Appendix G20

Report: Baker Lake Jet-A Tank As-built Report

AGNICO EAGLE
MEADOWBANK

AGNICO EAGLE MINES LTD

MEADOWBANK DIVISION

BAKER LAKE JET A FUEL STORAGE INSTALLATIONS

2013

AS BUILT CONSTRUCTION REPORT

PREPARED BY:

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Project General Foreman

AEM.

APPROVED BY:

REGISTERED PROFESSIONAL ENGINEER
R. MARCOUX
LICENSEE
NT/NU

AGNICO EAGLE MINES LTD

MEADOWBANK DIVISION

BAKER LAKE JET A FUEL STORAGE INSTALLATIONS

2013

AS BUILT CONSTRUCTION REPORT

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1- DESCRIPTION OF CONSTRUCTION ACTIVITIES

Agnico Eagle mines has contracted Stavibel Engineering Services to design the Jet A fuel storage facilities located in Baker Lake, Nunavut, complying with specifications required by environmental and governmental regulations, namely Environment Canada's Fuel Tank Storage Regulations and the CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.

Stavibel provided the design, planning and construction oversight related to the installation of infrastructure of AEM's new Jet A Fuel Storage facility which consists of 20 – 100,000L double walled tanks, associated piping and pumping systems and secondary requirement. AEM prepared a site survey to ensure proper measurements and elevation of the existing area.

The main activities related to the construction were scheduled as follow:

I: AEM sent surveyed data of the existing area to Stavibel

II: Stavibel sent first design plans for comments

III: AEM moved the existing tanks and prepared the field for the construction

IV: Construction of the infrastructure pad

V: Assembling of all the installation of tanks and mechanical infrastructure.

2- DESCRIPTION OF THE FUEL CONTAINEMENT PAD CONSTRUCTION STEPS

2.1 EXCAVATION OF THE EXISTING AREA. July 14th 2013.

Quality control and quality approval: Stavibel

Construction contractor: Quamanittuap-Sana (FGL)

General supervision and foreman: AEM

Starting with test pits, the presence of water was observed in the excavation area. It was then decided to increase the elevation of the pad by +300mm. Presence of contaminated soil was found as well; it was removed, analyzed by environmental department and sent to the soil landfarm at Meadowbank. The total amount was 128m3. All non-contaminated soil and rock that was removed and was placed aside to be used during the backfilling of the pad. (1) 365 CAT excavator, (1) D6 CAT dozer, (1) operator and (1) surveyor were necessary for the initial phase.

2.2 CONSTRUCTION OF THE PAD PHASE 1. July 15th – July 25th 2013.

Quality control and quality approval: Stavibel

Construction contractor: Quamanittuap-Sana (FGL)

Material transportation: BLCS

General supervision and foreman: AEM

During this phase of the project, a (1) 365 CAT excavator, (1) 320 CAT excavator, (1)Komatsu 39PX dozer, (1) Hamm 3625 compactor and (1) 740 CAT haul truck were utilized. In addition, staff included were (1) operator plus (1) surveyor. The first step was to backfill the pad up to the determined level with 0-200mm NPAG rock, and then enlarge the road south of the pad. Excess water (clean) was drained in order to construct the containment berms around the pad as showed in appendix 1 B. Once the rock pad was at the determined elevation, crushed 0-20mm NPAG material was placed on top of the berms. Correctives measures around the pad were undertaken due to some instability in the area where the fuel cabinet would be installed. Crushed 0-20mm NPAG material was placed on the top of the pad, compacted to prepare for the installation of the bituminous liner. Excavation in the surrounding ditches was completed in accordance with design specifications. A total amount of 1217m3 of NPAG 0-200mm and 455m3 of NPAG 0-20mm was used to complete this phase of the construction.

2.3 INSTALATION OF THE BITOUMINOUS LINER. July 25th – July 27th 2013

Quality control and quality approval: Stavibel

Construction contractor: Quamanittuap-Sana (FGL)

Liner crew: Texcel

General supervision and foreman: AEM

Equipment and manpower used included (1) 365 CAT excavator to unroll the liner and we had (1) operator, (1) surveyor, (2) liner installers and (3) laborers from Baker Lake. The liner was installed over a two day period. After installation, any holes that resulted were repaired and conformity tests were undertaken (pressure and tension). In addition, soft geotextile was placed under and over the liner to prevent puncturing that could occur while walking on the liner or during placement of the covering granular material. It was calculated that 2400m2 of bituminous liner and 2625m2 of soft geotextile was placed.

2.4 **CONSTRUCTION OF THE TANK PAD PHASE 2.** July 27th- July 31st 2013

Quality control and quality approval: Stavibel

Construction contractor: Quamanittuap-Sana (FGL)

Material transportation: BLCS

General supervision and foreman: AEM

Phase 2 of construction of the pad was to place crushed 0-20mm NPAG over the bituminous liner (previously covered with geotextile). The following equipment and manpower were used, (1) 365 CAT excavator, (1) 307 Cat excavator, (1) 39 PX Komatsu bulldozer, (1) 740 CAT haul truck, (1) Hamm 3625 compactor, (1) operator and (1) surveyor. During this phase the contractor's (BLCS) was out of service due to mechanical issues so the 0-20mm NPAG layer was screened to maintain quality. Any materials that screened larger than 0-20mm were removed by hand. A total of 728m3 of 0-20mm NPAG granular material were used to build the 300mm thick layer of liner protection. A slopped trench was excavated (1000mm up to ground level) to place an 8 inches steel conduit for electrical cable necessary to operate the pump house.

- FURTHER INFORMATION, PICTURES AND PLANS FOR THOSE STEPS CAN BE FOUND IN THE APPENDIX 1 AND 2

3- DESCRIPTION OF THE FACILITIES AND MECHANICAL PARTS ASSEMBLING.

3.1 NEW TANKS PLACEMENT AND INSTALATION OF THE PUMP HOUSE. Aug 5th –Aug 12th 2013

Installation crew: SM Construction

Field supervisor: Quamanittuap-Sana (FGL)

Crane and operator: J.M Francoeur

General supervision and foreman: AEM

20, double walled, 100,000L fuel storage tanks meeting CCME ULC requirements were placed on the pad described in Sec 2 above. Equipment and manpower used during this phase included (1) 35tns MCR crane, (6) technicians, (1) welder and (1) electrician. The tanks were placed according to the design specifications, ie level. Once the tanks placement was completed, foot bridges were installed as well as the pump house. * See figure at page 523 in SM'S manual, appendix 3

3.2 PIPING CONNECTION AND ELECTRICAL ASSEMBLING PHASE 1. Aug 12th – Aug 19th 2013

Installation crew: SM Construction

Field supervisor: Quamanittuap-Sana (FGL)

General supervision and foreman: AEM

During this phase (6) technicians and (1) welder assembled the 4 inch pipe and connections between the tanks and pump house. Also (1) electrician started the installation of electrical cables and control panels for the facility. All piping, pumps, electrical connections, etc. conformed to all applicable codes, specifications and regulations. * See SM'S manual under the technical data section, Pp. 3 to 512, APPENDIX 3.

3.3 PIPING CONNECTION AND ELECTRICAL ASSEMBLING PHASE 2. Aug 29th – Sept 17th

Installation crew: SM Construction

Field supervisor: Quamanittuap-Sana (FGL)

General supervision and foreman: AEM

For the final phase of the project, (6) technicians and (1) welder completed assembling and installation of the pipe connections between the tanks and inside the pump house. An (1) electrician connected all of the main cables, the panels and computers inside the pump hose. Hi-level alarms were also placed on all tanks and were tested as per specifications. All alarms were noted to be functional. After installation, all tanks were cleaned and washed inside and pressure tested as per specifications. During the pressure test, one tank indicated a loss of pressure. A small crack was found between the inside two layers of the tank. This might have occurred during the placement of this tank. It was decided not to add fuel to this tank this year. Repairs will be undertaken prior to re-fueling. At this point the tanks were ready to use for fuel storage.

- FURTHER INFORMATIONS, PARTS DESCRIPTIONS, PHOTOGRAPH, INSTALLATION AND ELECTRICAL PLANS CAN BE FOUND IN APPENDIX 3.

APPENDIX 1.

DRAWINGS.

A. DESIGN PLAN FOR COMMENTS:

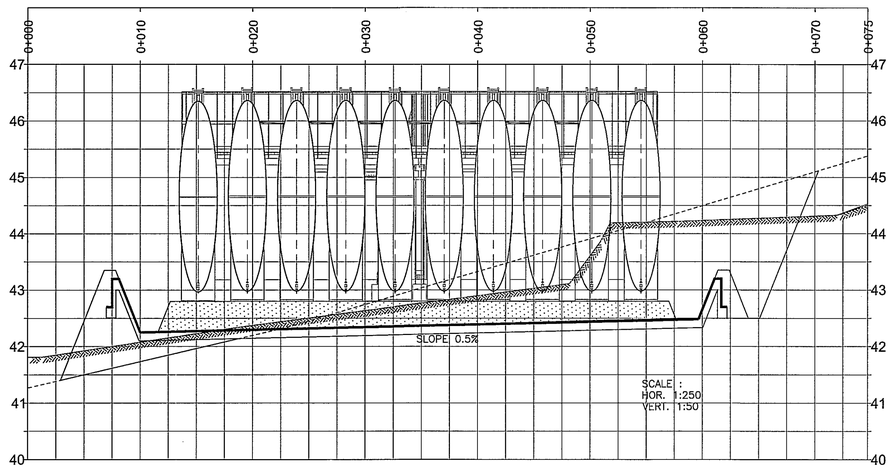
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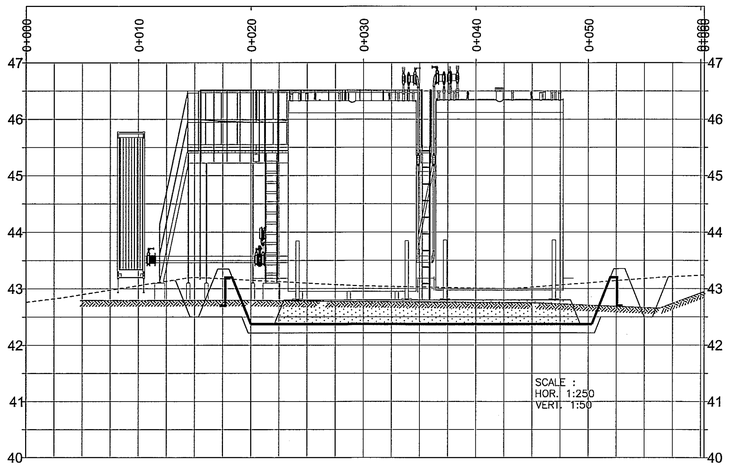
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	BAKER FF 2	SECTION VIEW

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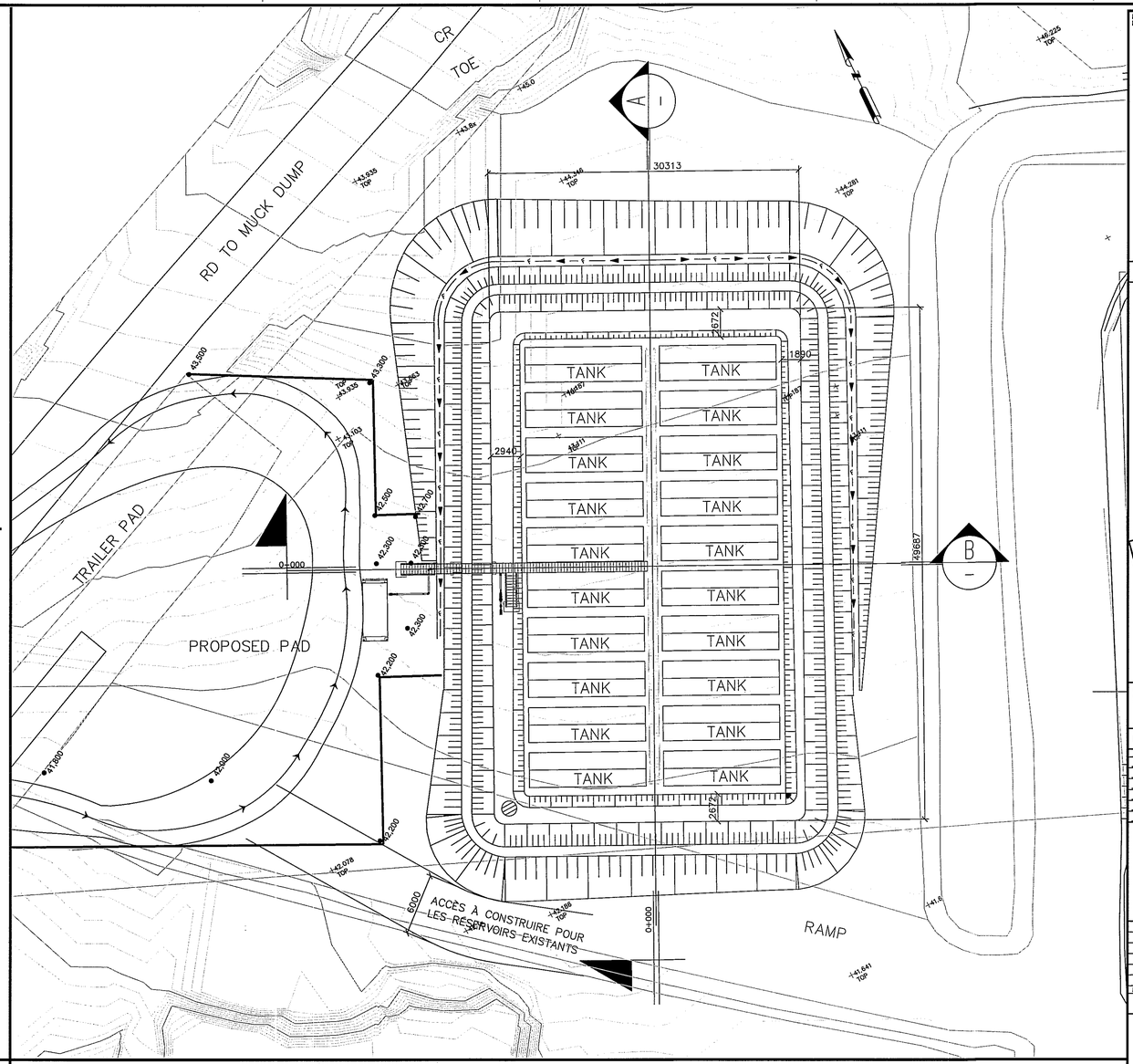
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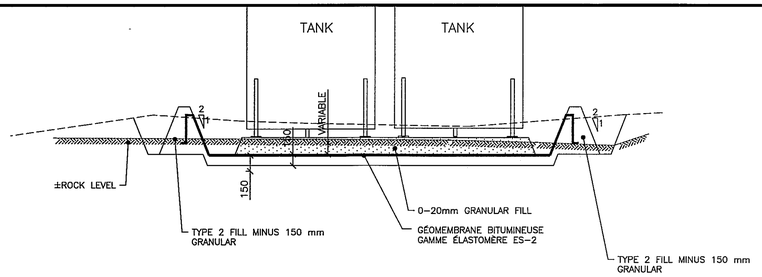


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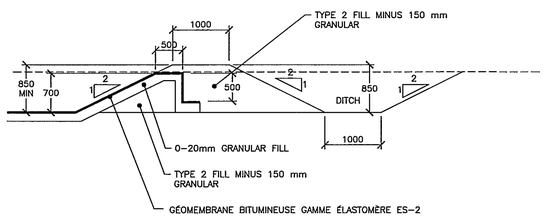
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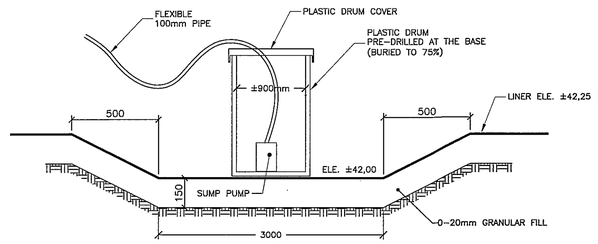
TYPICAL SECTION WITH OPTION COLETANCHE

SCALE : NONE



TYPICAL SECTION – DAM

SCALE : NONE



NOTES :

- THE WATER WILL BE REJECTED TO THE INFERIOR BASIN WHERE IT WILL BE TREATED WITH AN OIL SEPARATOR.

ACCESS WELL FOR DRAINING

SCALE : NONE

PLAN CLÉ
KEY PLAN

NOTES GÉNÉRAL / GENERAL NOTES

POUR COMMENTAIRES
FOR COMMENTS
AGNICO EAGLE
DATE : 2013-06-14

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TITRE / TITLE	# DWG

AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
A	2013-06-14	FOR COMMENTS	R.M.	R.M.	A.H.

REVISIONS

REGISTERED PROFESSIONAL ENGINEER
R. MARCOUX
LICENSEE
NTMU

TITRE / TITLE

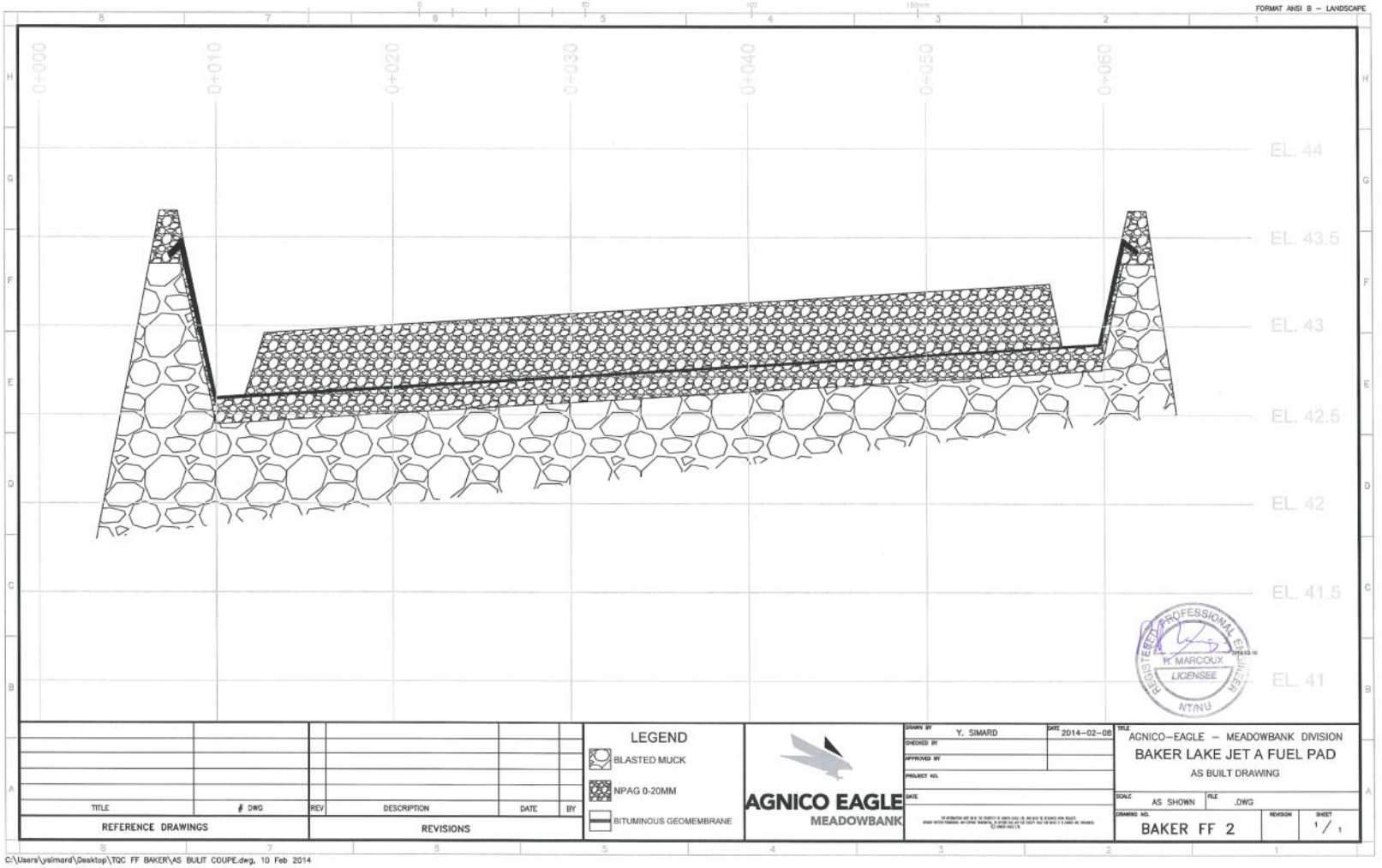
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PLAN VIEW AND CROSS SECTION
TANKS

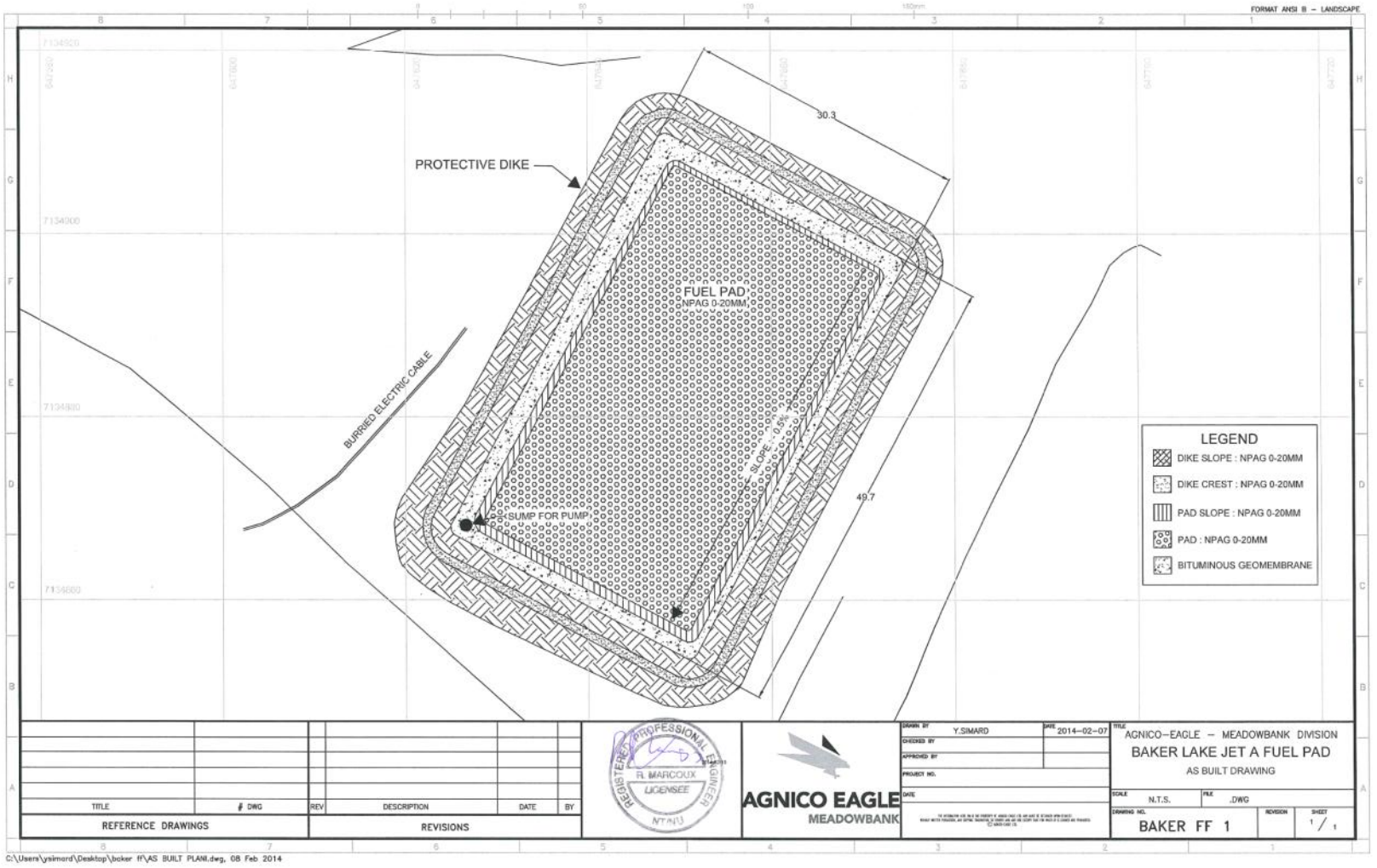
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VÉRIFIÉ PAR / CHECKED BY	RICHARD MARCOUX, ing.	2013-06-14
APPROUVÉ PAR / APPROVED BY	ALAIN HAMEL	2013-06-14
ÉCHELLE / SCALE	AS SHOWN	DATE 2013-06-14
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EL. 41.5
EL. 41
P. MARCOUX
LICENSEE
NT/NU
LEGEND
BLASTED MUCK
NPAG 0-20MM
BITUMINOUS GEOMEMBRANE
AGNICO EAGLE
MEADOWBANK
DRAWN BY Y. SIMARD
DATE 2014-02-06
CHECKED BY
APPROVED BY
PROJECT NO.
DATE
AGNICO–EAGLE – MEADOWBANK DIVISION
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PROTECTIVE DIKE
30.3
FUEL PAD
NPAG 0-20MM
BURRIED ELECTRIC CABLE
SUMP FOR PUMP
49.7
LEGEND
DIKE SLOPE : NPAG 0-20MM
DIKE CREST : NPAG 0-20MM
PAD SLOPE : NPAG 0-20MM
PAD : NPAG 0-20MM
BITUMINOUS GEOMEMBRANE
REFERENCE DRAWINGS
TITLE
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DATE
BY
R. MARCOUX
LICENSEE
AGNICO EAGLE
MEADOWBANK
DRAWN BY Y.SIMARD
DATE 2014-02-07
CHECKED BY
APPROVED BY
PROJECT NO.
DATE
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APPENDIX 2.

STAVIBEL'S CONSTRUCTION DAILY REPORT.

DESCRIPTION OF THE FUEL CONTAINEMENT PAD CONSTRUCTION STEPS.

AGNICO EAGLE

RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-14	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-01
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	10 à 16ºC Wind : 5 à 15 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**
1 Shovel CAT 365C L	FGL	11
Operator	FGL	12
Surveyor	FGL	9
10 tons roller compactor	BLCS	0
Bulldozer CAT D6 (DOZ09)	AEM	1
Field inspector	Stavibel	12

- **7h à 9h** Shovel 365 moves from Baker Lake to the Fuel Farm.
- **9h à 10h** Shovel 365 makes pit test at the North extremity of the projected pond.
- **10h à 12h** Shovel 365 removes the 0-20mm crushed stone in place.
- **13h à 17h30** Shovel 365 stockpiles the contaminated material outside the projected pond.
- **17h30 à 18h30** Bulldozer D6 profiles the infra.

Comments :

- Visit of Jean-François Béland (AEM foreman) and Dany Pageault (FGL superintendant) de 12h à 16h30
- After 3 test pits in the excavation zone, we found the presence of water and frozen material above the proposed elevation of the excavation. We need to increase the elevation of the project of 300mm.
- Presence of contaminated material and organic soil. The materials are stockpile and will be analyse by the environnment. Thereafter, they will indicate how to dispose of it.

- Photo #1 – 3 test pits. Smell of Jet-A fuel and water arrival.



- Photo #2 – Excavation and stockpile of the contaminated material until the final level of the infra.



Par : _____
Michaël Racine, tech.

_____
Richard Marcoux, ing.
No OIQ : 38724
Project manager

AGNICO EAGLE

RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-15	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-02
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	8 à 17ºC Wind : 5 à 30 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	Company	Working hours	Volume (m3)
1 Shovel CAT 365C L	FGL	7	
Opérator	FGL	12	
Surveyor	FGL	12	
Roller compactor	BLCS	1.9	
Bulldozer CAT D6T (DOZ09)	AEM	5	
Shovel 330C	BLCS	8.5	
2 articulated trucks CAT 740	BLCS	8.5	576
Field inspector	Stavibel	12	

- **6h30 à 18h30** Shovel 365 and Bulldozer D6T backfill with blasted rock 0-200 mm from quarry #1.
- **9h30 à 18h30** Loader 966 et 2 trucks haul the blasted rock 0-200 mm from quarry #1.
- **6h30 à 18h30** Compactor compacts the blasted rock when required.

Comments :

- Attempt to cover the stockpile of contaminated material with tarps after the request of the environment. Unfortunately the wind make this operation impossible.
- The water accumulations are pumped before backfilling above.

- Photo #1 – Overview of the infra. Some water accumulations caused by the thaw of the material in place. A small ditch will be make to try to drain this water during night.



Par : _____
Michaël Racine, tech.

_____
Richard Marcoux, ing.
No OIQ : 38724
Project manager

AGNICO EAGLE

RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-16	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-03
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	8 à 17ºC Wind : 5 à 30 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**	**Volume (m3)**
1 Shovel CAT 365C L	FGL	11	
Operator	FGL	12	
Surveyor	FGL	12	
Roller compactor Protec Boxer 114	BLCS	0	
Bulldozer CAT D6T (DOZ09)	AEM	0	
Shovel CAT 330C	BLCS	11	
2 Articulated trucks CAT 740	BLCS	11	816
Field inspector	Stavibel	12	

- **6h30 à 18h30** Loader 966 and 2 trucks haul the blasted rock 0-200 mm from quarry #1.
- **6h30 à 12h00** Shovel 365 widens the road on the south side of the pond Sud with blasted rock 0-200 mm from quarry #1.
- **6h30 à 18h30** Shovel 365 backfills with blasted rock 0-200 mm from quarry #1.

Comments :

- Beginning of haulage of the contaminated material to the mine (4 loads per day).

- Photo #1 – Windening of the road on the south side of the pond



- Photo #2 – Drainage of the water on north side of the pad. The ground is more stable at the end of the day.



Par : _____
Michaël Racine, tech.

_____
Richard Marcoux, ing.
No OIQ : 38724
Project manager

AGNICO EAGLE

RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-17	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-04
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	8 à 17ºC Wind : 30 à 70 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**	**Volume (m3)**
1 Shovel CAT 365C L	FGL	11	
Operator	FGL	12	
Surveyor	FGL	12	
Loader CAT 966H + operator	AEM	10	
Roller compactor Protec Boxer 114	BLCS	2.54	
Bulldozer CAT D6T (DOZ09)	AEM	0	
Shovel CAT 330C	BLCS	5	
2 articulated trucks CAT 740	BLCS	11	muck : 254.4 0-20mm : 272.5
Fiel inspector	Stavibel	12	

- **6h30 à 18h30** Shovel 365 builds the mini dikes with blasted rock 0-200 mm.
- **6h30 à 11h30** Shovel 330 and 2 trucks (BLCS) haul the blasted rock 0-200 mm from quarry #1.
- **7h30 à 10h15** Loader 966 separates the contaminated and the non-contaminated material.
- **10h15 à 18h30** Loader 966 builds the mini dikes.
- **13h à 18h** 2 trucks 740 (BLCS) haul the 0-20mm.

Comments :

- Haulage of the contaminated material to the mine (4 loads of 10 wheeler per day).
- The non-contaminated material that containt a bit of organic soil is stockpile in order to do the access road for the pump house.

- Photo #1 – Construction of the mini dikes around the pad. Stockpile of the 0-20mm on the pad.



- Photo #2 – Loading of the contaminated material.



Par : _____
Michaël Racine, tech.

_____
Richard Marcoux, ing.
No OIQ : 38724
Project manager

AGNICO EAGLE

RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-18	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-05
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	5 à 10ºC Wind : 30 à 50 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**
1 Shovel CAT 365C L	FGL	9
Operator	FGL	12
Surveyor	FGL	12
Loader CAT 966H + operator	AEM	8
Roller compactor Protec Boxer 114	BLCS	0
Bulldozer CAT D6T (DOZ09)	AEM	0
Field inspector	Stavibel	12

- **6h30 à 12h00** Shovel 365 builds the mini dikes with blasted rock 0-200 mm.
- **6h30 à 15h30** Loader 966 loads the contaminated material, moves the contaminated stockpile that disturbed the construction of the ditch and moves the sea-cans.
- **13h à 15h** Shovel 365 stands by for mechanical problems.
- **15h à 18h30** Shovel 365 puts the 0-20mm on the mini dike.

Comments :

- Haulage of the contaminated material to the mine (6 loads of 10 wheeler per day).
- The crushed stone 0-20mm is stockpile and survey. The results give 18,17 m3/trucks instead of 24m3 as specified in the spec of the truck. Here are the adjusted volumes for the last days :

	2013-07-15		**2013-07-16**		**2013-07-17**		**Cumulatif**	
	load	volume (m3)	load	volume (m3)	load	volume (m3)	load	volume (m3)
Muck quarry 1	24	436,048	34	617,7347	14	254,3613	72	**1308,144**
0-3/4" BLCS		0		0	15	272,53	15	**272,53**

- Photo #1 – Placing the crushed stone 0-20mm on the mini dike.



- Photo #2 – Moving the contaminated stockpile to make the drainage ditch behind the north dike.



Par : _____
Michaël Racine, tech.

_____
Richard Marcoux, ing.
No OIQ : 38724
Project manager

AGNICO EAGLE

RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-19	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-06
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	8 à 18ºC Wind : 20 à 30 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**
1 Shovel CAT 365C L	FGL	11
Opérateur	FGL	12
Arpenteur	FGL	12
Rouleau compacteur Protec Boxer 114	BLCS	1.21
Chargeur CAT 966H + opérateur	AEM	3.5
Camion 10 roues + opérateur	AEM	5.5
Bulldozer CAT D6T (DOZ09)	AEM	0
Surveillant de chantier	Stavibel	12

- **6h30 à 12h00** Shovel 365 loads the truck with the non-contaminated material that contain organic soil.
- **6h30 à 12h00** 10 wheels truck hauls the material containing organic soil for the construction of the access road for the pump house.
- **6h30 à 10h00** Loader 966 moves the concrete blocks and other small jobs.
- **13h à 18h30** Shovel 365 builds the mini dike and the infra on the north side of the pad.

Comments :

- Haulage of the contaminated material to the mine (6 loads of 10 wheeler per day).

- Photo #1 – Loading the truck with the non-contaminated material that contain organic soil for the construction of the access road for the pump house.



- Photo #2 – Reparation of an instability on the North-East side of the pad.



Par : _____
Michaël Racine, tech.

_____
Richard Marcoux, ing.
No OIQ : 38724
Project manager

AGNICO EAGLE

RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-20	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-07
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	8 à 18ºC Wind : 5 à 10 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**
Shovel CAT 365C L	FGL	2
Shovel CAT 320	FGL	5
Bulldozer Komat'su 39px	FGL	4
Operator	FGL	12
Surveyor	FGL	12
Roller compactor Protec Boxer 114	BLCS	0.4
Truck CAT 740	BLCS	114.1 m3
Bulldozer CAT D6T (DOZ09)	AEM	0
Field inspector	Stavibel	12

- **6h30 à 8h30** Shovel 365 builds the mini dike.
- **8h30 à 10h30** Shovel 320 is moving from Baker Lake to the field.
- **10h30 à 14h30** Shovel 320 builds the mini dike and profile the ditch.
- **14h30 à 18h30** Bulldozer 39px places the 0-20mm crushed stone.
- **14h30 à 18h30** Truck CAT 740 places the 0-20mm crushed stone.

Comments :

- Survey of a load of 0-20mm crushed stone to confirm the volume. Recalculation of the volumes with 16.3m^3/load.

	2013-07-15		2013-07-16		2013-07-17		2013-07-20		Cumulative	
	load	volume	load	volume	load	volume	load	volume	load	volume
Muck quarry 1	24	391,2	34	554,2	14	228,2			72	**1173,6**
0-3/4" BLCS		0		0	15	244,5	7	114,1	15	**407,5**

- Photo #1 – There is frost in the north ditch that prevent the excavation to the desired elevation.



- Photo #2 – A bit of water on the pad because of the ditch that is to high. No instability.



- Photo #3 – Placing the 0-20mm crushed stone.



Par : _____
Michaël Racine, tech.

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No OIQ : 38724
Project manager

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RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-21	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-08
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	8 à 18ºC Wind : 5 à 10 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**
Shovel CAT 365C L	FGL	0
Shovel CAT 320	FGL	9
Bulldozer Komat'su 39px	FGL	2
Operator	FGL	12
Surveyor	FGL	12
Roller compacter Hamm 3625	FGL	2
Truck CAT 740	BLCS	48.9 m3
Bulldozer CAT D6T (DOZ09)	AEM	0
Field inspector	Stavibel	12

- **6h30 à 15h30** Shovel 320 builds the dike, builds the access road and places the concrete blocks for the pump house.
- **15h30 à 17h30** Bulldozer 39px places the 0-20mm crushed stone.
- **17h30 à 18h30** Shovel 320 digs the ditch.
- **15h30 à 17h00** Truck CAT 740 hauls the 0-20mm crushed stone.

Comments :

- Volumes of material hauled by BLCS :

	2013-07-15		**2013-07-16**		**2013-07-17**		**2013-07-20**		**2013-07-21**		**Cumulative**	
	load	volume	load	volume	load	volume	load	volume	load	volume	load	volume
Muck quarry 1	24	391,2	34	554,2	14	228,2					72	**1173,6**
0-3/4" BLCS		0		0	15	244,5	7	114,1	3	48,9	15	**407,5**

- Photo #1 – Placing the 0-20mm crushed stone. All the 0-20mm is on the field at the end of the day.



- Photo #2 – Excavation of the north ditch at the good elevation to drain the pad infra.



Par : _____
Michaël Racine, tech.

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Richard Marcoux, ing.
No OIQ : 38724
Project manager

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RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-22	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-09
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	8 à 15ºC Wind : 5 à 10 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**
Shovel CAT 365C L	FGL	0
Shovel CAT 320	FGL	2.5
Bulldozer Komat'su 39px	FGL	0
Operator	FGL	5.5
Surveyor	FGL	5.5
Roller compactor Hamm 3625	FGL	0
Field inspector	Stavibel	12

- **16h à 18h30** Shovel 320 digs the ditch around the pad.

Comments :

- Cross shift. No activity on the field before 16h. I make a roundtrip to Meadowbank to go get the new operator and surveyor.
- Volumes of material hauled by BLCS :

	2013-07-15		**2013-07-16**		**2013-07-17**		**2013-07-20**		**2013-07-21**		**Cumulative**	
	load	volume	load	volume	load	volume	load	volume	load	volume	load	volume
Muck quarry 1	24	391,2	34	554,2	14	228,2					72	**1173,6**
0-3/4" BLCS		0		0	15	244,5	7	114,1	3	48,9	15	**407,5**

- Photo #1 – Excavation of the north ditch to the frost. There is a groundwater artery.



Par : _____
Michaël Racine, tech.

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Project manager

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RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-23	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-10
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	8 à 15ºC Wind : 5 à 10 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**
Shovel CAT 365C L	FGL	0
Shovel CAT 320	FGL	9
Bulldozer Komat'su 39px	FGL	1
Operator	FGL	12
Surveyor	FGL	12
Roller compactor Hamm 3625	FGL	5
Truck CAT 740	BLCS	32.6 m3
Field inspector	Stavibel	12

- **6h30 à 11h** Shovel 320 places the 0-20mm crushed stone.
- **8h à 9h** Truck CAT 740 hauls the 0-20mm cruched stone.
- **11h à 12h** Bulldozer 39px places the 0-20mm cruched stone.
- **12h à 15h** Shovel 320 finishes the mini dike and builds the key for the membrane.
- **15h à 18h30** Shovel 320 builds the acces road for the pump house.

Comments :

- Volumes of material hauled by BLCS :

	2013-07-15		**2013-07-16**		**2013-07-17**		**2013-07-20**		**2013-07-21**		**2013-07-23**		**Cumulative**	
	load	volume	load	volume	load	volume	load	volume	load	volume	load	volume	load	volume
Muck	24	391,2	34	554,2	14	228,2							72	**1173,6**
0-3/4"					15	244,5	7	114,1	3	48,9	2	32,6	15	**440,1**

- Photo #1 – Overview of the pond ready for the geotextile and the bituminous geomembrane.



- Photo #2 – Small key trench for the membrane.



- Photo #3 – Construction of the access road for the pump house.



- Photo #4 – Arrival of 11 tanks of 100 000L and 2 tanks of 50 000L on the barge.



Par : _____
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Project manager

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RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-24	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-11
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	15 à 23ºC Wind : 5 à 20 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**
Shovel CAT 365C L	FGL	0
Shovel CAT 320	FGL	0
Bulldozer Komat'su D39px	FGL	1
Operator	FGL	12
Surveyor	FGL	12
Roller compactor Hamm 3625	FGL	0
3 labours	FGL	4
2 membrane installers	Texcel	3.5
Shovel CAT 307	AEM	4.5
Field inspector	Stavibel	12

- **6h30 à 7h30** Stand by
- **7h30 à 12h** Shovel 307 cleans the membrane in previson of the reparations between the existing diesel tanks #1 and 2.
- **8h à 12h** 3 labours place the crushed stone 0-20 mm crushed stone to make sure the foundation for the bituminous geomembrane is flat.
- **17h à 18h** Bulldozer 39px places the 0-20mm crushed stone on the access road for the pump house.

Comments:

- The membrane installers arrive at 15h.

Par : _____
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No OIQ : 38724
Project manager

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RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-25	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-12
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	15 à 24ºC Wind : 5 à 20 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**
Shovel CAT 365C L	FGL	9
Shovel CAT 320	FGL	0
Bulldozer Komat'su 39px	FGL	0
Roller compactor Hamm 3625	FGL	0
Operator	FGL	12
Surveyor	FGL	12
3 Labours	FGL	12
Vibratory plate (small)	BLCS	1 jour
2 membrane installers	Texcel	12
Field inspector	Stavibel	12

- **6h30 à 11h30** Shovel 365 places the geotextile and failed attempt for the installation of the bituminous geomembrane.
- **11h30 à 16h30** Stand by
- **16h30 à 20h** Shovel 365 places the bituminous geomembrane.

Comments :

- Impossible to place the membrane with the membrane rack available. Waiting for the rack with bearings to roll out the membrane from 11h30 to 16h30. The wasted time is catched up after souper.

- Photo #1 – Compaction of the slopes with the vibratory plate to avoid rock punching in the membrane.



- Photo #2 – Placing the geotextile and the bituminous geomembrane.



Par : _____
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Richard Marcoux, ing.
No OIQ : 38724
Project manager

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RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-26	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-13
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	15 à 26ºC Wind: 5 à 20 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**
Shovel CAT 365C L	FGL	4.5
Shovel CAT 320	FGL	0
Bulldozer Komat'su 39px	FGL	0
Roller compactor Hamm 3625	FGL	0
Operator	FGL	12
Surveyor	FGL	12
3 labours	FGL	12
2 membrane installers	Texel	12
Field inspector	Stavibel	12

- **6h30 à 18h30** 4 labours (FGL) et 2 labours (Texcel) place the bituminous geomembrane.
- **6h30 à 9h** Shovel 365 places the bituminous geomembrane.
- **9h à 12h** Shovel 320 works on another project for the diesel fuel tanks.
- **13h à 15h** Shovel 365 places the bituminous geomembrane.
- **15h à 16h** Shovel 320 works on another project for the diesel fuel tanks.
- **16h à 18h30** Shovel 365 places the bituminous geomembrane.

Comments :

- Photo #1 – Placing the bituminous geomembrane with a geotextile under.



- Photo #2 – Reparation of hole in the bituminous geomembrane.



Par : _____
Michaël Racine, tech.

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Project manager

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RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-27	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-14
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	15 à 23ºC Wind : 0 à 10 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**
Shovel CAT 365C L	FGL	5.5
Shovel CAT 320	FGL	0
Bulldozer Komat'su 39px	FGL	0
Roller compactor Hamm 3625	FGL	0
Operator	FGL	12
Surveyor	FGL	12
3 Labours	FGL	4
Generator 6000 W	BLCS	1 jour
Truck Cat 740	BLCS	55.2 m3
2 membrane installers	Texel	6.5
Field inspector	Stavibel	12

- **6h30 à 12h** Shovel 365 et 2 labours (Texcel) place the bituminous geomembrane.
- **6h30 à 10h30** 3 labours (FGL) place the bituminous geomembrane.
- **13h à 15h** 2 labours (Texcel) test the resistance of the welds in the bituminous geomembrane.
- **13h à 18h30** Operator and surveyor (FGL) stand by.
- **17h à 18h30** Truck CAT 740 hauls the 0-20mm crushed stone.

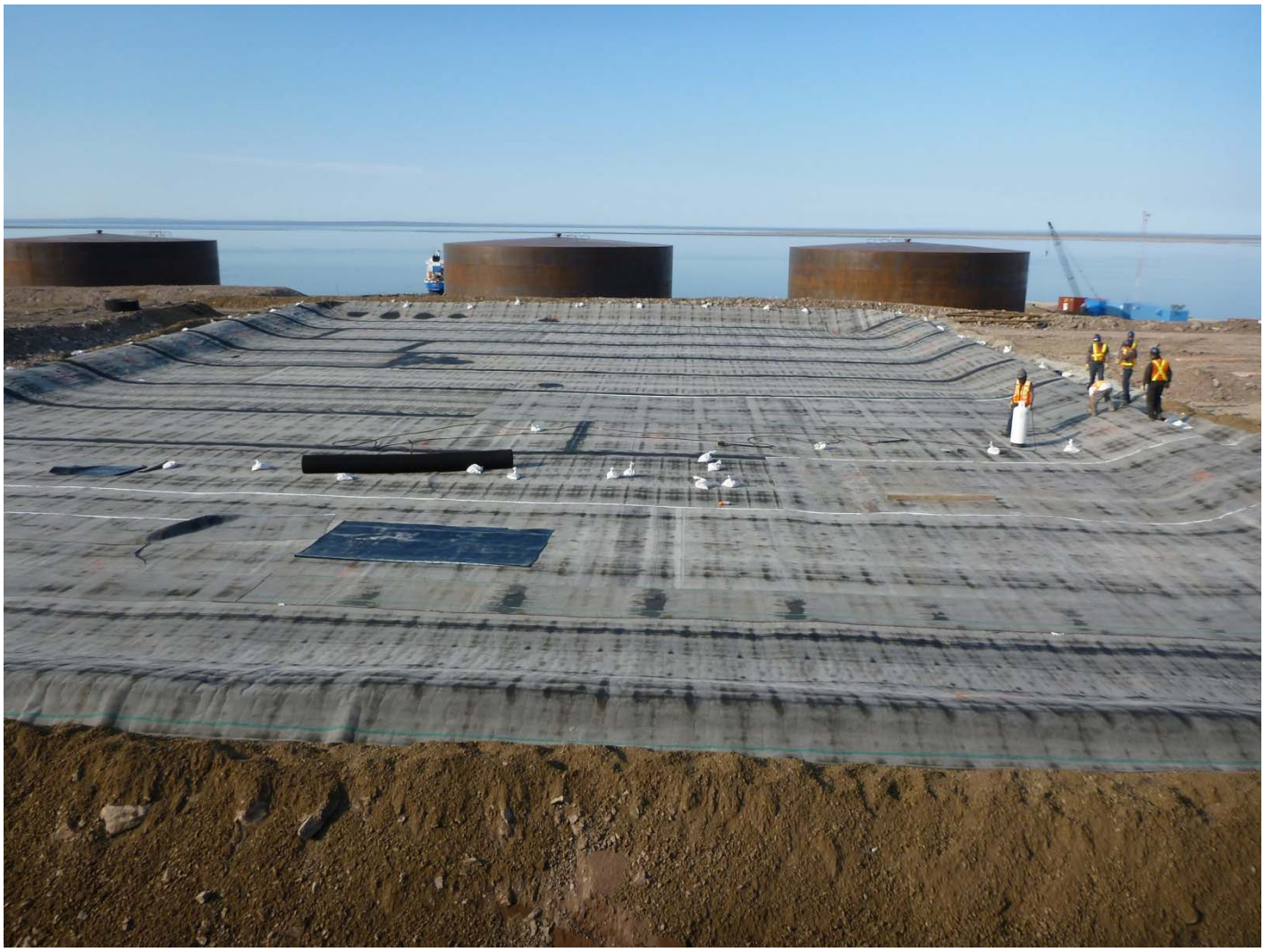
Comments :

- Inspection of the membrane.
- The 0-20 mm crushed stone produce by BLCS for the pad above the bituminous geomembrane is non- compliant. It contains particules up to 1-1/2". The material is rescreened and the placing of the 0-20 mm crushed stone begins at the end of the day.
- I inspect the membrane before filling above to make sure that no hole and no punching remains. Small rocks are detected under the membrane. Pieces of membrane are added on it.

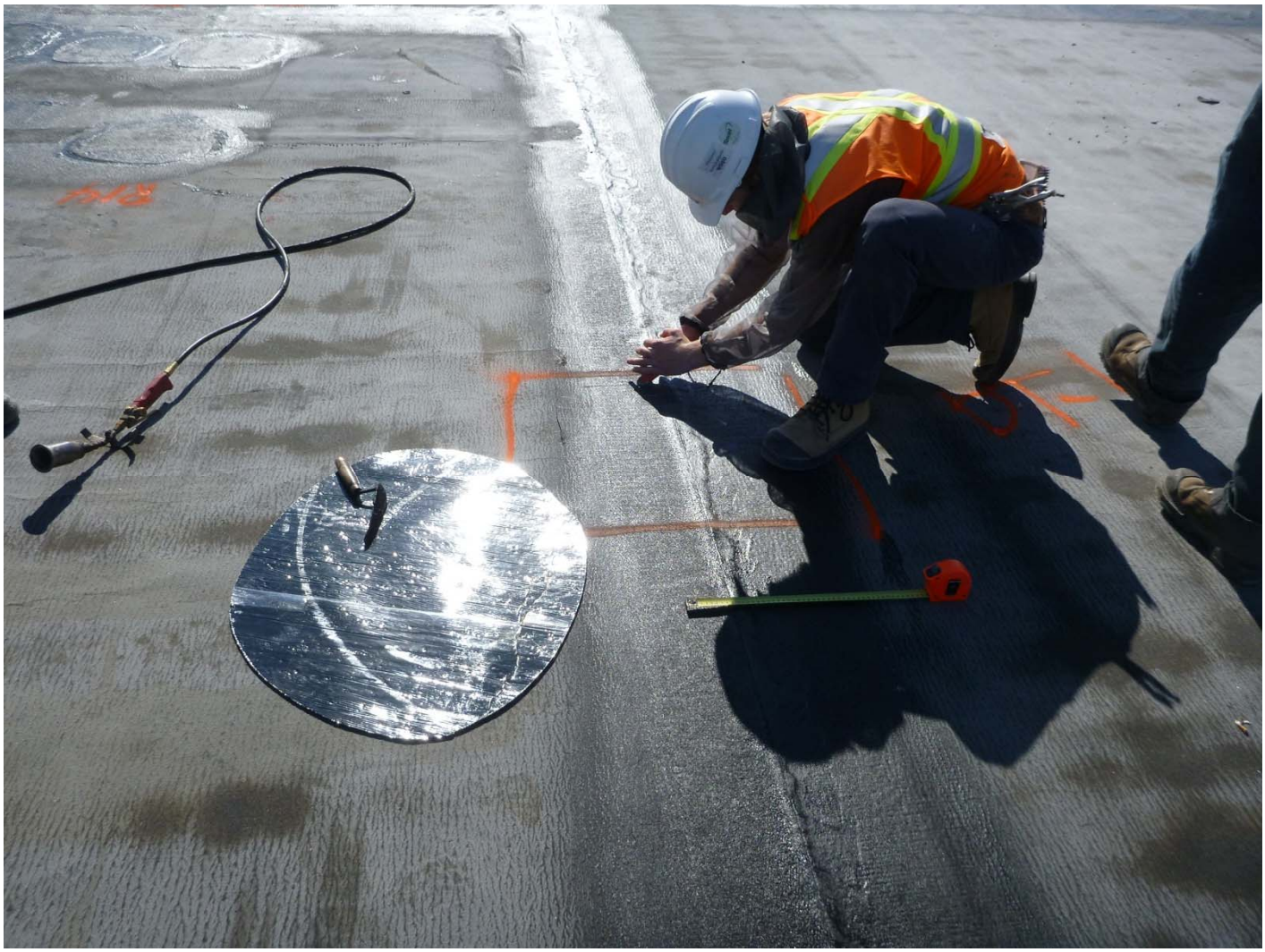
- Survey of a load of 0-20 mm crushed stone. The result is 18.4 m3/load. Here are the corrected quantities according to this new volume:

	0-3/4"		Muck quarry 1	
	load	volume (m3)	load	volume (m3)
2013-07-15			24	441,6
2013-07-16			34	625,6
2013-07-17	15	276	14	257,6
2013-07-20	7	128,8		
2013-07-21	3	55,2		
2013-07-23	2	36,8		
2013-07-27	3	55,2		
Cumulative	30	**552**	72	**1324,8**

- Photo #1 – Installing the bituminous geomembrane with a geotextile under.



- Photo #2 – Sampling of Colétanche in place to test the welds resistance with the tensometer. The results are compliant according to the Texel membrane installers.



- Photo #3 – Inspection of the membrane. Small proeminent rocks (10mm and less) are detected at some place under the membrane. A second tickness of colétanche is added on these spots to make sure there will not be any punching.



Par : _____
Michaël Racine, tech.

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Richard Marcoux, ing.
No OIQ : 38724
Project manager

AGNICO EAGLE

RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-28	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-15
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	15 à 23ºC Wind : 0 à 10 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**
Shovel CAT 365C L	FGL	8
Shovel CAT 320	FGL	0
Bulldozer Komat'su 39px	FGL	2
Roller compactor Hamm 3625	FGL	0
Operator	FGL	12
Surveyor	FGL	12
Truck Cat 740	BLCS	239.2 m3
Shovel Cat 307	AEM	1
Field inspector	Stavibel	12

- **6h30 à 18h30** Shovel 365, Shovel 320 et Bulldozer 39px (alternating) place the 0-20mm crushed stone on the bituminous geomembrane.
- **8h à 18h30** Truck CAT 740 hauls the 0-20mm crushed stone.

Comments :

- After comparison of the specs of the shovel CAT 307 and the bulldozer Komat'su 39px, we decide to use the bulldozer instead of the shovel 307. The ground pressure is 33.34 kPa (with the bulldozer) instead of 32.3 kPa (with the shovel).
- Big waiting time for the BLCS material. Only 1 truck. Around 2 loads/hour.

- Summary of the volumes hauled by BLCS (18.4 m^3/load) :

	0-3/4"		Muck quarry 1	
	load	volume (m3)	load	volume (m3)
2013-07-15			24	441,6
2013-07-16			34	625,6
2013-07-17	15	276	14	257,6
2013-07-20	7	128,8		
2013-07-21	3	55,2		
2013-07-23	2	36,8		
2013-07-27	3	55,2		
2013-07-28	13	239,2		
Cumulative	43	**791,2**	72	**1324,8**

- Photo #1 – Sreening of the 0-20mm and loading of the trucks at the Nuna Pad (BLCS).



- Photo #2 – Placing the 0-20mm above the bituminous geomembrane. A geotextile is place before.



Par : _____
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No OIQ : 38724
Project manager

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RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-29	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-16
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	15 à 17ºC Wind : 20 à 30 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**
Shovel CAT 365C L	FGL	7.5
Shovel CAT 320	FGL	0
Bulldozer Komat'su 39px	FGL	3.5
Rolle compactor Hamm 3625	FGL	0
Operator	FGL	12
Surveyor	FGL	12
Truck Cat 740	BLCS	257.6 m3
Shovel Cat 307	AEM	0
Field inspector	Stavibel	12

- **6h30 à 18h30** Shovel 365 et Bulldozer 39px (alterning) place the 0-20mm on the bituminous geomembrane.
- **7h à 18h30** Camion CAT 740 hauls the 0-20mm.

Comments :

- Big waiting time for the BLCS material. Only 1 truck. About 40 minutes between loads.
- The BLCS crusher is out of use. The 0-20mm will be make entirely by the screener.

- Summary of the volumes hauled by BLCS (18.4 m^3/load) :

	0-3/4"		Muck quarry 1	
	load	volume (m3)	load	volume (m3)
2013-07-15			24	441,6
2013-07-16			34	625,6
2013-07-17	15	276	14	257,6
2013-07-20	7	128,8		
2013-07-21	3	55,2		
2013-07-23	2	36,8		
2013-07-27	3	55,2		
2013-07-28	13	239,2		
2013-07-29	14	257,6		
Cumulative	57	**1048,8**	72	**1324,8**

- Photo #1 – Lot of particules bigger than 20mm in the 0-20mm brought by BLCS. We advise BLCS to check the sreener. Indeed, there was a gap on the side of the sreen because of a missing inner bar. After the reparation of the screener, there is still presence of particules up to 100mm in the material from an unknow source. We remove them by hand on the field, but there is still a lot of rocks around 1 1/2" big.



- Photo #2 – Placing the 0-20mm above the bituminous geomembrane. A geotextile is placed before.



Par : _____
Michaël Racine, tech.

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Richard Marcoux, ing.
No OIQ : 38724
Project manager

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RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-30	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-17
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	15 à 17ºC Wind : 20 à 30 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**
Shovel CAT 365C L	FGL	7
Shovel CAT 320	FGL	0
Bulldozer Komat'su 39px	FGL	4
Roller compactor Hamm 3625	FGL	0
Operator	FGL	12
Surveyor	FGL	12
Truck Cat 740	BLCS	202.4 m3
Shovel Cat 307	AEM	0
Field inspector	Stavibel	12

- **6h30 à 18h30** Shovel 365 and Bulldozer 39px (alterning) place the 0-20mm on the bituminous geomembrane.
- **8h à 18h00** Truck CAT 740 hauls the 0-20mm.

Comments :

- Big waiting time for the BLCS material. Only 1 truck. About 40 minutes between loads.
- The BLCS crusher is out of use. The 0-20mm will be make entirely by the screener.
- Taking of 2 samples of 0-20mm on the field and 1 more sample in the BLSC stockpile at the Nuna Pad.

- Summary of the volumes hauled by BLCS (18.4 m^3/load) :

	0-3/4"		Muck quarry 1	
	load	volume (m3)	load	volume (m3)
2013-07-15			24	441,6
2013-07-16			34	625,6
2013-07-17	15	276	14	257,6
2013-07-20	7	128,8		
2013-07-21	3	55,2		
2013-07-23	2	36,8		
2013-07-27	3	55,2		
2013-07-28	13	239,2		
2013-07-29	14	257,6		
2013-07-30	11	202,4		
Cumulative	68	**1251,2**	72	**1324,8**

- Photo #1 – I mesured the mesh size of the BLCS screener. The opening of 30mm explain the presence of particules higher than 20 mm. BLCS affirmed that they don't have a smaller screen on July 27th when they change the screen. Also, there is still several rocks up to 100 mm in the 0-20 mm. We remove them by hand on the field.





- Photo #2 – Placing the 0-20mm above the bituminous geomembrane. A geotextile is placed before.



- Photo #3 – Compaction test with the roller compacter Hamm 3625 on low vibration directly on the 0-20mm uncompacted and without any covering above. Not any hole nor any deformation are noticed on the bituminous geomembrane. The decision is taken to use the roller compactor for the compaction of the pad above the Colétanche membrane.



Par : _____
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Richard Marcoux, ing.
No OIQ : 38724
Project manager

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RAPPORT DE VISITE DE CHANTIER

STAVIBEL

Title of project :	Baker Lake Jet-A Fuel Farm	Date : 2013-07-31	
Project # :	OP-84541-J /VD3356	Doc #:	VD3356-003-RV-18
Prepared by :	Michaël Racine	Contractor :	Fernand Gilbert Ltée
Verified by :	Richard Marcoux, ing.	Temperature :	15 à 17ºC Wind : 20 à 30 km/h

Object : Contractor's schedule (approximative hours)

Labour and machinery	**Company**	**Working hours**
Shovel CAT 365C L	FGL	5
Shovel CAT 320	FGL	4.5
Bulldozer Komat'su 39px	FGL	1.5
Roller compactor Hamm 3625	FGL	2
Operator	FGL	12
Surveyor	FGL	12
Truck Cat 740	BLCS	33.8 m3
Water tanker	Hamlet	2
Shovel Cat 307	AEM	0
Field inspector	Stavibel	12

- **6h30 à 10h** Shovel 365 and Bulldozer 39px (alterning) place the 0-20mm on the bituminous geomembrane.
- **8h30 à 10h30** Water tanker moistens the 0-20mm using a total of 15234 L of water.
- **10h30 à 13h30** Compactor compacts the pad of 0-20mm.
- **10h à 14h** Shovel 365 moves the contaminated stockpile to profile better the ditch.
- **14h à 18h30** Shovel 320 backfills the small key trench for the bituminous geomembrane and installs a steel pipe for the electric wire feeding the pump house..

Comments :

- Departure of the field inspector (myself) on August 1st around 7h.

- Survey of 42 loads of 0-20mm in place uncompacted. Here is the summary of the volumes haules by BLCS (estimate with an average of 16.9 m^3/load) :

	0-3/4"		Muck quarry 1	
	load	volume (m3)	load	volume (m3)
2013-07-15			24	405,6
2013-07-16			34	574,6
2013-07-17	15	253,5	14	236,6
2013-07-20	7	118,3		
2013-07-21	3	50,7		
2013-07-23	2	33,8		
2013-07-27	3	50,7		
2013-07-28	13	219,7		
2013-07-29	14	236,6		
2013-07-30	11	185,9		
2013-07-31	2	33,8		
Cumulative	70	**1183**	72	**1216,8**

- Photo #1 – Moistening and compaction of the 0-20mm. Compaction: 2 static passes, 1 vibratory pass in each direction and 2 last static passes.



- Photo #2 – Installation of a steel pipe with a rope inside in prevision of passing the electric wire to the pump house.



- Photo #3 – Overview of the second containment system ready to take the Jet-A tanks.



Par : _____
Michaël Racine, tech.

_____
Richard Marcoux, ing.
No OIQ : 38724
Project manager

APPENDIX 3.

SM'S TECHNICAL DATA SHEETS & DRAWINGS DOCUMENTS.

MECHANICAL PARTS DESCRIPTIONS, PHOTOGRAPH, INSTALLATION AND ELECTRICAL PLANS.

SM CONSTRUCTION INC.

AGNICO EAGLE

Baker Lake

Technical Data Sheets & Drawings

SM Construction inc.
15971, boulevard de la Colline
Québec (Québec) G3G 3A7

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Electric Actuators and Control Systems

rotork®
Controls

Established Leaders in Valve Actuation



IQ Pro

IQ *Pro* Range

IQ and IQT Multi-turn and Quarter-turn
Electric Valve Actuators

Publication E110E Issue 09/09

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Rotork actuators have been in use all around the world for over 50 years. In this time Rotork has grown to become the leader in the valve automation industry. With manufacturing, service centres, offices and representatives throughout the world, Rotork is able to offer global service solutions to your company.

In the 50 years since the company was founded, Rotork has become a byword for excellence in the field of valve, sluice gate and damper actuation products for the oil, gas, power, water and waste treatment industries - worldwide.

We owe our success to an uncompromising focus on quality at every stage - and at every level - of Rotork's operations.

From initial site survey, specification and design, through to materials, manufacturing and testing, installation, commissioning and after-sales service we accept nothing but the best.

At the heart of the company is an exceptional workforce - the highly trained, forward-thinking engineers, technicians and support staff who each have a crucial role to play in maintaining Rotork's unrivalled reputation for innovation, reliability and first class customer support.

The Rotork family of products also includes pneumatic, hydraulic and electro-hydraulic actuators as well as a comprehensive range of gearboxes and valve accessories. Rotork's bespoke Pakscan digital control system offers market leading features whilst all our actuators offer the ability to interface with other digital control systems.

Rotork. Established leaders in valve actuation technology.

rotork® Controls

rotork® Fluid Systems

rotork® Gears

rotork® Site Services

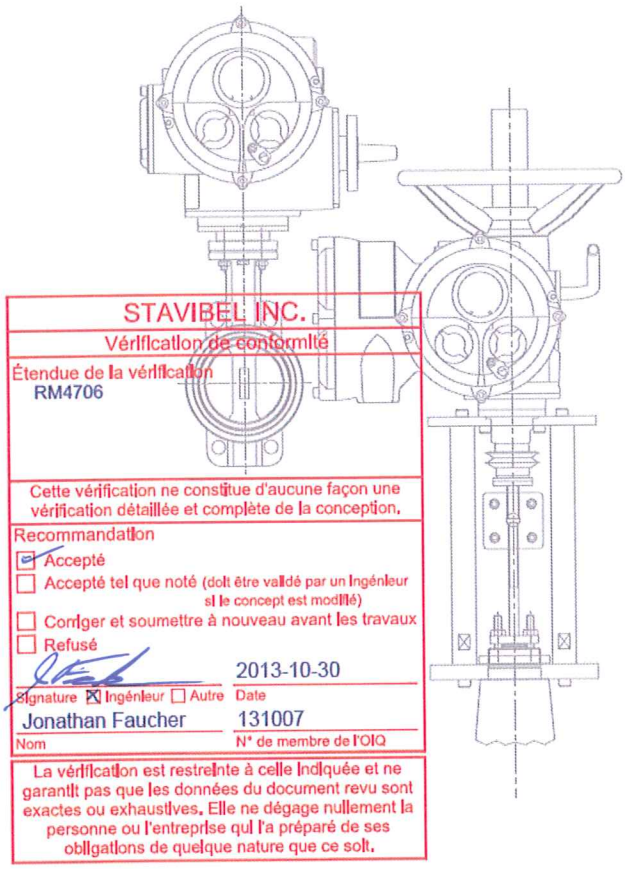
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This brochure provides a comprehensive overview of the applications and associated functions available with Rotork IQ *Pro* actuators - comprising IQ multi-turn and IQT quarter-turn ranges.

For information about IQ actuators and explanation of their features see Section 1. For detailed technical specifications and performance data see Section 2.

Launched in 1993, the IQ actuator was the first 'intelligent' non-intrusive actuator available to the valve market. It introduced revolutionary features including the data logging of actuator operation history and an infra-red setting tool replacing traditional mechanical setup.

In 2000 the IQ received a major upgrade with additional control and monitoring features, datalogging, piezo torque measurement technology, improvements in user interface, ergonomics and, corrosion resistance.

The IQT quarter-turn actuator was launched in 2004, encompassing all of the intelligent features of the IQ in a direct quarter-turn actuator.

Building on previous developments, IQ *Pro* brings together IQ and IQT ranges within a single integrated approach with additional common enhancements. These include multilingual text displays that can be uploaded without restriction (other than translation) and currently include Spanish, German, French, Chinese (Mandarin), and Russian. Downloadable of actuator configuration and data log files (using the supplied non-intrusive, intrinsically safe IQ Actuator Setting Tool *Pro)* allows comprehensive asset management and valve & actuator performance monitoring, using the free Windows™ operating system application IQ-Insight.

IQ multi-turn actuators

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The IQ range

The Rotork IQ delivers a complete range of actuators suitable for all multi-turn valve applications requiring control and indication flexibility. It offers end users ever higher standards of performance, build quality and overall value.

Simple Commissioning

The Rotork IQ provides simple, safe and rapid non-intrusive commissioning with infra-red control. Actuator settings such as torque levels, position limits, control and indication functions can be accessed and adjusted using the "point and shoot" IQ Setting Tool *Pro*. This supplied, intrinsically safe (IS) tool is unique to Rotork and allows for non-intrusive actuator set-up whatever the environment, power on or off.

Simple Troubleshooting

The large digital position display clearly indicates real time valve position from a distance. In addition, active valve, control, actuator status and alarm text messages are displayed on the easy to read back-lit display. Using the IQ Setting Tool *Pro* real-time torque against position profiles and actuator configuration can be accessed during commissioning, adjustment or local valve performance monitoring. The onboard data logger records operational, alarm and valve torque profile data providing valuable information on valve and plant operating performance and conditions.

IQ offers a range of powerful features:

- Three phase, direct current and single phase actuators
- On-board data logger included as standard
- IrDA™ compatible for local and remote actuator analysis via InSight PC software
- Clear, user friendly controls and indication
- Multilingual text display for status and setup
- Simplified torque and position control for increased reliability
- Comprehensive control and flexibility
- Approved for use in SIL applications†

IQ

IQ actuators are multi-turn electric actuators which can be used for isolation or regulating duties of up to 60 starts per hour. IQ's are watertight or watertight and explosionproof depending upon specification.

Direct torque output range from 34 Nm (25 lbf ft) to 3,000 Nm (2,200 lbf ft).

IQM

The modulating version of the IQ has a solid state reversing starter in place of the electromechanical contactors. "Hammerblow" lost motion drive is removed and fast response remote control circuits for rapid control are included. The IQM is suitable for up to 1,200 starts per hour. The solid state starter also adds an electronic motor 'brake' feature, improving positional control.

IQML

Benefiting from all the features of the IQ and IQM actuators, the IQML has a linear output drive providing modulating thrust output of up to 150 kN.

IQS

IQS actuators are single phase versions of IQ actuators.

Torque range from 65 Nm (48 lbf ft) to 450 Nm (332 lbf ft).

IQD

IQD actuators are direct current (DC) versions of IQ actuators.

Torque range from 34 Nm (25 lbf ft) to 305 Nm (225 lbf ft).

IQH

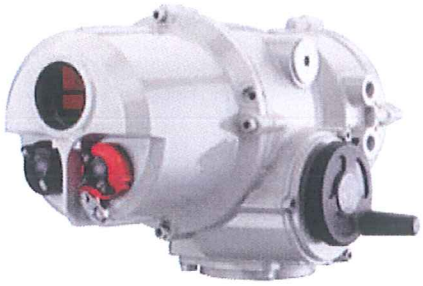
The IQH provides a range of high output speeds while being generally irreversible and therefore providing a self-locking* ability by the actuator for the valve. Developed for diverter valves in meter prover applications, IQH provides fast operation with positive seating without backdriving.

**For detailed information see publication E118E*

Special Designs

With our extensive product range and engineering knowledge Rotork can provide solutions for most applications.

†with an additional SFCM Control Module



The IQT range

The IQT (IQ quarter-turn) is the result of ongoing commitment to product development at the cutting edge of new technology.

Maintaining the simple commissioning and troubleshooting design of the Rotork IQ (see left), the new IQT introduces a direct drive, quarter turn actuator—offering the highest standards in comprehensive control, access to real time diagnostics and comprehensive bus compatibility.

IQT features:

- Direct drive quarter-turn
- Three phase, direct current and single phase actuators
- Multilingual text display for status and setup
- On-board data logger included as standard
- IrDA™ compatible for local and remote actuator analysis via InSight PC software
- Clear, user friendly controls and indication
- Simplified torque and position control for increased reliability
- Comprehensive control and flexibility
- Approved for use in SIL applications†

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IQT

IQT actuators are direct drive quarter-turn electric actuators which can be used for isolation or regulating duties of up to 60 starts per hour. IQT's are watertight or watertight and explosionproof depending upon specification.

Torque output from 50 Nm (37 lbf ft) to 2,000 Nm (1,476 lbf ft).

IQT Fail Safe

The IQT Failsafe actuator provides valve failsafe operation by utilising power from an internal battery during AC supply mains failure. Under normal supply conditions the actuator operates from the site AC electrical supply. On loss of this supply the actuator automatically switches over to receive power from a 24 V DC supply allowing control of the valve to the failsafe position.

For detailed information see publication E116E

IQTM

The modulating version of the IQT has solid state motor switching and includes fast response remote control circuits for rapid response to control signals. The IQTM is suitable for up to 1,200 starts per hour.

IQTF

The IQTF provides extended output rotation for part turn valve types requiring more than 90° for operation. Typical valves include 180° and 270° diverter valves and multiport manifolds requiring bi-directional 360° operation. The IQTF actuator has a low output speed for increased positional accuracy.

The IQTF may also be utilised for low turn, multiturn applications where slow operation is required.

For detailed information see publication E119E

IQTN

The IQTN has been developed to meet the specialist demands of nautical & military applications within a standard package.

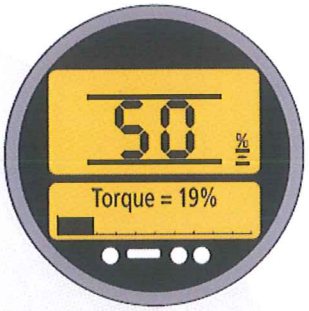
Retaining all the features of the IQT the IQTN has a shorter electronics cover for confined on-board spaces and an anti-shock base.

For detailed information see publication E1122E

Special Designs

With our extensive product range and engineering knowledge Rotork can provide solutions for all applications.

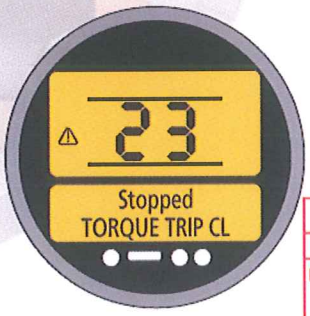
Pro



Torque and Position Monitoring



Realtime Monitoring



Actuator Alarms



Pro features

IQ *Pro* combines existing proven Rotork IQ features with additional control and indication functions, improved user interface design, performance monitoring and datalogging - including valve torque signature profiles. This means unparalleled support in achieving reliable valve actuation.

Founded on over 15 years of operational experience, the IQ *Pro* control system combines proven control logic with field programmable technology, thus providing increased functionality and reliability. IQ *Pro* control logic can be upgraded over the IrDA™ interface – this will "future proof" valve operation against control system and actuator developments and upgrades.

In combination with the new non-intrusive, Intrinsically Safe Rotork Setting Tool *Pro*, IQ actuator set-up and datalogger files can be transported from the field to the office for storage and analysis.

IQ and IQT *Pro* offer a range of powerful features unparalleled in Valve Actuation:

- Field upgradeable control system
- Larger, clearer display
- Customer configurable, multilingual text capability
- Datalogger valve torque signature profiling
- Status & monitoring diagnostics
- Retrofittable to existing IQ & IQT range of actuators (post 2000)
- Improved data download speed x 10

Setting Tool *Pro* features include:

- Non-intrusive, Infra-red communication
- Intrinsically safe for use in hazardous areas
- On site actuator configuration and data download
- Data transfer from actuator to PC with free Rotork Insight software
- Capacity for 10 configuration and 4 datalogger files
- Multiple configuration capability

Note: Setting Tool *Pro* data transfer capability is compatible only with IQ actuators supplied since 2000.

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Actuator display

IQ *Pro* incorporates a unique liquid crystal display developed specifically for actuator indication. The unique, diffused LED backlighting system has a top section which indicates valve position and is operational over the full operating temperature range of the actuator. Large segments with backlighting allow clear visibiltiy of valve position in all light conditions.

The lower section shows real time valve, control and actuator status, torque and alarm messaging during operation. Using the Setting Tool changes the display from position mode to set-up mode, allowing the user to view, adjust and change actuator settings.

The LCD display is supplemented with green, yellow and red position indication lights.

The display together with the control cover can be rotated through 90° increments to suit valve orientation and access.

Indication back up

Rotork recognise the need for local and remote position indication at all times, even when the actuator is powered down. The IQ incorporates a battery to maintain and update position indication when the main power is switched off. The battery also supports data logging and commissioning whilst power is off.

Set-up

Infra-red set up, adjustment and review using the supplied, intrinsically safe IQ Setting Tool *Pro* gives users access to the configuration of the actuator.

Help screens

Eight help screens can be accessed with the IQ setting tool allowing real time, grouped analysis of control signal status, valve and actuator status and indication status.

Valve torque indication

Valve torque against position can be displayed in real time with a single setting tool keystroke. Trip levels set for torque switches can be checked and adjusted based on the actual valve operating torque requirements. This results in a more realistic and accurate set up, therefore reducing the need for future "snagging". Problems such as valve tight-spots, seating and breakout forces can be assessed immediately in the field.

SIL and high integrity control systems

IQ *Pro* SIL option is available for Safety Instrumented Systems (SIS) requiring a defined Safety Integrity Level 1, 2 or 3*. The TÜV™ certified IQ *Pro* SIL option provides dual redundancy for control operation making safety functions "Stay-put" and "ESD" (IQ range only) available. For more information refer to section 2 - Specifications.

For applications requiring higher integrity but not SIL defined, standard IQ *Pro* can be configured for conditional control.

* SIL3 applications may be met using a 1oo2 actuator configuration

In this mode, operation depends on two discrete signals being applied. As an example of a close valve command, by applying a signal to the remote close input and close conditional input simultaneously the actuator will operate and close the valve. If only one signal is applied, or a signal is lost, the actuators will stayput. For applications requiring ESD, the dedicated ESD input is available with a higher priority over local or remote control signals. This will therefore override any existing or applied control signal while it is applied.

Asset Management - Data logging

IQ *Pro* allows complete actuator configuration and build information to be downloaded and saved to PC. It also includes a data logger that captures and stores valve, actuator and control system status information in non-volatile memory, including:

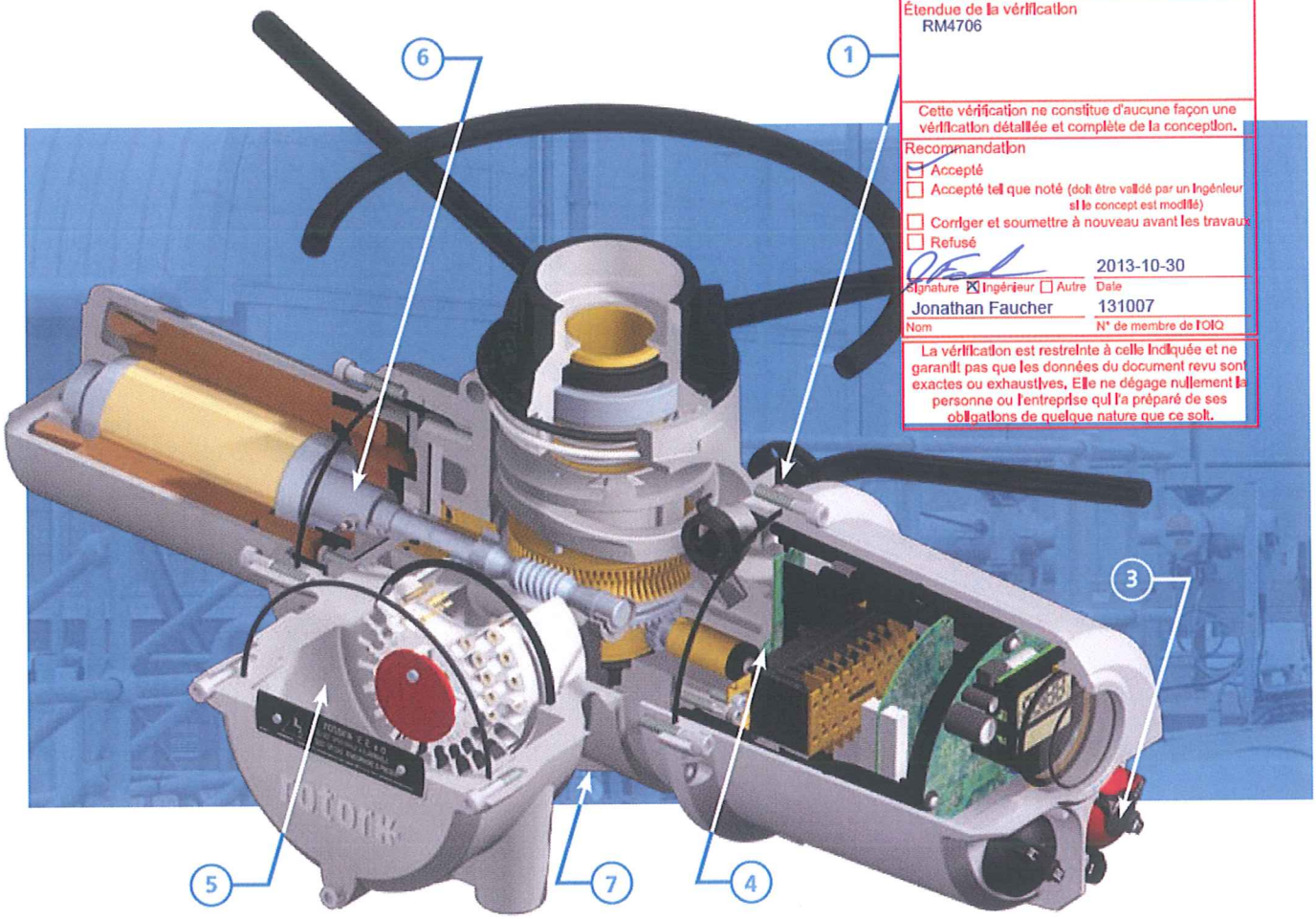
- **Valve torque profile** - open/closed instantaneous and average torque profiles plotted against valve stroke. Reference profiles stored during commissioning can be compared to in-service torque profiles for valve performance analysis.
- **Starts log** – open/closed start positions plotted against valve stroke. Allows process control valve operation.
- **Statistics** – number of operations, highest recorded torque, last limit switch operation, battery run time, battery voltage.
- Monitor log – control system, actuator and indication event log can be replayed and filtered for events of interest such as "torque trip". The last 1024 events are stored and stamped with date and time.

Using the IQ *Pro* IrDA™ interface, datalogger files can be downloaded to the IQ *Pro* tool or PDA running freeware IQ Pocket Insight for uploading to PC. IQ Insight PC based software is described in detail on page 12.

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1 Hand operation

Direct drive handwheel (or geared handwheel on larger sizes and IQT) provides reliable emergency manual operation in the event of a power supply failure. Includes padlockable* hand/auto clutch for safe operation even when the motor is running.

Note: power operation always has preference unless hand/auto lever is purposely locked into 'hand drive'. Lost motion 'hammerblow' effect is provided with both direct and independently geared handwheels.

2 Non intrusive setting

All actuator settings and diagnostics are made through the sealed indication window using IrDA™ communication. It is not necessary to remove electrical covers which would expose the integral controls to the plant environment.

3 Local controls

Local controls and padlockable* Local/Stop/Remote selector switch operate internal reed switches, avoiding penetrating shafts which would have to be sealed to prevent moisture ingress.

4 Position control

Hall effect magnetic pulse system accurately measures and controls the stroke of the actuator without using gears and switches.

5 Terminal compartment

Separately sealed terminal compartment ensures the integrity of the electrical equipment even when the terminal cover is removed during on-site wiring.

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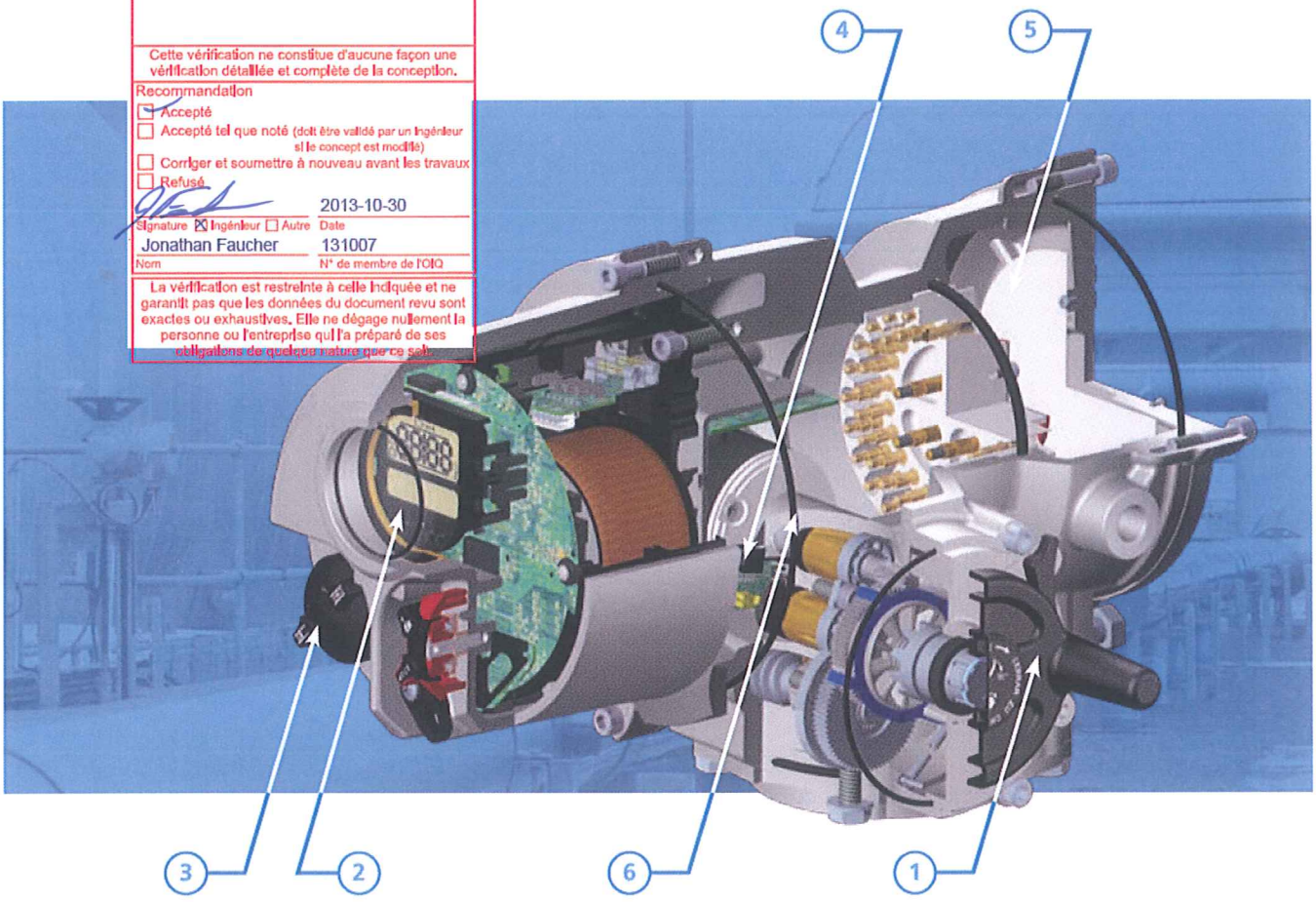
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6 IQ motor and drive

The motor shaft and worm shaft separate to facilitate simple actuator speed change. The motor has low inertia and high torque. Peak torque is produced rapidly after starting but with very little overrun when de-energized.

The winding thermostat provides accurate temperature sensing, independent of ambient temperature conditions, to optimize the motor's thermal capacity. The motor drive includes a lost motion 'hammerblow' to assist in unseating tightly shut valves. A single worm and wheel drive run in an oil bath for maximum life with ambient temperature tolerance.

IQT motor

This is a high efficiency compact unit with a proven reliability record in valve actuation applications over 20 years. Integrated speed control allows output speed adjustment over a 4:1 speed range.

7 Thrust base

Cast iron, water sealed bearings. Easily removable drive bushing for machining to suit valve stem for convenient valve adaptation.

*Minimum 6mm / ¼ inch padlock

Design Features – Reliability



Syncrophase prevents valve damage caused by incorrect wiring

Rotork's 'Syncrophase' automatic phase rotation correction control prevents valve damage caused by incorrect wiring by ensuring that the IQ three-phase motor is always presented with the correct phase rotation. Syncrophase senses the incoming phase rotation then energises the appropriate contactor to cause movement in the correct direction.

Single phasing protection*

IQ *Pro* control monitors all three phases of the power supply. Should one or more phases be lost the control system inhibits operation, preventing motor "single phasing" and burn out. The actuator display will indicate "phase lost", remote indication is also available from the configurable indication contacts.

Valve jammed protection

The actuator faces its severest operating test during unseating of the valve, when operating forces are at their highest or where an infrequently operated valve can get stuck. IQ *Pro* has the intelligence to systematically cope with these demands, ensuring reliable valve operation together with valve and actuator protection.

If valve "sticking" is considered possible, as with a wedge gate type, the torque switches can be by-passed during the first 5% of travel away from the valve seated position. This allows "extra" torque, averaging between 1.4 times and 2 times rated, to be applied in unseating the valve. In the majority of cases, applying additional force causes the sticky valve to move and allows operation to continue. After the 5% position has been reached, the torque switches return to the correct setting for the rest of travel. If this additional torque is still insufficient to cause movement IQ *Pro* recognises the valve is jammed and stops operation within seconds preventing further valve damage or motor burn out.

IQ thermostatic protection

In the event of overheating, two thermostats embedded in the motor windings directly sense the temperature and trip the actuator control circuit.

IQT thermostatic protection

Two thermostats are embedded within the motor power module providing comprehensive motor and motor power module protection.

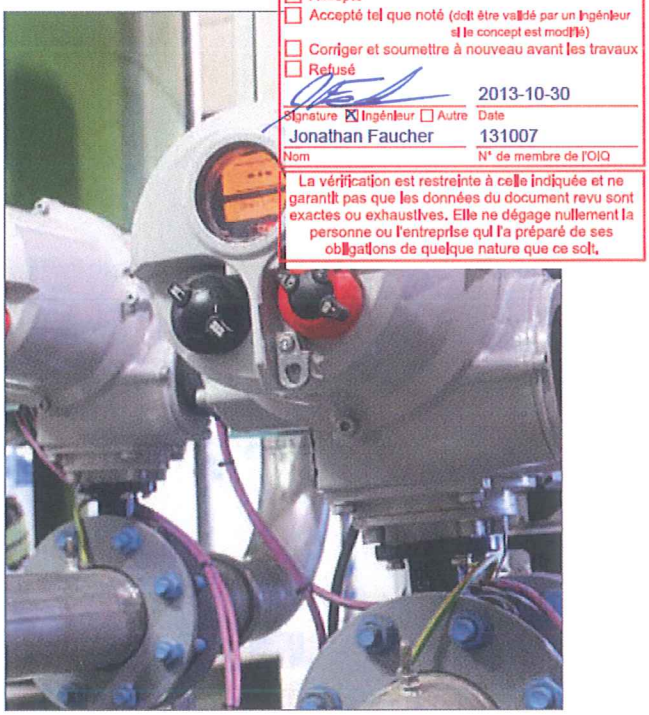
Auto self test and diagnosis (ASTD)

Vital operational circuits automatically self test to ensure correct operation. In the unlikely event that a fault is diagnosed the information is automatically presented using the display text. At the same time, actuator operation can be inhibited to enable on-site investigation.

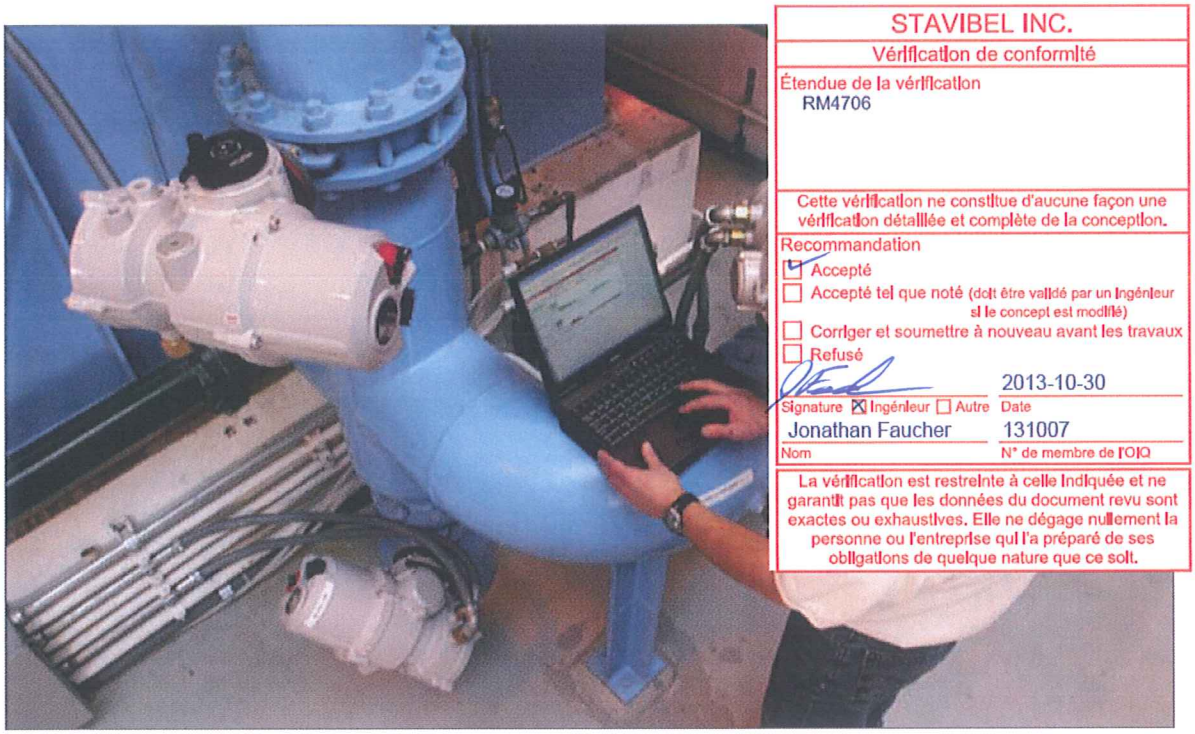
Instant reversal protection

When an actuator is ordered to reverse direction 'instantaneously' an automatic time-delay circuit avoids the shock loads which may cause unnecessary wear to valve stems and gearboxes. The delay also limits current surges through the contactor.

* IQ 3 phase only.



Design Features – Protection



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Protection - the key

Vast experience in the application of electric actuators has enabled Rotork to set the global standard in actuator ingress protection. Actuators have to perform unfailingly in environments ranging from desert to tundra, offshore to underground, where flooding, humidity, extremes of heat and cold, ultra violet and corrosive atmospheres are the norm. Rotork understands that the most important factor in the reliability of an actuator is protection from the environment - in simple terms, the enclosure.

Double sealed for double protection

The IQ enclosure is rated IP68 - 7 metres for 72 hours, NEMA 4/4X/6. It is completely watertight and dusttight and does not "breathe". The Rotork 'Double Seal' system ensures protection of internal components, separating them from the cable gland and terminal compartment by a watertight terminal block. Protection is maintained during site installation when terminal covers are removed and is independent of cable gland sealing.

Non-intrusive - sealed for life

IQ covers need not be removed for site commissioning. All settings and adjustments are made using the supplied infra-red Setting Tool *Pro*, including speed setting for the IQT. After assembly in the controlled environment of our manufacturing facilities, air exchanges are eliminated - all internal components are completely protected for life. Non-intrusive control selectors mean there are no moving shafts penetrating the control enclosure.

Reliability through simplicity

The IQ combines simplicity of design while extending specification and performance.

Torque measurement

An actuator's ability to reliably and accurately determine the force applied in operating a valve is fundamental to providing good valve and actuator protection. The IQ range uses tried and tested technology, proven in industry. Accurate, repeatable torque measurement is achieved independent of variations in frequency, voltage and temperature.

Position measurement

Reliable process control depends on accurate positioning of the valve throughout travel. The patented IQ non-contacting position measuring system is the most simple design devised for actuator control to date. With only one moving part, the resolver converts output centre column rotation into an electronic signal, which is then compared to position limits stored within a safe, non volatile memory.

IQT speed control

By use of motor control technology proven in the AQ range over 20 years, the output speed of the IQT can be adjusted without affecting the torque output.

Design Features – Intelligent Communication

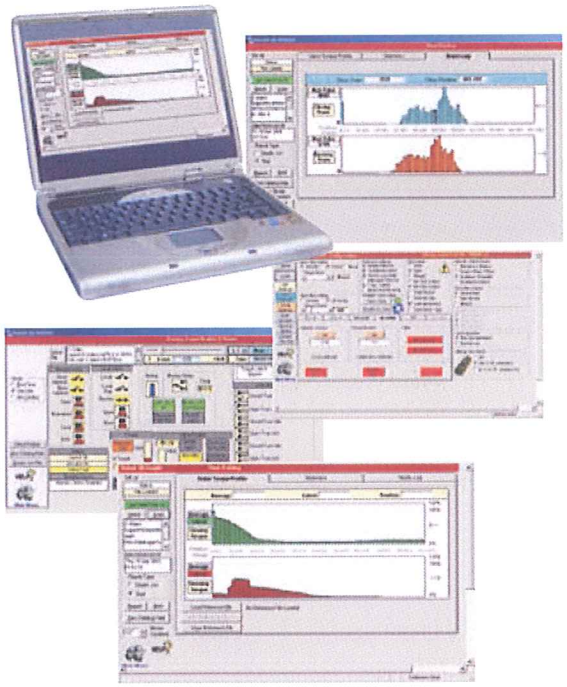
Lifetime support

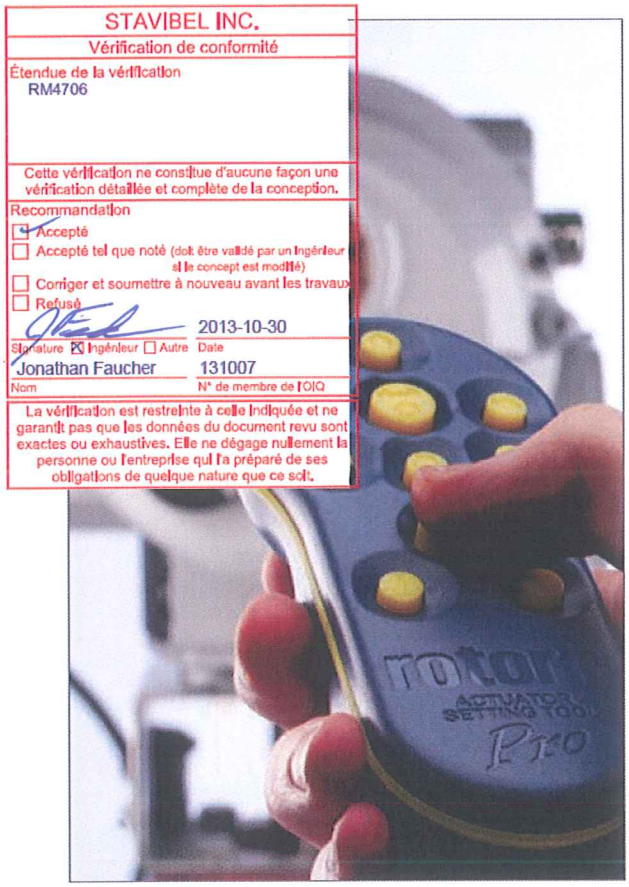
Rotork understands its customer's need for back up support. The costs and penalties of plant downtime, delayed commissioning schedules and inappropriate maintenance are too high to allow for inefficient support.

With IQ - IrDA™ (Infra-red Data Association) communication and the onboard datalogger, the IQ now offers unrivalled support to provide complete product back up with analysis and configuration. With Rotork's unrivalled worldwide service, network expert advice is always close to hand.

Remote diagnosis - IrDA™

The IQ utilises IrDA™ communication for fast, safe, non-intrusive and standardised data exchange. Actuator set-up configuration can be analysed and, if required, changed. As every IQ includes an onboard data logger, operational data such as valve torque profiles, actuator events and statistics can be downloaded for detailed investigation. Data logger information can also be relayed to a user site base via an IrDA™ compatible PDA. After analysis, any changes to the actuator set-up configuration can be relayed back to the actuator.





PC tools - IQ-Insight - Pocket-Insight

IQ-Insight PC software is a graphical user interface allowing all IQ set-up configuration and data logger information to be reviewed, analysed and reconfigured. This visually interactive application is browser based, running under Microsoft or other internet browser systems.

Intuitive controls make analysing the data from an IQ simple and fast. Laptop PCs with IrDA™ interface running IQ-Insight can be directly connected to an actuator located in the field to allow set-up, adjustment and analysis.

Alternatively, data can be uploaded from the actuator and later downloaded to a PC by using a PDA running IQ Pocket-Insight freeware.

Rotork help - online

Rotork has a comprehensive worldwide service network to provide you with local support wherever you are. Rotork trained technicians working from our network of offices and centres of excellence are available to offer immediate assistance.

To contact Rotork, visit www.rotork.com

Design Features – Customising

Although Rotork's standard IQ *Pro* actuator offers wide ranging control and indication flexibility, a variety of features can be customised to individual customer requirements. IQT *Pro* provides direct operation of small to medium sized quarter-turn valves up to 2,000 Nm. IQ *Pro* actuators can also be fitted with part-turn worm and wheel gearboxes to provide increased torque at reduced speeds for the operation of part-turn valves. A sizing program for both part-turn and multi-turn applications is available on the rotork website www.rotork.com

IQTF (full turn) actuators

For non-thrust, multi-turn, slow speed applications, the IQTF provides a reliable solution with the same general specification as the IQT range.

For further details please contact Rotork.

Fireproofing and extreme cold

Fully operational at temperatures of up to +70°C, the standard IQ *Pro* range actuator can operate for up to thirty minutes in a fire (when temperatures may quickly climb to over 1,000°C)* through the use of boxes, blankets or intumescent coating, as specified by the customer.

With modifications the IQ *Pro* range actuator can also operate in temperatures as low as -50°C.

**For further details see publication S310E.*

Floor mounting for easy remote coupling

Floor stands with upward or downward stubshafts are available for coupling to remote valves via customer shafts and universal joints.

Linear output drive assemblies

For applications requiring an actuator with a linear output, a leadscrew arrangement can be fitted to the base of the standard IQ *Pro* actuator.

Damper actuators

Single blade and multi vane dampers can be motorised either by direct connection to the damper spindle or by lever arm.

Valve stem expansion

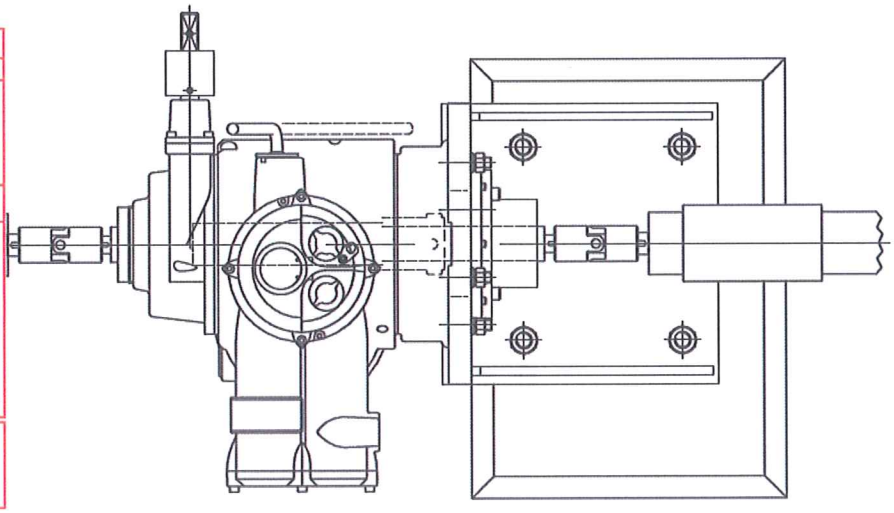
The stems of positive seating valves, such as solid or flexible wedge gates may be subject to significant expansion when used in high service temperature applications resulting in damaged or leaking valves. The effects of this expansion or contraction may be overcome by fitting the Rotork temperature compensator to the output of the IQ *Pro* actuator.

For further details see publication E152E.

Rotork Site Services division

Rotork Site Services, the projects, service and retrofit division - established in 2006 - is an illustration of Rotork innovation in practice. Throughout the company's history, aftermarket services such as retrofit and maintenance have developed to support customers and reinforce Rotork's market leading position. As a result, in some countries Rotork is now the number one service supplier for valve actuation. For detailed information on Rotork Site Services see page 18.

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Pakscan Bus Control System

Integration of the plant controls by use of network connectivity has been a hallmark of Rotork actuator products for many years. The use of proprietary and open systems makes the commissioning of the plant and the subsequent control and monitoring a simple and reliable task.

All Rotork actuators are compatible with a wide range of communication and process controls systems by including the appropriate option card during manufacture of the actuator. The actuator reports status feedback, via the field highway, to the overall plant control system (DCS or PLC) and valve control commands are actioned.

Our own Pakscan system compliments the open systems from Foundation Fieldbus, Profibus, Modbus and DeviceNet see page 16 for more details. Innovative technology together with expert bus system knowledge ensures that Rotork can always provide the ideal solution for the control system.

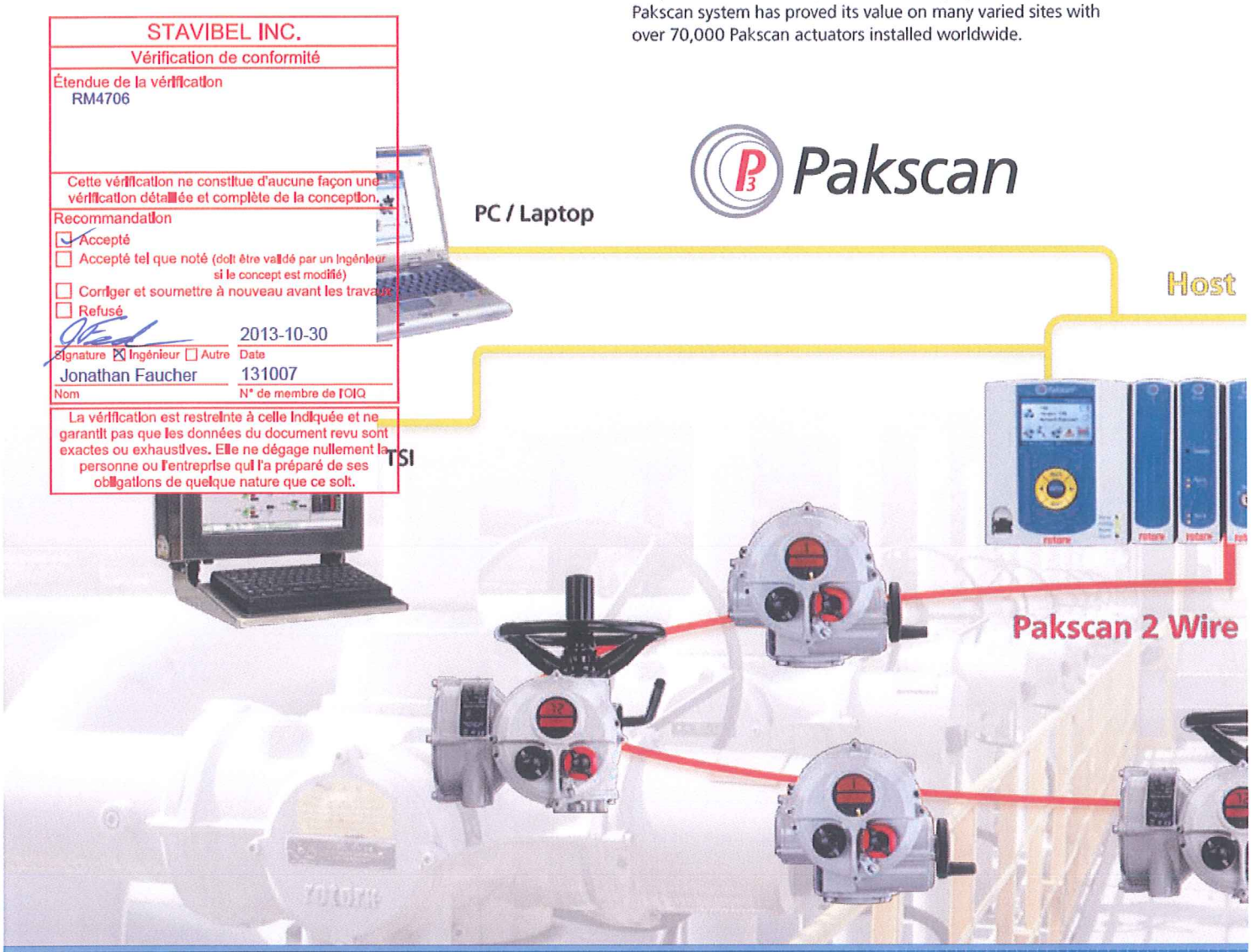
Rotork Pakscan - the total control solution

Whether you need remote control of a few motorised valves, or full automation of a complex plant, Pakscan can help you to achieve significant savings in both time and costs.

Pakscan allows the remote control of actuators and valves over a simple single twisted pair data highway, removing the need for heavy multicore cables. It also includes automatic inbuilt redundancy of the field network to ensure control will be maintained even in the event of equipment or cable failure.

Available as a single or hot standby master station variant, Pakscan has the ability to control up to 240 actuators, and other field devices, using secure field communications. The field data highway cable may be up to 20 km in length so even quite distant valves can easily be incorporated into the network, without the need for repeaters.

Simple to install and simple to use, the highly successful Pakscan system has proved its value on many varied sites with over 70,000 Pakscan actuators installed worldwide.



Pakscan

Rotork Pakscan P3 master station

The Pakscan P3 master station incorporates a local HMI which has a full colour integral display showing the status of all the field devices, the current state of the communications ports, system alarms and diagnostic information plus actuator control and set up facilities. The simple 5 button keypad provides easy navigation through the display screens.

Remote access to the asset management features are available via the built in web pages as well as the status, diagnostic, set up and control facilities provided by the local HMI. Asset management information includes historical master station command log, host port analyser, automatic alarm notification via e-mail and event loggers for both the master station and field control units. Web security is provided by named IP access, https (secure web pages) and password protection

The two serial and two ethernet host ports allow for redundant communication. Pakscans pre-configured database and vast interface experience ensure smooth integration with any Modbus host system.

For further details see publication S001E.

Rotork P3 Field Mount master station

The Rotork P3 Field Mount (P3F) master station enhances the P3 product range by allowing the master station to be mounted close to the process. Enclosed in an environmentally protected IP65 box, it provides (via a DCS or PLC) control and monitoring of 32 field units utilising serial or TCP/IP Modbus communications. Configuration is achieved using the comprehensive built in web pages.

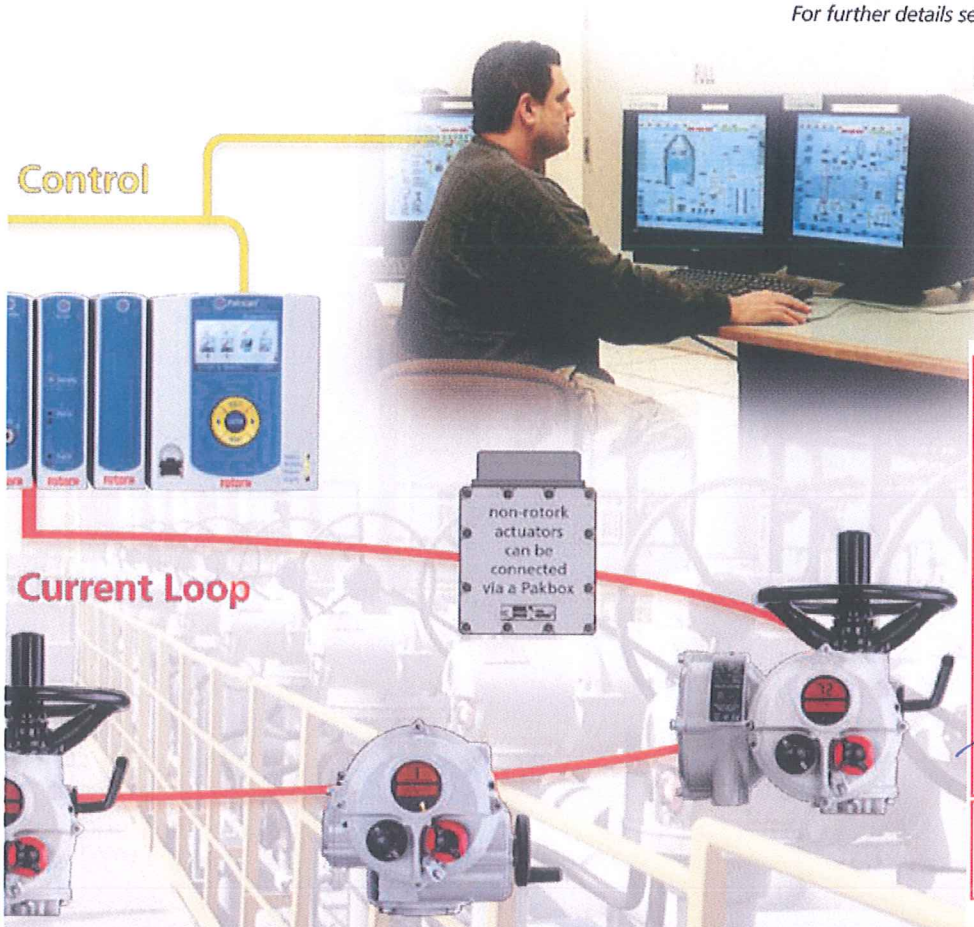
In-Vision - powerful, user-friendly

In-Vision is a SCADA (Supervisory Control And Data Acquisition) software application for full, user friendly control of complex installations, such as oil storage depots and water treatment plants, where there may be a high number of actuators and process signals to control and display.

Working with Pakscan and running on a standard PC, In-Vision offers a highly flexible series of graphic displays and controls that allow plant managers to view and control all aspects of their process at a fraction of the cost of other comparable systems.

The TSI computer is designed specifically to match the Pakscan system and In-Vision and the installed package can be a full In-Vision system, or an In-Vision MD.

For further details see publication S210E.



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Multiple Bus Connectivity

Multiple fieldbus connectivity

In addition to being fully compatible with Rotork Pakscan, IQ *Pro* actuators can be specified to interface seamlessly to many other fieldbus digital control systems. Open fieldbus protocols, such as Profibus, Foundation Fieldbus, DeviceNet and Modbus, are all available within the IQ actuator control option range.

This is achieved simply and cost effectively through fitting an appropriate Rotork manufactured circuit board module inside the actuator's electrical housing, normally at the time of production. Module commissioning and setup is carried out using a combination of the IQ Setting Tool *Pro* and the network commissioning tools used for the chosen protocol.

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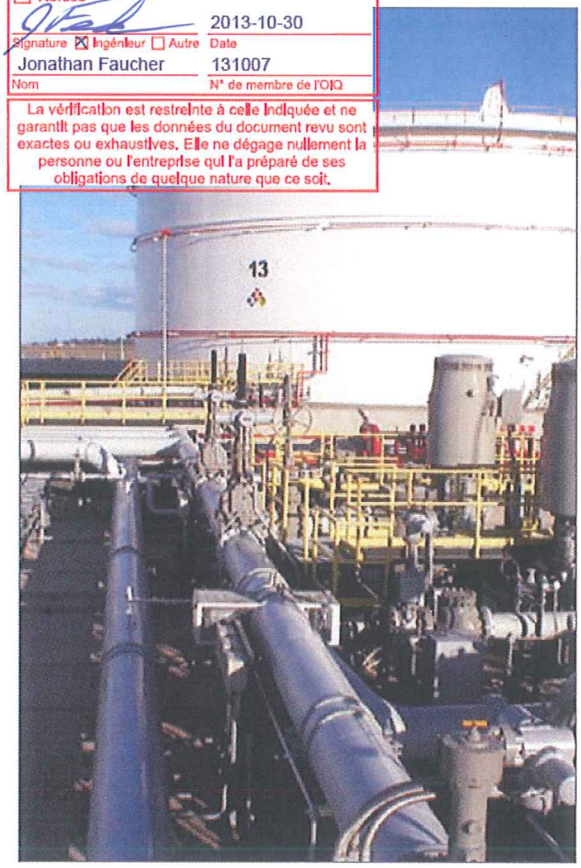
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Profibus

Profibus is a leading international network protocol for high speed data communications in industrial automation and control.

The Rotork Profibus DP interface card provides comprehensive control and feedback data about the valve and actuator using DP-V0 cyclic communications whilst extended actuator diagnostics and configuration is included in the DP-V1 acyclic data supported by this module.

EDD and DTM files allow the Rotork device to be incorporated into asset management systems giving access to performance critical parameters, whilst the independently certified GSD file guarantees device interoperability.

Rotork provide an optional switch disconnect module allowing for ease of installation and have multiple configuration options within the GSD file to enable a choice of data collection.

- RS485 Profibus DP V0 and V1 compliant
- Single and Dual Redundant options
- Fully meets IEC61158-3 standard
- Profibus PNO certified
- Supports speeds up to 1.5Mbit/s

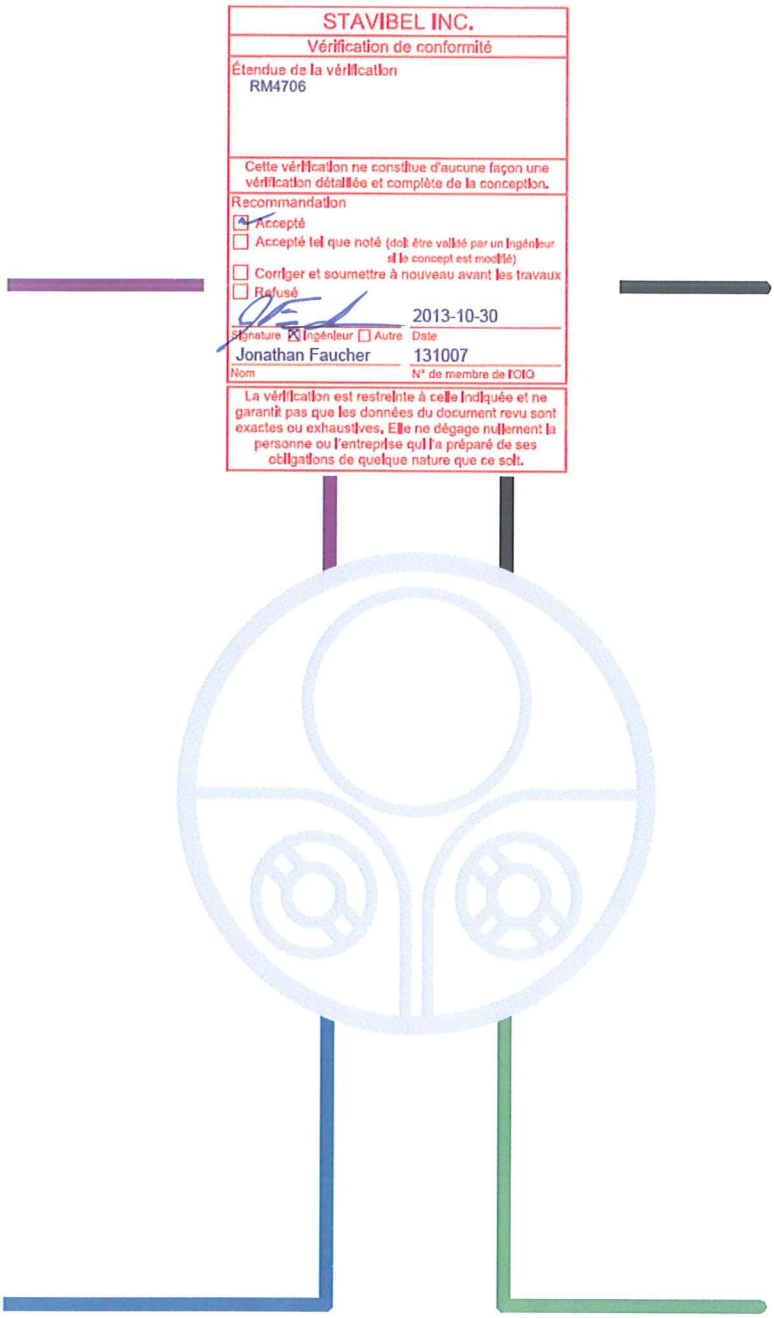
Foundation

Foundation Fieldbus has become widely accepted for use in process control systems. It's primary feature is the ability to distribute control away from the central DCS.

The Rotork Foundation Fieldbus interface card connects directly onto the standard Foundation H1 bus system. The function blocks embedded in the module cover the control and monitoring of the valve and actuator.

Using the certified Device Description files the FF card is simple and easy to use. The ability to report extensive actuator feedback within a single input block as well as system diagnostic information makes Rotork the first choice for use with a Foundation Fieldbus system.

- Foundation ITK inter-operability certified
- Fully compliant with IEC61158-2 standard
- Includes Link Master and LAS capability
- Independent HIST approval by major DCS vendors
- Full H1 Field capability



Modbus®

Modbus

Modbus remains the most popular process communication protocol in use today with the widest acceptance and highest number of applied systems of any automation protocol.

Rotork's Modbus interface card allows actuators to be connected to a 2 wire RS485 network for direct communication to a PLC or DCS using Modbus RTU protocol. The resulting network is able to monitor and control the connected actuator.

As the Modbus protocol is so simple the system engineer has full control over the data flow on the highway and the information to be collected and controls implemented.

There are no complications with device description files or special programming tools required when setting up a Modbus system.

- RS485 2 wire RTU communication
- International open standard
- Single and Dual redundant options
- Integral Repeater modules included where necessary
- Up to 115 kB

DeviceNet

DeviceNet

DeviceNet is an Open Network Standard for communication networks using the main features of CAN bus in an industrial environment.

The Rotork DeviceNet interface module provides easy access to actuator process control and feedback information. The Electronic Data Sheet description file is used to set up the actuator parameters to allow the systems performance to be optimised,

In addition to the standard actuator torque and position feedback a further analogue input is included as standard enabling integration of external analogue equipment onto the network.

The Rotork module has been certified by the Open DeviceNet Vendor Association to ensure its interoperability with other devices.

- Up to 63 devices on each network
- 4 wire cable, 2 for signal, 2 for power
- Trunk and Drop line permitted
- ODVA certified to ensure compatibility
- EDS electronic device description file

Rotork Site Services

Rotork Site Services division, bringing together project, service and retrofit activities, is active in 47 service centres in over 20 countries, with agents providing support services in a further 55 countries. The total number of expert technicians supporting Rotork customers is well over 1,000.

The division provides services in maintenance, management and the upgrading of installed actuation assets in order to fully support and satisfy the increasing demands for these activities from customers throughout the world. The services are tailored to meet customers' specific needs, encompassing the following:

Emergency and Planned Service

Available for all types of actuator, in all areas (including hazardous environments). Some customers require guaranteed emergency response times, others require planned response for all types of actuator work, including installation, commissioning, upgrading, connection and installation of bus communication systems, troubleshooting and repair of damaged or deteriorating assets.

Actuator Overhauls

After a long service life customers may prefer their actuators to be completely overhauled rather than replacing them with new ones. In our workshops we completely strip and rebuild actuators, returning them to their original state.

Health Checks

Some customers lack detailed information on their assets, making it difficult to prioritise maintenance and replacement investment. We can carry out a detailed and intrusive inspection of the actuators and combine this with build data from our own databases to give customers a holistic view of their assets.





Retrofitting actuators to existing valves

We have extensive experience in fitting actuators to valves, penstocks and dampers that are already installed as part of existing plant. Whether customers are replacing obsolete actuators, changing power sources or motorising manual valves, we offer a tailor made solution to meet customers' specific requirements.



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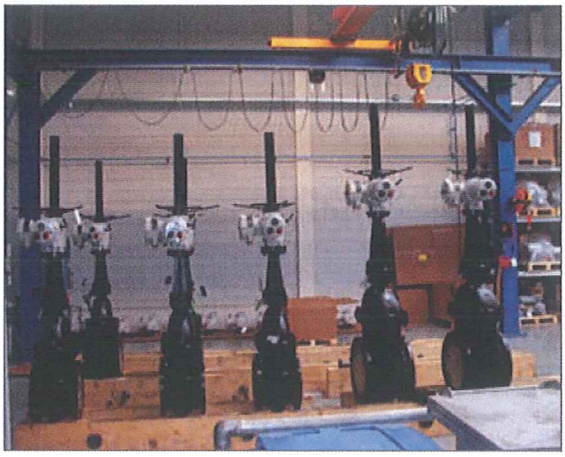
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Shutdown Outages

We can support customers in making sure that all their actuators are fully operational and that they meet tight shutdown deadlines. For example some power stations look for us to remove and overhaul in our workshops over 200 actuators when taking a unit out for maintenance. We do this, reinstall and commission the actuators and, where requested, carry out additional actuation projects simultaneously to ensure that customers make the most of their plant shutdown time.

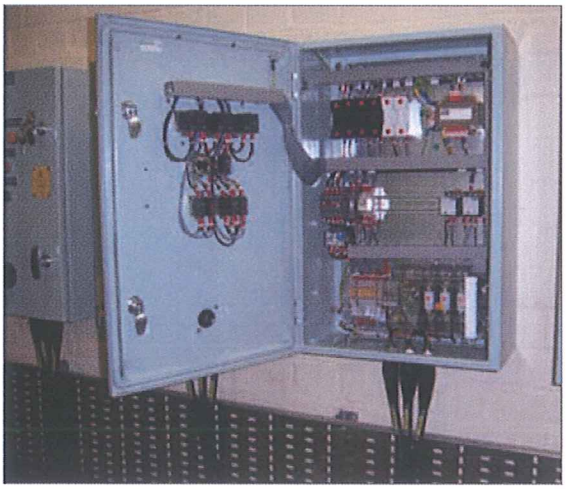


Preventative Maintenance

We provide regular scheduled maintenance to enhance the integrity of actuators and their associated valves. This service is typically sought by customers looking to maximise the up-time of their plant.

Factory fitting of actuators to new valves

The careful assembly of valve and actuator is critical to ensure that an automated valve performs correctly and reliably. Whilst this service is often carried out by valve manufacturers, if there is a need we can provide this serrvice.



Extended scope projects

This is a growing requirement and some of our service teams have the wide range of skills necessary to offer a "one-stop-shop" to automate part or all of a customer's process. Our capabilities cover all of the installation phases (scoping, design, procurement, manufacturing, installation, commissioning) on the broad scopes that typically surround actuation projects.

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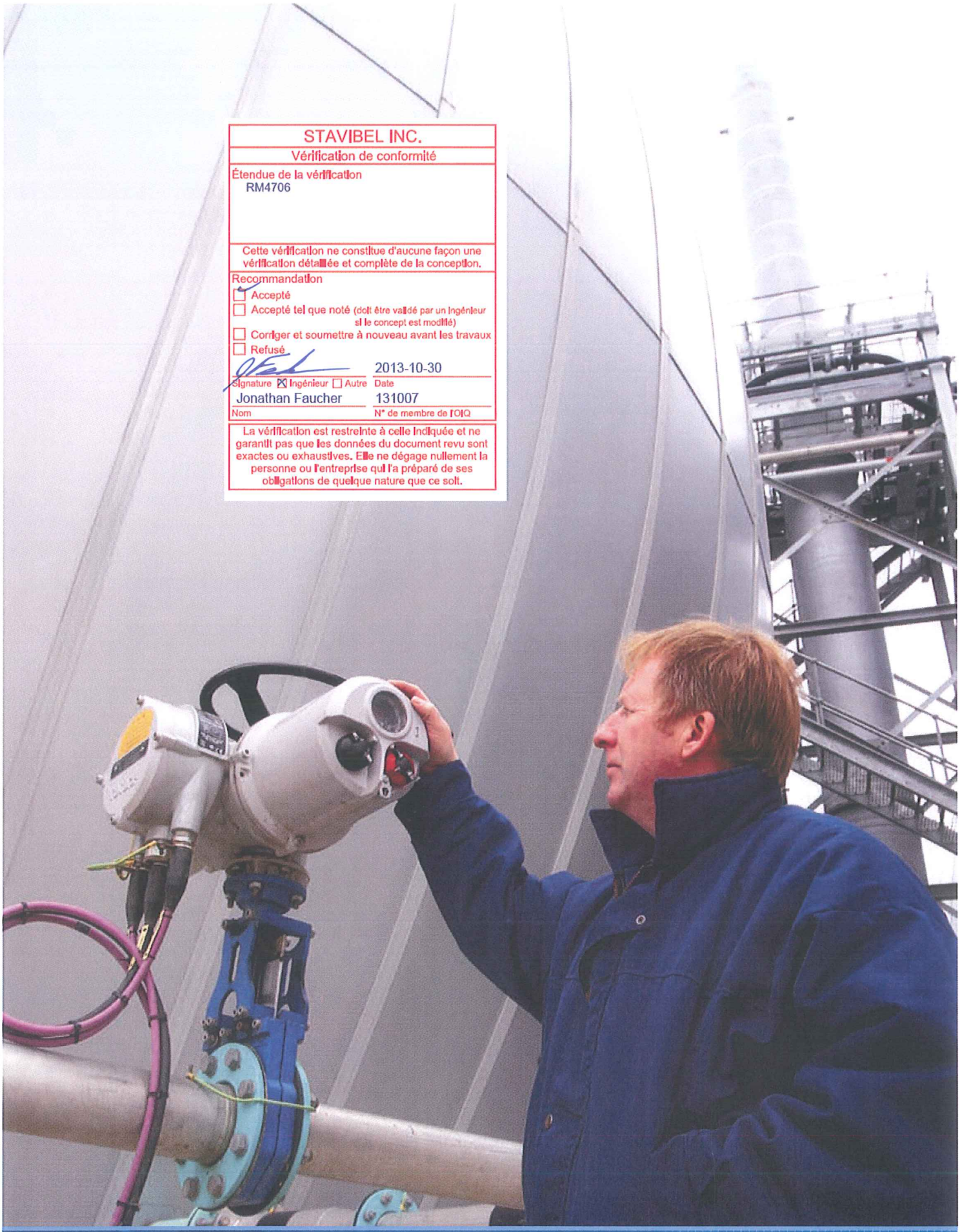
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Actuator Specification

The following pages contain details on performance and specification for the Rotork IQ range of actuators.

Please use the following contents table to help access the information you require.

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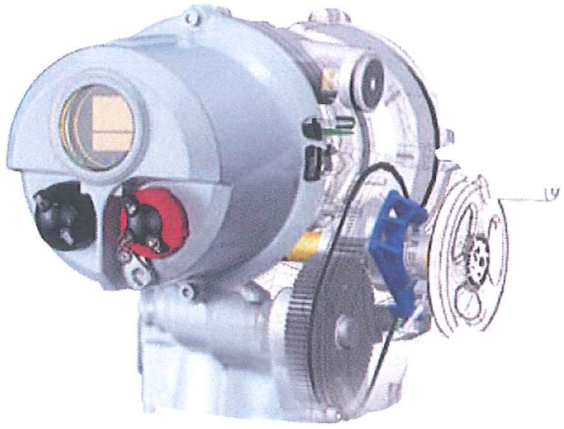
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IQ 3 Phase Performance Summary

Performance Data

	Actuator output speeds							
rpm at 50 Hz	18	24	36	48	72	96	144	192
rpm at 60 Hz	21	29	43	57	86	115	173	230

Actuator size	Torque**	Nm	Ft lbf						
IQ10		34	34	34	34	34	34		
		25	25	25	25	25	25		
IQ12		81	81	81	68	48	41		
		60	60	60	50	35	30		
IQ18		108	108						
		80	80						
IQ20		203	203	203	203	176	142	102*	
		150	150	150	150	130	105	75*	
IQ25		400	400	298	244	244	230	149*	
		295	295	220	180	180	170	110*	
IQ35		610	610	542	474	474	366	257*	
		450	450	400	350	350	270	190*	
IQ40		1020	1020	845	680	680	542	406*	
		750	750	625	500	500	400	300*	
IQ70		1490	1490	1290	1020	1020	745	645*	542*
		1100	1100	950	750	750	550	475*	400*
IQ90		2030	2030	1700	1355	1355	1020	865*	730*
		1500	1500	1250	1000	1000	750	640*	540*
IQ91								1355*	1355*
								1000*	1000*
IQ95			3000						
			2200						

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* Due to the effects of inertia and drive nut wear, speeds not recommended for direct mounted gate valve applications.

** Torque rating is maximum torque setting in both directions. Stall torque will be 1.4 to 2.0 times this value depending on speed and voltage.

If maximum torque is required for more than 20% of valve travel, refer to Rotork.

IQ Single Phase - Performance Data

	Actuator output speeds							
rpm at 50 Hz	18	24	36	48	72	96	144	
rpm at 60 Hz	21	29	43	57	86	115	173	
Actuator size	Torque**	Nm	Ft lbf					
IQS12	65	60	45	40	30	25		
	48	44	33	30	22	18		
IQS20	165	130	130	125	100	80	60	
	122	96	96	92	74	59	44	
IQS35*	450	400	350	320	230	190	135	
	332	295	258	236	170	140	100	

IQ DC - Performance Data

	Actuator output speeds							
rpm	18	24	36	48				
Actuator size	Torque**	Nm	Ft lbf					
IQD10	34	34	31	27				
	25	25	23	20				
IQD12	68	68	61	54				
	50	50	45	40				
IQD18		108						
		80						
IQD20	163	163	136	108				
	120	120	100	80				
IQD25	305	305	257	203				
	225	225	190	150				

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DC supply voltage	24V	48V	110V
IQD10	✔	✔	✔
IQD12	✗	✔	✔
IQD18	✗	✔	✔
IQD20	✗	✗	✔
IQD25	✗	✗	✔

* **IQS35 not available at 115v.** Actuator output speed 144/173 rpm is not recommended for direct mounted gate valve applications.

** Torque rating is maximum torque setting in both directions. Stall torque will be 1.4 to 2.0 times this value depending on speed and voltage.

If maximum torque is required for more than 20% of valve travel, refer to Rotork.

IQ Performance Summary

Mechanical Data

Actuator size IQ IQS IQD		10 12 18	20 25	35	40	70	90	91	95
Flange size	ISO 5210	F10	F14	F16	F25	F25	F30*	F25	F30
	MSS SP - 102	FA10	FA14	FA16	FA25	FA25	FA30*	FA25	FA30
Approximate weight**	kg	27	46	69	190	190	200	200	200
	lbs	60	101	152	418	418	440	440	440
Group 'A' couplings (thrust)									
Thrust rating	kN	44	100	150	220	220	334	N/A	445
	lbf	10,000	22,480	33,750	50,000	50,000	75,000	N/A	100,000
Stem acceptance diameter Type 'A' (maximum)									
Rising	mm	32	38	54	64	70	70	N/A	N/A
	ins	1 1/4	1 1/2	2 1/8	2 1/2	2 3/4	2 3/4	N/A	N/A
Non-rising	mm	26	32	45	51	57	57	N/A	N/A
	ins	1	1 1/4	1 3/4	2	2 1/4	2 1/4	N/A	N/A
Type 'Z' - 'Z3'									
Z Rising	mm	N/A	51	67	N/A	N/A	N/A	N/A	N/A
	ins	N/A	2	2 5/8	N/A	N/A	N/A	N/A	N/A
Z3 Rising	mm	32	51	67	73	83	83	N/A	83
	ins	1 1/4	2	2 5/8	2 7/8	3 1/4	3 1/4	N/A	3 1/4
Non-rising	mm	N/A	38	51	57 ††	73 ††	73 ††	N/A	73 ††
	ins	N/A	1 1/2	2	2 1/4 ††	2 7/8 ††	2 7/8 ††	N/A	2 7/8 ††
Group 'B' couplings (non-thrust) Bore diameter									
Type 'B1' (fixed bore)	mm	42	60	80	100	100	120	100	N/A
Type 'B3' (fixed bore)	mm	20 †	30 †	40 †	50	50	50	50	N/A
Type 'B4' (maximum)	mm	20 †	32 †	44 †	50	60	60	60	N/A
	ins	3/4	1 1/4	1 3/4	2	2 1/4	2 1/4	2 1/4	N/A
Handwheel ratio	Standard	Direct	Direct	Direct	Direct	15:1	15:1	15:1	15:1
	Optional	12:1	13.5:1	22.5:1	15:1 or 30:1	30:1	45:1	30:1	45:1

lings have flange size F25. ** Weight will be dependent on optional equipment fitted.
135 a type 'A' coupling must be used when required to drive shafts or stems having any axial movement.
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IQT Quarter-Turn Performance Summary

Performance and Mechanical Data

Actuator	IQT125	IQT250	IQT500	IQT1000	IQT2000
Torque					
Max Nm	125	250	500	1000	2000
Min Nm	50	100	200	400	800
Max Ft lbs	92	185	369	738	1476
Min Ft lbs	37	74	148	295	590
Operating time					
90° Min	5	8	15	30	60
90° Max	20	30	60	120	120
Flange					
ISO 5211	F05* F07* F10	F07* F10	F10	F12 F14*	F14
MSS SP-101	FA05* FA07* FA10	FA07* FA10	FA10	FA12 FA14*	FA14
Weight					
Kg	22	22	22	37	37
lbs	49	49	49	82	82
Couplings**					
Spindle acceptance					
Bore & key max mm	22 28 42	28 42	42	60	60
Bore & key max ins	0.87 1.1 1.65	1.1 1.65	1.65	2.36	2.36
Square AF max mm	14 19 32	19 32	32	41	41
Square AF max ins	0.56 0.75 1.25	0.75 1.25	1.25	1.62	1.62
Handwheel					
Turns for 90°	80	80	80	80	80
Angular adjustment					
(nominal) degrees	80 - 100	80 - 100	80 - 100	80 - 100	80 - 100

IQT 24V DC (17-37 Volts) Performance

Torque outputs for 24V DC are the same as above, however speed varies with load.

* Optional flanges F05, FA05, F07 and FA07 use a base adapter plate. Required base type must be specified.

** Couplings are supplied blank for machining by valve maker.

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IQM and IQML Performance Summary

Performance Data

Actuator size	Base sizes to ISO 5210	Thrust rating	Max. rising stem dia.		Actuator output speeds: rpm at 50 Hz / rpm at 60 Hz	18 / 21		24 / 29		36 / 43		48 / 57		72 / 86	
					Torque**	Nm	lbs ft								
IQM10	F10	44 kN	32 mm	Modulating torque		17	12.5	17	12.5	15.6	11.5	13.6	10	-	-
		10,000 lbf	1.25 ins	Max. seat. torque		34	25	34	25	30	23	27	20	-	-
IQM12	F10	44 kN	32 mm	Modulating torque		34	25	34	25	30	22	27	20	-	-
		10,000 lbf	1.25 ins	Max. seat. torque		61	45	54	40	54	40	48	35	-	-
IQM20	F14	100 kN	51 mm	Modulating torque		81	60	81	60	68	50	54	40	47	35
		22,480 lbf	2 ins	Max. seat. torque		122	90	109	80	81	60	68	50	54	40
IQM25	F14	100 kN	51 mm	Modulating torque		152	112.5	152	112.5	129	95	102	75	102	75
		22,480 lbf	2 ins	Max. seat. torque		204	150	204	150	163	120	136	100	136	100
IQM35	F16	150 kN	54 mm	Modulating torque		271	200	271	200	253	187	203	150	203	150
		33,750 lbf	2⅛ ins	Max. seat. torque		544	400	544	400	408	300	313	230	218	160

Actuator size	Base sizes to ISO 5210	Leadscrew dia/lead mm	Stroke Length		Speed at	50 Hz	60 Hz							
					Thrust	kN	lbf							
IQML10	F10	25 / 3	115 mm	Linear speed mm / sec		0.9	1.1	1.2	1.4	1.8	2.2	2.4	2.9	-	-
			4½ ins	Modulating thrust		7.94	1785	7.94	1785	7.3	1643	6.35	1429	-	-
				Rated seating thrust		15.88	3570	15.88	3570	14.61	3285	12.71	2858	-	-
IQML12	F10	25 / 3	115 mm	Linear speed mm / sec		0.9	1.1	1.2	1.4	1.8	2.2	2.4	2.9	-	-
			4½ ins	Modulating thrust		15.9	3571	15.9	3571	14.3	3214	12.7	2860	-	-
				Rated seating thrust		28.59	6428	25.42	5714	25.42	5714	22.26	5005	-	-
IQML20	F14	38 / 7	115 mm	Linear speed mm / sec		2.1	2.5	2.8	3.4	4.2	5.0	5.6	6.8	8.4	10.1
			4½ ins	Modulating thrust		24.36	5455	24.26	5455	20.22	4545	16.17	3636	14.15	3182
				Rated seating thrust		36.4	8183	36.4	8183	24.26	5454	20.2	4545	16.1	3636
IQML20	F14	38 / 15	115 mm	Linear speed mm / sec		4.5	5.4	6.0	7.2	9.0	10.8	12.0	14.4	18.0	21.6
			4½ ins	Modulating thrust		16.7	3750	16.7	3750	13.9	3125	11.1	2500	8.9	2000
				Rated seating thrust		25.1	5625	25.1	5625	16.7	3750	13.9	3125	11.1	2500
IQML25	F14	38 / 7	115 mm	Linear speed mm / sec		2.1	2.5	2.8	3.4	4.2	5.0	5.6	6.8	8.4	10.1
			4½ ins	Modulating thrust		45.49	10227	45.49	10227	38.41	8636	30.33	6818	30.33	6818
				Rated seating thrust		60.7	13636	60.7	13636	48.5	10908	40.4	9090	40.4	9090
IQML25	F14	38 / 15	115 mm	Linear speed mm / sec		4.5	5.4	6.0	7.3	9.0	10.8	12.0	14.4	18.0	21.6
			4½ ins	Modulating thrust		31.3	7031	31.3	7031	26.4	5937	20.85	4687	20.85	4687
				Rated seating thrust		41.7	9375	41.7	9375	33.3	7500	27.8	6249	27.8	6249

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IQTM Performance Summary

	Torque						Operating Time
	Max Nm	Modulating Nm	Min Nm	Max Ft lbs	Modulating Ft lbs	Min Ft lbs	90° Max
IQTM125	125	62.5	50	92	46	37	20
IQTM250	250	125	100	185	92.5	74	30
IQTM500	500	250	200	369	184.5	148	60
IQTM1000	1000	500	400	738	369	295	120
IQTM2000	2000	1000	800	1476	738	590	120

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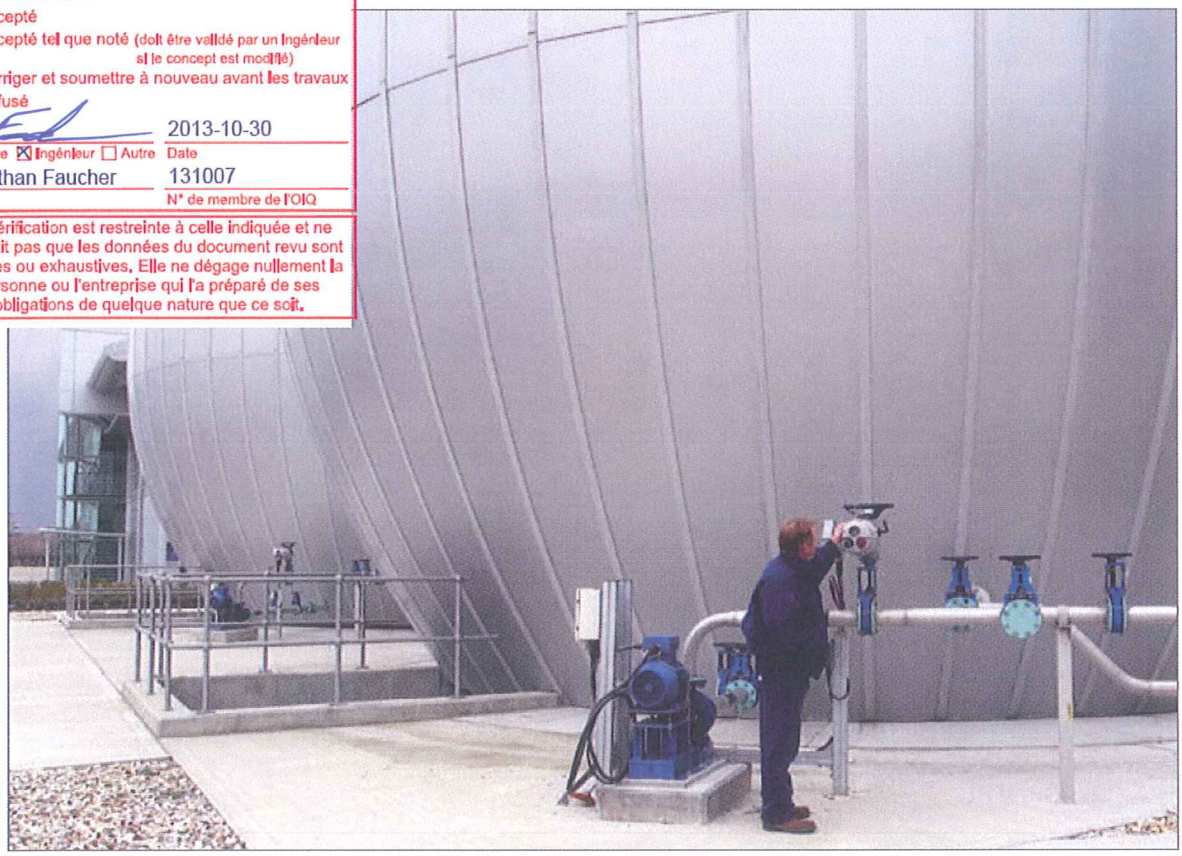
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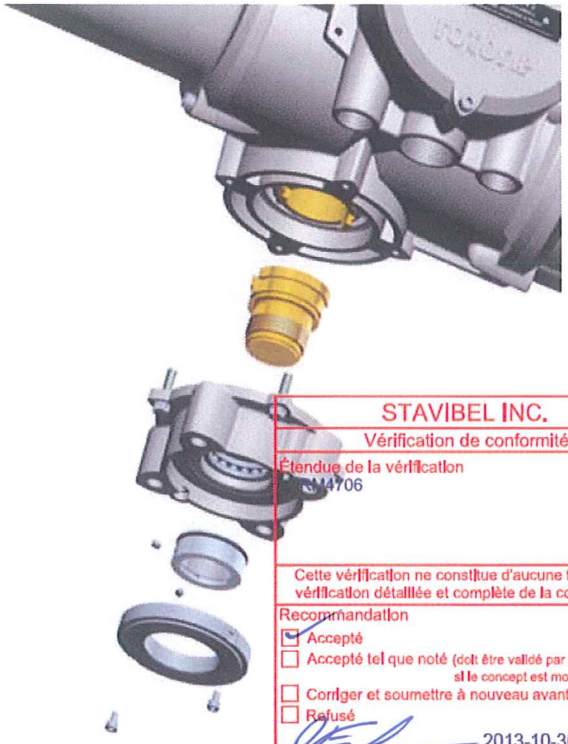
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Actuator Drive Couplings

The IQ *Pro* range features two actuator base designs - a removable base for the IQ10, 12, 18, 20, 25 and 35 sizes and an integral base for IQ40, 70, 90, 91 and 95. Both arrangements are available with flanges and couplings that comply with either ISO 5210 or MSS SP-102.



Thrust Bearings

Both type 'A' and 'Z' couplings feature an associated thrust bearing. In the case of the removable thrust base this is fully sealed and lubricated for life; in the integral base design this is lubricated by the actuator gearcase oil bath. Both integral and removable thrust bases are designed to retain all developed thrust reaction forces without any load appearing on the actuator gearcase.

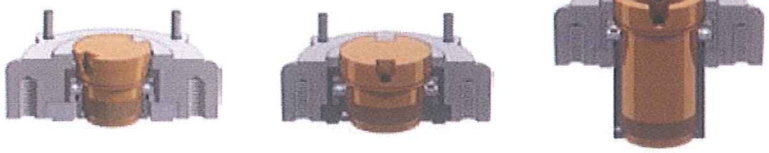
Drive Couplings

For convenient valve adaption the easily removable drive bush is supplied blank for machining to suit valve stem. The IQT *Pro* base design and drive couplings comply with either ISO 5211 or MSS SP-101.

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IQ Actuator Drive Couplings

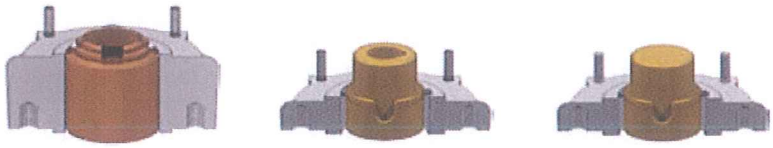
IQ10 to IQ35



Actuators:

IQ10 IQ12 IQ18
IQ20 IQ25 IQ35

	Type A	Type Z	Type Z3
	for sizes IQ10 to 35	for sizes IQ20 to 35 increased stem acceptance	for sizes IQ10 to 35 increased stem acceptance and reach
Thrust			
Non-Thrust	for sizes IQ10 to 35 large fixed bore with ISO standard bore and keyway	for sizes IQ10 to 35 fixed bore with ISO standard bore and keyway	for sizes IQ10 to 35 blank drive bush for machining by customer
	Type B1	**Type B3**	**Type B4**

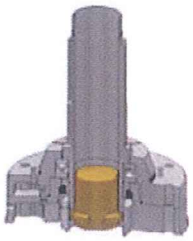


IQ Actuator Drive Couplings

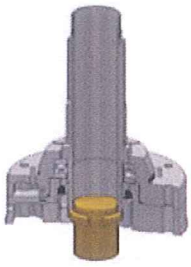
IQ40 to IQ95

Actuators:
IQ40 IQ70 IQ90
IQ91 IQ95

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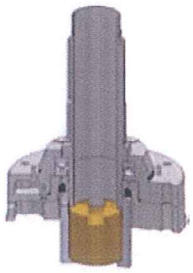


position 1



Type A
for sizes IQ40 to 90

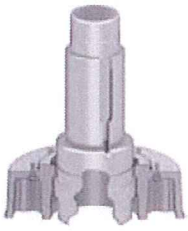
position 2



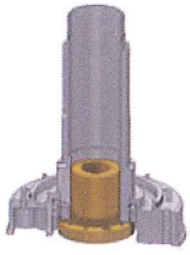
Type Z3
for sizes IQ40, 70, 90 and 95 increased stem acceptance and reach

Thrust

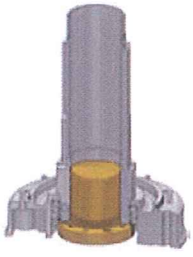
Non-Thrust



for sizes IQ40, 70 and 90 large fixed bore with ISO standard bore and keyway
Type B1



for sizes IQ40, 70, 90 and 91 fixed bore with ISO standard bore and keyway
Type B3



for sizes IQ40, 70, 90 and 91 blank drive bush for machining by customer
Type B4

IQT Actuator Drive Couplings

Actuators:
IQT125 IQT250
IQT500



F05/FA05
for size IQT125



F07/FA07
for sizes IQ125/250



F10/FA10
for sizes IQT125/250/500

Actuators:
IQT1000 IQT2000



F12/FA12
for size IQT1000



F14/FA14
for size IQT2000

3 Introduction

IQ *Pro* & IQT *Pro* range actuators are self contained, purpose designed and built for the local and remote electrical operation of valves. Comprising an electric motor, reduction gearing, reversing starter with local controls and indication, turns and torque limitation with electronic logic controls and monitoring facilities housed in a double-sealed watertight enclosure. Hazardous area certified enclosures meeting International and national requirements are also available.

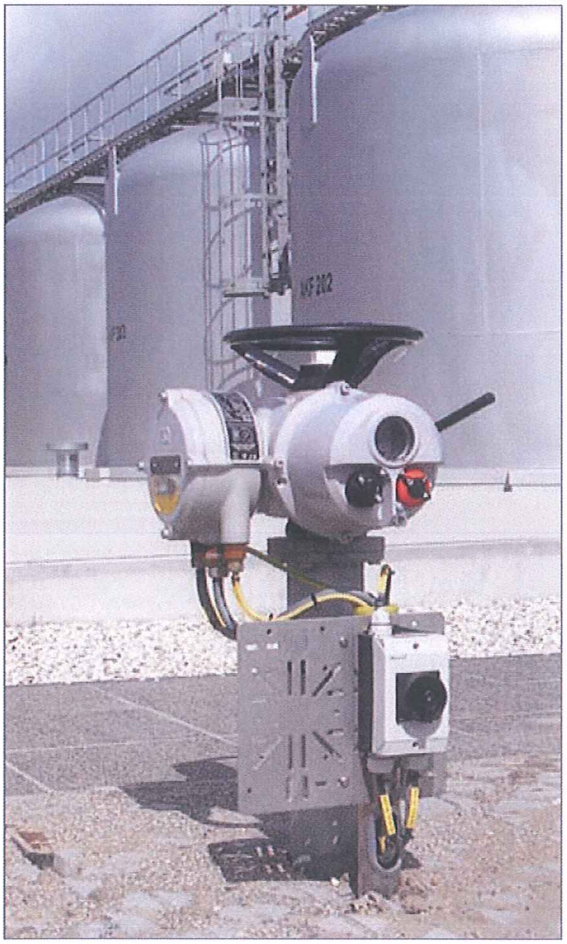
All torque, turns settings and configuration of the indication contacts are made using the non-intrusive, hand held, infra-red IQ *Pro* Setting Tool which is included with each order.

The specification detail in this section covers standard features and available optional features for the IQ *Pro* and IQT *Pro* range. Enclosure requirements and build options selected must be specified with enquiry.

The selection guideline in section 4 allows specifiers to identify suitable actuator types for particular valve and process applications, checking actuator type against other specification requirements.

The example enquiry datasheet opposite provides an outline of the basic information required for quotation. Where there is a project, framework or job specification applicable, Rotork will be pleased to analyse it in detail, in which case only valve details are required. The applicable actuator specification detail paragraph number is listed under the reference column for information.

It is not necessary to specify the actuator type, size or speed – Rotork will provide the most cost effective solution based on the information provided.



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Standard specifications

Page	Requirement	Options	Detail
32	**Valve type**	Part turn	Ball/butterfly / plug – or other (specify)
		Multi-turn	gate/globe / penstock/sluice or other (specify)
33	**Duty cycle**	Isolating	Starts / hour
		Regulating	Starts / hour
		Modulating	Starts / hour
22	**Operating time or turns**	Sec	Turns
22	**Seating Torque**	Nm	Lbs / ft
22	**Running torque (if known)**	Nm	Lbs / ft
22	**Thrust (multi turn only)**	kN	Lbsf
38	**Power supply**	1-phase	___Volts ___Hz
		3-phase	___Volts ___Hz
		DC	___Volts DC
38	**Failsafe**	No	
		Self contained	
		UPS or Battery	
34	**Enclosure**	Non-hazardous	IP / Nema rating
		Hazardous	Standard
39	**Local indication**	Position display plus text display	Language required
41	**Remote Control**	Contacts	Actuator powered / Control system powered
		Analogue	4-20mA other (specify)
		Digital bus-network	Type
41	**Remote Indication**	Volt free indication contacts	
		4-20mA position indication	
		Digital bus-network	

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4 Valve Type – Actuator Selection Guideline

Valve types are defined by the action required by the actuator for operation – multi turn, part turn or linear. The table below provides a guide to the actuators available and is determined by valve type, operating torque and duty requirement.

Actual selection may vary to those indicated below due to factors such as available power supply, mechanical interface, thrust requirements etc. Rotork will always offer the correct technical solution at the lowest cost for any application.

Valve Type	Duty*	Torque Min (Nm/lbsft)	Torque Max (Nm/lbsft)	Actuator Type	Comments
Multi-turn Gate valves	On-Off & Inching	13/10	3,000/2,200	IQ	General gate valves, penstock/sluice, Parallel slide, globe, choke
Multi-turn Gate valves	On-Off & Inching	100/135	43,000/32,000	IQ + IS or IB gearbox	General gate valves, penstock/sluice, Parallel slide globe, choke
Multi-turn Low turns – non thrust	On-Off & Inching	1,000Nm		IQ + MTW gearbox	Non-thrust applications such as cable operated river gates
Multi-turn Control valve	Modulating	13/10	544/400	IQM	Control valves such as globe/cage/choke
Multi-turn Control valve	Modulating	400	21,000/15,500	IQM + IB/IS gearbox	Control valves such as globe/cage/choke
Part turn	On-Off & Inching	50/37	2,000/1,500	IQT	General ¼ turn ball/ butterfly/damper
Part turn	On-Off & Inching	1,000/740	500,000/370,000	IQ + IW gearbox	General ¼ turn ball/ butterfly/damper
Part turn	Modulating	40	2,000	IQTM	¼ turn control valves ball,butterfly,damper
Part turn	Modulating	400	2100	IQM + MOW gearbox	¼ turn control valves ball,butterfly,damper
Linear	On-Off & Inching	Thrust 5.6kN/1260lbsf	Thrust 100kN/22,400lbsf	IQL	General gate valves, globe, choke
Linear	Modulating	Thrust 6.3kN/1428lbsf	Thrust 60kN/13,636lbsf	IQML	Control valves such as globe/choke/cage

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5 Design Specification

5.1 Duty Rating

Duty Classification*	Actuator Type	Rating
On-Off & Inching	IQ / IQS / IQD	Nominal 60 starts per hour, at a rate not exceeding 600 starts per hour. 15 minutes rated based on a nominal torque of 33% of rated
On-Off & Inching	IQT / IQTF	Nominal 60 starts at a rate not exceeding 600 starts per hour. 15 minutes rated based on a nominal torque of 75% of rated
Modulating	IQM	Nominal 1,200 starts per hour, 50% duty cycle based on a modulating torque of 50% of rated torque
Modulating	IQTM	Nominal 1,200 starts per hour, 50% duty cycled based on a modulating torque of 50% of rated torque

5.2 Design Life

Duty Classification*	Actuator Type	Size	Minimum Design Life Rating
On-Off & Inching	IQ / IQS / IQD	10 - 35	Torque and thrust test: 10,000 cycles (500,000 output turns) seating at rated torque, 33% rated torque through stroke
		40 - 95	Torque and thrust test: 5,000 cycles (250,000 output turns) seating at rated torque, 33% rated torque through stroke
Modulating	IQM	12-35	1,800,000 starts at load of 50% rated torque (1 start constitutes at least 1° movement)
On-Off & Inching	IQT / IQTF	All sizes	Torque test: 25,000 cycles seating at rated torque, 70% rated torque through stroke
Modulating	IQTM	All sizes	1,800,000 starts at load of 70% rated torque (1 start constitutes at least 1° movement)

Design life is a function of actuator torque and speed. Values quoted are the minimum requirements; for most sizes/speeds life will be extended above the values quoted. Actuators are stalled against a solid object 25 times to prove durability.
Contact Rotork for more information

5.3 Vibration, Shock and Noise

Standard IQ and IQT Range actuators are suitable for applications where vibration and shock severity does not exceed the following:

Type	Level
Plant induced vibration	1g rms total for all vibration within the frequency range of 10 to 1000Hz
Shock	5g peak acceleration
Seismic	2g acceleration over a frequency range of 1 to 50Hz if it is to operate during and after the event
Emitted noise	Independent tests have shown that at 1m generated noise does not exceed 61db(A)

Levels quoted are those present at the actuator mounting interface. It should be noted that the effects of vibration are cumulative and therefore an actuator subjected to significant levels may have a reduced lifespan. Where excessive plant induced vibration is anticipated, mounting the actuator remote from the valve and driving via extension shafting (incorporating vibration absorbing couplings) may provide a satisfactory solution.

5.4 Valve / Actuator Interface

The IQ *Pro* and IQT *Pro* range of actuators are available with mounting base and output drive couplings conforming to the following international standards:

Valve to actuator interface:

Valve type	Actuator Range	Area	Standard	Code
Multi-turn	IQ	International	ISO 5210	"F" metric
Multi-turn	IQ	USA	MSS SP-102	"FA" imperial
Part turn	IQT	International	ISO 5211	"F" metric
Part turn	IQT	USA	MSS SP-101	"FA" imperial

Applications for which the various types of couplings have been designed are outlined on pages 28/29.

5.5 Operating Temperature

Actuators are suitable for operation within the ambient temperature ranges shown below. Refer to Section 6 for Hazardous Area Certification operating temperature restrictions. For temperatures outside this range please contact Rotork. Prior to installation actuators should be stored in a dry location with a temperature range not exceeding -60° to 80°C (-76°F to 176°F).

Actuator Type	Standard Temperature*	Low temperature option*
IQ, IQM	-30°C to +70°C (-22°F to +158°F)	-50°C to +40°C (-58°F to +104°F)
IQS, IQD, IQH	-20°C to +70°C (-4°F to +158°F) only	NA
IQT / IQM / IQTF	-30°C to +70°C (-22°F to +158°F)	-50°C to +40°C (-58°F to +104°F)

*Hazardous Area certification determines permissable operating temperature range. Refer to 6.

6 Non-Hazardous & Hazardous Certified Enclosures

All IQ actuator hazardous and non-hazardous area enclosures are watertight to IP68/NEMA 4 & 6. Through the use of non-intrusive commissioning and adjustment using the supplied infra-red IQ Setting Tool, covers never need removing and therefore the hermetic, factory-sealed enclosure protects internal components for life. The terminal compartment is sealed from other areas by the Rotork double seal, maintaining watertight integrity even during site connection.

In addition, the IQ Setting Tool is certified Intrinsically Safe permitting power-on commissioning in hazardous areas.

Actuators are available with the following enclosure types for which the ambient working temperature ranges are stated. Where option temperatures are indicated, changes to some actuator components are required and therefore the temperature requirement must be specified. Hazardous area approvals for other country standards are available; please contact Rotork.

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Standard specifications

The IQ and IQT range are available built in accordance with the following standards:

6.1 Non-Hazardous Area Enclosures

WT: Standard Watertight

Standard	Rating	Standard temperature	Option 1	Option 2
IEC 60529 (1989-11)	IP68 – 7metres / 72 Hrs	-30°C to +70°C	-40°C to +70°C	-50°C to +40°C
BS EN 60529 (1992)	IP68 – 7metres / 72 Hrs	-30°C to +70°C	-40°C to +70°C	-50°C to +40°C
NEMA (US)	4 & 6	-22°F to +158°F	-40°F to +158°F	-58°F to +104°F
CSA (Canadian)	4 & 4X	-22°F to +158°F	-40°F to +158°F	-58°F to +104°F
Applicable actuator ranges and temperature limitations	ALL	IQS, IQD, IQH, IQT failsafe -20°C to +70°C only (-4°F to +158°F)		

6.2 Hazardous Area Enclosures

European Hazardous Area Directive - ATEX

Directive Code	Enclosure Code	Standard temperature	Temperature Option 1	Temperature Option 2	Temperature Option 3
ATEX II 2GD	**Exd IIB T4 Exd IIC T4**	-20°C to +70°C (-4°F to +158°F)	-30°C to +70°C (-22°F to +158°F)	-40°C to +70°C (-40°F to +158°F)	-50°C to +40°C (-58°F to +104°F)
ATEX II 2GD	**Exde IIB T4 Exde IIC T4**	-20°C to +70°C (-4°F to +158°F)	-30°C to +70°C (-22°F to +158°F)	-40°C to +70°C (-40°F to +158°F)	-50°C to +40°C (-58°F to +104°F)
Applicable actuator ranges and temperature limitations	ALL except IQT failsafe type 1	IQS, IQD, IQH, -20°C to +70°C (-4°F to +158°F) only			

International Hazardous Area - IECEx

	Enclosure Code	Standard temperature	Temperature Option 1	Temperature Option 2	Temperature Option 3
	Exd IIB T4 Exd IIC T4	-20°C to +60°C (-4°F to +140°F)	-30°C to +60°C (-22°F to +140°F)	-40°C to +60°C (-40°F to +140°F)	-50°C to +40°C (-58°F to +104°F)
	Exde IIB T4 Exde IIC T4	-20°C to +60°C (-4°F to +140°F)	-30°C to +60°C (-22°F to +140°F)	-40°C to +60°C (-40°F to +140°F)	-50°C to +40°C (-58°F to +104°F)
Applicable actuator ranges and temperature limitations	ALL except IQT failsafe type 1	IQS, IQD, IQH, -20°C to +60°C (-4°F to +140°F) only			

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6.2 Hazardous Area Enclosures cont.

USA Hazardous Area – Factory Mutual Certified Explosionproof to FM3615.

Class	Division	Groups	Standard temperature	Option 1	Option 2	Option 3
I II	1 1	C, D E, F, G	-22°F to +140°F (-30°C to +60°C)	-40°F to +40°F (-40°C to + 60°C)	-58°F to +104°F (-50°C to +40°C)	X
I II	1 1	B, C, D E, F, G	-22°F to +140°F (-30°C to +60°C)	-40°F to +40°F (-40°C to + 60°C)	-58°F to +104°F (-50°C to +40°C)	X
Applicable actuator ranges and temperature limitations		ALL except IQT failsafe type 1	IQS, IQD, IQH, -20°C to +60°C (-4°F to +140°F) only			

Canadian Hazardous Area – Canadian Standards Association (CSA EP) to C22.2 No 30-M

Class	Division	Groups	Standard temperature	Option 1	Option 2	Option 3
I II	1 1	C, D E, F, G	-22°F to +140°F (-30°C to +60°C)	-58°F to +104°F (-50°C to +40°C).	X	X
I II	1 1	B, C, D E, F, G	-22°F to +140°F (-30°C to +60°C)	-58°F to +104°F (-50°C to +40°C).	X	X
Applicable actuator ranges and temperature limitations		ALL except IQT failsafe type 1	IQS, IQD, IQH, -20°C to +60°C (-4°F to +140°F) only			

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IQ *Pro* Setting Tool Certification

Directive / Standard	Rating	Standard temperature
ATEX II 1G	**EExia IIC T4**	**-30°C to +50°C (-22°F to +122°F)**
FM3610	**Intrinsically Safe Class I, Div 1 groups A,B,C,D: T4**	**-30°C to +50°C (-22°F to +122°F)**
Canada CSA – C22.2 No.157-92	**Exia - Intrinsically Safe Class I, Div 1 groups A,B,C,D: T4**	**-30°C to +50°C (-22°F to +122°F)**

7 Regulatory Standards

Compliance with the following European Economic Community Directives permits the IQ *Pro* and IQT *Pro* range actuators to be CE marked under the provision of the Machinery Directive.

Directive	Applicable to	Reference
Electromagnetic compatibility (EMC)	**Immunity to/emissions of electromagnetic energy**	89/336/EEC as amended by 92/31/EEC
Low voltage (LV)	**Electrical Safety**	73/23/EEC amended by 93/68/EEC by the application of EN 60204-1 1993
Machinery*	**Product safety**	Actuators follow the provision of the Machinery Directive (89/392/EEC) as amended by 91/368/EEC and 93/44/EEC. The IQ must not be put into service until the equipment into which it is being incorporated has been declared to be in conformity with the provisions of the European Community Machinery Directive (89/392/EEC) 91/368/EEC and 93/44/EEC*
Waste Electrical Equipment (WEE)	**Exempt under the scope of the directive**	

***Actuators are not classified as machines within the scope of the machinery directive.**
Contact Rotork for a copy of our Declaration of Conformity and Incorporation

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8 Power, Control & Indication

8.1 Power Supplies

IQ and IQT actuators are suitable for operation with the following single, three phase - three wire and DC power supplies:

Supply voltage ranges – Actuator availability

Standard Voltages	Phase	IQ10 to IQ70 & IQ95	IQ90 & IQ91	IQM IQML	IQS	IQD10	IQD12 IQD18	IQD20 IQD25	IQT IQTM
24	DC	✗	✗	✗	✗	✔	✗	✗	✔
48	DC	✗	✗	✗	✗	✔	✔	✗	✗
110	DC	✗	✗	✗	✗	✔	✔	✔	✗
100,110,115,120	1	✗	✗	✗	✔	✗	✗	✗	✔
208,220,230,240	1	✗	✗	✗	✔	✗	✗	✗	✔
200,208,220,230,240	3	✔	✗**	✔**	✗	✗	✗	✗	✔*
380,400,415,440,460,480	3	✔	✔**	✔	✗	✗	✗	✗	✔*
500,550,575,590	3	✔	✔	✗	✗	✗	✗	✗	✔*
600,660,690	3	✔	✔	✗	✗	✗	✗	✗	✔*

Voltage tolerance	+/-10%	Applies for rated torque performance; duty cycle and speed is not guaranteed
Frequency tolerance	+/-5%	Applies for rated torque performance; duty cycle and speed is not guaranteed
Max. starting volt drop	-15%	Actuators capable of starting and running up to speed
Non standard tolerances	Larger volt drops / frequency variations than those quoted can be catered for but may affect actuator selection / sizing. Contact Rotork	
Uninterruptible Power Supply systems	For AC systems, UPS systems should conform to recognised supply standards such as EN60160 in respect of waveform, spikes, harmonics etc. The tolerances above should not be exceeded.	

*** IQT/IQTM ranges - 3 phase supplies**
The IQT utilises 2 phases only. A parking terminal for phase 3 is available for systems where all 3 phases are distributed. For multiple actuators, even diversity over all three phases should be considered.

**** Limited availability**
IQ91 not available at 380V 60Hz. IQ90 has limited availability at voltages up to 240V.
IQM/IQML35 not available at voltages below 380V.

Reference documents
For operating electrical consumption data refer to E130E (IQ ranges), E135E (IQT ranges) and E430E (IQM ranges) available to download at www.rotork.com

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8.2 Local Control, Indication & Set-up

Non-intrusive selectors are provided on the actuator electrical control cover which also includes a window showing actuator position, status and alarm display.

The control cover may be rotated through 360° (90° increments) to suit actuator orientation/operator access. Set-up is over an infra-red interface using the supplied setting tool.

Standard local controls

Operation	Type	Function	Comments
Control mode	Red, rotary selector	Selects "Local", "Stop" or "Remote" control	Can be padlocked in each position (stop remains available) for site operational protection
Local control	Black, rotary selector	Initiates local "Open" and "Close" operation	Spring return to centre neutral position. Local control may be user configured for inching action
Infra-red	IQ *Pro* Setting Tool	Initiates local "Open" and "Close" operation	May be user configured for I-R operation over a nominal distance of 0.5m (1.5')

Standard local indication

Operation	Type	Function	Comments
Position indication	LCD - Large character (16mm/0.6")	Open / close icons + 0-99% in 1% increments	Back-lit (power on) – operating temperature range -50°C to +70°C (-58°F to +158°F) Battery supported power off
Position indication	Coloured indication lights	Green (close), Red (open), Yellow (mid-travel)	Power-on lamp indication, colours can be reversed
Status and Alarm	LCD – text display 2 x 16 characters	Real time valve & actuator status and alarm text messages	Power on –battery supported (when awake) Multilingual-English plus 1 option: E, D, Fr, Ru. Single Chinese available (Mandarin).
Status and Alarm	General alarm icon Battery alarm Icon	Warning triangle Battery icon	Power on & off indication of active alarm Power on & off indication of low battery
Status and Alarm	Help screens	8 real time help screens (icon + text)	Complimentary to status / alarm text display

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8.2 Local Control, Indication & Set-up cont.

Actuator Set-Up, Configuration & Datalogging

Setting Tool LCD displays	Simple non-intrusive, interactive set-up procedure using supplied Infra red setting tool with read-back from LCD's. Settings include limits & torque switching, indication contacts and control options. Settings may be password protected. Setting tools are provided on a 1 for 10 actuators basis
PC/PDA	Using freeware IQ-Insight, actuators may be configured / analysed over IrDA™ interface
Datalogging	Standard onboard datalogger provides valve torque and starts profiles, operational statistics, events log. Actuator configuration & manufacturing data also available. Files can be downloaded direct to PC or to IQ *Pro* Setting Tool (IS certified) for transport to office PC. Freeware IQ Insight for PC is available to download at www.rotork.com

Options

Vandal resistant	**Option 1:** red/black control selectors not fitted	**Option 2:** red/black control selectors not fitted + lockable window cover	**Option 3:** Stainless steel lockable cover protects standard selectors and window

Reference documents
Refer to E170E3 (IQ *Pro*) / E175E3 (IQT *Pro*) for details of status and alarm text messages, alarm icons, help screens and actuator set up procedure. Refer to E117E for Setting Tool *Pro* / IQ insight details



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8.3 Remote Control & Indication

IQ *Pro* and IQT *Pro* range actuators enable remote control and indication of valves for centralised control. Actuator control and indication forms are available to meet the requirements of the various site control systems, from simple manual pushbutton control through to sophisticated distributed control systems ("DCS") using relay outputs or digital "bus" network systems.

Standard remote controls

Operation	Type	Range	Comments
Open/Close/Stop Common	Positive switched 3 x Opto-isolated inputs designed for fleeting or maintained contacts	20-60V AC/DC, 120V AC, 5mA per input (12mA at 120V AC)	Actuator derived - 24V DC (120V AC available as an option) or externally supplied derived from the control system. Various forms available
ESD Open interlock Close interlock Common	Positive switched 3 x Opto-isolated inputs designed for maintained contacts.	20-60V AC/DC, 120V AC, 5mA per input. (12mA at 120V AC)	ESD can be user configured open, stayput or close, from a NO or NC contact. ESD has priority over all other applied local or remote control signals. Interlocks provide hardwired "permissive" protection (ie. main and bypass control) and are active for local and remote or may be configured for remote signals only

Options

120V AC actuator derived supply	15VA rated	Actuator derived supply for remote control
125V DC remote control	20mA per input	Suitable for 125V DC remote control supply – positive switching
Negative switching	20-60V AC/DC, 120V AC - 5mA per input (12mA at 120V AC)	Suitable for Negative switched systems applies to Open, Stop, Close, ESD and Interlocks
Analogue control – Option Folomatic	0 to 5/10/20/mA or volt ranges	Proportional control over the whole or part of valve stroke. Configurable for open, close or stayput on loss of analogue signal
Hydraulic shock "water hammer"/surge protection – Option Interrupter timer	Internal control system	Pulsed operation with independently adjustable on and off time periods in the range 1-99 seconds can be selected to operate over any portion of the closing or opening valve stroke, effectively reducing valve speed.

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8.3 Remote Control & Indication cont.

Standard remote indication

Operation	Type	Range	Comments
Position, status and alarm indication	4 x Configurable volt free latching contacts - S1 to S4. Single pole -single throw (SPST), configurable NO or NC.	5mA to 5A, 120V AC, 30V DC	Independently configurable using the supplied IQ Setting Tool to signal one of the following: **Valve Position:** Fully open, fully closed or intermediate positions (0-99% open) **Status:** Valve opening, closing, moving, Local stop selected, local selected, remote selected, open or close interlock active, ESD active **Valve Alarms:** Torque tripped in mid travel, going open, going closed, valve jammed, handwheel operation **Actuator alarms:** Lost phase (3 phase IQ only), customer 24V dc (120V AC) supply lost, battery low, internal failure detected, thermostat tripped
Actuator availability	Monitor Relay - Non configurable relay - change over contact	5mA to 5A, 120V AC, 30V DC	The relay will de-energise when the actuator is un-available for remote control due to any one or more of the following conditions: Power supply or control supply lost; local control selected; local stop selected; motor thermostat tripped; detected internal failure

Options

Operation	Type	Range	Comments
Position, status and alarm indication	4 x Configurable volt free latching contacts – S5 to S8. Single pole – change over (SPCO)	5mA to 5A, 120V AC, 30V DC	Independently configurable using the supplied IQ Setting as per contacts S1 to S4 above
Analogue position feedback	Current position transmitter - CPT	4-20mA output proportional to position	Auto range to set limits. Normally internally powered, available suitable for externally "loop" powered (will default to 4mA when actuator is powered down).
Analogue torque feedback	Current torque transmitter - CTT	4-20mA output proportional to output torque	Range 0% to 120% of rated torque (4 to 20mA)
Auxiliary power supply	Maintains power to the actuator control on loss of mains	Nominal 24V DC, 1A (switching inrush 8A max)	Customer supply maintains backlit display, CPT analogue indication and bus network communications during actuator power outages. Customer supply is isolated from internal control power for protection

Reference documents
Refer to E120E - IQ Control and Monitoring

8.4 Fieldbus System Control Options

IQ *Pro* and IQT *Pro* range actuators are available with the following network interface cards to enable remote control and indication using digital "bus" network systems communication to the control systems ("DCS").

Standard remote controls

Network Type	Comments
Pakscan	An internally mounted Pakscan field unit for remote control and status indication over a fault tolerant two wire serial link. Loop distances of up to 20 km without repeaters and host communications using Modbus protocol. System variables programmable over the infra-red data link. For more information please refer to publication S000E
Modbus	Modbus modules suitable for single or dual communication highways may be included in the IQ and IQT actuator, to provide Fieldbus communication of all the actuator control functions and feedback data. Data is carried on an RS485 data highway and the communications protocol used is Modbus RTU. System variables such as unit address and data baud rate are programmed over the infra-red data link. For more information please refer to publication S117E
Profibus	A Profibus DP interface module is available to allow the actuator to be integrated into a Profibus network. Full compatibility with EN 50170 is provided and the Profibus network allows full actuator control and feedback of data to the host. For more information please refer to publication S113E
Foundation Fieldbus	An IEC 61158-2 compliant Foundation interface module allows the actuator to be connected to a Foundation network. The device has link scheduler capability as well as digital and analogue function block capability. Foundation Fieldbus actuators can communicate directly between themselves without the need of a host supervisory system. For more information please refer to publication S114E
DeviceNet	The ODVA certified DeviceNet interface module, with full status data feedback and actuator digital and analogue control, connects directly to the popular DeviceNet data highway. Data feedback includes both torque and high accuracy position information, while the inbuilt positioner allows for full modulating control. Up to 63 IQ actuators can be connected on a single DeviceNet highway. For further information refer to publication S116E

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8.5 Functional Safety - Safety Integrity Level Applications

IQ *Pro* and IQT *Pro* are TÜV certified for applications requiring functional safety to SIL 2 (or SIL 3 with a 1oo2 valve actuator configuration) as per standard IEC61508 with the addition of the Safety Function Control Module (SFCM) option.

Safety Function	Available actuator ranges	Power supply	Base wiring diagram	Plus 4-20mA analogue position indication
Stayput	IQ (3-phase only) IQT / IQTF IQTM	3-phase 1, 3-phase & DC 1, 3-phase & DC	3000S000 6000S000 7000S000	3000S000 6000S000 7000S000
ESD	IQ (3-phase only)	3 phase	3000S000	3000S000

Restrictions
No other actuator types or control / indication options are available within the scope of the TÜV approval certificate. To achieve the requirements under which approval by TÜV was granted, actuators must be installed, commissioned, operated and maintained in accordance with the safety manual E173E3.

Reference documents
IQ *Pro* -Option SFCM Actuator Safety Manual - publication E173E3

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Standard specifications

9 Protection & Operating Features

The IQ *Pro* and IQT *Pro* control system incorporates the following standard operating features and comprehensive valve, actuator and control protection to ensure reliable valve operation and protection under all circumstances.

Fault / Feature	Cause / Operation	Function
Obstructed valve	Valve meets an obstruction or process conditions that prevent movement. Obstruction must be sensed and operation prevented to prevent damage to valve and actuator	**Independent Settable Open and Close Torque Switches** Torque switch will "torque trip" the actuator motor when the preset output torque level is reached. Torque switches can be set in the range 40% to 100% of rated torque. Torque trips are indicated on the actuator display and can be remotely signalled
Jammed valve	Seated valve is stuck in its seat - often after long periods of inactivity	**Jammed Valve Protection** The motor is de-energized if no output movement occurs after a (nominal) 3 seconds from receipt of a signal to open or close. This prevents the actuator motor stalling for long periods and possible burn out. Torque trips are indicated on the actuator display and can be remotely signalled
Torque switch bypass	Provides increased torque above actuator rated for unseating sticky valves	**Torque Switch By-pass** User selectable – secondary setting "At". Torque switches are automatically bypassed during the first 5% of travel from both open and close limit positions. This permits torque above actuator rated torque and up to actuator stall torque (1.4 to 2.4 times rated torque) to be developed during unseating, ensuring "sticky" valves do not cause unwanted torque trips. Refer also to Jammed Valve Protection
Torque switch hammer	Actuator repeatedly tries to move an obstructed valve in response to a standing control signal. This can cause damage to both valve and actuator	**Anti Hammer Protection** Once a torque trip occurs the control prevents repeated operation in the same direction as a response to a standing remote or local control signal. Actuator must be operated in the opposite direction and therefore moved away from the obstruction, which then has chance to clear, before it can be signalled to run in the requested direction. Torque trips are indicated on the actuator display and can be remotely signalled
Incorrect phase rotation (3 phase actuators only)	Due to 3-phase supply wiring incorrectly connected to actuator. Actuator moves in the opposite direction to that signalled. At end of travel the wrong limit/torque switch is activated preventing the motor being de-energised and causing it to stall with consequent valve damage and/or motor burn out.	**Syncrophase™** Protection ensures actuator always runs in the correct direction corresponding to the applied control signal (open or close). The patented circuit senses connected phase rotation and ensures the actuator always runs in the correct direction by energising the appropriate motor control contactors/switches
Lost Phase / Motor overheating (3 phase actuators only)	"single phasing" one of the 3 phases applied to the actuator is lost due to fault causing the motor to single phase i.e. attempts to run with only 2 of the 3 phases applied. Motor may fail to start (stall) or run unbalanced causing overheating and possible burnout	**Syncrophase™** The patented circuit monitors all three supply phases. If a phase is lost the Syncrophase circuit prevents the motor from being energised. If during operation one phase is lost this cannot be detected due to back-feed through the motor windings, however once operation stops, re-energising of the motor will be prevented. Lost phase is indicated on the actuator display and can be remotely signalled
Motor overheating	Actuator duty cycle is exceeded causing the motor to overheat. This often occurs during factory acceptance testing /commissioning or during process start up	**Motor Thermostat Protection** Two thermostats are embedded in the motor end windings (hottest part of the motor) which directly sense motor temperature. Thermostats will open circuit when set temperature is reached causing the motor to be de-energised. Thermostats will auto-reset once the motor has cooled sufficiently allowing operation to continue. Motor Thermostat trips are indicated on the actuator display and can be remotely signalled

Fault / Feature	Cause / Operation	Function
Instantaneous reversal	Control system instantaneously reverses the control signal which causes the actuator to reverse direction with associated inertial stress to valve drive and internal motor switching surges	**Instantaneous Reversal Protection** A delay of 300ms is automatically applied between reversals allowing the actuator to come to rest before responding to reverse control signal
Actuator fault	Control system instantaneously	**ASTD (automatic self test & diagnosis)** ASTD detects any internal control system failures preventing operation. Detected internal control system faults are indicated on the actuator display allowing rapid diagnosis and can be remotely signalled. In addition help screens can be accessed allowing problem to be pin-pointed
Remote control circuit failure (actuator derived remote control supply only)	Loss of remote control	The 24V DC internal power supply made available for remote control switching is protected by an auto-reset fuse device. Should the power drawn from the supply exceed its rating (due to a remote control wiring fault, etc.), the fuse will disconnect the supply. Once the fault is cleared the supply will automatically be reinstated. Loss of internal supply is indicated on the actuator display and can be remotely signalled
Spurious operation	Operation commanded due to unintended or spurious remote control signals leading to process problems or hazards	**Conditional Control** User selectable – secondary settings A8 and A9. The interlock input can be configured for "conditional control", being active only for remote control. In this mode, for the actuator to respond to a remote control signal, two signals must be applied simultaneously, one to the control input and one to the interlock input. If an unintended or spurious signal is applied only to the control input it will be ignored. Intended signals can therefore be verified by applying a second "permissive" signal, effectively preventing spurious operation. In addition the TÜV approved SFCM option is available for SIL 2 applications requiring safety function "stayput". Refer to E173E3.
Emergency Shut Down ESD	Priority action where the valve is required to stayput or move to a safe end of travel position determined by the process (open or closed limit)	**Dedicated ESD Control Input** User configurable secondary settings A1 to A5 ESD action has priority over any existing or applied local or remote control signal. ESD can be configured to open, close or stayput depending on the process requirements. It must be derived from a stayput type, normally open or normally close ESD contact (configurable) and may be configured to override local stop, interlocks or interrupter timer. For IQ 3-phase units only, the TÜV approved SFCM option is available for SIL 2 applications requiring safety function "ESD". Refer to E173E3.

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10 Components

Details of major actuator mechanical and electrical/electronic components are provided below.

10.1 Handwheel

A handwheel is provided to allow manual operation of the valve during electrical power interruption. Handwheel size and mechanical advantage are generally designed in accordance with standards EN 12570 and AWWA C540 (American Water Works Association) to give the most efficient compromise of force and turns for emergency operation.

Handwheel turns:

Actuator Range	Actuator Size	Standard Ratio / Turns	Option 1	Option 2
IQ *Pro*	IQ10, IQ12, IQ18	1:1 (Direct)	12:1	✗
IQ *Pro*	IQ20, IQ25	1:1 (Direct)	13.5:1	✗
IQ *Pro*	IQ35	1:1 (Direct)	22.5:1	✗
IQ *Pro*	IQ40	1:1 (Direct)	15:1	30:1
IQ *Pro*	IQ70, IQ91	15:1	30:1	✗
IQ *Pro*	IQ90, IQ95	15:1	45:1	✗
IQT *Pro*	IQT125, IQT250, IQT500	80 turns/90°	✗	✗
IQT *Pro*	IQT1000, IQT2000	86 turns/90°	✗	✗

During electric operation of the actuator, the handwheel is mechanically disengaged from the drive. To engage handwheel operation, the hand/auto selection lever is pushed down and released after which handwheel operation remains selected. When electrical operation takes place the actuator will automatically return to motor drive without lever or handwheel kickback.

The hand/auto selection lever incorporates a facility for locking in the hand or auto positions using a 6mm diameter hasp padlock (not supplied by Rotork), preventing engagement of motor drive (locked in hand) or engagement of handwheel drive (locked in auto). Emergency disengagement of motor drive can be selected by pushing down and holding the hand/auto lever during electric operation.



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10.2 Lubrication

IQ and IQT actuators are factory filled for life with premium quality gear oil selected for the application. Standard oils are automotive grades easily available worldwide and have been used successfully for over 40 years. Oil lubrication out-performs grease over a wide temperature range and allows installation in any orientation. It has none of the problems associated with grease such as separation at elevated temperatures and "tunnelling" at lower temperatures where grease is thrown away from rotating components creating a void or tunnel in the grease around components that require lubrication.

Lubrication

Range	Standard Oil	Standard Temp range	Option Low temp -50°C to +40°C (-58°F to +104°F).	Option Food Grade -10°C to +70°C (-14°F to +158°F).
IQ *Pro*	SAE80EP	-30°C to +70°C (-22°F to +158°F).	MOBIL SHC624	Hydra Lube GB Heavy
IQT *Pro*	TEXACO 9330 +25% Kerosene	-30°C to +70°C (-22°F to +158°F).	TEXACO 9330 +75% BP SHF LT15	Hydra Lube GB Medium

Food grade
Lubricant is a synthetic, non-aromatic hydrocarbon mixture with PTFE and other additives. It does not contain chlorinated solvents. Food grade grease used in assembly and thrust bearings is Hydra Lube WIG Medium-NLGI-123.

10.3 Finish

All IQ and IQT actuator finishes are tested in accordance with Rotork 1,000 hour Cyclic salt spray test procedure which is the most realistic and arduous test cycle applicable. The test combines cyclic salt spray, drying and humidity at elevated temperatures on complete factory built actuators. This tests the finish and the various substrate materials, fixings and interfaces that make up an actuator. Substrate materials and finishes are selected to provide maximum corrosion resistance combined with good adhesion. For full specification of paint finishes refer to publication E151E.

Finish

Range	Size	Standard Finish	Offshore finish
IQ *Pro*	IQ10 to IQ35	polyester powder coating, silver grey	2 pack epoxy coatings
IQ *Pro*	IQ40 to IQ95	Air-dried urethane reinforced synthetic alkyd. silver grey	2 pack epoxy coatings
IQT *Pro*	IQT125 to IQT2000	polyester powder coating, silver grey	2 pack epoxy coatings

Project specific finishes / colours can be catered for. Apply to Rotork.

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10.4 Motor

IQ *Pro* and IQT *Pro* actuators utilise purpose designed motors integral to the actuator. As such motors do not fall within the scope of IEC 60034- MG1, however do meet the applicable requirements, where pertinent, to motor design for actuator operation.

Actuator Type	Duty Classification	Comments
IQ	On-Off & Inching	Class F insulated, 3-phase squirrel cage motor incorporating thermostat protection. Low inertia design. Nominal 60 Starts per hour at a rate not exceeding 200 starts per hour, 15 minutes rated based on a nominal torque of 33% of rated. Class H available as an option where hazardous area certification does not limit temperature rise to "T4" 135°C.
IQS	On-Off & Inching	Class F insulated, single phase capacitor / run start squirrel cage motor incorporating thermostat protection. Low inertia design. Nominal 60 Starts at a rate not exceeding 200 starts per hour per hour, 15 minutes rated based on a nominal torque of 33% of rated. Class H available as an option where hazardous area certification does not limit temperature rise to "T4" 135°C.
IQD	On-Off & Inching	Class F insulated, permanent DC brush motor incorporating permanent magnet DC brush motor incorporating thermostat protection. Nominal 60 Starts per hour at a rate not exceeding 200 starts per hour, 15 minutes rated based on a nominal torque of 33% of rated.
IQM	Modulating	Class F insulated, 3-phase squirrel cage motor incorporating thermostat protection. User selectable thyristor controlled dynamic braking available. Low inertia design. 1,200 starts per hour, 50% duty cycled based on a modulating torque of 50% of rated torque. Class H available as an option where hazardous area certification does not limit temperature rise to "T4" 135°C.
IQT / IQTF	On-Off & Inching	Permanent magnet 24V DC motor (DC supply derived internally from 3 and single phase supplies) incorporating thermostat protection. Low inertia design. Nominal 60 Starts at a rate not exceeding 200 starts per hour, 15 minutes rated based on a nominal torque of 75% of rated.
IQTM	Modulating	Permanent magnet 24V DC motor (DC supply derived internally from 3 and single phase supplies) incorporating thermostat protection. Low inertia design. Nominal 1,200 starts per hour, 50% duty cycled based on a modulating torque of 50% of rated torque.

Reference documents
IQ / IQS / IQD Motor data publication E130E
IQM / Motor data publication E430E
IQT / IQTF / IQTM Motor data publication E135E

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10.5 Power Module

The power module for IQ *Pro* and IQT *Pro* actuators produces internal power supplies for control systems and remote control derived from the actuator electrical supply. It also contains the motor control and switching components.

Actuator Type	Internal power supplies	Motor switching
IQ	Split bobbin transformer producing control circuits, option card supplies and supply for 24V DC actuator fed remote control (120V AC option).	Reversing contactor assembly, mechanically and electrically interlocked. 24V DC coil up to and including size IQ35 and 120V AC for IQ40 and above.
IQD	DC-DC converter isolates the DC actuator supply from internal supplies for control and 24V DC supply for actuator fed remote control. Fuse protected. Incorporates sleep circuit for power reduction when used on solar powered derived DC supplies.	Reversing contactor assembly, mechanically and electrically interlocked. 24V DC coil supply.
IQS	Split bobbin transformer producing control circuits, option card supplies and supply for 24V DC actuator fed remote control (120V AC option). Fuse protected.	Solid state thyristor array for motor switching / reversal and capacitor starting. Includes snubber protection and timing control.
IQM	Split bobbin transformer producing control circuits, option card supplies and supply for 24V DC actuator fed remote control. Fuse protected.	Solid state thyristor array for motor switching / reversal and braking (user selectable). Includes snubber protection and timing control.
IQT / IQTF / IQTM	Split bobbin transformer producing control circuits, option card supplies and supply for 24V DC actuator fed remote control (120V AC option). Fuse protected.	Torroidal power transformer / rectifier deriving DC motor power supply from AC actuator supply - fuse protected. Solid state motor switching incorporating motor speed control.
IQT / IQTF / IQTM 24V DC actuator power supply only	DC-DC converter isolates the DC actuator supply from internal supplies for control and 24V DC supply for actuator fed remote control. Fuse protected.	Rectifier and fuse protection ensures correct polarity and protection of supply. Solid state motor switching incorporating motor speed control.

10.6 Torque Sensor

State of the art piezo thrust sensor measures motor shaft thrust produced as a reaction to output torque developed in the motor worm and wheel gear assembly. Thrust measured is directly proportional to output torque. The piezo sensor develops a voltage proportional to shaft thrust (output torque) which is amplified and then measured by the control module. Output torque is controlled by switching the motor off when the set torque limits have been reached. This system allows the torque to be displayed via the LCD display and captured by the datalogger in the form of valve torque profiles, statistical torque information and the event log.

10.7 Position Sensor

Contact-less hall effect sensors measure actuator output shaft angular rotation to a resolution of 7.5° (15° max for reversal). Sensors are direction sensitive producing a phased digital pulse width modulated signal. The control module counts the pulses and compares these to the set limit range. Precise position control is then available for limit switching, position indication and data logging. The position sensor is very simple with only one moving component and has a proven, reliable track record in use with IQ actuators for over 15 years.

10.8 Control Module

The control module for IQ *Pro* and IQT *Pro* actuators is common and takes the form of a PCB with on-board liquid crystal displays (LCD) For IQM and IQTM actuators the control module incorporates "fast remote" control components (24V DC remote control only) allowing rapid actuator switching down to 20 ms pulses for precise positioning.

Logic controlled, the control module is programmed over the non-intrusive Infra-red interface with set-up configuration for torque, limits indication and control features undertaken using the supplied IQ *Pro* Setting tool. It monitors local and remote control signals, torque and position to switch the actuator motor in the correct direction or off.

Standard control features are shown below:

Feature	Type	Specification
Remote control	Input	User switched Open/Close/Stop/ESD and interlock signals. Opto-isolated inputs for protection.
Local control	Input	Open/Close/Stop and Local/Remote selection. Non intrusive control switches are magnetically operated so there is no penetration of covers.
Position IQ *Pro* range	Input	Digital signal derived by position sensor. Resolution to 7.5° of output rotation. Limit range configurable between 2.5 and 100,000 output turns.
Position IQT *Pro* range	Input	Digital signal derived by position sensor. Angular resolution to 0.1° Minimum Limit setting range is 10°. Maximum range will be limited by mechanical stops (nominally 95°). The IQTF actuator limits can be configured up to 50 turns nominal. Position sensing is battery backed up for operation when the main electrical supply to the actuator is switched off. Power off local and remote (contacts S1 – S4) position indication and updating is enabled using a standard battery located in a separate compartment.
Torque - IQ *Pro*	Input	The piezo thrust sensor directly measures output torque and converts value to a voltage signal. Torque can be set in the range 40% to 100% of rated torque with the additional facility to bypass torque switching
Torque - IQT *Pro*	Input	Torque signal derived from DC motor current which is directly proportional to torque. Torque can be set in the range 40% to 100% of rated torque with the additional facility to bypass torque switching
Set-up	Input	Set-up over the Infra red interface allows all settings to be configured for valve and process requirements. Set-up is non-intrusive requiring no covers be removed using the supplied IQ Pro Setting Tool. All settings can be password protected.
Indication contacts	Output	Four volt free contacts S1 to S4 can be configured for a variety of position, status and alarm indication for remote indication and monitoring
LCD Indication	Output	The on board backlit LCD display presents position, torque and set up displays for configuration. The LCD display is divided into 2 parts providing a large position indication (Open/Close icons plus % readout in 1% increments for mid travel) and a multilingual text display providing status, alarm and set up information.
Datalogger	Output	The control module includes a datalogger which stores torque, position and operational data in non volatile memory for download via IrDA™ to the supplied setting tool or notebook PC. Data is date/time stamped. Datalogger can be analysed using freeware IQ insight for PC.
Memory	System	All configured settings are stored in non volatile EEPROM memory (does not require power).
Micro-controller	System	Provides all control function logic, set up programming and allied system requirements. Software is field upgradeable for future enhancements. The micro-controller is widely used in the automotive industry with a long track record and a very reliable history.

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10.9 Conduit / Cable Entries

IQ *Pro* and IQT *Pro* gearcases are machined with conduit/ cable entries as indicated below. Unless otherwise specified IQ *Pro* range actuators are despatched with adapter 1 fitted into the gearcase entry. Unless otherwise specified IQT *Pro* range actuators are despatched with no adapters fitted. Alternative adapters are available. Number of entries required and adapter type must be specified with order.

Actuator Type	Gearcase Entries	Adapter 1	Adaptor 2
IQ *Pro*	1 x 1.5" plus 2 x 1" ASA NPT	1 x M40 plus 2 x M25	1 x PG29 and 2 x PG16
IQ *Pro* option	Additional 1 x 1"	Additional 1 x M25	Additional 1 x PG16
IQT *Pro*	2 x M25	2 x ASA NPT 1"	2 x PG16
IQT *Pro* option*	Additional 2 x M25	Additional 2 x ASA NPT 1"	Additional 2 x PG16

IQ *Pro* and IQT *Pro* actuators are despatched with transit plugs fitted into the conduit entries. It is the responsibility of the installer to ensure the appropriate cable/conduit adapters, cable glands and/or blanking plugs are fitted in order to maintain hazardous area certification and ingress protection levels. Certified adapters and blanking plugs are available as optional extras.

* IQT *Pro* actuators supplied with Pakscan, FieldBus, ProfiBus, ModBus or DeviceNet interface option cards will be supplied with the optional entries provided (4 entries in total).

10.10 Terminals

The terminal compartment for IQ *Pro* and IQT *Pro* actuators takes the form of a separately sealed compartment containing segregated metric thread M5 power and M4 control terminals. Terminal screws and washers are supplied with the actuator. Terminals are designed to accept ring tag crimped field wiring conductors up to 16mm² for power and 4mm² for control/indication. The terminal compartment cover carries a terminal identification code card. Each actuator is despatched with the applicable Installation and Maintenance Manual, actuator wiring diagram and remote control connection schematic.

10.11 Wiring

IQ *Pro* and IQT *Pro* actuators utilise jig built wiring harnesses of individually numbered, tropical grade PVC insulated, stranded conductors. All internal control connections to the printed circuit boards use unique or polarised plugs and sockets.

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10.12 Battery

When power to the actuator is isolated, all settings are retained in an EEPROM. In the event of manual operation of the valve during isolation or loss of the power supply a battery provides power to the position-sensor and control module to update the valve position. The battery also powers the LCD display, without backlighting, and the four latching contacts S1-S4 while the power to the actuator is not available. Infra-red set up is also available with main power off.

Based on experience gained over 15 years of typical applications, the expected battery life is around 5 years. Battery life is however subject to temperature and at elevated temperatures may be reduced. Actuators can operate perfectly well without a battery, however if operated by handwheel without power the control module cannot update with the new position when power is restored. Limits should therefore be reset.

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Controls

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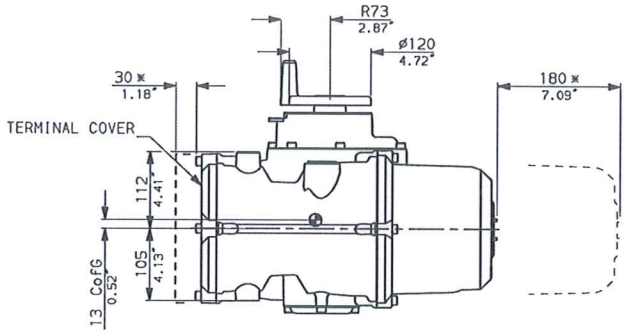
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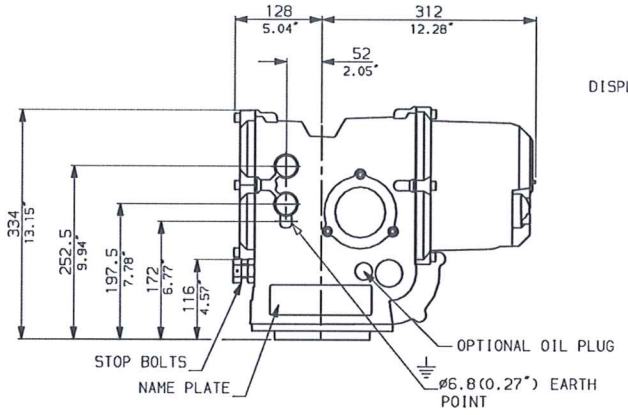
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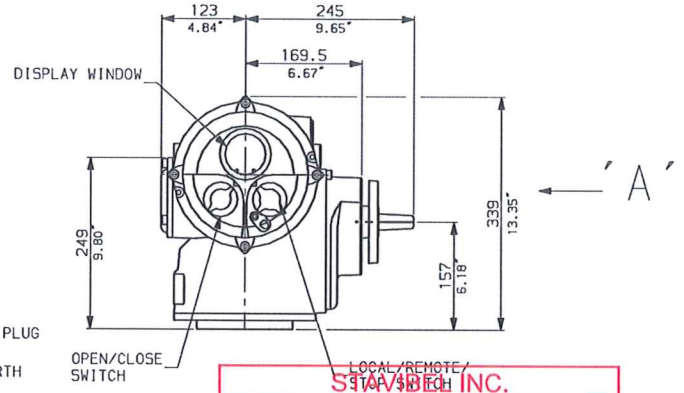
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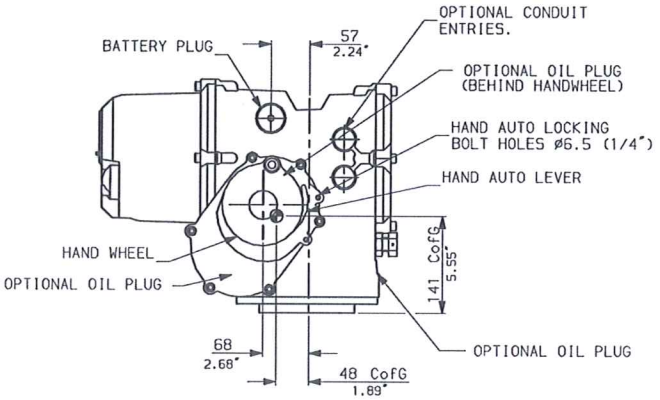
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IQT1000 & 2000 ACTUATORS









VIEW ON ARROW 'A'

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NOTES:
:REGISTERED DESIGN 000034863

:F12/FA12 /F14/FA14 BASE OPTION IS DETAILED TO SUIT THE RELEVENT COUPLING ARRANGEMENTS.

CONDUIT ENTRIES



TAPPED 2xM25x1.5p
(OPTIONAL ADAPTORS FOR M20,1/2",3/4",1"NPT,1 1/4",1 1/2", PG16 & PG21).

