BOSTON SEWAGE TREATMENT OPERATIONS AND MAINTENANCE MANAGEMENT PLAN

HOPE BAY PROJECT, NUNAVUT

SEPTEMBER 2017

PLAIN LANGUAGE SUMMARY

This Sewage Treatment Operation and Maintenance Plan describes the management and monitoring obligations for the sewage treatment plant at Boston. The plant is designed to remove contaminants from the sewage and greywater produced at Boston. The sewage treatment plant is an integral part of the site facilities required for continued exploration, mining, and infrastructure development of the Hope Bay Project. This plan should be reviewed in conjunction with the site wide Hope Bay Project Domestic Waste Water Treatment Plan (February 2017).

REVISION HISTORY

Revision #	Date	Section	Summary of Changes	Author	Approver
1	October 2010			Newmont	Newmont
2	September 2017	Throughout	Updated Management Plan	TMAC Resources Inc.	TMAC Resources Inc.

GLOSSARY AND ACRONYMS

TERM	DEFINITION
INAC	Indigenous and Northern Affairs Canada
BOD	Biochemical oxygen demand
DOE	Department of Environment
ERT	Emergency response team
GN	Government of Nunavut
GNWT	Government of the Northwest Territories
KIA	Kitikmeot Inuit Association
MSDS	Material safety data sheets
NWB	Nunavut Water Board
QA/QC	Quality assurance / quality control
STP	Sewage treatment plant

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CONFORMITY TABLE

Licence	Part	Item	Topic	Report Section
2BB-BOS1727	Part D.	Item 14	All Effluent discharged to the tundra from the Sewage Treatment Facility, at monitoring stations BOS-3 shall not exceed the following Effluent Quality Limits	Section 4
		Item 15	Upon confirming compliance required of Part D, Item 14, Effluent to be released to the environment may be used for other industrial purposes, including use for dust suppression activities on roads and quarries as well as drilling	Section 4
		Item 21	All Effluent shall be discharged in such a manner to minimize surface erosion	Section 4
		Item 22	The Licensee shall locate areas designated for Effluent discharge at a minimum distance of thirty-one (31) meters from the ordinary High-Water Mark of any water body where direct flow into a water body is not possible and additional impacts are not created, unless otherwise approved by the Board in writing.	Section 3
		Item 23	The Licensee shall provide at least 10 days notification to an Inspector, prior to initiating the release of Effluent from any facilities listed in the Par. The notice shall include Effluent quality monitoring results as estimate of volume and the proposed receiving location	Section 3
	Part J	Item 3	The Licensee shall measure and record all flow and volume measurements on a monthly basis, during the operations, and any use of water (unless otherwise stated):	Section 4
		Item 4	The volume of sewage sludge removed from the Wastewater Treatment Plant and the locations or method of sewage sludge disposal during construction, operation and closure.	Section 4
		Item 21	The Licensee shall, within thirty (30) days following the month being reported, submit to the NWB a monthly monitoring report in an electronic and hardcopy.	Section 4

1. INTRODUCTION

This Sewage Treatment Operations and Maintenance Plan for Boston (the Plan) has been prepared by TMAC Resources Inc. (TMAC) in accordance with various water licences held by TMAC associated with developments throughout the Hope Bay region.

The Nunavut Water Board (NWB) issued water licence 2BB-BOS1727 to TMAC on July 26, 2017 to allow for the use of water and disposal of waste during mineral exploration activities. These activities will be undertaken at the Boston site of the Hope Bay Project located within the Kitikmeot Region, Nunavut generally located at the geographical coordinates:

Project extents:
Latitude: 67° 41' 41" N Longitude: 106° 26' 27" W
Latitude: 67° 36' 13" N Longitude: 106° 19' 22" W

Existing Camp Location:
Latitude: 67° 39' 32"N Longitude: 106° 23' 17" W

The Plan is intended primarily for use by TMAC and its contractors to ensure that best practices for minimizing potential environmental impacts and potential environmental liabilities with respect to sewage treatment and disposal at Boston Camp are followed, and that the conditions of water licences are met. The "Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities" (MACA, 1996) were consulted during the preparation of this plan. This plan should be reviewed in conjunction with the overarching Doris Domestic Waste Water Management Plan for the Hope Bay Project (April 2016), which provides an overview of wastewater management at all TMAC sites along the Hope Bay Belt.

1.1. OBJECTIVES

The main objective of this Plan is to ensure the sewage treatment plant at Boston is operated in a safe, efficient and environmentally compliant manner. Consistent with TMAC's intent to be a responsible operator, these objectives are described as follows:

- Prevention of public health risk;
- Protection of surface and ground water;
- Protection of the operator;
- Protection of land, local flora and fauna; and
- Conservation of water; and
- Compliance with Project Certificate and Water Licence requirements and applicable regulations;

This plan consists of Operations and Maintenance Procedures for sewage treatment and disposal facility at Boston, including:

- A description and maps showing location of the sewage treatment facility
- Start up and Operations and maintenance methods
- Sludge Management
- Compliance sampling procedures.

1.2. Relevant Legislation and Guidance

Table 1: List of Regulations and Guidelines Pertinent to the Domestic Wastewater Treatment Management Plan

Regulation/Guideline	Year	Governing Body	Relevance
Environmental Protection Act	2011	Government of Nunavut (GN), Department of Environment (DOE), Environmental Protection division	Legislation to authorize discharge of wastewater
Environmental Rights Act	2011	GN, DOE, Environmental Protection division	Grants all residents the ability to launch an investigation
Camp Sanitation Regulations, Public Health Act	2006	GN, Department of Health and Social Services	Regulation sets minimum sanitation standards
Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories	1996	Government of the Northwest Territories (GNWT), Department of Municipal and Community Affairs	Guidance on developing an operation and maintenance manual
Environmental Guideline for Industrial Waste Discharges	2002	GN, Department of Environment	Guidance on effluent wastewater quality
Guidelines for the Disposal of Domestic Wastewater in Nunavut	2000	Nunavut Water Board (NWB)	Generic guidelines for wastewater effluent quality

1.3. Related TMAC Documents

Table 2: List of Documents Related to the Hope Bay Domestic Wastewater Treatment Management Plan

Document Title	Relevance
Doris Domestic Wastewater Treatment Plan	Overarching Wastewater Management Plan for the Hope Bay Belt - to be reviewed in conjunction with this plan.
Hope Bay Spill Contingency Plan	Spill response procedure
Incinerator Management Plan	Sludge disposal
Quality Assurance and Quality Control Plan	Discharge monitoring
Hazardous Waste Management Plan	Proper handling and disposal of hazardous chemicals to divert these materials from entering the wastewater treatment system
Sewage Treatment Plan Operation, Testing, Sampling and Monitoring Standard Operating Procedure	Safe operating procedures that outline operation, service, sampling and inspection of the Sewage Treatment Plan

1.4. Plan Management and Execution

The General Manager (GM) has overall responsibility for implementing this management plan and will provide the on-site resources to operate and maintain all wastewater treatment plants located in the Hope Bay Belt in accordance with the operation manuals and regulatory requirements.

The Surface Manager is responsible for implementing this management plan and providing on-site resources to operate, manage and maintain the STPs in accordance with this management plan and operating manual.

The Site Services Supervisor is responsible for revising this management plan in consultation with the Environmental Coordinator and will conduct regular inspections of the STP, audits of the maintenance records, and will provide input on modifications to design and operational procedures to improve operational performance of the facility.

The Environmental Coordinator will conduct sampling of the treated wastewater, report on the performance of the sewage treatment facilities, and assess whether the treated wastewater has met applicable regulatory standards. The Environmental Coordinator will provide direction to operational personnel as to storage and disposal of the STP sludge.

STP Operator is responsible for providing input on modifications to design and operational procedures to improve operational performance of the STP facilities. The Operator will provide technical expertise for the operation and maintenance of the facilities and ensure that inspections of the facility are conducted to ensure it is operating correctly.

2. SEWAGE TREATMENT PLANT MANAGEMENT AT BOSTON

2.1. FACILITY DESCRIPTION

The Clementine Rotating Biological Reactor Sewage Treatment Plant (STP) located at Boston is able to support the existing 72-person camp with a design flowrate of 200Lpcd and ADF of 13m^3 with a peaking factor of 3.0. This is a biological process and it takes time for the biomass to develop to a steady state. Generally, a 6 to 8 week start up is typical for a biological process to develop and stabilize.

Gravity Raw Sewage Flow

Raw sewage flows by gravity to the low lift. A flow sheet for the process is shown in Appendix A in Figure- SK1.

Low Lift

The low lift now comprises of an insulated gravity flow inlet pipe, a primary settling and sludge storage tank, a grinder-lift pump in a still well, and a heater in an insulated building. Further, it also contains emergency overflow tanks in separate insulated buildings. The low lift is so named because it is the lowest point. The Grinder pump is used in the still well to pump what is now primary effluent to the surge tank at the Clementine STP Pad. The discharge will recycle to control flow to the surge tank. Attached to the low lift are two emergency overflow tanks. The aerobic digester is located in a separate insulted building that contains a heated tank with a blower.

Clementine STP Pad

The Clementine STP Pad is so called after the manufacturer's name for the RBC process package plant unit that was originally at the Windy Camp and the pad that was built for the MBR. Further, the Clementine is so called, so that it is not confused with the old RBC even though that has been removed from service. As shown in Drawing SK1 (Appendix A) Clementine STP Pad is comprised of a surge tank, a flow equalization tank, the Clementine RBC treatment unit rated at 28m3/day with UV disinfection, and an emergency overflow tank. The Clementine RBC unit is a self-contained rotating biological contactor in an insulated container. Treated effluent flows by gravity to the high lift.

High Lift

The high lift is so called, as it is the last lift station before discharge to the tundra. Refer to flow sheet found in Appendix A Figure SK1 and SK2 for additional details.

Pumps used

The pumps used for this facility are listed in the table below. Further detail for all of these pumps are provided in Appendix B, C and E of this Plan.

3. WASTE DISPOSAL AND TREATMENT

3.1. EFFLUENT DISCHARGE

Ten days prior to the start-up or recommissioning of the STP following a shutdown, TMAC will notify the inspector, the notification shall include the location of effluent discharge, effluent quality monitoring results, and an estimate of volume in line with Part D Item 21 of the Type B Water Licence 2BB-BOS1727.

Under the existing Type B Water Licence 2BB-BOS1727, treated effluent from the Clementine STP can be discharged to tundra in an approved discharge location, once it meets water quality discharge criteria as outlined in Part D Item 14 of the Licence.

Treated effluent will be discharged in a manner as to not cause erosion. The discharge line is a two-inch diameter metal pipe groove lock with vocalic fittings at joints. The effluent is fed into the discharge pipeline by pumps. A lined box is located at the end of the discharge line and is designed to reduce the discharge energy before discharge onto the tundra, where coco matting has been installed to reduce/eliminate erosion.

The discharge is directed from the rock outcrop to the tundra and drains to Aimaokatalok lake also known as Spyder Lake. Monitoring is routinely conducted at the discharge point and the area down slope to ensure erosion management is effective. The closest downstream water body Aimaokatalok Lake. A generalized effluent flow path can be seen Appendix A, Photograph 1 of this plan. Photograph 1 shows that the actual effluent flow path meanders through grassy hummocks and is spread across a wide area; rather than following a defined channel. Sketch AD 01 found in Appendix A provides a topographic map referencing the effluent flow path (including distances and slope) and applicable monitoring stations.

Tundra Treatment Process

Overland flow sewage treatment is a web of complex physical and biological processes. Sedimentation, absorption of pollutants in the surface soils, nutrient uptake by plants, the oxidation of compounds by microorganisms and evaporation are just some of the processes that affect the treatment.

The plants within an overland flow area act as natural purifiers trapping and binding pollutants in the mud and roots. The plants also provide a media to which bacteria can cling as it grows. These bacteria, similar to those present in a mechanical sewage treatment plant, remove carbon and nutrients from the water.

Finally, the thin layer of now clean water allows sunlight to penetrate deeply, thus, killing pathogenic organisms and disinfecting the water. Photograph 2 found in Appendix A of this plan shows the start of the tundra treatment process area at Boston.

There are many positive aspects to using the land for sewage treatment including:

- By enhancing overland flow areas with nutrients and liquid, the ecology of the area becomes more productive. This, in turn, attracts birds and mammals to a rich, productive food source;
- Overland flow areas provide inexpensive secondary/tertiary treatment; and
- Overland flow areas are one of the few technologies that meet the *General Provisions of the Fisheries Act.*

Seasonal Variations

During the winter effluent discharge procedures remain. Effluent is stored as an ice accretion in the disposal location. Solids are rejected from the ice during the freezing process. Water is not discharged from the tundra treatment area.

As the ice thaws in the spring, rejected solids are deposited on the land. Freezing and thawing occurs for several weeks until the ambient temperature stabilizes above zero. During this period, water is distributed in a thin film over the lands surface where it is treated by evaporation, by mechanical filtration, and disinfected by UV radiation from sunlight. Melted ice combines with melted snow as the site warms.

As the tundra flora and fauna becomes active once again, the rejected solids are further treated biologically by soil organisms and through plant uptake. Subsequently, tundra treatment of effluent returns.

3.2. SLUDGE DISPOSAL

Only faecal solids and grey water will enter this system. There is no sewer connection for shops or other industrial areas. Cleaning products used are biodegradable household cleaners. Kitchen food wastes are not to be garburated, rather, they are collected dry for disposal. Therefore, the sludge that is generated by this facility will not contain noxious compounds or industrial waste that may otherwise prevent its future beneficial use.

Sludge removed from the sewage disposal facility will be disposed of in a sump/unlined depression located a minimum of thirty-one (31) meters from the normal high-water mark and such that it does not enter any water body. This method of disposal is in line with the previously approved Boston Water Licence 2BB-BOS1217 Part D 12. A proposed location for this disposal is at 0441191E 7504661N shown on figure SK4 found in Appendix A of this plan.

According to climate normals for the closest meteorological station at Cambridge Bay, both snow accumulation and melt, and extreme rainfall are insufficient to overtop the sump. Therefore, the limited potential for contribution from the watershed and the volume of introduced sludge, the sump is not expected to discharge. Should extraordinary environmental conditions cause a concern that overtopping is a potential, then depending on the conditions, excess water can be pumped to the tundra treatment area or an emergency amendment sought for an on-site discharge to the immediately adjacent tundra.

If required, treated sludge will be stored in plastic totes in seacans in a manner that will prevent wildlife from accessing the sludge until such time that it can be disposed off. Sludge will be transported to Doris where it will be disposed of in the in the Tailings Impoundment Area as per the Doris Domestic Wastewater Management Plan (February 2017).

TMAC will continue to explore alternative disposal methods for sludge. These alternative methods may include incineration, placing pressed cake into biodegradable bags and burring this in an overburden pile or blending sludge with other materials and using this material in reclamation programs.

Routine Management from Treatment

Sludge is to be removed as required from the primary settling tank and from the Clementine. Following is the operational procedure for the digester to accept faecal solids. Operational staff may have to modify this technique so it can continue into winter use.

1. Shut off the aeration and allow the digester to settle for two hours. It will separate into two sections – supernatant at the top and solids at the bottom;

2. Pump some of the supernatant into the adjacent low lift station to be removed for further treatment;

3. Pump sludge (solids) from the lift station into the digester ensuring that it does not overflow;

4. Turn on the aeration; and

5. Clean the pump and hose and store for the next use.

The rate of solids accumulation in the Clementine will vary with location. There may be solids drifted into corners of the surge tank and equalization tank. These solids could be removed manually for digestion or, they could be stirred into solution for treatment in the Clementine.

The Clementine RBC uses bacteria grown on rotating plates to treat the sewage. As they grow thicker on the plates, the rotational motion sheers them from the plates and they settle in various locations within the container. These solids are waste and if they are allowed to simply accumulate and remain in the Clementine, they will eventually begin to interfere with the operation and degrade the effluent quality.

Operators will manually monitor sludge accumulation in the Clementine and other tanks to determine when it should be removed. When removed, solids should immediately be placed into the digester for further treatment, rather than stored. If this is difficult or inconvenient, these solids could be pumped into the low lift with the incoming raw sewage for removal in that process.

For the Clementine, the following is a suggested operational procedure if the solids are to be disposed directly to the digester.

1. Follow steps 1 and 2 for the digester;

2. Stop the Clementine discs rotating;

3. Allow 30 to 60 minutes for settling;

4. Remove sludge as required to a suitable, easily managed container(s);

5. After a further 30 to 60 minutes to allow re-settling, re-start the Clementine;

6. Transport and pour the content of the container into the digester;

7. Return the digester to operation; and

8. Clean the pump, hose and container and store for the next use.

If barrels or totes are to be used as a container, only clean barrels should be used. Petroleum products should not be introduced to the digester or any sewage treatment process.

To remove sludge from the digester:

1. Follow step 1 and 2;

2. Pump sludge into barrels or other suitable container;

3. Store in a bermed area pending additional management; and

4. Clean the pump and hose and store for the next use.

Sludge Sump Management

Clean out sludge and digested sludge is to be managed in the sludge sump. Generally, the water will have evaporated before freeze-up. If excess water is apparent i.e. approach 0.5 meter freeboard, and will likely affect future operations, then it should be removed. The water should be first sampled to

determine if it can be discharged to tundra treatment or should be introduced to the flow equalization tank.

When the sludge sump is full, or has no further use, the sludge will be sampled representatively to determine if it meets the CCME fertilizer guidelines. If so, it will be blended with other materials and used in reclamation programs. If not, it may be removed from the sump, incinerated and disposed with the incinerator ash. Sludge may be stored in the sump or in appropriate containers prior to additional processing.

4. MONITORING AND REPORTING

4.1. RECORD KEEPING

Records of operation and maintenance are required to evaluate the effectiveness of the STP operation. Daily logs completed include the following information:

- Volume and flow rate of discharge, and discharge location of effluent discharged to environment;
- Sludge volume pressed and removed from the plant;
- Sludge disposal location/method; and
- Details of any maintenance undertaken at site.

Record sheets and daily operations logs are completed by the STP operator. Records of sewage sludge disposal are completed and maintained at site.

Monthly and annual reports are submitted to the Nunavut Water Board as per Part J, Item 21 of the 2BB-BOS1727 Water Licence.

4.2. DISCHARGE MONITORING

Effluent quality and quantity is monitored during daily operations, and STP operators adjust settings as effluent quality fluctuates. Monitoring equipment, such as pH meters, are calibrated regularly to ensure accurate readings are obtained during monitoring activities, and microorganism activity and abundance is assessed to evaluate the efficiency of the biological treatment system.

Effluent samples are collected by the Environmental Coordinator or delegate as prescribed under the applicable licence or if there are suspected issues with the effluent quality based on daily monitoring conducted by the STP operator. These samples are submitted for analysis at an accredited laboratory and compared to discharge criteria outlined in the water licence.

TMAC has implemented a monitoring program for the STP as required by the Type B Water Licence (2BB-BOS1727).

The objective of discharge monitoring is to:

- Measure the performance of the STP;
- Ensure treated water from the STP meets the appropriate ‘discharge limits; and
- Assess water quality in the receiving water environment.

Sampling Locations

There are two locations of surveillance stations required by water licence 2BB-BOS1727. One is located at the Clementine STP Pad and the other is located on tundra prior to entering Aimaokatalok Lake (Spyder Lake). These locations can be seen in Photograph 3 found in Appendix A of this document.

Table 3: Monitoring Stations under Licence 2BB-BOS1727

Station Number	Description
BOS-3	Sewage Disposal Facility Final Discharge
BOS-4	Treated sewage effluent prior to entry into Aimaokatalok (Spyder) Lake

Effluent Quality Requirements

All treated effluent discharged to tundra from the STP at the BOS-3 monitoring station shall meet the effluent limits as outlined in Part D, Item 14 of Water Licence (2BB-BOS1727) and summarized in Table Below.

Table 4: Effluent Discharge Quality Limits to Tundra from Sewage Treatment Plant at Monitoring Station BOS-03

Parameter	Maximum Allowable Concentration (mg/L)
pH	6-9.5
Total Suspended Solids	100
BOD_5	80
Fecal Coliforms	10,000 CFU/100mL
Total Oil and Grease	5 and no visible sheen

All samples are collected and handled following the sampling procedures and QA/QC methods outlined in the Hope Bay Quality Assurance and Quality Control Plan (TMAC 2017) and in any applicable water sampling standard operating procedures developed by TMAC's Environment Department. Sample results are reported to the STP operator upon receipt from the laboratory. The results are reported in the monthly and annual reports required under the Water Licence (No: 2BB-BOS1727).

Upon confirming compliance of Part D, Item 14, effluent to be released to the environment may be used for other industrial purposes, including use for dust suppression activities on roads and quarries as well as drilling.

Off-Specification Effluent Quality

The potential does exist for isolated, short-term discharges of treated wastewater effluent that does not meet the discharge limits due to equipment malfunction or operator error. However, the system design limits the potential for partially treated wastewater to be discharged from the plant. In addition, operators conduct daily checks throughout the treatment system to confirm that the unit is operating within an acceptable range. Parameters such as pH, dissolved oxygen, temperature, flow, settle ability of solids, etc. are measured to evaluate the systems performance. Adjustments within the system are made by the operator based on these results to ensure optimal treatment performance and compliance are achieved.

In the event that analysis indicates a sample exceeded the specified discharge limit and in line with Part D Item 14 of the Type B Water Licence 2BB-BOS1727, TMAC will, as soon as possible upon receiving the analytical results:

- Re-sample the effluent and submit the sample for appropriate analysis. A "same day" priority will be placed on the analysis to provide expedient turnaround time on results;
- Stop the discharge of effluent to the tundra and conduct a detailed inspection of the entire STP and all associated facilities to identify the cause of the off-specification discharge, correct any issues identified and ensure the facility is operating within the prescribed parameters and operation limits before resuming discharge; and, if necessary, implement additional monitoring of the downstream environment to assess the level of any potential impact of the off-specification discharge;
- Effluent discharge will be directed to the lined containment sump until compliant results have been received by the accredited laboratory.

During these upset conditions, the wastewater effluent may have slightly elevated pH and fecal coliforms. However, due to the limited frequency and relatively short duration of such events and the

distance to the lake receiving environment (~250 m), residual environmental effects are negligible If water quality samples indicate the effluent is not compliant with these discharge criteria or if monitoring activities conducted by the operators indicate there is an issue with the STP system, discharge to the tundra is stopped until the cause of the issue is identified. Adjustments are made to the operational settings of the WTP and additional sampling is conducted. Storage tanks on site are available to store non-compliant effluent or this effluent may be directed to the TIA until issues with the WTP operation are identified and repaired.

4.3. SEWAGE TREATMENT PLANT INSPECTIONS

The STP operator is responsible for providing input on modifications to design and operational procedures to improve operational performance of the STP facilities. The Operator will provide technical expertise for the operation and maintenance of the STP and carry out routine inspections as outlined in the table below to ensure the facility is operating correctly.

Table 5: Routine Inspection of Sewage Treatment Facility

	Daily	Weekly	Monthly
Lower Lift	Check pumps, temperature. Clear floatable material from primary tank and wier	Check sludge levels, remove sludge to digester as required	Follow manufactures specs for all components
Clementine Pad	Check pups, blower, temperature. Check disc color, odor	Check sludge levels, remove sludge to digester as required	Follow manufactures specs for all components
High Lift	Check pH, pumps and temperature.	Check sludge levels, remove sludge to digester as required.	Follow manufactures specs for all components.
Digester	Check blower and temperature	Check sludge levels, remove sludge sump as necessary.	Follow manufactures specs for all components
Tundra Discharge	Check erosion at surge box.	Check ponding, overflows, and erosion in the tundra treatment area.	NWB sampling requirements for monitoring locations.

5. WASTEWATER MANAGEMENT ISSUES

Exposure to Pathogens

Sewage and greywater have the potential to contain pathogens that can be transmitted to operators working with STP units.

Management Response

Employees are trained prior to the commencement of work to be aware of the health and safety risks associated with the wastewater treatment. The following two absolute points of compliance are part of the training program:

- No person is to drink the water in the STP or the water that is discharged from the plant.
- Working with wastewater requires adequate protection for operators that includes wearing steel toed boots, protective goggles, and protective gloves. Face shields should be used if there is a risk of wastewater or sludge being splashed near the operator's face.

Operators and workers assisting with operation or maintenance of the WTP must have current Hepatitis A and B vaccinations.

Exposure to Chemicals

Operation of the STPs involved the handling and use of a number of oxidizing chemicals that could pose hazards to operators working with these units.

Management Response

Before handling and using any chemicals, the appropriate material safety data sheets (MSDS) must be reviewed (MSDSs will be available). When handling chemicals operators should wear protective goggles, protective gloves and any other personal protective equipment as described in the MSDS. First aid and emergency response procedures described in the MSDS are to be followed. Chemicals required for the operation of an STP will be used according to manufactures specifications.

6. CONTINGENCIES

6.1. TREATMENT OPTION CONTINGENCY

The facility is not complex; it is made of tanks and pumps. Tanks can be repaired and pumps replaced if/when they fail. The only way that there could be a complete failure of the facility is if the electrical system for the entire camp failed and everything froze. If that happened the camp would be shut down until a new electrical system was installed and made operational. Any sewage that cannot be contained in a unit process will flow by gravity to an emergency overflow tank.

TMAC would also place restrictions on water usage to minimize the amount of wastewater produced. If required, pumps and holding tanks or totes will be used to store wastewater while the STP is not operational. Untreated wastewater stored temporarily would later be fed into the plant once repaired at a rate appropriate for effective plant treatment.

6.2. SPILL RESPONSE

In the event of a minor chemical spill, the MSDS instructions for containment and cleanup are followed and the incident must be reported to the environmental and health and safety departments. In the event of a large chemical spill, the emergency response team (ERT) are called and cleanup crew members follow the direction of the ERT. Spills of raw or partially treated wastewater are managed following the same procedure. The details for the spill response procedures are included in the Hope Bay Spill Contingency Plan (TMAC 2017).

All spills are internally reported, and any meeting Nunavut and Northwest Territories' spill reporting requirements will be reported to the spill line as required and will be included in the monthly and annual reports for the water licence.

7. REFERENCES

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TMAC, 2017. Hope Bay Project Quality Assurance and Quality Control Plan. TMAC Resources Inc. January.

