



Appendix F

Quality Assurance / Quality Control Plan



Hamlet of Cambridge Bay

Quality Assurance and Control Plan – Lagoon and Landfill

Prepared by:

AECOM
17203 103 Avenue NW
Edmonton, AB, Canada T5S 1J4
www.aecom.com

780 488 6800 tel
780 488 2121 fax

Project Number:
60120320

Date:
November, 2013

Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("Consultant") for the benefit of the client ("Client") in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations");
- represents Consultant's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to Consultant which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

Consultant shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. Consultant accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

Consultant agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but Consultant makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

Without in any way limiting the generality of the foregoing, any estimates or opinions regarding probable construction costs or construction schedule provided by Consultant represent Consultant's professional judgement in light of its experience and the knowledge and information available to it at the time of preparation. Since Consultant has no control over market or economic conditions, prices for construction labour, equipment or materials or bidding procedures, Consultant, its directors, officers and employees are not able to, nor do they, make any representations, warranties or guarantees whatsoever, whether express or implied, with respect to such estimates or opinions, or their variance from actual construction costs or schedules, and accept no responsibility for any loss or damage arising therefrom or in any way related thereto. Persons relying on such estimates or opinions do so at their own risk.

Except (1) as agreed to in writing by Consultant and Client; (2) as required by-law; or (3) to the extent used by governmental reviewing agencies for the purpose of obtaining permits or approvals, the Report and the Information may be used and relied upon only by Client.

Consultant accepts no responsibility, and denies any liability whatsoever, to parties other than Client who may obtain access to the Report or the Information for any injury, loss or damage suffered by such parties arising from their use of, reliance upon, or decisions or actions based on the Report or any of the Information ("improper use of the Report"), except to the extent those parties have obtained the prior written consent of Consultant to use and rely upon the Report and the Information. Any injury, loss or damages arising from improper use of the Report shall be borne by the party making such use.

This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

Table of Contents

Statement of Qualifications and Limitations

	page
1. Introduction.....	4
2. Sample Collection.....	5
2.1 Location	5
2.2 Sampling Parameters	5
2.3 Sampling Equipment.....	7
2.3.1 Flow Measurement – CAM-1	7
2.3.2 Water Quality Samples – CAM-4, CAM-5 and CAM-6	7
2.4 Sampling Methods	7
2.4.1 Replicates and Field Blanks	8
3. Sample Handling.....	9
3.1 Preservation.....	9
3.2 Sample Identification	9
3.3 Sample Transportation	9
4. Laboratory Analysis.....	10
5. Documentation and Records	11

List of Tables

Table 2.1. Monitoring Program Stations.....	5
Table 2.2. Sampling Station Parameters	5
Table 2.3. Monitoring Program Station Sampling Frequency	6
Table 4.1. Detection Limits and Analysis Methods for Analytical Parameters.....	10

1. Introduction

This Quality Assurance and Control Plan is intended to provide operating principles for the activities involved in the Hamlet of Cambridge Bay's Monitoring Program, specifically those required for the lagoon and landfill only. These operating principles will ensure that the samples collected for the Monitoring Program are reliable and of high quality.

Please note that this Quality Assurance and Control Plan is specific to Water License #3BM-CAM0914, issued April 30th, 2009. The Quality Assurance and Control Plan must be updated to meet the requirements of subsequent Water Licenses.

2. Sample Collection

2.1 Location

As per the Water License, the following Monitoring Program Stations will be utilized. Please refer to Figure 7.1 located in the Landfill Operations & Maintenance Manual for a map showing the approximate locations of CAM-4, CAM-5 and CAM-6.

Table 2.1. Monitoring Program Stations

Monitoring Program Station Number	Description
CAM-1	Raw water supply intake at Water Lake
CAM-4	Effluent from the eastern-most control pond in the Modified Solid Waste Disposal Facilities being discharged to the Retention Sewage Lagoon
CAM-5	Final Discharge Point for effluent from the Retention Sewage Lagoon to the Sewage Wetland
CAM-6	Outfall area for the Sewage Wetland

The Water License stipulates that CAM-4 is located at the sump in the Modified Solid Waste Disposal Facilities (landfill); however, this sump was not constructed. Instead, several control ponds were built in the ditches surrounding the landfill. All of these control ponds shall be designated as CAM-4, with the intent being that whichever of the control ponds are being pumped out shall be sampled. The control ponds are approximately 500 mm deep and should be pumped out to the lagoon (pending receipt of acceptable analytical results) when the depth of water in the ponds is about 300 mm or greater.

At the present time, the sampling locations shown on Figure 7-1 (located in the Landfill Operations & Maintenance Manual) are approximate – it is anticipated that sign posts will be installed during the next construction season. The co-ordinates of the sign posts (latitude and longitude) will be determined using GPS, and this Plan will be updated to include the new sign posts co-ordinates.

2.2 Sampling Parameters

Parameters of interest for each sampling station are shown in the Table below.

Table 2.2. Sampling Station Parameters

Parameter	Analytical Test Category	Monitoring Program Station		
		CAM-4	CAM-5	CAM-6
Alkalinity (Total)	Routine		X	X
Aluminum	Metals	X		
Ammonia Nitrogen	Nutrients		X	X
Arsenic	Metals	X	X	X
Barium	Metals	X		
Biochemical Oxygen Demand	Nutrients	X	X	X
Calcium	Routine		X	X
Cadmium	Metals	X	X	X
Chlorides	Routine	X	X	X

Parameter	Analytical Test Category	Monitoring Program Station		
Chromium	Metals	X	X	X
Cobalt	Metals		X	X
Conductivity	Routine		X	X
Copper	Metals	X	X	X
Cyanide	Cyanide (Special Request)	X		
Fecal Coliforms	Sterile		X	X
Fluoride	Routine	X		
Hardness	Routine		X	X
Lead	Metals	X	X	X
Iron	Metals	X	X	X
Magnesium	Routine		X	X
Manganese	Metals		X	X
Mercury	Metals	X	X	X
Nickel	Metals	X	X	X
Nitrate-Nitrite	Routine		X	X
Oil & Grease	Hexane Extractable Material	X	X	X
pH Range	Routine	X	X	X
Phenolic Compounds	Phenol (Special Request)	X		
Phosphorus	Nutrients	X		
Potassium	Routine		X	X
Silver	Metals	X		
Sodium	Routine		X	X
Sulphates	Routine	X	X	X
Sulphides	Sulphides (Special Request)	X		
Suspended Solids	Nutrients	X	X	X
Tin	Metals	X		
Total Organic Carbon (TOC)	Nutrients		X	X
Zinc	Metals	X	X	X

For CAM-1, the Hamlet is required only to measure and record the monthly and annual quantities of water pumped at that location.

Sampling frequency for each Monitoring Program Station is shown below.

Table 2.3. Monitoring Program Station Sampling Frequency

Monitoring Program Station	Sampling Frequency
CAM-4	Prior to discharge
CAM-5	Once at beginning of discharge, once during middle of discharge, and once near end of discharge
CAM-6	Monthly, during periods of observed flow

As noted above, for CAM-1, the Hamlet is required to measure and record pumped water quantities on a monthly and annual basis.

2.3 Sampling Equipment

2.3.1 Flow Measurement – CAM-1

Only volumes/flowrates are measured at the Monitoring Program Station CAM-1. The flow meter used (with totalizer) must be inspected and calibrated regularly as per the manufacturer's guidelines.

As mentioned in Section 1, this QA/QC plan is only for the lagoon and landfill. It is anticipated that the raw water intake flow meter will be maintained as part of activities related to providing potable water for the Hamlet of Cambridge Bay.

2.3.2 Water Quality Samples – CAM-4, CAM-5 and CAM-6

For water quality samples, it is anticipated that the only equipment needed will be the sample bottles and coolers. For the Monitoring Program Stations CAM-4, CAM-5 and CAM-6, sample bottles will be ordered from the analytical laboratory prior to testing, for each testing event. The sample bottles ordered will be specific to the tests requested, and will be of the type recommended by the analytical laboratory. Sample analysis will be performed by the same analytical laboratory.

As filtration does not appear to be required for any of the specified water quality samples, the Hamlet does not require filtration equipment. Moreover, there is not anticipated to be any need for specific stream sampling equipment, as the Monitoring Program Stations are either still water bodies or shallow streams and thus Hamlet staff should be able to obtain samples from the bank.

Since the Monitoring Program Stations CAM-4, CAM-5 and CAM-6 are anticipated to be sampled only a few times per year, re-use of sample bottles is not recommended. It may be difficult for the Hamlet to allocate the facilities and man hours necessary to properly wash sample bottles, and storage space is likely limited.

2.4 Sampling Methods

As mentioned above, stream water samples will be collected by Hamlet staff, and flown to an outside analytical laboratory for analysis. Samples will be obtained in accordance with the analytical laboratory's sampling instructions (Appendix G).

To ensure that samples arriving at the laboratory accurately reflect the site conditions, these general precautions must be taken:

- Obtain sample bottles and de-ionized water from the ISO accredited laboratory which will be performing the testing, and follow all instructions regarding their storage and usage
- Wear gloves when taking samples
- Avoid contaminating clean containers
- Determine the allowable headspace (air) in the sample container: most samples should fill the bottle, but some analyses (such as for volatile organic parameters) require absolutely no headspace, whereas a sample for

coliform counts should have two (2) centimeters of headspace. To check for the presence or absence of headspace, tilt the closed sample container upside-down and check for bubbles or large airspaces.

- Keep samples cool, but do not allow them to freeze. 4°C is recommended for most samples; if the temperature of the water is allowed to drop below zero, a sample may freeze and break the container (if glass). Thus, keep the samples in a cooler with ice, but do not leave the cooler outside for a long period of time during cold weather.
- If ice is used in the sample cooler, use additional packaging such as bubble wrap for glass containers, so that when the ice melts, the containers are still supported and cannot damage each other.
- Send samples to the laboratory as soon as possible. Some analyses have an allowable hold time as short as 24-48 hours. While samples can be analyzed past the hold time, the results are less reliable.
- Collect replicates and field blanks at the same time as samples.

2.4.1 Replicates and Field Blanks

The Hamlet should occasionally send a duplicate sample (taken at the same time, from the same location as the first sample) to the laboratory to check that consistent sampling is being done. To ensure sampling integrity, a duplicate sample should be taken once every ten (10) samples for wastewater samples from CAM-5 and CAM-6.

Likewise, a field blank should be collected at least once per sampling event for both CAM-5 and CAM-6. A field blank is a sample of distilled/deionized water that treated in same manner as samples, and is therefore taken to the field and handled identically

It is anticipated that CAM-4 events will be very infrequent, i.e., less than annually. It is recommended that for CAM-4 sampling events, complete sampling suites (all required tests) be performed on duplicates (either replicates or splits) and blanks for every sampling event.

3. Sample Handling

3.1 Preservation

Samples may need to be chemically preserved or kept at a certain temperature during storage and transportation to the laboratory. Samples must also arrive at the laboratory and be tested within a certain time frame (hold time), the length of which depends on the type of analysis to be performed. These requirements depend on the type of analysis that will be done; refer to *Standard Methods* and the laboratory guidelines. Taiga Environmental Laboratory's requirements are included in Appendix G.

For those samples requiring chemical preservation, preservative(s) will be added at the time of sample collection. Typically, these preservatives are provided along with the sample bottles and thus the amount of preservatives and concentration is determined by the analytical laboratory providing the sample bottles.

3.2 Sample Identification

Samples should be properly labeled to avoid confusion and inaccurate Monitoring Program reporting. The label on each sample needs to include:

- Sampling date and time
- Sample number (i.e. CAM-4.1).
- Monitoring Program station or other location
- Name of the sample collector
- Sample type (i.e. if the sample is for metals or routine analysis)
- Any preservative used
- Any other identifying label required by the laboratory (for example "Metals" if intended for metals analysis)
- Any other information that is important for identifying the sample.

It is anticipated that sample bottles will be supplied with labels that the sample collector can fill in. These labels must be filled in using a water resistant, non-smearing felt pen or grease pencil. In addition, it is recommended that the sample number, sampling date and sampling time be marked on the lid of each sample.

The Hamlet should keep a logbook for sampling events. This logbook should include the date and time of sampling event, sampling locations, number of samples, and time that samples were shipped out for analysis.

3.3 Sample Transportation

It is anticipated that the timing of sampling events will be chosen to coincide with scheduled flights to Yellowknife. Hamlet staff responsible for sample collection should conduct the sampling event such that samples are all collected and delivered to the airport several hours before the flight to Yellowknife is scheduled to leave.

The Hamlet should follow the analytical laboratory's shipping instructions. It is likely that samples will be shipped in coolers. Samples should be stored upright in the coolers, with cold packs and/or bubble wrap in between sample containers to reduce the possibility of sample containers breaking during transport. The use of cold packs or ice (cold packs are preferred) is recommended to maintain refrigeration for samples that require it. It may be advisable to secure the cooler lids with packing tape to ensure that the coolers remain closed during transportation and handling.

4. Laboratory Analysis

All analyses will be conducted by Taiga Environmental Laboratory, with the exception of cyanide, sulphides and phenolic compounds, which are subcontracted to a private analytical laboratory (also with CALA accreditation). Taiga's accreditation, methods used for analyses and detection limits for these analyses can be found in Appendix G.

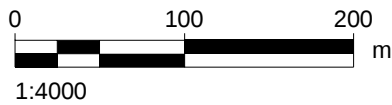
Methods and detection limits for the subcontracted analytical parameters can be seen in the Table below.

Table 4.1. Detection Limits and Analysis Methods for Analytical Parameters

Parameter	Detection Limit	Analysis Method
Total Cyanide	0.002 mg/L	EPA 335.3
Cyanide – weak acid dissociable	0.004 mg/L	SM 4500-CN:I
Cyanide – strong acid dissociable	0.002 mg/L	APHA 4500-CN-C
Total Phenol	0.002 mg/L	APHA 5530D
Sulphide	0.005 mg/L	SM 4500-S2-E

5. Documentation and Records

Results from the Monitoring Program must be included in the Annual Water License Report prepared by the Hamlet. Therefore, organized records should be kept of all laboratory analysis results, AANDC inspection reports, and field observations (for instance the presence of oil and grease on the lagoon surface, or lagoon colour).



SAMPLING LOCATION	DESCRIPTION
CAM 4	EFFLUENT FROM MODIFIED SOLID WASTE DISPOSAL FACILITIES BEING DISCHARGED TO THE RETENTION SEWAGE LAGOON
CAM 5	FINAL DISCHARGE POINT FOR EFFLUENT FROM THE RETENTION SEWAGE LAGOON TO THE SEWAGE WETLAND
CAM 6	OUTFALL AREA FOR THE SEWAGE WETLAND

EDGE OF ROAD (ELEV. 10.0m)	
DRAINAGE ROUTE	
RIP-RAP	
SEWAGE LAGOON/WETLAND BERM	
RUNOFF DIVERSION BERM	
OPEN WATER SECTION OF WETLAND	
FREE BOARD	
MAX OPERATION WATER LEVEL	
OPEN WATER SECTION	
SAMPLE POINT	

ELEVATIONS ARE EXPRESSED IN METER OR DECIMALS THEREOF.

BERM POINTS	NORTHING	EASTING
1	7667952.67	498928.34
2	7667964.75	498917.18
3	7668055.83	498919.56
4	7668050.75	498889.87
5	7668126.82	499757.16
6	7668252.15	498757.16
7	7668170.48	498878.77
8	7668372.90	499006.76
9	7668397.97	499082.42
10	7668347.00	498898.03
11	7668357.13	498883.20
12	7668505.96	498748.79
13	7668363.63	498956.63
14	7668573.61	498560.76
15	7668557.39	498499.29
16	7668597.34	498411.69
17	7668638.10	498410.28
18	7668722.31	498329.19
19	7668767.59	498452.94
20	7668684.04	498619.15
21	7668740.07	498610.20
22	7668835.17	498930.79
23	7668764.43	498930.23
24	7668752.28	498938.93
25	7668702.41	499054.24
26	7668171.72	498764.31
27	7668171.12	498829.37
28	7668170.48	498878.77
29	7667956.60	498915.42
30	7667970.84	498901.51



Aboriginal Affairs and
Northern Development Canada

Affaires autochtones et
Développement du Nord Canada

P. O. Box 1500
Yellowknife, NT X1A 2R3

Files :

License # #3BM-CAM0914

November 22, 2013

Ms Maureen Nakonechny
Water/Wastewater Engineer
AECOM
17203-103 Avenue
Edmonton, AB T5S 1J4

Dear Ms Nakonechny :

**Re: Quality Assurance/Quality Control Plan
 Hamlet of Cambridge Bay
 Water Board License #3BM-CAM0914
 Kitikmeot, NUNAVUT**

Submitted: November 7, 2013

Reviewed : November 8 and November 21, 2013

Thank you for the submission of the updated Quality Assurance and Quality Control Plan you have prepared for Hamlet of Cambridge Bay as per the Surveillance Monitoring Program outlined in the Nunavut Water Board issued Water License #3BM-CAM0914.

The license regulates the use of water and disposal of waste for the Hamlet of Cambridge Bay, located within the Kitikmeot Region, Nunavut.

Upon review, it has been found that the QAQC Plan is complete. Approval of the Plan is hereby granted. Should you require further information, please do not hesitate to contact me at (867) 669-2781.

Sincerely,

Angelique Ruzindana, M.Sc., Ph.D

Analyst Under the *Northwest Territories and Nunavut Waters Act*



Appendix G

Water Sampling Instructions, Forms and Documentation



CALA

Canadian Association for
Laboratory Accreditation Inc.

CALA Directory of Laboratories

Membership Number: 2635
Laboratory Name: Taiga Environmental Laboratory
Parent Institution: Aboriginal Affairs and Northern Development Canada (AANDC)
Address: P.O. Box 1500 4601 - 52nd Avenue Yellowknife NT X1A 2R3
Contact: Ms. Angelique Ruzindana Umunyana
Phone: (867) 669-2781
Fax: (867) 669-2718
Email: angelique.ruzindanaumunyana@aandc-aadnc.gc.ca

Standard: Conforms with requirements of ISO/IEC 17025
Clients Served: All Interested Parties
Revised On: August 31, 2012
Valid To: February 5, 2014

Scope of Accreditation

Solids (Inorganic)

Metals - Soil, Sediment (079)

TEL 061; modified from EPA SW-846 METHOD 3050 A

ICP/MS

Aluminum

Antimony

Arsenic

Barium

Beryllium

Boron

Cadmium

Calcium

Chromium

Cobalt

Copper

Iron

Lead

Lithium

Magnesium

Manganese

Mercury

Molybdenum

Nickel

Potassium

Selenium

Silver

Sodium

† "OSDWA" indicates the appendix is used for the analysis of Ontario drinking water samples, which is subject to the rules and related regulations under the Ontario "Safe Drinking Water Act" (2002).

The list of tests and measurement capabilities for which a laboratory is accredited can change at any time due to circumstances such as scope extensions, voluntary withdrawal of tests by the laboratory and suspension. Scopes are published by the CALA via the Internet at http://www.cala.ca/cala_directories.html

Strontium
Tin
Titanium
Uranium
Vanadium
Zinc

Solids (Inorganic)

Moisture - Soil (030)
TEL007; CWS-PHC CCME Tier 1
GRAVIMETRIC
Moisture

Solids (Organic)

BTEX - Soil (072)
TEL 038; modified from USEPA 5030 B, 602, 502.2
GC/MS - PURGE AND TRAP
Benzene
Ethylbenzene
m/p-xylene
o-xylene
Toluene

Solids (Organic)

Petroleum Hydrocarbons (PHC) - Soil (073)
TEL 057; modified from USEPA SW 846 METHODS 3500 B, 3541, 3630 C, 8100, 8310
GC/FID - PURGE AND TRAP
F2: C10-C16
F3: C16-C34
F4: C34-C50

Solids (Organic)

Petroleum Hydrocarbons (PHC) - Soil (075)
TEL 046; modified from US EPA SW-846 METHODS 5030, 8000, 8015, 8260 B
SOX THERM EXTRACTION - GRAVIMETRIC
F4: Gravimetric

Solids (Organic)

Polycyclic Aromatic Hydrocarbons (PAH) - Soil (071)
TEL 047; modified from USEPA SW 846 METHODS 3500 B, 3541, 3630 C, 8100, 8310
GC/MS - EXTRACTION
Acenaphthene
Acenaphthylene
Anthracene (Parameter suspended on 8/1/2012)
Benzo (a) anthracene
Benzo (a) pyrene
Benzo (b) fluoranthene
Benzo (g,h,i) perylene
Benzo (k) fluoranthene (Parameter suspended on 8/1/2012)
Chrysene
Dibenzo (a,h) anthracene
Fluoranthene
Fluorene
Indeno (1,2,3 - cd) pyrene
Naphthalene
Phenanthrene
Pyrene

† "OSDWA" indicates the appendix is used for the analysis of Ontario drinking water samples, which is subject to the rules and related regulations under the Ontario "Safe Drinking Water Act" (2002).

The list of tests and measurement capabilities for which a laboratory is accredited can change at any time due to circumstances such as scope extensions, voluntary withdrawal of tests by the laboratory and suspension. Scopes are published by the CALA via the Internet at http://www.cala.ca/cala_directories.html

Solids (Organic)

Purgeable Hydrocarbons- Soil (074)
TEL 056; CWS-PHC CCME TIER 1
GC/FID - PURGE AND TRAP
F1: C6-C10

Water (Inorganic)

Alkalinity - Water (066)
TEL 060:PC TITRATE; modified from SM 2320 A, B
AUTO TITRIMETRIC
Alkalinity (pH 4.5)

Water (Inorganic)

Ammonia - Water (022)
TEL013; modified from SM 4500-NH3 G
AUTO COLOR
Ammonia

Water (Inorganic)

Ammonia as Nitrogen - Water (089)
TEL 068; modified from SM 4500-NH3 G
COLORIMETRIC - DISCRETE
Ammonia

Water (Inorganic)

Anions - Water (059)
TEL 055; modified from SM 4110 B
ION CHROMATOGRAPHY
Chloride
Fluoride
Nitrate
Nitrite
Sulfate

Water (Inorganic)

Biochemical Oxygen Demand (BOD) - Water (004)
TEL 019/TEL 071; modified from SM 5210 A, B
D.O. METER/PC-BOD
BOD (5 day)
CBOD (5 day)

Water (Inorganic)

Carbon - Water (029)
TEL033; modified from SM 5310 B
INFRARED
Organic Carbon

Water (Inorganic)

Cations - Water (042)
TEL055; modified from SM 4110 B
ION CHROMATOGRAPHY
Calcium
Magnesium
Potassium
Sodium

† "OSDWA" indicates the appendix is used for the analysis of Ontario drinking water samples, which is subject to the rules and related regulations under the Ontario "Safe Drinking Water Act" (2002).

The list of tests and measurement capabilities for which a laboratory is accredited can change at any time due to circumstances such as scope extensions, voluntary withdrawal of tests by the laboratory and suspension. Scopes are published by the CALA via the Internet at http://www.cala.ca/cala_directories.html

Water (Inorganic)

Chemical Oxygen Demand (COD) - Water (061)

TEL 016; modified from SM 5220 D
REFLUX - COLORIMETRIC
COD

Water (Inorganic)

Chlorine - Water (078)

TEL049; modified from SM 4500-Cl G
HACH
Free Chlorine
Total Chlorine

Water (Inorganic)

Colour - Water (063)

TEL 051; modified from SM 2120 C
HACH - SPECTROPHOTOMETRIC
Apparent Color
True Colour

Water (Inorganic)

Conductivity - Water (068)

TEL 059:PC TITRATE; modified from SM 2510 B
AUTO CONDUCTIVITY METER
Conductivity (25°C)

Water (Inorganic)

Dissolved Metals - Water (013)

TEL035; modified from US EPA 200.8

ICP/MS
Aluminum
Antimony
Arsenic
Barium
Beryllium
Boron
Cadmium
Cesium
Chromium
Cobalt
Copper
Iron
Lead
Lithium
Manganese
Molybdenum
Nickel
Rubidium
Selenium
Silver
Strontium
Thallium
Tin
Titanium
Uranium
Vanadium
Zinc

† "OSDWA" indicates the appendix is used for the analysis of Ontario drinking water samples, which is subject to the rules and related regulations under the Ontario "Safe Drinking Water Act" (2002).

The list of tests and measurement capabilities for which a laboratory is accredited can change at any time due to circumstances such as scope extensions, voluntary withdrawal of tests by the laboratory and suspension. Scopes are published by the CALA via the Internet at http://www.cala.ca/cala_directories.html

Water (Inorganic)

Hexane Extractable Material (Oil and Grease) - Water (060)

TEL 024: HEM AND SGT-HEM; modified from US EPA 1664 A, REVISION A
SOLID PHASE EXTRACTION

Mineral Oil and Grease

Total Oil and Grease

Water (Inorganic)

Mercury - Water (080)

TEL 062; modified from EPA 245.7

ATOMIC FLUORESCENCE MERCURY ANALYSIS SYSTEM

Mercury

Water (Inorganic)

pH - Water (067)

TEL 058:PC TITRATE; modified from SM 4500-H+ A, B

AUTO - pH METER

pH

Water (Inorganic)

Phosphate - Water (040)

TEL015; modified from SM 4500-P D

AUTO COLOR

Phosphate

Water (Inorganic)

Phosphate - Water (087)

TEL 069; modified from SM 4500-P F

DISCRETE ANALYZER

Phosphate

Water (Inorganic)

Phosphorus - Water (009)

TEL015; modified from SM 4500-P B, D

AUTO COLOR - DIGESTION

Dissolved Phosphorus

Total Phosphorus

Water (Inorganic)

Reactive Silica - Water (007)

TEL012; modified from SM 4500-SiO₂ F

AUTO COLOR

Reactive Silica

Water (Inorganic)

Reactive Silica - Water (090)

TEL 070; modified from SM 4500-Si F

COLORIMETRIC - DISCRETE ANALYZER

Reactive Silica

Water (Inorganic)

Solids - Water (011)

TEL008, TEL009; modified from SM 2540 C, D

GRAVIMETRIC

Total Dissolved Solids

Total Suspended Solids

† "OSDWA" indicates the appendix is used for the analysis of Ontario drinking water samples, which is subject to the rules and related regulations under the Ontario "Safe Drinking Water Act" (2002).

Water (Inorganic)

Total and Dissolved Nitrogen - Water (086)

TEL 066; modified from ISO/TR 11905:1997(E) and ASTM D 5176-91

PYROLYSIS AND CHEMILUMINESCENCE DETECTION

Dissolved Nitrogen

Total Nitrogen

Water (Inorganic)

Total and Dissolved Phosphorus - Water (088)

TEL 069; modified from SM 4500-P F

COLORIMETRIC - DISCRETE

Dissolved Phosphorus

Total Phosphorus

Water (Inorganic)

Total Metals - Water (054)

TEL035; modified from US EPA 200.8

ICP/MS

Aluminum

Arsenic

Barium

Beryllium

Boron

Cadmium

Cesium

Chromium

Cobalt

Copper

Iron

Lead

Lithium

Manganese

Mercury

Molybdenum

Nickel

Rubidium

Selenium

Silver

Strontium

Thallium

Tin

Titanium

Uranium

Vanadium

Zinc

Water (Inorganic)

Turbidity - Water (028)

TEL006; modified from SM 2130 B

NEPHELOMETRY

Turbidity

Water (Microbiology)

Coliforms - Water (045)

TEL053; modified from IDEXX QUANTI-TRAY

MOST PROBABLE NUMBER (QUANTI-TRAY)

Escherichia coli (E. coli)

† "OSDWA" indicates the appendix is used for the analysis of Ontario drinking water samples, which is subject to the rules and related regulations under the Ontario "Safe Drinking Water Act" (2002).

Total Coliforms

Water (Microbiology)

Fecal (Thermotolerant) Coliforms - Water (041)

TEL017; modified from SM 9222 D

MEMBRANE FILTRATION (mFC)

Fecal (Thermotolerant) Coliforms

Water (Microbiology)

Fecal Streptococci - Water (055)

TEL053; modified from IDEXX QUANTI-TRAY

MOST PROBABLE NUMBER (QUANTI-TRAY)

Fecal Streptococcus

Water (Organic)

BTEX - Water (070)

TEL 037 (BTEX); modified from USEPA METHOD 5030 B, 602, 502.2

GC/MS - PURGE AND TRAP

Benzene

Ethylbenzene

m/p-xylene

o-xylene

Toluene

Water (Organic)

Extractable Hydrocarbons - Water (085)

TEL 067; modified from SM 6010 and USEPA 3510C, 3630C

GC/FID - SOLID PHASE EXTRACTION

C10-C50

Water (Organic)

Purgeable Hydrocarbons - Water (084)

TEL 044; modified from USEPA SW-846 5030, 8000, 8015, 8260B

GC/FID - PURGE AND TRAP

C6-C10

Water (Organic)

Trihalomethanes (THM) - Water (077)

TEL039 (THM); modified from USEPA 5030 B, 602, 502.2

GC/MS - PURGE AND TRAP

Bromodichloromethane

Bromoform

(Parameter suspended on 8/1/2012)

Chlorodibromomethane

Chloroform

† "OSDWA" indicates the appendix is used for the analysis of Ontario drinking water samples, which is subject to the rules and related regulations under the Ontario "Safe Drinking Water Act" (2002).

