# Installation, Operation and Maintenance Instructions

for AC Induction Motors 56- 6800 Frames (NEMA) 63 – 280 Frames (IEC)



# **MARATHON ELECTRIC**

**Contact Motor Customer Service at:** 

Phone: (715) 675-3311

www.marathonelectric.com

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE

OWNER: READ AND SAVE THESE INSTRUCTIONS

## SAFETY INSTRUCTIONS

A This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

# A WARNING

Before installing, using, or servicing this product, carefully read and fully understand the instructions including all warnings, cautions, & safety notice statements. To reduce risk of personal injury, death and/or property damage, follow all instructions for proper motor installation, operation and maintenance.

These instructions are not intended as a complete listing of all details for installation, operation, and maintenance. If you have any questions concerning any of the procedures, STOP, and call the appropriate Regal-Beloit motor company.

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motor is suitable for use on Pulse Width Modulated (PWM) type VFD power. In addition, the nameplate must be marked with the inverter rating; for example, "2:1 CT", "2 to 1 Constant Torque", etc.

# 1.0 INSTALLER/OWNER/OPERATOR RESPONSIBILITY:

# 1.1 ELECTRICAL SAFETY

# A WARNING: ELECTRICAL SHOCK HAZARD

Electrical connections shall be made by a qualified electrical personnel in accordance with all applicable codes, ordinances and sound practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage. Only qualified personnel who are familiar with the applicable National Code (USA = NEC) and local codes should install or repair electrical motors and their accessories.

# A WARNING: ELECTRICAL LIVE CIRCUIT HAZARD

Do not touch electrically live parts. Disconnect, lockout and tag input power supply before installing or servicing motor (includes accessory devices). Use a voltmeter to verify that power is off before contacting conductors.

# A WARNING: ELECTRICAL GROUNDING HAZARD

Failure to properly ground motors, per the National Electrical Code (NEC) Article 430 and local codes may cause serious injury or death to personnel. For general information on grounding refer to NEC Article 250. (Also see "Ground Connections section 3.4.4").

# MARNING: AUTOMATIC RESET PROTECTOR HAZARD

Do not use automatic reset protectors if automatically restarting the motor will place personnel or equipment at risk. Failure to follow this instruction could result in serious personal injury, death and/or property damage

### A WARNING: MANUAL RESET PROTECTOR HAZARD

If a tripped manual reset thermal protector is exposed to a temperature less than  $-7^{\circ}\mathrm{C}$  (20°F) it may reset and restart the motor automatically. If an application requires a motor with a manual reset thermal protector that will be operated at temperatures less than  $-7^{\circ}\mathrm{C}$  (20°F) contact the manufacturer to review the application / motor requirements. Failure to follow this instruction could result in serious personal injury, death and/or property damage

# **1.2 MECHANICAL SAFETY**

# MARNING: LOOSE PARTS HAZARD

Before starting the motor, remove all unused shaft keys and loose rotating parts to prevent them from flying off. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

# WARNING: ROTATING PARTS HAZARD

Keep extremities, hair, jewelry and clothing away from moving parts. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

# **1.3 ENVIRONMENTAL SAFETY**

# **MARNING: HAZARDOUS LOCATIONS**

- (1) The NEC and the local authority having jurisdiction must be consulted concerning the installation and suitability of motors for use in Hazardous Locations. The local authority having jurisdiction must make the final determination of what type of motor is required. The application and operation is beyond the control of the motor manufacturer.
- (2) Division 1 Hazardous Locations motors can only be modified or reworked by the manufacturer or a facility that is Listed under UL's category "Motors and Generators, Rebuilt for use in Hazardous Locations". Failure to follow these instructions could result in serious personal injury, death and/or property damage.
- (3) Do not use a Hazardous Locations motor with a Variable Frequency Drive (VFD) unless the motor nameplate specifically states that the

# 2.0 RECEIVING AND INSPECTION

#### 2.1 INITIAL INSPECTIONS

- **2.1.1 CHECK PACKING LIST AND INSPECT** the packaging to make certain no damage has occurred in shipment. If there is visible damage to the packaging, unpack and inspect the motor immediately. Claims for any damage done in shipment must be made by the purchaser against the transportation company.
- **2.1.2 TURN MOTOR SHAFT** by hand to be certain that it rotates freely. Note: Shaft seals and bearing seals may add drag.
- **2.1.3 CHECK NAMEPLATE** for conformance with purchase order requirements and compliance with power supply and control equipment requirements.

# 2.2 HANDLING:

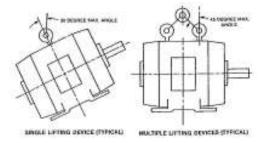
# WARNING: FALLING OBJECT HAZARD

Eyebolts or lifting lugs, where provided, are intended for lifting only the motor and accessories mounted by the motor manufacturer (unless specifically stated otherwise on the motor). Utilizing the motor lifting provision to lift other components such as pumps and gear boxes could result in serious personal injury, death and/or property damage.

# MARNING: FALLING OBJECT HAZARD

Before using the lifting provision, check the eyebolts and/or other lifting means to assure they are not bent or damaged and are completely threaded, seated & secured to the motor. Equipment to lift motor must have adequate lifting capacity. While lifting the motor DO NOT stand under or in the vicinity of the motor. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

# 2.2.1 LIFTING ANGLE LIMITATIONS



**2.3 STORAGE:** Motors, not put into service immediately, must be stored indoors in a clean, dry location. Avoid locations with large temperature swings that will result in condensation. Motors must be covered to eliminate airborne dust and dirt. If the storage location exhibits high vibration, place isolation pads under motor to minimize damage to motor bearings.

- **2.3.1 BEARING LUBRICATION:** Bearings are grease packed at the factory; relubrication upon receipt of motor or while in storage is not necessary. If stored more than one year, add grease per lubrication instructions (Table 4-4) before start-up.
- **2.3.2 SHAFT ROTATION:** It is recommended that the motor shaft be rotated 5 to 10 rotations every three months to distribute the grease in the bearings. This will reduce the chance for corrosion to form on the bearing rolling elements and raceways. Note: Shaft seals and bearing seals may add drag.
- **2.3.3 DAMP OR HUMID STORAGE LOCATIONS**: Treat unpainted flanges, shafts, and fittings with a rust inhibitor. Apply appropriate power to the motor's space heaters (if so equipped)

#### 3.0 INSTALLATION AND OPERATION

WARNING: Only qualified personnel who are familiar with the appropriate national code, local codes and sound practices should install or repair electrical motors and their accessories. Installation should conform to the appropriate national code as well as local codes and sound practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

# A WARNING: ELECTRICAL LIVE CIRCUIT HAZARD

Do not touch electrically live parts. Disconnect, Lockout and Tag input power supply before installing or servicing motor (includes accessory devices). Use a voltmeter to verify that power is off before contacting conductors.

# 3.1 LOCATION

- **3.1.1 SELECTING A LOCATION:** Consideration should be given to environment and ventilation. Motors should be installed in an area that is protected from direct sunlight, corrosives, harmful gases or liquids, dust, metallic particles, and vibration. A motor with the proper enclosure for the expected operating condition should be selected. Provide accessible clearance for cleaning, repair, service, and inspections (See section 3.1.3 for construction clearances). The location should be considered for possible future motor removal / handling. The free flow of air around the motor should not be obstructed.
- **3.1.2 AMBIENT TEMPERATURE LIMITS:** The ambient temperatures of the air inlet to the motor should not exceed 40°C (104°F) or be less than -30°C (-22°F) unless the motor nameplate specifically states an ambient temperature outside of these limits. The ambient inside an enclosure built around the motor shall not exceed the nameplate ambient. For ambient temperatures outside of these limits consult the motor manufacturer.

# A CAUTION: INSULATION DEGRADATION WARNING

Insulation at high temperatures ages at an accelerated rate. Each 10°C increase in temperature reduces the insulation life by one half.

WARNING: HAZARDOUS LOCATIONS AMBIENT LIMIT: Division 1 Hazardous Locations motors shall **NOT** be operated below -25°C (-13°F) ambient. (Low temperatures reduce the component mechanical properties.)

#### 3.1.3 CONSTRUCTION SELECTION per LOCATION:

- **3.1.3.1 DRIPPROOF (OPEN) MOTORS** are intended for use indoors where the atmosphere is relatively clean, dry, and non-corrosive. Recommended a minimum clearance of ½ the shaft height between vent openings and the nearest obstruction.
- **3.1.3.2 TOTALLY ENCLOSED MOTORS** are suitable for indoor or outdoor standard service applications.

**TEAO or AOM (Totally Enclosed Air Over)** motors must be mounted in the air stream. When the motor nameplate states a minimum airflow the motor must be mounted in an air stream meeting this minimum value.

**TEFC (Totally Enclosed Fan Cooled)** motors must meet a minimum distance of  $\frac{1}{2}$  the shaft height between the fan guard grill openings and the nearest obstruction.

**3.1.3.3** HAZARDOUS LOCATIONS MOTORS: Hazardous Locations motors are intended for installations in accordance with NEC Article 500. For all installations involving Hazardous Locations motors, consult the applicable national codes, local codes, and the authority having jurisdiction.

Division 1 Installations – includes Class I & II: Use only motors that are UL Listed and CSA Certified or UL Listed and UL Certified for Canada. These motors bear a separate nameplate that includes the UL Listing Mark and CSA Certification Mark or includes the UL Listing Mark and the UL Mark for Canada. This plate also bears the phrase: "Electric motor for Hazardous Locations" and is marked with the Class, Group and Operating Temperature Code.

<u>Division 2 Installations – Class I only:</u> Use only motors that are CSA Certified and bear the CSA Certification Mark. These motors include a phrase on the main motor nameplate that indicates the motor is CSA Certified for Class I, Division 2 / Zone 2 locations.

<u>Division 2 Installation – Class II only:</u> Use only Class II motors as described above under "Division I Installations".

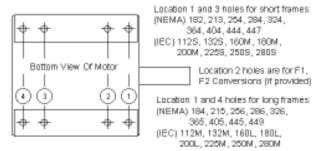
### MARNING: EXPLOSION HAZARD

A motor should never be placed in an area with a hazardous process or where flammable gases or combustible materials may be present unless it is specifically designed and nameplated for this type of service. Hazardous Locations motors are intended for installations in accordance with NEC Article 500. For all installations involving Hazardous Locations motors, consult the NEC, local codes, and the authority having jurisdiction. Failure to follow these instructions could result in serious personal injury, death and/or property damage. (For other limitations see section 1.3)

#### 3.2 MOUNTING MOTOR:

**3.2.1 RIGID BASE (FOOTED):** The motor must be securely installed to a rigid foundation or a mounting surface to minimize vibration and maintain alignment between the motor shaft and the load's shaft. The mounting surfaces of the four mounting pads must be flat within 0.01 inches for 210 frame & smaller; 0.015 inches for 250 frame & larger. [IEC 0.25 mm for 130 frame & smaller, 0.38 mm for 160 frame & larger]. This may be accomplished by shims under the motor feet. For special isolation mounting, contact manufacturer for assistance

#### 3.2.2 RIGID BASE HOLE SELECTION -6 OR 8 HOLES



### 3.2.3 VERTICAL MOUNTING:

**CAUTION: ENCLOSURE PROTECTION CAUTION:** Most Dripproof rigid base (footed) motors do **NOT** meet "Dripproof" requirements when mounted vertically. If the motor is located in unprotected environments, the addition of a drip cover may be available. Drip covers not available for cast iron rigid base motors.

## MARNING: FALLING OBJECT HAZARD

The lifting provision on standard horizontal footed motors is not designed for lifting the motor in a vertical shaft up or shaft down position. (see 2.2.1 lifting angles). Lifting method / provisions for

mounting a rigid base (footed) motor vertically is the responsibility of the installer.

VERTICAL SHAFT DOWN: Most standard horizontal motors thru 449 Fr. (excluding brake motors) can be mounted in a vertical shaft down orientation. For vertical brake motors see section 3.3.6.2.

## **VERTICAL SHAFT UP:**

**MARNING:** HAZARDOUS LOCATIONS VERTICAL MOUNT: Hazardous locations motors must NOT be mounted vertically shaft up without approval by the motor manufacturer. Without proper retaining provisions the rotor may move axially and contact components, creating a spark hazard.

Belted or Radial Load when mounted vertically: The following frame sizes / constructions with applied (axial) down loads within the limit stated are acceptable when mounted vertical

Table 3-1 Belted or Radial Load Applications (All speeds)

Table 3-	i beiled of K	adiai Load Appiid	ations (All s	
Frame Size	Enclosure	Construction	Shaft Up OK	Max Applied Down Load <sup>3</sup>
56	TEFC & ODP	Steel	Yes	25 lbs
140	TEFC	Steel & Cast Iron	Yes	25 lbs
	ODP	Steel	Yes	25 lbs
180	TEFC	All	Yes	35 lbs
100	ODP	Steel	Yes	35 lbs
210	TEFC	All	Yes	40 lbs
210	ODP	Steel	Yes	40 lbs
	TEFC	All	Yes	40 lbs
250	ODD	Steel	Yes	40 lbs
	ODP	Cast Iron	No <sup>2</sup>	N/A
	320 TTFC models	Cast Iron	Eng <sup>1</sup>	N/A
280-320	All Other TEFC	Cast Iron & Aluminum	Yes	30 lbs
	ODP	Cast Iron	No <sup>2</sup>	N/A
	TEFC & ODP	Steel	Build Up Only <sup>4</sup>	N/A
360 &	TEFC	Cast Iron	Build Up Only <sup>4</sup>	N/A
Up	ODP	Cast Iron	No²	N/A
Ор	TEFC & ODP	Steel	Build Up Only <sup>4</sup>	N/A

Notes:

- For TEFC model numbers beginning with 324TTFC or 326TTFC consult the motor manufacturer to determine if a build up motor is required
- 2 The max applied down load is any applied load external to the motor, including such things as sheave weight, fan loads, axial belt force, pump load, etc. If the application is direct drive with no applied radial load, consult the motor manufacturer.
- "Build-up only", refers to motors that are specifically ordered and built for shaft up applications. It does not imply that all buildup motors are suitable for shaft up applications.

# 3.3 APPLICATION ASSEMBLY TO MOTOR:

A CAUTION: EQUIPMENT DAMAGE:

Do not connect or couple motor to load until correct rotational direction is established.

3.3.1 GENERAL: PROPER ALIGNMENT of the motor and driven equipment minimizes vibration levels, maximizes bearing life, and extends the overall life of the machinery. Consult the drive or equipment manufacturer for more information.

A CAUTION: BEARING FAILURE

During assembly do NOT force components onto the shaft. Striking or hammering the component may result in bearing damage.

**3.3.2 DIRECT COUPLING:** Use flexible couplings if possible. For applications that apply radial, axial or moment loading on the motor shaft see section 3.3.3.



#### A CAUTION: BEARING FAILURE

Unless approved by the motor manufacturer do NOT direct couple a vertical shaft up or roller bearing motor. Direct coupling a vertical shaft up motor or a motor with a roller bearing may result in bearing damage.

3.3.3 DIRECT CONNECTED: Radial loading for direct connected equipment (gears, fans etc.) must be approved by the motor manufacturer unless within the maximum overhung load limits (Table 3-2). Combined loading (axial, radial and/or moments) must be approved by motor manufacturer. For belted loads see section 3.3.4.

Table 3-2 Maximum Radial Load (lbf) @ Middle of the Shaft **Extension Length** 

Frame	Motor Rated RPM							
Number	3600	1800	1200	900				
143T	106	166	193	210				
145T	109	170	199	218				
182T	187	230	261	287				
184T	193	237	273	301				
213T	319	317	470	510				
215T	327	320	480	533				
254T	500	631	729	793				
256T	510	631	736	820				
284T	-	866	990	1100				
286T	-	871	1005	1107				
324T	-	950	1100	1215				
326T	-	950	1113	1230				
364T	-	1078	1365	1515				
365T	-	1078	1380	1540				
404T	-	1388	1590	1762				
405T	-	1400	1610	1780				
444T	-	1580	1795	2005				
445T	-	1520	1795	1985				
447T		1455	1765	1985				
449T	-	1640	1885	2130				

Values based on 26,280 hrs B-10 Life

For "End of Shaft" Load multiply value by 0.88

To convert from lbf to N multiply value by 4.4482.

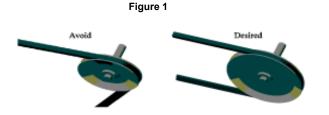
#### 3.3.4 BELTED:

The goal of any belted system is to efficiently transmit the required torque while minimizing the loads on the bearings and shafts of the motor and driven equipment. This can be accomplished by following four basic guidelines:

- Use the largest practical sheave diameter.
- Use the fewest number of belts possible. 2.
- Keep sheaves as close as possible to support bearings. 3
- Tension the belts to the lowest tension that will still transmit the required torque without slipping. It is normal for V-belts to squeal initially when line starting a motor

#### 3.3.4.1 Sheave Diameter Guidelines:

In general, smaller sheaves produce greater shaft stress and shaft deflection due to increased belt tension. See Table 3-3 for recommended minimum sheave diameters. Using larger sheaves increases the contact with belts which reduces the number of belts required. It also increases the belt speed, resulting in higher system When selecting sheaves, do not exceed the manufacturer's recommended maximum belt speed, typically 6,500 feet per minute for cast iron sheaves. Determine belt speed by the following formula:



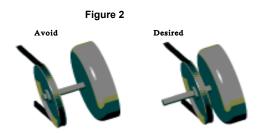
BELT SPEED (Ft/min) =  $\frac{Shaft RPM \times 3.14 \times Sheave Dia (inches)}{12}$ 

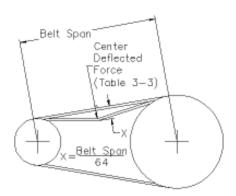
# 3.3.4.2 Number of Belts

In general, use the fewest number of belts that will transmit the required torque without slipping. See Table 3-3 for recommended maximum number of belts. Each belt adds to the tension in the system, which increases load on the shafts and bearings. Belts are most efficient when operated at or near their rated horsepower. If the sheaves have more grooves than the number of belts required, use the grooves closest to the motor.

#### 3.3.4.3 Sheave Location

Install sheaves as close to the housing as possible to increase the bearing life of the motor and driven equipment





# 3.3.4.4 Belt Tension

# A CAUTION: Equipment Failure Caution

Belt tensioning by feel is **NOT** acceptable. Tensioning by "feel" can be very misleading, and can damage motor and equipment. It is normal for V-belts to squeal initially when line starting a motor.

In general, belt tensions should be kept as loose as possible while still transmitting the required torque without slipping. Belt tensions must be measured with a belt tension gage. These inexpensive gages may be obtained through belt manufacturers, or distributors.

Proper belt tension is determined by measuring the force required to deflect the center of the belt a given distance. The proper deflection (in inches) is determined by dividing the belt span in inches by 64. Calculate the proper deflection and then see Table 3-3 for the required "Deflected Force" to achieve that deflection.

After tensioning the belt, rotate the sheaves for several rotations or operate the system for a few minutes to seat belts into the grooves, then re-tension the belts. New belts will stretch during use, and should be retensioned after the first eight hours of use.

Table 3-3 Recommended Minimum Sheave Diameters, Belt Type, Number of Belts and Deflected Force

		120	0 rpm			1800 rpm			3600 rpm			
	Min		Max	Avg.	Min		Max	Avg.	Min		Max	Avg.
	Sheave		#	Deflected	Sheave		#	Deflected	Sheave		#	Deflected
<b> </b>	Dia (in)	Belt	of	Force	Dia (in)	Belt	of	Force	Dia (in)	Belt	of	Force
Motor Hp		Type	Belts	(lbs)		Type	Belts	(lbs)		Type	Belts	(lbs)
0 7E	2.0	οι /∨	1	O 1	2.0	ე\ /∨	1	2.2	2.0	ე\ /∨	1	4.0
1	2.4	3VX	1	4.0	2.2	3VX	1	3.1	2.2	3VX	1	1.6
1.5	2.4	3VX	2	3.1	2.4	3VX	2	2.1	2.2	3VX	1	2.5
2	2.4	3VX	3	2.8	2.4	3VX	2	2.9	2.4	3VX	1	2.7
3	3.0	3VX	2	3.3	2.4	3VX	3	2.9	2.4	3VX	2	2.3
5	3.0	3VX	3	4.0	3.0	3VX	3	3.7	2.4	3VX	3	2.5
7.5	3.8	3VX	4	4.7	3.0	3VX	4	4.1	3.0	3VX	2	4.2
10	4.4	3VX	4	5.4	3.8	3VX	4	4.3	3.0	3VX	3	3.8
15	4.4	3VX	5	5.4	4.4	3VX	4	5.4	3.8	3VX	3	4.4
20	5.2	3VX	6	6.0	4.4	3VX	6	4.8	4.4	3VX	3	5.0
25	6.0	3VX	7	5.6	4.4	3VX	7	5.2	4.4	3VX	4	4.7
30	6.8	3\/X	7	59	5.2	3\/X	7	5.3				
40	6.8	5VX	4	11.6	6.0	3VX	7	6.0				
50	8.2	5VX	4	14.6	6.8	3VX	8	5.9				
60	8.2	5VX	5	14.1	7.4	5VX	4	13.3				
75	10.0	5VX	5	14.5	8.6	5VX	4	14.3		<b>-</b> 1 -		4
100	10.0	5VX	6	16.0	8.6	5VX	6	13	] (	Conta	ct Mo	tor
125	12.0	5V	7	14.1	10.5	5V	6	13.1		Manu	faatuu	
150	13.2	5V	7	15.4	10.5	5V	7	13.4		Manu <sup>.</sup>	iactur	er
200	15.0	5V	8	16.0	13.2	5V	8	13.1	]	when	Raltin	20
250	15.0	8V	6	27.6	14.0	5V	9	13.8				_
300	16.0	8V	7	27.1	14.0	5V/ <b>8V</b>	11 / 7	23.4	36	300 rp	m Mი	tors
350	16.5	8V	7	30.3	14.5	5V/ <b>8V</b>	12 / <b>7</b>	26.0		-		
400	17.5	8V	8	29.1	15.0	5V/ <b>8V</b>	13 / <b>8</b>	25.7	Greater than 25 HP			25 HP
450	18	8V	8	31.6	16.0	5V/ <b>8V</b>	14 / <b>9</b>	25.2				
500	18.5	8V	9	30.7	16.5	5V/ <b>8V</b>	15 / <b>9</b>	26.9	J			
600					17.5	8V	11	26.3	J			
700					19.0	8V	12	27.3	J			
800					20.0	8V	13	28.2				

#### Notes:

- 1. Horsepower is the nameplate motor horsepower, and RPM is the motor (driver) speed.
- 2. Minimum sheave diameters are from NEMA standards where applicable.
- 3. For variable speed applications or values outside these recommendations, consult motor manufacturer.
- 4. Selections are based on a 1.4 service factor, 5 to 1 speed ratio and various Power Transmission Manufacturers' catalogs.
- 5. These selections are for Narrow V-belt sections only. Consult manufacturer for details on conventional V-belt sections (A, B, C, D and E), or other belt types.
- 6. "Average Deflected Force is per section 3.3.4.4 of this document and is the force required to deflect the center of a belt 1/64 of the belt span distance. Tolerance on this force is ±1 lbf for forces ≤10 lbs, and ±2 lbs for forces >10 lbs as measured utilizing a belt tension gage.
- 7. When more than one belt is required the belts must be a matched set (matched for length).
- 8. If possible, the lower side of the belt should be the driving side to increase the length of wrap on the sheave).
- 9. For belted loads do not exceed 125% of 60 Hz operating RPM.

# 3.3.5 VFD (Variable Frequency Drives) OPERATION:

WARNING: VFD Motors with Reset Thermal Protectors
UL Recognition, UL Listing, or CSA certification does not apply to
motors that are equipped with a manual or automatic reset thermal
protector when the motor is operated on VFD power.

**WARNING:** Power Factor Correction Capacitors:

Power factor correction capacitors should never be installed between the drive and the motor.

# A CAUTION: VFD / Motor Setup:

It is the responsibility of the startup personnel during set up of the VFD / motor system to properly tune the drive to the motor for the specific application per the VFD user manual. The correct voltage boost and volts per hertz settings are application dependent and unique to each motor design. Failure to connect over temperature devices (when provided) will void the warranty.

#### 3.3.5.1 Overspeed Capability:

Belted loads: Do not exceed 125% of 60 Hz operating RPM.
Table 3-4 Maximum Safe Continuous Speed (RPM)
For Coupled and Direct Connected Loads

NEMA / [IEC] Frame Size	2-Pole	4, 6, or 8 Pole
56-180 [80-110]	7200 *	5400 *
210-250 [130-160]	5400 *	4200*
280 [180]	5400 *	3600
320 [200]	4500 *	3600
360 [225]	4500 *	2700
400-440 [250-280]	3600	2700
>440 [>280]	3600	1800

<sup>\* =</sup> Fan cooled motors (Totally Enclosed & Hazardous Locations Motors) are limited to a maximum safe continuous speed of 4000 RPM For higher speeds or shortened duty cycle contact motor manufacturer

**3.3.5.2 Cable Lengths:** For optimum insulation life, limit VFD to motor cable lengths of general purpose motors

to Table 3-5 values. Definite purpose VFD motors may accommodate longer cable lengths. For additional information contact motor manufacturer.

**Table 3-5 Max Cable Lengths General Purpose Motors**These values are based on 3 kHz carrier frequency. Add suitable VFD output-side filters when exceeding the listed values

valaco.			
Frame Size	230V	460 V	575 V
NEMA 56-320	600 ft.	125 ft.	40 ft.
NEMA 360-5011	1000 ft.	225 ft.	60 ft.
IEC 80-200	180 m.	40 m.	12 m.
IEC 225-280.	300 m.	70 m.	18 m.

**3.3.5.3 VFD Grounding:** Equipment grounding conductors may be run in the same conduit as the AC motor power leads. This wire must be used as the equipment ground for the motor and not as the fourth current carrying wire of a "WYE" motor circuit. The grounded metal conduit carrying the output power conductors can provide EMI shielding, but the conduit does not provide an adequate ground for the motor; a separate grounding conductor must be used. Grounding the motor neutral (WYE) of a VFD powered motor may result in a VFD ground fault trip. Improper grounding of an inverter fed motor may result in frame voltages in excess of 500 Volts. Refer to Grounding section 3.4.4

#### 3.3.5.4 VFD - Single Phase:

#### **CAUTION: SINGLE PHASE MOTOR FAILURE:**

Single Phase motors are **NOT** suitable for use on VFD power. Connecting a Single Phase Motor to a VFD voids the warranty.

# 3.3.5.5 Stray Voltage on Accessory Leads:

VFD's will couple stray (common-mode) voltage to motormounted RTDs, thermistors, thermostats and space heaters. The leads of these elements must be properly insulated and control input circuits must be designed to withstand this common-mode voltage.

#### 3.3.6 ACCESSORIES / PROVISIONS:

**3.3.6.1 General:** Carefully read and understand the accessory manufacturer's instructions, supplied with motor. Contact the manufacturer for additional information.

# 3.3.6.2 Brake Motors:

# A CAUTION: Vertical Motor Premature Brake Failure

Motors with brakes that are designed for vertical applications are equipped with springs to support the brake pressure plate. Mounting a horizontal brake motor vertically shaft up or down may require a pressure plate spring modification. Failure to modify the brake for the vertical application may result in premature brake failure. If in question, consult brake literature or brake manufacturer.

**Brake Solenoid Wiring:** Do NOT connect the brake solenoid to the output of a VFD. The brake solenoids must be wired to 50/60 Hz line power

# 3.3.6.3 Space Heaters:

Motors provided with space heaters have two leads that are brought into the conduit box or into an auxiliary box. These leads are marked "H1", "H2" ("H3", "H4" if a second space heater is supplied). See the space heater nameplate on motor for heater rating.

# ▲ WARNING: DIVISION 2 EXPLOSION HAZARD

The space heater temperature rating when used in Class I, Division 2 motors shall **NOT** exceed 80% of the auto ignition temperature of the hazardous gas or vapor. See the space heater nameplate on motor for heater Temperature Code and heater rating. Failure to follow this instruction could result in serious personal injury, death and/or property damage

# 3.3.6.4 Thermal Protection:

<u>General Information:</u> When thermal protection is provided, one of the following will be stamped on the nameplate:

- I. "THERMALLY PROTECTED" This motor has built in thermal protection. Thermal protectors open the motor circuit electrically when the motor overheats or is overloaded. The protector cannot be reset until the motor cools. If the protector is automatic, it will reset itself. If the protector is manual, disconnect motor from power supply. After protector cools (five minutes or more) press the reset button and reapply power to the motor. In some cases a motor is marked "Auto" and the connection diagram on the motor will identify T'Stat leads see "2" below. (See warnings on Manual and Automatic reset protectors section 1.1)
- 2. "WITH OVERHEAT PROTECTIVE DEVICE": This motor is provided with an overheat protective device that does not directly open the motor circuit. Motors nameplated with this phrase have either thermostats, thermisters or RTD's. The leads to these devices are routed into the motor conduit box or into an auxiliary box. The lead markings are defined on the nameplate (normally "P1", "P2"). The circuit controlled by the overheat protection device must be limited to a maximum of 600 volts and 360 volt-amps. See connection decal provided inside the terminal box cover. Failure to connect these over temperature devices (when provided) will void the warranty.

# **WARNING: EXPLOSION HAZARD**

For Hazardous Locations motors provided with thermostats UL and the NEC require connection of thermostat leads into the control portion of a manual reset start circuit. Failure to follow this instruction could result in serious personal injury, death and/or property damage

Resistance Temperature Detectors (RTD): When winding and/or bearing RTDs are provided the RTD lead markings are defined on the nameplate. (Normally "R1", "R2", "R3" etc.)

# 3.3.6.5 RTD Alarm & Trip Settings:

Tables 3-6 & 3-7 are suggested initial RTD alarm and trip settings. For motors found to operate significantly below these values the settings may be reduced accordingly.

Table 3-6 Winding RTD – Temperature Limit (°C) 40 °C Max Ambient

Motor Load	Class B Temp Rise≤ 80°C		Class F Temp Rise≤ 105°C		
	Alarm	Trip	Alarm	Trip	
Up to 1.0 SF	130	140	155	165	
>1.0 to 1.15 SF	140	150	160	165	

Table 3-7 Bearing RTD – Temperature Limit (°C) 40 °C Max Ambient

Ambient	Alarm	Trip
Up to 40 <b>°C</b>	95	100
> 40 <b>°C</b>	110	115
Bearings that are Heat Stabilized to 150 °C	130	135

# 3.3.7 GUARDS:

**MARNING:** ROTATING PARTS HAZARD

When devices are assembled to the motor shaft, be sure to install protective devices such as belt guards, chain guards, and shaft covers. These devices must protect against accidental contact with extremities, hair, and clothing. Consider the application and provide guarding to protect personnel. Remove all unused shaft keys and loose rotating parts to prevent them from flying off and causing bodily injury. Failure to follow this warning could result in serious personal injury, death and/or property damage.

# 3.4 ELECTRICAL CONNECTIONS:

WARNING: ELECTRICAL HAZARDS

Before proceeding read Section 1-1 on Electrical Safety. Failure to follow the instructions in Section 1-1 could result in serious personal injury, death and/or property damage

#### 3.4.1 POWER SUPPLY / BRANCH CIRCUIT

WARNING: POWER SUPPLY INCOMPATIBILITY HAZARD Check power supply to make certain that voltage, frequency and current carrying capacity are in accordance with the motor nameplate. Failure to match motor nameplate values could result in serious personal injury, death and/or property damage

A WARNING: BRANCH CIRCUIT SUPPLY HAZARD

Motor and control wiring, fusing, overload protection, disconnects, accessories and grounding must always conform to the applicable electrical codes as well as local codes and sound practices.

**3.4.1.1 Branch Circuit Supply** to a motor should include a disconnect switch, short circuit current fuse or breaker protection, motor starter (controller) and correctly sized thermal elements or overload relay protection.

# 3.4.1.2 Fuses, Breakers, Overload Relays

Short Circuit Current Fuses or Breakers are for the protection of the branch circuit. Starter or motor controller overload relays are for the protection of the motor. Each of these should be properly sized and installed per the applicable electrical codes as well as local codes and practices.

# MARNING: PROTECTIVE DEVICE DISABLED HAZARD

DO NOT bypass or disable protective devices. Protection removal could result in serious personal injury, death and/or property damage

# 3.4.1.3 AC Power Supply Limits

Motors are designed to operate within the following limits at the motor terminals:

- 1- AC power is within +/- 10 % of rated voltage with rated frequency applied. (Verify with nameplate ratings) **OR**
- 2- AC power is within +/- 5% of rated frequency with rated voltage **OR**
- 3- A combined variation in voltage and frequency of +/- 10% (sum of absolute values) of rated values, provided the frequency variation does not exceed +/-5% of rated frequency.
- 4- For 3 phase motors the line to line full load voltage must be balanced within 1%.
- 5- If the motor is rated 208-230V, the voltage deviations must be calculated from 230V.

#### **CAUTION: Reduced Motor Performance**

Operation outside of these limits will degrade motor performance and increase operating temperature.

# 3.4.2 TERMINAL BOX:

# **3.4.2.1 Conduit Opening:** For ease of connections,

motors are typically provided with large terminal boxes. Most motors have conduit access in 90 degree increments, the terminal box conduit opening is typically provided via knockouts, holes with covers, or the terminal box is rotate-able. Fabricated conduit boxes may have a removable plate for the installer to provide correctly sized hole(s).

#### 3.4.2.2 Hazardous Locations Motors:

# ▲ WARNING: EXPLOSION HAZARDS

(1) Terminal Boxes mounted to motor with a pipe nipple: If a pipe nipple mounted terminal box is removed or rotated it must be reassembled with a minimum of five full threads of engagement.

(2) Component Removal: Do not set a terminal box component on its machined surfaces. Prior to component reassembly wipe clean all machined surfaces.

(3) Machined Surface Gap (Hazardous Locations Terminal Boxes): The gap between mating surfaces with the machined terminal box MUST BE LESS THAN 0.002 inches. This gap must be checked with a feeler gage along the entire perimeter. If there is visible damage to the mating surfaces, or if the gap between these surfaces exceeds 0.002 inches, DO NOT complete the installation and contact the motor manufacturer. Failure to follow these instructions could result in serious personal injury, death and/or property damage

#### 3.4.3 LEAD CONNECTIONS

Electrical connections to be made per nameplate connection diagram or separate connection plate. In making connections follow the applicable electrical code as well as local codes and practices.

#### **▲ WARNING: ELECTRICAL CONNECTION HAZARD**

Failure to correctly connect the motor leads and grounding conductor can result in injury or death. Motor lead connections can short and cause damage or injury if not well secured and insulated.

## 3.4.3.1 Wire Size (Single Phase) Requirements

The minimum wire size for Single Phase, 115 & 230 Volt Circuits must meet table 3-8 for a given distance between motor and either Fuse or Meter Box.

Table 3-8 Minimum Wire Gage Size Single Phase 115 & 230 Volt Circuits

	Distance (Feet) - Motor to Fuse or Meter Box								
Motor	100	Ft.	200	Ft.	300	300 Ft.		Ft.	
HP	115	230	115	230	115	230	115	230	
1/4	14	14	10	12	8	10	6	8	
1/3	12	14	10	12	6	10	4	8	
1/2	10	12	8	10	6	8	4	6	
3/4	10	12	6	10	4	8	2	6	
1	8	10	6	8	4	6		4	
1 1/2	4	10	0	8		6		4	
2		8		6		4		2	
3		8		6		4		2	
5		6		4		2		0	

# 3.4.3.2 Extension Cords (Single Phase Motors):

Where an extension cord(s) is utilized to provide power to the motor the extension cord(s) must be...(1) the proper gauge size per table 3-8, (2) in good working condition (3) properly grounded.

# 3.4.4 GROUND CONNECTION(S):

# A WARNING: ELECTRICAL GROUNDING HAZARD

For general information on grounding (USA) refer to NEC Article 250. Improper grounding of an inverter fed motor may result in frame voltages in excess of 500 Volts. In making the ground connection, the installer must make certain that a good electrical connection is obtained between motor and grounding lead. Failure to properly ground motors, per the applicable national code (such as NEC Article 430) and local codes may cause serious injury or death to personnel.

**Primary "Internal" Ground:** A grounding conductor must be connected to the grounding terminal provided in the terminal housing. This grounding terminal is either a ground screw, ground lug, or a tapped hole to be used with a separately provided ground screw. The internal grounding feature is accessible inside the terminal housing and must be used as the primary grounding connection.

Secondary "External" Ground: Some motors are provided with a supplemental grounding terminal located on the external surface of the motor frame or feet. This external terminal is for supplemental bonding connections where local codes permit or require such connection

# 3.4.5 START UP:

WARNING: ELECTRICAL SHOCK HAZARD:

Be certain that all connections are secure and the conduit box cover is fastened in place before electrical power is connected. Failure to follow these instructions could result in serious personal injury, death, and/or property damage.

# ▲ WARNING: LOOSE & ROTATING PARTS HAZARD

Before proceeding read Section 1-2 on Mechanical Safety. Failure to follow the instructions in Section 1-2 could result in serious personal injury, death and/or property damage

# MARNING: EXCESSIVE SURFACE TEMPERATURE HAZARD

Motors with the temperature code stated on the nameplate are designed to operate within this limit. Improper application or operation can cause the maximum surface temperature to be exceeded. A motor operated in a Hazardous Location that exceeds this surface temperature limit increases the potential of igniting hazardous materials. Therefore, motor selection, installation, operation, and maintenance must be carefully considered to ensure against the following conditions: (1) Motor load exceeds service factor value, (2) Ambient temperature above nameplate value, (3) Voltages outside of limits (3.4.1.3), (4) Loss of proper ventilation, (5) VFD operation exceeding motor nameplate rating, (6) Altitude above 3300 feet / 1000 meters, (7) Severe duty cycles, (8) Repeated starts, (9) Motor stall, (10) Motor reversing, and (10) Single phase operation. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

# A CAUTION: HOT SURFACE

Normal motor surface temperatures may exceed 90  $^{\circ}$  C (194 $^{\circ}$  F). Touching the motor frame may cause discomfort or injury. Surface temperatures should only be measured with suitable instruments and not estimated by hand touch.

#### 3.4.5.1 Start Up - No Load Procedure

- Check Instructions: Before startup carefully read and fully understand these instructions including all warnings, cautions, and safety notice statements.
- Motor out of storage after more than three months: Check winding insulation integrity with a Megger. If winding resistance to ground is less than 1.5 Meg-ohms consult the local authorized service shop before energizing the motor.
- 3. Check Installation: Mechanical Check tightness of all bolts and nuts. Manually rotate the motor shaft to ensure motor shaft rotates freely. Note: Shaft & bearing seals will add drag. Electrical Inspect all electrical connections for proper terminations, clearance, mechanical tightness and electrical continuity. Be sure to verify connections are made per the nameplate connection diagram or separate connection plate. Replace all panels and covers that were removed during installation before energizing the motor.

# 4. Energize Motor: Check Rotation

If practical check motor rotation before coupling to the load. Unlock the electrical system. Momentarily provide power to motor to verify direction of rotation. If opposite rotation is required, lock out power before reconnecting motor. If motor has a rotational arrow only operate the motor in the rotation identified. Reapply power to ensure proper operation.

#### 5. Record No Load Amps. Watts & Voltage:

Recommend - To establish a baseline value check and record the no load amps, watts, and voltage.

#### 3.4.5.2 Start Up - Load Connected Procedure

- Check Instructions: Before startup carefully read and fully understand these instructions including all warnings, cautions, & safety notice statements.
- Coupling Installation: Check that the connected equipment is properly aligned and not binding. Check that all guards and protective devices are properly installed.
- 3. Energize Motor: When all personnel are clear of the machine, apply power and verify that the load is not transmitting excessive vibration back to the motor though the shaft or the foundation. Verify that motor amps are within nameplate rating. For repeated starts see 3.4.5.3. The equipment can now be fully loaded and operated within specified limits as stated on the nameplate.

#### 3.4.5.3 Jogging and/or Repeated Starts

Do not start more than twice in succession under full load. Repeated starts and/or jogs of induction motors can cause overheating and immediate failure. Contact the motor manufacturer if it is necessary to repeatedly start or jog the motor.

### **4.0 MAINTENANCE:**

# WARNING: Hazardous Locations Motor Repair HAZARD:

Division 1 Hazardous Locations motors can only be modified or repaired by the manufacturer or a facility that is Listed under UL's category "Motors and Generators, Rebuilt for use in Hazardous Locations". Failure to follow these instructions could result in serious personal injury, death and/or property damage.

# MARNING: ELECTRICAL SHOCK HAZARD

Electrical connections are to be made by qualified electrical personnel in accordance with all applicable codes, ordinances and sound practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage. Only qualified personnel who are familiar with the applicable national codes, local codes and sound practices should install or repair electric motors and their accessories.

# **WARNING:** ELECTRICAL LIVE CIRCUIT HAZARD

Do not touch electrically live parts. Disconnect, lockout and tag input power supply before installing or servicing motor (includes accessory devices).

#### **4.1 GENERAL INSPECTION**

Inspect the motor approximately every 500 hours of operation or every three months, whichever occurs first. Keep the motor clean and the ventilation and fin openings clear. The following steps should be performed at each inspection:

- **4.1.1 VENTILATION:** Check that the ventilation openings and/or exterior of the motor is free of dirt, oil, grease, water, etc, which can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
- **4.1.2 INSULATION**: Use a "Megger" periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. If winding resistance to ground is less than 1.5 Meg-ohms consult the local authorized service shop before reenergizing the motor.
- **4.1.3 ELECTRICAL CONNECTIONS:** Check all electrical connectors to be sure that they are tight.

#### **4.2 LUBRICATION & BEARINGS:**

The lubricating ability of grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Longer bearing life can be obtained if the listed recommendations are followed:

NOTE: If lubrication instructions are provided on the motor nameplate, the nameplate instructions will supersede these instructions. Motors marked "Permanently Lubricated" do not require additional service.

#### CAUTION: BEARING / MOTOR DAMAGE WARNING

Lubricant should be added at a steady moderate pressure. If added under heavy pressure bearing shield(s) may collapse. Over greasing bearings greatly increases bearing friction and can cause premature bearing and/or motor failure.

**4.2.1 GREASE TYPE** (unless nameplate states otherwise): Nameplate Ambient Temperature between -30°C (-22°F) to 65°C (150°F) inclusive: Recommended grease for standard service conditions is Mobil Polyrex ® EM. Equivalent and compatible greases include: Texaco Polystar RB, Rykon Premium #2, Pennzoil Pen 2 Lube, Chevron SRI & Mobil SHC 100.

Nameplate Ambient Temperature below -30°C (-22°F): Special low temperature grease is recommended, such as Aeroshell 7 or Beacon 325 for ball bearings and Mobil SHC 100 for roller bearings.

Nameplate Ambient Temperature above 65°C (150°F): Dow Corning DC44 or equivalent, a special high temperature grease is required. Note that Dow Corning DC44 grease does not mix with other grease types.

For RTD settings see Table 3-7.

# **4.2.2 BEARING OPERATING TEMPERATURE:**

A CAUTION: HOT SURFACE

The external surface temperature of the end shield (bracket) bearing hub may reach 100° C (212° F) during normal operation. Touching this surface may cause discomfort or injury. Surface temperatures should only be measured with suitable instruments and not estimated by hand touch.

# 4.2.3 LUBRICATION INTERVALS: (For motors with regreasing provisions)

# Eq. 4.2 <u>Lubrication Interval</u> = [(Table 4-1) hrs] x [Interval Multiplier (Table 4-2)] x [Construction Multiplier (Table 4-3)]

Table 4-1 Lubrication Intervals (Hours) These values are based on average use.

	Operati	Operating Speed – RPM (See Table 3.4 for Maximum Operating Speed)					
NEMA / [IEC] Frame Size	<7200	<5400	<4500	<3600	<1800	<1200	
56-180 [80-110]	2500 Hrs.	4000 Hrs	5000 Hrs	6000 Hrs.	17000 Hrs.	20000 Hrs.	
210-250 [130-160]		2500 Hrs	4000 Hrs	5000 Hrs.	12000 Hrs.	16000 Hrs.	
280 [180]		2000 Hrs	3000 Hrs	4000 Hrs.	10000 Hrs.	14000 Hrs.	
320 [200]			2000 Hrs	3000 Hrs.	9000 Hrs.	12000 Hrs.	
360 [225]			1500 Hrs	2000 Hrs.	8000 Hrs.	10000 Hrs.	
400-440 [250 – 280]				1500 Hrs.	4000 Hrs.	7000 Hrs.	
>440 [>280]				1000 Hrs.	3000 Hrs.	5000 Hrs.	

Seasonal Service: If motor remains idle for more than six months, Lubricate at the beginning of the season, then follow lubrication interval. Do not exceed maximum safe operating speed Table 3-4 without manufacturer's approval

**Table 4-2 Service Conditions** 

Use highest level Multiplier: Maximum Ambient Temperature and Contamination are independent factors

Severity of Service	Maximum Ambient Temperature	Atmospheric Contamination	Multiplier
Standard	Less than 40° C (104° F)	Clean, Slight Corrosion, indoors, less than 16 hrs per day	1.0
Severe	Above 40° C (104° F) to 50° C	Moderate dirt or Corrosion or outdoors or more than 16 hrs per day	0.5
Extreme	Greater than 50° C or Class H Insulation	Severe dirt or Abrasive dust or Corrosion	0.2

**Table 4-3 Construction Multiplier** 

Construction	Multiplier
Angular Contact or Roller Bearing	0.5
Vertical Motor	0.5
All others	1.0

**Table 4-4 Relubrication Amounts** 

Frame	Size	Volume				
NEMA	IEC	Cu. In.	Fluid oz	ml		
48-56	80	0.25	0.14	4.0		
143-145	90	0.25	0.14	4.0		
182-184	110	0.50	0.28	8.0		
213-215	130	0.75	0.42	12.5		
254-256	160	1.00	0.55	16.0		
284-286	180	1.50	0.83	25.0		
324-326	200	2.00	1.11	33.0		
364-365	225	3.00	1.66	50.0		
404-405	250	3.80	2.11	62.0		
444-449	280	4.10	2.27	67.0		
>449	>280	4.50	2.50	74.0		

For regreasing while operating multiply volume by 125%.

# 4.2.4 LUBRICATION PROCEDURE: (For Motors with Regreasing Provisions)

#### **CAUTION: BEARING DAMAGE WARNING**

Added grease must be compatible with the original equipment's grease. If a grease other than those stated in 4.2.1 is to be utilized contact the motor manufacturer. Nameplate information supersedes section 4.2.1 (GREASE TYPE). New grease must be free of dirt. Failure to follow these instructions and procedure below may result in bearing and/or motor damage.

For an extremely dirty environment, contact the motor manufacturer for additional information.

#### **LUBRICATION PROCEDURE:**

- 1. Clean the grease inlet plug or zerk fittings prior to regreasing.
- (If present) Remove grease drain plug and clear outlet hole blockage.

#### **CAUTION: GREASE DRAIN PLUGGED:**

Old grease may completely block the drain opening and must be mechanically removed prior to regreasing. Forcing a blocked drain open by increased greasing pressure may collapse bearing shields and / or force excess grease through the bearings and into the motor.

- 3. Add grease per Table 4-4
- **4.** Re-install grease inlet and drain plugs (if removed).

#### **WARNING: EXPLOSION HAZARD**

**Do NOT** energize a Hazardous Locations motor without all grease fittings properly installed.

# 4.2.5 EXAMPLE: LUBRICATION

Assume - NEMA 286T (IEC 180), 1750 RPM Vertical motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

- 1. Table 4-1 list 10,000 hours for standard conditions.
- Table 4-2 classifies severity of service as "Severe" with a multiplier of 0.5.
- **3.** Table 4-3 lists a multiplier value of 0.5 for "Vertical"
- **4.** (Eq. 4.2) Interval =  $10,000 \text{ hrs } \times 0.5 \times 0.5 = 2500 \text{ hrs}$

Table 4-4 shows that 1.5 in of grease is to be added.

Relubricate every 2,500 hrs of service with 1.5 in of recommended grease.

# 4.3 TROUBLE-SHOOTING

WARNING: READ INSTRUCTIONS:

Before trouble-shooting a motor, carefully read and fully understand the warnings, cautions, & safety notice statements in this manual.

**▲ WARNING:** Hazardous Locations Motor Repair:

Motors nameplated for use in Division 1 Hazardous Locations can only be disassembled, modified or repaired by the plant of manufacturer or a facility that is Listed under UL's category "Motors and Generators, Rebuilt for use in Hazardous Locations". Failure to follow these instructions could result in serious personal injury, death and/or property damage

#### **CAUTION: DISASSEMBLY APPROVAL REQUIRED:**

Motor disassembly must be performed by a party approved by the motor manufacturer. To disassemble the motor without approval voids the warranty.

# 4.3.1 GENERAL TROUBLE-SHOOTING WARNINGS

- 1. DISCONNECT POWER TO THE MOTOR BEFORE PERFORMING SERVICE OR MAINTENANCE.
- 2. Discharge all capacitors before servicing motor.
- Always keep hands and clothing away from moving parts.
- Be sure required safety guards are in place before starting equipment.
- 5. If the problem persists contact the manufacturer.

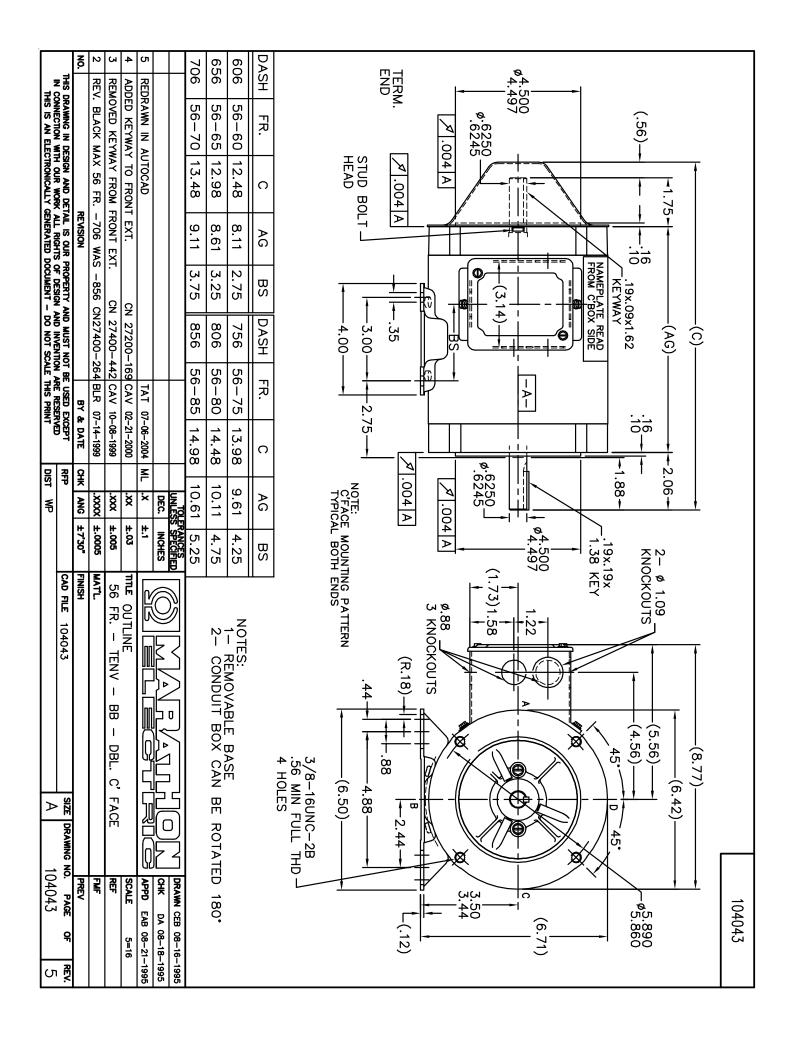
4.3.2 Motor Trouble-shooting Cause / Corrective Action - Table 4-5

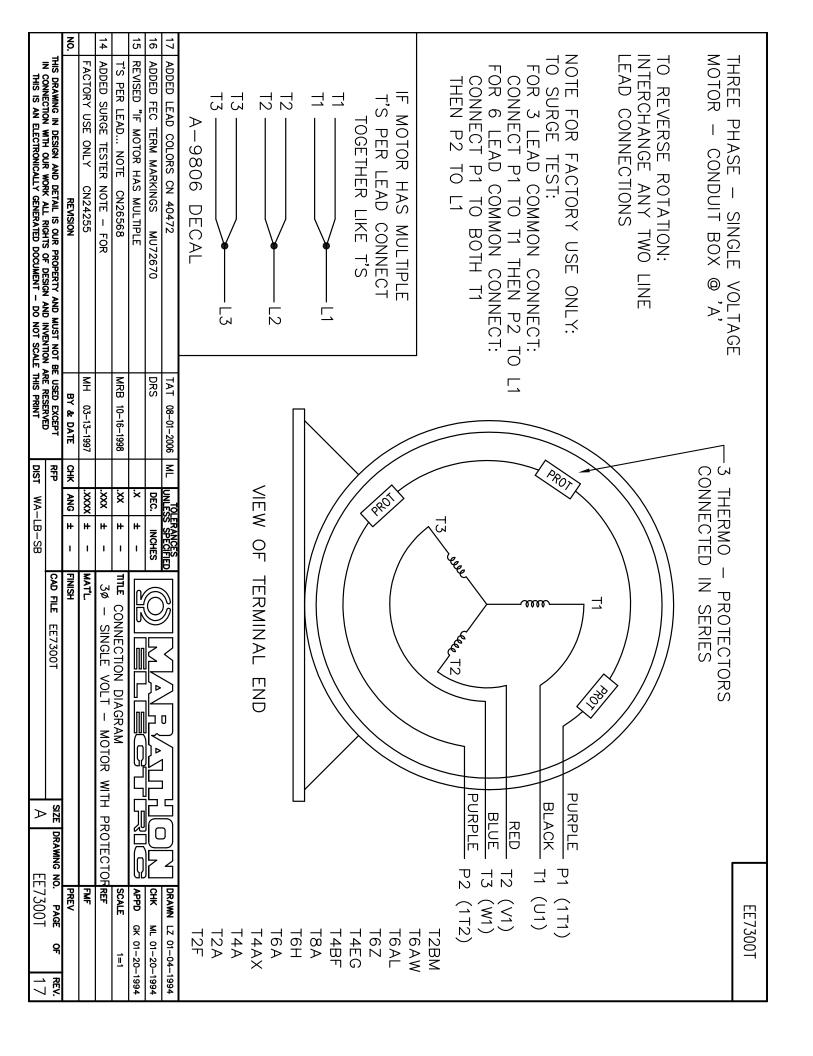
loo		Likely Cause:	Corrective Action:					
		Likely Cause:						
Mot	or f	fails to start upon initial installation:						
4	<b>A</b> .)	Supply voltage is too low or is severely unbalanced (one phase is low or missing).	(1) Check power supply fuses (2) Match motor lead wiring to nameplate connection diagram and supply voltage (3) Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3). Correct as needed (4) Obtain correct					
E	В.)	Motor leads are miswired at conduit box.	motor to match actual supply voltage.					
	C.)	Driven load exceeds motor capacity	(1) Verify that motor & load turn freely (2) Disconnect motor from load & ensumotor turns freely. Note: Roller bearings make noise when motor is uncoupled as shaft is rotated (3) Verify that motor starts when disconnected from load (					
<b>⊢</b> ⊢	D.)	Load is jammed.	Remove excessive / binding load if present.					
E	E.)	Fan guard is bent and making contact with fan	Replace fan guard & fan (if blades are damaged)					
F	F.)	VFD with power factor capacitors installed	Remove power factor correction capacitors if equipped					
(	G.)	VFD with motor neutral lead grounded	Ensure that motor neutral lead is ungrounded					
÷	Н.)	VFD programmed incorrectly	(1) Repeat checks listed above (2) Verify that VFD current limit and starting boost are set correctly (5) Double-check motor and feedback parameter settings and VFD permissives (6) Repeat autotune (for vector drives) procedure (7) Consult VFD supplier.					
Mot	or l	has been running, then slow down, s	stalls, or fails to restart:					
,	<b>A</b> .)	Supply voltage has drooped or has become severely unbalanced	(1) Replace fuse or reset circuit breaker. Allow motor to cool down before resetting manual protector on motor. <b>Warnings</b> - See section 1.1 for automatic and manual reset protector warnings (2) Verify that rated and balanced supply voltage has been restored before restarting motor. Measure voltage during restart. Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3).					
E	В.)	Motor is overloaded	(1) Verify that motor & load turn freely. Repair binding components as needed (2)					
C	C.)	Motor bearings are seized	Reduce driven load to match motor capacity or increase motor size to match load					
	D.)	Load Is jammed.	requirements.					
E	E.)	VFD will not restart motor after tripping	(1) Check fault codes on VFD and follow VFD troubleshooting procedures (2) Verify that VFD input voltage is balanced and within limits (3) Remove excessive mechanical load if present.					
F	F.)	Capacitor failure on single phase motor (if equipped)	Warning: Potential Shock Hazard: Contact service shop to check capacitor.					
Mot	or 1	takes too long to accelerate:						
/	<b>A</b> .)	Motor leads are not connected correctly	Match motor lead wiring to nameplate diagram.					
E	В.)	Supply voltage has drooped or become severely unbalanced.	(1) Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3). Correct as needed (2) Obtain correct motor to match actual supply voltage.					
	C.)	Load exceeds motor capability	Determine correct motor size and contact motor representative to obtain replacement motor.					
[	D.)	Faulty start capacitor (Single Phase)	Motor may be too small for load. Record acceleration time. Start capacitors may fail if acceleration time exceeds 3 seconds.					
E	E.)	Mechanical Failure	(1) Check to make sure motor & load turn freely (2) Disconnect motor from load & ensure motor turns freely					
Mot	or ı	rotates in the wrong direction:						
	<b>A</b> .)	Incorrect wiring connection at motor	[Single Phase] Reconnect motor according to wiring schematic provided. Note: Some motors are non-reversible					
			[Three Phase] Interchange any two power supply (phase) leads.					
Mot	or	overheats or overload protector repo	eatedly trips					
,	<b>A</b> .)	Driven Load is excessive	(1) If motor current exceeds nameplate value, ensure that driven load has not increased. Correct as needed. (2) If new motor is a replacement, verify that the rating is the same as the old motor. If previous motor was a special design, a general purpose motor may not have the correct performance.					
	В.)	Ambient temperature too high	Most motors are designed to operate in an ambient up to 40 $^{\circ}\text{C}.$ (See section 4.2.2 Hot Surface Caution)					
C	C.)	Motor cooling fins and/or vent openings blocked	Remove foreign materials — clear vent openings, fan guard air inlets and frame fins (TEFC motors)					
-			TEAO (Totally Enclosed Air Over) motors: Measure airflow next to motor surface					

	E.)	Motor is started too frequently	See section 3.4.5.3				
	F.)	Supply voltage too low, too high, or unbalanced	(1) Ensure that steady state supply voltage at motor terminals is within limits (s section 3.4.1.3) Correct as needed (2) Reconnect motor per input voltage Obtain correct motor to match power supply.				
Мо	tor	Vibrates					
	<b>A</b> .)	Motor misaligned to load.	Realign load				
	В.)	Load out of balance (Direct drive application)	(1) Ensure that load is dynamically balanced: (2) Remove motor from load and inspect motor by itself. Verify that motor shaft is not bent. Rule of thumb is 0.002" runout for shafts extension lengths up to 3.00". Add 0.0005" per every additional inch of shaft length beyond 3.00".				
	C.)	Uneven tension on multiple belts	Mixing new with used belts. Replace multiple belt applications with a complete set of matched belts.				
	D.)		(1) De-energize motor and record vibration as load coasts from 100% speed to 0 RPM. If vibration drops immediately, vibration source is electrical. If levels do not drop immediately, source is mechanical (2) Redesign system to operate below the resonant point (3) On VFD-driven loads, program skip frequencies to bypass resonant points (4) Increase carrier frequency to obtain <3% THD current (5) On variable torque loads reduce volts/hertz below base speed.				
	E.)	VFD torque pulsations	(1) Adjust VFD to obtain <3% THD current @ rated motor current (2) Adjust VFD stability for smooth operation. Vector drives may be unstable at light load.				
	F.)	Motor miswired at terminal box	Match motor lead wiring to nameplate connection diagram.				
	G.)	Uneven, weak or loose mounting support.	Shim, strengthen or tighten where required.				
	Н.)	Motor bearings defective	Test motor by itself. If bearings are bad, you will hear noise or feel roughness. Roller bearings are normally noisy when operated without load. If sleeve bearing, add oil per nameplate instructions. For motors with regreasing provisions, add grease per relubricating instructions (see section 4.2.3). If noise persists contact warranty service.				
	l.)	Motor out of balance	Disconnect from load. Set motor on rubber pads on solid floor. Secure a $\frac{1}{2}$ height key in shaft keyway and energize from balanced power supply @ rated voltage. Record vibration levels and compare with appropriate standards. If excessive vibration persists contact motor manufacturer.				

Beari	ngs repeatedly fail.	
<b>A</b> .)	Load to motor may be excessive or unbalanced	(1) If belt drive check system per section 3.3.4. (2) Other than belting, check loading on motor shaft. An unbalanced load will also cause the bearings to fail. (3) Check runouts of mating components, such as a C-face and pump flange.
В.)	Bearings contaminated.	Motor enclosure not suitable for environment. Replace with correct enclosure construction
C.)	Incorrect grease or bearings for ambient extremes.	See section 4.2.1
D.)	VFD bearing damage	Ground brush, common mode filter, or insulated bearings must be added. Contact motor manufacturer.
Motor	r, at start up, makes a loud rubbing, ເ	grinding, or squealing noise.
<b>A</b> .)	Contact between rotating and stationary components	Belt squeal during across the line starting is normal: (1) Verify that supply voltage is within limits (see section 3.4.1.3). (2) Ensure that motor lead wiring matches nameplate connection diagram: (3) Isolate motor from load. (4) To locate point of contact turn motor shaft by hand. (5) If point of contact is not located contact motor service shop.
Start	capacitors repeatedly fail.	
A.)	The motor acceleration time is too long	Motor may be too small for load. Record acceleration time. Start capacitors may fail if acceleration time exceeds 3 seconds.
В.)	Motor is being started too frequently	Excessive starting will damage motor capacitors. Contact motor manufacturer if motor is started more than 20 times/hour or if acceleration time exceeds 3 seconds.
C.)	Motor voltage low	Verify that voltage at the motor terminals is within limits (see section 3.4.1.3).
D.)	Defective start switch inside motor	Motor internal switch failure overheats start capacitor. Contact service shop or motor manufacturer.
Run c	apacitor fails.	
A.)	High ambient temperature	Verify that the ambient does not exceed motor's nameplate value
		•

,		Verify that voltage to the motor terminals is within limits (see section 3.4.1.3).
C.)	Power surge to motor (caused by lightning strike or other high transient voltage).	If a common problem, install surge protector.





# Warranty Card Complete and return to validate warranty

Please complete this card and return it to **seepex** Inc. By using this card, the valid warranty period will commence at the pump "start-up" date. If this card is not completed the warranty coverage period will commence on the date the pump is shipped from the **seepex** factory. This card must be completed and mailed no later than one year from the date of shipment.

User Entity:		
Mailing Address:	Pump Mode	el#
	Pump Commission	n #:
	Pumped Produ	uct:
Contact Person:	Diff. Pressure:	Flow Rate:
Phone Number:	Temperature:	Visosity:
Fax Number:	Solids Size:	Solids %:
Was the pump delivered as scheduled? Was the appearance of the pump acceptable? Did the pump suffer any freight damage? Did Other Comments:	Yes No Did you receive:	rm as expected?Yes No - Data Sheets?Yes No -O&M Manuals?Yes No ange a start-up?Yes No
Name of person completing card (please print):		
Date:	Signature:	



seepex, Inc. 511 Speedway Drive Enon, OH 45323 Phone (937) 864-7150 Fax (937) 864-7157 www.seepex.com sales@seepex.net

# TERMS & CONDITIONS OF SALES AND/OR REPAIR

The following terms and conditions shall apply to an order for all or any part the articles covered by this quotation unless specifically excepted therein:

#### **Prices**

Any prices quoted shall only be valid for orders placed within 30 days from the date of issue of the quotation. Prices are F.O.B. our plant in U.S. or Canadian dollars. We reserve the right to correct typographical or clerical errors.

All orders are subject to approval by our Credit Department. Unless otherwise stated, if payment for the invoice due is not made within thirty (30) days after shipment, administration fees of eighteen percent (18%) per year (equivalent to a nominal monthly interest rate of 1½%) will be applied on overdue accounts. The terms and conditions herein set forth are based upon tariffs, taxes, foreign exchange rates, delivery, and other conditions in effect on the date of this contract. In the event changed conditions, legislations, regulations, or other matters shall become applicable to any quotation, contract, or delivery hereunder, any increased exchange, duties, taxes, ocean freight, or other charges resulting from such action shall be for the customer's account and seepex, Inc. may charge such increased duties, taxes, or charges to the customer.

Unless the order includes the appropriate exemption certificates and/or licenses, duties, and taxes levied by Federal, State, or other governments are required to be charged automatically at the rate imposed at time of importation/shipment. Any change in law, regulations, or Government Department practice which causes a variation of any kind in the applicable charges from the amounts allowed for the quotation, shall result in an equivalent change in the price quoted.

Until payment is made in full, seepex, Inc. shall retain the right, without notice, to repossess and/or retain the items, and/or dispose of them, for its benefit and hold the customer responsible for any loss. Customer agrees to enter into any agreements, contracts, or notices required to confirm such rights.

In order to secure any obligations due to seepex, Inc. from the customer (whether or not under this contract) the customer grants and confirms in seepex, Inc. a security interest in:

- the merchandise covered by this contract, a)
- in all property and funds of the customer now or hereafter in seepex, Inc. possession, whether or not arising out of this contract, and in all additions, accessions, and proceeds of such merchandise and/or property. The customer hereby authorizes **seepex**, Inc. to sign alone any financing statement or statements and to do all and any other things which may be necessary to perfect such security interest.

<u>Cancellation</u>
After acceptance, orders may be canceled only with our approval and payment in accordance with contract by the customer for work performed and/or material expenses incurred by us to date of cancellation. We reserve the right to cancel the order if the customer's financial condition, in our sole judgment, places the payment in jeopardy.

No credit will be allowed for returns unless our

authorization in writing for such returns has been obtained beforehand. A copy of this authorization is to be returned with the item as the packing slip. Shipment

- Handling Charge: Customer shall be responsible for making all arrangements for shipment of the order with a suitable carrier. In the event that customer requests that seepex make arrangements for shipment, then customer agrees to pay to seepex, in addition to the applicable shipping charges, a handling charge in the amount of 10% of the shipping charges with a minimum \$5.00 to a maximum charge of \$150.00, with special services requiring
- additional charges.

  New Articles: Where shipping instructions indicate no exact routing, our best judgement will be used in determining routing but we shall not be liable for any charges beyond F.O.B. point. If change are made at customer's request in a) F.O.B. point, b) in our normal routing from either the manufacturers' or our own plants and in these changes involve extra costs, such costs shall be for the customer's account, unless otherwise noted on the seepex price
- Repair Work: Defined as work and services performed by **seepex**, Inc. All orders shall be delivered to and picked up from our plant unless otherwise specified. All costs of delivery shall be for the customer's account unless otherwise agreed to in writing prior to shipment.
- All Orders: On collect freight shipments, cartage charges from plant to carrier are for customer's account. Title to articles passes to customer upon delivery to carrier acting as customer's agent subject to any right of retention by us. All claims for shortage in, and damages in, shipment or otherwise must be reported to carrier immediately upon receipt with copy or report to ourselves within five (5) days.

### **Guarantee**

- New Articles: We guarantee articles of our manufacture against defects in material and/or workmanship for a period of three (3) vears from date of acceptance, providing that the articles have been installed, maintained, and operated in accordance with our recommendations and instructions.
- Repair Work: Defined herein as work and services performed by seepex, Inc. We

- guarantee all work and services performed by us against defect arising from workmanship and/or materials provided by us for a period of ninety (90) calendar days from the date of shipment to customer.
- All Orders: Claims shall be submitted promptly in writing to seepex, Inc. Replacement and/or repair under guarantee shall be made F.O.B. our plant. Our liability under these guarantees is limited to the replacement and/or repair only of defective material or workmanship and in no event shall seepex, Inc. be liable for any loss or damage of whatever kind of nature out of defects in material and/or workmanship, or resulting from delay, or loss of use of articles, or any installation into which the article may be installed, or arising out, of the contract of the work or service or from negligence.

seepex, Inc. shall not be liable for any loss or damage resulting from delay and/or late delivery due to causes beyond our reasonable control. In no event shall seepex, Inc. be liable for any claim exceeding the amount of this order. Our guarantee on products of other than our own manufacture is limited to the guarantee extended to us by the original manufacturer. On any claims for repairs and/or replacement under such guarantee, all costs incurred by us which are not underwritten by the original manufacturers shall be for the claimant's account. Except as stated above no representations, conditions, or warranties are made with respect to products, work, or services, express or implied verbal or otherwise, including warranties of merchantability and fitness. Our guarantee and warranty shall not apply to materials or workmanship which have been subject to misuse, neglect, or accident. seepex, Inc. shall be held free and harmless from any dispute or claim anywhere arising relating to infringement of patent, design, trademark, or copyright of items, sold or repaired under this contract.

## Property rights and risks

The customer's property at all times shall remain at the risk of the customer while being worked on by our personnel or on our premises and shall not be responsible for any loss or damage to the customer's property resulting from any cause

Title to and rights in relation to item sold under this contract/quotations shall remain with seepex, Inc. until such items are paid for, subject to risk on products sold passing to the customer upon acceptance by a carrier or other, which shall constitute good delivery.

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Ausgabe Dokument Blatt 02.01.2006 OM.ADR.01d 2(2)issue

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# **JOHN MEUNIER**

Meadowbank mining Corp. ACP-700R Technical Data Sheet Reference : NC01

# **SAFETY RELIEF VALVE**



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# TOP VALVE\*\*\*

# **Back Pressure & Pressure Relief Valves**

Designed to Enhance the ACCURACY and SAFETY of Metering Pumps



**Back Pressure/Anti-Siphon and Pressure Relief Valves** 

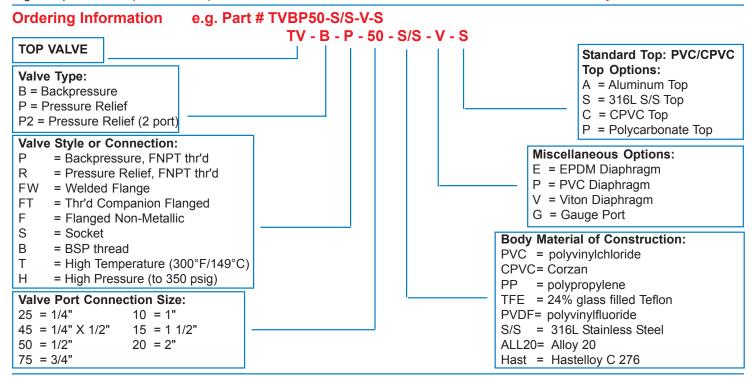
- Long life diaphragm
- Range to 350 PSIG
- Built-in air release and optional gauge port
- Available in PVC, CPVC, PVDF, polypropylene, Teflon, stainless steel, Alloy 20 and Hastelloy C
- 7 sizes (1/4" 2" threaded, flanged or socket)
- Color coded handles indicate size at a glance
- High temperature valves available to (300°F/149°C)

For detailed product information visit our website: primaryfluid.com

# Back Pressure/Anti-Siphon and Pressure Relief Valves

# **Description**

This line of diaphragm style, back pressure/anti-siphon and pressure relief valves features a completely adjustable pressure range to 350 PSIG and a built-in air release to reduce priming difficulties. The valves are available in sizes from 1/4" through 2", eight materials of construction, offer a three year warranty and are available with socket weld, flanged or special threaded connections. High temperature to (300°F/149°C) valves are available. *CRN certification available*. *Please contact factory*.



### Flow Rates

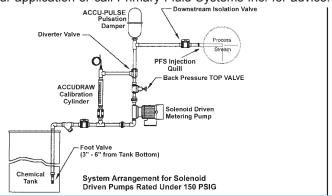
Flow capacity through TOP VALVE back pressure/anti-siphon and pressure relief valves under continuous flow conditions @ 50 PSIG with ambient temperature water.

Size	1/4"	1/4" / 1/2"	1/2"	3/4"	1"	1 1/2"	2"
Flow rate USGPM	4	4	6	8	14	25	40

Note: Capacities will increase with pressure. If pressure is doubled, flow rate wll approximately double. For capacities of valves with pulsating flow, use approximately 1/3 of the given flow rates.

# **Typical Installations**

The installations below are typical installation examples only. Consult your engineering department for the appropriate installation of your application or call Primary Fluid Systems Inc. for advice.



Pressure Relief
TOP VALVE

Pressure Relief
TOP VALVE

Process
Siream

ACCUDRAW
Calibration
Cylinder

(3" - 6" from Tank Bottom)

System Arrangement for Solenoid Driven
(Above 150 PSIG) or Motor Driven Pumps

**Distributed By:** 



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# **JOHN MEUNIER**

Meadowbank mining Corp. ACP-700R Technical Data Sheet Reference : NC01

# **CALIBRATION CYLINDER**

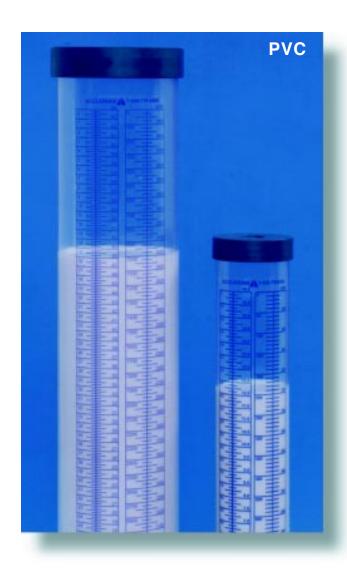


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# **ACCUDRAW®** Calibration Cylinders





ACCUDRAW® has been developed for the accurate calibration of metering pumps. Standard features include:

- · translucent
- chemical resistant
- · break resistant
- threaded or socket
- colored graduations and lettering

- PVC has dual scale USGPH & ml
- PVC sizes 100 20000 ml
- POLY sizes 100 4000 ml
- POLY meets ISO standards
- custom sizes and other materials (acrylic, glass) on request



# ACCUDRAW® Calibration Cylinders "For Accuracy That Counts"

# Sizing and Ordering Information

# Polypropylene Construction

	· · · ·									
Size	Conn.	BC	BTC	BDC						
100 ml	1/2" NPT	AC#1-100	AC#2-100	AC#3-100						
250 ml	1/2" NPT	AC#1-250	AC#2-250	AC#3-250						
500 ml	1/2" NPT	AC#1-500	AC#2-500	AC#3-500						
1000 ml	1/2" NPT	AC#1-1000	AC#2-1000	AC#3-1000						
2000 ml	1.0" NPT	AC#1-2000	AC#2-2000	AC#3-2000						
4000 ml	1.0" NPT	AC#1-4000	AC#2-4000	AC#3-4000						

BC = bottom connection only, open top BTC= bottom and top connections BDC= bottom connection and dust cover top

# **PVC Construction**

**PVC Construction** 

Size/Scale	Conn	BC	BTC	BDC
100 ml/ 1.6 GPH	1/2" NPT	PV#1-100	PV#2-100	PV#3-100
250 ml/ 4 GPH	1/2" NPT	PV#1-250	PV#2-250	PV#3-250
500 ml/ 8 GPH	1/2" NPT	PV#1-500	PV#2-500	PV#3-500
1000 ml/ 16 GPH	1/2" NPT	PV#1-1000	PV#2-1000	PV#3-1000
2000 ml/ 32 GPH	1.0" NPT	PV#1-2000	PV#2-2000	PV#3-2000
4000 ml/ 64 GPH	1.0" NPT	PV#1-4000	PV#2-4000	PV#3-4000
10000 ml/ 160 GPH	2.0" NPT	PV#1-10000	PV#2-10000	PV#3-10000
20000 ml/ 320 GPH	2.0" NPT	PV#1-20000	PV#2-20000	PV#3-20000

Note: PVC cylinders available with socket weld connections. Add suffix "S" to model # e.g. PV#3-100S For BSP threads, add suffix "B" to model # e.g. PV#3-100B

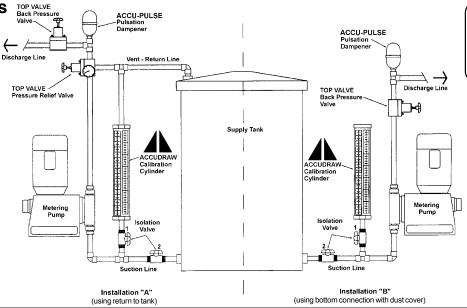
# **Dimensional Information**

# Polypropylene Construction

Model	Size (ml)	Dev (ml)	A (inches)	B (inches)
AC#1	100	1	9.88	1.38
AC#1	250	2	12.44	1.75
AC#1	500	5	14.1	2.33
AC#1	1000	10	17.19	2.63
AC#1	2000	20	20.88	3.38
AC#1	4000	50	23.56	4.38
AC#2/AC#3	100	1	9.25	1.38
AC#2/AC#3	250	2	11.63	1.75
AC#2/AC#3	500	5	13	2.32
AC#2/AC#3	1000	10	16.5	2.69
AC#2/AC#3	2000	20	19.5	3.38
AC#2/AC#3	4000	50	22.13	4.38

Model	Size	Divisions	Size	Divisions	A	В
	(m l)	(m l)	(GPH)	(GPH)	(inches)	(inches)
PV#1	100	1	1.6	0.02	10.24	1.388
PV#1	250	2	4	0.05	11.04	1.888
PV#1	500	5	8	0.05	12.25	2.388
PV#1	1000	10	16	0.125	16.24	2.765
PV#1	2000	20	32	0.25	20.16	3.517
PV#1	4000	25	64	0.25	22.16	4.521
PV#1	10000	200	160	2	22.64	6.906
PV#1	20000	200	320	2	42.19	6.906
PV#2/PV#3	100	1	1.6	0.02	10.75	1.388
PV#2/PV#3	250	2	4	0.05	11.51	1.888
PV#2/PV#3	500	5	8	0.05	12.75	2.388
PV#2/PV#3	1000	10	16	0.125	16.76	2.765
PV#2/PV#3	2000	20	32	0.25	20.67	3.517
PV#2/PV#3	4000	25	64	0.25	22.66	4.521
PV#2/PV#3	10000	200	160	2	23.16	6.906
PV#2/PV#3	20000	200	320	2	42.69	6.906

# Installations



В -

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Tel: (905) 333-8743

**Conversion Factors** 

1 ml = 1 cc

1000 ml = 1 liter ml/sec X 60 = ml/min

1 US gal/min X 0.063 = liters/sec 1 US gal = 3.786 liters

Fax: (905) 333-8746

E:Mail: primary@primaryfluid.com www.primaryfluid.com







# **JOHN MEUNIER**

Meadowbank mining Corp. ACP-700R Technical Data Sheet Reference : NC01

**CORPORATION STOPS** 



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# **PFS Corporation Stops**



PFS Corporation Stops have been designed to inject chemical into the center stream of the flow.

- isolation valve allows for ease of maintenance
- available in 6 materials of construction
- wetted components have comparable or greater chemical resistance than quill construction material
- standard and custom lengths available
- connection in NPT, metric or flanged
- standard 1/8" orifice discharge and optional 1/4" for higher flow

For detailed product information visit our website: primaryfluid.com

# **PFS Corporation Stops**

For detailed product information visit our website: www.primaryfluid.com

**Sizing and Ordering Information** 

Model	Body	Valve	Gland	Gland Seal	Ball Check	Check Spring	Pressure*	Temperature
	Material	Material	Material	Material**	Material	Material	Max. PSIG	Max.
CCS-56-PVC	PVC	PVC	PVC	VITON	Ceramic	316 S/S	150	140°F(60°C)
CCS-56-CPVC	CPVC	CPVC	CPVC	VITON	Ceramic	316 S/S	150	210°F(98°C)
CCS-56-PP	PP	PP	PVDF	VITON	Ceramic	316 S/S	150	195°F(90°C)
CCS-56-PVDF	PVDF	PVDF	PVDF	VITON	Ceramic	316 S/S	150	260°F(125°C)
CCS-56-316S/S	316S/S	316S/S	316 S/S	VITON	316 S/S	316 S/S	2000	350°F(176°C)
CCS-56-HastC	HASTC	HASTC	HASTC	VITON	HASTC	HASTC	2000	350°F(176°C)
CCS-58-PVC	PVC	PVC	PVC	VITON	Ceramic	316 S/S	150	140°F(60°C)
CCS-58-CPVC	CPVC	CPVC	CPVC	VITON	Ceramic	316 S/S	150	210°F(98°C)
CCS-58-PP	PP	PP	PVDF	VITON	Ceramic	316 S/S	150	195°F(90°C)
CCS-58-PVDF	PVDF	PVDF	PVDF	VITON	Ceramic	316 S/S	150	260°F(125°C)
CCS-58-316S/S	316S/S	316S/S	316S/S	VITON	316 S/S	316 S/S	2000	350°F(176°C)
CCS-58-HastC	HASTC	HASTC	HASTC	VITON	HASTC	HASTC	2000	350°F(176°C)

#### Notes

\* maximum pressure @ 70°F (21°C) working temperature; \*\* optional gland seal material available

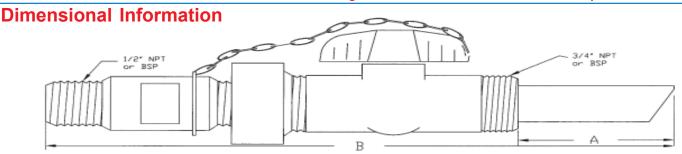
# **Options:**

Hastelloy C springs Suffix Model number with -H for this option(e.g. CCS-56-PVC-H) Hastelloy C ball check Suffix Model number -I (e.g. CCS-56-PVC-I) PVDF ball check Suffix Model number -K (e.g. CCS-56-PVC-K) **TFE ball check**Suffix Model number -T
(e.g. CCS-56-PVC-T)

BSPT Thread Suffix Model -B Flanged Suffix Model -F

CRN certification available. Please contact factory.

Other materials of construction and bubble tight/resilient seat check valve available on request.



**Dimensions** (\* subject to change without notice)

Model	Α	B*	Model	Α	B*
CCS-56-PVC	2-5/8"	10.50"	CCS-58-PVC	4-5/8"	12.50"
CCS-56-CPVC	2-5/8"	10.50"	CCS-58-CPVC	4-5/8"	12.50"
CCS-56-PP	2-5/8"	11.25"	CCS-58-PP	4-5/8"	13.25"
CCS-56-PVDF	2-5/8"	11.25"	CCS-58-PVDF	4-5/8"	13.25"
CCS-56-316S/S	2-5/8"	9.50"	CCS-58-316S/S	4-5/8"	11.50"
CCS-56-HastC	2-5/8"	9.50"	CCS-58-HastC	4-5/8"	11.50"

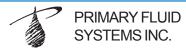
#### Note:

Corporation stops have standard 1/8" discharge orifice for high velocity discharge. Optional 1/4" discharge orifice available for higher capacity flow.

Capacities at Given Pressure (US & Metric)

Pressure		Flow Rate			
psi	kPa	1/8" Bore		1/4" Bore	
		USGPM	LPM	USGPM	LPM
20	138	0.05	0.19	0.70	2.65
30	207	1.35	5.11	1.42	5.38
40	276	1.68	6.36	2.51	9.50
50	345	2.03	7.68	3.43	12.98
60	414	2.25	8.52	4.24	16.05
70	483	2.51	9.50	4.94	18.70
80	552	2.76	10.45	5.52	20.90
90	621	2.99	11.32	6.13	23.20
100	689	3.21	12.15	6.81	25.78

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Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference: NC01

# **POLYMER DOSING**

ST-052



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7	JOHN MEUNIER	S	IER					NOMENCLATURE/ BILL OF MATERIALS
	TITRE/ TITLE	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	Rev. DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	Maria de la constanta de la co
			0 SUBMITTAL	Julie Trudel	J.T.	2009-03-26	Contract	Meadowbank Mining
		•	2				REF. No.	NC01 Rev. 0
			3					
	DESSIN /DWG# ST-	ST-052	4				Date:	2009-03-26
REV.	ITEM	ате/ату.	T. DESCRIPTION	P&ID	CAT.	SOURCE	FA/SA FI	Z d
		Unit. Total		I.D./TAG	ACCPAC		SITE	
	NC01ST-052- 1	1	1 AUTOMATIC POLYMER PREPARATION SYSTEM	DF9-521	D48		FI	
			Model #					
			PolyRex 2.0					
			Supplier					
			Nortec SGS / Tomal					
			Description					
			Polymer make-up unit PolyRex, preparation capacity at 0,20% and 90 min maturing time is 26,7 kg/day. The system includes a multi- screw feeder 182P, an hydratation system (dissolver cone and ventury), an hopper of 100 liters, a					
			maturing tank of 1000 litrers in SS 304 with pressure transmitter, a dosing tank of 1000 liters in SS 304 with pressure transmitter, agitator for the maturing tank and a control relay panel NEMA 4. Supply 575/3/60, control voltage is 110V 60Hz and 24VDC for the pressure transmitter.					
	NC01ST-052-2	-	Powder hopper level switch:For alarm indication of low powder level. The level switch is located in the 30 dm³ powder hopper, integrated in the support stand. Including mounting and electrical installation with an alarm lamp on the control panel					
	NC01ST-052-3	1	Powder vacuum conveyor with 3m hose.  Motor of 1.4 KW. Capacity of 10-15 Kg polymer powder/min.					
	NC01ST-052- 4	1	1 Viscosity > 2000 cps.					
	NC01ST-052-5	1	1 CSA approval					

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Height	JOHN MEUNIER	Z	ER				_	NOMENCLATURE/ BILL OF MATERIALS
	TITRE/ TITLE	Rev.	v. DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	Mooduobook
		0	SUBMITTAL	Julie Trudel	J.T.	2009-03-26	Contract	меасомрапк міппу
	Dolymor dosing	_						
		2					REF. No.	NC01 Rev. 0
		က						
DE	DESSIN / DWG # ST-052	52 4					Date:	2009-03-26
REV.	HITEM	ате/ату.	C. DESCRIPTION	P&ID	CAT.	SOURCE	FA/SA FI	Q Z
		Unit. Total		I.D./TAG	ACCFAC		SITE	
	NC01ST-052- 6	1	3 POLYMER METERING PUMP	P9-521	D48		SA	
			Model #	P9-522				
			MD 025-6L / A6-A7-A7-F0-GA-X	P9-523				
			Supplier					
			Seepex					
			Description					
			Progressive cavity pump:					
			Zo - Zou L/H @ z bars, z/1 rpm pump max speed.					
			1" NPT suction 1/2" NPT discharge stainless steel with					
			casing parts and rotor, mechanical seal. Motor inverter duty.					
			0.5 HP, 1800 rpm, 575V/3ph/60Hz.					
			Including a dry running protection and a 1 HP AC					
			Tech/Jacmar drive, model ESV751N06TXC, Nema 4x.					
	NC01ST-052- 7	_	3 SAFETY RELIEF VALVE	V9-525	D48		SA	
			Model #	V9-526				
			TVPR50-PVC-G	V9-527				
			Supplier					
			Primary Fluid					
			Description					
			Relief valve PVC, 1/2" FNPT c/w glycerine pressure gauge 0 60 psi with PVC Viton isolator.					
	NC01ST-052-8	-	1 CALIBRATION TUBE		D48		SA	
			Model #					
			PV#2-4000ml					
			Supplier					
			Primary Fluid					
			Description					
			Calibration tube; PVC; 4000 ml, connection 1" NPT at both ends					
		1						

# **JOHN MEUNIER**

Meadowbank mining Corp. ACP-700R Technical Data Sheet Reference: NC01

## **AUTOMATIC PREPARATION SYSTEM**



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## **INSTRUCTION MANUAL**

## POLYMER MAKE-UP SYSTEM TYPE POLYREX 2.0

	SAFETY INSTRUCTIONS	1	
	DESCRIPTION / FUNCTION	2	
	PART LIST / DRAWINGS	3	
	WIRING DIAGRAM	4	
	INSTALLATION	5	
PROJECT NAME:	BEFORE FIRST START	6	
Meadowbank Mining	START-UP / OPERATION	7	
	MAINTENANCE	8	
TOMAL ORDER NO: 54473	TROUBLE SHOOTING	9	
DATE:	DATASHEETS		
20-05-2009	DOSING PUMP	11	
	QUALITY DOCUMENTS	12	
TOMAL AB S-310 58 VESSIGEBRO / SWEDEN	TELEPHONE +46 (0)346 71 31 TELEFAX +46 (0)346 71 31 E-MAIL info@tomal.se		





**SAFETY INSTRUCTIONS** 

## **SAFETY INSTRUCTIONS**

Read the instructions in this manual carefully before installing or starting the system. Tomal AB will accept no liability for damages due to non-observance of this manual.

Information in this manual is subject to change without notice and does not represent a commitment on the part of Tomal AB.

No part of this manual may be reproduced or transmitted in any form or by any means, electronic or mechanical, without the prior written permission of Tomal AB.

The following signs may occur within this manual or on the Polymer make-up unit:



Electrical connections and maintenance must only be performed by qualified personnel!

Electrical elements have to be connected according to local regulations!



Attention!/Important!/Note!



Dangerous voltage!



Prior to use, read operation manual and observe safety regulations!



Do not open or remove safety shields while machine is in operation! Moving parts!





# DESCRIPTION / FUNCTION

## **DESCRIPTION / FUNCTION**

#### DESCRIPTION

- \* Tomal PolyRex is a turnkey, automatic machine for batch preparation of polymer solutions.
- \* Through batch preparation, the so-called short circuit effect is avoided. The polymer grains cannot pass the process without maturing.
- \* The vacuum conveyor ensures a dust free filling of the powder hopper.
- \* Tomal's proven double screw feeder supplies a constant discharge without pulsation. This, combined with high feeding accuracy, ensures consistent batch composition.
- \* The highly tested dissolver cone guarantees a clear solution without "fish-eyes".
- \* Gentle agitation and pumping ensures the polymer chains remain undamaged.
- \* Each polymer unit is "wet tested" prior to despatch from the factory.
- \* Our range of options/special equipment and our flexibility enable us to adapt machines to the individual requirements of customers.

**Powder feeder -** The feeder has a double screw type 182 Poly with a worm-geared motor. The feeder outlet has a gate, which effectively stops moisture from reaching the polymer powder.

**Dissolver cone** - The cone is designed for an optimal dissolving of polymer powder. At the cone's outlet there is an ejector which effectively sucks down, mixes and transports the solution into the preparation tank.

**Water control** - The armatures consist of a shut-off valve, a pressure switch, a manometer, a solenoid valve, and a reducing valve. If the water pressure drops, an alarm signal is given and the preparation cycle is shut off. When the water pressure rises, the preparation cycle continues automatically. If the required pressure (See chapter 6.) is not available, a water booster pump can be added.

**Preparation/Maturing tank** - The tank is provided with a slow rotating agitator with a worm-geared motor, which gently agitates the polymer solution, a pressure transmitter (high/low level) and an emptying solenoid valve. The tank is also provided with cover incl. inspection lid.

**Stock/Dosing tank** - The tank is provided with a pressure transmitter (low level/dry running protection for the dosing pump), shut-off valves for pump connection and bottom drain.

**Electrical equipment -** All electrical equipment and interconnecting cables are fitted in accordance with SS-EN60204-1.

**Materials** - The powder feeder, the support stand and the powder hopper are made of carbon steel SS1312 (equals Euronorm FE 360 BFN) painted with 40  $\mu$ m alkydprimer and 80  $\mu$ m acryl top coat. The tanks, the agitator and the dissolver cone are made of stainless steel SS2333 (equalsAISI 304) and blasted with glass pellets. The water armatures and the ejector are brass, whilst all pipework is in PVC.

#### **FUNCTION**

The low level in the preparation tank emits an impulse to start preparation, the solenoid valve for preparation water opens.

The pressure switch will stop the preparation if the inlet water pressure will be to low. When the water pressure rises, the preparation cycle continues automatically.

After a waterwhirl has formed in the dissolver cone the feeding starts. Polymer powder/(liquid polymer concentrate) is fed into the dissolver cone, after which the solution is mixed and transported to the preparation tank with help from the ejector.

The concentration required is achieved by adding the correct amount of polymer for each batch. This is controlled by the PLC.(in the front of the control cabinet)

When the high level in the preparation tank will be reached, the solenoid valve for preparation water closes.

The solution is kept in motion in the preparation tank. Once matured the batch is now ready to be transferred to the stock tank.

The low level in the stock tank will give a signal to the emptying solenoid valve in the preparation tank that will open.

When a batch is transferred, the low-level switch in the preparation tank will be reached and the emptying solenoid valve closes. At the same time a new preparation cycle starts.

The dry running level will protect the dosing pump from running dry.

The stock solution is pumped from the stock tank to the dosing point. The optional dilution water system can be set at a regulating valve and read at a flow meter.

The level switch in powder hopper will give an alarm at low level.

For PLC: The present preparation will finish. Next preparation will not start before the power hopper is filled and the alarm reset.



PART LIST / DRAWINGS

## **PART LIST / DRAWINGS**

#### Spare parts order

Only the use of original Tomal spare parts will ensure proper operation, reliability and long service life.

When ordering a spare part, always state:

- 1. Tomal order no. (front page of this manual).
- 2. Project name (front page of this manual).
- 3. Description from the part list below (item, quantity and type/size).

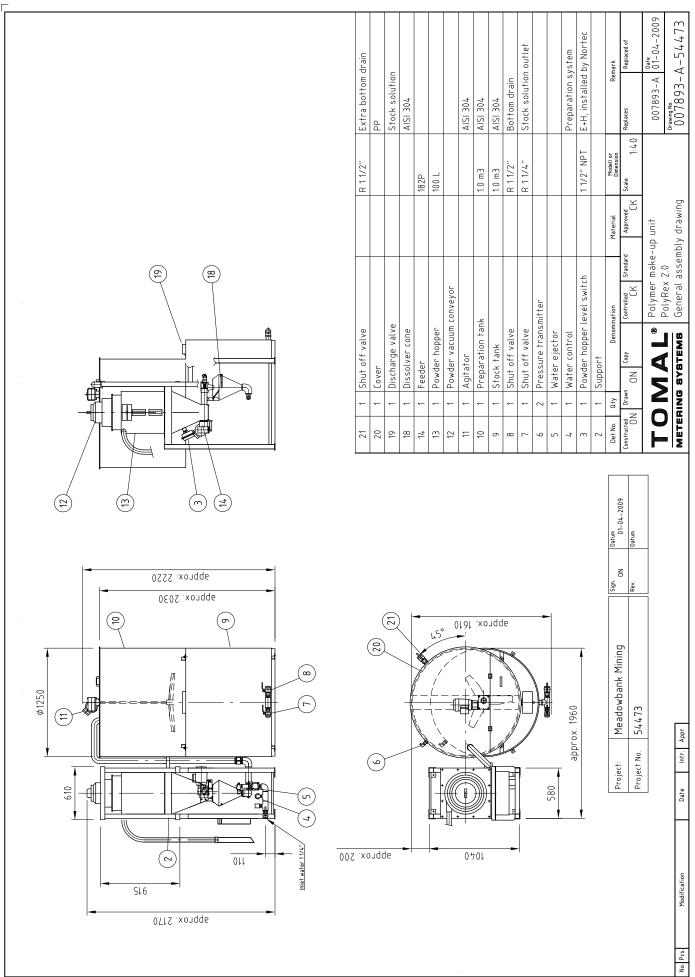


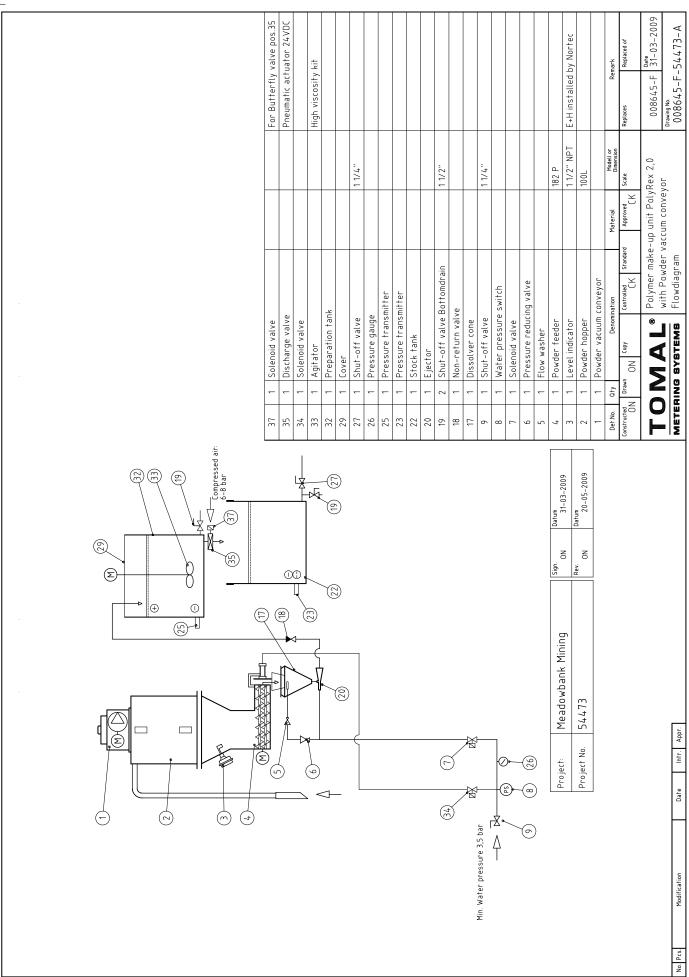
NOTE! When ordering spare parts for the powder feeder or the agitator, see also the data sheets.

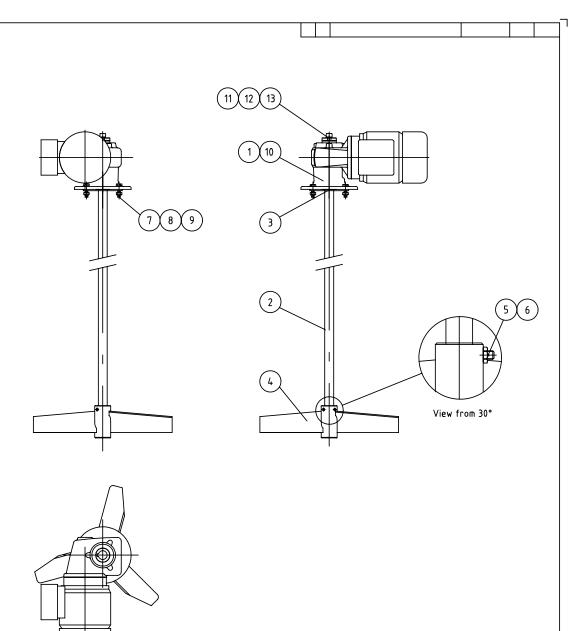
Part list belonging to flow diagram No. 008645-F-54473-A

ITEM	QTY.	DESCRIPTION	TYPE, SIZE	MANUFACTURER	REMARK
1	1	Vacuum unit	PV 350 D/T	Pullman	
1:1	1	Dustfilter	23/29	Pullman	
1:2	1	Vacuum hose	PC38	Pullman	
1:3	1	Suction nozzle	SM38-54	Pullman	
2	1	Powder hopper	100 dm <sup>3</sup>	Tomal	
3	1	Powder level switch	Soliswitch FTE31-C5C111	Endress+Hauser	
4	1	Powder feeder	182-Poly	Tomal	See also sep. drawing
4:1	1	Motor	IEC 63 L/4 0,18kW	Nord	
4:2	1	Gearbox	SK1SI40AD H n=20	Nord	
4:3	1	Cylinder	RT/57240/M/40	Norgren	
5	1	Flow washer	Ø 18x6,5mm t=1,5mm	Tomal AB	Dissolver cone
6	1	Pressure reducing valve	VM 7685 ½" DN15	Ventim	
7	1	Solenoid valve 2/2	VM 8631, 1" DN25	Ventim	Preparation water
8	1	Water pressure switch	901.51 G ¼"	Becks	
9	1	Shut-off valve	VM 4320, 11/4" DN32	Ventim	Water connection
17	1	Dissolver cone	Ø 300 DK - 65°	Tomal	
18	1	Non-return valve	VM 6565, 1½" DN40	Ventim	Ejector
19	2	Shut-off valve	VM 4320, 1½" DN40	Ventim	Bottom drain
20	1	Ejector	RG5 No.: 3	BGV	
22	1	Dosing tank	PR 2.0- 1,0 m <sup>3</sup>	Tomal	
23	1	Pressure transmitter	PL2658 0-200mbar / 4- 20mA 1" – DN25	IFM	Low level/dry running protection

25	1	Pressure transmitter	PL2658 0-200mbar / 4- 20mA 1" – DN25	IFM	High /Low level
26	1	Pressure gauge	VM 9706 ¼" Ø63mm 0-10 bar	Ventim	
27	1	Shut-off valve	VM 4320, 1¼" DN32	Ventim	Dosing pump
29	1	Cover	PP	Tomal	
32	1	Maturing tank	PR 2.0- 1,0 m <sup>3</sup>	Tomal	
33	1	Agitator	PR 2.0	Tomal	See also sep. drawing
33:1	1	Motor	80L/4 - 0,75kW	Nord	
33:2	1	Gearbox	SK1SM 63 AF n=54	Nord	
34	1	Solenoid valve 3/2	VM 8651, 1/4"	Ventim	Feeder outlet
35	1	Emptying valve	VM3001 DN50-Revo 006	Ventim	
37	1	Solenoid valve 3/2	M/49MAZ14J 110V AC	Norgrens	Butterfly valve (PR 3.0-8.4)

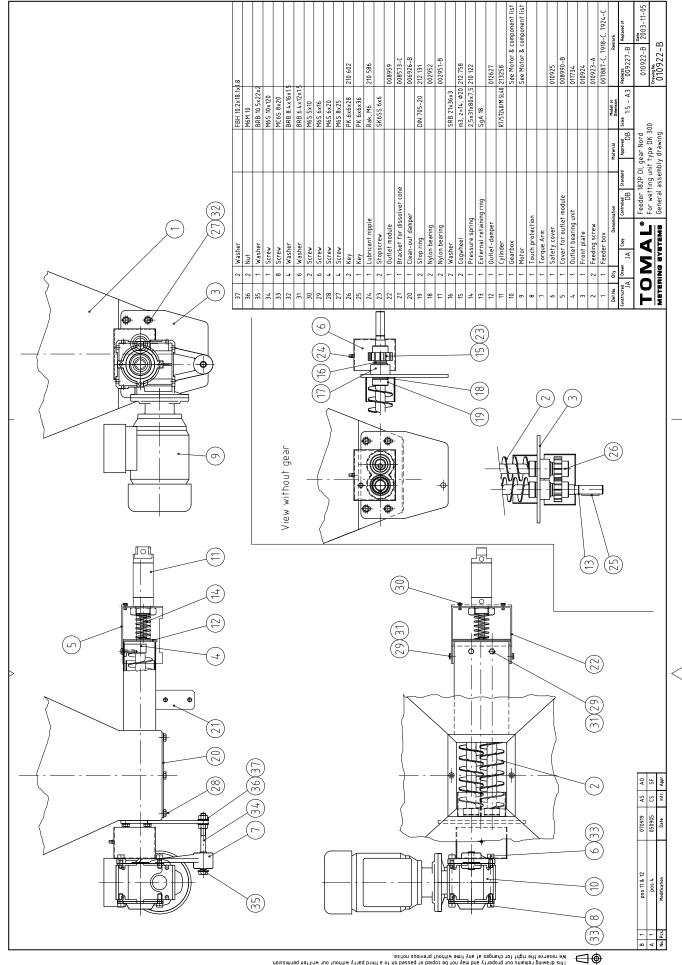






		_						г	1	
13	1	Wast	ner agitatoı	•					010937	
12	1	Nord	lock washe	r					010937	
11	1	Scre	W						010937	
10	1	Key							010937	
9	4/8	3 Wast	ner						010937	
8	4	Nut							010937	
7	4	Scre	w						010937	
6	2	Nut							010937	
5	2	Clam	ping screw						010937	
4	1	Prop	eller						010937	
3	1	Locki	Locking ring						010937	
2	1	Agita	Agitator shaft						010937	
1	1	Moto	Motor+gearbox					Nord	010937	
Det.No.	Qty		Denomination		Material		Modell or Dimension	Rei	mark	
Constructed		JA	Сору	Controlled Standard				1:10 - A4	Replaces 005788-D	Replaced of
TC		M	ΑĽ°				unit PR (	0.6-8.4	010938	Date 2003-11-10
METE			BTEMS	Agitato Spare p					Drawing No. 010938	







WIRING DIAGRAM

H	C		M	Motor and	P	Project name	me			Project no	D	Date	Page
<b>■</b>   <u>B</u>	FERIN -	METERING SYSTEMS	comp	component list		Mea	Meadowbank	bank	<b>L⊿</b>	54473	<u> </u>	2009-04-03	1 (1)
					<u>~</u>	Mining	ng						
Voltage PHASES: FREQUEN CONTROI SUPPLY V	Voltage PHASES: FREQUENCY: CONTROL VOLTAGE: SUPPLY VOLTAGE:	3 60 110/24 575	No Hz VAC		Z T A A A A	Motors TYPE: AMBIENT TEMP: PROTECTION: INSULATION CLASS:	EMP: N: v CLASS:	AC 20° IPSS F					
		Component			W	Motor				Drive		I P	P&I. dwg
POS.	NO.	DESIGNATION	NOL	MANUFACT.	TYPE	kW	A(575V)	RPM (60Hz)	MANUFACT.	TYPE	RATIO	RPM (60Hz)	(bos. no)
1	1	Feeder		Nord	63L/4	0,18	0,46	1690	Nord	SK 1SI40AD	80:1	20 4	
2	1	Agitator		Nord	80L/4	0,75	1,46	1350	Nord	SK 1SM63AF	25:1	54 33	
				Oı	Other electrical components	trical cc	mpone	nts					
POS.	NO.	DESIGNATION	NOI	MODEL		TYPE		VOLT	T,	REMARKS	RKS		(pos. no)
3	1	Powder vacuum conveyor	or	Pullman	PV350 n 100 dm <sup>3</sup>	PV350 modell:116352 100 dm <sup>3</sup>	5352	230V AC				1	
4	1	Powder level indicator		E+H	FTE31	FTE31-C5C111		110V AC				3	
5	1	Solenoid valve, preparation water	ion water	Ventim	98 MV	VM 8631, 1" (DN 25)	25)	110V AC	2/2-way	ay		7	
9	1	Solenoid valve, feeder discharge valve	lischarge valve	Ventim	98 MV	VM 8651 - 1/4"		110V AC	3/2-way	ay		34	
7	1	Pressure switch, preparation water	tion water	Becks	901.51 G 1/4"	G 1/4"		Pot.free	Stop 8	Stop at 2,0 bar, Start at 2,6 bar	t 2,6 bar	8	
8	1	Pressure transmitter		IFM	PY265	PY2658, 0-200mbar	ar	24V DC	High/	High/low level		23	
6	1	Pressure transmitter		IFM	PY265	PY2658, 0-200mbar	ar	24V DC	High/	High/low/dry running protection level	protection l	level 25	
10	1	Solenoid valve, discharge valve	ge valve	Norgrens	M/49N	M/49MAZ18J, NC, 1/8"	., 1/8"	110V AC	3/2-way	ay		37	



**INSTALLATION** 

## INSTALLATION

#### **UNLOADING**

The polymer machine is packed on pallets and is therefore possible to unload with a forklift. If an overhead crane is needed, straps shall be used, length = 3-4 m. The straps can only be fastened to the lifting eye on the tanks and the beams at support stand.

- PolyRex 0.6 3.0; both tanks are mounted upon each other.
- PolyRex 4.0 8.4; both tanks are 2 separate parts. They must be mounted on site. The maturing tank with agitator must be mounted upon the dosing tank.

#### **NOTICE**

- Lifting, handling or fastening during the installation, straps must be used according to the picture beside.



#### **STORAGE**

- During transport and later during storage the Polymer make-up unit must be protected against moisture, salt-water, rain, frost, dust, dirt and direct sunlight.
- The Polymer make-up unit can be stored for up to 2 years in dry and vented places without making any special arrangements.
- Storage outdoors is not recommended.

#### **ERECTION**



NOTE! Everything shall be mounted according to the General Assembly Drawing

Fastening: Expansion shell bolt shall be used. Size: M10x90.

Mount the maturing tank on top of the dosing tank (when applicable). Mount the powder hopper on the support stand (when applicable). Mount the vacuum conveyor on top of the powder hopper (when applicable). Mount the pipe from the ejector to the maturing tank.

#### **ELECTRICAL CONNECTIONS**



WARNING! Electrical connections and maintenance must only be performed by qualified personnel!

Electrical elements have to be connected according to local regulations!

Connect: The agitator-motor to the electrical cabinet.
Connect: Cable contact for the emptying solenoid valve.
Supply voltage according to the electrical drawings.

Connect: Cable contacts for the pressure transmitters.

Connect: External protective conductor to an external noiseless earth conductor.

#### PIPE CONNECTIONS



NOTE! See flow diagram and part list for all dimensions!

Connect: Water inlet.

Connect: The dosing pump to the pump connection on the dosing tank.

Connect: The dosing pump to the dilution water (when applicable).

Connect: The static mixer (when applicable) or the dosing pump to your dosing point.

Connect: Bottom drain valve to the sink.



**BEFORE FIRST START** 

## BEFORE FIRST START

#### **BEFORE START**

- 1.0 Check that the dissolver cone, ejector, tanks and pipe work are completely clean and free from dirt or foreign objects.
- 1.1 Check that correct amount of oil is in the gearboxes.