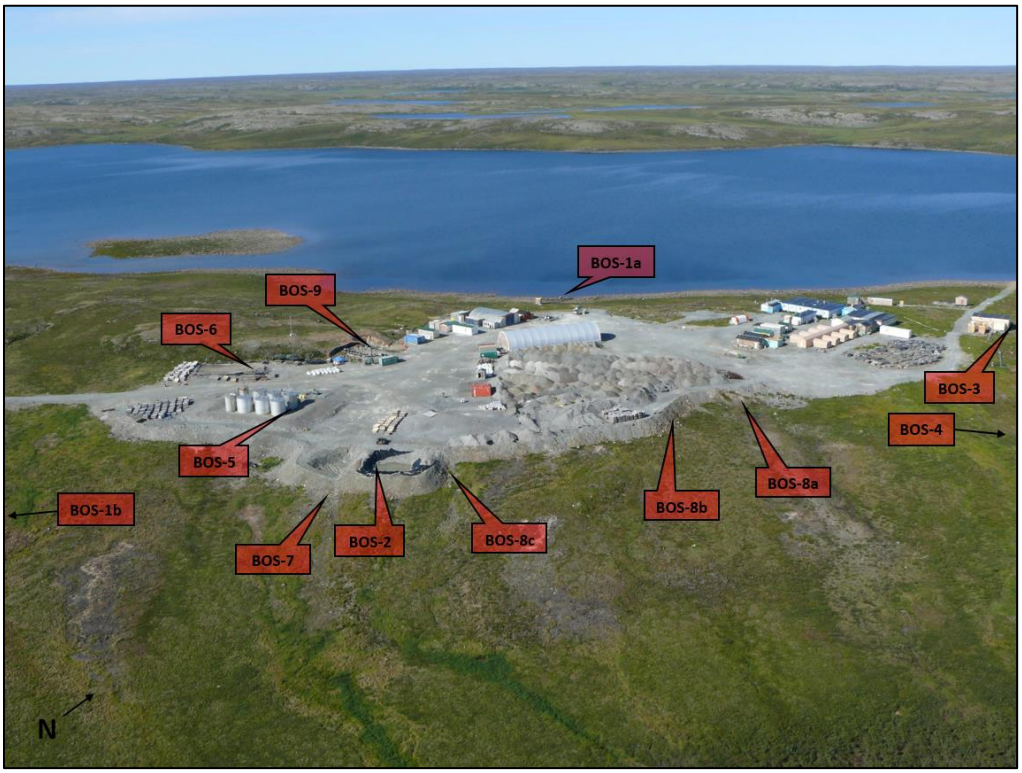
TMAC, 2016. Hope Bay Project Incinerator Management Plan. TMAC Resources Inc. April.

TMAC, 2017. Hope Bay Project Spill Contingency Plan. TMAC Resources Inc. January.

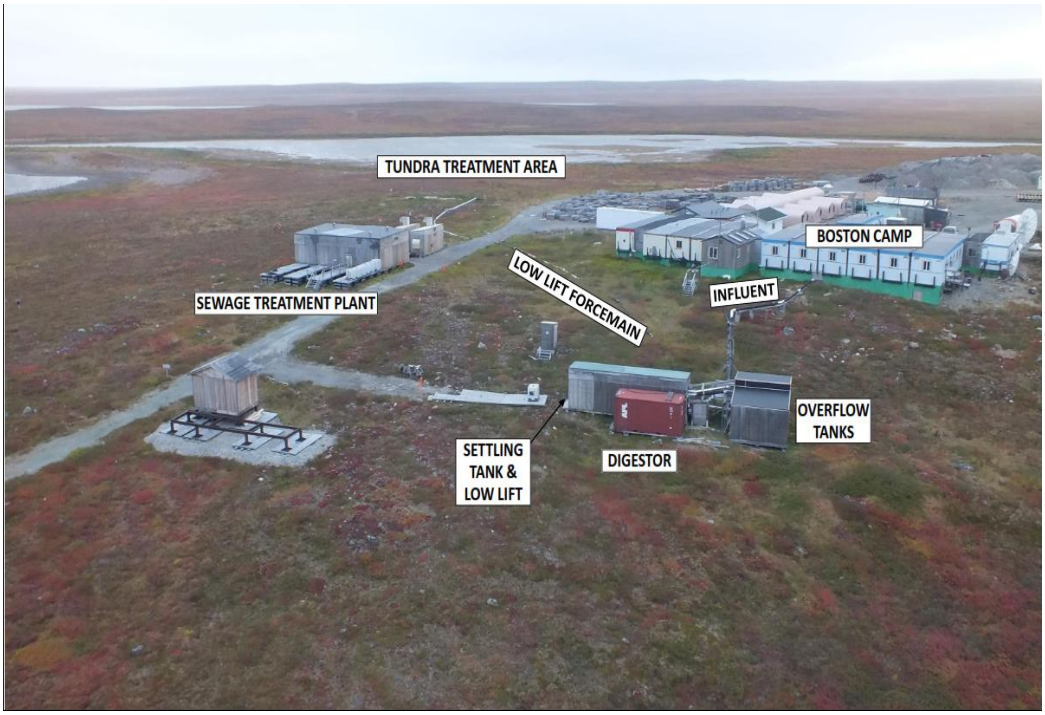
APPENDIX A: PHOTOGRAPHS AND FIGURES

Photograph 1: Flow Path Arial Photograph

Photograph 2: Start of Tundra Treatment Area



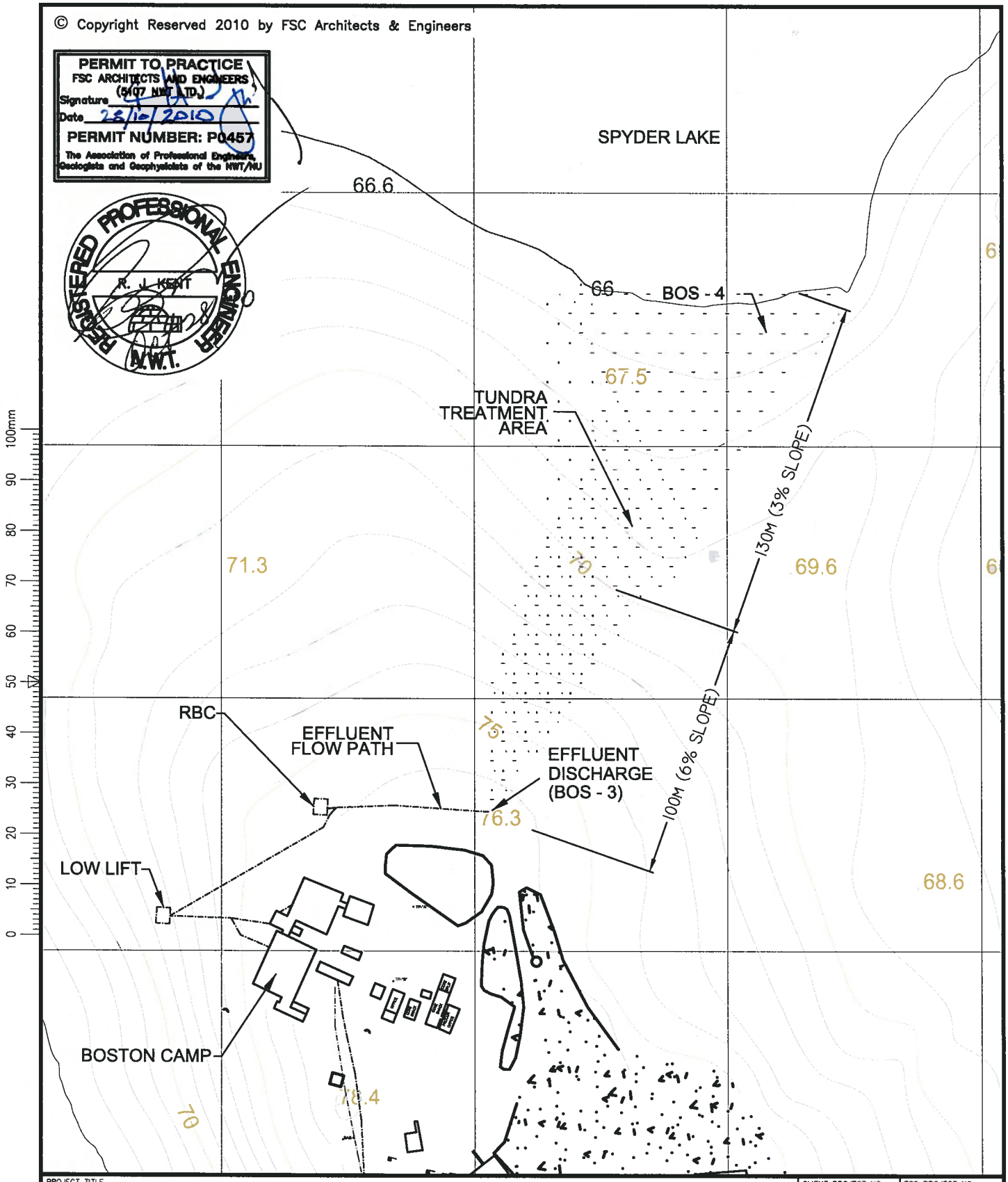
Photograph 3: Sampling Station as defined by Part J, Item 1 of Licence No. 2BB-BOS1727



Photograph 4: Boston Site and Sewage Treatment Plant Location

PERMIT TO PRACTICE
FSC ARCHITECTS AND ENGINEERS (5107 NWT LTD.)
Signature
Date 28/10/2010
PERMIT NUMBER: P0457
The Association of Professional Engineers, Geologists and Geophysicists of the NWT/NU

REGISTERED PROFESSIONAL ENGINEER R. J. KENT N.W.T.



PROJECT TITLE
BOSTON CAMP STP

CLIENT PROJECT NO.: -
FSC PROJECT NO.: 2010-0410

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DRAWN BY: AF
CHECKED BY: RK
DRAWING TITLE: TUNDRA TREATMENT AREA
SCALE: 1:2000
DATE: 2010/10/21
DRAWING NO.: AD 01 OF 1

FSC – ANSI-A – 8.5x11

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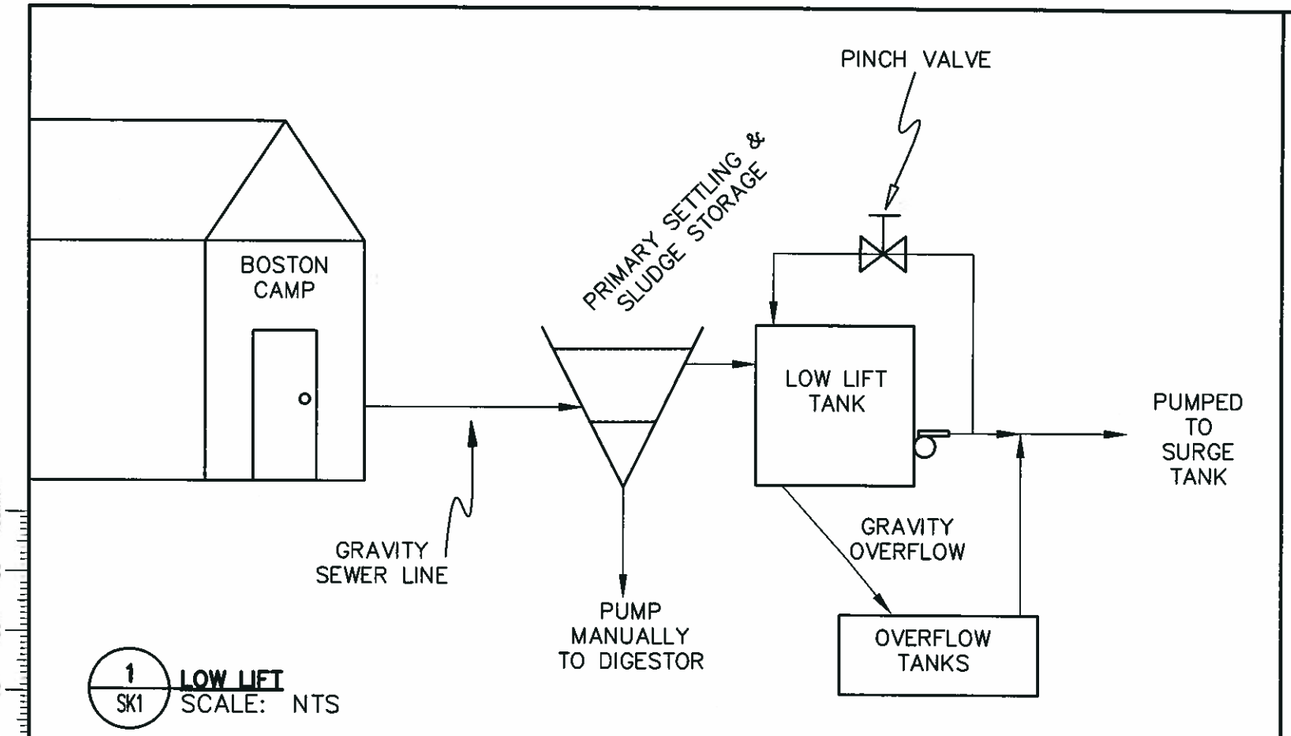
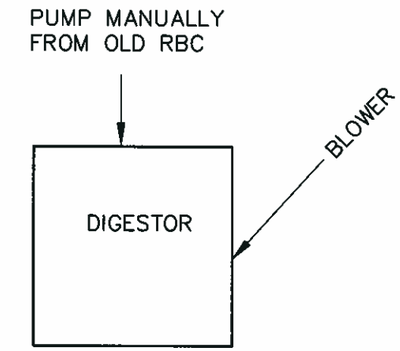


1 SK1 **LOW LIFT**
SCALE: NTS



2 SK1 **DIGESTOR**
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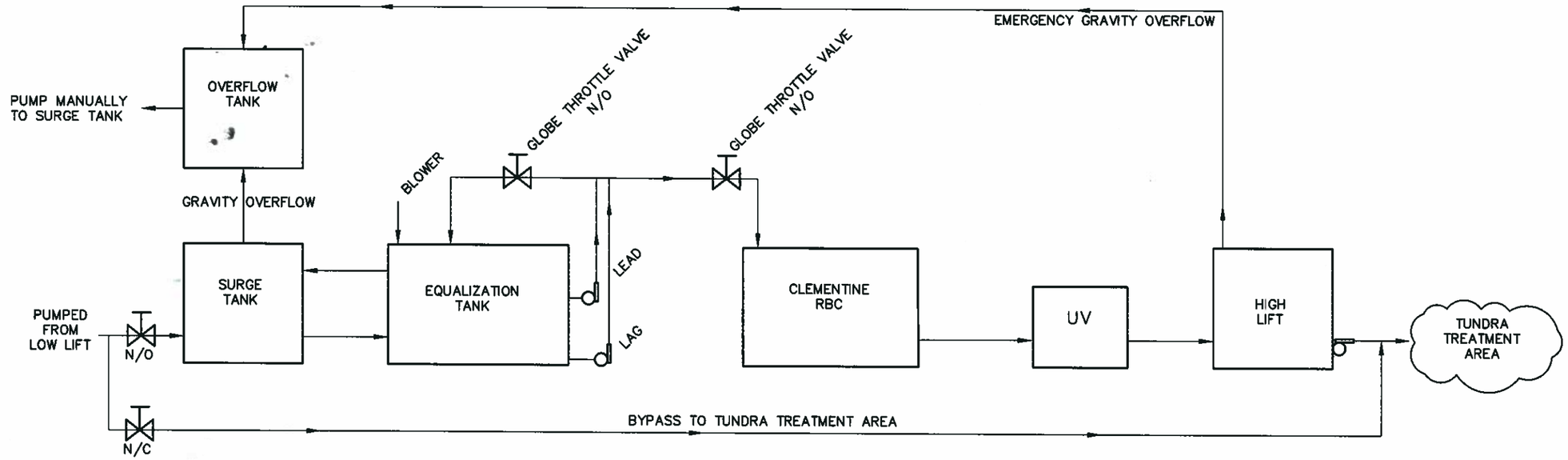


3 SK1 **CLEMENTINE STP PAD**
SCALE: NTS

REGISTERED PROFESSIONAL ENGINEER S. K. KENT N.W.T.

NO.	REVISION DESCRIPTION	DATE ISSUED
00		2010/07/20

PROFESSIONAL SEAL / PERMIT TO PRACTICE

PERMIT TO PRACTICE
FSC ARCHITECTS AND ENGINEERS (5107 NWT LTD.)
Signature
Date 23 Jul 2010
PERMIT NUMBER: P0457
The Association of Professional Engineers, Geologists and Geophysicists of the NWT/NU

FSC ARCHITECTS & ENGINEERS
4910 - 53rd Street, P.O. Box 1777
Yellowknife, NT, X1A 2P4, Canada
T 867.920.2882 | F 867.920.4319

PROJECT TITLE
BOSTON CAMP STP

LOCATION
HOPE BAY, NU

DRAWING TITLE
STP FLOW SHEET
AS-BUILT

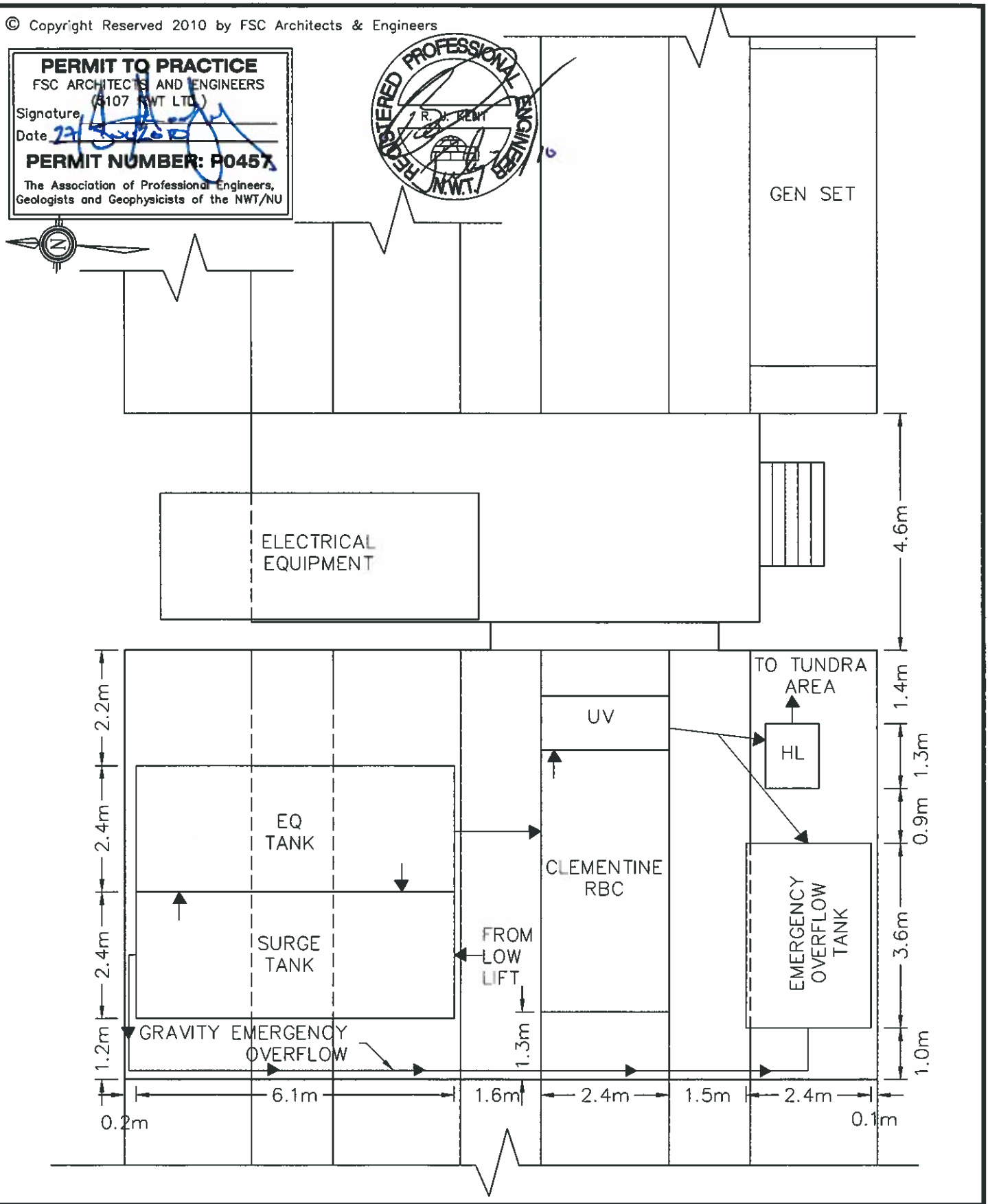
DRAWN BY	SCALE
AF	NTS
CHECKED BY	CLIENT PROJECT NO.
RK	-

FSC PROJECT NO.
2010-0410

DRAWING NO.
SK1

PERMIT TO PRACTICE
FSC ARCHITECTS AND ENGINEERS
(5107 NWT LTD.)
Signature
Date 27 July 2010
PERMIT NUMBER: P0457
The Association of Professional Engineers, Geologists and Geophysicists of the NWT/NU

REGISTERED PROFESSIONAL ENGINEER R. C. KENT N.W.T.



BOSTON CAMP STP

FSC ARCHITECTS & ENGINEERS
4910 - 53rd Street, P.O. Box 1777
Yellowknife, NT, X1A 2P4, Canada
T 867.920.2882 | F 867.920.4319

LOCATION: HOPE BAY, NU	CLIENT PROJECT NO.: -	FSC PROJECT NO.: 2010-0410
	DRAWN BY: AF	CHECKED BY: RK
DRAWING TITLE: FINAL STP LAYOUT AS-BUILT	SCALE: 1:100	DATE: 2010/07/19
	DRAWING NO.: SK2	OF 4

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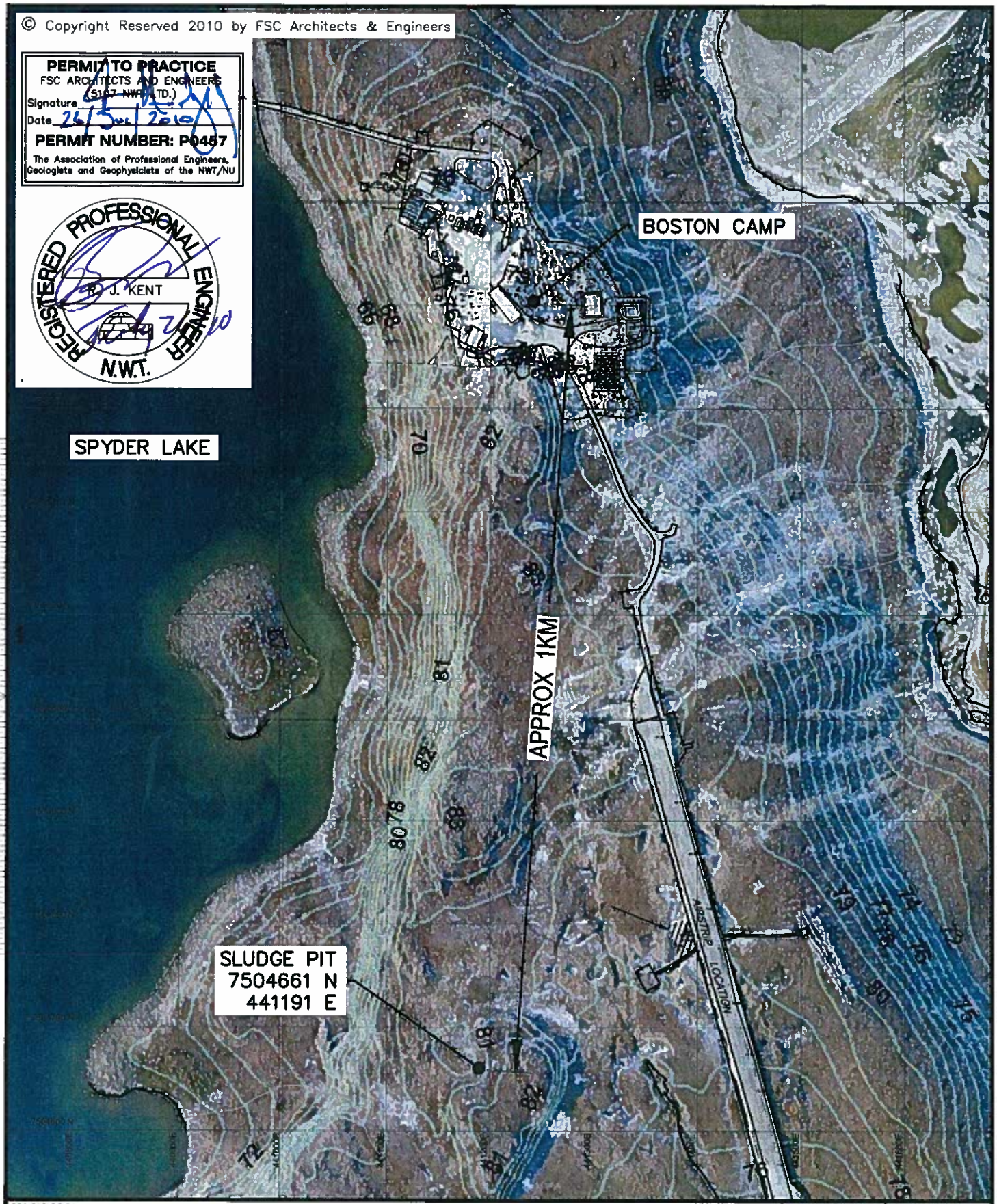
PERMIT TO PRACTICE
FSC ARCHITECTS AND ENGINEERS
(5107 NWT LTD.)
Signature
Date 26 July 2010
PERMIT NUMBER: P0457
The Association of Professional Engineers, Geologists and Geophysicists of the NWT/NU

REGISTERED PROFESSIONAL ENGINEER
R. J. KENT
N.W.T.