The list of tests and measurement capabilities for which a laboratory is accredited can change at any time due to circumstances such as scope extensions, voluntary withdrawal of tests by the laboratory and suspension. Scopes are published by the CALA via the Internet at http://www.cala.ca/cala_directories.html

Taiga Environmental Laboratory Detection Limits

Parameter	Analytical Test Category	Detection Limits
Alkalinity (Total)	Routine	0.4 mg/L
Aluminum	Metals	0.6 µg/L
Ammonia Nitrogen	Nutrients	0.005 mg/L
Arsenic	Metals	0.2 µg/L
Barium	Metals	0.1 µg/L
Biochemical Oxygen Demand	Nutrients	2 mg/L
Calcium	Routine	0.1 mg/L
Cadmium	Metals	0.05 µg/L
Chlorides	Routine	0.7 mg/L
Chromium	Metals	0.1 µg/L
Cobalt	Metals	0.1 µg/L
Conductivity	Routine	0.4 µS/cm
Copper	Metals	0.2 µg/L
Fecal Coliforms	Sterile	1 CFU/100 mL
Fluoride	Routine	0.1 mg/L
Hardness	Routine	0.7 mg/L
Lead	Metals	0.1 µg/L
Iron	Metals	5 µg/L
Magnesium	Routine	0.1 mg/L
Manganese	Metals	0.1 µg/L
Mercury	Metals	0.01 µg/L
Nickel	Metals	0.1 µg/L

Parameter	Analytical Test Category	Detection Limits
Nitrate-Nitrite	Routine	0.01 mg/L
Oil & Grease	Hexane Extractable Material	2.0 mg/L
pH Range	Routine	0 – 14 pH units
Phosphorus	Nutrients	0.002 mg/L
Potassium	Routine	0.1 mg/L
Silver	Metals	0.1 µg/L
Sodium	Routine	0.1 mg/L
Sulphates	Routine	1 mg/L
Suspended Solids	Nutrients	3 mg/L
Tin	Metals	0.1 µg/L
Total Organic Carbon (TOC)	Nutrients	0.5 mg/L
Zinc	Metals	0.4 µg/L



Taiga Environmental Laboratory

4601 52nd Avenue – Yellowknife, NT X1A 2R3

Phone: (867) 669-2788 Fax: (867) 669-2718 Email: taiga@inac-ainc.gc.ca

Water Sampling Instructions

Collecting the Sample



Step One:

Prior to sampling, ensure you have obtained all the sampling equipment you require, such as the proper bottles, filtration devices, *etc.* Refer to Taiga's Field Sheet and Bottle &/or Preservation Order Form. If there are any questions or concerns, do not hesitate to contact the laboratory. Please have your water license (if applicable) available before contacting the laboratory to ensure proper bottles are ordered. **Note: you may need more than one bottle per sampling site.**



Step Two:

Check your local departure flight schedule to Yellowknife for the day you plan to take your samples. Samples should be shipped to the Laboratory **as soon as possible** after collection. Time your sampling so that the samples can be shipped out by plane as soon as possible.



Step Three:

Follow the sampling instructions on the back of this sheet for each bottle type. Package bottles in a cooler and send to the laboratory. If you require microbiological tests, such as Total Coliforms, E. coli., Fecal Coliforms, BOD, *etc.*, please contact the laboratory with the collection date and time, the Airline name, the waybill number and the expected time of arrival.



Safety Issues:

Wear appropriate gloves when collecting any sample to avoid contamination and possible exposure to unhealthy substances. The sample preservatives provided by the Laboratory are corrosive and will cause a burning sensation on the skin. If you should spill any on your skin or clothes, rinse the area **immediately** with lots of cool water. Call a doctor should the burning sensation continue.



Taiga Environmental Laboratory

4601 52nd Avenue – Yellowknife, NT X1A 2R3

Phone: (867) 669-2788 Fax: (867) 669-2718 Email: taiga@inac-ainc.gc.ca

Water Sampling Instructions

Collecting the Sample

Parameter Group		Marking	Preservative	Instructions
	Routine	GREEN	Keep cool at 4°C	1. Rinse bottle three (3) times with sample 2. Fill to top and cap bottle.
	Nutrients	BLACK	Keep cool at 4°C	
	Biochemical Oxygen Demand (BOD)/Carbonaceous BOD (CBOD)	PURPLE	Keep cool at 4°C	1. Rinse bottle three (3) times with sample 2. Fill to top and cap bottle. 3. Sample must be sent to laboratory within 24 hours
	Microbiological	STERILE	Sodium thiosulphate and Keep cool at 4°C	1. DO NOT RINSE BOTTLE 2. Fill to top and cap bottle. 3. Sample must be sent to laboratory within 24 hours
	Total Metals	RED	5mL of 1:3 nitric acid in RED-dot vials	1. Rinse bottle three (3) times with sample 2. Fill to near the top. 3. Add contents of preservative vial 4. Cap bottle and mix.
	Dissolved Metals	RED	5mL of 1:3 nitric acid in RED-dot vials	1. Filter Sample with 0.45 µm Cellulose Acetate filter 2. Rinse bottle three (3) times with filtrate 3. Fill to near the top. 4. Add contents of preservative vial 5. Cap bottle and mix.
	Hexane Extractable Material (HEM) (also known as Oil and Grease)	YELLOW	4mL 1:1 sulphuric acid in YELLOW-dot vial	1. DO NOT RINSE BOTTLE 2. Fill to shoulder of bottle. 3. Add contents of preservative vial 4. Cap bottle and mix
	BTEX, THM & Purgeable Hydrocarbons	40 mL CLEAR GLASS W/ WHITE LID	Keep cool at 4°C	1. DO NOT RINSE BOTTLE 2. Fill bottle completely leaving NO air bubbles
	Extractable Hydrocarbons	1 L AMBER GLASS W/ WHITE LID	Keep cool at 4°C	1. DO NOT RINSE BOTTLE 2. Fill to top and cap bottle.
	Cyanide	BLUE	1mL of 6N sodium hydroxide	1. Rinse bottle three (3) times with sample 2. Fill to near the top. 3. Add contents of preservative vial 4. Cap bottle and mix.
	Thiocyanate	ORANGE	2ml of 25% sulphuric acid or keep cool at 4°C	
	Phenol	YELLOW with P	2mL of 20% sulphuric acid	
	Sulphide	ORANGE with S	2mL of 25% zinc acetate	
	Radionuclide	No Markings	10mL of 17.5% nitric acid per 1L sample	
	Chlorophyll A	1L PLASTIC BOTTLE	Keep cool at 4°C and keep in dark	1. Rinse bottle three (3) times with sample 2. Fill to top and cap bottle. 3. Sample must be sent to laboratory within 24 hours

TAIGA ENVIRONMENTAL LABORATORY

Bottle &/or Preservative Order Form

Date Ordered:	201_	Date Required:		201_	
Name:	Company:		Project name or Location		
Address:					
Phone:			Fax:		
Pick up:	Ship by Air:		Pack as TDG :	Cooler required:	
☐ Yes	☐ Yes		☐ Yes	☐ Yes	
☐ No	☐ No		☐ No	☐ No	
Date Filled:			201_	Filled By:	

NOTE: Bottles and preservatives are provided free of charge for analysis carried out at Taiga. Bottles, preservatives and laboratory supplies for other use, may be subject to additional charges. Unused bottles and preservative cannot be returned to the laboratory for reuse.

Parameter Type	No. of Field Blanks	No. of Travel Blanks	No. of Bottles for Samples	QC Batch # of Bottles Sent	Number of Preservatives	QC Batch # of Pres. Sent
 Routine (Green)					Not Required	
 Nutrients (Black)					Not Required	
 Bacti (Sterile sealed)	Not Required	Not Required			Not Required	
 BOD (Purple)	Not Required	Not Required			Not Required	
 Total Metals (Red)						
 Dissolved Metals (Red) <i>see note 1</i>						
 Arsenic Speciation Bottle	Not Required	Not Required			Not Required	
 Cyanide (Blue)						
 Thiocyanate (Orange)						
 Hexane Extractable Material (Oil & Grease) (Brown glass, wide or narrow-mouth)						
 Phenol (Brown glass, narrow-mouth)						
 Sulphide						
 Radionuclide						
Chlorophyll A	Not Required	Not Required			Not Required	
Extractable Hydrocarbons (Brown glass) <i>see note 2</i>					Not Required	
BTEX/Purgeable HC <i>see notes 2 and 3</i>					Not Required	
THM (Glass vial 40mL) <i>see note 3</i>					Not Required	
Metals or Hydrocarbons in sediment (500mL jar)	Not Required	Not Required			Not Required	
Metals or Hydrocarbons in sediment (250mL jar)	Not Required	Not Required			Not Required	
Metals or Hydrocarbons in sediment (125mL jar)	Not Required	Not Required			Not Required	
Metals or Hydrocarbons in sediment (60mL jar or Whirl Pak Bag)	Not Required	Not Required			Not Required	
Other:						
Other Field Supplies: (e.g. Type I UV ⁺ water)						

Notes:
1- Dissolved metals bottles will be preserved at the laboratory if the sample is not filtered in the field. The filtering and addition of preservative is \$20.00/sample.
2- For TPH requests, both the extractable hydrocarbons (brown glass bottle) and the BTEX/Purgeable HC (40mL vial) have to be submitted.
3- For BTEX/Purgeable HC and THM, please submit two vials for each sample (in the event air bubbles occur in the vials, a back-up sample can be analyzed)

Shaded areas are for laboratory use only.



Batch No. : Lab use only

Send Results & Invoice to:
(Please notify if results or invoice are to be sent to different locations)

Company/Agency: _____

Address: _____

City/Town: _____ Province/Territory: _____

Postal Code: _____

Phone: _____ Fax: _____

E-mail: _____

Signature : _____

Client Project No: _____

Date collected: _____

Time collected: _____

Sampler: _____

Location: _____

Rush Required: ☐Yes ☐No

Note: *Analysis may be subcontracted without prior notice.
See reverse for how to complete form and sampling protocols.*

Date Received: _____ Received By: _____

Comments: _____
(Laboratory use only)

-WATER SAMPLES -

Sample Type (freshwater, sewage, wastewater, potable , groundwater, salt water, etc)			
Client Sample ID (As it should appear on final report)			
Taiga Sample ID (Laboratory use only)			

Bottle Type and Parameter																[✓] PLEASE CHECK PARAMETERS REQUESTED BELOW:																														
Routine	pH, Conductivity, Alkalinity																pH		Cond		Alk		pH		Cond		Alk		pH		Cond		Alk													
	Individual Anions Suite ☐																Cl	SO ₄	F	NO ₂ -N	NO ₃ -N	Cl	SO ₄	F	NO ₂ -N	NO ₃ -N	Cl	SO ₄	F	NO ₂ -N	NO ₃ -N															
	Total Nitrite (NO ₂) + Nitrate (NO ₃)																NO ₂ + NO ₃ -N						NO ₂ + NO ₃ -N						NO ₂ + NO ₃ -N																	
	Individual Cations Suite ☐																Ca	Mg		Na	K	Ca	Mg	Na	K	Ca	Mg	Na	K																	
	Hardness (Calculated)																Hardness						Hardness						Hardness																	
	Reactive Silica																SiO ₂						SiO ₂						SiO ₂																	
	Laboratory use only																Rec'd: Y N						Rec'd: Y N						Rec'd: Y N																	
Nutrients	Chlorine: Total, Residual																T. Cl		R. Cl				T. Cl		R. Cl				T. Cl		R. Cl															
	Chemical Oxygen Demand																COD										COD										COD									
	Color																Apparent				True				Apparent				True				Apparent				True									
	Turbidity																Turbidity										Turbidity										Turbidity									
	Total Suspended Solids, Dissolved Solids																TSS				TDS				TSS				TDS				TSS				TDS									
	Ammonia																NH ₃										NH ₃										NH ₃ -N									
	Phosphorus: Total, Dissolved, Ortho																TP	DP				OP	TP	DP	OP	TP	DP	OP	TP	DP	OP															
	Carbon: Total, Dissolved																TOC				DOC				TOC				DOC				TOC				DOC									
	Nitrogen: Total, Dissolved																TN				DN				TN				DN				TN				DN									
	Visible Oil and Grease																Visible										Visible										Visible									
	Laboratory use only																Received : Y N						Received : Y N						Received : Y N																	
Sterile	Fecal Coliforms (FC)																FC										FC										FC									
	Total Coliforms (TC), E. Coli (EC)																TC				EC				TC				EC				TC				EC									
	Fecal Streptococcus (FS)																FS										FS										FS									
	Laboratory use only																Received: Y N T: _____°C Sterile container: Y N						Received: Y N T: _____°C Sterile container: Y N						Received: Y N T: _____°C Sterile container: Y N																	
	Biological Oxygen Demand																BOD										BOD										BOD									
	Carbonaceous BOD																CBOD										CBOD										CBOD									
	Laboratory use only																Received: Y N T: _____°C						Received: Y N T: _____°C						Received: Y N T: _____°C																	
Metals	Please indicate if sample is preserved and/or filtered																Pres ☐				Filt ☐ Pres ☐				Pres ☐				Filt ☐ Pres ☐				Pres ☐				Filt ☐ Pres ☐									
	ICP-MS(1): Cd, Cr, Cu, Co, Mn, Ni, Pb, Zn, Fe																Total				Dissolved				Total				Dissolved				Total				Dissolved									
	ICP-MS(2): 25 element scan includes As (not included: B, Bi, Hg, Sn)																Total				Dissolved				Total				Dissolved				Total				Dissolved									
	Individual Metals by ICP-MS (please circle each metal): Ag, Al, As, B, Ba, Be, Bi, Cd, Co, Cr, Cs, Cu, Fe, Hg, Li, Mn, Mo, Ni, Pb, Rb, Sb, Se, Sn, Sr, Ti, Tl, U, V, Zn																Total				Dissolved				Total				Dissolved				Total				Dissolved									
	Laboratory use only																TM rec'd: Y N				DM rec'd: Y N				TM rec'd: Y N				DM rec'd: Y N				TM rec'd: Y N				DM rec'd: Y N									
	Hexane Extractable Material (O&G)																HEM										HEM										HEM									
	Laboratory use only																Rec'd: Y N						Pres: Y N				Rec'd: Y N						Pres: Y N				Rec'd: Y N						Pres: Y N			
	BTEX, Purgeable HC (40mL x 2 vials)																BTEX				Purg HC				BTEX				Purg HC				BTEX				Purg HC									
	Extractable HC (1L amber glass bottle)																Ext HC										Ext HC										Ext HC									
	Trihalomethanes (40 mL x 2 vials)																THM										THM										THM									
	Laboratory use only																Vial rec'd: Y N				Ext rec'd: Y N				Vial rec'd: Y N				Ext rec'd: Y N				Vial rec'd: Y N				Ext rec'd: Y N									
	Other: <i>see special request form</i>																																													

For safety purposes, please disclose any contaminants (e.g. heavy metals, cyanide, etc.) that may be present at high levels and pose a risk to human health:

HOW TO FILL OUT THIS FORM

Company/Agency

The full, legal company name.

Address

Full street address including suite or unit number, if applicable. Final reports will be sent to this address.

City/Town

City or Town

Province/Territory

Province or Territory

Postal Code

Postal Code

Phone

Full telephone number, including area code and extension, if applicable

Fax

Facsimile number

E-mail

E-mail address, if available

Signature

Signature of the individual filling out the form

Client Project No

This information will appear on the final analytical report

Date Collected

Enter the date(s) that the samples were collected

Time Collected

Enter the time(s) the sample(s) were collected in military time or note if it is a.m or p.m

Sampler

The name of the individual who collected the sample

Location

The general location of where the samples were collected

Rush Required

Indicate if regular or Rush turnaround time is required. Check yes only if Rush is required, no if not.

Sample Type

Identify the sample matrix (freshwater, drinking water, soil, etc)

Client Sample ID

Identify each submitted sample. This identification will appear on the analytical report.

Test Column

Check off the tests you require for each sample submitted.

IMPORTANT INFORMATION

Turnaround time

Standard turnaround time is 10 business days. Please note that turnaround time delays may occur if the *Field Sheet* is incomplete or incorrectly filled out.

RUSH analysis

Rush turnaround time is 5 business days. All samples received at the lab are analyzed on a ‘first come, first serve’ basis unless otherwise specified as Rush. Rush samples will be place in the front of the line and analyzed prior to routine samples. A premium charge of 100% shall be charged for the analysis. Rush services depend on staff availability, analysis required, and capabilities of the lab. Please contact the lab prior to requesting this service.

Sample Receipt, Custody, and Storage

All submitted samples remain the sole property of the client and may be returned to the client for appropriate storage or disposal at the discretion of Taiga Environmental Laboratory.

All submitted samples will be stored for 30 days from the date the final report is printed. Arrangements can be made to hold the samples for an extended time at a nominal fee.

Sampling Supplies

Sample bottles, preservatives, labels, and forms are available at no cost when requesting services. To place a bottle order, please submit a *Bottle &/or Preservative Order Form* a minimum of 48 hours in advance. Please note the shipment of Dangerous Goods may be delayed due to availability of qualified airline agents to process the paperwork.

Shipping Charges

All shipping costs are the responsibility of the client.

Confidentiality

All data and reports are considered confidential and the property of the client. No information shall be released to others without documented approval from the client.

Limit of Liability

Although every care and precaution is taken in the performance of our services, our liability for loss or damage in all circumstances is limited to re-analysis of the sample(s) at our expense or the cancellation of charges.

Taiga Environmental Laboratory reserves the right to refuse to proceed with an analysis if the lab does not have the capability and /or resources to meet analysis requirements, including facilities and equipment, scientific expertise, analytical capabilities, staff scheduling, Quality Assurance/Quality Control specifications, and report.

Parameter Group		Marking	Preservative	Instructions
	Routine	GREEN	Keep Cool at 4°C	1. Rinse bottle three (3) times with sample. 2. Fill to top and cap bottle
	Nutrients	BLACK	Keep Cool at 4°C	
	Biochemical Oxygen Demand (BOD)/Carbonaceous BOD (CBOD)	PURPLE	Keep Cool at 4°C	1. Rinse bottle three (3) times with sample. 2. Fill to top and cap bottle. 3. Sample must be sent to the lab within 24 hours of collection.
	Microbiological	STERILE	Sodium Thiosulphate Keep Cool at 4°C	1. DO NOT RINSE BOTTLE. 2. Fill to top and cap. 3. Sample must be sent to the lab within 24 hours of collection.
	Total Metals	RED	5mL of 1:3 nitric acid in Red-dot vial	1. Rinse bottle three (3) times with sample. 2. Fill to near the top. 3. Add contents of preservative vial. 4. Cap bottle and mix.
	Dissolved Metals	RED	5mL of 1:3 nitric acid in Red-dot vial	1. Filter sample with 0.45um Cellulose Acetate filter. 2. Rinse bottle three (3) times with filtrate. 3. Fill to near the top. 4. Add contents of preservative vial. 5. Cap bottle and mix.
	Hexane Extractable Material (HEM)	YELLOW	4mL of 1:3 sulphuric acid in Yellow Dot vial	1. DO NOT RINSE BOTTLE. 2. Fill to shoulder of bottle. 3. Add contents of preservative vial. 4. Cap bottle and mix.
	BTEX, THM & Purgeable Hydrocarbons	40 mL CLEAR GLASS W/WHITE LID	Keep Cool at 4°C	1. DO NOT RINSE BOTTLE. 2. Fill vials completely leaving NO air bubbles.
	Extractable Hydrocarbons	1L AMBER GLASS WITH WHITE LID	Keep Cool at 4°C	1. DO NOT RINSE BOTTLE 2. Fill to top and cap
	Cyanide, Total and WAD	BLUE	1mL of 6N sodium hydroxide solution	1. Rinse bottle three (3) times with sample. 2. Fill to near the top of container. 3. Add contents of preservative vial. 4. Cap bottle and mix.
	Thiocyanate	ORANGE	2mL 25% sulphuric acid; or keep cool At 4°C	
	Phenol	YELLOW with P	2mL of 20% sulphuric acid	



Appendix H

Decant Pump Manual

ACDEU

Super
T SERIES
Cat-Pac

Diesel Engine Driven Self Priming Centrifugal Pump w/Autostart Model T8A60S-3054T Size 8" x 8"



Total Head		Capacity of Pump in U.S. Gallons per Minute (GPM) at Continuous Performance			
P.S.I.	Feet				
53.8	124	680	680	680	680
52.0	120	780	780	780	780
43.4	100	1300	1540	1540	1540
34.7	80	1360	1780	2030	2160
26.0	60	1420	1860	2120	2580
17.4	40	1480	1920	2220	2700
Suction Lift		25'	20'	15'	10'

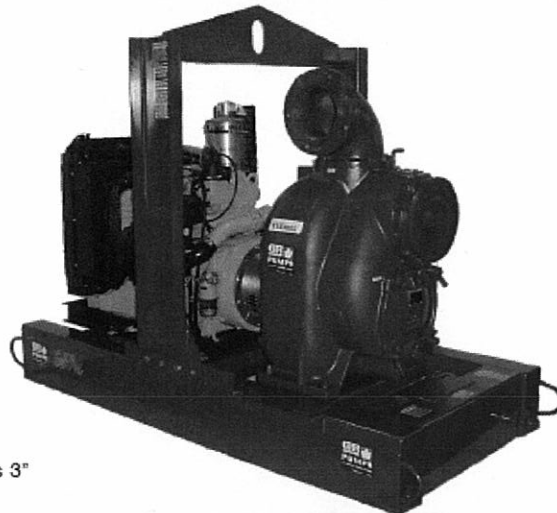
PUMP SPECIFICATIONS

Size: 8" x 8" NPT (203 mm x 203 mm) - Female.
Casing: Gray Iron No. 30. Maximum Operating Pressure 90 psi (621 kPa).
Open Type, Two Vane Impeller: Ductile Iron No. 65-45-12. Handles 3" (76.2 mm) Diameter Spherical Solids.
Impeller Shaft: Stainless Steel No. 17-4 PH.
Replaceable Wear Plate: Gray Iron No. 30.
Removable Adjustable Cover Plate: Gray Iron No. 30; 66 lbs. (30 kg).
Flap Valve: Neoprene w/Steel Reinforcing.
Intermediate: Gray Iron No. 30.
Seal Plate: Gray Iron No. 30.
Shaft Sleeve: Alloy Steel No. 4130.
Seal: Cartridge Type, Mechanical, Oil-Lubricated, Double Floating, Self-Aligning, Silicon Carbide Rotating and Stationary Faces. Stainless Steel No. 316 Stationary Seat. Fluorocarbon Elastomers (DuPont Viton® or Equivalent). Stainless Steel No. 18-8 Cage and Spring. Maximum Temperature of Liquid Pumped 160°F (71°C).
Radial/Thrust Bearings: Open Double Ball.
Bearing and Seal Cavity Lubrication: SAE No. 30 Non-Detergent Oil.
Flanges: 125# Gray Iron No. 30.
Gaskets: Buna-N, Compressed Synthetic Fibers, PTFE, Cork, and Rubber.
O-Rings: Buna-N.
Hardware: Standard Plated Steel.
Brass Pressure Relief Valve.
Bearing and Seal Cavity Oil Level Sight Gauges.

Standard Equipment: Hoisting Bail. 90° Discharge Elbow. Strainer. Single Level Actuated (Microswitch) Type Liquid Level Control System with 50 Ft. (15.2 M) of Cable (Double Float System and Alternate Cable Lengths Available; Consult the Factory).

Optional Equipment: Battery. G-R Hard Iron Impeller, Seal Plate and Wear Plate. High Speed (55 MPH/89 KM/H) Wheel Kit with P225/75R15 Pneumatic Tires. Over-the-Road Trailer (Meets D.O.T. and Transport Canada Requirements). EPS w/Submersible Transducer Liquid Level Sensor (50 Ft. [15.2 M] Cable Standard, Alternate Lengths Available).

*Consult Factory for Applications Exceeding Maximum Pressure and/or Temperature Indicated.



WARNING!

Do not use in explosive atmosphere or for pumping volatile flammable liquids.

ENGINE SPECIFICATIONS

Model: John Deere 4045H "Power Tech".
Type: Four Cylinder, Turbocharged, Charge Air Cooled, Enclosed, Liquid Cooled Diesel Engine.
Displacement: 275 Cu. In. (4.5 liters).
Governor: Electronic Isochronous.
Lubrication: Forced Circulation.
Air Cleaner: Dry Type.
Oil Reservoir: 15.5 U.S. Qts. (14.7 liters) Dry; 14.5 U.S. Qts. (13.7 liters) Refill.
Fuel Tank: 88 U.S. Gals. (330 liters).
Full Load Operating Time: 19.0 Hrs.
Starter: 12V Electric.

Standard Features: Low Oil Pressure and High Coolant Temperature Safety Shut Down Switches. Autostart Instrument Panel Includes: Tachometer, Voltmeter, Hourmeter, Coolant Temperature Gauge, Oil Pressure Gauge, Manual/Stop/Auto Key Switch, 10 Amp Pushbutton Circuit Breaker, Startup Warning Delay. Muffler w/Weather Cap. Throttle Control.

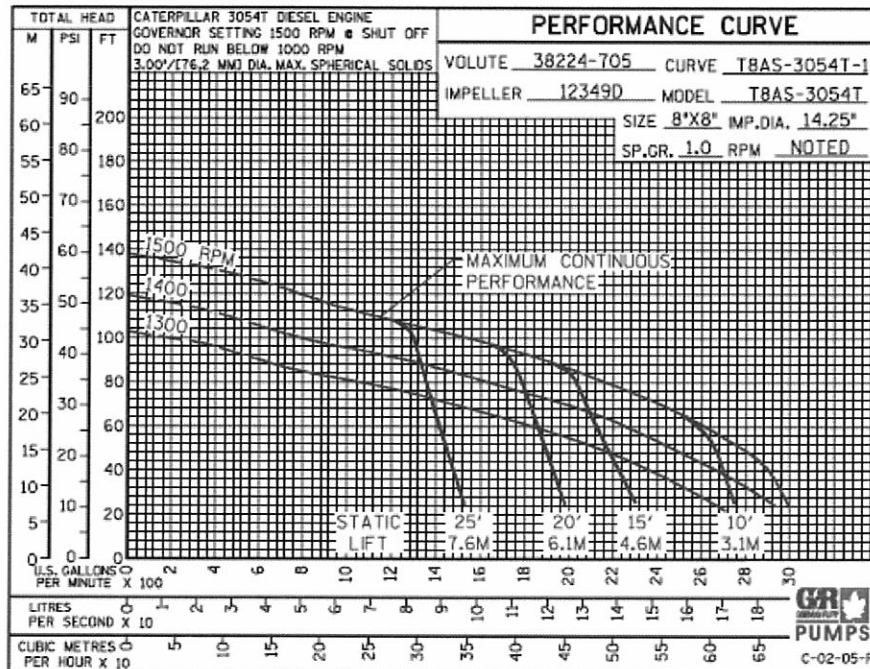
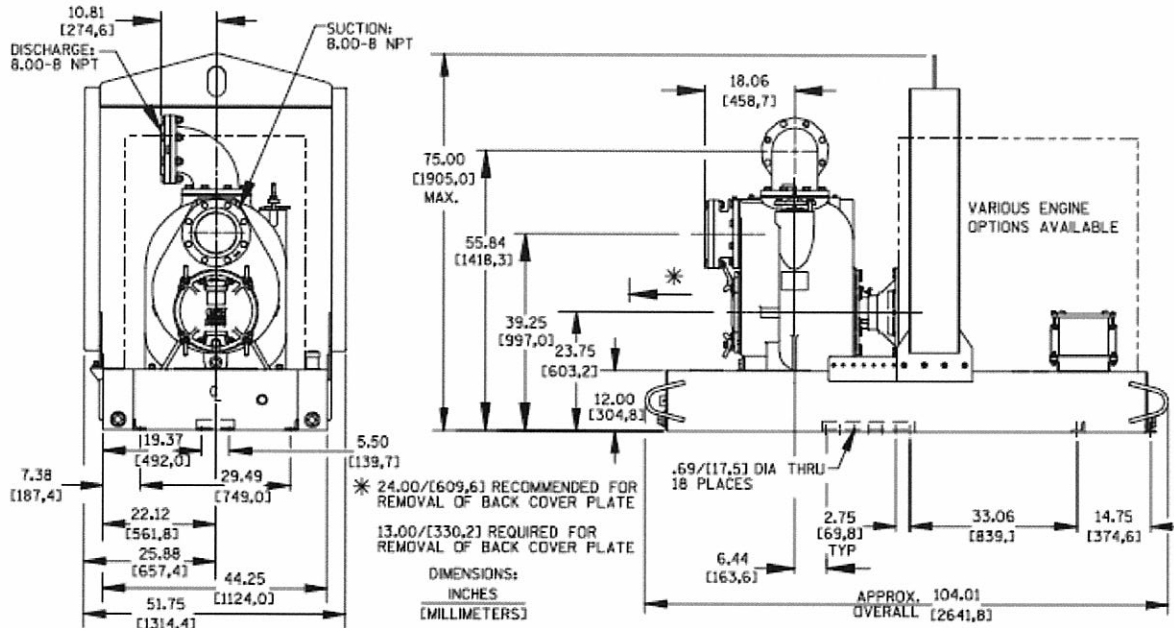
JOHN DEERE PUBLISHED PERFORMANCE:
Maximum Gross BHP (Ind/Hvy Duty) 115 (86 kW) @ 2200 RPM

Specification Data

SECTION 45, PAGE 1655C

APPROXIMATE
DIMENSIONS and WEIGHTS

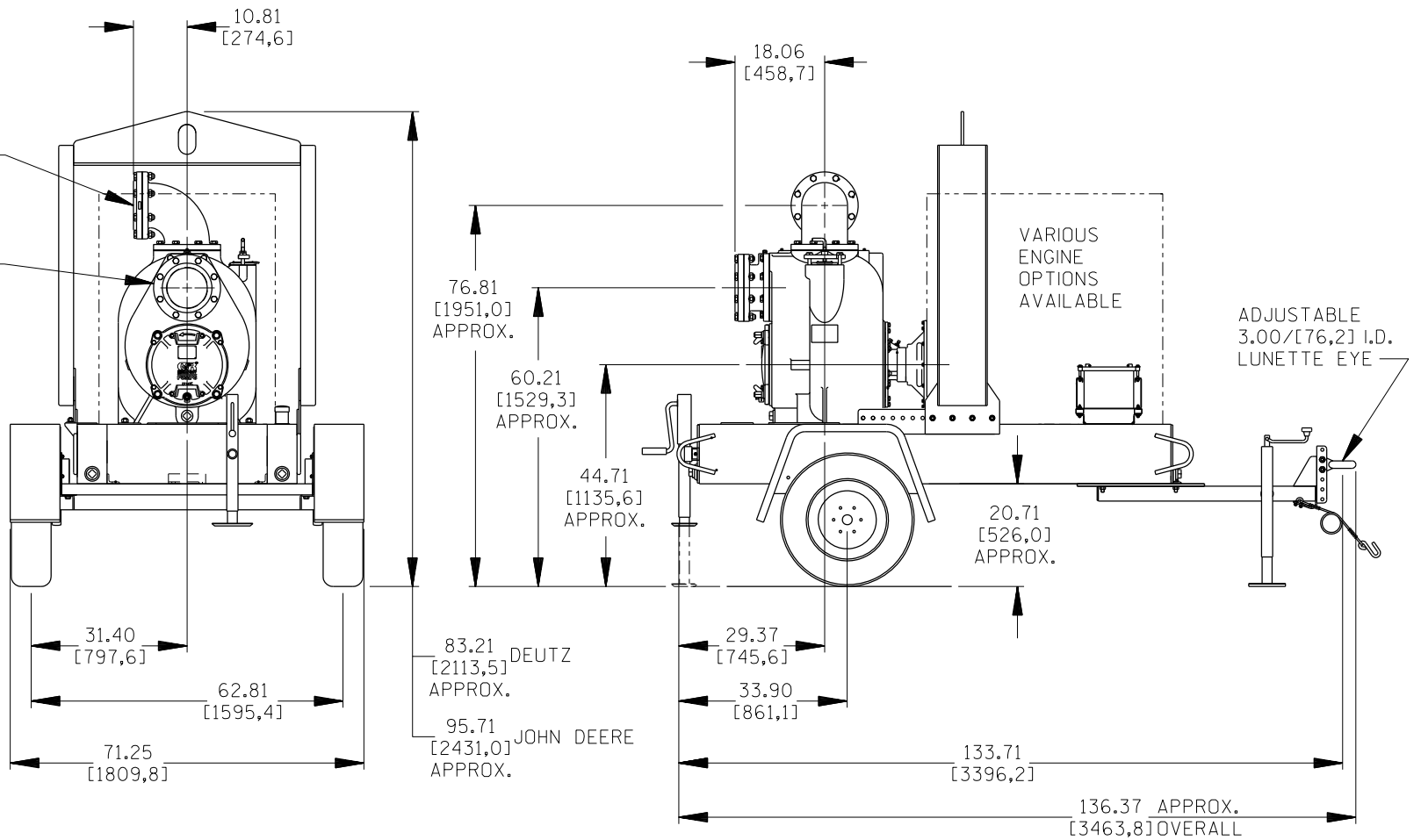
	SKID BASE	2-WHEEL
NET WEIGHT:	3023 LBS. (1371 KG.)	3533 LBS. (1603 KG.)
SHIPPING WEIGHT:	3258 LBS. (1478 KG.)	3533 LBS. (1603 KG.)
EXPORT CRATE SIZE:	288 CU. FT. (8,1 CU. M.)	