1.2 Connect/check: Voltage: 400/230 V

Water pressure: Min. 3,5 bar Max. 6 bar

Water consumption: Min. m<sup>3</sup>/h (Preparation water + dilution water, if included)

1.3 Capacity test

A capacity test of the feeding equipment for polymer has always to be carried out before start-up.

See chapter 7 for more information.

#### Powder feeder

The feeder is a volumetric double screw feeder.

The capacity of the feeder is set as [kg/time-unit] in the PLC-program.

Different types of polymer has different volume weight, therefor is it important that a capacity test is done before starting up or when changing type of polymer.

#### Note!

• Remember to adjust the polymer emulsion in the PLC program at start up or When changing type of polymer.

#### Attention!

The concentration of the stock solution can be set to maximum 1.0%.

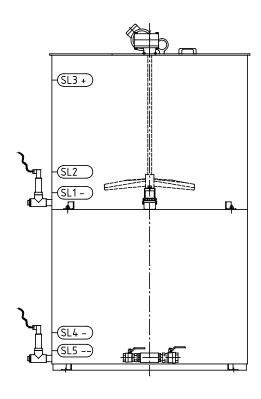
To avoid major problems recommended maximum concentration is:

- 0.5% when using powder feeder.

The viscosity of the stock solution is never allowed to exceed 2000 cP.



**START-UP / OPERATION** 



PolyRex	0,6	1,0	2,0	3,0	4,0	5,4	6,6	8,4
Batch volym (dm³)	218	400	940	1229	1985	2698	3292	4317
SL 1- (mm)	80	80	80	80	80	80	80	100
SL 2 (mm)	200	250	250	250	250	250	250	300
SL 3+ (mm)	520	640	850	850	1080	1080	1300	1500
SL 4- (mm)	100	100	130	130	130	130	130	130
SL 5 (mm)	80	80	110	110	110	110	110	110



**MAINTENANCE** 

## **MAINTENANCE**

EQUIPMENT	WEEKLY	MONTHLY	BI-MONTHLY	1/2 YEARLY	NOTE
AGITATOR:					
GEARBOX				A	
MOTOR				A	
SHUT-OFF VALVES				A	
REDUCING VALVE			A		
PRESSURE SWITCH				A	
REGULATING VALVES				A	
DRAIN VALVES			A (B)		
CHECK VALVES				A	
SOLENOID VALVES				A	
FLOW METER				A	
METERING GAUGE				A	
DOSING PUMP					SPEC. INSTR.
DISSOLVER CONE	A (B)				
EJECTOR	A (B)				
PRESSURE TRANSMITTER					SEE DATASHEET
<u>FEEDER 182-P:</u>					
GEARBOX				A	
MOTOR				A	
BEARINGS		A			
GEARWHEELS		A		C	Molykote 165 LT
					0,5 cm <sup>3</sup> /half year,
					Lubricant nipple
					Pos. 24, 010922
FEEDER OUTLET	A B			A	
CYLINDER				A	

A: GENERAL OVERLOOK

B: CLEANING/WASHING

C: GREASING, OIL FILLING - GENERAL



TROUBLE-SHOOTING

# TROUBLE-SHOOTING

PROBLEM	POSSIBLE CAUSE	REMEDY
Reduction of the suction capacity at the vacuum filling of the polymer powder.	The suction nozzle is not mounted.	Mount the nozzle according to the commissioning/operation instructions.
	Clogging of the dust filter.	Remove the external filter and clean it according to the maintenance instructions for the vacuum conveyor (data sheets).
	Max level in the powder hopper is exceeded.	Stop the filling.
	The feeder shutter at the outlet of the feeder is not shut.	Filling must not be done while the feeder is operating. Wait until the feeder has stopped.
Clogging of the dissolver cone.	The feeder shutter at the outlet of the feeder is not shut.	Check the function of the solenoid valve to the feeder shutter, or clean the shutter from possible clogging
	The water whirl in the dissolver cone is too small.	polymer powder.
Flooding in the maturing- or dosing tank.	The function of the level indicator is not correct.	Replace the incorrect one with a new one.
Incorrect concentration of the stock solution.	The dosing time of the powder feeder is not correctly set.	Set the dosing time according to the operation instructions.
Leakage - emptying valve.	Foreign particles have got stuck in the valve.	Remove the foreign object and check for possible damages.
	Too high concentration of the stock solution. The valve manages up to 0,5%.	Adjust the concentration according to problem above.



**DATA SHEETS** 

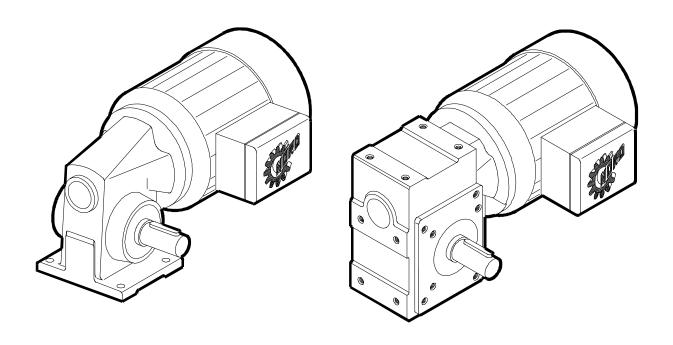


# Betriebs- und Wartungsanleitung Operating and Maintenance Instruction Instructions de conduite et d'entretien

B 1031 09/2000



Diese Sicherheitshinweise sind aufzubewahren These safety instructions must be kept available Ces instructions de sécurité doivent être observées



Minibloc - Schneckengetriebe

Minibloc - Worm Gear Units

Minibloc - Réducteurs à roue et vis sans fin



Tel. 0 45 32/4 01-0 · Telefax 0 45 32/40 15 55 **NORD Internet: http://www.nord.com** 

#### **∆** Warnung

Es wird vorausgesetzt, daß die grundsätzlichen Planungsarbeiten der Anlage Transport, Montage, Installation. Inbetriebnahme, Wartung und Reparaturen von qualifiziertem Personal ausgeführt bzw. durch verantwortliche Fachkräfte kontrolliert werden. Bei Arbeiten am Getriebemotor muß garantiert sein, daß keinerlei Spannung anliegt, und dieser gegen Wiedereinschaltung gesichert ist

#### **∆** Warnung

Veränderungen gegenüber dem Normalbetrieb (höhere Leistungsaufnahme, Temperaturen, Schwingungen, Geräusche usw. oder Ansprechen der Überwachungseinrichtungen) lassen vermuten, daß die Funktion beeinträchtigt ist. Zur Vermeidung von Störungen, die ihrerseits mittelbar oder unmittelbar schwere Personenoder Sachschäden bewirken könnten, muß das zuständige Wartungspersonal dann umgehend verständigt werden.

∆ Im Zweifelsfall die entspechenden Betriebsmittel sofort abschalten!

#### Aufstellung, Vorbereitung

- -Transportösen am Getriebe sind für das Gewicht des Antriebs ausgelegt
- -Fundamente ausreichend bemessen und schwingungsfrei ausführen
- -Getriebe oder -motor fest und ohne Verspannung montieren
- ausreichende Belüftung vorsehen
- serienmäßiges Innengewinde nach DIN 332 zum Aufziehen von Verbindungselementen auf die Wellen benutzen
- -Schläge auf die Wellen vermeiden (Lagerbeschädigung!)
- -Maschine und Getriebe möglichst mit elastischen Kupplungen verbinden
- -vor dem Einschalten Abtriebselemente aufziehen bzw. Paßfeder sichern
- -bei Aufsteckgetrieben mit Drehmomentstütze Gummipuffer verwenden

### **∆** Caution

**A Caution** 

assembly,

deviation from normal operating conditions (increased power consumption, temperature, vibrations, noise etc.) or warning signals by monitoring equipment suggest malfunction. Inform the responsible maintenance personnel at once to prevent the trouble from getting worse and causing, directly or indirectly, serious physical injury or material damage.

It is presumed that fundamental project work

as well as all work with regard to transport,

maintenance and repair is performed by

qualified personnel or supervised by skilled

labour taking overall responsibility. Make

absolutely sure that no voltage is applied at all

while work is being done on the geared motor.

Drive must also be secured against switching

starting-up,

installation,

Δ In case of doubt disconnect the machine

#### Preparing and performing installation

- -Lifting devices on the drive are designed to carry the drive weight
- -the foundation (base) should be of adequate size and vibration-proof
- -install gear unit or geared motor rigid and braceless
- ensure sufficient ventilation
- make use of tapped hole (DIN 332) to suit fastening to the shaft end
- -avoid shocks on shafts (bearing damage!)
- -preferably use flexible coupling between output shaft and driven machine
- -fit output elements to shaft end or secure feather key before starting the motor
- -use torque arm with rubber buffer on shaft mounting gearboxes
- Connect motor according to diagram
- -make sure that mains voltage/frequency are in accordance with nameplate information
- make secure protective conductor conection
- -if motor is running in reverse direction, interchange two phases
- -install protective switches to prevent overload and phase failure
- -set motor protection switch to nominal current

#### Connection of motor

- Close unused cable entrances holes and the box itself in a dust- and watertight manner.
- -wiring diagrams on the last page

## Starting up

- in case of long-time storage take special precautions (as provided in works standard sheet "Extended Storage")
- air-cooled motors are designed for ambient temperautres between -20°C and +40°C and for installation at altitudes â 1.000 m above M.S.L.
- Their use in hazardous areas is prohibited unless they are expressly intended for such use (follow additional instructions)

#### Λ Avertissement

Il est impératif que les travaux fondamentaux de l'installation, ainsi que tous les travaux de transport, montage, installation, mise en exploitation, entretien et réparation soient accomplis par du personnel qualifié et contrólés par des techniciens spécialisés dans ce domaine. Avant toute intervention sur le motoréducteur, il faut s'assurer que celui-ci n'est plus sous tension et que la remise sous tension soit interdite

#### Δ Avertissement

Si en utilisation normale, des modifications de fonctionnement apparaissent telles puissance absorbée trop élevée, température élevée, vibrations fortes, bruit intense etc. ou en rapport avec les contrôles techniques, cela laisse supposer que différentes fonctions de l'appareil peuvent être détériorées. Pour éviter ensuite des problèmes, qui pourraient entraîner de graves accidents corporels ou de graves dégats matériels, le personnel d'entretien compétent doit immédiatement être informé.

Δ Si vous êtes dans le doute, coupez immédiatement l'alimentation!

#### Mise en place, préparation

- -Le matériel utilisé pour la manutention doit tenir compte du poids de l'équipement
- -prendre largement les dimensions embases et les réaliser exemptes de vibrations
- -monter les réducteurs et motoréducteurs solidement et sans haubanage
- prévoir une aération suffisante
- prévoir le taraudage conforme à la norme DIN 332 pour monter des accouplements sur les arbres d'entrée et de sortie
- -éviter de donner des coups sur les arbres (cela pourrait détériorer le roulement!)
- -lier autant que possible la machine et le réducteur avec des accouplements élastiques
- avant la mise en service, enlever l'élément d'accouplement ou/et fixer la clavette
- utiliser pour l'exécution arbre creux avec bras de réaction une butée en caoutchouc

#### Branchements électriques

- brancher le moteur selon le schéma
- -s'assurer que la tension du réseau et la fréquence correspondent aux données inscrites sur la plaque signalétique
- -Le cable de raccordement doit être protégé
- -corriger un éventuel mauvais sens de rotation par une inversion de deux phases
- Les entrées de câbles non utilisées doivent être obturées, la boîte elle-même devant être fermée de façon à être étanche à l'eau et à la poussiére
- prévoir une protection électrique contre les surcharges, court-circuit et défaut de phases
- régler la protection électrique suivant l'intensité nominale du moteur
- schéma de branchement à la dernière page

#### Mise en fonctionnement

- -si un stockage longue durée du réducteur est prévu, il faut prendre les dispositions nécessaires (voir spécification "Stockage longue durée")
- les moteurs autoventilés sont dimensionnés pour des températures ambiantes comprises entre -20°C et +40°C, ainsi que pour une altitude â 1000 mètres au-dessus du niveau de la mer
- Leur utilisation dans des atmosphères explosives est interdite, à moins qu'elles ne soient expressément prévues à cet effet (respecter les indications supplémentaires)

- Motoranschluß nach Schaltbild vornehmen

Elektrischer Anschluß

- -Übereinstimmung von Netzspannung und Typenschild-Daten Frequenz mit den sicherstellen
- Sichere Schutzleiterverbindung herstellen
- -evtl. falsche Drehrichtung korrigieren durch Vertauschen von 2 Phasen
- Nicht benötigte Kabeleinführungsöffnungen und den Kasten selbst staubwasserdicht verschließen
- -Überbelastung und Phasenausfall durch Schutzschalter vorbeugen
- -Einstellen des Motorschutzschalters auf Nennstrom
- Schaltbilder auf der letzten Seite
- Inbetriebnahme
- längeren Lagerzeiten Vorkehrungen treffen (siehe Werknormblatt "Langzeitlagerung")
- -Luftgekühlte Motoren sind für Umgebungstemperaturen von - 20°C bis +40°C sowie Aufstellungshöhen å 1.000 m über NN ausgelegt
- Der Einsatz im Ex-Bereich ist nicht zulässig, sofern nicht ausdrücklich hierfür vorgesehen

## Wartung GETRIEBE/MOTOR

Die Minibloc-Schneckengetriebe sind mit synthetischem Öl befüllt, dadurch ist über die gesamte einwandfreie F nte Lebensdauer eine Funktion gewährleistet. die Minibloc-Schneckensind Daher getriebe wartungsfrei. Entlüftungsschrauben hrauben sind nicht die Minibloc-Schnecken-

erforderlich, die Minibloc-Schnecken-getriebe sind vollkommen geschlossen. Die Lager des Motors haben ebenfalls eine Lebensdauerschmierung.

#### Wirkungsgrade

Da bei neuen Getrieben der Schneckenradsatz einlaufen muß, ist der Reibungsfaktor zunächst noch größer als nach dem Einlauf. Dadurch ist vor dem Einlauf auch der Wirkungsgrad etwas niedriger. Dieser Effekt verstärkt sich bei kleinerem Steigerungswinkel, also bei größerer Übersetzung.

Aus Erfahrung ist mit folgenden Abzügen zu rechnen:

1-gängig bis ca. 12% 2-gängig bis ca. 3-gängig bis ca. 6-gängig bis ca. 6%

Der Einlaufvorgang ist nach ca. 25 Stunden Betriebszeit bei maximaler Belastung abgeschlossen.

Für die in den Tabellen angegebenen Wirkungsgrade müssen folgende Voraussetzungen erfüllt sein:

- Getriebe vollständig eingelaufen
- Getriebe hat Beharrungstemperatur

#### Maintenance GEARBOX/MOTOR

The Miniboc series of worm-gearboxes and the suitable motors are filled with synthetic lubricant/bearing-grease. This ensures proper operation throughout the full lifetime of the units. Therefore the Minibloc drives are maintenance-free.

No breather plugs are required because of synthetic lubricant used.

minibloc drives are completely closed.

#### **Efficiencies**

With new gearboxes however, an initially higher friction exists and the efficiency obtained before the gears are run-in will be somewhat reduced. This effect is increased with smaller angle of inclination

Experience shows that initial efficiencies may be reduced by:

single start worm up to approx. 12% two start worm up to approx. three start worm up to approx. six start worm up to

The gear unit will be run-in after a service period of 25 hours at full load.

The efficiencies shown in the selection tables can only be obtained when the gear unit:

- is fully run-in
- has achieved its operating temperature

#### **Entretien** DU REDUCTEUR/ DU MOTEUR

Les réducteurs et les motoréducteurs à roue et vis sans fin Minibloc sont remplis d'huile synthétique ce qui garantit un fonctionnement impeccable pendant toute la durée de vie. De ce fait, les réducteurs à roue et vis sans fin Minibloc ne nécessitent pas d'entretien.

Les vis d'évent ne sont pas non plus nécessiares et les réducteurs à roue vis sans fin sont livrés entièrement fermés. Les roulements des moteurs se également graissés à vie.

#### Rendements

Etant donnè que dans les réducteurs neufs le couple roue et vis doit d'abord être rodé, l'angle de frottement sera avant le rodage un peu plus élevé et le rendement donc légèrement inférieur. Cet effit est accentué pur un angle d'inclinaison plus petit, donc pour des rapports plus importants.

L'expérience nous démontre qu'il faut compter avec les pertes suivantes:

Vis à 1 filet iusqu'à environ 12% Vis à 2 filets jusqu'à environ 6% Vis à 3 filets jusqu'à environ Vis à 6 filets jusqu'à environ

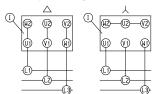
environ heures fonctionnement, à charge maximale, le rodage est terminé:

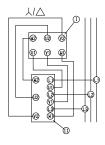
Pour obtenir les rendements indiqués tableaux, dans les préalables les les conditions doivent suivantes . remplies:

- réducteur parfaitement rodé
- réducteur ayant atteint la température de l'équilibre thermique

### Schaltbilder / Wiring diagrams / Schémas de branchement

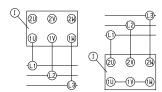
Drehstrom-Motor mit Kurzschlußanker Three phase squirrel-cage motor Moteur triphasé à cage d'écureull





- I) Klemmbrett Terminal board Plaque à bornes
- II) Schalter Switch Démarreur

Drehstrom-Motor mit Kurzschlußanker, in Dahlander-Schaltung Three phase squirrel-cage motor, Dahlander connection Moteur triphasé à cage d'écrureull, couplage Dahlander



niedrige inférieure - Drehzahl speed - vitesse

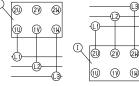
- hohe

- hiah - supérieure deux vitesses 20) (2V)

Drehstrom-Motor, polumschaltbar, zwei getrennte Wicklungen

Three phase motor, polechanging, two separate windings, two speeds

Moteur triphasé à commutation de pôles, deux bobinages séparés,



niedrige

- Drehzahl speed inférieure

- vitesse

- hohe - high - supérieure



Roundline Cylinders
Magnetic Piston
Double Acting
Ø 8 to 63 mm

- Very compact and shorter than the basic length of a corresponding ISO/VDMA and roundline cylinder.
- Magnetic piston as standard provides a wide range of control options.
- Comprehensive range of standard stroke lengths.
- International series available world-wide.



#### **Technical Data**

#### Medium:

Compressed air, filtered, lubricated or non-lubricated

#### Operation:

Double acting with buffer cushioning

RT/57200/M Side port, integral eye mounting (Ø 8 to 40 mm),

fixing holes in the end cover (Ø 50 and 63 mm)

RT/57200/MC Central rear port (Ø 8 to 40 mm) RT/57200/MF Flat rear cover (Ø 8 to 40 mm)

#### Operating Pressure:

1 to 10 bar

#### Operating Temperature:

-5°C\* to +80°C max.

\*Consult our Technical Service for use below +2°C

#### Cylinder Diameters:

8, 10, 12, 16, 20, 25, 32, 40, 50, 63 mm

#### Standard Strokes:

10, 25, 40, 50, 80, 100 mm	$\varnothing$ 8 and 10 mm
10, 25, 40, 50, 80, 100, 125, 160, 200 mm	$\varnothing$ 12 and 16 mm
10, 25, 40, 50, 80, 100, 125, 160, 200, 250, 320 mm	$\varnothing$ 20 and 25 mm
25, 40, 50, 80, 100, 125, 160, 200, 250, 320 mm	Ø 32 to 63 mm

#### Materials:

Stainless steel (8 to 16 mm bore Austenitic, 20 to 63 mm bore Martensitic) piston rod, Stainless steel (Austenitic) barrel, aluminium end covers, polyurethane wiper, nitrile rubber seals and 'O'-rings.

#### **Alternative Cylinders:**

See page N 1.5.041.02

#### **Ordering Information**

To order a basic 40 mm bore cylinder with a 50 mm stroke

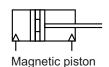
quote: RT/57240/M/50

To order a basic 25 mm bore cylinder (central rear port in the end cover) with a 200 mm stroke quote: RT/57225/MC/200

To order mounting brackets refer to appropriate cylinder and switch mounting table.

Order magnetically operated switches separately.

Accesso	See page		
Switches	QM/45/RAP, QM/45/LAP		
	QM/45/LSU	N <b>4.3.</b> 045.01	
Switch	QM/45/EAP	N <b>4.3.</b> 047.01	
Switches	QM/33, QM/34	N <b>4.3.</b> 051.01	
Switches	QM/134, QM/134/N	N <b>4.3.</b> 055.01	







#### **Alternative Cylinders**

Symbol	Model (magnetic piston)	Description
	RT/57200/JM	Double ended piston rod (16 to 63 mm bore)

#### Weight of Cylinders • Theoretical Forces • Air Consumption

	Weight (kg)	Weight (kg)		Theoretical forces (N) at 6 bar		Air consumption (I/cm stroke) at 6 bar	
Model	at 0 mm	per 100 mm	Outstroke	Instroke	Instroke	Outstroke	
57208	0,015	0,019	30	25,9	0,004	0,003	
57210	0,020	0,027	46,8	39,6	0,005	0,004	
57212	0,020	0,030	67,8	60	0,008	0,006	
57216	0,040	0,048	120	103	0,014	0,013	
57220	0,080	0,072	188	158	0,022	0,019	
57225	0,120	0,110	294	247	0,035	0,028	
57232	0,210	0,154	482	414	0,056	0,048	
57240	0,330	0,201	754	661	0,087	0,074	
57250	0,550	0,310	1178	1057	0,137	0,114	
57263	0,890	0,437	1870	1680	0,218	0,195	

#### Weights of Mountings (kg)

U		0 ( 0,								
				(m)	9			<b>(</b>		
Model	Style 'AK'	Style 'C'	Style 'F'	Style 'H'	Style 'L'	Style 'M'	Style 'N'	Style 'N2'	Style 'UF'	Switch bracket
57208	-	0,005	0,003	-	0,003	0,006	0,003	0,001	-	0,001
57210	0,015	0,007	0,010	-	0,010	0,020	0,003	0,001	0,015	0,002
57212	0,015	0,007	0,010	-	0,010	0,020	0,003	0,001	0,015	0,002
57216	0,020	0,016	0,012	-	0,020	0,032	0,010	0,002	0,021	0,005
57220	0,050	0,030	0,020	-	0,020	0,040	0,009	0,003	0,045	0,005
57225	0,200	0,040	0,040	-	0,034	0,074	0,011	0,007	0,080	0,006
57232	0,200	0,060	0,048	-	0,040	0,088	0,017	0,007	0,080	0,007
57240	0,200	0,083	0,090	-	0,086	0,176	0,025	0,010	0,120	0,008
57250	0,200	0,175	0,130	0,050	0,198	0,328	-	0,010	0,120	0,010
57263	0,650	0,294	0,220	0,070	0,318	0,538	-	0,021	0,150	0,012

### Warning

These products are intended for use in industrial compressed air systems only. Do not use these products where pressures and temperatures can exceed those listed under 'Technical Data'.

Before using these products with fluids other than those specified, for non-industrial applications, life-support systems, or other applications not within published specifications, consult NORGREN.

Through misuse, age, or malfunction, components used in fluid power systems can fail in various modes.

The system designer is warned to consider the failure modes of all component parts used in fluid power systems and to provide

and component parts used in little power systems and to provide adequate safeguards to prevent personal injury or damage to equipment in the event of such failure.

System designers must provide a warning to end users in the system instructional manual if protection against a failure mode

cannot be adequately provided.

System designers and end users are cautioned to review specific warnings found in instruction sheets packed and shipped with these products.



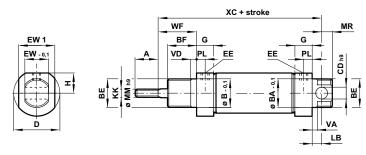
#### **Basic Dimensions**

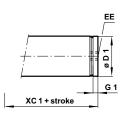
#### RT/57200/M

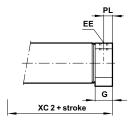
#### RT/57200/MC

RT/57200/MF

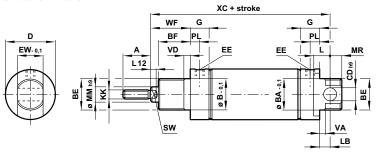
 $\varnothing$  8 to 12 mm bore

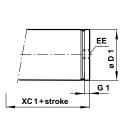


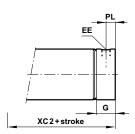




Ø 16 to 40 mm bore



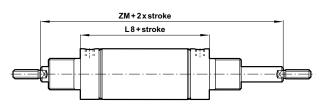




#### Double ended piston rod

#### RT/57200/JM

Ø 16 to 40 mm bore



Model	57208	57210	57212	57216	57220	57225	57232	57240
Ø	8	10	12	16	20	25	32	40
A	8	9	9	12	14	16	22	23
Ø B/Ø BA	10	10	10	12	16	18	22	30
BE	M 10 x 1	M 10 x 1	M 10 x 1	M 12 x 1,25	M 16 x 1,5	M 18 x 1,5	M 22 x 1,5	M 30 x 1,5
BF	7,5	8	8	10	12	12	15	15
Ø CD <sup>H9</sup>	3	4	4	5	6	8	8	10
Ø D	12	15	15	17,5	22	26,5	33,5	41,5
Ø D 1	9,5	11,5	13	17,5	21,5	26,5	33,5	41,5
EE	M 3	M 5	M 5	M 5	Rc 1/8	Rc 1/8	Rc 1/8	Rc 1/8
EW - 0,1	6	8	8	10	12	14	16	20
EW 1	10	12,5	-	-	-	-	-	-
G	7,5	9,5	9,5	11,5	15,5	15,5	17,5	18
G 1	3	4,5	4,5	4	8	8	5,5	5,5
Н	5	6,5	6,5	-	-	-	-	
KK	M 3	M 4	M 4	M 6	M 8	M 10 x 1,25	M 10 x 1,25	M 12 x 1,25
L	-	-	-	-	-	-	12	14
LB	4,5	5	5	7	7	9	7	5
L 8	-	-	-	44	53	53	63	67
L 12	-	-	-	5	5	5	5	6
Ø MM h9	3	4	4	6	8	10	12	14
MR	3	4	4	5	6	8	8	10
PL	4	5,5	5,5	5,5	9	9	9	10
SW				5	7	9	10	12
VA/VD	1,5	1,5	1,5	2	3	3	3	3
WF	8,5	10	10	13,5	15,5	16,5	23	24
XC	48	54	54	64,5	75,5	78,5	93	96
XC 1	39	44	44	50	61	62	74	78,5
XC 2	43,5	49	49	57,5	68,5	69,5	86	91
ZM	-	-	-	71	84	86	109	115



### VM 3001

# Butterfly valve, cast iron body, disc and shafts in stainless steel, EPDM liner, DN 20-500, PN 16/3, wafer type



#### General description

Butterfly valve for general applications with liquids, air and gases. High neck for insulation. The valve body is externally Epoxy coated and internaly completely covered by an exchangeble EPDM liner. The liner has also the function of as flange gasket on both sides.

Centric disc design assures tightness in both directions.

Standard split two-piwce shaft design with priple shaft bearings.

Mounting flange according to ISO 5211.

Designed to be mounted between flanges acc. to DIN2631, DIN2632, DIN2633 and ANSI B 16.5.

Approvals by TÜV, Lloyds, Bureau Veritas and others on request.

Options

Different types of actuators.
Extra high stem.
Other body coatings.
Different materials in body, disc, shaft and liner.

shaft and liner. SG iron body with DVGV gas approval Shaft bearings in PTFE. Vulcanised liner. Different flange standards. One-piece shaft Larger sizes.

Different face-to-face dimensions.

#### Materials

DN		20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500
Body	GG 25	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Disc	AISI 316	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Shafts	AISI 304	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Liner	EPDM	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
O-rings	NBR	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

#### Technical data

DN	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500
Pressure rating ∆p PN 16				•	•	•	•	•	•	•							
Pressure rating ∆p PN 10	•	•	•								•	•	•				
Pressure rating ∆p PN 6														•			
Presure rating ∆p PN 3															•	•	•
Mounting flanges PN 10/16	•	•															
Mounting flanges PN 6/10/16			•	•	•	•	•	•	•	•	•	• ¹)	• <sup>1</sup> )	• ¹)	• <sup>1</sup> )	• ¹)	• ¹)
Temperature -10 to +130 ℃	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Kv-value, m <sup>3</sup> /h	32	36	40	50	85	215	420	800	1010	2100	4000	6400	8500	11500	14500	20500	2100
Torque, Nm <sup>2</sup> )	5	5	5	8	9	18	24	37	59	125	140	200	280	610	750	860	2255

<sup>1)</sup> Standard PN 10. On request also PN 6 och PN 16.

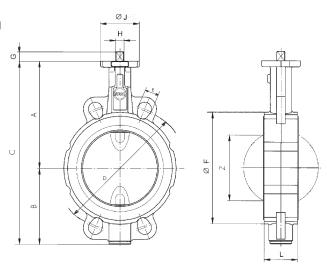
<sup>2</sup>) At max. Δp as standard design

 $(\bullet = standard)$ 

Kvalitets- & Miljöcertifierat enligt ISO 9002 och ISO 14001

Huvudkontor Filialkontor KALMAR **STOCKHOLM** GÄVLE GÖTEBORG HÄSSLEHOLM Tel. 0480 - 42 91 00 08 - 685 45 00 Tel. 026 - 54 36 00 Tel. 031 - 86 84 50 Tel. 0451 - 38 83 50 Fax. 0480 - 42 91 20 031 - 86 84 59 Fax. 0451 - 38 83 54 08 - 685 45 19 026 - 54 36 09 Fax. Fax.

#### Dimensional drawing



#### Dimensional data

DN	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500
L	33	33	33	33	43	46	46	52	56	56	60	68	78	92	102	114	127
Α	104	104	104	113	126	134	157	167	180	203	228	266	291	332	363	397	437
В	45	45	50	66	84	93	104	115	127	150	176	212	237	269	314	335	405
C	149	149	154	179	210	227	261	282	307	353	404	478	528	601	677	732	842
D	75	85	100	110	125	145	160	180	210	240	295	350	400	460	515	565	620
E	14	14	18	18	18	18	18	18	18	22	22	22	22	22	26	26	26
F	64	64	69	82	95	115	130	150	180	206	268	315	360	408	470	530	574
12	12	12	12	12	12	16	16	16	19	19	24	24	**	**	**	**	
Н	11	11	11	11	11	11	14	14	14	17	17	22	22	**	**	**	**
J	54	54	54	54	54	54	65	65	65	90	90	125	125	150	150	210	210
Z	-	-	-	22	25	45	65	85	111	139	190	240	287	330	378	417	474
Mount.fl. ISO-521	1 F04	F04	F04	F04	F04	F04	F05	F05	F05	F07	F07	F10	F10	F12	F12	F16	F16
Weight, kg *	1,3	1,3	1,4	1,8	2,2	2,9	4,0	5,2	6,9	9,5	13,2	22,5	31,5	39,4	58,7	91,0	107,0

<sup>\*</sup> split two-piece shaft Face-to.face acc. to DIN 3202-K1/ISO 5752 - Series 20

\*\* Acc. to actuator demand

G

#### Markings

Valve body is marked with producer, DN, PN, materials and type.

#### Mounting

Optional, but horizontal shafts is recommended.

#### Maintenance

The valve is maintenance free.

For best function though, regulary exercise is recommended.

#### Ordering umbers for hand operated valves

DN	With hand lever VM 3090 Art.no		With hand lever VM 3093 Art.no	With worm gear VM 3099 Art.no				
20 25 32 40 50 65 80 100 125 150 200 250 300	30010203090 30010253090 30010253090 30010323090 30010403090 30010503090 30010803090 30011003090 30011253090 30012503090 30012503090 30012503090 30012503090		Art.no 30010203093 30010253093 30010253093 30010403093 30010503093 30010803093 3001103093 3001153093 300112003093 30012003093 30012003093 3001303093	30010203099 30010253099 30010253099 30010323099 30010403099 30010503099 30010803099 300110303099 30011203099 300112503099 300112503099 30012503099 30013003099				
350				30013503099				
400 450				30014003099 30014003099				
500				30015003099				

Dimensions on levers and worm gears, please see separate data sheets VM 3090, VM 3093 and VM 3099.

In the interest of technical progress, designs and dimensions may be subject to modification

#### Ordering no for valves with free shaft

DN	Artikelnummer
20	3001020
25	3001025
32	3001032
40	3001040
50	3001050
65	3001065
80	3001080
100	3001100
125	3001125
150	3001150
200	3001200
250	3001250
300	3001300
350	3001350
400	3001400
450	3001450
500	3001500



### VM REVO RS7 002 - RS2 380

#### Pneumatic single acting actuator, with spring return



#### General

90°-pneumatic rack and pinion actuator with bearing supported pistons and a patented, balansed shaft.

High resistance wear and reliablility as well as long lifetime.

Blowout-proof design.

Top drilling and top of shaft according to Namur.

Bottom mounting according to ISO 5211.

Solenoid valve connection according to Namur.

Position indication in red polyamide.

The actuator is permanet greased and maintenance free.

#### Options

Double acting.

Mounted solenoid valve (bistable, monostable, Ex-design). Mounted limit switches, mekanical or inductive, and Ex-design. Mounted pneumatic positioner (20-100 kPa/3-15 Psi) or elektropneumatic/digital positioner (4-20 mA). Control block with Namur connection for adjustabel stroke time. Larger dimensions.

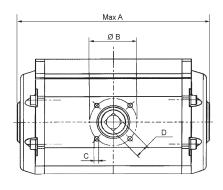
#### Technical data

Torque* (Nn	No of	-	٩ir		ina St	roke time	Ambient temp.	-20°C to +8	0°C
					- 1				
	springs	0°	90°	0°	90°	sek	Manual override	Sqare head	of shaft for manual emergancy
RS7 002	10	11	6	4,8	9,8	<0,5		operation	
RS7 006	10	26	15	11,3	22,7	<0,5			
RS5 012	12	49	24	25	50	<0,5	Travel stops	End opsitio	n tolerance +/- 1,5°
RS5 025	12	96	48	48	96	<0,5		RD7 has on	e adjustable travel stop as standard
RS5 050	12	178	88	88	178	0,8		End positio	n 90° can be adjusted -8°.
RS5 090	12	346	170	160	336	1,0		For RD5 & F	RD2, adjustable travel stops
RS5 130	12	526	264	244	506	1,0		is option (+	-4 / -8°).
RS5 180	12	692	347	320	665	1,2			
RS2 205	12	1011	506	506	1011	1,2	Materials		
RS2 380	12	1518	759	758	1517	2,1			
* N.B. Stated v			oe incre	eased v	vith 30%	6 for	Body	Anodised a	luminium
At lower air	pressure th	an 6 bar,	please	contac	t Ventin	n AB.	Shaft	Anodised a	luminium
Air pressure	Filt	ered pre	essuris	ed air,	non ag	ggressive	piston	RD2-RD5	Aluminium
	gas	i.					r	RD 7:	Plastic
	Fee	ding pr	essure	2-10 l	oar(e)				
	(RE	7: 1,5-7	bar)				End cap screws	Stainless st	el
Air consump	otion NI/	stroke ((	0-90°)	at 6 ba	ır(e)				
	RD:	7 001	0,35	RE	05 090	25,2	End caps	Aluminium	painted
	RD:	7 002	1,05		05 130	38,4			est plastic, painted
		7 006	2,10		05 180	50,5			or prostro, parried
		012	3,71		205	63,0	O-rings	Buna N	
		025	7,14	RE	02 380	91,0	O 111193		iton on request
	RD	050	13,3					(LI DIVI OI V	itori ori request

Kvalitets- & Miljöcertifierat enligt ISO 9002 och ISO 14001

Huvudkontor	Filialkontor			
KALMAR	STOCKHOLM	GÄVLE	GÖTEBORG	HÄSSLEHOLM
Tel. 0480 - 42 91 00	Tel. 08 - 685 45 00	Tel. 026 - 54 36 00	Tel. 031 - 86 84 50	Tel. 0451 - 38 83 50
Fax. 0480 - 42 91 20	Fax. 08 - 685 45 19	Fax. 026 - 54 36 09	Fax. 031 - 86 84 59	Fax. 0451 - 38 83 54

Dimensions bottom



Plana sidor, endast R7 001-006:14

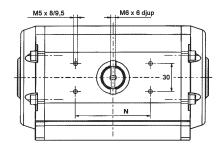
M5 x 6/8 djup

G1/4" x 12 djup

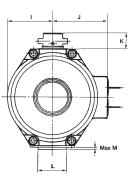
12] \_ 24

side

top



end cap



#### Dimensional data

	Α	В	С	D	Е	F	G	Н	I	J	K	L	М	N	0	ISO 5211	Weight
																	kg
RS7 002	167	42	M8x12,5/14	11H11x10	24	25,5	29	-	67	79	20	-	-	50	25	F04/V11	0,50
RS7 006	200	50	M6x10/11	14H11x10	24	35,5	39	-	34	41	20	-	-	80	30	F05/V14	0,95
RS5 012	207	50	M6x8,8/9,8	14H11x17	24	44,5	46,5	25,05	41	52,5	20	35	3	80	30	F05/V14	2,15
RS5 025	215	50	M6x8,8/9,8	14H11x17	24	59,5	61,5	25,15	55	67	20	35	3	80	30	F05/V14	3,50
RS5 050	270	70	M8x12,5/14	17H11x21	24	71,5	74,5	32,25	67	79	20	55	3	80	30	F07/V17	5,85
RS5 090	355	102	M10x16/18,5	22H11x25	24	81,5	84,5	46,85	78	94	30	70	4	130	30	F10/V22	10,40
RS5 130	415	102	M10x16/18,5	22H11x25	24	94	98	54,50	90	100	30	70	4	130	30	F10/V22	19,00
RS5 180	420	125	M12x18/22	27H11x30	24	106,5	111,5	54,50	102	114	30	85	4	130	30	F12/V27	22,50
RS2 205	490	140	M16x26/27,5	36H11x40	53	137	137	64,50	119	135,5	30	100	4	130	30	F14/V36	30,00
RS2 380	600	140	M16x26/27,5	36H11x40	53	137	137	92,90	119	135,5	30	100	4	130	30	F14/V36	37,00

## Mounting Optional mounting.

#### Maintenance

The actuator is maintenance free. Lubricated with grease for minimum 500 000 strokes. Spare parts list can be provided on request.

#### Testing

Every actuator is individually tested mand provided with a serial number for easy identification.

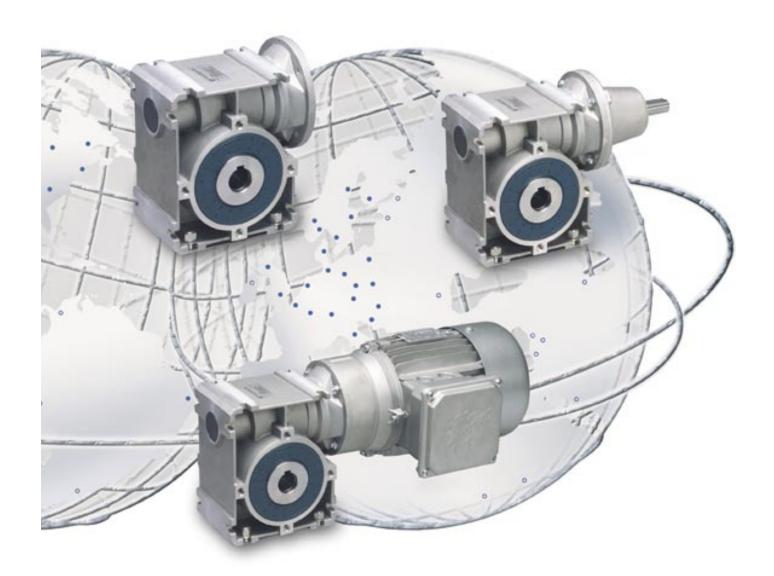
Ordering numbers											
DN	Art no	RSK-no									
	RS7 002										
	RS7 006										
	RS5 012										
	RS5 025										
	RS5 050										
	RS5 090										
	RS5 130										
	RS5 180										
	RS2 205										
	RS2 380										

In the interest of technical progress, designs and dimensions may be subject to modification

**Betriebs- und Wartungsanleitung Operating and Maintenance Instruction** Notice de mise en service et d'entretien

**B** 1033 DE GB FR

**UNIVERSAL – Schneckengetriebe, Typ SD / SI UNIVERSAL – Worm Gear Units, Typ SD / SI** UNIVERSAL - Réducteurs à roue et vis sans fin, Typ SD / SI



Diese Sicherheitshinweise sind aufzubewahren These safety instructions must be kept available Ces instructions de sécurité doivent être observées

### Getriebebau NORD

D-22934 Bargteheide · P.O.Box 1262, D-22941 Bargteheide · Rudolf-Diesel-Straße 1 Tel. 0-45-32-/-401-0 · Fax 0-45-32-/-401-253 · NORD Internet: http://www.nord.com



#### **∆** Warnung

Es wird vorausgesetzt, daß die grundsätzlichen Planungsarbeiten der Anlage Montage, Transport, Installation, Inbetriebnahme, Wartung und Reparaturen von qualifiziertem Personal ausgeführt bzw. durch verantwortliche Fachkräfte kontrolliert werden. Bei Arbeiten am Getriebemotor muß garantiert sein, daß keinerlei Spannung anliegt, und dieser gegen Wiedereinschaltung aesichert ist.

#### **∆** Warnung

Veränderungen gegenüber dem Normalbetrieb (höhere Leistungsaufnahme, Schwingungen, Geräusche Temperaturen, usw. oder Ansprechen der Überwachungseinrichtungen) lassen vermuten, daß die Funktion beeinträchtigt ist. Zur Vermeidung von Störungen, die ihrerseits mittelbar oder Personenunmittelbar schwere oder Sachschäden bewirken könnten, muß das zuständige Wartungspersonal dann umgehend verständigt werden.

Δ Im Zweifelsfall die entsprechenden Betriebsmittel sofort abschalten!

#### Aufstellung, Vorbereitung

- Fundamente ausreichend bemessen und schwingungsfrei ausführen
- Getriebe oder -motor fest und ohne Verspannung montieren
- ausreichende Belüftung vorsehen
- serienmäßiges Innengewinde nach DIN 332 zum Aufziehen von Verbindungselementen auf die Wellen benutzen
- Schläge auf die Wellen vermeiden (Lagerbeschädigung!)
- Maschine und Getriebe möglichst mit elastischen Kupplungen verbinden
- vor dem Einschalten Abtriebselemente aufziehen bzw. Paßfeder sichern
- bei Aufsteckgetrieben mit Drehmomentstütze Gummipuffer verwenden
- die EU-Maschinenrichtlinie ist zu beachten
- bei Anwendungen bei denen der Ausfall eines Getriebe oder –motors zu einer Personengefährdung führen könnte, sind entsprechende Sicherheitsmaßnahmen vorzusehen

#### Elektrischer Anschluß

- Motoranschluß nach Schaltbild vornehmen
- Übereinstimmung von Netzspannung und Frequenz mit den Typenschild-Daten sicherstellen
- Sichere Schutzleiterverbindung herstellen
- evtl. falsche Drehrichtung korrigieren durch Vertauschen von 2 Phasen
- Nicht benötigte Kabeleinführungsöffnungen und den Kasten selbst staub- und wasserdicht verschließen
- Überbelastung und Phasenausfall durch Schutzschalter vorbeugen
- Einstellen des Motorschutzschalters auf Nennstrom
- Schaltbilder auf der letzten Seite
- Bei Bremsmotoren ist die Betriebs- und Wartungsanleitung B1090 zu beachten.

#### Wirkungsgrade

Da bei neuen Getrieben der Schneckenradsatz einlaufen muß, ist die Reibung zunächst noch größer als nach dem Einlauf.

#### **Λ** Caution

It is presumed that fundamental project work as well as all work with regard to transport, assembly, installation, starting-up, maintenance and repair is performed by qualified personnel resp. supervised by skilled labour taking overall responsibility. Make absolutely sure that no voltage is applied at all while work is being done on the geared motor. Drive must also be secured against switching on while work is in progress.

#### **∆** Caution

Any deviation from normal operating conditions (increased power consumption, temperature, vibrations, noise etc.) or warning signals by monitoring equipment suggest malfunction. Inform the responsible maintenance personnel at once to prevent the trouble from getting worse and causing, directly or indirectly, serious physical injury or material damage.

 $\Delta$  In case of doubt switch-off the machine immediately!

#### Preparing and performing installation

- the foundation (base) should be of adequate size and vibration-proof
- install gear unit or geared motor rigid and braceless
- ensure sufficient ventilation
- make use of tapped hole (DIN 332) to fit transmission element to the shaft end
- avoid shocks on shafts (bearing damage!)
- preferably use flexible coupling between output shaft and driven machine
- fit transmission element to shaft end or secure feather key before starting the motor
- use rubber buffer on shaft mounting gearboxes with torque arm
- the EC-machinery directive must be observed
- in applications where the failure of the gearbox or motor could be hazardous for personnel, appropriate safety measures must be taken

#### Connection of motor

- Connect motor according to diagram
- make sure that mains voltage/frequency are in accordance with nameplate information
- make secure protective conductor
- if motor is running in reverse direction, interchange two phases
- Close unused cable entrance holes and the box itself in a dust- and watertight manner.
- install protective switches to prevent overload and phase failure
- set motor protection switch to nominal current
- wiring diagrams on the last page
- When using brakemotors observe the O&M manual B1090

#### Efficiencies

New worm gearsets in gearboxes must be run-in for an initial phase before reaching their maximum rated efficiency. During the initial run-in phase the coefficient of friction is higher than after completing the run-in phase.

#### ∆ Avertissement

Il est impératif que les travaux fondamentaux de l'installation, ainsi que tous les travaux de transport, montage, installation, mise en exploitation, entretien et réparation soient accomplis par du personnel qualifié et contrólés par des techniciens spécialisés dans ce domaine. Avant toute intervention sur le motoréducteur, il faut s'assurer que celui-ci n'est plus sous tension et que la remise sous tension soit interdite.

#### ∆ Avertissement

Si en utilisation normale, des modifications de fonctionnement apparaissent telles que puissance absorbée trop élevée, température élevée, vibrations fortes, bruit intense etc. ou en rapport avec les contrôles techniques, cela laisse supposer que différentes fonctions de l'appareil peuvent être détériorées. Pour éviter ensuite des problèmes, qui pourraient entraîner de graves accidents corporels ou de graves dégats matériels, le personnel d'entretien compétent doit immédiatement être informé.

Δ Si vous êtes dans le doute, coupez immédiatement l'alimentation!

#### Mise en place, préparation

- prendre largement les dimensions des embases et les réaliser exemptes de vibrations
- monter les réducteurs et motoréducteurs solidement et sans haubanage
- prévoir une aération suffisante
- prévoir le taraudage conforme à la norme DIN 332 pour monter des accouplements sur les arbres d'entrée et de sortie
- éviter de donner des coups sur les arbres (cela pourrait détériorer le roulement!)
- lier autant que possible la machine et le réducteur avec des accouplements élastiques
- avant la mise en service, enlever l'élément d'accouplement ou/et fixer la clavette
- utiliser pour l'exécution arbre creux avec bras de réaction une butée en caoutchouc
- La directive machine EU est à prendre en considération
- pour les applications où la défaillance d'un réducteur ou d'un moteur pourrait blesser des personnes, des mesures de sécurité doivent être prises

#### Branchements électriques

- brancher le moteur selon le schéma
- s'assurer que la tension du réseau et la fréquence correspondent aux données inscrites sur la plaque signalétique
- Le cable de raccordement doit être protégé
- corriger un éventuel mauvais sens de rotation par une inversion de deux phases
- Les entrées de câbles non utilisées doivent être obturées, la boîte elle-même devant être fermée de façon à être étanche à l'eau et à la poussiére
- prévoir une protection électrique contre les surcharges, court-circuit et défaut de phases
- régler la protection électrique suivan l'intensité nominale du moteur
- schéma de branchement à la derniére page
- Pour les moteurs frein veuillez vous reporter à la notice de mise en service et d'entretien B1090

#### Rendements

Le couple roue et vis d'un réducteur neuf doit fonctionner pendant quelques heures avant d'obtenir son rendement maximum. Pendant cette phase de rodage les rendements sont inférieurs aux rendements indiqués dans le catalogue.

Wartung GETRIEBE/MOTOR

Die UNIVERSAL-Schneckengetriebe sind mit synthetischem Öl befüllt, dadurch ist über die gesamte Lebensdauer eine einwandfreie Funktion gewährleistet. Daher sind die UNIVERSAL-Schneckengetriebe wartungsfrei.

Entlüftungsschrauben sind nicht erforderlich, die UNIVERSAL-Schnecken-getriebe sind vollkommen geschlossen. Die Lager des Motors haben ebenfalls

eine Lebensdauerschmierung. Bei Bremsmotoren ist die Betriebs- und Wartungsanleitung B1090 zu beachten.

#### Zusammenbau von Modulen und **Anbau eines Motors**

- Montageanleitungen der Anbau-Module beachten
- Eventuelle Hinweise Motorlieferanten beachten
- Motorwelle beim Schläge auf die Aufstecken der Kupplungshülse
- Außenaufstellung oder feuchter Umgebung sind die Fugen zwischen Motor und Getriebe mit geeigneter Dichtpaste gegen Eir Feuchtigkeit abzudichten. Eindringen `

#### Inbetriebnahme

- bei längeren Lagerzeiten besondere Vorkehrungen treffen (siehe Werknormblatt "Langzeitlagerung") Luftgekühlte Motoren sind für
- Umgebungstemperaturen von 20°C bis +40°C sowie Aufstellungshöhen bis 1.000 m über NN ausgelegt
- Der Einsatz im Ex-Bereich zulässig, sofern nicht ausdrücklich von NORD geprüft freigegeben. und schriftlich
- Getriebe oder -motor nur mit den zulässigen Leistungsdaten betreiben

## Maintenance GEARBOX/MOTOR The UNIVERSAL

series of wormgearboxes are filled with synthetic lubricant/bearing-grease. This ensures proper operation throughout the full lifetime of the units. Therefore lifetime of the units. Therefore UNIVERSAL drives are maintenance-free. No breather plugs are required. UNIVERSAL drives are

completely sealed.

The motor bearings are also lifetime

lubricated.
When using brakemotors observe the O&M manual B1090.

#### Assembly of modules and fitting of a

- observe the assembly instructions of the optional modules
- instructions of the observe supplier if any
- avoid shocks onto the motorshaft when fitting the coupling-sleeve damage!)
- For outdoor operation or in other humid/wet environment seal the gap between motor and gearbox with suitable sealant against the ingress of humidity.

- Starting up
   in case of long-time storage take special precautions (as provided in w standard sheet "Extended Storage")
- -air-cooled motors are designed for ambient temperatures between -20°C and +40°C and for installation at altitudes up to 1.000 m a.m.s.l.
- The use in hazardous areas is prohibited unless explicitly checked by NORD and confirmed in writing.
- Use gearbox or motor only within the permissible performance data

#### Entretien DU REDUCTEUR/ DU MOTEUR

Les réducteurs et les motoréducteurs à roue et vis sans fin UNIVERSAL sont remplis d'huile synthétique ce qui garantit un bon fonctionnement pendant toute la durée de vie. De ce fait, les réducteurs à roue et vis sans fin UNIVERSAL ne nécessitent pas d'entretien.

Les vis d'évent ne sont pas non plus nécessiares et les réducteurs à roue vis sans fin sont livrés entièrement fermés. Les roulements des moteurs sont également graissés à vie. Pour les moteurs frein veuillez vous reporter à la notice de mise en service et d'entretien

#### Assemblage des modules et montage

- du moteur

   prendre en considération la notice de montage
- éventuellement tenir compte recommandations du fournisseur du moteur
- éviter les coups sur l'arbre du moteur lors du montage de l'accouplement (endommagement des roulements)
- Pour des installations à l'extérieur ou dans un milieu humide, il faut appliquer de la pâte à joint sur les plans de joint entre le moteur et le réducteur, ou entre les modules, pour éviter la pénétration d'humidité.

#### Mise en fonctionnement

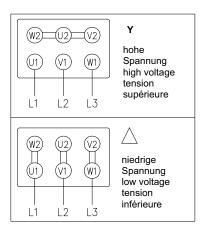
- -si un stockage longue durée du réducteur est prévu, il faut prendre les dispositions nécessaires (voir dispositions nécessaires (vo spécification "Stockage longue durée")
- les moteurs autoventilés sont dimensionnés pour des températures ambiantes comprises entre -20°C et +40°C, ainsi que pour une altitude â 1000 mètres au-dessus du niveau de la
- Leur utilisation dans des atmosphères explosives Ex est interdite, à moins que ces moteurs ne soient expressément prévus à cet effet et avec accord écrit de NORD
- Les réducteurs et les moteurs ne doivent fonctionner qu'avec caractéristiques de puissance indiquées.

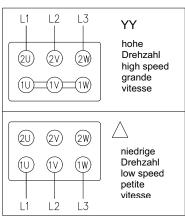
#### Schaltbilder / Wiring diagrams / Schémas de branchement

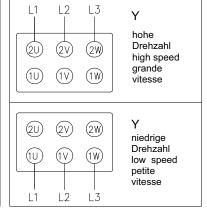
Drehstrommotor Three phase motor Moteur triphasé

Drehstrommotor, polumschaltbar Dahlanderschaltung Three phase motor, polechanging, Dahlander connection Moteur triphasé à commutation de pôles, couplage Dahlander

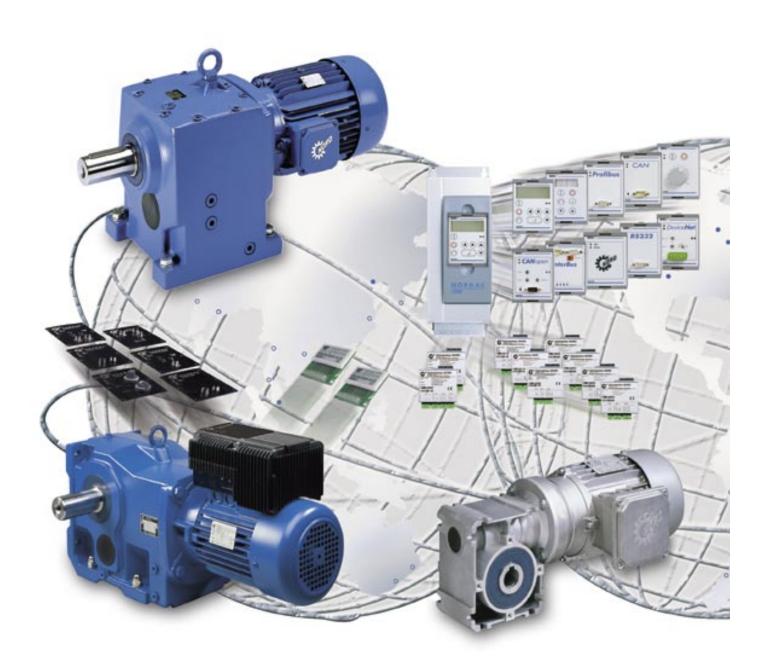
Drehstrommotor, polumschaltbar getrennte Wicklungen Three phase motor, polechanging, separate windings Moteur triphasé à commutation de pôles, bobinages séparés







# www.nord.com





#### Ventilsysteme GmbH

# Type 785/786

## The Flowmeter Type 785 is based on the variable area principle.

The position of the top of the float against the scale on the tube shows the flow rate level.

In addition to the visual readout, this flowmeter may be fitted with minimum and maximum limit switches, or with a transmitter.

#### Technical Data:

#### Temperature range:

Tube Material Trogamid	= 60° (	Э
Tube Material Polysulfon	= 60° (	С
End Connections uPVC	= 100° (	С
End Connections Malleable Iron	= 100° (	0
End Connections Stainless Steel	= 100° (	0

#### 'O' Ring Seals EPDM or FPM.

#### Float Material

Stainless Steel or PVC.

#### **Accuracy Class**

2,5 according to VDE/VDI 3513 Sheet 2 e.g.  $\pm$  0,625 % of end-scale,  $\pm$  1,875 % of measured value, inaccuracy in I/hr resp. m³/hr.

#### **Maximum Pressure**

10 bar bei Trogamid with PVC end connections 16 bar bei Polysulfon with metal end connections.

#### Standard Scales

I/hr and m³/hr based on water at 20° C or % scale. Special scales available on request.

#### Limit Switches (K) and Transmitter (FG)

Limit switches or a continuous transmitter may be fitted to the flowmeter tube.

When these accessories are used a magnetic floater must also be used.

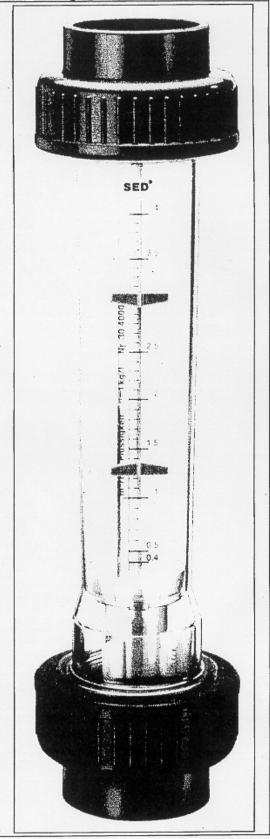
#### Installation Details: Controlled System

When the flowmeter is used in a system with valve control the following criteria must be observed:

- 1) With liquid flows the valve can be fitted before or after the flowmeter;
- 2) With gases, the valve must be fitted after the flow-meter.

#### Important!

The floater in the flowmeter reacts very sensitively to any change in flow rate, therefore any valve setting adjustment must be gradual and slow.



# Beck. The factory-set pressure switches.





#### Pressure switch 901

with factory-set pressure setting



#### **Application**

Factory-set pressure switch monitoring overpressure, vacuum or differential pressure of liquid and gaseous – also aggressive – media.

Pressure setting and switching differential are factory-set by the manufacturer.

#### **Temperature range**

Ambient temperature from -20° C to 85° C.
Temperature of media up to 85° C or 130° C depending on material of pressure connection and diaphragm.

#### Diaphragm material

Depending on media NBR, Silicone, Viton®, EPDM. For 901.30 Silicone, others upon request.

#### **Electrical rating**

Values indicated for resistive load

AgCdO-contacts: 6 (1.5) A/250 VAC 2 A/24 VDC Gold-plated contacts: 100 mA/24 VAC

100 mA/24 VAC 30 mA/24 VDC

AgCdO-contacts up to 10 A/250 VAC can be supplied upon

request.

#### **Electrical connection**

AMP connection 6.3 mm x 0.8 mm DIN 46244.

#### **Arrangement of contacts**

for 901.1x, 901.30, 901.41, 901.51

only for 901.2x





#### **Approvals**

CE conformance according to EC Low Voltage Directive 73/23/EEC. Product types tested by TÜV Südwest.

#### Life

Minimum 10<sup>6</sup> cycles.

#### **Damping**

Restrictors alternatively with 0.3/0.5/0.8 mm diameter.

#### **Accessories**

Various mounting brackets and protection caps with IP 44, IP 54 and IP 65.

#### Mounting position

Mounting in any position, to be specified for settings below 100 mbar.

#### **Pressure connection**

Туре	Tub	e connection				Threaded co	nnection		
	5.0 mm	6.5 mm	10.0 mm	M 10 x1	G 1/8	M 10 x1	G 1/8	G 1/4	G 1/2
	FS	FS	FS						
901.1x	PA	PA	PA	PA	PA	CuZn40	CuZn40	CuZn40	CuZn40
		PPS	PPS	PVDF	PVDF			PVDF	
901.2x	PA	PA	PA	PA	PA	CuZn40	CuZn40	CuZn40	CuZn40
		PPS	PPS	PVDF	PVDF			PVDF	
901.30		PA							
901.41						CuZn40	CuZn40	CuZn40	CuZn40
								PVDF	
901.51						CuZn40	CuZn40	CuZn40	CuZn40
								PVDF	

 $PA = polyamide, \ PVDF = polyvinyldifluoride, \ PPS = polyphenylensulfide, \ CuZn40 = brass, \ FS = fastening \ spring$ 

For temperature above 85° C brass, PVDF or PPS pressure connection is required. Upon request pressure connections of other sizes, other plastics or stainless steel are available.



#### Overpressure range

Туре		ory-set ressure		switching ential	Tolerance band in % of trip pressure	Maximum positive working pressure	Maximum negative working pressure
	between	and	lower end of range	upper end of range		standard/ extended	standard/ extended
901.1x	5 mbar	200 mbar	2.5 mbar	50 mbar	10 %	0.5/4 bar	-/-1 bar
	200 mbar	1.000 mbar	50 mbar	150 mbar	10 %	1/4 bar	-/-1 bar
901.41	500 mbar	3.000 mbar	200 mbar	600 mbar	10 %	7 bar	-1 bar
901.51	1.0 bar	12 bar	0.2 – 0.5 bar	1.0 – 2.0 bar	10 %	25 bar	-1 bar

#### Vacuum range

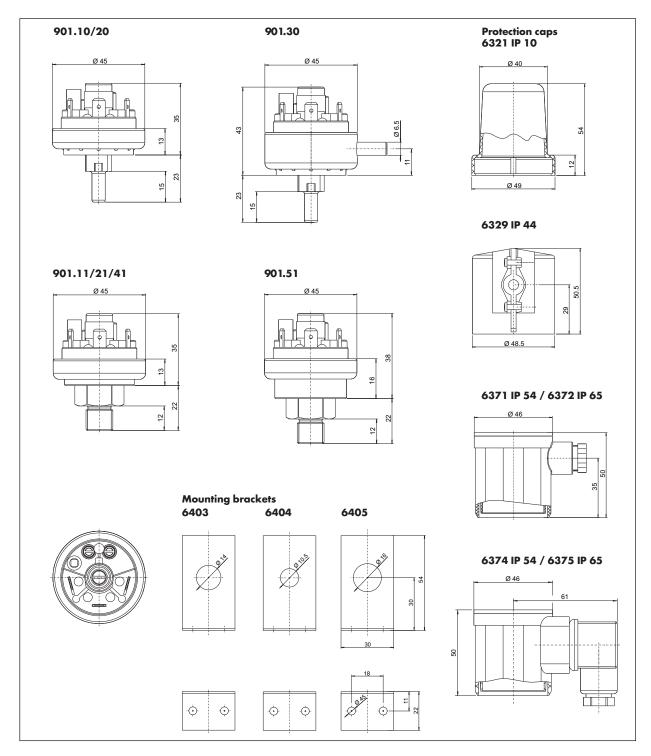
	3						
Туре		ory-set ressure		switching ential	Tolerance band in % of trip pressure	Maximum positive working pressure	Maximum negative working pressure
	between	and	lower end of range	upper end of range		standard/ extended	standard/ extended
901.2x	– 5 mbar	– 200 mbar	2.5 mbar	50 mbar	10 %	0.5/4 bar	-1 bar
	- 200 mbar	– 900 mbar	50 mbar	150 mbar	10 %	1/4 bar	-1 bar

#### Differential pressure range

Туре		ory-set ressure		switching rential	Tolerance band in % of trip pressure	Maximum positive working pressure	Maximum negative working pressure
	between	and	lower end of range	upper end of range		standard/ extended	standard/ extended
901.30	5 mbar	50 mbar	2.5 mbar	25 mbar	10 %	100 mbar	-100 mbar

#### **Pressure switch 901**

with factory-set pressure setting





Beck GmbH
Druckkontrolltechnik
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Phone +49 711 7 90 83-0
Fax +49 711 7 90 83-83
e-mail sales@beck-sensors.com
http://www.beck-sensors.com



## **VM** 7685

### Pressure Reducing Valve, 1/2" - 4", PN 25.



#### Beskrivning

Pressure Reducing Valve for water and pressure air. Compensated operation.

Outlet pressure gauge connections 1/4" on both sides. Outlet pressure can be adjusted between 0.5 and 6 bar. Factory preadjustment: 3 bar.

#### Accessories

Pressure Gauge with body diameter 2", connection DN 1/4", 0-10 bar (VM 9710).

#### Material

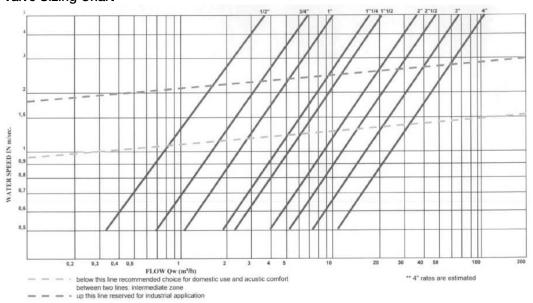
ı	Body	N Partial indicate at terrain	
ı	Boay	Nickel-plated brass	

#### Technical data

Size, inches	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4
Maximum inlet pressure	25	25	25	25	25	25	25	25	25
Min and Max working teperatures 0°C-130°C	•	•	•	•	•	•	•	•	•

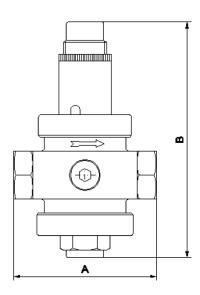
 $<sup>(\</sup>bullet = standard)$ 

#### Valve Sizing Chart



**Head Quarter** Sales Offices GÄVLE GÖTEBORG KALMAR STOCKHOLM SUNDSVALL HÄSSLEHOLM Tel. 0480 - 42 91 00 Tel. 08 - 685 45 00 Tel. 026 - 54 36 00 Tel. 060 - 61 79 77 Tel. 031 - 86 84 50 Tel. 0451 - 38 83 50 Fax. 0480 - 42 91 20 Fax. 08 - 685 45 19 Fax. 026 - 54 36 09 Fax. 060 - 61 79 77 Fax. 031 - 86 84 59 Fax. 0451 - 38 83 54

#### **Dimension Sk**



#### **Dimension Table**

Size, inches	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4
A (mm)	77	85	89	125	130	138	148	177	190
B (mm)	120	150	160	220	220	250	256	285	310

#### Mounting

Can be installed in any position: vertical, horizontal, oblique.

#### Maintenance

The valve is maintenance free.

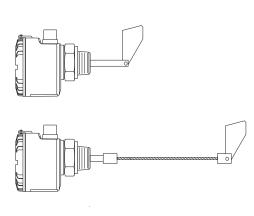
#### **Order Information**

• • • • •	
Size	Art nr
1/2	7685015
3/4	7685020
1	7685025
1 1/4	7685032
1 1/2	7685040
2	7685050
2 1/2	7685065
3	7685080
4	7685100

KA 094R/09/a3/04.00 No.: 510 00917



- d Füllstandgrenzschalter
  e Level Limit Switch
  f Détecteur de niveau



Endress+Hauser The Power of Know How

d Inhalt	Seite	e Contents	Page f	f Sommaire	Page
Sicherheitshinweise	ო	Notes on safety	က	Conseils de sécurité	ო
Einbaubeispiele	4	Mounting examples	4	Exemples	
Funktion	7	Function	7	d'implantation	4
Anschluss	8	Connection	œ	Fonction	7
Wartung	10	Maintenance	10	Raccordement	ω
Technische Daten	<del></del>	Technical data	Ξ	Entretien	10
Abmessungen und	Ç	Dimensions and	(	Caractéristiques	<del>,</del>
Werkstorre Geräteidentifikation	<sub>Σ</sub> 4	materials Device identification	ε <u>†</u>	Dimensions et	=
Fraänzende		Supplementary		matériaux	13
Dokumentation	16	documentation	16	Dénomination	4
				Documentation complémentaire	9

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# d Sicherheitshinweise

mäßem Gebrauch können Gefahren von ihm ausgehen. standsgrenzschalter für spesetzt werden. Bei unsachge-Der FTE 31 darf nur als Füllzifizierte Schüttgüter einge-

derer Beachtung dieser Betriebsanleitung, der gesetzli-Das Gerät darf nur von qualischlossen, in Betrieb genomfiziertem und autorisiertem Fachpersonal unter beson-Zertifikate (je nach Anwenmen und gewartet werden. chen Vorschriften und der dung) eingebaut, ange-



# Achtung!

= verboten - führt zu fehlerhaftem Betrieb oder Zerstörung.

# e Notes on safety

The FTE 31 paddle switch is a level limit switch, designed for use in fine-grained bulk solids in non-hazardous areas.

pour produits solides en vrac de faible granulométrie, uti-lisable en zones non explosi-

de niveau à palette rotative

Le FTE 31 est un détecteur

f Conseils de sécurité

operated and maintained by related dangers may arise. connected, commissioned, The FTE 31 paddle switch possible that application-If used incorrectly it is may be installed,

non conforme aux prescriptions. L'appareil ne doit être in-

bles. Il peut être source de

danger en cas d'utilisation

personnel qualifié et autorisé, qui tiendra compte des in-

dications contenues dans la

des certificats disponibles des normes en vigueur et présente mise en service,

(selon l'application).

vice et maintenu que par un

stallé, raccordé, mis en ser-

requirements, and, where appropriate, the certificate. ting instructions, any relevant personnel only, under strict observance of these operaqualified and authorised standards, legal



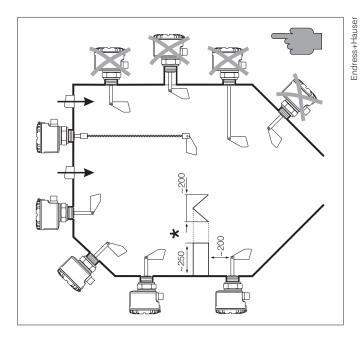
# Attention!

dysfonctionnements ou = interdit - peut provoquer des

la destruction. = forbidden - leads to incorrect operation or destruction. Caution!

က

Endress+Hauser



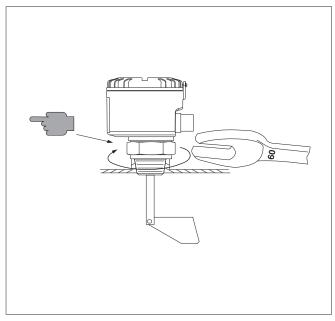
Exemples d'implantation \* Déflecteur

e Mounting examples
\* Protective roof

d Einbaubeispiele
\* Schutzdach

4





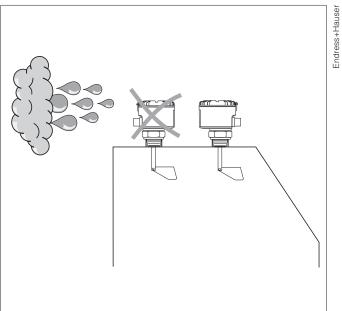
d Füllstandgrenzschalter
FTE 31 einschrauben
Nicht am Gehäuse drehen!

e Screw the FTE 31 paddle switch into the process connection

Don't use housing to turn!

f Visser le détecteur à palette rotative FTE 31
 Ne pas se servir du boîtier!

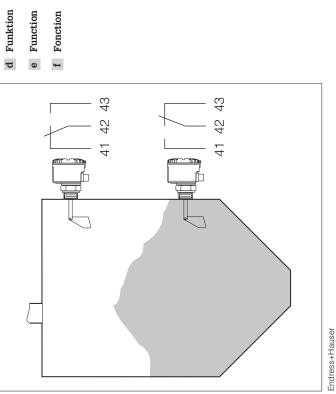
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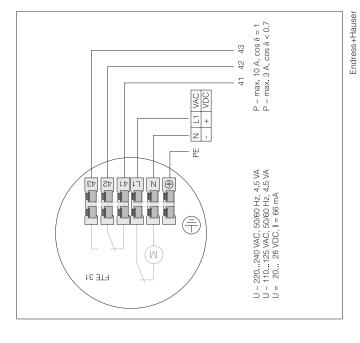


**d** Gehäuse in richtige Position drehen.

Screw the housing to the correct position.

f Positionner le boîtier.

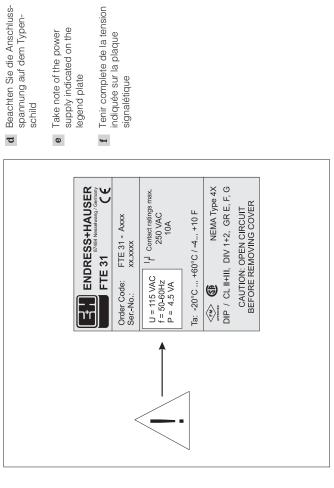




d Anschluss FTE 31
e Connection FTE 31
f Raccordement FTE 31

∞





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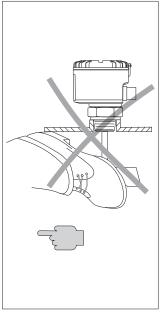
d Wartung
Anbackungen entfernen

# Maintenance Build up removal

f Entretien
Enlever les incrustations



- d Nicht besteigen!
- e Don't use as a step!
- **I Ne pas** marcher sur les lames vibrantes!



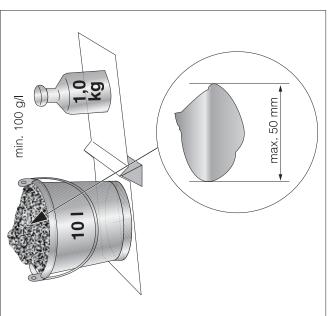
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d Technische Daten Schüttgröße und Korngewicht

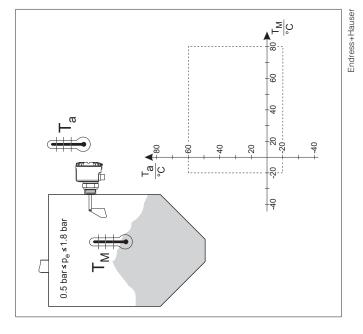
# e Technical data

Solids density and grain size in mm.

Caractéristiques techniques
Densité apparente et granulométrie en mm.

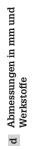


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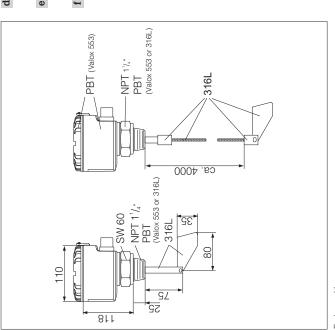


 Umgebungstemperatur Ta Betriebstemperatur TM Betriebsdruck pe
 Ambient temperature Ta Operating temperature TM Operating pressure pe
 Température ambiante Ta Température de service TM Pression de service pe

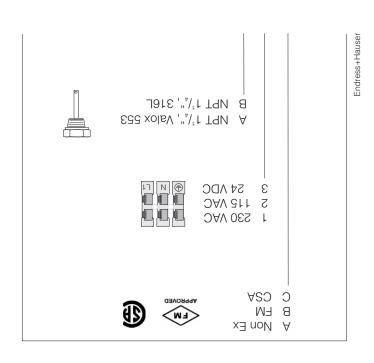




- e Dimensions in mm and materials
- f Dimensions en mm et matériaux

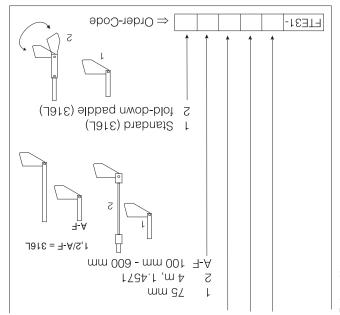


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d Geräte Identifikation
e Device identification
f Dénomination

4



+Hauser

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Φ
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Technische Information	Technical information
Füllstandgrenzschalter FTE 31	Paddle limit switch FTE 31
TI 068R/09/de	TI 068R/09/en
d Ergänzende	e Supplementary
Dokumentation	documentation

f Documentation complémentaire

f Notes:

Endress+Hauser

d Notizen:
e Notes:
f Notes:

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Belgium, Luxembourg	Italy	Sweden
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Burlington, Ontario Tel (905) 6819292 Fax (905) 6819444	Tokyo Tel (0422) 54 06 11 Eax (04 22) 55 02 75	Reinach/BL 1 Tel (061) 7 15 75 75 Fax (061) 7 11 16 50
Denmark	Malaysia	Thailand
Endress+Hauser A/S	Endress+Hauser (M) Sdn. Bhd.	Endress+Hauser Ltd.
Søborg Tel 70 13 11 32 Esv 70 13 21 33	Petaling Jaya, Selangor Darul Ehsan	Bangkok Tel (2) 9 96 78 11 -20 Eav (2) 9 96 78 10
Finland	Netherlands	USA
Endress+Hauser Ov	Endress+Hauser B.V.	Endress+Hauser Inc.
Espoo Tal (90) 8596155 Eav (90) 8596055	Naarden Tel (035) 6958611 Eav (035) 6958825	Greenwood, Indiana Tel (317) 535-7138 Eav (317) 535-1489
France	Norway	International
Fndress+Hauser	Endress+Hauser A/S	Fudress+Hallser GmbH+Co
Huningue	Lierskogen	Instruments International
Tel. 89696768, Fax 89694802	Tel. (032) 85 98 50, Fax (032) 85 98 51	Weil am Rhein
Germany	Singapore	Tel. (07621) 97502, Fax (07621) 975345
Endress+Hauser Messtechnik GmbH+Co.	Endress+Hauser (S.E.A.) Pte., Ltd.	:
Weil am Rhein Fal. (078,31), 975,01 Fax. (078,31), 975,555	Singapore	http://www.endress.com
Great Britain	South Africa	
Endress+Hauser   td	Endress+Hallser Ptv   td	
Manchester Manchester Tel (0161) 2865000 Eav (0161) 9981841	Sandton Sandton Tel (011) 4441386 Eav (011) 4441977	Endress+Hauser
(1000)		The Power of Know How

KA 094R/09/a3/04.00 Mat-Nr.: 510 00917 SS/CV5



Miniature, 22 mm normally closed and normally open models

3/2 Poppet Valves
Electrically Actuated
G¹/8

- Sub-base mounted and manifold mounted
- Manual override as standard
- Encapsulated coils with very rapid fitting

#### **Technical Data**

Medium:

Compressed air, filtered, lubricated and non-lubricated Operation:

Poppet valve, directly actuated with spring return

Mounting:

Through-holes with thread in sub-base

Port Size:

G1/8

Operating Pressure:

0 - 10 bar M/49, DM/49

0 - 7 bar M/149, DM/149

Flow (to CETOP RP50P):

Conductance dm³/s/bar 0,25 M/49, DM/49 Conductance dm³/s/bar 0,297 M/149, DM/149 Critical pressure ratio 0,43 M/49, DM/49 Critical pressure ratio 0,117 M/149, DM/149 Cv 0,067

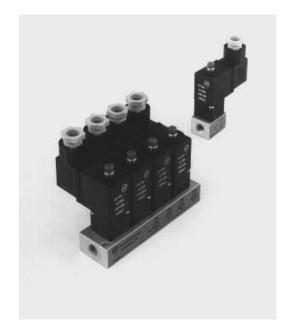
Cv 0,04 -/127

Operating Temperature:

-5°C\* to +50°C supply air

+5°C to +50°C ambient

\*Consult our Technical Service for use below +2°C



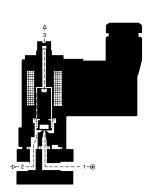


#### Materials

Plastic encapsulated coil, moulded plastic manual override base, stainless steel armature tube and spring, aluminium sub-base, nitrile rubber seals.

#### Ordering Information

To order, quote model number followed by voltage code shown in the tables overleaf, e.g. M/49/167 for a normally closed low power model suitable for a 220V 50Hz electrical supply. Replacement coil and terminal box assemblies can also be supplied, quote required model number with 'Q' prefix before the 'M' and '/28' suffix after the voltage code as shown in the table overleaf. For manifold models order the required number as indicated by the 'T' suffix in the model number, e.g. 4 off QM/48/10/28 for DM/149/10/T4.



#### **General Information**

Model	Operation	Manifold Models - Number of valves	Weight (Kg)	Coil and Terminal Box Assembly	Spares kit
M/49	Normally closed	-	0,14	QM/48/*/28	QM/48/00
DM/49/T2	Normally closed	2	0,31	QM/48/*/28	QM/48/T2/00
DM/49/T3	Normally closed	3	0,45	QM/48/*/28	QM/48/T3/00
DM/49/T4	Normally closed	4	0,60	QM/48/*/28	QM/48/T4/00
M/149	Normally open	-	0,14	QM/48/*/28	QM/48/00

<sup>\*</sup>Insert voltage code, e.g. QM/48/173/28 for the low power 24V d.c. model.

#### Electrical Details for M/49 and M/149 Valves

Voltage	Codes	Availability
12 V d.c.	160	M/49, DM/49
24 V d.c. (low power)	173	M/49, DM/49
24 V d.c.	127	M/49, DM/49, M/149,
24 V 50/60Hz	164	M/49, DM/49, M/149
48 V 50/60Hz	165	M/49, DM/49, M/149
110/120 V 50/60Hz	166	M/49, DM/49, M/149
220/240 V 50/60Hz	167	M/49, DM/49, M/149

Note: DC version of M/149 available on request.

Voltage Tolerances:	d.c.: +10/-15% a.c.: +10/-15%
Power:	d.c.: 2 W (low power - 0,5 W on 24 V)
Inrush/Hold:	a.c.: 4/2,5 VA (9/5 VA on 220/240 V) 100%% E.D.
Inlet Orifice:	1,0 mm
Operating Pressure:	0 - 10 bar
Terminal Box:	3 pin plug with cable grip (DIN 43650 Form B) May be rotated 180°
Cable Entry:	Pg9
Solenoid Coil:	May be rotated at 90° intervals
Manual Override:	Standard, turn 180° anti-clockwise to operate, turn clockwise to release
Protection Class:	IP65 (DIN 40050)
Typical Response Times:	12 ms on 15 ms off

#### Warning

These products are intended for use in industrial compressed air systems only. Do not use these products where pressures and temperatures can exceed those listed under 'Technical Data'.

Before using these products with fluids other than those specified, for non-industrial applications, life-support systems, or other applications not within published specifications, consult NORGREN MARTONAIR.

Through misuse, age, or malfunction, components used in fluid power systems can fail in various modes. The system designer is warned to consider the failure modes of all component parts used in fluid power systems and to provide adequate safeguards to prevent personal injury or damage to equipment in the event of such failure

System designers must provide a warning to end users in the system instructional manual if protection against a failure mode cannot be adequately provided.

System designers and end users are cautioned to review specific warnings found in instruction sheets packed and shipped with these products.



## VM 8631

# 2-way/2-position solenoid valve, normally closed, DN 15-50, type 21WAKB - 21W7KB



#### General

Soft acting servo controlled diaphragm valve for water, air and neutral gases.
Viscosity max ca 12 mm<sup>2</sup>/s.
Standard voltages: 24, 110, 230 V / 50 Hz, 24 V DC.

#### **Options**

Manual override and adjustable closing time 5W-coil

Different voltages: 12-380 V AC/DC.

Sealing materials: EPDM -10°C to +140°C

Viton -10°C to+140°C

Normally open Explosion proof

Stainless steel design - VM 8641

#### Materials

G	1/2	3/4	1	11/4	11/2	2
DN	15	20	25	32	40	50
Valve body in brass	•	•	•	•	•	•
Internal parts in stainless steel	•	•	•	•	•	•
Sealings in Buna -10°C to +90°C	•	•	•	•	•	•

#### Tecnichal data

G	1/2	3/4	1	11/4	11/2	2
DN	15	20	25	32	40	50
Pressure range 0,2-16 bar AC/DC	•	•	•			
Pressure range 0,2-10 bar AC/DC				•	•	•
Kv-value m³/h vatten	4,2	8,4	11,4	24,0	31,2	45,0
QNn-value I/min (air)	4527	9000	12300	25900	33600	48500
Bore size (Ø mm)	13	19	25	35	40	50
Ambient temp with cable contact max 55°C	•	•	•	•	•	•
Protection class with cable contact IP65	•	•	•	•	•	•
Coil 8 W - 100% ED	•	•	•	•	•	•
Power consumption 1): AC 25 VA (start), 14,5 VA (hold)	•	•	•	•	•	•
DC 8W	•	•	•	•	•	•

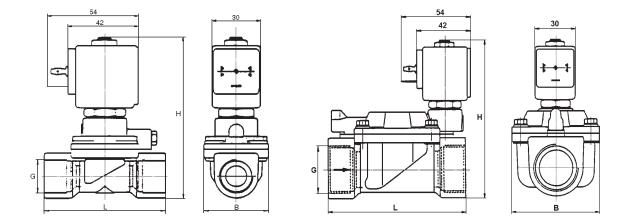
¹) in duty

Voltage tolerance: DC +10% -5% AC +10% -15%

Kvalitets- & Miljöcertifierat enligt ISO 9002 och ISO 14001

Huvudkontor Filialkontor KALMAR **STOCKHOLM** GÄVLE GÖTEBORG HÄSSLEHOLM Tel. 0480 - 42 91 00 Tel. 08 - 685 45 00 Tel. 026 - 54 36 00 Tel. 031 - 86 84 50 Tel. 0451 - 38 83 50 Fax. 0480 - 42 91 20 Fax. 031 - 86 84 59 Fax. 0451 - 38 83 54 Fax. 08 - 685 45 19 Fax. 026 - 54 36 09

#### Dimensional drawing



#### Dimensional data

G	1/2	3/4	1	11/4	11/2	2
l .	·		2.5	-		
DN	15	20	25	32	40	50
L	66	104	104	144	144	172
Н	97	105	112	125	125	141
В	40	65	65	98	98	118
Weight, kg	0,52	1,03	1,17	2,65	2,65	4,80

#### Mounting

Optional (vertical magnet system is recommended). If polluted fluid, strainer type VM 6381 is recommended.

When mounted direct to control system, use transient protection or low effect coil.

Ordering:

Please specify desired voltage. 24, 110, 230 V / 50 Hz, 24 V DC are standard voltages.

Other voltage on request.

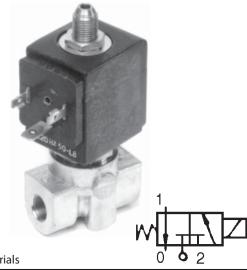
Cable contact should be ordered separately, type VM 8700.

Ordering numbers							
DN	Art no	RSK-no					
15	863121WA4KOB130	452 0923					
20	863121W3KB190	452 0924					
25	863121W4KB250	452 0925					
32	863121W5KB350						
40	863121W6KB400						
50	863121W7KB500						



## VM 8651

# 3/2-way solenoid valve, normally closed, DN 6-8, type 31A3AB - 31A2AB



#### General

Direct controlled solenoid valve for water, air and gases. Viscosity max ~20 mm<sup>2</sup>/s. Standard voltage: 24, 110, 230 V / 50 Hz, 24 V DC.

#### **Options**

Different sealing materials

Different voltage 12-380 V AC/DC.
Universal function (for ex. normally open - VM 8652).
5W-design - VM 8653.
Coil with integrated cable.
Manual override.

Viton -10°C till +140°C, Ruby -40°C till +180°C.

#### Materials

G	1/8	1/4
DN	6	8
Valve body in brass	•	•
Internal parts in stainless steel	•	•
Sealings in NBR -10°C till +90°C	•	•

#### Technical data

G	1/8	1/4
DN	6	8
Max pressure, bar Ø 1,0 mm Rport Ø 2,5 mm	20	20
Max pressure, Ø 1,5 mm Rport Ø 2,5 mm	15	15
Max pressure, Ø 2,0 mm Rport Ø 2,5 mm	10	10
Max pressure, Ø 2,5 mm Rport Ø 2,5 mm	6	6
Max pressure, Ø 3,0 mm Rport Ø 2,5 mm	5	5
Kv-value m³/h, water Ø 1,0 mm	0,048	0,048
Kv-value m³/h, water Ø 1,5 mm	0,084	0,084
Kv-value m³/h, water Ø 2,0 mm	0,12	0,12
Kv-value m³/h, water Ø 2,5 mm	0,19	0,19
Kv-value m³/h, water Ø 3,0 mm	0,24	0,24
Ambient temp. with cable head, max 55°C	•	•
Coil 8 W 100% ED	•	•
Protection class IP65	•	.
Power consumption 1): AC 25 VA (start), 14,5 VA (hold)	•	•
DC8 W	•	

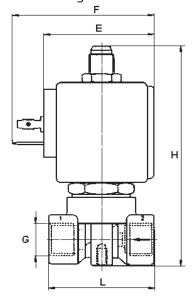
¹) in duty (•=standard)

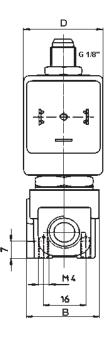
Voltage tolerance: DC +10% -5% AC +10% -15%

Kvalitets- & Miljöcertifierat enligt ISO 9002 och ISO 14001

Huvudkontor Filialkontor KALMAR STOCKHOLM GÄVLE GÖTEBORG HÄSSLEHOLM Tel. 0480 - 42 91 00 Tel. 08 - 685 45 00 Tel. 026 - 54 36 00 Tel. 031 - 86 84 50 Tel. 0451 - 38 83 50 Fax. 0480 - 42 91 20 Fax. 031 - 86 84 59 Fax. 0451 - 38 83 54 Fax. 08 - 685 45 19 Fax. 026 - 54 36 09

#### Dimensional drawing





#### Dimensional data

G	1/8	1/4
DN	6	8
L	40	40
H	87	87
В	27	27
D	30	30
E	42	42
F	54	54
Weight,kg	0,30	0,30

#### Mounting

Optional (vertical magnet system is recomended).

If polluted fluids, strainer is recommended - type VM 6381.

When mounted direct to process control ystem, transient protection is recommended.

#### Ordering:

Please specify desired voltage 24, 110, 230 V / 50 Hz, 24 V DC. Different voltages on request.

Please specify desired bore.

Cable head should be ordered separately, type VM 8700.

Orde	ring numbers	
DN	Art no	RSK-no
6	865131A3AB	
8	865131A2AB	

PL2658 Sida 1 av 2

#### efectorsod



Pressure sensors

#### **PL2658**

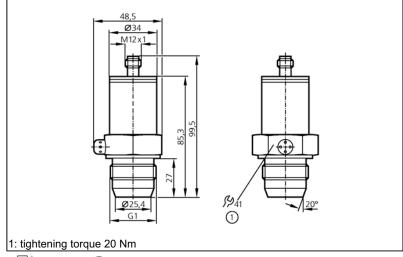
Electronic pressure sensor PL26

Process connection G1 A

flush mounting Zero and span adjustable Programmable via EPS interface

Analogue output

Measuring range -12.5...250 mbar -5.0...100.4 inH2O -1.25...25.00 kPa



Type of pressure: relative pressure







Application	Hygienic systems, viscous media and liquids with suspended particles				
Electrical design	3-wire DC; 2-wire DC				
Output	420 mA analogue				
Operating voltage [V]		1430 DC			
Reverse polarity protection		yes			
Overload protection		yes			
Analogue output		420 mA			
Load for analogue output [ohms]	max.	(Ub - 13 V) x 50; 550 at Ub	= 24 V		
Pressure rating	10000 mbar	4000 inH2O	1000 kPa		
Bursting pressure min.	30000 mbar	12000 inH2O	3000 kPa		
Factory setting	ASP = 0 mbar; AEP = 250 mbar COF = 0.0; dAA = 0; Uni = mbar				
Setting range					
Analogue start point, ASP	-12.5100.0 mbar	-5.040.2 inH2O	-1.2510.00 kPa		
Analogue end point, AEP	50.0250.0 mbar	20.2100.4 inH2O	5.0025.00 kPa		
in steps of	0.5 mbar	0.2 inH2O	0.05 kPa		
Accuracy / deviations (in % of the span) Turn down 1:1					
Characteristics deviation *)		< ± 0.6			
Linearity		< ± 0.5			
Hysteresis		< ± 0.1			
Repeatability **)	< ± 0.1				
Long-term stability ***)	< ± 0.1				
Temperature coefficients (TEMPCO) in the temperature range 080° C (in% of the span per 10 K)					
greatest TEMPCO of the zero point	TEMPCO of the zero point <± 0.1				
greatest TEMPCO of the span		< ± 0.4			

PL2658 Sida 2 av 2

#### efectorsod

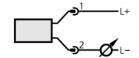


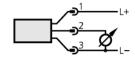
#### PL2658

Response time analogue output [ms]	3
Operating temperature [°C]	-2580
Medium temperature [°C]	-2580
Storage temperature [°C]	-40100
Protection	IP 67, III
Insulation resistance [MΩ]	> 100 (500 V DC)
Shock resistance	DIN IEC 68-2-27:50 g (11 ms)
Vibration resistance	DIN IEC 68-2-6:20 g (102000 Hz)
Min. pressure cycles	100 million
EMC	EN 61000-4-2 ESD: 4 kV CD / 8 kV AD EN 61000-4-3 HF radiated: 10 V/m EN 61000-4-4 Burst: 2 kV EN 61000-4-6 HF conducted: 10 V
Housing material	stainless steel (316S12); PEI; FPM (Viton)
Materials (wetted parts)	stainless steel (316S12); ceramics (99.9 % Al2 O3); PTFE
Connection	M12 connector
Remarks	*) linearity, incl. hysteresis and repeatability; (limit value setting to DIN 16086)  **) with temperature fluctuations < 10 K  ***) in % of the span per year  The 3A approval is only valid if adapters with 3A approval are used for installation.

Wiring







ifm electronic gmbh • Teichstraße 4 • 45127 Essen — We reserve the right to make technical alterations without prior notice. — GB — PL2658 — 2/2 — 09.06.2005



## OPERATING AND MAINTENANCE INSTRUCTIONS FOR PULLMAN MODEL PV350

We congratulate You on Your choice of a Pullman suction apparatus and thank You for the confidence You have thus shown us.

Take a few minutes to read through these instructions, which will give you some advice on how to use and maintain your new workmate.

If you use and maintain your suction apparatus correctly, it will continue to perform its work tasks for many years into the future.

Please always state the the type designation and serial number when ordering accessories and spare parts and in connection with technical questions concerning the suction apparatus.

This suction	apparatur has ty	pe designation				
with serial n	umber:	•••••		••••••		
Model	<u>Voltage</u> Volt	<u>Power</u> Watt	<u>Vacuum</u> kPa	<u>Airflow</u>	Sound-level	

3200

79

#### SAFETY REGULATIONS

230

PV350

((

Pullman Scandinavian AB cannot be held liable, as the manufacturer, for damage caused by negligence or incorrect use.

25

Do not suck up liquids and chemicals, which can release toxic or explosive gases, and particles which can cause ignition as a result of being charged with static electricity.

#### IMPORTANT NOTE REGARDING ELECTRICAL DETAILS

1200

Before carrying out all cleanig and service work on the suction apparatus, the plug on the electrical main cable must be removed from the electrical outlet/wall socket. Check that the electrical cable and plug are whole and clean. Electrical details must always be serviced by specialist electricians or a qualified service workshop. During work and in connection with cleaning, no electrical details may be exposed to direct flushing. This can cause water to penetrate into electrical parts and cause damage.

#### WARRANTY

All Pullman suction devises and accessories have a 12-month factory warranty for material and manufacturing defects. Do not attempt to repair the suction apparatus without the consent of the manufactur.

The warranty does not cover defects which are the result of normal wear and tear, negligence, defective use, unauthorised repair or the suction apparatus being connected to the incorrect voltage.

In the event of any complaint, the suction apparatus or an agreed part of it must be returned to us or our authorised representative for warranty examination and for any warranty repair or replacement.

#### STARTING

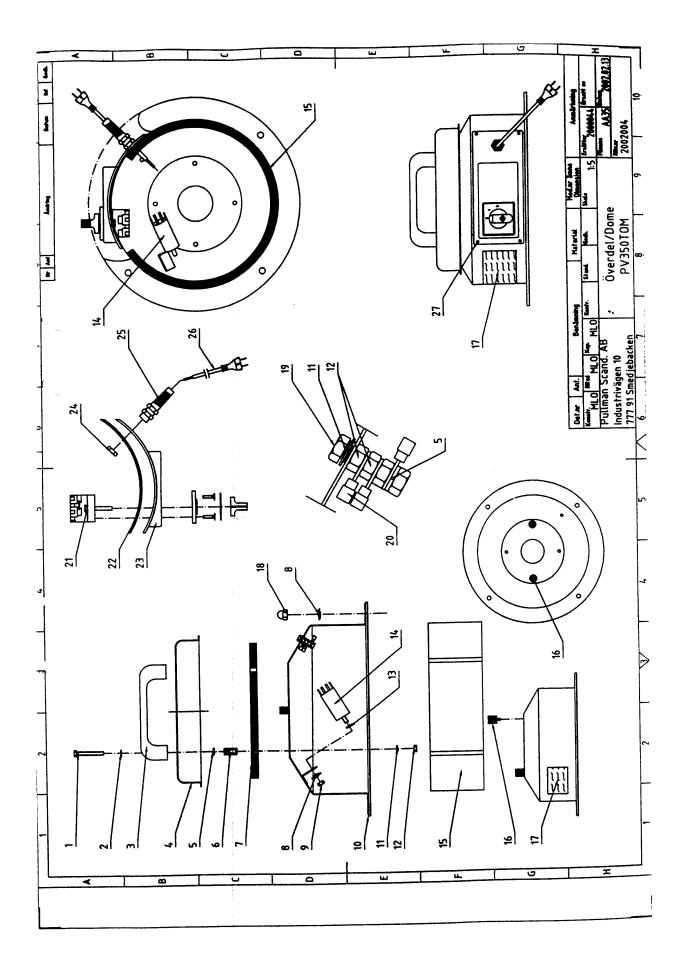
Connect the electric plug of the suction apparatus to an electrical outlet with the <u>correct voltage</u> (see the designation plate). Start the suction apparatus with the switch.

#### AFTER USE

Switch off the suction apparatus with the switch. Remove the plug on the electrical cable from the electrical outlet. Do not pull the electrical cable!

Good luck with Your new workmate; we hope that it will function to Your full satisfaction for many years.

