifies that the engine has been certified with the EPA and/or CARB. The EPA and CARB warranties only apply to new engines having the certification label affixed to the engine and sold as stated above in the geographic areas governed by the regulating agencies.

NOTE: The hp/kW rating on the engine emissions certification label specifies the gross engine hp/kW, which is flywheel power without fan. In most applications this will not be the same rating as the advertised vehicle hp/kW rating.

BK34394,00001BD –19–31JUL08–1/1

John Deere Emissions Control Warranty Statement

RG15780 –UN–30JUL08



EMISSIONS CONTROL WARRANTY STATEMENT FOR NON-ROAD EQUIPMENT WITH A JOHN DEERE COMPRESSION IGNITION (CI) ENGINE (U.S. AND CANADA)

To determine if the John Deere engine qualifies for the additional warranties set forth below, look for the "Engine Information" label located on the engine. If the engine is operated in the United States or Canada and the engine label states: "This engine complies with US EPA regulations for nonroad and stationary diesel engines", or "This engine conforms to US EPA nonroad compression-ignition emission regulations", refer to the "U.S. and Canada Emissions Control Warranty Statement". If the engine is operated in California, and the engine label states: "This engine complies with US EPA and CARB regulations for nonroad diesel engines", or "This engine conforms to US EPA and California nonroad compression-ignition emission regulations", also refer to the "California Emissions Control Warranty Statement".

Warranties stated on this certificate refer only to emissions-related parts and components of your engine. The complete engine warranty, less emissions-related parts and components, is provided separately. If you have any questions regarding your warranty rights and responsibilities, contact John Deere at 1-800-JD-ENGINE.

Continued on next page

U.S. AND CANADA EMISSIONS CONTROL WARRANTY STATEMENT:

John Deere warrants to the ultimate purchaser and each subsequent purchaser that this non road diesel engine was designed, built, and equipped so as to conform at the time of sale with applicable regulations under section 213 of the Clean Air Act, and is free from defects in materials and workmanship which would cause the engine to fail to conform with applicable regulations for a period of five years from the date of delivery to the original ultimate purchaser or 3,000 hours of operation, whichever first occurs.

John Deere will repair or replace, as it elects, any John Deere supplied emissions-related part or component with a defect in materials or workmanship that would cause the engine to not meet U.S. emissions standards within the stated warranty period. Warranty coverage is subject to the limitations and exclusions set forth herein.

EMISSIONS WARRANTY EXCLUSIONS:

John Deere may deny warranty claims for failures caused by non-performance of maintenance requirements as documented in the Operator's Manual.

John Deere is not liable for damage to other engine components caused by a failure of an emissions related part, unless otherwise covered by standard warranty.

John Deere may deny the owner warranty coverage if the non road diesel engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications or alterations.

John Deere may deny warranty claims for failures caused by the unauthorized or unreasonable use of an engine following sale.

Where permitted by law, neither John Deere, or any authorized John Deere engine distributor, dealer, or repair facility, or any company affiliated with John Deere will be liable for incidental or consequential damages.

CALIFORNIA EMISSIONS CONTROL WARRANTY STATEMENT:

John Deere warrants to the ultimate purchaser and each subsequent purchaser that this non road diesel engine was designed, built, and equipped so as to conform at the time of sale with all applicable regulations adopted by the California Air Resources Board and free from defects in materials and workmanship which would cause the failure of a warranted part to be identical in all material respects to the part as described in John Deere's application for certification for a period of five years from the date the engine is delivered to an ultimate purchaser or 3,000 hours of operation, whichever occurs first.

CALIFORNIA EMISSIONS WARRANTY EXCLUSIONS:

John Deere may deny warranty claims for failures caused by the use of an add-on or modified part which has not been exempted by the CARB. A modified part is an aftermarket part intended to replace an original emission-related part which is not functionally identical in all respects and which in any way affects emissions. An add-on part is any aftermarket part which is not a modified part or a replacement part.

In no event will John Deere, any authorized engine distributor, dealer, or repair facility, or any company affiliated with John Deere be liable for incidental or consequential damages.

John Deere may deny warranty claims based upon improper performance of maintenance or service by a person or facility other than a John Deere authorized service or repair facility.

John Deere may deny the owner warranty coverage if the non road diesel engine or any part has failed due to abuse, neglect, improper maintenance or unapproved modifications or alterations.

Continued on next page

JOHN DEERE'S WARRANTY RESPONSIBILITY

John Deere will repair or replace, as it elects, a John Deere supplied emissions-related part or component with a defect in material or workmanship that would cause the failure of the part to be identical in all material respects to the part as described in John Deere's application for certification within the stated warranty period, at no cost to the owner for diagnosis, parts or labor. Warranty coverage is subject to the limitations and exclusions set forth herein.

The following are emissions-related parts:

Air Induction System
- Intake manifold
- Turbocharger
- Charge air cooler

Fuel Metering system
- Fuel injection system

Exhaust Gas Recirculation (EGR) System
- EGR valve

Particulate Controls
- Any device used to capture particulate emissions
- Any device used in the regeneration of the capturing system
- Enclosures and manifolding
- Smoke Puff Limiters

Catalyst or Thermal Reactor System
- Catalytic converter
- Exhaust manifold

Positive Crankcase Ventilation (PCV) System
- PCV valve
- Oil filler cap

Advanced Oxides of Nitrogen (NOx) Controls
- NOx adsorbers and catalysts
- SCR systems and urea containers / dispensing systems

Miscellaneous Items used in Above Systems
- Electronic control units, sensors, actuators, wiring harnesses
- Hoses, connectors, clamps, fittings, gaskets, mounting hardware
- Emission control information labels

Any warranted emissions-related part scheduled for replacement as required maintenance is warranted by John Deere for the period of time prior to the first scheduled replacement point for the part. Any warranted emissions-related part not scheduled for replacement as required maintenance or scheduled only for regular inspection is warranted by John Deere for the stated warranty period.

OWNER'S WARRANTY RESPONSIBILITIES:

The non road diesel engine owner is responsible for proper maintenance and servicing of the engine as documented in the Operator's Manual. John Deere recommends that the owner retain all receipts covering maintenance on the heavy-duty engine, but John Deere will not deny warranty solely for the lack of receipts or for the owner's failure to ensure the performance of all scheduled maintenance.

Emissions regulations require the customer to bring the unit to an authorized servicing dealer when required. As a result, John Deere is NOT liable for travel or mileage on emissions warranty service calls.

The non road diesel engine is designed to operate on diesel fuel as specified in the Fuels, Lubricants and Coolants section in the Operators Manual. Use of any other fuel may result in the engine no longer operating in compliance with mandated emissions requirements.

The owner is responsible for initiating the warranty process, and should present the machine to the nearest authorized John Deere dealer as soon as a problem is suspected. The warranty repairs should be completed by the authorized John Deere dealer as quickly as possible.