BOSTON CAMP STP

CLIENT PROJECT NO.	FSC PROJECT NO.
-	2010-0410
LOCATION	DRAWN BY / CHECKED BY
HOPE BAY, NU	AF / RK
DRAWING TITLE	SCALE / DATE
SLUDGE PIT LOCATION AS-BUILT	1: 5000 / 2010/07/20
	DRAWING NO.
	SK4

FSC ARCHITECTS & ENGINEERS
4910 - 53rd Street, P.O. Box 1777
Yellowknife, NT, X1A 2P4, Canada
T 867.920.2882 | F 867.920.4319

APPENDIX B: MYERS PUMPS

Myers®

MWH50 - MW200 SERIES
ME33 - ME150 SERIES
Submersible Sump, Effluent & Sewage Pumps

Installation and Service Manual

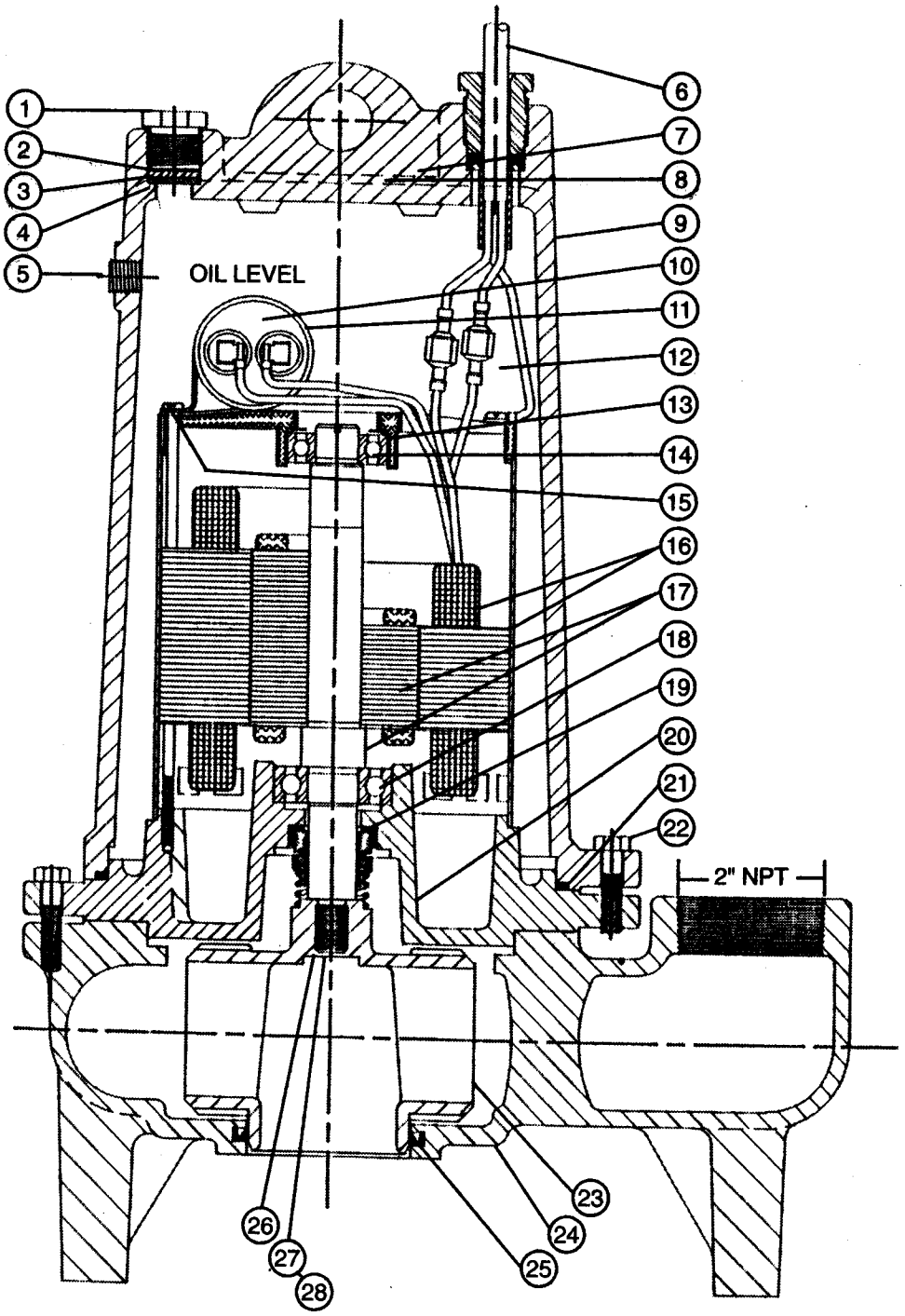
Single and double seal. Single and three phase power.

SINGLE SEAL PUMP
ME33S, ME50S, ME75S
ME100S, ME150S,
MWH50, MW100,
MW150, MW200

DOUBLE SEAL PUMP
ME33D, ME50D, ME75D
ME100D, ME150D,
MWH50D, MW100D,
MW150D, MW200D

23833A278

TYPICAL SECTION DRAWING FOR ME/MW33-200 SINGLE SEAL PUMPS



SINGLE SEAL REPAIR PARTS LIST

Ref. No.	Description	No. Req'd.	Part Numbers
1	Nut, cord plug, solid	1	25341A002
2	Washer, 1/32" Thk.	1	05030A234
3	Gasket, rubber	1	05014A193
4	Washer, 3/32" Thk.	1	05030A235
5	Plug, 1/4" pipe	1	05022A009
6	Cord, power	1	See Chart
7	Screw, drive	2	05160A004
8	Nameplate, blank, 1 Ph	1	25488A000
8	Nameplate, blank, 3 Ph	1	25499A000
9	Housing, motor (ME33-150/MWH50-200)	1	25327D000
10	Capacitor (1 Ph only)	1	See Chart
11	Clip, capacitor (1 Ph only)	1	See Chart
12	Oil, transformer (5 gal.) (ME33-50)	.8 gal.	11009A006
12	Oil, transformer (5 gal.) (ME/MWH50-200)	1 gal.	11009A006
12A	Connectors (3 Ph only)	3/6	15781A001
13	Washer, bearing	1	19331A005
13B	Ring, retaining (ME33-50)	2	12558A021
14	Bearing, ball, upper	1	08565A013
15	Screw, ST, #10 x 3/8	2	09822A032
16	Stator with shell	1	See Chart

Ref. No.	Description	No. Req'd.	Part Numbers
17	Rotor with shaft	1	See Chart
18	Bearing, ball, lower (ME33-50)	1	08565A013
18	Bearing, ball, lower (ME75-150/MWH50-200)	1	08565A022
19	Seal, shaft (ME33-50)	1	22447A020
19	Seal, shaft (ME/MWH50-200)	1	25370A000
20	Plate, brg. & seal (ME33-50)	1	25364D000
20	Plate, brg. & seal (ME/MWH50-200)	1	25367D000
21	Gasket, tetraseal, 7 x 6-3/4 x 1/8	1	05014A181
22	Screw, cap, 5/16 x 1-1/4	8	19100A012
23	Impeller, plastic (std. series)	1	See Chart
23	Impeller, BRASS ('B' series)	1	See Chart
24	Case, volute (ME33-50)	1	25357D000
24	Case, volute (ME75-150)	1	25331D000
24	Case, volute (MWH50-200)	1	26057D000
25	Cup, U, HUVA (ME33-150)	1	22835A005
25	Cup, U, HUVA (MWH50-200)	1	22835A009
27	Nut, Jam (ME50)	1	19109A070
28	Sealant (Grade 271 Loctite)	1	14550A001

SINGLE SEAL ME SERIES PUMPS CHART

Pump Catalog Numbers	Pump Engineer. Numbers	⑥ Cord, Power	⑩ Capacitor	⑪ Clip, Capacitor	⑯ Stator w/shell	⑰ Rotor w/shaft	㉓ Impeller, Plastic (standard)	㉓ Impeller, Brass ("B" series)
ME33S-11	25325D000	25338B004	23838A000	20333A004	25482C000	25486B004	25333B010	25333B110
ME33S-11B	25325D100							
ME33S-01	25325D001	25338B005	23839A000	20333A006	25482C001	25486B004	25333B010	25333B110
ME33S-01B	25325D101							
ME33S-21	25325D002	25338B005	23838A000	20333A004	25482C001	25486B004	25333B010	25333B110
ME33S-21B	25325D102							
ME33S-01 L/P	25325D033	25338B006	23839A000	20333A006	25482C001	25486B004	25333B010	25333B110
ME33S-01B L/P	25325D133							
ME33S-21 L/P	25325D034	25338B006	23838A000	20333A004	25482C001	25486B004	25333B010	25333B110
ME33S-21B L/P	25325D134							
ME33S-03	25325D003	25338B003	–	–	25482C002	25486B005	25333B010	25333B110
ME33S-03B	25325D103							
ME33S-23	25325D004	25338B003	–	–	25482C002	25486B005	25333B010	25333B110
ME33S-23B	25325D104							
ME33S-43	25325D005	25338B003	–	–	25482C002	25486B005	25333B010	25333B110
ME33S-43B	25325D105							
ME33S-53	25325D006	25338B003	–	–	25482C003	25486B005	25333B010	25333B110
ME33S-53B	25325D106							

SINGLE SEAL ME SERIES PUMPS CHART

Pump Catalog Numbers	Pump Engineer. Numbers	⑥ Cord, Power	⑩ Capacitor	⑪ Clip, Capacitor	⑯ Stator w/shell	⑰ Rotor w/shaft	㉓ Impeller, Plastic (standard)	㉓ Impeller, Brass ("B" series)
ME50S-11	25325D007	25338B004	23838A000	20333A004	25482C004	25486B006	25333B005	25333B100
ME50S-11B	25325D107							
ME50S-01	25325D008	25338B005	23839A000	20333A006	25482C008	25486B006	25333B005	25333B100
ME50S-01B	25325D108							
ME50S-21	25325D009	25338B005	23838A000	20333A004	25482C005	25486B006	25333B005	25333B100
ME50S-21B	25325D109							
ME50S-01 L/P	25325D035	25338B006	23839A000	20333A006	25482C008	25486B006	25333B005	25333B100
ME50S-01B L/P	25325D135							
ME50S-21 L/P	25325D036	25338B006	23838A000	20333A004	25482C005	25486B006	25333B005	25333B100
ME50S-21B L/P	25325D136							
ME50S-03	25325D010	25338B003	–	–	25482C006	25486B007	25333B005	25333B100
ME50S-03B	25325D110							
ME50S-23	25325D011	25338B003	–	–	25482C006	25486B007	25333B005	25333B100
ME50S-23B	25325D111							
ME50S-43	25325D012	25338B003	–	–	25482C006	25486B007	25333B005	25333B100
ME50S-43B	25325D112							
ME50S-53	25325D013	25338B003	–	–	25482C007	25486B007	25333B005	25333B100
ME50S-53B	25325D113							
ME75S-11	25325D014	25338B000	23839A000	20333A006	25484C002	25487B002	25348B020	25348B120
ME75S-11B	25325D114							
ME75S-01	25325D015	25338B001	23839A000	20333A006	25484C003	25487B002	25348B020	25348B120
ME75S-01B	25325D115							
ME75S-21	25325D016	25338B001	23838A000	20333A004	25484C003	25487B002	25348B020	25348B120
ME75S-21B	25325D116							
ME75S-01 L/P	25325D037	25338B002	23839A000	20333A006	25484C003	25487B002	25348B020	25348B120
ME75S-01B L/P	25325D137							
ME75S-21 L/P	25325D038	25338B002	23838A000	20333A004	25484C003	25487B002	25348B020	25348B120
ME75S-21B L/P	25325D138							
ME75S-03	25325D017	25338B003	–	–	25484C004	25487B003	25348B020	25348B120
ME75S-03B	25325D117							
ME75S-23	25325D018	25338B003	–	–	25484C004	25487B003	25348B020	25348B120
ME75S-23B	25325D118							
ME75S-43	25325D019	25338B003	–	–	25484C004	25487B003	25348B020	25348B120
ME75S-43B	25325D119							
ME75S-53	25325D020	25338B003	–	–	25484C005	25487B003	25348B020	25348B120
ME75S-53B	25325D120							
ME100S-01	25325D021	25338B001	23838A000	20333A004	25484C012	25487B004	25348B010	25348B110
ME100S-01B	25325D121							
ME100S-21	25325D022	25338B001	23838A000	20333A004	25484C006	25487B004	25348B010	25348B110
ME100S-21B	25325D122							
ME100S-01 L/P	25325D039	25338B002	23838A000	20333A004	25484C012	25487B004	25348B010	25348B110
ME100S-01B L/P	25325D139							
ME100S-21 L/P	25325D040	25338B002	23838A000	20333A004	25484C006	25487B004	25348B010	25348B110
ME100S-21B L/P	25325D140							
ME100S-03	25325D023	25338B003	–	–	25484C007	25487B005	25348B010	25348B110
ME100S-03B	25325D123							
ME100S-23	25325D024	25338B003	–	–	25484C007	25487B005	25348B010	25348B110
ME100S-23B	25325D124							
ME100S-43	25325D025	25338B003	–	–	25484C007	25487B005	25348B010	25348B110
ME100S-43B	25325D125							
ME100S-53	25325D026	25338B003	–	–	25484C008	25487B005	25348B010	25348B110
ME100S-53B	25325D126							
ME150S-01	25325D027	25338B001	23838A000	20333A004	25484C013	25487B004	25348B000	25348B100
ME150S-01B	25325D127							
ME150S-21	25325D028	25338B001	23838A000	20333A004	25484C009	25487B004	25348B000	25348B100
ME150S-21B	25325D128							
ME150S-01 L/P	25325D041	25338B002	23838A000	20333A004	25484C013	25487B004	25348B000	25348B100
ME150S-01B L/P	25325D141							
ME150S-21 L/P	25325D042	25338B002	23838A000	20333A004	25484C009	25487B004	25348B000	25348B100
ME150S-21B L/P	25325D142							
ME150S-03	25325D029	25338B003	–	–	25484C010	25487B006	25348B000	25348B100
ME150S-03B	25325D129							
ME150S-23	25325D030	25338B003	–	–	25484C010	25487B006	25348B000	25348B100
ME150S-23B	25325D130							
ME150S-43	25325D031	25338B003	–	–	25484C010	25487B006	25348B000	25348B100
ME150S-43B	25325D131							
ME150S-53	25325D032	25338B003	–	–	25484C011	25487B006	25348B000	25348B100
ME150S-53B	25325D132							

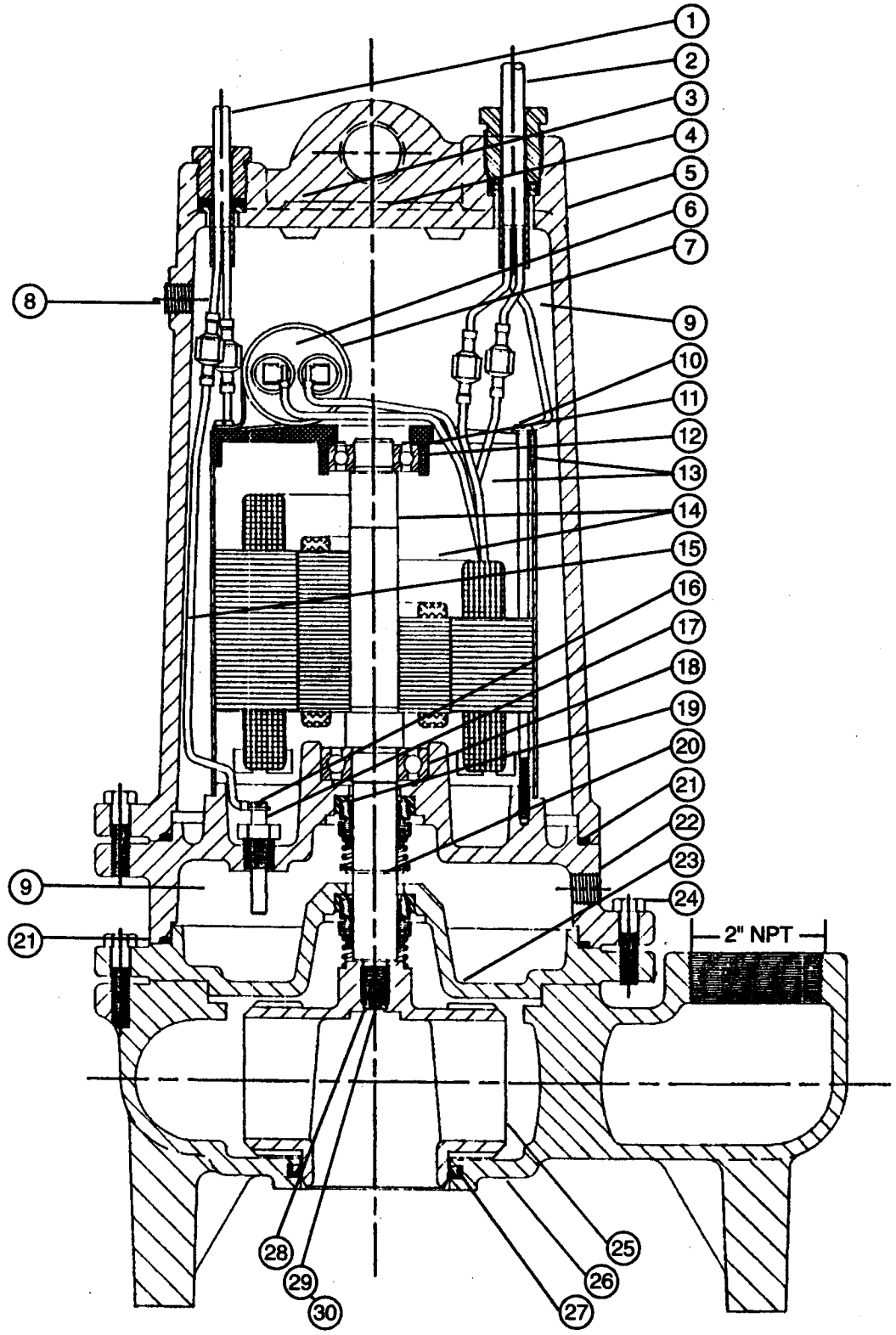
SINGLE SEAL MW SERIES PUMPS CHART

Pump Catalog Numbers	Pump Engineer. Numbers	② Cord, Power	⑥ Capacitor	⑦ Clip, Capacitor	⑬ Stator w/shell	⑭ Rotor w/shaft	㉕ Impeller (standard)**	㉕ Impeller, Brass**
MWH50-01 L/P	26089D039	25338B002	23839A000	20333A006	25484C003	25487B002 25487B012*	26029B003	26029B103
MWH50-01B L/P	26089D139							
MWH50-01P	26089D013	25338B001						
MWH50-01BP	26089D113							
MWH50-21 L/P	26089D040	25338B002	23838A000	20333A004	25484C003	25487B002 25487B012*	26029B003	26029B103
MWH50-21B L/P	26089D140							
MWH50-21P	26089D014	25338B001						
MWH50-21BP	26089D114							
MWH50-01	26089D015	25338B001	23839A000	20333A006	25484C003	25487B002 25487B012*	26029B003	26029B103
MWH50-01B	26089D115							
MWH50-21	26089D016	25338B001	23838A000	20333A004	25484C003	25487B002 25487B012*	26029B003	26029B103
MWH50-21B	26089D116							
MWH50-03	26089D017	25338B003	-	-	25484C004	25487B003 25487B013*	26029B003	26029B103
MWH50-03B	26089D117							
MWH50-23	26089D018	25338B003	-	-	25484C004	25487B003 25487B013*	26029B003	26029B103
MWH50-23B	26089D118							
MWH50-43	26089D019	25338B003	-	-	25484C004	25487B003 25487B013*	26029B003	26029B103
MWH50-43B	26089D119							
MWH50-53	26089D020	25338B003	-	-	25484C005	25487B003 25487B013*	26029B003	26029B103
MWH50-53B	26089D120							
MW100-01 L/P	26089D041	25338B002	23838A000	20333A004	25484C012	25487B004 25487B014*	26029B002	26029B102
MW100-01B L/P	26089D141							
MW100-21 L/P	26089D042	25338B002	23838A000	20333A004	25484C006	25487B004 25487B014*	26029B002	26029B102
MW100-21B L/P	26089D142							
MW100-03	26089D023	25338B003	-	-	25484C007	25487B005 25487B015*	26029B002	26029B102
MW100-03B	26089D123							
MW100-23	26089D024	25338B003	-	-	25484C007	25487B005 25487B015*	26029B002	26029B102
MW100-23B	26089D124							
MW100-43	26089D025	25338B003	-	-	25484C007	25487B005 25487B015*	26029B002	26029B102
MW100-43B	26089D125							
MW100-53	26089D026	25338B003	-	-	25484C008	25487B005 25487B015*	26029B002	26029B102
MW100-53B	26089D126							
MW100-01	26089D021	25338B001	23838A000	20333A004	25484C012	25487B004 25487B014*	26029B002	26029B102
MW100-01B	26089D121							
MW100-21	26089D022	25338B001	23838A000	20333A004	25484C006	25487B004 25487B014*	26029B002	26029B102
MW100-21B	26089D122							
MW150-01 L/P	26089D043	25338B002	23838A000	20333A004	25484C014	25487B004 25487B014*	26029B001	26029B101
MW150-01B L/P	26089D143							
MW150-21 L/P	26089D044	25338B002	23838A000	20333A004	25484C015	25487B004 25487B014*	26029B001	26029B101
MW150-21B L/P	26089D144							
MW150-03	26089D029	25338B003	-	-	25484C016	25487B006 25487B016*	26029B001	26029B101
MW150-03B	26089D129							
MW150-23	26089D030	25338B003	-	-	25484C016	25487B006 25487B016*	26029B001	26029B101
MW150-23B	26089D130							
MW150-43	26089D031	25338B003	-	-	25484C016	25487B006 25487B016*	26029B001	26029B101
MW150-43B	26089D131							
MW150-53	26089D032	25338B003	-	-	25484C017	25487B006 25487B016*	26029B001	26029B101
MW150-53B	26089D132							
MW150-01	26089D027	25338B001	23838A000	20333A004	25484C014	25487B004 25487B014*	26029B001	26029B101
MW150-01B	26089D127							
MW150-21	26089D028	25338B001	23838A000	20333A004	25484C015	25487B004 25487B014*	26029B001	26029B101
MW150-21B	26089D128							
MW200-01 L/P	26089D045	25338B002	23839A000	20333A006	25484C014	25487B004 25487B014*	26029B000	26029B100
MW200-01B L/P	26089D145							
MW200-21 L/P	26089D046	25338B002	23839A000	20333A006	25484C015	25487B004 25487B014*	26029B000	26029B100
MW200-21B L/P	26089D146							
MW200-03	26089D035	25338B003	-	-	25484C016	25487B006 25487B016*	26029B000	26029B100
MW200-03B	26089D135							
MW200-23	26089D036	25338B003	-	-	25484C016	25487B006 25487B016*	26029B000	26029B100
MW200-23B	26089D136							
MW200-43	26089D037	25338B003	-	-	25484C016	25487B006 25487B016*	26029B000	26029B100
MW200-43B	26089D137							
MW200-53	26089D038	25338B003	-	-	25484C017	25487B006 25487B016*	26029B000	26029B100
MW200-53B	26089D138							
MW200-01	26089D033	25338B001	23839A000	20333A006	25484C014	25487B004 25487B014*	26029B000	26029B100
MW200-01B	26089D133							
MW200-21	26089D034	25338B001	23839A000	20333A006	25484C015	25487B004 25487B014*	26029B000	26029B100
MW200-21B	26089D134							

* If unit manufacture date is after May 1996, order indicated rotor/shaft assembly designated with asterik (*).

** If impeller is required for unit built prior to May 1996, a replacement rotor/shaft assembly must be ordered as well. Order rotor/shaft assembly designated with asterik (*).