**SAVE THESE INSTRUCTIONS!** 



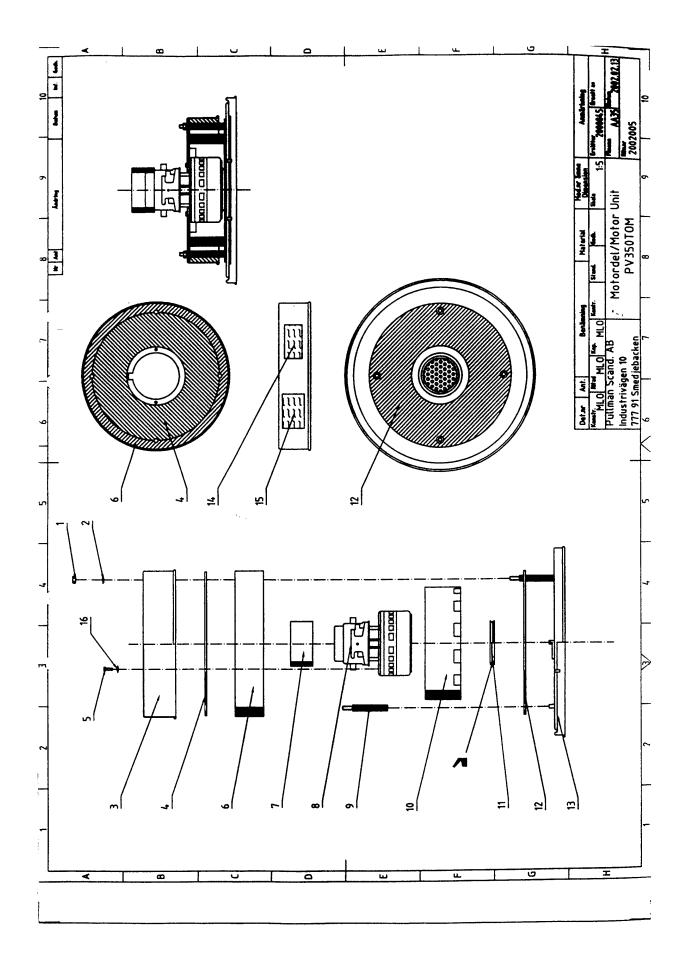
## **DETALJSPECIFIKATION**

## SPARE PARTS LIST ERSATZTEILLISTE

PRODUKT/PRODUCT: PV350TOM (2002004) NR./N0. 1204026

DET.NR.	ARTIKEL	BENÄMNING	ART.NR.	ANTAL
ITEM	PART	DESCRIPTION	PART.NO.	QTY
INDEX	TEIL	BEZEICHNUNG	TEIL NR.	ANZAHL
			1360208	2
1	MCS5X40	SKRUV/Screw/Schraube	1360149	2
2	A6016	BRICKA/Washer/Scheibe	1345009	1
3	WN130	HANDTAG/Handle/Handgriff	1350116	1
4	350-1	TOPPLOCK/Can Cap/Deckel		2
5	FBB5	LASBRICKA/Locking Washer/Sicherungsscheibe	1360056	2
6	8LG20	DISTANSMUTTER/Spacer/Mutter	1360111	
7	350-5	LJUDISOLERING/Sound Insulation/Isolierung	1351154	1
8	ITS8	TANDBRICKA/Toothed Washer/Sicherungsscheibe	1360210	5
9	M6M8	MUTTER/Nut/Mutter	1360113	5
10	350-2B	MOTORKAPA/Dome/Gehäuse	1350143	1
11	ITS5	TANDBRICKA/Toothed Washer/Sicherungsscheibe	1360055	2
12	M6M5	MUTTER/Nut/Mutter	1360047	3
13	FBB8	LASBRICKA/Locking Washer/Sicherungsscheibe	1360118	1
14	FP250	AVSTÖRNINGSFILTER/Filter/Filter	1362165	1
15	350-7	LJUDISOLERING/Sound Insulation/Isolierung	1351156	1
16	350-12	LOCKDISTANS/Spacer/Abstand	1357052	2
18	HM8	HATTMUTTER/Acorn Nut/Mutter	1360115	4
19	MCS5X25	SKRUV/Screw/Schraube	1360073	1
20	A1553	RINGKABELSKO/Eyelet Terminal/Kabelklemme	1362036	3
21	PR1211	STRÖMSTÄLLARE/Switch/Schalter	1362135	1
22	350-11	TÄTNING/Sealing/Dichtung	1351159	1
23	350-9	ELKAPA/Cover/Panel	1362136	1
24	E12.191.18	KONTRAMUTTER/Jam Nut/Mutter	1362055	ı
25	350044	KABELFÖRSKRUVNING/Cable Inlet/Kabeldurchfül	ır.1362132	1
26	RDV12.5	SLADDSTÄLL/Cord Set/Kabel 5M	1361023	1
2 <del>0</del> 27	TAP410S	POPNIT/Rivet/Niet	1359014	4
41	1 AP4103	LOLIATI/ICIAENTAIEC		

 $EL-SCHEMA/Wiring\ Diagram/Elektrische\ Schema-RITNING/Drawing\ / Zeichnung\ NR./No.\ 2002006$ 



## **DETALJSPECIFIKATION**

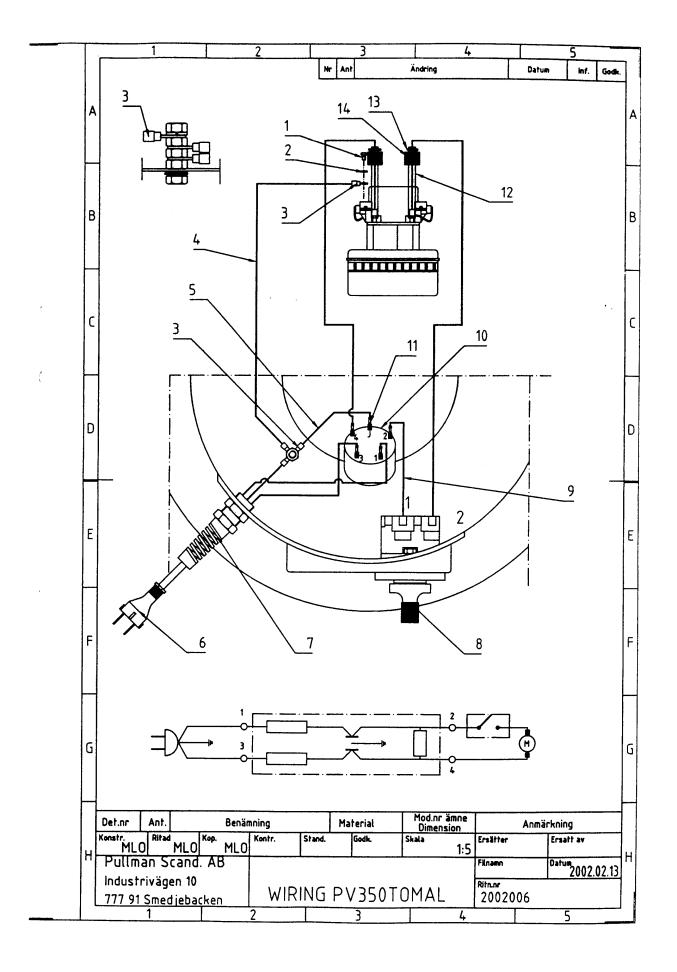
#### SPARE PARTS LIST ERSATZTEILLISTE

PRODUKT/PRODUCT: PV350TOM (2002005) NR./NO. 1204026

DET.NR.	ARTIKEL	BENÄMNING	ART.NR.	ANTAL
ITEM	PART	DESCRIPTION	PART.NO.	QTY
INDEX	TEIL	BEZEICHNUNG TEIL NR	t. ANZ	AHL
			1260112	4
1	M6M8	MUTTER/Nut/Mutter	1360113	4
2	ITS8	TANDBRICKA/Toothed Washer/Sicherungsscheibe	1360210	4
3	350-3B	MELLANKÅPA/Chamber/Gehäuse	1350144	1
4	350-14	PACKNING/Sealing/Dichtung	1351166	1
5	RXSB10X10	SKRUV/Screw/Schraube	1360168	2 .
6	350-13	LJUDISOLERING/Sound Insulation/Schallisolierung	1351165	1
7	2000125	KYLPACKNING/Sealing/Dichtung	1351189	1
,	116352	MOTOR/Motor/motor	1352013	1
0	DSM878	DISTANSSKRUV/Screw/Schraube	1360207	4
9		LJUDISOLERING/Sound Insulation	1351157	1
10	350-8		1351158	1
11	V85A	V-RING/V-ring/V-ring	1351166	ī
12	350-14	PACKNING/Sealing/Dichtung		1
13	350-4	BOTTENPLATTA/Can Cap/Platte	1350119	1
14	NS49	SKYLT/Name Plate/Schildt	1365049	1
15	DEK8	DEKAL/Label/Abziehbild	1364006	1
16	ITS5	TANDBRICKA/Toothed Washer/Sicherungsscheibe	1360055	2

EL-SCHEMA/Wiring Drawing RITNING/Drawing NR/No. 2002006 ELEKTRISCHE SCHEMA, ZEICHNUNG NR.2002006

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#### DETALJSPECIFIKATION SPARE PARTS LIST

PRODUKT/PRODUCT: PV350TOMAL (2002006) NR. 1204026

DET.NR. ITEM INDEX	ARTIKEL PART TEIL	BENÄMNING DESCRIPTION BEZEICHNUNG	ART.NR. PART.NO. TEIL NR	ANTAL QTY ANZAHL
1	MCS5X8	SKRUV/Screw/Schraube	1360058	1
;	FBB5	LASBRICKA/Washer/Sicherungsscheibe	1360056	i
3	A1553	RINGKABELSKO/Cable Clip/Kabelklemme	1362036	3
4	RK92	KABEL-GUL/GRÖN/Cable yellow/green/Kabel	1361016	0.3
5.	RK92	KABEL-GUL/GRÖN/Cable yellow/green/Kabel	1361016	0.1
6	RDV12.5	SLADDSTÄLL/Cord set/Kabel 5m	1361023	1
7	350044	KABELFÖRSKRUVN/Cable Inlet/Kabeldurchfürung	1362132	1
8	PR1211	STRÖMSTÄLLARE/Switch/Schalter	1362135	1
9	RK82	KABEL-BRUN/Cable-brown/Kabel-Braun	1361015	0.15
10	FP250	AVSTÖRNINGSFILTER/Filter/Filter	1362165	1
11	A1507	FLATSTIFTSHYLSA/Cable Clip/Kabelklemme	1362118	5
12	E19.360.47	SLANG/Hose/Schlauch	1362075	0.6
	L418	BUNTBAND/Cable tie/Band	1362113	2
13 14	fb243	ferritblock/Ferrite block/Ferrite Block	1362166	2

### FÖRSÄKRAN OM ÖVERENSSTÄMMELSE DECLARATION OF CONFORMITY DECLARATION DE CONFORMITÉ ERKLÄRUNG DER ÜBERSTIMMUNG SAMSVARSERKLÆRING

Pullman Scandinavian AB Industrivägen 10 S-777 91 SMEDJEBACKEN

Försäkrar under eget ansvar att maskinen
Declare under our sole responsibility that the machine
Certifie sous sa propre responsabilité que le produit ciaprès
Versichern auf eigener verantwortung, dass das Produkt
Forsikrer under eget ansvar at maskinen

PV350TOM

Nr./No: 020001 - 029999

Tillv.år/Manufact.year/Baujahr: 2002

som omfattas av denna försäkring är i överensstämmelse med standarder: included in this declaration, follows the provisions of the: est conforme aux aux normes suivantes: den folgenden Normen entspricht: er i overensstemmelse med standarder:

SS-EN 60 204-1 (1993.11.30) SS-EN 55011:1989 SS-EN 50082-1 SS-EN 60335-1, SS-EN 60335-2-2

enligt villkoren i/according to/selon/laut/i henhold til vilkårene i Machine Directive 89/392/EEC, 91/368/EEC Low Voltage Directive 73/23/EEC EMC Directive 89/336/EEC

SMEDJEBACKEN 2002.01.01

Mats Lennmo
Kvalitetssamordnare
Quality Manager
Responsable de qualité



11

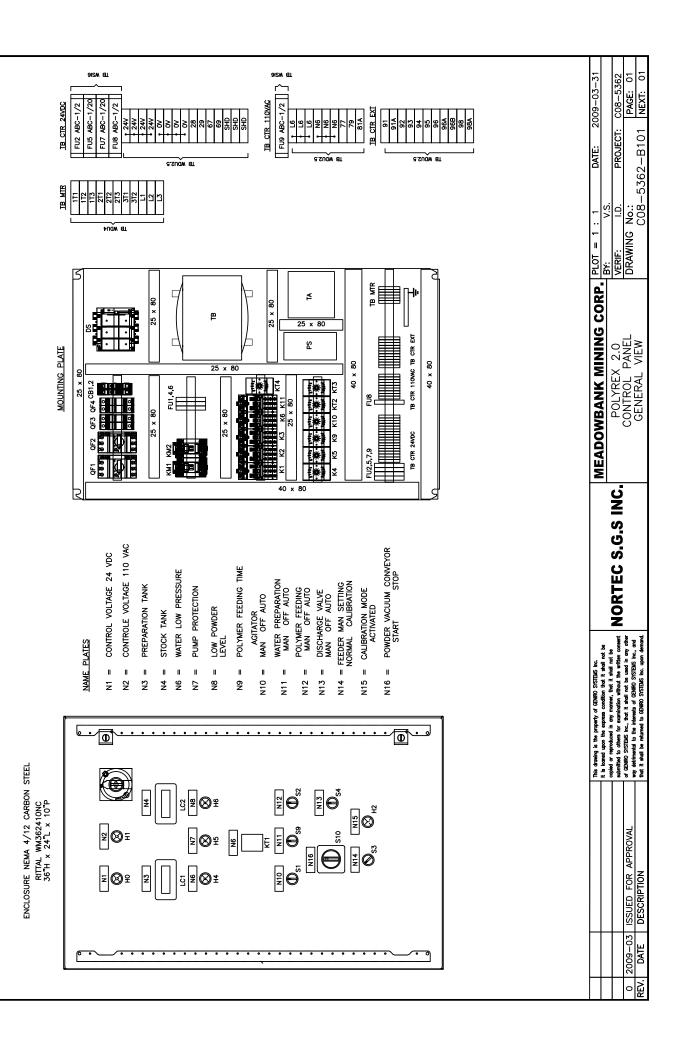
**DOSING PUMP** 

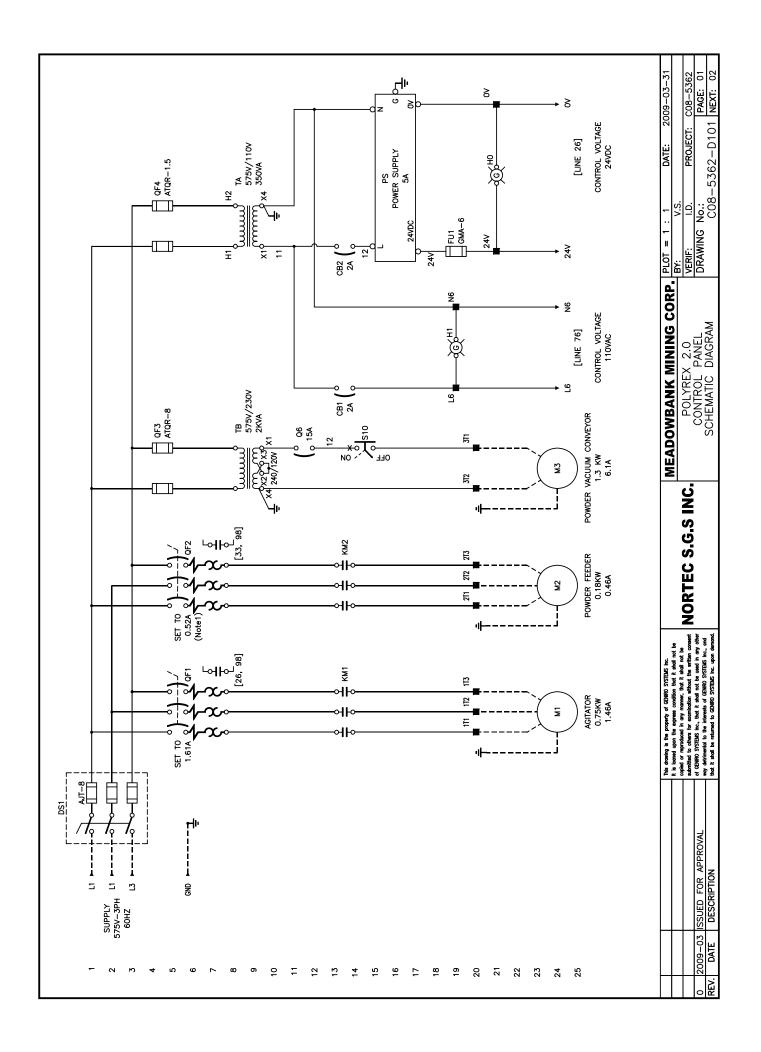


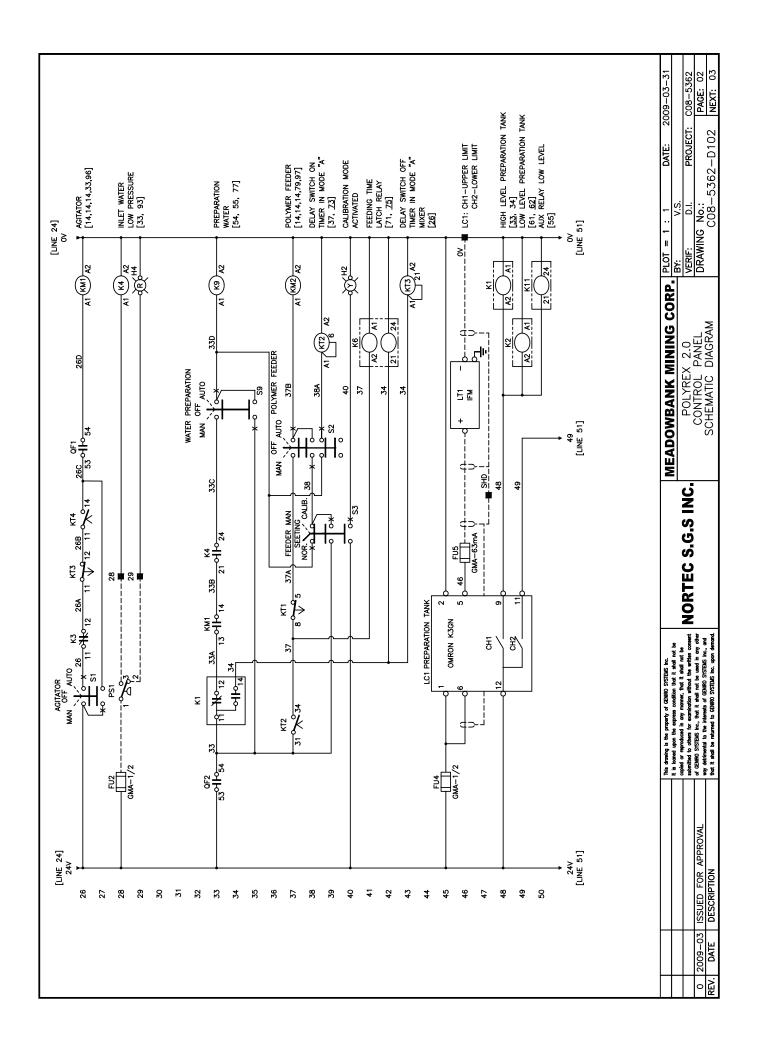
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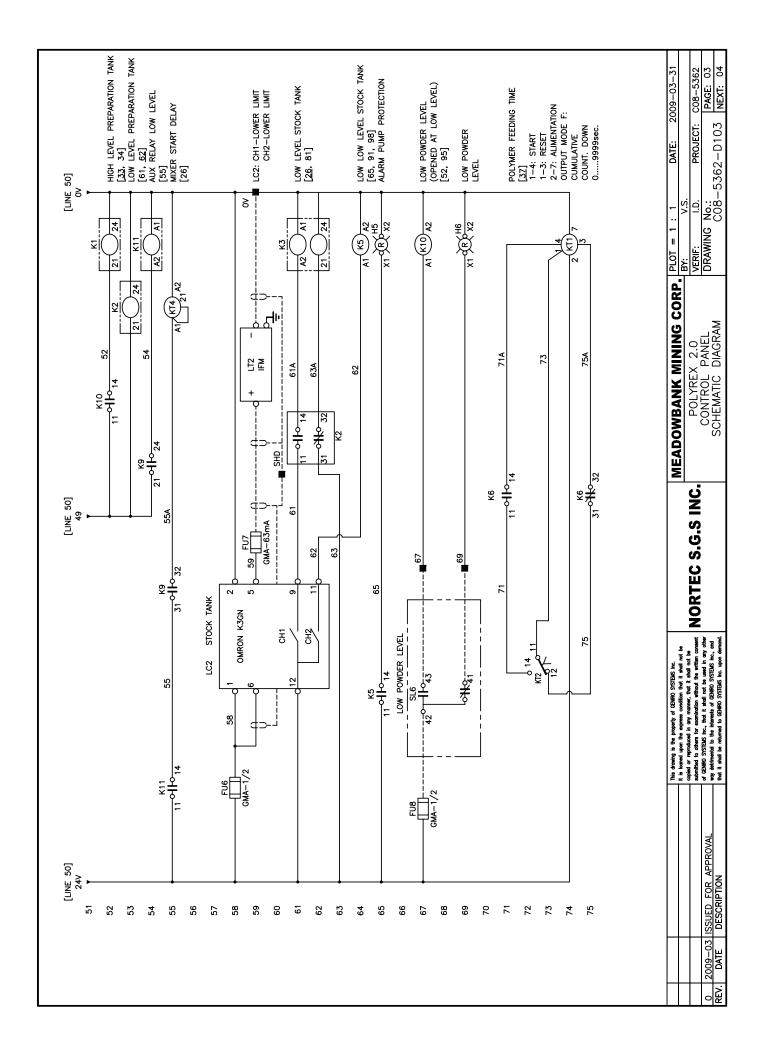
**QUALITY DOCUMENTS** 

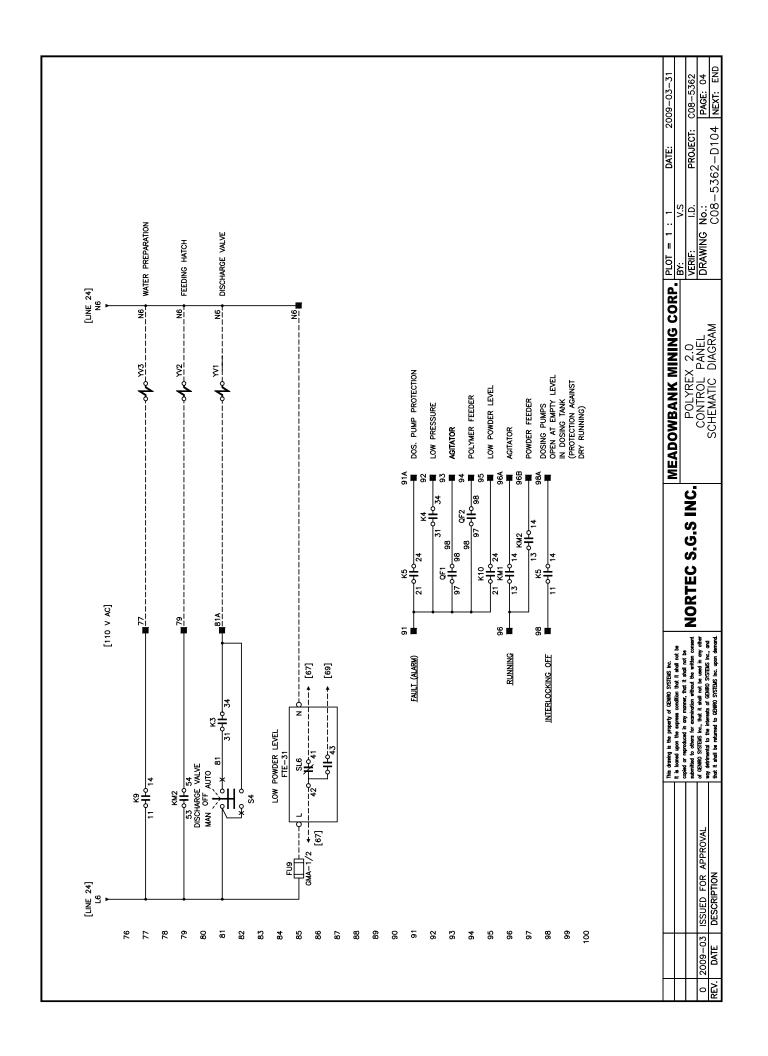
CE	DECLARATION OF	1971 1771 1	HURE - 2 B
MANUFACTURER	TOMAL AB		
ADDRESS	S-310 58 VESSIGEBRO,	SWEDEN	
TELEPHONE	+ 46 (0)346-71 31 00	FAX	+ 46 (0)346-71 31 39
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flowdiagram 008645-F	<del></del>		
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## **JOHN MEUNIER**

Meadowbank mining Corp. ACP-700R Technical Data Sheet Reference: NC01

#### **DOSING PUMP**



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seepex Inc. 511 Speedway Drive Enon, Ohio 45323 Tel +1 (937) 864-71 50 Fax+1 (937) 864-71 57 sales@seepex.net www.seepex.com

# Operating and Maintenance Instructions Progressive Cavity Pump

range size pressure stage 17.01.2006

MD

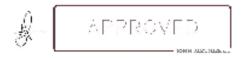
commission-No.

Job#

2109552

This operating and maintenance instruction includes important safety information and instructions for installation, commissioning, operating and maintenance of the seepex machinery. It is essential therefore, that the responsible specialist refers to it before starting any work on the machinery as well as prior to commissioning. Futhermore, this instruction must always be available on site.

#### seepex.com



#### Offer No. 5357/0500/09-MA

#### John Meunier Inc/Veolia Water Water Treatment, Saint-Laurent

03/16/2009 Item 2

qty. 1 seepex progressive cavity pump

MD 025-6L / A6-A7-A7-F0-GA-X

X= 0802, 17T, 20A7

#### **General remarks**

PROJECT: Meadowbank
Delivery Period :4 to 5 weeks
Terms of Delivery:FOB Enon, Ohio

Terms of Payment:30 days net; Terms are per the "seepex, Inc. - Terms and Conditions of

Sales and/or Repair" or as negotiated at time of purchase Resale discount:Prices are at a End User pricing levels

Shipping charges are not included in pricing.

#### **Application data**

**Pumped liquid** polymer Viscosity no advice Solids content no advice Size of solids no advice Spec. gravity no advice **Temperature** 32 to 113F pH value no advice Composition/Concentr. no advice Kind of operation 24h/day indoors Site of installation

Performance data	Flow rate	Pressure	Speed	
	26 l/h	2 bar	27 rpm	min
	260 l/h	2 bar	271 rpm	max
Starting torque	9 lb.ft			
Max. power absorbed	0.11 hp			
NPSH required	6.89 ft			
Suction pressure	ass. flooded	d		
Discharge pressure	2 bar			

#### Materials and executions

**Installation** horizontal

Rotation counter clockwise (left)
Lantern / drive casing lantern, standard

Lantern / drive casing material 1.0037 (St 37-2) / A 283 C

Wetted casing parts standard

Wetted casing parts material 1.4408 / A 743 CF8M

Joint execution encapsulated (closed) joints with

universal joint sleeve

Joints material standard
Universal joint sleeve material NBR - Perbunan

Coupling rod standard

Coupling rod material 1.6582 encapsulated

Rotor standard

#### Offer No. 5357/0500/09-MA

#### John Meunier Inc/Veolia Water Water Treatment, Saint-Laurent

Rotor material 1.4571 / 316 TI SS

Rotor coating without

Stator stator in TSE-design

sensor sleeve 1.4571 / 316 TI SS

Stator material NBR - Perbunan

Shaft sealing mechanical seal, single acting

elastomer bellows, either sense of

rotation, unbalanced

Shaft seal casing material 1.4571 / 316 TI SS

Shaft seal material rotating seal face: carbon graphite

stationary seal face: SiC solid

elastomers: FPM

spring: 1.4571 / 316 TI SS

metal parts: 1.4571 / 316 TI SS

Plug-in shaft standard

Plug-in shaft material 1.4571 / 316 TI SS

Pump screw fitting bolting entirely in stainless steel

inclusive tie rods

Painting standard RAL 5013 (blue)

**Connections** 

**Branch / hopper position** branch / hopper position 1 **Casing parts connections** Suction connection NPT thread:

NPT 1"

discharge connection NPT thread:

NPT 1/2"

**Drive** 

Type gear box for mounting of a NEMA motor

 $\begin{tabular}{lll} \mbox{Manufacturer} & \mbox{Nord} \\ \mbox{Model} & \mbox{SK02F-56C} \\ \mbox{Design} & \mbox{B3/B5} \\ \mbox{Gear ratio} & \mbox{$i=9.28$} \\ \end{tabular}$ 

 Nom.
 Min.
 Max.

 Output speed (rpm)
 194
 27
 271

 Motor speed (rpm)
 1800
 251
 2515

 Frequency (Hz)
 60
 8
 84

Electr. motor

Type NEMA Motor

ManufacturerMarathon - BLACK MAXModelY555 (56H17T5311)

**Rated output** 0.5 hp Rated speed 1800 rpm

Starting direct on frequency inverter

 Voltage
 3 x 575

 Frequency
 60 Hz

#### Offer No. 5357/0500/09-MA

John Meunier Inc/Veolia Water Water Treatment, Saint-Laurent

#### **Dry-running protection device**

Dry running protection device

TSE 115AC consisting of:
- sensor sleeve fitted to the
stator of the pump with installed
NTC temperature sensor in IP55
connection head inst. in pump stator
- TSE control device for installation

in a control panel - 110-115V / 50-60 Hz

#### **Price composition**

pump with flanged drive, dry running protection device

#### **General remarks**

Prices are valid for 60 days after the quotation and for 365 days after receipt of the purchase order. seepex reserves the right to renegotiate prices for any job delayed by the customer for more than 365 days after receipt of the purchase order.

Commissioning and Training performed by seepex Sales personnel or Distributors.

If seepex personnel from factory are required for commissioning or training, the following rates apply:

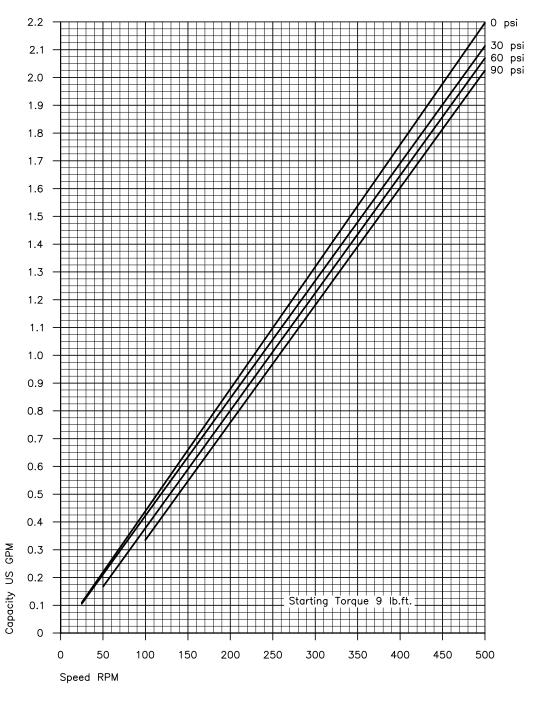
Daily rate: \$800.00 (US) /8 hr day plus all expenses including but not limited to airfare, standard mileage rate\*, lodging, meal, rental car, and etc. Billing is in whole day segments, only. Exceptions to this will negotiated as needed. Minimum two (2) days will be invoiced.

\*Mileage rate will be calculated based on the U.S. General Services Administration Privately Owned Vehicle (POV) Mileage Reimbursement Rates.

Copyright: This drawing is our property and patented for us according to the law of copyright and associated rights!

## seepex.com

Characteristic Curves Size **025-6L** 



Values based upon water 68°F

CHA.025-6L B 01.03us

Seepex.com General

#### 1.0 General

#### 1.1

#### **Application**

These operating instructions contain basic information on the installation, commissioning and maintenance of seepex machines. Compliance with the work steps described in the individual sections is essential.

#### 1.2

#### Details of the seepex machines

#### 121

#### **Operating Instructions**

The Commission Number (comm. no) assigns the operating instructions to a particular seepex machine. The operating instructions are produced in relation to a specific job/commission and are valid only for the machine whose comm. no. is identical with that indicated on the cover sheet and possessing the associated data sheet, Point 9.

#### 1.2.2

#### Manufacturer

The machines were manufactured by seepex.

#### 123

#### Range, Size, Version

of the machines are stated in the appended data sheet, Point 9.

#### 1.2.4

#### Machine Comm. No. and Year of Construction

are stated on the type plate at the machine.

#### 1.2.5

#### **Release Date of the Operating Instructions**

is stated on the cover sheet of the operating instructions.

#### 1.2.6

#### Modifications, Notes of Modification

If modifications to the machines are carried out in agreement with seepex, a new set of operating instructions will be provided, or the existing operating instructions will be supplemented by an additional sheet together with a new cover sheet. The date of modification and modification index will be noted on the new cover sheet.

## 1.2.7 EEC Machine Directive

#### 1.2.7.1

#### **Manufacturer's Declaration**

seepex Manufacturer's Declaration as required by the EEC Machine Directive 89/392/EEC, Appendix II B:

The seepex machines delivered in accordance with our design are intended to be fitted in one machine or assembled together with other machines to form one machine/plant. The commissioning of the machine is forbidden until such a time as has been established that the entire machine/plant satisfies the requirements of the EEC Directive for Machines as amended 91/368/EEC and 93/44/EEC.

Particular attention must be paid to the safety requirements specified in EN809 (s and Equipment for Fluids) as well as the information in these operating instructions.

## 1.2.7.2 Declaration of Conformity

seepex machines possessing no safety accessories do not fulfill the requirements of the EEC Machine Directive 89/392/EEC as amended 91/368/EEC and 93/44/FEC.

For this reason, no Declaration of Conformity as required by the EEC Machine Directive 89/392/EEC, Appendix IIA can be issued before appropriate safety devices have been installed/mounted on the machine and/or plant with due regard to the information given in these operating instructions.

The following harmonized standards are particularly applicable:

EN 809, EN292T1, EN292T2

Applicable national standards and specifications must be taken into consideration.

Following assessment of the conformity of the machine/plant with the EEC Machine Directive, customers may on their own initiative place on the full machine/plant the EEC symbol 'CE' as defined in Identification Directive 93/68/EEC.

#### CAUTION

This documentation must be kept available for at least 10 years.

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## 1.2.8 Copyright and Industrial Property Rights

These operating instructions are copyrighted. The reproduction, in particular by photocopying, of these instructions is not permitted (§§ 54, 54 UrhG) and constitutes a criminal offence (§ 106 UrhG). Proceedings will be instituted if the copyright is violated.

#### 1.2.9

#### **Specifications Required for Inquiries and Orders**

The following information must be included when inquiring about replacement parts or placing orders:

- comm. no.
- / machine type

This information is given on the type plate mounted the machine.

#### 1.2.10

#### **Technical Data Sheet**

see Point 9.

#### 1.2.11

## Performance Data, Load Index, Power Consumption

are indicated in the associated data sheet, Point 9.

#### 1.2.12

#### **Sound Pressure Level**

The sound pressure level and/or noise characteris-tics of the seepex machines are ascertained in accordance with DIN 45635. The measuring guidelines are largely identical with the international standards ISO 3740-1980 and ISO 3744-1981.

#### 1.2.13

#### **Operating Range**

Employment of the machine is not permissible for purposes other than those stated in the data sheet, see Point 9. seepex cannot accept liability for damage arising through failure to comply with this operating range.

#### 1.3

#### **Supplementary Information**

#### 1.3.1

#### **Accessories, Optional Extras**

Please refer to the data sheet, Point 9.

## 1.3.2 Company Address, Service Addresses

see Point 11

Seepex.com Safety

#### 2.0 Safety

These operating instructions contain basic requirements to be observed during the installation, operation and maintenance of the machine. Therefore, the instructions must be read by the mechanical fitter and by the technical personnel/operator responsible for the machine prior to assembly and commissioning, and kept available at the operating site of the machine/plant at all times.

Compliance is required not only with the general safety instructions given in this section but also with the detailed instructions, e.g. for private usage, given under the other main headings in these operating instructions.

## 2.1 Labeling of Advice in the Operating Instructions

In these operating instructions safety advice whose non-observance could lead to danger for life or limb is labeled with the following general hazard symbol:



safety symbol acc. to ISO 3864 - B.3.1

Warnings regarding electric power are labeled with:



safety symbol acc. to ISO 3864 - B.3.6

Safety instructions whose non-observance could jeopardize the machine and its functions are labeled by the word

#### CAUTION

Always comply with instructions mounted directly on the machine, e.g.

- rotational direction arrow
- fluid connection indicators

and ensure that the information remains legible.

## 2.2 Personnel Qualifications and Training

Personnel charged with operation, maintenance, inspection and assembly must be in possession of the appropriate qualifications for the tasks. The company operating the machine must define exact areas of responsibility, accountabilities and personnel supervision schemes. Personnel lacking the required skills and knowledge must receive training and instruction. If necessary, the opera-ting company may commission the manufacturer/ supplier to conduct these training courses. Furthermore, the operating company must ensure that the personnel fully understand the contents of the operating instructions.

## 2.3 Dangers Resulting from Failure to Observe Safety Instructions

Failure to comply with the safety instructions may lead to hazards to life and limb as well as dangers for the environment and the machine. Non-observance of safety instructions can invalidate the right of claim to damages.

The following are just some **examples** of possible dangers resulting from failure to comply with the safety instructions:

- Failure of important machine/plant functions
- Failure of prescribed methods of service and maintenance
- Danger to life and limb due to electrical, mechanical and chemical influences
- Danger to the environment due to the leakage of hazardous substances

## 2.4 Safety-conscious Working

Always comply with the safety instructions listed in this document, the existing national accident prevention regulations and any company-internal work, operating and safety rules. Seepex.com Safety

# 2.5 Safety Instructions for the Operating Company/Machine Operator

- Any potentially hazardous hot or cold machine parts must be provided with protection against accidental contact at the customer's premises.
- Protective guards for moving parts (e.g. coupling) must never be removed while the machine is in operation.
- Leakages (e.g. in the shaft seal) of hazardous conveying liquids (e.g. explosive, toxic, hot) must be drained in such a way that no danger arises for persons or for the environment. Always observe the relevant statutory requirements.
- The risk of exposure to electrical power must be eliminated (for details, see the VDE regulations, for example, or those of the local power supply company).

#### 2.6 Safety Instructions for Maintenance, Inspection and Assembly Work

The operator must ensure that all maintenance, inspection and assembly tasks are carried out by authorized and qualified personnel who have studied the operating instructions closely and become sufficiently familiar with the machine.

As a basic rule, the machine must be brought to a standstill before work is carried out. Always comply with the de-commissioning procedure described in this document.

Any machiness or assemblies conveying media that are detrimental to health must be decontaminated.

Immediately following completion of work, all safety and protective devices must be replaced in position and, where applicable, re-activated.

Before re-starting the machine, observe the points listed under the heading "Initial Startup".

#### 2.7 Unauthorized Modification and Manufacture of Replacement Parts

Conversions or modifications of the machine are permissible only in consultation with the manufacturers. Original manufacturer replacement parts and manufacturer-approved accessories enhance the operational safety of the machine. The usage of unauthorized parts may lead to the nullification of the manufacturer's liability for any resultant damages.

## 2.8 Impermissible Modes of Operation

The operational safety of the machines supplied is warranted only for employment in accordance with the intended use as defined in Section 1 - General - of these operating instructions. Never allow the threshold values specified in the data sheet to be exceeded.

### 3.0 Transport and Intermediate Storage

#### 3.1

### **Safety Precautions**

Employ appropriate transport means, hoists and tools when transporting and storing the machine, always observing the safety instructions.

#### 3.2

### **Transport**

Depending on its weight, the seepex machine must be transported manually or with appropriate transport means. Comply with the transport instructions on the packing.

#### 3.3

### Unpacking

The design of the packing is such that the equip-ment can be removed manually or, if demanded by the weight, by means of appropriate hoists.

Any screw fittings between the machine and the packing must be undone. Comply with the attached information notices and symbols.

### 3.4 Intermediate Storage/Preservation

Unless otherwise indicated in the data sheet, seepex machines are provided with preservation only for the duration of transport. If a long period of intermediate storage is foreseen before the machine is commissioned, it is necessary to pro-vide supplementary preservation. If necessary, the appropriate measures should be drawn up in consultation with seepex.

Intermediate storage in extreme climatic conditions is permissible only for machine whose design is appropriate to the circumstances. If necessary, seepex must be consulted.

#### CAUTION

Pumps of the range MAP

If the period from supply and subsequent storage until the commissioning is more than 4 weeks, the hoses should be dismantled, refer to Point 7.

#### 3 5

#### **Protection against Environmental Influences**

To afford protection against environmental influences, the intermediate storage location must be dry, enclosed and free from frost.

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# 4. Description of the seepex Progressive Cavity Pump and Accessories

#### 4.1

### General Description, Design and Mode of Operation

Like all progressive cavity pumps, seepex pumps belong to the rotating positive-displacement pump family. The characteristic attribute of these pumps is the special formation and arrangement of the two conveying elements, namely the rotor and the stator.

The difference in the number of threads possessed respectively by the rotor and stator produces a chamber that opens and closes alternately in line with the constant turning motion of the rotor, effecting the continuous transportation of the conveying product from the suction side to the pressure side.

The geometrical formation of the two conveying elements combined with the constant contact that exists between them result in sealing lines that effect an airtight seal between the suction and pressure side in every position of the eccentric screw, even when the pump is stationary. The pump owes its high suction capacity to this sealing between the suction and pressure sides.

### 4.2

### **Mechanical Design**

Please consult the sectional drawing, Point 9, for the mechanical design of the pump. The data sheet, Point 9, gives information on the design of the pump housing, stator, rotor and rotating components.

Refer to document OM. SEA. \_\_\_, for information on the design of the shaft seal.

The data sheet, specifies details of the design of the drive engine. Further details are given in the appended manufacturer's documents, Point 10.

#### 4.3

### **Accessories**

Consult the data sheet for information.

#### 4.4

### Dimensions, Weight

Consult the appended dimensional drawing,

### 4.5 Design Variants

Refer to the data sheet, Point 9, for the design of the seepex progressive cavity pump. Other design variants are possible, whereby seepex must first check whether a particular pump is suitable for the intended purpose.

### 4.6 Operating Site Specifications

Operating site specifications are listed in the data sheet, Point 9. Details of the space required for installation, operation and maintenance are given in Point 5.2.1.

### 5.0 Assembly / Installation

#### 5.1

### **Mounting Tools / Hoists**

No special tools are required for the assembly and installation of the pump.

The customer must check the dimensions and weight of the seepex progressive cavity pump to ascertain whether the available hoisting apparatus is sufficient for the assembly and fitting of the pump.

### 5.2 Initial Assembly

#### 521

#### Inspection Prior to Commencement of Assembly

### 5.2.1.1 Location

The place of installation for the pump must con-form with the site stated in the data sheet in Point 9. Any change of location must be checked and approved by seepex.

### 5.2.1.2 Space Requirements

Customers are responsible for determining the space requirements; the following factors must be taken into consideration:

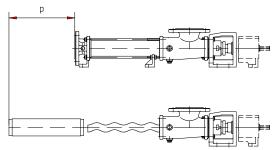
- · dimensions and weight of the machine
- required transport and hoisting equipment
- possible piping layout with allowance for the space allowing disassembly of the rotor as defined in 5.2.1.3
- freedom of movement to:
   operate the drive /
   speed regulation
   read speed and pressure indicators
   adjust a stator retensioning device, if fitted
   operate a buffer fluid supply unit, if fitted
- space required for lubrication / renewal of lubricants
- disassembly of mechanical protective devices, e.g.
   V-belt or coupling protection
- space required for handling the mounting tools, e.g. sufficient wall clearance

### 5.2.1.3 Space Allowing Disassembly of Stator P

A specific space must be allowed for exchanging the stator. The required dimension "P" is indicated in the index of these operating instructions or in the appended dimensional drawing, Point 9.

CAUTION

Ensure also that the pipe work can be dismounted at this location too.



5.2.2 Installation of the Fully Assembled Pump

- Installation in conformity with data sheet
  Installation of the pump is permissible only in
  accordance with the data sheet specifications and
  the associated basic drawing, see Point 9. Any
  change in the position must be checked and
  approved by seepex.
- Tension-free mounting of pump
   This rule applies to pumps with and without drives,
   to versions with and without baseplate, for
   mounting on the foundation or other bearing
   elements. The entire area of all bearing surfaces of
   the machine must rest on the ground. Any
   unevenness must be corrected by appropriate
   supports.
- Correct seating of drives
   All drives have been aligned ready for operation
   and mounted by seepex. However, displace-ments
   may occur during transport or installation. For this
   reason, check that the alignment and fastening of
   the drive and coupling are correct.
- Protective devices
   On completion of the assembly and installation work, immediately mount all safety and protective devices in their proper locations and set them in operation.



### 5.2.3 Protective and Controlling Equipment

Information on equipment of this nature, where fitted, is provided in the data sheet, Point 9. Consult the attached manufacturer's specifications, Point 10, for instructions on assembly and installation.

# 5.2.4 Electric Connection of Electric Motor and Frequency Converter

The electric connections must be established in accordance with the manufacturer's specifications, Point 10, as well as the safety specifications applying at the installation site. The mains voltage and frequency must match the ratings indicated on the type and rating plates.

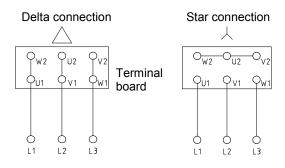


• Switch on electric motor "direct-on-line"

CAUTION

An increased starting torque is necessary due to the clamping between the rotor and stator conveying elements. This means the electric motors that drive the progressive cavity pumps must always be switched on directly. As a rule, star-delta startup is not possible unless special arrangements have been made with seepex.

Three-phase cage motor



low . . . high . . . . . . voltage indicated on rating plate

Speed regulation via frequency inverter
When progressive cavity pumps with frequencycontrolled drives are started up problems may occur
due to unsuitable or wrongly set frequency inverters.
For this reason we recommend the purchase of the
complete drive, including frequency inverter, from
seepex, so that the frequency inverter can be tuned
on the seepex test field along with a trial run.

Ensure that customer-supplied frequency inverters comply with the starting torque and running power specified in the appended data sheet, Point 9.

#### CAUTION

Consult the appended document TI.FRU.01, see Point 9, for further information on the electric connection and the setting of frequency inverter and variable-speed motor.

### 5.2.5 Piping

### 5.2.5.1 Suction and Pressure Flanges

The position, nominal width and standard of the suction and pressure flange of the progressive cavity pump are specified in the dimension drawing, Point 9, and data sheet, Point 9. Always observe the rotational direction and flow direction defined in Point 6.2.5.

# 5.2.5.2 Piping Dimensioning CAUTION

The pipe diameters on the suction and pressure sides must be dimensioned in accordance with the customer's pressure-loss calculation in such a way that the pressures specified in the data sheet, Point 9, are not exceeded. The nominal width of the suction pipe should at least match that of the pump suction flange.

# 5.2.5.3 Residue-free Piping CAUTION

Prior to starting up the pump, ensure that all pipelines are free from foreign bodies. Installation residues (such as weld spatter, screws, steel chips etc.) will lead to damage of the **seepex** pump for which guarantee claims will not be accepted.

### 5.2.5.4 Tension-free Mounting CAUTION

Pipelines and other components requiring to be connected with the pump must be mounted without stresses.

### 5.2.5.5

#### Fluid Connections for Optional Extras

Consult the data sheets, Point 9, for information regarding the optional extras, if any, that are fitted. The technical description is given under Point 9.

Ausgabe issue	B / 02.01.2006	Dokument document	OM.INS.01e	Blatt sheet	2 (2)	
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### 6.0 Commissioning/De-commissioning

#### 6.1

#### **Engineering Data**

Details regarding all technical specifications and operating conditions are given in these operating instructions together with the data sheet, Point 9.

To guarantee the correct assignment of documentation to pump, the commission number on the

- · cover sheet
- and data sheet of these operating instructions must match the commission number stated on
- the nameplate of the pump.

#### 6.1.1

#### See Point 7.2.2 for Lubricant Chart

#### 6.2

#### **Preparation for Operation**

### 6.2.1 Bearing

#### 6.2.1.1

See Point 7.2.1.4 for pump bearing.

#### 6.2.1.2

See manufacturer's documents, Point 10, for drive bearings.

### 6.2.2

### **Shaft Sealing**

See document OM.SEA.\_\_\_,.

#### 6.2.3

### Filling Up of Suction Side to Avoid Dry Running at Startup

### CAUTION

Before switching on the pump, fill the suction-sided pump casing with fluid so that the first rotations will lubricate the conveying elements immediately. A small quantity of fluid is sufficient for lubrication; the subsequent operation of the pump is self-priming, even if an air column up to the liquid level remains.

### 6.2.4 Electric/Hydraulic Connections



The connections are listed in the appended manufacturer's documents, Point 10.

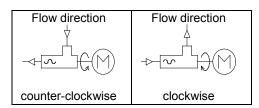
The risk of exposure to electrical hazards must be ruled out. Always observe the safety regulations valid at the site of installation.



### 6.2.5 Checking Direction of Rotation

The rotational direction of the pump determines the flow direction of the conveying medium.





Prior to commissioning the rotational direction of the pump must be checked for compliance with the data sheet specification and the rotational direction arrow on the type plate of the pump.

### 6.3 Control and Monitoring Equipment

Where applicable, please refer to the associated documents, Point 10, for information on commissioning.

### 6.3.1 Performance Check

Any optional extras must be subjected to a performance check in conformity with the specifications by seepex or other manufacturers, see manufacturer's documents.

### 6.3.2 Setting

Unless already performed in the factory, setting must be carried out in accordance with the appended manufacturer's specifications, Point 10. Pay attention to the operating specifications in the data sheet.

### 6.4 Equipment for Protection of Persons

Machines must be fitted with mechanical protective devices complying with DIN EN 809.

- Moving or working parts must be protected against accidental contact.
- However, safety considerations demand it be possible at all times to check without hindrance whether the shaft seal is fully functional.
   A protective guard is necessary in this area only if components are mounted on the rotating, smooth shaft.



- If pumps are operated with an open suction flange/feed hopper, a suitable protective guard complying with DIN EN 294 must be mounted.
- Country-specific protective regu-lations must be observed at the site of installation.
   Prior to activation of the pump, check the proper function of all protective equipment.

### 6.5 Commissioning

# 6.5.1 Initial Startup/Re-starting CAUTION

Every seepex progressive cavity pump is designed for the specific operating conditions documented in the data sheet. Commissioning is permissible only if the operating conditions conform with those indicated in the data sheet. Although the potential usages of the seepex pump are not confined to the specified operating conditions, any change in the original conditions must be checked and approved by seepex.

The right to make claims under the warranty agreement will be annulled if operating conditions are changed without prior approval by seepex.

### 6.5.2 Avoid Dry Running of Pump CAUTION

The dry running of a pump increases the friction between rotor and stator, quickly causing an unacceptably high temperature to develop on the inner surface of the stator. This overheating leads to burning of the stator material and the total failure of the pump.

For this reason it is necessary to ensure that the suction-sided flow never dries up completely. If a continuous flow cannot be guaranteed for the plant, it is essential to fit the seepex dry running protection device TSE, available as an optional accessory.

### 6.5.3 Check Pressure at Suction and Pressure Flanges

### 6.5.3.1 Safeguard Pump Against Excessive Pressure at the Suction Flange

The seepex pump is designed to operate with the pressure at the suction flange (suction head or inlet pressure) specified in the data sheet. Deviating pressure conditions may lead to the failure and/or destruction of the shaft seal or entire pump.



For this reason the suction pressure specified in the data sheet must be guaranteed. Appropriate monitoring devices are oil-filled contact manometers that deactivate the pump.

### 6.5.3.2 Safeguard Pump Against Excessive Pressure at the Pressure Flange

The seepex pump operates according to the positive displacement principle. Operation of the pump against an excessive pressure caused by closed valves, by high pressure losses in the piping or by product sedimentation will lead to the destruction of the pump, drive, pipe work and/or downstream equipment. Every progressive cavity pump must therefore be protected against overpressure. Safety valves with bypass pipes or oil-filled contact manometers that disactivate the pump are appropriate protective devices.



### 6.5.4 Drive Engine

Consult the attached manufacturer's operating instructions, Point 10, for information on commissioning the drive engine.



# 6.5.5 Establish Clear Passage Through Pipelines CAUTION

To prevent damage to the pump the unhindered flow of liquid must be guaranteed between the points of entry to and exit from the pipeline. For this reason, open all relevant valves etc. prior to activation of the pump.

### 6.6 De-commissioning

### 6.6.1 De-activation

The electric connections must be switched off and protected against accidental re-activation. Observe the safety regulations applying to the plants.



### 6.6.2 Stationary Pump

The pump and all optional equipment must be provided with the following protection modes while at a standstill:

- Frost protection
- Protection against solid particle deposits
- Protection against sedimentation of the medium
- Corrosion protection for parts in contact with the medium

We recommend that the pipeline and pump be emptied for the duration of the plant standstill. Following evacuation, the pump should be preserved.

### 6.6.3 Evacuation of the Pump

The pipeline must be evacuated on the suction and pressure side or shut-off directly behind the pump connections. Drain any residual liquid in the pump casing by opening/ removing the screwed sealing plugs (705) and (502), sealing rings (706) and (503). Casings without screwed plug must be evacuated by the connection branch (SAG and DRS). Refer to the data sheet and the sectional drawing of the associated operating instruction, Point 9, for information on the pump design. Conveying medium residues always remain in the rotor/ stator chambers and may run out during transport or disassembly of the pump. If conveying aggressive or hazardous media, therefore, wear appropriate protective gear during all installation work.



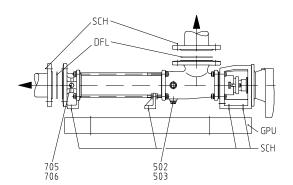
### 6.6.4 Disassembling the Pump

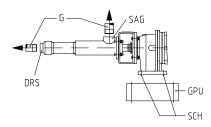
Dismantle the pipe work by removing the flange bolts (SCH) and flange seals (DFL) or the threaded connections (G).

Disassemble the pump together with the baseplate (GPU) or, as applicable, without the baseplate (GPU) following removal of the bolts (SCH) at the pump feet

Block-design pumps with direct flangemounted drive engine are liable to become unstable during disassembly. Stability can be restored by propping up the drive engine.







6.6.5 Preservation/Storage

The pump must be preserved prior to storage. Appropriate preservation measures must be agreed with **seepex**. Always state the pump commission number when making inquiries.

# These operating instructions are valid for range MD (stainless steel-design) size 0015-24 to 012-24

#### 7.0

### **Service and Maintenance**

Contents

7.1 General Instructions

7.2 Service and Inspection

7.3 Dismantling

7.4 Re-assembly

The sectional drawing and parts list relevant for Points 7.3 and 7.4 can be found in Point 9.

### 7.1

#### **General Instructions**

A requirement for the reliable operation of any pump is service and maintenance in compliance with instructions. Maintenance personnel must therefore have access to these operating instructions and adhere to them meticulously. seepex will accept no liability for damages arising through non-observance of these operating instructions.

#### 7.2

#### Maintenance and Inspection

### 7.2.1

### Lubrication

#### 7.2.1.1

### **Rotor and Stator**

The rotor and stator are lubricated by the conveying medium.

### 7.2.1.2

#### **Shaft Sealing**

Consult document OM.SEA.\_\_ for information on lubricating the shaft seal.

### 7.2.1.3

### **Pin Joint**

The pin joints are filled with special grease and lubricated for the expected duration of service. The seepex joint grease specified in the index of these operating instructions should be used exclusively for any required maintenance work.

### CAUTION

Usage of other grease types will lead to premature joint failure and render invalid any right to claims under guarantee.

#### 7.2.1.4

#### Bearing of the Pump/Drive Engine

The bearing of the rotating pump parts is effected by the drive engine. Lubrication instructions are therefore included in the appended drive engine operating instructions.

#### 722

### **Lubricant Filling Levels**

Details are specified in the index.

### 7.2.3

### **Drives and Optional Extras**

For maintenance and inspection specifications, see the appended manufacturer's documents.



#### 7.2.4

### **Supervision during Operation**

#### 7.2.4.1

### **Shaft Sealing**

See document OM.SEA. .

#### 7.2.4.2

### **Optional Extras**

These must be monitored in accordance with the separate documents, Point 9/Point 10.

### 7.2.4.3

#### **Drive Engines**

These must be monitored in accordance with the separate manufacturer's documents, Point 10.

#### 725

#### **Preventive Measures**

To avoid the expenses incurred by lengthy stop periods of the pump, seepex recommends the acquisition of a set of wearing parts and a set of gaskets. The contents are listed in the document OM.WPS.40.

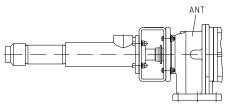
### 7.3 Dismantling the seepex Progressive Cavity Pump

Tools are required for dismantling and re-assembly. These tools are listed in Point 9 of the document OM.SPT.01.

The stator (601) and the rotating pump parts can be exchanged in site. The rotating pump parts can be dismantled as a complete rotating unit (RTE) (Point 7.3.4) or as individual components (Point 7.3.5).

Before commencing the dismantling of pump parts, safeguard the pump against tipping over or falling down by fastening it at the drive (ANT).





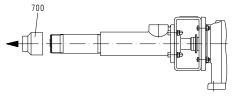
7.3.1 Pressure Flange (700) - Dismantling

Prior to dismantling see Point 7.3.2

CAUTION

Pressure branch (700) is glued in place with an adhesive of medium strength.

Therefore, to break the seal / adhesive compound it is recommended to heat upto a maximum of 80 °C.



7.3.2 Stator (601) - Dismantling

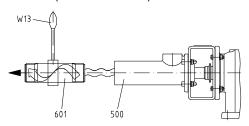
### • Maintenance tip:

Disassembly of the stator can be made considerably easier by first moistening the inner surface of the stator with antiseize agent (soft or liquid soap). Before removing the pressure flange (700), pour the antiseize agent into the opening between rotor and stator on the pressure flange side. Several clockwise (see Point 6.2.5) revolutions of the rotor will then distribute the antiseize agent over the inner surface of the stator and reduce the friction between rotor and stator considerably.

### • Lock drive shaft against rotation.

### CAUTION

Stator (601) is glued in place with an adhesive of medium strength. Therefore, to break the seal / adhesive compound it is recommended to heat upto a maximum of 80 °C. Dismantling the stator (601) with tool (W13/see Point 9).



7.3.3 Suction Casing (500), Casing Gasket (501) -Dismantling

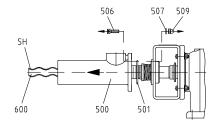
Fit the rotor (600) with a protective cover (SH).

### CAUTION

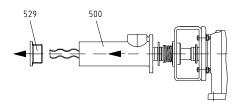
Suction casing (500) with reducing unit (529) Reducing unit (529) is glued in place with an adhesive of medium strength.

Therefore, to break the seal /adhesive compound it is recommended to heat upto a maximum of 80°C.

Suction casing (500) without reducing unit (529)



Suction casing (500) with reducing unit (529)

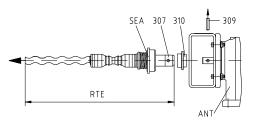


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# 7.3.4 Rotating Unit (RTE) - Dismantling CAUTION

Before dismantling the rotating unit it is essential to comply with the specifications in document OM.SEA. Shaft Seal Dismantling, see Point 9...

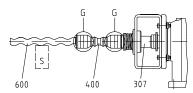
- Remove flushing connections at shaft seal housing (SEA).
- Raise/shift splash ring (310) and eject plug-in shaft pin (309) in horizontal direction.
- Remove rotating unit (RTE)/plug-in shaft (307), together with shaft seal (SEA) from output shaft of the drive (ANT). See Document OM.SPT.01, in Point 9 for tool (W10) used for pulling off.
- See in document OM.SEA.\_\_ for removal of the shaft seal (SEA) from the plug-in shaft (307).



7.3.5 Rotating Pump Parts - Dismantling

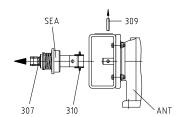
### 7.3.5.1 Rotor (600), Coupling Rod (400)

Detach the rotor (600) and coupling rod (400) from the plug-in shaft (307) by dismantling the joint (G) in accordance with Point 7.3.6.



7.3.5.2 Plug-in Shaft (307)

The plug-in shaft (307) is removed in the same way as the rotating unit (RTE), see Point 7.3.4.



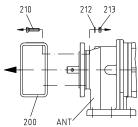
### 7.3.6 Dismantling of Joint

see document OM.PJT.04 Point 1.

### 7.3.7 Shaft Sealing

See document OM.SEA.\_\_ for information on dismantling the shaft sealing.

7.3.8 Lantern (200)/Drive (ANT) - Dismantling



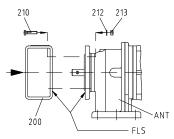
7.4 Re-assembly

Before commencing the reassembly, fasten the drive (ANT) in such a way that it cannot tip over or fall down during the re-assembly of the drive and all pump components.



#### 7.4.1 Lantern (200)/Drive (ANT) - Assembly

Clean flange bearing surfaces (FLS), centering diameter and output pivot of the drive (ANT).

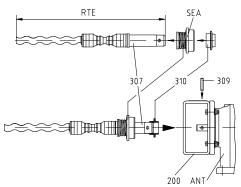


7.4.2 Rotating Unit (RTE) - Re-assembly

The rotating unit (RTE) has been assembled in accordance with the description in document OM.PJT.04

 Mount shaft seal (SEA) on plug-in shaft (307) in the way described in document OM.SEA.\_\_, see Point 9.

- Moisten splash ring (310) and plug-in shaft (307) with joint grease (see index for type) and slide splash ring (310) onto plug-in shaft (307), observing the fitting position of the splash ring, (see lettering on the splash ring).
- Apply antiseize graphite petroleum to the output pivot of the drive (ANT) and slide on the rotating unit (RTE). Insert plug-in shaft pin (309) horizontally.
- Splash ring position (310)
   Outer edge of splash ring (310) has to occlude with outer edge of plug-in shaft (309).

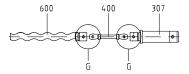


7.4.3 Rotating Pump Parts - Re-assembly

Prepare main components:

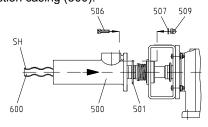
Prepare rotor (600), coupling rod (400) and plug-in shaft (307) as described in document OM.PJT.04 Point 2. to 2.3 Joint (G) re-assembly as described in document

Joint (G) re-assembly as described in document OM.PJT.04 Point 3.



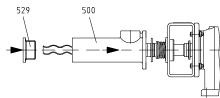
7.4.4 Suction Casing (500), Casing Gasket (501) - Reassembly

Fit protective cover (SH) on rotor (600). Assemble casing gasket (501) and suction casing (500).



### CAUTION

Install reducing unit (529) to suction casing (500) with an adhesive of medium strength



7.4.5 Stator (601) - Assembly / Re-assembly

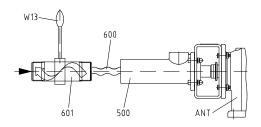
#### Maintenance tip:

Disassembly of the stator can be facilitated considerably by first moistening the inner surface of the stator with antiseize agent (soft or liquid soap). Before removing the pressure flanges (700), pour the antiseize agent into the opening between rotor and stator on the pressure flange side. Several clockwise (see Point 6.2.5) revolutions of the rotor will then distribute the antiseize agent over the inner surface of the stator and reduce the friction between rotor and stator considerably

Lock drive (ANT) shaft against rotation.

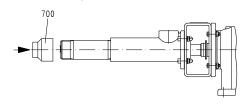
### CAUTION

Install external thread of stator (601) with an adhesive of medium strength. Turn stator (601) to the right using a tool (W13/see Point 9), slip it onto rotor (600) and screw it into the suction casing (500) at the same time.



# 7.4.6 Pressure Flange (700) - Assembly CAUTION

Install pressure branch (700) with an adhesive of medium strength



### 1.0 Dismantling of Joint

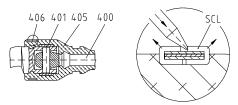
### 1.1 Holding Band (406) - Dismounting

Cut through loop (SCL) of the holding band (406) with a metal saw.

Wear protective goggles when squeezing out the two halves of the holding band loop (SCL).

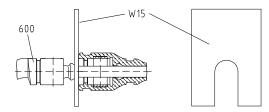


Remove holding band (406).



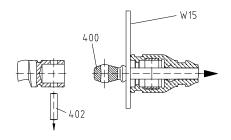
1.2 Rotor (600) - Dismantling

Withdraw universal joint sleeve (405) with retaining sleeve (401) in coupling rod direction and fix it by using a special maintenance tool (W15/see document OM.SPT.01)

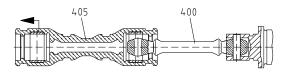


### Separation of Joint

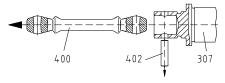
Eject coupling rod pins (402). Pull coupling rod (400) out of joint top.



### 1.3 Universal Joint Sleeve (405)

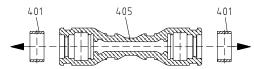


### 1.4 Coupling Rod (400)



### 1.5 Retaining Sleeve (401)

Remove retaining sleeve (401) from universal joint sleeve (405).



2.0 Prepare main components for Re-assembly

### 2.1 Rotor (600) - Preparation for Joint Assembly

First remove any burr, flaws or similar defects from the rotor, then clean it.

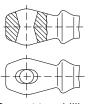
If the hole for the coupling rod pin (402) has worn out, a new rotor (600) has to be installed.

### 2.2 Coupling Rod (400) - Preparation for the Joint Assembly

Clean coupling rod and check top drilling regarding wear.

### CAUTION

If the top drilling shows wear, a new coupling rod will have to be used.



Correct top drilling

### 2.3 Plug-in Shaft (307) - Preparation for Joint Assembly

Remove any burr, flaws or similar defects from the plug-in shaft (307), then clean it.

If the hole for the coupling rod pin (402) has worn out, a new plug-in shaft (307) has to be installed.

### 3.0 Joint - Re-assembly CAUTION

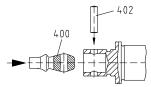
To ensure a perfect operation of the joints, coupling rod pins (402) and coupling rods (400) showing wear should be replaced. Refer to Point 2.2

### 3.1 Joint Grease (098)

Joint head at rotor (600) and plug-in shaft (307) Fill joint head with joint grease (098). (Regarding joint grease (098) refer to index of operating instruction)

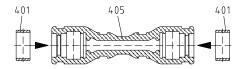


### 3.2 Coupling Rod (400)



### 3.3 Retaining Sleeve (401)

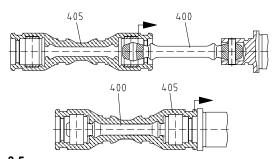
Moisten both sides of retaining sleeve (401) with joint grease and insert this unit in universal joint sleeve (405).



### 3.4 Universal Joint Sleeve (405)

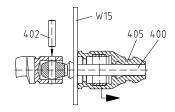
Moisten surface of coupling rod (400) and inner surface of universal joint sleeve with joint grease Regarding joint grease (098) refer to index of operating instruction.

Slip universal joint sleeve (405) with fitted retaining sleeves (401) onto coupling rod (400) and joint head.



3.5 Rotor (600)

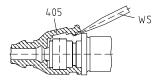
Push back universal joint sleeve (405) at rotor side towards coupling rod (400) and fix it using the relevant tool (W15/refer to document OM.SPT.01).



Slip universal joint sleeve (405) onto joint head.

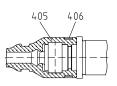
### 3.6 Universal Joint Sleeve - Deaeration

Deaerate interior space of joint at the side of plug-in shaft and rotor using relevant tool/screw driver (WS)



#### 3.7 Holding Band Re-assembly

Mount holding band (406) using tool (W3/OM:SPT.01) as described in document OM.HBD.01.



### Holding Band (HBD) - Assembly

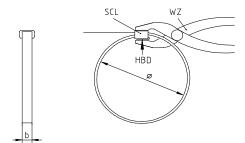
Tools required for the re-assembly, see document OM.SPT.01.

### · Prepare holding band

Only prefabricated double-band holding bands should be used. The diameter  $(\emptyset)$  and in particular the breadth (b) of the holding band is matched to the universal joint sleeve.

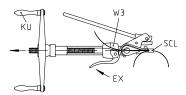
### · Test holding band

The bent holding band (HBD) must fit against the holding band loop (SCL), if necessary apply pressure with the tool/pliers (WZ).

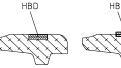


### · Assembly of holding band

Insert holding band in tool (W3/ see Point 9). Hold free end of holding band with control lever (EX), turn crank (KU) until the holding band is strained and fitting against the holding band loop (SCL). Carefully contract holding band until it fits inside the circular groove of the universal joint sleeve.



### • Correct holding band tension (HBD)



Correct
Holding band
(HBD) has
slightly contracted outer
form of
univers-al joint
sleeve and is
stuck in
position.



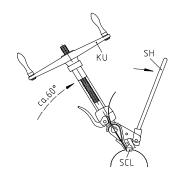
Incorrect Holding band (HBD) is too slack and liable to slip.



Incorrect
Holding band
(HBD) is too tight.
Universal joint
sleeve will be
damaged/sheared
off.

• Folding back the holding band (HBD)

Slowly swivel mounting tool upward by 60°, at the same time slackening the crank (KU) by approximately one half revolution. Swivel cutting lever (SH) forward until the pressure plate fits against the holding band loop (SCL).



 Shearing off holding band (HBD) made of material AISI 304 and AISI 316

A blow with the palm of the hand against the cutting lever (SH) causes the end of the holding band behind the loop (SCL) to be folded back and sheared off. If the holding band on the sheared off side is slightly raised as a result, it must be straightened carefully.

### CAÚTION

Never tap or hammer against the loop of the holding band (SCL), otherwise damage to the universal joint sleeve may occur.



 Shearing off holding band (HBD) made of Hastelloy C

The high strength of this material makes it impossible to shear off the holding band (HBD) with the cutting lever (SH). Once the end of the holding band is folded back, cut off the holding band (HBD), file off projecting edges and remove burr.



Check after mounting of holding band

The holding band must run all the way round the groove of the universal joint sleeve.

The holding band (HBD) must be bent back and sheared off at the holding band loop (SCL) in such a way that the holding band (HBD) is unable to slip back through the holding band loop (SCL). If this has not been accomplished, then the holding band (HBD) must be replaced by a new one.

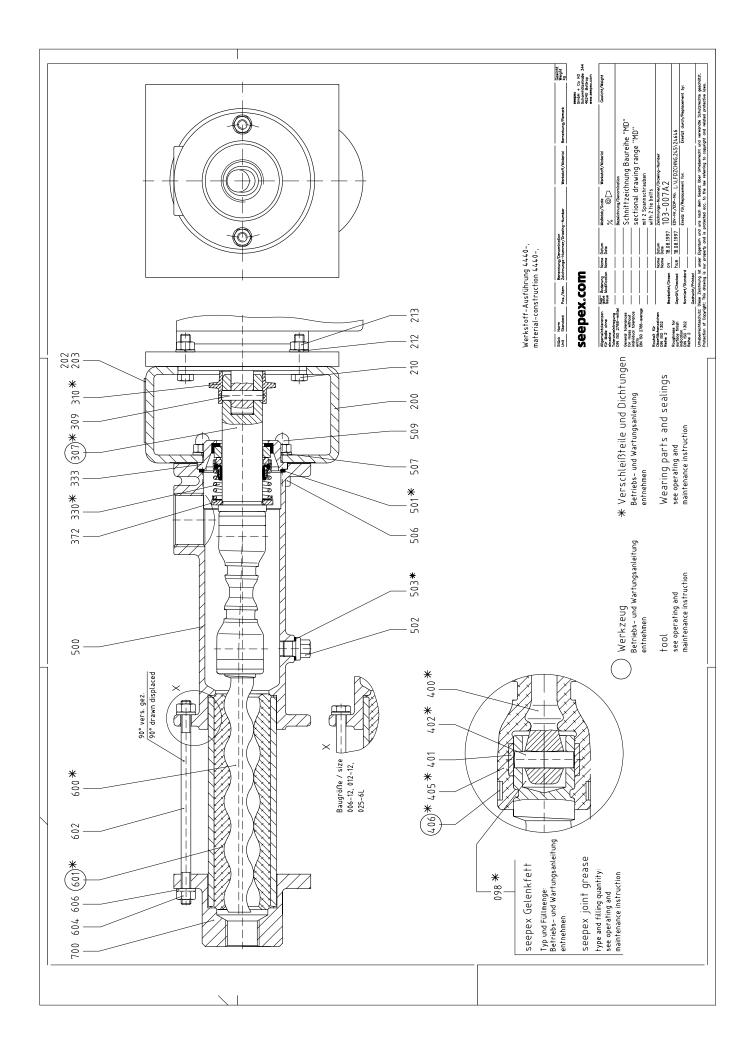




				<b>D</b>	11								
	Breakdown												
pump has no suction	pump conveys irregularly	the conveying capacity is not achieved	pressure is not achieved	pump does not start	pump has seized or has stopped conveying	pump operates noisily	motor becomes too warm	the stator wears out early	shaft sealing leaks	seepex progressive cavity pumps will operate trouble-free if they ar used in accordance with our data sheet (see item 9) and our operating and maintenance instructions:			
1	2	3	4	5	6	7	8	9	10		Reasons / Remedies		
				Х			X			а	Adhesion between rotor and stator excessive (as delivered). Lubricate (soft soap, genuine soap) between stator and rotor.  Then turn the pump by means of the tool W2.		
Х										b	Check rotational direction of the pump per data sheet and nameplate. In case of wrong direction, change wiring of motor.		
Х	Χ	Х			Х	Х				С	Suction pipe or shaft sealing leak. Eliminate the leakage.		
Х	Х	Х				Х				d	Suction head too high (item 6.5.3.1). Check suction head with vacuum gauge. Increase the suction pipe diameter and fit larger filters. Open the suction valve fully.		
Х	Χ	Χ								е	Viscosity of the liquid too high.		
-		Χ		Χ			Х			f	Check and accommodate per data sheet.  Wrong pump speed. Correct pump speed per data sheet.		
	Х	X								g	Avoid inclusions of air in the conveying liquid.		
		Х		Х	Х		Х	Х		h	Pressure head too high (point 6.5.3.2). Check pressure head with manometer. Reduce the pressure head by increasing the pressure pipe diameter or by shortening the pressure pipe.		
X	Χ	Χ			Χ			Χ		i	Pump runs partially or completely dry (point 6.5.2). Check flow in the suction chamber. Install dry running protection TSE.		
						X	X			j	Check coupling, possibly pump shaft is misaligned to drive. Check whether coupling gear is worn. Realign coupling. The coupling gear has perhaps to be replaced.		
Χ		Χ								k	Speed too low. Increase the speed when high suction performances are required and when the liquid is very thin.		
Х	Χ					Х				I	Speed too high. Reduce the speed when pumping products with high viscosities - danger of cavitation.		
						Χ				m	Check the axial play in the coupling rod linkage. Check that the bush has been installed correctly see document OM.PJT		
Х		Χ		Х	Χ			Χ		n	Check for foreign substances in the pump. Dismantle the pump, remove foreign substances and replace worn parts.		
Χ		Χ	Χ		Χ					0	Stator or rotor worn. Dismantle the pump and replace defective parts.		
Х		Х			Х	Х				р	Joint parts worn. Replace worn parts and fill with special pin joint grease .		
Х		Х			Х			Х		q	Suction pipework partially or completely blocked. Clean suction pipework.		
Х				Х	Х		Х	X		r	Temperature of the pumping liquid too high. Excessive expansion of the stator. Check temperature and install rotor with diameter smaller than specified.		
Х		Х		Х			Х		Х	s	Gland packing too strongly tightened or worn. Ease or tighten stuffing box. Replace defective packing rings.		
Х				Х	Х			Х		t	Solid contents and/or size of solids too large. Reduce pump speed and install perhaps a screen with suitable meshes. Increase fluid share.		
Х				Х				Х	Х	u	When the pump is non operational the solids settle out and become hard. Clear and flush the pump immediately.		
Х				Х	Χ			Х	Х	٧	The liquid becomes hard when temperature falls below a certain limit. Heat the pump.		
				Х	Х		Х	Х		w	Stator swollen and unsuitable for the pumped liquid. Select a suitable stator material. Use perhaps rotor with diameter smaller than specified.		
						Χ			Х	х	The bearing in the drive casing of the pump or in the drive engine is defective. Replace bearing.		
									Х	у	Mechanical seal defective. Check seal faces and O-rings. If necessary replace corresponding defective parts.		

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# 9.0 **Auxiliary seepex documentation**

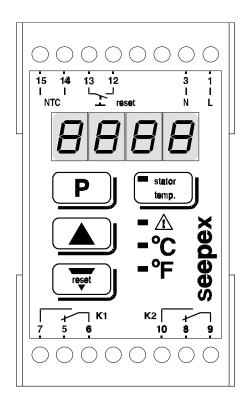


		DE	GB	FR
		Baureihe MD	range MD	série MD
		Schnittzeichnung Nr.	sectional drawing No.	plan no.
		103-007_2	103-007 2	103-007 2
		Benennung	denomination	désignation
Stck.	Pos.	Stck. / Pos.	Qty. / item	Qté. / Poste
			_	
1		Laterne	lantern	lanterne
2		Halbrundkerbnägel	round head grooved pin	rivet
1		Typenschild	type plate	plaque signalitique
4		6kt-Schraube	hexagon bolt	vis
4		Federring	spring washer	rondelle frein
4	213	6kt-Mutter	hexagon nut	écrou
1		Steckwelle	plug-in shaft	arbre à broche
1		Steckwellenbolzen	plug-in shaft pin	cheville pour arbre à broche
1	310		splash ring	bague de projection
1	330		mechanical seal	garniture mécanique
1	333	Gleitringdichtungsgehäuse	mechanical seal casing	carter de la garniture
				mécanique
1	372		support ring	bague d'appui
1		Kuppelstange	coupling rod	barre d'accouplement
2	401		retaining sleeve	douille d'articulation
2	402	-   -	coupling rod pin	axe d'articulation
1	405		universal joint sleeve	manchette
2		Halteband	holding band	collier de serrage
1		Sauggehäuse	suction casing	carter d'aspiration
1		Sauggehäusedichtung	casing gasket	étanchéité du carter d'aspiration
4		Zylinderschraube	socket screw	vis à tête cylindrique
4		Federring	spring washer	rondelle frein
4		6kt-Mutter	hexagon nut	écrou
1		Rotor	rotor	rotor
1	601		stator	stator
2 2		6kt-Schraube	hexagon bolt hexagon nut	Vis
2	604	6kt-Mutter Scheibe	washer	écrou rondelle
1	700	Druckstutzen	pressure branch	bride de refoulement
'	700	Druckstutzen	pressure branch	bride de relouiement
	098	seepex Gelenkfett	seepex joint grease	seepex graisse d' articulations
		Typ und Füllmenge:	type and filling quantity:	sommaire pour type et quantité:
		Betriebs- und	see Operating and Maintenance	
		Wartungsanleitung entnehmen	Instruction	d'entretien
		Verschleißteile und Dichtungen:	Wear parts and sealings:	pièces d'usure et étanchéités:
		Betriebs- und	see Operating and Maintenance	voir Instructions de service et
		Wartungsanleitung entnehmen	Instruction	d'entretien
		Werkzeuge:	Tools:	Outils:
		Betriebs- und	see Operating and Maintenance	voir Instructions de service et
		Wartungsanleitung entnehmen	Instruction	d'entretien
		versetzt gezeichnet	drawn displaced	plan separé

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- 1.1 Introduction
- 1.2 Function

#### 2.0 Technical Data

- 2.1 Temperature Sensor
- 2.2 TSE Control Device for Installation in Control Panel

### 3.0 Electrical Connection of the TSE

- 3.1 Installation Instructions
- 3.2 Connection Diagram of TSE Control Device
- 3.3 Relay Function

### 4.0 Procedures prior to Commissinong

- 4.1 Check Position of the Temperature Measuring Point at the Pump
- 4.2 Function Check
- 4.3 Approximate Adjustment of Trip Temperature

### 5.0 Commissioning and Operation

- 5.1 Fine Adjustment of Trip Temperature
- 5.2. Resetting of the Control Device after Dry-Running
- 5.3 Changeover of Display from °C to °F

### 6.0 Replacement of Stator

- 6.1 Order of Replacement Stator
- 6.2 Dismantling and Re-Assembly of Connection Head and Temperature Sensor

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### 8.0 Enclosures

- . 8.1 Drawing 702-000/0000-0-009 \_\_ for sizes 006-12 and 025-6L
- 8.2 Drawing 702-000/0000-0-008 \_\_\_ for Sizes 025-12 up to 500-6LA
- 8.3 Additional Information ZU.TSE.02 for TSE Motor Control
- . 8.4 Additional Information ZU.TSE.03 for TSE in Explosion Proof Construction

Dokument / document ZU.TSE.01e

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### 1.0 General

#### 1.1 Introduction

Progressive cavity pumps should generally be protected against dry-running. Due to the increased friction between the main conveying elements ie. rotor and stator, which occurs in the event of dry-running the pump, the temperature at the internal surface of the stator can quickly rise depending on the pump speed.

When exceeding the max. permissible operating temperature the internal surface of the stator will burn and cease operation. If this occurs the stator needs to be replaced. The possible malfunction of an progressive cavity pump can be easily avoided by using the patented dry-running protection device TSE.

### 1.2 Function

The general operating principle of the dry-running protection device TSE is to continuously monitor the temperature in the stator and to trip the pump when reaching a limit temperature. The temperature in the pump stator is compared with the pre-set trip temperature via a NTC temperature sensor, which is fitted in the stator of the pump as well as the TSE control device, which is positioned in the control panel. In case of dry-running of the pump and a temperature increase in the stator up to the pre-set switch-off value, two relays will switch.

The drive motor of the pump will be switched-off via the potential-free changeover contacts and a fault message will be released. After rectification of the cause of the dry-running and the cooling down of the stator, the fault message at the TSE device can be acknowledged and the pump can be switched on again.

By acknowledging the fault message an automatic re-connection without inspection and correction of the cause of the dry-running is avoided.

### 2. 0 Technical Data

#### 2.1

#### **Temperature Sensor**

The NTC thermister is installed in a stainless steel protection sleeve in the stator of the pump. Permissible Temperature Range: 0-150 °C Standard Resistance: 10 kOhm at 25 °C

Temp.	Resistance	Temp.	Resistance
°C	Ohm	°C	Ohm
0	32.650	70	1.752
10	19.900	80	1.255
20	12.490	90	915
25	10.000	100	678
30	8.057	110	510
40	5.327	120	389
50	3.603	130	301
60	2.488	140	235

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### TSE Control Device for Installation in Control Panel

#### 2.2.1

### **Technical Data**

Type: SGRTSE 230 AC, SGRTSE 115 AC,

SGRTSE 24 AC, SGRTSE 24 DC

Temperature Range: 0-150 °C

Input: NTC temperature sensor

10 kOhm (at 25 °C) with sensor breaking protection

at - 25 °C.

Relay Output: 2 potential-free

changeover contacts (K1,K2), breaking

capacity 500 VA at 110/230 V Ohmic load.

Deliverable

Operating Voltage: 24V, 115V, 230V AC; 24V DC

Power Consumption: max. 4VA

Sensor Circuit: No load voltage max. 2.5 VDC

Short circuit current 0.5 mA DC

Display at Device: Fault/Dry Running

Trip temperature Stator temperature

Operation at Device: Adjustment of trip temperature.

Reset of fault message.

Casing Material: ABS

Fastening: Mounting on standard rail

35 mm acc. to standards or screw fixings acc. to standards

Kind of Protection: Casing IP 40

Terminals IP 20

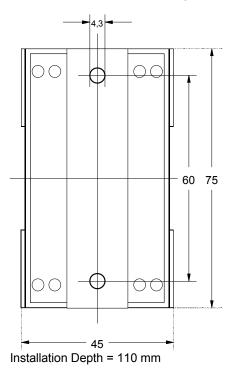
Ambient Temperature: 0-50 °C

Dimension: 45x75x110 mm (WxHxD) EMV (89/336/EEC) CE conform acc. to standards

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2.2.2 Dimensions and Wall Mounting



3.0 Electrical Connection of the TSE

### 3.1 Installation Instructions

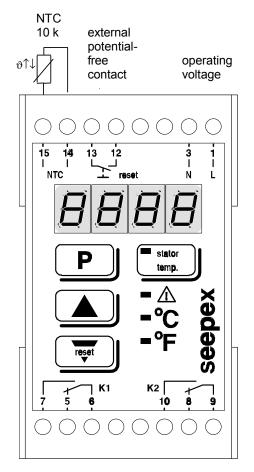
Prior to the connection and the commissioning of the device it has to be ensured that the supply voltage corresponds to the nominal voltage shown on the name plate. Nominal voltage fluctuations are permissible in the range of +/- 10 % of the device's nominal voltage.

The electrical connections have to be carried out in accordance with the wiring diagram and the regulation of the local EVV or the VDE directions.

In case of power fluctuations which lead to a malfunction of the device, adequate procedures have to be taken to avoid its reoccurrence. Alternatively these errors could be filtered out by an external supply filter. The device has to be provided with an internal supply filter.

Sensor leads have to be shielded. The shield has to be earthed at one end.

3.2 Connection Diagram of TSE Control Device



Should the TSE control device be reset after a dry-running from the control panel door or another remote position, a button ("make contact") at the terminals 12 +13 can be used.

### 3.3. Relay Function

Actual temperature < trip temperature (trouble free operation)
Contacts 6 to 7 and 9 to 10 closed
Contacts 6 to 5 and 9 to 8 open

Actual temperature > trip temperature (Malfunction/Dry Running)
Contacts 6 to 5 and 9 to 8 closed
Contacts 6 to 7 and 9 to 10 open

Relays K1 and K2 are switched parallel to each other and operate simultaneously. K1 is integrated in the motor contactor control serving as a switch-off provision. K 2 is optional as stand by for additional connection to a fault indicator or as a reserve to the process control computer.

Dokument / document **ZU.TSE.01e** 

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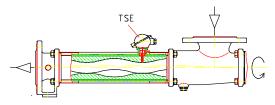
### 4.0 Procedures prior to Commissioning

# 4.1 Check Position of the Temperature Measuring Point at the Pump

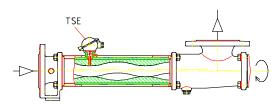
Considering the rotating direction and thus the conveying direction of the pump, the temperature sensor is fitted in our factory as per the following figures.

When changing direction of the pump and when replacing the stator the specified installation position of the temperature measuring point has to be checked. The temperature sensor must always be installed at the product entry side of the stator as the quickest temperature increase in case of dry-running will arise at this point.

# 4.1.1 Pump "counter clockwise rotation" - standard construction



# 4.1.2 Pump "clockwise rotation" special construction



### 4.2 Function Check

After the electrical connection of the TSE and prior to the initial operation of the pump the following function check has to be carried out.

Switch-on control voltage at terminals 1 and 3 (Digital display at the TSE control device illuminates).



Press and hold button "stator temp" and read the temperature value.

If the shown temperature correspond to the ambient temperature in the pump the TSE is functioning correctly. In case of deviation proceed as per paragraph 7 - Malfunctioning.



# 4.3 Approximate Adjustment of Trip Temperature

The TSE control device is pre-set to a trip temperature of 50 °C prior to leaving our factory. In order to achieve the shortest trip time after a dry-run and thus the max. protection of the pump stator, the trip temperature at the TSE control device has to be set as low as possible.

For the initial commissioning the temperature value pre-set in our factory should be maintained. Should the product have higher temperatures the value has to be adjusted to 20 to 30 ° C above the temperature of the conveying product.

Switch on control voltage. After self-check of the control device the actual pre-set temperature will show at the display.



Press and release button. Adjusting Mode is activated. The displays shows alternately "set" and the last set trip temperature.



Increasing the trip temperature - press button and release.
The adjusted temperature increases by + 1°C. Press button and hold approx. 3 seconds in + 10 ° C steps.



Decreasing of trip temperature - press button and release. The adjusted temperature decreases by - 1° C. Press button and hold approx. 3 sec. in - 10° C steps.



Press and release button. Return the unit to the operating mode. The adjusted trip temperature is transferred to a continuous memory and shown on the display.

Note:

During the adjusting mode, if a button is not pressed within 10 seconds the controller automatically returns to the operating mode and disregards any previous adjustment.

Following the above approximate instruction, the seepex pump can operate for a limited period of time (approx. 1 hour). Then a correction of the adjustment according to paragraph 5 - Fine Adjustment - has to be carried out.



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### 5.0 Commissioning and Operation

### 5.1 Fine Adjustment of the Trip Temperature

Following the instruction for approximate adjustment in paragraph 4.3 the seepex pump has to operate for at least 30 to 60 minutes to allow the operating temperature in the stator become stable.



While the pump is in operation the temperature of the pump is shown on the display of the TSE controller by continuously pressing the button.

The final trip temperature has now to be set 10 °C higher then the indicated operating temperature according to the instructions in paragraph 4.3.

### Attention

For all adjustments the max. product temperature occurring during operation has always to be considered. In case of a product temperature higher than 40 °C, it always has to be checked if this is mentioned in the data sheet of the pump and has therefore been considered in the rotor/stator design. If the temperature shown on the data sheet does not correspond to the actual temperature, please contact seepex.

### Resetting of the Control Device after Dry-Running

In the event of dry-running of the pump and temperature increase in the stator above the preset limit value, the installed relays trip and maintain locked in this position. After the pump has cooled down the remaining fault message (red LED) has to be acknowledged using one of the following procedures, so that the relay will be reset.



Press at the TSE control device for at least 1 sec.

#### 5.2.2

Switch-off operating voltage at TSE control device (terminals 1-3).

#### 5.2.3

With external contact (reset button, closed for at least 1 sec.)

### 5.3 Changeover of the Display from °C to °F.



Press and hold button for 10 secs. until display changes over

The selected temperature units are shown via an LED next to the Symbol °C or °F.

### 6.0 Replacement of Stator

### 6.1 Order of Replacement Stator

When ordering a replacement stator for a seepex pump, please quote:

### Stator drilled for TSE fitted with sensor sleeve in 1.4571.

If the pump is used to convey highly corrosive products where 1.4571 material is not resistant, a sensor sleeve made of 2.4610 (Hastelloy C4) has to be ordered.



### Attention

The sensor sleeve is fitted in our factory. It is preset for operation and may not be adjusted.

# 6.2 Dismantling/Re-Assembly of the Connection Head and Temperature Sensor.

The following drawings apply:

For TSE in elastic stators:
 Drawing No. 702-000/0000-0-009 \_\_\_
 for pump sizes 006-12 and 025-6L.

Drawing No. 702-000/0000-0-008 \_\_ for pump sizes 025-12 to 500-6LA.

- For TSE in fixed stators: Drawing No. 702-000/0000-0-005

### 6.2.1 Dismantling

Lift the cover of the connection head and disconnect wires of the temperature sensor. After having loosened the side screw slide the connection head off the threaded sleeve. Remove threaded sleeve from the stator and remove clamping ring, rubber ring and temperature sensor from sensor sleeve. The temperature sensor cannot be re-used and can thus be disposed off with the damaged stator.

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### 6.2.2 Re-Assembly

The items mentioned in paragraph 6.2.1 have to be re-installed into the new stator. It is vital to consider the temperature measuring point when installing the stator (refer to paragraph 4.1).

Do not further adjust or change the sensor sleeve setting as this has already been done in our factory.

Remove protective pipe (protective transport packaging).

Push the thermistor sensor with clamping screws and rubber ring to the bottom of the sensor sleeve and adjust.

Screw the threaded sleeve with 2 O-Rings in the tapped hole at the stator.

When installing the connection head, the connection wires of the thermistor sensor must be threaded through the hole in the junction box. After fastening the connection head on the threaded stator barred, recannect wires and put the cover back onto the connection head.

### 7.0 Malfunction

#### 7.1 General

Fault messages and switch-off of the pump without actual dry-running or overload might be caused by a defect in the temperature sensor wire, the TSE control device or other electrical switch devices.



The following reasons might have caused this error alarm at the TSE control device:

break of sensor or line short circuit of sensor or line measuring range (-25 ...150°C) is exceeded or remained under

The following procedure is recommended to check the TSE control device and the sensor circuit including temperature sensor:

### 7.2 Function Check of Sensor Circuit

Disconnect the temperature sensor wire at the TSE control device terminals 14 and 15 and connect a resistance measuring device (Multimeter or Ohmmeter). The measured electrical resistance must conform with the value in the table shown in paragraph 2.1 in accordance with the pump temperature. In case of deviations of the resistance value of more than 10% of the set value, measure the resistance at the connection head of the TSE at the pump. To do this the wire to the control device at the connection head of the pump needs to be removed. If the same deviations occur when measuring the resistance at the temperature sensor

directly at the pump, the temperature sensor is damaged and needs to be replaced (refer to paragraph 6.2 and 6.3).

Should the resistance check at the temperature sensor show correct values, then damage to the connection cable or the connection terminal is the cause of malfunction.

### 7.3 Function Check of TSE Control Device

If an trouble-free sensor circuit has been determined during the testing according to paragraph 7.2, damage to the TSE control device is most likely. In order to carry out the check, remove the sensor wires at terminals 14 and 15 and connect a commercial deposited carbon or metal film resistor as per the following list.:

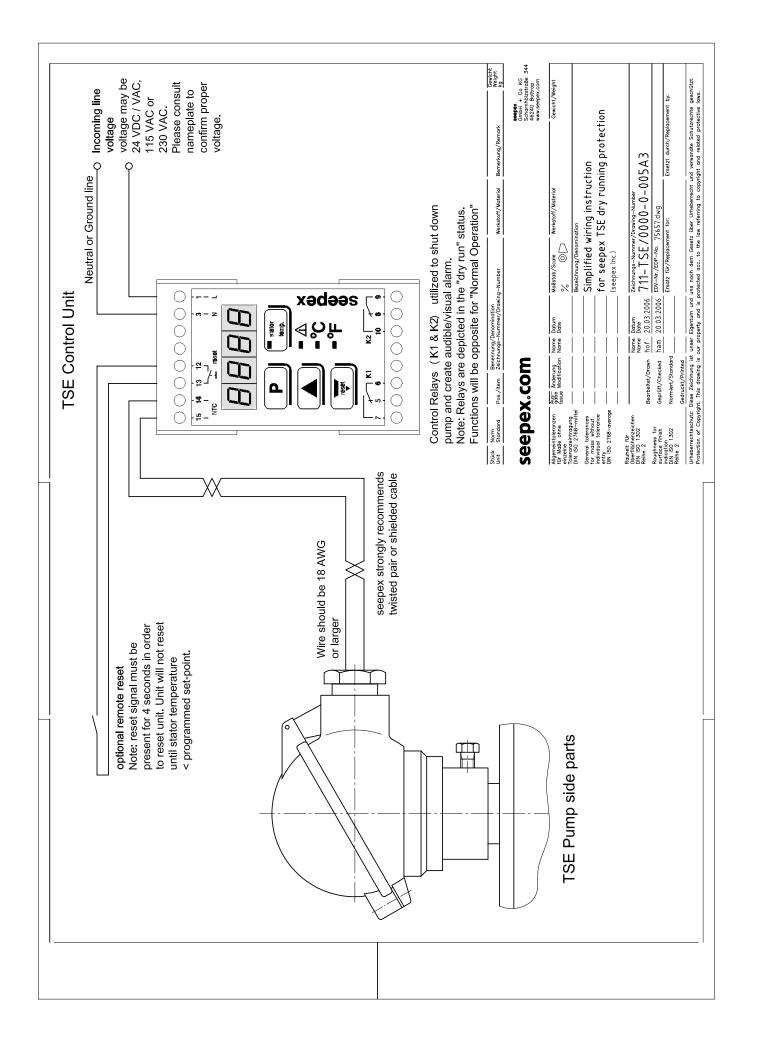
Resistance	Switching Temp.
(Ohm)	°Č
10.000	25
5.600	39
2.200	63
1.000	87
560	107
220	143

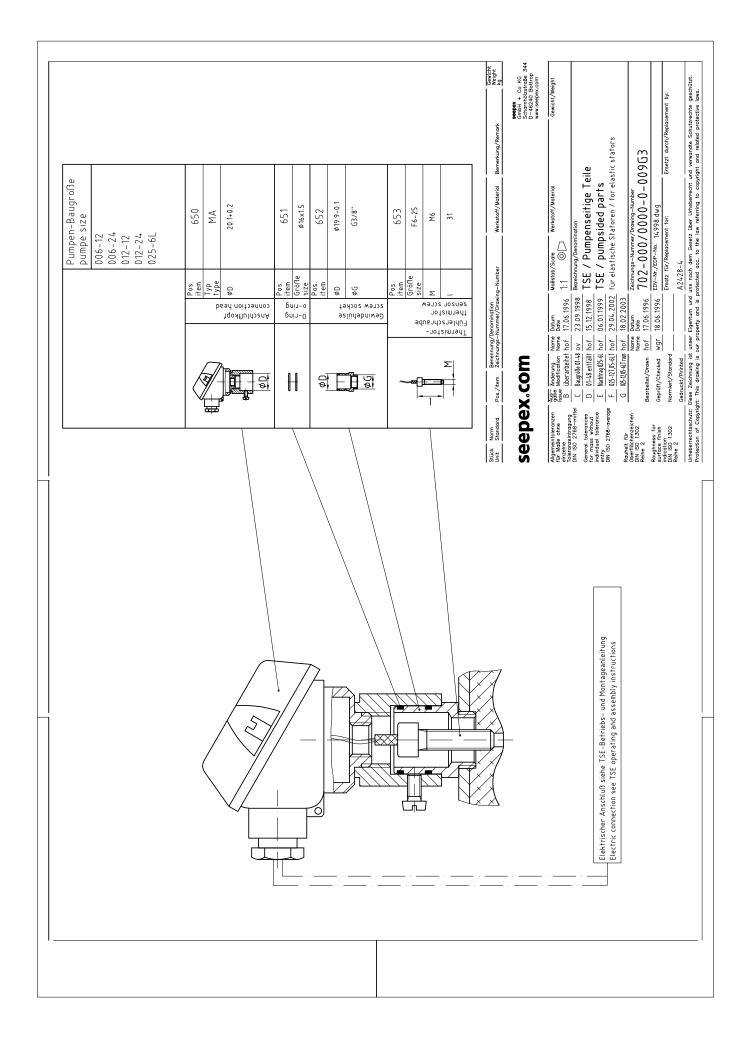
Switch-on control voltage at terminal 1+3 (Digital Display at the TSE device illuminates)

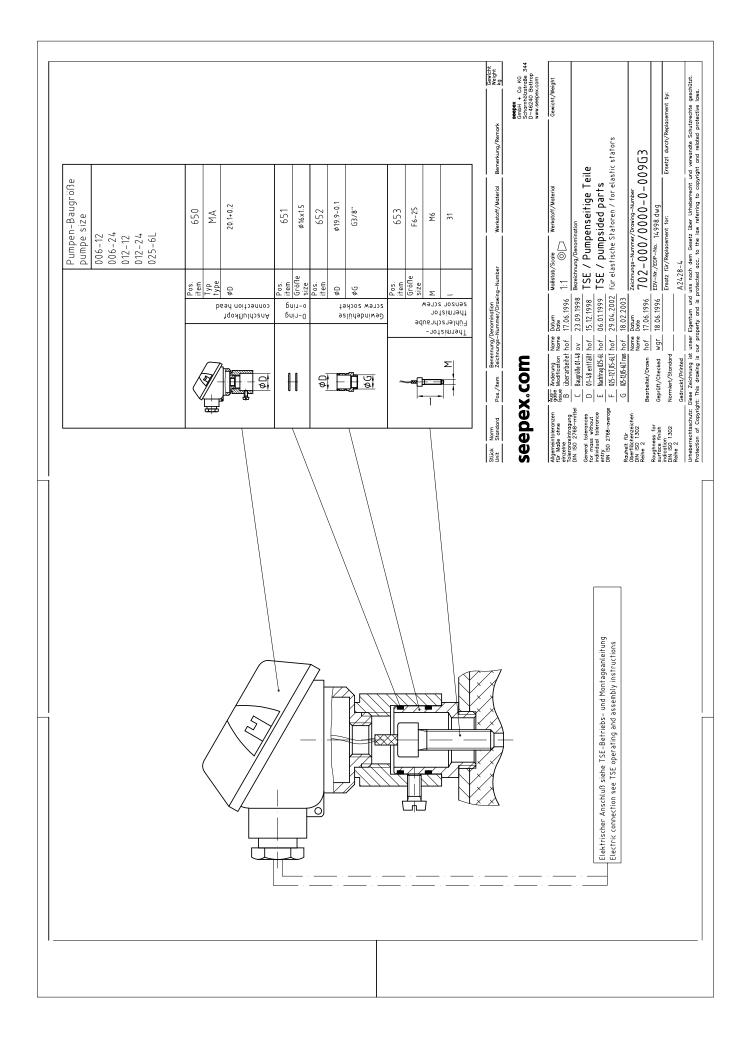


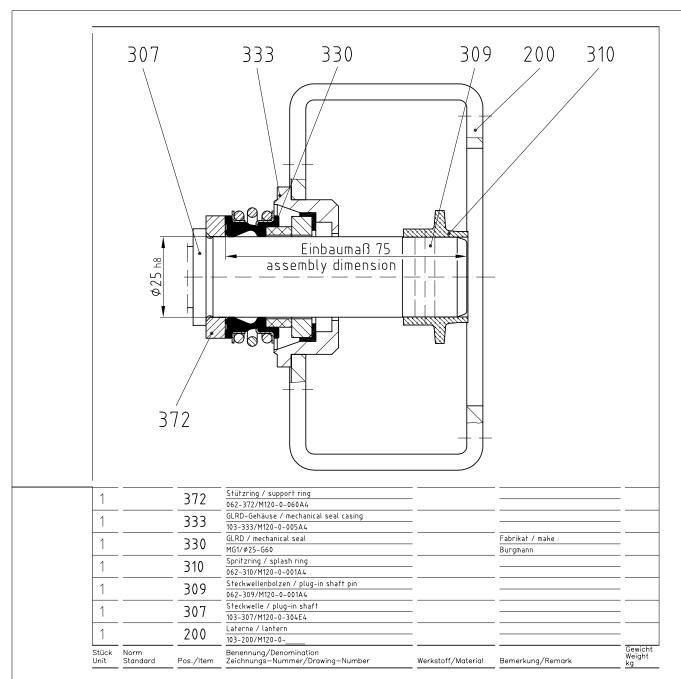
Press and hold button "stator temp." and read the temperature value.

The shown value must correspond to the switch temperature, which applies to the resistance used. Should the shown value deviate by more than 5-10 °C or should the value be absent at all, the TSE control device must be sent to seepex for repair.









### seepex.com

seepex GmbH + Co KG Scharnhölzstraße 344 46240 Bottrop www.seepex.com

Allgemeintoleranzen für Maße ohne einzelne Toleranzeintragung	Aus- gabe Änderung Issue Modification	Name Name	Datum Date	Maßstab/Scale 1:1 © 🗀	Werkstoff/Material		Gewicht/Weight		
DIN ISO 2768-mittel				Bezeichnung/Denomination					
General tolerances for mass without				GLRD Schnittzeichnung					
individual tolerance entry				_ mechanical seal sectional drawing					
DIN ISO 2768-average				Burgmann MG1/Ø25/G60 für Sondermaterial / for special materia					
Rauheit für				mit erhöhter Vo	-spannung/ with	increased pre-clar	nping		
Oberflächenzeichen DIN ISO 1302		Name Name	Datum Date	Zeichnungs-Nummer	*	201/			
Reihe 2	Bearbeitet/Drawn hgg		28.05.2004	are 8.05.2004 103-0GB/M120-0-129A4					
Roughness for surface finish	Geprüft/Checked	kno	28.04.2004	EDV-Nr./EDP-No. 6	2810.dwg				
indication DIN ISO 1302	Normiert/Standard			Ersatz für/Replacement for: Ersetzt durch/Replacement by:					
Reihe 2	Gedruckt/Printed								
			-			und verwandte Schutzre right and related prote			

#### 1. General

- Please take the appertaining drawing from respective pump data sheet.
- The mechanical seal is suitable for the operating conditions indicated in the pump data sheet.
   Modifications are only admissible after the customer has consulted with seepex. Additionally, attention must be paid to the manufacturer's operating manual.

### 2. Safety

Any mode of operation impairing the operating safety of the mechanical seal has to be avoided.

The operator is advised to consider the possible effects on the environment which could be caused by a defective mechanical seal and what additional measures must be taken to protect the environment and the public.

The pump must be mounted and operated in such a way that operation with a defective mechanical seal will not result in injury or harm to the public and that any leakage can be safely and properly dealt with.

Mechanical seals are often used to seal hazardous material (chemicals, drugs, etc.). It is essential that rules pertaining to the handling of hazardous materials are adhered to.

Modifications effected by the customer himself and changes influencing the safety of the mechanical seal are not allowed.

#### 3. Emissions

A mechanical seal is a dynamic seal and leakage is unavoidable.

### ATTENTION

Components that may contact leakage must be resistant to corrosion or be protected accordingly.

Mechanical seal leakage must be drained in a safe and proper manner.

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# 4.0 Flushing or circulation of single-acting mechanical seals

Single-acting mechanical seals contacting the conveying liquid require no additional flushing or a circulation pipe because sufficient flushing and heat exchange occurs around the seal due to the conveying liquid.

However, in particular cases, a direct flushing pipe can be installed into the flushing connection on the mechanical seal housing.

### 5.0 Commissioning

Regardless of the pump's operating status, the conveying medium to be sealed must always be in liquid form at the mechanical seal. This particularly applies to the pump's commissioning and its placing out of service.

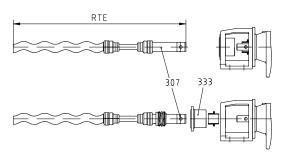
### 6.0 Maintenance

When operating the pump according to the instructions, no maintenance is required.

### 7.0 Disassembly / Reassembly

### 7.1 Disassembly

- Remove flushing connections at shaft seal housing (SEA).
- Lift / displace splash ring (310) and eject plug-in shaft pin (309) horizontally.
- Withdraw rotating unit (RTE) together with shaft seal parallel from output shaft of drive and avoid chocking.
- Clean plug-in shaft (307) and remove burrs etc., which may damage sealing elements. Moisten plugin shaft (307) with slip additive (diluted fluid soap).
- Loosen axial safety device of mechanical seal (330 or 372) and withdraw mechanical seal (330) from plug-in shaft (307).
- Remove mechanical seal housing (333) from lantern (200).
- Press counter-ring of mechanical seal with o-ring out of mechanical seal housing (333).



### 7.2 Reassembly

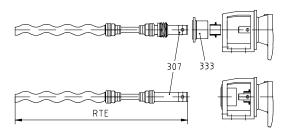
### ATTENTION

Mechanical seals are precision parts of high quality. Therefore, the installation must be effected with care. Gentle handling and extreme neatness are essential.

- Clean mechanical seal housing (333)
- Evenly press counter-ring with o-ring into mechanical seal housing (333). To facilitate assembly, the o-ring should be moistened with a lubricant (diluted fluid soap).

#### ATTENTION

- Oil or grease must not be used to facilitate assembly.
- Install mechanical seal housing (333) to lantern (200) and onsure correct position of flushing connections.
- Remove plug-in shaft (307), burrs and roughness and clean the unit.
- Check / adjust set dimension of mechanical seal on plug-in shaft (307). Moisten plug-in shaft (307) and elastomer parts of mechanical seal with lubricant (diluted fluid soap).
- Slip mechanical seal onto plug-in shaft (307) as far as set ring.
- Lubricate drive shaft (ANT) with antiseize graphite petroleum.
- Moisten splash ring (310) and plug-in shaft (307) with pin joint grease, (for type, please see index) and slip splash ring (310) onto output shaft of drive. Note installating position of splash ring and refer to description on splash ring.
- Move rotating unit (RTE) through mechanical seal housing (333) and splash ring (310) and slip splash ring (310) onto output shaft of drive (ANT). Push in plug-in shaft pin (309) in horizontal position.
- Position of splash ring:
   Collar of splash ring shall be fitted in a distance of about 0.5 mm to lantern (200).



### seepex.com

Range: MD, MDF

To avoid the expenses incurred by lengthy stop periods of the pump, seepex recommend the acquisition of a set of wearing parts and a set of gaskets. The table below shows the contents of these sets.

Part designation		small set of wearing parts big set of wearing parts a set of gaskets			Item number acc. to sectional drawing of pump and parts list
Rotor			1		600
Stator	2)	1	1		601
Universal joint sleeve			1		405
Coupling rod pin			2		402
Guide bush	2)		-		-
Coupling rod			1		400
Coupling rod bush	2)		-		-
Casing gasket				1	501
Holding band, small	2)		-		-
Holding band, large	2)		2		406
Packing ring set	2) 3)	1	1		301
Mechanical seal	3)			1	330
Sealing ring				4	571, 726
Splash ring				1	310
O-ring				1	572
Plug-in shaft	2)		1		307
Special joint grease					098 1 cart. 300 gr (c. 315cm³) grease quantity per pin joint, see tech.
Tool					Essential for assembly, see Point 9, document OM.SPT.01

- 2) see tools Point 9., document OM.SPT.01
- 3) Item 330 and item 301 (as an alternative) depend on the pump design. With regard to the pump design, refer to the appertaining data sheet and the sectional drawing. See Point 9.

### seepex.com

W1 ackung acking	Siehe W 13 see W 13	W5 Gelenk joint Durchschlag drift	W6 Lager bearing Bolzen pin	W9 allgemein general Montierhebel mounting lever	W11 Mutter für Teflonmanschette nut for teflon universal joint sleeve Bandschlüssel strap wrench	W13 Stator Stator 1) Bandschlüssel strap wrench
acking  ackungszieher  acking lever  KZ XX 000 000 0 X35M0	Ketten-Rohrzange + Ersatzkette chain pipe wrench +replacement chain	joint Durchschlag	bearing Bolzen	general  Montierhebel	manschette nut for teflon universal joint sleeve Bandschlüssel	Stator 1) Bandschlüssel
ackungszieher acking lever  KZ XX 000 000 0 X35M0	Ketten-Rohrzange + Ersatzkette chain pipe wrench +replacement chain	Durchschlag	Bolzen	Montierhebel	nut for teflon universal joint sleeve Bandschlüssel	1) Bandschlüssel
KZ XX 000 000 0 X35M0	+ Ersatzkette chain pipe wrench +replacement chain				Bandschlüssel	
KZ XX 000 000 0 X35M0	chain pipe wrench +replacement chain	drift	pin	mounting lever	strap wrench	strap wrench
KZ XX 000 000 0 X35M0 KZ XX 000						
KZ XX 000 000 0 X35M0 KZ XX 000					0	
000 0 X35M0 KZ XX 000						)
						WKZ BDS 027 0 430
		DHS XX 020 0000 0 A2620				
	KRZ XX Z55 0250 0 00000 KEZ XX Z55	DHS XX 050 0000 0 A2620	BLZ XX 020 0008 0 A2619			
KZ XX 000	0250 0 00000	DHS XX 050 0000 0 A2620	BLZ XX 020 0010 0 A2619			
000 0 XOHV0		DHS XX 100 0000 0 A2620	BLZ XX 020 0010 0 A2619			
	KRZ XX Z55 0300 6 00000 KEZ XX Z55 0300 6 00000	DHS XX 120 0000 0 A2620	BLZ XX 025 0012 0 A2619	2 Stück 2 pieces MHL XX SA 610	WKZ BDS 027 0 430	
PKZ XX 000 0000 0 XA01A	KRZ XX Z55 0300 8 00000 KEZ XX Z55					
	0300 8 00000	DHS XX 200 0200 0 A2620	BLZ XX 035 0012 0 A2619			
	KRZ XX Z55 0301 2 00000 KEZ XX Z55 0301 2 00000	DHS XX 240 0250 0 A2620	BLZ XX 040 0015 0 A2619			
		KRZ XX Z55 0300 8 00000 KEZ XX Z55 0300 8 00000 KEZ XX Z55 0300 8 00000 KRZ XX Z55 0301 2 00000 KEZ XX Z55	KRZ XX Z55 0300 8 00000 KEZ XX Z55 0300 8 00000 KEZ XX Z55 0300 8 00000 KRZ XX Z55 0301 2 00000 KEZ XX Z55 0301 2 00000 KEZ XX Z55	Z XX 000 0 0 XA01A	MHL XX SA 610  DHS XX 160 0200 0 A2620  O XA01A  KRZ XX Z55 0300 8 00000  KEZ XX Z55 0300 8 00000  MEZ XX Z55 0300 8 00000  DHS XX 200 012 0 A2619  KRZ XX Z55 0301 2 00000  KEZ XX Z55 0301 2 00000	MHL XX SA 610  DHS XX 160 0200 0 A2620 0012 0 A2619  EX XX 000 00 0 XA01A  CARREL XX Z55 0300 8 00000 KEZ XX Z55 0300 8 00000  DHS XX 200 0200 0 A2620 0012 0 A2619  DHS XX 200 0200 0 A2620 0012 0 A2619  KRZ XX Z55 0301 2 00000 KEZ XX Z55 0301 2 00000 KEZ XX Z55 0301 2 00000 KEZ XX Z55

<sup>1)</sup> Gilt nur für Pumpen in Edelstahl Ausführung / only valid for pumps in special steel design

Ausgabe issue	D / 26.04.2006	Dokument document	OM.SPT.01de	Blatt sheet	1 (4)

	Empfohlene seepex Werkzeuge Aufgrund der Ausführung für bestimmte Montagen empfohlen, durch allgemeine normierte Werkzeuge bedingt ersetzbar.								
	Recommended seepex tools  Due to the design recommended for certain repairs, these tools partially replace the standardized tools.								
Werkzeug Nr. tool	W4	W7	W8	W10	W12	W14	W15	W16	
No. zur Montage von:	Gelenk	Lager	Schmier-	Steckwelle	Teflon-	Kuppelstangen-	Manschette	Lippendichtung	
tool for mounting of:	joint	bearing	nippel lubrication nipple	plug-in shaft	manschette teflon universal joint sleeve	buchsen coupling rod bushing	universal joint sleeve	lip seal	
Benennung:	Montagedorn	Montage-	Einschlag-	Demontage-	Montage-	Presswerkzeug	Montageplatte	Montagehülse	
denomination:	assembly mandrel	hülse mounting sleeve	hülse drive-in sleeve	werkzeug dismantling tool	werkzeug mounting tool	pressing tool	mounting plate	Mounting sleeve	
Baugröße									
size			<b>5</b> 2						
0005-24, 0015-24 003-12/-24 006-12/-24 012-12/-24 025-6L 025-12T, 05-6LT	MTD L2 060 M120 0 XXXXX 2)						MTP A7 703 M500 0 002XX	MTH B7 703 M120 0 W0260	
025-12, 025-24 05-12, 1-6L	MTD L2 060 M500 0 XXXXX	MTH M8 060 M500 0 XXXXX		AZV B2 262 M500 0 XXXXX			MTP A7 703 M500 0 002XX		
05-24, 01-48, 025-48, 1-12, 2-6L 1-24, 1-12V 2-12, 5-6L	MTD L2 060 0020 0 XXXXX	MTH M8 060 0020 0 XXXXX		AZV B2 262 0020 0 XXXXX	MMT M8 060 0020 0 XXXXX	PWZ C6 060 0020 0 XXXXX			
2-24, 2-12V 5-12, 8-12T 10-6L, 15-6LT 05-48	MTD L2 060 0050 0 XXXXX	MTH M8 060 0050 0 XXXXX		AZV B2 262 0050 0 XXXXX	MMT M8 060 0050 0 XXXXX	PWZ C6 060 0050 0 XXXXX			
5-24, 5-12V									
10-12, 17-6L, 30-6LT, 15-12T, 10-24R, 1-48	MTD L2 060 0100 0 XXXXX	MTH M8 060 0100 0 XXXXX		AZV B2 262 0100 0 XXXXX	MMT M8 060 0100 0 XXXXX	PWZ C6 060 0100 0 XXXXX			
14-12, 26-6L, 40-6LT	MTD L2 060 0140 0 XXXXX	MTH M8 060 0140 0 XXXXX		AZV B2 262 0170 0 XF5XX		PWZ C6 060 1400 0 XXXXX			
10-24, 10-12V 17-12, 35-6L, 26-12, 52-6L, 55-6LT, 75-6LT 30-12T, 10-24, 17-24R 2-48	MTD L2 060 0170 0 XXXXX	MTH M8 060 0170 0 XXXXX	ESH N0 000 0000 0 A01A4	AZV B2 262 0170 0 XG0XX	MMT M8 060 0170 0 XXXXX	PWZ C6 060 0170 0 XXXXX			
17-24, 17-12V 35-12, 52-12, 70-6L, 100-6L, 110-6LT, 55-12T 34-24R, 5-48	MTD L2 060 0350 0 XXXXX	MTH M8 060 0350 0 XXXXX		AZV B2 262 0350 0 XH0XX		PWZ C6 060 0350 0 XXXXX			
35-24, 35-12V 70-12, 130-6L, 200-6L, 110-12T 70-24R, 10-48, 200-6L	MTD L2 060 0700 0 XXXXX	MTH M8 060 0700 0 XXXXX		AZV L7 703 0700 0 XK0XX		PWZ C6 060 0700 0 XXXXX			
130-12, 202-6L, 300-6L, 200-12T 70-18, 100-18, 130-18 70-24, 70-12V 130-24R 17-48	MTD L2 060 1300 0 XXXXX	MTH M8 060 1300 0 XXXXX				PWZ C6 060 1300 0 XXXXX			
240-12, 300-12T 130-18, 130-24 35-48/70-48						PWZ C6 060 2400 0 XXXXX			

 $<sup>2) \</sup>quad \text{entf\"{a}llt ab Pumpen-Herstellungs} \\ \text{datum 01.04.93 / can be omitted as from 01.04.93 (pump manufacturing date)} \\$ 

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	Empfohlene : Aufgrund der Aus durch allgemeine	sführuna für be	stimmte Montac	gen empfohl t ersetzbar.	en,				Spezial- werkzeuge
	Recommend Due to the design	ed seepex recommende	<b>tools</b> d for certain rep	airs, these t	ools partially	replace the	standardize	d tools.	Special tools
Werkzeug Nr. tool No.	W17	W18	W19	W20	W22	W23	W24	W25	W3
zur Montage von:	Lippendichtung	Gleitlager- buchse	Wellen- schonhülse	Cartridge- Einheit	Wellen- dichtring	Wellen- dichtring	Antriebs- gehäuse	Steckwellen- bolzen	Halteband
tool for mounting of:	lip seal	plain bearing bush	shaft securing sleeve	cartridge- unit	lip seal	lip seal	drive casing	plug-in shaft pin	holding band
Benennung:	Schlagzylinder Zentrierdorn Montagebolzen	Montagedorn	Montagehülse	Aufnahme	Montage- werkzeug	Montage- werkzeug	Aufhänge- vorrichtung	Montagedorn	Montage- werkzeug
denomination:	cylinder centering mandrel mounting pin	mounting mandrel	mounting sleeve	intake	mounting tool	mounting tool	suspension device	mounting mandrel	mounting tool
Baugröße size	0								
0005-24, 0015-24 0015-24 003-12/-24 006-12/-24 012-12/-24 025-6L, 025-12, 025-24 05-12, 1-6L 05-24, 01-48, 025-48, 1-12, 2-6L 1-24, 1-12V 2-12, 5-6L 2-24, 2-12V 5-12, 8-12T 10-6L, 15-6LT 05-48 5-24, 5-12V 10-12, 17-6L, 30-6LT, 15-12T, 10-24R, 1-48 14-12, 26-6L, 40-6LT 10-24, 10-12V 17-12, 35-6L,	ZSH B7 703 M120 0 W0171 ZDR B7 703 M120 0 W0172 MBL A7 703 M120 0 W0173			SPT MR 7/13	SPT B4 703			MTD L8 703 0050 0 SXX0J MTD L8 703 0170 0 SXX0J	MHB WH A00 1WHV 0 01000
26-12, 52-6L, 55-6LT, 75-6LT 30-12T, 10-24, 17-24R, 2-48			0170 0 01000	0170 0 00900	0170 0 01100				
17-24, 17-12V 35-12, 52-12, 70-6L, 100-6L, 110-6LT, 55-12T 34-24R, 5-48 35-24, 35-12V								MTD L8 703 0350 0 SXX0J	
70-12, 130-6L, 200-6L, 110-12T 70-24R, 10-48, 200-6L 130-12, 202-6L,		SPT M8 703 1300 0 01000	SPT M8 703 1300 0 01100	SPT M8 703 1300 0 00900	SPT B4 703 1300 0 0A200	SPT B4 703 1300 0 0A300		MTD L8 703 0700 0 SXX0J	
300-6L, 200-12T 70-18, 100-18, 130-18 70-24, 70-12V 130-24R 17-48								MTD L8 703 1300 0 SXX0J	
240-12, 300-12T 130-18, 130-24 35-48/70-48							SPT M8 703 2400 0 01400		

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# 10.0 Manufacturer's documents from sub-supplier



# **OPERATING MANUAL**

This document was drawn up observing the EC directives "Machinery" 98/37/EC, EN ISO 12100-2 and the German Standard VDI 4500



In case of this mechanical seal is operated in **explosion area an appropriate additional operating manual**, following EC directives 94/9/EC (ATEX 95), has to be observed **by all means**! If required this could be ordered at BURGMANN.

# **BURGMANN MECHANICAL SEAL (M.S.)**

# Type MG1/dw-00 and versions

applies to all mechanical seals of the same series dw = specified shaft diameter

These instructions are intended for the assembly, operating and control personnel and should be kept at hand on site.