BK34394,00001CB –19–13AUG08–3/3

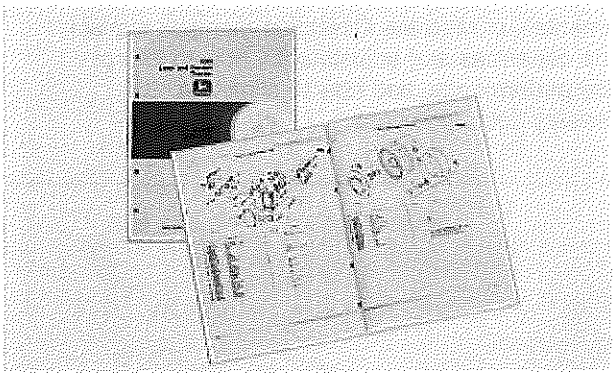
John Deere Service Literature Available

Technical Information

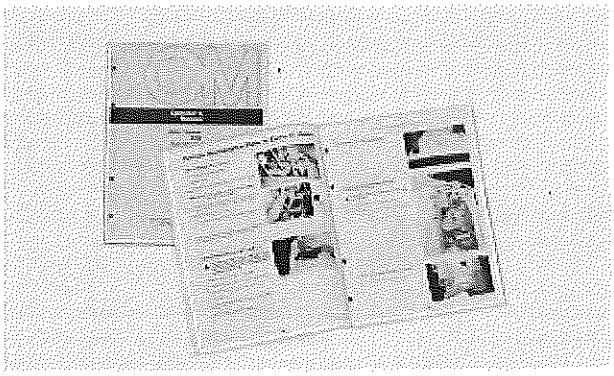
echnical information can be purchased from John Deere. Some of this information is available in electronic media, such as CD-ROM disks, and in printed form. There are many ways to order. Contact your John Deere dealer. Call **1-800-522-7448** to order using a credit card. Search online from http://www.JohnDeere.com. Please have available the model number, serial number, and name of the product.

Available information includes:

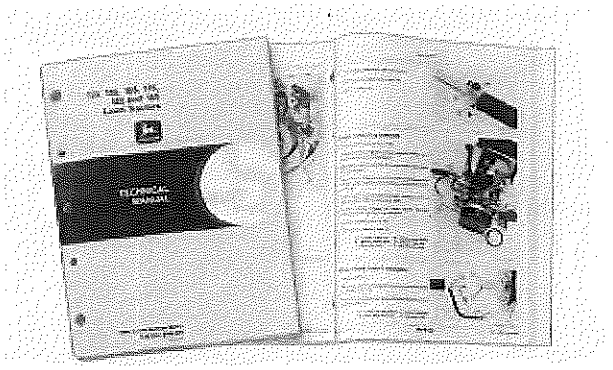
- PARTS CATALOGS list service parts available for your machine with exploded view illustrations to help you identify the correct parts. It is also useful in assembling and disassembling.
- OPERATOR'S MANUALS providing safety, operating, maintenance, and service information. These manuals and safety signs on your machine may also be available in other languages.
- OPERATOR'S VIDEO TAPES showing highlights of safety, operating, maintenance, and service information. These tapes may be available in multiple languages and formats.
- TECHNICAL MANUALS outlining service information for your machine. Included are specifications, illustrated assembly and disassembly procedures, hydraulic oil flow diagrams, and wiring diagrams. Some products have separate manuals for repair and diagnostic information. Some components, such as engines, are available in separate component technical manuals
- FUNDAMENTAL MANUALS detailing basic information regardless of manufacturer:
  - Agricultural Primer series covers technology in farming and ranching, featuring subjects like computers, the Internet, and precision farming.
  - Farm Business Management series examines "real-world" problems and offers practical solutions in the areas of marketing, financing, equipment selection, and compliance.
  - Fundamentals of Services manuals show you how to repair and maintain off-road equipment.



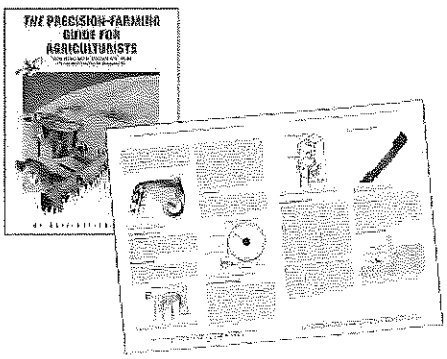
TS189 –UN–17JAN89



TS191 –UN–02DEC88



TS224 –UN–17JAN89



TS1663 –UN–10OCT97

Continued on next page

– Fundamentals of Machine Operation manuals explain machine capacities and adjustments, how to improve machine performance, and how to eliminate unnecessary field operations.

DX,SERVLIT –19–31JUL03–2/2

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6.0 Record Drawings

Section 6.0 - Record drawings

Overview

During construction, minor changes were made to the original prints. They are indicated on the attached drawings.

ELECTRICAL LEGEND

LIGHTING

	WALL MOUNT H1D
	EMERGENCY LIGHTING BATTERY PACK C/W HEADS
	PHOTO-ELECTRIC CELL
	DOUBLE REMOTE HEAD
	SURFACE FLUORESCENT
	WALL MOUNT EXIT

SWITCHES

	MAGNETIC STARTER	
	COMBINATION MAGNETIC STARTER	
	SINGLE POLE SWITCH	'MP' MOTOR PROTECTION SWITCH
	DISCONNECT SWITCH	'P' INDICATES PILOT LIGHT
	RELAY CONTACT	'2' INDICATES 2-POLE

RECEPTACLES

	DUPLEX RECEPTACLE	WP - INDICATES WEATHERPROOF
		GFR - GROUND FAULT RECEPT

MISCELLANEOUS

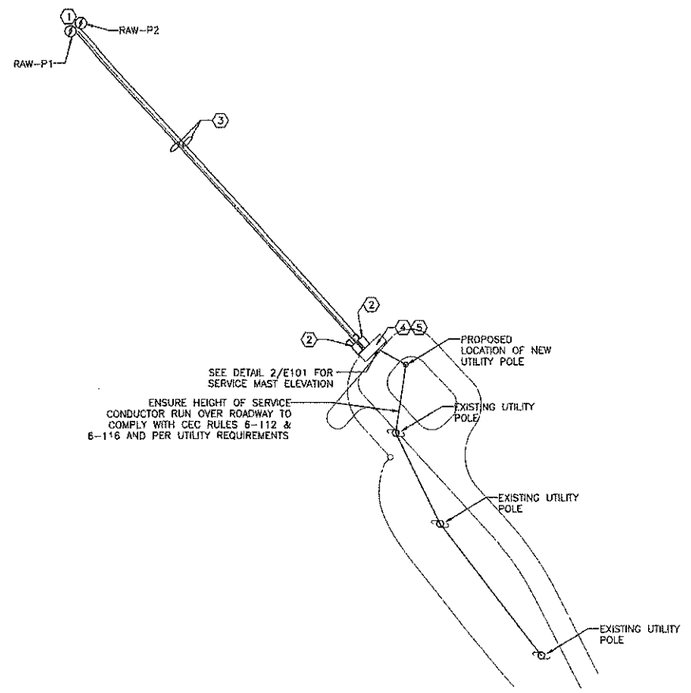
	JUNCTION BOX
	MOTOR
	SURFACE MOUNT ELECTRICAL PANEL

ABBREVIATION

AFF	ABOVE FINISH FLOOR
CEC	CANADIAN ELECTRICAL CODE
QEC	QULLIQ ENERGY CORPORATION
AFG	ABOVE FINISH GRADE
CON	CONDUCTOR
CU	COPPER
GRS	GALVANIZED RIGID STEEL
C	CONDUIT
GND	GROUND
GBPG	GOOD BUILDING PRACTICE GUIDELINES (NUNAVUT)
MTG	MOUNTING
ATS	AUTO TRANSFER SWITCH
BLDG	BUILDING