TYPICAL SECTION DRAWING FOR ME/MW33-200 DOUBLE SEAL PUMPS



DOUBLE SEAL REPAIR PARTS LIST

Ref. No.	Description	No. Req'd.	Part Numbers
1	Cord, sensor	1	25339B000
2	Cord, power	1	See Chart
3	Screw, drive	2	05160A004
4	Nameplate, blank, 1 Ph	1	25488A000
4	Nameplate, blank, 3 Ph	1	25499A000
5	Housing, motor (ME33-150/MWH50-200)	1	25327D000
6	Capacitor (1 Ph only)	1	See Chart
7	Clip, capacitor (1 Ph only)	1	See Chart
8	Plug, 1/4" pipe	2	05022A056
9	Oil, transformer (5 gal.) (ME33-50)	1 gal.	11009A006
9	Oil, transformer (5 gal.) (ME/MWH50-200)	1.12 gal.	11009A006
9A	Connectors (3 Ph only)	3/6	15781A001
10	Screw, ST, #10 x 3/8	2	09822A032
11	Washer, bearing	1	19331A005
12	Bearing, ball, upper	1	08565A013
13	Stator with shell	1	See Chart
14	Rotor with shaft	1	See Chart
15	Wire, electrode	2	21792A004
16	Screw, #6 x 1/4	2	05434A025
17	Probe, seal leak	2	25343A000

Ref. No.	Description	No. Req'd.	Part Numbers
18	Bearing, ball, lower (ME33-50)	1	08565A013
18	Bearing, ball, lower (ME/MWH50-200)	1	08565A022
19	Seal, shaft (ME33-50)	2	22447A020
19	Seal, shaft (ME/MWH50-200)	2	25370A000
20	Ring, retaining (ME33-50)	2	12558A021
20	Ring, retaining (ME/MWH50-200)	1	12558A033
21	Gasket, tetraseal, 7 x 6-3/4 x 1/8	2	05014A181
22	Housing, seal (ME33-50)	1	25365D000
22	Housing, seal (ME75-150/MWH50-200)	1	25369D000
23	Plate, bottom (ME33-50)	1	25366D000
23	Plate, bottom (ME75-150/MWH50-200)	1	25368D000
24	Screw, cap, 5/16 x 1-1/4	12	19100A012
25	Impeller, (std. series)	1	See Chart
25	Impeller, brass ('B' series)	1	See Chart
26	Case, volute (ME33-50)	1	25357D000
26	Case, volute (ME75-150)	1	25331D000
26	Case, volute (MWH50-200)	1	26057D000
27	Cup, U, HUVA (ME33-150)	1	22835A005
27	Cup, U, HUVA (MWH50-200)	1	22835A009
29	Nut, Jam (ME50)	1	19109A070
30	Sealant (Grade 271 Loctite)	1	14550A001

DOUBLE SEAL ME SERIES PUMPS CHART

Pump Catalog Numbers	Pump Engineer. Numbers	② Cord, Power	⑥ Capacitor	⑦ Clip, Capacitor	⑬ Stator w/shell	⑭ Rotor w/shaft	㉕ Impeller, Plastic (standard)	㉕ Impeller, Brass ("B" series)
ME33D-11	25326D000	25338B006	23838A000	20333A004	25482C000	25486B000	25333B010	25333B110
ME33D-11B	25326D100							
ME33D-01	25326D001	25338B006	23839A000	20333A006	25482C001	25486B000	25333B010	25333B110
ME33D-01B	25326D101							
ME33D-21	25326D002	25338B006	23838A000	20333A004	25482C001	25486B000	25333B010	25333B110
ME33D-21B	25326D102							
ME33D-03	25326D003	25338B003	–	–	25482C002	25486B001	25333B010	25333B110
ME33D-03B	25326D103							
ME33D-23	25326D004	25338B003	–	–	25482C002	25486B001	25333B010	25333B110
ME33D-23B	25326D104							
ME33D-43	25326D005	25338B003	–	–	25482C002	25486B001	25333B010	25333B110
ME33D-43B	25326D105							
ME33D-53	25326D006	25338B003	–	–	25482C003	25486B001	25333B010	25333B110
ME33D-53B	25326D106							
ME50D-11	25326D007	25338B006	23838A000	20333A004	25482C004	25486B002	25333B005	25333B100
ME50D-11B	25326D107							
ME50D-01	25326D008	25338B006	23839A000	20333A006	25482C008	25486B002	25333B005	25333B100
ME50D-01B	25326D108							
ME50D-21	25326D009	25338B006	23838A000	20333A004	25482C005	25486B002	25333B005	25333B100
ME50D-21B	25326D109							
ME50D-03	25326D010	25338B003	–	–	25482C006	25486B003	25333B005	25333B100
ME50D-03B	25326D110							
ME50D-23	25326D011	25338B003	–	–	25482C006	25486B003	25333B005	25333B100
ME50D-23B	25326D111							
ME50D-43	25326D012	25338B003	–	–	25482C006	25486B003	25333B005	25333B100
ME50D-43B	25326D112							
ME50D-53	25326D013	25338B003	–	–	25482C007	25486B003	25333B005	25333B100
ME50D-53B	25326D113							
ME75D-11	25326D014	25338B002	23839A000	20333A006	25484C002	25487B007	25348B020	25348B120
ME75D-11B	25326D114							
ME75D-01	25326D015	25338B002	23839A000	20333A006	25484C003	25487B007	25348B020	25348B120
ME75D-01B	25326D115							
ME75D-21	25326D016	25338B002	23838A000	20333A004	25484C003	25487B007	25348B020	25348B120
ME75D-21B	25326D116							
ME75D-03	25326D017	25338B003	–	–	25484C004	25487B008	25348B020	25348B120
ME75D-03B	25326D117							
ME75D-23	25326D018	25338B003	–	–	25484C004	25487B008	25348B020	25348B120
ME75D-23B	25326D118							
ME75D-43	25326D019	25338B003	–	–	25484C004	25487B008	25348B020	25348B120
ME75D-43B	25326D119							
ME75D-53	25326D020	25338B003	–	–	25484C005	25487B008	25348B020	25348B120
ME75D-53B	25326D120							
ME100D-01	25326D021	25338B002	23838A000	20333A004	25484C012	25487B009	25348B010	25348B110
ME100D-01B	25326D121							
ME100D-21	25326D022	25338B002	23838A000	20333A004	25484C006	25487B009	25348B010	25348B110
ME100D-21B	25326D122							
ME100D-03	25326D023	25338B003	–	–	25484C007	25487B010	25348B010	25348B110
ME100D-03B	25326D123							
ME100D-23	25326D024	25338B003	–	–	25484C007	25487B010	25348B010	25348B110
ME100D-23B	25326D124							
ME100D-43	25326D025	25338B003	–	–	25484C007	25487B010	25348B010	25348B110
ME100D-43B	25326D125							
ME100D-53	25326D026	25338B003	–	–	25484C008	25487B010	25348B010	25348B110
ME100D-53B	25326D126							
ME150D-01	25326D027	25338B002	23838A000	20333A004	25484C013	25487B009	25348B000	25348B100
ME150D-01B	25326D127							
ME150D-21	25326D028	25338B002	23838A000	20333A004	25484C009	25487B009	25348B000	25348B100
ME150D-21B	25326D128							
ME150D-03	25326D029	25338B003	–	–	25484C010	25487B011	25348B000	25348B100
ME150D-03B	25326D129							
ME150D-23	25326D030	25338B003	–	–	25484C010	25487B011	25348B000	25348B100
ME150D-23B	25326D130							
ME150D-43	25326D031	25338B003	–	–	25484C010	25487B011	25348B000	25348B100
ME150D-43B	25326D131							
ME150D-53	25326D032	25338B003	–	–	25484C011	25487B011	25348B000	25348B100
ME150D-53B	25326D132							

DOUBLE SEAL MW SERIES PUMPS CHART

Pump Catalog Numbers	Pump Engineer. Numbers	② Cord, Power	⑥ Capacitor	⑦ Clip, Capacitor	⑬ Stator w/shell	⑭ Rotor w/shaft	㉕ Impeller (standard)**	㉕ Impeller, Brass**
MWH50D-01	26090D015	25338B002	23839A000	20333A006	25484C003	25487B007 25487B017*	26029B003	26029B103
MWH50D-01B	26090D115							
MWH50D-01P	26090D013							
MWH50D-01BP	26090D113							
MWH50D-21	26090D016	25338B002	23838A000	20333A004	25484C003	25487B007 25487B017*	26029B003	26029B103
MWH50D-21B	26090D116							
MWH50D-21P	26090D014							
MWH50D-21BP	26090D114							
MWH50D-03	26090D017	25338B003	-	-	25484C004	25487B008 25487B018*	26029B003	26029B103
MWH50D-03B	26090D117							
MWH50D-23	26090D018	25338B003	-	-	25484C004	25487B008 25487B018*	26029B003	26029B103
MWH50D-23B	26090D118							
MWH50D-43	26090D019	25338B003	-	-	25484C004	25487B008 25487B018*	26029B003	26029B103
MWH50D-43B	26090D119							
MWH50D-53	26090D020	25338B003	-	-	25484C005	25487B008 25487B018*	26029B003	26029B103
MWH50D-53B	26090D120							
MW100D-01	26090D021	25338B002	23838A000	20333A004	25484C012	25487B009 25487B019*	26029B002	26029B102
MW100D-01B	26090D121							
MW100D-21	26090D022	25338B002	23838A000	20333A004	25484C006	25487B009 25487B019*	26029B002	26029B102
MW100D-21B	26090D122							
MW100D-03	26090D023	25338B003	-	-	25484C007	25487B010 25487B020*	26029B002	26029B102
MW100D-03B	26090D123							
MW100D-23	26090D024	25338B003	-	-	25484C007	25487B010 25487B020*	26029B002	26029B102
MW100D-23B	26090D124							
MW100D-43	26090D025	25338B003	-	-	25484C007	25487B010 25487B020*	26029B002	26029B102
MW100D-43B	26090D125							
MW100D-53	26090D026	25338B003	-	-	25484C008	25487B010 25487B020*	26029B002	26029B102
MW100D-53B	26090D126							
MW150D-01	26090D027	25338B002	23838A000	20333A004	25484C014	25487B009 25487B019*	26029B001	26029B101
MW150D-01B	26090D127							
MW150D-21	26090D028	25338B002	23838A000	20333A004	25484C015	25487B009 25487B019*	26029B001	26029B101
MW150D-21B	26090D128							
MW150D-03	26090D029	25338B003	-	-	25484C016	25487B011 25487B021*	26029B001	26029B101
MW150D-03B	26090D129							
MW150D-23	26090D030	25338B003	-	-	25484C016	25487B011 25487B021*	26029B001	26029B101
MW150D-23B	26090D130							
MW150D-43	26090D031	25338B003	-	-	25484C016	25487B011 25487B021*	26029B001	26029B101
MW150D-43B	26090D131							
MW150D-53	26090D032	25338B003	-	-	25484C017	25487B011 25487B021*	26029B001	26029B101
MW150D-53B	26090D132							
MW200D-01	26090D033	25338B002	23839A000	20333A006	25484C014	25487B009 25487B019*	26029B000	26029B100
MW200D-01B	26090D133							
MW200D-21	26090D034	25338B002	23839A000	20333A006	25484C015	25487B009 25487B019*	26029B000	26029B100
MW200D-21B	26090D134							
MW200D-03	26090D035	25338B003	-	-	25484C016	25487B011 25487B021*	26029B000	26029B100
MW200D-03B	26090D135							
MW200D-23	26090D036	25338B003	-	-	25484C016	25487B011 25487B021*	26029B000	26029B100
MW200D-23B	26090D136							
MW200D-43	26090D037	25338B003	-	-	25484C016	25487B011 25487B021*	26029B000	26029B100
MW200D-43B	26090D137							
MW200D-53	26090D038	25338B003	-	-	25484C017	25487B011 25487B021*	26029B000	26029B100
MW200D-53B	26090D138							

* If unit manufacture date is after May 1996, order indicated rotor/shaft assembly.

** If impeller is required for unit built prior to May 1996, a replacement rotor/shaft assembly must be ordered as well. Order rotor/shaft assembly designated with asterik (*).

GENERAL DESCRIPTION AND APPLICATION

Myers ME and MW series pumps are available in both a single seal design and double seal design with leak detector. The ME33-150 models are designed for Effluent dosing, Septic Tank Effluent Pumping (S.T.E.P.) or normal sump and general dewatering applications where higher pressure is required. These units are designed to handle 3/4" spherical solids. The MWH50-MW200 models are designed for raw sewage applications and can pass 2" spherical solids. These units can also be used for sump and general dewatering applications where larger solids capabilities are required.

When used in Effluent dosing or S.T.E.P. applications, the pump must be installed in a separate tank or compartment at the discharge side of the septic tank. NEVER INSTALL PUMP IN MAIN TANK WHERE SLUDGE COLLECTS.

These pumps are available in single phase and three phase, and either in single seal or double seal with seal leak detector. All three phase units, all double seal units and all duplex installations must be used with a control box. All power cords and seal leak detector cords are 20 feet long.

The ME model impellers are enclosed two vane type to handle 3/4" spherical solids and are available made of engineered thermoplastic or cast brass. All pumps have a 2" NPT discharge tapping.

The MW model impellers are enclosed two vane non-clog style, designed to handle 2" spherical solids. The MW pumps are available with standard cast iron or optional cast brass impellers.

These pumps are NOT for use in swimming pools or fountains.

AIR LOCKING

A sump pump is said to be air locked if water traps air in the pump and it cannot get out, thus preventing the pump from operating.

In installation of this type a 1/8" hole should be drilled in the discharge pipe below the check valve. The check valve should be 12 to 18 inches above pump discharge. Do not put check valve directly into pump discharge opening.

PACKAGING

Each pump is packaged separately in a carton marked with a catalog number and Myers engineering number.

LEVEL CONTROLS

All pumps must use sealed level control switches for automatic operation. MLC and MFLC controls have sealed switches that are 1 HP rated at 230 volts. ALC and AWS-1 controls have sealed mechanical switches that are rated 2 HP at 230 volts.

Simplex single phase pumps can be made automatic by attaching MFLC or MLC controls to the pump. These switches have a fixed draw off level of 8 to 10 inches and can be used up to 1 HP. For higher horsepower ratings two mercury switches (or SMNO) controls with a magnetic starter can be used. Simplex systems may also use on/off pilot mercury control switches with control box and magnetic starter. The ALC and AWS-1 controls can be used for simplex single phase pumps with ratings up to 2 HP. All duplex systems must use pilot mercury control switches with control box and magnetic starters.

Plug-in cords can be used on all the single phase pumps with a single seal (does not have a seal leak detector). This cord has a GROUND pin that plugs into a grounded receptacle. The grounded receptacle cannot be used in the wet sump or basin due to DANGER of current leakage. Sealed junction boxes must be used in wet sumps or basins to make connections to motor cord. The AWS-1 control also acts as a sealed junction box for connecting power cord to pump cord.

DOUBLE SEAL PUMPS

All pumps in this series "ME--D" or "MW--D" have two seals with an oil chamber between the seals so that the seal faces of both the lower and upper seals are oil lubricated for longer life and greater protection against water leaking into the motor windings. These double seal units are all made with a seal leak detector.

The leak detector in the oil seal chamber detects any water leakage into the chamber and turns on a red signal light in the control panel. Pumps should be removed from the sump and seals replaced after the seal light shows in the panel. Control panels must be used for pumps having the seal leak detectors, and seal leak detectors **must** be wired as illustrated in these instructions.

DESIGN OF PRESSURE SEWER SYSTEMS

MYERS has available complete computer SOFTWARE for designing PRESSURE SEWER SYSTEMS. This gives pipe sizes to use and gives exact flow from any pump or group of pumps in the system when operating simultaneously.

This design DISK for IBM® or COMPATIBLE computers is available to engineers on request.

MOTOR TYPE

Motors are 3/4 frame, 1/3 – 2 HP single or three phase, 60 Hertz, 3450 R.P.M. with class B insulation. All single phase motors are permanent split-capacitor (PSC) type with built-in on-winding overload protection and do not require a start switch or start relay. The three phase pump motors require a magnetic starter with 3 leg overload protection. All motors have upper and lower ball bearings and all are oil-cooled and lubricated.

SAFETY WARNINGS

WARNING: Risk of electric shock. Pumps with a single seal are supplied with a grounding conductor and grounding-type attachment plug on the power cord. To reduce the risk of electric shock, be certain that it is connected only to a properly grounded, grounding-type receptacle. DO NOT cut off ground pin or use an adapter fitting. DO NOT use an extension cord with this pump. Entire plug may be cut off if a control panel is used. All double seal pumps, all duplex installations and all three phase pumps require a control box.

When wiring this pump follow all local electrical and safety codes and ordinances as well as the most recent National Electric Code (NEC-ANSI/NFPA 70).

All pumps have a GROUND WIRE that is connected to a screw in the metal motor housing. This wire goes to the receptacle or control box which must be connected to a good outside GROUND such as a metal water pipe or GROUND STAKE driven at least 8 feet into the ground.

UL AND CSA APPROVAL

All pumps have UL and CSA approval pending. Myers is a SSPMA certified pump member.

INSTALLATION

WARNING: Basin or tank must be vented in accordance with local plumbing codes. These pumps are not designed for and CANNOT be installed in locations classified as hazardous in accordance with the National Electric Code ANSI/NFPA 70.

CAUTION: Never enter pump chamber after sewage or effluent has been in basin. Sewage water can give off methane, hydrogen sulfide and other gasses which are highly poisonous.

For this reason, Myers recommends installing the ME series effluent pumps with a quick removal system. The quick removal system may be a union or Cam-lok coupling if the pipe or discharge hose is within reach from the surface, or a rail system type quick disconnect on deeper installations. See installation drawings for suggested installation.

The dosing tank or pumping chamber must be constructed of corrosion resistant materials and must be capable of withstanding all anticipated internal and external loads. It also must not allow infiltration or exfiltration. The tank must have provisions for anti-buoyancy. Access holes or covers must be of adequate size and be accessible from the surface to allow for installation and maintenance of the system. Access covers must be lockable or heavy enough to prevent easy access by unauthorized personnel. The pumping chamber holding capacity should be selected to allow for emergency conditions.

The discharge pipe must be the same size as the pump discharge (2 inches) or larger. In order to insure sufficient fluid velocity to prevent any residual solids from collecting in the discharge pipe, it is recommended that a minimum flow of 2 feet per second be maintained. (21 GPM through 2" pipe and 46 GPM through 3" pipe). It is recommended that PVC or equal pipe is used for corrosion resistance. A full flow (ball or gate) shut off valve must be installed to prevent back flow of effluent if the pump must be removed for service. A check valve must be installed on pressure sewer systems and on other systems where conditions allow to prevent backflow and to reduce wear on the pump system.

A high water alarm must be installed on a separate circuit from the pump circuit. The alarm should have the ability to be tested for proper operation.

SPECIAL INSTRUCTIONS FOR THREE PHASE PUMPS

(1) F. E. Myers recommends three phase pumps to be installed by qualified personnel. **CAUTION: Risk of electric shock. Do not remove cord and strain relief. Do not connect conduit to pump.**

(2) Three phase pumps are always installed with control boxes having magnetic starters with 3 leg overload protection. DO NOT TRY TO RUN THREE PHASE PUMPS DIRECTLY ACROSS THE LINE.

(3) **To Connect Pump**: Run wire from pump to the bottom of control box or appropriate junction box suitable for enclosing splice connections. A hole must be cut into the control box for the wires. With power to control box off, connect green (ground) line to ground lug. Connect black (power) wires to power lead terminals. Note: for a typical CE style control box, these terminals are marked M1, M2 and M3. Make sure that all wires are inside control box and not in a position to be pinched or shorted when the door is closed.

(4) All three phase motors can run either direction. ROTATION can be changed by interchanging any two line leads at magnetic starter. **BE SURE CIRCUIT BREAKER IS OFF BEFORE MAKING THIS CHANGE.** To find if rotation is correct operate pumps and check delivery operation. If flow and head is low (refer to pump curves shown in this manual) the rotation is wrong. With duplex pumps check operation of both pumps.

(5) All pump impellers either single or three phase must turn counterclockwise when looking into pump inlet. If uncertain of rotation, TURN OFF POWER and lift pump from basin with cord connected and lay pump on side so impeller can be seen. Turn on power and start pump using hand position of H-O-A switch. Turn on and off fast so that coast of impeller can be seen. **NEVER PUT HAND OR FINGERS ON THE IMPELLER.** Interchange any two line leads at the magnetic starter to change rotation.

POINTS TO CHECK IF PUMP DOES NOT RUN OR DOES NOT RUN PROPERLY

(1) Pump does not run or start when water is up in tank.
- (a) Check for blown fuse or tripped circuit breaker.
- (b) Check for defective level switch.
- (c) Where control panel is used be sure H-O-A switch is in the AUTO position. If it does not run, turn switch to the HAND position and if the pump runs then the trouble is in the automatic electrical system. Have an ELECTRICIAN make electrical checks.
- (d) Check for burned out motor. Occasionally lightning can damage a motor even with lightning protection.
- (e) Where plug-in cords are used be sure contact blades are clean and making good contact. DO NOT USE PLUG-IN CORDS INSIDE A SUMP OR WET WELL.
- (f) Level control ball or weight may be stuck on side of basin. Be sure it floats freely.

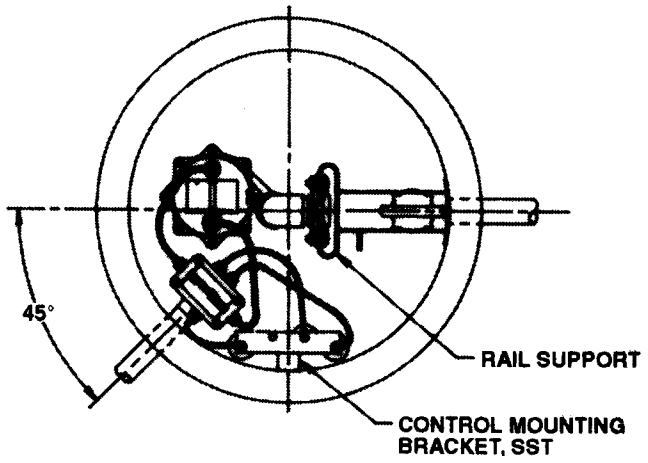
(2) Pump runs but does not deliver flow.
- (a) Check air lock. Start and stop pump several times, if this does not help it may be necessary to loosen a union in the discharge line to relieve air lock.
- (b) Check valve may be installed backwards. Check flow arrow on valve body. Check shut-off valve. It may be closed.
- (c) Check vertical elevation. It may be higher than pump can develop. (See pump curve).
- (d) Pump inlet may be plugged. Remove pump to check.

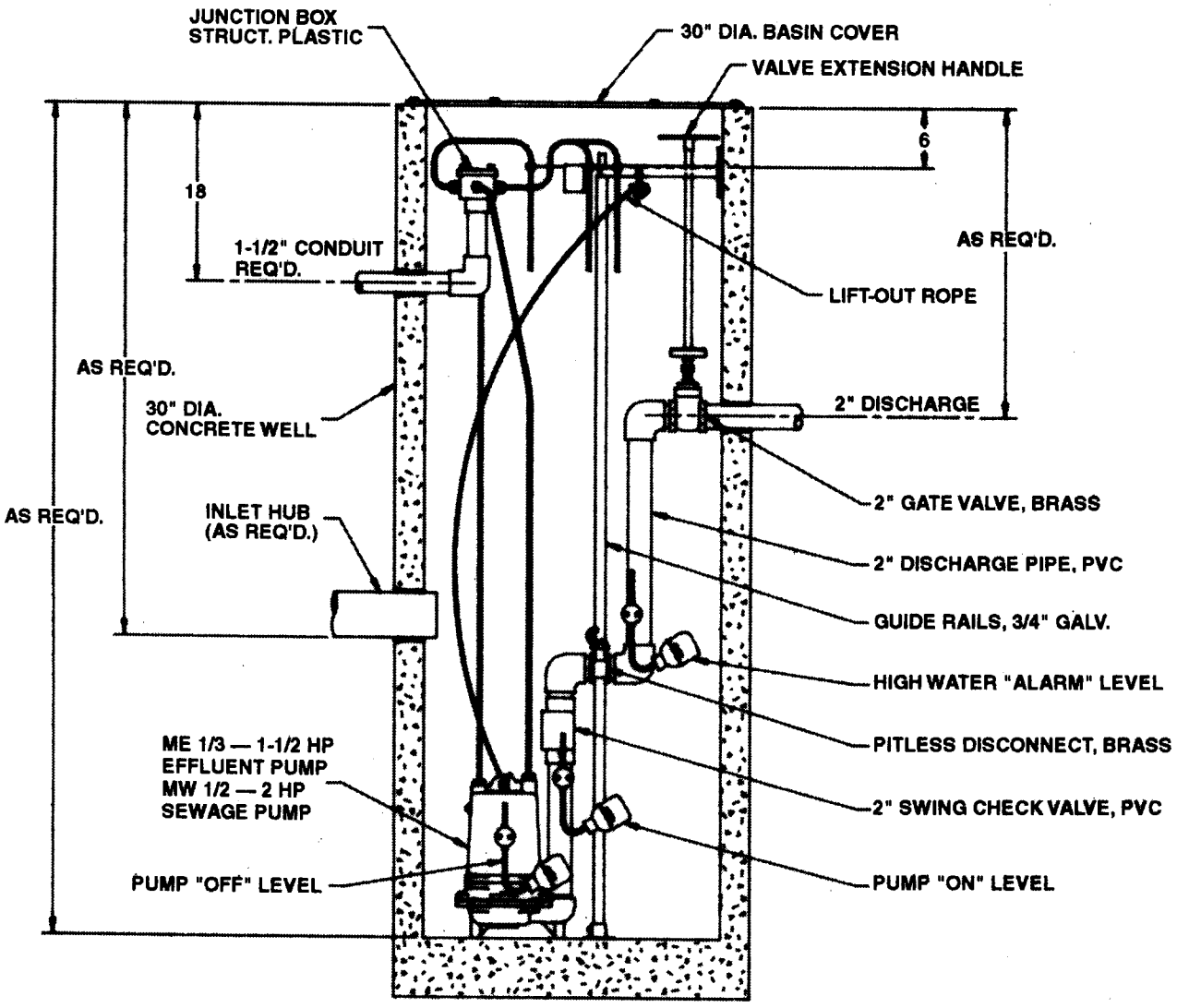
CAUTION: ALWAYS UNPLUG POWER CORDS OR TURN OFF ALL MAIN AND BRANCH CIRCUIT BREAKERS BEFORE DOING ANY WORK ON THE PUMP. If control panel is remote from pump, disconnect lead wires to motor so that no one can turn the circuit breaker back on. If motor is three phase mark the leads so they can be replaced in the same order.

BEFORE DISMANTLING PUMP FOR REPLACEMENT OF PARTS

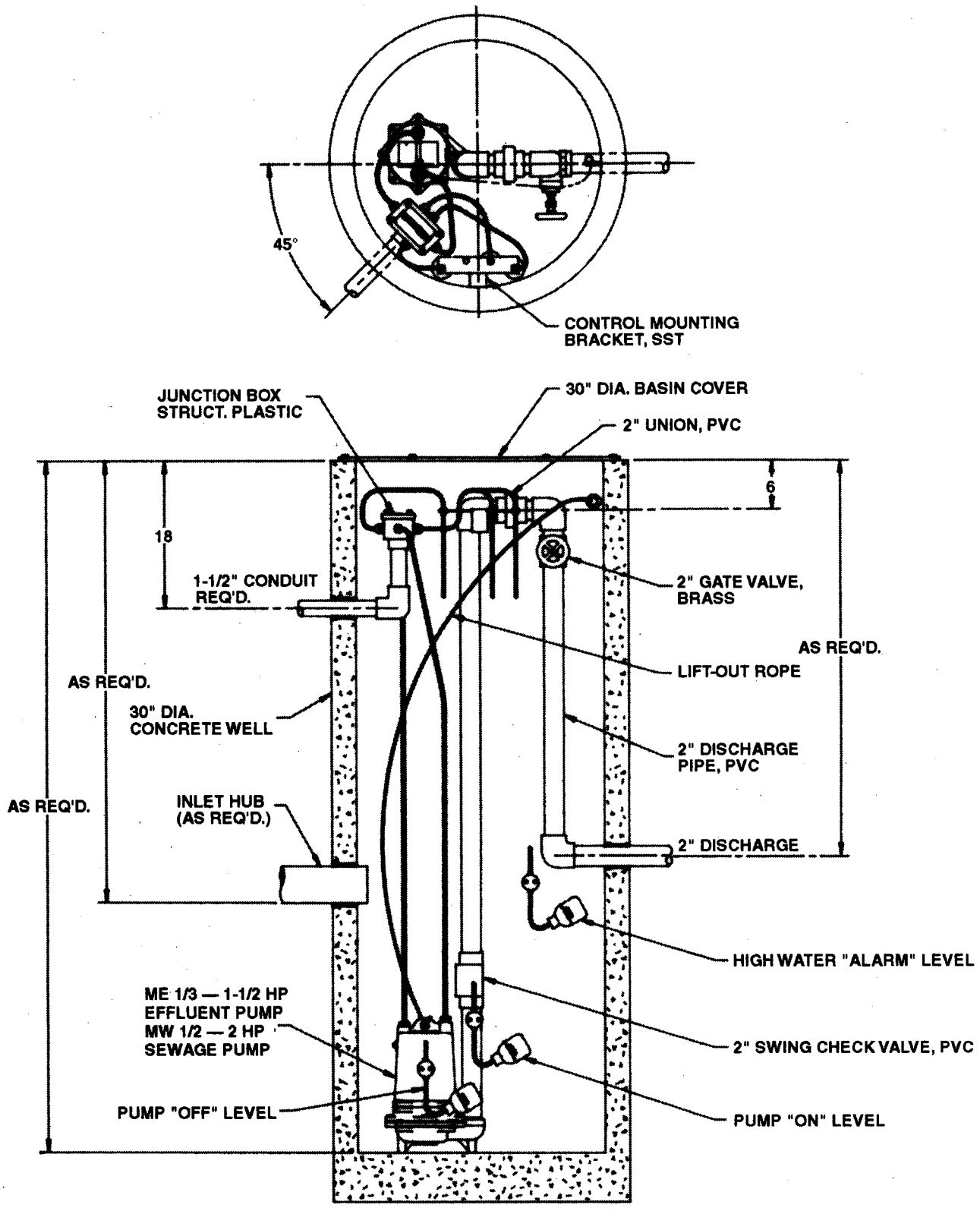
Clean pump thoroughly. Knock off all scale and deposits. Use sandblast if possible. Submerge complete unit in Clorox solution for one hour before taking apart.