B 17719

DISCHARGE:
8.00-8 NPT

SUCTION:
8.00-8 NPT



* 24.00/[609,6] RECOMMENDED FOR
REMOVAL OF BACK COVER PLATE

13.00/[330,2] REQUIRED FOR
REMOVAL OF BACK COVER PLATE

SHOWN ON 88 GALLON INTEGRAL FUEL TANK BASE
WITH OPTIONAL GRP30-255 WHEEL KIT

DIMENSIONS:
INCHES
[MILLIMETERS]

07-024

	THE GORMAN-RUPP CO.		DRAWN BY	SS	SCALE	3/64	MODEL	T8A60S
	MANSFIELD, OHIO	ST. THOMAS, ONTARIO	DATE	2-11-05	REVISED	7-3-07	OUTLINE NUMBER	17719

PowerTech

4045H Diesel Engine

Industrial Engine Specifications



JOHN DEERE

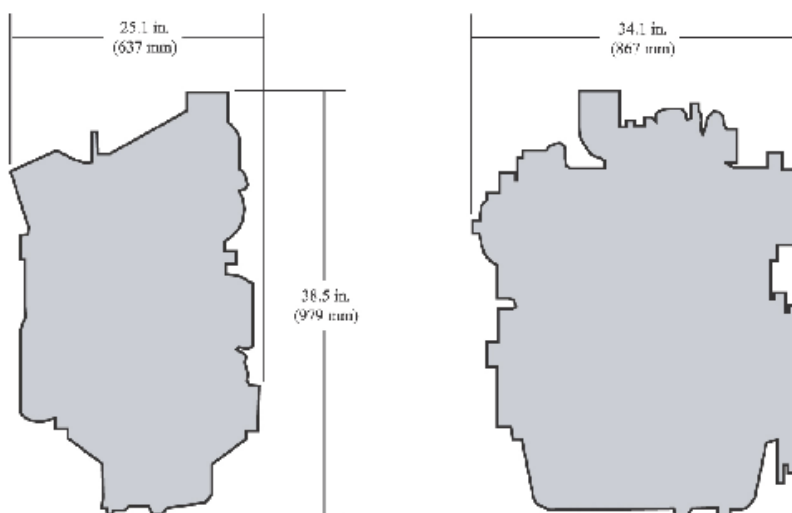


4045H shown

Emissions certifications

CARB
EPA Tier 2
EU Stage II

Dimensions



General data

Model	4045HF275
Number of cylinders	4
Displacement-- L (cu in)	4.5 (275)
Bore and Stroke-- mm (in)	106 x 127 (4.17 x 5.00)
Compression Ratio	17.0:1
Engine Type	In-line, 4-Cycle

Aspiration	Turbocharged and air-to-air aftercooled
Length-- mm (in)	867 (34.1)
Width-- mm (in)	637 (25.1)
Height-- mm (in)	979 (38.5)
Weight, dry-- kg (lb)	451 (994)

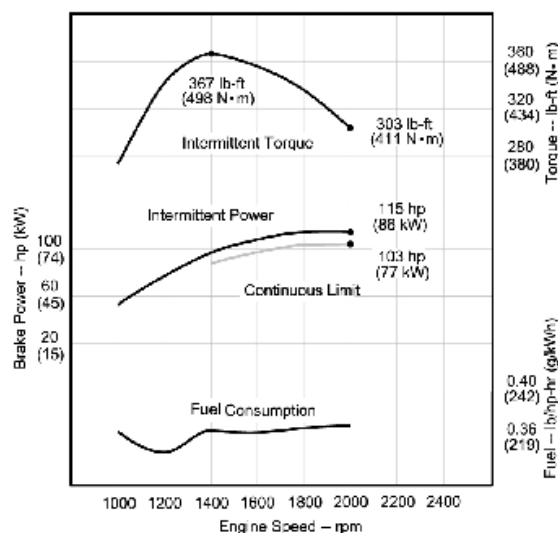
Intermittent BHP is the power rating for variable speed and load applications where full power is required intermittently.

Heavy duty - see application ratings/definitions, engine performance curves.

Continuous BHP is the power rating for applications operating under a constant load and speed for long periods of time.

Power output is within + or - 5% at standard SAE J 1995 and ISO 3046.

Performance curves



Performance data

Intermittent rated speed	86 kW (115 hp) @ 2000 rpm
Peak power	86 kW (115 hp) @ 2000 rpm
Peak torque	498 N·m (367 ft-lb) @ 1400 rpm
Torque rise %	21% @ 1400 rpm

Features and benefits

Dynamically Balanced Crankshaft

- Crankshafts are formed from nodular iron

Forged-Steel Connecting Rods

- Unique 45-degree design permits use of larger crankshaft connecting-rod bearings for increased durability

Self-adjusting Poly-vee Fan Drive

- Self-adjusting, eight-groove, poly-vee fan drive provides multiple fan drive ratios and fan heights that can be matched to specific application requirements
- Poly-vee design provides more than twice the drive capacity of comparable vee-belts

Replaceable Wet-Type Cylinder Liners

- Provides excellent heat dissipation
- Precision machined for long life

Either-Side Service

- Engine installation and maintenance simplified and convenient by providing dipstick and oil filter options on both sides of the engine

500-Hour Oil Change

- Customers save significant costs on oil, filters and labor with a 500-hour oil change interval

Standard Gear Auxiliary Drive

- Standard gear auxiliary drive produces up to 50 hp (37 kW) for gear-driven accessories

Mounting Points

- Standard front and side mounting points provide easy installation and application flexibility

Electronic-controlled Rotary Injection Pump

- Electronic-controlled rotary injection pump distributes the precise amount of fuel required by each cylinder at exactly the right time
- Electronic controls monitor engine speed and load to determine fuel timing

SAE J1939 Standard Communication Link

- Industry standard, which provides an interface with vehicle systems, like the transmission, hydraulics and various accessory drives minimizing machine complexity and reducing the installed cost

Optional Engine-Balancer Shafts

- Provides smooth engine operation

John Deere Power Systems

3801 W. Ridgeway Ave.
PO Box 5100
Waterloo, IA 50704-5100
Phone: 1-800-533-6446
Fax: 319.292.5075

John Deere Power Systems

Usine de Saran
La Foulonnerie - B.P. 11.13
45401 Fleury les Aubrais Cedex
France
Phone: 33.2.38.82.61.19
Fax: 33.2.38.82.60.00

*All values at rated speed and power with standard options unless otherwise noted.
Specifications and design subject to change without notice.*

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WITH PARTS LIST



SUPER T SERIES PUMP

MODEL
T8A60S—F6L

THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO

www.gormanrupp.com

GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA

Printed in U.S.A.

© Copyright by the Gorman-Rupp Company



The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

TABLE OF CONTENTS

INTRODUCTION	PAGE I – 1
SAFETY - SECTION A	PAGE A – 1
INSTALLATION – SECTION B	PAGE B – 1
Pump Dimensions	PAGE B – 1
PREINSTALLATION INSPECTION	PAGE B – 2
Battery Specifications And Installation	PAGE B – 2
POSITIONING PUMP	PAGE B – 2
Lifting	PAGE B – 2
Mounting	PAGE B – 3
Clearance	PAGE B – 3
SUCTION AND DISCHARGE PIPING	PAGE B – 3
Materials	PAGE B – 3
Line Configuration	PAGE B – 3
Connections to Pump	PAGE B – 3
Gauges	PAGE B – 3
SUCTION LINES	PAGE B – 3
Fittings	PAGE B – 3
Strainers	PAGE B – 4
Sealing	PAGE B – 4
Suction Lines In Sumps	PAGE B – 4
Suction Line Positioning	PAGE B – 4
FLOAT SWITCHES	PAGE B – 5
Installation	PAGE B – 5
OPTIONAL SUBMERSIBLE TRANSDUCER	PAGE B – 6
DISCHARGE LINES	PAGE B – 7
Siphoning	PAGE B – 7
Valves	PAGE B – 7
Bypass Lines	PAGE B – 7
AUTOMATIC AIR RELEASE VALVE	PAGE B – 8
Theory of Operation	PAGE B – 8
Air Release Valve Installation	PAGE B – 9
ALIGNMENT	PAGE B – 10
OPERATION – SECTION C	PAGE C – 1
PRIMING	PAGE C – 1
STARTING	PAGE C – 2
Manual Starting	PAGE C – 2
Automatic Starting	PAGE C – 2
OPTIONAL EPS CONTROL	PAGE C – 2
Features	PAGE C – 2
Functional Description	PAGE C – 2
EPS Functions	PAGE C – 3
EPS Calibration	PAGE C – 4
Zero Adjustment	PAGE C – 4
Span Adjustment	PAGE C – 4
Level Adjustment	PAGE C – 4

TABLE OF CONTENTS (continued)

Horn Delay	PAGE C – 5
OPERATION	PAGE C – 5
Lines With a Bypass	PAGE C – 5
Lines Without a Bypass	PAGE C – 5
Leakage	PAGE C – 5
Liquid Temperature And Overheating	PAGE C – 5
Strainer Check	PAGE C – 6
Pump Vacuum Check	PAGE C – 6
STOPPING	PAGE C – 6
Manual Stopping	PAGE C – 6
Automatic Stopping	PAGE C – 6
Safety Shutdown System	PAGE C – 6
OPERATION IN EXTREME HEAT	PAGE C – 7
Cold Weather Preservation	PAGE C – 7
BEARING TEMPERATURE CHECK	PAGE C – 7
TROUBLESHOOTING – SECTION D	PAGE D – 1
PREVENTIVE MAINTENANCE	PAGE D – 4
PUMP MAINTENANCE AND REPAIR - SECTION E	PAGE E – 1
STANDARD PERFORMANCE CURVE	PAGE E – 1
PARTS LISTS:	
Pump Model	PAGE E – 3
Power Unit Kit	PAGE E – 5
Pump End Assy	PAGE E – 7
Repair Rotating Assy	PAGE E – 9
Drive Assy	PAGE E – 10
PUMP AND SEAL DISASSEMBLY AND REASSEMBLY	PAGE E – 11
Back Cover And Wear Plate Removal	PAGE E – 11
Suction Check Valve Removal	PAGE E – 12
Separating Intermediate And Drive Assembly From Engine	PAGE E – 12
Loosening Impeller	PAGE E – 12
Rotating Assembly Removal	PAGE E – 13
Impeller Removal	PAGE E – 13
Seal Removal	PAGE E – 14
Shaft and Bearing Removal and Disassembly	PAGE E – 14
Shaft and Bearing Reassembly and Installation	PAGE E – 15
Seal Installation	PAGE E – 17
Impeller Installation	PAGE E – 19
Rotating Assembly Installation	PAGE E – 20
Suction Check Valve Installation	PAGE E – 20
Back Cover Installation And Adjustment	PAGE E – 20
Securing Pump End To Engine	PAGE E – 21
PRESSURE RELIEF VALVE MAINTENANCE	PAGE E – 22
Final Pump Assembly	PAGE E – 22
LUBRICATION	PAGE E – 22
Seal Assembly	PAGE E – 22
Bearings	PAGE E – 23
Engine	PAGE E – 23

INTRODUCTION

Thank You for purchasing a Gorman-Rupp pump. **Read this manual** carefully to learn how to safely install and operate your pump. Failure to do so could result in personal injury or damage to the pump.

This Installation, Operation, and Maintenance manual is designed to help you achieve the best performance and longest life from your Gorman-Rupp pump.

This pump is a Super T Series, semi-open impeller, self-priming centrifugal model with a suction check valve. The pump also is designed with external shimless adjusters for setting the wear plate to impeller clearance. The pump is close coupled to a Deutz F6L diesel engine, and is designed for handling dirty water containing specified entrained solids and slurries. The basic material of construction is gray iron, with ductile iron impeller and steel wearing parts.

If there are any questions regarding the pump or its application which are not covered in this manual or in other literature accompanying this unit, please contact your Gorman-Rupp distributor, or write:

The Gorman-Rupp Company
P.O. Box 1217
Mansfield, Ohio 44901—1217
Phone: (419) 755—1011

or:

Gorman-Rupp of Canada Limited
70 Burwell Road
St. Thomas, Ontario N5P 3R7
Phone: (519) 631—2870

For information or technical assistance on the engine, contact the engine manufacturer's local dealer or representative.

Because pump installations are seldom identical, this manual cannot possibly provide detailed instructions and precautions for every aspect of each specific application. Therefore, it is the responsibility of the owner/installer of the pump to ensure that applications not addressed in this manual are performed **only** after establishing that

neither operator safety nor pump integrity are compromised by the installation. Pumps and related equipment **must** be installed and operated according to all national, local and industry standards.

The following are used to alert maintenance personnel to procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel:



Immediate hazards which WILL result in severe personal injury or death. These instructions describe the procedure required and the injury which will result from failure to follow the procedure.



Hazards or unsafe practices which COULD result in severe personal injury or death. These instructions describe the procedure required and the injury which could result from failure to follow the procedure.



Hazards or unsafe practices which COULD result in minor personal injury or product or property damage. These instructions describe the requirements and the possible damage which could result from failure to follow the procedure.

NOTE

Instructions to aid in installation, operation, and maintenance or which clarify a procedure.

SAFETY - SECTION A

This information applies to Super T Series engine driven pumps. Refer to the manual accompanying the engine before attempting to begin operation.

Because pump installations are seldom identical, this manual cannot possibly provide detailed instructions and precautions for each specific application. Therefore, it is the owner/installer's responsibility to ensure that applications not addressed in this manual are performed only after establishing that neither operator safety nor pump integrity are compromised by the installation.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Switch off the engine ignition, remove the key, and disconnect the positive battery cable to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Check the temperature before opening any covers, plates, or plugs.
5. Close the suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.



This pump is equipped with an automatic starting system, and is subject to automatic restart. Keep hands and cloth-

ing away from the unit to prevent injury during automatic operation. Disconnect the positive battery cable before performing any maintenance. Failure to do so may result in serious personal injury.



This pump is designed to handle dirty water containing specified entrained solids. Do not attempt to pump volatile, corrosive, or flammable liquids which may damage the pump or endanger personnel as a result of pump failure.



Do not operate an internal combustion engine in an explosive atmosphere. When operating internal combustion engines in an enclosed area, make certain that exhaust fumes are piped to the outside. These fumes contain carbon monoxide, a deadly gas that is colorless, tasteless, and odorless.



After the pump has been positioned, make certain that the pump and all piping connections are tight, properly supported and secure before operation.



Do not operate the pump without shields and /or guards in place over the drive shafts, belts and/or couplings, or other rotating parts. Exposed rotating

parts can catch clothing, fingers, or tools. causing severe injury to personnel.



Do not remove plates, covers, gauges, pipe plugs, or fittings from an overheated pump. Vapor pressure within the pump can cause parts being disengaged to be ejected with great force. Allow the pump to completely cool before servicing.



Do not operate the pump against a closed discharge valve for long periods of time. If operated against a closed discharge valve, pump components will deteriorate, and the liquid could come to a boil, build pressure, and cause the pump casing to rupture or explode.



Pumps and related equipment must be installed and operated according to all national, local and industry standards.



Fuel used by internal combustion engines presents an extreme explosion and fire hazard. Make certain that all fuel lines are securely connected and free of leaks. Never refuel a hot or run-

ning engine. Avoid overfilling the fuel tank. Always use the correct type of fuel.



Never tamper with the governor to gain more power. The governor establishes safe operating limits that should not be exceeded. The maximum continuous operating speed for this pump is 1500 RPM.



Do not attempt to disengage any part of an overheated pump unit. Vapor pressure within the pump casing can eject these parts with great force when they are disengaged. Allow the pump to completely cool before servicing it.



Overheated pumps can cause severe burns and injury. If overheating of the pump occurs:

1. Stop the pump immediately.
2. Allow the pump to completely cool.
3. Refer to instructions in this manual before restarting the pump.



Use lifting and moving equipment in good repair and with adequate capacity to prevent injuries to personnel or damage to equipment. Suction and discharge hoses and piping must be removed from the pump before lifting.

INSTALLATION – SECTION B

Review all SAFETY information in Section A.

Since pump installations are seldom identical, this section offers only general recommendations and practices required to inspect, position, and arrange the pump and piping.

Most of the information pertains to a standard **static lift** application where the pump is positioned above the free level of liquid to be pumped.

If installed in a **flooded suction application** where the liquid is supplied to the pump under pressure, some of the information such as mounting, line configuration, and priming must be tailored to the

specific application. Since the pressure supplied to the pump is critical to performance and safety, **be sure** to limit the incoming pressure to 50% of the maximum permissible operating pressure as shown on the pump performance curve.

For further assistance, contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

Pump Dimensions

See Figure 1 for the approximate physical dimensions of this pump.

OUTLINE DRAWING

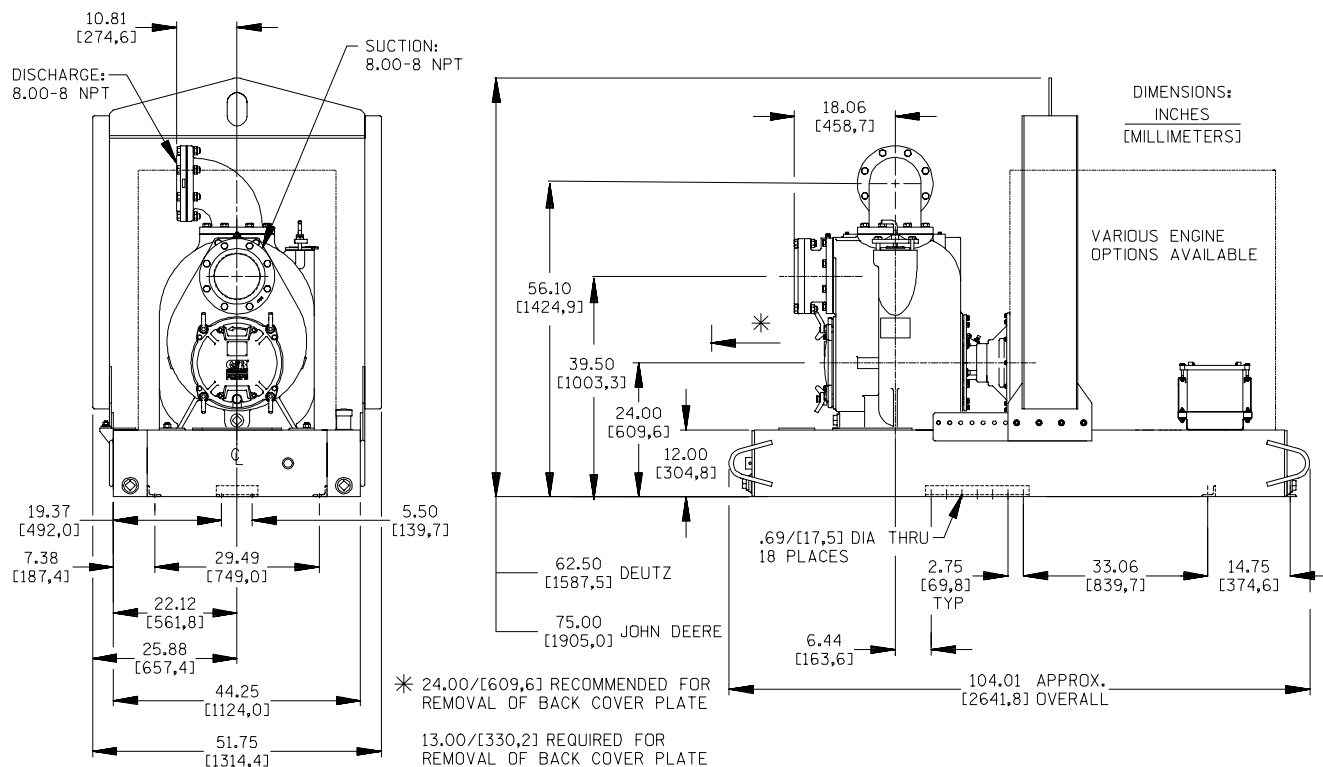


Figure 1. Pump Model T8A60S-F6L

PREINSTALLATION INSPECTION

The pump assembly was inspected and tested before shipment from the factory. Before installation, inspect the pump for damage which may have occurred during shipment. Check as follows:

- Inspect the pump assembly for cracks, dents, damaged threads, and other obvious damage.
- Check for and tighten loose attaching hardware. Since gaskets tend to shrink after drying, check for loose hardware at mating surfaces.
- Carefully read all warnings and cautions contained in this manual or affixed to the pump, and perform all duties indicated. Note the direction of rotation indicated on the pump. Check that the pump shaft rotates counter-clockwise when facing the impeller.



Only operate this pump in the direction indicated by the arrow on the pump body and on the accompanying decal. Refer to **Rotation** in **OPERATION**, Section C.

- Check levels and lubricate as necessary. Refer to **LUBRICATION** in the **MAINTENANCE AND REPAIR** section of this manual and perform duties as instructed.
- If the pump and engine have been stored for more than 12 months, some of the components or lubricants may have exceeded their maximum shelf life. These **must be inspected or replaced** to ensure maximum pump service.

If the maximum shelf life has been exceeded, or if anything appears to be abnormal, contact your Gorman-Rupp distributor or the factory to determine the repair or updating policy. **Do not** put the pump into service until appropriate action has been taken.

Battery Specifications And Installation

Unless otherwise specified on the pump order, the engine battery was **not** included with the unit. Refer to the following specifications when selecting a battery.

Table 1. Battery Specifications

Voltage	Cold Crank Amps @ 0° F	Reserve Capacity @ 80° F (Minutes)	Amp/ Hr. Rating	Approx. Overall Dims. (Inches)
12 Volts	850	120	75	10.25L x 6.75W x 8.88H

Refer to the information accompanying the battery and/or electrolyte solution for activation and charging instructions.

Before installing the battery, clean the positive and negative cable connectors, and the battery terminals. Secure the battery by tightening the holddown brackets. The terminals and clamps may be coated with petroleum jelly to retard corrosion. Connect and tighten the positive cable first, then the negative cable.

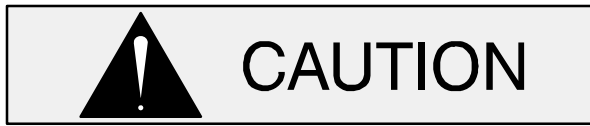
POSITIONING PUMP



Use lifting and moving equipment in good repair and with adequate capacity to prevent injuries to personnel or damage to equipment. The bail is intended for use in lifting the pump assembly only. Suction and discharge hoses and piping must be removed from the pump before lifting.

Lifting

Pump unit weights will vary depending on the mounting and drive provided. Check the shipping tag on the unit packaging for the actual weight, and use lifting equipment with appropriate capacity. Drain the pump and remove all customer-installed equipment such as suction and discharge hoses or piping before attempting to lift existing, installed units.



The pump assembly can be seriously damaged if the cables or chains used to lift and move the unit are improperly wrapped around the pump.

Mounting

Locate the pump in an accessible place as close as practical to the liquid being pumped. Level mounting is essential for proper operation.

The pump may have to be supported or shimmed to provide for level operation or to eliminate vibration.

If the pump has been mounted on a moveable base, make certain the base is stationary by setting the brake and blocking the wheels before attempting to operate the pump.

To ensure sufficient lubrication and fuel supply to the engine, **do not** position the pump and engine more than 15° off horizontal for continuous operation. The pump and engine may be positioned up to 30° off horizontal for **intermittent operation only**; however, the engine manufacturer should be consulted for continuous operation at angles greater than 15°.

Clearance

When positioning the pump, allow a minimum clearance of **18 inches (457,2 mm)** in front of the back cover to permit removal of the cover and easy access to the pump interior.

SUCTION AND DISCHARGE PIPING

Pump performance is adversely effected by increased suction lift, discharge elevation, and friction losses. See the performance curve and notes on Page E-1 to be sure your overall application al-

lows pump to operate within the safe operation range.

Materials

Either pipe or hose maybe used for suction and discharge lines; however, the materials must be compatible with the liquid being pumped. If hose is used in suction lines, it must be the rigid-wall, reinforced type to prevent collapse under suction. Using piping couplings in suction lines is not recommended.

Line Configuration

Keep suction and discharge lines as straight as possible to minimize friction losses. Make minimum use of elbows and fittings, which substantially increase friction loss. If elbows are necessary, use the long-radius type to minimize friction loss.

Connections to Pump

Before tightening a connecting flange, align it exactly with the pump port. Never pull a pipe line into place by tightening the flange bolts and/or couplings.

Lines near the pump must be independently supported to avoid strain on the pump which could cause excessive vibration, decreased bearing life, and increased shaft and seal wear. If hose-type lines are used, they should have adequate support to secure them when filled with liquid and under pressure.

Gauges

Most pumps are drilled and tapped for installing discharge pressure and vacuum suction gauges. If these gauges are desired for pumps that are not tapped, drill and tap the suction and discharge lines not less than 18 inches (457,2 mm) from the suction and discharge ports and install the lines. Installation closer to the pump may result in erratic readings.

SUCTION LINES

To avoid air pockets which could affect pump priming, the suction line must be as short and direct as possible. When operation involves a suction lift, the line must always slope upward to the pump from the source of the liquid being pumped; if the line slopes down to the pump at any point along the suction run, air pockets will be created.

Fittings

Suction lines should be the same size as the pump inlet. If reducers are used in suction lines, they should be the eccentric type, and should be installed with the flat part of the reducers uppermost to avoid creating air pockets. Valves are not normally used in suction lines, but if a valve is used, install it with the stem horizontal to avoid air pockets.

Strainers

If a strainer is furnished with the pump, be certain to use it; any spherical solids which pass through a strainer furnished with the pump will also pass through the pump itself.

If a strainer is not furnished with the pump, but is installed by the pump user, make certain that the total area of the openings in the strainer is at least three or four times the cross section of the suction line, and that the openings will not permit passage of solids larger than the solids handling capability of the pump.

This pump is designed to handle up to 3-inch (76,2 mm) diameter spherical solids.