DRAWING LIST

E101	LEGEND, SITE PLAN AND DETAIL
E102	SINGLE LINE DIAGRAM, GENERATOR RM DETAIL AND MOTOR SCHEDULE
E103	LIGHTING PLAN AND LUMINAIRE SCHEDULE
E104	POWER FLOOR PLAN
E105	HEAT TRACE DETAILS



1 / E101 ELECTRICAL SITE PLAN
SCALE 1:1000

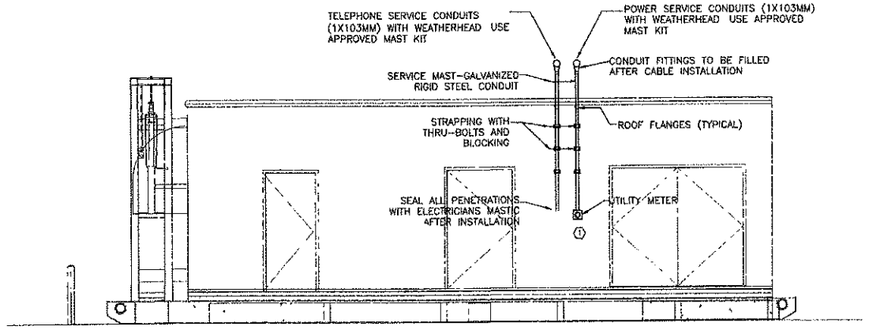
KEYNOTES FOR DETAIL 1/E101

1. PUMPS ARE TO BE LOCATED 160M FROM SHORE REFER TO CIVIL DRAWINGS FOR EXACT LOCATION
2. PROVIDE WEATHERPROOF DISCONNECTS FOR EACH SUBMERSIBLE PUMP (2 TOTAL) AT EXTERIOR OF BUILDING WHERE WATER INTAKE LINES ENTER THE BUILDING DISCONNECTS ARE TO BE CLEARLY AND PERMANENTLY LABELED WITH EQUIPMENT NAME, HORSEPOWER AND VOLTAGE AND LOCKABLE IN "OFF" POSITION COMPLETE WITH PADLOCK REFER TO SINGLE LINE ON SHEET E102 FOR SIZES
3. REFER TO SINGLE LINE DIAGRAM FOR CABLE AND CONDUIT SIZE AND TYPE INSTALLATION TO COMPLY WITH CEC 26-956-1(c)
4. BUILDING TO BE BUILT IN SECTIONS FOR SHIPPING AND ASSEMBLED ON SITE REFER TO ARCHITECTURAL DOCUMENTS FOR SHIPPING SPLIT LOCATIONS PROVIDE JUNCTION BOXES AT EACH LOCATION WHERE CONDUIT AND WIRING ENTER/EXIT A SHIPPING SECTION ONCE ON SITE, CONNECT AND MAKE OPERATIONAL ALL ELECTRICAL SYSTEMS
5. BUILDING STRUCTURES BUILT OUTSIDE THE TERRITORY SHALL BE IN COMPLIANCE OF NUNAVUT TERRITORY ELECTRICAL SAFETY BULLETIN # 28 1 00, DATED, NOVEMBER 16, 2010
6. EXISTING POWER SERVICE IS SINGLE PHASE ONLY NEW FACILITY REQUIRES THREE PHASE POWER TO BE BROUGHT TO SITE FROM THE COMMUNITY COSTS FOR UPGRADING THE POWER AND TELEPHONE SERVICES TO BE CARRIED BY THE CONTRACTOR

GENERAL KEYNOTES FOR ALL ELECTRICAL DRAWINGS

PERFORM COMPLETE INSTALLATION AND EQUIPMENT IN STRICT ACCORDANCE SHALL MEET THE MOST STRINGENT REQUIREMENTS OF THE FOLLOWING

a) CSA C22 1-12-22ND EDITION OF THE CANADIAN ELECTRICAL CODE 2009
b) NATIONAL ENERGY CODE FOR BUILDINGS 2011
c) GN's STRUCTURED CABLING GUIDELINES VERSION 1 4 MARCH, 2011
d) GN'S GOOD BUILDING PRACTICE GUIDELINES
f) GN's ELECTRICAL/MECHANICAL SAFETY SECTION ELECTRICAL BULLETINS AND FIRE MARSHALL TECHNICAL BULLETINS
g) THE CONTRACTOR TO VERIFY WITH THE ELECTRICAL INSPECTION DEPARTMENT THE ACCEPTABILITY OF ANY PRE-WIRING DONE WITHIN THE NEW POTABLE WATER SYSTEM BUILDING IF THE WIRING IS DONE OUTSIDE OF NUNAVUT AND, TO ENSURE THAT A PERMIT IS ACQUIRED FROM THE NUNAVUT INSPECTION DEPARTMENT FOR ANY PRE-WRING THAT MAY BE DONE



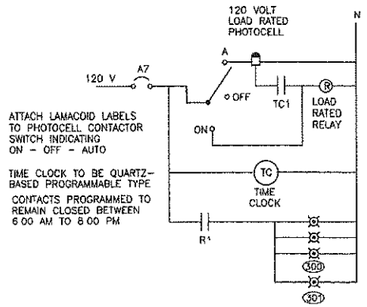
2 / E101 SERVICE MAST ELEVATION
SCALE 1:50

GENERAL NOTES FOR DETAIL 2/E101

1. LOCATE AND SUPPORT SERVICE MASTS PER CEC & QEC REQUIREMENTS
2. ADJUST FINAL MOUNTING HEIGHT OF SERVICE MASTS TO ENSURE COMPLIANCE WITH CEC RULES 6-112 & 6-116

KEYNOTE FOR DETAIL 2/E101

1. UTILITY METER SHALL BE INSTALLED AT 1 7M ABOVE FINISHED GRADE FROM CENTRE OF THE METER FACE AS REQUIRED PER UTILITY



3 / E101 PHOTOCELL CONTROL SCHEMATIC
NTS

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4999 53rd Street
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X1A 2R3
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Fax (867) 920-4343
www.stantec.com

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Consultants

Legend

NORTH PROJECT

Notes

Revision	By	Appd	YY.MM.DD
ISSUED FOR CONSTRUCTION	NJK		24.05.17
TENDER SUBMISSION	NJK		24.04.12
Issued	RJ	SMC	24.04.05