30" DIAMETER SIMPLEX ME/MW 1/3 – 2 HP

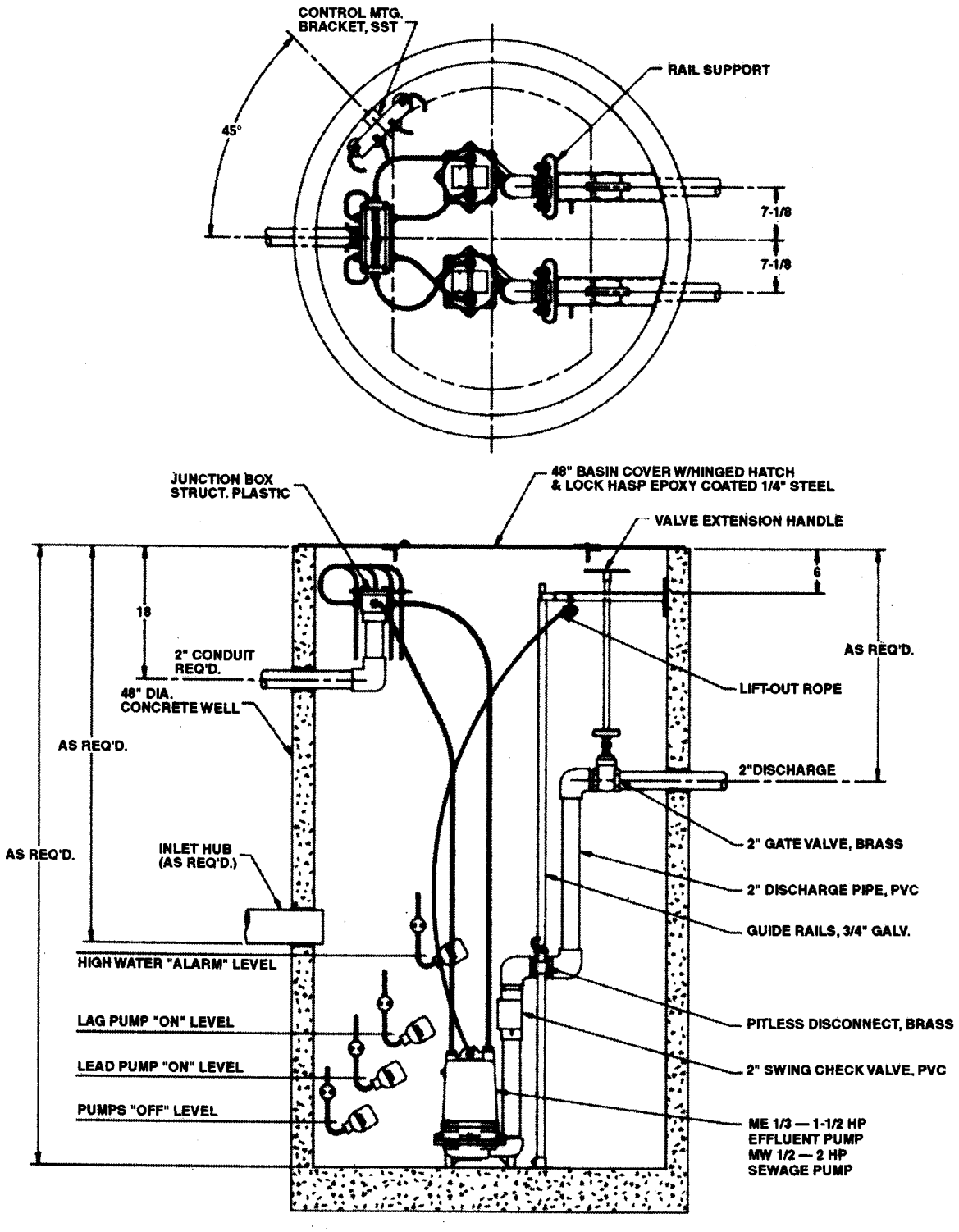




30" DIAMETER SIMPLEX UNION SYSTEM ME/MW 1/3 – 2 HP



48" DIAMETER DUPLEX ME/MW 1/3 – 2 HP



TO REPLACE CAPACITORS ONLY

All of the single phase motors are of the permanent split capacitor type and have no relays or starting switch. They have only a starting capacitor that is in the circuit for both starting and running conditions.

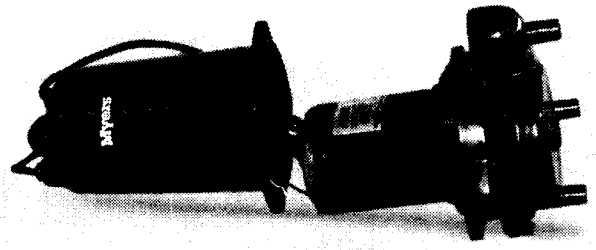
(1) Remove oil fill plug near the top of the motor and pour the oil out.

(2) Loosen the plug nuts around the cords until they are loose enough to push the cords down inside of the motor housing.

(3) Remove the four bolts from the motor housing and bump the housing with a plastic hammer to loosen. Lay the pump on its side.

(4) Remove the housing carefully to be sure that enough cord is pushed into the housing to create no tension on the cords.

(5) Slide motor housing up far enough to expose the capacitor and to be able to lay the housing down.



(6) Disconnect wiring from capacitor and loosen capacitor clamp and slide out capacitor. Replace with new capacitor, tighten and re-connect. Wiring diagram is given in these instructions.

(7) Check all wiring connectors to be sure they are secure.

(8) Be sure tetraseal gasket is in place.

(9) Slide motor housing back onto pump while pulling the cords out slowly. Assembly the motor housing with the four bolts.

(10) Re-assemble cord nuts. Be sure washers are seated and cords are pulled up to stop against the washers. Tighten nuts securely.

(11) Put pump upright and refill motor with Myers submersible motor oil. DO NOT OVER FILL WITH OIL. With pump upright fill oil to bottom of oil fill tapping. Replace oil fill plug.

(12) Be sure pump turns freely before connecting to power. Turn pump on side and turn impeller, using screwdriver in slotted shaft. Plug pump into receptacle to test operation. Pump must run quiet and free of vibration.

TO REPLACE POWER CORD AND/OR SEAL LEAK DETECTOR CORD

(1) Remove motor housing as described above. Disconnect the push-together terminals and remove the ground screw from the power cord if being replace.

(2) Completely unscrew cord bushing to be replaced and remove cord assembly from housing. Be sure remaining terminals are secure on the wires.

(3) Replace with proper cord with fittings. Push cord into the motor housing far enough to make proper connections. Re-connect ground wire if replacing power cord and securely connect the wires correctly. See wiring diagram in these instructions.

(4) Assemble cords and motor housing as described in "Capacitor Replacement". Fill with oil as noted and be sure pump turns freely before connecting to power.

TO REPLACE MOTOR STATOR AND SHELL

(1) Remove motor housing as described above.

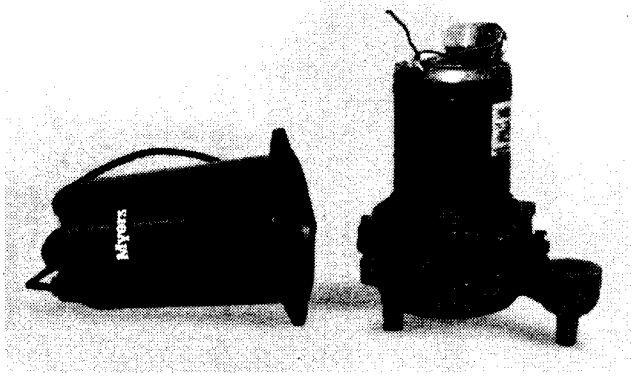
(2) Disconnect all leads from power and seal leak cords and ground wire and set pump upright.

(3) Loosen the four long screws holding the motor and remove slowly. If unit has seal leak probes be sure to feed the wires through the slots as the motor is being removed.

(4) Either remove previous capacitor and clamp from old motor and assemble onto new stator and shell or replace with a new capacitor and assemble the two capacitor leads per wiring diagram.

(5) Position bearing spring washer on top of upper ball bearing. (For 3/4 – 1-1/2 HP.)

(6) Tighten terminal screws of seal leak probes and feed wires through the motor slots.



(7) Position the "stator with shell" into place and line up screws with the bosses and tighten the (4) long screws. Extend probe wires out through the slots. Lay unit down in line with motor housing.

(8) Be sure pump turns freely with screwdriver in impeller end of shaft.

(9) Re-connect all terminals securely per wiring diagram.

(10) Be sure tetraseal gasket is in place.

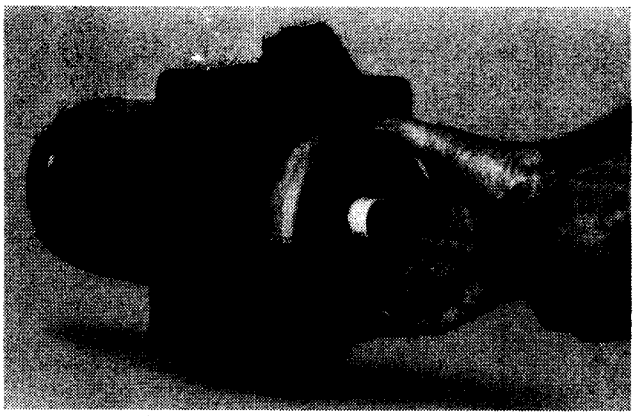
(11) Reassemble motor housing and fill with oil as noted above in "capacitor replacement".

NOTE: On three phase motors always check unit for proper rotation. With pump on its side apply power by turning on, then off, quickly. Impeller must turn counterclockwise when looking into the impeller inlet. If not, interchange any two leads in the control box.

SHAFT SEAL REPLACEMENT

(1) Remove plugs in motor housing and in seal housing (for double seal units) and drain oil.

(2) Remove four bolts holding the volute case and bump with a plastic hammer to loosen and remove case.



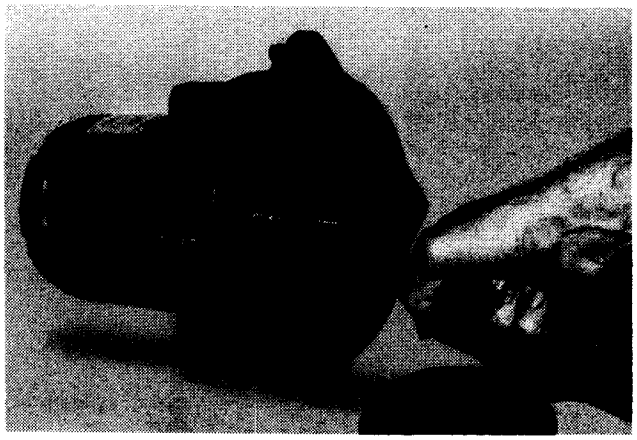
(3) Hold impeller and unscrew impeller locking screw or jam nut. Turn counterclockwise to loosen.

(4) Pry off seal bellows and ceramic seat. Break seats if necessary to get out since they must be replaced with new parts.

(5) NEVER USE OLD SEAL PARTS. USE ONLY COMPLETELY NEW SEALS. (Do not use seal spring retainer plate on single seal pump or lower seal of double seal pump.)

(6) For single seal pumps or if only replacing the lower seal of a double seal pump it is not necessary to disassemble further and on a double seal pump it is not necessary to drain oil out of the motor housing, just the seal housing.

(7) On a double seal pump to remove the upper seal, remove four bolts holding the bottom plate and remove bottom plate.



(8) Remove snap ring with snap ring pliers. Pry off upper seal bellows and ceramic seat.

(9) If no water has entered motor housing (check winding with ohmmeter or megger) wipe seal chambers thoroughly and replace seals. (Use seal retainer plate on upper seal only, do not use on lower seal.) Clean seal faces and use light oil on face before installing bellows part of seal.

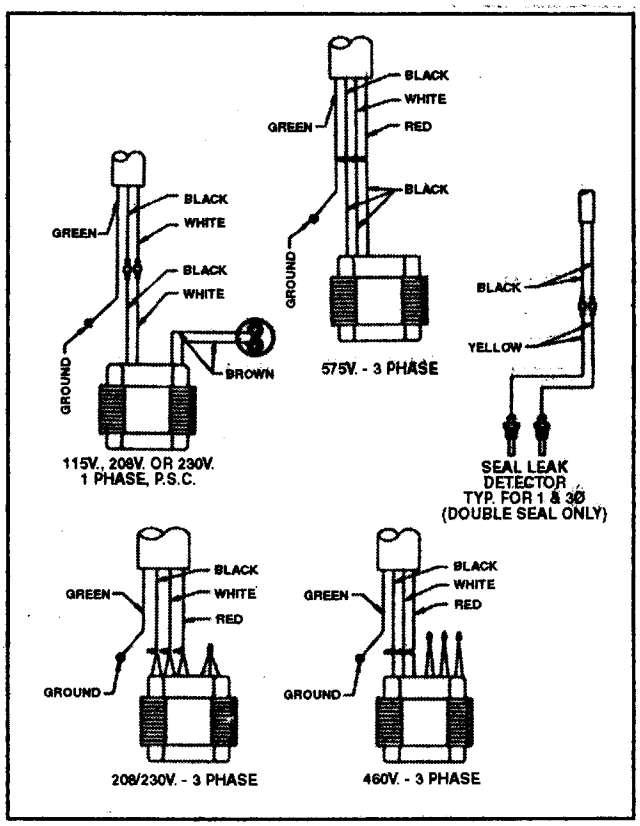
(10) Check HUVA cup seal in volute case inlet. If worn, replace.

(11) Be sure tetraseal seal is in position (replace if worn) and reassemble.

(12) Replace oil in motor housing and seal chamber. Use only Myers submersible oil.

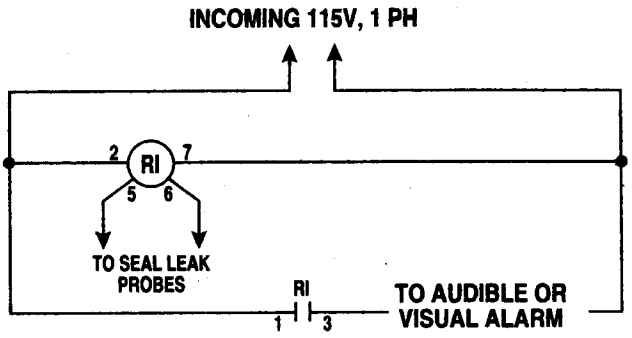
(13) Be sure pump turns freely before connecting to power. After connecting, check for proper rotation noted under "Stator Replacement".

WIRING DIAGRAM



3 PHASE DUAL VOLTAGE WINDING

	LEADS			
VOLTAGE	BLACK	WHITE	RED	TOGETHER
208 & 230	1 & 7	2 & 8	3 & 9	4 & 5 & 6
460	1	2	3	4 & 7, 5 & 8, 6 & 9



ME SERIES DIMENSIONS

Model Series	Inches (millimeters)			
	A	B	C	F
ME33S & ME50S	16.8 (427)	4.09 (104)	1.03 (26)	12.13 (308)
ME33D & ME50D	18.6 (472)	4.09 (104)	1.03 (26)	12.13 (308)
ME75S, ME100S, ME150S	16.8 (427)	4.0 (102)	1.06 (27)	12.5 (318)
ME75D, ME100D, ME150D	18.6 (472)	4.0 (102)	1.06 (27)	12.5 (318)

MOISTURE SENSOR SEAL PROBE CIRCUIT

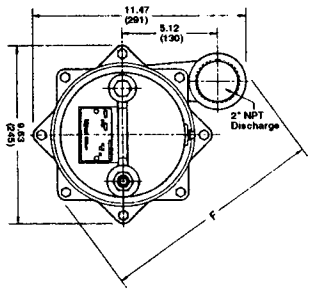
Relay - SSAC Inc. #LLC44A5A
Socket - Standard 8-pin plug-in type
If Myers panel is used, see below.

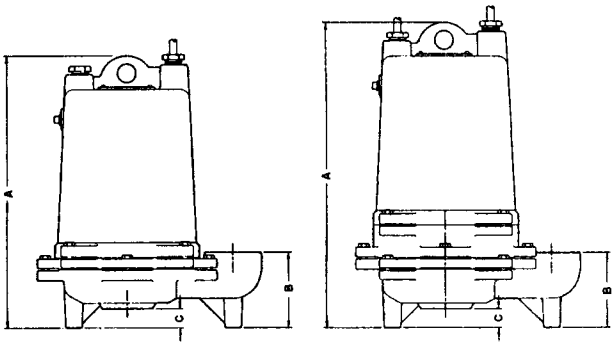
Pumps: ME33D-11,
ME50D-11,
ME75D-11
Required Panel:
CMEP (SL)-11S, -11SW, -11D or -11DW

Pumps: ME33D-01, ME33D-21,
ME50D-01, ME50D-21,
ME75D-01, ME75D-21,
ME100D-01, ME100D-21,
ME150D-01, ME150D-21,
MWH50D-01, MWH50D-21,
MW100D-01, MW100D-21,
MW150D-01, MW150D-21,
MW200D-01, MW200D-21
Required Panel:
CMEP(SL)-21S, -21SW, -21D or -21DW

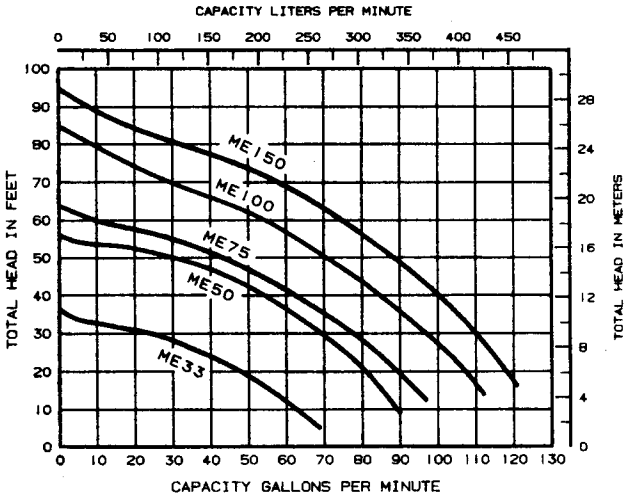
Pumps: ME33D-03, ME33D-23,
ME50D-03, ME50D-23,
ME75D-03, ME75D-23,
ME100D-03, ME100D-23,
ME150D-03, ME150D-23,
MWH50D-03, MWH50D-23,
MW100D-03, MW100D-23,
MW150D-03, MW150D-23,
MW200D-03, MW200D-23
Required Panel:
CMEP(SL)-23S, -23SW, -23D or -23DW

Pumps: ME33D-43,
ME50D-43,
ME75D-43,
ME100D-43,
ME150D-43,
MWH50D-43,
MW100D-43,
MW150D-43,
MW200D-43
Required Panel:
CMEP(SL)-43S, -43SW, -43D or -43DW

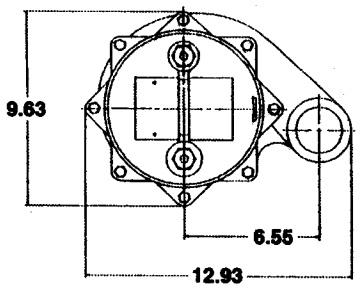


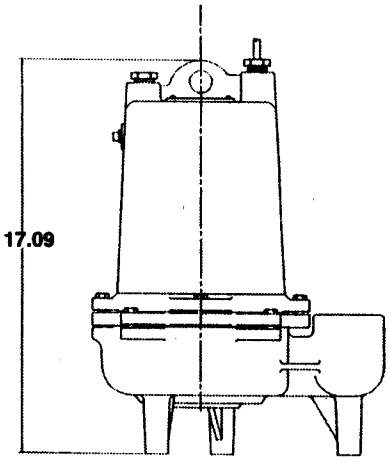


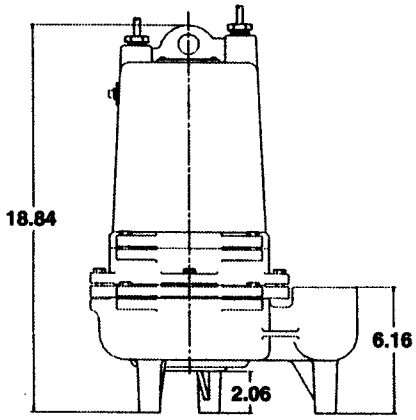
ME PERFORMANCE CURVE



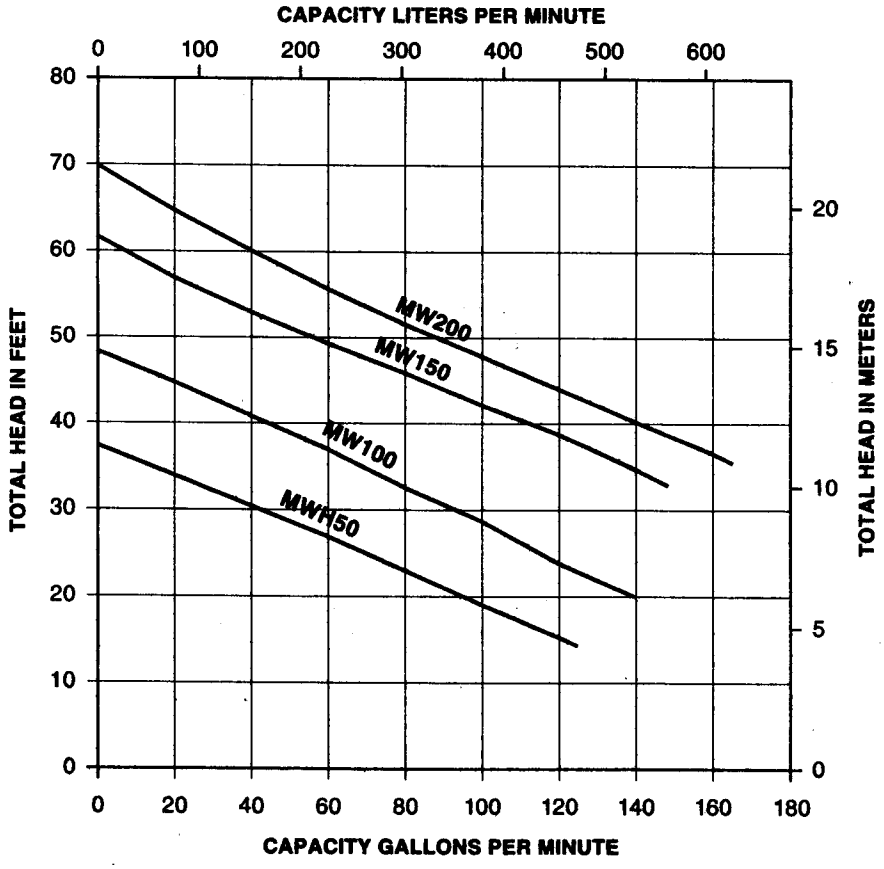
MW SERIES DIMENSIONS







MW PERFORMANCE CURVE



MOTOR DATA CHART

H.P.	SPEED	VOLTS	PHASE	STACK HEIGHT	WINDING RESISTANCE IN OHMS			MAX. AMPS	LOCKED ROTOR AMPS
					MAIN BLACK TO WHITE	START – 1Ø BRN. TO BRN. OR PURPLE BLACK TO RED – 3Ø	WHITE TO RED		
ME SERIES									
1/3	3450	115	1	1-1/4	2.4	20.5	–	8.4	13.5
1/3	3450	208/230	1	1-1/4	11.4	7.0	–	4.7/4.2	6.7
1/3	3450	208/230	3	1-1/4	15.8	15.8	15.8	2.4/2.2	10.8
1/3	3450	460	3	1-1/4	63.2	63.2	63.2	1.1	5.4
1/3	3450	575	3	1-1/4	98.8	98.8	98.8	0.9	4.3
1/2	3450	115	1	1-5/8	.9/.8	14.7	–	12.1	29.6
1/2	3450	208	1	1-5/8			–	6.7	16.5
1/2	3450	230	1	1-5/8	9.8	19.7	–	6.0	15.0
1/2	3450	208/230	3	1-5/8	11.3	11.3	11.3	3.5/3.2	12.8
1/2	3450	460	3	1-5/8	45.4	45.4	45.4	1.6	6.4
1/2	3450	575	3	1-5/8	71.0	71.0	71.0	1.3	5.1
3/4	3450	115	1	2-1/4	.85	4.9	–	13.8	30.4
3/4	3450	208/230	1	2-1/4	4.5	12.0	–	7.6/6.9	16.2
3/4	3450	208/230	3	2	7.6	7.6	7.6	5.2/4.7	20.2
3/4	3450	460	3	2	30.1	30.1	30.1	2.3	10.1
3/4	3450	575	3	2	47.0	47.0	47.0	1.9	8.1
1	3450	208	1	2-3/4			–	10.3	21.0
1	3450	230	1	2-3/4	3.0/2.6	16/14	–	9.3	19.0
1	3450	208/230	3	2-1/2	5.3	5.3	5.3	6.6/6.0	29.0
1	3450	460	3	2-1/2	21.2	21.2	21.2	3.0	14.5
1	3450	575	3	2-1/2	33.1	33.1	33.1	2.4	11.6
1-1/2	3450	208	1	2-3/4			–	14.1	
1-1/2	3450	230	1	2-3/4	2.4	12.0	–	12.8	23.0
1-1/2	3450	208/230	3	2-3/4	4.5	4.5	4.5	8.8/8.0	30.0
1-1/2	3450	460	3	2-3/4	16.0	16.0	16.0	4.0	15.0
1-1/2	3450	575	3	2-3/4	25.0	25.0	25.0	3.2	12.0
MW SERIES									
1/2	3450	208	1	2-1/4	4.5	12.0	–	7.6	16.2
1/2	3450	230	1	2-1/4	4.5	12.0	–	6.9	16.2
1/2	3450	208	3	2	7.6	7.6	7.6	5.2	20.2
1/2	3450	230	3	2	7.6	7.6	7.6	4.7	20.2
1/2	3450	460	3	2	30.1	30.1	30.1	2.3	10.1
1/2	3450	575	3	2	47.0	47.0	47.0	1.9	8.1
1	3450	208	1	2-3/4	2.2	11.5	–	10.3	21.0
1	3450	230	1	2-3/4	2.8	15.0	–	9.3	19.0
1	3450	208	3	2-1/2	5.3	5.3	5.3	6.6	29.0
1	3450	230	3	2-1/2	5.3	5.3	5.3	6.0	29.0
1	3450	460	3	2-1/2	21.2	21.2	21.2	3.0	14.5
1	3450	575	3	2-1/2	33.1	33.1	33.1	2.4	11.6
1-1/2	3450	208	1	2-3/4	2.1	9.3	–	14.8	39.9
1-1/2	3450	230	1	2-3/4	1.6	7.4	–	12.8	33.4
1-1/2	3450	208	3	2-3/4	4.5	4.5	4.5	7.7	30.0
1-1/2	3450	230	3	2-3/4	4.5	4.5	4.5	7.0	30.0
1-1/2	3450	460	3	2-3/4	18.0	18.0	18.0	3.5	15.0
1-1/2	3450	575	3	2-3/4	28.0	28.0	28.0	2.8	12.0
2	3450	208	1	2-3/4	2.1	9.3	–	15.3	39.9
2	3450	230	1	2-3/4	1.6	7.4	–	13.1	33.4
2	3450	208	3	2-3/4	4.5	4.5	4.5	8.5	30.0
2	3450	230	3	2-3/4	4.5	4.5	4.5	7.7	30.0
2	3450	460	3	2-3/4	18.0	18.0	18.0	3.9	15.0
2	3450	575	3	2-3/4	28.0	28.0	28.0	3.1	12.0

MYERS
LIMITED WARRANTY
GRINDERS, NON-CLOG SEWAGE and WASTEWATER PUMPS

F. E. MYERS warrants that its products are free from defects in material and workmanship for a period of twelve (12) months from the date of purchase or eighteen (18) months from the date of manufacture.