Sealing

Since even a slight leak will affect priming, head, and capacity, especially when operating with a high suction lift, all connections in the suction line should be sealed with pipe dope to ensure an air-tight seal. Follow the sealant manufacturer's rec-

ommendations when selecting and applying the pipe dope. The pipe dope should be compatible with the liquid being pumped.

Suction Lines In Sumps

If a single suction line is installed in a sump, it should be positioned away from the wall of the sump at a distance equal to 1 1/2 times the diameter of the suction line.

If there is a liquid flow from an open pipe into the sump, the flow should be kept away from the suction inlet because the inflow will carry air down into the sump, and air entering the suction line will reduce pump efficiency.

If it is necessary to position inflow close to the suction inlet, install a baffle between the inflow and the suction inlet at a distance 1-1/2 times the diameter of the suction pipe. The baffle will allow entrained air to escape from the liquid before it is drawn into the suction inlet.

If two suction lines are installed in a single sump, the flow paths may interact, reducing the efficiency of one or both pumps. To avoid this, position the suction inlets so that they are separated by a distance equal to at least 3 times the diameter of the suction pipe.

Suction Line Positioning

The depth of submergence of the suction line is critical to efficient pump operation. Figure 2 shows recommended minimum submergence vs. velocity.

NOTE

The pipe submergence required may be reduced by installing a standard pipe increaser fitting at the end of the suction line. The larger opening size will reduce the inlet velocity. Calculate the required submergence using the following formula based on the increased opening size (area or diameter).

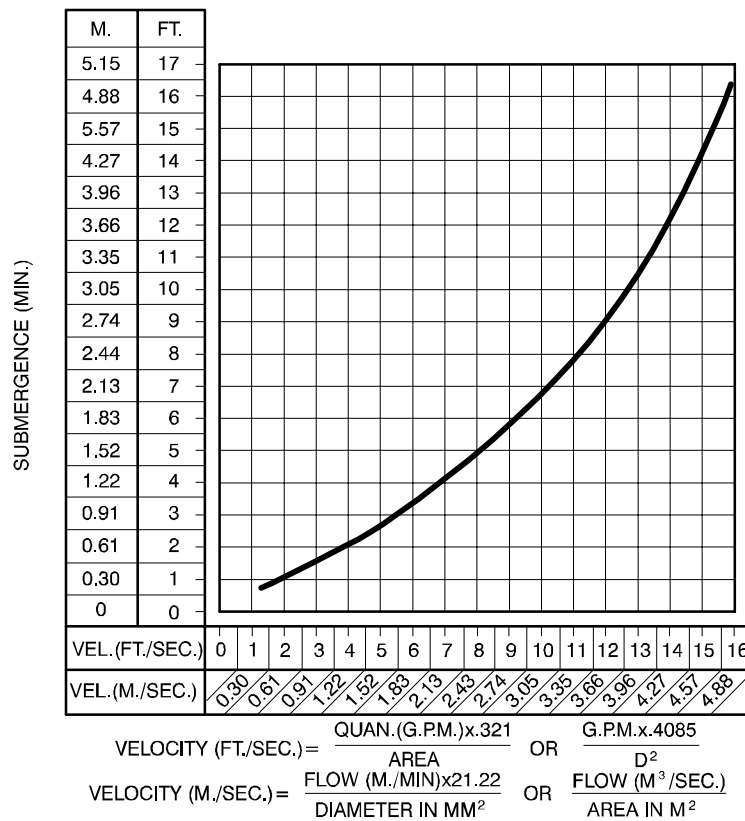


Figure 2. Recommended Minimum Suction Line Submergence vs. Velocity

FLOAT SWITCHES

Installation

The standard pump is equipped with an auto-start control system, and can be conformed to start and stop as the liquid level in the wet well or sump rises and falls. The autostart unit employs either a single or double float switch system, where a bulb raises or lowers (floats) with the liquid level, thus activating an enclosed miniature switch. The floats are equipped with a socket type connector that plugs into a matching receptacle on the auto-start control box.

Standard floats are equipped with 50 feet (15.2 m) of cable.

When installing the floats, note the following:

- Be sure** to provide sufficient room in the wet well or sump so that floats do not get obstructed or drawn into the suction line. If a flexible suction hose is used, it may be extended to lay along the bottom of the wet well or sump and the float can be attached to the hose

above the point where it bends along the bottom. Direct the suction line toward the flow, and the float(s) away from the flow. If a standpipe is available, attach the float switch cable to the standpipe in the sump at the approximate desired liquid level.

- In a single float system, the cable can be tethered to the suction line or standpipe approximately 6 inches (152 mm) above the float. This setting allows approximately 9 inches (229 mm) of liquid rise between pump start/stop. The start/stop interval may be increased by extending the float end of the cable. The liquid level in the sump will increase approximately 8 inches (203 mm) between start/stop intervals for every 6 inches (152 mm) of cable increase.
- If a double float switch system is used, position the "Start" float at the desired high water level in the sump, and the "Stop" float at the desired low water level in the pump.
- Refer to Figure 3 for additional float switch data.

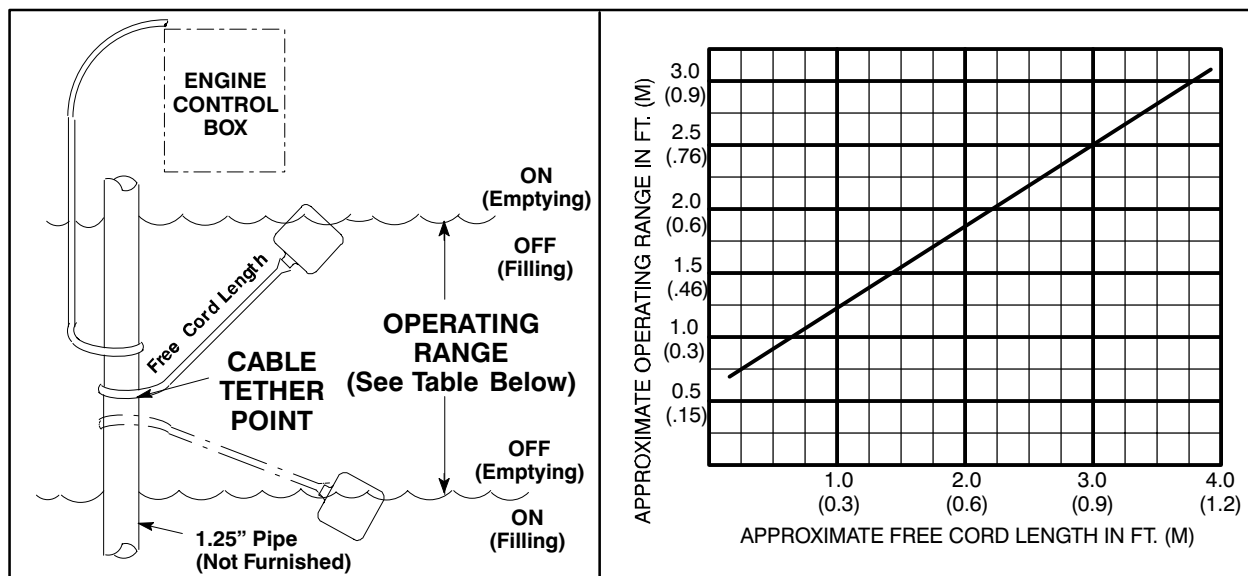


Figure 3. Float Switch Data

OPTIONAL SUBMERSIBLE TRANSDUCER

This unit may be equipped with an optional Electronic Pressure Switch (EPS) that works in conjunction with a submersible transducer. The submersible transducer converts pressure to an electrical signal proportional to liquid level. This electrical signal is distributed to the digital display on the EPS through a scaling circuit which converts the electrical signal to “feet of water”.

When installing the submersible transducer, note the following:

- Handle the signal cable and transducer with care during installation. **Carefully** lower the transducer into the wet well or sump; **do not** drop it to the bottom. To avoid clogging, suspend the transducer off the bottom.
- Be sure** to provide sufficient room in the wet well or sump so that the transducer does not get drawn into the suction line. To prevent this, a flexible suction hose may be extended to lay along the bottom of the wet well or sump. The transducer can then be attached to the hose

above the point where it bends along the bottom. See Figure B-4 for a typical installation.

- The wet well or sump must be vented to atmosphere.
- The EPS is scaled in feet of water column. If the measured medium is other than 1.0 specific gravity, the reading on the EPS should be divided by the specific gravity of the measured medium to obtain the actual level.
- Thoroughly** clean the transducer after each use to prevent clogging.



Do not disassemble the transducer or loosen the compression nut at the signal cable entry. **This will void warranty.** There are no user-serviceable parts inside. Do not nick or cut the jacket of the signal cable; this will cause leakage and **void warranty.**

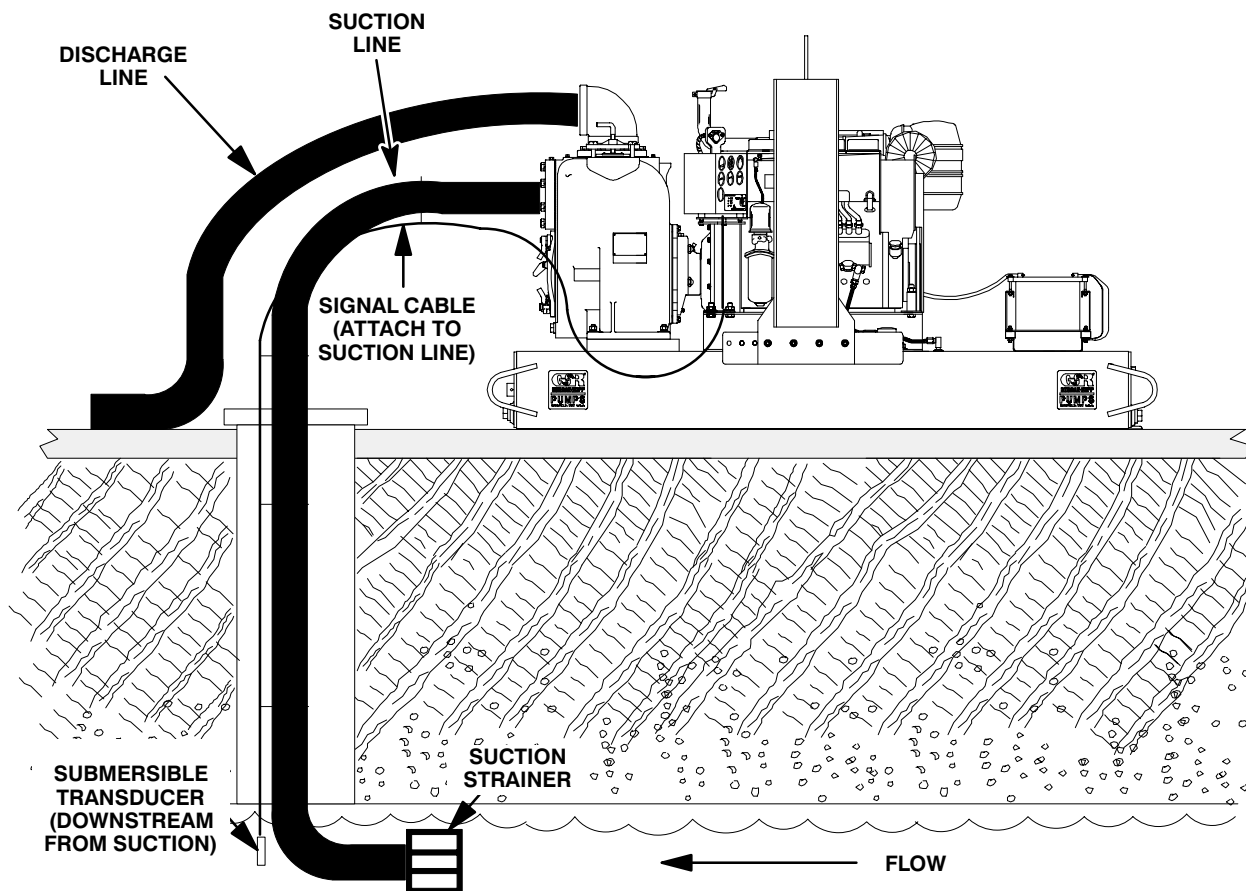


Figure 4. Typical Submersible Transducer Installation

DISCHARGE LINES

Siphoning

Do not terminate the discharge line at a level lower than that of the liquid being pumped unless a siphon breaker is used in the line. Otherwise, a siphoning action causing damage to the pump could result.

Valves

If a throttling valve is desired in the discharge line, use a valve as large as the largest pipe to minimize friction losses. Never install a throttling valve in a suction line.

With high discharge heads, it is recommended that a throttling valve and a system check valve be installed in the discharge line to protect the pump from excessive shock pressure and reverse rotation when it is stopped.



If the application involves a high discharge head, gradually close the discharge throttling valve before stopping the pump.

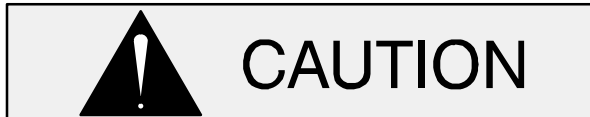
Bypass Lines

Self-priming pumps are not air compressors. During the priming cycle, air from the suction line must be vented to atmosphere on the discharge side. If the discharge line is open, this air will be vented through the discharge. However, if a check valve has been installed in the discharge line, the discharge side of the pump must be opened to atmospheric pressure through a bypass line installed between the pump discharge and the check valve. A self-priming centrifugal pump **will not prime** if there is sufficient static liquid head to hold the discharge check valve closed.

NOTE

The bypass line should be sized so that it does not affect pump discharge capacity; however, the bypass line should be at least 1 inch (25,4 mm) in diameter to minimize the chance of plugging.

In **low discharge head applications** (less than 30 feet (9,1 m)), it is recommended that the bypass line be run back to the wet well, and located 6 inches below the water level or cut-off point of the low level pump. In some installations, this bypass outline may be terminated with a six-to-eight foot (1,8 to 2,4 m) length of 1-1/4 inch (31,8 mm) I.D. **smooth-bore** hose; air and liquid vented during the priming process will then agitate the hose and break up any solids, grease, or other substances likely to cause clogging.



A bypass line that is returned to a wet well must be secured against being drawn into the pump suction inlet.

It is also recommended that pipe unions be installed at each 90° elbow in a bypass line to ease disassembly and maintenance.

In **high discharge head applications** (more than 30 feet (9,1 m)), an excessive amount of liquid may be bypassed and forced back to the wet well under the full working pressure of the pump; this will reduce overall pumping efficiency. **Therefore, it is recommended that a Gorman-Rupp Automatic Air Release Valve be installed in the bypass line.**

Gorman-Rupp Automatic Air Release Valves are reliable, and require minimum maintenance. See **Automatic Air Release Valves** in this section for installation and theory of operation of the Automatic Air Release Valve. Consult your Gorman-Rupp distributor, or contact the Gorman-Rupp Company for selection of an Automatic Air Release Valve to fit your application.



Except in certain specific applications (to

prevent flooding during service of an automatic air release valve in a below-ground lift station), if a manual shut-off valve is installed **anywhere** in a bypass line, it **must** be a full-opening, **ball-type** valve to prevent plugging by solids.



A manual shut-off valve should not be installed in any bypass line. A manual shut-off valve may inadvertently be left closed during operation. A pump which has lost prime may continue to operate without reaching prime, causing dangerous overheating and possible explosive rupture of the pump casing. Personnel could be severely injured.

Allow an over-heated pump to completely cool before servicing. Do not remove plates, covers, gauges, or fittings from an over-heated pump. Liquid within the pump can reach boiling temperatures, and vapor pressure within the pump can cause parts being disengaged to be ejected with great force. After the pump completely cools, drain the liquid from the pump by removing the casing drain plug. Use caution when removing the plug to prevent injury to personnel from hot liquid.

AUTOMATIC AIR RELEASE VALVE

When properly installed and correctly adjusted to the specific hydraulic operating conditions of the application, the Gorman-Rupp Automatic Air Release Valve will permit air to escape through the bypass line, and then close automatically when the pump is fully primed and pumping at full capacity.

Theory of Operation

Figures 5 and 6 show a cross-sectional view of the Automatic Air Release Valve, and a corresponding description of operation.

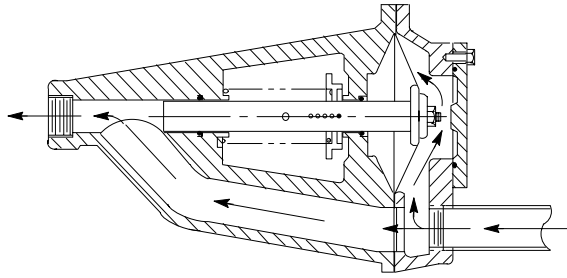


Figure 5. Valve in Open Position

During the priming cycle, air from the pump casing flows through the bypass line, and passes through the Air Release Valve to the wet well (Figure 5).

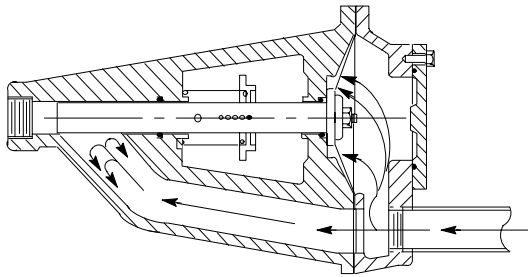


Figure 6. Valve in Closed Position

When the pump is fully primed, pressure resulting from flow against the valve diaphragm compresses the spring and closes the valve (Figure 6). The valve will remain closed, reducing the bypass of liquid to 1 to 5 gallons per minute, until the pump loses its prime or stops.



WARNING!

Some leakage (1 to 5 gallons (3,8 to 18,9

Liters) per minute) will occur when the valve is fully closed. Be sure the bypass line is directed back to the wet well or tank to prevent hazardous spills.

When the pump shuts down, the spring returns the diaphragm to its original position. Any solids that may have accumulated in the diaphragm chamber settle to the bottom and are flushed out during the next priming cycle.

NOTE

The valve will remain open if the pump does not reach its designed capacity or head. Valve closing pressure is dependent upon the discharge head of the pump at full capacity. The range of the valve closing pressure is established by the tension rate of the spring as ordered from the factory. Valve closing pressure can be further adjusted to the exact system requirements by moving the spring retaining pin up or down the plunger rod to increase or decrease tension on the spring. Contact your Gorman-Rupp distributor or the Gorman-Rupp Company for information about an Automatic Air Release Valve for your specific application.

Air Release Valve Installation

The Automatic Air Release Valve must be independently mounted in a horizontal position and connected to the discharge line of the self-priming centrifugal pump (see Figure 7).

NOTE

*If the Air Release Valve is to be installed on a **staged** pump application, contact the factory for specific installation instructions.*

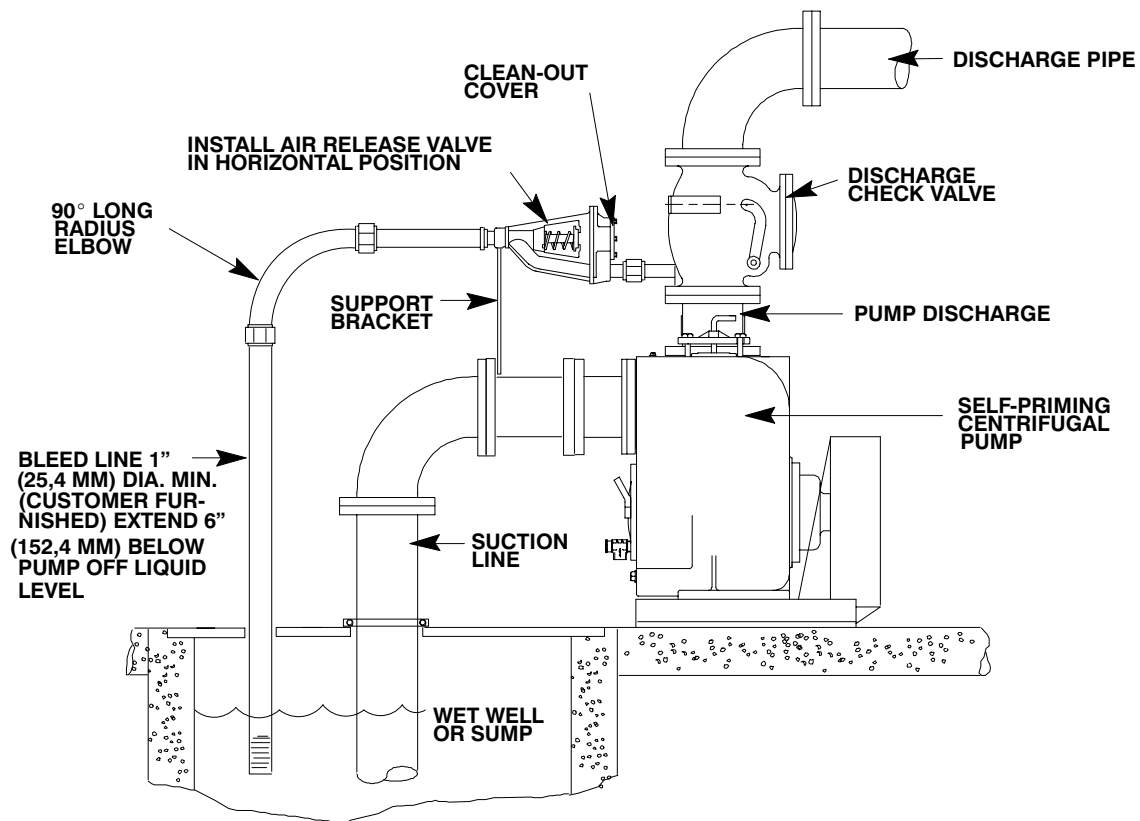


Figure 7. Typical Automatic Air Release Valve Installation

The valve inlet line must be installed between the pump discharge port and the non-pressurized side of the discharge check valve. The valve inlet is at the large end of the valve body, and is provided with standard 1 inch NPT pipe threads.

The valve outlet is located at the opposite end of the valve, and is also equipped with standard 1 inch NPT pipe threads. The outlet should be connected to a bleed line which slopes back to the wet well or sump. The bleed line must be the same size as the inlet piping, or larger. If **piping** is used for the bleed line, avoid the use of elbows whenever possible.

NOTE

*It is recommended that each Air Release Valve be fitted with an independent bleeder line directed back to the wet well. If multiple Air Release Valves are installed in a system, they **must** be fitted with independent bleeder lines; **never** use a common manifold pipe. Contact your Gorman-Rupp distributor or the Gorman-Rupp Company for information about installation of an Automatic Air Release Valve for your specific application.*

ALIGNMENT

The alignment of the pump and the engine is critical for trouble-free mechanical operation. See Section E, **Securing Intermediate And Drive Assembly To Engine** for detailed information.

OPERATION – SECTION C

Review all **SAFETY** information in Section A.

Follow the instructions on all tags, labels and decals attached to the pump.



Do not operate an internal combustion engine in an explosive atmosphere. When operating internal combustion engines in an enclosed area, make certain that exhaust fumes are piped to the outside. These fumes contain carbon monoxide, a deadly gas that is colorless, tasteless, and odorless.



This pump is designed to handle dirty water containing specified entrained solids and slurries. Do not attempt to pump volatile, corrosive, or flammable liquids which may damage the pump or endanger personnel as a result of pump failure.



Never tamper with the governor to gain more power. The governor establishes safe operating limits that should not be exceeded. The maximum continuous operating speed for this pump is 1500 RPM.

PRIMING

Install the pump and piping as described in **INSTALLATION**. Make sure that the piping connections are tight, and that the pump is securely mounted. Check that the pump is properly lubri-

cated (see **LUBRICATION** in **MAINTENANCE AND REPAIR**).

This pump is self-priming, but the pump should never be operated unless there is liquid in the pump casing.



Never operate this pump unless there is liquid in the pump casing. The pump will not prime when dry. Extended operation of a dry pump will destroy the seal assembly.

Add liquid to the pump casing when:

1. The pump is being put into service for the first time.
2. The pump has not been used for a considerable length of time.
3. The liquid in the pump casing has evaporated.

Once the pump casing has been filled, the pump will prime and reprime as necessary.



After filling the pump casing, reinstall and tighten the fill plug. Do not attempt to operate the pump unless all connecting piping is securely installed. Otherwise, liquid in the pump forced out under pressure could cause injury to personnel.

To fill the pump, remove the pump casing fill cover or fill plug in the top of the casing, and add clean liquid until the casing is filled. Replace the fill cover or fill plug before operating the pump.

NOTE

If the suction or discharge piping is open, a hose can be used to fill the casing through the piping.

STARTING



This pump is equipped with an automatic starting system, and is subject to automatic restart. Keep hands and clothing away from the unit to prevent injury during automatic operation. Disconnect the positive battery cable before performing any maintenance. Failure to do so may result in serious personal injury.

Consult the operations manual furnished with the engine.

Manual Starting

On initial start-up, set the engine speed at the half-throttle position. Turn the keyswitch on the control box to the "START" position until the engine starts. Release the key and the switch will return to the "RUN" position.

After the engine starts and the unit is fully primed, adjust the engine RPM until the desired flow rate is achieved.



Pump speed and operating condition points must be within the continuous performance range shown on the curve on page E-1.

Automatic Starting

Install the float(s) or submersible transducer as described in **INSTALLATION, Section B**.

Follow the procedures outlined for manual starting and throttle adjustment, then turn the key to the "AUTO START" position.

NOTE

For security purposes, the key can be removed with the switch in the "AUTO START" position.

Press and hold the white "AUTO" button on the control panel until the red "AUTO" light illuminates. The auto-start system is now armed.

NOTE

The unit can continue to be started manually with the keyswitch in the "AUTO START" position by pressing the white "MAN" button on the control. The "Single Lightning Bolt" light on the control will illuminate in conjunction with an audible alarm before the unit starts. The unit can then be stopped manually by pressing the "OFF/SET" button.

In the auto-start mode, the "Single Lightning Bolt" light will illuminate in conjunction with an audible alarm when the liquid level in the sump or wet well rises and activates the float(s). The light will blink and the alarm will sound for approximately 8 seconds before the unit starts.

When the liquid level in the sump or wet well is sufficiently pumped down, the unit will automatically shut down.

NOTE

If the keyswitch is moved to the "OFF" position while in the auto-start mode, the engine will stop. However, the auto-start process will continue as soon as the keyswitch is moved back to the "AUTO START" position. To cancel the auto-start process, press the "OFF/SET" button.

The control panel is equipped with high oil temperature, low oil pressure, V-belt and start failure (3 attempts) safety shutdowns. If any of these problems occur, the red "Double Lightning Bolt" light will illuminate to indicate a system fault. When the problem is corrected, press the "OFF/SET" button to reset the control.

NOTE

The "OFF/SET" button has dual functionality when in program mode. If necessary, consult the factory for details on programming functions.

The unit can be started manually with the keyswitch in the "AUTO START" position by pressing the white "MAN" button. The "Single Lightning Bolt" light will illuminate in conjunction with an audible alarm before the unit starts.

Stop the unit manually by pressing the “OFF/SET” button.

OPTIONAL EPS CONTROL

Features

The optional EPS Control is equipped with a 12VDC Electronic Pressure Switch which includes the following features:

- 3 Output Relays: 1. A output, delayed
2. B output, no delay
3. Horn output, no delay
- 3 Inputs: 1. Horn silence
2. Pressure transducer
3. Low Temp Thermostat
- LCD screen with backlight for function monitoring
- Bright LEDs to indicate output status and display modes
- Three switches on front panel for **all** adjustments
- Battery level indicator on LCD screen to alert operator of low battery condition
- Microprocessor Control
- Error display to alert user of errors in calibration

Functional Description

Front Panel Controls/Displays

1. The LCD screen displays level information, A and B setpoint off/on levels, Horn delay, and calibration information.

Typical Messages on the display:

- a) EEP bAd... Eeprom memory is not correct, user **must** recalibrate unit.
- b) USr CAL... User calibrate mode, i.e., user **wants** to calibrate unit.
- c) SEt a.oF... A OFF setpoint, units of level.
- d) SEt a.on... A ON setpoint, units of level.
- e) SEt b.oF... B OFF setpoint, units of level.

- f) SEt b.on... B ON setpoint, units of level.
- g) Hrn dLy... Horn on, A output delay time, 5–30 seconds, in 5-second increments.
- h) LO BAT... Indicator, shows battery voltage level is below 12VDC.
- i) Lo tpt... Shows status of Low Temperature Thermostat contacts.

2. LEDs:

- a) When the green LED is lighted, the unit is showing level on the LCD display.
- b) When the A output LED is lighted, the A output relay is closed.
- c) When the B output LED is lighted, the B output relay is closed

NOTE

LED's and all segments of the display are lighted upon connection of power as a lamp test feature. However, no relay outputs are closed during test.

3. Switches:

- a) The  switch functions as a “round robin” type switch. Pressing this switch will cause the unit to show the next selection in the order listed above.
- b) The  switch functions to decrease the selection showing. This switch can be used to decrease the smallest digit by “bumping” the switch, or to continuously decrease the digit by pressing and holding for at least one second and releasing when desired setting is reached.
- c) The  switch functions to increase the selection showing. This switch can be used to increase the smallest digit by “bumping” the switch, or to continuously increase the digit by pressing and holding for at least one second and releasing when desired setting is reached.

Liquid level adjustment of the Electronic Pressure Switch is accomplished using the three buttons on the control. For EPS functions and level adjustment, refer to the following instructions.

EPS Functions

Actual functions of the control occur as follows:

Power is applied to the unit.

Unit performs display test for approximately 4 seconds.