PLEASE READ this manual carefully and OBSERVE the information contained as to:

■ Safety

■ Transport / Storage

■ Information about the product

Installation

Operation

■ Servicing

If there are any unclear points please contact BURGMANN by all means!

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# **Keywords and Symbols**

Following symbols for particularly important information are used:



"Attention, please pay special attention to these sections of text"

DANGER!

Draws attention to a direct hazard that will lead to injury or death of persons

WARNING!

Draws attention to the risk that a hazard could lead to serious injury or death of persons

CAUTION!

Draws attention to a hazard or unsafe method of working that could lead to personal injury or damage to equipment

**ATTENTION!** 

Identifies a potentially dangerous situation. If it is not avoided the product or something in its vicinity could be damaged

IMPORTANT!

Identifies tips for use and other particularly useful information.

# **GENERAL SAFETY NOTES**



Any person being involved in assembly, disassembly, start up, operation and maintenance of the BURGMANN Mechanical Seal must have read and understood this Instruction Manual and in particular the safety notes. We recommend the user to have this confirmed.

**BURGMANN Mechanical Seals** are manufactured on a **high quality level** (quality management EN ISO 9001: 2000) and they keep a **high working reliability**. Yet, if they are **not operated** within their **intended purpose** or handled **inexpertly** by untrained personnel they may cause **risks**.

The machine has to be set up in such a way that seal leakage can be led off and disposed properly and that any personal injury caused by spurting product in the event of a seal failure is avoided.

Any operation mode that affects the **operational safety** of the mechanical seal is not permitted.

Unauthorised modifications or alterations are **not permitted** as they affect the **operational safety** of the mechanical seal.

BURGMANN mechanical seals must be installed, operated, maintained, removed or repaired by **authorised**, **trained and instructed personnel only.** 

The **responsibilities** for the respective jobs to be done **have to be determined clearly and observed** in order to prevent unclear competencies from the point of **security**.

Any work to be done on the mechanical seal is **generally** only **permitted** when the seal is **neither operating nor pressurised**.

**WARNING!** Seals that have been used with **hazardous substances must be properly cleaned** so that there is no possible **danger** to people or to the environment.

Apart from the notes given in this manual the general **regulations for worker's protection and those for prevention of accidents** have to be observed.

# Instructions for worker's protection



WARNING! If the medium to be sealed and/or the supply liquid is subject to the Hazardous Substances Regulation (GefStoffV), the instructions for handling dangerous substances (safety data sheets to EU Directive 91/155/EEC) and the accident prevention regulations have be observed.

**Medium to be sealed** and/or **supply medium may escape** if the seal **fails**. Injury of persons and environment may be **prevented by the user** providing for splash protection and wearing safety goggles. Care has to be taken by the user for **proper disposal** of the leakage. The user has to control these measures.

The **user** has to **check** what **effects a failure** of the mechanical seal might have and what safety measures have to be taken to prevent **personal** injury or damage to the environment.

# TRANSPORT / STORAGE

# **Transport**

If not specified differently by contract the BURGMANN standard packing is used which is suitable for dry transport by truck, train or plane. The warning signs and notes on the packing must be observed.

In addition seaworthy packing may become necessary.

Notes for income inspection:

- Check packaging for visible damages.
- Open packaging carefully. Do not damage or lose parts supplied separately.
- Check if consignment is complete (delivery note). Inform the supplier immediately in writing if parts are damaged or missing.

The mechanical seal has to be protected from damage during transport and storage. The transport case in which the seal is supplied is well suited for this purpose and should be kept for a possible return transport.

**ATTENTION!** If the machine as well as the mechanical seal installed into the machine are transported together the shaft has to be protected from deflection and shocks.

# Packing and storage

The following recommendations apply to all BURGMANN mechanical seals which have been supplied and stored in their **undamaged original packaging**, as well as to seals which have been installed in a machine (e.g. pump, compressor, agitator, etc.) but have not yet been put into operation.

BURGMANN mechanical seals and spare parts are super finished and repeatedly tested machine elements. For the storage special conditions have to be followed.

Sliding materials and elastomers are subject to material-specific and time-based alterations (distortion, ageing) which might reduce the full efficiency of the mechanical seals. Yet, this may be avoided by observing the storage instructions.

For the stock keeping of elastomers special conditions are required. For all rubberelastic parts the rules of DIN 7716 resp. of ISO 2230-1973 (E) are valid.

#### Conveniences for storing of mechanical seals

- · dust free
- moderately ventilated
- constantly tempered
  - relative air humidity below 65 %.
  - temperature between 15 °C and 25 °C.

#### Protect the seal from

- direct exposure to heat (sun, heating)
- ultraviolet light (halogen or fluorescent lamps, sunlight, arc welding)
- presence or development of ozone (arc welding, mercury vapour lamps, highvoltage devices, electric motors)
- > risk of embrittlement of elastomeric materials

It has to be differentiated between:

- M.S. stored in the stock room
- M.S. installed in the machine, but not yet in operation.
- ☐ M.S. in the stock

**IMPORTANT!** Store the seal in the original packing lying on a flat surface.

- Check the packaging periodically for damages.
- Plastic sheet packagings with humidity indicators have to be checked every 8 weeks. The check has to be recorded.
- Packings exceeding 50 % rel. humidity values have to be sent to the manufacturer or the nearest BURGMANN service centre for inspection and new packaging.

#### **Duly stored mechanical seal:**

- · Latest 3 years after delivery of the mechanical seal
- For reasons of safety shipment of the M.S. to BURGMANN resp. nearest BURGMANN service centre for
- > Exchange of all secondary seals and springs
- Verification of the flatness of the faces
- Perhaps static pressure test.

#### ☐ M.S. installed into the machine:

**ATTENTION!** A preservation of the BURGMANN mechanical seals is not allowed.

Check in case of a preservation of complete machines with mechanical seals installed BURGMANN has to be contacted.

- Do not use corrosion protection agents.
- Risk of deposition and possibly chemical attack of the secondary seals.

Due to longer erecting times of new designed plants the period between delivery of the mechanical seal and on the other hand its installation and start up may exceed the period of 2-3 years.

Latest after 3 years and in time before the planned start-up of the plant the seal has to be dismantled and to be sent to the manufacturer or the nearest BURGMANN service centre where it can be checked and reconditioned, if necessary.

Damages caused by **improper** storage may **not** be claimed with reference to the **warranty** on the BURGMANN company.

# INFORMATION ABOUT THE PRODUCT

All technical information given is based on the results of extensive testing and on BURGMANN's long term practical experience. However, in view of the great diversity of possible applications the technical data can only be taken as being of approximate nature. We can only guarantee the safe and efficient functioning in individual cases if we have been comprehensively informed of the operating conditions to which they will be subject, and if this has been confirmed in a separate agreement.

# Manufacturer and country of origin

Burgmann Industries GmbH & Co. KG Äußere Sauerlacher Str. 6-10 D - 82515 Wolfratshausen Germany

# **Declaration by the manufacturer**

within the meaning of the EC-directive "MACHINERY" 98/37/EG

A mechanical seal does **not function independently**. It is intended to be incorporated into or assembled with machinery.

# Type designation

BURGMANN Mechanical Seal MG1/dw-00

# **Designated use**

This mechanical seal is **exclusively** designed for the use in the specified application. A **different utilisation** or a utilisation going beyond the specification is considered **contrary to its designated use** and excludes a liability by the manufacturer.

Operation under conditions lying **outside** those limits stated in paragraph "**Operating limits**" is considered **contrary to its designated use**.

Should the seal be operated under different conditions or at a different application BURGMANN has to be asked for recognition as safe in advance. > Changes to operating conditions have to be documented.

# **Operating limits**

**ATTENTION!** Operating limits depend on the materials, the media to be sealed and the diameter of the sealing. (If there are any unclear points please contact BURGMANN.)

Shaft diameter (dw): 10 - 100 mm

Pressure to be sealed (p1) : 12 bar g
Temperature to be sealed (t1) : -20 ... 120° C
Max. sliding speed (vg) : 10 m/s

Operation under several limit values **simultaneously** should be **avoided** as higher loads (pressure, temperature, speed) can increase wear or lead to **damage** of sliding faces or elastomers. This could result in a shorter service life and in the **risk** of a sudden seal failure **endangering** men and environment.

The **selection** of the mechanical seal (type, suitability, materials) should be done **by BURGMANN staff** or other **authorised** persons. A wrong selection by unauthorised persons is **not covered by** BURGMANN's **warranty**.

Further information about the operating conditions can be found in the BURGMANN assembly drawing MG1/dw-00 or in the specification sheets of the machine manufacturer.

#### **Materials**

The materials of the mechanical seal depend on the application and are fixed in the order.

# Drawings, diagrams

Assembly drawing MG1/dw-00

The original assembly drawing in its latest edition (latest revision) only is decisive for both the design of M.S. as well as the utilisation of this manual.

In the following description all figures in parentheses, e.g. (2) define the respective part item no. in fig. 1. The part item no. may vary from those stated in the assembly drawing.

# **Versions**

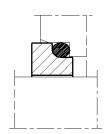
- MG12/...
- MG13/...
- MG1S20/...
- RMG12/...
- MG1 MULTIPLE M.S.

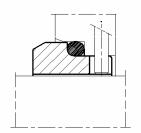
The mechanical seal type MG1 can also be used as **multiple mechanical seal** (also in combination with seal types of other series) in **tandem arrangement** with quench (API, plan 52) or as **dual mechanical seal** with barrier fluid (API, plan 53). Consultation with the BURGMANN company is recommended.

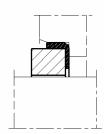
**ATTENTION!** PTFE o-rings or double-PTFE-wrapped o-rings **may** not be used at seat versions **without torsion lock**.

This operating manual applies also to the mentioned seal versions with slight modifications and/or to combinations with seats not stated in this manual.

# **Seat Versions**

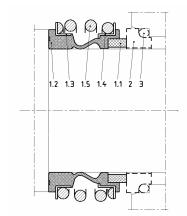






# **Description and function**

- single seal
- unbalanced
- bi-directional
- stationary seat (2)
- **o-ring** (3)
- rotating seal face (1.1)
- elastomeric bellow (1.2)
- cylindrical single spring (1.5)
- no glued joints
- materials of the sliding parts replaceable
- for media containing solids (e.g. sewage applications)
- rotating, torsion-free elastomeric bellows serving as
  - face housing
  - secondary sealing element
  - drive collar
- torque transmission from the seal face by means of "L"-rings and a rotating, cylindrical single spring
- axial movability



# Required space, connecting dimensions

The required mounting space for the mechanical seal is decisive for the design of the housing parts by the machine manufacturer. The connecting dimensions have to be checked by the machine manufacturer by means of the BURGMANN drawing before mounting the mechanical seal.

# Supply of M.S.

The mechanical seal has to be constantly wetted by liquid medium. The medium to be sealed must not damage the M.S. neither chemically (e.g. corrosion, embrittlement) nor physically (e.g. erosion, abrasion).

For a safe operation of the mechanical seal we recommend to apply at inboard the most suitable type of circulation described in API 610 / 682. This measure protects the seal cavity from deposition of solids.

To operate multiple seals special supply systems are required. Please contact BURGMANN.

#### **Emissions**

A mechanical seal is a **dynamic seal** that **cannot be free of leakage** due to physical and technical reasons. Seal design, manufacture tolerances, operating conditions, running quality of the machine, etc. mainly define the leakage value. In fact, compared to other sealing systems there is **few leakage**.

WARNING! If the medium to be sealed and/or the supply liquid is subject to the Hazardous Substances Regulation (GefStoffV), the instructions for handling dangerous substances (safety data sheets to EU Directive 91/155/EEC) and the accident prevention regulations have be observed.

A possibly increased leakage during start-up will decrease to a normal quantity after the running-in period of the sliding faces.

If this is not the case or if there are other malfunctions the mechanical seal has to be shut down, removed and checked for reasons of safety.

The leakage can be liquid or gaseous. Its aggressiveness corresponds to that of the medium to be sealed.

Leakage of mechanical seal at outboard side has to be drained and disposed properly.

**IMPORTANT!** Components which may get in contact with the leakage have to be corrosion-resistant or have to be adequately protected.

# INSTALLATION

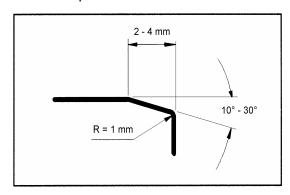
# **Assembly utilities**

- ethyl alcohol
- cellulose-tissue (no rag, no cloth!)
- o-ring lifter
- water and washing up liquid
- cardboard discs

# **Preparation for assembly**

**ATTENTION!** The seal should remain **packed** until the following working steps have been completely **terminated**.

Check the parts of the machine for:



- chamfered edges
  - (sliding cones i.e. 2 mm / 30° or in accordance with EN 12756)
- radiused transitions
- mating fits and o-ring surfaces: fine finished Rz 10 μm (= N7 = CLA 63)
- Shaft surface in the area of the mechanical seal finished according to EN 12756:
   Ra = 0.8 μm (= N6 = CLA 32).
- Shoulder or stop device for the bellows of the mech. seal to take up axial forces

#### Check at the machine:

- damage of connecting surfaces to the M.S.
- mating dimensions, rectangularity and concentricity to the shaft axis.

#### **Run-out accuracy** of the shaft (acc. to DIN ISO 5199):

- Shaft diameters up to 50 mm: max. 0.05 mm
   Shaft diameters 50 mm 100 mm: max. 0.08 mm
- Prepare the place of assembly, take away any not required tool, cuttings, dirty cleaning wool etc.
- Cover the work bench with a piece of clean, non-fibrous cardboard.

# Assembly / installation

BURGMANN mechanical seals are super-finished and repeatedly tested machine elements whose handling during assembly in particular of sliding materials and elastomers requires special care during several procedures.

For installation the assembly drawing of mechanical seal has to be observed.

**IMPORTANT!** The mechanical seal has to be installed under the cleanest conditions and very carefully.

- Unpack the seal and check seal face, seat and elastomer bellows for possible damages.
- Never place the seal faces or seats on their sliding faces without having covered them adequately.
- Check before starting assembly:
  - complete availability of all components by means of the drawing
  - all components have to be clean and in perfect condition.
- Sprinkle the elastomer bellows and the shaft with low-surface-tension water (add washing up liquid) or ethyl alcohol to decrease frictional force during assembly of the seal.



Oil or grease as assembly agent is not permitted in any case.

**ATTENTION!** Do never force during installation.

**ATTENTION!** Avoid unnecessary rotation of the shaft (damage of the sliding faces is possible).

**ATTENTION!** Avoid knocking the seal! Damage to mechanical seals has an adverse effect on their safe operation.

#### Possible installation order:

• Feed the **degreased** sealing element (o-ring, rubber cup) onto the seat.

#### If present:

- At the seat mark the position of the rear slot beside the sliding face.
- Align the seat with the torque transmission pin.
- Cover the sliding face of the seat with a cardboard washer
- Press the seat slowly and without interruption into its position.
  - Use plenty of water or alcohol as lubricant.
  - Use a distance sleeve, if necessary.
- Remove the cardboard washer from the sliding face.
- Check the rectangular position of the seat to the shaft axis.

- Mount the seal cover with the seat installed before.
- Clean the sliding faces thoroughly with ethyl alcohol and paper tissues (no fabric, no cloths!).
- In case of material **"BUKO"** (carbon graphite) wipe it until the paper tissues stay clean.
- > Do not touch the sliding faces any more with bare fingers.
- Mount the sliding faces absolutely dry, dust-free and clean. Do not use any lubricants!



- Push rotating seal unit (bellows unit) with a slow clockwise turn onto the shaft.
- Stick to the dimensions in the assembly drawing!
- If necessary use a mounting sleeve.
- > For long pushing distances add liquid several times.
- Check "L" rings, spring and seal face for correct fit.
- Mount stop device for bellows unit to take up axial forces.
- > Stick to the dimensions in the assembly drawing by all means!
- Further assembly of the machine in accordance with the instructions of the machine manufacturer.

# **OPERATION**

# Instructions for safe operation

For a single mechanical seal the **pressure in the seal chamber** (stuffing box pressure) has to be **higher** than the ambient pressure at the machine at any time. Otherwise the machine will **suck in air** via the sliding faces, which will result in **dryrunning** and consequent **failure** of the mechanical seal.

Damages due to dry-running are excluded from the warranty.

**During every state of operation** the mechanical seal has to be constantly wetted by the **medium** to be sealed **in its liquid form**, in particular when the machine is **started** or **stopped**. The machine design has to be such as to take this necessity into consideration.

If the medium to be pumped builds deposits or tends to solidify during cooling down or standstill of the machine the stuffing box has to be flushed with suitable clean liquid. The flow and the liquid should be determined by the user.

If the operation limit values and the instructions given in this manual are followed a trouble-free operation of the mechanical seal can be expected.

# Instructions for start up

#### Safety checks before start up

- Torque transmission between mechanical seal and shaft duly installed
- Supply connections tightened pressure-sealed
- Disposal connections installed environmentally safe

For a safe operation of the mechanical seal we recommend to apply at inboard the most suitable type of circulation described in API 610 / 682. This measure protects the seal cavity from deposition of solids.

- Flood machine and seal cavity (stuffing box) with medium and vent thoroughly.
- Now the seal is ready for operation.

# **SERVICING**

#### Maintenance

A correctly operated mechanical seal needs **low maintenance**. Wear parts, however, have to be replaced, if necessary.

A duly operation includes a regular check of the following parameters:

- Temperature
- Leakage (drainage) rate of the mechanical seal

An inspection of the mechanical seal should be carried out during a revision of the complete plant. We recommend to have this inspection be performed by responsible BURGMANN personnel.

If the mechanical seal is removed during a revision of the plant it has to be replaced by a new one.

#### Directives in case of failure

Try to define the kind of failure and record it.

- In the event of excessive leakage, note changes in the leakage amount and switch the pump off if necessary.
- > If a constant amount is leaking in a steady flow, the mechanical seal is damaged.
- In the event of a inadmissible temperature rise, the machine has to be stopped for safety reasons.

If there is a **malfunction** which you cannot correct on your own, or if the cause of malfunction is not clearly recognisable please immediately contact the nearest **BURGMANN** agency, a BURGMANN service centre or the BURGMANN headquarters.

During the **warranty period** the BURGMANN mechanical seal must only be disassembled with approval of the manufacturer or when a representative is present.

# After-sales service by BURGMANN

BURGMANN's customer service department offers a comprehensive service package covering consultancy, engineering, standardisation, installation, commissioning as well as damage analysis right through to seminars on sealing technology.

Addresses are listed in the known BURGMANN Design Manuals as well as in various other BURGMANN brochures.

# Address of headquarters:

Burgmann Industries GmbH & Co. KG

Postfach 1240

D - 82515 Wolfratshausen

Germany

**+49 (0) 81 71-23 0** 

Fax +49 (0) 81 71-23 12 14

www.burgmann.com

# Reconditioning (repair)

If **reconditioning** is necessary, the complete **seal** should be sent **to the manufacturer**, as this is the best way to find out which components can be reconditioned or which parts must be replaced in order to ensure an optimum tightness.

If, for compelling reasons, a reconditioning has to be carried out on site (e.g. no. spare seal on stock, long transport, problems with customs) the seal may be repaired in a clean room by trained personnel of the user under the direction of **BURGMANN** mechanics.

# Disassembly / removal



- Stop the machine as instructed, allow to cool, depressurise and ensure that pressure cannot build up again.
- Work on the M.S. is only permitted when the machine is at a standstill and depressurised.
- There must be no product on the M.S. ⇒ if necessary drain the machine and rinse it out.
- Isolate the machine to prevent it starting up unexpectedly.
- Comply with the safety notes (safety data sheets).

**IMPORTANT!** When removing, please observe by all means:

- current accident prevention regulations
- regulations for handling hazardous substances

WARNING! Seals that have been used with hazardous substances must be properly cleaned so that there is no possible danger to people or to the environment.

**IMPORTANT!** The packaging used to transport the seal must

- be identified with the relevant hazard symbol and
- include the safety data sheet for the product and/or supply medium

The order of disassembly to remove the mechanical seal out of the machine depends on the design of the machine and should be determined by the machine manufacturer.

• Remove the seal in the reverse sequence as described for assembly (set up).

# Spare parts

- Only BURGMANN original spare parts must be used. Otherwise
- > Risks of a seal failure, endangering persons and environment.
- > The BURGMANN guarantee for the mechanical seal lapses.
- For a quick exchange a complete **spare seal** should be on stock.

# Required details for enquiries and orders

For enquiries and orders the following details are required:

- BURGMANN commission no.
- Drawing no. of M.S. MG1/dw-00 dw = specified shaft diameter
- Part item no., designation, material, number of pieces with reference to the drawing.

Address of headquarters product field FA

Standard Mechanical Seals

Burgmann Industries GmbH & Co. KG

Postfach 1240

D - 82502 Wolfratshausen

Germany

+49 (0) 81 71 - 23 0 Fax +49 (0) 81 71 - 23 14 44

# Disposal of the BURGMANN mechanical seal

Usually, the BURGMANN mechanical seals can be easily disposed after a thorough cleaning.

- Metal parts (steels, stainless steels, non-ferrous heavy metals) divided into the different groups belong to scrap metal waste.
- Ceramic materials (synthetic carbons, ceramics, carbides) belong to waste products. They can be separated from their housing materials, as are physiologically recognised as safe.
- Synthetic materials/plastics (elastomers, PTFE) belong to special waste.

**CAUTION!** Material containing fluorine must not be burnt.

**IMPORTANT!** Some of the synthetic materials, divided into the different groups can be recycled.

# Copyright

The **Burgmann Industries GmbH & Co. KG** (Germany) holds the copyright to this document. Customers and operators of mechanical seals are free to use this document in the preparation of their own documentation. No claims of any type or form can be derived in such instance.

We reserve the right to carry out technical modifications of the product, even if they have not yet been considered in this manual.

June 13, 2006 Department Technical Documentation



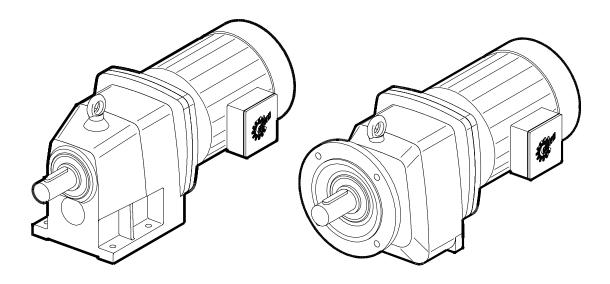
# UNICASE® Helical Inline Gearboxes Installation and Maintenance Instructions

#### **BIM 1010**





# **Retain These Safety Instructions For Future Use**



#### **INSPECTION OF UNIT**

Thoroughly inspect the equipment for any shipping and handling damage before accepting shipment from the freight company. If any of the goods called for in the bill of lading or express receipt are damaged or the quantity is short, do not accept until the freight or express agent makes an appropriate notation on your freight bill or express receipt. If any concealed loss or damage is discovered later, notify your freight carrier or express agent at once and request him to make an inspection. We will be very happy to assist you in collecting claims for loss or damage during shipment; however, this willingness on our part does not remove the transportation company's responsibility in reimbursing you for collection of claims or replacement of material. Claims for loss or damage in shipment must not be deducted from the NORD Gear invoice, nor should payment of the NORD Gear invoice be withheld awaiting adjustment of such claims, as the carrier guarantees safe delivery.

If considerable damage has been incurred and the situation is urgent, contact the nearest NORD Gear Sales Office for assistance. Please keep a written record of all communications.

RECORD NAMEPLATE DATA							
	Locate the gear reducer nameplate a	nd record all nameplate data	for future reference.				
SK		S/N					
RATIO	MAX TORQUE	RPM	MTG. POS				

#### **STORAGE**

#### PROPER STORAGE UNTIL INSTALLED

Keep unit in a dry, temperature controlled area. If stored other than said, long term storage methods must be applied to the unit including complete fill with lubricant. Protect machined surfaces and rotate shafts periodically. Prior to putting unit into service, drain lubricant and refill to proper level as determined by the mounting position.

# PROPER HANDLING OF THE UNIT

Exercise care to prevent damage to the unit when moving. Lift only at designed lifting points. Do not attach other machinery and lift by the unit lifting points. The lifting points are to be used to lift the unit only. Insure that adequate safety measures are taken to protect personnel during transportation. Protect the mounting surface from damage.

#### **INSTALLATION OF UNIT**

To ensure long service and dependable performance, an enclosed gear drive must be rigidly supported and the shafts accurately aligned. The following describes the minimum precautions required to accomplish this end.

#### **FOUNDATION**

The responsibility for the design and construction of the foundation lies with the user. The foundation must be adequate to withstand normal operating loads and possible overloads while maintaining alignment to attached system components under such loads

#### MOUNTING POSITION

Unless a unit is specifically ordered for inclined mounting, the foundation must be level and flat. The lubrication system may not operate properly if the unit is not mounted in the position for which it is designed. It may be desirable to elevate the foundation to facilitate oil drainage.

#### **CONCRETE FOUNDATION**

If a concrete foundation is used, steel mounting pads and bolts of sufficient size to distribute the stress into the concrete should be grouted into the foundation.

#### STEEL FOUNDATION

If a structural steel foundation is used (i.e. wide flange beams or channels), a base plate or sole plate of suitable thickness should be used and should extend under the entire unit.

#### **FOOT MOUNTED UNITS**

Use shims under the feet of the unit to align the output shaft to the driven equipment. Make sure that all feet are supported so that the housing will not distort when it is bolted down. Improper shimming will reduce the life of the unit and may cause failure. Dowel pins may be installed to prevent misalignment and ensure proper realignment if removed for service.

#### **FLANGE MOUNTED UNITS**

If a structural steel foundation is used (i.e. wide flange beams or channels), a base plate or sole plate of suitable thickness should be used and should extend under the entire unit. If a bulk head plate is used it should be of proper strength to minimize buckling distortions.

# Flange Pilot 'AK' or 'AK1' tolerance

Metric (mm)

```
> Ø 50 ≤ Ø 80 = +0.012/-0.007
           > Ø 80 ≤ Ø 120 = +0.013/-0.009
           > Ø 120 ≤ Ø 180 = +0.014/-0.011
           > Ø 180 ≤ Ø 230 = +0.016/-0.013
           > Ø 230 ≤ Ø 315 = +0.000-0.032
           > Ø 315 ≤ Ø 400 = +0.000/-0.036
           > Ø 400 ≤ Ø 500 = +0.000/-0.040
Inch
           > \varnothing 1.969 \le \varnothing 3.150 = +0.005/-0.0003
           > Ø 3.150 ≤ Ø 4.724 = +0.005/-0.0004
           > \emptyset 4.724 \leq \emptyset 7.087 = +0.006/-0.0004
           > \emptyset 7.087 \leq \emptyset 9.055 = +0.006/-0.0005
           > \varnothing 9.055 \le \varnothing 12.402 = +0.000/-0.0013
           > Ø 12.402 ≤ Ø 15.748 = +0.000/-0.0014
           > Ø 15.748 ≤ Ø 19.685 = +0.000/-0.0016
```

#### **BOLT STRENGTH**

Bolt size, strength and quantity should be verified to insure proper torque reaction capacity whatever the mounting arrangement.

#### PRIME MOVER MOUNTING

Align the prime mover to the reducer-input shaft using shims under the feet. Make sure that the feet are supported. Dowel the prime mover to its foundation.

#### **SHAFT CONNECTIONS**

When connecting shafts to either the input or output of the reducer, consider the following instructions.

#### **FITS**

Clearance or interference fits for coupling hubs should be in accordance with ANSI/AGMA 9002-A86 or as follows.

#### Output and Input shaft Diameter tolerance Metric (mm)

```
\leq \emptyset 18 = +0.012/+0.001
          > \emptyset 18 \leq \emptyset 30 = +0.015/+0.002
          > \emptyset 30 \leq \emptyset 50 = +0.018/+0.002
          > Ø 50 ≤ Ø 80 = +0.030/+0.011
          > Ø 80 ≤ Ø 120 = +0.035/+0.013
          > Ø 120 ≤ Ø 180 = +0.040/+0.015
Inch
          ≤ Ø 1.750 = +0.0000/-0.0005
          > Ø 1.750 = +0.0000/-0.0010
```

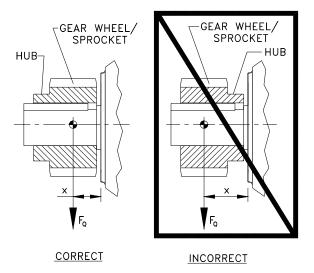
# Output and Input shaft Drill and tap shaft end

Metric (mm)

Inch

```
≤ Ø 16 = M5
> Ø 16 ≤ Ø 21 = M6
> Ø 21 ≤ Ø 24 = M8
> Ø 24 ≤ Ø 30 = M10
> Ø 30 ≤ Ø 38 = M12
> Ø 38 ≤ Ø 50 = M16
> Ø 50 ≤ Ø 85 = M20
> Ø 85 ≤ Ø 130 = M24
             \leq \emptyset 0.438 = #10-24 x 0.4 deep
> \emptyset 0.438 \le \emptyset 0.813 = \frac{1}{4}-20 \times 0.6 \text{ deep}
> \emptyset 0.813 \le \emptyset 0.938 = 5/16-18 \times 0.7 \text{ deep}
> \emptyset 0.938 \le \emptyset 1.125 = 3/8-16 \times 0.9 \text{ deep}
> \varnothing 1.125 \le \varnothing 1.375 = 1/2-13 \text{ x } 1.1 \text{ deep}
> Ø 1.375 ≤ Ø 1.875 = 5/8-11 x 1.4 deep
> \varnothing 1.875 \le \varnothing 3.250 = 3/4-10 \times 1.7 \text{ deep}
> Ø 3.250
                            = 1-8 x 2.2 deep
```

Outboard pinion and sprocket fits should be as recommended by the pin sprockets with interference fits should be heated according to the manufacturer's recommendations, generally 250°F to 300°F, (120°C to 150° C) before assembling to the shaft.



#### **LOCATION**

Coupling hubs should be mounted flush with the shaft ends, unless specifically ordered for overhung mounting. Pinions, sprockets and sheaves should be mounted as close as possible to the unit housing to minimize bearing loads and shaft deflections.

#### **COUPLING ALIGNMENT**

Shaft couplings should be installed according to the coupling manufacturer's recommendations for gap, angular and parallel alignment. In many installations, it is necessary to allow for thermal and mechanical shaft movement when determining shaft alignment. The coupling manufacturer's recommendations should be followed.

#### **AXIAL DISPLACEMENT**

The gap between shaft ends should be the same as the specified coupling gap unless overhung mounting of the coupling hub is specified. The coupling gap and shaft gap must be sufficient to accommodate any anticipated thermal or mechanical axial movement.

#### **ANGULAR ALIGNMENT**

Insert a spacer or shim stock equal to the required coupling gap between the coupling hub faces and measure the clearance using feeler gauges. Repeat this at the same depth at 90-degree intervals to determine the amount of angular misalignment.

#### PARALLEL ALIGNMENT

Mount a dial indicator to one coupling hub, and rotate this hub, sweeping the outside diameter of the other hub. The parallel misalignment is equal to one-half of the total indicator reading. Another method is to rest a straight edge squarely on the outside diameter of the hubs at 90-degree intervals and measure any gaps with feeler gauges. The maximum gap measurement is the parallel misalignment.

#### **CHECKING ALIGNMENT**

After both angular and parallel alignments are within specified limits, tighten all foundation bolts securely and repeat the above procedure to check alignment. If any of the specified limits for alignment are exceeded, realign the coupling.

#### SPROCKET OR SHEAVE ALIGNMENT

Align the sheaves or sprockets square and parallel by placing a straight edge across their faces. Alignment of bushed sheaves and sprockets should be checked after bushings have been tightened. Check horizontal shaft alignment by placing a level vertically against the face of the sheave or sprocket. Adjust belt or chain tension per the manufacturer's specified procedure.

#### **OUTBOARD PINION ALIGNMENT**

Align the pinion by adjusting the gear tooth clearance according to the manufacturer's recommendations and checking for acceptable outboard pinion tooth contact. The foundation bolts may have to be loosened and the unit moved slightly to obtain this contact. When the unit is moved to correct tooth contact, the prime mover should be realigned.

#### **RECHECK ALIGNMENT**

After a period of operation, recheck alignment and adjust as required.

- 1. Properly install unit on a rigid foundation
  - adequately supported
  - securely bolted into place
  - leveled so as not to distort the gear case
- Properly install couplings suitable for the application and connected equipment.
- 3. Ensure accurate alignment with other equipment.
- Furnish and install adequate machinery guards as needed to protect operating personnel and as required by the applicable standards of the Occupational Safety and Health Administration (OSHA), and by other applicable safety regulations;

 Ensure that driving equipment is running in the correct direction before coupling to reducers with backstops (designed to operate only in a specific direction) or machinery designed to operate only in one direction.

#### **CHANGES IN PERFORMANCE SPECIFICATIONS**

Owner has the responsibility to consult with NORD GEAR if such items such as applied loads, operating speeds or other operating conditions have changed.



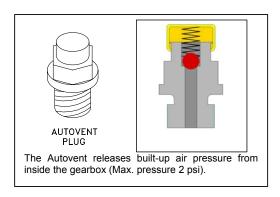
LOCK OUT POWER before any maintenance is performed. Make absolutely sure that no voltage is applied while work is being done on the gearbox.

#### START-UP

- Ensure that switches, alarms, heaters, coolers and other safety and protection devices are installed and operational for their intended purpose.
- Verify that the installed mounting position is the same as the nametag mounting position. If not, adjust the oil level accordingly and relocate the vent plug, fill plug and drain plug according to the mounting position. See following.

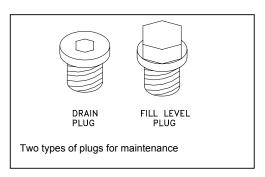
#### **AUTOVENT PLUG**

The Autovent plug is brass in color and will be located at the highest point on the gearbox. It operates like a check-valve to allow the reducer to relieve internal pressure while preventing lubricant contamination during cooling. A spring presses a ball or plunger against a machined orifice until pressure exceeds 2 psi. Above 2 psi the air is allowed to escape depressurizing the gearcase. When internal pressure drops below 2 psi, the autovent re-seals closing the unit to the outside environment. After shutdown, the reducer cools along with the air inside the reducer. The unit will temporarily maintain a slight vacuum until normalization occurs. NORD Gear supplies an Autovent as a standard feature.



#### **FILL LEVEL & DRAIN PLUGS**

The drain plugs are metric socket head cap screws. They will be located at the lowest part of the gearbox for ease of draining. The fill level plug is a hex head cap screw. It will be located between the Autovent and drain plug. Both types of plugs will have gaskets included to prevent oil from leaking.



#### LUBRICANT

All NORD reducers are shipped from the factory properly filled with lubricant and all plugs are installed according to the mounting position given on the reducer nametag. Acceptable oil fill level is within ½ inch of the bottom of the fill plug threads.

#### **OPERATION AND MAINTENANCE CHECKLIST**

- Operate the equipment as it was intended to be operated
- Do not overload.
- 3. Run at correct speed.
- Maintain lubricant in good condition and at proper level.
- Dispose of used lubricant in accordance with applicable laws and regulations.
- Apply proper maintenance to attached equipment at prescribed intervals recommended by the manufacturer.
  Perform periodic maintenance of the gear drive as
- recommended by NORD.

# **MOUNTING POSITIONS**

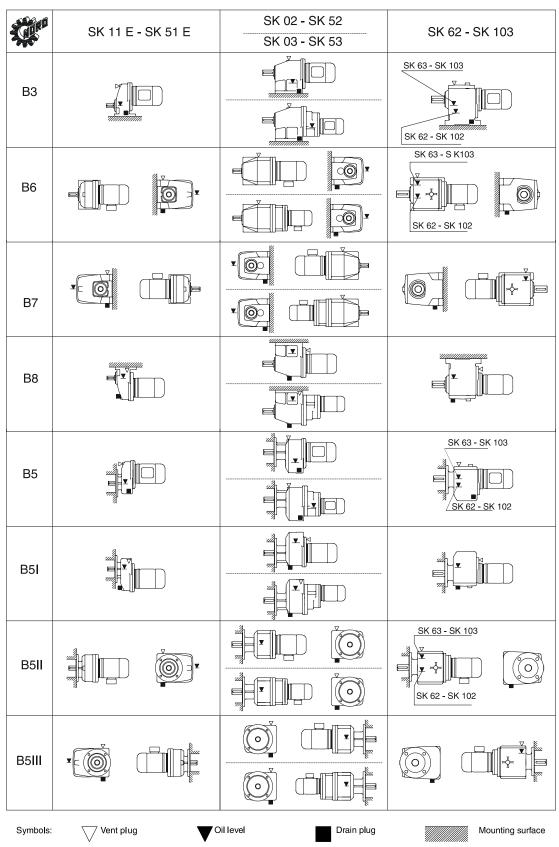
These charts detail the mounting positions for horizontal and vertical mounting. The Autovent, oil fill plug and drain plug are indicated on each mounting position picture. The factory set mounting position and plug locations match that shown on the gearbox nametag. For mounting orientations other than shown consult NORD Gear.

#### **VERTICAL POSITION**

TIPE OF THE PROPERTY OF THE PR	SK 11E - SK 51 E	SK 02 - SK 52	SK 03 - SK 53	SK 62 - SK 103
V1 *				SK 63
V3		¥ T	¥ T	
V5 *				SK 63
V6				
Symbols:	Vent plug	Oil level	Drain plu	ug Mounting surface

<sup>\*</sup> Mounting position V1 or V5 with lubricant expansion unit

# **HORIZONTAL POSITION**



#### **MAINTENANCE**

Mineral lubricant should be changed every 10,000 service hours or after two years. For synthetic oils, the lube should be changed every 20,000 service hours or after four years. In case of extreme operating (e.g. high humidity, aggressive environment or large temperature variations), shorter intervals between changes are recommended.

#### **OIL SPECIFICATIONS**

NORD supplies all reducers filled with oil from the factory. Consult the sticker adjacent to the fill plug to determine the type of lubricant installed at the factory. Standard lubricant is ISO VG220 mineral-based oil. However, some units have special lubricants designed to operate in certain environments or to extend the service life of the lubricant. If in doubt about which lubricant is needed, contact NORD Gear.

#### STANDARD OIL - ISO VG220

Ambient Temperature	Formulation
20 to 104°F (-5 to 40°C)	Mineral

#### TYPICAL OILS

I TFICAL OIL								
Viscosity ISO NLGI	Formulation	Service Temperature Range	Mobil*	Shell	Castrol	KLÜBER WBRICATION	bp	Tribol*
VG 460	Conventional Mineral	20°C to +50°C 68F to +122°F	Mobilgear 634	Omala 460	7EP	Klüberoil GEM 1-460	Energol GR-XP 460	Tribol 1100/460
VG 460	Synthetic PAO	-30°C to +80°C -22°F to +176°F	Mobil SHC 634	Omala 460 HD	Isolube EP 460	Klübersynth EG 4-460	N/A	Tribol 1510/460
VG 320	Conventional Mineral	0°C to +30°C 32°F to +86°F	Mobilgear 632	Omala 320	6EP	Klüberoil GEM 1-320	Energol GR-XP 320	Tribol 1100/320
VG 320	Synthetic PAO	-35°C to +80°C -31°F to +176°F	Mobil SHC 632	Omala 320 HD	Isolube EP 460	Klübersynth EG 4-320	N/A	Tribol 1510/320
VG 220	Conventional Mineral	-5°C to +40°C +20°F to +104°F	Mobilgear 630	Omala 220	5EP	Klüberoil GEM 1-220	Energol GR-XP 220	Tribol 1100/220
VG 220	Synthetic PAO	-34°C to +80°C -30°F to +176°F	Mobil SHC 630	Omala 220 HD	Isolube EP 220	Klübersynth EG 4-220	N/A	Tribol 1510/220
VG 150 &	Conventional Mineral	-15°C to +25°C 5°F to +77°F	Mobilgear 629	Omala 100	4EP	Klüberoil GEM 1-150	Energol GR-XP 100	Tribol 1100/100
VG 100	Synthetic PAO	-37°C to +10°C -35°F to +50°F	Mobil SHC 629	Omala 150 HD	Isolube EP 150	Klübersynth EG 4-150	N/A	N/A
VG 68	Conventional Mineral	-15°C to +25°C 5°F to +77F	Mobilgear 626	Omala 68	2EP	Klüberoil GEM 1-68	Energol GR-XP 68	Tribol 1100/68
V 3 66	Synthetic PAO	-40°C to +10°C -40°F to +50F	Mobil SHC 626	N/A	Isolube EP 68	N/A	N/A	N/A
VG 32	Synthetic PAO	-40°C to +10°C -40°F to +50°F	Mobil SHC 624	N/A	N/A	Klüber-Summit HySyn FG-32	N/A	N/A

PAO = Poly Alpha Olefin

#### **SPECIAL PURPOSE LUBRICANTS**

Ambient Temperature	Formulation	Manufacturer	Oil Brand Name
20 to 104°F (-5 to 40°C)	Food Grade Oil - Synthetic	Chevron	FM ISO 220
20 to 104°F (-5 to 40°C)	Food Grade Oil - Synthetic	OilJAX	Magnaplate 85W140-FG
5 to 125°F (-20 to 50°C)	Fluid Grease	Mobil	Mobilux EP023
-30 to 140°F (-35 to 60°C)	Fluid Grease - Synthetic	Mobil	Mobilith SHC 007
-30 to 140°F (-35 to 60°C)	Fluid Grease - Synthetic	Shell	Albida LC

#### STANDARD BEARING GREASE - NLGI 2EP Lithium

Ambient Temperature	Formulation
-20 to 140°F (-30 to 60°C)	Mineral

#### **OPTIONAL BEARING GREASES**

Ambient Temperature	Formulation	Manufacturer	Grease Brand Name
-40 to 230°F (-40 to 110°C)	Synthetic	Shell	Aeroshell 6
-40 to 230°F (-40 to 110°C)	Food Grade - Synthetic	Lubriplate	SFL1

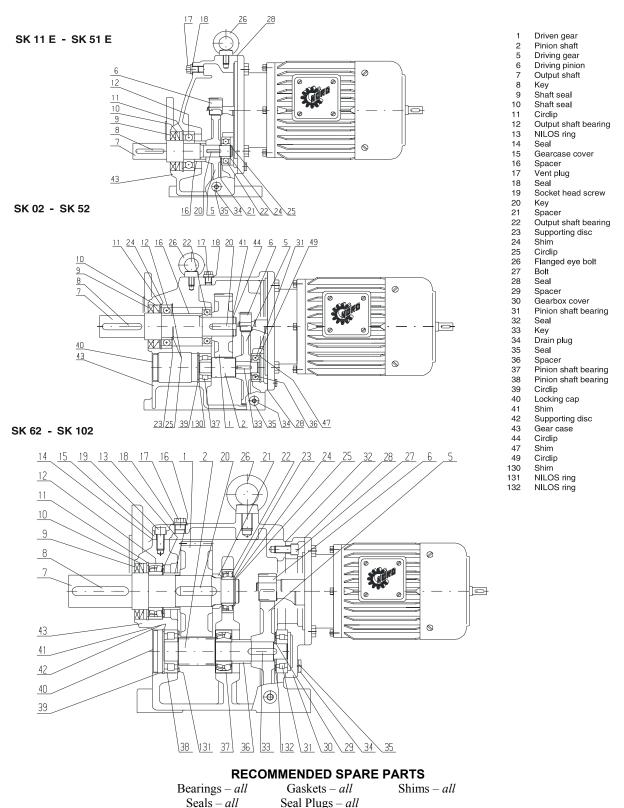
#### **LUBRICANT CAPACITY**

Each reducer has the oil level and oil quantity adjusted according to the mounting position shown in the tables. When replacing the oil, consult the tables below to determine the proper amount of oil to be installed according to the reducer size and mounting position. Note that this is approximate and the final level will be adjusted when the reducer is installed. Acceptable oil fill level is within ½ inch of the bottom of the fill plug threads.

					Horizon	tal position	)				Vertical p	osition	
Mounting p	nosition				110112011	tar position	single re	duction			v critical p	OGILIOIT	
wounting p	00111011	В3	В 6	B 7	B 8	B 5	B 5I	B 5II	B 5III	V 1	V 3	V 5	VE
	quarts	0.26	0.37	0.37	0.58	0.32	0.53	0.42	0.42	0.32	0.37	0.42	0.5
SK 11E	liters	0.25	0.35	0.35	0.55	0.30	0.50	0.42	0.42	0.32	0.35	0.42	0.5
	quarts	0.63	1.06	1.06	1.27	0.53	1.16	0.40	0.40	0.74	1.48	1.06	1.2
SK 21E	liters	0.60	1.00	1.00	1.20	0.50	1.10	0.90	0.90	0.74	1.40	1.00	1.2
		1.16	1.80	1.80	2.32	0.85	1.74	2.11	2.11	1.16	1.40	2.43	2.8
SK 31E	quarts	1.10	1.70	1.70	2.32	0.80	1.74	2.00	2.11	1.10	1.30	2.43	2.7
	liters											2.64	
SK 41E	quarts	1.80	2.75	2.75	3.49	1.06	2.96	3.49	3.49	1.69	2.75		2.7
	liters	1.70	2.60	2.60	3.30	1.00	2.80	3.30	3.30	1.60	2.60	2.50	2.6
SK 51E	quarts	2.32	3.59	3.59	4.97	1.90	4.33	4.02	4.02	3.17	3.70	4.23	4.6
	liters	2.20	3.40	3.40	4.70	1.80	4.10	3.80	3.80	3.00	3.50	4.00	4.4
Mounting p	osition						double re						
		B 3	В6	B 7	B 8	B 5	B 5I	B 5II	B 5III	V 1	V 3	V 5	V
SK 02	quarts	0.16	0.42	0.42	0.74	0.26	0.63	0.53	0.53	0.63	0.63	0.63	0.6
011 02	liters	0.15	0.40	0.40	0.70	0.25	0.60	0.50	0.50	0.60	0.60	0.60	0.6
SK 12	quarts	0.26	0.53	0.53	0.90	0.37	0.95	0.63	0.63	0.95	0.90	0.79	0.7
3K 12	liters	0.25	0.50	0.50	0.85	0.35	0.90	0.60	0.60	0.90	0.85	0.75	0.7
SK 22	quarts	0.53	1.43	1.43	2.11	0.74	2.11	1.64	1.64	1.90	2.11	1.90	1.9
3N 22	liters	0.50	1.35	1.35	2.00	0.70	2.00	1.55	1.55	1.80	2.00	1.80	1.8
SK 32	quarts	0.95	2.11	2.11	3.17	1.37	3.49	2.54	2.54	3.28	3.06	3.06	2.6
3K 32	liters	0.90	2.00	2.00	3.00	1.30	3.30	2.40	2.40	3.10	2.90	2.90	2.5
01/ 40	quarts	1.37	3.38	3.38	4.76	1.90	4.76	3.91	3.91	4.23	4.65	4.54	6.1
SK 42	liters	1.30	3.20	3.20	4.50	1.80	4.50	3.70	3.70	4.00	4.40	4.30	5.8
014.50	quarts	2.64	5.39	5.39	7.19	3.17	6.55	5.92	5.92	7.82	7.19	7.19	7.4
SK 52	liters	2.50	5.10	5.10	6.80	3.00	6.20	5.60	5.60	7.40	6.80	6.80	7.0
	quarts	6.87	15.85	15.85	13.74	7.40	14.79	16.91	16.91	19.55	15.85	16.91	15.
SK 62	liters	6.50	15.00	15.00	13.00	7.00	14.00	16.00	16.00	18.50	15.00	16.00	15.
	quarts	9.51	24.30	24.30	19.02	10.57	19.55	24.30	24.30	29.59	24.30	27.47	24.
SK 72	liters	9.00	23.00	23.00	18.00	10.00	18.50	23.00	23.00	28.00	23.00	26.00	23.
	quarts	14.79	33.81	33.81	28.53	15.85	30.64	36.46	36.46	47.55	39.10	46.49	36.9
SK 82	liters	14.00	32.00	32.00	27.00	15.00	29.00	34.50	34.50	45.00	37.00	44.00	35.
	quarts	26.42	54.95	54.95	49.66	27.47	49.66	54.95	54.95	82.42	77.14	80.31	77.
SK 92	liters	25.00	52.00	52.00	47.00	26.00	47.00	52.00	52.00	78.00	73.00	76.00	73.
	quarts	38.04	75.02	75.02	69.74	42.27	69.74	76.08	76.08	109.90	85.59	107.78	83.
SK 102	liters	36.00	71.00	71.00	66.00	40.00	66.00	72.00	72.00	104.00	81.00	102.00	79.
	IIICIS	30.00	7 1.00	7 1.00	00.00	40.00	triple red		72.00	104.00	01.00	102.00	19.
Mounting p	osition	Б.	Б.	D 7	Б.0	D. C.			D EIII	V 4	V/ 0	\ \ F	
		B 3	B 6	B 7	B 8	B 5	B 5I	B 5II	B 5III	V 1	V 3	V 5	V
SK 03	quarts	0.32	0.63	0.63	0.85	0.53	0.95	0.85	0.85	1.16	0.86	0.95	1.3
	liters	0.30	0.60	0.60	0.80	0.50	0.90	0.80	0.80	1.10	0.81	0.90	1.2
SK 13	quarts	0.63	0.74	0.74	1.16	0.85	1.27	1.00	1.00	1.27	1.27	1.27	1.3
	liters	0.60	0.70	0.70	1.10	0.80	1.20	0.95	0.95	1.20	1.20	1.20	1.2
SK 23	quarts	1.37	1.69	1.69	2.43	2.64	1.59	2.96	2.96	2.96	2.75	2.48	2.5
	liters	1.30	1.60	1.60	2.30	2.50	1.50	2.80	2.80	2.80	2.60	2.35	2.4
SK 33	quarts	1.69	2.43	2.43	3.38	2.01	3.70	2.75	2.75	4.65	3.59	4.44	3.0
J. 100	liters	1.60	2.30	2.30	3.20	1.90	3.50	2.60	2.60	4.40	3.40	4.20	2.9
SK 43	quarts	3.17	3.80	3.80	5.49	3.70	5.28	4.33	4.33	6.45	6.02	6.97	5.9
UI 40	liters	3.00	3.60	3.60	5.20	3.50	5.00	4.10	4.10	6.10	5.70	6.60	5.6
SK 53	quarts	4.76	6.34	6.34	8.14	5.49	7.40	7.08	7.08	9.40	8.88	9.19	9.
JN 33	liters	4.50	6.00	6.00	7.70	5.20	7.00	6.70	6.70	8.90	8.40	8.70	8.7
SK 63	quarts	10.57	13.74	13.74	11.62	11.62	12.68	14.79	14.79	19.02	14.79	16.91	15.
3N 03	liters	10.00	13.00	13.00	11.00	11.00	12.00	14.00	14.00	18.00	14.00	16.00	14.
CV 72	quarts	14.79	21.13	21.13	18.49	14.79	19.02	21.13	21.13	29.06	23.78	28.53	21
SK 73	liters	14.00	20.00	20.00	17.50	14.00	18.00	20.00	20.00	27.50	22.50	27.00	20
01/ 00	quarts	23.25	34.87	34.87	27.47	24.30	28.53	35.93	35.93	42.27	35.93	39.10	32
SK 83	liters	22.00	33.00	33.00	26.00	23.00	27.00	34.00	34.00	40.00	34.00	37.00	31
017.55	quarts	42.27	51.78	51.78	46.49	42.27	46.49	51.78	51.78	78.19	73.97	76.08	73.
													70.
SK 93	liters	4() ()()	49 00	49 00	44 ((()	4()(1()	44 (10)	49 00	49 00	/4 ()()	/() ()()	// 00	
SK 93	liters quarts	40.00 58.12	49.00 70.80	49.00 70.80	44.00 58.12	40.00 58.12	44.00 62.34	49.00 70.80	49.00 70.80	74.00 104.61	70.00 82.42	72.00 102.50	75

Note: Filling quantities are approximate figures. Oil level must be checked according to oil level plug after final installation. Acceptable oil fill level is within ½ inch of the bottom of the fill plug threads For mounting angles not shown, consult factory.

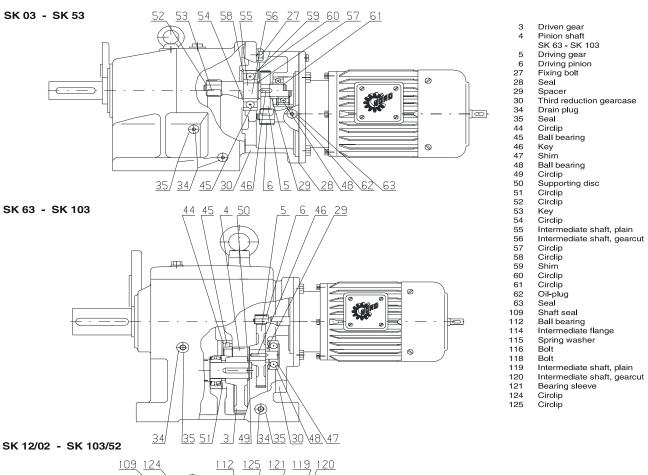
#### **PARTS LIST**



#### **IMPORTANT!**

When ordering parts, it is necessary to have the *NORD SERIAL NUMBER* from the unit the parts are for. The serial number will dictate the correct parts for that particular unit. The gearbox nameplate will have the serial number on it.

#### **PARTS LIST**



# **NOTES**

# **TROUBLE SHOOTING**

PROBLEM WITH	THE REDUCER	POSSIBLE CAUSES	SUGGESTED REMEDY
	Overloading	Load exceeds the capacity of the reducer	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce load
Runs Hot		Insufficient lubrication	Check lubricant level and adjust up to recommended levels
	Improper lubrication	Excessive lubrication	Check lubricant level and adjust down to recommended levels
		Wrong lubrication	Flush out and refill with correct lubricant as recommended
	Loose foundation bolts	Weak mounting structure	Inspect mounting of reducer. Tighten loose bolts and/ or reinforce mounting and structure
Runs Noisy		Loose hold down bolts	Tighten bolts
	Worn RV Disc	Overloading unit may result in damage to disc	Disassemble and replace disc. Recheck rated capacity of reducer.
	Failure of Bearings	May be due to lack of lubricant	Replace bearing. Clean and flush reducer and fill with recommended lubricant.
		Overload	Check rated capacity of reducer.
	Insufficient Lubricant	Level of lubricant in the reducer not properly maintained.	Check lubricant level and adjust to factory recommended level.
	Internal parts are broken	Overloading of reducer can cause damage.	Replace broken parts. Check rated capacity of reducer.
Output Shaft Does Not Turn	internal parts are broken	Key missing or sheared off on input shaft.	Replace key.
		Coupling loose or disconnected.	Properly align reducer and coupling. Tighten coupling.
	Worn Seals	Caused by dirt or grit entering seal.	Replace seals. Autovent may be clogged. Replace or clean.
Oil Leakage		Overfilled reducer.	Check lubricant level and adjust to recommended level.
		Autovent clogged.	Clean or replace, being sure to prevent any dirt from falling into the reducer.
		Improper mounting position, such as wall or ceiling mount of horizontal reducer.	Check mounting position. Name tag & verify with mounting chart in manual.

NORD Gear Corpo National Customer Service	<b>NORD Gear Limited</b> Toll Free in Canada 800-668-4378		
WEST 1121 Railroad Street Building 101 Corona, CA 92882 Phone 951-279-2600 Fax 888-408-6673	MIDWEST PO Box 367 800 Nord Drive Waunakee, WI 53597 Phone 608-849-7300 Fax 800-373-6673	SOUTH 100 Forsyth Hall Dr. Building 100B Charlotte, NC 28273 Phone 704-529-1255 Fax 888-259-6673	CANADA 41 West Drive Brampton, Ontario L6T 4A1 Phone 905-796-3606 Fax 905-796-8130

# Installation, Operation and Maintenance Instructions

for AC Induction Motors 56- 6800 Frames (NEMA) 63 – 280 Frames (IEC)



# **MARATHON ELECTRIC**

**Contact Motor Customer Service at:** 

Phone: (715) 675-3311

www.marathonelectric.com

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE

OWNER: READ AND SAVE THESE INSTRUCTIONS

#### SAFETY INSTRUCTIONS

A This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

## WARNING

Before installing, using, or servicing this product, carefully read and fully understand the instructions including all warnings, cautions, & safety notice statements. To reduce risk of personal injury, death and/or property damage, follow all instructions for proper motor installation, operation and maintenance.

These instructions are not intended as a complete listing of all details for installation, operation, and maintenance. If you have any questions concerning any of the procedures, STOP, and call the appropriate Regal-Beloit motor company.

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motor is suitable for use on Pulse Width Modulated (PWM) type VFD power. In addition, the nameplate must be marked with the inverter rating; for example, "2:1 CT", "2 to 1 Constant Torque", etc.

#### 1.0 INSTALLER/OWNER/OPERATOR RESPONSIBILITY:

#### 1.1 ELECTRICAL SAFETY

# A WARNING: ELECTRICAL SHOCK HAZARD

Electrical connections shall be made by a qualified electrical personnel in accordance with all applicable codes, ordinances and sound practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage. Only qualified personnel who are familiar with the applicable National Code (USA = NEC) and local codes should install or repair electrical motors and their accessories.

# A WARNING: ELECTRICAL LIVE CIRCUIT HAZARD

Do not touch electrically live parts. Disconnect, lockout and tag input power supply before installing or servicing motor (includes accessory devices). Use a voltmeter to verify that power is off before contacting conductors.

#### A WARNING: ELECTRICAL GROUNDING HAZARD

Failure to properly ground motors, per the National Electrical Code (NEC) Article 430 and local codes may cause serious injury or death to personnel. For general information on grounding refer to NEC Article 250. (Also see "Ground Connections section 3.4.4").

# MARNING: AUTOMATIC RESET PROTECTOR HAZARD

Do not use automatic reset protectors if automatically restarting the motor will place personnel or equipment at risk. Failure to follow this instruction could result in serious personal injury, death and/or property damage

#### A WARNING: MANUAL RESET PROTECTOR HAZARD

If a tripped manual reset thermal protector is exposed to a temperature less than  $-7^{\circ}\mathrm{C}$  (20°F) it may reset and restart the motor automatically. If an application requires a motor with a manual reset thermal protector that will be operated at temperatures less than  $-7^{\circ}\mathrm{C}$  (20°F) contact the manufacturer to review the application / motor requirements. Failure to follow this instruction could result in serious personal injury, death and/or property damage

#### **1.2 MECHANICAL SAFETY**

# MARNING: LOOSE PARTS HAZARD

Before starting the motor, remove all unused shaft keys and loose rotating parts to prevent them from flying off. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

#### WARNING: ROTATING PARTS HAZARD

Keep extremities, hair, jewelry and clothing away from moving parts. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

#### **1.3 ENVIRONMENTAL SAFETY**

#### **MARNING: HAZARDOUS LOCATIONS**

- (1) The NEC and the local authority having jurisdiction must be consulted concerning the installation and suitability of motors for use in Hazardous Locations. The local authority having jurisdiction must make the final determination of what type of motor is required. The application and operation is beyond the control of the motor manufacturer.
- (2) Division 1 Hazardous Locations motors can only be modified or reworked by the manufacturer or a facility that is Listed under UL's category "Motors and Generators, Rebuilt for use in Hazardous Locations". Failure to follow these instructions could result in serious personal injury, death and/or property damage.
- (3) Do not use a Hazardous Locations motor with a Variable Frequency Drive (VFD) unless the motor nameplate specifically states that the

# 2.0 RECEIVING AND INSPECTION

#### 2.1 INITIAL INSPECTIONS

- **2.1.1 CHECK PACKING LIST AND INSPECT** the packaging to make certain no damage has occurred in shipment. If there is visible damage to the packaging, unpack and inspect the motor immediately. Claims for any damage done in shipment must be made by the purchaser against the transportation company.
- **2.1.2 TURN MOTOR SHAFT** by hand to be certain that it rotates freely. Note: Shaft seals and bearing seals may add drag.
- **2.1.3 CHECK NAMEPLATE** for conformance with purchase order requirements and compliance with power supply and control equipment requirements.

#### 2.2 HANDLING:

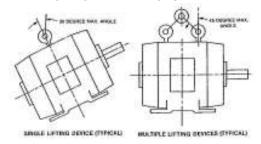
#### WARNING: FALLING OBJECT HAZARD

Eyebolts or lifting lugs, where provided, are intended for lifting only the motor and accessories mounted by the motor manufacturer (unless specifically stated otherwise on the motor). Utilizing the motor lifting provision to lift other components such as pumps and gear boxes could result in serious personal injury, death and/or property damage.

#### MARNING: FALLING OBJECT HAZARD

Before using the lifting provision, check the eyebolts and/or other lifting means to assure they are not bent or damaged and are completely threaded, seated & secured to the motor. Equipment to lift motor must have adequate lifting capacity. While lifting the motor DO NOT stand under or in the vicinity of the motor. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

#### 2.2.1 LIFTING ANGLE LIMITATIONS



**2.3 STORAGE:** Motors, not put into service immediately, must be stored indoors in a clean, dry location. Avoid locations with large temperature swings that will result in condensation. Motors must be covered to eliminate airborne dust and dirt. If the storage location exhibits high vibration, place isolation pads under motor to minimize damage to motor bearings.

- **2.3.1 BEARING LUBRICATION:** Bearings are grease packed at the factory; relubrication upon receipt of motor or while in storage is not necessary. If stored more than one year, add grease per lubrication instructions (Table 4-4) before start-up.
- **2.3.2 SHAFT ROTATION:** It is recommended that the motor shaft be rotated 5 to 10 rotations every three months to distribute the grease in the bearings. This will reduce the chance for corrosion to form on the bearing rolling elements and raceways. Note: Shaft seals and bearing seals may add drag.
- **2.3.3 DAMP OR HUMID STORAGE LOCATIONS**: Treat unpainted flanges, shafts, and fittings with a rust inhibitor. Apply appropriate power to the motor's space heaters (if so equipped)

#### 3.0 INSTALLATION AND OPERATION

WARNING: Only qualified personnel who are familiar with the appropriate national code, local codes and sound practices should install or repair electrical motors and their accessories. Installation should conform to the appropriate national code as well as local codes and sound practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

#### A WARNING: ELECTRICAL LIVE CIRCUIT HAZARD

Do not touch electrically live parts. Disconnect, Lockout and Tag input power supply before installing or servicing motor (includes accessory devices). Use a voltmeter to verify that power is off before contacting conductors.

#### 3.1 LOCATION

- **3.1.1 SELECTING A LOCATION:** Consideration should be given to environment and ventilation. Motors should be installed in an area that is protected from direct sunlight, corrosives, harmful gases or liquids, dust, metallic particles, and vibration. A motor with the proper enclosure for the expected operating condition should be selected. Provide accessible clearance for cleaning, repair, service, and inspections (See section 3.1.3 for construction clearances). The location should be considered for possible future motor removal / handling. The free flow of air around the motor should not be obstructed.
- **3.1.2 AMBIENT TEMPERATURE LIMITS:** The ambient temperatures of the air inlet to the motor should not exceed 40°C (104°F) or be less than -30°C (-22°F) unless the motor nameplate specifically states an ambient temperature outside of these limits. The ambient inside an enclosure built around the motor shall not exceed the nameplate ambient. For ambient temperatures outside of these limits consult the motor manufacturer.

#### A CAUTION: INSULATION DEGRADATION WARNING

Insulation at high temperatures ages at an accelerated rate. Each 10°C increase in temperature reduces the insulation life by one half.

WARNING: HAZARDOUS LOCATIONS AMBIENT LIMIT: Division 1 Hazardous Locations motors shall **NOT** be operated below -25°C (-13°F) ambient. (Low temperatures reduce the component mechanical properties.)

#### 3.1.3 CONSTRUCTION SELECTION per LOCATION:

- **3.1.3.1 DRIPPROOF (OPEN) MOTORS** are intended for use indoors where the atmosphere is relatively clean, dry, and non-corrosive. Recommended a minimum clearance of ½ the shaft height between vent openings and the nearest obstruction.
- **3.1.3.2 TOTALLY ENCLOSED MOTORS** are suitable for indoor or outdoor standard service applications.

**TEAO or AOM (Totally Enclosed Air Over)** motors must be mounted in the air stream. When the motor nameplate states a minimum airflow the motor must be mounted in an air stream meeting this minimum value.

**TEFC (Totally Enclosed Fan Cooled)** motors must meet a minimum distance of  $\frac{1}{2}$  the shaft height between the fan guard grill openings and the nearest obstruction.

**3.1.3.3** HAZARDOUS LOCATIONS MOTORS: Hazardous Locations motors are intended for installations in accordance with NEC Article 500. For all installations involving Hazardous Locations motors, consult the applicable national codes, local codes, and the authority having jurisdiction.

Division 1 Installations – includes Class I & II: Use only motors that are UL Listed and CSA Certified or UL Listed and UL Certified for Canada. These motors bear a separate nameplate that includes the UL Listing Mark and CSA Certification Mark or includes the UL Listing Mark and the UL Mark for Canada. This plate also bears the phrase: "Electric motor for Hazardous Locations" and is marked with the Class, Group and Operating Temperature Code.

<u>Division 2 Installations – Class I only:</u> Use only motors that are CSA Certified and bear the CSA Certification Mark. These motors include a phrase on the main motor nameplate that indicates the motor is CSA Certified for Class I, Division 2 / Zone 2 locations.

<u>Division 2 Installation – Class II only:</u> Use only Class II motors as described above under "Division I Installations".

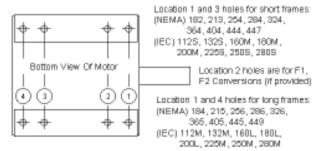
#### MARNING: EXPLOSION HAZARD

A motor should never be placed in an area with a hazardous process or where flammable gases or combustible materials may be present unless it is specifically designed and nameplated for this type of service. Hazardous Locations motors are intended for installations in accordance with NEC Article 500. For all installations involving Hazardous Locations motors, consult the NEC, local codes, and the authority having jurisdiction. Failure to follow these instructions could result in serious personal injury, death and/or property damage. (For other limitations see section 1.3)

#### 3.2 MOUNTING MOTOR:

**3.2.1 RIGID BASE (FOOTED):** The motor must be securely installed to a rigid foundation or a mounting surface to minimize vibration and maintain alignment between the motor shaft and the load's shaft. The mounting surfaces of the four mounting pads must be flat within 0.01 inches for 210 frame & smaller; 0.015 inches for 250 frame & larger. [IEC 0.25 mm for 130 frame & smaller, 0.38 mm for 160 frame & larger]. This may be accomplished by shims under the motor feet. For special isolation mounting, contact manufacturer for assistance

#### 3.2.2 RIGID BASE HOLE SELECTION -6 OR 8 HOLES



#### 3.2.3 VERTICAL MOUNTING:

**CAUTION: ENCLOSURE PROTECTION CAUTION:** Most Dripproof rigid base (footed) motors do **NOT** meet "Dripproof" requirements when mounted vertically. If the motor is located in unprotected environments, the addition of a drip cover may be available. Drip covers not available for cast iron rigid base motors.

#### MARNING: FALLING OBJECT HAZARD

The lifting provision on standard horizontal footed motors is not designed for lifting the motor in a vertical shaft up or shaft down position. (see 2.2.1 lifting angles). Lifting method / provisions for

mounting a rigid base (footed) motor vertically is the responsibility of the installer.

VERTICAL SHAFT DOWN: Most standard horizontal motors thru 449 Fr. (excluding brake motors) can be mounted in a vertical shaft down orientation. For vertical brake motors see section 3.3.6.2

#### **VERTICAL SHAFT UP:**

**MARNING:** HAZARDOUS LOCATIONS VERTICAL MOUNT: Hazardous locations motors must NOT be mounted vertically shaft up without approval by the motor manufacturer. Without proper retaining provisions the rotor may move axially and contact components, creating a spark hazard.

Belted or Radial Load when mounted vertically: The following frame sizes / constructions with applied (axial) down loads within the limit stated are acceptable when mounted vertical

Table 3-1 Belted or Radial Load Applications (All speeds)

Table 3-	i beiled of K	adiai Load Appiid	ations (All s	
Frame Size	Enclosure	Construction	Shaft Up OK	Max Applied Down Load <sup>3</sup>
56	TEFC & ODP	Steel	Yes	25 lbs
140	TEFC	Steel & Cast Iron	Yes	25 lbs
	ODP	Steel	Yes	25 lbs
180	TEFC	All	Yes	35 lbs
100	ODP	Steel	Yes	35 lbs
210	TEFC	All	Yes	40 lbs
210	ODP	Steel	Yes	40 lbs
	TEFC	All	Yes	40 lbs
250	ODD	Steel	Yes	40 lbs
	ODP	Cast Iron	No <sup>2</sup>	N/A
	320 TTFC models	Cast Iron	Eng <sup>1</sup>	N/A
280-320	All Other TEFC	Cast Iron & Aluminum	Yes	30 lbs
	ODP	Cast Iron	No <sup>2</sup>	N/A
	TEFC & ODP	Steel	Build Up Only <sup>4</sup>	N/A
360 &	TEFC	Cast Iron	Build Up Only <sup>4</sup>	N/A
Up	ODP	Cast Iron	No <sup>2</sup>	N/A
Ор	TEFC & ODP	Steel	Build Up Only <sup>4</sup>	N/A

Notes:

- For TEFC model numbers beginning with 324TTFC or 326TTFC consult the motor manufacturer to determine if a build up motor is required
- 2 The max applied down load is any applied load external to the motor, including such things as sheave weight, fan loads, axial belt force, pump load, etc. If the application is direct drive with no applied radial load, consult the motor manufacturer.
- "Build-up only", refers to motors that are specifically ordered and built for shaft up applications. It does not imply that all buildup motors are suitable for shaft up applications.

#### 3.3 APPLICATION ASSEMBLY TO MOTOR:

A CAUTION: EQUIPMENT DAMAGE:

Do not connect or couple motor to load until correct rotational direction is established.

3.3.1 GENERAL: PROPER ALIGNMENT of the motor and driven equipment minimizes vibration levels, maximizes bearing life, and extends the overall life of the machinery. Consult the drive or equipment manufacturer for more information.

A CAUTION: BEARING FAILURE

During assembly do NOT force components onto the shaft. Striking or hammering the component may result in bearing damage.

**3.3.2 DIRECT COUPLING:** Use flexible couplings if possible. For applications that apply radial, axial or moment loading on the motor shaft see section 3.3.3.



#### A CAUTION: BEARING FAILURE

Unless approved by the motor manufacturer do NOT direct couple a vertical shaft up or roller bearing motor. Direct coupling a vertical shaft up motor or a motor with a roller bearing may result in bearing damage.

3.3.3 DIRECT CONNECTED: Radial loading for direct connected equipment (gears, fans etc.) must be approved by the motor manufacturer unless within the maximum overhung load limits (Table 3-2). Combined loading (axial, radial and/or moments) must be approved by motor manufacturer. For belted loads see section 3.3.4.

Table 3-2 Maximum Radial Load (lbf) @ Middle of the Shaft **Extension Length** 

Frame	Motor Rated RPM							
Number	3600	1800	1200	900				
143T	106	166	193	210				
145T	109	170	199	218				
182T	187	230	261	287				
184T	193	237	273	301				
213T	319	317	470	510				
215T	327	320	480	533				
254T	500	631	729	793				
256T	510	631	736	820				
284T	-	866	990	1100				
286T	-	871	1005	1107				
324T	-	950	1100	1215				
326T	-	950	1113	1230				
364T	-	1078	1365	1515				
365T	-	1078	1380	1540				
404T	-	1388	1590	1762				
405T	-	1400	1610	1780				
444T	-	1580	1795	2005				
445T	-	1520	1795	1985				
447T		1455	1765	1985				
449T	-	1640	1885	2130				

Values based on 26,280 hrs B-10 Life

For "End of Shaft" Load multiply value by 0.88

To convert from lbf to N multiply value by 4.4482.

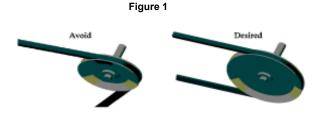
#### 3.3.4 BELTED:

The goal of any belted system is to efficiently transmit the required torque while minimizing the loads on the bearings and shafts of the motor and driven equipment. This can be accomplished by following four basic guidelines:

- Use the largest practical sheave diameter.
- Use the fewest number of belts possible. 2.
- Keep sheaves as close as possible to support bearings. 3
- Tension the belts to the lowest tension that will still transmit the required torque without slipping. It is normal for V-belts to squeal initially when line starting a motor

#### 3.3.4.1 Sheave Diameter Guidelines:

In general, smaller sheaves produce greater shaft stress and shaft deflection due to increased belt tension. See Table 3-3 for recommended minimum sheave diameters. Using larger sheaves increases the contact with belts which reduces the number of belts required. It also increases the belt speed, resulting in higher system When selecting sheaves, do not exceed the manufacturer's recommended maximum belt speed, typically 6,500 feet per minute for cast iron sheaves. Determine belt speed by the following formula:



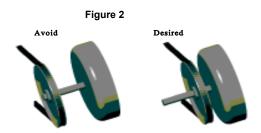
BELT SPEED (Ft/min) =  $\frac{Shaft RPM \times 3.14 \times Sheave Dia (inches)}{12}$ 

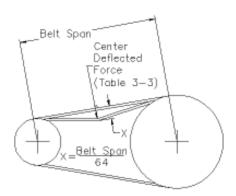
#### 3.3.4.2 Number of Belts

In general, use the fewest number of belts that will transmit the required torque without slipping. See Table 3-3 for recommended maximum number of belts. Each belt adds to the tension in the system, which increases load on the shafts and bearings. Belts are most efficient when operated at or near their rated horsepower. If the sheaves have more grooves than the number of belts required, use the grooves closest to the motor.

#### 3.3.4.3 Sheave Location

Install sheaves as close to the housing as possible to increase the bearing life of the motor and driven equipment





#### 3.3.4.4 Belt Tension

#### A CAUTION: Equipment Failure Caution

Belt tensioning by feel is **NOT** acceptable. Tensioning by "feel" can be very misleading, and can damage motor and equipment. It is normal for V-belts to squeal initially when line starting a motor.

In general, belt tensions should be kept as loose as possible while still transmitting the required torque without slipping. Belt tensions must be measured with a belt tension gage. These inexpensive gages may be obtained through belt manufacturers, or distributors.

Proper belt tension is determined by measuring the force required to deflect the center of the belt a given distance. The proper deflection (in inches) is determined by dividing the belt span in inches by 64. Calculate the proper deflection and then see Table 3-3 for the required "Deflected Force" to achieve that deflection.

After tensioning the belt, rotate the sheaves for several rotations or operate the system for a few minutes to seat belts into the grooves, then re-tension the belts. New belts will stretch during use, and should be retensioned after the first eight hours of use.

Table 3-3 Recommended Minimum Sheave Diameters, Belt Type, Number of Belts and Deflected Force

		120	0 rpm			1800 rpm			3600 rpm			
	Min		Max	Avg.	Min		Max	Avg.	Min		Max	Avg.
	Sheave		#	Deflected	Sheave		#	Deflected	Sheave		#	Deflected
<b> </b>	Dia (in)	Belt	of	Force	Dia (in)	Belt	of	Force	Dia (in)	Belt	of	Force
Motor Hp		Type	Belts	(lbs)		Type	Belts	(lbs)		Type	Belts	(lbs)
0 7E	2.0	οι /∨	1	O 1	2.0	ა/.\<	1	2.2	2.0	ე\ /∨	1	4.0
1	2.4	3VX	1	4.0	2.2	3VX	1	3.1	2.2	3VX	1	1.6
1.5	2.4	3VX	2	3.1	2.4	3VX	2	2.1	2.2	3VX	1	2.5
2	2.4	3VX	3	2.8	2.4	3VX	2	2.9	2.4	3VX	1	2.7
3	3.0	3VX	2	3.3	2.4	3VX	3	2.9	2.4	3VX	2	2.3
5	3.0	3VX	3	4.0	3.0	3VX	3	3.7	2.4	3VX	3	2.5
7.5	3.8	3VX	4	4.7	3.0	3VX	4	4.1	3.0	3VX	2	4.2
10	4.4	3VX	4	5.4	3.8	3VX	4	4.3	3.0	3VX	3	3.8
15	4.4	3VX	5	5.4	4.4	3VX	4	5.4	3.8	3VX	3	4.4
20	5.2	3VX	6	6.0	4.4	3VX	6	4.8	4.4	3VX	3	5.0
25	6.0	3VX	7	5.6	4.4	3VX	7	5.2	4.4	3VX	4	4.7
30	6.8	3\/X	7	59	5.2	3\/X	7	5.3				
40	6.8	5VX	4	11.6	6.0	3VX	7	6.0				
50	8.2	5VX	4	14.6	6.8	3VX	8	5.9				
60	8.2	5VX	5	14.1	7.4	5VX	4	13.3				
75	10.0	5VX	5	14.5	8.6	5VX	4	14.3		<b>-</b> 1 -		4
100	10.0	5VX	6	16.0	8.6	5VX	6	13	] (	Conta	ct Mo	tor
125	12.0	5V	7	14.1	10.5	5V	6	13.1		Manu	faatuu	
150	13.2	5V	7	15.4	10.5	5V	7	13.4		Manu <sup>.</sup>	iactur	er
200	15.0	5V	8	16.0	13.2	5V	8	13.1	]	when	Raltin	20
250	15.0	8V	6	27.6	14.0	5V	9	13.8				_
300	16.0	8V	7	27.1	14.0	5V/ <b>8V</b>	11 / 7	23.4	36	300 rp	m Mი	tors
350	16.5	8V	7	30.3	14.5	5V/ <b>8V</b>	12 / <b>7</b>	26.0		-		
400	17.5	8V	8	29.1	15.0	5V/ <b>8V</b>	13 / <b>8</b>	25.7	Greater than 25 HP			25 HP
450	18	8V	8	31.6	16.0	5V/ <b>8V</b>	14 / <b>9</b>	25.2				
500	18.5	8V	9	30.7	16.5	5V/ <b>8V</b>	15 / <b>9</b>	26.9	J			
600					17.5	8V	11	26.3	J			
700					19.0	8V	12	27.3	J			
800					20.0	8V	13	28.2				

#### Notes:

- 1. Horsepower is the nameplate motor horsepower, and RPM is the motor (driver) speed.
- 2. Minimum sheave diameters are from NEMA standards where applicable.
- 3. For variable speed applications or values outside these recommendations, consult motor manufacturer.
- 4. Selections are based on a 1.4 service factor, 5 to 1 speed ratio and various Power Transmission Manufacturers' catalogs.
- 5. These selections are for Narrow V-belt sections only. Consult manufacturer for details on conventional V-belt sections (A, B, C, D and E), or other belt types.
- 6. "Average Deflected Force is per section 3.3.4.4 of this document and is the force required to deflect the center of a belt 1/64 of the belt span distance. Tolerance on this force is ±1 lbf for forces ≤10 lbs, and ±2 lbs for forces >10 lbs as measured utilizing a belt tension gage.
- 7. When more than one belt is required the belts must be a matched set (matched for length).
- 8. If possible, the lower side of the belt should be the driving side to increase the length of wrap on the sheave).
- 9. For belted loads do not exceed 125% of 60 Hz operating RPM.

#### 3.3.5 VFD (Variable Frequency Drives) OPERATION:

WARNING: VFD Motors with Reset Thermal Protectors
UL Recognition, UL Listing, or CSA certification does not apply to
motors that are equipped with a manual or automatic reset thermal
protector when the motor is operated on VFD power.

**WARNING:** Power Factor Correction Capacitors:

Power factor correction capacitors should never be installed between the drive and the motor.

#### A CAUTION: VFD / Motor Setup:

It is the responsibility of the startup personnel during set up of the VFD / motor system to properly tune the drive to the motor for the specific application per the VFD user manual. The correct voltage boost and volts per hertz settings are application dependent and unique to each motor design. Failure to connect over temperature devices (when provided) will void the warranty.

#### 3.3.5.1 Overspeed Capability:

Belted loads: Do not exceed 125% of 60 Hz operating RPM.
Table 3-4 Maximum Safe Continuous Speed (RPM)
For Coupled and Direct Connected Loads

NEMA / [IEC] Frame Size	2-Pole	4, 6, or 8 Pole
56-180 [80-110]	7200 *	5400 *
210-250 [130-160]	5400 *	4200*
280 [180]	5400 *	3600
320 [200]	4500 *	3600
360 [225]	4500 *	2700
400-440 [250-280]	3600	2700
>440 [>280]	3600	1800

<sup>\* =</sup> Fan cooled motors (Totally Enclosed & Hazardous Locations Motors) are limited to a maximum safe continuous speed of 4000 RPM For higher speeds or shortened duty cycle contact motor manufacturer

**3.3.5.2 Cable Lengths:** For optimum insulation life, limit VFD to motor cable lengths of general purpose motors

to Table 3-5 values. Definite purpose VFD motors may accommodate longer cable lengths. For additional information contact motor manufacturer.

**Table 3-5 Max Cable Lengths General Purpose Motors**These values are based on 3 kHz carrier frequency. Add suitable VFD output-side filters when exceeding the listed values

valaco.			
Frame Size	230V	460 V	575 V
NEMA 56-320	600 ft.	125 ft.	40 ft.
NEMA 360-5011	1000 ft.	225 ft.	60 ft.
IEC 80-200	180 m.	40 m.	12 m.
IEC 225-280.	300 m.	70 m.	18 m.

**3.3.5.3 VFD Grounding:** Equipment grounding conductors may be run in the same conduit as the AC motor power leads. This wire must be used as the equipment ground for the motor and not as the fourth current carrying wire of a "WYE" motor circuit. The grounded metal conduit carrying the output power conductors can provide EMI shielding, but the conduit does not provide an adequate ground for the motor; a separate grounding conductor must be used. Grounding the motor neutral (WYE) of a VFD powered motor may result in a VFD ground fault trip. Improper grounding of an inverter fed motor may result in frame voltages in excess of 500 Volts. Refer to Grounding section 3.4.4

#### 3.3.5.4 VFD - Single Phase:

#### **CAUTION: SINGLE PHASE MOTOR FAILURE:**

Single Phase motors are **NOT** suitable for use on VFD power. Connecting a Single Phase Motor to a VFD voids the warranty.

#### 3.3.5.5 Stray Voltage on Accessory Leads:

VFD's will couple stray (common-mode) voltage to motormounted RTDs, thermistors, thermostats and space heaters. The leads of these elements must be properly insulated and control input circuits must be designed to withstand this common-mode voltage.

#### 3.3.6 ACCESSORIES / PROVISIONS:

**3.3.6.1 General:** Carefully read and understand the accessory manufacturer's instructions, supplied with motor. Contact the manufacturer for additional information.

#### 3.3.6.2 Brake Motors:

#### CAUTION: Vertical Motor Premature Brake Failure

Motors with brakes that are designed for vertical applications are equipped with springs to support the brake pressure plate. Mounting a horizontal brake motor vertically shaft up or down may require a pressure plate spring modification. Failure to modify the brake for the vertical application may result in premature brake failure. If in question, consult brake literature or brake manufacturer.

**Brake Solenoid Wiring:** Do NOT connect the brake solenoid to the output of a VFD. The brake solenoids must be wired to 50/60 Hz line power

#### 3.3.6.3 Space Heaters:

Motors provided with space heaters have two leads that are brought into the conduit box or into an auxiliary box. These leads are marked "H1", "H2" ("H3", "H4" if a second space heater is supplied). See the space heater nameplate on motor for heater rating.

#### ▲ WARNING: DIVISION 2 EXPLOSION HAZARD

The space heater temperature rating when used in Class I, Division 2 motors shall **NOT** exceed 80% of the auto ignition temperature of the hazardous gas or vapor. See the space heater nameplate on motor for heater Temperature Code and heater rating. Failure to follow this instruction could result in serious personal injury, death and/or property damage

#### 3.3.6.4 Thermal Protection:

<u>General Information:</u> When thermal protection is provided, one of the following will be stamped on the nameplate:

- I. "THERMALLY PROTECTED" This motor has built in thermal protection. Thermal protectors open the motor circuit electrically when the motor overheats or is overloaded. The protector cannot be reset until the motor cools. If the protector is automatic, it will reset itself. If the protector is manual, disconnect motor from power supply. After protector cools (five minutes or more) press the reset button and reapply power to the motor. In some cases a motor is marked "Auto" and the connection diagram on the motor will identify T'Stat leads see "2" below. (See warnings on Manual and Automatic reset protectors section 1.1)
- 2. "WITH OVERHEAT PROTECTIVE DEVICE": This motor is provided with an overheat protective device that does not directly open the motor circuit. Motors nameplated with this phrase have either thermostats, thermisters or RTD's. The leads to these devices are routed into the motor conduit box or into an auxiliary box. The lead markings are defined on the nameplate (normally "P1", "P2"). The circuit controlled by the overheat protection device must be limited to a maximum of 600 volts and 360 volt-amps. See connection decal provided inside the terminal box cover. Failure to connect these over temperature devices (when provided) will void the warranty.

#### **WARNING: EXPLOSION HAZARD**

For Hazardous Locations motors provided with thermostats UL and the NEC require connection of thermostat leads into the control portion of a manual reset start circuit. Failure to follow this instruction could result in serious personal injury, death and/or property damage

Resistance Temperature Detectors (RTD): When winding and/or bearing RTDs are provided the RTD lead markings are defined on the nameplate. (Normally "R1", "R2", "R3" etc.)

#### 3.3.6.5 RTD Alarm & Trip Settings:

Tables 3-6 & 3-7 are suggested initial RTD alarm and trip settings. For motors found to operate significantly below these values the settings may be reduced accordingly.

Table 3-6 Winding RTD – Temperature Limit (°C) 40 °C Max Ambient

Motor Load	Class B Temp Rise≤ 80°C		Class F Temp Rise≤ 105°C		
	Alarm	Trip	Alarm	Trip	
Up to 1.0 SF	130	140	155	165	
>1.0 to 1.15 SF	140	150	160	165	

Table 3-7 Bearing RTD – Temperature Limit (°C) 40 °C Max Ambient

Ambient	Alarm	Trip
Up to 40 <b>°C</b>	95	100
> 40 <b>°C</b>	110	115
Bearings that are Heat Stabilized to 150 °C	130	135

#### 3.3.7 GUARDS:

**MARNING:** ROTATING PARTS HAZARD

When devices are assembled to the motor shaft, be sure to install protective devices such as belt guards, chain guards, and shaft covers. These devices must protect against accidental contact with extremities, hair, and clothing. Consider the application and provide guarding to protect personnel. Remove all unused shaft keys and loose rotating parts to prevent them from flying off and causing bodily injury. Failure to follow this warning could result in serious personal injury, death and/or property damage.

#### 3.4 ELECTRICAL CONNECTIONS:

WARNING: ELECTRICAL HAZARDS

Before proceeding read Section 1-1 on Electrical Safety. Failure to follow the instructions in Section 1-1 could result in serious personal injury, death and/or property damage

#### 3.4.1 POWER SUPPLY / BRANCH CIRCUIT

WARNING: POWER SUPPLY INCOMPATIBILITY HAZARD Check power supply to make certain that voltage, frequency and current carrying capacity are in accordance with the motor nameplate. Failure to match motor nameplate values could result in serious personal injury, death and/or property damage

A WARNING: BRANCH CIRCUIT SUPPLY HAZARD

Motor and control wiring, fusing, overload protection, disconnects, accessories and grounding must always conform to the applicable electrical codes as well as local codes and sound practices.

**3.4.1.1 Branch Circuit Supply** to a motor should include a disconnect switch, short circuit current fuse or breaker protection, motor starter (controller) and correctly sized thermal elements or overload relay protection.

#### 3.4.1.2 Fuses, Breakers, Overload Relays

Short Circuit Current Fuses or Breakers are for the protection of the branch circuit. Starter or motor controller overload relays are for the protection of the motor. Each of these should be properly sized and installed per the applicable electrical codes as well as local codes and practices.

#### MARNING: PROTECTIVE DEVICE DISABLED HAZARD

DO NOT bypass or disable protective devices. Protection removal could result in serious personal injury, death and/or property damage

#### 3.4.1.3 AC Power Supply Limits

Motors are designed to operate within the following limits at the motor terminals:

- 1- AC power is within +/- 10 % of rated voltage with rated frequency applied. (Verify with nameplate ratings) **OR**
- 2- AC power is within +/- 5% of rated frequency with rated voltage **OR**
- 3- A combined variation in voltage and frequency of +/- 10% (sum of absolute values) of rated values, provided the frequency variation does not exceed +/-5% of rated frequency.
- 4- For 3 phase motors the line to line full load voltage must be balanced within 1%.
- 5- If the motor is rated 208-230V, the voltage deviations must be calculated from 230V.

#### **CAUTION: Reduced Motor Performance**

Operation outside of these limits will degrade motor performance and increase operating temperature.

#### 3.4.2 TERMINAL BOX:

#### **3.4.2.1 Conduit Opening:** For ease of connections,

motors are typically provided with large terminal boxes. Most motors have conduit access in 90 degree increments, the terminal box conduit opening is typically provided via knockouts, holes with covers, or the terminal box is rotate-able. Fabricated conduit boxes may have a removable plate for the installer to provide correctly sized hole(s).

#### 3.4.2.2 Hazardous Locations Motors:

#### ▲ WARNING: EXPLOSION HAZARDS

(1) Terminal Boxes mounted to motor with a pipe nipple: If a pipe nipple mounted terminal box is removed or rotated it must be reassembled with a minimum of five full threads of engagement.

(2) Component Removal: Do not set a terminal box component on its machined surfaces. Prior to component reassembly wipe clean all machined surfaces.

(3) Machined Surface Gap (Hazardous Locations Terminal Boxes): The gap between mating surfaces with the machined terminal box MUST BE LESS THAN 0.002 inches. This gap must be checked with a feeler gage along the entire perimeter. If there is visible damage to the mating surfaces, or if the gap between these surfaces exceeds 0.002 inches, DO NOT complete the installation and contact the motor manufacturer. Failure to follow these instructions could result in serious personal injury, death and/or property damage

#### 3.4.3 LEAD CONNECTIONS

Electrical connections to be made per nameplate connection diagram or separate connection plate. In making connections follow the applicable electrical code as well as local codes and practices.

#### **▲ WARNING: ELECTRICAL CONNECTION HAZARD**

Failure to correctly connect the motor leads and grounding conductor can result in injury or death. Motor lead connections can short and cause damage or injury if not well secured and insulated.

#### 3.4.3.1 Wire Size (Single Phase) Requirements

The minimum wire size for Single Phase, 115 & 230 Volt Circuits must meet table 3-8 for a given distance between motor and either Fuse or Meter Box.

Table 3-8 Minimum Wire Gage Size Single Phase 115 & 230 Volt Circuits

	Distance (Feet) - Motor to Fuse or Meter Box								
Motor	100	Ft.	200	Ft.	300	300 Ft.		Ft.	
HP	115	230	115	230	115	230	115	230	
1/4	14	14	10	12	8	10	6	8	
1/3	12	14	10	12	6	10	4	8	
1/2	10	12	8	10	6	8	4	6	
3/4	10	12	6	10	4	8	2	6	
1	8	10	6	8	4	6		4	
1 1/2	4	10	0	8		6		4	
2		8		6		4		2	
3		8		6		4		2	
5		6		4		2		0	

#### 3.4.3.2 Extension Cords (Single Phase Motors):

Where an extension cord(s) is utilized to provide power to the motor the extension cord(s) must be...(1) the proper gauge size per table 3-8, (2) in good working condition (3) properly grounded.

#### 3.4.4 GROUND CONNECTION(S):

#### A WARNING: ELECTRICAL GROUNDING HAZARD

For general information on grounding (USA) refer to NEC Article 250. Improper grounding of an inverter fed motor may result in frame voltages in excess of 500 Volts. In making the ground connection, the installer must make certain that a good electrical connection is obtained between motor and grounding lead. Failure to properly ground motors, per the applicable national code (such as NEC Article 430) and local codes may cause serious injury or death to personnel.

**Primary "Internal" Ground:** A grounding conductor must be connected to the grounding terminal provided in the terminal housing. This grounding terminal is either a ground screw, ground lug, or a tapped hole to be used with a separately provided ground screw. The internal grounding feature is accessible inside the terminal housing and must be used as the primary grounding connection.

Secondary "External" Ground: Some motors are provided with a supplemental grounding terminal located on the external surface of the motor frame or feet. This external terminal is for supplemental bonding connections where local codes permit or require such connection

#### 3.4.5 START UP:

WARNING: ELECTRICAL SHOCK HAZARD:

Be certain that all connections are secure and the conduit box cover is fastened in place before electrical power is connected. Failure to follow these instructions could result in serious personal injury, death, and/or property damage.

#### ▲ WARNING: LOOSE & ROTATING PARTS HAZARD

Before proceeding read Section 1-2 on Mechanical Safety. Failure to follow the instructions in Section 1-2 could result in serious personal injury, death and/or property damage

## MARNING: EXCESSIVE SURFACE TEMPERATURE HAZARD

Motors with the temperature code stated on the nameplate are designed to operate within this limit. Improper application or operation can cause the maximum surface temperature to be exceeded. A motor operated in a Hazardous Location that exceeds this surface temperature limit increases the potential of igniting hazardous materials. Therefore, motor selection, installation, operation, and maintenance must be carefully considered to ensure against the following conditions: (1) Motor load exceeds service factor value, (2) Ambient temperature above nameplate value, (3) Voltages outside of limits (3.4.1.3), (4) Loss of proper ventilation, (5) VFD operation exceeding motor nameplate rating, (6) Altitude above 3300 feet / 1000 meters, (7) Severe duty cycles, (8) Repeated starts, (9) Motor stall, (10) Motor reversing, and (10) Single phase operation. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

#### A CAUTION: HOT SURFACE

Normal motor surface temperatures may exceed 90  $^{\circ}$  C (194 $^{\circ}$  F). Touching the motor frame may cause discomfort or injury. Surface temperatures should only be measured with suitable instruments and not estimated by hand touch.

#### 3.4.5.1 Start Up - No Load Procedure

- Check Instructions: Before startup carefully read and fully understand these instructions including all warnings, cautions, and safety notice statements.
- Motor out of storage after more than three months: Check winding insulation integrity with a Megger. If winding resistance to ground is less than 1.5 Meg-ohms consult the local authorized service shop before energizing the motor.
- 3. Check Installation: Mechanical Check tightness of all bolts and nuts. Manually rotate the motor shaft to ensure motor shaft rotates freely. Note: Shaft & bearing seals will add drag. Electrical Inspect all electrical connections for proper terminations, clearance, mechanical tightness and electrical continuity. Be sure to verify connections are made per the nameplate connection diagram or separate connection plate. Replace all panels and covers that were removed during installation before energizing the motor.

#### 4. Energize Motor: Check Rotation

If practical check motor rotation before coupling to the load. Unlock the electrical system. Momentarily provide power to motor to verify direction of rotation. If opposite rotation is required, lock out power before reconnecting motor. If motor has a rotational arrow only operate the motor in the rotation identified. Reapply power to ensure proper operation.

#### 5. Record No Load Amps. Watts & Voltage:

Recommend - To establish a baseline value check and record the no load amps, watts, and voltage.

#### 3.4.5.2 Start Up - Load Connected Procedure

- Check Instructions: Before startup carefully read and fully understand these instructions including all warnings, cautions, & safety notice statements.
- Coupling Installation: Check that the connected equipment is properly aligned and not binding. Check that all guards and protective devices are properly installed.
- 3. Energize Motor: When all personnel are clear of the machine, apply power and verify that the load is not transmitting excessive vibration back to the motor though the shaft or the foundation. Verify that motor amps are within nameplate rating. For repeated starts see 3.4.5.3. The equipment can now be fully loaded and operated within specified limits as stated on the nameplate.

#### 3.4.5.3 Jogging and/or Repeated Starts

Do not start more than twice in succession under full load. Repeated starts and/or jogs of induction motors can cause overheating and immediate failure. Contact the motor manufacturer if it is necessary to repeatedly start or jog the motor.

#### **4.0 MAINTENANCE:**

#### WARNING: Hazardous Locations Motor Repair HAZARD:

Division 1 Hazardous Locations motors can only be modified or repaired by the manufacturer or a facility that is Listed under UL's category "Motors and Generators, Rebuilt for use in Hazardous Locations". Failure to follow these instructions could result in serious personal injury, death and/or property damage.

#### MARNING: ELECTRICAL SHOCK HAZARD

Electrical connections are to be made by qualified electrical personnel in accordance with all applicable codes, ordinances and sound practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage. Only qualified personnel who are familiar with the applicable national codes, local codes and sound practices should install or repair electric motors and their accessories.

#### **WARNING:** ELECTRICAL LIVE CIRCUIT HAZARD

Do not touch electrically live parts. Disconnect, lockout and tag input power supply before installing or servicing motor (includes accessory devices).

#### **4.1 GENERAL INSPECTION**

Inspect the motor approximately every 500 hours of operation or every three months, whichever occurs first. Keep the motor clean and the ventilation and fin openings clear. The following steps should be performed at each inspection:

- **4.1.1 VENTILATION:** Check that the ventilation openings and/or exterior of the motor is free of dirt, oil, grease, water, etc, which can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
- **4.1.2 INSULATION**: Use a "Megger" periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. If winding resistance to ground is less than 1.5 Meg-ohms consult the local authorized service shop before reenergizing the motor.
- **4.1.3 ELECTRICAL CONNECTIONS:** Check all electrical connectors to be sure that they are tight.

#### **4.2 LUBRICATION & BEARINGS:**

The lubricating ability of grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Longer bearing life can be obtained if the listed recommendations are followed:

NOTE: If lubrication instructions are provided on the motor nameplate, the nameplate instructions will supersede these instructions. Motors marked "Permanently Lubricated" do not require additional service.

#### CAUTION: BEARING / MOTOR DAMAGE WARNING

Lubricant should be added at a steady moderate pressure. If added under heavy pressure bearing shield(s) may collapse. Over greasing bearings greatly increases bearing friction and can cause premature bearing and/or motor failure.

**4.2.1 GREASE TYPE** (unless nameplate states otherwise): Nameplate Ambient Temperature between -30°C (-22°F) to 65°C (150°F) inclusive: Recommended grease for standard service conditions is Mobil Polyrex ® EM. Equivalent and compatible greases include: Texaco Polystar RB, Rykon Premium #2, Pennzoil Pen 2 Lube, Chevron SRI & Mobil SHC 100.

Nameplate Ambient Temperature below -30°C (-22°F): Special low temperature grease is recommended, such as Aeroshell 7 or Beacon 325 for ball bearings and Mobil SHC 100 for roller bearings.

Nameplate Ambient Temperature above 65°C (150°F): Dow Corning DC44 or equivalent, a special high temperature grease is required. Note that Dow Corning DC44 grease does not mix with other grease types.

For RTD settings see Table 3-7.

#### **4.2.2 BEARING OPERATING TEMPERATURE:**

A CAUTION: HOT SURFACE

The external surface temperature of the end shield (bracket) bearing hub may reach 100° C (212° F) during normal operation. Touching this surface may cause discomfort or injury. Surface temperatures should only be measured with suitable instruments and not estimated by hand touch.

#### 4.2.3 LUBRICATION INTERVALS: (For motors with regreasing provisions)

#### Eq. 4.2 <u>Lubrication Interval</u> = [(Table 4-1) hrs] x [Interval Multiplier (Table 4-2)] x [Construction Multiplier (Table 4-3)]

Table 4-1 Lubrication Intervals (Hours) These values are based on average use.

	Operati	Operating Speed – RPM (See Table 3.4 for Maximum Operating Speed)					
NEMA / [IEC] Frame Size	<7200	<5400	<4500	<3600	<1800	<1200	
56-180 [80-110]	2500 Hrs.	4000 Hrs	5000 Hrs	6000 Hrs.	17000 Hrs.	20000 Hrs.	
210-250 [130-160]		2500 Hrs	4000 Hrs	5000 Hrs.	12000 Hrs.	16000 Hrs.	
280 [180]		2000 Hrs	3000 Hrs	4000 Hrs.	10000 Hrs.	14000 Hrs.	
320 [200]			2000 Hrs	3000 Hrs.	9000 Hrs.	12000 Hrs.	
360 [225]			1500 Hrs	2000 Hrs.	8000 Hrs.	10000 Hrs.	
400-440 [250 – 280]				1500 Hrs.	4000 Hrs.	7000 Hrs.	
>440 [>280]				1000 Hrs.	3000 Hrs.	5000 Hrs.	

Seasonal Service: If motor remains idle for more than six months, Lubricate at the beginning of the season, then follow lubrication interval. Do not exceed maximum safe operating speed Table 3-4 without manufacturer's approval

**Table 4-2 Service Conditions** 

Use highest level Multiplier: Maximum Ambient Temperature and Contamination are independent factors

Severity of Service	Maximum Ambient Temperature	Atmospheric Contamination	Multiplier
Standard	Less than 40° C (104° F)	Clean, Slight Corrosion, indoors, less than 16 hrs per day	1.0
Severe	Above 40° C (104° F) to 50° C	Moderate dirt or Corrosion or outdoors or more than 16 hrs per day	0.5
Extreme	Greater than 50° C or Class H Insulation	Severe dirt or Abrasive dust or Corrosion	0.2

**Table 4-3 Construction Multiplier** 

Construction	Multiplier
Angular Contact or Roller Bearing	0.5
Vertical Motor	0.5
All others	1.0

**Table 4-4 Relubrication Amounts** 

Frame	Size	Volume				
NEMA	IEC	Cu. In.	Fluid oz	ml		
48-56	80	0.25	0.14	4.0		
143-145	90	0.25	0.14	4.0		
182-184	110	0.50	0.28	8.0		
213-215	130	0.75	0.42	12.5		
254-256	160	1.00	0.55	16.0		
284-286	180	1.50	0.83	25.0		
324-326	200	2.00	1.11	33.0		
364-365	225	3.00	1.66	50.0		
404-405	250	3.80	2.11	62.0		
444-449	280	4.10	2.27	67.0		
>449	>280	4.50	2.50	74.0		

For regreasing while operating multiply volume by 125%.

## 4.2.4 LUBRICATION PROCEDURE: (For Motors with Regreasing Provisions)

#### **CAUTION: BEARING DAMAGE WARNING**

Added grease must be compatible with the original equipment's grease. If a grease other than those stated in 4.2.1 is to be utilized contact the motor manufacturer. Nameplate information supersedes section 4.2.1 (GREASE TYPE). New grease must be free of dirt. Failure to follow these instructions and procedure below may result in bearing and/or motor damage.

For an extremely dirty environment, contact the motor manufacturer for additional information.

#### **LUBRICATION PROCEDURE:**

- 1. Clean the grease inlet plug or zerk fittings prior to regreasing.
- (If present) Remove grease drain plug and clear outlet hole blockage.

#### **CAUTION: GREASE DRAIN PLUGGED:**

Old grease may completely block the drain opening and must be mechanically removed prior to regreasing. Forcing a blocked drain open by increased greasing pressure may collapse bearing shields and / or force excess grease through the bearings and into the motor.

- 3. Add grease per Table 4-4
- **4.** Re-install grease inlet and drain plugs (if removed).

#### **WARNING: EXPLOSION HAZARD**

**Do NOT** energize a Hazardous Locations motor without all grease fittings properly installed.

#### 4.2.5 EXAMPLE: LUBRICATION

Assume - NEMA 286T (IEC 180), 1750 RPM Vertical motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

- 1. Table 4-1 list 10,000 hours for standard conditions.
- Table 4-2 classifies severity of service as "Severe" with a multiplier of 0.5.
- **3.** Table 4-3 lists a multiplier value of 0.5 for "Vertical"
- **4.** (Eq. 4.2) Interval =  $10,000 \text{ hrs } \times 0.5 \times 0.5 = 2500 \text{ hrs}$

Table 4-4 shows that 1.5 in of grease is to be added.

Relubricate every 2,500 hrs of service with 1.5 in of recommended grease.

#### 4.3 TROUBLE-SHOOTING

WARNING: READ INSTRUCTIONS:

Before trouble-shooting a motor, carefully read and fully understand the warnings, cautions, & safety notice statements in this manual.

**▲ WARNING:** Hazardous Locations Motor Repair:

Motors nameplated for use in Division 1 Hazardous Locations can only be disassembled, modified or repaired by the plant of manufacturer or a facility that is Listed under UL's category "Motors and Generators, Rebuilt for use in Hazardous Locations". Failure to follow these instructions could result in serious personal injury, death and/or property damage

#### **CAUTION: DISASSEMBLY APPROVAL REQUIRED:**

Motor disassembly must be performed by a party approved by the motor manufacturer. To disassemble the motor without approval voids the warranty.

#### 4.3.1 GENERAL TROUBLE-SHOOTING WARNINGS

- 1. DISCONNECT POWER TO THE MOTOR BEFORE PERFORMING SERVICE OR MAINTENANCE.
- 2. Discharge all capacitors before servicing motor.
- Always keep hands and clothing away from moving parts.
- Be sure required safety guards are in place before starting equipment.
- 5. If the problem persists contact the manufacturer.