File Name:	Dwn	Chkd	Dsgn	YY.MM.DD

Permit-Seal

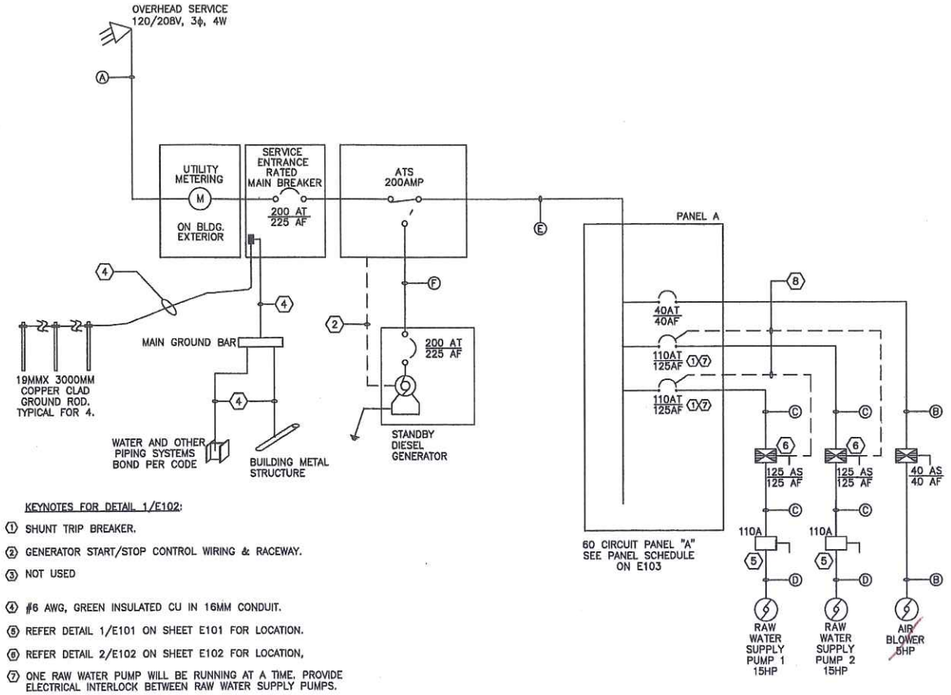
REGISTERED PROFESSIONAL ENGINEER
N. J. BOURASSA
14491
NUNAVUT
N.W.T.

Client/Project
GOVERNMENT OF NUNAVUT

POTABLE WATER SYSTEM
PHASE I
Cambridge Bay, NU

Title
LEGEND, SITE PLAN AND DETAILS

Project No.	Scale	
1449-01252	AS SHOWN	
Drawing No.	Sheet	Revision
E101	1 of 5	



KEYNOTES FOR DETAIL 1/E102:

1. SHUNT TRIP BREAKER.
2. GENERATOR START/STOP CONTROL WIRING & RACEWAY.
3. NOT USED
4. #6 AWG, GREEN INSULATED CU IN 16MM CONDUIT.
5. REFER DETAIL 1/E101 ON SHEET E101 FOR LOCATION.
6. REFER DETAIL 2/E102 ON SHEET E102 FOR LOCATION,
7. ONE RAW WATER PUMP WILL BE RUNNING AT A TIME. PROVIDE ELECTRICAL INTERLOCK BETWEEN RAW WATER SUPPLY PUMPS.
8. PROVIDE RACEWAY AND WIRING BETWEEN SHUNT TRIP BREAKER AND GROUND FAULT RELAY IN STARTER. GROUND FAULT CURRENT SETTING SHALL NOT BE GREATER THAN 10mA FOR AND OPERATING PERIOD NOT EXCEEDING 2.7S COMPLYING WITH CEC 26-956 (1)(d). GROUND FAULT SENSOR TO BE EATON EGFL.

1 / E102 SINGLE LINE DIAGRAM
SCALE : N.T.S.

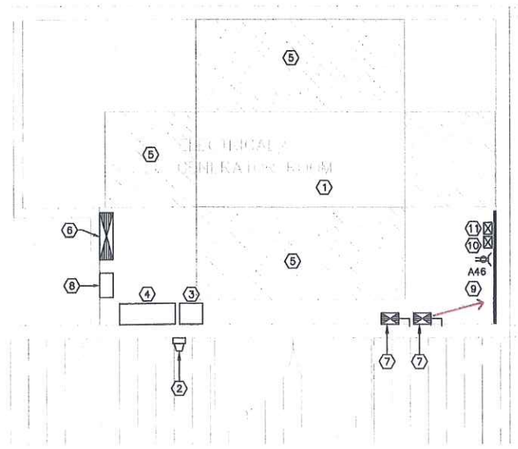
CABLE SCHEDULE	
Ⓐ	4 CON 3/0 AWG CU RW90-XLPE IN 103MM RIGID STEEL C
Ⓑ	3 CON 8 AWG CU RW90-XLPE PLUS 1 #10 AWG CU GND IN 27MM C
Ⓒ	3 CON #2 AWG CU RW90-XLPE PLUS 1 #6 AWG CU GND IN 35MM C
Ⓓ	3 CON #2 AWG CU RWU90-XLPE PLUS 1 #6 AWG CU RWU90-XLPE GND IN 41MM PLASTIC WATER PIPE
Ⓔ	4 CON #3/0 AWG CU RW90-XLPE PLUS 1 #3 AWG CU GND IN 53MM C
Ⓕ	4 CON 3/0 AWG CU RW90-XLPE PLUS 1 #3 AWG CU GND IN 63MM C

DEMAND CALCULATION AS PER C22.1-09

SERVICE FEEDER CALCULATION

INDUSTRIAL

AREA				39 m²		
	AREA(m²)	W/m²	PERCENT	LOAD		
BASIC AREA CALC	44	25	100	= 1100	W	
SPECIAL LOADS						
RAW WATER PUMP (QTY. 2) (ONE RUNNING AT A TIME)				= 15000	W	
BLOWER				= 5000	W	
MISC. PROCESS LOADS				= 1000	W	
MECH LOAD				= 2600	W	
HEAT TRACE				6400		
SUB TOTAL				= 31100	W	
15% SPARE PER GBPG-4.4.3				= 4665	W	
TOTAL				= 35765	W	
AT 120/208V, 3ø, 60Hz			I	= 99	A	
USE 80% MAIN BREAKER			I	= 124.1	A	
MAIN DISCONNECT SIZE				200	A	
EXPECTED DEMAND				58	KVA	



2 / E102 ELECTRICAL/GENERATOR ROOM PLAN
SCALE : 1:30

KEYNOTES FOR DETAIL 2/E102:

1. STANDBY GENERATOR
2. UTILITY METER
3. MAIN SERVICE CIRCUIT BREAKER
4. AUTO TRANSFER SWITCH (ATS)
5. ENSURE 1M WORKING CLEARANCE ALL TIME IN FRONT OF ELECTRICAL EQUIPMENT.
6. PANEL A
7. STARTER FOR EACH RAW WATER PUMPS.
8. EXTERIOR LIGHTING CONTROL BOX
9. TELEPHONE BACKBOARD 1219 X 2438 MM GIS PAINTED WITH FIRE RETARDANT PAINT.
10. AUTODIALER
11. CONTRACTOR SUPPLIED MODEM FOR INTERNET CONNECTIVITY FOR CONTROLS AND MONITORING.