When the pressure level showing is equal to or greater than the "A.on" setpoint, the Horn output contacts will close in approximately 1 second and a delay, equal to the "Hrn dLy" time, will occur before the A output contacts close.

When the level showing is equal to or greater than the "B.on" setpoint, the B output contacts will close in approximately 1 second.

When the pressure decreases to a level equal to or less than the "B.of" setpoint, B output contacts will open in approximately one second.

When the pressure decreases to a level equal to or less than the "A.of" setpoint, A output contacts will open in approximately one second.

If an optional Low Temperature Thermostat is connected to the unit and the thermostat contacts close, the unit displays "lo tpt" on the display. In approximately 1 second, the Horn output contacts close, then after the "Hrn dLy" time, A output contacts close. A output contacts will remain closed as long as Low Temperature Thermostat contacts are closed.

When the Low Temperature Contacts open, A output contact will open **only** if the level is equal to or less than the "A.off" setpoint.

As long as the Low Temperature Thermostat contacts are closed, the display will show "lo tpt" unless  switch is pressed to display some other information. Level is not viewable until the Low Temperature Thermostat contacts open.

The user may wish to check Setpoints Off/On and Horn output/A output delay times. "Bumping" the  switch will display all of the information desired.

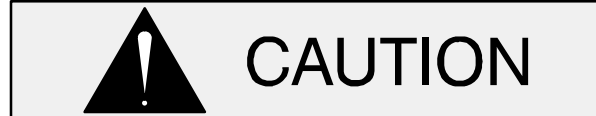
NOTE

One second delays in contact opening/closing is a result of time sampling of the pressure signal to fil-

ter false signals that could cause "nuisance" tripping of the contacts.

NOTE

If the "Hrn dLy" is changed during the actual A output delay cycle, the current cycle is not changed; the change becomes effective on the next A output delay cycle.



Use caution to ensure that the "--.on" setpoint (i.e. "A.on") is not adjusted to a level less than the corresponding "--.of" setpoint (i.e. "A.of"). Improper adjustment of the off/on setpoints will render the unit non-functional, resulting in flooding.

EPS Calibration

NOTE

Zero offset and span adjustments are only necessary to calibrate a new unit, or when replacing the transducer. Once calibrated, "ON" and "OFF" setpoints will be stored in the unit's memory. Liquid level adjustments will be used whenever "ON" and "OFF" liquid levels must be reset.

There are two reasons for the user to calibrate the unit. When power is applied, the unit confirms setpoints and other calibration information for validity. If the setpoints are not valid, the LCD screen shows "EEP bAd" and the unit must be recalibrated. Also, if the unit is moved, or some other external change takes place, the unit must be recalibrated.

Zero Adjustment

Zero adjustment tells the unit when the transducer is exposed to zero water (atmospheric) pressure. When recalibration is desired, hold the transducer in hand and apply power to the unit. The LCD screen will display "Level ABC". Press and hold  for 5 seconds. The LCD screen displays "Input? External XDUCR". Perform the following calibration procedures.

Press  3 times and the LCD screen will display “Calibrate Zro”. Press  or  until a character or number on the display changes.

Press  to accept the entry and advance to “Calibrate Span”.

Span Adjustment

Span adjustment calibrates the unit to a known water pressure (depth). To set:

Submerge the transducer to an exact known depth. At “Calibrate Span”, the span setting in the unit’s memory will display. Press  to increase or  to decrease the value until the LCD screen display equals the actual known depth of the transducer.

Level Adjustment

Level adjustment tells the unit when to turn the pump on and off. To set:

From “Level ABC” display, press  once and “Pump Setpt A On” will display. Press  to increase or  to decrease to the desired level at which the pump turns on. Press  to advance to “Pump Setpt A Off”. Press  to increase or  to decrease to the desired level at which the pump turns off.

Press  again to advance to “Pump Setpt B On”. If “B” is to be used, repeat the procedure described above for adjusting level “A”.

Horn Delay

The horn delay is pre-set from the factory through the engine control panel, therefore this function is not utilized through the EPS.

OPERATION

A Gorman-Rupp automatic air release valve may be installed in a bypass line, or the bypass line may be left open.



A manual shut-off valve should not be installed in any bypass line. A manual shut-off valve may inadvertently be left closed during operation. A pump which has lost prime may continue to operate without reaching prime, causing dangerous overheating and possible explosive rupture of the pump casing. Personnel could be severely injured.

Lines With a Bypass

If a Gorman-Rupp Automatic Air Release Valve has been installed, the valve will automatically open to allow the pump to prime, and automatically close after priming is complete (see **INSTALLATION** for Air Release Valve operation).

If the bypass line is open, air from the suction line will be discharged through the bypass line back to the wet well during the priming cycle. Liquid will then continue to circulate through the bypass line while the pump is in operation.

Lines Without a Bypass

Open all valves in the discharge line and start the engine. Priming is indicated by a positive reading on the discharge pressure gauge or by a quieter operation. The pump may not prime immediately because the suction line must first fill with liquid. If the pump fails to prime within five minutes, stop it and check the suction line for leaks.

After the pump has been primed, partially close the discharge line throttling valve in order to fill the line slowly and guard against excessive shock pressure which could damage pipe ends, gaskets, sprinkler heads, and any other fixtures connected to the line. When the discharge line is completely filled, adjust the throttling valve to the required flow rate.

Leakage

No leakage should be visible at pump mating surfaces, or at pump connections or fittings. Keep all line connections and fittings tight to maintain maximum pump efficiency.

Liquid Temperature And Overheating

The **maximum** liquid temperature for this pump is 160° F (71° C). Do not apply it at a higher operating temperature.

Overheating can occur if operated with the valves in the suction or discharge lines closed. Operating against closed valves could bring the liquid to a boil, build pressure, and cause the pump to rupture or explode. If overheating occurs, stop the pump and allow it to completely cool before servicing it. Refill the pump casing with cool liquid.



Allow an over-heated pump to completely cool before servicing. Do not remove plates, covers, gauges, or fittings from an over-heated pump. Liquid within the pump can reach boiling temperatures, and vapor pressure within the pump can cause parts being disengaged to be ejected with great force. After the pump completely cools, drain the liquid from the pump by removing the casing drain plug. Use caution when removing the plug to prevent injury to personnel from hot liquid.

As a safeguard against rupture or explosion due to heat, this pump is equipped with a pressure relief valve which will open if vapor pressure within the pump casing reaches a critical point. If over-heating does occur, stop the pump immediately and allow it to completely cool before servicing it. **Approach any over-heated pump cautiously.** It is recommended that the pressure relief valve assembly be replaced at each overhaul, or any time the pump casing over-heats and activates the valve. **Never** replace this valve with a substitute which has not been specified or provided by the Gorman-Rupp Company.

Strainer Check

If a suction strainer has been shipped with the pump or installed by the user, check the strainer regularly, and clean it as necessary. The strainer

should also be checked if pump flow rate begins to drop. If a vacuum suction gauge has been installed, monitor and record the readings regularly to detect strainer blockage.

Never introduce air or steam pressure into the pump casing or piping to remove a blockage. This could result in personal injury or damage to the equipment. If backflushing is absolutely necessary, **liquid pressure** must be limited to 50% of the maximum permissible operating pressure shown on the pump performance curve.

Pump Vacuum Check

With the pump inoperative, install a vacuum gauge in the system, using pipe dope on the threads. Block the suction line and start the pump. At operating speed the pump should pull a vacuum of 20 inches (508 mm) or more of mercury. If it does not, check for air leaks in the seal, gasket, or discharge valve.

Open the suction line, and read the vacuum gauge with the pump primed and at operation speed. Shut off the pump. The vacuum gauge reading will immediately drop proportionate to static suction lift, and should then stabilize. If the vacuum reading falls off rapidly after stabilization, an air leak exists. Before checking for the source of the leak, check the point of installation of the vacuum gauge.

STOPPING

Manual Stopping

In the manual mode, reduce the throttle speed slowly, and allow the engine to idle briefly before switching the HAND-OFF-AUTO switch to 'OFF'.



If the application involves a high discharge head, gradually close the discharge throttling valve before stopping the pump.

After stopping the pump, close and lock the control panel cover, or disconnect the positive battery cable to ensure that the pump will remain inoperative.

Automatic Stopping

In the automatic mode, the pump will stop when the liquid in the wet well or sump lowers and acti-

vates the “Off” float switch(s) or “Off” setpoint stored in the optional EPS. The pump will restart automatically when the liquid rises and activates the “On” float switch(s) or “On” setpoint stored in the optional EPS.

Safety Shutdown System

The unit is equipped with a safety system to automatically shut down the engine under certain conditions. The engine will automatically shut down:

1. If the engine exceeds its safe operating temperature.
2. If the engine oil pressure drops below design limits.
3. If the engine fails to start within a pre-set period of time.
4. If the engine speed exceeds the safe operating range.
5. If the engine V-belt breaks.

Lights on the control panel will indicate which of the safety features has caused the engine to shut down.

Should any of the safety features cause the engine to shut down, **the cause must be determined and corrected** before putting the unit back into service. The engine **will not restart** until the keyswitch has been returned to the ‘OFF’ position for at least 10 seconds.

All safety shutdown features are pre-set at the factory for optimum performance and safety; **do not** attempt to adjust these settings.



Never disconnect any of the safety shutdown features; this will void the warranty and could result in serious damage to the unit and/or injury to personnel. Safety shutdown features are pre-set at the factory; do not attempt to adjust any of the settings. Determine the cause of

shutdown before putting the unit back into service. Consult the factory for additional information.

OPERATION IN EXTREME HEAT

The safety shutdown system will automatically stop the unit if engine operating temperature exceeds design limits. If engine over-temperature shutdown occurs, allow the unit to completely cool before restarting.

If engine overheating continues, check the engine lubricant level and viscosity. Consult the engine operation manual for the recommended lubricant for operation in extreme heat.

If the unit is equipped with the optional auto-start control, the float(s) may need to be adjusted to allow shorter run and longer cooling periods, if possible.



This pump is equipped with an automatic starting system, and is subject to automatic restart. Keep hands and clothing away from the unit to prevent injury during automatic operation. Disconnect the positive battery cable before performing any maintenance. Failure to do so may result in serious personal injury.

Cold Weather Preservation

In below freezing conditions, drain the pump to prevent damage from freezing. Also, clean out any solids by flushing with a hose. Operate the pump for approximately one minute; this will remove any remaining liquid that could freeze the pump rotating parts. If the pump will be idle for more than a few hours, or if it has been pumping liquids containing a large amount of solids, drain the pump, and flush it thoroughly with clean water. To prevent large solids from clogging the drain port and preventing the pump from completely draining, insert a rod or stiff wire in the drain port, and agitate the liquid during the draining process. Clean out any remaining solids by flushing with a hose.

BEARING TEMPERATURE CHECK

Bearings normally run at higher than ambient temperatures because of heat generated by friction. Temperatures up to 160°F (71°C) are considered normal for bearings, and they can operate safely to at least 180°F (82°C).

Checking bearing temperatures by hand is inaccurate. Bearing temperatures can be measured accurately by placing a contact-type thermometer against the housing. Record this temperature for future reference.

A sudden increase in bearing temperatures is a warning that the bearings are at the point of failing to operate properly. Make certain that the bearing lubricant is of the proper viscosity and at the correct level (see **LUBRICATION** in Section E). Bearing overheating can also be caused by shaft misalignment and/or excessive vibration.

When pumps are first started, the bearings may seem to run at temperatures above normal. Continued operation should bring the temperatures down to normal levels.

TROUBLESHOOTING – SECTION D

Review all **SAFETY** information in Section A.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Shut down the engine, remove the key, and disconnect the positive battery cable to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Check the temperature before opening any covers, plates, or plugs.

5. Close the suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.



This pump is equipped with an automatic starting system, and is subject to automatic restart. Keep hands and clothing away from the unit to prevent injury during automatic operation. Disconnect the positive battery cable before performing any maintenance. Failure to do so may result in serious personal injury.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP FAILS TO PRIME	Not enough liquid in casing.	Add liquid to casing. See PRIMING .
	Suction check valve contaminated or damaged.	Clean or replace check valve.
	Air leak in suction line.	Correct leak.
	Lining of suction hose collapsed.	Replace suction hose.
	Leaking or worn seal or pump gasket.	Check pump vacuum. Replace leaking or worn seal or gasket.
	Suction lift or discharge head too high.	Check piping installation and install bypass line if needed. See INSTALLATION .
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE	Strainer clogged.	Check strainer and clean if necessary.
	Air leak in suction line.	Correct leak.
	Lining of suction hose collapsed.	Replace suction hose.
	Leaking or worn seal or pump gasket.	Check pump vacuum. Replace leaking or worn seal or gasket.
	Strainer clogged.	Check strainer and clean if necessary.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE (cont.)	Suction intake not submerged at proper level or sump too small. Impeller or other wearing parts worn or damaged. Impeller clogged. Discharge head too high. Suction lift too high. Pump speed too slow.	Check installation and correct submergence as needed. Replace worn or damaged parts. Check that impeller is properly centered and rotates freely. Free impeller of debris. Install bypass line. Measure lift w/vacuum gauge. Reduce lift and/or friction losses in suction line. Check engine output; consult engine operation manual.
PUMP REQUIRES TOO MUCH POWER	Pump speed too high. Discharge head too low. Liquid solution too thick. Bearing(s) frozen.	Check engine output. Adjust discharge valve. Dilute if possible. Disassemble pump and check bearing(s).
PUMP CLOGS FREQUENTLY	Discharge flow too slow. Suction check valve or foot valve clogged or binding. Liquid solution too thick.	Open discharge valve fully to increase flow rate, and run engine at maximum governed speed. Clean valve. Dilute if possible.
EXCESSIVE NOISE	Cavitation in pump. Pumping entrained air. Pump or drive not securely mounted. Impeller clogged or damaged.	Reduce suction lift and/or friction losses in suction line. Record vacuum and pressure gauge readings and consult local representative or factory. Locate and eliminate source of air bubble. Secure mounting hardware. Clean out debris; replace damaged parts.
BEARINGS RUN TOO HOT	Bearing temperature is high, but within limits. Low or incorrect lubricant. Suction and discharge lines not properly supported. Drive misaligned.	Check bearing temperature regularly to monitor any increase. Check for proper type and level of lubricant. Check piping installation for proper support. Align drive properly.

PREVENTIVE MAINTENANCE

Since pump applications are seldom identical, and pump wear is directly affected by such things as the abrasive qualities, pressure and temperature of the liquid being pumped, this section is intended only to provide general recommendations and practices for preventive maintenance. Regardless of the application however, following a routine preventive maintenance schedule will help assure trouble-free performance and long life from your Gorman-Rupp pump. For specific questions concerning your application, contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

Record keeping is an essential component of a good preventive maintenance program. Changes in suction and discharge gauge readings (if so

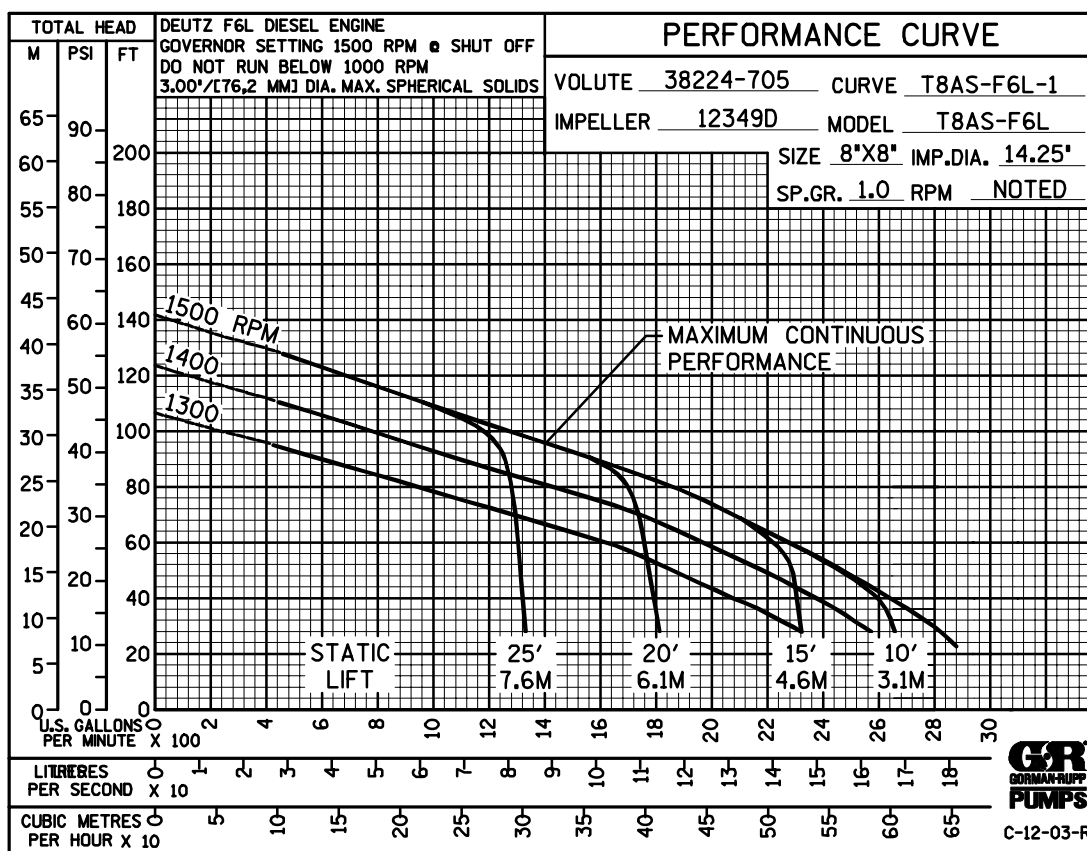
equipped) between regularly scheduled inspections can indicate problems that can be corrected before system damage or catastrophic failure occurs. The appearance of wearing parts should also be documented at each inspection for comparison as well. Also, if records indicate that a certain part (such as the seal) fails at approximately the same duty cycle, the part can be checked and replaced before failure occurs, reducing unscheduled down time.

For new applications, a first inspection of wearing parts at 250 hours will give insight into the wear rate for your particular application. Subsequent inspections should be performed at the intervals shown on the chart below. Critical applications should be inspected more frequently.

Preventive Maintenance Schedule					
Item	Service Interval*				
	Daily	Weekly	Monthly	Semi-Annually	Annually
General Condition (Temperature, Unusual Noises or Vibrations, Cracks, Leaks, Loose Hardware, Etc.)	I				
Pump Performance (Gauges, Speed, Flow)	I				
Bearing Lubrication		I			R
Seal Lubrication (And Packing Adjustment, If So Equipped)		I			R
V-Belts (If So Equipped)			I		
Air Release Valve Plunger Rod (If So Equipped)			I	C	
Front Impeller Clearance (Wear Plate)				I	
Rear Impeller Clearance (Seal Plate)				I	
Check Valve					I
Pressure Relief Valve (If So Equipped)					C
Pump and Driver Alignment					I
Shaft Deflection					I
Bearings					I
Bearing Housing					I
Piping					I
Driver Lubrication — See Mfgr's Literature					
Legend: I = Inspect, Clean, Adjust, Repair or Replace as Necessary C = Clean R = Replace * Service interval based on an intermittent duty cycle equal to approximately 4000 hours annually. Adjust schedule as required for lower or higher duty cycles or extreme operating conditions.					

PUMP MAINTENANCE AND REPAIR - SECTION E

MAINTENANCE AND REPAIR OF THE WEARING PARTS OF THE PUMP WILL MAINTAIN PEAK OPERATING PERFORMANCE.



* STANDARD PERFORMANCE FOR PUMP MODEL T8A60S-F6L

* Based on 70° F (21° C) clear water at sea level with minimum suction lift. Since pump installations are seldom identical, your performance may be different due to such factors as viscosity, specific gravity, elevation, temperature, and impeller trim.

If your pump serial number is followed by an "N", your pump is **NOT** a standard production model.

Contact the Gorman-Rupp Company to verify performance or part numbers.



CAUTION

Pump speed and operating condition points must be within the continuous performance range shown on the curve.

SECTION DRAWING

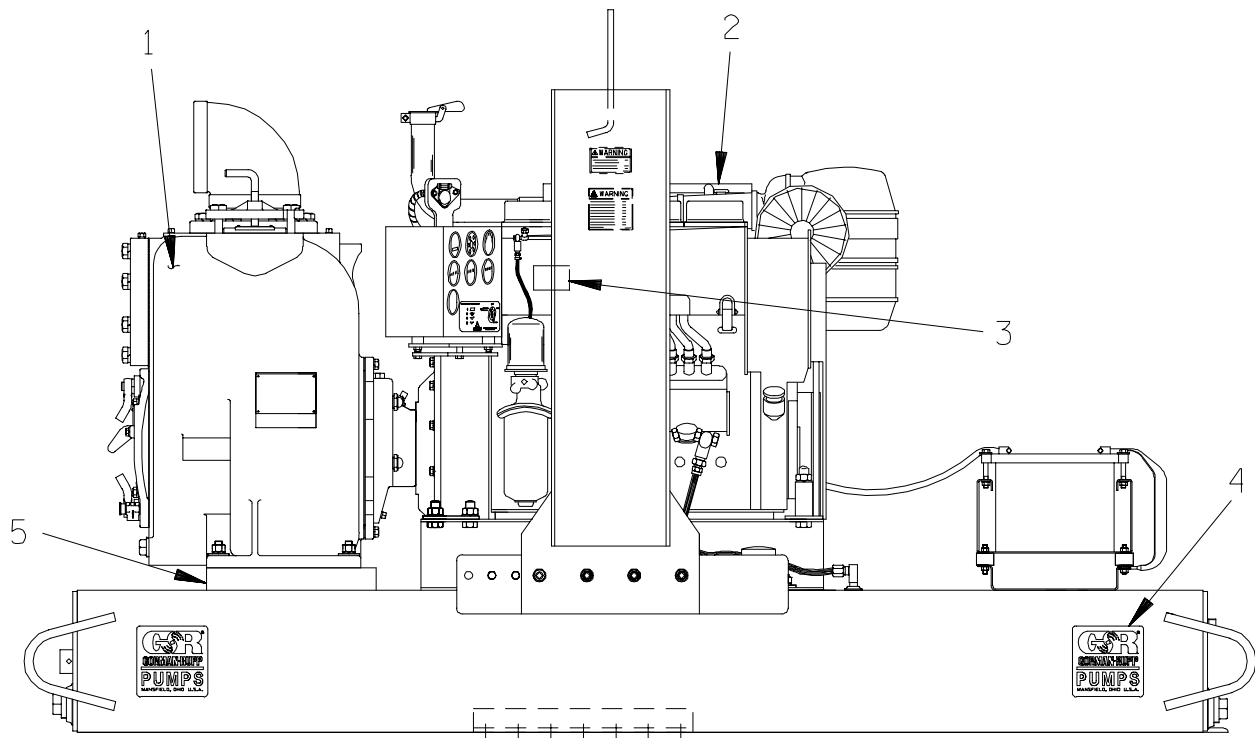


Figure 1. Pump Model T8A60S-F6L

PARTS LIST
Pump Model T8A60S-F6L
 (From S/N 1318431 up)

If your pump serial number is followed by an "N", your pump is **NOT** a standard production model. Contact the Gorman-Rupp Company to verify part numbers.

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	PUMP END ASSY	T8A60S-(SAE 3/10)	---	1
2	POWER UNIT KIT	46143-042	---	1
3	G-R DECAL	GR-06	---	4
4	PUMP MOUNTING KIT	48157-004	---	1
OPTIONAL:				
	12V BATTERY	29331-515	---	1
	WHEEL KIT	GRP30-255	---	1

* INDICATES PARTS RECOMMENDED FOR STOCK

SECTION DRAWING

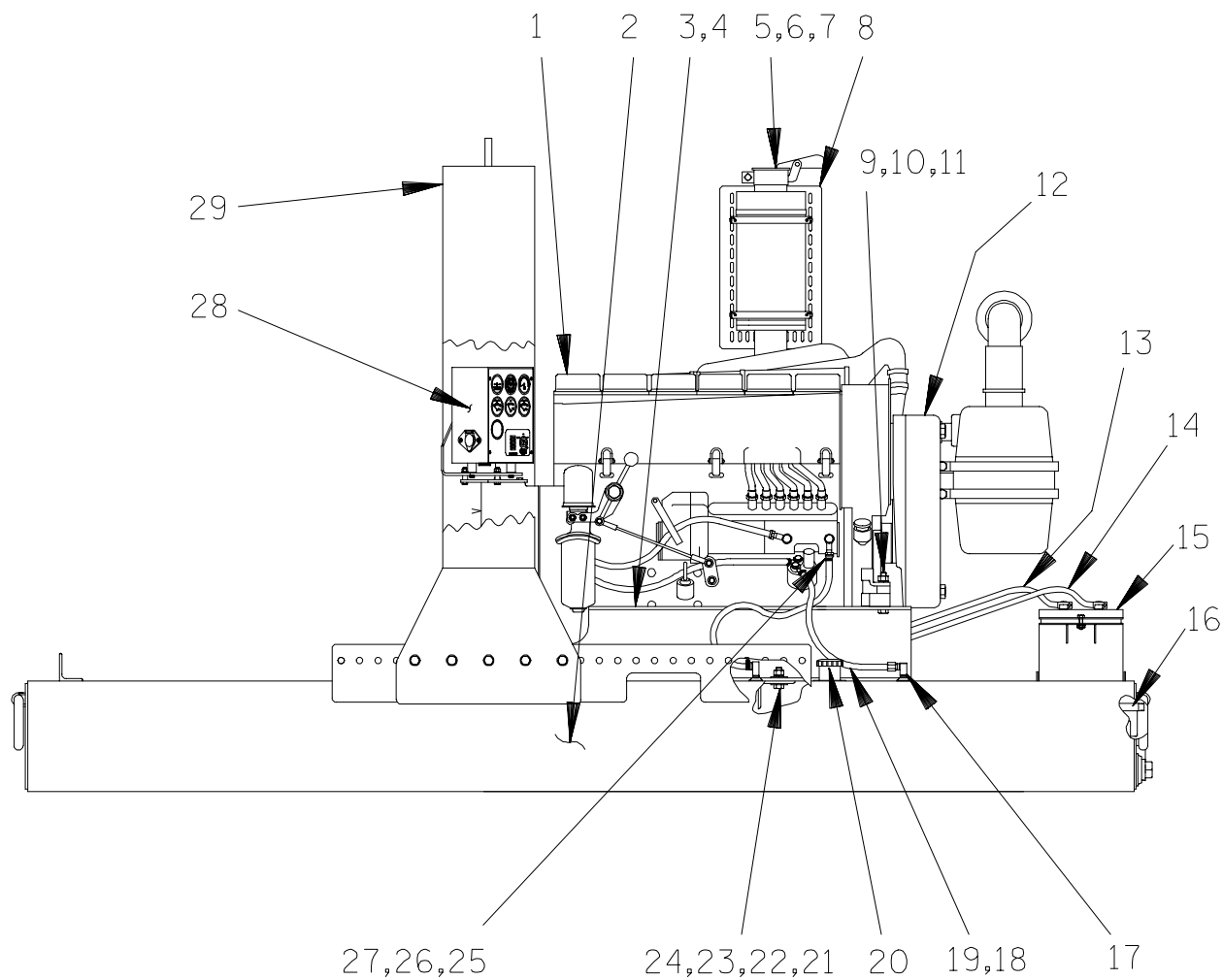


Figure 2. 46143-042 Deutz Power Unit Kit

PARTS LIST
46143—042 Deutz Power Unit Kit

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	DEUTZ F6L ENGINE	29271—211	---	1
2	BASE/FUEL TANK	41553—007	24150	1
3	R.H. ENGINE RAIL	34458—038	15080	1
4	L.H. ENGINE RAIL	34441—069	15080	1
5	EXHAUST ELBOW	31912—036	15210	1
6	WEATHER CAP	S1387	---	1
7	NOT REQUIRED			
8	MUFFLER GUARD ASSY	42331—035	---	1
9	HEX HD CAPSCREW	B0816	15991	4
10	HEX NUT	D08	15991	4
11	LOCKWASHER	J08	15991	4
12	NOT REQUIRED			
13	POS BATTERY CABLE ASSY	47311—210	---	1
14	NEG BATTERY CABLE ASSY	47311—142	---	1
15	BATTERY BOX KIT	42432—001	---	1
16	OIL DRAIN ASSY	46342—033	---	1
17	FUEL PICKUP	29332—145	---	2
18	HOSE ASSY	46341—796	---	1
19	MALE CONNECTOR	S1447	---	1
20	FUEL GAUGE	29332—135	---	1
21	HEX HD CAPSCREW	B1007	15991	4
22	HEX NUT	D10	15991	4
23	LOCKWASHER	J10	15991	4
24	FLAT WASHER	K10	15991	8
25	FUEL LINE	18513—302	---	1
26	HOSE CLAMP	26518—642	---	2
27	MALE CONNECTOR	26523—333	---	1
28	CONTROL PANEL KIT	48313—794	---	1
29	LIFTING BAIL KIT	48274—801	---	1

NOT SHOWN:

FLOAT SWITCH KIT	48312—980	---	1
ENGINE STARTUP TAG	38816—269	---	1
INSTRUCTION DECAL	38818—144	---	1
WARNING DECAL	38816—203	---	1