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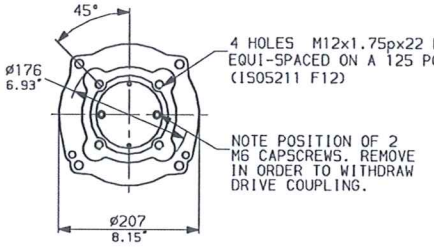
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Date 180905 Scale 1:10

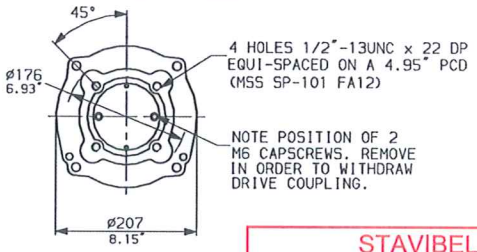
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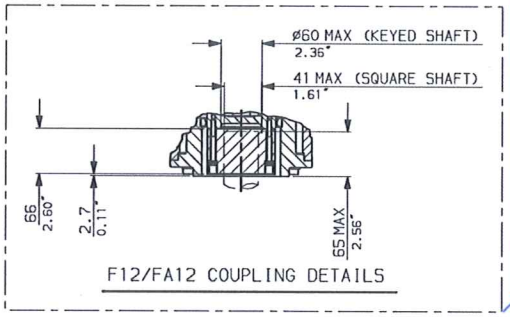
F12 / FA12 BASES

F12 BASE DETAILS



FA12 BASE DETAILS





F12/FA12 COUPLING DETAILS

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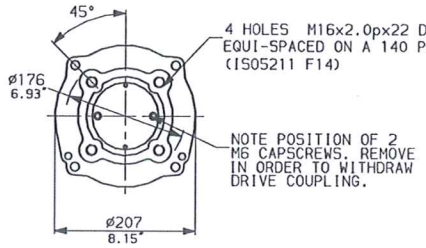
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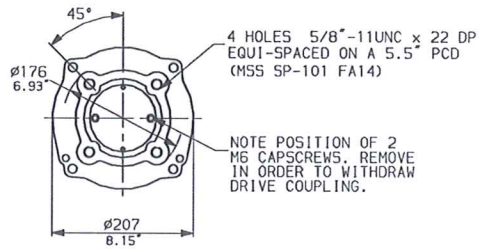
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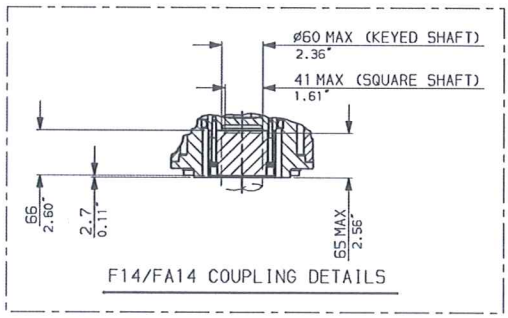
F14 / FA14 BASES

F14 BASE DETAILS



FA14 BASE DETAILS





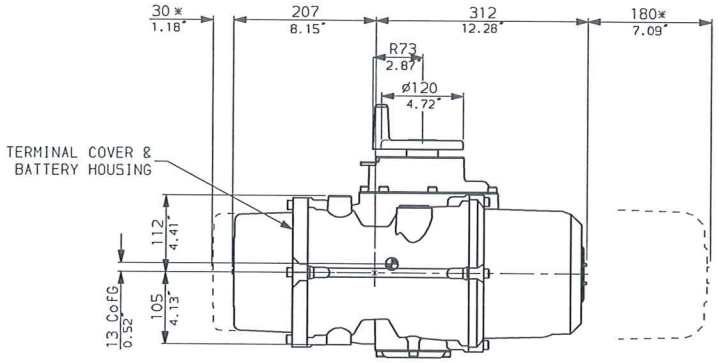
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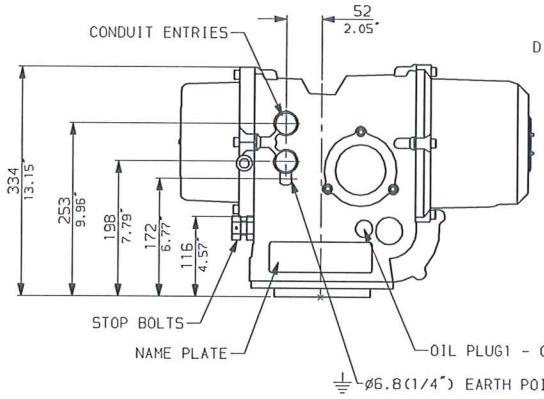
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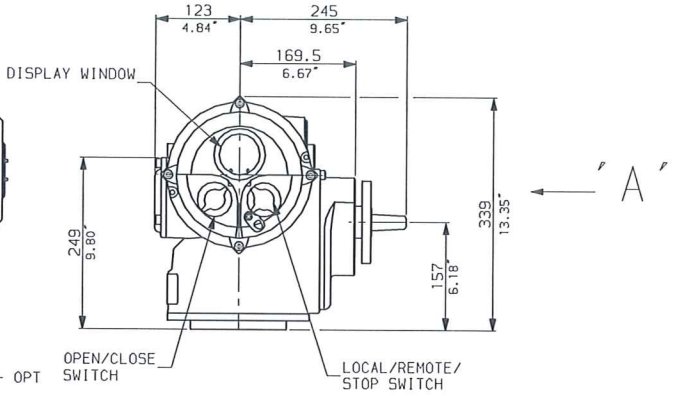
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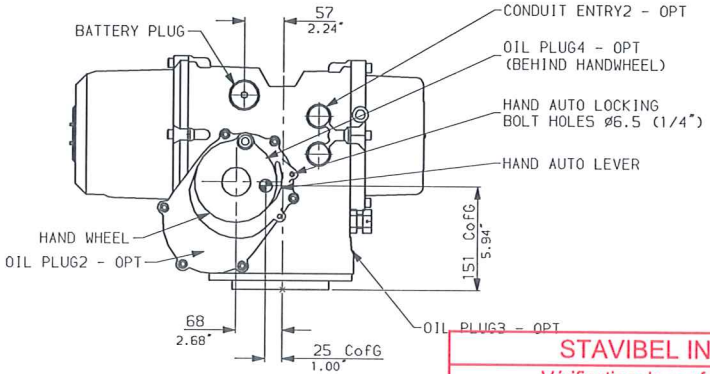
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IQT1000 & 2000 ACTUATORS
WITH FAILSAFE OPTION









VIEW ON ARROW 'A'

CONDUIT ENTRIES



TAPPED 2xM25x1.5p
(OPTIONAL ADAPTORS FOR
M20,1/2",3/4",1"NPT,1 1/4",1 1/2",
PG16 & PG21).

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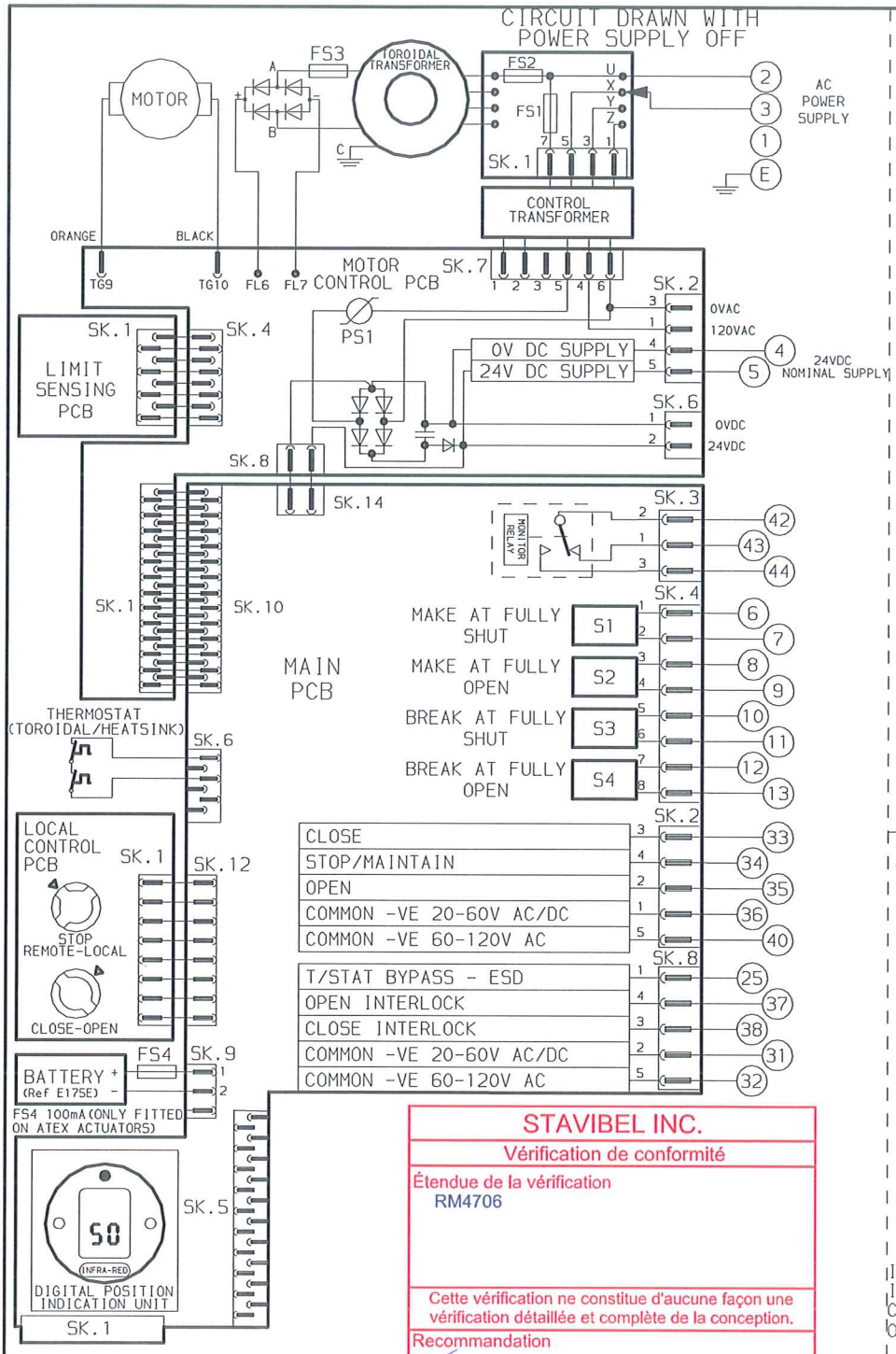
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IQT1000,2000 FS DATA
Date 180905 Scale 1:10

IQT2FS-2 A4



FOR TYPICAL REMOTE CONTROL DETAILS SEE DOCUMENT
RWS300

TRANSFORMER TAPPING OPTIONS

TYPE 1

TAP	NOM	RANGE
X	100	80-120
Y	110	88-132
Z	120	96-144
FS1-250mA A/S FS2-5A A/S		

TYPE 2

TAP	NOM	RANGE
X	200	160-240
Y	230	184-276
Z	270	216-324
FS1-150mA A/S FS2-2.5A A/S		

TYPE 3

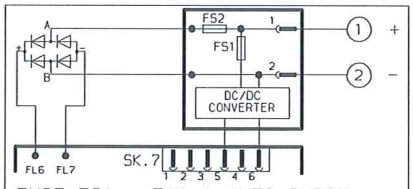
TAP	NOM	RANGE
X	380	304-456
Y	400	320-480
Z	415	332-498
FS1-100mA A/S FS2-1.5A A/S		

TYPE 4

TAP	NOM	RANGE
X	480	384-576
Y	575	460-690
Z	690	552-828
FS1-50mA A/S FS2-1.6A F/A		

TRANSFORMER TYPES 1,2,3 & 4 -
FUSE FS3 - 20A ATO FAST ACTING

TYPE 5 24VDC



FUSE FS1 - 500mA ANTI-SURGE
FUSE FS2 - 20A ATO FAST ACTING

ALL TRANSFORMER TYPES -
PS1 SELF RESETTING FUSE

NOTE

REFER TO PUBLICATION E175E FOR APPROVED FUSES FS1, FS2 AND FS3.

MAX EXTERNAL LOAD ON TERMINALS 4 & 5 TO BE 5W.

CONTROL SIGNAL THRESHOLD VOLTAGES
TO BE MINIMUM 'ON' 20V AC/DC
MAXIMUM 'OFF'= 3V
MINIMUM CONTROL SIGNAL DURATION
TO BE 300mS.

CURRENT DRAWN FROM EACH REMOTE CONTROL SIGNAL IS 5mA ON 24V DC OR 12mA ON 120V AC

WIRES ARE IDENTIFIED AT EACH END BY TERMINAL No. OR TAG No.

INDICATION CONTACTS S1-S4 ARE SHOWN IN THEIR DEFAULT CONFIGURATION. CONTACTS MAY BE CONFIGURED FOR ANY OF THE FUNCTIONS DESCRIBED IN E175E

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No	DATE	REVISION DETAILS
02	090903 P.J.W	MTR CONNECTION NOTE REMOVED CHECKED T.H

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BATH, BA1 3JQ
ENGLAND
Tel:01225-733200

ROTORK CONTROLS INC
ROCHESTER
NY 14624, USA
Tel:585-328-1550

CONFIG BY PJW
DATE 160703
CHECKED TH
BASE WD 6000-000
JOB No -
M.I.No -

IQT BASIC

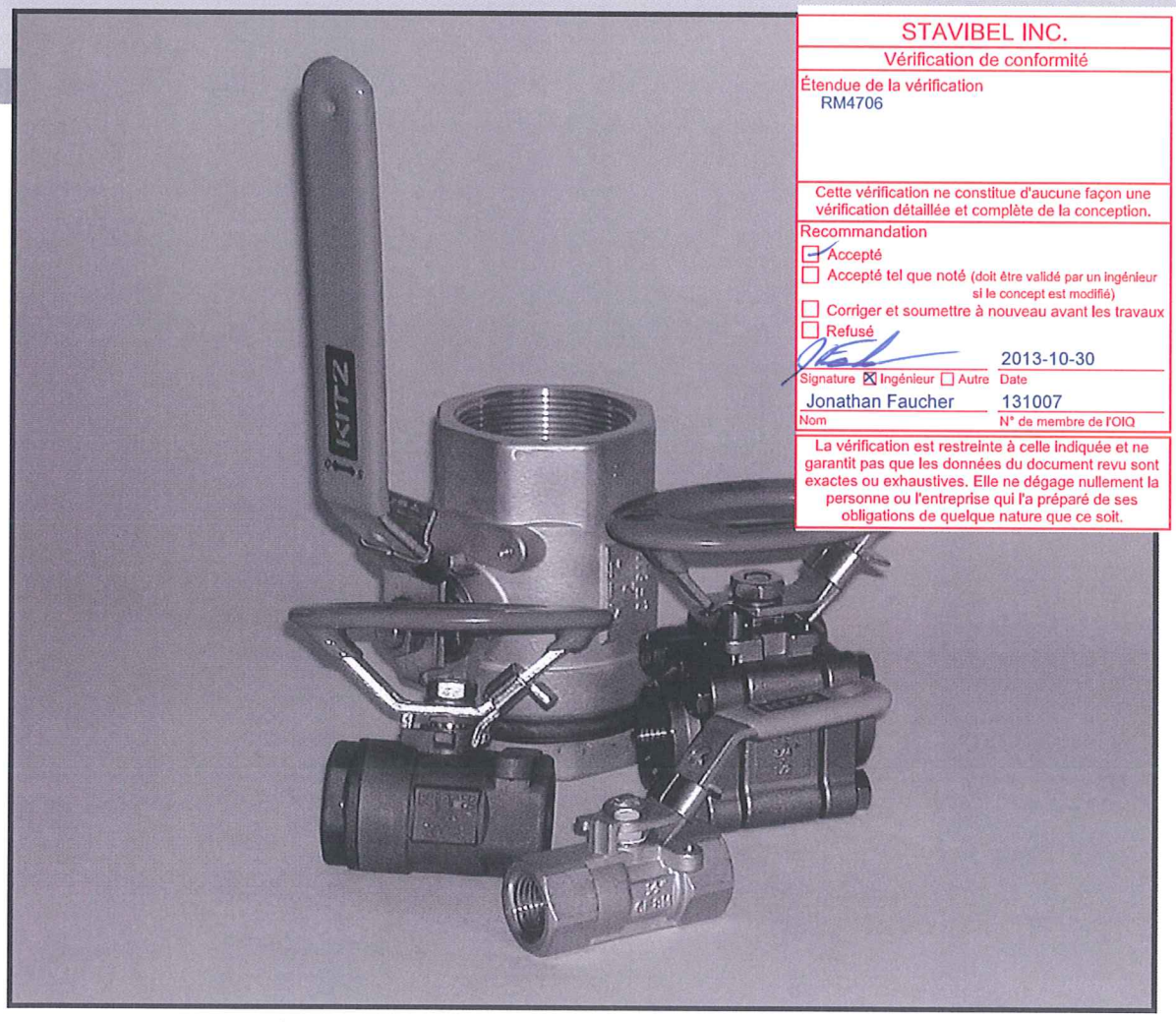
CIRCUIT DIAGRAM No -REV
6000-000-02
B1 C1 B2 C2

KITZ

Industrial Threaded Ball Valves

(Includes socket weld & buttweld ends)

Carbon & Stainless Steel



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KITZ CORPORATION OF AMERICA

INDUSTRIAL THREADED BALL VALVES

Carbon and Stainless Steel

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UNIBODY/2-Piece and 2-Piece Seal Welded

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3-Piece

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Ball valve 1/2" - AKSCTKZM-FS
Ball valve 3/4" - AKSCTKZM-FS

FIGURE NUMBER CONSTRUCTION

AK	SC	T	K	Z	M	-	FS	O
1	2	3	4	5	6		7	8

AK	U	T	H	W	Z	M
1	2	3	4	9	5	6

AW	SC	3T	F	Z	M	-	FS
1	2	3	4	5	6		7

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1 - END CONNECTION
- AK - Tapered NPT (ASME B1.20.1)
- AW - Socket Weld (ASME B16.11)
- BW - Buttweld (ASME B16.25)
- AK/AW - Threaded x Socket Weld

2 - SHELL MATERIAL
- SC - Carbon Steel
- U - Stainless Steel

3 - VALVE TYPE
- T - Floating Ball
- 3T - 3-PC

4 - PORT DESIGN
- K - Reduced
- H - Regular
- F - Full

5 - MOUNTING PAD
- Z - Integral

(ISO-5211 on 3-pc)

6 - TRIM (Ball and Stem)
- M - 316SS

7 - OPTIONS
- FS - Fire Tested per API 607

8 - OPERATOR
- ( ) - Locking Lever
- O - Locking Oval

9 - SPECIAL FEATURES
- W - Seal Welded

CODE NUMBERS

1-pc / 2-pc & 2-pc Seal Welded

FIRESAFE UNIBODY (Page 5)

AKSCTKZM-FS (CS/Locking Lever) - #119
AKUTKZM-FS (SS/Locking Lever) - #129

AKSCTKZM-FSO (CS/Locking Oval) - #119-LOH
AKUTKZM-FSO (SS/Locking Oval) - #129-LOH

2-Piece (Page 6)

AKSCTHZM (CS/Non-Firesafe/Locking Lever) - #217
AKUTHZM (SS/Non-Firesafe/Locking Lever) - #227

AKSCTHZM-FS (CS/Firesafe/Locking Lever) - #219
AKUTHZM-FS (SS/Firesafe/Locking Lever) - #229

AKSCTHZM-O (CS/Non-Firesafe/Locking Oval) - #217-LOH
AKUTHZM-O (SS/Non-Firesafe/Locking Oval) - #227-LOH

AKSCTHZM-FSO (CS/Firesafe/Locking Oval) - #219-LOH
AKUTHZM-FSO (SS/Firesafe/Locking Oval) - #229-LOH

2-Piece, Seal Welded (Page 7)

AKSCTHWZM (CS/Non-Firesafe/Locking Lever) - #237
AKUTHWZM (SS/Non-Firesafe/Locking Lever) - #247

AKSCTHWZM-FS (CS/Firesafe/Locking Lever) - #239
AKUTHWZM-FS (SS/Firesafe/Locking Lever) - #249

AKSCTHWZM-O (CS/Non-Firesafe/Locking Oval) - #237-LOH
AKUTHWZM-O (SS/Non-Firesafe/Locking Oval) - #247-LOH

AKSCTHWZM-FSO (CS/Firesafe/Locking Oval) - #239-LOH
AKUTHWZM-FSO (SS/Firesafe/Locking Oval) - #249-LOH

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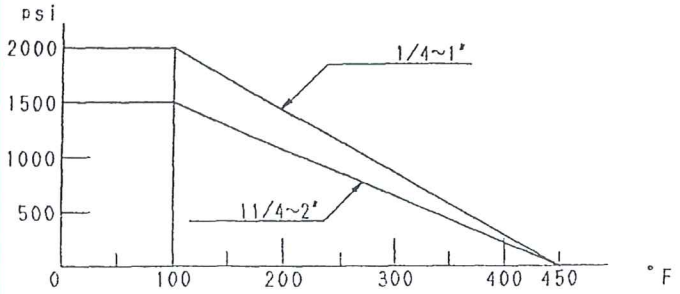
TECHNICAL INFORMATION

PRODUCT OVERVIEW

PRODUCT TYPE	MATERIAL	BASIC FIGURE	STANDARD OPTIONS	SIZE RANGE
FIRESAFE UNIBODY, REDUCED PORT	WCB CF8M	AKSCTKZM-FS AKUTKZM-FS	FIRESAFE (API 607) LOCKING OVAL LOCKING LEVER	1/4", 3/8", 1/2", 3/4", 1", 1-1/4", 1-1/2", 2"
TWO-PIECE REGULAR PORT	WCB CF8M	AKSCTHZM (-FS) AKUTHZM (-FS)		
TWO-PIECE REGULAR PORT, SEAL WELDED	WCB CF8M	AKSCTHWZM (-FS) AKUTHWZM (-FS)		

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PRESSURE-TEMPERATURE RATING



BASIC DESIGN

FIRESAFE UNIBODY

Face-to Face Dimensions - KITZ Standard
End Connections - ASME B1.20.1
Wall Thickness - KITZ Standard
Port - Reduced port in accordance with API 608
Mounting Pad - KITZ Standard
Standard Handle - Locking Oval (1/4"~1")
Locking Lever (1-1/4"~2")
Optional Locking Oval and Lever for other sizes
Body Seat - Hypatite PTFE
Body Seal - Flexible Graphite
Pressure Rating - 2000 WOG (1/4"~1)
240 WSP (1/4"~1)
1500 WOG (1-1/4"~2")
220 WSP (1-1/4"~2")
NACE MR-01-75

2-Piece

Face-to Face Dimensions - KITZ Standard
End Connections - ASME B1.20.1
Wall Thickness - BS 5351 Class 800 (1/4"~1")
ASME B16.34 Class 600 (1-1/4"~2")
Port - Regular port in accordance with API 608
Mounting Pad - KITZ Standard
Standard Handle - Locking Oval (1/4"~1")
Locking Lever (1-1/4"~2")
Optional Locking Oval and Lever for other sizes
Body Seat - Hypatite PTFE
Body Seal - PTFE (Standard)/Flexible Graphite (FS)
Pressure Rating - 2000 WOG (1/4"~1)
240 WSP (1/4"~1)
1500 WOG (1-1/4"~2")
220 WSP (1-1/4"~2")
NACE MR-01-75

2-Piece, Seal Welded

Face-to Face Dimensions - KITZ Standard
End Connections - ASME B1.20.1
Wall Thickness - BS 5351 Class 800 (1/4"~1")
ASME B16.34 Class 600 (1-1/4"~2")
Port - Regular port in accordance with API 608
Mounting Pad - KITZ Standard
Standard Handle - Locking Oval (1/4"~1")
Locking Lever (1-1/4"~2")
Optional Locking Oval and Lever for other sizes
Body Seat - Hypatite PTFE
Body Seal - None (Seal welded construction)
Pressure Rating - 2000 WOG (1/4"~1)
240 WSP (1/4"~1)
1500 WOG (1-1/4"~2")
220 WSP (1-1/4"~2")
NACE MR-01-75

TEST PRESSURES

Test Method - API 598
Body Test Pressure - 3000 psi, Hydrostatic (1/4"~1")
2250 psi, Hydrostatic (1-1/4"~2")
Seat Test Pressure - 80 psi, Air

TECHNICAL DATA

CARBON and STAINLESS STEEL
FIRESAFE UNIBODY
FIGURE: AKSCTKZM-FS/AKUTKZM-FS

*OPERATING TORQUE, in-lbs**

VALVE SIZE	DIFFERENTIAL PRESSURE, psi				
	up to 400	500	1,000	1,500	2,000
1/4"	14.5	15	18	21	24
3/8"	19	20	25	30	35
1/2"	29	30	35	40	45
3/4"	44	45	50	55	60
1"	68	70	80	90	100
1-1/4"	78	80	95	110	-
1-1/2"	108	110	130	150	-
2"	138	140	160	180	-

FLOW COEFFICIENT

VALVE SIZE	APPROX Cv
1/4"	2.2
3/8"	2.3
1/2"	4.3
3/4"	8.0
1"	12.0
1-1/4"	18.0
1-1/2"	32.0
2"	53.0

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CARBON and STAINLESS STEEL
2-pc and 2-pc SEAL WELDED
FIGURE: AKSCTHZM/AKUTHZM (-FS) and AKSCTHWZM/AKUTHWZM (-FS)

*OPERATING TORQUE, in-lbs**

VALVE SIZE	DIFFERENTIAL PRESSURE, psi				
	up to 400	500	1,000	1,500	2,000
1/4"	14.5	20	25	30	35
3/8"	19	30	35	40	45
1/2"	29	45	50	55	60
3/4"	44	70	80	90	100
1"	68	80	95	110	125
1-1/4"	78	110	130	150	-
1-1/2"	108	140	160	180	-
2"	138	160	180	200	-

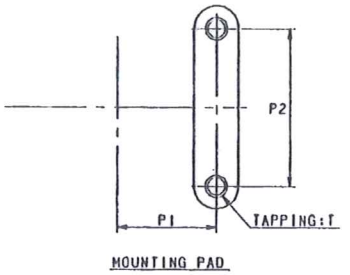
FLOW COEFFICIENT

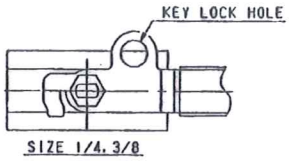
VALVE SIZE	APPROX Cv
1/4"	4.0
3/8"	4.5
1/2"	5.0
3/4"	11.0
1"	24.0
1-1/4"	35.0
1-1/2"	74.0
2"	128.0

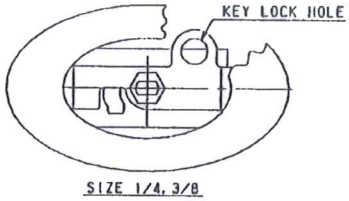
* Values are for clean water at ambient temperature.
KITZ recommends applying a safety factor when selecting an actuator.

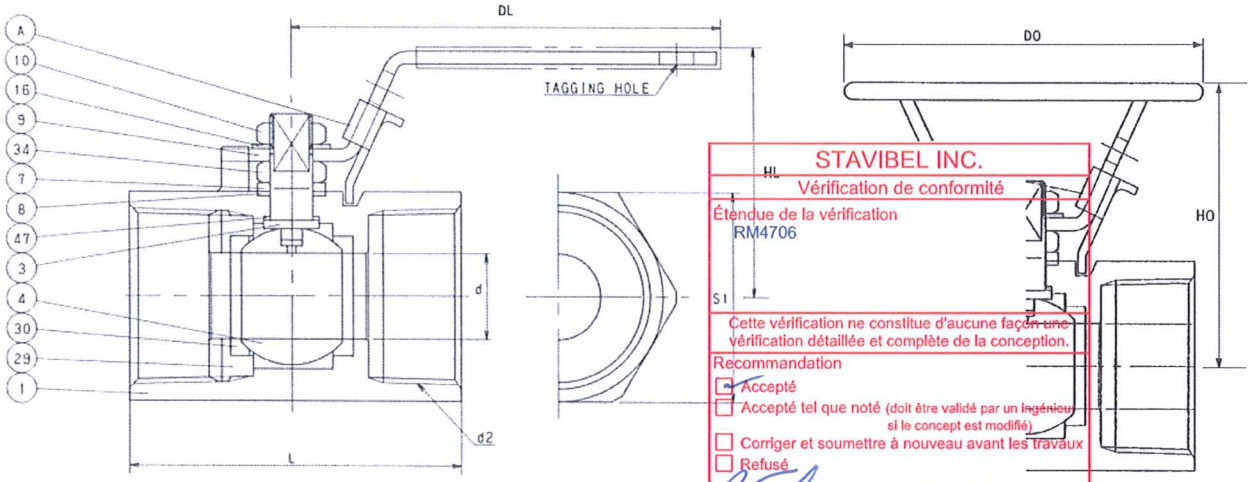
UNIBODY

AKSCTKZM-FS/AKUTKZM-FS









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MATERIALS OF CONSTRUCTION

CARBON STEEL	STAINLESS STEEL

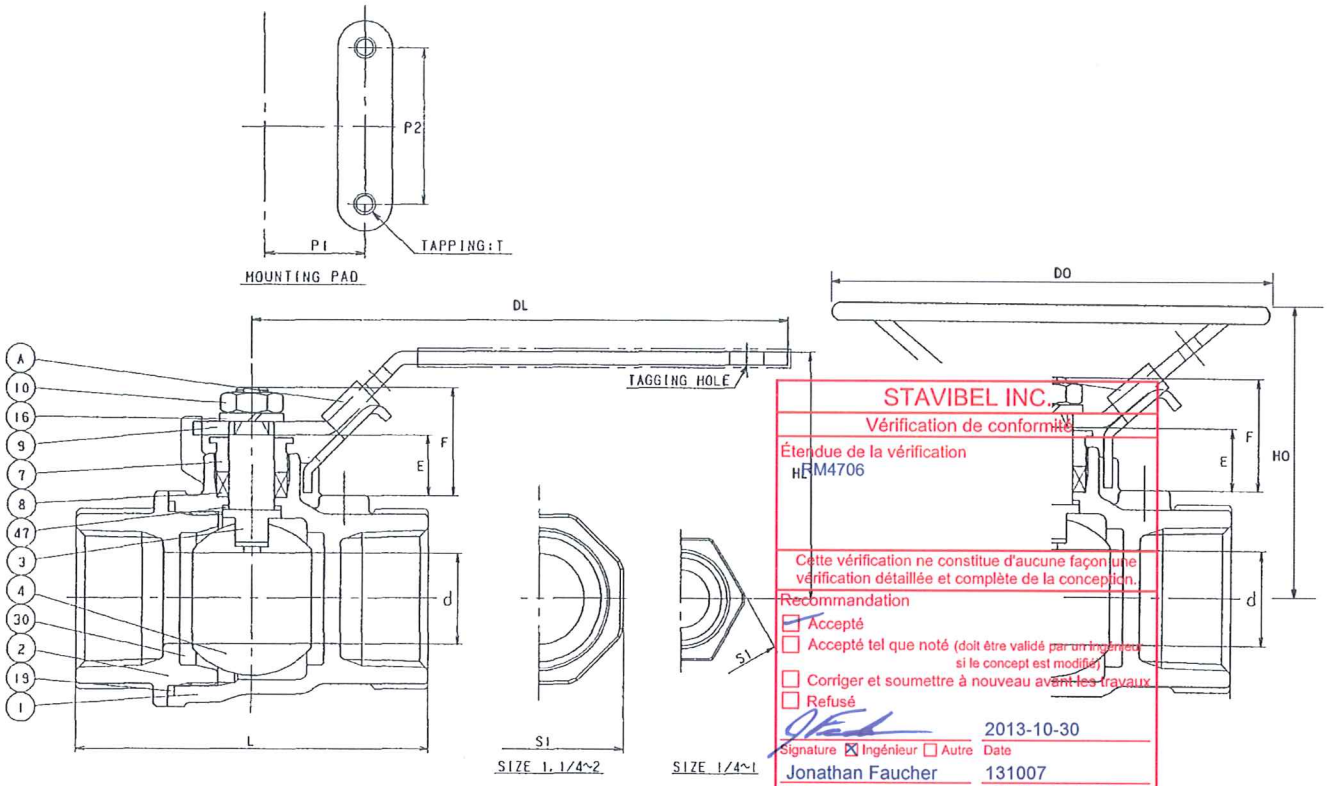
No	PARTS	Qty.	MATERIALS	MATERIALS	ASTM SPECIFICATION
1	BODY	1	CAST STEEL		A216 Gr. WCB
				STAINLESS STEEL	A351 Gr. CF8M
3	STEM	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 316
4	BALL	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 316
7	GLAND	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 304
8	GLAND PACKING	1	FLEXIBLE GRAPHITE	FLEXIBLE GRAPHITE	
9	HANDLE	1	CARBON STEEL (1)		
				STAINLESS STEEL (1)	
10	NUT	2	STAINLESS STEEL	STAINLESS STEEL	A194 Gr. 8
16	WASHER	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 304
29	INSERT	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 316 or A351 Gr. CF8M
30	BALL SEAT	2	HYPATITE PTFE	HYPATITE PTFE	
34	NUT	1	STAINLESS STEEL	STAINLESS STEEL	A194 Gr. 8 (1/2" and LARGER)
47	THRUST WASHER	1	G/F PTFE	G/F PTFE	
A	LATCH LOCK	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 430 (1/2" and LARGER)

NOTES: (1) PLASTIC COATED

VALVE SIZE	DIMENSIONS, Inches											APPROX WT. lbs.
	d	HL	HO	DL	DO	L	d2	S1	P1	P2	T	
1/4"	0.18	1.12	1.71	2.80	3.94	1.97	1/4 NPT	0.72	-	-	-	0.35
3/8"	0.27	1.16	1.87	3.23	3.94	2.05	3/8 NPT	0.87	-	-	-	0.37
1/2"	0.36	1.93	2.13	3.54	3.94	2.56	1/2 NPT	1.10	0.50	1.12	No. 10-24UNC	0.62
3/4"	0.49	2.05	2.24	3.54	3.94	2.76	3/4 NPT	1.34	0.57	1.37	No. 10-24UNC	0.86
1"	0.63	2.15	2.38	4.33	3.94	3.15	1 NPT	1.57	0.87	1.37	No. 10-24UNC	1.21
1-1/4"	0.79	2.34	2.58	4.33	3.94	3.74	1-1/4 NPT	1.97	1.00	1.50	1/4-20UNC	1.92
1-1/2"	0.96	2.68	3.07	5.51	5.12	3.94	1-1/2 NPT	2.24	1.00	1.50	1/4-20UNC	2.84
2"	1.26	2.89	3.29	5.51	5.12	4.49	2 NPT	2.72	1.00	1.50	1/4-20UNC	4.26

2-PIECE

AKSCTHZM (-FS) / AKUTHZM (-FS)



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MATERIALS OF CONSTRUCTION

CARBON STEEL	STAINLESS STEEL

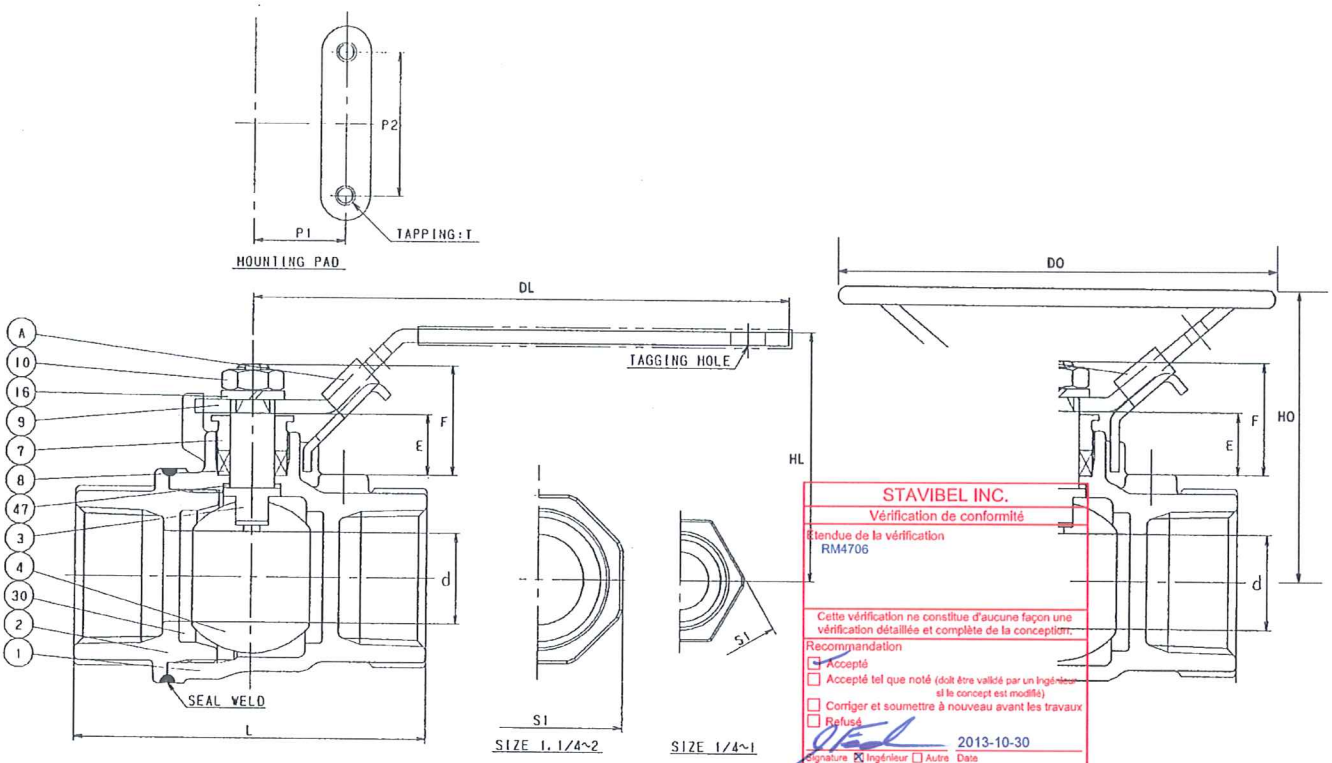
No	PARTS	Qty.	MATERIALS	MATERIALS	ASTM SPECIFICATION
1	BODY	1	CAST STEEL		A216 Gr. WCB
				STAINLESS STEEL	A351 Gr. CF8M
2	BODY CAP	1	CAST STEEL		A216 Gr. WCB
				STAINLESS STEEL	A351 Gr. CF8M
3	STEM	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 316
4	BALL	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 316
7	GLAND	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 304
8	GLAND PACKING	1	PTFE or FLEX GRAPH (FS)	PTFE or FLEX GRAPH (FS)	
9	HANDLE	1	CARBON STEEL (1)		
				STAINLESS STEEL (1)	A276 Type 430
10	HANDLE NUT	1	STAINLESS STEEL	STAINLESS STEEL	A194 Gr. 8
16	WASHER	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 304
19	GASKET	1	PTFE or FLEX GRAPH (FS)	PTFE or FLEX GRAPH (FS)	
30	BALL SEAT	2	HYPATITE PTFE	HYPATITE PTFE	
47	THRUST WASHER	1	G/F PTFE	G/F PTFE	
A	LATCH LOCK	1	CARBON STEEL	STAINLESS STEEL	A276 Type 430

NOTES: (1) PLASTIC COATED

VALVE SIZE	DIMENSIONS, Inches													APPROX WT. lbs.
	d	HL	HO	DL	DO	L	d2	S1	P1	P2	E	F	T	
1/4"	0.37	1.99	2.42	3.94	3.94	2.09	1/4 NPT	0.827	0.50	1.12	0.571	0.925	No. 10-24UNC	0.44
3/8"	0.37	1.99	2.42	3.94	3.94	2.09	3/8 NPT	0.945	0.50	1.12	0.571	0.925	No. 10-24UNC	0.44
1/2"	0.39	2.29	2.46	4.53	3.94	2.44	1/2 NPT	1.102	0.50	1.12	0.531	0.925	No. 10-24UNC	0.66
3/4"	0.59	2.47	2.64	4.53	3.94	2.83	3/4 NPT	1.378	0.87	1.37	0.551	1.004	No. 10-24UNC	1.01
1"	0.79	2.50	2.70	5.31	3.94	3.35	1 NPT	1.614	0.87	1.37	0.571	1.063	No. 10-24UNC	1.94
1-1/4"	0.98	2.66	2.85	5.31	3.94	3.70	1-1/4 NPT	2.047	0.93	1.50	0.531	1.024	1/4-20UNC	2.21
1-1/2"	1.26	3.27	3.66	6.14	5.12	4.21	1-1/2-NPT	2.323	0.93	1.50	0.669	1.240	1/4-20UNC	3.62
2"	1.57	3.58	3.98	7.48	5.12	4.72	2 NPT	2.835	0.93	1.50	0.591	1.240	1/4-20UNC	5.64

2-PIECE SEAL WELDED

AKSCTHWZM (-FS) / AKUTHWZM (-FS)



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MATERIALS OF CONSTRUCTION

CARBON STEEL	STAINLESS STEEL

No	PARTS	Qty.	MATERIALS	MATERIALS	ASTM SPECIFICATION
1	BODY	1	CAST STEEL	STAINLESS STEEL	A216 Gr. WCB A351 Gr. CF8M
2	BODY CAP	1	CAST STEEL	STAINLESS STEEL	A216 Gr. WCB A351 Gr. CF8M
3	STEM	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 316
4	BALL	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 316
7	GLAND	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 304
8	GLAND PACKING	1	PTFE or FLEX GRAPH (FS)	PTFE or FLEX GRAPH (FS)	
9	HANDLE	1	CARBON STEEL (1)	STAINLESS STEEL (1)	A276 Type 430
10	HANDLE NUT	1	STAINLESS STEEL	STAINLESS STEEL	A194 Gr. 8
16	WASHER	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 304
30	BALL SEAT	2	HYPATITE PTFE	HYPATITE PTFE	
47	THRUST WASHER	1	G/F PTFE	G/F PTFE	
A	LATCH LOCK	1	CARBON STEEL	STAINLESS STEEL	A276 Type 430

NOTES: (1) PLASTIC COATED

VALVE SIZE	DIMENSIONS, Inches													APPROX WT. lbs.
	d	HL	HO	DL	DO	L	d2	S1	P1	P2	E	F	T	
1/4"	0.37	1.99	2.42	3.94	3.94	2.09	1/4 NPT	0.827	0.50	1.12	0.571	0.925	No. 10-24UNC	0.44
3/8"	0.37	1.99	2.42	3.94	3.94	2.09	3/8 NPT	0.945	0.50	1.12	0.571	0.925	No. 10-24UNC	0.44
1/2"	0.39	2.29	2.46	4.53	3.94	2.44	1/2 NPT	1.102	0.50	1.12	0.531	0.925	No. 10-24UNC	0.66
3/4"	0.59	2.47	2.64	4.53	3.94	2.83	3/4 NPT	1.378	0.87	1.37	0.551	1.004	No. 10-24UNC	1.01
1"	0.79	2.50	2.70	5.31	3.94	3.35	1 NPT	1.614	0.87	1.37	0.571	1.063	No. 10-24UNC	1.94
1-1/4"	0.98	2.66	2.85	5.31	3.94	3.70	1-1/4 NPT	2.047	0.93	1.50	0.531	1.024	1/4-20UNC	2.21
1-1/2"	1.26	3.27	3.66	6.14	5.12	4.21	1-1/2-NPT	2.323	0.93	1.50	0.669	1.240	1/4-20UNC	3.62
2"	1.57	3.58	3.98	7.48	5.12	4.72	2 NPT	2.835	0.93	1.50	0.591	1.240	1/4-20UNC	5.64

CODE NUMBERS

3-Piece

Threaded (Pages 9 - 13)

AKSC3THZM (CS/Regular Port/Non-Firesafe/Locking Lever) - #317
AKU3THZM (SS/Regular Port/Non-Firesafe/Locking Lever) - #327

AKSC3THZM-FS (CS/Regular Port/Firesafe/Locking Lever) - #319
AKU3THZM-FS (SS/Regular Port/Firesafe/Locking Lever) - #329

AKSC3THZM-O (CS/Regular Port/Non-Firesafe/Locking Oval) - #317-LOH
AKU3THZM-O (SS/Regular Port/Non-Firesafe/Locking Oval) - #327-LOH

AKSC3THZM-FSO (CS/Regular Port/Firesafe/Locking Oval) - #319-LOH
AKU3THZM-FSO (SS/Regular Port/Firesafe/Locking Oval) - #329-LOH

AKSC3TFZM (CS/Full Port/Non-Firesafe/Locking Lever) - #317F
AKU3TFZM (SS/Full Port/Non-Firesafe/Locking Lever) - #327F

AKSC3TFZM-FS (CS/Full Port/Firesafe/Locking Lever) - #319F
AKU3TFZM-FS (SS/Full Port/Firesafe/Locking Lever) - #329F

AKSC3TFZM-O (CS/Full Port/Non-Firesafe/Locking Oval) - #317F-LOH
AKU3TFZM-O (SS/Full Port/Non-Firesafe/Locking Oval) - #327F-LOH

AKSC3TFZM-FSO (CS/Full Port/Firesafe/Locking Oval) - #319F-LOH
AKU3TFZM-FSO (SS/Full Port/Firesafe/Locking Oval) - #329F-LOH

Socket Weld (Pages 9 - 13)

AWSC3THZM (CS/Regular Port/Non-Firesafe/Locking Lever) - #317S
AWU3THZM (SS/Regular Port/Non-Firesafe/Locking Lever) - #327S

AWSC3THZM-FS (CS/Regular Port/Firesafe/Locking Lever) - #319S
AWU3THZM-FS (SS/Regular Port/Firesafe/Locking Lever) - #329S

AWSC3THZM-O (CS/Regular Port/Non-Firesafe/Locking Oval) - #317S-LOH
AWU3THZM-O (SS/Regular Port/Non-Firesafe/Locking Oval) - #327S-LOH

AWSC3THZM-FSO (CS/Regular Port/Firesafe/Locking Oval) - #319S-LOH
AWU3THZM-FSO (SS/Regular Port/Firesafe/Locking Oval) - #329S-LOH

AWSC3TFZM (CS/Full Port/Non-Firesafe/Locking Lever) - #317FS
AWU3TFZM (SS/Full Port/Non-Firesafe/Locking Lever) - #327FS

AWSC3TFZM-FS (CS/Full Port/Firesafe/Locking Lever) - #319FS
AWU3TFZM-FS (SS/Full Port/Firesafe/Locking Lever) - #329FS

AWSC3TFZM-O (CS/Full Port/Non-Firesafe/Locking Oval) - #317FS-LOH
AWU3TFZM-O (SS/Full Port/Non-Firesafe/Locking Oval) - #327FS-LOH

AWSC3TFZM-FSO (CS/Full Port/Firesafe/Locking Oval) - #319FS-LOH
AWU3TFZM-FSO (SS/Full Port/Firesafe/Locking Oval) - #329FS-LOH

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☐ Refusé

Signature ☒ Ingénieur ☐ Autre — Date: 2013-10-30
Nom: Jonathan Faucher — N° de membre de l'OIQ: 131007

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Buttweld (Pages 9 - 13)

BWSC3THZM (CS/Regular Port/Non-Firesafe/Locking Lever) - #317B
BWU3THZM (SS/Regular Port/Non-Firesafe/Locking Lever) - #327B

BWSC3THZM-FS (CS/Regular Port/Firesafe/Locking Lever) - #319B
BWU3THZM-FS (SS/Regular Port/Firesafe/Locking Lever) - #329B

BWSC3THZM-O (CS/Regular Port/Non-Firesafe/Locking Oval) - #317B-LOH
BWU3THZM-O (SS/Regular Port/Non-Firesafe/Locking Oval) - #327B-LOH

BWSC3THZM-FSO (CS/Regular Port/Firesafe/Locking Oval) - #319B-LOH
BWU3THZM-FSO (SS/Regular Port/Firesafe/Locking Oval) - #329B-LOH

BWSC3TFZM (CS/Full Port/Non-Firesafe/Locking Lever) - #317FB
BWU3TFZM (SS/Full Port/Non-Firesafe/Locking Lever) - #327FB

BWSC3TFZM-FS (CS/Full Port/Firesafe/Locking Lever) - #319FB
BWU3TFZM-FS (SS/Full Port/Firesafe/Locking Lever) - #329FB

BWSC3FZM-O (CS/Full Port/Non-Firesafe/Locking Oval) - #317FB-LOH
BWU3TFZM-O (SS/Full Port/Non-Firesafe/Locking Oval) - #327FB-LOH

BWSC3TFZM-FSO (CS/Full Port/Firesafe/Locking Oval) - #319FB-LOH
BWU3TFZM-FSO (SS/Full Port/Firesafe/Locking Oval) - #329FB-LOH

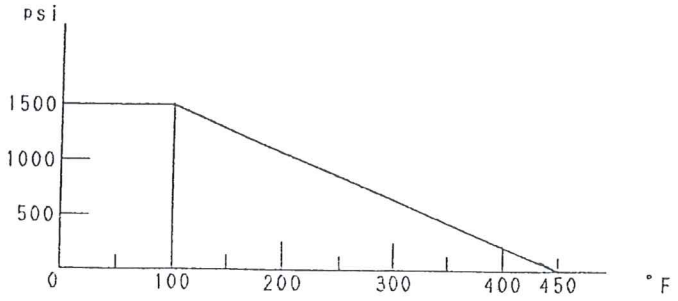
TECHNICAL INFORMATION

PRODUCT OVERVIEW*

PRODUCT TYPE	MATERIAL	BASIC FIGURE	STANDARD OPTIONS	SIZE RANGE
THREADED, REGULAR PORT	WCB CF8M	AKSC3TKZM (-FS) AKU3TKZM (-FS)	FIRESAFE (API 607) LOCKING OVAL LOCKING LEVER	1/2", 3/4", 1", 1-1/4", 1-1/2", 2", 2-1/2"
SOCKET WELD, REGULAR PORT	WCB CF8M	AWSC3THZM (-FS) AWU3THZM (-FS)		
BUTTWELD, REGULAR PORT	WCB CF8M	BWSC3THZM (-FS) BWU3THZM (-FS)		
THREADED, FULL PORT	WCB CF8M	AKSC3TFZM (-FS) AKU3TFZM (-FS)		1/4", 3/8", 1/2", 3/4", 1", 1-1/4", 1-1/2", 2"
SOCKET WELD, FULL PORT	WCB CF8M	AWSC3TFZM (-FS) AWU3TFZM (-FS)		
BUTTWELD, FULL PORT	WCB CF8M	BWSC3TFZM (-FS) BWU3TFZM (-FS)		

*Contact KITZ for special configurations such as threaded x socket weld

PRESSURE-TEMPERATURE RATING



BASIC DESIGN

Face-to Face Dimensions - KITZ Standard
End Connections - NPT (ASME B1.20.1)
Socket Weld (ASME B16.11)
Buttweld (ASME B16.25)
Wall Thickness - KITZ Standard
Port - Regular and Full port in accordance with API 608
Mounting Pad - In accordance with ISO 5211 except 1/2" regular port and 1/4" ~ 3/8" full port
Standard Handle - Locking Oval (1/2"~1") - Regular Port
Locking Oval (1/4" ~ 1") - Full Port
Locking Lever (1-1/4"~2-1/2") - Regular Port
Locking Lever (1-1/4"~2") - Full Port
Optional Locking Oval and Lever for other sizes
Body Seat - Hypatite PTFE
Body Seal - PTFE (Standard)/Flexible Graphite (FS)
Pressure Rating - 1500 WOG (1/2"~2" regular port and 1/4"~1-1/2" full port)
240 WSP (1/2"~2" regular port and 1/4"~1-1/2" full port)
1000 WOG (2-1/2" regular port and 2" full port)
186 WSP (2-1/2" regular port and 2" full port)
NACE MR-01-75

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☐ Refusé
2013-10-30
Signature ☒ Ingénieur ☐ Autre Date
Jonathan Faucher 131007
Nom N° de membre de l'OIQ
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TEST PRESSURE

Test Method - API 598
Body Test Pressure - 2250 ps i, Hydrostatic (1/2"~2" regular port and 1/4"~1-1/2" full port)
1500 psi, Hydrostatic (2-1/2" regular port and 2" full port)
Seat Test Pressure - 80 psi, Air

TECHNICAL DATA

*OPERATING TORQUE, in-lbs**

VALVE SIZE		DIFFERENTIAL PRESSURE, psi									
FB	RB	up to 145	290	435	580	725	870	1,015	1,160	1,305	1,500
1/4" & 3/8"	1/2"	40	43	45	48	51	53	58	59	61	65
1/2"	3/4"	62	66	71	75	80	84	89	93	97	104
3/4"	1"	89	98	108	118	128	137	147	157	166	179
1"	1-1/4"	124	149	174	198	223	248	273	297	322	355
1-1/4"	1-1/2"	195	216	237	259	280	301	322	343	365	392
1-1/2"	2"	221	255	289	322	356	389	423	457	490	534
2"	2-1/2"	310	354	434	513	593	673	752	832	912	1,015

FLOW COEFFICIENT

FULL PORT

VALVE SIZE	APPROX Cv
1/4"	5
3/8"	7
1/2"	22
3/4"	43
1"	72
1-1/4"	126
1-1/2"	215
2"	346

REGULAR PORT

VALVE SIZE	APPROX Cv
1/2"	5
3/4"	11
1"	24
1-1/4"	35
1-1/2"	74
2"	128
2-1/2"	276

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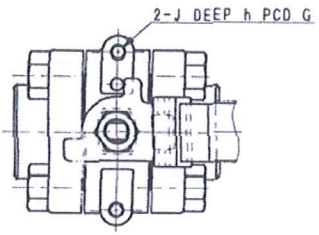
Nom: Jonathan Faucher — N° de membre de l'OIQ: 131007

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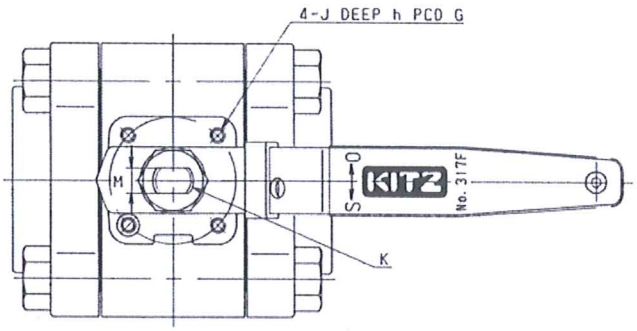
* Values are for clean water at ambient temperature.
KITZ recommends applying a safety factor when selecting an actuator.

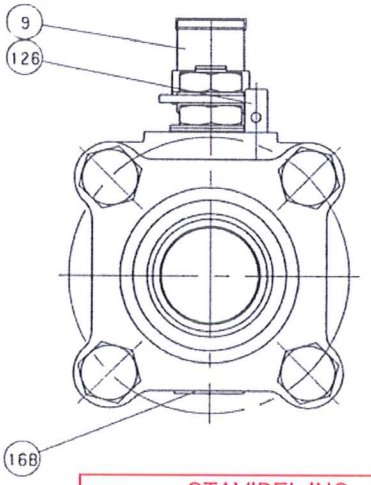
3-PIECE

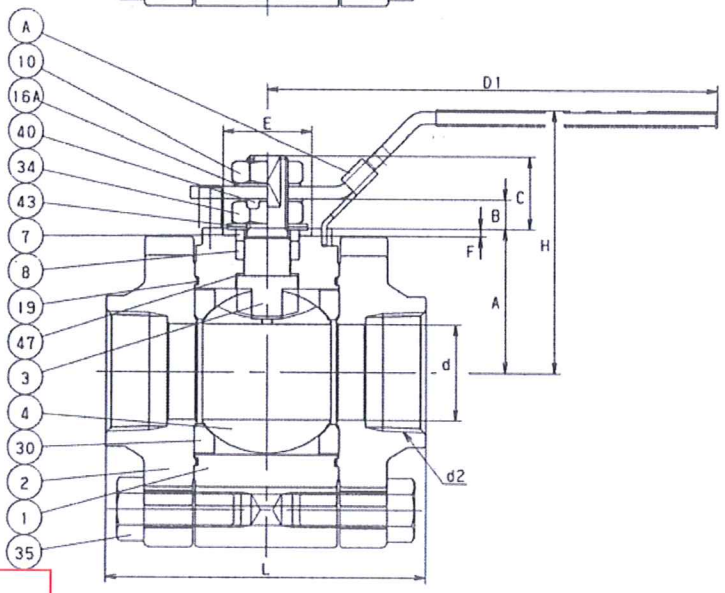
AKSC3THZM (-FS)/AKU3THZM (-FS) (Regular Port)
AKSC3TFZM (-FS)/AKU3TFZM (-FS) (Full Port)



1/2" Regular Port
1/4"-3/8" Full Port







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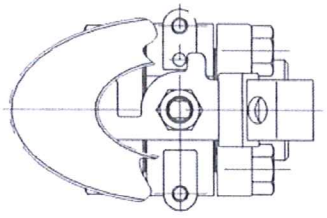
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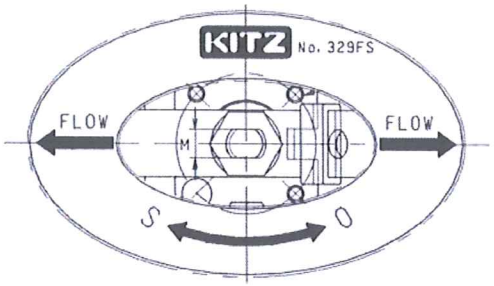
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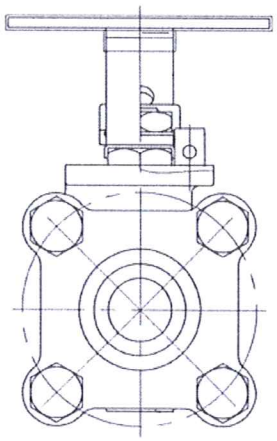
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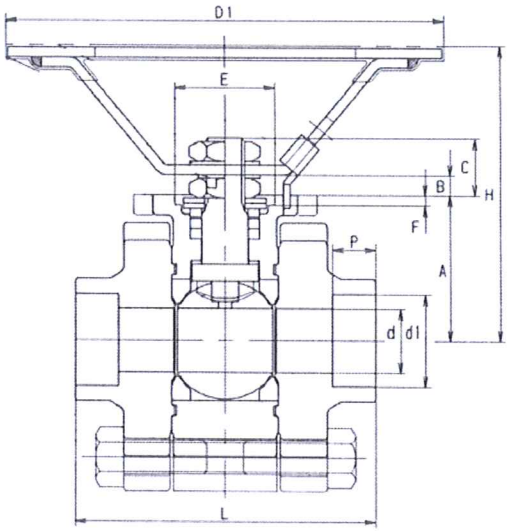
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1/2" Regular Port
1/4"-3/8" Full Port

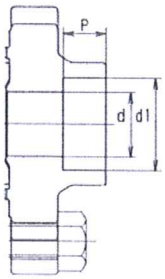






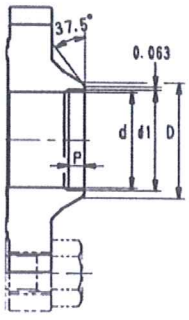
SOCKET WELD ENDS

AWSC3THZM (-FS)/AWU3THZM (-FS) (Regular Port)
AWSC3TFZM (-FS)/AWU3TFZM (-FS) (Full Port)



BUTTWELD ENDS

BWSC3THZM (-FS)/BWU3THZM (-FS) (Regular Port)
BWSC3TFZM (-FS)/BWU3TFZM (-FS) (Full Port)



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MATERIALS OF CONSTRUCTION

CARBON STEEL	STAINLESS STEEL

No	PARTS	Qty.	MATERIALS	MATERIALS	ASTM SPECIFICATION
1	BODY	1	CARBON STEEL		A216 Gr. WCB
				STAINLESS STEEL	A351 Gr. CF8M
2	CAP	2	CARBON STEEL		A216 Gr. WCB
				STAINLESS STEEL	A351 Gr.CF3M
3	STEM	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 316
4	BALL	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 316 or A351 Gr. CF8M
7	GLAND	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 316
8A	GLAND PACKING	1S	PTFE or FLEX GRAPH (FS)	PTFE or FLEX GRAPH (FS)	
8B	SPACER PACKING	1	G/F PFFE (FS ONLY)	G/F PTFE (FS ONLY)	
9	HANDLE	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 430 (1)
10	HANDLE NUT	1	STAINLESS STEEL	STAINLESS STEEL	A194 Gr. 8
16A	WASHER	1	STAINLESS STEEL	STAINLESS STEEL	
16B	NAME PLATE	1	STAINLESS STEEL	STAINLESS STEEL	
19	GASKET	2	PTFE or FLEX GRAPH (FS)	PTFE or FLEX GRAPH (FS)	
30	BALL SEAT	2	HYPATITE PTFE	HYPATITE PTFE	
34	GLAND NUT	1	STAINLESS STEEL	STAINLESS STEEL	A194 Gr. 8
35	CAP BOLT	8	STAINLESS STEEL	STAINLESS STEEL	A193 Gr. B8
40	LOCK PLATE	1	STAINLESS STEEL	STAINLESS STEEL	
43	BELLEVILLE SPRING	2	STAINLESS STEEL	STAINLESS STEEL	
47	THRUST WASHER	1	C/F PTFE (2)	C/F PTFE (2)	
126	STOPPER PIN	1	STAINLESS STEEL	STAINLESS STEEL	A276 Type 304
A	LATCH LOCK	1	STAINLESS STEEL	STAINLESS STEEL	

NOTES: (1) PLASTIC COATED (2) ANTI-STATIC THRUST WASHER

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	VALVE SIZE	VALVE DIMENSIONS, Inches											
		d	HL	HO	DL	DO	L	d2	SOCKET WELD		BUTT WELD (SCH 40)		
									d1	P	d1	P	D
REGULAR PORT	1/2"	0.39	1.87	2.48	4.72	3.49	2.48	1/2 NPT	0.86	0.38	0.620	0.236	0.839
	3/4"	0.55	2.33	3.07	5.12	5.12	2.80	3/4 NPT	1.07	0.50	0.825	0.276	1.051
	1"	0.75	2.64	3.43	5.12	5.12	3.54	1 NPT	1.33	0.50	1.049	0.394	1.315
	1-1/4"	0.94	3.23	3.31	5.91	7.09	4.06	1-1/4 NPT	1.68	0.50	1.381	0.236	1.661
	1-1/2"	1.18	2.46	3.54	5.91	7.09	4.33	1-1/2 NPT	1.92	0.50	1.616	0.315	1.902
	2"	1.50	4.06	3.93	7.09	7.09	5.00	2 NPT	2.41	0.63	2.066	0.335	2.374
	2-1/2"	1.97	5.98	6.66	9.06	9.84	5.98	2-1/2 NPT	2.91	0.63	2.469	0.512	2.874
FULL PORT	1/4"	0.39	1.87	2.48	4.72	3.94	2.48	1/4 NPT	0.56	0.38	0.363	0.197	0.539
	3/8"	0.39	1.87	2.48	4.72	3.49	2.48	3/8 NPT	0.69	0.38	0.491	0.197	0.673
	1/2"	0.55	2.33	3.07	5.12	5.12	2.80	1/2 NPT	0.86	0.38	0.620	0.177	0.839
	3/4"	0.75	2.64	3.43	5.12	5.12	3.54	3/4 NPT	1.07	0.50	0.825	0.177	1.051
	1"	0.94	3.23	3.31	5.91	7.09	4.06	1 NPT	1.33	0.50	1.049	0.217	1.315
	1-1/4"	1.18	2.46	3.54	5.91	7.09	4.33	1-1/4 NPT	1.68	0.50	1.381	0.315	1.661
	1-1/2"	1.50	4.06	3.93	7.09	7.09	5.00	1-1/2 NPT	1.82	0.50	1.616	0.217	1.902
	2"	1.97	5.98	6.66	9.06	9.84	5.98	2 NPT	2.41	0.63	2.027	0.335	2.374

	VALVE SIZE	ACTUATOR MOUNTING PAD DIMENSIONS, Inches										
		A	B	C	E	F	G	K	h	J	M	ISO FLANGE
REGULAR PORT	1/2"	1.043	0.079	0.413	-	-	1.969	M8	0.275	1/4-20UNC	0.197	-
	3/4"	1.378	0.169	0.559	0.984	0.118	1.417	M10	0.197	1/4-20UNC	0.236	F03
	1"	1.693	0.197	0.669	1.181	0.118	1.654	M12	0.315	1/4-20UNC	0.335	F04
	1-1/4"	1.732	0.531	1.083	1.181	0.118	1.654	M14	0.315	1/4-20UNC	0.394	F04
	1-1/2"	1.949	0.531	1.071	1.181	0.118	1.654	M14	0.315	1/4-20UNC	0.394	F04
	2"	2.244	0.461	1.142	1.378	0.118	1.969	M16	0.394	1/4-20UNC	0.394	F05
	2-1/2"	3.15	1.339	0.669	0.669	2.165	2.756	0.866	0.591	5/16-18UNC	0.669	F07
FULL PORT	1/4"	1.043	0.079	0.413	-	-	1.969	M8	0.275	1/4-20UNC	0.197	-
	3/8"	1.043	0.079	0.413	-	-	1.969	M8	0.275	1/4-20UNC	0.197	-
	1/2"	1.378	0.169	0.559	9.984	0.118	1.417	M10	0.197	1/4-20UNC	0.236	F03
	3/4"	1.693	0.197	0.669	1.181	0.118	1.654	M12	0.315	1/4-20UNC	0.335	F04
	1"	1.732	0.531	1.083	1.181	0.118	1.654	M14	0.315	1/4-20UNC	0.394	F04
	1-1/4"	1.949	0.351	1.071	1.181	0.118	1.654	M14	0.315	1/4-20UNC	0.394	F04
	1-1/2"	2.244	0.461	1.142	1.378	0.118	1.969	M16	0.394	1/4-20UNC	0.394	F05
	2"	3.15	1.119	0.669	0.669	2.165	2.756	0.866	0.591	5/16-18UNC	0.669	F07

OPTIONS and ACCESSORIES

LOCKING LEVER HANDLES

FIGURE NUMBER	VALVE SIZE	MODEL NUMBER
AKSCTKZM-FS AKUTKZM-FS	1/4"	LL-10
	3/8"	LL-11
	1/2" & 3/4"	LL-12
	1" & 1-1/4"	LL-13
	1-1/2" & 2"	LL-14
AKSCTHZM (FS) AKUTHZM (FS) and AKSCTWZM (FS) AKUTHWZM (FS)	1/4" & 3/8"	LL-15
	1/2" & 34"	LL-16
	1" & 1-14"	LL-17
	1-1/2"	LL-18
	2"	LL-19
AKSC3THZM (FS) AWSC3THZM (FS) BWS3THZM (FS) AKU3THZM (FS) AWU3THZM (FS) BWU3THZM (FS)	1/2"	LL-20
	3/4" & 1"	LL-21
	1-1/4" & 1-1/2"	LL-22
	2"	LL-23
	2-1/2"	LL-24
AKSC3TFZM (FS) AWSC3TFZM (FS) BWSC3TFZM (FS) AKU3TFZM (FS) AWU3TFZM (FS)	1/4" & 3/8"	LL-20
	1/2" & 3/4"	LL-21
	1" & 1-1/4"	LL-22
	1-1/2"	LL-23
	2"	LL-24

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LOCKING OVAL HANDLES

FIGURE NUMBER	VALVE SIZE	MODEL NUMBER
AKSCTKZM-FS AKUTKZM-FS	1/4"	OH-10L
	3/8"	OH-11L
	1/2" & 3/4"	OH-12L
	1" & 1-1/4"	OH-13L
	1-1/2" & 2"	OH-14L
AKSCTHZM (FS) AKUTHZM (FS) and AKSCTWZM (FS) AKUTHWZM (FS)	1/4" & 3/8"	OH-15L
	1/2" & 34"	OH-16L
	1" & 1-14"	OH-17L
	1-1/2" & 2"	OH-18L
AKSC3THZM (FS) AWSC3THZM (FS) BWS3THZM (FS) AKU3THZM (FS) AWU3THZM (FS) BWU3THZM (FS)	1/2"	OH-20L
	3/4" & 1"	OH-21L
	1-1/4" & 1-1/2"	OH-22L
	2"	OH-23L
	2-1/2"	OH-24L
AKSC3TFZM (FS) AWSC3TFZM (FS) BWSC3TFZM (FS) AKU3TFZM (FS) AWU3TFZM (FS)	1/4" & 3/8"	OH-20L
	1/2" & 3/4"	OH-21L
	1" & 1-1/4"	OH-22L
	1-1/2"	OH-23L
	2"	OH-24L

ADDITIONAL THREADED ITEMS

For more detailed information please consult KITZ product brochure BV-100-0701

☐ **BRASS - AGA/CGA/UL/FM approval. 150 WSP/600 WOG. Full Port.**
Chrome plated ball and stem (316 SS ball and stem optional), PTFE seat and seals, blow-out proof
stem, lever handle (locking lever and oval and locking oval handles optional).
Figure Number: AKTAF (#68) - standard trim/AKTAFM (#68M) - stainless trim

☐ **BRASS - UL approval. 150 WSP/600 WOG. Full Port.**
Chrome plated ball and stem, PTFE seats and seals, blow-out proof stem, KITZ standard actuator
mounting pad, lever handle (locking lever and oval and locking oval handles optional).
Figure Number: AKTAFP (#68P)

☐ **BRASS - UL approval. 250 WSP/600 WOG. Full Port.**
316 SS ball and stem, R-PTFE 250# seats and seals, blow-out proof stem, KITZ standard actuator
mounting pad, locking lever handle (oval and locking oval handles optional).
Figure Number: AKTAFPM (#68PM)

☐ **BRASS - SAFETY EXHAUST. 200 WOG. Full Port. 1/4" EXHAUST PORT (1" and 2")**
Chrome plated ball and stem, PTFE seat and seals, blow-out proof stem, locking lever handle (oval and locking oval handles optional), integral exhaust tap on sizes 1" and 2".
Figure Number: AKTAFS (#68S)

☐ **CARBON STEEL - 150 WSP/600 WOG. Reduced Port.**
316 SS ball and stem, R-PTFE seats and seals, blow-out proof stem, lever handle
Figure Number: AKSCTK (#50)

☐ **CARBON STEEL - 125 WSP/2000 WOG (1500WOG 1-1/4"-2"). Regular Port.**
316 SS ball and stem, PTFE seats and seals, blow-out proof stem, KITZ standard actuator mounting pad, locking lever handle (oval handle optional).
Figure Number: AKSCTAHM (#49M)

☐ **STAINLESS STEEL - 150 WSP/600 WOG. Reduced Port.**
316 SS body, ball and stem, R-PTFE seats and seals, blow-out proof stem, lever handle.
Figure Number: AKUTKM (#52)

☐ **STAINLESS STEEL - 125 WSP/800 WOG. Full Port.**
316 body, ball and stem, PTFE seats and seals, blow-out proof stem, KITZ standard actuator mounting pad, lever handle (oval handle optional).
Figure Number: AKUTFM (#53F)

☐ **STAINLESS STEEL - 125 WSP/2000 WOG (1500WOG 1-1/4"-2"). Regular Port.**
316 SS body, ball and stem, PTFE seats and seals, blow-out proof stem, KITZ standard actuator mounting pad, locking lever handle (oval handle optional).
Figure Number: AKUTAHM (#39)

STAINLESS STEEL - 125 WSP/1000 WOG. Three Piece. Regular Port.

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NOTES

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For any specific application, users are kindly requested to contact KITZ Corporation for technical advice, or to carry out their own study and evaluation for proving suitability of these products to such an application. Failure to follow this request could result in property damage and/or personal injury, for which we shall not be liable.

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KITZ

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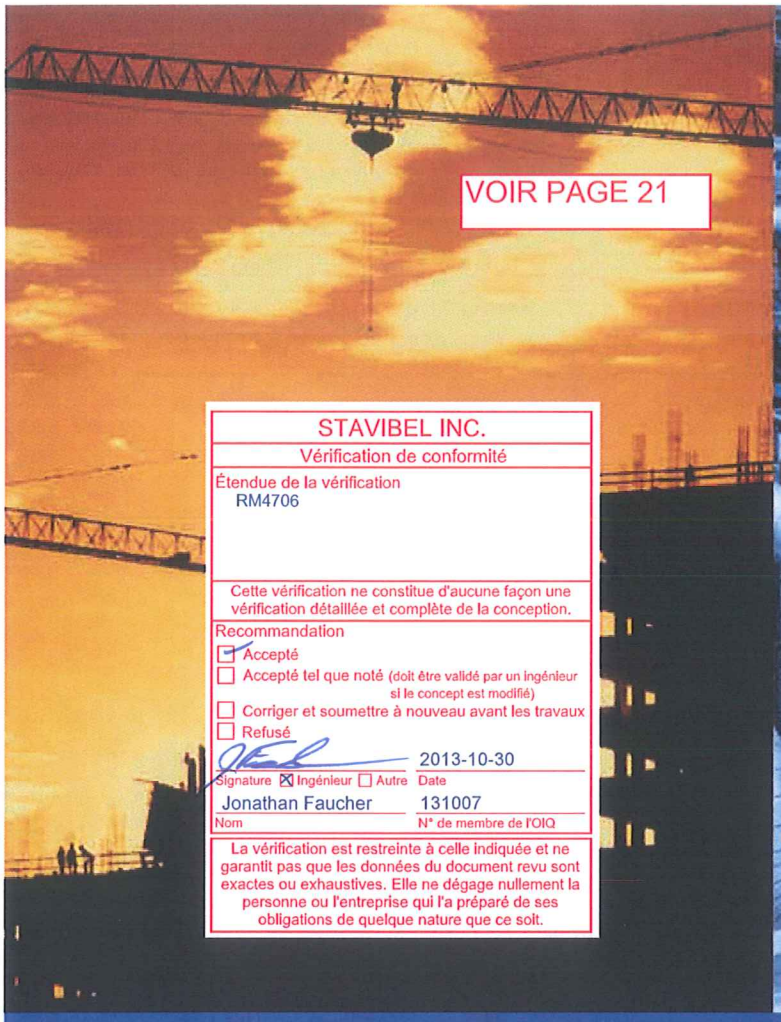
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Product Guide

M. A. Stewart & Sons Ltd.
VALVES AND AUTOMATION





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Additional products & services

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Product Catalogues

M.A. Stewart & Sons has a wide selection of products available.

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VALVES AND FITTINGS

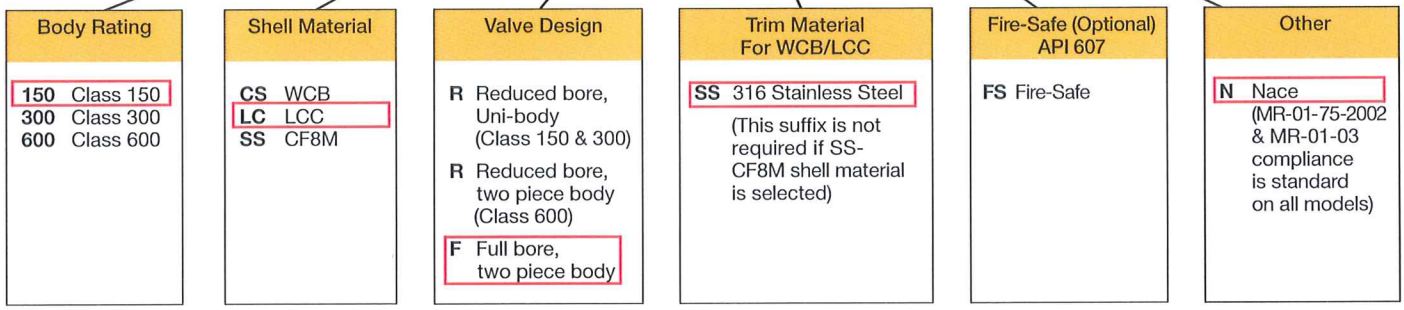
F Series Flanged Ball Valves

Order code information

2", 3" et 4"

F-150-LC-F-SS- N

F-□□□-□□-□-□□-□□-N



The order code system lets you specify your pressure class, material, design (reduced or full port), trim materials and whether or not you require Fire-Safe materials to API 607 4th edition.

So for instance, a 150 pressure class in carbon steel with reduced port and stainless trims with fire-safe seals would be indicated as:
F-150-CS-R-SS-FS-N

Refer to the chart above for feature designations.

Please contact us for more information on:

- Special Trims
- Manual Operators
- Pneumatic Operators
- Electric Operators
- Control Packages

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VALVES AND FITTINGS

F Series
Flanged Carbon Steel
Ball Valves

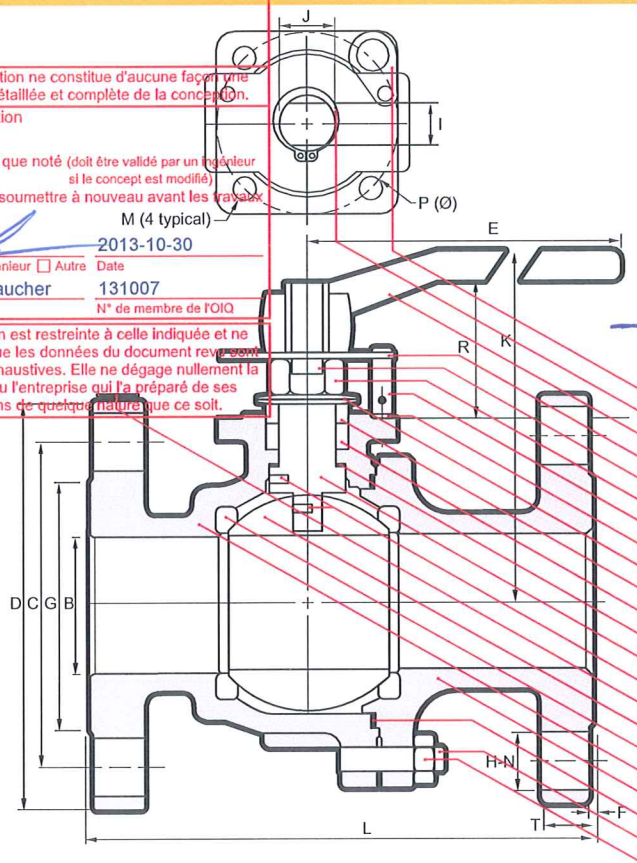
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F-150-CS-F-SS-N



Full port, Two piece body
ANSI B16.34 Class 150
Blowout-proof stem
ISO 5211 Mounting pad
Floating Ball, Anti-static device
Fire-safe design
Comply to NACE MR-01-75-2002 & MR-01-03

3.3



Model F-150-LC-F-SS-N (LCC body) is available

NAME / MATERIAL			
	Model Code; CS	LC	*FS
1.	Lock Plate / Stainless Steel A276 Type 304		
2.	Retaining Ring / Carbon Steel		
3.	Handle / Ductile Iron		
4.	Stopper Plate / Stainless Steel A276 Type 304		
5.	Lock Washer / Stainless Steel A276 Type 304		
6.	Gland Nut / Carbon Steel		
7.	Stopper Pin / Stainless Steel A276 Type 304		
8.	Lock Washer / Stainless Steel A276 Type 304		
9.	Belleville Washer / Stainless Steel 301		
10.	Gland / Stainless Steel A276 Type 304		
11.	Packing / PTFE		(Graphite)
12.	Thrust Washer / RPTFE 15% GFT		
13.	Stem / Stainless Steel A276 Type 316		
14.	Anti-Static Device / Stainless Steel A276 Type 304		
15.	Identification Plate / Stainless Steel A276 Type 304		
16.	Ball / Stainless Steel A351 - CF8M		
17.	Seat / PTFE (TFM-1600)		
18.	Body / Cast Steel A216-WCB	(LC: A352 LCC)	
19.	Cap / Cast Steel A216-WCB	(LC: A352 LCC)	
20.	Body Seal / PTFE		(Graphite)
21.	Bolt Nut / A194 Grade 2HM	(LC: A194 7M)	
22.	Stud Bolt / A193 Grade B7M	(LC FS: A320 Grade L7M)	

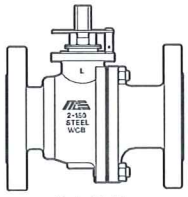
*Fire Safe Certified to API-607

FIG.	F-150-CS-F-SS-N	CLASS	150	SIZE	2	B16.34
SEAT	PTFE-S	BODY	WCB	TRIM	316	NACE
RATING	285 PSIG AT 100°F/200 PSIG AT 400° MAX					

CS – IDENTIFICATION PLATE

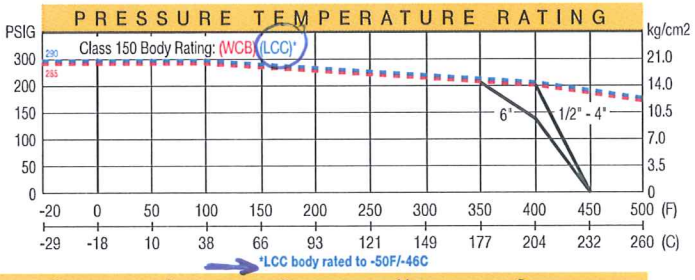
FIG.	F-150-LC-F-SS-N	CLASS	150	SIZE	2	B16.34
SEAT	PTFE-S	BODY	LCC	TRIM	316	NACE
RATING	290 PSIG AT 100°F/200 PSIG AT 400° MAX					

LC – IDENTIFICATION PLATE



Body Marking

PRESSURE TEMPERATURE RATING



*LCC body rated to -50F/-46C

D		I		M		E		N		S		I		O		N	S	
size (mm/in)	B	C	D	E	F	G	H	I	J	K	L	M	N	P	T	R	ISO 5211 flange	kg/lb
1/2	15	60.5	89	130	1.6	35	16	8	11	83	108	1/4" UNC	4	36	11.2	27	F03	1.64
	0.59	2.38	3.50	5.12	0.06	1.38	0.62	0.31	0.43	3.27	4.25			1.42	0.44	1.06		3.60
3/4	19	70.0	98.5	130	1.6	43	16	8	11	86	117	1/4" UNC	4	36	11.2	27	F03	2.00
	0.75	2.75	3.88	5.12	0.06	1.69	0.62	0.31	0.43	3.39	4.62			1.42	0.44	1.06		4.40
1"	24	79.0	108	160	1.6	51	16	10	14	104	127	1/4" UNC	4	50	11.2	35.5	F05	3.15
	0.95	3.12	4.25	6.30	0.06	2.00	0.62	0.39	0.55	4.09	5.00			1.97	0.44	1.40		6.93
1 1/2	38	98.5	127	230	1.6	73	16	14	20	125	165	5/16" UNC	4	70	14.3	49	F07	6.26
	1.50	3.88	5.00	9.06	0.06	2.88	0.62	0.55	0.79	4.92	6.50			2.76	0.56	1.93		13.77
2"	50	120.5	152	230	1.6	92	19	14	20	134.5	178	5/16" UNC	4	70	15.9	49	F07	9.30
	1.97	4.75	5.98	9.06	0.06	3.62	0.75	0.55	0.79	5.30	7.00			2.76	0.63	1.93		20.46
2 1/2	65	139.7	178	400	1.6	104.6	19	17	25	170.5	190.5	3/8" UNC	4	102	17.5	61	F10	16.82
	2.56	5.50	7.00	15.75	0.06	4.12	0.75	0.67	0.98	6.71	7.50			4.02	0.69	2.40		37.00
3"	76	152.5	190	400	1.6	127	19	17	25	181.5	203	3/8" UNC	4	102	19.1	61	F10	22.00
	3.00	6.00	7.48	15.75	0.06	5.00	0.75	0.67	0.98	7.15	8.00			4.02	0.75	2.40		48.40
4"	100	190.5	229	460	1.6	157	19	23	34	205.5	229	1/2" UNC	8	125	23.9	73	F12	37.00
	3.94	7.50	9.02	18.11	0.06	6.18	0.75	0.91	1.34	8.09	9.02			4.92	0.94	2.87		81.40
6"	150	241.5	279	1000	1.6	216	22	27	40	289.5	394	5/8" UNC	8	140	25.4	90	F14	85.3
	5.91	9.50	10.98	39.37	0.06	8.50	0.88	1.06	1.57	11.40	15.51			5.51	1.00	3.54		187.66

Technical data, dimensions, materials & specifications are subject to change without notice.

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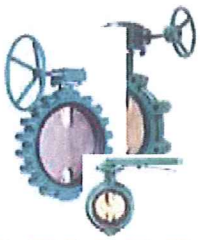
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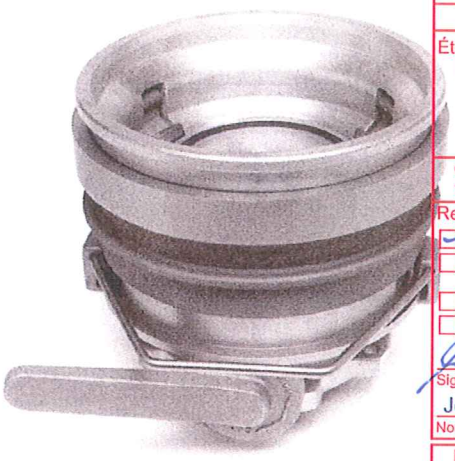
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BOTTOM LOADING COUPLER
F228

WHITTAKER

Ground Fueling Products



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F228 Bottom Loading Coupler

The Whittaker 4 inch bottom loading coupler is designed in accordance with API RP1004.

NOTES;

1. Modification A, K & N may be added to the basic F228 and all other modifications
2. Modification C may be used in conjunction with all other modifications
3. Modifications D, F, & G are separate modifications and cannot be combined with each other
4. See back page for dimension of basic style coupler

Features

- Push-on, pull-off, one-hand operation – no rotation-no slots
- Fully interlocked – can't be opened unless locked and can't be removed unless closed
- Minimum disconnect spillage with dual seals within API specs
- Floating nose seal provides positive seal under operating conditions
- Dust protection sleeve seal
- Full flow four-inch design – 4.7 PSI pressure drop thru F228/F433 at 1000 gpm
- Light weight design – 13.6 lbs.
- Four inch NTT flanged inlet standard, other options available as listed below
- Mates adapters made to API PR1004 (See catalog page on API adapters)
- Standard seals recommended for all commercial automotive and aircraft fuels, Viton seals available
- Whittaker 4 inch swivels available as modifications
- Operating pressure – 120 PSI maximum, 350 PSI peak surge

For modifications see Modification Page M228.

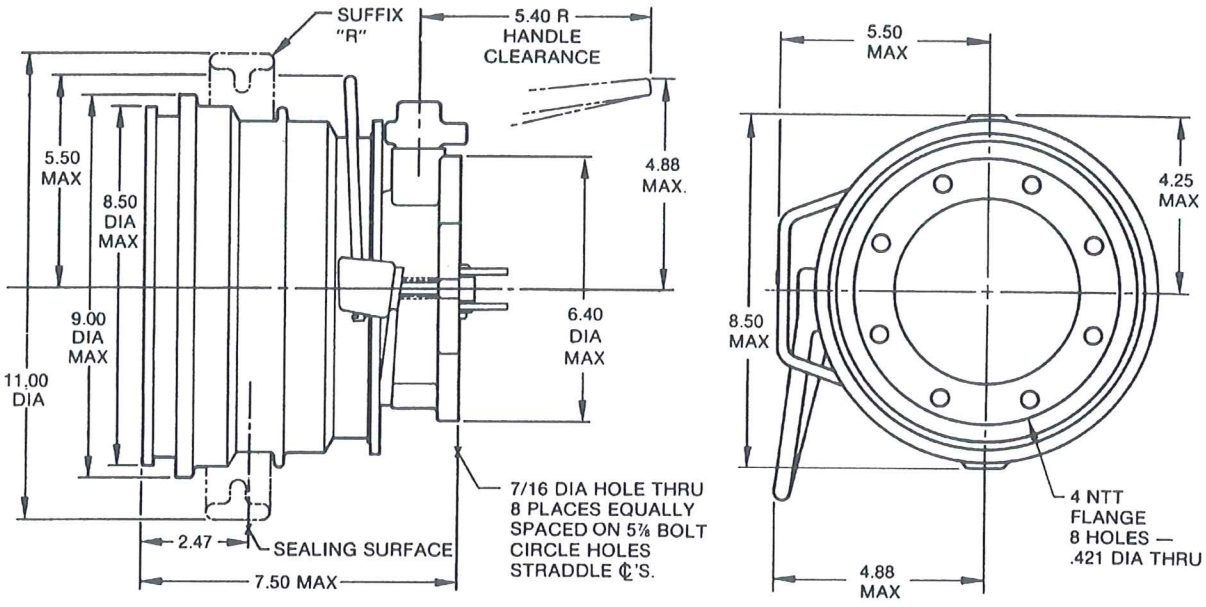
See the Modification Section of this catalog for various options to the part number listed above.

Contact your local Whittaker distributor or Whittaker directly for technical information beyond that listed in the technical section of this catalog.

Whittaker
12838 Saticoy Street, North Hollywood, CA 91605
Tel (818) 765-8160 Fax (818) 759-2194

BOTTOM LOADING COUPLER
F228

F228 Dimensions



(9.12 ON SUFFIX "A") (11.25 ON SUFFIX "B")
(10.5 ON SUFFIX "N") (8.50 ON SUFFIX "K")

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Maintenance Manual

BOTTOM LOADING COUPLER

F228 SERIES



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Original 1.0 ..... 12/15/2002

The total number of pages in this technical document is 17 consisting of the following:

Title, A, 1 – 15

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Description and Operation 1
Fault Isolation 5
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INTRODUCTION

1. General

This manual provides component maintenance shop instructions for the Bottom Loading Coupler (coupler).

2. Revision Service

This manual will be revised as necessary to show the current information.

3. Weights and Measurements

Weights and measurements in this manual are expressed in both English (U.S. customary) and Metric (SI) units.

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DESCRIPTION AND OPERATION

1. Description

The Bottom Loading Coupler (coupler) (see Figure 1) is a push-on pull-off one-hand operation coupler designed to mate with adapters conforming to API Standard RP1004. The major functional components of the coupler are the coupler body, the poppet, the operating handle, the bail, and the crank mechanism. A floating nose seal provides positive sealing under all normal operating conditions.

2. Operation

A. Connecting the Coupler to the Adapter

The coupler may be connected to the adapter by pressing it forward onto the adapter. This actuates the three locking lugs, and releases the spring-loaded shroud. The shroud slides forward and holds the locking lugs in their locked position.

B. Operating the Coupler

CAUTION: THE SLEEVE SEAL WILL BE DAMAGED IF THE COUPLER IS OPENED WITHOUT BEING CONNECTED TO AN ADAPTER.

When the coupler is connected to the adapter, it may be opened by rotating its operating handle to the OPEN position. To close the coupler, rotate its operating handle to the CLOSED position.

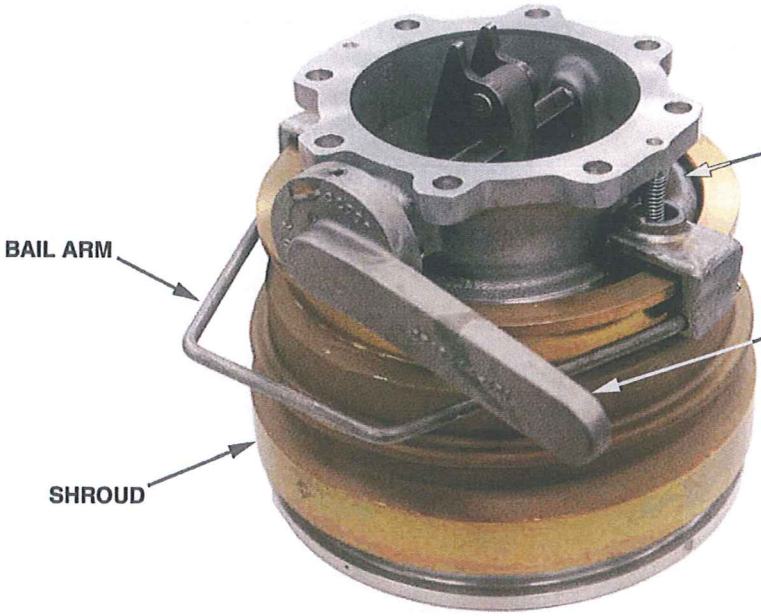


Figure 1. Bottom Loading Coupler

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C. Disconnecting the Coupler from the Adapter

The coupler may be disengaged from the adapter by rotating its operating handle to the CLOSED position and pulling back on the bail arm to disengage the locking lugs.

3. Leading Particulars (Refer to Table 1)

4. Model Variations

A. The basic F228 series coupler is equipped with standard seals. The Mod C variation utilizes Viton seals. The Mod E variation adds a stainless steel insert for heavy duty service (see Figure 2). Refer to the **ILLUSTRATED PARTS LIST** section for additional details.

B. Viton Seal Notes (Mod C Only)

1) Viton seals are not recommended for use in areas where the ambient temperature falls below 0°F (–18°C).

2) Viton seals are not recommended for use with diesel fuel because of the peroxides it contains.

Table 1. Leading Particulars

Service	Automotive and Aviation Fuels
Line Size	4-inch
Operating Pressure	
Working	0 to 120 psi (0 to 827 kPa)
Peak Surge	350 psi (2 400 kPa)
Pressure Drop	4.7 psi through F228/F433 at 1000 gpm ( )
Fluid Temperature	–65 to 125°F (–54 to 71°C)
Ambient Temperature	–65 to 160°F (–54 to 71°C)
Key Dimensions	See Figure 3
Weight (approximate)	13.6 pounds (6,2 kg)

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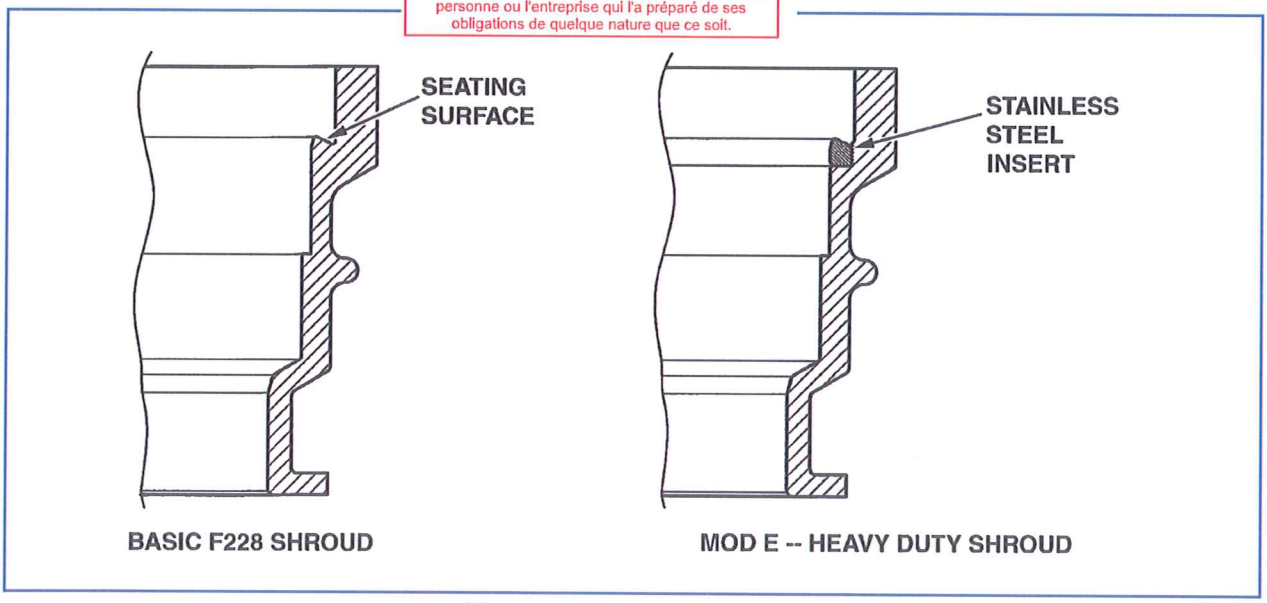


Figure 2. Shroud Variations

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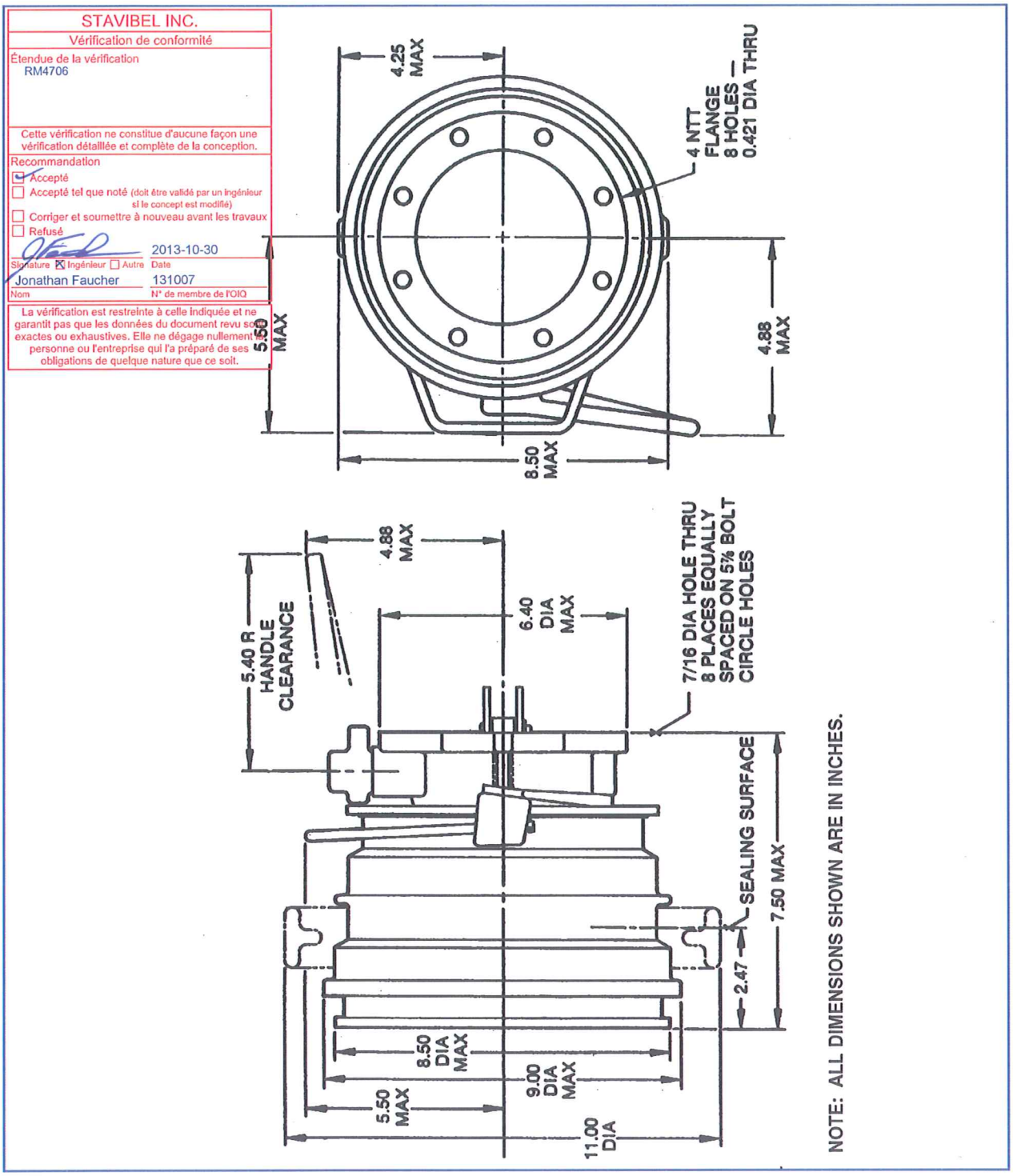


Figure 3. Envelope Dimensions

FAULT ISOLATION

1. General

Refer to Table 2 for fault isolation information. Locate suspected faulty component and take appropriate remedial action.

Table 2. Fault Isolation

FAULT	POSSIBLE CAUSE	CORRECTIVE ACTION
Leakage past poppet when closed	Damaged or worn seat (bonded) on sleeve (5)	Replace the sleeve.
Nose seal leakage	Damaged or worn nose seal (3)	Replace the nose seal.
Leakage past sleeve	Damaged or worn packing (6)	Replace the packing.
Leakage around operating handle shaft	Damaged or worn packing (15)	Replace the packing.

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SPECIAL TOOLS

1. General

Refer to Table 3 for the special tools recommended for maintenance of the coupler. Equivalent tools may be substituted for the items listed.

Table 3. Recommended Special Tools

PART NUMBER	DESCRIPTION	APPLICATION
2702058	Adapter (API RP1004)	To drain the coupler/hose before removal.

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DISASSEMBLY

1. Replacement Parts Kits

Refer to the **ILLUSTRATED PARTS LIST** section for the Replacement Parts Kit information.

2. Disassembling the Coupler

A. Using an API-style adapter (PN 2702058, or equivalent) without a poppet, release the locking lugs (24) and drain the product.

B. Unbolt the coupler from the adapter or hose connection. Remove the API-style adapter from the coupler.

C. Manually release the locking lugs (24). The sleeve assembly (2) should slide forward.

D. Rotate the operating handle (10) to its OPEN position to release the spring force on the sleeve assembly (5).

WARNING: THE SLEEVE ASSEMBLY IS SPRING-LOADED. BE CAREFUL WHEN RELEASING THE SPRING FORCE.

E. Remove the pin (23), the washer (20), the clevis pin (21) and to release the poppet (17). Remove the poppet from the coupler body (1).

F. If the sleeve assembly (5) did not come out of the coupler body (1) when the poppet (17) was removed, place the coupler body face down and gently tap out the sleeve assembly from the inlet side. Remove the wave washers (7) from the coupler body.

G. Pry the retainer (4) off of the sleeve assembly (5). Remove the nose seal (3) from the sleeve assembly. Remove the wiper (32) and the packing (6) from the sleeve assembly.

H. Pull back on the bail arm (27), rotate the operating handle (10) to its CLOSED position, and loosen the setscrew (25) in the crank (16).

I. Note the relative positions of the crank (16) and the links (18) for reassembly reference. Drive the pin (8) out of the coupler body (1). Remove the operating handle assembly from the coupler body (1).

J. Drive the pin (11) out of the operating handle (10). Remove the operating handle, the washer (35), felt wiper (12), the bushing (13), the washers (14) and the packing (15) from the shaft (9).

K. Remove the cotter pin (34), the washer (20) and the clevis pin (21) from the crank (16) and the links (18).

L. Remove the cotter pins (28) to remove the bail arm (27) from the bail.

M. Remove the retaining rings (33), the pins (30), the springs (31) and the washers (29) from the coupler body (1).

N. Remove the bail (26) from the coupler body (1).

O. Remove the shroud (2) and the wiper (19) from the coupler body (1).

P. Remove the springs (22) and the locking lugs (24) from the coupler body (1).

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CLEANING

1. Cleaning Materials

Refer to Table 4 for recommended cleaning materials. Suitable equivalent cleaning materials may be substituted for the items listed.

Table 4. Recommended Cleaning Materials

DESCRIPTION	SPECIFICATION	SOURCE
Brush, Bristle, stiff, nonmetallic	– –	Commercially available
Dry Cleaning Solvent	P-D-680, Type 2	Commercially available
Pick, Teflon	– –	Commercially available
Plastic Bags	– –	Commercially available
Tissues, lint-free	– –	Commercially available

2. Cleaning Procedures

WARNING: DRY CLEANING SOLVENT IS FLAMMABLE AND TOXIC TO EYES, SKIN, AND RESPIRATORY TRACT. SKIN/EYE PROTECTION REQUIRED. AVOID REPEATED/ PROLONGED CONTACT. USE ONLY IN WELL VENTILATED AREAS. GOOD GENERAL VENTILATION IS NORMALLY ADEQUATE. KEEP AWAY FROM OPEN FLAMES OR OTHER IGNITION SOURCES.

A. Clean all metal parts by washing thoroughly in dry cleaning solvent. Remove stubborn deposits by scrubbing with a nonmetallic stiff bristle brush. Use a Teflon pick to remove obstructions from ports, grooves and passages.

NOTE: All of the parts must be free of corrosion, dirt, grease, oil, or any other foreign matter.

WARNING: WEAR EYE PROTECTION WHEN DRYING PARTS WITH COMPRESSED AIR. DO NOT DIRECT AIRSTREAM AT PERSONNEL OR LIGHT METAL PARTS.

B. Dry parts with clean lint-free tissues or clean, dry compressed air.

C. Package clean parts in plastic bags.

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INSPECTION

1. General

A. Under strong light and magnification, visually check all parts in accordance with the general criteria specified in paragraph 2 below.

B. Repair minor damage in accordance with local directives. If damage is major or beyond simple repair, replace the part rather than attempt extensive repairs.

2. Component Checks (Refer to Table 5)

Table 5. Component Checks

DESCRIPTION	CHECK CRITERIA
General	Visually check all parts as applicable for nicks, cracks, cuts, burrs, corrosion, breaks, scoring, chafing, scarring, deformation, dents, thread damage, or any other obvious defects. Make sure that the ports, passages, recesses and sealing grooves are clean and unobstructed. Check all sealing and seating surfaces for damage or corrosion that would affect sealing.
Nose Seal (3)	Check for any damage or excessive wear that would affect sealing.
Sleeve Assembly (5)	Check the bonded seal on the sleeve assembly for any damage or excessive wear that would affect sealing.
Clevis Pins (21)	There must not be any wear grooving from contact with the links (18).

ASSEMBLY

1. Replacement Parts Kits

Refer to the **ILLUSTRATED PARTS LIST** section for recommended replacements parts information.

2. Assembly Materials

Refer to Table 6 for recommended assembly materials. Suitable equivalent materials may be substituted for the items listed.

Table 6. Recommended Assembly Materials

DESCRIPTION	SPECIFICATION	SOURCE
Thread Locking Compound	Loctite, Grade 242	Commercially available
Petrolatum	–	Commercially available

3. Assembling the Coupler

A. Lubrication

Prior to assembly, lightly lubricate all of the packings and seals with petrolatum.

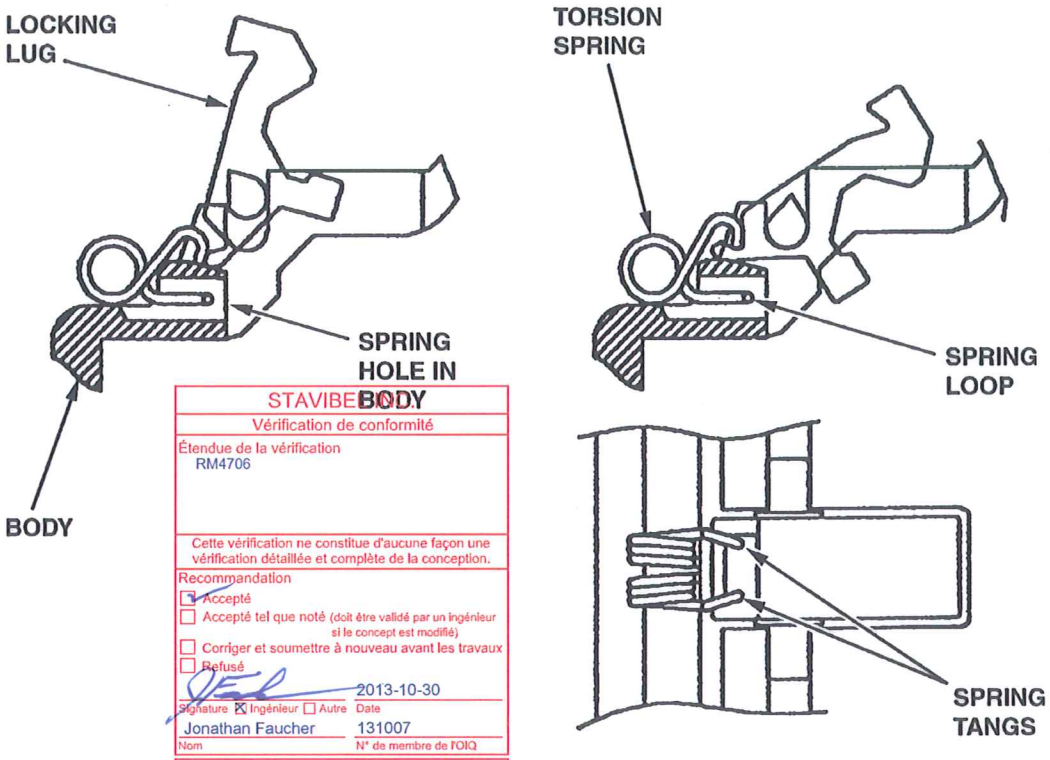
B. Assembly Procedure (Refer to IPL Figure 1)

1) Refer to Figure 4 and install the springs (22) and the locking lugs (24) in the coupler body (1) as follows:

NOTE: Long nose pliers can be used to close the spring loop during installation of a spring in the body, but be careful to avoid damaging the spring. The wire should not be marked or scratched.

a) Push the loop of the spring (22) into the hole in the body (1), with the two tangs resting on the top surface. Push the spring in as far as possible, so that the two tangs contact the body surface. The loop of the spring should be a tight press fit in the hole.

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Figure 4 Installing the Springs and the Locking Lugs

b) Position the locking lug (24) in its groove of the body (1), spring anchor end inward to contact the ends of the two tangs of the spring (22). Lift and place the ends of the spring tangs into the groove of the locking lug. Press the locking lug inward and rotate it into position. Make sure that both of the spring tangs are still in their correct positions and that the locking lug rotates freely.

c) Repeat steps 1 and 2 above each of the remaining springs (22) and locking lugs (24).

4) Install the felt wiper (19) in the wiper groove of the shroud (2).

5) Put the coupler body (1) on the API-style adapter (PN 2702058, or equivalent) you used during disassembly of the coupler. Install the shroud (2) on the body.

6) Install the bail (26) on the coupler body (1).

7) Install the washers (29), the pins (30), the springs (31) and the retaining rings (33) on the coupler body (1).

8) Install the bail on (27) on the bail arm (26) and secure it with the cotter pins (28).

9) Install the links (18) on the crank (16) and secure them with the clevis pin (21), the washer (20) and the cotter pin (34).

CAUTION: BEFORE INSTALLING THE PIN (11), MAKE SURE THAT ANY BURR CAUSED BY REMOVING IT DURING DISASSEMBLY HAS BEEN REMOVED. IF THE BURR IS NOT REMOVED, IT WILL DAMAGE THE PACKING (15) AND CAUSE LEAKAGE AROUND THE OPERATING HANDLE SHAFT DURING OPERATION.

10) Install the washers (14), the packing (15), the bushing (13) the felt wiper (12), the washer (35) and the operating handle (10) on the shaft (9). Secure the handle by installing the pin (11). The pin must be flush or below the surface of the handle.

11) Assemble the crank (16) (with the links) and the operating handle assembly in the coupler body (1).

12) Make sure that the operating handle and the links are oriented as shown in IPL Figure 1. Apply thread locking compound (Grade 242) to the threads of the setscrew (25). Install the setscrew in the crank (16) and tighten it securely to lock its position on the shaft (9).

13) Drive the pin (12) into the pin bore of the body (30) to secure the shaft assembly (items 13 through 18).

14) Install the nose seal (3) in the nose seal groove of the sleeve assembly (5) and secure it with the retainer (4). Install the wiper (32) and the packing (6) in the grooves of the sleeve assembly.

15) Install the wave washers (7), the sleeve assembly (5) and the poppet (17) in the coupler body. Connect the links (18) to the poppet by installing the clevis pin (21), the washer (20) and the cotter pin (23).

16) Rotate the operating handle to its OPEN and CLOSED positions several times to verify proper operation.

17) Rotate operating handle to its CLOSED position. Slide the sheaud (2) toward the operating handle until the locking lugs (24) engage.

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ILLUSTRATED PARTS LIST

1. General

This section lists, describes, and illustrates all detail parts required for maintenance support of the Bottom Loading Coupler.

2. Scope of Information

A. The parts list is arranged in the general order of disassembly. The listing is indentured to show the relationship between each part and its next higher assembly. Item numbers used in the parts list are keyed to the corresponding numbers of the accompanying illustration.

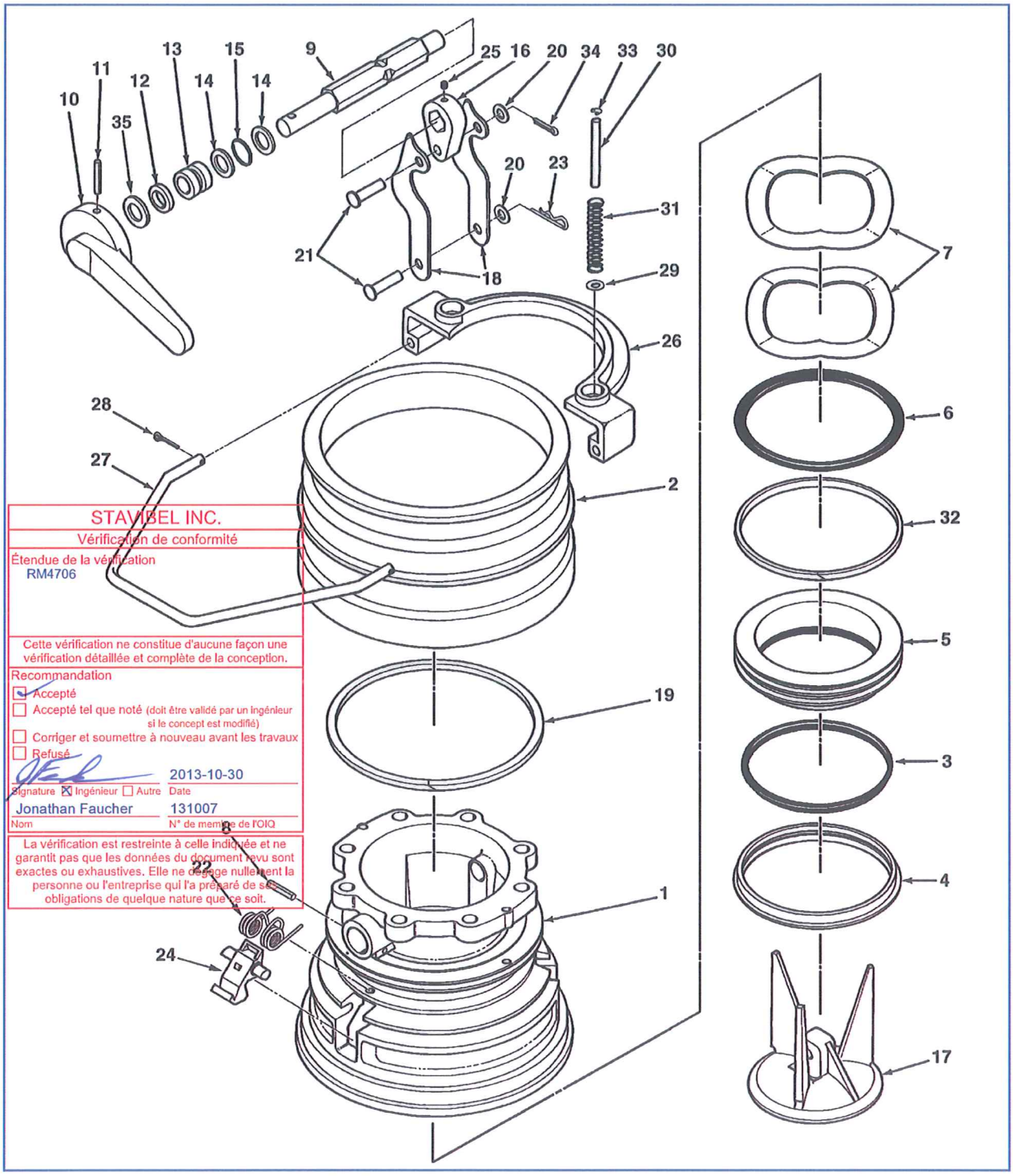
B. MODIFICATION CODE

The modification code indicates the parts usage with respect to the end item. When the MODIFICATION CODE column is blank, the part usage is applicable to all versions unless otherwise specified in the DESCRIPTION column.

C. Abbreviations

ASSY	Assembly.
FIG.	Figure.
IPL	Illustrated Parts List.
MOD	Modification.
NP	No longer available.

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IPL Figure 1. Bottom Loading Coupler

FIG. ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	MOD CODES	UNITS PER ASSY
1-	F228	COUPLER, BOTTOM LOADING		REF
1	2773209-101	• BODY, COUPLER		1
2	2773207-101	• SHROUD		1
2A	971027-101	• SHROUD (With stainless steel insert)	E	1
3	2672292-1	• SEAL, NOSE		1
3A	2672292-2	• SEAL, NOSE (Viton)	C	1
4	2672293	• RETAINER		1
5	2763489-101	• SLEEVE ASSEMBLY		1
5A	2763489-102	• SLEEVE ASSEMBLY (Viton)	C	1
6	2661058BD350	• PACKING, PREFORMED		1
6A	2661058AF350	• PACKING, PREFORMED (Viton)	C	1
7	W4997-050	• WASHER, WAVE		2
8	CMS171594	• PIN, SPRING		1
9	2763496-101	• SHAFT, HANDLE		1
10	2763484-101	• HANDLE, OPERATING		2
11	CMS171660	• PIN, SPRING		1
12	2763494-101	• WIPER		1
13	2763492-101	• BUSHING		1
14	2763493-101	• WASHER		2
15	2661058A207	• PACKING, PREFORMED		1
15A	2661058AF207	• PACKING, PREFORMED (Viton)	C	1
16	2733269-1	• CRANK		1
17	2763483-101	• POPPET		1
18	2763497-102	• LINK		2
19	CMS28932C20-8	• WIPER		1
20	CAN960-516L	• WASHER, FLAT		2
21	CMS20392-4C33	• PIN, CLEVIS		2
22	941016-101	• SPRING (See Service Bulletin 76)		3
	2763491-101	• SPRING (Replaced by PN 941016-101)		NP
23	98335A054	• PIN, STRAIGHT		1
24	2763487-101	• LUG, LOCKING		3
25	LP565A428H4	• SETSCREW		1
26	2773211-101	• BAIL		1
27	2773212-101	• ARM, BAIL		1
28	CMS24665-210	• PIN, COTTER		2
29	CAN960-416L	• WASHER, FLAT		2
30	2773214-101	• PIN		2
31	LC042E17	• SPRING, COMPRESSION		2
32	CMS28932C15-5	• WIPER		1
33	CMS16625-1025	• PIN, SPRING		2

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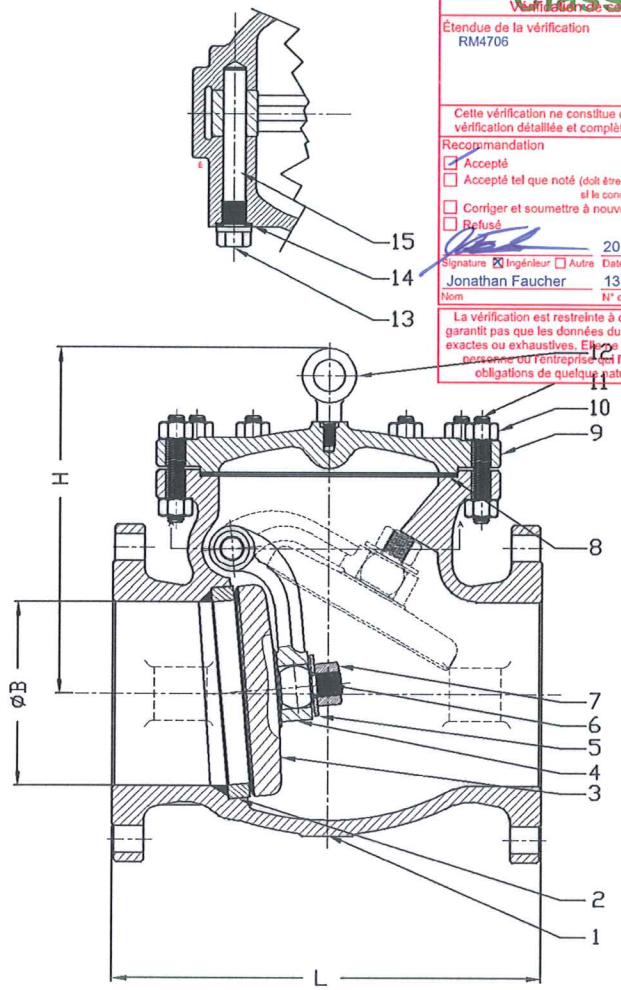
FIG. ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	MOD CODES	UNITS PER ASSY
1 34	CMS24665-300	• PIN, COTTER		1
35	CAN960-916L	• WASHER, FLAT		1

REPLACEMENT PARTS KITS AVAILABLE		
KIT PART NUMBER	DESCRIPTION	ITEMS IN KIT (IPL Figure 1)
KITF228-102	Standard (Buna-N) Seals	3, 6, 15
KITF228-103	Standard (Buna-N) Overhaul	3, 5, 6, 8, 11, 12, 13, 15, 19, 21, 23, 25, 28, 30, 33
KITF228-104	Viton Conversion	3A, 5A, 6A, 15A
KITF228-106	Viton Overhaul	3A, 5A, 6A, 8, 15A 11, 12, 13, 19, 21, 23, 25, 28, 30, 33
KITF228-107	Viton Seals	3A, 6A, 15A

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Standards:

Face to Face Dimensions:	ANSI B16.10
End Flange Dimensions:	ANSI B16.5 26" ≥ MSS SP-44
Basic Design:	API 594 ANSI B16.34

* Conforms to the applicable requirements of API 600

Test Standard: API 598

MATERIAL LIST

NO.	Part Name	ASTM Specification (Specs – Grades/Types)				
		A 216	A 352	A 217		A 351
		WCB	LCC	WC6	WC5	CF8M
1	Body	A216-WCB	A352-LCC	A217-WC6	A217-C5	A351-CF8M
2	Seat Ring	A105	A350-LF2	A182-F11	A182-F11	
	Seat Ring Surface	13CR, HF (CoCr-A), 316, 304, or Monel				
3	Disc	A105	A350-LF2	A182-F11	A182-F11	A182-316
	Disc Seating Surface	13CR, HF (CoCr-A), 316, 304, or Monel				
4	Swing Arm	A 216-WCB	A 352-LCC	A217-WC6	A 217-WC5	A 351-CF8M
5	Washer	ASTM A276 Gr. 316				
6	Pin	ASTM A276 Gr. 316				
7	Disc Nut	A194 Gr. 8				
8	Gasket	F5				
9	Bonnet	A216-WCB	A352-LCC	A217-WC6	A217-C5	A351-CF8M
10	Body Nut	A 193-B7	A 320-L7	A 193-B7	A 193-B16	A 193-B8
11	Body Stud	A 193-B7	A 320-L7	A 193-B7	A 193-B16	A 193-B8
12	Eyebolt	A181				
13	Hinge Pin Bolt	A 193-B7	A 320-L7	A 193-B7	A 193-B16	A 193-B8
14	Gasket	08F				
15	Hinge Pin	A276-410	A276-410	A276-410	A276-410	A276-316

DIMENSIONS AND WEIGHTS

Size	NPS	2	2-1/2	3	4	5	6	8	10	12	14	16	18	20	24
L (RF)	In	8.00	8.50	9.50	11.50	13.00	14.00	19.50	24.50	27.50	31.00	34.00	38.50	38.50	51.00
	Mm	203	216	241	292	330	356	495	622	698	787	864	978	978	1295
L (RTJ)	In	8.50	9.00	10.00	12.00	13.50	14.50	20.00	25.00	28.00	31.50	34.50	38.90	38.98	51.50
	Mm	216	229	254	305	343	368	508	635	711	800	876	990	990	1308
L (BW)	In	8.00	8.50	9.50	11.50	13.00	14.00	19.50	24.50	27.50	31.00	34.00	38.50	38.50	51.00
	Mm	203	216	241	292	330	356	495	622	698	787	864	978	978	1295
ØB	In	2	2.50	3	4	5	6	8	10	12	13.25	15.25	17.25	19.25	23.25
	Mm	51	64	76	102	127	152	203	254	305	337	387	438	489	591
H	In	6.50	7.00	7.30	8.50	9.06	10.50	12.50	14.50	16.00	17.00	19.00	23.60	26.00	29.10
	Mm	165	178	186	217	230	266	318	368	406	432	483	600	660	740
WT	KG	19	26	29	48	69	77	133	266	347	451	556	784	835	1580
	LB	41.9	57.3	63.9	105.8	152.1	169.8	293.2	586.4	765.0	994.3	1225.8	1728.4	1840.8	3483.3

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BERIC FIGURE NUMBER SYSTEM

XXX-XX-XX-XXXX-X

TYPE	CLASS & BONNET STYLE	SIZE	END CONFIGURATION	DESIGN	SHELL MATERIAL	TRIM	OPERATION	OTHER
1 - GATE	01 - 150#, BB	02"	RF - RAISED FACE FLGD END	A - API 600	A - A216-WCB	01	H - HANDWHEEL	N - NACE
2 - GLOBE	03 - 300#, BB	02.5"	FF - FLAT FACE FLGD END	B - API 600, STYLE A	B - A216-WCC	02	G - GEAR OPERATED	EB - EXT. BONNET
3 - SW, CHECK	06 - 600#,BB	03"	RJ - RING TYPE JOINT, FLGD END	C - API 600, STYLE B	C - A217-WC6	03	M - MOTOR OPERATED	Y - Y-PATTERN
	06P - 600#,PS	04"	BW(#) - BUTTWELD END (SCHED)	D - API 603	D - A217-WC9	04	L - LEVER POERATED	MP - MOUNTING PLATAE
	09 - 900#,BB	05"		E - ASME B16.34	E - A217-C5	05	C - CHAINWHEEL	B - BY-PASS
	09P - 900,PS	06"		F - API 6D	F - A217-C12	05A	B - BARE STEM	D - DRAIN
	15 - 1500,BB	08"			G - A352-LCB	06	X - CHECK VALVE	W - WIGHT & LEVER
	15P - 1500,PS	10"			H - A352-LCC	07	O - OTHER, SPECIFY	J - JACKETED
	25 - 2500#,BB	12"			I - A351-CF8	08		C - CRYOGENIC
	25P - 2500#,PS	14"			J - A351-CF8M	08A		Z - OTHER, SPECIFY
		16"			K - A351-CF3	09		
		18"			L - A351-CF3M	10		
		20"			M - A351-CN7M	11		
		24"			N - A351-CF8C	12		
		30"				13		
		36"				14		
		40"				15		
		42"				16		
		48"				17		
						18		
						X - SPECIFY		

STAVIBEL INC.

Vérification de conformité

Étendue de la vérification
RM4706

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- [ ] Refusé

Signature ☒ Ingénieur ☐ Autre — Date: 2013-10-30

Nom: Jonathan Faucher — N° de membre de l'OIQ: 131007

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EAGLEVIEW

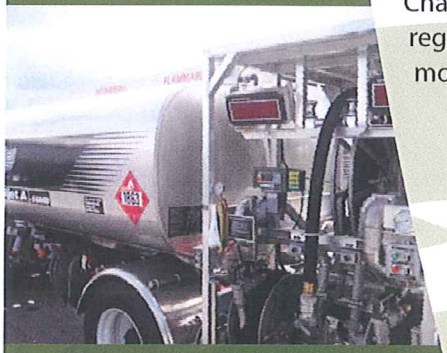
Information visible de n'importe où

3 ANS GARANTIE

L'afficheur EAGLEVIEW est le seul modèle alphanumérique disponible sur le marché des camions-citernes. L'afficheur EagleView est robuste et rencontre les normes NEMA4X. Il vous offre la possibilité de voir de très loin l'information essentielle à vos opérations de remplissage. Il a été installé dans les climats les plus rudes. Nos clients satisfaits se retrouvent de l'Alaska au Texas. La température n'est jamais un problème.



C'est le meilleur afficheur conçu pour le domaine de l'aviation. Il est personnalisable et adaptable à n'importe quelle application que vous recherchez. C'est un système intelligent et unique en son genre car il offre la flexibilité et la capacité d'évoluer en même temps que votre entreprise. Quel que soit votre besoin pour la transmission d'information et d'affichage, nous avons le bon produit pour vous.



Chaque appareil peut communiquer avec deux (2) registres électroniques ou bien deux (2) registres mécaniques (mode pulser) sur un seul camion. Économisez de l'argent en achetant moins d'afficheurs et augmentez vos résultats.



Spécification de l'afficheur

- Entrée d'alimentation 8-40 Volts, 3 Ampères
- Température de fonctionnement étendue (-40 à +75 degrés Celsius)
- Dimensions externes du boîtier Largeur 15.75" x Largeur 7.87" x Épaisseur 4.84
- Toutes les composantes respectent le grade industriel (-40 à +85 degrés Celsius

Vos avantages

- Facile à installer et à mettre à jour avec notre connexion « PLUG & PLAY » et notre logiciel d'installation
- Personnalisation des messages textes pour vos clients et/ou pour afficher de l'information à votre personnel de manière simple et efficace.
- Facile à reprogrammer même durant la journée de travail sans avoir besoin de désinstaller l'afficheur

Caractéristiques clés

- Six (06) Digits à DEL d'une hauteur de 3.5 pouces
- rôle de l'intensité en fonction des conditions d'éclairage extérieur (jour, brouillard, etc.)
- erfacée avec système EMR et les registres mécaniques (Veeder-Root IR3, etc.)
- Affiche autant des messages numériques et textes
- Communication RF optionnelle
- Boitier NEMA4X résistant aux intempéries
- Visible de 175 pieds

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Contact:

Tekinno Corporation Inc.
Téléphone: (514) 316-1880
Fax: (514) 316-1882
Sans frais: (877) 698-3546
info@tekinno.com
www.eagleviewdisplay.com
www.tekinno.com

TEKINNO CORP. INC.
L'excellence dans la simplicité.

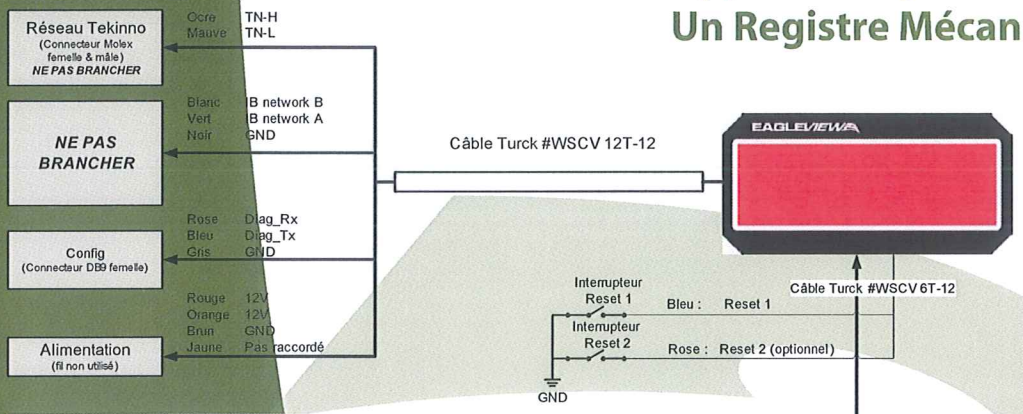
TEKK.EAG1r

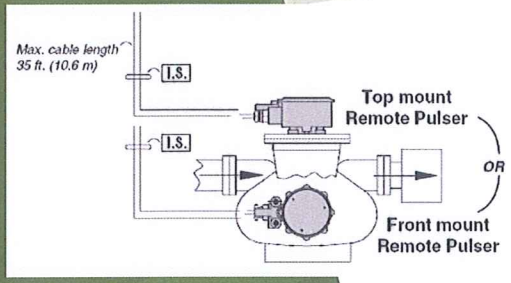
EAGLEVIEW

Information visible de n'importe où

3 ANS GARANTIE

Application pour Un Registre Mécanique





Blanc: Pas branché
Brun: Pulse 1 (ChA pour bidirectionnel)
Gris: Pulse 2 (ChB pour bidirectionnel)
Noir: GND

Note : SVP référez vous au manuel d'utilisateur du pulser pour un raccordement conforme et fonctionnel

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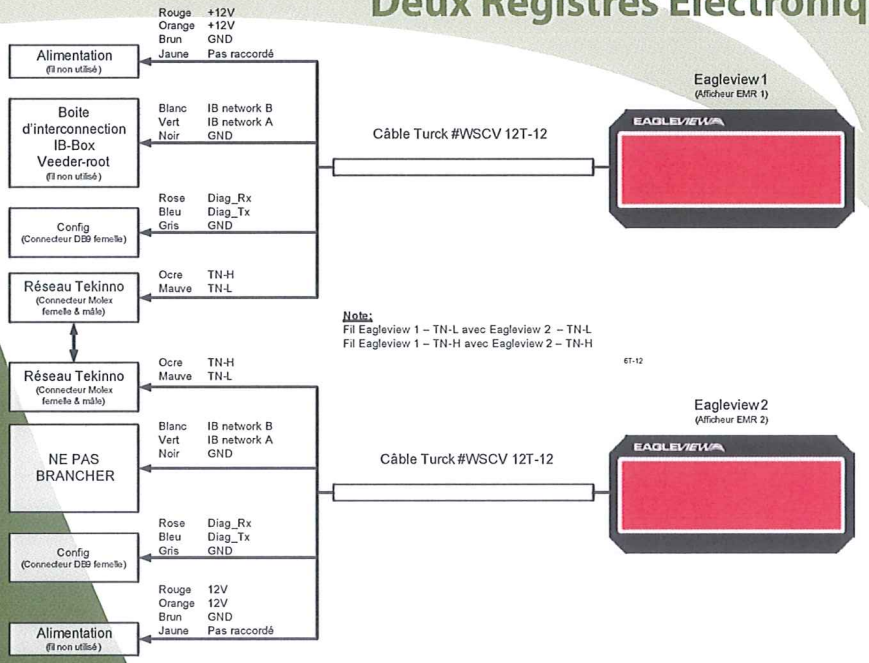
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Application pour Deux Registres Électroniques



L'afficheur EagleView supporte les registres suivants en mode pulser :

- EMR3 de Veerder-Root
- EMH600 de Liquip
- PPT-300-100 de Metermatic
- TRAC-40 de Contrec
- Vega T de Isoil
- LCRII de Liquid Controls
- RUBY ou EQUALIS de Satam

Spécification du câblage:

- Câbles industriels approuvé CSA/UL (IP68, NEMA4x)
- PVC Résistant à l'huile et aux rayons UV
- UL94-V2
- Accessoires listés UL, CSA & VDE

www.eagleviewdisplay.com
www.tekinno.com

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L'excellence dans la simplicité.

TEKK.EAG1v

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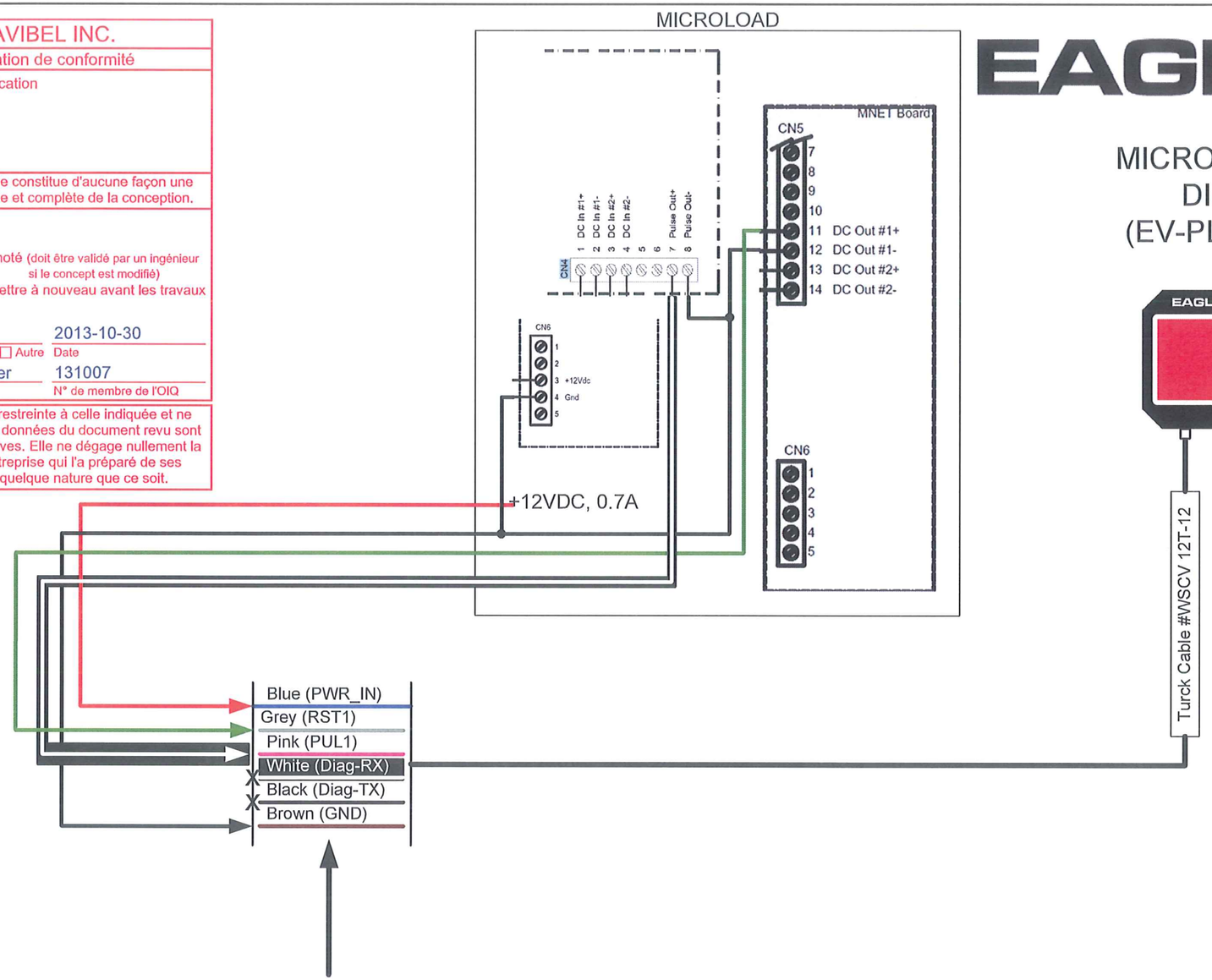
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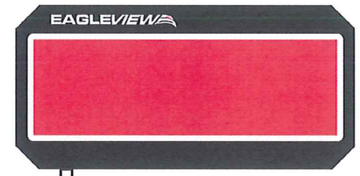
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EAGLEVIEW

MICROLOAD SINGLE DISPLAY DIRECT CONNECTION (EV-PLR 6 wires internal wiring)



MASTER UNIT

EAGLEVIEW PULSER OPERATING MODE

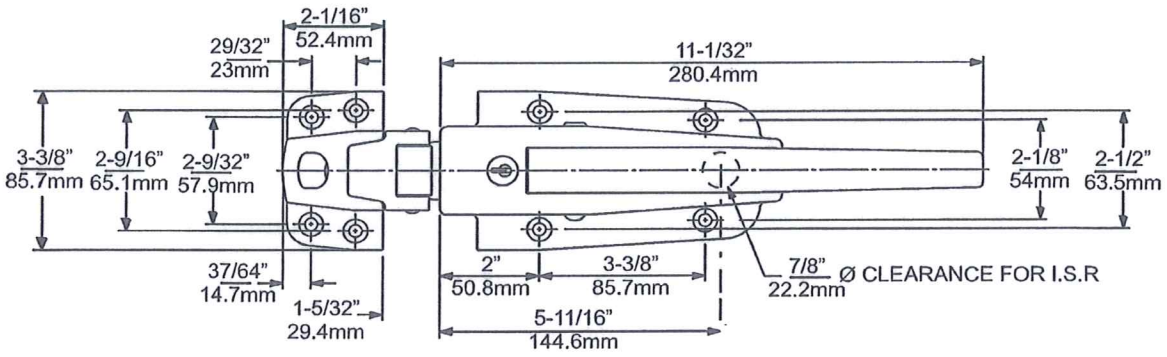
When a +12 volts is applied on the RST1 input, the display resets its count to 0. Then the Eagleview will start to count every pulse it receives on the PUL1 input. The end of delivery occurs when the RST1 input falls back to 0 volts.

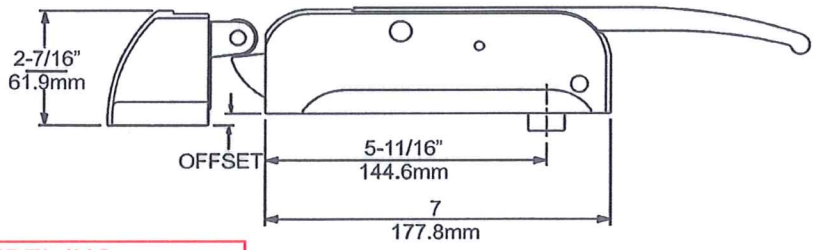
Note : Predefined and other configurations (text messages, pulser ratio,etc) can be programmed by opening the display cover and connect to the main controller board (DB9 connector) located at the enclosure bottom. You have to install the Eagleview PC configuration manager software.

Please cut your cable going from the display to the equipment you want to link, at the specific length your application requires then connect wire by wire on the terminal block P1. The color code represents the Eagleview internal wiring with (signal name).

TEKINNO CORPORATION INC	
EAGLEVIEW MICROLOAD WIRING (EV-PLR)	
ELECTRICAL INSTALLATION (REV1.0)	
SCALE : -/-	BY : S.L.
DATE : 2012-04-18	PAGE : 1 OF 1
DWG NO : EAGLEVIEW-JB(EV-PLR)-MICROLOAD-EN-REV1	

0056 SAFEGUARD® LATCH





ORDERING INFORMATION ON FOLLOWING PAGE

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KASON

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WALK-IN

0056 SAFEGUARD® LATCH

NSF®

Model No.	Item	Description	Finish
0056CH5020	Cylinder Locking Body	Heavy Spring	Polished Chrome
0056CH6021	Cylinder Locking Body	Heavy Spring	Brushed Chrome
0056CH0086	Cylinder Locking Body	Heavy Spring	Tuffkote
0056CL5020	Cylinder Locking Body	Light Spring	Polished Chrome
0056CL6021	Cylinder Locking Body	Light Spring	Brushed Chrome
0056CL0086	Cylinder Locking Body	Light Spring	Tuffkote
0056CX5020	Cylinder Locking Body	X-Light Spring	Polished Chrome
0056H05020	Padlocking Body	Heavy Spring	Polished Chrome
0056H06021	Padlocking Body	Heavy Spring	Brushed Chrome
0056L05020	Padlocking Body	Light Spring	Polished Chrome
0056L06021	Padlocking Body	Light Spring	Brushed Chrome
0056L00086	Padlocking Body	Light Spring	Tuffkote
0056XL5020	Padlocking Body	X-Light Spring	Polished Chrome
0056XL6020	Padlocking Body	X-Light Spring	Brushed Chrome
0056XL0086	Padlocking Body	X-Light Spring	Tuffkote
0056005002	Strike	–1/8" to 1/4" (–3.2 to 6.4 mm)	Polished Chrome
0056005003	Strike	3/4" to 1-1/2" (19.0 to 38.1 mm)	Polished Chrome
0056005005	Strike	1-3/4" to 2-1/2" (44.5 to 63.5 mm)	Polished Chrome
0056005008	Strike	3" to 4" (76.2 to 101.6 mm)	Polished Chrome
0056006002	Strike	–1/8" to 1/4" (–3.2 to 6.4 mm)	Brushed Chrome
0056006003	Strike	3/4" to 1-1/2" (19.0 to 38.1 mm)	Brushed Chrome
0056006005	Strike	1-3/4" to 2-1/2" (44.5 to 63.5 mm)	Brushed Chrome
0056006008	Strike	3" to 4" (76.2 to 101.6 mm)	Brushed Chrome
005600T002	Strike	–1/8" to 1/4" (–3.2 to 6.4 mm)	Tuffkote
005600T003	Strike	3/4" to 1-1/2" (19.0 to 38.1 mm)	Tuffkote
005600T005	Strike	1-3/4" to 2-1/2" (44.5 to 63.5 mm)	Tuffkote
005600T008	Strike	3" to 4" (76.2 to 101.6 mm)	Tuffkote
0056CM0004	Cylinder Kit for 56C models.		

Cylinder locks may be keyed alike or differently; 5 key changes available. Please specify.

KASON INDUSTRIES, INC.* 57 AMLAJACK BLVD.*NEWNAN*GEORGIA*30265 1.800.93KASON WWW.KASONIND.COM

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Clément Bédard inc.
Distributeur Overhead door
126 rue Lebouthillier
Québec, Qc
G1N 3R6
Tél. : (418) 527-7414
Fax : (418) 527-9902
E-mail : info@lesportescbinc.com
Service 24 heures 7 jours

Date : 22 mars 2013
Destinataire : Mme. Véronique Mainguy
Télécopieur : (418) 849-6464
Expéditeur : Serge Rouleau

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Réf : 20889-36913

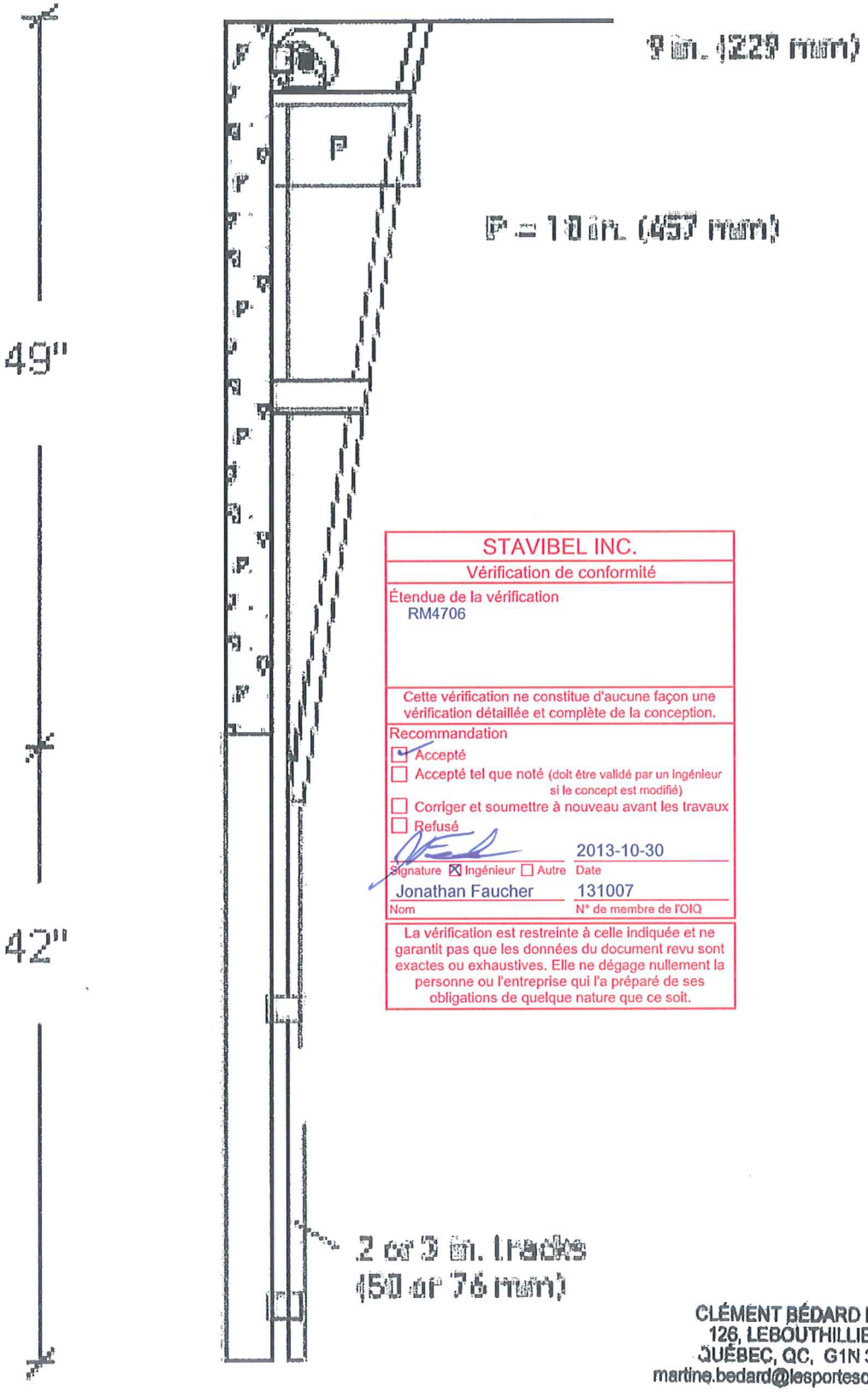
Tel que demandé, voici les dessin d'atelier. Si vous avez des questions, h'hésitez pas a me contacter.

Merci!

Pages incluant celle-ci :4

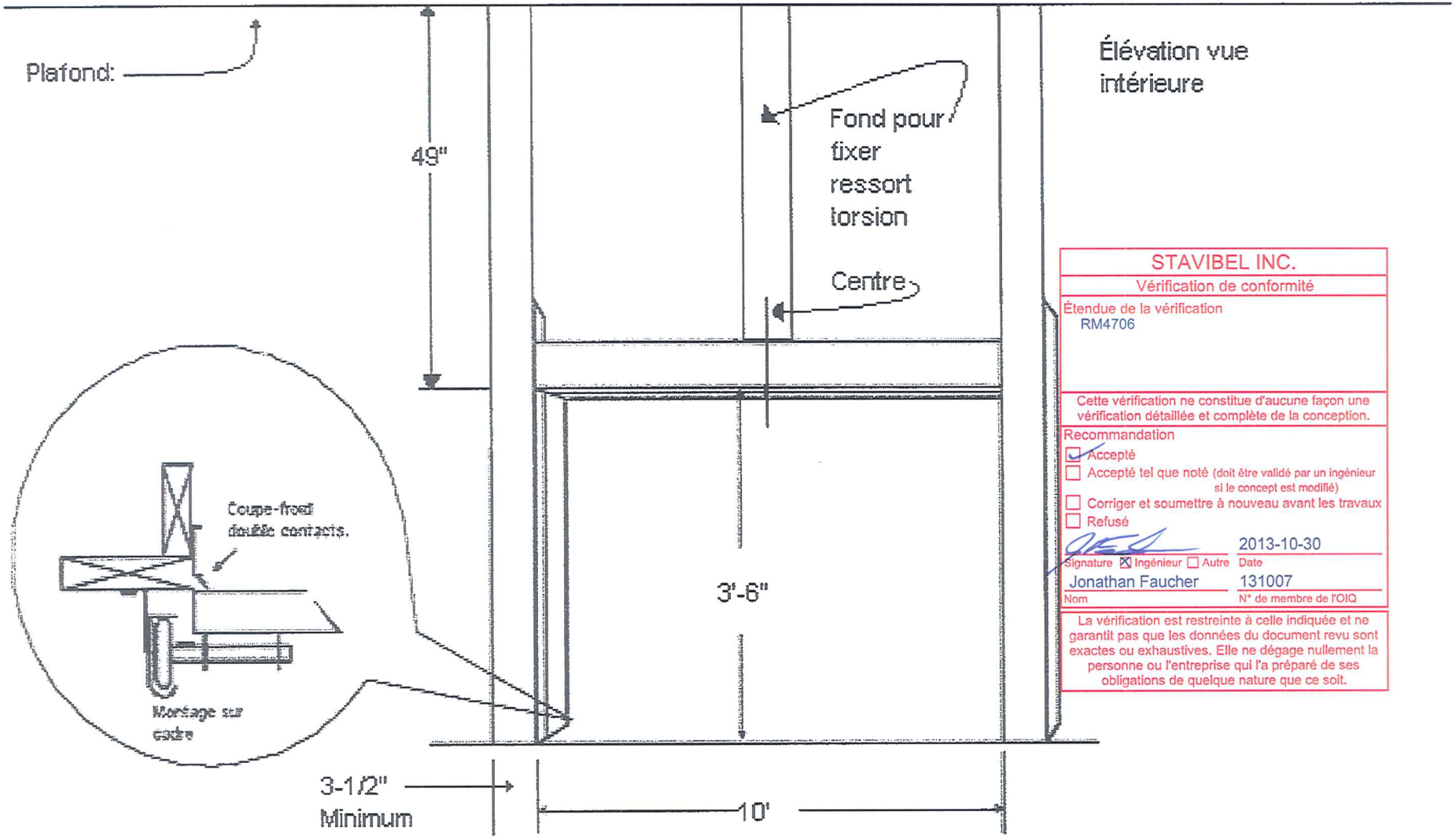
Vente - Installation - Réparation
De portes de garage de toutes marques
Manuelle ou électrique
RÉSIDENTIEL - COMMERCIAL

Full vertical lift (FV)



STAVIBEL INC.	
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CLÉMENT BÉDARD INC.
126, LEBOUTHILLIER
QUÉBEC, QC, G1N 3R6
martine.bedard@lesportescbinc.com



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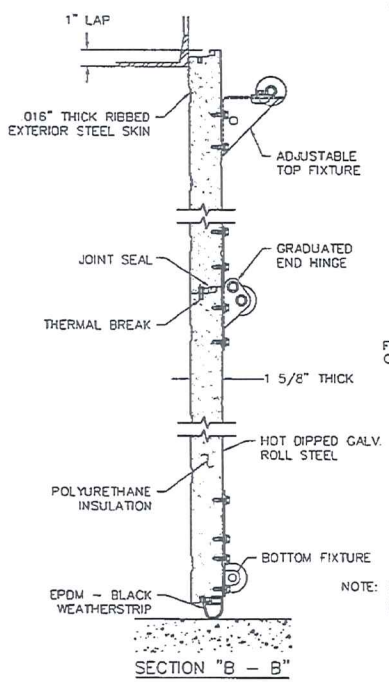
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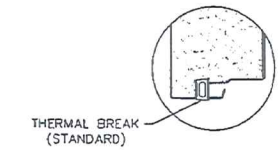
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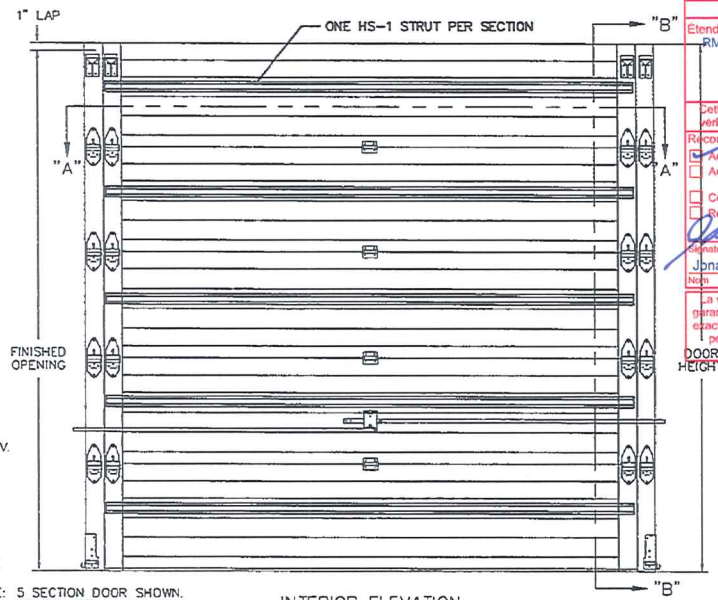
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126, LEBOUTHILLIER
QUÉBEC, QC, G1N 3R6
martine.bedard@lesportescbinc.com

MAR-22-2013 08:29A DE :CLEMENT BEDARD INC 4185279902 A:4188496464 P.4



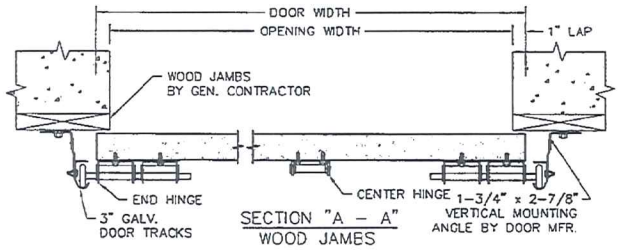
SECTION "B - B"





NOTE: 5 SECTION DOOR SHOWN. SECTION QTY WILL VARY. SEE TABLE BELOW.

INTERIOR ELEVATION



SECTION "A - A"
WOOD JAMES

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126, LEBOUTHILLIER
QUÉBEC, QC, G1N 3R6
martine.bedard@lesportescbinc.com

STANDARD SPECIFICATIONS

WORK INCLUDED
The doors will be Series 591 as manufactured by Overhead Door Corporation.
RELATED WORK
Opening preparation, miscellaneous or structural metal work, access panels, finish or field painting, field electrical wiring, wire, conduit, fuses and disconnect switches are in the Scope of Work of other divisions or trades.
SECTIONS
Sections will be roll-formed, hot dipped, galvanized steel exterior no less than .016". Sections will be manufactured by a continuous foamed-in-place polyurethane lamination process resulting in a metal/foam/metal sandwich of homogeneous polyurethane insulation. Sections will have a nominal thickness of 1-5/8" and will incorporate an EPDM rubber thermal break to prevent heat or cold conductivity. Sections will have a shiplap rabbet.
INSULATION
Insulation will be a rigid, foamed-in-place, polyurethane core free of CFCs and HCFCs and will be fully encapsulated in nonpermeable materials to prevent loss of thermal efficiency over time. The insulation will have an R-Value of 14.86, U-Value of 067 - calculated values based on certified test data.
AIR INFILTRATION
All doors will be constructed with an air infiltration rating of .08 cfm per square foot of door at 15 mph. (ASTM-E-283-73)
END STILES
End stiles will be 16 gauge steel.
TRACK
Track is 3" and angle mounted.
HARDWARE
Hinges and fixtures will be galvanized steel Full-floating ball-bearing rollers will have hardened steel races. Roller sizes will be adequate for design requirements and limitations.
WEATHERSTRIP
Bottom weatherstrip will be EPDM rubber bulb-type strip or electric safety edge.
FINISH
Finish will be 2 coat baked-on polyester with a white interior and QC-6067 exterior.
OPERATION
Operation will be MANUAL
INSTALLATION
Install the doors in accordance with Overhead Door Corporation instructions and standards, using an authorized Overhead Door Corporation distributor.

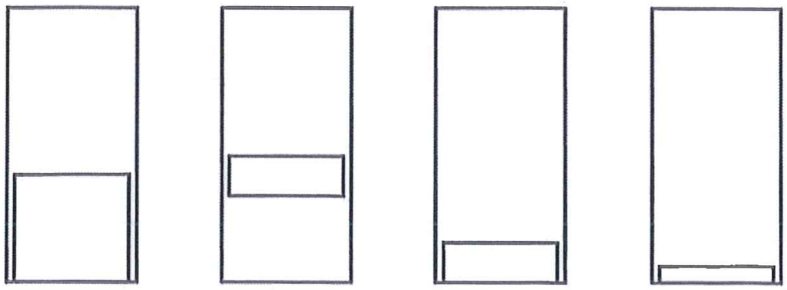
ARCHITECT DOOR NUMBER	OVERHEAD DOOR MARK	QTY	OPENING SIZE WIDTH	OPENING SIZE HEIGHT	DOOR SIZE WIDTH	DOOR SIZE HEIGHT	TRACK TYPE	LIFT TYPE	WEATHERSTRIP JAMB	WEATHERSTRIP HEAD	WEATHERSTRIP BOT SEAL	SECTIONS HIGH	LITE/PANEL QTY	EXTERIOR COLOR	NOTES :
		1	10'	3'-6"	10'	3'-6"	3"	VERTICALE	✓	✓	✓	21"	0	QC-6067	3'-6" DE HAUT = 2 SECTIONS DE 21"
							3"							QC-6067	RESSORTS TORSION 50,000 CYCLES
							3"							QC-6067	ROULETTE 3" PRÉCISION U.H.M.W.
							3"							QC-6067	COUPE-FROID ALUMINIUM & VINYLE NOIR
							3"							QC-6067	

591 THERMACORE SERIES

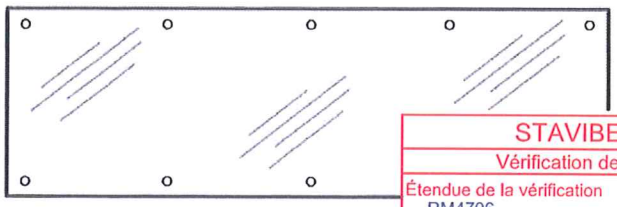
PROJECT	S.M. CONSTRUCTION
ARCHITECT	
CONTRACTOR	S.M. CONSTRUCTION
DISTRIBUTOR	CLÉMENT BÉDARD INC.
PLANT	PENNSYLVANIA
DISTRIBUTOR DWG. NO.	1
DATE:	22 MARS 2013
SHEET	
BY:	SERGE ROULEAU

DOOR PLATES K SERIES

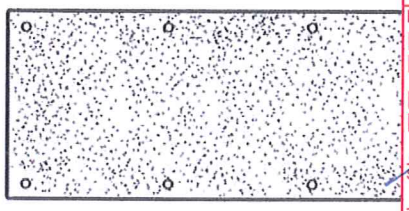
ARMOR STRETCHER KICK MOP



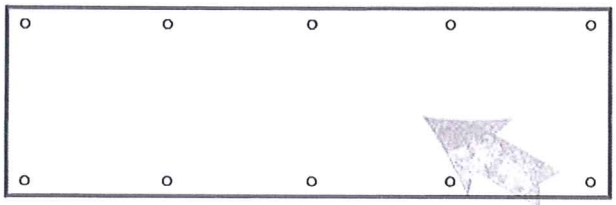
K08



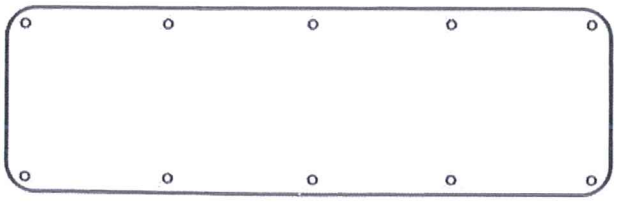
K09



K10A



K10R



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Vérification de conformité
Étendue de la vérification
RM4706

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Recommandation
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☐ Corriger et soumettre à nouveau avant les travaux
☐ Refusé

2013-10-30
Signature ☒ Ingénieur ☐ Autre Date

Jonathan Faucher 131007
Nom N° de membre de l'OIQ

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STANDARD FEATURES:

- ALL ARCHITECTURAL FINISHES ARE AVAILABLE
- PROTECTIVE PLASTIC COVER
- COUNTERSUNK SCREW HOLES
- #6 x 0.625" (16) UNDERCUT S.M.S.
- #6 x 0.375" (9.5) MACHINE SCREWS ON REQUEST
- AVAILABLE TAPE OR EPOXY MOUNTING
- BRASS & BRONZE PLATES STOCKED UP TO 24" (609.6) HEIGHT
- ALUMINUM, ACRYLIC, KYDEX & ST. STEEL PLATES, STOCKED UP TO 48" (1219.2) HEIGHT

CLEAR ACRYLIC PLATE OR PUSHPLATE

K08

- 0.125" (3.81) THICKNESS
- ALL EDGES BEVELLED

KYDEX (PVC & ACRYLIC, TEXTURED FINISH) PLATE OR PUSHPLATE

K09

- 0.060" (1.52) OR 0.090" (2.28) THICKNESS
- ALL EDGES BEVELLED
- TAPE OR EPOXY MOUNTING (EPOXY RECOMMENDED)
- STOCK COLOURS: BEIGE, BLACK, BLUE, GRAY & WHITE
- OVER 30 COLOURS AVAILABLE

SOLID METAL PLATES: ALUMINUM, BRASS, BRONZE & STAINLESS STEEL

K10A • 0.050" (1.27) THICKNESS

K10B • 0.062" (1.57) THICKNESS

K10C • 0.125" (3.81) THICKNESS

K10R

- KICK PLATE WITH RADIUS CORNERS

ECONOMY DOORPLATES

- AVAILABLE IN STAINLESS STEEL ONLY

K10-430

- TYPE 430, LOW GRADE STAINLESS

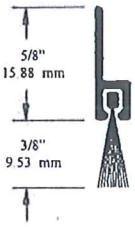
K10-20

- 20 GAUGE THICKNESS, 0.037" (0.94)

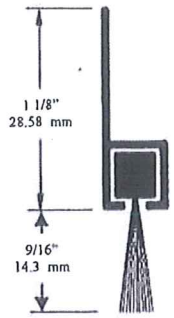
Balais de nylon

CLASSIFIED UL 28H6

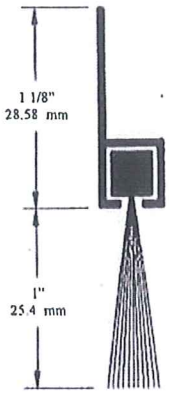
voir installation, page 18



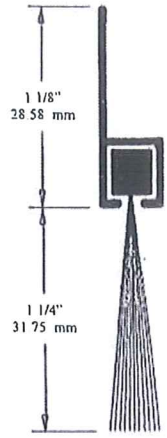
A180-3/8



C380-9/16

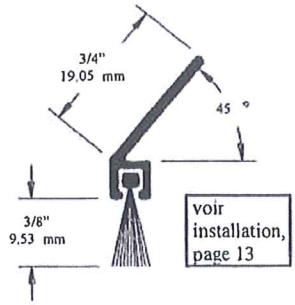


D480-1

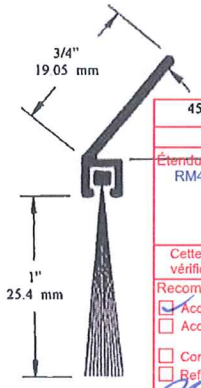


D480- 1 1/4

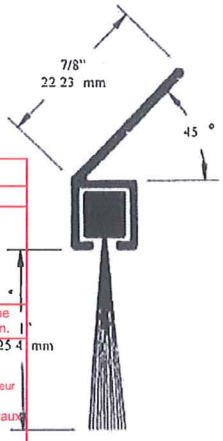
Disponible, anodisé **clair** ou anodisé **médium**



J140-3/8



J140-

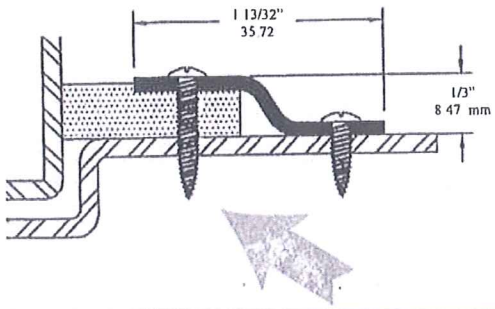


D445-1

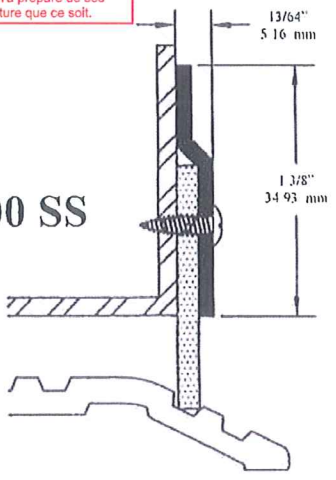
STAVIBEL INC.
Vérification de conformité
Étendue de la vérification
RM4706
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☐ Corriger et soumettre à nouveau avant les travaux
☐ Refusé
2013-10-30
Signature ☒ Ingénieur ☐ Autre — Date
Jonathan Faucher — 131007
Nom — N° de membre de l'OIQ
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Coupe-froid et/ou coupe-son en acier inoxydable

2000 SS
ou
14 SS
astragale



2100 SS



Société Industrielle Unique Ltée
8301, Marconi, Anjou, Qc, H1J 2W4
Tél: (514) 493-1353 Fax: (514) 493-0571 1-800-663-1353

Unique

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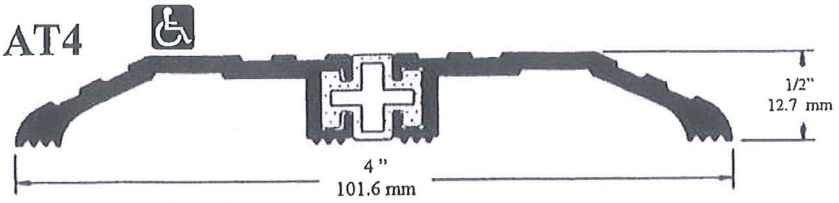
Recommandation
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- [ ] Corriger et soumettre à nouveau avant les travaux
- [ ] Refusé

Signature [x] Ingénieur [ ] Autre — Date: 2013-10-30
Nom: Jonathan Faucher — N° de membre de l'OIQ: 131007

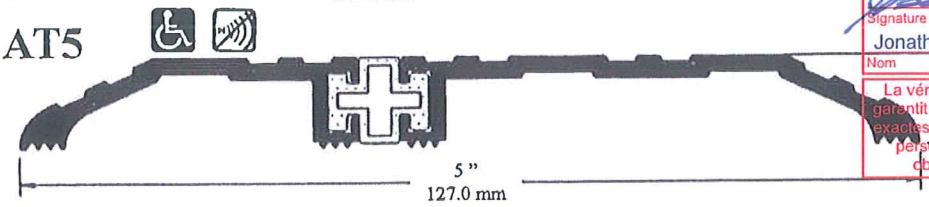
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Seuils d'aluminium

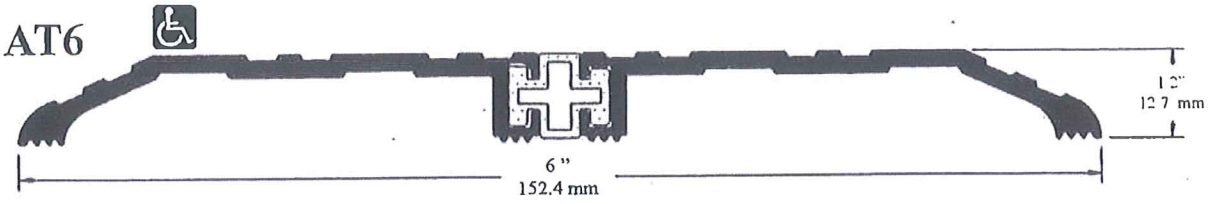
AT4



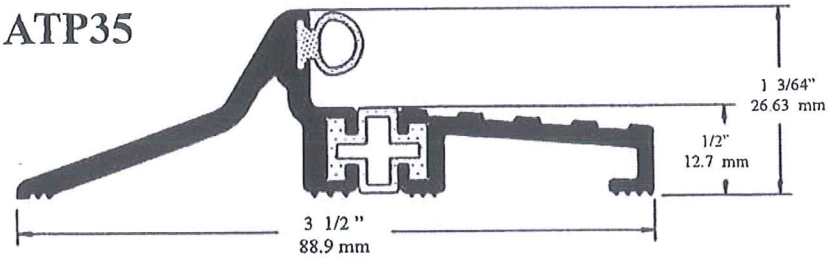
AT5



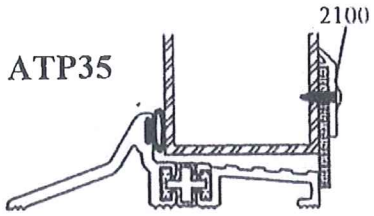
AT6



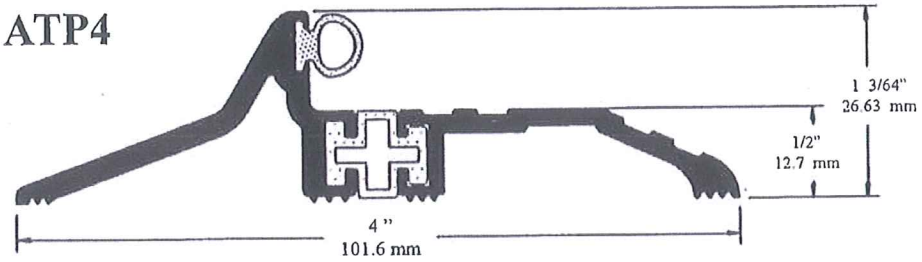
ATP35



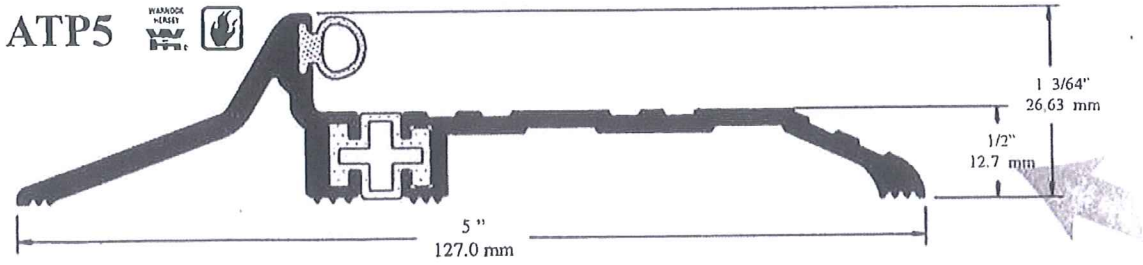
ATP35



ATP4



ATP5



Extrusion d'aluminium alliage 6063T5

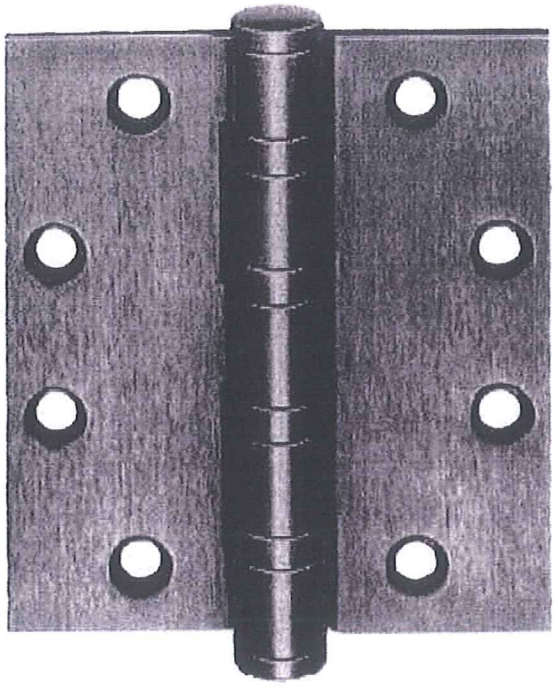
Échelle 1" (25.4 mm) = 1" (25.4 mm)

Société Industrielle Unique Ltée
8301, Marconi, Anjou, Qc, H1J 2W4
Tél: (514) 493-1353 Fax: (514) 493-0571 1-800-663-1353

TYPE MORTAISE

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Vérification de conformité
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2013-12-30
Signature ☒ Ingénieur ☐ Autre
Date
Jonathan Faucher
13100
Nom
N° de membre OIQ
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5 charnons
Quatre coussinets à billes
Fiche amovible



Charnières fortes

BB-1099
Laiton

STSBB-1099
Acier inoxydable

BB-1068
Acier

Représentée : 4 1/2 po x 4 po (114 mm x 101 mm)

Usage : En usage sur portes pesantes ou sur portes recevant un service de grande fréquence.

Recommandées pour portes d'entrées d'édifices publics, d'édifices à bureaux, d'hôpitaux, d'écoles, édifices à logements, et portes de corridors vers les bureaux.

Fiches : Assemblées avec fiches amovibles à tête plate. En acier inoxydable pour charnières en métal non ferreux.

En pouces

Dimensions ouvertes	Jauge du métal	Vis à tête plate « Philips »		Nombre de trous
		Vis machine	Vis à bois	
4 1/2 x 4	0,180	1/2 x 12-24	1 1/2 x 12	8
4 1/2 x 4 1/2	0,180	1/2 x 12-24	1 1/2 x 12	8
5 x 4	0,190	1/2 x 12-24	1 1/2 x 12	8

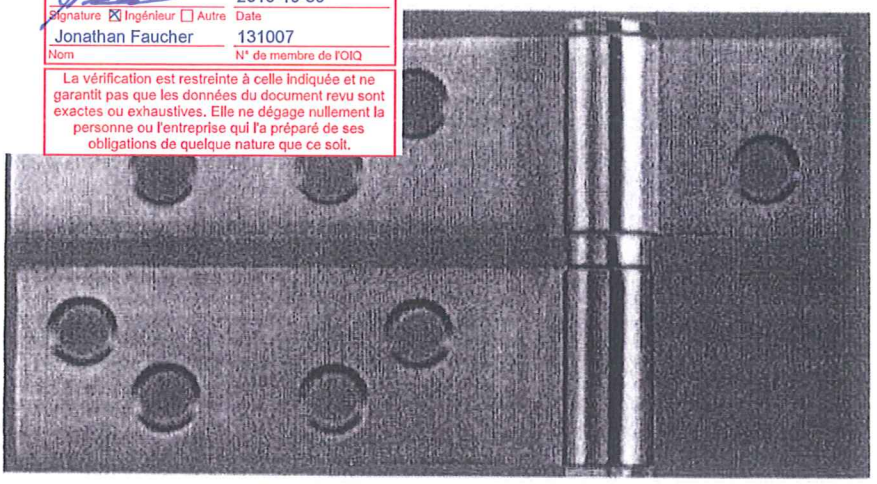
En millimètres

Dimensions ouvertes	Jauge du métal	Vis à tête plate « Philips »		Nombre de trous
		Vis machine	Vis à bois	
114 x 101	4,57	13 x 12-24	38 x 12	8
114 x 114	4,57	13 x 12-24	38 x 12	8
127 x 101	4,83	13 x 12-24	38 x 12	8

Autres dimensions disponibles – 6 à 8 semaines de livraison. Quantité minimum requise

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DORMA
Contract Special



Heavy Weight
Reinforcing Hinge
Full Surface
2 Knuckles
Ball Bearing
Fixed Pin
Handed
Not Reversible

BB 55 Stainless Steel
BB 85 Steel

Use: A simple solution to the problem of loose screws, distorted hinge leaves, pulled open knuckles caused by heavy vibration, door slamming or excessive use.

The shock comes first to the reinforcing hinge and is transmitted to all bearing surfaces of the frame.

Specifications: Width of hinges used on the door must be specified when ordering – as follows:

With 4" x 4", 4 ½" x 4" or 5" x 4" hinges,
Specify: BB 8540 for steel, BB5540 for stainless steel

With 4 ½" x 4 ½", 5" x 4 ½" or 6" x 4 ½" hinges,
Specify: BB 8545 for steel, BB5545 for stainless steel

With 5" x 5" or 6" x 5" hinges,
Specify: BB 8550 for steel, BB5550 for stainless steel

} Available on request & in large quantity only

Supplied with all necessary-fixing accessories for wood or metal doors and frames, installation template and instruction sheet.

Available Option: Leaves can be beveled for better appearance and easier cleaning

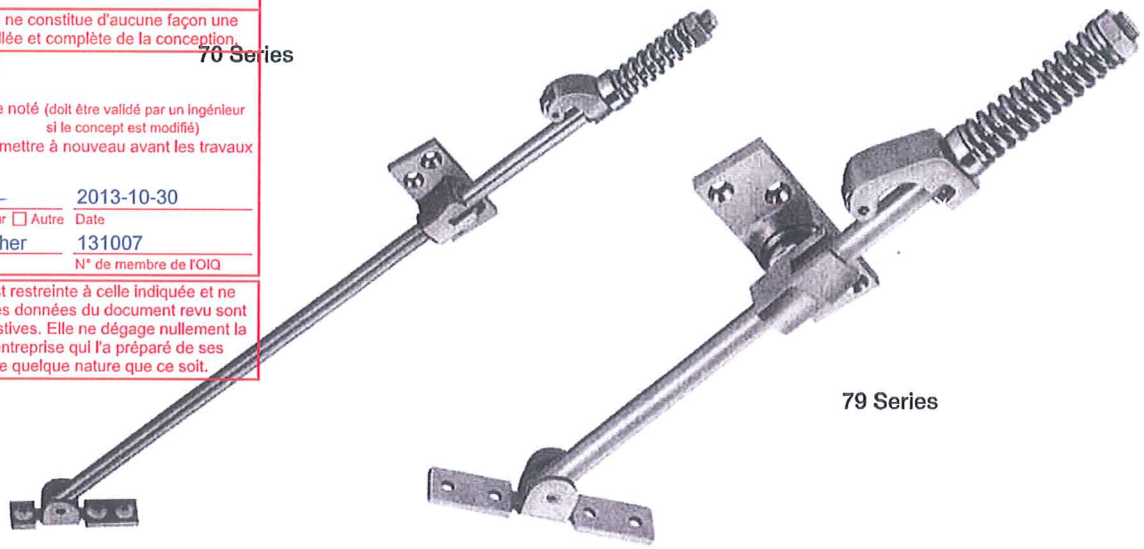
Thickness of Material: .180" (4.57mm)

Finishes: Available in most architectural finishes.

GLYNN-JOHNSON

70 / 79 SERIES
SURFACE OVERHEAD DOOR HOLDERS / STOPS
70 Series - Heavy Duty
79 Series - Extra Heavy Duty

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70 Series

79 Series

- Improved Design
- Hold Open, Stop Only Functions
- Improved Corrosion Resistance
- Meets All Criteria for BHMA Grade 1 Holders / Stops
- Simplified Standardized Sizing
- 79 Series - Most Rugged Surface Mounted Holders Available - Ideal for Large, Heavy Doors

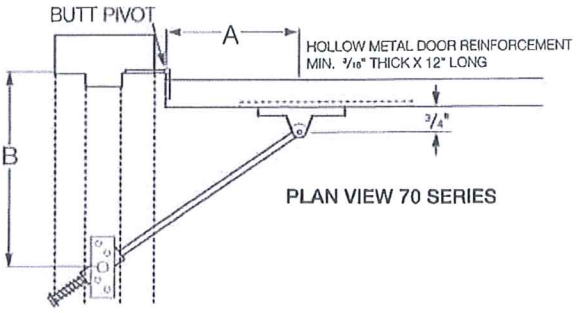
GLYNN-JOHNSON
P.O. Box 6135
Indianapolis, IN 46206
1-800-525-0336 (Customer Service)
317-899-9440 (General Office)

FAX:
1-800-525-0337 (Customer Service)
317-899-9432 (General Office)

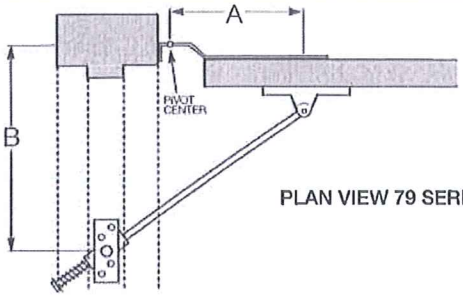
In Canada:
Ingersoll-Rand Door Hardware
Port Credit P.O. Box 100
Mississauga, Ontario L5G 4L5
TEL: 416-278-6128 • FAX: 416-278-1413

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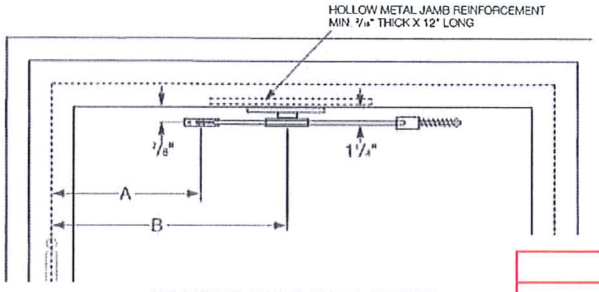
GLYNN-JOHNSON



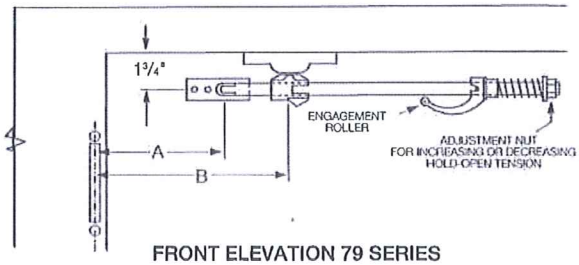
PLAN VIEW 70 SERIES



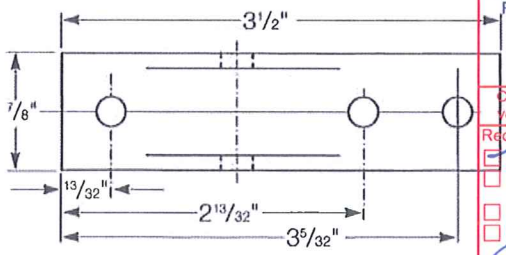
PLAN VIEW 79 SERIES



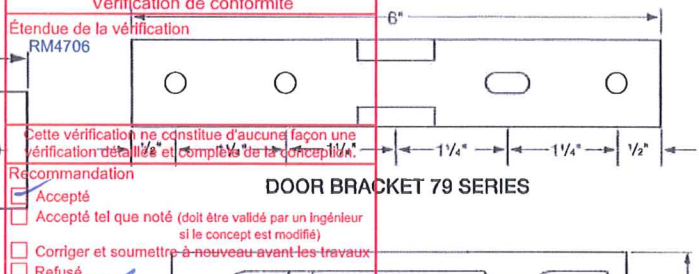
FRONT ELEVATION 70 SERIES



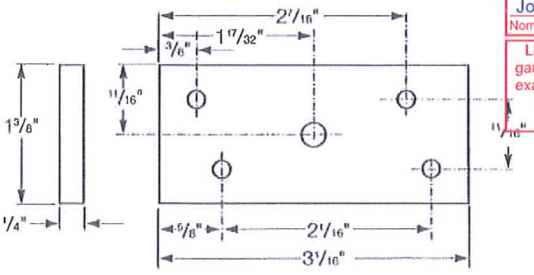
FRONT ELEVATION 79 SERIES



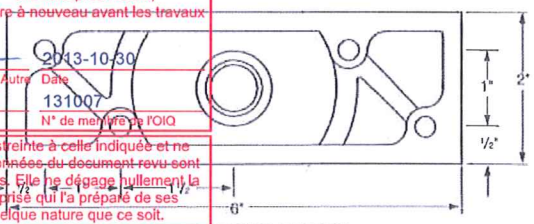
DOOR BRACKET 70 SERIES



DOOR BRACKET 79 SERIES



JAMB BRACKET 70 SERIES



JAMB BRACKET 79 SERIES

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The template information on this page is for reference only and is not intended to serve as an installation template. For complete dimensional information, refer to the Glynn-Johnson template book.

70 Series Sizing Chart

	BUTTS/OFFSET PIVOTS			CENTER HUNG		
SIZE	DOOR OPENING	STOP ONLY	HOLD OPEN	DOOR OPENING	STOP ONLY	HOLD OPEN
1	-----	-----	-----	-----	-----	-----
2	23 1/16" - 27"	702S	702H	27 1/16" - 33"	702S	702H
3	27 1/16" - 33"	703S	703H	33 1/16" - 39"	703S	703H
4	33 1/16" - 39"	704S	704H	39 1/16" - 45"	704S	704H
5	39 1/16" - 45"	705S	705H	45 1/16" - 51"	705S	705H
6	45 1/16" - 54"	706S	706H	51 1/16" - 57"	706S	706H

79 Series Sizing Chart

	BUTTS/OFFSET PIVOTS			CENTER HUNG		
SIZE	DOOR OPENING	STOP ONLY	HOLD OPEN	DOOR OPENING	STOP ONLY	HOLD OPEN
1	-----	-----	-----	-----	-----	-----
2	23 1/16" - 27"	792S	792H	27 1/16" - 33"	792S	792H
3	27 1/16" - 33"	793S	793H	33 1/16" - 39"	793S	793H
4	33 1/16" - 39"	794S	794H	39 1/16" - 45"	794S	794H
5	39 1/16" - 45"	795S	795H	45 1/16" - 51"	795S	795H
6	45 1/16" - 54"	796S	796H	51 1/16" - 57"	796S	796H

Note: These charts illustrate the most common types of hinging and door opening sizes
For unusual door details, contact Glynn-Johnson for availability.

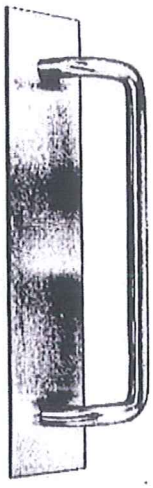
PULL/PLATE COMBINATIONS



Style 1700



Style 4600



Style 1185

Standard Product No.	Pull	81 Plate size x .050	*WT. ALUM. LBS.	KGS.
1707	1007 X	3 1/2 x 15 (88.9 x 381.0)	.58	.26
1709	1009 X	3 1/2 x 15 (88.9 x 381.0)	.76	.35
1712	1012 X	4 x 16 (101.6 x 406.4)	.97	.44
4607	4007-1 X	3 x 12 (76.2 x 304.8)	.61	.28
4609	4009-1 X	3 1/2 x 15 (88.9 x 381.0)	.77	.35
4612	4012-1 X	4 x 16 (101.6 x 406.4)	.96	.44
1185	1180-1 X	4 x 16 (101.6 x 406.4)	1.22	.55

* Weight in other materials, multiply aluminum weight by three

Standard Plate Gauge: Plates supplied .050 thick standard. Note other plate codes below. See pgs. D2, D3 for complete plate information.

.050 - Suffix A .062 - Suffix B .125 - Suffix C

Cylinder Cutouts: For plates requiring cutout for standard 1-1/8" (28.5) cylinder specify CFC and indicate position required. All other cutouts must be specified by size and position.

Fastenings: Plates are supplied standard drilled for screw mounting. For tape mounting of plates specify "no holes x tape." Pulls are supplied with standard mountings as required (see general information).

How to Order:

Back Plate Gauge: Pull plate combinations supplied standard with .050 ga. plates.

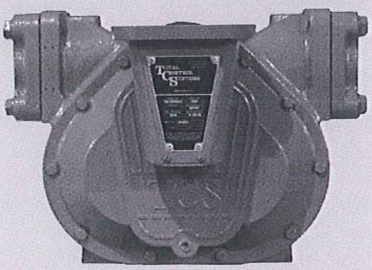
If other gauge plate required add gauge suffix to product numbers. (Ex: 1707C = 1707 with .125 ga. plate.)

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Modèle utilisé: 70040SPA4DX

SPECIFICATIONS
700-40 Flow Meter

TOTAL CONTROL SYSTEMS

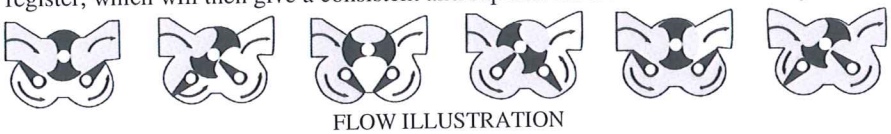


Total Control Systems rotary positive displacement flow meters offer reliable and precise measurement solutions for preset delivery, flow rate control, blending and custody transfer of vehicle or wholesale measurement applications.

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INDUSTRIES SERVED
- Petroleum Products
- Alternative Fuels
- Aviation Fuels
- Agricultural Chemicals
- Petrochemicals
- Textiles
- Foods and Beverages
- Paints and Coatings
- Pharmaceuticals
- Printing Inks

DESIGN
The 700-40 flow meter has a simple and efficient meter design consisting of a housing and three rotors that rotate in unison within the measuring chamber. The absence of wear, from no metal-to-metal contact inside the chamber, eliminates any deterioration in accuracy and provides a long service life. The rotors are supported by bearings inserted into two bearing plates, where at the end of each rotor shaft is a timing gear. The timed rotation between each rotor is then transferred through the calibration adjuster to the register, which will then give a consistent and superior measurement of accuracy.



FLOW ILLUSTRATION

PERFORMANCE FEATURES
LOW PRESSURE DROP: will operate on gravity flow or pump pressure

SUSTAINED ACCURACY: no metal-to-metal contact inside the measuring chamber means minimal wear and deterioration in accuracy over time, fewer recalibrations and longer service life.

VISCOSITY RANGE: will accurately measure liquids up to 1,500,000 SSU (325,000 CPS)

LINEARITY:
5:1 Turndown - capable of ± 0.10% of maximum nominal flow rate
12.5:1 Turndown - capable of ± 0.15% of maximum nominal flow rate

REPEATABILITY: capable of 0.02% over the entire range of flow

Data provided from test conditions where all system variables were constant. The results are based on the 700 series flow meter and Veeder Root mechanical registration, using 32 SSU testing fluid.

REGULATORY: Meets NIST, USA military and other international weights and measures accuracy requirements.

OPERATING SPECIFICATIONS

DESIGN TYPE:	Positive Displacement Rotary Abutment
FLOW CAPACITY:	40 GPM to 500 GPM 151 LPM to 1893 LPM
VISCOSITY:	Up to 1,500,00 SSU (325,000 CPS)
PRESSURE RATING:	150 PSI 10.5 BAR
TEMPERATURE RATING:	-40°F to 160°F -40°C to 71°C
CONNECTIONS:	4" NPT Standard, 3" Optional. BSPT, Slip Weld, ANSI and DIN flanges are available upon request.

METER TYPES

SP Standard Petroleum
For metering refined petroleum products such as Leaded and Unleaded Gasoline, Fuel Oils, Diesel, Bio-Diesel, Kerosene, Jet Fuels, Vegetable Oils, Motor Oils, Ethylene Glycol (Anti-Freeze), etc.

SPA Standard Petroleum (Aviation)
For metering refined petroleum products; such as Aviation Gasoline, Jet Fuel, Regular and Unleaded Gasoline, Diesel, Bio-Diesel, Naptha, Kerosene, etc

SPD Standard Petroleum (Ductile Iron)
For metering refined petroleum products; such as Ethanol, Methanol, Regular and Unleaded Gasoline, Diesel, Bio-Diesel, Natural Gasoline, Vegetable Oil, Kerosene, etc.

IP Industrial Products
For metering Food Processing Liquids, Industrial Chemicals, General Solvents and many other liquids; such as Liquid Sugars, Corn Syrup, Soy Bean Oil, Shortenings, Latex Products, Adhesives, etc.

IC Industrial Products (Carbon Graphite)
For metering Industrial Chemicals, General Solvents, Water and other Non-Lubricating Liquids, such as Alcohol, Acetones, Ethanol, Naphtha, Xylene, MEK, Toluene, Deionized Water, Demineralized Water, Potable Water, etc.

AF All-Ferrous
For metering Pesticides, Fertilizers, Chemicals, Chlorinated Solvents, Agricultural Chemicals, Paints, Ink, Alkaline pH Latex Products, Adhesives, Liquid Feeds, etc.

70040SPA4DX

MATERIALS OF CONSTRUCTION

Meter Type	Housing	Rotors	Bearing Plates	Bearing Sleeves	Journals	Timing Gears	Internal Hardware	Seals
SP	Anodized Aluminum	Anodized Aluminum	Ni-Resist	Ni-Resist	Hardchrome Stainless Steel	Stainless Steel	Stainless Steel	Viton ®
SPA	Anodized Aluminum	Anodized Aluminum	Ni-Resist	Carbon Graphite	Hardchrome Stainless Steel	Stainless Steel	Stainless Steel	Viton ®
SPD	Ductile Iron	Ni-Resist	Ni-Resist	Carbon Graphite	Hardchrome Stainless Steel	Stainless Steel	Stainless Steel	Teflon ® & Simriz ®
IP	Anodized Aluminum	Anodized Aluminum	Stainless Steel	Non-galling Illium 88 SS	Hardchrome Stainless Steel	Stainless Steel	Stainless Steel	Teflon ® & Simriz ®
IC	Anodized Aluminum	Anodized Aluminum	Ni-Resist	Carbon Graphite	Hardchrome Stainless Steel	Stainless Steel	Stainless Steel	Teflon ® & Simriz ®
AF	Ductile Iron	Ni-Resist	Ni-Resist	Carbon Graphite	Hardchrome Stainless Steel	Stainless Steel	Stainless Steel	Teflon ® & Simriz ®

Viton is a registered trademark of E.I. Dupont de Nemours & Co.
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Simriz is a registered trademark of Freudenberg-NOK

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REGISTRATION OPTIONS

COUNTER REGISTER
Liquid measurement volume indication, using a 5 digit large numeral reset display and an 8 digit non-reset totalizer. Electronic or mechanical meter counter register is available. U.S. or Imperial Gallons, Liters, Dekaliter, Barrels, pounds, etc.

COUNTER PRESET
Select predetermined volume for precise batch control, utilizing preset control valve. Mechanical or electronic preset counters or batch controllers are available.

TICKET PRINTER
Provides an imprinted ticket record of each delivery transaction. Accumulative or Zero-Start, Face down or Face Up mechanical ticket printers available. Electronic slip or roll printers available for use with various electronic registration.

ELECTRONIC METER REGISTER
Digital liquid measurement volume indication that offers multiple functions to enhance the flow meter's accuracy and accountability. Most electronic registration are available with rate of flow indication, pulse output, valve control, RS232 and RS485 communication, currency and temperature compensation.

PULSE TRANSMITTER
The electronic pulse signal output converts the register counter volume per unit value into a electrical pulse stream. The electronic pulse stream can be transmitted to other electronic controllers for rate of flow, volume indication, additive injection or data acquisition.

TEMPERATURE COMPENSATION
Automatically corrects changes in volume caused by liquid temperature variations, during metered delivery. Normally corrects net volume or mass to 60°F (15°C) based on the product's coefficient of expansion, API or specific gravity.

MICROSWITCH
Mechanical signal from the Veeder Root preset counter converted into an electrical or pneumatic signal to provide control of remotely located valve, pump, and other system related equipment.

COUNTER EXTENSION
Raises the elevation of the counter registration for easy visibility or to protect from high temperatures. Counter Extension is required for temperatures more than 180°C (82°C).

RATE OF FLOW INDICATOR
Mechanical or digital indicator displays the volume at which the liquid is flowing through the flow meter.

SWIVEL
Allows mechanical registration to be rotated 360°. Designed for the Veeder Root counter register and ticket printer only.

METER ACCESSORIES

AIR ELIMINATOR

A float and reed valve operated design senses and removes free air or vapor before it can enter the flow meter. Required for custody transfer applications to ensure the most precise measurement.



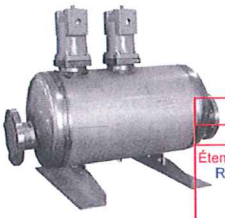
STRAINER

A 90° strainer provides protection from debris entering into the flow meter. Must be mounted in vertical position when assembled with air eliminator. Stainless steel screens are available in 40, 80, 100 & 200 mesh, and 0.050 perforation.



BULK AIR ELIMINATOR

A bulk air eliminator assembly is designed for use in applications where a high volume of free air may enter the measurement storage system. Available with single or dual SP, AF or SS air eliminators assembled to stainless steel vessel.



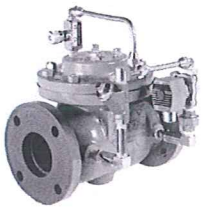
MECHANICAL PRESET VALVE

A normally closed, hydraulically balanced piston control valve allows for auto-batch preset deliveries. The right angle, two–stage control valve is mechanically linked to Veeder Root Preset Counter.



ELECTRONIC PRESET VALVE

A normally closed, two-stage diaphragm preset valve for use with electronic relay control. The solenoid valves are available in 12 or 24 VDC, or 110 VAC coils.



WAFER CHECK VALVE

In-line check valve is mounted between the strainer and meter assembly to help increase air eliminator efficiency by creating additional back pressure.