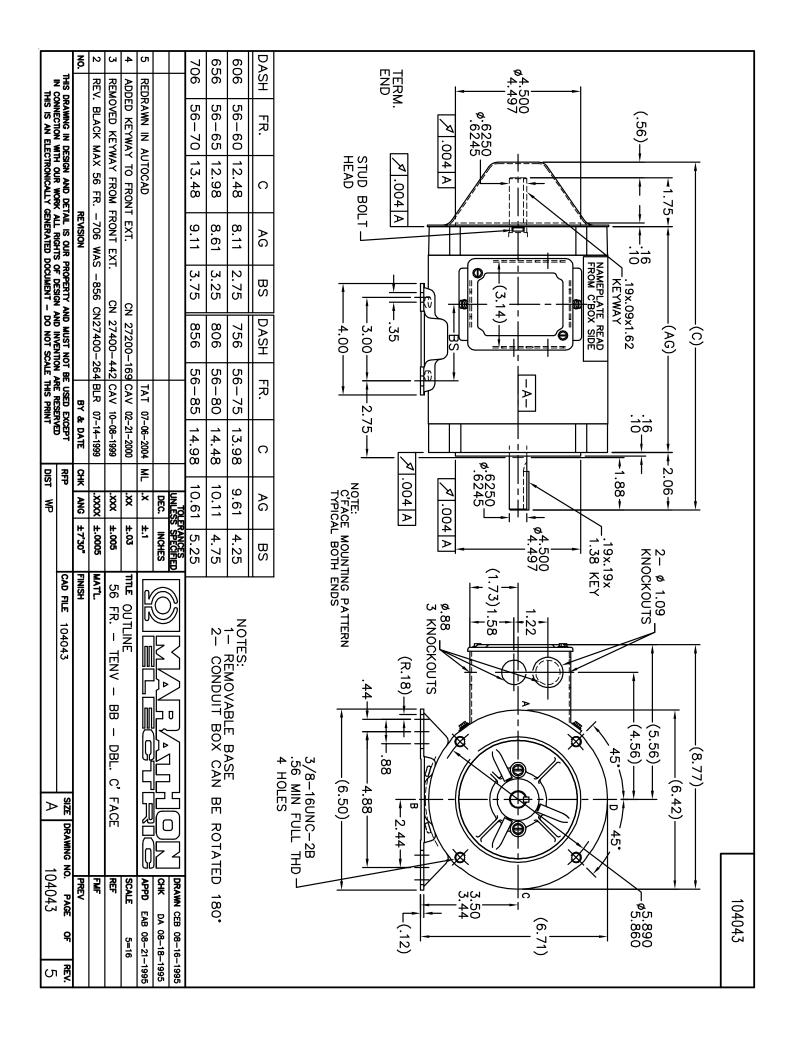
4.3.2 Motor Trouble-shooting Cause / Corrective Action - Table 4-5

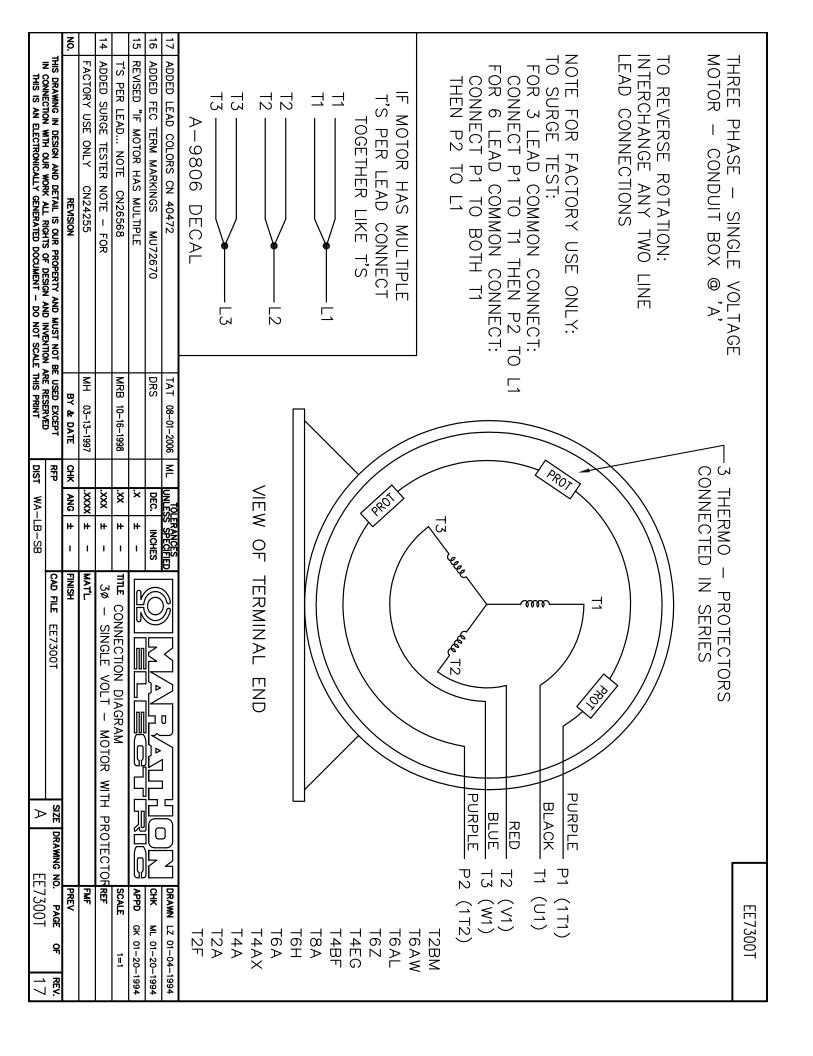
loo		Likely Cause:	Corrective Action:
		Likely Cause:	
Mot	or 1	fails to start upon initial installation:	
4	<b>A</b> .)	Supply voltage is too low or is severely unbalanced (one phase is low or missing).	(1) Check power supply fuses (2) Match motor lead wiring to nameplate connection diagram and supply voltage (3) Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3). Correct as needed (4) Obtain correct
E	В.)	Motor leads are miswired at conduit box.	motor to match actual supply voltage.
	C.)	Driven load exceeds motor capacity	(1) Verify that motor & load turn freely (2) Disconnect motor from load & ensure motor turns freely. Note: Roller bearings make noise when motor is uncoupled and shaft is rotated (3) Verify that motor starts when disconnected from load (4)
<b>⊢</b> ⊢	D.)	Load is jammed.	Remove excessive / binding load if present.
E	E.)	Fan guard is bent and making contact with fan	Replace fan guard & fan (if blades are damaged)
F	F.)	VFD with power factor capacitors installed	Remove power factor correction capacitors if equipped
(	G.)	VFD with motor neutral lead grounded	Ensure that motor neutral lead is ungrounded
÷	Н.)	VFD programmed incorrectly	(1) Repeat checks listed above (2) Verify that VFD current limit and starting boost are set correctly (5) Double-check motor and feedback parameter settings and VFD permissives (6) Repeat autotune (for vector drives) procedure (7) Consult VFD supplier.
Mot	or l	has been running, then slow down, s	stalls, or fails to restart:
,	<b>A</b> .)	Supply voltage has drooped or has become severely unbalanced	(1) Replace fuse or reset circuit breaker. Allow motor to cool down before resetting manual protector on motor. <b>Warnings</b> - See section 1.1 for automatic and manual reset protector warnings (2) Verify that rated and balanced supply voltage has been restored before restarting motor. Measure voltage during restart. Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3).
E	В.)	Motor is overloaded	(1) Verify that motor & load turn freely. Repair binding components as needed (2)
0	C.)	Motor bearings are seized	Reduce driven load to match motor capacity or increase motor size to match load
	D.)	Load Is jammed.	requirements.
E	E.)	VFD will not restart motor after tripping	(1) Check fault codes on VFD and follow VFD troubleshooting procedures (2) Verify that VFD input voltage is balanced and within limits (3) Remove excessive mechanical load if present.
F	F.)	Capacitor failure on single phase motor (if equipped)	Warning: Potential Shock Hazard: Contact service shop to check capacitor.
Mot	or 1	takes too long to accelerate:	
/	<b>A</b> .)	Motor leads are not connected correctly	Match motor lead wiring to nameplate diagram.
E	В.)	Supply voltage has drooped or become severely unbalanced.	(1) Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3). Correct as needed (2) Obtain correct motor to match actual supply voltage.
	C.)	Load exceeds motor capability	Determine correct motor size and contact motor representative to obtain replacement motor.
[	D.)	Faulty start capacitor (Single Phase)	Motor may be too small for load. Record acceleration time. Start capacitors may fail if acceleration time exceeds 3 seconds.
E	E.)	Mechanical Failure	(1) Check to make sure motor & load turn freely (2) Disconnect motor from load & ensure motor turns freely
Mot	or ı	rotates in the wrong direction:	
	<b>A</b> .)	Incorrect wiring connection at motor	[Single Phase] Reconnect motor according to wiring schematic provided. Note: Some motors are non-reversible
			[Three Phase] Interchange any two power supply (phase) leads.
Mot	or	overheats or overload protector repo	eatedly trips
,	<b>A</b> .)	Driven Load is excessive	(1) If motor current exceeds nameplate value, ensure that driven load has not increased. Correct as needed. (2) If new motor is a replacement, verify that the rating is the same as the old motor. If previous motor was a special design, a general purpose motor may not have the correct performance.
	В.)	Ambient temperature too high	Most motors are designed to operate in an ambient up to 40 $^{\circ}\text{C}.$ (See section 4.2.2 Hot Surface Caution)
C	C.)	Motor cooling fins and/or vent openings blocked	Remove foreign materials — clear vent openings, fan guard air inlets and frame fins (TEFC motors)
-			TEAO (Totally Enclosed Air Over) motors: Measure airflow next to motor surface

	E.)	Motor is started too frequently	See section 3.4.5.3
	F.)	Supply voltage too low, too high, or unbalanced	(1) Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3) Correct as needed (2) Reconnect motor per input voltage (3) Obtain correct motor to match power supply.
Мо	tor	Vibrates	
	<b>A</b> .)	Motor misaligned to load.	Realign load
	В.)	Load out of balance (Direct drive application)	(1) Ensure that load is dynamically balanced: (2) Remove motor from load and inspect motor by itself. Verify that motor shaft is not bent. Rule of thumb is 0.002" runout for shafts extension lengths up to 3.00". Add 0.0005" per every additional inch of shaft length beyond 3.00".
	C.)	Uneven tension on multiple belts	Mixing new with used belts. Replace multiple belt applications with a complete set of matched belts.
	D.)		(1) De-energize motor and record vibration as load coasts from 100% speed to 0 RPM. If vibration drops immediately, vibration source is electrical. If levels do not drop immediately, source is mechanical (2) Redesign system to operate below the resonant point (3) On VFD-driven loads, program skip frequencies to bypass resonant points (4) Increase carrier frequency to obtain <3% THD current (5) On variable torque loads reduce volts/hertz below base speed.
	E.)	VFD torque pulsations	(1) Adjust VFD to obtain <3% THD current @ rated motor current (2) Adjust VFD stability for smooth operation. Vector drives may be unstable at light load.
	F.)	Motor miswired at terminal box	Match motor lead wiring to nameplate connection diagram.
	G.)	Uneven, weak or loose mounting support.	Shim, strengthen or tighten where required.
	Н.)	Motor bearings defective	Test motor by itself. If bearings are bad, you will hear noise or feel roughness. Roller bearings are normally noisy when operated without load. If sleeve bearing, add oil per nameplate instructions. For motors with regreasing provisions, add grease per relubricating instructions (see section 4.2.3). If noise persists contact warranty service.
	l.)	Motor out of balance	Disconnect from load. Set motor on rubber pads on solid floor. Secure a $\frac{1}{2}$ height key in shaft keyway and energize from balanced power supply @ rated voltage. Record vibration levels and compare with appropriate standards. If excessive vibration persists contact motor manufacturer.

Beari	ngs repeatedly fail.	
<b>A</b> .)	Load to motor may be excessive or unbalanced	(1) If belt drive check system per section 3.3.4. (2) Other than belting, check loading on motor shaft. An unbalanced load will also cause the bearings to fail. (3) Check runouts of mating components, such as a C-face and pump flange.
В.)	Bearings contaminated.	Motor enclosure not suitable for environment. Replace with correct enclosure construction
C.)	Incorrect grease or bearings for ambient extremes.	See section 4.2.1
D.)	VFD bearing damage	Ground brush, common mode filter, or insulated bearings must be added. Contact motor manufacturer.
Motor	r, at start up, makes a loud rubbing, ເ	grinding, or squealing noise.
<b>A</b> .)	Contact between rotating and stationary components	Belt squeal during across the line starting is normal: (1) Verify that supply voltage is within limits (see section 3.4.1.3). (2) Ensure that motor lead wiring matches nameplate connection diagram: (3) Isolate motor from load. (4) To locate point of contact turn motor shaft by hand. (5) If point of contact is not located contact motor service shop.
Start	capacitors repeatedly fail.	
A.)	The motor acceleration time is too long	Motor may be too small for load. Record acceleration time. Start capacitors may fail if acceleration time exceeds 3 seconds.
В.)	Motor is being started too frequently	Excessive starting will damage motor capacitors. Contact motor manufacturer if motor is started more than 20 times/hour or if acceleration time exceeds 3 seconds.
C.)	Motor voltage low	Verify that voltage at the motor terminals is within limits (see section 3.4.1.3).
D.)	Defective start switch inside motor	Motor internal switch failure overheats start capacitor. Contact service shop or motor manufacturer.
Run c	apacitor fails.	
A.)	High ambient temperature	Verify that the ambient does not exceed motor's nameplate value
		•

,		Verify that voltage to the motor terminals is within limits (see section 3.4.1.3).
C.)	Power surge to motor (caused by lightning strike or other high transient voltage).	If a common problem, install surge protector.





# Warranty Card Complete and return to validate warranty

Please complete this card and return it to **seepex** Inc. By using this card, the valid warranty period will commence at the pump "start-up" date. If this card is not completed the warranty coverage period will commence on the date the pump is shipped from the **seepex** factory. This card must be completed and mailed no later than one year from the date of shipment.

User Entity:		
Mailing Address:	Pump Mode	el#
	Pump Commission	n #:
	Pumped Produ	uct:
Contact Person:	Diff. Pressure:	Flow Rate:
Phone Number:	Temperature:	Visosity:
Fax Number:	Solids Size:	Solids %:
Was the pump delivered as scheduled? Was the appearance of the pump acceptable? Did the pump suffer any freight damage? Did Other Comments:	Yes No Did you receive:	rm as expected?Yes No - Data Sheets?Yes No -O&M Manuals?Yes No ange a start-up?Yes No
Name of person completing card (please print):		
Date:	Signature:	



seepex, Inc. 511 Speedway Drive Enon, OH 45323 Phone (937) 864-7150 Fax (937) 864-7157 www.seepex.com sales@seepex.net

#### TERMS & CONDITIONS OF SALES AND/OR REPAIR

The following terms and conditions shall apply to an order for all or any part the articles covered by this quotation unless specifically excepted therein:

#### **Prices**

Any prices quoted shall only be valid for orders placed within 30 days from the date of issue of the quotation. Prices are F.O.B. our plant in U.S. or Canadian dollars. We reserve the right to correct typographical or clerical errors.

All orders are subject to approval by our Credit Department. Unless otherwise stated, if payment for the invoice due is not made within thirty (30) days after shipment, administration fees of eighteen percent (18%) per year (equivalent to a nominal monthly interest rate of 1½%) will be applied on overdue accounts. The terms and conditions herein set forth are based upon tariffs, taxes, foreign exchange rates, delivery, and other conditions in effect on the date of this contract. In the event changed conditions, legislations, regulations, or other matters shall become applicable to any quotation, contract, or delivery hereunder, any increased exchange, duties, taxes, ocean freight, or other charges resulting from such action shall be for the customer's account and seepex, Inc. may charge such increased duties, taxes, or charges to the customer.

Unless the order includes the appropriate exemption certificates and/or licenses, duties, and taxes levied by Federal, State, or other governments are required to be charged automatically at the rate imposed at time of importation/shipment. Any change in law, regulations, or Government Department practice which causes a variation of any kind in the applicable charges from the amounts allowed for the quotation, shall result in an equivalent change in the price quoted.

Until payment is made in full, seepex, Inc. shall retain the right, without notice, to repossess and/or retain the items, and/or dispose of them, for its benefit and hold the customer responsible for any loss. Customer agrees to enter into any agreements, contracts, or notices required to confirm such rights.

In order to secure any obligations due to seepex, Inc. from the customer (whether or not under this contract) the customer grants and confirms in seepex, Inc. a security interest in:

- the merchandise covered by this contract, a)
- in all property and funds of the customer now or hereafter in seepex, Inc. possession, whether or not arising out of this contract, and in all additions, accessions, and proceeds of such merchandise and/or property. The customer hereby authorizes **seepex**, Inc. to sign alone any financing statement or statements and to do all and any other things which may be necessary to perfect such security interest.

<u>Cancellation</u>
After acceptance, orders may be canceled only with our approval and payment in accordance with contract by the customer for work performed and/or material expenses incurred by us to date of cancellation. We reserve the right to cancel the order if the customer's financial condition, in our sole judgment, places the payment in jeopardy.

No credit will be allowed for returns unless our

authorization in writing for such returns has been obtained beforehand. A copy of this authorization is to be returned with the item as the packing slip. Shipment

- Handling Charge: Customer shall be responsible for making all arrangements for shipment of the order with a suitable carrier. In the event that customer requests that seepex make arrangements for shipment, then customer agrees to pay to seepex, in addition to the applicable shipping charges, a handling charge in the amount of 10% of the shipping charges with a minimum \$5.00 to a maximum charge of \$150.00, with special services requiring
- additional charges.

  New Articles: Where shipping instructions indicate no exact routing, our best judgement will be used in determining routing but we shall not be liable for any charges beyond F.O.B. point. If change are made at customer's request in a) F.O.B. point, b) in our normal routing from either the manufacturers' or our own plants and in these changes involve extra costs, such costs shall be for the customer's account, unless otherwise noted on the seepex price
- Repair Work: Defined as work and services performed by **seepex**, Inc. All orders shall be delivered to and picked up from our plant unless otherwise specified. All costs of delivery shall be for the customer's account unless otherwise agreed to in writing prior to shipment.
- All Orders: On collect freight shipments, cartage charges from plant to carrier are for customer's account. Title to articles passes to customer upon delivery to carrier acting as customer's agent subject to any right of retention by us. All claims for shortage in, and damages in, shipment or otherwise must be reported to carrier immediately upon receipt with copy or report to ourselves within five (5) days.

#### <u>Guarantee</u>

- New Articles: We guarantee articles of our manufacture against defects in material and/or workmanship for a period of three (3) vears from date of acceptance, providing that the articles have been installed, maintained, and operated in accordance with our recommendations and instructions.
- Repair Work: Defined herein as work and services performed by seepex, Inc. We

- guarantee all work and services performed by us against defect arising from workmanship and/or materials provided by us for a period of ninety (90) calendar days from the date of shipment to customer.
- All Orders: Claims shall be submitted promptly in writing to seepex, Inc. Replacement and/or repair under guarantee shall be made F.O.B. our plant. Our liability under these guarantees is limited to the replacement and/or repair only of defective material or workmanship and in no event shall seepex, Inc. be liable for any loss or damage of whatever kind of nature out of defects in material and/or workmanship, or resulting from delay, or loss of use of articles, or any installation into which the article may be installed, or arising out, of the contract of the work or service or from negligence.

seepex, Inc. shall not be liable for any loss or damage resulting from delay and/or late delivery due to causes beyond our reasonable control. In no event shall seepex, Inc. be liable for any claim exceeding the amount of this order. Our guarantee on products of other than our own manufacture is limited to the guarantee extended to us by the original manufacturer. On any claims for repairs and/or replacement under such guarantee, all costs incurred by us which are not underwritten by the original manufacturers shall be for the claimant's account. Except as stated above no representations, conditions, or warranties are made with respect to products, work, or services, express or implied verbal or otherwise, including warranties of merchantability and fitness. Our guarantee and warranty shall not apply to materials or workmanship which have been subject to misuse, neglect, or accident. seepex, Inc. shall be held free and harmless from any dispute or claim anywhere arising relating to infringement of patent, design, trademark, or copyright of items, sold or repaired under this contract.

#### Property rights and risks

The customer's property at all times shall remain at the risk of the customer while being worked on by our personnel or on our premises and shall not be responsible for any loss or damage to the customer's property resulting from any cause

Title to and rights in relation to item sold under this contract/quotations shall remain with seepex, Inc. until such items are paid for, subject to risk on products sold passing to the customer upon acceptance by a carrier or other, which shall constitute good delivery.

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Finnland Griechenland Island Italien Norwegen Polen Portugal Rumänien Russland

Europa:

Schweiz Spanien Tschechische Republik Ungarn

Argentinien Chile Equador Kanada Kolumbien Mexiko Panama Peru Puerto Rico

Amerika: Asien: Brunei Indien Indonesien Iran Israel Japan Kasachstan Korea Kuwait Venezuela Pakistan Philippinen Saudi Arabien

> Singapur Taiwan Thailand V.A.E

Afrika:

Ägypten Südafrika

Ozeanien:

Australien

Neuseeland

Ausgabe Dokument Blatt 02.01.2006 OM.ADR.01d 2(2)issue

## **JOHN MEUNIER**

Meadowbank mining Corp. ACP-700R Technical Data Sheet Reference: NC01

**SAFETY RELIEF VALVE** 



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# TOP VALVE\*\*\*

## **Back Pressure & Pressure Relief Valves**

Designed to Enhance the ACCURACY and SAFETY of Metering Pumps



**Back Pressure/Anti-Siphon and Pressure Relief Valves** 

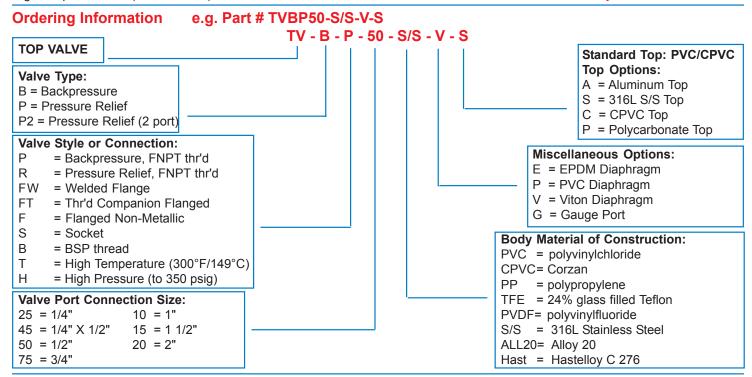
- Long life diaphragm
- Range to 350 PSIG
- Built-in air release and optional gauge port
- Available in PVC, CPVC, PVDF, polypropylene, Teflon, stainless steel, Alloy 20 and Hastelloy C
- 7 sizes (1/4" 2" threaded, flanged or socket)
- Color coded handles indicate size at a glance
- High temperature valves available to (300°F/149°C)

For detailed product information visit our website: primaryfluid.com

### Back Pressure/Anti-Siphon and Pressure Relief Valves

#### **Description**

This line of diaphragm style, back pressure/anti-siphon and pressure relief valves features a completely adjustable pressure range to 350 PSIG and a built-in air release to reduce priming difficulties. The valves are available in sizes from 1/4" through 2", eight materials of construction, offer a three year warranty and are available with socket weld, flanged or special threaded connections. High temperature to (300°F/149°C) valves are available. *CRN certification available*. *Please contact factory*.



#### Flow Rates

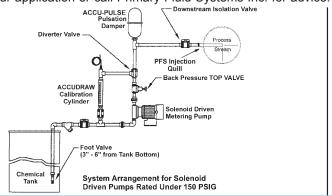
Flow capacity through TOP VALVE back pressure/anti-siphon and pressure relief valves under continuous flow conditions @ 50 PSIG with ambient temperature water.

Size	1/4"	1/4" / 1/2"	1/2"	3/4"	1"	1 1/2"	2"
Flow rate USGPM	4	4	6	8	14	25	40

Note: Capacities will increase with pressure. If pressure is doubled, flow rate wll approximately double. For capacities of valves with pulsating flow, use approximately 1/3 of the given flow rates.

#### **Typical Installations**

The installations below are typical installation examples only. Consult your engineering department for the appropriate installation of your application or call Primary Fluid Systems Inc. for advice.



Pressure Relief
TOP VALVE

Pressure Relief
TOP VALVE

Process
Siream

ACCUDRAW
Calibration
Cylinder

(3" - 6" from Tank Bottom)

System Arrangement for Solenoid Driven
(Above 150 PSIG) or Motor Driven Pumps

**Distributed By:** 



Call Toll Free 1-800-776-6580 Tel: (905) 333-8743

Fax: (905) 333-8743

E:Mail: primary@primaryfluid.com www.primaryfluid.com





## **JOHN MEUNIER**

Meadowbank mining Corp. ACP-700R Technical Data Sheet Reference: NC01

#### **CALIBRATION CYLINDER**

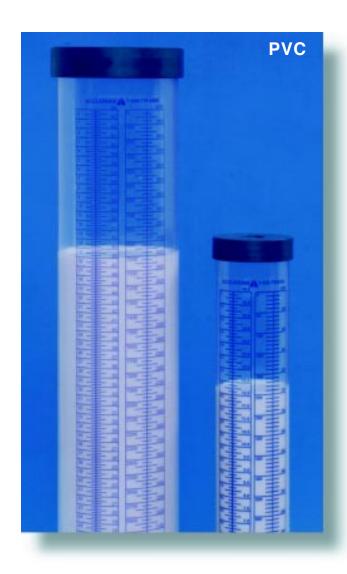


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# **ACCUDRAW®** Calibration Cylinders





ACCUDRAW® has been developed for the accurate calibration of metering pumps. Standard features include:

- · translucent
- chemical resistant
- · break resistant
- threaded or socket
- colored graduations and lettering

- PVC has dual scale USGPH & ml
- PVC sizes 100 20000 ml
- POLY sizes 100 4000 ml
- POLY meets ISO standards
- custom sizes and other materials (acrylic, glass) on request



# ACCUDRAW® Calibration Cylinders "For Accuracy That Counts"

#### Sizing and Ordering Information

#### Polypropylene Construction

- 71-			_	
Size	Conn.	BC	BTC	BDC
100 ml	1/2" NPT	AC#1-100	AC#2-100	AC#3-100
250 ml	1/2" NPT	AC#1-250	AC#2-250	AC#3-250
500 ml	1/2" NPT	AC#1-500	AC#2-500	AC#3-500
1000 ml	1/2" NPT	AC#1-1000	AC#2-1000	AC#3-1000
2000 ml	1.0" NPT	AC#1-2000	AC#2-2000	AC#3-2000
4000 ml	1.0" NPT	AC#1-4000	AC#2-4000	AC#3-4000

BC = bottom connection only, open top BTC= bottom and top connections BDC= bottom connection and dust cover top

#### **PVC Construction**

	Size/Scale	Conn	BC	ВТС	BDC
1	100 ml/ 1.6 GPH	1/2" NPT	PV#1-100	PV#2-100	PV#3-100
	250 ml/ 4 GPH	1/2" NPT	PV#1-250	PV#2-250	PV#3-250
	500 ml/ 8 GPH	1/2" NPT	PV#1-500	PV#2-500	PV#3-500
	1000 ml/ 16 GPH	1/2" NPT	PV#1-1000	PV#2-1000	PV#3-1000
	2000 ml/ 32 GPH	1.0" NPT	PV#1-2000	PV#2-2000	PV#3-2000
ı	4000 ml/ 64 GPH	1.0" NPT	PV#1-4000	PV#2-4000	PV#3-4000
•	10000 ml/ 160 GPH	2.0" NPT	PV#1-10000	PV#2-10000	PV#3-10000
	20000 ml/ 320 GPH	2.0" NPT	PV#1-20000	PV#2-20000	PV#3-20000

Note: PVC cylinders available with socket weld connections. Add suffix "S" to model # e.g. PV#3-100S For BSP threads, add suffix "B" to model # e.g. PV#3-100B

#### **Dimensional Information**

#### Polypropylene Construction

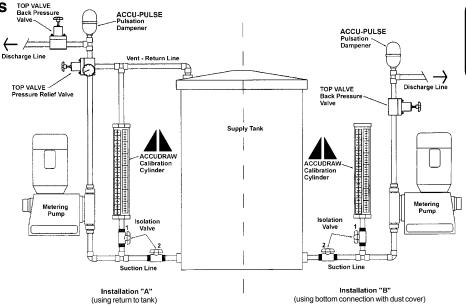
Model	Size (ml)	Dev (ml)	A (inches)	B (inches)
AC#1	100	1	9.88	1.38
AC#1	250	2	12.44	1.75
AC#1	500	5	14.1	2.33
AC#1	1000	10	17.19	2.63
AC#1	2000	20	20.88	3.38
AC#1	4000	50	23.56	4.38
AC#2/AC#3	100	1	9.25	1.38
AC#2/AC#3	250	2	11.63	1.75
AC#2/AC#3	500	5	13	2.32
AC#2/AC#3	1000	10	16.5	2.69
AC#2/AC#3	2000	20	19.5	3.38
AC#2/AC#3	4000	50	22.13	4.38

# В-

PVC	Construction	

Model	Size	Divisions	Size	Divisions	A	В
	(m l)	(m l)	(GPH)	(GPH)	(inches)	(inches)
PV#1	100	1	1.6	0.02	10.24	1.388
PV#1	250	2	4	0.05	11.04	1.888
PV#1	500	5	8	0.05	12.25	2.388
PV#1	1000	10	16	0.125	16.24	2.765
PV#1	2000	20	32	0.25	20.16	3.517
PV#1	4000	25	64	0.25	22.16	4.521
PV#1	10000	200	160	2	22.64	6.906
PV#1	20000	200	320	2	42.19	6.906
PV#2/PV#3	100	1	1.6	0.02	10.75	1.388
PV#2/PV#3	250	2	4	0.05	11.51	1.888
PV#2/PV#3	500	5	8	0.05	12.75	2.388
PV#2/PV#3	1000	10	16	0.125	16.76	2.765
PV#2/PV#3	2000	20	32	0.25	20.67	3.517
PV#2/PV#3	4000	25	64	0.25	22.66	4.521
PV#2/PV#3	10000	200	160	2	23.16	6.906
PV#2/PV#3	20000	200	320	2	42.69	6.906

#### Installations



#### **Conversion Factors**

1 ml = 1 cc 1000 ml = 1 liter ml/sec X 60 = ml/min 1 US gal/min X 0.063 = liters/sec 1 US gal = 3.786 liters

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E:Mail: primary@primaryfluid.com www.primaryfluid.com









Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference: NC01

## **CAUSTIC SODA DOSING**

ST-054



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NOMEN BILL OF M
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מכ	Islic soud dosili	ם	2				REF. No.	NC01 Rev. 0	
			8						
SSI	DESSIN/DWG# ST	ST-054	4				Date:	2009-05-15	
	ITEM	QTE/QTY.	QTY. DESCRIPTION	P&ID	CAT. ACCPAC	SOURCE	FA/SA FI	Z/d	
		<u> </u>	MANUAL CAUSTIC SODA PREPARATION SYSTEM	1.D.71AG			9 1		
			Model #						
Ž	NC01ST-054- 1	7	1	T9-541	D64		SA		
			Supplier						
			Plastique PV / ACO						
			Open top polyethylene tank. Capacity 75 gallons imp., 24 inches diameter x 47 inches height (with lid); material LLPE 1,5SG						
			Model #						
Ž	NC01ST-054-2	_	1		D64		SA		
			Supplier						
			Plastique PV / ACO						
			Description						
			Lid OT-75						
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ž	NC0151-054-3		1 Grad. OI-/5		D64		SA		
			Supplier						
		1	ACO						
			Description						
			Self adhesive metric graduation for U I-75 tank						
			Model #						
Ž	NC01ST-054-4	1	1 OT-15	T9-542	D64		SA		
			Supplier						
			Plastique PV / ACO						
			polyethylene tank.						
			inches diameter x 23 inches height (with lid); material HDPE 1,9SG						
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LATURE/ TERIALS	V. Minima	ik Mining		Rev. 0		5-15	7																									
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æ	DESCRIPTION	SUBMITTAL					DESCRIPTION	# CTON	Model #	Supplier	Plastique PV / ACO	Description	Lid OT-15	Model #	Grad. OT-15	Supplier	ACO	Description	Self adhesive metric graduation for OT-15 tank	MIXER 	Model #	EV3Q-3U	NORTEC S G S/ LIGHTNIN	Description	Mechanical mixer, 1/2 HP, 350 RPM, 575V/3/60Hz, one	propeller of 11,2" dia, shaft 56" x %". Fix mounted. Including	aligie lisel					
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Ť	JOHN MEUNIER	EUN	MER					NOMENCLATURE/ BILL OF MATERIALS
	TITRE/ TITLE		Rev. DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	Maria in Maria de Company
			0 SUBMITTAL	Julie Trudel	J.T.	2009-05-15	Contract	меадомрапк міпіпд
	יקף קליים יוויים	200	1					
	Causiic soua uosiiig	6	2				REF. No.	NC01 Rev. 0
			3					
	DESSIN /DWG #	ST-054	4				Date:	2009-05-15
NEV.	MHL	ате/ату.	QTY.	P&ID	CAT.	SOIIRCE	FA/SA FI	N/ d
L		Unit. Total		I.D./TAG	ACCPAC	SOCIAL	SITE	Z
	NC01ST-054-8		3 CAUSTIC SODA METERING PUMP	P9-541	D64		SA	
			Model #	P9-542				
			MD 006-12 / A6-A7-A7-R0-GA-X	P9-543				
			Supplier					
			Seepex					
			Description					
			Progressive cavity pump :					
			3,3 - 50 L/H @ 7 bars, 307 rpm pump max speed. Progressive cavity pump in stainless steel construction with	ed. struction with				
			1" NPT suction, 1/2" NPT discharge, stainless steel wetted casing parts and rotor, mechanical seal. Motor inverter duty,	steel wetted ir inverter duty,				
			0.5 HP, 1800 rpm, 575V/3ph/60Hz. Including a dry running protect and a 1 HP AC Tech/Jacmar drive, model ESV751N06TXC, Nema 4x.	Tech/Jacmar				
	NC01ST-054-9	1	3 SAFETY RELIEF VALVE	V9-545	D64		SA	
			Model #	V9-546				
			TVPR50-PVC-G	V9-547				
			Supplier					
			Primary Fluid					
			Description					
			Relief valve PVC, 1/2" FNPT c/w glycerine pressure gauge 0. 160 psi with PVC Teflon isolator.	ssure gauge 0-				
	NC01ST-054- 10	0 1	1 CALIBRATION TUBE		D64		SA	
			Model #					
			PV#2-500ml					
			Supplier					
			Primary Fluid					
			Description					
			Calibration tube; PVC; 500 ml, connection 1/2" NPT at both ends					
		$\frac{1}{1}$						

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ĭ	JOHN MEUNIER		Ĭ	ER					NOMENCLATURE/ BILL OF MATERIALS	J S
	TITRE/ TITLE		Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	Moodensk Minis	3
			0	SUBMITTAL	Julie Trudel	J.T.	2009-05-15	Contract	меасомрапк міппд	<u> </u>
	Caustic soda dosing	, or	7							
	Causine sour	B	2					REF. No.	NC01 Rev. 0	
			3							
a	DESSIN /DWG #	ST-054	4					Date:	2009-05-15	
REV.	ITEM	QTE/	ате/ату.	DESCRIPTION	P&ID	CAT.	SOURCE	FA/SA FI	N/d	
			Tota		I.D./TAG	ACCEAC		SITE		
	NC01ST-054-11	1 1		2 CORPORATION STOPS		D64		됴		
				Model #						
				CCS-56-PVC						
				Supplier						
				Primary Fluid System						
				Description						
				QUILL 6", Body PVC, Ball Check ceramic Check, spring in SS 316 and cland seal in EPDM						
										1

## **JOHN MEUNIER**

Meadowbank mining Corp. ACP-700R Technical Data Sheet Reference: NC01

#### **ACO CONTAINER**



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# Corporate Profile

#### **ACO Container Systems**

For more than 20 years, ACO has been recognized as one of the leading manufacturers of quality rotationally moulded products.

ACO tanks, moulded in premium grade linear or crosslinked polyethylene, provide a wide range of sizes and capacities to suit all applications.

ACO tanks, moulded products are made under a tough quality control standard to ensure that you get a reliable and consistent product.

ACO tanks provide the toughest tanks available today, capable of withstanding the most stringent tests of strength, reliability and chemical resistance. Polyethylene offers chemical resistance which is superior to FRP, stainless steel and mild steel.

ACO manufactures a complete line of storage tanks, specialty tanks, Transport Canada and United Nations approved shipping containers as well as hopper systems for powder/granular applications. Our tank systems have been serving the chemical process industry, oils/lubricant market, adhesive companies, food and beverage industry and many others successfully over the past 20 years.

ACO also can custom design a system to suit your needs, our staff is here to help you. To get more in-depth answers to your questions please contact your local ACO representative.

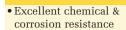
794 McKay Road, Pickering, Ontario L1W 2Y4

T (905) 683-8222, 1-800-542-9942

F (905) 683-2969, 1-800-542-4722

# open top storage

# tanks



- Narrow diameters for economical in-plant use
- U.V. stablized for sunlight protection
- Custom accessories to your specifications



Code No.	Capacity		Dimension	Wall	Weight	LID
	Imp. Gallons Litres		in Dia.x Height	Thickness		Available
OT-5	5	22	11"x 18"	.125"	4.4 lbs.	Yes
OT-9	9	40	15"x 16"	.125"	5.5 lbs.	No
OT-15	15	68	16"x 23"	.125"	6.6 lbs.	Yes

# open top storage

# tanks

	Code No.	Capaci Imp. Gallons		Dimension	Wall	Weight	LID
	OT-17	17	Litres 77	in Dia.x Height 18"x 21"	Thickness .188"	10 lbs.	Available No
<ul> <li>All dimensions are in inches (approx.)</li> </ul>	OT-25	25	110	16"x 36"	.188"	11 lbs.	Yes
• Manufactured from LLDPE (linear	OT-30	30	136	18"x 37"	.188″	12 lbs.	Yes
Polyethylene) XLPE - (cross-linked	OT-36	36	160	18"x 39"	.188″	13 lbs.	Yes
Polyethylene)	OT-45	45	200	22"x 36"	.188″	22 lbs.	Yes
available	OT-50	50	220	22"x 40"	.188"	24 lbs.	Yes
	OT-60	60	270	22"x 44"	.188″	26 lbs.	Yes
	OT-66	66	300	26"x 38"	.188″	30 lbs.	Yes
	OT-75	75	340	24"x 47"	.250"	30 lbs.	Yes
The second	OT-100	100	450	30"x 45"	.250"	38.5 lbs.	Yes
	OT-125	125	560	30"x 49"	.250"	44 lbs.	Yes
	OT-150	150	680	37"x 45"	.250"	52 lbs.	Yes
STATE OF STA	OT-175	175	790	36"x 49"	.250"	65 lbs.	Yes
And the second	OT-178	178	800	30"x 73"	.250"	68 lbs.	Yes
	OT-220	220	1000	55"x 34"	.250"	100 lbs.	Yes
A CONTRACTOR	OT-240	240	1080	43"x 50"	.250"	95 lbs.	Yes
THE PARTY OF THE P	OT-300A	300	1360	48"x 50"	.375"	110 lbs.	Yes
Contract of the Contract of th	OT-300B	300	1360	55"x 41"	.375"	125 lbs.	Yes
1000	OT-400	400	1800	55"x 50"	.375"	143 lbs.	Yes
2003/2007	OT-500	500	2200	55"x 62"	.375"	150 lbs.	Yes
200	OT-750	750	3400	70"x 58"	.375"	247 lbs.	Yes
A STATE OF THE PARTY OF	OT-1000	1000	4500	70"x 78"	.375"	280 lbs.	Yes
200000	OT-1250	1250	5600	70"x 93"	.375"	350 lbs.	Yes

All dimensions and measurements are approximate.

# tote barrels

PTB Series Tanks are designed to mount pumping equipment.



Code No.	Litres	Imp. Gallons	Diameter Ins.	Height Ins.
PTB-60	60	13	15″	28"
PTB-100	100	22	18"	29"
PTB-200	200	44	22"	39"
PTB-300	300	66	26"	44"
PTB-400	400	88	30"	43"

All dimensions and measurements are approximate.

# round tanks

ACO Round Tanks for custom applications.



Code No.	Litres	Imp. Gallons	Diameter Ins.	Length Ins.	Height Ins.
RT-40	40	9	15"	18"	16"
RT-100	100	22	20"	27"	18"
RT-300	300	66	27"	37"	27"
RT-500	500	110	30"	45"	32"

All dimensions and measurements are approximate.

See us on line at www.acotainers.on.ca





# ACO Container Systems Ltd.

794 McKay Road Pickering, Ontario L1W 2Y4

Tel (905) 683-8222, 1-800-542-9942
Fax (905) 683-2969, 1-800-542-4722
e-mail: custserv@acotainers.on.ca
See us on line at www.acotainers.on.ca

# **JOHN MEUNIER**

Meadowbank mining Corp. ACP-700R Technical Data Sheet Reference: NC01

# PREPARATION SYSTEM MIXER



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# **MIXER MANUAL**

# INSTRUCTIONS

**INSTALLATION** 

**OPERATION** 

**MAINTENANCE** 

Ship To Customer: JOHN MEUNIER INC Bill To Customer: JOHN MEUNIER INC

Lightnin Mixer Model EV5Q50

Bill To Cusco...

PO Number: 015488

Model: Lightnin Mi
Order Number: 0001125100

Number: 000010

Tagging:



# INSTRUCTION WANDAL

# **LIGHTNIN LINE ITEM 000010**

**LIGHTNIN SALES ORDER 0001125100** 

# **TABLE OF CONTENTS**

# TITLE DOCUMENT NO.

Safety Check List	IT-2144
GENERAL ARRANGEMENT DRAWING	1125100000010-A
Machine Assembly Drawing	L-17637
General Instructions	IT-3815
Motor Electric Instructions	IT-2588
Spare Parts - Mixer	IT-3796
Sales Offices	TT-3839

# SAFETY CHECK LIST

# **IMPORTANT WARNINGS**

All LIGHTNIN Mixers and Aerators are provided with properly designed lifting devices and safety covers to avoid potential injury and/or equipment damage. The following SAFETY CHECK LIST should be THOROUGHLY REVIEWED AND ADHERED TO before installing, operating or performing maintenance on the mixer. FAIL-URE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS INJURY. Ensure the use of qualified, quality trained and safety conscious personnel.

- Use only the lifting device, if provided, on your unit to install the mixer. Use shouldered eyebolts and tighten securely to handle component parts. We strongly recommend that the hoist rings be of safety swivel type with 360° rotational capability. Lift per instructions in the instruction manual.
- DO NOT connect the motor to the power source until all components are assembled, the mixer is installed, and all hardware is tightened to the proper torque which is specified in the operation and maintenance manuals supplied by LIGHTNIN.
- DO NOT operate shaft sealing devices at temperatures or pressures higher than those specified in the manual or on the nameplates.
- 4. DO NOT service the mixer until you have followed your "Control of Hazardous Energy Sources" (lockout, tagout procedure) as required by OSHA 29 CFR Part 1910.
- DO NOT touch rotating mixer parts or any part of mixer that has the potential of having a hot surface including motor, gear drive housing, seal, shafting and flange.
- DO NOT operate mixer for service other than its intended use, that being fluid mixing with the mixer attached to a rigid structure and connected to a power source appropriate to operate the drive motor.
- DO NOT make any field changes or modifications (horsepower, seal material components, output speed, shaft lengths, impellers, etc.) without reviewing the changes with your LIGHTNIN Sales Representative or the LIGHTNIN Customer Service Department.
- DO NOT install an aftermarket Variable Frequency Drive without first consulting your LIGHTNIN Sales Representative or the LIGHTNIN Customer Service Department to determine the compatibility of the existing motor with the Variable Frequency Drive.
- DO NOT operate mixer until you have checked the following items:
  - Make sure the mixer is properly grounded. Α.
  - B. Ensure all protective guards and covers are installed. Guarding of the mixer shaft below mixer mounting surface is the responsibility of the customer.
  - Ensure all detachable components are securely coupled to the mixer.
  - Thoroughly REVIEW and ADHERE TO the mixer operating instructions supplied by LIGHTNIN.
  - E. Ensure the mixer output shaft rotates freely by hand.
  - F. Ensure all personnel and equipment are clear of rotating parts.
  - G. Ensure all external connections (electrical, hydraulic, pneumatic, etc.) have been completed in accordance with all applicable codes and regulations.
- 10. DO NOT enter the mixing vessel UNLESS:
  - The mixer power supply is locked out (follow Item number 4). Α.
  - The mixer shaft is firmly attached to the mixer drive or the shaft is supported securely from below. В.
  - C. You have followed applicable confined space regulations.

# CE COMPLIANCE

If mixer nameplate has a CE marking on it, then the equipment furnished conforms to the following directives:

98/37/EC Machinery Directive 89/336/EEC Electro–Magnetic Compatibility 73/23/EEC Low Voltage

Any CE marking and/or associated documentation applies to the mixer only. This has been supplied on the basis that the mixer is a unique system. When the mixer is installed, it becomes an integral part of a larger system which is not within the scope of supply and CE marking is the responsibility of others.



**CAUTION:** CE Compliance does not imply that the mixer satisfies PED (Pressure Equipment 97/23/EC) or ATEX (Potential

Explosive Atmospheres 94/9/EC) unless marking is clearly shown on mixer.

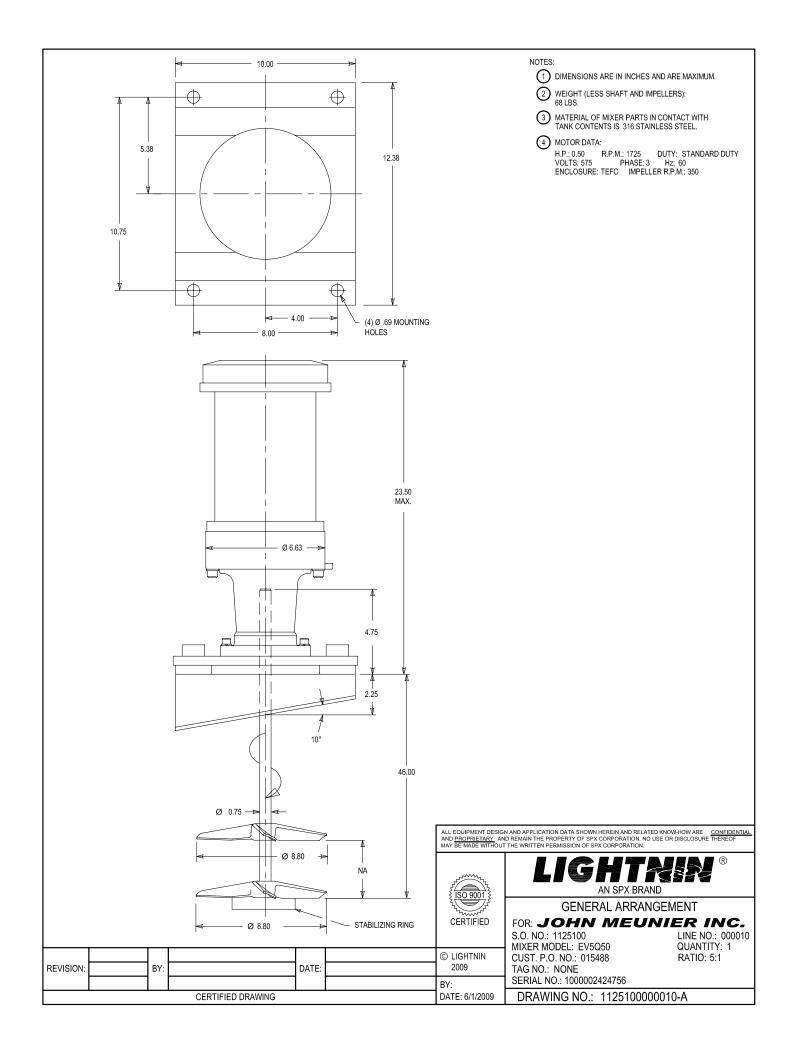
# **NOISE LEVELS**

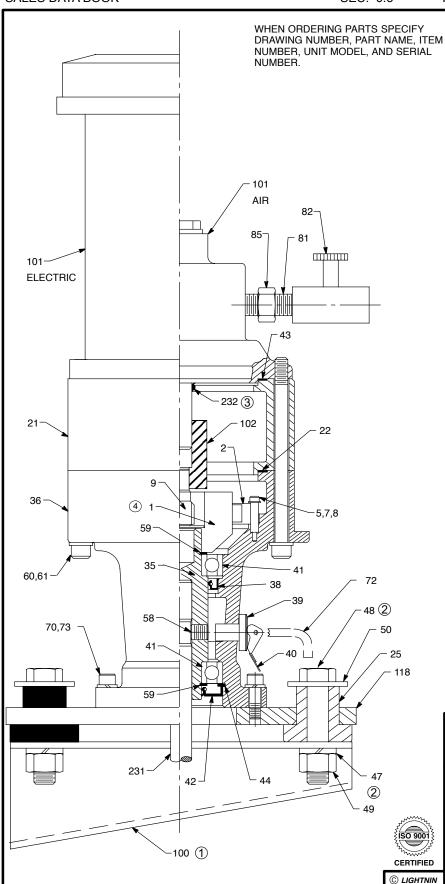
SOUND PRESSURE LEVELS

Portable Series: ECL, EV – maximum 80 Dba @ 1 meter Heavy Series: S10, 70/80, 500/600 – maximum 85 Dba @ 1 meter

THIS PRODUCT MAY BE COVERED BY ONE OR MORE OF THE FOLLOWING U. S. PATENTS:

5006283	5046245	5118199	5152934	5152606	5203630
5344235	5364184	5368390	5378062	5427450	5454986
5470152	5478149	5480228	5501523	5511881	5560709
5568975	5568985	5655780	5720286	5746536	5758965
5779359	5842377	5925293	5951162	5972661	5988604
6089748	6109449	6142458	6158722	6250797	6299776
6334705	6386753	6457853	6634784	6715913	6742923
6746147	6789314	6796707	6796770	6808306	6843612
6860474	6877750	6935771	6986507	6997444	7001063
	7056095	7168641	7168848	7168849	





GEAR CARRIER ASSEMBLY (4) RING GEAR 5 HOLLOW PIN(4) 7 SOC HD CAP SCREW(4) 8 FLATWASHER(4) SUN GEAR 9 21 **SPACER** 22 25 35 36 GASKET FLEXIBLE MOUNT(4) DRIVE QUILL HOUSING 38 OIL SEAL 39 EXPANSION PLUG 40 LANYARD 41 BALL BEARING(2) 42 OIL SEAL 43 44 47 **GASKET** RETAINING RING LOCKWASHER(4) HEX HD CAP SCREW(4) HEX NUT(4) 48 49 50 PLAIN WASHER(4)
HEX SOC SET SCREW(NYLOK)
RETAINING RING(2) 58 59 60 SOC HD CAP SCREW(4) 61 FLAT WASHER(4) 70 SOC HD CAP SCREW(4) 72 HEX WRENCH 73 LOCKWASHER(4) CLOSE NIPPLE NEEDLE VALVE 81 85 REDUCER ADAPTER 100 ANGLE RISER ASSEMBLY 101 **MOTOR** 102 COUPLING MOUNTING PLATE 118 231 MIXER SHAFT 232 V-RING ITEM PART NAME

## NOTES:

- (1) ANGLE RISER ASSEMBLY (100) FURNISHED ONLY FOR UNITS WITH ANGULAR OFFSET MOUNTING.
- (2) ITEMS 47, 48, 49, AND 50 FUR-NISHED ONLY WITH ANGLE RISERS.
- ③ V-RING (232) REQUIRED ONLY WITH GEAR DRIVE/ELECTRIC MOTORS. NOT REQUIRED WITH AIR MOTORS OR DIRECT DRIVE UNITS.
- GEAR CARRIER ASSEMBLY (CONSISTING OF ITEMS 9, 11, 12, 13, 14, 15 & 24) IS SOLD AS A SET. INDIVIDUAL ITEMS ARE NOT AVAILABLE.

ALL EQUIPMENT DESIGN AND APPLICATION DATA SHOWN HEREIN AND RELATED KNOW-HOW IS **CONFIDENTIAL** AND THE PROPERTY OF THE LIGHTNIN GROUP OF COMPANIES. NO USE OR DISCLOSURE THEREOF MAY BE MADE WITHOUT OUR WRITTEN PERMISSION

# LIGHTAIN®

MIXERS AND AERATORS

ASSEMBLY DRAWING

EV "Q" SERIES MIXER GEAR DRIVE PLATE MOUNT

# GENERAL INSTRUCTIONS EV "Q" SERIES MIXERS GEAR DRIVE

# SECTION 1 - INITIAL INSPECTION, SHIPPING ARRANGEMENTS

- 1. 1 Check the shipping crates and your *LIGHTNIN* equipment for possible shipping damage. Report any damage immediately to the carrier and our factory.
- 1. 2 The mixer and impellers are packed together. The mixer shaft, if over 48 inches long, is packed in a separate container.
- 1.3 Do not remove any protective coatings or wrappings until the mixer is ready to be put into service. If the mixer is to be stored, store only in an indoor, clean, dry location with controlled temperatures of  $15^{\circ}$  C to  $40^{\circ}$  C ( $59^{\circ}$  F to  $104^{\circ}$  F). When gear drive models have been stored for more than one year, the gear lubricant should be replaced (see Lubrication instructions).

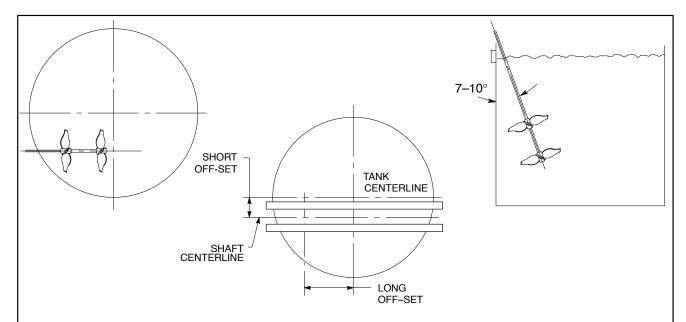
# **SECTION 2 – MIXER INSTALLATION**

## WARNING: EYE PROTECTION MUST BE WORN AT ALL TIMES WHILE SERVICING THIS MIXER.

- 2. 1 Refer to Installation drawing and Table 1 for:
  - a. Proper mixer mounting and location.
  - b. Proper minimum impeller off-bottom and relative spacing for dual impeller applications.
- 2. 2 Lock-out power before positioning mixer, and review safety instructions before starting mixer.
- 2. 3 This mixer can be mounted either vertically or angular offset with optional angle risers.
- 2. 4 BOLT TIGHTENING TORQUE RECOMMENDATIONS
  - a. Inadequately or improperly tightened hardware can loosen due to vibration or the reactions imposed by fluid forces. This can result in reduced equipment service life or damage and failure.
  - b. Recommended torques for tightening the bolts and screws on your *LIGHTNIN* mixer are listed with assembly instructions. Use of a torque wrench is recommended to ensure compliance with torque recommendations.
  - c. The amount of torque required to maintain a tight connection can vary considerably for bolts of the same size under different operating conditions. Variations such as basic joint design, compression factors, type and strength of base and hardware material, surface finish of mating parts and lubrication are only some of the factors that influence the tightness of bolted connections for given torque values.
  - d. All bolts should be coated with oil, grease, or an anti-seize compound whenever possible. The threads and bearing face of bolt heads and/or nuts should be lubricated.
  - e. ALL BOLTS SHOULD BE RETIGHTENED AFTER THE UNIT HAS BEEN RUN UNDER LOAD FOR TWO (2) WEEKS, AND AT EACH SCHEDULED SHUT-DOWN THEREAFTER.
  - f. Unless otherwise specified, it is recommended that metric commercial standard class 8.8 bolts and screws, and class 8 nuts be used for all bolted connections. For inch hardware use GR5.

**REVISED** 

© 1996



# **OPEN TANK UNITS**

TANKS WITH AN OVERALL HGT. TO DIA. RATIO LESS THAN 1.5  $$10^{\circ}$$  Mounting Angle

**OVERALL** SHORT LONG TANK DIA. TANK OFF-SET OFF-SET HEIGHT inches inches mm mm mm inches mm inches 4.41 2.54 5.19 3.00 5.97 3.45 6.75 3.90 7.53 4.35 8.31 4.80 9.88 5.70 11.44 6.60 13.00 7.51 14.57 8.41 16.13 9.31 10.21 17.69 19.25 11.12 12.02 20.82 22.38 12.92 23.94 13.82 25.51 14.73 27.07 15.63 28.63 16.53 30.19 17.43 31.76 18.33

TANKS WITH AN OVERALL HGT. TO DIA. RATIO BETWEEN 1.5 AND 2.0  $$7^{\circ}$$  Mounting Angle

TANK DIA.		OVERALL TANK HEIGHT		_	ONG F-SET	SHORT OFF-SET	
mm	inches	mm	inches	mm	inches	mm	inches
381	15	762	30	106	4.16	84	3.30
457	18	914	36	124	4.89	99	3.90
533	21	1067	42	143	5.62	114	4.50
610	24	1219	48	161	6.35	130	5.10
686	27	1372	54	180	7.08	145	5.70
762	30	1524	60	198	7.81	160	6.30
914	36	1829	72	236	9.27	191	7.51
1067	42	2134	84	273	10.74	221	8.71
1219	48	2438	96	310	12.20	252	9.91
1372	54	2743	108	347	13.66	282	11.12
1524	60	3048	120	384	15.12	313	12.32
1676	66	3353	132	421	16.59	343	13.52
1829	72	3658	144	458	18.05	374	14.73
1981	78	3962	156	496	19.51	405	15.93
2134	84	4267	168	533	20.97	435	17.13
2286	90	4572	180	570	22.44	466	18.33
2438	96	4877	192	607	23.90	496	19.54
2591	102	5182	204	644	25.36	527	20.74
2743	108	5486	216	681	26.82	557	21.94
2896	114	5791	228	718	28.29	588	23.15
3048	120	6096	240	756	29.75	618	24.35

# **SECTION 3 – SHAFT AND IMPELLER INSTALLATION**

- 3. 1 Install the impeller(s) on the mixer shaft (231) by tightening the set screws in the impeller hub. Refer to the installation drawing for recommended dual impeller spacing if two impellers are supplied. Refer to Impeller Assembly drawing for general impeller orientation.
- 3. 2 Clean the mixer shaft (231) end and drive quill (35) thoroughly.
- 3. 3 Orient the drive quill so that the set screw (58) aligns with the hole in the bearing housing (36). Align quill shaft by inserting mixer shaft (231) into quill and rotate quill manually.
- 3. 4 Grasp mixer shaft approximately 20 inches below the shaft top and insert the mixer shaft completely into the drive quill, until it contacts the top of the quill bore. Tighten set screw (58).

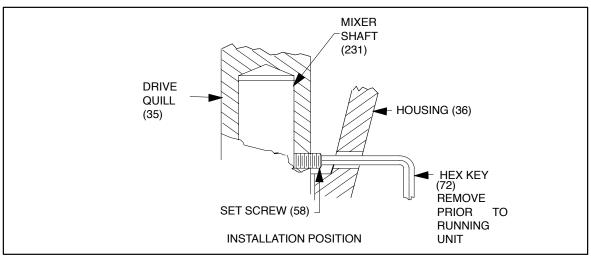


Figure 1 - Shaft Installation

# 3. 5 DRIVE QUILL ORIENTATION

- a. NORMAL LIGHT CONDITIONS Rotate the drive quill until the set screw (58) aligns with the access hole in the housing (36). Rotate drive quill by inserting lower shaft into drive quill and rotating by hand.
- b. LOW LIGHT CONDITIONS If the mixer shaft is being installed in low light conditions, the drive quill can be oriented by feel. Insert lower shaft into drive quill and rotate the drive quill (35) by hand until the set screw (58) can be felt with the hex wrench through the access opening.
- 3. 6 With the drive quill oriented, insert the 7/32" hex key (72) provided into the housing opening and tighten the set screw (58) to (15–30 ft–lbs). **DO NOT IMPACT THE WRENCH OR USE AN EXTENSION.**
- 3. 7 Check for free movement of all components by rotating the mixer shaft.

### **SECTION 4 – SHAFT REMOVAL**

CAUTION: THE UPPER PORTION OF THE MIXER SHAFT (231) MAY BE HOT TO THE TOUCH. ONCE REMOVED FROM THE DRIVE QUILL (35), DO NOT GRASP THE UPPER 20" OF THE MIXER SHAFT.

It is recommended that the mixer be removed from the tank before shaft or shaft and impeller are removed.

- a. Make sure all electrical power is disconnected.
- b. Grasp impeller by hand (or shaft with a strap wrench) and rotate mixer shaft (231) until the drive quill set screw (58) aligns with the access hole in the housing (36). See Caution above.

- c. With hex key (72) loosen set screw (58) and back out two (2) turns. See Figure 2.
- d. Remove mixer shaft from quill. See Caution above.

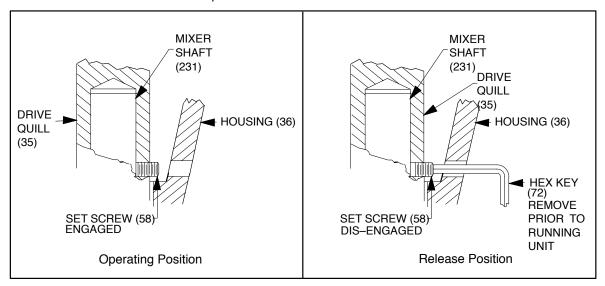


Figure 2 - Shaft Removal

# **SECTION 5 – MIXER OPERATION**

- 5. 1 This *LIGHTNIN* mixer is designed for continuous operation and normally needs no additional maintenance.
- 5. 2 Variable speed air drive units should not be operated at the lower shafts natural frequency. At this speed the lower shaft will have excessive runout ( $\pm$  2" T.I.R.) at the end of the shaft while operating in air. Vary the speed  $\pm$  5% to avoid this speed range.

CAUTION: IT IS NOT RECOMMENDED TO OPERATE THE MIXER WITH EXTREME VORTEXING OR SURGING OF THE LIQUID BEING MIXED.

5. 3 At the end of two weeks service, check all hardware for tightness.

WARNING: AT THE END OF THE MIXING CYCLE, IT IS GOOD PRACTICE TO TURN OFF THE MIXER BEFORE THE TANK HAS BEEN DRAINED TO A LEVEL WHICH WILL RESULT IN EXCESSIVE SPLASHING. THIS MAY RESULT IN SHAFT DAMAGE.

# **SECTION 6 – LUBRICATION**

- 6. 1 Your *LIGHTNIN* mixer has been lubricated at the factory with the correct type and amount of high quality lubricants. Lubricant cleanliness is protected by properly designed closures.
- 6. 2 All mixer bearings are the sealed type and are pre-packed with lubricant. Relubrication of these bearings is not necessary.
- 6. 3 The gear chamber of this **LIGHTNIN** mixer has been factory filled with a grease suitable for ambient temperature ranges of  $-20^{\circ}$  C to  $+50^{\circ}$  C ( $-4^{\circ}$  F to  $+122^{\circ}$  F). Under normal operating conditions, this lubricant need not be changed until the unit has been dismantled for some reason. Refer to Table 2 for lubricant specifications.

DATE 5-6-96

6. 4 Under adverse operating conditions, periodic changes of lubricant may be necessary. Adverse conditions are defined as operating in very humid, dust laden, chemical atmospheres, or where wide variations in ambient temperatures occurs. Such adverse conditions can lead to deterioration of lubricant compounds and additives and it is recommended that the condition of the grease be checked within six months of start-up.

Refer to Section 7 for instructions on disassembling the gear unit.

NOTE: THE BEARING HOUSING SHOULD BE FILLED 1/2 INCH FROM THE TOP OF THE BEARING HOUSING. ALL GASKETS SHOULD BE CHECKED FOR INTEGRITY AND REPLACED IF THEY ARE DEFORMED, CUT OR DETERIORATED.

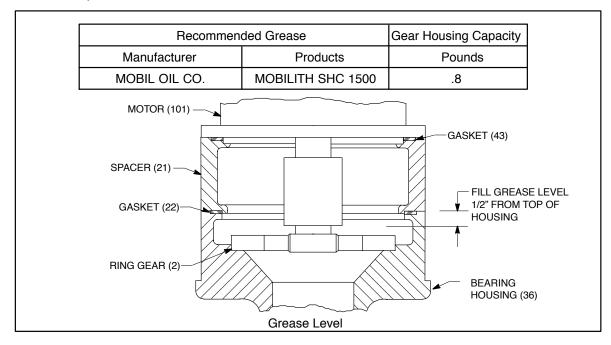


Table 2 – Lubricant Recommendations & Capacity

## 6. 5 CHANGING GEAR LUBRICANT

- a. Remove all old grease from the gear chamber and wipe clean.
- b. Pack the chamber with fresh grease. See Table 2. Paddle the grease to fill voids and remove air pockets, rotating the shaft and shaking the housing while paddling.
- c. Check for free movement of all components by rotating the drive shaft.

# SECTION 7 - DISASSEMBLY INSTRUCTIONS

# WARNING: DISCONNECT MOTOR LEADS OR OTHERWISE LOCK-OUT POWER SUPPLY BEFORE SERVICING THE MIXER. EYE PROTECTION MUST BE WORN.

- 7. 1 This mixer is precision manufactured and assembled to provide long trouble free service when properly maintained. If it becomes necessary to disassemble the unit, careful precise reassembly is necessary.
- 7. 2 Refer to the assembly drawings for location of parts.
- 7.3 Equipment that will be required to service the mixer, in addition to standard mechanics tools is, a rubber mallet, retaining ring pliers, metric and "inch" allen wrenches, arbor press and torque wrench.

- 7. 4 Disassemble mixer on a clean work surface to prevent dirt from entering the housing.
- 7.5 It is recommended that oil seals and gaskets be replaced when the mixer is disassembled.

#### 7. 6 SEAL REPLACEMENT

Inspect oil seals and gaskets for nicks, gouges and deformities. When replacing seals:

- a. Coat the lips of seals with bearing grease.
- b. Install oil seal with lip facing up as shown in Figure 3.
- c. Coat the section of shaft sealing surface with oil.

### 7. 7 BEARING REPLACEMENT

- a. Remove old bearings with either a puller or an arbor press.
- b. Press new bearings on shaft. Be careful to apply load only to the inner race.
- c. Make sure the bearings are tightly seated against the shaft or housing shoulders with no clearance.

### 7.8 SHAFT REMOVAL

Loosen set screw (58) and remove mixer shaft (231) as outlined in Section 4.

# 7.9 MOTOR REMOVAL

- a. Remove the mixer from the tank.
- b. Set the mixer upright on a clean work surface.
- c. Remove the (4) socket head cap screws (60) holding the bearing housing (36) and spacer (21) to the motor (101).
- d. Lift the motor (101), motor coupling assembly (102) and sun gear (9) (Figure 4) off the spacer (21). It may be necessary to tap the bearing housing (36) gently with a rubber mallet to get the bearing housing to separate from the spacer and motor.
- e. Remove the sun gear (9) from the motor coupling (102) and examine for wear. If "reuseable" replace sun gear in gear mesh.
- f. Remove the drive coupling (102) from the motor if necessary.

# 7. 10 BEARING HOUSING DISASSEMBLY

- a. Remove grease from gear chamber of bearing housing (36).
- b. Remove sun gear (9) and gear carrier assembly (1) as an assembly. Tape these parts together to prevent the sun gear from accidental removal. Remove any remaining old lubricant.
- c. Remove hardware (7,8) and remove ring gear (2) from bearing housing (36).
- d. Remove upper retaining ring (59).
- e. Place housing motor end down and remove oil seal (42) from drive quill (35). This seal will be damaged and must be replaced.
- f. Remove lower retaining ring (44).
- g. Place the bearing housing upright in a press, and press out drive quill (35) and lower bearing (41).
- h. Remove lower retaining ring (59) and bearing (41) from the drive quill (35).
- i. Remove upper bearing (41) and oil seal (38) from bearing housing (36).
- j. Inspect bearing (41) for excessive wear. Replace if necessary.

# **SECTION 8 – ASSEMBLY INSTRUCTIONS**

# 8. 1 QUILL ASSEMBLY

Insert the set screw (58) into the drive quill (35) until it is flush with the bore of the quill.

### 8. 2 BEARING HOUSING ASSEMBLY

- a. Press the lower bearing (41) onto the drive quill (35) bearing journal. The bearing must seat against the drive quill shaft shoulder with no visible gap.
- b. Install the lower external retaining ring (59).
- c. Press the drive quill assembly into the bearing housing (36) from the bottom until the bearing seats on the housing shoulder.
- d. Install lower retaining ring (44).
- e. Press oil seal (42) in place as shown in Figure 3. Make sure the oil seal has the internal spring removed. This is a non-lubricated seal, and will run hot and have a shortened life if the spring is not removed.
- f. Turn the bearing housing over, support the assembly on the guill shaft (35) and install the upper bearing (41) by pressing it into the bearing housing and onto the quill shaft.
- g. Install the upper retaining ring (59).
- h. Support the bearing housing assembly in an upright position and press the drive quill downward until the bearing (41) shoulders on the retaining ring (59). This will relieve any locked in axial load on the bearing created during assembly.

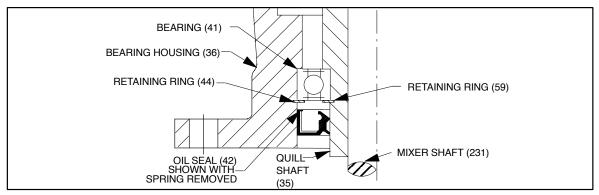


Figure 3 - Oil Seal Installation

- i. PACK THE GEAR CARRIER (1) with grease and rotate the gears several times to distribute the grease to the needle bearings. Refer to Section 6 for lubricant recommendations.
- j. Align the flats on the inside of the gear carrier (1) with the flats on the drive quill (35). Place the gear carrier and sun gear (9) assembly onto the drive quill.
- k. Install the ring gear (2), hollow pins (5), and hardware (7,8) in bearing housing (36).
- I. Install gasket (22) in its groove on the bearing housing, and gasket (43) in its groove in the spacer.
- m. Remove the sun gear (9) from the gear carrier (1).
- n. Replace v-ring (232) on motor shaft (if removed). Press v-ring on shaft until lips contact face of motor. V-rings are required only on electric motors used on gear drive models. V-rings are not required on direct drive models or on air motors. Refer to Figure 4.
- o. Place the drive coupling (102) on the motor shaft if necessary.
- p. Install the sun gear (9) into the drive coupling (102) until it shoulders against the drive coupling. Tighten the two set screws to 7 ft-lbs.

DATE 5-6-96

q. Set the elevation of the sun gear to the dimension shown in Figure 4 and tighten the remaining two coupling set screws to 7 ft-lbs.

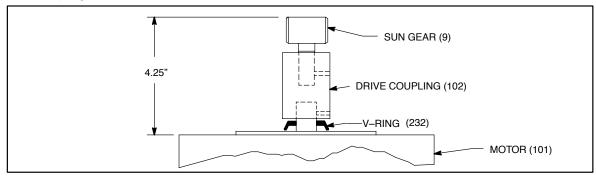


Figure 4 - Sun Gear Placement

- r. Fill the bearing housing with lubricant to approximately 1/2" from the top. Refer to Section 6 for lubricant recommendations.
- 8. 3 FINAL ASSEMBLY (REFER TO ASSEMBLY DRAWING)
  - a. Bolt the bearing housing (36) and spacer (21) to the motor (101), using socket head cap screws (60) and washers (61). Alternately tighten the hardware to 9 ft-lbs to ensure that all components are drawn evenly together.
  - b. Install mixer shaft (231) as outlined in Section 3.

# **SECTION 9 – AIR MOTOR REQUIREMENTS**

Be sure your compressor has capacity for both pressure and the proper cubic feet per minute air displacement. Wet air, and low pressure will cause sticking of the motor, requiring hand starting. It is important to use an air filter and moisture trap near the motor for removal of foreign matter. Maximum recommended operating pressure is 100 P.S.I.

> AIR PRESSURE / AIR CONSUMPTION GUIDE FOR AIR MOTOR DRIVEN MIXER (AIR MOTOR OPERATING AT 1800 RPM)

				RE CONSUMPTION EQUIRED
H.P.	GAST MOTOR #	SHAFT RPM	* (PSIG)	** (CFM FREE AIR)
1/3	#2	1800	60	15
1/3	#2	360	60	15
1	#4	1800	85	30
1	#4	360	85	30

<sup>\*</sup> Live pressure should be approximately 1-1/2 times the operating pressure of the air motor. The full line pressure will then be available for overloads and startup.

Table 3

PAGE 8 OF 9

<sup>\*\*</sup> CFM free air refers to air at atmospheric conditions measured at the inlet of the compressor.

# **SECTION 10 – AIR MOTOR LUBRICATION**

- 10. 1 Use only a high detergent lubricant of the recommended viscosity. Recommended oils are shown in Table 4.
- 10. 2 For continuous duty or high speed operation, it is recommended that an automatic lubricating device in the air line be provided to feed 1 to 3 drops per minute to the motor. If required request optional air–line lubricator (part # 151030psp).
- 10. 3 For manual oiling, remove the oil cap at the top of the motor, and add one squirt of oil at the end of each 8 hours of operation.

RECOMMENDED LUBRICANT	AMBIENT TEMPERATURE	GRADE OF OIL
GAST AD 220 (SAE #10) OR A HIGH DETERGENT AUTOMOTIVE ENGINE OIL DESIGNED FOR ANY ONE OR MORE OF	BELOW 32° F	DILUTE SAE #10 OIL WITH 25% KEROSENE
THE FOLLOWING API SERVICE RATINGS SB, SC, SD, SE, CB, CC, CD.	32° F TO 100° F	SAE #10 OIL
A HIGH DETERGENT AUTOMOTIVE ENGINE OIL DESIGNATED FOR ANY ONE OR MORE OF THE FOLLOWING API SERVICE RATINGS – SB, SC, CD, CE, CB, CC, CD.	101° F TO 200° F	SAE #20 OIL

Table 4 - Motor Lubrication

# **SECTION 11 – FLEX MOUNT REPLACEMENT**

- 11. 1 The flex mounts can be removed with a long bolt and two pieces of tubing as shown in Figure 5.
- 11. 2 Tighten the hex nut until the flex mount is free of the housing.
- 11. 3 To install the new flex mounts use a long bolt and a piece of tubing as shown in Figure 5.
- 11. 4 Lubricate the flex mount with a natural rubber lubricant or liquid hand soap.
- 11. 5 Tighten the hex nut until the flex mount is tight with mounting plate (118).
- 11. 6 Replace all mounts if one is replaced.

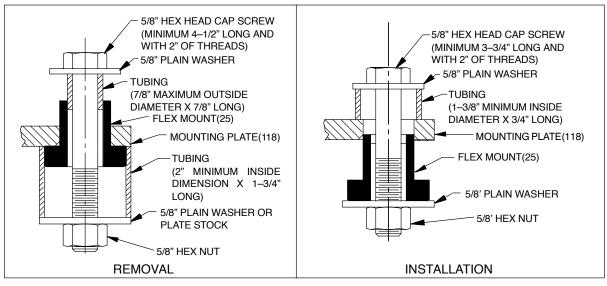


Figure 5 - Flex Mount Removal and Installation

# ELECTRIC MOTOR INSTRUCTIONS

# **SECTION 1 - INITIAL INSPECTION**

1.1 Care is taken at the factory to assure that the motor arrives at its destination in first class condition. If there is evidence of rough handling or damage in shipment, file a claim at once with the carrier and notify our factory.

Examine the outside of the motor carefully for damage, with particular attention to the conduit box, fans and covers. Check nameplate for correct speed, kilowatt, voltage, hertz and phase for conformance with power supply. See Section 1.3 for warning on explosion-proof motors.

# 1.2 GENERAL DATA:

- a .Single phase totally enclosed motors are wired at our factory for correct rotation.
- b .All three phase and explosion-proof motors must be field wired for proper rotation. If rotation does not agree with nameplate, reverse any two line leads.
- c .Dual voltage motors must be wired for the desired voltage. Refer to the connection diagrams provided on the motor nameplate, inside the conduit box cover or in this manual.
- d .Refer to Section 2 for motor maintenance and storage instructions.

### 1.3 WARNING

- EXPLOSION-PROOF MOTORS These motors are constructed to comply with the U.L. Label Service Procedure manual. When repairing and reassembling a motor that has an Underwriter's Label, it is imperative that the unit be reinspected and;
  - a .All original fits and tolerances must be maintained
  - b .All plugs and hardware to be securely fastened
  - c .Any part replacements, including hardware, be accurate duplicates of the originals

REPAIR WORK ON EXPLOSION-PROOF MOTORS CAN ONLY BE DONE BY THE ORIGINAL MANUFACTURER. VIOLATIONS OF ANY OF THE ABOVE ITEMS WILL INVALIDATE THE SIGNIFICANCE OF THE U.L. LABEL.

- EXPLOSION-PROOF MOTORS ARE EQUIPPED WITH AN INTERNAL CIRCUIT INTERRUPTING DEVICE WHICH TRIPS WHEN OVER HEATING OCCURS. THIS THERMAL PROTECTION CIRCUIT WILL RESET AUTOMATICALLY WHEN UNIT COOLS.
- If the thermal protector continues to trip, some abnormal condition exists. This condition must be corrected before motor will operate normally.
- ALWAYS DISCONNECT POWER LINE BEFORE SERVICING ANY PART OF THE MIXER. Unexpected motor start-up may occur after the thermal protection circuit trips.
- 1.4 After unpacking and inspection to see that all parts are in good condition, turn the shaft by hand to be sure there are no obstructions to free rotation. Equipment which has been in storage should be tested prior to being put into service.
  - a .It is best to check the insulation resistance of the stator winding with a megohmeter. If resistance is lower than one megaohm, consult *LIGHTNIN*.
  - b .Motors are shipped from the factory with sealed, shielded bearings properly packed with grease and ready to operate. Bearings are not regreaseable.

# LIGHTMIN

- 1.5 WIRING Examine the nameplate data to see that it agrees with the power circuit to which the motor is to be connected. The motor is guaranteed to operate successfully with frequency not more than 5% and voltage not more than 10% above or below the nameplate data, or combined variation of voltage and frequency of not more than 10% above or below nameplate data. Efficiency, power factor and current may vary from nameplate data.
- 1.6 Connect the motor leads to a power source that matches the line voltage and wiring diagram specified on the motor nameplate.
- 1.7 Check impeller shaft rotation by jogging the motor until it is determined that rotation is correct.

### 1.8 CAUTION

Repeated trial starts can overheat the motor (particularly for across-the-line starting). If repeated trial starts are made, allow sufficient time between trials to permit heat to dissipate from the windings or rotor to prevent overheating. Starting currents are several times running currents, and heating varies as the square of the current. Do not exceed 12 starts per hour.

### 1.9 WARNING

The frames and other metal exteriors of motors should be grounded to limit their potential to ground in the event of accidental connection or contact between live electrical parts and the metal exteriors. All motors should be grounded through the conduit box. Explosion-proof motors have an integral ground lead for grounding.

# 1.10 WARNING

Before starting motor, remove all unused shaft keys and loose rotating parts to prevent them from flying off.

1.11 Start motor and operate at minimum load prior to filling the tank or basin. Look for any unusual condition.

The motor should run smoothly with little noise. If the motor should fail to start and produces a decided hum, it may be that the load is too great for the motor or that it has been connected improperly. Shut down immediately and investigate for trouble.

# **SECTION 2 - MOTOR MAINTENANCE AND STORAGE**

Electric motors or other prime movers are not prepared by *LIGHTNIN*<sup>®</sup> for indoor storage beyond 12 months in a dry ambient atmosphere with controlled temperatures, or 6 months in a dry ambient atmosphere with no temperature control. OUTDOOR STORAGE OF ELECTRIC MOTORS IS NOT RECOMMENDED BY ANY MOTOR MANUFACTURER. For information on storage periods beyond those shown, consult *LIGHTNIN*<sup>®</sup>.

- 2.1 To insure continued reliable operation of electric motors, the following basic rule applies: KEEP THE MOTOR CLEAN AND DRY. Motors should be inspected, and output shaft rotated, at a minimum of 6 month intervals with increased frequency as needed depending upon the type of motor and the service.
- 2.2 Terminal connections and assembly hardware may loosen from vibration during service and should be tightened.
- 2.3 Insulation resistance should be checked at operative temperature and humidity conditions to determine possible deterioration of insulation due to excessive moisture or extremes in operating environment. If wide variations are detected, motors should be reconditioned.
- 2.4 LUBRICATION The ball bearing has deep grooved, double shielded sealed bearings with sufficient lubricant packed into the bearings by the manufacturer for "life lubrication". The initial lubricant is supplemented by a supply packed into larger reservoirs in the end shield at time of assembly. No grease fittings are provided, as the initial lubrication is adequate for up to 10 years of operation under normal conditions.

# LIGHTMIN

- 2.5 **STORAGE REQUIREMENTS FOR MOTORS -** These extended storage requirements must be followed to allow the submission of a valid warranty claim.
  - a .The motors, if not mounted, are to be stored in the original containers in a clean, dry, protected warehouse.
  - b .The storage area is to be free from any vibration and from extremes in temperature.
  - c .Windings to be megged at the time equipment is put in storage. At the time of removal from storage, the resistance reading must not have dropped more than 50% from the initial reading. Any drop below this point, consult  $\textbf{LIGHTNIN}^{\textcircled{B}}$ .
  - d .All external parts and motors subjected to corrosion should be protected by a corrosive resistant coating.



SECTION: 2 PAGE: 81.10 DATE: 7-31-06

#### UNIT SIZE: EV "Q" **MIXER PARTS**

# **GEAR DRIVE UNIT**

# For service and repair, call 1-888-MIX BEST (1-888-649-2378)

ITEM NO.	IDENT. CODE	DESCRIPTION	QTY.	PART NO.	PRICE (EACH)	SHIPMENT (WEEKS)		
NC	NOTE: See mixer nameplate or spec. sheet for unit size & ratio. See Assembly Drawing for item no. identifier							
		DRAWING: L-17637						
		GEAR CARRIER ASSEMBLY - 5:1 RATIO (Includes item 9)		869616PSP				
1		GEAR CARRIER ASSEMBLY - 6:1 RATIO (Includes item 9)	1	869617PSP				
2		RING GEAR	1	290901PSP				
5		HOLLOW PIN	4	291612STL				
7		SOCKET HEAD CAP SCREW	4	291556PSP				
8		FLAT WASHER	4	291613STL				
21		SPACER	1	271751ALF				
22*		GASKET	1	271795PSP				
25*		FLEX MOUNT	4	138317PSP				
35		DRIVE QUILL	1	271781316				
36		HOUSING	1	271853ALF				
38*		OIL SEAL	1	290706PSP				
39*		EXPANSION PLUG	1	271868PSP				
40		LANYARD	1	271869PSP				
41*		BALL BEARING	2	290151PSP				
42*		OIL SEAL	1	290701PSP				
43*		GASKET	1	271795PSP				
44*		RETAINING RING	1	270822PSP				
47		LOCKWASHER	4	112207CPS				
48		HEX HEAD CAP SCREW	4	100159CPS				
49		HEX NUT	4	107010CPS				
50		WASHER	4	112012CPS				
58		SET SCREW - NYLOK	1	271757STL				
59*		RETAINING RING	2	291592PSP				
60		SOCKET HEAD CAP SCREW	4	271758CPS				
61		FLAT WASHER	4	112005316				
70		SOCKET HEAD CAP SCREW	4	102506316				
72		HEX WRENCH	1	127210BPF				
73		LOCKWASHER	4	112204316				
81	А	CLOSE NIPPLE	1	122022BRS				

# ♦ IDENTITY CODE:

A = Air Motor

Blank code denotes common parts

REVISION

IT-3796

<sup>\*</sup> Recommended spare parts



SECTION: 2 PAGE: 81.11 DATE: 7-31-06

#### UNIT SIZE: EV "Q" **MIXER PARTS**

# **GEAR DRIVE UNIT**

For service and repair, call 1-888-MIX BEST (1-888-649-2378)

ITEM NO.	IDE CO	NT. DE	DESCRIPTION			PART NO.	PRICE (EACH)	SHIPMENT (WEEKS)
82		Α	NEEDLE VALVE		1	122911BRS		
85		Α	REDUCER ADAPTER		1	122312BRS		
100			ANGLE RISER ASSEME	SLY (CONSISTING OF	1	802062PSP		
			LEFT HAND AND RIGHT	HAND ANGLE RISERS, AND				
			ITEMS 47, 48, 49 & 50)					
			ANGLE RISER (LEFT I	HAND)	1	130015STL		
			ANGLE RISER (RIGHT	HAND)	1	130016STL		
101			MOTOR		Cor	ntact <i>LIGHTN</i>	IIN Repre	sentative
102			COUPLING		1	292248PSP		
118			MOUNTING PLATE		1	271855STL		
231			MIXER SHAFT		Cor	ntact <i>LIGHTN</i>	IN Repre	sentative
232*			V-RING		Cor	ntact <i>LIGHTN</i>	IN Repre	sentative
							-	
				STANDARD - 2 LB CAN (1)	1	123620PSP		
			LUBRICANT	FOOD GRADE - 14 OZ TUBE	1	275255PSP		

# ♦ IDENTITY CODE:

A = Air Motor

1) = Ambient temperature 50 - 200 Deg. F

Blank code denotes common parts

REVISION IT-3796

<sup>\*</sup> Recommended spare parts

# FOR AN UP TO DATE REPRESENTATIVE LIST PLEASE GO TO: www.lightnin-mixers.com

-OR-

CALL: 1-888-649-2378

1-888-MIX-BEST

# LIGHT

# **REPAIR & SERVICE GUIDE**

# LIGHTNIN Process Equipment Services (LPES): The fastest route to uptime.

**Expertise:** LPES technicians are the backbone of our dedicated service organization. They're uniquely qualified to keep your LIGHTNIN mixers running right.

**Lightnin Certified Technicians:** All LPES technicians are certified via training courses to ensure that the work they do meets the highest standards for consistency and reliability.

**Genuine LIGHTNIN Parts:** All LPES repairs follow original design specs and use only factory-authorized replacement parts.

**Full LIGHTNIN Factory Warranty:** We're so confident we'll do the job right that all LPES repair and service work is covered by a full factory warranty. What we repair, we guarantee – 100%.

**Repair Services:** LIGHTNIN provides quick, reliable repair services — using only certified technicians and factory-authorized replacement parts — on gearboxes, mechanical seals (seal cartridge and seal assembly), steady bearings, machine assemblies, impellers, shafts and all portable units. This service can be provided either at your site or at a LIGHTNIN Service Center location. All work is backed by LIGHTNIN's full warranty on all parts and service.

**Exchange Services:** By eliminating repair time, LIGHTNIN Exchange Services offer the fastest way to get up and running when a breakdown occurs. LPES keeps selected speed reducers, portable units and mixer subassemblies in stock — and available for immediate exchange — at regional service centers. Simply call and we will configure the appropriate assembly and ship it to you within 24 hours. Then send the damaged assembly back to us within 30 days — to ensure you receive a discounted price.

**Equipment Upgrade Services:** Preventive maintenance is your best defense against costly unplanned downtime and repairs associated with old or obsolete equipment. The full range of LPES upgrade services give you a convenient and cost-efficient way to address problems before they happen by converting older equipment to the latest, most reliable LIGHTNIN designs.

**Additional LPES Services:** In addition to minimizing downtime and repair costs when equipment failure occurs, LPES offers a comprehensive range of services for maximizing productivity through every stage of the equipment life cycle.

- Installation and Start-up
- Maintenance and Repair
- Asset Management

# LIGHTNIN

# Process Equipment Services Warranty

When repairs to your LIGHTNIN mixer are needed, we guarantee the results for one full year. This exclusive warranty covers all parts and labor. Talk to your LIGHTNIN sales representative for more information.

# Call:

# **The LIGHTNIN Experts**

When your need is urgent and after normal business hours call our 24-hour response team hotline at I-888-MIX-BEST (U.S. and Canada). Your request will be promptly processed and directed to your nearest LPES team member. For more information visit our website at: www.lightninmixers.com.

# **Factory Service Center Locations**

Chicago, Illinois
Houston, Texas
Mulberry, Florida
Reading, Pennsylvania
Rochester, New York
San Francisco, California
Wytheville, Virginia

# Authorized Service Center Locations

Baton Rouge, Louisiana Concord, Ontario, Canada East Hanover, New Jersey Macon, Pooler, Roswell, Georgia

# **JOHN MEUNIER**

Meadowbank mining Corp. ACP-700R Technical Data Sheet Reference: NC01

# **DOSING PUMP**



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seepex Inc. 511 Speedway Drive Enon, Ohio 45323 Tel +1 (937) 864-71 50 Fax+1 (937) 864-71 57 sales@seepex.net www.seepex.com

# Operating and Maintenance Instructions Progressive Cavity Pump

range size pressure stage 17.01.2006

MD

commission-No.

Job#

2109552

This operating and maintenance instruction includes important safety information and instructions for installation, commissioning, operating and maintenance of the seepex machinery. It is essential therefore, that the responsible specialist refers to it before starting any work on the machinery as well as prior to commissioning. Futhermore, this instruction must always be available on site.

# Offer No. 5357/0556/09-MA

John Meunier Inc/Veolia Water Water Treatment, Saint-Laurent

05/11/2009	Item 1				
qty. 1		rogressive		•	
		2 / A6-A7-	A7-R0-G	A-X	
	X= 0802, 11	NU, 2UA1			
Application data					
Pumped liquid	Sodium Hyd	Iroxide			
Viscosity	78 cPs				
Solids content	no advice				
Size of solids	no advice				
Spec. gravity	1.27 kg/L				
Temperature	32 to 113F				
pH value	no advice				
Composition/Concentr.	25%				
Kind of operation	8h/day				
Site of installation	indoors				
Performance data	Flow rate	Pressure	Speed		
	3.3 l/h	100 psi	27 rpm	min	
	50 l/h	100 psi	307 rpm	max	
Starting torque	3 lb.ft				
Max. power absorbed	0.03 hp				
NPSH required	6.73 ft				
Suction pressure	ass. flooded	l			
Discharge pressure	100 psi				
Differential pressure	100 psi				
Materials and executions					
Installation	horizontal				
Rotation	counter cloc	kwise (left)			
Lantern / drive casing	lantern, star	ndard			
Lantern / drive casing material	1.0037 (St 3	87-2) / A 283	С		
Wetted casing parts	standard				
Wetted casing parts material	1.4408 / A 7	'43 CF8M			
Joint execution	encapsulate	ed (closed) jo	ints with		
	universal joi	nt sleeve			
Joints material	standard				
Universal joint sleeve material	EPDM - ethy	ylene-propyle	ene diene		
Coupling rod	standard				
Coupling rod material	1.6582 enca	apsulated			
Rotor	standard				
Rotor material	1.4571 / 316	S TI SS			
Rotor coating	without				
Stator	standard				
Stator material	EPDM - eth	ylene-propyle	ene-diene		
Shaft sealing	mechanical	seal, single a	acting		
	elastomer b	ellows, either	r sense of		
	rotation, unb	palanced			
Shaft seal casing material	1.4571 / 316	STI SS			

# Offer No. 5357/0556/09-MA

# John Meunier Inc/Veolia Water Water Treatment, Saint-Laurent

Shaft seal material rotating seal face: SiC solid

stationary seal face: SiC solid

elastomers: EPDM

spring: 1.4571 / 316 TI SS metal parts: 1.4571 / 316 TI SS

Plug-in shaft standard

1.4571 / 316 TI SS Plug-in shaft material

**Pump screw fitting** bolting entirely in stainless steel

inclusive tie rods

standard RAL 5013 (blue) **Painting** 

Connections

Branch / hopper position branch / hopper position 1 Casing parts connections Suction connection NPT thread:

NPT 1"

discharge connection NPT thread:

Min.

NPT 1/2"

**Drive** 

Type gear box for mounting of a NEMA motor

Manufacturer Nord SK02F-56C Model Design B3/B5 Gear ratio i = 6.89

Nom. Max. Output speed (rpm) 307 261 27 186 2115 Motor speed (rpm) 1800 Frequency (Hz) 60 71

Electr. motor

Type **NEMA Motor** Manufacturer Baldor VEM3581T-5 Model Rated output 1 hp Rated speed 1800 rpm

Starting direct on frequency inverter

Voltage 3 x 575 VAC Frequency 60 Hz

Premium Efficient Super-E Motor

20:1 Variable Speed

# **Dry-running protection device**

Dry running protection device

TSE 115AC consisting of: - sensor sleeve fitted to the

stator of the pump with installed NTC temperature sensor in IP55 connection head inst. in pump stator - TSE control device for installation

in a control panel - 110-115V / 50-60 Hz



# seepex

# << Back to curves main

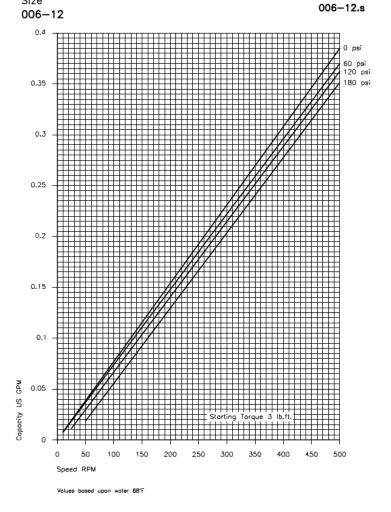
# 12 Pumps

003-12 (low) 003-12 (high) 006-12 (low) 006-12 (high) 012-12 (low) 012-12 025-12 (low) 025-12 (high) 05-12 (low) 05-12 (high) 1-12 (low) 1-12 (high) 2-12 (low) 2-12 (high) 5-12 10-12 14-12 17-12 26-12 35-12 52-12 70-12 130-12

240-12

# Characteristic Curves Size

CHA.006-12.s B 01.03us



quit product catalog

print page | page 37

instructions for printing

Seepex.com General

#### 1.0 General

#### 1.1

## **Application**

These operating instructions contain basic information on the installation, commissioning and maintenance of seepex machines. Compliance with the work steps described in the individual sections is essential.

#### 1.2

# Details of the seepex machines

#### 121

## **Operating Instructions**

The Commission Number (comm. no) assigns the operating instructions to a particular seepex machine. The operating instructions are produced in relation to a specific job/commission and are valid only for the machine whose comm. no. is identical with that indicated on the cover sheet and possessing the associated data sheet, Point 9.

#### 1.2.2

#### Manufacturer

The machines were manufactured by seepex.

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## Range, Size, Version

of the machines are stated in the appended data sheet, Point 9.

#### 1.2.4

### Machine Comm. No. and Year of Construction

are stated on the type plate at the machine.

#### 1.2.5

# **Release Date of the Operating Instructions**

is stated on the cover sheet of the operating instructions.

#### 1.2.6

# Modifications, Notes of Modification

If modifications to the machines are carried out in agreement with seepex, a new set of operating instructions will be provided, or the existing operating instructions will be supplemented by an additional sheet together with a new cover sheet. The date of modification and modification index will be noted on the new cover sheet.

# 1.2.7 EEC Machine Directive

#### 1.2.7.1

# **Manufacturer's Declaration**

seepex Manufacturer's Declaration as required by the EEC Machine Directive 89/392/EEC, Appendix II B:

The seepex machines delivered in accordance with our design are intended to be fitted in one machine or assembled together with other machines to form one machine/plant. The commissioning of the machine is forbidden until such a time as has been established that the entire machine/plant satisfies the requirements of the EEC Directive for Machines as amended 91/368/EEC and 93/44/EEC.

Particular attention must be paid to the safety requirements specified in EN809 (s and Equipment for Fluids) as well as the information in these operating instructions.

# 1.2.7.2 Declaration of Conformity

seepex machines possessing no safety accessories do not fulfill the requirements of the EEC Machine Directive 89/392/EEC as amended 91/368/EEC and 93/44/FFC.

For this reason, no Declaration of Conformity as required by the EEC Machine Directive 89/392/EEC, Appendix IIA can be issued before appropriate safety devices have been installed/mounted on the machine and/or plant with due regard to the information given in these operating instructions.

The following harmonized standards are particularly applicable:

EN 809, EN292T1, EN292T2

Applicable national standards and specifications must be taken into consideration.

Following assessment of the conformity of the machine/plant with the EEC Machine Directive, customers may on their own initiative place on the full machine/plant the EEC symbol 'CE' as defined in Identification Directive 93/68/EEC.

# CAUTION

This documentation must be kept available for at least 10 years.

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# 1.2.8 Copyright and Industrial Property Rights

These operating instructions are copyrighted. The reproduction, in particular by photocopying, of these instructions is not permitted (§§ 54, 54 UrhG) and constitutes a criminal offence (§ 106 UrhG). Proceedings will be instituted if the copyright is violated.

#### 1.2.9

# **Specifications Required for Inquiries and Orders**

The following information must be included when inquiring about replacement parts or placing orders:

- comm. no.
- / machine type

This information is given on the type plate mounted the machine.

#### 1.2.10

# **Technical Data Sheet**

see Point 9.

### 1.2.11

# Performance Data, Load Index, Power Consumption

are indicated in the associated data sheet, Point 9.

## 1.2.12

# **Sound Pressure Level**

The sound pressure level and/or noise characteris-tics of the seepex machines are ascertained in accordance with DIN 45635. The measuring guidelines are largely identical with the international standards ISO 3740-1980 and ISO 3744-1981.

# 1.2.13

# **Operating Range**

Employment of the machine is not permissible for purposes other than those stated in the data sheet, see Point 9. seepex cannot accept liability for damage arising through failure to comply with this operating range.

#### 1.3

# **Supplementary Information**

#### 1.3.1

# **Accessories, Optional Extras**

Please refer to the data sheet, Point 9.

# 1.3.2 Company Address, Service Addresses

see Point 11

Seepex.com Safety

### 2.0 Safety

These operating instructions contain basic requirements to be observed during the installation, operation and maintenance of the machine. Therefore, the instructions must be read by the mechanical fitter and by the technical personnel/operator responsible for the machine prior to assembly and commissioning, and kept available at the operating site of the machine/plant at all times.

Compliance is required not only with the general safety instructions given in this section but also with the detailed instructions, e.g. for private usage, given under the other main headings in these operating instructions.

# 2.1 Labeling of Advice in the Operating Instructions

In these operating instructions safety advice whose non-observance could lead to danger for life or limb is labeled with the following general hazard symbol:



safety symbol acc. to ISO 3864 - B.3.1

Warnings regarding electric power are labeled with:



safety symbol acc. to ISO 3864 - B.3.6

Safety instructions whose non-observance could jeopardize the machine and its functions are labeled by the word

#### CAUTION

Always comply with instructions mounted directly on the machine, e.g.

- rotational direction arrow
- fluid connection indicators

and ensure that the information remains legible.

# 2.2 Personnel Qualifications and Training

Personnel charged with operation, maintenance, inspection and assembly must be in possession of the appropriate qualifications for the tasks. The company operating the machine must define exact areas of responsibility, accountabilities and personnel supervision schemes. Personnel lacking the required skills and knowledge must receive training and instruction. If necessary, the opera-ting company may commission the manufacturer/ supplier to conduct these training courses. Furthermore, the operating company must ensure that the personnel fully understand the contents of the operating instructions.

# 2.3 Dangers Resulting from Failure to Observe Safety Instructions

Failure to comply with the safety instructions may lead to hazards to life and limb as well as dangers for the environment and the machine. Non-observance of safety instructions can invalidate the right of claim to damages.

The following are just some **examples** of possible dangers resulting from failure to comply with the safety instructions:

- Failure of important machine/plant functions
- Failure of prescribed methods of service and maintenance
- Danger to life and limb due to electrical, mechanical and chemical influences
- Danger to the environment due to the leakage of hazardous substances

# 2.4 Safety-conscious Working

Always comply with the safety instructions listed in this document, the existing national accident prevention regulations and any company-internal work, operating and safety rules. Seepex.com Safety

# 2.5 Safety Instructions for the Operating Company/Machine Operator

- Any potentially hazardous hot or cold machine parts must be provided with protection against accidental contact at the customer's premises.
- Protective guards for moving parts (e.g. coupling) must never be removed while the machine is in operation.
- Leakages (e.g. in the shaft seal) of hazardous conveying liquids (e.g. explosive, toxic, hot) must be drained in such a way that no danger arises for persons or for the environment. Always observe the relevant statutory requirements.
- The risk of exposure to electrical power must be eliminated (for details, see the VDE regulations, for example, or those of the local power supply company).

## 2.6 Safety Instructions for Maintenance, Inspection and Assembly Work

The operator must ensure that all maintenance, inspection and assembly tasks are carried out by authorized and qualified personnel who have studied the operating instructions closely and become sufficiently familiar with the machine.

As a basic rule, the machine must be brought to a standstill before work is carried out. Always comply with the de-commissioning procedure described in this document.

Any machiness or assemblies conveying media that are detrimental to health must be decontaminated.

Immediately following completion of work, all safety and protective devices must be replaced in position and, where applicable, re-activated.

Before re-starting the machine, observe the points listed under the heading "Initial Startup".

## 2.7 Unauthorized Modification and Manufacture of Replacement Parts

Conversions or modifications of the machine are permissible only in consultation with the manufacturers. Original manufacturer replacement parts and manufacturer-approved accessories enhance the operational safety of the machine. The usage of unauthorized parts may lead to the nullification of the manufacturer's liability for any resultant damages.

# 2.8 Impermissible Modes of Operation

The operational safety of the machines supplied is warranted only for employment in accordance with the intended use as defined in Section 1 - General - of these operating instructions. Never allow the threshold values specified in the data sheet to be exceeded.

# 3.0 Transport and Intermediate Storage

#### 3.1

### **Safety Precautions**

Employ appropriate transport means, hoists and tools when transporting and storing the machine, always observing the safety instructions.

#### 3.2

#### **Transport**

Depending on its weight, the seepex machine must be transported manually or with appropriate transport means. Comply with the transport instructions on the packing.

#### 3.3

## Unpacking

The design of the packing is such that the equip-ment can be removed manually or, if demanded by the weight, by means of appropriate hoists.

Any screw fittings between the machine and the packing must be undone. Comply with the attached information notices and symbols.

# 3.4 Intermediate Storage/Preservation

Unless otherwise indicated in the data sheet, seepex machines are provided with preservation only for the duration of transport. If a long period of intermediate storage is foreseen before the machine is commissioned, it is necessary to pro-vide supplementary preservation. If necessary, the appropriate measures should be drawn up in consultation with seepex.

Intermediate storage in extreme climatic conditions is permissible only for machine whose design is appropriate to the circumstances. If necessary, seepex must be consulted.

#### CAUTION

Pumps of the range MAP

If the period from supply and subsequent storage until the commissioning is more than 4 weeks, the hoses should be dismantled, refer to Point 7.

#### 3 5

#### **Protection against Environmental Influences**

To afford protection against environmental influences, the intermediate storage location must be dry, enclosed and free from frost.

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# 4. Description of the seepex Progressive Cavity Pump and Accessories

#### 4.1

## General Description, Design and Mode of Operation

Like all progressive cavity pumps, seepex pumps belong to the rotating positive-displacement pump family. The characteristic attribute of these pumps is the special formation and arrangement of the two conveying elements, namely the rotor and the stator.

The difference in the number of threads possessed respectively by the rotor and stator produces a chamber that opens and closes alternately in line with the constant turning motion of the rotor, effecting the continuous transportation of the conveying product from the suction side to the pressure side.

The geometrical formation of the two conveying elements combined with the constant contact that exists between them result in sealing lines that effect an airtight seal between the suction and pressure side in every position of the eccentric screw, even when the pump is stationary. The pump owes its high suction capacity to this sealing between the suction and pressure sides.

## 4.2

## **Mechanical Design**

Please consult the sectional drawing, Point 9, for the mechanical design of the pump. The data sheet, Point 9, gives information on the design of the pump housing, stator, rotor and rotating components.

Refer to document OM. SEA. \_\_\_, for information on the design of the shaft seal.

The data sheet, specifies details of the design of the drive engine. Further details are given in the appended manufacturer's documents, Point 10.

#### 4.3

### **Accessories**

Consult the data sheet for information.

#### 4.4

## Dimensions, Weight

Consult the appended dimensional drawing,

# 4.5 Design Variants

Refer to the data sheet, Point 9, for the design of the seepex progressive cavity pump. Other design variants are possible, whereby seepex must first check whether a particular pump is suitable for the intended purpose.

# 4.6 Operating Site Specifications

Operating site specifications are listed in the data sheet, Point 9. Details of the space required for installation, operation and maintenance are given in Point 5.2.1.

# 5.0 Assembly / Installation

#### 5.1

## **Mounting Tools / Hoists**

No special tools are required for the assembly and installation of the pump.

The customer must check the dimensions and weight of the seepex progressive cavity pump to ascertain whether the available hoisting apparatus is sufficient for the assembly and fitting of the pump.

# 5.2 Initial Assembly

#### 521

#### Inspection Prior to Commencement of Assembly

#### 5.2.1.1 Location

The place of installation for the pump must con-form with the site stated in the data sheet in Point 9. Any change of location must be checked and approved by seepex.

# 5.2.1.2 Space Requirements

Customers are responsible for determining the space requirements; the following factors must be taken into consideration:

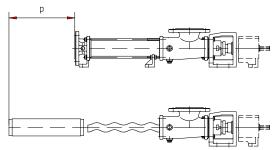
- · dimensions and weight of the machine
- required transport and hoisting equipment
- possible piping layout with allowance for the space allowing disassembly of the rotor as defined in 5.2.1.3
- freedom of movement to:
   operate the drive /
   speed regulation
   read speed and pressure indicators
   adjust a stator retensioning device, if fitted
   operate a buffer fluid supply unit, if fitted
- space required for lubrication / renewal of lubricants
- disassembly of mechanical protective devices, e.g.
   V-belt or coupling protection
- space required for handling the mounting tools, e.g. sufficient wall clearance

#### 5.2.1.3 Space Allowing Disassembly of Stator P

A specific space must be allowed for exchanging the stator. The required dimension "P" is indicated in the index of these operating instructions or in the appended dimensional drawing, Point 9.

CAUTION

Ensure also that the pipe work can be dismounted at this location too.



5.2.2 Installation of the Fully Assembled Pump

- Installation in conformity with data sheet
  Installation of the pump is permissible only in
  accordance with the data sheet specifications and
  the associated basic drawing, see Point 9. Any
  change in the position must be checked and
  approved by seepex.
- Tension-free mounting of pump
   This rule applies to pumps with and without drives,
   to versions with and without baseplate, for
   mounting on the foundation or other bearing
   elements. The entire area of all bearing surfaces of
   the machine must rest on the ground. Any
   unevenness must be corrected by appropriate
   supports.
- Correct seating of drives
   All drives have been aligned ready for operation
   and mounted by seepex. However, displace-ments
   may occur during transport or installation. For this
   reason, check that the alignment and fastening of
   the drive and coupling are correct.
- Protective devices
   On completion of the assembly and installation work, immediately mount all safety and protective devices in their proper locations and set them in operation.



# 5.2.3 Protective and Controlling Equipment

Information on equipment of this nature, where fitted, is provided in the data sheet, Point 9. Consult the attached manufacturer's specifications, Point 10, for instructions on assembly and installation.

# 5.2.4 Electric Connection of Electric Motor and Frequency Converter

The electric connections must be established in accordance with the manufacturer's specifications, Point 10, as well as the safety specifications applying at the installation site. The mains voltage and frequency must match the ratings indicated on the type and rating plates.

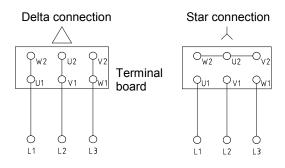


• Switch on electric motor "direct-on-line"

CAUTION

An increased starting torque is necessary due to the clamping between the rotor and stator conveying elements. This means the electric motors that drive the progressive cavity pumps must always be switched on directly. As a rule, star-delta startup is not possible unless special arrangements have been made with seepex.

Three-phase cage motor



low . . . high . . . . . . voltage indicated on rating plate

Speed regulation via frequency inverter
When progressive cavity pumps with frequencycontrolled drives are started up problems may occur
due to unsuitable or wrongly set frequency inverters.
For this reason we recommend the purchase of the
complete drive, including frequency inverter, from
seepex, so that the frequency inverter can be tuned
on the seepex test field along with a trial run.

Ensure that customer-supplied frequency inverters comply with the starting torque and running power specified in the appended data sheet, Point 9.

#### CAUTION

Consult the appended document TI.FRU.01, see Point 9, for further information on the electric connection and the setting of frequency inverter and variable-speed motor.

### 5.2.5 Piping

# 5.2.5.1 Suction and Pressure Flanges

The position, nominal width and standard of the suction and pressure flange of the progressive cavity pump are specified in the dimension drawing, Point 9, and data sheet, Point 9. Always observe the rotational direction and flow direction defined in Point 6.2.5.

# 5.2.5.2 Piping Dimensioning CAUTION

The pipe diameters on the suction and pressure sides must be dimensioned in accordance with the customer's pressure-loss calculation in such a way that the pressures specified in the data sheet, Point 9, are not exceeded. The nominal width of the suction pipe should at least match that of the pump suction flange.

# 5.2.5.3 Residue-free Piping CAUTION

Prior to starting up the pump, ensure that all pipelines are free from foreign bodies. Installation residues (such as weld spatter, screws, steel chips etc.) will lead to damage of the **seepex** pump for which guarantee claims will not be accepted.

## 5.2.5.4 Tension-free Mounting CAUTION

Pipelines and other components requiring to be connected with the pump must be mounted without stresses.

## 5.2.5.5

#### Fluid Connections for Optional Extras

Consult the data sheets, Point 9, for information regarding the optional extras, if any, that are fitted. The technical description is given under Point 9.

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# 6.0 Commissioning/De-commissioning

#### 6.1

#### **Engineering Data**

Details regarding all technical specifications and operating conditions are given in these operating instructions together with the data sheet, Point 9.

To guarantee the correct assignment of documentation to pump, the commission number on the

- · cover sheet
- and data sheet of these operating instructions must match the commission number stated on
- the nameplate of the pump.

#### 6.1.1

#### See Point 7.2.2 for Lubricant Chart

#### 6.2

#### **Preparation for Operation**

### 6.2.1 Bearing

#### 6.2.1.1

See Point 7.2.1.4 for pump bearing.

#### 6.2.1.2

See manufacturer's documents, Point 10, for drive bearings.

## 6.2.2

### **Shaft Sealing**

See document OM.SEA.\_\_\_,.

#### 6.2.3

# Filling Up of Suction Side to Avoid Dry Running at Startup

## CAUTION

Before switching on the pump, fill the suction-sided pump casing with fluid so that the first rotations will lubricate the conveying elements immediately. A small quantity of fluid is sufficient for lubrication; the subsequent operation of the pump is self-priming, even if an air column up to the liquid level remains.

# 6.2.4 Electric/Hydraulic Connections



The connections are listed in the appended manufacturer's documents, Point 10.

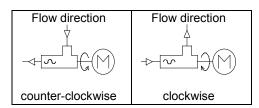
The risk of exposure to electrical hazards must be ruled out. Always observe the safety regulations valid at the site of installation.



# 6.2.5 Checking Direction of Rotation

The rotational direction of the pump determines the flow direction of the conveying medium.





Prior to commissioning the rotational direction of the pump must be checked for compliance with the data sheet specification and the rotational direction arrow on the type plate of the pump.

## 6.3 Control and Monitoring Equipment

Where applicable, please refer to the associated documents, Point 10, for information on commissioning.

# 6.3.1 Performance Check

Any optional extras must be subjected to a performance check in conformity with the specifications by seepex or other manufacturers, see manufacturer's documents.

## 6.3.2 Setting

Unless already performed in the factory, setting must be carried out in accordance with the appended manufacturer's specifications, Point 10. Pay attention to the operating specifications in the data sheet.

# 6.4 Equipment for Protection of Persons

Machines must be fitted with mechanical protective devices complying with DIN EN 809.

- Moving or working parts must be protected against accidental contact.
- However, safety considerations demand it be possible at all times to check without hindrance whether the shaft seal is fully functional.
   A protective guard is necessary in this area only if components are mounted on the rotating, smooth shaft.



- If pumps are operated with an open suction flange/feed hopper, a suitable protective guard complying with DIN EN 294 must be mounted.
- Country-specific protective regu-lations must be observed at the site of installation.
   Prior to activation of the pump, check the proper function of all protective equipment.

# 6.5 Commissioning

# 6.5.1 Initial Startup/Re-starting CAUTION

Every seepex progressive cavity pump is designed for the specific operating conditions documented in the data sheet. Commissioning is permissible only if the operating conditions conform with those indicated in the data sheet. Although the potential usages of the seepex pump are not confined to the specified operating conditions, any change in the original conditions must be checked and approved by seepex.

The right to make claims under the warranty agreement will be annulled if operating conditions are changed without prior approval by seepex.

## 6.5.2 Avoid Dry Running of Pump CAUTION

The dry running of a pump increases the friction between rotor and stator, quickly causing an unacceptably high temperature to develop on the inner surface of the stator. This overheating leads to burning of the stator material and the total failure of the pump.

For this reason it is necessary to ensure that the suction-sided flow never dries up completely. If a continuous flow cannot be guaranteed for the plant, it is essential to fit the seepex dry running protection device TSE, available as an optional accessory.

# 6.5.3 Check Pressure at Suction and Pressure Flanges

## 6.5.3.1 Safeguard Pump Against Excessive Pressure at the Suction Flange

The seepex pump is designed to operate with the pressure at the suction flange (suction head or inlet pressure) specified in the data sheet. Deviating pressure conditions may lead to the failure and/or destruction of the shaft seal or entire pump.



For this reason the suction pressure specified in the data sheet must be guaranteed. Appropriate monitoring devices are oil-filled contact manometers that deactivate the pump.

## 6.5.3.2 Safeguard Pump Against Excessive Pressure at the Pressure Flange

The seepex pump operates according to the positive displacement principle. Operation of the pump against an excessive pressure caused by closed valves, by high pressure losses in the piping or by product sedimentation will lead to the destruction of the pump, drive, pipe work and/or downstream equipment. Every progressive cavity pump must therefore be protected against overpressure. Safety valves with bypass pipes or oil-filled contact manometers that disactivate the pump are appropriate protective devices.



# 6.5.4 Drive Engine

Consult the attached manufacturer's operating instructions, Point 10, for information on commissioning the drive engine.



# 6.5.5 Establish Clear Passage Through Pipelines CAUTION

To prevent damage to the pump the unhindered flow of liquid must be guaranteed between the points of entry to and exit from the pipeline. For this reason, open all relevant valves etc. prior to activation of the pump.