* INDICATES PARTS RECOMMENDED FOR STOCK

SECTION DRAWING

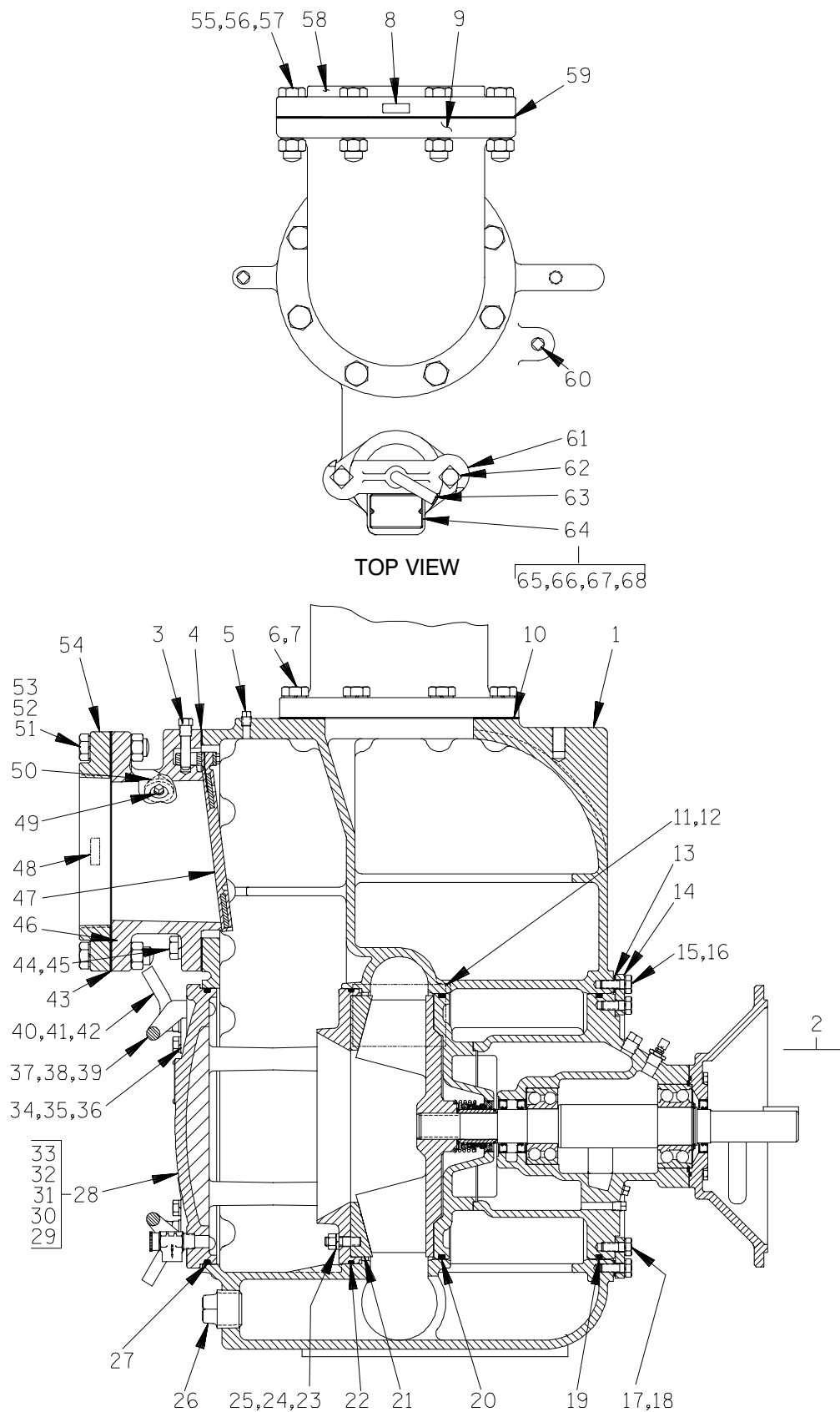


Figure 3. T8A60S—(SAE 3/10) Pump End Assembly

PARTS LIST **T8A60S—(SAE 3/10) Pump End Assembly**

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	PUMP CASING	38224—705	10000	1	48	SUCTION STICKER	6588AG	----	1
2	REPAIR ROTATING ASSY	44163—357	----	1	49	PIPE PLUG	P04	15079	1
3	CHECK VALVE PIN	12357	17010	1	50	PIPE PLUG	P20	10079	1
4 *	SUCT FLANGE GASKET	12356G	19370	1	51	HEX HD CAPSCREW	B1214	15991	8
5	PIPE PLUG	P04	15079	1	52	LOCKWASHER	J12	15991	8
6	HEX HD CAPSCREW	B1209	15991	8	53	HEX NUT	D12	15991	8
7	LOCKWASHER	J12	15991	8	54	SUCTION FLANGE	1759	10010	1
8	DISCHARGE STICKER	6588BJ	----	1	55	HEX HD CAPSCREW	B1214	15991	8
9	DISCHARGE ELBOW	S5015	----	1	56	LOCKWASHER	J12	15991	8
10 *	DISCH ELBOW GASKET	25113—038	----	1	57	HEX NUT	D12	15991	8
11	NAME PLATE	38818—040	13990	1	58	DISCHARGE FLANGE	1759	10010	1
12	DRIVE SCREW	BM#04—03	170001	4	59 *	SUCTION FLG GASKET	25113—038	----	1
13 *	ROT ASSY ADJ SHIM	33221—018	17040	12	60	PIPE PLUG	P04	15079	1
14	PUMP CASING RING	31281—016	15990	1	61	CLAMP BAR	38111—004	11010	1
15	HEX HD CAPSCREW	B0806	15991	6	62	MACHINE BOLT	A1014	15991	2
16	LOCKWASHER	J08	15991	6	63	CLAMP BAR SCREW	31912—009	15000	1
17	HEX HD CAPSCREW	B0805	15991	6	64	FILL COVER ASSY	42111—344	----	1
18	LOCKWASHER	J08	15991	6	65	—FILL COVER PLATE	NOT AVAILABLE		1
19 *	BEARING HSG O-RING	S1914	----	1	66	—WARNING PLATE	38816—097	13990	1
20 *	SEAL PLATE O-RING	S1914	----	1	67	—DRIVE SCREW	BM#04—03	17000	2
21 *	WEAR PLATE	12348A	10010	1	68	—FILL COVER GASKET	50G	19210	1
22 *	WEAR PLATE O-RING	25152—384	----	1	NOT SHOWN:				
23	STUD	C0808	15991	3		PIPE PLUG	P08	15079	1
24	HEX NUT	D08	15991	3		PRIMING STICKER	6588AH	----	1
25	LOCKWASHER	J08	15991	3		LUBE DECAL	38817—084	----	1
26	PIPE PLUG	P32	10009	1		INSTRUCTION LABEL	2613DK	----	2
27 *	BACK CVR O-RING	S1915	----	1		WARNING DECAL	2613FE	----	1
28	BACK COVER ASSY	42111—808	----	1		G-R DECAL	GR—03	----	1
29	—BACK COVER	NOT AVAILABLE		1		INSTR TAG PAPER	38817—023	----	1
30	—WARNING PLATE	2613EV	13900	1		SUPER "T" DECAL	38812—089	----	1
31	—DRIVE SCREW	BM#04—03	17000	4		DRIVE ASSEMBLY	44162—171	----	1
32	—PRESSURE RLF VALVE	26662—005	----	1		STRAINER	46641—010	24150	1
33	—WARNING DECAL	38816—302	----	1		ROTATION DECAL	2613M	----	1
34	LOCKING COLLAR	38115—551	15001	4	OPTIONAL:				
35	HEX HD CAPSCREW ¹	B0804-1/2	15991	4		CASING HEATER ASSEMBLIES			
36	LOCKWASHER	J08	15991	4		—120V	47811—096	----	1
37	COVER PLATE HANDLE	12354	13010	2		—240	47811—097	----	1
38	HEX HD CAPSCEW	B0604	15991	4		IMP CLEAN-OUT KIT	48783—011	----	1
39	LOCKWASHER	J06	15991	4		SEAL PLATE AND BEARING HOUSING O-RINGS			
40	STUD	C1214	15991	4	✓	—VITON	25154—458	----	1
41	HAND NUT	38115—202	15040	4		DISASSEMBLY TOOL	12858	24000	1
42	ADJUSTING SCREW	31871—070	1500X	4		SEWAGE SLUDGE			
43 *	SUCT FLANGE GASKET	25113—038	----	1		PRESS RELIEF VALVE	46431—628	----	1
44	HEX HD CAPSCREW	B1209	15991	8		AIR RELEASE VALVES:			
45	LOCKWASHER	J12	15991	8		—10# COMP SPRING	GRP33—07A	----	1
46	SUCTION FLANGE	12356	10010	1		—25# COMP SPRING	GRP33—07	----	1
47 *	FLAP VALVE ASSY	46411—066	----	1		—80# COMP SPRING	GRP33—07B	----	1

* INDICATES PARTS RECOMMENDED FOR STOCK

✓ VITON® IS A REGISTERED TRADEMARK OF THE DUPONT CORP.

SECTION DRAWING

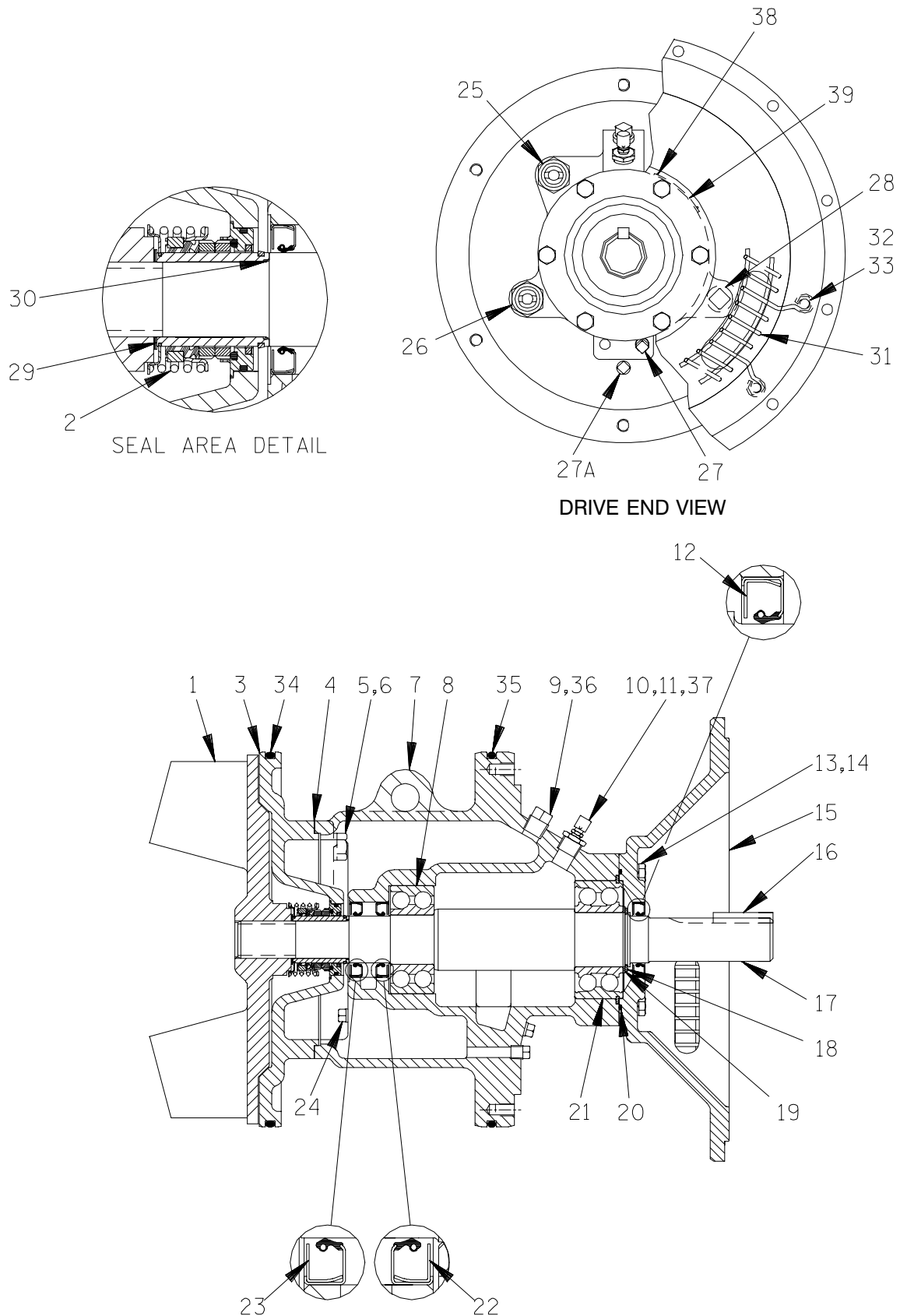


Figure 4. 44163-357 Repair Rotating Assembly

PARTS LIST **44163-357 Repair Rotating Assembly**

ITEM NO.		PART NAME	PART NUMBER	MAT'L CODE	QTY
1	*	IMPELLER	12349D	11000	1
2	*	CARTRIDGE SEAL ASSY	46513-154	---	1
3		SEAL PLATE	12350	10010	1
4	*	SEAL PLATE GASKET	12350G	20000	1
5		HEX HD CAPSCREW	B1006	15991	4
6		LOCKWASHER	J10	15991	4
7		BEARING HOUSING	38251-412	10000	1
8	*	INBOARD BALL BEARING	23421-461	---	1
9		VENTED PLUG	4823A	15079	1
10		AIR VENT	S1530	---	1
11		REDUCING PIPE BUSHING	AP0802	15079	1
12		OIL SEAL	S1917	---	1
13		HEX HD CAPSCREW	B0605-1/2	15991	6
14		LOCKWASHER	J06	15991	6
15		DRIVE FLANGE	38545-007	11010	1
16	*	SHAFT KEY	N0608	15990	1
17	*	IMPELLER SHAFT	38515-589	1706H	1
18		RETAINING RING	S215	---	1
19		THRUST WASHER	31134-113	15210	1
20	*	DRIVE FLANGE O-RING	S333	---	1
21	*	OUTBOARD BALL BRG	23422-412	---	1
22	*	INBOARD OIL SEAL	S1917	---	1
23	*	OUTBOARD OIL SEAL	S1917	---	1
24		PIPE PLUG	P04	15079	1
25		SEAL SIGHT GAUGE	S1417	---	1
26		BEARING SIGHT GAUGE	S1417	---	1
27		BRG CAVITY DRAIN PLUG	P04	15079	1
27A		SEAL CAVITY DRAIN PLUG	P04	15079	1
28		PIPE PLUG	P12	15079	1
29	*	IMP ADJ SHIM SET	5091	17090	REF
30	*	SHAFT SLEEVE O-RING	25154-026	---	REF
31		INTERMEDIATE GUARD	42381-509	24152	2
32		HEX HD CAPSCREW	B0603	15991	4
33		LOCKWASHER	J06	15991	4
34	*	SEAL PLATE O-RING	S1914	---	1
35		BEARING HSG O-RING	S1914	---	1
36		SHIPPING PLUG	11495B	15079	1
37		SHIPPING PLUG	11495B	15079	1
38		DRIVE SCREW	BM#04-03	17000	2
39		S/N PLATE	2613GG	13990	1
NOT SHOWN:					
		ROT ASSY ADJ SHIMS	33221-018	17040	12
		INSTRUCTION TAG	6588U	---	1
		ROTATION DECAL	2613M	---	1
OPTIONAL:					
		G-R HARD IRON PARTS			
		-IMPELLER	12349	1102H	1
		-SEAL PLATE	12350	1102H	1
		-WEAR PLATE	12348A	1102H	1

* INDICATES PARTS RECOMMENDED FOR STOCK

SECTION DRAWING

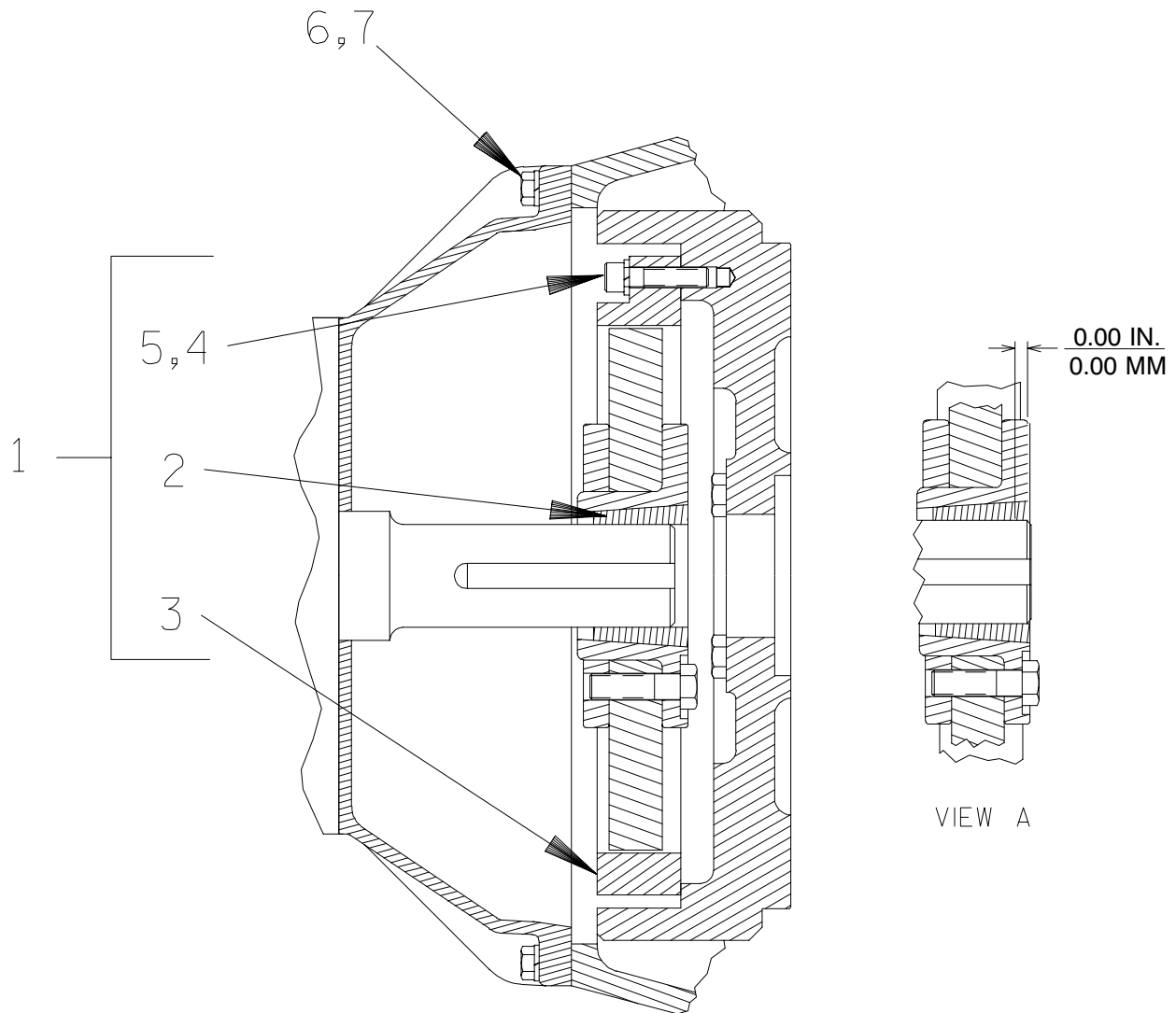


Figure E-5. 44162-171 Drive Assembly
PARTS LIST

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	COUPLING KIT	48112-015	---	1
2	-BUSHING	24131-497	---	1
3	-COUPLING ASSEMBLY	24391-104	---	1
4	-LOCKWASHER	21171-536	---	8
5	-SOCKET HD CAPSCREW	22644-220	---	8
6	HEX HD CAPSCREW	22645-164	---	12
7	LOCKWASHER	21171-511	---	12

PUMP AND SEAL DISASSEMBLY AND REASSEMBLY

Review all **SAFETY** information in Section A.

Follow the instructions on all tags, label and decals attached to the pump.

This pump requires little service due to its rugged, minimum-maintenance design. However, if it becomes necessary to inspect or replace the wearing parts, follow these instructions which are keyed to the sectional views (see Figures 1, 2, 3, 4 and 5) and the accompanying parts lists.

This manual will alert personnel to known procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel. However, this manual cannot possibly anticipate and provide detailed precautions for every situation that might occur during maintenance of the unit. Therefore, it is the responsibility of the owner/maintenance personnel to ensure that **only** safe, established maintenance procedures are used, and that any procedures not addressed in this manual are performed **only** after establishing that neither personal safety nor pump integrity are compromised by such practices.

Many service functions may be performed by draining the pump and removing the back cover assembly. If major repair is required, the piping and/or power source must be disconnected. The following instructions assume complete disassembly is required.

Before attempting to service the pump, switch off the engine ignition and disconnect the positive battery cable to ensure that the pump will remain inoperative. Close all valves in the suction and discharge lines.

For engine disassembly and repair, consult the literature supplied with the engine, or contact your local John Deere engine representative.



WARNING!

Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Switch off the engine ignition and disconnect the positive battery cable to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Check the temperature before opening any covers, plates, or plugs.
5. Close the suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.



WARNING!

Use lifting and moving equipment in good repair and with adequate capacity to prevent injuries to personnel or damage to equipment.

Back Cover And Wear Plate Removal

(Figure 3)

The wear plate (21) is easily accessible and may be serviced by removing the back cover assembly (28). Before attempting to service the pump, remove the pump casing drain plug (26) and drain the pump. Clean and reinstall the drain plug.

Remove the hand nuts (41) and pry the back cover and assembled wear plate from the pump casing (1).

NOTE

An alternate method of removing the back cover from the pump casing is to remove the hand nuts (41) and two diagonally opposing locking collars (34). Install two 1/2—16 UNC x 2 inch long screws in the tapped holes in the back cover and use them to press the back cover out of the pump casing.

Inspect the wear plate, and replace it if badly scored or worn. To remove the wear plate, disengage the hardware (24 and 25).

Inspect the back cover and wear plate O-rings (22 and 27) and replace them if damaged or worn.

Suction Check Valve Removal

(Figure 3)

If the check valve assembly (47) is to be serviced, remove the check valve pin (3), reach through the back cover opening and pull the complete assembly from the suction flange (46).

NOTE

Further disassembly of the check valve is not required since it must be replaced as a complete unit. Individual parts are not sold separately.

Separating Intermediate And Drive Assembly From Engine

(Figure 5)

Further disassembly requires separating the pump end and drive assembly from the engine. Install a standard 3/4–10 UNC lifting eye in the tapped hole in the top of the pump casing. **Be sure** to screw the eye into the casing until fully engaged. Support the pump using a suitable hoist and the lifting eye.



WARNING!

Do not attempt to lift the complete pump unit using the lifting eye. It is designed to facilitate removal or installation of individual components only. Additional weight may result in damage to the pump or failure of the eye bolt.

Remove the hardware securing the pump casing to the base.

Disengage the hardware (6 and 7) securing the drive flange to the engine bellhousing, and remove the guards (31, Figure 4). Separate the pump end and drive assembly from the engine by pulling the pump end straight away from the engine.

As the assemblies separate, the flexible portion of the coupling assembly (3) will remain on the shaft. To remove the coupling from the shaft, unscrew the two allen head setscrews from the bushing (2).

Screw one of the setscrews into the puller hole on the circumference of the bushing. As the coupling and bushing separate, remove the bushing, and slide the coupling off the shaft. Remove the shaft key (16, Figure 4).

It is not necessary to remove the outer ring of the coupling from the engine flywheel unless the coupling must be replaced. To remove the ring, disengage the hardware (4 and 5) securing it to the flywheel.

Remove any leveling shims used under the casing mounting feet. Tie and tag the shims for ease of reassembly.

Move the pump end to a clean, well equipped shop area for further disassembly.

Loosening Impeller

(Figure 4)

Before attempting to loosen the impeller, remove the seal cavity drain plug (27A) and drain the lubricant. This will prevent the oil from escaping as the impeller is removed. Clean and reinstall the drain plug.

With the pump end separated from the engine and the back cover (28, Figure 3) removed, wedge a block of wood between the vanes of the impeller and the pump casing to prevent rotation.

If removed, install the shaft key (16) in the shaft keyway. Install a lathe dog on the drive end of the shaft (17) with the “V” notch positioned over the shaft key.

With the impeller rotation still blocked, see Figure 6 and use a long piece of heavy bar stock to pry against the arm of the lathe dog in a counterclockwise direction (when facing the drive end of the shaft). **Use caution** not to damage the shaft or keyway. When the impeller breaks loose, remove the lathe dog, key and wood block.

NOTE

Do not remove the impeller until the rotating assembly has been removed from the pump casing.

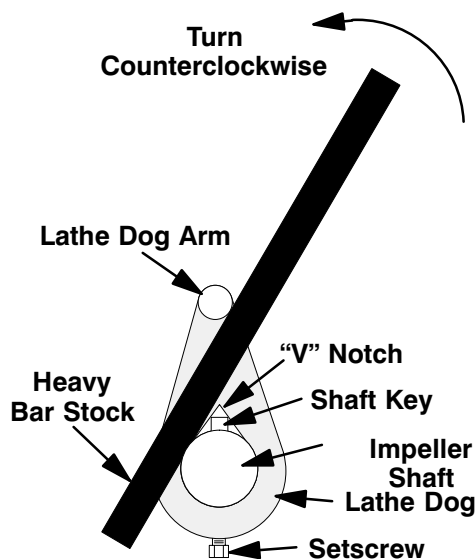


Figure 6. Loosening Impeller

Rotating Assembly Removal (Figure 3)

To ease removal of the rotating assembly, it is recommended that the pump be positioned on supporting blocks with the suction head opening down and the drive flange (15, Figure 4) up.

Remove the outer hardware (15 and 16) from the casing ring (14). Install three of the outer cap-screws in the jacking holes in the casing ring, and use them to jack the rotating assembly loose from the pump casing.

After the rotating assembly is loosened, remove the jacking screws from the casing ring. Remove the inner hardware (17 and 18) and shim sets (13). Separate the casing ring from the pump casing. Tie and tag the shim sets for ease of reassembly.

Install hooks in the mounting holes in the drive flange (15, Figure 4) and attach the hooks to a three-legged sling and suitable lifting device. Carefully lift the rotating assembly out of the pump casing far enough to reach inside the casing and remove the seal plate O-ring (20). With the O-ring removed, the rotating assembly can be easily removed from the casing using the lifting device.

Move the rotating assembly to a suitable work area for further disassembly.

Impeller Removal

(Figure 4)

With the rotating assembly removed from the pump casing, unscrew the impeller from the shaft. Use caution when unscrewing the impeller; tension on the shaft seal spring will be released as the impeller is removed. Inspect the impeller and replace if cracked or badly worn.

Remove the impeller adjusting shims (29); tie and tag the shims, or measure and record their thickness for ease of reassembly.

Seal Removal

(Figure 4)

Slide the integral shaft sleeve and rotating portion of the seal off the shaft as a unit.

Use a pair of stiff wires with hooked ends to remove the stationary element and seat.

An alternate method of removing the stationary seal components is to remove the hardware (5 and 6) and separate the seal plate (3) and gasket (4) from the bearing housing (7). Position the seal plate on a flat surface with the impeller side down. Use a wooden dowel or other suitable tool to press on the back side of the stationary seat until the seat, O-rings, and stationary element can be removed.

Remove the shaft sleeve O-ring (30).

If no further disassembly is required, refer to **Seal Installation**.

Shaft and Bearing Removal and Disassembly

(Figure 4)

When the pump is properly operated and maintained, the bearing housing should not require disassembly. Disassemble the shaft and bearings **only** when there is evidence of wear or damage.



Shaft and bearing disassembly in the field is not recommended. These operations should be performed only in a properly-equipped shop by qualified personnel.

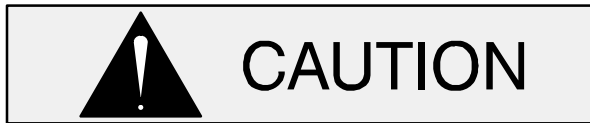
Remove the bearing housing drain plug (27) and drain the lubricant. Clean and reinstall the drain plug.

Disengage the hardware (13 and 14) and slide the drive flange (15) and oil seal (12) off the shaft. Remove the flange O-ring (20), and press the oil seal from the drive flange.

Place a block of wood against the impeller end of the shaft and tap the shaft and assembled bearings (8 and 21) from the bearing housing.

Pry or press the oil seals (22 and 23) from the bearing housing.

After removing the shaft and bearings, clean and inspect the bearings **in place** as follows.



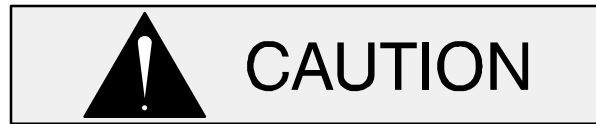
To prevent damage during removal from the shaft, it is recommended that bearings be cleaned and inspected **in place**. It is **strongly** recommended that the bearings be replaced **any** time the shaft and bearings are removed.

Clean the bearing housing, shaft and all component parts (except the bearings) with a soft cloth soaked in cleaning solvent. Inspect the parts for wear or damage and replace as necessary.



Most cleaning solvents are toxic and flammable. Use them only in a well ventilated area free from excessive heat, sparks, and flame. Read and follow all precautions printed on solvent containers.

Clean the bearings thoroughly in **fresh** cleaning solvent. Dry the bearings with filtered compressed air and coat with light oil.



Bearings must be kept free of all dirt and foreign material. Failure to do so will greatly shorten bearing life. **Do not** spin dry bearings. This may scratch the balls or races and cause premature bearing failure.

Rotate the bearings by hand to check for roughness or binding and inspect the bearing balls. If rotation is rough or the bearing balls are discolored, replace the bearings.