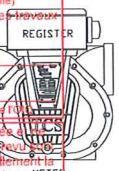


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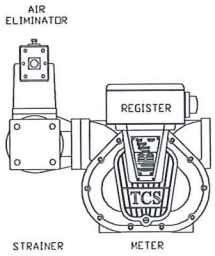
ASSEMBLY COMBINATIONS

GROUP COMBINATIONS

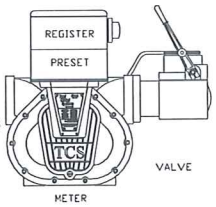
2 Meter & Register
3 Meter, Register & Ticket Printer
4 Meter, Register, Air Eliminator & Strainer
4R Meter, Register, Air Eliminator & High Volume Strainer
5 Meter, Register & Strainer
6 Meter, Register, Ticket Printer, Air Eliminator & Strainer
6R Meter, Register, Ticket Printer, Air Eliminator & High Volume Strainer
7 Meter, Register, Printer, & Strainer
8 Meter, Register, Preset & Valve
9 Meter, Register, Ticket Printer, Preset & Valve
10 Meter, Register, Preset, Valve, Air Eliminator & Strainer
10R Meter, Register, Preset, Valve, Air Eliminator & High Volume Strainer
11 Meter, Register, Ticket Printer, Preset, Valve, Air Eliminator & Strainer
11R Meter, Register, Ticket Printer, Preset, Valve, Air Eliminator & High Volume Strainer
12 Meter, Register, Preset, Valve & Strainer
13 Meter, Register, Ticket Printer, Preset, Valve & Strainer



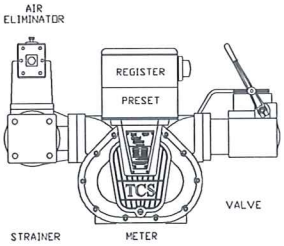
GROUP 2



GROUP 4



GROUP 8



GROUP 10

METER ORIENTATION

A Meter Assembly with Veeder Root Registration
B Meter assembly less Veeder Root Registration
C Meter Assembly for use with Electronic Registration (less calibration adjuster)
D Meter Assembly with direct drive pulse transmitter

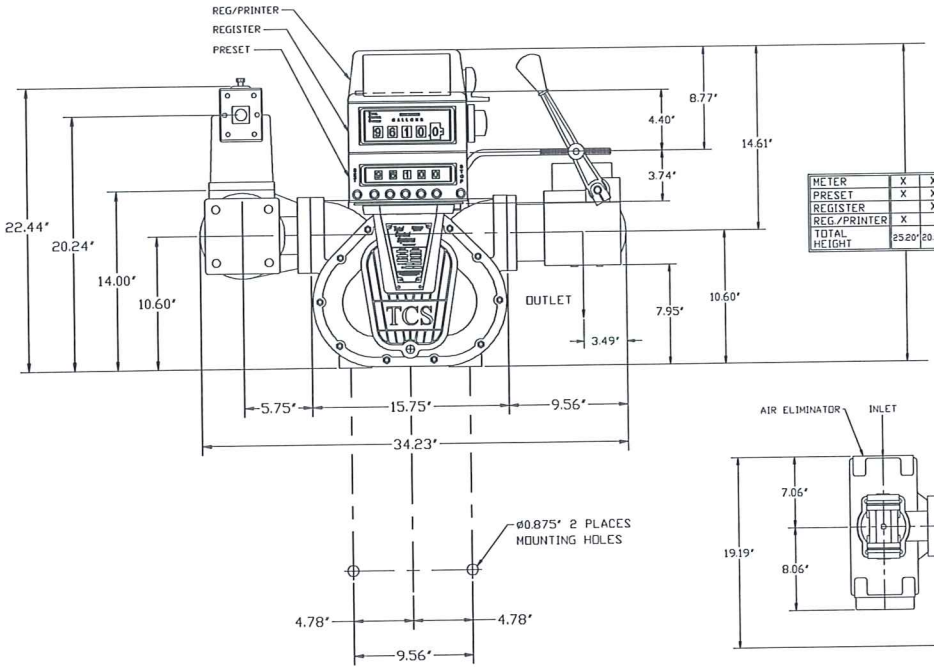

Meter A
(700-20SP10AT)

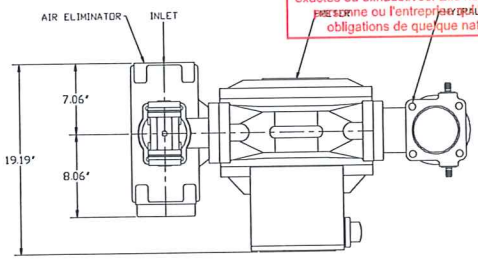

Meter B
(700-20SP10RBX)


Meter C
(700-20SP10CXA)


Meter D
(700-30SP2DX)

700-40 DIMENSIONS





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700-40 NET WEIGHTS IN POUNDS (KILOGRAMS)

Meter Type	Flow Meter	Register Counter	Preset Counter	Ticket Printer	Air Eliminator/ Strainer	Bulk Air Eliminator	Strainer	Electronic Valve	Mechanical Valve
SP	110 (49.9)	12 (5.4)	10 (4.5)	12 (5.4)	32 (14.5)	134 (60.8)	25 (11.3)	Consult Factory	17 (7.7)
SPA	110 (49.9)	12 (5.4)	10 (4.5)	12 (5.4)	32 (14.5)	134 (60.8)	25 (11.3)	Consult Factory	17 (7.7)
SPD	275 (124.7))	12 5.4	10 4.5	12 5.4	74 (33.6)	144 (65.3)	53 (24.0)	Consult Factory	N/A
IP	110 (49.9)	12 (5.4)	10 (4.5)	12 (5.4)	32 (14.5)	134 (60.8)	25 (11.3)	Consult Factory	17 (7.7)
IC	110 (49.9)	12 (5.4)	10 (4.5)	12 (5.4)	32 (14.5)	134 (60.8)	25 (11.3)	Consult Factory	17 (7.7)
AF	275 (124.7))	12 5.4	10 4.5	12 5.4	74 (33.6)	144 (65.3)	53 (24.0)	Consult Factory	N/A

WARRANTY

Total Control Systems 700 rotary meters and accessory components sold to the original purchaser for a period of TWELVE (12) months from installation or EIGHTEEN (18) months from the date of shipment, to be free, under normal use and service, from defects in material and workmanship. If a warranty dispute occurs the DISTIBUTOR may be required to provide proof of date of sale. Defects occurring within the stated warranty period, will be repaired or replaced, at TCS's option; provided that part or parts are returned to TCS transportation changes prepaid, and TCS's examination discloses the parts or workmanship to have been defective upon delivery to the purchaser. All repaired or warranted meters will be shipped Ex-works Fort Wayne, Indiana. Total Control Systems shall not be liable for consequential damages, whether or not arising out of warranty, negligence or otherwise.

NOTE: The above warranty applies only to Total Control Systems, Fort Wayne, Indiana manufactured products. Private label and OEM engineered products are specifically excluded from the above warranty. Consult factory for non-TCS manufacturer's warranty.

TOTAL CONTROL SYSTEMS

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Fort Wayne, Indiana 46808 USA
(800) 348-4753 • (260) 484-0382
Fax: (260) 484-9230
sales@tcsmeters.com • www.tcsmeters.com

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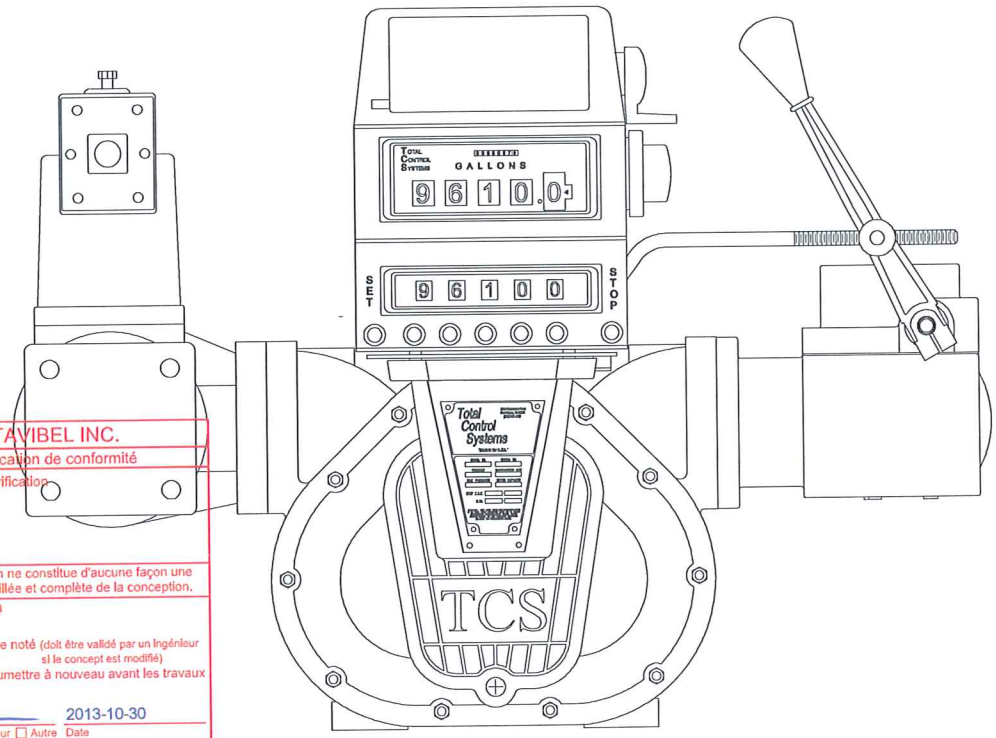
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700-40SPA4DX

TOTAL CONTROL SYSTEMS

700-40/45 Rotary Meter

"The Standard of Measurement"



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Installation, Operation & Maintenance Manual

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Warning Symbols



CAUTION
Follow the warning instructions within the following information to avoid equipment failure, personal injury or death.



TURN POWER OFF
Before performing any maintenance, be sure to turn system power off to avoid any potential electric spark



FLAMMABLE
Flammable liquids and their vapors may cause a fire or explosion if ignited.



EYE PROTECTION
Pressurized systems may cause hazardous leaks and spray that may be dangerous for your eyes. Always wear eye protection around pressurized systems and its hazardous liquids.



INJURY
Wear gloves for protection from hazardous liquids that may cause irritation or burns.

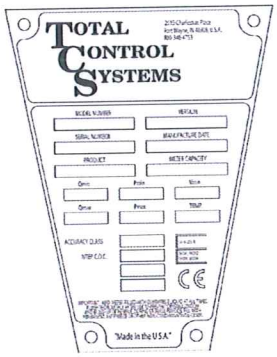


READ
Read and understand all related manuals thoroughly. The Engineering and OIM manuals will provide the knowledge for all systems, maintenance and operation procedures. If you have any questions, please consult the factory.

Receipt & Inspection

Upon receipt of meter shipment, be sure to inspect the packaging and the flow meter assembly for any damage before signing the receipt of the shipment. Notify the delivery company about possible damage and refuse receipt of the shipment.

Flow Meter Identification Plate



Meters are individually boxed and are protected with packing material. Each package is identified with the flow meter assembly part number, description, direction of flow and serial number. Verify the meter model is the correct model, size, and configuration as ordered. Contact your distributor if there is any discrepancy or question.

Meter assemblies should be handled with appropriate methods for the awkwardness of size and weight involved. Appropriate clothing and shoes need to be utilized. Transport the meter package to the installation site with appropriate transportation methods, careful not to damage the flow meter.

Be careful of any loose or protruding staples from the packaging, as they can be very sharp and may potentially cause injury.

If foam has been used to protect meter, carefully remove top foam layer before attempting to remove meter assembly from box. Foam packaging maybe formed around the meter assembly making it difficult to remove. If meter is bolted upon a wood pallet remove bolts while being careful not to let the meter tip over when the support has been removed. Do not lift the meter assembly by flex hoses, thermowells, wires, pulsers, or put objects through meter. Removing meter assembly from packaging without adhering these warnings may cause serious injury.

The wooden pallets and bases meet the ISPM 15; Guidelines for Regulating Wood Packaging Material in International Trade through the Timber Products Inspection Company (TP #2134).

Every effort has been made to remove the calibration fluid before shipment. All TCS flow meters are plugged and enclosed in a plastic bag. A Material Safety Data Sheet (MSDS) can be reviewed on PAGE 47. Appropriate precautions should be taken regarding any personal, environmental and material compatibility with the end use system.

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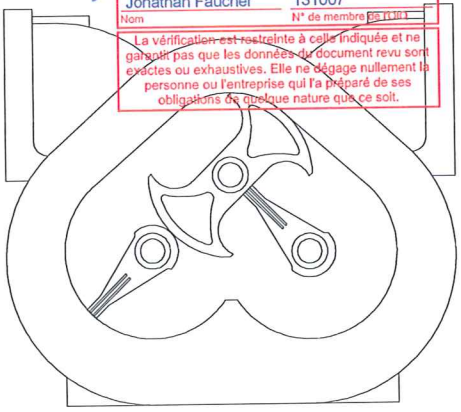
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Meter Overview



The TCS Model 700 series flow meter is a simple and efficient design. The meter consists of a single fluid chamber that contains a single blocking rotor and two displacement rotors whose rotation is synchronized with mating gears. As the fluid enters the fluid chamber, the blocking rotor is forced to rotate. The displacement rotors, also rotating in conjunction with the blocking rotor help direct the fluid flow through the chamber and to the outlet. The linear flow of the fluid is thus translated into rotary motion in the meter. The output of the meter is picked up from the rotation of the blocking rotor and transmitted to a register or pulse transmitter.

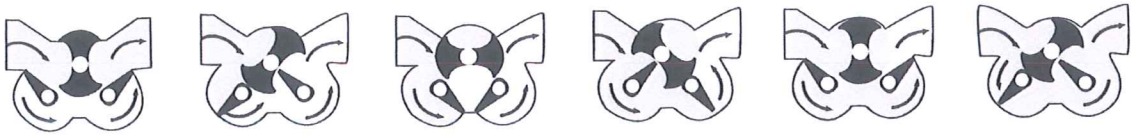
The rotors in the meter are designed to operate at close tolerances to one another and the wall of the fluid chamber. There are slight clearances between the rotors and the chamber wall. Because of this, it is important that the meter be properly applied for the flow rate and operating pressure of the system.

Because the fluid flowing through the meter is redirected only slightly from its natural flow, there is very little pressure drop across the meter, unlike other meters that use multiple measuring chambers.

The meter design uses high performance materials for the rotor bearings and journals. Since there is no contact between the rotors and the fluid chamber wall, these critical components have a long life expectancy.

Calibration of the meter involves adjusting the rotation of the output shaft relative to the rotation of the internal rotors of the meter. This is accomplished by changing the settings on an adjuster device. Calibration of the meter is discussed in detail in the section Meter Calibration.

FLOW ILLUSTRATION



Meter Specifications

Flange Connection: 4" NPT Flange Connection, 3" NPT Flange. Optional BSPT, Slip Weld or ANSI flanges available upon request.

Flow Rate: 700-40 up to 500 GPM (1893 LPM)
700-45 up to 600 GPM (2271 LPM); only for fluids under 225 SSU

Maximum Pressure: 150 PSI (10.5 BAR)

Working Temperature: -20 F to 160 F (-28.9 C to 71 C)



Meter Types

SP - Standard Petroleum
For metering refined petroleum products such as Leaded and Unleaded Gasoline, Fuel Oils, Diesel, Bio-Diesel, Kerosene, Jet Fuels, Vegetable Oils, Motor Oils, Ethylene Glycol (Antifreeze), etc.

SPA - Standard Petroleum (Aviation)
For metering refined petroleum products such as Aviation Gasoline, Fuel Oils, Jet Fuels, Gasoline, Diesel, Bio-Diesel, Kerosene, etc.

SPD - Standard Petroleum (Ductile Iron)
For metering refined petroleum products such as Aviation Gasoline, Ethanol Blends, Methanol Blends, Gasoline, Fuels Oils, Diesel, Bio-Diesel, Kerosene, etc.

IC - Industrial Products (Carbon Bearings)
For metering Industrial Chemicals, General Solvents, Water and other Non-lubricating Liquids, such as Alcohol, Acetones, Ethanol, Naptha, Xylene, MEK, Toluene, Deionized Water, Demineralized Water, Potable Water, etc.

IP - Industrial Products

For metering Industrial Chemicals, General Solvents and many other liquids; such as Liquid Sugars, Corn Syrup, Soy Bean Oil, Shortenings, Latex Products, Adhesives, etc.

AF - All Ferrous
For metering Pesticides, Nitrogen Solutions, Fertilizer, Chlorinated Solvents, Paints, Inks, Alcohols, Adhesives, Motor Oils, Molasses, Corn Syrup, Liquid Sugars, etc.

Material of Construction

Description	SP	SPA	SPD	IP	IC	AF
Housing	Hardcoat Anodized Aluminum	Hardcoat Anodized Aluminum	Ductile Iron	Hardcoat Anodized Aluminum	Hardcoat Anodized Aluminum	Ductile Iron
Rotors	Hardcoat Anodized Aluminum	Hardcoat Anodized Aluminum	Ni-Resist	Hardcoat Anodized Aluminum	Hardcoat Anodized Aluminum	Ni-Resist
Rotor Journals	Plated SS	Plated SS	Plated SS	Plated SS	Plated SS	Plated SS
Bearing Plates	Ni-Resist	Ni-Resist	Ni-Resist	Stainless Steel	Ni-Resist	Ni-Resist
Bearing Sleeves	Ni-Resist	Carbon Graphite	Carbon Graphite	Non-Galling SS	Carbon Graphite	Carbon Graphite
Timing Gears	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Packing Seal	Viton®	Viton®	Simriz®	Simriz®	Simriz®	Simriz®
Body O-rings	Viton®	Viton®	Teflon®	Teflon®	Teflon®	Teflon®

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Simriz® is a registered trademark of Freudenberg-NOK.
Teflon® is a registered trademark of Dupont Dow Elastomers, L.L.C.

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System Recommendations

Meter Selection

The flow meter must be carefully chosen from the Meter Selection factors in the Engineering Manual. The meter must be selected based on the operating system and product characteristics. System variables include flow rate, temperature and pressure. The product characteristics include the material compatibility, lubricity, viscosity, suspensions, pH, and whether the product can congeal, crystallize or leave a dry film. Failure to select the correct flow meter may result in system failure or serious injury.

Air Elimination

In any system that the tank may be completely drained or multiple products manifold into one metering system, the possibility of air being present increases. The solution is an air or vapor eliminator located before the flow meter to vent the air or vapor from the system before it can be measured. Air or vapor elimination is required for all weights and measures regulatory approvals in custody transfer applications.

System Recommendations (Continued)



Control Valves

Safety and isolation valves should be used throughout the metering system. In any pumping system where there is one (1) pump and multiple flow meters, a digital or hydro-mechanical Rate-of-Flow control valve must be used at each flow meter to prevent over speeding of the flow meters.

Best Plumbing Configuration

1). Flow meter must have secure mounting to a riser or foundation
2). The inlet and outlet piping must be securely supported, in a manner of not to allow pipe stress on flow meter.
3). System should be designed to keep the flow meter full of liquid at all times.
4). System piping should have full 4" pipe diameter throughout the metering system to allow for minimal pressure loss.
5). The pipe should be laid out as straight as possible to reduce pressure loss from flow restriction.
6). The meter and piping must be installed in such as way as to avoid accidental draining of the meter. Meter inlet and outlet should be lower than the associated system plumbing (sump position).
7). It is not necessary for the air eliminator to be installed bolted directly to the meter. It can be installed upstream from the meter. For effective operation of the air eliminator, it should be mounted between the meter and any valves, tees or any other potential places where air may enter the system.
8). The metering system should include a means for calibration.

Protection From Debris

On new installations, care must be taken to protect the meter from damage during start-up. It is recommended to put a strainer before the meter. Damage may result from the passage through the meter of dirt, sand, welding slag or spatter, thread cuttings, rust, etc. The insertion of a spool (a flanged length of pipe equal in length to the meter and accessories attached to the meter) in place of the meter until the system is flushed, temporarily bypassing the plumbing around the meter, will also protect the meter from debris. Once the system has run "clean" for a period of time the meter may be reinstalled or protective devices removed.

Thermal Expansion

As with most liquids, they will expand and contract with temperature. In any system where there is a chance for liquid to be captured between closed valves without relief, thermal expansion will likely occur and create dangerously high pressures within the system. Care should be taken in designing the system in which thermal shock may occur by implementing Pressure Relief Valves or Thermal Expansion Joints in the system design.

When product is trapped within the system, the pressure will increase by 126 PSI (8.69 BAR) for every one (1) temperature degree increase.

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System Recommendations (Continued)



Thermal Shock

The system operating temperature will expand or contract the metals within the flow meter. For systems that have sudden or immediate temperature increases of 68 F (20 C) degrees or more, will require clearance rotors. Clearance rotors will be necessary to eliminate the effect of immediate expansion of the rotors vs. meter body, caused by thermal shock.

Hydraulic Shock (Water Hammer)

Hydraulic shock is a rise in pressure, which happens when an operating system has immediate change in direction of flow such as a fast valve closure at a high operating flow rate. Hydraulic shock can damage any item in the way of the product flow such as internal parts of the meter, valves, and pump. System design and improper operating procedures will elevate this problem. The use of 2-stage preset control valves or surge suppressing bladders or risers will help reduce or eliminate this problem.

To compute the shock pressure when a valve is closed quickly (recommended to be less than 6 PSI):

$$\text{Shock Pressure (PSI)} = 63 \times \text{Velocity (FPS)}$$

In order to eliminate hydraulic shock, you need to slow down the valve closure rate. The time required to close the valve so that the line pressure will not exceed the normal pressure at no flow is:

$$\text{Time (seconds)} = \frac{0.027 \times L \times V}{N - F}$$

V = Velocity in Feet/Seconds
L = Length of pipe before the valve in feet
N = Line pressure at no flow
F = Line pressure at full flow

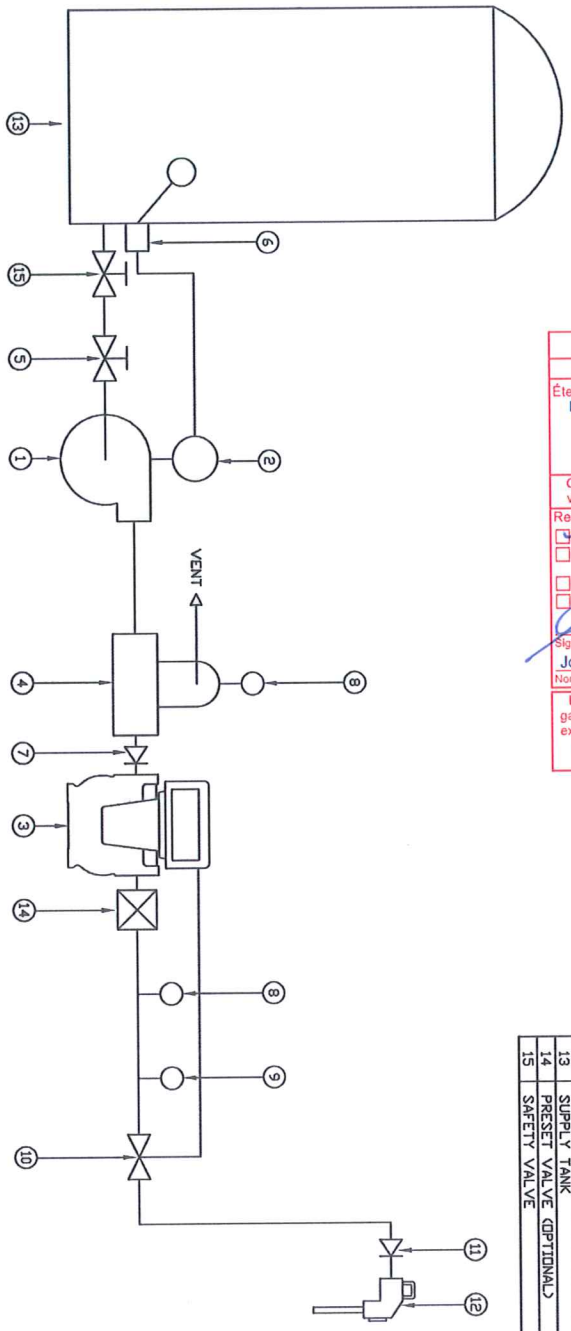
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Products that Dry/Congeal/Crystallize

There are many liquids that crystallize, harden and/or solidify on contact with air or with an increase in temperature. A proper system design and a good understanding of the product being measured will help to avoid the possibility of air entering into the system and the product being affected.

Calibration

The meter shall be tested and calibrated with the product it is intended to measure when installed. Total Control Systems shall not be responsible for loss of product or any damages resulting from the end user's failure to test this meter to insure proper calibration. Every 700 series meter is tested and calibrated at the factory to prove it is calibratable in your system. It is the owner's responsibility to report this device to the local Weights and Measures officials for their inspection before the meter is put to use.



ITEM	DESCRIPTION
1	PUMP
2	PUMP MOTOR
3	FLOV METER W/ REGISTER
4	STRAINER/VAPOR ELIMINATOR
5	ISOLATION VALVE
6	LIQUID LEVEL CONTROL DEVISE (OPTIONAL)
7	CHECK VALVE
8	PRESSURE GAUGE (OPTIONAL)
9	TEMPERATURE GAUGE (OPTIONAL)
10	FLOV RATE CONTROL VALVE
11	CHECK VALVE
12	FILL NOZZLE
13	SUPPLY TANK
14	PRESET VALVE (OPTIONAL)
15	SAFETY VALVE

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FOR

TOTAL CONTROL SYSTEMS
A DIVISION OF
MURRAY EQUIPMENT, INC.

MURRAY EQUIPMENT, INC.

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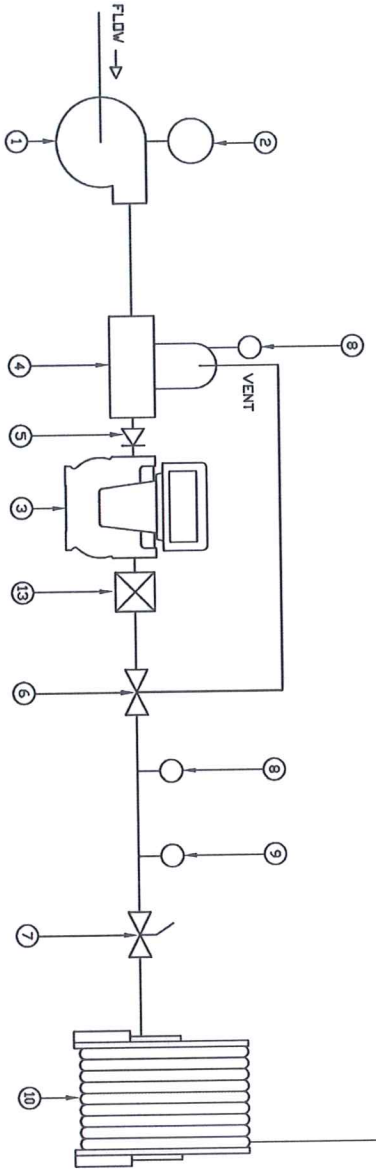
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6	AIR CHECK VALVE (OPTIONAL)
7	FLOW RATE CONTROL VALVE
8	PRESSURE GAUGE (OPTIONAL)
9	TEMPERATURE GAUGE (OPTIONAL)
10	HOSEREEL
11	CHECK VALVE
12	FILL NOZZLE
13	PRESET VALVE (OPTIONAL)

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FOR
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A DIVISION OF
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Start up Recommendations



¡WARNING!

Test equipment should be grounded to prevent a possible spark. Test area should have no ignition source. Operators should wear personal protection and prevent any product exposure and environmental issues.

Start-up instruction for new installations or after maintenance and repairs:

1). Only properly trained personal should design, install, or operate metering system.

2). Remove plastic threaded plugs placed in meter for shipping protection. They are not to be used in meter system because of the PVC plugs low rated pressure, compatibility, and sealing issues.

3). Place the meter in an area with ample workspace, secure from vibration, and pipe line stress. Mount and bolt down on to a fixed stand or platform. This prevents meter stress, which will cause leakage and metal fatigue.

4). Apply thread sealing compound and gasket materials that are compatible with product.

5). Do not weld to meter or accessories. This will weaken housings and cause o-ring and casting leaks and potentially distort the critical tolerances within the flow meter.

6). Always wear personal safety protection equipment such as goggles, steel toed shoes, gloves and full body clothing.

7). Be sure to install a pressure relief valve or expansion joint in the system to protect against thermal expansion.

8). Make sure all system components are properly secured and tightened.

9). All meter assembly bolts and connections are tight.

10). Air eliminator vapor release is properly vented and piped into a reservoir container or back to the supply tank.

11). Electrical connections are properly installed and start/stop switches are off and locked out.

12). Flooded suction to the Pump. Fluid is available to system and will not starve or cavitate pump.

13). Slow flooding of system
Start up system with all shut off valves in the closed position. When a pump is turned on and a valve opened in a new, dry system, tremendous liquid and air pressure can be built up in the piping and forced through the meter. The high pressure and volume of air causes the meter to operate more quickly than normal. When product reaches the meter, there is an abrupt slowing of the meter rotors, which could cause damage to the register, rotor shafts, packing gear and/or blade, timing gears and other components. *The recommended method of starting any system is to flood the piping gradually. This allows product to slowly force the air from the entire system.*

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Start-Up Recommendations (CONTINUED)

15). When operating the meter with accessories, valves should be opened slowly to avoid a pressure surge that can damage the meter or air eliminator. System pressures should be maintained below 70 PSI (4.9 BAR).

16). Custody transfer metering systems must be calibrated by a regulatory agency before product can be sold off the meter. Contact your local authorities for proper calibration.

17). Strainers should be cleaned frequently or have a maintenance schedule. This will ensure a clean system and long service life.

Direction of Flow

The meter is set up at the factory for left to right flow. To change the meter to right to left flow, begin by removing the screws (#9 on the Meter Assembly Breakdown) and the adjuster cover plate (#7) on the front of the meter. Remove both the screws (#1), the drive shaft retainer (#10), the drive shaft (#3), the e-ring (#4) and the face gear (#5). Reinstall the gear on the shaft with the gear teeth facing up. Snap the e-ring back into place to hold the gear in place. Reinstall the shaft, mating the face gear with the drive gear of the packing capsule assembly. Reinstall the screw and cover plate. The meter will now be set up for right to left flow. See Page for a parts breakdown of entire meter assembly.

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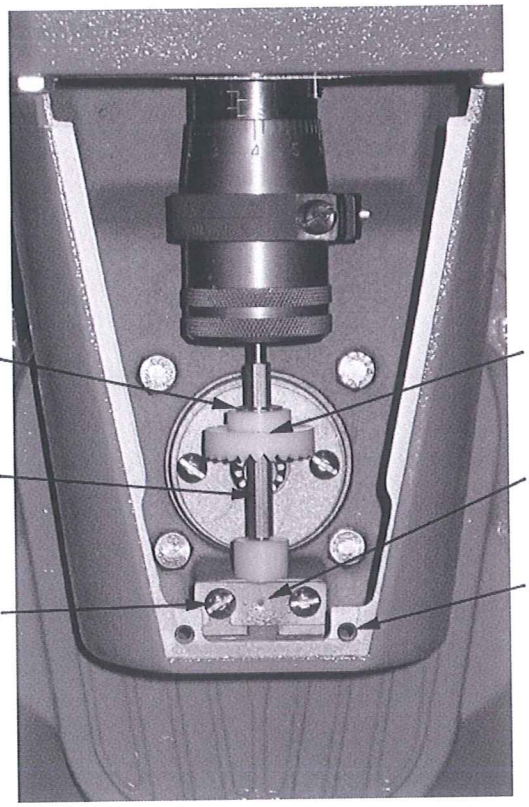
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Meter Calibration



The method of proving should be selected, and necessary provisions made, during the design stage of the installation. Of the most common used systems, portable provers have the advantage of more closely reproducing the condition under which the product is normally delivered.

Use Accurate Prover
Scientifically designed provers are commercially available for proving meters, and no other kind should be used. Even scientifically designed provers should be checked periodically for accuracy. Weights and Measures officials have been very cooperative in giving assistance to checking privately owned volumetric provers.

Recommended size of test measure:
The prover capacity should be equal to at least one minute's flow through the meter at its maximum rate.

These provers are not merely truck compartments or drums, but are scientifically designed test measures, having proper drainage means built into them, a calibration gauge glass neck, and protection against deformation (which causes volume changes).

A "homemade" prover, whether a drum or a tank is not likely to be satisfactory, and may cause expensive errors due to inaccurate meter calibration.

Setting a Prover
The prover should be set level, using the levels provided on the prover, or separate ones. This insures consistent results when moving the prover from meter to meter.

Where to Test a Meter
The best place to test is in its normal operating position, instead of a test stand. In this way, the correctness of the installation and of the operation conditions will be verified by the test. Always test a meter with the same liquid it is to measure, because a difference in viscosity, temperature and system plumbing slightly affects meter accuracy.

Discharge Line from Meter
Where a portable prover is used, the liquid is generally discharged in to the prover in the same manner, as a normal delivery would be made. Where a special test connection is used, the discharge line must be arranged to drain to the same point on each test. The meter flow rate and off/on is controlled at the end of the discharge line.

Wetting the Prover
Reset the meter register to zero, and fill the prover to the zero or 100% marking of the scale. Disregard the meter reading. Drain the prover, and reset the register. The reason for disregarding the first meter reading is that the prover must be wetted, as its calibrated capacity is determined on its wet measure capacity by its manufacturer, and because the prover will be wet for the subsequent tests to be run.

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Meter Calibration (Continued)



After the prover has drained, allow a definitive time of a few minutes for drainage from the sides of the tank. Total drainage time should be the same between all tests to insure uniform results. If a considerable length of time is to elapse between tests, the wetting operation can be eliminated by allowing the prover to remain full until the next test is to be run.

Making the Tests

The setup is now ready for accuracy the test. Reset the register to zero, and run the required test through the meter. Do not exceed the maximum recommended rate of flow for the meter. Maximum and minimum recommended rates of flow for various sizes and types of 700 series meters are marked on their identification plates and maintenance manuals.

Determining Test Results

Run the meter to the mark on the dial corresponding to the prover capacity, and read the over or under delivery in cubic inches or percent on the calibrated plate on the neck of the prover. If the plate is calibrated in cubic inches, the percentage error can readily be computed on the following basis:

(a) One gallon equals 231cu.in.
(b) A 100-gallon prover holds 23,100cu.in. Therefore, 23.1cu.in. represents 0.1% error.

The National Institute of Standards and Technology, in its NIST Handbook 44 specifies a tolerance of plus or minus the following:

METER TOLERANCE

	Tolerance		
Indication of Device	Acceptance Test	Maintenance Test	Special Test
Wholesale	0.2%	0.3%	0.5%
Vehicle	0.15%	0.3%	0.45%

Acceptance tolerances apply to new meters and repaired meters after reconditioning.

Repeatability

When multiple tests are conducted at approximately the same flow rate and draft size, the range of test results for the flow rate shall not exceed 40% of the absolute value of the maintenance/normal tolerance and the results of each test shall be within the applicable tolerance.

Changing Meter Calibration

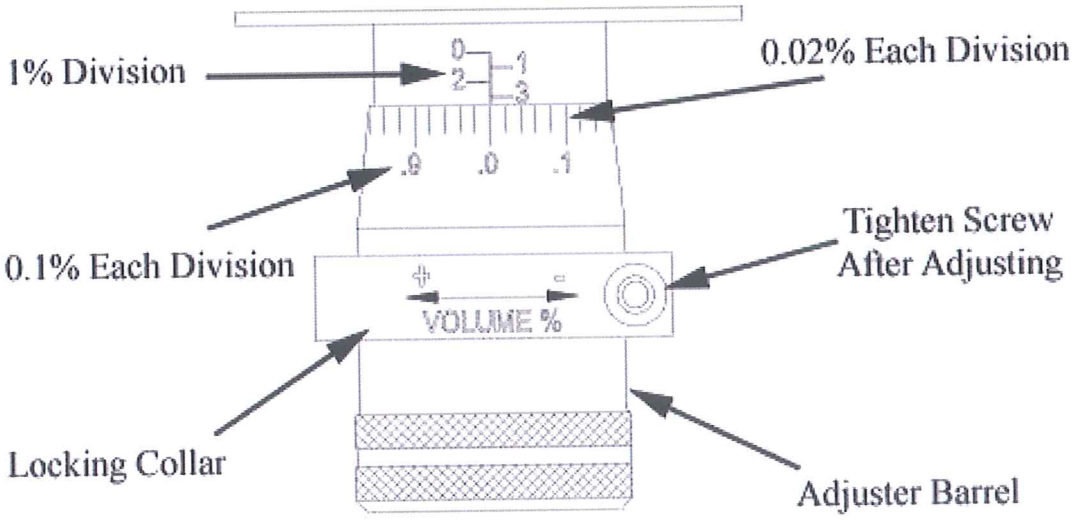
Refer to meter literature for method of changing meter calibration. Any change in the meter calibration adjustment will change the delivery in the same amount for all rates of flow. That is, the calibration curve retains its shape, but is moved up or down. Therefore, if a meter tests satisfactorily at full flow, but drops off too much at low flow, changing the calibration will not remedy this condition; it will bring the low flow test to 100%, but it will also bring the full flow above 100% by the same amount that the low flow was raised. A condition of this kind is caused either by the metering system, need for meter cleaning or repairs, or because of an attempt to retain accuracy below the minimum recommended rate of flow for the meter.

Meter Calibration (Continued)

Temperature Correction
If the conditions of testing are such that there will be a change of more than a few degrees in the temperature of the liquids between the time it passes through the meter and the time the prover is read, it will be advisable to make a temperature correction to the prover readings. To do this, it is necessary to install thermowells; to take readings of the temperature of the liquids in the meter and in the prover; and to take the degrees API of the liquid. Corrections can then be easily made by the use of the National Standard API Tables.

Calibration Adjustment

One complete turn of the adjuster barrel is equal to 1 gallon in 100 gallons or 1% of delivered volume. The adjuster body will show divisions of 1%, while the adjuster barrel has divisions of 0.02%.



For volumes other than 100 gallons, the following formula may be used to calculate the Adjuster percent to increase or decrease prover volume.

$$\frac{\text{Volume on Prover minus Volume on Meter Counter}}{\text{Volume on Meter Counter}}$$

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Split Compartment Test



Purpose: A product depletion test verifies the proper operation of air elimination when the storage tank for the product being measured is pumped dry. This test is necessary for meters that may drain a tank completely, such as a vehicle tank meter.

Multiple-Compartment Test Procedure:

1). Begin the test from a compartment (ideally the largest compartment) containing an amount of fuel equal to or less than one-half the nominal capacity of the prover being used. Operate the meter at the normal full flow rate until the compartment is empty. There are several methods for determining that the compartment is empty. There may be a significant change in the sound of the pump. There may be visual evidence that the compartment has run dry. The meter may stop entirely or may begin to move in jumps (pause, resume running, then pause, then run again.)

2). Continue the test until the meter indication stops entirely for at least 10 seconds. If the meter stops for 10 seconds or more, proceed to step 3. If the meter indication fails to stop entirely for a period of 10 seconds, continue to operate the system for 3 minutes.

3). Close the valve from the empty compartment, and if top filling, then close the nozzle or valve at the end of the delivery hose. Open the valve from another compartment containing the same product. Carefully open the valve at the end of the delivery hose. Pockets of vapor or air may cause product to splash out of the prover. The test results may not be valid if product is splashed out of prover. Appropriate attire and protection is required, but caution is still necessary.

4). Continue delivering product at the normal full flow rate until the liquid level in the power reaches the nominal capacity of the prover.

5). Close the delivery nozzle or valve, stop the meter. Allow any foam to settle, then read the prover sight gauge.

6). Compare the meter indication with the actual delivered volume in the prover.

7). Calculate the meter error, apply Product Depletion test tolerance, and determine whether or not the meter error is acceptable. Reference the NIST Handbook 44 for further information.

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Split Compartment Test (Continued)

Single Compartment Test Procedure:

The test of single-compartment tanks is easier to accomplish if there is a quick-connect hose coupling between the compartment valve and the pump that supplies product the meter. If the system does not have quick-connect couplings between the compartment and the meter, an additional source of sufficient product at the test site is required.

Without a quick-connect coupling:

1). Begin the tests with the compartment containing an amount of fuel equal to or less than one-half the nominal capacity of the prover being used. Operate the meter at the normal full flow rate until the supply tank is empty. There are several methods for determining that the tank is empty. There may be significant change in the sound of the pump. Someone may visually watch for the tank to run dry. The meter may stop entirely or may begin to move in jumps (pause, resume running, the pause, then run again).

2). Continue the test until the meter indication stop entirely for at east 10 seconds. If the meter stops for at least 10 seconds, proceed to step 3. If the meter indication fails to stop entirely for at least 10 seconds, continue to operate the system for 3 minutes.

3). Close the compartment valve and the delivery nozzle or valve if top filling. Stop the pump and load sufficient product from the alternate source into the supply compartment for the meter being tested. Allow the product to stand in the compartment for a brief time to allow entrained vapor or air to escape.

4). Open the compartment valve and restart the pump without pump resetting the meter to zero. Care fully open the nozzle of valve at the end of the delivery hose. Pockets of vapor or air may cause product to splash out of the prover. The test results may not be valid if product is splashed out of the prover. Appropriate attire and protection is required, but caution is still necessary.

5). Continue delivery of product at the normal full flow rate until the liquid level in the prover reached the nominal capacity of the prover.

6). Close the delivery nozzle or valve, stop the meter, and allow any foam to settle, then read prover sight gauge.

7). Compare the meter indication with the actual delivered volume in the prover.

8). Calculate the meter error, apply Product Depletion test tolerance, and determine whether or not the meter error is acceptable. Reference the NIST Handbook 44 for further information.

Split Compartment Test (Continued)



With a quick-connect coupling:

1). During a normal full flow test run; close the compartment valve at approximately one-half of the nominal prover capacity. Then slowly and carefully disconnect the quick-connect coupling, allowing the pump to drain the supply line.

2). Continue the test until the meter indication stops entirely for at least 10 seconds. If the meter fails to stop entirely for at least 10 seconds, continue to operate the system for 3 minutes.

3). If the meter stops for at least 10 second or after 3 minutes, close the delivery nozzle or valve at the end of the delivery hose if top filling.

4). Disconnect and reconnect the quick-connect coupling and open the compartment valve.

5). Carefully open the nozzle or valve at the end of the delivery hose. Pockets of vapor or air may cause product to splash out of the prover. The test results may not be valid if product is splashed out of the prover. Appropriate attire and protection is required, but caution is still necessary.

6). Continue the delivery of product at the normal full flow rate until the liquid level in the prover reaches the prover's nominal capacity.

7). Close the delivery nozzle or valve, stop the meter, allow any foam to settle, then read the prover sight gauge.

8). Compare the meter indication with the actual delivered volume in the prover.

9). Calculate the meter error, apply Product Depletion test tolerance, and determine whether or not the meter error is acceptable.

Tolerance for Vehicle-Tank Meters

Meter size	Maintenance and Acceptance
2" (50 mm)	137 cubic inches
3" (75 mm) and larger	229 cubic inches

The results of the product depletion test may fall outside of the applicable test tolerance as this is a stand-alone test.

The test draft should be equal to at least the amount delivered by the device in 1 minute at its maxi mum discharge rate, and in no case should it be less than 50 gallons.

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Maintenance



¡WARNING!

Test equipment should be grounded to prevent a possible spark. Test area should have no ignition source. Operators should wear personal protection and prevent any product exposure and environmental issues.

1). Keeping accurate maintenance and calibration records can be an excellent tool in determining the frequency of inspection or maintenance for a system. As the meter wears, the calibration will be affected and require adjustment. A personality profile can be created for each meter to help guide in a maintenance schedule.

2). Great care should be utilized in the maintenance of the metering system. Personal safety protection, environmental hazards, and government regulations need to be the foremost priority. Only fully trained personnel should be involved in maintenance. Failure to use original TCS replacement parts will void any Weights & Measures approvals and risk damage to the meter system.

3). ALWAYS RELIEVE INTERNAL SYSTEM PRESSURE TO ZERO BEFORE DISASSEMBLY OR INSPECTION.

4). SERIOUS INJURY OR DEATH FROM FIRE OR EXPLOSION COULD RESULT FROM MAINTENANCE OF AN IMPROPERLY DEPRESSURIZED AND EVACUATED SYSTEM.

5). Total Control Systems flow meters and accessories are often used with petroleum, solvents, chemicals, and other liquids that may be explosive, extremely flammable, very toxic, oxidizing, and corrosive. Severe injury or fatalities may arise if appropriate safety precautions are not followed.

6). Before replacing or cleaning filter/strainer screen, the electrical system must be turned off. Product needs to be drained from system. Collect all product and return to storage or dispose of properly. Replace all drain plugs that were removed. Personal safety protection must be warn at this time. Make sure there is adequate ventilation in the area. The metering system will not completely drain so make sure you collect extra product when you remove the strainer cover. Clean the screen once a week, or more often if there is a lot of sediment in the system. Make sure there is no ignition source and the system is grounded. Replace all plugs that were removed for drainage.

7). The metering system is heavy and awkward so take precaution to handle it properly.

8). Do not use force to disassemble or use a screwdriver to pry open any part of the metering system. Have the proper tools available before trying to repair the meter system. Be careful of the parts as they can be sharp and heavy. Do not drop housing or rotors as they can cause injury and can destroy the parts. Be careful when inspecting and turning the timing gears and rotors as they can pinch fingers, turn slowly to verify smooth operation.

9). When inspecting the spring loaded preset valves do not place anything inside the housing, as the action of the valve will pinch this object when the valve closes.

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Maintenance (CONTINUED)



¡WARNING!

Test equipment should be grounded to prevent a possible spark. Test area should have no ignition source. Operators should wear personal protection and prevent any product exposure and environmental issues.

10). When removing gaskets or o-rings, carefully check for damage or corrosion. Cracked, rough, worn, elongated, swollen o-rings need to be replaced. When replacing the o-rings place grease along the inside of the races or completely around the o-ring to help the o-ring stay in the o-ring grove during assembly. If o-ring is pinched or not in o-ring grove the meter system will leak and cause serious problems to personal, environment, and equipment. Collect all replaced parts and dispose of properly. Do not weld any part of the meter system or accessories as this will weaken the part and allow for leaks

11). Coat with anti-seize and replace all bolts and screws, torque to TCS design specifications.

12). Recommended levels of maintenance and inspection will depend upon the products being meas ured, their corrosiveness, system pressure requirements, government or company regulations, and age of metering system. If hydrostatic testing is required pressure should not exceed 1.5 times the marked meter pressure. It is not recommended to pneumatically test the meter system at anytime.

13). If any part of the meter system is removed from system it should be thoroughly flushed with a compatible liquid. After this is done, immediately refill the meter or accessory with a compatible liquid to prevent corrosion and water build up.

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Storage Instructions



Short periods of non-use of the meter (a week or less) will present no problem, provided that the meter remains full of product. For long periods of non-use, such as winter storage, the following procedure is recommended. Before long-term storage, a good practice is calibration of the meter to determine that it is functioning properly.

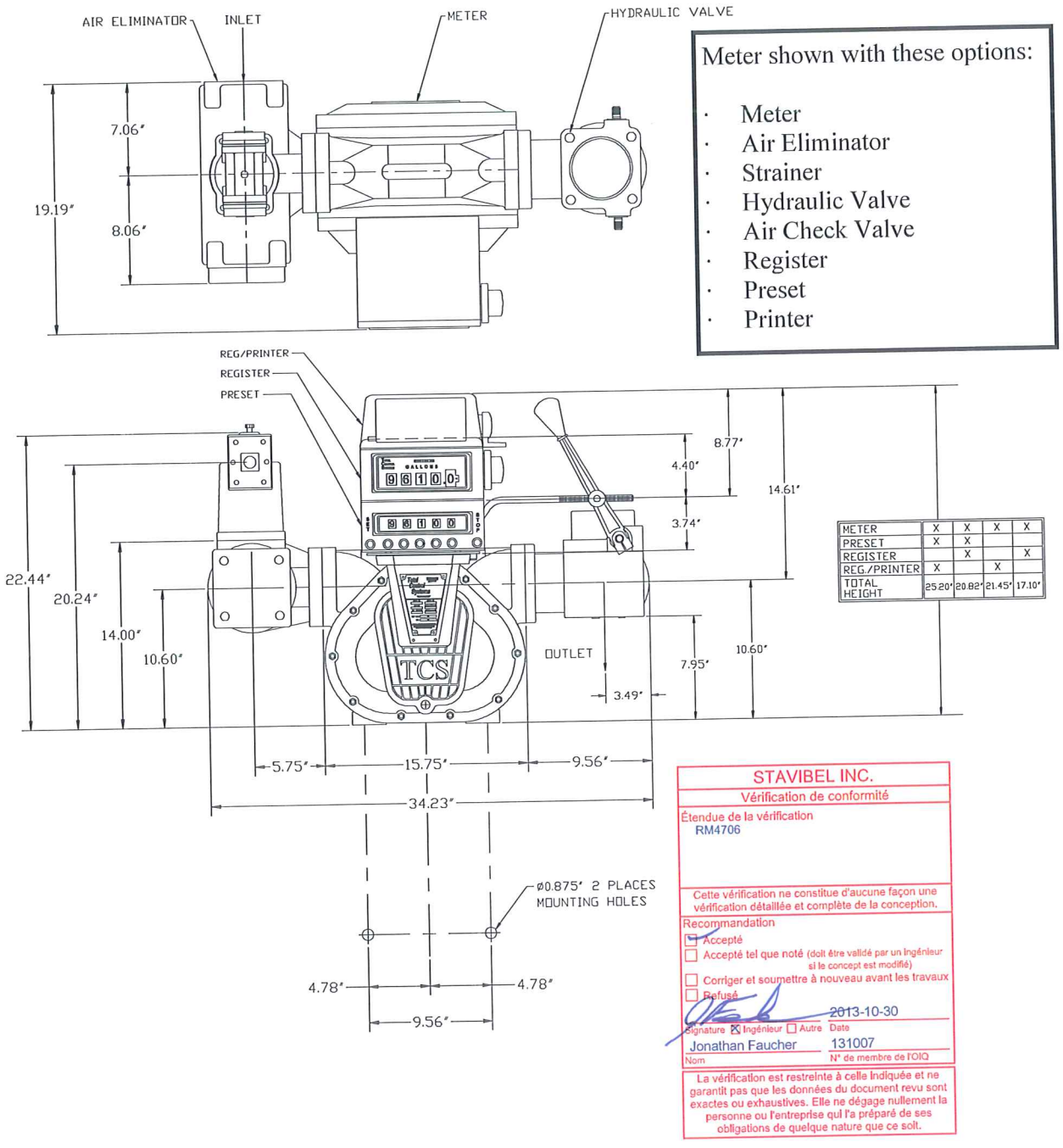
1). To store the meter when it is left in line, flush the system with clean water until 70-80 gallons of water have gone through the meter.

2) Pump a 50% anti-freeze / 50% water solution through the entire system (100% RV antifreeze may be used instead). With the pump running, shut off a valve downstream from the meter, making sure that anti-freeze solution is present at that point. Then close an upstream valve, such that the meter remains full of anti-freeze solution.

3) Remove the register from the meter, and lubricate the drive coupling shaft. After lubrication it, replace the register onto the meter.

When starting the system after a period of storage, check the meter's calibration as detailed earlier in the service manual.

700-40 / 700-45 Dimensions



All measurements are in inches.

700-40 / 700-45 Meter Assembly

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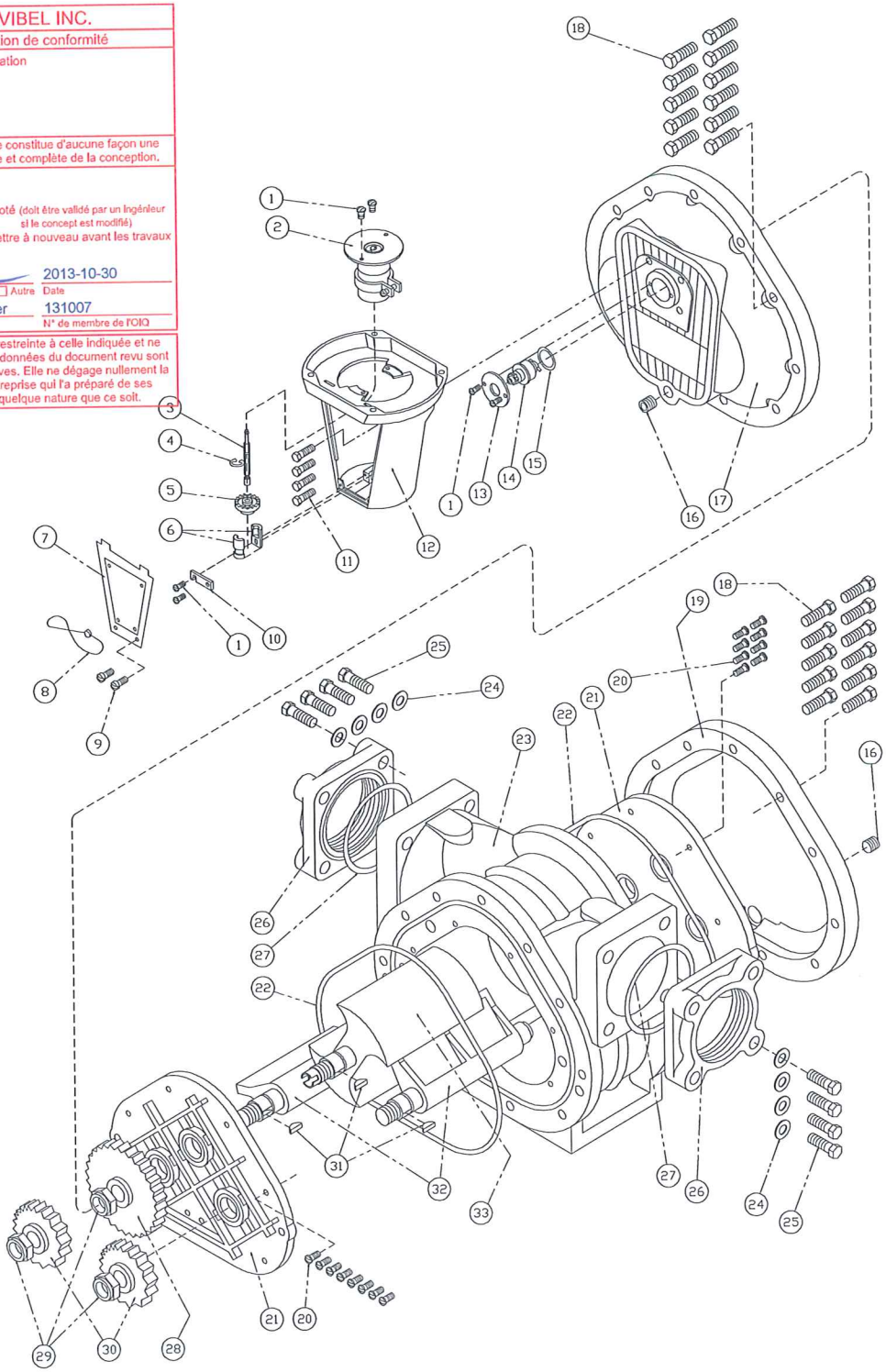
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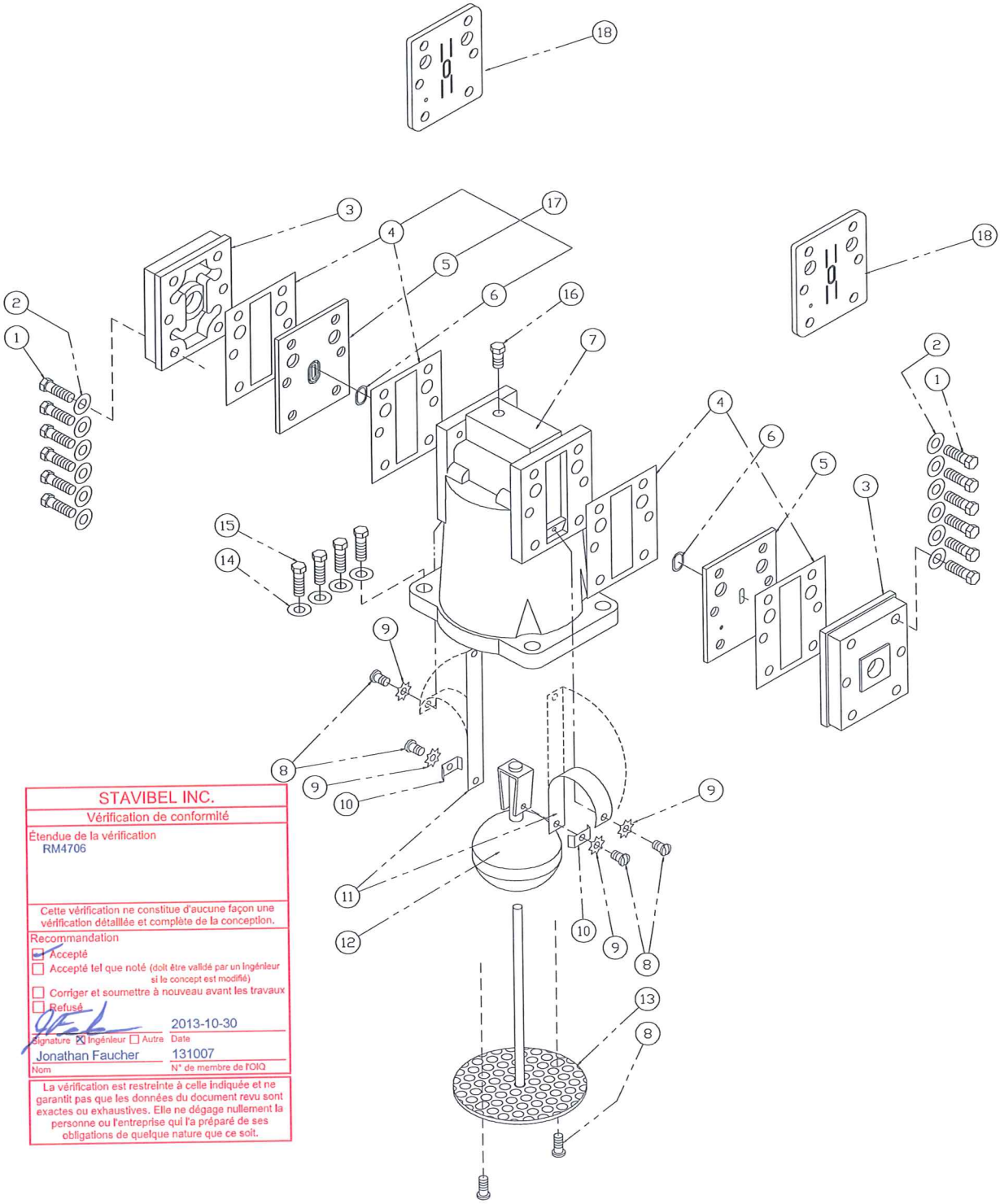


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700-40 / 700-45 Meter Assembly

Item	Description	Qty	700-40				700-45			
			SP	SPA	SPD	IP	IC	AP	SPA	SPD
1	Round Head Screw	6	1-128279	1-128279	1-128279	1-128279	1-128279	1-128279	1-128279	1-128279
2	Adjuster Assembly	1	700100	700100	700100	700100	700100	700100	700100	700100
3	Drive Shaft	1	700019	700019	700019	700019	700019	700019	700019	700019
4	E-Ring	1	700016	700016	700016	700016	700016	700016	700016	700016
5A	Acetal Face Gear, STD	1	700018	700018	700018	700018	700018	700018	700018	700018
5B	Brass Face Gear, High Temp.	1	700027	700027	700027	700027	700027	700027	700027	700027
6A	Acetal Bushing, STD	2	700020	700020	700020	700020	700020	700020	700020	700020
6B	Brass Bushing, High Temp.	2	700055	700055	700055	700055	700055	700055	700055	700055
7	Adjuster Cover Plate	1	700017	700017	700017	700017	700017	700017	700017	700017
8	Seal Wire	1	1-118849	1-118849	1-118849	1-118849	1-118849	1-118849	1-118849	1-118849
9	Drilled Head Screw	2	700042	700042	700042	700042	700042	700042	700042	700042
10	Drive Shaft Retainer	1	700022	700022	700022	700022	700022	700022	700022	700022
11	Head Mount Screw	4	700040	700040	700040	700040	700040	700040	700040	700040
12	Register Support	1	700200	700200	700200	700200	700200	700200	700200	700200
13	Packing Retaining Plate	1	700015	700015	700015	700015	700015	700015	700015	700015
14A	2:1 Packing Capsule Assy., STD	1	700150	700150	700155	700155	700155	700155	700150	700155
14B	1:1 Packing Capsule Assy.	1	700170	700170	700175	700175	700175	700175	700170	700175
15	Packing O-ring	1	700009	700009	700010	700010	700010	700009	700010	700009
16	Plug	2	700024	700024	700024	700024	700024	700024	700024	700024
17	Front Cover	1	704500	704500	704503	704500	704500	704503	704500	704503
18	Cap Screw	22	704016	704016	704016	704016	704016	704016	704016	704016
19	Rear Cover	1	704550	704550	704553	704550	704550	704553	704550	704553
20	Round Head Screw	16	704014	704014	704014	704014	704014	704014	704014	704014
21	Bearing Plate	2	704230	704235	704235	704205	704215	704225	704225	704225
22	Cover O-ring	2	704001	704001	704002	704002	704002	704002	704001	704002
23	Housing	1	704110	704110	704113	704115	704115	704113	704110	704113
24	Flat Washer	8	704018	704018	704018	704018	704018	704018	704018	704018
25	Cap Screw	8	704017	704017	704017	704017	704017	704017	704017	704017
26	Flange	2	704600	704600	704613	704600	704600	704613	704600	704613
27	Flange O-ring	2	704012	704012	704013	704013	704013	704013	704012	704013
28	Blocking Rotor Gear	1	704350	704350	704350	704350	704350	704350	704350	704350
29	Rotor Lock Nut	3	704010	704010	704010	704010	704010	704010	704010	704010
30	Displacement Rotor Gear	2	704450	704450	704450	704450	704450	704450	704450	704450
31	Rotor Key	3	704008	704008	704008	704008	704008	704008	704008	704008
32	Displacement Rotor	2	704405	704405	704422	704410	704410	704425	704405	704422
33	Blocking Rotor	1	704305	704305	704322	704310	704310	704325	704305	704322

730 Air Eliminator Assembly



STAVIBEL INC.

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RM4706

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Signature ☒ Ingénieur ☐ Autre — Date: 2013-10-30

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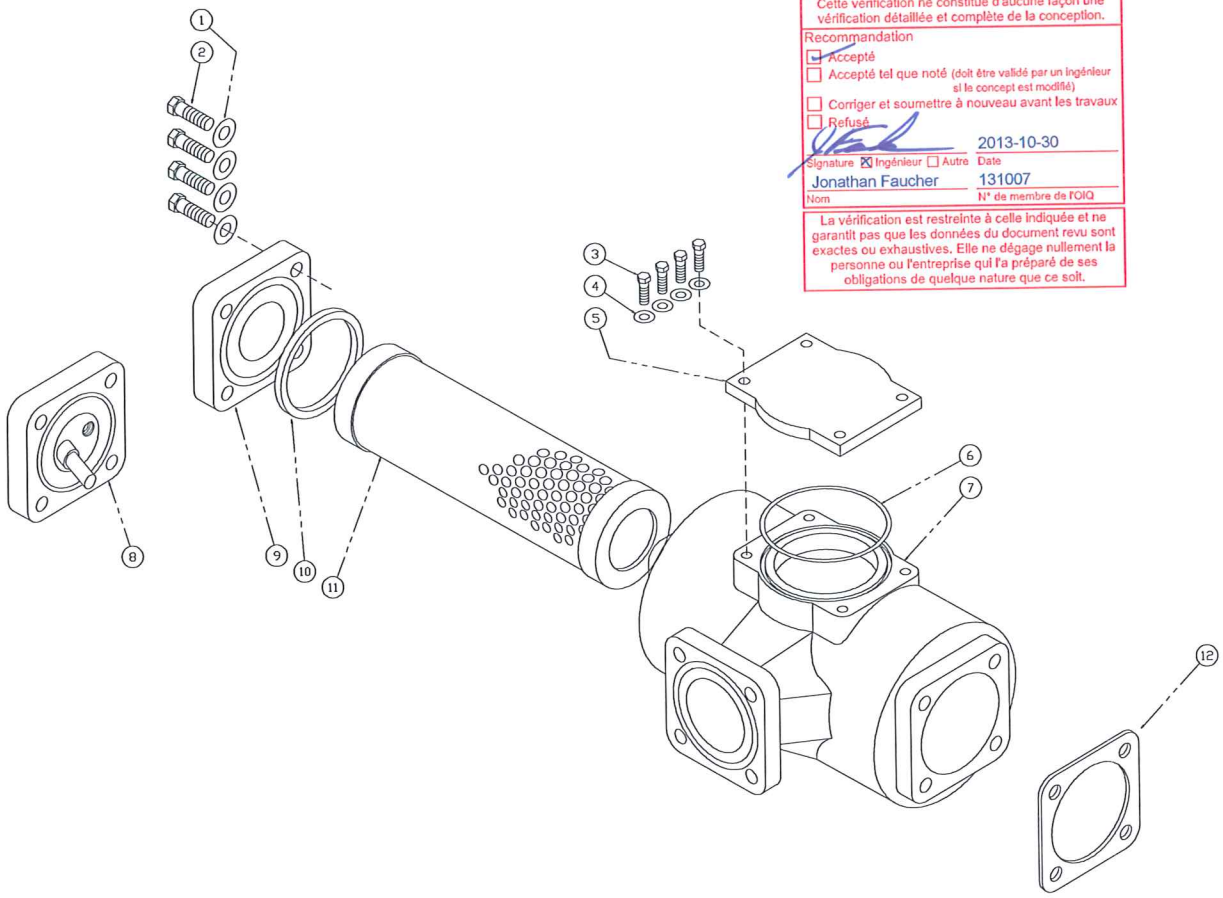
730 Air Eliminator Assembly

730-20

Item	Description	Qty	SP	SPD	IP	AF
1	Cap Screw	12	740050	740050	740050	740050
2	Ring Washer	12	740051	740051	740051	740051
3	Outlet Cover	2	740010	740016	740010	740016
4	Plate Seal	4	740005	740004	740004	740004
5	Valve Plate	2	740038	740006	740006	740006
6	O-ring	2	740036	740037	740037	740037
7	Air Eliminator Housing	1	740020	740022	740020	740022
8	Screw	6	740030	740030	740030	740030
9	Split Lock Washer	2	740017	740017	740017	740017
10	Retaining Clip	2	740012	740012	740012	740012
11	Reed Valve	2	740007	740007	740007	740007
12	Float Assembly	1	740013	740013	740013	740013
13	Diffuser and Shaft Assembly	1	740035	740035	740035	740035
14	Flat Washer	4	702018	702018	702018	702018
15	Cap Screw	4	701017	700054	701017	700054
16	Plug	1	2-126146	2-126146	2-126146	2-126146
17	Valve Plate Kit	1	740138	740106	740106	740106
18	Encapsulated Plate	2	740205	740215	740215	740215

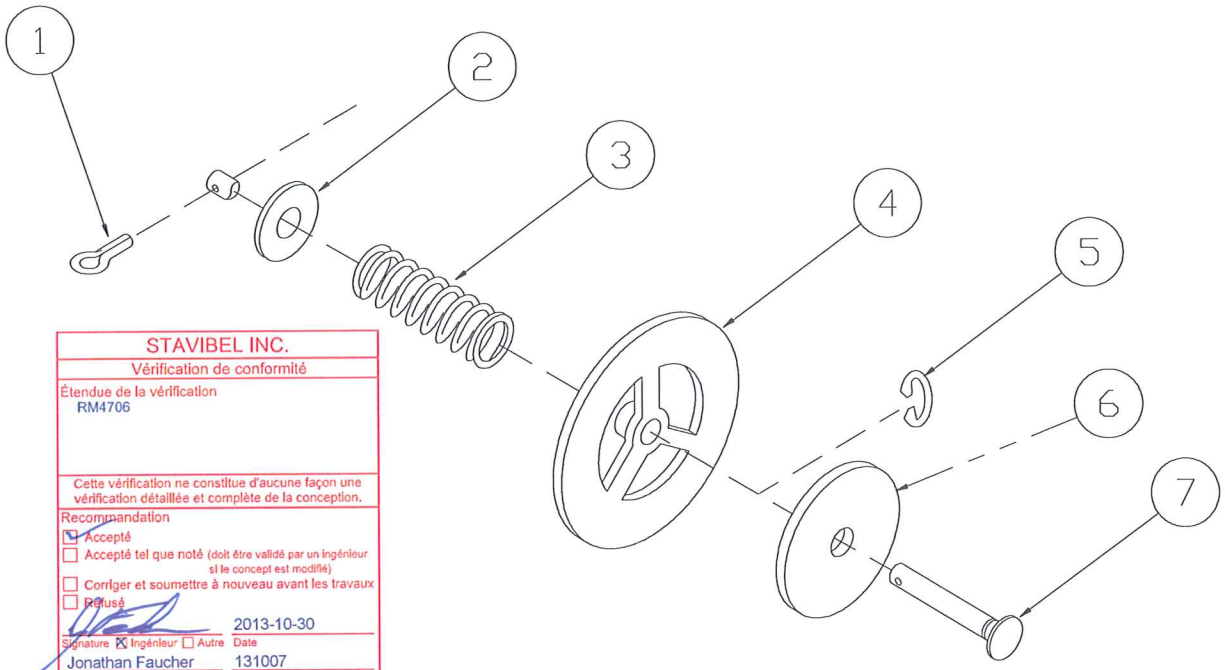
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720-40 Strainer Assembly



Item	Description	Qty	720-40			
			SP	SPD	IP	AF
1	Flat Washer	4	704018	704018	704018	704018
2	Cap Screw	4	704027	704027	704027	704027
3	Cap Screw	4	700054	700054	700054	700054
4	Flat Washer	4	702018	702018	702018	702018
5	Strainer Cover, Optional	1	740041	740042	740041	740042
6	Top Seal O-ring	1	740009	740019	740019	740019
7	Strainer Housing	1	744021	744023	743021	744023
8	Basket Cover, Thermowell	1	744055	-	743055	-
9	Basket Cover	1	744050	744053	743050	744053
10	Seal Ring	1	744003	744004	744004	744004
11A	0.050P Strainer Basket, STD	1	-	-	743005	743005
11B	40M Strainer Basket, STD	1	744010	744010	-	-
11C	80M Strainer Basket	1	744015	744015	-	-
11D	100M Strainer Basket	1	744025	744025	-	-

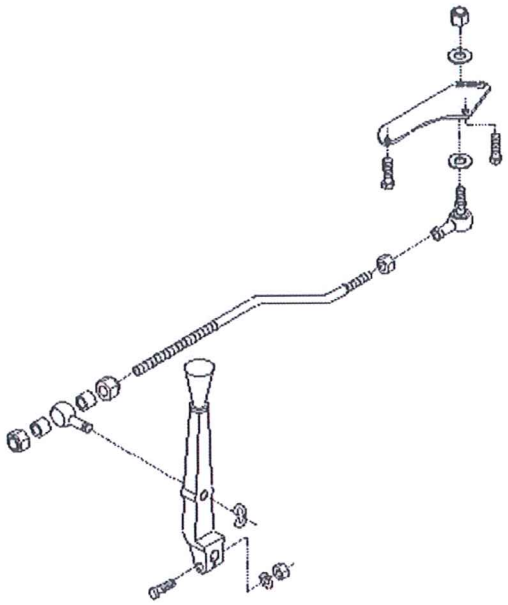
700CV40SP Back Pressure Check Valve Assembly



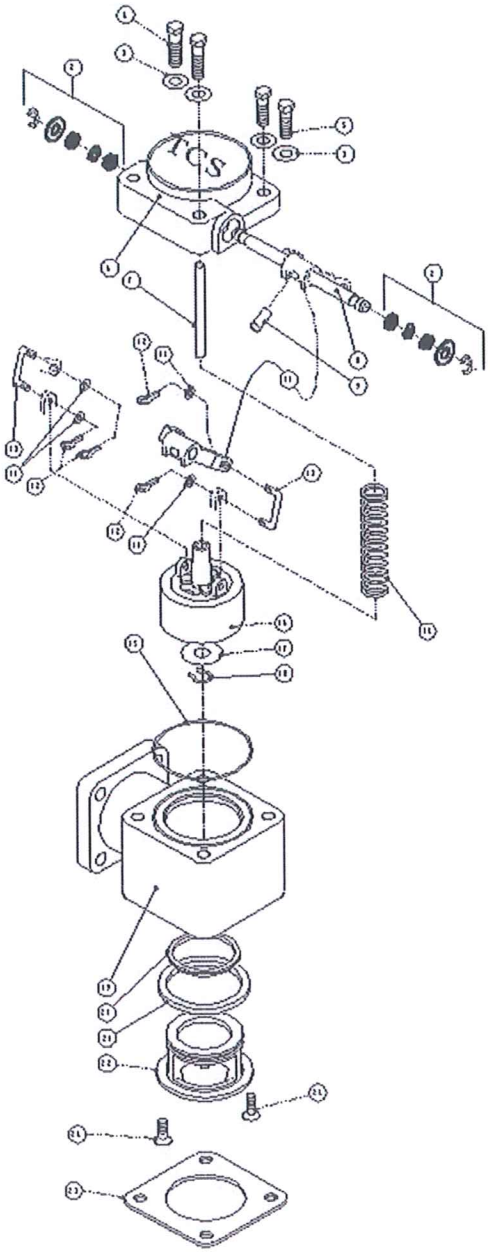
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Item	Description	Quantity	700CV40
			SP
1	Cotter Pin	1	70003
2	Flat Washer	1	70070
3	Compression Spring	1	70002
4	Valve Plate Assembly	1	70016
5	Retaining Ring	1	6-052482
6	Valve Disc	1	70005
7	Poppet Post	1	70033

750-40 Hydraulic Preset Valve Assembly



VALVE LINKAGE/HANDLE KIT



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750-40 Hydraulic Preset Valve Assembly

Item	Description	Qty	750-40SP	750-40IP
1	Linkage/Handle Kit	1	754001KT	754001KT
2	Seal Kit	1	754314KT	754314KT
3	Flat Washer	4	754013	754013
4	Cap Screw	2	754011	754011
5	Cap Screw	2	754012	754012
6	Valve Cover	1	754015	754015
7	Shaft	1	754008	754008
8	Lever Arm Shaft	1	754005	754005
9	Spring Pin	1	754022	754022
10	Lever	1	754023	754023
11	Flat Washer	4	754024	754024
12	Cotter Pin	4	754037	754037
13	Swivel Pin	2	754027	754027
14	Internal Valve Spring	1	754019	754019
15	Cover Gasket	1	754009	754009
16	Piston	1	754020	754020
17	Flat Washer	1	754028	754028
18	Snap Ring	1	754029	754029
19	Valve Body	1	754040	754040
20	Upper Seal	1	754035	754036
21	Lower Seal	1	754033	754034
22	Piston Guide	1	754030	754031
23	Gasket	1	704022	704022
24	Screw	2	792004	792004

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Torque Specifications

700-40/45 METER ASSEMBLY

Part Number & Description	Tool	Bolt/Nut Size	Foot Lbs.		Newton Meter	
			Unlubricated	Lubricated	Unlubricated	Lubricated
TCS 704016 Cover Screws	9/16" hex wrench/socket	3/8-16 UNC 2B	19.7	11.8	26.7	16.0
TCS 700040 Counter Support	7/16" hex wrench/socket	1/4-20 UNC 2B	6.3	3.8	8.5	5.2
TCS 704014 Bearing Plate	slotted screwdriver	1/4-20 UNC 2B	6.3	3.8	8.5	5.2
TCS 1-128279 Dust Cover	slotted screwdriver	10-24 UNC-2B	1.9	1.1	2.6	1.5
TCS 704010 Rotor Gear	1-1/4" hex wrench/socket	7/8-14	193.2	115.9	261.9	157.1

740-40 AIR ELIMINATOR/STRAINER ASSEMBLY

Part Number & Description	Tool	Bolt/Nut Size	Foot Lbs.		Newton Meter	
			Unlubricated	Lubricated	Unlubricated	Lubricated
TCS 740050 Cover Plate	1/2" hex screw wrench/socket	5/16-18 UNC 2B	11	6.6	14.9	8.9
TCS 704017 Cap Screws	15/16" hex wrench/socket	5/8-11 UNC 2B	92.5	55.5	125.4	75.2
TCS 740030 Reed & Diffuser	slotted screwdriver	8-32 UNC 2B	1.65	1.0	2.2	1.4

750-40 HYDRAULIC PRESET VALVE ASSEMBLY

Part Number & Description	Tool	Bolt/Nut Size	Foot Lbs.		Newton Meter	
			Unlubricated	Lubricated	Unlubricated	Lubricated
TCS 754011 Cap Screw	3/4" hex screw wrench/socket	1/2-13 UNC 2B	43.1	25.9	58.4	35.1
TCS 754012 Cap Screw	3/4" hex nut wrench/socket	1/2-13 UNF 2B	43.1	25.9	58.4	35.1
TCS 792004 Guide Screw	1/8" allen wrench	10-24 UNC 2B	1.9	1.1	2.6	1.5

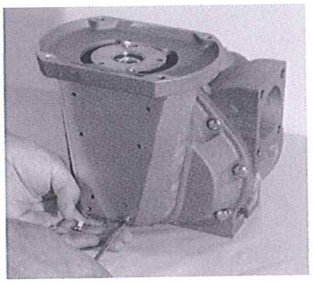
This Torque Chart is for 18-8 Stainless Steel Bolts
Values can be +/- 10% of value listed

Drive Components

Removing the Dust Cover

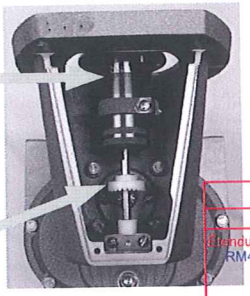
1) Cut dust cover seal. Remove the dust cover screws with a standard flathead screwdriver.
2) Note the setting on micrometer.
3) Note the position of the drive gear (either above or below the packing gland pinion).

1



2

3

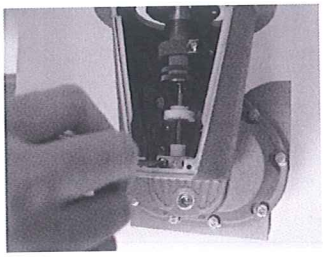


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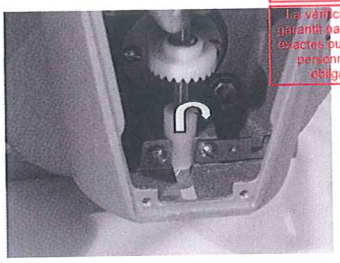
Removing the Adjuster

1) Loosen the retaining screws using a standard flathead screwdriver.
2) Slide the retaining clip up and over to the left side.

1

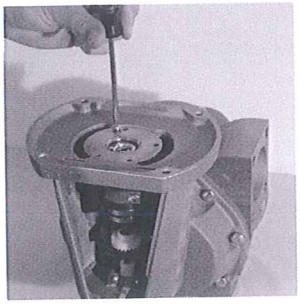


2

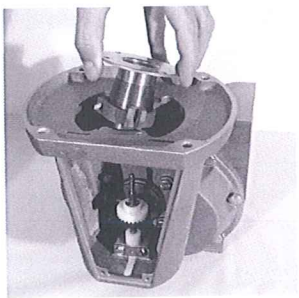


3) From the top, remove the screws to adjustor plate.
4) Lift adjustor out of the counter adapter.
5) Remove the adjustor drive assembly.

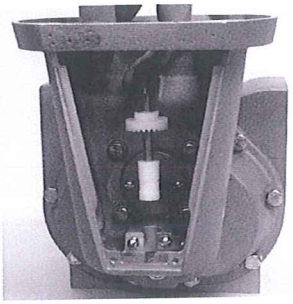
3



4



5



Disassembly of Meter (Continued)

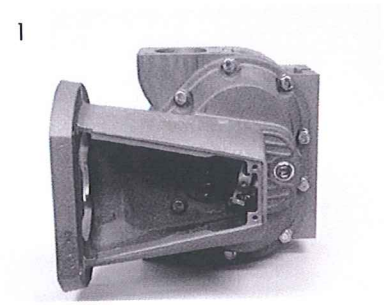
¡WARNING!

All internal pressure must be relieved to ZERO (0) pressure before beginning disassembly of meter or components

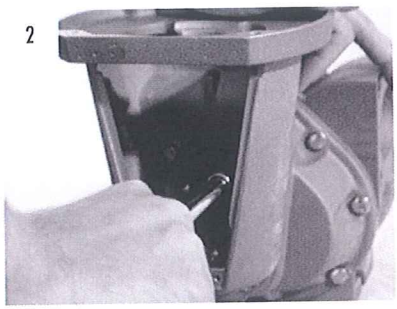
Draining Meter & Removing Counter Support

1) Drain the meter by turning it on either the inlet or outlet side.
2) Remove the counter bracket screws with a hex wrench or socket driver.
3) Remove the drain plugs on the front and rear covers using an allen wrench. Allow more fluid to drain from the meter.

1



2



3



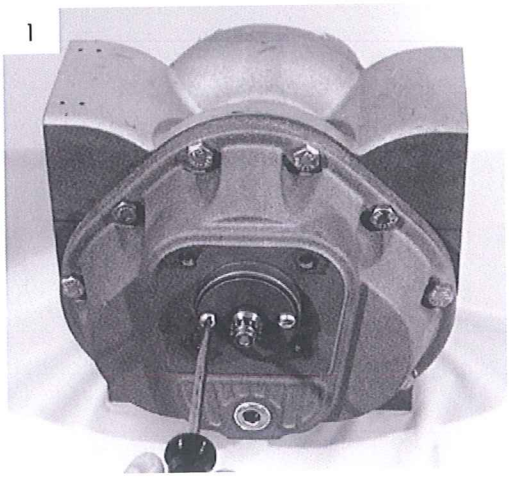
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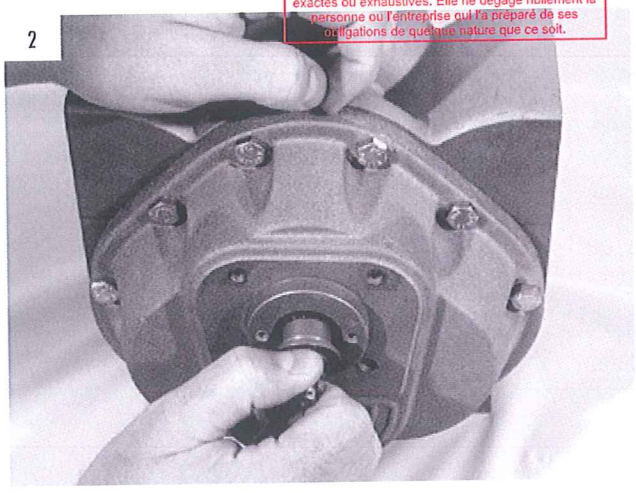
Removing Packing Capsule

1) Remove the retaining plate using a standard flathead screwdriver.
2) Pull out the packing gland from the meter.

1



2

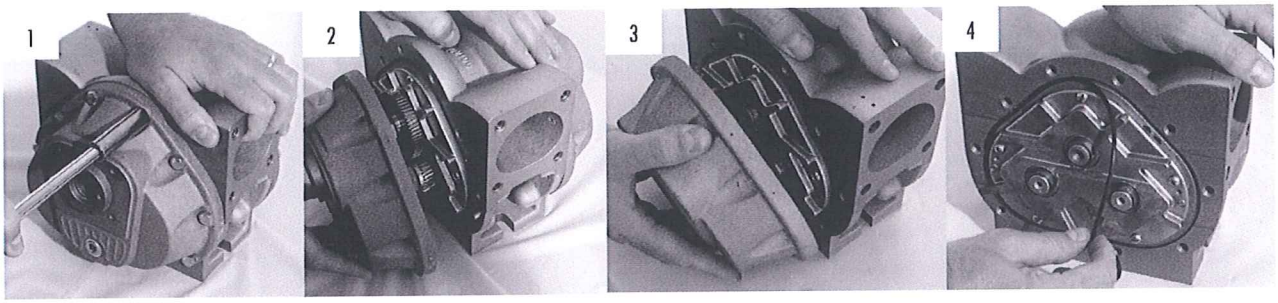


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Disassembly of Meter (Continued)

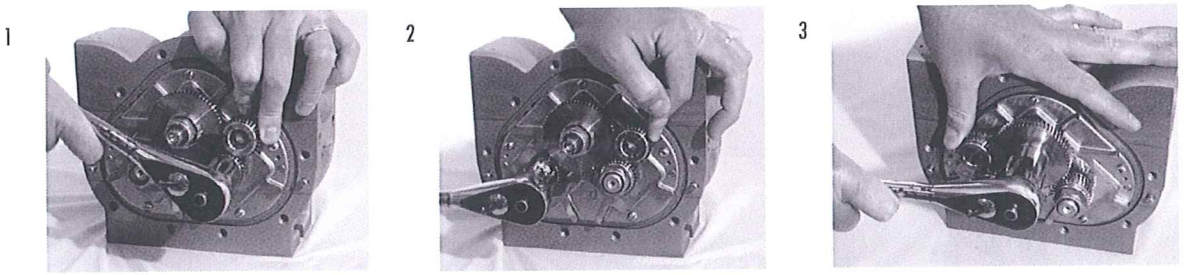
Front & Rear Cover

1) Remove the screws on the front cover using a socket or box wrench.
2) Remove front cover.
3) Remove the screws on the back and remove rear cover.
4) Remove the O-ring from both sides of the housing



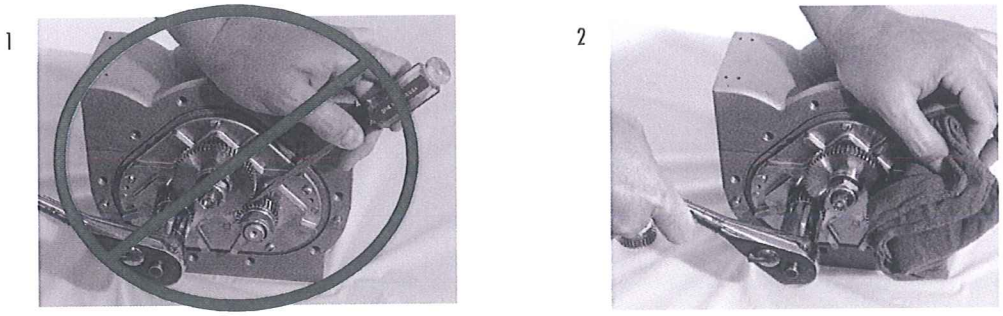
Rotor Gears

1) Using a spare displacement rotor gear, place it between the rotor and blocking gear on the meter.
2) Use the socket or box wrench to loosen the right rotor gear lock nut. Repeat for the left rotor gear lock nut.
3) Move the spare displacement rotor gear to the other side and loosen the blocking rotor lock nut.



Special Notes

1) DO NOT remove rotor gears using a screwdriver! This could damage the rotor gear and create potential wear problems within the measuring chamber.
2) If a spare rotor gear is not available, then use shop rag between gear teeth.

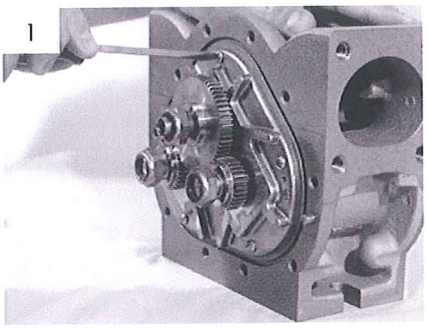


Disassembly of Meter (Continued)

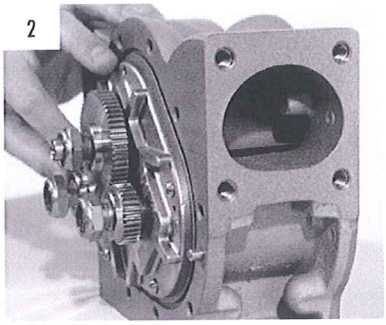
Removing Bearing Plate

1) Remove the bearing plate retaining screws with a standard flathead screwdriver.
2) To remove bearing plate & rotors, insert a screwdriver into the notches near the dowel pins.
3) Gently pry the bearing plate off the dowel pins and slide out the bearing plate and rotors from the housing.

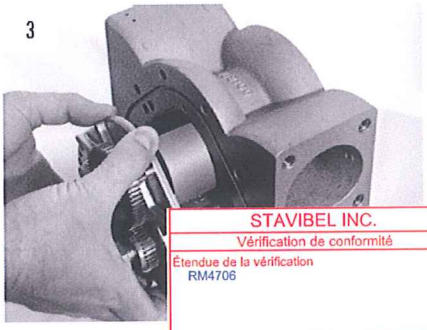
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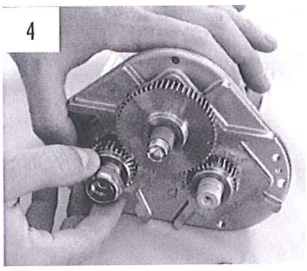


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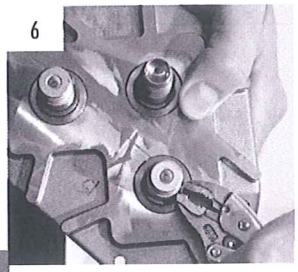
Removing Lock Nuts & Rotors

4) Remove rotor lock nuts from each gear.
5) Pull gears off of rotor shaft.
6) Remove rotor key using pliers (this might not be necessary as rotor may slide right out of bearing plate).
7) Remove rotors from bearing plate.

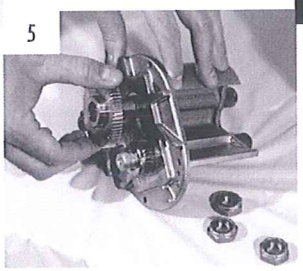
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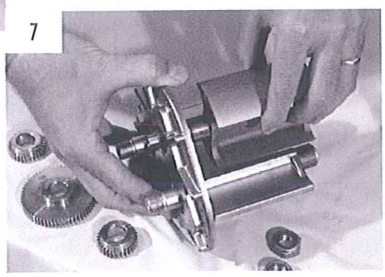
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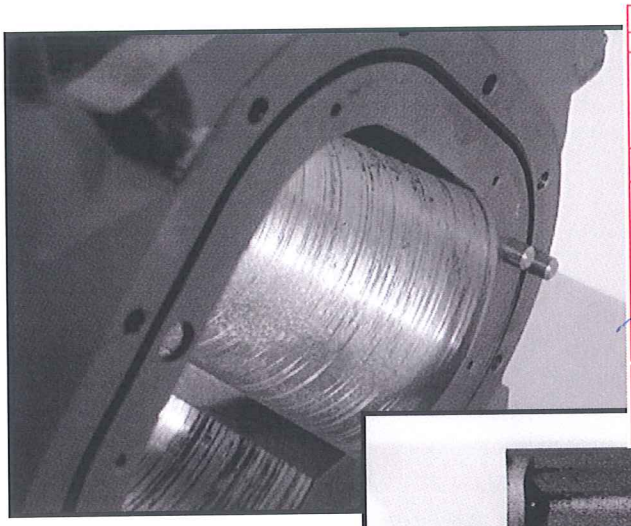


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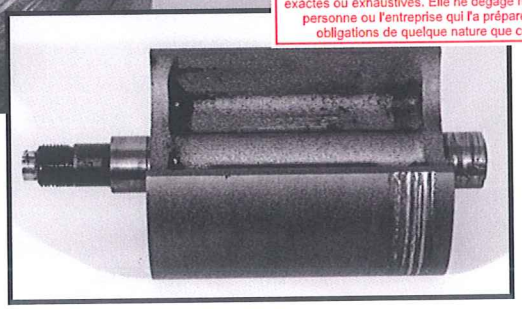
Inspection of Parts

1) Inspect the surfaces of rotors, bearing plates, meter housing and gear teeth for any damage or wear.
2) Replace parts as needed.

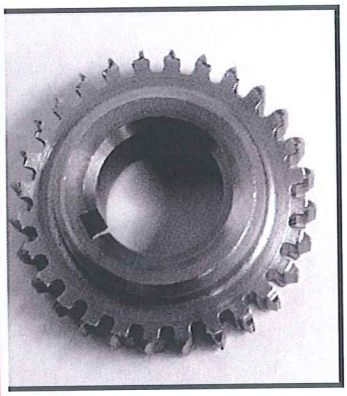


CHAMBER WEAR

A) Foreign debris, similar to sand or sludge, has run through the meter.
B) Meter has been operated at a higher capacity and has worn the bearings out, allowing rotors to drop into the chamber.

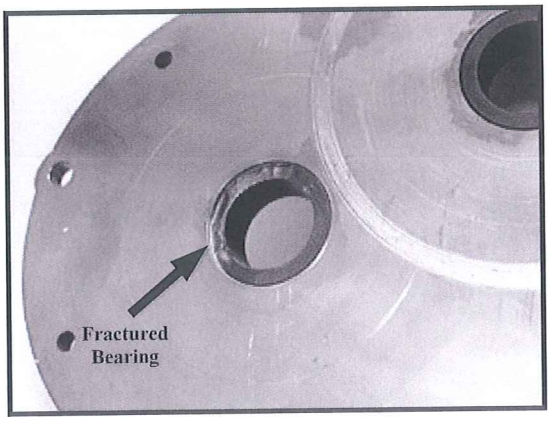


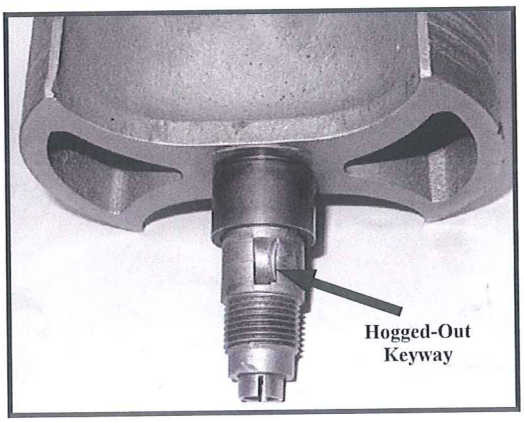
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GEAR WEAR

A) Meter has been run on air.
B) Meter has been operated at a higher volume capacity than what is rated.





HYDRAULIC SHOCK

A) A valve downstream of the flow meter has abruptly shut off, creating hydraulic shock.
B) Flow meter potentially had large volume of free air flowing within the system, followed by fluid.

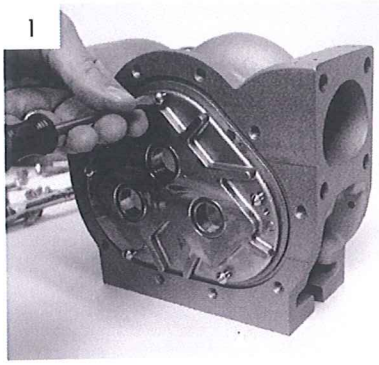
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Reassembly of Meter

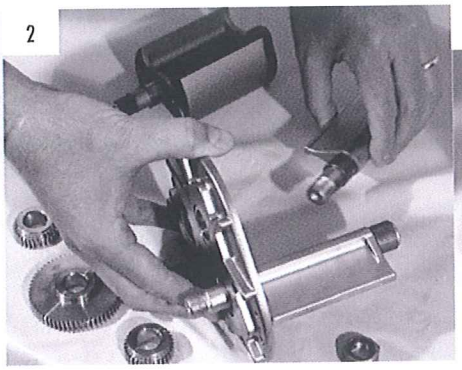
Reinstalling Rotors

1) Install rear bearing plate on meter.
2) Insert threaded end of blocking rotor and the right displacement rotor into front gear plate (reinsert rotor keys if necessary).
3) Align the two rotors (see picture 3) before applying gears.

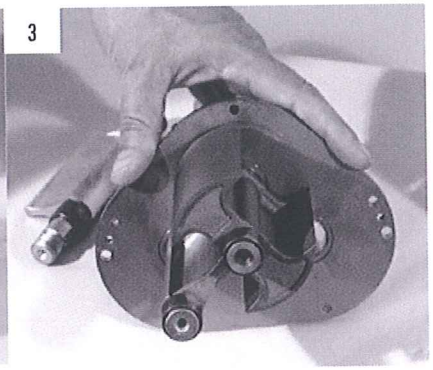
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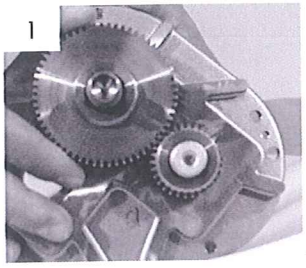
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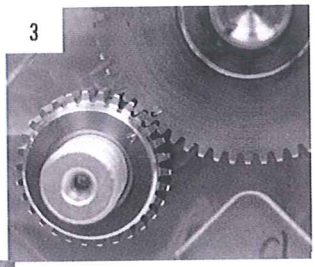
Rotor Gear Timing

1) Slide on blocking rotor gear and position the 'arrow' that it is pointing toward the right displacement gear.
2) Align 'arrow' on displacement gear with the 'arrow' on the blocking gear and slide on right displacement gear.
3) Rotate the blocking rotor gear toward the left displacement gear and again align 'arrows' and slide on left displacement gear.
4) Gears and rotors should rotate freely if gears have been installed properly. If so, proceed with starting on the lock nuts until finger tight.

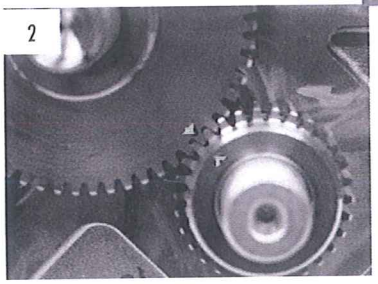
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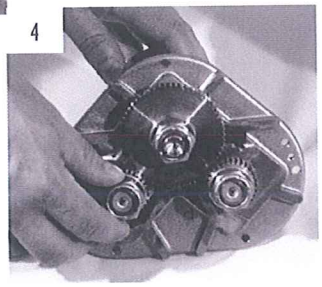
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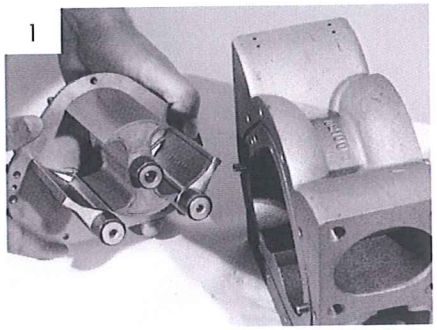


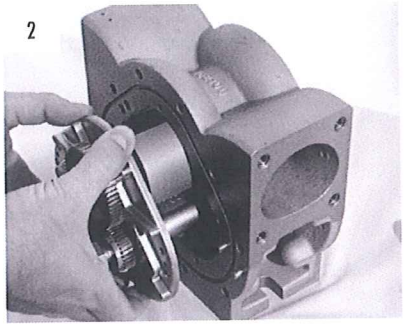
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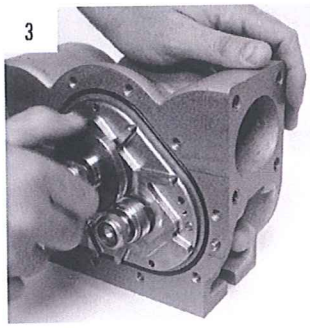
Reassembly of Meter

Reinstalling Bearing Plate

1) Align rotors on bearing plate (see picture) before inserting into meter.
2) Slide front bearing plate with rotors into meter housing and rear bearing plate.
3) Again, rotate gears to make sure they turn freely within the housing before proceeding.

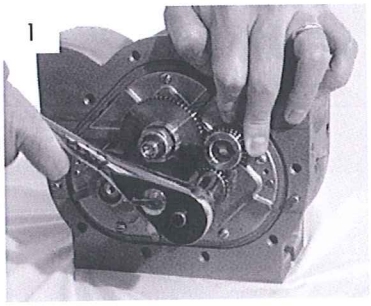


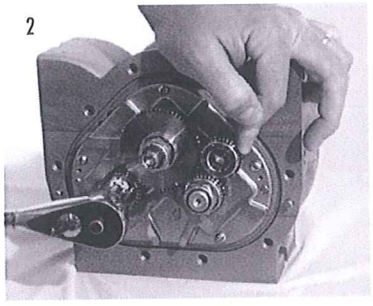


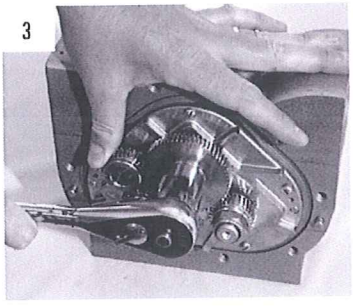


Reinstalling Rotor Gears & Lock Nuts

1) Using the spare displacement gear (or shop rag), position between right displacement gear and blocking rotor gear.
2) Using the torque specifications, apply and tighten the lock nut on the right and left displacement gears.
3) Move the spare gear between the left displacement and blocking rotor gears and then tighten the lock nut on the blocking rotor gear.





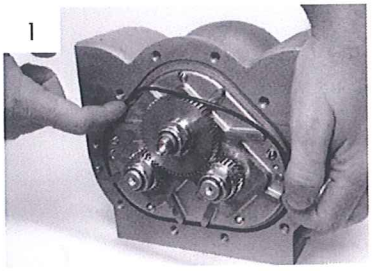


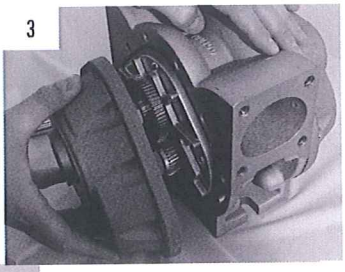
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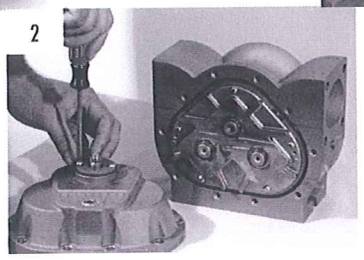
Reassembly of Meter

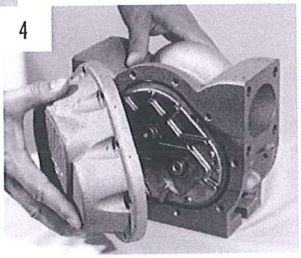
Reinstalling Packing Capsule & Front/Rear Covers

1) Reinstall cover O-rings on the front and rear of meter housing.
2) Reinsert packing capsule into front cover of meter with retaining plate and tighten screws.
3) When attaching front cover, align packing capsule blade so that it seats itself properly in blocking rotor shaft blade. Tighten all front cover screws.
4) Attach rear cover and tighten all screws.



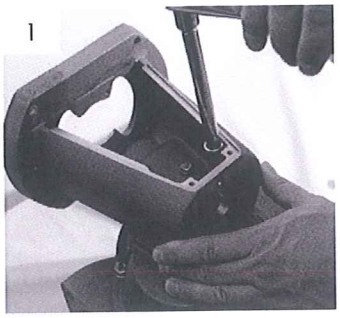


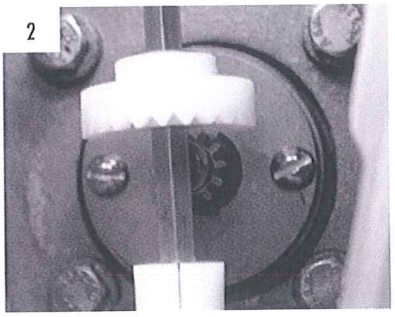


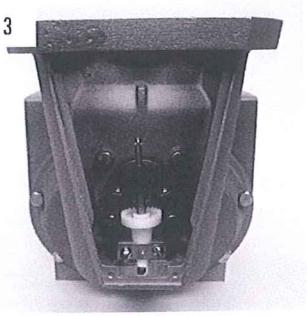


Reinstalling Counter Support & Adjustor Drive Shaft

1) Position the counter support on the front side of meter and tighten all screws.
2) Reinsert adjustor drive shaft into the support housing and assure that adjustor face gear teeth meshes with the packing capsule gear.
3) Slide down the adjustor mounting bracket and tighten the screws.



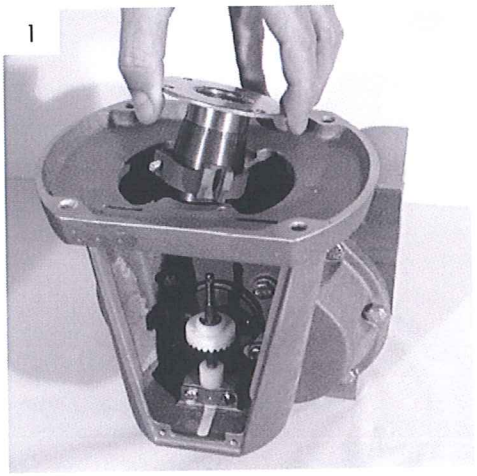


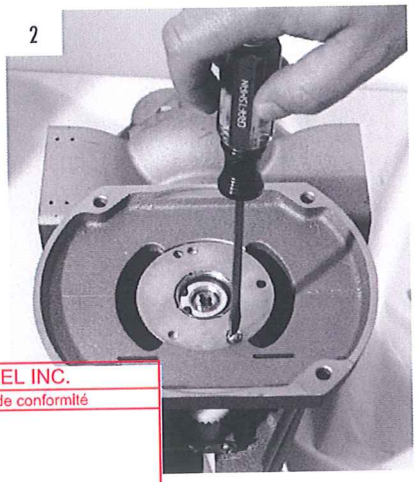


Reassembly of Meter (Continued)

Reinstalling Adjustor

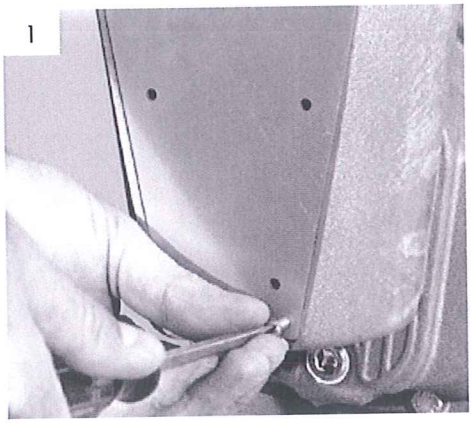
1) Reinsert the adjustor into the top of the counter support and assuring that it mates with the drive shaft.
2) Tighten the screws that secure the adjustor plate to the counter support.

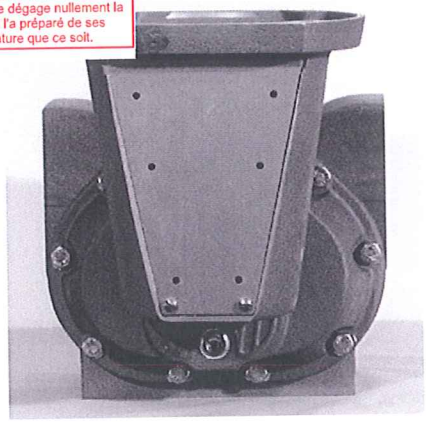




Reinstalling Dust Cover

1) Reattach dust cover and tighten the screws.
2) Back where we started.





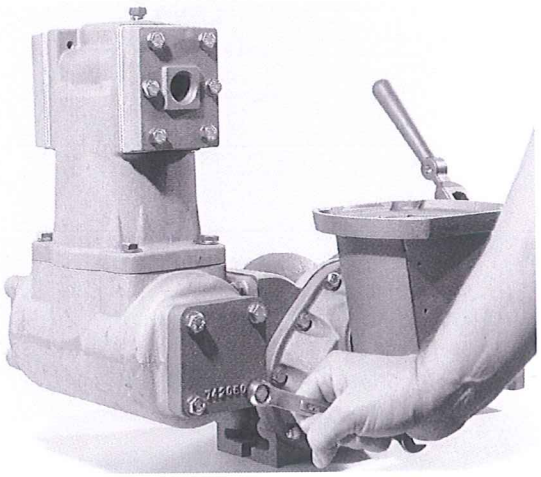
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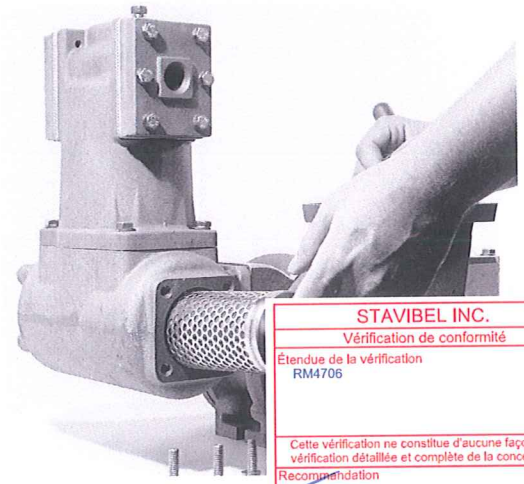
Disassembly of 720 Strainer Assembly

¡WARNING!

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1) Using a hex or socket wrench, remove the four screws and washers from the cover plate.
2) Remove the cover plate and o-ring from the housing.
3) Remove the strainer screen.
4) Check inside housing for any debris and remove using a clean cloth.
5) Clean strainer screen by rinsing with a liquid cleaning agent compatible to your product application. A brush may be used to remove imbedded particles. If screen is too dirty to clean, then replace the screen.
1) Wipe clean the face of the cover plate and seal ring. Check o-rings for damage and replace as needed.





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Reassembly of 720 Strainer Assembly

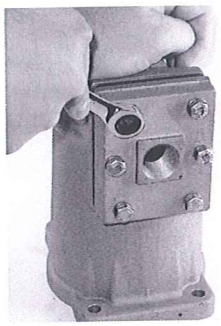
1) Replace the strainer screen into the housing.
2) Place the end cover o-ring in the groove of the end cover.
3) Put the end cover with o-ring installed on the strainer housing.
Replace and fasten end cover with the 4 screws and washers. Tighten the screws according to the torque chart.

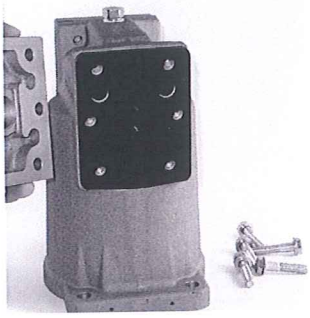
Disassembly of 730 Air Eliminator Assembly

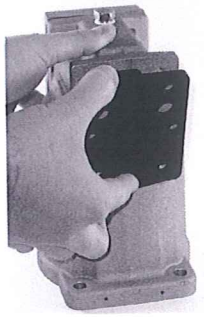
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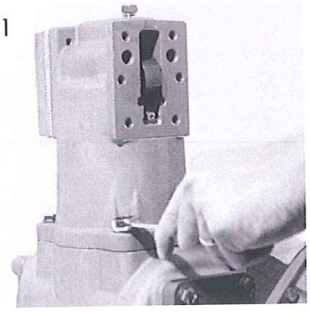
1) Using a 1/2" wrench or socket, remove the cover screws from air eliminator cover plate.
2) Remove cover plate.
3) Remove valve plate, inspect and replace as needed.

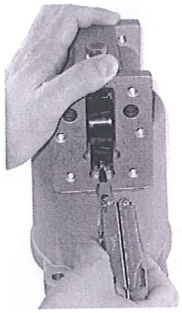
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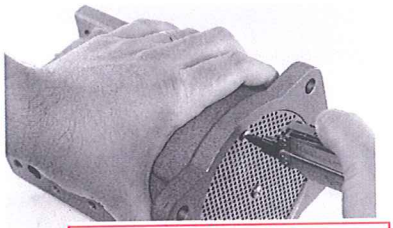
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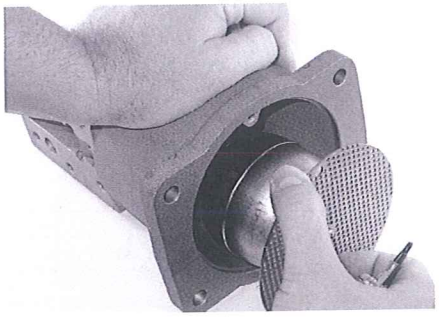
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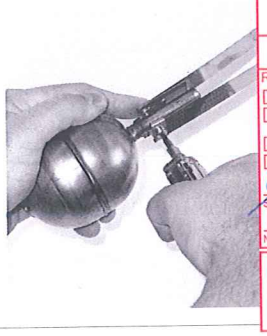
1) To remove the air eliminator assembly, remove the four screws and washers attaching it to the strainer assembly.
2) Using a flathead screwdriver, remove the screws attaching reed valves to air eliminator housing.
3) Remove the two screws on the diffuser screen.
4) Slide out diffuser shaft assembly.
5) Remove the two screws attaching reed valve to the float assembly. Inspect and replace reed valves as needed.

1 

2 

3 

4 

5 

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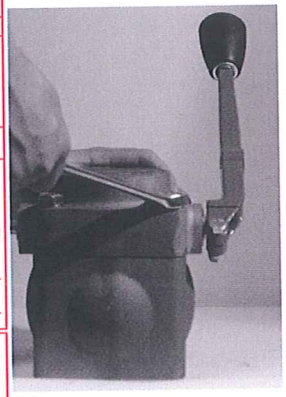
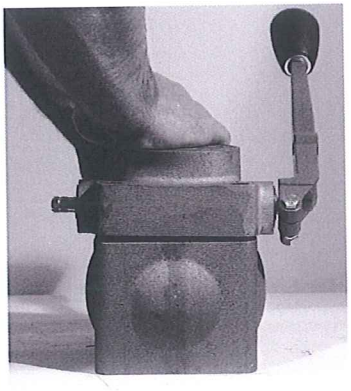
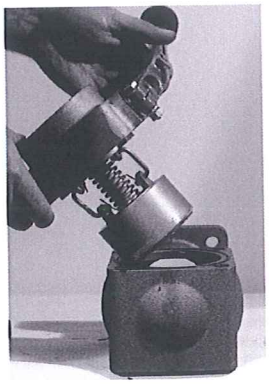
Disassembly of 750-40 Hydraulic Valve

¡WARNING!

All internal pressure must be relieved to ZERO (0) pressure before beginning disassembly of meter or components

1) Drain all fluid from metering system prior to valve removal.
2) Using a hex or socket wrench, remove the four screws connecting the valve to the meter.
3) Remove valve from meter and piping.
4) Place valve on flat surface with valve outlet facing downward.
5) Slowly loosen the four screws located on the valve cap. You should feel force from the compression spring on the valve cap.
6) Completely remove three bolts on the valve cap first. While holding the valve cap down, then remove the remaining bolt until you feel no more force from the compression spring.
7) The components are in the cap and will come out of the valve housing.

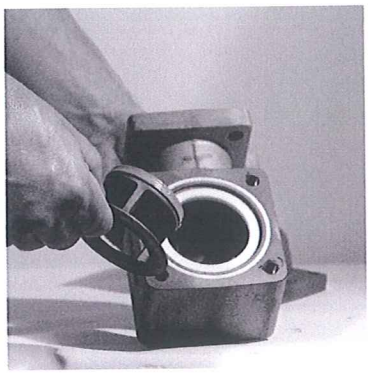
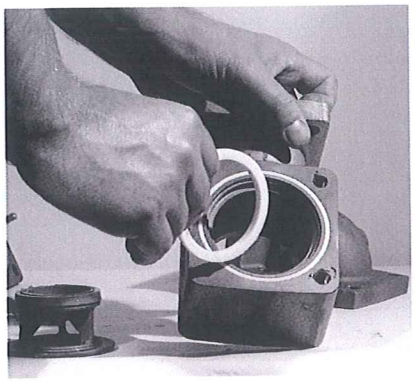
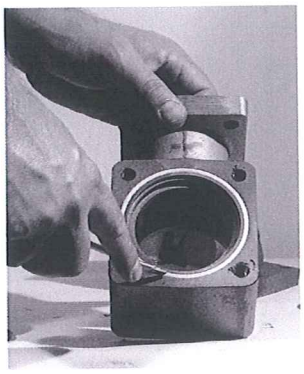
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8) To remove the cap assembly, remove the four cotter pins (this is only needed when replacing spring or cup).
9) To replace the flat washer, remove the retaining ring on end of guide shaft.
10) Turn outlet of valve so that is facing upward.
11) Remove the two screws that hold the guide and seal.
12) Remove the retaining ring from one side of the valve shaft.
13) Remove shaft seal, bearing, o-ring, inner bearing and inner o-ring.
14) Inspect and replace parts as needed.
15) Press down on the valve housing so that the valve piston is forced in and pushing the valve shaft handle away from valve housing.
16) While keeping pressure on the valve, remove the swivel pin.
17) Slowly release the valve until spring exerts no pressure. As the valve housing is lifted, the piston and spring should slide out of valve housing.
18) Inspect piston and seals, clean and replace as needed.

Disassembly of 750-40 Hydraulic Valve

1). Remove the piston guide from the valve body.
2). Remove and inspect the upper and lower seals and replace as needed.
3). Using a flathead screwdriver, gently remove the valve body o-ring, inspect and replace if needed.

Reassembly of 750-40 Hydraulic Valve

1). Place the seal into valve housing.
2). Place guide into valve outlet.
3). Secure seal and guide with the two screws.
4). Turn outlet of valve in downward position.
5). Place the flat washer, spring and washer on the valve shaft and secure by placing nut on the end of the valve shaft.
6). Place the compression spring into the valve housing.
7). Insert the valve shaft and piston assembly into valve housing.
8). Place the assembly on a flat surface with piston facing downward.
9). Press down on the valve housing, compressing the spring.
10). While keeping pressure on the valve assembly, insert link connector through the valve shaft opening and the valve handle opening.

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Meter Trouble Shooting



PROBLEM: Leaking packing gland and/or housing

Two common causes of packing gland leakage are thermal expansion and hydraulic shock. If two valves in a piping system (on either side of the meter) are closed at one time, and if the temperature rises as little as 1°F in the system, it could result in a rise in pressure within the system that would exceed the working pressure rating of the meter. To avoid this hazard caused by thermal expansion, a pressure-relief valve of some kind must be installed in the system.

Hydraulic shock occurs when a large volume (mass) of liquid is moving through a pipe line at some flow rate and a valve is suddenly closed. When the flow is so stopped, the entire mass of the liquid in the piping system acts as a battering ram, causing a shock effect within the meter. The greater the mass, length of line and/or velocity, the greater the hydraulic shock. Since the valve is usually located at the meter outlet, the meter housing, packing gland and the meter internal members receive the full impact of such hydraulic shock. To prevent this hazard a slow closing two-stage valve should be used with the meter. On those systems where mass, length of line, etc. are of such magnitude as to preclude the elimination of hydraulic shock with the use of a two-stage slow closing valve an impact-absorbing air cushioning device should be used.

O-Ring has been damaged or cover bolts have not been tightened enough.

PROBLEM: Product flows through meter but register does not operate.

A) Gear train motion interrupted by non-functioning gear due to broken pin or key. Replace pin or key where required.
B) If all meter parts are moving then problem is in register.
C) Remove register from meter. If all meter parts are moving but output shaft of adjuster assembly is not, adjuster is worn and must be replaced.
D) If totalizer numerals (small numbers) on register are recording, but the big numerals are not moving, register needs repair.

PROBLEM: Product flows through meter but register does not record correctly.

A) Adjuster assembly not properly calibrated, See METER CALIBRATION on page 13 for more instructions.
B) The factory installed gear train may have incorrect gearing ratio.
C) Check register for defects.

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PROBLEM: No flow through meter.

A) Faulty non-functioning pump.
B) Foreign matter within the system, meter or components.
C) Meter has a broken rotor or rotor shaft.
D) Excessive wear on timing gears or bearings.
E) Meter "frozen" due to build-up of chemical "salts" inside metering chamber, sufficient to stop rotation of rotors.
F) Valve not open or not functioning.

PROBLEM: Meter runs too slow.

A) There is a flow restriction within the system. (i.e.: tees, elbows, valves, etc.)
B) Foreign matter in system, meter or components.
C) Product viscosity is different or has changed from what was originally known.
D) Meter gears or rotors partially "salted" enough to slow up rotation of parts.
E) Valve internal mechanism faulty. Valve does not open fully or the linkage is not properly adjusted.

Air Eliminator Trouble Shooting



PROBLEM: Product is flowing from the Air Eliminators vents

A) Foreign matter located in between seal plate orings and metal reeds.
B) The seal plate oring may be worn through service life.
C) The seal plate oring may be cut or dislodged and requires replacement.
D) The float may have been punctured, containing liquid, not allowing the float to rise and seal the air vents.
E) The float may have been ruptured from a surge of pressure within the system.
F) The metal reeds may be fatigued and requires replacement.
G) The metal reeds may be out of alignment with the seal plate.

PROBLEM: The meter is still registering air within the system

There can be numerous reasons why the meter may still register air. First look at the system configuration and see where air is being introduced into the system. Then determine if the meter is registering "free air" or "entrained air". Free Air is much easier to remove from the metering system and may require the use of the Spring Loaded Back Check Valve and/or the Differential Air Check Valve and/or High Volume Strainer to help the air eliminator operate more effectively. Entrained Air is much more difficult to remove. Typically the best way to eliminate Entrained Air will be to remove the air source of entry into the system. Some examples are from cavitating pumps and leaking pump/valve seals. A High Volume Strainer may be help accumulate the liquid long enough to disperse the Entrained Air from the system. See Air Elimination in the Service Manual for more information.

A) The air return line is not the required minimum of 1/2" ID.
B) The metering system has no sufficient way of eliminating the air to atmosphere. Example: Incorrectly installed "Catch Can" reservoir (lower than the air eliminator itself), or the reservoir is allowed to become full, incorrectly sized vent, etc…)

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Preset Valve Trouble Shooting



PROBLEM: The valve will not close completely.

A) The shaft of the piston may be bent from excessive force.
B) Debris may be between the piston and piston guide.
C) The upper or lower seals may be worn, swollen from incompatibility or cut from debris.
D) The mechanical linkage to the Veeder Root 7889 preset counter may be tight. The linkage must be loose for the preset to operate correctly.
E) The Veeder Root preset may have a worn or bent trip mechanism that is not allowing the preset to function.

PROBLEM: The valve shuts immediately upon first stage trip, bypassing the second stage closure.

A) The mechanical linkage might need to be adjusted, moving the Nylon locking nuts forward or backwards to change the closing of the preset valve.
B) The Veeder Root preset may need to be "raked" or adjusted for the correct shut-off volume. See Veeder Root 7889 preset service manual for further instructions.
C) The Veeder Root preset may have a worn or bent trip mechanism that is not allowing the preset to function.

PROBLEM: The preset batch over or under registers correct volume.

A) The mechanical linkage might need to be adjusted, moving the Nylon locking nuts forward or backwards to change the closing of the preset valve.
B) The Veeder Root preset may need to be "raked" or adjusted for the correct shut-off volume. See Veeder Root 7889 preset service manual for further instructions.
C) The Veeder Root preset may have a worn or bent trip mechanism that is not allowing the preset to function.

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Material Safety Data Sheet (MSDS)

24 HOUR EMERGENCY ASSISTANCE
(260) 833-3173

GENERAL MSDS ASSISTANCE
(260) 484-0301

CODE: RPS

HAZARD RATING> LEAST-0 SLIGHT-1 MODERATE-2 HIGH-3 EXTREME-4

DR LUBRICANTS, INC.
4611 NEWAYGO ROAD, SUITE D
FORT WAYNE, IN 46808

DATE: 01/21/06

TELEPHONE NUMBER: (260 484-0301

SECTION I - PRODUCT IDENTIFICATION

PRODUCT: **RP 1039**

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SECTION II - COMPOSITION AND HAZARDOUS INFORMATION*

CHEMICAL NAME	CAS NUMBER	WT. PERCENT IS LESS THAN	OCCUPATIONAL EXPOSURE LIMITS (TLV-TWA) (TLV-STEL
PETROLEUM HYDROCARBON	64741-65-7	90.0	100MG/M3
PETROLEUM HYDROCARBON	64742-53-6	10.0	5MG/M3

*ITEMS NOT SHOWN ARE NOT LISTED IN THE OSHA - T.S.C.A. HAZARDOUS CHEMICALS LISTING.

SECTION III - PHYSICAL DATA

BOILING RANGE:	NA	VAPOR DENSITY:	NA
ODOR:	PETROLEUM ODOR	EVAPORATION RATE:	NA
APPEARANCE	AMBER LIQUID	SOLUBILITY:	INSOLUBLE
VOLATILE BY WEIGHT:	NA	PRODUCT DENSITY:	0.790
VOLATILE BY VOLUME:	NA		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY CLASSIFICATION: COMBUSTIBLE

FLASH POINT: 150 F (CLEVELAND OPEN CUP)

LEL: NA
UEL: NA

DOT: COMBUSTIBLE LIQUID

EXTINGUISHING MEDIA: CARBON DIOXIDE, DRY CHEMICAL, FOAM

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Material Safety Data Sheet (Continued)

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

UNUSUAL FIRE AND EXPLOSION HAZARDS : DO NOT DIRECT A SOLID STREAM OF WATER ONTO BURNING PRODUCT. THIS MAY CAUSE SPREADING AND INCREASE THE FIRES INTENSITY. COMBUSTION MAY PRODUCE: OXIDES OF CARBON, AND INCOMPLETELY BURNED HYDROCARBONS IN THE FORM OF FUMES AND SMOKE.

SPECIAL FIREFIGHTING PROCEDURES: WEAR A SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE.

SECTION V - HEALTH HAZARD DATA

EFFECTS OF OVER EXPOSURE: MAY CAUSE MILD EYE IRRITATION AND REDNESS. PROLONGED OR REPEATED EXPOSURE TO THE SKIN MAY RESULT IN LOSS OF NATURAL OILS ACCOMPANIED BY DRYNESS, CRACKING AND DERMATITIS. INGESTION MAY RESULT IN NAUSEA, DIARRHEA AND GASTRO INTESTINAL IRRITATION. OVEREXPOSURE TO MIST MAY CAUSE UPPER RESPIRATORY TRACT IRRITATION AND DIFFICULTY BREATHING.

MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: NONE KNOWN.

PRIMARY ROUTE(S) OF ENTRY: DERMAL INHALATION INGESTION.

EMERGENCY AND FIRST AID PROCEDURES: IN CASE OF EYE CONTACT, IMMEDIATELY FLUSH EYES WITH CLEAN WATER FOR AT LEAST 15 MINUTES. IF EYE IRRITATION PERSISTS, CONTACT A PHYSICIAN. IN CASE OF SKIN CONTACT, REMOVE ANY CONTAMINATED CLOTHING AND RINSE SKIN THOROUGHLY WITH WATER FOR AT LEAST 15 MINUTES. IF SKIN IRRITATION PERSISTS, CONTACT A PHYSICIAN. IN CASE OF OVEREXPOSURE TO MIST, REMOVE VICTIM TO FRESH AIR: IF BREATHING IS DIFFICULT ADMINISTER OXYGEN: AND CONTACT A PHYSICIAN IMMEDIATELY. IF PRODUCT IS INGESTED DO NOT INDUCE VOMITING: CONTACT A PHYSICIAN.

SECTION VI - REACTIVITY DATA

STABILITY: THIS PRODUCT IS STABLE UNDER NORMAL STORAGE CONDITIONS.

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR UNDER NORMAL CONDITIONS.

HAZARDOUS DECOMPOSITION PRODUCTS: THERMAL DECOMPOSITION MAY RESULT IN THE FORMATION OF: OXIDES OF CARBON, AND INCOMPLETELY BURNED HYDROCARBONS IN THE FORM OF FUMES AND SMOKE.

CONDITIONS TO AVOID: AVOID CONTACT WITH OPEN FLAME, STORE IN ROOM TEMPERATURE AREA.

STAVIBEL INC.
Vérification de conformité
Étendue de la vérification
RM4706
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Recommandation
☑ Accepté
☐ Accepté tel que noté (doit être validé par un ingénieur si le concept est modifié)
☐ Corriger et soumettre à nouveau avant les travaux
☐ Refusé
2013-10-30
Signature ☒ Ingénieur ☐ Autre
Date
Jonathan Faucher
131007
Nom
N° de membre de l'OIQ
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Material Safety Data Sheet (Continued)

INCOMPATIBILITY: AVOID CONTACT WITH STRONG OXIDIZING AND REDUCING AGENTS AND STRONG ALKLI.

==========

SECTION VII - SPILL OR LEAK PROCEDURES

==========

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: FOR SMALL SPILLS: SOAK UP SPILL WITH ABSORBENT MATERIAL. FOR LARGE SPILLS: DIKE SPILL AND PUMP INTO DRUMS FOR PROPER DISPOSAL.

WASTE DISPOSAL METHOD: DISPOSE OF IN ACCORDANCE WITH ALL LOCAL STATE AND FEDERAL REGULATIONS.

==========

SECTION VIII - SAFE HANDLING AND USE INFORMATION

==========

RESPIRATORY PROTECTION: NORMALLY NOT REQUIRED, HOWEVER, WHEN THE TLV IS EXCEEDED WEAR THE APPROPRICATE MSHA/NIOSH APPROVED RESPIRATOR.

VENTILATION: PROVIDE ADEQUATE VENTILATION (SUCH AS MECHANICAL OR LOCAL) TO ASSURE TLV IS NOT EXCEEDED.

PROTECTIVE GLOVES: NORMALLY NOT REQUIRED, HOWEVER, IF HANDS ARE FREQUENTLY IN FLUID WEAR OIL AND CHEMICAL IMPERVIOUS GLOVES.

EYE PROTECTION: SAFETY GLASSES REQUIRED FOR NORMAL USAGE, WEAR CHEMICAL GOGGLES WHEN EXCESSIVE SPLASHING MAY OCCUR.

OTHER PROTECTIVE EQUIPMENT: NORMALLY NOT REQUIRED, HOWEVER, WHERE REPEATED CONTACT OCCURS, WEAR IMPERVIOUS CLOTHING AND BOOTS.

HYGIENIC PRACTICES: FOLLOW STANDARD INDUSTRIAL HYGIENE PRACTICES. LAUNDER ANY CONTAMINATED CLOTHING BEFORE RE-USE.

==========

SECTION IX - SPECIAL PRECAUTIONS

==========

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: DO NOT STORE IN THE PRESENCE OF HEAT, SPARKS, FLAME OR ANY OTHER SOURCES OF IGNITION. STORE AWAY FROM STRONG OXIDIZING AGENTS. EMPTY DRUMS MAY CONTAIN PRODUCT RESIDUES. ALL SAFETY PRECAUTIONS TAKEN WHEN HANDLING THIS PRODUCT SHOULD ALSO BE TAKEN WHEN HANDLING EMPTY DRUMS AND CONTAINERS.

OTHER PRECAUTIONS: NONE

Material Safety Data Sheet (Continued)

SECTION X - HMIS/NFPA RATINGS

HMIS:HEALTH:1 FLAMMABILITY:2 REACTIVITY:0 PERSONAL PROTECTION:C
NFPA:HEALTH:1 FLAMMABILITY:2 REACTIVITY:0 SPECIFIC HAZARD:

SECTION XI - OTHER REGULATORY INFORMATION

DOT HAZARDOUS: NATURAL DESCRIPTION:

THE INFORMATION CONTAINED HEREIN IS, TO THE BEST OF OUR KNOWLEDGE AND BELIEF, ACCURATE. HOWEVER, SINCE THE CONDITIONS OF HANDLING AND USE ARE BEYOND OUR CONTROL, WE MAKE NO GUARANTEE OF RESULTS, AND ASSUME NO LIABILITY FOR DAMAGES INCURRED BY USE OF THIS MATERIAL. IT IS THE RESPONSIBILITY OF THE USER TO COMPLY WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL LAWS AND REGULATIONS.

STAVIBEL INC.
Vérification de conformité

Étendue de la vérification
RM4706

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☐ Corriger et soumettre à nouveau avant les travaux
☐ Refusé

Signature ☒ Ingénieur ☐ Autre — Date: 2013-10-30
Nom: Jonathan Faucher — N° de membre de l'OIQ: 131007

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Warranty Information

Warranty

New 700 rotary meters, equipment or components manufactured by Total Control Systems, a division of Murray Equipment, Inc. (TCS) with which this warranty is enclosed, are warranted by TCS to the original purchaser only for a period of TWELVE (12) months from installation or EIGHTEEN (18) months from the date of shipment, to be free, under normal use and service, from defects in material and workmanship. Defects occurring within the stated warranty period, TCS will repair or replace, at TCS's option; provided that part or parts are returned to TCS transportation changes prepaid, and TCS's examination discloses the parts or workmanship to have been defective upon delivery to the purchaser.

Exclusions

This warranty does not cover any parts or equipment not manufactured by TCS or related companies. This warranty does not extend to any equipment that has been altered in any way, subjected to misuse, negligence, accident, or if operated in any manner other than in accordance with TCS's operating instructions or have been operated under conditions more severe than, or otherwise exceeding those set forth in the specifications. General maintenance, calibration, clean up and normal wear is excluded from this limited warranty.

Claim Procedures

In order to obtain performance by TCS of its obligations under this warranty, the original purchaser must obtain a Return Goods Authorization (RGA) number from TCS's customer service department within 30 days of discovery of a purported breach of warranty, but not later than the expiration of the warranty period. Once authorization is received, return the defective meter, piece of equipment, or component covered by this warranty, with transportation charges prepaid, to TCS at the address shown below together with a written statement setting forth the nature of the defect and RGA number.

Repair Warranty

All repair work is warranted for ninety (90) days from the date of shipment to customer. Some parts may be warranted for longer periods by the Original Equipment Manufacturer.

Design and Equipment Changes

Any changes in design or improvements added shall not create any obligation to install same on equipment previously sold or ordered.

Limitations

THERE ARE NO OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED. TCS SPECIFICALLY DISCLAIMS ANY WARRANTY OR MERCHANTABILITY OR OF FITNESS FOR ANY PARTICULAR PURPOSE. TCS's sole obligation, which shall represent the buyer's sole and exclusive remedy, shall be to repair or at TCS's option, to replace any product or part determined to be defective. In no event shall TCS be liable for any special, direct, indirect, incidental, consequential or other damages of similar nature incurred by the buyer or any third party. TCS has not authorized on its behalf any representations or warranties to be made, nor any liability to be assumed except as expressly provided herein; there is no other express or implied warranty.

TOTAL CONTROL SYSTEMS

"The Standard of Measurement"

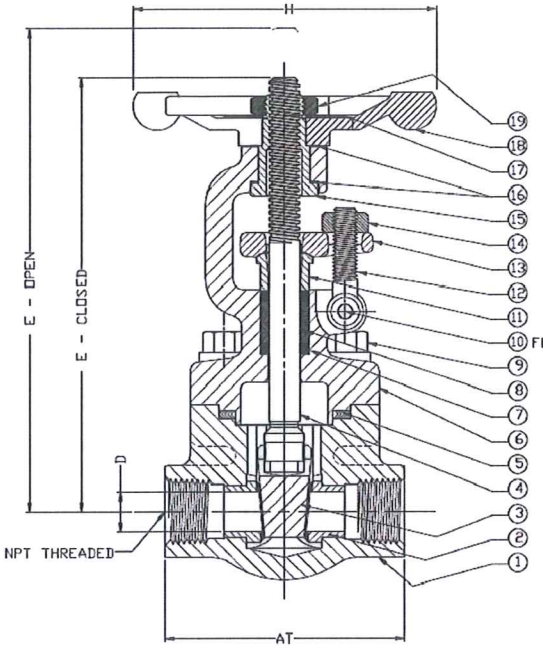
2515 Charleston Place
Fort Wayne, IN 46808

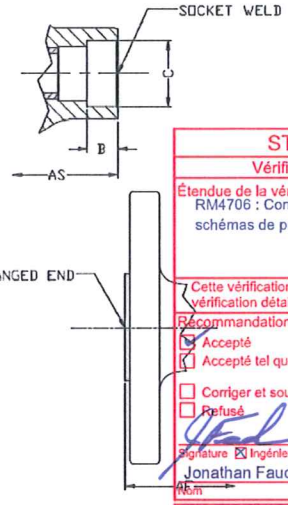
Toll Free: (800) 348-4753
Phone: (260) 484-0382
Fax: (260) 484-9230
Email: sales@tcsmeters.com

Gate Valve

Standard Port, Bolted Bonnet
Forged Steel

501 SERIES





STAVIBEL INC.
Vérification de conformité
Étendue de la vérification
RM4706 : Conformité aux normes et aux schémas de procédé.
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2013-11-26
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131007
Nom
N° de membre de l'OIQ
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STANDARDS

DESIGN:
API 602
ASME B16.34

TESTING:
API 598

PRESSURE CLASS:
NPT & SW – 800
FLANGED – 150,300,600

CONNECTIONS:
NPT – ASME B1.20.1
SW - ASME B16.11
FLANGED – ASME B16.5
ASME B16.10

MATERIAL LIST								
NO.	Part Name	A105	LF2	F5	F9	F11	F22	F316/F316L
1	Body	A105N	A350-LF2	A182-F5	A182-F9	A182-F11	A182-F22	A182-F316/F316L
2	Seat Ring	A276-410/CoCr-A						A276-316/CoCr-A
3	Gate	A276-410						A276-316
4	Stem	A276-410						A276-316
5	Gasket	Spiral Wound 304/Graphite						316/Graphite
6	Bonnet	A105N	A350-LF2	A182-F5	A182-F9	A182-F11	A182-F22	A182-F316/F316L
7	Wiper Ring	Braided Graphite						
8	Packing	Die Formed Graphite						
9	Body Bolt	A193-B7	A193-B8M	A193-B16				A193-B8M
10	Eyebolt Pin	A276-410						A276-316
11	Gland	A276-410						A276-316
12	Eyebolt	A193-B7	A193-B8M	A193-B16				A193-B8M
13	Gland Plate	A105						A182-F316
14	Gland Nut	A194-2H	A194-8M					
15	Op Nut	A276-410						A276-316
16	Washer	A276-410						
17	Nameplate	Aluminum						
18	Handwheel	KTH330-08						
19	Handwheel Nut	LY12 Steel						

DIMENSIONS AND WEIGHTS													WGT.			
SIZE			AT	AS	AF-150	AF-300	AF-600	B	C	D (Min)	EO	EC	H	150	300	600	800
1/2	Inch		3.11	3.11	4.25	5.50	6.50	0.37	0.87	0.39	6.30	5.83	3.94	7.50	9.31	9.26	4.89
	mm		79.00	79.00	108.00	140.00	165.00	9.50	22.0	10.00	160.00	148.00	100.00	3.40	3.77	4.20	2.22
3/4	Inch		3.62	3.62	4.60	6.00	7.50	0.49	1.07	0.51	6.65	6.02	3.94	8.77	10.78	12.79	5.27
	mm		92.00	92.00	117.00	152.00	190.00	12.50	27.4	13.60	169.00	153.00	100.00	3.98	4.89	5.80	2.39
1	Inch		4.37	4.37	5.00	6.50	8.50	0.49	1.34	0.71	7.60	6.73	4.92	13.50	15.94	19.40	9.35
	mm		111.00	111.00	127.00	165.00	216.00	12.50	34.1	18.00	193.00	171.00	125.00	6.12	7.23	8.80	4.24
1-1/4	Inch		4.75	4.75	5.50	7.00	9.00	0.49	1.68	0.94	9.06	7.95	6.30	19.93	23.25	29.50	15.54
	mm		120.00	120.00	140.00	178.00	229.00	12.50	42.9	24.00	230.00	202.00	160.00	9.04	10.55	13.38	7.05
1-1/2	Inch		4.75	4.75	6.50	7.50	9.50	0.49	1.92	1.14	9.69	8.31	6.30	22.93	27.87	34.39	15.54
	mm		120.00	120.00	165.00	190.00	241.00	12.50	49.0	29.00	246.00	211.00	160.00	10.40	12.64	15.60	7.05
2	Inch		5.50	5.50	7.00	8.50	11.50	0.63	2.41	1.45	11.14	9.45	7.09	34.17	39.68	43.00	24.03
	mm		140.00	140.00	178.00	216.00	292.00	16.00	61.5	36.80	283.00	240.00	180.00	15.50	18.00	19.50	10.90

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BERIC DAVIS COMPANIES INTERNATIONAL, LTD.

Connecting Business Worldwide!

501-T-3-8-A08

BERIC FORGED STEEL VALVE NUMBERING CHART

Valve Style		End Connection		Size		Class		Material		Trim
501	BB Gate	B(SCH)	Butt Weld	1	¼	1	#150	A	A105N	01
502	BB Globe	F	Flanged	2	3/8	3	#300	B	A 350 LF2	02
503	BB Piston Check	G	Flat Face Flange	3	½	6	#600	C	A 182 F5	03
504	BB Swing Check	H	MNPT X FNPT	4	¾	8	#800	D	A 182 F9	04
505	WB Gate	J	MNPT X FSW	5	1	9	#1500	E	A 182 F11	05
506	WB Globe	K	MSW X FNPT	6	1 ¼	0	#2500	F	A 182 F22	06
507	WB Piston Check	L	MSW X FSW	7	1 ½	A	#900	G	A 182 F304/304L	07
508	WB Swing Check	R	RTJ	8	2			H	A 182 F316/316L	08
509	BB Y-Pattern Globe	S	Socket Weld					J	A 182 F321	09
510	BB Y-Pattern Check	T	NPT					K	A 182 F52	10
511	FP BB Gate	X	TSW					M	A 182 F347	11
512	WB Y-Pattern Globe	Y	RMSW X FNPT							12
513	WB Y-Pattern Check	Z	RMSW X FSW							13
514	FP BB Swing Check									14
515	FP WB Gate									15
522	FP BB Globe									16
524	FP BB Swing Check									
552	WB Y-Pattern Stop/Check									

Options *	
A	316 Stn. Stl. Trim
B	B7M Bolting
C	Chain Operated
D	Cr13 Trim (1/2 HF)
E	17-4 ph Stem
F	Industrial Gas Cleaned
G	Garlock EVSP Packing
H	Hastelloy C Stem
J	RTJ Flanges
K	Live Loaded
L	Lock Bonnet
M	Monel Trim
N	NACE
O	Oxygen Cleaned
P	125rms Flat Faced Flng
R	L7M Bolting
S	B8M Bolting
T	TFE Packing, 316/TFE Gasket
U	316/TFE Gasket Only
V	Vacuum Service (TFE)
W	Bellow Seal
X	Nipple Extensions
Y	Cryogenic Service
Z	Mounting Plate
A2	HF Alkylation Service

* More than one option may be used in combination.

Notes:

1. Not all options are available in combinations. Please consult the factory. Minimum quantities may apply to certain materials or trim configurations.
2. Beric trim number corresponds to the equivalent API 602 trim designation.

Vérification de conformité

Étendue de la vérification
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2013-11-26
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Jonathan Faucher — 131007
Nom — N° de membre de l'OIQ

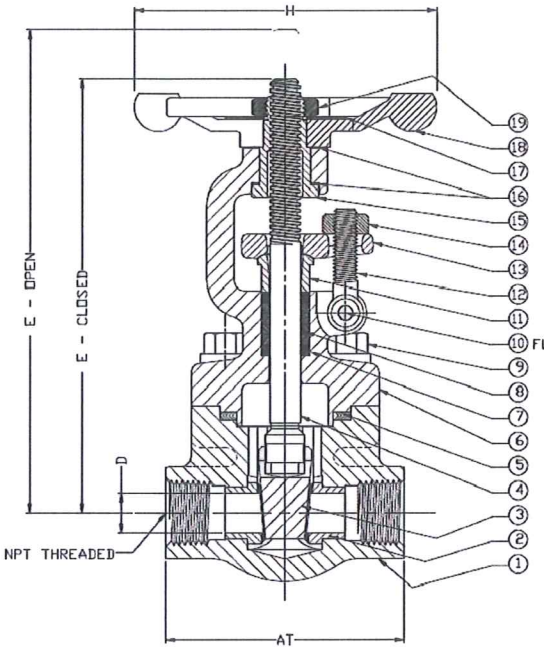
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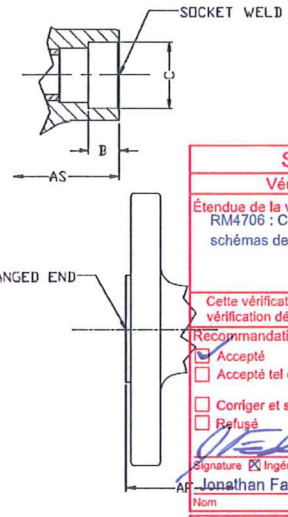
Rev. 102011

Gate Valve

Standard Port, Bolted Bonnet
Forged Steel

501 SERIES





STANDARDS

DESIGN:
API 602
ASME B16.34

TESTING:
API 598

PRESSURE CLASS:
NPT & SW – 800
FLANGED – 150,300,600

CONNECTIONS:
NPT – ASME B1.20.1
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NO.	Part Name	A105	LF2	F5	F9	F11	F22	F316/F316L
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3	Gate	A276-410						A276-316
4	Stem	A276-410						A276-316
5	Gasket	Spiral Wound 304/Graphite						316/Graphite
6	Bonnet	A105N	A350-LF2	A182-F5	A182-F9	A182-F11	A182-F22	A182-F316/F316L
7	Wiper Ring	Braided Graphite						
8	Packing	Die Formed Graphite						
9	Body Bolt	A193-B7	A193-B8M	A193-B16				A193-B8M
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18	Handwheel	KTH330-08						
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DIMENSIONS AND WEIGHTS													WGT.			
SIZE			AT	AS	AF-150	AF-300	AF-600	B	C	D (Min)	EO	EC	H	150	300	600	800
1/2	Inch		3.11	3.11	4.25	5.50	6.50	0.37	0.87	0.39	6.30	5.83	3.94	7.50	9.31	9.26	4.89
	mm		79.00	79.00	108.00	140.00	165.00	9.50	22.0	10.00	160.00	148.00	100.00	3.40	3.77	4.20	2.22
3/4	Inch		3.62	3.62	4.60	6.00	7.50	0.49	1.07	0.51	6.65	6.02	3.94	8.77	10.78	12.79	5.27
	mm		92.00	92.00	117.00	152.00	190.00	12.50	27.4	13.60	169.00	153.00	100.00	3.98	4.89	5.80	2.39
1	Inch		4.37	4.37	5.00	6.50	8.50	0.49	1.34	0.71	7.60	6.73	4.92	13.50	15.94	19.40	9.35
	mm		111.00	111.00	127.00	165.00	216.00	12.50	34.1	18.00	193.00	171.00	125.00	6.12	7.23	8.80	4.24
1-1/4	Inch		4.75	4.75	5.50	7.00	9.00	0.49	1.68	0.94	9.06	7.95	6.30	19.93	23.25	29.50	15.54
	mm		120.00	120.00	140.00	178.00	229.00	12.50	42.9	24.00	230.00	202.00	160.00	9.04	10.55	13.38	7.05
1-1/2	Inch		4.75	4.75	6.50	7.50	9.50	0.49	1.92	1.14	9.69	8.31	6.30	22.93	27.87	34.39	15.54
	mm		120.00	120.00	165.00	190.00	241.00	12.50	49.0	29.00	246.00	211.00	160.00	10.40	12.64	15.60	7.05
2	Inch		5.50	5.50	7.00	8.50	11.50	0.63	2.41	1.45	11.14	9.45	7.09	34.17	39.68	43.00	24.03
	mm		140.00	140.00	178.00	216.00	292.00	16.00	61.5	36.80	283.00	240.00	180.00	15.50	18.00	19.50	10.90

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501-T-4-8-A08

BERIC FORGED STEEL VALVE NUMBERING CHART

	Valve Style
501	BB Gate
502	BB Globe
503	BB Piston Check
504	BB Swing Check
505	WB Gate
506	WB Globe
507	WB Piston Check
508	WB Swing Check
509	BB Y-Pattern Globe
510	BB Y-Pattern Check
511	FP BB Gate
512	WB Y-Pattern Globe
513	WB Y-Pattern Check
514	FP BB Swing Check
515	FP WB Gate
522	FP BB Globe
524	FP BB Swing Check
552	WB Y-Pattern Stop/Check

	End Connection
B(SCH)	Butt Weld
F	Flanged
G	Flat Face Flange
H	MNPT X FNPT
J	MNPT X FSW
K	MSW X FNPT
L	MSW X FSW
R	RTJ
S	Socket Weld
T	NPT
X	TSW
Y	RMSW X FNPT
Z	RMSW X FSW

	Size
1	¼
2	⅜
3	½
4	¾
5	1
6	1 ¼
7	1 ½
8	2

	Class
1	#150
3	#300
6	#600
8	#800
9	#1500
0	#2500
A	#900

	Material
A	A105N
B	A 350 LF2
C	A 182 F5
D	A 182 F9
E	A 182 F11
F	A 182 F22
G	A 182 F304/304L
H	A 182 F316/316L
J	A 182 F321
K	A 182 F52
M	A 182 F347

Trim
01
02
03
04
05
06
07
08
09
10
11
12
13
14
15
16

	Options *
A	316 Stn. Stl. Trim
B	B7M Bolting
C	Chain Operated
D	Cr13 Trim (1/2 HF)
E	17-4 ph Stem
F	Industrial Gas Cleaned
G	Garlock EVSP Packing
H	Hastelloy C Stem
J	RTJ Flanges
K	Live Loaded
L	Lock Bonnet
M	Monel Trim
N	NACE
O	Oxygen Cleaned
P	125rms Flat Faced Flng
R	L7M Bolting
S	B8M Bolting
T	TFE Packing, 316/TFE Gasket
U	316/TFE Gasket Only
V	Vacuum Service (TFE)
W	Bellow Seal
X	Nipple Extensions
Y	Cryogenic Service
Z	Mounting Plate
A2	HF Alkylation Service

* More than one option may be used in combination.

Notes:

1. Not all options are available in combinations. Please consult the factory. Minimum quantities may apply to certain materials or trim configurations.
2. Beric trim number corresponds to the equivalent API 602 trim designation.

STAMPED NOT

Vérification de conformité

Étendue de la vérification

RM4706 : Conformité aux normes et aux schémas de procédé.

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Recommandation

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☐ Corriger et soumettre à nouveau avant les travaux

☐ Refusé

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Signature ☒ Ingénieur ☐ Autre — Date

Jonathan Faucher — 131007

Nom — N° de membre de l'OIQ

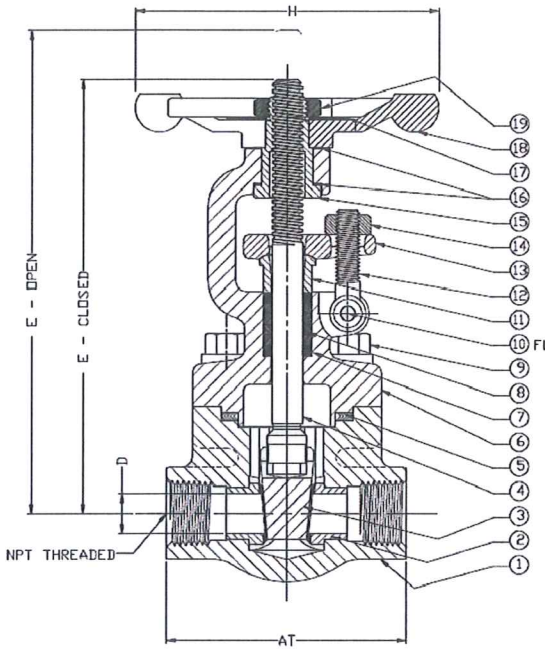
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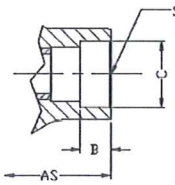
Rev. 102011

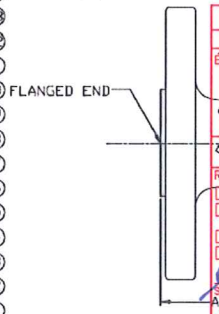
Gate Valve

Standard Port, Bolted Bonnet
Forged Steel

501 SERIES







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STANDARDS

DESIGN:
API 602
ASME B16.34

TESTING:
API 598

PRESSURE CLASS:
NPT & SW – 800
FLANGED – 150,300,600

CONNECTIONS:
NPT – ASME B1.20.1
SW - ASME B16.11
FLANGED – ASME B16.5
ASME B16.10

MATERIAL LIST								
NO.	Part Name	A105	LF2	F5	F9	F11	F22	F316/F316L
1	Body	A105N	A350-LF2	A182-F5	A182-F9	A182-F11	A182-F22	A182-F316/F316L
2	Seat Ring	A276-410/CoCr-A						A276-316/CoCr-A
3	Gate	A276-410						A276-316
4	Stem	A276-410						A276-316
5	Gasket	Spiral Wound 304/Graphite						316/Graphite
6	Bonnet	A105N	A350-LF2	A182-F5	A182-F9	A182-F11	A182-F22	A182-F316/F316L
7	Wiper Ring	Braided Graphite						
8	Packing	Die Formed Graphite						
9	Body Bolt	A193-B7	A193-B8M	A193-B16				A193-B8M
10	Eyebolt Pin	A276-410						A276-316
11	Gland	A276-410						A276-316
12	Eyebolt	A193-B7	A193-B8M	A193-B16				A193-B8M
13	Gland Plate	A105						A182-F316
14	Gland Nut	A194-2H	A194-8M					
15	Op Nut	A276-410						A276-316
16	Washer	A276-410						
17	Nameplate	Aluminum						
18	Handwheel	KTH330-08						
19	Handwheel Nut	LY12 Steel						

DIMENSIONS AND WEIGHTS													WGT.			
SIZE			AT	AS	AF-150	AF-300	AF-600	B	C	D (Min)	EO	EC	H	150	300	600	800
1/2	Inch		3.11	3.11	4.25	5.50	6.50	0.37	0.87	0.39	6.30	5.83	3.94	7.50	9.31	9.26	4.89
	mm		79.00	79.00	108.00	140.00	165.00	9.50	22.0	10.00	160.00	148.00	100.00	3.40	3.77	4.20	2.22
3/4	Inch		3.62	3.62	4.60	6.00	7.50	0.49	1.07	0.51	6.65	6.02	3.94	8.77	10.78	12.79	5.27
	mm		92.00	92.00	117.00	152.00	190.00	12.50	27.4	13.60	169.00	153.00	100.00	3.98	4.89	5.80	2.39
1	Inch		4.37	4.37	5.00	6.50	8.50	0.49	1.34	0.71	7.60	6.73	4.92	13.50	15.94	19.40	9.35
	mm		111.00	111.00	127.00	165.00	216.00	12.50	34.1	18.00	193.00	171.00	125.00	6.12	7.23	8.80	4.24
1-1/4	Inch		4.75	4.75	5.50	7.00	9.00	0.49	1.68	0.94	9.06	7.95	6.30	19.93	23.25	29.50	15.54
	mm		120.00	120.00	140.00	178.00	229.00	12.50	42.9	24.00	230.00	202.00	160.00	9.04	10.55	13.38	7.05
1-1/2	Inch		4.75	4.75	6.50	7.50	9.50	0.49	1.92	1.14	9.69	8.31	6.30	22.93	27.87	34.39	15.54
	mm		120.00	120.00	165.00	190.00	241.00	12.50	49.0	29.00	246.00	211.00	160.00	10.40	12.64	15.60	7.05
2	Inch		5.50	5.50	7.00	8.50	11.50	0.63	2.41	1.45	11.14	9.45	7.09	34.17	39.68	43.00	24.03
	mm		140.00	140.00	178.00	216.00	292.00	16.00	61.5	36.80	283.00	240.00	180.00	15.50	18.00	19.50	10.90

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501 - T - 5 - 8 - A08

BERIC FORGED STEEL VALVE NUMBERING CHART

Valve Style		End Connection		Size		Class		Material		Trim	Options *	
501	BB Gate	B(SCH)	Butt Weld	1	¼	1	#150	A	A105N	01	A	316 Stn. Stl. Trim
502	BB Globe	F	Flanged	2	3/8	3	#300	B	A 350 LF2	02	B	B7M Bolting
503	BB Piston Check	G	Flat Face Flange	3	½	6	#600	C	A 182 F5	03	C	Chain Operated
504	BB Swing Check	H	MNPT X FNPT	4	¾	8	#800	D	A 182 F9	04	D	Cr13 Trim (1/2 HF)
505	WB Gate	J	MNPT X FSW	5	1	9	#1500	E	A 182 F11	05	E	17-4 ph Stem
506	WB Globe	K	MSW X FNPT	6	1 ¼	0	#2500	F	A 182 F22	06	F	Industrial Gas Cleaned
507	WB Piston Check	L	MSW X FSW	7	1 ½	A	#900	G	A 182 F304/304L	07	G	Garlock EVSP Packing
508	WB Swing Check	R	RTJ	8	2			H	A 182 F316/316L	08	H	Hastelloy C Stem
509	BB Y-Pattern Globe	S	Socket Weld					J	A 182 F321	09	J	RTJ Flanges
510	BB Y-Pattern Check	T	NPT					K	A 182 F52	10	K	Live Loaded
511	FP BB Gate	X	TSW					M	A 182 F347	11	L	Lock Bonnet
512	WB Y-Pattern Globe	Y	RMSW X FNPT							12	M	Monel Trim
513	WB Y-Pattern Check	Z	RMSW X FSW							13	N	NACE
514	FP BB Swing Check									14	O	Oxygen Cleaned
515	FP WB Gate									15	P	125rms Flat Faced Flng
522	FP BB Globe									16	R	L7M Bolting
524	FP BB Swing Check										S	B8M Bolting
552	WB Y-Pattern Stop/Check										T	TFE Packing, 316/TFE Gasket
											U	316/TFE Gasket Only
											V	Vacuum Service (TFE)
											W	Bellow Seal
											X	Nipple Extensions
											Y	Cryogenic Service
											Z	Mounting Plate
											A2	HF Alkylation Service

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Notes:

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Rev. 102011

TERMINAL LOAD RACK EQUIPMENT

8580C-8580-120

AUTOMATIC SWITCHING, DIAGNOSTIC OPTI-THERM RACK MONITOR

MODEL 8580 DIAGNOSTIC OPTI-THERM RACK MONITOR



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Civacon Model 8580 features include:

- High-resolution 3" x 5" LED diagnostic display is easy to read from a distance, limits chance for errors (optional remote display available)
- Two separate output relays for overfill and ground verification providing superior flexibility and safety
- Compatible with all 5-wire optic, thermistor, and 2-wire thermo-optic sensors. Will load all trailers equipped with any brand or style of overfill detection system

- Automatic recognition and switching between Optic and Thermistor technology; no decisions or manual efforts required by your customers
- Convenient wireless handheld bypass controller
- Diagnostic capabilities include ground verification, permissive status and compartment identification



Discover the many advantages of our new Model 8580 Diagnostic Opti-Therm Rack Monitor…

Learn more — call 888-526-5657 or visit us at www.civacon.com

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CIVACON MODEL 8580
DIAGNOSTIC OPTI-THERM RACK MONITOR

OPERATION

Civacon, Opti-Therm rack monitors are used to automatically recognize the type of overfill system (optic or thermistor signal technology) that is being used on a transport. When connected to the transport, the monitor checks the status of sensors within tanks or compartments. Overfill detection systems, such as the 8580, provide automatic warning of product overfill detection at predetermined levels and warn of a pending overfill condition.

Rack monitors using standard optic and thermistor signal formats communicate with the onboard monitor (overfill detection chassis) or directly to the "straight" optic or thermistor systems on the transport.

This communication is accomplished via a pulsed, intrinsically safe electrical signal. The electrical signal is generated by the control monitor and is transmitted to the sensors through a coiled cord and industry standard plug.

During normal operation, when the sensors on the trailer are dry and functioning properly, a signal is returned to the monitor. Providing this signal meets predetermined characteristics, the monitor goes to a "permissive" state. This "permissive" state provides a signal which changes the status lights on the front of the rack monitor (model number 8580), from a red to a green color, signaling to the terminal automation system (T.A.S) that everything is fine.

During the loading process, if a sensor becomes wetted, it sends a signal enabling the monitor to recognize the changed condition. Immediately, the status lights on the rack monitor (model number 8580) switch to red, a "non-permissive" state, and signals the terminal automation system (T.A.S.) for action (i.e. immediate shut-down). This system can be used for applications that include as many as twelve optic or eight thermistor liquid-level type sensors.

The Model 8580 Opti-Therm Diagnostic Rack Monitor includes display status of the optic or thermistor, "permissive" or "non-permissive" status and mode of operation.

SPECIFICATIONS

Operating Temperature:
-40°F to 140°F (-40°C to 60°C)

Input Requirements:
120 VAC 60 Hz, 15VA (Standard)
240 VAC available — please inquire

Output Relay Contacts:
240 VAC — 5A DPDT

Response Time:
0.5 seconds maximum, dry to wet transition

Electrical Connections:
Internal Terminal Strips

Enclosure:
NEMA 4 explosion proof, Class I, Div. 1, Group D

Housing Material:
Aluminum

Approximate Weight:
Model 8580 — 43 lbs.

Approvals:
UL, CUL (Canada); CENELEC (Europe)

Installation Information:
Provided with the monitor. If necessary, installation instructions can be ordered separately at no charge.

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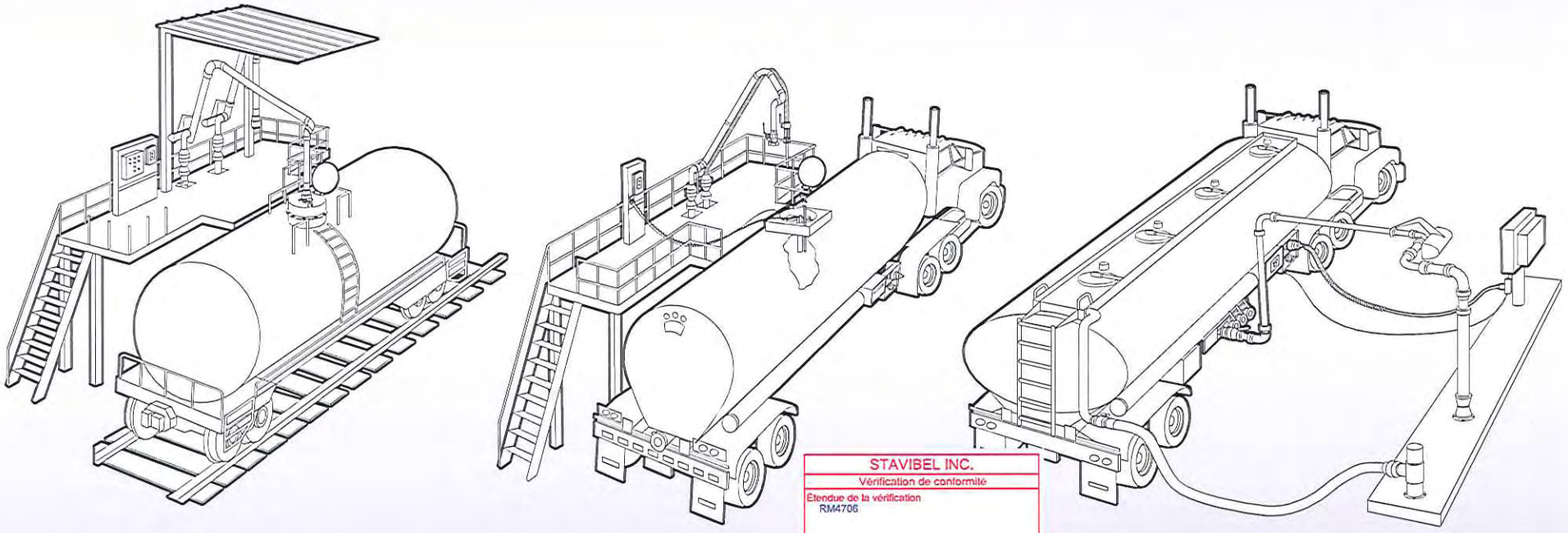
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OVERFILL PROTECTION

TOP OR BOTTOM-LOADING RAILCAR AND TANK-TRUCK PARTS AND ACCESSORIES



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8130-120



1300HS-3062



1300KMLS-3062



1400RHS-3060



1400RKMLS-3060



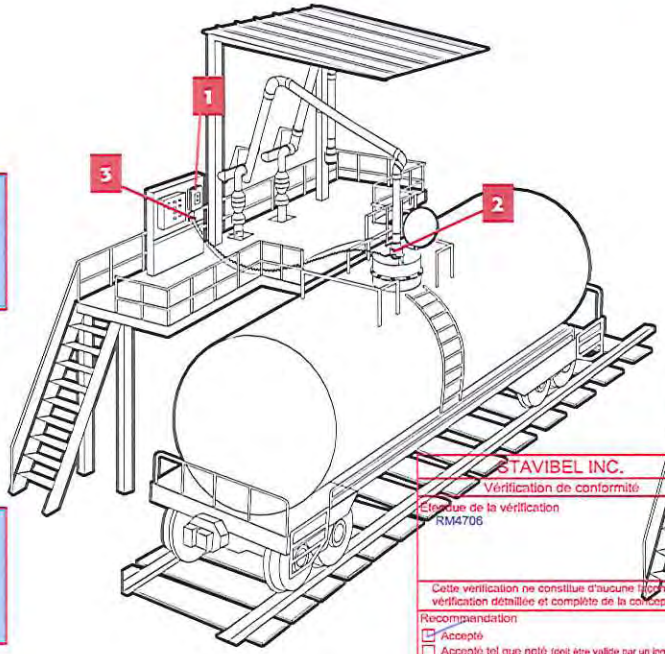
7500-7500

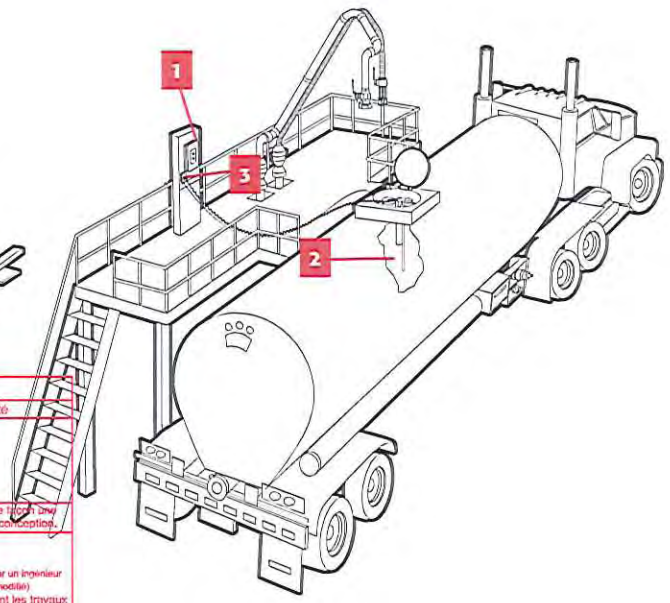


7540-7540



7540-8x30





1300HS-36

	PRODUCT	PRODUCT #	DESCRIPTION
1	~~RACK MONITOR~~	8130-120	Optic Rack Monitor with Ground Verification, Red/Green Indicator Lights. Available in 120 or 240 Volt
2	CANE PROBE (select 1)	1300HS-3062	Optic Cane Probe (Aluminum) 62" standard length with universal clamp, 30' coiled cord and 7-pin plug
		1300KMLS-3062	Optic Cane Probe (Aluminum) 62" standard length with Kamlok Coupler, 30' coiled cord and 7-pin plug
		1400RHS-3060	Optic Cane Probe (Stainless Steel) 60" standard length with universal clamp, 30' coiled cord and 7-pin plug
		1400RKMLS-3060	Optic Cane Probe (Stainless Steel) 60" standard length with Kamlok Coupler, 30' coiled cord and 7-pin plug
3	~~JUNCTION BOX~~	7500-7500	Junction Box for Optic, Thermistor, and Ground Verification Plug and Cord Sets (Non-Breakaway)
		7540-7540	Junction Box with 7-pin socket for Cane Probes or Breakaway Optic Plug & Cord Set
		7540-8X30	Junction Box with 7-pin socket for Breakaway Optic Plug and Cord Set. Includes bypass connection for 8130 Optic Rack Monitor **(Does not include BCU-2)**

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Grounding Cable & Clamp and options continued on next page

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7720-7720


7720-COIL


7790-7790


7790-COIL


7620-7620


7620-COIL


7690-7690

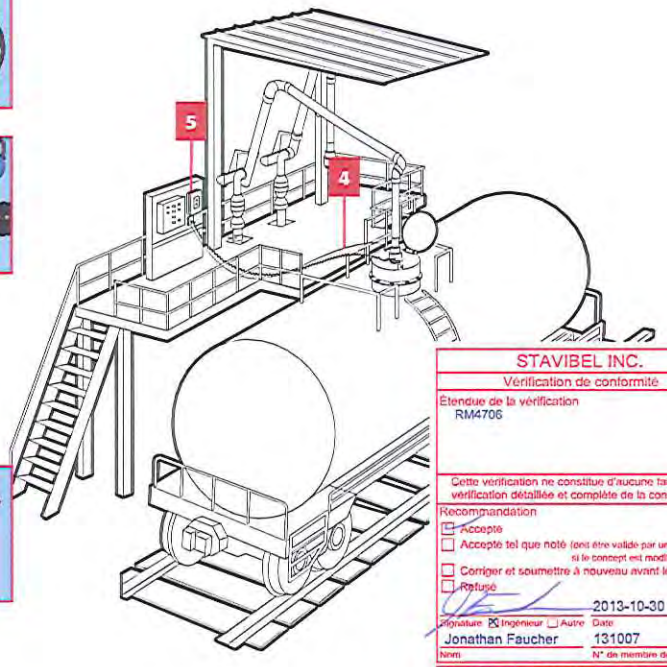

7690-COIL

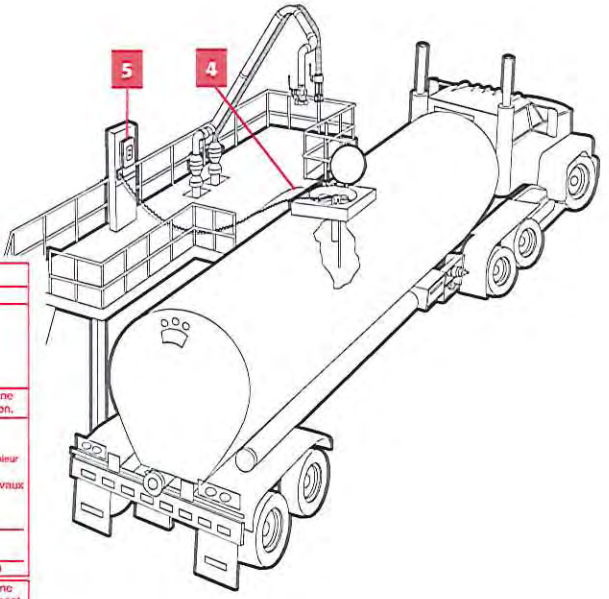


8150-120


7560-7560


BCU-2





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	PRODUCT	PRODUCT #	DESCRIPTION
4	GROUNDING CABLE & CLAMP	7720-7720	Ground Verification Clamp with 40' straight cord
		7720-COIL	Ground Verification Clamp with 30' coiled cord
		7790-7790	Ground Verification Clamp with 40' straight cord and 7500-7500 Junction Box
		7790-COIL	Ground Verification Clamp with 30' coiled cord and 7500-7500 Junction Box
		7620-7620	Ground Verification Plug & Cord Set for dual ball application with 30' straight cord
		7620-COIL	Ground Verification Plug & Cord Set for dual ball application with 30' coiled cord
		7690-7690	Ground Verification Plug & Cord Set for dual ball application with 30' straight cord and 7500-7500 Junction Box
		7690-COIL	Ground Verification Plug & Cord Set for dual ball application with 30' coiled cord and 7500-7500 Junction Box
5	OPTION: BYPASS	8150-120	8130-120 Optic Rack Monitor with Ground Verification, Red/Green Indicator Lights. Includes 7560-7560 Junction Box and one (BCU-2) Bypass Control Unit
		7560-7560	Junction Box with bypass connection for 8150 Optic Rack Monitor **(Does not include BCU-2 Bypass Control Unit)**
		BCU-2	Bypass Control Unit for 8150 Optic Rack Monitor **(7560-7560 or 7540-8x30 Junction Box required)**

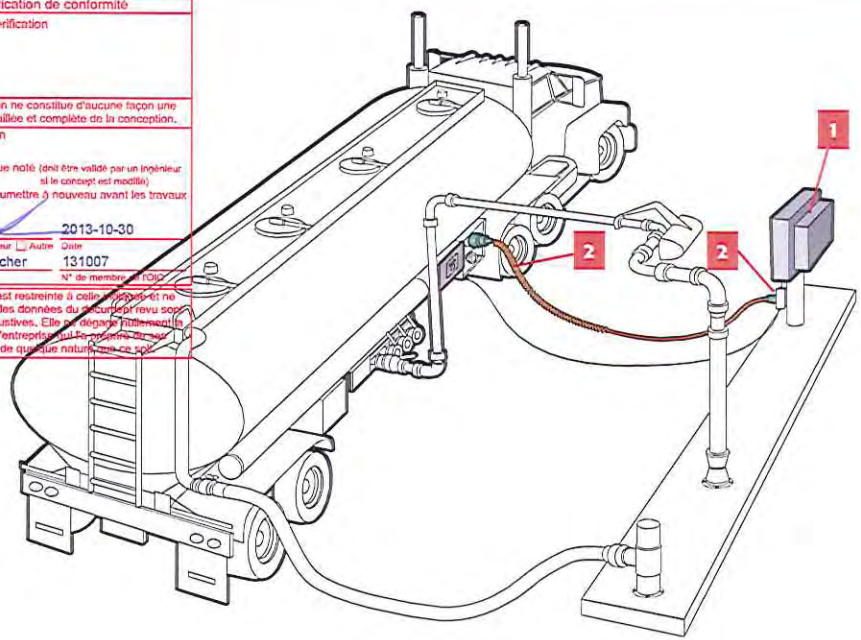
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BOTTOM-LOADING TRUCK OPTI/THERM RACK SYSTEM (TYPICAL EASTERN US & EASTERN CANADA)

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	PRODUCT	PRODUCT #	DESCRIPTION
1	**RACK MONITOR**	8460-8460	Opti/Therm Rack Monitor with Ground Verification, 6 Channel and Key Bypass - (US Only)
		8580C (Canada)	Opti/Therm Rack Monitor with Ground Verification, 8 Channel, LED Display and Bypass - (Canada Only)
2	**PLUG & CORD SETS** (select thermistor or optic)	7100-7100	Optic Plug with 30' 10-conductor coiled cord
		7120-7120	Optic Plug with 30' 10-conductor coiled cord and 7-pin breakaway plug
		7100SR-7100	Optic Plug with 30' 6-conductor blue coiled cord for Scully replacement
		7120SR-7120	Optic Plug with 30' 6-conductor blue coiled cord for Scully replacement and 7-pin breakaway plug
		7190S-0020	7100-7100 Optic Plug with 30' coiled cord and 7500-7500 Junction Box
		7191S-0020	7120-7120 Optic Breakaway Plug with 30' coiled cord and 7540-7540 breakaway Junction Box
		7191SR-7191	7120SR-7120 Optic Breakaway Plug with 30' 6-conductor blue coiled cord for Scully replacement, 7-pin breakaway plug and 7540-7540 Junction Box
		7300-7300	Thermistor Plug with 30' 10-conductor coiled cord
		7300C-7300	Thermistor Plug with 30' 10-conductor coiled cord (Canada only)
		7320-7320	Thermistor Plug with 30' 10-conductor coiled cord and 13-pin breakaway plug
		7300SR-7300	Thermistor Plug with 30' 10-conductor coiled cord for Scully replacement
		7320SR-7320	Thermistor Plug with 30' 10-conductor coiled cord for Scully replacement and 13-pin breakaway plug
		7390S-0020	7300-7300 Thermistor Plug with 30' 10-conductor coiled cord and 7500-7500 Junction Box
		7391S-0020	7320-7320 Thermistor Breakaway Plug with 30' 10 conductor coiled cord, 13-pin breakaway plug and 7510T-7510 Junction Box
		7391SR-7391	7320SR-7320 Thermistor Breakaway Plug with 30' 10-conductor coiled cord for Scully replacement, 13-pin breakaway plug and 7510T-7510 Junction Box

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Junction Boxes and options continued on next page

BOTTOM-LOADING TRUCK OPTI/THERM RACK SYSTEM (TYPICAL EASTERN US & EASTERN CANADA)

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7720-7720


7720-COIL


7790-7790


7790-COIL


7620-7620


7620-COIL


7690-7690


7690-COIL



7500-7500


7540-7540


7510T-7510



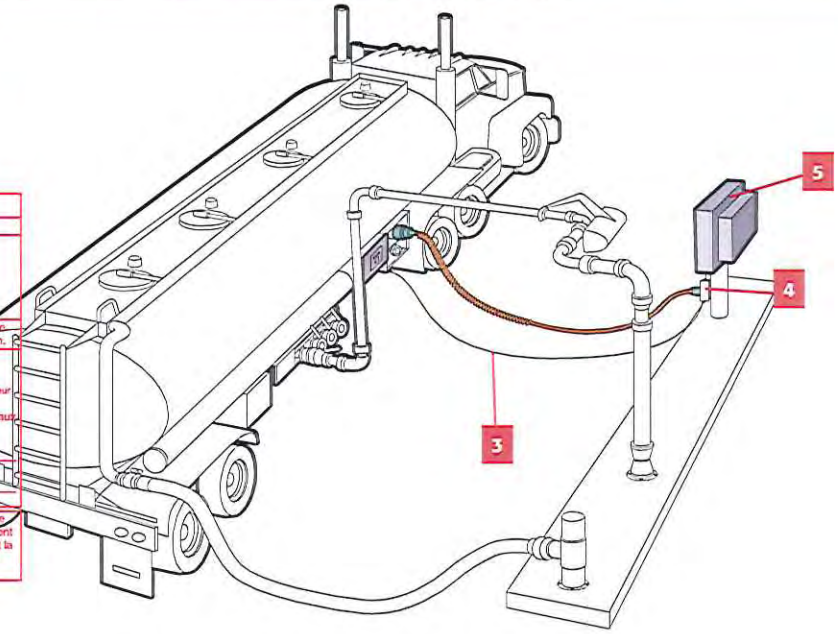
8580


7150-7150


7350-7350


1386-1386

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Vérification de conformité
Etendue de la vérification
RM4706
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Recommandation
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☐ Corriger et soumettre à nouveau avant les travaux
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2013-10-30
Signature ☒ Ingénieur ☐ Autre
Date
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131007
Nom
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	PRODUCT	PRODUCT #	DESCRIPTION
3	GROUNDING CABLES & CLAMP	7720-7720	Ground Verification Clamp with 40' straight cord
		7720-COIL	Ground Verification Clamp with 30' coiled cord
		7790-7790	Ground Verification Clamp with 40' straight cord and 7500-7500 Junction Box
		7790-COIL	Ground Verification Clamp with 30' coiled cord and 7500-7500 Junction Box
		7620-7620	Ground Verification Plug & Cord Set for dual ball application with 30' straight cord
		7620-COIL	Ground Verification Plug & Cord Set for dual ball application with 30' coiled cord
		7690-7690	Ground Verification Plug & Cord Set for dual ball application with 30' straight cord and 7500-7500 Junction Box
		7690-COIL	Ground Verification Plug & Cord Set for dual ball application with 30' coiled cord and 7500-7500 Junction Box
4	JUNCTION BOX	7500-7500	Junction Box for Optic, Thermistor, and Ground Verification Plug and Cord Sets (Non-Breakaway)
		7540-7540	Junction Box with 7-pin socket for Cane Probes or Breakaway Optic Plug & Cord Set
		7510T-7510	Junction Box with 7-pin socket for breakaway Thermistor Plug and Cord Set
5	OPTIONS:	8580	Opti/Therm Rack Monitor with Ground Verification, 6 Channel, LED Display and Bypass -(US Only)
		7150-7150	Optic Plug Hanger
		7350-7350	Thermistor Plug Hanger
		1386-1386	Opti/Therm Rack Monitor Tester

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BOTTOM-LOADING OPTIC-ONLY RACK SYSTEMS (TYPICAL WESTERN US AND WESTERN CANADA)

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8130-120



7100-7100


7120-7120


7100SR-7100


7120SR-7120


7190S-0020


7191S-0020


7191SR-7191



7720-7720


7720-COIL


7790-7790


7790-COIL


7620-7620


7620-COIL


7690-7690


7690-COIL

STAVIBEL INC.
Vérification de conformité

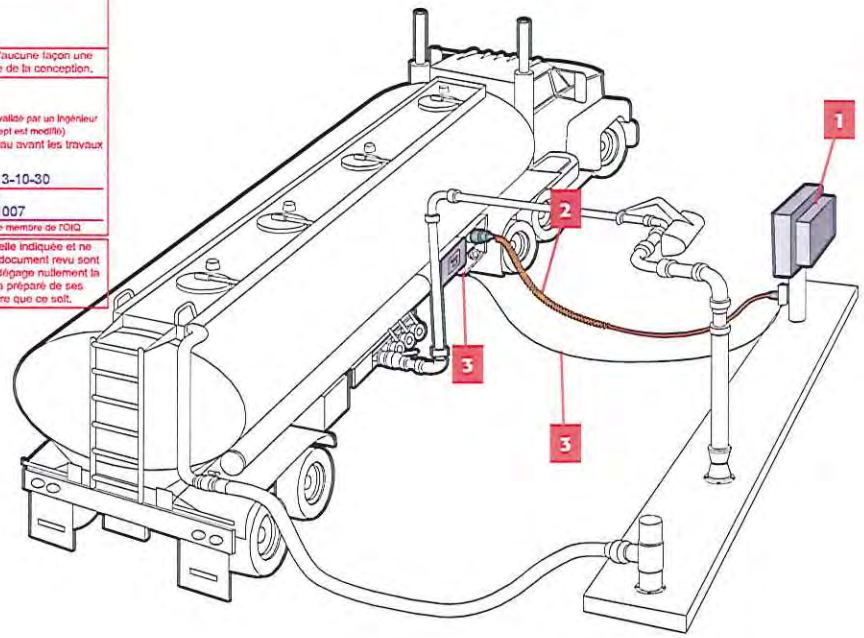
Étendue de la vérification
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	PRODUCT	PRODUCT #	DESCRIPTION
1	RACK MONITOR	8130-120	Optic Rack Monitor with Ground Verification, Red/Green Indicator Lights. Available in 120 or 240 Volt
2	OPTIC PLUG	7100-7100	Optic Plug with 30' 10-conductor coiled cord
		7120-7120	Optic Plug with 30' 10-conductor coiled cord and 7-pin breakaway plug
		7100SR-7100	Optic Plug with 30' 6-conductor blue coiled cord for Scully replacement
		7120SR-7120	Optic Plug with 30' 6-conductor blue coiled cord for Scully replacement and 7-pin breakaway plug
		7190S-0020	7100-7100 Optic Plug with 30' coiled cord and 7500-7500 Junction Box
		7191S-0020	7120-7120 Optic Breakaway Plug with 30' coiled cord and 7540-7540 breakaway Junction Box
		7191SR-7191	7120SR-7120 Optic Breakaway Plug with 30' 6-conductor blue coiled cord for Scully replacement, 7-pin breakaway plug and 7540-7540 Junction Box
3	GROUNDING CABLE & CLAMP	7720-7720	Ground Verification Clamp with 40' straight cord
		7720-COIL	Ground Verification Clamp with 30' coiled cord
		7790-7790	Ground Verification Clamp with 40' straight cord and 7500-7500 Junction Box
		7790-COIL	Ground Verification Clamp with 30' coiled cord and 7500-7500 Junction Box
		7620-7620	Ground Verification Plug & Cord Set for dual ball application with 30' straight cord
		7620-COIL	Ground Verification Plug & Cord Set for dual ball application with 30' coiled cord
		7690-7690	Ground Verification Plug & Cord Set for dual ball application with 30' straight cord and 7500-7500 Junction Box
		7690-COIL	Ground Verification Plug & Cord Set for dual ball application with 30' coiled cord and 7500-7500 Junction Box

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Junction Boxes and options continued on next page



7500-7500


7540-7540


7540-8x30



8150-120


7150-7150


7560-7560


BCU-2


1386-1386

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Vérification de conformité

Étendue de la vérification
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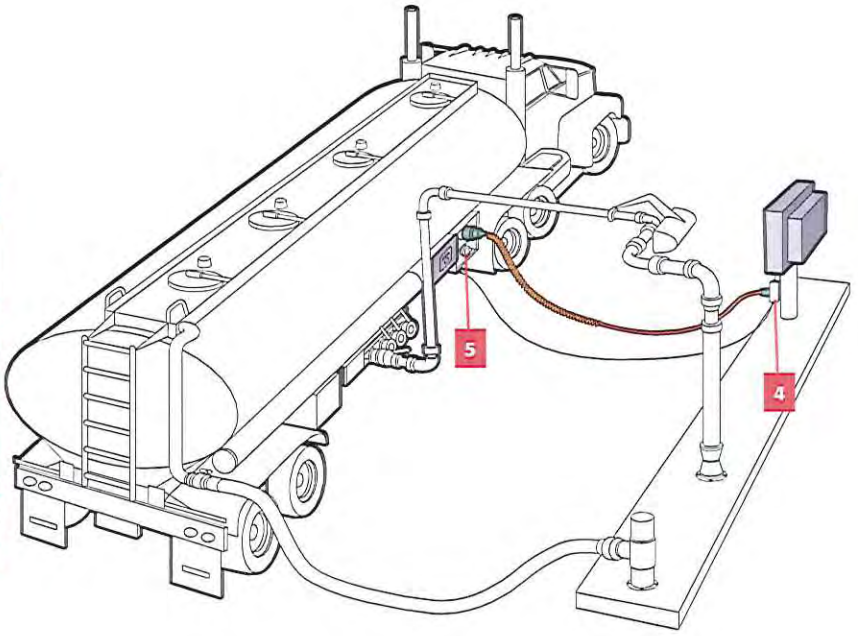
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	PRODUCT	PRODUCT #	DESCRIPTION
4	JUNCTION BOX	7500-7500	Junction Box for Optic, Thermistor, and Ground Verification Plug and Cord Sets (Non-Breakaway)
		7540-7540	Junction Box with 7-pin socket for Cane Probes or Breakaway Optic Plug & Cord Set
		7540-8X30	Junction Box with 7-pin socket for Breakaway Optic Plug and Cord Set. Includes bypass connection for 8130 Optic Rack Monitor **(Does not include BCU-2)**
5	OPTIONS:	8150-120	8130-120 Optic Rack Monitor with Ground Verification, Red/Green Indicator Lights. Includes 7560-7560 Junction Box and one BCU-2 Bypass Control Unit
		7150-7150	Optic Plug Hanger
		7560-7560	Junction Box with bypass connection for 8150 Optic Rack Monitor **(Does not include BCU-2 Bypass Control Unit)**
		BCU-2	Bypass Control Unit for 8150 Optic Rack Monitor **(7560-7560 or 7540-8x30 Junction Box required)**
		1386-1386	Opti/Therm Rack Monitor Tester

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GROUND VERIFICATION ONLY

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8030-120



7720-7720


7720-COIL


7790-7790


7790-COIL


7620-7620


7620-COIL


7690-7690


7690-COIL

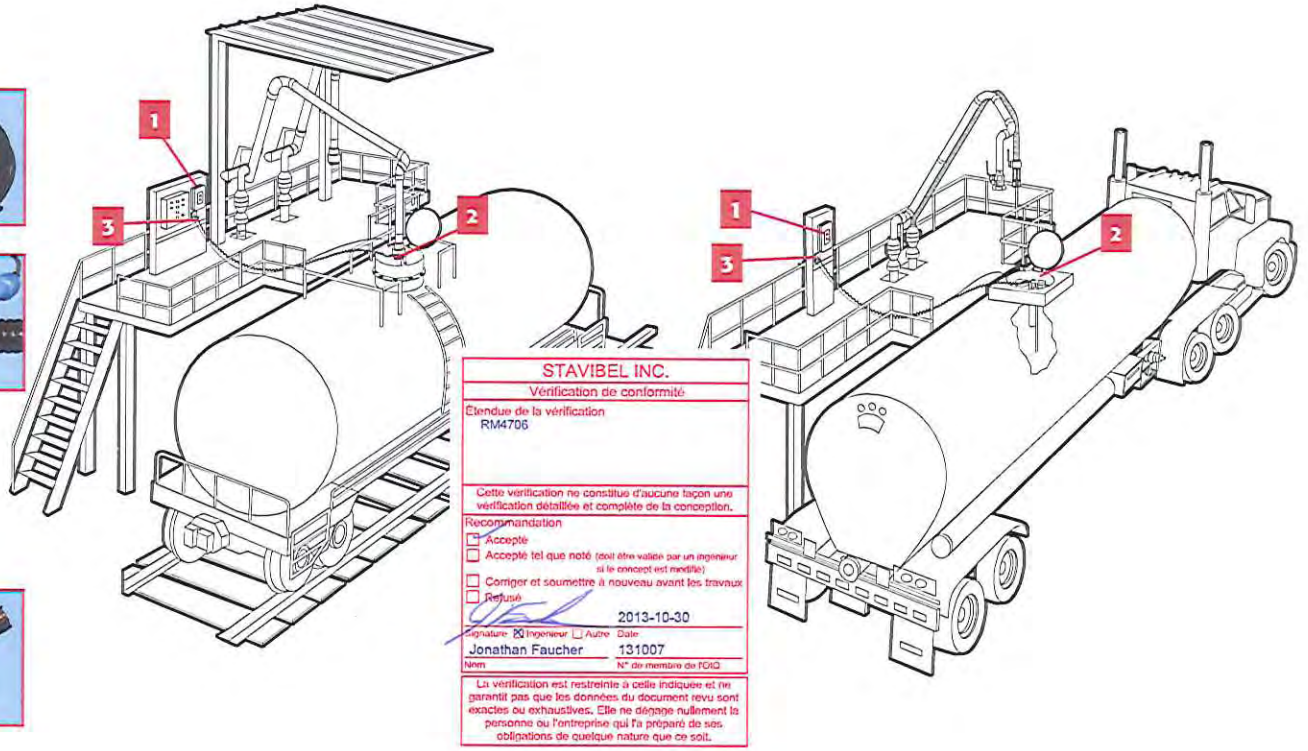


7500-7500



7560-7560


BCU-2



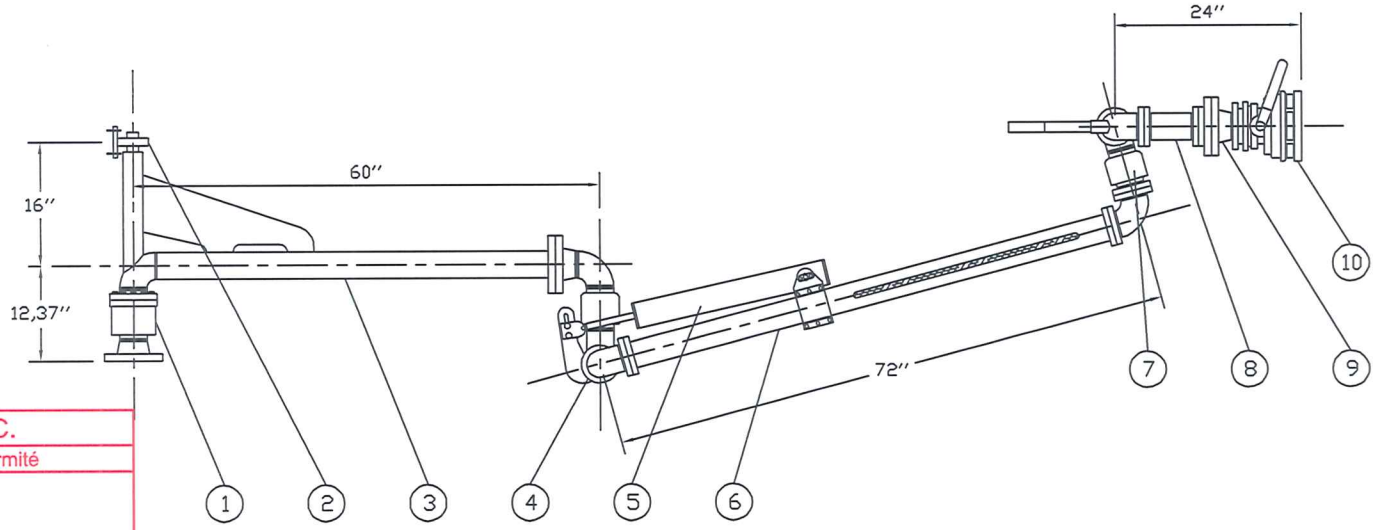
	PRODUCT	PRODUCT #	DESCRIPTION
1	**GROUND MONITOR**	8030-120	Ground Monitor, with Red/Green Status Lights Available in 120 or 240 Volt
2	**GROUNDING CABLE & CLAMP**	7720-7720	Ground Verification Clamp with 40' straight cord
		7720-COIL	Ground Verification Clamp with 30' coiled cord
		7790-7790	Ground Verification Clamp with 40' straight cord and 7500-7500 Junction Box
		7790-COIL	Ground Verification Clamp with 30' coiled cord and 7500-7500 Junction Box
		7620-7620	Ground Verification Plug & Cord Set for dual ball application with 30' straight cord
		7620-COIL	Ground Verification Plug & Cord Set for dual ball application with 30' coiled cord
		7690-7690	Ground Verification Plug & Cord Set for dual ball application with 30' straight cord and 7500-7500 Junction Box
		7690-COIL	Ground Verification Plug & Cord Set for dual ball application with 30' coiled cord and 7500-7500 Junction Box
3	**JUNCTION BOX**	7500-7500	Junction Box for Optic, Thermistor, and Ground Verification Plug and Cord Sets (Non-Breakaway)
4	**OPTIONS:**	7560-7560	Junction Box with bypass connection for 8150 Optic Rack Monitor **(Does not include BCU-2 Bypass Control Unit)**
		BCU-2	Bypass Control Unit for 8150 Optic Rack Monitor **(7560-7560 or 7540-8x30 Junction Box required)**

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NO.	DESCRIPTION
1.	SWIVEL 2174 HD- VITON PL
2.	RENFORT WITH PILLOW BLOCK 1-1/4''
3.	PRIMARY ARM STEEL PIPE
4.	SWIVEL 2174- STD. VITON PL STEEL
5.	SPRING BALANCING CYLINDER 5182-LIGHT
6.	SECONDARY ARM STEEL FLANGE
7.	DOUBLE SWIVEL 2175- ALUM. STYLE 50
8.	SPOOL X 6'' LONG ALUM.
9.	BRIDE WNF
10.	COUPLER WHITTAKER F228

NAME

UNLOADER EN VITON LT



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Vérification de conformité

Étendue de la vérification
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NATIONAL ENERGY EQUIPMENT INC.