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Tel. (867) 920-2882
Fax. (867) 920-4319
www.stantec.com

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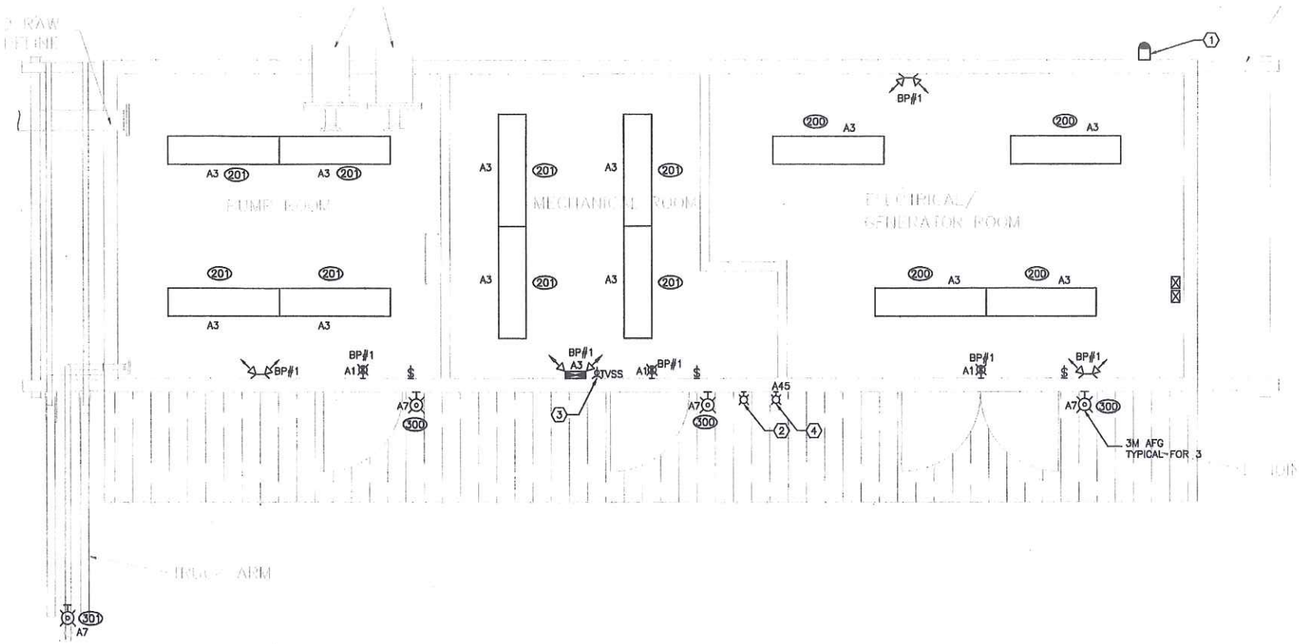
POTABLE WATER SYSTEM
PHASE I
Cambridge Bay, NU

Title
SINGLE LINE DIAGRAM, GENERATOR ROOM DETAIL AND SERVICE CALCULATION

Project No.	Scale	
1449-01252		
Drawing No.	Sheet	Revision
E102	2 of 5	

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ORIGINAL SHEET – ANSI D



1 / E103 LIGHTING AND EMERGENCY PLAN
1:30

KEYNOTES:

1. EXTERIOR LIGHTING PHOTOCELL INSTALL HIGHER ABOVE BUILDING, AWAY FROM OBSTRUCTION AND ARTIFICIAL LIGHT SOURCES, FACING NORTH.
2. AMBER STROBE FOR MECHANICAL ALARM TO BE RIGIDLY MOUNTED WITH RIGID CONDUIT AND INSTALL ABOVE BUILDING AND TO BE VISIBLE FROM ROADSIDE. REFER SPECIFICATION SECTION 28 32 00 FOR DETAIL.
3. EMERGENCY BATTERY PACK ON TVSS RECEPTACLE.
4. FUEL TANK FULL LIGHT

LUMINAIRE SCHEDULE

TYPE: 200 DESCRIPTION: SURFACE OR PENDENT MOUNTED FLUORESCENT STRIPLIGHT
HOUSING: 1219 MM LONG DIE FORMED STEEL CHANNEL
FINISH: BAKED WHITE ENAMEL
BALLAST: ELECTRONIC PROGRAM RAPID START, 120V, 10% THD
LAMP: TWO F32T8
ACCESSORIES: WIRE GUARD
MOUNTING: CHAIN HANGERS AND ACCESSORIES
MANUFACTURERS: METALUX STW-232-120V-ER81 OR APPROVED EQUAL

TYPE: 201 DESCRIPTION: SURFACE OR PENDENT MOUNTED VAPORTIGHT INDUSTRIAL FLUORESCENT LUMINAIRE
HOUSING: 1265 MM LONG FIBERGLASS HOUSING REINFORCED POLYESTER AND SELF-EXTINGUISHING PLASTIC WITH WATERTIGHT HUBS FOR CONDUIT ENTRY
LENS: HIGH IMPACT CLEAR LOW BRIGHTNESS PATTERN POLYCARBONATE
BALLAST: ELECTRONIC PROGRAM RAPID START, 120V, 10% THD
LAMP: TWO F32T8
MOUNTING: CHAIN HANGING SET AND ACCESSORIES
LISTING: UL/CUL LISTED FOR WET LOCATIONS
MANUFACTURER: METALUX VT2-232-LEX-120-ER8--WL OR APPROVED EQUAL

TYPE: 300 DESCRIPTION: EXTERIOR WALL MOUNTED HID
HOUSING: DIE CAST ALUMINUM
LENS: PATTERNED TAMPERED GLASS
FINISH: DARK BRONZE POLYSTER POWER COAT
BALLAST: -30 DEGREE, HIGH POWER FACTOR, 120V
LAMP: ONE 70 WATT HPS
LISTING: UL WET LOCATION LISTED, CSA CERTIFIED
ACCESSORIES: MOUNTING ACCESSORIES AS REQUIRED -- SEE DRAWINGS
MANUFACTURER: LUMARK WALLY CUTOFF OR APPROVED EQUAL

TYPE: 301 DESCRIPTION: EXTERIOR TRUCK FILL ARM MOUNTED HID
HOUSING: DIE CAST ALUMINUM
FINISH: DARK BRONZE POLYESTER POWDER PAINT
GASKET: FULL CIRCUMFERENCE SILICON GASKET
BALLAST: -40 DEGREE, HIGH POWER FACTOR, 120V
LAMP: ONE 50 WATT HPS
LISTING: UL WET LOCATION LISTED
ACCESSORIES: MOUNTING ACCESSORIES AS REQUIRED -- SEE DRAWINGS
MANUFACTURER: LUMARK FALCON HP-SF-50HP-H-120V-TR-SF/WG OR APPROVED EQUAL

NOTES:

1. THIS LUMINAIRE SCHEDULE IS NOT COMPLETE WITHOUT A COPY OF THE PROJECT DOCUMENTS CONTAINING THE ELECTRICAL SPECIFICATIONS.
2. VERIFY LUMINAIRE VOLTAGE WITH BRANCH CIRCUIT SUPPLYING POWER TO LUMINAIRE PRIOR TO ORDERING.
3. VERIFY AND COORDINATE ALL CEILING TYPES WITH LUMINAIRE LOCATIONS.
4. PROVIDE LUMINAIRES COMPLETE WITH LAMP AND ALL ACCESSORIES FOR MOUNTING AS SHOWN ON DRAWINGS. FOR EXACT CEILING AND WALL TYPES REFER TO BUILDING DRAWINGS.
5. ALL FLUORESCENT LAMPS TO COMPLY WITH LOCAL AND NATIONAL TOXICITY RULES AND REGULATIONS, WHERE AVAILABLE.
6. SPECIFIED MANUFACTURERS ARE APPROVED TO SUBMIT BID WHERE SPECIFIED. INCLUSION DOES NOT RELIEVE MANUFACTURER FROM PROVIDING PRODUCT AS DESCRIBED.
7. EQUALS SHALL MEET THE DESCRIPTIONS LISTED AND IDENTIFIED BY THE CATALOG NUMBER INDICATED FOR ALL ELEMENTS AND PROPERTIES. THE MERE FACT THAT THE SERIES IS LISTED HEREIN DOES NOT AUTOMATICALLY QUALIFY ANY LUMINAIRE OF SUCH FAMILY AS EQUAL.
8. ALL THE AVERAGE MAINTAINED HORIZONTAL AND VERTICAL ILLUMINANCE LEVELS SHALL CONFORM TO THE 10th EDITION OF "LIGHTING HANDBOOK" ILLUMINATING ENGINEERING SOCIETY (IES) AND NATIONAL ENERGY CODE FOR BUILDINGS 2011 (NECB)