The bearing tolerances provide a tight press fit onto the shaft and a snug slip fit into the bearing housing. Replace the bearings, shaft, or bearing housing if the proper bearing fit is not achieved.

If bearing replacement is required, remove the outboard bearing retaining ring (18) and thrust washer (19), and use a bearing puller to remove the bearings from the shaft.

Shaft and Bearing Reassembly and Installation (Figure 4)

Clean the bearing housing, shaft and all component parts (except the bearings) with a soft cloth soaked in cleaning solvent. Inspect the parts for wear or damage as necessary.

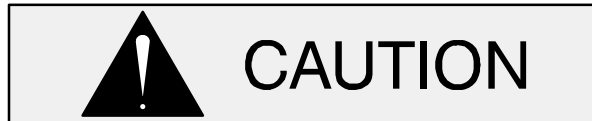


Most cleaning solvents are toxic and flammable. Use them only in a well ventilated area free from excessive heat, sparks, and flame. Read and follow all precautions printed on solvent containers.

Inspect the shaft for distortion, nicks or scratches, or for thread damage on the impeller end. Dress small nicks and burrs with a fine file or emery cloth. Replace the shaft if defective.

Position the inboard oil seal (22) in the bearing housing bore with the lip positioned as shown in Figure 4. Press the oil seal into the housing until the

face is **just flush** with the machined surface on the inside of the housing.

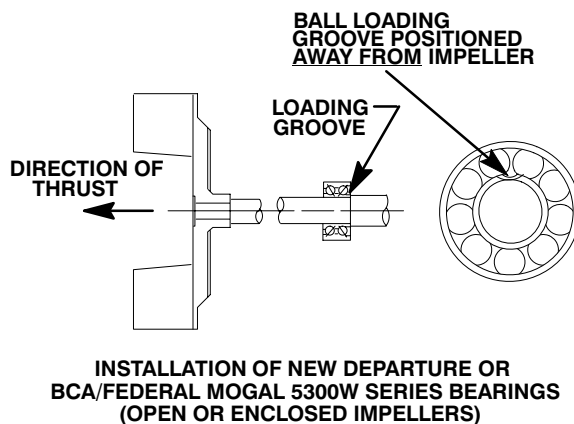


To prevent damage during removal from the shaft, it is recommended that bearings be cleaned and inspected **in place**. It is **strongly** recommended that the bearings be replaced **any** time the shaft and bearings are removed.

The bearings may be heated to ease installation. An induction heater, hot oil bath, electric oven, or hot plate may be used to heat the bearings. Bearings should **never** be heated with a direct flame or directly on a hot plate.

NOTE

If a hot oil bath is used to heat the bearings, both the



*oil and the container must be **absolutely** clean. If the oil has been previously used, it must be **thoroughly** filtered.*

Heat the bearings to a uniform temperature **no higher than** 250°F (120°C), and slide the bearings onto the shaft, one at a time, until they are fully seated. This should be done quickly, in one continuous motion, to prevent the bearings from cooling and sticking on the shaft.



Use caution when handling hot bearings to prevent burns.

NOTE

Position the inboard bearing (8) on the shaft as indicated by the following illustration.

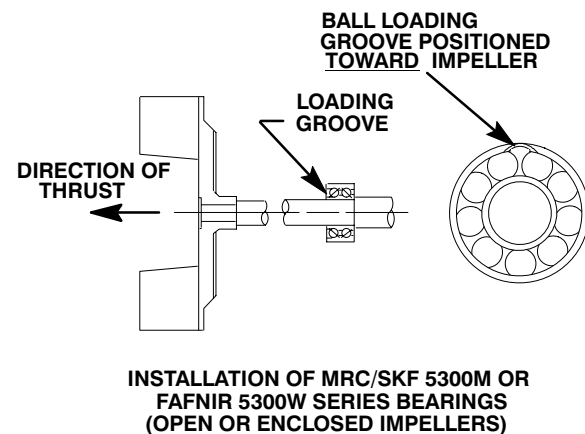


Figure 8. Inboard Bearing Positioning

NOTE

Position the outboard bearing (20) on the shaft with the retaining ring in the outer race toward the drive end of the shaft.

After the bearings have been installed and allowed to cool, check to ensure that they have not moved away from the shaft shoulders in shrinking. If movement has occurred, use a suitably sized sleeve and a press to reposition the bearings against the shaft shoulders.

If heating the bearings is not practical, use a suitably sized sleeve, and an arbor (or hydraulic) press to install the bearings on the shaft.



When installing the bearings onto the shaft, **never** press or hit against the outer race, balls, or ball cage. Press **only** on the inner race.

Install the thrust washer (19) and secure the outboard bearing (21) to the shaft with the bearing retaining ring (18).

It is recommended that a sleeve be positioned against the inboard oil seal (22) to prevent the lip of the oil seal from rolling as the shaft and bearings are installed in the bearing housing. The O.D. of the sleeve should be just smaller than the bearing housing bore, while the I.D. of the sleeve should be just larger than the O.D. of the lip seal area of the shaft.

With the lip seal sleeve in place, lubricate the lip seal area of the shaft, and slide the shaft and assembled bearings into the bearing housing until the retaining ring on the outboard bearing seats against the bearing housing. Remove the lip seal sleeve.



When installing the shaft and bearings into the bearing bore, push against the outer race. **Never** hit the balls or ball cage.

Position the outboard oil seal (23) on the lubricated shaft with the lip positioned as shown in Figure 4. Press the oil seal into the bearing housing until the face of the seal is **just flush** with the machined surface on the bearing housing.

Press the oil seal (12) into the drive flange (15) with the lip positioned as shown in Figure 4. Lightly lubricate the flange O-ring (20), install it in the groove in the flange, and secure the flange to the bearing

housing with the hardware (13 and 14). **Be careful** not to damage the oil seal lip on the shaft keyway.

Lubricate the bearing housing as indicated in **LUBRICATION**.

Seal Installation

(Figures 4, 9, 10 and 11)



Most cleaning solvents are toxic and flammable. Use them only in a well ventilated area free from excessive heat, sparks, and flame. Read and follow all precautions printed on solvent containers.

Clean the seal cavity and shaft with a cloth soaked in fresh cleaning solvent. Inspect the stationary seat bore in the seal plate for dirt, nicks and burrs, and remove any that exist. The stationary seat bore **must** be completely clean before installing the seal.



A new seal assembly should be installed **any time** the old seal is removed from the pump. Wear patterns on the finished faces cannot be realigned during reassembly. Reusing an old seal could result in premature failure.

To ease installation of the seal, lubricate the shaft sleeve O-ring (30) and the external stationary seat

O-ring with a very **small** amount of light lubricating oil. See Figure 9 for seal part identification.

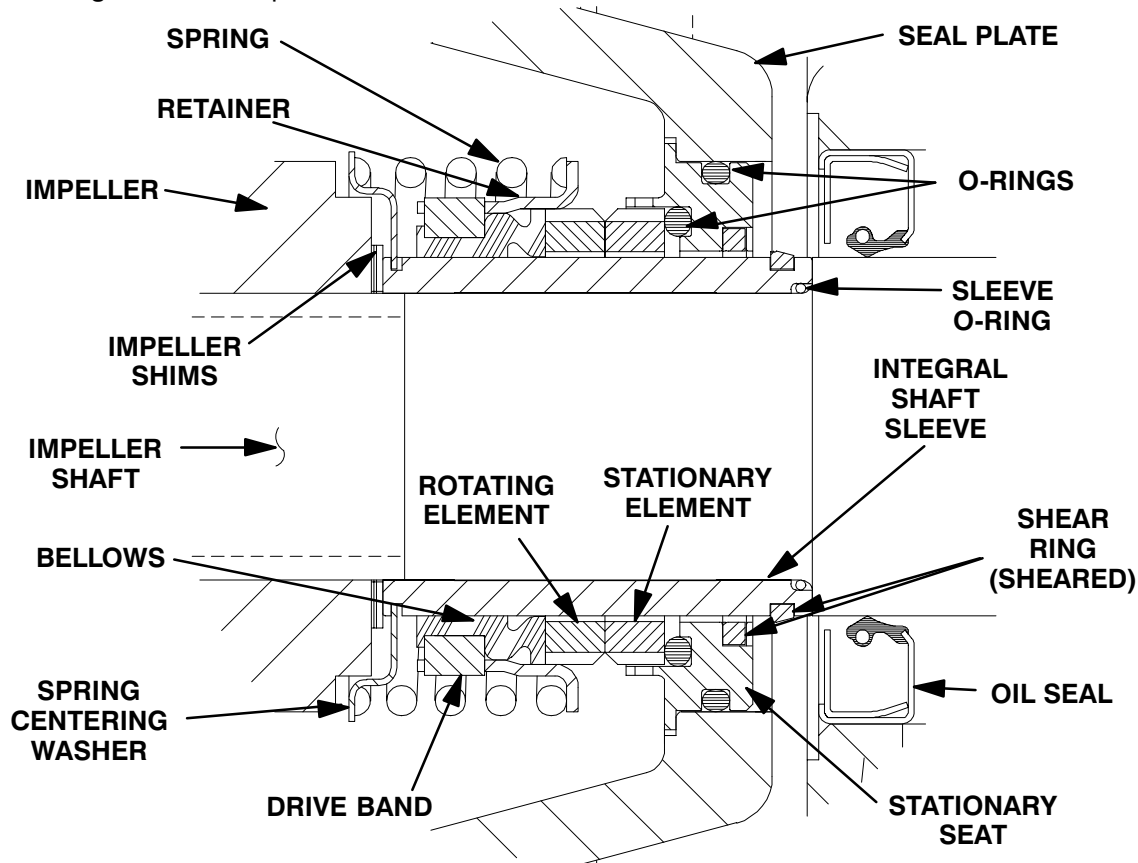


Figure 9. 46513-151 Cartridge Seal Assembly



This seal is not designed for operation at temperatures above 160°F (71°C). Do not use at higher operating temperatures.

If the seal plate (3) was removed, install the seal plate gasket (4). Position the seal plate over the shaft and secure it to the bearing housing with the hardware (5 and 6). Install the seal plate O-ring (34) and lubricate it with light grease.

To prevent damaging the shaft sleeve O-ring (30) on the shaft threads, stretch the O-ring over a piece of tubing 1-1/2 I.D. x 1-3/4 O.D. x 2-inches long (38 mm x 43 mm x 51 mm). Slide the tube over the shaft threads, then slide the O-ring off the tube and onto the shaft. Remove the tube, and continue to slide the O-ring down the shaft until it seats against the shaft shoulder.

When installing a new cartridge seal assembly, remove the seal from the container, and remove the mylar storage tabs, if so equipped, from between the seal faces.



New cartridge seal assemblies may be equipped with mylar storage tabs between the seal faces. If so equipped, these storage tabs **must** be removed before installing the seal.

Lubricate the external stationary seat O-ring with light oil. Slide the seal assembly onto the shaft until the external stationary seat O-ring engages the bore in the seal plate.

Clean and inspect the impeller as described in **Impeller Installation and Adjustment**. Install the full set of impeller shims (29) provided with the seal, and screw the impeller onto the shaft until it is seated against the seal (see Figure 10).

Continue to screw the impeller onto the shaft. This will press the stationary seat into the seal plate bore.

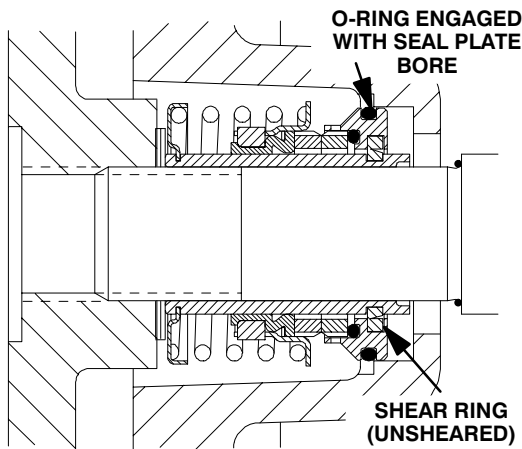


Figure 10. Seal Partially Installed

NOTE

A firm resistance will be felt as the impeller presses the stationary seat into the seal plate bore.

As the stationary seat becomes fully seated, the seal spring compresses, and the shaft sleeve will break the nylon shear ring. This allows the sleeve to slide down the shaft until seated against the shaft shoulder. Continue to screw the impeller onto the shaft until the impeller, shims, and sleeve are fully seated against the shaft shoulder (see Figure 11).

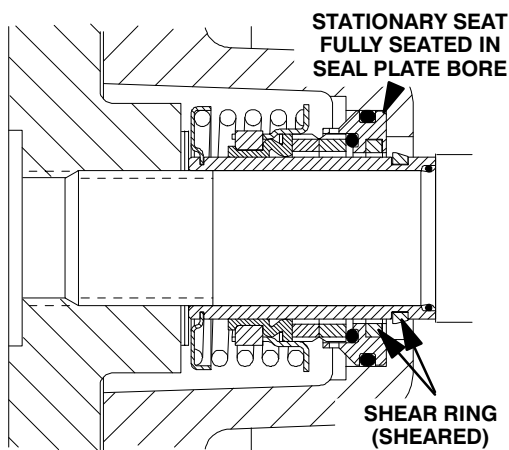
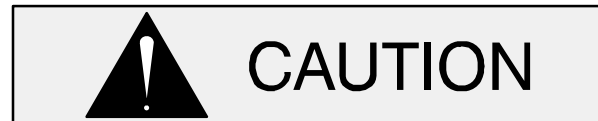


Figure 11. Seal Fully Installed

Measure the impeller-to-seal plate clearance, and remove impeller adjusting shims to obtain the

proper clearance as described in **Impeller Installation and Adjustment**.

If necessary to reuse an old seal in an emergency, carefully separate the rotating and stationary seal faces from the bellows retainer and stationary seat.



A new seal assembly should be installed **any time** the old seal is removed from the pump. Wear patterns on the finished faces cannot be realigned during reassembly. Reusing an old seal could result in premature failure.

Handle the seal parts with extreme care to prevent damage. Be careful not to contaminate precision finished faces; even fingerprints on the faces can shorten seal life. If necessary, clean the faces with a non-oil based solvent and a clean, lint-free tissue. Wipe **lightly** in a concentric pattern to avoid scratching the faces.

Carefully wash all metallic parts in fresh cleaning solvent and allow to dry thoroughly.



Do not attempt to separate the rotating portion of the seal from the shaft sleeve when reusing an old seal. The rubber bellows will adhere to the sleeve during use, and attempting to separate them could damage the bellows.

Inspect the seal components for wear, scoring, grooves, and other damage that might cause leakage. Inspect the integral shaft sleeve for nicks or cuts on either end. If any components are worn, or the sleeve is damaged, replace the complete seal; **never mix old and new seal parts**.

Install the stationary seal element in the stationary seat. Press this stationary subassembly into the seal plate bore until it seats squarely against the bore shoulder. A push tube made from a piece of plastic pipe would aid this installation. The I.D. of the pipe should be slightly larger than the O.D. of the shaft sleeve.

Slide the rotating portion of the seal (consisting of the integral shaft sleeve, spring centering washer, spring, bellows and retainer, and rotating element) onto the shaft until the seal faces contact.

Proceed with **Impeller Installation and Adjustment**.

Impeller Installation

(Figure 4)

Inspect the impeller, and replace it if cracked or badly worn. Inspect the impeller and shaft threads for dirt or damage, and clean or dress the threads as required.



The shaft and impeller threads **must** be completely clean before reinstalling the impeller. Even the slightest amount of dirt on the threads can cause the impeller to seize to the shaft, making future removal difficult or impossible without damage to the impeller or shaft.

Install the same thickness of impeller adjusting shims (29) as previously removed. Apply 'Never-Seez' or equivalent to the shaft threads and screw the impeller onto the shaft until tight. Be sure the seal spring seats squarely on the back side of the impeller.

NOTE

*At the slightest sign of binding, immediately back the impeller off, and check the threads for dirt. **Do not** try to force the impeller onto the shaft.*

A clearance of .025 to .040 inch (0,64 to 1,02 mm) between the impeller and the seal plate is recommended for maximum pump efficiency. Measure this clearance, and add or remove impeller adjusting shims as required.

NOTE

If the rotating assembly has been installed in the pump casing, this clearance may be measured by reaching through the priming port with a feeler gauge.

Rotating Assembly Installation

(Figure 3)

Install the bearing housing and seal plate O-rings (19 and 20), and lubricate them with light grease. Ease the rotating assembly into the pump casing. **Be careful** not to damage the O-rings.

Install the pump casing ring (14), and secure it to the rotating assembly with the inner hardware (17 and 18).

NOTE

The inner capscrews are 1/4 inch (3,2 mm) shorter than the outer capscrews.

Install the rotating assembly adjusting shims (12) under the pump casing ring using the same thickness as previously removed. Secure the ring to the pump casing with the outer hardware (15 and 16).

To set the impeller and wear plate clearance refer to the **Back Cover Installation And Adjustment**.

Suction Check Valve Installation

(Figure 3)

Inspect the check valve assembly (47) and replace it if badly worn.

NOTE

The check valve assembly must be replaced as a complete unit. Individual parts are not sold separately.

Reach through the back cover opening with the check valve and position the check valve adaptor in the mounting slot in the suction flange (46). Align the adaptor with the flange hole, and secure the assembly with the check valve pin (3).

NOTE

If the suction or discharge flanges were removed, replace the respective gaskets, apply 'Permatex Aviation No. 3 Form-A-Gasket' or equivalent compound to the mating surfaces, and secure them to the pump casing with the attaching hardware.

Back Cover Installation And Adjustment

(Figures 3 and 12)

If the wear plate (21) was removed for replacement, carefully center it on the back cover and se-

cure it with the hardware (24 and 25). The wear plate **must** be concentric to prevent binding when the back cover is installed.

The clearance between the impeller and wear plate is adjusted using four adjusting screws (42) and locking collars (34). There are 18 detents on the I.D. of each locking collar. Indexing the collars one detent on the adjusting screws represents approximately .005 inch (0,13 mm) of wear plate clearance. The recommended clearance between the wear plate and the impeller is .010 to .020 inch (0,25 to 0,50 mm).

Replace the back cover and wear plate O-rings (22 and 27) and lubricate them with a generous amount of No. 2 grease. Clean any scale or debris from the contacting surfaces in the pump casing that might interfere or prevent a good seal with the back cover.

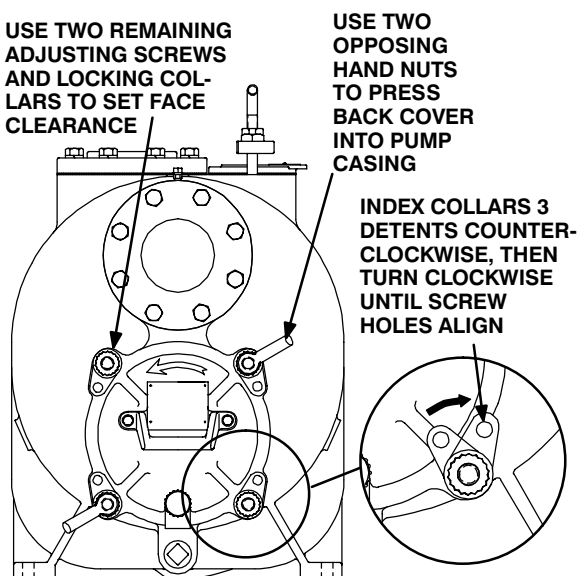


Figure 12. Installing and Adjusting Back Cover

Screw the four adjusting screws (42) into the tapped holes in the back cover plate until they are **just flush** with the machined surface on the back side of the cover plate.

Align the back cover plate over the studs (40) and slide it into the pump casing. Use two hand nuts (41) on diagonally opposing studs to press the back cover into the pump casing until the wear plate **just touches** the impeller when the shaft is turned by hand. **Tighten the hand nuts evenly to avoid binding.**

With the wear plate just touching the impeller, turn the two free adjusting screws until they engage the pump casing. Position the locking collars over the adjusting screws so the holes in the collars for the locking screws align approximately with the holes in the cover plate.

Loosen the hand nuts used to press the back cover into the pump casing one full turn.

Pull the collars off the adjusting screws, index them three detents counterclockwise, and reinstall the collars on the adjusting screws. Use the collars to turn the adjusting screws clockwise until the holes in the locking collars realign with the tapped screw holes in the back cover plate. Secure the locking collars to the back cover plate with the hardware (35 and 36). Install the two remaining hand nuts snugly against the adjusting screws.

Remove the first two hand nuts from their studs. Turn the adjusting screws clockwise until they engage the pump casing. Install the locking collars and hardware (35 and 36). Reinstall the hand nuts.

Be sure the wear plate does not scrape against the impeller.

Over time it may be necessary to repeat the adjustment process to compensate for normal wear between the impeller and wear plate. When all of the adjustment has been used on the back cover side of the pump, an additional 0.125 inch (3,2 mm) of adjustment may be obtained by removing the rotating assembly adjusting shims (13).

Allow an installed pump to completely cool before draining liquid from the pump casing. Remove the back cover. Remove the rotating assembly adjusting shims, then reinstall the hardware securing the casing ring (14) and rotating assembly to the pump casing. Perform the back cover adjustment procedure described above to obtain the proper face clearance.

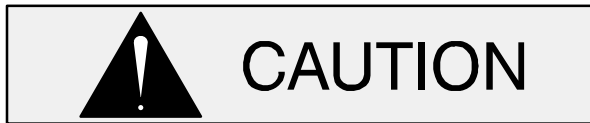
Securing Pump End To Engine

(Figure 5)

Install the shaft key (16, Figure 4) in the shaft keyway. Position the flexible portion of the coupling assembly (3) on the shaft as shown in Figure 5.

Align the keyway in the bushing (2) with the shaft key, and slide it onto the shaft until it is **just flush**

with the end of the shaft. Rotate the flexible portion of the coupling until the tapped holes for the two setscrews align with those in the bushing, and install the setscrews.



Make certain that the flexible portion of the coupling is mounted as shown in Figure 5. **This is critical.** If the coupling is not properly positioned on the shaft, the coupling parts may not fully engage, or a pre-load condition can cause premature bearing failure.

The end of the shaft must be **just flush** with the face of the bushing. This will allow the two portions of the coupling to fully engage when the drive flange is secured to the engine bellhousing, without pre-loading the bearings.

With the flexible portion of the coupling and the bushing properly positioned on the shaft, tighten the two setscrews in an alternating sequence until the bushing and coupling are fully secured. Torque the setscrews to 14.6 ft. lbs. (175 in. lbs. or 2 m. kg.).

If the complete coupling assembly is being replaced, apply 'Loctite Retaining Compound No. 242' or equivalent to the threads of the hardware (4 and 5), and secure the outer ring of the coupling to the engine flywheel by torquing the hardware to 45 ft. lbs. (540 in. lbs. or 6,2 m. kg.).

Using a suitable lifting device, position the pump end so the flexible portion of the coupling seats inside the outer ring attached to the engine flywheel.

NOTE

To ease installation, **lightly** lubricate the rubber portion of the coupling with a **non-petroleum based lubricant** such as vegetable oil or glycerin, or a silicon-based lubricant such as "WD40" or equivalent. **Do not** use petroleum-based lubricants, or any other substance which may soften or otherwise damage the rubber.

(Figure 1)

Install any leveling shims used under the casing mounting feet, and secure the casing to the base with the previously removed hardware.

If a lifting eye was used to move the pump casing, **be sure** to remove the lifting eye from the pump casing.



Do not attempt to lift the complete pump unit using the lifting eye. It is designed to facilitate removal or installation of individual components only. Additional weight may result in damage to the pump or failure of the eye bolt.

PRESSURE RELIEF VALVE MAINTENANCE

(Figure 3)

The back cover is equipped with a pressure relief valve (32) to provide additional safety for the pump and operator (refer to **Liquid Temperature And Overheating** in **OPERATION**).

It is recommended that the pressure relief valve assembly be replaced at each overhaul, or any time the pump overheats and activates the valve. **Never** replace this valve with a substitute which has not been specified or provided by the Gorman-Rupp Company.

Periodically, the valve should be removed for inspection and cleaning. When reinstalling the relief valve, apply 'Loctite Pipe Sealant With Teflon No. 592', or equivalent compound, on the relief valve threads. Position the valve as shown in Figure 3 with the discharge port pointing down.

Final Pump Assembly

(Figure 1)

Be sure the pump is secured to the base and engine. Be sure to install any guards used over the rotating members.



Do not operate the pump without the guards in place over the rotating parts. Exposed rotating parts can catch clothing, fingers, or tools, causing severe injury to personnel.

Install the suction and discharge lines and open all valves. Make certain that all piping connections are tight, properly supported and secure.

Be sure the pump and engine have been properly lubricated, see **LUBRICATION**.

Remove the fill cover assembly (64, Figure 3) and fill the pump casing with clean liquid. Reinstall the fill cover and tighten it. Refer to **OPERATION**, Section C, before putting the pump back into service.

LUBRICATION

Seal Assembly

(Figure 4)

Before starting the pump, remove the vented plug (9) and fill the seal cavity with approximately 92 ounces (2,7 liter) of SAE No. 30 non-detergent oil to the middle of the sight gauge (25) and maintain it at the middle of the gauge. Clean and reinstall the vented plug. Maintain the oil at this level.

NOTE

The white reflector in the sight gauge must be positioned horizontally to provide proper drainage.

Bearings

(Figure 4)

The bearing housing was fully lubricated when shipped from the factory. Check the oil level regularly through the sight gauge (26) and maintain it at the middle of the gauge. When lubrication is required, add SAE No. 30 non-detergent oil through the hole for the air vent (10). **Do not** over-lubricate. Over-lubrication can cause the bearings to over-heat, resulting in premature bearing failure.

NOTE

The white reflector in the sight gauge must be positioned horizontally to provide proper drainage.

Under normal conditions, drain the bearing housing once each year and refill with approximately 16 ounces (0,5 liter) clean oil. Change the oil more frequently if the pump is operated continuously or installed in an environment with rapid temperature change.



Monitor the condition of the bearing lubricant regularly for evidence of rust or moisture condensation. This is especially important in areas where variable hot and cold temperatures are common.

For cold weather operation, consult the factory or a lubricant supplier for the recommended grade of oil.

Engine

Consult the literature supplied with the engine, or contact your local Deutz engine representative.

**For U.S. and International Warranty Information,
Please Visit www.grpumps.com/warranty
or call:**

**U.S.: 419-755-1280
International: +1-419-755-1352**

**For Canadian Warranty Information,
Please Visit www.grcanada.com/warranty
or call:**

519-631-2870

WARRANTY COVERAGE

EXTENT AND DURATION OF WARRANTY

COVERAGE

The Gorman-Rupp Company or Gorman-Rupp of Canada Limited (herein individually referred to as "Gorman-Rupp") each individually warrant that its products and parts shall be free from defects in material and workmanship for the various periods specified in Addendum 1 – Warranty Periods beginning: (a) for pumps and parts on the date of purchase by the original end user; or (b) for pump stations, industrial pump packages, and fiberglass reinforced polyester enclosures on the date of acceptance by the purchaser or the purchaser's authorized agent, or sixty (60) days after installation, or ninety (90) days after shipment from the factory, whichever occurs first. In addition to defects in material and workmanship, fiberglass reinforced polyester enclosures are warranted to be resistant to rust, corrosion, corrosive soils, effects of airborne contamination or physical failures occurring in normal service for the period of the pump station warranty. This Limited Warranty shall be valid only when installation is made and use and maintenance is performed in accordance with Gorman-Rupp recommendations. In the case of pump stations and pump packages, in order for this Limited Warranty to be valid, a Start-Up Report completed by an authorized Gorman-Rupp agent must be received by Gorman-Rupp within thirty (30) days of the initial date the unit is placed into service.

EXCEPTIONS TO COVERAGE

- This Limited Warranty shall not apply to the following products and parts: engines, motors, trade accessories and other products, components or materials not manufactured by Gorman-Rupp. Any warranty for these products and parts shall be provided by the manufacturer(s) of those products and parts. With respect to submersible pumps, the pump and motor are an integral unit and are therefore warranted as a unit. However, with respect to the electrical components in submersible pumps, this warranty is valid only when electrical controls for the pump have been approved and/or provided by Gorman-Rupp. With respect to Pump Stations, all components installed in the Pump Station by Gorman-Rupp are an integral unit and are therefore warranted as a unit. Items normally consumed in use, and wear and tear resulting from normal use are not covered by this Limited Warranty.
- This Limited Warranty shall not apply to any Gorman-Rupp product or part which: (a) has been subjected to misuse, misapplication, alteration, neglect, or physical damage resulting from these causes (b) has been installed, operated, used, and/or maintained in a manner which is not in accordance with Gorman-Rupp's printed recommendations, including but not limited to operation of equipment without being connected to monitoring components provided with the product or damaged as the result of defective power supply, improper electrical protection, faulty installation, improper installation, ordinary wear and tear, corrosion or chemical attack, an Act of God, an Act of War or Terrorism or has been damaged as the result of the use with equipment not sold by Gorman-Rupp and/or not approved by Gorman-Rupp for use with the product.
- This Limited Warranty does not cover costs for any standard and/or scheduled maintenance, nor does it cover parts that, by nature of their function, require replacement as a result of normal wear (e.g., Wear Parts), unless a determination of defect in material or workmanship is made by Gorman-Rupp. Wear Parts include, but are not limited to, impellers, wear plates, wear rings, seals, volutes, diffusers, oil, grease, and/or other items which are required for operation of the pump or pump station and are subject to regular inspection and maintenance.
- Determination of coverage or exceptions to coverage are solely at the option of Gorman-Rupp.