During the warranty period and subject to the conditions hereinafter set forth, **MYERS**, will repair or replace to the original user or consumer parts which prove defective due to defective materials or workmanship of **MYERS**. Contact your nearest authorized **MYERS** distributor or **MYERS** for warranty service. At all times, **MYERS** shall have and possess the sole right and option to determine whether to repair or replace defective equipment, parts or components..

Start up reports and electrical system schematics may be required to support warranty claims. Warranty effective only if **MYERS** supplied or authorized control panels are used.

LABOR, ETC. COSTS: MYERS shall IN NO EVENT be responsible or liable for the cost of field labor or other charges incurred by any customer in removing and/or reaffixing any **MYERS** product, part or component thereof.

THIS WARRANTY WILL NOT APPLY: (a) to defects or malfunctions resulting from failure to properly install, operate or maintain the unit in accordance with printed instructions provided; (b) to failures resulting from abuse, accident or negligence; (c) to normal maintenance services and the parts used in connection with such service; (d) to units which are not installed in accordance with applicable local codes, ordinances and good trade practices; or (e) if the unit is moved from its original installation location and (f) unit is used for purposes other than for what it was designed and manufactured.

RETURN OR REPLACED COMPONENTS: any item to be replaced under this Warranty must be returned to **MYERS** in Ashland, Ohio, or such other place as **MYERS** may designate, freight prepaid.

PRODUCT IMPROVEMENTS: MYERS reserves the right to change or improve its products or any portions thereof without being obligated to provide such a change or improvement for units sold and/or shipped prior to such a change or improvement.

WARRANTY EXCLUSIONS: MYERS MAKES NO EXPRESS OR IMPLIED WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. MYERS SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR ANY PARTICULAR PURPOSE.

Some states do not permit some or all of the above warranty limitations and, therefore, such limitations may not apply to you. No warranties or representations at any time made by any representatives of Myers shall vary or expand the provision hereof.

LIABILITY LIMITATION: IN NO EVENT SHALL **MYERS** BE LIABLE OR RESPONSIBLE FOR CONSEQUENTIAL, INCIDENTAL OR SPECIAL DAMAGES RESULTING FROM OR RELATED IN ANY MANNER TO ANY **MYERS** PRODUCT OR PARTS THEREOF. PERSONAL INJURY AND/OR PROPERTY DAMAGE MAY RESULT FROM IMPROPER INSTALLATION. MYERS DISCLAIMS ALL LIABILITY, INCLUDING LIABILITY UNDER THIS WARRANTY, FOR IMPROPER INSTALLATION -- MYERS RECOMMENDS INSTALLATION BY PROFESSIONALS.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This Warranty gives you specific legal rights and you may also have other rights which vary from state to state.

In the absence of suitable proof of this purchase date, the effective date of this warranty will be based upon the date of manufacture.

Myers

F. E. Myers, 1101 Myers Parkway, Ashland, Ohio 44805-1969
419/289-1144, FAX: 419/289-6658, TLX: 98-7443

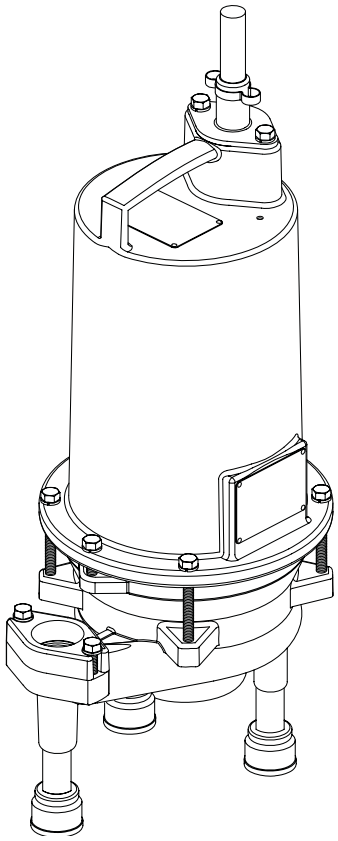
Printed in U.S.A. 5/96
23833A278

APPENDIX C: BARNES PUMPS

Manual Index

BARNES®

INSTALLATION MANUAL
Submersible Grinder Pump



ProGrind
Series: PGPP
2 HP, 3450 RPM, 60 Hz.

IMPORTANT! ***Read all instructions in this manual before operating pump. As a result of Crane Pumps & Systems, Inc., constant product improvement program, product changes may occur. As such Crane Pumps & Systems reserves the right to change product without prior written notification.***

CRANE®
A Crane Co. Company

PUMPS & SYSTEMS

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Piqua, Ohio 45356
Phone: (937) 778-8947
Fax: (937) 773-7157
www.cranepumps.com

83 West Drive, Bramton
Ontario, Canada L6T 2J6
Phone: (905) 457-6223
Fax: (905) 457-2650

Submersible Wastewater Pump Association SWPA MEMBER

Form No. 112871-Rev. J

SAFETY FIRST!

Please Read This Before Installing Or Operating Pump. This information is provided for **SAFETY and to PREVENT EQUIPMENT PROBLEMS**. To help recognize this information, observe the following symbols:

IMPORTANT! Warns about hazards that can result in personal injury orIndicates factors concerned with assembly, installation, operation, or maintenance which could result in damage to the machine or equipment if ignored.

CAUTION ! Warns about hazards that can or will cause minor personal injury or property damage if ignored. Used with symbols below.

WARNING ! Warns about hazards that can or will cause serious personal injury, death, or major property damage if ignored. Used with symbols below.


Hazardous fluids can cause fire or explosions, burnes or death could result.


Extremely hot - Severe burnes can occur on contact.


Biohazard can cause serious personal injury.


Hazardous fluids can Hazardous pressure, eruptions or explosions could cause personal injury or property damage.


Rotating machinery Amputation or severe laceration can result.


Hazardous voltage can shock, burn or cause death.

Only qualified personnel should install, operate and repair pump. Any wiring of pumps should be performed by a qualified electrician.

WARNING ! - To reduce risk of electrical shock, pumps and control panels must be properly grounded in accordance with the National Electric Code (NEC) or the Canadian Electrical Code (CEC) and all applicable state, province, local codes and ordinances.

WARNING! - To reduce risk of electrical shock, always disconnect the pump from the power source before handling or servicing. Lock out power and tag.

Prevent large articles of clothing, large amounts of chemicals, other materials or substances such as are uncommon in domestic sewage from entering the system.

During power black-outs, minimize water consumption at the home(s) to prevent sewage from backing up into the house.

Always keep the shut-off valve completely open when system is in operation (unless advised otherwise by the proper authorities). Before removing the pump from the basin, be sure to close the shut-off valve. (This prevents backflow from the pressure sewer.)

Keep the control panel locked or confined to prevent unauthorized access to it.

If the pump is idle for long periods of time, it is advisable to start the pump occasionally by adding water to the basin.

CAUTION! Pumps build up heat and pressure during operation-allow time for pumps to cool before handling or servicing.

WARNING! - **DO NOT** pump hazardous materials (flammable, caustic, etc.) unless the pump is specifically designed and designated to handle them.

Do not block or restrict discharge hose, as discharge hose may whip under pressure.

WARNING! - DO NOT wear loose clothing that may become entangled in the impeller or other moving parts.

WARNING! - Keep clear of suction and discharge openings. DO NOT insert fingers in pump with power connected.

Make sure lifting handles are securely fastened each time before lifting. Do not operate pump without safety devices in place. Always replace safety devices that have been removed during service or repair.

Do not exceed manufacturers recommendation for maximum performance, as this could cause the motor to overheat.

Secure the pump in its operating position so it can not tip over, fall or slide.

Cable should be protected at all times to avoid punctures, cut, bruises and abrasions - inspect frequently.

Never handle connected power cords with wet hands.

To reduce risk of electrical shock, all wiring and junction connections should be made per the NEC or CEC and applicable state or province and local codes. Requirements may vary depending on usage and location.

Submersible Pumps are not approved for use in swimming pools, recreational water installations, decorative fountains or any installation where human contact with the pumped fluid is common.

Do not remove cord and strain relief. Do not connect conduit to pump.

Products Returned Must Be Cleaned, Sanitized, Or Decontaminated As Necessary Prior To Shipment, To Insure That Employees Will Not Be Exposed To Health Hazards In Handling Said Material. All Applicable Laws And Regulations Shall Apply.

Bronze/brass and bronze/brass fitted pumps may contain lead levels higher than considered safe for potable water systems. Lead is known to cause cancer and birth defects or other reproductive harm. Various government agencies have determined that leaded copper alloys should not be used in potable water applications. For non-leaded copper alloy materials of construction, please contact factory.

IMPORTANT! - Crane Pumps & Systems, Inc. is not responsible for losses, injury, or death resulting from a failure to observe these safety precautions, misuse or abuse of pumps or equipment.

USER GUIDE

USER GUIDE
Congratulations on your purchase of a Barnes *Ultra*GRIND™ grinder pump system. With proper care and by following a few simple guidelines your grinder pump will give you many years of dependable service.

Use and Care
The *Ultra*GRIND grinder pump station is designed to handle routine, domestic sewage. Solid waste materials should be thrown in the trash. While your station is capable of accepting and pumping a wide range of materials, regulatory agencies advise that the following items should not be introduced into any sewer either directly or through a kitchen waste disposal:

- Glass
- Metal
- Diapers
- Socks, rags or cloth
- Plastic objects (e.g., toys, utensils, etc.)
- Sanitary napkins or tampons

In addition you must **NEVER** introduce into any sewer:

- Explosives
- Flammable Material
- Lubricating Oil and/or Grease
- Strong Chemicals
- Gasoline

General Information
Your home wastewater disposal service is part of a low pressure sewer system. The key element in this system is the Barnes *Ultra*GRIND grinder pump station. The basin collects all wastewater from the house. The solids in the sewage are then ground to a small size suitable for pumping in the slurry.

The grinder pump generates sufficient pressure to pump this slurry from your home to the wastewater plant.

Power Failure
Your grinder pump cannot dispose of wastewater or provide an alarm signal without electrical power. If electrical power service is interrupted, keep water usage to a minimum.

Warranty
Your grinder pump is furnished with a warranty against defects in material or workmanship. A properly completed
Start-Up/Warranty Registration form must be on file at the Barnes factory in order to activate your warranty. In addition your pump must be installed in accordance with the installation instructions.
If you have a claim under the provisions of the warranty, contact your local Barnes Distributor.
When contacting your representative for service, please include your station serial number, pump model number, and pump serial number.

For future reference, record the following information:

Station Serial No: _____

Pump Model No: _____

Pump Serial No: _____

Local Distributor: _____

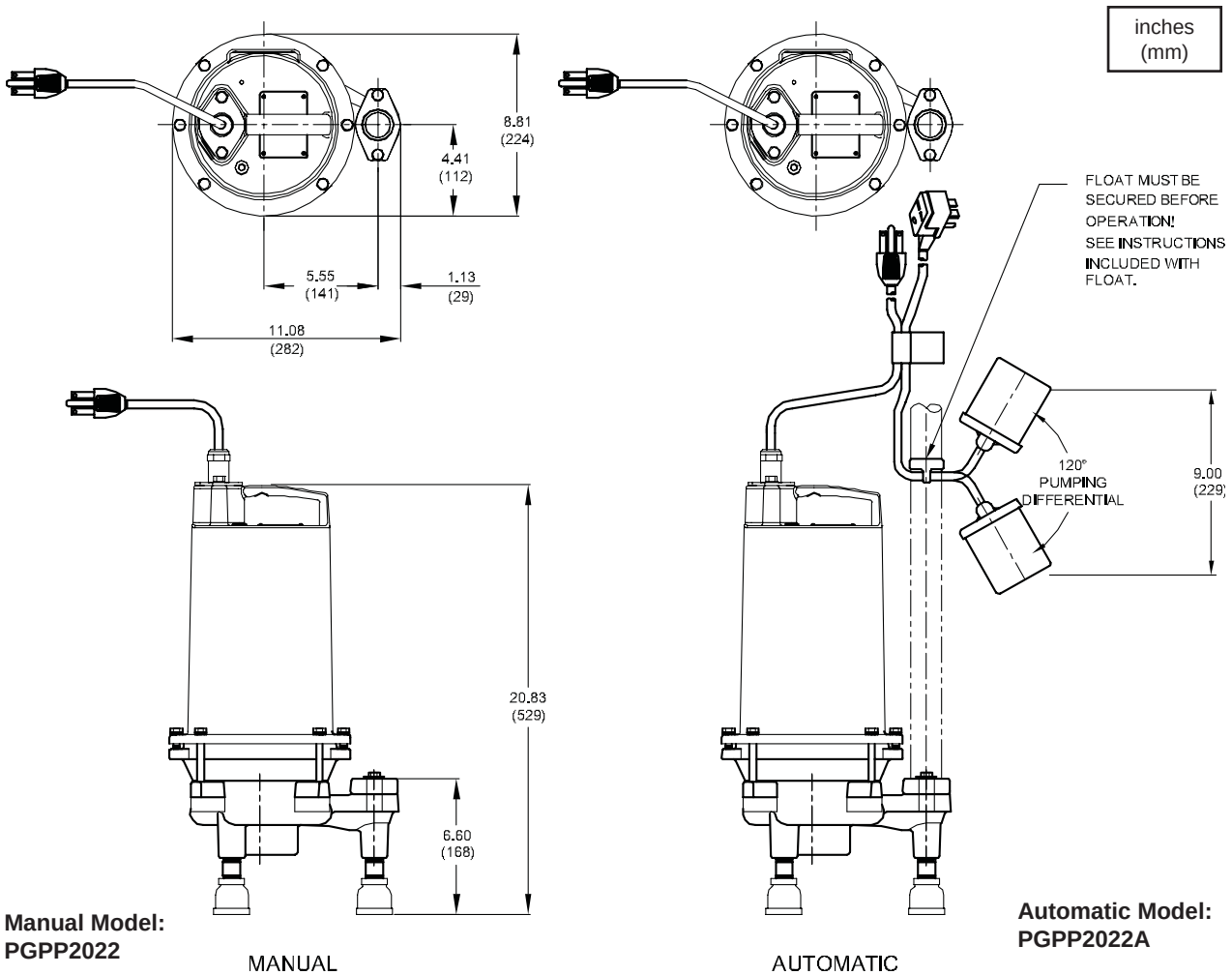
Distributor Telephone: _____

PUMP SPECIFICATIONS:

DISCHARGE..... 1¼" NPT, Female, Vertical, Bolt-on Flange
LIQUID TEMPERATURE .... 160°F (71°C) Intermittent
MOTOR HOUSING ..... Cast Iron ASTM A-48, Class 30
VOLUTE..... Cast Iron ASTM A-48, Class 30
SEAL PLATE ..... Cast Iron ASTM A-48, Class 30
LEGS:..... Removable and Adjustable
IMPELLER:
Design ..... 12 vane, vortex, with pump out vanes on back side. Dynamically balanced, ISO G6.3
Material..... Cast Iron ASTM A-48, Class 30
SHREDDING RING..... Hardened 440C Stainless Steel Rockwell® C-55
CUTTER..... Hardened 440C Stainless Steel Rockwell® C-55
SHAFT..... 416 Stainless Steel
SQUARE RINGS..... Buna-N
HARDWARE ..... 300 Series Stainless Steel
PAINT..... Air dry enamel
SEAL *Design*..... Single Mechanical
Material..... Rotating Faces - Silicon-Carbide
Stationary Faces - Silicon-Carbide
Elastomer - Buna-N
Hardware - 300 series stainless steel

CORD ENTRY..... 20 Ft. (6m) Cord with Plug Custom Molded Quick Connected for sealing and strain relief.
CORD..... CSA/UL Approved 14/3 Type SOW

SPEED ..... 3450 RPM, 60Hz (nominal)
UPPER BEARING:
Design..... Single Row, Ball, Oil Lubricated
Load..... Radial
LOWER BEARING:
Design..... Single Row, Ball, Oil Lubricated
Load..... Radial & Thrust
MOTOR: *Design*..... NEMA L, Single phase torque curve, Oil Filled, Squirrel Cage Induction
Insulation ..... Class B
SINGLE PHASE..... Capacitor start/capacitor run.
LEVEL CONTROLS:
A Series ..... Pipe Mounted, Piggy-Back, Mechanical, with 240 Volt Plug.



Manual Model:
PGPP2022

MANUAL

AUTOMATIC

Automatic Model:
PGPP2022A

MODEL NO	HP	VOLT	PH/Hz	RPM (Nom)	NEMA START CODE	FULL LOAD AMPS	LOCKED ROTOR AMPS	CORD SIZE	CODE TYPE	CORD O.D. ± .02 (.5) in (mm)	WINDING RESISTANCE MAIN -- START
PGPP2022	2	240	1 / 60	3450	H	15.0	53.8	14/3	SOW	.61 (15.5)	1.5 -- 5.1
PGPP2022A	2	240	1 / 60	3450	H	15.0	53.8	14/3	SOW	.61 (15.5)	1.5 -- 5.1

Winding Resistance ± 5%, measured from terminal block. Pump rated for operation at ± 10% voltage at motor.

Recommended Breaker				
Pump Model	HP	Phase	Volts	Breaker Size
PGPP2022	2	1	240	25 AMP
PGPP2022A	2	1	240	25 AMP

RECEIVING/UNPACKING:

Upon receiving the pump, it should be inspected for damage or shortages. If damage has occurred, file a claim immediately with the company that delivered the pump. Unpack pump and record pump serial and model number before installing. If the manual is removed from the packaging, do not lose or misplace.

STORAGE:

Short Term- For best results, pumps can be retained in storage, as factory assembled, in a dry atmosphere with constant temperatures for up to six (6) months.

Long Term- Any length of time exceeding six (6) months, but not more than twenty-four (24) months. The units should be stored in a temperature controlled area, a roofed over walled enclosure that provides protection from the elements (rain, snow, wind-blown dust, etc.), and whose temperature can be maintained between +40 deg. F and +120 deg. F. If extended high humidity is expected to be a problem, all exposed parts should be inspected before storage and all surfaces that have the paint scratched, damaged, or worn should be recoated with a air dry enamel paint. All surfaces should then be sprayed with a rust-inhibiting oil.

Pump should be stored in its original shipping container. On initial start up, rotate shaft by hand to assure seal and motor rotate freely. If it is required that the pump be installed and tested before the long term storage begins, such installation will be allowed provided:

1.) The pump is not installed under water for more than one (1) month.

2.) Immediately upon satisfactory completion of the test, the pump is removed, thoroughly dried, repacked in the original shipping container, and placed in a temperature controlled storage area.

SERVICE CENTERS:

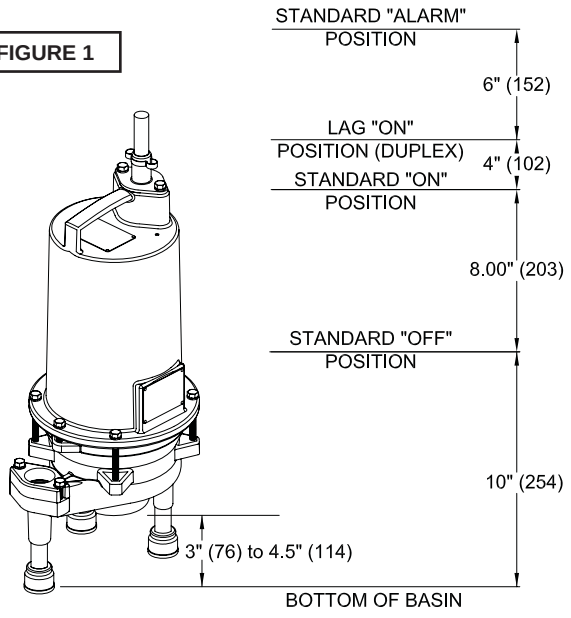
For the location of the nearest Barnes Service Center, check your Barnes representative or Crane Pumps & Systems, Inc., Service Department in Piqua, Ohio, telephone (937) 778-8947 or in Brampton, Ontario, Canada (905) 457-6223.

INSTALLATION:

Location - The pump is designed with pipe legs to keep a minimum of 3 inch clearance. **THIS PUMP MUST BE INSTALLED WITH A MINIMUM OF 3 INCHES CLEARANCE UNDER THE PUMP FOR THE ENTRANCE OF SEWAGE SOLIDS.**

Discharge - Assemble discharge piping or hose assembly (whichever is required by your application), to the pump. Discharge piping should be as short as possible. Both a check valve and a shut-off valve are required for each pump being used. The check valve is used to prevent backflow into the sump. Excessive backflow can cause flooding and/or damage to the pump. The shut-off valve is used to stop system flow during pump or check valve servicing.

FIGURE 1



If pump is installed with a discharge hose rather than a moveable fitting assembly, make sure the discharge pipe has a 1/8" dia. hole approx. 5" from end nearest volute and oriented towards the pump body.

ELECTRICAL CONNECTIONS:

Pump Cords - The quick connect cord assembly mounted to the pump must **NOT** be modified in any way except for shortening to a specific application. Any supply cables connections between the pump and the control panel must be made in accordance with the National Electric Code or the Canadian Electric Code and all applicable state, province and local electric codes. It is recommended that a junction box, be mounted outside the sump or be of at least Nema 4 (EEMAC-4) construction if located within the wet well. **DO NOT USE THE POWER OR CONTROL CABLES TO LIFT PUMP!**

Overload Protection - The type of in-winding overload protector used is referred to as an inherent overheating protector and operates on the combined effect of temperature and current. This means that the overload protector will trip out and shut the pump off if the windings become too hot, or the load current passing through them becomes too high. It will then automatically reset and start the pump up after the motor cools to a safe temperature. In the event of an overload, the source of this condition should be determined and rectified immediately. **DO NOT LET THE PUMP CYCLE OR RUN IF AN OVERLOAD CONDITION OCCURS !**

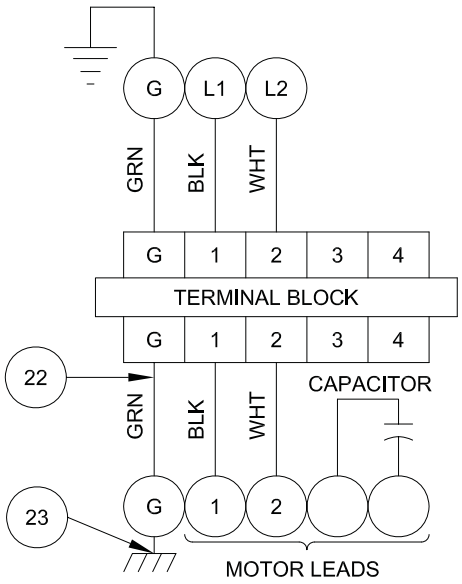


FIGURE 2

Wire Size - If additional cord is required consult a qualified electrician for proper wire size.

CORD CONNECTIONS:

Power/Control Cord- Insert female end of cord plug into housing bore aligning alignment mark with hole in terminal block see Figure 3. Tighten bolts on compression flange until flush with motor housing.