# 6.6 De-commissioning

# 6.6.1 De-activation

The electric connections must be switched off and protected against accidental re-activation. Observe the safety regulations applying to the plants.



## 6.6.2 Stationary Pump

The pump and all optional equipment must be provided with the following protection modes while at a standstill:

- Frost protection
- Protection against solid particle deposits
- Protection against sedimentation of the medium
- Corrosion protection for parts in contact with the medium

We recommend that the pipeline and pump be emptied for the duration of the plant standstill. Following evacuation, the pump should be preserved.

# 6.6.3 Evacuation of the Pump

The pipeline must be evacuated on the suction and pressure side or shut-off directly behind the pump connections. Drain any residual liquid in the pump casing by opening/ removing the screwed sealing plugs (705) and (502), sealing rings (706) and (503). Casings without screwed plug must be evacuated by the connection branch (SAG and DRS). Refer to the data sheet and the sectional drawing of the associated operating instruction, Point 9, for information on the pump design. Conveying medium residues always remain in the rotor/ stator chambers and may run out during transport or disassembly of the pump. If conveying aggressive or hazardous media, therefore, wear appropriate protective gear during all installation work.



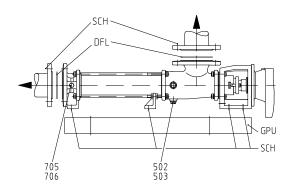
# 6.6.4 Disassembling the Pump

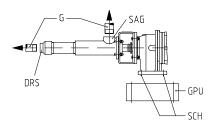
Dismantle the pipe work by removing the flange bolts (SCH) and flange seals (DFL) or the threaded connections (G).

Disassemble the pump together with the baseplate (GPU) or, as applicable, without the baseplate (GPU) following removal of the bolts (SCH) at the pump feet

Block-design pumps with direct flangemounted drive engine are liable to become unstable during disassembly. Stability can be restored by propping up the drive engine.







6.6.5 Preservation/Storage

The pump must be preserved prior to storage. Appropriate preservation measures must be agreed with **seepex**. Always state the pump commission number when making inquiries.

# These operating instructions are valid for range MD (stainless steel-design) size 0015-24 to 012-24

#### 7.0

### **Service and Maintenance**

Contents

7.1 General Instructions

7.2 Service and Inspection

7.3 Dismantling

7.4 Re-assembly

The sectional drawing and parts list relevant for Points 7.3 and 7.4 can be found in Point 9.

#### 7.1

#### **General Instructions**

A requirement for the reliable operation of any pump is service and maintenance in compliance with instructions. Maintenance personnel must therefore have access to these operating instructions and adhere to them meticulously. seepex will accept no liability for damages arising through non-observance of these operating instructions.

#### 7.2

#### Maintenance and Inspection

## 7.2.1

## Lubrication

#### 7.2.1.1

#### **Rotor and Stator**

The rotor and stator are lubricated by the conveying medium.

## 7.2.1.2

#### **Shaft Sealing**

Consult document OM.SEA.\_\_ for information on lubricating the shaft seal.

## 7.2.1.3

## **Pin Joint**

The pin joints are filled with special grease and lubricated for the expected duration of service. The seepex joint grease specified in the index of these operating instructions should be used exclusively for any required maintenance work.

### CAUTION

Usage of other grease types will lead to premature joint failure and render invalid any right to claims under guarantee.

#### 7.2.1.4

#### Bearing of the Pump/Drive Engine

The bearing of the rotating pump parts is effected by the drive engine. Lubrication instructions are therefore included in the appended drive engine operating instructions.

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## **Lubricant Filling Levels**

Details are specified in the index.

### 7.2.3

### **Drives and Optional Extras**

For maintenance and inspection specifications, see the appended manufacturer's documents.



#### 7.2.4

### **Supervision during Operation**

#### 7.2.4.1

## **Shaft Sealing**

See document OM.SEA. .

#### 7.2.4.2

## **Optional Extras**

These must be monitored in accordance with the separate documents, Point 9/Point 10.

#### 7.2.4.3

#### **Drive Engines**

These must be monitored in accordance with the separate manufacturer's documents, Point 10.

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#### **Preventive Measures**

To avoid the expenses incurred by lengthy stop periods of the pump, seepex recommends the acquisition of a set of wearing parts and a set of gaskets. The contents are listed in the document OM.WPS.40.

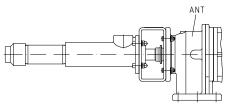
## 7.3 Dismantling the seepex Progressive Cavity Pump

Tools are required for dismantling and re-assembly. These tools are listed in Point 9 of the document OM.SPT.01.

The stator (601) and the rotating pump parts can be exchanged in site. The rotating pump parts can be dismantled as a complete rotating unit (RTE) (Point 7.3.4) or as individual components (Point 7.3.5).

Before commencing the dismantling of pump parts, safeguard the pump against tipping over or falling down by fastening it at the drive (ANT).





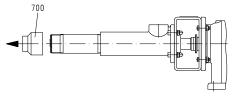
7.3.1 Pressure Flange (700) - Dismantling

Prior to dismantling see Point 7.3.2

CAUTION

Pressure branch (700) is glued in place with an adhesive of medium strength.

Therefore, to break the seal / adhesive compound it is recommended to heat upto a maximum of 80 °C.



7.3.2 Stator (601) - Dismantling

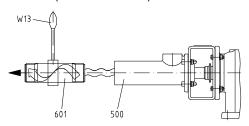
#### • Maintenance tip:

Disassembly of the stator can be made considerably easier by first moistening the inner surface of the stator with antiseize agent (soft or liquid soap). Before removing the pressure flange (700), pour the antiseize agent into the opening between rotor and stator on the pressure flange side. Several clockwise (see Point 6.2.5) revolutions of the rotor will then distribute the antiseize agent over the inner surface of the stator and reduce the friction between rotor and stator considerably.

## • Lock drive shaft against rotation.

## CAUTION

Stator (601) is glued in place with an adhesive of medium strength. Therefore, to break the seal / adhesive compound it is recommended to heat upto a maximum of 80 °C. Dismantling the stator (601) with tool (W13/see Point 9).



7.3.3 Suction Casing (500), Casing Gasket (501) -Dismantling

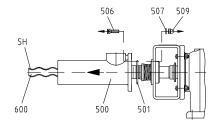
Fit the rotor (600) with a protective cover (SH).

#### CAUTION

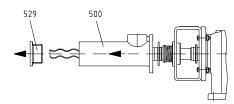
Suction casing (500) with reducing unit (529) Reducing unit (529) is glued in place with an adhesive of medium strength.

Therefore, to break the seal /adhesive compound it is recommended to heat upto a maximum of 80°C.

Suction casing (500) without reducing unit (529)



Suction casing (500) with reducing unit (529)

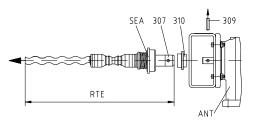


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# 7.3.4 Rotating Unit (RTE) - Dismantling CAUTION

Before dismantling the rotating unit it is essential to comply with the specifications in document OM.SEA. Shaft Seal Dismantling, see Point 9...

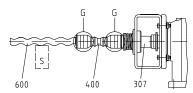
- Remove flushing connections at shaft seal housing (SEA).
- Raise/shift splash ring (310) and eject plug-in shaft pin (309) in horizontal direction.
- Remove rotating unit (RTE)/plug-in shaft (307), together with shaft seal (SEA) from output shaft of the drive (ANT). See Document OM.SPT.01, in Point 9 for tool (W10) used for pulling off.
- See in document OM.SEA.\_\_ for removal of the shaft seal (SEA) from the plug-in shaft (307).



7.3.5 Rotating Pump Parts - Dismantling

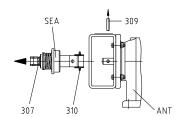
## 7.3.5.1 Rotor (600), Coupling Rod (400)

Detach the rotor (600) and coupling rod (400) from the plug-in shaft (307) by dismantling the joint (G) in accordance with Point 7.3.6.



7.3.5.2 Plug-in Shaft (307)

The plug-in shaft (307) is removed in the same way as the rotating unit (RTE), see Point 7.3.4.



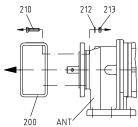
# 7.3.6 Dismantling of Joint

see document OM.PJT.04 Point 1.

## 7.3.7 Shaft Sealing

See document OM.SEA.\_\_ for information on dismantling the shaft sealing.

7.3.8 Lantern (200)/Drive (ANT) - Dismantling



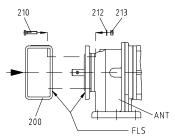
7.4 Re-assembly

Before commencing the reassembly, fasten the drive (ANT) in such a way that it cannot tip over or fall down during the re-assembly of the drive and all pump components.



#### 7.4.1 Lantern (200)/Drive (ANT) - Assembly

Clean flange bearing surfaces (FLS), centering diameter and output pivot of the drive (ANT).

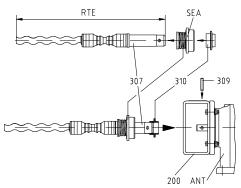


7.4.2 Rotating Unit (RTE) - Re-assembly

The rotating unit (RTE) has been assembled in accordance with the description in document OM.PJT.04

 Mount shaft seal (SEA) on plug-in shaft (307) in the way described in document OM.SEA.\_\_, see Point 9.

- Moisten splash ring (310) and plug-in shaft (307) with joint grease (see index for type) and slide splash ring (310) onto plug-in shaft (307), observing the fitting position of the splash ring, (see lettering on the splash ring).
- Apply antiseize graphite petroleum to the output pivot of the drive (ANT) and slide on the rotating unit (RTE). Insert plug-in shaft pin (309) horizontally.
- Splash ring position (310)
   Outer edge of splash ring (310) has to occlude with outer edge of plug-in shaft (309).

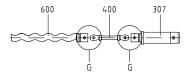


7.4.3 Rotating Pump Parts - Re-assembly

Prepare main components:

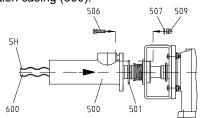
Prepare rotor (600), coupling rod (400) and plug-in shaft (307) as described in document OM.PJT.04 Point 2. to 2.3

Joint (G) re-assembly as described in document OM.PJT.04 Point 3.



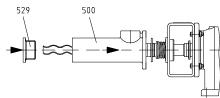
7.4.4 Suction Casing (500), Casing Gasket (501) - Reassembly

Fit protective cover (SH) on rotor (600). Assemble casing gasket (501) and suction casing (500).



## CAUTION

Install reducing unit (529) to suction casing (500) with an adhesive of medium strength



7.4.5 Stator (601) - Assembly / Re-assembly

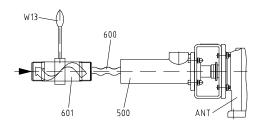
#### Maintenance tip:

Disassembly of the stator can be facilitated considerably by first moistening the inner surface of the stator with antiseize agent (soft or liquid soap). Before removing the pressure flanges (700), pour the antiseize agent into the opening between rotor and stator on the pressure flange side. Several clockwise (see Point 6.2.5) revolutions of the rotor will then distribute the antiseize agent over the inner surface of the stator and reduce the friction between rotor and stator considerably

Lock drive (ANT) shaft against rotation.

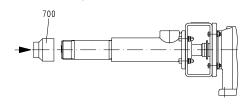
## CAUTION

Install external thread of stator (601) with an adhesive of medium strength. Turn stator (601) to the right using a tool (W13/see Point 9), slip it onto rotor (600) and screw it into the suction casing (500) at the same time.



# 7.4.6 Pressure Flange (700) - Assembly CAUTION

Install pressure branch (700) with an adhesive of medium strength



# 1.0 Dismantling of Joint

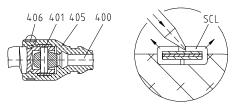
# 1.1 Holding Band (406) - Dismounting

Cut through loop (SCL) of the holding band (406) with a metal saw.

Wear protective goggles when squeezing out the two halves of the holding band loop (SCL).

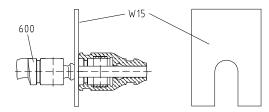


Remove holding band (406).



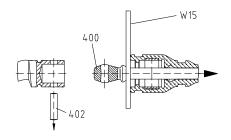
1.2 Rotor (600) - Dismantling

Withdraw universal joint sleeve (405) with retaining sleeve (401) in coupling rod direction and fix it by using a special maintenance tool (W15/see document OM.SPT.01)

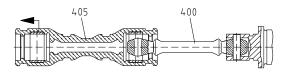


## Separation of Joint

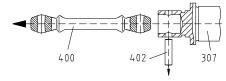
Eject coupling rod pins (402). Pull coupling rod (400) out of joint top.



### 1.3 Universal Joint Sleeve (405)

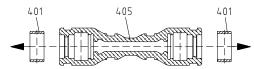


## 1.4 Coupling Rod (400)



## 1.5 Retaining Sleeve (401)

Remove retaining sleeve (401) from universal joint sleeve (405).



2.0 Prepare main components for Re-assembly

## 2.1 Rotor (600) - Preparation for Joint Assembly

First remove any burr, flaws or similar defects from the rotor, then clean it.

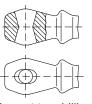
If the hole for the coupling rod pin (402) has worn out, a new rotor (600) has to be installed.

# Coupling Rod (400) - Preparation for the Joint Assembly

Clean coupling rod and check top drilling regarding wear.

## CAUTION

If the top drilling shows wear, a new coupling rod will have to be used.



Correct top drilling

### 2.3 Plug-in Shaft (307) - Preparation for Joint Assembly

Remove any burr, flaws or similar defects from the plug-in shaft (307), then clean it.

If the hole for the coupling rod pin (402) has worn out, a new plug-in shaft (307) has to be installed.

## 3.0 Joint - Re-assembly CAUTION

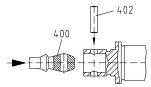
To ensure a perfect operation of the joints, coupling rod pins (402) and coupling rods (400) showing wear should be replaced. Refer to Point 2.2

## 3.1 Joint Grease (098)

Joint head at rotor (600) and plug-in shaft (307) Fill joint head with joint grease (098). (Regarding joint grease (098) refer to index of operating instruction)

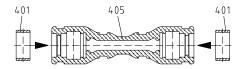


# 3.2 Coupling Rod (400)



# 3.3 Retaining Sleeve (401)

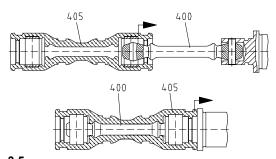
Moisten both sides of retaining sleeve (401) with joint grease and insert this unit in universal joint sleeve (405).



## 3.4 Universal Joint Sleeve (405)

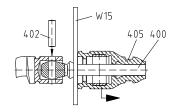
Moisten surface of coupling rod (400) and inner surface of universal joint sleeve with joint grease Regarding joint grease (098) refer to index of operating instruction.

Slip universal joint sleeve (405) with fitted retaining sleeves (401) onto coupling rod (400) and joint head.



3.5 Rotor (600)

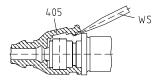
Push back universal joint sleeve (405) at rotor side towards coupling rod (400) and fix it using the relevant tool (W15/refer to document OM.SPT.01).



Slip universal joint sleeve (405) onto joint head.

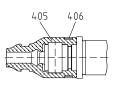
# 3.6 Universal Joint Sleeve - Deaeration

Deaerate interior space of joint at the side of plug-in shaft and rotor using relevant tool/screw driver (WS)



#### 3.7 Holding Band Re-assembly

Mount holding band (406) using tool (W3/OM:SPT.01) as described in document OM.HBD.01.



## Holding Band (HBD) - Assembly

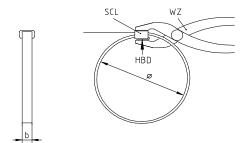
Tools required for the re-assembly, see document OM.SPT.01.

### · Prepare holding band

Only prefabricated double-band holding bands should be used. The diameter  $(\emptyset)$  and in particular the breadth (b) of the holding band is matched to the universal joint sleeve.

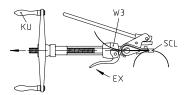
### · Test holding band

The bent holding band (HBD) must fit against the holding band loop (SCL), if necessary apply pressure with the tool/pliers (WZ).

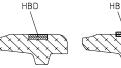


#### · Assembly of holding band

Insert holding band in tool (W3/ see Point 9). Hold free end of holding band with control lever (EX), turn crank (KU) until the holding band is strained and fitting against the holding band loop (SCL). Carefully contract holding band until it fits inside the circular groove of the universal joint sleeve.



## • Correct holding band tension (HBD)



Correct
Holding band
(HBD) has
slightly contracted outer
form of
univers-al joint
sleeve and is
stuck in
position.



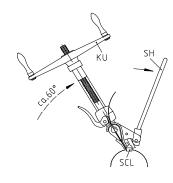
Incorrect Holding band (HBD) is too slack and liable to slip.



Incorrect
Holding band
(HBD) is too tight.
Universal joint
sleeve will be
damaged/sheared
off.

• Folding back the holding band (HBD)

Slowly swivel mounting tool upward by 60°, at the same time slackening the crank (KU) by approximately one half revolution. Swivel cutting lever (SH) forward until the pressure plate fits against the holding band loop (SCL).



 Shearing off holding band (HBD) made of material AISI 304 and AISI 316

A blow with the palm of the hand against the cutting lever (SH) causes the end of the holding band behind the loop (SCL) to be folded back and sheared off. If the holding band on the sheared off side is slightly raised as a result, it must be straightened carefully.

## CAÚTION

Never tap or hammer against the loop of the holding band (SCL), otherwise damage to the universal joint sleeve may occur.



 Shearing off holding band (HBD) made of Hastelloy C

The high strength of this material makes it impossible to shear off the holding band (HBD) with the cutting lever (SH). Once the end of the holding band is folded back, cut off the holding band (HBD), file off projecting edges and remove burr.



Check after mounting of holding band

The holding band must run all the way round the groove of the universal joint sleeve.

The holding band (HBD) must be bent back and sheared off at the holding band loop (SCL) in such a way that the holding band (HBD) is unable to slip back through the holding band loop (SCL). If this has not been accomplished, then the holding band (HBD) must be replaced by a new one.

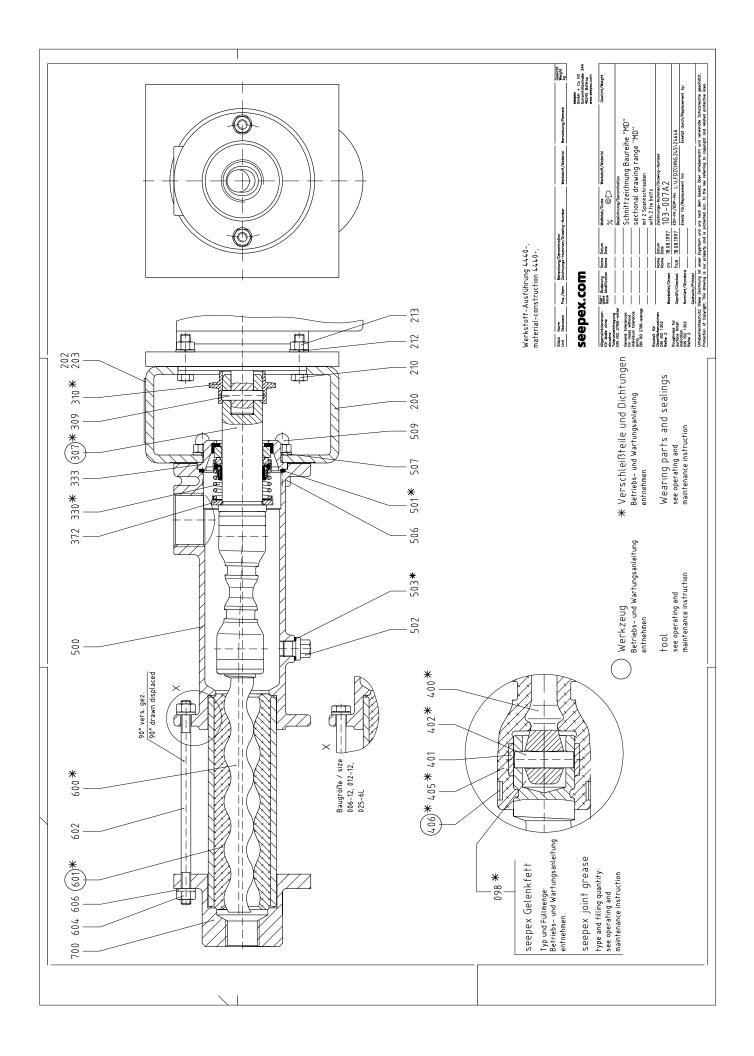




				<b>D</b>	11								
	Breakdown												
pump has no suction	pump conveys irregularly	the conveying capacity is not achieved	pressure is not achieved	pump does not start	pump has seized or has stopped conveying	pump operates noisily	motor becomes too warm	the stator wears out early	shaft sealing leaks	seepex progressive cavity pumps will operate trouble-free if they ar used in accordance with our data sheet (see item 9) and our operating and maintenance instructions:			
1	2	3	4	5	6	7	8	9	10		Reasons / Remedies		
				Х			X			а	Adhesion between rotor and stator excessive (as delivered). Lubricate (soft soap, genuine soap) between stator and rotor.  Then turn the pump by means of the tool W2.		
Х										b	Check rotational direction of the pump per data sheet and nameplate. In case of wrong direction, change wiring of motor.		
Х	Χ	Х			Х	Х				С	Suction pipe or shaft sealing leak. Eliminate the leakage.		
Х	Х	Х				Х				d	Suction head too high (item 6.5.3.1). Check suction head with vacuum gauge. Increase the suction pipe diameter and fit larger filters. Open the suction valve fully.		
Х	Χ	Χ								е	Viscosity of the liquid too high.		
-		Χ		Χ			Х			f	Check and accommodate per data sheet.  Wrong pump speed. Correct pump speed per data sheet.		
	Χ	X								g	Avoid inclusions of air in the conveying liquid.		
		Х		Х	Х		Х	Х		h	Pressure head too high (point 6.5.3.2). Check pressure head with manometer. Reduce the pressure head by increasing the pressure pipe diameter or by shortening the pressure pipe.		
X	Χ	Χ			Х			Х		i	Pump runs partially or completely dry (point 6.5.2). Check flow in the suction chamber. Install dry running protection TSE.		
						X	X			j	Check coupling, possibly pump shaft is misaligned to drive. Check whether coupling gear is worn. Realign coupling. The coupling gear has perhaps to be replaced.		
Χ		Χ								k	Speed too low. Increase the speed when high suction performances are required and when the liquid is very thin.		
Х	Χ					Х				I	Speed too high. Reduce the speed when pumping products with high viscosities - danger of cavitation.		
						Х				m	Check the axial play in the coupling rod linkage. Check that the bush has been installed correctly see document OM.PJT		
Х		Χ		Х	Χ			Χ		n	Check for foreign substances in the pump. Dismantle the pump, remove foreign substances and replace worn parts.		
Χ		Χ	Χ		Χ					0	Stator or rotor worn. Dismantle the pump and replace defective parts.		
Х		Х			Х	Х				р	Joint parts worn. Replace worn parts and fill with special pin joint grease .		
Х		Х			Х			Х		q	Suction pipework partially or completely blocked. Clean suction pipework.		
Х				Х	Х		X	X		r	Temperature of the pumping liquid too high. Excessive expansion of the stator. Check temperature and install rotor with diameter smaller than specified.		
Х		Х		Х			Х		Х	s	Gland packing too strongly tightened or worn. Ease or tighten stuffing box. Replace defective packing rings.		
Х				Х	Х			Х		t	Solid contents and/or size of solids too large. Reduce pump speed and install perhaps a screen with suitable meshes. Increase fluid share.		
Х				Х				Х	Х	u	When the pump is non operational the solids settle out and become hard. Clear and flush the pump immediately.		
Х				Х	Χ			Х	Х	٧	The liquid becomes hard when temperature falls below a certain limit. Heat the pump.		
				Х	Х		Х	Х		w	Stator swollen and unsuitable for the pumped liquid. Select a suitable stator material. Use perhaps rotor with diameter smaller than specified.		
						Χ			Х	х	The bearing in the drive casing of the pump or in the drive engine is defective. Replace bearing.		
									Х	у	Mechanical seal defective. Check seal faces and O-rings. If necessary replace corresponding defective parts.		

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# 9.0 **Auxiliary seepex documentation**

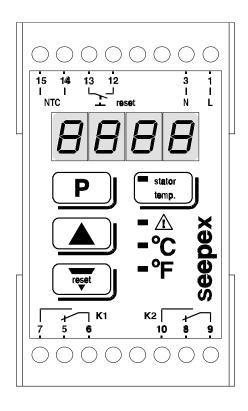


		DE	GB	FR
		Baureihe MD	range MD	série MD
		Schnittzeichnung Nr.	sectional drawing No.	plan no.
		103-007_2	103-007 2	103-007 2
		Benennung	denomination	désignation
Stck.	Pos.	Stck. / Pos.	Qty. / item	Qté. / Poste
			_	
1		Laterne	lantern	lanterne
2		Halbrundkerbnägel	round head grooved pin	rivet
1		Typenschild	type plate	plaque signalitique
4		6kt-Schraube	hexagon bolt	vis
4		Federring	spring washer	rondelle frein
4	213	6kt-Mutter	hexagon nut	écrou
1		Steckwelle	plug-in shaft	arbre à broche
1		Steckwellenbolzen	plug-in shaft pin	cheville pour arbre à broche
1	310		splash ring	bague de projection
1	330		mechanical seal	garniture mécanique
1	333	Gleitringdichtungsgehäuse	mechanical seal casing	carter de la garniture
				mécanique
1	372		support ring	bague d'appui
1		Kuppelstange	coupling rod	barre d'accouplement
2	401		retaining sleeve	douille d'articulation
2	402	-   -	coupling rod pin	axe d'articulation
1	405		universal joint sleeve	manchette
2		Halteband	holding band	collier de serrage
1		Sauggehäuse	suction casing	carter d'aspiration
1		Sauggehäusedichtung	casing gasket	étanchéité du carter d'aspiration
4		Zylinderschraube	socket screw	vis à tête cylindrique
4		Federring	spring washer	rondelle frein
4		6kt-Mutter	hexagon nut	écrou
1		Rotor	rotor	rotor
1	601		stator	stator
2 2		6kt-Schraube	hexagon bolt hexagon nut	Vis
2	604	6kt-Mutter Scheibe	washer	écrou rondelle
1	700	Druckstutzen	pressure branch	bride de refoulement
'	700	Druckstutzen	pressure branch	bride de relouiement
	098	seepex Gelenkfett	seepex joint grease	seepex graisse d' articulations
		Typ und Füllmenge:	type and filling quantity:	sommaire pour type et quantité:
		Betriebs- und	see Operating and Maintenance	
		Wartungsanleitung entnehmen	Instruction	d'entretien
		Verschleißteile und Dichtungen:	Wear parts and sealings:	pièces d'usure et étanchéités:
		Betriebs- und	see Operating and Maintenance	voir Instructions de service et
		Wartungsanleitung entnehmen	Instruction	d'entretien
		Werkzeuge:	Tools:	Outils:
		Betriebs- und	see Operating and Maintenance	voir Instructions de service et
		Wartungsanleitung entnehmen	Instruction	d'entretien
		versetzt gezeichnet	drawn displaced	plan separé

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- 1.2 Function

#### 2.0 Technical Data

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- 2.2 TSE Control Device for Installation in Control Panel

## 3.0 Electrical Connection of the TSE

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- 3.2 Connection Diagram of TSE Control Device
- 3.3 Relay Function

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- 4.2 Function Check
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- 8.2 Drawing 702-000/0000-0-008 \_\_\_ for Sizes 025-12 up to 500-6LA
- 8.3 Additional Information ZU.TSE.02 for TSE Motor Control
- . 8.4 Additional Information ZU.TSE.03 for TSE in Explosion Proof Construction

Dokument / document ZU.TSE.01e

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## 1.0 General

#### 1.1 Introduction

Progressive cavity pumps should generally be protected against dry-running. Due to the increased friction between the main conveying elements ie. rotor and stator, which occurs in the event of dry-running the pump, the temperature at the internal surface of the stator can quickly rise depending on the pump speed.

When exceeding the max. permissible operating temperature the internal surface of the stator will burn and cease operation. If this occurs the stator needs to be replaced. The possible malfunction of an progressive cavity pump can be easily avoided by using the patented dry-running protection device TSE.

# 1.2 Function

The general operating principle of the dry-running protection device TSE is to continuously monitor the temperature in the stator and to trip the pump when reaching a limit temperature. The temperature in the pump stator is compared with the pre-set trip temperature via a NTC temperature sensor, which is fitted in the stator of the pump as well as the TSE control device, which is positioned in the control panel. In case of dry-running of the pump and a temperature increase in the stator up to the pre-set switch-off value, two relays will switch.

The drive motor of the pump will be switched-off via the potential-free changeover contacts and a fault message will be released. After rectification of the cause of the dry-running and the cooling down of the stator, the fault message at the TSE device can be acknowledged and the pump can be switched on again.

By acknowledging the fault message an automatic re-connection without inspection and correction of the cause of the dry-running is avoided.

# 2. 0 Technical Data

#### 2.1

#### **Temperature Sensor**

The NTC thermister is installed in a stainless steel protection sleeve in the stator of the pump. Permissible Temperature Range: 0-150 °C Standard Resistance: 10 kOhm at 25 °C

Temp.	Resistance	Temp.	Resistance
°C	Ohm	°C	Ohm
0	32.650	70	1.752
10	19.900	80	1.255
20	12.490	90	915
25	10.000	100	678
30	8.057	110	510
40	5.327	120	389
50	3.603	130	301
60	2.488	140	235

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# TSE Control Device for Installation in Control Panel

#### 2.2.1

#### **Technical Data**

Type: SGRTSE 230 AC, SGRTSE 115 AC,

SGRTSE 24 AC, SGRTSE 24 DC

Temperature Range: 0-150 °C

Input: NTC temperature sensor

10 kOhm (at 25 °C) with sensor breaking protection

at - 25 °C.

Relay Output: 2 potential-free

changeover contacts (K1,K2), breaking

capacity 500 VA at 110/230 V Ohmic load.

Deliverable

Operating Voltage: 24V, 115V, 230V AC; 24V DC

Power Consumption: max. 4VA

Sensor Circuit: No load voltage max. 2.5 VDC

Short circuit current 0.5 mA DC

Display at Device: Fault/Dry Running

Trip temperature Stator temperature

Operation at Device: Adjustment of trip temperature.

Reset of fault message.

Casing Material: ABS

Fastening: Mounting on standard rail

35 mm acc. to standards or screw fixings acc. to standards

Kind of Protection: Casing IP 40

Terminals IP 20

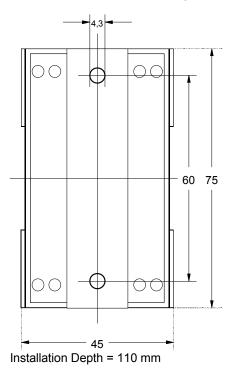
Ambient Temperature: 0-50 °C

Dimension: 45x75x110 mm (WxHxD) EMV (89/336/EEC) CE conform acc. to standards

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Blatt / sheet 3 (6)

2.2.2 Dimensions and Wall Mounting



3.0 Electrical Connection of the TSE

# 3.1 Installation Instructions

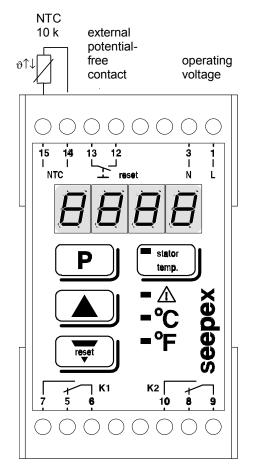
Prior to the connection and the commissioning of the device it has to be ensured that the supply voltage corresponds to the nominal voltage shown on the name plate. Nominal voltage fluctuations are permissible in the range of +/- 10 % of the device's nominal voltage.

The electrical connections have to be carried out in accordance with the wiring diagram and the regulation of the local EVV or the VDE directions.

In case of power fluctuations which lead to a malfunction of the device, adequate procedures have to be taken to avoid its reoccurrence. Alternatively these errors could be filtered out by an external supply filter. The device has to be provided with an internal supply filter.

Sensor leads have to be shielded. The shield has to be earthed at one end.

3.2 Connection Diagram of TSE Control Device



Should the TSE control device be reset after a dry-running from the control panel door or another remote position, a button ("make contact") at the terminals 12 +13 can be used.

# 3.3. Relay Function

Actual temperature < trip temperature (trouble free operation)
Contacts 6 to 7 and 9 to 10 closed
Contacts 6 to 5 and 9 to 8 open

Actual temperature > trip temperature (Malfunction/Dry Running)
Contacts 6 to 5 and 9 to 8 closed
Contacts 6 to 7 and 9 to 10 open

Relays K1 and K2 are switched parallel to each other and operate simultaneously. K1 is integrated in the motor contactor control serving as a switch-off provision. K 2 is optional as stand by for additional connection to a fault indicator or as a reserve to the process control computer.

Dokument / document **ZU.TSE.01e** 

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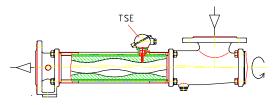
# 4.0 Procedures prior to Commissioning

# 4.1 Check Position of the Temperature Measuring Point at the Pump

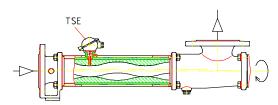
Considering the rotating direction and thus the conveying direction of the pump, the temperature sensor is fitted in our factory as per the following figures.

When changing direction of the pump and when replacing the stator the specified installation position of the temperature measuring point has to be checked. The temperature sensor must always be installed at the product entry side of the stator as the quickest temperature increase in case of dry-running will arise at this point.

# 4.1.1 Pump "counter clockwise rotation" - standard construction



# 4.1.2 Pump "clockwise rotation" special construction



# 4.2 Function Check

After the electrical connection of the TSE and prior to the initial operation of the pump the following function check has to be carried out.

Switch-on control voltage at terminals 1 and 3 (Digital display at the TSE control device illuminates).



Press and hold button "stator temp" and read the temperature value.

If the shown temperature correspond to the ambient temperature in the pump the TSE is functioning correctly. In case of deviation proceed as per paragraph 7 - Malfunctioning.



# 4.3 Approximate Adjustment of Trip Temperature

The TSE control device is pre-set to a trip temperature of 50 °C prior to leaving our factory. In order to achieve the shortest trip time after a dry-run and thus the max. protection of the pump stator, the trip temperature at the TSE control device has to be set as low as possible.

For the initial commissioning the temperature value pre-set in our factory should be maintained. Should the product have higher temperatures the value has to be adjusted to 20 to 30 ° C above the temperature of the conveying product.

Switch on control voltage. After self-check of the control device the actual pre-set temperature will show at the display.



Press and release button. Adjusting Mode is activated. The displays shows alternately "set" and the last set trip temperature.



Increasing the trip temperature - press button and release.
The adjusted temperature increases by + 1°C. Press button and hold approx. 3 seconds in + 10 ° C steps.



Decreasing of trip temperature - press button and release. The adjusted temperature decreases by - 1° C. Press button and hold approx. 3 sec. in - 10° C steps.



Press and release button. Return the unit to the operating mode. The adjusted trip temperature is transferred to a continuous memory and shown on the display.

Note:

During the adjusting mode, if a button is not pressed within 10 seconds the controller automatically returns to the operating mode and disregards any previous adjustment.

Following the above approximate instruction, the seepex pump can operate for a limited period of time (approx. 1 hour). Then a correction of the adjustment according to paragraph 5 - Fine Adjustment - has to be carried out.



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# 5.0 Commissioning and Operation

## 5.1 Fine Adjustment of the Trip Temperature

Following the instruction for approximate adjustment in paragraph 4.3 the seepex pump has to operate for at least 30 to 60 minutes to allow the operating temperature in the stator become stable.



While the pump is in operation the temperature of the pump is shown on the display of the TSE controller by continuously pressing the button.

The final trip temperature has now to be set 10 °C higher then the indicated operating temperature according to the instructions in paragraph 4.3.

## Attention

For all adjustments the max. product temperature occurring during operation has always to be considered. In case of a product temperature higher than 40 °C, it always has to be checked if this is mentioned in the data sheet of the pump and has therefore been considered in the rotor/stator design. If the temperature shown on the data sheet does not correspond to the actual temperature, please contact seepex.

## Resetting of the Control Device after Dry-Running

In the event of dry-running of the pump and temperature increase in the stator above the preset limit value, the installed relays trip and maintain locked in this position. After the pump has cooled down the remaining fault message (red LED) has to be acknowledged using one of the following procedures, so that the relay will be reset.



Press at the TSE control device for at least 1 sec.

#### 5.2.2

Switch-off operating voltage at TSE control device (terminals 1-3).

#### 5.2.3

With external contact (reset button, closed for at least 1 sec.)

#### 5.3 Changeover of the Display from °C to °F.



Press and hold button for 10 secs. until display changes over

The selected temperature units are shown via an LED next to the Symbol °C or °F.

# 6.0 Replacement of Stator

## 6.1 Order of Replacement Stator

When ordering a replacement stator for a seepex pump, please quote:

# Stator drilled for TSE fitted with sensor sleeve in 1.4571.

If the pump is used to convey highly corrosive products where 1.4571 material is not resistant, a sensor sleeve made of 2.4610 (Hastelloy C4) has to be ordered.



### Attention

The sensor sleeve is fitted in our factory. It is preset for operation and may not be adjusted.

# 6.2 Dismantling/Re-Assembly of the Connection Head and Temperature Sensor.

The following drawings apply:

For TSE in elastic stators:
 Drawing No. 702-000/0000-0-009 \_\_\_
 for pump sizes 006-12 and 025-6L.

Drawing No. 702-000/0000-0-008 \_\_ for pump sizes 025-12 to 500-6LA.

- For TSE in fixed stators: Drawing No. 702-000/0000-0-005

# 6.2.1 Dismantling

Lift the cover of the connection head and disconnect wires of the temperature sensor. After having loosened the side screw slide the connection head off the threaded sleeve. Remove threaded sleeve from the stator and remove clamping ring, rubber ring and temperature sensor from sensor sleeve. The temperature sensor cannot be re-used and can thus be disposed off with the damaged stator.

Dokument / document ZU.TSE.01e

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# 6.2.2 Re-Assembly

The items mentioned in paragraph 6.2.1 have to be re-installed into the new stator. It is vital to consider the temperature measuring point when installing the stator (refer to paragraph 4.1).

Do not further adjust or change the sensor sleeve setting as this has already been done in our factory.

Remove protective pipe (protective transport packaging).

Push the thermistor sensor with clamping screws and rubber ring to the bottom of the sensor sleeve and adjust.

Screw the threaded sleeve with 2 O-Rings in the tapped hole at the stator.

When installing the connection head, the connection wires of the thermistor sensor must be threaded through the hole in the junction box. After fastening the connection head on the threaded stator barred, recannect wires and put the cover back onto the connection head.

# 7.0 Malfunction

#### 7.1 General

Fault messages and switch-off of the pump without actual dry-running or overload might be caused by a defect in the temperature sensor wire, the TSE control device or other electrical switch devices.



The following reasons might have caused this error alarm at the TSE control device:

break of sensor or line short circuit of sensor or line measuring range (-25 ...150°C) is exceeded or remained under

The following procedure is recommended to check the TSE control device and the sensor circuit including temperature sensor:

# 7.2 Function Check of Sensor Circuit

Disconnect the temperature sensor wire at the TSE control device terminals 14 and 15 and connect a resistance measuring device (Multimeter or Ohmmeter). The measured electrical resistance must conform with the value in the table shown in paragraph 2.1 in accordance with the pump temperature. In case of deviations of the resistance value of more than 10% of the set value, measure the resistance at the connection head of the TSE at the pump. To do this the wire to the control device at the connection head of the pump needs to be removed. If the same deviations occur when measuring the resistance at the temperature sensor

directly at the pump, the temperature sensor is damaged and needs to be replaced (refer to paragraph 6.2 and 6.3).

Should the resistance check at the temperature sensor show correct values, then damage to the connection cable or the connection terminal is the cause of malfunction.

# 7.3 Function Check of TSE Control Device

If an trouble-free sensor circuit has been determined during the testing according to paragraph 7.2, damage to the TSE control device is most likely. In order to carry out the check, remove the sensor wires at terminals 14 and 15 and connect a commercial deposited carbon or metal film resistor as per the following list.:

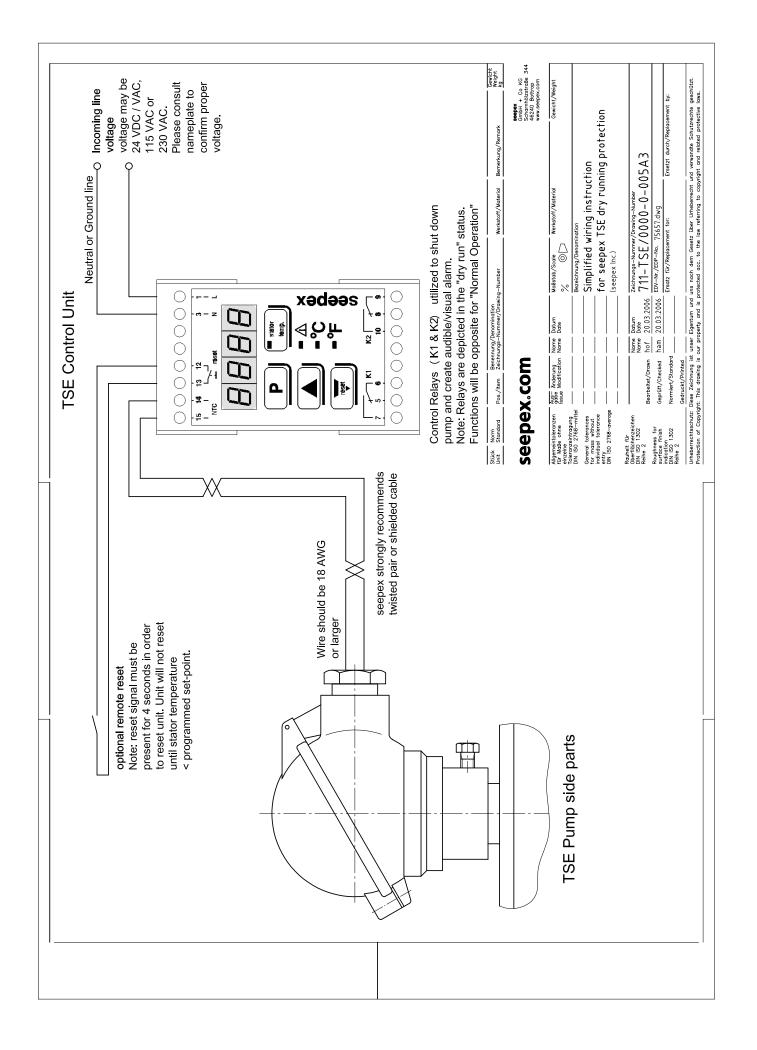
Resistance	Switching Temp.
(Ohm)	°Č
10.000	25
5.600	39
2.200	63
1.000	87
560	107
220	143

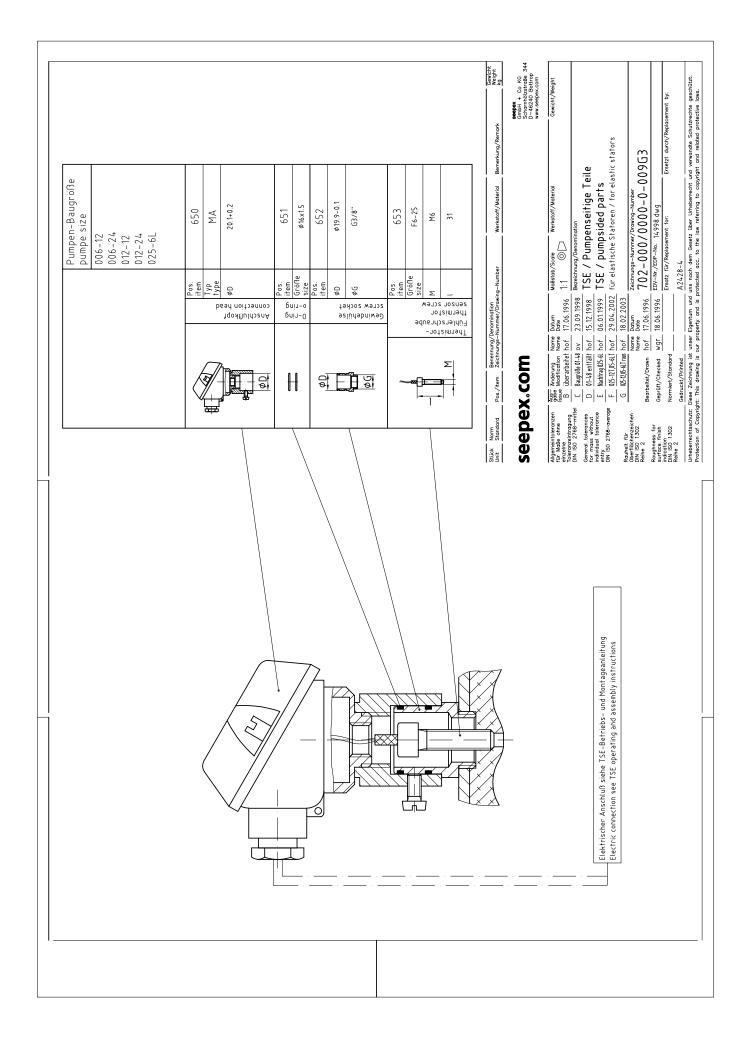
Switch-on control voltage at terminal 1+3 (Digital Display at the TSE device illuminates)

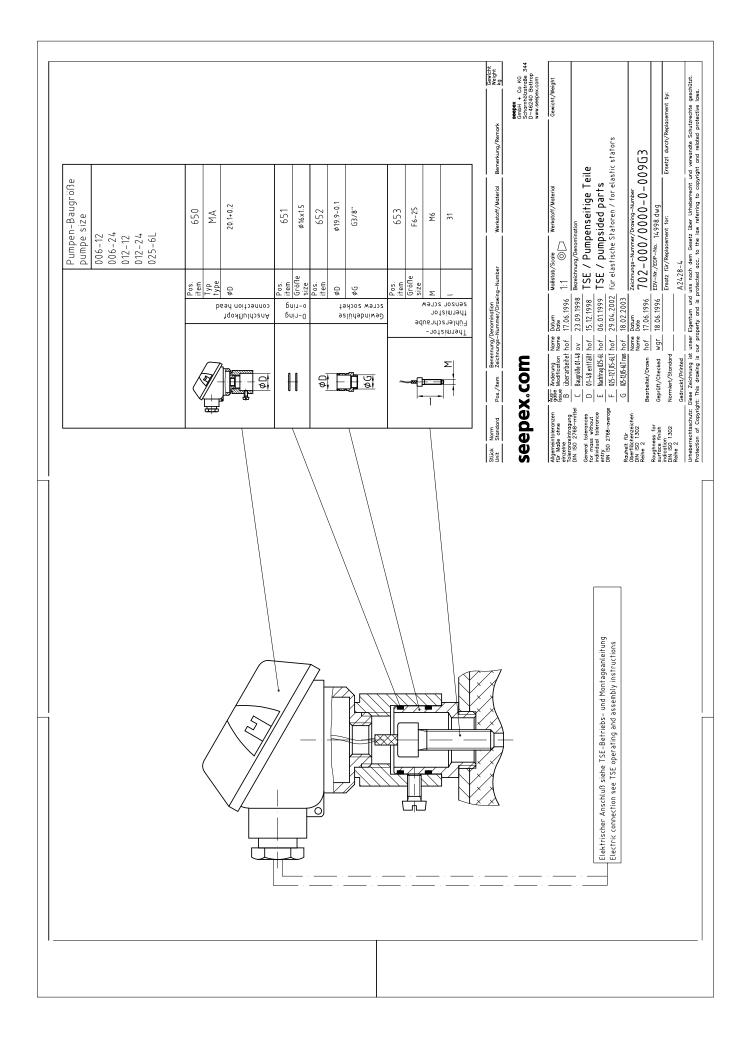


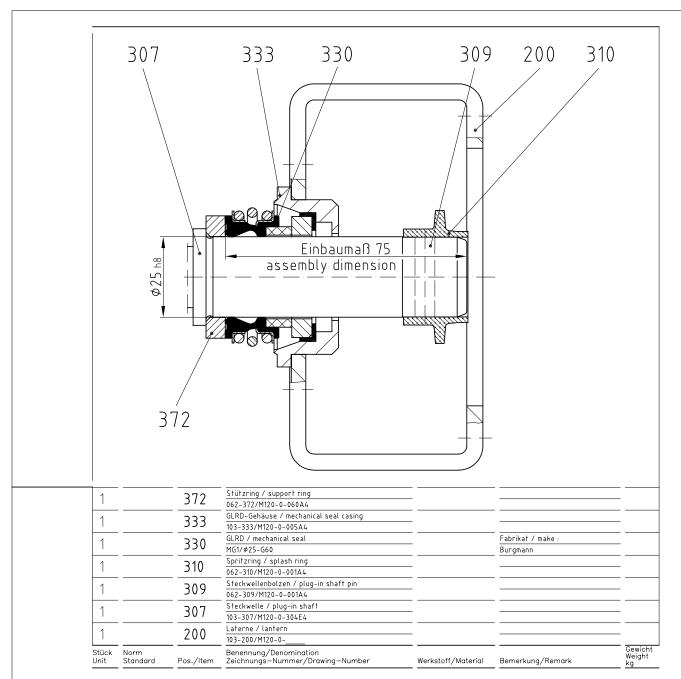
Press and hold button "stator temp." and read the temperature value.

The shown value must correspond to the switch temperature, which applies to the resistance used. Should the shown value deviate by more than 5-10 °C or should the value be absent at all, the TSE control device must be sent to seepex for repair.









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Allgemeintoleranzen für Maße ohne einzelne Toleranzeintragung	Aus- gabe Änderung Issue Modification	Name Name	Datum Date	Maßstab/Scale 1:1 © 🗀	Werkstoff/Material		Gewicht/Weight		
DIN ISO 2768-mittel				Bezeichnung/Denomination					
General tolerances for mass without				—— GLRD Schnittzeichnung					
individual tolerance entry				_ mechanical seal sectional drawing					
DIN ISO 2768-average				Burgmann MG1/Ø25/G60 für Sondermaterial / for special materia					
Rauheit für				mit erhöhter Vo	-spannung/ with	increased pre-clar	nping		
Oberflächenzeichen DIN ISO 1302		Name Name	Datum Date	Zeichnungs-Nummer	*	201/			
Reihe 2	Bearbeitet/Drawn hgg		28.05.2004	are 8.05.2004 103-0GB/M120-0-129A4					
Roughness for surface finish	Geprüft/Checked	kno	28.04.2004	EDV-Nr./EDP-No. 6	2810.dwg				
indication DIN ISO 1302	Normiert/Standard			Ersatz für/Replacement for: Ersetzt durch/Replacement by:					
Reihe 2	Gedruckt/Printed								
			-			und verwandte Schutzre right and related prote			

#### 1. General

- Please take the appertaining drawing from respective pump data sheet.
- The mechanical seal is suitable for the operating conditions indicated in the pump data sheet.
   Modifications are only admissible after the customer has consulted with seepex. Additionally, attention must be paid to the manufacturer's operating manual.

## 2. Safety

Any mode of operation impairing the operating safety of the mechanical seal has to be avoided.

The operator is advised to consider the possible effects on the environment which could be caused by a defective mechanical seal and what additional measures must be taken to protect the environment and the public.

The pump must be mounted and operated in such a way that operation with a defective mechanical seal will not result in injury or harm to the public and that any leakage can be safely and properly dealt with.

Mechanical seals are often used to seal hazardous material (chemicals, drugs, etc.). It is essential that rules pertaining to the handling of hazardous materials are adhered to.

Modifications effected by the customer himself and changes influencing the safety of the mechanical seal are not allowed.

#### 3. Emissions

A mechanical seal is a dynamic seal and leakage is unavoidable.

### ATTENTION

Components that may contact leakage must be resistant to corrosion or be protected accordingly.

Mechanical seal leakage must be drained in a safe and proper manner.

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# 4.0 Flushing or circulation of single-acting mechanical seals

Single-acting mechanical seals contacting the conveying liquid require no additional flushing or a circulation pipe because sufficient flushing and heat exchange occurs around the seal due to the conveying liquid.

However, in particular cases, a direct flushing pipe can be installed into the flushing connection on the mechanical seal housing.

# 5.0 Commissioning

Regardless of the pump's operating status, the conveying medium to be sealed must always be in liquid form at the mechanical seal. This particularly applies to the pump's commissioning and its placing out of service.

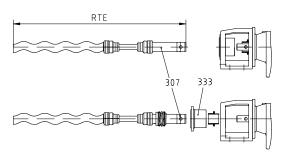
## 6.0 Maintenance

When operating the pump according to the instructions, no maintenance is required.

# 7.0 Disassembly / Reassembly

# 7.1 Disassembly

- Remove flushing connections at shaft seal housing (SEA).
- Lift / displace splash ring (310) and eject plug-in shaft pin (309) horizontally.
- Withdraw rotating unit (RTE) together with shaft seal parallel from output shaft of drive and avoid chocking.
- Clean plug-in shaft (307) and remove burrs etc., which may damage sealing elements. Moisten plugin shaft (307) with slip additive (diluted fluid soap).
- Loosen axial safety device of mechanical seal (330 or 372) and withdraw mechanical seal (330) from plug-in shaft (307).
- Remove mechanical seal housing (333) from lantern (200).
- Press counter-ring of mechanical seal with o-ring out of mechanical seal housing (333).



# 7.2 Reassembly

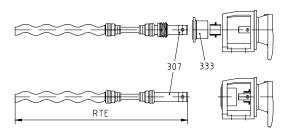
## ATTENTION

Mechanical seals are precision parts of high quality. Therefore, the installation must be effected with care. Gentle handling and extreme neatness are essential.

- Clean mechanical seal housing (333)
- Evenly press counter-ring with o-ring into mechanical seal housing (333). To facilitate assembly, the o-ring should be moistened with a lubricant (diluted fluid soap).

#### ATTENTION

- Oil or grease must not be used to facilitate assembly.
- Install mechanical seal housing (333) to lantern (200) and onsure correct position of flushing connections.
- Remove plug-in shaft (307), burrs and roughness and clean the unit.
- Check / adjust set dimension of mechanical seal on plug-in shaft (307). Moisten plug-in shaft (307) and elastomer parts of mechanical seal with lubricant (diluted fluid soap).
- Slip mechanical seal onto plug-in shaft (307) as far as set ring.
- Lubricate drive shaft (ANT) with antiseize graphite petroleum.
- Moisten splash ring (310) and plug-in shaft (307) with pin joint grease, (for type, please see index) and slip splash ring (310) onto output shaft of drive. Note installating position of splash ring and refer to description on splash ring.
- Move rotating unit (RTE) through mechanical seal housing (333) and splash ring (310) and slip splash ring (310) onto output shaft of drive (ANT). Push in plug-in shaft pin (309) in horizontal position.
- Position of splash ring:
   Collar of splash ring shall be fitted in a distance of about 0.5 mm to lantern (200).



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Range: MD, MDF

To avoid the expenses incurred by lengthy stop periods of the pump, seepex recommend the acquisition of a set of wearing parts and a set of gaskets. The table below shows the contents of these sets.

Part designation		small set of wearing parts big set of wearing parts a set of gaskets			Item number acc. to sectional drawing of pump and parts list
Rotor			1		600
Stator	2)	1	1		601
Universal joint sleeve			1		405
Coupling rod pin			2		402
Guide bush	2)		-		-
Coupling rod			1		400
Coupling rod bush	2)		-		-
Casing gasket				1	501
Holding band, small	2)		-		-
Holding band, large	2)		2		406
Packing ring set	2) 3)	1	1		301
Mechanical seal	3)			1	330
Sealing ring				4	571, 726
Splash ring				1	310
O-ring				1	572
Plug-in shaft	2)		1		307
Special joint grease					098 1 cart. 300 gr (c. 315cm³) grease quantity per pin joint, see tech.
Tool					Essential for assembly, see Point 9, document OM.SPT.01

- 2) see tools Point 9., document OM.SPT.01
- 3) Item 330 and item 301 (as an alternative) depend on the pump design. With regard to the pump design, refer to the appertaining data sheet and the sectional drawing. See Point 9.

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W1 ackung acking	Siehe W 13 see W 13	W5 Gelenk joint Durchschlag drift	W6 Lager bearing Bolzen pin	W9 allgemein general Montierhebel mounting lever	W11 Mutter für Teflonmanschette nut for teflon universal joint sleeve Bandschlüssel strap wrench	W13 Stator Stator 1) Bandschlüssel strap wrench
acking  ackungszieher  acking lever  KZ XX 000 000 0 X35M0	Ketten-Rohrzange + Ersatzkette chain pipe wrench +replacement chain	joint Durchschlag	bearing Bolzen	general  Montierhebel	manschette nut for teflon universal joint sleeve Bandschlüssel	Stator 1) Bandschlüssel
ackungszieher acking lever  KZ XX 000 000 0 X35M0	Ketten-Rohrzange + Ersatzkette chain pipe wrench +replacement chain	Durchschlag	Bolzen	Montierhebel	nut for teflon universal joint sleeve Bandschlüssel	1) Bandschlüssel
KZ XX 000 000 0 X35M0	+ Ersatzkette chain pipe wrench +replacement chain				Bandschlüssel	
KZ XX 000 000 0 X35M0	chain pipe wrench +replacement chain	drift	pin	mounting lever	strap wrench	strap wrench
KZ XX 000 000 0 X35M0 KZ XX 000						
KZ XX 000 000 0 X35M0 KZ XX 000					0	
000 0 X35M0 KZ XX 000						)
						WKZ BDS 027 0 430
		DHS XX 020 0000 0 A2620				
	KRZ XX Z55 0250 0 00000 KEZ XX Z55	DHS XX 050 0000 0 A2620	BLZ XX 020 0008 0 A2619			
KZ XX 000	0250 0 00000	DHS XX 050 0000 0 A2620	BLZ XX 020 0010 0 A2619			
000 0 XOHV0		DHS XX 100 0000 0 A2620	BLZ XX 020 0010 0 A2619			
	KRZ XX Z55 0300 6 00000 KEZ XX Z55 0300 6 00000	DHS XX 120 0000 0 A2620	BLZ XX 025 0012 0 A2619	2 Stück 2 pieces MHL XX SA 610	WKZ BDS 027 0 430	
PKZ XX 000 0000 0 XA01A	KRZ XX Z55 0300 8 00000 KEZ XX Z55					
	0300 8 00000	DHS XX 200 0200 0 A2620	BLZ XX 035 0012 0 A2619			
	KRZ XX Z55 0301 2 00000 KEZ XX Z55 0301 2 00000	DHS XX 240 0250 0 A2620	BLZ XX 040 0015 0 A2619			
		KRZ XX Z55 0300 8 00000 KEZ XX Z55 0300 8 00000 KEZ XX Z55 0300 8 00000 KRZ XX Z55 0301 2 00000 KEZ XX Z55	KRZ XX Z55 0300 8 00000 KEZ XX Z55 0300 8 00000 KEZ XX Z55 0300 8 00000 KRZ XX Z55 0301 2 00000 KEZ XX Z55 0301 2 00000 KEZ XX Z55	Z XX 000 0 0 XA01A	MHL XX SA 610  DHS XX 160 0200 0 A2620  O XA01A  KRZ XX Z55 0300 8 00000  KEZ XX Z55 0300 8 00000  MEZ XX Z55 0300 8 00000  DHS XX 200 012 0 A2619  KRZ XX Z55 0301 2 00000  KEZ XX Z55 0301 2 00000	MHL XX SA 610  DHS XX 160 0200 0 A2620 0012 0 A2619  EX XX 000 00 0 XA01A  CARREL XX Z55 0300 8 00000 KEZ XX Z55 0300 8 00000  DHS XX 200 0200 0 A2620 0012 0 A2619  DHS XX 200 0200 0 A2620 0012 0 A2619  KRZ XX Z55 0301 2 00000 KEZ XX Z55 0301 2 00000 KEZ XX Z55 0301 2 00000 KEZ XX Z55

<sup>1)</sup> Gilt nur für Pumpen in Edelstahl Ausführung / only valid for pumps in special steel design

Ausgabe issue	D / 26.04.2006	Dokument document	OM.SPT.01de	Blatt sheet	1 (4)

	Empfohlene seepex Werkzeuge Aufgrund der Ausführung für bestimmte Montagen empfohlen, durch allgemeine normierte Werkzeuge bedingt ersetzbar.							
	Recommer Due to the des			n repairs, thes	e tools partially i	eplace the standa	ardized tools.	
Werkzeug Nr. tool	W4	W7	W8	W10	W12	W14	W15	W16
No. zur Montage von:	Gelenk	Lager	Schmier-	Steckwelle	Teflon-	Kuppelstangen-	Manschette	Lippendichtung
tool for mounting of:	joint	bearing	nippel lubrication nipple	plug-in shaft	manschette teflon universal joint sleeve	buchsen coupling rod bushing	universal joint sleeve	lip seal
Benennung:	Montagedorn	Montage-	Einschlag-	Demontage-	Montage-	Presswerkzeug	Montageplatte	Montagehülse
denomination:	assembly mandrel	hülse mounting sleeve	hülse drive-in sleeve	werkzeug dismantling tool	werkzeug mounting tool	pressing tool	mounting plate	Mounting sleeve
Baugröße								
size								
0005-24, 0015-24 003-12/-24 006-12/-24 012-12/-24 025-6L 025-12T, 05-6LT	MTD L2 060 M120 0 XXXXX 2)						MTP A7 703 M500 0 002XX	MTH B7 703 M120 0 W0260
025-12, 025-24 05-12, 1-6L	MTD L2 060 M500 0 XXXXX	MTH M8 060 M500 0 XXXXX		AZV B2 262 M500 0 XXXXX			MTP A7 703 M500 0 002XX	
05-24, 01-48, 025-48, 1-12, 2-6L 1-24, 1-12V 2-12, 5-6L	MTD L2 060 0020 0 XXXXX	MTH M8 060 0020 0 XXXXX		AZV B2 262 0020 0 XXXXX	MMT M8 060 0020 0 XXXXX	PWZ C6 060 0020 0 XXXXX		
2-24, 2-12V 5-12, 8-12T 10-6L, 15-6LT 05-48	MTD L2 060 0050 0 XXXXX	MTH M8 060 0050 0 XXXXX		AZV B2 262 0050 0 XXXXX	MMT M8 060 0050 0 XXXXX	PWZ C6 060 0050 0 XXXXX		
5-24, 5-12V								
10-12, 17-6L, 30-6LT, 15-12T, 10-24R, 1-48	MTD L2 060 0100 0 XXXXX	MTH M8 060 0100 0 XXXXX		AZV B2 262 0100 0 XXXXX	MMT M8 060 0100 0 XXXXX	PWZ C6 060 0100 0 XXXXX		
14-12, 26-6L, 40-6LT	MTD L2 060 0140 0 XXXXX	MTH M8 060 0140 0 XXXXX		AZV B2 262 0170 0 XF5XX		PWZ C6 060 1400 0 XXXXX		
10-24, 10-12V 17-12, 35-6L, 26-12, 52-6L, 55-6LT, 75-6LT 30-12T, 10-24, 17-24R 2-48	MTD L2 060 0170 0 XXXXX	MTH M8 060 0170 0 XXXXX	ESH N0 000 0000 0 A01A4	AZV B2 262 0170 0 XG0XX	MMT M8 060 0170 0 XXXXX	PWZ C6 060 0170 0 XXXXX		
17-24, 17-12V 35-12, 52-12, 70-6L, 100-6L, 110-6LT, 55-12T 34-24R, 5-48	MTD L2 060 0350 0 XXXXX	MTH M8 060 0350 0 XXXXX		AZV B2 262 0350 0 XH0XX		PWZ C6 060 0350 0 XXXXX		
35-24, 35-12V 70-12, 130-6L, 200-6L, 110-12T 70-24R, 10-48, 200-6L	MTD L2 060 0700 0 XXXXX	MTH M8 060 0700 0 XXXXX		AZV L7 703 0700 0 XK0XX		PWZ C6 060 0700 0 XXXXX		
130-12, 202-6L, 300-6L, 200-12T 70-18, 100-18, 130-18 70-24, 70-12V 130-24R 17-48	MTD L2 060 1300 0 XXXXX	MTH M8 060 1300 0 XXXXX				PWZ C6 060 1300 0 XXXXX		
240-12, 300-12T 130-18, 130-24 35-48/70-48						PWZ C6 060 2400 0 XXXXX		

 $<sup>2) \</sup>quad \text{entf\"{a}llt ab Pumpen-Herstellungs} \\ \text{datum 01.04.93 / can be omitted as from 01.04.93 (pump manufacturing date)} \\$ 

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							Spezial- werkzeuge		
	Recommend Due to the design			airs, these t	ools partially	replace the	standardize	d tools.	Special tools
Werkzeug Nr. tool No.	W17	W18	W19	W20	W22	W23	W24	W25	W3
zur Montage von:	Lippendichtung	Gleitlager- buchse	Wellen- schonhülse	Cartridge- Einheit	Wellen- dichtring	Wellen- dichtring	Antriebs- gehäuse	Steckwellen- bolzen	Halteband
tool for mounting of:	lip seal	plain bearing bush	shaft securing sleeve	cartridge- unit	lip seal	lip seal	drive casing	plug-in shaft pin	holding band
Benennung:	Schlagzylinder Zentrierdorn Montagebolzen	Montagedorn	Montagehülse	Aufnahme	Montage- werkzeug	Montage- werkzeug	Aufhänge- vorrichtung	Montagedorn	Montage- werkzeug
denomination:	cylinder centering mandrel mounting pin	mounting mandrel	mounting sleeve	intake	mounting tool	mounting tool	suspension device	mounting mandrel	mounting tool
Baugröße size	0								
0005-24, 0015-24 0015-24 003-12/-24 012-12/-24 012-12/-24 025-6L, 025-12, 025-24 05-12, 1-6L 05-24, 01-48, 025-48, 1-12, 2-6L 1-24, 1-12V 2-12, 5-6L 2-24, 2-12V 5-12, 8-12T 10-6L, 15-6LT 05-48 5-24, 5-12V 10-12, 17-6L, 30-6LT, 15-12T, 10-24R, 1-48 14-12, 26-6L, 40-6LT 10-24, 10-12V 17-12, 35-6L,	ZSH B7 703 M120 0 W0171 ZDR B7 703 M120 0 W0172 MBL A7 703 M120 0 W0173			SPT MR 703	SPT B4 703			MTD L8 703 0050 0 SXX0J MTD L8 703 0170 0 SXX0J	MHB WH A00 1WHV 0 01000
26-12, 52-6L, 55-6LT, 75-6LT 30-12T, 10-24, 17-24R, 2-48			0170 0 01000	0170 0 00900	0170 0 01100				
17-24, 17-12V 35-12, 52-12, 70-6L, 100-6L, 110-6LT, 55-12T 34-24R, 5-48 35-24, 35-12V								MTD L8 703 0350 0 SXX0J	
70-12, 130-6L, 200-6L, 110-12T 70-24R, 10-48, 200-6L 130-12, 202-6L,		SPT M8 703 1300 0 01000	SPT M8 703 1300 0 01100	SPT M8 703 1300 0 00900	SPT B4 703 1300 0 0A200	SPT B4 703 1300 0 0A300		MTD L8 703 0700 0 SXX0J	
300-6L, 200-12T 70-18, 100-18, 130-18 70-24, 70-12V 130-24R 17-48								MTD L8 703 1300 0 SXX0J	
240-12, 300-12T 130-18, 130-24 35-48/70-48							SPT M8 703 2400 0 01400		

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# 10.0 Manufacturer's documents from sub-supplier



# **OPERATING MANUAL**

This document was drawn up observing the EC directives "Machinery" 98/37/EC, EN ISO 12100-2 and the German Standard VDI 4500



In case of this mechanical seal is operated in **explosion area an appropriate additional operating manual**, following EC directives 94/9/EC (ATEX 95), has to be observed **by all means**! If required this could be ordered at BURGMANN.

# **BURGMANN MECHANICAL SEAL (M.S.)**

# Type MG1/dw-00 and versions

applies to all mechanical seals of the same series dw = specified shaft diameter

These instructions are intended for the assembly, operating and control personnel and should be kept at hand on site.

PLEASE READ this manual carefully and OBSERVE the information contained as to:

■ Safety

■ Transport / Storage

■ Information about the product

Installation

Operation

■ Servicing

If there are any unclear points please contact BURGMANN by all means!

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# **Keywords and Symbols**

Following symbols for particularly important information are used:



"Attention, please pay special attention to these sections of text"

DANGER!

Draws attention to a direct hazard that will lead to injury or death of persons

WARNING!

Draws attention to the risk that a hazard could lead to serious injury or death of persons

CAUTION!

Draws attention to a hazard or unsafe method of working that could lead to personal injury or damage to equipment

**ATTENTION!** 

Identifies a potentially dangerous situation. If it is not avoided the product or something in its vicinity could be damaged

IMPORTANT!

Identifies tips for use and other particularly useful information.

# **GENERAL SAFETY NOTES**



Any person being involved in assembly, disassembly, start up, operation and maintenance of the BURGMANN Mechanical Seal must have read and understood this Instruction Manual and in particular the safety notes. We recommend the user to have this confirmed.

**BURGMANN Mechanical Seals** are manufactured on a **high quality level** (quality management EN ISO 9001: 2000) and they keep a **high working reliability**. Yet, if they are **not operated** within their **intended purpose** or handled **inexpertly** by untrained personnel they may cause **risks**.

The machine has to be set up in such a way that seal leakage can be led off and disposed properly and that any personal injury caused by spurting product in the event of a seal failure is avoided.

Any operation mode that affects the **operational safety** of the mechanical seal is not permitted.

Unauthorised modifications or alterations are **not permitted** as they affect the **operational safety** of the mechanical seal.

BURGMANN mechanical seals must be installed, operated, maintained, removed or repaired by **authorised**, **trained and instructed personnel only.** 

The **responsibilities** for the respective jobs to be done **have to be determined clearly and observed** in order to prevent unclear competencies from the point of **security**.

Any work to be done on the mechanical seal is **generally** only **permitted** when the seal is **neither operating nor pressurised**.

**WARNING!** Seals that have been used with **hazardous substances must be properly cleaned** so that there is no possible **danger** to people or to the environment.

Apart from the notes given in this manual the general **regulations for worker's protection and those for prevention of accidents** have to be observed.

# Instructions for worker's protection



WARNING! If the medium to be sealed and/or the supply liquid is subject to the Hazardous Substances Regulation (GefStoffV), the instructions for handling dangerous substances (safety data sheets to EU Directive 91/155/EEC) and the accident prevention regulations have be observed.

**Medium to be sealed** and/or **supply medium may escape** if the seal **fails**. Injury of persons and environment may be **prevented by the user** providing for splash protection and wearing safety goggles. Care has to be taken by the user for **proper disposal** of the leakage. The user has to control these measures.

The **user** has to **check** what **effects a failure** of the mechanical seal might have and what safety measures have to be taken to prevent **personal** injury or damage to the environment.

# TRANSPORT / STORAGE

# **Transport**

If not specified differently by contract the BURGMANN standard packing is used which is suitable for dry transport by truck, train or plane. The warning signs and notes on the packing must be observed.

In addition seaworthy packing may become necessary.

Notes for income inspection:

- Check packaging for visible damages.
- Open packaging carefully. Do not damage or lose parts supplied separately.
- Check if consignment is complete (delivery note). Inform the supplier immediately in writing if parts are damaged or missing.

The mechanical seal has to be protected from damage during transport and storage. The transport case in which the seal is supplied is well suited for this purpose and should be kept for a possible return transport.

**ATTENTION!** If the machine as well as the mechanical seal installed into the machine are transported together the shaft has to be protected from deflection and shocks.

# Packing and storage

The following recommendations apply to all BURGMANN mechanical seals which have been supplied and stored in their **undamaged original packaging**, as well as to seals which have been installed in a machine (e.g. pump, compressor, agitator, etc.) but have not yet been put into operation.

BURGMANN mechanical seals and spare parts are super finished and repeatedly tested machine elements. For the storage special conditions have to be followed.

Sliding materials and elastomers are subject to material-specific and time-based alterations (distortion, ageing) which might reduce the full efficiency of the mechanical seals. Yet, this may be avoided by observing the storage instructions.

For the stock keeping of elastomers special conditions are required. For all rubberelastic parts the rules of DIN 7716 resp. of ISO 2230-1973 (E) are valid.

# Conveniences for storing of mechanical seals

- · dust free
- moderately ventilated
- constantly tempered
  - relative air humidity below 65 %.
  - temperature between 15 °C and 25 °C.

#### Protect the seal from

- direct exposure to heat (sun, heating)
- ultraviolet light (halogen or fluorescent lamps, sunlight, arc welding)
- presence or development of ozone (arc welding, mercury vapour lamps, highvoltage devices, electric motors)
- > risk of embrittlement of elastomeric materials

It has to be differentiated between:

- M.S. stored in the stock room
- M.S. installed in the machine, but not yet in operation.
- ☐ M.S. in the stock

**IMPORTANT!** Store the seal in the original packing lying on a flat surface.

- Check the packaging periodically for damages.
- Plastic sheet packagings with humidity indicators have to be checked every 8 weeks. The check has to be recorded.
- Packings exceeding 50 % rel. humidity values have to be sent to the manufacturer or the nearest BURGMANN service centre for inspection and new packaging.

#### **Duly stored mechanical seal:**

- · Latest 3 years after delivery of the mechanical seal
- For reasons of safety shipment of the M.S. to BURGMANN resp. nearest BURGMANN service centre for
- > Exchange of all secondary seals and springs
- Verification of the flatness of the faces
- Perhaps static pressure test.

#### ☐ M.S. installed into the machine:

**ATTENTION!** A preservation of the BURGMANN mechanical seals is not allowed.

Check in case of a preservation of complete machines with mechanical seals installed BURGMANN has to be contacted.

- Do not use corrosion protection agents.
- Risk of deposition and possibly chemical attack of the secondary seals.

Due to longer erecting times of new designed plants the period between delivery of the mechanical seal and on the other hand its installation and start up may exceed the period of 2-3 years.

Latest after 3 years and in time before the planned start-up of the plant the seal has to be dismantled and to be sent to the manufacturer or the nearest BURGMANN service centre where it can be checked and reconditioned, if necessary.

Damages caused by **improper** storage may **not** be claimed with reference to the **warranty** on the BURGMANN company.

# INFORMATION ABOUT THE PRODUCT

All technical information given is based on the results of extensive testing and on BURGMANN's long term practical experience. However, in view of the great diversity of possible applications the technical data can only be taken as being of approximate nature. We can only guarantee the safe and efficient functioning in individual cases if we have been comprehensively informed of the operating conditions to which they will be subject, and if this has been confirmed in a separate agreement.

# Manufacturer and country of origin

Burgmann Industries GmbH & Co. KG Äußere Sauerlacher Str. 6-10 D - 82515 Wolfratshausen Germany

# **Declaration by the manufacturer**

within the meaning of the EC-directive "MACHINERY" 98/37/EG

A mechanical seal does **not function independently**. It is intended to be incorporated into or assembled with machinery.

# Type designation

BURGMANN Mechanical Seal MG1/dw-00

# **Designated use**

This mechanical seal is **exclusively** designed for the use in the specified application. A **different utilisation** or a utilisation going beyond the specification is considered **contrary to its designated use** and excludes a liability by the manufacturer.

Operation under conditions lying **outside** those limits stated in paragraph "**Operating limits**" is considered **contrary to its designated use**.

Should the seal be operated under different conditions or at a different application BURGMANN has to be asked for recognition as safe in advance. > Changes to operating conditions have to be documented.

# **Operating limits**

**ATTENTION!** Operating limits depend on the materials, the media to be sealed and the diameter of the sealing. (If there are any unclear points please contact BURGMANN.)

Shaft diameter (dw): 10 - 100 mm

Pressure to be sealed (p1) : 12 bar g
Temperature to be sealed (t1) : -20 ... 120° C
Max. sliding speed (vg) : 10 m/s

Operation under several limit values **simultaneously** should be **avoided** as higher loads (pressure, temperature, speed) can increase wear or lead to **damage** of sliding faces or elastomers. This could result in a shorter service life and in the **risk** of a sudden seal failure **endangering** men and environment.

The **selection** of the mechanical seal (type, suitability, materials) should be done **by BURGMANN staff** or other **authorised** persons. A wrong selection by unauthorised persons is **not covered by** BURGMANN's **warranty**.

Further information about the operating conditions can be found in the BURGMANN assembly drawing MG1/dw-00 or in the specification sheets of the machine manufacturer.

#### **Materials**

The materials of the mechanical seal depend on the application and are fixed in the order.

# Drawings, diagrams

Assembly drawing MG1/dw-00

The original assembly drawing in its latest edition (latest revision) only is decisive for both the design of M.S. as well as the utilisation of this manual.

In the following description all figures in parentheses, e.g. (2) define the respective part item no. in fig. 1. The part item no. may vary from those stated in the assembly drawing.

# **Versions**

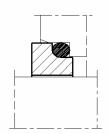
- MG12/...
- MG13/...
- MG1S20/...
- RMG12/...
- MG1 MULTIPLE M.S.

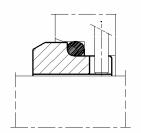
The mechanical seal type MG1 can also be used as **multiple mechanical seal** (also in combination with seal types of other series) in **tandem arrangement** with quench (API, plan 52) or as **dual mechanical seal** with barrier fluid (API, plan 53). Consultation with the BURGMANN company is recommended.

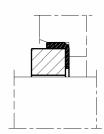
**ATTENTION!** PTFE o-rings or double-PTFE-wrapped o-rings **may** not be used at seat versions **without torsion lock**.

This operating manual applies also to the mentioned seal versions with slight modifications and/or to combinations with seats not stated in this manual.

# **Seat Versions**

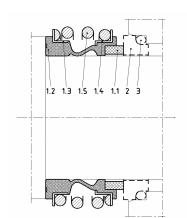






# **Description and function**

- single seal
- unbalanced
- bi-directional
- stationary seat (2)
- **o-ring** (3)
- rotating seal face (1.1)
- elastomeric bellow (1.2)
- cylindrical single spring (1.5)
- no glued joints
- materials of the sliding parts replaceable
- for media containing solids (e.g. sewage applications)
- rotating, torsion-free elastomeric bellows serving as
  - face housing
  - secondary sealing element
  - drive collar
- torque transmission from the seal face by means of "L"-rings and a rotating, cylindrical single spring
- axial movability



# Required space, connecting dimensions

The required mounting space for the mechanical seal is decisive for the design of the housing parts by the machine manufacturer. The connecting dimensions have to be checked by the machine manufacturer by means of the BURGMANN drawing before mounting the mechanical seal.

# Supply of M.S.

The mechanical seal has to be constantly wetted by liquid medium. The medium to be sealed must not damage the M.S. neither chemically (e.g. corrosion, embrittlement) nor physically (e.g. erosion, abrasion).

For a safe operation of the mechanical seal we recommend to apply at inboard the most suitable type of circulation described in API 610 / 682. This measure protects the seal cavity from deposition of solids.

To operate multiple seals special supply systems are required. Please contact BURGMANN.

# **Emissions**

A mechanical seal is a **dynamic seal** that **cannot be free of leakage** due to physical and technical reasons. Seal design, manufacture tolerances, operating conditions, running quality of the machine, etc. mainly define the leakage value. In fact, compared to other sealing systems there is **few leakage**.

WARNING! If the medium to be sealed and/or the supply liquid is subject to the Hazardous Substances Regulation (GefStoffV), the instructions for handling dangerous substances (safety data sheets to EU Directive 91/155/EEC) and the accident prevention regulations have be observed.

A possibly increased leakage during start-up will decrease to a normal quantity after the running-in period of the sliding faces.

If this is not the case or if there are other malfunctions the mechanical seal has to be shut down, removed and checked for reasons of safety.

The leakage can be liquid or gaseous. Its aggressiveness corresponds to that of the medium to be sealed.

Leakage of mechanical seal at outboard side has to be drained and disposed properly.

**IMPORTANT!** Components which may get in contact with the leakage have to be corrosion-resistant or have to be adequately protected.

# INSTALLATION

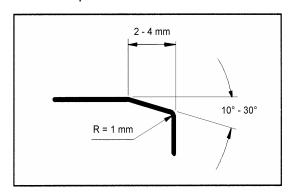
# **Assembly utilities**

- ethyl alcohol
- cellulose-tissue (no rag, no cloth!)
- o-ring lifter
- water and washing up liquid
- cardboard discs

# **Preparation for assembly**

**ATTENTION!** The seal should remain **packed** until the following working steps have been completely **terminated**.

Check the parts of the machine for:



- chamfered edges
  - (sliding cones i.e. 2 mm / 30° or in accordance with EN 12756)
- radiused transitions
- mating fits and o-ring surfaces: fine finished Rz 10 μm (= N7 = CLA 63)
- Shaft surface in the area of the mechanical seal finished according to EN 12756:
   Ra = 0.8 μm (= N6 = CLA 32).
- Shoulder or stop device for the bellows of the mech. seal to take up axial forces

#### Check at the machine:

- damage of connecting surfaces to the M.S.
- mating dimensions, rectangularity and concentricity to the shaft axis.

# **Run-out accuracy** of the shaft (acc. to DIN ISO 5199):

- Shaft diameters up to 50 mm: max. 0.05 mm
   Shaft diameters 50 mm 100 mm: max. 0.08 mm
- Prepare the place of assembly, take away any not required tool, cuttings, dirty cleaning wool etc.
- Cover the work bench with a piece of clean, non-fibrous cardboard.

# Assembly / installation

BURGMANN mechanical seals are super-finished and repeatedly tested machine elements whose handling during assembly in particular of sliding materials and elastomers requires special care during several procedures.

For installation the assembly drawing of mechanical seal has to be observed.

**IMPORTANT!** The mechanical seal has to be installed under the cleanest conditions and very carefully.

- Unpack the seal and check seal face, seat and elastomer bellows for possible damages.
- Never place the seal faces or seats on their sliding faces without having covered them adequately.
- Check before starting assembly:
  - complete availability of all components by means of the drawing
  - all components have to be clean and in perfect condition.
- Sprinkle the elastomer bellows and the shaft with low-surface-tension water (add washing up liquid) or ethyl alcohol to decrease frictional force during assembly of the seal.



Oil or grease as assembly agent is not permitted in any case.

**ATTENTION!** Do never force during installation.

**ATTENTION!** Avoid unnecessary rotation of the shaft (damage of the sliding faces is possible).

**ATTENTION!** Avoid knocking the seal! Damage to mechanical seals has an adverse effect on their safe operation.

#### Possible installation order:

• Feed the **degreased** sealing element (o-ring, rubber cup) onto the seat.

#### If present:

- At the seat mark the position of the rear slot beside the sliding face.
- Align the seat with the torque transmission pin.
- Cover the sliding face of the seat with a cardboard washer
- Press the seat slowly and without interruption into its position.
  - Use plenty of water or alcohol as lubricant.
  - Use a distance sleeve, if necessary.
- Remove the cardboard washer from the sliding face.
- Check the rectangular position of the seat to the shaft axis.

- Mount the seal cover with the seat installed before.
- Clean the sliding faces thoroughly with ethyl alcohol and paper tissues (no fabric, no cloths!).
- In case of material **"BUKO"** (carbon graphite) wipe it until the paper tissues stay clean.
- > Do not touch the sliding faces any more with bare fingers.
- Mount the sliding faces absolutely dry, dust-free and clean. Do not use any lubricants!



- Push rotating seal unit (bellows unit) with a slow clockwise turn onto the shaft.
- Stick to the dimensions in the assembly drawing!
- If necessary use a mounting sleeve.
- > For long pushing distances add liquid several times.
- Check "L" rings, spring and seal face for correct fit.
- Mount stop device for bellows unit to take up axial forces.
- > Stick to the dimensions in the assembly drawing by all means!
- Further assembly of the machine in accordance with the instructions of the machine manufacturer.

# **OPERATION**

# Instructions for safe operation

For a single mechanical seal the **pressure in the seal chamber** (stuffing box pressure) has to be **higher** than the ambient pressure at the machine at any time. Otherwise the machine will **suck in air** via the sliding faces, which will result in **dryrunning** and consequent **failure** of the mechanical seal.

Damages due to dry-running are excluded from the warranty.

**During every state of operation** the mechanical seal has to be constantly wetted by the **medium** to be sealed **in its liquid form**, in particular when the machine is **started** or **stopped**. The machine design has to be such as to take this necessity into consideration.

If the medium to be pumped builds deposits or tends to solidify during cooling down or standstill of the machine the stuffing box has to be flushed with suitable clean liquid. The flow and the liquid should be determined by the user.

If the operation limit values and the instructions given in this manual are followed a trouble-free operation of the mechanical seal can be expected.

# Instructions for start up

#### Safety checks before start up

- Torque transmission between mechanical seal and shaft duly installed
- Supply connections tightened pressure-sealed
- Disposal connections installed environmentally safe

For a safe operation of the mechanical seal we recommend to apply at inboard the most suitable type of circulation described in API 610 / 682. This measure protects the seal cavity from deposition of solids.

- Flood machine and seal cavity (stuffing box) with medium and vent thoroughly.
- Now the seal is ready for operation.

# **SERVICING**

# Maintenance

A correctly operated mechanical seal needs **low maintenance**. Wear parts, however, have to be replaced, if necessary.

A duly operation includes a regular check of the following parameters:

- Temperature
- Leakage (drainage) rate of the mechanical seal

An inspection of the mechanical seal should be carried out during a revision of the complete plant. We recommend to have this inspection be performed by responsible BURGMANN personnel.

If the mechanical seal is removed during a revision of the plant it has to be replaced by a new one.

#### Directives in case of failure

Try to define the kind of failure and record it.

- In the event of excessive leakage, note changes in the leakage amount and switch the pump off if necessary.
- > If a constant amount is leaking in a steady flow, the mechanical seal is damaged.
- In the event of a inadmissible temperature rise, the machine has to be stopped for safety reasons.

If there is a **malfunction** which you cannot correct on your own, or if the cause of malfunction is not clearly recognisable please immediately contact the nearest **BURGMANN** agency, a BURGMANN service centre or the BURGMANN headquarters.

During the **warranty period** the BURGMANN mechanical seal must only be disassembled with approval of the manufacturer or when a representative is present.

# After-sales service by BURGMANN

BURGMANN's customer service department offers a comprehensive service package covering consultancy, engineering, standardisation, installation, commissioning as well as damage analysis right through to seminars on sealing technology.

Addresses are listed in the known BURGMANN Design Manuals as well as in various other BURGMANN brochures.

# Address of headquarters:

Burgmann Industries GmbH & Co. KG

Postfach 1240

D - 82515 Wolfratshausen

Germany

**+49 (0) 81 71-23 0** 

Fax +49 (0) 81 71-23 12 14

www.burgmann.com

# Reconditioning (repair)

If **reconditioning** is necessary, the complete **seal** should be sent **to the manufacturer**, as this is the best way to find out which components can be reconditioned or which parts must be replaced in order to ensure an optimum tightness.

If, for compelling reasons, a reconditioning has to be carried out on site (e.g. no. spare seal on stock, long transport, problems with customs) the seal may be repaired in a clean room by trained personnel of the user under the direction of **BURGMANN** mechanics.

# Disassembly / removal



- Stop the machine as instructed, allow to cool, depressurise and ensure that pressure cannot build up again.
- Work on the M.S. is only permitted when the machine is at a standstill and depressurised.
- There must be no product on the M.S. ⇒ if necessary drain the machine and rinse it out.
- Isolate the machine to prevent it starting up unexpectedly.
- Comply with the safety notes (safety data sheets).

**IMPORTANT!** When removing, please observe by all means:

- current accident prevention regulations
- regulations for handling hazardous substances

WARNING! Seals that have been used with hazardous substances must be properly cleaned so that there is no possible danger to people or to the environment.

**IMPORTANT!** The packaging used to transport the seal must

- be identified with the relevant hazard symbol and
- include the safety data sheet for the product and/or supply medium

The order of disassembly to remove the mechanical seal out of the machine depends on the design of the machine and should be determined by the machine manufacturer.

• Remove the seal in the reverse sequence as described for assembly (set up).

# Spare parts

- Only BURGMANN original spare parts must be used. Otherwise
- > Risks of a seal failure, endangering persons and environment.
- > The BURGMANN guarantee for the mechanical seal lapses.
- For a quick exchange a complete **spare seal** should be on stock.

# Required details for enquiries and orders

For enquiries and orders the following details are required:

- BURGMANN commission no.
- Drawing no. of M.S. MG1/dw-00 dw = specified shaft diameter
- Part item no., designation, material, number of pieces with reference to the drawing.

Address of headquarters product field FA

Standard Mechanical Seals

Burgmann Industries GmbH & Co. KG

Postfach 1240

D - 82502 Wolfratshausen

Germany

+49 (0) 81 71 - 23 0 Fax +49 (0) 81 71 - 23 14 44

# Disposal of the BURGMANN mechanical seal

Usually, the BURGMANN mechanical seals can be easily disposed after a thorough cleaning.

- Metal parts (steels, stainless steels, non-ferrous heavy metals) divided into the different groups belong to scrap metal waste.
- Ceramic materials (synthetic carbons, ceramics, carbides) belong to waste products. They can be separated from their housing materials, as are physiologically recognised as safe.
- Synthetic materials/plastics (elastomers, PTFE) belong to special waste.

**CAUTION!** Material containing fluorine must not be burnt.

**IMPORTANT!** Some of the synthetic materials, divided into the different groups can be recycled.

# Copyright

The **Burgmann Industries GmbH & Co. KG** (Germany) holds the copyright to this document. Customers and operators of mechanical seals are free to use this document in the preparation of their own documentation. No claims of any type or form can be derived in such instance.

We reserve the right to carry out technical modifications of the product, even if they have not yet been considered in this manual.

June 13, 2006 Department Technical Documentation



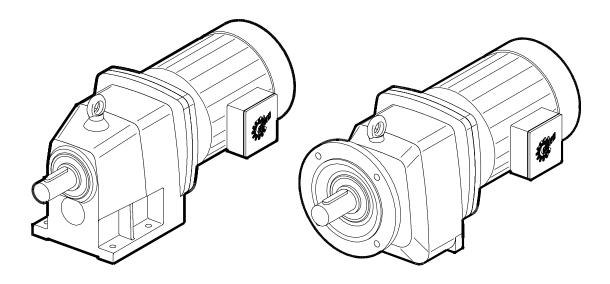
# UNICASE® Helical Inline Gearboxes Installation and Maintenance Instructions

# **BIM 1010**





# **Retain These Safety Instructions For Future Use**



#### **INSPECTION OF UNIT**

Thoroughly inspect the equipment for any shipping and handling damage before accepting shipment from the freight company. If any of the goods called for in the bill of lading or express receipt are damaged or the quantity is short, do not accept until the freight or express agent makes an appropriate notation on your freight bill or express receipt. If any concealed loss or damage is discovered later, notify your freight carrier or express agent at once and request him to make an inspection. We will be very happy to assist you in collecting claims for loss or damage during shipment; however, this willingness on our part does not remove the transportation company's responsibility in reimbursing you for collection of claims or replacement of material. Claims for loss or damage in shipment must not be deducted from the NORD Gear invoice, nor should payment of the NORD Gear invoice be withheld awaiting adjustment of such claims, as the carrier guarantees safe delivery.

If considerable damage has been incurred and the situation is urgent, contact the nearest NORD Gear Sales Office for assistance. Please keep a written record of all communications.

RECORD NAMEPLATE DATA						
	Locate the gear reducer nameplate and record all nameplate data for future reference.					
SK		S/N				
RATIO	MAX TORQUE	RPM	MTG. POS			

#### **STORAGE**

#### PROPER STORAGE UNTIL INSTALLED

Keep unit in a dry, temperature controlled area. If stored other than said, long term storage methods must be applied to the unit including complete fill with lubricant. Protect machined surfaces and rotate shafts periodically. Prior to putting unit into service, drain lubricant and refill to proper level as determined by the mounting position.

# PROPER HANDLING OF THE UNIT

Exercise care to prevent damage to the unit when moving. Lift only at designed lifting points. Do not attach other machinery and lift by the unit lifting points. The lifting points are to be used to lift the unit only. Insure that adequate safety measures are taken to protect personnel during transportation. Protect the mounting surface from damage.

#### **INSTALLATION OF UNIT**

To ensure long service and dependable performance, an enclosed gear drive must be rigidly supported and the shafts accurately aligned. The following describes the minimum precautions required to accomplish this end.

#### **FOUNDATION**

The responsibility for the design and construction of the foundation lies with the user. The foundation must be adequate to withstand normal operating loads and possible overloads while maintaining alignment to attached system components under such loads

#### MOUNTING POSITION

Unless a unit is specifically ordered for inclined mounting, the foundation must be level and flat. The lubrication system may not operate properly if the unit is not mounted in the position for which it is designed. It may be desirable to elevate the foundation to facilitate oil drainage.

#### **CONCRETE FOUNDATION**

If a concrete foundation is used, steel mounting pads and bolts of sufficient size to distribute the stress into the concrete should be grouted into the foundation.

#### STEEL FOUNDATION

If a structural steel foundation is used (i.e. wide flange beams or channels), a base plate or sole plate of suitable thickness should be used and should extend under the entire unit.

#### **FOOT MOUNTED UNITS**

Use shims under the feet of the unit to align the output shaft to the driven equipment. Make sure that all feet are supported so that the housing will not distort when it is bolted down. Improper shimming will reduce the life of the unit and may cause failure. Dowel pins may be installed to prevent misalignment and ensure proper realignment if removed for service.

#### **FLANGE MOUNTED UNITS**

If a structural steel foundation is used (i.e. wide flange beams or channels), a base plate or sole plate of suitable thickness should be used and should extend under the entire unit. If a bulk head plate is used it should be of proper strength to minimize buckling distortions.

# Flange Pilot 'AK' or 'AK1' tolerance

Metric (mm)

```
> Ø 50 ≤ Ø 80 = +0.012/-0.007
           > Ø 80 ≤ Ø 120 = +0.013/-0.009
           > Ø 120 ≤ Ø 180 = +0.014/-0.011
           > Ø 180 ≤ Ø 230 = +0.016/-0.013
           > Ø 230 ≤ Ø 315 = +0.000-0.032
           > Ø 315 ≤ Ø 400 = +0.000/-0.036
           > Ø 400 ≤ Ø 500 = +0.000/-0.040
Inch
           > \varnothing 1.969 \le \varnothing 3.150 = +0.005/-0.0003
           > Ø 3.150 ≤ Ø 4.724 = +0.005/-0.0004
           > \emptyset 4.724 \leq \emptyset 7.087 = +0.006/-0.0004
           > \emptyset 7.087 \leq \emptyset 9.055 = +0.006/-0.0005
           > \varnothing 9.055 \le \varnothing 12.402 = +0.000/-0.0013
           > Ø 12.402 ≤ Ø 15.748 = +0.000/-0.0014
           > Ø 15.748 ≤ Ø 19.685 = +0.000/-0.0016
```

#### **BOLT STRENGTH**

Bolt size, strength and quantity should be verified to insure proper torque reaction capacity whatever the mounting arrangement.

#### PRIME MOVER MOUNTING

Align the prime mover to the reducer-input shaft using shims under the feet. Make sure that the feet are supported. Dowel the prime mover to its foundation.

#### **SHAFT CONNECTIONS**

When connecting shafts to either the input or output of the reducer, consider the following instructions.

#### **FITS**

Clearance or interference fits for coupling hubs should be in accordance with ANSI/AGMA 9002-A86 or as follows.

#### **Output and Input shaft Diameter tolerance** Metric (mm)

```
\leq \emptyset 18 = +0.012/+0.001
          > \emptyset 18 \leq \emptyset 30 = +0.015/+0.002
          > \emptyset 30 \leq \emptyset 50 = +0.018/+0.002
          > Ø 50 ≤ Ø 80 = +0.030/+0.011
          > Ø 80 ≤ Ø 120 = +0.035/+0.013
          > Ø 120 ≤ Ø 180 = +0.040/+0.015
Inch
          ≤ Ø 1.750 = +0.0000/-0.0005
          > Ø 1.750 = +0.0000/-0.0010
```

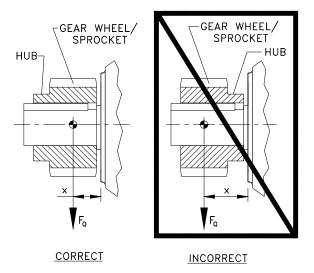
# Output and Input shaft Drill and tap shaft end

Metric (mm)

Inch

```
≤ Ø 16 = M5
> Ø 16 ≤ Ø 21 = M6
> Ø 21 ≤ Ø 24 = M8
> Ø 24 ≤ Ø 30 = M10
> Ø 30 ≤ Ø 38 = M12
> Ø 38 ≤ Ø 50 = M16
> Ø 50 ≤ Ø 85 = M20
> Ø 85 ≤ Ø 130 = M24
             \leq \emptyset 0.438 = #10-24 x 0.4 deep
> \emptyset 0.438 \le \emptyset 0.813 = \frac{1}{4}-20 \times 0.6 \text{ deep}
> \emptyset 0.813 \le \emptyset 0.938 = 5/16-18 \times 0.7 \text{ deep}
> \emptyset 0.938 \le \emptyset 1.125 = 3/8-16 \times 0.9 deep
> \varnothing 1.125 \le \varnothing 1.375 = 1/2-13 \text{ x } 1.1 \text{ deep}
> Ø 1.375 ≤ Ø 1.875 = 5/8-11 x 1.4 deep
> \varnothing 1.875 \le \varnothing 3.250 = 3/4-10 \times 1.7 \text{ deep}
> Ø 3.250
                            = 1-8 x 2.2 deep
```

Outboard pinion and sprocket fits should be as recommended by the pin sprockets with interference fits should be heated according to the manufacturer's recommendations, generally 250°F to 300°F, (120°C to 150° C) before assembling to the shaft.



#### **LOCATION**

Coupling hubs should be mounted flush with the shaft ends, unless specifically ordered for overhung mounting. Pinions, sprockets and sheaves should be mounted as close as possible to the unit housing to minimize bearing loads and shaft deflections.

#### **COUPLING ALIGNMENT**

Shaft couplings should be installed according to the coupling manufacturer's recommendations for gap, angular and parallel alignment. In many installations, it is necessary to allow for thermal and mechanical shaft movement when determining shaft alignment. The coupling manufacturer's recommendations should be followed.

#### **AXIAL DISPLACEMENT**

The gap between shaft ends should be the same as the specified coupling gap unless overhung mounting of the coupling hub is specified. The coupling gap and shaft gap must be sufficient to accommodate any anticipated thermal or mechanical axial movement.

#### **ANGULAR ALIGNMENT**

Insert a spacer or shim stock equal to the required coupling gap between the coupling hub faces and measure the clearance using feeler gauges. Repeat this at the same depth at 90-degree intervals to determine the amount of angular misalignment.

#### PARALLEL ALIGNMENT

Mount a dial indicator to one coupling hub, and rotate this hub, sweeping the outside diameter of the other hub. The parallel misalignment is equal to one-half of the total indicator reading. Another method is to rest a straight edge squarely on the outside diameter of the hubs at 90-degree intervals and measure any gaps with feeler gauges. The maximum gap measurement is the parallel misalignment.

#### **CHECKING ALIGNMENT**

After both angular and parallel alignments are within specified limits, tighten all foundation bolts securely and repeat the above procedure to check alignment. If any of the specified limits for alignment are exceeded, realign the coupling.

#### SPROCKET OR SHEAVE ALIGNMENT

Align the sheaves or sprockets square and parallel by placing a straight edge across their faces. Alignment of bushed sheaves and sprockets should be checked after bushings have been tightened. Check horizontal shaft alignment by placing a level vertically against the face of the sheave or sprocket. Adjust belt or chain tension per the manufacturer's specified procedure.

#### **OUTBOARD PINION ALIGNMENT**

Align the pinion by adjusting the gear tooth clearance according to the manufacturer's recommendations and checking for acceptable outboard pinion tooth contact. The foundation bolts may have to be loosened and the unit moved slightly to obtain this contact. When the unit is moved to correct tooth contact, the prime mover should be realigned.

#### **RECHECK ALIGNMENT**

After a period of operation, recheck alignment and adjust as required.

- 1. Properly install unit on a rigid foundation
  - adequately supported
  - securely bolted into place
  - leveled so as not to distort the gear case
- Properly install couplings suitable for the application and connected equipment.
- 3. Ensure accurate alignment with other equipment.
- Furnish and install adequate machinery guards as needed to protect operating personnel and as required by the applicable standards of the Occupational Safety and Health Administration (OSHA), and by other applicable safety regulations;

 Ensure that driving equipment is running in the correct direction before coupling to reducers with backstops (designed to operate only in a specific direction) or machinery designed to operate only in one direction.

#### **CHANGES IN PERFORMANCE SPECIFICATIONS**

Owner has the responsibility to consult with NORD GEAR if such items such as applied loads, operating speeds or other operating conditions have changed.



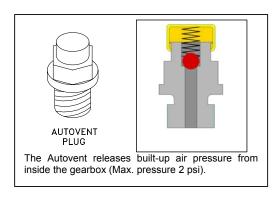
LOCK OUT POWER before any maintenance is performed. Make absolutely sure that no voltage is applied while work is being done on the gearbox.

#### START-UP

- Ensure that switches, alarms, heaters, coolers and other safety and protection devices are installed and operational for their intended purpose.
- Verify that the installed mounting position is the same as the nametag mounting position. If not, adjust the oil level accordingly and relocate the vent plug, fill plug and drain plug according to the mounting position. See following.

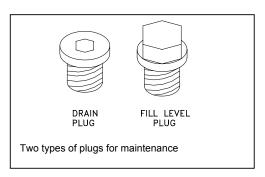
#### **AUTOVENT PLUG**

The Autovent plug is brass in color and will be located at the highest point on the gearbox. It operates like a check-valve to allow the reducer to relieve internal pressure while preventing lubricant contamination during cooling. A spring presses a ball or plunger against a machined orifice until pressure exceeds 2 psi. Above 2 psi the air is allowed to escape depressurizing the gearcase. When internal pressure drops below 2 psi, the autovent re-seals closing the unit to the outside environment. After shutdown, the reducer cools along with the air inside the reducer. The unit will temporarily maintain a slight vacuum until normalization occurs. NORD Gear supplies an Autovent as a standard feature.



#### **FILL LEVEL & DRAIN PLUGS**

The drain plugs are metric socket head cap screws. They will be located at the lowest part of the gearbox for ease of draining. The fill level plug is a hex head cap screw. It will be located between the Autovent and drain plug. Both types of plugs will have gaskets included to prevent oil from leaking.



#### LUBRICANT

All NORD reducers are shipped from the factory properly filled with lubricant and all plugs are installed according to the mounting position given on the reducer nametag. Acceptable oil fill level is within ½ inch of the bottom of the fill plug threads.

#### **OPERATION AND MAINTENANCE CHECKLIST**

- Operate the equipment as it was intended to be operated
- Do not overload.
- 3. Run at correct speed.
- Maintain lubricant in good condition and at proper level.
- Dispose of used lubricant in accordance with applicable laws and regulations.
- Apply proper maintenance to attached equipment at prescribed intervals recommended by the manufacturer.
  Perform periodic maintenance of the gear drive as
- recommended by NORD.

# **MOUNTING POSITIONS**

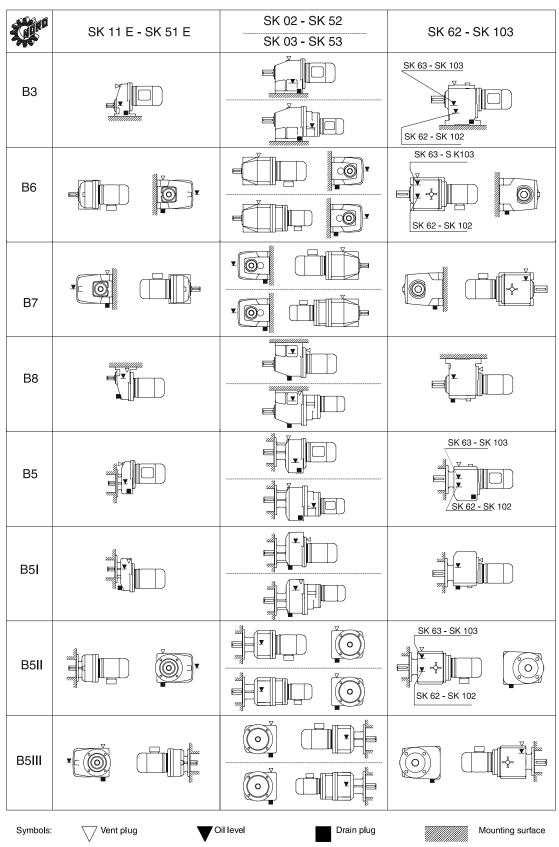
These charts detail the mounting positions for horizontal and vertical mounting. The Autovent, oil fill plug and drain plug are indicated on each mounting position picture. The factory set mounting position and plug locations match that shown on the gearbox nametag. For mounting orientations other than shown consult NORD Gear.

# **VERTICAL POSITION**

TIPE OF THE PROPERTY OF THE PR	SK 11E - SK 51 E	SK 02 - SK 52	SK 03 - SK 53	SK 62 - SK 103
V1 *				SK 63
V3		¥ T	¥ T	
V5 *				SK 63
V6				
Symbols:	Vent plug	Oil level	Drain plu	ug Mounting surface

<sup>\*</sup> Mounting position V1 or V5 with lubricant expansion unit

# **HORIZONTAL POSITION**



# **MAINTENANCE**

Mineral lubricant should be changed every 10,000 service hours or after two years. For synthetic oils, the lube should be changed every 20,000 service hours or after four years. In case of extreme operating (e.g. high humidity, aggressive environment or large temperature variations), shorter intervals between changes are recommended.

#### **OIL SPECIFICATIONS**

NORD supplies all reducers filled with oil from the factory. Consult the sticker adjacent to the fill plug to determine the type of lubricant installed at the factory. Standard lubricant is ISO VG220 mineral-based oil. However, some units have special lubricants designed to operate in certain environments or to extend the service life of the lubricant. If in doubt about which lubricant is needed, contact NORD Gear.

#### STANDARD OIL - ISO VG220

Ambient Temperature	Formulation
20 to 104°F (-5 to 40°C)	Mineral

#### **TYPICAL OILS**

I TFICAL OIL								
Viscosity ISO NLGI	Formulation	Service Temperature Range	Mobil*	Shell	Castrol	KLÜBER WBRICATION	bp	Tribol*
VG 460	Conventional Mineral	20°C to +50°C 68F to +122°F	Mobilgear 634	Omala 460	7EP	Klüberoil GEM 1-460	Energol GR-XP 460	Tribol 1100/460
VG 460	Synthetic PAO	-30°C to +80°C -22°F to +176°F	Mobil SHC 634	Omala 460 HD	Isolube EP 460	Klübersynth EG 4-460	N/A	Tribol 1510/460
VG 320	Conventional Mineral	0°C to +30°C 32°F to +86°F	Mobilgear 632	Omala 320	6EP	Klüberoil GEM 1-320	Energol GR-XP 320	Tribol 1100/320
VG 320	Synthetic PAO	-35°C to +80°C -31°F to +176°F	Mobil SHC 632	Omala 320 HD	Isolube EP 460	Klübersynth EG 4-320	N/A	Tribol 1510/320
VG 220	Conventional Mineral	-5°C to +40°C +20°F to +104°F	Mobilgear 630	Omala 220	5EP	Klüberoil GEM 1-220	Energol GR-XP 220	Tribol 1100/220
VG 220	Synthetic PAO	-34°C to +80°C -30°F to +176°F	Mobil SHC 630	Omala 220 HD	Isolube EP 220	Klübersynth EG 4-220	N/A	Tribol 1510/220
VG 150 &	Conventional Mineral	-15°C to +25°C 5°F to +77°F	Mobilgear 629	Omala 100	4EP	Klüberoil GEM 1-150	Energol GR-XP 100	Tribol 1100/100
VG 100	Synthetic PAO	-37°C to +10°C -35°F to +50°F	Mobil SHC 629	Omala 150 HD	Isolube EP 150	Klübersynth EG 4-150	N/A	N/A
VG 68	Conventional Mineral	-15°C to +25°C 5°F to +77F	Mobilgear 626	Omala 68	2EP	Klüberoil GEM 1-68	Energol GR-XP 68	Tribol 1100/68
V 3 66	Synthetic PAO	-40°C to +10°C -40°F to +50F	Mobil SHC 626	N/A	Isolube EP 68	N/A	N/A	N/A
VG 32	Synthetic PAO	-40°C to +10°C -40°F to +50°F	Mobil SHC 624	N/A	N/A	Klüber-Summit HySyn FG-32	N/A	N/A

PAO = Poly Alpha Olefin

#### **SPECIAL PURPOSE LUBRICANTS**

Ambient Temperature	Formulation	Manufacturer	Oil Brand Name
20 to 104°F (-5 to 40°C)	Food Grade Oil - Synthetic	Chevron	FM ISO 220
20 to 104°F (-5 to 40°C)	Food Grade Oil - Synthetic	OilJAX	Magnaplate 85W140-FG
5 to 125°F (-20 to 50°C)	Fluid Grease	Mobil	Mobilux EP023
-30 to 140°F (-35 to 60°C)	Fluid Grease - Synthetic	Mobil	Mobilith SHC 007
-30 to 140°F (-35 to 60°C)	Fluid Grease - Synthetic	Shell	Albida LC

#### STANDARD BEARING GREASE - NLGI 2EP Lithium

Ambient Temperature	Formulation
-20 to 140°F (-30 to 60°C)	Mineral

#### **OPTIONAL BEARING GREASES**

Ambient Temperature	Formulation	Manufacturer	Grease Brand Name
-40 to 230°F (-40 to 110°C)	Synthetic	Shell	Aeroshell 6
-40 to 230°F (-40 to 110°C)	Food Grade - Synthetic	Lubriplate	SFL1

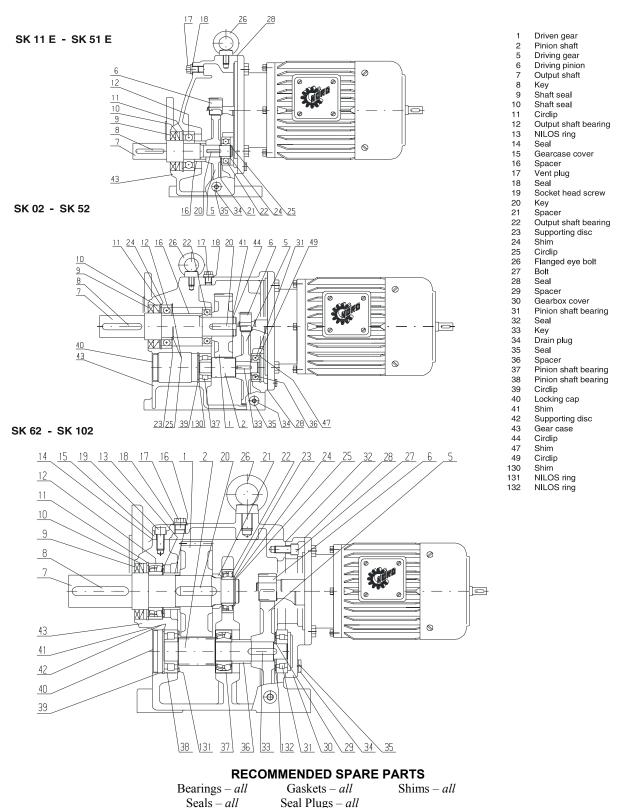
#### **LUBRICANT CAPACITY**

Each reducer has the oil level and oil quantity adjusted according to the mounting position shown in the tables. When replacing the oil, consult the tables below to determine the proper amount of oil to be installed according to the reducer size and mounting position. Note that this is approximate and the final level will be adjusted when the reducer is installed. Acceptable oil fill level is within ½ inch of the bottom of the fill plug threads.