NAME
UNLOADER EN VITON LT

SIZE	FSCM NO.	DWG NO.	REV
		2013-04-08-01	1

DATE 2013-04-08 | SCALE --- | SHEET

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Étendue de la vérification
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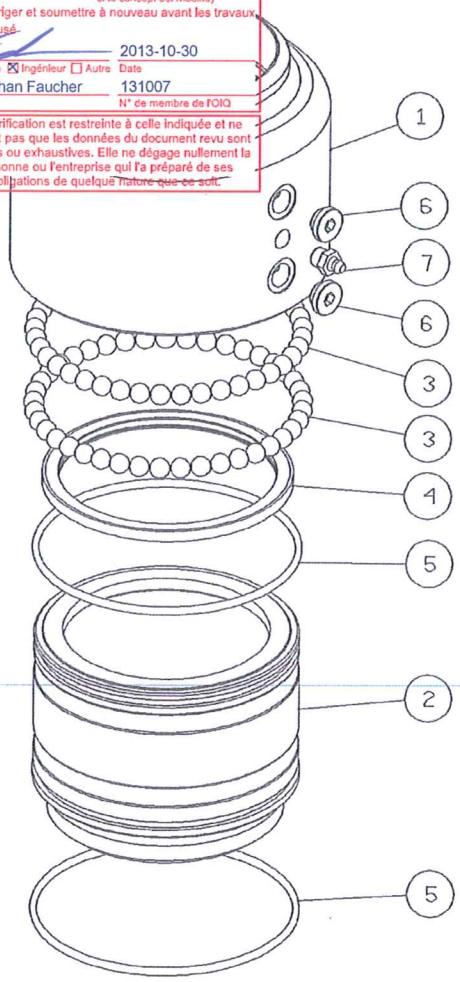
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Snodo girevole Tp.2175

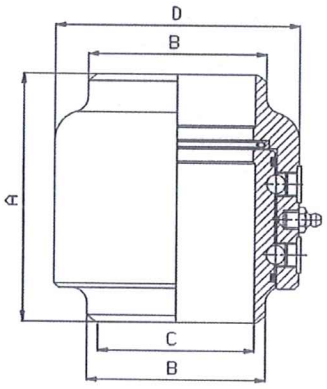
(acciaio al carbonio, acciaio inox o alluminio)

2175 Mod. swivel joint

(Carbon Steel, Stainless Steel or Aluminum made)



Dimensioni primarie / *Dimensions*





Size	A	B	C	D	Kg	Design Pressure
1"	80	33.4	26.5	62	1.8	40 Bar
1.1/2"	100	48.3	41	87	2.2	40 Bar
2"	101	60.3	52	93	2.8	40 Bar
3"	123	88.9	78	122	5	40 Bar
4"	136	114.3	102	154	8.7	40 Bar
6"	175	168.3	152	225	21	10 Bar

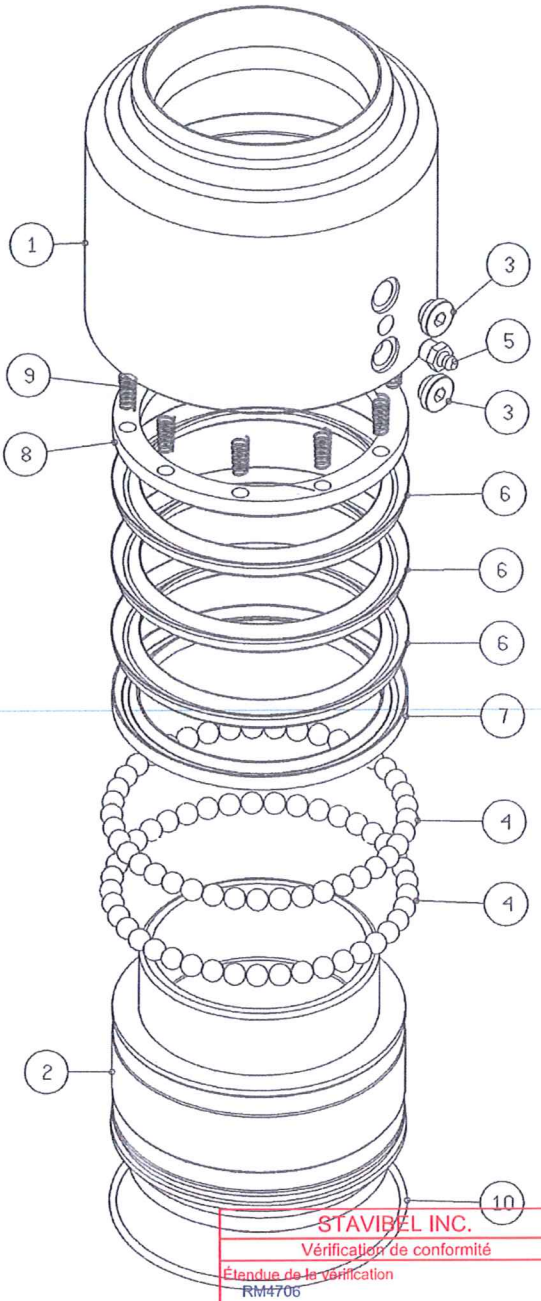
- Le pressioni e pesi sopra indicati sono riferiti allo snodo in esecuzione in Acciaio al Carbonio e Acciaio Inox. Per lo snodo in Alluminio la pressione di progetto è da considerarsi di 10 Bar per tutti i diametri disponibili.
- *Indicated pressures and weight are referred to Carbon Steel and Stainless Steel swivel joints. Aluminum swivel joint design pressure is 10 Bar for all available diameters.*

Note / *Remark*

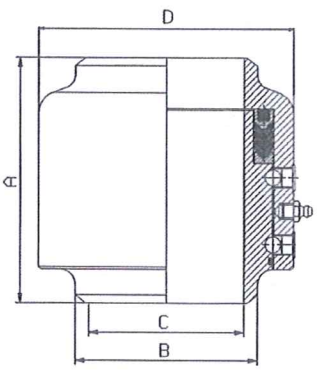
- **Solo per snodo in Acc.Carbonio:**
  Superfici di rotolamento temperate per induzione e rettificate.
- ***Only for Carbon Steel type:***
  Induction hardened and grinded ball bearing raceways

Part	Description	Q.ty	Material	Material	Material
1	Corpo dello snodo *Body*	1	Acc.Carbonio *Carbon Steel*	AISI 304L/316L	Alluminio *Alu. Alloy*
2	Maschio *Sleeve*	1	Acc.Carbonio *Carbon Steel*	AISI 304L/316L	Alluminio *Alu. Alloy*
3	Sfere *Balls*		Acc.Carbonio *Carbon Steel*	Acc.Carbonio *Carbon Steel*	Acc.Carbonio *Carbon Steel*
4	Anello di tenuta energizzato *Energized seal*	1	PTFE caricato+ELGILOY® *PTFE filled+ELGILOY®*	PTFE caricato+ELGILOY® *PTFE filled+ELGILOY®*	PTFE caricato+ELGILOY® *PTFE filled+ELGILOY®*
5	Anelli di ritegno grasso *Grease O'Ring*	2	BUNA N / VITON	BUNA N / VITON	BUNA N / VITON
6	Tappi fermo sfere *Ball plugs*	2	AISI 303	AISI 303	AISI 303
7	Ingrassatore *Grease nipple*	1	Acc.Carbonio *Carbon Steel*	Acc.Carbonio *Carbon Steel*	Acc.Carbonio *Carbon Steel*
			ACC.CARBONIO/C.S.	ACC.INOX/S.S.	ALLUMINIO/*ALU.ALLOY*

Snodo girevole Tp.2174
2174 Mod. swivel joint



Dimensioni primarie / *Dimensions*





Size	A	B	C	D	Kg	Design Pressure
1"	96.5	33.4	26.5	62	2.1	40 Bar
1.1/2"	115	48.3	40	85	2.7	40 Bar
2"	115	60.3	51	94	3.2	40 Bar
2.1/2"	125	73	63	113	5.2	40 Bar
3"	139.5	88.9	78	124	6	40 Bar
4"	146	114.3	102	156	9.8	40 Bar
6"	216.5	168.3	152	225	26.6	10 Bar
8"	249	219.1	202.5	290	49.2	10 Bar

Note / *Remark*

- Superfici di rotolamento temperate per induzione e rettificate.
- *Induction hardened and grinded ball bearing raceways.*

Part	Description	Q.ty	Material
1	Corpo dello snodo *Body*	1	Acc.Carbonio *Carbon Steel*
2	Maschio *Sleeve*	1	Acc.Carbonio *Carbon Steel*
3	Tappi fermo sfere *Ball plugs*	2	AISI 303
4	Sfere *Balls*		Acc.Carbonio *Carbon Steel*
5	Ingrassatore *Grease nipple*	1	Acc.Carbonio *Carbon Steel*
6	Guarnizioni a "V" *"V" ring seals*	3	BUNA N/VITON
7	Anello di appoggio *Female adapter*	1	Ottone *Brass*
8	Anello controspinta *Spring adapter*	1	Ottone *Brass*
9	Molle *Springs*		INOX
10	Anello ritegno grasso *Grease O'Ring*	1	BUNA N/VITON

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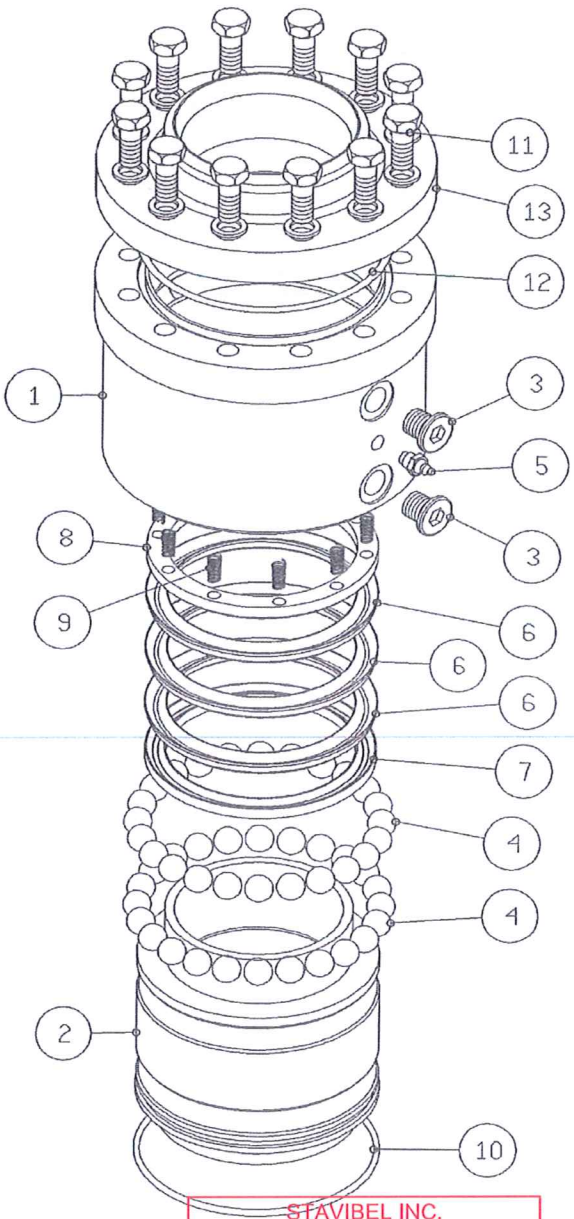
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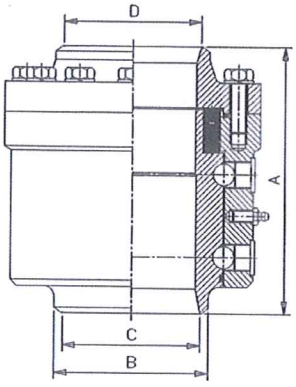
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Snodo girevole Tp.2174-HD per carichi elevati
2174-HD Mod. heavy-duty swivel joint



Dimensioni primarie / *Dimensions*





Size	A	B	C	D	Kg	Design Pressure
2"	129	60.3	51	52	5.4	40 Bar
3"	168.5	88.9	78	78	12	40 Bar
4"	193.5	114.3	102	102	20	40 Bar
6"	245.5	169	152	152	50	10 Bar

Note / *Remark*

- Superfici di rotolamento temperate per induzione e rettificate.
- *Induction hardened and grinded ball bearing raceways.*

Part	Description	Q.ty	Material
1	Corpo *Body*	1	Acc.Carbonio *Carbon Steel*
2	Maschio *Sleeve*	1	Acc.Carbonio *Carbon Steel*
3	Tappi fermo sfere *Ball plugs*	2	AISI 303
4	Sfere *Balls*		Acc.Carbonio *Carbon Steel*
5	Ingrassatore *Grease nipple*	1	Acc.Carbonio *Carbon Steel*
6	Guarnizioni a "V" *"V" ring seals*	3	BUNA N/VITON
7	Anello di appoggio *Female adapter*	1	Ottone Brass
8	Anello controspinta *Spring adapter*	1	All./ Bronzo *Alum. / Bronze*
9	Molle *Springs*		INOX
10	Anello di ritegno grasso *Grease O'Ring*	1	BUNA N/VITON
11	Viti di bloccaggio *Locking screws*		Acc.Carbonio *Carbon Steel*
12	Anello di tenuta del corpo *Body O'Ring*	1	BUNA N/VITON
13	Flangia superiore *Body flange*	1	Acc.Carbonio *Carbon Steel*

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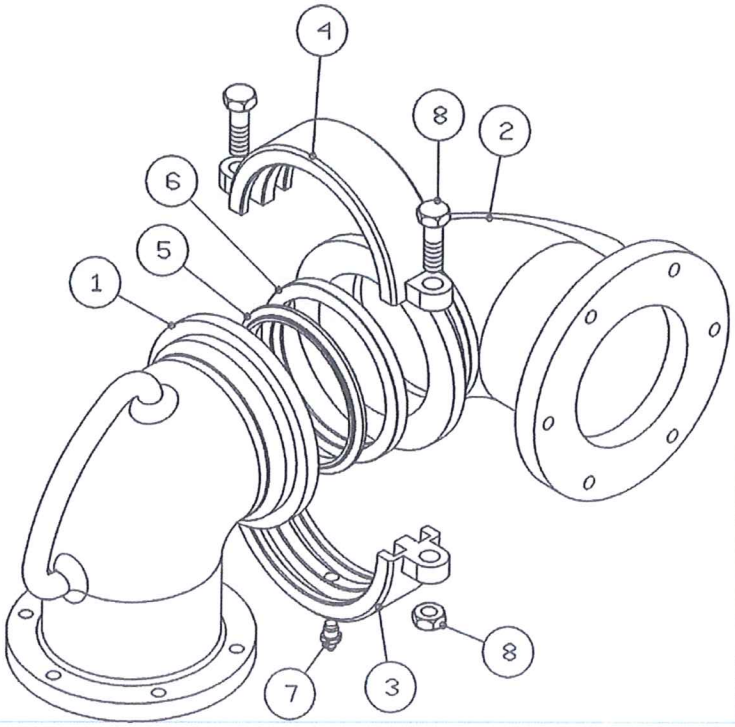
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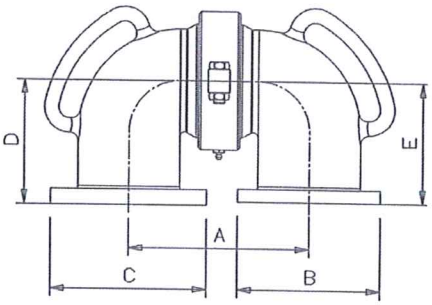
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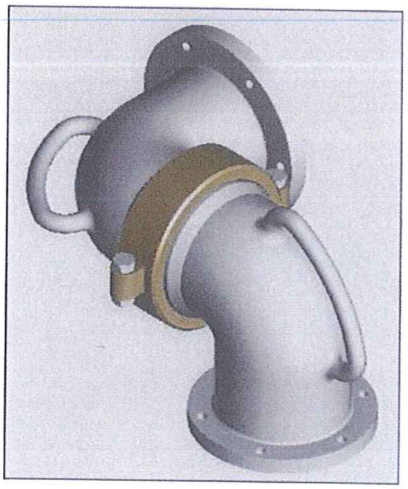
Gomito rotante Tp.536
536 Mod. drop tube swivel



Dimensioni primarie / *Dimensions*



Size	3"	4"	6"
A	174	201	275
B	128	159	222
C	154	175	222
D	122	138	160
E	127	134	160
Kg	4.5	6.5	13
Design Pressure	10 Bar	10 Bar	10 Bar



Part	Description	Q.ty	Material
1	Gomito di uscita *Outlet elbow*	1	Lega Alluminio *Alu.Alloy*
2	Gomito di entrata *Inlet elbow*	1	Lega Alluminio *Alu.Alloy*
3	Mezzo collare *Half collar*	1	Bronzo *Bronze*
4	Mezzo collare *Half collar*	1	Bronzo *Bronze*
5	Anello interno guarnizione *Seal ring*	1	Lega Allum. / INOX *Alu.Alloy / INOX*
6	Guarnizione di tenuta *Packing seal*	1	BUNA N / VITON
7	Ingrassatore *Grease fitting*	1	Acc.Carbonio *Carbon Steel*
8	Viti e dadi di fissaggio *Screws and nuts*	2	Acc.Carbonio *Carbon Steel*

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OPW Installation and Maintenance Instructions

OPW 200TG Mechanical AST Liquid Level Gauge

IMPORTANT: Please read these warnings and use the assembly instructions completely and carefully before starting. Failure to do so may cause product failure, or result in environmental contamination due to liquid leakage into the soil, creating hazardous spill conditions.

IMPORTANT: The OPW 200TG Tank Gauges are pre-assembled for your convenience and ease of use. Check to make sure the unit is intact and undamaged and all parts have been supplied. Never substitute parts for those supplied. Doing so may cause product failure.

WARNING-DANGER: Using electrically operated equipment near gasoline or gasoline vapors may result in a fire or explosion, causing personal injury and property damage. Be sure that the working area is free from such hazards, and always use proper precautions.
NOTE: At all times when product is in the storage tank keep the riser pipe capped, so the vapors cannot escape into the environment.

Notice: OPW products must be used in compliance with applicable federal, state, and local laws and regulations. Product selection should be based on physical specifications and limitations and compatibility with the environment and material to be handled. All illustrations and specifications in this literature are based on the latest production information available at the time of publication. Prices, materials, and specification are subject to change at any time, and models may be discontinued at any time, in either case, without notice or obligation.

Standard Product Warranty

OPW warrants that products sold by it are free from defects in materials and workmanship for a period of one year from the date of manufacture by OPW (ECO products two years from date of manufacture.) Proof of purchase may be required. As the exclusive remedy under this limited warranty, OPW, will at its sole discretion, repair, replace, or issue credit for future orders for any product that may prove defective within the one year date of manufacture period (repairs, replacements, or credits may be subject to prorated warranty for remainder of the original warranty period, complete proper warranty claim documentation required.) This warranty shall not apply to any product that has been altered in any way, which has been repaired by any party other than a service representative authorized by OPW, or when failure is due to misuse, or improper installation or maintenance. OPW shall have no liability whatsoever for special, incidental or consequential damages to any party, and shall have no liability for the cost of labor, freight, excavation, clean up, downtime, removal, reinstallation, loss of profit, or any other cost or charges.

For any product certified to California 2001 standards, OPW warrants that product sold by it are free from defects in material and workmanship for a period of one year from date of manufacture or one year from date of registration of installation not to exceed 15 months from date of manufacture by OPW.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, AND SPECIFICALLY THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES, WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF.

200TG Specifications:

Accuracy: ±2 inches
Specific Gravity of Fluid: 0.65 to 1.025.
Temperature Range: -40°F to 120°F (-40°C to 59°C)
Materials: Enclosure/Base – Powder-Coated Aluminum, Float – Stainless Steel, Lens – Tempered Borosilicate, Gears – Acetal, Gaskets/O-Rings – Nitrile, Hardware – Stainless Steel

Torque Specifications:

Swivel Base: 80 ft-lbs maximum. (As a general rule, hand tight plus 1½ turns is adequate.)
Cover Bolts: 15-20 ft-lbs.
Lens Screws: Tighten evenly; be careful not to over-tighten.

Replacement Parts:

Lid Gasket: P/N H14909M
Lens: P/N H14358M
Float: P/N C05165M
Cover Bolt P/N: H14911M

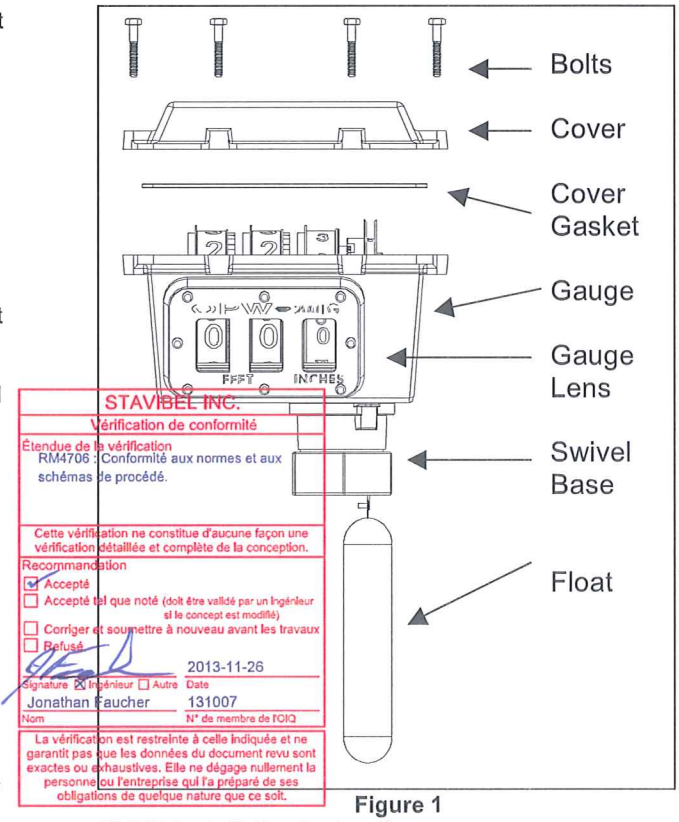


Figure 1

200TG Installation Instructions

1. For maximum accuracy, calibration should be undertaken when the tank is half full. Using a

dipstick, measure and record tank fluid level in feet and inches. If tank is empty, record level as 3.75 inches.

2. Remove tank gauge from packaging. Be sure to keep the cable taut before installation.
3. If installing a drop tube, drill a 5/16" vent hole within 6 inches from the top of the drop tube.
   NOTE: Drop tubes are highly recommended for use in tanks that have any components near the tank gauge operating space in which the float and cable could become entangled, or in any tanks in which there is a high amount of turbulence. OPW offers a line of 61T Drop Tubes specifically for the 200TG tank gauge.
4. Remove the eight (8) bolts from the top of the gauge. Place them, the cover and the lid gasket in a safe place. Be careful not to damage the lid gasket.
5. While supporting the float, remove the cardboard insert that is holding the drive gear in place. See Figure 2.
   WARNING: When this cardboard piece is removed the spool is no longer secured. It is necessary to hold the float to prevent the spool from tangling. This insert must be removed for operation of the gauge.

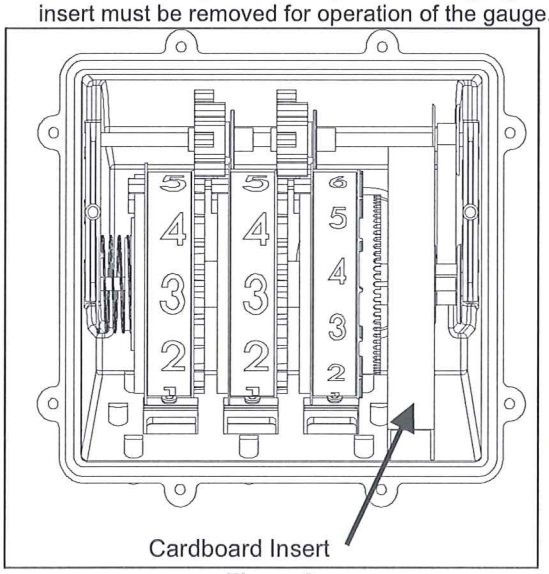


Figure 2

6. Apply pipe dope to threads on swivel base to ensure a tight seal. Pipe dope to be a non-hardening, gasoline resistant pipe thread sealant compound.
7. Slowly lower the float into the desired tank opening. Remember to keep the cable taut at all times.
8. Thread swivel base onto desired tank opening and tighten to 80 ft-lbs.
9. Rotate tank gauge to desired orientation for best visibility.
10. From inside of the tank gauge housing, disengage the gears by sliding them toward the spring at one end of the housing to allow for calibration of gears. While the gears are disengaged, start by rotating the inch gear to the match the inch value found in Step 1. Slide this gear away from the spring to re-engage. Repeat for two remaining gears. Be sure to view the gauge from the vantage point it will be viewed from in day-to-day operations to properly calibrate the gears. See Figure 3.

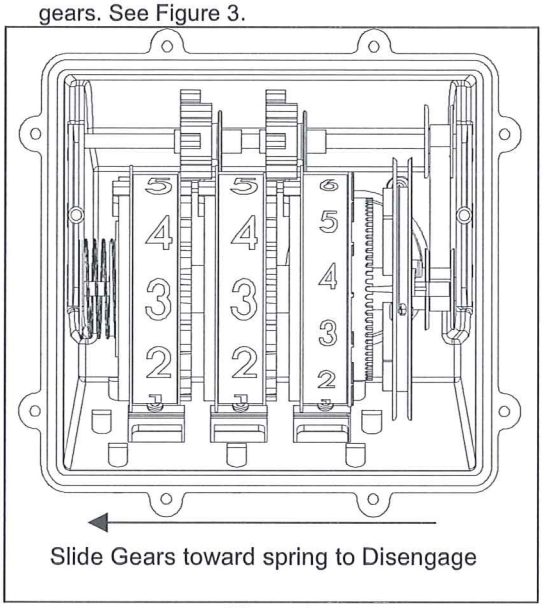


Figure 3

11. Place the lid gasket back into the groove, being careful not to damage it and keep it clean from debris. No sealant is necessary for this gasket. Add the cover and secure it tightly with the eight (8) bolts, using a crossing pattern, torque the bolts to 15-20 ft-lbs.

Annual Maintenance:

Using a dip stick, measure the liquid level of the tank and check this value with the value displayed on the tank gauge. The values should be within ±2 inches of each other. Recalibrate if necessary.

Remove cover and visually inspect the internal parts for signs of wear, tangles in the spool, and corrosion. Replace parts if necessary.

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FMC Technologies

Electronic Preset Delivery System

Smith Meter™ microLoad.net

Specifications

Issue/Rev. 0.2 (11/06) Bulletin SS06045

*The **Smith Meter™ microLoad.net** is a microprocessor based instrument with Ethernet capability. It is designed to monitor and control single product, straight loading. The unit can operate either as a stand-alone instrument or be part of system where it communicates with an automation or SCADA system.*

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Smith Meter microLoad.net

Features

- One Arm, single product loading
- Ethernet communications port
- Modbus protocol
- Three mulit-drop EIA-485 or EIA-232 communications ports
- Continuous monitoring of critical functions
- User configurable inputs and outputs
- Programmable language/messages
- Event logging/audit trail
- Configurable load ticket/BOL emulation printing
- Automatic temperature correction
- API tables from LPG to crude oil
- ISO 9 1-2 Tables
- Coefficient of expansion for chemicals
- Explosion-proof
- Display backed-up per OIML
- S-Mass and Apollo Coriolis meter communications
- Card Reader Interface with data base (200 users)
- Three security levels
- Automated proving
- Boolean/Algebraic expressions
- Additization of metered or unmetered products
- Print server / preset
- Modbus (Modicon Modbus RTU)
- Pulse Security Level B
- Adjustable Display Constrast

Applications

Applications include batch loading of alcohol, gasoline, antifreeze, lube oils, fuel oils, solvents, fertilizers, LPGs, LNGs and chemicals. The system is ideal for bulk plants, shipping docks, processing installations, and tank farms where straight products must be loaded. Also includes injecting lubricity additive into either a metered or unmetered pipleline.

Standard Features

Temperature Compensation

The temperature compensation feature provides the customer with the ability to compensate for variance in temperature from a reference temperature. This feature is used with an RTD input or a temperature transducer and, excluding the accuracy of the fluid temperature measurement, will exactly match the proper volume correction factor of ASTM-D-1250-04, and API MPMS CH 11.1 - 2004 tables as noted below, over the fluid temperature range of -40°F to 572°F (-40°C to 300°C). The following API tables can be programmed in the microLoad.net: 5A, 5B, 5D, 6A, 6B, 6C, 6D, 23A, 23B, 23D, 23E, 24, 24A, 24B, 24D, 24E, 53A, 53B, 53D, 54, 54A, 54B, 54C, 54D, 59A, 59B, 59D, 60A, 60B, 60D, BR1A, BR1P, and BR2P.

Pressure Compensation

Pressure compensation provides the customer with the ability to compensate the volume of product delivered at varying pressures per API Tables 11.2.1 and 11.2.2, using a 4-20 mA pressure transducer input. This feature also contains real-time control functions for maintaining system pressures at the meter to a minimally-acceptable, user-definable level (pressure transducer not

included). Pressure compensation is particularly useful for light products, such as LPG, where the compressibility factor varies greatly with different pressures.

Density Correction

The density correction feature provides the customer with the ability to correct the volume of product delivered at varying densities. Using communications from an S-Mass or Apollo Coriolis meter, density can be read directly or obtained through a 4-20 mA input.

Metered Injectors, Piston Injectors and Smart Additives

The microLoad.net has been designed to provide maximum flexibility when it comes to additive control. The unit is capable of handling metered injectors, piston injectors and smart additives simultaneously.

The microLoad.net is capable of controlling four additive injector systems. (One metered injector and three piston or Smart or zero metered injectors and four piston or Smart.)

The microLoad.net controls the additive solenoids of metered injectors to precisely inject additive into the main product. It monitors the pulses of the additive meter and controls the amount of additive, based on the incoming pulses from the additive meter and main product meter.

Additive monitoring provides the capability for the microLoad.net to monitor feedback from the piston injectors of the additive products. The microLoad.net monitors the injector feedback switches for a change of state and counts the errors and alarms if no change is detected within the cycle or a period of time, depending on how the unit is programmed. The microLoad.net will totalize additive volume based on confirmation signals and a programmable volume per cycle. The totalized volume will print on the emulated load ticket printed on the printer output.

For Smart additives, the firmware has also been designed with a Master/Slave type of communications, with the microLoad.net being the master and the Additive Injector System being the slave. The microLoad.net constantly interrogates the Additive Injector System for a change in status. The microLoad.net can be operated with communications control over the Smart Additive Injector System or with communication/pulse control. When the microLoad.net has communication control over the Additive System, it will constantly monitor the Additive System for its status, poll the additive totals, and signal the system when to inject additive – all through the communications line.

The microLoad.net communications package has also been designed with a pass-through communications mode. In this mode of operation the supervisory computer can talk to the Additive Injector System through communication lines run to the microLoad.net and from the microLoad.net to the Additive Injector System(s).

Additization of Unmetered Products

The microLoad.net has a feature that allows it to additize products that do not have a meter providing pulses on the main product stream. This feature was added to provide a device to handle the injection of lubricity additive into low sulfur diesel where the diesel is not being metered. The microLoad.net has been designed to handle three separate scenarios for the application:

Scenario 1 – With meter on main product (standard method). microLoad.net receives pulses from product meter and paces additive accordingly.

Scenario 2 – Flow switch on main product line (no meter). No meter on the main product; the microLoad.net will simulate pulses. These pulses will be generated to match the selected high flow rate. Thus, the additive will be paced according to the predicted flow rate rather than the actual flow.

Scenario 3 – No flow switch or meter on main product.

The microLoad.net will start simulating pulses when the START key is pressed; thus, an operator must be present. Similarly, the batch preset size must be accurate as the addization will be done over the entire preset amount.

Dual Pulse Security

This feature provides continuous monitoring and error indication alarm of pulse transmission for each preset position per API Petroleum Measurement Standard, Chapter 5.5, Level B, and Institute of Petroleum Standard, IP 252/76, Part XIII, Section 1, Level B.

Automated Proving Mode

The microLoad.net firmware provides an automated proving mode of operation. When the automated proving mode is activated, the microLoad.net will calculate the meter factor for a proving run based on information obtained during the prove. The operator can select the flow rate and meter factor being proved through the keypad of the microLoad.net. After the prove is complete, the operator enters the prover volume and prover temperature and the microLoad.net will calculate the new meter factor which the operator can download to the program or ignore. The microLoad.net also has the capability of providing an average meter factor over a maximum of ten batches. This feature allows the operator to prove the meter at up to four different flow rates without having to enter the program mode for each meter factor.

Boolean and Algebraic Processing

The microLoad.net provides the customer the flexibility to set-up inputs and outputs for tasks that are not standard in the unit. Through Boolean processing, relays can be turned on and off through equations and events set-up by the customer. For example, a relay is required to close at the first trip point of the load. This can be set-up using Boolean processing and does not require special software from the manufacturer.

Algebraic processing is also an area the customer can use to do simple mathematical calculations not in the unit. These calculations can then be used on the configurable reports or delivery display for the current transaction being run by the unit. The last 5 user boolean and the last 5 user float registers are also stored with the transaction.

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Shared Printing

Shared printing allows multiple microLoads to generate reports on a single printer. A single microLoad.net can be configured to act as a "print server" (host) and all other microLoads to be "shared printers" (clients). Once the client microLoad.nets are configured as shared printers, they will have their communication, transmit, and receive lines tied together and connected to a single comm port on the print server. When a shared printer microLoad is done with a transaction and print is pressed on its keypad, the report is sent via communications to the host, where it will be printed.

Communications

The microLoad.net is equipped with three standard programmable communication ports that can be set up to be either EIA-232 or EIA-485 compatible communication ports, with baud rates up to 38,400 bps. In addition to these three communication ports an Ethernet port is available which supports FTP, HTTP, and Modbus/TCP protocols.

Hardware Options

OIML Display

The microLoad.net is designed to have two display options. The standard display option will operate until the power is lost and then will go blank. The OIML display option is the same display but when the power is lost, the display will maintain the data for reading by an operator for up to fifteen minutes.

Specifications

Accuracy

Calculated Accuracy: The gross at standard temperature to gross volume ratio, excluding the accuracy of fluid temperature measurement, will exactly match the proper volume correction factor or ASTM-D-1250-04 over fluid temperature range of -40°F to +572°F (-40°C to +300°C).

Temperature Measurement Accuracy: Fluid Temperature is measured to within +/- 0.72°F (+/-0.4°C) over the fluid temperature of -148°F to 572°F(-100°C to 300°C). Fluid temperature is measured to within +/-0.45°F (+/-0.25°C) over the fluid temperature range of 32°F to 572°F (0°C to 300°C)

Stability: 0.1°F(0.06°C)/year

Flow Totalization within one pulse of input frequency.

Electrical Inputs

AC Instrument Input Power

Dual Voltage input 115 or 230 VAC via Switch, 50/60 Hz

Power consumption: Approximately 9 watts.

Power Interruption Tolerance: Interruption of power greater than 0.05 seconds (typical) will cause an orderly shut-down of the microLoad.net and the control valve will be immediately signaled to close.

DC Instrument Input Power

Voltage: 24 VDC

Power consumption: Approximately 9 watts.

The DC power input circuitry is reverse current protected.

Digital (Meter Signal) Pulse Inputs

Type: Optically-isolated solid-state voltage sensors

Quantity: Two

Input Voltage Range: 5 to 28 Vdc compatible

Pickup Voltage: 5 Vdc minimum

Drop-Out Voltage: 1 Vdc maximum

Current at Maximum Voltage: 20 mA maximum

Minimum pulse input frquency: 3 Hz

Input Level Duration: 83 µS minimum

Digital Control Inputs

Type: Optically-isolated solid-state voltage sensors

Quantity: Three

Input Voltage Range: 5 to 28 Vdc compatible

Pickup Voltage: 5 Vdc minimum

Drop-Out Voltage: 1 Vdc maximum

Current at Maximum Voltage: 20 mA maximum

Input Level Duration: 120 mSec minimum

Analog Inputs

Type: 20-bit analog to digital converters

Function: One RTD, one 4-20 mA

Temperature (RTD – Resistance Temperature Device)

Type: Four-wire 100Ω platinum resistance temperature detector (PRTD)

PRTD Temperature Coefficient @ 32°F to be: 0.00214 Ω/Ω/°F (0.00385 Ω/Ω/°C)

Temperature Range: -148°F to +572°F (-100°C to +300°C)

Temperature Measurement Accuracy: ±0.72°F (±0.4°C) over the specified range

Current (4-20 mA) Input

Type: Two-wire, 4-20 mA current loop receiver, programmable as to function.

Span Adjustment: Program adjustable

Input Burden: 50Ω

Accuracy: ±0.025% of range

Resolution: One part in 1,048,576

Voltage Drop: Two volts maximum

Sampling Rate: One Sample/300 mSec minimum.

Electrical Outputs

DC Power

12 Vdc +/-5%, 180 mA maximum, short circuited protected.

AC Digital Outputs

Type: Optically isolated solid-state output user-programmable as to function

Quantity: Four

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Load Voltage Range: 90 – 280 Vac (rms) 48 – 63 Hz

Steady-State Load Current Range: 0.05A (rms) minimum to 0.50 amp (rms) maximum into an inductive load.

Leakage Current at Maximum Voltage Rating: 2.5 mA maximum at 240 Vac.

On-State Voltage Drop: 2.0 Vac at maximum load

DC Digital Outputs

Type: Optically-isolated solid-state output user-programmable as to function

Quantity: Two

Switch Blocking Voltage: 30 Vdc maximum

Load Current: 150 mA maximum with 0.6 volt drop

Power down normally open

Pulse Output

Type: Optically-isolated solid state open-collector output. Pulser output units are program selectable through the microLoad.net keypad or communications

Switch Blocking Voltage (Switch off):30 Vdc maximum

Load Current (Switch On): 10 mA with 0.6 volts drop

Frequency Range: 0 to 3000Hz

Duty Cycle: 50/50 (on/off)

Environmental

Ambient Operating Temperature

-13°F to 140°F (-25°C to +60°C)

Humidity

5 to 95% with condensation

Enclosure

Explosion-proof (NEMA7, Class I, Groups C and D) and watertight (NEMA4X), IP 65

Approvals

UL/CUL

Class I, Groups C & D; Class II, Groups E, F & G

Class I, Zone1, Aex d [ib] IIB T6

UL Enclosure 4X, CSA Enclosure 4, Pending

ATEX

EEx d [ib] IIB T6

DEMKO 04 ATEX 0403315

IEC

IEC Ex UL 04.0007

Ex d [ib] T6 IP65 Tamb -25° C to +60° C

Electromagnetic Compatibility

Complies with the European Community Electromagnetic Capabilities (CE Mark) Requirements as per EN50082-2: 1994

Communications

Number of ports: Three plus Ethernet

Configuration: EIA-485 Four-wire or two wire Multi-drop network with optional termination resistor or EIA-232 Three-wire communications link

Data Rate: Programmable asynchronous data (Baud) rate from 2,400 to 38,400 bps

Data Format: Fixed at one start bit, one stop bit, eight data bits, and no parity

Line Protocol: Full duplex, no echo character.

Data Structure: ASCII character oriented, modeled after ISO Standard 1155

Protocol: Smith ASCII LRC, Smith ASCII CR, Smith ASCII binary, Modicon Modbus (PI-MBUS-300 Rev. D)

Ethernet: 10/100 Base TRJ-45

8 or 10 pin UTP (unshielded twisted pair) connector

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microLoad.net – Modeling

ML - XP - STD - 1

Model Designation

Housing

XP - UL/CUL, EExd [ib] IIB T6
DEMKO A/S (Explosion proof)

Hardware Option

1 - STD
2 - OIML Display Option

Firmware

STD - Standard

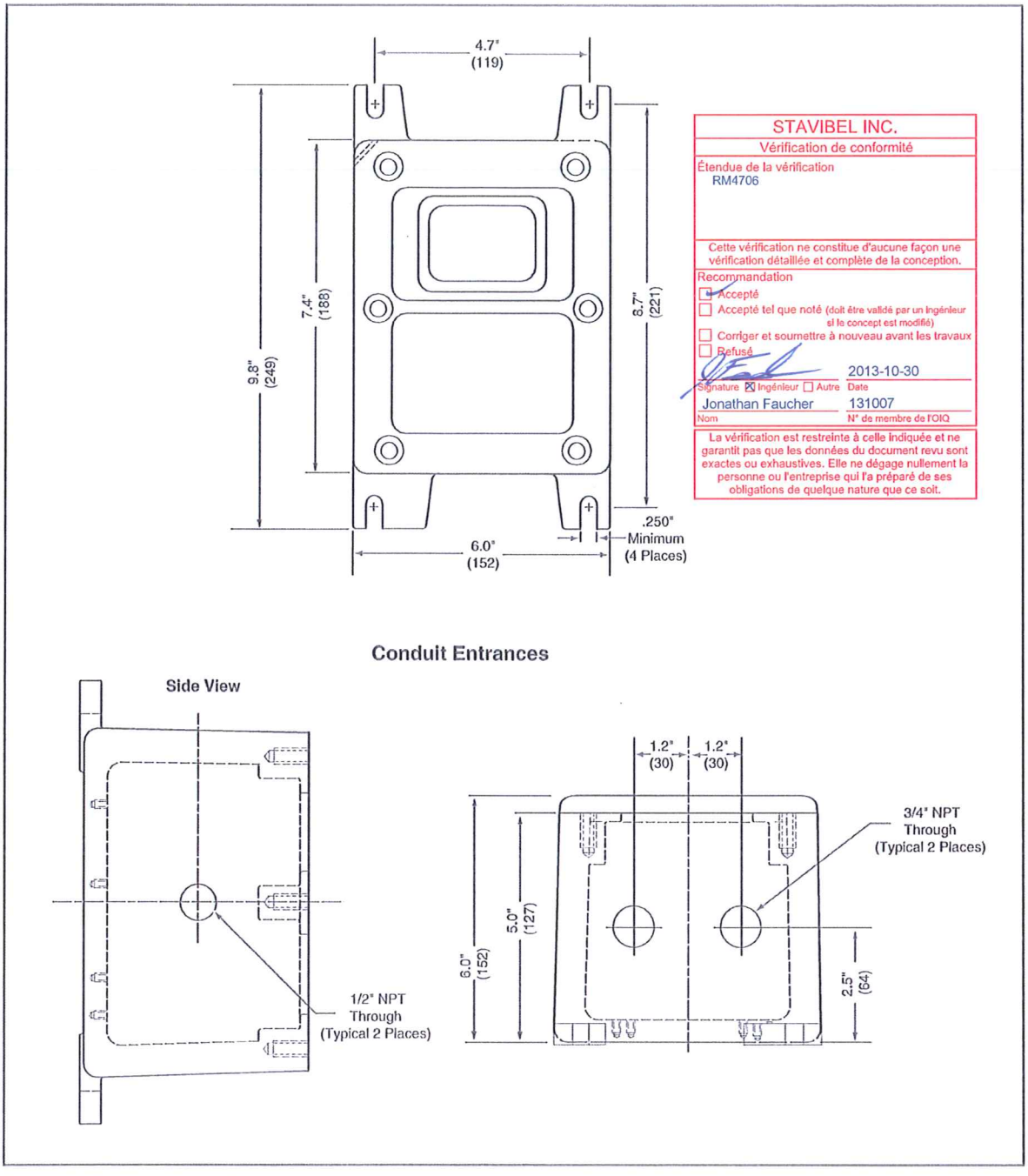


Figure 1 – Explosion-proof Housing

Note: Dimensions — Inches to the nearest tenth (millimetres to the nearest whole mm), each independently dimensioned from respective engineering drawings.

Revisions included in SS06046 Issue/Rev. 0.2 (11/06):

Page 1: Added Features to the list, and revised Temperature Compensation section
Page 2: Added Shared Printing section
Page 3: Clarified ASTM-D-1250-04
Page 4: Added Modicon Modbus (PI-MBUS-300 Rev. D) to Communications section

The specifications contained herein are subject to change without notice and any user of said specifications should verify from the manufacturer that the specifications are currently in effect. Otherwise, the manufacturer assumes no responsibility for the use of specifications which may have been changed and are no longer in effect.

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Morrison Bros. Co.
Fig. 9095A-AV

www.morbros.com

Pressurized Fill Overfill Prevention Valve for Aviation Systems

The 9095A AST Overfill Prevention Valve is installed at the fill port of a tank. Used in a pressurized tight fill application, the valve terminates flow of product when the liquid level reaches a preset warning level (90-95% full). The valve is installed on a standard N.P.T. male connection when used with the quick disconnect or female adaptor. When installed to manufacturers requirements the Overfill Prevention Valve can eliminate hazardous spills. ULC Listed.

The valve can be used in conjunction with the Morrison Fig. 518 and 515 lines of AST Spill Containers for added spill protection. All models are supplied with an adaptor to mount Morrison Fig. 419 aluminum drop tubes. A test mechanism is also sold seperately for denoted models. The test mechanism allows a technician to pull on the test line at any time during the filling process to actuate the float and stop the fill. This allows a technician to verify the valve is working properly.

This Valve Complies With the Following Codes:
NFPA 30, 30A, UFC, IFC and PEI /RP2000, Florida EQ356, CARB VR-402A (some models)

Product Warnings and Cautions:

- 5 PSI & 5 GPM is the *minimum* flow requirement for valve operation at the following *maximum* viscosities (in centistokes): 2" Valve—150 3" Valve—60.
- Maximum flow rate of the 2" valve is 183 GPM at 10 PSI pressure drop. The 3" valve is 566 GPM at 10 PSI pressure drop.
- Once closed th valve will allow up to 1.5 GPM to pass through to relieve line pressure.
- A tight fill is required for the valve to operate. Do not substitute any other fill adaptors for the special adaptor supplied.
- The valve must be used with clean product. Debris from products such as contaminated waste oil may cause the valve to function improperly.
- Consult Morrison Bros. Co. for product compatibility with the valve.
- The 3" valve can be used w/6" Sch. 40 or 80 pipe.
- The 2" valve can be only be used with Sch. 40 pipe.
- Not suitable for motor oil or other heavy oils.

Failure to follow any or all of the above warnings may render the valve non-functional and could result in a hazardous product spill, which may result in personal injury, property damage, fire, explosion or environmental contamination.



MALE QUICK DISCONNECT ADAPTOR
9095A-0200 AV or
9095A-0300 AV

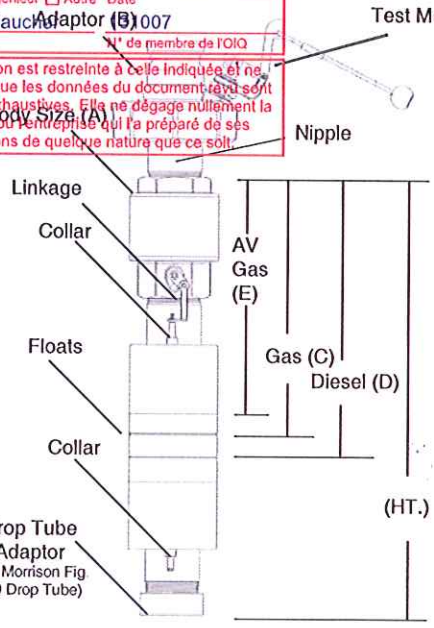


DRY DISCONNECT ADAPTOR
9095A-5200AVEVR



FEMALE THREADED ADAPTOR WITH TEST MECHANISM
9095A-3200 AV
9095A-3300 AV
9095ATM0100 AM

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Established 1855

P.O. Box 238 • Dubuque, Iowa 52004-0238
563.583.5701 (tel) • 800.553.4840 • 563.583.5028 (fax)
www.morbros.com

Fig. 9095A-AV

SPECIFICATION/DETAIL OPTIONS

A—Body Size: 2" N.P.T. (2"), 3" N.P.T. (3")
B—Adaptor :
- (2B): 2" Male Dry Disconnect x 4" Female
- (2S): 2" x 4" Standard 2" Male Disconnect x 4" Female
- (2X): 2" Quick Disconnect Adaptor
- (2D): 2" x 2" x 4" Female Ductile Iron Adaptor
- (3S4): 3" x 4" Standard 3" Male Disconnect x 4" Female
- (3S): 3" x 6" Standard 3" Male Disconnect x 6" Female
- (3X): 3" Quick Disconnect Adaptor
- (3D): 3" x 3" x 6" Female Ductile Iron Adaptor
- (LA): Less Adaptor

C—Gasoline Shutoff Height From Top of Valve (Inches)
D—Diesel Shutoff Height From Top of Valve (Inches)
E—AV Gas Shutoff Height From Top of Valve
F—Test Mechanism Available: Yes (Y) or No (N)
HT.—Height: Dimension from base to top of valve (Inches)
WT.—Shipping Weight (lbs.)

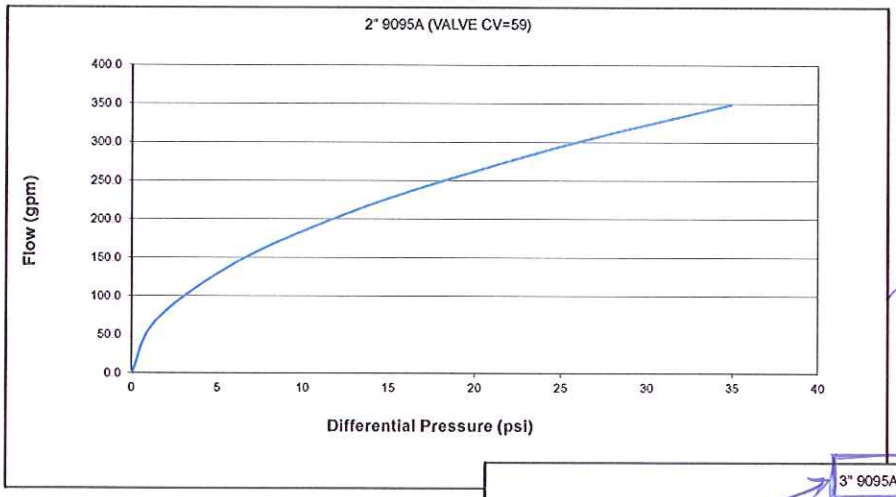
Body: Anodized Aluminum
Internal Components: Nickel Plated Brass
Floats: Closed Cell Buna-N
Linkage: Stainless Steel

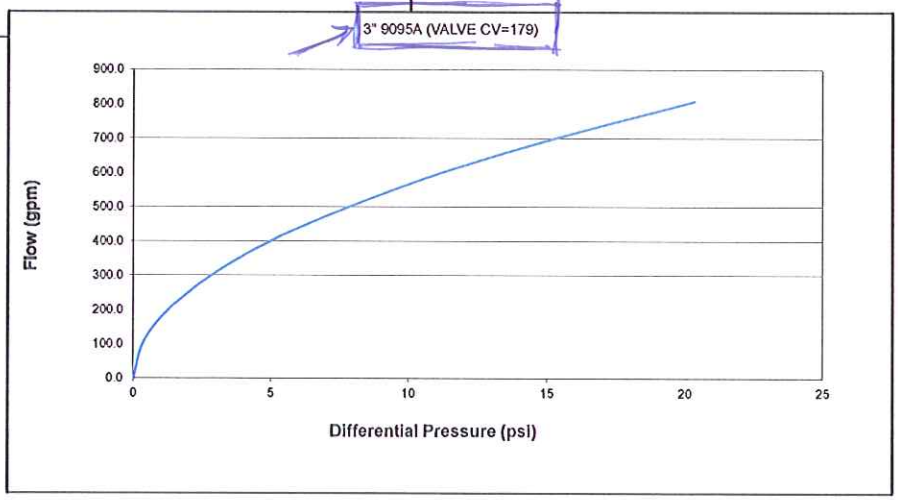
Specification Options:

I.D. Number	A	B	C	D	E	F	HT.	WT.
9095A-AV0200 AV	2"	2S	11.25	12.25	9.5	Y	19.25	14.1
9095A-AV0300 AV	3"	3S	13.45	13.72	12.63	Y	19.5	29
9095A-AV0500 AV	2"	2X	11.25	12.25	9.5	N	19.25	12.5
9095A-AV0600 AV	3"	3X	13.45	13.72	12.63	N	19.56	26
9095A-AV3200 AV	2"	2D	11.25	12.25	9.5	Y	19.56	14.1
9095A-AV3200AVEVR	2"	2D	11.25	12.25	9.5	N	19.56	14.1
9095A-AV3300 AV	3"	3D	13.45	13.72	12.63	Y	19.56	38
9095A-AV3300AVEVR	3"	3D	13.45	13.72	12.63	N	19.56	38
9095A-AV4000 AV	2"	3S4	11.25	12.25	9.5	N	19.9	16.8
9095A-AV4200 AV	2"	3S	11.25	12.25	9.5	N	19.9	21.25
9095A-AV4200AVEVR	2"	3S	11.25	12.25	9.5	N	19.9	21.25
9095A-AV5200AVEVR	2"	2B	11.25	12.25	9.5	N	19.25	21.25
9095A-AV9200AVEVR	2"	LA	11.25	12.25	9.5	N	19.25	14.1
9095A-AV9300AVEVR	3"	LA	13.45	13.72	12.63	N	19.5	21.25

Notes:
- British threads available.

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Morrison Bros. Co.
Established 1855

Poppet Check Valves



Part No.

SS-8CPA2-3

Part Description:

SS 1-Piece Poppet Check Valve, Adjustable Pressure, 1/2 in. MNPT, 3 to 50 psig (0.21 to 3.5 bar)

Product Specifications

General

Valve Material	316 Stainless Steel
End Connection 1 Size	1/2 in
End Connection 1 Type	Male NPT
End Connection 2 Size	1/2 in
End Connection 2 Type	Male NPT
Approval	No Approval
Cleaning	Swagelok SC-10
Cracking Pressure	3 - 50 PSI
Lubricant	Christo-lube MCG 111 (WL8)
Seal Material	Fluorocarbon FKM
Spring Coating	None
Surface Finish	Standard
Testing	No Optional Testing
Max Temperature Pressure Rating	375°F @ 2185 PSIG /190°C @ 150 BAR
Room Temperature Pressure Rating	3000 PSIG @ 100°F /206 @ BAR 37°C

The complete catalog contents must be reviewed to ensure that the system designer and user make a safe product selection. When selecting products, the total system design must be considered to ensure safe, trouble-free performance. Function, material compatibility, adequate ratings, proper installation, operation, and maintenance are the responsibilities of the system designer and user.

Caution: Do not mix or interchange valve components with those of other manufacturers.

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OCV Control Valves

Model 115-3 (Fuel Service)



▲ Model 115-3

The Model 115-3 has a wide range of applications: anywhere it may be required to position a valve electrically.
Typical examples include:
- Process control
- Supervisory flow or pressure control
- Fuel terminal loading racks

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SERIES FEATURES

- Electrically operated solenoids enable the valve to be opened, closed, or held in any position
- Can be maintained without removal from the line
- Independently adjustable opening and closing speeds
- Factory tested and can be pre-set to your requirements

Modèle 115-3-3" - Globe - 150# FLGD - CS

OPERATION

Two two-way solenoids operate the Model 115-3. The first connects the main valve inlet to the diaphragm chamber and, when it is open, causes the main valve to close. The second solenoid connects the diaphragm chamber to the main valve outlet and, when it is open, allows the main valve to open. A needle valve is installed in series with each solenoid, giving separate adjustment of the valve opening and closing speeds.

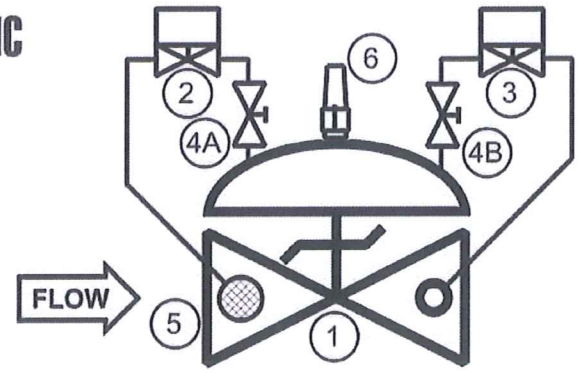
The solenoids can be supplied to give one of the following "default" modes on absence or loss of electrical power:
-Default to closed
-Default to open
-Default in last position

COMPONENTS

The Model 115-3 consists of the following components, arranged as shown on the schematic diagram:

1.) **Model 65 Basic Control Valve** (Fail Closed)
2.) **Model 450 Two-Way Solenoid Pilot**
3.) **Model 451 Two-Way Solenoid Pilot**
4.) **Model 141-2 Needle Valve**
5.) **Model 123 Inline Strainer**
6.) **Model 155L Visual Indicator** (Optional)

SCHEMATIC



RECOMMENDED INSTALLATION

- Install the valve with adequate space above and around the valve to facilitate servicing. Refer to the Dimension Table.
- Valve should be installed with the bonnet (cover) at the top, particularly 8" and larger valves, and any valve with a limit switch.
- Shut-off valves should be installed upstream and downstream of the control valve. These are used to isolate the valve during start-up and maintenance.
- Following main valve installation, the solenoid must be wired into the user's control system. This is a simple two-wire (plus ground) connection.

SIZING

Definitive sizing information can be found in the Series 115 section of the OCV Catalog and Engineering section Performance Charts. Consult the factory for assistance.

MAX. PRESSURE

Note: Working pressures of solenoids vary greatly, consult factory on application of OCV Model 115-3 valves.

END CONNECTIONS	DUCTILE IRON	STEEL/STN STL	ALUMINUM
Threaded	640 psi	640 psi	285 psi
Grooved	300 psi	300 psi	200 psi
150# Flanged	250 psi	285 psi	285 psi
300# Flanged	640 psi	740 psi	---

Model 115-3 Digital Preset Valve

TOLL FREE 1.888.628.8258 • **phone:** (918)627.1942 • **fax:** (918)622.8916 • 7400 East 42nd Place, Tulsa, Ok 74145
email: sales@controlvalves.com • **website:** www.controlvalves.com

Model 115-3 (Fuel Service)

OCV Control Valves

SIZES
GLOBE/ANGLE
Screwed Ends: 1 1/4" - 3"
Grooved Ends: 1 1/2" - 6"
Flanged Ends: 1 1/4" - 24" (globe);
1 1/4" - 16" (angle)

TEMPERATURE RANGE
(Valve Elastomers)
Buna-N -40° F - 180°F
Viton 0° F - 400°F

MATERIALS
Consult factory for others.
Body/Bonnet: Ductile Iron (epoxy coated), Carbon Steel (epoxy coated), Stainless Steel, Aluminum
Seat Ring: Stainless Steel, Bronze
Stem: Stainless Steel, Monel
Spring: Stainless Steel
Diaphragm: Buna-N, Viton, (Nylon reinforced)
Seat Disc: Buna-N, Viton
Pilot: Stainless Steel, Bronze
Other pilot system components:
Stainless Steel, Bronze/Brass
Tubing & Fittings: Stainless Steel, Copper/Brass

SOLENOID
Enclosure: Explosion Proof NEMA 4X, 6P, 7, 9
Body: Stainless Steel, Brass
Voltages: 24, 120, 240, 480 VAC
12, 24 VDC
Note: Working pressures of solenoids vary greatly, consult factory on application of OCV Model 115-3 valves.

SPECIFICATIONS (Typical Fuel Application)

The solenoid control valve shall operate by means of discrete electrical signals. The valve shall be equipped with two two-way solenoid valves that will allow the valve to be opened, closed, or held in any intermediate position. The solenoids shall be configured so that the valve will <open, close, hold position> on loss of electric power.

DESIGN
The solenoid valve shall be a single-seated, line pressure operated, diaphragm actuated, pilot controlled globe valve. The valve shall seal by means of a corrosion-resistant seat and a resilient, rectangular seat disc. These, and other parts, shall be replaceable without removing the valve from the line. The stem of the main valve shall be guided top and bottom by integral bushings. Alignment of the body, bonnet and diaphragm assembly shall be by precision dowel pins. The diaphragm shall not be used as a seating surface, nor shall the pistons be used as an operating means. The pilot system shall be furnished complete and installed on the main valve. It shall include two needle valves, an inline strainer and two solenoid valves. The solenoid control valve shall be operationally and hydrostatically tested prior to shipment.

MATERIALS OF CONSTRUCTION
The main valve body and bonnet shall be ductile iron per ASTM A536, Grade 65-45-12. All ferrous surfaces shall be coated with 4 mils of epoxy. The main valve seat ring shall be CF8M stainless steel. Elastomers (diaphragms, resilient seats and O-rings) shall be Buna-N. The needle valve and control line tubing shall be stainless steel. The solenoid valves shall have stainless steel bodies, explosion-proof enclosures and be suitable for operation on <voltage>.

OPERATING CONDITIONS
The solenoid control valve shall be suitable for pressures of <X to X> psi at flow rates up to <X> gpm.

ACCEPTABLE PRODUCTS
The solenoid control valve shall be a <size> Model 115-3, <globe pattern, angle pattern>, with <150# flanged, 300# flanged, threaded, grooved> end connections, as manufactured by OCV Control Valves, Tulsa, Oklahoma, USA.

U.S. DIMENSIONS - INCHES

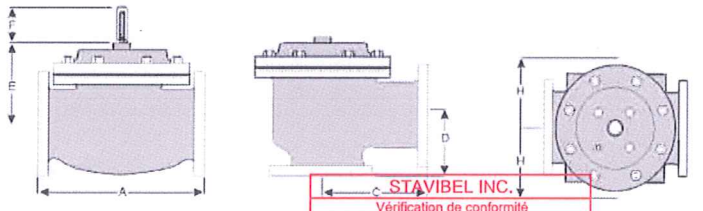
DIM	END CONN.	1 1/4-1 1/2	2	2 1/2	3	4	6	8	10	12	14	16	24
A	SCREWED	8 3/4	9 7/8	10 1/2	13	--	--	--	--	--	--	--	--
	GROOVED	8 3/4	9 7/8	10 1/2	13	15 1/4	20	--	--	--	--	--	--
	150# FLGD	8 1/2	9 3/8	10 1/2	12	15	17 3/4	25 3/8	29 3/4	34	39	40 3/8	62
	300# FLGD	8 3/4	9 7/8	11 1/8	12 3/4	15 5/8	18 5/8	26 3/8	31 1/8	35 1/2	40 1/2	42	63 3/4
C ANGLE	SCREWED	4 3/8	4 3/4	6	6 1/2	--	--	--	--	--	--	--	--
	GROOVED	4 3/8*	4 3/4	6	6 1/2	7 5/8	--	--	--	--	--	--	--
	150# FLGD	4 1/4	4 3/4	6	6	7 1/2	10	12 11/16	14 7/8	17	--	20 13/16	--
	300# FLGD	4 3/8	5	6 3/8	6 3/8	7 13/16	10 1/2	13 3/16	15 9/16	17 3/4	--	21 5/8	--
D ANGLE	SCREWED	3 1/8	3 7/8	4	4 1/2	--	--	--	--	--	--	--	--
	GROOVED	3 1/8*	3 7/8	4	4 1/2	5 5/8	--	--	--	--	--	--	--
	150# FLGD	3	3 7/8	4	4	5 1/2	6	8	11 3/8	11	--	15 11/16	--
	300# FLGD	3 1/8	4 1/8	4 3/8	4 3/8	5 13/16	6 1/2	8 1/2	12 1/16	11 3/4	--	16 1/2	--
E	ALL	6	6	7	6 1/2	8	10	11 7/8	15 3/8	17	18	19	27
F (OPT)	ALL	3 7/8	3 7/8	3 7/8	3 7/8	3 7/8	3 7/8	6 3/8	6 3/8	6 3/8	6 3/8	6 3/8	8
H	ALL	10	11	11	11	12	13	14	17	18	20	20	28 1/2

*GROOVED END NOT AVAILABLE IN 1 1/4"

For maximum efficiency, the OCV control valve should be mounted in a piping system so that the valve bonnet (cover) is in the top position. Other positions are acceptable but may not allow the valve to function to its fullest and safest potential. In particular, please consult the factory before installing 8" and larger valves, or any valves with a limit switch, in positions other than described. Space should be taken into consideration when mounting valves and their pilot systems.

A routine inspection & maintenance program should be established and conducted yearly by a qualified technician. Consult our factory @ **1-888-628-8258** for parts and service.

How to order your Model 115-3 valve
When ordering please provide:
Fluid to be controlled - Model Number - Size - Globe or Angle - End Connection - Body Material - Trim Material - Solenoid Voltage - Energize to Open or Close Valve - Special Requirements / Installation Requirements - Power failure mide open/close/hold last position

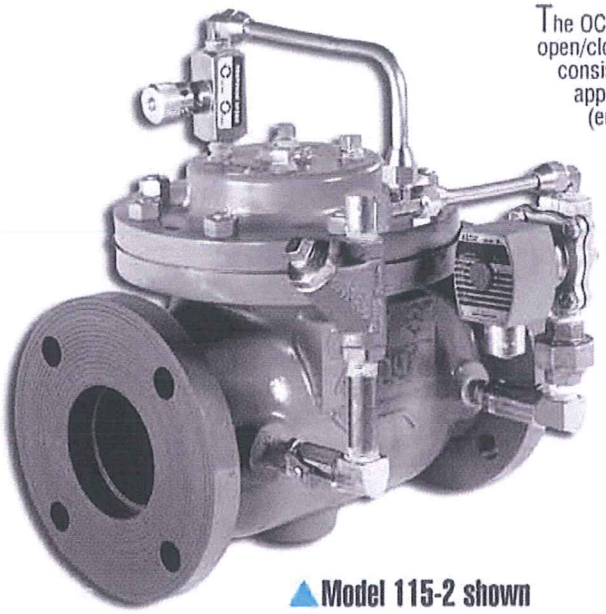


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email: sales@controlvalves.com • **website:** www.controlvalves.com



▲Model 115-2 shown

The OCV Series 115 Solenoid Control Valve is designed to provide on/off or open/close control of fluids in response to an electrical signal. The valve consists of the basic OCV model 65 with solenoid-operated pilot. With the appropriate solenoid, the valve may be normally closed (energize to open) or normally open (de-energize to open).

SERIES FEATURES

- The 115 Series provides responsive control in answer to such triggering devices as clocks, timers, relays, probes, pressure or temperature sensors.
- Available for AC or DC voltages.
- Wider range of sizes and flow capacity than is available with direct acting solenoid valves.
- Valves can be equipped with Manual Override solenoid operation.
- Solenoid feature can be added to other hydraulic control functions.

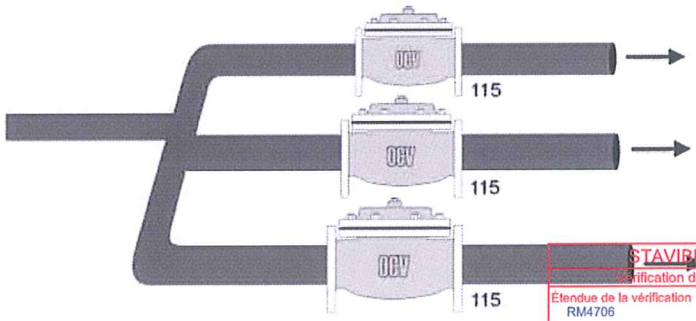
Modèle 115-3-3" - GLOBE - 150# FLGD - CS

VALVE FEATURES

- Operates automatically off line pressure.
- Heavy-duty, nylon-reinforced diaphragm.
- Rectangular-shaped, soft seat seal provides drip-tight Class VI closure.
- Diaphragm assembly guided top and bottom.
- Throttling seat retainer for flow and pressure stability.
- Easily maintained without removal from the line.
- Replaceable seat ring.
- Alignment pins assure proper reassembly after maintenance.
- Valves are factory tested.
- Valves are serial numbered and registered to facilitate replacement parts and factory support.

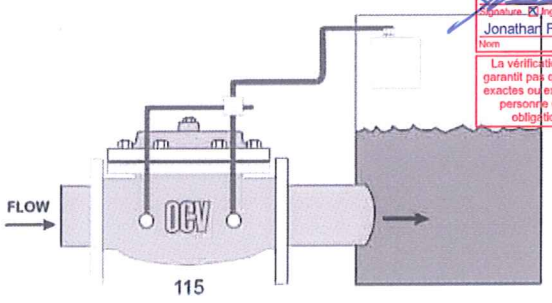
ZONE CONTROL

Used in irrigation and industrial processes, each flow line can be activated independently of the others.



LEVEL CONTROL

Valve, activated by level sensor, fills storage tank.



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2013-10-30
Date
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Nom
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N° de membre de l'OIQ
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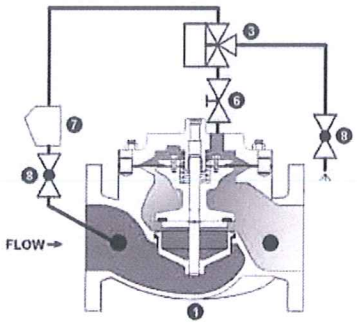
Solenoid Control Valve Series 115

VALVE OPERATION

SOLENOID VALVE TYPES

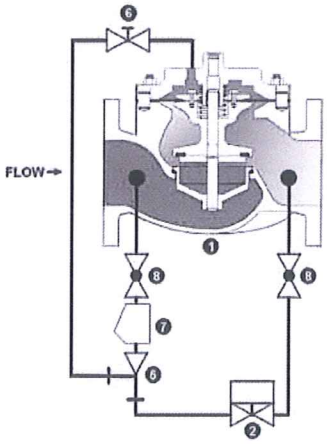
Model 115-1 Three-Way Solenoid

Operated by a 3-way solenoid. The main valve diaphragm chamber may be exhausted to atmosphere, allowing for full open operation at any flow rate. Standard with needle valve opening/closing speed control adjustment. Size ranges 1 ¼" - 4", consult factory on application of larger sizes.



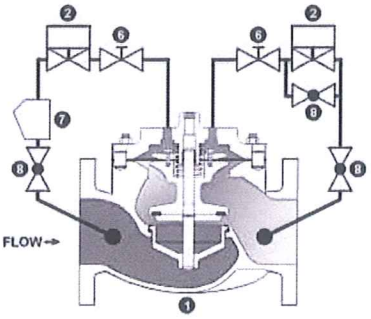
Model 115-2 Two-Way Solenoid

Operated by a 2-way solenoid and ejector. The main valve diaphragm is exhausted to valve outlet port. Valve position is determined by flow rate demand (differential pressure). Standard with needle valve opening/closing speed control adjustment. Size ranges 1 ¼" - 6", consult factory on application of larger sizes.



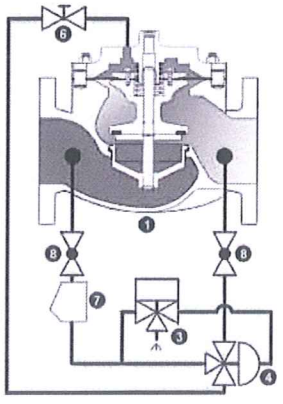
Model 115-3 Positioned Valve

Operated by two 2-way solenoids, the valve maybe positioned from full closed to full open or locked in any intermediate position. Equipped with both opening and closing speed adjustment. The valve can be configured to open, close, or hold position in the event of electrical power failure. The Model 115-3 is the basis for the OCV Series 22 and 88 Electronic Control Valves.



Model 115-4 Three-Way Solenoid With Accelerator

Operated by a 3-way solenoid which operates a large port accelerator pilot, allowing quick response on larger valves. Standard with needle valve opening/closing speed control adjustment. Size ranges 3 - 24".



Components

1. Basic Valve
2. 2-way solenoid
3. 3-way solenoid
4. 3-way auxiliary pilot
5. Ejector
6. Needle valve speed control
7. Y-strainer
8. Isolation ball valve

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SIZING CONSIDERATIONS

Sizing of Series 115 Valves

Our ValveMaster selection and sizing software covers this in detail; however, if you do not have the software, sizing per the following procedure should result in satisfactory operation.

1. Decide whether a globe or angle valve will best fit your installation. Keep in mind that it is always best to install any control valve "bonnet up," particularly in sizes 8" and larger.

2. Begin with a line-sized valve.

   Calculate the pressure drop from the formula:

$$DP = sg\left(Q/C_v\right)^2$$

where: DP = pressure drop, psi
sg = specific gravity of line fluid (water = 1.0)
Q = rated flow of pump, gpm
Cv = Valve coefficient from the table below.

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3. The pressure drop calculated is for a wide-open valve and would be true for an exhaust-to-atmosphere valve (115-3 or 115-4) regardless of flow rate. On the other hand, a valve exhausting to downstream (e.g., 115-2) may not be wide open. Refer to the "wide open at" column of the table. If the flow rate is less than this figure, the pressure drop of the valve can be 2-3 psi higher than the value calculated in Step 2. If the flow rate is higher than the figure given, the valve will be wide open and will have a pressure drop equal to the exhaust-to-atmosphere valve.

4. Check to see that the flow velocity does not exceed 20 ft/sec. If it does, or if the pressure drop is excessive, consider using the next size larger valve.

5. Finally, if an exhaust-to-atmosphere valve is selected, make note of the diaphragm chamber discharge. This quantity of water will be discharged into the atmosphere each time the valve opens or closes. Provision should be made to drain or otherwise dispose of this water.

FLOW CHARACTERISTICS

SIZE	C_v (GLOBE)	C_v (ANGLE)	FLOW @ 20 FT/SEC (GPM)	WIDE OPEN AT: (GPM)	DIAPH. CHAMBER DISCHARGE (GALLONS)
1 ¼	23	30	85	50	0.02
1 ½	27	35	120	50	0.02
2	47	65	210	100	0.05
2 ½	68	87	300	140	0.06
3	120	160	460	220	0.10
4	200	270	800	400	0.2
6	450	550	1800	950	0.6
8	760	1000	3100	1300	1.0
10	1250	1600	4900	2000	2.5
12	1940	2400	7000	2800	4.0
14	2200	--	8450	3300	6.5
16	2850	4000	11,000	4500	9.6
24	6900	--	25,000	9300	28.0

VALVE SELECTION GUIDE

This chart shows only a sample of those most often specified valves. Consult the factory for specific data on the model you selected.

Combination valves can often reduce or eliminate other equipment. Example: If the system requires a reverse flow check function, the check feature can be added as a function of the Solenoid Valve Series 115.

Feature	115-1	115-2	115-26	115-3	115-36	115-4	115-46	Definition
Two-Way Solenoid		X	X					Two-Way solenoid with ejector system
Check Feature			X		X		X	Closes valve on pressure reversal
Three-Way Solenoid	X							Three-Way solenoid operates valve directly
Three-Way Solenoid with Accelerator						X	X	Three-Way solenoid actuates high capacity pilot
Digital Modulation				X	X			Valve positioned via discrete electrical signals to two solenoids

ABOUT YOUR VALVE

OCV Control Valves was founded more than 50 years ago with a vision and commitment to quality and reliability. From modest beginnings, the company has grown to be a global leader just a half century later. In fact, OCV valves can be found in some capacity in nearly every country around the world from fire protection systems in Malaysia to aircraft fueling systems in Africa and from oil refineries in Russia to water supply systems in the USA and Canada. You will also find our valves in irrigation systems in Europe, South America and the Middle East.

The original foundation on which the company was built allows our team of professionals to not only provide the service required to be a worldwide supplier, but more importantly, the opportunity to afford the personal touch necessary to be each of our customers' best partner. Simply stated, we take pride in all that we do.

Committed to the work they do, our employees average over 15 years of service with our company. This wealth of knowledge allows us to provide quality engineering, expert support, exacting control and the know-how to create valves known for their long life.

Being ISO 9001:2000 certified means we are committed to a quality assurance program. Our policy is to supply each customer with consistent quality products and ensure that the process is right every time. Our valves meet and exceed industry standards around the world, including approvals by:

QUALITY SYSTEM REGISTERED TO ISO 9001

NSF

UL

Factory Mutual System

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All valves are not created equal. OCV Control Valves proves that day in and day out.
We stand behind our valves and are ready to serve your needs.

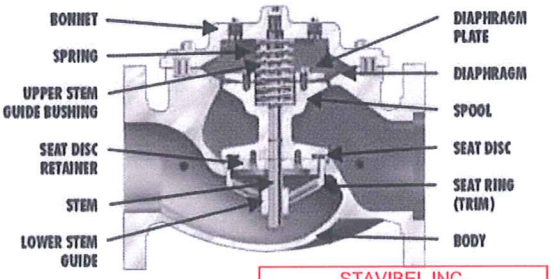
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SPECIFICATIONS

VALVE BODY & BONNET	DUCTILE IRON		CAST STEEL		CAST BRONZE		STAINLESS STEEL	
Material Specifications	ASTM A536 (epoxy coated)		ASTM A216/WCB (epoxy coated)		ASTM B61		ASTM A743/CF8M	
END CONNECTIONS								
Flange Standard (also available in metric)	ANSI B16.42		ANSI B16.5		ANSI B16.24		ANSI B16.5	
Flange Class	150#	300#	150#	300#	150#	300#	150#	300#
Flange Face	Flat	Raised	Raised	Raised	Flat	Flat	Raised	Raised
Maximum Working Pressure	250 psi	640 psi	285 psi	740 psi	225 psi	500 psi	285 psi	740 psi
Screwed Working Pressure: ANSI B1.20.1 (B2.1) 640 psi (Bronze 500 psi)			Grooved End Working Pressure: 300 psi					
INTERNALS								
Stem	STAINLESS STEEL AISI 303			OPTIONAL MONEL				
Spring	STAINLESS STEEL AISI 302							
Spool	DUCTILE IRON ASTM A536 (epoxy coated)				B-61		STN. STL. ASTM A 743/CF8M	
Seat Disc Retainer	DUCTILE IRON ASTM A536 (epoxy coated) 4" & SMALLER VALVES - STAINLESS STEEL				B-61		STAINLESS STEEL	
Diaphragm Plate	DUCTILE IRON ASTM A536 (epoxy coated)				B-61		STAINLESS STEEL	
Seat Ring (Trim)	BRONZE B61 OPTIONAL STAINLESS STEEL ASTM A743/CF8M						STN. STL. ASTM A 743/CF8M	
Upper Stem Bushing	STANDARD BRONZE ASTM B438		VALVE W/ STAINLESS STEEL SEAT RING-TEFLON				TEFLON	
Lower Stem Bushing	SEAT MATERIAL VALVES W/ STAINLESS STEEL SEAT RING-TEFLON						TEFLON	
ELASTOMER PARTS (Rubber)								
Diaphragm/Seat Disc/O-Rings	STANDARD - BUNA-N NYLON REINFORCED				OPTIONAL - VITON®		OPTIONAL - EPDM	
Operating Temperature	-40°F to 180°F				32°F to 400°F		0°F to 300 F°	
COATINGS	WIDE RANGE OF COATING PER YOUR FLUID APPLICATION. COATINGS HANDLE MUNICIPAL POTABLE WATER, SEAWATER, PETROLEUM AND REFINED PRODUCTS.							
ELECTRICAL SOLENOIDS								
Bodies	STANDARD BRASS				STAINLESS STEEL (OPTIONAL)			
Elastomers	STANDARD - BUNA-N NYLON REINFORCED				OPTIONAL - VITON®			
Enclosures	WATER TIGHT, NEMA 1, 3, 4, & 4X - EXPLOSION PROOF - OPTIONAL (NEMA 7 & 9)							
Power	AC, 60HZ - 24, 120, 240, 480 VOLTS		AC, 50HZ - In 110 VOLT MULTIPLES		DC, 6 12, 24, 240 VOLTS			
Operation	ENERGIZE TO OPEN (NORMALLY CLOSED)		DE-ENERGIZE TO OPEN (NORMALLY OPEN)					

CONTROL PILOTS		
Bodies	BRONZE B61	STAINLESS STEEL ASTM A743/CF8M
Internal		AISI 303
CONTROL CIRCUITS		
Tubing		COPPER OR STAINLESS STEEL
Fittings		BRASS OR STAINLESS STEEL

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SALTWATER SERVICE VALVE MATERIALS

Cast Steel Special Coatings --Ni Aluminum Bronze ASTM B148 --Super Duplex Stainless Steel



Globe Flanged Sizes

1.25"	1.5"	2"	2.5"	3"	4"	6"	8"	10"	12"	14"	16"	18"*	20"*	24"*
32mm	40mm	50mm	65mm	80mm	100mm	150mm	200mm	250mm	300mm	350mm	400mm	450mm*	500mm*	600mm*

*CONSULT FACTORY



Angle Flanged Sizes

1.25"	1.5"	2"	2.5"	3"	4"	6"	8"	10"	12"	16"
32mm	40mm	50mm	65mm	80mm	100mm	150mm	200mm	250mm	300mm	400mm



Globe/Angle Screwed Sizes

1.25"	1.5"	2"	2.5"	3"
32mm	40mm	50mm	65mm	80mm



Globe/Angle Grooved Sizes

1.5"	2"	2.5"	3"	4"
32mm	50mm	65mm	80mm	100mm

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DIMENSIONS

U.S. DIMENSIONS - INCHES

DIM	END CONN.	1 1/4-1 1/2	2	2 1/2	3	4	6	8	10	12	14	16	24
A	SCREWED	8 3/4	9 7/8	10 1/2	13	--	--	--	--	--	--	--	--
	GROOVED	8 3/4	9 7/8	10 1/2	13	15 1/4	20	--	--	--	--	--	--
	150# FLGD	8 1/2	9 3/8	10 1/2	12	15	17 3/4	25 3/8	29 3/4	34	39	40 3/8	62
	300# FLGD	8 3/4	9 7/8	11 1/8	12 3/4	15 5/8	18 5/8	26 3/8	31 1/8	35 1/2	40 1/2	42	63 3/4
B	SCREWED	1 7/16	1 11/16	1 7/8	2 1/4	--	--	--	--	--	--	--	--
	GROOVED	1*	1 3/16	1 7/16	1 3/4	2 1/4	3 5/16	--	--	--	--	--	--
	150# FLGD	2 5/16-2 1/2	3	3 1/2	3 3/4	4 1/2	5 1/2	6 3/4	8	9 1/2	10 5/8	11 3/4	16
	300# FLGD	2 5/8-3 1/16	3 1/4	3 3/4	4 1/8	5	6 1/4	7 1/2	8 3/4	10 1/4	11 1/2	12 3/4	18
C ANGLE	SCREWED	4 3/8	4 3/4	6	6 1/2	--	--	--	--	--	--	--	--
	GROOVED	4 3/8*	4 3/4	6	6 1/2	7 5/8	--	--	--	--	--	--	--
	150# FLGD	4 1/4	4 3/4	6	6	7 1/2	10	12 11/16	14 7/8	17	--	20 13/16	--
	300# FLGD	4 3/8	5	6 3/8	6 3/8	7 13/16	10 1/2	13 3/16	15 9/16	17 3/4	--	21 5/8	--
D ANGLE	SCREWED	3 1/8	3 7/8	4	4 1/2	--	--	--	--	--	--	--	--
	GROOVED	3 1/8*	3 7/8	4	4 1/2	5 5/8	--	--	--	--	--	--	--
	150# FLGD	3	3 7/8	4	4	5 1/2	6	8	11 3/8	11	--	15 11/16	--
	300# FLGD	3 1/8	4 1/8	4 3/8	4 3/8	5 13/16	6 1/2	8 1/2	12 1/16	11 3/4	--	16 1/2	--
E	ALL	6	6	7	6 1/2	8	10	11 7/8	15 3/8	17	18	19	27
F	ALL	3 7/8	3 7/8	3 7/8	3 7/8	3 7/8	3 7/8	6 3/8	6 3/8	6 3/8	6 3/8	6 3/8	8
G	ALL	6	6 3/4	7 11/16	8 3/4	11 3/4	14	21	24 1/2	28	31 1/4	34 1/2	52
H	ALL	10	11	11	11	12	13	14	17	18	20	20	28 1/2

*GROOVED END NOT AVAILABLE IN 1 1/4"

METRIC DIMENSIONS - M.M.

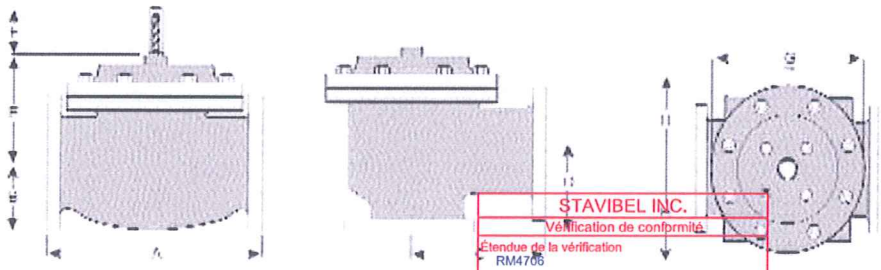
DIM	END CONN.	DN32-DN40	DN50	DN65	DN80	DN100	DN150	DN200	DN250	DN300	DN350	DN400	DN600
A	SCREWED	222	251	267	330	--	--	--	--	--	--	--	--
	GROOVED	222	251	267	330	387	508	--	--	--	--	--	--
	150# FLGD	216	238	267	305	381	451	645	756	864	991	1026	1575
	300# FLGD	222	251	283	324	397	473	670	791	902	1029	1067	1619
B	SCREWED	37	43	48	57	--	--	--	--	--	--	--	--
	GROOVED	25*	30	37	44	57	84	--	--	--	--	--	--
	150# FLGD	59-64	76	89	95	114	140	171	203	241	270	298	406
	300# FLGD	67-78	83	95	105	127	159	191	222	260	292	324	457
C ANGLE	SCREWED	111	121	152	165	--	--	--	--	--	--	--	--
	GROOVED	111*	121	152	165	194	--	--	--	--	--	--	--
	150# FLGD	108	121	152	152	191	254	322	378	432	--	529	--
	300# FLGD	111	127	162	162	198	267	335	395	451	--	549	--
D ANGLE	SCREWED	79	98	102	114	--	--	--	--	--	--	--	--
	GROOVED	79*	98	102	114	143	--	--	--	--	--	--	--
	150# FLGD	76	98	102	102	140	152	203	289	279	--	398	--
	300# FLGD	79	105	111	111	148	165	216	306	298	--	419	--
E	ALL	152	152	178	165	203	254	302	391	432	457	483	686
F	ALL	98	98	98	98	98	98	162	162	162	162	162	203
G	ALL	152	171	195	222	298	356	533	622	711	794	876	1321
H	ALL	254	279	279	279	305	330	356	432	457	508	508	724

*GROOVED END NOT AVAILABLE IN DN32

For maximum efficiency, the OCV control valve should be mounted in a piping system so that the valve bonnet (cover) is in the top position. Other positions are acceptable but may not allow the valve to function to its fullest and safest potential. In particular, please consult the factory before installing 8" and larger valves, or any valves with a limit switch, in positions other than described. Space should be taken into consideration when mounting valves and their pilot systems.

A routine inspection & maintenance program should be established and conducted yearly by a qualified technician. Consult our factory @ **1-888-628-8258** for parts and service.

How to order your valve
When Ordering please provide:
Series Number - Valve size - Globe or Angle - Pressure Class - Screwed, Flanged, Grooved - Trim Material - Adjustment Range - Pilot Options - Special needs / or installation requirements.



Represented by:

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installation, operating, and maintenance instructions

digital preset valve

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model 115-3

revised 6-12-00

GENERAL DESCRIPTION

The OCV Model 115-3 is designed to open, close and control flow rate based on electrical signals received from the preset controller (Smith Accu-load or similar device.)

The 115-3 consists of the following components:

1. **Model 65 Basic Control Valve,** a hydraulically-operated, diaphragm-actuated, globe valve which closes with an elastomer-on-metal seal.
2. **Model 450 Two-Way, Normally-Open Solenoid Pilot,** which acts to close the valve.
3. **Model 451 Two-Way , Normally-Closed Solenoid Pilot,** which acts to open the valve.
4. **Two Model 141-2 Needle Valves.** Installed in series with both solenoid pilots. Acts as opening and closing speed controls.
5. **Model 123 Inline Strainer,** which serves to protect the pilot system from solid contaminants in the line fluid.

At user option, the Model 115-3 may also be equipped with:

1. Two **Model 141-4 Ball Valves.** Serve to isolate all or various parts of the pilot system for maintenance or troubleshooting.
2. **Model 155 Visual Indicator.**
3. **Model 150 Limit Switch Assembly.** For remote indication of valve position.

THEORY OF OPERATION

First, it is important to understand the basic principles of operation of the diaphragm-actuated control valve. The main valve contains two "chambers", separated and sealed from each other by the flexible diaphragm. The lower chamber contains the flow passages of the valve. The forces that exist in this chamber are (1) valve inlet pressure, acting under the diaphragm, and (2) the difference between valve inlet and outlet pressures, acting across the valve seat. The upper chamber, hereinafter called the diaphragm chamber, is connected to the pilot system, which can pressurize the chamber to the inlet pressure, to outlet pressure or anywhere in between. It is the balance of forces between the two chambers which determines what the valve does.

If the pilot system applies full inlet pressure to the diaphragm chamber, there is no force acting across the diaphragm, leaving only the differential across the seat, which fully closes the valve.

If the pilot system reduces the pressure on the diaphragm chamber to outlet pressure, the same differential will exist across the diaphragm as exists across the seat. However, because the effective diaphragm area is greater than the seat area, the valve will be driven open.

Finally, if the pilot system applies an intermediate pressure (between inlet and outlet) to the diaphragm chamber, the valve will hold a position between full open and full closed. With this in mind, refer to the schematic diagram, and let's see how the valve works to control pressure.

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Assume that it is desired to open the valve or increase the flow rate. The preset controller energizes both solenoids, releasing pressure from the diaphragm chamber to the outlet side. As described above, the main valve opens further, increasing the flow. Once the controller is "satisfied", it deenergizes solenoid (3) only. This pilot closes, the diaphragm chamber is hydraulically "locked", and the valve maintains its new position.

Conversely, assume that it is desired to close the valve or decrease the flow rate. The controller deenergizes solenoid pilot (2), opening this pilot. This increases pressure on the diaphragm chamber from the inlet side. As described above, the main valve closes further, decreasing the flow rate. Once the controller is "satisfied", it again energizes and closes solenoid pilot (2). The diaphragm chamber is again hydraulically "locked:, and the valve maintains its new position.

INSTALLATION

The 115-3 is furnished fully factory assembled and ready for installation at the appropriate point in the system. The user is referred to the Series 65 Basic Valve section of this manual for full installation details.

Following mechanical installation, the two solenoid pilots are wired to the controller.

STARTUP

1. Prior to starting the pump, make sure any isolation valves in the main line are open, i.e., that flow can be allowed.
2. Start pump. The main valve should close.
3. Carefully loosen a pipe plug in the main valve bonnet until fluid appears around the threads. When only clear fluid (no air) is discharging, retighten the plug.
4. Energize solenoid 2 and 3. The valve should open. With the valve partially open, deenergize solenoid 3. The valve should hold its position.
5. Deenergize solenoid 2. The valve should close. With the valve partially open, energize solenoid 2. The valve should hold its position.
6. Again, deenergize solenoid 2. The valve should close fully.
7. The valve may now be placed in normal operation.

MAINTENANCE

Due to the simplicity of the 115-3 and its pilot system, required maintenance is minimal.

1. Periodically check for leaks at fittings and around flanges and connections. Tighten as required.
2. Periodically check that all electrical connections are secure.
3. It is recommended that the main valve and pilot diaphragms and seats be checked for signs of wear or deterioration after the first year of operation. Unless service conditions are unusually severe, a diaphragm/seat life of 3-5 years can be expected.

TROUBLESHOOTING

In the event of malfunction of the 115-3, the following guide should enable the technician to isolate the cause of the problem.

A. MAIN VALVE FAILS TO OPEN

1. Make sure main line isolation valves are open.
2. Check for voltage at coil of solenoid 3.
   (a) If no voltage is present, the problem is in the controller.
   (b) If proper voltage is present, proceed to Step 3.
3. Check for voltage at coil of solenoid 2.
   (a) If no voltage is present, problem is in the controller.
   (b) If voltage is present, proceed to Step 4.
4. Coil of solenoid 3 burned out or stuck closed. See SOLENOID VALVE section of this manual.
5. Coil of solenoid 2 burned out, or seat is damaged. See SOLENOID VALVE section of this manual.
6. Main valve stem binding or diaphragm ruptured. See SERIES 65 of this manual.

B. MAIN VALVE FAILS TO CLOSE

1. Check for voltage at coil of solenoid 3.
   (a) If voltage is present, problem is in the controller.
   (b) If no voltage is present, proceed to Step 2.
2. Check for voltage at coil of solenoid 2.
   (a) If voltage is present, problem is in the controller.
   (b) If no voltage is present, proceed to Step 3.

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3. Solenoid Pilot 3: Stuck open or seat damaged. See SOLENOID VALVE section of this manual.
4. Solenoid Pilot 2: Stuck closed. See SOLENOID VALVE section of this manual.
5. Clogged strainer. Clean as required.
6. Main valve stem binding or object in valve. See SERIES 65 section of this manual.

C. MAIN VALVE OPENS AND CLOSES BUT WILL NOT MAINTAIN "HOLD" POSITION.

1. If valve drifts closed, refer to Steps 3 and 5 under MAIN VALVE FAILS TO OPEN.
2. If valve drifts open, refer to Step 3 under MAIN VALVE FAILS TO CLOSE.

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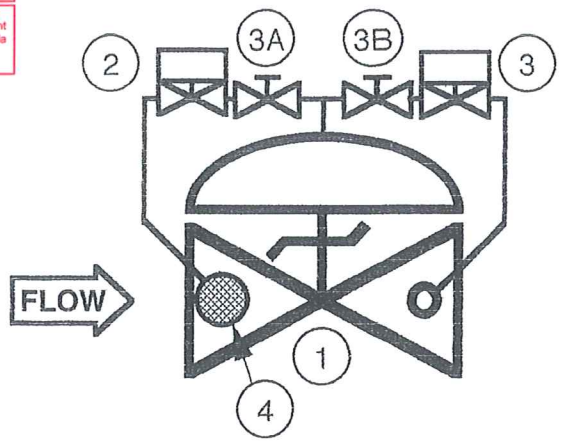
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SOLENOID CONTROL VALVE
DIGITAL THROTTLING TYPE
(Fuel Service)



OPERATION

SOLENOID 2	SOLENOID 3	MAIN VALVE 1
ENERGIZED	ENERGIZED	OPENS
ENERGIZED	DE-ENERGIZED	HOLDS
DE-ENERGIZED	DE-ENERGIZED	CLOSES

ITEM	PART NO.	QTY	DESCRIPTION
1	65	1	BASIC VALVE ASSEMBLY (Fail Closed)
2	450	1	TWO-WAY SOLENOID PILOT, N.O.
3	451	1	TWO-WAY SOLENOID PILOT, N.C.
4	123	1	INLINE STRAINER
5	--	1	J-BOX (Optional - Not Shown)

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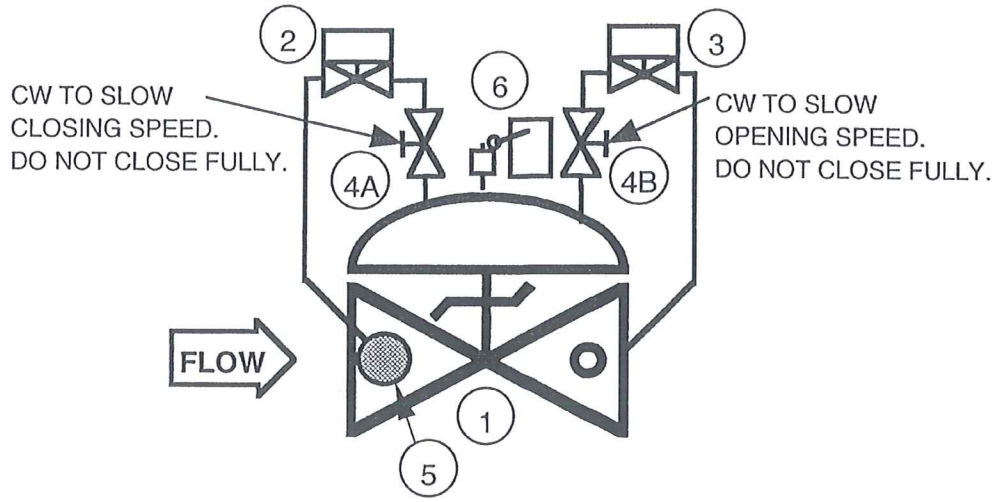
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SOLENOID CONTROL VALVE
DIGITAL THROTTLING TYPE
WITH LIMIT SWITCH
(Fuel Service)



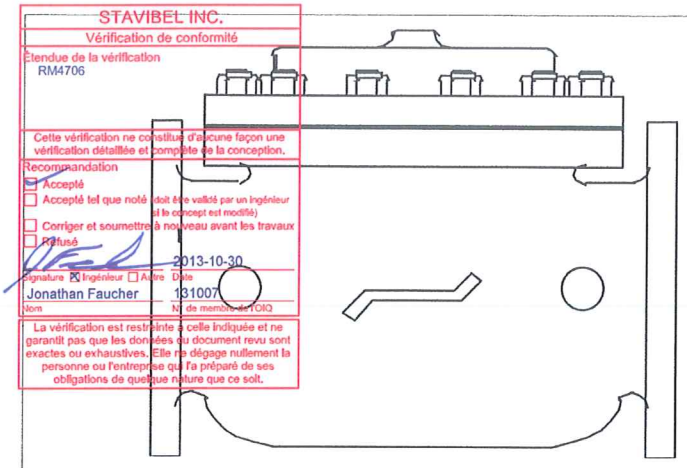
OPERATION:

SOL. 2	SOL. 3	VALVE
ENERGIZED	ENERGIZED	OPENS
DEENERGIZED	DEENERGIZED	CLOSES
ENERGIZED	DEENERGIZED	HOLDS POS.

ITEM	PART NO.	QTY	DESCRIPTION
1	65	1	BASIC VALVE ASSEMBLY (Fail Closed)
2	450	1	TWO-WAY SOLENOID PILOT, N.O.
3	451	1	TWO-WAY SOLENOID PILOT, N.C.
4	141-2	2	NEEDLE VALVE
5	123	1	INLINE STRAINER
6	150	1	LIMIT SWITCH ASSEMBLY (OPTIONAL)

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installation, operating, and maintenance instructions

series 65

basic control valve

GENERAL DESCRIPTION

The OCV Series 65 is a hydraulically-operated, diaphragm-actuated valve. It is available in either a globe (Model 65) or angle (Model 65A) configuration. The diaphragm is nylon-fabric bonded with synthetic rubber and forms a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. An elastomeric seat disc forms a tight seal with the valve seat when pressure is applied above the diaphragm.

FUNCTIONAL DESCRIPTION

Because the Series 65 is a hydraulically operated valve, it requires a minimum line pressure of approximately 5 psig in order to function. The valve functions on a simple principle of pressure differential. The line pressure at the inlet of the valve is bypassed through the pilot control piping to the diaphragm chamber of the valve. This pressure, together with the valve spring, works against the pressure under the valve seat. Because the effective area of the diaphragm is greater than that of the seat, the valve is held tightly closed. As the controlling pilot(s) allow the pressure to bleed off the diaphragm chamber, the two opposing pressures begin to balance and the valve will begin to open. The valve can be used to perform a simple on-off function, or with the proper pilot system, a modulating, or regulating function.

In cases where the line fluid is unusually dirty, or is otherwise unsuitable for operating the valve, an independent operating pressure source may be employed. The pressure available from such a source must be equal to, or greater than, line pressure.

INSTALLATION

In order to insure safe, accurate and efficient operation of the OCV control valve, the following list of checkpoints and procedures should be followed when installing the valve.

1. Make a careful visual inspection of the valve to insure that there has been no damage to the external piping, fittings or controls. Check that all fittings are tight.
2. Thoroughly flush all interconnecting piping of chips, scale and foreign matter prior to mounting the valve.
3. Install the valve in the line according to the flow arrow on the inlet flange. The arrow should point downstream.
4. Allow sufficient room around the valve for ease of adjustment and maintenance service.

In addition, it is highly recommended that:

1. Isolation valves (eg., gate or butterfly) be installed on the inlet and discharge sides of the valve to facilitate isolating the valve for maintenance.
2. Pressure gauges be installed at the inlet and outlet sides of the valve to provide monitoring of the valve during initial start-up and during operation. The body side ports, if unused by the pilot system, provide a convenient connection for the gauges.
3. All valves larger than 6" be installed horizontally, i.e., with the bonnet pointed up, for ease of adjustment and maintenance servicing.

MAINTENANCE

The OCV control valve requires no lubrication and a minimum of maintenance. However, a periodic inspection should be established to determine how the fluid being handled is affecting the efficiency of the valve. In a water system, for example, the fluid velocity as well as the substances occurring in natural waters, such as dissolved minerals and suspended particles, vary in every installation. The effect of these actions or substances must be determined by inspection. It is recommended that an annual inspection, which includes ex-

amination of the valve interior, be conducted. Particular attention should be paid to the elastomeric parts, i.e., the diaphragm and seat disc. Any obviously worn parts should be replaced.

REPAIR PROCEDURES

In the event of malfunction of the OCV control valve, troubleshooting should be conducted according to the procedures outlined for the specific model of valve. Then, if those steps indicate a problem with the main valve, this section will outline the procedures necessary to correct the problem.

Problems with the main valve can be classed in three basic categories:

1. VALVE FAILS TO OPEN
   a. Diaphragm damaged* - See Procedure A
   b. Stem binding - See Procedure B
2. VALVE FAILS TO CLOSE
   a. Diaphragm damaged* - See Procedure A
   b. Stem binding - See Procedure B
   c. Object lodged in valve - See Procedure B
3. VALVE OPENS AND CLOSES BUT LEAKS WHEN CLOSED
   a. Seat disc damaged - See Procedure C
   b. Seat ring damaged - See Procedure D

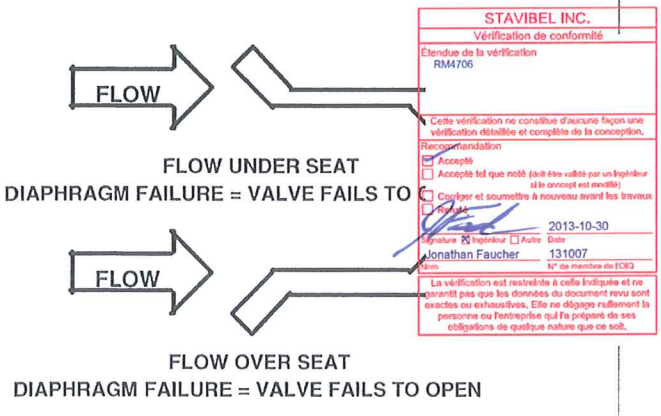
**A diaphragm failure can prevent the valve from either opening or closing, depending on the flow direction. Most water service valves flow "under the seat", in which case a diaphragm failure will keep the valve from closing. On the other hand, most fuel service valves flow "over the seat", in which case a diaphragm failure will keep the valve from opening. To determine which you have, examine the bridge mark cast into the side of the valve body, then compare it with the figures below.*

PROCEDURE A : DIAPHRAGM REPLACEMENT

1. Isolate the valve from the system by closing upstream amd downstream block valves.
2. Loosen one of the tubing connections on the bonnet. Allow any residual pressure to bleed off.
3. Remove all tubing connected at the bonnet.
4. Remove the bonnet nuts.
5. Remove the bonnet. If the bonnet sticks in place, it may be loosened by rapping sharply around its edge with a *rubber-headed* mallet. *NOTE: 8" and larger valves are equipped with eye bolts through which a chain can be fastened to aid in lifting the bonnet.*
6. Remove the spring.
7. Remove the diaphragm plate capscrews and the diaphragm plate.
8. Remove the old diaphragm.
9. Making sure the dowel pin holes are in the proper location, place the new diaphragm over the studs and press down until it is flat against the body and spool.
10. Replace the diaphragm plate and the diaphragm plate capscrews.
11. Tighten all diaphragm plate capscrews snugly.
12. Replace the spring.
13. Replace the bonnet and reinstall the bonnet nuts.
14. Tighten the bonnet nuts snugly using a criss-cross tightening pattern.
15. Reinstall the control tubing.
16. Reopen the upstream and downstream block valves.
17. Before placing the valve back in service, perform the air bleed procedure described in the first section of this manual.

PROCEDURE B: CORRECTION OF BINDING STEM

1. Perform Steps 1 thru 6 of Procedure A, above.
2. Remove the spool assembly from the valve. *NOTE: On smaller valves, this can be accomplished simply by grasping the stem and pulling upward. Valves 6" and larger have the top of the stem threaded to accept an eyebolt to aid in lifting the spool out of the body. 6" thru 12" valves are threaded 3/8-16. 14" and 16" valves are threaded 5/8-11.*
3. Carefully examine both ends of the stem for deep scratches, scoring or buildup of mineral deposits.



Polish the stem if necessary using a fine grade of emery cloth.

4. Similarly, examine and polish the upper bushing (in the bonnet) and the lower guide (in the seat ring).
5. Reinstall the spool assembly.
6. Reassemble the valve, following Steps 12 thru 17 in Procedure A.

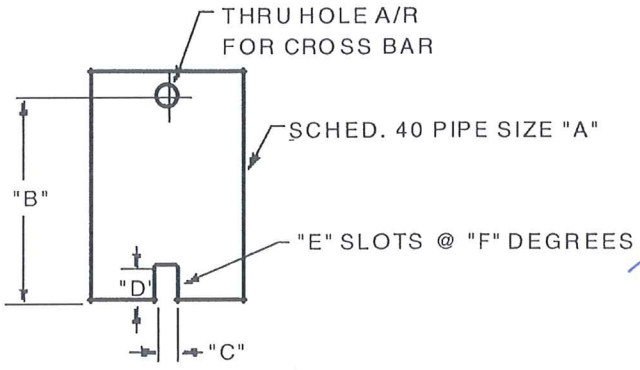
PROCEDURE C: SEAT DISC REPLACEMENT

1. Perform Steps 1 and 2 of Procedure B, above.
2. With the spool assembly removed from the body, remove the seat retainer screws.
3. Slide the seat retainer off the lower end of the stem.
4. Remove the seat disc from its groove in the spool. *NOTE: The seat disc may fit quite tightly in the groove. If necessary, it may be pried out using a thin-bladed screwdriver or similar tool.*
5. Install the new seat disc in the groove.
6. Reinstall the seat retainer and tighten the seat retainer screws.
7. Reassemble the valve, following Steps 5 and 6 of Procedure B.

PROCEDURE D: SEAT RING REPLACEMENT

NOTE: It is rare for a seat ring to require replacement. Minor nicks and scratches in the seating surface can usually be smoothed out with emery cloth.

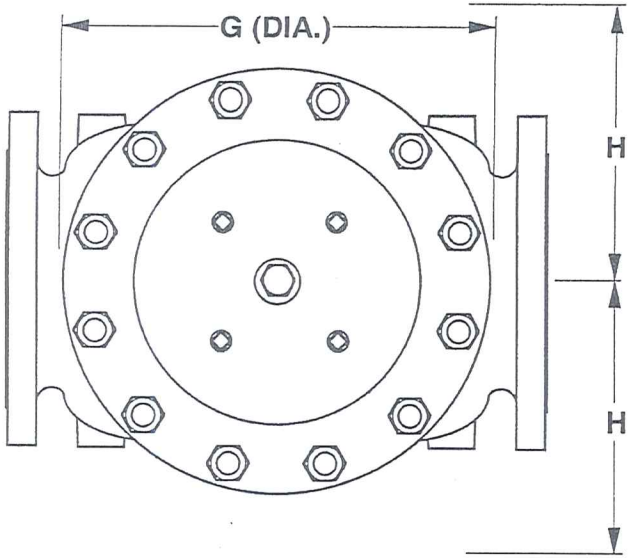
1. Perform Steps 1 and 2 of Procedure B, above.
2. If you are working on a 4" or smaller valve, follow Steps 3 thru 9, below.
3. If you are working on a 6" or larger valve, follow Steps 10 thru 16, below.
4. Seat rings in valves 4" and smaller are threaded into the valve body. To remove, you will need a special seat ring tool. You may fabricate one using standard pipe as shown in the sketch below, or one may be purchased from OCV.
5. Using the seat ring tool, unthread the seat ring from the body.
6. Remove the old o-ring from the counterbore in the body.
7. Install the new o-ring in the counterbore.
8. Using the seat ring tool, install the new seat ring.
9. Reassemble the valve, following Steps 5 & 6 of Procedure B.
10. Seat rings in valves 6" and larger are bolted into the body with socket head capscrews. In addition you will note that the seat ring is equipped with additional threaded holes that may be used for "jacking" the seat ring out of the body.
11. Remove the socket head capscrews.
12. Remove the old seat ring from the body by temporarily installing two or more of the capscrews in the "jacking" holes.
13. Install a new o-ring in the groove of the new seat ring. Lubricate the o-ring and outer seat ring wall with Vaseline® or similar lubricant.
14. Install the new seat ring in the body, making sure that the capscrew holes line up.
15. Replace and tighten all the capscrews.
16. Reassemble the valve, following Steps 5 and 6 of Procedure B.



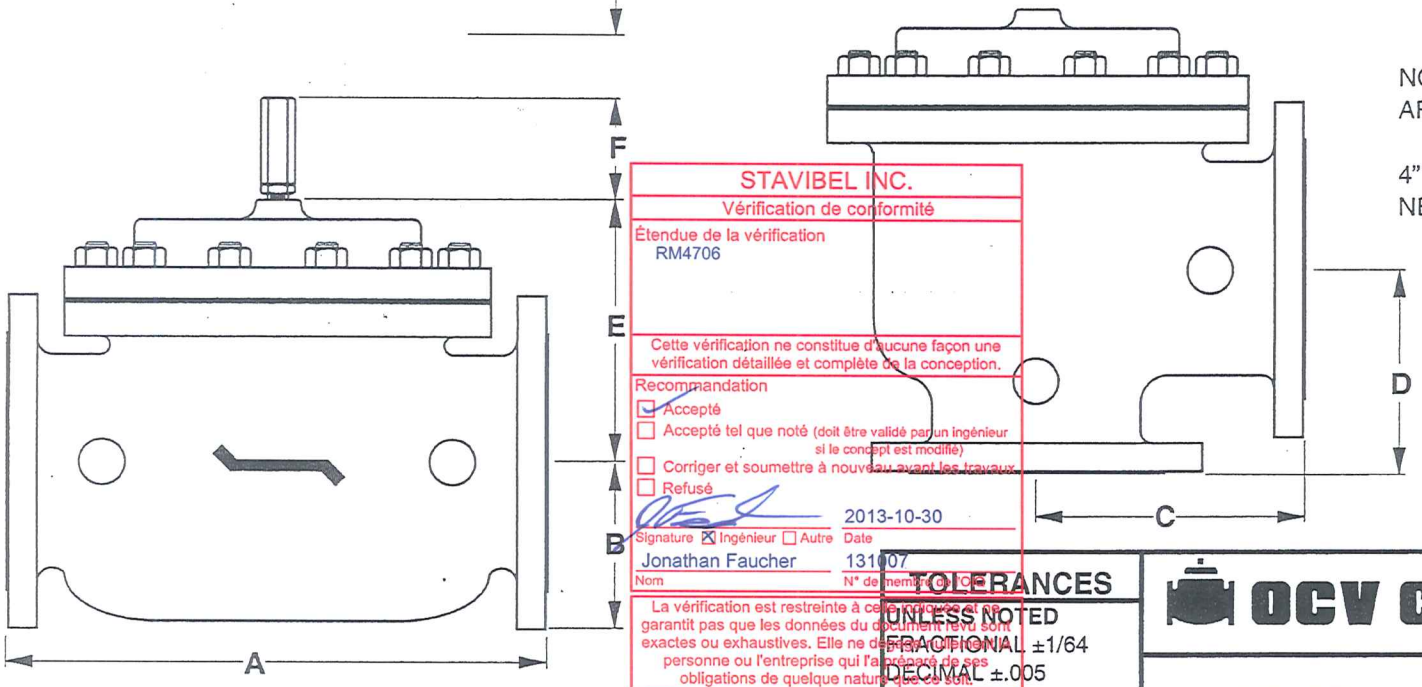
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VALVE SIZE	"A" PIPE SIZE	"B" MIN. LENGTH	"C" SLOT WIDTH	"D" SLOT DEPTH	"E" NO. OF SLOTS	"F" SLOT SPACING
1-1/4"	3/4"	6"	3/8"	3/8"	2	180°
1-1/2"	3/4"	6"	3/8"	3/8"	2	180°
2"	1-1/2"	7"	3/8"	3/8"	2	180°
2-1/2"	2"	8"	1/2"	1/2"	3	120°
3"	2-1/2"	9"	5/8"	5/8"	2	180°
4"	3"	10"	5/8"	5/8"	2	180°

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DIM	ANSI CLASS	VALVE SIZE 1 1/4	1 1/2	2	2 1/2	3	4	6	8	10	12	14	16	24
A	S.E	8.75	8.75	9.88	10.50	13.00	–	–	–	–	–	–	–	–
	150	8.50	8.50	9.38	10.50	12.00	15.00	17.75	25.38	29.75	34.00	39.00	40.38	62.00
	300	8.75	8.75	9.88	11.12	12.75	15.62	18.62	26.38	31.12	35.50	40.50	42.00	63.75
B	SE	1.44	1.44	1.69	1.88	2.25	–	–	–	–	–	–	–	–
	150	2.31	2.50	3.00	3.50	3.75	4.50	5.50	6.75	8.00	9.50	10.62	11.75	16.00
	300	2.62	3.06	3.25	3.75	4.12	5.00	6.25	7.50	8.75	10.25	11.50	12.75	18.00
C	SE	4.38	4.38	4.75	6.00	6.50	–	–	–	–	–	–	–	–
	150	4.25	4.25	4.75	6.00	6.00	7.50	10.00	12.69	14.88	17.00	–	20.81	–
	300	4 3/8	4.38	5.00	6.38	6.38	7.81	10.50	13.19	15.56	17.75	–	21.62	–
D	SE	3.12	3.12	3.88	4.00	4.50	–	–	–	–	–	–	–	–
	150	3.00	3.00	3.88	4.00	4.00	5.50	6.00	8.00	11.38	11.00	–	15.69	–
	300	3.25	3.25	4.12	4.38	4.38	5.81	6.50	8.50	12.06	11.75	–	16.50	–
E	ALL	6.00	6.00	6.00	7.00	6.50	7.92	10.00	11.88	15.38	17.00	18.00	19.00	27.00
F	ALL	3.88	3.88	3.88	3.88	3.88	3.88	3.88	6.38	6.38	6.38	6.38	6.38	8.00
G	ALL	6.00	6.00	6.75	7.69	8.75	11.75	14.00	21.00	24.50	28.00	31.25	34.50	52.00
H	ALL	10.00	10.00	11.00	11.00	11.00	12.00	13.00	14.00	17.00	18.00	20.00	20.00	28.50



NOTE: 3" VALVE DIMENSIONS ARE FOR NEW MODEL 3100

4" VALVE DIMENSIONS ARE FOR NEW MODEL 4400

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REV. A SDJ 6-6-02
REV. B SDJ 2-3-02

TOLERANCES
UNLESS NOTED
FRACTIONAL ±1/64
DECIMAL ±.005
MACH. FINISH 125
ANGULAR ±1/2°

DRAWN BY	DATE
SDJ	10-6-97
CHKD. BY	DATE

OCV Control Valves
TULSA, OKLAHOMA U.S.A.

GENERAL VALVE DIMENSIONS

SIZE	DRAWING NUMBER	REV.
A	65D	B

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Installation & Maintenance Instructions

2-WAY DIRECT-ACTING SOLENOID VALVES
NORMALLY OPEN OR NORMALLY CLOSED OPERATION
BRASS OR STAINLESS STEEL CONSTRUCTION - 1/8", 1/4", OR 3/8" NPT

SERIES
8262
8263

Form No. V5256R7

IMPORTANT: See separate solenoid installation and maintenance instructions for information on: Wiring, Solenoid Temperature, Causes of Improper Operation, and Coil or Solenoid Replacement.

DESCRIPTION

Series 8262 and 8263 valves are 2-way direct-acting general service solenoid valves. Valves bodies are of rugged brass or stainless steel. Series 8262 or 8263 valves may be provided with a general purpose or explosionproof solenoid enclosure.

Series 8262 and 8263 valves with suffix "P" in the catalog number are designed for dry inert gas and non-lubricated air service.

OPERATION

Normally Open: Valve is open when solenoid is de-energized; closed when is energized.

Normally Closed: Valve is closed when solenoid is de-energized; open when energized.

IMPORTANT: No Minimum operating pressure required.

Manual Operator (Optional)

Manual operator allows manual operation when desired or during an electrical power outage. Two types of manual operators are available - push type (Suffix MO) and screw type (Suffix MS). To operate valve manually with push type operator, push stem at base of valve body as far upward as possible. Valve will now be in the same position as when the solenoid is energized. Removing pressure from stem will release manual operator to original position. To operate valve with a screw type manual operator, rotate manual operator stem at base of valve body clockwise until it hits a stop. Valve will now be in the same position as when the solenoid is energized. Rotate manual operator stem fully counterclockwise before operating valve electrically.

Flow Metering Devices

Valves with suffix "M" in catalog number are provided with a metering device for flow control. Turn stem to right to reduce flow; left to increase flow.

INSTALLATION

Check nameplate for correct catalog number, pressure, voltage, frequency, and service. Never apply incompatible fluids or exceed pressure rating of the valve. Installation and valve maintenance to be performed by qualified personnel.

Note: Inlet port will either be marked "I" or "IN". Outlet port will be marked "2".

Future Service Considerations.

Provision should be made for performing seat leakage, external leakage, and operational tests on the valve with a nonhazardous,noncombustible fluid after disassembly and reassembly.

Temperature Limitations

For maximum valve ambient and fluid temperatures, refer to charts below. Check catalog number, coil prefix, suffix, and watt rating on nameplate to determine the maximum temperatures.

Wattage	Catalog Number Coil Prefix	Coil Class	Max. Ambient Temp. °F	Max. Fluid Temp. °F
6, 10.5, 12.4	none, DA or S	A	77	180
6,10.5 12.4	DF, FT or SF	F	125	180
6,10.5, 12.4	HT	H	140	180
9,10.7	none, DP or SP	F	77	180
9.7	none, FT or HT	A, F or H	77	120
11.2	none, FT or HT	A, F or H	77	150
16.7	none, DP or SP	F	77	200
17.1	none, KP SP or SD	F	125	180
17.1	HB, KB SS or SV	H	140	180

Catalog Nos.8262B200 and 8262 C200 AC construction only and Catalog Nos.8262B214 and 8262 D200 AC and DC construction are limited to 140°F fluid temperature.
Valves with Suffix V or W that are designed for AC service and normally closed operation are for use with No. 2 and 4 fuel oil service. These valves have the same maximum temperatures per the above table except Suffix W valves are limited to a maximum fluid temperature of 140°F.

Listed below are valves with Suffix V in the catalog number that are acceptable for higher temperatures.

Catalog Number Coil Prefix	Max. Ambient Temp.°F	Max. Fluid Temp.°F
FT8262, HB8262 FT8263, HB8263 8262G, 8263G	125	250*
HT or HB 8262G HT or HB 8263G	140	250

*The only exception is the 8262G and 8263G series (Class F coil) at 50 Hertz rated 11.1 and 17.1 watts are limited to 210°F fluid temperature.

Positioning

This valve is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub-assembly area. Valves with suffix "P" in the catalog number must be mounted with the solenoid vertical and upright.

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Mounting
Refer to Figure 2 for mounting dimensions.

Piping
Connect piping or tubing to valve according to markings on valve body. Inlet port will either be marked "1" or "IN". Outlet port will be marked "2". Wipe the pipe threads clean of cutting oils. Apply pipe compound sparingly to male pipe threads only. If applied to valve threads, the compound may enter the valve and cause operational difficulty. Avoid pipe strain by properly supporting and aligning piping. When tightening the pipe, do not use valve or solenoid as a lever. Locate wrenches applied to valve body or piping as close as possible to connection point.

IMPORTANT: To protect the solenoid valve, install a strainer or filter suitable for the service involved, in the inlet side as close to the valve as possible. Clean periodically depending on service conditions. See ASCO Series 8600, 8601 and 8602 for strainers.

MAINTENANCE

⚠ WARNING: To prevent the possibility of personal injury or property damage, turn off electrical power, depressurize valve, and vent fluid to a safe area before servicing the valve.

NOTE: It is not necessary to remove the valve from the pipeline for repairs.

Cleaning
All solenoid valves should be cleaned periodically. The time between cleanings will vary depending on the medium and service conditions. In general, if the voltage to the coil is correct,sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. In the extreme case, faulty valve operation will occur and the valve may fail to open or close. Clean valve strainer or filter when cleaning the valve.

Preventive Maintenance
1. Keep the medium flowing through the valve as free from dirt and foreign material as possible.
2. While in service, the valve should be operated at least once a month to insure proper opening and closing.
3. Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Causes of Improper Operation
1. Incorrect Pressure: Check valve pressure. Pressure to valve must be within range specified on nameplate.
2. Excessive Leakage: Disassemble valve (see Maintenance) and clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Valve Disassembly

⚠ WARNING: To prevent the possibility of personal injury or property damage, turn off electrical power, depressurize valve, and vent fluid to a safe area before servicing the valve.

1. Disassemble valve using exploded views for identification of parts.
2. Remove solenoid, see separate instructions.
3. Unscrew solenoid base sub-assembly or valve bonnet with special wrench adapter supplied in ASCO Rebuild Kit. For wrench adapter only, order No.K218-948. Remove core assembly, core spring, and solenoid base gasket from valve body. For normal maintenance on Series 8263 valves it is not necessary to remove valve seat. See Figure 1. for metering or manual operator constructions.
4. For normally open construction (Figure 3) remove end cap, or manual operator, (not shown) end cap gasket, disc holder spring, and disc holder assembly.
5. All parts are now accessible to clean or replace. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Valve Reassembly
1. Use exploded views for identification, orientation and placement of parts.
2. Lubricate all gaskets with DOW CORNING ® 111 Compound lubricant or an equivalent high-grade silicone grease.
3. For normally open construction (Figure 3), install disc holder assembly, disc holder spring, end cap gasket and end cap or manual operator. For valves with 1/8" NPT, torque end cap or manual operator to 90 ± 10 in-lbs (10,2 ± 1,1 Nm). For all other valves torque end cap or manual operator to 175 ± 25 in-lbs (19,8 ± 2,8 Nm).
4. For Series 8263 apply a small amount of LOCTITE ® PST ® pipe sealant to threads of valve seat (if removed). Follow manufacturers instructions for application of pipe sealant. Then install valve seat and torque to 75 ± 10 in-lbs (8,5 ± 1,1 Nm).
5. Replace solenoid base gasket, core assembly with core spring and solenoid base sub-assembly or plugnut/core tube sub-assembly and valve bonnet. Note: For core assemblies with internal type core springs, install wide end of core spring in core assembly first, closed end of core spring protrudes from top of core assembly.
6. For 1/8" NPT valve constructions, Torque valve bonnet to 90 ± 10 in-lbs (10,2 ± 1,1 Nm). Torque solenoid base sub-assembly to 175 ± 25 in-lbs (19,8 ± 2,8 Nm).
7. Install solenoid, see separate solenoid instructions. Then make electrical hookup to solenoid.

⚠ WARNING: To prevent the possibility of personal injury or property damage, check valve for proper operation before returning to service. Also perform internal seat and external leakage tests with a nonhazardous, noncombustible fluid.

8. Restore line pressure and electrical power supply to valve.
9. After maintenance is completed, operate the valve a few times to be sure of proper operation. A metallic "click" signifies the solenoid is operating.

ORDERING INFORMATION FOR ASCO REBUILD KITS

Parts marked with an asterisk (*) in the exploded view are supplied in Rebuild Kits.

• When Ordering Rebuild Kits for ASCO valves, order the Rebuild Kit number stamped on the valve nameplate. +

+ If the number of the kit is not visible, order by indicating the number of kits required, and the Catalog Number and Serial Number of the valve(s) for which they are intended.

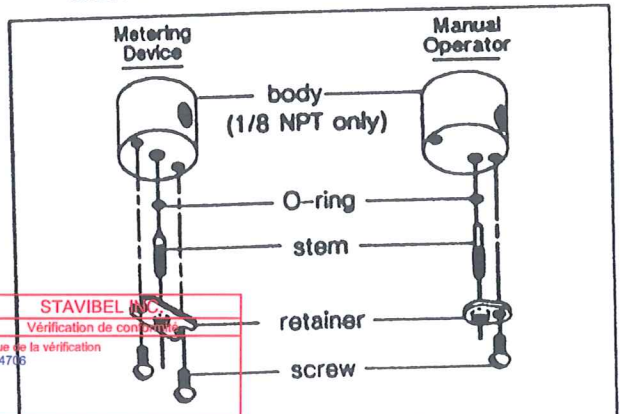


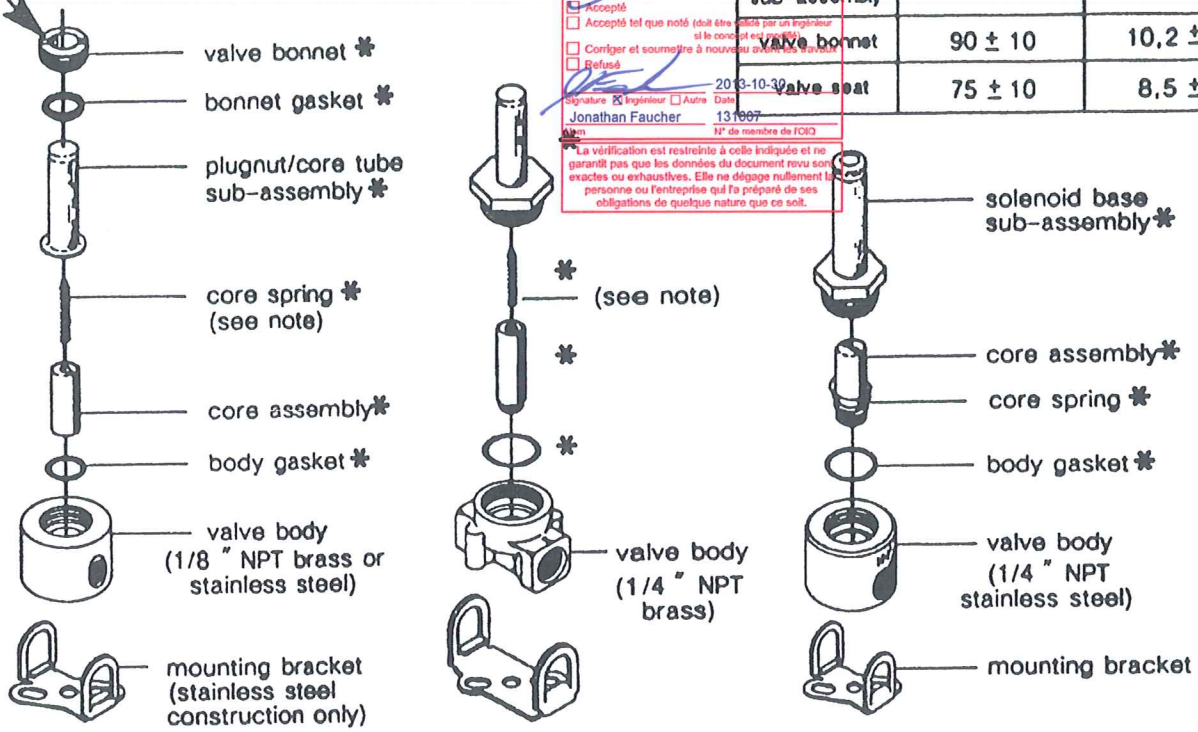
Figure 1. Metering and Manual Operator Constructions

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*Bonnet wrench supplied in ASCO Rebuild Kits. For bonnet wrench only order No. K218-948.

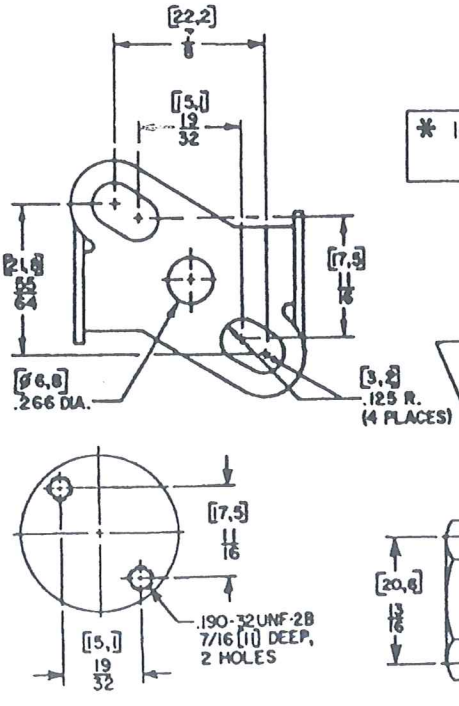
Torque Chart		
Part Name	Torque value Inch-Pounds	Torque value Newton-Meters
solenoid base sub-assembly	175 ± 25	19,8 ± 2,8
valve bonnet	90 ± 10	10,2 ± 1,1
valve seat	75 ± 10	8,5 ± 1,1

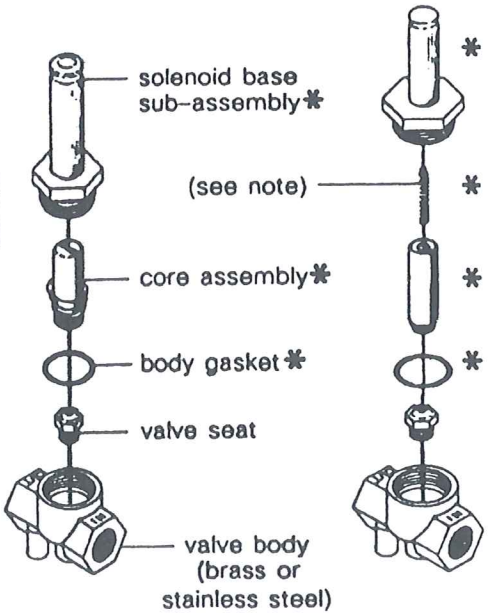


Series 8262

* Indicates Parts Supplied in ASCO Rebuild Kits.

[m m] — INCHES





Series 8263

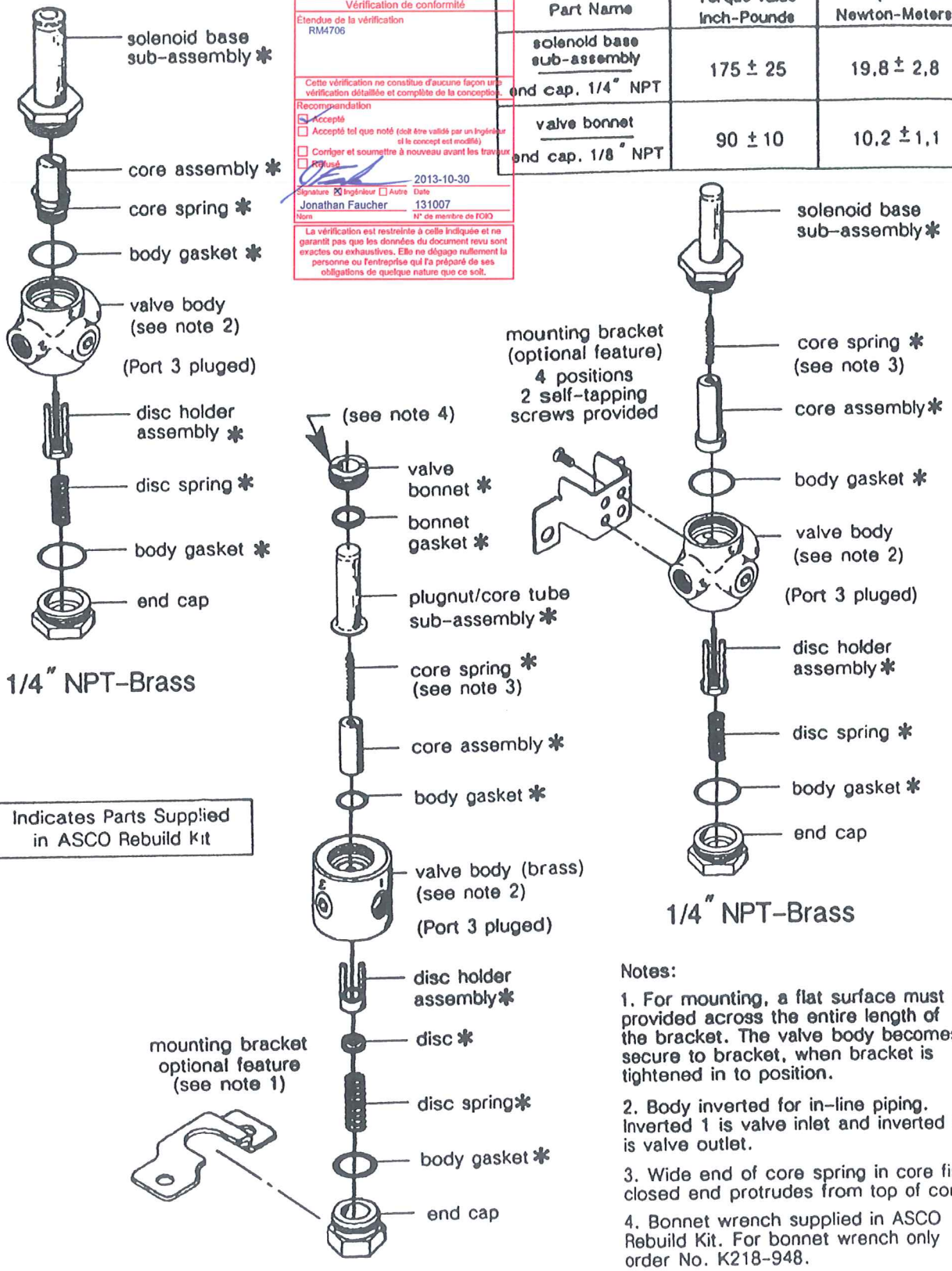
Note:
Wide end of core spring in core first, closed end protrudes from top of core.

Figure 2. Series 8262 and 8263, Normally Closed Construction

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Torque Chart

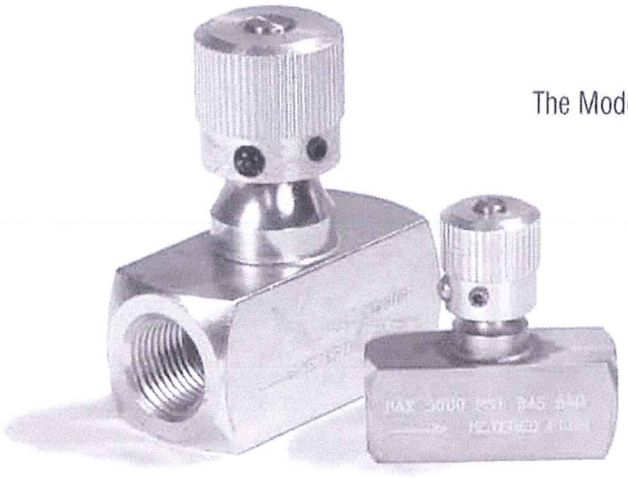
Part Name	Torque value Inch-Pounds	Torque value Newton-Meters
solenoid base sub-assembly / end cap, 1/4" NPT	175 ± 25	19,8 ± 2,8
valve bonnet / end cap, 1/8" NPT	90 ± 10	10,2 ± 1,1



Notes:

1. For mounting, a flat surface must be provided across the entire length of the bracket. The valve body becomes secure to bracket, when bracket is tightened in to position.
2. Body inverted for in-line piping. Inverted 1 is valve inlet and inverted 2 is valve outlet.
3. Wide end of core spring in core first, closed end protrudes from top of core.
4. Bonnet wrench supplied in ASCO Rebuild Kit. For bonnet wrench only order No. K218-948.

Figure 3. Series 8262, Normally Open Construction

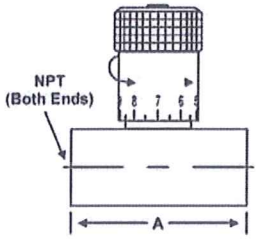


Needle Valves shown
Sizes: 3/4" & 1/4"

DESCRIPTION

The Model 141-2 Needle Valve is an adjustable restriction device installed in the control circuit tubing. The setting of the needle valve meters the flow into and out of the main valve diaphragm chamber, thus controlling the response speed of the main valve. Depending on the application, the needle valve may be used as a closing speed control, opening speed control, or both simultaneously.

MODEL 141-2 MATRIX



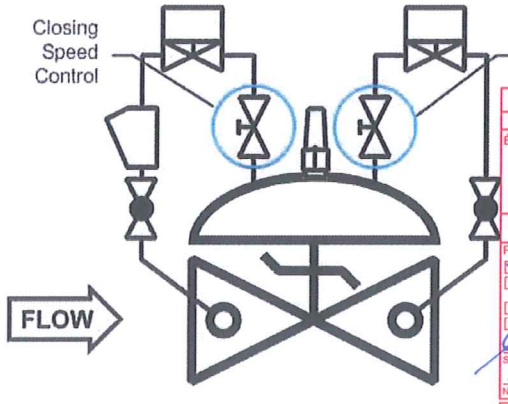
MATERIAL	PART NUMBER	INLET/OUTLET (NPT)	A	USED ON VALVE SIZE*
Brass	683100	1/4	2	1 ¼"-2"
Brass	683101	3/8	2 1/4	2 ½"-6"
Brass	683102	1/2	2 5/8	8"-10"
Brass	683103	3/4	3 1/4	12"-16"
Stn. Steel	683700	1/4	2	1 ¼"-2"
Stn. Steel	683702	3/8	2 1/4	2 ½"-6"
Stn. Steel	682704	1/2	2 5/8	8"-10"
Stn. Steel	683703	3/4	3 5/8	12"-16"

Note: Needle valve size may vary on valve application. Consult factory.

SCHEMATIC SYMBOL

The Model 141-2 Needle Valve is shown on OCV Valve Schematics as:



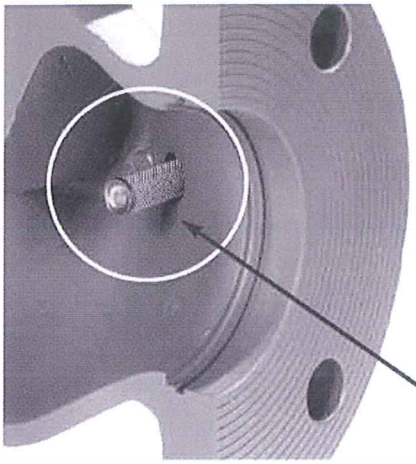


EXAMPLE: Shown here on a MODEL 115-3 DIGITAL VALVE as separate opening and closing speed controls.

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Needle Valve 141-2



Strainer Shown Installed

DESCRIPTION

The 123 Inline Strainer installs in the inlet side port of the main valve, and protects the pilot system from solid contaminates in the line fluid. The screen prevents the entrance of particles into the pilot system piping while flow through the main valve washes the screen clean. Recommended use on petroleum valve applications where flushing or removal of the screen for cleaning is not practical or may be considered hazardous.

DIMENSIONS

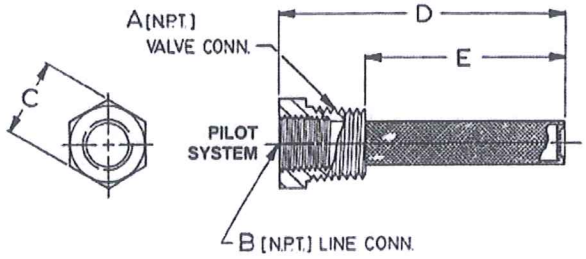
PART NUMBER	A	B	C	D	E	USED ON VALVE SIZE
660704	3/8	1/4	11/16	2 3/16	1 1/2	1 1/4"-6"
660705	1/2	3/8	7/8	2 1/4	1 1/2	8"-10"
660706	3/4	1/2	1 1/8	2 3/8	1 1/2	12"-16"

MATERIALS

Inline strainers are all-stainless steel construction.

SCREEN SIZE

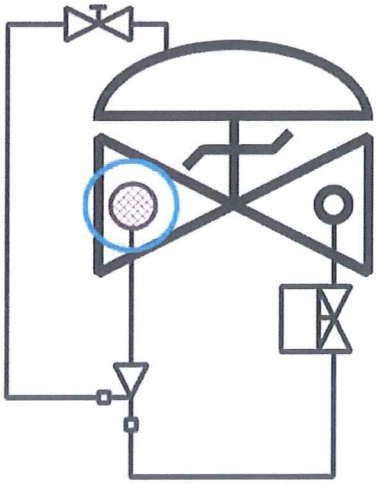
Standard screen is 40 mesh. Other mesh sizes are available.



SCHEMATIC SYMBOL

The Model 123 Inline Strainer is shown on OCV Valve Schematics as:





EXAMPLE: Shown here on a MODEL 115-2 Solenoid Valve.

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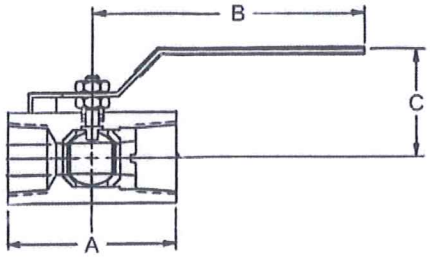
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email: sales@controlvalves.com • website: www.controlvalves.com

DESCRIPTION



The Model 141-4 Ball Valve is a ¼-turn shutoff device used for isolating the pilot system from the main valve. They are extremely useful for performing routine maintenance and troubleshooting.

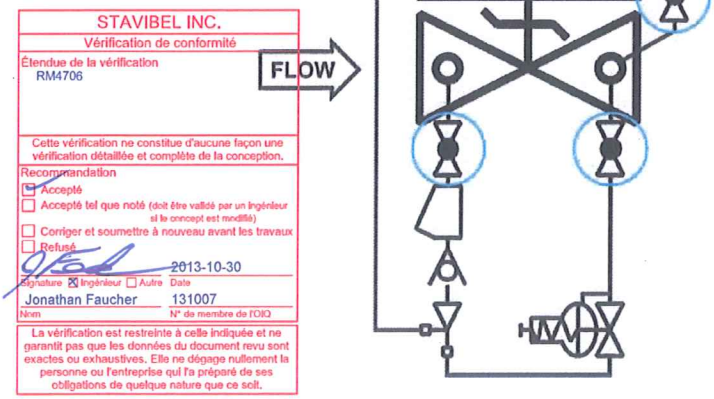
Ball valves are standard on water service valves; optional on fuel service valves.



MODEL 141-4 MATRIX

MATERIAL	PART NUMBER	INLET/OUTLET (NPT)	A	B	C	USED ON VALVE SIZE*
Bronze	680100	3/8	1 3/4	3 1/2	1 7/8	1 ¼"-6"
Bronze	680101	1/2	2	3 1/2	2 1/4	8"-10"
Bronze	680102	3/4	3	4 3/4	2 1/4	12"-16"
Stn. Steel	680700	3/8	2	3 3/4	2 1/8	1 ¼"-6"
Stn. Steel	680701	1/2	2 1/4	3 3/4	2 1/2	8"-10"
Stn. Steel	680702	3/4	3	4 3/4	2 1/4	12"-16"

SCHEMATIC SYMBOL



The Model 141-4 Ball Valve is shown on OCV Valve Schematics as:

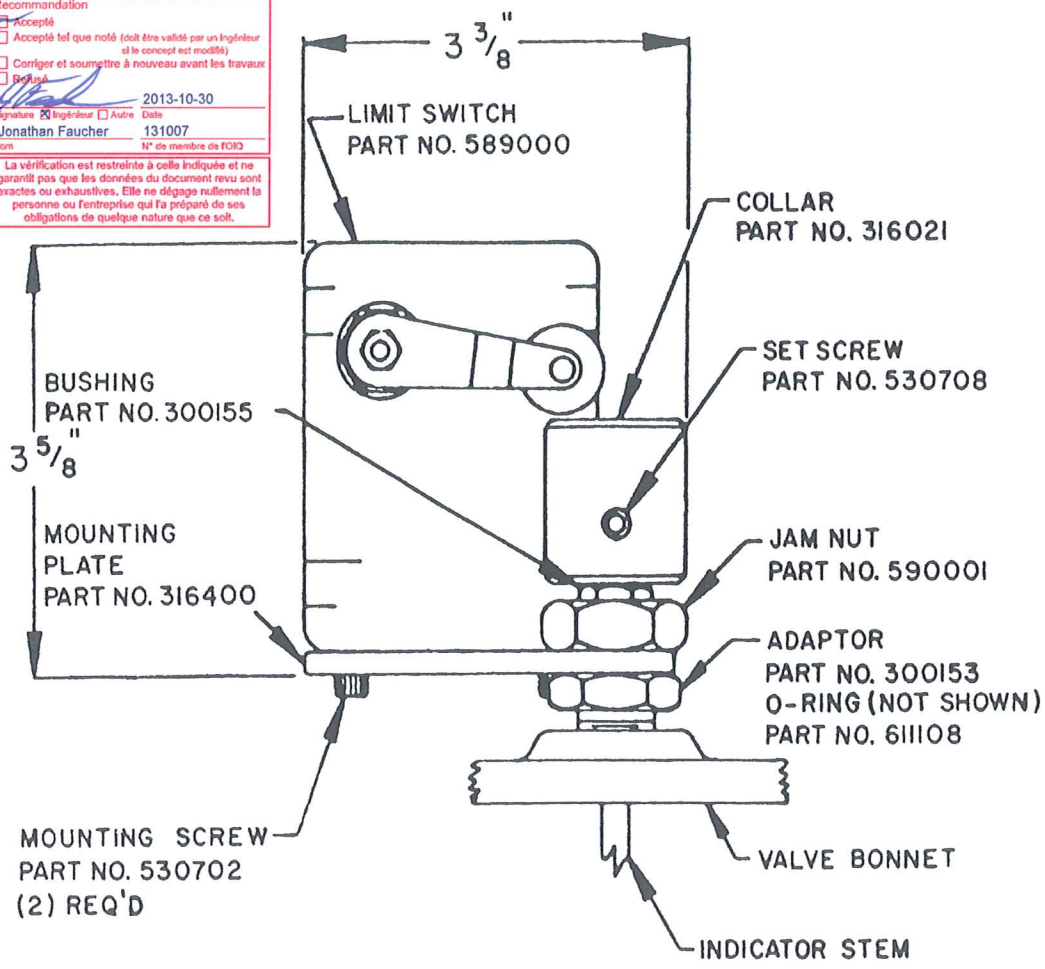


EXAMPLE: Shown here on a MODEL 127-4 Pressure Reducing / Check Valve.

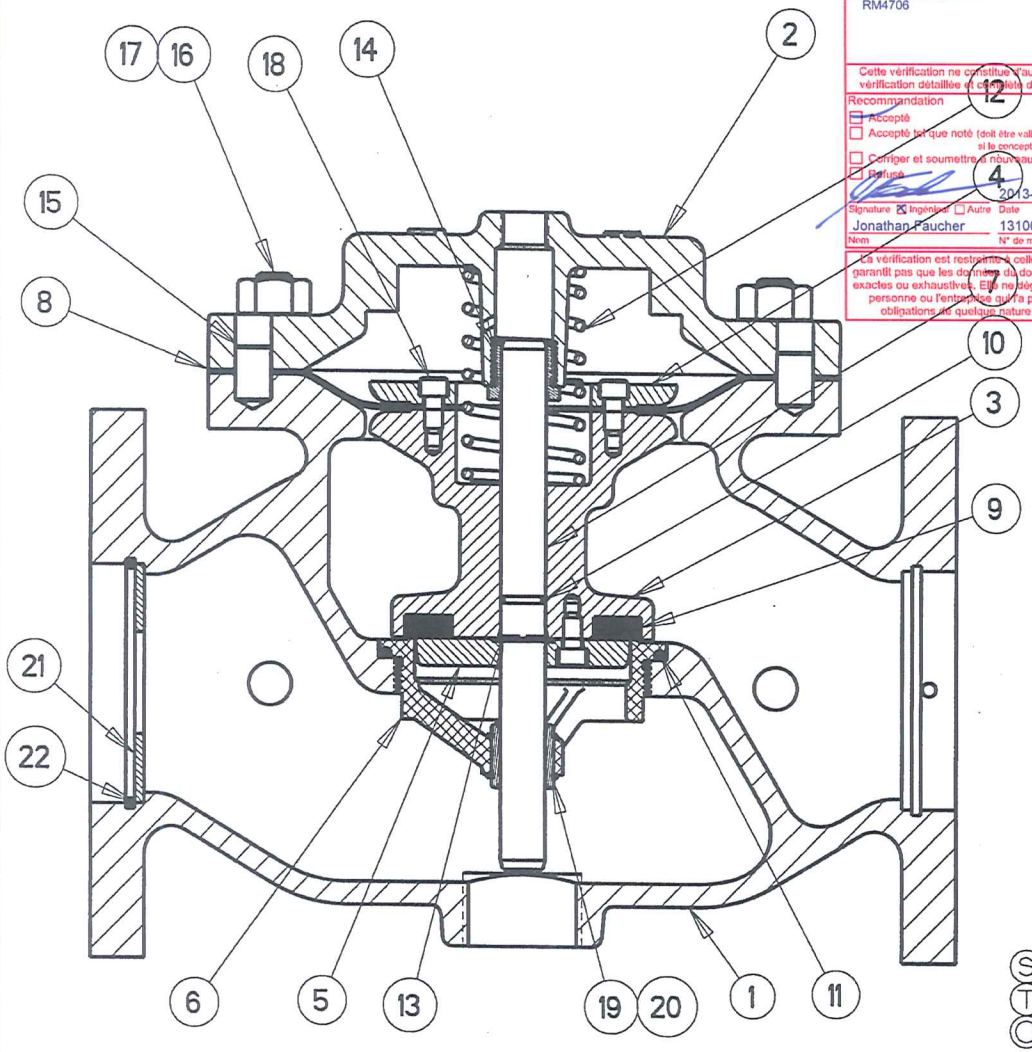
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Étendue de la vérification
RM4706
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Recommandation
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☐ Refusé
2013-10-30
Signature ☒ Ingénieur ☐ Autre Date
Jonathan Faucher 131007
Nom N° de membre de l'OIQ
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MODEL 150
LIMIT SWITCH ASSEMBLY



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ITEM	PART NO	QTY	DESCRIPTION	MATL
1	301091 301691 301391 301791	1	BODY, 150# BODY, 300# BODY, 150# BODY, 300#	DUCT. IRON DUCT. IRON CAST STEEL CAST STEEL
2	303091 303391	1	BONNET	DUCT. IRON CAST STEEL
3	305091	1	SPOOL	DUCT. IRON
4	307091	1	DIAPHRAGM PLATE	STN. STL.
5	309091	1	SEAT RETAINER	STN. STL.
6	311191 311791(T)	1	SEAT RING	BRONZE STN. STL.
7	313791	1	STEM	STN. STL.
8	690091(S) 690191(S)	1	DIAPHRAGM	NYLON/BUNA-N NYLON/VITON
9	690591(S) 691591(S)	1	SEAT DISC	BUNA-N VITON
10	611014(S)	1	O-RING	VITON
11	610154(S) 611154(S)	1	O-RING	BUNA-N VITON
12	650700	1	SPRING	STN. STL.
13	630706	1	SNAP RING	STN. STL.
14	300291 300631(T)	1	UPPER BUSHING	BRONZE TEFLON
15	620701	2	DOWEL PIN	STN. STL.
16	300026	8	STUD	ZN PL STL
17	590011	8	HEX NUT	ZN PL STL
18	530700	9	SKT HD CAPSCREW	STN. STL.
19#	300071(T)	1	LOWER BUSHING	TEFLON
20#	630711(T)	2	SNAP RING	STN. STL.
21	306743(◎)	1	ORIF. PL.(1.41" BORE)	STN. STEEL
22	630732(◎)	1	SNAP RING	STN. STL.

(S) : RECOMMENDED SPARE PARTS
(T) : PARTS PROVIDED WITH STAINLESS STEEL SEAT RING
(◎) : PROVIDED WITH RATE OF FLOW CONTROL VALVE ONLY

CHG	ECN	DATE	BY
E			
D			
C			
B			
A			

REVISIONS

REF DWG NO'S

MATERIAL

TOLERANCES
UNLESS NOTED
.XX ±.015
.XXX ±.005
ANGULAR ±0.5°
MACH. FINISH 125

NO. REQ'D

SCALE
40%

DRAWN BY: SDJ
DATE: 081902
CHKD BY:
DATE:

OCV Control Valves
TULSA OKLAHOMA USA

3" BASIC VALVE ASSEMBLY

SIZE	DRAWING NUMBER	REV
A	3100	

450 Series

Solid Front • Field Liquid Fillable • Turret Case

PROCESS GAUGES



450B shown

- 4½" Dial Size
- ±0.5% Accuracy
- Solid Front/Blow-Out Back
- Field Liquid Fillable

The Trerice **450 Series** Process Gauge is designed for the petrochemical and industrial process industries. This solid front, blow-out back gauge is noted for its fiberglass reinforced polypropylene turret case and screwed ring; its sturdy interior design; and its field liquid-fill capability (no kit required). The 450 Series can withstand the most rugged industrial applications, while maintaining precise accuracy. Wetted parts are bronze tube/brass socket, stainless steel, or Monel.

- Optional features available: Please consult the Options & Accessories Section for details.
- For correct use and application of all pressure gauges, please refer to: Pressure Gauge Standard ASME B40.100.

Specifications

Models		Wetted Parts
450B 450LFB	(dry) (liquid-filled)	Bronze tube, brass socket
450SS 450LFSS	(dry) (liquid-filled)	316 stainless steel* tube and socket
450M 450LFM	(dry) (liquid-filled)	Monel tube and socket (meets NACE MR 01.75)

Dial Size	4½"
Fill	Glycerine. Other fills available. See Options & Accessories
Movement	Stainless steel
Connection	Lower male or lower back male, ¼ or ½ NPT
Case	Fiberglass reinforced polypropylene, turret, solid front with blow-out back
Ring	Threaded fiberglass reinforced polypropylene
Window	Acrylic
Pointer	Micro adjustable, black finished
Dial Face	Aluminum, white background with black graduations and markings
Additional Features	Overload and underload stops
Accuracy	±0.5% Full Scale, ASME B40.100 Grade 2A
Maximum Temperature	450B, 450SS, 450M: **250°F (121°C)** 450LFB, 450LFSS, 450LFM: **150°F (65°C)**
Approximate Shipping Weight	450B, 450SS, 450M: 2.2 lbs [1.00 kg] 450LFB, 450LFSS, 450LFM: 3.1 lbs [1.41 kg]

* Ranges over 10,000 PSI have Ni-Span-C tube.

HOW TO ORDER

Sample Order Number: **450LFB 45 02 L D 110**

Model	Dial Size	Connection Size	Connection Location	Units of Measure	Range Code
450B 450LFB 450SS 450LFSS 450M 450LFM	45 4½"	02 ¼ NPT 04 ½ NPT	L Lower B Back	A psi B kPa C kg/cm² D psi/kPa E psi & kg/cm²	See Standard Ranges

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Signature ☒ Ingénieur ☐ Autre — Date: 2013-10-30
Nom: Jonathan Faucher — N° de membre de l'OIQ: 131007

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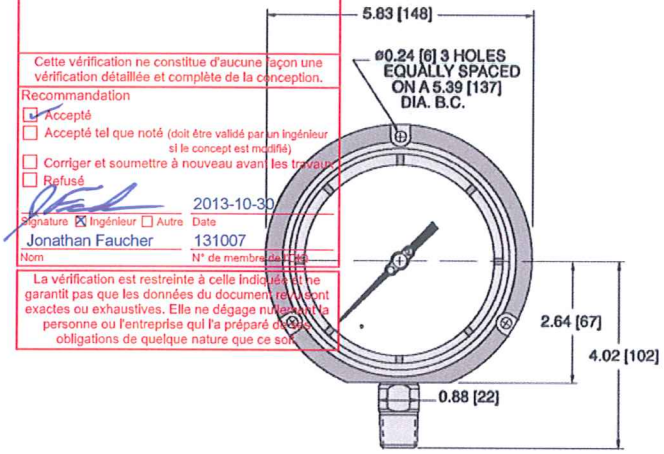
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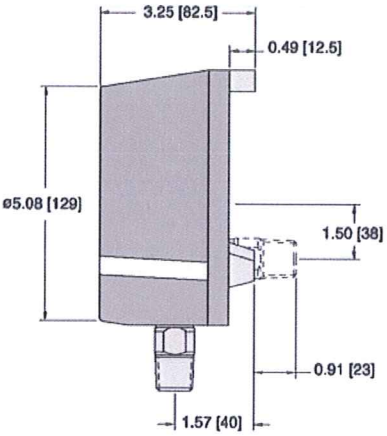
450 Series

Solid Front • Field Liquid Fillable • Turret Case

All dimensions are nominal. Dimensions in [ ] are in millimeters.

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Standard Ranges

psi Ranges (A)				kPa Ranges (B)				kg/cm² Ranges (C)			
Range Code	Specific Range (psi)	Figure Intervals	Minor Divisions	Range Code	Specific Range	Figure Intervals	Minor Divisions	Range Code	Specific Range	Figure Intervals	Minor Divisions
010	30" Hg to 0	5	0.2	010	-100 to 0 kPa	10	1	010	76 cm Hg to 0	10	0.5
020	30" Hg to 15 psi	5/5	0.5/0.2	020	-100 to 100 kPa	20	2	020	76 cm Hg to 1 kg/cm²	20/0.2	1/.02
030	30" Hg to 30 psi	10/5	1/0.5	030	-100 to 200 kPa	50	2	030	76 cm Hg to 2 kg/cm²	20/0.5	2/.02
040	30" Hg to 60 psi	10/10	1/1	040	-100 to 400 kPa	50	5	040	76 cm Hg to 4 kg/cm²	25/0.5	5/.05
050	30" Hg to 100 psi	30/10	2/1	050	-100 to 600 kPa	100	5	050	76 cm Hg to 7 kg/cm²	76/1	5/0.1
060	30" Hg to 150 psi	30/20	5/2	060	-100 to 1000 kPa	100	10	060	76 cm Hg to 10 kg/cm²	76/1	15/0.1
070	30" Hg to 300 psi	30/50	5/2	070	-100 to 2000 kPa	200	20	070	76 cm Hg to 21 kg/cm²	76/2	19/0.2
080	0 to 15 psi	3	0.1	080	0 to 100 kPa	10	1	080	0 to 1 kg/cm²	0.1	0.01
090	0 to 30 psi	5	0.2	090	0 to 200 kPa	20	2	090	0 to 2 kg/cm²	0.2	0.02
100	0 to 60 psi	10	0.5	100	0 to 400 kPa	50	5	100	0 to 4.2 kg/cm²	0.5	0.05
110	0 to 100 psi	10	1	110	0 to 700 kPa	100	5	110	0 to 7 kg/cm²	1	0.05
120	0 to 160 psi	20	1	120	0 to 1200 kPa	200	10	120	0 to 11 kg/cm²	1	0.1
130	0 to 200 psi	20	2	130	0 to 1500 kPa	300	10	130	0 to 14 kg/cm²	2	0.1
140	0 to 300 psi	50	2	140	0 to 2000 kPa	200	20	140	0 to 21 kg/cm²	3	0.2
150	0 to 400 psi	50	5	150	0 to 3000 kPa	300	20	150	0 to 28 kg/cm²	4	0.2
160	0 to 600 psi	50	5	160	0 to 4000 kPa	500	50	160	0 to 42 kg/cm²	6	0.5
180	0 to 1000 psi	100	10	180	0 to 7000 kPa	1000	50	180	0 to 70 kg/cm²	10	0.5
Ranges over 1000 psi are not available on 450B and 450LFB.											
190	0 to 1500 psi	300	10	190	0 to 10,000 kPa	1000	100	190	0 to 100 kg/cm²	10	1
200	0 to 2000 psi	200	20	200	0 to 14,000 kPa	2000	100	200	0 to 140 kg/cm²	20	1
210	0 to 3000 psi	300	20	210	0 to 20,000 kPa	2000	200	210	0 to 210 kg/cm²	30	2
220	0 to 5000 psi	500	50	220	0 to 35,000 kPa	5000	250	220	0 to 350 kg/cm²	50	2
230	0 to 10,000 psi	1000	100	230	0 to 60,000 kPa	10,000	500	230	0 to 700 kg/cm²	100	10
Ranges over 10,000 psi are only available on 450SS and 450LFSS, and have Ni-Span-C tubes.											
240	0 to 15,000 psi	2000	100	240	0 to 100,000 kPa	20,000	1000	240	0 to 1000 kg/cm²	100	10
250	0 to 20,000 psi	2000	200	250	0 to 140,000 kPa	20,000	1000	250	0 to 1400 kg/cm²	200	20

For dual scale ranges, specify the appropriate **Units of Measure: D** *(psi/kPa) or* **E** *(psi & kg/cm²) followed by the equivalent* **A** *(psi)* **Range Code**. *Other pressure ranges are also available including: Altitude, Ammonia, Refrigerant and Receiver. Consult Special Application Ranges section or factory for availability.*

450 Series

Solid Front • Field Liquid Fillable • Turret Case

PROCESS GAUGES



450B shown

- 4½" Dial Size
- ±0.5% Accuracy
- Solid Front/Blow-Out Back
- Field Liquid Fillable

The Trerice **450 Series** Process Gauge is designed for the petrochemical and industrial process industries. This solid front, blow-out back gauge is noted for its fiberglass reinforced polypropylene turret case and screwed ring; its sturdy interior design; and its field liquid-fill capability (no kit required). The 450 Series can withstand the most rugged industrial applications, while maintaining precise accuracy. Wetted parts are bronze tube/brass socket, stainless steel, or Monel.

- Optional features available: Please consult the Options & Accessories Section for details.
- For correct use and application of all pressure gauges, please refer to: Pressure Gauge Standard ASME B40.100.

Specifications

Models		Wetted Parts
450B 450LFB	(dry) (liquid-filled)	Bronze tube, brass socket
450SS 450LFSS	(dry) (liquid-filled)	316 stainless steel* tube and socket
450M 450LFM	(dry) (liquid-filled)	Monel tube and socket (meets NACE MR 01.75)

Dial Size 4½"

Fill Glycerine. Other fills available. See Options & Accessories

Movement Stainless steel

Connection Lower male or lower back male, ¼ or ½ NPT

Case Fiberglass reinforced polypropylene, turret, solid front with blow-out back

Ring Threaded fiberglass reinforced polypropylene

Window Acrylic

Pointer Micro adjustable, black finished

Dial Face Aluminum, white background with black graduations and markings

Additional Features
Overload and underload stops

Accuracy ±0.5% Full Scale, ASME B40.100 Grade 2A

Maximum Temperature
450B, 450SS, 450M:
250°F (121°C)
450LFB, 450LFSS, 450LFM:
150°F (65°C)

Approximate Shipping Weight
450B, 450SS, 450M:
2.2 lbs [1.00 kg]
450LFB, 450LFSS, 450LFM:
3.1 lbs [1.41 kg]

* Ranges over 10,000 PSI have Ni-Span-C tube.

HOW TO ORDER

Sample Order Number: **450LFB 45 02 L D 110**

Model	Dial Size	Connection Size	Connection Location	Units of Measure	Range Code
450B 450LFB 450SS 450LFSS 450M 450LFM	45 4½"	02 ¼ NPT 04 ½ NPT	L Lower B Back	A psi B kPa C kg/cm² D psi/kPa E psi & kg/cm²	See Standard Ranges

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450 Series

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Solid Front • Field Liquid Fillable • Turret Case

STAVIBEL INC.
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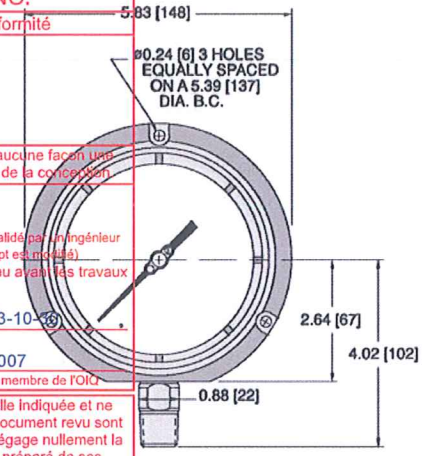
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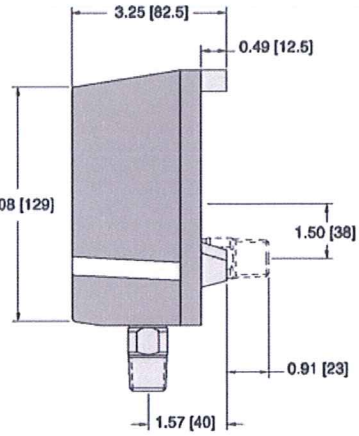
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Standard Ranges

psi Ranges (A)				kPa Ranges (B)				kg/cm² Ranges (C)			
Range Code	Specific Range (psi)	Figure Intervals	Minor Divisions	Range Code	Specific Range	Figure Intervals	Minor Divisions	Range Code	Specific Range	Figure Intervals	Minor Divisions
010	30" Hg to 0	5	0.2	010	-100 to 0 kPa	10	1	010	76 cm Hg to 0	10	0.5
020	30" Hg to 15 psi	5/5	0.5/0.2	020	-100 to 100 kPa	20	2	020	76 cm Hg to 1 kg/cm²	20/0.2	1/.02
030	30" Hg to 30 psi	10/5	1/0.5	030	-100 to 200 kPa	50	2	030	76 cm Hg to 2 kg/cm²	20/0.5	2/.02
040	30" Hg to 60 psi	10/10	1/1	040	-100 to 400 kPa	50	5	040	76 cm Hg to 4 kg/cm²	25/0.5	5/.05
050	30" Hg to 100 psi	30/10	2/1	050	-100 to 600 kPa	100	5	050	76 cm Hg to 7 kg/cm²	76/1	5/0.1
060	30" Hg to 150 psi	30/20	5/2	060	-100 to 1000 kPa	100	10	060	76 cm Hg to 10 kg/cm²	76/1	15/0.1
070	30" Hg to 300 psi	30/50	5/2	070	-100 to 2000 kPa	200	20	070	76 cm Hg to 21 kg/cm²	76/2	19/0.2
080	0 to 15 psi	3	0.1	080	0 to 100 kPa	10	1	080	0 to 1 kg/cm²	0.1	0.01
090	0 to 30 psi	5	0.2	090	0 to 200 kPa	20	2	090	0 to 2 kg/cm²	0.2	0.02
100	0 to 60 psi	10	0.5	100	0 to 400 kPa	50	5	100	0 to 4.2 kg/cm²	0.5	0.05
110	0 to 100 psi	10	1	110	0 to 700 kPa	100	5	110	0 to 7 kg/cm²	1	0.05
120	0 to 160 psi	20	1	120	0 to 1200 kPa	200	10	120	0 to 11 kg/cm²	1	0.1
130	0 to 200 psi	20	2	130	0 to 1500 kPa	300	10	130	0 to 14 kg/cm²	2	0.1
140	0 to 300 psi	50	2	140	0 to 2000 kPa	200	20	140	0 to 21 kg/cm²	3	0.2
150	0 to 400 psi	50	5	150	0 to 3000 kPa	300	20	150	0 to 28 kg/cm²	4	0.2
160	0 to 600 psi	50	5	160	0 to 4000 kPa	500	50	160	0 to 42 kg/cm²	6	0.5
180	0 to 1000 psi	100	10	180	0 to 7000 kPa	1000	50	180	0 to 70 kg/cm²	10	0.5
Ranges over 1000 psi are not available on 450B and 450LFB.											
190	0 to 1500 psi	300	10	190	0 to 10,000 kPa	1000	100	190	0 to 100 kg/cm²	10	1
200	0 to 2000 psi	200	20	200	0 to 14,000 kPa	2000	100	200	0 to 140 kg/cm²	20	1
210	0 to 3000 psi	300	20	210	0 to 20,000 kPa	2000	200	210	0 to 210 kg/cm²	30	2
220	0 to 5000 psi	500	50	220	0 to 35,000 kPa	5000	250	220	0 to 350 kg/cm²	50	2
230	0 to 10,000 psi	1000	100	230	0 to 60,000 kPa	10,000	500	230	0 to 700 kg/cm²	100	10
Ranges over 10,000 psi are only available on 450SS and 450LFSS, and have Ni-Span-C tubes.											
240	0 to 15,000 psi	2000	100	240	0 to 100,000 kPa	20,000	1000	240	0 to 1000 kg/cm²	100	10
250	0 to 20,000 psi	2000	200	250	0 to 140,000 kPa	20,000	1000	250	0 to 1400 kg/cm²	200	20

For dual scale ranges, specify the appropriate **Units of Measure: D** *(psi/kPa) or* **E** *(psi & kg/cm²) followed by the equivalent* **A** *(psi)* **Range Code**. *Other pressure ranges are also available including: Altitude, Ammonia, Refrigerant and Receiver. Consult Special Application Ranges section or factory for availability.*

Pulse Transmitters

Model #	Agency Listing & Approvals	Description	Model #	Agency Listing & Approvals	Description
DMP100-1	UL/cUL	700-15 Direct Mount 100 ppr Quadrature Pulse Output Device with Viton O-ring; 6 to 30 VDC	DMP100-1-5	UL/cUL	700-15 Direct Mount 100 ppr Quadrature Pulse Output Device with Viton O-ring; 5 VDC
DMP100-1A	ATEX/IECEx		DMP100-1A5	ATEX/IECEx	
DMP100-2	UL/cUL	700-15 Direct Mount 100 ppr Quadrature Pulse Output Device with Simriz O-ring; 6 to 30 VDC	DMP100-2-5	UL/cUL	700-15 Direct Mount 100 ppr Quadrature Pulse Output Device with Simriz O-ring; 5 VDC
DMP100-2A	ATEX/IECEx		DMP100-2A5	ATEX/IECEx	
DMP100-3	UL/cUL	Direct Mount 100 ppr Quadrature Pulse Output Device with Viton O-ring; 6 to 30 VDC	DMP100-3-5	UL/cUL	Direct Mount 100 ppr Quadrature Pulse Output Device with Viton O-ring; 5 VDC
DMP100-3A	ATEX/IECEx		DMP100-3A5	ATEX/IECEx	
DMP100-4	UL/cUL	Direct Mount 100 ppr Quadrature Pulse Output Device with Simriz O-ring; 6 to 30 VDC	DMP100-4-5	UL/cUL	Direct Mount 100 ppr Quadrature Pulse Output Device with Simriz O-ring; 5 VDC
DMP100-4A	ATEX/IECEx		DMP100-4A5	ATEX/IECEx	
DMP100-5	UL/cUL	Direct Mount 100 ppr Quadrature Pulse Output Device, Fork Drive with Viton O-ring; 6 to 30 VDC	DMP100-5-5	UL/cUL	Direct Mount 100 ppr Quadrature Pulse Output Device, Fork Drive with Viton O-ring; 5 VDC
DMP100-5A	ATEX/IECEx		DMP100-5A5	ATEX/IECEx	
DMP100-6	UL/cUL	Direct Mount 100 ppr Quadrature Pulse Output Device, Fork Drive with Simriz O-ring; 6 to 30 VDC	DMP100-6-5	UL/cUL	Direct Mount 100 ppr Quadrature Pulse Output Device, Fork Drive with Simriz O-ring; 5 VDC
DMP100-6A	ATEX/IECEx		DMP100-6A5	ATEX/IECEx	
RMP100		Register Mount 100 ppr Quadrature Pulse Output Device; 6 to 30 VDC	RMP100-5	*Not Approved*	Register Mount 100 ppr Quadrature Pulse Output Device; 5 VDC

Encoder Specifications

POWER REQUIREMENTS (Input power MUST be supplied by a Class 2 Power Supply)

Input Supply Voltage:	6 to 30 VDC 5 VDC
Current Supply:	30 mA maximum at 6 to 30 VDC, per channel 20 mA maximum at 5 VDC, per channel

SIGNAL

Type:	Square Wave
Signal:	Single or Dual Channel
Output Resolution:	100 pulses per revolution unscaled
Amplitude:	6 to 30 VDC (1.0 KΩ Internal Pull-up, No Load) 5 VDC (1.0 KΩ Internal Pull-up, No Load)
Rotation:	Standard is bi-directional
Input Shaft Speed:	2500 rpm maximum
Pulse Timing:	Nominal 50% on and 50% off
Output:	Current sinking 100 mA maximum in "ON" state. V+ supply @ 1.0 KΩ in "OFF" state.
Rise/Fall Time of Pulse:	<5 µs
Pulse Transmission Distance:	Up to 5,000 feet (1,524 meters)

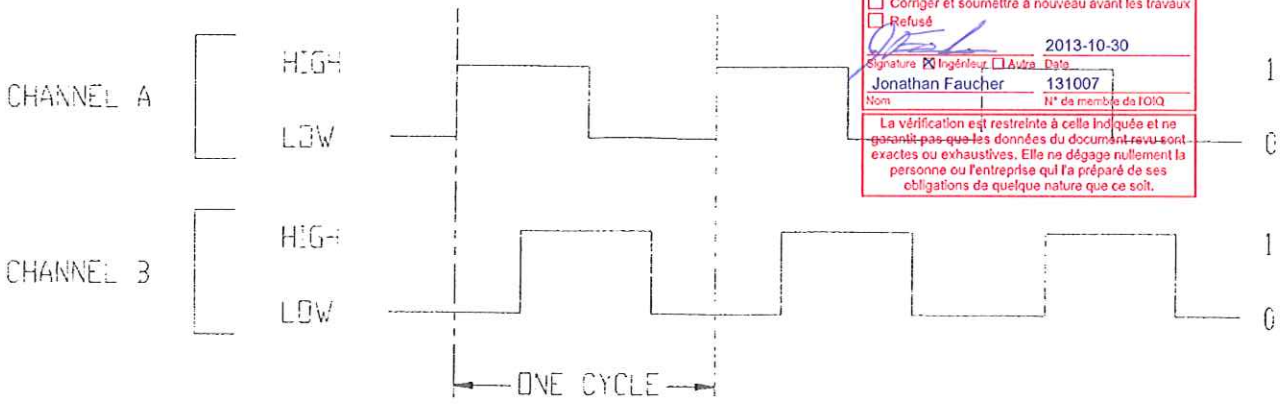
DMP ENVIRONMENTAL RATINGS

Enclosure:	Type 4X, Class I, Division 1, Groups C & D, II 2 G Ex d IIB T5 Gb
IP Code:	IPX6
Connections:	1/2" NPT Conduit Hub or M20 x 1.5 6H
Operating Temperature Range:	- 40° to 185°F (- 40° to 85°C)
Relative Humidity:	0-98% at 104°F (40°C), non-condensing
Vibration Resistance:	Harmonic motion with amplitude of 15g, within a varied 10 - 2000 Hz frequency per MIL-STD-202:M204
Shock Resistance:	50g for 11 µs per MIL-STD-202:M213

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Encoder Specifications (Continued)



Channel A leads channel B by 90°, ± 45° in all rotations for clockwise rotation of shaft.

Direct Mount Pulser (DMP) Output Resolution

METER	PULSES PER GALLON	PULSES PER LITRE	MAXIMUM OUTPUT — Hz
682-15	400.0	105.7	333.3
700-15	1223.7	323.4	1223.7
700-20	555.5	146.8	925.8
700-25	555.5	146.8	1388.8
700-30	205.8	54.4	686.0
700-35	205.8	54.4	1029.0
700-40	74.2	19.6	618.3
700-45	74.2	19.6	742.0

Register Mount Pulser (RMP) Output Resolution

RMP100	1/10TH MECHANICAL REGISTER	1/1 MECHANICAL REGISTER
100:1	100 Pulses Per Unit of Measure	10 Pulses Per Unit of Measure

Direct Mount Pulser (DMP) Installation

¡WARNING!

All internal pressure must be relieved to ZERO (0) pressure before beginning disassembly of meter or components.

To install the Direct Mount Pulser onto a 700 Series Flow Meter, follow the following procedure:

1) Relieve system pressure to zero (0) PSI and remove the 1/2" plugs from the front and rear covers to drain fluid from the flow meter
2) Remove the mechanical register counter, calibration adjuster and drive assembly from the counter support.
3) Remove the counter support from the front cover.
4) Remove the packing gland screws and retaining plate, then pull the packing gland from the front cover.
5) Assemble the Direct Mount Pulser assembly to the front cover. During assembly, note that the joint between the stainless steel hub and the DMP housing has Loctite on the threads. This joint is NOT intended to be disassembled because the joint may become damaged. Please contact the factory for details on joints if there are any questions.
   a). Assemble packing o-ring around stainless steel drive hub.
   b). Align the blade drive of the DMP to the drive coupling from the rotor, through the front cover assembly.
   c). Rotate pulser assembly to a position from Illustration 2, making sure that moisture drains away from the conduit hub.
   d). Tighten mounting screws on DMP retaining plate.
6) Reassemble the 1/2" NPT plugs in front and rear covers.
7) Whether using a cable gland, rigid or flexible conduit for wiring connection, review and understand all local electrical codes for hazardous location installation (National Electrical Code, Canadian Electrical Code, ATEX Electrical Code, etc…).
8) Use seal wire on each drilled head screw for weights and measures seal.
9) See pages 12-13 for wiring instructions.

ILLUSTRATION 1

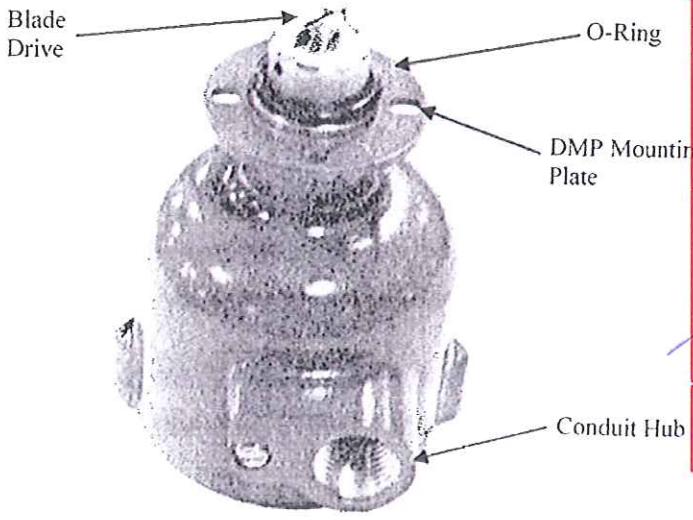


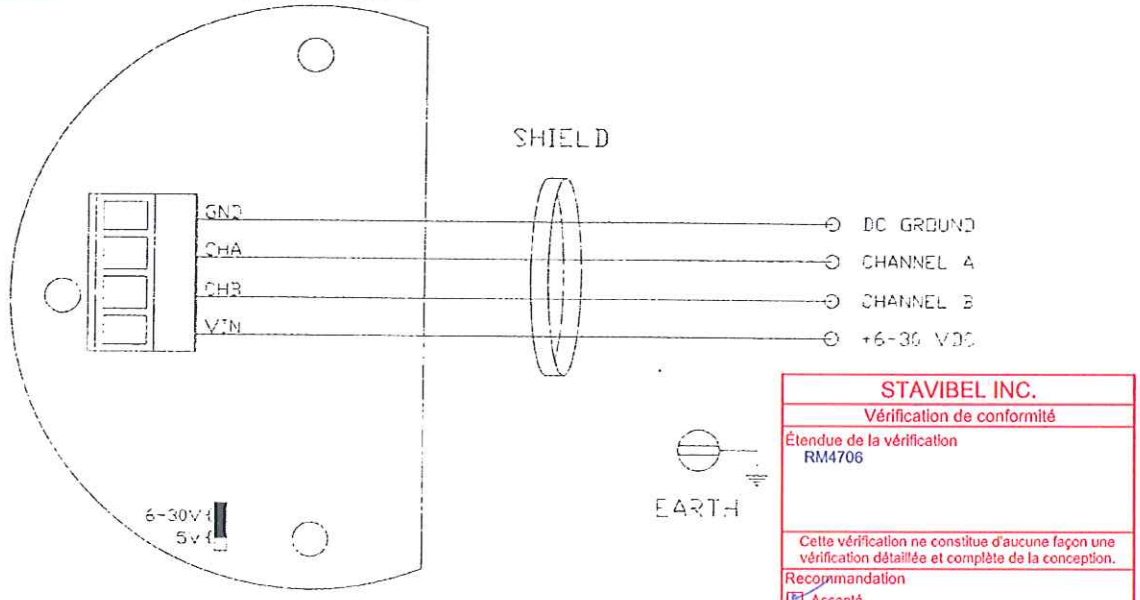
ILLUSTRATION 2


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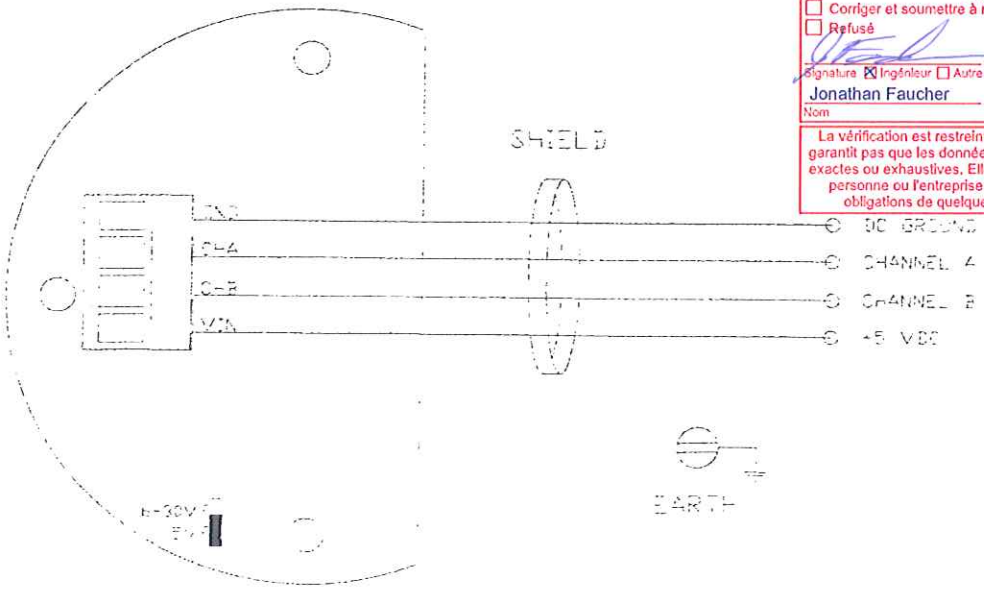
Dual Channel Wiring Instructions

1) TURN SYSTEM POWER OFF
2) Keep all stripped wire leads short as possible.
3) Use shielded cable for signal wiring suitable for the ambient temperature range (recommended 18 AWG).
4) Connect shielded drain to earth or chassis ground.
5) Use only 1/8th straight blade for tightening terminal blocks screws.
6) The internal grounding terminal shall be used as the equipment grounding means and the external terminal is only a supplemental bonding connection where local authorities require/permit such a connection.

DUAL CHANNEL - 6 TO 30 VDC



DUAL CHANNEL - 5 VDC



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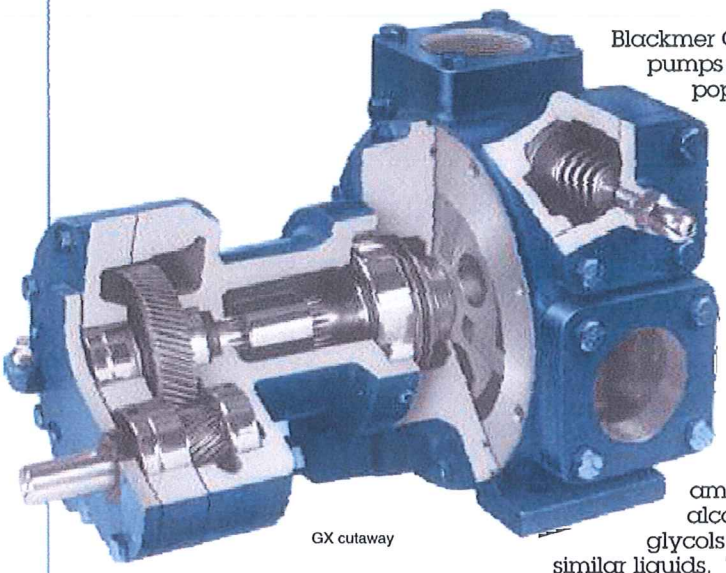
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SPEC SHEET 101/3

Section	100
Effective	October 1995
Replaces	November 1991

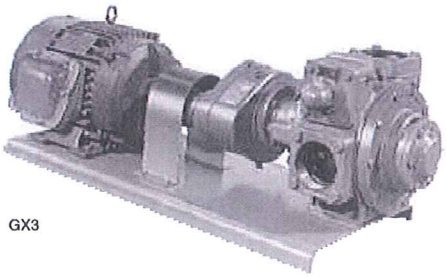
GX AND X SERIES GENERAL DUTY PUMPS

GX4, 15 HP

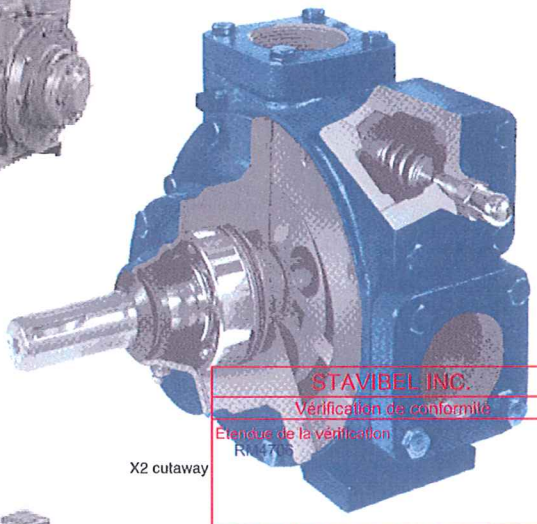


GX cutaway

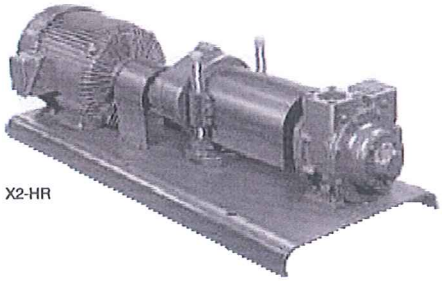
Blackmer GX and X type pumps have long been popular for handling a wide range of non-corrosive, non-abrasive industrial liquids and petroleum products. Typical applications include fuel oils, lube oils, jet fuels, gasoline, edible oils and a variety of solvents and thinners such as esters, ketones, naphthas, ethers, amines, aromatics, alcohols, terpenes, glycols and many other similar liquids. The high suction lift capabilities of these pumps makes them especially suitable for pumping from underground tanks, bulk plant service, and aircraft refueling.



GX3



X2 cutaway



X2-HR

Utilizing Blackmer's unique sliding-vane design, these positive displacement rotary pumps offer the best combined characteristics of sustained high level performance, energy efficiency, trouble-free operation and low maintenance cost.

Models are available in 2, 2.5, 3 and 4-inch flanged port sizes with capacities from 30 to 520 U.S. gpm (114-1855 lpm). Cast iron construction is standard on all models. The X4 model is also available in ductile iron construction as an option. All models have external ball bearings isolated from the pumpage by mechanical seals.

The GX type pumps feature an integral head-mounted gear reduction drive with oil lubricated, hardened helical gears that provide quiet, trouble-free operation. Gear shafts are supported at both ends by ball bearings for smooth operation and long life.

A splined shaft simplifies alignment of the pump and reducer, and the reducer can be rotated on the pump head to accommodate a variety of motor sizes without shimming. The integral pump and reducer design makes the GX pump models the first choice for economy and compactness.

The X type pumps are used in installations where other reduction drives are desirable, such as the helical gear reducer drive unit shown. Assembled pump units are available from the factory for all models.

Technical Assistance

In some applications, selecting the right pump may require more detailed information than can be presented here. Your Blackmer representative can help you find the correct equipment to ensure the best performance possible for your specific application.

If you have a unique fluid handling problem, please call your Blackmer representative listed under "Pumps" in the Yellow Pages, or contact Blackmer's Fluid Processing and Transfer Pump group at our main office listed on the backside of this Spec Sheet.

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PUMP PERFORMANCE DATA*

PUMP MODEL	GX2, X2				GX2.5, X2.5				GX3, X3				GX4, X4				
RATED PUMP SPEED (RPM)	640	520	420	350	640	520	420	350	640	520	420	350	500	400	300	230	190
U.S. GPM	70	55	44	36	121	96	76	63	270	220	177	146	507	404	299	225	190
LPM	264	210	165	135	461	363	288	237	1023	835	671	544	1919	1532	1135	855	695
HP	3.2	2.6	2.0	1.7	4.7	3.7	2.9	2.4	11.2	8.5	6.5	5.2	20.8	15.9	11.5	8.6	7.0

*Approximate capacities and horsepower (HP) are based on a 100 SSU (22 cP) fluid at a 50 psi (345 kPa) differential pressure.
Centipoise (cP) = Centistokes (cSt) at fluid specific gravity of 1.0.
Refer to Characteristic Curves for capacities and horsepower at other pressures and viscosities.

MAXIMUM OPERATING LIMITS

PUMP MODEL	MAXIMUM PUMP SPEED			MINIMUM PUMP SPEED			MAXIMUM DIFFERENTIAL PRESSURE	MAXIMUM WORKING PRESSURE	MAXIMUM OPERATING TEMPERATURE
	SPEED	FLOW[2]	VISCOSITY[3]	SPEED	FLOW[2]	VISCOSITY[3]			
	RPM	GPM (LPM)	SSU (cP)[4]	RPM	GPM (LPM)	SSU (cP)[4]	PSI (kPa)	PSI (kPa)	°F (°C)
GX2[1]	780	87 (329)	100 (22)	190	20 (76)	20,000 (4,250)	125 (862)	175 (1207)	300 (149)
X2	780	87 (329)	100 (22)	68	7 (26)	75,000 (15,750)	125 (862)	175 (1207)	300 (149)
GX2.5[1]	780	155 (587)	100 (22)	190	33 (125)	20,000 (4,250)	125 (862)	175 (1207)	300 (149)
X2.5	780	155 (587)	100 (22)	68	12 (45)	75,000 (15,750)	125 (862)	175 (1207)	300 (149)
GX3[1]	640	270 (1022)	100 (22)	125	46 (174)	20,000 (4,250)	125 (862)	175 (1207)	300 (149)
X3	640	270 (1022)	100 (22)	68	28 (106)	75,000 (15,750)	125 (862)	175 (1207)	300 (149)
GX4[1]	520	528 (1999)	100 (22)	100	90 (341)	20,000 (4,250)	125 (862)	175 (1207)	300 (149)
X4	520	528 (1999)	100 (22)	68	66 (250)	50,000 (10,500)	125 (862)	175 (1207)	300 (149)

[1] GX pump models are limited by gear reducer capability (pressure/rpm/viscosity dependent).
[2] Flow is nominal at 50 psi (345 kPa) differential pressure.
[3] Viscosity listed is maximum. Blackmer GX and X pump models are also well suited for viscosities less than 31 SSU (1 cP).
[4] Centipoise (cP) = Centistokes (cSt) at fluid specific gravity of 1.0.

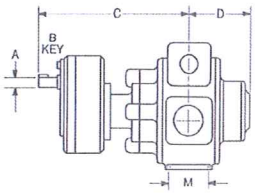
Note: Optional materials of construction may be required to meet specific application requirements — refer to Blackmer Material Specification Sheet 101/95-96.

PIPE COMPANION FLANGES

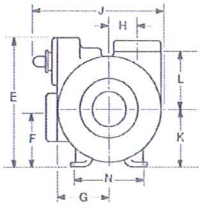
PUMP MODEL	STANDARD	OPTIONAL
GX2, X2	2" NPT	2" Blackmer Weld
		2" ANSI**
		50 MM DIN**
GX2.5, X2.5	2.5" NPT	2.5" Blackmer Weld
		3" ANSI**
		80 MM DIN**
GX3, X3	3" NPT	3" Blackmer Weld
		3" ANSI**
		80 MM DIN**
GX4, X4	4" NPT	4" Blackmer Weld
		4" ANSI**
		100 MM DIN**

**Din and ANSI compatible flanges are Raised Flat Faced.

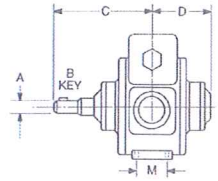
PUMP DIMENSIONS



GX Pump Models



GX and X Pump Models



PUMP MODEL		A	B	C	D	E	F	G	H	J	K	L	M	N	APPROX. WT. WITH STD. FLANGES
GX2	IN	3/4	3/16	11 9/16	5 3/8	8 11/16	3 1/2	4	1 1/2	9 3/4	4	4 1/8	1 5/8	5	110 lbs.
	MM	19	5	294	137	221	89	102	38	248	102	105	41	127	50 kgs.
GX2.5	IN	3/4	3/16	12 5/16	6	9 5/8	3 3/4	4 5/16	1 3/4	10 11/16	4	5 1/16	3	5 1/2	130 lbs.
	MM	19	5	313	152	244	95	110	44	271	102	129	76	140	59 kgs.
GX3	IN	1	1/4	14 1/2	6 1/2	12 3/16	4 5/8	5	2 1/2	13 3/8	5 3/8	5 1/4	2 1/2	6	230 lbs.
	MM	25	6	368	165	310	117	127	64	340	137	133	64	152	104 kgs.
GX4	IN	1 1/8	1/4	18 5/8	8 1/8	15 1/2	5	7 3/8	2 1/2	16 7/8	6 3/8	8	4 1/2	8	430 lbs.
	MM	29	6	473	206	394	127	187	64	429	162	203	114	203	195 kgs.

PUMP MODEL		A	B	C	D	E	F	G	H	J	K	L	M	N	APPROX. WT. WITH STD. FLANGES
X2	IN	1 1/8	1/4	8	5 3/8	8 11/16	3 1/2	4	1 1/2	9 3/4	4	4 1/8	1 5/8	5	70 lbs.
	MM	29	6	203	137	221	89	102	38	248	102	105	41	127	32 kgs.
X2.5	IN	1 1/8	1/4	8 3/4	6	9 5/8	3 3/4	4 5/16	1 3/4	10 11/16	4	5 1/16	3	5 1/2	93 lbs.
	MM	29	6	222	152	244	95	110	44	271	102	129	76	140	42 kgs.
X3	IN	1 1/8	1/4	9 5/8	6 1/2	12 3/16	4 5/8	5	2 1/2	13 3/8					152 lbs.
	MM	29	6	244	165	310	117	127	64	340					69 kgs.
X4	IN	1 1/2	3/8	11	8 1/8	15 1/2	5	7 3/8	2 1/2	16 7/8					275 lbs.
	MM	38	10	280	206	394	127	187	64	429					125 kgs.

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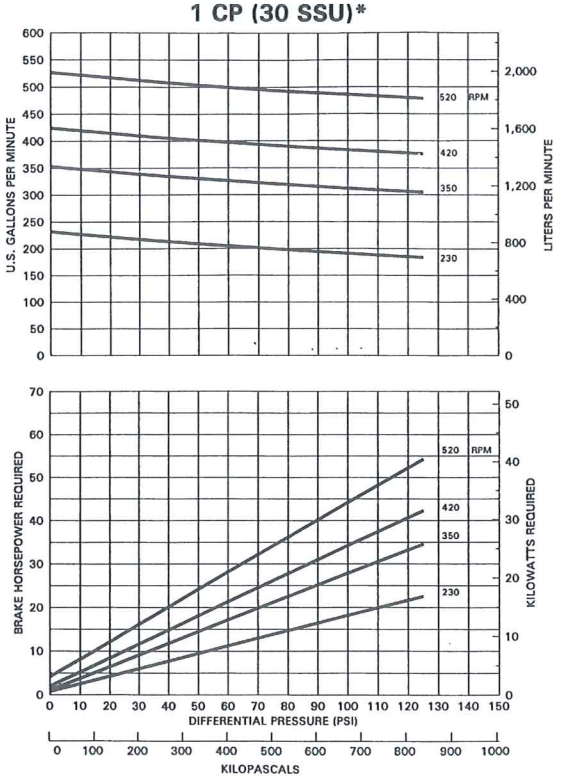
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8/96

CHARACTERISTIC CURVES

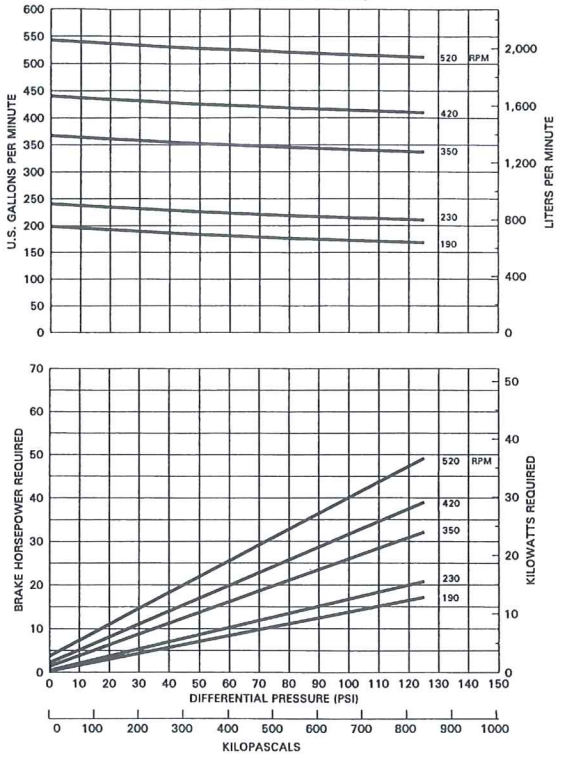
Models: GX4, X4

1 CP (30 SSU)*



Performance Note: Non-metallic vanes Only.

20 CP (100 SSU)*



Performance Note: Non-metallic vanes Only.

Blackmer Characteristic Curves are based on Brake Horsepower (BHp). To determine Motor Horsepower, drive train inefficiencies must be added to the BHp.

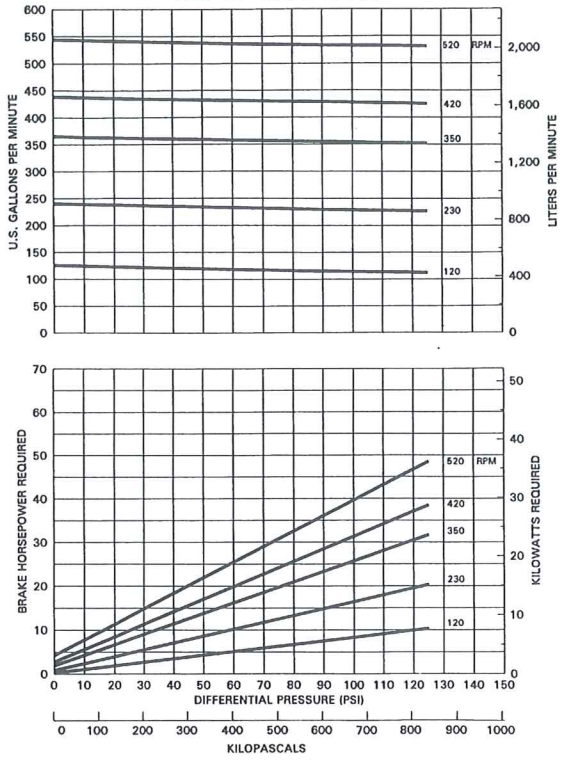
Actual capacities are dependent upon the vapor pressure of the liquid and the inlet conditions of the system.

*Centipoise (cP) to SSU conversion is based on a fluid specific gravity of 1.0.
Centipoise = centistokes at 1.0 specific gravity.

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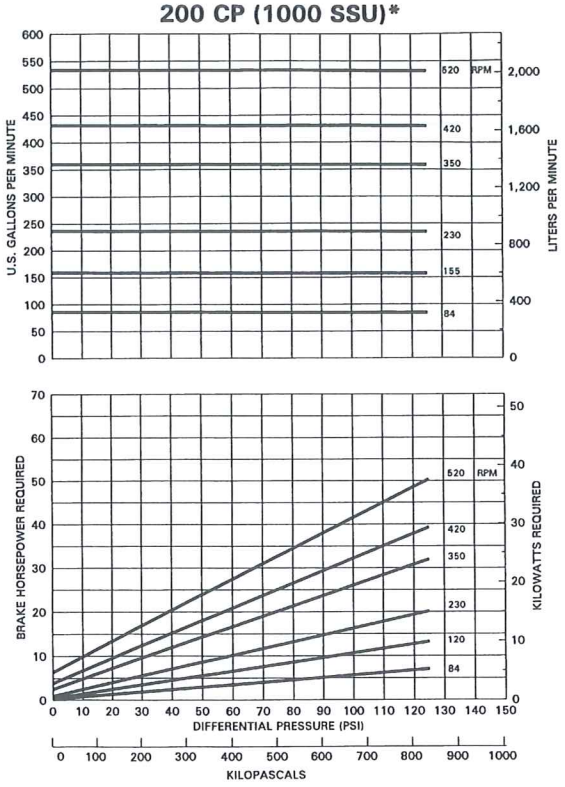
CHARACTERISTIC CURVES
Models: GX4, X4

100 CP (500 SSU)*



Performance Note: Non-metallic or metallic vanes.

200 CP (1000 SSU)*



Performance Note: Non-metallic or metallic vanes.

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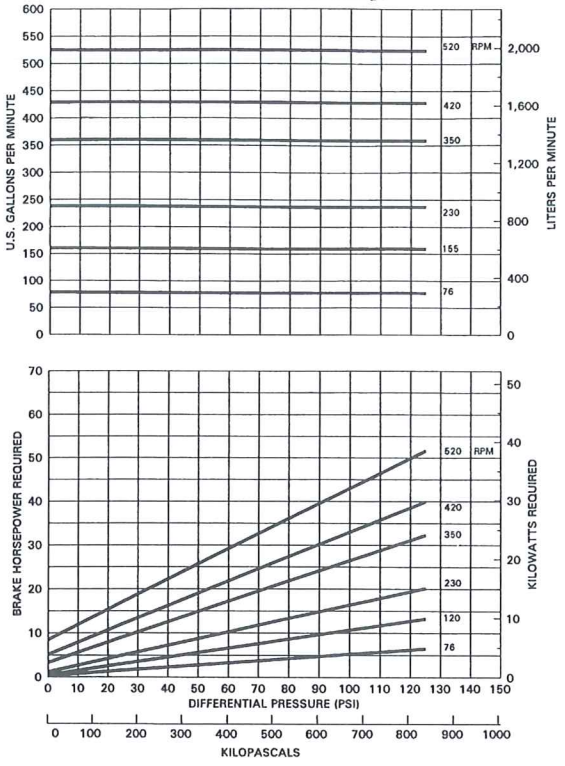
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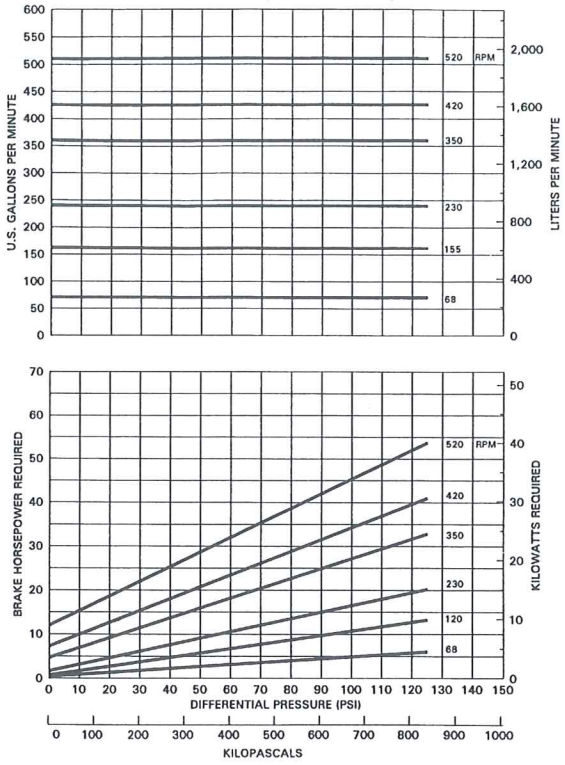
CHARACTERISTIC CURVES
Models: GX4, X4

500 CP (2500 SSU)*



Performance Note: Non-metallic or metallic vanes.

1000 CP (4600 SSU)*



Performance Note: Non-metallic or metallic vanes.

Blackmer Characteristic Curves are based on Brake Horsepower (BHp). To determine Motor Horsepower, drive train inefficiencies must be added to the BHp.

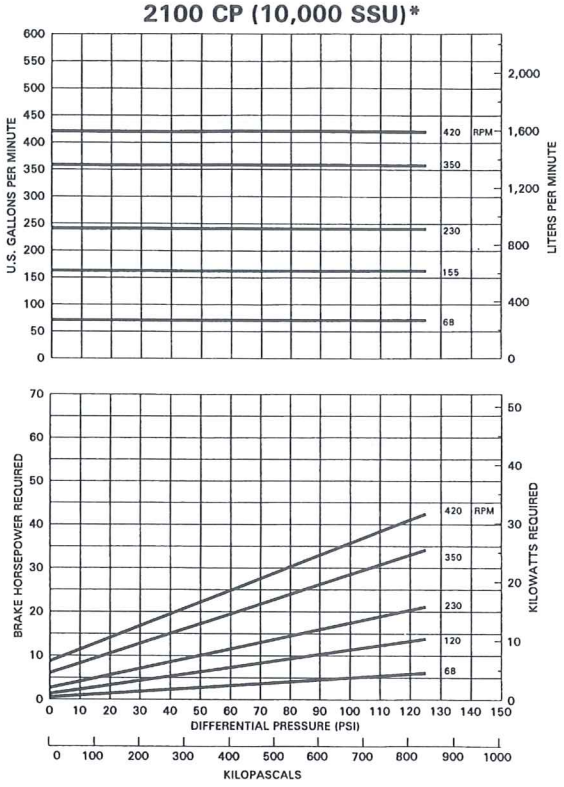
Actual capacities are dependent upon the vapor pressure of the liquid and the inlet conditions of the system.

*Centipoise (cP) to SSU conversion is based on a fluid specific gravity of 1.0.
Centipoise = centistokes at 1.0 specific gravity.

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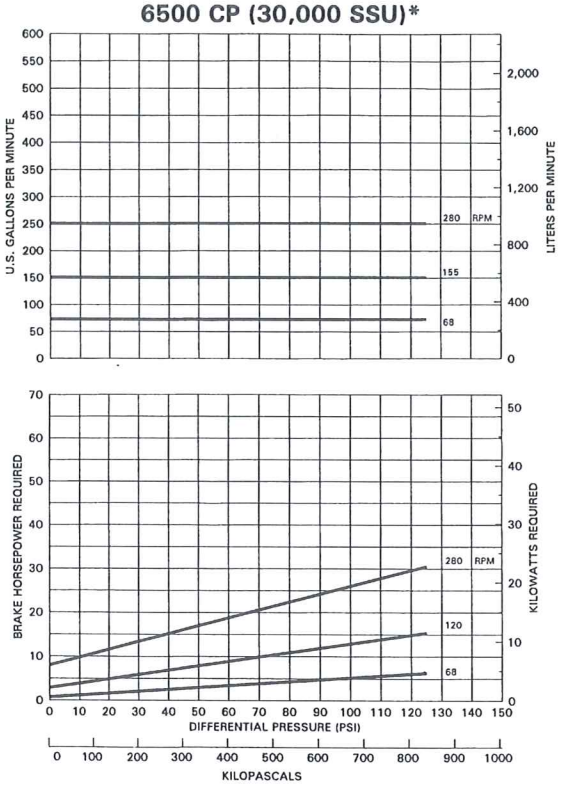
CHARACTERISTIC CURVES
Models: GX4, X4

2100 CP (10,000 SSU)*



Performance Note: Non-metallic or metallic vanes. Metallic vanes recommended above 2100 cP (10,000 SSU).

6500 CP (30,000 SSU)*



Performance Note: Metallic vanes and extra – clearance rotor required over 4250 cP (20,000 SSU).

Blackmer Characteristic Curves are based on Brake Horsepower (BHp). To determine Motor Horsepower, drive train inefficiencies must be added to the BHp.

Actual capacities are dependent upon the vapor pressure of the liquid and the inlet conditions of the system.

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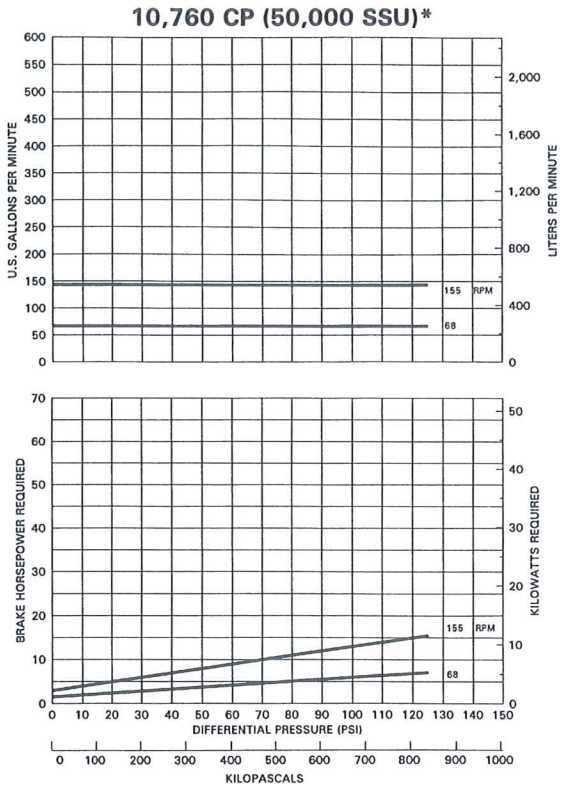
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Models: GX4, X4



Performance Note: Metallic vanes and extra-clearance rotor required over 4250 cP (20,000 SSU).