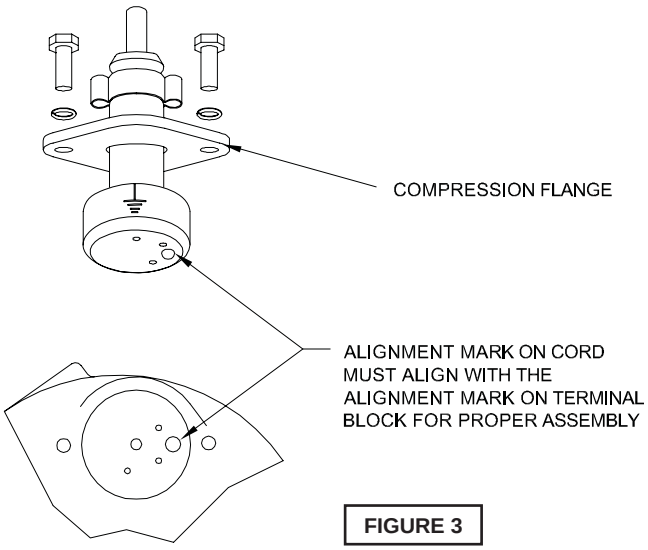


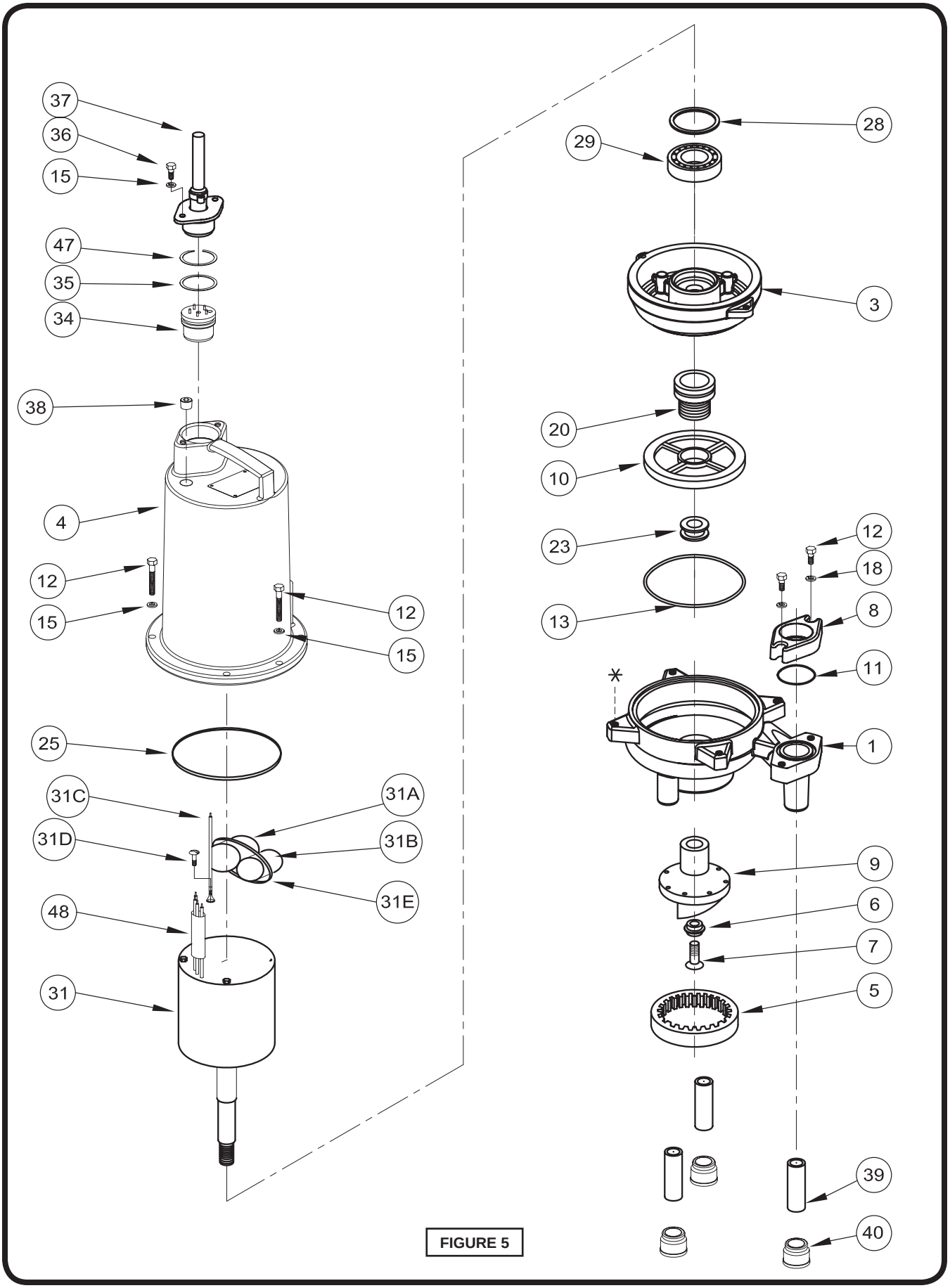
FIGURE 3

TROUBLE SHOOTING

CAUTION ! Always disconnect the pump from the electrical power source before handling.
If the system fails to operate properly, carefully read instructions and perform maintenance recommendations.
If operating problems persist, the following chart may be of assistance in identifying and correcting them:
MATCH "CAUSE" NUMBER WITH CORRELATING "CORRECTION" NUMBER.

NOTE: Not all problems and corrections will apply to each pump model.

PROBLEM	CAUSE	CORRECTION
Pump will not run	**1.** Poor electrical connection, blown fuse, tripped breaker or other interruption of power, improper power supply. **2.** Motor or switch inoperative (to isolate cause, go to manual operation of pump). **2a.** Float movement restricted. 2b. Switch will not activate pump or is defective. **3.** Insufficient liquid level.	1. Check all electrical connections for security. Have electrician measure current in motor leads, if current is within ±20% of locked rotor Amps, impeller is probably locked. If current is 0, overload may be tripped. Remove power, allow pump to cool, then recheck current. 2a. Reposition pump or clean basin as required to provide adequate clearance for float. 2b. Disconnect level control. Set ohmmeter for a low range, such as 100 ohms full scale and connect to level control leads. Actuate level control manually and check to see that ohmmeter shows zero ohms for closed switch and full scale for open switch. (Float Switch). 3. Make sure liquid level is at least equal to suggested turn-on point. 4. Recheck all sizing calculations to determine proper pump size. 5. Check discharge line for restrictions, including ice if line passes through or into cold areas. 6. Remove and examine check valve for proper installation and freedom of operation. 7. Open valve. 8. Check cutter for freedom of operation, security and condition. Clean cutter and inlet of any obstruction. 9. Loosen union slightly to allow trapped air to escape.Verify that turn-off level of switch is set so that the suction is always flooded. Clean vent hole. 10. Remove & examine for damage. Replace pump stator if required. 11. Repair fixtures as required to eliminate leakage. 12. Check pump temperature limits & fluid temperature. 13. Replace portion of discharge pipe with flexible connector. 14. Turn to automatic position. 15. Check for leaks around basin inlet and outlets.
Pump will not turn off	2a. Float movement restricted. 2b. Switch will not activate pump or is defective. 4. Excessive inflow or pump not properly sized for application. 9. Pump may be airlocked. 14. H-O-A switch on panel is in "HAND" position	
Pump hums but does not run	1. Incorrect voltage 8. Cutter jammed or loose on shaft, worn or damaged, inlet plugged.	
Pump delivers insufficient capacity	1. Incorrect voltage. 4. Excessive inflow or pump not properly sized for application. 5. Discharge restricted. 6. Check valve stuck closed or installed backwards. 7. Shut-off valve closed. 8. Cutter jammed or loose on shaft, worn or damaged, inlet plugged. 9. Pump may be airlocked. 10. Pump stator damaged/torn.	
Pump cycles too frequently or runs periodically when fixtures are not in use	6. Check valve stuck closed or installed backwards. 11. Fixtures are leaking. 15. Ground water entering basin.	
Pump shuts off and turns on independent of switch, (trips thermal overload protector). **CAUTION!** Pump may start unexpectedly. Disconnect power supply.	1. Incorrect voltage. 4. Excessive inflow or pump not properly sized for application. 8. Cutter jammed, loose on shaft, worn or damaged, inlet plugged. 12. Excessive water temperature.	
Pump operates noisily or vibrates excessively	4. Operating at too high a pressure. 5. Discharge restricted. 8. Cutter broken. 13. Piping attachments to buiding structure too rigid or too loose.	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31C
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31D
31B
31E
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FIGURE 5

PARTS KITS

Seal Repair Kit.....P/N: 108302 Item #'s 6,7,13,14,15,19,20,21,25,26,27,32,35,47

Cutter Kit .....P/N: 108321 Item #'s 5,6,7,9,15,19,23

PARTS LIST

ITEM	QTY	PART NO.	DESCRIPTION
1	1	108344	Volute
3	1	108343	Seal Plate
4	1	108342	Motor Housing
5	1	082085A	Shredding Ring
6	1	067556	Washer
7	1	070704	Skhd Screw, 1/4-20 x .75" SS
8	1	108369	Discharge Flange 1-1/4" NPT
9	1	082088	Radial Cutter
10	1	109026TD	Impeller, 5.13" Dia.
11	1	625-01558	O-Ring (-223)
12	4	1-131-1	Screw, 5/16-18 x 1.25" SS
13	1	067564	Square Ring
15	8	026322	Lockwasher, 5/16" SS
16	A/R	---------	LOCTITE™ RC609
17	A/R	---------	LOCTITE 242
18	2	062941	5/16" Flatwasher
20	1	110395SD	Seal, outer Silicon-Carbide
22	A/R	---------	Permatex Sealent 2C
23	1	016079	Shim set
24	3 Qts.	029034	Cooling Oil - Mtr. Housing
25	1	095368	Square Ring
26	4	1-300-1	Screw, 5/16-18 x 1.25", SS
28	1	061143	Retaining Ring
29	1	Q10-36-E4	Ball Bearing
31	1	108368**	Motor, 2HP, 240 Volt, 1 Phase w/capacitors & Ground wire
31A	1	112470	Capacitor, Run
31B	1	099198	Capacitor, Start
31C	1	105111B	Ground wire
31D	1	016660	Screw, Self-Tap #8-32 x .31"
31E	6	039462	Cable tie strap
34	1	103760	Terminal Block, Power, Manual

ITEM	QTY	PART NO.	DESCRIPTION
35	1	2-31051-224	O-Ring
36	2	1-156-1	Screw, 5/16-18 x 1.00" SS
37	1	105818XA	14/3 Cord Set, 20Ft (STD)
38	1	014270	Pipe Plug, C'sunk, 3/8" NPT
39	3	110660	1/2" x 2-1/2" Nipple
40	3	111328	1/2" x 1" Reducer
47	1	105197	Retaining Ring
48	1	625-02117	Sleeving
"A*" Model (Level Control)			
	1	111144XA	Float Switch, 20Ft. cord (Not Shown)

Contact your local Distributor or the Factory for other impeller sizes, cord lengths and other optional equipment.

(**) Items 31A thru 31E are included with item 31 motor.

BARNES® BARNES® PRESSURE PS SYSTEMS CROWN

burks® WEINMAN® DEMING® PROSSER®

Limited 24 Month Warranty

Crane Pumps & Systems warrants that products of our manufacture will be free of defects in material and workmanship under normal use and service for twenty-four (24) months after manufacture date, when installed and maintained in accordance with our instructions.This warranty gives you specific legal rights, and there may also be other rights which vary from state to state. In the event the product is covered by the Federal Consumer Product Warranties Law (1) the duration of any implied warranties associated with the product by virtue of said law is limited to the same duration as stated herein, (2) this warranty is a LIMITED WARRANTY, and (3) no claims of any nature whatsoever shall be made against us, until the ultimate consumer, his successor, or assigns, notifies us in writing of the defect, and delivers the product and/or defective part(s) freight prepaid to our factory or nearest authorized service station. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply. **THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF ANY AND ALL WARRANTIES WITH RESPECT TO ANY PRODUCT SHALL BE TO REPLACE OR REPAIR AT OUR ELECTION, F.O.B. POINT OF MANUFACTURE OR AUTHORIZED REPAIR STATION, SUCH PRODUCTS AND/OR PARTS AS PROVEN DEFECTIVE. THERE SHALL BE NO FURTHER LIABILITY, WHETHER BASED ON WARRANTY, NEGLIGENCE OR OTHERWISE.** Unless expressly stated otherwise, guarantees in the nature of performance specifications furnished in addition to the foregoing material and workmanship warranties on a product manufactured by us, if any, are subject to laboratory tests corrected for field performance. Any additional guarantees, in the nature of performance specifications must be in writing and such writing must be signed by our authorized representative. Due to inaccuracies in field testing if a conflict arises between the results of field testing conducted by or for user, and laboratory tests corrected for field performance, the latter shall control. **RECOMMENDATIONS FOR SPECIAL APPLICATIONS OR THOSE RESULTING FROM SYSTEMS ANALYSES AND EVALUATIONS WE CONDUCT WILL BE BASED ON OUR BEST AVAILABLE EXPERIENCE AND PUBLISHED INDUSTRY INFORMATION. SUCH RECOMMENDATIONS DO NOT CONSTITUTE A WARRANTY OF SATISFACTORY PERFORMANCE AND NO SUCH WARRANTY IS GIVEN.**

This warranty shall not apply when damage is caused by (a) improper installation, (b) improper voltage (c) lightning (d) excessive sand or other abrasive material (e) scale or corrosion build-up due to excessive chemical content. Any modification of the original equipment will also void the warranty. We will not be responsible for loss, damage or labor cost due to interruption of service caused by defective parts. Neither will we accept charges incurred by others without our prior written approval.

This warranty is void if our inspection reveals the product was used in a manner inconsistent with normal industry practice and\or our specific recommendations. The purchaser is responsible for communication of all necessary information regarding the application and use of the product. **UNDER NO CIRCUMSTANCES WILL WE BE RESPONSIBLE FOR ANY OTHER DIRECT OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO TRAVEL EXPENSES, RENTED EQUIPMENT, OUTSIDE CONTRACTOR FEES, UNAUTHORIZED REPAIR SHOP EXPENSES, LOST PROFITS, LOST INCOME, LABOR CHARGES, DELAYS IN PRODUCTION, IDLE PRODUCTION, WHICH DAMAGES ARE CAUSED BY ANY DEFECTS IN MATERIAL AND\OR WORKMANSHIP AND\OR DAMAGE OR DELAYS IN SHIPMENT. THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER EXPRESS OR IMPLIED WARRANTY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE**.

No rights extended under this warranty shall be assigned to any other person, whether by operation of law or otherwise, without our prior written approval.

CRANE®

PUMPS & SYSTEMS

A Crane Co. Company

420 Third Street
Piqua, Ohio 45356
Phone: (937) 778-8947
Fax: (937) 773-7157
www.cranepumps.com

83 West Drive, Brampton
Ontario, Canada L6T 2J6
Phone: (905) 457-6223
Fax: (905) 457-2650

IMPORTANT!
WARRANTY REGISTRATION

Your product is covered by the enclosed Warranty.
To complete the Warranty Registration Form go to:

http://www.cranepumps.com/ProductRegistration/

If you have a claim under the provision of the warranty, contact your local Crane Pumps & Systems, Inc. Distributor.

RETURNED GOODS
RETURN OF MERCHANDISE REQUIRES A "RETURNED GOODS AUTHORIZATION". CONTACT YOUR LOCAL CRANE PUMPS & SYSTEMS, INC. DISTRIBUTOR.

Products Returned Must Be Cleaned, Sanitized, Or Decontaminated As Necessary Prior To Shipment, To Insure That Employees Will Not Be Exposed To Health Hazards In Handling Said Material. All Applicable Laws And Regulations Shall Apply.

CRANE PUMPS & SYSTEMS

A Crane Co. Company

START-UP REPORT

General Information

Pump Owner's Name: _____

Address: _____

Location of Installation: _____

Contact Person: _____ Phone: _____

Purchased From: _____

Nameplate Data

Pump Model #: _____ Serial #: _____

Part #: _____ Impeller Diameter: _____

Voltage: _____ Phase: _____ Ø Hertz: _____ Horsepower: _____

Full Load Amps: _____ Service Factor Amps: _____

Motor Manufacturer: _____

Controls

Control panel manufacturer: _____

Model/Part number: _____

Number of pumps operated by control panel: _____

Short circuit protection? YES___ NO___ Type: _____

Number and size of short circuit device(s): _____ Amp rating: _____

Overload Type: _____ Size: _____ Amp rating: _____

Do protection devices comply with pump and motor Amp rating? YES___ NO___

Are all electrical and panel entry connections tight? YES___ NO___

Is the interior of the panel dry? YES___ NO___

Liquid level Control Brand and Model: _____

Pre-Startup

All Pumps

Type of equipment: NEW___ REBUILT___ USED___

Condition of equipment at Start-Up: DRY___ WET___ MUDDY___

Was Equipment Stored? YES___ NO___ Length of Storage: _____

Liquid being pumped: _____ Liquid Temperature: _____

Supply Voltage/Phase/Frequency matches nameplate? YES___ NO___

Shaft turns freely? YES___ NO___

Direction of rotation verified for 3Ø motors? YES___ NO___

Debris in piping or wet well? YES___ NO___

Debris removed in your presence? YES___ NO___

Pump case/wet well filled with liquid before startup? YES___ NO___

Is piping properly supported? YES___ NO___

Non-Submersible Pumps

Is base plate properly installed / grouted? YES___ NO___ N/A___

Coupling Alignment Verified per I&O Manual? YES___ NO___ N/A___

Grease Cup/Oil Reservoir Level checked? YES___ NO___ N/A___

Submersible Pumps

Resistance of cable and pump motor (measured at pump control):

Red-Black:_____Ohms(Ω) Red-White:_____Ohms(Ω) White-Black:_____Ohms(Ω)

Resistance of Ground Circuit between Control Panel and outside of pump:_____Ohms(Ω)

MEG Ohms check of insulation:

Red to Ground: _____ White to Ground: _____ Black to Ground: _____

Operational Checks

Is there noise or vibration present? YES___ NO___ Source of noise/vibration: _____

Does check valve operate properly? YES___ NO___ N/A___

Is system free of leaks? YES___ NO___ Leaks at: _____

Does system appear to operate at design flow rate? YES___ NO___

Nominal Voltage: _____ Phase: 1Ø 3Ø (select one)

Voltage Reading at panel connection, Pump OFF: L1, L2 _____ L2, L3 _____ L1, L3 _____

Voltage Reading at panel connection, Pump ON: L1, L2 _____ L2, L3 _____ L1, L3 _____

Amperage Draw, Pump ON: L1 _____ L2 _____ L3 _____

Submersible Pumps

Are BAF and guide rails level / plumb? YES___ NO___

Is pump seated on discharge properly? YES___ NO___

Are level controls installed away from turbulence? YES___ NO___

Is level control operating properly? YES___ NO___

Is pump fully submerged during operation? YES___ NO___

Follow up/Corrective Action Required

YES___ NO___

Additional Comments:

_____

_____

_____

_____

_____

_____

_____

Startup performed by: _____ Date: _____

Present at Start-Up

( ) Engineer: _____ ( ) Operator: _____

( ) Contactor:_____ ( ) Other:_____

All parties should retain a copy of this report for future trouble shooting/reference

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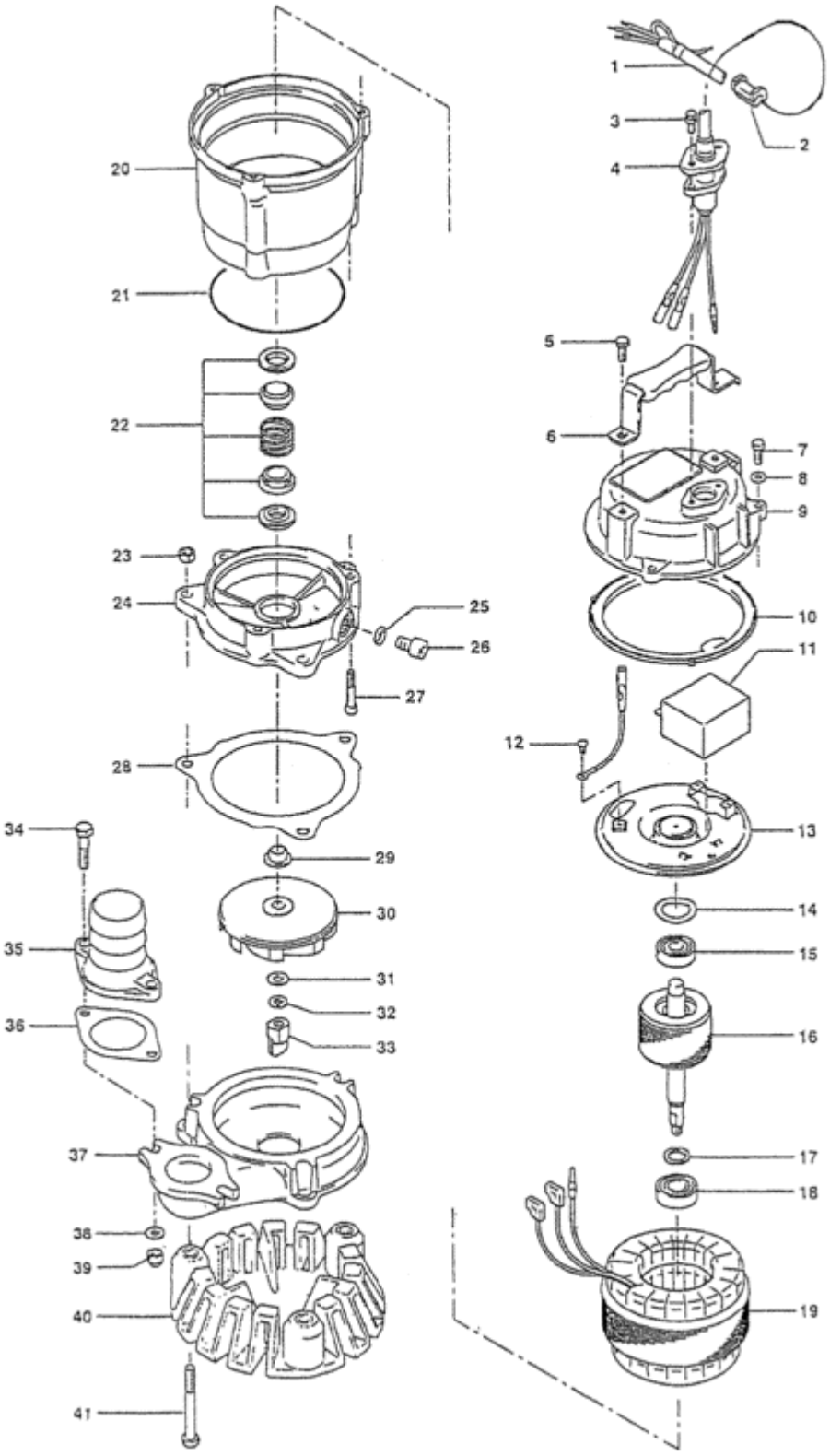
Ontario, Canada L6T 2J6
Phone: (905) 457-6223
Fax: (905) 457-2650

APPENDIX D: TSURUMI PUMPS

Tsurumi Pump - HS2.4S-62 - Submersible Pump 1/2HP

Ref	Part Number	Description
1	001-943-36	Cab-Tyre Cable
2	010-134-18	Cable Clip, Rubber
3	140-427-17	HEX BOLT
4	003-100-13	Gland
5	140-032-37	HEX BOLT
6	068-272-18	HANDLE
7	140-036-15	HEX BOLT
8	142-126-19	PLAIN WASHER
9	051-250-18	Head Cover
10	121-546-14	Packing
11	076-148-19	Capacitor
12	143-073-26	CROSS PAN SCREW
13	050-451-18	MOTOR BRACKET
14	142-192-16	Wave Washer
15	052-100-15	Ball Bearing
16	055-773-14	ROTOR AND SHAFT
17	061-178-12	BEARING COLLAR
18	052-101-16	Ball Bearing
19	056-B09-16	STATOR
20	064-516-15	MOTOR FRAME
21	122-133-17	O-Ring
22	025-291-10	Mechanical Seal
23	141-005-34	Nut
24	029-360-13	OIL CASING
25	121-246-11	Packing
26	035-124-12	OIL PLUG
27	140-256-26	HEX SOCKET CAP SCREW
28	121-000-20	Packing
29	071-292-14	Shaft Sleeve
30	021-L79-18	Impeller
31	142-127-10	PLAIN WASHER
32	142-163-18	Spring Washer
33	024-174-13	Stirrer
34	140-057-38	HEX BOLT
35	032-214-11	Hose Coupling
35	032-289-17	Hose Coupling
36	121-138-19	Packing PC 84
37	020-000-41	PUMP CASING
38	142-127-10	PLAIN WASHER
39	141-005-34	Nut
40	023-453-16	Strainer Stand
41	140-064-12	Bolt

42	173-550-12	Packing O-Ring Set
43	122-441-11	V-Ring



APPENDIX E: VALVES

Installation, Operation, and Maintenance Manual

Gate, Globe, and Check Valves

TNC Doc EDC 303, Revision 2, Issued October 2008

The Newdell Company, 13750 Hollister Road, Houston, Texas 77086-1213
Tel: 713-590-1312, 877-510-7853, Fax: 713-590-1319, www.smithvalves.com

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1.0 GENERAL

The majority of this information is common knowledge to experienced forged steel valve users. This information applies to all standard Smith API Std 602 Forged valves. When properly installed in applications for which they were designed, Smith valves will give long trouble free service.

We do recommend however that this entire document be read prior to proceeding with any installation or repair.

1.1 Responsibility For Valve Application

The End User is responsible for ordering the correct valves. SMITH VALVES are to be installed in the observance of the pressure rating and design temperature. Prior to installation, the valves and nameplates should be checked for proper identification to be sure the valve is of the proper type, material, and is of a suitable pressure class and temperature limit to satisfy the application requirements.

Do not use any valve in applications where either the pressure or temperature is higher than the allowable working values. Also valves should not be used in service media if not compatible with the valve material of construction, as this will cause chemical attacks.

1.2 Receiving Inspection and Handling

Valves should be inspected upon receipt to determine:
Compliance to purchase order requirements.
Correct type, pressure class, size, body and trim materials and end connections (this information may be found on the nameplate or may be stamped on the body of the valve).
Any damage caused during shipping and handling to end connections, handwheel or stem.

The End User is advised that misapplication of the product may result in injuries or property damage. A selection consistent with the particular performance requirements is important for proper application.

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2.0 INSTALLATION

Piping should be properly aligned and supported to reduce mechanical loading on the end connections.

2.1 Installation Positions

Gate valves are usually bi-directional, and therefore may be installed in either direction. In some special cases, gate valves may be unidirectional, in which case the direction of flow will be indicated on the valve body.

Globe and Check valves are unidirectional, and have the direction of flow indicated on the valve body.

Smith piston and ball check valves are recommended for use only in horizontal lines with the cover facing up.

Spring loaded Smith piston and ball check valves are recommended for use in horizontal lines only, but may be installed with the cap facing down as well as up.

Smith swing check valves may be installed in horizontal lines or vertical lines where the direction of flow as indicated on the valve body is upwards.

2.2 Preparation for Installation

Remove protective end caps or plugs, and inspect valve ends for damage to threads, socket weld bores or flange faces.

Thoroughly clean adjacent piping system to remove any foreign material that could cause damage to seating surfaces during valve operation.

Verify that the space available for installation is adequate to allow the valve to be installed and to be operated.

Insufficient clearance for the stem in the fully open position may cause the valve to be inoperable. Inadequate clearance for valves may add mechanical loading to the valve ends. Sufficient clearance should be allowed for threaded valves to be "swung" during installation.

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2.3 End Connections

2.3.1 Threaded Ends

Check condition of threads on mating piping.
Apply joint compound to the male end of joint only. This will prevent compound from entering the valve flowpath.

Smith valves have wrenching lugs forged onto the body ends. Wrenches should be used on the valve end closest to the joint being tightened.