					Horizon	tal position	)				Vertical p	osition	
Mounting p	nosition	Horizontal position single reduction							v critical p	Oomon			
wounting p	00111011	В3	В 6	B 7	B 8	B 5	B 5I	B 5II	B 5III	V 1	V 3	V 5	VE
SK 11E	quarts	0.26	0.37	0.37	0.58	0.32	0.53	0.42	0.42	0.32	0.37	0.42	0.5
	liters	0.25	0.35	0.35	0.55	0.30	0.50	0.42	0.42	0.32	0.35	0.42	0.5
	quarts	0.63	1.06	1.06	1.27	0.53	1.16	0.40	0.40	0.74	1.48	1.06	1.2
SK 21E	liters	0.60	1.00	1.00	1.20	0.50	1.10	0.90	0.90	0.74	1.40	1.00	1.2
		1.16	1.80	1.80	2.32	0.85	1.74	2.11	2.11	1.16	1.40	2.43	2.8
SK 31E	quarts	1.10	1.70	1.70	2.32	0.80	1.74	2.00	2.11	1.10	1.30	2.43	2.7
	liters											2.64	
SK 41E	quarts	1.80	2.75	2.75	3.49	1.06	2.96	3.49	3.49	1.69	2.75		2.7
	liters	1.70	2.60	2.60	3.30	1.00	2.80	3.30	3.30	1.60	2.60	2.50	2.6
SK 51E	quarts	2.32	3.59	3.59	4.97	1.90	4.33	4.02	4.02	3.17	3.70	4.23	4.6
	liters	2.20	3.40	3.40	4.70	1.80	4.10	3.80	3.80	3.00	3.50	4.00	4.4
Mounting p	osition						double re						
		B 3	В6	B 7	B 8	B 5	B 5I	B 5II	B 5III	V 1	V 3	V 5	V
SK 02	quarts	0.16	0.42	0.42	0.74	0.26	0.63	0.53	0.53	0.63	0.63	0.63	0.6
011 02	liters	0.15	0.40	0.40	0.70	0.25	0.60	0.50	0.50	0.60	0.60	0.60	0.6
SK 12	quarts	0.26	0.53	0.53	0.90	0.37	0.95	0.63	0.63	0.95	0.90	0.79	0.7
3K 12	liters	0.25	0.50	0.50	0.85	0.35	0.90	0.60	0.60	0.90	0.85	0.75	0.7
SK 22	quarts	0.53	1.43	1.43	2.11	0.74	2.11	1.64	1.64	1.90	2.11	1.90	1.9
3N 22	liters	0.50	1.35	1.35	2.00	0.70	2.00	1.55	1.55	1.80	2.00	1.80	1.8
SK 32	quarts	0.95	2.11	2.11	3.17	1.37	3.49	2.54	2.54	3.28	3.06	3.06	2.6
3K 3Z	liters	0.90	2.00	2.00	3.00	1.30	3.30	2.40	2.40	3.10	2.90	2.90	2.5
01/ 40	quarts	1.37	3.38	3.38	4.76	1.90	4.76	3.91	3.91	4.23	4.65	4.54	6.1
SK 42	liters	1.30	3.20	3.20	4.50	1.80	4.50	3.70	3.70	4.00	4.40	4.30	5.8
014.50	quarts	2.64	5.39	5.39	7.19	3.17	6.55	5.92	5.92	7.82	7.19	7.19	7.4
SK 52	liters	2.50	5.10	5.10	6.80	3.00	6.20	5.60	5.60	7.40	6.80	6.80	7.0
	quarts	6.87	15.85	15.85	13.74	7.40	14.79	16.91	16.91	19.55	15.85	16.91	15.
SK 62	liters	6.50	15.00	15.00	13.00	7.00	14.00	16.00	16.00	18.50	15.00	16.00	15.
	quarts	9.51	24.30	24.30	19.02	10.57	19.55	24.30	24.30	29.59	24.30	27.47	24.
SK 72	liters	9.00	23.00	23.00	18.00	10.00	18.50	23.00	23.00	28.00	23.00	26.00	23.
	quarts	14.79	33.81	33.81	28.53	15.85	30.64	36.46	36.46	47.55	39.10	46.49	36.
SK 82	liters	14.00	32.00	32.00	27.00	15.00	29.00	34.50	34.50	45.00	37.00	44.00	35.
	quarts	26.42	54.95	54.95	49.66	27.47	49.66	54.95	54.95	82.42	77.14	80.31	77.
SK 92	liters	25.00	52.00	52.00	47.00	26.00	47.00	52.00	52.00	78.00	73.00	76.00	73.
	quarts	38.04	75.02	75.02	69.74	42.27	69.74	76.08	76.08	109.90	85.59	107.78	83.
SK 102	liters	36.00	71.00	71.00	66.00	40.00	66.00	72.00	72.00	104.00	81.00	102.00	79.
	IIICIS	30.00	7 1.00	71.00	00.00	40.00			72.00	104.00	01.00	102.00	19.
Mounting p	osition	Б.	B 6	D.7	Б.0	B 5	triple red		D EIII	V 1	V 3	V 5	٧
		B 3		B 7	B 8		B 5I	B 5II	B 5III				
SK 03	quarts	0.32	0.63	0.63	0.85	0.53	0.95	0.85	0.85	1.16	0.86	0.95	1.3
	liters	0.30	0.60	0.60	0.80	0.50	0.90	0.80	0.80	1.10	0.81	0.90	1.2
SK 13	quarts	0.63	0.74	0.74	1.16	0.85	1.27	1.00	1.00	1.27	1.27	1.27	1.3
O. 10	liters	0.60	0.70	0.70	1.10	0.80	1.20	0.95	0.95	1.20	1.20	1.20	1.2
SK 23	quarts	1.37	1.69	1.69	2.43	2.64	1.59	2.96	2.96	2.96	2.75	2.48	2.5
	liters	1.30	1.60	1.60	2.30	2.50	1.50	2.80	2.80	2.80	2.60	2.35	2.4
SK 33	quarts	1.69	2.43	2.43	3.38	2.01	3.70	2.75	2.75	4.65	3.59	4.44	3.0
J. 100	liters	1.60	2.30	2.30	3.20	1.90	3.50	2.60	2.60	4.40	3.40	4.20	2.9
SK 43	quarts	3.17	3.80	3.80	5.49	3.70	5.28	4.33	4.33	6.45	6.02	6.97	5.9
SK 43	liters	3.00	3.60	3.60	5.20	3.50	5.00	4.10	4.10	6.10	5.70	6.60	5.6
CK E2	quarts	4.76	6.34	6.34	8.14	5.49	7.40	7.08	7.08	9.40	8.88	9.19	9.
SK 53	liters	4.50	6.00	6.00	7.70	5.20	7.00	6.70	6.70	8.90	8.40	8.70	8.7
SK 63	quarts	10.57	13.74	13.74	11.62	11.62	12.68	14.79	14.79	19.02	14.79	16.91	15.
	liters	10.00	13.00	13.00	11.00	11.00	12.00	14.00	14.00	18.00	14.00	16.00	14.
	quarts	14.79	21.13	21.13	18.49	14.79	19.02	21.13	21.13	29.06	23.78	28.53	21
SK 73	liters	14.00	20.00	20.00	17.50	14.00	18.00	20.00	20.00	27.50	22.50	27.00	20
SK 83	quarts	23.25	34.87	34.87	27.47	24.30	28.53	35.93	35.93	42.27	35.93	39.10	32
	liters	22.00	33.00	33.00	26.00	23.00	27.00	34.00	34.00	40.00	34.00	37.00	31
SK 93	quarts	42.27	51.78	51.78	46.49	42.27	46.49	51.78	51.78	78.19	73.97	76.08	73.
										74.00		72.00	70.
SK 93	liters	40 NN	49 00	49 00	44 (10	4()(11)	44 (10)	49 00	49 00				
SK 93	liters quarts	40.00 58.12	49.00 70.80	49.00 70.80	44.00 58.12	40.00 58.12	44.00 62.34	49.00 70.80	49.00 70.80	104.61	70.00 82.42	102.50	75

Note: Filling quantities are approximate figures. Oil level must be checked according to oil level plug after final installation. Acceptable oil fill level is within ½ inch of the bottom of the fill plug threads For mounting angles not shown, consult factory.

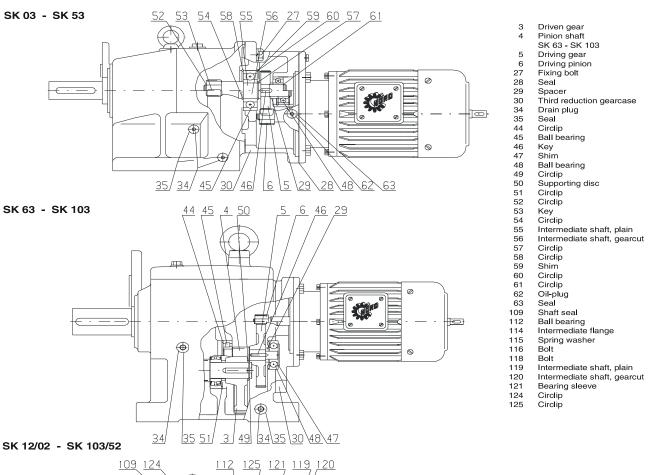
# **PARTS LIST**



#### **IMPORTANT!**

When ordering parts, it is necessary to have the *NORD SERIAL NUMBER* from the unit the parts are for. The serial number will dictate the correct parts for that particular unit. The gearbox nameplate will have the serial number on it.

# **PARTS LIST**



# **NOTES**

# **TROUBLE SHOOTING**

PROBLEM WITH	THE REDUCER	POSSIBLE CAUSES	SUGGESTED REMEDY		
	Overloading	Load exceeds the capacity of the reducer	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce load		
Runs Hot		Insufficient lubrication	Check lubricant level and adjust up to recommended levels		
	Improper lubrication	Excessive lubrication	Check lubricant level and adjust down to recommended levels		
		Wrong lubrication	Flush out and refill with correct lubricant as recommended		
	Loose foundation bolts	Weak mounting structure	Inspect mounting of reducer. Tighten loose bolts and/ or reinforce mounting and structure		
		Loose hold down bolts	Tighten bolts		
Runs Noisy	Worn RV Disc	Overloading unit may result in damage to disc	Disassemble and replace disc. Recheck rated capacity of reducer.		
	Failure of Bearings	May be due to lack of lubricant	Replace bearing. Clean and flush reducer and fill with recommended lubricant.		
		Overload	Check rated capacity of reducer.		
	Insufficient Lubricant	Level of lubricant in the reducer not properly maintained.	Check lubricant level and adjust to factory recommended level.		
	Internal parts are broken	Overloading of reducer can cause damage.	Replace broken parts. Check rated capacity of reducer.		
Output Shaft Does Not Turn	internal parts are broken	Key missing or sheared off on input shaft.	Replace key.		
		Coupling loose or disconnected.	Properly align reducer and coupling. Tighten coupling.		
	Worn Seals	Caused by dirt or grit entering seal.	Replace seals. Autovent may be clogged. Replace or clean.		
		Overfilled reducer.	Check lubricant level and adjust to recommended level.		
Oil Leakage		Autovent clogged.	Clean or replace, being sure to prevent any dirt from falling into the reducer.		
		Improper mounting position, such as wall or ceiling mount of horizontal reducer.	Check mounting position. Name tag & verify with mounting chart in manual.		

NORD Gear Corpo National Customer Service	<b>NORD Gear Limited</b> Toll Free in Canada 800-668-4378		
WEST 1121 Railroad Street Building 101 Corona, CA 92882 Phone 951-279-2600 Fax 888-408-6673	MIDWEST PO Box 367 800 Nord Drive Waunakee, WI 53597 Phone 608-849-7300 Fax 800-373-6673	SOUTH 100 Forsyth Hall Dr. Building 100B Charlotte, NC 28273 Phone 704-529-1255 Fax 888-259-6673	CANADA 41 West Drive Brampton, Ontario L6T 4A1 Phone 905-796-3606 Fax 905-796-8130

# Installation, Operation and Maintenance Instructions

for AC Induction Motors 56- 6800 Frames (NEMA) 63 – 280 Frames (IEC)



# **MARATHON ELECTRIC**

**Contact Motor Customer Service at:** 

Phone: (715) 675-3311

www.marathonelectric.com

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE

OWNER: READ AND SAVE THESE INSTRUCTIONS

#### SAFETY INSTRUCTIONS

A This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

#### A WARNING

Before installing, using, or servicing this product, carefully read and fully understand the instructions including all warnings, cautions, & safety notice statements. To reduce risk of personal injury, death and/or property damage, follow all instructions for proper motor installation, operation and maintenance.

These instructions are not intended as a complete listing of all details for installation, operation, and maintenance. If you have any questions concerning any of the procedures, STOP, and call the appropriate Regal-Beloit motor company.

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motor is suitable for use on Pulse Width Modulated (PWM) type VFD power. In addition, the nameplate must be marked with the inverter rating; for example, "2:1 CT", "2 to 1 Constant Torque", etc.

#### 1.0 INSTALLER/OWNER/OPERATOR RESPONSIBILITY:

#### 1.1 ELECTRICAL SAFETY

#### A WARNING: ELECTRICAL SHOCK HAZARD

Electrical connections shall be made by a qualified electrical personnel in accordance with all applicable codes, ordinances and sound practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage. Only qualified personnel who are familiar with the applicable National Code (USA = NEC) and local codes should install or repair electrical motors and their accessories.

#### A WARNING: ELECTRICAL LIVE CIRCUIT HAZARD

Do not touch electrically live parts. Disconnect, lockout and tag input power supply before installing or servicing motor (includes accessory devices). Use a voltmeter to verify that power is off before contacting conductors.

#### A WARNING: ELECTRICAL GROUNDING HAZARD

Failure to properly ground motors, per the National Electrical Code (NEC) Article 430 and local codes may cause serious injury or death to personnel. For general information on grounding refer to NEC Article 250. (Also see "Ground Connections section 3.4.4").

#### MARNING: AUTOMATIC RESET PROTECTOR HAZARD

Do not use automatic reset protectors if automatically restarting the motor will place personnel or equipment at risk. Failure to follow this instruction could result in serious personal injury, death and/or property damage

#### A WARNING: MANUAL RESET PROTECTOR HAZARD

If a tripped manual reset thermal protector is exposed to a temperature less than  $-7^{\circ}\mathrm{C}$  (20°F) it may reset and restart the motor automatically. If an application requires a motor with a manual reset thermal protector that will be operated at temperatures less than  $-7^{\circ}\mathrm{C}$  (20°F) contact the manufacturer to review the application / motor requirements. Failure to follow this instruction could result in serious personal injury, death and/or property damage

#### **1.2 MECHANICAL SAFETY**

#### MARNING: LOOSE PARTS HAZARD

Before starting the motor, remove all unused shaft keys and loose rotating parts to prevent them from flying off. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

#### WARNING: ROTATING PARTS HAZARD

Keep extremities, hair, jewelry and clothing away from moving parts. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

#### **1.3 ENVIRONMENTAL SAFETY**

#### **MARNING: HAZARDOUS LOCATIONS**

- (1) The NEC and the local authority having jurisdiction must be consulted concerning the installation and suitability of motors for use in Hazardous Locations. The local authority having jurisdiction must make the final determination of what type of motor is required. The application and operation is beyond the control of the motor manufacturer.
- (2) Division 1 Hazardous Locations motors can only be modified or reworked by the manufacturer or a facility that is Listed under UL's category "Motors and Generators, Rebuilt for use in Hazardous Locations". Failure to follow these instructions could result in serious personal injury, death and/or property damage.
- (3) Do not use a Hazardous Locations motor with a Variable Frequency Drive (VFD) unless the motor nameplate specifically states that the

#### 2.0 RECEIVING AND INSPECTION

#### 2.1 INITIAL INSPECTIONS

- **2.1.1 CHECK PACKING LIST AND INSPECT** the packaging to make certain no damage has occurred in shipment. If there is visible damage to the packaging, unpack and inspect the motor immediately. Claims for any damage done in shipment must be made by the purchaser against the transportation company.
- **2.1.2 TURN MOTOR SHAFT** by hand to be certain that it rotates freely. Note: Shaft seals and bearing seals may add drag.
- **2.1.3 CHECK NAMEPLATE** for conformance with purchase order requirements and compliance with power supply and control equipment requirements.

#### 2.2 HANDLING:

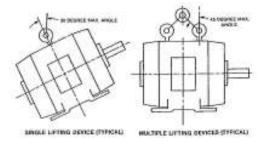
#### WARNING: FALLING OBJECT HAZARD

Eyebolts or lifting lugs, where provided, are intended for lifting only the motor and accessories mounted by the motor manufacturer (unless specifically stated otherwise on the motor). Utilizing the motor lifting provision to lift other components such as pumps and gear boxes could result in serious personal injury, death and/or property damage.

#### MARNING: FALLING OBJECT HAZARD

Before using the lifting provision, check the eyebolts and/or other lifting means to assure they are not bent or damaged and are completely threaded, seated & secured to the motor. Equipment to lift motor must have adequate lifting capacity. While lifting the motor DO NOT stand under or in the vicinity of the motor. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

#### 2.2.1 LIFTING ANGLE LIMITATIONS



**2.3 STORAGE:** Motors, not put into service immediately, must be stored indoors in a clean, dry location. Avoid locations with large temperature swings that will result in condensation. Motors must be covered to eliminate airborne dust and dirt. If the storage location exhibits high vibration, place isolation pads under motor to minimize damage to motor bearings.

- **2.3.1 BEARING LUBRICATION:** Bearings are grease packed at the factory; relubrication upon receipt of motor or while in storage is not necessary. If stored more than one year, add grease per lubrication instructions (Table 4-4) before start-up.
- **2.3.2 SHAFT ROTATION:** It is recommended that the motor shaft be rotated 5 to 10 rotations every three months to distribute the grease in the bearings. This will reduce the chance for corrosion to form on the bearing rolling elements and raceways. Note: Shaft seals and bearing seals may add drag.
- **2.3.3 DAMP OR HUMID STORAGE LOCATIONS**: Treat unpainted flanges, shafts, and fittings with a rust inhibitor. Apply appropriate power to the motor's space heaters (if so equipped)

#### 3.0 INSTALLATION AND OPERATION

WARNING: Only qualified personnel who are familiar with the appropriate national code, local codes and sound practices should install or repair electrical motors and their accessories. Installation should conform to the appropriate national code as well as local codes and sound practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

#### A WARNING: ELECTRICAL LIVE CIRCUIT HAZARD

Do not touch electrically live parts. Disconnect, Lockout and Tag input power supply before installing or servicing motor (includes accessory devices). Use a voltmeter to verify that power is off before contacting conductors.

#### 3.1 LOCATION

- **3.1.1 SELECTING A LOCATION:** Consideration should be given to environment and ventilation. Motors should be installed in an area that is protected from direct sunlight, corrosives, harmful gases or liquids, dust, metallic particles, and vibration. A motor with the proper enclosure for the expected operating condition should be selected. Provide accessible clearance for cleaning, repair, service, and inspections (See section 3.1.3 for construction clearances). The location should be considered for possible future motor removal / handling. The free flow of air around the motor should not be obstructed.
- **3.1.2 AMBIENT TEMPERATURE LIMITS:** The ambient temperatures of the air inlet to the motor should not exceed 40°C (104°F) or be less than -30°C (-22°F) unless the motor nameplate specifically states an ambient temperature outside of these limits. The ambient inside an enclosure built around the motor shall not exceed the nameplate ambient. For ambient temperatures outside of these limits consult the motor manufacturer.

#### A CAUTION: INSULATION DEGRADATION WARNING

Insulation at high temperatures ages at an accelerated rate. Each 10°C increase in temperature reduces the insulation life by one half.

WARNING: HAZARDOUS LOCATIONS AMBIENT LIMIT: Division 1 Hazardous Locations motors shall **NOT** be operated below -25°C (-13°F) ambient. (Low temperatures reduce the component mechanical properties.)

#### 3.1.3 CONSTRUCTION SELECTION per LOCATION:

- **3.1.3.1 DRIPPROOF (OPEN) MOTORS** are intended for use indoors where the atmosphere is relatively clean, dry, and non-corrosive. Recommended a minimum clearance of ½ the shaft height between vent openings and the nearest obstruction.
- **3.1.3.2 TOTALLY ENCLOSED MOTORS** are suitable for indoor or outdoor standard service applications.

**TEAO or AOM (Totally Enclosed Air Over)** motors must be mounted in the air stream. When the motor nameplate states a minimum airflow the motor must be mounted in an air stream meeting this minimum value.

**TEFC (Totally Enclosed Fan Cooled)** motors must meet a minimum distance of  $\frac{1}{2}$  the shaft height between the fan guard grill openings and the nearest obstruction.

**3.1.3.3** HAZARDOUS LOCATIONS MOTORS: Hazardous Locations motors are intended for installations in accordance with NEC Article 500. For all installations involving Hazardous Locations motors, consult the applicable national codes, local codes, and the authority having jurisdiction.

Division 1 Installations – includes Class I & II: Use only motors that are UL Listed and CSA Certified or UL Listed and UL Certified for Canada. These motors bear a separate nameplate that includes the UL Listing Mark and CSA Certification Mark or includes the UL Listing Mark and the UL Mark for Canada. This plate also bears the phrase: "Electric motor for Hazardous Locations" and is marked with the Class, Group and Operating Temperature Code.

<u>Division 2 Installations – Class I only:</u> Use only motors that are CSA Certified and bear the CSA Certification Mark. These motors include a phrase on the main motor nameplate that indicates the motor is CSA Certified for Class I, Division 2 / Zone 2 locations.

<u>Division 2 Installation – Class II only:</u> Use only Class II motors as described above under "Division I Installations".

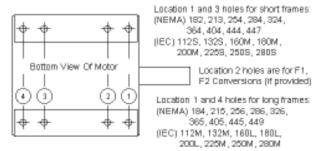
#### MARNING: EXPLOSION HAZARD

A motor should never be placed in an area with a hazardous process or where flammable gases or combustible materials may be present unless it is specifically designed and nameplated for this type of service. Hazardous Locations motors are intended for installations in accordance with NEC Article 500. For all installations involving Hazardous Locations motors, consult the NEC, local codes, and the authority having jurisdiction. Failure to follow these instructions could result in serious personal injury, death and/or property damage. (For other limitations see section 1.3)

#### 3.2 MOUNTING MOTOR:

**3.2.1 RIGID BASE (FOOTED):** The motor must be securely installed to a rigid foundation or a mounting surface to minimize vibration and maintain alignment between the motor shaft and the load's shaft. The mounting surfaces of the four mounting pads must be flat within 0.01 inches for 210 frame & smaller; 0.015 inches for 250 frame & larger. [IEC 0.25 mm for 130 frame & smaller, 0.38 mm for 160 frame & larger]. This may be accomplished by shims under the motor feet. For special isolation mounting, contact manufacturer for assistance

#### 3.2.2 RIGID BASE HOLE SELECTION -6 OR 8 HOLES



#### 3.2.3 VERTICAL MOUNTING:

**CAUTION: ENCLOSURE PROTECTION CAUTION:** Most Dripproof rigid base (footed) motors do **NOT** meet "Dripproof" requirements when mounted vertically. If the motor is located in unprotected environments, the addition of a drip cover may be available. Drip covers not available for cast iron rigid base motors.

#### MARNING: FALLING OBJECT HAZARD

The lifting provision on standard horizontal footed motors is not designed for lifting the motor in a vertical shaft up or shaft down position. (see 2.2.1 lifting angles). Lifting method / provisions for

mounting a rigid base (footed) motor vertically is the responsibility of the installer.

VERTICAL SHAFT DOWN: Most standard horizontal motors thru 449 Fr. (excluding brake motors) can be mounted in a vertical shaft down orientation. For vertical brake motors see section 3.3.6.2.

#### **VERTICAL SHAFT UP:**

**MARNING:** HAZARDOUS LOCATIONS VERTICAL MOUNT: Hazardous locations motors must NOT be mounted vertically shaft up without approval by the motor manufacturer. Without proper retaining provisions the rotor may move axially and contact components, creating a spark hazard.

Belted or Radial Load when mounted vertically: The following frame sizes / constructions with applied (axial) down loads within the limit stated are acceptable when mounted vertical

Table 3-1 Belted or Radial Load Applications (All speeds)

Table 3-	i beiled of K	adiai Load Appiid	ations (All s	
Frame Size	Enclosure	Construction	Shaft Up OK	Max Applied Down Load <sup>3</sup>
56	TEFC & ODP	Steel	Yes	25 lbs
140	TEFC	Steel & Cast Iron	Yes	25 lbs
	ODP	Steel	Yes	25 lbs
180	TEFC	All	Yes	35 lbs
100	ODP	Steel	Yes	35 lbs
210	TEFC	All	Yes	40 lbs
210	ODP	Steel	Yes	40 lbs
	TEFC	All	Yes	40 lbs
250	ODD	Steel	Yes	40 lbs
	ODP	Cast Iron	No <sup>2</sup>	N/A
	320 TTFC models	Cast Iron	Eng <sup>1</sup>	N/A
280-320	All Other TEFC	Cast Iron & Aluminum	Yes	30 lbs
	ODP	Cast Iron	No <sup>2</sup>	N/A
	TEFC & ODP	Steel	Build Up Only <sup>4</sup>	N/A
360 &	TEFC	Cast Iron	Build Up Only <sup>4</sup>	N/A
Up	ODP	Cast Iron	No <sup>2</sup>	N/A
Ор	TEFC & ODP	Steel	Build Up Only <sup>4</sup>	N/A

Notes:

- For TEFC model numbers beginning with 324TTFC or 326TTFC consult the motor manufacturer to determine if a build up motor is required
- 2 The max applied down load is any applied load external to the motor, including such things as sheave weight, fan loads, axial belt force, pump load, etc. If the application is direct drive with no applied radial load, consult the motor manufacturer.
- "Build-up only", refers to motors that are specifically ordered and built for shaft up applications. It does not imply that all buildup motors are suitable for shaft up applications.

#### 3.3 APPLICATION ASSEMBLY TO MOTOR:

A CAUTION: EQUIPMENT DAMAGE:

Do not connect or couple motor to load until correct rotational direction is established.

3.3.1 GENERAL: PROPER ALIGNMENT of the motor and driven equipment minimizes vibration levels, maximizes bearing life, and extends the overall life of the machinery. Consult the drive or equipment manufacturer for more information.

A CAUTION: BEARING FAILURE

During assembly do NOT force components onto the shaft. Striking or hammering the component may result in bearing damage.

**3.3.2 DIRECT COUPLING:** Use flexible couplings if possible. For applications that apply radial, axial or moment loading on the motor shaft see section 3.3.3.



#### A CAUTION: BEARING FAILURE

Unless approved by the motor manufacturer do NOT direct couple a vertical shaft up or roller bearing motor. Direct coupling a vertical shaft up motor or a motor with a roller bearing may result in bearing damage.

3.3.3 DIRECT CONNECTED: Radial loading for direct connected equipment (gears, fans etc.) must be approved by the motor manufacturer unless within the maximum overhung load limits (Table 3-2). Combined loading (axial, radial and/or moments) must be approved by motor manufacturer. For belted loads see section 3.3.4.

Table 3-2 Maximum Radial Load (lbf) @ Middle of the Shaft **Extension Length** 

Frame	Motor Rated RPM							
Number	3600	1800	1200	900				
143T	106	166	193	210				
145T	109	170	199	218				
182T	187	230	261	287				
184T	193	237	273	301				
213T	319	317	470	510				
215T	327	320	480	533				
254T	500	631	729	793				
256T	510	631	736	820				
284T	-	866	990	1100				
286T	-	871	1005	1107				
324T	-	950	1100	1215				
326T	-	950	1113	1230				
364T	-	1078	1365	1515				
365T	-	1078	1380	1540				
404T	-	1388	1590	1762				
405T	-	1400	1610	1780				
444T	-	1580	1795	2005				
445T	-	1520	1795	1985				
447T		1455	1765	1985				
449T	-	1640	1885	2130				

Values based on 26,280 hrs B-10 Life

For "End of Shaft" Load multiply value by 0.88

To convert from lbf to N multiply value by 4.4482.

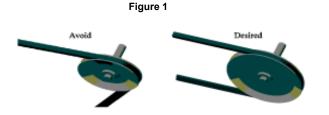
#### 3.3.4 BELTED:

The goal of any belted system is to efficiently transmit the required torque while minimizing the loads on the bearings and shafts of the motor and driven equipment. This can be accomplished by following four basic guidelines:

- Use the largest practical sheave diameter.
- Use the fewest number of belts possible. 2.
- Keep sheaves as close as possible to support bearings. 3
- Tension the belts to the lowest tension that will still transmit the required torque without slipping. It is normal for V-belts to squeal initially when line starting a motor

#### 3.3.4.1 Sheave Diameter Guidelines:

In general, smaller sheaves produce greater shaft stress and shaft deflection due to increased belt tension. See Table 3-3 for recommended minimum sheave diameters. Using larger sheaves increases the contact with belts which reduces the number of belts required. It also increases the belt speed, resulting in higher system When selecting sheaves, do not exceed the manufacturer's recommended maximum belt speed, typically 6,500 feet per minute for cast iron sheaves. Determine belt speed by the following formula:



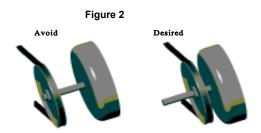
BELT SPEED (Ft/min) =  $\frac{Shaft RPM \times 3.14 \times Sheave Dia (inches)}{12}$ 

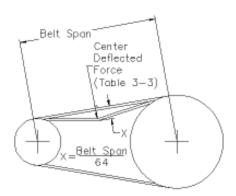
#### 3.3.4.2 Number of Belts

In general, use the fewest number of belts that will transmit the required torque without slipping. See Table 3-3 for recommended maximum number of belts. Each belt adds to the tension in the system, which increases load on the shafts and bearings. Belts are most efficient when operated at or near their rated horsepower. If the sheaves have more grooves than the number of belts required, use the grooves closest to the motor.

#### 3.3.4.3 Sheave Location

Install sheaves as close to the housing as possible to increase the bearing life of the motor and driven equipment





#### 3.3.4.4 Belt Tension

#### A CAUTION: Equipment Failure Caution

Belt tensioning by feel is **NOT** acceptable. Tensioning by "feel" can be very misleading, and can damage motor and equipment. It is normal for V-belts to squeal initially when line starting a motor.

In general, belt tensions should be kept as loose as possible while still transmitting the required torque without slipping. Belt tensions must be measured with a belt tension gage. These inexpensive gages may be obtained through belt manufacturers, or distributors.

Proper belt tension is determined by measuring the force required to deflect the center of the belt a given distance. The proper deflection (in inches) is determined by dividing the belt span in inches by 64. Calculate the proper deflection and then see Table 3-3 for the required "Deflected Force" to achieve that deflection.

After tensioning the belt, rotate the sheaves for several rotations or operate the system for a few minutes to seat belts into the grooves, then re-tension the belts. New belts will stretch during use, and should be retensioned after the first eight hours of use.

Table 3-3 Recommended Minimum Sheave Diameters, Belt Type, Number of Belts and Deflected Force

		120	0 rpm			1800 rpm			3600 rpm			
	Min		Max	Avg.	Min		Max	Avg.	Min		Max	Avg.
	Sheave		#	Deflected	Sheave		#	Deflected	Sheave		#	Deflected
<b> </b>	Dia (in)	Belt	of	Force	Dia (in)	Belt	of	Force	Dia (in)	Belt	of	Force
Motor Hp		Type	Belts	(lbs)		Type	Belts	(lbs)		Type	Belts	(lbs)
0 7E	2.0	οι /∨	1	O 1	2.0	ა/.\<	1	2.2	2.0	ე\ /∨	1	4.0
1	2.4	3VX	1	4.0	2.2	3VX	1	3.1	2.2	3VX	1	1.6
1.5	2.4	3VX	2	3.1	2.4	3VX	2	2.1	2.2	3VX	1	2.5
2	2.4	3VX	3	2.8	2.4	3VX	2	2.9	2.4	3VX	1	2.7
3	3.0	3VX	2	3.3	2.4	3VX	3	2.9	2.4	3VX	2	2.3
5	3.0	3VX	3	4.0	3.0	3VX	3	3.7	2.4	3VX	3	2.5
7.5	3.8	3VX	4	4.7	3.0	3VX	4	4.1	3.0	3VX	2	4.2
10	4.4	3VX	4	5.4	3.8	3VX	4	4.3	3.0	3VX	3	3.8
15	4.4	3VX	5	5.4	4.4	3VX	4	5.4	3.8	3VX	3	4.4
20	5.2	3VX	6	6.0	4.4	3VX	6	4.8	4.4	3VX	3	5.0
25	6.0	3VX	7	5.6	4.4	3VX	7	5.2	4.4	3VX	4	4.7
30	6.8	3\/X	7	59	5.2	3\/X	7	5.3				
40	6.8	5VX	4	11.6	6.0	3VX	7	6.0				
50	8.2	5VX	4	14.6	6.8	3VX	8	5.9				
60	8.2	5VX	5	14.1	7.4	5VX	4	13.3				
75	10.0	5VX	5	14.5	8.6	5VX	4	14.3		<b>-</b> 1 -		4
100	10.0	5VX	6	16.0	8.6	5VX	6	13	] (	Conta	ct Mo	tor
125	12.0	5V	7	14.1	10.5	5V	6	13.1		Manu	faatuu	
150	13.2	5V	7	15.4	10.5	5V	7	13.4		Manu <sup>.</sup>	iactur	er
200	15.0	5V	8	16.0	13.2	5V	8	13.1	]	when	Raltin	20
250	15.0	8V	6	27.6	14.0	5V	9	13.8				_
300	16.0	8V	7	27.1	14.0	5V/ <b>8V</b>	11 / 7	23.4	36	300 rp	m Mი	tors
350	16.5	8V	7	30.3	14.5	5V/ <b>8V</b>	12 / <b>7</b>	26.0		-		
400	17.5	8V	8	29.1	15.0	5V/ <b>8V</b>	13 / <b>8</b>	25.7	Greater than 25 HP			25 HP
450	18	8V	8	31.6	16.0	5V/ <b>8V</b>	14 / <b>9</b>	25.2				
500	18.5	8V	9	30.7	16.5	5V/ <b>8V</b>	15 / <b>9</b>	26.9	J			
600					17.5	8V	11	26.3	J			
700					19.0	8V	12	27.3	J			
800					20.0	8V	13	28.2				

#### Notes:

- 1. Horsepower is the nameplate motor horsepower, and RPM is the motor (driver) speed.
- 2. Minimum sheave diameters are from NEMA standards where applicable.
- 3. For variable speed applications or values outside these recommendations, consult motor manufacturer.
- 4. Selections are based on a 1.4 service factor, 5 to 1 speed ratio and various Power Transmission Manufacturers' catalogs.
- 5. These selections are for Narrow V-belt sections only. Consult manufacturer for details on conventional V-belt sections (A, B, C, D and E), or other belt types.
- 6. "Average Deflected Force is per section 3.3.4.4 of this document and is the force required to deflect the center of a belt 1/64 of the belt span distance. Tolerance on this force is ±1 lbf for forces ≤10 lbs, and ±2 lbs for forces >10 lbs as measured utilizing a belt tension gage.
- 7. When more than one belt is required the belts must be a matched set (matched for length).
- 8. If possible, the lower side of the belt should be the driving side to increase the length of wrap on the sheave).
- 9. For belted loads do not exceed 125% of 60 Hz operating RPM.

#### 3.3.5 VFD (Variable Frequency Drives) OPERATION:

WARNING: VFD Motors with Reset Thermal Protectors
UL Recognition, UL Listing, or CSA certification does not apply to
motors that are equipped with a manual or automatic reset thermal
protector when the motor is operated on VFD power.

**WARNING:** Power Factor Correction Capacitors:

Power factor correction capacitors should never be installed between the drive and the motor.

#### A CAUTION: VFD / Motor Setup:

It is the responsibility of the startup personnel during set up of the VFD / motor system to properly tune the drive to the motor for the specific application per the VFD user manual. The correct voltage boost and volts per hertz settings are application dependent and unique to each motor design. Failure to connect over temperature devices (when provided) will void the warranty.

#### 3.3.5.1 Overspeed Capability:

Belted loads: Do not exceed 125% of 60 Hz operating RPM.
Table 3-4 Maximum Safe Continuous Speed (RPM)
For Coupled and Direct Connected Loads

NEMA / [IEC] Frame Size	2-Pole	4, 6, or 8 Pole
56-180 [80-110]	7200 *	5400 *
210-250 [130-160]	5400 *	4200*
280 [180]	5400 *	3600
320 [200]	4500 *	3600
360 [225]	4500 *	2700
400-440 [250-280]	3600	2700
>440 [>280]	3600	1800

<sup>\* =</sup> Fan cooled motors (Totally Enclosed & Hazardous Locations Motors) are limited to a maximum safe continuous speed of 4000 RPM For higher speeds or shortened duty cycle contact motor manufacturer

**3.3.5.2 Cable Lengths:** For optimum insulation life, limit VFD to motor cable lengths of general purpose motors

to Table 3-5 values. Definite purpose VFD motors may accommodate longer cable lengths. For additional information contact motor manufacturer.

**Table 3-5 Max Cable Lengths General Purpose Motors**These values are based on 3 kHz carrier frequency. Add suitable VFD output-side filters when exceeding the listed values

valaco.			
Frame Size	230V	460 V	575 V
NEMA 56-320	600 ft.	125 ft.	40 ft.
NEMA 360-5011	1000 ft.	225 ft.	60 ft.
IEC 80-200	180 m.	40 m.	12 m.
IEC 225-280.	300 m.	70 m.	18 m.

**3.3.5.3 VFD Grounding:** Equipment grounding conductors may be run in the same conduit as the AC motor power leads. This wire must be used as the equipment ground for the motor and not as the fourth current carrying wire of a "WYE" motor circuit. The grounded metal conduit carrying the output power conductors can provide EMI shielding, but the conduit does not provide an adequate ground for the motor; a separate grounding conductor must be used. Grounding the motor neutral (WYE) of a VFD powered motor may result in a VFD ground fault trip. Improper grounding of an inverter fed motor may result in frame voltages in excess of 500 Volts. Refer to Grounding section 3.4.4

#### 3.3.5.4 VFD - Single Phase:

#### **CAUTION: SINGLE PHASE MOTOR FAILURE:**

Single Phase motors are **NOT** suitable for use on VFD power. Connecting a Single Phase Motor to a VFD voids the warranty.

#### 3.3.5.5 Stray Voltage on Accessory Leads:

VFD's will couple stray (common-mode) voltage to motormounted RTDs, thermistors, thermostats and space heaters. The leads of these elements must be properly insulated and control input circuits must be designed to withstand this common-mode voltage.

#### 3.3.6 ACCESSORIES / PROVISIONS:

**3.3.6.1 General:** Carefully read and understand the accessory manufacturer's instructions, supplied with motor. Contact the manufacturer for additional information.

#### 3.3.6.2 Brake Motors:

#### CAUTION: Vertical Motor Premature Brake Failure

Motors with brakes that are designed for vertical applications are equipped with springs to support the brake pressure plate. Mounting a horizontal brake motor vertically shaft up or down may require a pressure plate spring modification. Failure to modify the brake for the vertical application may result in premature brake failure. If in question, consult brake literature or brake manufacturer.

**Brake Solenoid Wiring:** Do NOT connect the brake solenoid to the output of a VFD. The brake solenoids must be wired to 50/60 Hz line power

#### 3.3.6.3 Space Heaters:

Motors provided with space heaters have two leads that are brought into the conduit box or into an auxiliary box. These leads are marked "H1", "H2" ("H3", "H4" if a second space heater is supplied). See the space heater nameplate on motor for heater rating.

#### ▲ WARNING: DIVISION 2 EXPLOSION HAZARD

The space heater temperature rating when used in Class I, Division 2 motors shall **NOT** exceed 80% of the auto ignition temperature of the hazardous gas or vapor. See the space heater nameplate on motor for heater Temperature Code and heater rating. Failure to follow this instruction could result in serious personal injury, death and/or property damage

#### 3.3.6.4 Thermal Protection:

<u>General Information:</u> When thermal protection is provided, one of the following will be stamped on the nameplate:

- I. "THERMALLY PROTECTED" This motor has built in thermal protection. Thermal protectors open the motor circuit electrically when the motor overheats or is overloaded. The protector cannot be reset until the motor cools. If the protector is automatic, it will reset itself. If the protector is manual, disconnect motor from power supply. After protector cools (five minutes or more) press the reset button and reapply power to the motor. In some cases a motor is marked "Auto" and the connection diagram on the motor will identify T'Stat leads see "2" below. (See warnings on Manual and Automatic reset protectors section 1.1)
- 2. "WITH OVERHEAT PROTECTIVE DEVICE": This motor is provided with an overheat protective device that does not directly open the motor circuit. Motors nameplated with this phrase have either thermostats, thermisters or RTD's. The leads to these devices are routed into the motor conduit box or into an auxiliary box. The lead markings are defined on the nameplate (normally "P1", "P2"). The circuit controlled by the overheat protection device must be limited to a maximum of 600 volts and 360 volt-amps. See connection decal provided inside the terminal box cover. Failure to connect these over temperature devices (when provided) will void the warranty.

#### **WARNING: EXPLOSION HAZARD**

For Hazardous Locations motors provided with thermostats UL and the NEC require connection of thermostat leads into the control portion of a manual reset start circuit. Failure to follow this instruction could result in serious personal injury, death and/or property damage

Resistance Temperature Detectors (RTD): When winding and/or bearing RTDs are provided the RTD lead markings are defined on the nameplate. (Normally "R1", "R2", "R3" etc.)

#### 3.3.6.5 RTD Alarm & Trip Settings:

Tables 3-6 & 3-7 are suggested initial RTD alarm and trip settings. For motors found to operate significantly below these values the settings may be reduced accordingly.

Table 3-6 Winding RTD – Temperature Limit (°C) 40 °C Max Ambient

Motor Load	Class B Temp Rise≤ 80°C		Class F Temp Rise≤ 105°C		
	Alarm	Trip	Alarm	Trip	
Up to 1.0 SF	130	140	155	165	
>1.0 to 1.15 SF	140	150	160	165	

Table 3-7 Bearing RTD – Temperature Limit (°C) 40 °C Max Ambient

Ambient	Alarm	Trip
Up to 40 <b>°C</b>	95	100
> 40 <b>°C</b>	110	115
Bearings that are Heat Stabilized to 150 °C	130	135

#### 3.3.7 GUARDS:

**MARNING:** ROTATING PARTS HAZARD

When devices are assembled to the motor shaft, be sure to install protective devices such as belt guards, chain guards, and shaft covers. These devices must protect against accidental contact with extremities, hair, and clothing. Consider the application and provide guarding to protect personnel. Remove all unused shaft keys and loose rotating parts to prevent them from flying off and causing bodily injury. Failure to follow this warning could result in serious personal injury, death and/or property damage.

#### 3.4 ELECTRICAL CONNECTIONS:

WARNING: ELECTRICAL HAZARDS

Before proceeding read Section 1-1 on Electrical Safety. Failure to follow the instructions in Section 1-1 could result in serious personal injury, death and/or property damage

#### 3.4.1 POWER SUPPLY / BRANCH CIRCUIT

WARNING: POWER SUPPLY INCOMPATIBILITY HAZARD Check power supply to make certain that voltage, frequency and current carrying capacity are in accordance with the motor nameplate. Failure to match motor nameplate values could result in serious personal injury, death and/or property damage

A WARNING: BRANCH CIRCUIT SUPPLY HAZARD

Motor and control wiring, fusing, overload protection, disconnects, accessories and grounding must always conform to the applicable electrical codes as well as local codes and sound practices.

**3.4.1.1 Branch Circuit Supply** to a motor should include a disconnect switch, short circuit current fuse or breaker protection, motor starter (controller) and correctly sized thermal elements or overload relay protection.

#### 3.4.1.2 Fuses, Breakers, Overload Relays

Short Circuit Current Fuses or Breakers are for the protection of the branch circuit. Starter or motor controller overload relays are for the protection of the motor. Each of these should be properly sized and installed per the applicable electrical codes as well as local codes and practices.

#### MARNING: PROTECTIVE DEVICE DISABLED HAZARD

DO NOT bypass or disable protective devices. Protection removal could result in serious personal injury, death and/or property damage

#### 3.4.1.3 AC Power Supply Limits

Motors are designed to operate within the following limits at the motor terminals:

- 1- AC power is within +/- 10 % of rated voltage with rated frequency applied. (Verify with nameplate ratings) **OR**
- 2- AC power is within +/- 5% of rated frequency with rated voltage **OR**
- 3- A combined variation in voltage and frequency of +/- 10% (sum of absolute values) of rated values, provided the frequency variation does not exceed +/-5% of rated frequency.
- 4- For 3 phase motors the line to line full load voltage must be balanced within 1%.
- 5- If the motor is rated 208-230V, the voltage deviations must be calculated from 230V.

#### **CAUTION: Reduced Motor Performance**

Operation outside of these limits will degrade motor performance and increase operating temperature.

#### 3.4.2 TERMINAL BOX:

#### **3.4.2.1 Conduit Opening:** For ease of connections,

motors are typically provided with large terminal boxes. Most motors have conduit access in 90 degree increments, the terminal box conduit opening is typically provided via knockouts, holes with covers, or the terminal box is rotate-able. Fabricated conduit boxes may have a removable plate for the installer to provide correctly sized hole(s).

#### 3.4.2.2 Hazardous Locations Motors:

#### ▲ WARNING: EXPLOSION HAZARDS

(1) Terminal Boxes mounted to motor with a pipe nipple: If a pipe nipple mounted terminal box is removed or rotated it must be reassembled with a minimum of five full threads of engagement.

(2) Component Removal: Do not set a terminal box component on its machined surfaces. Prior to component reassembly wipe clean all machined surfaces.

(3) Machined Surface Gap (Hazardous Locations Terminal Boxes): The gap between mating surfaces with the machined terminal box MUST BE LESS THAN 0.002 inches. This gap must be checked with a feeler gage along the entire perimeter. If there is visible damage to the mating surfaces, or if the gap between these surfaces exceeds 0.002 inches, DO NOT complete the installation and contact the motor manufacturer. Failure to follow these instructions could result in serious personal injury, death and/or property damage

#### 3.4.3 LEAD CONNECTIONS

Electrical connections to be made per nameplate connection diagram or separate connection plate. In making connections follow the applicable electrical code as well as local codes and practices.

#### **▲ WARNING: ELECTRICAL CONNECTION HAZARD**

Failure to correctly connect the motor leads and grounding conductor can result in injury or death. Motor lead connections can short and cause damage or injury if not well secured and insulated.

#### 3.4.3.1 Wire Size (Single Phase) Requirements

The minimum wire size for Single Phase, 115 & 230 Volt Circuits must meet table 3-8 for a given distance between motor and either Fuse or Meter Box.

Table 3-8 Minimum Wire Gage Size Single Phase 115 & 230 Volt Circuits

	Distance (Feet) - Motor to Fuse or Meter Box								
Motor	100	Ft.	200	Ft.	300	300 Ft.		Ft.	
HP	115	230	115	230	115	230	115	230	
1/4	14	14	10	12	8	10	6	8	
1/3	12	14	10	12	6	10	4	8	
1/2	10	12	8	10	6	8	4	6	
3/4	10	12	6	10	4	8	2	6	
1	8	10	6	8	4	6		4	
1 1/2	4	10	0	8		6		4	
2		8		6		4		2	
3		8		6		4		2	
5		6		4		2		0	

#### 3.4.3.2 Extension Cords (Single Phase Motors):

Where an extension cord(s) is utilized to provide power to the motor the extension cord(s) must be...(1) the proper gauge size per table 3-8, (2) in good working condition (3) properly grounded.

#### 3.4.4 GROUND CONNECTION(S):

#### A WARNING: ELECTRICAL GROUNDING HAZARD

For general information on grounding (USA) refer to NEC Article 250. Improper grounding of an inverter fed motor may result in frame voltages in excess of 500 Volts. In making the ground connection, the installer must make certain that a good electrical connection is obtained between motor and grounding lead. Failure to properly ground motors, per the applicable national code (such as NEC Article 430) and local codes may cause serious injury or death to personnel.

**Primary "Internal" Ground:** A grounding conductor must be connected to the grounding terminal provided in the terminal housing. This grounding terminal is either a ground screw, ground lug, or a tapped hole to be used with a separately provided ground screw. The internal grounding feature is accessible inside the terminal housing and must be used as the primary grounding connection.

Secondary "External" Ground: Some motors are provided with a supplemental grounding terminal located on the external surface of the motor frame or feet. This external terminal is for supplemental bonding connections where local codes permit or require such connection

#### 3.4.5 START UP:

WARNING: ELECTRICAL SHOCK HAZARD:

Be certain that all connections are secure and the conduit box cover is fastened in place before electrical power is connected. Failure to follow these instructions could result in serious personal injury, death, and/or property damage.

#### ▲ WARNING: LOOSE & ROTATING PARTS HAZARD

Before proceeding read Section 1-2 on Mechanical Safety. Failure to follow the instructions in Section 1-2 could result in serious personal injury, death and/or property damage

## MARNING: EXCESSIVE SURFACE TEMPERATURE HAZARD

Motors with the temperature code stated on the nameplate are designed to operate within this limit. Improper application or operation can cause the maximum surface temperature to be exceeded. A motor operated in a Hazardous Location that exceeds this surface temperature limit increases the potential of igniting hazardous materials. Therefore, motor selection, installation, operation, and maintenance must be carefully considered to ensure against the following conditions: (1) Motor load exceeds service factor value, (2) Ambient temperature above nameplate value, (3) Voltages outside of limits (3.4.1.3), (4) Loss of proper ventilation, (5) VFD operation exceeding motor nameplate rating, (6) Altitude above 3300 feet / 1000 meters, (7) Severe duty cycles, (8) Repeated starts, (9) Motor stall, (10) Motor reversing, and (10) Single phase operation. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

#### A CAUTION: HOT SURFACE

Normal motor surface temperatures may exceed 90  $^{\circ}$  C (194 $^{\circ}$  F). Touching the motor frame may cause discomfort or injury. Surface temperatures should only be measured with suitable instruments and not estimated by hand touch.

#### 3.4.5.1 Start Up - No Load Procedure

- Check Instructions: Before startup carefully read and fully understand these instructions including all warnings, cautions, and safety notice statements.
- Motor out of storage after more than three months: Check winding insulation integrity with a Megger. If winding resistance to ground is less than 1.5 Meg-ohms consult the local authorized service shop before energizing the motor.
- 3. Check Installation: Mechanical Check tightness of all bolts and nuts. Manually rotate the motor shaft to ensure motor shaft rotates freely. Note: Shaft & bearing seals will add drag. Electrical Inspect all electrical connections for proper terminations, clearance, mechanical tightness and electrical continuity. Be sure to verify connections are made per the nameplate connection diagram or separate connection plate. Replace all panels and covers that were removed during installation before energizing the motor.

#### 4. Energize Motor: Check Rotation

If practical check motor rotation before coupling to the load. Unlock the electrical system. Momentarily provide power to motor to verify direction of rotation. If opposite rotation is required, lock out power before reconnecting motor. If motor has a rotational arrow only operate the motor in the rotation identified. Reapply power to ensure proper operation.

#### 5. Record No Load Amps. Watts & Voltage:

Recommend - To establish a baseline value check and record the no load amps, watts, and voltage.

#### 3.4.5.2 Start Up - Load Connected Procedure

- Check Instructions: Before startup carefully read and fully understand these instructions including all warnings, cautions, & safety notice statements.
- Coupling Installation: Check that the connected equipment is properly aligned and not binding. Check that all guards and protective devices are properly installed.
- 3. Energize Motor: When all personnel are clear of the machine, apply power and verify that the load is not transmitting excessive vibration back to the motor though the shaft or the foundation. Verify that motor amps are within nameplate rating. For repeated starts see 3.4.5.3. The equipment can now be fully loaded and operated within specified limits as stated on the nameplate.

#### 3.4.5.3 Jogging and/or Repeated Starts

Do not start more than twice in succession under full load. Repeated starts and/or jogs of induction motors can cause overheating and immediate failure. Contact the motor manufacturer if it is necessary to repeatedly start or jog the motor.

#### **4.0 MAINTENANCE:**

#### WARNING: Hazardous Locations Motor Repair HAZARD:

Division 1 Hazardous Locations motors can only be modified or repaired by the manufacturer or a facility that is Listed under UL's category "Motors and Generators, Rebuilt for use in Hazardous Locations". Failure to follow these instructions could result in serious personal injury, death and/or property damage.

#### MARNING: ELECTRICAL SHOCK HAZARD

Electrical connections are to be made by qualified electrical personnel in accordance with all applicable codes, ordinances and sound practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage. Only qualified personnel who are familiar with the applicable national codes, local codes and sound practices should install or repair electric motors and their accessories.

#### **WARNING:** ELECTRICAL LIVE CIRCUIT HAZARD

Do not touch electrically live parts. Disconnect, lockout and tag input power supply before installing or servicing motor (includes accessory devices).

#### **4.1 GENERAL INSPECTION**

Inspect the motor approximately every 500 hours of operation or every three months, whichever occurs first. Keep the motor clean and the ventilation and fin openings clear. The following steps should be performed at each inspection:

- **4.1.1 VENTILATION:** Check that the ventilation openings and/or exterior of the motor is free of dirt, oil, grease, water, etc, which can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
- **4.1.2 INSULATION**: Use a "Megger" periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. If winding resistance to ground is less than 1.5 Meg-ohms consult the local authorized service shop before reenergizing the motor.
- **4.1.3 ELECTRICAL CONNECTIONS:** Check all electrical connectors to be sure that they are tight.

#### **4.2 LUBRICATION & BEARINGS:**

The lubricating ability of grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Longer bearing life can be obtained if the listed recommendations are followed:

NOTE: If lubrication instructions are provided on the motor nameplate, the nameplate instructions will supersede these instructions. Motors marked "Permanently Lubricated" do not require additional service.

#### CAUTION: BEARING / MOTOR DAMAGE WARNING

Lubricant should be added at a steady moderate pressure. If added under heavy pressure bearing shield(s) may collapse. Over greasing bearings greatly increases bearing friction and can cause premature bearing and/or motor failure.

**4.2.1 GREASE TYPE** (unless nameplate states otherwise): Nameplate Ambient Temperature between -30°C (-22°F) to 65°C (150°F) inclusive: Recommended grease for standard service conditions is Mobil Polyrex ® EM. Equivalent and compatible greases include: Texaco Polystar RB, Rykon Premium #2, Pennzoil Pen 2 Lube, Chevron SRI & Mobil SHC 100.

Nameplate Ambient Temperature below -30°C (-22°F): Special low temperature grease is recommended, such as Aeroshell 7 or Beacon 325 for ball bearings and Mobil SHC 100 for roller bearings.

Nameplate Ambient Temperature above 65°C (150°F): Dow Corning DC44 or equivalent, a special high temperature grease is required. Note that Dow Corning DC44 grease does not mix with other grease types.

For RTD settings see Table 3-7.

#### **4.2.2 BEARING OPERATING TEMPERATURE:**

A CAUTION: HOT SURFACE

The external surface temperature of the end shield (bracket) bearing hub may reach 100° C (212° F) during normal operation. Touching this surface may cause discomfort or injury. Surface temperatures should only be measured with suitable instruments and not estimated by hand touch.

#### 4.2.3 LUBRICATION INTERVALS: (For motors with regreasing provisions)

#### Eq. 4.2 <u>Lubrication Interval</u> = [(Table 4-1) hrs] x [Interval Multiplier (Table 4-2)] x [Construction Multiplier (Table 4-3)]

Table 4-1 Lubrication Intervals (Hours) These values are based on average use.

	Operati	Operating Speed – RPM (See Table 3.4 for Maximum Operating Speed)					
NEMA / [IEC] Frame Size	<7200	<5400	<4500	<3600	<1800	<1200	
56-180 [80-110]	2500 Hrs.	4000 Hrs	5000 Hrs	6000 Hrs.	17000 Hrs.	20000 Hrs.	
210-250 [130-160]		2500 Hrs	4000 Hrs	5000 Hrs.	12000 Hrs.	16000 Hrs.	
280 [180]		2000 Hrs	3000 Hrs	4000 Hrs.	10000 Hrs.	14000 Hrs.	
320 [200]			2000 Hrs	3000 Hrs.	9000 Hrs.	12000 Hrs.	
360 [225]			1500 Hrs	2000 Hrs.	8000 Hrs.	10000 Hrs.	
400-440 [250 – 280]				1500 Hrs.	4000 Hrs.	7000 Hrs.	
>440 [>280]				1000 Hrs.	3000 Hrs.	5000 Hrs.	

Seasonal Service: If motor remains idle for more than six months, Lubricate at the beginning of the season, then follow lubrication interval. Do not exceed maximum safe operating speed Table 3-4 without manufacturer's approval

**Table 4-2 Service Conditions** 

Use highest level Multiplier: Maximum Ambient Temperature and Contamination are independent factors

Severity of Service	Maximum Ambient Temperature	Atmospheric Contamination	Multiplier
Standard	Less than 40° C (104° F)	Clean, Slight Corrosion, indoors, less than 16 hrs per day	1.0
Severe	Above 40° C (104° F) to 50° C	Moderate dirt or Corrosion or outdoors or more than 16 hrs per day	0.5
Extreme	Greater than 50° C or Class H Insulation	Severe dirt or Abrasive dust or Corrosion	0.2

**Table 4-3 Construction Multiplier** 

Construction	Multiplier
Angular Contact or Roller Bearing	0.5
Vertical Motor	0.5
All others	1.0

**Table 4-4 Relubrication Amounts** 

Frame	Size	Volume				
NEMA	IEC	Cu. In.	Fluid oz	ml		
48-56	80	0.25	0.14	4.0		
143-145	90	0.25	0.14	4.0		
182-184	110	0.50	0.28	8.0		
213-215	130	0.75	0.42	12.5		
254-256	160	1.00	0.55	16.0		
284-286	180	1.50	0.83	25.0		
324-326	200	2.00	1.11	33.0		
364-365	225	3.00	1.66	50.0		
404-405	250	3.80	2.11	62.0		
444-449	280	4.10	2.27	67.0		
>449	>280	4.50	2.50	74.0		

For regreasing while operating multiply volume by 125%.

## 4.2.4 LUBRICATION PROCEDURE: (For Motors with Regreasing Provisions)

#### **CAUTION: BEARING DAMAGE WARNING**

Added grease must be compatible with the original equipment's grease. If a grease other than those stated in 4.2.1 is to be utilized contact the motor manufacturer. Nameplate information supersedes section 4.2.1 (GREASE TYPE). New grease must be free of dirt. Failure to follow these instructions and procedure below may result in bearing and/or motor damage.

For an extremely dirty environment, contact the motor manufacturer for additional information.

#### **LUBRICATION PROCEDURE:**

- 1. Clean the grease inlet plug or zerk fittings prior to regreasing.
- (If present) Remove grease drain plug and clear outlet hole blockage.

#### **CAUTION: GREASE DRAIN PLUGGED:**

Old grease may completely block the drain opening and must be mechanically removed prior to regreasing. Forcing a blocked drain open by increased greasing pressure may collapse bearing shields and / or force excess grease through the bearings and into the motor.

- 3. Add grease per Table 4-4
- **4.** Re-install grease inlet and drain plugs (if removed).

#### **WARNING: EXPLOSION HAZARD**

**Do NOT** energize a Hazardous Locations motor without all grease fittings properly installed.

#### 4.2.5 EXAMPLE: LUBRICATION

Assume - NEMA 286T (IEC 180), 1750 RPM Vertical motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

- 1. Table 4-1 list 10,000 hours for standard conditions.
- Table 4-2 classifies severity of service as "Severe" with a multiplier of 0.5.
- **3.** Table 4-3 lists a multiplier value of 0.5 for "Vertical"
- **4.** (Eq. 4.2) Interval =  $10,000 \text{ hrs } \times 0.5 \times 0.5 = 2500 \text{ hrs}$

Table 4-4 shows that 1.5 in of grease is to be added.

Relubricate every 2,500 hrs of service with 1.5 in of recommended grease.

#### 4.3 TROUBLE-SHOOTING

WARNING: READ INSTRUCTIONS:

Before trouble-shooting a motor, carefully read and fully understand the warnings, cautions, & safety notice statements in this manual.

**▲ WARNING:** Hazardous Locations Motor Repair:

Motors nameplated for use in Division 1 Hazardous Locations can only be disassembled, modified or repaired by the plant of manufacturer or a facility that is Listed under UL's category "Motors and Generators, Rebuilt for use in Hazardous Locations". Failure to follow these instructions could result in serious personal injury, death and/or property damage

#### **CAUTION: DISASSEMBLY APPROVAL REQUIRED:**

Motor disassembly must be performed by a party approved by the motor manufacturer. To disassemble the motor without approval voids the warranty.

#### 4.3.1 GENERAL TROUBLE-SHOOTING WARNINGS

- 1. DISCONNECT POWER TO THE MOTOR BEFORE PERFORMING SERVICE OR MAINTENANCE.
- 2. Discharge all capacitors before servicing motor.
- Always keep hands and clothing away from moving parts.
- Be sure required safety guards are in place before starting equipment.
- 5. If the problem persists contact the manufacturer.

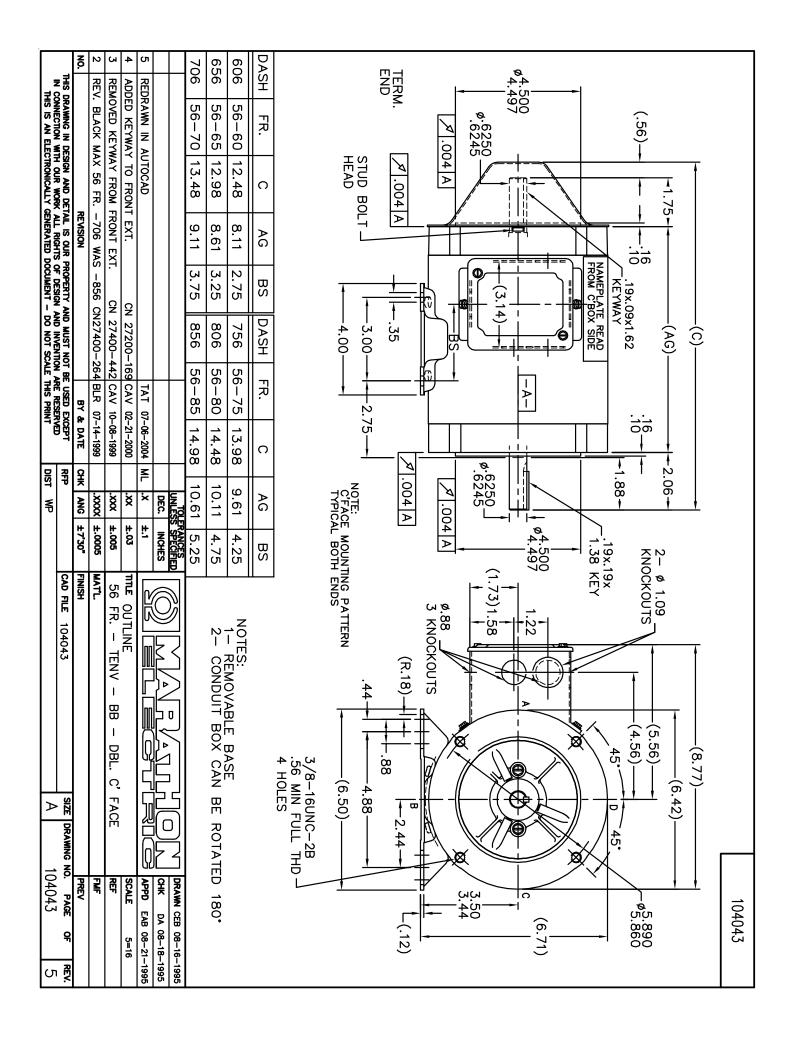
4.3.2 Motor Trouble-shooting Cause / Corrective Action - Table 4-5

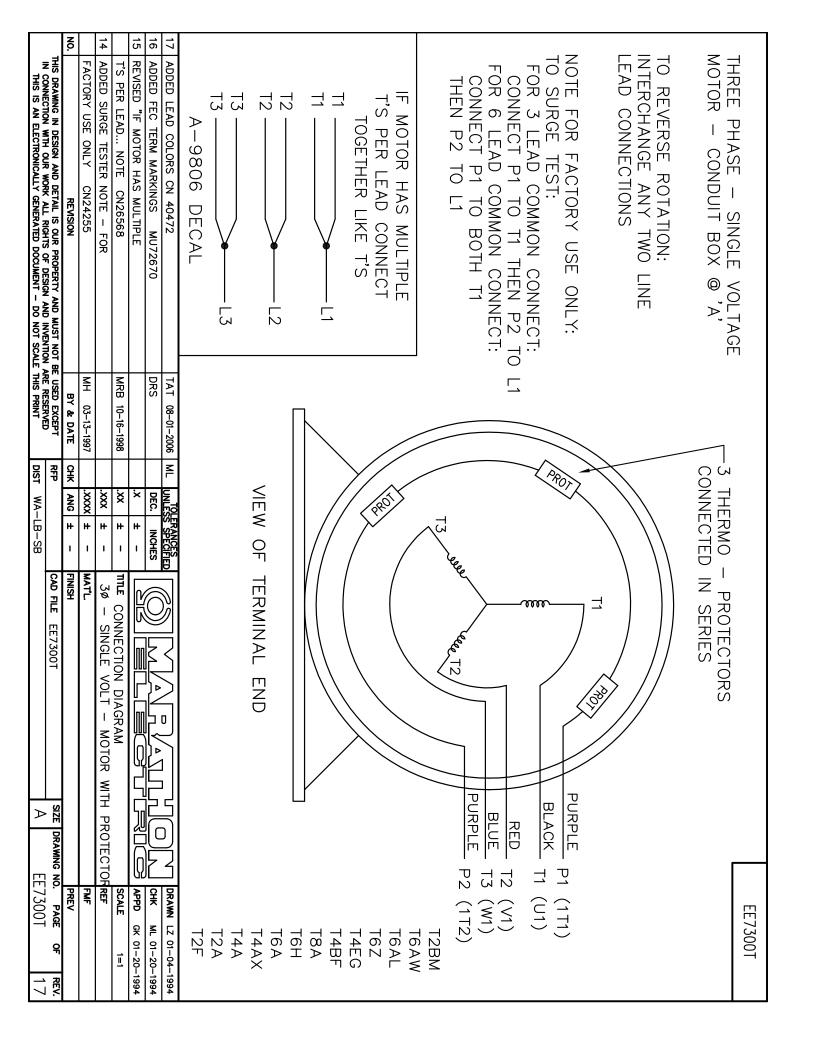
loo		Likely Cause:	Corrective Action:						
		Likely Cause:							
Mot	or 1	fails to start upon initial installation:							
4	<b>A</b> .)	Supply voltage is too low or is severely unbalanced (one phase is low or missing).	(1) Check power supply fuses (2) Match motor lead wiring to nameplate connection diagram and supply voltage (3) Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3). Correct as needed (4) Obtain correct						
E	В.)	Motor leads are miswired at conduit box.	motor to match actual supply voltage.						
	C.)	Driven load exceeds motor capacity	(1) Verify that motor & load turn freely (2) Disconnect motor from load & ensumotor turns freely. Note: Roller bearings make noise when motor is uncoupled a shaft is rotated (3) Verify that motor starts when disconnected from load (						
<b>⊢</b> ⊢	D.)	Load is jammed.	Remove excessive / binding load if present.						
E	E.)	Fan guard is bent and making contact with fan	Replace fan guard & fan (if blades are damaged)						
F	F.)	VFD with power factor capacitors installed	Remove power factor correction capacitors if equipped						
(	G.)	VFD with motor neutral lead grounded	Ensure that motor neutral lead is ungrounded						
÷	Н.)	VFD programmed incorrectly	(1) Repeat checks listed above (2) Verify that VFD current limit and starting boost are set correctly (5) Double-check motor and feedback parameter settings and VFD permissives (6) Repeat autotune (for vector drives) procedure (7) Consult VFD supplier.						
Mot	or l	has been running, then slow down, s	stalls, or fails to restart:						
,	<b>A</b> .)	Supply voltage has drooped or has become severely unbalanced	(1) Replace fuse or reset circuit breaker. Allow motor to cool down before resetting manual protector on motor. <b>Warnings</b> - See section 1.1 for automatic and manual reset protector warnings (2) Verify that rated and balanced supply voltage has been restored before restarting motor. Measure voltage during restart. Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3).						
E	В.)	Motor is overloaded	(1) Verify that motor & load turn freely. Repair binding components as needed (2)						
C	C.)	Motor bearings are seized	Reduce driven load to match motor capacity or increase motor size to match load						
	D.)	Load Is jammed.	requirements.						
E	E.)	VFD will not restart motor after tripping	(1) Check fault codes on VFD and follow VFD troubleshooting procedures (2) Verify that VFD input voltage is balanced and within limits (3) Remove excessive mechanical load if present.						
F	F.)	Capacitor failure on single phase motor (if equipped)	Warning: Potential Shock Hazard: Contact service shop to check capacitor.						
Mot	or 1	takes too long to accelerate:							
/	<b>A</b> .)	Motor leads are not connected correctly	Match motor lead wiring to nameplate diagram.						
E	В.)	Supply voltage has drooped or become severely unbalanced.	(1) Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3). Correct as needed (2) Obtain correct motor to match actual supply voltage.						
	C.)	Load exceeds motor capability	Determine correct motor size and contact motor representative to obtain replacement motor.						
[	D.)	Faulty start capacitor (Single Phase)	Motor may be too small for load. Record acceleration time. Start capacitors may fail if acceleration time exceeds 3 seconds.						
E	E.)	Mechanical Failure	(1) Check to make sure motor & load turn freely (2) Disconnect motor from load & ensure motor turns freely						
Mot	or ı	rotates in the wrong direction:							
	<b>A</b> .)	Incorrect wiring connection at motor	[Single Phase] Reconnect motor according to wiring schematic provided. Note: Some motors are non-reversible						
			[Three Phase] Interchange any two power supply (phase) leads.						
Mot	or	overheats or overload protector repo	eatedly trips						
,	<b>A</b> .)	Driven Load is excessive	(1) If motor current exceeds nameplate value, ensure that driven load has not increased. Correct as needed. (2) If new motor is a replacement, verify that the rating is the same as the old motor. If previous motor was a special design, a general purpose motor may not have the correct performance.						
	В.)	Ambient temperature too high	Most motors are designed to operate in an ambient up to 40 $^{\circ}\text{C}.$ (See section 4.2.2 Hot Surface Caution)						
C	C.)	Motor cooling fins and/or vent openings blocked	Remove foreign materials — clear vent openings, fan guard air inlets and frame fins (TEFC motors)						
<del>   -</del>			TEAO (Totally Enclosed Air Over) motors: Measure airflow next to motor surface						

	E.)	Motor is started too frequently	See section 3.4.5.3				
	F.)	Supply voltage too low, too high, or unbalanced	(1) Ensure that steady state supply voltage at motor terminals is within limits (s section 3.4.1.3) Correct as needed (2) Reconnect motor per input voltage Obtain correct motor to match power supply.				
Мо	tor	Vibrates					
	<b>A</b> .)	Motor misaligned to load.	Realign load				
	В.)	Load out of balance (Direct drive application)	(1) Ensure that load is dynamically balanced: (2) Remove motor from load and inspect motor by itself. Verify that motor shaft is not bent. Rule of thumb is 0.002" runout for shafts extension lengths up to 3.00". Add 0.0005" per every additional inch of shaft length beyond 3.00".				
	C.)	Uneven tension on multiple belts	Mixing new with used belts. Replace multiple belt applications with a complete set of matched belts.				
	D.)		(1) De-energize motor and record vibration as load coasts from 100% speed to 0 RPM. If vibration drops immediately, vibration source is electrical. If levels do not drop immediately, source is mechanical (2) Redesign system to operate below the resonant point (3) On VFD-driven loads, program skip frequencies to bypass resonant points (4) Increase carrier frequency to obtain <3% THD current (5) On variable torque loads reduce volts/hertz below base speed.				
	E.)	VFD torque pulsations	(1) Adjust VFD to obtain <3% THD current @ rated motor current (2) Adjust VFD stability for smooth operation. Vector drives may be unstable at light load.				
	F.)	Motor miswired at terminal box	Match motor lead wiring to nameplate connection diagram.				
	G.)	Uneven, weak or loose mounting support.	Shim, strengthen or tighten where required.				
	Н.)	Motor bearings defective	Test motor by itself. If bearings are bad, you will hear noise or feel roughness. Roller bearings are normally noisy when operated without load. If sleeve bearing, add oil per nameplate instructions. For motors with regreasing provisions, add grease per relubricating instructions (see section 4.2.3). If noise persists contact warranty service.				
	l.)	Motor out of balance	Disconnect from load. Set motor on rubber pads on solid floor. Secure a $\frac{1}{2}$ height key in shaft keyway and energize from balanced power supply @ rated voltage. Record vibration levels and compare with appropriate standards. If excessive vibration persists contact motor manufacturer.				

Beari	ngs repeatedly fail.	
<b>A</b> .)	Load to motor may be excessive or unbalanced	(1) If belt drive check system per section 3.3.4. (2) Other than belting, check loading on motor shaft. An unbalanced load will also cause the bearings to fail. (3) Check runouts of mating components, such as a C-face and pump flange.
В.)	Bearings contaminated.	Motor enclosure not suitable for environment. Replace with correct enclosure construction
C.)	Incorrect grease or bearings for ambient extremes.	See section 4.2.1
D.)	VFD bearing damage	Ground brush, common mode filter, or insulated bearings must be added. Contact motor manufacturer.
Motor	r, at start up, makes a loud rubbing, ເ	grinding, or squealing noise.
<b>A</b> .)	Contact between rotating and stationary components	Belt squeal during across the line starting is normal: (1) Verify that supply voltage is within limits (see section 3.4.1.3). (2) Ensure that motor lead wiring matches nameplate connection diagram: (3) Isolate motor from load. (4) To locate point of contact turn motor shaft by hand. (5) If point of contact is not located contact motor service shop.
Start	capacitors repeatedly fail.	
A.)	The motor acceleration time is too long	Motor may be too small for load. Record acceleration time. Start capacitors may fail if acceleration time exceeds 3 seconds.
В.)	Motor is being started too frequently	Excessive starting will damage motor capacitors. Contact motor manufacturer if motor is started more than 20 times/hour or if acceleration time exceeds 3 seconds.
C.)	Motor voltage low	Verify that voltage at the motor terminals is within limits (see section 3.4.1.3).
D.)	Defective start switch inside motor	Motor internal switch failure overheats start capacitor. Contact service shop or motor manufacturer.
Run c	apacitor fails.	
A.)	High ambient temperature	Verify that the ambient does not exceed motor's nameplate value
		•

,		Verify that voltage to the motor terminals is within limits (see section 3.4.1.3).
C.)	Power surge to motor (caused by lightning strike or other high transient voltage).	If a common problem, install surge protector.





# Warranty Card Complete and return to validate warranty

Please complete this card and return it to **seepex** Inc. By using this card, the valid warranty period will commence at the pump "start-up" date. If this card is not completed the warranty coverage period will commence on the date the pump is shipped from the **seepex** factory. This card must be completed and mailed no later than one year from the date of shipment.

User Entity:		
Mailing Address:	Pump Mode	el#
	Pump Commission	n #:
	Pumped Produ	uct:
Contact Person:	Diff. Pressure:	Flow Rate:
Phone Number:	Temperature:	Visosity:
Fax Number:	Solids Size:	Solids %:
Was the pump delivered as scheduled? Was the appearance of the pump acceptable? Did the pump suffer any freight damage? Did Other Comments:	Yes No Did you receive:	rm as expected?Yes No - Data Sheets?Yes No -O&M Manuals?Yes No ange a start-up?Yes No
Name of person completing card (please print):		
Date:	Signature:	



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#### TERMS & CONDITIONS OF SALES AND/OR REPAIR

The following terms and conditions shall apply to an order for all or any part the articles covered by this quotation unless specifically excepted therein:

#### **Prices**

Any prices quoted shall only be valid for orders placed within 30 days from the date of issue of the quotation. Prices are F.O.B. our plant in U.S. or Canadian dollars. We reserve the right to correct typographical or clerical errors.

All orders are subject to approval by our Credit Department. Unless otherwise stated, if payment for the invoice due is not made within thirty (30) days after shipment, administration fees of eighteen percent (18%) per year (equivalent to a nominal monthly interest rate of 1½%) will be applied on overdue accounts. The terms and conditions herein set forth are based upon tariffs, taxes, foreign exchange rates, delivery, and other conditions in effect on the date of this contract. In the event changed conditions, legislations, regulations, or other matters shall become applicable to any quotation, contract, or delivery hereunder, any increased exchange, duties, taxes, ocean freight, or other charges resulting from such action shall be for the customer's account and seepex, Inc. may charge such increased duties, taxes, or charges to the customer.

Unless the order includes the appropriate exemption certificates and/or licenses, duties, and taxes levied by Federal, State, or other governments are required to be charged automatically at the rate imposed at time of importation/shipment. Any change in law, regulations, or Government Department practice which causes a variation of any kind in the applicable charges from the amounts allowed for the quotation, shall result in an equivalent change in the price quoted.

Until payment is made in full, seepex, Inc. shall retain the right, without notice, to repossess and/or retain the items, and/or dispose of them, for its benefit and hold the customer responsible for any loss. Customer agrees to enter into any agreements, contracts, or notices required to confirm such rights.

In order to secure any obligations due to seepex, Inc. from the customer (whether or not under this contract) the customer grants and confirms in seepex, Inc. a security interest in:

- the merchandise covered by this contract, a)
- in all property and funds of the customer now or hereafter in seepex, Inc. possession, whether or not arising out of this contract, and in all additions, accessions, and proceeds of such merchandise and/or property. The customer hereby authorizes **seepex**, Inc. to sign alone any financing statement or statements and to do all and any other things which may be necessary to perfect such security interest.

<u>Cancellation</u>
After acceptance, orders may be canceled only with our approval and payment in accordance with contract by the customer for work performed and/or material expenses incurred by us to date of cancellation. We reserve the right to cancel the order if the customer's financial condition, in our sole judgment, places the payment in jeopardy.

No credit will be allowed for returns unless our

authorization in writing for such returns has been obtained beforehand. A copy of this authorization is to be returned with the item as the packing slip. Shipment

- Handling Charge: Customer shall be responsible for making all arrangements for shipment of the order with a suitable carrier. In the event that customer requests that seepex make arrangements for shipment, then customer agrees to pay to seepex, in addition to the applicable shipping charges, a handling charge in the amount of 10% of the shipping charges with a minimum \$5.00 to a maximum charge of \$150.00, with special services requiring
- additional charges.

  New Articles: Where shipping instructions indicate no exact routing, our best judgement will be used in determining routing but we shall not be liable for any charges beyond F.O.B. point. If change are made at customer's request in a) F.O.B. point, b) in our normal routing from either the manufacturers' or our own plants and in these changes involve extra costs, such costs shall be for the customer's account, unless otherwise noted on the seepex price
- Repair Work: Defined as work and services performed by **seepex**, Inc. All orders shall be delivered to and picked up from our plant unless otherwise specified. All costs of delivery shall be for the customer's account unless otherwise agreed to in writing prior to shipment.
- All Orders: On collect freight shipments, cartage charges from plant to carrier are for customer's account. Title to articles passes to customer upon delivery to carrier acting as customer's agent subject to any right of retention by us. All claims for shortage in, and damages in, shipment or otherwise must be reported to carrier immediately upon receipt with copy or report to ourselves within five (5) days.

#### **Guarantee**

- New Articles: We guarantee articles of our manufacture against defects in material and/or workmanship for a period of three (3) vears from date of acceptance, providing that the articles have been installed, maintained, and operated in accordance with our recommendations and instructions.
- Repair Work: Defined herein as work and services performed by seepex, Inc. We

- guarantee all work and services performed by us against defect arising from workmanship and/or materials provided by us for a period of ninety (90) calendar days from the date of shipment to customer.
- All Orders: Claims shall be submitted promptly in writing to seepex, Inc. Replacement and/or repair under guarantee shall be made F.O.B. our plant. Our liability under these guarantees is limited to the replacement and/or repair only of defective material or workmanship and in no event shall seepex, Inc. be liable for any loss or damage of whatever kind of nature out of defects in material and/or workmanship, or resulting from delay, or loss of use of articles, or any installation into which the article may be installed, or arising out, of the contract of the work or service or from negligence.

seepex, Inc. shall not be liable for any loss or damage resulting from delay and/or late delivery due to causes beyond our reasonable control. In no event shall seepex, Inc. be liable for any claim exceeding the amount of this order. Our guarantee on products of other than our own manufacture is limited to the guarantee extended to us by the original manufacturer. On any claims for repairs and/or replacement under such guarantee, all costs incurred by us which are not underwritten by the original manufacturers shall be for the claimant's account. Except as stated above no representations, conditions, or warranties are made with respect to products, work, or services, express or implied verbal or otherwise, including warranties of merchantability and fitness. Our guarantee and warranty shall not apply to materials or workmanship which have been subject to misuse, neglect, or accident. seepex, Inc. shall be held free and harmless from any dispute or claim anywhere arising relating to infringement of patent, design, trademark, or copyright of items, sold or repaired under this contract.

#### Property rights and risks

The customer's property at all times shall remain at the risk of the customer while being worked on by our personnel or on our premises and shall not be responsible for any loss or damage to the customer's property resulting from any cause

Title to and rights in relation to item sold under this contract/quotations shall remain with seepex, Inc. until such items are paid for, subject to risk on products sold passing to the customer upon acceptance by a carrier or other, which shall constitute good delivery.

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Europa:

Schweiz Spanien Tschechische Republik Ungarn

Argentinien Chile Equador Kanada Kolumbien Mexiko Panama Peru Puerto Rico

Amerika: Asien: Brunei Indien Indonesien Iran Israel Japan Kasachstan Korea Kuwait Venezuela Pakistan Philippinen Saudi Arabien

> Singapur Taiwan Thailand V.A.E

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Neuseeland

Ausgabe Dokument Blatt 02.01.2006 OM.ADR.01d 2(2)issue

## **JOHN MEUNIER**

Meadowbank mining Corp. ACP-700R Technical Data Sheet Reference: NC01

**SAFETY RELIEF VALVE** 



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# TOP VALVE\*\*\*

## **Back Pressure & Pressure Relief Valves**

Designed to Enhance the ACCURACY and SAFETY of Metering Pumps



**Back Pressure/Anti-Siphon and Pressure Relief Valves** 

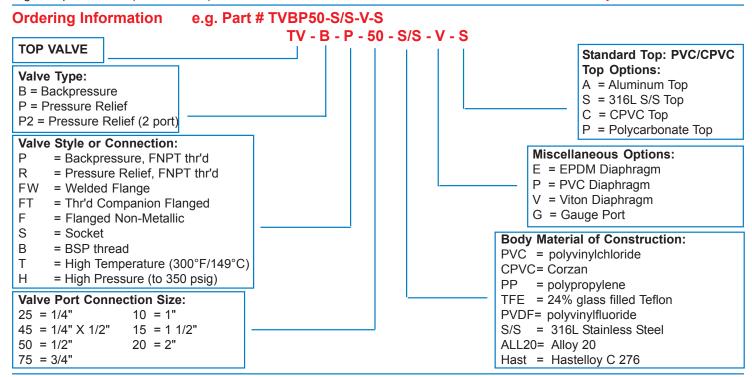
- Long life diaphragm
- Range to 350 PSIG
- Built-in air release and optional gauge port
- Available in PVC, CPVC, PVDF, polypropylene, Teflon, stainless steel, Alloy 20 and Hastelloy C
- 7 sizes (1/4" 2" threaded, flanged or socket)
- Color coded handles indicate size at a glance
- High temperature valves available to (300°F/149°C)

For detailed product information visit our website: primaryfluid.com

## Back Pressure/Anti-Siphon and Pressure Relief Valves

#### **Description**

This line of diaphragm style, back pressure/anti-siphon and pressure relief valves features a completely adjustable pressure range to 350 PSIG and a built-in air release to reduce priming difficulties. The valves are available in sizes from 1/4" through 2", eight materials of construction, offer a three year warranty and are available with socket weld, flanged or special threaded connections. High temperature to (300°F/149°C) valves are available. *CRN certification available*. *Please contact factory*.



#### Flow Rates

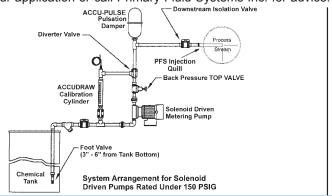
Flow capacity through TOP VALVE back pressure/anti-siphon and pressure relief valves under continuous flow conditions @ 50 PSIG with ambient temperature water.

Size	1/4"	1/4" / 1/2"	1/2"	3/4"	1"	1 1/2"	2"
Flow rate USGPM	4	4	6	8	14	25	40

Note: Capacities will increase with pressure. If pressure is doubled, flow rate wll approximately double. For capacities of valves with pulsating flow, use approximately 1/3 of the given flow rates.

#### **Typical Installations**

The installations below are typical installation examples only. Consult your engineering department for the appropriate installation of your application or call Primary Fluid Systems Inc. for advice.



Pressure Relief
TOP VALVE

Pressure Relief
TOP VALVE

Process
Siream

ACCUDRAW
Calibration
Cylinder

(3" - 6" from Tank Bottom)

System Arrangement for Solenoid Driven
(Above 150 PSIG) or Motor Driven Pumps

**Distributed By:** 



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## **JOHN MEUNIER**

Meadowbank mining Corp. ACP-700R Technical Data Sheet Reference: NC01

#### **CALIBRATION CYLINDER**

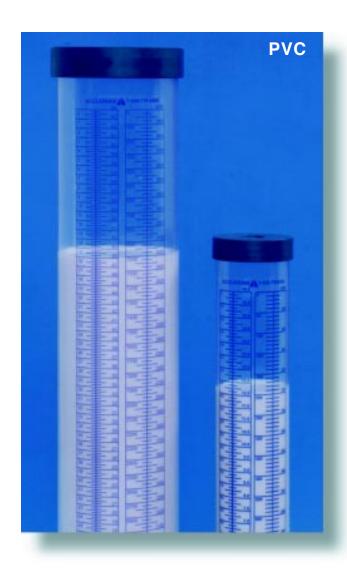


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# **ACCUDRAW®** Calibration Cylinders





ACCUDRAW® has been developed for the accurate calibration of metering pumps. Standard features include:

- · translucent
- chemical resistant
- · break resistant
- threaded or socket
- colored graduations and lettering

- PVC has dual scale USGPH & ml
- PVC sizes 100 20000 ml
- POLY sizes 100 4000 ml
- POLY meets ISO standards
- custom sizes and other materials (acrylic, glass) on request



ACCUDRAW Calibration Cylinders
"For Accuracy That Counts"

#### Sizing and Ordering Information

#### Polypropylene Construction

	. ,			
Size	Conn.	BC	BTC	BDC
100 ml	1/2" NPT	AC#1-100	AC#2-100	AC#3-100
250 ml	1/2" NPT	AC#1-250	AC#2-250	AC#3-250
500 ml	1/2" NPT	AC#1-500	AC#2-500	AC#3-500
1000 ml	1/2" NPT	AC#1-1000	AC#2-1000	AC#3-1000
2000 ml	1.0" NPT	AC#1-2000	AC#2-2000	AC#3-2000
4000 ml	1.0" NPT	AC#1-4000	AC#2-4000	AC#3-4000

BC = bottom connection only, open top BTC= bottom and top connections BDC= bottom connection and dust cover top

#### **PVC Construction**

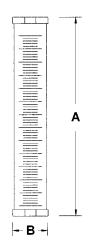
Size/Scale	Conn	BC	BTC	BDC
100 ml/ 1.6 GPH	1/2" NPT	PV#1-100	PV#2-100	PV#3-100
250 ml/ 4 GPH	1/2" NPT	PV#1-250	PV#2-250	PV#3-250
500 ml/ 8 GPH	1/2" NPT	PV#1-500	PV#2-500	PV#3-500
1000 ml/ 16 GPH	1/2" NPT	PV#1-1000	PV#2-1000	PV#3-1000
2000 ml/ 32 GPH	1.0" NPT	PV#1-2000	PV#2-2000	PV#3-2000
4000 ml/ 64 GPH	1.0" NPT	PV#1-4000	PV#2-4000	PV#3-4000
10000 ml/ 160 GPH	2.0" NPT	PV#1-10000	PV#2-10000	PV#3-10000
20000 ml/ 320 GPH	2.0" NPT	PV#1-20000	PV#2-20000	PV#3-20000

Note: PVC cylinders available with socket weld connections. Add suffix "S" to model # e.g. PV#3-100S For BSP threads, add suffix "B" to model # e.g. PV#3-100B

#### **Dimensional Information**

#### Polypropylene Construction

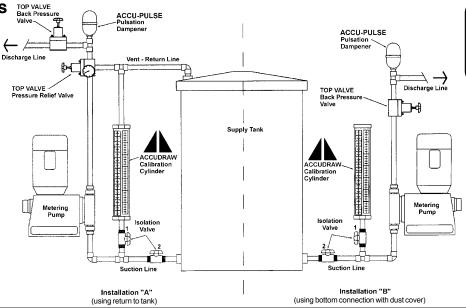
Model	Size (ml)	Dev (ml)	A (inches)	B (inches)
AC#1	100	1	9.88	1.38
AC#1	250	2	12.44	1.75
AC#1	500	5	14.1	2.33
AC#1	1000	10	17.19	2.63
AC#1	2000	20	20.88	3.38
AC#1	4000	50	23.56	4.38
AC#2/AC#3	100	1	9.25	1.38
AC#2/AC#3	250	2	11.63	1.75
AC#2/AC#3	500	5	13	2.32
AC#2/AC#3	1000	10	16.5	2.69
AC#2/AC#3	2000	20	19.5	3.38
AC#2/AC#3	4000	50	22.13	4.38



#### **PVC Construction**

Model	Size	Divisions	Size	Divisions	Α	В
	(m l)	(m l)	(GPH)	(GPH)	(inches)	(inches)
PV#1	100	1	1.6	0.02	10.24	1.388
PV#1	250	2	4	0.05	11.04	1.888
PV#1	500	5	8	0.05	12.25	2.388
PV#1	1000	10	16	0.125	16.24	2.765
PV#1	2000	20	32	0.25	20.16	3.517
PV#1	4000	25	64	0.25	22.16	4.521
PV#1	10000	200	160	2	22.64	6.906
PV#1	20000	200	320	2	42.19	6.906
PV#2/PV#3	100	1	1.6	0.02	10.75	1.388
PV#2/PV#3	250	2	4	0.05	11.51	1.888
PV#2/PV#3	500	5	8	0.05	12.75	2.388
PV#2/PV#3	1000	10	16	0.125	16.76	2.765
PV#2/PV#3	2000	20	32	0.25	20.67	3.517
PV#2/PV#3	4000	25	64	0.25	22.66	4.521
PV#2/PV#3	10000	200	160	2	23.16	6.906
PV#2/PV#3	20000	200	320	2	42.69	6.906

#### Installations



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**Conversion Factors** 

1 ml = 1 cc

1000 ml = 1 liter ml/sec X 60 = ml/min

1 US gal/min X 0.063 = liters/sec 1 US gal = 3.786 liters

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## **JOHN MEUNIER**

Meadowbank mining Corp. ACP-700R Technical Data Sheet Reference: NC01

#### **CORPORATION STOPS**



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# **PFS Corporation Stops**



PFS Corporation Stops have been designed to inject chemical into the center stream of the flow.

- isolation valve allows for ease of maintenance
- available in 6 materials of construction
- wetted components have comparable or greater chemical resistance than quill construction material
- standard and custom lengths available
- connection in NPT, metric or flanged
- standard 1/8" orifice discharge and optional 1/4" for higher flow

For detailed product information visit our website: primaryfluid.com

# **PFS Corporation Stops**

For detailed product information visit our website: www.primaryfluid.com

**Sizing and Ordering Information** 

Model	Body	Valve	Gland	Gland Seal	Ball Check	Check Spring	Pressure*	Temperature
	Material	Material	Material	Material**	Material	Material	Max. PSIG	Max.
CCS-56-PVC	PVC	PVC	PVC	VITON	Ceramic	316 S/S	150	140°F(60°C)
CCS-56-CPVC	CPVC	CPVC	CPVC	VITON	Ceramic	316 S/S	150	210°F(98°C)
CCS-56-PP	PP	PP	PVDF	VITON	Ceramic	316 S/S	150	195°F(90°C)
CCS-56-PVDF	PVDF	PVDF	PVDF	VITON	Ceramic	316 S/S	150	260°F(125°C)
CCS-56-316S/S	316S/S	316S/S	316 S/S	VITON	316 S/S	316 S/S	2000	350°F(176°C)
CCS-56-HastC	HASTC	HASTC	HASTC	VITON	HASTC	HASTC	2000	350°F(176°C)
CCS-58-PVC	PVC	PVC	PVC	VITON	Ceramic	316 S/S	150	140°F(60°C)
CCS-58-CPVC	CPVC	CPVC	CPVC	VITON	Ceramic	316 S/S	150	210°F(98°C)
CCS-58-PP	PP	PP	PVDF	VITON	Ceramic	316 S/S	150	195°F(90°C)
CCS-58-PVDF	PVDF	PVDF	PVDF	VITON	Ceramic	316 S/S	150	260°F(125°C)
CCS-58-316S/S	316S/S	316S/S	316S/S	VITON	316 S/S	316 S/S	2000	350°F(176°C)
CCS-58-HastC	HASTC	HASTC	HASTC	VITON	HASTC	HASTC	2000	350°F(176°C)

#### Notes

\* maximum pressure @ 70°F (21°C) working temperature; \*\* optional gland seal material available

#### **Options:**

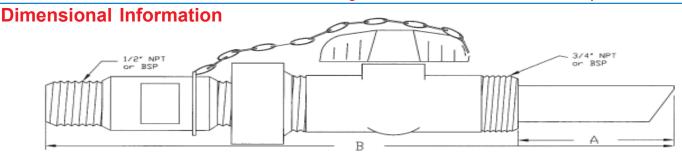
**Hastelloy C springs** Suffix Model number with -H for this option(e.g. CCS-56-PVC-H) Hastelloy C ball check Suffix Model number -I (e.g. CCS-56-PVC-I) PVDF ball check Suffix Model number -K (e.g. CCS-56-PVC-K) **TFE ball check**Suffix Model number -T
(e.g. CCS-56-PVC-T)

Pressure

BSPT Thread Suffix Model -B Flanged Suffix Model -F

CRN certification available. Please contact factory.

Other materials of construction and bubble tight/resilient seat check valve available on request.



**Dimensions** (\* subject to change without notice)

Model	Α	B*	Model	Α	B*
CCS-56-PVC	2-5/8"	10.50"	CCS-58-PVC	4-5/8"	12.50"
CCS-56-CPVC	2-5/8"	10.50"	CCS-58-CPVC	4-5/8"	12.50"
CCS-56-PP	2-5/8"	11.25"	CCS-58-PP	4-5/8"	13.25"
CCS-56-PVDF	2-5/8"	11.25"	CCS-58-PVDF	4-5/8"	13.25"
CCS-56-316S/S	2-5/8"	9.50"	CCS-58-316S/S	4-5/8"	11.50"
CCS-56-HastC	2-5/8"	9.50"	CCS-58-HastC	4-5/8"	11.50"

#### Note:

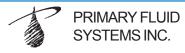
Corporation stops have standard 1/8" discharge orifice for high velocity discharge. Optional 1/4" discharge orifice available for higher capacity flow.

psi	kPa	1/8" E	Bore	1/4" E	Bore
μ		USGPM	LPM	USGPM	LPM
20	138	0.05	0.19	0.70	2.65
30	207	1.35	5.11	1.42	5.38
40	276	1.68	6.36	2.51	9.50
50	345	2.03	7.68	3.43	12.98
60	414	2.25	8.52	4.24	16.05
70	483	2.51	9.50	4.94	18.70
80	552	2.76	10.45	5.52	20.90
90	621	2.99	11.32	6.13	23.20
100	689	3.21	12.15	6.81	25.78

Capacities at Given Pressure (US & Metric)

Flow Rate

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Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference: NC01

## **SERVICE WATER PUMPS**

ST-090



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ш

TITES TITE   T	JOHN MEUNIER	MEL	3	IER					NOMENCLATURE/ BILL OF MATERIALS	
The content	ITRE/ TIT	J.E	Z.		PAR/ BY:	APPR:	DATE:	Affaire /	Modern Minim	
STATE   1   STATE					Julie Trudel	J.T.	2009-03-26	Contract	Meadowbally Milling	
Note   1   1   1   1   1   1   1   1   1	op wotor									
ST-030   2   2   2   2   2   2   2   2   2	ce water	edilind		2				REF. No.	Rev.	
ST-090   4			.,	3						
QTEOTY.         DESCRIPTION         DESCRIPTION         PRID         FIT           1         2 SEKVICE WATER PUMPS         P7-071         140         FIT           1         AMENTOR         P7-021         140         FIT           Manufacturer:         P7-021         140         FIT           Advitoral         P7-021         140         FIT           Advitoral         P7-021         140         FIT           PVMIB-60         PVMIB-60         PVMIB-60         PVMIB-60           Stainless steel 304         Stainless steel 304         PVMIB-60         PVMIB-60           Discharge diameter:         2 - 250# flange         PVMIB-60         PVMIB-60           Operation speed:         3500 rpm         Capacity:         PVMIB-60           Station © 225 FT         Station Station (By others)         PVMIB-60           Mote:         Afoot check valve is required (by others)         PVMIB-60	# DMQ/	ST-0		4				Date:	2009-03-26	
1   SERVICE WATER PUMPS	ITEM		QTE/QT	DESCR	P&ID	CAT. ACCPAC	SOURCE	FA/SA FI	N/d	
Manufacturer:   Aurora	C01ST-09		Unit. 1	2 SERVICE WATER PUMPS	I.D./TAG P7-011	140				
Mutorial Middle				Manufacturer:	P7-021					
Model:   PryMis-60     Type:   Vertical multi-stage     Vertical multi-stage     Vertical multi-stage     Stainless steel 304     Stainless steel 304     Stainless steel 304     Discharge diameter:     Discharge diameter				Aurora						
PVMI8-60   Type:				Model:						
Type:   Wertical multi stage   Wertical multi stage				PVMI8-60						
Nuterial multi-stage   Netical multi-stage   Netical multi-stage   Netical multi-stage   Netical multi-stage   Netical multi-stage   Suction diameter: Station speed:   Suction diameter:   Suction diameter:   Netical multi-stage diameter:   Note:   Note				Туре:						
Material:   Sucrines steel 304				Vertical multi-stage						
Stainless sieel 304   Suction flameter:				Material:						
Suction diameter:   2 * 25.0				Stainless steel 304						
Discharge diameter:   Discharge diameter:				Suction diameter:						
Discharge diameter:   2º 250# flange   2º 250# flange   3500 pm   525 FT   5 HP, 3500 pm, 575/3/60, TEFC, frame 184TC   5 HP, 3500 pm, 575/3/60, TEFC, fra				2" 250# flange						
Capacity flange   Capacity   Ca				Discharge diameter:						
Operation speed:   3500 rpm				2" 250# flange						
3500 rpm   Capacity:   Capacity:				Operation speed:						
Capacity:   52 usgpm@225 FT				3500 rpm						
52 usgpm @ 225 FT				Capacity:						
Motor:   Motor:				52 usgpm @ 225 FT						
Motor:         Motor:<				NPSHr:						
Motor:   5 HP, 3500 rpm, 575/3/60, TEFC, frame 184TC     Note:   A foot check valve is required (by others)				8 FT						
5 HP, 3500 rpm, 575/3/60, TEFC, frame 184TC				Motor:						
A foot check valve is required (by others)  A foot check valve is required (by others)				5 HP, 3500 rpm, 575/3/60, TEFC, frame 184TC						
Note:   A foot check valve is required (by others)   A foot chec										
A foot check valve is required (by others)  A foot check valve is required (by others)				Note:						
				A foot check valve is required (by others)						

# MWW2 1,1257

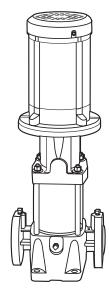


# **OWNER'S MANUAL**

INSTALLATION AND OPERATING INSTRUCTIONS PVM (IX) 2 - PVM (IX) 16

# **VERTICAL MULTISTAGE PUMPS**

Single and Three Phase 60 Cycle



Record the following information from the motor and pump nameplates for future reference:

Pump Model No.	
Bill of Material No.	
Motor Model No.	
Motor Serial No.	
<u>H.P.</u>	Volts/Hz/Ph
Rated Amp Draw	

Aurora Pump, 800 Airport Road, North Aurora, IL 60542

AP473 (10/1/06)

#### TABLE OF CONTENTS

Safety Instructions	2
Applications and Operating Ranges	
Installation	5
Electrical	6-7
Operation	7-8
Maintenance	9-12
Troubleshooting Guide	
Repair Parts	

# Carefully read and follow all safety instructions in this manual or on pump.

This is the safety-alert. When you see this symbol on your pump or in this manual, look for one of the following signal words and be alert to the potential for personal injury.

A DANGER warns about hazards that will cause serious personal injury, death or major property damage if ignored.

**AWARNING** warns about hazards that **can** cause serious personal injury, death or major property damage if ignored.

**A CAUTION** warns about hazards that **will** or **can** cause minor personal injury or property damage if ignored.

The word **NOTICE** indicates special instructions which are important but not related to hazards.

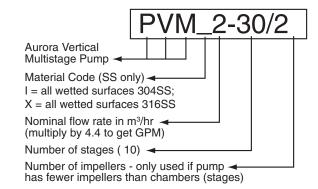
To avoid serious or fatal personal injury and possible property damage, carefully read and follow the safety instructions.

- 1. Install pump according to all code requirements.
- 2. Compare pump nameplate data with desired operating range.
- 3. Pump only liquids compatible with pump component materials (that is, liquids that will not attack the pump).
- 4. Make sure plumbing is adequate to handle system pressure.
- 5. Periodically perform maintenance inspection on pump and system components.
- 6. Wear safety glasses at all times when working on pumps.

#### **INSPECT THE SHIPMENT**

The vertical multistage centrifugal inline pump has been carefully inspected and packaged to assure safe delivery. Inspect the pump and fittings and report to the carrier any items which are damaged or missing.

# CONFIRM THAT YOU HAVE THE RIGHT PUMP



MODEL	#1555555	PART #	177777777	MFG. DATE	17777777
GPM	2000000	FEET	177777777	RPM	1222222
HP	2222223	PRESS. MAX (PSI)	177777777	TEMP. MAX (F)	17777777

FIGURE 1 - Model Plate Information

# APPLICATIONS AND OPERATING RANGES

Aurora multistage in-line centrifugal pumps are designed for liquid transfer, circulation, and pressure boosting of hot or cold clean water or other thin, non-explosive liquids, not containing solid particles or fibers, which will not chemically attack the pump materials.

Typical applications include:

- · Municipal water supply and pressure boosting
- · Boiler feed and condensate systems
- Cooling water systems
- Irrigation
- · Fire fighting

8 8	
Maximum Ambient Temperatur	re104° F(40° C)
Liquid Temperature Range	5° F to 250° F
	(-15° C to +121° C)
Maximum Permissible	
Operating Pressure Curves	See Figure 4
the actual inl when the pum valve m	Table II shows the maximum ible inlet pressure. However, let pressure plus the pressure p is running against a closed ust always be lower than the missible Operating Pressure".
Electrical Data:	See Motor Nameplate
Dimensions and Port to Port Lengths:	See Figures 2A, 2B, 3A

and 3B, Pages 3 and 4

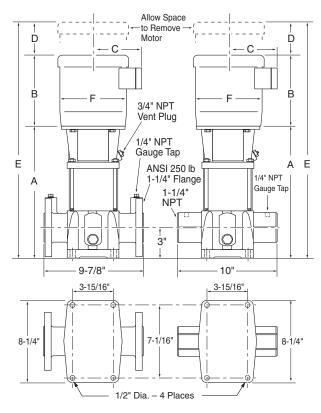


FIGURE 2A - Height, width and baseplate dimensions for PVM2 and PVM4 Series pumps

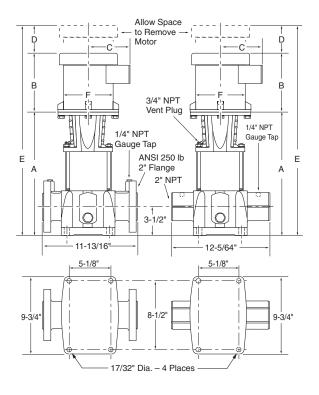


FIGURE 2B - Height, width, and baseplate dimensions for PVM8 and PVM16 Series pumps

TABLE I - Maximum Height and Width Dimensions\*

	I			·		
Model Number	A	B	Dimension C	n in Inches	E	F
						-
PVM2-30/2	11-3/8	9-1/4	4-7/8	2	22-5/8	6
PVM2-30	11-3/8	9-7/8	4-7/8	2	23-1/4	6
PVM2-40	12	11-1/8	5-1/4	2 1/0	25-1/4	7-1/8
PVM2-50	12-3/4	11-1/8	5-3/4	2-1/8	26	7-1/4
PVM2-60	13-1/2	11-1/8	5-3/4	2-1/8	26-5/8	7-1/4
PVM2-70	14-1/8	12-1/8	5-3/4	2-1/8	28-1/4	7-1/4
PVM2-80	14-7/8	12-1/8	5-3/4	2-1/8	29	7-1/4
PVM2-90	15-15/16		6-7/8	2-7/8	31-1/8	8-1/2
PVM2-100	16-5/8	13-5/8	2-7/8	2-7/8	33-1/4	8-1/2
PVM2-110	17-3/8	12-5/16	6-7/8 6-7/8	2-7/8	32-17/32	8-1/2 8-1/2
PVM2-120	18-1/8	13-5/8		2-7/8	34-5/8	
PVM2-130	18-13/16		6-7/8	2-7/8		8-1/2
PVM2-140 PVM2-150	19-1/2 20-1/4	15-9/32	8	3-3/8	38-5/32 38-7/8	10-9/16
PVM2-150 PVM2-160	20-1/4	15-1/4 15-1/4	8	3-3/8		10-5/8
PVM2-160 PVM2-170	21-9/16	15-1/4	8	3-3/8 3-3/8	39-9/16 40-9/32	10-5/8 10-5/8
PVM2-170	22-3/8	15-1/4	8	3-3/8	40-9/32	10-5/8
PVM4-20/1	11-3/8	9-1/4	4-7/8	2	22-5/8	
PVM4-20/1	11-3/8	9-1/4	4-7/8	2	23-1/4	6
PVM4-30	12-3/8		5-1/4	2		7-1/8
PVM4-40	13-1/2	11-1/8 11-1/8	5-3/4	2-1/8	25-5/8 26-5/8	7-1/6
PVM4-50	14-1/2	12	5-3/4	2-1/8	28-5/8	7-1/4
PVM4-60	16	13-5/8	6-7/8	2-7/8	32-1/2	8-1/2
PVM4-80/7	18-1/8	13-5/8	6-7/8	2-7/8	34-5/8	8-1/2
PVM4-80	18-1/8	13-5/8	6-7/8	2-7/8	34-5/8	8-1/2
PVM4-90	19-5/32	15-1/4	8	3-3/8	37-13/16	10-5/8
PVM4-100	20-1/4	15-1/4	8	3-3/8	38-7/8	10-5/8
PVM4-110	21-1/4	15-1/4	8	3-3/8	39-15/16	10-5/8
PVM4-110	22-3/8	15-1/4	8	3-3/8	41	10-5/8
PVM4-130	23-13/32	15-1/4	8	3-3/8	42	10-5/8
PVM4-140	24-1/2	15-1/4	8	3-3/8	43-1/8	10-5/8
PVM4-150	25-1/2	15-1/4	8	3-3/8	44-3/16	10-5/8
PVM4-160	26-5/8	15-1/4	8	3-3/8	45-1/4	10-5/8
PVM8-20/1	15	9-7/8	4-7/8	2	27	6
PVM8-20	15	11-1/8	5-3/4	2-1/8	28-1/4	7-1/4
PVM8-30	17-3/4	13-5/8	6-7/8	2-7/8	34-1/4	8-1/2
PVM8-40	18-7/8	13-5/8	6-7/8	2-7/8	35-1/2	8-1/2
PVM8-50	20-1/8	15-1/4	8	3-3/8	38-3/4	10-5/8
PVM8-60	21-1/4	15-1/4	8	3-3/8	40	10-5/8
PVM8-70	21-5/16	15-1/4	8	3-3/8	39-15/16	10-5/8
PVM8-80	23-5/8	15-1/4	8	3-3/8	42-1/4	10-5/8
PVM8-90	26	15-1/4	8	3-3/8	44-21/32	10-5/8
PVM8-100	26	15-1/4	8	3-3/8	44-5/8	10-5/8
PVM8-110	27-3/16	16-3/8	8-3/4	3-3/8	47	10-5/8
PVM8-120	28-3/8	16-1/2	8-3/4	3-3/8	48-1/4	10-5/8
PVM8-130	29-9/16	16-3/8	8-3/4	3-3/8	49-5/16	10-5/8
PVM8-140	30-3/4	16-3/8	8-3/4	3-3/8	50-1/2	10-5/8
PVM8-150	33-9/16	19-21/32	9-1/2	4-1/4	57-9/16	12-15/16
PVM8-160	33-5/8	19-5/8	9-1/2	4-1/4	57-1/2	13
PVM16-30/2	19-1/2	15-1/4	8	3-3/8	38-1/4	10-5/8
PVM16-30	19-1/2	15-1/4	8	3-3/8	38-1/4	10-5/8
PVM16-40	21-3/8	15-1/4	8	3-3/8	40	10-5/8
PVM16-50	23-1/8	16-3/8	8-3/4	3-3/8	42-7/8	10-5/8
PVM16-60	25-3/8	19-5/8	9-1/2	4-1/4	49-1/4	13
PVM16-70	27-1/8	19-5/8	9-1/2	4-1/4	51	13
PVM16-80	28-7/8	19-5/8	9-1/2	4-1/4	52-7/8	13
PVM16-90	30-3/16	21-3/4	9-3/16	4	55-15/16	11-1/2
PVM16-100	32	21-3/4	9-1/8	4	57-3/4	11-1/2
PVM16-110	33-9/16	21-3/4	9-1/2	3-1/4	58-9/16	12-15/16
PVM16-120	35-3/8	21-3/4	9-1/2	3-1/4	60-3/8	13
			=			

<sup>\*</sup> Measurements represent the largest number possible for each Model.