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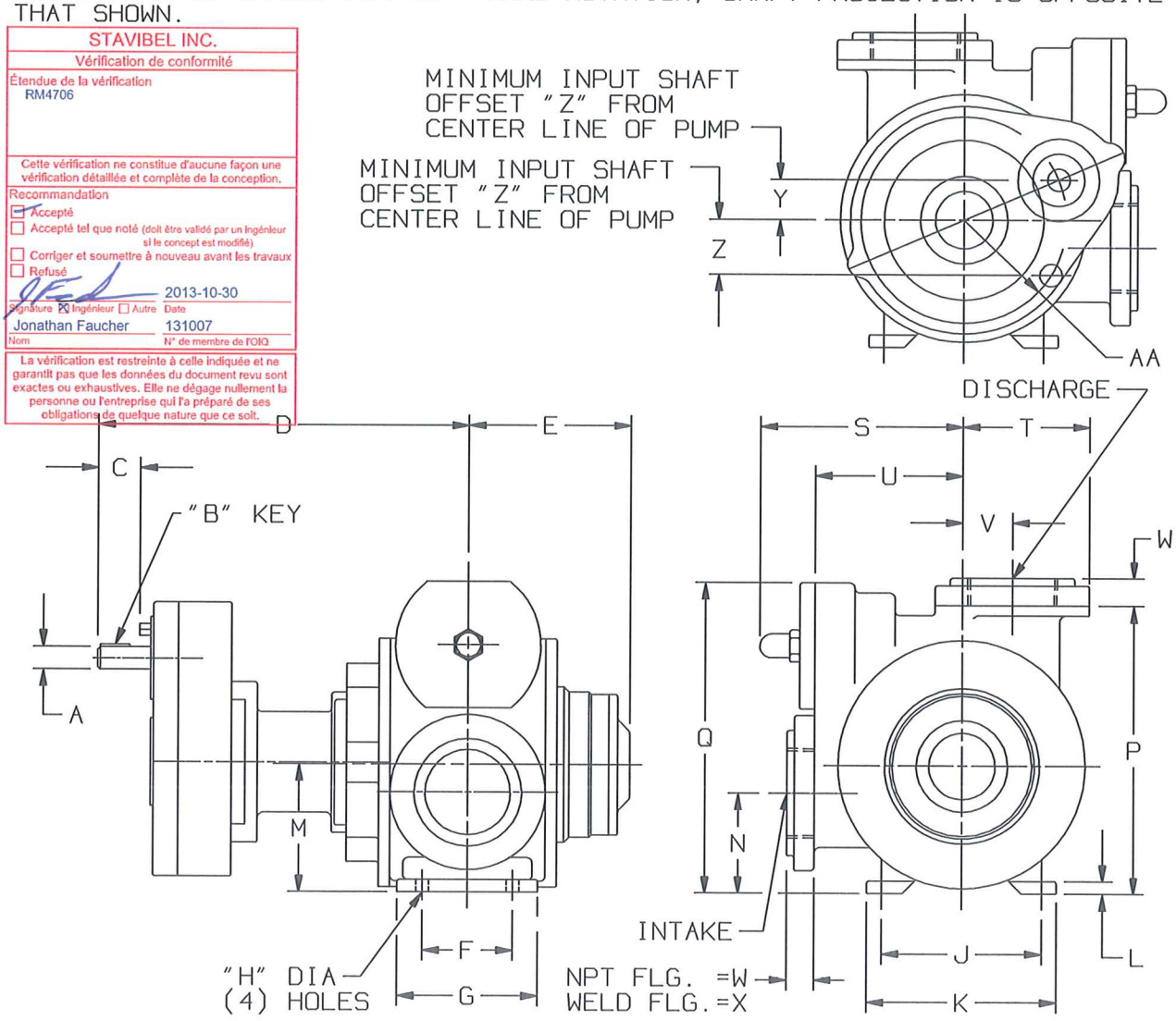
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Blackmer Part of Pump Solutions Group, A DOVER COMPANY, www.blackmer.com	TYPE	SIZE	UNIT STYLE	DIMENSIONS 101-108
	GX	4B	PO	Section 101 Effective February 2003 Replaces October 1995 Page 1/3

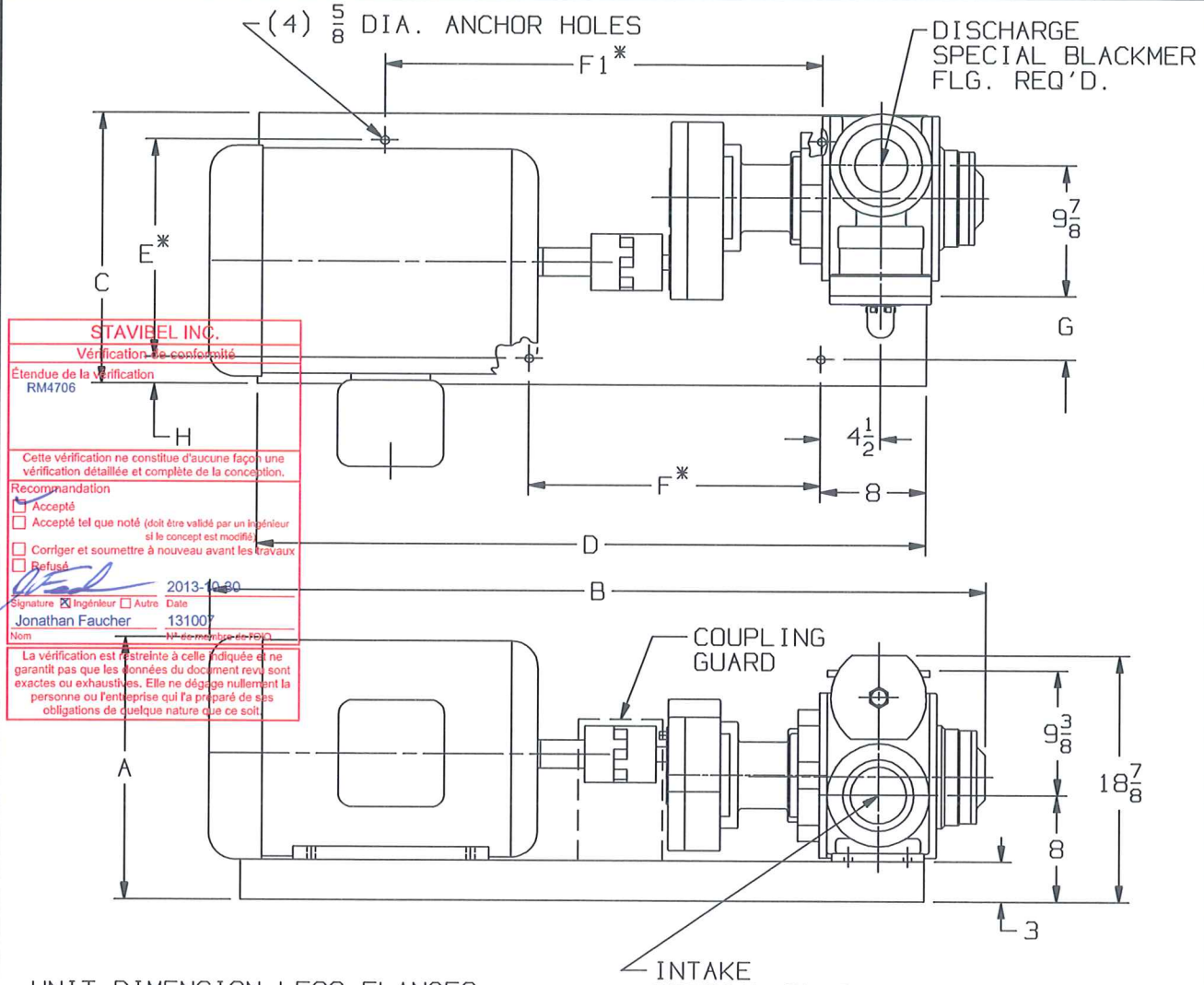
RIGHT HAND ROTATION. FOR LEFT HAND ROTATION, SHAFT PROJECTION IS OPPOSITE THAT SHOWN.

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MOTOR FRAME SIZE			UNITS	A	B	C	D	E	F	G	H	J	K
			IN	1 1/8	1/4	2 1/8	18 5/8	8 1/8	4 1/2	7	5/8	8	9 1/2
			MM	28,6	6,4	54	473,1	206,4	114,3	177,8	15,9	203,2	241,3
				L	M	N	P	Q	R	S	T	U	V
			IN	5/8	6 3/8	5	14 3/8	15 1/2	—	10 1/8	6 3/8	7 3/8	2 1/2
			MM	15,9	177,8	127,0	365,1	393,7	—	257,2	161,9	187,3	63,5
				W	X	Y	Z	AA	BB	CC	DD		WEIGHT WITHOUT FLANGES
			IN	1 3/8	3	2	2 3/4	5 5/32	—	—	—	LBS	430
			MM	34.9	76,2	50,8	69,9	131	—	—	—	KG	195

Blackmer Part of Pump Solutions Group — www.blackmer.com	TYPE	SIZE	UNIT STYLE	DIMENSIONS 101-108
	GX RIGHT HAND ROTATION	4B	GX	Section 101 · Effective April 2003 · Replaces February 2003 · Page 2/3



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UNIT DIMENSION LESS FLANGES

* TOLERANCE ±1/8

TOLERANCE ON OTHER DIMENSIONS ± 1/4

"A" DIMENSION LESS EYEBOLT

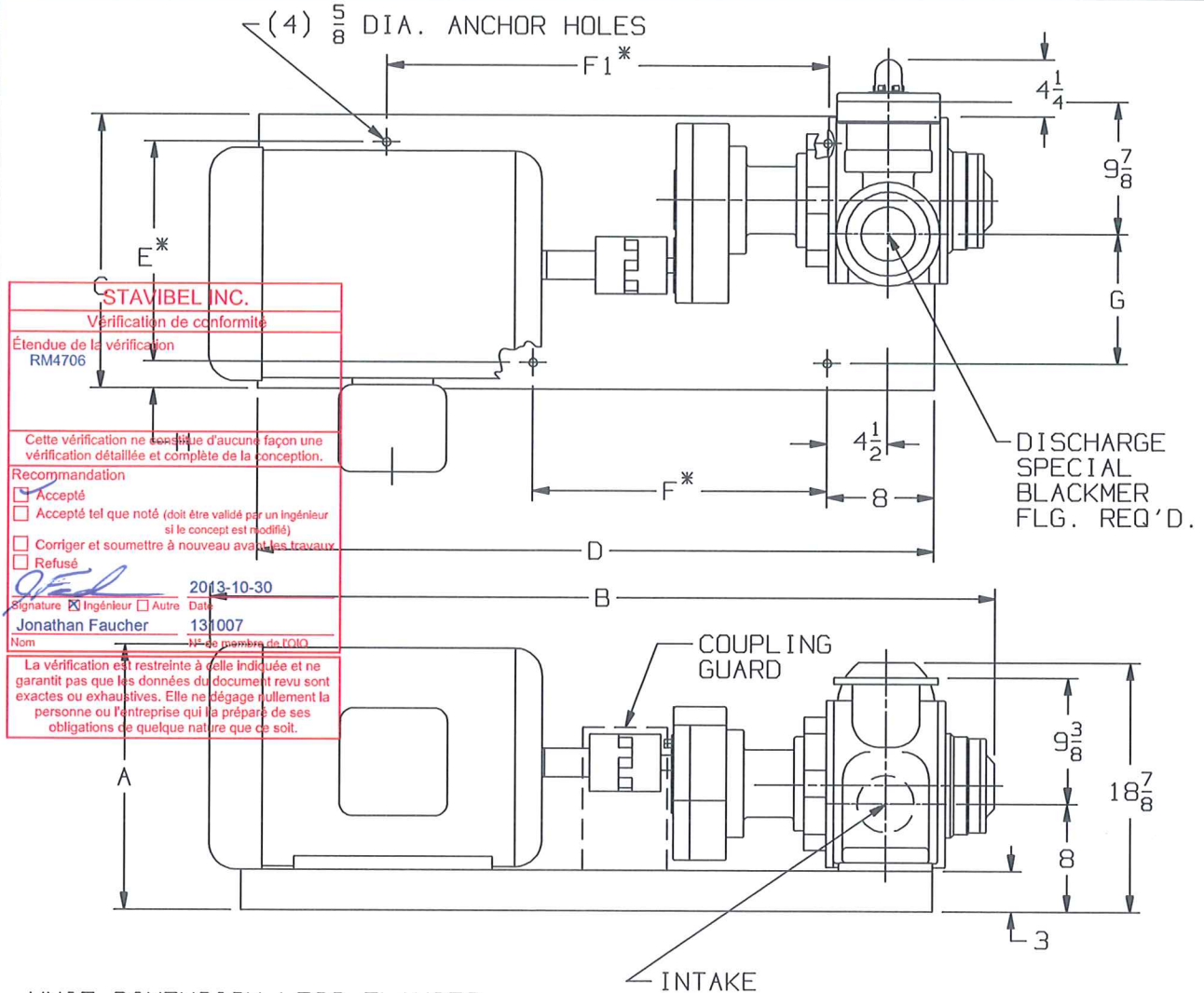
FLG. HT: 4" NPT-1 3/8

4" WELD-3

MOTOR FRAME SIZE			BASE NO.	DIMENSIONS A	B	C	D	E	F	F1	G	H	J	K	L
213T			901650	14 1/4	48 3/8	19 5/8	43	14	15	26	3	2 7/8			
215T			901650	14 1/4	48 3/8	19 5/8	43	14	15	26	3	2 7/8			
254T			901653	16 3/8	52 1/4	19 5/8	43	14	15	26	3	2 7/8			
256T			901653	16 3/8	54	19 5/8	43	14	15	26	3	2 7/8			
284T			901498	18	56	20 3/8	50 1/2	16 3/8	22	33	4 3/4	2			
286T			901498	18	57 1/2	20 3/8	50 1/2	16 3/8	22	33	4 3/4	2			
324T			901498	20	59 5/8	20 3/8	50 1/2	16 3/8	22	33	4 3/4	2			
326T			901498	20	61 1/8	20 3/8	50 1/2	16 3/8	22	33	4 3/4	2			

DIMENSIONS 101-108	TYPE	SIZE	UNIT STYLE
Section 101 Effective April 2003 Replaces February 2003 Page 3/3	GX LEFT HAND ROTATION	4B	GX

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UNIT DIMENSION LESS FLANGES

* TOLERANCE ± 1/8

TOLERANCE ON OTHER DIMENSIONS ± 1/4

"A" DIMENSION LESS EYEBOLT

FLG. HT: 4" NPT-1 3/8

4" WELD-3

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254T			901653	16 3/8	52 1/4	19 5/8	43	14	15	26	7 7/8	2 7/8			
256T			901653	16 3/8	54	19 5/8	43	14	15	26	7 7/8	2 7/8			
284T			901498	18	56	20 3/8	50 1/2	16 3/8	22	33	9 5/8	2			
286T			901498	18	57 1/2	20 3/8	50 1/2	16 3/8	22	33	9 5/8	2			
324T			901498	20	59 5/8	20 3/8	50 1/2	16 3/8	22	33	9 5/8	2			
326T			901498	20	61 1/8	20 3/8	50 1/2	16 3/8	22	33	9 5/8	2			

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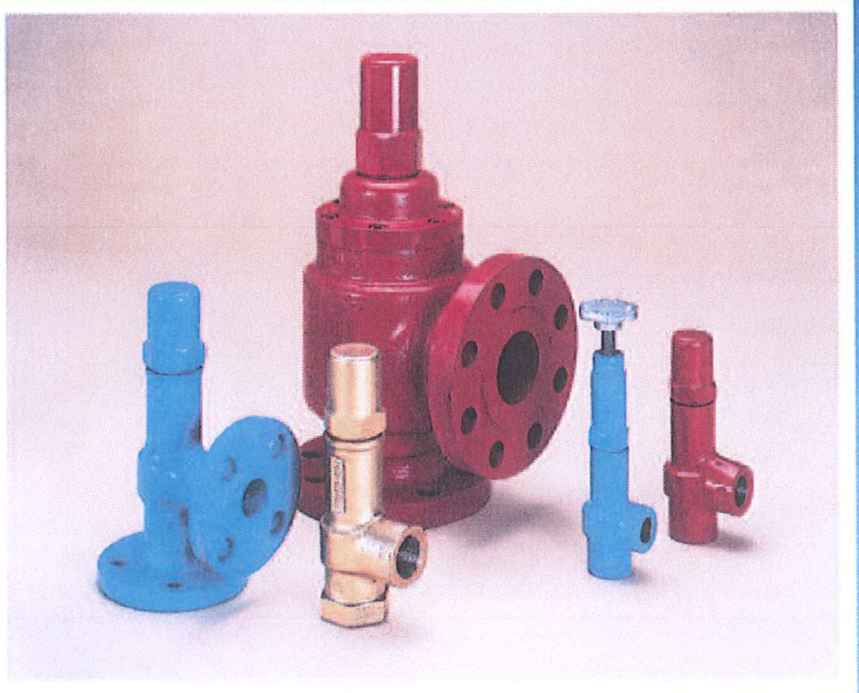
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HYDRAULIC BYPASS RELIEF VALVES

VOIR PAGE 22

the Quiet Ones

CHATTER FREE PERFORMANCE



MADE IN THE USA

FULFLO SPECIALTIES COMPANY . . .

Pioneers in Fluid Power

Established in 1912, FULFLO was incorporated in 1933 under its present name and trademark. Patents for the original guided piston, direct-acting relief valve were obtained in 1935, coincident with the onset of fluid power systems. The need for providing large flows without excessive bulk was subsequently met by the pilot-valve-controlled relief valve, a patent on which was issued to FULFLO in 1943 (U.S. Patent No. 2,333,522).

FULFLO is located in Blanchester, Ohio just 30 miles northeast of Cincinnati, close to some of the state's largest manufacturing centers. Blanchester is served by air from Greater Cincinnati Airport and alternately from Dayton Municipal Airport.

From Cincinnati, travel Interstate 71 north to Interstate 275, east to US 28 and northeast to Blanchester.

From Dayton, travel Interstate 75 south to Route 123 and southeast to Blanchester.

If you plan to visit FULFLO, advise us of your itinerary and we will be happy to assist with transportation and hotel arrangements.

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TERMS AND CONDITIONS

Product Information. Please include complete product data as described in the catalog. **Note:** All valves will be set to charge pressure of the spring, unless otherwise specified.

Instructions. All requirements specific to a customer's order must be stated on original purchase order. This includes, but is not limited to, tagging, markings, documentation, packaging, ship via collect account numbers, etc... All requirements regarding a puchase order should be verified by the faxed acknowledgment.

Shipping Information. Please include purchaser's name, complete address and requested routing. Product many be shipped via Ground, insured parcel post or commercial motor freight.

Guarantee. Fulflo products are guaranteed against defects in workmanship or material for one year after date of shipment. Fulflo is not liable for any damages resulting from misuse or misapplication of its product.

Specifications. For continued improvement of our product line, we reserve the right to change product specifications without prior notice.

Cancellations. Charges are based on work accomplished prior to the receipt of cancellation.

Returned Material. An RGA (Return Goods Authorization) Number **must** be issued before returning any valves, parts not accepted.

©The Fulflo Specialties Company, 2006

Restocking. Product returned is subject to a restocking charge. Restocking fee is 25% of List Price on standard product line. Special products are subject to additional charges.

Prices. F.O.B. Blanchester, Ohio. Prices are subject to change without notice.

Terms. Net 30 days to buyers with approved credit: all other shipments are C.O.D., MC / or VISA.

Invoicing. Buyers will be invoiced by Fulflo Specialties, 459 E. Fancy Street, Blanchester, Ohio 45107.

Delivery. Deliveries are scheduled after receipt of orders which should include all required technical information. Shipping dates are **estimated** based on conditions prevailing at the time of quotation, but are not guaranteed. Fulflo shall not be liable for delays in delivery due to causes beyond its reasonable control. Fulflo shall not be liable for any special or consequential damages caused by or resulting from delay, failure to manufacture or deliver.

Minimum Order. Minimum order charge required is $30.00.

Expediting Fee. Orders may be subject to a 20% net expediting fee.

Change Order Fee. There is a $25.00 change order fee, per order.

DUE TO ENGINEERING UPGRADING, THE DIMENSIONS AND SPECIFICATIONS ARE SUBJECT TO CHANGE, BUT ARE CORRECT HERE AT TIME OF PRINTING.

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FULFLO

OUR MISSION STATEMENT: ***Fulflo Specialties will strive to be the world leader in the valve manufacturing industry. Our mission is to achieve and sustain through continual improvement, the highest quality of product and services. Fulflo will ensure that every employee, vendor, and subcontractor share a common goal of quality and reliability at an affordable price.***

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SPECIALTY VALVES

Please contact Fulflo direct for special applications. We provide special valves or modified valves to meet your application.

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VALVE SIZING...Use of Performance Charts

FULFLO GUIDED PISTON VALVES

The trademark FULFLO expresses the basic principle that the relief valve must have flow capacity equal to that of the pipe lines to which it is connected. The sliding piston concept and internal design contours of FULFLO valves provide unique flow and stability characteristics for reliable performance without chatter.

FULFLO valves are designed to operate reliably at pressures as low as 2 PSI and as high as 1000 PSI. The FULFLO valve reduces velocities through all but the controlling interface of the valve thereby minimizing system power loss.

Unlike ordinary direct acting relief valves, FULFLO guided piston valves are less responsive to transient pressure surges thereby eliminating the tendency to pound, squeal or chatter. Quiet, stable, efficient performance is assured in both load regulation and system protection applications.

FULFLO valves operate effectively with all types of liquids in the full range of viscosities including hydraulic oils, water, solvents and chemicals.

FULFLO valves are not designed to be positive shut off, and will pass a minimal amount of leakage before the set pressure.

FULFLO valves are NOT designed for use with air, gas or steam.

Since the FULFLO relief valve is a flow-modulating device, pressure flow characteristics are completely different from spring loaded poppet or ball check valves. Both types remain substantially tight up to *cracking pressure*. When this pressure is exceeded, the "conventional" valve pops open with a pressure drop at very low flow and an exponential pressure rise as the flow increases.

In contrast the FULFLO valve causes a pressure rise, *over-pressure*, as soon as flow starts; pressure increases almost proportionally with flow. Springs and areas on FULFLO valves are carefully designed to minimize this over-pressure.

Both pressures are important in sizing a valve. *Cracking pressure* must be selected high enough to permit system operation at its maximum rated pressure and flow. *Over-pressure* is limited by the system's capability to withstand the additional pressure and the motor's ability to sustain the pump output at the increased pressure for the required time interval.

The over-pressure to produce a certain flow is a function of valve size and spring constant and can be determined with the aid of the over-pressure charts given for the different valve sizes. The valve performance charts are based on tests made with oil of 150 SSU viscosity at 100˚ F and may be used with reasonable accuracy within the conventional range of oil viscosities from 30 to 500 SSU. For operation with high viscosity fluids, consult FULFLO's engineering department.

In sizing a valve, the first attempt should be to select a valve equal in size to the pipe to which it is connected. A larger or smaller valve may be used to suit individual requirements, depending on the permissible amount of over-pressure. Assume we have selected a 3/4" valve for 17 GPM flow and a cracking pressure of 325 PSI. By referring to the pressure range chart, we find that we may use either a "YS" or a "ZS" spring.

Assuming a "YS" spring, draw a line horizontally at 17 GPM in the 3/4" valve chart, to intersect the slanted line marked "YS" and drop a vertical line to the over-pressure scale to read an over-pressure of 44 PSI. The 17 GPM will be discharged at a pressure of 325 + 44 or 369 PSI. The percentage of over-pressure would be 44/325 X 100 or 13.5%.

If a "ZS" spring is used, extend the horizontal line to the "ZS" slope and the over-pressure is 70 PSU. The pressure to pass 17 GPM would be 325 + 70 or 395 PSI and the over-pressure would be 21.5%. If the over-pressure is higher than desired for the particular application, the procedure may be repeated for the next larger size valve.

In some cases, maximum flow through a valve at a given pressure is specified. To determine the cracking pressure, assume a 3/4" valve is to pass 12 GPM at 50 PSI. A horizontal line drawn from the 12 GPM capacity to the intersection with the "WS" spring line results in an over-pressure of 14 PSI, therefore the cracking pressure must be 50 – 14 or 36 PSI, and the percentage of over-pressure of only 9 PSI, but the cracking pressure would be 14/36 x 100 or 38.8%. The use of a "US" spring would produce an over pressure of only 9 PSI but the cracking pressure would then be 50 – 9 or 41 PSI, which would exceed the rating of the "US" spring.

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For sizing valves for higher viscosity than 500 SSU, the following formula is used:

$$\sqrt[4]{\frac{V2}{V1}} \times \text{area of valve for 150 SSU}$$

V1 = 150 SSU

V2 = higher viscosity

Assume we have the following application;

GPM = 10

Viscosity = 12,000 SSU

Normally for 10 GPM a 1/2" valve would be used. Referring to the orifice area chart on page 9, to find the area of a 1/2" valve. The area is .305.

$$\sqrt[4]{\frac{12000}{150}} = \sqrt[4]{80} = 2.99$$

2.99 x .305=.9120 area needed to pass 10 GPM

Again referring to the orifice area chart, we find that the area of 1¼" valve is 1.224. Therefore a 1¼" valve would be used. To find the over-pressure refer to the performance chart for a 1¼" valve.

Performance charts based on actual test results are available on request. For additional information contact THE FULFLO SPECIALTIES CO.

PIPE SIZING...Use of the Nomograph

The flow velocity, which must first be determined, is dependent on the viscosity of the fluid and the permissible flow resistance in the piping. Lower velocities are for higher viscosity fluids and/or lower pressure drops; higher velocities are for less viscous fluids and cases where higher pressure drops can be tolerated. In all cases, allowable suction velocities are much lower and the lowest velocities should be used for the more viscous fluids and/or higher suction lifts.

Suction velocities are much more critical than discharge velocities. Too high a discharge velocity may only result in excessive power loss but an excessive suction velocity may make the system inoperative or cause damage to the pump and system.

After the velocity has been selected, the nomograph chart is used to determine the inside diameter of the pipe at a given flow rate. For example, assume a flow of 17 gpm and a velocity of 12 fps for the discharge pipe is required. Draw a line from the 12 fps point on the velocity scale through the 17 gpm point on the flow rate scale and the extended line intersects the pipe inside diameter scale at 0.76 inches. This inside diameter applies to either pipe or tubing.

The correct pipe or tube size also depends on the pressure it must carry. The conversion chart for pipe sizes and schedules facilitates this section.

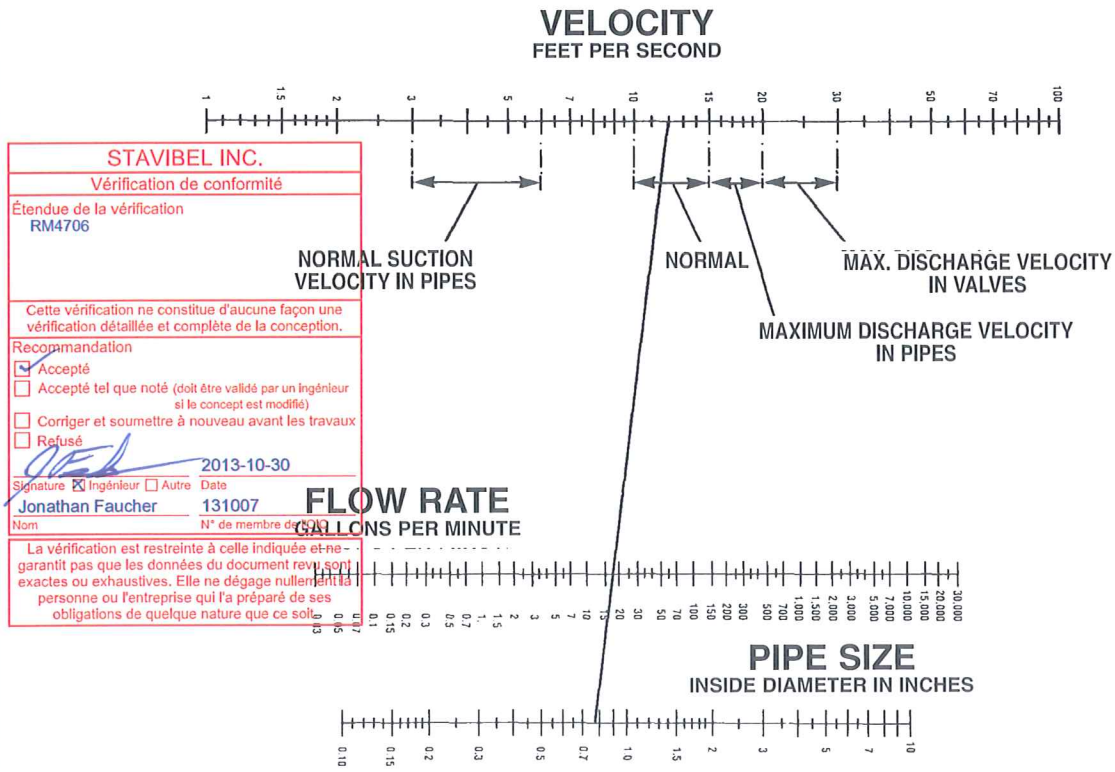
Note the different weights or piping are grouped under various schedule numbers. Approximate pressure for each schedule number may be computed from the formula.

$$\text{Pressure} = \frac{S}{1000} \times \text{schedule number}$$

S is the permissible stress to which the pipe is subjected. Thus, for a stress of 10,000 psi, the allowable pressure is equal to ten times the schedule number. Higher pressures may be carried if higher stresses are allowed.

In the example, a schedule 40 pipe is more than adequate for 250 psi. Twice the wall thickness of a 3/4" schedule 40 pipe of 0.226 or 0.976". Since the actual outside diameter of a 3/4" schedule 40 pipe is 1.05", the selection of a 3/4" pipe is adequate.

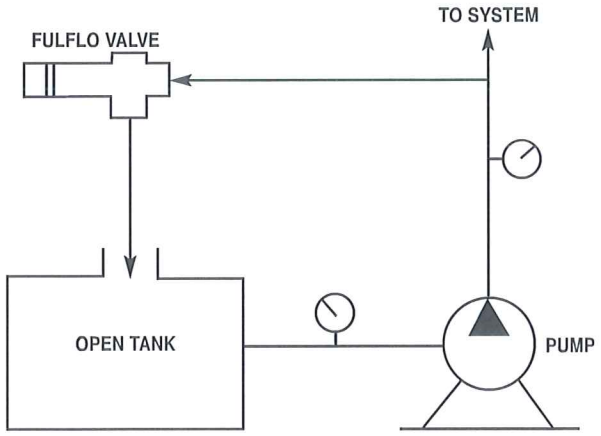
A 3/4" Fulflo relief valve should be selected. Operational characteristics of this valve, that is cracking pressure and overpressure, may be determined from the performance chart precisely in the manner explained in the example. The maximum discharge pressure of 285 psi is still well below the safe carrying capacity of the pipe. The design of the Fulflo valves is such that if used within their rating and with properly selected springs, the overpressure is not sufficient to endanger system or system components.



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APPLICATIONS

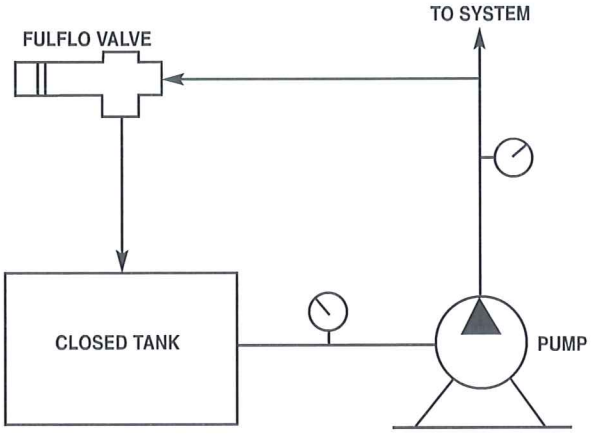
SYSTEM 1



OPEN TANK

VALVE SET PRESSURE EQUAL
SYSTEM OPERATING PRESSUR

SYSTEM 2

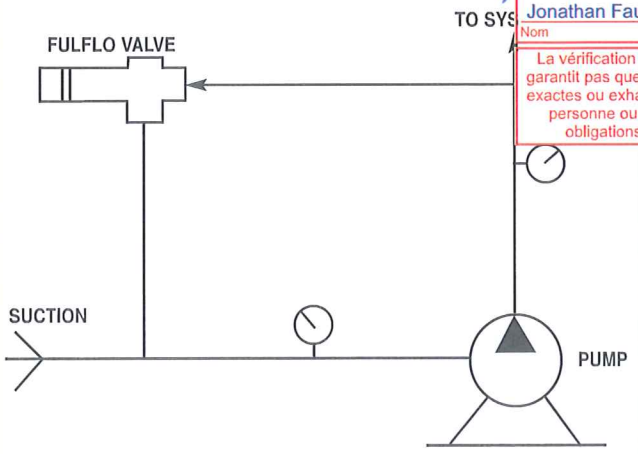


CLOSED TANK

:SSURE + VALVE SET PRESSURE
SYSTEM OPERATING PRESSURE

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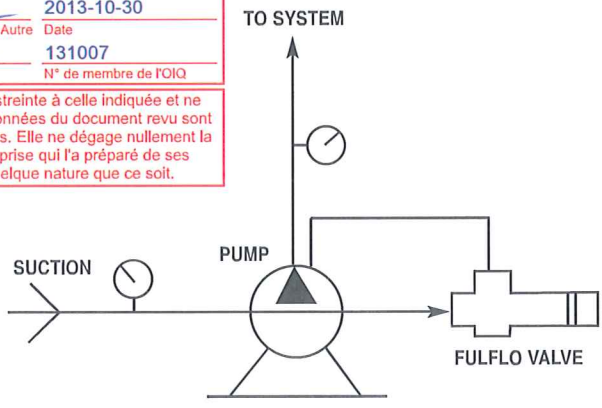
SYSTEM 3



CLOSED LOOP

SUCTION PRESSURE + VALVE SET PRESSURE
EQUALS SYSTEM OPERATING PRESSURE

SYSTEM 4



PUMP INTERNAL RELIEF

FOR PUMPS WITH (2) SUCTION PORTS
AND (2) DISCHARGE PORTS

SUCTION PRESSURE + VALVE SET PRESSURE
EQUALS SYSTEM OPERATING PRESSURE

SPRING MATERIAL & TEMPERATURE CHART

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VALVE SIZE	PART NO.	MATERIAL					MAX TEMP.				ASTM SPEC.				
		17-7PHSS	18-8SS	CHR. VANADIUM	OIL TEMP.	MUSIC WIRE	650 F	550 F	425 F	250 F	313 TYPE 631	A581 COND. A	A 231	229	228
3/8"	207-AS		•					•				•			
	207-US		•					•				•			
	207-WS		•					•				•			
	207-XS		•					•				•			
	207-YS	•					•				•				
	207-ZS	•					•				•				
	207-RS	•					•				•				
	207-TS	•					•				•				
	207-A					•				•					•
	207-U					•				•					•
	207-W				•					•				•	
	207-X				•					•				•	
	207-Y			•					•				•		
	207-Z			•					•				•		
	207-RS		•					•				•			
	207-TS		•					•				•			
1/2"	307-AS		•					•				•			
	307-US		•					•				•			
	307-WS		•					•				•			
	307-XS	•					•				•				
	307-YS	•					•				•				
	307-ZS	•					•				•				
	307-RS	•					•				•				
	307-TS	•					•				•				
	307-A					•				•					•
	307-U				•					•				•	
	307-W				•					•				•	
	307-X				•					•				•	
	307-Y				•					•				•	
	307-Z				•					•				•	
	307-RS		•					•				•			
	307-TS		•					•				•			
3/4"	407-AS		•					•				•			
	407-US		•					•				•			
	407-WS		•					•				•			
	407-XS	•					•				•				
	407-YS	•					•				•				
	407-ZS	•					•				•				
	407-U				•					•				•	
	407-W				•					•				•	
	407-X			•					•				•		
	407-Y			•					•				•		
	407-Z				•					•				•	
1"	507-AS		•					•				•			
	507-US		•					•					•		
	507-WS		•					•					•		
	507-XS	•					•				•				
	507-YS	•					•				•				
	507-ZS	•					•				•				
	507-A				•					•				•	
	507-U				•					•				•	
	507-W				•					•				•	
	507-X			•					•				•		
	507-Y				•					•				•	
	507-Z				•					•				•	
	507-R			•					•				•		

VALVE SIZE	PART NO.	MATERIAL					MAX TEMP.				ASTM SPEC.				
		17-7PHSS	18-8SS	CHR. VANADIUM	OIL TEMP.	CHROME SILICON	650 F	550 F	425 F	250 F	313 TYPE 631	A581 COND. A	A 231	229	228
1 1/4"	607-AS		•					•				•			
	607-US		•					•				•			
	607-WS		•					•				•			
	607-XS	•					•				•				
	607-YS	•					•				•				
	607-ZS	•					•				•				
	607-A				•					•				•	
	607-U				•					•				•	
	607-W				•					•				•	
	607-Y				•					•				•	
	607-Z				•					•				•	
	607-R			•					•				•		
1 1/2"	707-AS		•					•				•			
	707-US		•					•				•			
	707-WS		•					•				•			
	707-XS	•					•				•				
	707YS	•					•				•				
	707-ZS	•					•				•				
	707-A				•					•				•	
	707-U				•					•				•	
	707-W				•					•				•	
	707-X				•					•				•	
	707-Y				•	•				•				•	
	707-Z				•					•				•	
	707-R				•					•				•	
2"	807-AS		•					•				•			
	807-US		•					•				•			
	807-WS		•					•				•			
	807-XS	•					•				•				
	807-YS	•					•				•				
	807-ZS	•					•				•				
	807-A				•					•				•	
	807-U				•					•				•	
	807-W				•					•				•	
	807-X				•					•				•	
	807-Y				•					•				•	
	807-Z	•					•				•				
2 1/2"	A0960D		•					•				•			
	A0961C			•					•				•		
	A0970D		•					•				•			
	A0971C			•					•				•		
	A0980D		•					•				•			
3"	A1060D		•					•				•			
	A1061C			•					•				•		
	A1070D		•					•				•			
	A1071C			•					•				•		
	A1080D		•					•				•			
4"	A1160D		•					•				•			
	A1170D		•					•				•			
	A1181D		•					•				•			
4" 3" 2 1/2"	A1190D		•					•				•			

SAE O-RING BOSS CONNECTIONS

ENGINEERING DATA

VALVE SIZE	SAE NUMBER								
	5	6	8	10	12	16	20	24	32
3/8"	X	X	X						
1/2"		X	X	X					
3/4"					X				
1"					X	X	X		
1¼"							X	X	
1½"								X	
2"									X

SAE (Society Automotive Engineers)

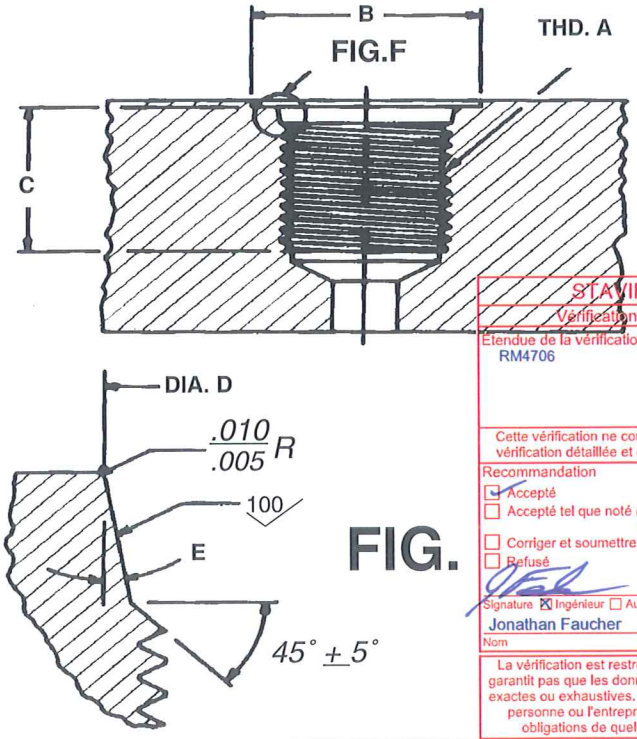


FIG.

DIMENSIONS (INCHES)

SAE NO.	A	B	C	D	E
5	1/2"-20	.937	.547	.550	12°F
6	9/16"-18	1.000	.609	.616	12°F
8	3/4"-16	1.218	.688	.811	12°F
10	7/8"-14	1.375	.781	.942	15°F
12	1 1/16"-12	1.656	.906	1.148	15°F
16	1 5/16"-12	2.000	.906	1.398	15°F
20	1 5/8"-12	2.312	.906	1.713	15°F
24	1 7/8"-12	2.562	.906	1.962	15°F
32	2 1/2"-12	3.192	.906	2.587	15°F

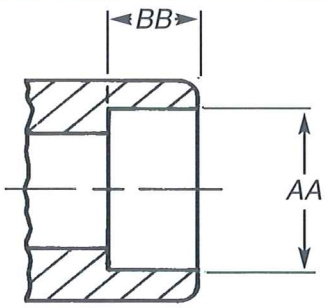
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VALVE SIZE	SAE NO.	MATERIAL			
		CAST IRON	BRASS	STEEL	STAINLESS
3/8"	5	SVJ-2039	SVB-2039	SVS-2039	SVSS-2039
	6	SVJ-2036	SVB-2036	SVS-2036	SVSS-2036
	8	SVJ-2042	SVB-2042	SVS-2042	SVSS-2042
1/2"	6	SVJ-3065	SVB-3065	SVS-3065	SVSS-3065
	8	SVJ-3066	SVB-3066	SVS-3066	SVSS-3066
	10	SVJ-3051	SVB-3051	SVS-3051	SVSS-3051
	12	SVJ-4049	SVB-4049	SVS-4049	SVSS-4049
1"	12	SVJ-5084	SVB-5084	SVS-5084	SVSS-5084
	16	SVJ-5071	SVB-5071	SVS-5071	SVSS-5071
	20	SVJ-5083	SVB-5083	SVS-5083	SVSS-5083
1¼"	20	SVJ-6065	SVB-6065	SVS-6065	SVSS-6065
	24	SVJ-6066	SVB-6066	SVS-6066	SVSS-6066
1½"	24	SVJ-7050	SVB-7050	SVS-7050	SVSS-7050
2"	32	SVJ-8047	SVB-8047	SVS-8047	SVSS-8047

SOCKET WELD & STANDARD MATERIALS

SOCKET WELD

VALVE SIZE	MODEL NUMBER		AA		BB
	STEEL	STAINLESS	MIN.	MAX.	
3/8"	SVS-2033	SVSS-2033	.685	.690	.312
1/2"	SVS-3037	SVSS-3037	.850	.855	.437
3/4"	SVS-4038	SVSS-4038	1.060	1.065	.562
1"	SVS-5024	SVSS-5024	1.325	1.330	.625
1¼"	SVS-6058	SVSS-6058	1.670	1.675	.750
1½"	SVS-7067	SVSS-7067	1.910	1.915	.812
2"	SVS-8070	SVSS-8070	2.410	2.415	.875



ASTM/ASME SPECIFICATIONS

Adjusting Screws 303
Stop Rings, Glands, Bonnets
- Brass – ASTM B16
- Steel – ASTM 108-79
- Stainless Steel – ASME ASME SA479
  Stop Rings Only Class 316

Caps
- Cast Iron – 401 thru 801 ASTM A 126-42 Class A
- Brass – 201-B thru 501-B ASTM B16
- Brass – 601B thru 801-B ASME B62
- Steel – All models ASTM 108-79
- Stainless Steel – All models ASME SA479 Class 303

Locknuts, Retainers
- Steel – ASTM 108-79
- Stainless Steel – ASTM A582 Class 303
- Brass – ASTM B16

Pistons
- Hardened Steel – ASTM 108-79
- 416 Stainless Steel – ASTM A 582 Cond. A
- 303 Stainless Steel – ASTM A 582 Class 303

Bodies
- Cast Iron – ASTM A126-42 Class A
- Brass – ASME B62
- Steel – ASTM A 216 Grade WCB
- Stainless Steel – ASTM A 351 CF8M

Material Codes
(Unless Otherwise Specified)
- A – 416 Stainless Steel
- J – Cast Iron (No Part # Suffix)
- B – Brass
- S – Steel
- SS – Stainless Steel

O-RING & PAD MATERIAL SPECIFICATIONS

MATERIAL	SUFFIX CODE	COMPOUND	TEMP. RANGE		ASTM SPEC.
			MIN.	MAX.	
BUNA	R	B 46	-40˚F	257˚F	D2000
ETHYLENE-PROPYLENE	EPR	E 50	-67˚F	302˚F	D2000
VITON	RV	V 14	-31˚F	437˚F	D2000
SILICONE	RS	S 71	-103˚F	482˚F	D2000
TEFLON	RT	– –	-423˚F	500˚F	D2000
NEOPRENE	RN	– –	-67˚F	284˚F	D2000
AFLAS	RA	– –	-25˚F	450˚F	D2000

MAX / MIN TEMP. OF BODIES

MATERIAL	MIN TEMP.	MAX TEMP.
CAST IRON	-20˚F	400˚F
BRASS	-20˚F	400˚F
STEEL	-30˚F	600˚F
STAINLESS STEEL	-50˚F	600˚F

MAXIMUM ALLOWABLE WORKING PRESSURE

CAST IRON	1500 PSI
BRASS	1500 PSI
STEEL	2000 PSI
STAINLESS STEEL	2000 PSI

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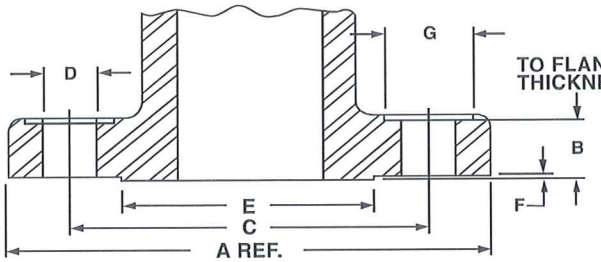
ORIFICE AREA & PISTON/BODY TOLERANCES

DIMENSIONS IN INCHES

VALVE SIZE	PISTON DIA. ±.000-.0003	AREA IN 2	BODY GO RC 3 FIT	BODY NO GO RC 3 FIT
3/8	.4985	.195	.4993	.4999
1/2	.6235	.305	.6243	.6249
3/4	.7485	.440	.7493	.7499
1	.9985	.783	.9993	1.0003
1¼	1.2485	1.224	1.2495	1.2507
1½	1.4985	1.764	1.4995	1.5007
2	1.9985	3.167	1.9997	2.0011
2½	2.6500	5.515	2.6517	2.6527
3	3.1235	7.663	3.1247	3.1261
4	4.1222	13.346	4.1250	4.1262

FLANGE AND DRILLING DIMENSIONS (INCHES

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CLASS 150 (BRASS – CAST IRON – STEEL – STAINLESS STEEL)

Valve Size	A Flange Diameter	B Flange Thickness		C Bolt Circle Diameter	D Bolt Holes Diameter	E Raised Face Diameter	F Raised Face Height	G Spotface Diameter	Number of Bolts
		Brass	Cl/Steel						
1"	4 1/4"	3/8"	9/16"	3 1/8"	5/8"	2"	1/16"	1.12	4
1 1/4"	4 5/8"	13/32"	5/8"	3 1/2"	5/8"	2 1/2"	1/16"	1.12	4
1 1/2"	5"	7/16"	11/16"	3 7/8"	5/8"	2 7/8"	1/16"	1.12	4
2"	6"	1/2"	3/4"	4 3/4"	3/4"	3 5/8"	1/16"	1.37	4
2 1/2"*	7"	N/A	7/8"	5 1/2"	3/4"	4 1/8"	1/16"	1.37	4
3"*	7 1/2"	N/A	15/16"	6"	3/4"	5"	1/16"	1.37	4
4"*	9"	N/A	15/16"	7 1/2"	3/4"	6 3/16"	1/16"	1.37	8

Note: Brass flanges conform to 150# ANSI B 16.24 *except* with raised face. Cast iron and steel flanges conform to 150# ANSI B 16.5 steel specifications.
*Available in Cast Iron & Steel only. 125-250 AARH flange finish (Steel & Stainless Steel only)

CLASS 250 (CAST IRON)

Valve Size	A Flange Diameter	B Flange Thickness	C Bolt Circle Diameter	D Bolt Holes Diameter	E Raised Face Diameter	F Raised Face Height	G Spotface Diameter	Number of Bolts
1"	4 7/8"	11/16"	3 1/2"	3/4"	2 11/16"	1/16"	1.37	4
1 1/4"	5 1/4"	3/4"	3 7/8"	3/4"	3 1/16"	1/16"	1.37	4
1 1/2"	6 1/8"	13/16"	4 1/2"	7/8"	3 9/16"	1/16"	1.56	4
2"	6 1/2"	7/8"	5	3/4"	4 3/16"	1/16"	1.37	8

Note: Cast iron flanges conform to 250# ANSI B 16.2 steel specifications.

CLASS 300 (BRASS – STEEL – STAINLESS STEEL)

Valve Size	A Flange Diameter	B Flange Thickness	C Bolt Circle Diameter	D Bolt Holes Diameter	E Raised Face Diameter	F Raised Face Height	G Spotface Diameter	Number of Bolts
1"	4 7/8"	11/16"	3 1/2"	3/4"	2"	1/16"	1.37	4
1 1/4"	5 1/4"	3/4"	3 7/8"	3/4"	2 1/2"	1/16"	1.37	4
1 1/2"	6 1/8"	13/16"	4 1/2"	7/8"	2 7/8"	1/16"	1.56	4
2"	6 1/2"	7/8"	5"	3/4"	3 5/8"	1/16"	1.37	8
2 1/2"	7 1/2"	1"	5 7/8"	7/8"	4 1/8"	1/16"	1.56	8
3"	8 1/4"	1 1/8"	6 5/8"	7/8"	5"	1/16"	1.56	8
4"	10"	1 1/4"	7 7/8"	7/8"	6 3/16"	1/16"	1.56	8

Note: Available in steel and cast iron only. Brass flanges conform to 300# ANSI B 16.24 *except* with raised face.
Steel flanges conform to 300# ANSI B 16.5 steel specifications. 125-250 AARH flange finish (Steel & Stainless Steel only)

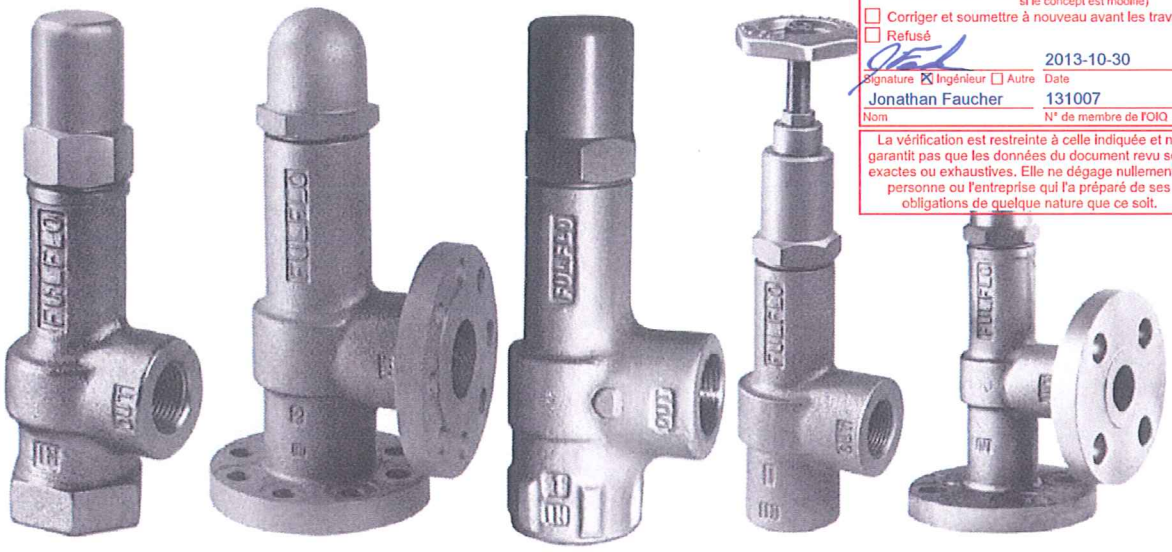
CLASS 600 (STEEL – STAINLESS STEEL)

Valve Size	A Flange Diameter	B Flange Thickness	C Bolt Circle Diameter	D Bolt Holes Diameter	E Raised Face Diameter	F Raised Face Height	G Spotface Diameter	Number of Bolts
1"	4 7/8"	15/16"	3 1/2"	3/4"	2"	1/4"	1.37	4
1 1/4"	5 1/4"	1 1/16"	3 7/8"	3/4"	2 1/2"	1/4"	1.37	4
1 1/2"	6 1/8"	1 1/8"	4 1/2"	7/8"	2 7/8"	1/4"	1.56	4
2"	6 1/2"	1 1/4"	5"	3/4"	3 5/8"	1/4"	1.37	8
2 1/2"	7 1/2"	1 3/8"	5 7/8"	7/8"	4 1/8"	1/4"	1.56	8
3"	8 1/4"	1 1/2"	6 5/8"	7/8"	5"	1/4"	1.56	8
4"	10 3/4"	1 3/4"	8 1/2"	1"	6 3/16"	1/4"	1.78	8

Note: Cast iron and steel flanges conform to 600# ANSI B 16.5 steel specifications. 125-250 AARH flange finish (Steel & Stainless Steel only)
Note: Special Flanges With Drilling On Or Off Center And Smooth Or Raised Face Are Available Upon Request.

V-SERIES VALVES

STAVIBEL INC.
Vérification de conformité
Étendue de la vérification
RM4706
Cette vérification ne constitue d'aucune façon une vérification détaillée et complète de la conception.
Recommandation
☑ Accepté
☐ Accepté tel que noté (doit être validé par un Ingénieur si le concept est modifié)
☐ Corriger et soumettre à nouveau avant les travaux
☐ Refusé
Signature ☒ Ingénieur ☐ Autre
Date 2013-10-30
Jonathan Faucher
Nom
131007
N° de membre de l'OIQ
La vérification est restreinte à celle indiquée et ne garantit pas que les données du document revu sont exactes ou exhaustives. Elle ne dégage nullement la personne ou l'entreprise qui l'a préparé de ses obligations de quelque nature que ce soit.



Standard with Screw Connections | Standard with Flange Connections | Stainless Steel with Screw Connections | Handwheel with Screw Connections | Handwheel with Flange Connections

APPLICATION

The Fulflo "V" Series range in size from 3/8" through 2" and operate efficiently with liquids of any viscosity at pressures from 2 to 1000 P.S.I. The "V" series valves are available in flange or screw type...cartridge or handwheel in a choice of brass, cast iron, steel and stainless steel.

Widely used in a variety of applications, the "V" series valves are ideally suited in hydraulic and lubricating systems for load regulation and system protection. Special trim or packings are available for use with fire resisting fluids and other liquids of this type. Unusual applications and special requirements should be referred to our engineering staff for recommendation.

INSTALLATION

Fulflo valves can be mounted in any position. A tee may be inserted in the pump discharge line to mount the valve. The correct size of valve should be installed, preferably matching the pump discharge line. Screw the valve into the nipple in the tee, or in the case of the flange style, bolt the valve to the companion flange screwed into the nipple. When the valve is used for frequent bypassing of oil pressure, its outlet should be piped back to the tank. Care must be taken to have the discharge well below the oil level in the tank to prevent air entrainment and erratic operation.

Only if the valve is used as safety or overload relief and operates infrequently may its discharge be piped back into the pump suction line. Frequent or continuous operation under these conditions will cause excessive heating of the oil and possible damage.

SETTING VALVES

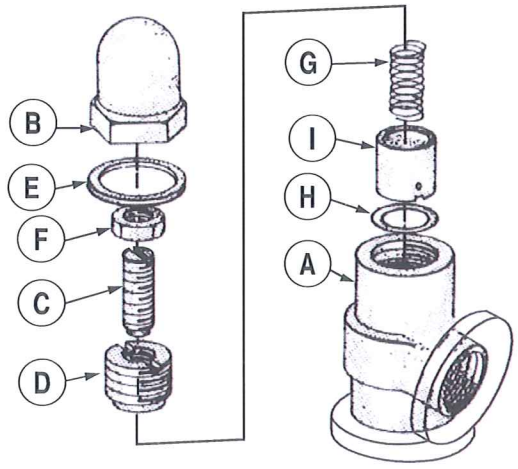
Valves may be set with a hydraulic hand pump for cracking pressure. If a test stand is available, valve should be connected to the discharge header with the pump bypass open, and the bypass gradually closed until the desired pressure registers on the gauge. Adjust valve adjusting screw until valve slightly bleeds at the set bypass pressure and lock adjusting screw.

Fulflo valves are not designed to be positive shut-off, and will pass a minimal amount of leakage before the set pressure. If a valve is required to bypass a given amount of fluid at a given pressure, a test stand having a flow meter in the pump discharge line must be available. With a valve adjusted for cracking pressure as above, continue closing bypass until the required flow registers on the flow meter and observe pressure. Readjust pressure, if necessary, to obtain desired pressure at desired flow.

MAINTENANCE

Fulflo valves provide reliable "chatter-free" operation when the system is free of abrasives and foreign matter. Continuous filtration of the liquid used is strongly recommended.

TYPICAL DISASSEMBLY OF STANDARD TYPE VALVE



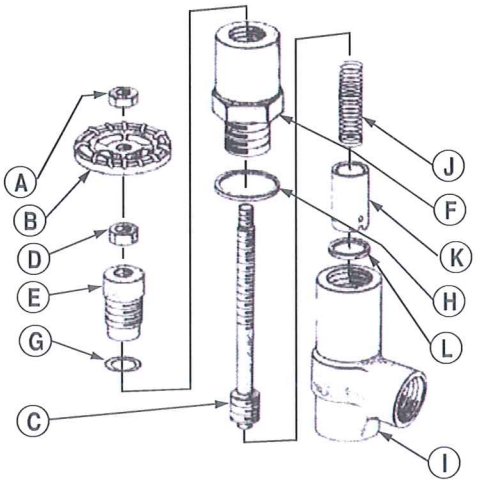
To dismantle valve for inspection or cleaning:

1. Remove cap "B"
2. Remove O-Ring "E"
3. Remove lock nut "F"
4. Remove adjusting screw "C"
5. Remove retainer "D"
6. Remove spring "G"
7. Remove piston "I"
8. Remove stop ring "H" (Not Recommended)
   (Special tooling is required to install new stop ring.)

Inspect valve bore and piston for wear and scoring. Replace broken or damaged parts. Clean all parts thoroughly and re-assemble by reversing the above procedure.

STAVIBEL INC.
Vérification de conformité
Référence de la vérification
RMA726
Cette vérification ne constitue aucune façon une vérification détaillée et complète de l'élévation.
Recommandation
☑ Accepté
☐ Accepté tel que noté (doit être validé par un ingénieur si le concept est modifié)
☐ Corriger et soumettre à nouveau avant les travaux
☐ Refusé
2013-10-30
Signature ☒ Ingénieur ☐ Autre Date
Jonathan Faucher 131007
Nom N° de membre de l'OIQ
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TYPICAL DISASSEMBLY OF HANDWHEEL TYPE VALVE



To dismantle the valve for inspection or cleaning:

1. Release spring tension by backing off handwheel as far as it will go.
2. Remove lock nut "A" or set screw and take off handwheel "B"
3. Remove lock nut "D"
4. Unscrew and remove gland "E"
5. Unscrew and remove bonnet "F"
6. Remove O-Ring "H"
7. Remove adjusting screw "C" (turn clockwise and pull out from bottom of bonnet "F")
8. Remove O-ring packing "G"
9. Remove spring "J"
10. Remove piston "K"
11. Remove stop ring "L" (Not Recommended)

(Special tooling is required to install new stop ring.)

Inspect valve bore and piston for wear or scoring. Replace broken or damaged parts. Clean all parts thoroughly and re-assemble by reversing the above procedure.

V-SERIES

ASSEMBLY NUMBER IDENTIFICATION CHART

Symbol No.	Designation	Code	Description
1	Style	None H	Standard Model Handwheel Model
2	Series	V	
3	Material	J B S SS	Cast iron Brass Steel Stainless Steel (300 Series Stainless)
4	Connections	None F	Screw Connections Flange Connections 300# Flange Class Standard (250# Flange Class - Cast Iron Standard)
5	Size	-2 -3 -4 -5 -6 -7 -8	3/8" 1/2" 3/4" 1" 1¼" 1½" 2"
6,7,8	ASA Flange Rating	None -150 -600	300# Flange Standard (no designation required)
9	Flange Style 150# & 600# Only	A B C D	Raised Face, Staggered Bolt Centers Smooth Face, Staggered Bolt Centers Raised Face, Bolts on Valve Centerline Smooth Face, Bolts on Valve Centerline
10	O-Ring Material	R RV RS RT RA EPR RN	Buna O-Ring Cap Seal (standard) Viton O-Ring Cap Seal Silicone O-Ring Cap Seal Teflon O-Ring Cap Seal Aflas O-Ring Cap Seal Ethylene Propylene Neoprene
11	Options	SP P	Steel Parts (used on cast iron only) Panel Mount on Handwheel Series
12	Piston Material	/HS /SS /3SS	Hardened Steel 416 Stainless Steel 303 Stainless Steel
13	Spring	/AS /US /WS /XS /YS /ZS	
14	Setting		Desired Pressure Setting

STAVIBEL INC.
Vérification de conformité
Étendue de la vérification
RM4706
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Recommandation
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☐ Refusé
Signature ☒ Ingénieur ☐ Autre — Date: 2013-10-30
Nom: Jonathan Faucher — N° de membre de l'OIQ: 131007
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EXAMPLES:

VJ-5RVSP/HS/WS

V	J	-5	RV	SP	/HS	/WS
Series	Cast Iron	1"	Viton O-Ring	Steel Parts	H.S. Piston	WS Spring

VJF-5R/HS/WS

V	J	F	-5	R	/HS	/WS
Series	Cast Iron	Flanged	1"	Buna O-Ring	H.S. Piston	WS Spring

VJF-5-150AR/HS/WS

V	J	F	-5	-150	A	R	/HS	/WS
Series	Cast Iron	Flanged	1"	Rating	Style	Buna O-Ring	H.S. Piston	WS Spring

NOTE: Stainless steel pistons are supplied on brass valves, unless hardened steel is specified. Hardened steel pistons are supplied on cast iron or steel unless stainless steel is specified. Buna O-Rings are supplied as standard unless other material is specified.

STANDARD PRESSURE RANGE CHART

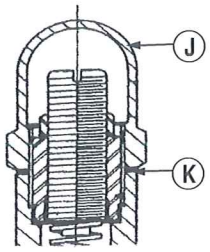
Valve Pipe Size	Valve Flange Size	SPRING PRESSURE AND IDENTIFICATION NO.															
		BLACK-AS		RED-US		GREEN-WS		YELLOW-XS		WHITE-YS		BLUE-ZS		PURPLE-TS		BROWN-RS	
		Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
3/8"		3	15	7	35	30	100	60	175	150	350	300	500	400	600	550	750
1/2"		3	15	7	35	30	100	60	175	150	350	300	500	400	600	550	750
3/4"		3	15	7	35	30	100	60	175	150	350	300	500				
1"	1"	3	15	7	35	30	100	60	175	150	350	300	500				
1¼"	1¼"	3	15	7	35	30	100	60	175	150	350	300	500				
1½"	1½"	3	15	7	35	30	100	60	175	150	350	300	500				
2"	2"	3	15	7	35	30	100	60	175	150	350	250	600				

+/-1-5 PSI ON ALL SPRING RANGES

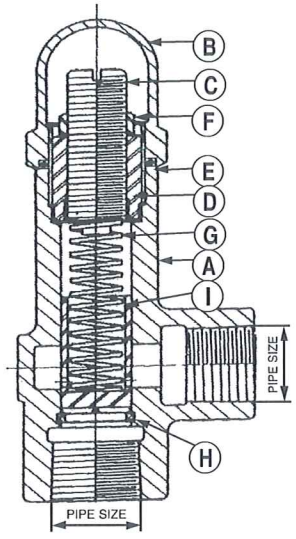
V-SERIES

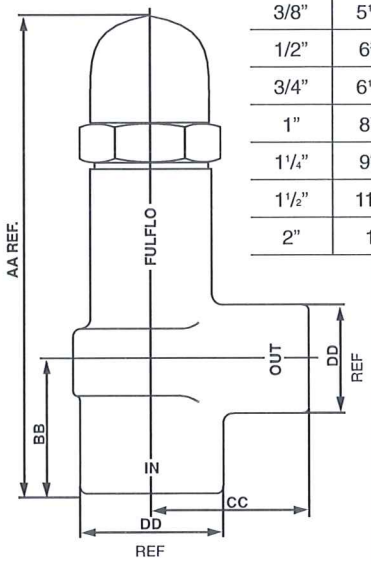
VJ Cast Iron **VB** Brass
VS Steel **VSS** Stainless Steel **VJ-SP** Cast Iron with Steel Parts

DIMENSIONS



CAP
(GASKET SEAL)





Valve Size	DIMENSIONS IN INCHES			
	AA	BB	CC	DD
3/8"	5 11/32	1 11/32	1 11/32	1 3/8
1/2"	6 3/16	1 11/16	1 7/16	1 7/16
3/4"	6 15/16	1 15/16	1 13/16	1 11/16
1"	8 7/32	2 3/32	2 3/32	2 1/16
1 1/4"	9 3/16	2 3/16	2 3/16	2 1/2
1 1/2"	11 1/16	2 11/16	2 11/16	2 7/8
2"	13	3	3	3 1/4

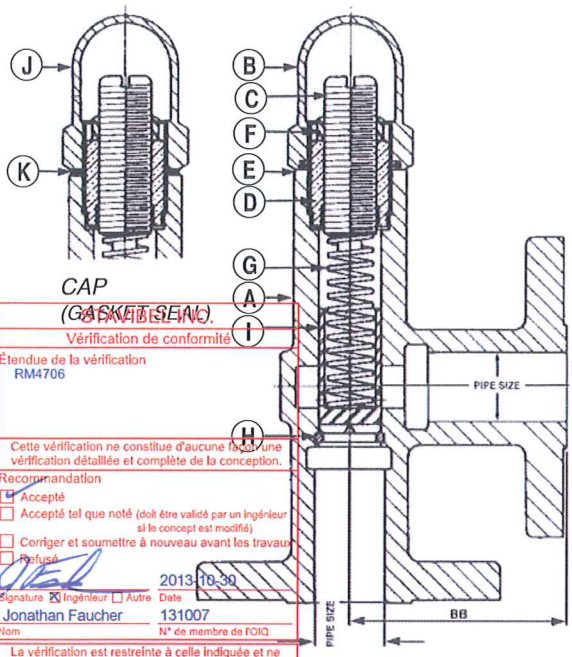
STAVIBEL INC.
Vérification de conformité
Étendue de la vérification
RM4706
Cette vérification ne constitue d'aucune façon une vérification détaillée et complète de la conception.
Recommandation
☑ Accepté
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☐ Refusé
2013-10-30
Signature ☒ Ingénieur ☐ Autre — Date
Jonathan Faucher — 131007
Nom — N° de membre de l'OIQ
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PARTS LIST

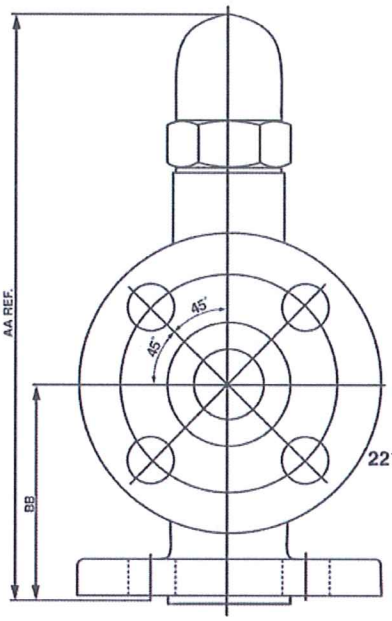
SYM.	NAME	MODEL	VALVE SIZE						
			3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
A	BODY	VJ, VJ-SP	200	300	400	500	600	700	800
		VB	200-B	300-B	400-B	500-B	600-B	700-B	800-B
		VS	200-S	300-S	400-S	500-S	600-S	700-S	800-S
		VSS	200-SS	300-SS	400-SS	500-SS	600-SS	700-SS	800-SS
B	CAP (O-RING SEAL)	VJ, VJ-SP	201-SR	301-SR	401-R	501-R	601-R	701-R	801-R
		VB	201-BR	301-BR	401-BR	501-BR	601-BR	701-BR	801-BR
		VS	201-SR	301-SR	401-SR	501-SR	601-SR	701-SR	801-SR
		VSS	201-SSR	301-SSR	401-SSR	501-SSR	601-SSR	701-SSR	801-SSR
C	ADJUSTING SCREW	VJ, VB	202-B	302-B	402-B	502-B	602-B	702-B	802-B
		VS, VJ-SP	202-S	302-S	402-S	502-S	602-S	702-S	802-S
		VSS	202-SS	302-SS	402-SS	502-SS	602-SS	702-SS	802-SS
D	RETAINER	VJ, VB	203-B	303-B	403-B	503-B	603-B	703-B	803-B
		VS, VJ-SP	203-S	303-S	403-S	503-S	603-S	703-S	803-S
		VSS	203-SS	303-SS	403-SS	503-SS	603-SS	703-SS	803-SS
E	O-RING †	VJ, VJ-SP, VB, VS	204-*	304-*	404-*	504-*	604-*	704-*	804-*
		VSS	204-RT	304-RT	404-RT	504-RT	604-RT	704-RT	804-RT
F	LOCK NUT	VJ, VJ-SP, VS, VB	205-S	305-S	405-S	505-S	605-S	705-S	805-S
		VSS	205-SS	305-SS	405-SS	505-SS	605-SS	705-SS	805-SS
G	SPRING †	ALL MODELS	207-**	307-**	407-**	507-**	607-**	707-**	807-**
H	STOP RING	VJ, VB	208-B	308-B	408-B	508-B	608-B	708-B	808-B
		VS, VJ-SP	208-S	308-S	408-S	508-S	608-S	708-S	808-S
		VSS	208-SS	308-SS	408-SS	508-SS	608-SS	708-SS	808-SS
I	PISTON †	HARDENED STEEL	206	306	406	506	606	706	806
		416 STAINLESS STEEL	206-A	306-A	406-A	506-A	606-A	706-A	806-A
		303 STAINLESS STEEL	206-SS	306-SS	406-SS	506-SS	606-SS	706-SS	806-SS
J	CAP (GASKET SEAL)	VJ, VJ-SP	201-S	301-S	401	501	601	701	801
		VB	201-B	301-B	401-B	501-B	601-B	701-B	801-B
		VS	201-S	301-S	401-S	501-S	601-S	701-S	801-S
K	GASKET †	VJ, VB	204	304	404	504	604	704	804
		VS, VJ-SP	204-S	304-S	404-S	504-S	604-S	704-S	804-S

* See o-ring selection chart
** See spring pressure chart
† Recommended spare parts

DIMENSIONS



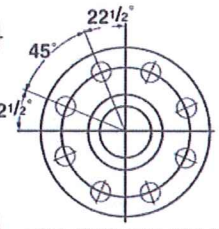
Vérification de conformité
Étendue de la vérification
RM4706
Cette vérification ne constitue d'aucune façon une vérification détaillée et complète de la conception.
Recommandation
☑ Accepté
☐ Accepté tel que noté (doit être validé par un ingénieur si le concept est modifié)
☐ Corriger et soumettre à nouveau avant les travaux
☐ Refusé
2013-10-30
Signature ☒ Ingénieur ☐ Autre Date
Jonathan Faucher 131007
Nom N° de membre de l'OIQ
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DIMENSIONS IN INCHES

Valve Size	AA	BB
1"	9 1/2"	3 1/2"
1 1/4"	10 13/16"	3 3/4"
1 1/2"	12 7/16"	4 1/16"
2"	14 9/16"	4 9/16"

Note: Dimensions reflect 150# and 300# only



FOR 2" VALVE ONLY

PARTS LIST

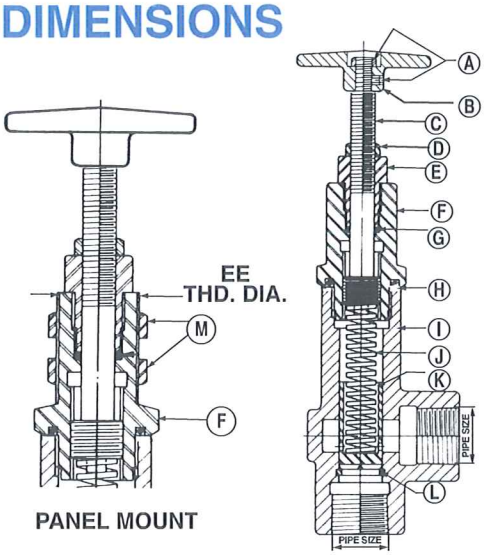
SYM.	NAME	MODEL	VALVE SIZE			
			1"	1 1/4"	1 1/2"	2"
A	BODY	VJF, VJF-SP VBF VSF VSSF	500-F 500-BF 500-SF 500-SSF	600-F 600-BF 600-SF 600-SSF	700-F 700-BF 700-SF 700-SSF	800-F 800-BF 800-SF 800-SSF
B	CAP (O-RING SEAL)	VJF, VJF-SP VBF VSF VSSF	501-R 501-BR 501-SR 501-SSR	601-R 601-BR 601-SR 601-SSR	701-R 701-BR 701-SR 701-SSR	801-R 801-BR 801-SR 801-SSR
C	ADJUSTING SCREW	VJF, VBF VSF, VJF-SP VSSF	502-B 502-S 502-SS	602-B 602-S 602-SS	702-B 702-S 702-SS	802-B 802-S 802-SS
D	RETAINER	VJF, VBF VSF, VJF-SP VSSF	503-B 503-S 503-SS	603-B 603-S 603-SS	703-B 703-S 703-SS	803-B 803-S 803-SS
E	O-RING †	VJF, VJF-SP VBF, VSF VSSF	504* 504-* 504-RT	604* 604-* 604-RT	704* 704-* 704-RT	804* 804-* 804-RT
F	LOCK NUT	VJF, VJF-SP VSF, VBF VSSF	505-S 505-S 505-SS	605-S 605-S 605-SS	705-S 705-S 705-SS	805-S 805-S 805-SS
G	SPRING †	ALL MODELS	507-**	607-**	707-**	807-**
H	STOP RING	VJF, VBF VJF-SP, VSF VSSF	508-B 508-S 508-SS	608-B 608-S 608-SS	708-B 708-S 708-SS	808-B 808-S 808-SS
I	PISTON †	HARDENED STEEL 416 STAINLESS STEEL 303 STAINLESS STEEL	506 506-A 506-SS	606 606-A 606-SS	706 706-A 706-SS	806 806-A 806-SS
J	CAP (GASKET SEAL)	VJF, VJF-SP VBF VSF	501 501-B 501-S	601 601-B 601-S	701 701-B 701-S	801 801-B 801-S
K	GASKET †	VJF, VBF VJF-SP, VSF	504 504-S	604 604-S	704 704-S	804 804-S

* See o-ring selection chart
** See spring pressure chart
† Recommended spare parts

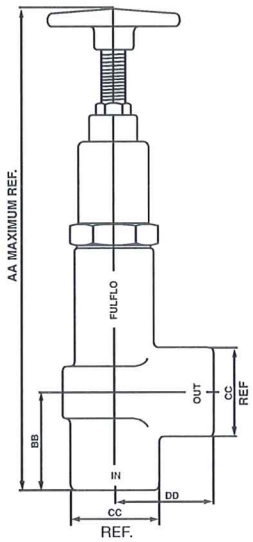
V-SERIES

HVJ Cast Iron **HVS** Steel **HVJ-P** Cast Iron **HVS-P** Steel
HVB BRASS **HVSS** Stainless Steel **HVB-P** Brass **HVSS-P** Stainless Steel

DIMENSIONS



PANEL MOUNT



Valve Size	DIMENSIONS IN INCHES				
	AA	BB	CC	DD	EE
3/8"	8 1/8	1 11/32	1 3/16	1 3/8	7/8
1/2"	9 5/8	1 11/16	1 7/16	1 7/16	1 1/8
3/4"	9 3/16	1 15/16	1 11/16	1 13/16	1 3/8
1"	12 7/16	2 9/32	2 1/16	2 9/32	1 3/8
1 1/4"	13 7/16	2 9/16	2 1/2	2 9/16	1 5/8
1 1/2"	17 1/16	2 11/16	2 7/8	2 11/16	2 1/4
2"	17 15/16	3	3 3/8	3	2 1/4

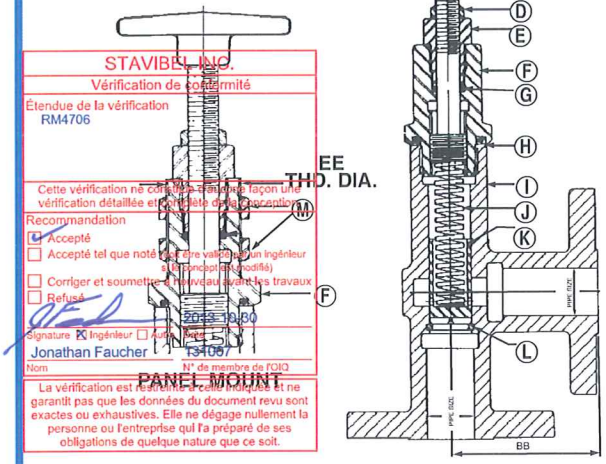
STAVIBEL INC.
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Étendue de la vérification
RM4706
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☐ Refusé
2013-10-30
Signature ☒ Ingénieur ☐ Autre Date
Jonathan Faucher 131007
Nom N° de membre de l'OIQ
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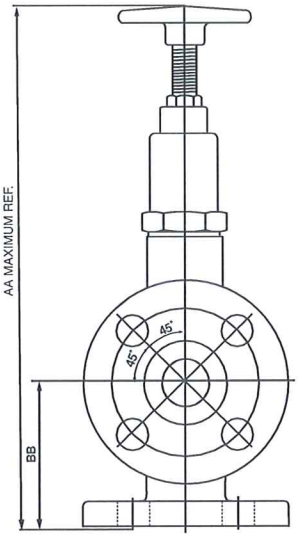
PARTS LIST

SYM.	NAME	MODEL	VALVE SIZE						
			3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
A	LOCK NUT OR SET SCREW	ALL MODELS	1/4"-20 COMM.	1/4"-20 COMM.	205-S	205-S	1/4"-20 COMM.	1/4"-20 COMM.	1/4"-20 COMM.
B	HANDWHEEL	ALL MODELS	229	229	429	429	629	629	629
C	ADJUSTING SCREW	HVJ(P), HVS(P) HVB(P) HVSS(P)	222-S 222-B 222-SS	322-S 322-B 322-SS	422-S 422-B 422-SS	522-S 522-B 522-SS	622-S 622-B 622-SS	722-S 722-B 722-SS	822-S 822-B 822-SS
D	LOCK NUT	HVJ(P), HVS(P) HVB(P) HVSS(P)	205-S 205-S 205-SS	205-S 205-S 205-SS	305-S 305-S 305-SS	305-S 305-S 305-SS	655-S 655-S 655-SS	655-S 655-S 655-SS	655-S 655-S 655-SS
E	GLAND	HVJ(P), HVS(P) HVB(P) HVSS(P)	225-S 225-B 225-SS	325-S 325-B 325-SS	525-S 525-B 525-SS	525-S 525-B 525-SS	625-S 625-B 625-SS	725-S 725-B 725-SS	825-S 825-B 825-SS
F	BONNET	HVJ, HVS HVB HVSS HVJ(P), HVS(P) HVB(P) HVSS(P)	223-SR 223-BR 223-SSR 228-SR 228-BR 228-SSR	323-SR 323-BR 323-SSR 328-SR 328-BR 328-SSR	423-SR 423-BR 423-SSR 428-SR 428-BR 428-SSR	523-SR 523-BR 523-SSR 528-SR 528-BR 528-SSR	623-SR 623-BR 623-SSR 628-SR 628-BR 628-SSR	723-SR 723-BR 723-SSR 728-SR 728-BR 728-SSR	823-SR 823-BR 823-SSR 828-SR 828-BR 828-SSR
G	O-RING †	HVJ(P), HVS(P) HVB(P) HVSS(P) only	224* 224-* 224-RT	224* 224-* 224-RT	424* 424-* 424-RT	424* 424-* 424-RT	624* 624-* 624-RT	624* 624-* 624-RT	624* 624-* 624-RT
H	O-RING †	HVJ(P), HVS(P) HVB(P) HVSS(P) only	204* 204-* 204-RT	304* 304-* 304-RT	404* 404-* 404-RT	504* 504-* 504-RT	604* 604-* 604-RT	704* 704-* 704-RT	804* 804-* 804-RT
I	BODY	HVJ(P) HVB(P) HVS(P) HVSS(P)	200 200-B 200-S 200-SS	300 300-B 300-S 300-SS	400 400-B 400-S 400-SS	500 500-B 500-S 500-SS	600 600-B 600-S 600-SS	700 700-B 700-S 700-SS	800 800-B 800-S 800-SS
J	SPRING †	ALL MODELS	207-**	307-**	407-**	507-**	607-**	707-**	807-**
K	PISTON †	HARDENED STEEL 416 STAINLESS STEEL 303 STAINLESS STEEL	206 206-A 206-SS	306 306-A 306-SS	406 406-A 406-SS	506 506-A 506-SS	606 606-A 606-SS	706 706-A 706-SS	806 806-A 806-SS
L	STOP RING	HVJ(P), HVS(P) HVB(P) HVSS(P)	208-S 208-B 208-SS	308-S 308-B 308-SS	408-S 408-B 408-SS	508-S 508-B 508-SS	608-S 608-B 608-SS	708-S 708-B 708-SS	808-S 808-B 808-SS
M	LOCK NUTS 2 REQ'D	HVJ(P), HVS(P), HVB(P) HVSS(P)	505-S 505-S 505-SS	605-S 605-S 605-SS	705-S 705-S 705-SS	705-S 705-S 705-SS	805-S 805-S 805-SS	745-S 745-S 745-SS	745-S 745-S 745-SS

* See o-ring selection chart
** See spring pressure chart
† Recommended spare parts

DIMENSIONS

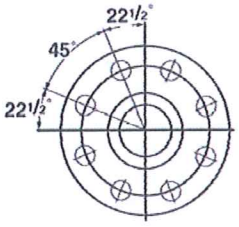




DIMENSIONS IN INCHES

Valve Size	AA	BB	EE
1"	13 11/16	3 1/2	1 3/8
1 1/4"	14 11/16	3 3/4	1 5/8
1 1/2"	18 7/16	4 1/16	2 1/4
2"	18 5/8	4 9/16	2 1/4

Note: Dimensions reflect 150# and 300# only



FOR 2" VALVE ONLY

PARTS LIST

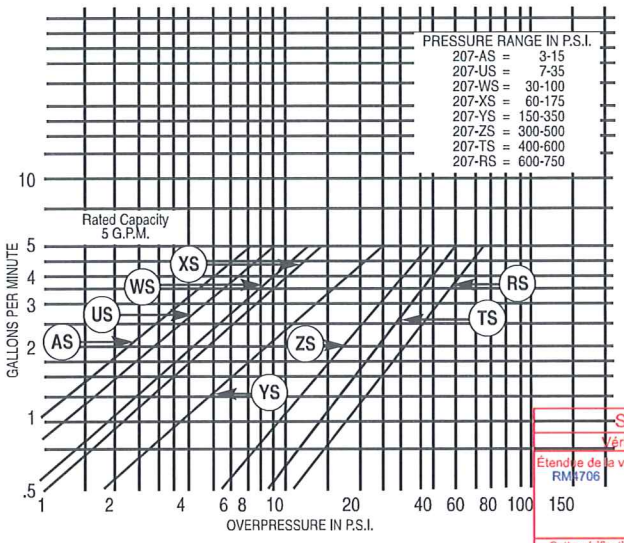
SYM.	NAME	MODEL	DIMENSIONS IN INCHES			
			1"	1 1/4"	1 1/2"	2"
A	LOCK NUT OR SET SCREW	ALL MODELS	205-S	1/4"-20 COMM.	1/4"-20 COMM.	1/4"-20 COMM.
B	HANDWHEEL	ALL MODELS	429	629	629	629
C	ADJUSTING SCREW	HVJF(P) HVSF(P) HVBF(P) HVSSF(P)	522-S 522-B 522-SS	622-S 622-B 622-SS	722-S 722-B 722-SS	822-S 822-B 822-SS
D	LOCK NUT	HVJF(P), HVSF(P) HVBF(P) HVSSF(P) only	305-S 305-S 305-SS	655-S 655-S 655-SS	655-S 655-S 655-SS	655-S 655-S 655-SS
E	GLAND	HVJF(P), HVSF(P) HVBF(P) HVSSF(P)	525-S 525-B 525-SS	625-S 625-B 625-SS	725-S 725-B 725-SS	825-S 825-B 825-SS
F	BONNET	HVJF, HVSF HVBF HVSSF HVJF(P) HVBF(P), HVSF(P) HVSSF(P)	523-SR 523-BR 523-SSR 528-SR 528-BR 528-SSR	623-SR 623-BR 623-SSR 628-SR 628-BR 628-SSR	723-SR 723-BR 723-SSR 728-SR 728-BR 728-SSR	823-SR 823-BR 823-SSR 828-SR 828-BR 828-SSR
G	O-RING †	HVJF(P), HVSF(P) HVBF(P) HVSSF(P) only	424* 424-* 424-RT	624* 624-* 624-RT	624* 624-* 624-RT	624* 624-* 624-RT
H	O-RING †	HVJF(P), HVSF(P) HVBF(P) HVSSF(P) only	504* 504-* 504-RT	604* 604-* 604-RT	704* 704-* 704-RT	804* 804-* 804-RT
I	BODY	HVJF(P) HVBF(P) HVSF(P) HVSSF(P)	500-F 500-BF 500-SF 500-SSF	600-F 600-BF 600-SF 600-SSF	700-F 700-BF 700-SF 700-SSF	800-F 800-BF 800-SF 800-SSF
J	SPRING †	ALL MODELS	507-**	607-**	707-**	807-**
K	PISTON †	HARDENED STEEL 416 STAINLESS STEEL 303 STAINLESS STEEL	506 506-A 506-SS	606 606-A 606-SS	706 706-A 706-SS	806 806-A 806-SS
L	STOP RING	HVJF(P), HVSF(P) HVBF(P) HVSSF(P)	508-S 508-B 508-SS	608-S 608-B 608-SS	708-S 708-B 708-SS	808-S 808-B 808-SS
M	LOCK NUTS 2 REQ'D	HVJF(P), HVSF(P), HVBF(P) HVSSF(P)	705-S 705-S 705-SS	805-S 805-S 805-SS	745-S 745-S 745-SS	745-S 745-S 745-SS

* See o-ring selection chart
** See spring pressure chart
† Recommended spare parts

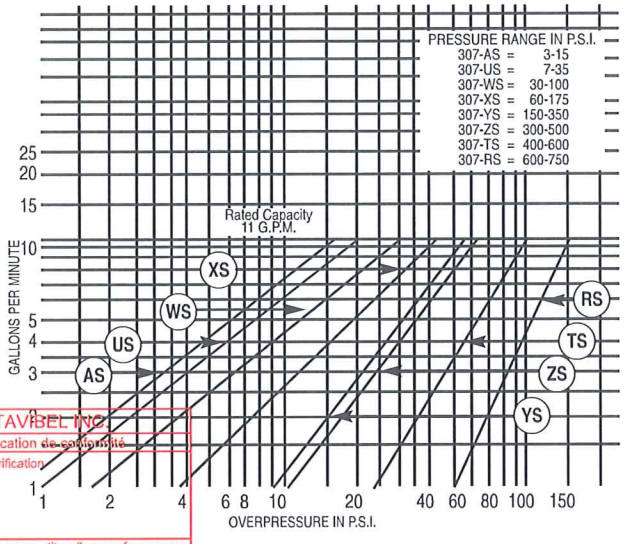
V-SERIES PERFORMANCE CHARTS

All valve tests 110°F. to 120°F. Oil Viscosity 150 S.S.U. at 100°F.
(Charts good from 30 to 500 S.S.U.)

3/8" VALVE TESTS

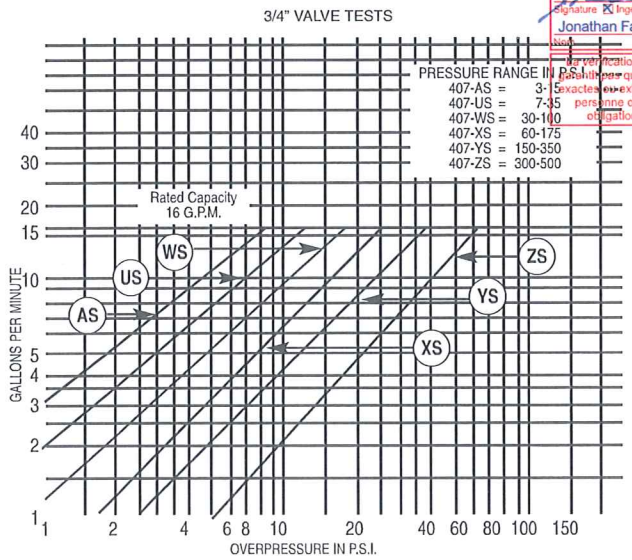


1/2" VALVE TESTS

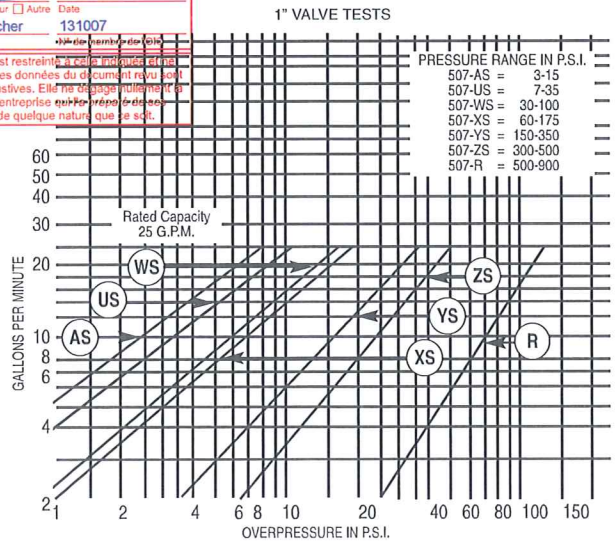


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Étendue de la vérification
RM4706
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Recommandation
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2013-10-30
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Date
Jonathan Faucher
131007
Nom
N° de membre de l'OIQ
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3/4" VALVE TESTS



1" VALVE TESTS

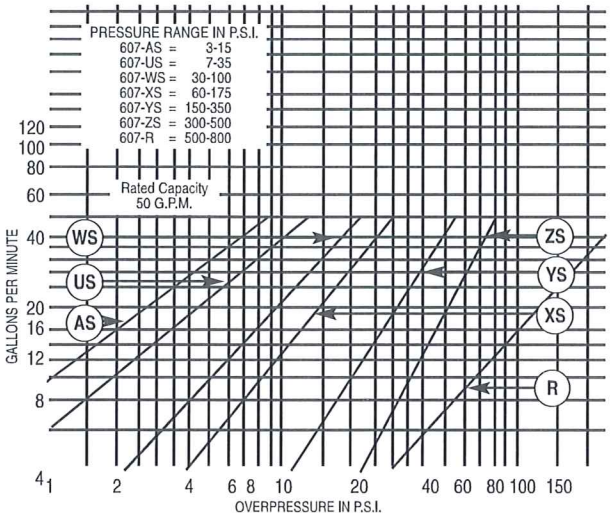


Overpressure - The pressure increase or accumulation above the set pressure when the valve is discharging flow.

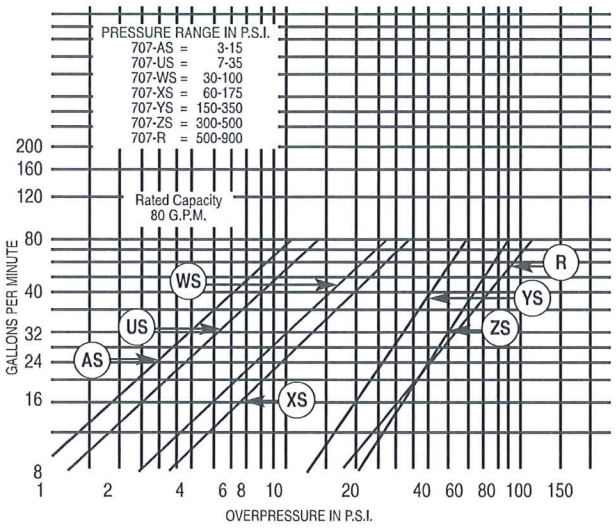
V-SERIES PERFORMANCE CHARTS

All valve tests 110˚F. to 120˚F. Oil Viscosity 150 S.S.U. at 100˚F.
(Charts good from 30 to 500 S.S.U.)

1¼" VALVE TESTS



1½" VALVE TESTS



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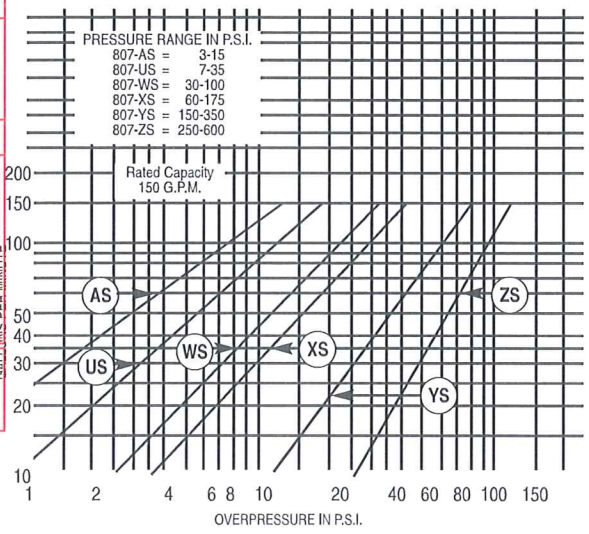
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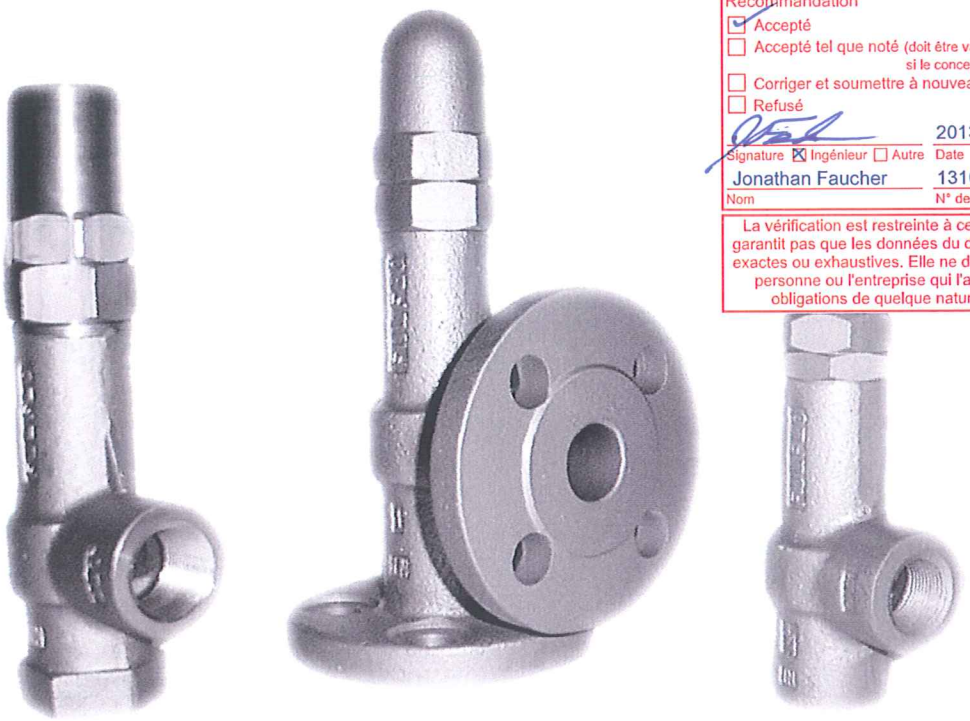
2" VALVE TESTS



Overpressure - The pressure increase or accumulation above the set pressure when the valve is discharging flow.

FV2000 SERIES VALVE

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The Fulflo FV2000 Series valve is similar to the V-Series valve, includes a new safer design that protects liquid and gasses from venting out of the valve during normal operation and adjustment conditions. This valve has been especially designed to prevent the adjusting screw from backing out while making adjustments to the pressure setting. An o-ring has been incorporated around the adjusting screw to further prevent liquid from escaping.

APPLICATION

The Fulflo "FV" Series range in size from 3/8" through 2" and operate efficiently with liquids of any viscosity at pressures from 2 to 1000 P.S.I. The "FV" series valves are available in flange or screw type... in a choice of brass, cast iron, steel and stainless steel.

Widely used in a variety of applications, the "FV" series valves are ideally suited in hydraulic and lubricating systems for load regulation and system protection. Special trim or packings are available for use with fire resisting fluids and other liquids of this type. Unusual applications and special requirements should be referred to our engineering staff for recommendation.

INSTALLATION

Fulflo valves can be mounted in any position. A tee may be inserted in the pump discharge line to mount the valve. The correct size of valve should be installed, preferably matching the pump discharge line. Screw the valve into the nipple in the tee, or in the case of the flange style, bolt the valve to the companion flange screwed into the nipple. When the valve is used for frequent bypassing of oil pressure, its outlet should be piped back to the tank. Care must be taken to have the discharge well below the oil level in the tank to prevent air entrainment and erratic operation.

Only if the valve is used as safety or overload relief and operates infrequently may its discharge be piped back into the pump suction line. Frequent or continuous operation under these conditions will cause excessive heating of the oil and possible damage.

SETTING VALVES

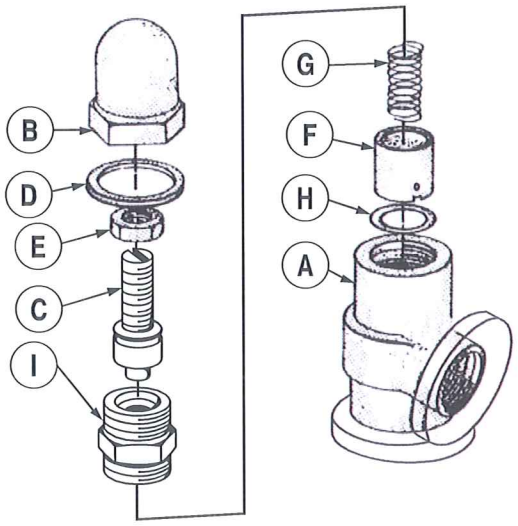
Valves may be set with a hydraulic hand pump for cracking pressure. If a test stand is available, valve should be connected to the discharge header with the pump bypass open, and the bypass gradually closed until the desired pressure registers on the gauge. Adjust valve adjusting screw until valve slightly bleeds at the set bypass pressure and lock adjusting screw.

Fulflo valves are not designed to be positive shut-off, and will pass a minimal amount of leakage before the set pressure. If a valve is required to bypass a given amount of fluid at a given pressure, a test stand having a flow meter in the pump discharge line must be available. With a valve adjusted for cracking pressure as above, continue closing bypass until the required flow registers on the flow meter and observe pressure. Readjust pressure, if necessary, to obtain desired pressure at desired flow.

MAINTENANCE

Fulflo valves provide reliable "chatter-free" operation when the system is free of abrasives and foreign matter. Continuous filtration of the liquid used is strongly recommended.

TYPICAL DISASSEMBLY OF STANDARD TYPE VALVE



To dismantle valve for inspection cleaning:

1. Remove cap "B"
2. Remove O-Ring "D"
3. Remove lock nut "E"
4. Remove adjusting screw "C"
5. Remove bonnet "I"
6. Remove spring "G"
7. Remove piston "F"
8. Remove stop ring "H" (Not Recommended)
   (Special tooling is required to install new stop ring.)

Inspect valve bore and piston for wear and scoring. Replace broken or damaged parts. Clean all parts thoroughly and re-assemble by reversing the above procedure.

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RM/F705
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No Leaking, Dripping, Spills or Venting

The Fulflo FV2000 Series valve includes a new safer design that prevents liquid and gasses from venting out of the valve during normal operation and adjustment conditions. This valve has been especially designed to prevent the adjusting screw from backing out while making adjustments to the pressure setting. An o-ring has been incorporated around the adjusting screw to further prevent liquid from escaping.

Operates Efficiently and Effectively

The FV2000 Series valves can be mounted in any position with sizes ranging from 3/8" through 2", and will operate efficiently with any application or viscosity at pressures from 2 to 1000 psi. Flange or screw connections are available in brass, cast iron, steel or stainless steel. All parts are completely interchangeable and convertible with other Fulflo V-Series valves.

Fulflo Valve Advantages

These valves offer Fulflo's patented "chatter-free" performance and are ideally suited for hydraulic and lubricating system protection. All Fulflo valves include a patented modulating piston design with absolute or differential pressure operation. Our advanced modulating operation allows Fulflo valves to be used in many different applications including positive displacement or centrifugal pump and system protection. Fulflo valves can be mounted in any position.

FV-SERIES

ASSEMBLY NUMBER IDENTIFICATION CHART

Symbol No.	Designation	Code	Description
1	Series	FV	
2	Material	J B S SS	Cast iron Brass Steel Stainless Steel (300 Series Stainless)
3	Connections	None F	Screw Connections Flange Connections 300# Flange Class Standard (250# Flange Class - Cast Iron Standard)
4	Size	-2 -3 -4 -5 -6 -7 -8	3/8" 1/2" 3/4" 1" 1 1/4" 1 1/2" 2"
5,6,7	ASA Flange Rating	None -150 -600	300# Flange Standard (no designation required)
8	Flange Style 150# & 600# only	A B C D	Raised Face, Staggered Bolt Centers Smooth Face, Staggered Bolt Centers Raised Face, Bolts on Valve Centerline Smooth Face, Bolts on Valve Centerlne
9	O-Ring Material	R RV RS RA EPR RN	Buna O-Ring Cap Seal (standard) Viton O-Ring Cap Seal Silicone O-Ring Cap Seal Aflas O-Ring Cap Seal Ethylene Propylene Neoprene
10	Piston Material	/HS /SS /3SS	Hardened Steel 416 Stainless Steel 303 Stainless Steel
11	Spring	/AS /US /WS /XS /YS /ZS	
12	Setting		Desired Pressure Setting

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EXAMPLES: FVS-8R/SS/WS - FV Series, acier, 2", Buna O-Ring, 416SS, WS spring

FVJ-5RV/HS/WS					
FV	J	-5	RV	/HS	/WS
Series	Cast Iron	1"	Viton O-Ring	H.S. Piston	WS Spring

FVJF-5R/HS/WS					
FV	J	F	-5	R	/HS	/WS
Series	Cast Iron	Flanged	1"	Buna O-Ring	H.S. Piston	WS Spring

FVJF-5-150AR/HS/WS								
FV	J	F	-5	-150	A	R	/HS	/WS
Series	Cast Iron	Flanged	1"	Rating	Style	Buna O-Ring	H.S. Piston	WS Spring

NOTE: Stainless steel pistons are supplied on brass valves, unless hardened steel is specified. Hardened steel pistons are supplied on cast iron or steel unless stainless steel is specified. Buna O-Rings are supplied as standard unless other material is specified.

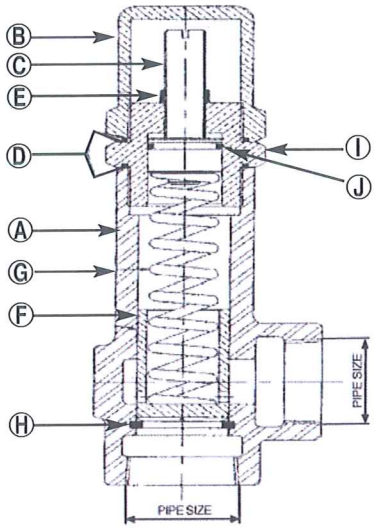
STANDARD PRESSURE RANGE CHART

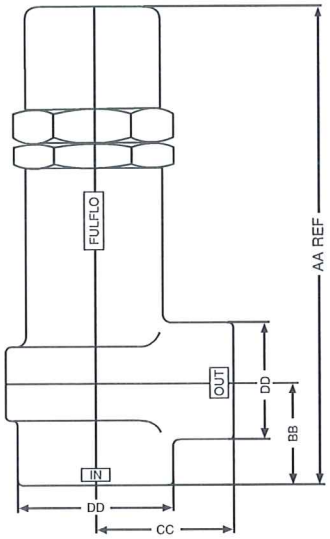
Valve Pipe Size	Valve Flange Size	SPRING PRESSURE AND IDENTIFICATION NO.															
		BLACK-AS		RED-US		GREEN-WS		YELLOW-XS		WHITE-YS		BLUE-ZS		PURPLE-TS		BROWN-RS	
		Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
3/8"		3	15	7	35	30	100	60	175	150	350	300	500	400	600	550	750
1/2"		3	15	7	35	30	100	60	175	150	350	300	500	400	600	550	750
3/4"		3	15	7	35	30	100	60	175	150	350	300	500				
1"	1"	3	15	7	35	30	100	60	175	150	350	300	500				
1 1/4"	1 1/4"	3	15	7	35	30	100	60	175	150	350	300	500				
1 1/2"	1 1/2"	3	15	7	35	30	100	60	175	150	350	300	500				
2"	2"	3	15	7	35	30	100	60	175	150	350	250	600				

FV-SERIES

FVJ Cast Iron **FVS** Steel
FVB Brass **FVSS** Stainless Steel

DIMENSIONS





Valve Size	DIMENSIONS IN INCHES			
	AA	BB	CC	DD
3/8"	5 31/32	1 11/32	1 11/32	1 3/8
1/2"	7 3/32	1 11/16	1 7/16	1 7/16
3/4"	7 5/16	1 15/16	1 13/16	1 11/16
1"	9 1/32	2 9/32	2 9/32	2 1/16
1 1/4"	10 1/16	2 9/16	2 9/16	2 1/2
1 1/2"	12 15/32	2 11/16	2 11/16	2 7/8
2"	13 3/4	3 1/8	3	3 1/4

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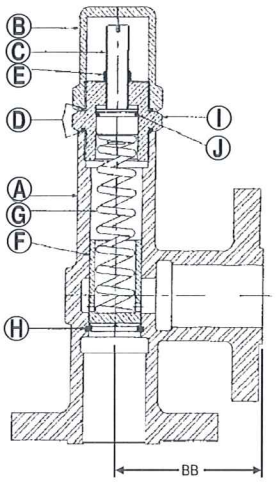
PARTS LIST

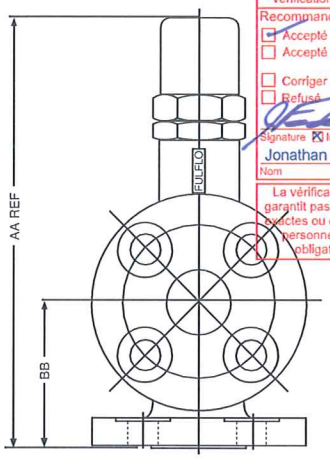
SYM.	NAME	MODEL	VALVE SIZE						
			3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
A	BODY	FVJ	200	300	400	500	600	700	800
		FVB	200-B	300-B	400-B	500-B	600-B	700-B	800-B
		FVS	200-S	300-S	400-S	500-S	600-S	700-S	800-S
		FVSS	200-SS	300-SS	400-SS	500-SS	600-SS	700-SS	800-SS
B	CAP	FVJ	201-SR	301-SR	401-SR	501-SR	601-SR	701-SR	801-SR
		FVB	201-BR	301-BR	401-BR	501-BR	601-BR	701-BR	801-BR
		FVS	201-SR	301-SR	401-SR	501-SR	601-SR	701-SR	801-SR
		FVSS	201-SSR	301-SSR	401-SSR	501-SSR	601-SSR	701-SSR	801-SSR
C	ADJUSTING SCREW	FVJ	202-S8	302-S8	402-S8	502-S8	602-S8	702-S8	802-S8
		FVB	202-B8	302-B8	402-B8	502-B8	602-B8	702-B8	802-B8
		FVS	202-S8	302-S8	402-S8	502-S8	602-S8	702-S8	802-S8
		FVSS	202-SS8	302-SS8	402-SS8	502-SS8	602-SS8	702-SS8	802-SS8
D	O-RING † (2 REQUIRED)	FVJ	204-*	304-*	404-*	504-*	604-*	704-*	804-*
		FVB	204-*	304-*	404-*	504-*	604-*	704-*	804-*
		FVS	204-*	304-*	404-*	504-*	604-*	704-*	804-*
		FVSS	204-*	304-*	404-*	504-*	604-*	704-*	804-*
E	LOCK NUT	FVJ	205-S	305-S	305-S	505-S	505-S	505-S	505-S
		FVB	205-S	305-S	305-S	505-S	505-S	505-S	505-S
		FVS	205-S	305-S	305-S	505-S	505-S	505-S	505-S
		FVSS	205-SS	305-SS	305-SS	505-SS	505-SS	505-SS	505-SS
F	PISTON †	HARDENED STEEL	206	306	406	506	606	706	806
		416 STAINLESS STEEL	206-A	306-A	406-A	506-A	606-A	706-A	806-A
		303 STAINLESS STEEL	206-SS	306-SS	406-SS	506-SS	606-SS	706-SS	806-SS
G	SPRING †	ALL MODELS	207-**	307-**	407-**	507-**	607-**	707-**	807-**
H	STOP RING	FVJ	208-S	308-S	408-S	508-S	608-S	708-S	808-S
		FVB	208-B	308-B	408-B	508-B	608-B	708-B	808-B
		FVS	208-S	308-S	408-S	508-S	608-S	708-S	808-S
		FVSS	208-SS	308-SS	408-SS	508-SS	608-SS	708-SS	808-SS
I	BONNET	FVJ	223-S4	323-S4	423-S4	523-S4	623-S4	723-S4	823-S4
		FVB	223-B4	323-B4	423-B4	523-B4	623-B4	723-B4	823-B4
		FVS	223-S4	323-S4	423-S4	523-S4	623-S4	723-S4	823-S4
		FVSS	223-SS4	323-SS4	423-SS4	523-SS4	623-SS4	723-SS4	823-SS4
J	O-RING † (1 REQUIRED)	FVJ	7058-*	7006-*	7025-*	7003-*	7061-*	7062-*	504-*
		FVB	7058-*	7006*	7025-*	7003-*	7061-*	7062-*	504-*
		FVS	7058-*	7006-*	7025-*	7003-*	7061-*	7062-*	504-*
		FVSS	7058-*	7006-*	7025-*	7003-*	7061-*	7062-*	504-*

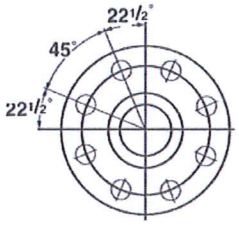
* See o-ring selection chart
** See spring pressure chart
† Recommended spare parts

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DIMENSIONS







FOR 2" VALVE ONLY

DIMENSIONS IN INCHES

Valve Size	AA	BB
1"	$10\frac{5}{16}$"	$3\frac{1}{2}$"
$1\frac{1}{4}$"	$11\frac{13}{16}$"	$3\frac{3}{4}$"
$1\frac{1}{2}$"	$12\frac{5}{8}$"	$4\frac{1}{16}$"
2"	$15\frac{5}{16}$"	$4\frac{9}{16}$"

Note: Dimensions reflect 150# and 300# only

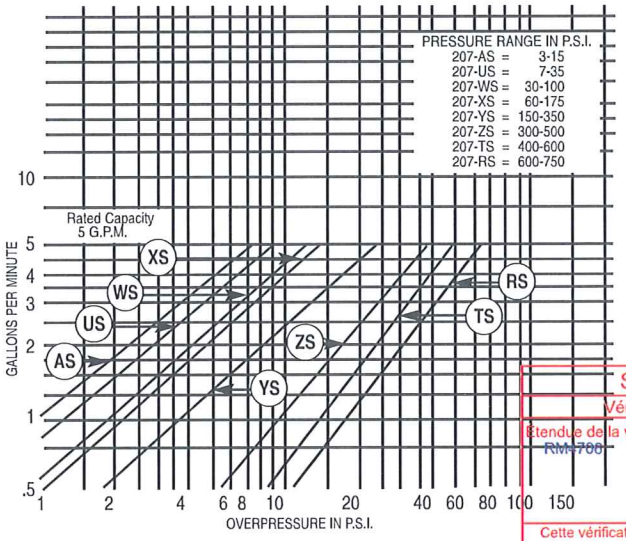
PARTS LIST

SYM.	NAME	MODEL	VALVE SIZE 1"	1¼"	1½"	2"
A	BODY	FVJF FVBF FVSF FVSSF	500-F 500-BF 500-SF 500-SSF	600-F 600-BF 600-SF 600-SSF	700-F 700-BF 700-SF 700-SSF	800-F 800-BF 800-SF 800-SSF
B	CAP	FVJF FVBF FVSF FVSSF	501-R 501-BR 501-SR 501-SSR	601-R 601-BR 601-SR 601-SSR	701-R 701-BR 701-SR 701-SSR	801-R 801-BR 801-SR 801-SSR
C	ADJUSTING SCREW	FVJF FVBF FVSF FVSSF	502-S8 502-B8 502-S8 502-SS8	602-S8 602-B8 602-S8 602-SS8	702-S8 702-B8 702-S8 702-SS8	802-S8 802-B8 802-S8 802-SS8
D	O-RING † (2 REQUIRED)	FVJF FVBF FVSF FVSSF	504-* 504-* 504-* 504-*	604-* 604-* 604-* 604-*	704-* 704-* 704-* 704-*	804-* 804-* 804-* 804-*
E	LOCK NUT	FVJF FVBF FVSF FVSSF	505-S 505-S 505-S 505-SS	505-S 505-S 505-S 505-SS	505-S 505-S 505-S 505-SS	505-S 505-S 505-S 505-SS
F	PISTON †	HARDENED STEEL 416 STAINLESS STEEL 303 STAINLESS STEEL	506 506-A 506-SS	606 606-A 606-SS	706 706-A 706-SS	806 806-A 806-SS
G	SPRING †	ALL MODELS	507-**	607-**	707-**	807-**
H	STOP RING	FVJF FVBF FVSF FVSSF	508-S 508-B 508-S 508-SS	608-S 608-B 608-S 608-SS	708-S 708-B 708-S 708-SS	808-S 808-B 808-S 808-SS
I	BONNET	FVJF FVBF FVSF FVSSF	523-S4 523-B4 523-S4 523-SS4	623-S4 623-B4 623-S4 623-SS4	723-S4 723-B4 723-S4 723-SS4	823-S4 823-B4 823-S4 823-SS4
J	O-RING † (1 REQUIRED)	FVJF FVBF FVSF FVSSF	7003-* 7003-* 7003-* 7003-*	7061-* 7061-* 7061-* 7061-*	7062-* 7062-* 7062-* 7062-*	504-* 504-* 504-* 504-*

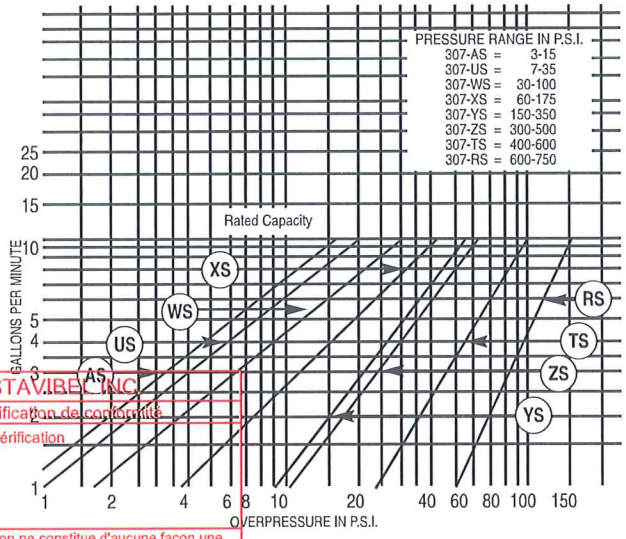
* See o-ring selection chart
** See spring pressure chart
† Recommended spare parts

All valve tests 110°F. to 120°F. Oil Viscosity 150 S.S.U. at 100°F.
(Charts good from 30 to 500 S.S.U.)

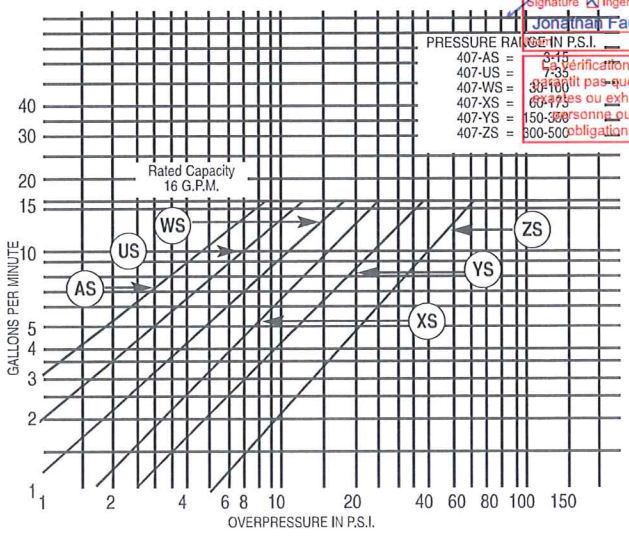
3/8" VALVE TESTS



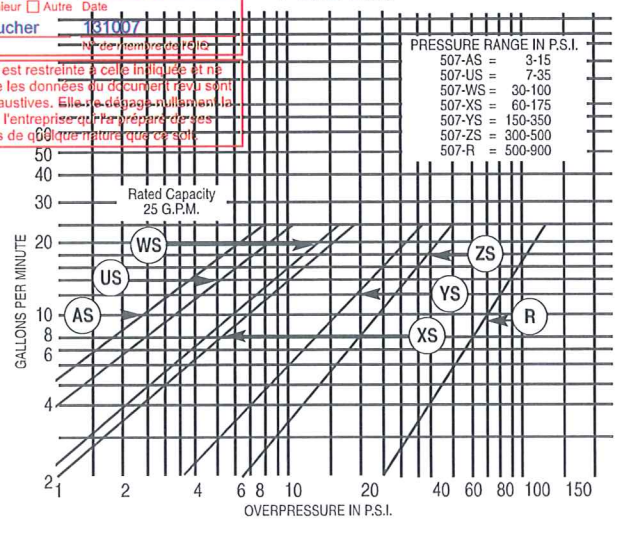
1/2" VALVE TESTS



3/4" VALVE TESTS



1" VALVE TESTS

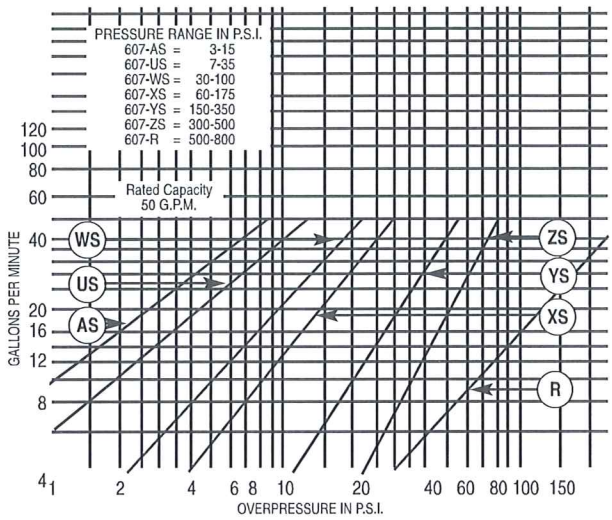


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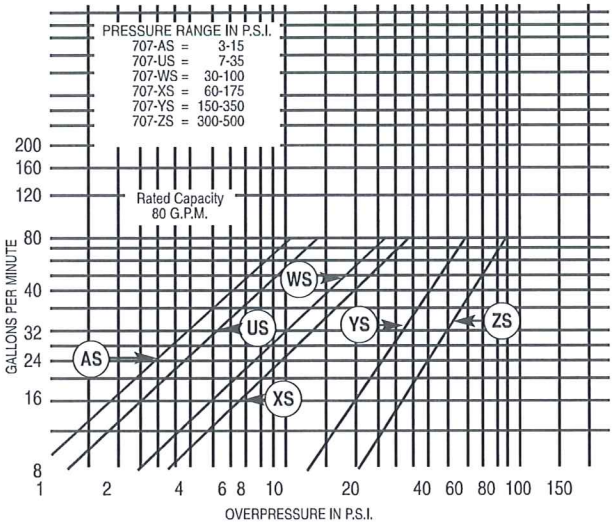
Overpressure - The pressure increase or accumulation above the set pressure when the valve is discharging flow.

All valve tests 110˚F. to 120˚F. Oil Viscosity 150 S.S.U. at 100˚F.
(Charts good from 30 to 500 S.S.U.)

1¼" VALVE TESTS



1½" VALVE TESTS



STAVIBEL INC.
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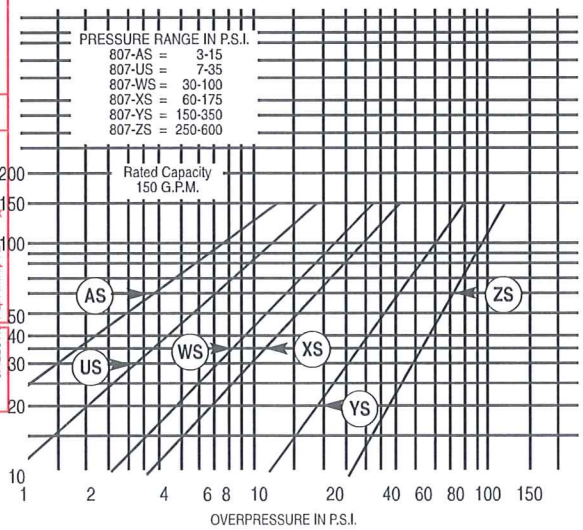
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2" VALVE TESTS



Overpressure - The pressure increase or accumulation above the set pressure when the valve is discharging flow.

A-SERIES VALVES

STAVIBEL INC.

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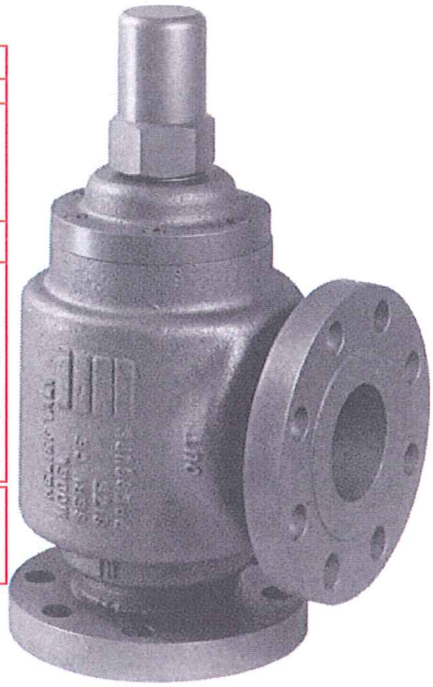
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Nom: Jonathan Faucher — N° de membre de l'OIQ: 131007

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APPLICATION

The Fulflo "A" Series feature both direct acting and internal pilot operated models with either screw or flange type connections. The threaded valves are available in both 2½" and 3" sizes in either cast iron or steel. The flange type valves also include a 4" model and may be specified with 150#, 300# or 600# ANSI flanges. Note that 600# is available in steel and SS only.

The direct acting valves operate at pressures to 150 P.S.I.; the internal pilot operated models at pressures to 500 P.S.I. Both types handle large flows of liquid of all viscosities encountered in industrial practice.

The "A" Series valves may be used in a variety of applications including hydraulic and lubrication systems for load regulation and system protection.

Unusual applications and special or stainless steel requirements should be referred to our engineering staff for recommendation.

INSTALLATION

Fulflo valves can be mounted in any position. A tee may be inserted in the pump discharge line to mount the valve. The pipe lines carrying the heavy valves must be well supported and overhung weights avoided. The correct size of valve must be used, preferably equal to the size of the pipe line to which they are connected. Threaded valves (AAD and ACD) may be threaded into pipe nipples. Overhung weights on threads should be avoided. Flanged valves (AADF and ACDF) are bolted to the companion flange which may be threaded or welded to the pipe. The outlet of the valve should be piped to the supply tank, unless specific applications call for alternate piping of return lines. Care must be taken to have the discharge well below the oil level in the tank to prevent air entrainment and erratic operation.

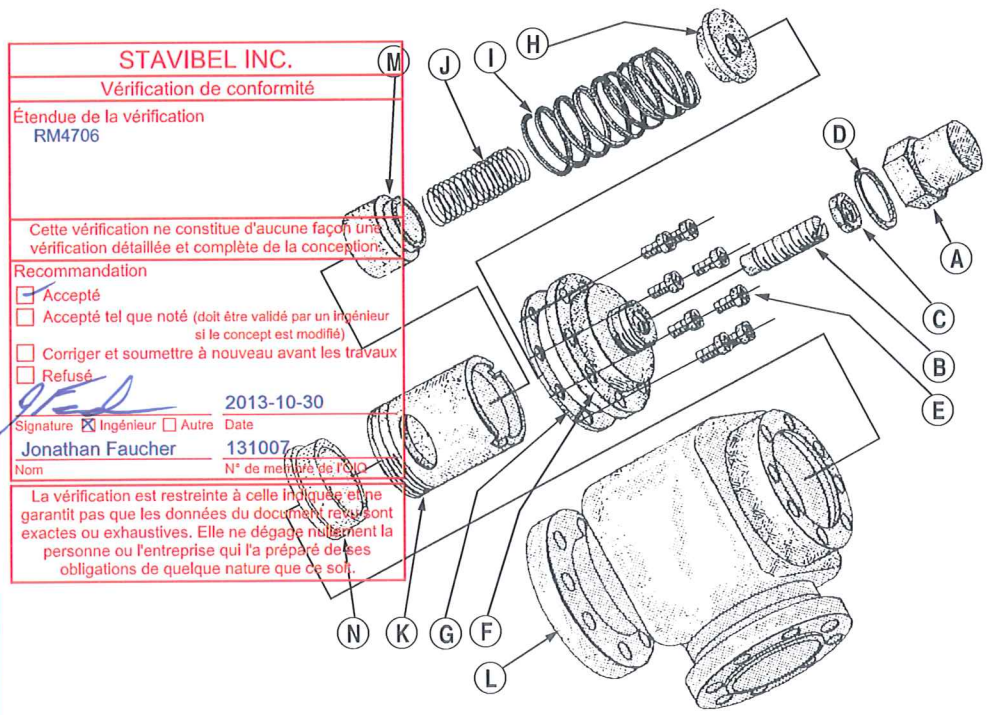
SETTING VALVES

Valve may be set with a hydraulic hand pump for cracking pressure. If a test stand is available, valve should be connected to the discharge header with the pump bypass open, and the bypass gradually closed until the desired pressure registers on the gauge. **"Direct"** Adjust valve adjusting screw until valve slightly bleeds at the set bypass pressure and lock adjusting screw. **"Pilot"** Adjust valve adjusting screw until approximately 5-7 GPM is flowing through the valve, at that point the main piston will open and then the valve will be considered at the set point, then lock adjusting screw. If a valve is required to bypass a given amount of fluid at a given pressure, a test stand having a flow meter in the pump discharge line must be available. With a valve adjusting for cracking pressure as above, continue closing bypass until the required flow registers on the flow meter and observe pressure. Readjust pressure, if necessary, to obtain desired pressure at desired flow.

MAINTENANCE

Fulflo valves provide reliable "chatter-free" operation when the system is free of abrasives and foreign matter. Continuous filtration of the liquid used is strongly recommended.

DISASSEMBLY OF DIRECT ACTING VALVES



To dismantle the valve for inspection or cleaning:

1. Remove cap "A" and gasket "D"
2. Remove lock nut "C"
3. Remove adjusting screw "B"
4. Remove cap screws "E"
5. Remove bonnet "F"
6. Remove gasket "G"
7. Remove spring retainer "H"
8. Remove spring or springs "I" and "J"
9. Remove piston "M"
10. Unscrew and withdraw cylinder "K"
11. Remove retaining bushing "N" if necessary

Inspect cylinder bore and piston for wear or scoring. Replace broken or damaged parts. Clean all parts thoroughly and re-assemble as follows:

Reverse process of disassembly from operation 11 to 6, then thread adjusting screw "B" into bonnet "F" so that it may be guided into the recess of spring retainer "H", while re-assembling bonnet "F" to body "L". Then proceed with steps 5, 4, 2, 1, in reverse order.

ASSEMBLY NUMBER IDENTIFICATION CHART

Symbol No.	Designation	Code	Description
1	Series	A	
2	Material	A C	Cast Iron Cast Steel
3	Type	D P	Direct Acting Internal Pilot Operated
4 & 5	Size	09 10 11	2½" 3" 4"
6	Connection	None F	Screw Type Flange
7,8,9	ASA Flange Rating	150# 300# 600#	
10	Flange Style Only	A B C D	Raised Face, Staggered Bolt Centers Smooth Face, Staggered Bolt Centers Raised Face, Bolts on Valve Centerline Smooth Face, Bolts on Valve Centerline
11	O-Ring Material	R RV RS RT RA EPR RN	Buna O-Ring Cap Seal (Standard) Viton O-Ring Cap Seal Silicone O-Ring Cap Seal Teflon O-Ring Cap Seal Aflas O-Ring Cap Seal Ethylene Propylene Neoprene

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EXAMPLE:

ACP09R

A	C	P	09	R
Series	Steel	Pilot Operated	2½"	Buna

NOTE: Special valves are prefixed by numbers assigned by the factory.

EXAMPLE:

Specify:
1. Valve Model Number
2. O-Ring Identification Number
3. Piston Material
4. Spring Part Number
5. Spring pressure range or desired pressure setting.

SERIES "A" VALVES (Direct Acting) PRESSURE RANGE CHART

Valve Size	Symbol	Spring Part No.	Pressure Range
2½"	I	A0960D	7-57 P.S.I.
	I	A0961C	8-75 P.S.I
	I & J	A0960D and A0970D	14-115 P.S.I.
	I & J	A0961C and A0971C	16-150 P.S.I.
3"	I	A1060D	5-50 P.S.I.
	I	A1061C	5-67 P.S.I.

NOTE: Springs suffixed with "C" are Chrome Vanadium, "D" indicates Stainless Steel. For pressures other than listed, consult factory.

(Continued)

3"	I & J	A1060D and A1070D	10-100 P.S.I.
	I & J	A1061C A1071C	10-135 P.S.I.
4"	I	A1160D	2-37 P.S.I.
	I & J	A1160D and A1170D	4-75 P.S.I.

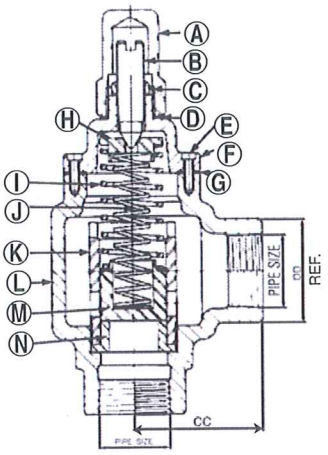
SERIES "A" VALVES (Pilot Operated)

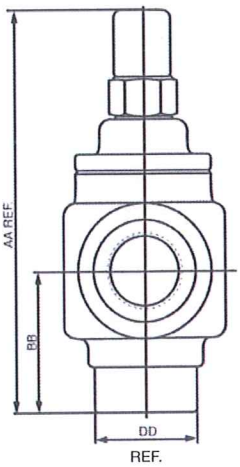
Valve Size	Symbol	Spring Part No.	Pressure Range
2½"	O & J	A0980D and A1190D	50-500 P.S.I.
3"	O & J	A1080D and A1190D	50-500 P.S.I.
4"	O & J	A1181D and A1190D	50-500 P.S.I.

A-SERIES 2½" and 3" (Direct Acting)

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Vérification de conformité
Étendue de la vérification
RM4706
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Recommandation
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☐ Corriger et soumettre à nouveau avant les travaux
☐ Refusé
2013-10-30
Signature ☒ Ingénieur ☐ Autre Date
Jonathan Faucher 131007
Nom N° de membre de l'OIQ
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DIMENSIONS





Valve Size	DIMENSIONS IN INCHES			
	AA	BB	CC	DD
2½"	15 9/16	5½	5 1/16	4
3"	17½	6⅝	6⅜	4⅞

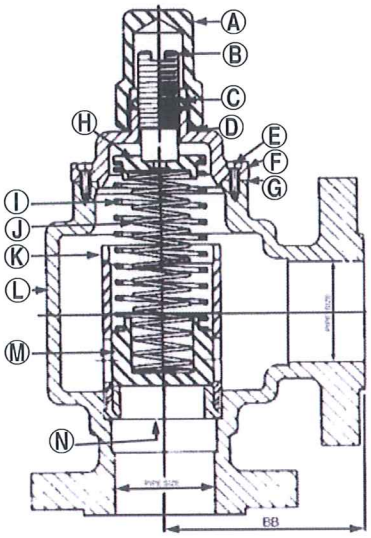
PARTS LIST

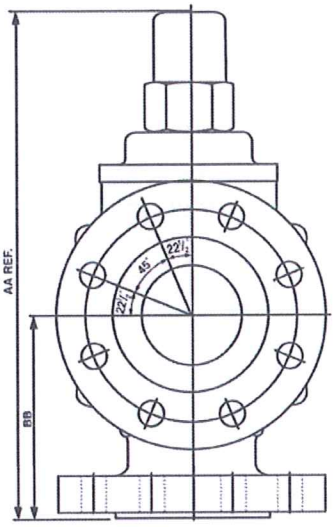
Symbol	NAME	VALVE SIZE	
		2½"	3"
A	Cap	A1101CR	A1013CR
B	Adjusting Screw	A0922C	A1022C
C	Lock Nut	605-S	705-S
D	O-Ring †	604-R	704-R
E	Cap Screw	3/8 x 1 SHCS	3/8 x 1 SHCS
F	Bonnet Cast Iron Steel	 A0909A A0909C	 A1009A A1009C
G	Gasket †	A0903E	A1003E
H	Spring Retainer	A0916C	A1016C
I	Spring †	See Chart	See Chart
J	Spring †	See Chart	See Chart
K	Cylinder †	A0908C	A1008C
L	Body Cast Iron Steel	 A0900A A0900C	 A1000A A1000C
M	Piston † Hardened Steel Stainless Steel	 A0906C A0906D	 A1006C A1006D
N	Retaining Bushing	A0911C	A1011C

† Recommended spare parts

A-SERIES 2½", 3" and 4" (Direct Acting)

DIMENSIONS





DIMENSIONS IN INCHES			
Valve Size	Flange Rating	AA	BB
2½	150# 300#	15 12/16	5 3/4
2½	600#	16 3/16	6 1/8
3	150# 300#	17 1/8	6 1/4
3	600#	17 1/2	6 5/8
4	150# 300#	20	7 15/16
4	600#	20 3/16	8 1/8

Note! Refer to Page 10 for Flange and Drilling Dimensions.

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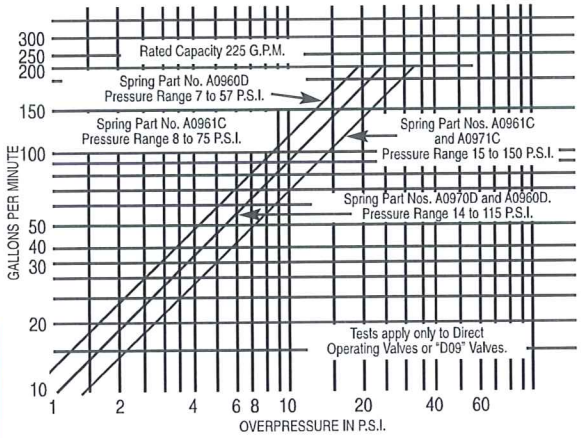
Symbol	NAME			VALVE SIZE 2½"	3"	4"
A	Cap			A1101CR	A1013CR	A1113CR
B	Adjusting Screw			A0922C	A1022C	A1122C
C	Lock Nut			605-S	705-S	805-S
D	O-Ring †			604-R	704-R	804-R
E	Cap Screw			3/8 x 1 SHCS	3/8 x 1 SHCS	3/8 x 1 SHCS
F	Bonnet Cast Iron Steel			 A0909A A0909C	 A1009A A1009C	 A1109A A1109C
G	Gasket †			A0903E	A1003E	A1103E
H	Spring Retainer			A0916C	A1016C	A1116C
I	Spring †			See Chart	See Chart	See Chart
J	Spring †			See Chart	See Chart	See Chart
K	Cylinder †			A0908C	A1008C	A1108C
L	Body	Cast Iron	150#	A0900AF150A	A1000AF150A	A1100AF150A
			300#	A0900AF300A	A1000AF300A	A1100AF300A
		Steel	150#	A0900CF150A	A1000CF150A	A1100CF150A
			300#	A0900CF300A	A1000CF300A	A1100CF300A
			600#	A0900CF600A	A1000CF600A	A1100CF600A
M	Piston † Hardened Steel Stainless Steel			 A0906C A0906D	 A1006C A1006D	 A1106C A1106D
N	Retaining Bushing			A0911C	A1011C	A1111C

† Recommended spare parts

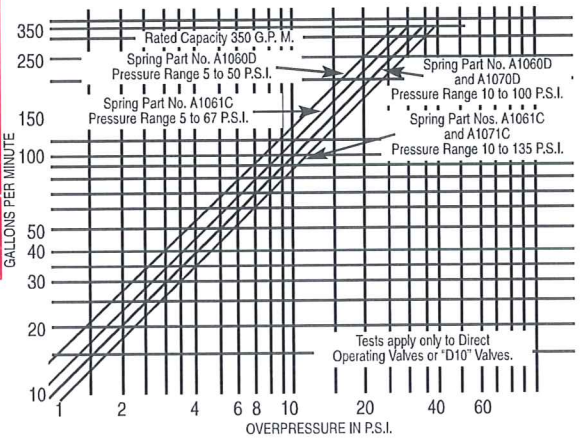
A-SERIES PERFORMANCE CHARTS
(Direct Acting)

All valve tests 110˚F. to 120˚F. Oil Viscosity 150 S.S.U. at 100˚F.
(Charts good from 30 to 500 S.S.U.)

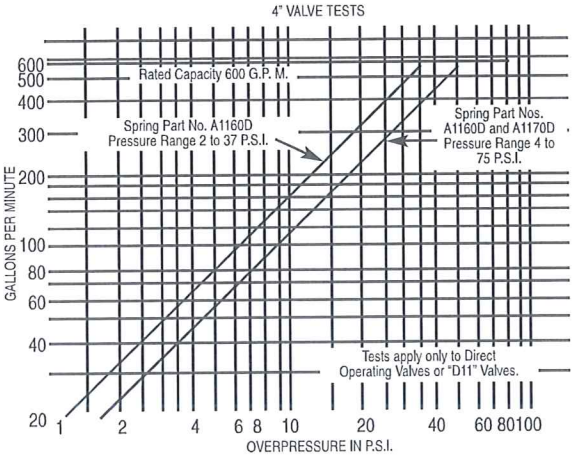
2½" VALVE TESTS



3" VALVE TESTS



4" VALVE TESTS



STAVIBEL INC.
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Étendue de la vérification
RM4706

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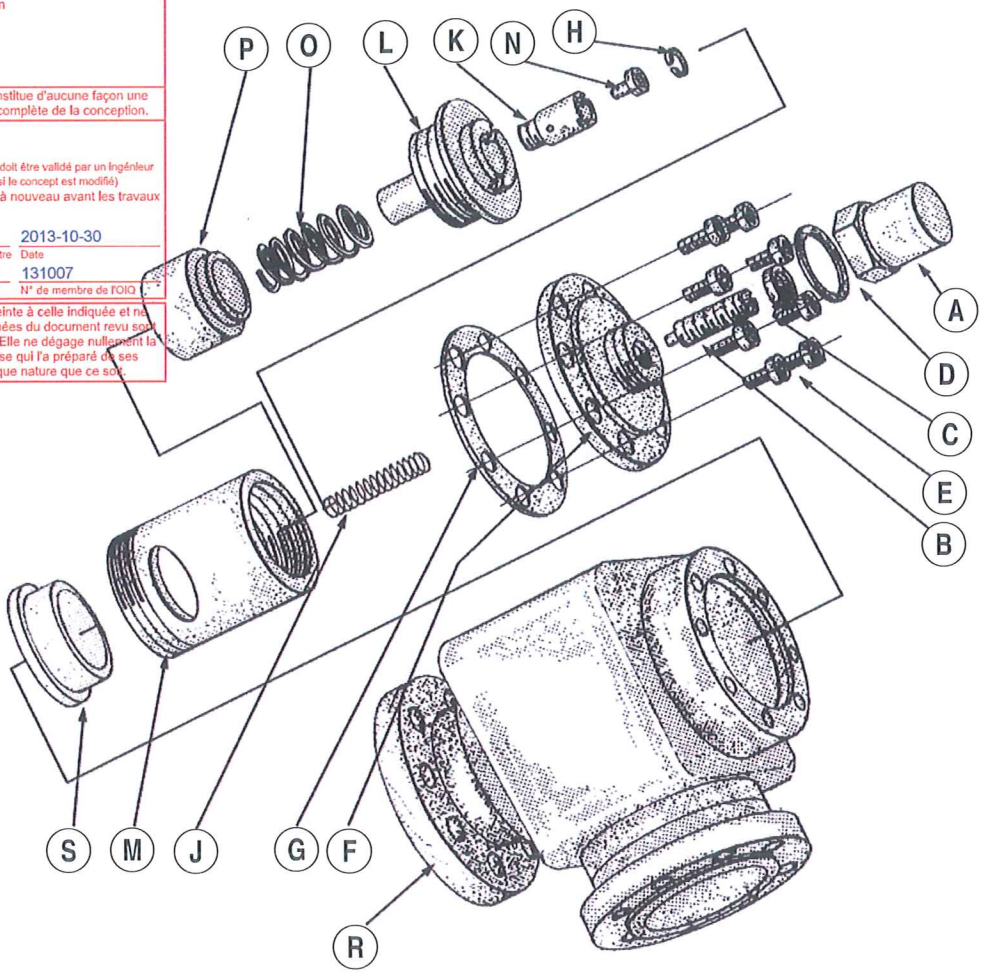
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2013-10-30
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Overpressure - The pressure increase or accumulation above the set pressure when the valve is discharging flow.

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DISASSEMBLY OF INTERNAL PILOT OPERATED VALVES

To dismantle the valve for inspection or cleaning:

1. Remove cap “A” and gasket “D”
2. Remove nut “C”
3. Remove adjusting screw “B”
4. Remove cap screws “E”
5. Remove bonnet “F”
6. Remove gasket “G”
7. Remove pilot spring “J”
8. Unscrew and withdraw cylinder “M” (do not unscrew cylinder retainer “L”)
9. Unscrew and remove cylinder retainer “L”, after removing cylinder “M”.

   Caution: hold in vise. Balance spring “O” under heavy compression.
10. Unscrew and remove piston retainer “K”
11. Remove retaining ring “H”
12. Remove pilot piston “N”
13. Remove balance spring “O”
14. Remove piston “P”
15. Remove retaining bushing “S” if necessary

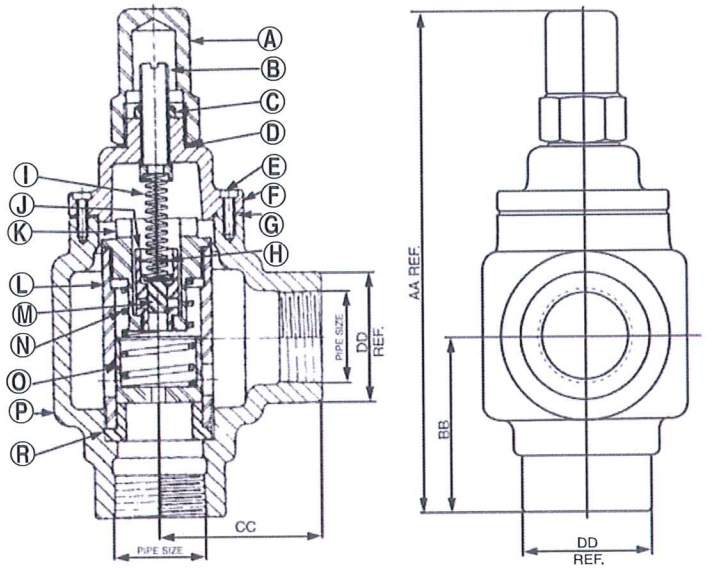
Inspect bores of both piston retainer “K” and cylinder “M”. Inspect pistons “N” and “P” for wear or scoring. Replace broken or damaged parts. Clean all parts thoroughly and re-assemble as follows:

Reverse process of disassembly from operation 16 to 6, then thread adjusting screw “B” into bonnet “F”, while re-assembling “F” to body “R”. Then proceed with steps 5, 4, 2, 1 in reverse order.

A-SERIES 2½" and 3" (Internal Pilot Operated)

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DIMENSIONS



DIMENSIONS IN INCHES

Valve Size	AA	BB	CC	DD
2½"	15⅝	5½	5 1/16	4
3"	16½	6⅝	6⅜	4⅞

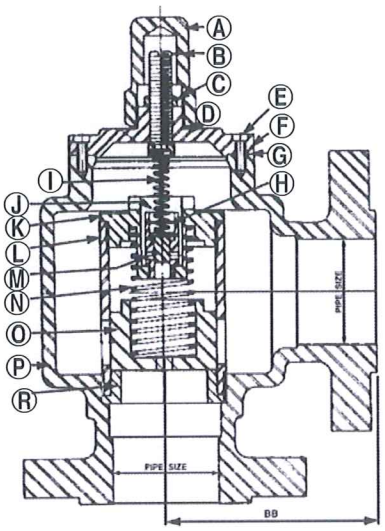
PARTS LIST

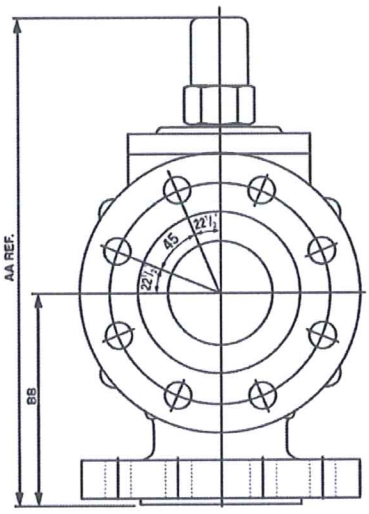
Symbol	NAME	VALVE SIZE	
		2½"	3"
A	Cap	A1101CR	A1101CR
B	Adjusting Screw	A1102C	A1102C
C	Lock Nut	505-S	505-S
D	O-Ring †	604-R	604-R
E	Cap Screw	3/8 x 1 SHCS	3/8 x 1 SHCS
F	Bonnet Cast Iron Steel	 A0919A A0919C	 A1019A A1019C
G	Gasket †	A0903E	A1003E
H	Retainer Ring †	A1120D	A1120D
I	Pilot Spring †	A1190D	A1190D
J	Piston Retainer †	A1118C	A1118C
K	Cylinder Retainer	A0912C	A1012C
L	Cylinder †	A0928C	A1028C
M	Pilot Piston † Hardened Steel Stainless Steel	 A1115C A1115D	 A1115C A1115D
N	Balance Spring †	A0980D	A1080D
O	Piston † Hardened Steel Stainless Steel	 A0936C A0936D	 A1036C A1036D
P	Body Cast Iron Steel	 A0900A A0900C	 A1000A A1000C
R	Retaining Bushing	A0911C	A1011C

† Recommended spare parts

A-SERIES 2½", 3" and 4"
(Internal Pilot Operated)

DIMENSIONS





DIMENSIONS IN INCHES			
Valve Size	Flange Rating	AA	BB
2½	150# 300#	15⅞	5¾
2½	600#	16¼	6⅛
3	150# 300#	16⅛	6¼
3	600#	16½	6⅝
4	150# 300#	18 3/16	7 15/16
4	600#	18⅜	8⅛

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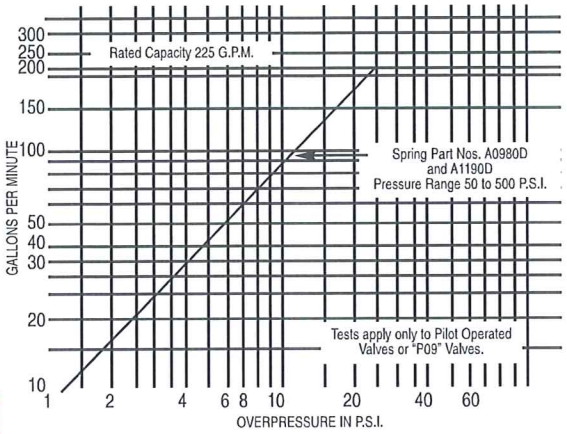
Symbol	NAME			VALVE SIZE 2½"	3"	4"
A	Cap			A1101CR	A1101CR	A1101CR
B	Adjusting Screw			A1102C	A1102C	A1102C
C	Lock Nut			505-S	505-S	505-S
D	O-Ring †			604-R	604-R	604-R
E	Cap Screw			3/8 x 1 SHCS	3/8 x 1 SHCS	3/8 x 1 SHCS
F	Bonnet Cast Iron Steel			 A0919A A0919C	 A1019A A1019C	 A1119A A1119C
G	Gasket †			A0903E	A1003E	A1103E
H	Retainer Ring †			A1120D	A1120D	A1120D
I	Pilot Spring †			A1190D	A1190D	A1190D
J	Piston Retainer †			A1118C	A1118C	A1118C
K	Cylinder Retainer			A0912C	A1012C	A1112C
L	Cylinder †			A0928C	A1028C	A1128C
M	Pilot Piston † Hardened Steel Stainless Steel			 A1115C A1115D	 A1115C A1115D	 A1115C A1115D
N	Balance Spring †			A0980D	A1080D	A1181D
O	Piston † Hardened Steel Stainless Steel			 A0936C A0936D	 A1036C A1036D	 A1136C A1136D
P	Body	Cast Iron	150# 300#	A0900AF150A A0900AF300A	A1000AF150A A1000AF300A	A1100AF150A A1100AF300A
		Steel	150# 300# 600#	A0900CF150A A0900CF300A A0900CF600A	A1000CF150A A1000CF300A A1000CF600A	A1100CF150A A1100CF300A A1100CF600A
R	Retaining Bushing			A0911C	A1011C	A1111C

† Recommended spare parts

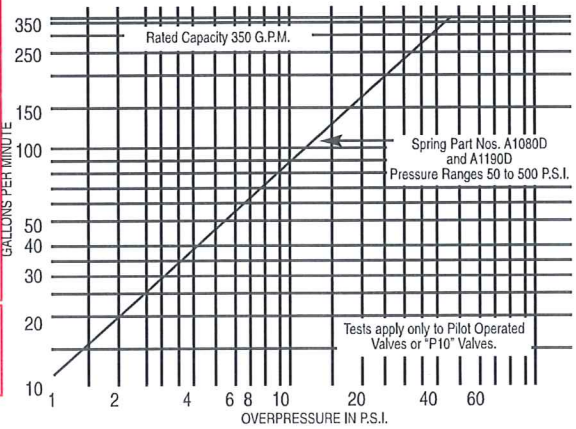
A-SERIES PERFORMANCE CHARTS
(Internal Pilot Operated)

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(Charts good from 30 to 500 S.S.U.)

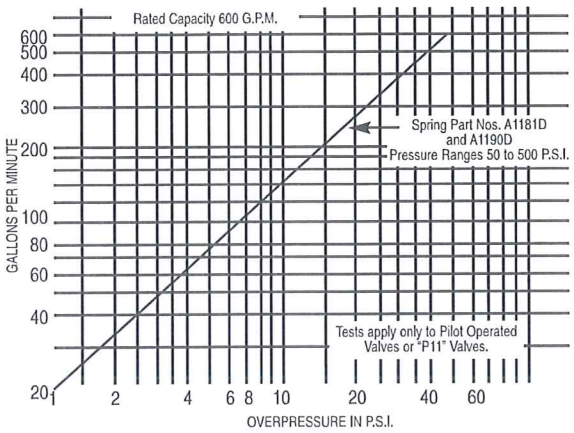
2½" VALVE TESTS



3" VALVE TESTS



4" VALVE TESTS



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Overpressure - The pressure increase or accumulation above the set pressure when the valve is discharging flow.

SVB-SERIES VALVES*

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*Underwriter Listed

APPLICATION

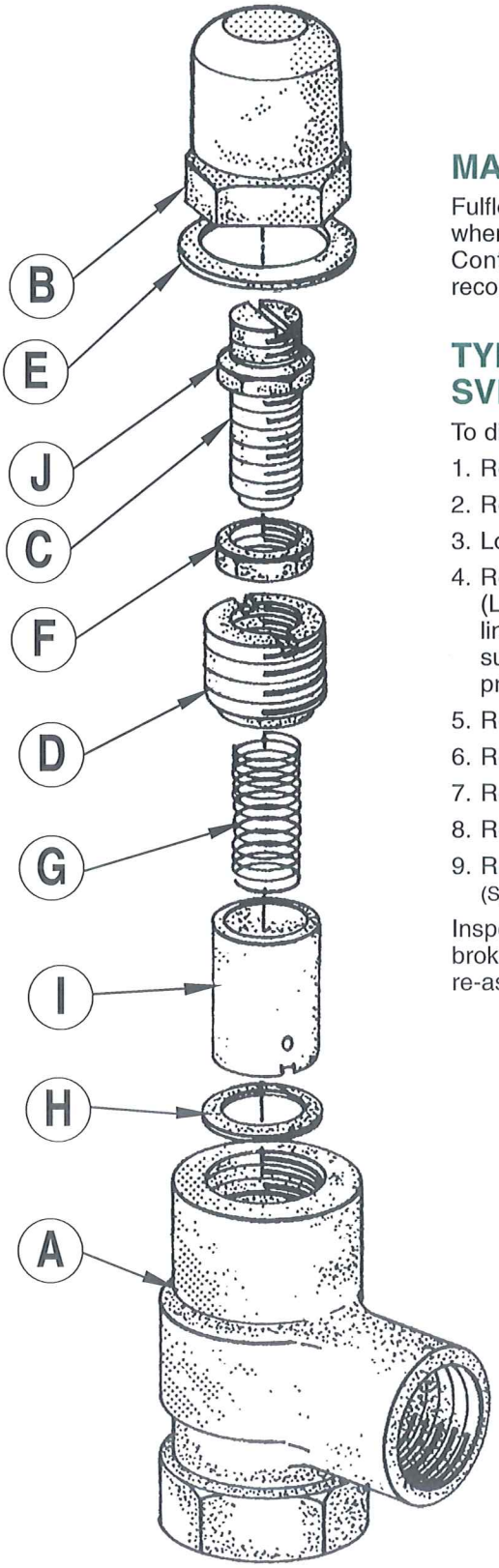
The Fulflo "SVB" Series, Underwriter Listed, range in size from 3/8" through 1" and operate efficiently with liquids of any viscosity at pressures from 7 through 500 P.S.I. The "SVB" valves are of brass construction with threaded connections.

Primarily designed for use with fuel oils on oil burner service, the "SVB" valves may be used wherever Underwriter Listed valves are required. Each valve is pre-set to the specified pressure and is equipped with a limiting device to prevent over-adjustment.

INSTALLATION

Fulflo valves can be mounted in any position. A tee may be inserted in the pump discharge line to mount the valve. The correct size of valve should be installed, preferably matching the pump discharge line. Screw the valve into the nipple in the tee. When the valve is used for frequent bypassing of oil under pressure, its outlet should be piped back to the tank. Care must be taken to have the discharge well below the oil level in the tank to prevent air entrainment and erratic operations.

Only if the valve is used as safety or overload relief and operates infrequently may its discharge be piped back into the pump suction line. Frequent or continuous operation under these conditions will cause excessive heating of the oil and possible damage.



MAINTENANCE

Fulflo valves provided reliable "chatter-free" operation when the system is free of abrasives and foreign matter. Continuous filtration of the liquid used is strongly recommended.

TYPICAL DISASSEMBLY OF SVB VALVES

To dismantle valve for inspection and cleaning:

1. Remove cap "B"
2. Remove gasket "E" (replace, if necessary)
3. Loosen lock nut "F"
4. Remove adjusting screw "C"
   (Limit collar "J" is soldered to adjusting screw "C", to limit the maximum pressure to which the valve may be subjected.) Limit collar is set at 25% above normal pressure setting.
5. Remove lock nut "F"
6. Remove retainer "D"
7. Remove spring "G"
8. Remove piston "I"
9. Remove stop ring "H" (Not Recommended)
   (Special tooling is required to install new stop ring.)

Inspect valve bore and piston for wear or scoring. Replace broken or damaged parts. Clean all parts thoroughly and re-assemble by reversing the above procedure.

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SVB-SERIES

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ASSEMBLY NUMBER IDENTIFICATION CHART

Symbol Number	Designation	Code	Description
1	Style	S	Underwriter Listed
2	Series	V	–
3	Material	B	Brass
4 or 5	Size	-25 -35 -45 -55	3/8" 1/2" 3/4" 1"
6	Spring	See Chart	See Spring Pressure Chart
7	Piston	0 1 2 3	Hardened Steel, deep grove Stainless Steel, deep grove Hardened Steel, shallow groove Stainless Steel, shallow groove

EXAMPLE:

SVB-55ZSO

S	V	B	-55	ZS	O
Underwriter's Listed	Series	Brass	1"	Spring	Hardened Steel Piston, Deep Groove

HOW TO ORDER

Specify:

1. Valve Model Number
2. Spring Letter
3. Piston Number
4. Pressure Setting

NOTE: A definite pressure setting is required due to Underwriter restrictions. A limiting device is furnished to prevent over-adjustment more than 25% above set pressure.

SETTING VALVES

Valve may be set with a hand pump for cracking pressure. It will be noted that the maximum set pressure is limited by the collar "J" soldered to the adjusting screw "C".

If a test stand is available, valve should be connected to the discharge header with the pump bypass open, and the bypass gradually closed until the desired pressure registers on the gauge. Adjust valve adjusting screw until valve slightly bleeds at the set bypass pressure and lock adjusting screw.

If valve is required to bypass a given amount of fluid at a given pressure, a test stand having a flow meter in the pump discharge line must be available. With valve adjusted for cracking pressure as above, continue closing bypass until the required flow registers on the flow meter and observe pressure. Re-adjust pressure, if necessary, to obtain desired pressure at desired flow.

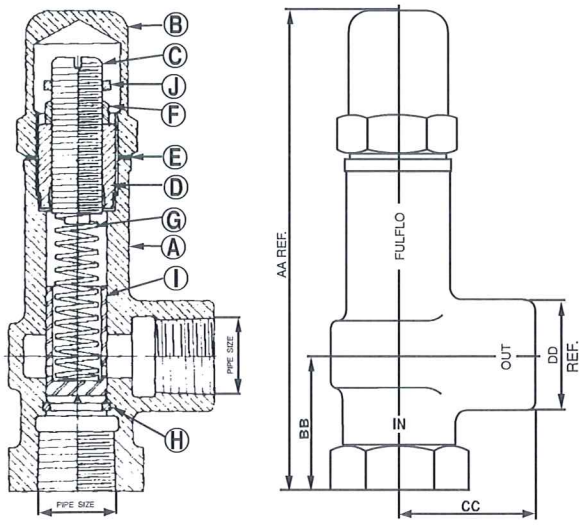
UNDERWRITER VALVE PRESSURE RANGE CHART

Pipe Size	"U.L." Symbol	SPRING PRESSURE RANGE AND PART NO. SUFFIX									
		RED-US		GREEN-WS		YELLOW-XS		WHITE-YS		BLUE-ZS	
		Low	High	Low	High	Low	High	Low	High	Low	High
3/8"	SVB-25	7	35	30	100	60	175	150	350	300	500
1/2"	SVB-35	7	35	30	100	60	175	150	350	300	500
3/4"	SVB-45	7	35	30	100	60	175	150	350	300	500
1"	SVB-55	7	35	30	100	60	175	150	350	300	500

SVB-SERIES (Brass)

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DIMENSIONS



Pipe Size	"U.L." Symbol	DIMENSIONS IN INCHES			
		AA	BB	CC	DD
3/8"'	SVB-25	$5^{11}/_{32}$	$1^{11}/_{32}$	$1^{11}/_{32}$	$1^{3}/_{8}$
1/2"	SVB-35	$6^{3}/_{16}$	$1^{11}/_{16}$	$1^{7}/_{16}$	$1^{7}/_{16}$
3/4"	SVB-45	$6^{15}/_{16}$	$1^{15}/_{16}$	$1^{13}/_{16}$	$1^{11}/_{16}$
1"	SVB-55	$8^{7}/_{32}$	$2^{9}/_{32}$	$2^{9}/_{32}$	$2^{1}/_{16}$

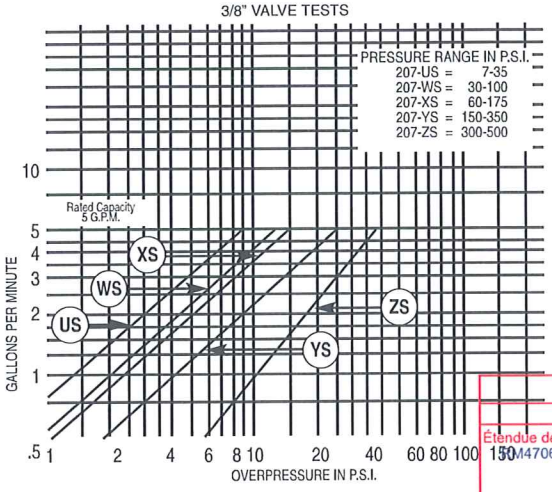
PARTS LIST

Symbol	NAME	VALVE SIZE			
		3/8"	1/2"	3/4"	1"
A	Body	200-B	300-B	400-B	500-B
B	Cap	201-B	301-B	401-B	501-B
C	Adjusting Screw	202-B	302-B	402-B	502-B
D	Retainer	203-B	303-B	403-B	503-B
E	Gasket	204	304	404	504
F	Lock Nut	205-S	305-S	405-S	505-S
G	Spring	See Chart	See Chart	See Chart	See Chart
H	Stop Ring	208-B	308-B	408-B	508-B
I	Piston Hardened Steel Stainless Steel	 206 206-A	 306 306-A	 406 406-A	 506 506-A
J	Limit Collar	221-B	321-B	421-B	521-B

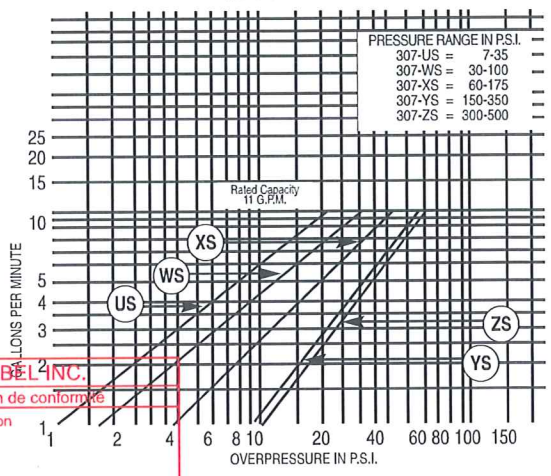
SVB-SERIES PERFORMANCE CHARTS

All valve tests 110˚F. to 120˚F. Oil Viscosity 150 S.S.U. at 100˚F.
(Charts good from 30 to 500 S.S.U.)

3/8" VALVE TESTS

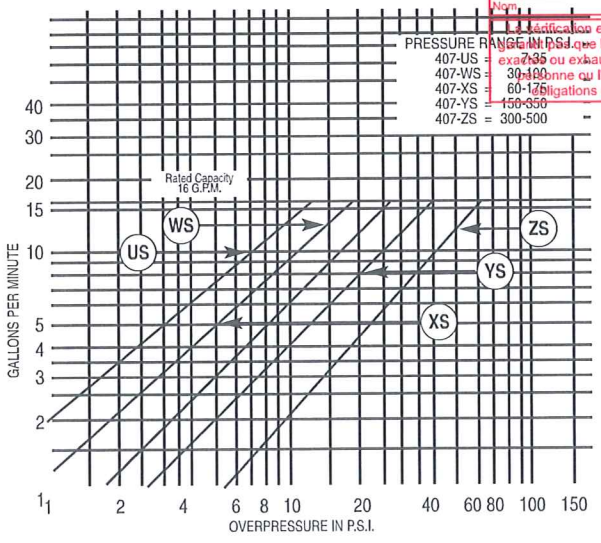


1/2" VALVE TESTS

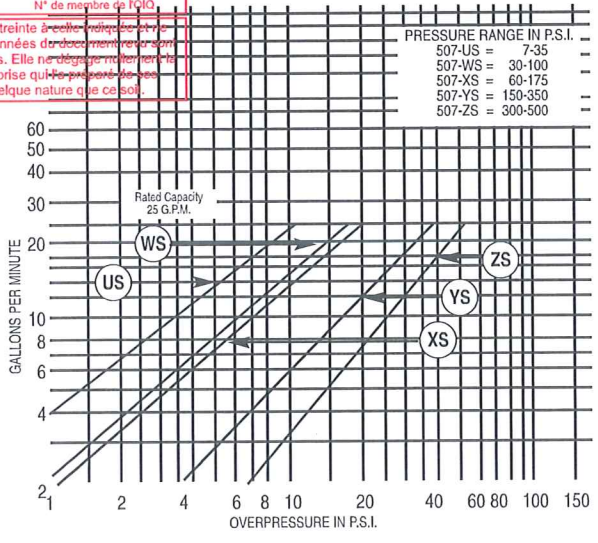


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3/4" VALVE TESTS



1" VALVE TESTS



Overpressure - The pressure increase or accumulation above the set pressure when the valve is discharging flow.

NOTES

NOTES

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TYPICAL APPLICATIONS

Combustion Equipment
- Circulating Oil Systems
- Heating Equipment on Railroad Cars
- Package and Industrial Boilers
- Oil Burning Equipment

Machine Tools
- Valves are used for:
  - Regulation of Lubricating System Pressure
  - Regulation of Pressure for Hydraulic Feeds
  - Regulation of Coolant Pressure
- Boring Machines
- Drills (Radial, Single or Multiple Spindle)
- Grinders (Surface, Cylindrical, Centerless and Universal)
- Lathes (Engine, Turret, Automatic)
- Milling Machines
- Hydraulic Tracing Units

Hydraulic Manufacturing and Processing Equipment
- Stamping Presses
- Press Brakes
- Molding Presses
- Rams
- Crushers
- Bending and Forming Equipment

Hydraulic Test Stands
- To Maintain Specific Pressures
- As Safety Relief Valve to Protect Pumps, Gauges, etc.
- Aircraft Test Equipment and Ground Support Equipment
- Equipment Test Racks
- Pressure Test Racks

Hydraulic Power Units
- Used in Basic Tank, Pump and Motor Systems

Material Handling Equipment
- Hydraulic Hoists
- Hydraulic Elevators
- Hydraulic Platforms

Special Equipment
- Fire Equipment
- Laundry Equipment
- Coal Mining Equipment
- Road Spraying Machinery
- Car Washing Machinery
- Cleaning Machinery (Steam or Solution)
- Industrial Sewing Machines
- Dairy Machinery
- Special and Custom Engineered Industrial Machinery
- Equipment for Oxygen and Industrial Gasses

Industrial Air Conditioning Equipment
- Pumps - Filters

Engines and Turbines, Lubrication and Control System
- Diesel Engines
- Steam Turbines
- Hydraulic Turbines
- Gas Turbines

Mobile Equipment
Industrial Compressors

Processing Systems
- Public Utilities
  - Maintaining City Water System Pressures
  - Protection and Control of Fire Hydrant Pressures
- Oil Refineries
- Chemical Plants
- Distilleries
- Irrigation Systems
- Steel Mill and Processing Plants
- Food Processing Plants
- Papermill and Pulp Processing Plants

Liquids Handled
- Hydraulic Oils
- Water (Treated, Purified and Salt Water)
- Dry Cleaning Solvent
- Heated Tar (Pumped)
- Heated Molasses (Pumped)
- Anhydrous Ammonia
- Edible Fats and Oils
- Processed Liquid Foods
- Processed Petroleum Products

VALVE DEFINITIONS

Pressure Safety Valve (PSV)
A pressure safety valve actuated by inlet static pressure and characterized by rapid opening or rapid popping action. this safety valve is tight shut-off and is for safety only. Meets ASME SEC. VIII (Not a Fulflo valve)

Pressure Relief Valve (PRV)
A pressure relief device designed to re-close and prevent further flow after normal conditions have been restored. (Fulflo)

Relief Valve (RV)
A spring loaded pressure relief valve, actuated by the static pressure upstream of the valve. The valve opens normally in proportion to the increase in pressure over the set pressure. (Fulflo)

Safety Relief Valve (SRV)
A pressure relief valve characterized by rapid opening or pop-action in direct proportion to the pressure increase, depending on the application. (Fulflo)

Conventional Safety Relief Valve (CSRV)
A spring-loaded pressure relief valve whose performance characteristics are directly affected by change in the back pressure of the valve. (Fulflo)

Backpressure
The pressure existing at the outlet of a pressure relief valve, due to the pressure in the discharge system. the pressure can be constant or variable. It is the sum of the superimposed and build-up pressure.

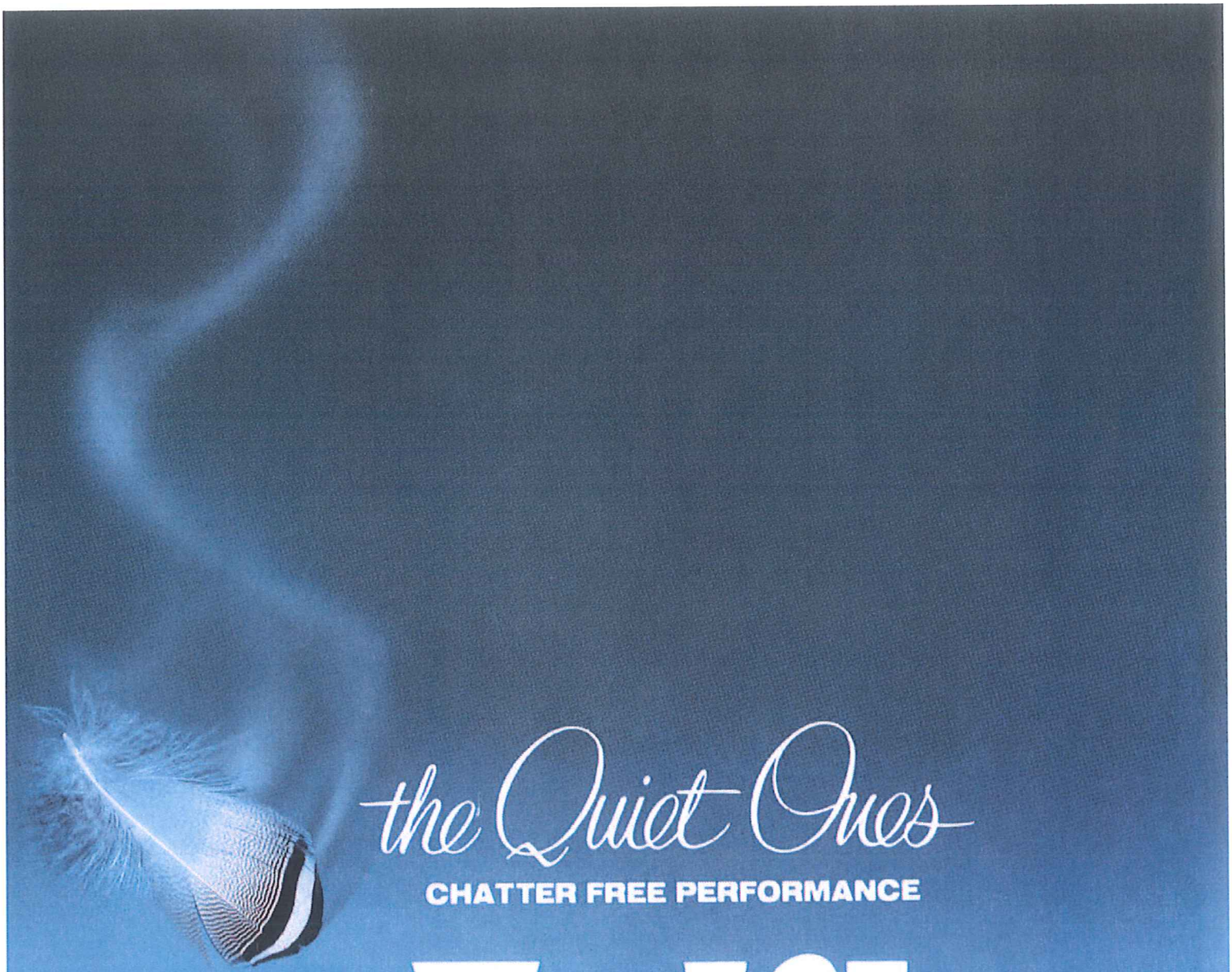
Cracking Pressure
The pressure which the valve starts to leak flow through the valve, but before the set pressure.

Set Pressure
The inlet pressure the valve is adjusted to open, maintain or control under service conditions.

Differential Set Pressure
The pressure differential between the set pressure and constant superimposed backpressure.

Superimposed Backpressure
The static pressure existing at the outlet of the relief device at the time the device is required to operate. It is a result of pressure in the discharge system coming from another source. This pressure may be constant or variable.

Overpressure
The pressure increase or accumulation above the set pressure when the valve is discharging flow.



the Quiet Ones

CHATTER FREE PERFORMANCE

Fulflo

THE FULFLO SPECIALTIES COMPANY

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Catalog FS-706

Printed in USA

OPW 444TA AST Four Signal Tank Alarm and OPW 144TA AST Liquid Level Tank Alarm

The OPW AST remote Four Signal Tank Alarm is designed to sense up to four different liquid levels or other signals using just one device.

The OPW 144TA Tank Alarm is designed for liquid level sensing.

Alarm Technical Information:
Hazardous Location Approval: Class I, Groups C & D
Maximum Voltage: 7.2 Volts
Maximum Current: 8 ma. per input (32 ma. total)
Maximum Internal Capacitance: 23 uF
Maximum Internal Inductance: 33 mH
Maximum Ambient Temperature Rating: 60° C
Maximum Surface Temperature Classification: T4 Surface Code
Wiring limitations: 1000 foot maximum between the 144TA/444TA unit and any remote switch for each channel of the alarm. This assumes that maximum capacitance for any input is 60 nanoFarads and that the maximum inductance is 0.2 milliHenry per input (UL-913 A7.3)
Note: This device is designed to work independently and should not be wired in parallel with another device, except as defined in the following instructions.
Requirements for devices wired to the 144TA/444TA:

- Attached wiring and devices must be classed Intrinsically Safe
- No voltage or current source
- Maximum capacitance: 60 nanoFarads (.06 uF) per input
- Maximum inductance: 200 microHenrys (.2 mH) per input

Float Switch Technical Information: Minimum liquid specific gravity: 0.45. Stem material: Stainless steel. Float Material: Closed Cell Buna-N (UL Approved) for gasoline services. Max Pressure: 150 psi @ 70° F. Thread 1/8" NPT.

***NOTE:** When replacing the battery for the 144TA-0100, open the alarm box and locate the OPW number on the black battery module. If the number reads "C05346" then use the replacement part 15615M. If the number reads "144TA-0100" then use the replacement part 202891.

444TA Dimensions:

	in.	cm
A	5 1/32	12.8
B	5 1/32	12.8
C	4 3/16	10.6

144TA Dimensions:

	in.	cm
A	5 1/32	12.8
B	5 1/32	12.8
C	3	7.6
D	4 3/16	10.6
E	1 15/16	4.9
F	35	88.9
G	1 15/16	4.9
H	1	2.5

Materials

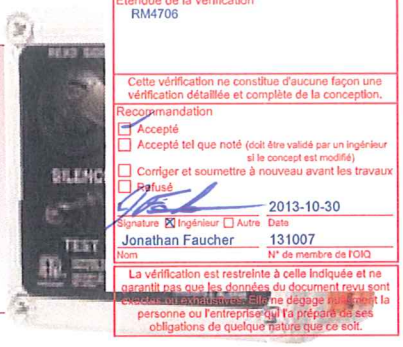
Enclosure: Polybutylene terephthalate

Wire Grommet: Nylon w/ buna seal

Float Switch: Closed cell buna float & stainless steel rod

Pipe: Stainless steel

Tank Adaptor: Aluminum hardcoat anodized



444TA

Features

- **Up to four alarm signals (444TA)** – can be used for high or low liquid level sensing, interstitial monitoring, and/or other signals in one to 4 separate tanks.
- **Self-Powered** – lithium battery with a 10-year shelf life for long service life.
- **Audible Alarm** – sounds a 90-decibel alarm at 4 feet away.
- **Visual Notifications** – red alarm light will flash during use for notification to the user. Low battery light indicates when battery needs replaced.
- **Corrosion-Resistant Construction** – petroleum and environmental resistant housing and all stainless steel pipe fitting ensure a long product life.
- **Product /Alarm Identification Label** – located on top of the alarm for quick and easy identification, allowing you to correspond alarms to signals. Label has a protective covering.
- **Intrinsically Safe** – complies with ANSI/ UL 913 for Class 1, Division 1 & 2 for Groups C & D hazardous locations.
- **Cold Weather Resistant** – all components are safe for temperatures down to -40°F operation (and up to 120° F).
- **Long Life Lithium Battery** – self-powered by a lithium battery which includes a 10-year shelf life to ensure peace of mind for the owner.
- **Easy Installation** – requires no calibration and installs easily into a 1" tank bung. **May be assembled remotely or directly on top of tank.**

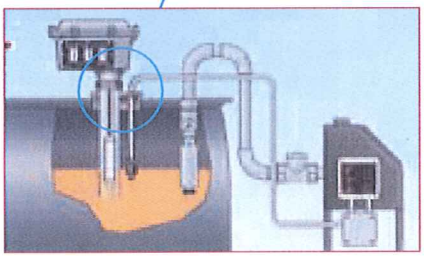


TGTA-0400 4" Tank Bung Combo Fitting Note: Drop Tube must be used with TGTA-0400.

Ordering Specifications:

Product #	Description	lb.	kg
444TA-0100*	Four Signal Tank Alarm, does not include Float Switch	4	1.8
44TA-LLFS*	36" Liquid-Level Float Switch Sub-Assembly	0	0.0
144TA-0100	Single Channel Liquid Level Tank Alarm, does not include Float Switch	4	1.8
TGTA-0400	4" Tank Bung Gauge and Alarm Combo Fitting (OPW 61T required for use)	10	4.5

The OPW 144TA Requires the OPW 44TA-LLFS, the OPW 44TA-LLFS must be purchased as a separate item.



Replacement Parts:

Part #	Description
44TA-LLFS	Liquid-Level Float Switch ASSY
H15412M	Wire Fitting
H15411M	Float Switch
Items to Convert to a Low Level Alarm:	
202430	1/8" SST Nipple
C05295M	SST Tube
Battery Module	
H15937M	444TA-0100
See Note	144TA-0100*

Approvals and Listings

3069027

Conforms to ANSI / UL STD 913
Certified to CAN / CSA STD C22.2 No. 157-92
Florida EQ-610
CARB Certified

444TA and 144TA Instruction Sheet Order Number: **200655**

FMC Technologies

Modèle TPW-3-2.5

Smith Meter® Electronic Equipment

Temperature Probes Thermowells

Specifications

Issue/Rev. 0.2 (9/09) Bulletin SS09035

Temperature Probes and Wells

Smith Meter's temperature probes and wells are used to interface the temperature input necessary for Smith Meter's electronic presets and flow computers to make temperature-related calculations.

Features

- 316 Stainless Steel Well
- Platinum Probe
- Explosion-Proof
- UL- and CSA-Approved

Applications

Applications include pipelines, shipping docks, loading racks, refineries, chemical plants, processing installations, and tank farms.

Applications	Probe/Well Model No.
Customer-installed in system piping. (3/4" NPT well)	TPW-3
Customer-installed in 3 or 4-inch 210 valve or system piping. (1/2" NPT Well)	TPW-4

Specifications

Probes (TP-3, 4)

Sheath Diameter: 1/4".

Number of Wires: Four (TP_-3, 4).

Material of Construction: High purity platinum wire, fiberglass insulation.

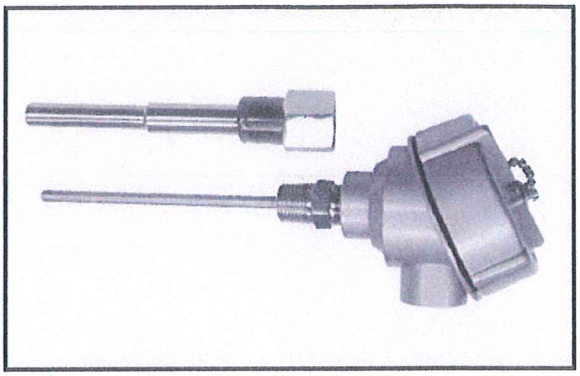
Resistance: At 32°F (0°C) - 100 Ω.

Temperature Coefficient: At 32°F to 212°F (0°C to 100°C) - 0.00385 Ω/Ω/°C.

Temperature Tolerance: At (0°C) - (±0.1°C).

Temperature Range: -50°F to 800°F (-45°C to 425°C).

Connection Head: Listed by FM or UL and CSA for Class I, Div. 1, Groups B, C and D; Enclosure - NEMA Type 4.



Thermowell (TPW-3)

Process Connection Size: 3/4" NPT (Standard).

Bore Size: 0.260.

Insertion Length: See Dimensional Table, Figure 2.

Material of Construction: 316 Stainless Steel.

Thermowell (TPW-4)

Process Connection Size: 1/2" NPT.

Bore Size: 0.260.

Insertion Length: See Dimensional Table, Figure 2.

Material of Construction: 316 Stainless Steel.

***Note:** Can be mounted in the body of a PD meter that has a temperature boss or in a port of a 3" or 4" valve.*

Pipe size and Well Insertion Length Reference

Nominal Pipe Size	Well Insertion Length
2"	1.5
3-4"	2.5
6-8"	4.5
10-12"	7.5

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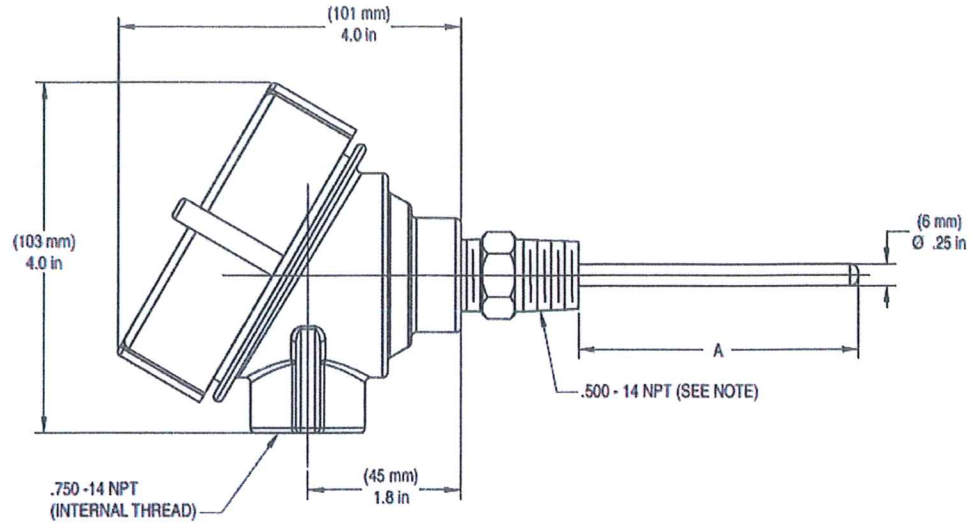
☐ Refusé

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Dimensions – Inches (mm)



Note: *Apply Loctite anti-seize compound (Part No. 005893-600) to threads before insertion.*

Dimensions – Inches to the nearest tenth (millimetres to the nearest whole mm), each independently dimensioned from respective engineering drawings.

Figure 1 – Explosion-Proof Temperature Probe

Explosion-Proof Temperature Probe

Model	Dimensions – inches (mm)
	A
TP -__3-1.5	2.2 (57)
TP -__3-2.5	3.2 (83)
TP -__3-4.5	5.2 (133)

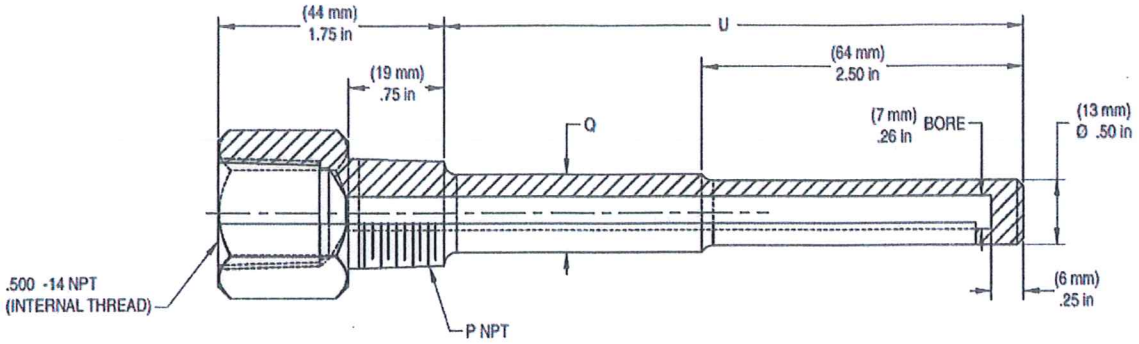
Model	Dimensions – inches (mm)
	A
TP -__4-1.5	2.2 (57)
TP -__4-2.5	3.2 (83)
TP -__4-4.5	5.2 (133)
TP -__4-7.5	8.2 (210)

Note: *Insert model designation for thermowell at the __line. (See Modeling, Page 4.)*

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Dimensions – Inches (mm)



Note: *The temperature well should be filled with thermal grease (Part No. 644802-401) before temperature probe is inserted.*

Dimensions – Inches to the nearest tenth (millimetres to the nearest whole mm), each independently dimensioned from respective engineering drawings.

Figure 2 – Explosion-Proof Temperature Well

Probe	External Thread	Dimensions – Inches (mm)	Diameter – Inches (mm)
	P	U	Q
Application 3			
TP - W 3-1.5	.750-14 NPT	1.5 (38)	.5 (13)
TP - W 3-2.5	.750-14 NPT	2.5 (95)	.5 (13)
TP - W 3-4.5	.750-14 NPT	4.5 (114)	.8 (19)
Application 4			
TP - W 4-1.5	.500-14 NPT	1.5 (38)	.5 (13)
TP - W 4-2.5	.500-14 NPT	2.5 (95)	.5 (13)
TP - W 4-4.5	.500-14 NPT	4.5 (114)	.6 (16)
TP - W 4-7.5	.500-14 NPT	7.5 (191)	.6 (16)



Note: *Refer to Installation Manual of receiving equipment for terminal connections.*

Figure 3 – Wiring – Four-Wire Probe (TPW-3, 4)

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Modeling – Temperature Probe and Well (For Direct RTD Input)

TP W — 3 — 2.5

Model Designation

TP – Temperature Probe (4 wire) with Explosion Proof Junction Box

Thermowell

Blank – 1/2" NPT Probe; No Well
W – With Thermowell

Application

3 – Used with AccuLoad II and III; 1/2" NPT Probe and 3/4" NPT Well

4 – Used with AccuLoad II and III; 1/2" NPT Probe and 1/2" NPT Well; Well can be installed in a port on 3" or 4" 210 Valves

Well Insertion Length

For No Well, use pipe size to determine length
1.5"
2.5"
4.5"
7.5"

Note: *For applications other than AccuLoad II and III, reference probe specifications for compatibility to other instrumentation.*

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Revisions included in SS09035 Issue/Rev. 0.2 (9/09):
Total Revision.

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Straights



Part No.

SS-810-1-8

Part Description:

SS Swagelok Tube Fitting, Male Connector, 1/2 in. Tube OD x 1/2 in. Male NPT

Product Specifications

General

Body Material	Stainless Steel
Body Type	Male connector
Series	Swagelok tube and adapter fittings
End Connection 1 Size	1/2 in
End Connection 1 Type	Swagelok® tube fitting
End Connection 2 Size	1/2 in
End Connection 2 Type	Male NPT
Cleaning	Swagelok SC-10

! The complete catalog contents must be reviewed to ensure that the system designer and user make a safe product selection. When selecting products, the total system design must be considered to ensure safe, trouble-free performance. Function, material compatibility, adequate ratings, proper installation, operation, and maintenance are the responsibilities of the system designer and user.

⚠ Caution: Do not mix or interchange valve components with those of other manufacturers.

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RM4706

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PART #H32199PA
February 2009

OPW® Engineered Systems
PART OF OPW FLUID TRANSFER GROUP
A DOVER COMPANY

VISI-FLO® SIGHT FLOW INDICATORS

OPW Engineered Systems has been manufacturing Sight Flow Indicators for over 60 years. Our experience has led to many innovations in design and manufacturing, making VISI-FLO® the most thoroughly engineered Sight Flow Indicator on the market. VISI-FLO's are available in two series: the Standard 1400 series, and the 1500 High-Pressure, High-Temperature Series.



BENEFITS

- **Exclusive 3-Year 'No-Leak' Guarantee-** VISI-FLO's innovative radial seal design creates a constant and uninterrupted sealing force between the body and the outside diameter of the glass lens. This sealing method provides a longer lasting and better seal than convention flat seals, common with tie-rod designs.
- **Dimensionally Interchangeable-** with most competitive units (FJP Units).
- **No Maintenance Required-** VISI-FLO's unique, bolt-on body design requires no special maintenance or torquing sequence. This results in a safer, more reliable sight flow indicator than units using tie rods to fasten lens and seal to body.
- **Rated for vacuum service** up to 635 mm (25") of Hq (Mercury) at 85.5% vacuum. This equates to 12.3 PSI vacuum.

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SELECTION GUIDE

Construction
2 - Carbon Steel
3 - Bronze
7 - 316 Stainless Steel
8 - Ductile Iron
9 - Alloy 20
Other construction materials available

Indicator Material
D - Delrin® (Std. 1400 Series, white)
R - Ryton® (Std. 1500 Series, brown)
P - PTFE (Std. 6" - 12", white)
C - Carbon Steel (Drip Tubes only)
S - Stainless Steel (Drip Tubes only)

End Connections
Blank - FNPT
F - ASME 150 Lb. Flange
B - British Threaded
FJP - Flanged Replacement
FT - ASME 300 Lb. Flange
SW - Socket Weld

Shielding
Blank - Not Shielded
SK - Shielded

1520RF□-020 1

Seal Materials
1 - Buna-N
2 - Fluorocarbon (Std. 1500 Series)
3 - PTFE
4 - EPDM
5 - Neoprene (Std. 1400 Series)
6 - Kalrez®
X - Customer Specified

Series
14 - 1400 Series
15 - 1500 Series
See charts below for temperature and pressure ratings.

Indicator
1 - Propeller (1/4" to 4" only)
2 - Flapper
3 - Drip Tube
4 - Low Flow (1/4", 3/8", 1/2" only)

Size
001 - 1/8"
002 - 1/4"
004 - 3/8"
005 - 1/2"
007 - 3/4"
010 - 1"
012 - 1-1/4"
015 - 1-1/2"
020 - 2"
030 - 3"
040 - 4"
060 - 6"
080 - 8"
100 - 10"
120 - 12"

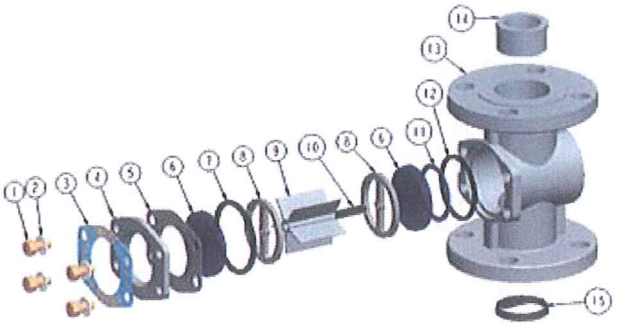
Availability of styles, sizes and materials may vary depending upon Visi-Flo configuration. Consult OPW Customer Service regarding your exact requirements

OPW® Engineered Systems
PHONE: (800) 547-9393 • (513) 696-1500 • Fax: (800) 245-8536 • (513) 932-9845
2726 Henkle Drive • Lebanon, OH 45036 • www.opw-es.com

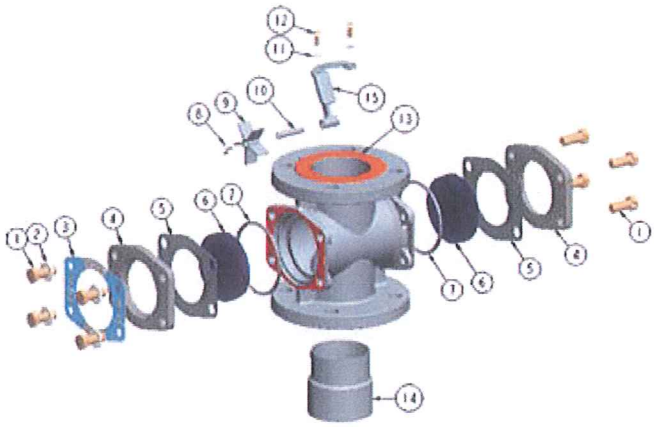
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VISI-FLO® Sight Flow Indicators

PARTS BREAKDOWN



Key	Description	Series	¼", 3/8" & ½"	¾" & 1"	1¼", 1½" & 2"
1	Retaining Bolt	1400	H40190M	H40191M	H40191M
		1500	H30497M	H30498M	H30498M
2	Washer	1400 & 1500	H40193M	H40194M	H40194M
3	Nameplate	1400 & 1500	H30756M	H30757M	H30758M
4	Cap, Plated Steel	1400	H2888M	H2889M	H2890M
		1500	H30448M	H30449M	H30450M
5	Gasket*	1400 &1500	H3870M	H3871M	H3873M
6	Glass*	1400	H5997M	H6001M	H10152M
		1500	H5998M	H6002M	H10153M
7	Seal*	See Repair Kits			
8	Retaining Bridge (2 required per unit)	1400 & 1500	H5996M	H6000M	H6004M
9	Indicator				
	Propeller-Delrin	1400	H40153M	H40152M	H40141M
	Propeller-Ryton	1500	H2910M	H2911M	H2912M
	Propeller-PTFE	1400 & 1500	H40171M	H40172M	H40173M
	Flapper-Delrin	1400	H40150M	H40149M	H40148M
	Flapper-Ryton	1500	H2944M	H2947M	H2948M
	Flapper-PTFE	1400 & 1500	H40196M	H40197M	H40198M
10	Shaft	1400 & 1500	H5999M	H6003M	H6011M
11	Seal*	See Repair Kits			
12	Spacer, PTFE*	1400 & 1500	H31752M	H31753M	H31636M
13	Body				
14	Drip Tube	1400 & 1500	H30357RS	H30359RP	H30354RP
15	Deflector (propeller units only)	1400 & 1500	H5012M	H5018M	H5020M



Key	Description	Series	3" & 4"	6" – 12"
1	Retaining Bolts	1400 & 1500	H-40192-M	H-40109-M
2	Washers	1400 & 1500	H40195M	H40194M
3	Nameplate	1400 & 1500	C20190M	C20191M
4	Cap, Plated Steel	1400 & 1500	C-20136-M	C-30012-RS
5	Gasket*	1400 & 1500	H3874M	H40108M
6	Glass*	1400	C00665M	H40107M
		1500	C00667M	H30368M
7	Seals*	See Repair Kits		
8	Button, PTFE	1400&1500	H40157P	H40117RP
9	Indicator			
	Propeller-Delrin	1400	H40154P	NA
	Propeller-Ryton	1500	H40158P	NA
	Propeller-PTFE	1400 & 1500	H40174M	NA
	Flapper-Delrin	1400	H40148M	NA
	Flapper-Ryton	1500	H2948M	NA
	Flapper-PTFE	1400 & 1500	H40198M	NA
10	Shaft	1400 & 1500	H40155M	H40116RE
11	Lockwasher, SST	1400 & 1500	H5162M	
12	Retaining Screw/Bolt	1400 & 1500	H40155M	H40144RP
14	Drip Tube			
15	Indicator Support Arm	1400 & 1500	C00025EW	H40114RS

*Included in 1400RK/1500RK Seal Kits

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VISI-FLO® Sight Flow Indicators

TECHNICAL INFORMATION

CONSTRUCTION AND MATERIAL

Body:	Steel	ASTM A216 WCB
	316 Stainless Steel	ASTM A351 CF8M*
	*6"and larger ASTM A351 CF3M (316L)	
	Ductile Iron	ASTM A536 65-45-12
	Bronze	ASTM B62 83600
	Optional Materials:	Hastelloy®, Alloy® 20, Monel®, Others upon request
Windows:	1400 Series (1/4"- 2")	Tempered Soda Lime
	1400 Series (3" and Above)	Annealed Soda Lime
	1500 Series	Tempered Borosilicate
Indicators:	1400 Series	Delrin®
	1500 Series	Ryton®
	Optional Materials:	PTFE
Seals:	1400 Series	Neoprene (Std.)
	1500 Series	Fluorocarbon (Std.)
Connections:	1400 Series	ASME B1.20 FNPT ASME B16.5 150RF
	1500 Series	ASME B1.20 FNPT ASME B16.5 150RF
	Options	
	Socket Weld	ASME B16.11
	BSP	ASME BS21
Options:	Protective Shield (1400SK)	Polycarbonate lens cover
	Pressure/Temperature Probe:	Consult Factory

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SEAL AND INDICATOR OPERATING TEMPERATURES

Material	Degrees F	Degrees C
Neoprene (1400 series standard)	-20 to 250	-29 to 121
Fluorocarbon (1500 series standard)	0 to 400	-17 to 204
Buna-N	-20 to 212	-29 to 100
EPDM	-50 to 250	-46 to 121
PTFE	-40 to 400	-40 to 204
Kalrez®	0 to 500	-18 to 260
Indicators		
Delrin®	-40 to 250	-40 to 121
Ryton®	-40 to 450	-40 to 232
PTFE	-40 to 500	-40 to 260

SERVICE RATINGS

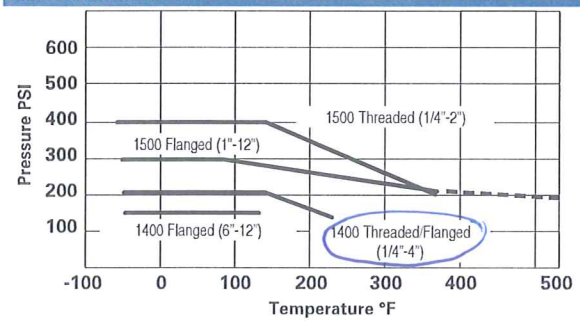


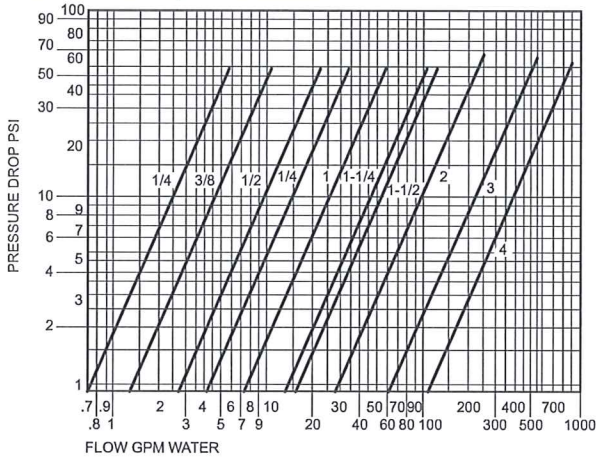
CHART INTERPRETATION

VISI-FLO®	Max. Pressure	Max. Temperature [1]
1400 Series Flanged	150 PSIG @ 150°F	150°F @ 150 PSIG
1400 Series Threaded/ Flanged (1/4"-4")	200 PSIG @ 150°F	225°F @ 150 PSIG
1500 Series Flanged (1"-12")	275 PSIG @ 100°F [2]	350°F @ 205 PSIG [2]
1500 Series Threaded (1/4"-2")	400 PSIG @ 150°F	350°F @ 200 PSIG

[1] With standard seals [2] Steel units rated @ 235 PSIG MAX @ 100°F & 350°F Max @ 215 PSIG

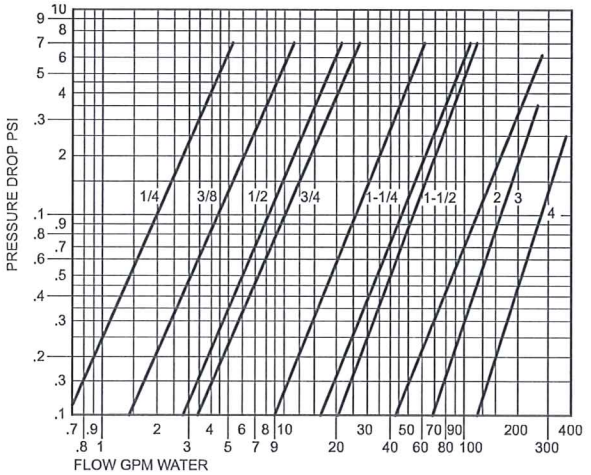
FLOW CHARTS

Visi-Flo with Propeller Indicator



NOTE: Over 100 gpm Flapper indicator advised

Visi-Flo with Flapper or Drip-Tube Indicators & Plain



Minimum Flow* Required to Turn Propeller

Size	1/4	3/8	1/2	3/4	1	1-1/4	1-1/2	2
GPM	.14	.25	.30	.60	.7	1.05	1.25	1.30

* Visi-Flo installed in horizontal position with deflector opening down.