PANEL: A

VOLTS: 120/208 LOCATION: ELECTRICAL/GENERATOR ROOM BUSS: 250A
PHASE: 3 FEEDER: REFER TO SINGLE LINE MTG: SURFACE
WIRE: 4

CIRC	BRKR	WATTS A	WATTS B	WATTS C	DESCRIPTION	DESCRIPTION	WATTS A	WATTS B	WATTS C	BRKR	CIRC
* 1	1P15	50			EXIT SIGNS	RECEPTACLES PROCESS RM	375			1P15	2
3	1P15		1000		LIGHTS & EMERGENCY LGTHS	RECEPTACLES MECH RM		375		1P15	4
5	1P15				SPARE	RECEPTACLES GEN RM			250	1P15	6
7	1P15	400			EXTERIOR LIGHTS	RECEPTACLES EXTERIOR	250			1P15	8
9	1P15		176		B-1	SPARE				1P15	10
11	1P15			176	B-2	P-3.1			187	1P15	12
13	1P25	335			HRV-1	P-3.2	187			1P15	14
15	1P15		60		UH-1	P-3.3		478		1P15	16
17	1P15			60	UH-2	P-3.4			478	1P15	18
19	1P15	60			UH-3	P-3.5	100			1P15	20
21	1P15		100		MAS	P-M1		125			22
23	1P15			100	TBS	P-P5.2			125		24
25	1P15	100			TPS		125				26
27	1P15		150		MISC. LOADS-GEN RM	P-P1		40		3P15	28
29	1P15			50	CF-1				150		30
31	1P15				GEN. SET BLOCK HEATER	SEQUANS CONTROL PNL				1P15	32
33	1P15				FOP-1						34
35	1P15				FOP-2	MECH ALARM/FUEL FULL					36
37						HEAT TRACE CONTROLLERS					38
39	3P40									2P15	40
41											42
43	1P15	100			GEN RM QUAD RECP	PARKING RECP					44
45	1P15				GEN RM QUAD RECP	AUTODIALER		100		1P15	46
47	1P15				BATTERY CHANRGER	SPARE				1P15	48
49											50
51	3P110				RWP-2	RWP-1				3P110	52
53											54
55	2P40				HEAT TRACE #1	HEAT TRACE #2				2P40	56
57											58
59					SPACE	SPACE					60
TOTAL		7712	8153	7053			10537	8368	8440	TOTAL	

PHASE A TOTAL = 18249
PHASE B TOTAL = 16521
PHASE C TOTAL = 15493
PANEL TOTAL = 50263 @120/208 VOLTS 3 PHASE 139.5 AMPS

REMARKS
* PROVIDE LOCK-ON DEVICE ON BREAKER.
PROVIDE INTEGRAL TVSS, BREAKERS FOR HEAT TRACE #1 AND #2 ARE TO BE GFCI

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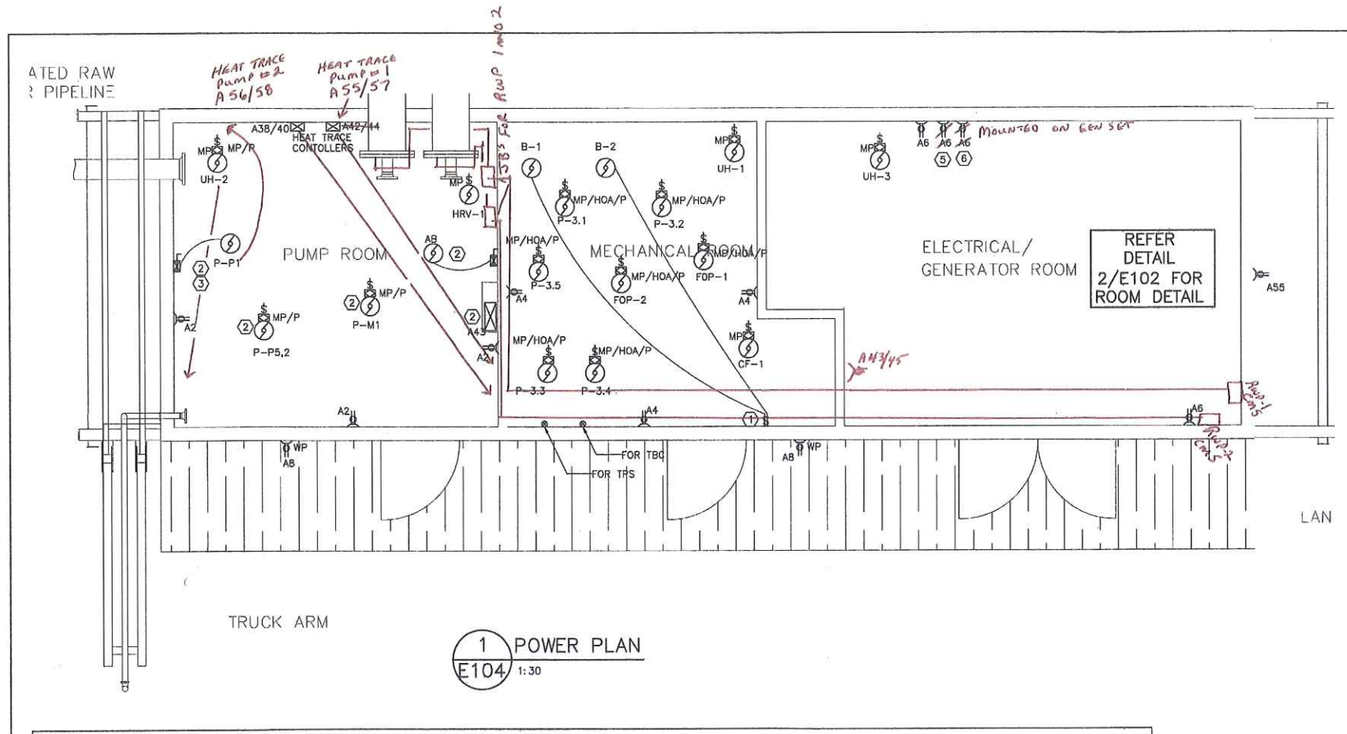
Client/Project
GOVERNMENT OF NUNAVUT

POTABLE WATER SYSTEM
PHASE I
Cambridge Bay, NU

Title
LIGHTING FLOOR PLAN
AND LUMINAIRE SCHEDULE

Project No. 1449-01252
Scale
Drawing No. E103
Sheet 3 of 5
Revision

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ORIGINAL SHEET - ANSI D



1 / E104 POWER PLAN 1:30

KEYNOTES:

1. EMERGENCY BOILER DISCONNECT AT 1600 AFF. PROVIDE SIZE 2 NAME PLATE, RED BACKGROUND WITH WHITE LETTERS READING "BOILER 1 EMERGENCY DISCONNECT", "BOILER 2 EMERGENCY DISCONNECT".
2. EXACT LOCATIONS OF MECHANICAL AND PROCESS EQUIPMENT ARE TO BE COORDINATED WITH MECHANICAL AND PROCESS DRAWINGS PRIOR TO ROUGH-IN.
3. ENSURE 1M WORKING CLEARANCE IN FRONT OF ELECTRICAL EQUIPMENT AT ALL TIME.
4. PROCESS PANEL
5. BATTERY CHANGER RECEPTACLE
6. BLOCK HEATER RECEPTACLE

MECHANICAL MOTOR LIST

MOTOR	DESCRIPTION	LOCATION	H.P.	VOLTS	PHASE	FLA	BRANCH CIRCUIT	BREAKER	SOURCE	CONTROL
B-1	HW BOILER	MECH RM	0.235	120	1	5.8	2CON #12 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A9	LRD
B-2	HW BOILER	MECH RM	0.235	120	1	5.8	2CON #12 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A11	LRD
HRV-1	HEAT RECOVERY VENTILATOR	MECH RM	0.446	120	1	9.8	2CON #10 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	25	A13	MMP/P
P-3.1	PRIMARY HW CIRC. PUMP	MECH RM	0.25	120	1	5.8	2CON #12 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A12	MMP/HOA/R/P NOTE D
P-3.2	PRIMARY HW CIRC. PUMP	MECH RM	0.25	120	1	5.8	2CON #12 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A14	MMP/HOA/R/P NOTE D
P-3.3	SECONDARY HE CIRC. PUMP	MECH RM	0.64	120	1	12.2	2CON #10 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A16	MMP/HOA/R/P NOTE D
P-3.4	SECONDARY HE CIRC. PUMP	MECH RM	0.64	120	1	12.2	2CON #10 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A18	MMP/HOA/R/P NOTE D
P-3.5	HW MAKE-UP PUMP	MECH RM	FRACT	120	1	–	2CON #12 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A20	MMP/HOA/R/P
FOP-1	FUEL OIL PIMP	MECH RM	0.500	120	1	9.8	2CON #10 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A33	MMP/HOA/R/P
FOP-2	FUEL OIL PIMP	MECH RM	0.500	120	1	9.8	2CON #10 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A35	MMP/HOA/R/P
UH-1	UNIT HEATER	MECH RM	FRACT	120	1	–	2CON #12 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A15	MMP/R/P NOTE D
UH-2	UNIT HEATER	PUMP RM	FRACT	120	1	–	2CON #12 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A17	MMP/R/P NOTE D
UH-3	UNIT HEATER	ELEC RM	FRACT	120	1	–	2CON #12 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A19	MMP/R/P NOTE D
CF-1	COOLING FAN	MECH RM	FRACT	120	1	–	2CON #12 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A29	MMP/R/P NOTE D
MAS	MECHANICAL ALARM STROBE	MECH RM	FRACT	120	1	–	2CON #12 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A36	BY DIVISION 23
~~TBC~~	~~BOILER CONTROLLER~~	MECH RM	FRACT	120	1	–	2CON #12 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A23	NOTE E
~~TPS~~	~~PUMP SEQUENCER~~	MECH RM	FRACT	120	1	–	2CON #12 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A25	NOTE E
	MISCELLANEOUS 24V LOADS	GENERATOR RM	FRACT	120	1	–	2CON #12 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A27	MMP/R/P

PROCESS MOTOR LIST

MOTOR	DESCRIPTION	LOCATION	H.P.	VOLTS	PHASE	FLA	BRANCH CIRCUIT	BREAKER	SOURCE	CONTROL
RWP-1	RAW WATER PUMP -1	END OF INTAKE LINE	15	208	3	46.2	SEE SINGLE LINE	110	A50,52,54	CMS/GF NOTE F
RWP-2	RAW WATER PUMP -2	END OF INTAKE LINE	15	208	3	46.2	SEE SINGLE LINE	110	A49,51,53	CMS/GF NOTE F
~~AB~~	~~AIR BLOWER~~	PROCESS ROOM	5	208	3	16.72	SEE SINGLE LINE	40		~~CMS~~
P-P1	PUMP 1 RECIRC	PROCESS ROOM	0.5	208	3	2.2	3CON #12 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A26,28,30	CMS
P-P5,2	CHLORINATION PUMP	PROCESS ROOM	0.2	120	1	–	2CON #12 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A24	MMP/R/P
P-M1	CHLORINE MIXING MOTOR	PROCESS ROOM	FRACT	120	1	–	2CON #12 CU RW90-XLPE, 1 #12 CU GND, IN 16 MM C	15	A22	MMP/R/P

NOTES:

A. MOTOR SCHEDULE IS FOR ESTIMATING PURPOSES ONLY. CONFIRM ALL MOTOR FULL LOAD CURRENTS WITH NAMEPLATES AND SIZE MOTOR DISCONNECTS, BREAKERS, FEEDERS AND OVERLOADS ACCORDINGLY.

B. CONFIRM MECHANICAL EQUIPMENT LOCATIONS WITH DIVISION 23.

C. COORDINATE THE LOCATIONS OF ALL LINE VOLTAGE PILOT DEVICES WITH DIVISION 23 AND PROVIDE CONDUIT AND WIRING AS NECESSARY

D. PROVIDE RACEWAY AND WIRING FROM LINE-VOLTAGE THERMOSTAT PROVIDED BY DIV-23 TO THE UNIT.

E. EQUIPMENT WITH HARDWIRE CONNECTION.

F. PROVIDE RACEWAY, WIRING AND ACCESSORIES BETWEEN RWP-1 AND RWP-2 FOR INTERLOCK. ONE PUMP RUNNING AT A TIME.

CONTROL DEVICE LEGEND

LRD – LOAD RATED DISCONNECT
MAG – MAGNETIC STARTER
CMS – MAGNETIC STARTER WITH DISCONNECT
MMP – MANUAL MOTOR PROTECTION
/R – WITH LOAD RATED RELAY
/HOA – WITH H-O-A SWITCH
/K – KEYED
/P – PILOT LIGHT
/SS – SOFT START
/GF – GROUND FAULT DETECTION

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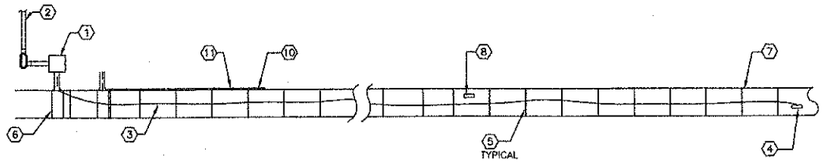


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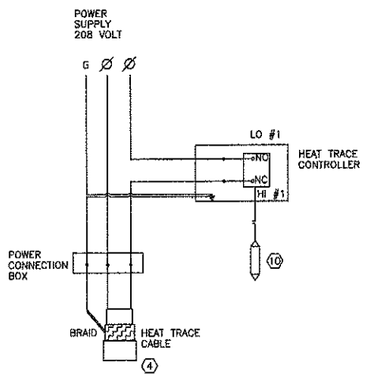
POTABLE WATER SYSTEM
PHASE I
Cambridge Bay, NU