LIMITATIONS

GORMAN-RUPP'S SOLE AND EXCLUSIVE WARRANTY WITH RESPECT TO ITS PRODUCTS AND PARTS IS THIS LIMITED WARRANTY. THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER EXPRESS AND/OR IMPLIED WARRANTIES, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE.

EQUIPMENT SELECTED OR SUPPLIED BY OTHERS AND INCORPORATED INTO A GORMAN-RUPP PUMP STATION OR ENCLOSURE IS NOT COVERED BY THIS LIMITED WARRANTY. ANY WARRANTY APPLICABLE TO EQUIPMENT SELECTED OR SUPPLIED BY OTHERS WILL BE LIMITED SOLELY TO THE WARRANTY, IF ANY, PROVIDED BY THE MANUFACTURER OF THE EQUIPMENT.

EXCLUSIVE REMEDY AND DAMAGES

The sole and exclusive remedy for breach of this Limited Warranty by Gorman-Rupp, and the entire extent of its liability for such breach or for damages arising and/or resulting from the use of the products and parts covered by this Limited Warranty shall be as follows:

- **REPAIR OR REPLACEMENT:** If inspection shows that any Gorman-Rupp product or part covered under this Limited Warranty is defective in materials or workmanship, Gorman-Rupp shall repair or replace the defective product or part(s) at its option, without charge in the percentage indicated in **Addendum 1 – Warranty Periods**. The product or part(s) claimed to be defective must have been properly installed, maintained and used in accordance with the maintenance schedule and/or instructions contained in the manual which comes with the product. No allowance will be made for labor, freight, transportation or other charges incurred in connection with such repair or replacement.
- **TO OBTAIN THE ABOVE REMEDY:**
 - Immediately notify Gorman-Rupp at the address below of the claimed defect in materials or workmanship and provide the serial number or date code of the product and/or part(s) and provide a copy of the invoice or bill of sale referencing the product and/or part by no later than the expiration date of the Limited Warranty period.
 - Gorman-Rupp will advise whether inspection of the product and/or part(s) will be necessary and whether and how inspection, repair or replacement will be effected. If inspection is necessary, Gorman-Rupp will, at its discretion, provide field inspection by an authorized agent or require that the product or part(s) be sent freight prepaid to Gorman-Rupp at the address shown below. If the product or part is returned to Gorman-Rupp for inspection, return shipment of the repaired product or part(s) will be F.O.B. the address stated below.
- **DAMAGES:** Gorman-Rupp's liability for damages for breach of this Limited Warranty shall not exceed the amount of the purchase price of the product or part in respect to which damages are claimed. **IN NO EVENT SHALL GORMAN-RUPP BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES FOR BREACH OF THIS LIMITED WARRANTY OTHER THAN AS STATED HEREIN.**

Some states do not allow the exclusion or limitation of incidental or consequential damages. Accordingly, the above may not apply to you. This Limited Warranty gives you specific legal rights, and you may also have other rights which vary from state to state and province to province.

THE GORMAN-RUPP COMPANY
P.O. BOX 1217
MANSFIELD, OH 44901-1217
Phone: (419) 755-1011

GORMAN-RUPP OF CANADA LIMITED
70 Burwell Road
St. Thomas, Ontario N5P 3R7
Phone: (519) 631-2870

For additional copies please visit www.GRpumps.com/warranty or www.GRcanada.com/warranty.



ADDENDUM 1 - WARRANTY PERIODS

PRODUCT		0 – 6 MONTHS*	7 – 12 MONTHS*	13 – 18 MONTHS*	19 – 24 MONTHS*	25 – 39 MONTHS*	40 – 60 MONTHS*	
PUMPS	0 SERIES®	100%						
	10 SERIES®	100%						
	30 SERIES	100%						
	50 SERIES	100%						
	60 SERIES	100%						
	80 SERIES®	100%						
	D SERIES (DIAPHRAGM PUMPS)	100%						
	G SERIES (ROTARY GEAR)	100%						
	HS SERIES® (HYDRAULIC SUBMERSIBLE)	100%						
	J SERIES® – PUMP ONLY	100%						
	J SERIES® – PERMANENT MUNICIPAL INSTALLATION**	100%			50%		25%	
	JW SERIES	100%						
	M SERIES	100%						
	PRIME AIRE® (PA SERIES®)	100%						
	RP SERIES	100%						
	ROTO-PRIME® SERIES (RD & RS SERIES)	100%						
	S SERIES	100%						
	SC SERIES	100%						
	SM SERIES	100%						
	S1 1/2 A3 (A), S2C3 (A), S2D3 (A) – FROM OTS	100%						
	SILENT PUMP	Warranty Period is based on Pump Model included in product						
	TANKLEENOR	100%						
	T SERIES®	100%						
	SUPER T SERIES®				100%			
	U SERIES®	100%						
	SUPER U SERIES®				100%			
	ULTRA V SERIES®				100%			
	VG & VGH SERIES	100%						
	AMT, IPT, GORMAN-RUPP INDUSTRIES, & PATTERSON PUMPS (THROUGH THE OTS CATALOG)	100%		Exceptions may apply, refer to Manufacturer's Warranty for excluded components				
STATIONS	RELIASOURCE™ / COMPLETE GR PUMP & PACKAGE STATIONS ***	100%						
	PRESSURE BOOSTER / PARTIAL / NON-STANDARD PUMP & PACKAGE STATIONS ****	100%						
OTHER	PARTS	100%						
	ROTATING ASSEMBLIES FOR SUPER T, SUPER U, & ULTRA V SERIES				100%			
	EXCHANGE STOCK PRODUCT	100%						
	REMANUFACTURED EQUIPMENT	Warranty Period as agreed to at time of Purchase						
	REPAIRS PERFORMED AT G-R MANSFIELD	Parts and workmanship used in Repairs only – Warranty Period for the remainder of original Product Warranty or 12 months, whichever is greater						

* Proration periods are applied based on months after purchase, acceptance, shipment, or installation, as applicable. Percentages for proration periods define the amount of warranted costs to be borne by Gorman-Rupp.

** Approved Permanent Municipal Installations are permanent pump installations and require appropriate controls documents at time of installation.

*** Pump & Package Stations require submission to Gorman-Rupp of Start-Up Report for this Limited Warranty to be in effect on the complete package. In the event that Start-Up Report is not submitted to Gorman-Rupp, each component in the package will be subject to its individual manufacturer warranty, if available.

**** Partial / Non-Standard Pump & Package Stations refer to packages using pumps other than those produced by Gorman-Rupp – Mansfield Division or Gorman-Rupp of Canada or using components other than those specified by Gorman-Rupp or excluding components specified by Gorman-Rupp.

Water Hose

FOR WATER TRANSFER,
WASHDOWN AND WATER JETTING



N2582

CROCODILE

Applications

Heavy-duty water suction hose for use in quarries, on large construction projects or other areas where an extra rugged heavy-duty cover hose is required.

Advantages

- High-grade abrasion resistant EPDM tube and cover
- Heavy-duty construction
- Full vacuum
- Light weight

Tube: High-grade abrasion resistant EPDM
Reinforcement: Multiple high tensile textile braids and dual helix wire
Cover: Black abrasion, weather & ozone resistant EPDM
Recommended Fittings: Cam & Groove, Short Shank, King nipples
Temperature Range: -40°F to 180°F
Standard Length: 100 feet
Branding: Goodall N2582 Crocodile Water 250 PSI Max WP
 Yellow longitudinal Mylar stripe

SPECIFICATIONS

Nom. I.D.	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
Nom. O.D.	1.85"	2.00"	2.58"	3.09"	3.67"	4.70"
Weight (lbs/ft)	0.70	0.82	1.05	1.38	1.87	2.57
W.P. (psi)	250	250	250	250	250	250
Bend Radius (In.)	5"	6"	8"	10"	12"	16"



N645

ALLIGATOR

Applications

General purpose water suction on construction sites. Also for use in rental yards and general in-plant water service.

Advantages

- High-grade abrasion resistant EPDM/SBR tube and cover
- Heavy-duty construction
- Easy to handle

Tube: High-grade EPDM/SBR blend
Reinforcement: Multiple high tensile textile spiral with dual steel helix wire
Cover: Black abrasion, oil, weather & ozone resistant EPDM/SBR blend
Recommended Fittings: Cam & Groove, Short Shank, King nipples
Temperature Range: -22°F to 195°F
Standard Length: 100 feet
Branding: Goodall N645 Alligator Water
 Blue & white longitudinal Mylar stripe

SPECIFICATIONS

Nom. I.D.	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"
Nom. O.D.	1.72"	2.00"	2.50"	3.00"	3.50"	4.53"	6.70"
Weight (lbs/ft)	0.75	0.90	1.10	1.45	1.85	2.60	5.20
W.P. (psi)	150	150	150	150	150	150	100
Bend Radius (in.)	5	6	8	10	12	16	24
Vacuum (in.Hg)	27	27	27	27	27	27	27

VISIT OUR WEBSITE:
www.goodallonline.com

800-466-3255

CONTRACTORS PLUS WATER DISCHARGE



Application	: A Medium duty water discharge hose for use on construction sites and general water service
Cover	: Black abrasion and weather resistant synthetic rubber.
Reinforcement	: Multiple layers of synthetic yarns.
Tube	: Black synthetic rubber compounded for water service.
Temperature	: -35C to +80C(-30F to +180F)

Nom. I.D	Nom. O.D	PSI	Weight (lbs)	Std Pack Qty	Part #
1-1/4"	1.57"	100	0.38	100'	CWBY-125
1-1/2"	1.81"	100	0.52	100'	CWBY-150
2"	2.32"	100	0.69	100'	CWBY-200
2-1/2"	2.79"	100	0.72	100'	CWBY-250
3"	3.35"	100	0.99	100'	CWBY-300
4"	4.33"	100	1.21	100'	CWBY-400
6"	6.38"	100	2.28	100'	CWBY-600
→ 8"	8.38"	100	3.47	100'	CWBY-800
10"	10.43"	100	4.58	50'	CWBY-1000
12"	12.52"	75	5.56	50'	CWBY-1200

Cut Lengths : Plus 10%

Standard Lengths : 50'/100'

Recommended Couplings : Cam and groove or short shank

BROWN LAYFLAT



Application	: Heavy duty layflat hose for portable pump and irrigation use.
Cover	: Brown PVC impregnation.
Reinforcement	: Woven high tensile synthetic yarns.
Tube	: Brown heavy PVC impregnation.
Temperature	: -10C to +60C(15F to +140F)

Nom. I.D	Nom. O.D	PSI	Weight (lbs)	Std Pack Qty	Part #
1-1/2"	1.66"	130	0.20	300'	BRLAY-150
2"	2.16"	115	0.28	300'	BRLAY-200
→ 3"	3.18"	100	0.46	300'	BRLAY-300
4"	4.18"	90	0.68	300'	BRLAY-400
6"	6.18"	70	1.10	300'	BRLAY-600
8"	8.19"	60	1.66	300'	BRLAY-800

Cut Lengths : Plus 10%

Standard Lengths : Multiples of 50' up to 300' maximum

Safety Information : Reduce pressures by 50% at maximum working temperature

Recommended Couplings : Cam and groove or short shank

OROFLEX AIR/WATER LAYFLAT DISCHARGE



Application	: A superior quality, lightweight, highly portable, high pressure air hose. Ideal where excessive oil is a factor. One man can carry 100'.
Cover	: Yellow abrasion, weather and oil resistant nitrile rubber.
Reinforcement	: Circular woven high strength polyester yarns.
Tube	: Yellow abrasion and oil resistant nitrile rubber.
Temperature	: -20C to +80C(0F to +180F)

Nom. I.D	Nom. O.D	PSI Air	PSI Water	Weight (lbs)	Std Pack Qty	Part #
3/4"	0.98"	300	400	0.10	200'	ORO20-075
1"	1.34"	300	400	0.14	200'	ORO20-100
1-1/2"	1.86"	200	300	0.30	200'	ORO20-150
2"	2.36"	200	300	0.44	200'	ORO20-200
→ 3"	3.40"	150	250	0.64	200'	ORO20-300
4"	4.40"	150	250	0.86	200'	ORO20-400

Cut Lengths : No Cut Lengths

Standard Lengths : 50'/100'/200'

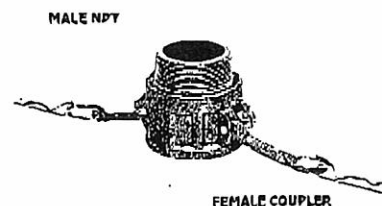
Safety Information : Not recommended for Bull Hose use in quarries or other areas where external cutting may occur

Recommended Couplings : High Pressure all sizes, mine stem and nut 1/2" - 2"

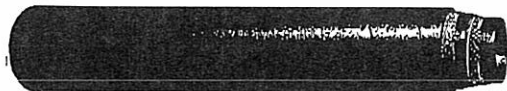
PART B ALUMINUM

Vacuum Rating	: FULL
Gasket Material	: NBR
Gasket Temp.	: -40C to +100C(-40F to +212F)
Casting Temp.	: -101C to +121C(-150F to +250F)

Size	Max Operating PSI (70F)	Weight (lbs)	Std Pack Qty	Part #
1/2"	250	0.15	100	CGB-050-A1
3/4"	250	0.21	50	CGB-075-A1
1"	250	0.39	50	CGB-100-A1
1-1/4"	250	0.66	40	CGB-125-A1
1-1/2"	250	0.70	40	CGB-150-A1
2"	250	0.90	25	CGB-200-A1
2-1/2"	150	1.05	18	CGB-250-A1
3"	125	1.73	12	CGB-300-A1
4"	100	2.49	8	CGB-400-A1
5"	75	2.76	2	CGB-500-A1
6"	75	4.63	2	CGB-600-A1
→ 8"	50	8.27	3	CGB-800-A1
10"	50	13.20	1	CGB-1000-A



RUBBER WATER S&D



Application : A heavy duty wire reinforced rubber suction hose for construction, quarries and general use.
Cover : Black smooth abrasion and weather resistant synthetic rubber.
Reinforcement : High tensile wire helix embedded between layers of textile cords.
Tube : Smooth black synthetic rubber.
Temperature : -30C to +80C(-22F to +180F)

Nom. I.D	Nom. O.D	Vacuum (Hg)	Bend Radius	PSI	Weight (lbs)	Std Pack Qty	Part #
3/4"	1.14"	29"	2.00"	200	0.50	100'	WSB-075
1"	1.42"	29"	3.00"	150	0.68	100'	WSB-100
1-1/4"	1.65"	29"	4.00"	150	0.77	100'	WSB-125
1-1/2"	1.93"	29"	4.00"	150	1.00	100'	WSB-150
2"	2.48"	29"	5.00"	150	1.45	100'	WSB-200
2-1/2"	2.99"	29"	8.00"	150	1.84	100'	WSB-250
3"	3.50"	29"	10.00"	150	2.23	100'	WSB-300
4"	4.64"	29"	14.00"	125	3.72	100'	WSB-400
5"	5.67"	29"	20.00"	125	3.90	100'	WSB-500
6"	6.66"	29"	30.00"	125	5.10	100'	WSB-600
→ 8"	8.90"	29"	65.00"	50	8.83	60'	WSB-800
10"	10.90"	29"	80.00"	50	12.00	40'	WSB-1000
12"	12.99"	29"	100.00"	50	18.57	20'	WSB-1200

Cut Lengths : Plus 10%

Standard Lengths : 3/4" to 4" - 50'/100' -- 5" and 6" - 20'/100' -- 8" - 20'/60' -- 10" and 12" - 40'/20'

Recommended Couplings : Cam and groove or Short Shank

PART F ALUMINUM

Casting Temp. : -101C to +121C(-150F to +250F)

	Size	Weight (lbs)	Std Pack Qty	Part #
	1/2"	0.10	100	CGF-050-A1
	3/4"	0.16	50	CGF-075-A1
	1"	0.20	40	CGF-100-A1
	1-1/4"	0.31	50	CGF-125-A1
	1-1/2"	0.45	50	CGF-150-A1
	2"	0.65	30	CGF-200-A1
	2-1/2"	0.92	20	CGF-250-A1
→	3"	1.28	15	CGF-300-A1
	4"	1.47	5	CGF-400-A1
	5"	1.84	2	CGF-500-A1
	6"	2.33	2	CGF-600-A1
→	8"	8.82	2	CGF-800-A1

MALE ADAPTER



MALE NPT

PART E ALUMINUM

Casting Temp. : -101C to +121C(-150F to +250F)

HOSE SHANK



MALE ADAPTER

Size	Weight (lbs)	Std Pack Qty	Part #
1/2"	0.10	100	CGE-050-A1
3/4"	0.12	50	CGE-075-A1
1"	0.20	50	CGE-100-A1
1-1/4"	0.35	50	CGE-125-A1
1-1/2"	0.49	50	CGE-150-A1
2"	0.71	25	CGE-200-A1
2-1/2"	1.01	12	CGE-250-A1
→ 3"	1.47	12	CGE-300-A1
4"	2.48	6	CGE-400-A1
5"	3.31	2	CGE-500-A1
6"	4.41	2	CGE-600-A1
→ 8"	5.14	4	CGE-800-A1
10"	14.20	1	CGE-1000-A

PART C ALUMINUM

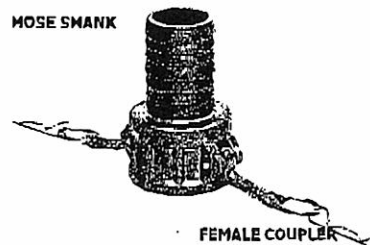
Vacuum Rating : FULL

Gasket Material : NBR

Gasket Temp. : -40C to +100C(-40F to +212F)

Casting Temp. : -101C to +121C(-150F to +250F)

HOSE SHANK



FEMALE COUPLER

Size	Max Operating PSI (70F)	Weight (lbs)	Std Pack Qty	Part #
1/2"	250	0.10	100	CGC-050-A1
3/4"	250	0.24	50	CGC-075-A1
1"	250	0.44	50	CGC-100-A1
1-1/4"	250	0.66	30	CGC-125-A1
1-1/2"	250	0.81	30	CGC-150-A1
2"	250	1.06	20	CGC-200-A1
2-1/2"	150	1.28	10	CGC-250-A1
→ 3"	125	2.07	10	CGC-300-A1
4"	100	3.30	4	CGC-400-A1
5"	75	3.97	2	CGC-500-A1
6"	75	6.24	2	CGC-600-A1
→ 8"	50	11.02	2	CGC-800-A1
10"	50	19.40	1	CGC-1000-A

Claudette Dion-St. Jean
Kitnuna Corporation
PO Box 92
Cambridge Bay, NU
X0B 0C0

August 25, 2010

Dear Ms. Dion- St. Jean,

Please find below our responses to the queries that were posed to WESA Technologies July 29th, 2010 with reference to the Gorman-Rupp decant pump.

1. Specifications call for a high speed wheel kit, shop dwgs do not show or imply a wheel kit is included

Gorman-Rupp pump: A shop drawing for the wheel kit for the Gorman-Rupp pump is found on page 3 of the Gorman-Rupp Package pdf file. The high speed wheel kit, suitable for highway driving, has been installed on the pump and has its RIV certification. This has been supplied as requested.

2. Pump performance curve to indicate Horsepower Required

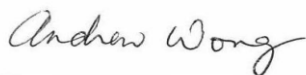
Pump curves have been provided for each pump, and are found in the attached pdf file. For each of these pump curves, the engine has already been specified with a horsepower rating.

Gorman-Rupp pump: The pump curves presented are dependent on the operating rpm and not horsepower, and can be found on page 2 of the Gorman-Rupp Package pdf file.

3. Caterpillar engine specified, John Deere shown on shop drawings

Gorman-Rupp pump: The Caterpillar engine was replaced by the manufacturer with the John Deere engine. The Caterpillar cat engine no longer meets EPA standards and is no longer available. Further, the John Deere engine is equivalent to the Caterpillar engine. The performance curves of the pump do not change.

Regards,



Andrew WT Wong
Project Coordinator, WESA Technologies Inc.



Appendix I

Forms



**HAMLET OF CAMBRIDGE BAY
LAGOON FACILITY
HAZARD ASSESSMENT CHECKLIST**

Step 1: Fire Hazard Assessment Checklist			
Facility: _____			Date: _____, _____
Priority for Corrective Action # 1 high risk #2 moderate risk #3 low risk #4 no risk #5 not applicable			
Item	Identified Hazard	Status (Priority)	Safety Hazard and Location
Fire Safety			
1	Employee training		
2	Employee knowledge		
3	On-site communications		
4	Off-site communications		
5	Water supply		
6	Site security		
7	Fire safety plan		
8	Fire drills		
Storage of Materials			
1	30 m clearance of stored materials. From brush or forest		
2	6 m clearance of stored materials. From uncontrolled grass or weeds		
3	Fire Dept. access		
4	Fencing/Security		
5	Access to water		
6	Fire Dept. Access		
7	Fire breaks		

Hamlet of Cambridge Bay

Cambridge Bay Sewage Lagoon



Step 2: Fire Safety Hazard Assessment Corrective Action				
Facility:			Date	
Assessment Team			Persons	Position
Item	Priority	Recommended Action	Follow-up	
			Action taken Date/Time	By whom?
Municipal Systems Manager Signature:			Date:	



Step #3 Health and Safety Hazard Assessment Checklist			
Facility		Date/Time:	
Priority Status		#1 very hazardous, previous accident of high potential #2 hazardous with moderate risk #3 low risk #4 O.K. #5 not applicable (N/A)	
Item #	Identified Hazards	Status/Priority	Safety Hazard and Location
1	Housekeeping		
2	Material Storage		
3	Waste disposal		
4	Extreme Temperature		
5	Radiation exposure		
6	Gas (toxic or non-life supporting)		
7	Flammables (Fire/Explosion)		
8	Dangerous Pressure		
9	Chemicals		
10	Hazardous Materials (WHMIS)		
11	High Risk Positioning		
12	Electrical Hazards		
13	Overhead Hazards		
14	Underground Hazards		
15	Confined Space Entry		
16	Excavations		
17	Restricted Access/Egress		
18	Ladders		
19	Work at Heights		
20	Work over water		
21	Major lifts (hoisting)		
22	Vehicles		



Step #3 Health and Safety Hazard Assessment Checklist			
Facility		Date/Time:	
Priority Status		#1 very hazardous, previous accident of high potential #2 hazardous with moderate risk #3 low risk #4 O.K. #5 not applicable (N/A)	
Item #	Identified Hazards	Status/Priority	Safety Hazard and Location
23	Mobile equipment		
24	High traffic		
25	Power tools		
26	Permits		
27	Communications		
28	First Aid		
29	Personal Protection Equipment		
30	Other items		
Municipal Systems Manager Signature:			Date:

Hamlet of Cambridge Bay

Cambridge Bay Sewage Lagoon



**HAMLET OF CAMBRIDGE BAY
SEWAGE LAGOON
INCIDENT/NEAR MISS REPORT**

Incident Date: _____ Time: _____

Location:

Name and Position of Person Making Report _____

Name of individual(s) involved:

Drivers License No.(s) if required _____

Individual or Company _____ Phone No. _____

Did the Incident Result in Personal Injury? Yes _____ No _____

Injury report attached Yes _____ No _____
(i.e. Worker's Safety and Compensation Commission form or other applicable form)

Did the incident cause damage to Landfill or other property? Yes _____ No _____

Who investigated the Incident?

Supervisor _____ RCMP _____ Special Committee _____ HS&S _____

Contact Person(s) _____

Details of Equipment/Property Damage if Applicable

Damage was to: Vehicle Equipment Property

Description:

Unit No. Year Make Model

Estimated Value of Vehicle/Equipment/Property _____

Estimated Damage to Vehicle/Equipment/Property _____

Hamlet of Cambridge Bay

Cambridge Bay Sewage Lagoon



Description of Incident (use attachment if necessary)

Incident Cause (use attachment if necessary)

Sketch of Incident Where Applicable (use attachment if necessary)

Recommendation to Prevent Re-occurrence (use attachment if necessary)

Comments (use attachment if necessary)

Name: _____ Signature: _____

Report Date _____

Distribution List:

The Hamlet of Cambridge Bay
Cambridge Bay Sewage Lagoon



HAMLET OF CAMBRIDGE BAY SEWAGE LAGOON VISITOR LOG

[illegible]

Hamlet of Cambridge Bay

Cambridge Bay Sewage Lagoon



**HAMLET OF CAMBRIDGE BAY
SEWAGE LAGOON
Annual Records Review**

Date: _____ **Inspector:** _____

A: Acceptable, U: Unacceptable

No	Item	A	U	COMMENTS
----	------	---	---	----------

1.0 PERMITS AND APPROVALS

1.1	Municipal Development Permit			
1.2	Land Titles, Lease Agreements			
1.3	Nunavut Water Board Approvals			
1.4	Annual Decant Record			
1.5	Geotechnical Inspection Report			
1.6	Sampling Data			
1.7	Inspector's Reports			
1.8	Other			



**HAMLET OF CAMBRIDGE BAY
SEWAGE LAGOON
MONTHLY SITE OPERATIONS INSPECTION**

Date: _____ **Inspector:** _____

A: Acceptable, U: Unacceptable

No	Item	A	U	COMMENTS
----	------	---	---	----------

1.0 RECORDS

1.1	Daily Operating Logs			
1.2	Discharge Records (if applicable)			
1.3	Monitoring Reports			

2.0 PERSONNEL TRAINING AND CERTIFICATION

2.1	Lagoon Operator			
2.2	First Aid			
2.3	Work Place Safety (OH&S)			
2.4	WHMIS			
2.5	Other			

3.0 DESIGN AND OPERATION AND MAINTENANCE PLAN

3.1	Site Development Plan current			
3.2	Operations Procedures & Policies Current			
3.3	Construction/As-built records			

4.0 PERSONNEL, OPERATING EQUIPMENT AND FACILITIES

4.1	Lagoon Operator			
4.2	Support Personnel			
4.3	Lagoon Equipment			
4.4	Communication equipment			

5.0 ENTRANCE AND ROADWAYS

5.1	Site Appearance / Signage			
5.2	Entrance Road			
5.3	On-site Access Roads			
5.4	Road Surfacing			

6.0 MAIN LAGOON BERMS

6.1	Main Landfill Site Berm			
6.2	Pond 2/3 Berm			
6.3	Overflow Structure on Pond 2/3 Berm			
6.4	Scrap Metal Dump Berm			



No	Item	A	U	COMMENTS
7.0 DIVERSION BERMS				
7.1	Northeast Berms			
7.2	Northwest Berm			
7.3	Wetland Berms			
8.0 INLET STRUCTURES				
8.1	Truck Discharge			
8.2	Flume			
8.3	Flume Support			
8.4	Rip Rap			
9.0 WETLAND OUTLET STRUCTURES				
9.1	Flow Control Berm			
9.2	Culverts			
9.3	Outfall			
10.0 SAFETY				
10.1	Employee Safety Practices/Issues			
10.2	Customer Safety Practices/Issues			
10.3	Documentation			
11.0 EMERGENCY RESPONSE				
11.1	Medical Emergency Response			
11.2	Fire Response			
11.3	Environmental Response			

Hamlet of Cambridge Bay

Cambridge Bay Sewage Lagoon



**HAMLET OF CAMBRIDGE BAY
SEWAGE LAGOON
DAILY OPERATIONS LOG**

DATE: Day _____ Month _____ Year _____

WEATHER: Precipitation _____ mm Temp. _____ °C Wind : _____ km from _____

DAILY WATER LEVEL RECORD:

Pond 2 Berm _____ m

STAFF:

Lagoon Operator Start: _____ Leave: _____

EQUIPMENT:

Decant Pump
(if performing annual
discharge) Hours: _____ Activity: _____

SITE MAINTENANCE:

(i.e. litter, fences, roads, other)

Activities

Comments

SITE INSPECTIONS:

Observations

Action Taken or Required

Lagoon Surface

Truck Discharge

SITE MAINTENANCE:

SAFETY CONCERNS OR ISSUES:

OTHER:

(Use back of form to note other activities.)



**HAMLET OF CAMBRIDGE BAY
SEWAGE LAGOON
WEEKLY SYSTEMS CHECK**

Date: _____ **Inspector:** _____

A: Acceptable, U: Unacceptable

No	Item	A	U	COMMENTS
----	------	---	---	----------

1.0 RECORDS

1.1	Daily Operating Logs			
1.2	Discharge Records			
1.3	Monitoring Reports			

2.0 ENTRANCE AND ROADWAYS

2.1	Site Appearance			
2.2	Entrance Road			
2.3	On-site Access Roads			
2.4	Road Surfacing			

3.0 MAIN LAGOON BERMS

3.1	Main Landfill Site Berm			
3.2	Pond 2/3 Berm			
3.3	Overflow Structure on Pond 2/3 Berm			
3.4	Scrap Metal Dump Berm			

4.0 DIVERSION BERMS

4.1	Northeast Berms			
4.2	Northwest Berm			
4.3	Wetland Berms			

5.0 INLET STRUCTURES

5.1	Truck Discharge			
5.2	Flume			
5.3	Flume Support			
5.4	Rip Rap			

6.0 WETLAND OUTLET STRUCTURES

6.1	Flow Control Berm			
6.2	Culverts			
6.3	Outfall			

7.0 SAFETY

7.1	Employee Safety Practices/Issues			
7.2	Customer Safety Practices/Issues			

Hamlet of Cambridge Bay

Cambridge Bay Sewage Lagoon



**HAMLET OF CAMBRIDGE BAY
SEWAGE LAGOON
Annual Decant Record**

Start Date: _____ **End Date:** _____

Date	Hours Operated	Approximate Decant Value (m ³)	Comments

Summary: _____