1435 (Low Flow Orifice Plate) Minimum Flow Requirement to Turn Propeller

Size	1/4	3/8	1/2
GPM	.08	.09	.11

DIMENSIONAL DRAWINGS ARE AVAILABLE FROM THE DOWNLOAD SECTION OF OUR WEBSITE - WWW.OPW-ES.COM

SHIELD KITS

1400SK - 1720

Shield Kit, 1400 & 1500 Series

Size
1720 = 1/4", 3/8", 1/2"
1740 = 3/4", 1"
1770 = 1-1/4", 1-1/2", 2"
1790 = 3", 4"
1800 = 6", 12"

NOTE:
All Shield Kits include Shield (1) & mounting hardware

SEAL REPAIR KITS

1400 RK - 005 0

Series
14 = 1400 Series
15 = 1500 Series

RK
Repair Kit

Size
005 - 1/4", 3/8", 1/2"
010 - 3/4", 1"
020 - 1-1/4", 1-1/2", 2"
040 - 3", 4"
060 - 6", 12"

Seal Materials
1 = Buna
2 = Fluocarbon (Viton)
3 = PTFE
4 = EPDM
5 = Neoprene
B = Buna
N = Neoprene
V = Fluocarbon etc.

NOTES:
1. *Original seal material should be stamped on unit nameplate.*
2. *All kits include top & bottom seals, glass, gaskets & instruction sheet*

SHIELD KIT INSTALLATION

1. With wrench, remove one bolt only from face plate
2. Insert stud into open hole and turn to approximately four (4) turns
3. Place lock washer under nut on stud and tighten
4. Repeat steps 1, 2 and 3 in that order on second face plate bolts
5. Install shield on stud extension, resting shield on the nuts already tightened in place
6. Install hold down nuts on shield

INSTALLATION INSTRUCTIONS

1. Before installation, the user should check the unit for damage during shipping and freedom from defects such as lens scratches or chips.
2. Check and remove any foreign material inside the VISI-FLO®.
3. Determine direction of flow and install the unit according to the arrow stamped on nameplate.

Note:
- If unit is to be installed in a location or position where objects could strike the unit, a 1400 SK Shield kit is recommended.

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- The Visi-Flo is not designed to be a load bearing component, therefore the piping should be supported accordingly.
- Position the specific models as follows:
  - plain VISI-FLO can be mounted in any plane or position
  - propeller unit can be mounted in any plane or position (except horizontal with nameplate facing down)
  - Drip tube model must be mounted vertically with flow downward
  - Flapper model should be mounted horizontally or vertically with flow upwards

MAINTENANCE

BEFORE YOU BEGIN

Consider the Following:

1. Periodic inspection (every 3 months for leakages is recommended.)
2. Maintenance must be performed by authorized personnel.
3. Before performing any maintenance on sight flow indicator, the full installation must be shut down/off before proceeding.
4. Do not attempt any maintenance or servicing without reading this entire manual.

When any leaks are found, have seals replaced immediately.

DISASSEMBLY INSTRUCTIONS (UNITS UP TO 2")

Step 1:

- For drip tube units, begin by removing the drip funnel
- Note: The drip funnel will require that you push it out from the opposite end with some sort of rod. Be sure to use something relatively soft, so as not to damage any components inside the VISI-FLO®



Step 2:

- Remove the bolts, washers, name plate, plate, and gasket



Step 3:

- Remove the o-rings, spacers, bridges and shaft, propeller / flapper (does not apply to drip tube units), and glass plates
- You can apply moderate pressure to the bottom glass and it should push everything above it out
- If this does not work, then you may have to remove the top O-ring with a pick made of soft brass or aluminum
- If this is the case, discard the removed O-ring as it may have been damaged, and replace it with a new one
- Thoroughly clean all sealing surfaces with a non-abrasive cleaning pad



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ASSEMBLY INSTRUCTIONS (UNITS UP TO 2")

Step 1:

- Install flow director, (propeller unit only)

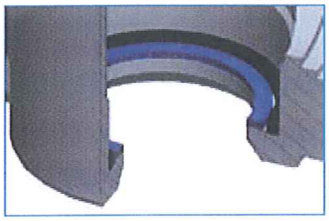
Single Plate Visi-Flo units (Up to 2" in Size)



Step 2:

- Lightly lubricate seals with a light oil
- Press seal into body, install PTFE spacer so it is concentric to seal
- (PTFE spacer fits inside seal)

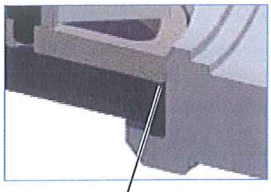




NOTE: EPDM seals are NOT compatible with petroleum based lubricants. A silicone based lubricant must be used with EPDM.

Step 3:

- Drop Glass on top of seal and spacer, followed by bridge/shaft assembly
- Be sure that Beveled Edge of glass faces retaining bridge

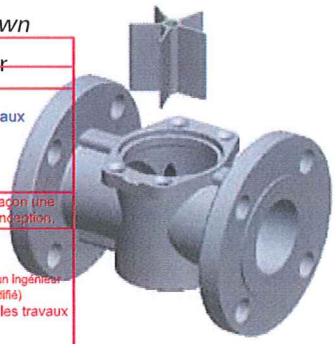


Beveled Edge



Step 4:

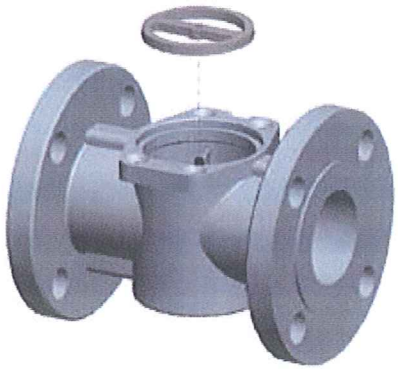
- ***Note:*** *Propeller unit shown*
- Drop propeller or flapper onto shaft
- Drip tube units skip this step



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Step 5:

- ***Note:*** *Propeller unit shown*
- Orient second bridge so center boss faces inward
- Press onto shaft until shoulder on shaft touches boss



Step 6:

- Lightly lubricate O-ring with light oil before pressing into ridge



NOTE: EPDM seals are NOT compatible with petroleum based lubricants. A silicone based lubricant must be used with EPDM.

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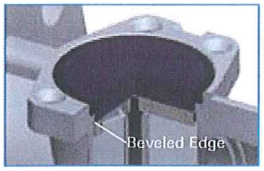
ASSEMBLY INSTRUCTIONS (UNITS UP TO 2") CONTINUED

Step 7:

Press glass inside O-ring making sure beveled edge of glass is facing towards retaining bridge.



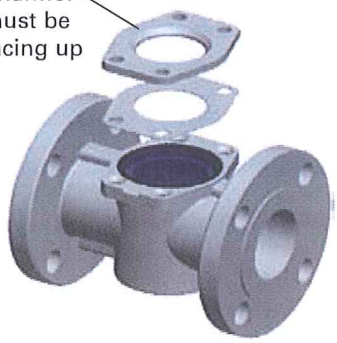




Step 8:

- Place gasket, plate and nameplate over glass
- Make sure chamfer in the center of the plate faces away from the glass

NOTE: Chamfer must be facing up



Step 9:

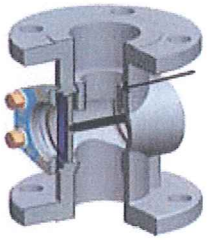
- Flow direction starts on the end with flow director and passes through the unit
- Hand tighten bolts with wrench only
- **Propeller units only:** Make sure to orient nameplate so flow direction arrow is correct

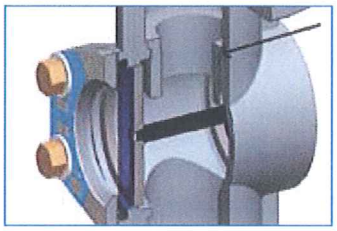


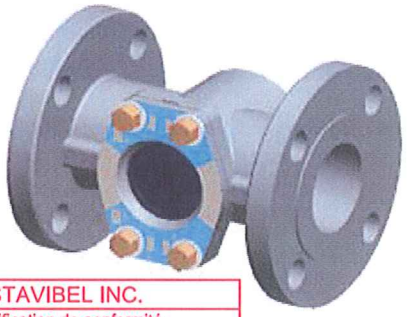
Step 10:

- **Drip Tube Versions Only:** Drop bushing into body, either side is fine, and press into place so shoulder on bushing touches shoulder inside body









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2013-11-26
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Jonathan Faucher — 131007
Nom — N° de membre de l'OIQ

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Assembly Complete!

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DETAILED DISASSEMBLY (3" & ABOVE)

Step 1:

- Remove bolts, washers, name plate, plate, and gasket



Step 2:

- Remove glass and O-ring
- Repeat process for other side
- Thoroughly clean all sealing surfaces with a non-abrasive cleaning pad



ASSEMBLY INSTRUCTIONS (UNITS 3" AND UP)

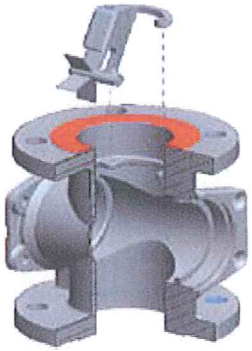
Step 1:

- Make sure that flapper or propeller (which ever is being installed) is assembled as shown



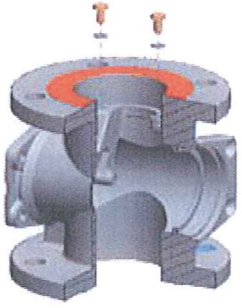
Step 2:

- Fit flapper or propeller assembly down into body so bolt holes on support arm match with bolt ears on body



Step 3:

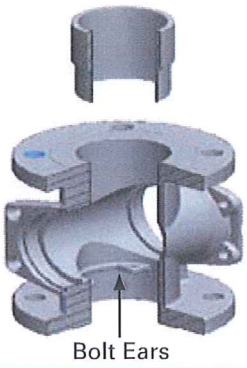
- Secure with lock washers and bolts



Step 4:

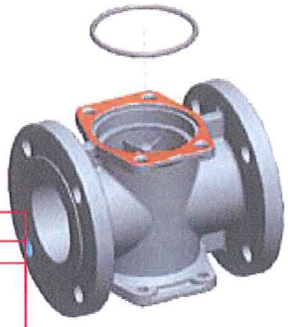
- **Drip tube units-**press drip tube into end *opposite* bolt hole ears
- 3"and 4" SST have Teflon insert. All other 3" and over are welded

NOTE: 3" and 4" Carbon Steel VISI-FLO's drip-tube is welded in place.



Step 5:

- *Propeller version shown*
- For flapper or propeller versions, start with whichever side exposes indicator retainer button
- Lightly lubricate O-ring with light oil **before** pressing it into ridge
- If building drip tube version you may begin with either side



NOTE: *EPDM seals are NOT compatible with petroleum based lubricants. A silicone based lubricant must be used with EPDM.*

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ASSEMBLY INSTRUCTIONS (UNITS 3" AND UP) CONTINUED

Step 6:

- Wedge beveled glass down inside O-ring, with the smallest diameter towards the center
- Once glass begins to resist further seating, stop



Step 7:

- Place one gasket and plate over glass
- Make sure chamfered side of the plate faces up



Step 8:

- With your palm, press down with even pressure until glass seats and gasket bottoms out



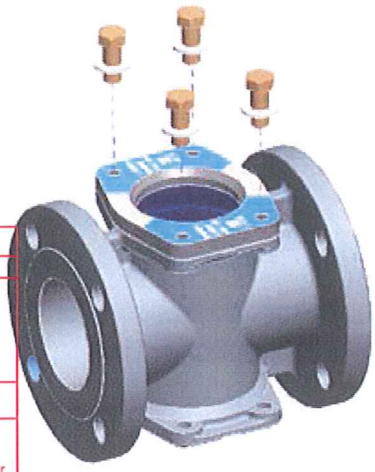
Step 9:

- Place nameplate on top of compressed components with flow direction facing the correct way
- Flow direction for propeller version can be determined by looking through Visi-Flo
- Flow starts on the side with bolt ears, and travels through to the opposite side
- Drip Tube version is opposite this
- Flapper units do not have a flow direction



Step 10:

- Secure components with bolts and flat washers
- Hand tighten with wrench only
- REPEAT ON OPPOSITE SIDE.
- REBUILD COMPLETE



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⚠WARNING

Failure to follow these warnings could result in serious personal injury, property damage or product failure.

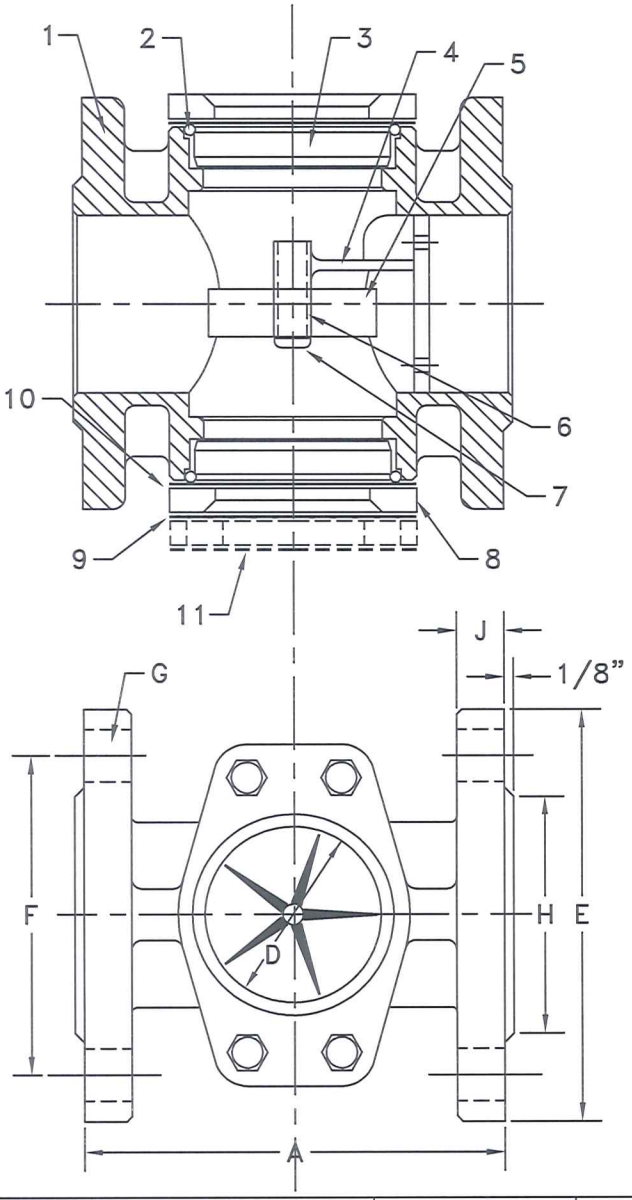
1) Do not attempt any maintenance service while the equipment is in operation. System pressure must be relieved and the product drained before attempting any service on the unit. The line must be locked out while service is in progress. Proper thermal relief must be provided at all times while equipment is in service.

2) OPW products do not eliminate possible exposure to hazardous substances. The conditions of handling and use are beyond our control, and we make no guarantee and assume no liability for damages or injuries related to the use of our products. Follow the safety precautions outlined in the Material Safety Data Sheets for the material being used. It is the responsibility of the user to comply with all federal, state and local regulations. Always employ proper safety precautions and handling techniques.

3) Proper seal and wetted material part selection is critical for safe operation. To assure maximum life for the service intended, use only those materials compatible with the fluids being handled. Please note material being supplied and make certain that it is suited for the intended service.

4) OPW Visi-Flo's are NOT recommended for compressed gas (i.e. air, nitrogen, etc.) applications.

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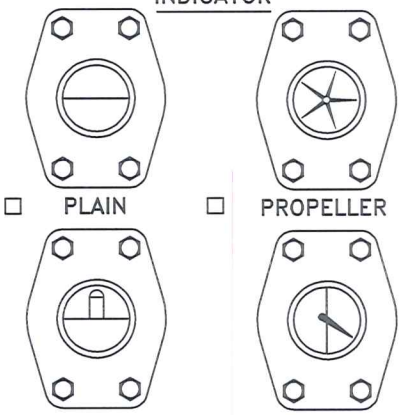


SIZE	3"	4"	COMMENTS
A	8"	9"	
D	3"	3"	
E	7-1/2"	9"	
F	6"	7-1/2"	
G	4 (3/4")	8 (3/4")	
H	5"	6-3/16"	
J	13/16"	1"	
K (SHIELD HT.)	9/16"	9/16"	
WEIGHT (LBS)	29.3	35	

PARTS LIST

PART NO.	NAME OF PART	QTY	MATERIAL
1	BODY	1	SEE BELOW
2	O-RING SEAL	2	SEE BELOW
3	GLASS	2	STD
4	SHAFT SUPPORT	1	SST
5	INDICATOR	1	SEE BELOW
6	PROPELLER SHAFT	1	SST
7	TEFLON BUTTON	1	---
8	CAP PLATED STL	2	STL
9	SST TAG	1	SST
10	GASKET	2	NON ASBESTOS
11	SHIELD (OPTIONAL)	1	PLEXIGLASS

INDICATOR



☐ PLAIN ☐ PROPELLER

☐ DRIP TUBE ☐ BI-DIRECTIONAL FLAPPER

STANDARD DESIGN MATERIALS:

SERIES OF UNIT: ☑ 1500 TEMPERED BOROSILICATE GLASS, TEFLON (INDICATOR STND.)
☐ 1400 ANNEALED BOROSILICATE GLASS, TEFLON (INDICATOR STND.)

METAL: ☐ ASTM A216 WCB CARBON STEEL
☐ ASTM A351 316L STAINLESS STEEL

OPTIONS: ☐ SHIELD KIT

SEAL MATERIAL: ☐ VITON (1500 STD)
☐ BUNA-N
☐ NEOPRENE (1400 STD)
☐ EPT
☐ TEFLON

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SERVICE RATINGS	MAX .PRESSURE	MAX. TEMP [1]
1400 SERIES FLGD (6"-12")	150 PSI @250°F	250°F @150 PSI
1400 SERIES THRD/FLG (1/4"-4")	200 PSI @150°F	250°F @150 PSI
1500 SERIES FLGD (1"-12")	275 PSI @100°F [2]	350°F @215 PSI [2,3]
1500 SERIES THRD (1/4"-2")	400 PSI @150°F	350°F @200 PSI

1 STD NEOPRENE SEALS FOR 1400 SERIES AND VITON SEALS FOR 1500 SERIES.
2 STL UNITS RATED @ 285 PSI MAX. @ 100°, & 350° MAX. @215 PSI
3 TEMPERATURES UP TO 500°F POSSIBLE WITH SPECIAL HIGH TEMPERATURE SEALS (CONSULT FACTORY)

FLANGED VISI-FLO SFI

OPW Engineered Systems

PH: 1-800-547-9393
FAX: 1-800-245-8536

5-12-2008

Models: 781*, 781-WE*

Cast Carbon & Alloy Steel Flanged & Butt Weld End Y Strainers
Sizes: ½" – 24" (15 – 600mm)

Pressure/Temperature - Non-Shock

Model	Material	Rating
781, 781-WE	Carbon Steel	285 psi @ -20 to 100°F 19.65 bar @ 37.78°C 150psi @ 565°F 10.34 bar @ 296.11°C
781, 781-WE	Chrome-Moly	290psi @ -20 to 100°F 19.99 bar @ 37.78°C 150psi @ 565°F 10.34 bar @ 296.11°C

781 **Class 150**
781-WE **Class 150**





Model 781-WE

* 781/781-WE supersedes model 761/741-WE. 761/761-WE available upon request.

Typical Service
- Used extensively to strain foreign matter from pipelines and provide economical protection for costly pumps, meters, valves, and other similar mechanical equipment.
- Especially important where weld debris is likely present in the pipeline.
- Well suited for long service in high pressure and temperature applications.

Features
- Machined seats in both body and cap align and lock the screen in place to stop sediment bypass.
- Machined seats facilitate alignment and accurate reseating after servicing.

Construction
- Designed for Class 150 specifications.
- Heavy gauge reinforced screens are used.

IMPORTANT NOTE: Model 781-WE ends are machined to match Schedule 40 pipe. Other connections are available, consult factory.

Self-Cleaning
- Self-cleaning is accomplished by opening the plug or valve connected to the blowoff outlet.
- Blowoff Outlets
- Blowoff outlets are NPT tapped at location C. See next page for NPT sizes.
- Blind covers are available, consult factory.

Capacity
- Generously proportioned bodies.
- Open Area Ratio much greater than pipe size, ensuring low pressure drop.
- Minimum of 4 to 1 Open Area Ratio.

Screens

		STANDARD (WATER)		STEAM RECOMMENDATION	
MODEL	SIZES	MATERIAL	OPENING	MATERIAL	OPENING
All	5" - 12"	304SS	.062 perf	304SS	.045 perf
All	5" - 12"	304SS	.062 perf	304SS	.045 perf
All	14" and Up	304SS	.125 perf	304SS	.062 perf

Materials

	781, 781-WE
Body	Carbon Steel, ASTM A216 Grade WCB
Cover	Carbon Steel, ASTM A216 Grade WCB
Gasket	Compressed Fiber

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Job Name _____ Contractor _____

Job Location _____ Approval _____

Engineer _____ Contractor's P.O. No. _____

Approval _____ Representative _____

Mueller Steam Specialty™

ALSO AVAILABLE:

Body/Cap: Carbon-Moly ASTM A217 Gr. W1
Chrome-Moly ASTM A217 Gr. WC6
Chrome-Moly ASTM A217 Gr. WC9

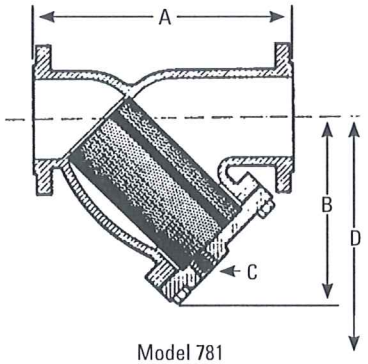
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Pressure Drop

See Pressure Drop Charts in Technical Data Section of the Mueller Steam Specialty Engineering binder.

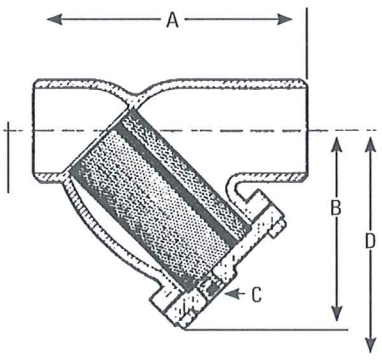
Dimensions and Weights

SIZE		DIMENSIONS								WEIGHT	
		A		B		C (NPT)		D Screen Removal			
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	kgs.
½	15	5⅞	149	3½	89	⅜	10	5	130	5.5	2.5
¾	20	7⅜	187	3¾	95	½	15	5	130	10.25	4.6
1	25	7⅜	187	3¾	95	½	15	5	130	10.25	4.6
1¼	32	7	178	4¾	121	½	15	7	178	9.75	4.4
1½	40	7⅛	181	4¾	121	½	15	7	178	12.5	5.6
2	50	7⅞	200	5¼	133	½	15	7	178	18	8.1
2½	65	9¾	248	6½	165	1	25	9¾	248	28	12.7
3	80	10 1/16	256	7	178	1	25	10	254	34	15
4	100	12⅛	308	8¼	210	1½	40	12	305	55	25
5	125	15⅝	397	11¼	286	2	50	20	508	90	40
6	150	18½	470	13½	343	2	50	20	508	153	69
8	200	21⅜	543	15½	394	2	50	22¾	578	220	100
10	250	26	660	18½	470	2	50	28	711	320	145
12	300	29⅞	759	22¼	565	2	50	30	762	550	250
14	350	36	914	25	635	2	50	36½	927	975	442
16	400	41 9/16	1056	26½	673	2	50	42	1067	1635	741
18	450	46	1168	34⅞	886	2	50	50⅞	1292	2376	1078
20	500	49½	1257	39	991	2	50	55⅜	1407	2675	1213
24	600	58⅜	1483	44⅛	1122	2	50	67¼	1708	4880	2213



Model 781

SIZE		DIMENSIONS								WEIGHT	
		A		B		C (NPT)		D Screen Removal			
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	kgs.
½	15	6⅝	168	3½	89	⅜	10	5	130	3	1.3
¾	20	8 5/16	211	3¾	95	½	15	5	130	9	4
1	25	8 5/16	257	3¾	95	½	15	5	130	9	4
1¼	32	10⅛	260	5¼	133	½	15	7	178	12	5.4
1½	40	10¼	279	5¼	133	½	15	7	178	13	5.9
2	50	8⅝	219	5¼	133	½	15	7	178	10	4.5
2½	65	10⅝	269	6½	165	1	25	9¾	248	14	6.3
3	80	12	305	7	178	1	25	10	254	20	9
4	100	14½	368	8¼	210	1½	40	12	305	40	18
5	125	19 5/16	491	13½	343	2	50	20	508	90	40
6	150	19 5/16	491	13½	343	2	50	20	508	90	40
8	200	23⅜	594	15¾	400	2	50	22¾	578	168	76
10	250	27⅜	695	19	483	2	50	28	711	250	113
12	300	32	813	22½	565	2	50	30	762	440	200
14	350	36	914	25	635	2	50	36½	927	815	370
16	400	41⅛	1056	26½	673	2	50	42	1067	1433	650
18	450	46	1168	34⅞	886	2	50	50⅞	1292	2152	976
20	500	49½	1257	39	991	2	50	55⅜	1407	2393	1085
24	600	58⅜	1483	44⅛	1122	2	50	67¼	1708	4486	2034



Model 781-WE

Apply for certified drawing

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A Watts Water Technologies Company

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Agnico Eagle, Baker Lake
Jet-A Tank Farm
BR1 - 125A Splitter Through

Type 1 Splitter Trough

Standard Sizes Type 1 Splitter Trough

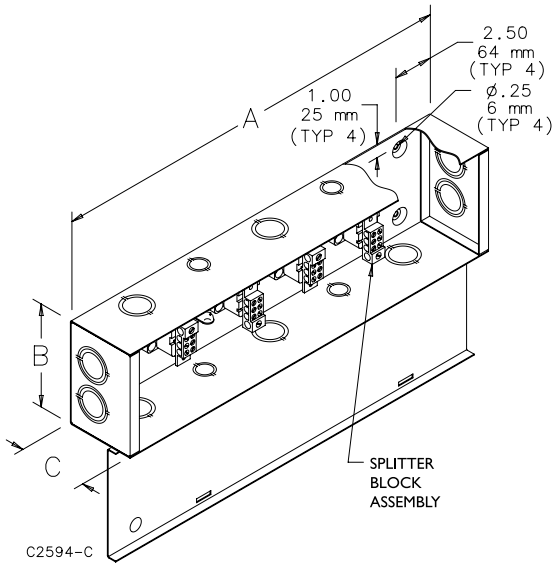
Catalog Number	A x B x C in. (mm)	Number of Wires	Main Lugs: AMPs CU	Main Lugs: Wire Size Range	Main Lugs: Qty.	Branch Lugs: Amps CU	Branch Lugs: Wire Size Range	Branch Lugs: Qty.
AST283R	24.00 x 6.00 x 4.50 (610 x 152 x 114)	3	85	14-1	1	55	14-6	6
AST284R	24.00 x 6.00 x 4.50 (610 x 152 x 114)	4	85	14-1	1	55	14-6	6
AST383R	36.00 x 6.00 x 4.50 (914 x 152 x 114)	3	85	14-1	1	55	14-6	6
AST384R	36.00 x 6.00 x 4.50 (914 x 152 x 114)	4	85	14-1	1	55	14-6	6
AST483R	48.00 x 6.00 x 4.50 (1219 x 152 x 114)	3	85	14-1	1	55	14-6	6
AST484R	48.00 x 6.00 x 4.50 (1219 x 152 x 114)	4	85	14-1	1	55	14-6	6
AST2123R	24.00 x 6.00 x 4.50 (610 x 152 x 114)	3	125	14-1/0	1	110	14-2	6
AST2124R	24.00 x 6.00 x 4.50 (610 x 152 x 114)	4	125	14-1/0	1	110	14-2	6
AST3123R	36.00 x 6.00 x 4.50 (914 x 152 x 114)	3	125	14-1/0	1	110	14-2	6
AST3124R	36.00 x 6.00 x 4.50 (914 x 152 x 114)	4	125	14-1/0	1	110	14-2	6
AST4123R	48.00 x 6.00 x 4.50 (1219 x 152 x 114)	3	125	14-1/0	1	110	14-2	6
AST4124R	48.00 x 6.00 x 4.50 (1219 x 152 x 114)	4	125	14-1/0	1	110	14-2	6
AST3223R	36.00 x 8.25 x 4.50 (914 x 210 x 114)	3	225	6-300MCM	1	150	14-2/0	6
AST3224R	36.00 x 8.25 x 4.50 (914 x 210 x 114)	4	225	6-300MCM	1	150	14-2/0	6
AST4223R	48.00 x 8.25 x 4.50 (1219 x 210 x 114)	3	225	6-300MCM	1	150	14-2/0	6
AST4224R	48.00 x 8.25 x 4.50 (1219 x 210 x 114)	4	225	6-300MCM	1	150	14-2/0	6
AST5223R	60.00 x 8.25 x 4.50 (1524 x 210 x 114)	3	225	6-300MCM	1	150	14-2/0	6
AST5224R	60.00 x 8.25 x 4.50 (1524 x 210 x 114)	4	225	6-300MCM	1	150	14-2/0	6
AST6223R	72.00 x 8.25 x 4.50 (1829 x 210 x 114)	3	225	6-300MCM	1	150	14-2/0	6
AST6224R	72.00 x 8.25 x 4.50 (1829 x 210 x 114)	4	225	6-300MCM	1	150	14-2/0	6
AST3403R	36.00 x 10.00 x 6.00 (914 x 254 x 152)	3	400	1/0-250MCM: 4-600MCM	2 1	175	6-4/0 and 14-3/0[a]	4[a] 2
AST4403R	48.00 x 10.00 x 6.00 (1219 x 254 x 152)	3	400	1/0-250MCM: 4-600MCM	2 1	175	6-4/0 and 14-3/0[a]	4[a] 2
AST4404R	48.00 x 10.00 x 6.00 (1219 x 254 x 152)	4	400	1/0-250MCM: 4-600MCM	2 1	175	6-4/0 and 14-3/0[a]	4[a] 2
AST5403R	60.00 x 10.00 x 6.00 (1524 x 254 x 152)	3	400	1/0-250MCM: 4-600MCM	2 1	175	6-4/0 and 14-3/0[a]	4[a] 2
AST5404R	60.00 x 10.00 x 6.00 (1524 x 254 x 152)	4	400	1/0-250MCM: 4-600MCM	2 1	175	6-4/0 and 14-3/0[a]	4[a] 2
AST6403R	72.00 x 10.00 x 6.00 (1829 x 254 x 152)	3	400	1/0-250MCM: 4-600MCM	2 1	175	6-4/0 and 14-3/0[a]	4[a] 2
AST6404R	72.00 x 10.00 x 6.00 (1829 x 254 x 152)	4	400	1/0-250MCM: 4-600MCM	2 1	175	6-4/0 and 14-3/0[a]	4[a] 2
AST4603R	48.00 x 11.00 x 6.50 (1219 x 279 x 165)	3	600	1/0-250MCM: 4-600MCM	4 2	175	6-4/0 and 14-3/0[a]	4[a] 2
AST4604R	48.00 x 11.00 x 6.50 (1219 x 279 x 165)	4	600	1/0-250MCM: 4-600MCM	4 2	175	6-4/0 and 14-3/0[a]	4[a] 2
AST5603R	60.00 x 11.00 x 6.50 (1524 x 279 x 165)	3	600	1/0-250MCM: 4-600MCM	4 2	175	6-4/0 and 14-3/0[a]	4[a] 2
AST5604R	60.00 x 11.00 x 6.50 (1524 x 279 x 165)	4	600	1/0-250MCM: 4-600MCM	4 2	175	6-4/0 and 14-3/0[a]	4[a] 2
AST6603R	72.00 x 11.00 x 6.50 (1829 x 279 x 165)	3	600	1/0-250MCM: 4-600MCM	4 2	175	6-4/0 and 14-3/0[a]	4[a] 2
AST6604R	72.00 x 11.00 x 6.50 (1829 x 279 x 165)	4	600	1/0-250MCM: 4-600MCM	4 2	175	6-4/0 and 14-3/0[a]	4[a] 2

[a]Six total branch lugs: (4) 6-4/0 and (2) 14-3/0

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Type 1 Splitter Trough





Application

Used in indoor applications for cabling electrical power distribution, allowing feeder circuit conductors to be split into multiple branch circuit conductors. Terminal blocks are pre-installed for both three- and four-wire power distribution systems.

Features

- Various size knockouts on each side for wire entry and exit
- Hinged covers

Construction

- 16 or 14 gauge steel
- Mounting holes in back
- Includes single-point ground lug
- Ground Splitter (ground bar) accessory available

Finish

ANSI 61 gray polyester powder paint finish inside and out

Industry Standards

CSA C22.2 No. 76, File No. 42184: Type 1
NEMA/EEMAC Type 1
IEC 60529, IP30

Accessories

Ground Splitter (ground bar)
Splitter Blocks
Touch-Up Paint (ATPPY61)

Knockout Sizing and Spacing

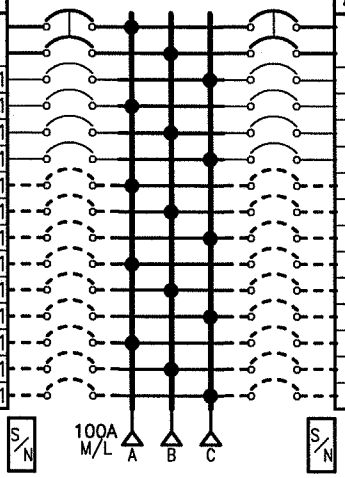
Amp Rating	Qty.	End Knockout Size	Spacing (in.)	Spacing (mm)	Side Knockout Size and Position	Spacing (in.)	Spacing (mm)
85	2	1-3/4 - 2	2.75	70	Alternating 1/2 - 3/4 and 1 - 1-1/4	4.50	114
125	2	1-3/4 - 2	2.75	70	Alternating 1/2 - 3/4 and 1 - 1-1/4	4.50	114
225	2	2-1/5 - 3	4.06	103	Alternating 1/2 - 3/4 and 1 - 1-1/4	4.50	114
400	2	3 - 3-1/2	4.91	125	Alternating 1/2 - 3/4 and 1 - 1-1/4	4.50	114
600	2	3 - 3-1/2	4.91	125	Alternating 1/2 - 3/4 and 1 - 1-1/4	4.50	114

Subject to change without notice
PH 763 422 2211 • FX 763 422 2600 • www.hoffmanonline.com
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PD1 - Distribution panel
Agnico Eagle, Baker Lake
Jet-A Tank Farm

BY	DATE				
--	--/--/--	-	----	--	--/--/--
--	--/--/--	-	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		QOB	15/2	15/2	QOB		2
3							4
5		QOB	15/1	15/1	QOB		6
7		QOB	15/1	15/1	QOB		8
9		QOB	15/1	15/1	QOB		10
11		QOB	15/1	15/1	QOB		12
13	PREPARED SPACE	QOB	15/1	15/1	QOB	PREPARED SPACE	14
15	PREPARED SPACE	QOB	15/1	15/1	QOB	PREPARED SPACE	16
17	PREPARED SPACE	QOB	15/1	15/1	QOB	PREPARED SPACE	18
19	PREPARED SPACE	QOB	15/1	15/1	QOB	PREPARED SPACE	20
21	PREPARED SPACE	QOB	15/1	15/1	QOB	PREPARED SPACE	22
23	PREPARED SPACE	QOB	15/1	15/1	QOB	PREPARED SPACE	24
25	PREPARED SPACE	QOB	15/1	15/1	QOB	PREPARED SPACE	26
27	PREPARED SPACE	QOB	15/1	15/1	QOB	PREPARED SPACE	28
29	PREPARED SPACE	QOB	15/1	15/1	QOB	PREPARED SPACE	30



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC32S
BOX CAT#: MH32
DIMENSIONS:
32"H x 20"W x 5.75"D
WIRE BENDING SPACE:
TOP – 3.25
BOTTOM – 9.6
SIDE – 6.13
PBA: 701A
BUSSING: Aluminum
Tin Plated
OPTIONAL FEATURES:
ALUMINUM SOLID NEUTRAL
ALUMINUM GROUND BAR

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 100A
10kA SYMS. SCCR
MAIN: MAIN LUGS : 100A
Bottom FEED
INCOMING CONDUCTORS(S) PER NEC:
#6 – 2/0 AWG
BRANCH MOUNTING TYPE: BOLT-ON
----------BRANCH SUMMATION----------
2 – 15A/2P QOB
8 – 15A/1P QOB
18 – 15A/1P-PS QOB

JOB NAME:	SPER 92975 PROJET 30768 ACHAT	EQUIPMENT DESIGNATION:	**100a 120/208v 30circ**
JOB LOCATION:	QUEBEC QC	EQUIPMENT TYPE:	NQ (Circuit Breaker Type) PANEL 1 OF 1
DRAWN BY:	(Q2C)	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			SQUARE D by Schneider Electric
DATE:	March 28 2013		
DRAWING STATUS:	QUOTE **NOT FOR CONSTRUCTION**	DWG# **033091793-01**	PG 1 OF 1 REV –

Travaux exécutés par:

(418) 849-1832

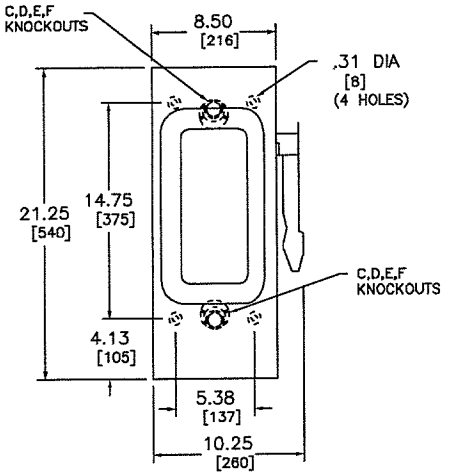
lighting control	1
Indoor ligthing	3
Spare to light control	5
Pump House Outdoor Lighting	7
Tank Farm Outdoor Lighting	9
Emergency lighting	11
	13
	15
	17
	19
	21
	23
	25
	27
	29

Travaux exécutés par:

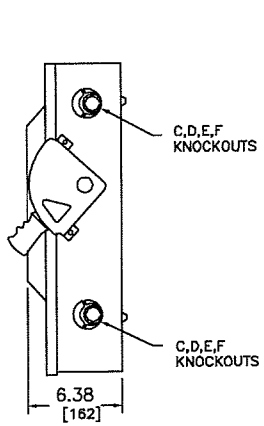
(418) 849-1832

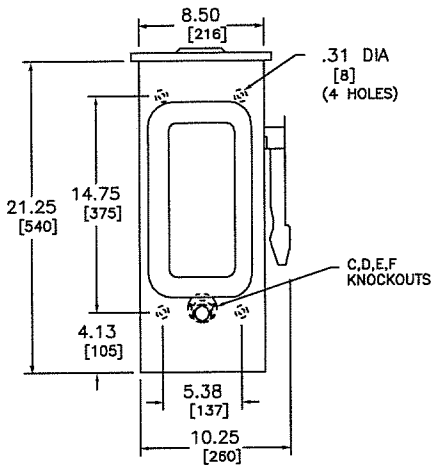
2	Outlet Panel
4	Control Panel
6	UPS
8	Exhaust Fan
10	
12	
14	
16	
18	
20	
22	
24	
26	
28	
30	

Agnico Eagle, Baker Lake
Jet-A Tank Farm
SE1 - 100A Main Switch

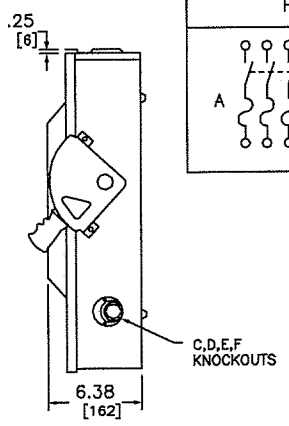


TYPE 1





TYPE 3R ▲



WIRING DIAGRAMS

FUSIBLE		NOT FUSIBLE
A	B	C

TERMINAL LUGS ‡			
AMPERES	MAX. WIRE	MIN. WIRE	TYPE
100	#1/0 AWG	#12 AWG	AL
	#1/0 AWG	#14 AWG	CU

KNOCKOUTS				
SYMBOL	CONDUIT SIZE		DIAMETER	
	IN	MM	IN	MM
A	.50	13	.88	22
B	.75	19	1.13	29
C	1.00	25	1.38	35
D	1.25	32	1.75	45
E	1.50	38	2.00	51
F	2.00	51	2.50	64

DUAL DIMENSIONS: INCHES / MILLIMETERS

CATALOG NUMBER	VOLTAGE RATINGS	WIRING DIAG.	HORSEPOWER RATINGS									250 VDC.	600 VDC.
			240VAC			480VAC			600VAC				
			STD.	MAX.		STD.	MAX.		STD.	MAX.			
			3Ø	1Ø	3Ø	3Ø	1Ø	3Ø	3Ø	1Ø	3Ø	MAX.	MAX.
CH323N	240VAC,250VDC	B	15	–	30	–	–	–	–	–	–	20	–
CH323NRB	240VAC,250VDC	B	15	–	30	–	–	–	–	–	–	20	–
CH363	600VAC;600VDC	A	–	–	–	25	–	60	30	–	75	20	50
CH363RB	600VAC;600VDC	A	–	–	–	25	–	60	30	–	75	20	50
CH363N	600VAC,600VDC	B	–	–	–	25	–	60	30	–	75	–	50
CH363NRB	600VAC,600VDC	B	–	–	–	25	–	60	30	–	75	–	50
CHU363	600VAC;600VDC	C	–	20	40	–	40	75	–	40	100	20	50
CHU363RB	600VAC;600VDC	C	–	20	40	–	40	75	–	40	100	20	50

NOTES:
FINISH – GRAY BAKED ENAMEL
CSA CERTIFIED – FILE #LL-89067
ALL NEUTRALS – INSULATED GROUNDABLE
SHORT CIRCUIT CURRENT RATINGS:
10,000 AMPERES WITH CLASS H OR K FUSES.
200,000 AMPERES WITH CLASS R FUSES HAVING CLASS R REJECTION KITS INSTALLED OR CLASS J FUSES.
WHEN MOUNTING THESE SWITCHES, ALLOW 4.00/[102] MIN. CLEARANCE BETWEEN ENCLOSURES FOR OPENING OF SIDE HINGED DOOR.
▲ TYPE 3R SWITCHES HAVE PROVISIONS FOR MAXIMUM 2.50 IN / 64 MM BOLT-ON B-HUB.
‡ LUGS SUITABLE FOR 60°C OR 75°C COPPER OR ALUMINUM CONDUCTORS.
SUFFIX EI – ELECTRICAL INTERLOCK INSTALLED: 1 N.O., 1 N.C. CONTACTS
SUFFIX EI2 – ELECTRICAL INTERLOCK INSTALLED: 2 N.O., 2 N.C. CONTACTS

HEAVY DUTY SAFETY SWITCHES
VISIBLE BLADE TYPE
100 AMPERE
ENCLOSURE – TYPE 1 GENERAL PURPOSE
TYPE 3R RAINPROOF

SQUARE D
Schneider Electric

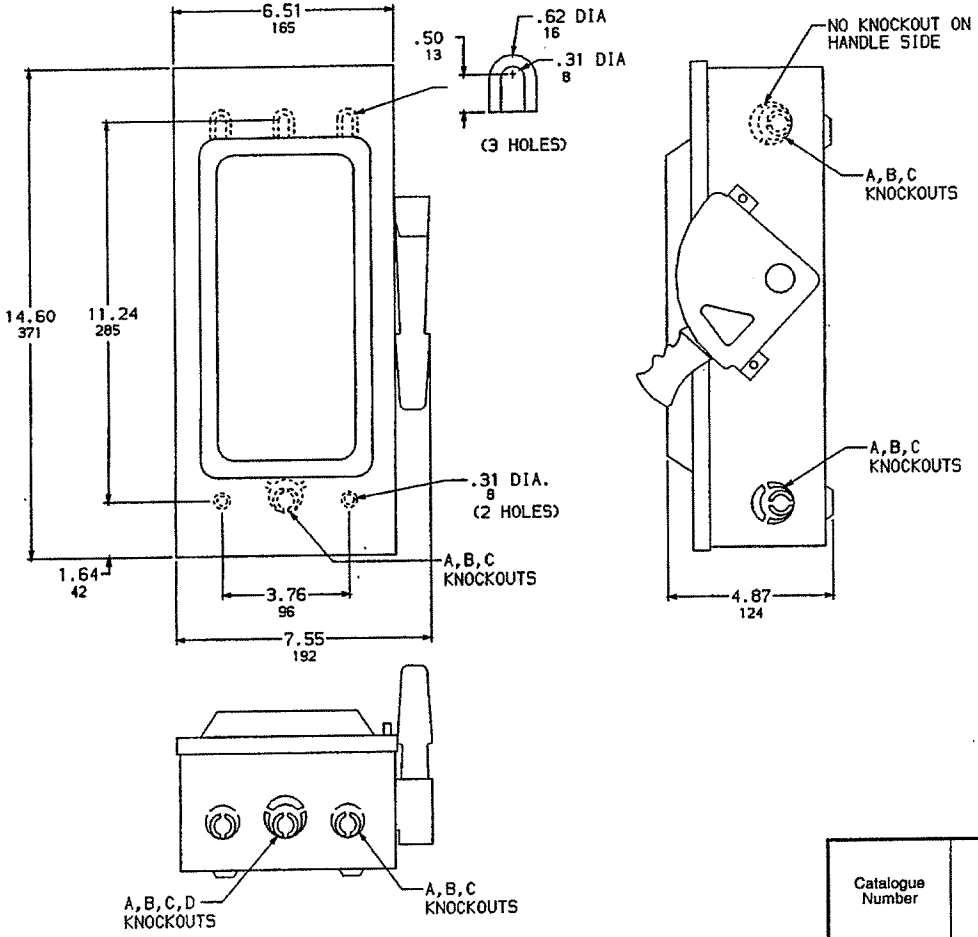
DWG# NO. 1905C

REF DWG #1905C

OCTOBER 2006

Agnico Eagle, Baker Lake
Jet-A Tank Farm
SE2-SE3 - 30A Safety Switch

CSSD-30H-E



NEMA TYPE 1

WIRING DIAGRAMS

Fusible			Not Fusible
A	C		D
B			

TERMINAL LUGS

Amperes	Max. Wire	Min. Wire	Type
30	#6 AWG	#14 AWG	Al or Cu

KNOCKOUTS

Symbol	Conduit Size		Diameter	
	IN	mm	IN	mm
A	1/2	13	.88	22
B	3/4	19	1.13	29
C	1	25	1.38	35
D	1 1/4	32	1.75	44

Dual Dimensions: INCHES
Millimeters

Catalogue Number	Voltage Ratings	Wiring Diag.	Horsepower Ratings														
			240 Vac				480 Vac				600 Vac				250 Vdc	600 Vdc	
			Std.		Max.		Std.		Max.		Std.		Max.				
			1Ø	3Ø	1Ø	3Ø	1Ø	3Ø	1Ø	3Ø	1Ø	3Ø	1Ø	3Ø	Max.	Std.	Max.
CH221N	240 Vac; 250 Vdc	A	1 1/2●	3★	3●	7 1/2★	–	–	–	–	–	–	–	–	5▲	–	–
CH321N	240 Vac; 250 Vdc	B	1 1/2▲	3★	3▲	7 1/2★	–	–	–	–	–	–	–	–	5▲	–	–
CH361	600 Vac; 600 Vdc	C	–	–	–	–	3▲	5■	7 1/2▲	15■	–	7 1/2	–	20	5▲	10▲	15▲
CHU361 ‡	600 Vac; 600 Vdc	D	–	–	5▲	10■	–	–	7 1/2▲	20■	–	–	10▲	30	5▲	–	15▲

NOTES:
- Finish – Gray baked enamel electrodeposited over cleaned phosphatized steel.
- Neutrals – Insulated Groundable.
- CSA Certified – File #LL-89067

‡ Not suitable for use as service equipment.
▲ Use both outer switching poles
● Use both switching poles
■ If corner grounded delta, install neutral and use outer switching poles for ungrounded conductors.
★ For corner grounded delta only, use outer switching poles fo ungrounded conductors.

HEAVY DUTY SAFETY SWITCHES
Visible Blade Type
30 Ampere
Enclosure – Type 1 General Purpose

SQUARE D
GROUPE SCHNEIDER

DWG. NO. CSSD-30H-E

August 98 Printed in Canada

Agnico Eagle, Baker Lake
Jet-A Tank Farm
TF1 - 10kVA Transformer

TEL : (450) 293-8998, (800) 822-3565 FAX : (450) 293-8999 WEB : WWW.BEMAG.CA

TECHNICAL DATA : BC3010V

DESCRIPTION

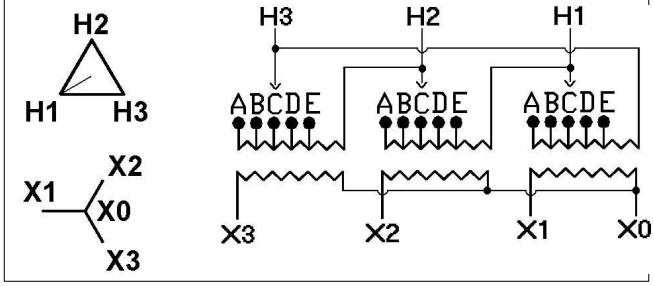
Type	**DRY TYPE DISTRIBUTION**
KVA	**10**
Primary (Volts)	**600**
Secondary (Volts)	**120 / 208**
Phase	**3**
Enclosure NEMA	**NEMA 2**
Impedance	**5.0 %**
Temp. Rise	**130°C**
Temp. Class	**200°C**
Frequency	**60 Hz**
K Factor	**1**
Weight	**148 Lbs / 67 Kg**

TAPS

Pos	A	B	C	D	E	F	G
%	**+5**	**+2.5**	**0**	**-2.5**	**-5**		
Volts	**630**	**615**	**600**	**585**	**570**		

Primary connectors by phase 1 #2 AWG - #14 AWG
Secondary connectors by phase 1 #2 AWG - #14 AWG
Primary Winding in Copper
Secondary Winding in Copper

CONNECTION DIAGRAM

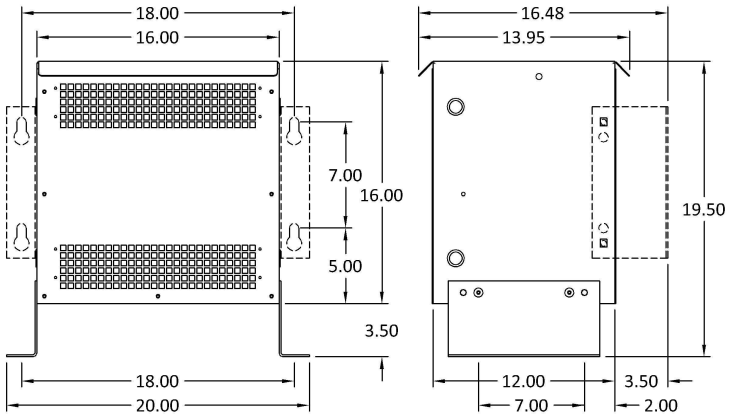


PERFORMANCES

No Load loss	**117.7 Watts**
Load loss 150°C	**476.4 Watts**
Total loss	**594.1 Watts**
Excitation current	**5.42 %**
Noise level	**45 DB**
Impedance from secondary	**0.375 Ohm (Line To Line)**

% EFFICIENCY AT 150°C				% REGULATION (FULL LOAD)			
100%	**75%**	**50%**	**25%**	**1.00**	**0.95**	**0.90**	**0.85**
94.29	**95.09**	**95.49**	**94.32**	**4.77%**	**5.00%**	**4.95%**	**4.85%**

PHYSICAL DIMENSIONS



MOUNTING : WALL AND FLOOR

Customer / PO		COMMENTS
Contact		
Project		
Revised by	**FRÉDÉRICK DUBEAU**	
Revision Date	**Friday, 24 aout 2012 08:46**	



Agnico Eagle, Baker Lake
Jet-A tank farm
Emergency lighting

RGS Series

6, 12 and 24V

Project/Location:
AGNICO EAGLE, BAKER LAKE JET-A TANK FARM

Contractor:
PAGUI INC.

Date:

Prepared by:

Lumacell Model:
RG12S100-2MT9W

10-year life expectancy, maintenance-free emergency lighting units.

The **RGS Series** battery units combine long-life expectancy, high performance design and a reasonable initial cost outlay. Ideally suited for a range of commercial applications, the long-life lead acid battery is specifically recommended for environments where the unit will be exposed to large variances in ambient temperature.

FEATURES

- Rugged steel cabinet with corrosion-resistant undercoating – standard colour is factory white. Optional: Polar white and black.
- Removable front panel on cabinet provides easy access and allows the unit to be mounted at ceiling height
- Solid-state pulse-type charger – current-limited, temperature-compensated, short-circuit proof and reverse-polarity protected.
- Unit comes standard with electronic lockout and brownout circuits
- Sealed dust-proof transfer relay, test switch and LED indicator lights
- Long-life, maintenance-free lead acid battery
- Wide range of lampheads available – consult Ordering Information for complete list
- Standard 120/347VAC input voltage with line cord kit
- NEXUS® compatible (for more information on NEXUS®, please consult your sales representative)
- CSA C22.2 No. 141 certified

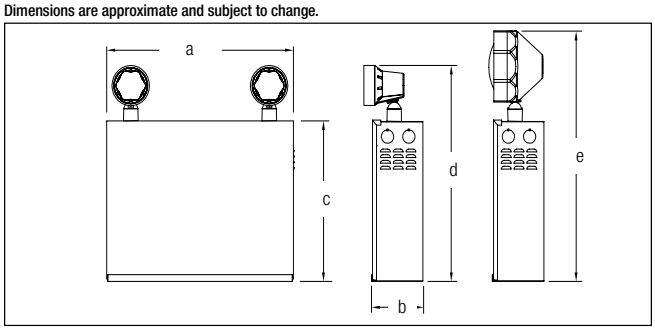
Made in Canada

nexus®

CABINET	DIMENSIONS				
	A	B	C	D	E
A	13 1/4" (33.7 cm)	3 5/8" (9.2 cm)	10 1/2" (26.7 cm)	14 1/4" (36.2 cm)	16 1/2" (41.9 cm)
B	16 1/8" (40.9 cm)	5 1/2" (13.9 cm)	10 1/4" (26.0 cm)	13 7/8" (35.2 cm)	16 1/8" (41.0 cm)
C	23 1/8" (58.7 cm)	5 1/2" (13.9 cm)	10 1/4" (26.0 cm)	13 7/8" (35.2 cm)	16 1/8" (41.0 cm)

DIMENSIONS

Dimensions are approximate and subject to change.



TYPICAL SPECIFICATIONS

Supply and install a complete emergency lighting system as described herein and shown on the drawings.

The **Lumacell® Smart Diagnostic** micro-controller board shall supply the rated load for a minimum of a 1/2 hour to 87.5% of the rated battery voltage. The unit shall be rated 120V or 347V, 60 Hz and be CSA listed. The unit shall have an output of: 12 V and 100 W.

The charger shall be fully computer tested and its charge voltage factory set to ± 1% tolerance. Chargers with field-adjusted potentiometers are not acceptable. A pulse-type charger shall be employed to promote long battery life and reduce the potential for grid corrosion. The charger shall provide a continuous high charge to recharge the battery, when the battery is at full capacity, the charger will shut-off.

Periodically the charger shall provide a pulse of energy to keep the battery topped off. The pulse charger shall be precisely regulated and shall charge the battery in relation to its temperature, state or charge and input voltage fluctuations. The charger shall be current limited, temperature compensated, short-circuit proof and reverse polarity protected.

The unit shall be furnished with an electronic lockout circuit, which will connect the battery when the AC circuit is activated, and an electronic brownout circuit, which will activate the emergency lights when utility power dips below 75% of nominal voltage. A low voltage battery protection circuit shall be provided and will disconnect the load when the battery reaches the end of discharge. The unit shall self-test for 1 minute every 30 days, 10 minutes on the 6th month and 30 minutes every 12 months. The unit shall be capable of full recharge in compliance with CSA specifications. The unit shall be furnished with sealed dust tight relay, a test switch and diagnostic LED indicator lights to continuously monitor the status of the unit: Battery Failure, Battery Disconnected, Charger Failure, Lamp Failure, Service Alarm, AC "ON", Charger High Rate. The emergency lighting heads shall require no tools for orientation.

The unit shall be **Lumacell®** model: RG12S1002MT9W.

WIRE GUARDS

460.0078-L	Wall Mount	"A" Cabinet
460.0081-L	Wall Mount	"B" Cabinet
460.0034-L	Wall Mount	"C" Cabinet

REPLACEMENT LAMPS

ORDERING CODE	LAMP TYPE	VOLTAGE/WATTAGE
570.0016-L	Mini tungsten (MT9W)	6V-9W
570.0025-L	Mini tungsten (MT9W)	12V-9W
570.0045-L	Mini tungsten (MT9W)	24V-9W
580.0093-L	MR16 LED	12V-4W
580.0104-L	MR16 LED	12V-5W
580.0098-L	MR16 LED	24V-4W
580.0106-L	MR16 LED	12V-6W

For the complete list, please see the lamp chart on page 144 to 146

RGS Series

6, 12 and 24V



POWER CONSUMPTION AND UNIT RATING

MODEL	AC SPECS		WATTAGE CAPACITY				
			30 MIN	1H00	1H30	2H00	4H00
RGS36	120/347VAC	0.10/0.04A	36	21	15	12	6
RGS72		0.22/0.08A	72	42	30	24	12
RGS108		0.22/0.08A	108	63	45	36	18
RGS180		0.22/0.08A	180	105	75	60	30
RG12S36		0.09/0.03A	36	21	15	12	6
RG12S72		0.15/0.06A	72	42	30	24	12
RG12S100		0.34/0.12A	100	58	42	33	17
RG12S144		0.40/0.14A	144	84	60	48	24
RG12S200		0.41/0.14A	200	117	83	67	33
RG12S220		0.41/0.14A	220	120	90	72	36
RG12S250		0.41/0.14A	250	144	100	83	42
RG12S360		0.43/0.15A	360	200	144	108	60
RG12S360HP		0.43/0.15A	360	330	240	180	100
RG24S144		0.55/0.20A	144	84	60	48	24
RG24S200		0.67/0.23A	200	117	83	67	33
RG24S288		0.67/0.23A	288	168	120	96	48
RG24S350		0.67/0.23A	350	200	144	120	60
RG24S432		0.67/0.23A	432	250	180	144	72
RG24S550		0.88/0.33A	550	320	230	180	90
RG24S720		0.88/0.33A	720	400	288	216	120
RG24S720HP		0.88/0.33A	720	660	480	360	200

Note: Units provide higher power for minimum one hour of emergency lighting.

ORDERING INFORMATION

SERIES	CAPACITY	# OF HEADS	HEADS STYLE/WATTAGE	COLOUR	AC VOLTAGE	OPTIONS
RGS= 6V	**36**= 36W (A)* **72**= 72W (A)* **108**= 108W (A)* **180**= 180W (B)*	**Blank**= no head **1**= one head **2**= two heads **3**= three heads	**LD1**= 6V-4W, MR16 LED **LD7**= 12V-4W, MR16 LED **LD9**= 12V-5W, MR16 LED **LD10**= 12V-6W, MR16 LED **LD13**= 24V-4W, MR16 LED **MT9W**= mini-tungsten, 6V, 12V, 24V-9W, wedge base **MT18W**= mini-tungsten, 12V, 24V-18W, wedge base **MQ8W**= mini-halogen, 6V, 12V-8W, quartz bi-pin **MQ12W**= mini-halogen, 6V, 12V, 24V-12W, quartz bi-pin **MQM6W**= mini-halogen, 6V-6W, MR16 **MQM10W**= mini-halogen, 6V-10W, MR16 **MQM12W**= mini-halogen, 12 V, 24V-12W, MR16 **MQM20W**= mini-halogen, 12V-20W, MR16 **LH9W**= tungsten, 6V, 12V, 24V-9W, wedge base **LH18W**= tungsten, 12V, 24V-18W, wedge base **LH25W**= tungsten, 6V, 12V, 24V-25W, DCB **LHQ8W**= halogen, 6V, 12V-8W, quartz bi-pin **LHQ12W**= halogen, 6V, 12V-12W, quartz bi-pin **LHQ20W**= halogen, 6V, 12V, 24V-20W, quartz bi-pin **LHQ55W**= halogen, 12V-55W*, quartz bi-pin **LHQ70W**= halogen, 24V-70W**, quartz bi-pin **SB8W**= tungsten, 6V-8W, sealed beam **SB12W**= tungsten, 12V-12W, sealed beam **SB18W**= tungsten, 6V, 12V-18W, sealed beam **SB25W**= tungsten, 6V, 12V-25W, sealed beam **QSB8W**= halogen, 6V, 12V-8W, quartz sealed beam **QSB12W**= halogen, 6V, 12V-12W, quartz sealed beam **QSB20W**= halogen, 6V-20W, quartz sealed beam * Aluminum heads only. ** High temperature heads only.	**Blank**= factory white **BK**= black	**Blank**= 120/347VAC input **ZB**= 240VAC input **ZC**= 277VAC input **ZE**= 220VAC, 50Hz input	**A**= ammeter **AT**= auto-test **ATN**= auto-test (non-audible) **CT**= cabtire **DPF6**= 6cct. fuse panel **LD**= lamp disconnect **LTS**= light activated test switch **RR2**= remote test receiver **TD**= time delay (programmable) **TL**= twistlock plug **TMBB**= AC/DC terminal block **TMBD**= DC terminal block **TMBK**= AC terminal block **V**= voltmeter **HH2**= remote test transmitter (one per order) **HP**= high power **NEX**= NEXUS® system interface* **NEXRF**= wireless NEXUS® system interface* * Consult your sales representative for options available with NEXUS® system.
RG12S= 12V	**36**= 36W (A)* **72**= 72W (A)* **100**= 100W (A)* **144**= 144W (A)* **200**= 200W (B)* **220**= 220W (B)* **250**= 250W (B)* **360**= 360W (B)					
RG24S= 24V	**144**= 144W (A)* **200**= 200W (B)* **288**= 288W (B)* **350**= 350W (C)* **432**= 432W (C)* **550**= 550W (C)* **720**= 720W (C)* * Cabinet size is not part of the ordering information					

EXAMPLE: RGS362MT9W

ILLUMINA
BS100
FLUORESCENT (T8)

Conforms to ANSI / NSF STD NO. 2 — 9901281

T8 2' - 4'
Wet/IP66



Suspended Luminaire

Application: The ILLUMINA® BS100T8 linear fluorescent has been designed to offer performance, efficiency, reliability and easy installation. The three piece design snaps together without the need of any tools. The BS100T8 HT version weighs a mere 6.5lbs and is available in 2ft or 4ft versions. Construction is 100% polycarbonate, which makes it corrosion, flame and vandal resistant. The ILLUMINA® BS100T8 is ideal for parking structures, warehouses, breezeways, canopies and schools.

Agnico Eagle, Baker Lake
Jet-A Tank Farm
Indoor Lighting

CONFIGURE:

a MODEL	b LENGTH	c OPERATION	d LAMPS	e INPUT	f OPTIONS
BS100T8 ILLUMINA® *BS100 T8 SERIES*	**2** *2 foot* **4** *4 foot*	**HT** *AC only* **SA** *AC & Emergency* *NOTE: (SA) versions 700 lumens*	**117W** *1x17W T8* **217W** *2x17W T8* **132W** *1x32W T8* **232W** *2x32W T8*	**120V** **277V** **120/277V** **347V** *NOTE: consult factory for 347V (SA)*	**SS** *stainless steel clips* **FP** *inline fuse protection* **LUCE3** *1400 lumen EM (USA only)* **PK** *rigid pendant kit: 18", 24", 36" & 48"* **AC** *aviation cable: 50", 72", 100", 150" & 250"* **CH** *chain hang kit* **SL** *sanitation listed* *NOTE: (AC & PK) length to be specified, i.e. PK24 or AC100*
MODEL a	LENGTH b	OPERATION c	LAMPS d	INPUT e	OPTIONS f
BS100T8					

HOUSING: 100% UV stabilized polycarbonate material, integrated liquid silicone perimeter gasket with memory retention, recessed stainless steel mounting brackets.

REFLECTOR: Dual parabolic (2-lamp versions) and single parabolic (1-lamp versions) high emission reflector. Vacuum metallized finish. Direct mount reflector configuration supports all electrical components.

DIFFUSER: High performance diffuser. Complete light emission (CLE) technology. 100% Polycarbonate construction, impact resistant, UV stabilized to reduce yellowing index.

LAMP/SOCKET: Two (2) or four (4) T8 ratchet type sockets.

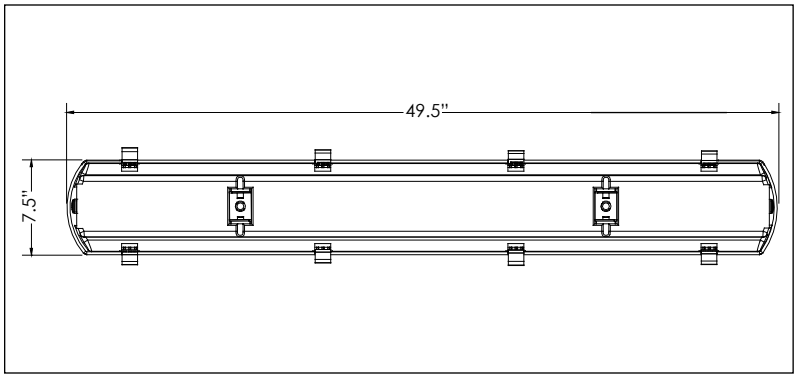
MOUNTING: Surface mount configuration as standard. Optional (**AC**) aviation cable, adjustable and (**PK**) pendant mounting are available. Required mounting height to be specified.

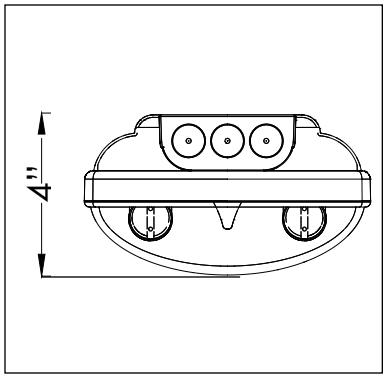
POWER LINE/FEED: 3-wire, solid type 18awg, pre-stripped 12" leads for quick in-field connection.

EMERGENCY (SA): Integral emergency ballast to operate one (1) lamp for a minimum duration of 90 minutes. Reflector mounted monitor indicator and test switch. (SA) for AC & emergency operation. The (SA) version is only available with either 120V or 277V inputs, (consult factory for 347V).

WEIGHT: 6.5 lbs. / 2.948 kilo.

Sanitation listed (SL): is equivalent to the NSF standard 2, meeting the rigorous sanitation, electrical safety and performance standards. The ILLUMINA® BS100 is ideal for use in food service equipment environments.





Beghelli reserves the right to change, without notice, specifications or materials that in our opinion will not alter the function or performance of the product. Technical specifications that appear on www.beghellilluce.com supersede all other versions existing in print or electronic form.

Agnico Eagle, Baker Lake
Jet-A Tank Farm
Outdoor lighting control

TI044

Installation and User Guide

Industrial Indoor/Outdoor Solar Timer

1 Applications

The TI044 is a heavy-duty indoor/outdoor timer designed to control the following loads:

Load type	Maximum load	Examples
Resistive load	3600 W (30 A @ 120 V)	• incandescent lights • halogen lights • block heaters
Inductive load	1200 W (10 A @ 120 V)	• fluorescent lights • compact fluorescent lights (CFL) • sodium lamps • electronic ballasts
Motor	1.5 hp @ 120 V	• pumps • fans

The TI044 is equipped with two normally-open (NO) dry contacts identified as **Load 1** and **Load 2** for connecting two independently operated loads:

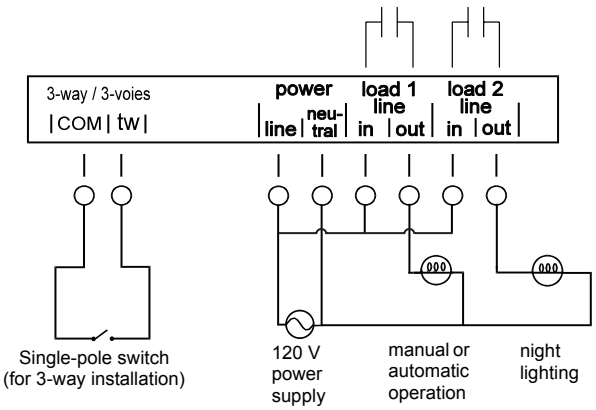
- **Load 1** follows the schedule that you have programmed into the timer when placed in automatic mode. The load can also be activated or deactivated manually similar to the operation of a regular switch.
  A single-pole switch can be connected to the timer to control **Load 1** as in a 3-way installation. For example, the timer can be installed outside whereas the switch can be located remotely (e.g., inside the house).
- **Load 2** always follows the sunset/sunrise program; i.e., it is activated at sunset and deactivated at sunrise. It is usually used for night lighting.

2 Installation

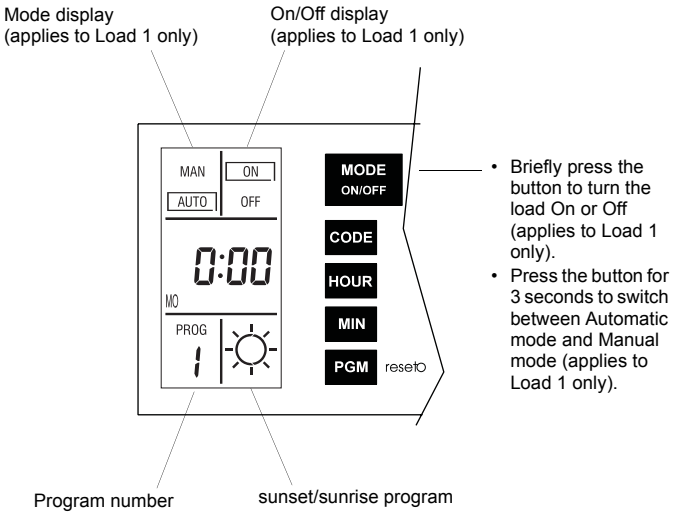
1. Cut power at the circuit breaker to avoid electric shock.
2. Connect the power supply between **power line** and **power neutral** terminals.
3. Connect the load and its power supply in series between **Load 1 in** and **Load 1 out** or between **Load 2 in** and **Load 2 out** depending on the application.

***NOTE**: For a 3-way installation, connect a standard single-pole switch to the **3-way** terminals of the timer as shown on the wiring diagram.*

4. Apply power at the circuit breaker.



3 Operation



3.1 Load 1

Load 1 can operate in Manual or Automatic mode. To switch between the two modes, press and hold the **MODE** button for 3 seconds.

Manual Mode

In Manual mode, the TI044 operates like a regular switch to control Load 1. Briefly press the **MODE** button to activate or deactivate the load. (If you have connected a remote switch to the timer for a 3-way installation, the switch can also be used to activate or deactivate Load 1.) The mode indicator (**MAN**) and the state (**ON** or **OFF**) are displayed.

Automatic Mode

In Automatic mode, the TI044 controls Load 1 according to the programmed schedule (see section 6). The mode indicator (**AUTO**), the state (**ON** or **OFF**) and the current program number are displayed.

To temporarily override the programmed schedule, press the **MODE** button or use the remote switch (if connected). The new state indicator will flash to show that this state is temporary. The override remains in effect until you press the **MODE** button (or use the remote switch) or until the beginning of the next program.

3.2 Load 2

Load 2 follows the sunset/sunrise program (regardless of the operating mode of the timer). For example, if Load 2 is a light, the light will turn On at sunset and turns Off at sunrise.

***NOTE**: To use Load 2, you first need to enter the city coordinates and set the date (see section 6).*

4 Setting the Clock

***NOTE**: The switch displays the time in 24-hour format by default or following a reset.*

❶ To switch between 12-hour format and 24-hour format, proceed as follows:

a) Press the **MODE** button to ensure the **MAN** or **AUTO** indicator is displayed.

b) Briefly press the **MIN** and **HOUR** buttons simultaneously (**0:00** display = 24-hour; **12:00** display = 12-hour).

❷ Set the time using the **HOUR** and **MIN** buttons. For the 12-hour time format, if you are setting an afternoon time, ensure **PM** appears on the screen.

❸ Press the **MODE** button to return to normal operation.

5 Daylight Savings Time

This procedure sets the switch for daylight savings time or for standard time.

❶ Press the **CODE** button four times.

❷ Press the **MIN** button to switch between **nor** and **Ad**.

nor	Standard time / Normal time / Winter time
Ad	Daylight savings time / Advanced time / Summer time

❸ Press the **MODE** button to return to normal operation.

6 Sunset/Sunrise Program

***NOTE 1**: Load 2 always follows the sunset/sunrise program. Therefore, to use Load 2, you need to enter the city coordinates (longitude and latitude) and set the date.*

***NOTE 2**: By default, once you have programmed the sunset/sunrise parameters, Load 1 will follow the sunset/sunrise program when you place the timer in Automatic mode. To set your own schedule, see section 7.*

6.1 Determining the sunset/sunrise parameters

Fill out the following table:

Latitude	Longitude	Day #	nor/Ad	Lc

1) LATITUDE & LONGITUDE: Enter the coordinates of your city or the nearest city using the supplied table. If none of the cities in the table is applicable, this information is usually available on the Internet.

NOTE: Add a minus sign when entering a south latitude coordinate or a west longitude coordinate.

2) DAY #: Enter the day #. (Add the code of the current month to the current date.)

For example: For June 24th, the day # = 151 + 24 = 175

January	0	May	120	September	243
February	31	June	151	October	273
March	59	July	181	November	304
April	90	August	212	December	334

3) nor/Ad: If your country has daylight savings time, select the current time period.

nor	Standard time / Normal time / Winter time
Ad	Daylight savings time / Advanced time / Summer time

4) Lc: If your city's time zone is based on political or economic boundaries instead of its coordinates, your lights might switch On/Off too early or too late with respect to sunset and sunrise. Therefore, apply a correction factor (+1 or -1). Otherwise, leave it at 0.

6.2 Programming the sunset/sunrise parameters

Once you have completed section 6.1, proceed as follows:

❶ Press the **CODE** button until the desired parameter appears. The parameters appear in the following order.

Parameter	Default setting	Possible settings	Buttons used
Latitude (LAT)	00	-65 to 65	HOUR & MIN
Longitude (LONG)	000	-180 to 180	HOUR & MIN
Day number (DAY #)	000	1 to 365	HOUR & MIN
Daylight savings time	nor	nor / Ad	MIN
Local correction factor (Lc)	0	-1, 0, 1	MIN

❷ Press the **HOUR** or **MIN** button to modify the value (see table above for the buttons to use).

❸ Press the **MODE** button to return to normal operation.

7 Programming the Schedule

***NOTE**: Applies to Load 1 only. The programmed schedule does not affect Load 2 which follows the sunset/sunrise program only.*

The switch can hold 2 programs which are repeated every day. When you place the timer in Automatic mode, it will activate the load at the start of each program and deactivate it at the end of the program. You need to set the following parameters:

P1 ON : Start time of program 1
P1 OFF : End time of program 1
P2 ON : Start time of program 2
P2 OFF : End time of program 2

❶ Press the **PGM** button until the desired parameter is displayed.

If you have entered your city's parameters (see section 6), the parameters **P1 ON** and **P2 OFF** show the sunset time and sunrise time for this time of the year. If Load 1 is used for lighting, when the timer will be placed in **AUTO** mode, it will turn the light ON at sunset and will turn it Off at sunrise. For example:

P1 ON : **20:38** (sunset)
P1 OFF : **--:--** (blank)
P2 ON : **--:--** (blank)
P2 OFF : **6:10** (sunrise)

❷ Press the **HOUR** and **MIN** buttons to set the time.

Example: If you want your lights to turn On at sunset and to turn Off at 10:00 PM, set **P1 OFF** to **22:00**. If you also want your lights to turn back On at 5:00 AM then turn Off at sunrise, set **P2 ON** to **5:00**.

P1 ON	:	**20:38** (sunset)
P1 OFF	:	**22:00** (programmed)
P2 ON	:	**5:00** (programmed)
P2 OFF	:	**6:10** (sunrise)

NOTE: **P1 OFF** and **P2 OFF** have priority over **P1 ON** and **P2 ON** respectively. For example, if sunrise is at 4:58 and **P2 ON** is set to 5:00, the lights will not turn on.

You can replace the sunrise and sunset times by fixed times. Select program **P1 ON** or **P2 OFF** and enter the desired time using the **HOUR** and **MIN** buttons.

❸ Press the **MODE** button to return to normal operation.

Clearing a programmed time

❶ Press the **PGM** button to display the programmed time.

❷ Press the **CODE** button. The time will be erased and **--:--** will be displayed.

***NOTE**: For **P1 ON** and **P2 OFF**, if you have programmed the city parameters, the programmed time will be replaced by sunset time and sunrise time respectively.*

❸ Press the **MODE** button to return to normal operation.

8 Technical Specifications

Supply: 120 VAC, 50 / 60 Hz
3-way input: Requires a dry contact
Maximum load: See section 1
Operating temperature range: -40 °C to 50 °C (-40 °F to 122 °F)
Solar table precision: +/- 11 min. (max error around poles)
Enclosure type: 3R
Certifications: CSA & UL

☑ Warranty

AUBE warrants this product, excluding battery, to be free from defects in the workmanship or materials, under normal use and service, for a period of three (3) years from the date of purchase by the consumer. If at any time during the warranty period the product is determined to be defective or malfunctions, AUBE shall repair or replace it (at AUBE's option).
If the product is defective,

(i) return it, with a bill of sale or other dated proof of purchase, to the place from which you purchased it, or
(ii) contact AUBE. AUBE will make the determination whether the product should be returned, or whether a replacement product can be sent to you.

This warranty does not cover removal or reinstallation costs. This warranty shall not apply if it is shown by AUBE that the defect or malfunction was caused by damage which occurred while the product was in the possession of a consumer.
AUBE's sole responsibility shall be to repair or replace the product within the terms stated above. AUBE SHALL NOT BE LIABLE FOR ANY LOSS OR DAMAGE OF ANY KIND, INCLUDING ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING, DIRECTLY OR INDIRECTLY, FROM ANY BREACH OF ANY WARRANTY, EXPRESS OR IMPLIED, OR ANY OTHER FAILURE OF THIS PRODUCT. Some provinces, states or regions do not allow the exclusion or limitation of incidental or consequential damages, so this limitation may not apply to you.
THIS WARRANTY IS THE ONLY EXPRESS WARRANTY AUBE MAKES ON THIS PRODUCT. THE DURATION OF ANY IMPLIED WARRANTIES, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, IS HEREBY LIMITED TO THE THREE-YEAR DURATION OF THIS WARRANTY. Some provinces, states or regions do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.
This warranty gives you specific legal rights, and you may have other rights which vary from one province, state or region to another.

☎ Customer Assistance

If you have any questions on the product installation or operation, contact us at:

705 Montrichard Avenue
Saint-Jean-sur-Richelieu, Quebec
J2X 5K8
Canada
Tel.: (450) 358-4600
Toll-free: 1-800-831-AUBE
Fax: (450) 358-4650
Email: aube.service@honeywell.com

For more information on our products, go to
www.aubetech.com

CANADA

CITY	LAT	LONG	Lc
BANFF	51	-115	1
BURNABY	49	-122	0
CALGARY	51	-114	1
CAPE - DORSET	64	-76	0
CHICOUTIMI	48	-71	0
DAWSON	64	-139	1
EASTMAIN	52	-78	0
EDMONTON	53	-113	1
FORT SEVERN	56	-87	1
HALIFAX	44	-63	0
IGALUIT	63	-68	0
INUKJUAK	58	-78	0
KITCHENER	43	-80	0
LONDON	42	-81	0
MISTASSINI	50	-73	0
MONTREAL	45	-73	0
OSHAWA	43	-78	0
OTTAWA	45	-75	0
QUEBEC	46	-71	0
REGINA	50	-104	1
RICHMOND	49	-123	0
SASKATOON	52	-106	1
SEPT-ILES	50	-66	-1
SHERBROOKE	45	-71	0
ST. ANTHONY	51	-55	0
SAINT JOHN (NB)	45	-66	0
ST. JOHN'S (NFLD)	47	-52	0
SUDBURY	46	-81	0
THUNDER BAY	48	-89	1
TORONTO	43	-79	0
TROIS-RIVIÈRES	46	-72	0
URANIUM CITY	59	-108	0
VANCOUVER	49	-123	0
WINDSOR	42	-83	1
WINNIPEG	49	-97	0

USA

CITY	LAT	LONG	Lc
ABILENE	32	-99	1
ALBUQUERQUE	35	-106	0
ALLENTOWN	40	-75	0
AMARILLO	35	-101	1
ANCHORAGE	61	-149	1
ATLANTA	33	-84	1
AUSTIN	30	-97	0
BAKERSFIELD	35	-119	0
BALTIMORE	39	-76	0
BATON ROUGE	30	-91	0
BEAUMONT	30	-94	0
BILLINGS	45	-108	0
BIRMINGHAM	33	-86	0
BOISE	43	-116	1
BOISE CITY	36	-102	1
BOSTON	42	-71	0
BROWNSVILLE	25	-97	0
BUFFALO	42	-78	0
CEDAR RAPIDS	41	-91	0
CHARLOTTE	35	-80	0
CHATTANOOGA	35	-85	1
CHEYENNE	41	-104	0
CHICAGO	41	-87	0
CINCINNATI	39	-84	1
CLEVELAND	41	-81	0
COLOMBUS	39	-82	0
COLORADO SPRINGS	38	-104	0
CORPUS CHRISTI	27	-97	0
DALLAS	32	-96	0
DENVER	39	-104	0
DES MOINES	41	-93	0
DETROIT	42	-83	1
DULUTH	46	-92	0
EL PASO	31	-106	0
ERIE	42	-80	0
EUGENE	44	-123	0
EVANSVILLE	37	-87	0
FLINT	43	-83	1
FORT LAUDERDALE	26	-80	0
FORT WAYNE	41	-85	1
FRESNO	36	-119	0
GRAND RAPIDS	42	-85	1
GREAT FALLS	47	-111	0
GREENSBORO	36	-79	0
HAMPTON	37	-76	0
HARTFORD	41	-72	0
HONOLULU	21	-157	0
HOUSTON	29	-95	0
HUNTSVILLE	34	-86	0
INDIANAPOLIS	39	-86	1
JACKSON	32	-90	0
JACKSONVILLE	30	-81	0
KANSAS CITY	39	-94	0
KNOXVILLE	35	-83	1
LAKEWOOD	39	-105	0
LANSING	42	-84	1
LAREDO	27	-99	1
LAS VEGAS	36	-115	0
LEXINGTON	38	-84	1
LINCOLN	40	-96	0
LITTLE ROCK	34	-92	0
LONG BEACH	33	-118	0
LOS ANGELES	34	-118	0

USA

CITY	LAT	LONG	Lc
LOUISVILLE	38	-85	1
LUBBOCK	33	-101	1
MACON	32	-83	1
MADISON	43	-89	0
MEMPHIS	35	-90	0
MIAMI	25	-80	0
MILWAUKEE	43	-87	0
MINNEAPOLIS	44	-93	0
MOBILE	30	-88	0
MODESTO	37	-120	0
MONTGOMERY	32	-86	0
NASHVILLE	36	-86	0
NEW ORLEANS	29	-90	0
NEW YORK	40	-74	0
NORFOLK	36	-76	0
OKLAHOMA CITY	35	-97	0
OMAHA	41	-95	0
ORLANDO	28	-81	0
OVERLAND PARK	38	-94	0
OXNARD	34	-119	0
PEORIA	40	-89	0
PHILADELPHIA	40	-75	0
PHOENIX	33	-112	0
PITTSBURG	40	-79	0
PLANO	33	-96	0
PORTLAND	45	-122	0
PROVIDENCE	41	-71	0
RALEIGH	35	-78	0
RAPID CITY	44	-103	1
RENO	39	-119	0
RICHMOND	37	-77	0
ROANOKE	37	-79	0
ROCHESTER	43	-77	0
ROCKFORD	42	-89	0
SACRAMENTO	38	-121	0
SALT LAKE CITY	40	-111	0
SAN ANTONIO	29	-98	1
SAN DIEGO	32	-117	0
SAN FRANCISCO	37	-122	0
SANTA ROSA	38	-122	0
SAVANNAH	32	-81	0
SEATTLE	47	-122	0
SHREVEPORT	32	-93	0
SOUTH BEND	41	-86	0
SPOKANE	47	-117	0
SPRINGFIELD (IL)	39	-89	0
SPRINGFIELD (MA)	42	-72	0
SPRINGFIELD (MO)	37	-93	0
ST. LOUIS	38	-90	0
SYRACUSE	43	-76	0
TALLAHASSEE	30	-84	1
TAMPA	27	-82	0
TOLEDO	41	-83	1
TOPEKA	39	-95	0
TUCSON	32	-110	0
TULSA	36	-95	0
VIRGINIA BEACH	36	-75	0
WACO	31	-97	0
WASHINGTON DC	38	-77	0
WICHITA	37	-97	0
WINSTON-SALEM	36	-80	0
YONKERS	40	-73	0
YOUNGSTOWN	41	-80	0

MEXICO

CITY	LAT	LONG	Lc
TIJUANA	32	-117	0
NOGALES	31	-111	0
CIUDAD JUAREZ	31	-106	0
MATAMOROS	26	-97	0
NUEVO LAREDO	27	-99	1
MONTERREY	25	-100	1
CHIHUAHUA	28	-106	0
MAZATLÁN	23	-106	0
TAMPICO	22	-98	1
ZACATECAS	22	-102	1
LÉON	21	-101	1
LA PAZ	24	-110	0
MEXICO CITY	19	-99	1
PUEBLA	19	-98	1
GUADALAJARA	20	-103	1
OAXACA	17	-96	0
ACAPULCO	16	-100	1
CANCUN	21	-86	0
MERIDA	21	-89	0

Puerto Rico

CITY	LAT	LONG	Lc
SAN JUAN	18	-66	0

Dominican Republic

CITY	LAT	LONG	Lc
SANTO DOMINGO	18	-70	1



TIo44

This powerful timer accepts two loads and features solar programming—ideal for lighting



Print this page

MODEL & RATINGS

TI044	1.5 HP @ 120 V	30 A (resistive), 10 A (ballast)

SPECIFICATIONS

PROGRAMMING
Load 1: solar timetable with 2 optional settings (1 on, 1 off)
Load 2: solar timetable

OPERATING MODES
Manual (conventional switch)
Automatic
Temporary bypass

CONNECTION
Terminals for #14 to #10 AWG wire
Multiswitch (3-way) compatible

DIMENSIONS (H•W•D)
182 x 238 x 102 mm / 9.4 x 7.2 x 3.8 inches

FEATURES

Heavy-duty weatherproof casing (Nema 3R) ideal for outdoor use

Solar timetable programming automatically turns lights on at sunset and off at sunrise

Lockable casing for increased security

Temporary bypass enables override without affecting programming

Compatible with 3-way switches

ADDITIONAL INFORMATION

SOLAR TIMETABLE
• No need to continually re-program on/off times – ideal for outdoor lighting
• Calculates on (sunset) and off (sunrise) times according to the longitude and latitude entered for your city (coordinates are provided in the instruction manual)
• Simple daylight savings time adjustment

INSTRUCTION MANUAL

TI044.pdf (format PDF)

To view a PDF, you must have Acrobat Reader.
Click on the icon to download it for free.

KEENE

Agnico Eagle, Baker Lake
Jet-A Tank Farm
Tank farm lighting

PentaFlood
Size 4

Features

- One-piece die-cast aluminum housing and lens frame. Lens frame fully gasketed, internally hinged and secured with four captive stainless steel hex-head screws for weatherproofing and leaves both hands free for service. Standard finish is Duraplex II™ bronze electrostatic powder coat,.
- Lens is a clear, tempered, shock and heat resistant soda lime glass, permanently sealed with silicone to the lens frame.
- Porcelain, 4kV pulse rated, grip-type Mogul base socket prevents lamp loosening.
- HID ballast, class H insulation, high power factor, CWA.
- HID lamps are ED28, Metal Halide & Pulse Start MH, ED23-1/2 & E18 for High Pressure Sodium
- Reflectors come in three standard grade & three specification grade "PentaLume" distribution options:
  Standard Grade
  - Square (Standard)
  - Spot (S)
  - Cut-off (C)

  PentaLume Grade
  - Wide (PLW)
  - Narrow x Wide (PLNW)
  - Spot (PLS)
- Available in two mounting configurations:
  - **Adjustable Tenon Mount:** Die-cast aluminum construction, powder finished same as fixture, with 180° of adjustability. For 2" (2 3/8" OD) pipe or tenon. Includes fully enclosed wiring compartment with access plate.
  - **Yoke Mount:** Heavy gauge steel, powder finished same as fixture. Supplied standard with 3ft. SOW 16/3 cable.
- EPA: Effective Projected Area: 1.20 ft^2 [0.111m^2]
- 3 year limited warranty.

Available up to 400W Metal Halide, Pulse Start Metal Halide & High Pressure Sodium



cUL Approved for Wet Locations
Yoke Mount IP65 Tested & Certified

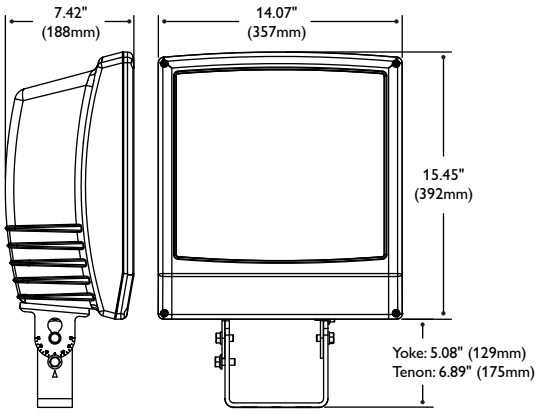
Job Information	Type:
Job Name:	
Cat. No.:	PF4A400MAL-T
Lamp(s):	
Notes:	

Canlyte
3015 Louis-Amos, Lachine, Québec H8T 1C4
canlyte-info@philips.com • (514) 636-0670 • www.canlyte.com

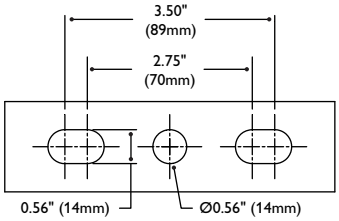
KEENE

PentaFlood
Size 4

Dimensions



Yoke Mounting Pattern



Ordering information

Explanation of catalog number: PF4A400MAL-T

PF	4	A	400		MA	L	-	T	

Series:
PF: Pentaflood

Size:
4

Mounting:
A = Adjustable Tenon
Y = Yoke[2]

Wattage[1]:
150 = 150W
175 = 175W
200 = 200W
250 = 250W
320 = 320W
350 = 350W
400 = 400W

Reflector Type:
Blank = Square
C = Cutoff
PLW = PentaLume Wide
PLNW = PentaLume Narrow x Wide
PLS = PentaLume Spot

Source:
MA = Metal Halide
LX = High Pressure Sodium
PS = Pulse Start Metal Halide

Options:
L = Lamp Included
AM = Automatic Quartz Socket & Relay (Lamp not supplied)
EM = Emergency Auxiliary Quartz Socket only (150W max.)
FS = Single Line Fusing (120, 277, 347V only)
TLR = Twist lock photocontrol receptacle
TRP = Twist lock receptacle & photocontrol
PCB = Button Photocontrol (120, 277V and 347V)

Voltage:
1 = 120V
2 = 208V
3 = 240V
4 = 277V
5 = 480V[3]
6 = 347V
7 = 600V[3]
T = Tri-Tap (120/277/347V)

Finish:
Blank = Bronze
W = White
B = Black
G = Grey

1 MA (175, 250, 400W); LX (150, 250, 400W); PS (200, 250, 320, 350, 400W)
2 Supplied with 3' SOW cable.
3 Not available in 400W, all sources.

Canlyte
3015 Louis-Amos, Lachine, Québec H8T 1C4
canlyte-info@philips.com • (514) 636-0670 • www.canlyte.com
SD0827 June 30, 2011.
Specifications are subject to change without notice.
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Job Information **Type:**

KEENE

Agnico Eagle, Baker Lake
Jet-A Tank Farm
Loading area lighting

PentaFlood
Size 3

Features

- One-piece die-cast aluminum housing and lens frame. Lens frame fully gasketed, internally hinged and secured with four captive stainless steel hex-head screws for weatherproofing and leaves both hands free for service. Standard finish is Duraplex II™ bronze electrostatic powder coat, optional colours available.
- Lens is a clear, tempered, shock and heat resistant soda lime glass, permanently sealed with silicone to the lens frame.
- Porcelain, 4kV pulse rated, grip-type Mogul base socket prevents lamp loosening.
- HID ballast, class H insulation, high power factor, CWA.
- HID lamps are ED28, Metal Halide & Pulse Start MH, ED23-1/2 & E18 for High Pressure Sodium.
- Reflectors come in three distribution options:
  - Square (Standard)
  - Wide x Narrow (WN)
  - Cutoff (C)
- Available in two mounting configurations:
  - **Adjustable Tenon Mount:** Die-cast aluminum construction, powder finished same as fixture, with 180° of adjustability. For 2" (2-3/8" OD) pipe or tenon. Includes fully enclosed wiring compartment with access plate.
  - **Yoke Mount:** Heavy gauge steel, powder finished same as fixture. Supplied standard with 3ft. SOW 16/3 cable.
- EPA: Effective Projected Area: 1.0 ft^2 [0.093m^2]
- 3 year limited warranty.

Available up to 400W Metal Halide, Pulse Start Metal Halide & High Pressure Sodium



CSA Approved for Wet Locations
Yoke Mount IP65 Tested & Certified

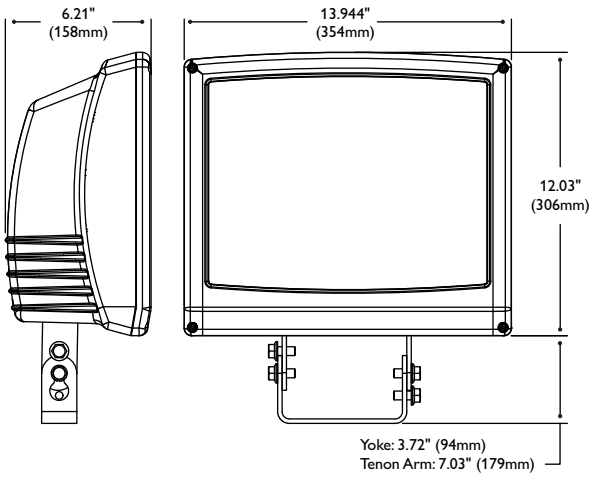
Job Information	Type:
Job Name:	
Cat. No.:	PF3Y250LXL-T
Lamp(s):	
Notes:	

Canlyte
3015 Louis-Amos, Lachine, Québec H8T 1C4
canlyte-info@philips.com • (514) 636-0670 • www.canlyte.com

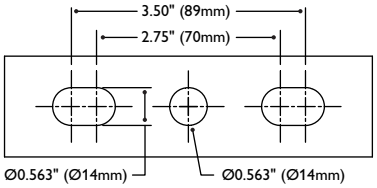
KEENE

PentaFlood
Size 3

Dimensions



Yoke Mounting Pattern



Ordering information

Explanation of catalog number: PF3Y250LXL-T

PF	3	Y	250		LX	L	-	T	
Series:	Size:	Mounting:	Wattage[1]:	Reflector Type:	Source:	Options:		Voltage:	Finish:

Series:
PF: Pentaflood

Size:
3

Mounting:
A = Adjustable Tenon
Y = Yoke[2]

Wattage[1]:
070 = 70W
100 = 100W
150 = 150W
175 = 175W
250 = 250W
320 = 320W
350 = 350W
400 = 400W

Reflector Type:
Blank = Square
WN = Wide x Narrow
C = Cutoff

Source:
MA = Metal Halide
LX = High Pressure Sodium
PS = Pulse Start Metal Halide

Options:
L = Lamp Included
AM = Automatic Quartz Socket & Relay (Lamp not supplied)
EM = Emergency Auxiliary Quartz Socket only (150W max.)
FS = Single Line Fusing (120, 277, 347V only)
TLR = Twist lock photocontrol receptacle
TRP = Twist lock receptacle & photocontrol
PCB = Button Photocontrol (for 120 or 277V only)

Voltage:
1 = 120V
2 = 208V
3 = 240V
4 = 277V
5 = 480V[3]
6 = 347V
7 = 600V[3]
T = Tri-Tap (120/277/347V)

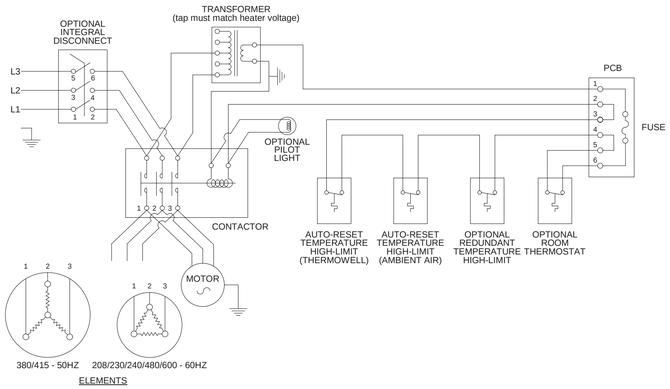
Finish:
Blank = Bronze
W = White
B = Black
G = Grey

1 MA (175, 250, 400W); LX (70, 100, 150, 250, 400W); PS (200, 250, 320, 350, 400W)
2 Supplied with 3' SOW 16/3 cable.
3 480V & 600V are available up to 250W max. Not available in 400W

Canlyte
3015 Louis-Amos, Lachine, Québec H8T 1C4
canlyte-info@philips.com • (514) 636-0670 • www.canlyte.com
SD0826 June 30, 2011.
Specifications are subject to change without notice.
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Job Information	Type:

Agnico Eagle, Baker Lake
Jet-A Tank Farm
Forced air Heater



3-PHASE
WIRING SCHEMATIC

TABLE 1 - SPECIFICATIONS

KW (BTU/HR)	VOLT	PH	TOTAL CURRENT	MIN. CIRCUIT	MAX. FUSE	WIRE SIZE	BASIC MODEL	BUILT-IN THERMOSTAT	3-WAY SWITCH	PILOT LIGHT	DISCONNECT SWITCH	CONTINUOUS FAN
3 (10236)	208	1	14.4	18.0	20	12	FX5-208160-030	☐	☐	☐	☐	☐
		3	8.3	10.4	15	14	FX5-208360-030	☐	☐	☐	☐	☐
	240	1	12.5	15.6	20	12	FX5-240160-030	☐	☐	☐	☐	☐
		3	7.2	9.0	15	14	FX5-240360-030	☐	☐	☐	☐	☐
	480	1	6.3	7.9	15	14	FX5-480160-030	☐	☐	☐	☐	☐
		3	3.6	4.5	15	14	FX5-480360-030	☐	☐	☐	☐	☐
	600	3	2.9	33.6	15	14	FX5-600360-030	☐	☐	☐	☐	☐
5 (17060)	208	1	24.0	30.0	30	10	FX5-208160-050	☐	☐	☐	☐	☐
		3	13.9	17.4	20	14	FX5-208360-050	☐	☐	☐	☐	☐
	240	1	20.8	26.0	30	10	FX5-240160-050	☐	☐	☐	☐	☐
		3	12.0	15.0	15	14	FX5-240360-050	☐	☐	☐	☐	☐
	480	1	10.4	13.0	15	14	FX5-480160-050	☐	☐	☐	☐	☐
		3	6.0	7.5	15	14	FX5-480360-050	☐	☐	☐	☐	☐
	600	3	4.8	6.0	15	14	FX5-600360-050	☑	☐	☐	☑	☐
7.5 (25591)	208	1	36.1	45.1	50	6	FX5-208160-075	☐	☐	☐	☐	☐
		3	20.8	26.0	30	10	FX5-208360-075	☐	☐	☐	☐	☐
	240	1	31.3	39.1	40	8	FX5-240160-075	☐	☐	☐	☐	☐
		3	18.0	22.5	25	10	FX5-240360-075	☐	☐	☐	☐	☐
	480	1	15.6	19.5	20	12	FX5-480160-075	☐	☐	☐	☐	☐
		3	9.0	11.3	15	14	FX5-480360-075	☐	☐	☐	☐	☐
	600	3	7.2	9.0	15	14	FX5-600360-075	☐	☐	☐	☐	☐
10 (34121)	208	1	48.1	60.1	70	4	FX5-208160-100	☐	☐	☐	☐	☐
		3	27.8	34.8	35	8	FX5-208360-100	☐	☐	☐	☐	☐
	240	1	41.7	52.1	60	6	FX5-240160-100	☐	☐	☐	☐	☐
		3	24.1	30.1	35	8	FX5-240360-100	☐	☐	☐	☐	☐
	480	1	20.8	26.0	30	10	FX5-480160-100	☐	☐	☐	☐	☐
		3	12.0	15.0	15	14	FX5-480360-100	☐	☐	☐	☐	☐
	600	3	9.6	12.0	15	14	FX5-600360-100	☐	☐	☐	☐	☐

MODEL CODING

FX5- 600360- 050- TD

MODEL SERIES

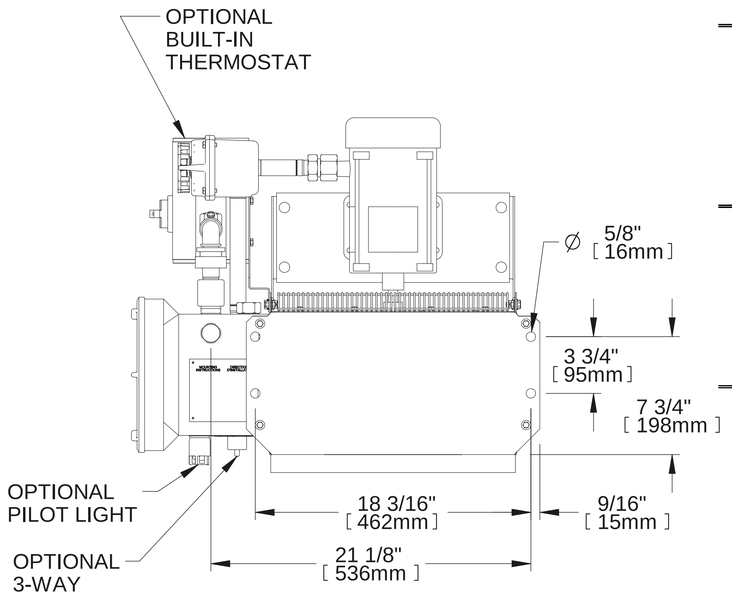
HEATER VOLTAGE
208V
240V
480V
600V

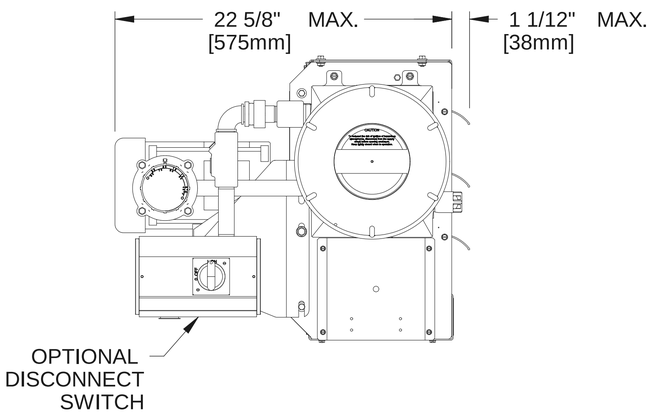
PHASE
UNITS AVAILABLE IN SINGLE OR 3 PHASE

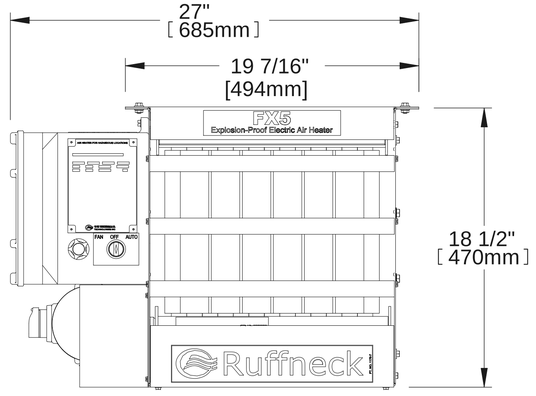
FREQUENCY
60 - 60 HERTZ

HEATER KILOWATTS
030 - 3 Kw
050 - 5 Kw
075 - 7.5 Kw
100 - 10 Kw

T - BUILT-IN THERMOSTAT
D - DISCONNECT SWITCH
P - PILOT LIGHT
S - 3-WAY SWITCH
U - CONTINUOUS RUN FAN







NOTES:

1. NET WEIGHT:
Without Disconnect 64 KG [141 LBS]
With Disconnect 70 KG [153 LBS]

2. SHIPPING WEIGHT:
Without Disconnect 82 KG [181 LBS]
With Disconnect 93 KG [205 LBS]

3. MAX. OPERATING AMBIENT TEMP:
40°C [104°F]

4. HAZARDOUS LOCATION CLASSIFICATION:
$_{C}UL_{US}$ LISTED FOR THE FOLLOWING LOCATIONS:
CLASS I, DIVISION 1 & 2, GROUPS C & D
CLASS II, DIVISION 1, GROUPS E, F, & G
CLASS II, DIVISION2, GROUPS F & G
CLASS I, ZONES 1 & 2, GROUPS IIA & IIB

TEMPERATURE CODE:
T3B 165°C [329°F]

5. AIR DELIVERY:
FOR 3 kW and 5 kW UNITS:
500 CFM @ 70°F (NOMINAL)
850 m³/hr @ 21°C (NOMINAL)
FOR 7.5 kW and 10 kW UNITS:
850 CFM @ 70°F (NOMINAL)
1,444 m³/hr @ 21°C (NOMINAL)

6. MATERIALS:
CABINET: 14 GA. EPOXY POWDER COATED RUFFNECK GREEN.
CORE: STEEL WITH INTEGRAL ALUMINUM FINS

REV.	REVISION DESCRIPTION	DATE	BY
TITLE:	APPROVAL DATA SHEET RUFFNECK FX5 12" HEATER		
DWG NO.: 50960	SHEET:	TOLERANCE UNLESS NOTED OTHERWISE	
SYTELINE NO.:50960		± 1/2° ANGULAR	± 0.005" DECIMAL
SCALE: N.T.S.		± 1/16" FRACTIONAL	± 1 mm METRIC
DRN BY: MCARGILL	11 Dec 2006	CCI Thermal Technologies INC.	
CHK'D BY:		EDMONTON, ALBERTA	
APP'D. BY:			

Ruffneck™
Heaters for the Harshest Environments

Certified System™
ISO 9001

Owner's Manual

FX5 Series

Electric Forced Air Heaters for Hazardous Locations





This manual covers the installation, maintenance, repair and replacement parts.

APPROVED LOCATIONS

The Electric Forced Air Heaters are cULus listed certified for the following locations:

Class I, Divisions 1 & 2, Groups C & D;
Class II, Division 1, Groups E, F, & G;
Class II, Division 2 , Groups F & G;
Class I, Zones 1 & 2, Groups IIA & IIB;
Temperature Code T3B 329˚F (165˚C)
(50 Hz & 60 Hz Models)

For details of hazardous locations with potential for explosion, refer to the Canadian Electrical Code, Part 1, Section 18 or National Electrical Code articles 500-516.

FX5 - 600 3 60 - 050 - W T, D,

- FX5 — MODEL SERIES
- 5 — 5th GENERATION
- 600 — HEATER VOLTAGE
- 3 — PHASE
- 60 — HERTZ
- 050 — HEATER KILOWATTS
- W — WELDED CORE
- T, D, — OPTIONS

OPTIONS

T - Built-in thermostat
D - Built-in disconnect switch
P - Built-in pilot light
S - 3-way switch
H - Unit with high "off" (deenergized) ambient temperatures
C - Heresite® coating
A - Stainless-steel cabinet
U - Continuous Fan

WARNING!

READ ALL IMPORTANT INFORMATION NOTICES ON PAGES 2, 3 & 4.

Part No. 9714.Rev.8.00 Issue Date: November 2013 Printed in Canada

UL® C US Listed

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HEATER MAINTENANCE CHECKLIST

For Electric Forced Air Heaters

Photocopy this page for reuse.

Heater Model: _____ Serial No.: _____

Date of Maintenance: _____ Maintenance Done By: _____

Comments: _____

_____

WARNING

Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater.
Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application.
IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel.
Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application.
This heater should only be serviced by personnel with heating and hazardous location equipment experience.

PREVENTATIVE MAINTENANCE GRID

		Regular Service				Severe Service			
		Annual Start Up	1 Month	3 Month	12 Month	Annual Start Up	1 Month	3 Month	12 Month
Clean: ▪ Finned Tubes ▪ Fan ▪ Fan Guard ▪ Motor ▪ Louvers	Remove dust using compressed air. **Do not Spray with water or solvents.** **Do not immerse in water or solvents.**	X				X		X	
Electrical									
Check all terminal connections and conductors.	Tighten loose connections. Replace conductors with damaged insulation & frayed wiring. **For drilling rigs, this should be done with every rig re-location.**	X			X	X		X	
Inspect contactor contacts.	If badly pitted, burned or welded shut, replace with factory supplied contactor. **For drilling rigs, this should be done with every rig re-location.**	X				X		X	
Check Fuses	The Correct fuse rating and type are printed on the circuit board. Always ensure a backup fuse is available on the PCB. **For drilling rigs, this should be done with every rig re-location.**	X				X			
Mechanical									
Check for fluid leakage	Inspect the Pressure Release Valve label indicator for signs of rupture and degradation. If any fluid leakage occurs from the heater, disconnect it from the power supply and have the core replaced immediately. **For drilling rigs, this should be done with every rig re-location.**	X				X		X	
Check all enclosures	The interiors of each enclosure must be clean, dry and free of foreign materials. **For drilling rigs, this should be done with every rig re-location.**	X				X		X	
Check motor shaft bearing play	If the motor does not run quietly and smoothly and has excessive play replace the motor. **For drilling rigs, this should be done with every rig re-location.**	X				X		X	

PERIODIC (before and as required during heating season)

Photocopy this page for reuse.

1. CLEAN

- ☐ Finned Tubes
- ☐ Fan
- ☐ Fan Guard
- ☐ Motor
- ☐ Louvers

2. CHECK

- ☐ Motor for smooth, quiet operation
- ☐ Louvers for proper angle and tightness
- ☐ All explosion-proof covers for tightness
- ☐ Pressure relief device for signs of leakage. See Figure 1 and refer to the ANNUAL Section (see below) item 2 for further instructions

Remove dust using compressed air. Do not spray with water or solvents.
Do not immerse in water or solvents.

ANNUAL (before heating season)

1. ELECTRICAL

- ☐ **Check all terminal connections and conductors.** Tighten loose connections. Conductors with damaged insulation must be replaced.
- ☐ **Inspect contactor contacts.** If badly pitted, burned or welded shut, replace with factory supplied contactor. For severe duty conditions such as arctic duty or drilling rigs, CCI Thermal recommends the contactor be replaced every two years.
- ☐ **Check fuses.** Fuse rating and type are on printed circuit board. Correct fuse must be in the active fuse clip. It is recommended that a spare fuse be stored in the spare fuse clip.
- ☐ **Check all explosion-proof conduits.** Replace damaged conduits. All threaded conduit connections must have a minimum 5 turns engagement. Straight threaded conduit must protrude a minimum of 1/16” (1.6mm) inside enclosures. Taper threaded connections must be at least hand tight.
- ☐ **Check electrical resistance on all load side legs.** Reading should be balanced (± 5%).

2. MECHANICAL

- ☐ **Check for fluid leakage.** The heater core is vacuum charged and contains propylene glycol. Inspect the Pressure Relief Valve label indicator for signs of rupture and degradation. If the paper is torn, disintegrated or otherwise compromised this is an indication that fluid has leaked from the core. If any fluid leakage occurs from the heater, disconnect it from the power supply and have the core replaced. A factory supplied exchange core can be shipped immediately from stock. Refer to the "Repair and Replacement" section for details.
- ☐ **Check all enclosures.** Interior of enclosures must be clean, dry and free of foreign materials. Threaded covers must be installed and hand tight.
  Note: Enclosure joints are metal to metal. Do not use gasket material or sealant in joints. A grease is applied to the joints at the factory and should be left intact.
- ☐ **Check motor shaft bearing play.** Replace motor if play is excessive, or if motor does not run quietly and smoothly. Motor bearings are permanently lubricated.
- ☐ **Check fan.** Replace immediately if cracked or damaged.
- ☐ **Check louvers.** Louver screws should be tight. Louvers shall not be fully closed or override stops.
- ☐ **Check the tightness of all hardware.** All nuts and bolts, including mounting hardware, must be tight.
- ☐ **Turn heater on for a minimum of five minutes.** Check for warm air exiting heater through louvers. Crackling or pinging noises within heater during start-up are normal.

IMPORTANT NOTICES

Photocopy this page for reuse.

WARNING

Read and adhere to the following. Failure to do so may result in severe or fatal injury.
WARRANTY WILL BE VOID

1. Read and follow all instructions in this manual.
2. Heater is to be used only in atmospheres having an ignition temperature higher than the heater's maximum rated operating temperature as shown on the heater data plate. Refer to applicable electrical codes for additional information.
3. Heater to be used only in the hazardous locations indicated on the heater's data plate.
4. Heater is for dry indoor use only. Do not immerse in water. Do not store or use in areas exposed to rain or snow.
5. Heater is to be connected and serviced only by a qualified electrician experienced with hazardous location equipment.
6. Installation and wiring of the heater must adhere to all applicable codes.
7. Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application. IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application.
8. This heater is equipped with a single bimetal overtemperature high-limit. It is of the automatic reset type and therefore the heater may restart without warning. The heater is not to be operated with the high-limit disabled or disconnected from the control circuit.
9. Venting pressure of the pressure relief valve is factory set. Do not tamper with lock nut.
10. Do not tamper or remove warning label indicator on the PRV.
11. Operate the heater only while it is permanently mounted in an upright position. Refer to the "Installation - Mechanical" section for details.
12. Heater must be kept clean. When operating in a dirty environment, regularly clean the finned tubes, fan, and fan guard. Follow the recommended maintenance procedures. Refer to the "Heater Maintenance Checklist" section for details.
13. The heater core is vacuum charged and contains propylene glycol. **If any fluid leakage occurs from the heater, disconnect it from the power supply and have the core replaced with a factory supplied core. Refer to the "Repair and Replacement" section for details.**
14. Do not operate the heater with any of the louvers fully closed or overriding their stops.
15. Do not operate the heater in atmospheres corrosive to steel or aluminum.
16. Do not operate heater in ambient temperatures above 104°F (40°C).
17. Use factory approved replacement parts only.
18. See applicable electrical codes for seal requirements in field installed conduits. Factory installed conduits require no further sealing.
19. Crackling or pinging noises within the heater core during start up may occur. This is normal.
20. Air discharge near the bottom of the heater may be warmer than the top. This is normal.
21. If there are any questions or concerns regarding the heater, contact the factory. Refer to the last page of this manual for details.

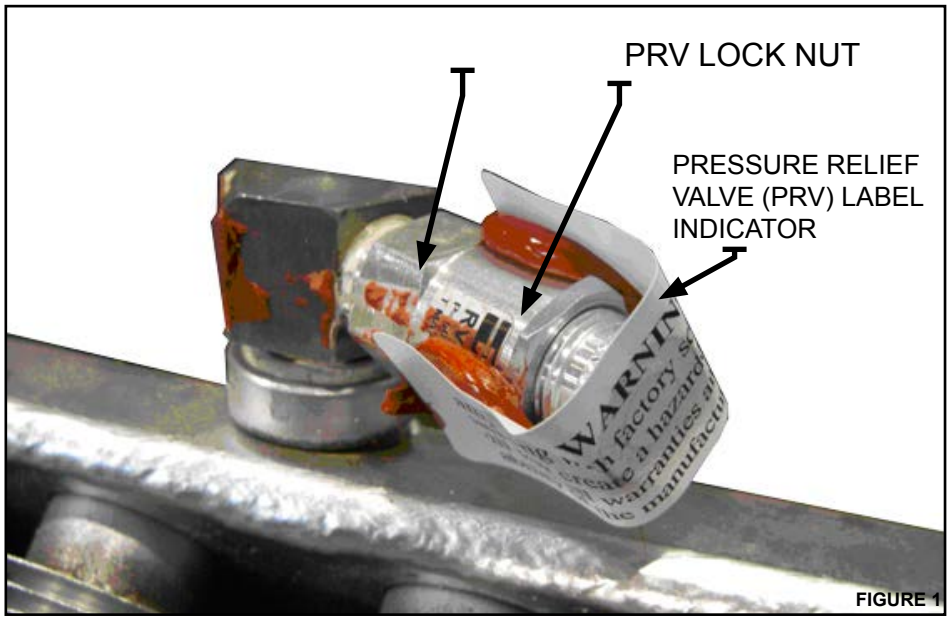


FIGURE 1

TROUBLESHOOTING TIPS

1.0 Heater is not operating
- 1.1 Check all fuses in heater control box.
- 1.2 Check remote disconnect switch and circuit breaker.
- 1.3 Check voltage supplied to the heater – refer to the heater data plate for voltage requirements.
- 1.4 Check thermostat by turning it and check continuity with a multimeter.
- 1.5 Check the condition of the disconnect switch if the heater is so equipped. Measure continuity through the disconnect by engaging the switch.
- 1.6 Verify that there is a jumper wire present between terminals 5 and 6 on the terminal block located in the control box.

2.0 Contactor is chattering
- 2.1 Check supply voltage.
- 2.2 Check wiring connections. Tighten all loose electrical connections.
- 2.3 Check thermostat for continuity (See 1.4). If thermostat does not break continuity replace thermostat.

3.0 Contactor is burned or welded
- 3.1 Check the contactor for burn marks and blackening. Replace the contactor.
- 3.2 Check incoming power to the heater to ensure there are no voltage fluctuations.

4.0 Heat exchanger is dirty
- 4.1 Clean the heat exchanger using compressed air.

5.0. PRV has released
- 5.1 If there are signs that the PRV has released fluid, PRV indicator is broken, blackening around the PRV exit hole, or there are fluid stains visible on the top louver, shut the unit down immediately.
- 5.2 Check for restricted air flow, bad motor, broken thermostat or malfunctioned high limit.

6.0 Heater is cold on top and warm on bottom
- 6.1 The core may have lost its vacuum. Check the PRV for signs of loss of fluid and verify that the PRV label indicator is not broken. If PRV has released, send the unit in for repair or replace the core.
- 6.2 If the PRV does not indicate loss of fluid, the heater should operate normally. Check for loss of fluid on a weekly basis as a minimum.
- 6.3 The ambient temperature may be too low. If the ambient temperature is very cold the top of the core will be colder than the bottom – this is normal.

7.0 Unit cycles on high limit – unit turns on and turns off within less than 5 minutes.
- 7.1 Check and see if the PRV has released fluid. Core may have lost most or all of its fluid. If PRV has released, send the unit in for repair or replace core.
- 7.2 The core may be dirty, fan may not be working or may be turning the wrong way (the fan must rotate clockwise as seen from the front of the unit) objects may be stuck in the heat exchanger for drying or warming up – remove any items from the exchanger.

8.0 The Ground Fault Interrupter (GFI) trips on the main panel, or heater blows fuses.
- 8.1 Check that you have a fuse of the proper amperage rating.
- 8.2 Check for loose or frayed wiring.
- 8.3 If condition is not observable, send heater in for repair.
- 8.4 Change sensitivity of GFI.

9.0 The fan is turning but very little air comes from the front of the heater.
- 9.1 Check fan rotation and ensure that the fan turns clockwise as seen from the front of the heater. Refer to the Installation section below for more information.
- 9.2 Check motor winding resistance and verify that they are balanced.
- 9.3 Check fan blade set screws to ensure fan blade is not loose on the motor shaft.

INSTALLATION

The installation instructions provide a general guideline for the installation and wiring of the heater.
All applicable codes must be adhered to.

MECHANICAL

LOCATION

For optimum heating, the heater should be installed as follows:

1. There are no obstructions that may impede the heater's air inlet or discharge.
2. The air discharge is directed into open areas and not at occupants.
3. The air discharge is not directed at a thermostat.
4. The air discharge is directed across areas of heat loss, such as doors and windows (see Figure 2).
5. The air discharge is directed along and at a slight angle toward exterior walls (see Figure 2).
6. If equipment freeze protection is important, direct air discharge at equipment.
7. Air discharge streams support each other and create a circular air flow. It is not required that the heater's air throw reaches the next heater (see Figure 2).

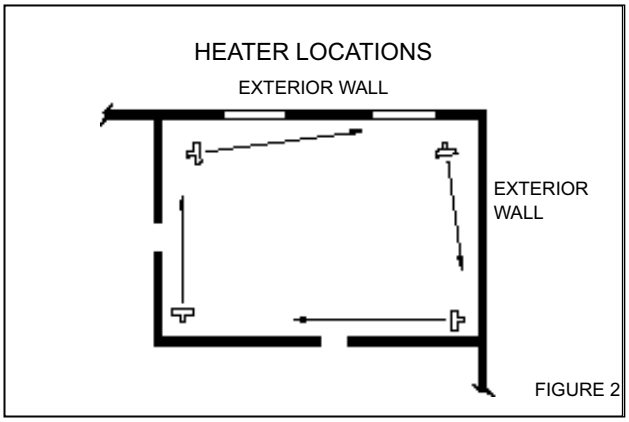
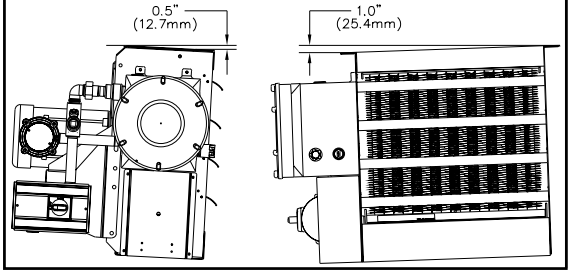
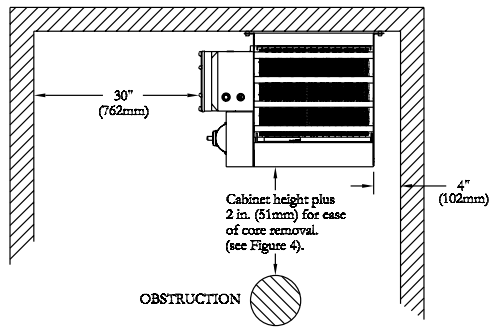


FIGURE 2

FIGURE 3 MAXIMUM TILT ANGLES (EITHER DIRECTION)



MINIMUM INSTALLATION CLEARANCES
(MUST BE MAINTAINED FOR SERVICE AND AIR FLOW)



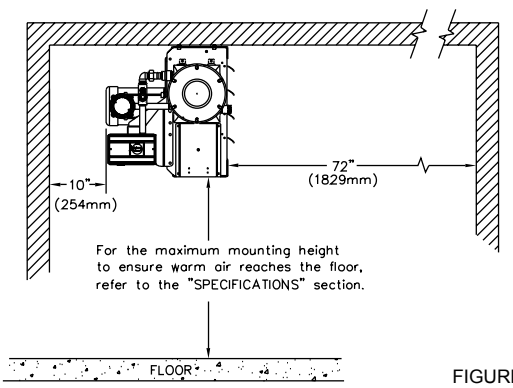


FIGURE 4

MOUNTING

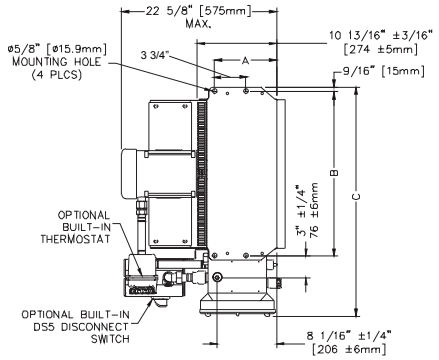
1. The heater must be permanently mounted in a level, upright position for operation. See Figures 3, 4, and 5 for maximum tilt angles, installation clearances, and physical dimensions. For ease of installation, a variety of mounting kits are available from the factory.

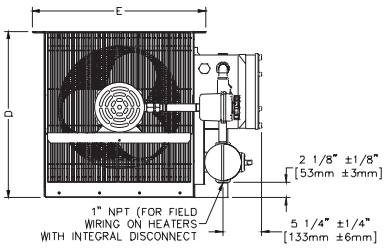
2. The mounting structure must be strong enough to:

   a. support the heater's weight, refer to the "Specifications" section,
   b. provide sufficient stiffness to prevent excessive vibration, and
   c. withstand harsh situations such as transportable installations.

DIM. \ kW		2.5–10	12.5–20	20.9–35	DIM. TOL. ±
A	in.	7.75	7.75	7.75	1/8
	mm	198	198	198	3
B	in.	18–3/16	22–5/16	26–1/4	1/8
	mm	462	566	667	3
C	in.	27	31	35	3/16
	mm	686	787	889	4
D	in.	18–1/2	22–1/2	26–1/2	1/8
	mm	470	572	674	3
E	in.	19–7/16	23–7/16	27–7/16	3/8
	mm	494	596	697	10
F	in.	17–1/2	19–1/2	21–13/16	5/16
	mm	444	495	554	8

DIMENSIONAL TOLERANCES ±1/8" [±3mm] UNLESS OTHERWISE SPECIFIED.





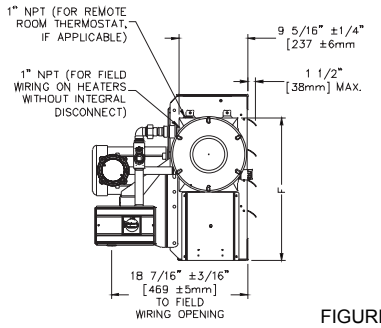


FIGURE 5

ELECTRICAL

WARNING

Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application. IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application. Installation and wiring of the heater must adhere to all application codes.

GENERAL

1. Use only copper conductors and approved explosion-proof wiring methods during installation. Refer to the "Technical Data" table and heater data plate for conductor rating.
2. External overcurrent protection is required. Refer to the "Technical Data" table and heater data plate for voltage, frequency amperage, and phase. Supply voltage is to be within 10% of the data plate voltage.
3. The heater must be installed by qualified personnel in strict compliance with electrical codes.
4. All heaters come factory prewired and ready for direct connection to the power supply leads.
5. The heater must be individually fused, preferably with Class J time-delay fuses for maximum safety. Unless stated otherwise in your local code, fuse size shall be 125% of line current or next size larger.

FIELD WIRING

1. The supply conductors, ground conductor, and room thermostat conductors (see point 2, page 5) all pass through the 1" NPT opening (see Figure 6) and are to be wired into the control enclosure (see Figure 7A).
2. Heater may be supplied with a factory installed built-in room thermostat (see Figure 8). On heaters not supplied with this option, it is recommended that a remote room thermostat be used. Connect the remote room thermostat conductors to the printed circuit board terminal block marked "TSTAT".
   Any thermostat used with this heater must:
   a. be of an explosion-proof type,
   b. be rated 125 V minimum,
   c. have a minimum 2 amp capacity, and
   d. open on temperature rise.

3. Heater may be supplied with a factory installed built-in integral disconnect. (See Figure 7B)

   Field Wiring for Integral Disconnect:

   a. Power Supply conductors and Ground conductor pass through 1"NPT opening of Disconnect Enclosure (see Figure 7B). Supply conductors to be wired to Disconnect Switch inside. Ground conductor to be wired to Ground Lug fastened to inside of Disconnect Enclosure.

   b. If applicable, Remote Room Thermostat conductors pass through 3/4"NPT opening (see Figure 7b) and are to be wired to printed circuit board terminals marked “T’STAT”.

   c. To reduce risk of ignition of hazardous atmospheres, conduit runs must have a sealing fitting connected within 18 inches (457 mm).

   Factory installed conduits require no further sealing. Integral Disconnect is sealed at factory.

4. The internal grounding terminal in the control enclosure (or in the integral disconnect enclosure when this option is provided) shall be used as the equipment grounding means. An external bonding terminal is provided for a supplementary bonding connection where local authorities permit or require such a connection.

FINAL INSPECTION

1. Before application of electrical power:

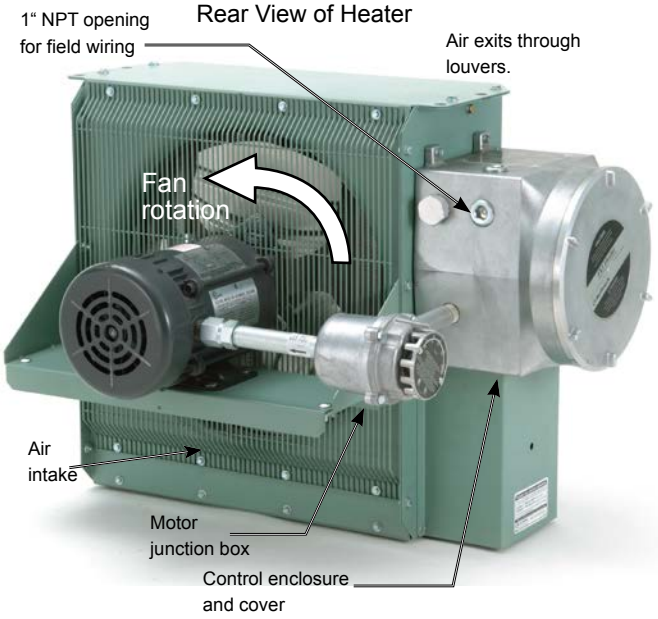
   a. Check that all connections are secured and comply with the applicable wiring diagram (see Figure 9) and code requirements,

   b. Confirm that the power supply is compatible with the data plate rating of the heater,

   c. Remove any foreign objects from the heater,

   d. Install all covers and verify that all enclosures are well secured, and

   e. Ensure that the fan rotates freely. See Figure 6 for proper direction of fan rotation.



Do not install conduit below heater (see Figure 3).

FIGURE 6

Control Enclosure & Field Wiring

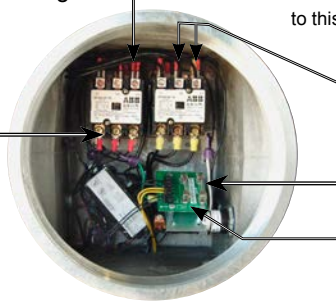


FIGURE 7A



FIGURE 8

Optional Built-in Disconnect & Field Wiring

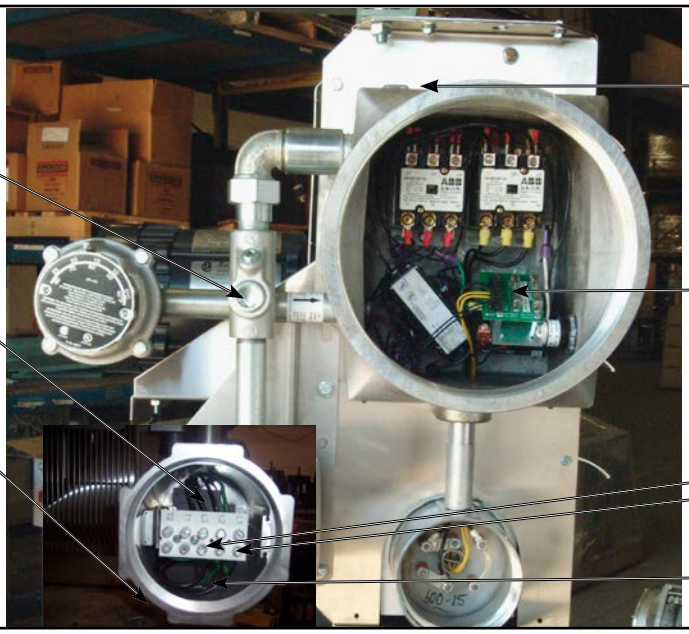
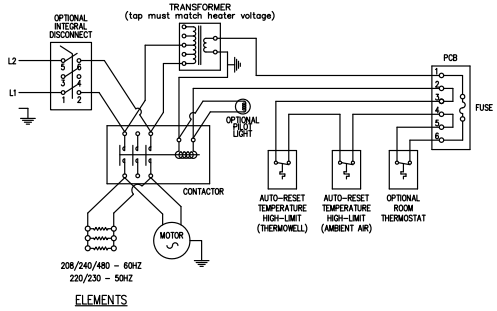
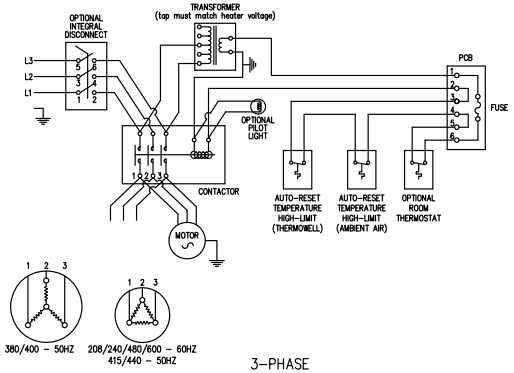


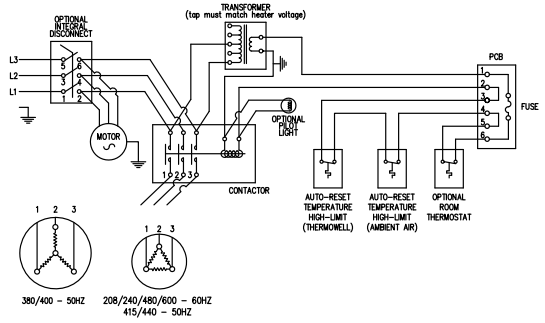
FIGURE 7B



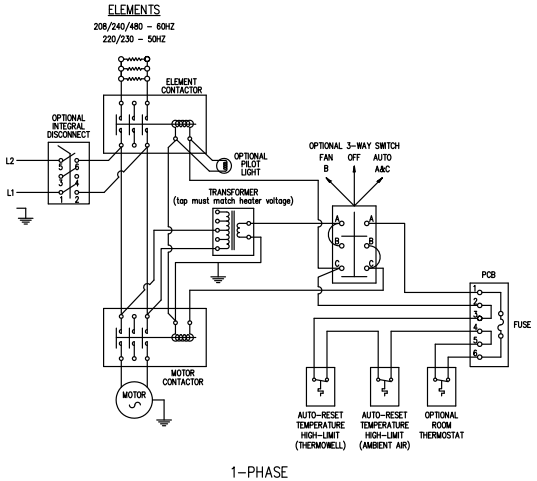
1-PHASE
WIRING SCHEMATIC



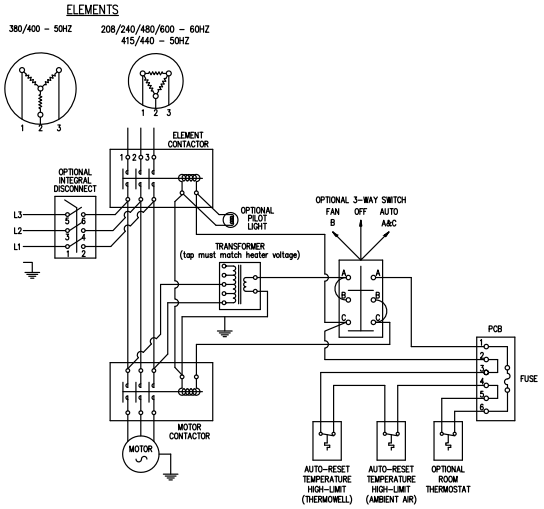
3-PHASE
WIRING SCHEMATIC



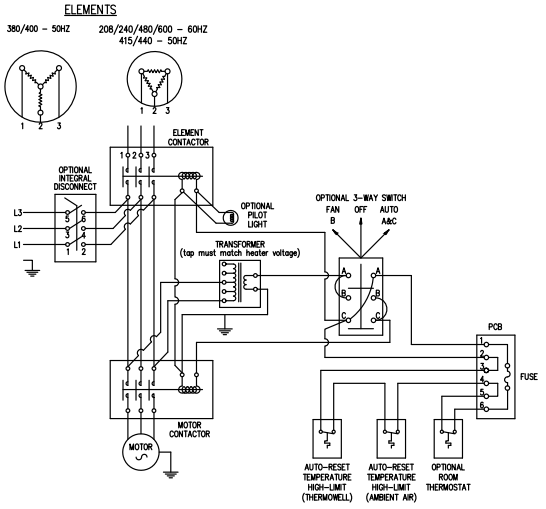
3-PHASE
WIRING SCHEMATIC
CONTINUOUS FAN OPTION



1-PHASE
WIRING SCHEMATIC
W/OPTIONAL PILOT LIGHT AND 3-WAY SWITCH



3-PHASE
WIRING SCHEMATIC
3-WAY SWITCH



3-PHASE
WIRING SCHEMATIC
3-WAY SWITCH AND CONTINUOUS FAN OPTION

FIGURE 9

FX5 TECHNICAL DATA FOR 60 HZ ELECTRIC HEATERS

Model	Note	Voltage	Nominal Wattage	Phase	Max. Motor Nameplate Current	Heater Wattage	Total Current	Minimum Circuit Ampacity	Supply Wire	Maximum Fuse Size	Temperature Rise		Core Kit Part Number	Contactor Part Number
		(V)	(kW)			(W)	(A)	(A)	(AWG)	(A)	°F	°C		
FX5-208160-030		208	3.0	1	2.7	2700	14.4	18.0	12	20	19.0	10.5	12116	10557
FX5-208160-050		208	5.0	1	2.7	4700	24.0	30.0	10	30	31.6	17.6	12117	10557
FX5-208160-075		208	7.5	1	2.7	7200	36.1	45.1	6	50	27.9	15.5	12118	10557
FX5-208160-100	*	208	10.0	1	2.7	9690	48.1	60.1	4	70	37.2	20.7	12119	10558
FX5-208360-030		208	3.0	3	1.4	2700	8.3	10.4	14	15	11.2	6.2	12116	10557
FX5-208360-050		208	5.0	3	1.4	4700	13.9	17.4	12	20	18.6	10.3	12117	10557
FX5-208360-075		208	7.5	3	1.4	7200	20.8	26.0	10	30	27.9	15.5	12118	10557
FX5-208360-100		208	10.0	3	1.4	9700	27.8	34.8	8	35	37.2	20.7	12119	10557
FX5-208360-150		208	15	3	1.4	14400	41.6	52.0	6	60	27.1	15.1	12120	10557
FX5-240160-030		240	3.0	1	2.7	2700	12.5	15.6	12	20	19.0	10.5	12122	10557
FX5-240160-050		240	5.0	1	2.7	4700	20.8	26.0	10	30	31.6	17.6	12123	10557
FX5-240160-075		240	7.5	1	2.7	7200	31.3	39.1	8	40	27.9	15.5	12124	10557
FX5-240160-100		240	10.0	1	2.7	9700	41.7	52.1	6	60	37.2	20.7	12125	10557
FX5-240160-150	*	240	15.0	1	1.4	14400	62.5	78.1	2	80	27.1	15.1	12126	10558
FX5-240360-030		240	3.0	3	1.4	2700	7.2	9.0	14	15	19.0	10.5	12122	10557
FX5-240360-050		240	5.0	3	1.4	4700	12.0	15.0	14	15	31.6	17.6	12123	10557
FX5-240360-075		240	7.5	3	1.4	7200	18.0	22.5	10	25	27.9	15.5	12124	10557
FX5-240360-100		240	10.0	3	1.4	9700	24.1	30.1	8	35	37.2	20.7	12125	10557
FX5-240360-150		240	15.0	3	1.4	14400	36.1	45.1	6	50	27.1	15.1	12126	10557
FX5-240360-200	*	240	20.0	3	1.4	19400	48.1	60.1	4	70	36.1	20.1	12127	10558
FX5-480160-030	°	480	3.0	1	1.3	2700	6.3	7.9	14	15	19.0	10.5	12129	10557
FX5-480160-050	°	480	5.0	1	1.3	4700	10.4	13.0	14	15	31.6	17.6	12130	10557
FX5-480160-075	°	480	7.5	1	1.3	7200	15.6	19.5	12	20	27.9	15.5	12131	10557
FX5-480160-100	°	480	10.0	1	1.3	9700	20.8	26.0	10	30	37.2	20.7	12132	10557
FX5-480160-150	°	480	15.0	1	1.3	14400	31.3	39.1	8	40	27.1	15.1	12133	10557
FX5-480160-200	°	480	20.0	1	1.3	19400	41.7	52.1	6	60	36.1	20.1	12134	10557
FX5-480360-030		480	3.0	3	0.7	2700	3.6	4.5	14	15	19.0	10.5	12129	10557
FX5-480360-050		480	5.0	3	0.7	4700	6.0	7.5	14	15	31.6	17.6	12130	10557
FX5-480360-075		480	7.5	3	0.7	7200	9.0	11.3	14	15	27.9	15.5	12131	10557
FX5-480360-100		480	10.0	3	0.7	9700	12.0	15.0	14	15	37.2	20.7	12134	10557
FX5-480360-150		480	15.0	3	0.7	14400	18.0	22.5	10	25	27.1	15.1	12133	10557
FX5-480360-200		480	20.0	3	0.7	19400	24.1	30.1	8	35	36.1	20.1	12134	10557
FX5-480360-250		480	25.0	3	1.0	24200	30.1	37.6	8	40	22.0	12.2	12135	10557
FX5-480360-300		480	30.0	3	1.0	29200	36.1	45.1	6	50	26.4	14.6	12136	10557
FX5-480360-350		480	35.0	3	1.0	34200	42.1	52.6	6	60	30.7	17.1	12137	10557
FX5-600360-030		600	3.0	3	0.6	2700	2.9	3.6	14	15	19.0	10.5	12138	10557
FX5-600360-050		600	5.0	3	0.6	4700	4.8	6.0	14	15	31.6	17.6	12139	10557
FX5-600360-075		600	7.5	3	0.6	7200	7.2	9.0	14	15	27.9	15.5	12140	10557
FX5-600360-100		600	10.0	3	0.6	9700	9.6	12.0	14	15	18.1	20.7	12141	10557
FX5-600360-150		600	15.0	3	0.6	14400	14.4	18.0	12	20	27.1	15.1	12142	10557
FX5-600360-200		600	20.0	3	0.6	19400	19.2	24.0	10	25	36.1	20.1	12143	10557
FX5-600360-250		600	25.0	3	0.8	24200	24.1	30.1	8	35	45.2	25.1	12144	10557
FX5-600360-300		600	30.0	3	0.8	29200	28.9	36.1	8	40	26.4	14.6	12145	10557
FX5-600360-350		600	35.0	3	0.8	34200	33.7	42.1	8	45	30.7	17.1	12126	10557

NOTES:

* Exceeds the 48 Amp Curcuit limit of NEC 424-22. DS5 not available for these units.

° 480 - 1 phase units are certified Class I, Div. 1, Group D and Class II, Div. 1 Groups F & G.

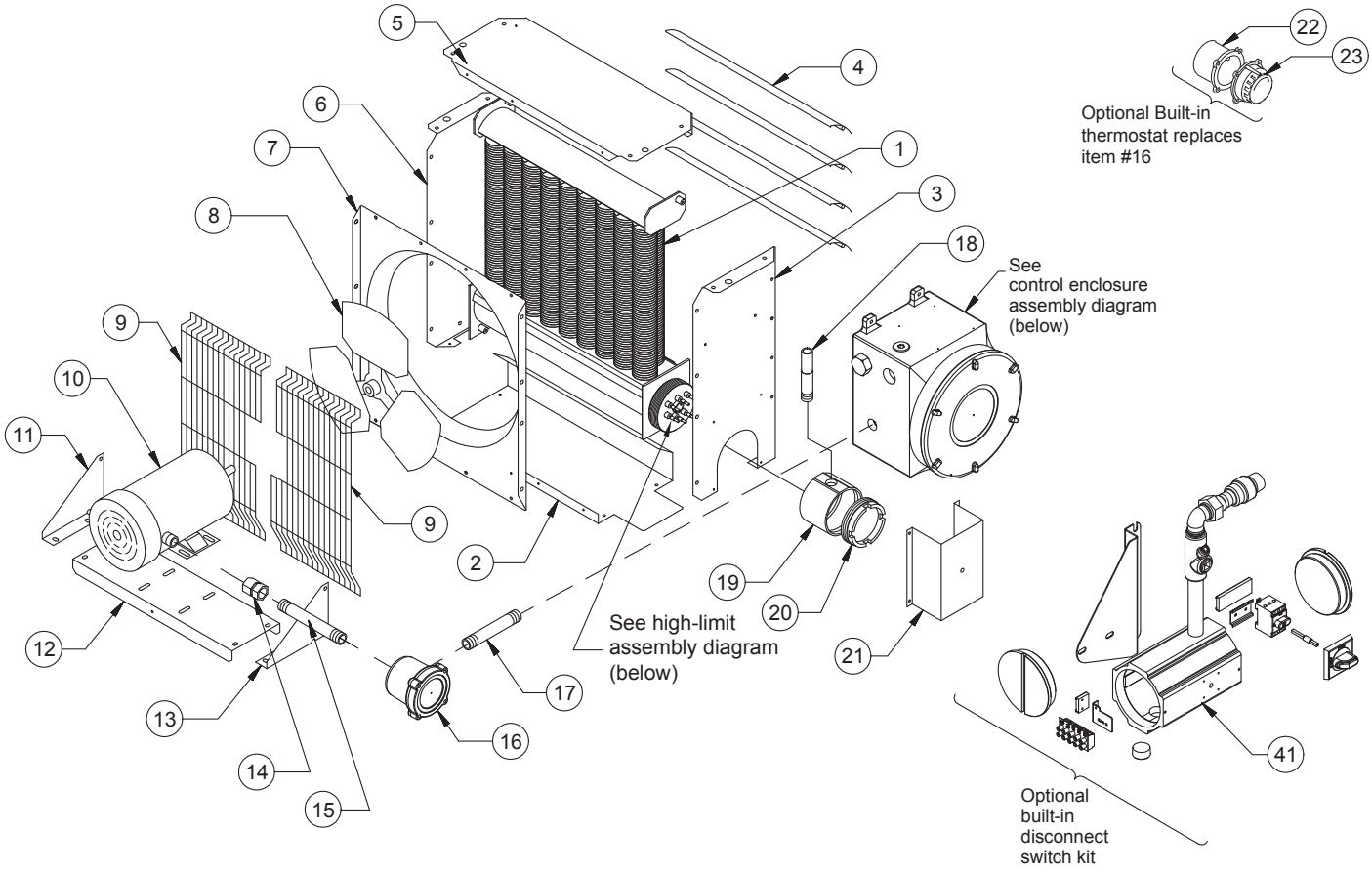
1. Minimum conductor size for 86˚F (30˚C) ambient. Derate conductor for ambient temperature. Use minimum 194˚F (90˚C) insulation.
2. Heater is functioning normally if at rated voltage the amp draw is within 10% of the value in this table.
3. Operation at lower voltages will result in reduced heat output and amp draw
4. Add "T" to model number when adding a built-in thermostat
5. Add "D" to model number when adding a built-in disconnect switch
6. Add "P" to model number when adding a built-in pilot light
7. Add "S" to model number when adding a 3-way switch
8. Add "H" to model number for units with high "off" (deenergized) ambient temperatures
9. Add "U" to model number for units with continuous fan option.
10. Add "A" to model number for units with stainless steel cabinet.

SPECIFICATIONS FOR ALL 60 HZ MODEL

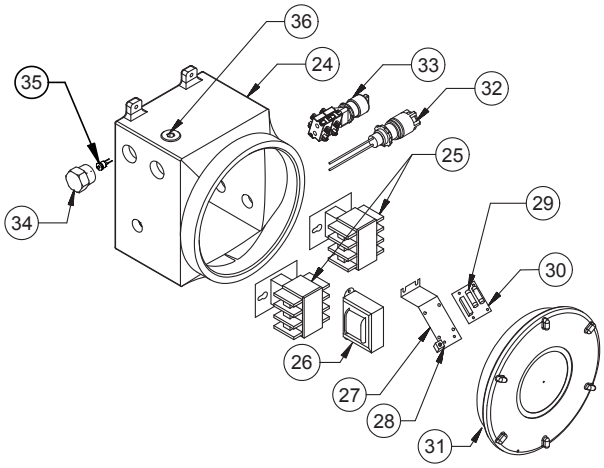
		Nominal kW	3	5	7.5	10	15	20	25	30	35
Max. Altitude		(ft.)	12,000	8,000	10,000	7,000	10,000	7,000	10,000	7,000	6,000
		(m)	3,658	2,438	3,048	2,134	3,048	2,134	3,048	2,134	1,829
Air Flow	@ 70°F	(CFM)	500		850		1750		3600		
	@ 21°C	(m^3/hr.)	850		1444		2973		6116		
Horizontal Air Throw		(ft.)	15		30		40		70		
		(m)	4.6		9.1		12.2		21.3		
Max. Mounting Height		(ft.)	7		10		10		20		
(to underside)		(m)	2.1		3.0		3.0		6.1		
Motor Power		(HP)	1/2				1/2		1/2		
(min)		(kW)	0.373				0.373		0.373		
Fan Diameter		(in.)	12				16		20		
		(mm)	305				406		508		
Net Weight	without DS5	(lbs.)	140				168		201		
		(kg)	63.5				76.2		91.2		
	with DS5	(lbs.)	152				180		213		
		(kg)	78.9				81.6		96.6		
Shipping Weight	without DS5	(lbs.)	194				218		252		
		(kg)	88				98.9		114.3		
	with DS5	(lbs.)	206				230		264		
		(kg)	93.4				104.3		119.7		

Hazardous Location Rating	Class I, Groups C and D; Class II, Groups E, F and G; Temperature Code T3B [329°F (165°C)]
Enclosures	NEMA Type 7 & 9. For dry, indoor use only. Do not immerse in water. Do not store or use in areas exposed to rain or snow
Motor Type	Explosion-proof. Thermally protected. Permanently lubricated ball bearings. 1725 RPM
Fan	Aluminum blade. Steel spider and hub with 5/8 in. (15.875 mm) bore
Fan Guard	Split design with close wire spacing. 1/4 in. (6.3 mm) dia. probe will not enter
Mounting Holes	Four 9/16 in. (14.3 mm) diameter holes at top of heater
Heating Elements	Three long-life, low watt-density, high grade metal-sheathed elements
Temperature High-Limit	Automatic reset type, snap-action bimetal, open on temperature rise. Rated 100,000 cycles at 10 amps, handles 0.128 amps
Control Circuit	120 Volts, 0.128 amps, 15VA. (Grounded)
Optional Built-in Thermostat	Explosion-proof. 36°F to 82°F (2°C to 28°C)
Optional Built-in Disconnect Switch	DS5 for use only on heaters with total current not exceeding 48-Amps. Lockout handle accepts 1/4” diameter padlock shackle
Optional Three Way Switch	Fan only, Off, Auto
Optional Pilot Light	Indicates heat-on cycle
Control Transformer	Multi-tap primary, 120 V secondary, 50 VA
Contactor	60 or 80 amp. Rated for 1,000,000 mechanical operations. 120 Volts, 15VA coil (separately fuse-protected)
Heat Transfer Fluid	Long life formulated propylene glycol and water
Cabinet Material	14 ga. (0.075 in.) (1.90 mm) steel. Epoxy coated with five-stage pretreatment, including iron phosphate. Optional stainless steel
Core	Steel with integral aluminum fins, vacuum charged and hermetically sealed
Conduit Material	Heavy walled, 0.122 in. (3.1 mm) steel
Overpressure Protection	Preset 100 psig (690 kPa) pressure relief valve, aluminum body, no field serviceable parts
Operational Temperature Limitations	-4°F to 104°F (-20°C to 40°C)
Storage Limitations	-49°F to 176°F (-45°C to 80°C), short term to 248°F (120°C). Do not immerse in water Do not expose to rain or snow

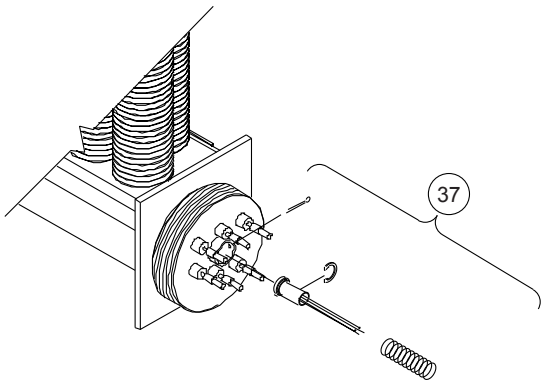
HEATER ASSEMBLY DIAGRAM



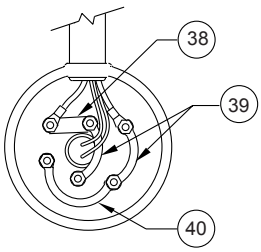
CONTROL ENCLOSURE
ASSEMBLY DIAGRAM



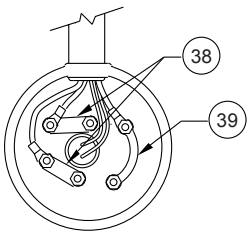
HIGH LIMIT
ASSEMBLY DIAGRAM



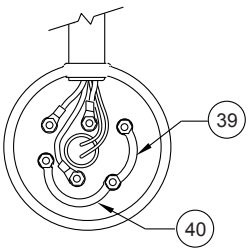
BUS-BAR CONFIGURATION
ALL 1-PHASE MODELS



BUS-BAR CONFIGURATION
FOR ALL 3-PHASE
(EXCEPT 380 50 HERTZ & 400 50 HERTZ)



BUS-BAR CONFIGURATION
FOR ALL 3-PHASE 380 V & 400 V 50 HERTZ MODELS



PARTS LIST

FORCED AIR ELECTRIC HEATERS

	PART NUMBERS			Please have model and serial number available before calling	
ITEM	**2.5 - 4.6 kW**	**6.3 - 10 kW**	**12.5 - 20 kW**	**20.9 - 35 kW**	**Description**
1	**	**	**	**	Core
2	Painted: 9203 S.S.: 9507		Painted: 9204 S.S.: 9508	Painted: 9205 S.S.: 9509	Panel, Bottom
3	Painted: 9191 S.S.: 9192		Painted: 9193 S.S.: 9194	Painted: 9195 S.S.: 9196	Panel, Left Side
4	4075		4076	4077	Louver Kit, c/w screws
5	Painted: 9200 S.S.: 9513		Painted: 9201 S.S.: 9514	Painted: 9202 S.S.: 9515	Panel, Top
6	Painted: 9197 S.S.: 9510		Painted: 9198 S.S.: 9511	Painted: 9199 S.S.: 9512	Panel, Right
7	Painted: 3782 S.S.: 9212		Painted: 3783 S.S.: 9213	Painted: 3784 S.S.:9214	Panel, Fan Shroud
8	4022	4023	4024	4025	Fan Blade
9	Painted: 4078 S.S.: 9504		Painted: 4079 S.S.: 9505	Painted: 4080 S.S.: 9506	Fan Guard Kit
10	1979 (Emerson)		10388 (Marathon)		208/240V 1PH 60HZ 220V 1PH 50HZ
	9896 (Baldor)			N/A	480V 1PH 60HZ
	1699 (Emerson)		10387 (Marathon)		208/240/480V 3PH 60HZ 380/415V 3PH 50HZ
	2433 (Emerson)		10672 (Marathon)		600V 3PH 60HZ
11	Painted: 3789 S.S.: 9112		Painted: 3789 S.S.: 9112	Painted: 3789 S.S.: 9112	Bracket, Motor Mount Right
12	Painted: 3785 S.S.: 9206		Painted: 3786 S.S.: 9207	Painted: 3787 S.S.: 9208	Channel, Motor Mount
13	Painted: 3788 S.S.: 9111		Painted: 3788 S.S.: 9111	Painted: 3788 S.S.: 9111	Bracket, Motor Mount Left
14	3737 (Emerson Motors)		4590 (Baldor & Marathon Motors)		Coupling, Motor
15	9500		3813	10389	Conduit, Motor
16	5371		5371	5371	Cover, Thermostat Enclosure
17	3813		3813	3813	Conduit, Control Enclosure
18	9314		9315	9316	Conduit, Element Enclosure
19	9679		9679	9679	Enclosure, Element
20	3510		3510	3510	Cover, Element Enclosure
21	Painted: 9354 S.S.: 9516		Painted: 9355 S.S.: 9517	Painted: 9356 S.S.: 9518	Panel, Element Enclosure Guard
22	4983		4983	4983	Enclosure, Thermostat
23	5032		5032	5032	Thermostat, Built-in-kit
24	-		-	-	Enclosure, Control
25	**		**	**	Contactor
26	10556 (60HZ)		11295 (50HZ)		Transformer
27	3809	3809	3809	3809	Bracket, Printed Circuit Board
28	1876	1876	1876	1876	Terminal, 6-14 Ga. Screw Lug
29	9357	9357	9357	9357	Fuse, Buss MDQ - 1/2 Amp
30	3514	3514	3514	3514	Assembly, Printed Circuit Board
31	9158	9158	9158	9158	Cover, Control Enclosure
32	9279	9279	9279	9279	Bulb, Pilot Light
33	9775	9775	9775	9775	Switch, Explosion Proof 3-Way
34	9267	9267	9267	9267	Thermowell, Ambient High-Limit
35	-	-	-	-	High Limit, Ambient Temperature
36	9289	9289	9289	9289	Plug, 1" NPT Explosion Proof
37	-	-	-	-	Temperature High-Limit Kit
38	Provided with Core Kits**				Bus-Bar, Straight
39					Bus-Bar, Small Curved
40					Bus-Bar, Large Curved
41	-	-	-	-	Kit, DS5 Assembly
**See technical data table for part numbers. NOTE: For items not shown, please contact factory.					

REPAIR & REPLACEMENT

WARNING
Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application. IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application. Heater surfaces may be hot.

1. After repairing any component:
   a. check that electrical connections are correct and secure (see Figure 9),
   b. remove any foreign material from enclosures,
   c. install and secure all covers,
   d. ensure that all fasteners are tight,
   e. remove all foreign objects from heater, and
   f. ensure air exits through louvers and fan rotates counterclockwise when viewed from rear of heater (see Figure 14).

CORE

The heater core is vacuum charged and not field repairable.
For core removal:

1. Remove cabinet bottom and element enclosure cover.
2. Disconnect all wires entering element enclosure (see Figure 10).
3. Slightly loosen all cabinet bolts shown in Figure 10, to prevent the core from binding.
4. With an assistant supporting the weight of the core, remove the 3 core mounting bolts. Carefully lower the core out of the cabinet (see Figure 11).
5. To return core to factory, use crate supplied with exchange core to protect the element terminals and plate threads.
6. To reinstall, lift the core up into cabinet while an assistant guides the element wires into the element enclosure conduit.
7. Position the core and tighten the 3 core mounting bolts. Tighten the remaining cabinet bolts.

TEMPERATURE HIGH-LIMIT

1. Remove temperature high-limit assembly and clean the inside of the thermowell (see Figure 12). A clean thermowell will ensure good thermal contact.
2. Use only a factory supplied temperature high-limit to ensure safe operation. (refer to the instructions that accompany the replacement Temperature High-Limit Kit).
3. Reinstall the temperature high-limit assembly with the snap ring and spring into the thermowell without damaging the insulating tube. Secure in place with the cotter pin (see Figure 13).

MOTOR, FAN & FAN GUARD

1. Remove bolts holding the motor to the motor mount. On units with a built in thermostat, remove the bolts on the back of the thermostat enclosure.
2. Remove conduit #1 located between motor junction box and control enclosure by turning it in the direction illustrated (see Figure 14). Note conduits #1 and #2 are not interchangeable and have left hand threads on one end, this end is indicated by a machined groove.
3. Remove the 2 piece fan guard assembly (see Figure 15).
4. Lift the motor assembly off the motor mount.
5. Before removing the fan, measure and record the location of the fan hub on the motor shaft (see Figure 16). If difficult to remove, use a gear puller on the fan hub.
6. To reassemble, place motor assembly onto motor mount and fasten the fan guard to cabinet.
7. Simultaneously engage and tighten both ends of conduit #1 into enclosures. Leave a 1/16" to 3/16" (1.6 to 4.8 mm) gap between the motor and fan guard (see Figure 16). Adjust conduit #2 to center the fan in the shroud.
8. To ensure a minimum 5 thread engagement, threaded ends of conduits must protrude a minimum of 1/16" (1.6mm) into enclosures. The groove on conduit #2 must not be more than 7/8" (22mm) from motor coupling (see Figure 14).
9. Bolt motor to motor mount. Manually spin the fan blade to ensure fan rotates freely.
10. Air must exit through louvers and fan must rotate counterclockwise when viewed from rear of heater (see Figure 14).

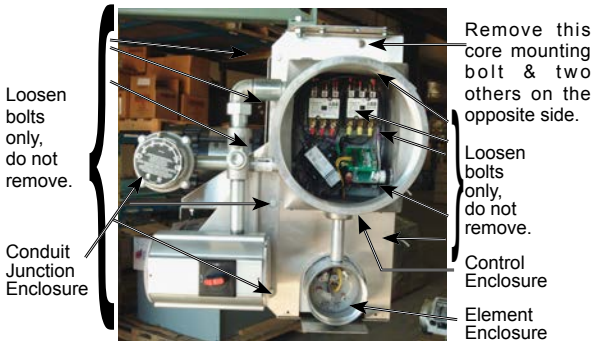


FIGURE 10


FIGURE 11



FIGURE 12


FIGURE 13

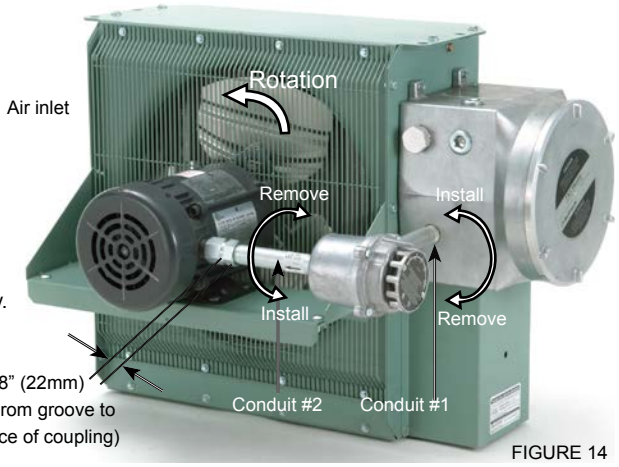


FIGURE 14


FIGURE 15


FIGURE 16

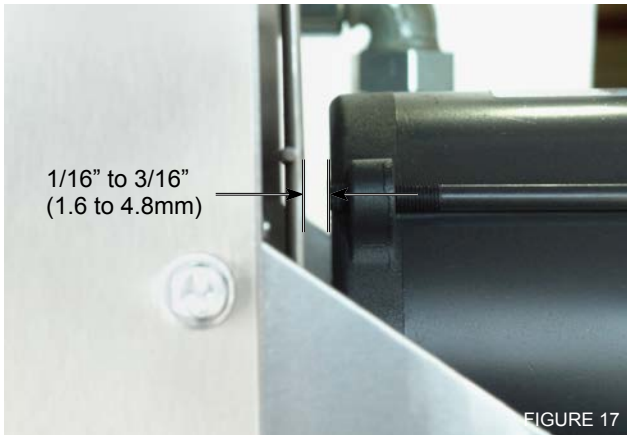
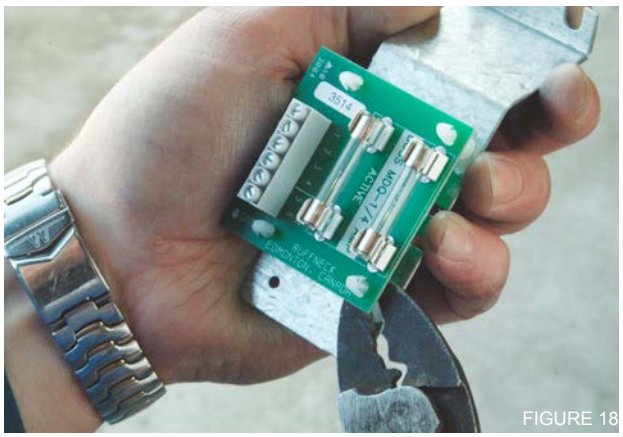


FIGURE 17


FIGURE 18

PRINTED CIRCUIT BOARD

1. After removing the printed circuit board (P.C. Board) bracket assembly from the control enclosure, separate the P.C. Board from the bracket by cutting off the plastic spacers (see Figure 18).
2. Reinstall a new factory supplied P.C. Board onto the mounting bracket using new non-conducting spacers of the same length. Spacers are supplied with a new P.C. Board. Reinstall the control circuit ground wire to the printed circuit board bracket (see Figure 9).

CONTACTOR

1. Loosen, but do not remove contactor mounting screws. Slide contactor off mounting screws.
2. Replace with a factory supplied contactor of the same rating.

TRANSFORMER

1. Replace with a factory supplied transformer of the same rating.
2. On the new transformer, select primary wires to match heater voltage. Ensure that the correct transformer secondary lead is grounded (see Figure 9). Individually terminate all unused wires using closed end connectors.

FUSE

Replace fuse with one of the same type and rating as indicated on P.C. Board or refer to parts list. An extra fuse should be stored in the clips marked “SPARE”.

HEATING ELEMENTS

Heating elements are an integral part of the vacuum charged core. A factory exchange core can be shipped immediately from stock. Refer to “Core” section for details.

CABINET PANELS

Bolt-on cabinet panels are individually replaceable.



Ruffneck™
Heaters for the Harshest Environments
5918 Roper Road, Edmonton, Alberta, Canada T6B 3E1
Phone: (780) 466-3178 Fax: (780) 468-5904

PLEASE ADHERE TO INSTRUCTIONS PUBLISHED IN THIS MANUAL.
Failure to do so may be dangerous and may void certain provisions of your warranty.
For further assistance, please call:

24 Hr. Hotline: 1-800-661-8529

(U.S.A. and Canada)

Please have model and serial numbers available before calling.

WARRANTY: Under normal use the Company warrants to the purchaser that defects in material or workmanship will be repaired or replaced without charge for a period of 36 months from date of shipment. Any claim for warranty must be reported to the sales office where the product was purchased for authorized repair or replacement within the terms of this warranty.

Subject to State or Provincial law to the contrary, the Company will not be responsible for any expense for installation, removal from service, transportation, or damages of any type whatsoever, including damages arising from lack of use, business interruptions, or incidental or consequential damages.

The Company cannot anticipate or control the conditions of product usage and therefore accepts no responsibility for the safe application and suitability of its products when used alone or in combination with other products. Tests for the safe application and suitability of the products are the sole responsibility of the user.

This warranty will be void if, in the judgment of the Company, the damage, failure or defect is the result of:

- vibration, radiation, erosion, corrosion, process contamination, abnormal process conditions, temperature and pressures, unusual surges or pulsation, fouling, ordinary wear and tear, lack of maintenance, incorrectly applied utilities such as voltage, air, gas, water, and others or any combination of the aforementioned causes not specifically allowed for in the design conditions or
- any act or omission by the Purchaser, its agents, servants or independent contractors which for greater certainty, but not so as to limit the generality of the foregoing, includes physical, chemical or mechanical abuse, accident, improper installation of the product, improper storage and handling of the product, improper application or the misalignment of parts.

No warranty applies to paint finishes except for manufacturing defects apparent within 30 days from the date of installation.

The Company neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with the product(s).

The Purchaser agrees that all warranty work required after the initial commissioning of the product will be provided only if the Company has been paid by the Purchaser in full accordance with the terms and conditions of the contract.

The Purchaser agrees that the Company makes no warranty or guarantee, express, implied or statutory, **(INCLUDING ANY WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE)** written or oral, of the Article or incidental labour, except as is expressed or contained in the agreement herein.

LIABILITY: Technical data contained in the catalog or on the website is subject to change without notice. The Company reserves the right to make dimensional and other design changes as required. The Purchaser acknowledges the Company shall not be obligated to modify those articles manufactured before the formulation of the changes in design or improvements of the products by the Company.

The Company shall not be liable to compensate or indemnify the Purchaser, end user or any other party against any actions, claims, liabilities, injury, loss, loss of use, loss of business, damages, indirect or consequential damages, demands, penalties, fines, expenses (including legal expenses), costs, obligations and causes of action of any kind arising wholly or partly from negligence or omission of the user or the misuse, incorrect application, unsafe application, incorrect storage and handling, incorrect installation, lack of maintenance, improper maintenance or improper operation of products furnished by the Company.

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(780) 466-3178	(905) 829-4422	(705) 325-3473	(812) 663-4141	(281) 506-2310	(303) 979-7339
F 780-468-5904	F 905-829-4430	F 705-325-2106	F 812-663-4202	F 281-506-2316	F 303-979-7350

Agnico Eagle, Baker Lake
Jet-A Tank Farm
Control equipment UPS

Eaton 5110 UPS



Now featuring a 3-year warranty with product registration!

Product Snapshot

Product rating:	350–1500 VA
Voltage	120V and 230V
Frequency:	50 Hz and 60 Hz, auto-sensing
Configuration:	Plug-and-play tower or under monitor
Topology:	Line-interactive

Features

- Protect the integrity of your data and applications by shielding electronic equipment from power outages, surges, sags, brown-outs, and overvoltage conditions
- Save space with a compact design that can be deployed as a tower or under a computer monitor
- Protect loads on eight outlets—four with surge suppression and battery backup, four with surge suppression only
- Deliver consistent, clean output with automatic voltage regulation (AVR) that doesn't drain battery power
- Extend UPS service life with user-replaceable batteries
- Protect networked equipment from "back door" power surges coming through LAN or telephone lines
- Stay informed of power problems and battery conditions with audible alarms and remote alarm notification via e-mail, pager, the Web, or SNMP
- Deliver short-term mobile power with start-on-battery capability
- USB port and cables are standard
- Rest easy with a three-year limited warranty with product registration and a $150,000 load protection guarantee (US and Canada); optional multi-year Gold Plan service is available to provide repair and replacement coverage that goes beyond the provisions of the limited warranty

As much as business depends on electric power, public utility power is anything but dependable. By law, public utilities do not have to supply computer-grade power. That's bad news in an age when sensitive computer systems form the core of virtually all business functions. Advances in processing capacity and miniaturization make these systems more susceptible than ever to power fluctuations—and make system crashes and data losses more costly than ever.

According to National Power Laboratories (NPL) and the Electric Power Research Institute, the typical power customer location can experience an average of 24 power disturbances each month, costing the US economy $119 billion to $188 billion every year.

You don't have to be a part of those statistics. Effective protection is here, at a very attractive price.

The Eaton® 5110 uninterruptible power system (UPS) provides a layer of defense between your equipment and raw utility power. This line-interactive UPS constantly safeguards your systems from power outages, surges, sags, brownouts, and overvoltage conditions—and provides varying degrees of protection from other power problems as well. If utility power is interrupted, even briefly, the 5110 transfers to battery power.

Powering Business Worldwide

Introducing the Eaton 5110 UPS

Affordable protection for small to medium organizations

Incorporating more than 40 years of UPS design experience, the 5110 provides cost-effective power management, backup power, and power quality for office workstations, PBX or key telephone systems, servers, small network nodes, point-of-sale systems, and computer peripheral devices. This UPS is ideal for any small- to mid-sized business or institutional setting where reliable power must be provided at an affordable price.

Automatic voltage regulation (AVR)—clean power without draining the battery

The 5110 uses AVR to smooth out wide fluctuations in input voltage. If input voltage varies as much as 25 percent over or 23 percent under nominal voltage—which can easily happen when running on generator power or in severe environments—the 5110 accepts this inconsistent voltage and delivers clean, consistent output for protected equipment. AVR enables you to work through even the most frequent brownouts and power sags.

Unlike typical line-interactive systems, the 5110 does not switch back and forth to battery power to accomplish this voltage regulation—which would shorten battery life and increase battery replacement costs. As a result, battery power is conserved for when you really need it.

Eight outlets in a low-profile tower

The 5110 occupies a small footprint—about the size of a dictionary for low-power units (500–700 VA), or a sleek tower for higher-rated models (1000–1500 VA). This tower package fits easily under a monitor.

The cost-effective design features eight outlets, four with surge protection and battery backup and four with surge protection only. You can plug less critical equipment, such as printers or monitors, into surge-protection-only outlets that do not drain battery power.

Protection for data lines

Incoming power lines aren't the only source of damaging surges. Power also travels across network links, such as LANs and telephone lines. The 5110 uses an integral network transient protector to safeguard network-connected equipment—such as fax machines, modems, or electronic telephones—from "back door" power surges coming through network or phone wiring.

Short-term power for mobile applications

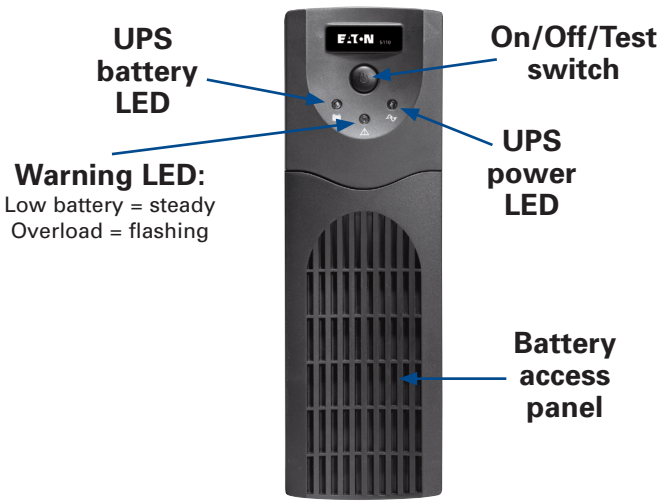
The 5110 supports start-on-battery capability, which means you can unplug the UPS from utility power, then restart and run it from battery power elsewhere. This capability offers tremendous flexibility for short-term powering needs, such as in mobile offices or service vans.

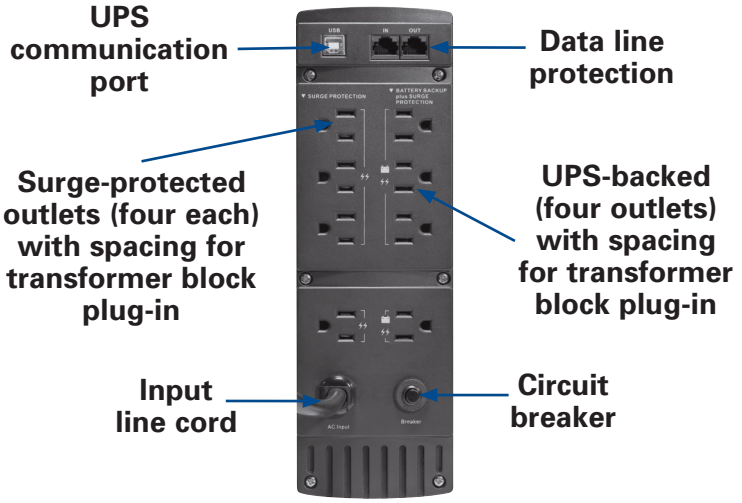
User-replaceable batteries for extended service life

Many UPS products in this range are useful only up to the service life of their batteries. When the battery fails, the unit is worthless. Not so with the 5110. You can replace the batteries yourself—a simple process that can be performed by easy access through the front panel. When the audible alarm indicates that batteries need replacing, you can safely and easily install supplied batteries and remove the old batteries for proper disposal and recycling. You can also choose to return the entire unit for repair or battery replacement under our warranty and service programs.

Easy-to-understand LEDs and audible alarms

You never have to guess about the status and condition of your 5110. Simple LED indicators and audible alarms warn of power problems and low battery conditions. The Battery LED illuminates when the UPS is operating on battery power. The Warning LED turns on when the battery is low and flashes under overload conditions.





The 5110 delivers confidence—confidence that your vital business equipment is protected and confidence that Eaton will be there with you for the long term.

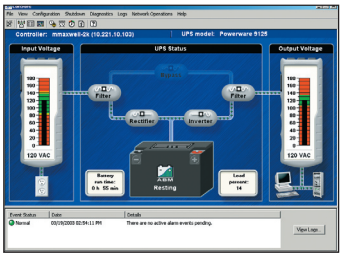
Remote UPS monitoring from anywhere

You don't have to be within sight of the UPS to stay informed. You can connect the 5110 to a network using the built-in USB port, and monitor its working status. The UPS comes with Eaton LanSafe® software, free of charge. This UPS management software gives you control and visibility over all your UPSs, using an intuitive, graphical interface.

Warranty coverage with load protection guarantee

Rest easy with industry-leading protection from Eaton. The 5110 is backed by a two-year limited warranty and a $150,000 load protection guarantee. We're that confident of the performance and reliability of the 5110.

To find out more about how the 5110 can protect your critical equipment, applications, and data:
www.eaton.com/powerquality
800-356-5794



5110 technical specifications[1]

OPERATION	
Input voltage range	0–160Vac/0–300Vac
Output voltage range	Nominal -23% to +25%
On battery output voltage	Nominal -12% to +10%
Frequency	50/60 Hz auto sensing
Lighting / surge protection	120V models 320 joules; 230V models 476 joules
Safety	UL 1778, designed to meet UL497A, CAN/CSAOC22.2 No107.1/IEC 62040-1-1: CE low voltage directive
EMI	FCC Class B/IEC 62040-2, EN55022: Class B: CE EMC directive
Transfer time to battery/AC	2-6 msec. typical
Battery type	Sealed, maintenance free lead-acid battery
Typical backup time	Three minutes at full rated load
Internet / phone / fax protection	RJ11/RJ45
Short circuit protection	Circuit breaker
Communication port	USB

ENVIRONMENTAL	
Operation temperature	0°C ~ 40°C
Operation relative humidity	0 to 95% non-condensing
Storage temperature	-15°C ~ 50°C

SOFTWARE
LanSafe software is included free of charge

SERVICE PLANS		
PRODUCT	**LENGTH OF SERVICE**	**GOLD PLAN PART NUMBER**
5110 500-1500 VA	Three years	3XXGX5100XALLCX
5110 500-1500 VA	Five years	5XXGX5100XALLCX

REPLACEMENT BATTERIES		
MODEL NUMBER	**PART NUMBER**	**DESCRIPTION**
PW5110 500 VA	106711159-001	BATT. KIT 500 VA PW5110
PW5110 700 VA	106711160-001	BATT. KIT 700 VA PW5110
PW 5110 1000 VA	106711161-001	BATT. KIT 1000 VA PW5110
PW5110 1500 VA	106711162-001	BATT. KIT 1500 VA PW5110

1. Specifications are subject to change without notice due to continuing product improvement programs.

5110 NORTH AMERICAN MODELS: 120V, 50/60 Hz

Model	Part Number	Power Out (VA/Watt)	Input Connection	Output Receptacles	Dimensions (H x W x D, inches)	Weight (lb)
PW5110 500	103004256-5591	500/300	1.8m line cord with 90 deg. 5-15P	(8) 5-15R Outlets*	10.6 x 3.4 x 10.2	12.1
PW5110 700	103004257-5591	700/420	1.8m line cord with 90 deg. 5-15P	(8) 5-15R Outlets*	10.6 x 3.4 x 10.2	15.2
PW5110 1000	103004258-5591	1000/600	1.8m line cord with 90 deg. 5-15P	(8) 5-15R Outlets*	10.6 x 3.4 x 15.1	28.0
PW5110 1500	103004259-5591	1440/900	1.8m line cord with 90 deg. 5-15P	(8) 5-15R Outlets*	10.6 x 3.4 x 15.1	29.1

5110 INTERNATIONAL MODELS: 230V, 50/60 Hz

Model	Part Number	Power Out (VA/Watt)	Input Connection	Output Receptacles	Dimensions H x W x D (inches)	Weight (lb)
PW5110 500i	103004261-5591	500/300	IEC C14 inlet, 1.8 meter line patch cord IEC to IEC	(8) IE C13 Outlets*	10.6 x 3.4 x 10.2	13.4
PW5110 700i	103004262-5591	700/420	IEC C14 inlet, 1.8 meter line patch cord IEC to IEC	(8) IE C13 Outlets*	10.6 x 3.4 x 10.2	16.5
PW5110 1000i	103004263-5591	1000/600	IEC C14 inlet, 1.8 meter line patch cord IEC to IEC	(8) IE C13 Outlets*	10.6 x 3.4 x 15.1	29.1
PW5110 1500i	103004264-5591	1500/900	IEC C14 inlet, 1.8 meter line patch cord IEC to IEC	(8) IE C13 Outlets*	10.6 x 3.4 x 15.1	30.2

* Four battery backup & surge protection; four surge protection only.

5110 BATTERY BACKUP TIMES (in minutes)

Load (VA)	30W	60W	90W	120W	150W	180W	210W	240W	270W	300W	330W	360W	390W	420W
500	52	35	22	14	11	8	6	5	4	3	-	-	-	-
700	63	46	34	23	16	12	10	8	7	6	5	4	4	3
Load (VA)	**120W**	**180W**	**240W**	**300W**	**360W**	**420W**	**480W**	**540W**	**600W**	**660W**	**720W**	**780W**	**840W**	**900W**
1000	52	35	23	17	13	10	9	7	5	-	-	-	-	-
1500	62	43	29	20	16	14	12	11	9	8	7	6	5	4.4

Note: Battery runtimes are approximate and may vary with equipment, configuration, battery age, temperature, etc.

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8609 Six Forks Road
Raleigh, NC 27615 U.S.A.
Toll Free: 1.800.356.5794

www.eaton.com/powerquality

CANADA
Ontario: 416.798.0112
Toll free: 1.800.461.9166

LATIN AMERICA
Brazil: 55.11.3616.8500
Caribbean: 1.949.452.9610
México & Central America:
52.55.9000.5252
South Cone: 54.11.4343.6323

EUROPE/MIDDLE EAST/AFRICA
Denmark: 45.3686.7910
Finland: 358.94.52.661
France: 33.1.6012.7400
Germany: 49.0.7841.604.0
Italy: 39.02.66.04.05.40
Norway: 47.23.03.65.50
Sweden: 46.8.598.940.00
United Kingdom: 44.1753.608.700

ASIA PACIFIC
Australia: 61.2.9693.9366
New Zealand: 64.0.3.343.3314
China: 86.21.6361.5599
HK/Korea/Taiwan: 852.2745.6682
India: 91.11.4223.2300
Singapore/SEA: 65.6825.1668

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EATON
Powering Business Worldwide

Powerware 5110 UPS

USER'S MANUAL

The Powerware 5110 uninterruptible power system (UPS) protects your sensitive electronic equipment from power problems such as power failures, power sags, power surges, brownouts, and line noise.

Features:

- Processor-controlled voltage regulation
- Eight outlets
  -Four with surge and backup protection
  -Four with surge protection only
- Data Line (Internet fax - modem - DSL) or telephone line surge protection jacks
- Cold start capability
- USB communication port
- User-replaceable batteries

SAFETY INSTRUCTIONS

Once you have received the Powerware 5110 UPS product, you should remove and inspect the product for shipping damage. If any damage is found, please notify the carrier and your dealer. Please keep the shipping carton and the packing foam in the event the product must be returned to the factory for service.

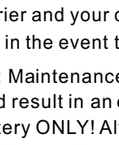
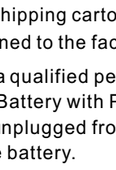
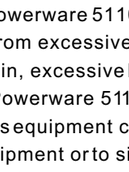
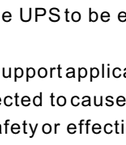
ATTENTION: Maintenance must be performed by a qualified personnel. Failure to do so could result in an electric shock. Replace Battery with Powerware supplied Battery ONLY! Although the unit may be unplugged from utility power, hazardous voltage still may be present through the battery.

1. Place the Powerware 5110 UPS indoors in an area that has adequate airflow and is free from excessive dust. Do NOT allow the UPS to be exposed to moisture, rain, excessive heat or direct sunlight.
2. Use of the Powerware 5110 UPS product in life support applications where failure of this equipment can reasonably be expected to cause failure of life support equipment or to significantly affect its safety or effectiveness is NOT recommended.
3. Always disconnect the input power cord from the wall outlet before replacing the battery.
4. When replacing the battery, use the same number and type of battery.
5. Do **NOT** dispose of the battery in a fire: the battery may explode.
6. Do **NOT** open or mutilate the battery. Batteries contain an electrolyte that is toxic and harmful to both the skin and eyes.
7. Proper disposal of the battery is required. Please refer to your local laws/regulations regarding battery disposal.
8. Use tools with insulated handles to replace the battery to avoid personal injury. Due to energy hazards, please remove wristwatches and jewelry such as rings when replacing battery.

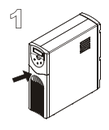
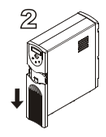
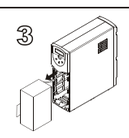
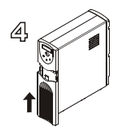
BATTERY CONNECTION REQUIRED BEFORE USE!

Connecting the Battery:

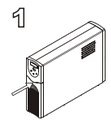
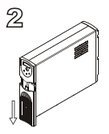
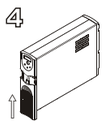
4.5 AH, 5 AH batteries (350 VA, 500 VA models)

1  Push at the top Edge to remove the battery cover	2  Slide down to remove the battery cover
3  Pull out the battery and connect the battery wire to the battery terminal	4  Reinstall the battery cover

7 AH battery (700 VA models)

1  Push at the top Edge to remove the battery cover	2  Slide down to remove the battery cover
3  Pull out the battery and connect the battery wire to the battery terminal	4  Reinstall the battery cover

7AH x 2, 9AH x 2 batteries (1000VA, 1500VA models)

1  Push at the top Edge to remove the battery cover	2  Slide down to remove the battery cover
3  Connect the battery cable	4  Reinstall the battery cover

INSTALLATION AND OPERATION:

Following steps explain how to connect and operate the Powerware 5110 UPS.

1. Connect the UPS to a grounded power outlet.

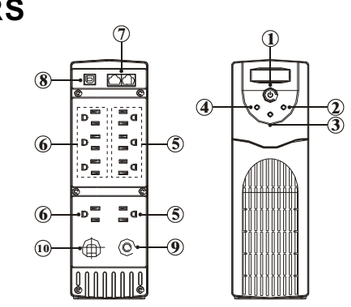
Note: It is recommended that the battery should be charged for minimum 8 hours to ensure full charge before placing the UPS in service.

2. Plug your computer, monitor or load to be protected into the "Battery Backup & Surge Protection" outlets. (These outlets will provide emergency battery backup power during power outages as well as protection from surges and spikes.)

CAUTION: Do NOT plug **LASER PRINTERS** into the "Battery Backup" outlets.
CAUTION: Do NOT plug **ACCESSORY SURGE** strips into the "Battery Backup" outlets.

3. Plug your peripheral equipment or non-critical loads (printer, scanner, fax, speaker, etc.) into the "Surge Protection" outlets. (These outlets provide surge and spike protection only, they will NOT provide battery backup power during a utility power failure).
4. Connect your computer to the UPS using USB cable provided.
5. With your equipment turned off, switch on the UPS.
6. When the "On/Off" LED light is illuminated, turn on the connected equipment.
7. Install Power management software provided with the UPS

INDICATORS



1.On/Off Push Button
Push button switch that controls power to the UPS and initiates the self-test function.
Depress the push button to turn on the UPS.
Depress the push button again to turn off the UPS.
The UPS will perform a self-test for about 5 seconds when the UPS is turned on.

2.AC mode (Green) LED
Indicates that AC utility power is present and regulated power (AVR) is applied to the connected equipment.

3.Fault / Warning (Red) LED
Indicates that a fault condition has occurred.
-Flashing Red LED indicates an overload condition or that the battery should be replaced.
-Solid On LED indicates that the output is shorted or an internal UPS fault exits.
See the Indicator Table below for further detail.

4.Backup mode (Yellow) LED
Indicates that the UPS is operating on battery and providing regulated AC power to the backup only outlets and the connected equipment.

5.Battery Backup & Surge Protection Outlets
Four 5-15R output receptacles that provide both backup and surge protection.

6.Surge Protection Outlets
Four 5-15R output receptacles that provide surge and spike protection only.

7.Data /Phone/Fax Protection Connectors

8.USB Communication Port
The built-in USB port connects to your computer. The LanSafe monitoring and shutdown software provided can automatically save your files and shut down your computer in the event of a prolonged power outage. The software also provides information regarding the status of your utility power line.

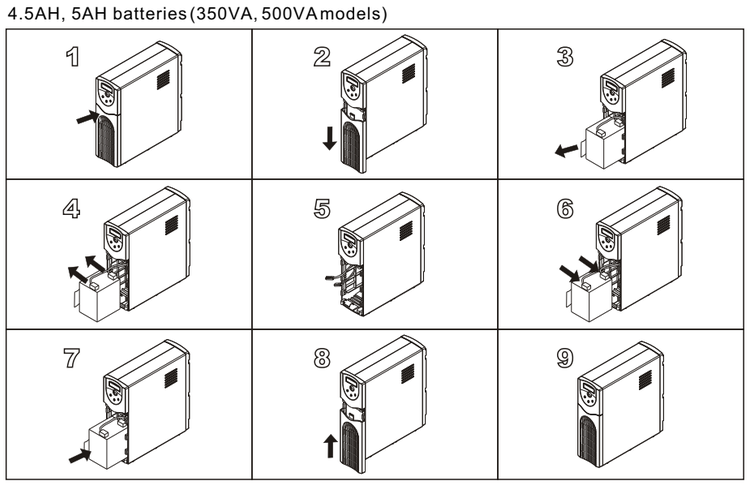
9.Circuit Breaker (resetable)
The button will protrude when the overload condition occurs. If the button protrudes, disconnect some non-essential equipment and reset the circuit breaker by pushing the button inward.

10.Power Cord
6 foot line cord

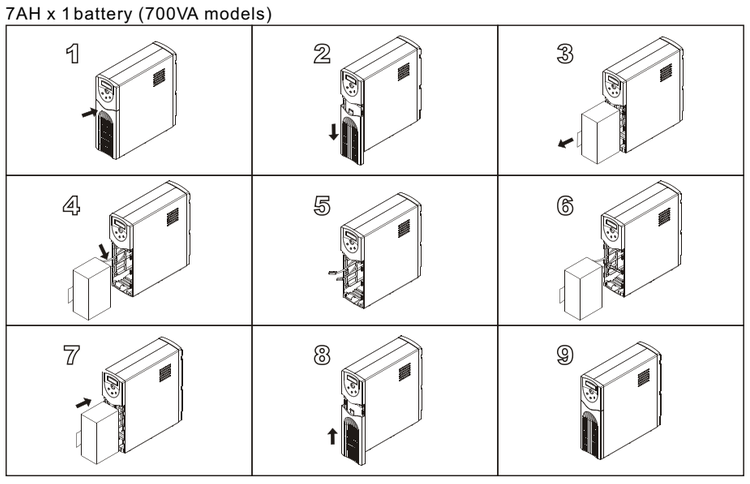
BATTERY REPLACEMENT PROCEDURE:

1.Disconnect the UPS from the power source and slide the battery door open. See pictures 1 and 2.
2.Disconnect the battery and remove as indicated below. See pictures 3 and 4
3.Insert the replacement battery and reconnect the battery cables.
See pictures 6 and 7
NOTE: It is important that the connectors be firmly attached to new batteries.
4.Reposition the battery door and slide closed. See pictures 8 and 9.
NOTE: Properly recycle used battery.

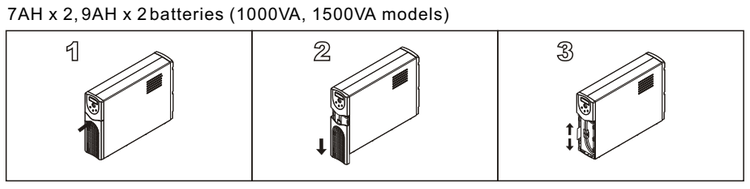
4.5AH, 5AH batteries (350VA, 500VA models)

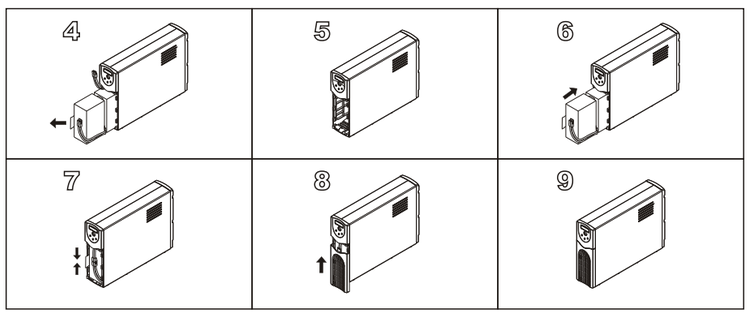


7AH x 1 battery (700VA models)



7AH x 2, 9AH x 2 batteries (1000VA, 1500VA models)





Status Indicators

The UPS provides both visual and audible status indicators. Visual indicators consist of three LEDs to represent the following conditions:

- On utility power operation
- On battery power operation
- UPS fault/alarm

LED Indicator Table

On Utility (AC mode)	Green Lighting
On Battery (Backup mode)	Yellow Lighting
Low Battery	Yellow Flashing
Fault/Output Short	Red Lighting
Overload/Check Battery	Red Flashing

LED Audible Alarm Table

Backup mode	Sounding every 5 seconds
Battery low	Sounding (two beeps) every 5 seconds
Overload	Sounding every 0.5 seconds
Replace battery	Sounding (three beeps) every 30 seconds
Fault or output short circuit	Continuous sounding
Battery over charge	Sounding (three beeps) every 5 seconds

SPECIFICATIONS

Model Numbers PW5110 350 USB PW5110 500 USB PW5110 700 USB PW5110 1000 USB PW5110 1500 USB	Capacity 350 VA / 210W 500 VA / 300W 700 VA / 420W 1000 VA / 600W 1500 VA / 900W
Nominal Input Voltage	120Vac
Nominal Output Voltage	120Vac
Automatic Voltage Regulation (AVR)	±15%
Frequency	50 / 60 Hz auto sensing
Outlets	8 Outlets (4 Battery Backup & Surge Protection; 4 Surge Protection only)
Lighting / Surge Protection	320 Joules
Transfer time to Battery/AC	6ms typical
Battery Type	Maintenance free lead-acid battery
Battery Specification	350 VA: 12V 4.5 Ah 500 VA: 12V 5 Ah 750 VA: 12V 7 Ah 1000 VA: (2) 12V 7 Ah 1500 VA: (2) 12V 9 Ah
Typical Backup Time	3 MINUTES MINIMUM AT FULL RATED LOAD
LAN / Phone / Fax Protection	RJ11/RJ45
Short Circuit Protection	Circuit Breaker
Communication Port	USB
Operation Temperature	0°C~40°C
Operation Relative Humidity	0 to 95% non-condensing
Storage Temperature	-15°C~50°C
Net Weight	350 VA: 11.9 pounds / 5.4 kg 500 VA: 12.13 pounds / 5.5 kg 700 VA: 15.21 pounds / 6.9 kg 1000 VA: 28 pounds / 12.7kg 1500 VA: 29.1 pounds / 13.2 kg
Dimensions (HxWxD)	350 / 500 / 700 VA: 10.6 x 3.4 x 10 in. 1000 / 1500 VA: 10.6 x 3.4 x 15 in.

* Due to continuing product improvement programs, specifications are subject to change without notice.

TROUBLESHOOTING

Symptom	Possible Cause	Action to Take
UPS will not turn on	The UPS is not connected to the power source.	Ensure the UPS is securely connected to an AC outlet.
	Circuit Breaker has tripped.	Reduce the amount of equipment plugged into the "Battery Backup & Surge Protection" outlets of the UPS. Reset the circuit breaker by pushing it back in. Switch the UPS back on.
UPS is making a continuous sound and the "Overload" indicator is on	The "Battery Backup & Surge Protection" outlets are overload.	Turn off the UPS and reduce the amount of equipment connected to these outlets.
UPS does not provide expected runtime	The UPS battery is discharged due to a power outage and has not recharged.	Charge the battery for 8 hours. The UPS runtime is reduced until the battery is fully charged.
	Devices plugged into Back up & surge protection receptacles exceed the rated load for the UPS run time	Unplug non-essential equipment (printers, scanners, etc) from the Battery Backup outlets and plug into 'Surge Only' outlets
UPS does not power essential equipment during an outage	The UPS circuit breaker "tripped".	Disconnect non-essential equipment from the UPS. Reset (push in) the circuit breaker and switch the UPS on. Plug equipment in one-at-a-time. If the circuit breaker trips again, disconnect the device that caused the breaker to trip.
	The battery has reached the end of its life.	Replace the battery or the battery module.
	Equipment plugged into a Surge Only outlet.	Unplug device from 'Surge Only' outlet and move to a 'Battery Backup outlet.
Red LED Indicator ON	Internal UPS fault.	Contact Technical Support (see Service and Support below).

SERVICE AND SUPPORT

For questions and/or problems, please call your local distributor or the help desk at one of the following telephone numbers and ask for a UPS technical representative.

United States:	1.800.356.5737
Europe, Middle East, and Africa:	+44.17.53.608.700
Asia:	+852.2830.3030
Australia:	+61.3.9706.5022

Please have the following information ready when you call the Help Desk:

- Model number
- Serial number
- Version number (if available)
- Date of failure or problem
- Symptoms of failure or problem
- Customer return address and contact information

If repair is required, you will be given a Returned Material Authorization (RMA) Number. This number must appear on the outside of the package and on the Bill of Lading (if applicable). Use the original packaging or request packaging from the Help Desk or distributor. Units damaged in shipment as a result of improper packaging are not covered under warranty.
A replacement unit will be shipped, freight prepaid for all units under warranty.
For additional information please visit us online: **www.powerware.com**

EATON | Powerware

MA6B411003A(2005/01/25)

SIEMENS

Agnico Eagle, Baker Lake
Jet-A Tank Farm
Motor soft starter
3RW4026-1BB15

Industrial Controls

Soft starters
SIRIUS 3RW30 / 3RW40

Manual

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Appendix A

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE

indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation for the specific task, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction 1

1.1 Important notes

Purpose of the manual

This manual contains fundamental information and practical tips for using SIRIUS soft starters. The SIRIUS 3RW30 and 3RW40 soft starters are electronic motor control devices that facilitate optimal starting and stopping three-phase induction motors.
The manual describes all of the functions of the SIRIUS 3RW30 and 3RW40 soft starters.

Target group

This manual is intended for any user involved in

- Commissioning
- Servicing and maintaining
- Planning and configuring systems

Basic knowledge required

A general knowledge of the field of electrical engineering is required to understand this manual.

Scope of validity

The manual is valid for the SIRIUS 3RW30 and 3RW40 soft starters. It describes the components that are valid at the time of publication. SIEMENS reserves the right to include a Product Information for each new component, and for each component of a later version.

Standards and approvals

The SIRIUS 3RW30 and 3RW40 soft starters are based on the IEC/EN 60947-4-2 standard.

Disclaimer of liability

It is the responsibility of the manufacturer to ensure that a system or machine is functioning properly as a whole. SIEMENS AG, its regional offices, and associated companies (hereinafter referred to as "SIEMENS") cannot guarantee all the properties of a whole plant system or machine that has not been designed by SIEMENS.

Similarly, SIEMENS can assume no liability for recommendations that appear or are implied in the following description. No new guarantee, warranty, or liability claims beyond the scope of the SIEMENS general terms of supply are to be derived or inferred from the following description.

Orientation aids

The manual contains various features supporting quick access to specific information:

- At the beginning of the manual you will find a table of contents.
- A comprehensive index at the end of the manual allows quick access to information on specific subjects.