Title
POWER FLOOR PLAN
AND MOTOR SCHEDULE

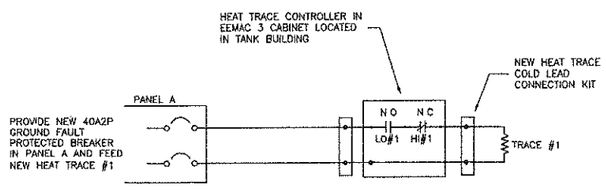
Project No. 1449-01252
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Sheet 4 of 5
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1 / E105 HEAT TRACE INSTALLATION
NTS



2 / E105 HEAT TRACE WIRING
NTS



3 / E105 HEAT TRACE INSTALLATION
NTS

1. POWER CONNECTION BOX FOR ONE HEATING CABLE
2. 21 MM CONDUIT AND WIRING TO ELECTRICAL PANEL BOARD
3. HEAT TRACE CABLE, SEE SPECIFICATION TOTAL LENGTH OF THE PIPE IS EXPECTED TO BE 160 METERS PLUS/MINUS 5% SITE VERIFY THE LENGTH AND INFORM THE ENGINEER IMMEDIATELY IF THE ACTUAL LENGTH IS DIFFERENT
4. END SEAL
5. GLASS INSULATION TAPE
6. PIPE STRAP, PROVIDE AS AND WHERE NECESSARY AS PER MANUFACTURER INSTRUCTIONS.
7. FRESH WATER PIPE 100MM (4")
8. ELECTRICALLY TRACED LABEL, SEE SPECIFICATION
9. NOT USED
10. THERMOSTAT BULB SEE SPECIFICATION
11. POSITION THERMOSTAT BULB AND LINE AWAY FROM HEATER CABLE AND EFFECTIVELY INSULATE PER MANUFACTURER INSTRUCTIONS
12. HEAT TRACE IS NOT TO ENTER BUILDING ENVELOPE

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Notes

Revision	By	Appd	YY.MM.DD
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Client/Project
GOVERNMENT OF NUNAVUT

POTABLE WATER SYSTEM
PHASE I
Cambridge Bay, NU

Title
HEAT TRACE DETAILS

Project No.	Scale	
1449-01252	AS SHOWN	
Drawing No.	Sheet	Revision
E105	5 of 5	

7.0 Certifications & Warranties

Section 7.0 – Certifications and Warranties

Overview

A copy of the training sign off sheets and the contractor warranty are located in this section.

RYFAN KITIKMEOT INC.

LETTER OF WARRANTY

Cambridge Bay Potable Water System Phase 1

The electrical installation has been thoroughly tested and found to be in proper operating condition at time of turn over and is guaranteed to be free from any defect in workmanship and material that may develop within a one year period from date of substantial completion.

Any part or parts of the electrical installation, as defined in the Electrical Specifications, that prove defective within a one year period shall be replaced without charge, when subjected to examination by one of our representatives, providing that such defect, in our opinion, is due to faulty material or workmanship and not caused by tampering, abuse, or misapplication.

This warranty is limited to division 26 materials and associated equipment and in no event shall Ryfan Kitikmeot Inc. have any liability for consequential damages, or expenses, or lost revenues directly or indirectly arising from an electrical system failure. Any alterations to the system without the written expressed approval from a Ryfan Kitikmeot Inc. representative will render this warranty null and void.

January 12, 2015

Jesse Mailloux
Ryfan Kitikmeot Inc.

RYFAN HITHMEOT INC.

Potable Water System Phase 1
Cambridge Bay, NU
Training Sign-Off Sheet

Section – Service and Distribution

System operation

The operation of the breakers in the panel boards has been demonstrated to the local maintainer. This includes, but not limited to:

1.) An overview of the distribution system and location of all panel boards
2.) Demonstration of how to locate a tripped breaker and how to safely reset it

Rick Sigmund
Ryfan representative

Owners representative

Nov 25/14
Date

Ryfan Electric Ltd., 485 South Avenue, Spruce Grove, AB
Phone (780) 960-3601, Fax (780) 962-3266

Section 28 32 00 – Mechanical Alarm Detection

System operation

The operation of the sound system has been demonstrated to the local maintainer. This includes, but not limited to:

1.) An overview of the entire alarm system and location of all devices
2.) How to use program the autodialer
3.) Operation of equipment

Ryfan representative

Owners representative

Nov 25/14
Date

Section 26 32 14 – Power Generation Diesel

System operation

The operation of the generator has been demonstrated to the local maintainer. This includes, but not limited to:

1.) An overview of the entire emergency power supply unit and location of all equipment.
2.) Demonstration of how to operate the units, its control panel, paralleling gear, distribution panel, remote annunciator, using menus, reading information, and downloading information.
3.) How to test the system.
4.) How to maintain the system, its modes of operation and user adjustments.

Bill Sayand
Ryfan representative

Owners representative

Nov 25/14
Date

RYFAN KITIKMEOT INC.

Potable Water System Phase 1
Cambridge Bay, NU
Training Sign-Off Sheet

Section 26 50 00 – Lighting

System operation

The operation of the lighting system has been demonstrated to the local maintainer. This includes, but not limited to:

1.) An overview of the entire lighting system and location of all switches
2.) Location of photocell that controls exterior lights
3.) How to program the time clock that controls the exterior lights
4.) How to switch from photocell control to manual control for the exterior lights.

Rick Sayward
Ryfan representative

Owners representative

Nov 25/14
Date

Ryfan Electric Ltd., 485 South Avenue, Spruce Grove, AB
Phone (780) 960–3601, Fax (780) 962-3266

Section 26 52 01 – Emergency lighting

System operation

The operation of the emergency lighting system has been demonstrated to the local maintainer. This includes, but not limited to:

1.) An overview of the entire emergency lighting system and location of all battery packs
2.) How to test the battery packs

Ryfan representative

Owners representative

Nov 25/14
Date

Section 26 36 23 - Automatic transfer switches

System operation

The operation of the automatic transfer switch has been demonstrated to the local maintainer. This includes, but not limited to:

1.) An overview of the entire transfer switch unit.
2.) Demonstration of how to switch from manual operation to automatic.
3.) How to maintain the system.

Rick Sampson
Ryfan representative

Owners representative

Nov 25/14
Date

Section 26 60 00 – Spare Parts

The following spare parts were turned over at the end of the project;

LIGHTING

- ✓ .1 Lamps:
  - .1 Furnish 10 percent spare lamps for each size and type installed.
- ✓ .2 Ballasts:
  - .1 Furnish 5 percent spare ballasts for each size and type.

MOTOR STARTERS

- ✓ .1 Three (3) spare fuses of each type and size used.
- ✓ .2 One (1) set of each type of adjustable thermal overload device. ?
- ✓ .3 One (1) spare coil of each starter size. ?
- ✓ .4 Two (2) spare control transformers.
- .5 One spare time delay device of each type used. NA

GENERATOR

- ✓ .1 Six (6) fuel filter replacement elements — 6 ea.
- ✓ .2 Six (6) oil filter elements — 6 ea.
- ✓ .3 Six (6) air cleaner replacement elements — 6 ea.
- ✓ .4 Two (2) fuses of each type used in control panel
- ✓ .5 Two (2) accessory belts of each type used on engine
- .6 Special; tools for servicing NA.

Rick Sanford
Ryfan representative

Owners representative

Date