2.3.2 Flanged Ends

Check to see that companion flanges are dimensionally compatible with the flanges on the valve body and make sure sealing surfaces are free of dirt.

Install the proper studs and nuts for the application and place the flange gasket between the flange facings.

Stud nuts should be tightened in a criss-cross pattern in equal increments to ensure proper gasket compression.

2.3.3 Socket weld Ends

Remove all grease, oil or paint from the pipe that is to be welded into the valve and from the valve end connections.

Insert the pipe into the valve end connection until it bottoms out in the socket weld bore. Withdraw the pipe 1/16" so that a gap remains between the pipe and the bottom of the socket weld bore to prevent cracks (ASME B16.11). Tack the pipe into the valve and complete the fillet weld.

Gate and Globe valves should be lightly closed to prevent damage to the seating surfaces and stem caused by thermal expansion during the socket welding process.

2.3.4 Integrally Reinforced Extended Body Valves (IREB)

Smith integrally reinforced extended body valves are manufactured with an optional integral backing ring for ease of installation.

A pilot hole not greater than 1/16" larger than the backing ring diameter is drilled through the wall of the run pipe. Tack weld the valve onto the run pipe (two opposing points). Complete the weld to the outside diameter of the reinforced valve end.

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2.4 Post-Installation Procedures

After installation, the line should be cleaned by flushing to remove any foreign material. When caustics are used to flush the line, additional flushing with clean water is required. The valve should be opened and closed after installation to ensure proper operating function.

With the line pressurized, check the valve end connections, body to bonnet/cover joints and stem packing area for leaks. The packing may have to be tightened to stop packing leakage at the system pressure.

3.0 Operation

Gate valves should be used only in the fully opened or fully closed position.

Globe valves should not be used continuously at openings less than 25%.

Gate and Globe valves should not be left in the fully back seated position under normal operating conditions. The packing may dry out under these conditions and leak as the valve is closed.

A cool valve may leak through the gland when opened to hot fluid. Wait before tightening the packing as the problem may go away.

Metal seated check valves (piston, ball and swing) are not zero leak devices and may "seep" in service. This type of valve should always be backed up with an isolation valve (either gate or globe)

4.0 MAINTENANCE

Proper PPE should be worn when preparing to service a valve. Observe the following general warnings:

- ***A valve is a pressurized device containing energized fluids and should be handled with appropriate care.***
- ***Valve surface temperature may be dangerously too hot or too cold to the skin.***
- ***Upon disassembly, attention should be paid to the possibility of releasing dangerous and or ignitable accumulated fluids.***
- ***Adequate ventilation should be available for service.***

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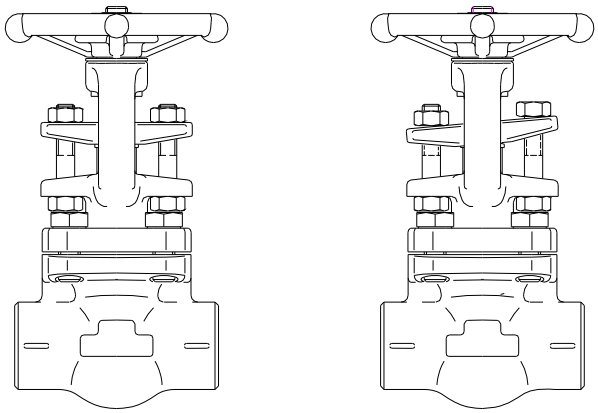
Tools Required

Aside from standard wrenches (for bonnet cap screws and packing gland nuts) the only tool needed for Smith valve maintenance is a packing hook.

Packing

Special care is to be placed in the tightening of gland nuts during installation, in order to get the proper packing adjustment and functionality.

The packing gland should be checked periodically in service and tightened as necessary to stop leakage around the stem. Tighten in a manner to develop uniform loading on the gland. Tighten only enough to stop the leak.



Over tightening will cause the packing to fail prematurely as well as increasing the force required to operate the valve.

If the leak cannot be stopped by tightening the gland nuts, it is necessary to add additional packing rings or completely repack the valve. While Smith gate and globe valves are equipped with a back seat feature, it is NOT RECOMMENDED TO REPACKED THEM UNDER PRESSURE.

Back seating the valve and attempting to repack under pressure is hazardous and is not recommended. Rather than attempting to repack under pressure, it is preferable to use the backseat to control the stem leakage until a shutdown provides safe repacking conditions.

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The end rings (top and bottom) of the standard Smith graphite packing set have a diagonal cut that will allow them to be installed around the stem of an assembled valve. However, the factory installed intermediate graphite packing rings are die formed and have no end cut. As a result, these rings cannot be replaced without removing the valve bonnet. If the valve is to be repacked without removing the bonnet (see re packing the valve in line below), care must be taken when removing the original packing not to scratch the valve stem sealing surface.

Where it is necessary to repack the valve in line, a compatible ribbon packing system or equivalent braided packing stock should be used. The joints in the packing rings should be diagonally cut. When installing the rings, care should be taken to stagger the ring joints.

Other specialty packing such as V ring teflon will require that the valve be disassembled if repacking is required.

Stem Thread Lubrication

The operating nut of Smith OS&Y valves is coated with a dry film lubricant (molybdenum disulfide). Should it be necessary to re- lubricate the stem/operating nut in service, spray cans of this product are commercially available.

4.1 Repairs

Due to the relatively low replacement cost of standard carbon steel valves, it is usually less expensive to replace the complete valve than to have maintenance personnel effect repairs. Additionally, in the case of a gate valve, it must be removed from the line in order to replace seat rings. Generally, the only justifiable repairs are replacement of packing and gaskets as previously described.

Always replace the bonnet gasket whenever a valve is disassembled. Gasket seating surfaces should be scraped clean (avoid radial marks). Bonnet bolts should be tightened in a diagonal pattern at several different increasing torque settings until the final recommended torque value is attained.

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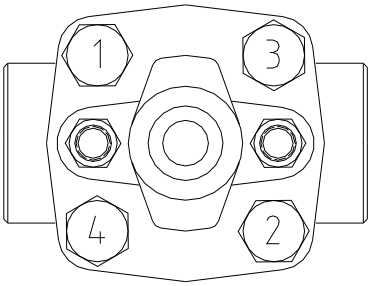
5.0 BODY-BONNET/COVER BOLTINGS

Only proceed to this operation changing one bolt at a time to prevent losses of pressure on the gasket. If this is not possible, replace the body-bonnet gasket locking bolts in a crossed way (see figure) till torque are the same of Appendix C.



BOLTING SEQUENCE

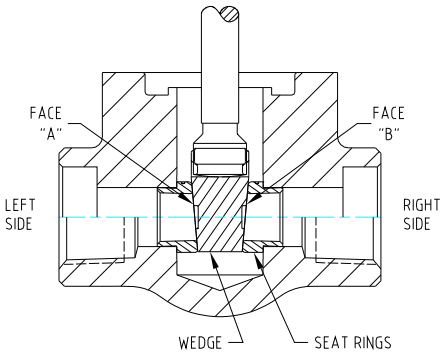
6.0 MAINTENANCE ON BOLTED BONNET GATE VALVES

6.1 WEDGE

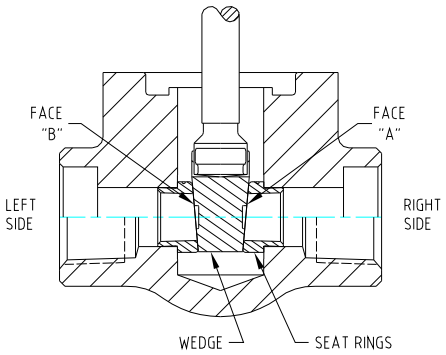
a. Proceed opening completely the valve assuring that the stem is brought to the backseat position.

b. Loosen the body-bonnet bolting.

c. Remove the bonnet-stem assembly. Take note of wedge sealing surfaces relative to the valve seats. Faces should be matched during re-assembly. Extract wedge from the stem T-head.



RIGHT POSITION



WRONG POSITION

d. Check that no incisions or marks are on sealing surfaces. If any, use fine sand paper or emery cloth to eliminate them, assuring that the original planarity of these surfaces is not modified.

e. Replace the gasket between body and bonnet, insert wedge in the stem T-head making sure that the faces are matched as noted above.

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f. Bring the bonnet-stem assembly to its original position and tighten the body-bonnet bolts as described in section 5.

6.2 STEM

a. Proceed opening completely the valve assuring that the stem is brought to the backseat position.
b. Loosen the body-bonnet bolting.
c. Remove the bonnet-stem assembly. Take note of wedge sealing surfaces relative to the valve seats. Faces should be matched during re-assembly. Extract wedge from the stem T-head.
d. Disassemble the stem by turning it in the counter-clockwise direction.
e. Make sure that the stem surface in contact with the packing is not damaged. If the stem is damaged beyond repair, call for a stem replacement or consider replacing the entire valve.
f. Replace the stem by screwing it clockwise in the bonnet.
g. Replace the gasket between body and bonnet, insert wedge in the stem T-head making sure that the faces are matched as noted above.
h. Bring the bonnet-stem assembly to its original position and tighten the body-bonnet bolts as described in section 5.

6.3 SEATS

No repairs are possible on seats of gate valves. Replacement of seat is possible, provided the right tools are available.

Blunt chisels and a hammer can be used to remove the old seats after removal of the bonnet-stem and wedge assembly. New seats must be assembled by expanding the ends as shown. We recommend that this process be carried out only in our factory where proper tooling is available, or call us for a replacement valve.

7.0 MAINTENANCE ON BOLTED BONNET GLOBE VALVES

7.1 DISC and SEAT

The seating surface is integral to the body. To check the seal characteristics between the disc and body seating area, we suggest the “BLUEING TEST”:

a. Proceed opening completely the valve, assuring that the stem is brought to the backseat position.
b. Loosen the body-bonnet bolting.
c. Remove the bonnet-stem and disc assembly. Apply some prussic-blue on the body seating surface.
d. Place the bonnet-stem and disc assembly in the original position, and tighten the bolts as described in section 5.
e. Take the valve in the close position, wait 20 seconds, and repeat steps “a” and “b” above.
f. Remove the bonnet again, and check that the blue trace on the disc and the body is

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uniformly present on the contact surfaces. If this has not occurred there are two possibilities:

- There are incisions or marks on sealing surfaces, either the disc or the body. Check and, if any, use fine sand paper or emery cloth to eliminate them, taking care that the original planarity of these surfaces is not modified.
- Repair is not possible because great damage has occurred. Contact our sales department giving details as described later to receive a new disc and replace it.

g. Replace the body-bonnet gasket.

h. Reassemble the bonnet-stem and disc assembly and tighten bolts as described in section 5.

7.2 STEM

a. Proceed opening completely the valve, assuring that the stem is brought to the backseat position.

b. Loosen the body-bonnet bolting.

c. Remove the bonnet-stem and disc assembly. Extract the disc from the stem end.

d. Disassemble the stem by turning it in the counter-clockwise direction.

e. Make sure that the stem surface in contact with the packing is not damaged. If the stem is damaged beyond repair, call for a stem replacement or consider replacing the entire valve.

f. Replace the stem by screwing it clockwise in the bonnet.

g. Replace the gasket between body and bonnet, insert disc into the stem end.

h. Bring the bonnet-stem assembly to its original position, and tighten the body-bonnet bolts as described in section 5.

8.0 MAINTENANCE ON BOLTED BONNET CHECK VALVES

There are three types of check valves: ball, piston, and swing type.

8.1 BALL, PISTON, and their SEATS

a. Seats are integral to the body.

b. Loosen the body-cover bolting.

c. Remove all parts, taking note of the order of disassembly.

d. Visual check all sealing surfaces.

e. No incisions or marks shall be on sealing surfaces.

f. If any on the piston or the body, use emery cloth to eliminate them, assuring that the original planarity of the surface is not modified.

g. If there are any incisions or marks on the ball, or the above step is not successful, contact our sales department giving details as described later to purchase a new ball, piston, or a replacement valve.

h. Replace the body-bonnet gasket.

i. Reassemble the valve in the reverse order of the disassembly, and tighten the bolts as described in section 5.

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8.2 SWING TYPE VALVE

a. Loosen the body-cover bolting.
b. Remove the cover.
c. Visually check all sealing surfaces.
d. No incisions or marks must be on sealing surfaces.
e. If there are damages, proceed with the aid of a hinge pin extractor to disassemble the swing. Note the order of disassembly.
f. If possible, use fine sand paper or emery cloth to eliminate incisions or marks, assuring that the original planarity of the surface is not modified. If results are not satisfactory, contact our sales department giving details as described later to purchase new parts or replace the entire valve.
g. Replace the body-bonnet gasket.
h. Reassemble the valve in the reverse order of the disassembly, and tighten the bolts as described in section 5.

8.3 SEAT FOR SWING TYPE VALVES

Similar to the gate valve, only limited work is possible. Refer to the gate valve section 6.3.

9.0 GATE, GLOBE AND CHECK VALVES WELDED BONNET OR CAP

The only one difference with respect to the above mentioned cases is that there is a weld between body and bonnet or cover.

Maintenance is only limited to the packing area.

10.0 PWHT (POST WELD HEAT TREATMENT)

10.1 PWHT RESPONSIBILITY

Smith is responsible for all valve fabrication PWHT during manufacture of valve.
The end user is responsible for any PWHT required after welding the valve in line.

10.2 PWHT REQUIREMENTS / RECOMMENDATIONS

PWHT shall be performed in accordance with the appropriate user's WPS-PQR instructions.

All heating shall be performed with localized heating equipment to minimize adverse effects to the rest of the valve. The heat band shall be extended to include the weld HAZ (heat affected zone) of the joints.

In the absence of a governing specification, the requirements of ASME B31.1 or B31.3 for PWHT shall be considered.

For NACE valves, a NACE qualified user's WPS shall be used.

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Furnace heating of a complete valve assembly is not recommended as supplied valve trim part material conditions can be adversely impacted and the packing and gasket may be damaged or destroyed.

Please note that welded bonnet valves cannot be disassembled without the removal of the weld. This design should not be used if the valve assembly must undergo PWHT in a furnace. In this case, a bolted bonnet design valve should be used.

10.3 PWHT PROCEDURE

The following steps relate to post weld heat treatment of valve welded in line:

For bolted and welded bonnet valves (localized heating):

1. The valve to undergo PWHT shall be in the lightly closed position.
2. Place the localized heating equipment around the welded joint.
3. Heat to the desired temperature for the desired length of time.
4. Allow the heated assembly to cool before actuating the valve.
5. Make sure that no adverse effect has taken place during heating and that the valve is functional before proceeding.

For bolted bonnet valves (furnace heating):

Disassembly of bolted bonnet valves is permitted only when closed furnace PWHT is the only heating option. Care must be taken in that case in choosing a suitable controlled atmosphere type furnace in the effort to eliminate heat scale formation which may adversely impact the sealing surfaces. This procedure voids the API 598 pressure tests performed during manufacture of the valve.

1. Loosen and remove bonnet bolting.
2. Remove bonnet/stem/gate/disc/piston assembly.
3. The seat rings in gate valves should not be removed.
4. During disassembly of the gate valves, the gate and body shall be marked to ensure that the same gate goes back into the same valve body in the same orientation as it was removed. The gate shall not be rotated when reassembled.
5. Place only the valve body and welded piping in the furnace.
6. Heat to the desired temperature for the desired length of time.
7. Allow the heated assembly to cool.
8. During reassembly, care should be taken to ensure that seats have not rotated or floated off the body during heating.
9. Replace a new bonnet gasket during reassembly following PWHT.
10. Cap screws should be re-installed using recommended bonnet cap screw torque values and practice from the IOM.
11. Cycle valve to ensure full open and close actuation and that seats are secured in place.

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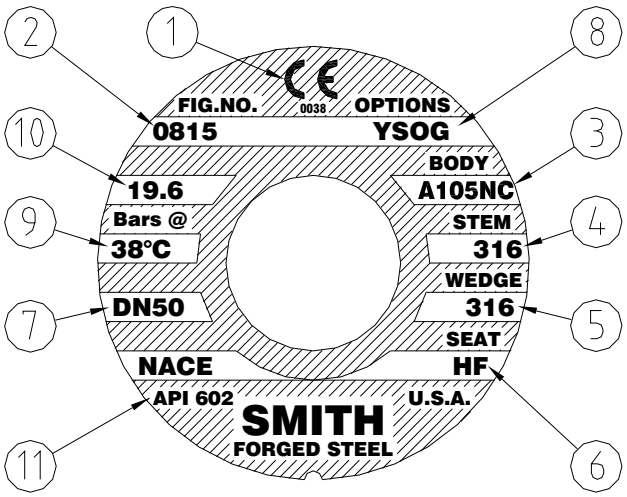
11.0 THE NAMEPLATE

Each SMITH valve is equipped with an identification nameplate, placed over the handwheel for gate and globe valves and on the cover of check valve.

SMITH nameplates are custom laser printed to prevent any possibility of counterfeit or imitation.

The following is an example. The figure shows several descriptive data. The meaning of each data is given below:



1. CE marking, which means that the valves comply with the requirements of European Pressure Equipment Directive 97/23/EC.
2. SMITH Valve's catalogue figure number.
3. Shell material (body, bonnet, cover).
4. Stem material.
5. Closure member material. In case of hardface overlay, "HF" will be marked.
6. Seat material. In case of hardface overlay, "HF" will be marked.
7. Nominal diameter.
8. Valve material code option.
9. Reference ambient temperature per ASME B16.34
10. Maximum working pressure at reference ambient temperature per ASME B16.34
11. Applicable Design codes.

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12. 0 RECOMMENDED TORQUE VALUES

Bolt Size	MATERIAL	TORQUE (ft-lbs)
3/8 - 16	Depending on material	**21 - 37**
7/16 - 14	Depending on material	**14 - 58**
½ - 13	Depending on material	**22 - 87**
5/8 - 11	Depending on material	**46 - 170**
¾ - 10	Depending on material	**214 - 294**

13.0 VALVE COMPONENTS

Gate Valves		Globe Valve		Check Valve	
Item	Description	Item	Description	Item	Description
1	Body	1	Body	1	Body
2	Bonnet	2	Bonnet	2	Cap
3	Seat	3	Seat (integral)	3	Seat
4	Wedge	4	Disc	4	Piston/Ball
5	Stem	5	Stem	6	Gasket
6	Gasket	6	Gasket	7	Cap Bolts
7	Bonnet Bolts	7	Bonnet Bolts	17	Nameplate (not shown)
8	Packing	8	Packing	21	Cage
9	Gland	9	Gland	22	Spring
10	Gland Flange	10	Gland Flange	23	Drive Screws
11	Stud	11	Stud		
12	Gland Nut	12	Gland Nut		
14	Yoke Nut	14	Yoke Nut		
15	Thrustwasher	16	Handwheel		
16	Handwheel	17	Nameplate		
17	Nameplate	19	Handwheel Nut		
18	Lock Washer				
19	Handwheel Nut				

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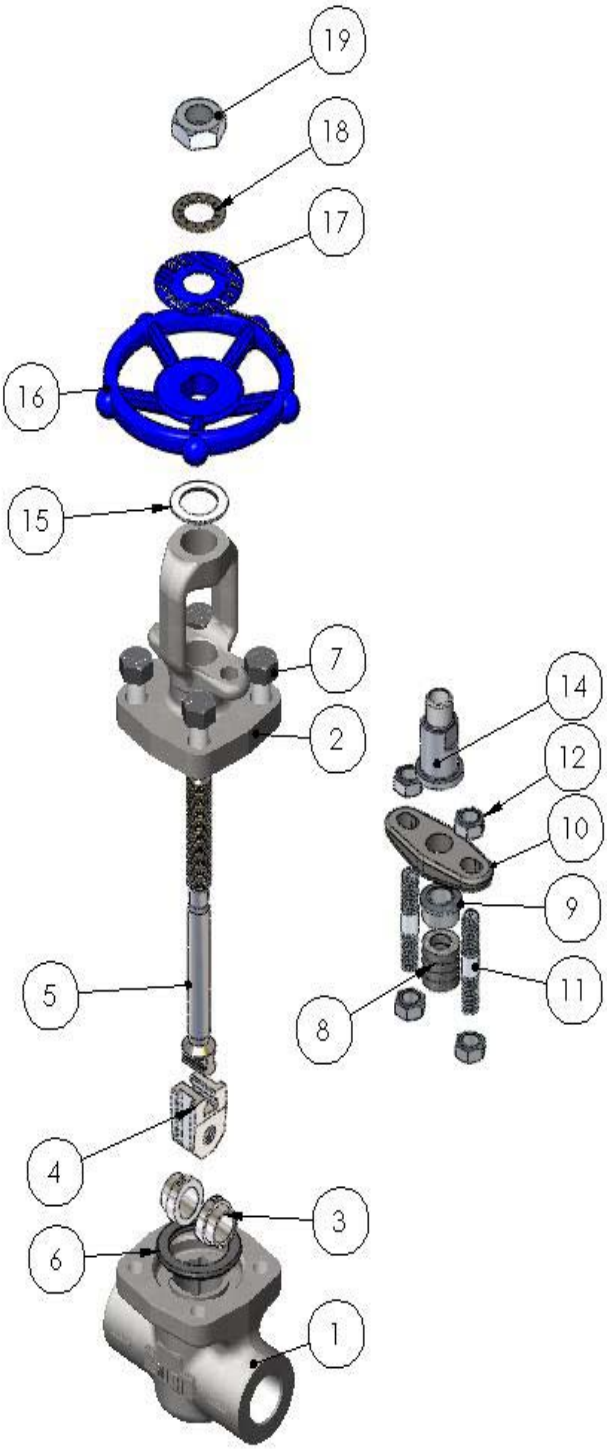

GATE VALVE

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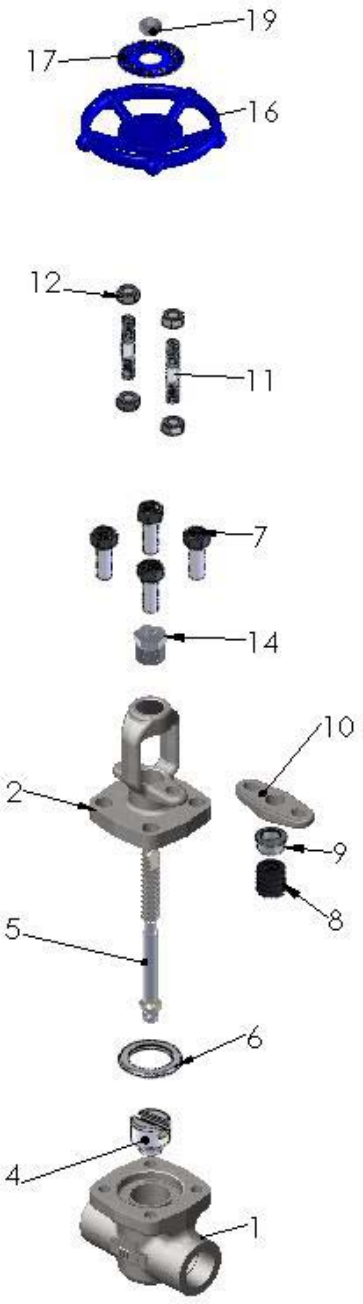

Globe Valve

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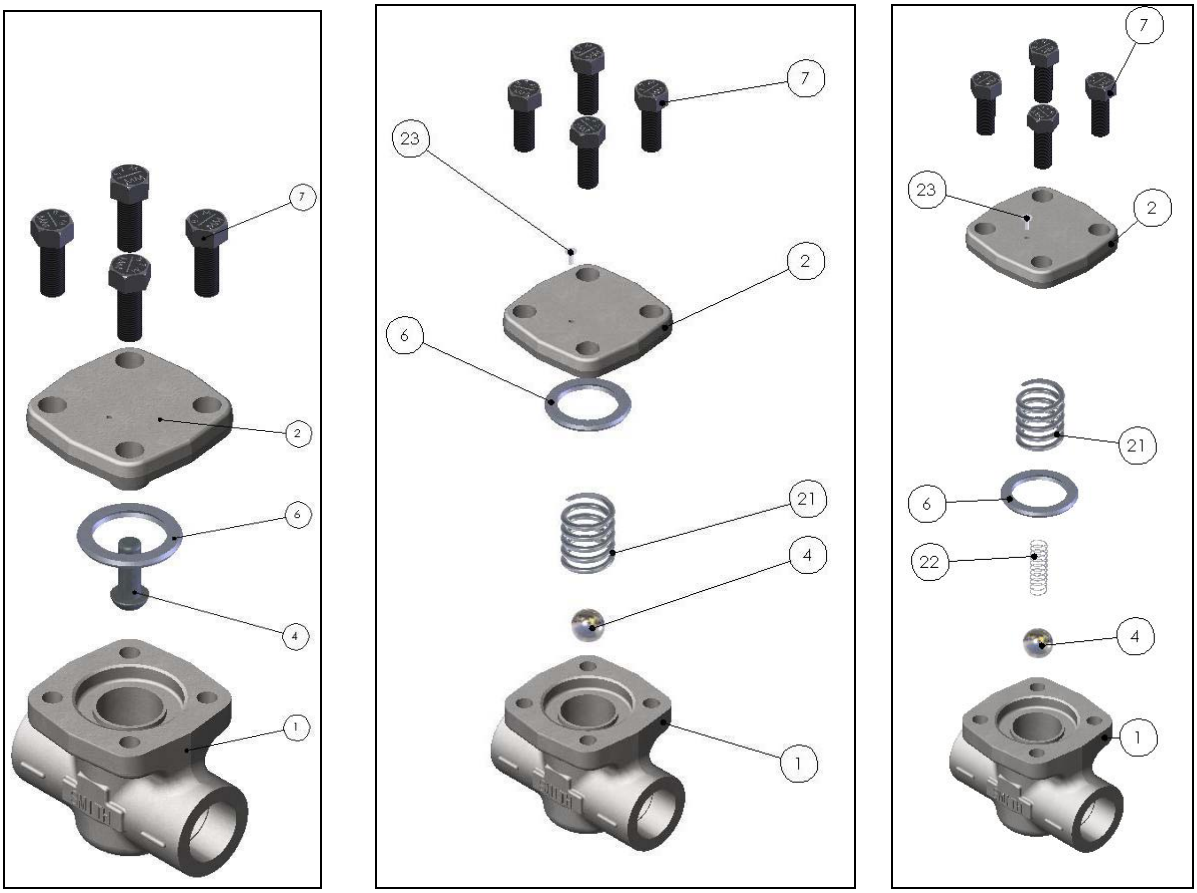

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