Continuously updated information

Your regional contact for low-voltage switchgear with communications capability will be happy to help you with any queries you have regarding the soft starters. A list of contacts and the latest version of the manual are available on the Internet at (www.siemens.com/softstarter):

For all technical queries, please contact:

Technical Assistance:	Phone: +49 (0) 911-895-5900 (8°° - 17°° CET) Fax: +49 (0) 911-895-5907 e-mail: (mailto:technical-assistance@siemens.com) Internet: (www.siemens.com/lowvoltage/technical-assistance)

Correction sheet

A correction sheet is included at the end of the manual. Please use it to record your suggestions for improvements, additions, and corrections, and return the sheet to us. This will help us to improve the next edition of the manual.

Safety information 2

2.1 Before commencing work: Isolating the equipment from the supply system and ensuring that it cannot be reconnected.

⚠ DANGER

Hazardous voltage Will cause death or serious injury.

- Disconnect the system and all devices from the power supply before starting work.
- Secure against switching on again.
- Verify that the equipment is not live.
- Ground and short-circuit.
- Erect barriers around or cover adjacent live parts.

⚠ DANGER

Hazardous voltage Will cause death or serious injury.

Qualified Personnel.

The equipment / system may only be commissioned and operated by qualified personnel. For the purpose of the safety information in these Operating Instructions, a "qualified person" is someone who is authorized to energize, ground, and tag equipment, systems, and circuits in accordance with established safety procedures.

2.2 Five safety rules for work in or on electrical systems

A set of rules, which are summarized in DIN VDE 0105 as the "five safety rules", are defined for work in or on electrical systems as a preventative measure against electrical accidents:

1. Isolate
2. Secure against switching on again
3. Verify that the equipment is not live
4. Ground and short-circuit
5. Erect barriers around or cover adjacent live parts

These five safety rules must be applied in the above order prior to starting work on an electrical system. After completing the work, proceed in the reverse order.

It is assumed that every electrician is familiar with these rules.

Explanations

1. The isolating distances between live and deenergized parts of the system must vary according to the operating voltage that is applied.
   "Isolate" refers to the all-pole disconnection of live parts.
   All-pole disconnection can be achieved, e.g. by.:
   - Switching off the miniature circuit breaker
   - Switching off the motor circuit breaker
   - Unscrewing fusible links
   - Removing LV HRC fuses
2. The feeder must be secured against inadvertent restarting to ensure that it remains isolated for the duration of the work. This can be achieved, for instance, by securing the motor and miniature circuit breakers with lockable blocking elements in the disconnected state, either using a lock or by unscrewing the fuses.
3. The deenergized state of the equipment should be verified using suitable test equipment, e.g. a two-pole voltmeter. Single-pole test pins are not suitable for this purpose. The absence of power must be established for all poles, phase to phase, and phase to N/PE.
4. Grounding and short-circuiting are only mandatory if the system has a nominal voltage greater than 1 kV. In this case, the system should always be grounded first and then connected to the live parts to be short-circuited.
5. These parts should be covered, or barriers erected around them, to avoid accidental contact during the work with adjacent parts that are still live.

Product description 3

3.1 Fields of application

Soft starters are used to start three-phase induction motors with reduced torque and reduced starting current.

SIRIUS soft starter family

The SIEMENS SIRIUS soft starter family comprises three different versions with different functionalities and prices.

3RW30 and 3RW40

Simple or standard applications are covered by the SIRIUS 3RW30 and 3RW40 soft starters and are described in this manual.

3RW44

The SIRIUS 3RW44 soft starter is used if higher functionality is specified, e.g. communication over PROFIBUS or the availability of measuring and monitoring values, as well as for ultra-heavy-duty starting. The SIRIUS 3RW44 soft starter is described in a separate system manual.

Download from 3RW44 manual (http://support.automation.siemens.com/WW/llisapi.dll?func=cslib.csinfo&lang=de&objid=21772518&caller=view).

3.2 Basic physical principles of a three-phase induction motor

SIRIUS soft starters are used to reduce the current and torque of a three-phase induction motor during the startup process.

3.2.1 Three-phase induction motor

Fields of application

Three-phase induction motors are used in a wide range of applications in commerce, industry, and trade owing to their simple, robust design and their minimal maintenance.

Problem

If a three-phase induction motor is started directly, its typical current and torque characteristics can cause disturbances in the supply system and the load machine.

Starting current

Three-phase induction motors have a high direct starting current $I_{starting}$. Depending on the motor type, this current can be between three and fifteen times as high as the rated operational current. Seven or eight times the motor's rated current can be assumed as a typical value.

Disadvantage

This results in the following disadvantage:

- Higher load on the electrical supply system. The supply system must therefore be dimensioned for this higher power during the motor startup.

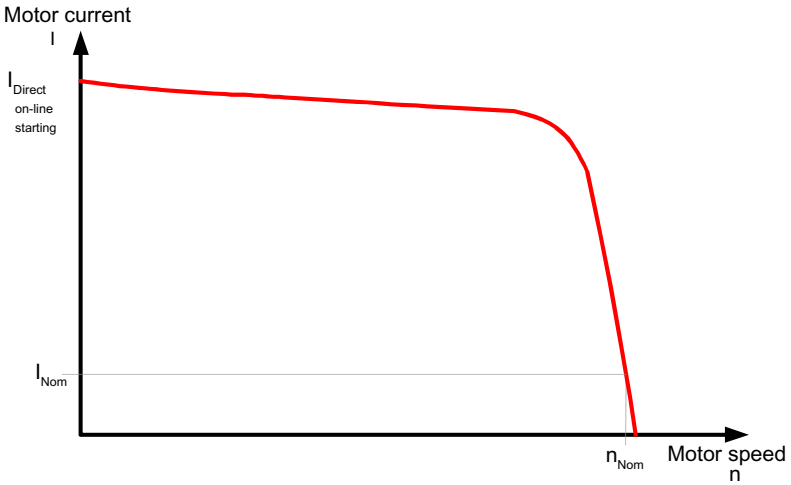


Figure 3-1 Typical starting current characteristic of a three-phase induction motor

Starting torque

The starting torque and the breakdown torque can usually be assumed to be between two and four times the rated torque. From the point of view of the load machine, this means that the starting and acceleration forces exert a higher mechanical load on the machine and the product being conveyed compared to nominal operation.

Disadvantages

This results in the following disadvantages

- A higher load is placed on the machine's mechanical components
- The costs for replacing worn parts and maintaining the application are higher

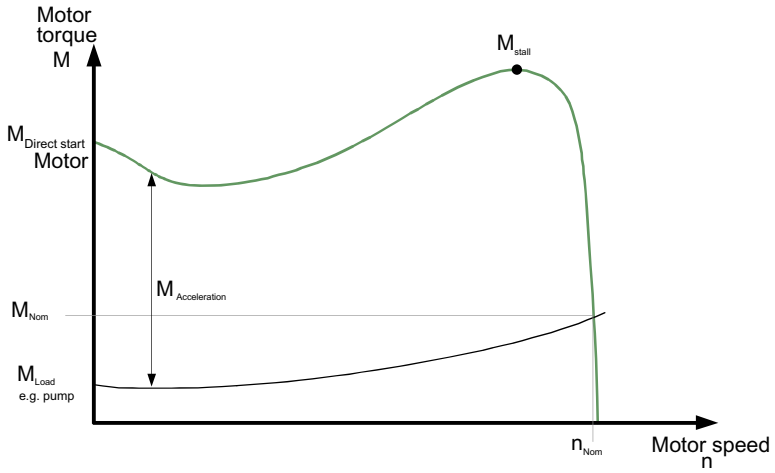


Figure 3-2 Typical starting torque characteristic of a three-phase induction motor

Remedy

The SIRIUS 3RW30 and 3RW40 electronic soft starters allow the current and torque characteristics during starting to be optimally adapted to the requirements of each application.

3.3 Functional principle of the SIRIUS 3RW30 and 3RW40 soft starters

The SIRIUS 3RW30 and 3RW40 soft starters have two antiparallel thyristors in two out of the three phases. One thyristor for the positive half-wave and one for the negative half-wave is provided in each phase (refer to Fig. "Phase angle control and schematic diagram of a two-phase controlled soft starter with integral bypass contacts"). The current in the third, uncontrolled phase is the sum of the currents in the controlled phases.

The rms value of the motor voltage is increased (from a settable starting voltage) to the rated motor voltage within a definable ramp-up time by means of the phase angle control.

The motor current changes in proportion to the voltage applied to the motor. As a result, the starting current is reduced by the factor of this voltage.

There is a quadratic relationship between the torque and the voltage applied to the motor. As a result, the starting torque is reduced quadratically in relation to this voltage.

Example

SIEMENS 1LG4253AA motor (55 kW)

Rated data at 400 V

P_e:	55 kW
I_e:	100 A
$I_{direct\ starting}$:	Approx. 700 A
M_e:	355 Nm ; e.g.: $M_e = 9.55 \times 55\ kW \times \frac{1000}{1480\ min^{-1}}$
n_e:	1480 rpm
$M_{direct\ starting}$:	Approx. 700 Nm
Set starting voltage:	50 % (½ of mains voltage)

=> $I_{starting}$ ½ of direct starting current (approx. 350 A)

=> $M_{starting}$ ¼ of direct starting torque (approx. 175 Nm)

The diagrams below show the starting current and torque characteristics for a three-phase induction motor in combination with a soft starter:

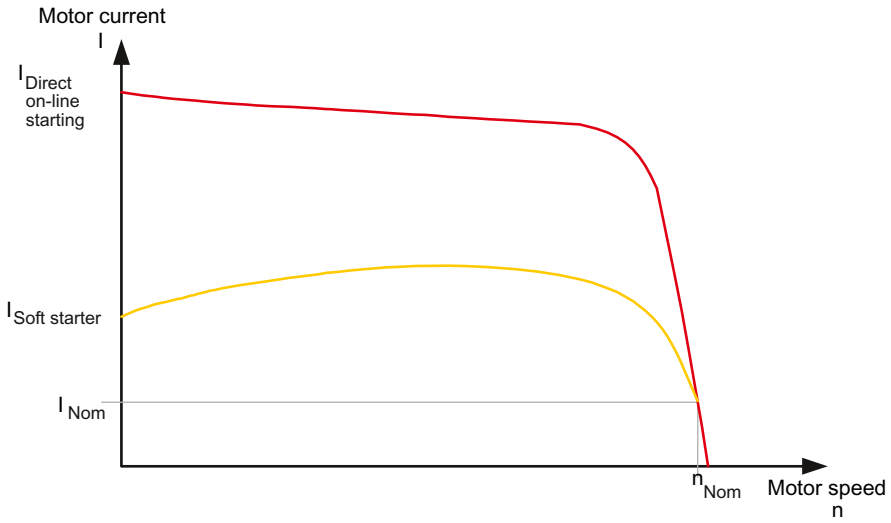


Figure 3-3 Reduced current characteristic of a three-phase induction motor during starting with a SIRIUS 3RW30 or 3RW40 soft starter

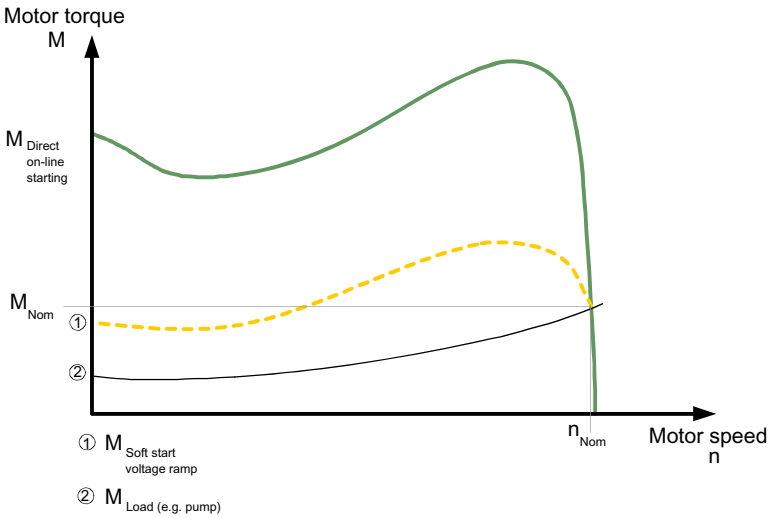


Figure 3-4 Reduced torque characteristic of a three-phase induction motor during starting with a SIRIUS 3RW30 or 3RW40 soft starter

Soft start /soft stop

This means that, since the motor voltage is controlled by the electronic soft starter during the startup process, the consumed starting current and the starting torque generated in the motor are also controlled.

The same principle is applied during the stop process. This ensures that the torque generated in the motor is gradually reduced, so that the application can stop smoothly (the soft stop function is only supported by the 3RW40).

The frequency remains constant during this process and corresponds to the mains frequency, in contrast to frequency controlled starting and stopping of a frequency converter.

Bypass mode

Once the motor has been started up correctly, the thyristors are subject to fully advanced control, meaning that the whole mains voltage is applied to the motor terminals. As the motor voltage does not have to be controlled during operation, the thyristors are bridged by integral bypass contacts that are rated for AC1 current. This minimizes the waste heat generated during uninterrupted duty (which is caused by the thyristor's power loss), and minimizes heating up of the switching device's environment.

The bypass contacts are protected by an integrated, electronic arc quenching system during operation. If they are opened in the event of a fault, e.g. if the control voltage is temporarily interrupted, mechanical vibrations occur, or the coil operating mechanism or the main contact spring has reached the end of its service life and is defective, the equipment is not damaged.

The diagram below shows the method of operation of the SIRIUS 3RW30 and 3RW40 soft starters:

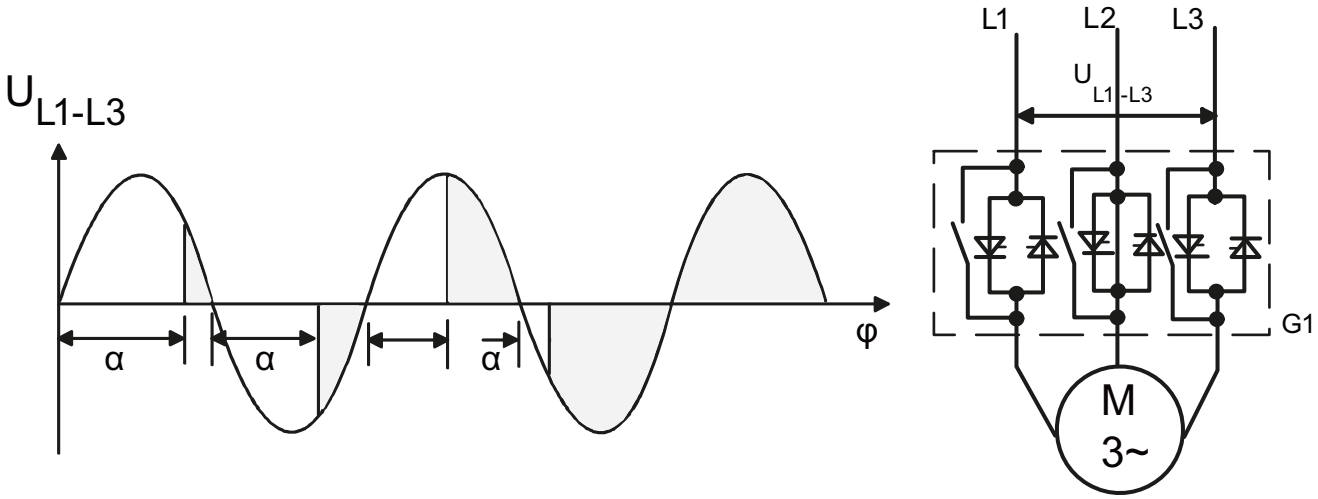


Figure 3-5 Phase angle control and schematic diagram of a two-phase controlled soft starter with integral bypass contacts

3.3.1 Method of operation of a two-phase controlled soft starter

A special method of operation is used for the SIRIUS 3RW30 and 3RW40 two-phase controlled soft starters based on SIEMENS' patented "polarity balancing" control principle.

Two-phase control

The SIRIUS 3RW30 and 3RW40 soft starters are two-phase controlled soft starters, in other words they are designed with two antiparallel thyristors in each of phases L1 and L3. Phase 2 is an uncontrolled phase, which is merely guided through the starter by a copper connection.

In a two-phase controlled soft starter, the current that results from the superimposition of the two controlled phases flows in the uncontrolled phase. The main advantages of two-phase control include the more compact size compared to a three-phase version and the lower hardware costs.

The occurrence of DC components, caused by the phase angle and the overlapping phase currents, is a negative physical effect of two-phase control during the startup process that can mean a louder noise is produced by the motor. The "polarity balancing" control principle was developed and patented by SIEMENS to prevent these DC components during starting.

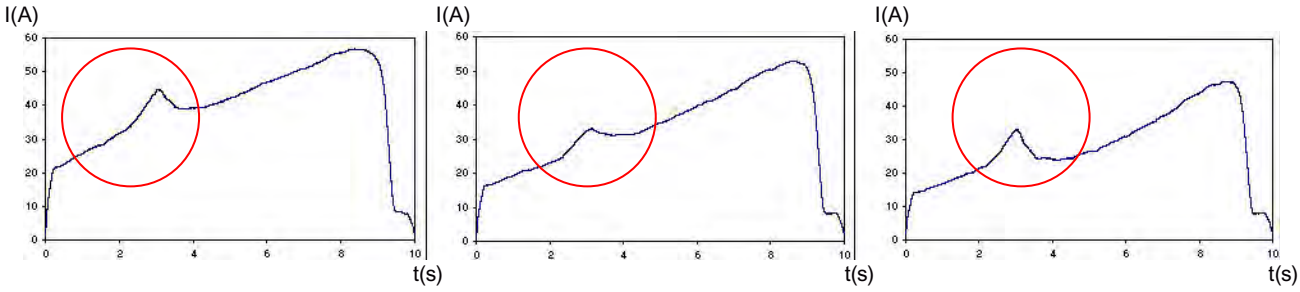


Figure 3-6 Current characteristic and occurrence of DC components in the three phases without "polarity balancing"

Polarity balancing

"Polarity balancing" effectively eliminates these DC components during the ramp-up phase. It allows the motor to be started up with a constant speed, torque, and current rise.

The acoustic quality of the startup process comes very close to that of a three-phase controlled startup. This is made possible by the continuous dynamic alignment and balancing of current half-waves with different polarities during the motor startup.

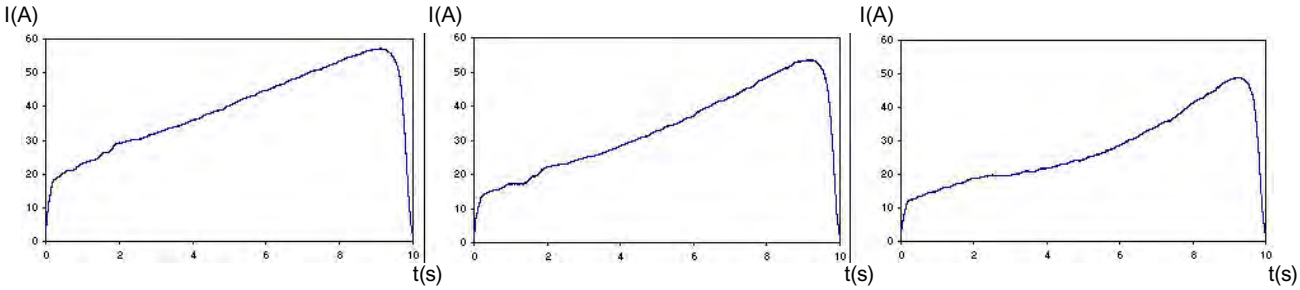


Figure 3-7 Current characteristic in the three phases without DC components thanks to "polarity balancing"

3.3.2 Starting current asymmetry

With two-phase control the starting current is asymmetrical for physical reasons, because the current in the uncontrolled phase is the sum of the currents in the two controlled phases.

This asymmetry can be as much as 30 to 40% during starting (ratio of minimum current to maximum current in all three phases).

Even though this cannot be influenced, it is not critical in most applications. It could cause an insufficiently rated fuse to trip in the uncontrolled phase, for instance. For recommended fuse ratings, refer to the tables in chapter Technical data [Page 121].

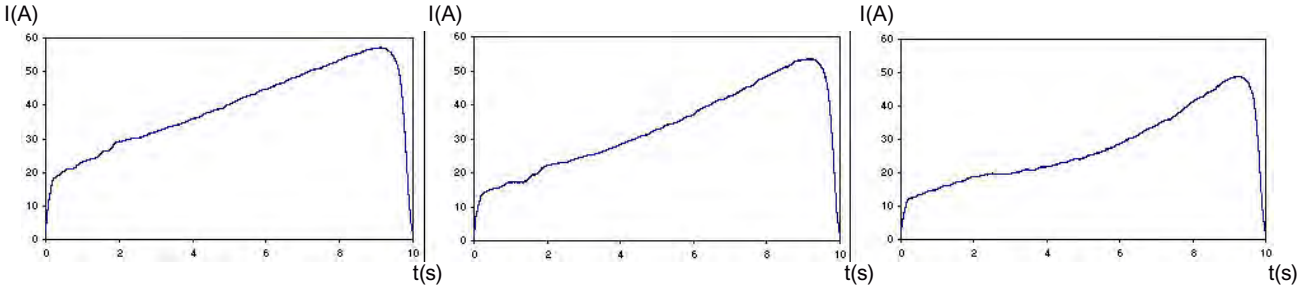


Figure 3-8 Starting current asymmetry

Note

If wye-delta starters are exchanged for soft starters in an existing system, you should check the fuse ratings in the feeder in order to avoid false tripping. This is particularly important in connection with heavy-duty starting or if the fuse that is installed has already been operated close to the thermal tripping limit with the wye-delta assembly.

All elements of the main circuit (such as fuses, motor starter protectors, and switching devices) must be dimensioned for direct starting and according to the on-site short-circuit conditions, and ordered separately.

For recommended fuse and motor starter protector ratings for the feeder with soft starter, refer to chapter Technical data [Page 121].

3.3.3 Applications and use

Applications and selection criteria

The SIRIUS 3RW30 and 3RW40 soft starters represent a good alternative to direct or wye-delta starters.

The most important advantages are:

- Soft start
- Soft stop (3RW40 only)
- Uninterrupted switching without current peaks that place a heavy load on the system
- Simple installation and commissioning
- Compact, space-saving design

Applications

The typical applications include:

- Conveyor belts
- Roller conveyors
- Compressors
- Fans
- Pumps
- Hydraulic pumps
- Agitators
- Circular saws / band saws

Advantages

Conveyor belts and transport systems:

- Smooth starting
- Smooth stopping

Rotary pumps and piston pumps:

- No pressure surges
- Increased service life of the pipe system

Agitators and mixers:

- Reduced starting current

Fans:

- Protection for the gearbox and V belt

3.4 Comparison of device functions






		SIRIUS 3RW30 Standard applications	SIRIUS 3RW40 Standard applications	SIRIUS 3RW44 High Feature applications
Rated current at 40 °C / 50 °C	A	3 . . . 1 0 6 / 3 . . . 9 8	12.5...432 / 11 ... 385	29 ... 1214 / 26 ... 1076
Rated operational voltage	V	200...480	200...600	200...690
Motor rating at 400 V / 460 V •Standard connection •Inside-delta circuit	 kW /hp kW /hp	 1.5...55 / 1.5 ... 75 –	 5.5...250 / 7.5 ... 300 –	 15...710 / 15 ... 950 22...1200 / 30 ... 1700
Ambient temperature	°C	-25...+60	-25...+60	0 . . . + 6 0
Soft start/soft stop		✔[1]	✔	✔
Voltage ramp		✔	✔	✔
Starting/stopping voltage	%	40...100	40...100	20...100
Ramp-up and ramp-down time	s	0 . . . 2 0	0 . . . 2 0	1 . . . 3 6 0
Torque control		–	–	✔
Starting/stopping torque	%	–	–	20...100
Torque limiting	%	–	–	20...200
Ramp time	s	–	–	1 . . . 3 6 0
Integrated jumper contact system		✔	✔	✔
Intrinsic device protection		–	✔	✔
Motor overload protection		–	✔[7]	✔
Thermistor motor protection		–	✔[2]	✔
Integrated remote RESET		–	✔[3]	✔
Settable current limiting		–	✔	✔
Inside-delta circuit		–	–	✔
Breakaway torque		–	–	✔
Creep speed in both directions of rotation		–	–	✔
Pump stop		–	–	✔[4]
DC braking		–	–	✔[4] [5]
Combined braking		–	–	✔[4] [5]
Motor heating		–	–	✔
Communication		–	–	With PROFIBUS DP (option)
External display and operator control module		–	–	(option)
Status measured value display		–	–	✔
Error log		–	–	✔
Events list		–	–	✔
Min/max pointer function		–	–	✔
Trace function		–	–	✔[6]
Programmable control inputs and outputs		–	–	✔
Number of parameter sets		1	1	3
Parameterizing software (SoftStarterES)		–	–	✔
Power semiconductors (thyristors)		2 controlled phases	2 controlled phases	3 controlled phases
Screw terminals		✔	✔	✔
Spring-loaded terminals		✔	✔	✔
UL/CSA		✔	✔	✔
CE mark		✔	✔	✔
Soft starting under heavy-duty starting		–	–	✔[4]
Support for configuration		Win-Soft Starter, electronic selection slider, Technical Assistance ++49 9118955900		

✔ Function available; – function not available.

1) For 3RW30 only soft start.

2) Optional up to size S3 (device variants).

3) For 3RW402. to 3RW404.; for 3RW405. and 3RW407. optional.

4) If necessary, overdimension soft starter and motor.

5) Not possible in inside-delta circuit.

6) Trace function with SoftStarterES software.

7) Acc. to ATEX

Product combinations

4

4.1 SIRIUS modular system

Switching, protecting, and starting motors

In order to simplify the assembly of load feeders, the SIRIUS modular system offers standard components that are optimally harmonized and are easy to combine. Just 7 sizes cover the entire performance range up to 250 kW / 300 hp. The individual switching devices can be assembled to form complete load feeders, either using link modules or by mounting directly.

For a selection of matching device combinations, e.g. soft starters and motor starter protectors, refer to chapter Technical data [Page 121].

For further information on individual products, refer to System manual (http://support.automation.siemens.com/WW/llisapi.dll?aktprim=0&lang=en&referer=%2fWW%2f&func=cslib.csinfo&siteid=csius&caller=view&extranet=standard&viewreg=WW&nodeid0=20025979&objaction=csopen) "Innovations in the SIRIUS modular system", Order No. 3ZX1012-0RA01-1AB1.

SIRIUS motor starter protectors


3RV20 11 (S00)


3RV20 21 (S0)


3RV10 31 (S2)


3RV10 41 (S3)

SENTRON circuit breakers


VL250/3VL3


VL400/3VL4


VL630/3VL5

SIRIUS contactors


3RT20 1 (S00)


3RT20 2 (S0)


3RT10 3 (S2)


3RT1. 4 (S3)


3RT1. 5 (S6)


3RT1. 6 (S10)


3RT1. 7 (S12)

SIRIUS overload relays


3RB30 16 (S00)


3RB30 26 (S0)


3RB20 36 (S2)


3RB20 46 (S3)


3RB20 56 (S6)


3RB20 66 (S10/S12)

SIRIUS soft starters


3RW30 1 (S00)


3RW40 2 (S0)


3RW40 3 (S2)


3RW40 4 (S3)


3RW40 5 (S6)


3RW40 7 (S10/S12)

Figure 4-1 SIRIUS modular system

Functions

5

5.1 Start modes

You can choose between different startup functions reflecting the wide range of applications and functionality of the SIRIUS 3RW30 and 3RW40 soft starters. The motor start can be optimally adapted to each particular application.

5.1.1 Voltage ramp

The SIRIUS 3RW30 and 3RW40 soft starters achieve soft starting by means of a voltage ramp. The motor terminal voltage is increased from a parameterizable starting voltage up to the mains voltage within a definable ramp-up time.

Starting voltage

The starting voltage determines the starting torque of the motor. A lower starting voltage results in a lower starting torque and a lower starting current. The starting voltage selected must be sufficiently high to ensure that motor starts up smoothly as soon as the start command is received by the soft starter.

Ramp time

The length of the set ramp time determines the time taken to increase the motor voltage from the parameterized starting voltage to the mains voltage. This influences the motor's acceleration torque, which drives the load during the ramp-up process. A longer ramp time results in a lower acceleration torque as the motor is started up. The startup is slower and smoother as a result. The ramp time should be long enough for the motor to reach its nominal speed. If the time selected is too short, in other words if the ramp time ends before the motor has started up successfully, a very high starting current that can even equal the direct starting current at the same speed occurs at this instant.

The SIRIUS 3RW40 soft starter limits the current to the value set with the current limiting potentiometer (refer to chapter Current limiting and ramp-up detection (3RW40 only) [Page 29]). As soon as the current limiting value is also reached, the voltage ramp or the ramp time is interrupted and the motor is started with the current limiting value until it has started up successfully. In this case, the motor ramp-up time may be longer than the maximum parameterizable 20 seconds ramp time (for further information about the maximum ramp-up times and switching frequencies, refer to chapter 3RW40 2. to 7. power electronics [Page 148] ff).

The SIRIUS 3RW40 soft starter has intrinsic device protection, current limiting, and ramp-up detection functions. These functions do not form part of the SIRIUS 3RW30 soft starter.

CAUTION
Risk of property damage When using the 3RW30: Make sure the selected ramp time is longer than the actual motor ramp-up time. If not, the SIRIUS 3RW30 may be damaged because the internal bypass contacts close when the set ramp time elapses. If the motor has not finished starting up, an AC3 current that could damage the bypass contact system will flow. When using the 3RW40: The 3RW40 has an integrated ramp-up detection function that prevents this operating state from occurring.

The maximum ramp time for the SIRIUS 3RW30 soft starter is 20 seconds An appropriately dimensioned SIRIUS 3RW40 or 3RW44 soft starter should be chosen for startup processes with a motor ramp-up time > 20 seconds.

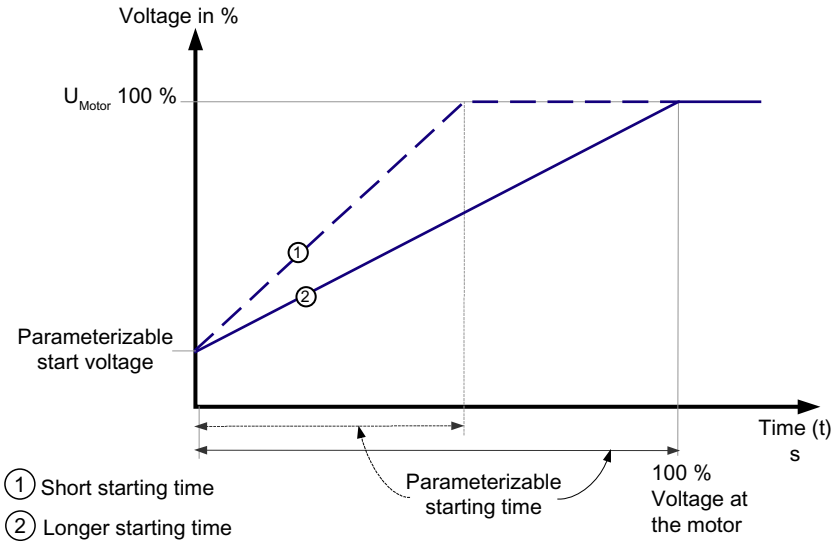


Figure 5-1 Principle of the voltage ramp

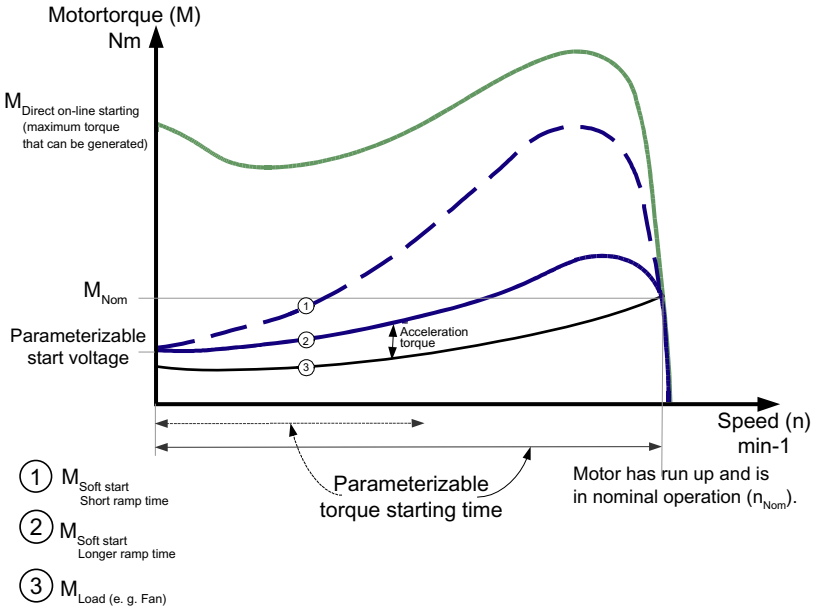


Figure 5-2 Principle of the voltage ramp for the torque characteristic

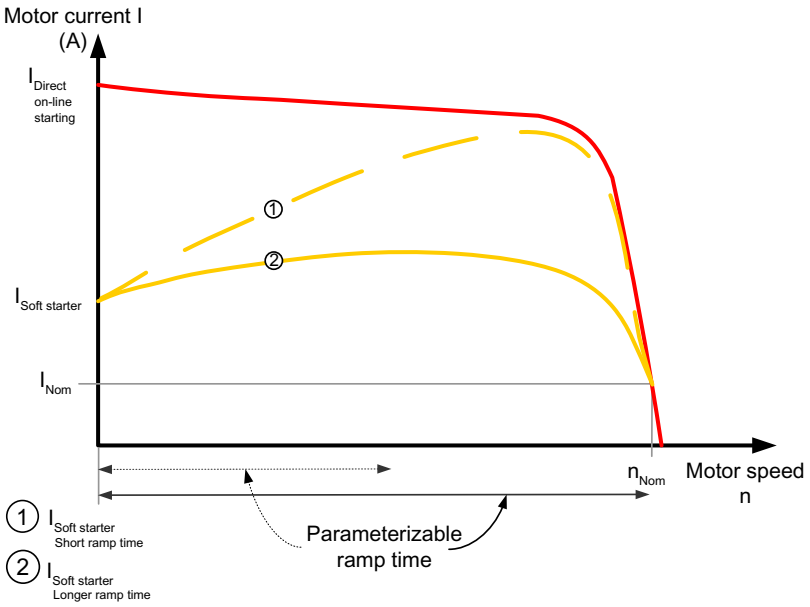


Figure 5-3 Principle of the voltage ramp for the starting current characteristic

Typical applications of the voltage ramp

The voltage ramp principle is valid for all applications, e.g. pumps, compressors, conveyor belts.

5.1.2 Current limiting and ramp-up detection (3RW40 only)

The SIRIUS 3RW40 soft starter measures the phase current (motor current) continuously with the help of integrated current transformers.
The motor current that flows during the startup process can be actively limited by means of the soft starter. The current limiting function takes priority over the voltage ramp function. As soon as a parameterizable current limit is reached, in other words, the voltage ramp is interrupted and the motor is started with the current limiting value until it has started up successfully. The current limiting function is always active with SIRIUS 3RW40 soft starters. If the current limiting potentiometer is set to the clockwise stop (maximum), the starting current is limited to five times the set rated motor current.

Current limiting value

The current limiting value is set to the current required during starting as a factor of the rated motor current. Since the starting current is asymmetrical, the set current corresponds to the arithmetic mean value for the three phases.

Example

If the current limiting value is set to 100 A, the currents might be approx. 80 A in L1, 120 A in L2, and 100 A in L3 (refer to chapter Starting current asymmetry [Page 21]).

As soon as the selected current limiting value is reached, the motor voltage is reduced or controlled by the soft starter to prevent the current from exceeding the limit. The set current limiting value must be high enough to ensure that the torque generated in the motor is sufficient to accelerate the motor to nominal speed. Three to four times the value of the motor's rated operational current (Ie) can be assumed as typical here.

The current limiting function is always active because it is required by the intrinsic device protection. If the current limiting potentiometer is set to the clockwise stop (maximum), the starting current is limited to five times the set rated motor current.

Ramp-up detection (3RW40 only)

The SIRIUS 3RW40 soft starter is equipped with an integrated ramp-up detection function. If it detects a motor startup, the motor voltage is immediately increased to 100 % of the mains voltage. The internal bypass contacts close and the thyristors are bridged.

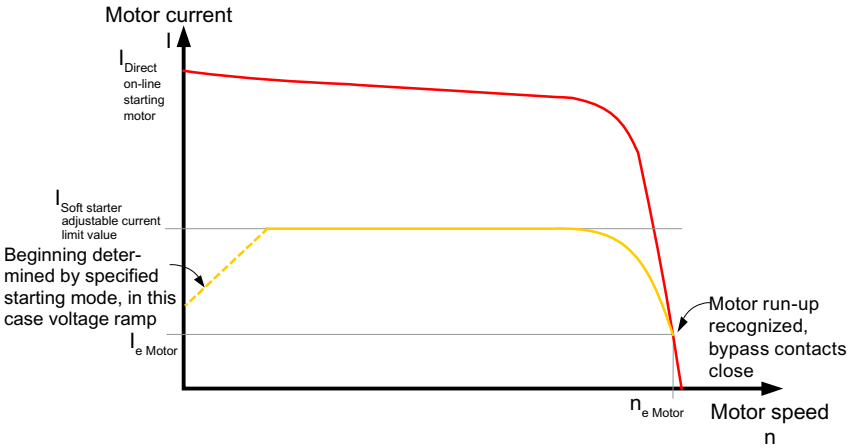


Figure 5-4 Current limiting with soft starter

Typical applications for current limiting

Current limiting is used for applications with large centrifugal masses (mass inertias) and therefore longer ramp-up times, e.g. fans, circular saws etc.

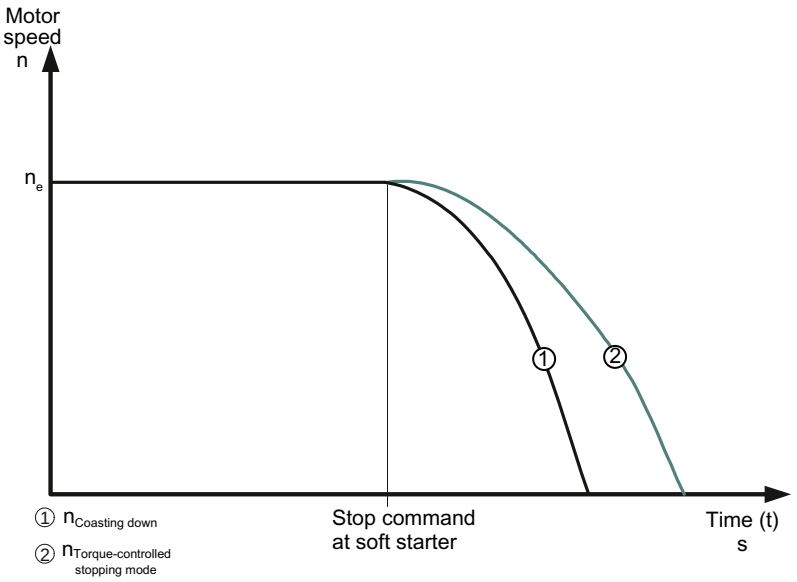
5.2 Stop modes

You can choose between different stop modes reflecting the wide range of applications for SIRIUS soft starters. The motor stop can be optimally adapted to each particular application.

If a start command is issued during the stop process, the process is interrupted and the motor is started again with the set start mode.

Note

If you select "soft stop" (3RW40 only) as the stop mode, the feeder (soft starter, cables, feeder protective devices, and motor) may need to be dimensioned for higher values because the current exceeds the rated motor current during the stop process.



5.2.1 Stop without load (3RW30 and 3RW40)

"Stop without load" means the power supplied to the motor via the soft starter is interrupted when the ON command is removed from the starter. The motor coasts to a standstill, driven only by the mass inertia (centrifugal mass) of the rotor and load. This is also referred to as a natural stop. A large centrifugal mass means a longer stop time without load.

Typical applications for stop without load

Stop without load is used for loads that place no special demands on the startup characteristic, e.g. fans.

5.2.2 Soft stop (3RW40 only)

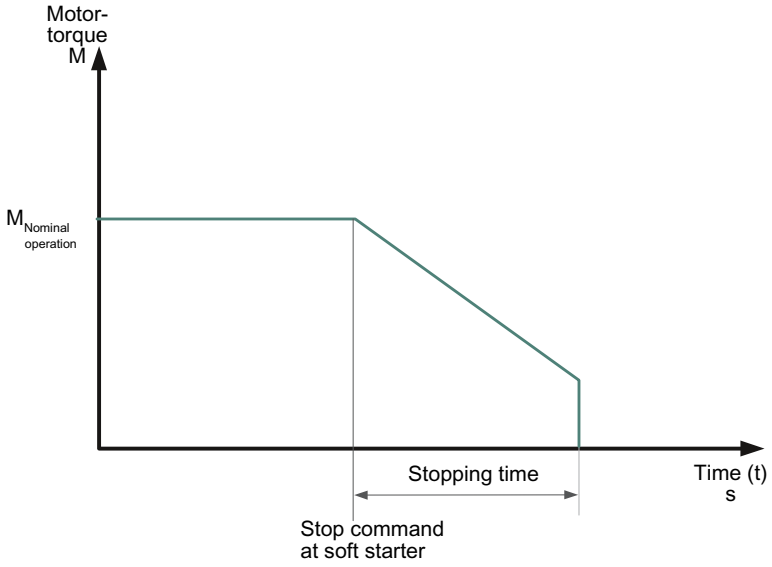
In "soft stop" mode, the natural stop process of the load is decelerated. The function is used when the load must be prevented from stopping abruptly. This is typically the case in applications with a low mass inertia or a high counter-torque.

Ramp-down time

The "Ramp-down time" potentiometer on the soft starter allows you to specify how long power should still be supplied to the motor after the ON command is removed. The torque generated in the motor is reduced by means of a voltage ramp function within this ramp-down time and the application stops smoothly.

If the motor is stopped abruptly in pump applications, as is normal with wye-delta or direct starting, for instance, water hammer can occur. Water hammer is caused by the sudden flow separation, leading to pressure fluctuations on the pump. It has the effect of producing noise and mechanical impacts on the pipelines as well as on any flaps and valves installed there.

Water hammer can be reduced compared to direct or wye-delta starting by using the SIRIUS 3RW40 soft starter. An optimum pump stop is achieved using a SIRIUS 3RW44 soft starter with an integrated pump stop function (refer to chapter Comparison of device functions [Page 24]).



Typical applications for soft stop

Use soft stop for

- Pumps to reduce water hammer.
- Conveyor belts to prevent the conveyed product from tilting.

5.3 Motor protection / intrinsic device protection (3RW40 only)

NOTICE
If the soft starter is disconnected because the motor overload protection or the intrinsic device protection trips, you must wait a defined cooling time (recovery time) prior to acknowledging the fault or starting the motor again. (Motor overload tripping time: 60 seconds, temperature sensor: after cooling, intrinsic device protection tripping time: > 30 seconds)

5.3.1 Motor protection function

The motor overload protection function is implemented on the basis of the winding temperature. This indicates whether the motor is overloaded or functioning in the normal operating range.

The winding temperature can either be calculated with the help of the integrated, electronic motor overload function or measured with a connected motor thermistor.

The two types of protection must be combined to achieve full motor protection. This combination is recommended to protect the motor optimally.

Note

Thermistor motor protection evaluation

The thermistor motor protection evaluation function is optionally available for the SIRIUS 3RW40 2 to 3RW40 4 soft starters in the 24 V AC/DC control voltage version.

Motor overload protection

The current flow during motor operation is measured by measuring the current with transformers integrated in the soft starter. The temperature rise in the winding is calculated based on the rated operational current set for the motor.
A trip is generated by the soft starter when the characteristic is reached, depending on the trip class (CLASS setting).

ATEX
"Increased safety" type of protection EEx e acc. to ATEX Directive 94/9/EC

The SIRIUS 3RW40 soft starter sizes S0 to S12 are suitable for starting explosion-proof motors with the "increased safety" type of protection EEx e (type of protection / marking: Ex II (2) GD).

Wire the fault output (95 96) to an upstream switching device in such a way that if a fault occurs, this device disconnects the feeder (refer to Fig. "3RW40 wiring fault with 3RV").

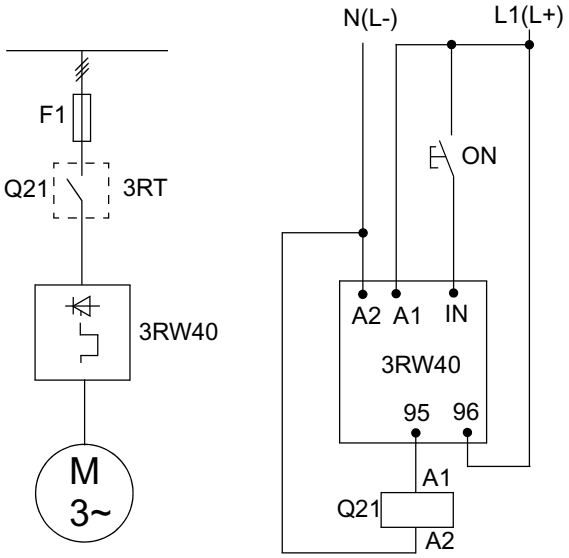


Figure 5-5 3RW40 wiring fault

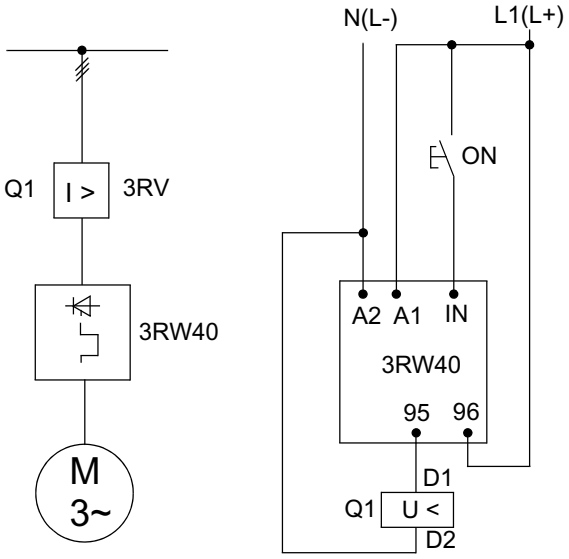


Figure 5-6 3RW40 wiring fault with 3RV

For further information, refer to the operating instructions, Order No. 3ZX1012-0RW40-1CA1 (http://support.automation.siemens.com/WW/view/de/22809303).

⚠ WARNING

Danger of death or serious injury.

The 3RW40 is not suitable for installation in hazardous areas. The device is only allowed to be installed in a control cabinet with the IP4x degree of protection. Appropriate measures (e.g. encapsulation) must be taken if it is to be installed in a hazardous area.

Trip class (electronic overload protection)

The trip class (CLASS) specifies the maximum time within which a protective device must trip from a cold state at 7.2 x the rated operational current (motor protection to IEC 60947). The tripping characteristics represent this time as a function of the tripping current (refer to chapter Motor protection tripping characteristics for 3RW40 (with symmetry) [Page 161]). You can set different CLASS characteristics according to the startup class.

Note

The rated data of the soft starters refers to normal starting (CLASS 10). The starters may need to be calculated with a size allowance for heavy-duty starting (> CLASS 10). You can only set a rated motor current that is lower than the soft starter rated current (for the permissible settings, refer to chapter Technical data [Page 121]).

Recovery time (motor overload protection)

A recovery time of 60 seconds, during which the motor cools down and cannot be restarted, starts if the thermal motor model is tripped.

Protection against voltage failure in the event of a fault

If the control supply voltage fails during a trip, the current tripping state of the thermal motor model and the current recovery time are stored in the soft starter. When the control supply voltage is restored, the current tripping state of the thermal motor model and the intrinsic device protection prior to the power failure are likewise automatically restored. If the control voltage is disconnected during operation (without a preceding fault trip), the starter is not protected against voltage failure.

Temperature sensor

Note

Temperature sensor

The temperature sensor evaluation function is optionally available for the SIRIUS 3RW40 24 to 3RW40 47 soft starters in the 24 V AC/DC control voltage version.

This motor protection function measures the motor's stator winding temperature directly with the help of a sensor installed in the motor, in other words the motor must have a sensor wound into the stator winding.
You can choose between two different sensor types for the evaluation.

1. Type A PTC thermistors ("type A sensors") for connection to terminals T11/21 and T12
2. Thermoclick sensors for connection to terminals T11/21 and T22

The wiring and sensors are monitored for wire breakage and short-circuits.

Recovery time (thermistor motor protection)

If the thermistor motor protection is tripped, the soft starter cannot be restarted until the sensor installed in the motor has cooled down. The recovery time varies according to the temperature state of the sensor.

5.3.2 Intrinsic device protection (3RW40 only)

Thyristor protection (thermal)

SIRIUS 3RW40 soft starters are equipped with integrated intrinsic device protection to prevent thermal overloading of the thyristors.
This is achieved on the one hand by means of current measuring transformers in the three phases and on the other, by measuring the temperature with temperature sensors on the thyristor's heat sink.
If the fixed, internally set trip value is exceeded, the soft starter is automatically disconnected.

Recovery time (intrinsic device protection)

If the intrinsic device protection is tripped, the soft starter cannot be restarted until a recovery time of at least 30 seconds has elapsed.

Thyristor protection (short-circuit)

SITOR semiconductor fuses must be connected upstream to protect the thyristors against short-circuits (e.g. in case of cable damage or an interturn fault in the motor; refer to chapter Soft starter assembly with type of coordination 2 [Page 61]). For the fuse selection tables, refer to chapter Technical data [Page 121].

Protection against voltage failure (in the event of a fault)

If the control supply voltage fails during a trip, the current tripping state of the thermal intrinsic device protection model and the current recovery time are stored in the soft starter. When the control supply voltage is restored, the current tripping state of the thermal intrinsic device protection prior to the power failure are likewise automatically restored.

NOTICE
If the control voltage is disconnected during operation (e.g. in "automatic mode"), the starter is not protected against voltage failure. You must wait five minutes between two starts to ensure that the motor protection and the intrinsic device protection are working correctly.

5.4 Functions of the RESET buttons

5.4.1 SIRIUS 3RW40 2, 3RW40 3, and 3RW40 4 soft starters

5.4.1.1 RESET MODE button and LED

By pressing the RESET MODE button, you define the reset procedure in case of a fault. This is indicated by the RESET MODE LED.





Yellow = AUTO

Off = MANUAL

Green = REMOTE

Note

On the SIRIUS 3RW40 2. soft starter, the RESET MODE button is located underneath the label (refer to chapter Operator controls, displays, and connections on the 3RW40 [Page 70])

5.4.1.2 Manual RESET

Manual RESET with the RESET / TEST button (RESET MODE LED = off)

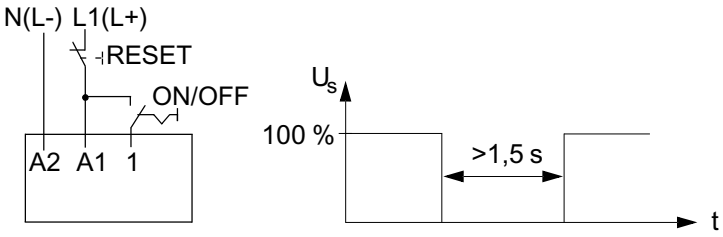
You can reset a fault by pressing the RESET / TEST button.



5.4.1.3 Remote RESET

Remote RESET (RESET MODE LED = green)

You can reset a fault signal by disconnecting the control supply voltage for >1.5 s.



5.4.1.4 AUTO RESET

AUTO RESET (RESET MODE LED = yellow)

If you set the RESET mode to AUTO, a fault is automatically reset as follows:

- If the motor overload protection function trips: after 60 s
- If the intrinsic device protection function trips: after 30 s
- If the thermistor evaluation function trips: after the temperature sensor in the motor has cooled down

⚠ WARNING

Automatic restart
Danger of death, serious injury, or property damage.

The automatic RESET mode (AUTO RESET) must not be used in applications where there is a risk of serious injury to persons or substantial damage to property if the motor starts up again unexpectedly. The start command (e.g. issued by a contact or the PLC) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

5.4.1.5 Acknowledging faults

For information about whether or not faults can be acknowledged as well as the corresponding LED and output contact states, refer to chapter Diagnostics and fault signals [Page 44].

5.4.2 SIRIUS 3RW40 5 and 3RW40 7 soft starters

5.4.2.1 RESET MODE button and AUTO LED

By pressing the RESET MODE button, you define the reset procedure in case of a fault. This is indicated by the AUTO LED.

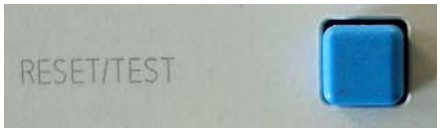


Yellow = AUTO
Off = MANUAL (REMOTE)

5.4.2.2 Manual RESET

Manual RESET with the RESET / TEST button (AUTO LED = off)

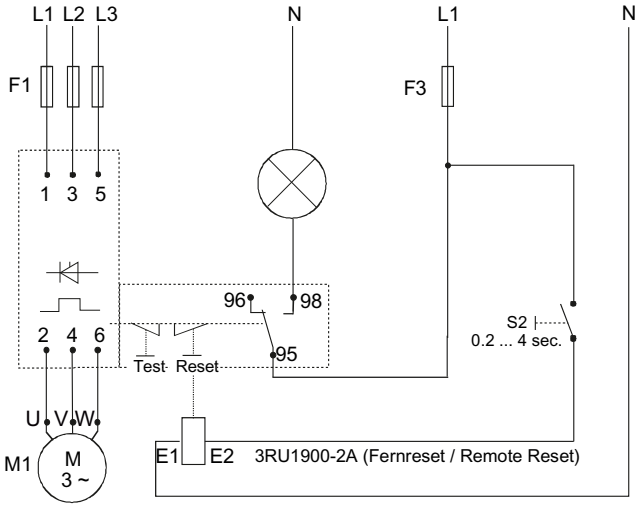
You can reset a fault by pressing the RESET / TEST button.



5.4.2.3 Remote RESET

Remote RESET (AUTO LED = green)

You can initiate a remote RESET by controlling the optional module for RESET (3RU1900-2A).



5.4.2.4 AUTO RESET

AUTO RESET (AUTO LED = yellow)

If you set the RESET mode to AUTO, a fault is automatically reset as follows:

- If the motor overload protection function trips: after 60 s
- If the intrinsic device protection function trips: after 30 s

⚠ WARNING

Automatic restart
Can result in death, serious injury, or property damage.

The automatic RESET mode (AUTO RESET) must not be used in applications where there is a risk of serious injury to persons or substantial damage to property if the motor starts up again unexpectedly. The start command (e.g. issued by a contact or the PLC) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

5.4.2.5 Acknowledging faults

For information about whether or not faults can be acknowledged as well as the corresponding LED and output contact states, refer to chapter Diagnostics and fault signals [Page 44].

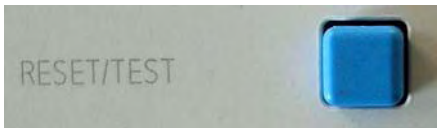
5.4.3 Other functions of the RESET button

5.4.3.1 Motor protection trip test

You initiate a motor overload trip by pressing the RESET / TEST button for longer than five seconds. The SIRIUS 3RW40 soft starter is tripped by the fault signal at the OVERLOAD LED, the FAILURE / OVERLOAD contact 95-98 closes, and the motor that is connected and running is switched off.



RESET / TEST button on the 3RW40 2, 3RW40 3, and 3RW40 4



RESET / TEST button on the 3RW40 5 and 3RW40 7

5.4.3.2 Reparameterizing the ON / RUN output contact

For information about reparameterizing the output with the RESET / TEST button, refer to chapter Parameterizing the 3RW40 outputs [Page 110] .

5.5 Functions of the inputs

5.5.1 Start input (terminal 1) on 3RW30 and 3RW40 2 to 3RW40 4

Rated control voltage is present at terminal A1 / A2: The startup process of the soft starter begins when a signal is present at terminal 1 (IN). The starter operates until the signal is removed again.

If a ramp-down time is parameterized (3RW40 only), a soft stop starts as soon as the signal is removed.

The potential of the signal at terminal 1 must correspond to the potential of the rated control voltage at terminal A1 / A2.



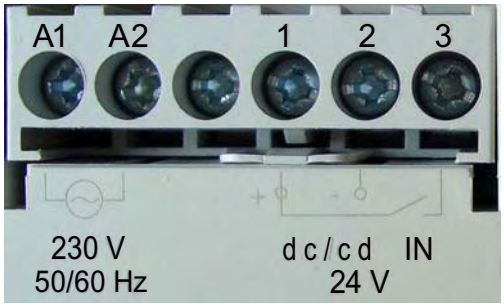
For recommended circuits, e.g. control by means of pushbuttons, contactor contacts, or a PLC, refer to chapter Typical circuit diagrams [Page 167].

5.5.2 Start input (terminal 3) on 3RW40 5 and 3RW40 7

Rated control voltage is present at terminal A1 / A2: The startup process of the soft starter begins when a signal is present at terminal 3 (IN). The starter operates until the signal is removed again. If a ramp-down time is parameterized, a soft stop starts as soon as the signal is removed.

The 24 V DC control voltage supplied by the soft starter must be taken from terminal 1 (+) as voltage for the signal at terminal 3.

If you select direct control by a PLC, the "M" of the PLC's reference potential must be connected to terminal 2 (-).



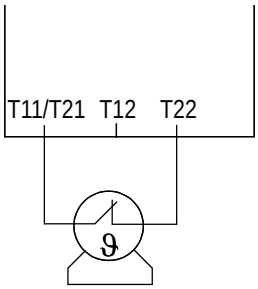
For recommended circuits, e.g. control by means of pushbuttons, contactor contacts, or a PLC, refer to chapter Typical circuit diagrams [Page 167].

5.5.3 Thermistor input / connection on 3RW40 2 to 3RW40 4

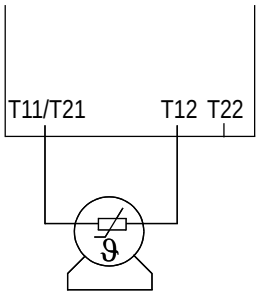
24 V AC/DC rated control voltage

After removing the copper jumper between T11/21 and T22, you can connect and evaluate either a Klixon thermistor integrated in the motor winding (at terminal T11/T21-T22) or a type A PTC (at terminal T11/T21-T12).





Klixon



Type A PTC

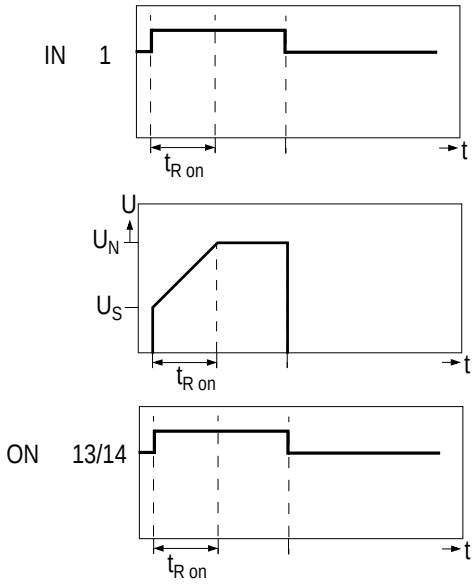
5.6 Functions of the outputs

5.6.1 3RW30: Output terminal 13 / 14 ON

The potential-free output contact at terminal 13/14 (ON) closes if a signal is present at terminal 1 (IN); it remains closed until the start command is removed.

The output can be used, for instance, to control a line contactor connected upstream or to implement latching if you selected pushbutton control. For recommended circuits, refer to chapter Typical circuit diagrams [Page 167].





For a state diagram of the contact in the various operating states, refer to chapter Diagnostics and fault signals [Page 44].

5.6.2 3RW40: Output terminals 13 / 14 ON / RUN and 23 / 24 BYPASSED

ON

The potential-free output contact at terminal 13/14 (ON) closes if a signal is present at terminal 1 (IN); it remains closed until the start command is removed (factory default). The ON function can be used, for instance, as a latching contact if you selected pushbutton control.

Reparameterizing from ON to RUN

You can reparameterize the function of the ON output on the 3RW40 to RUN by simultaneously pressing the RESET TEST and RESET MODE buttons (refer to chapter Commissioning the 3RW40 [Page 98]).

RUN

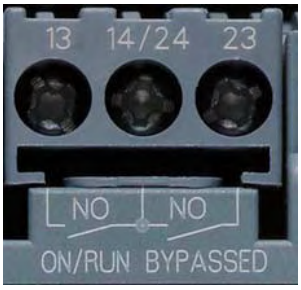
The RUN output remains closed as long as the motor is controlled by the soft starter, in other words during the startup phase, in bypass mode, and during the soft stop (if set). This output function can be used, for instance, if a line contactor connected upstream must be controlled by the soft starter, especially if the soft stop function is set.

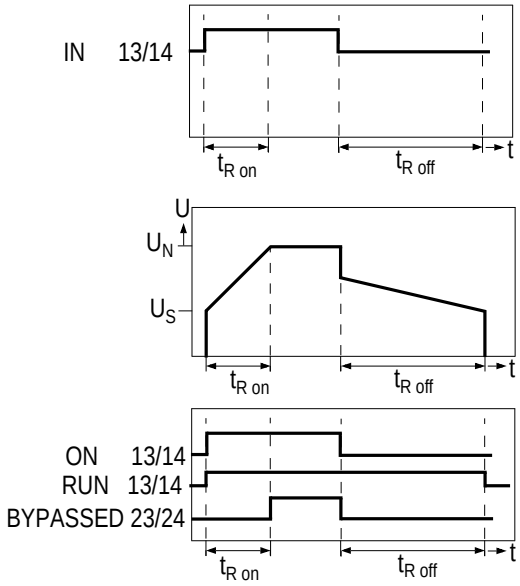
BYPASSED

The BYPASSED function can be used, for instance, to indicate that the motor has started up successfully.

The BYPASSED output at terminal 23 / 24 closes as soon as the SIRIUS 3RW40 soft starter detects that the motor has started up (refer to chapter Ramp-up detection [Page 104]).

The integral bypass contacts simultaneously close and the thyristors are bridged. The integral bypass contacts and output 23 / 24 open again as soon as the start input IN is removed.





For a state diagram of the contacts and the LEDs in the various operating and fault states, refer to chapter Diagnostics and fault signals [Page 44].

For recommended circuits, refer to chapter Typical circuit diagrams [Page 167].

5.6.3 3RW40: Group fault output at terminal 95 / 96 / 98 OVERLOAD / FAILURE

If there is no rated control voltage or if a failure occurs, the potential-free FAILURE / OVERLOAD output is switched.



For recommended circuits, refer to chapter Typical circuit diagrams [Page 167].

For a state diagram of the contacts in the various fault and operating states, refer to chapter Diagnostics and fault signals [Page 44].

5.7 Diagnostics and fault signals

5.7.1 3RW30: LEDs and troubleshooting

		LEDs on 3RW30		Auxiliary contact
		Soft starter		
3RW30		DEVICE (rd/gn/ylw)	STATE/BYPASSED/ FAILURE (gn/rd)	13 14/ (ON)
U_s= 0		●	●	
Operating state	IN			
Off	0	☼ gn	●	
Start	1	☼ gn	◑ gn	
Bypassed	1	☼ gn	☼ gn	
Fault				
Impermissible electronics supply voltage [1]		●	☼ rd	
Bypass overload [2]		☼ ylw	☼ rd	
- Missing load voltage [1] - Phase failure, missing load [1]		☼ gn	☼ rd	
Device fault [3]		☼ rd	☼ rd	

LEDs					
●	☼	◑	gn =	rd =	ylw =
Off	ON	Flashing	Green	Red	Yellow

1) The fault is automatically reset by an outgoing event. An automatic restart is initiated and the 3RW restarted if a start command is present at the input.

⚠ WARNING

Automatic restart
Danger of death, serious injury, or property damage.

If you do not want the motor to start automatically, you must integrate suitable additional components, e.g. phase failure or load monitoring devices, into the control and main circuits.

2) The fault can be acknowledged by removing the start command at the start input.

3) Switch off the control voltage, then switch it on again. If the fault is still present, contact your SIEMENS partner or Technical Assistance.

For notes on troubleshooting, refer to the table below.

Fault	Cause	Remedy
Impermissible electronics supply voltage	The control supply voltage does not correspond to the soft starter's rated voltage.	Check the control supply voltage; an incorrect control supply voltage could be caused by a power failure or a voltage dip.
Bypass overload	A current > 3.5 x I_e of the soft starter occurs for > 60 ms in bypass mode (e.g. because the motor is blocked).	Check the motor and load, and check the soft starter's dimensions.
Missing load voltage, phase failure / missing load	Cause 1: Phase L1 / L2 / L3 is missing or fails / collapses when the motor is operating. Tripped as a result of a dip in the permissible rated operational voltage > 15 % for > 100 ms during the startup process or > 200 ms in bypass mode.	Connect L1 / L2 / L3 or correct the voltage dip.
	Cause 2: The motor that is connected is too small and the fault occurs as soon as it is switched to bypass mode.	If less than 10 % of the soft starter's rated current is flowing, the motor cannot be operated with soft starter. Use another soft starter.
	Cause 3: Motor phase T1 / T2 / T3 is not connected.	Connect the motor properly (e.g. jumpers in the motor terminal box, repair switch closed etc.)
Device fault	Soft starter defective.	Contact your SIEMENS partner or Technical Assistance.

5.7.2 3RW40: LEDs and troubleshooting

		LEDs on 3RW40				Auxiliary contacts			
		Soft starter		Motor protection					
3RW40		DEVICE (rd/gn/ylw)	STATE / BYPASSED / FAILURE (gn/rd)	OVERLOAD (rd)	RESET MODE / AUTO (ylw/gn)	13 14 (ON)	13 14 (RUN)	24 23 (BYPASSED)	96 95 98 FAILURE / OVERLOAD
U_S= 0		●	●	●	●				
Operating state	IN								
Off	0	☼ gn	●	●	●				
Start	1	☼ gn	◑ gn	●	●				
Bypassed	1	☼ gn	☼ gn	●	●				
Stop	0	☼ gn	◑ gn	●	●				
Warning									
I_e/ impermissible CLASS setting [2]		☼ gn	● ◑ ☼ gn gn	◑	●				
Start inhibited, device too hot (cooling time may vary according to thyristor temperature) [3]		◑ ylw	●	●	●				
Fault									
Impermissible electronics supply voltage [2]		●	☼ rd	●	●				
Impermissible I_e / CLASS setting and IN (0 -> 1) [2]		☼ gn	☼ rd	◑	●				
Motor protection tripping, overload relay [1] cooling time 60 s / thermistor cooling time may vary according to motor temperature		☼ gn	●	☼	●				
Thermistor motor protection Wire breakage / short-circuit [1] [3]		☼ gn	●	⋈	●				
Thermal overload on device [3] (cooling time > 30 s)		☼ ylw	☼ rd	●	●				
- Missing load voltage - Phase failure, missing load [3]		☼ gn	☼ rd	●	●				
Device fault (cannot be acknowledged, device defective) [5]		☼ rd	☼ rd	●	●				
Test function									
Press TEST t>5 s [4]		☼ gn	●	☼ rd	●				
RESET MODE (press to change)									
Manual RESET		●	●	●	●				
Auto RESET		●	●	●	☼ ylw				
Remote RESET		●	●	●	☼ gn				

LEDs							1) Optional, 3RW40 2. to 3RW40 4. in 24 V AC/DC only
●	☼	◑	⋈	gn =	ylw =	rd =	2) Automatically reset if the setting is corrected or when the system returns to normal
							3) Must be acknowledged according to the selected RESET mode 4) Motor protection trip test
Off	ON	Flashing	Flickering	Green	Yellow	Red	5) Device fault cannot be acknowledged. Contact your SIEMENS partner or Technical Assistance.

⚠ WARNING

Automatic restart
Can result in death, serious injury, or property damage.

The automatic RESET mode (AUTO RESET) must not be used in applications where there is a risk of serious injury to persons or substantial damage to property if the motor starts up again unexpectedly. The start command (e.g. issued by a contact or the PLC) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output on the 3RW40 (terminals 95 and 96), or the signaling contact of the motor or miniature circuit breaker on all devices, in the controller.

Notes on troubleshooting

Warning	Cause	Remedy
Impermissible I_e CLASS setting (control voltage present, no start command)	The rated operational current I_e set for the motor (control voltage present, no start command) exceeds the associated, maximum permissible setting current referred to the selected CLASS setting (chapter Motor current settings [Page 107]).	Check the rated operational current set for the motor, select a lower CLASS setting, or calculate the soft starter with a size allowance. As long as the 3RW40 is not controlled IN (0->1), this is only a status signal. However, it becomes a fault signal if the start command is applied.
Start inhibited, device too hot	The acknowledgment and the motor start are inhibited for a defined time by the inherent device protection following an overload trip, to allow the 3RW40 to cool down. Possible causes • Too many starts, • Motor ramp-up time too long, • Ambient temperature in switching device's environment too high, • Minimum installation clearances not complied with.	The device cannot be started until the temperature of the thyristor or the heat sink has cooled down enough to guarantee sufficient reserve for a successful startup. The time until restarting is allowed can vary but is a minimum of 30 s. Rectify the causes and possibly retrofit the optional fan (3RW40 2. to 3RW40 4.).

Fault	Cause	Remedy
Impermissible electronics supply voltage:	The control supply voltage does not correspond to the soft starter's rated voltage.	Check the control supply voltage; could be caused by a power failure, voltage dip, or incorrect control supply voltage. Use a stabilized power supply unit if due to mains fluctuations.
Impermissible Ie/CLASS setting and IN (0->1) (control voltage present, IN start command changes from 0 to 1)	The rated operational current I_e set for the motor (control voltage present, start command present) exceeds the associated, maximum permissible setting current referred to the selected CLASS setting (chapter Motor current settings [Page 107]). For the maximum permissible settings, refer to chapter "Technical data [Page 121]".	Check the rated operational current set for the motor, select a lower CLASS setting, or calculate the soft starter with a size allowance.
Motor protection tripping Overload relay / thermistor:	The thermal motor model has tripped. After an overload trip, restarting is inhibited until the recovery time has elapsed. - Overload relay tripping time: 60 s - Thermistor tripping time: When the temperature sensor (thermistor) in the motor has cooled down.	- Check whether the motor's rated operational current I_e is set correctly, or - Change the CLASS setting, or - Possibly reduce the switching frequency, or - Deactivate the motor protection (CLASS OFF), or - Check the motor and the application.
Thermistor protection: wire breakage / short-circuit (optional for 3RW40 2. to 3RW40 4. devices):	Temperature sensor at terminals T11/ T12/T22 is short-circuited or defective, a cable is not connected, or no sensor is connected.	Check the temperature sensor and the wiring
Thermal overload on the device:	Overload trip of the thermal model for the power unit of the 3RW40 Possible causes • Too many starts, • Motor ramp-up time too long, • Ambient temperature in switching device's environment too high, • Minimum installation clearances not complied with.	Wait until the device has cooled down again, possibly increase the current limiting value set for starting, or reduce the switching frequency (too many consecutive starts). Possibly retrofit the optional fan (3RW40 2. to 3RW40 4.). Check the load and the motor, check whether the ambient temperature in the soft starter's environment is too high (derating above 40 °C, refer to chapter Technical data [Page 121]), comply with the minimum clearances.

Fault	Cause	Remedy
Missing load voltage, phase failure / missing load:	Cause 1: Phase L1 / L2 / L3 is missing or fails / collapses when the motor is operating. Tripped as a result of a dip in the permissible rated operational voltage > 15 % for > 100 ms during the startup process or > 200 ms in bypass mode.	Connect L1 / L2 / L3 or correct the voltage dip.
	Cause 2: The motor that is connected is too small and the fault occurs as soon as it is switched to bypass mode.	Set the correct rated operational current for the connected motor or set it to the minimum value (if the motor current is less than 10 % of the set I_e, the motor cannot be operated with this starter).
	Cause 3: Motor phase T1 / T2 / T3 is not connected.	Connect the motor properly (e.g. jumpers in the motor terminal box, repair switch closed etc.)
Device fault	Soft starter defective.	Contact your SIEMENS partner or Technical Assistance.

Application planning

6

6.1 Application examples

6.1.1 Roller conveyor application

Using the 3RW30 with roller conveyors

Roller conveyors are employed, for example, in parcel distribution systems for transporting parcels to and from individual workstations. For this purpose, the direction of rotation of the 11 kW / 15 hp motor that is used has to be adjustable in order for the conveyor to work in both directions.

The following requirements must be met by the roller conveyor:

- The roller conveyor has to start smoothly, to prevent damage to the transported goods due to slipping or tilting.
- The machine's wear and maintenance intervals should be minimized, which is why slippage of the belt drive during startup must be prevented.
- The high current load upon motor startup must be reduced by means of a voltage ramp.
- The feeder assembly should be as small as possible so as not to exceed the control cabinet's space capacity.

The SIRIUS 3RW30 soft starter offers the following advantages:

- The roller conveyor is rapidly accelerated to the nominal speed without torque surges thanks to the optimum setting of the voltage ramp during startup.
- The motor's starting current is reduced.
- Reversing operation of the conveyor belt is realized through contactor interconnection with SIRIUS 3RA13 reversing contactor combinations.
- The feeder and the motor protection are implemented with SIRIUS 3RV motor starter protectors.
- The use of SIRIUS system components guarantees maximum wiring reductions and space savings.

6.1.2 Hydraulic pump application

Using the 3RW40 with hydraulic pumps

The SIRIUS 3RW40 is optimally suited for soft starting and stopping of hydraulic pumps. With a rating of 200 kW / 250 hp, this soft starter is used, for example, in the production of sheet parts to drive the presses.

The drives for hydraulic pumps must meet the following requirements:

- The motor's starting current has to be reduced to minimize the load on the higher-level mains transformer during startup.
- Integrated motor protection is called for to reduce wiring expenditure and space requirements in the control box.
- The hydraulic pump must be started and stopped in a soft manner to minimize the mechanical load on the drive and the pump caused by torque surges during starting and stopping.

The SIRIUS 3RW40 soft starter offers the following advantages:

- The settable current limiting of the SIRIUS 3RW40 limits the load on the mains transformer during the motor startup.
- Motor protection is ensured by the motor overload relay with settable tripping times integrated in the soft starter.
- The adjustable voltage ramp ensures that the hydraulic pump is started and stopped without torque surges.

Installation

7

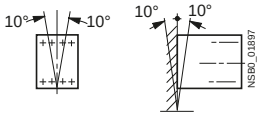
7.1 Installing the soft starter

7.1.1 Unpacking

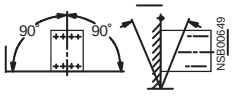
CAUTION
Do not lift the device by the cover in order to unpack it, especially sizes 3RW40 55 to 3RW40 76, because this could lead to damage.

7.1.2 Permissible mounting position

3RW30	3RW40 2 to 3RW40 4 (with optional additional fan)
3RW40	3RW40 5 to 3RW40 7



Vertical mounting



Horizontal mounting

NOTICE
The permissible switching frequency values can vary according to the selected mounting position. For information about factors and how to determine the new switching frequency, refer to chapter Configuration [Page 73].

Note

An optional fan can be ordered for the 3RW40 24 to 3RW40 47 sizes; this fan is integrated in the device for 3RW40 55 to 3RW40 76. The 3RW30 cannot be equipped with a fan.

7.1.3 Mounting dimensions, clearances, and assembly type

The minimum clearances from other devices must be complied with to ensure unobstructed cooling as well as the free supply and discharge of air to and from the heat sink.

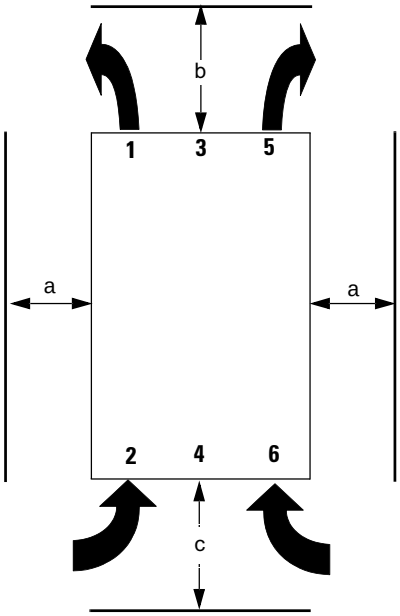


Figure 7-1 Clearances from other devices

MLFB	a (mm)	a (in)	b (mm)	b (in)	c (mm)	c (in)
3RW30 1./3RW30 2.	15	0.59	60	2.36	40	1.56
3RW30 3./3RW30 4	30	1.18	60	2.36	40	1.56
3RW40 2.	15	0.59	60	2.36	40	1.56
3RW40 3./3RW40 4.	30	1.18	60	2.36	40	1.56
3RW40 5./3RW40 7.	5	0.2	100	4	75	3

NOTICE

Allow sufficient clearances for the cooling air to circulate freely. The device is ventilated from bottom to top.

7.1.4 Assembly type: Standalone assembly, side-by-side assembly, direct mounting

Standalone assembly



The term "standalone assembly" is used if the clearances a / b / c described in chapter Mounting dimensions, clearances, and assembly type [Page 54] are complied with.

Side-by-side assembly



The term "side-by-side assembly" is used if the lateral clearance a described in chapter Mounting dimensions, clearances, and assembly type [Page 54] are not complied with, e.g. if several switching devices are assembled side by side.

Direct mounting



The term "direct mounting" is used if the top clearance b described in chapter Mounting dimensions, clearances, and assembly type [Page 54] is not complied with, e.g. if the soft starter is mounted directly on a motor starter protector (e.g. 3RV2) using a link module (e.g. 3RV29).

NOTICE
The permissible switching frequency values can vary according to the selected assembly type. For information about factors and how to determine the new switching frequency, refer to chapter Configuration [Page 73].

7.1.5 Installation requirements

Degree of protection IP00

The SIRIUS 3RW30 / 3RW40 soft starters conform to the IP00 degree of protection.

The devices must be installed in control cabinets with the IP54 degree of protection (pollution degree 2), taking account of the ambient conditions.

Make sure no liquids, dust, or conductive objects can get inside the soft starter. The soft starter produces waste heat (power loss) while it is operating (refer to chapter Technical data [Page 121]).

CAUTION
Provide adequate cooling at the place of installation to prevent the switching device from overheating.

Installation / mounting

8

8.1 General information

General information

A motor feeder comprises a **disconnector**, a **contact**, and a **motor** as a minimum.

Line protection against short-circuits must be implemented, together with overload protection for the line and motor.

Disconnector

The isolating function with line protection against overload and short-circuits can be achieved with a motor starter protector or a fuse disconnector, for instance. The motor overload protection function is integrated in the SIRIUS 3RW40 soft starter. The motor overload protection for the SIRIUS 3RW30 soft starter can be implemented with a motor circuit breaker, for instance, or using a motor overload relay in conjunction with a contactor (for the fuse and motor starter protector assignment, refer to Technical data [Page 121]).

Contact

The contact function is taken care of by the SIRIUS 3RW30 or 3RW40 soft starter.

⚠ DANGER

Hazardous voltage
Danger of death or serious injury.

If mains voltage is present at the input terminals of the soft starter, hazardous voltage may still be present at the soft starter output even if a start command has not been issued. This voltage must be isolated by means of a disconnector (open isolating distance, e.g. with an open switch disconnector) whenever work is carried out on the feeder (refer to chapter Five safety rules for work in or on electrical systems [Page 58]).

Note

All elements of the main circuit (such as fuses, motor starter protectors, and switching devices) must be dimensioned for direct starting and according to the on-site short-circuit conditions, and ordered separately.

For recommended fuse and motor starter protector ratings for the feeder with soft starter, refer to chapter Technical data [Page 121].

8.2 Five safety rules for work in or on electrical systems

A set of rules, which are summarized in DIN VDE 0105 as the "five safety rules", are defined for work in or on electrical systems as a preventative measure against electrical accidents:

1. Isolate
2. Secure against switching on again
3. Verify that the equipment is not live
4. Ground and short-circuit
5. Erect barriers around or cover adjacent live parts

These five safety rules must be applied in the above order prior to starting work on an electrical system. After completing the work, proceed in the reverse order.

It is assumed that every electrician is familiar with these rules.

Explanations

1. The isolating distances between live and deenergized parts of the system must vary according to the operating voltage that is applied.
   "Isolate" refers to the all-pole disconnection of live parts.
   All-pole disconnection can be achieved, e.g. by.:
   - Switching off the miniature circuit breaker
   - Switching off the motor circuit breaker
   - Unscrewing fusible links
   - Removing LV HRC fuses
2. The feeder must be secured against inadvertent restarting to ensure that it remains isolated for the duration of the work. This can be achieved, for instance, by securing the motor and miniature circuit breakers with lockable blocking elements in the disconnected state, either using a lock or by unscrewing the fuses.
3. The deenergized state of the equipment should be verified using suitable test equipment, e.g. a two-pole voltmeter. Single-pole test pins are not suitable for this purpose. The absence of power must be established for all poles, phase to phase, and phase to N/PE.
4. Grounding and short-circuiting are only mandatory if the system has a nominal voltage greater than 1 kV. In this case, the system should always be grounded first and then connected to the live parts to be short-circuited.
5. These parts should be covered, or barriers erected around them, to avoid accidental contact during the work with adjacent parts that are still live.

8.3 General feeder assembly (type of coordination 1)

The SIRIUS 3RW30 or 3RW40 soft starter is connected into the motor feeder between the motor starter protector and the motor.

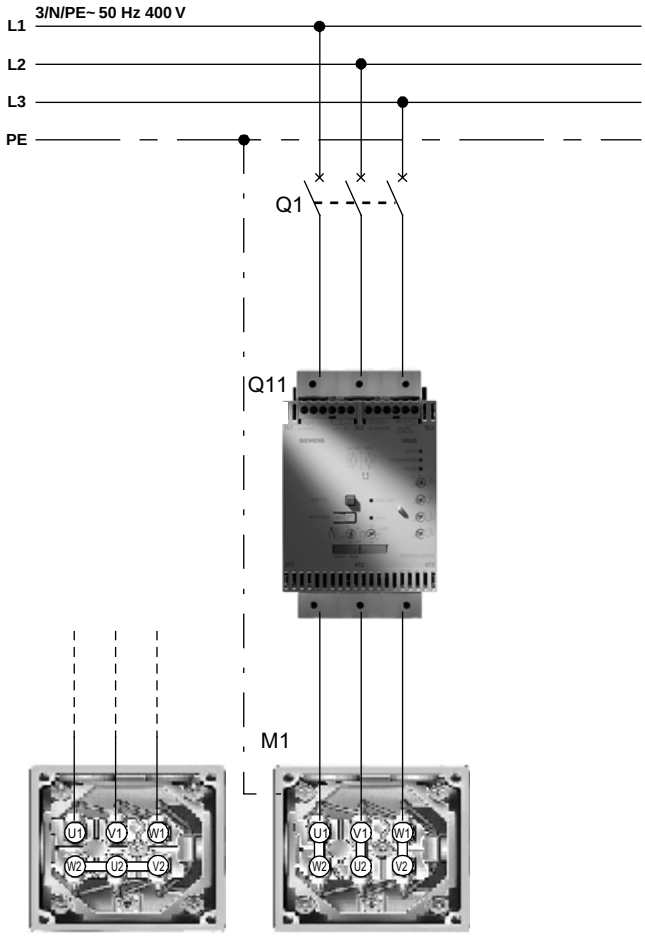


Figure 8-1 Block diagram of the SIRIUS 3RW40 soft starter

Note

For the component design, refer to chapter Technical data [Page 121].

8.4 Soft starter with line contactor (type of coordination 1)

If electrical isolation is specified, you can install a motor contactor between the soft starter and the motor starter protector.

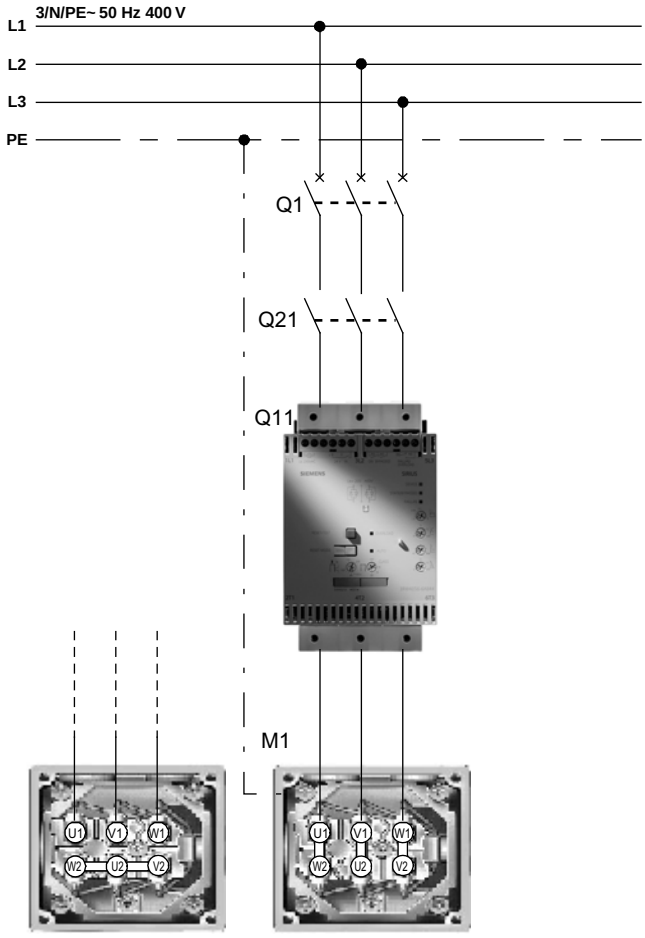


Figure 8-2 Block diagram of a feeder with an optional main / line contactor

Note

For the component design, refer to chapter Technical data [Page 121].

NOTICE

If a main or line contactor is used, it should not be connected between the soft starter and the motor. The soft starter could otherwise indicate a "Missing load voltage" fault in case of a start command and delayed connection of the contactor.

8.5 Soft starter assembly with type of coordination 2

The SIRIUS 3RW40 soft starter has internal protection to prevent overloading of the thyristors. The SIRIUS 3RW30 soft starter has no internal protection to prevent overloading of the thyristors. The soft starter must always be dimensioned according to the duration of the startup process and the desired starting frequency. If the feeder of the SIRIUS 3RW30 or 3RW40 soft starter is assembled accordingly with the feeder components recommended in chapter Technical data [Page 121] (e.g. motor starter protector or LV HRC fuse), type of coordination 1 is achieved. In order to achieve type of coordination 2, all thyristors must be additionally protected against short-circuits by means of special semiconductor fuses (e.g. SIEMENS SITOR). A short-circuit can occur, for instance, as a result of a defect in the motor windings or in the motor's power supply cable.

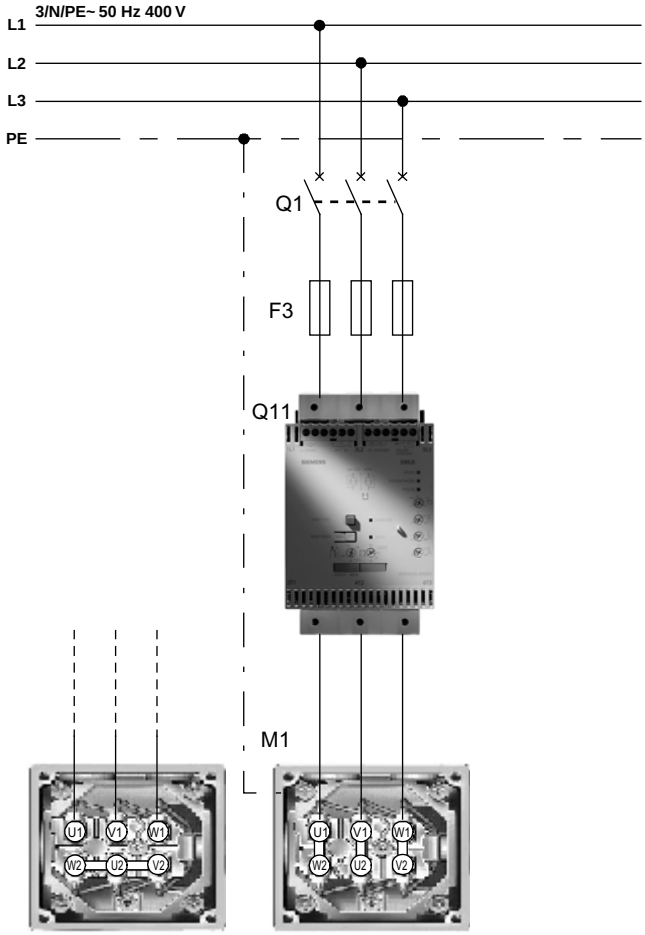


Figure 8-3 Block diagram of a feeder with semiconductor fuses

Note

For the component design, refer to chapter Technical data [Page 121].

Note

Minimum and maximum configuration of the semiconductor fuses

The fuses for the minimum and maximum configuration are specified in chapter Technical data [Page 121].

Minimum configuration: The fuse is optimized for the thyristor's I^2t value.

If the thyristor is cold (ambient temperature) and the startup process lasts a maximum of 20 s at 3.5 times the rated current of the device, the fuse does not trip.

Maximum configuration: The maximum current permitted for the thyristor can flow without the fuse tripping.

The maximum configuration is recommended for heavy-duty starting.

CAUTION

Risk of property damage

Type of coordination 1 in accordance with IEC 60947-4-1:

The device is defective following a short-circuit failure and therefore unsuitable for further use (personnel and equipment must not be put at risk).

Type of coordination 2 in accordance with IEC 60947-4-1:

The device is suitable for further use following a short-circuit failure (personnel and equipment must not be put at risk).

The type of coordination only refers to soft starters in conjunction with the stipulated protective device (motor starter protector / fuse), not to additional components in the feeder.

8.6 Capacitors to improve the power factor

⚠ CAUTION

No capacitors must be connected to the output terminals of the soft starter. If so, the soft starter will be damaged.
Active filters, e.g. for power factor correction, must not be operated parallel to the motor control device.

If capacitors are to be used to correct the power factor, they must be connected on the device's line side. If an isolating or main contactor is used together with the electronic soft starter, the capacitors must be disconnected from the soft starter when the contactor is open.

8.7 Maximum cable length

The cable between the soft starter and the motor must not be more than 300 m long (3RW30 and 3RW40).

The voltage drop due to the length of the cable to the motor may need to be considered when dimensioning the cable.

Cable lengths up to 500 m are permitted for SIRIUS 3RW44 soft starters (refer to the 3RW44 System Manual (http://support.automation.siemens.com/WW/llisapi.dll?query=3RW44&func=cslib.cssearch&content=skm%2Fmain.asp&lang=de&siteid=csius&objaction=cssearch&searchinprim=0&nodeid0=20025979)).

Connecting

9

9.1 Electrical connection

9.1.1 Control and auxiliary terminals

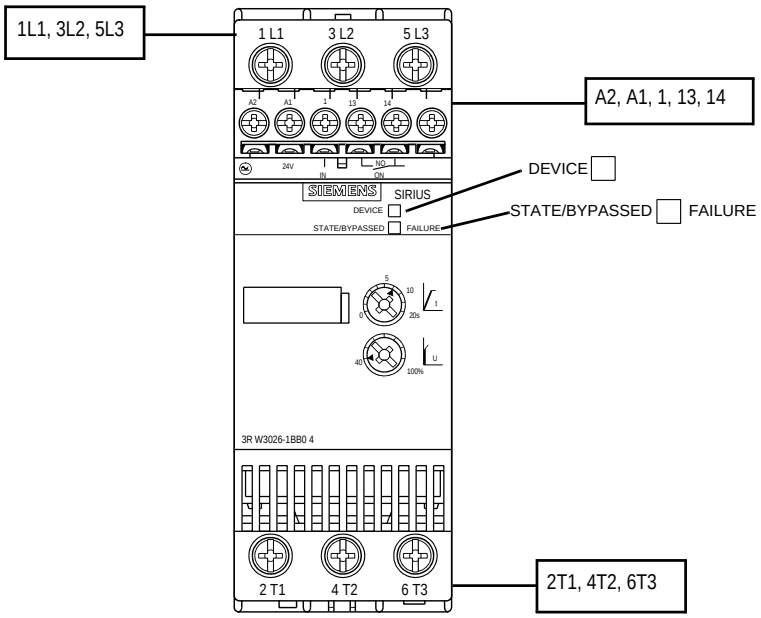
The SIRIUS 3RW30 and 3RW40 soft starters can be supplied with two different connection technologies:

- Screw-type technology
- Spring-loaded technology

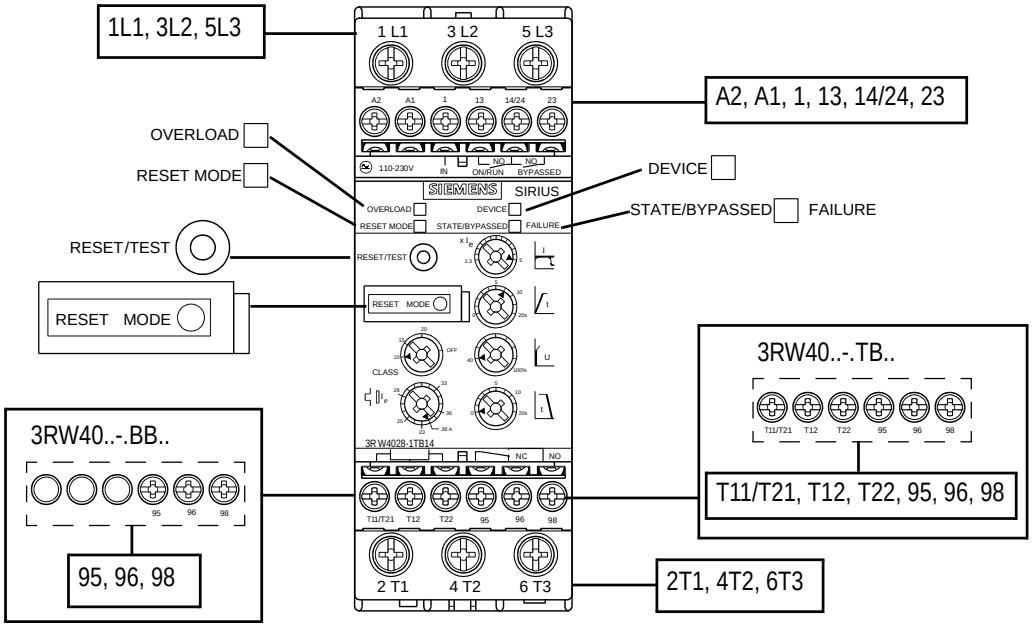
9.1.2 Main circuit connection

SIRIUS 3RW30 and 3RW40 soft starters up to the 55 kW / 75 hp size at 400 V / 480 V are designed with removable terminals at the main circuit connections.

Sizes 3RW30 1. to 3RW30 4.



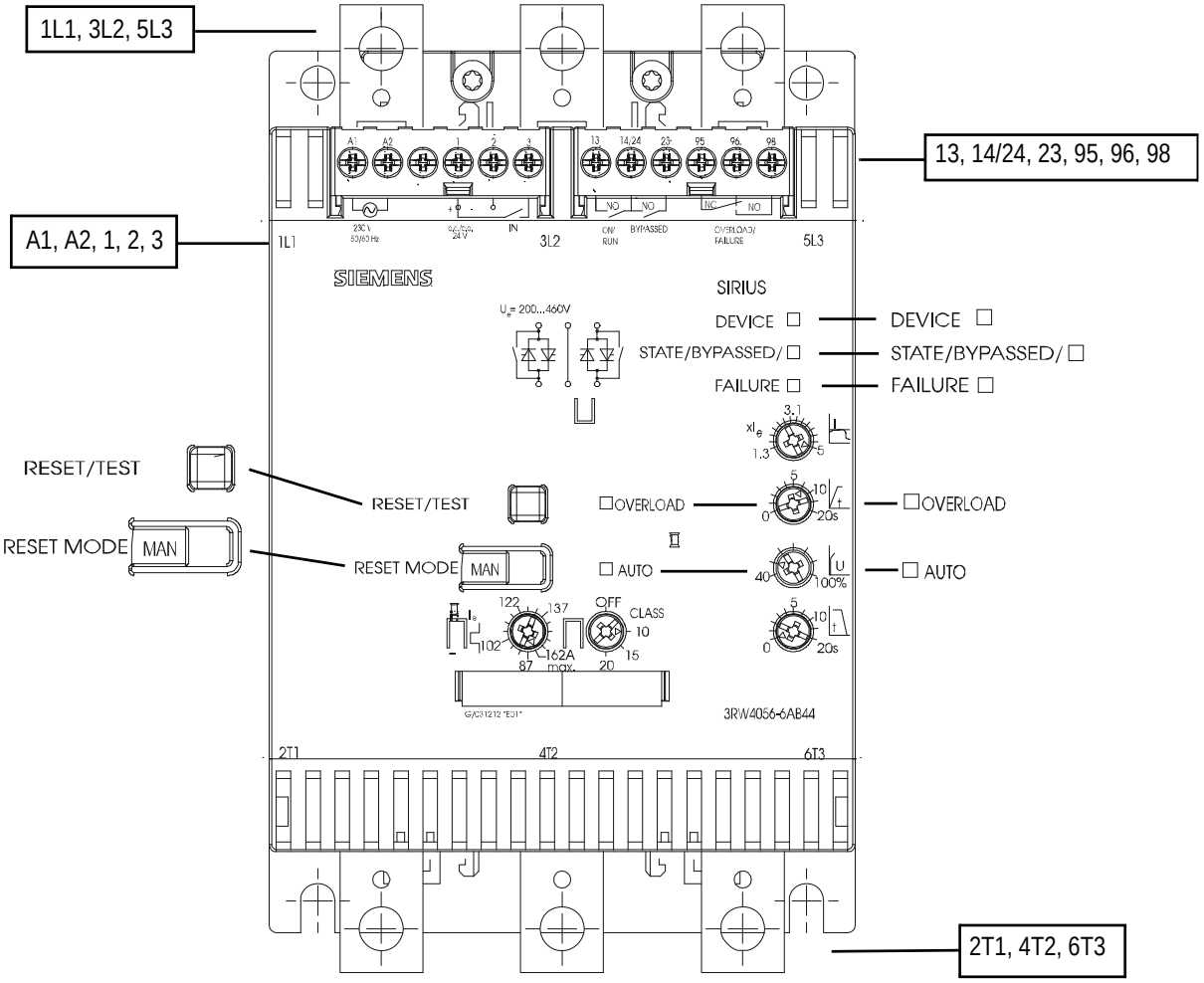
Sizes 3RW40 2. to 3RW40 4.



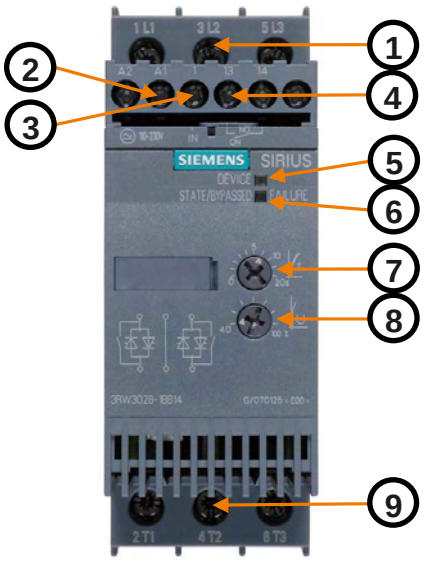
Sizes 3RW40 5. and 3RW40 7.

Sizes 3RW40 5. and 3RW40 7. have busbar connections for the main circuit connection.

Box terminals can be retrofitted on these devices as optional accessories (refer to chapter Accessories [Page 199]).

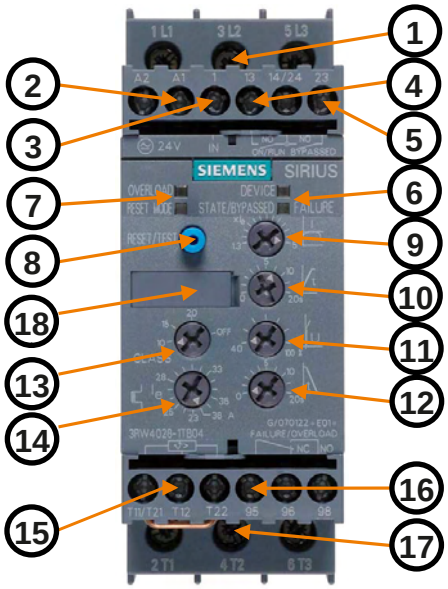


10.1 Operator controls, displays, and connections on the 3RW30



1	Operating voltage (three-phase mains voltage)
2	Control supply voltage
3	IN start input
4	ON output
5	DEVICE status LED
6	STATE / BYPASSED / FAILURE status LED
7	Ramp-up time
8	Starting voltage
9	Motor terminals

10.2 Operator controls, displays, and connections on the 3RW40



1 Operating voltage (three-phase mains voltage)
2 Control supply voltage
3 IN start input
4 ON / RUN output
5 BYPASSED output
6 DEVICE / STATE / BYPASSED / FAILURE status LEDs
7 OVERLOAD, RESET MODE status LEDs
8 TEST / RESET button
9 Current limiting
10 Ramp-up time
11 Starting voltage
12 Ramp-down time
13 Trip class
14 Motor current
15 Thermistor input (can be optionally ordered with 24 V AC/DC control voltage for 3RW40 2. to 3RW40 4. devices)
16 Fault output
17 Motor terminals
18 RESET MODE button (behind the label on the 3RW40 2., refer to the diagram below)

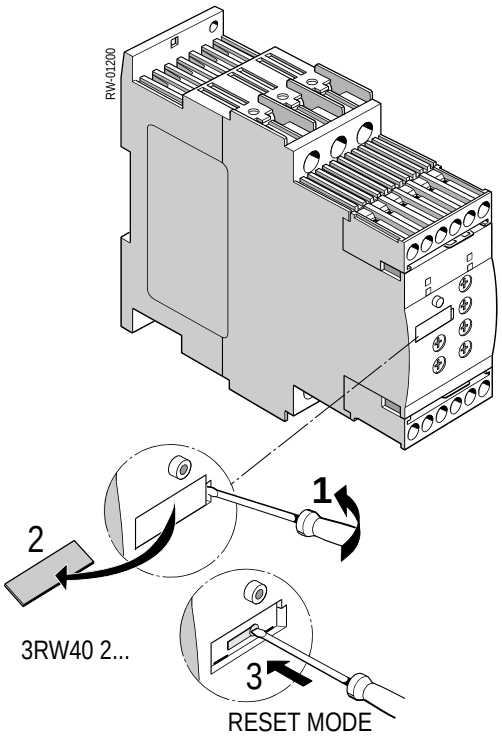


Figure 10-1 Button for setting RESET MODE behind the label

Configuration 11

11.1 Configuration in general

The SIRIUS 3RW30 and 3RW40 electronic soft starters are designed for normal starting. A larger size may need to be selected for longer ramp-up times or a higher starting frequency.

An appropriately dimensioned SIRIUS 3RW40 or 3RW44 soft starter should be chosen for startup processes with motor ramp-up times > 20 s.

The motor feeder between the soft starter and motor must not contain any capacitive elements (such as compensation systems). Active filters must not be operated in combination with soft starters.

All elements of the main circuit (such as fuses and switching devices) must be dimensioned for direct starting and according to the on-site short-circuit conditions, and ordered separately.

The harmonic component load of the starting current must be taken into consideration when selecting motor starter protectors (trip selection).

Note

Voltage dips generally occur in all start modes (direct starting, wye-delta starting, soft starting) when a three-phase motor is switched on. The infeed transformer must always be dimensioned so that the voltage dip at the motor startup remains within the permissible tolerance. If the infeed transformer is insufficiently dimensioned, the control voltage should be supplied from a separate circuit (independently of the main voltage) in order to prevent the voltage dip from disconnecting the 3RW.

Note

All elements of the main circuit (such as fuses, motor starter protectors, and switching devices) must be dimensioned for direct starting and according to the on-site short-circuit conditions, and ordered separately.

If wye-delta starters are exchanged for soft starters in an existing system, you should check the fuse ratings in the feeder in order to avoid false tripping. This is particularly important in connection with heavy-duty starting or if the fuse that is installed has already been operated close to the thermal tripping limit with the wye-delta assembly.

For recommended fuse and motor starter protector ratings for the feeder with soft starter, refer to chapter Technical data [Page 121].

11.1.1 Configuration procedure

1. Select the correct starter

What application must be started and what functionality must be provided by the soft starter?

Chapter Selecting the optimum soft starter [Page 74]

2. Take account of the startup class and the switching frequency

Chapters Startup class [Page 76] and Calculating the permissible switching frequency [Page 81]

3. Take account of a possible reduction in the soft starter's rated data due to the ambient conditions and the type of assembly.

Chapter Reducing the rated data [Page 80]

11.1.2 Selecting the optimum soft starter

Selection aid

You can choose the optimum starter from the soft starter types available based on the intended application or the required functionality.

Normal starting (CLASS 10) applications	**3RW30**	**3RW40**	**3RW44**
Pump	+	+	+
Pump with special stop (against water hammer)	-	-	+
Heat pump	+	+	+
Hydraulic pump	x	+	+
Press	x	+	+
Conveyor belt	x	+	+
Roller conveyor	x	+	+
Conveyor worm	x	+	+
Escalator	-	+	+
Piston compressor	-	+	+
Screw compressor	-	+	+
Small fan [1)]	-	+	+
Centrifugal blower	-	+	+
Bow thruster	-	+	+

+ Recommended soft starter

x Possible soft starter

1) Small fan: Mass inertia (centrifugal mass) of fan < 10 x mass inertia of motor

Heavy-duty starting (CLASS 20) applications	**3RW30**	**3RW40**	**3RW44**
Agitator	-	x	+
Extruder	-	x	+
Turning machine	-	x	+
Milling machine	-	x	+

+ Recommended soft starter

x Possible soft starter

Ultra-heavy-duty starting (CLASS 30) applications	**3RW30**	**3RW40**	**3RW44**
Large fan [2)]	-	-	+
Circular saw / band saw	-	-	+
Centrifuge	-	-	+
Mill	-	-	+
Crusher	-	-	+

+ Recommended soft starter

2) Large fan: Mass inertia (centrifugal mass) of fan >= 10 x mass inertia of motor

Soft starter functions	**3RW30**	**3RW40**	**3RW44**
Soft start function	+	+	+
Soft stop function	-	+	+
Integrated intrinsic device protection	-	+	+
Integrated electronic motor overload protection	-	+	+
Settable current limiting	-	+	+
Special pump stop function	-	-	+
Braking in ramp-down	-	-	+
Settable breakaway torque	-	-	+
Communication via PROFIBUS (optional)	-	-	+
External operation and indication display (optional)	-	-	+
Soft Starter ES parameterization software	-	-	+
Special functions, e.g. measured values, display languages etc.	-	-	+
Motor overload protection acc. to ATEX	-	+	-

+ Recommended soft starter

Note

SIRIUS 3RW44 soft starter

For more information about the SIRIUS soft starter, refer to the 3RW44 System Manual. You can download (http://support.automation.siemens.com/WW/llisapi.dll?func=cslib.csinfo&lang=de&objID=20356385&subtype=133300) the manual free of charge.

11.2 Startup class

To achieve the optimum soft starter design, it is important to know and take into account the ramp-up time (startup class) of the application. Long ramp-up times mean a higher thermal load on the thyristors of the soft starter. An appropriately dimensioned SIRIUS 3RW40 or 3RW44 soft starter should be chosen for startup processes with a motor ramp-up time > 20 s. The maximum permissible ramp-up time for SIRIUS 3RW30 soft starters is 20 seconds. SIRIUS soft starters are designed for continuous operation with normal starting (CLASS 10), an ambient temperature of 40 °C, and a defined switching frequency (refer to chapter Technical data [Page 121]). If other data applies, the starters may need to be calculated with a size allowance. Using the SIEMENS Win-Soft Starter selection and simulation software, you can enter your application data and requirements to obtain an optimally dimensioned soft starter (refer to chapter Win-Soft Starter selection and simulation software [Page 162]).

CAUTION
Risk of property damage When using the 3RW30: Make sure the selected ramp time is longer than the actual motor ramp-up time. If not, the SIRIUS 3RW30 may be damaged because the internal bypass contacts close when the set ramp time elapses. If the motor has not finished starting up, an AC3 current that could damage the bypass contact system will flow. When using the 3RW40: The 3RW40 has an integrated ramp-up detection function that prevents this operating state from occurring.

Selection criteria

Note

You must select the size of your SIRIUS soft starters according to the rated motor current (rated $current_{soft\ starter}$ >= rated motor current).

11.2.1 Application examples for normal starting (CLASS 10) with 3RW30 and 3RW40

Recommended basic parameter settings

Assuming the conditions and constraints indicated below apply, the size of the soft starters can be equivalent to the motor rating for a normal starting characteristic (CLASS 10).

You can find a suitable soft starter for the required motor rating based on the required startup class in chapter Technical data [Page 121].

For typical applications where normal starting applies as well as recommended parameter settings for the soft starter, refer to the table below.

Normal starting (CLASS 10)
The soft starter rating can be equivalent to the motor rating.

Application		Conveyor belt	Roller conveyor	Compressor	Small fan[1)]	Pump	Heat / hydraulic pump
Start parameters							
• Voltage ramp and current limiting							
- Starting voltage	%	70	60	50	40	40	40
- Ramp-up time	s	10	10	10	10	10	10
- Current limiting value (3RW40)		Off (5 x I_M)	Off (5 x I_M)	4 x I_M	4 x I_M	4 x I_M	4 x I_M
Stop mode		Soft stop (3RW40 only)	Soft stop (3RW40 only)	Stop without load	Stop without load	Soft stop (3RW40 only)	Stop without load

1) Small fan: Mass inertia (centrifugal mass) of fan < 10 x mass inertia of motor

General conditions and constraints	
CLASS 10 (normal starting)	
3RW30: Maximum ramp-up time 3 s, 300 % starting current, 20 starts / hour	
3RW40: Maximum ramp-up time 10 s, 300 % current limiting, 5 starts / hour	
ON time	30 %
Standalone assembly	
Installation altitude	Max. 1000 m / 3280 ft
Ambient temperature kW	40 °C / 104 °F

11.2.2 Application examples for heavy-duty starting (CLASS 20): 3RW40 only

Recommended basic parameter settings

Assuming the conditions and constraints indicated below apply, the soft starter size must be at least one power class higher than the motor rating for heavy-duty starting (CLASS 20).

You can find a suitable soft starter for the required motor rating based on the required startup class in chapter Technical data [Page 121].

For typical applications where heavy-duty starting can apply as well as recommended parameter settings for the soft starter, refer to the table below.

Heavy-duty starting (CLASS 20)
The soft starter must be at least one power class larger than the motor rating.

Application		Agitator	Extruder	Milling machine
Start parameters				
• Voltage ramp and current limiting				
- Starting voltage	%	40	70	40
- Ramp-up time	s	20	10	20
- Current limiting value (3RW40)		4 x I_M	Off (5 x I_M)	4 x I_M
Stop mode		Stop without load	Stop without load	Stop without load

General conditions and constraints	
CLASS 20 (heavy-duty starting)	
3RW40 2. / 3RW40 3. / 3RW40 4.	Maximum ramp-up time 20 s, 300 % current limiting, max. 5 starts / hour
3RW40 5. / 3RW40 7.	Maximum ramp-up time 40 s, 350 % current limiting, max. 1 start / hour
ON time	30 %
Standalone assembly	
Installation altitude	Max. 1000 m / 3280 ft
Ambient temperature kW	40 °C / 104 °F

Note

The settings and device dimensions indicated in these tables are examples only; they are merely provided for information purposes and are not binding. The actual settings depend on the application and must be optimized when the equipment is commissioned.

If other conditions and constraints apply, either refer to chapter Technical data [Page 121] or check your requirements and selection with the Win-Soft Starter software or with Technical Assistance (chapter Important notes [Page 11])

11.3 ON time and switching frequency

Based on the rated motor current and the startup class, the SIRIUS 3RW30 and 3RW40 soft starters are dimensioned for a maximum permissible switching frequency in combination with a relative ON time (refer to chapter Technical data [Page 121]). If these values are exceeded, a larger soft starter may have to be selected.

ON time

The relative ON time in % is the ratio between the load duration and the cycle duration for loads that are frequently switched on and off.

The ON time (OT) can be calculated using the following formula:

$$OT = \frac{t_s + t_b}{t_s + t_b + t_p}$$

where:

OT = ON time [%]
t_s = ramp-up time [s]
t_b = operating time [s]
t_p = idle time [s]

The following diagram illustrates this process.

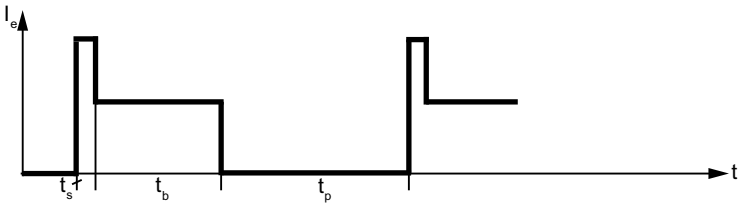


Figure 11-1 ON time

Switching frequency

The maximum permissible switching frequency must not be exceeded because the devices could be damaged due to thermal overloading.

Optional additional fan

The switching frequency of the 3RW40 2. to 3RW40 4. soft starters can be increased by installing an optional additional fan. For information about factors and how to determine the maximum switching frequency if an additional fan is installed, refer to chapter Calculating the permissible switching frequency [Page 81].

11.4 Reducing the rated data

You can reduce the rated data of the SIRIUS 3RW30 and 3RW40 soft starters if

- The installation altitude is higher than 1000 m.
- The ambient temperature in the switching device's environment exceeds 40 °C.
- The lateral clearances described earlier are not complied with, e.g. side-by-side assembly or direct mounting of other switching devices (assembly type).
- The vertical mounting position is not complied with.

11.5 Installation altitude and ambient temperature

Installation altitude

The permissible installation altitude must not be higher than 5000 m above sea level (higher than 5000 m on request).

If the installation altitude exceeds 1000 m, the rated operational current must be reduced for thermal reasons.

If the installation altitude exceeds 2000 m, the rated voltage must also be reduced owing to the restricted dielectric strength. A maximum permissible rated voltage of 460 V applies at installation altitudes between 2000 m and 5000 m above sea level.

The following diagram shows the reduction in the rated device current as a function of the installation altitude:
The rated operational current I_e must be reduced at altitudes higher than 1000 m above sea level.

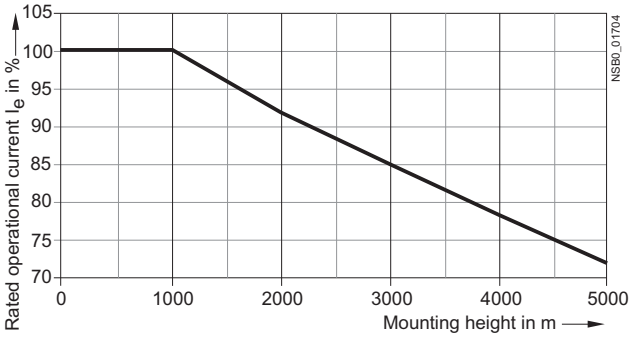


Figure 11-2 Reduction as a function of the installation altitude

Ambient temperature

The maximum permissible ambient temperature of the soft starter must not exceed 60 °C.

SIRIUS 3RW30 and 3RW40 soft starters are designed for operation with nominal current at an ambient temperature of 40 °C. If this temperature is exceeded, e.g. owing to an impermissible temperature rise in the control cabinet, other loads, or a general increase in the ambient temperature, the resulting deterioration in the soft starter's performance must be

taken into account when the device is dimensioned (refer to chapter Technical data [Page 121]).

CAUTION
Risk of property damage. The soft starter may be damaged if the maximum installation altitude (5000 m above sea level) or an ambient temperature of 60 °C is ignored.

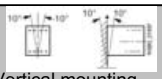
Mounting position, assembly type

The mounting position and assembly type (refer to chapter Installing the soft starter [Page 53]) can influence the soft starter's permissible switching frequency. Refer to chapter Calculating the permissible switching frequency [Page 81] for the permissible mounting and assembly combinations as well as the resulting factors for the soft starter switching frequencies.

11.6 Calculating the permissible switching frequency

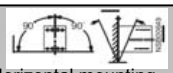
11.6.1 Table of permissible assembly combinations with switching frequency factors

The factors indicated in the table refer to the switching frequency (starts / hour) as specified in chapter Technical data [Page 121].



Vertical mounting

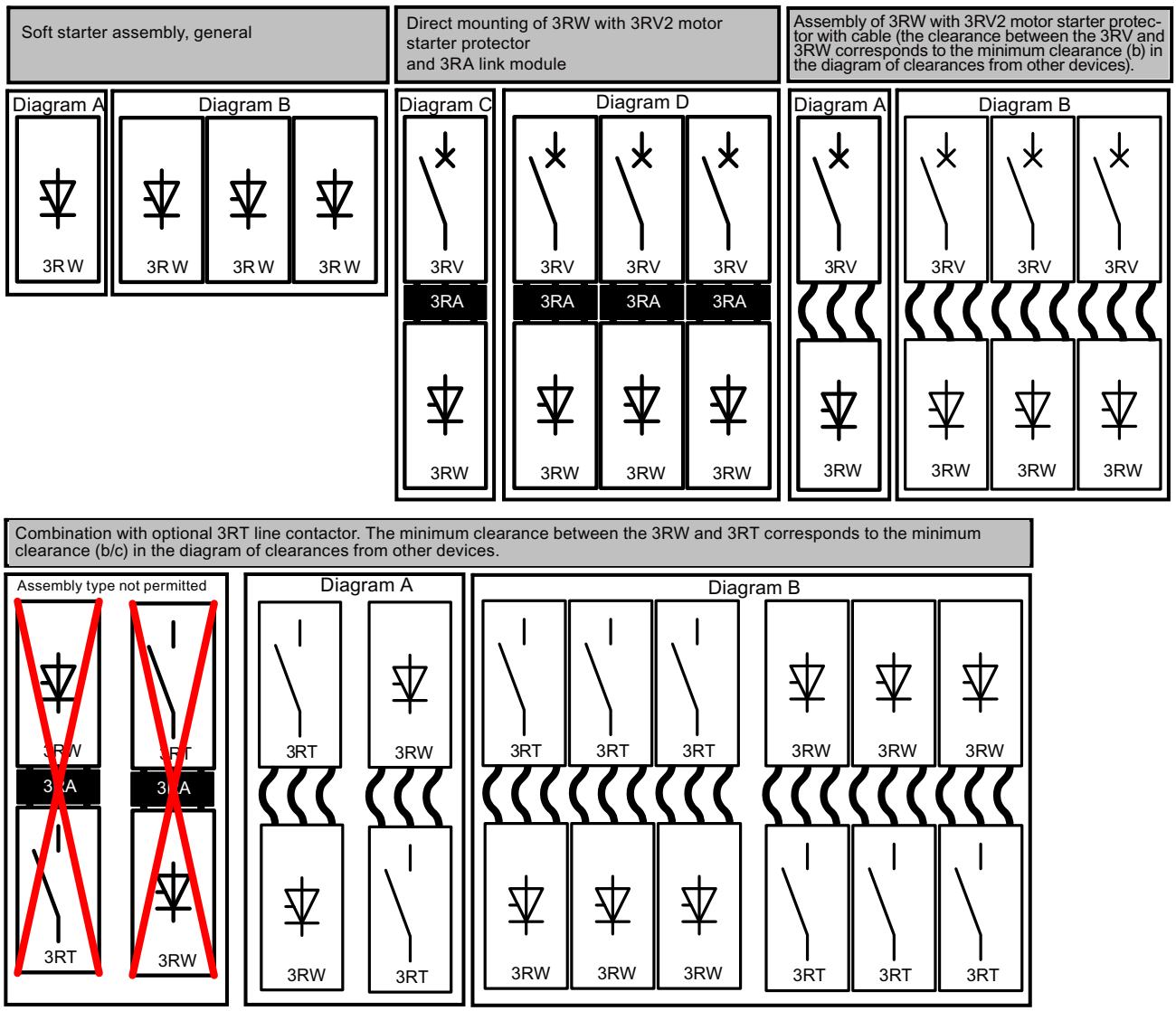
Graph	Assembly type	3RW30				3RW40			3RW40 + optional fan		
		3RW301*	3RW302*	3RW303*	3RW304*	3RW402*	3RW403*	3RW404*	3RW402*	3RW403*	3RW404*
A	Standalone assembly	1.0				1.0			1.6	2.0	2.8
B	Side-by-side assembly	0.7	0.1	0.3		0.1	0.3		1.6	2.0	2.8
C	Standalone assembly	0.5				0.5			1.8		
D	Side-by-side assembly	0.3	-			-			1.7		



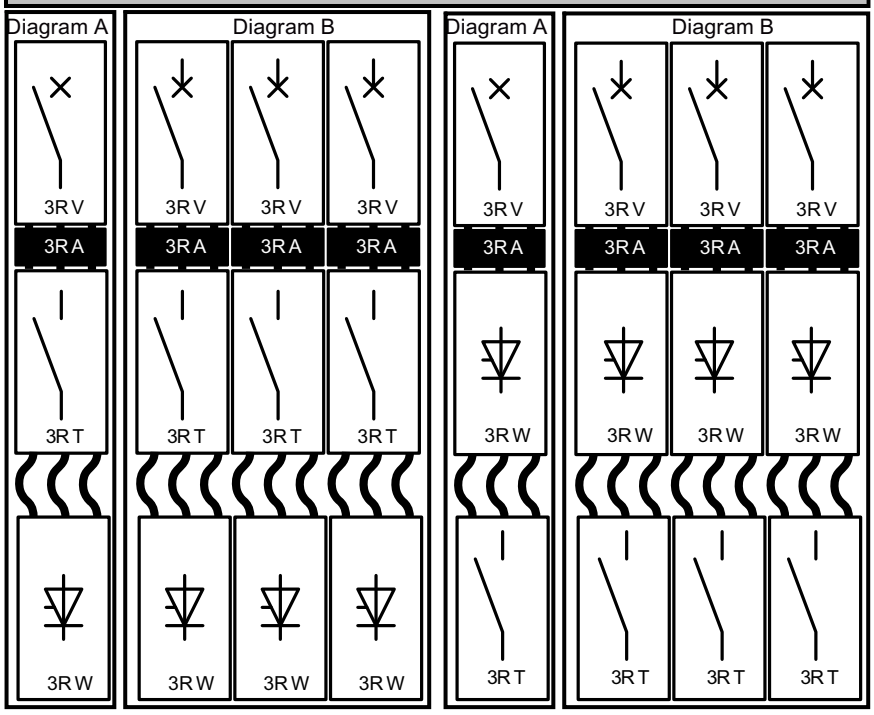
Horizontal mounting

Graph	Assembly type	3RW30/40	3RW40 + optional fan		
			3RW402*	3RW403*	3RW404*
A	Standalone assembly	-	1.6	2.0	2.8
B	Side-by-side assembly	-	1.6	2.0	2.8
C	Standalone assembly	-	1.6		
D	Side-by-side assembly	-	1.4		

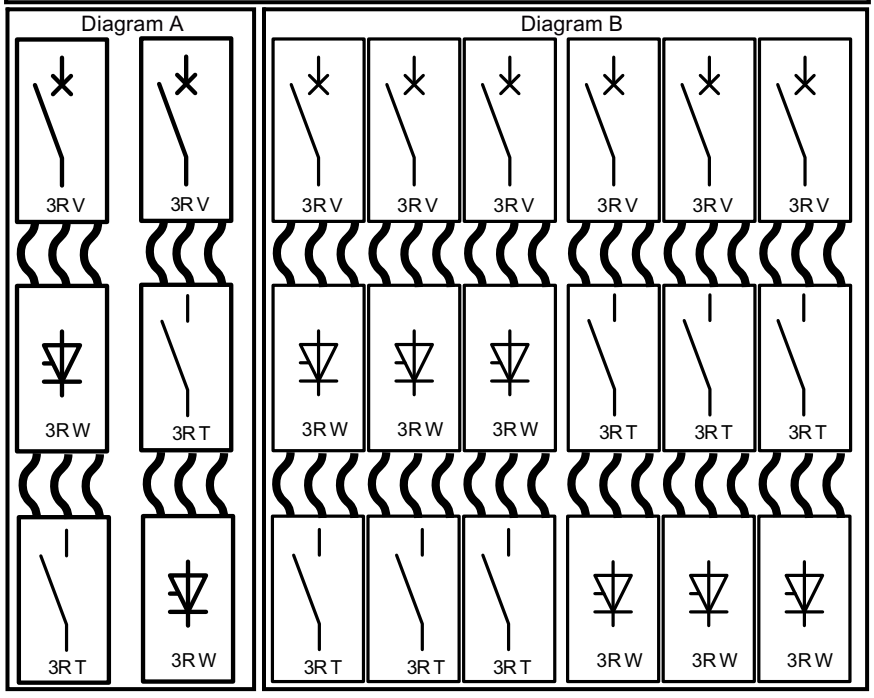
Standard switching frequency
High switching frequency (fan required)
Reduced switching frequency
Assembly type not permitted
Assembly type not tested


Soft starter assembly, general
Direct mounting of 3RW with 3RV2 motor starter protector and 3RA link module
Assembly of 3RW with 3RV2 motor starter protector with cable (the clearance between the 3RV and 3RW corresponds to the minimum clearance (b) in the diagram of clearances from other devices).
Diagram A
Diagram B
Diagram C
Diagram D
Diagram A
Diagram B
3RW
3RV
3RA
Combination with optional 3RT line contactor. The minimum clearance between the 3RW and 3RT corresponds to the minimum clearance (b/c) in the diagram of clearances from other devices.
Assembly type not permitted
Diagram A
Diagram B
3RT
3RW

Assembly of 3RW with 3RV2 motor starter protector, 3RA link module, cable, and 3RT line contactor. The minimum clearance between the 3RW, 3RV, and 3RT corresponds to the minimum clearance (b/c) in the diagram of clearances from other devices.



Assembly of 3RW with 3RV2 motor starter protector and 3RT line contactor with cable. The minimum clearance between the 3RV and 3RT corresponds to the minimum clearance (b/c) in the diagram of clearances from other devices.



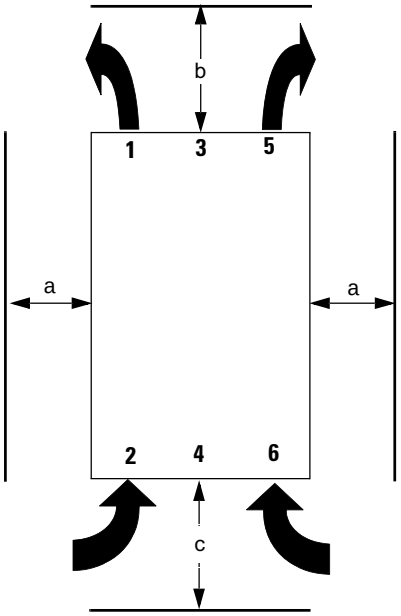


Figure 11-3 Clearances from other devices

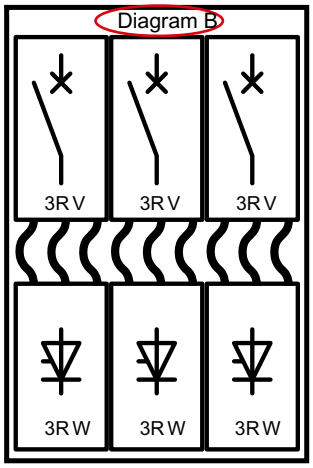
MLFB	a (mm)	a (in)	b (mm)	b (in)	c (mm)	c (in)
3RW30 1./3RW30 2.	15	0.59	60	2.36	40	1.56
3RW30 3./3RW30 4	30	1.18	60	2.36	40	1.56
3RW40 2.	15	0.59	60	2.36	40	1.56
3RW40 3./3RW40 4.	30	1.18	60	2.36	40	1.56
3RW40 5./3RW40 7.	5	0.2	100	4	75	3

11.6.2 Calculating the switching frequency (example)

Problem

The maximum permissible switching frequency of a 5.5 kW (12.5 A) 3RW4024 soft starter must be determined. The requirements are side-by-side assembly and vertical mounting. A ramp-up time of approx. 3 s at an ambient temperature of 40 °C is specified as a supplementary condition (e.g. a pump motor with CLASS 10 starting). The soft starter must be connected to a 3RV2021 motor starter protector by means of cables. (Clearance between 3RV and 3RW >= 40 mm)

Calculating the number of starts / hour of a 3RW40 for side-by-side assembly and vertical mounting



Vertical mounting

Graph	Assembly type	3RW30				3RW40			3RW40 + optional fan		
		3RW301*	3RW302*	3RW303*	3RW304*	3RW402*	3RW403*	3RW404*	3RW402*	3RW403*	3RW404*
A	Standalone assembly	1.0				1.0			1.6	2.0	2.8
B	Side-by-side assembly	0.7	0.1	**0.3**		0.1	**0.3**		1.6	2.0	2.8
C	Standalone assembly	0.5				0.5			1.8		
D	Side-by-side assembly	0.3	-			-			1.7		

Type		3RW4024
Power electronics		
Load rating with rated operational current I_e		
• According to IEC and UL/CSA[1], for standalone assembly, AC-53a		
- At 40°C	A	12.5
- At 50°C	A	11
- At 60°C	A	10
Minimum settable rated motor current I_M for the motor overload protection	A	5
Power loss		
• During operation after successful startup with uninterrupted rated operational current (40°C) approx.	W	2
• During starting with current limit set to 300% I_M (40°C)	W	68
Permissible rated motor current and starts per hour		
• For normal starting (CLASS 10)		
- Rated motor current I_M[2], ramp-up time 3 s	A	12.5
- Starts per hour[3]	1 / h	50

Assembly of a 3RV2021 motor starter protector and connection of a 3RW40 24 soft starter with cables and vertical mounting for CLASS 10 starting:

Switching frequency of 3RW40 with standalone assembly:	50 1/h
Switching frequency factor for diagram B without a fan:	0.1
Switching frequency factor for diagram B with a fan [1]:	1.6
Maximum permissible switching frequency:	
Without fan	50 1/h x 0.1 = 5 1/h
With fan [1]:	50 1/h x 1.6 = 80 1/h

1) Optional fan: 3RW49 28-8VB00

Result

The pump could be started five times an hour providing the above assembly conditions are complied with (side-by-side assembly, vertical mounting). A switching frequency of up to 80 starts per hour can be achieved by equipping the 3RW4026 with the optional 3RW4928-8VB00 fan.

11.7 Configuration aids

11.7.1 Online configurator

Using the online configurator, you can select soft starters based on the rated motor data and the specified device functionality. The selection of the soft starter is subject to fixed conditions and constraints, such as switching frequency, startup class etc. These conditions cannot be changed. You can find the online configurator at www.siemens.de/sanftstarter (https://mall.automation.siemens.com/WW/guest/configurators/ipc/ipcFrameset.asp?serumpage=guiIpc&urlParams=PROD%5FID%3D3RW&MLFB=&proxy=mall%2Eautomation%2Esiemens%2Ecom&retURL=%2FWW%2Fguest%2Findex%2Easp%3FnodeID%3D9990301%26lang%3Dde&lang=en).

11.7.2 Win-Soft Starter selection and simulation software

The Win-Soft Starter software can be used to simulate and select all SIEMENS soft starters, taking into account various parameters such as the supply system conditions, motor data, load data, high switching frequencies etc.

It is a useful tool, which does away with the need for time-consuming and complex manual calculations if you need to select the optimum soft starter for your particular case.

Further information under:
www.siemens.de/sanftstarter > software > Win-Soft Starter (http://www.automation.siemens.com/mcms/low-voltage/en/industrial-controls/controls/solid-state-switching-devices/soft/software/win-soft-starter/Pages/default.aspx)

11.7.3 Technical Assistance

SIEMENS Technical Assistance offers personal support to help you find the optimum device and provides assistance with technical queries relating to low-voltage switchgear and controlgear

Technical Assistance:	Phone: +49 (0) 911-895-5900 (8°° - 17°° CET) Fax: +49 (0) 911-895-5907 e-mail: (mailto:technical-assistance@siemens.com) Internet: (www.siemens.com/lowvoltage/technical-assistance)

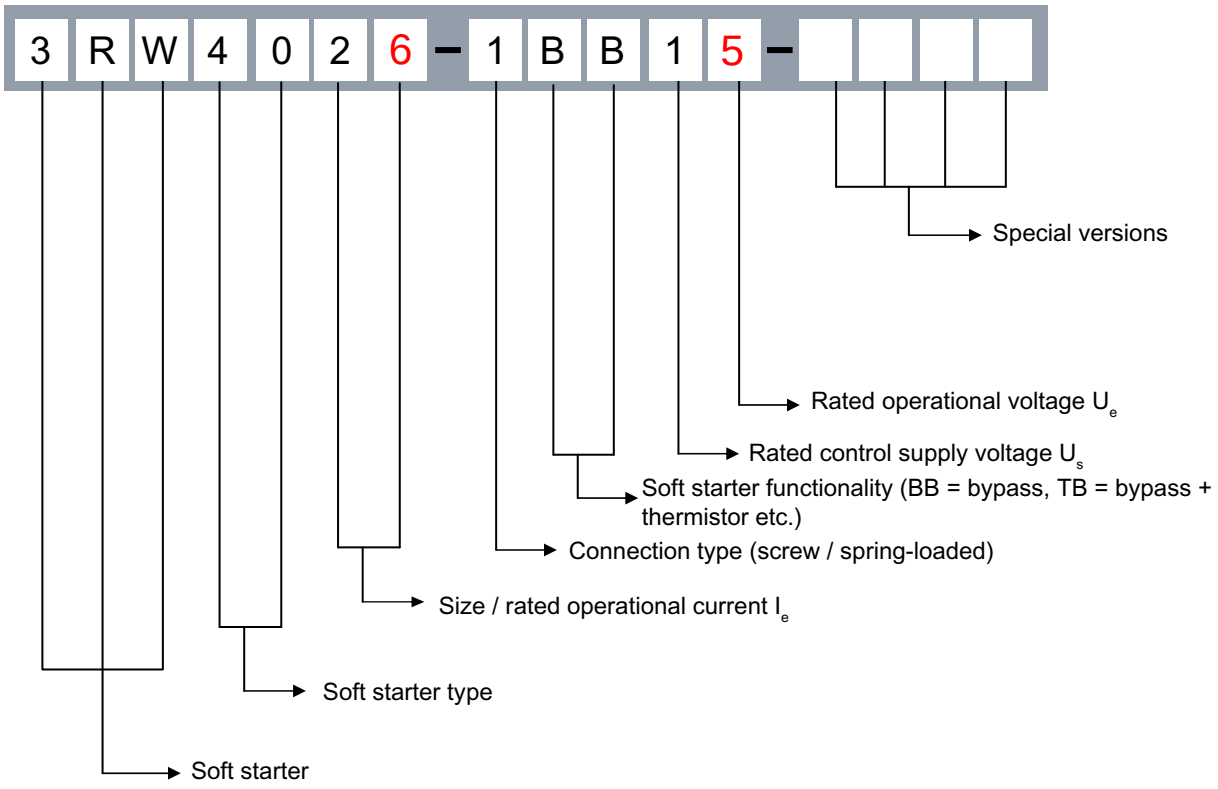
11.7.4 SIRIUS soft starter training course (SD-SIRIUSO)

SIEMENS offers a two-day training course on SIRIUS electronic soft starters to keep both customers and our own employees up to date with the latest information about configuring, commissioning, and maintenance.

Please address all inquiries and enrollments to:

Training Center Erlangen
A&D PT 4
Werner-von-Siemens-Str. 65
D-91052 Erlangen
Phone: ++49 9131 729262
Fax: ++49 9131 728172
e-mail: (mailto:sibrain.industry@siemens.com)
Internet: (http://www.siemens.com/sitrain)

11.9 Order number system for the 3RW40



Rated current and rated power at U_e= 400 V / 460 V and T_{amb} = 40 °C / 50 °C

24	Ie = 12.5 A / 11 A	Pe = 5.5 kW / 7.5 hp	Size S0
26	Ie = 25 A / 23 A	Pe = 11 kW / 15 hp	
27	Ie = 32 A / 29 A	Pe = 15 kW / 20 hp	
28	Ie = 38 A / 34 A	Pe = 18.5 kW / 25 hp	
36	Ie = 45 A / 42 A	Pe = 22 kW / 30 hp	Size S2
37	Ie = 63 A / 58 A	Pe = 30 kW / 40 hp	
38	Ie = 72 A / 62 A	Pe = 37 kW / 40 hp	
46	Ie = 80 A / 73 A	Pe = 45 kW / 50 hp	Size S3
47	Ie = 106 A / 98 A	Pe = 55 kW / 75 hp	
55	Ie = 132 A / 117 A	Pe = 75 kW / 75 hp	Size S6
56	Ie = 160 A / 145 A	Pe = 90 kW / 100 hp	
73	Ie = 230 A / 205 A	Pe = 132 kW / 150 hp	Size S12
74	Ie = 280 A / 248 A	Pe = 160 kW / 200 hp	
75	Ie = 350 A / 315 A	Pe = 200 kW / 250 hp	
76	Ie = 432 A / 385 A	Pe = 250 kW / 300 hp	

For more information, refer to chapter Technical data [Page 121].

Commissioning 12

12.1 Before commencing work: Isolating the equipment from the supply system and ensuring that it cannot be reconnected.

⚠ DANGER

Hazardous voltage Will cause death or serious injury.

- Disconnect the system and all devices from the power supply before starting work.
- Secure against switching on again.
- Verify that the equipment is not live.
- Ground and short-circuit.
- Erect barriers around or cover adjacent live parts.

⚠ DANGER

Hazardous voltage Will cause death or serious injury.

Qualified Personnel.

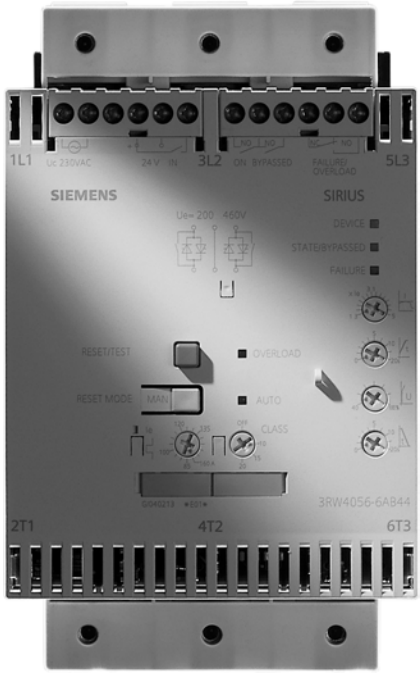
The equipment / system may only be commissioned and operated by qualified personnel. For the purpose of the safety information in these Operating Instructions, a "qualified person" is someone who is authorized to energize, ground, and tag equipment, systems, and circuits in accordance with established safety procedures.

Fault	Cause	Remedy
Missing load voltage, phase failure / missing load	Cause 1: Phase L1 / L2 / L3 is missing or fails / collapses when the motor is operating. Tripped as a result of a dip in the permissible rated operational voltage > 15 % for > 100 ms during the startup process or > 200 ms in bypass mode.	Connect L1 / L2 / L3 or correct the voltage dip.
	Cause 2: The motor that is connected is too small and the fault occurs as soon as it is switched to bypass mode.	If less than 10 % of the soft starter's rated current is flowing, the motor cannot be operated with soft starter. Use another soft starter.
	Cause 3: Motor phase T1 / T2 / T3 is not connected.	Connect the motor properly (e.g. jumpers in the motor terminal box, repair switch closed etc.)
Device fault	Soft starter defective.	Contact your SIEMENS partner or Technical Assistance.

12.4 Commissioning the 3RW40

Commissioning, description of the start, stop, motor protection, and output parameters





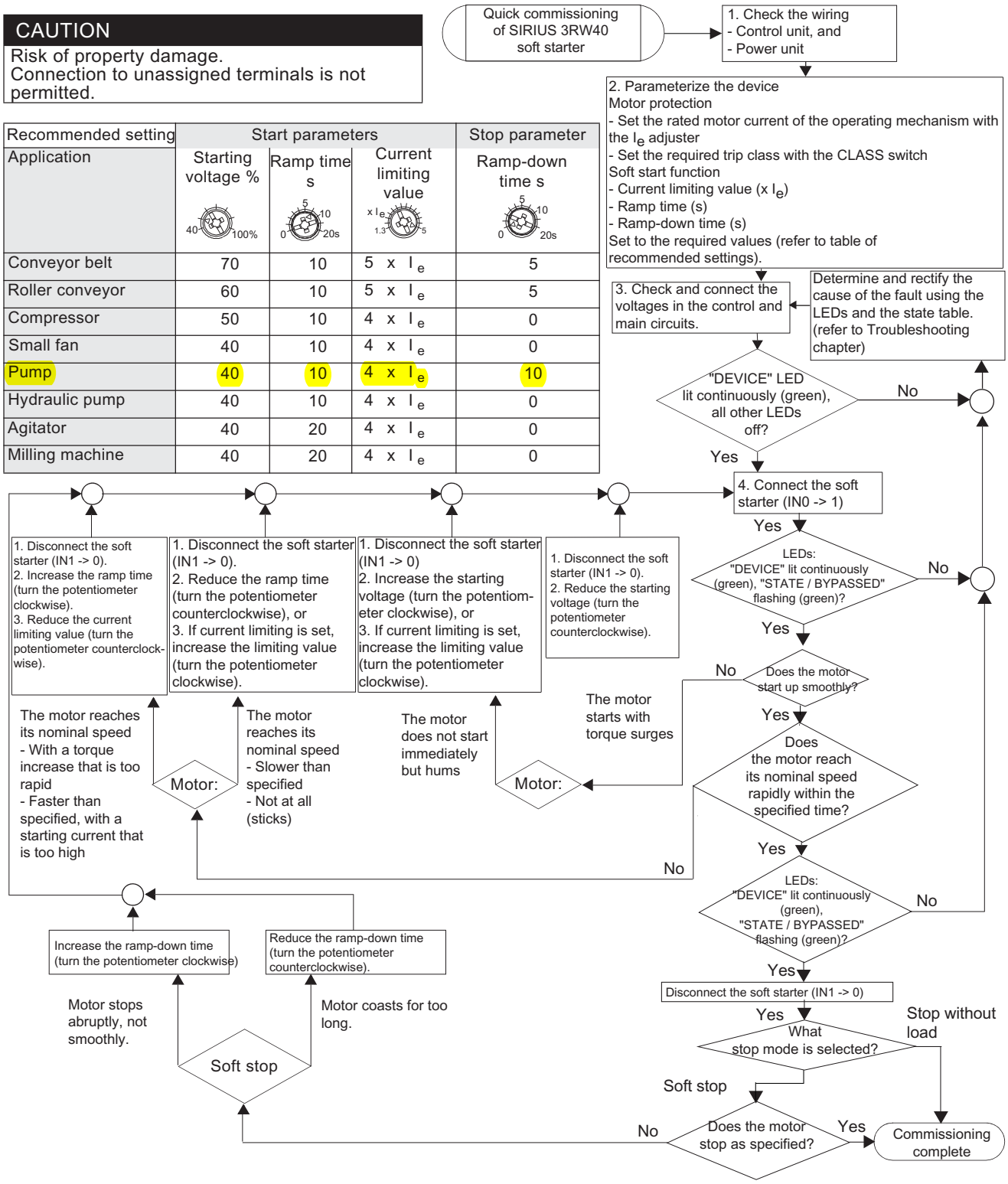
12.4.1 Commissioning procedure

1. Check the voltages and wiring.
2. Set the start and stop parameters (for recommended parameters, refer to the quick commissioning table).
3. Set the motor overload function (if required)
4. Define the RESET mode if a failure occurs.
5. Start up the motor and if necessary optimize the parameters (refer to the quick commissioning table).
6. Document the parameter settings if required.

12.4.2 Quick commissioning of the 3RW40 and optimization of the parameters

CAUTION
Risk of property damage.
Connection to unassigned terminals is not permitted.

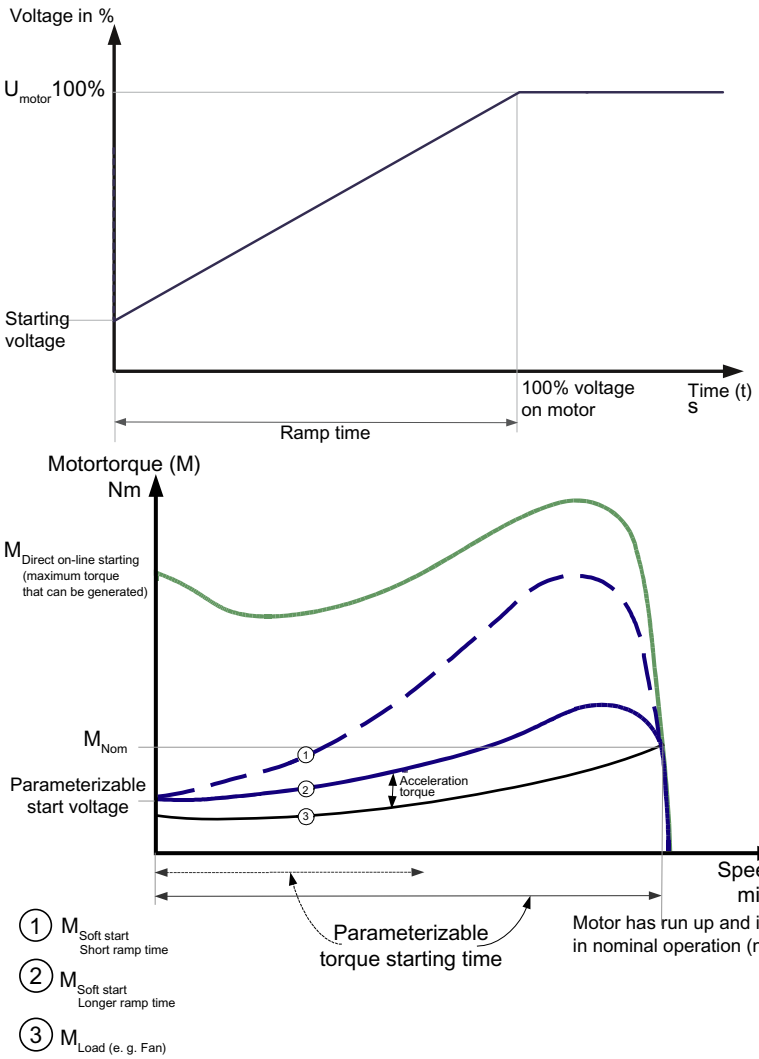
Recommended setting	Start parameters			Stop parameter
Application	Starting voltage %	Ramp time s	Current limiting value	Ramp-down time s
Conveyor belt	70	10	5 x I_e	5
Roller conveyor	60	10	5 x I_e	5
Compressor	50	10	4 x I_e	0
Small fan	40	10	4 x I_e	0
Pump	40	10	4 x I_e	10
Hydraulic pump	40	10	4 x I_e	0
Agitator	40	20	4 x I_e	0
Milling machine	40	20	4 x I_e	0



12.4.3 Setting the soft start function

Voltage ramp

The SIRIUS 3RW40 achieves soft starting by means of a voltage ramp. The motor terminal voltage is increased from a parameterizable starting voltage to the mains voltage within a definable ramp time.



12.4.4 Setting the starting voltage

U potentiometer



The starting voltage value is set with the U potentiometer. This value determines the starting torque of the motor. A lower starting voltage results in a lower starting torque (softer start) and a lower starting current.

The starting voltage selected must be sufficiently high to ensure that motor starts up smoothly as soon as the start command is received by the soft starter.

12.4.5 Setting the ramp time

t potentiometer



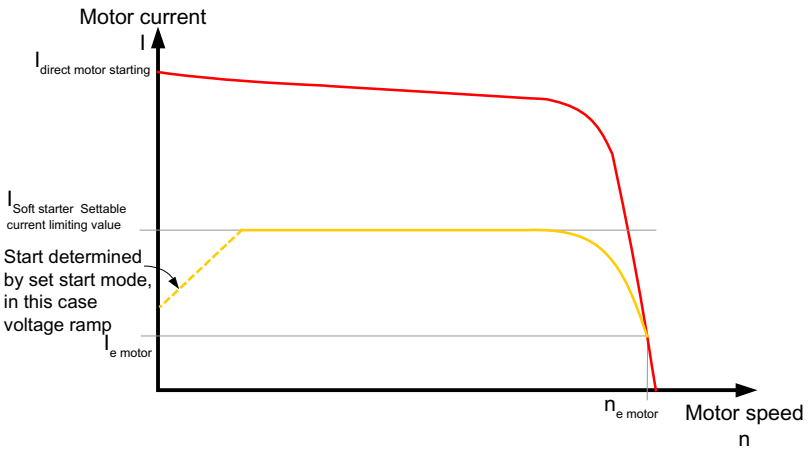
You define the length of the required ramp time with the t potentiometer. The ramp time determines the time taken to increase the motor voltage from the parameterized starting voltage to the mains voltage. This time merely influences the motor's acceleration torque, which drives the load during the ramp-up process. The actual motor starting times are load-dependent and can differ from the 3RW soft starter settings.

A longer ramp time results in a lower starting current and a reduced acceleration torque as the motor starts up. The startup is slower and smoother as a result. The ramp time must be long enough for the motor to reach its nominal speed. If the time selected is too short, in other words if the ramp time ends before the motor has started up successfully, a very high starting current that can even equal the direct starting current at the same speed occurs at this instant.

The SIRIUS 3RW40 soft starter additionally limits the current to the value set with the current limiting potentiometer. As soon as the current limiting value is reached, the voltage ramp or the ramp time is interrupted and the motor is started with the current limiting value until it has started up successfully. In this case, the motor ramp-up times may be longer than the maximum parameterizable 20 seconds ramp time or the ramp time that is actually set on the soft starter (for further information about the maximum ramp-up times and switching frequencies, refer to the Technical data chapter > 3RW30 13, 14, 16, 17, 18-.BB.. power electronics [Page 124]) ff. and 3RW40 24, 26, 27, 28 power electronics [Page 149] ff.).

12.4.6 Current limiting in conjunction with a starting voltage ramp and ramp-up detection

Current limiting



The SIRIUS 3RW40 soft starter measures the phase current (motor current) continuously with the help of integrated current transformers.

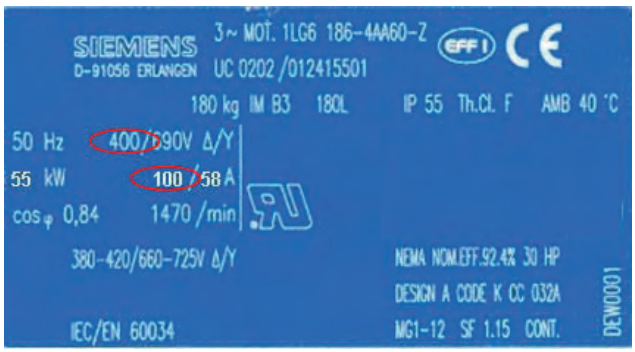
The motor current that flows during the startup process can be actively limited by means of the soft starter. The current limiting function takes priority over the voltage ramp function.

As soon as a parameterizable current limit is reached, in other words, the voltage ramp is interrupted and the motor is started with the current limiting value until it has started up successfully. The current limiting function is always active with SIRIUS 3RW40 soft starters. If the current limiting potentiometer is set to the clockwise stop (maximum), the starting current is limited to five times the set rated motor current.

12.4.7 Setting the motor current

I_e potentiometer





The rated operational current of the motor must be set with the I_e potentiometer according to the mains voltage and the motor connection (wye-delta). The electronic motor overload

protection also refers to this set value if it is active. For the permissible settings referred to the required motor overload trip class, refer to chapter Motor current settings [Page 107].

12.4.8 Setting the current limiting value

xI_e potentiometer



The current limiting value is set with the xI_e potentiometer to the maximum required starting current as a factor of the set rated motor current (I_e).

Example

- I_e potentiometer set to 100 A
- xI_e potentiometer set to 5 => current limiting 500 A.

As soon as the selected current limiting value is reached, the motor voltage is reduced or controlled by the soft starter to prevent the current from exceeding the limit. Since the starting current is asymmetrical, the set current corresponds to the arithmetic mean value for the three phases.

If the current limiting value is set to the equivalent of 100 A, the starting currents might be approx. 80 A in L1, 120 A in L2, and 100 A in L3 (refer to chapter Starting current asymmetry [Page 21]).

The set current limiting value must be high enough to ensure that the torque generated in the motor is sufficient to accelerate the motor to nominal speed. Three to four times the value of the motor's rated operational current (I_e) can be assumed as typical here.

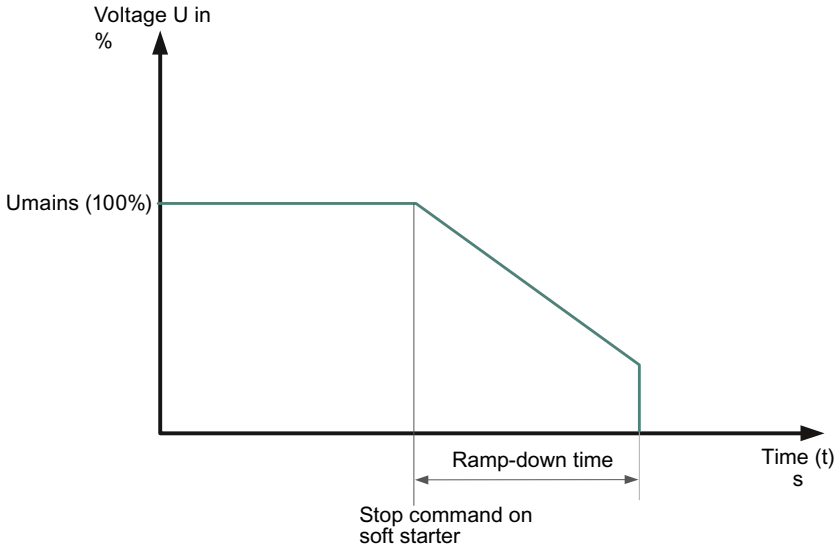
The current limiting function is always active because it is required by the intrinsic device protection. If the current limiting potentiometer is set to the clockwise stop (maximum), the starting current is limited to five times the set rated motor current.

12.4.9 Ramp-up detection

The SIRIUS soft starter has a motor ramp-up detection function that is always active regardless of the start mode. If it detects a motor startup, the motor voltage is immediately increased to 100 % of the mains voltage. The thyristors of the soft starter are bridged by the bypass contacts integrated in the device and the successful startup is indicated by means of the BYPASS output and the STATE / BYPASSED LED.

12.5 Setting the soft stop function

In "soft stop" mode, the natural stop process of the load is decelerated. The function is used when the load must be prevented from stopping abruptly. This is typically the case in applications with a low mass inertia or a high counter-torque.



12.5.1 Setting the ramp-down time

t potentiometer



You can set a ramp-down time with the t potentiometer. This determines how long power should still be supplied to the motor after the ON command is removed. The torque generated in the motor is reduced by means of a voltage ramp function within this ramp-down time and the application stops smoothly.

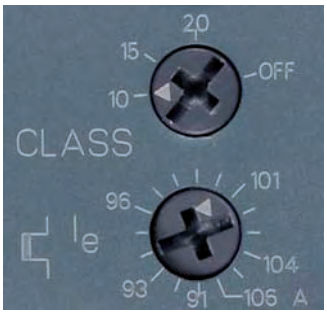
If the potentiometer is set to 0, there is no voltage ramp during stopping (stop without load).

12.6 Setting the motor protection function

The motor overload protection function is implemented on the basis of the winding temperature. This indicates whether the motor is overloaded or functioning in the normal operating range.

The winding temperature can either be calculated with the help of the integrated, electronic motor overload function or measured with a connected motor thermistor.

12.6.1 Setting the electronic motor overload protection





I_e potentiometer

The rated operational current of the motor must be set with the I_e potentiometer according to the mains voltage and the motor connection (wye-delta).

The current flow during motor operation is measured by measuring the current with transformers integrated in the soft starter. This value is also used for the current limiting function. The temperature rise in the winding is calculated based on the rated operational current set for the motor.

CLASS potentiometer

You can set the required trip class (10, 15, or 20) with the CLASS potentiometer. A trip is generated by the soft starter when the standardized characteristic is reached, depending on the trip class (CLASS setting).

The trip class specifies the maximum time within which a protective device must trip from a cold state at 7.2 x the rated operational current (motor protection to IEC 60947). The tripping characteristics represent this time as a function of the tripping current (refer to chapter Motor protection tripping characteristics for 3RW40 (with symmetry) [Page 161]).

You can set different CLASS characteristics according to the startup class. If the potentiometer is set to OFF, the "electronic motor overload protection" function is deactivated.

Note

The rated data of the soft starters refers to normal starting (CLASS 10). The starters may need to be calculated with a size allowance for heavy-duty starting (> CLASS 10). You can only set a rated motor current that is lower than the soft starter rated current (refer to chapter Motor current settings [Page 107]); if not, a fault will be indicated by the OVERLOAD LED (red flashing) and it will not be possible to start the SIRIUS 3RW soft starter.

12.6.2 Motor current settings

Motor current settings



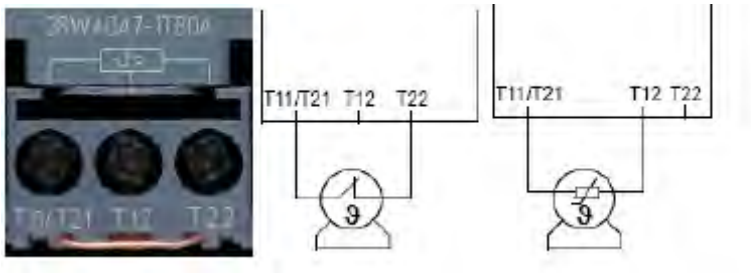
	I_e [A]	I_{min} [A]	I_{max} [A] CLASS 10	I_{max} [A] CLASS 15	I_{max} [A] CLASS 20
3RW40 24-...	12.5	5	12.5	11	10
3RW40 26-...	25.3	10.3	25.3	23	21
3RW40 27-...	32.2	17.2	32.2	30	27
3RW40 28-...	38	23	38	34	31
3RW40 36-...	45	22.5	45	42	38
3RW40 37-...	63	25.5	63	50	46
3RW40 38-...	72	34.5	72	56	50
3RW40 46-...	80	42.5	80	70	64
3RW40 47-...	106	46	106	84	77
3RW40 55-...	134	59	134	134	124
3RW40 56-...	162	87	162	152	142
3RW40 73-...	230	80	230	210	200
3RW40 74-...	280	130	280	250	230
3RW40 75-...	356	131	356	341	311
3RW40 76-...	432	207	432	402	372

12.6.3 Motor protection acc. to ATEX

Refer to the information in chapter Motor protection / intrinsic device protection (3RW40 only) [Page 32].

12.7 Thermistor motor protection

(Optional for 3RW40 2. to 3RW40 4. with 24 V AC/DC rated control voltage)



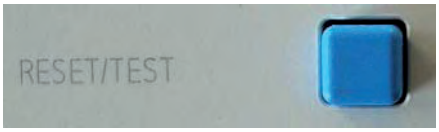
Klixon thermistor Type A PTC thermistor

Thermistor motor protection

After removing the copper jumper between T11/21 and T22, you can connect and evaluate either a Klixon thermistor integrated in the motor winding (at terminal T11/T21-T22) or a type A PTC (at terminal T11/T21-T12).

12.8 Motor protection trip test



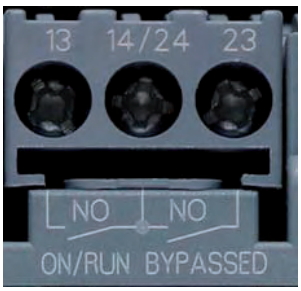


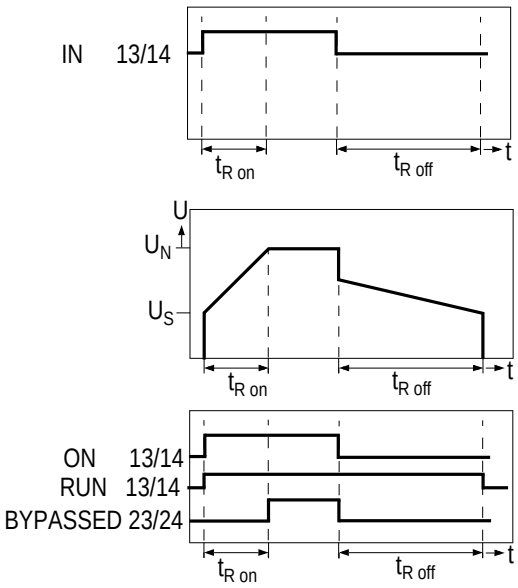
TEST / RESET button

You initiate a motor overload trip by pressing the RESET / TEST button for longer than five seconds. The SIRIUS 3RW40 soft starter is tripped by the fault signal at the OVERLOAD LED, the FAILURE / OVERLOAD contact 95-98 closes, and the motor that is connected and running is switched off.

12.9 Functions of the outputs

12.9.1 Functions of the BYPASSED and ON / RUN outputs





BYPASSED output contact

The BYPASSED output at terminal 23 / 24 closes as soon as the SIRIUS 3RW40 soft starter detects that the motor has started up (refer to chapter Ramp-up detection [Page 104]). The integral bypass contacts simultaneously close and the thyristors are bridged. The integral bypass contacts and output 23 / 24 open again as soon as the start input IN is removed.

ON / RUN output contact

ON function set: The potential-free output contact at terminal 13/14 (ON) closes if a signal is present at terminal 1 (IN); it remains closed until the start command is removed (factory default). The ON function can be used, for instance, as a latching contact if you selected pushbutton control (refer to chapter Control by pushbutton [Page 168]).

Reparameterizing the output of the ON function (factory default) to RUN

You can reparameterize the output function from ON to RUN by simultaneously pressing two buttons (refer to chapter Parameterizing the 3RW40 outputs [Page 110]).

RUN function set: The potential-free output contact at terminal 13/14 closes if a signal is present at terminal 1 (IN); it remains closed until the start command is removed and after that until the set ramp-down time has elapsed.

If the RUN function is set, you can control a line contactor during the startup process, operation, or the set soft stop (refer to chapter Control with an optional main / line contactor [Page 177])

For recommended circuits, refer to chapter Typical circuit diagrams [Page 167].

12.9.2 Parameterizing the 3RW40 outputs

Programming the ON / RUN output 13/14 on the SIRIUS 3RW40 soft starter

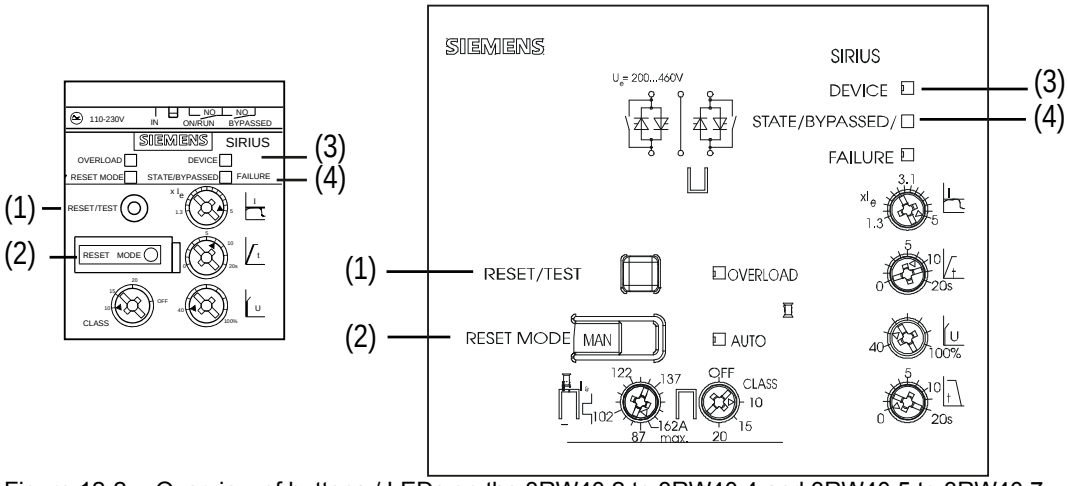
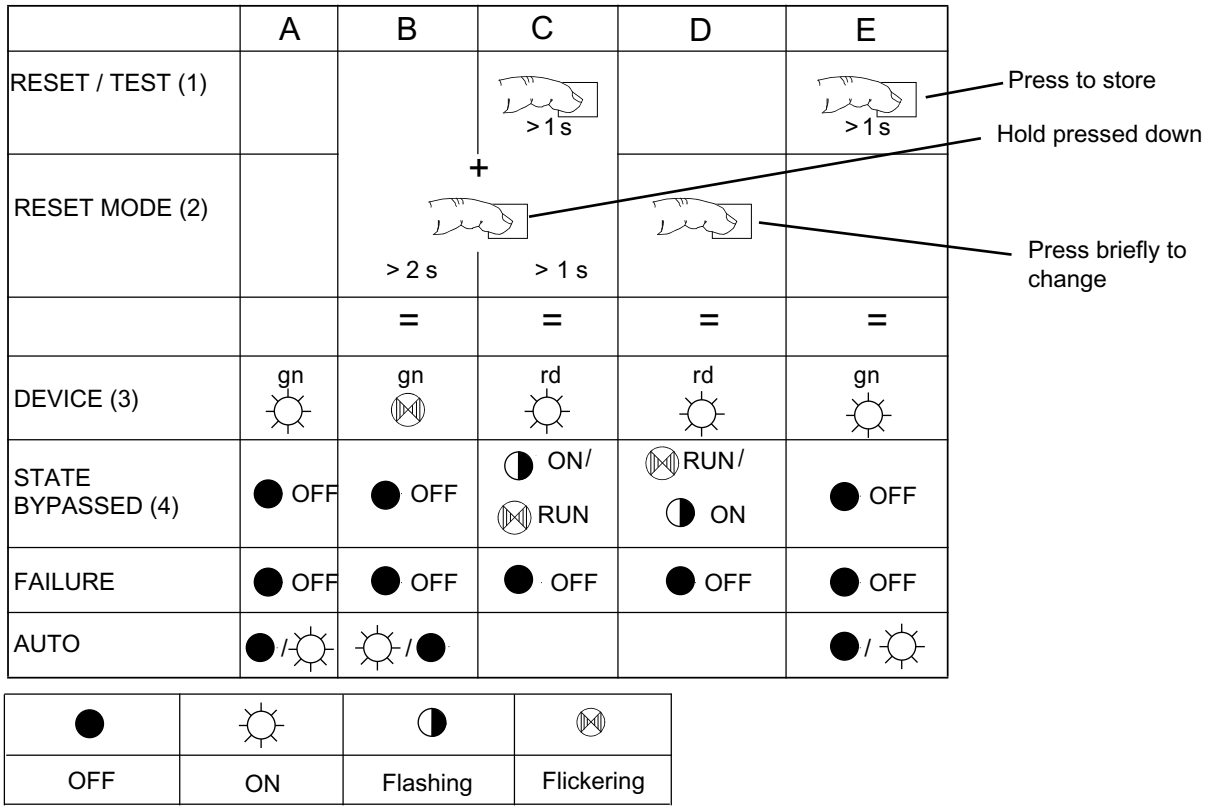


Figure 12-2 Overview of buttons / LEDs on the 3RW40 2 to 3RW40 4 and 3RW40 5 to 3RW40 7



Reparameterizing the ON / RUN output

A: Control voltage is present and the soft starter is in the normal, fault-free position:
The DEVICE LED is continuously lit (green) while the STATE / BYPASSED and FAILURE LEDs are off.
The AUTO LED indicates the color of the set RESET mode.

B: Start programming:
(On the 3RW40 2 device, remove the RESET MODE cover as shown in chapter Setting the RESET MODE [Page 113].) Press the RESET MODE button (2) for longer than 2 s until the DEVICE LED (3) flickers (green). Hold the RESET MODE button (2) pressed down.

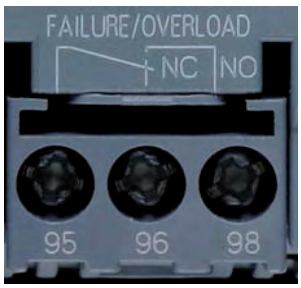
C: Simultaneously press the RESET / TEST button (1) for longer than 1 s until the DEVICE LED (3) lights up (red). The active mode set at the ON / RUN output is indicated by the STATE / BYPASSED / FAILURE LED (4):
STATE / BYPASSED / FAILURE LED (4) flashes (green): ON mode (factory setting).
STATE / BYPASSED / FAILURE LED (4) flickers (green): RUN mode.

D: Change the mode:
Press the RESET MODE button (2) briefly. By pressing this button, you change the mode at the output, and the new mode is indicated by the STATE / BYPASSED / FAILURE LED (4):
STATE / BYPASSED / FAILURE LED (4) flickers (green): RUN mode is set.
STATE / BYPASSED / FAILURE LED (4) flashes (green): ON mode is set.

E: Exit programming and save the settings:
Press the RESET / TEST MODE button (1) for longer than 1 s until the DEVICE LED (3) lights up (green).
The LEDs indicate the following states again if the output was successfully parameterized:

DEVICE LED: Continuously lit (green).
STATE / BYPASSED and FAILURE LEDs: Off.
The AUTO LED indicates the color of the set RESET mode.

12.9.3 Function of the FAILURE / OVERLOAD output



FAILURE / OVERLOAD output contact

If there is no rated control voltage or if a failure occurs, the potential-free FAILURE / OVERLOAD output is switched.

Note

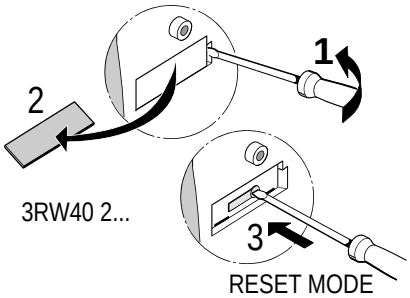
For information about whether or not faults can be acknowledged, as well as the recovery time and the corresponding LED and output contact states, refer to chapter Diagnostics and fault signals [Page 44].

12.10 RESET MODE and functions of the RESET / TEST button

12.10.1 SIRIUS 3RW40 2. to 3RW40 4. soft starters

12.10.1.1 Setting the RESET MODE

Position of the RESET button behind the label on the 3RW40 2.







AUTO RESET	Yellow
Manual RESET	Off
Remote RESET	Green

RESET MODE button

By pressing the RESET MODE button, you define the reset procedure in case of a fault. This is indicated by the RESET MODE LED.

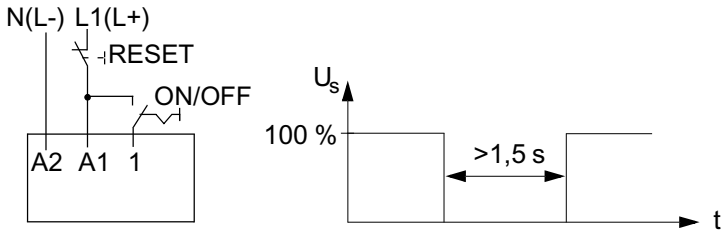
12.10.1.2 Manual RESET



RESET / TEST button (RESET MODE LED off)

You can reset a fault by pressing the RESET / TEST button.

12.10.1.3 Remote RESET



Remote RESET (RESET MODE LED = green)

You can reset a fault signal by disconnecting the control supply voltage for >1.5 s.

12.10.1.4 AUTO RESET

AUTO RESET (RESET MODE LED = yellow)

If you set the RESET mode to AUTO, a fault is automatically reset.

Note

For information about whether or not faults can be acknowledged, as well as the recovery time and the corresponding LED and output contact states, refer to chapter Diagnostics and fault signals [Page 44].

⚠ WARNING

Automatic restart
Can result in death, serious injury, or property damage.

The automatic RESET mode (AUTO RESET) must not be used in applications where there is a risk of serious injury to persons or substantial damage to property if the motor starts up again unexpectedly. The start command (e.g. issued by a contact or the PLC) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output on the 3RW40 (terminals 95 and 96), or the signaling contact of the motor or miniature circuit breaker on all devices, in the controller.

12.10.2 SIRIUS 3RW40 5. to 3RW40 7. soft starters

12.10.2.1 Setting the RESET MODE



AUTO RESET	Yellow
Manual / (remote) RESET	Off

RESET MODE button

By pressing the RESET MODE button, you define the reset procedure in case of a fault. This is indicated by the AUTO LED.

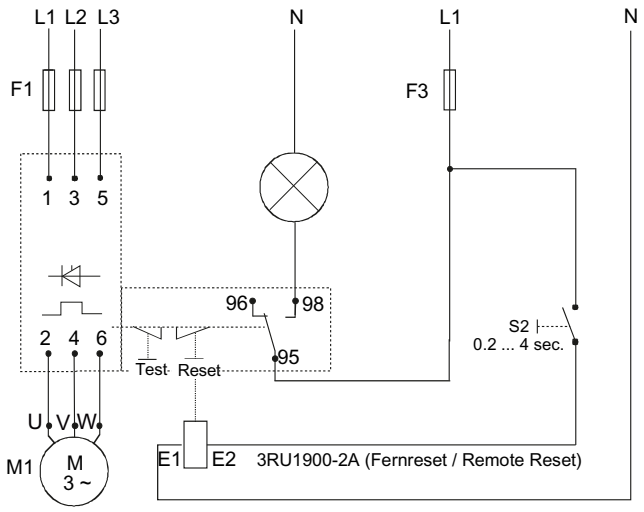
12.10.2.2 Manual RESET



RESET / TEST button (AUTO LED off)

You can reset a fault by pressing the RESET / TEST button.

12.10.2.3 Remote RESET



Remote RESET with module for RESET (AUTO LED = off)

You can perform a remote RESET (the RESET MODE set on the starter is MANUAL RESET) by controlling the optional module for RESET (3RU1900-2A).

12.10.2.4 AUTO RESET

AUTO RESET (AUTO LED = yellow)

If you set the RESET mode to AUTO, a fault is automatically reset.

Note

For information about whether or not faults can be acknowledged, as well as the recovery time and the corresponding LED and output contact states, refer to chapter Diagnostics and fault signals [Page 44].

⚠ WARNING

Automatic restart
Can result in death, serious injury, or property damage.

The automatic RESET mode (AUTO RESET) must not be used in applications where there is a risk of serious injury to persons or substantial damage to property if the motor starts up again unexpectedly. The start command (e.g. issued by a contact or the PLC) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output on the 3RW40 (terminals 95 and 96), or the signaling contact of the motor or miniature circuit breaker on all devices, in the controller.

12.11 3RW40: LEDs and troubleshooting

		LEDs on 3RW40				Auxiliary contacts			
		Soft starter		Motor protection					
3RW40		DEVICE (rd/gn/ylw)	STATE / BYPASSED / FAILURE (gn/rd)	OVERLOAD (rd)	RESET MODE / AUTO (ylw/gn)	13 14 (ON)	13 14 (RUN)	24 23 (BYPASSED)	96 95 98 FAILURE / OVERLOAD
U_S= 0		●	●	●	●				
Operating state	IN								
Off	0	☼ gn	●	●	●				
Start	1	☼ gn	◑ gn	●	●				
Bypassed	1	☼ gn	☼ gn	●	●				
Stop	0	☼ gn	◑ gn	●	●				
Warning									
I_e/ impermissible CLASS setting [2]		☼ gn	● ◑ ☼ gn gn	◑	●				
Start inhibited, device too hot (cooling time may vary according to thyristor temperature) [3]		◑ ylw	●	●	●				
Fault									
Impermissible electronics supply voltage [2]		●	☼ rd	●	●				
Impermissible I_e / CLASS setting and IN (0 -> 1) [2]		☼ gn	☼ rd	◑	●				
Motor protection tripping, overload relay [1] cooling time 60 s / thermistor cooling time may vary according to motor temperature		☼ gn	●	☼	●				
Thermistor motor protection Wire breakage / short-circuit [1] [3]		☼ gn	●	⋈	●				
Thermal overload on device [3] (cooling time > 30 s)		☼ ylw	☼ rd	●	●				
- Missing load voltage - Phase failure, missing load [3]		☼ gn	☼ rd	●	●				
Device fault (cannot be acknowledged, device defective) [5]		☼ rd	☼ rd	●	●				
Test function									
Press TEST t>5 s [4]		☼ gn	●	☼ rd	●				
RESET MODE (press to change)									
Manual RESET		●	●	●	●				
Auto RESET		●	●	●	☼ ylw				
Remote RESET		●	●	●	☼ gn				

LEDs							1) Optional, 3RW40 2. to 3RW40 4. in 24 V AC/DC only
●	☼	◑	⋈	gn =	ylw =	rd =	2) Automatically reset if the setting is corrected or when the system returns to normal
Off	ON	Flashing	Flickering	Green	Yellow	Red	3) Must be acknowledged according to the selected RESET mode 4) Motor protection trip test
							5) Device fault cannot be acknowledged. Contact your SIEMENS partner or Technical Assistance.

⚠ WARNING

Automatic restart
Can result in death, serious injury, or property damage.

The automatic RESET mode (AUTO RESET) must not be used in applications where there is a risk of serious injury to persons or substantial damage to property if the motor starts up again unexpectedly. The start command (e.g. issued by a contact or the PLC) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output on the 3RW40 (terminals 95 and 96), or the signaling contact of the motor or miniature circuit breaker on all devices, in the controller.

Notes on troubleshooting

Warning	Cause	Remedy
Impermissible I_e CLASS setting (control voltage present, no start command)	The rated operational current I_e set for the motor (control voltage present, no start command) exceeds the associated, maximum permissible setting current referred to the selected CLASS setting (chapter Motor current settings [Page 107]).	Check the rated operational current set for the motor, select a lower CLASS setting, or calculate the soft starter with a size allowance. As long as the 3RW40 is not controlled IN (0->1), this is only a status signal. However, it becomes a fault signal if the start command is applied.
Start inhibited, device too hot	The acknowledgment and the motor start are inhibited for a defined time by the inherent device protection following an overload trip, to allow the 3RW40 to cool down. Possible causes • Too many starts, • Motor ramp-up time too long, • Ambient temperature in switching device's environment too high, • Minimum installation clearances not complied with.	The device cannot be started until the temperature of the thyristor or the heat sink has cooled down enough to guarantee sufficient reserve for a successful startup. The time until restarting is allowed can vary but is a minimum of 30 s. Rectify the causes and possibly retrofit the optional fan (3RW40 2. to 3RW40 4.).

Fault	Cause	Remedy
Impermissible electronics supply voltage:	The control supply voltage does not correspond to the soft starter's rated voltage.	Check the control supply voltage; could be caused by a power failure, voltage dip, or incorrect control supply voltage. Use a stabilized power supply unit if due to mains fluctuations.
Impermissible Ie/CLASS setting and IN (0->1) (control voltage present, IN start command changes from 0 to 1)	The rated operational current I_e set for the motor (control voltage present, start command present) exceeds the associated, maximum permissible setting current referred to the selected CLASS setting (chapter Motor current settings [Page 107]). For the maximum permissible settings, refer to chapter "Technical data [Page 121]".	Check the rated operational current set for the motor, select a lower CLASS setting, or calculate the soft starter with a size allowance.
Motor protection tripping Overload relay / thermistor:	The thermal motor model has tripped. After an overload trip, restarting is inhibited until the recovery time has elapsed. - Overload relay tripping time: 60 s - Thermistor tripping time: When the temperature sensor (thermistor) in the motor has cooled down.	- Check whether the motor's rated operational current I_e is set correctly, or - Change the CLASS setting, or - Possibly reduce the switching frequency, or - Deactivate the motor protection (CLASS OFF), or - Check the motor and the application.
Thermistor protection: wire breakage / short-circuit (optional for 3RW40 2. to 3RW40 4. devices):	Temperature sensor at terminals T11/ T12/T22 is short-circuited or defective, a cable is not connected, or no sensor is connected.	Check the temperature sensor and the wiring
Thermal overload on the device:	Overload trip of the thermal model for the power unit of the 3RW40 Possible causes • Too many starts, • Motor ramp-up time too long, • Ambient temperature in switching device's environment too high, • Minimum installation clearances not complied with.	Wait until the device has cooled down again, possibly increase the current limiting value set for starting, or reduce the switching frequency (too many consecutive starts). Possibly retrofit the optional fan (3RW40 2. to 3RW40 4.). Check the load and the motor, check whether the ambient temperature in the soft starter's environment is too high (derating above 40 °C, refer to chapter Technical data [Page 121]), comply with the minimum clearances.

Fault	Cause	Remedy
Missing load voltage, phase failure / missing load:	Cause 1: Phase L1 / L2 / L3 is missing or fails / collapses when the motor is operating. Tripped as a result of a dip in the permissible rated operational voltage > 15 % for > 100 ms during the startup process or > 200 ms in bypass mode.	Connect L1 / L2 / L3 or correct the voltage dip.
	Cause 2: The motor that is connected is too small and the fault occurs as soon as it is switched to bypass mode.	Set the correct rated operational current for the connected motor or set it to the minimum value (if the motor current is less than 10 % of the set I_e, the motor cannot be operated with this starter).
	Cause 3: Motor phase T1 / T2 / T3 is not connected.	Connect the motor properly (e.g. jumpers in the motor terminal box, repair switch closed etc.)
Device fault	Soft starter defective.	Contact your SIEMENS partner or Technical Assistance.

13.2 3RW40

13.2.1 Overview

SIRIUS 3RW40 soft starters have all the same advantages as the 3RW30 soft starters.

SIRIUS 3RW40 soft starters are characterized above all by their small space requirements. Integral bypass contacts mean that no power loss has to be taken into account at the power semiconductors (thyristors) after the motor has started up. This cuts down on heat losses, enabling a more compact design and making external bypass circuits superfluous.

At the same time, this soft starter comes with additional integrated functions such as settable current limiting, motor overload and intrinsic device protection, and optional thermistor motor protection. The higher the motor rating, the more important these functions become because they make it unnecessary to purchase and install protection equipment (such as overload relays).

Internal intrinsic device protection prevents thermal overloading of the thyristors and the power unit defects this can cause. As an option, the thyristors can also be protected against short-circuiting with semiconductor fuses.

Thanks to integrated status and fault monitoring, this compact soft starter offers many different diagnostics options. Up to four LEDs and relay outputs permit differentiated monitoring and diagnostics of the operating mechanism by indicating the operating state as well as, for example, mains or phase failures, missing load, impermissible tripping times / CLASS settings, thermal overloading, or device faults.

Soft starters rated up to 250 kW (at 400 V) can be supplied for standard applications in three-phase systems. Extremely small sizes, low power losses, and simple commissioning are just three of the many advantages of the SIRIUS 3RW40 soft starters.

"Increased safety" type of protection EEx e according to ATEX Directive 94/9/EC

The SIRIUS 3RW40 soft starter sizes S0 to S12 are suitable for starting explosion-proof motors with the "increased safety" type of protection EEx e.

13.2.2 Selection and ordering data for standard applications and normal starting (CLASS 10)



3RW40 28-1BB14



3RW40 38-1BB14



3RW40 47-1BB14

Ambient temperature 40°C				Ambient temperature 50°C					Size	Normal starting
Rated operational current I_e [1]	Rated power of three-phase induction motors for rated operational voltage U_e			Rated operational current I_e [1]	Rated power of three-phase induction motors for rated operational voltage U_e					
	230 V	400 V	500 V		200 V	230 V	460 V	575 V		Order No.
A	kW	kW	kW	A	hp	hp	hp	hp		
Rated operational voltage U_e 200 to 480 V [2]										
• With screw or spring-loaded terminals										
12.5	3	5.5	–	11	3	3	7.5	–	S0	3RW40 24-□BB□4
25	5.5	11	–	23	5	5	15	–	S0	3RW40 26-□BB□4
32	7.5	15	–	29	7.5	7.5	20	–	S0	3RW40 27-□BB□4
38	11	18.5	–	34	10	10	25	–	S0	3RW40 28-□BB□4
• With screw or spring-loaded terminals										
45	11	22	–	42	10	15	30	–	S2	3RW40 36-□BB□4
58	18.5	30	–	58	15	20	40	–	S2	3RW40 37-□BB□4
72	22	37	–	62	20	20	40	–	S2	3RW40 38-□BB□4
• With screw or spring-loaded terminals										
80	22	45	–	73	20	25	50	–	S3	3RW40 46-□BB□4
106	30	55	–	98	30	30	75	–	S3	3RW40 47-□BB□4
Rated operational voltage U_e 400 to 600 V [2]										
• With screw or spring-loaded terminals										
12.5	–	5.5	7.5	11	–	–	7.5	10	S0	3RW40 24-□BB□5
25	–	11	15	23	–	–	15	20	S0	3RW40 26-□BB□5
32	–	15	18.5	29	–	–	20	25	S0	3RW40 27-□BB□5
38	–	18.5	22	34	–	–	25	30	S0	3RW40 28-□BB□5
• With screw or spring-loaded terminals										
45	–	22	30	42	–	–	30	40	S2	3RW40 36-□BB□5
58	–	30	37	58	–	–	40	50	S2	3RW40 37-□BB□5
72	–	37	45	62	–	–	40	60	S2	3RW40 38-□BB□5
• With screw or spring-loaded terminals										
80	–	45	55	73	–	–	50	60	S3	3RW40 46-□BB□5
106	–	55	75	98	–	–	75	75	S3	3RW40 47-□BB□5
Order number supplement for connection types										
• With screw terminals										1
• With spring-loaded terminals [3]										2
Order number supplement for rated control supply voltage U_s										
• 24 V AC/DC										0
• 110 to 230 V AC/DC										1

[1] Standalone assembly without additional fan.

[2] Soft starter with screw terminals.

[3] Main circuit connection: screw terminals.

Note

The rated motor current is extremely important when selecting a soft starter.

Refer to the information about selecting soft starters in chapter Configuration [Page 73].

Conditions for normal starting (CLASS 10):
Max. ramp-up time 10 s, current limiting 300 %, 5 starts / hour, ON time 30 %, standalone assembly, max. installation altitude 1000 m / 3280 ft, ambient temperature kW 40 °C / 104 °F. A larger model may need to be selected if other conditions and constraints apply or for a higher starting frequency. We recommend using the "Win-Soft Starter" selection and simulation software. For information about the rated currents for ambient temperatures > 40 °C, refer to chapter 3RW40 2. to 7. power electronics [Page 148].

13.2.5 Selection and ordering data for standard applications and heavy-duty starting (CLASS 20)


3RW40 28-1BB14


3RW40 28-1TB04


3RW40 38-1BB14


3RW40 38-1TB04


3RW40 47-1BB14


3RW40 47-1TB04

Ambient temperature 40°C				Ambient temperature 50°C					Size	Heavy-duty starting (CLASS 20)
Rated operational current I_e [1]	Rated power of three-phase induction motors for rated operational voltage U_e			Rated operational current I_e [1]	Rated power of three-phase induction motors for rated operational voltage U_e					
	230 V	400 V	500 V		200 V	230 V	460 V	575 V		Order No.
A	kW	kW	kW	A	hp	hp	hp	hp		
Rated operational voltage U_e 200 to 480 V [2]										
• With screw or spring-loaded terminals										
12.5	3	5.5	–	11	3	3	7.5	–	S0	3RW40 26-□□B□4
25	5.5	11	–	23	5	5	15	–	S0	3RW40 27-□□B□4
32	7.5	15	–	29	7.5	7.5	20	–	S2	3RW40 36-□□B□4
38	11	18.5	–	34	10	10	25	–	S2	3RW40 37-□□B□4
45	11	22	–	42	10	15	30	–	S2	3RW40 37-□□B□4
63	18.5	30	–	58	15	20	40	–	S3	3RW40 47-□□B□4
72	22	37	–	62	20	20	40	–	S3	3RW40 47-□□B□4
Rated operational voltage U_e 400 to 600 V										
• With screw or spring-loaded terminals										
12.5	–	5.5	7.5	11	–	–	7.5	10	S0	3RW40 26-□□B□5
25	–	11	15	23	–	–	15	20	S0	3RW40 27-□□B□5
32	–	15	18.5	29	–	–	20	25	S2	3RW40 36-□□B□5
38	–	18.5	22	34	–	–	25	30	S2	3RW40 37-□□B□5
45	–	22	30	42	–	–	30	40	S2	3RW40 37-□□B□5
63	–	30	37	58	–	–	40	50	S3	3RW40 47-□□B□5
72	–	37	45	62	–	–	40	60	S3	3RW40 47-□□B□5

Order number supplement for connection types

• With screw terminals	1
• With spring-loaded terminals [3]	2

Order number supplement for thermistor motor protection

• Standard function	B
•Thermistor motor protection only with rated control supply voltage U_s24 V AC/DC	T

Order number supplement for rated control supply voltage U_s

• 24 V AC/DC	0
• 110...230 V AC/DC	1

[1] Standalone assembly without additional fan.

[2] Soft starter with screw terminals.

[3] Main circuit connection: screw terminals.

Note

The rated motor current is extremely important when selecting a soft starter.

Refer to the information about selecting soft starters in chapter Configuration [Page 73].

Conditions for normal starting (CLASS 10):
Max. ramp-up time 20 s, current limiting 300 %, 5 starts / hour, ON time 30 %, standalone assembly, max. installation altitude 1000 m / 3280 ft, ambient temperature kW 40 °C / 104°. A larger model may need to be selected if other conditions and constraints apply or for a higher starting frequency. We recommend using the "Win-Soft Starter" selection and simulation software. For information about the rated currents for ambient temperatures > 40 °C, refer to chapter 3RW40 24, 26, 27, 28 power electronics [Page 149].

13.2.7 3RW40 2., 3., 4. control electronics

Type				3RW402.		3RW403., 3RW404.	
Control electronics							
Rated values		Terminal					
Rated control supply voltage		A1 / A2	V	24	110...230	24	110...230
• Tolerance			%	±20	-15/+10	±20	-15/+10
Rated control supply current							
• STANDBY			mA	<150	<50	<200	<50
• During pickup			mA	<200	<100	<5000	<1500
• ON without fan			mA	<250	<50	<200	<50
• ON with fan			mA	<300	<70	<250	<70
Rated frequency			Hz	50/60			
• Tolerance			%	±20			
Control inputs							
IN				ON / OFF			
Rated operational current							
• AC			mA	Approx. 12	3/6	Approx. 12	3/6
• DC			mA	Approx. 12	1.5/3	Approx. 12	1.5/3
Relay outputs							
Output 1	ON / RUN mode[1)]	13/14		Operating indication (NO)			
Output 2	BYPASSED	23/24		Bypass indication (NO)			
Output 3	OVERLOAD/FAILURE	95/96/98		Overload / fault indication (NC/NO)			
Rated operational current			A	3AC-15/AC-14 at 230 V,			
			A	1DC-13 at 24 V			
Protection against overvoltages				Protection by means of varistor through contact			
Short-circuit protection				4 A gL/gG operational class; 6 A quick (fuse is not included in scope of supply)			

1) Factory default: ON mode.

13.2.8 3RW40 5., 7. control electronics

Type				3RW405.		3RW407.	
Control electronics							
Rated values		Terminal					
Rated control supply voltage		A1 / A2	V AC	115	230	115	230
• Tolerance			%	-15/+10		-15/+10	
Rated control supply current							
• STANDBY			mA	15		15	
• During pickup			mA	<1700	<850	<400	<2000
• ON[1)]			mA	440	200	660	360
Rated frequency			Hz	50/60		50/60	
• Tolerance			%	±10		±10	
Control inputs							
IN				ON / OFF			
Rated operational current			mA	Approx. 10 according to DIN 19240			
Rated operational voltage			V DC	24 from internal supply DC+ or external DC supply (according to DIN 19240) through terminals and IN			
Relay outputs							
Output 1	ON / RUN mode[2)]	13/14		Operating indication (NO)			
Output 2	BYPASSED	23/24		Bypass indication (NO)			
Output 3	OVERLOAD/FAILURE	95/96/98		Overload / fault indication (NC/NO)			
Rated operational current			A	3AC-15/AC-14 at 230 V,			
			A	1DC-13 at 24 V			
Protection against overvoltages				Protection by means of varistor through contact			
Short-circuit protection				4 A gL/gG operational class; 6 A quick (fuse is not included in scope of supply)			

1) Values for the coil power consumption at +10% U_n, 50 Hz.

2) Factory default: ON mode.

13.2.9 3RW40 2., 3., 4. control electronics

Type		3RW402., 3RW403., 3RW404.		
Control electronics				
Operating indications	LED	DEVICE	STATE/BYPASSED/FAILURE	OVERLOAD
Off		Green	Off	Off
Start		Green	Green flashing	Off
Bypass		Green	Green	Off
Stop		Green	Green flashing	Off
Alarm signals				
Impermissible I_e / CLASS setting		Green	Not relevant	Red flashing
Start inhibited / thyristors too hot		Yellow flashing	Not relevant	Off
Fault signals				
• 24 V: $U < 0.75 \times U_s$ or $U > 1.25 \times U_s$		Off	Red	Off
• 110...230 V: $U < 0.75 \times U_s$ or $U > 1.15 \times U_s$		Off	Red	Off
Impermissible I_e/ CLASS setting for edge 0–>1 on input IN		Green	Red	Red flashing
Motor protection tripping (overload thermistor)		Green	Off	Red
Thermistor defective (wire breakage, short-circuit)		Green	Off	Red flickering
Thermal overload of the thyristors		Yellow	Red	Off
Missing mains voltage, phase failure / missing load		Green	Red	Off
Device fault		Red	Red	Off

13.2.10 3RW40 5., 7. control electronics

Type		3RW405. and 3RW407.			
Control electronics					
Operating indications	LEDs	DEVICE	STATE/BYPASSED	FAILURE	OVERLOAD
Off		Green	Off	Off	Off
Start		Green	Green flashing	Off	Off
Bypass		Green	Green	Off	Off
Stop		Green	Green flashing	Off	Off
Alarm signals					
Impermissible I_e / CLASS setting		Green	Not relevant	Not relevant	Red flashing
Start inhibited / thyristors too hot		Yellow flashing	Not relevant	Not relevant	Off
Fault signals					
$U < 0.75 \times U_s$ or $U > 1.15 \times U_s$		Off	Off	Red	Off
Impermissible I_e/ CLASS setting for edge 0–>1 on input IN		Green	Off	Red	Red flashing
Motor protection tripping		Green	Off	Off	Red
Thermal overload of the thyristors		Yellow	Off	Red	Off
Missing mains voltage, phase failure / missing load		Green	Off	Red	Off
Device fault		Red	Off	Red	Off

13.2.11 3RW40 protection functions

Type		3RW40..	Factory default
Protection functions			
Motor protection functions			
Trips in the event of		Thermal overloading of the motor	
Trip class to IEC 60947-4-1	Class	10/15/20	10
Phase failure sensitivity	%	>40	
Overload warning		No	
Thermistor protection according to IEC 60947-8, type A / IEC 60947-5-1		Yes[1)]	
Reset option after tripping		Manual / automatic / remote reset[2)] (MAN / AUTO / REMOTE[2)])	
Recovery time	min	5	
Device protection functions			
Trips in the event of		Thermal overloading of the thyristors or bypass[3)]	
Reset option after tripping		Manual / automatic / remote reset[2)] (MAN / AUTO / REMOTE[2)])	
Recovery time			
• During overloading of the thyristors	s	30	
• During overloading of the bypass	s	60	

1) Optional up to size S3 (device version).

2) Integrated remote reset (REMOTE) available only for 3RW40 2. to 3RW40 4.; remote reset with accessory module 3RU19 available for 3RW405. and 3RW407.

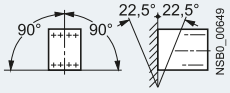
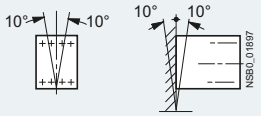
3) Bypass protection up to size S3.

13.2.12 3RW40 control times and parameters

Type		3RW40..	Factory default
Control times and parameters			
Control times			
Closing delay (with connected control voltage)	ms	<50	
Closing delay (automatic / line contactor mode)	ms	<300	
Recovery time (closing command during active stop)	ms	100	
Mains failure bridging time			
Control supply voltage	ms	50	
Mains / phase failure response time			
Load current circuit			
• During starting and stopping	s	1	
• During bypass	s	5	
Reclosing lockout after overload trip			
Motor protection trip	min	5	
Device protection trip			
• During overloading of the thyristors	s	30	
• During overloading of the bypass	s	60	
Start parameters			
Ramp-up time	s	0...20	7.5
Starting voltage	%	40...100	40
Starting current limiting		1.3...5 x I_e	5 x I_e
Stop parameter			
Ramp-down time	s	0...20	0
Reset mode parameters (for motor / device protection trip)			
Manual reset	LED	Off	Off
Automatic reset	LED	Yellow	
Remote reset (REMOTE)[1)]	LED	Green	
Ramp-up detection		Yes	
Operating mode output 13/14			
Rising edge at	Start command		
Falling edge at	Off command	ON	ON
	Ramp-down end	RUN	

1) Integrated remote reset (REMOTE) available only for 3RW40 2. to 3RW40 4.; remote reset with accessory module 3RU19 available for 3RW405. and 3RW407.

13.2.13 3RW40 2. to 7. power electronics

Type		3RW402.-..B.4, 3RW403.-..B.4, 3RW404.-..B.4	3RW402.-..B.5, 3RW403.-..B.5, 3RW404.-..B.5	3RW405.-.BB.4, 3RW407.-.BB.4	3RW405.-.BB.5, 3RW407.-.BB.5
Power electronics					
Rated operational voltage Tolerance	V AC %	200...480 -15/+10	400...600 -15/+10	200...460 -15/+10	400...600 -15/+10
Maximum thyristor blocking voltage	V AC	1600		1400	1800
Rated frequency Tolerance	Hz %	50/60 ±10			
Continuous duty at 40°C (% of I_e)		115			
Minimum load (% of minimum selectable rated motor current I_M)	%	20 (at least 2 A)			
Maximum cable length between soft starter and motor	m	300			
Permissible installation altitude	m	5000 (Derating from 1000, see characteristic curves); higher on request			
Permissible mounting position					
• With auxiliary fan (for 3RW402. ... 3RW404.)					
• Without auxiliary fan (for 3RW402. ... 3RW404.)				– (fan integrated in the soft starter)	
Permissible ambient temperature Operation Storage	 °C °C	 -25...+60; (derating from +40) -40...+80			
Degree of protection		IP20 for 3RW40 2.; IP00 for 3RW40 3. and 3RW40 4.		IP00	

13.2.14 3RW40 24, 26, 27, 28 power electronics

Type		3RW4024	3RW4026	3RW4027	3RW4028
Power electronics					
Current carrying capacity rated operating current I_e •Acc. to IEC and UL/CSA[1], for standalone assembly, AC-53a					
-At 40°C	A	12.5	25.3	32.2	38
-At 50 °C	A	11	23	29	34
-At 60 °C	A	10	21	26	31
Minimum settable rated motor current I_M for motor overload protection	A	5	10	17	23
Power loss					
•During operation after startup of the motor at uninterrupted rated operat. curr. (40°C) approx.	W	2	8	13	19
•During starting at 300 % current limiting I_M (40°C)	W	68	188	220	256
Permissible rated motor current and starts per hour					
•For normal starting (class 10):					
-Rated motor curr. I_M[2], ramp-up t. 3s	A	12.5 / 11	25 / 23	32 / 29	38 / 34
-Starts per hour[3]	1/h	50 / 50	23 / 23	23 / 23	19 / 19
-Rated motor curr. I_M[2][4], ramp-up t. 4s	A	12.5 / 11	25 / 23	32 / 29	38 / 34
-Starts per hour[3]	1/h	36 / 36	15 / 15	16 / 16	12 / 12
•For heavy-duty starting (class 15)					
-Rated motor curr. I_M[2], ramp-up t. 4,5s	A	11 / 10	23 / 21	30 / 27	34 / 31
-Starts per hour[3]	1/h	49 / 49	21 / 21	18 / 18	18 / 18
-Rated motor curr. I_M[2][4], ramp-up t. 6s	A	11 / 10	23 / 21	30 / 27	34 / 31
-Starts per hour[3]	1/h	36 / 36	14 / 14	13 / 13	13 / 13
•For heavy-duty starting (class 20)					
-Rated motor curr. I_M[2], ramp-up t. 6s	A	10 / 9	21 / 19	27 / 24	31 / 28
-Starts per hour[3]	1/h	47 / 47	21 / 21	20 / 20	18 / 18
-Rated motor curr. I_M[2][4], ramp-up t. 8s	A	10 / 9	21 / 19	27 / 24	31 / 28
-Starts per hour[3]	1/h	34 / 34	15 / 15	14 / 14	13 / 13

1) Measurement at 60°C in accordance with UL/CSA not required.

2) 300 % current limiting on soft starter I_M. Tamb = 40 °C / 50 °C.

3) For intermittent duty S4 with ON time 30%, T_{amb}=40°C / 50 °C, vertical standalone assembly. The specified switching frequencies do not apply to automatic mode. Factors for permissible switching frequency with different mounting position, direct assembly, side-by-side assembly and installation of an optional additional fan, see Configuration chapter.

4) Maximum settable rated motor current I_M, depending on the CLASS setting.

13.2.15 3RW40 36, 37, 38, 46, 47 power electronics

Type		3RW4036	3RW4037	3RW4038	3RW4046	3RW4047
Power electronics						
Current carrying capacity rated operating current I_e						
•Acc. to IEC and UL/CSA[1], for standalone assembly, AC-53a						
-At 40°C	A	45	63	72	80	106
-At 50 °C	A	42	58	62.1	73	98
-At 60 °C	A	39	53	60	66	90
Minimum settable rated motor current I_M for motor overload protection	A	23	26	35	43	46
Power loss						
•During operation after startup of the motor at uninterrupted rated operat. curr. (40°C) approx.	W	6	12	15	12	21
•During starting at 300 % current limiting I_M (40°C)	W	316	444	500	576	768
Permissible rated motor current and starts per hour						
•For normal starting (class 10):						
-Rated motor curr. I_M[2], ramp-up t. 3s	A	45 / 42	63 / 58	72 / 62	80 / 73	106 / 98
-Starts per hour[3]	1/h	38 / 38	23 / 23	22 / 22	22 / 22	15 / 15
-Rated motor curr. I_M[2)4)], ramp-up t. 4s	A	45 / 42	63 / 58	72 / 62	80 / 73	106 / 98
-Starts per hour[3]	1/h	26 / 26	15 / 15	15 / 15	15 / 15	10 / 10
•For heavy-duty starting (class 15)						
-Rated motor curr. I_M[2], ramp-up t. 4,5s	A	42 / 38	50 / 46	56 / 52	70 / 64	84 / 77
-Starts per hour[3]	1/h	30 / 30	34 / 34	34 / 34	24 / 24	23 / 23
-Rated motor curr. I_M[2)4)], ramp-up t. 6s	A	42 / 38	50 / 46	56 / 52	70 / 64	84 / 77
-Starts per hour[3]	1/h	21 / 21	24 / 24	24 / 24	16 / 16	17 / 17
•For heavy-duty starting (class 20)						
-Rated motor curr. I_M[2], ramp-up t. 6s	A	38 / 34	46 / 42	50 / 46	64 / 58	77 / 70
-Starts per hour[3]	1/h	30 / 30	31 / 31	34 / 34	23 / 23	23 / 23
-Rated motor curr. I_M[2)4)], ramp-up t. 8s	A	38 / 34	46 / 42	50 / 46	64 / 58	77 / 70
-Starts per hour[3]	1/h	21 / 21	22 / 22	24 / 24	16 / 16	16 / 16

1) Measurement at 60°C in accordance with UL/CSA not required.

2) 300 % current limiting on soft starter I_M. Tamb = 40 °C / 50 °C

3) For intermittent duty S4 with ON time 30%, T_{amb}=40°C / 50 °C, vertical standalone assembly. The specified switching frequencies do not apply to automatic mode. Factors for permissible switching frequency with different mounting position, direct assembly, side-by-side assembly and installation of an optional additional fan, see Configuration chapter.

4) Maximum settable rated motor current I_M, depending on the CLASS setting.

13.2.16 3RW40 55, 56, 73, 74, 75, 76 power electronics

Type		3RW4055	3RW4056	3RW4073	3RW4074	3RW4075	3RW4076
Power electronics							
Current carrying capacity rated operating current I_e							
•Acc. to IEC and UL/CSA[1], for standalone assembly, AC-53a							
-At 40°C	A	134	162	230	280	356	432
-At 50 °C	A	117	145	205	248	315	385
-At 60 °C	A	100	125	180	215	280	335
Minimum settable rated motor current I_M for motor overload protection	A	59	87	80	130	131	207
Power loss							
•During operation after startup of the motor at uninterrupted rated operat. curr. (40°C) approx.	W	60	75	75	90	125	165
•During starting at 350%[2] current limiting I_M (40°C)	W	1043	1355	2448	3257	3277	3600
Permissible rated motor current and starts per hour							
•For normal starting (class 10):							
-Rated motor curr. I_M[2], ramp-up t. 10s	A	134 / 117	162 / 145	230 / 205	280 / 248	356 / 315	432 / 385
-Starts per hour[3]	1/h	20 / 20	8 / 8	14 / 14	20 / 20	16 / 16	17 / 17
-Rated motor curr. I_M[2)4)], ramp-up t. 20s	A	134 / 117	162 / 145	230 / 205	280 / 248	356 / 315	432 / 385
-Starts per hour[3]	1/h	7 / 7	1.4 / 1.4	3 / 3	8 / 8	5 / 5	5 / 5
•For heavy-duty starting (class 15)							
-Rated motor curr. I_M[2], ramp-up t. 15s	A	134 / 117	152 / 140	210 / 200	250 / 220	341 / 315	402 / 385
-Starts per hour[3]	1/h	11 / 11	8 / 8	11 / 11	13 / 13	11 / 11	12 / 12
-Rated motor curr. I_M[2)4)], ramp-up t. 30s	A	134 / 117	152 / 140	210 / 200	250 / 220	341 / 315	402 / 385
-Starts per hour[3]	1/h	1.2 / 1.2	1.7 / 1.7	1 / 1	6 / 6	2 / 2	2 / 2
•For heavy-duty starting (class 20)							
-Rated motor curr. I_M[2], ramp-up t. 20s	A	124 / 112	142 / 132	200 / 185	230 / 205	311 / 280	372 / 340
-Starts per hour[3]	1/h	12 / 12	9 / 9	10 / 10	10 / 10	10 / 10	10 / 10
-Rated motor curr. I_M[2)4)], ramp-up t. 40s	A	124 / 112	142 / 132	200 / 185	230 / 205	311 / 280	372 / 340
-Starts per hour[3]	1/h	2 / 2	2 / 2	1 / 1	5 / 5	1 / 1	1 / 1

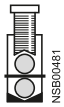
1) Measurement at 60°C in accordance with UL/CSA not required.

2) 350% current limiting on soft starter I_M. Tamb = 40 °C / 50 °C

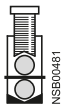
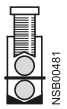
3) For intermittent duty S4 with ON time 70%, T_{amb}=40°C / 50 °C, vertical standalone assembly. The specified switching frequencies do not apply to automatic mode.

4) Maximum settable rated motor current I_M, depending on the CLASS setting.

13.2.17 3RW40 2., 3., 4. main conductor cross-sections

Soft starters	Type		3RW402.	3RW403.	3RW404.
Conductor cross-sections					
Screw terminals	Main conductors				
Front clamping point connected 	• Solid	mm^2	2 x (1.5...2.5); 2 x (2.5...6) according to IEC 60947; max. 1 x 10	2 x (1.5...16)	2 x (2.5...16)
	• With end sleeve	mm^2	2 x (1.5...2.5); 2 x (2.5...6)	1 x (0.75...25)	1 x (2.5...35)
	• Stranded	mm^2	–	1 x (0.75...35)	1 x (4...70)
	• AWG cables				
	- Solid	AWG	2 x (16 ... 12)		
	- Solid or stranded	AWG	2 x (14...10)	1 x (18...2)	2 x (10...1/0)
	- Stranded	AWG	1 x 8	–	–
Rear clamping point connected 	• Solid	mm^2	–	2 x (1.5...16)	2 x (2.5...16)
	• With end sleeve	mm^2	–	1 x (1.5...25)	1 x (2.5...50)
	• Stranded	mm^2	–	1 x (1.5...35)	1 x (10...70)
	• AWG cables				
	- Solid or stranded	AWG	–	1 x (16...2)	2 x (10...1/0)
Both clamping points connected 	• Solid	mm^2	–	2 x (1.5...16)	2 x (2.5...16)
	• With end sleeve	mm^2	–	2 x (1.5...16)	2 x (2.5...35)
	• Stranded	mm^2	–	2 x (1.5...25)	2 x (10...50)
	• AWG cables				
	- Solid or stranded	AWG	–	2 x (16...2)	1 x (10...2/0)
	• Tightening torque	Nm lb.in	2...2.5 18...22	4.5 40	6.5 58
	Tools		PZ2	PZ2	Allen screw 4 mm
	Degree of protection		IP20	IP20 (terminal compartment IP00)	IP20 (terminal compartment IP00)
Spring-loaded terminals	Main conductors				
	• Solid	mm^2	1...10	–	
	• Finely stranded with end sleeve	mm^2	1...6 end sleeves without plastic collar	–	
	• AWG cables				
	- Solid or stranded (finely stranded)	AWG	16...10	–	
	- Stranded	AWG	1 x 8	–	
	Tools		DIN ISO 2380-1A0; 5 x 3	–	
	Degree of protection		IP20	–	
Busbar connections	Main conductors				
	• With cable lug according to DIN 46234 or 20 mm wide				
	- Stranded	mm^2	–		2 x (10...70)
	- Finely-stranded	mm^2	–		2 x (10...50)
	• AWG cables, solid or stranded	AWG	–		2 x (7...1/0)

13.2.18 3RW40 5., 7. main conductor cross-sections

Soft starters	Type		3RW405.	3RW407.
Conductor cross-sections				
Screw terminals	Main conductors:			
With box terminal			3RT19 55-4G (55 kW)	3RT19 66-4G
Front clamping point connected	• Finely stranded with end sleeve	mm^2	16...70	70...240
	• Stranded	mm^2	16...70	95...300
 NSB00479	• Ribbon cable conductors (number x width x thickness)	mm	Min. 3 x 9 x 0.8, Max. 6 x 15.5 x 0.8	Min. 6 x 9 x 0.8 Max. 20 x 24 x 0.5
	• AWG cables, solid or stranded	AWG	6...2/0	3/0...600 kcmil
Rear clamping point connected	• Finely stranded with end sleeve	mm^2	16...70	120...185
	• Stranded	mm^2	16...70	120...240
 NSB00480	• Ribbon cable conductors (number x width x thickness)	mm	Min. 3 x 9 x 0.8, Max. 6 x 15.5 x 0.8	Min. 6 x 9 x 0.8 Max. 20 x 24 x 0.5
	• AWG cables, solid or stranded	AWG	6...2/0	250...500 kcmil
Both clamping points connected	• Finely stranded with end sleeve	mm^2	Max. 1 x 50, 1 x 70	Min. 2 x 50; max. 2 x 185
	• Stranded	mm^2	Max. 2 x 70	Max. 2 x 70; max. 2 x 240
 NSB00481	• Ribbon cable conductors (number x width x thickness)	mm	Max. 2 x (6 x 15.5 x 0.8)	Max. 2 x (20 x 24 x 0.5)
	• AWG cables, solid or stranded	AWG	Max. 2 x 1/0	Min. 2 x 2/0; max. 2 x 500 kcmil
	• Terminal screws		M10 (hexagon socket, A/F4)	M12 (hexagon socket, A/F5)
	- Tightening torque	Nm	10...12	20...22
		lb.in	90...110	180...195
Screw terminals	Main conductors:			
With box terminal			3RT19 56-4G	
Front or rear clamping point connected	• Finely stranded with end sleeve	mm^2	16...120	
	• Stranded	mm^2	16...120	
 NSB00479  NSB00480	• Ribbon cable conductors (number x width x thickness)	mm	Min. 3 x 9 x 0.8 Max. 6 x 15.5 x 0.8	
	• AWG cables, solid or stranded	AWG	6...250 kcmil	
Both clamping points connected	• Finely stranded with end sleeve	mm^2	Max. 1 x 95, 1 x 120	
	• Stranded	mm^2	Max. 2 x 120	
 NSB00481	• Ribbon cable conductors (number x width x thickness)	mm	Max. 2 x (10 x 15.5 x 0.8)	
	• AWG cables, solid or stranded	AWG	Max. 2 x 3/0	
Screw terminals	Main conductors:			
	Without box terminal / busbar connection			
	• Finely stranded with cable lug	mm^2	16...95[1)]	50...240[2)]
	• Stranded with cable lug	mm^2	25...120[1)]	70...240[2)]
	• AWG cables, solid or stranded	AWG	4...250 kcmil	2/0...500 kcmil
	• Connecting bar (max. width)	mm	17	25
	• Terminal screws		M8x25 (A/F13)	M10x30 (A/F17)
	- Tightening torque	Nm	10...14	14...24
		lb.in	89...124	124...210

1) When connecting cable lugs to DIN 46235, use 3RT19 56-4EA1 terminal cover for conductor cross-sections from 95 mm² to ensure the required clearance between phases.

2) When connecting cable lugs to DIN 46234 or DIN 46235, use 3RT19 66-4EA1 terminal cover for conductor cross-sections from 240 mm² or 185 mm² respectively to ensure the required clearance between phases.

13.2.19 3RW40 .. auxiliary conductor cross-sections

Soft starters	Type		3RW40..
Conductor cross-sections			
Auxiliary conductors (1 or 2 conductors can be connected)			
	Screw terminals		
	• Solid	mm^2	2 x (0.5...2.5)
	• Finely stranded with end sleeve	mm^2	2 x (0.5...1.5)
	• AWG cables		
	- Solid or stranded	AWG	2 x (20...14)
	- Finely stranded with end sleeve	AWG	2 x (20...16)
	• Terminal screws		
	- Tightening torque	Nm	0.8...1.2
		lb.in	7...10.3
	Spring-loaded terminals		
	• Solid		
	- 3RW40 2. to 3RW40 4.	mm^2	2 x (0.25...2.5)
	- 3RW40 5., 3RW40 7.	mm^2	2 x (0.25...1.5)
	• Finely stranded with end sleeve	mm^2	2 x (0.25...1.5)
	• AWG cables, solid or stranded	AWG	2 x (24...14) for 3RW402....3RW404.; 2 x (24...16) for 3RW405. and 3RW407.

13.2.20 Electromagnetic compatibility according to EN 60947-4-2

	Standard	Parameters
Electromagnetic compatibility according to EN 60947-4-2		
EMC interference immunity		
Electrostatic discharge (ESD)	EN 61000-4-2	± 4 kV contact discharge, ± 8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Frequency range: 80 to 1000 MHz with 80% at 1 kHz Degree of severity 3: 10 V/m
Conducted RF interference	EN 61000-4-6	Frequency range: 150 kHz...80 MHz with 80% at 1 kHz Interference 10 V
RF voltages and RF currents on cables		
• Burst	EN 61000-4-4	± 2 kV / 5 kHz
• Surge	EN 61000-4-5	±1 kV line to line ±2 kV line to ground
EMC interference emission		
EMC interference field strength	EN 55011	Limit value of Class A at 30...1000 MHz, Limit value of Class B for 3RW402.; 24 V AC/DC
Radio interference voltage	EN 55011	Limit value of Class A at 0.15...30 MHz, Limit value of Class B for 3RW402.; 24 V AC/DC
Radio interference suppression filters		
Degree of noise suppression A (industrial applications)	Not required	
Degree of noise suppression B (applications for residential areas)		
Control voltage		
• 110...230 V AC/DC	Not available[1)]	
• 115/230 V AC	Not available[1)]	
• 24 V AC/DC	Not required for 3RW402.; Required for 3RW403. and 3RW404. (see table)	

1) Degree of noise suppression B cannot be obtained through the use of filters as the strength of the electromagnetic field is not attenuated by the filter.

13.2.21 Recommended filters

Soft starter types	Nominal current Soft starters	Recommended filters[1] Voltage range 200 to 480 V		
		Filter types	Nominal current filters	Terminals
	A		A	mm^2
3RW40 36	45	4EF1512-1AA10	50	16
3RW40 37	63	4EF1512-2AA10	66	25
3RW40 38	72	4EF1512-3AA10	90	25
3RW40 46	80	4EF1512-3AA10	90	25
3RW40 47	106	4EF1512-4AA10	120	50

1) The radio interference suppression filter is used to remove the conducted interference from the main circuit. The field-related emissions comply with degree of noise suppression B. The filter should be selected under standard conditions: 10 starts per hour, ramp-up time 4 s at 300% I_e

13.2.22 Types of coordination

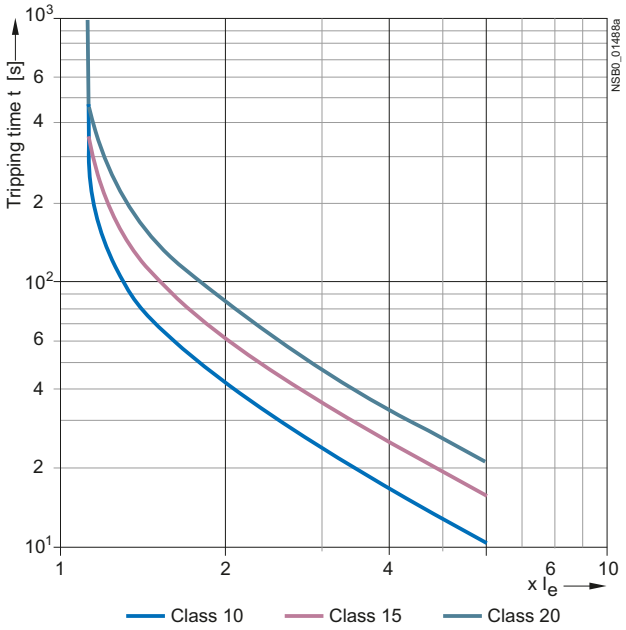
Types of coordination

The type of coordination according to which the motor feeder with soft starter is mounted depends on the application-specific requirements. Normally, fuseless mounting (combination of motor starter protector and soft starter) is sufficient. If type of coordination 2 needs to be fulfilled, semiconductor fuses must be fitted in the motor feeder.

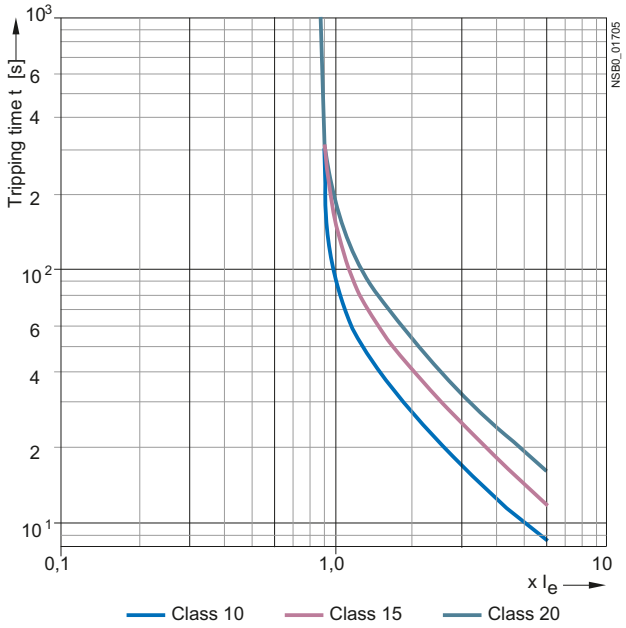
ToC 1 Type of coordination 1 in accordance with IEC 60947-4-1:
The device is defective following a short-circuit failure and therefore unsuitable for further use (personnel and equipment must not be put at risk).

ToC 2 Type of coordination 2 in accordance with IEC 60947-4-1:
The device is suitable for further use following a short-circuit failure (personnel and equipment must not be put at risk).
The type of coordination only refers to soft starters in conjunction with the stipulated protective device (motor starter protector / fuse), not to additional components in the feeder.

13.2.27 Motor protection tripping characteristics for 3RW40 (with symmetry)



13.2.28 Motor protection tripping characteristics for 3RW40 (with asymmetry)



13.3 Win-Soft Starter selection and simulation software

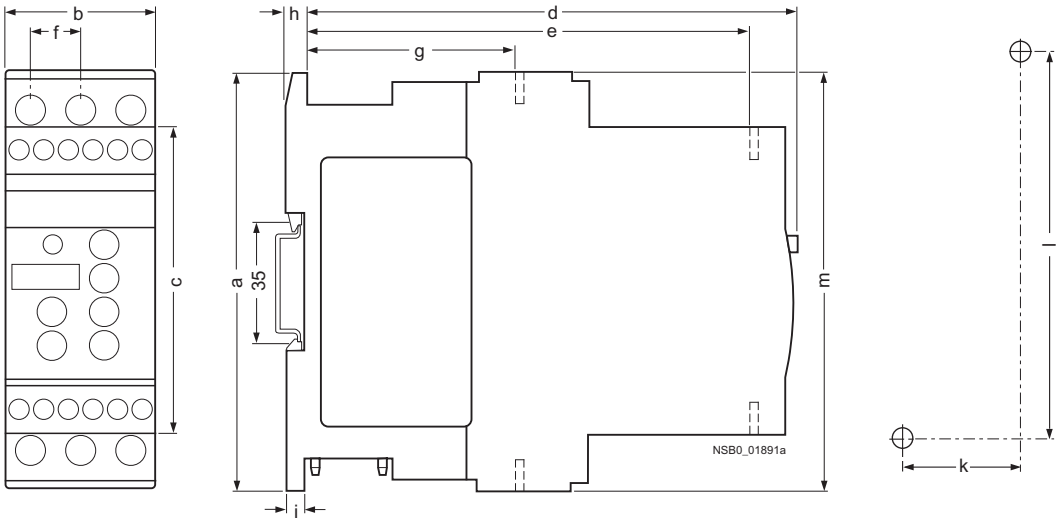
This software can be used to simulate and select all SIEMENS soft starters, taking into account various parameters such as the supply system conditions, motor data, load data, specific application requirements, etc.

It is a useful tool, which does away with the need for time-consuming and complex manual calculations if you need to select the optimum soft starter for your particular case.

The Win-Soft Starter selection and simulation software can be downloaded from (http://www.automation.siemens.com/mcms/low-voltage/en/industrial-controls/controls/solid-state-switching-devices/soft/software/Pages/default.aspx)

More information about soft starters can likewise be found on the Internet at (http://www.siemens.com/softstarter)

14.2 3RW40 for standard applications



Type / dimensions (mm)	a	b	c	d	e	f	g	h	i	k	l	m
3RW402.-1.	125	45	92	149	126	14.4	63	5	6.5	35	115	**125**
3RW402.-2.	125	45	92	149	126	14.4	63	5	6.5	35	115	**150**
3RW403.	160	55	110	165	140	18	63	5	6.5	30	150	**144**
3RW404.	170	70	110	183	158	22.5	85	5	10	60	160	**160**

Distances from grounded parts (mm)	Lateral	Top	Bottom	Fixing screws	Tightening torques (Nm)
3RW402.	5	60	40	M4	1
3RW403.	30	60	40	M4	1
3RW404.	30	60	40	M4	2

Typical circuit diagrams

15

15.1 Typical circuit for the optional thermistor motor protection evaluation

A thermistor motor protection evaluation function is optionally available for the 24 V AC/DC control voltage version of the 3RW40 2 to 3RW40 4.

Note

If a thermistor is connected (PTC type A or Klixon), you must remove the copper jumper between terminals T11/21 and T22.

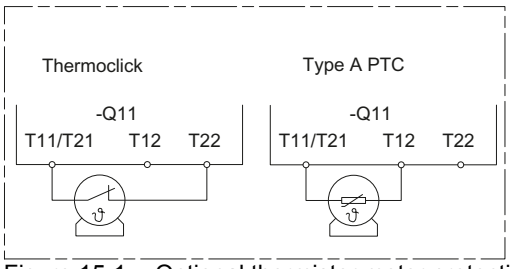


Figure 15-1 Optional thermistor motor protection evaluation

15.2.2 Control of the 3RW40 by pushbutton

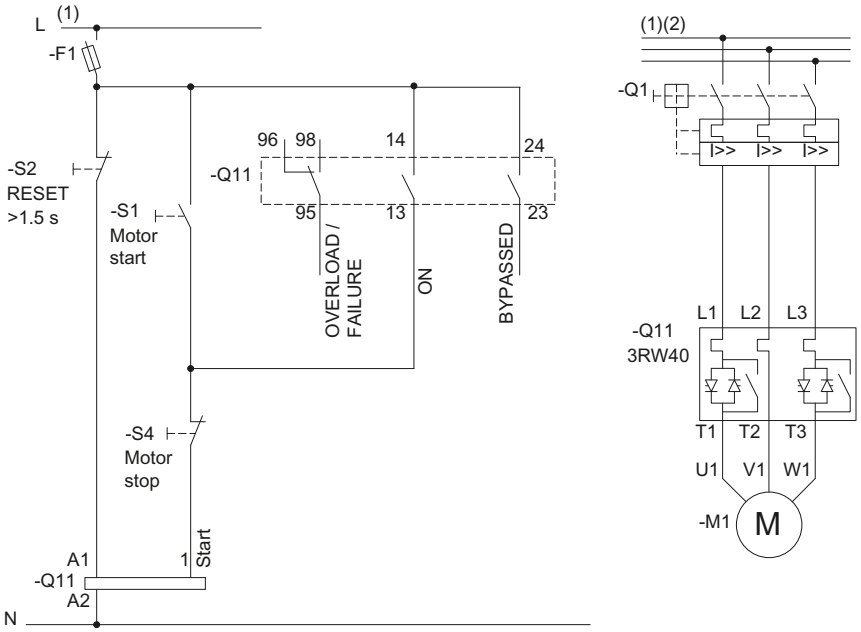


Figure 15-3 Wiring of the 3RW40 2 to 3RW40 4 control circuit and the 3RW40 2 to 3RW40 7 main circuit

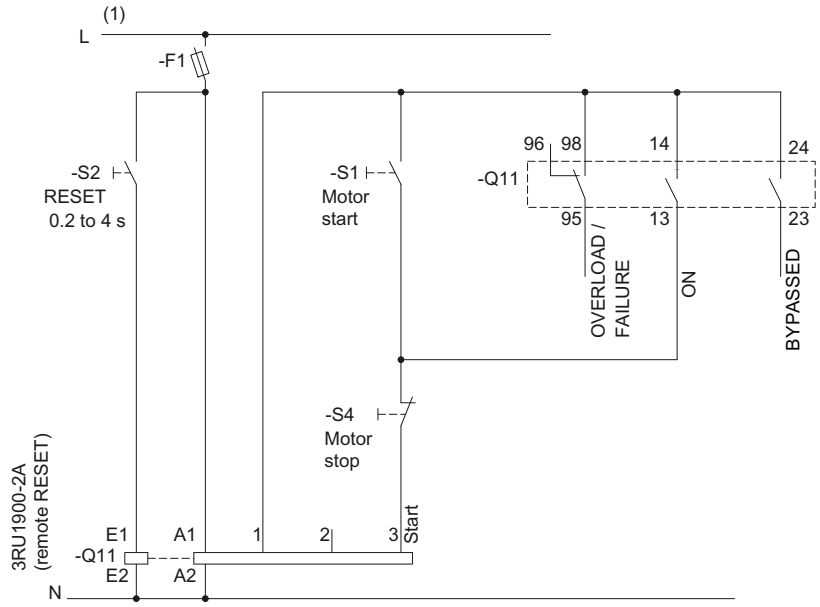


Figure 15-4 Wiring of the 3RW40 5 to 3RW40 7 control circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

(2) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

15.3.2 Control of the 3RW40 by switch

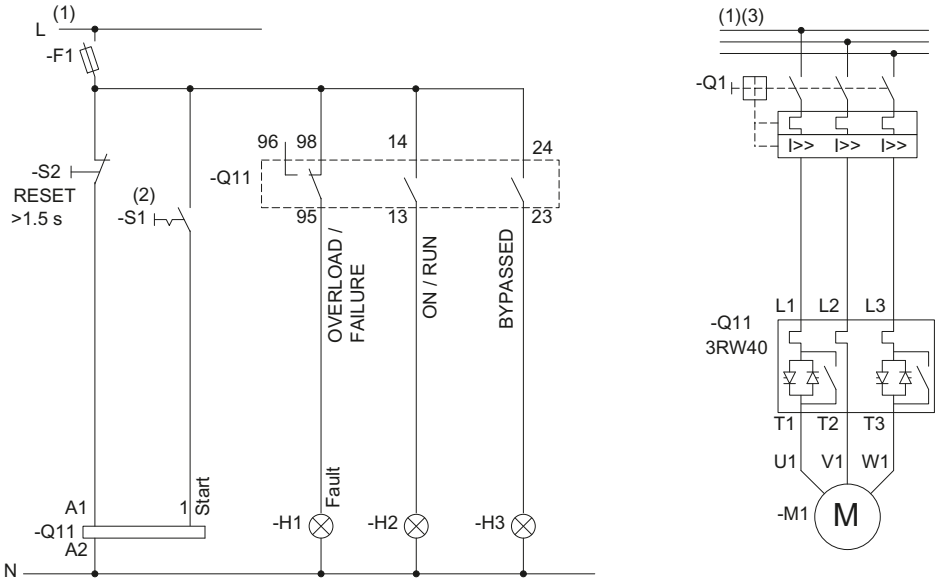


Figure 15-6 Wiring of the 3RW40 2 to 3RW40 4 control circuit and the 3RW40 2 to 3RW40 7 main circuit

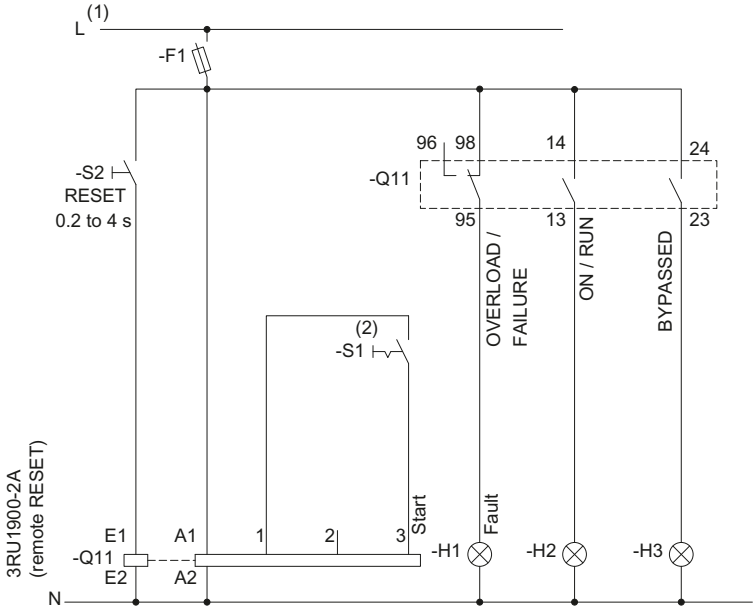


Figure 15-7 Wiring of the 3RW40 5 to 3RW40 7 control circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

⚠ WARNING

(2) Automatic restart. Can result in death, serious injury, or property damage.

Faults caused by incorrect control voltage, a missing load, or a phase failure (refer to chapter 3RW30: LEDs and troubleshooting [Page 44]) are automatically reset when the system returns to normal. An automatic restart is initiated and the 3RW restarted if a start command is present at the input.
If you do not want the motor to start automatically, you must integrate suitable additional components, e.g. phase failure or load monitoring devices, into the control and main circuits.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

15.4.2 Control of the 3RW40 in automatic mode

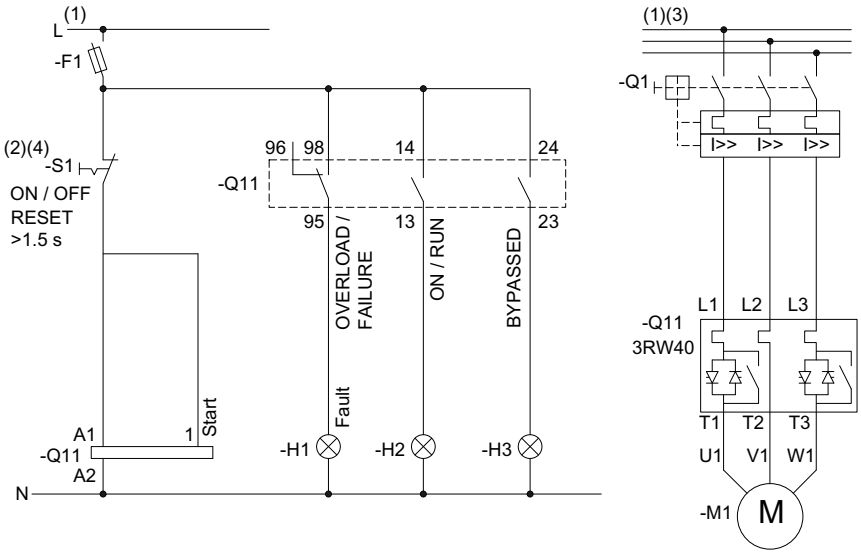


Figure 15-9 Wiring of the 3RW40 2 to 3RW40 4 control circuit and the 3RW40 2 to 3RW40 7 main circuit

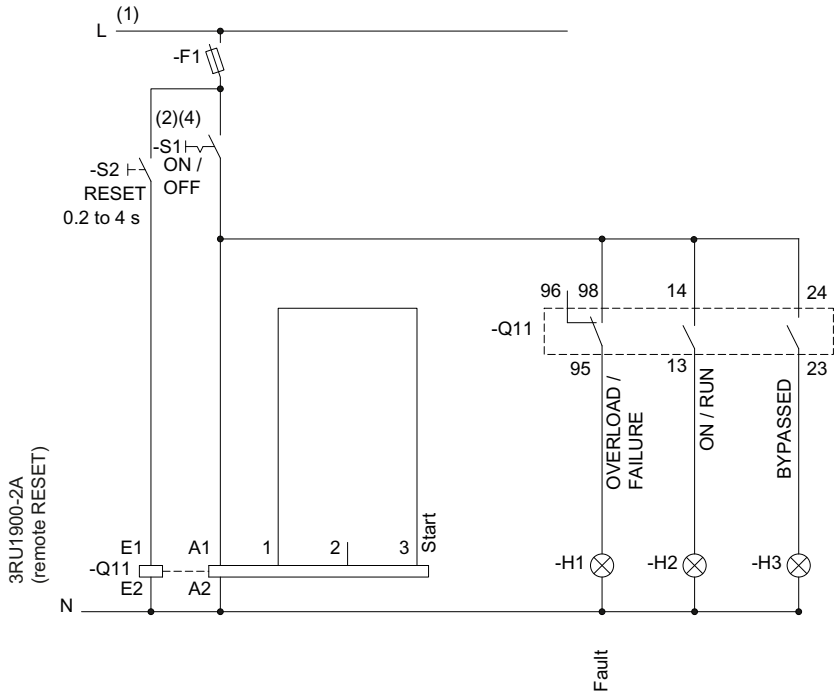


Figure 15-10 Wiring of the 3RW40 5 to 3RW40 7 control circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

⚠ WARNING

(2) Automatic restart.

Can result in death, serious injury, or property damage.

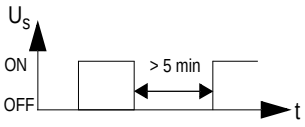
The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

Note

(4) Idle time until restart.

Owing to the intrinsic protection (3RW), an idle time of at least five minutes must be allowed prior to restarting if the device is switched on and off by means of the control voltage under field conditions.



15.5.2 Control of the 3RW40 by PLC

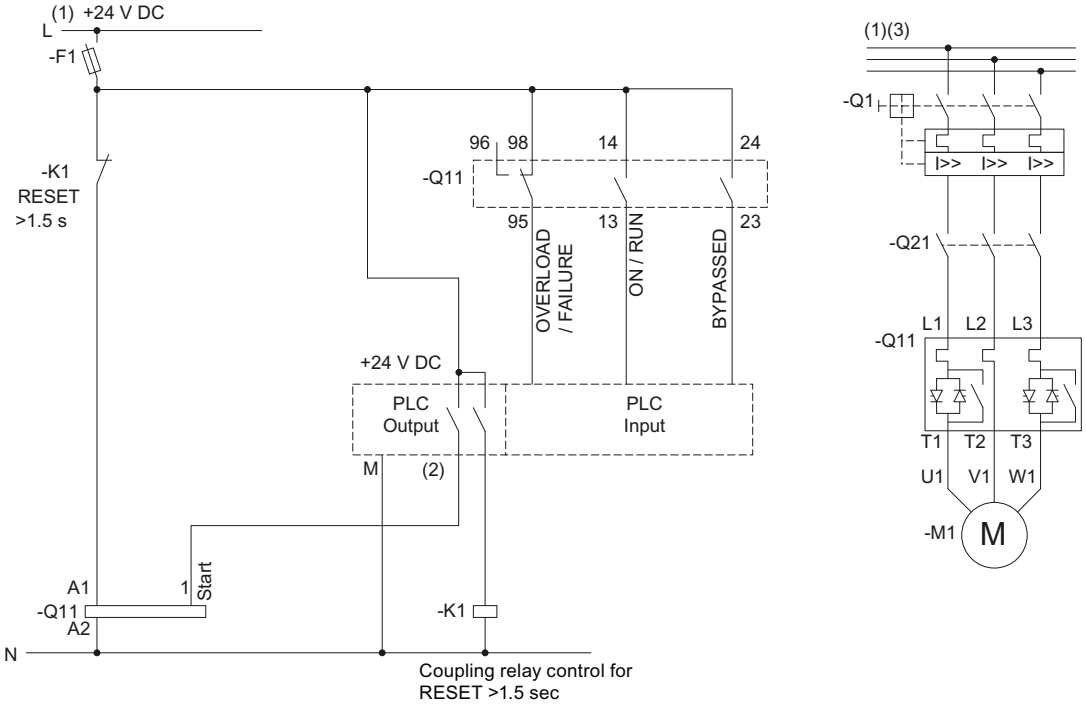


Figure 15-12 Wiring of the 3RW40 2 to 3RW40 4 control circuit (with 24 V control voltage) and the 3RW40 2 to 3RW40 7 main circuit

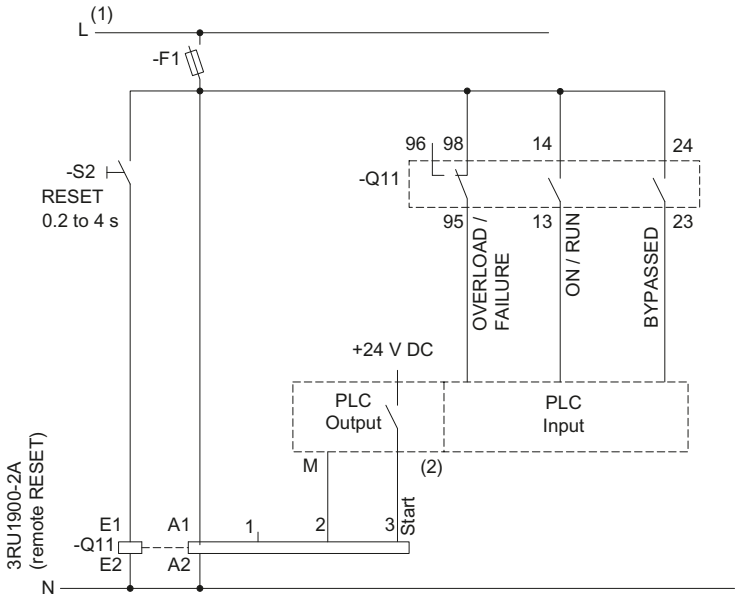


Figure 15-13 Wiring of the 3RW40 5 to 3RW40 7 control circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

⚠ WARNING

(2) Automatic restart. Can result in death, serious injury, or property damage.

Faults caused by incorrect control voltage, a missing load, or a phase failure (refer to chapter 3RW30: LEDs and troubleshooting [Page 44]) are automatically reset when the system returns to normal. An automatic restart is initiated and the 3RW restarted if a start command is present at the input.
If you do not want the motor to start automatically, you must integrate suitable additional components, e.g. phase failure or load monitoring devices, into the control and main circuits.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

15.6.2 Control of the 3RW40 with a main contactor

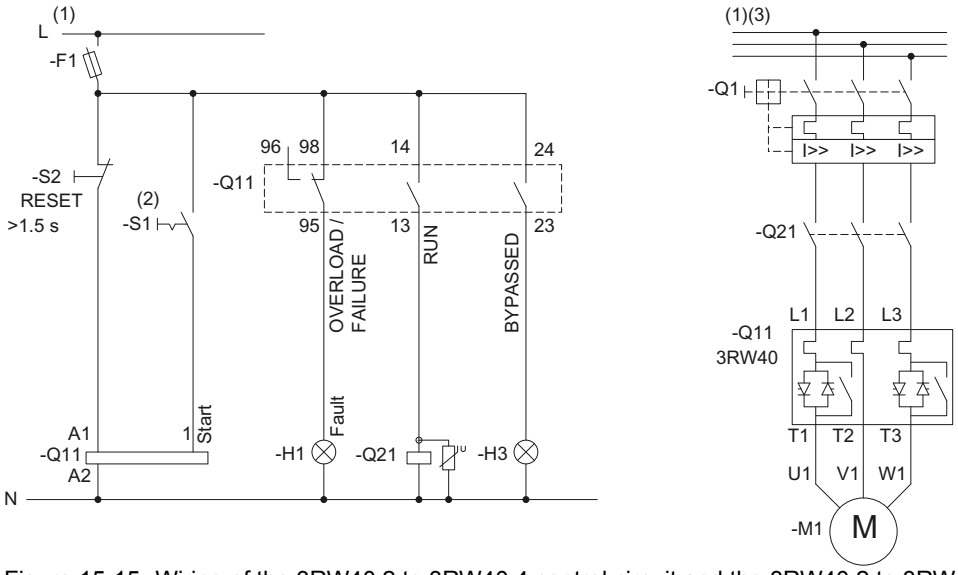


Figure 15-15 Wiring of the 3RW40 2 to 3RW40 4 control circuit and the 3RW40 2 to 3RW40 7 main circuit

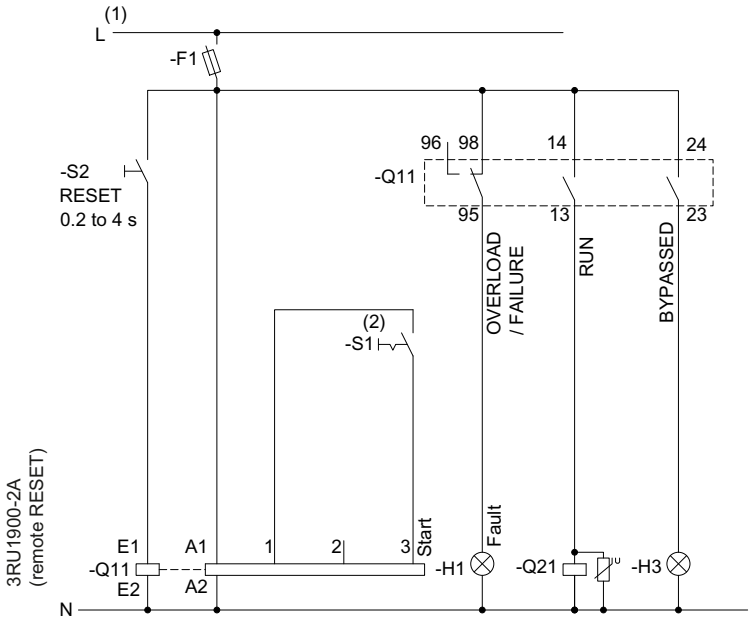


Figure 15-16 Wiring of the 3RW40 5 to 3RW40 7 control circuit

Note

If a soft stop is required, the function of output 13/14 must be reparameterized to "RUN" (refer to Commissioning the 3RW40 [Page 98]).

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

⚠ WARNING

(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

15.7.2 3RW40 reversing circuit

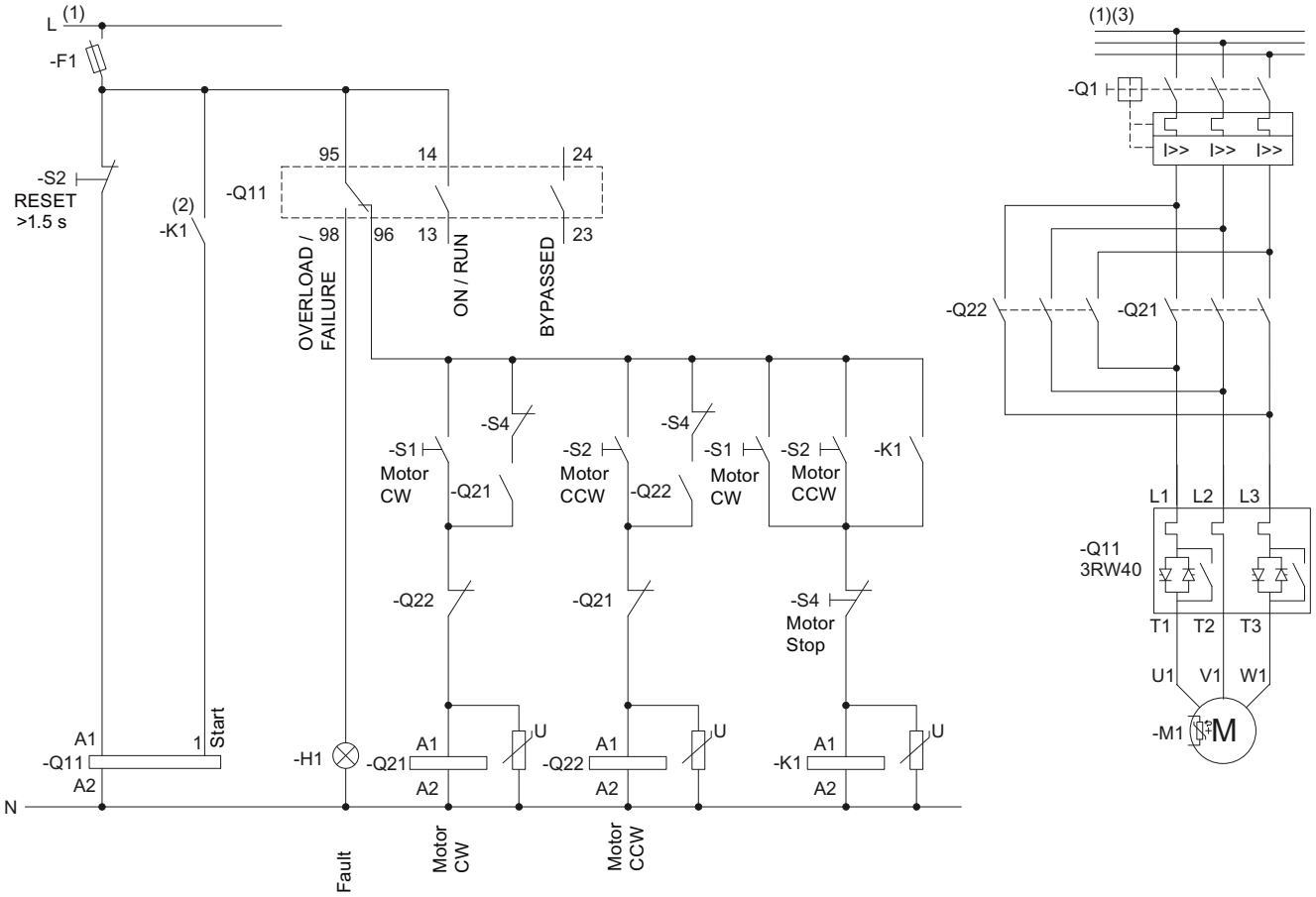


Figure 15-18 Wiring of the 3RW40 2 to 3RW40 5 control circuit and the 3RW40 2 to 3RW40 7 main circuit

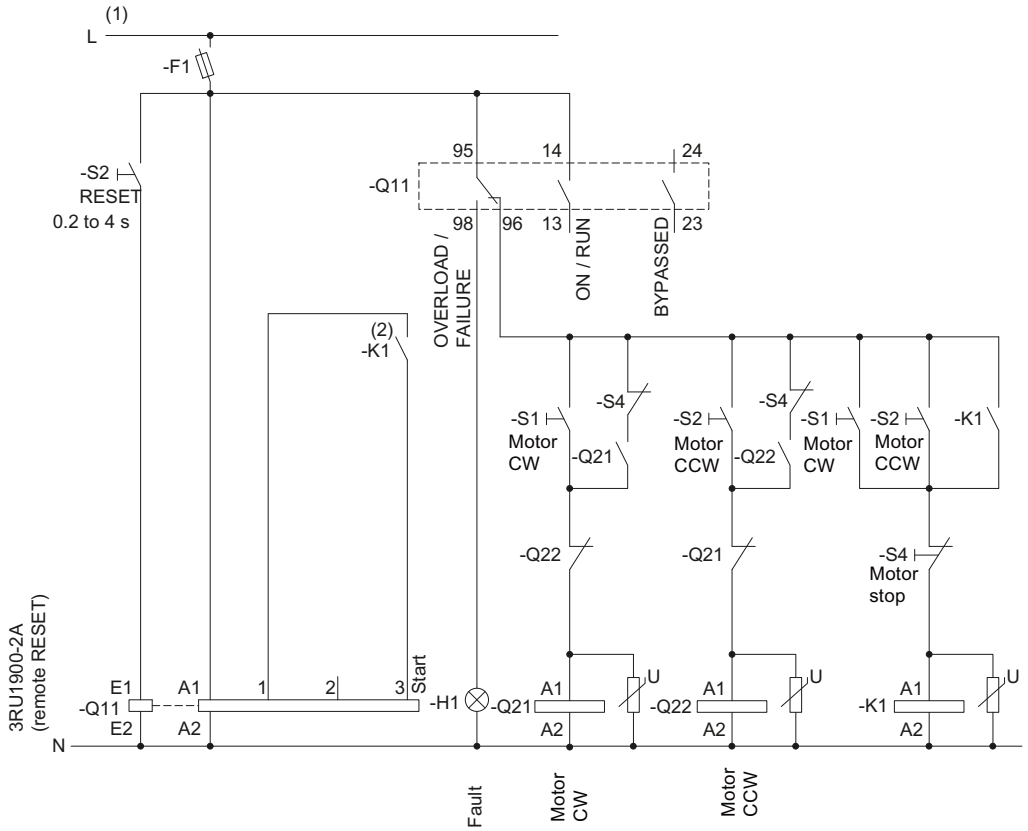


Figure 15-19 Wiring of the 3RW40 5 to 3RW40 7 control circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

⚠ WARNING

(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

NOTICE

No soft stop possible. Set the ramp-down time to 0 s with the potentiometer.

15.8.2 3RW40 2 to 3RW40 4, control of a motor with a magnetic parking brake

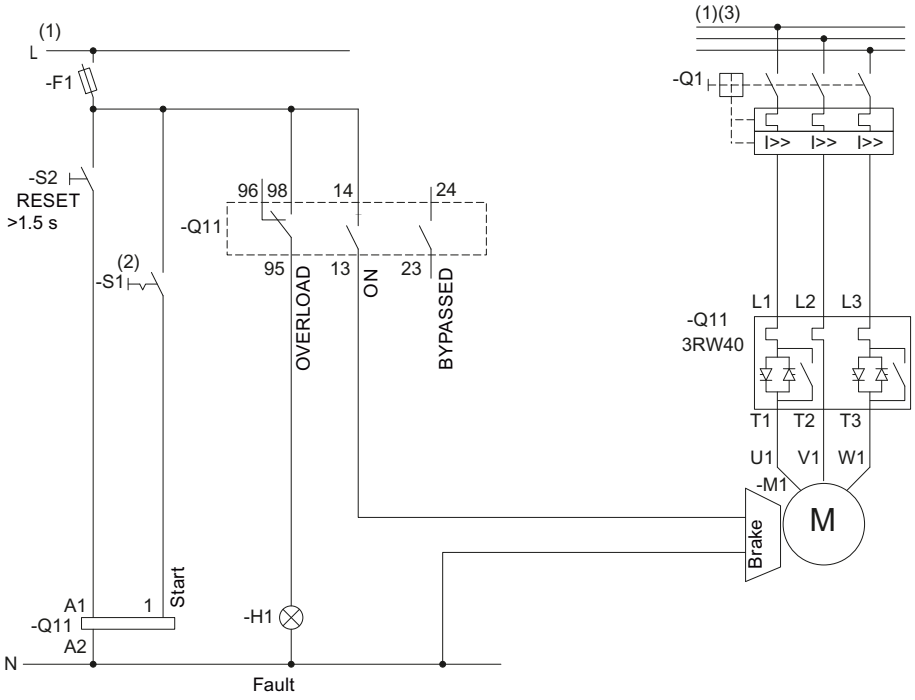


Figure 15-21 Wiring of the 3RW40 2 to 3RW40 4 control / main circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

⚠ WARNING

(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

NOTICE

No soft stop possible. Set the ramp-down time to 0 s with the potentiometer.

15.8.3 3RW40 5 to 3RW40 7, control of a motor with a magnetic parking brake

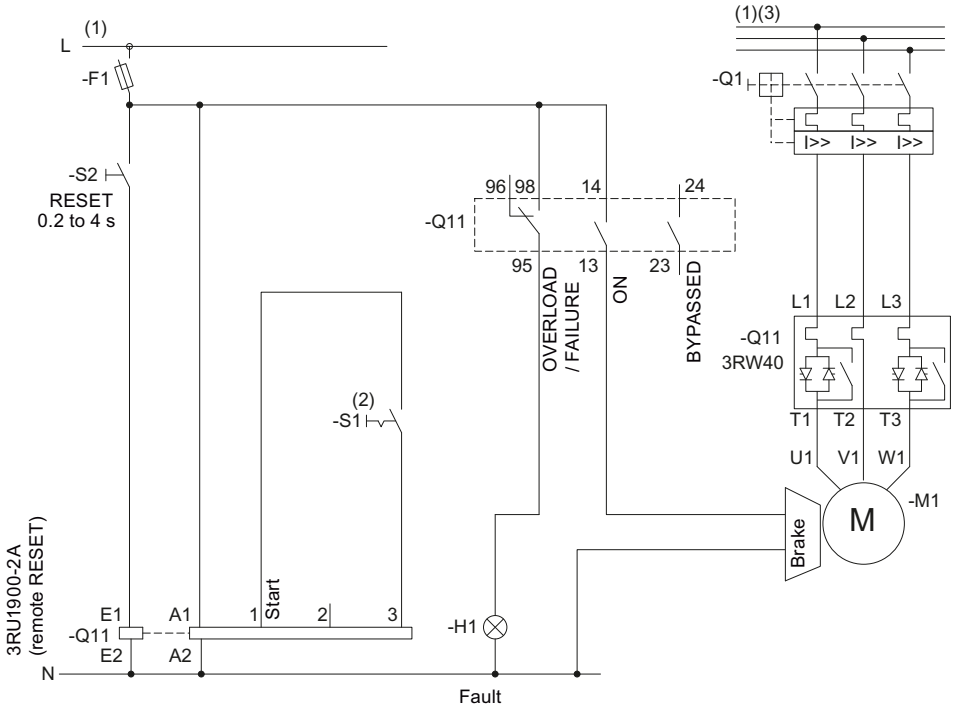


Figure 15-22 Wiring of the 3RW40 5 to 3RW40 7 control / main circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

⚠ WARNING

(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

NOTICE

No soft stop possible. Set the ramp-down time to 0 s with the potentiometer.

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

⚠ WARNING

(2) Automatic restart. Can result in death, serious injury, or property damage.

- If the 3TK28 is reset

Faults caused by incorrect control voltage, a missing load, or a phase failure (refer to chapter 3RW30: LEDs and troubleshooting [Page 44]) are automatically reset when the system returns to normal.

An automatic restart is initiated and the 3RW restarted if a start command is present at the input.
If you do not want the motor to start automatically, you must integrate suitable additional components, e.g. phase failure or load monitoring devices, into the control and main circuits.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

15.9.2 3RW40 2 to 3RW40 4 emergency stop and 3TK2823 safety relay

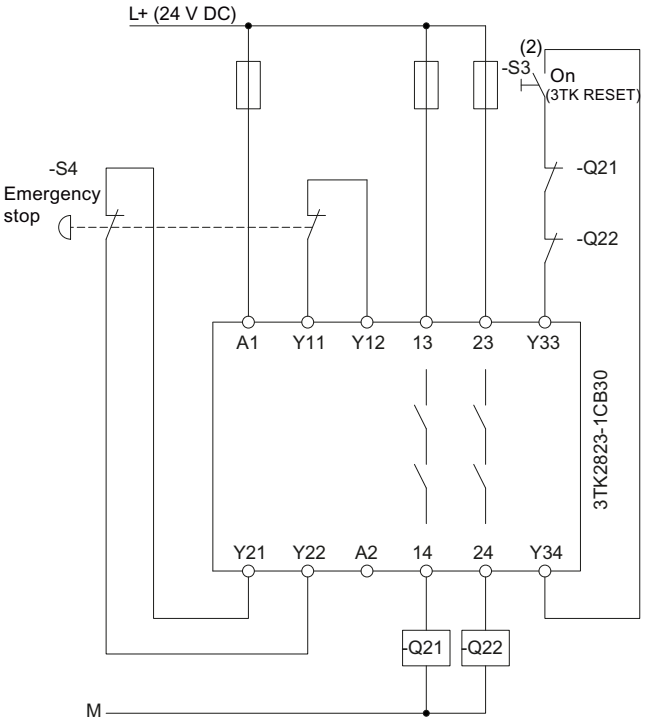


Figure 15-25 Wiring of the emergency stop control circuit and the 3TK28 safety relay

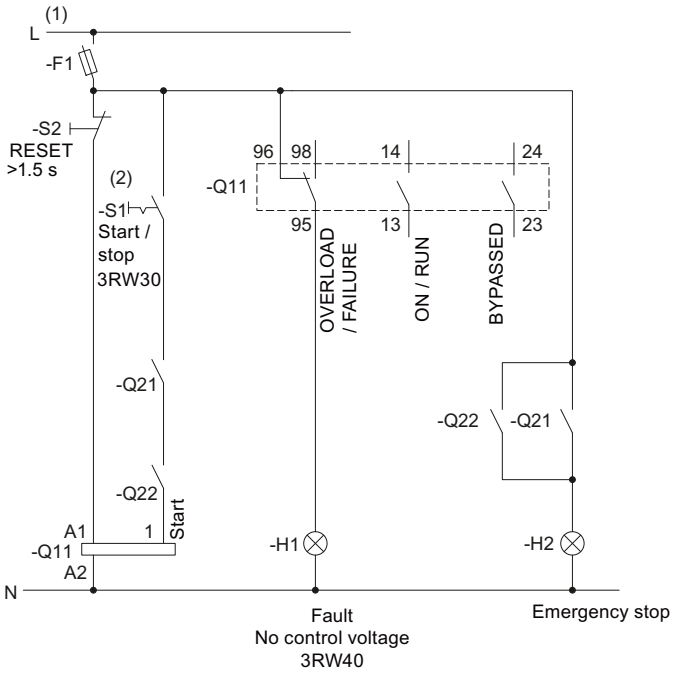


Figure 15-26 Wiring of the 3RW40 2 to 3RW40 4 control circuit and the 3RW40 2 to 3RW40 7 main circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

⚠ WARNING

(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command (3TK or 3RW) if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

NOTICE

If the soft stop function is set (ramp-down time potentiometer set to >0 s) and the emergency stop circuit is tripped, a "Missing load voltage, phase failure / missing load" fault may be indicated on the soft starter. In this case, the soft starter must be reset according to the selected RESET MODE.

15.9.3 3RW40 5 to 3RW40 7 emergency stop and 3TK2823 safety relay

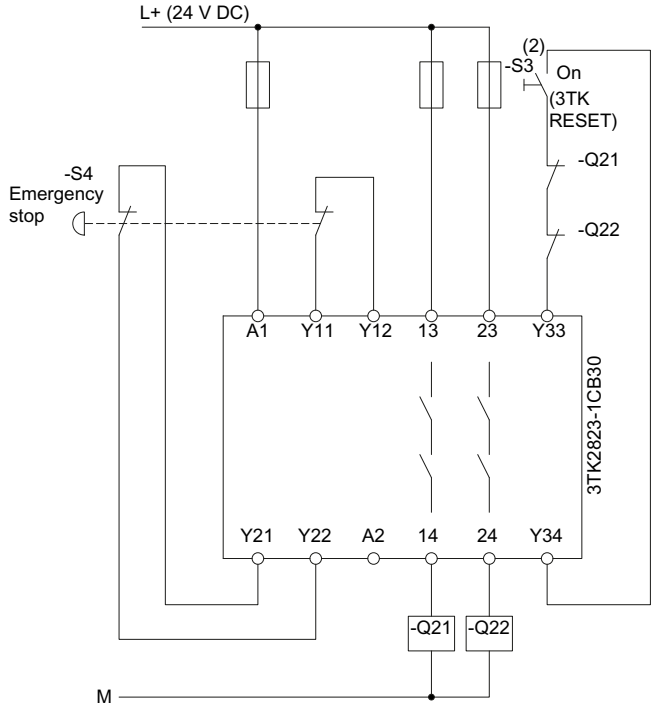


Figure 15-27 Wiring of the emergency stop control circuit and the 3TK28 safety relay

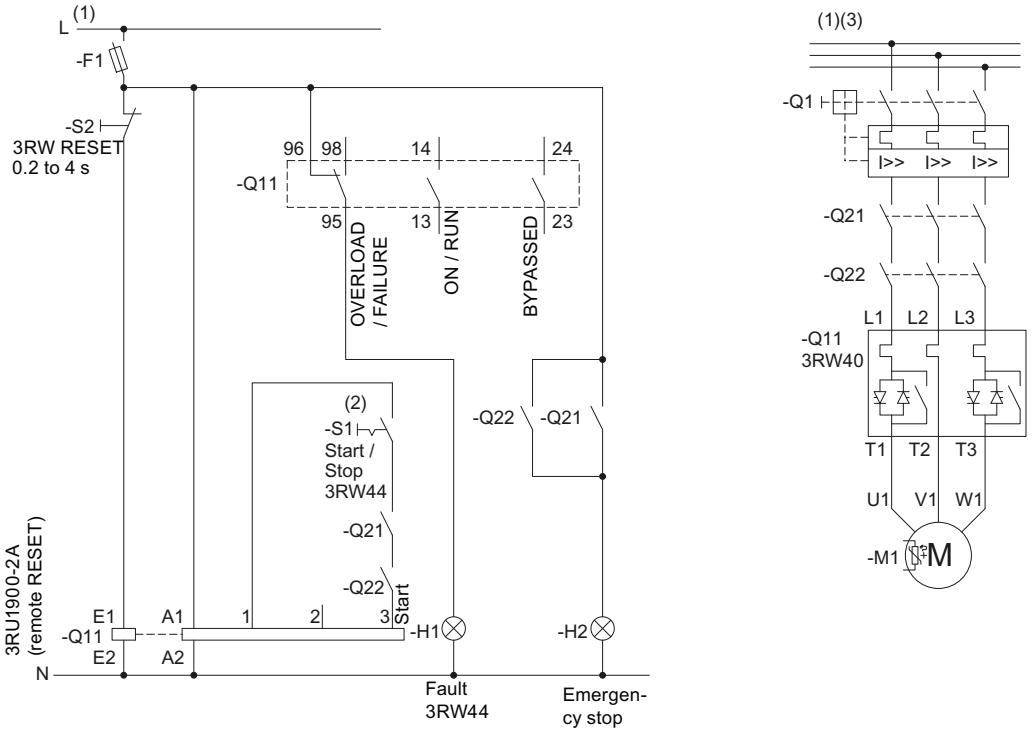


Figure 15-28 Wiring of the 3RW40 5 to 3RW40 7 control circuit and the 3RW40 2 to 3RW40 7 main circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

⚠ WARNING

(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command (3TK or 3RW) if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

NOTICE

If the soft stop function is set (ramp-down time potentiometer set to >0 s) and the emergency stop circuit is tripped, a "Missing load voltage, phase failure / missing load" fault may be indicated on the soft starter. In this case, the soft starter must be reset according to the selected RESET MODE.

15.10.2 3RW40 and contactor for emergency starting

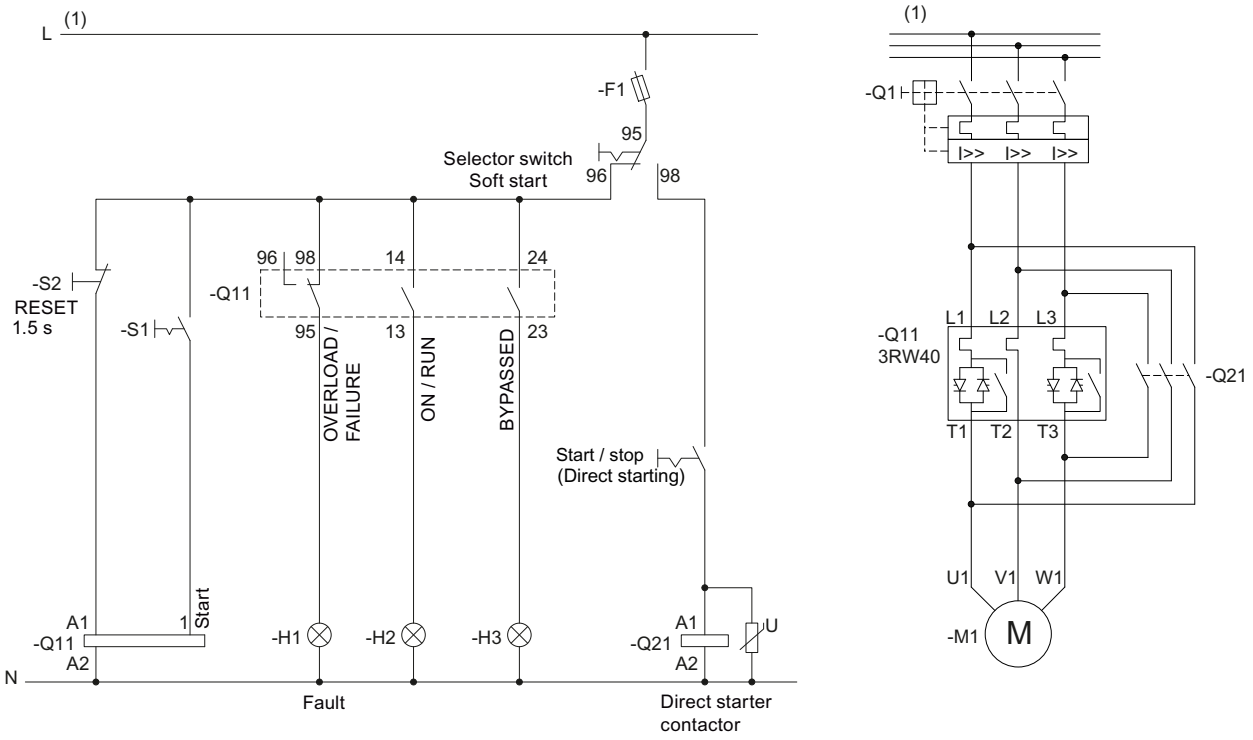


Figure 15-30 Wiring of the 3RW40 2 to 3RW40 4 control circuit and the 3RW40 2 to 3RW40 7 main circuit

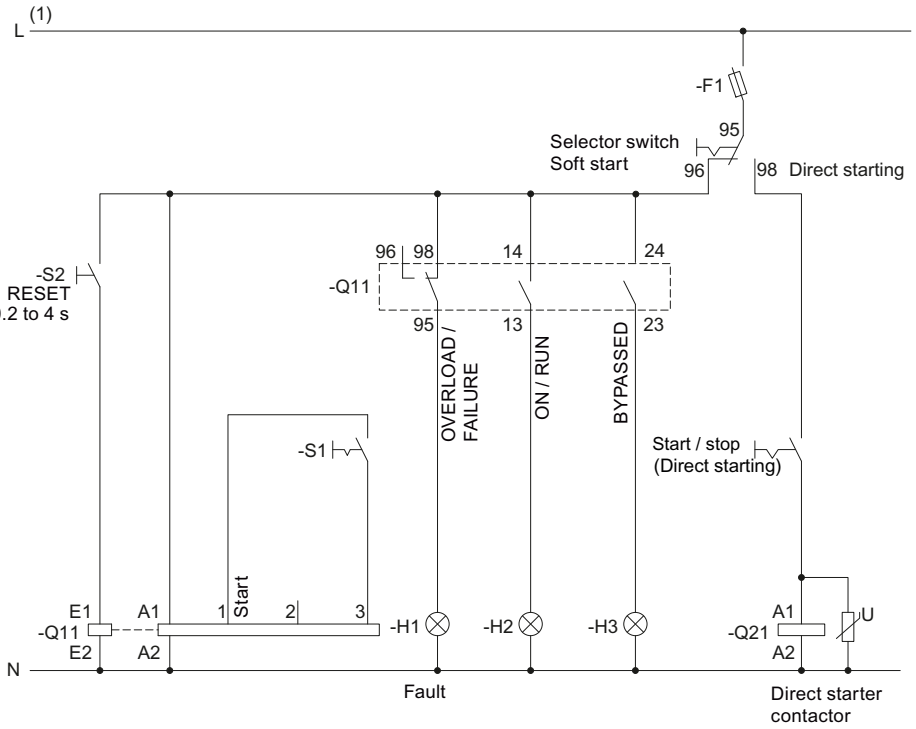


Figure 15-31 Wiring of the 3RW40 5 to 3RW40 7 control circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

⚠ WARNING

(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

15.11.2 3RW40 2 to 3RW40 4 and Dahlander motor starting

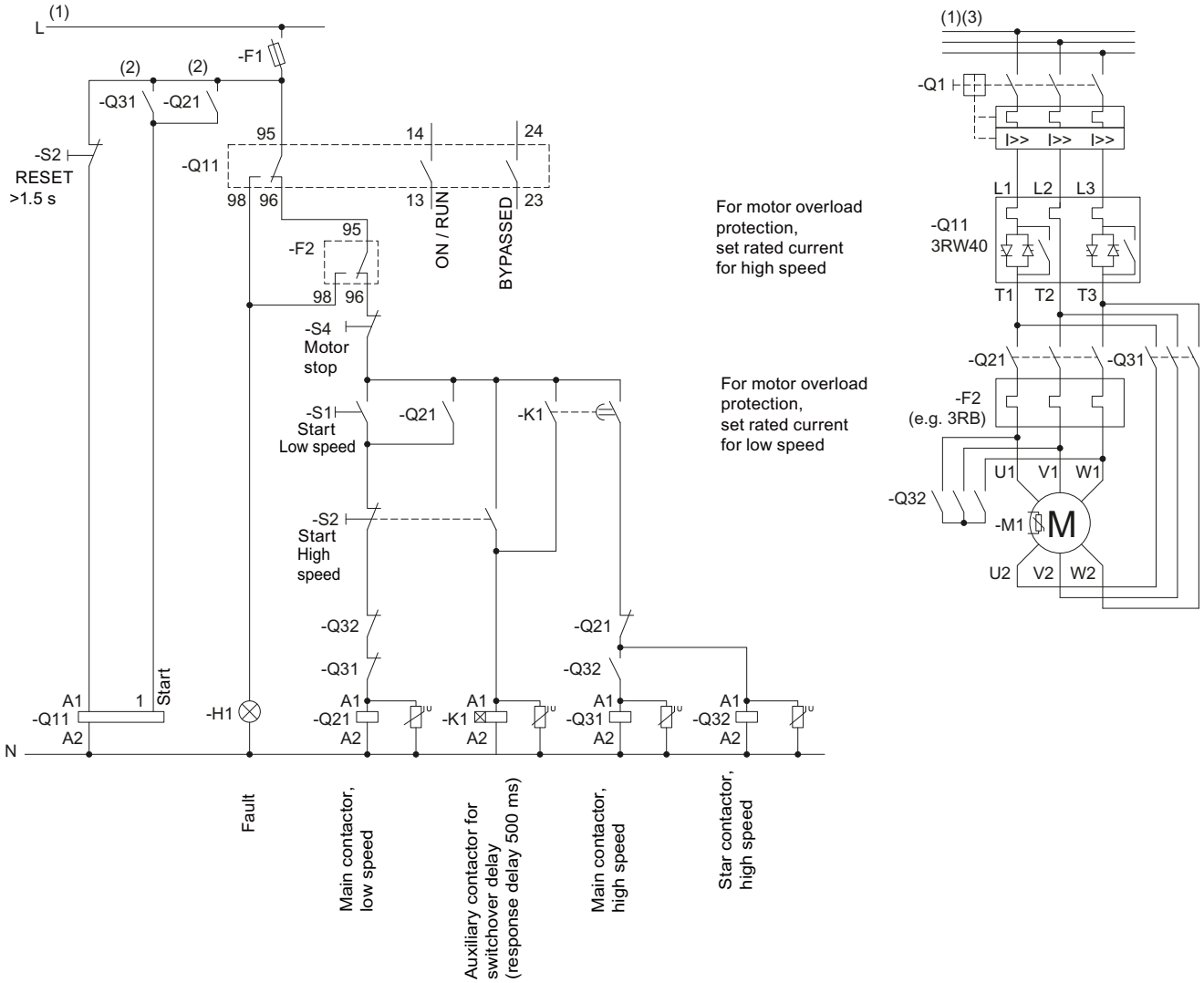


Figure 15-33 Wiring of the 3RW40 2 to 3RW40 4 control circuit and the 3RW40 2 to 3RW40 7 main circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

⚠ WARNING

(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

NOTICE

No soft stop possible. Set the ramp-down time to 0 s with the potentiometer.

15.11.3 3RW40 5 to 3RW40 7 and Dahlander motor starting

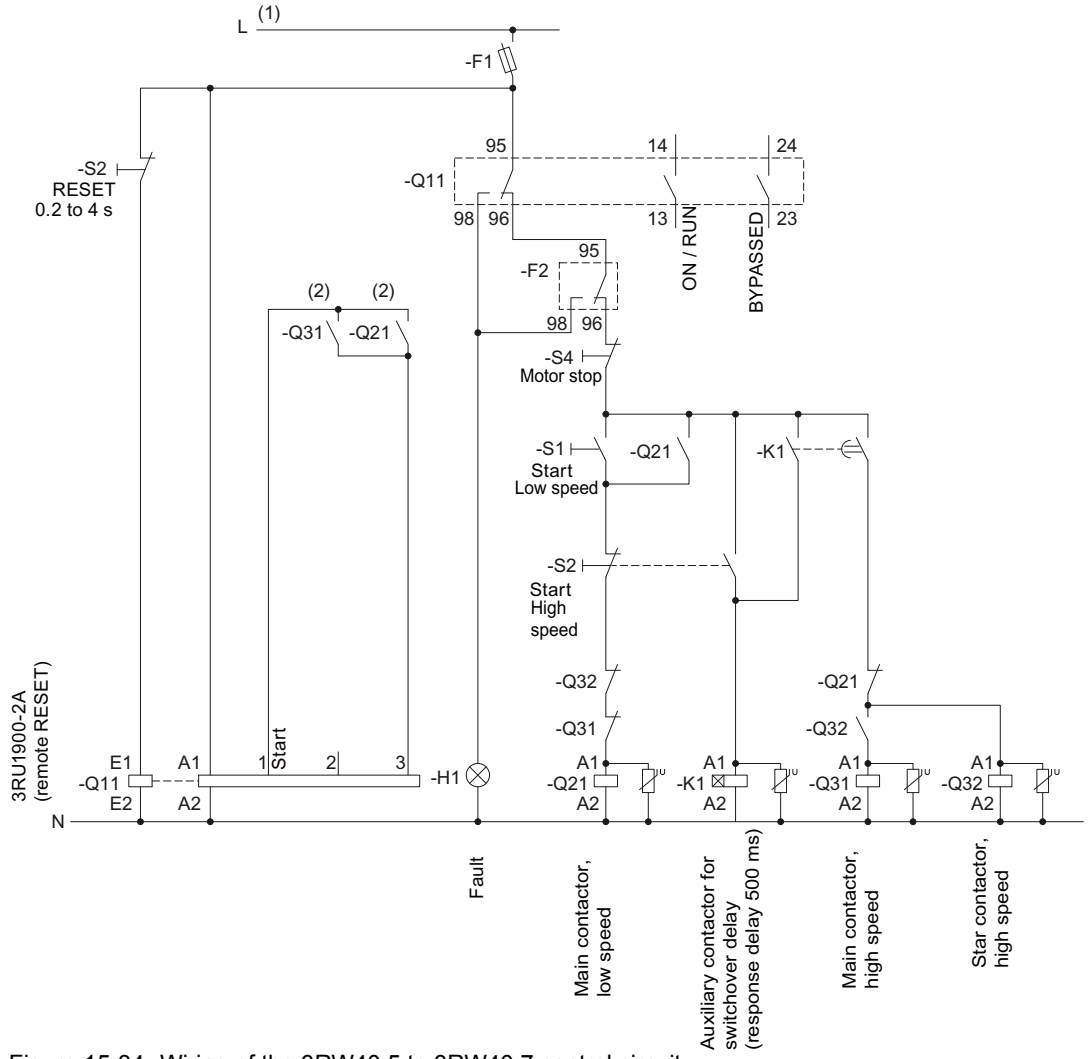


Figure 15-34 Wiring of the 3RW40 5 to 3RW40 7 control circuit

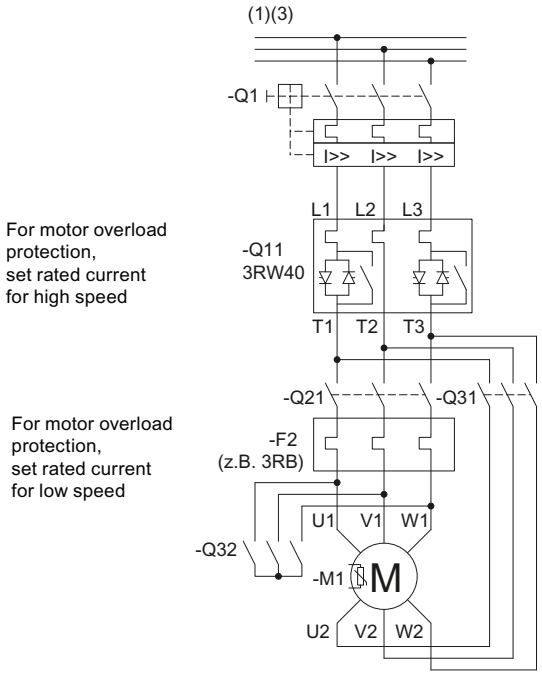


Figure 15-35 Wiring of the 3RW40 5 to 3RW40 7 main circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

⚠ WARNING

(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

NOTICE

No soft stop possible. Set the ramp-down time to 0 s with the potentiometer.

Accessories

16

16.1 Box terminal blocks for soft starters

	For soft starter type	Size	Version	Order No.
Box terminal blocks for soft starters for round and ribbon cables				
	3RW40 5.	S6	• Max. 70 mm^2 • Max. 120 mm^2	3RT19 55-4G 3RT19 56-4G
	3RW40 7.	S12	• Max. 240 mm^2	3RT19 66-4G

16.2 Auxiliary conductor terminals

	For soft starter type	Size	Order No.
Auxiliary conductor terminals, 3-pole			
	3RW30 4. 3RW40 4.	S3	3RT19 46-4F

16.3 Covers for soft starters

	For soft starter type	Size	Order No.
Terminal covers for box terminals			
	Additional touch protection to be fitted at the box terminals (2 units required per device)		
	3RW30 3. 3RW40 3.	S2	3RT19 36-4EA2
	3RW30 4. 3RW40 4.	S3	3RT19 46-4EA2
	3RW40 5.	S6	3RT19 56-4EA2
	3RW40 7.	S12	3RT19 66-4EA2
Terminal covers for cable lug and busbar connections			
	For complying with the phase clearances and as touch protection if box terminal is removed (2 units required per contactor)		
	3RW30 4. 3RW40 4.	S3	3RT19 46-4EA1
	3RW40 5.	S6	3RT19 56-4EA1
	3RW40 7.	S12	3RT19 66-4EA1

	For soft starter type	Size	Order No.
Sealing covers			
	3RW40 2 to 3RW40 4.	S0, S2, S3	3RW49 00-0PB10
	3RW40 5. and 3RW40 7	S6 S12	3RW49 00-0PB00

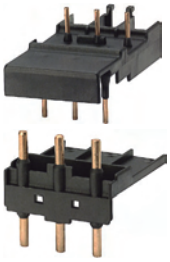
16.4 Modules for RESET

	For soft starter type	Size	Version	Order No.
Modules for remote RESET, electrical				
	Operating range 0.85 to 1.1 x Us, Power consumption AC 80 VA, DC 70 W, ON time 0.2 s to 4 s, Switching frequency 60/h			
	3RW40 5. and 3RW40 7.	S6, S12	• AC/DC 24 V ... 30 V	3RU19 00-2AB71
			• AC/DC 110 V ... 127 V	3RU19 00-2AF71
			• AC/DC 220 V ... 250 V	3RU19 00-2AM71
Mechanical RESET, comprising				
	3RW40 5. and 3RW40 7.	S6, S12	• Resetting plunger, holder, and former	3RU19 00-1A
			• Suitable pushbutton IP65, 22 mm diameter, 12 mm stroke	3SB30 00-0EA11
			• Extension plunger	3SX13 35
Cable releases with holder for RESET				
	For 6.5 mm diameter holes in the control panel; max. control panel thickness 8 mm			
	3RW40 5. and	S6,	• Length 400 mm	3RU19 00-1B
	3RW40 7.	S12	• Length 600 mm	3RU19 00-1C

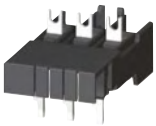
Note

Remote RESET is already integrated in the 3RW40 2. to 3RW40 4. soft starters.

16.5 Link modules to 3RV10 motor starter protectors

	For soft starter type	Size	Motor starter protector size	Order No.
Link modules to 3RV10 motor starter protectors				
	3RW30 13, 3RW30 14, 3RW30 16, 3RW30 17, 3RW30 18	S00	S0	3RA19 21-1A
	3RW30 26 3RW40 24 3RW40 26	S0	S0	3RA19 21-1A
	3RW30 36 3RW40 36	S2	S2	3RA19 31-1A
	3RW30 46, 3RW30 47 3RW40 46, 3RW40 47	S3	S3	3RA19 41-1A

16.6 Link modules to 3RV20 motor starter protectors

	For soft starter type	Size	Motor starter protector size	Order No.
Link modules to 3RV20 motor starter protectors [1]				
	**With screw terminals**			
	3RW30 1.	S00	S00	3RA29 21-1BA00
	3RW30 2.	S0	S0	3RA29 21-1BA00
	3RW40 2.	S0	S0	3RA29 21-1BA00
	With spring-loaded terminals			
	3RW30 1.	S00	S00	3RA29 11-2GA00
	3RW30 2.	S0	S0	3RA29 21-2GA00
	3RW40 2	S0	S0	3RA29 21-2GA00

1) Size S0 can be used up to 32 A.

16.7 Optional fan to increase the switching frequency (3RW40 2. to 3RW40 4.).

	For soft starter type	Size	Order No.
Fan (to increase the switching frequency and for device mounting in positions different from the normal position)			
	3RW40 2.	S0	3RW49 28-8VB00
	3RW40 3., 3RW40 4	S2, S3	3RW49 47-8VB00

16.8 Spare parts for fans (3RW40 5., 3RW40 7.)

	For soft starter type	Size	Version Rated control supply voltage U_S	Order No.
	3RW40 5.-.BB3.	S6	115 V AC	3RW49 36-8VX30
	3RW40 5.-.BB4.	S6	230 V AC	3RW49 36-8VX40
	3RW40 7.-.BB3.	S12	115 V AC	3RW47 36-8VX30
	3RW40 7.-.BB4.	S12	230 V AC	3RW47 36-8VX40

16.9 Operating instructions

For soft starter type	Size	Order No.
Operating instructions for soft starters		
3RW30 1. to 3RW30 4.	S00 to S3	3ZX10 12-0RW30-2DA1
3RW40 2. to 3RW40 4.	S0 to S3	3ZX10 12-0RW40-1AA1
3RW40 5., 3RW40 7.	S6 , S12	3ZX10 12-0RW40-2DA1

Note

The operating instructions are included in the scope of supply.

Appendix

A

A.1 Configuration data

Configuration data

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Technical Support Low-Voltage Control Systems

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Fax: +49 (0) 911-895-5907

e-mail: technical-assistance@siemens.com

1. Motor data

Siemens motor?	
Rated output:	kW
Rated voltage:	V
Mains frequency:	Hz
Rated current:	A
Starting current:	A
Rated speed:	rpm
Rated torque:	Nm
Breakdown torque:	Nm
Mass moment of inertia:	kg*m2

Speed / torque characteristic curve

(The speed increments of the value pairs do not have to be equal)

n_M 1/m												"n_{syn}"
M_M / M_B												

Speed / current characteristic curve

(The speed increments of the value pairs do not have to be equal)

n_M 1/m						"n_{syn}"
I_M / I_B						

1. Load data

Load type (e.g. pump, mill etc.):	
Rated speed:	rpm
Rated torque or rated output	Nm or kW
Mass moment of inertia (load-specific)	$kg*m^2$
Mass moment of inertia (motor-specific)	$kg*m^2$

Speed / torque characteristic curve

(The speed increments of the value pairs do not have to be equal)

n_L 1/m												"n_{syn}"
M_L / M_B												

1. Start conditions

Starting frequency			Starts
Switching cycles:	Rampup time		
	Operating time		
	Idle time		
	Ramp-down time		
Ambient temperature			°C
		Yes	Value
Starting current limitation?			.....
Acceleration torque limitation?			.....
Maximum ramp-up time?			.....

1. Personal details

Last name, first name:

Company: .....

Department: .....

Street: .....

Zip code, town/city:

.....

Country: .....

Phone: .....

Fax: .....

e-mail: .....

A.2 Table of parameters used

You can document your parameter settings in the table below.

Plant identifier	Installed 3RW type	3RW40 parameters														
		Parameters 3RW30 or 3RW40						RESET MODE LED			Output ON / RUN		Thermistor	
		U starting %	t ramp-up s	t ramp-down s	Ie motor A	Factor Ie limit value	CLASS value	Manual (off)	AUTO (yellow)	Remote (green)	ON	RUN	PTC	Klixon
Pump XYZ	3RW4038-1TB04	40	10	10	72A	3x72A = 216A	10		X			X	X	
	3RW___-_B__													
	3RW___-_B__													
	3RW___-_B__													
	3RW___-_B__													
	3RW___-_B__													
	3RW___-_B__													

A.3 Correction sheet

TO	FROM (please complete):
SIEMENS AG A&D CD MM3	Name
	Company / Department
92220 Amberg / Germany	
	Address
	Phone
Fax: 0 96 21 / 80-33 37	Fax

System Manual for SIRIUS 3RW30 / 3RW40 soft starters

Have you noticed any errors while reading this manual?

If so, please use this form to tell us about them.

We welcome comments and suggestions for improvement.

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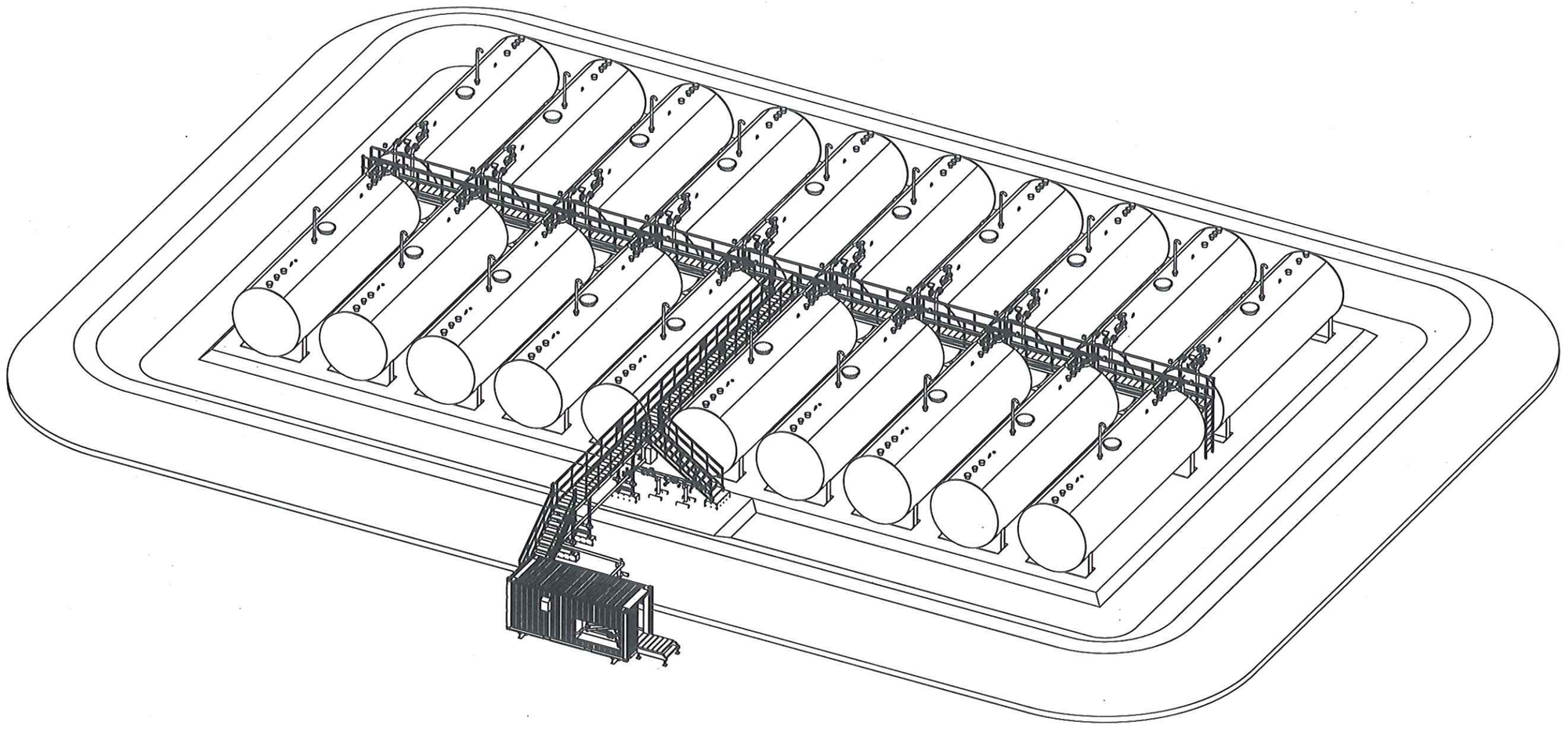
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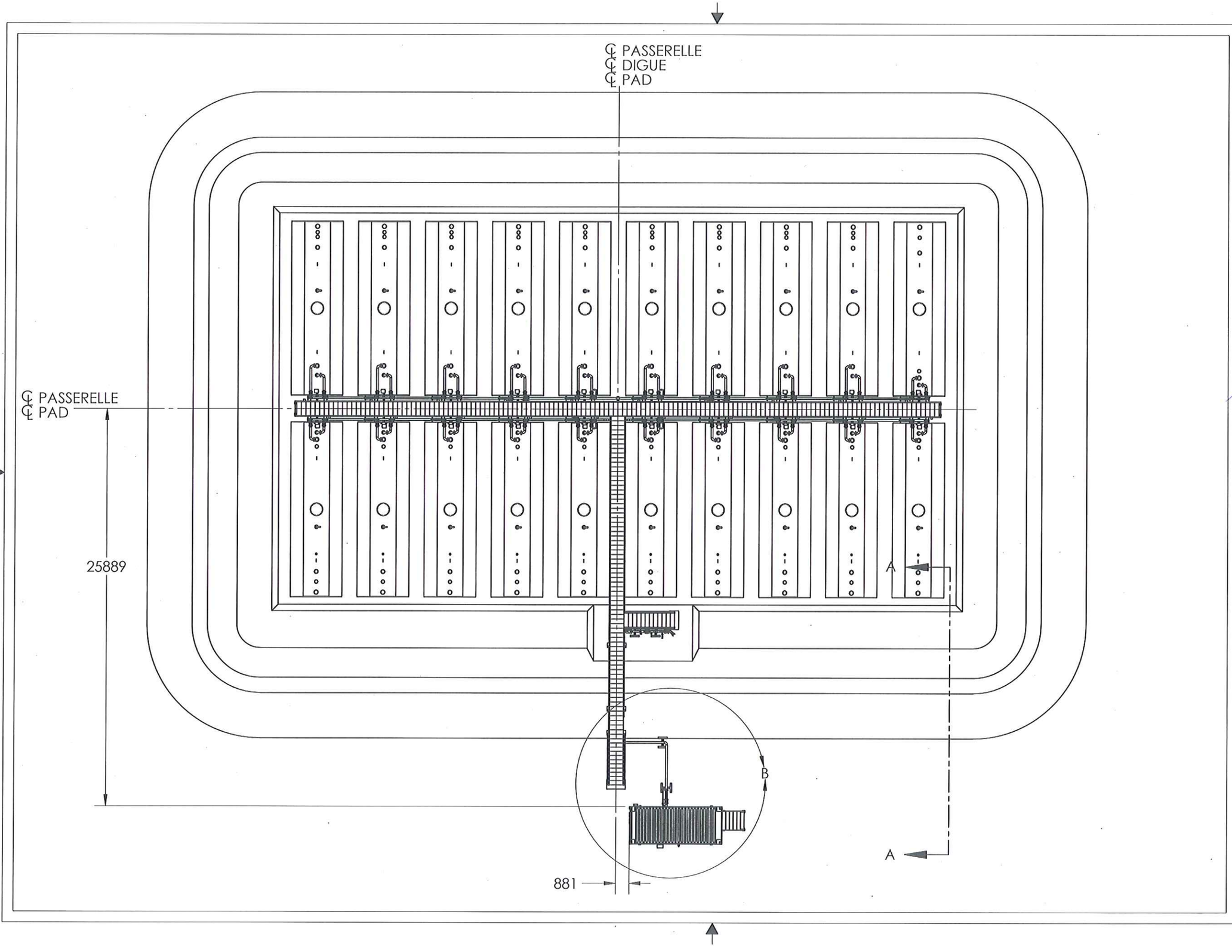
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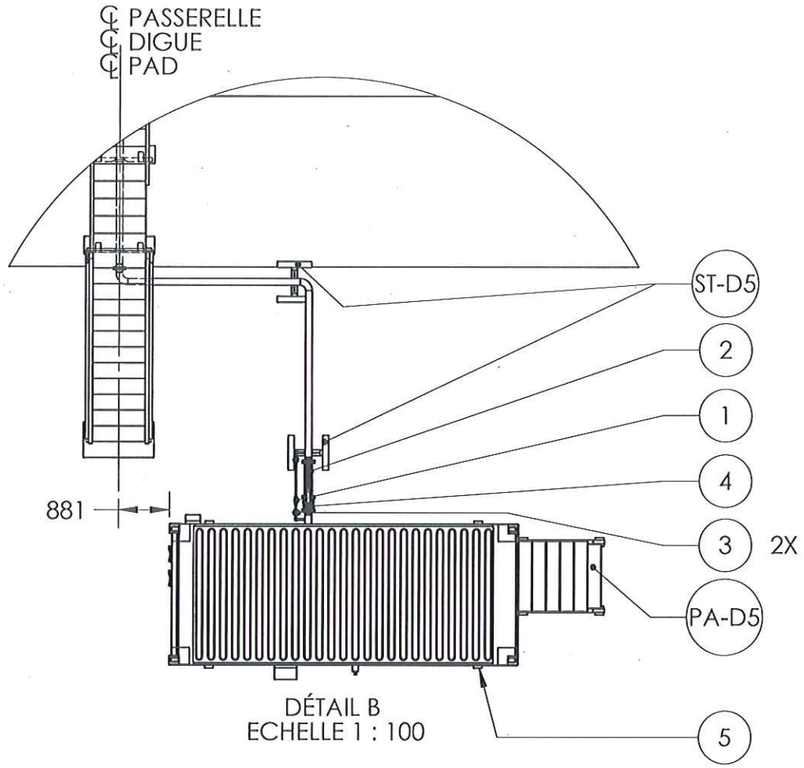
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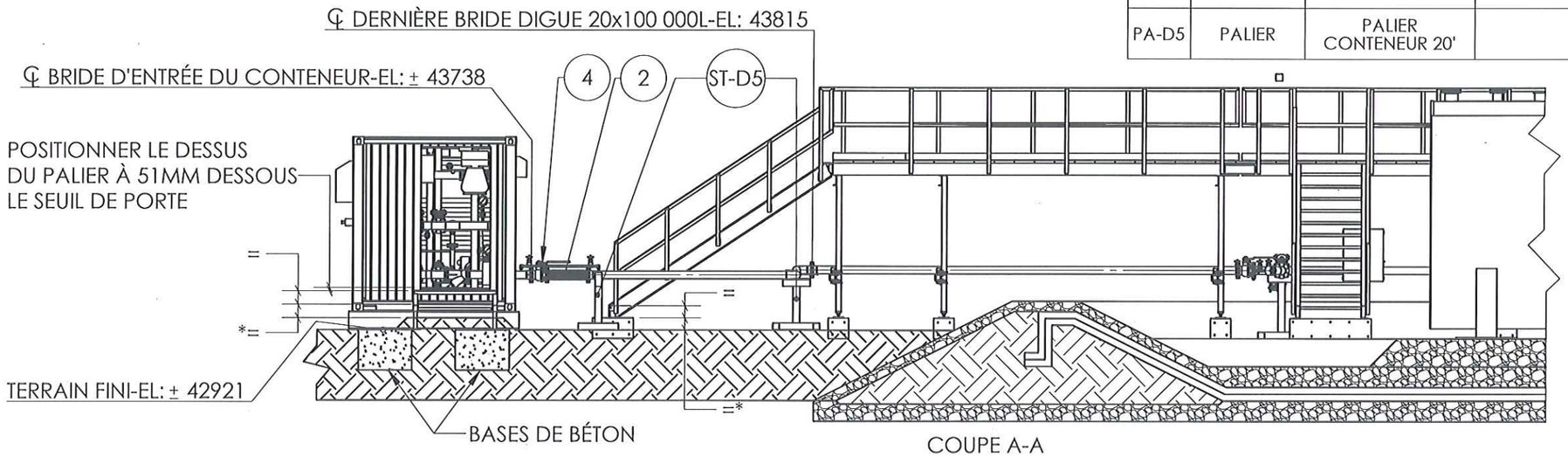
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1	CLAPET ANTI-RETOUR	CLAPET ANTI-RETOUR ½ NPT MÂLE, PRESSION DE TARAGE RÉGLABLE 3 À 50PSI, SÉRIE CPA	SWAGELOK # SS-8CPA2-3	1
2	FLEXIBLE	FLEXIBLE BRIDÉ CLASSE 150 NPS 4 X 24 po	H-SS101-060060-064-0024.00	1
3	VALVE	BERIC BB GATE VALVE ½" SERIE 501 (ASME B16.34), CLASS 800 NPT (ASME B1.20.1)	BERIC # 501-T-3-8-A08	2
4	VALVE	SPLIT BODY BALL VALVE (ASME B16.34), FULL PORT, CLASSE #150 RF, NPS 4, MONTAGE ISO 5211-F12, ACIER AU CARBONE GRADE LCC (-46°C)	M.A. STEWART # 4"-F-150-LC-F-SS-N	1
5	SUPPORT	BASE DE CONTENEUR 20'		1
ST-D5	SUPPORT	SUPPORT TUYAUTERIE W400 X H760		2
PA-D5	PALIER	PALIER CONTENEUR 20'		1



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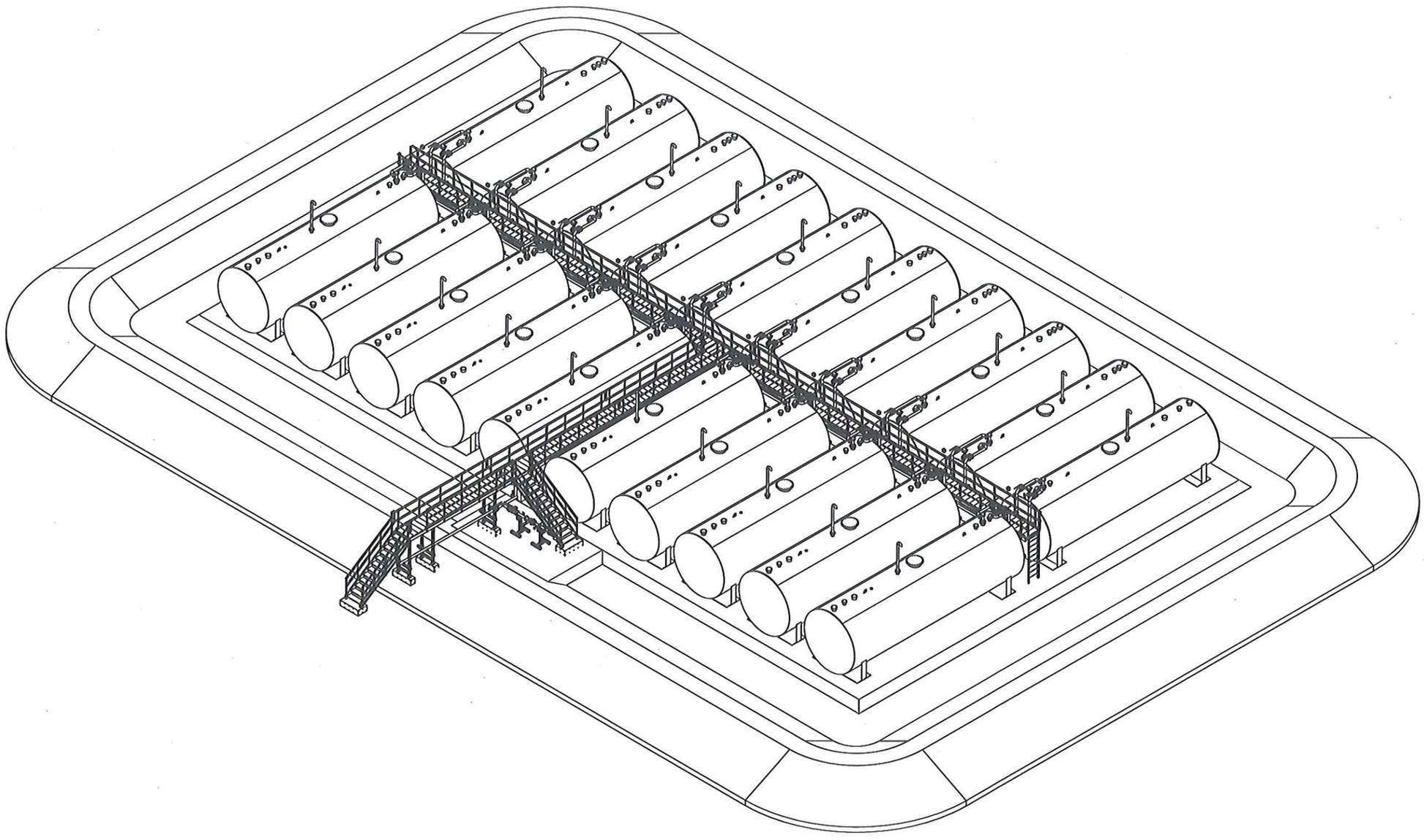
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Étendue de la vérification
RM4706 : Conformité aux normes et aux schémas de procédé.

Cette vérification ne constitue d'aucune façon une vérification détaillée et complète de la conception.

Recommandation
- [x] Accepté
- [ ] Accepté tel que noté (doit être validé par un ingénieur si le concept est modifié)
- [ ] Corriger et soumettre à nouveau avant les travaux
- [ ] Refusé

2013-11-26
Signature ☒ Ingénieur ☐ Autre — Date

Jonathan Faucher — 131007
Nom — N° de membre de l'OIQ

La vérification est restreinte à celle indiquée et ne garantit pas que les données du document revu sont exactes ou exhaustives. Elle ne dégage nullement la personne ou l'entreprise qui l'a préparé de ses obligations de quelque nature que ce soit.

#	REVISION:	DATE
02	AJOUTS-TQC	2013-11-15
01	ÉMIS POUR CONSTRUCTION	2013-05-31

TOLERANCES NON SPECIFIEES
DIMENSIONS EN MILLIMÈTRES
ETAT DE SURFACE
DECIMALES:
1 (X.X) ±0.50
2 (X.XX) ±0.25
3 (X.XXX) ±0.15

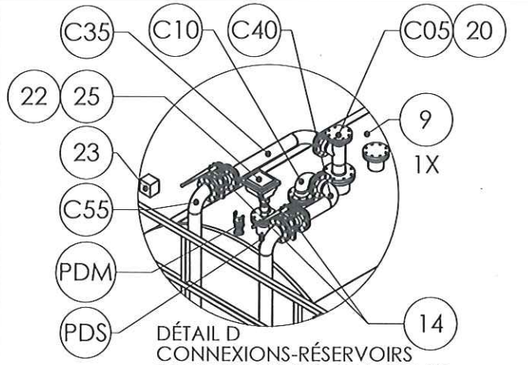
ANGLES A 90° ± 1/2°
AUTRES ANGLES ±1°

TITRE DU PROJET/ SOUMISSION#:
AGNICO-EAGLE-MEADOWBANK BAKER-LAKE-DÉPÔT JET-A
#20898

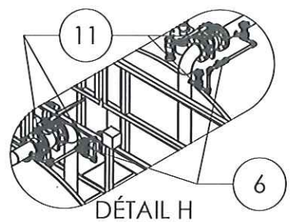
TITRE DU DESSIN:
ENSEMBLE-DIGUE 20x100 000L

NOM DU FICHIER:
DÉPÔT 20 RÉSERVOIRS-FABRICATION SLDDRW

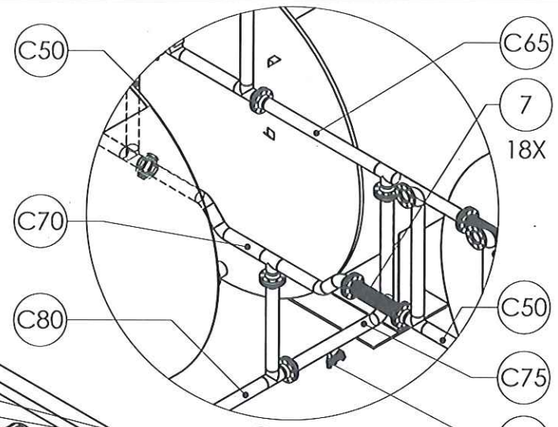
DESSINÉ PAR:	VÉRIFIÉ PAR:
NOM: Samuel Dube DATE: 2013-05-31	NOM: XXXX DATE:
ÉCHELLE: 1:200	APPROUVÉ PAR: NOM: XXXX DATE:
DATE: 2013-11-15	FEUILLE:
FORMAT: B	1 DE 25



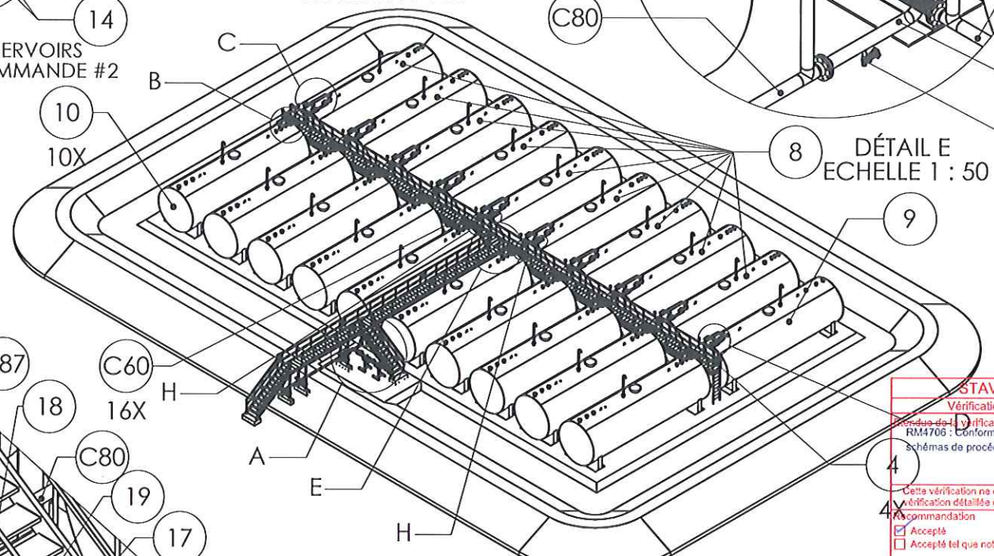
DÉTAIL D
CONNEXIONS-RÉSERVOIRS
SOUDURE FM-COMMANDE #2
TYP.1
ECHELLE 1 : 50

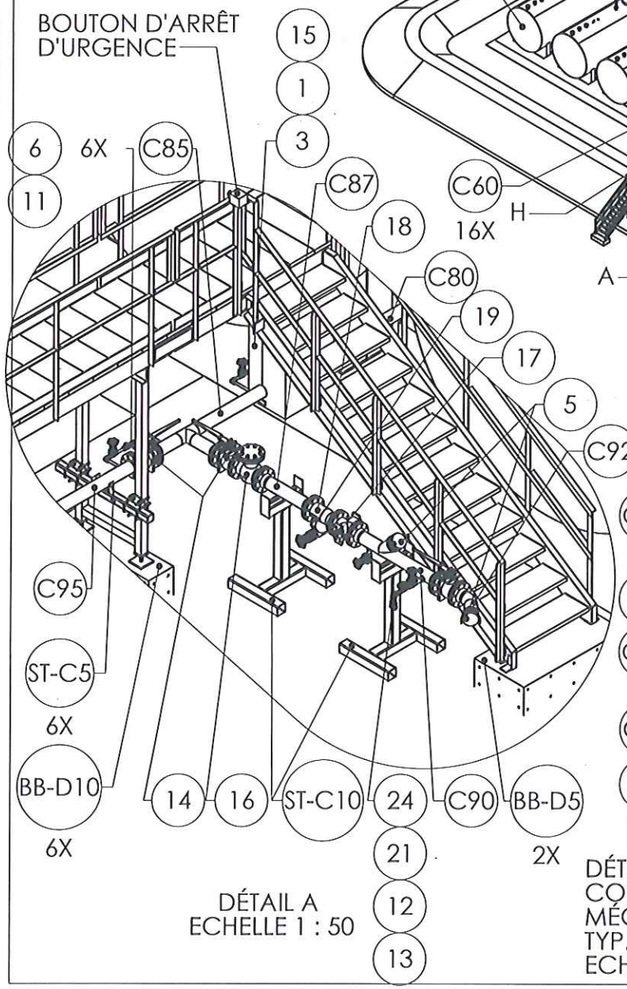


DÉTAIL H
RETOURS DE PRESSION
AUX RÉSERVOIRS TYP.2
ECHELLE 1 : 50

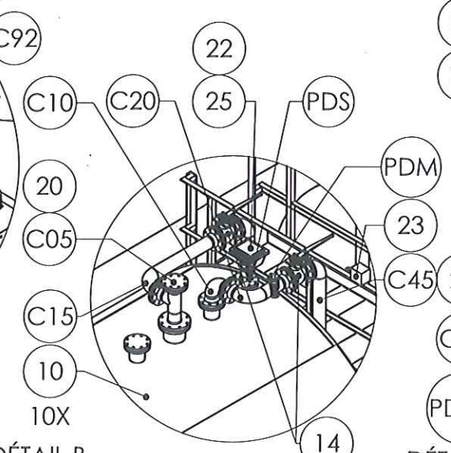


DÉTAIL E
ECHELLE 1 : 50

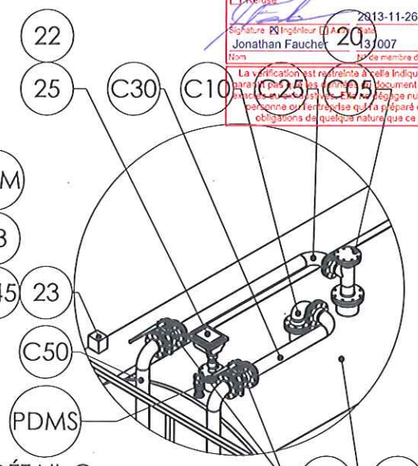




DÉTAIL A
ECHELLE 1 : 50



DÉTAIL B
CONNEXIONS-RÉSERVOIRS
MÉCANO-SOUDURE DRUMMOND
TYP.10
ECHELLE 1 : 50



DÉTAIL C
CONNEXIONS-RÉSERVOIRS
SOUDURE FM-COMMANDE #1
TYP.9
ECHELLE 1 : 50

STAVIBEL INC.
Vérification de conformité
Produit de la vérification
RM4706 : Conformité aux normes et aux schémas de procédé.
Cette vérification ne constitue d'aucune façon une vérification détaillée et complète de la conception.
Recommandation
☑ Accepté
☐ Accepté tel que noté (doit être validé par un ingénieur si le concept est modifié)
☐ Corriger et soumettre à nouveau avant les travaux
☐ Rejeté
2013-11-26
Signature Ingénieur (P.Eng. Qc)
Jonathan Fauchér 137007
Nom Date
La vérification est restreinte à celle indiquée et ne garantit pas que le document reçu soit exempt de toute erreur ou omission. Stavibel n'assume aucune responsabilité envers toute personne qui s'est préparé de ses obligations de quelque nature que ce soit.

ID	NO PIÈCE	DESCRIPTION	FOURNISSEUR	QTÉ
1	ACTUATEUR	ACTUATEUR "LOW TEMP" - 50°C À +40°C, CLASSE 1476 FTLBS, BRIDE MSS SP - 102 TAILLE FA14	ROTORK # IQT2000 FA14	1
2	ADAPTATEUR	4" Adaptor with Female thread, Aluminium construction	RITE # 400 A.A.	2
3	BOÎTIER	BOITIER BALL VALVE MAS RF-150 4PO-ROTORK IQT2000 & BRAQUETTE 4PO		1
4	BRIDE	Flg. Bld, NPS 4in, CLASS ASME 150, RF		4
5	CAP	4" DUST CAP (Caps 1611AN-0300 Kamvalok Adaptor or 633AST-0400 Adaptor)	OPW # 634B-0180	2
6	CLAPET ANTI-RETOUR	CLAPET ANTI-RETOUR ½ NPT MÂLE, PRESSION DE TARAGE RÉGLABLE 3 À 50PSI, SÉRIE CPA	SWAGELOK # SS-8CPA2-3	6
7	FLEXIBLE	FLEXIBLE BRIDÉ CLASSE 150 NPS 4 X 24 po	H-SS101-060060-064-0024.00	18
8	RÉSERVOIR	RÉSERVOIR DE STOCKAGE CYLINDRIQUE HORIZONTAL MODÈLE 22 000 GAL.IMP (100 000L) DOUBLE PAROIS SOUS VACUUM POUR PRODUITS PÉTROLIERS, HOMOLOGUÉ CAN/ULC-S601-07. **COMMANDE 1**	SOUDURE F.M. # RÉSERVOIR TYPE S601, 100 000L, Ø132" ID	9
9	RÉSERVOIR	RÉSERVOIR DE STOCKAGE CYLINDRIQUE HORIZONTAL MODÈLE 22 000 GAL.IMP (100 000L) DOUBLE PAROIS SOUS VACUUM POUR PRODUITS PÉTROLIERS, HOMOLOGUÉ CAN/ULC-S601-07. **COMMANDE 2**	SOUDURE F.M. # RÉSERVOIR TYPE S601, 100 000L, Ø132" ID	1
10	RÉSERVOIR	RÉSERVOIR DE STOCKAGE CYLINDRIQUE HORIZONTAL MODÈLE 22 000 GAL.IMP (100 000L) DOUBLE PAROIS SOUS VACUUM POUR PRODUITS PÉTROLIERS, HOMOLOGUÉ CAN/ULC-S601-07	MÉCANO-SOUDURE DRUMMOND INC # RÉSERVOIR TYPE S601, 100 000L, Ø132" ID	10
11	VALVE	BERIC BB GATE VALVE ½" SERIE 501 (ASME B16.34), CLASS 800 NPT (ASME B1.20.1)	BERIC # 501-T-3-8-A08	12
12	VALVE	ONE PIECE THREADED BALL VALVE (ASME B16.34), REDUCED PORT, CLASSE 2000 WOG, NPS ¾, TESTÉE API 607	KITZ # ¾"-AKSCTKZM-FSO	1
13	VALVE	BERIC BB GATE VALVE ¾" SERIE 501 (ASME B16.34), CLASS 800 NPT (ASME B1.20.1)	BERIC # 501-T-4-8-A08	3
14	VALVE	SPLIT BODY BALL VALVE (ASME B16.34), FULL PORT, CLASSE #150 RF, NPS 4, MONTAGE ISO 5211-F12, ACIER AU CARBONE GRADE LCC (-46°C)	M.A. STEWART # 4"-F-150-LC-F-SS-N	43
15	VALVE	SPLIT BODY BALL VALVE (ASME B16.34), FULL PORT, CLASSE #150 RF, NPS 4, MONTAGE ISO 5211-F12, ACIER AU CARBONE LCC	4"-F-150-LC-F-SS-N	1
16	VALVE	SWING CHECK VALVE NPS4, CLASS 150 RF, ACIER ASTM A352 GRADE LCC, DESIGN ASME B16.34	BERIC # 301-04"-RF-EH12-X-N	1
17	VISI-FLO	VISI-FLOW NPS4, SÉRIE 1400, ACIER AU CARBONE, INDICATEUR EN TÉFLON TYPE "FLAPPER", BRIDÉ ASME CLASSE 150	OPW # 1422TF-040	1
18	CRÉPINE	Y-STRAINER 150-NPS4	MUELLER # 781-NPS4	1
19	VALVE	BERIC BB GATE VALVE 1" SERIE 501 (ASME B16.34), CLASS 800 NPT (ASME B1.20.1)	BERIC # 501-T-5-8-A08	1
20	VALVE	CLAPET ANTI DÉBORDEMENT AVEC FLOTTEUR CYLINDRIQUE, 3" NPT	MORRISON BROS. CO. # 9095A-AV 3" OP VALVE	20
21	ADAPTATEUR C&G	ADAPTATEUR CAM & GROOVE ¾ MNPT MODÈLE F, ALUMINIUM [A-A-59326D]	RITE # 075 F.A	1
22	ALARME DE NIVEAU	OPW SOUS ASSEMBLAGE FLOTTEUR FLOAT SWITCH 44TA-LLFS	OPW # 44TA-LLFS	20
23	ALARME DE NIVEAU	ALARME DE HAUT NIVEAU OPW 144TA	OPW # 144TA-0100	20
24	DUST CAP C&G	DUST CAP CAM & GROOVE NPS¾ MODÈLE DC, ALUMINIUM [A-A-59326D]	RITE # 075 D.C.A	1
25	JAUGE	MÉCHANICAL TANK GAUGE 2FNPT, PRÉCISION ±2", TYPE D'UNITÉS: MÉTRIQUE (GRADUÉ DE 0 À 6m), BOÎTIER ET BASE PIVOTANTE D'ALUMINIUM, FLOTTEUR ET QUINCAILLERIE D'INOX.	OPW # 200TG-MET	20
BB-D5	BÉTON	BLOC DE BÉTON ARMÉ 12"x24"x48"		2
BB-D10	BÉTON	BLOC DE BÉTON ARMÉ 12"x12"x48"		6
ST-C5	SUPPORT	SUPPORT INTER-COLONNES		6
ST-C10	SUPPORT	SUPPORT TUYAUTERIE W400 X H957		2

SM CONSTRUCTION INC.

SM CONSTRUCTION INC.
QUÉBEC: (418) 849-7104 FAX: (418) 849-6464
MONTRÉAL: (450) 978-0929 FAX: (450) 978-2490
www.sm-inc.com

NOTES GENERALES:

TUYAUTERIE D'ALIMENTATION D'ACIER SOUDÉ NPS4, ASTM A333

PDM:
POINT DE MESURAGE DU PRODUIT

PDS:
POINT DE SOUTIRAGE D'EAU

PDMS:
POINT COMMUN DE MESURAGE DU PRODUIT ET DE SOUTIRAGE D'EAU

#	REVISION:	DATE
02	AJOUTS-TQC	2013-11-15
01	ÉMIS POUR CONSTRUCTION	2013-05-31

TOLERANCES NON SPECIFIEES
DIMENSIONS EN MILLIMÈTRES
ETAT DE SURFACE
DECIMALES:
1 (X.X) ±0.50
2 (X.XX) ±0.25
3 (X.XXX) ±0.15

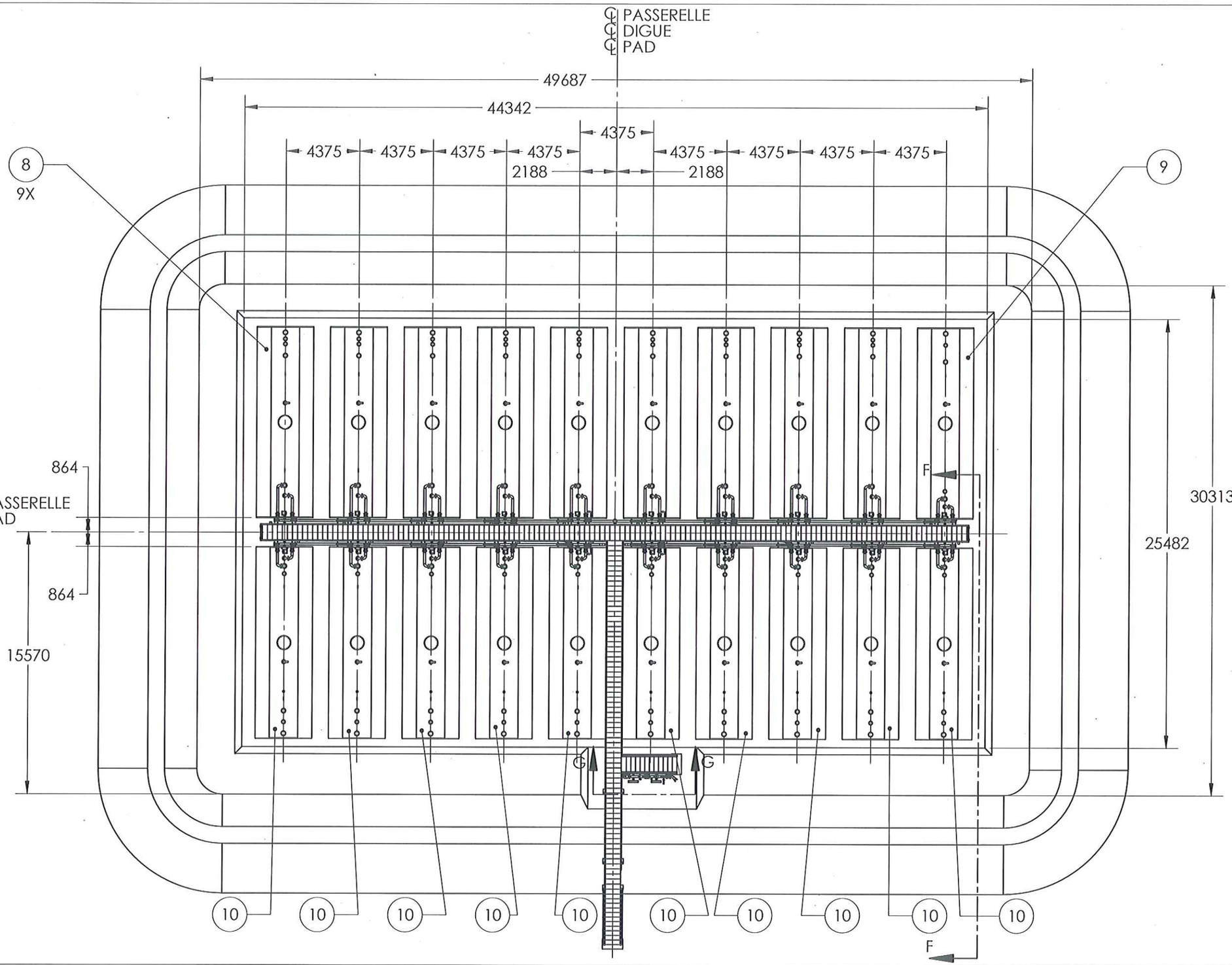
ANGLES A 90° ± 1/2°
AUTRES ANGLES ±1°

TITRE DU PROJET/ SOUMISSION#:
AGNICO-EAGLE-MEADOWBANK BAKER-LAKE-DÉPÔT JET-A
#20898

TITRE DU DESSIN:
ASSEMBLAGE-DIGUE 20x100 000L

NOM DU FICHIER:
DÉPÔT 20 RÉSERVOIRS-FABRICATION SLDDRW

DESSINÉ PAR:	VÉRIFIÉ PAR:
NOM: Samuel Dube DATE: 2013-05-31	NOM: XXXX DATE:
ÉCHELLE: 1:400	APPROUVÉ PAR: NOM: XXXX DATE:
DATE: 2013-11-15	FEUILLE: 2 DE 25
FORMAT: B	



SM CONSTRUCTION INC.

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QUÉBEC: (418) 849-7104 FAX: (418) 849-6464
MONTRÉAL: (450) 978-0929 FAX: (450) 978-2490
www.sm-inc.com

NOTES GENERALES:

STAVIBEL INC.
Vérification de conformité

Étendue de la vérification
RM4706 : Conformité aux normes et aux schémas de procédé.

Cette vérification ne constitue d'aucune façon une vérification détaillée et complète de la conception.

Recommandation
☑ Accepté
☐ Accepté tel que noté (doit être validé par un ingénieur si le concept est modifié)
☐ Corriger et soumettre à nouveau avant les travaux
☐ Refusé

2013-11-26
Signature ☒ Ingénieur ☐ Autre — Date
Jonathan Faucher — 131007
Nom — N° de membre de l'OIQ

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#	REVISION:	DATE
02	AJOUTS-TQC	2013-11-15
01	ÉMIS POUR CONSTRUCTION	2013-05-31

TOLERANCES NON SPECIFIEES
DIMENSIONS EN MILLIMÈTRES
ETAT DE SURFACE
DECIMALES:
1 (X.X) ±0.50
2 (X.XX) ±0.25
3 (X.XXX) ±0.15

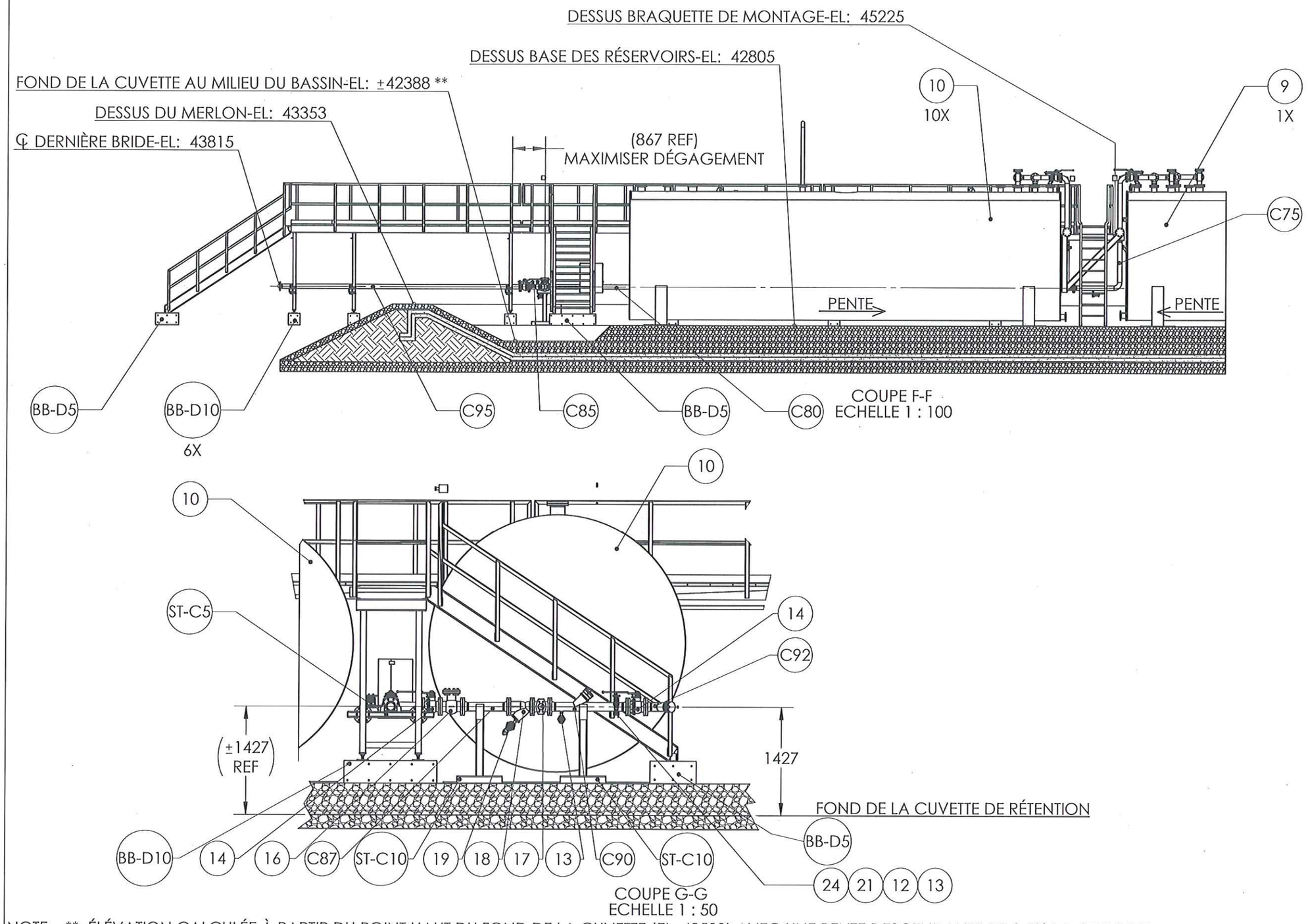
ANGLES A 90° ± 1/2°
AUTRES ANGLES ±1°

TITRE DU PROJET/ SOUMISSION#:
AGNICO-EAGLE-MEADOWBANK BAKER-LAKE-DÉPÔT JET-A
#20598

TITRE DU DESSIN:
ASSEMBLAGE-DIGUE 20x100 000L-COUPES ET DÉTAILS

NOM DU FICHIER:
DÉPÔT 20 RÉSERVOIRS-FABRICATION SLDDRW

DESSINÉ PAR:	VÉRIFIÉ PAR:
NOM: Samuel Dube DATE: 2013-05-31	NOM: XXXX DATE:
ÉCHELLE: 1:225	APPROUVÉ PAR:
	NOM: XXXX DATE:
DATE: 2013-11-15	FEUILLE:
FORMAT: B	3 DE 25



NOTE **: ÉLÉVATION CALCULÉE À PARTIR DU POINT HAUT DU FOND DE LA CUVETTE (EL: 42500) AVEC UNE PENTE DESCENDANTE DE 0.5% DE CE POINT

SM CONSTRUCTION INC.

SM CONSTRUCTION INC.
QUÉBEC: (418) 849-7104 FAX: (418) 849-6464
MONTRÉAL: (450) 978-0929 FAX: (450) 978-2490
www.sm-inc.com

NOTES GENERALES:

STAVIBEL INC.
Vérification de conformité

Étendue de la vérification
RM4706 : Conformité aux normes et aux schémas de procédé.

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Recommandation
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☐ Corriger et soumettre à nouveau avant les travaux
☐ Refusé

Signature ☒ Ingénieur ☐ Autre — Date: 2013-11-26
Nom: Jonathan Faucher — N° de membre de l'OIQ: 131007

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#	REVISION:	DATE
02	AJOUTS-TQC	2013-11-15
01	ÉMIS POUR CONSTRUCTION	2013-05-31

TOLERANCES NON SPECIFIEES
DIMENSIONS EN MILLIMÈTRES
ETAT DE SURFACE
DECIMALES:
1 (X.X) ±0.50
2 (X.XX) ±0.25
3 (X.XXX) ±0.15

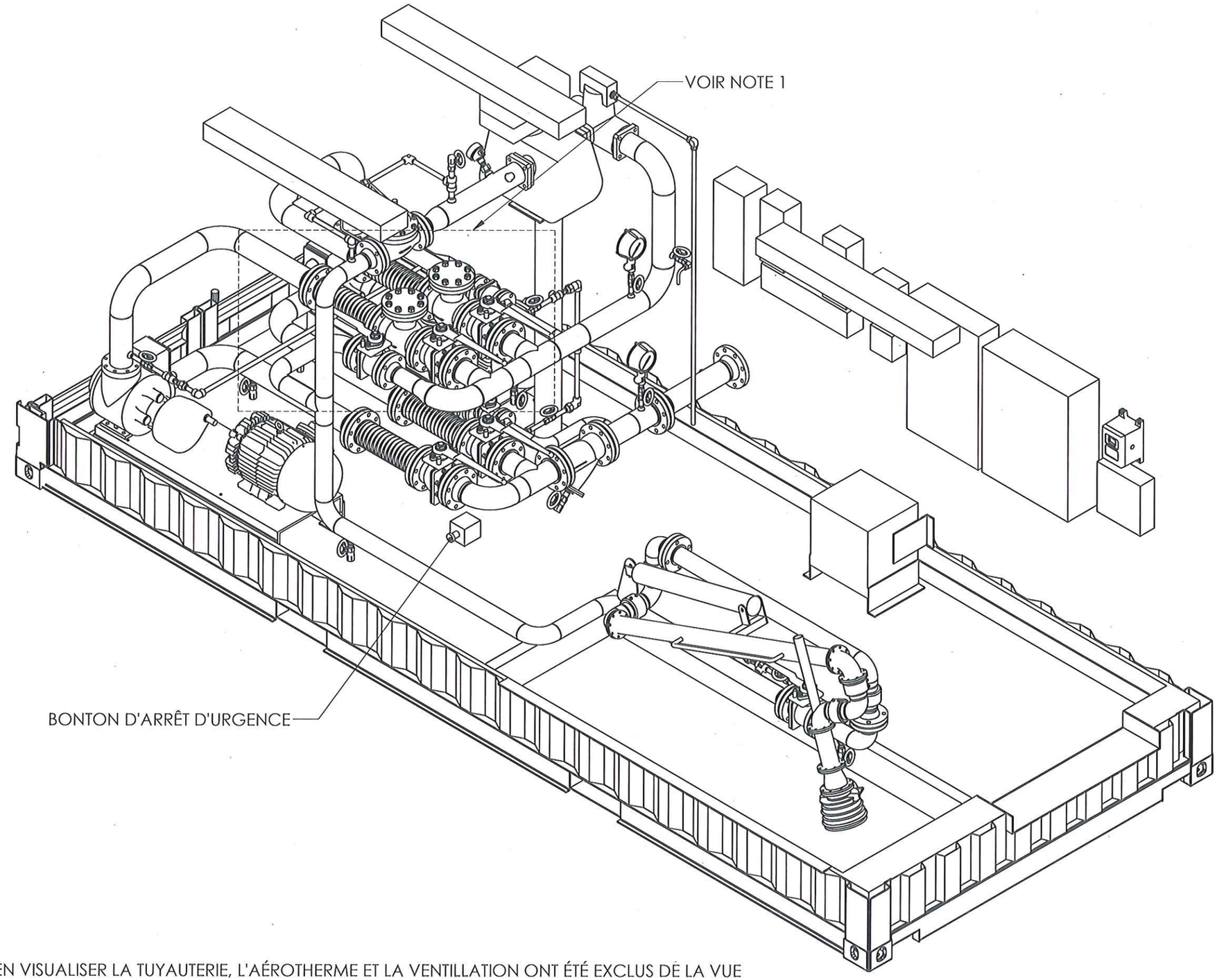
ANGLES A 90° ± 1/2°
AUTRES ANGLES ±1°

TITRE DU PROJET/ SOUMISSION#:
AGNICO-EAGLE-MEADOWBANK BAKER-LAKE-DÉPÔT JET-A
#20898

TITRE DU DESSIN:
ASSEMBLAGE-DIGUE 20x100 000L-COUPES ET DÉTAILS-SUITE

NOM DU FICHIER:
DÉPÔT 20 RÉSERVOIRS-FABRICATION SLDDRW

DESSINÉ PAR:	VÉRIFIÉ PAR:
NOM: Samuel Dube DATE: 2013-05-31	NOM: XXXX DATE:
ÉCHELLE: 1:200	APPROUVÉ PAR:
	NOM: XXXX DATE:
DATE: 2013-11-15	FEUILLE:
FORMAT: B	4 DE 25



NOTE 1: AFIN DE BIEN VISUALISER LA TUYAUTERIE, L'AÉROTHERME ET LA VENTILLATION ONT ÉTÉ EXCLUS DE LA VUE

SM CONSTRUCTION INC.

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NOTES GENERALES:

STAVIBEL INC.
Vérification de conformité

Étendue de la vérification
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☐ Refusé

Signature ☒ Ingénieur ☐ Autre — Date: 2013-11-26
Nom: Jonathan Faucher — N° de membre de l'OIQ: 131007

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#	REVISION:	DATE
04	AJOUTS-TQC	2013-11-15
03	AJOUTS-VENTILLATION	2013-07-15
02	AJOUTS-COMP. ÉLECTRIQUES	2013-06-19
01	ÉMIS POUR CONSTRUCTION	2013-05-22

TOLERANCES NON SPECIFIEES
DIMENSIONS EN MILLIMÈTRES
ETAT DE SURFACE
DECIMALES:
1 (X.X) ±0.50
2 (X.XX) ±0.25
3 (X.XXX) ±0.15

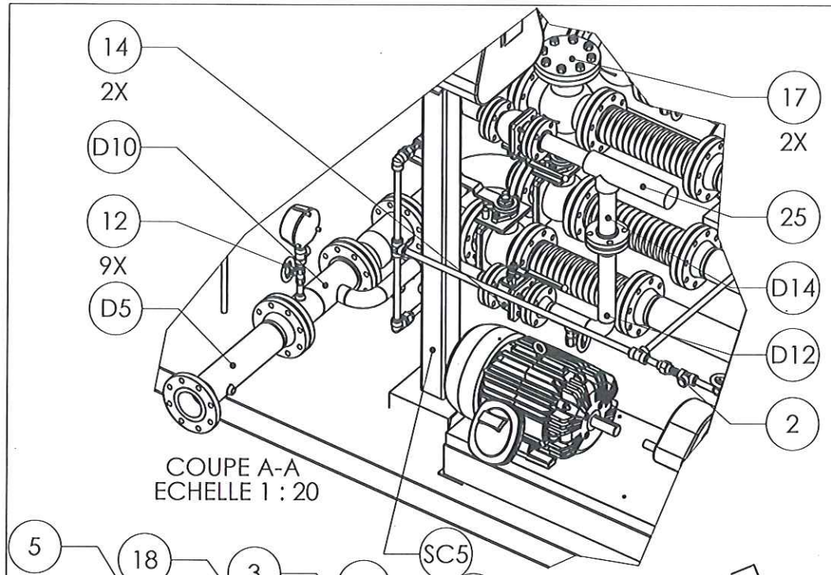
ANGLES A 90° ± 1/2°
AUTRES ANGLES ±1°

TITRE DU PROJET/ SOUMISSION#:
AGNICO-EAGLE-MEADOWBANK BAKER-LAKE-DÉPÔT JET A
#20898

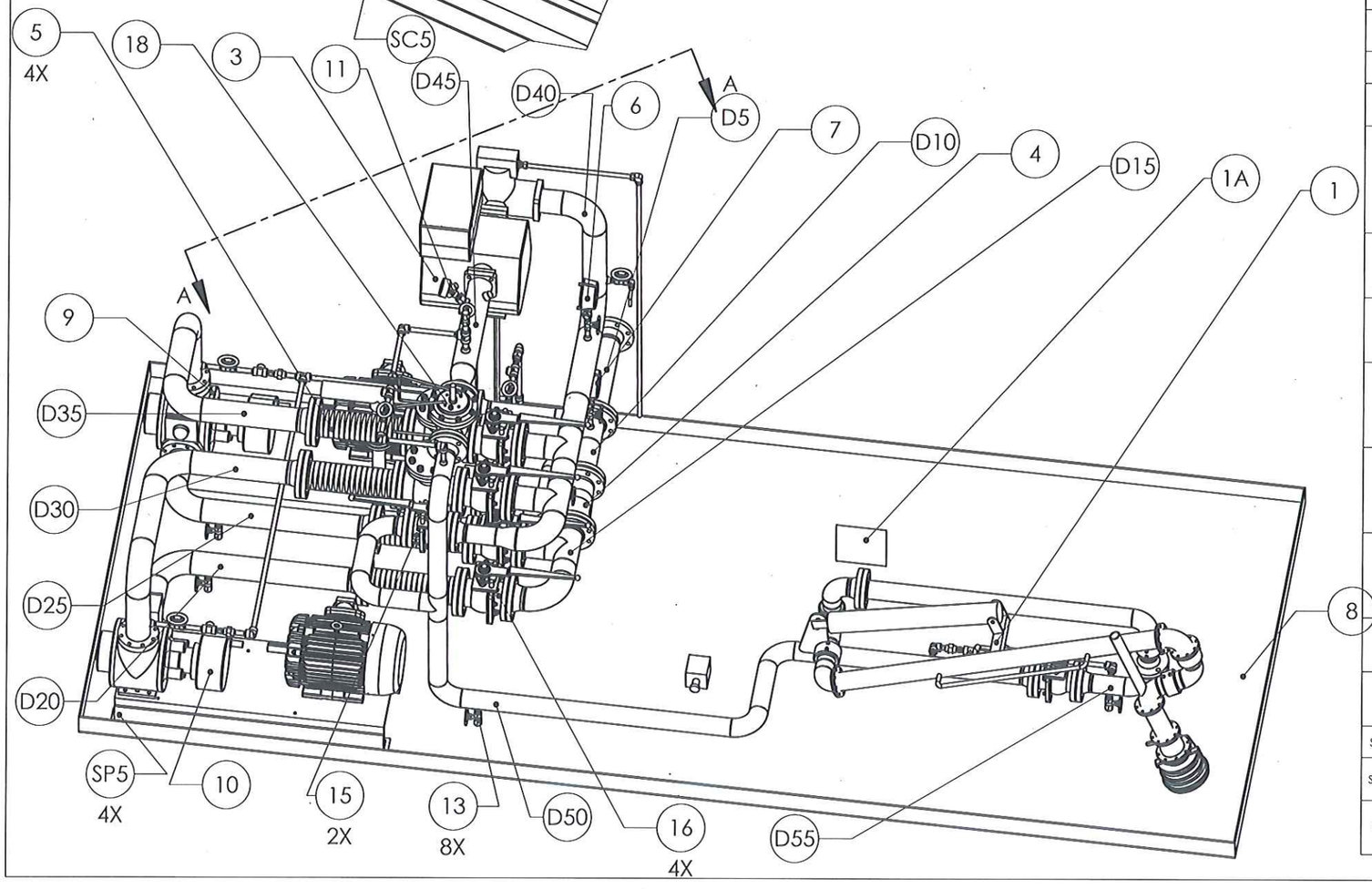
TITRE DU DESSIN:
ENSEMBLE-
STATION DE POMPAGE 20'

NOM DU FICHIER:
CONTENEUR DE POMPAGE 20'-FABRICATION.SLDDRW

DESSINÉ PAR:	VÉRIFIÉ PAR:
NOM: Samuel Dube DATE: 2013-05-22	NOM: XXXX DATE:
ÉCHELLE: 1:20	APPROUVÉ PAR: NOM: XXXX DATE:
DATE: 2013-11-15	FEUILLE:
FORMAT: B	1 DE19



COUPE A-A
ECHELLE 1 : 20



ID	NO PIÈCE	DESCRIPTION	FOURNISSEUR	QTÉ
1	BRAS	BRAS DE CHARGEMENT 3" NEE-COUPLEUR API 4" WHITTAKER F228		1
1A	GROUND/OVERFILL MONITOR	MONITEUR DE VÉRIFICATION DE MISE À LA TERRE AINSI QUE DE TROP-PLEIN	CIVACON #8580C	
2	CLAPET ANTI-RETOUR	CLAPET ANTI-RETOUR ½ NPT MÂLE, PRESSION DE TARAGE RÉGLABLE 3 À 50PSI, SÉRIE CPA	SWAGELOK # SS-8CPA2-3	5
3	COMPTEUR	COMPTEUR 4" MODELE 700-40 COMPRENANT ÉLIMINATEUR D'AIR, CRÉPINE + POD('PULSE TRANSMITTER')	TCS # 700-40SPA4DX + DMP100-5	1
4	CRÉPINE	Y-STRAINER 150-NPS4	MUELLER # 781-NPS4	1
5	FLEXIBLE	FLEXIBLE BRIDÉ CLASSE 150 NPS 4 X 18 po	H-SS101-060060-064-0018.00	4
6	MANOMÈTRE	MANOMÈTRE GRADUÉ (0 À 160PSI)/(0 À 1200 KPA), CONNEXION ½NPT DANS LE BAS, REMPLI DE GLYCÉRINE, TUBE ET CONNECTION EN 316 SS, CADRAN 4-½"	TRERICE # 450LFSS 45 04 L D 120	1
7	MANOMÈTRE	MANOMÈTRE GRADUÉ (30 Hg À 100PSI)/(-100 À 600 KPA), CONNEXION ½NPT DANS LE BAS, REMPLI DE GLYCÉRINE, TUBE ET CONNECTION EN 316 SS, CADRAN 4-½"	TRERICE # 450LFSS 45 04 L D 050	1
8	PANNE	PANNE 89"x219"EXT. POUR CONTENEUR RÉFRIGÉRÉ 20'		1
9	POMPE	POMPE À PALETTES AUTO-AMORÇANTE NPS 4'x 4', 'LEFT HAND ROTATION'	BLACKMER # GX4B	1
10	POMPE	POMPE À PALETTES AUTO-AMORÇANTE NPS 4'x 4', 'RIGHT HAND ROTATION'	BLACKMER # GX4B	1
11	SONDE	TEMPERATURE PROBE(4 WIRE) WITH EXPLOSION PROOF JUNCTION BOX, WITH THERMOWELL, USED WITH ACCULOAD II AND III; 1/2' NPT PROBE AND 3/4' NPT WELL, WELL INSERTION LENGTH 2-1/2'	FMC # TPW-3-2.5	1
12	VALVE	ONE PIECE THREADED BALL VALVE (ASME B16.34), REDUCED PORT, CLASSE 2000 WOG, NPS ½, TESTÉE API 607	KITZ # ½"-AKSCTKZM-FS	9
13	VALVE	ONE PIECE THREADED BALL VALVE (ASME B16.34), REDUCED PORT, CLASSE 2000 WOG, NPS ¾, TESTÉE API 607	KITZ # ¾"-AKSCTKZM-FS	8
14	VALVE	SPLIT BODY BALL VALVE (ASME B16.34), FULL PORT, CLASSE #150 RF, NPS 2, MONTAGE ISO 5211-F07, ACIER AU CARBONE GRADE LCC (-46°C)	M.A. STEWART # 2'-F-150-LC-F-SS-N	2
15	VALVE	SPLIT BODY BALL VALVE (ASME B16.34), FULL PORT, CLASSE #150 RF, NPS 3, MONTAGE ISO 5211-F10, ACIER AU CARBONE GRADE LCC (-46°C)	M.A. STEWART # 3'-F-150-LC-F-SS-N	2
16	VALVE	SPLIT BODY BALL VALVE (ASME B16.34), FULL PORT, CLASSE #150 RF, NPS 4, MONTAGE ISO 5211-F12, ACIER AU CARBONE GRADE LCC (-46°C)	M.A. STEWART # 4'-F-150-LC-F-SS-N	4
17	VALVE	SWING CHECK VALVE NPS4, CLASS 150 RF, ACIER ASTM A352 GRADE LCC, DESIGN ASME B16.34	BERIC # 301-04'-RF-EH12-X-N	2
18	VALVE	VANNE DE CONTRÔLE DIGITALE TYPE GLOBE 3' BRIDÉE CLASSE 150, ACIER AU CARBONE(ENDUIT ÉPOXY)	OCV # 115-3-3'-GLOBE-150# FLGD-CS	1
SP5	SUPPORT	ASSEMBLAGE DE SUPPORT DE POMPE GX4B		4
SC5	SUPPORT	SUPPORT-COMPTEUR TCS 700-40, HAUTEUR=59,54PO, ANGLE=0°	TCS 700-40-H59,54-0°	1
25	VALVE	RELIEF VALVE 2 FNPT, AJUSTEMENT 30-100 PSI (VERT), ACIER AU CARBONE, O'RING BUNA, CAPACITÉ: 150GPM	FULFLO#FVS-8R/SS/WS	1

SM CONSTRUCTION INC.

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QUÉBEC: (418) 849-7104 FAX: (418) 849-6464
MONTRÉAL: (450) 978-0929 FAX: (450) 978-2490
www.sm-inc.com

NOTES GENERALES:

STAVIBEL INC.
Vérification de conformité
Étendue de la vérification
RM4706 : Conformité aux normes et aux schémas de procédé.

Cette vérification ne constitue d'aucune façon une vérification détaillée et complète de la conception.
Recommandation
☒ Accepté
☐ Accepté tel que noté (doit être validé par un ingénieur si le concept est modifié)
☐ Corriger et soumettre à nouveau avant les travaux
☐ Refusé
2013-11-26
Signature ☒ Ingénieur ☐ Autre Date
Jonathan Faucher 131007
Nom N° de membre de l'OIQ
La vérification est restreinte à celle indiquée et ne garantit pas que les données du document revu sont exactes ou exhaustives. Elle ne dégage nullement la personne ou l'entreprise qui l'a préparé de ses obligations de quelque nature que ce soit.

#	REVISION:	DATE
03	AJOUT À LA LISTE DE MATÉRIEL-TQC	2013-11-15
02	AJUSTEMENT NOMENCLATURE	2013-05-24
01	ÉMIS POUR CONSTRUCTION	2013-05-22

TOLERANCES NON SPECIFIEES
DIMENSIONS EN MILLIMÈTRES
ETAT DE SURFACE
DECIMALES:
1 (X.X) ±0.50
2 (X.XX) ±0.25
3 (X.XXX) ±0.15

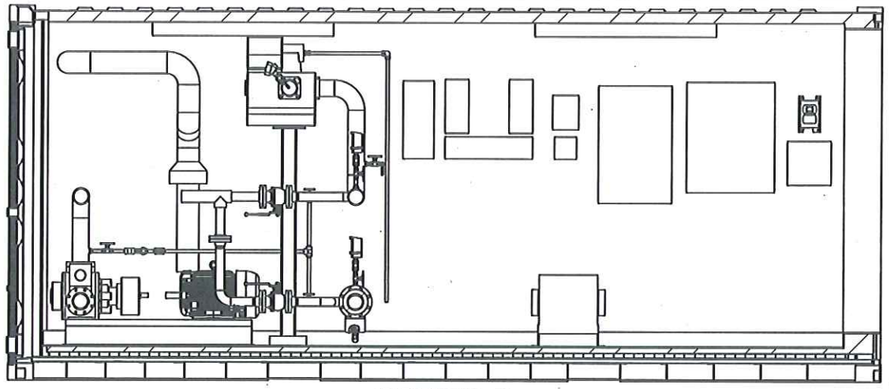
ANGLES A 90° ± 1/2°
AUTRES ANGLES ±1°

TITRE DU PROJET/ SOUMISSION#:
AGNICO-EAGLE-MEADOWBANK BAKER-LAKE-DÉPÔT JET A
#20898

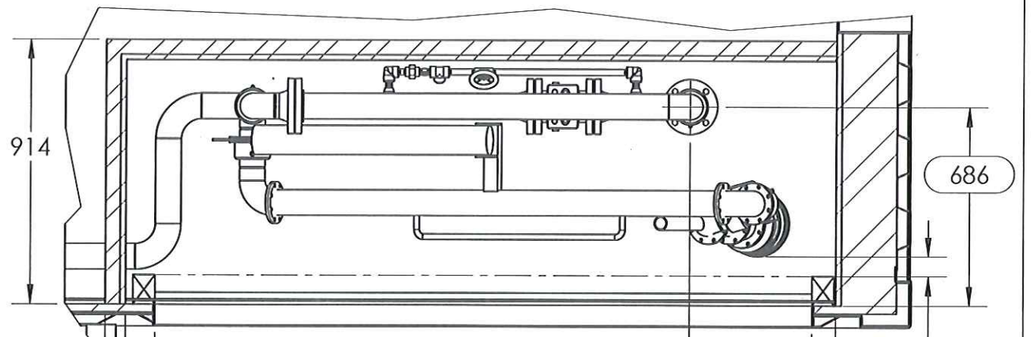
TITRE DU DESSIN:
ASSEMBLAGE-
STATION DE POMPAGE 20'

NOM DU FICHIER:
CONTENEUR DE POMPAGE 20'-FABRICATION.SLDDRW

DESSINÉ PAR:	VÉRIFIÉ PAR:
NOM: Samuel Dube DATE: 2013-05-22	NOM: XXXX DATE:
ÉCHELLE: 1:25	APPROUVÉ PAR: NOM: XXXX DATE:
DATE: 2013-11-15	FEUILLE:
FORMAT: B	2 DE 19



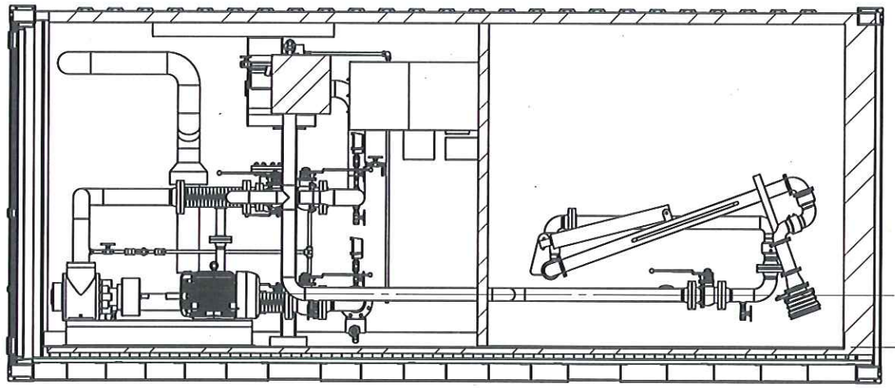
COUPE D-D



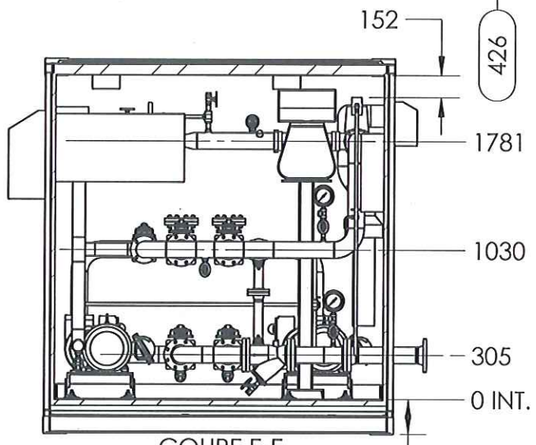
COUPE AA-AA
ECHELLE 1 : 20

70 TYP.
-TÔLE 19mm
-L50.8 x 50.8

2388 INT. MUR TÔLÉ 19mm
2286 INT. OUVERTURE MUR CAPÉ

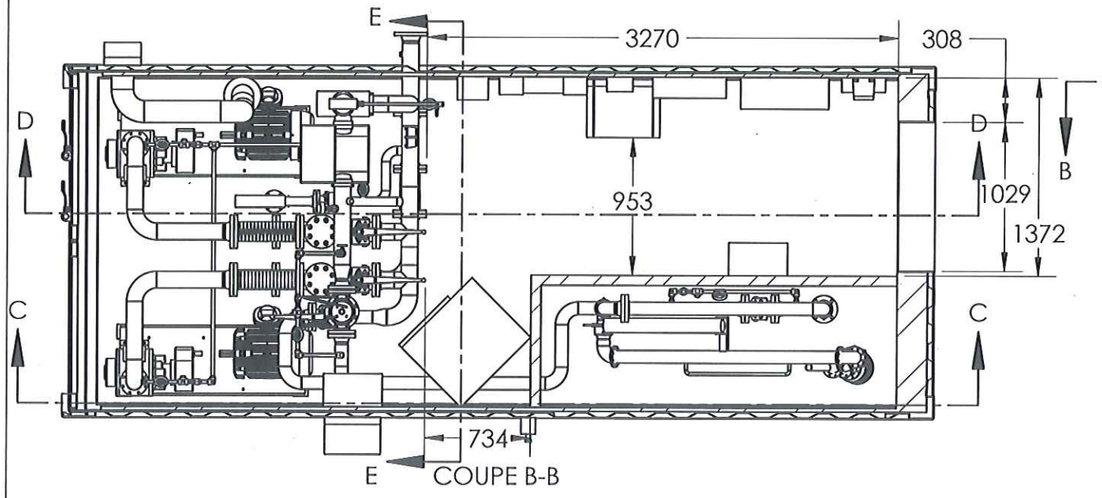


COUPE C-C

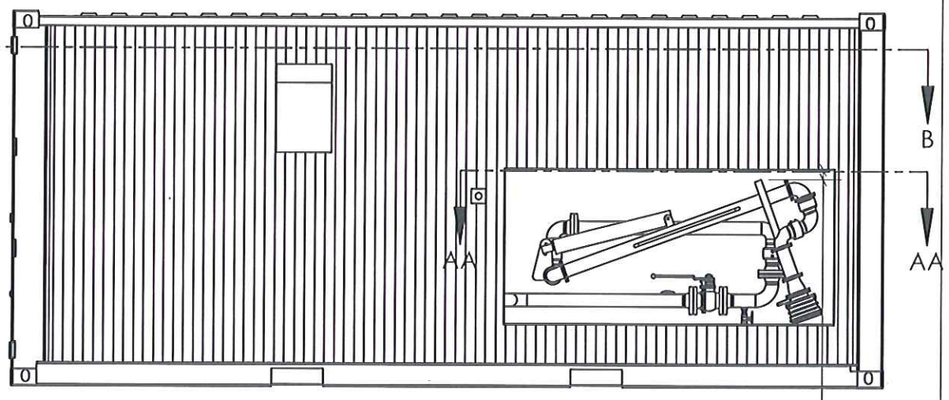


COUPE E-E

0 INT. OUVERTURE MUR CAPÉ
83 INT. MUR TÔLÉ 19mm



COUPE B-B



AJUSTER AU DÉGAGEMENT MINIMUM

NOTE **: CONSTRUIRE LE MUR DE FACON À POUVOIR EN RETIRER UN PANNEAU FACILEMENT POUR L'ACCESSIBILITÉ À L'ENROULEUR

SM CONSTRUCTION INC.

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QUÉBEC: (418) 849-7104 FAX: (418) 849-6464
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www.sm-inc.com

NOTES GENERALES:

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Vérification de conformité
Étendue de la vérification
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Recommandation
☑ Accepté
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☐ Corriger et soumettre à nouveau avant les travaux
☐ Refusé

2013-11-26
Signature ☒ Ingénieur ☐ Autre — Date
Jonathan Faucher — 131007
Nom — N° de membre de l'OIQ

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#	REVISION:	DATE
04	AJOUTS-VENTILLATION	2013-07-15
03	AJOUTS-COMP. ÉLECTRIQUES	2013-06-19
02	AJUSTEMENT-COUPE B-B	2013-05-24
01	ÉMIS POUR CONSTRUCTION	2013-05-22

TOLERANCES NON SPECIFIEES
DIMENSIONS EN MILLIMÈTRES
ETAT DE SURFACE
DECIMALES:
1 (X.X) ±0.50
2 (X.XX) ±0.25
3 (X.XXX) ±0.15

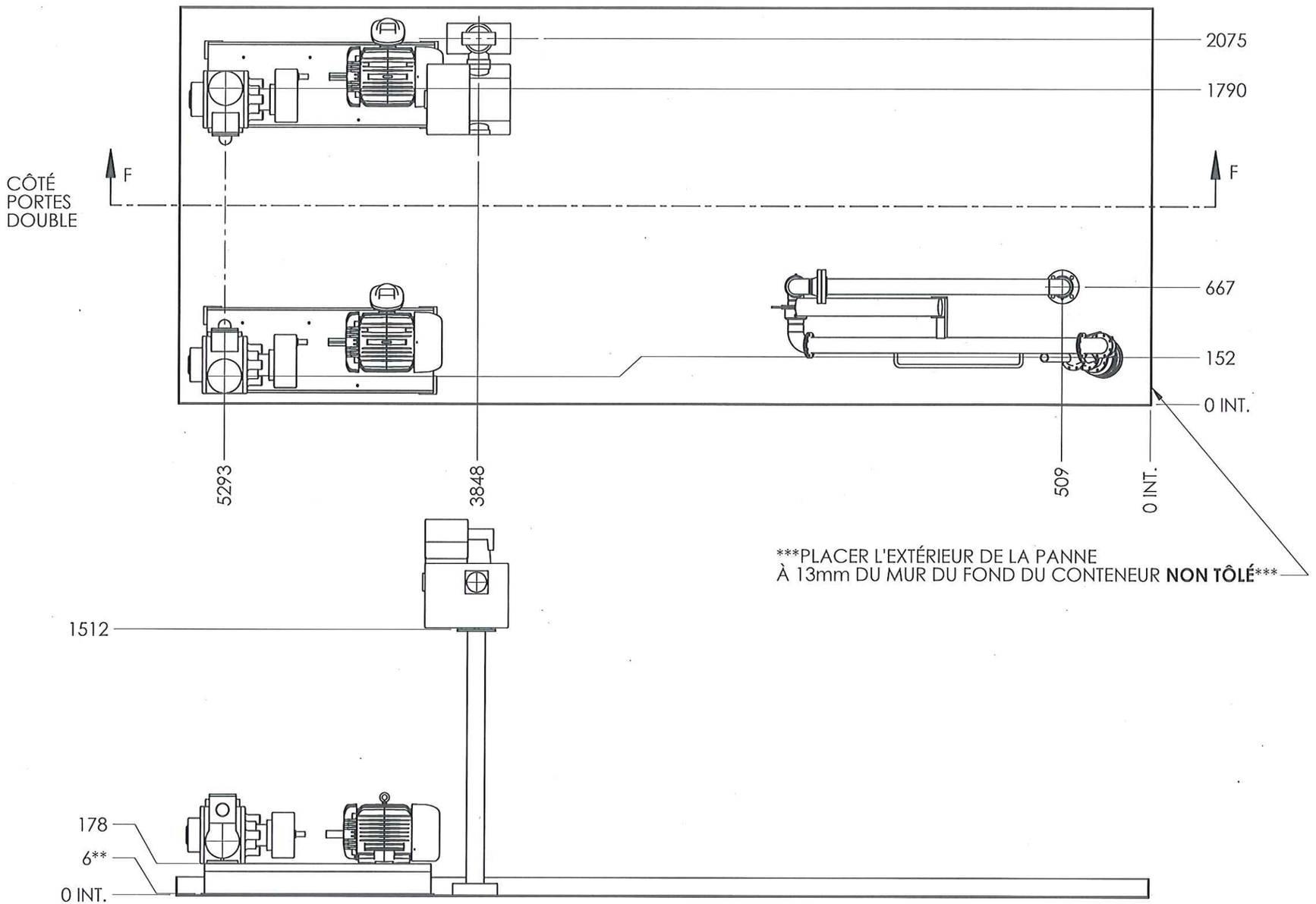
ANGLES A 90° ± 1/2°
AUTRES ANGLES ±1°

TITRE DU PROJET/ SOUMISSION#:
AGNICO-EAGLE-MEADOWBANK BAKER-LAKE-DÉPÔT JET A
#20898

TITRE DU DESSIN:
PROJECTIONS DÉGAGEMENTS-STATION DE POMPAGE 20'

NOM DU FICHIER:
CONTENEUR DE POMPAGE 20'-FABRICATION.SLDDRW

DESSINÉ PAR:	VÉRIFIÉ PAR:
NOM: Samuel Dube DATE: 2013-05-22	NOM: XXXX DATE:
ÉCHELLE: 1:40	APPROUVÉ PAR: NOM: XXXX DATE:
DATE: 2013-11-15	FEUILLE: 3 DE 19
FORMAT: B	



COUPE F-F

NOTE **: LES COMPOSANTS EN QUESTION DEVRONT ÊTRE FIXÉS AU PLANCHER À L'AIDE DE FL¼" SOUDÉS À DES STUDS CORRESPONDANTS AUX DIAMÈTRES DES TROUS DE FIXATION CORRESPONDANTS.

SM CONSTRUCTION INC.
SM CONSTRUCTION INC.
QUÉBEC: (418) 849-7104 FAX: (418) 849-6464
MONTRÉAL: (450) 978-0929 FAX: (450) 978-2490
www.sm-inc.com

NOTES GENERALES:

STAVIBEL INC.
Vérification de conformité

Étendue de la vérification
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Recommandation
- [x] Accepté
- [ ] Accepté tel que noté (doit être validé par un ingénieur si le concept est modifié)
- [ ] Corriger et soumettre à nouveau avant les travaux
- [ ] Refusé

2013-11-26
Signature ☒ Ingénieur ☐ Autre — Date
Jonathan Faucher — 131007
Nom — N° de membre de l'OIQ

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#	REVISION:	DATE
01	ÉMIS POUR CONSTRUCTION	2013-05-22

TOLERANCES NON SPECIFIEES
DIMENSIONS EN MILLIMÈTRES
ETAT DE SURFACE
DECIMALES:
1 (X.X) ±0.50
2 (X.XX) ±0.25
3 (X.XXX) ±0.15

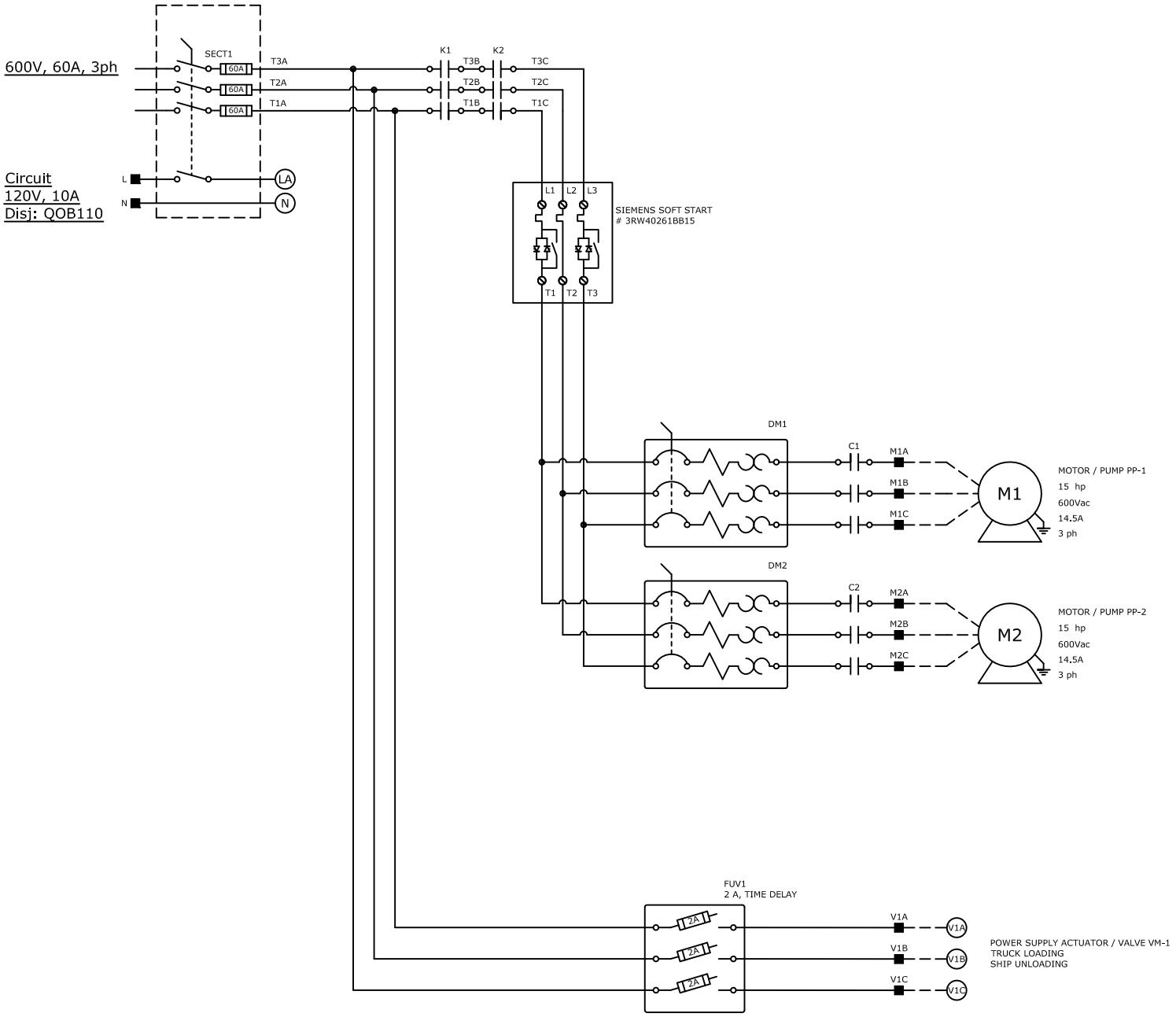
ANGLES A 90° ± 1/2°
AUTRES ANGLES ±1°

TITRE DU PROJET/ SOUMISSION#:

TITRE DU DESSIN:
PLACEMENT DES COMPOSANTS-
STATION DE POMPAGE 20'

NOM DU FICHIER:
CONTENEUR DE POMPAGE 20'-FABRICATION.SLDDRW

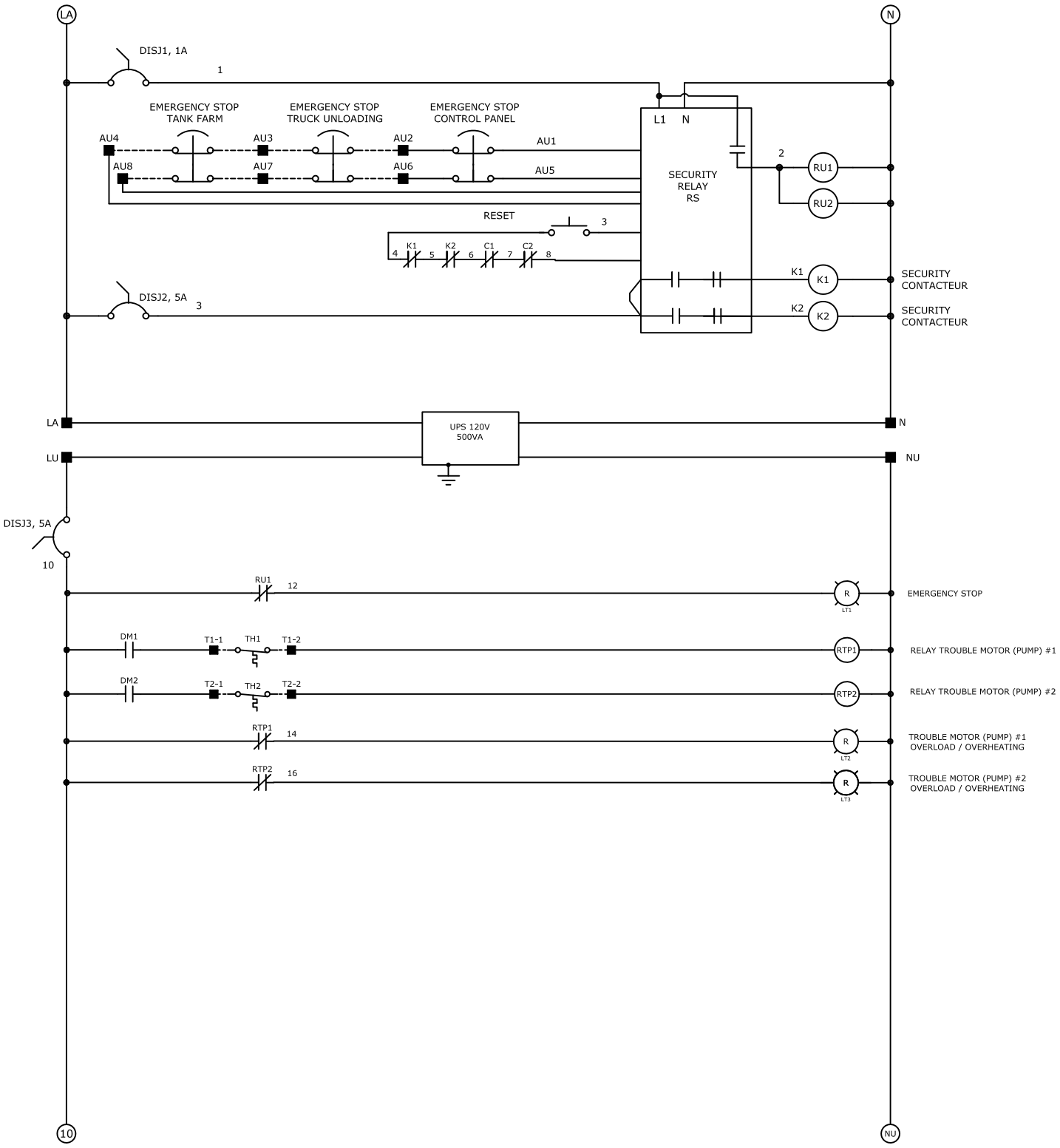
DESSINÉ PAR:	VÉRIFIÉ PAR:
NOM: Samuel Dube DATE: 2013-05-22	NOM: XXXX DATE:
ÉCHELLE: 1:25	APPROUVÉ PAR: NOM: XXXX DATE:
DATE: 2013-11-15	FEUILLE:
FORMAT: B	4 DE 19



PAGUI inc.
FILIALE DU GROUPE SM TARDIF INC.

15971 DE LA COLLINE, LAC-ST-CHARLES
(QUEBEC) G3G 3A7
TELEPHONE : 849-1832
FAX : 849-2159

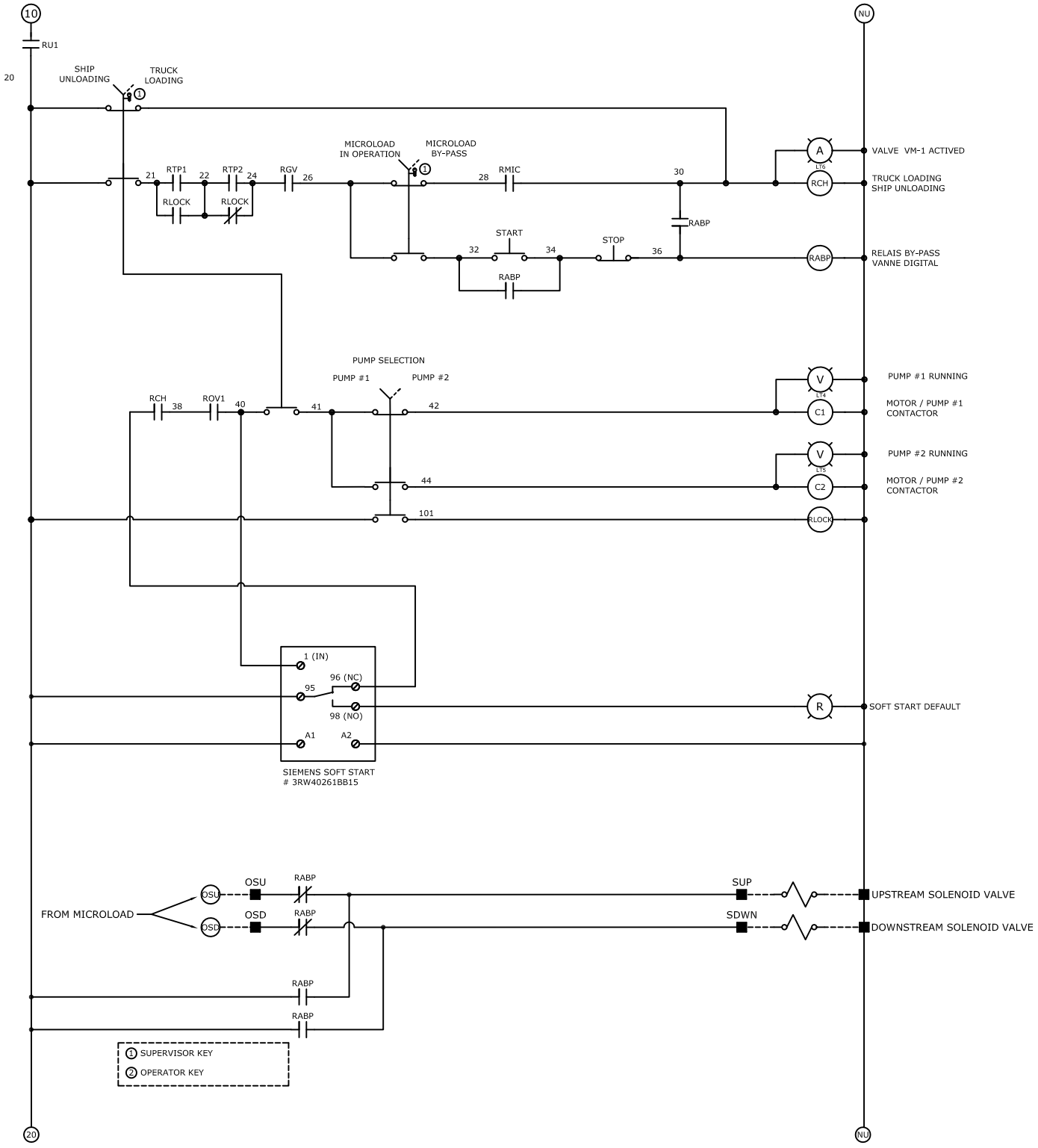
Projet : BAKER LAKE, TANK FARM JET-A				Dessiné par : Guillaume Boutin	Vérifié par :
Titre : CONTROL PANEL / MOTOR STARTER				No# Soumission	No# Projet : 30791
Client : AGNICO EAGLE	3	AS BUILT	29-11-13	Échelle : N/A	No# Dessin : *.dwg
	2	POUR FABRICATION	21-05-13		
	1	POUR SOUMISSION	14-05-13	Date : 14-05-2013	Feuille : 1/6
	No#	Révision	Date		



PAGUI inc.
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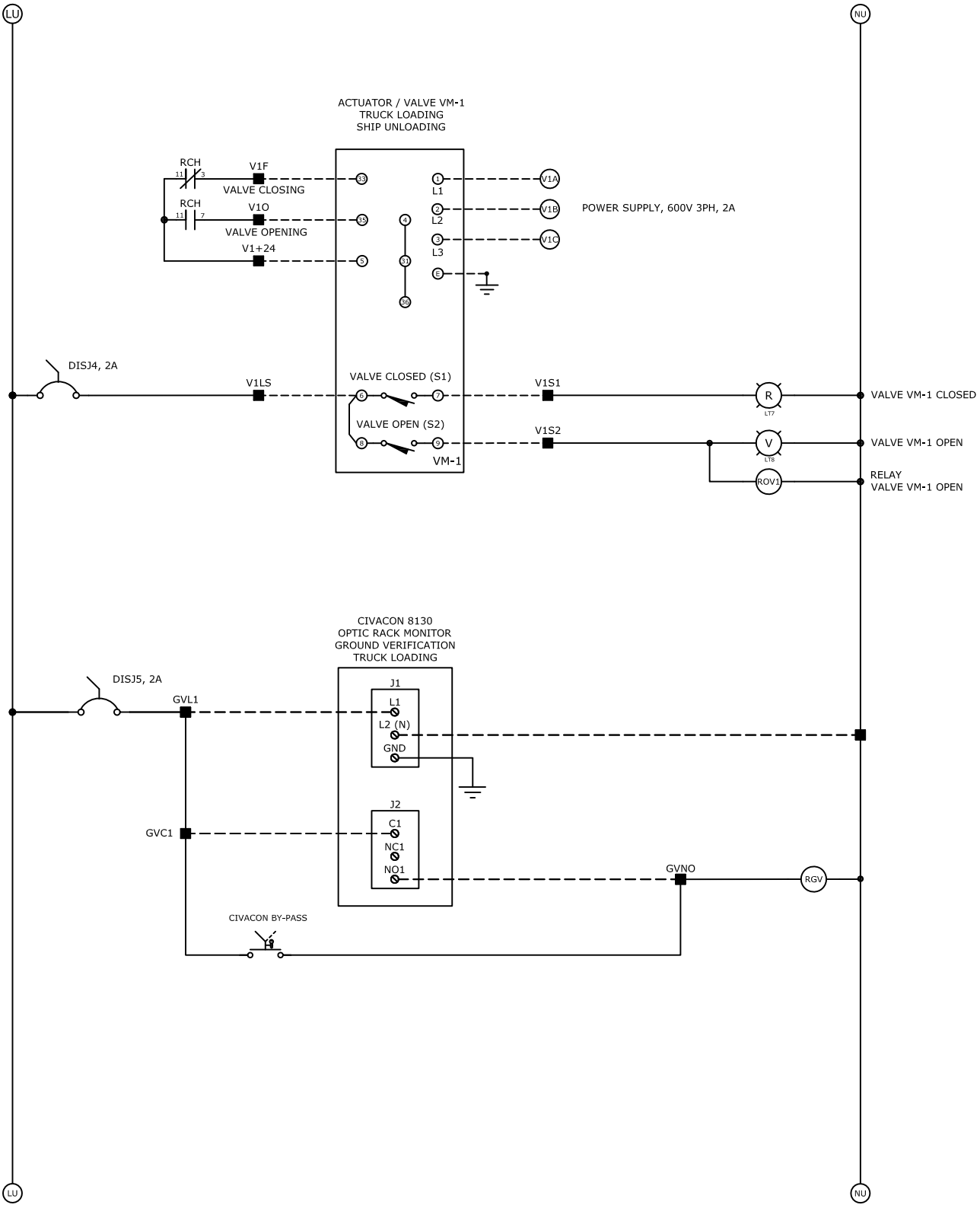
Projet : BAKER LAKE, TANK FARM JET-A				Dessiné par : Guillaume Boutin	Vérifié par :
Titre : CONTROL PANEL / MOTOR STARTER				No# Soumission	No# Projet : 30791
Client : AGNICO EAGLE	3	AS BUILT	29-11-13	Échelle : N/A	No# Dessin : *.dwg
	2	POUR FABRICATION	21-05-13		
	1	POUR SOUMISSION	14-05-13	Date : 14-05-2013	Feuille : 2/6
	No#	Révision	Date		



PAGUI inc.
FILIALE DU GROUPE SM TARDIF INC.

15971 DE LA COLLINE, LAC-ST-CHARLES
(QUEBEC) G3G 3A7
TELEPHONE : 849-1832
FAX : 849-2159

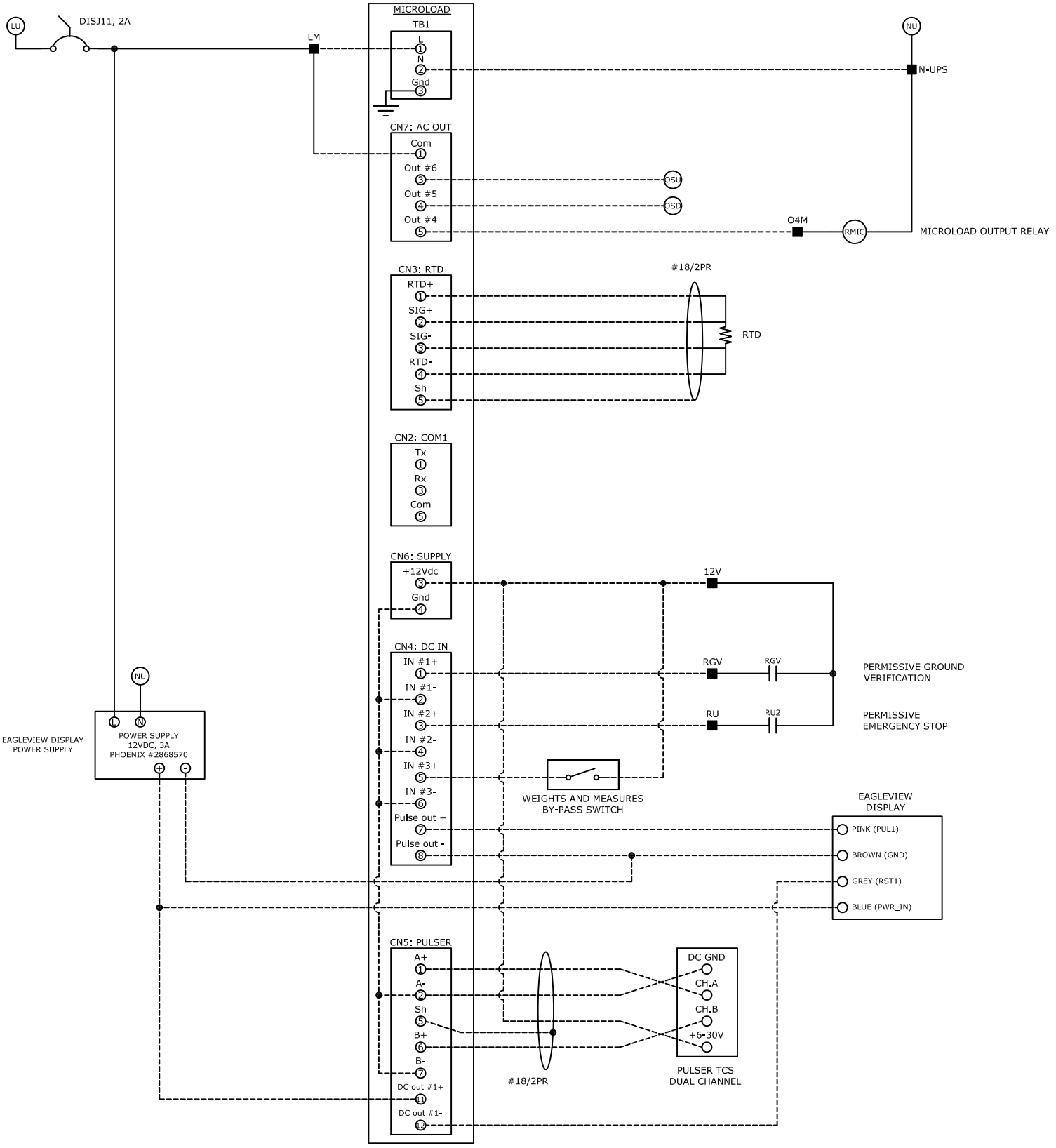
Projet : BAKER LAKE, TANK FARM JET-A				Dessiné par : Guillaume Boutin	Vérifié par :
Titre : CONTROL PANEL / MOTOR STARTER				No# Soumission	No# Projet : 30791
Client : AGNICO EAGLE	3	AS BUILT	29-11-13	Échelle : N/A	No# Dessin : *.dwg
	2	POUR FABRICATION	21-05-13		
	1	POUR SOUMISSION	14-05-13	Date : 14-05-2013	Feuille : 3/6
	No#	Révision	Date		



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(QUEBEC) G3G 3A7
TELEPHONE : 849-1832
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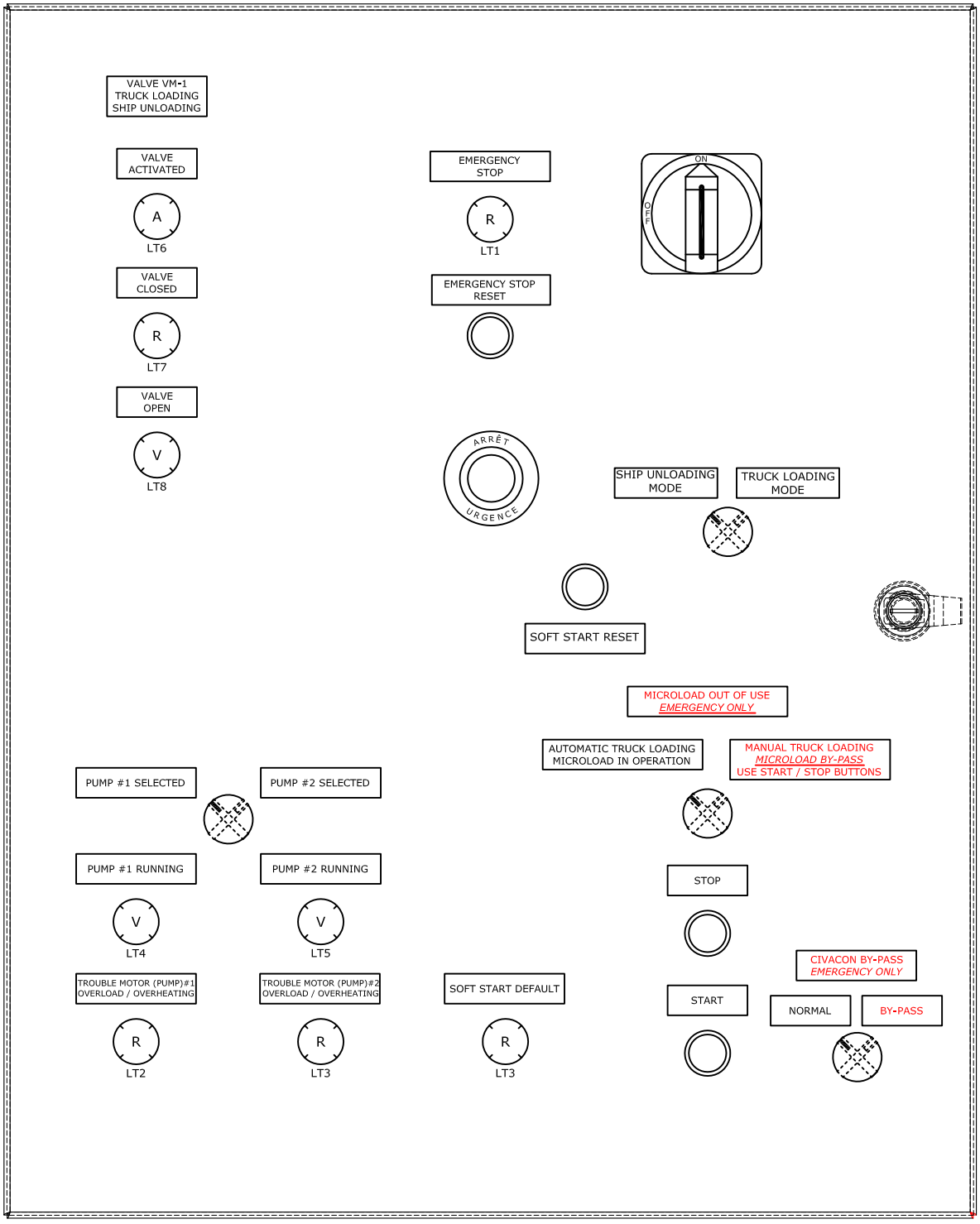
Projet : BAKER LAKE, TANK FARM JET-A				Dessiné par : Guillaume Boutin	Vérifié par :
Titre : CONTROL PANEL / MOTOR STARTER				No# Soumission	No# Projet : 30791
Client : AGNICO EAGLE	3	AS BUILT	29-11-13	Échelle : N/A	No# Dessin : *.dwg
	2	POUR FABRICATION	21-05-13		
	1	POUR SOUMISSION	14-05-13	Date : 14-05-2013	Feuille : 4/6
	No#	Révision	Date		



PAGUI inc.
FILIALE DU GROUPE SM TARDIF INC.

15971 DE LA COLLINE, LAC-ST-CHARLES
(QUEBEC) G3G 3A7
TELEPHONE : 849-1832
FAX : 849-2159

Projet : BAKER LAKE, TANK FARM JET-A				Dessiné par : Guillaume Boutin	Vérifié par :
Titre : CONTROL PANEL / MOTOR STARTER				No# Soumission	No# Projet : 30791
Client : AGNICO EAGLE	3	AS BUILT	29-11-13	Échelle : N/A	No# Dessin : *.dwg
	2	POUR FABRICATION	21-05-13		
	1	POUR SOUMISSION	14-05-13	Date : 14-05-2013	Feuille : 5/6
	No#	Révision	Date		



PAGUI inc.
FILIALE DU GROUPE SM TARDIF INC.

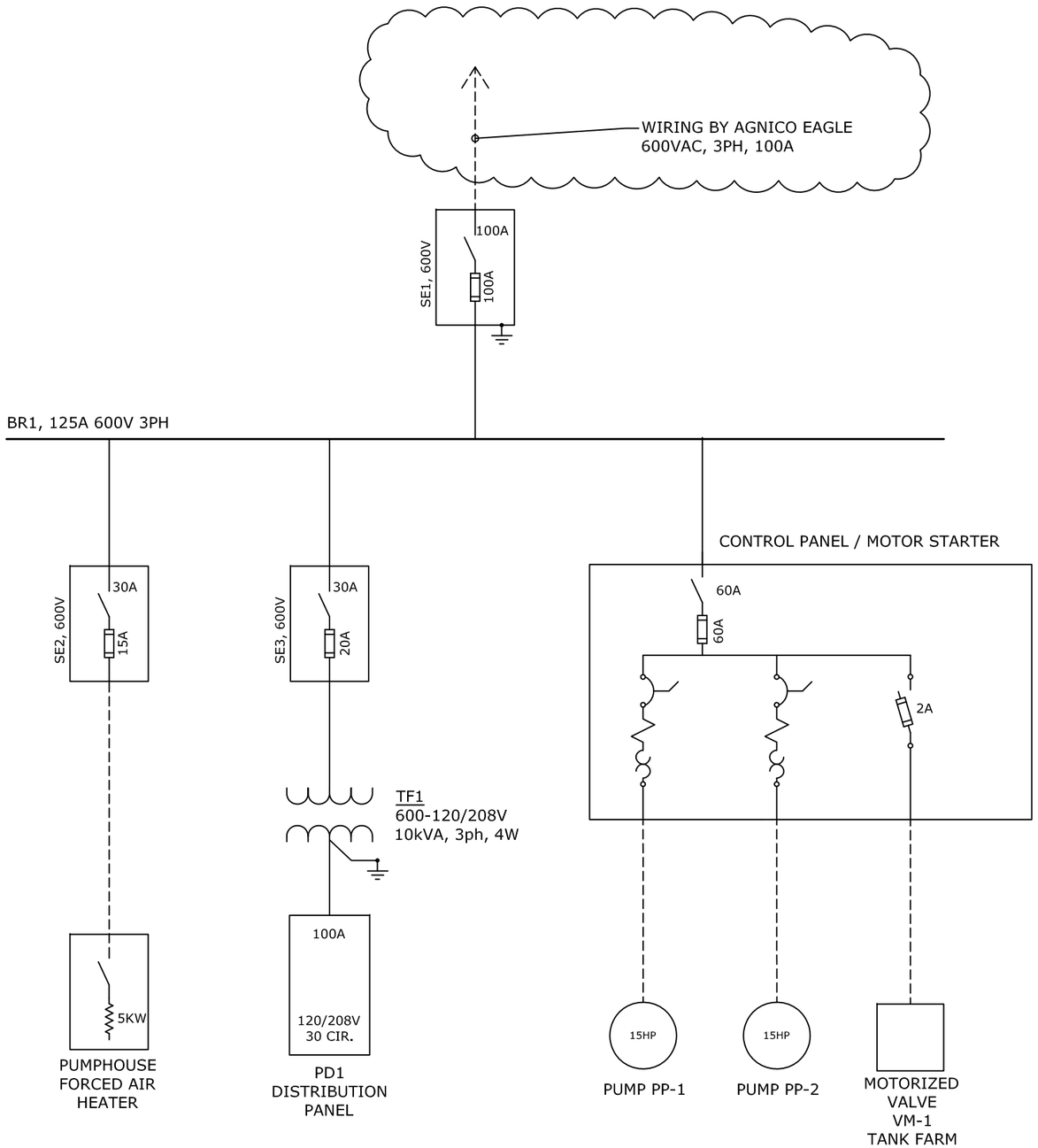
15971 DE LA COLLINE, LAC-ST-CHARLES
(QUEBEC) G3G 3A7
TELEPHONE : 849-1832
FAX : 849-2159

Projet : BAKER LAKE, TANK FARM JET-A				Dessiné par : Guillaume Boutin	Vérifié par :
Titre : PANNEAU DE CONTRÔLE / DÉMARREURS				No# Soumission	No# Projet : 30791
Client : AGNICO EAGLE	3	AS BUILT	29-11-13	Échelle : N/A	No# Dessin : *.dwg
	2	POUR FABRICATION	21-05-13		
	1	POUR SOUMISSION	14-05-13	Date : 14-05-2013	Feuille : 6/6
	No#	Révision	Date		

Manufacturer	Model number	Description	Qty
GOULD	AJT60	Fusible AJT 60 A 600V temporisé	3
GOULD	ATDRXX	Fusible time delay	9
HOFFMAN	A30N24BLP	Boîtier métal 30x24x8 Nema1	1
HOFFMAN	A30N24MP	Plaque de fond 30X24"	1
ITC	400.203	Porte fusible 3P 30A 600V	1
OMRON	MY4INAC110120S	Relais 4 pôles avec néon 120 Vac	10
OMRON	PYF14AE	Base de relais MY4	10
PHOENIX	3044102	Lot de bornes 30A UT4	1
PHOENIX	3044128	Lot de borne MALT UT4	1
PHOENIX	3044131	Lot de borne 50A UT6	1
POWERWARE	PW5110-500	UPS 120v 500VA classe 5	1
SCHNEIDER	60101	Mini disjoncteur BPC 1 pôle 1A	2
SCHNEIDER	60103	Mini disjoncteur BPC 1 pôle 2A	3
SCHNEIDER	60106	Mini disjoncteur BPC 1 pôle 5A	2
SCHNEIDER	GS1AM110	Contact auxiliaire pour GS1AM110	1
SCHNEIDER	GS2AE21	Tige 10x400mm pour GS2GU3 - QU3 et LK4JU3 -	1
SCHNEIDER	GS2AH140	Poignée rouge/jaune 10 mm 100-400A	1
SCHNEIDER	GS2GU3N	Sectionneur fusibles 60amp	1
SCHNEIDER	GV2ME20	Démarreur manuel 13-18A	2
SCHNEIDER	GVAN11	Contact aux. 1no/1nc GV2 montage côté	2
SCHNEIDER	LC1D18G7	Contacteur 15HP@600V 1no/1nc	2
SCHNEIDER	LC1D50AG7	Contacteur 40hp@600V 1no/1nc	2
SCHNEIDER	XB4BA942	Bouton de réarrmement rouge tige 130257	1
SCHNEIDER	ZB4BA9	Bouton poussoir affleurant 6 capuchons	2
SCHNEIDER	ZB4BG4	Sélecteur 2 pos. maintenues retrait à gauche	3
SCHNEIDER	ZB4BL4	Bouton poussoir 22mm dépassant rouge	2
SCHNEIDER	ZB4BT4	Champignon 22mm tête poussé/tiré 40mm rouge	1
SCHNEIDER	ZB4BV033	Tête verte lampe témoin led ZB4	3
SCHNEIDER	ZB4BV043	Tête rouge lampe témoin led ZB4	5
SCHNEIDER	ZB4BV053	Tête jaune lampe témoin à led ZB4	1
SCHNEIDER	ZB4BZ009	Embase de fixation pour série ZB4	8
SCHNEIDER	ZB4BZ101	Base de bouton avec 1no	4
SCHNEIDER	ZB4BZ102	Base de bouton avec 1 nc	1
SCHNEIDER	ZB4BZ102	Base de bouton avec 1 nc	1
SCHNEIDER	ZBE102	Bloc contact 1 nf	1
SCHNEIDER	ZBE102	Bloc contact 1 nf	2
SCHNEIDER	ZBG455	Pair de clé 455	5
SCHNEIDER	ZBVBG3	Led vert 24-120V	3
SCHNEIDER	ZBVBG4	Led rouge 24-120V	5
SCHNEIDER	ZBVBG5	Led jaune 24-120V	1
SCHNEIDER	ZBY9130	Plaque circulaire 60mm bouton 22mm ARRET	1
SIEMENS	3TK28251AJ20	Relais de sécurité 120v pour arrêt d'urgence Cat 4	1
SIEMENS	3RW40261BB15	Soft start 20hp, 600V ctrl 120 vac	1

PAGUI inc.
FILIALE DU GROUPE SM TARDIF INC.
15971 DE LA COLLINE, LAC-ST-CHARLES
(QUEBEC) G3G 3A7
TELEPHONE : 849-1832
FAX : 849-2159

Projet : BAKER LAKE, TANK FARM JET-A				Dessiné par : Guillaume Boutin	Vérifié par :
Titre : CONTROL PANEL PART LIST				No# Soumission	No# Projet : 30791
Client : AGNICO EAGLE	3			Échelle : N/A	No# Dessin : *.dwg
	2	AS BUILT	29-11-13		
	1	POUR SOUMISSION	14-05-13	Date : 14-05-2013	Feuille : 6/6
	No#	Révision	Date		



EQUIPMENT LIST

PD1:
Distribution panel
Square D, NQ, bolt-on
120/208V, 3ph, 4f. 100A, Aluminium

SE1:
Main disconnect switch
Square D, CH363
100 A, 600 Vac, 3 ph, fu.: 100A

SE2
Pumphouse heater disconnect switch
Square D, CH361
30 A, 600 V, 3 ph, fu.: 15 A

SE3
Transformer disconnect switch
Square D, CH361
30 A, 600 V, 3 ph, fu.: 20 A

TF1
Transformer
Bemag, BC3010V
600-120/208V, 10kVA, copper

BR1
Splitter through
Hoffman AST2123R
125 A, 600 Vac, 3 ph

CONTROL PANEL / MOTOR STARTER
30A, 600VAC, 3PH

PAGUI inc.
FILIALE DU GROUPE SM TARDIF INC.
15971 DE LA COLLINE, QUÉBEC
(QUEBEC) G3G 3A7
TELEPHONE : 849-1832
FAX : 849-2159

Projet : BAKER LAKE, TANK FARM JET-A				Dessiné par : Guillaume Boutin	Vérifié par :
Titre : ELECTRICAL DISTRIBUTION				No# Soumission	No# Projet : 30794
Client : AGNICO EAGLE	3			Échelle : N/A	No# Dessin : *.dwg
	2				
	1	AS BUILT (WORKSHOP)	27-06-13	Date : 14-05-2013	Feuille : 1/1
	No#	Révision	Date		