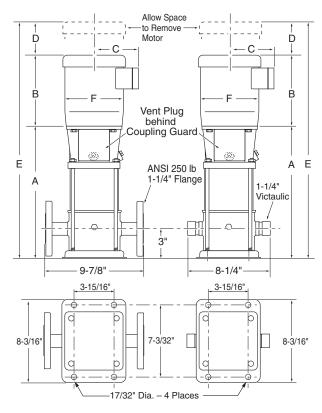


FIGURE 3A - Height, width and baseplate dimensions for PVMI/X2 and PVMI/X4 Series pumps

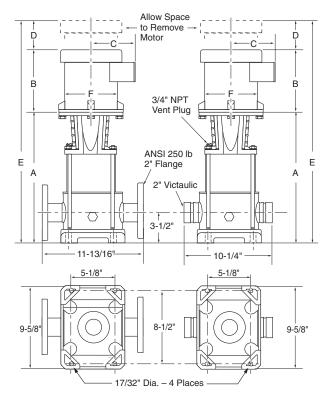


FIGURE 3B - Height, width, and baseplate dimensions for PVMI/X8 and PVMI/X16 Series pumps

TABLE II - Maximum Height and Width Dimensions\*

Madal			Dimensio	n in Inch	es	
Model Number	A	В	С	D	E	F
PVMI/X2-30/2	11-3/4	9-1/4	4-7/8	2	23	6
PVMI/X2-30	11-3/4	9-7/8	4-7/8	2	23-5/8	6
PVMI/X2-40	12-3/8	11-1/8	5-1/4	2	25-5/8	7-1/8
PVMI/X2-50	13-1/8	11-1/8	5-3/4	2-1/8	26-3/8	7-1/4
PVMI/X2-60	13-7/8	11-1/8	5-3/4	2-1/8	27	7-1/4
PVMI/X2-70	14-1/2	12-1/8	5-3/4	2-1/8	28-5/8	7-1/4
PVMI/X2-80	15-1/4	12-1/8	5-3/4	2-1/8	29-3/8	7-1/4
PVMI/X2-90	16-3/8	12-5/16	6-7/8	2-7/8	31-17/32	8-1/2
PVMI/X2-100	17	13-5/8	2-7/8	2-7/8	33-5/8	8-1/2
PVMI/X2-110	17-3/4	12-5/16	6-7/8	2-7/8	33	8-1/2
PVMI/X2-120	18-1/2	13-5/8	6-7/8	2-7/8	35	8-1/2
PVMI/X2-130	19-3/16	12-5/16	6-7/8	2-7/8	34-3/8	8-1/2
PVMI/X2-140	19-15/16		8-1/16	3-3/8	38-9/16	10-5/8
PVMI/X2-150	20-5/8	15-1/4	8	3-3/8	39-1/4	10-5/8
PVMI/X2-160	21-5/16	15-1/4	8-1/16	3-3/8	40	10-5/8
PVMI/X2-170	22-1/32	15-1/4	8-1/16	3-3/8	40	10-5/8
PVMI/X2-180	22-3/4	15-1/4	8	3-3/8	41-3/8	10-5/8
PVMI/X4-20/1	11-3/4	9-1/4	4-7/8	2	23	6
PVMI/X4-20	11-3/4	9-7/8	4-7/8	2	23-5/8	6
PVMI/X4-30	12-3/4	11-1/8	5-1/4	2	26	7-1/8
PVMI/X4-40	13-7/8	11-1/8	5-3/4	2-1/8	27	7-1/4
PVMI/X4-50	14-7/8	12 5/0	5-3/4	2-1/8	29	7-1/4
PVMI/X4-60	16-3/8	13-5/8	6-7/8	2-7/8	32-7/8	8-1/2
PVMI/X4-80/7	18-1/2	13-5/8	6-7/8	2-7/8	35	8-1/2
PVMI/X4-80 PVMI/X4-90	18-1/2	13-5/8	6-7/8	2-7/8	35	8-1/2
	19-17/32	15-1/4	8-1/16	3-3/8	38-3/16	10-5/8
PVMI/X4-100 PVMI/X4-110	20-5/8	15-1/4 15-1/4	8 8-1/16	3-3/8 3-3/8	39-1/4 40-3/16	10-5/8 10-5/8
PVMI/X4-110	22-3/4	15-1/4	8	3-3/8	41-3/8	10-5/8
PVMI/X4-130	23-13/16		8-1/16	3-3/8	42-1/2	10-5/8
PVMI/X4-140	24-7/8	15-1/4	8	3-3/8	43-1/2	10-5/8
PVMI/X4-150	25-15/16		8-1/16	3-3/8	44-17/32	10-5/8
PVMI/X4-160	27	15-1/4	8	3-3/8	45-3/8	10-5/8
PVMI/X8-20/1	15	9-7/8	4-7/8	2	27	6
PVMI/X8-20	15	11-1/8	5-3/4	2-1/8	28-1/4	7-1/4
PVMI/X8-30	17-3/4	13-5/8	6-7/8	2-7/8	34-1/4	8-1/2
PVMI/X8-40	18-7/8	13-5/8	6-7/8	2-7/8	35-1/2	8-1/2
PVMI/X8-50	20-1/8	15-1/4	8	3-3/8	38-3/4	10-5/8
PVMI/X8-60	21-1/4	15-1/4	8	3-3/8	40	10-5/8
PVMI/X8-70	21-3/8	15-1/4	8-1/16	3-3/8	40	10-5/8
PVMI/X8-80	23-5/8	15-1/4	8	3-3/8	42-1/4	10-5/8
PVMI/X8-90	26-1/8	15-1/4	8-1/16	3-3/8	44-3/4	10-5/8
PVMI/X8-100	26	15-1/4	8	3-3/8	44-5/8	10-5/8
PVMI/X8-110	28-1/2	16-3/8	8-7/8	3-3/8	48-1/4	10-5/8
PVMI/X8-120	28-3/8	16-1/2	8-3/4	3-3/8	48-1/4	10-5/8
PVMI/X8-130	28-1/2	16-3/8	8-7/8	3-3/8	48-1/4	10-5/8
PVMI/X8-140	30-3/4	16-3/8	8-3/4	3-3/8	50-1/2	10-5/8
PVMI/X8-150	33-3/4	19-11/16	9-1/2	4-1/4	57-5/8	12-15/16
PVMI/X8-160	33-5/8	19-5/8	9-1/2	4-1/4	57-1/2	13
PVMI/X16-30/2	19-1/2	15-1/4	8	3-3/8	38-1/4	10-5/8
PVMI/X16-30	19-1/2	15-1/4	8	3-3/8	38-1/4	10-5/8
PVMI/X16-40	21-3/8	15-1/4	8	3-3/8	40	10-5/8
PVMI/X16-50	23-1/8	16-3/8	8-3/4	3-3/8	42-7/8	10-5/8
PVMI/X16-60	25-3/8	19-5/8	9-1/2	4-1/4	49-1/4	13
PVMI/X16-70	27-1/8	19-5/8	9-1/2	4-1/4	51	13
PVMI/X16-80	28-7/8	19-5/8	9-1/2	4-1/4	52-7/8	13
PVMI/X16-90	30-5/16	21-3/4	9-3/16	4	56	11-1/2
PVMI/X16-100	32	21-3/4	9-1/8	2 1/4	57-3/4	11-1/2
PVMI/X16-110	35-3/8		9-1/2	3-1/4	58-11/16	
PVMI/X16-120	35-3/8	21-3/4	9-1/2	3-1/4	60-3/8	13

<sup>\*</sup> Measurements represent the largest number possible for each Model. **NOTE:** PVMI models are 304 stainless steel; PVMX models are 316 stainless steel.

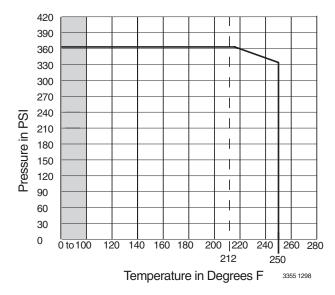


FIGURE 4 - Maximum Permissible Operating Pressure

**TABLE III – Permissible Operating Pressures** 

PVM2-30/2 to PVM2-180
PVM4-20/1 to PVM4-160
PVM8-20/1 to PVM8-160
PVM16-30/2 to PVM16-120

Model	Maximum Inlet Pressure (PSI)	
D) // // 2	30/2 - 60	145
PVM2	70 - 180	220
	20/1 - 20	90
PVM4	30 - 80/7	145
	80 - 160	220
PVM8	20/1 - 40	90
PVIVIO	50 - 160	145
PVM16	30/2 - 30	90
PVIVITO	40 - 120	145

#### **INSTALLATION**

▲ WARNING Hazardous voltage. Voltage can shock, burn, or cause death. Ground pump motor correctly before connecting to power supply, per article 250-80 of the National Electrical Code (NEC) in the U.S., or the Canadian Electrical Code (CEC), as applicable.

#### Location

Locate pump in a dry, well-ventilated area, not subject to freezing or extreme variations in temperature.

Mount pump a minimum of 6'' from any obstruction or hot surface. Install the pump with the motor shaft vertical. Make sure that an adequate supply of cool air reaches the motor cooling fan. Maximum ambient air temperature is  $104^{\circ}$  F ( $40^{\circ}$  C).

For open systems requiring suction lift, locate the pump as close to the water source as possible.

#### **Foundation**

Foundation should be concrete or a similarly rigid foundation to provide a secure, stable mounting base for the pump.

Secure pump to foundation using all bolt holes. Refer to Figures 2 and 3 for bolt plate dimensions. Be sure that all four pads on the base are properly supported.

Shim pump base to make sure that pump is level.

#### **Piping**

pump with discharge valve closed; the water in the pump may boil, with risk of explosion and steam burns to anyone near. If there is any danger of the pump running against a closed discharge valve, install a pressure relief or bypass valve in the discharge pipe to allow for minimum liquid flow through the pump. Minimum liquid flow through the pump is needed for cooling and lubrication of the pump (See Table IV). Run the bypass/relief valve and discharge pipe to a floor drain or a tank for collection.

Suction pipe should be adequately sized (See Table V) and run as straight and as short as possible to keep friction losses to a minimum. Pipes, valves, and fittings must have a pressure rating equal to or greater than the maximum system pressure.

**TABLE IV – Minimum Pumping Rates** 

Туре	Liquid Temperature +5° F to +250° F
PVM2	1 GPM
PVM4	2 GPM
PVM8	4 GPM
PVM16	8 GPM

**TABLE V – Minimum Suction Pipe Sizes** 

Туре	Pipe Size
PVM2	1-1/4" Nominal Diameter, Schedule 40 Pipe
PVM4	1-1/4" Nominal Diameter, Schedule 40 Pipe
PVM8	2" Nominal Diameter, Schedule 40 Pipe
PVM16	2" Nominal Diameter, Schedule 40 Pipe

Pressure check the discharge piping as required by codes or local regulations.

"Inlet" and "Outlet" are marked on the pump base to show the direction of the liquid flow through the pump.

Install anti-vibration mountings on either side of the pump if a minimum noise level is desired.

Install isolation valves in both inlet and outlet pipes near the pump (see Figure 5). This allows for removal of pump for service without draining the system and isolation of the pump in case of a flooded suction condition.

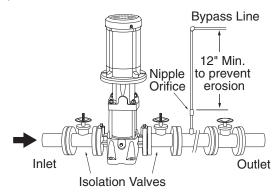


FIGURE 5 - Bypass required if pump might operate with discharge valve closed. See Table IV for minimum required flow through pump to prevent overheating and to ensure lubrication.

If the system pressure is greater than the pumps maximum inlet pressure the limits of the pump can be exceeded if the discharge pressure backs up to the inlet side of the pump. Installation of a check valve in the discharge pipe is recommended to prevent this condition.

Make sure, especially on the inlet side of the pump, that there are no airlocks in the system. See Figure 6 for correct pipe work to avoid airlocks. The suction pipe should be level or slightly rising.

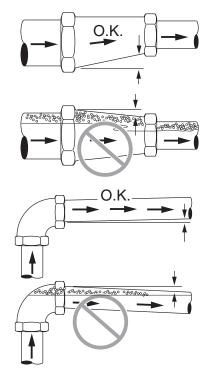


FIGURE 6 - Install Pipe Correctly to Prevent Air Locks

Support all piping independently of the pump so the weight of the piping system does not strain the pump case. Make sure that the expansion and contraction of the piping system from temperature variations cannot put a strain on the pump.

If the system or pump must be drained periodically (especially if the discharge pipe is horizontal or slopes downward away from the pump), install a loop and vacuum valve as shown in Figure 7 to protect the pump against running dry. The highest point of the loop should be at least as high as the lowest point of the motor. This loop/valve combination will allow the pump and the system to be drained independently of one another.

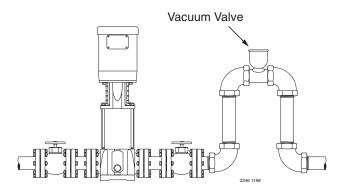


FIGURE 7 - Loop and Vacuum Valve Installation

#### **ELECTRICAL**

AWARNING Hazardous voltage. Can shock, burn or cause death. All electrical work should be performed by a qualified electrician in accordance with the National Electrical Code and all local codes and regulations. Make sure that the motor voltage, phase, and frequency match the incoming electrical supply. The proper operating voltage and other electrical information can be found on the motor nameplate. These motors are designed to run up to ±10% of the nameplate-rated voltage. The wiring connection diagram can be found on either a plate attached to the motor or on a diagram inside the terminal box cover.

- If voltage variations are greater than ±10% do not operate the pump.
- Incorrect voltage can cause fire or serious damage to the motor and voids warranty.
- Ground the pump motor correctly before connecting it to the power supply.
- Follow the wiring instructions when connecting the motor to the power lines.

#### **Position of Terminal Box**

To turn the motor so that the terminal box faces the right direction, proceed as follows:

1. Disconnect the power to the pump motor.

- 2. Remove the coupling guards (use a screwdriver).
- 3. Remove the couplings.
- 4. Remove the bolts that fasten the motor to the pump.
- Turn the motor to the required position (in quarter-turn increments).
- Follow steps 10 20 under "Motor Replacement", on Page 9.

#### **Field Wiring**

All wiring connections and wiring sizes must meet National Electrical Code and local requirements.

#### **Motor Protection**

See the motor nameplate for electrical connection/wiring diagram.

Aurora pumps must be used with the proper size and type of motor starter to ensure protection against damage from low voltage, phase failure, current imbalances and overloads. The overload should be sized to trip at the full-load current rating of the motor.

#### **OPERATION**

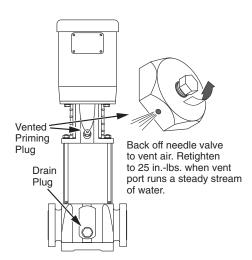
#### **Priming**

**AWARNING** Hazardous pressure. Do not run the pump with the discharge valve closed; the water in the pump may boil, causing risk of explosion and steam burns to anyone nearby.

**AWARNING** Hazardous voltage. Disconnect all power to the pump before servicing or working on the pump. Make sure that the power is locked out and that the pump cannot be accidentally started.

**NOTICE:** Under no circumstances should the pump be operated without flow through the pump. **Never** operate the pump dry.

Operation of closed systems or open systems with the liquid level above the pump priming plug:



**FIGURE 8 - Priming and Drain Plugs** 

1. Close the discharge isolating valve and loosen the needle valve located in the assembly in the pump head (Figure 8). Do not remove the needle valve.

**NOTICE:** On PVMI(X)2/4 models, remove the coupling guard for access to the vent plug.

AWARNING Risk of water damage and injury. Watch the direction of the priming plug and make sure that the liquid escaping from it does not injure persons nearby or damage the motor or other components. In hot water installations, pay particular attention to the risk of injury from scalding hot water.

- 2. Slowly open the isolation valve in the suction pipe until a steady stream of liquid runs out the vent in the priming port.
- 3. Tighten needle valve to 25 inch-pounds. Completely open isolation valves.

**NOTICE:** Please turn to "Starting", Page 8, before proceeding any further.

# Operation of open systems with the liquid level below the top of the pump:

**NOTICE:** The suction pipe requires a check valve or isolation valve.

- 1. Close the discharge isolation valve.
- 2. Remove the vented priming plug.
- 3. Pour liquid through the priming port until the suction pipe and the pump are completely filled with liquid.
- 4. Replace the vented priming plug and tighten it securely.
- 5. Repeat steps 1-4 until the pump is primed.

**NOTICE:** Please turn to "Starting", Page 8, before proceeding any further.

#### **Checking Direction of Rotation**

**NOTICE:** Do not disconnect the motor from the shaft to check the direction of rotation. If you remove the coupling, then you must adjust the shaft position when you reinstall it. This must be done before starting the pump.

Arrows on the pump head show the correct direction of rotation. When seen from the motor fan, the pump should rotate *counterclockwise* ( ). For pump motors without a fan remove one of the coupling guards and look at the coupling to determine the direction of rotation. Turn off the pump and replace coupling guard.

**NOTICE:** Do not check the direction of rotation until the pump has been filled with liquid. See "Priming", at left and above.

- 1. Switch power off.
- 2. Remove the coupling guard and rotate the pump shaft to be certain it can turn freely. Replace the coupling guard.
- 3. Verify that the electrical connections are in accordance with the wiring diagram on the motor.
- 4. If the fan is visible, turn on and off to verify rotation.
- 5. To reverse the direction of rotation, first switch OFF the power supply.

6. On three-phase motors, switch 2 of the 3 power leads on the load side of the starter. On single-phase motors, see the connection diagram on the motor nameplate. Change the wiring as indicated.

**AWARNING** Hazardous voltage. Voltage can shock, burn or cause death. Ground the pump motor correctly before connecting to power supply per article 250-80 of National Electrical Code (NEC) in the U.S., or the Canadian Electrical Code (CEC), as applicable.

7. Switch on the power supply and recheck the direction of motor rotation.

#### **Starting**

- 1. If a suction line isolation valve has been installed, check to be sure that it is completely opened.
- 2. For initial starting, the isolation valve in the discharge pipe should be almost closed.
- 3. Start the pump.
- 4. When the piping system has been filled with liquid, slowly open the discharge isolation valve until it is completely open. Opening the valve too fast may result in water hammer in the discharge pipe. If the pump or system start to rattle, the pump is cavitating; to avoid damage to the pump, reduce the flow through the discharge isolation valve until the rattling stops. If this does not give adequate flow for your installation, call your installer or system designer.
- 5. Record the voltage and amperage of the motor. Adjust the motor overloads if required.
- If pressure gauges have been installed, check and record operating pressures.
- 7. Check all controls for proper operation.

#### **Motor Bearings**

For the greasing schedule and greasing procedure of the motor bearings follow the motor manufacturers recommendations.

#### **Calculating Minimum Inlet Pressure:**

Minimum inlet pressure is required to avoid cavitation in the pump and is calculated as follows:

 $H = Pb - NPSHR - H_f - H_v - H_s$ 

H = Minimum Inlet Pressure in Feet of Head

Pb = Barometric Pressure in Feet

1 Bar = 29.53 inches of Mercury (Hg)

1 PSI = 2.31 Ft of Head

1 Bar = 33.5 Ft. of Head

NPSHR = Net Positive suction head required. To be read from the NPSHR curve, Figure 9, at the highest flow the pump will be delivering.

 $H_f$  = Friction Loss in suction pipe in ft of head

 $H_V$  = Vapor pressure in feet of head (See Table VI).

 $H_S = A$  safety margin of 1.64 ft of head

#### **Example for PVM8:**

If: Flow = 60 GPM

Pb = 1 Bar = 29.53 Inches of Mercury\*

(Convert from Bar to Feet of Head)

1 Inch of mercury = 1.13' feet of water

 $T = 100^{\circ} F$ 

NPSHR = 10' (See Figure 9)

 $H_f = 10'$  of 2" Steel Pipe @ 11.9' of loss per 100'

of Pipe  $(H_f = 11.9'/10' = 1.19')$ 

 $H_V = 2.195'$  (from Table VI)

 $H_s = 1.64'$  (safety factor from above)

**Then:**  $H = 33.5'^* - NPSHR^{**} - H_f - H_v - H_s$ 

H = 33.5' - 10' - 1.19' - 2.195' - 1.64 = 18.475'

H = 18.475′ = Minimum Inlet Pressure

\* 1 Bar = 14.5 PSI x 2.31 Ft of Head = 33.5'

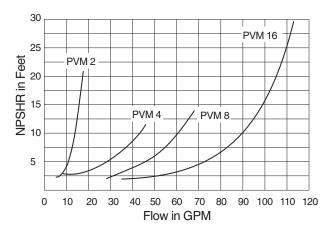


FIGURE 9 - PVM2 through PVM16 Net Positive Suction Head Requirement (NPSHR)

**TABLE VI – Vapor Pressure of Water** 

Temperature in °F (°C)	Vapor Pressure in PSIA (kPa)	Absolute Pressure in Feet (M) of Water
32 (0)	0.089 (.61)	0.205 (.062)
40 (4.4)	0.122 (.84)	0.281 (.086)
60 (15.6)	0.256 (1.77)	0.592 (.180)
80 (26.7)	0.507 (3.50)	1.172 (.358)
100 (37.8)	0.95 (6.55)	2.195 (.669)
120 (48.9)	1.695 (11.69)	3.914 (1.193)
140 (60.0)	2.892 (19.94)	6.681 (2.036)
160 (71.1)	4.745 (32.72)	10.961 (3.341)
180 (82.2)	7.515 (51.84)	17.36 (5.291)
200 (93.3)	11.529 (79.49)	26.632 (8.117)
210 (98.9)	14.125 (97.39)	32.629 (9.945)
212 (100)	14.698 (101.34)	33.952 (10.349)
220 (104.4)	17.188 (118.51)	39.704 (12.102)
230 (110.0)	20.78 (143.28)	48.002 (14.631)
240 (115.6)	24.97 (172.17)	57.681 (17.581)
248 (120.0)	28.79 (188.51)	66.505 (20.271)

#### **MAINTENANCE**

#### **Motor Replacement**

For Key Numbers, refer to the Exploded View, Figure 14, Page 14 for PVM2 and PVM4 Series Models, Figure 16, Page 16 for PVMI/X2 and PVMI/X4 Models, Figure 15, Page 15 for PVM8 and PVM16 Series Models, and Figure 17, Page 17 for PVMI/X8 and PVMI/X16 Series Models.

**AWARNING** Hazardous voltage. Disconnect all power to the pump before servicing or working on pump. Make sure that power is locked out and that pump cannot be accidentally started.

- 1. Disconnect the power to the pump motor.
- 2. Close the nearest suction and discharge valves.
- 3. Remove the coupling guards (Key No. 4) by prying them loose with a screw driver.
- 4. Remove the socket head screws (Key No. 3) and the coupling halves (Key No. 2) from the shaft (Key No. 16A). For additional reference, see Figure 12, Page 10.

**NOTICE:** Socket head screws are metric. See Table VIII on Page 12 for specific metric driver sizes.

- 5. Remove the shaft pin (Key No. 5).
- 6. Remove the capscrews (Key No. 12), flatwashers (Key No.10), and lockwashers (Key No.11) that hold the motor (Key No. 1) and the motor bracket (Key No. 7) together.
- Pull the old motor up and off of the motor bracket.
   NOTICE: Note the location of the conduit box on the motor.
- 8. Thoroughly clean the surfaces of the mounting flanges on the new motor and the pump end.
- 9. Install the new motor on the pump with the conduit box in the desired position.
- 10. Lubricate the capscrews (Key No. 12) with oil.
- 11. Reinstall the lockwashers, flatwashers, and capscrews that hold the motor and the motor bracket together, then tighten evenly and diagonally. See Table VIII, Page 12 for torque specifications.
- 12. Reinstall the shaft pin (Key No. 5) in the shaft.
- 13. Reinstall the coupling halves (Key No. 2) on the pump and motor shaft. Make sure to engage the shaft pin (Key No. 5).

**NOTICE:** Be sure coupling surfaces are thoroughly clean prior to assembly.

- 14. Snug up the socket head screws (Key No. 3) until the coupling begins to bind and then loosen 1/2 turn.
- 15. Draw up the capscrews evenly so the gap between the coupling halves is equal on both sides (See Figure 10A).

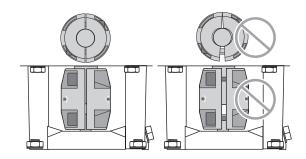


FIGURE 10A - Make Sure that the Coupling Halves are Evenly Tightened

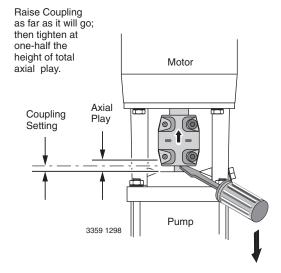


FIGURE 10B - Vertically (axial) Centering the Coupling

- 16. Insert a screw driver under the coupling (See Figure 10B).
- 17. Raise the pump shaft to its highest point.
- 18. Lower the shaft halfway back down the distance you just raised it and retighten the capscrews. See Figure 10.

**NOTICE:** Torque settings are critical to prevent coupling movement. Refer to Table VIII, Page 12 for torque specifications.

- 19. Rotate the shaft to make sure that there is no interference. If rubbing is noted repeat steps 16, 17, and 18 above and readjust pump shaft height.
- 20. Reinstall the coupling guards by snapping them into place.

**NOTICE:** The guards should be in place before the unit is run.

Open the suction and discharge valves. Turn the power back on.

#### **Replacing Pump Stack**

For Key Numbers, refer to the Exploded View, Figure 14 on Page 14, for the PVM2 and PVM4 Series Models and Figure 15 on Page 15 for PVM8 and PVM16 Series Models.

**AWARNING** Hazardous pressure. Do not run pump with discharge valve closed; the water in the pump may boil, causing risk of explosion and steam burns to anyone nearby.

- 1. Follow steps 1-8 under "Motor Replacement" section on Page 9; then proceed with step 2 below.
- 2. Remove the four staybolt nuts, flatwashers, and lockwashers (Key Nos. 8, 9A, and 9B) from the staybolts (Key No. 19).

**NOTICE:** It is not necessary to remove the staybolts when replacing the stack.

3. Lift the motor bracket (Key No. 7) off of the pump body.

**NOTICE:** Note the position of the priming plug. The priming plug must be returned to its original position during reassembly.

- 4. Remove and discard upper sleeve gasket (Key No. 17).
- 5. Clean gasket seat.
- Remove and replace round spring ring (PVM2 and PVM4) or stack spring (PVM8 and PVM16) (Key No. 13).
- 7. Pull the old stack (16A through 16L) out of the stainless steel sleeve (Key No. 18) by pulling straight up on the pump shaft (Key No. 16A).
- 8. Remove the stainless steel sleeve (Key No. 18).
- 9. Remove and discard the bottom sleeve gasket (Key No. 17).
- 10. Clean the gasket seat.
- 11. Remove and discard the O-Ring (Key No. 21A) from the suction/discharge (Key No. 21 PVM2 and PVM4 only).
- 12. Cast Iron Models Only: Clean the O-Ring seat and install a new O-Ring (Key No. 21A).
- 13. Install a new lower sleeve gasket.
- 14. Install the new stack without the stainless steel sleeve.

**NOTICE:** Be sure to align either the small priming hole or the suction interconnector pin hole (located on the bottom stage of the stack) properly in the base of the Suction/Discharge (Key No. 21). See Figure 11 (not necessary on PVMI/X models).

- 15. Use a rubber mallet to tap the stainless steel sleeve (Key No. 18) into place.
- 16. Install a new mechanical shaft seal (Key Nos. 14A and 14B, or Key Nos 15A through 15G). Refer to "Mechanical Seal Disassembly and Mechanical Seal Reassembly" sections, Pages 11 and 12.
- 17. Install a new upper sleeve gasket (Key No. 17).

- 18. Install a new round spring ring or stack spring (Key No. 13).
- 19. Reinstall the motor bracket (Key No. 7) on the pump body. Align the priming plug (Key No. 6) to its original position.
- 20. Oil the threads on the staybolts (Key No. 19).
- 21. Replace the lockwashers, flatwashers, and staybolt nuts (Key Nos. 8, 9A and 9B) and cross-torque the staybolts. See Table VIII, Page 12, for torque specifications.
- 22. Reinstall the motor (Key No. 1) on the motor bracket (Key No. 7) and turn the motor to the desired terminal box position.
- Follow steps 10 21 under "Motor Replacement", Page
   You have now finished changing out the impeller stack.

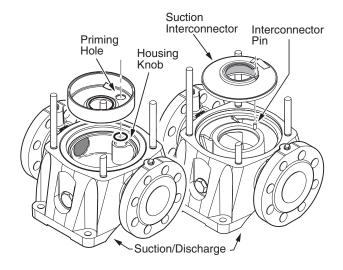


FIGURE 11 - PVM2, PVM4 - Align Small Priming Port. PVM8, PVM16 - Align Interconnector Pin. No alignment is necessary on PVMI/X models.

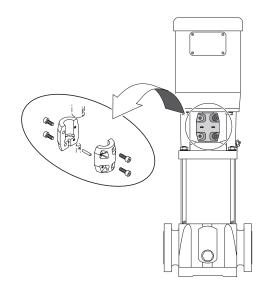


FIGURE 12 - Remove the Socket Head Screws and the Coupling Halves

#### **Seven Part Mechanical Seal/Disassembly:**

See Figure 13 for Seal Key Numbers.

See Figures 14 through 17 for Pump Key Numbers.

**AWARNING** Hazardous voltage. Can Shock, burn or cause death. Disconnect power to pump before disassembly.

- 1. Follow Steps 1-8 under "Motor Replacement" Page 9, and proceed with step 2 below.
- 2. Remove the four nuts, lockwashers and washers (Key Nos. 8, 9A, and 9B) from the staybolts (Key No. 19).
- 3. The shaft seal consists of an O-Ring (Key No. 15A), the stationary half of the mechanical seal (Key No. 15B), the rotating half of the mechanical seal (Key No. 15C), a second O-Ring (Key No. 15D inside No. 15C), a flat washer (Key No. 15E), a spring (Key No. 15F), and a mechanical drive ring (Key No. 15G), in that order, see Figure 13, below. Turn the pump head upside down and remove the stationary part of the seal (Key No. 15B) from the seal seat in the base of the motor bracket.

**NOTICE:** Use care not to chip or scratch the seal seat during disassembly and assembly.

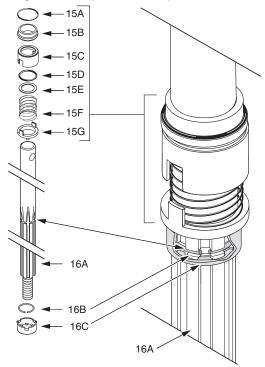


FIGURE 13

- 4. Clean the seal seat with a wet cloth.
- 5. Remove the rotating parts of the seal by twisting and pulling up on them until they come off of the shaft (Key Nos.15C and 15D, 15E, 15F, and 15G). Discard the old seal.

#### Seven Part Mechanical Seal Reassembly:

**NOTICE:** Before assembly check and clean all sealing and gasket surfaces with a clean wet cloth. Replace all seals, gaskets and O-Rings.

- 1. Turn the motor bracket (Key No.6) upside down.
- 2. Moisten the seal seat (in the motor bracket) with a small amount of water.
- 3. Lubricate the larger diameter O-Ring (Key No. 15A) with a small amount of water and install it on the stationary half of mechanical seal (Key No. 15B).
- 4. Press the stationary half of the shaft seal (Key No. 15B) with O-Ring (Key Nos. 15A and 15B) into the seal seat of the motor bracket. Use finger pressure only. If a tool is used, protect the seal face from tools with a clean cloth.

**NOTICE:** Be sure the seal is installed evenly to avoid pinching the O-Ring.

- 5. Lubricate smaller diameter O-Ring (Key No. 15D) with water and press it into the rotating half of the mechanical seal (Key No.15C).
- 6. Install the mechanical drive ring (Key No. 15G) on the shaft (Key No. 16A). Be sure the drive ring butts up against the mechanical seal spacer (Key No. 16C).
- 7. Install the spring (Key No.15F) up against the drive ring on the shaft .
- 8. Install the flatwasher (Key No.15E) on the shaft, against the spring.
- 9. Install the rotating half of the mechanical seal (Key No.15C) on the shaft. Align the grooves on the rotating half of the mechanical seal with the teeth on the mechanical drive ring (Key No. 15G).
- 10. Follow Steps 11 23 under "Replacing Pump Stack", Page 10.

#### **Frequency of Starts and Stops**

Check pump cycling frequency and make sure that the pump is not starting more than:

**TABLE VII – Maximum Number of Cycles** 

Cycles	Motor HP Rating
20 times per hour	1/2 - 5 HP motors
15 times per hour	7- 1/2 - 15 HP motors
10 times per hour	20 and 25 HP motors

#### **Frost Protection**

1. If you do not use your pump during seasons of frost, drain it and add a glycol based antifreeze (50/50 mixture) to avoid damage.

A CAUTION Risk of water damage and injury. Watch the direction of the priming plug and make sure that liquid escaping from it does not injure persons nearby or damage the motor or other components. In hot water installations, pay particular attention to the risk of injury from scalding hot water.

- 2. Upon restart dispose of spent antifreeze properly.
- 3. Do not replace the drain plug or tighten the priming plug until you put the pump back in service again.

#### **Regular Maintenance Checks**

The following checks should be made at regular intervals:

- 1. The pump meets required performance and is operating smoothly and quietly.
- 2. There are no leaks.
- 3. The motor is not overheating.
- 4. Remove and clean all strainers and filters in the system.
- 5. Verify amp draw check motor amperage.
- 6. Pump wear rings and shaft require no regular maintenance.

TABLE VIII - Torque Specifications (foot-lbs.) For Cast Iron and Stainless Steel Models

		Coupling		Mo	tor	Stay	bolt	Stack	Nut
Pump Model	Socket Head Screw	Socket Head Screw	Socket Head Screw	Capscrew Hex Head	Capscrew Hex Head	Hex Nut	Hex Nut	Hex Nut	Hex Nut
Number	M6 x 20	M8 x 25	M10 x 25	3/8 x 1-1/2	1/2 x 1-1/2	1/2 - 13	5/8 - 11	M8	M12
PVM2 Series	15	20	_	30	35	45	-	10	_
PVM4 Series	15	20	_	30	35	45	_	10	_
PVM8 Series	15	20	45	30	35	_	75	_	30
PVM16 Series	_	20	45	-	35	-	75	_	30

#### TROUBLESHOOTING GUIDE

AWARNING Hazardous voltage and risk of sudden starts. Disconnect all power to the pump before servicing or working on pump. Make sure that power is locked out and that pump cannot be accidentally started.

PROBLEM	CAUSE
Motor does not run when started	A. Power failure     B. Fuses blown     C. Motor starter overload has tripped out     D. Main contacts in motor starter are not making contact or the coil is faulty     E Control circuit fuses are defective     F. Motor is defective
Motor starter overload trips out immediately when power supply is switched on	A. One fuse has blown     B. Contacts in motor overload relay are faulty     C. Cable connections are loose or faulty     D. Motor winding is defective     E. Pump mechanically blocked     F. Overload setting is too low
3. Motor starter overload trips out occasionally	A. Overload setting is too low     B. Low voltage at peak times
Motor starter has not tripped out but the motor does not run	A. Check 1 A), B), D,) and E)
5. Pump capacity is not constant	A. Pump inlet pressure is too low     B. Suction pipe/pump partly blocked     C. Pump is sucking air
6. Pump runs but gives no water	A. Suction pipe/pump blocked     B. Foot or non-return valve is blocked in closed position     C. Leakage in suction pipe     D. Air in suction pipe or pump     E. Motor rotates in the wrong direction
7. Pump runs backwards when switched off	A. Leakage in suction pipe     B. Foot or non-return valve is defective     C. Foot valve is blocked in open or partly open position     D. Non return valve leaks or is blocked in open or partly open position     E. Discharge valve is defective
8. Leakage from shaft seal	A. Pump shaft position is incorrect     B. Shaft seal is defective
9. Noise	A. Cavitation is occurring in the pump     B. Pump does not rotate freely (That is, there is increased frictional resistance) because of incorrect shaft position

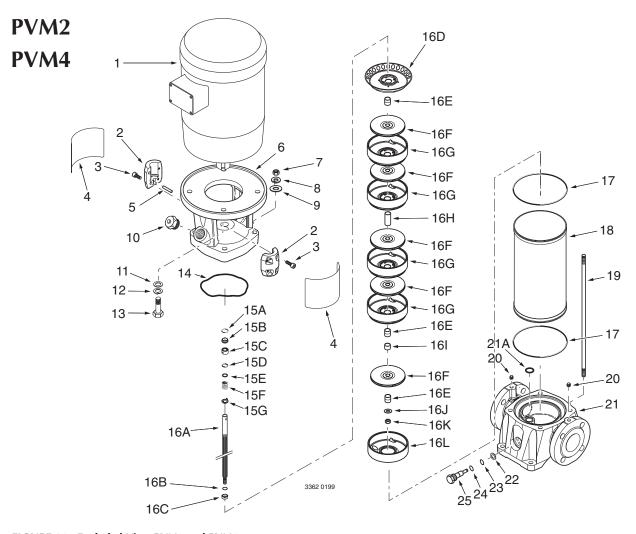


FIGURE 14 - Exploded View PVM2 and PVM4

Key		Key	
No.	Description	No.	Description
1	Motor	15G	Mechanical Drive Ring
2	Coupling Half	16	Replacement Stack Kit (Incl. Key Nos. 16A thru 16L)
3	Socket Head Screw	16A	Shaft
4	Coupling Guard	16B	Stop Ring
5	Coupling Pin	16C	Mechanical Seal Spacer
6	Vented Priming Plug	16D	Upper Intermediate Chamber
7	Motor Bracket	16E	Spacer
8	Staybolt Nut	16F	Impeller
9A	Staybolt Lockwasher	16G	Diffuser
9B	Staybolt Flat Washer	16H	Spacer
10	Flatwasher	16l	Bearing
11	Lockwasher	16J	Shaft Washer
12	Capscrew	16K	Nut
13	Spring Ring	16L	Chamber without Diffuser
14	Two part Mechanical Seal (Includes 14A and 14B)	17	Sleeve Gasket
14A	Stationary Half of Mechanical Seal	18	Stainless Steel Sleeve
14B	Rotating Half of Mechanical Seal	19	Staybolt
15	Seven Part Mechanical Seal (Includes 15A thru 15G)	20	Pipe Plug
15A	O-Ring, Larger Diameter	21	Suction/Discharge
15B	Stationary Half of Mechanical Seal	21A	O-Ring (Bottom Chamber)
15C	Rotating Half of Mechanical Seal	22	Drain Plug Gasket
15D	O-Ring, Smaller Diameter	23	O-Ring
15E	Flat Washer	24	O-Ring
15F	Spring	25	Drain Plug

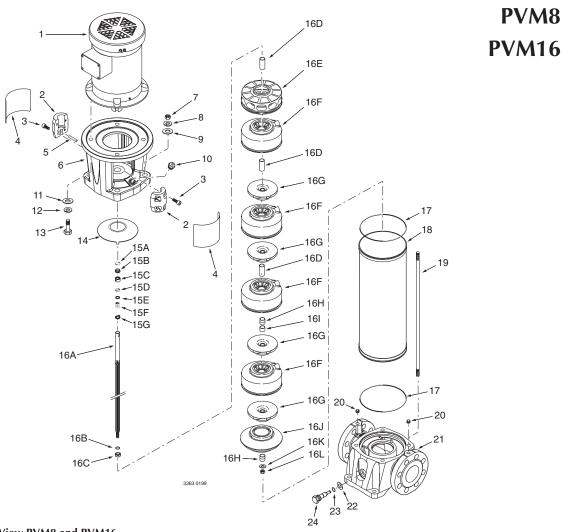


Figure 15 - Exploded View PVM8 and PVM16

Key No.	Description	Key No.	Description
1	Motor	15G	Mechanical Drive Ring
2	Coupling Half	16	Replacement Stack Kit (Incl.16A thru 16L)
3	Socket Head Screw	16A	Shaft
4	Coupling Guard	16B	Stop Ring
5	Coupling Pin	16C	Mechanical Seal Spacer
6	Vented Priming Plug	16D	Upper Intermediate Chamber
7	Motor Bracket	16E	Spacer
8	Staybolt Nut	16F	Impeller
9A	Staybolt Lockwasher	16G	Diffuser
9B	Staybolt Flat Washer	16H	Spacer
10	Flat Washer	16I	Bearing
11	Lock Washer	16J	Shaft Washer
12	Capscrew	16K	Nut
13	Spring Ring	16L	Chamber without Diffuser
14	Two Part Mechanical Seal (Includes 14A and 14B)	17	Sleeve Gasket
14A	Stationary Half of Shaft Seal	18	Stainless Steel Sleeve
14B	Rotating Half of Shaft Seal	19	Staybolt
15	Seven Part Mechanical Seal (Includes 15A thru 15G)	20	Pipe Plug
15A	O-Ring, Larger Diameter	21	Suction/Discharge
15B	Stationary Half of Mechanical Seal	21A	O-Ring (Bottom Chamber)
15C	Rotating Half of Mechanical Seal	22	Drain Plug Gasket
15D	O-Ring, Smaller Diameter	23	O-Ring
15E	Flat Washer	24	O-Ring
15F	Spring	25	Drain Plug

# PVMI/X2 PVMI/X4

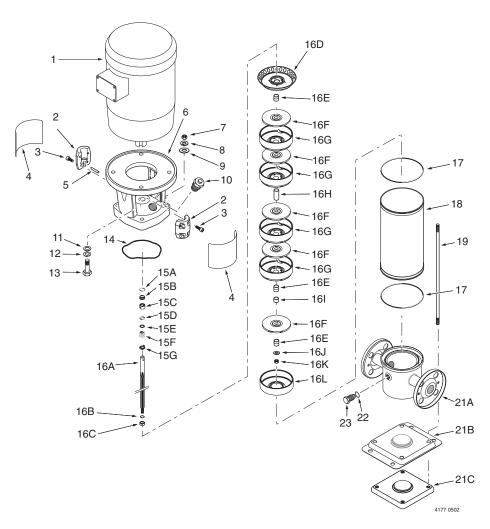
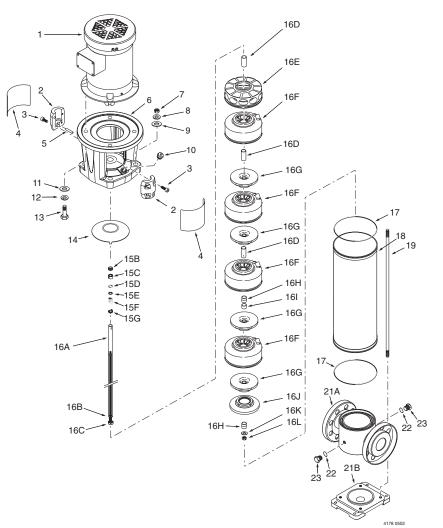


FIGURE 16 - Exploded View PVMI/X2 and PVMI/X4

Key No.	Description	Key No.	Description
1	Motor	15G	Mechanical Drive Ring
2	Coupling Half	16	Replacement Stack Kit (Incl. Key Nos. 16A thru 16L)
3	Socket Head Screw	16A	Shaft
4	Coupling Guard	16B	Stop Ring
5	Coupling Pin	16C	Mechanical Seal Spacer
6	Motor Bracket	16D	Upper Intermediate Chamber
7	Staybolt Nut	16E	Spacer
8A	Staybolt Lockwasher	16F	Impeller
8B	Staybolt Flat Washer	16G	Diffuser
9	Vented Priming Plug	16H	Spacer
10	Flatwasher	16I	Bearing
11	Lockwasher	16J	Shaft Washer
12	Capscrew	16K	Nut
13	Spring Ring	16L	Chamber without Diffuser
14	Two part Mechanical Seal (Includes 14A and 14B)	17	Sleeve Gasket
14A	Stationary Half of Mechanical Seal	18	Stainless Steel Sleeve
14B	Rotating Half of Mechanical Seal	19	Staybolt
15	Seven Part Mechanical Seal (Includes 15A thru 15G)	21A	Suction/Discharge
15A	O-Ring, Larger Diameter	21B	Base
15B	Stationary Half of Mechanical Seal	21C	Base Reinforcement
15C	Rotating Half of Mechanical Seal	22	O-Ring
15D	O-Ring, Smaller Diameter	23	O-Ring
15E	Flat Washer	24	Drain Plug (Low Pressure Side)
15F	Spring	25	Drain Plug (High Pressure Side)



PVMI/X8

PVMI/X16

Figure 17 - Exploded View PVMI/X8 and PVMI/X16

Key No.	Description	Key No.	Description
140.	Description	110.	Description
1	Motor	15G	Mechanical Drive Ring
2	Coupling Half	16	Replacement Stack Kit (Incl.16A thru 16L)
3	Socket Head Screw	16A	Shaft
4	Coupling Guard	16B	Stop Ring
5	Coupling Pin	16C	Mechanical Seal Spacer
6	Vented Priming Plug	16D	Spacer
7	Motor Bracket	16E	Top Diffuser
8	Staybolt Nut	16F	Diffuser
9A	Staybolt Lockwasher	16G	Impeller
9B	Staybolt Flat Washer	16H	Spacer
10	Flat Washer	16I	Bearing
11	Lock Washer	16J	Suction Interconnector
12	Capscrew	16K	Washer
13	Spring Ring	16L	Lock Nut
14	Two Part Mechanical Seal (Includes 14A and 14B)	17	Sleeve Gasket
14A	Stationary Half of Shaft Seal	18	Stainless Steel Sleeve
14B	Rotating Half of Shaft Seal	19	Staybolt
15	Seven Part Mechanical Seal (Includes 15A thru 15G)	21A	Suction/Discharge
15A	O-Ring, Larger Diameter	21B	Base
15B	Stationary Half of Mechanical Seal	22	O-Ring
15C	Rotating Half of Mechanical Seal	23	O-Ring
15D	O-Ring, Smaller Diameter	24	Drain Plug (Low Pressure Side)
15E	Flat Washer	25	Drain Plug (High Pressure Side)
15F	Spring	l	

# **JOHN MEUNIER**

Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference: NC01

# MIXERS ST-100



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		-	1	Application:	M2-021	† †		5	
				Coagulation tank					
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				0.45.8.11					
				Pumping number (Na)					
				0.72 s.u.					
				Rotational speed					
				67.23 rpm					
				Dissipated power					
				2,48 HP					
				Nimbor					
				- Ave					
				axial (F-4) 13.5 degrees					
				Diameter					
				49,3 in (1252,2 mm)					
				Distance from bottom					
				36,975 in (939 mm)					
				Rotation direction					
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				Material					
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				SHAFT							
				Length							
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				Diameter							
				2,25 in (57,1mm)							
				Material							
				S.S. 304L							
				REDUCER							
				Manufacturer							
				NORD							
				Model							
				SK4282 AHZ/VL111							
				Туре							
				Parallel shaft AGMA11 (LS) and AGMA 13 (HS)							
				Ratio							
				26,25:1							
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				1,21 on motor name plate							

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				Manufacturer/Model							
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				Туре							
				Squirrel cage							
				Efficiency							
				87.5%							
				Enclosure							
				Isolation Class F / IP55							
				Speed							
				1765 rpm							
				Power							
				3 HP							
				Electrical feed							
				575 Vac / 3 ph / 60 Hz							
				Paint protection							
				Manufacturer standard							
				Lubrificant:							
				c/w food grade oil fill							
			<u>_</u>								

Y	JOHN MEUNIER	1EUI	É	<b>GR</b>					NOMENCLATURE/
	TITRE/ TITLE	U	Bev	DESCRIPTION	PAR/ BY:	APPR:	DATE	Affaire /	
	i		0	SUBMITTAL	P.Ste-Marie	P.S.M.	2009-03-26	Contract	Meadowbank Mining
			-						
	MIXers		7					REF. No.	NC01 0
			က						
۵	DESSIN /DWG#	ST-100	4					Date:	2009-03-26
REV.	ITEM	QTE.	ατε/ατγ.	DESCRIPTION	P&ID	CAT. ACCPAC	SOURCE	FA/SA FI	N/d
	NC01ST-100-2		Unit. I otal	OIN.IECTION MIXER	1.D./TAG M2-012	B44		SA	
		1		Application:	M2-022	5		5	
				Injection tank					
				Manufacturer					
				ENVIREQUIP W.T.E.M. INC					
				Model MAY HOLL FLOOR 4 0 0					
				Win-1ECH EVGA 4-3,0					
				variable speed					
				Weight					
				568 lb (258 kg)					
				MIXING CHARACTERISTICS					
				Power number (Np)					
				0.45 s.u.					
				Pumping number (Nq)					
				0.72 s.u.					
				Rotational speed					
				67.23 rpm					
				Dissipated power					
				7,48 П					
				MPIII SER					
				Number					
				1					
				Туре					
				axial (F-4) 13,5 degrees					
				Diameter					
				49,3 in (1252,2 mm)					
				Distance from bottom					
				36,975 in (939 mm)					
				Rotation direction					
				ccw nb					
				Material					
				S.S. 304L					

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TITRE/ TITLE	31	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	Mac desirated
		0	SUBMITTAL	P.Ste-Marie	P.S.M.	2009-03-26	Contract	Meadowbank Mining
Mixor		1						
MIXE		2					REF. No.	NC01 0
		ဗ						
DESSIN /DWG#	ST-100	4					Date:	2009-03-26
REV. ITEM	QTE/	QTE/QTY.	DESCRIPTION	P&ID PAT/ G I	CAT. ACCPAC	SOURCE	FA/SA FI SITE	N/d
		20	INJECTION MIXER (CONT'D)					
			SHAFT					
			Length					
			106,72 in (2711 mm)					
			Diameter					
			2,25 in (57,1mm)					
			Material					
			S.S. 304L					
			REDUCER					
			Manufacturer					
			NORD					
			Model					
			SK4282 AHZ/VL111					
			Туре					
			Parallel shaft AGMA11 (LS) and AGMA 13 (HS)					
			Ratio					
			26,25:1					
			Service factor					
			1,21 on motor name plate					
		<u>_</u>						

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	TITRE/ TITLE	_	Rev. DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	animin Jacobach
			0 SUBMITTAL	P.Ste-Marie	P.S.M.	2009-03-26	Contract	меасом рапк міпіпд
	, contract of the second		1					
	MIXELS		2				REF. No.	NC01 0
			8					
_	DESSIN/DWG# ST	ST-100	4				Date:	2009-03-26
REV.	. ITEM	ате/ату.	QTY. DESCRIPTION	P&ID	CAT.	SOURCE	FA/SA FI	N/d
		Unit. Total		I.D./TAG	04 1004		SITE	
			INJECTION MIXER (CONT'D)					
			MOTOR					
			Manufacturer/Model					
			Nord - frame size 100LH/4 outdoor protection					
			Туре					
			Squirrel cage					
			Efficiency					
			87.5%					
			Enclosure					
			Isolation Class F / IP55					
			Speed					
			1765 rpm					
			Power					
			3 HP					
			Electrical feed					
			575 Vac / 3 ph / 60 Hz					
			Paint protection					
			Manufacturer standard					
			Lubrificant:					
			c/w food grade oil fill					

	JOHN MEUNIER		Ĭ	<b>GR</b>					BILL OF MATERIALS	ALS
	TITRE/ TITLE		Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
			0	SUBMITTAL	P.Ste-Marie	P.S.M.	2009-03-26	Contract	Meadowbank Mining	- Bul
	Mixoro		-							
	SINIYEIS		2					REF. No.	NC01	0
			3							
DE	DESSIN/DWG#	ST-100	4					Date:	2009-03-26	
REV.	ПЕМ	QTE/QTY.	OTY.	DESCRIPTION	P&ID	CAT. ACCPAC	SOURCE	FA/SA FI	N / d	
	NC01ST-100-3	7	2	2 MATURATION MIXER	M2-013	B44		SA		
			1	Application:	M2-023	1				
				Maturation tank						
				Manufacturer						
				ENVIREQUIP W.T.E.M. INC						
				Model						
				MIX-I ECH EVGX 6-5						
				Variable speed						
				yes (byt others)						
				1903 lk (692 kg)						
				(80 cc) (100 cc)						
				MIXING CHARACTERISTICS						
				Power number (Np)						
				0.733 s.u.						
				Pumping number (Nq)						
				0.72 s.u.						
				Rotational speed						
				22,03 rpm						
				Dissipated power						
				2,99 HP						
				IMPULSER						
				Number						
				axial (F-4) 22 degrees						
				Diameter						
				89,68 in (2277,9 mm)						
				Distance from bottom						
				44,84 in (1139 mm)						
				Rotation direction						
				cw down						
				Material						
				S.S. 304L						

Page 7 de/of 9

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		0	SUBMITTAL	P.Ste-Marie	P.S.M.	2009-03-26	Contract	меасом рапк міппд	guin Buin
N.		-							
NI VOI		2					REF. No.	NC01	0
		က							
DESSIN /DWG #	ST-100	4					Date:	2009-03-26	
REV. ITEM	QTE/	QTE/QTY.	DESCRIPTION	P&ID	CAT. ACCPAC	SOURCE	FA/SA FI SITE	N/d	
	5	- Cla	MATURATION MIXER (CONT'D)	DK 1.0.			2		
			SHAFT						
			Length						
			98,86 in (2511 mm)						
			Diameter						
			3 in (76,2 mm)						
			Material						
			S.S. 304L						
			REDUCER						
			Manufacturer						
			NORD						
			Model						
			SK6282 AHZ/VL111						
			Туре						
			Parallel shaft AGMA11 (LS) and AGMA 13 (HS)						
			Ratio						
			80,33:1						
			Service factor						
			1,68 on motor HP						

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TITRE/ TITLE		Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	Modern Control
		0	SUBMITTAL	P.Ste-Marie	P.S.M.	2009-03-26	Contract	Meadowbank Mining
Mixoro		1						
		2					REF. No.	NC01 0
		3						
DESSIN /DWG #	ST-100	4					Date:	2009-03-26
REV.	QTE/	ате/ату.	DESCRIPTION	P&ID	CAT. ACCPAC	SOURCE	FA/SA FI	Z/d
	Unit. Total	Total	MATURATION MIXER (CONT'D)	I.D./TAG			SIIE	
			,					
			MOTOR					
			Manufacturer/Model					
			Nord - frame size 112MH/4 outdoor protection					
			Туре					
			Squirrel cage					
			Efficiency					
			87,5%					
			Enclosure					
			Isolation Class F / IP55					
			Speed					
			1770 rpm					
			Power					
			5 HP					
			Electrical feed					
			575 Vac / 3 ph /60 Hz					
			Paint protection					
			Manufacturer standard					
			Lubrificant:					
			c/w food grade oil fill					

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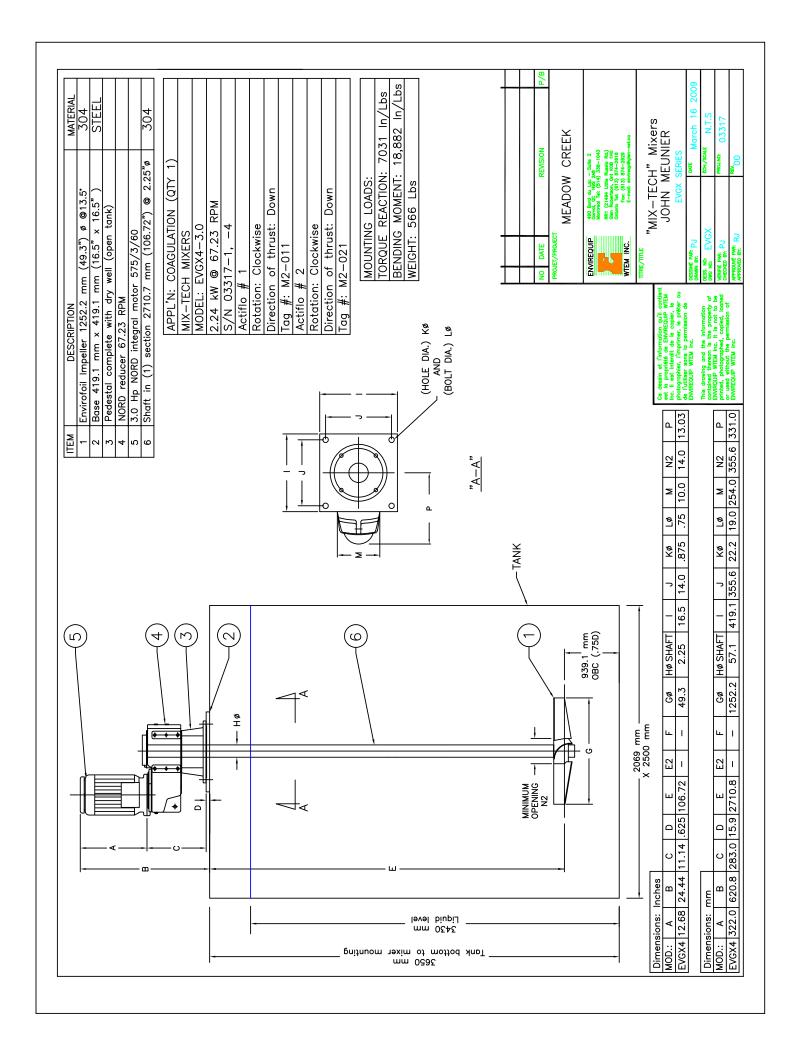
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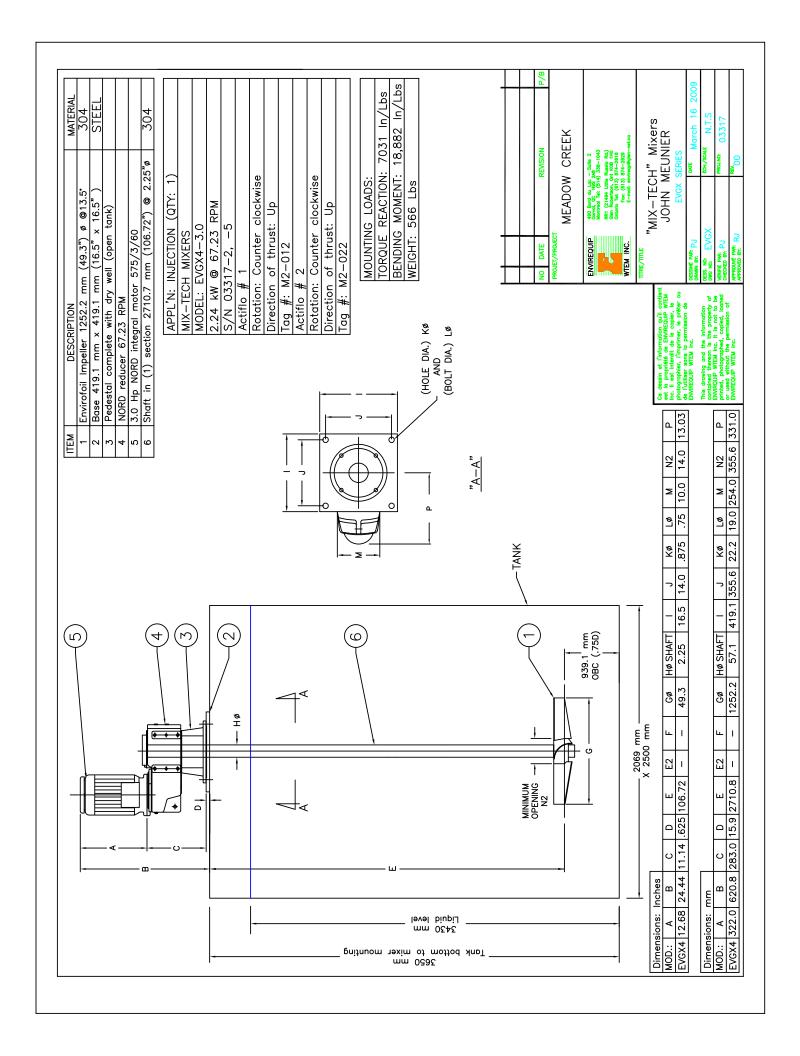
Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference: NC01

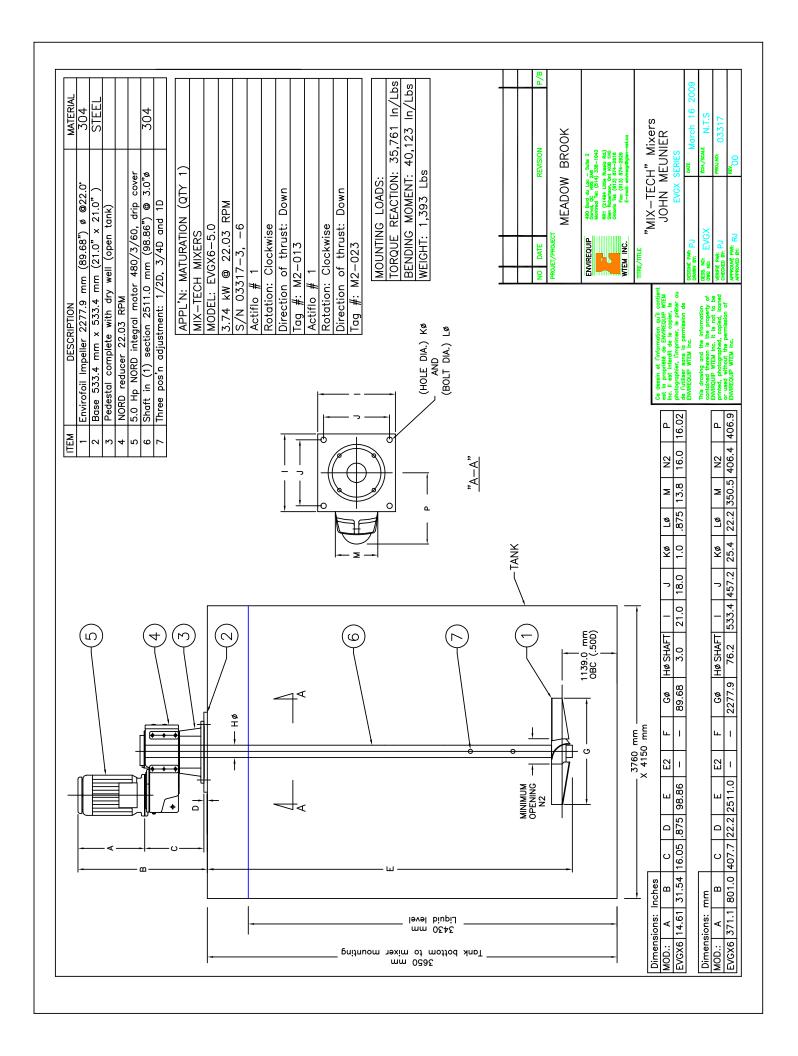
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#### ENVIREQUIP (Division 6445772 Canada Inc)

MIX-TECH DYNAMIC MIXERS

490, Bord du Lac - Suite 2, *toll free*: 1.866.819.6123

Dorval, QC, Canada H9S 2A8 *mobile:* 514.386.1043

RR1, (21494 Little Russia Rd), *tel:* 613.874.2616

e-mail: envireqp@glen-net.ca

internet: <a href="http://www.envirequip.com">http://www.envirequip.com</a>

# INSTRUCTION & OPERATING MANUAL

## **MIX-TECH MIXERS**

#### SEE SECTION FOR AGITATOR / GEAR REDUCER DESIGN: (at end of Manual)

EVG (Parallel Shafts with Hollow Output Shafts & Tapered Roller Bearings)

EVGX (Parallel Shafts with Hollow Output Shafts & High Capacity Upper Cylindrical

**&** Lower (2) - Row

**Spherical Roller Bearings** 

EHG (Worm drives for Small Top Entry & Portable Mixers with Hollow Output

Shafts)

EHGB Helical / Bevel gearing with Hollow Output Shafts & Tapered Roller Bearings)

EVGFS Helical in-line gears with Solid Output Shaft Tapered Roller or Spherical Roller

**Bearings - Refer to Nord Installation & Operation Manual** 

NOTE: For Units with Solid Output Shafts, Refer to the Nord Manual Oct/2006

#### ENVIREQUIP / MIX-TECH MIXERS - INDEX I.O.M.

For mixer(s) installed in OPEN TANKS See Section for Mechanical seals & Packing (Stuffing boxes) at end of LO.M. PAGE (S)

- See Section for Mechanical seals & Packing (Stuffing boxes) at end of I.O.M. PAGE (S)						
PAGE / DRAWING MIX-TECH MIXER (SECTION)		MIXER (SECTION)	Rev 0			
SECTION	1	INSPECTION	I	1		
SECTION	2	INSTALLAT	ION	1, 2, 3 & 4		
SECTION	3	MIXER ASSI	EMBLY	4		
SECTION	4	MOTORS		5 & 6		
SECTION	5	PEDESTALS	6 & 7			
SECTION	6	SHAFTS, IMI Note: Shaft &	7,8 & 9			
SECTION	7	GEAR DRIVI	9, 10 & 11			
SECTION	8	BOLTS	11 & 12			
SECTION	9	OPERATION	12			
SECTION	10	MOTOR REMOVAL & INSTALLATION		13		
SECTION	11	TROUBLE-SHOOTING / MIXER PERFORMANCE		13 & 14		
SECTION	12	WARRANTY		15		
PAGE		USEFUL CONVERSIONS		16		
PAGE		MAINTENANCE LOG		19		
PAGES		IMPELLER B	SLADE INSTALLATION	A, B C & D		
NORD		BIM 1020	I.O.M. PARALLEL SHAFT REDUCERS	(pdf)		
NORD		DM 006	DIS-ASSEMBLY MANUAL SK6282 to SK11282 for DOUBLE reduction)	(pdf)		
NORD		DM 007	SK11282 for <u>DOUBLE</u> reduction) as above but for <u>TRIPPLE</u> reduction drives.	(pdf)		
PARTS LIST	(S)	(to suit)	suit)			

### ENVIREQUIP (Division 6445772 Canada Inc)

Page 1

Page 1

#### MIX-TECH DYNAMIC MIXERS

490 Bord du Lac - Suite 2, toll free: 1.866.819.6123 Dorval, QC, Canada mobile: 514.386.1043 H9S 2A8 RR1, (21494 Little Russia Rd), tel: 613.874.2616 Glen Robertson, ON, CanadaK0B 1H0 fax: 613.874.2629

internet: http://www.envirequip.com

e-mail: envireqp@glen-net.ca

### INSTALLATION & OPERATION MANUAL **MIX-TECH MIXERS**

#### SECTION 1 - INSPECTION

- Make sure that all mixer parts have been removed from the crate(s) before discarding.
- Each mixer should be carefully checked for any possible shipping damage. Any shipping damage should be reported to the TRANSPORT COMPANY immediately.
- Check the paint and make any necessary touch-ups.

#### SECTION 2 - INSTALLATION

- Most mixer problems can be avoided by following proper installation and operation instructions. The following is a list of hints to help insure proper installation and therefore satisfactory mixer service.
- Please read all appropriate instruction manuals prior to proceeding with the installation of the mixers.

#### CAUTION

- Lock-out the motor starter if any person is in the tank.
- Remove wick from the breather vent plug.
- DO NOT Paint breather / vent plug

#### MOST COMMON PROBLEMS: Mixer Shaft(s) not vertical; Impeller going through liquid level

• Make sure the impeller blades have been installed onto the hubs in the proper position with regards Rotation and Direction of flow. Please also note that the impellers blades are installed with the hubs ears always backing the blade into the flow. Also be sure that the leading edge and not the trailing edge is presented into the flow and that the angle at the impeller tip (angle of attack) from the horizontal is closer to 15° rather than to 75°.

#### CAUTION

- If the angle of attack (at the impeller tip is closer to 75°, either an incorrect hub in combination with the correct impeller blade (OR VICE VERSA) has been incorrectly assembled to make an incorrect matching of possible hub and blade combinations. For help in determining what the correct combination should be, Please refer to the mixer nameplate that will have the Rotation and direction of thrust written. Once you know the combination, refer to the pictorial guide of impeller / hub installation positions A, B, C or D.
- Depending on whether the concave or the convex surface is facing the fluid, if the angle of attach at the impeller is closer to 75°, the HP drawn will be 2 to 3 times greater than what it should be. This could result in overloading the motor and damaging the mixer.
- Make sure that the impeller blades are installed in the correct position for the required rotation. e.g. if the impeller blades are installed up-side-down, the pumping capacity will be reduced by about 65%. Check the mixer nameplate for the flow direction and install the impeller blades to suit.

#### CAUTION

#### POTENTIALLY DAMAGING SITUATIONS FOR MIXERS

- Prolonged operation of the mixer (impeller) at the liquid interface causes increased stress
  on the shaft & impeller for which the system was not designed to accommodate. Damage
  could result.
- Installations where there is a large hydraulic flow (or Velocity) in the mixer reservoir.: Make sure that if should such a flow is present, that the flow is baffled or dispersed over a larger area (as opposed to directed flow via a pipe), or that the flow be re-directed away form the impeller/shaft assembly, or is introduced evenly e.g via a weir. If this cannot be done, this external hydraulic flow will exert additional un-designed for stress loads and deflection on the mixer shaft and impeller which could result in component failure.

#### CAUTION

• Before permanently wiring the motor, check for the correct rotation of the low speed shaft. Normal is Clock-wise looking down from the top of the tank, although the reverse may also be required. Please check mixer nameplate for other instructions. (e.g. Letters A, B, C or D)

#### SECTION 2 - INSTALLATION

- Read and follow the instructions of all tags and nameplates before operating.
- Check the mixer full load motor amperage and voltage before operating any mixer.
- It is recommended that the mixer impeller be rotated by hand in order to check for smooth operation. **N.B**: For crown & worm drives, remove the fan cover and rotate the fan manually.
- Always operate the mixer in a fluid which had a specific gravity and viscosity less than or equal to the design specific gravity and viscosity.
- Do not dump the contents of large bags of chemicals directly onto the rotating mixer impeller(s); but add the contents into the reservoir gradually. This will also promote better mixing.
- Before starting the mixer, make sure the impeller is not buried in solids or a "set-up" fluid Note: If solids have settled-out, then dilute or jog the mixer clockwise then counterclockwise
- Please check that there is no directed flow from an external source at the impeller or shaft
  unless the mixer was specifically designed to accommodate these additional stress loads, as
  mixers could be damaged.
- During START-UP, please listen for unusual noises and check for excessive vibration.
- Check the temperature of the motor and gear reducer. The temperature should not exceed 180° F. (82°C) If they are too hot, please stop the operation of the mixer and contact MIX-TECH immediately.
- Measure the motor amperage. The measured amperage must be less than the nameplate rating nameplate value. If the amps are over, please check the rotational speed of the gear reducer/mixer output shaft. Place a piece of tape onto the shaft (or use an RPM counter if available, and count the number of revolutions for a period of e.g. 10 seconds using your watch second hand. Multiply the result by (6) for 60 Hz operation and this will provide you with the rotational speed of the mixer. Check Rotation, & impeller blade installation to be sure they are correct. If the power draw remains high, please check with MIX-TECH

**Note**: - Record the full load motor amperage (FLA) and measure them every (3) months.

- Some motor amperage readings are poor indicators at low loads

#### CAUTION:

#### DO NOT STAY IN THE TANK DURING MIXER ROTATION

• Never use the mixer impeller as a foot stand or support for body weight - as such actions could damage the mixer as well as result in serious bodily injury.

#### SECTION 2 - INSTALLATION

- As with any rotating equipment, in order to avoid injury, extreme care should be taken to
  avoid contacting the rotating parts including not connecting the motors to the electrical power
  source until the mixer is completely assembled. Then, vacate the tank prior to operating the
  mixer.
- Before making field changes of motor horsepower, mixer speed, shaft length, impeller diameter or width, etc. be sure to consult with ENVIREQUIP, MIX TECH DIVISION.
- After any plant electrical work has been done, check that the mixer(s) rotation(s) are correct as power lines may have been reversed.

#### SECTION 3 - MIXER ASSEMBLY: - Closed tanks are Flange Mounted

- Open tank models usually are mounted on a steel structure. Level the drive as closely as possible. This assures that the shaft will turn in a true vertical position. Incorrect mounting is often a cause of mechanical difficulty with a mixer. Unless specified on the mixer assembly drawing, the mixer extension shaft is designed to run in a true vertical position. Never angle or side mount the mixers.
- While operating, there is random fluid motion in the vessel that exerts great forces on the extension shaft of the mixer. The mixer accommodates these forces since they are transmitted directly to the support mounting(s). Therefore, the mounting system must be rigid. It must support the static mixer weight as well as live mixer reactions that result from Torque and Bending Moment. It is not enough to design the support system for acceptable levels of stress. It must be rigid enough to take care of Start-up torque load (2.5 times the Torque), and preclude large deflections that may result in mixer vibration.
- When designing the support structure to accommodate bending moments, be sure that the structure is sufficiently rigid so that the mixer extension shaft will not move more than 1/32" per (10) feet (0.8 m per 3.05 meters) of shaft length due to deflection of the support structure.
- After the gear drive (with the motor already flange mounted onto the drive) has been properly installed, the mixer extension shaft should be installed into the gear drive's hollow output shaft (quill shaft) and fastened in the quill shaft with the thrust plate and secured in position with the threaded bolt provided use Locktite Blue (or equivalent), or in the case of an output shaft coupling, bolt the mating flanges together.
- Mixer blades over 20" in diameter are generally bolted to a welded hub. Check the welds on the hub on your yearly overall inspection.

- These mixers are supplied with the finest electric motors available. They are manufactured by a nationally known manufacturer, (e.g. NORD, WEG, Brook etc). Under normal operating conditions, within specified temperatures, proper installation and maintenance, these motors are guaranteed to deliver rated output.
- In order to get top performance from any electric motor, be sure that there is plenty of air circulation and a minimum of obstructions. On fan cooled motors, be sure not to choke off the suction inlets, also be sure to check the allowable temperature that's indicated on the motor nameplate. Don't decrease the service life of a motor by operating it at excessively high ambient temperature.
- In order to avoid damage to the motor during temporary overloads, jams, etc. be sure that correctly sized overload protection is provided. Starter overload heater elements can be sized from the full load current of the motor as shown on the motor nameplate. It is advisable to consult a supplier of motor control equipment when selecting thermal overload heaters.
- Before the motor is permanently wired, check to be sure that the output shaft rotation is correct (Normally clockwise looking down from the mixer drive, but sometimes counterclockwise depending on the process requirements)

#### CAUTION:

• Make sure to check rotation of the mixer before it is operated. To reverse the rotation of standard 3 phrase electric motors, simply switch any two power leads.

#### MOTOR SPECIFICATIONS: 1800 RPM - (4) pole

NORD motors carry the CE mark in accordance with the Low Voltage Directive

NORD motors are designed to operate at elevations up to 1000 m (3300 ft) above sea level

Altitude: up to 1000 m = 100% output Ambient Temp =  $40^{\circ}$  C Above 1000 up to 2000 m = 92% output Ambient Temp.=  $32^{\circ}$  C Above 2000 up to 3000 m = 83% output Ambient Temp =  $24^{\circ}$  C Above 3000 up to 4000 m = 74% output Ambient Temp =  $16^{\circ}$  C

- NORD motors are designed to operate with a maximum ambient temperature of 40° C (104°F) - for higher temperatures, motors have to be de-rated or an upgraded insulation used.

Ambient Temperature:  $(104^{\circ}F) \ 40^{\circ} \ C = 100\%$   $45^{\circ} \ C = 95\%$   $50^{\circ} \ C = 89\%$   $55^{\circ} \ C = 83\%$   $60^{\circ} \ C = 67\%$  $70^{\circ} \ C = 64\%$ 

EXAMPLE: A motor designed for an output of 100 HP to operate in the mining area of Bolivia (altitude 4000 m above sea level). NOTE: 1000 meters = 3281 Feet

Output reduction: the maximum allowable output of the motor would be 74% (74 HP)

Ambient temperature limit: the motor may operate at its rated output of 100 HP provided that the ambient temperature does not exceed 16° C

Note: You can operate over 3300 feet, but you have to de-rate the motor

- Voltages: Canada 575/3/60, TEFC; USA 460/3/60, TEFC; Europe 400/3/50, IP55; Australia 415/3/50
- Tolerances Voltage & Frequency: ± 10% based on rated voltage; Line frequency tolerance
   + 5%. Combined MAXIMUM variation in voltage and frequency + 10%
- -- MG1 Part 31 suitable for inverter service
- Insulation Class is Class F (non organic)
- -- High-efficiency design for motors 1 HP and up
- Service Factor 1.15
- The Standard Nord motor fan is a non-sparking
- Each Nord motor uses a terminal block
- Integral Nord motor (unless Nema motor with "C" flange)

#### SECTION 5 - Pedestals: Shaft & Gearbox Removal - EVG SERIES

• Series EVG standard design of the dry-well pedestal and shaft catcher is one where the flinger (for the dry well) and the shaft catcher are one-in-the-same part serving both purposes.

#### SHAFT REMOVAL AND/OR TO REMOVE THE GEAR REDUCER:- See assembly dwg

- i) Lock-out electrical power to the electric motor.
- ii) If the electrical wiring is not long enough to allow removal of the gear reducer, dis-connect the motor wiring.
- iii) Remove the safety cover located on top of the gear reducer exposing the bolt (# 3) and top plate (# 4) which holds the shaft (# 12).
- iv) Slowly remove the top bolt.(# 3).
- v) As the bolt is loosened, the shaft and impeller assembly will be lowered a distance of about 0.125" (3.175 mm).
- vi) After the bolt has been loosened sufficiently, the flinger (# 8) will come into contact with the Pedestal to the inner support pipe (# 11) and stop there.
- vii) Remove the bolts holding together the Adaptor plate Reducer to Pedestal top plate (#7).
- viii) Lift-off the complete gear reducer unit the gearbox clears the shaft.
- ix) Inside of the Pedestal (# 10), you can now see the flinger (#8) which rests on the Collar / Clamp (2) Bolts / Shaft catcher (# 9).
- x) Prior to un-doing the set screws on the collar / Clamp, make preparation to handle the shaft which will now fall through the dry well (# 11) and into the tank.
- xi) Once the shaft is secured loosen the set screws on the Flinger assembly or Clamp bolts (# 9).
- xii) To Reinstall the shaft (et al) follow the above procedure in Reverse.

<u>Note</u>: In older designs, the flinger was welded-onto the shaft. In that case, the shaft can only be removed vertically through the top of the Pedestal.

#### SECTION 5 - Pedestals: Shaft & Gearbox Removal Page 7

#### CAUTION:

- Prior to loosening the (3) set screws on the flinger/shaft-catcher, please ensure that there is some means of holding the shaft in-place (if no Clamp supplied, use (2) pieces of wood 4" x 4" or 6" x 6" with tightening bolts to hold the shaft in place via friction) IF NOT, THE SHAFT WILL DROP INTO THE TANK possible causing damage to the equipment or vessel and bodily injury. Shafts are often of sufficient weight to cause serious bodily injury or even death were it not properly secured.
- You may want to install a plastic hose in the pedestal so that you can monitor if the gear reducer is losing oil and collecting in the dry-well pedestal.

A Split Collar is used to prevent the shaft from accidentally falling from the gear reducer:

**NOTE**: On older Series EVG, there may not be a Split Ring but rather a flinger that rests on the dry well seal to hold the shaft in-place

- (i) Insert eye-bolt in top centre of the impeller shaft.
  - (ii) Slowly lift up the complete impeller shaft assembly a distance of 6 mm (0.25").
  - (iii) Remove the split collar that rests against the top of the quill shaft of the gearbox.
  - (iv) Slowly lower the complete shaft/impeller assembly a distance of 10 to 12 mm (0.375"to 0.50".
  - (v) At this point, the flinger/clamp ass'y will come into contact with the pedestal top inner support pipe/Dry-well
  - (vi) Remove bolts.
  - (vii) Lift off the complete gear reducer until the gearbox clears the shaft and eye-bolt.
  - (viii) The reinstall the gear drive, follow the above procedure in reverse

#### SECTION 5 - SHAFTS, IMPELLERS & FLANGED COUPLINGS

#### **SHAFT - STRAIGHTNESS**:

• When shipped, the mixer extension shaft was straight to within 0.003" per foot (0.25 mm per meter) of shaft length for mixers equipped with centre-less ground shafts (Special Order/uncommonly used). If the shaft does not appear to be damaged, but the run-out is greater than the above standard, the shafting supplied may have been "smooth-turn" (more commonly used), which might not be dimensionally

the same over the entire length of the shaft. This is probably still acceptable. In such cases, or where it might be difficult to obtain an accurate shaft run-out value, we may apply another rule: 0.25 to 0.50% of the impeller diameter = the maximum shaft run-out at the bottom of the

shaft. e.g: 50" diameter impeller 0.14 to 0.28" 100" diameter impeller 0.26 to 0.53" 150"diameter impeller 0.40 to 0.67"

#### SECTION 5 - SHAFTS, IMPELLERS & FLANGED COUPLINGS

• Flanges are used as shaft couplings when shaft extensions exceed approx 12'-0" (3.65 m) Ensure that the bolts are tightened and that a product like Never Seize (or equivalent) is used. Refer to the table (in this manual) for torque tightening values

Recheck bolt tightness after 1500 hours (or (3 months) These couplings are welded onto the shafts with (4 to 6) gussets and are not removable.

#### CAUTION:

- Handle the shaft carefully to be sure that it is not bent.
- After the shaft has been installed, check it for straightness. Storage and handling may have resulted in a bend. To check it, an indicator is placed at the end of the shaft, and the high speed shaft is then rotated by hand. Runout of the total shaft should not be greater than the above \references values. If the runout is greater than the above values, the shaft can be restraightened in the field. To re-straighten the shaft, follow this procedure:
- Where the maximum, positive readout is found, place the indicator on that side of the shaft.
- Heat the shaft at a point of 180° from the indicator, (and just below the first in-tank coupling if applicable), apply heat just below the mounting nozzle.
- The shaft will grow toward the indicator as heat is applied to it. However, <u>DO NOT</u> permit the surface temperature to go over 500° F (260° C). Use Tempilstics or equivalent
- The shaft will straighten since it will draw more than it grows.
- After each heating process, rotate the shaft and recheck until the straightness is within tolerance to meet the allowable tolerance
- To install any impeller, simply slide the impeller hub onto the extension shaft above the shaft keyway. Install Hook type (Gib) key into the keyway making sure that the pin is inserted into the

correct hole for proper impeller location. Lower the hub (with or without blades bolted-on) down onto the key. Tighten set screw. Bolt -on blades if not already done.

NOTE: All MIX-TECH Portable mixers operate at least 35% below the 1st Critical speed or harmonic frequency - There is no danger of "hitting-on" or approaching the 1st Critical speed - (Unless specifically mentioned otherwise)

- Please refer to the specific manufacturer's installation and operating manual.
- Correct lubrication practices are essential to long life and satisfactory performance of a gear drive. Be sure to use the right lubricants as recommended. With proper lubrication

maintenance, the gear drive will carry its rated design load and provide years of satisfactory operation.

#### SECTION 6 - SHAFTS, IMPELLERS & COUPLINGS Page 9

#### **IMPELLERS**

• Make sure that the impeller blades have been installed onto the hubs in the proper position with regard Rotation and Direction of flow. Please also note that the impellers blades are installed with the hubs ears always backing the blade into the flow. Also be sure that the leading edge and not the trailing edge is presented into the flow and that the angle at the impeller tip (angle of attack) from the horizontal is closer to 15° rather than to 75°.

#### CAUTION

- If the angle of attack (at the impeller tip is closer to 75°, either an incorrect hub in combination with the correct impeller blade (OR VICE VERSA) has been incorrectly assembled to make an incorrect matching of possible hub and blade combinations. For help in determining what the correct combination should be, please refer to the mixer nameplate that will have the Rotation and direction of thrust written. Once you know the combination, refer to the pictorial guide of impeller / hub installation positions A, B, C or D.
- Depending on whether the concave or the convex surface is facing the fluid, if the angle of attach at the impeller is closer to 75°, the HP drawn will be 2 to 3 times greater than what it should be. This could result in overloading the motor and damaging the mixer.
- Make sure that the impeller blades are installed in the correct position for the required rotation. e.g. if the impeller blades are installed up-side-down, the pumping capacity will be reduced by about 65%. Check the mixer nameplate for the flow direction and install the blades to suit.

#### SECTION 7 - GEAR DRIVE MAINTENANCE

#### CAUTION:

- By following instructions, many premature gear and bearing failures can be avoided.
- Keeping a maintenance log is highly recommended.
- Lubricant used in the gear case must be free of dirt, metal particles and other contaminants. Use only new oil. Strain the oil if there is any possibility that it contains contaminants.
- To equalize pressure inside and outside the gear case, a breather vrnt is installed on top of the unit. This breather normally requires no maintenance, and must not be blocked. Check hole for free breathing.

#### **PORTABLE MIXERS:**

Lubrication For PORTABLE MIXERS (**Series "EHG"**), the Crown & worm gear reducers are filled for life (20,000 hours or (4) years) with synthetic oil

#### CAUTION:

• For shipment, the gear-case is drained of oil (EXCEPT FOR NORD drives) - Be sure to fill the gear case with the proper lubricant to the proper level. Install breather. DO NOT OVERFILL - N.B: if the reducer is already filled, (as is the case with NORD drives), Do not forget to install the breather(s) or the seals may fail.

#### RECOMMENDED LUBRICANTS FOR NORD HELICAL GEARING:

These Nord Gear reducers are factory-filled with Shell Omala 220 mineral oil or with Chevron ISO FM 220 food grade oil (if required), or equivalent: or with Shell Omala 220 regular mineral oil fill when the mixer is provided with a dry well seal unless otherwise specified:

**N.B**: A reducer previously filled with Shell Omala 220 mineral can be drained (as much as practical to achieve), and Chevron ISO FM 220 substituted without any harmful chemical reactions or reduction to the lubricating quality of the new (or old) oil.

- Please note that the gear reducers for MIX-TECH'S "EVG" series are Nord Parallel shaft drives. The top output bearing is grease packed although there is not grease nipple. Please remove the seal and re-pack the bearing with grease. (please refer to NORD instruction attached)
- The output shaft seals are "Quadrilip" having (2) discrete grease filled pockets

# S E C T I O N 7 - GEAR DRIVE MAINTENANCE FOR SERIES EVG & EVGX parallel Shaft design gear reducers:

#### • RECOMMENDED OIL CHANGE INTERVALS IN NORD IOM: -

Synthetic lubricants should be changed every 20,000 service hours or (4) years; Mineral oils should be changed every 10,000 service hours or after (2) years. See gear reducer service manual (IOM).

#### CAUTION:

Units should be checked out periodically for increased noise, surface temperature, vibration, shaft

#### SECTION 7 - GEAR DRIVE MAINTENANCE

movement, and amperage draw. Units with inspection covers should not be operated with the inspection covers removed.

**PROCEDURE FOR RE-GREASING THE UPPER OUTPUT BEARING** equipped with Tapered roller bearing option:

- Remove upper output shaft seal(s).
- Inspect bearing cavity for presence of grease. The bearing cavity should be packed to approximately 1/3 full with grease.
- If required, inject grease into the taper roller bearing until the cavity is filled to 1/3. A Needle Nozzle is generally required on the grease gun, because the shim(s) partially cover the access to the bearing cavity.
- Install new upper output seals.

**Note**: The other bearings in these gearboxes are open and are submerged in oil.

The recommended interval for changing the gearbox oil is every 10,000 hours of operation.

- The standard ambient temperature selected is 15 to 125° F (9 to 52° C) for the gear reducer.
- Some Gear reducers are equipped with bulls-eye oil level indicators, others have a plug.

#### SECTION 8-BOLTS

• Impeller blades & other in-tank fasteners are supplied as standard with lock-washers.

#### CAUTION:

• Extreme care should be taken to see that locking devices are properly installed and to be sure that the bolts/studs are properly tightened and lubricated.

It is recommended that all in-tank fasteners (and all other bolts), be rechecked for tightness after the first 1500 hours of operation and subsequently, at each scheduled shut-down and that a suitable lubricant be used e.g. Never seize or equivalent.

#### **RECOMMENDED BOLT TORQUE VALUES:**

#### **BOLT SIZE TIGHTENING TORQUE**

	(Foot Pounds)		
1/2" - 13	50	1.25" - 7	580
5/8" - 11	100	7/8" - 9	190
3/4" - 10	190	1.50" - 6	1000
1" - 8	290		

NOTE: Tighten all bolts as specified. Lubricate all fasteners with an anti-seize product. If no lubrication is used when tightening the bolts as specified, multiply the table values by 1.3

#### **GEAR REDUCER & MOUNTING PLATE BOLTS:**

These bolts are also subject to high loads and should be properly torqued to prevent bolt stretch and/or reducer wobble. For situations with large reducers or long shafts with large reducers, use additional care to make sure that these bolts are installed and torqued properly

This "Turn of the nut Method" can be summed up in one sentence: "Turn the Nut ½ to 2/3 turns beyond the snug tight position, "this applies to any bolt of any size. However, fasteners should be clean, rust free and lightly oiled.

In cases where the nut is not accessible, the bolt may be turned ½ to 3/4 turn beyond snug tight.

LEVER ARM SYSTEM	<b>Bolt size</b>	Lever Arm
	1/4 - 3/8"	6" handle
	7/16" - 5/8"	12" handle
	3/4" - 1.125"	24" handle
	1.25" and over	36" handle

**Note:** This lever arm system should be used with or without lock-washers. If lock-washers show sign of splitting or fatigue, they must be replaced

#### SECTION 9 - OPERATION

• The mixers that you have purchased have been designed to accommodate all the loads that will be encountered in the normal course of operation.

#### CAUTION:

• Care must be taken to avoid prolonged operation of the mixer impeller(s) at liquid interface. These mixers were not designed to operate under those severe conditions and could become damaged.

# SECTION 10 - MOTOR REMOVAL & INSTALLATION OF MOTORS:

- For Nema "C" Flanged motors (not integral motors)
  The motors supplied have been installed onto the reducers. In the event of motor maintenance, remove the bolts which hold the gear reducer's Nema "C" flange adaptor to the motor's "C" face. Remove the coupling half and service the standard NEMA motor as required. INSTALLATION: reverse the procedure. Please refer to "COUPLING ENCLOSED" cross sectional drawing which shows the mounting distance 1 13/16" (46.03 mm). Note that the coupling is keyed onto the motor shaft (key provided).
- In the case of <u>NORD integral motors</u>, remove the bolts. The motor can then be removed exposing the high speed pinion gear mounted on the motor shaft. The motor can then be serviced as required.

#### SECTION 11 - TROUBLE-SHOOTING / MIXER PERFORMANCE

• <u>PERFORMANCE</u>: If you find that the mixer is not performing according to your expectations, one of the things that directly affects mixer performance is Baffles (or lack thereof)

<u>Note</u>: Also check that the impeller blades are in the correct configuration A, B, C or D, that the correct blades are matched to the correct hubs and that the rotation is correct.(Please refer to Section 6 Pages 7, 8 & 9 for more information.

N.B: <u>Baffles always help any mixer application</u> by providing the means to convert rotational motion into to top-to-bottom- pumping/mixing.

- If the viscosity of the fluid is over 25,000 cp, then baffles are not necessary.
- If the vessel is rectangular in shape, baffles may not be necessary.
- In circular or square vessels, the use of baffles is mandatory.
- OTHER METHODS of achieving top-to-bottom motion without using baffles:
  - Off-centering the mixer by 20% (uses the vessel as a baffle)
  - Angle mounting (into a quadrant)- often seen on Portable mixers. If you want to angle-mount a larger mixer, please check to be sure that the shaft was designed to accept these additional stress loads.
- OIL LEAK(S) problems with Nord Gear reducers: In order to be able to address the

**OIL LEAK(S)** For Series EVG supplied with a flinger / shaft Catcher & dry well seal:

**NOTE**: For Series **EVGX**, There is an oil overflow plastic pipe indicating oil leak>

If one of the (2) output oil seals were to fail (very rare), then the oil would migrate down the output shaft, and be pumped by the flinger into the moat surrounding the dry well pipe. Any such leak would be contained by our sealed pedestal. (access to it is by a plug). Any other oil leak will be visible on the outside of the gear reducer

SYMPTOM		REASON(S)	SOLUTION	
Oil leak on the reducer		Vent plug not installed Vent plug painted over Vent plug failure	Clean up oil and remove the vent plug If this stops the leak, change the vent plug	
Oil leak on top of the	reduce	Motor and/or top bolts not tightened	Use Teflon tape and tighten bolts	
Oil leak on top of redu	icer	Too much oil in the reducer will be forced out of the vent	Check oil level and adjust to site glass	
Oil leak on end plate		Bolts loose	Tighten bolts	
Oil leak on top of the	reduce	Gasket between motor and the reducer failed	Replace gasket and silicone dealant	
Sign of oil on the reducer		Drain pipe & valve damaged	Use Teflon tape /sealant to try to reseal	
Oil leaking on reducers with "C" flanged motor(s)		if the vent was not installed, Change the input oil seal plugged or faulty, the oil presure in the reducer might have exceeded 2 psi causing the input oil seal to "blow-out"		
, <del></del>	Under normal circumstances, Mix-Tech mixers operate quietly and without vibration. If there is a metal-on-metal noise, check to see if the top bolt # 3 is properly tightened to the shaft. If the bolt is not, the shaft will lower than it should be and the flinger/shaft catcher may be touching the dry well pipe			
• <u>HEAT</u> :	Check	the temperature of the Reduce	er and motor. If hot, check the oil level.	

**NOTE:** On Series EVG & EVGX, an oil expansion chamber is supplied to minimize problems with over-filling of oil into the gearcase

#### SECTION 12 - WARRANTY

- These mixers should provide long and satisfactory service. Only the finest materials were employed in their manufacture. However, if any defects in materials or workmanship occur, the defective part(s) must be returned to ENVIREQUIP (div 6335772 Canada Inc), MIX TECH Division, freight prepaid. ENVIREQUIP reserves the right to repair or replace, at its discretion, any part that proves to have been defective in materials or workmanship.
- ENVIREQUIP is not responsible for the warranties on components purchased, e.g. motors, but will endeavour to help to obtain resolution of any problem(s) with any of our subsupplier(s) as regards their warranties.
- ENVIREQUIP specifically excludes any liability as to loss of production, improper use of the equipment, abuse, any other liability expressed or implied that exceed the limited warranty given as applies to the equipment being free of defects in materials and/or workmanship.
- ENVIREQUIP's warranty is for (2) years against defects in materials or workmanship and also includes a process warranty.
- This Process warranty only applies to the actual conditions that were specified at the time of bidding.
- Please refer to the terms and conditions as well as to the warranty for complete details.

Call toll free 1-866-819-6123

#### **ENVIREQUIP / MIX-TECH MIXERS**

Page 16

#### **CONVERSION FACTORS**

1 inch = 25.4 mm

1 kilogram = 2.205 lbs

1 U.S. gallon = 3.785 litres

U.S. gallons x 0.2642 = litres

 $1 \text{ m}^3 = 264.2 \text{ U.S. gal}$ 

 $1 \text{ ft}^3 = 7.481 \text{ usg}$ 

 $1 \text{ ft}^3 \text{ of water} = 62.4 \text{ lbs}$ 

1 foot = 0.3048 meters

1 psi = 6.895 Kpa

1 Kpa = 0.145 psi

1 K Cal = 3.967 BTU

1 HP = 0.7457 kW

1 kW = 1.341 HP

1 Bar = 14.5 psi

 $1 \text{ kg/m}^2 = 14.22 \text{ psi}$ 

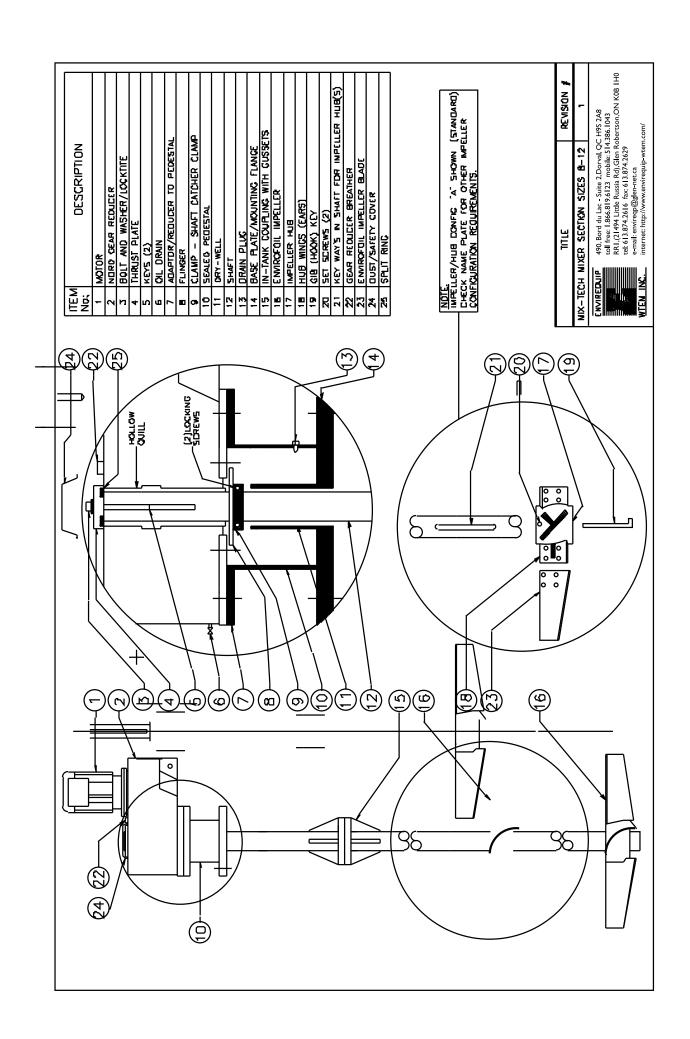
1 Newton = 0.2248 pounds (force)

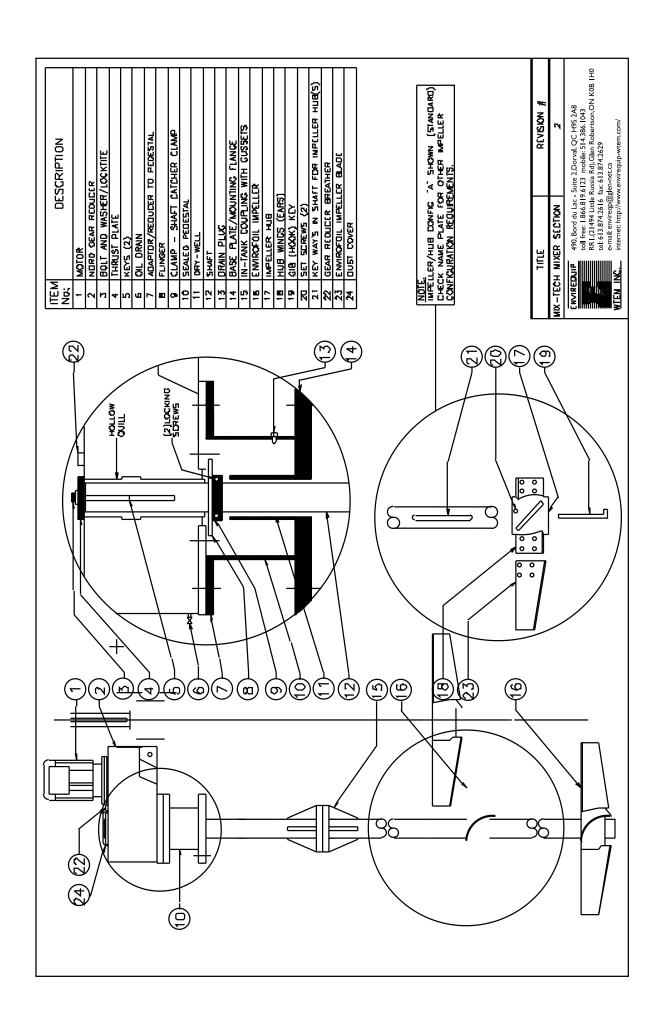
1 lb in = 0.1129 Newton-meter (Nm) force

1 lb in = 1.1519 kg-cm

 $1 \text{ kg/cm}^2 = 14.23 \text{ psi}$ 

ENVIREQUIP / MIX-TECH MIXERS	S		Page 17
MAINTENANCE LOG	BY: DAT	E:	Signed
TASK			
CHECK OIL			
CHANGE OIL			
CHECK PEDESTAL for OIL LEAKAG	E		
CHECK FOR HEAT			
CHECK FOR NOISE			
CHECK FOR VIBRATION			
CHECK BOLT TIGHTNESS: Top bolt & Pedestal bolts Base bolts Clamp Coupling Hub & blades Reducer end cover bolts			
CHECK MOTOR AMPERAGE			
CHECK ROTATION AFTER ELECTRICAL WORK			
OTHER			

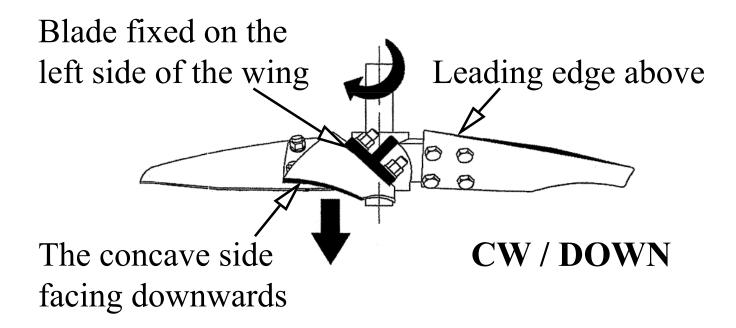


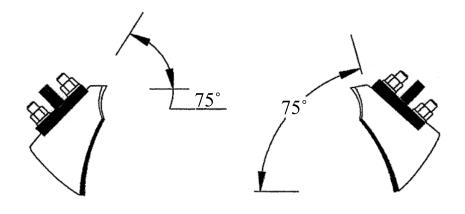


# IMPELLER BLADE INSTALLATION (A)

Please check the mixer nameplate for Rotation and Direction of Thrust

## ► CLOCKWISE / DOWN (Standard)

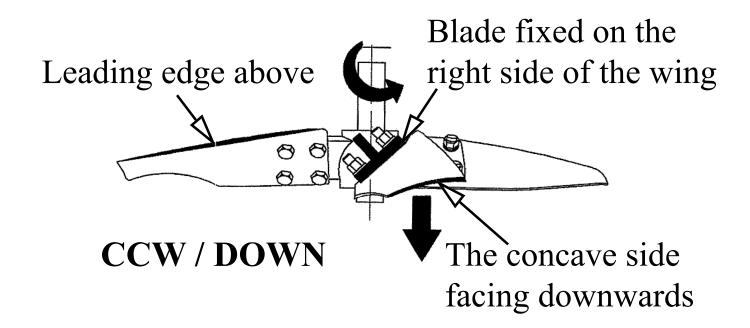


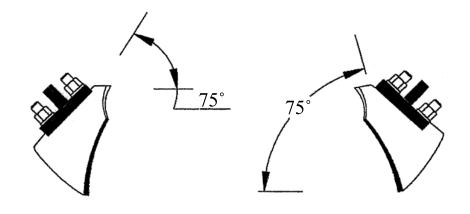


# IMPELLER BLADE INSTALLATION(B)

Please check the mixer nameplate for Rotation and Direction of Thrust

## **▶ COUNTER-CLOCKWISE / DOWN (Mirror)**

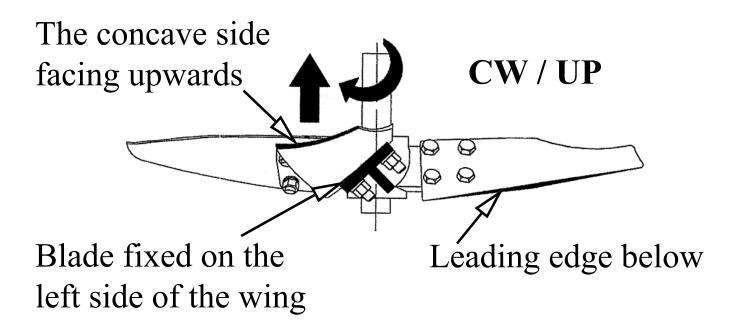


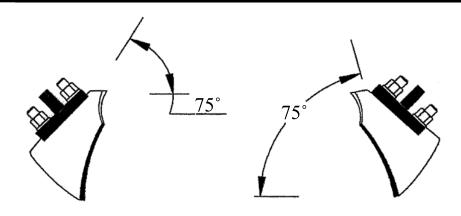


# IMPELLER BLADE INSTALLATION ©

Please check the mixer nameplate for Rotation and Direction of Thrust

# **CLOCKWISE / UP (Mirror)**

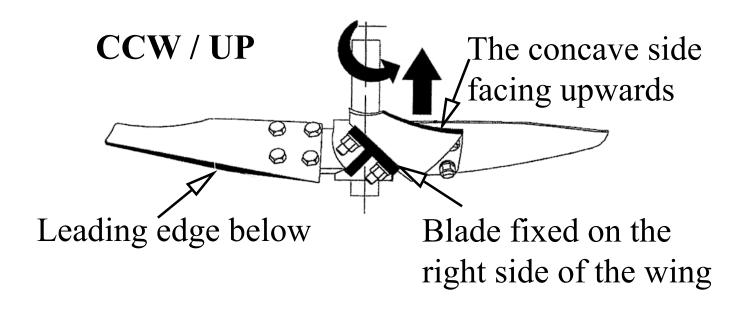


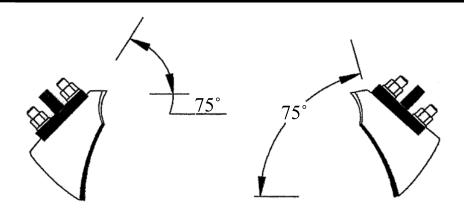


# IMPELLER BLADE INSTALLATION (D)

Please check the mixer nameplate for Rotation and Direction of Thrust

# ▶ COUNTER-CLOCKWISE / UP (Standard)





#### **CONVERSION FACTORS**

1 inch = 25.4 mm

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1 U.S. gallon = 3.785 litres

U.S. gallons x 0.2642 = litres

 $1 \text{ m}^3 = 264.2 \text{ U.S. gal}$ 

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1 foot = 0.3048 meters

1 psi = 6.895 Kpa

1 Kpa = 0.145 psi

1 K Cal = 3.967 BTU

1 HP = 0.7457 kW

1 kW = 1.341 HP

1 Bar = 14.5 psi

 $1 \text{ kg/m}^2 = 14.22 \text{ psi}$ 

1 Newton = 0.2248 pounds (force)

1 lb in = 0.1129 Newton-meter (Nm) force

1 lb in = 1.1519 kg-cm

 $1 \text{ kg/cm}^2 = 14.23 \text{ psi}$ 

#### **ENVIREQUIP-JMI/MIX-TECH MIXERS**

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**MAINTENANCE LOG** 

BY:

DATE:

**TASK** 

**CHECK OIL** 

**CHANGE OIL** 

CHECK PEDESTAL FOR OIL LEAKAGE

CHECK FOR HEAT

**CHECK FOR NOISE** 

CHECK FOR VIBRATION

**CHECK BOLT TIGHTNESS:** 

Top bolt & Pedestal bolts

Base bolts

Clamp

Coupling

Hub & blades

Reducer end cover bolts

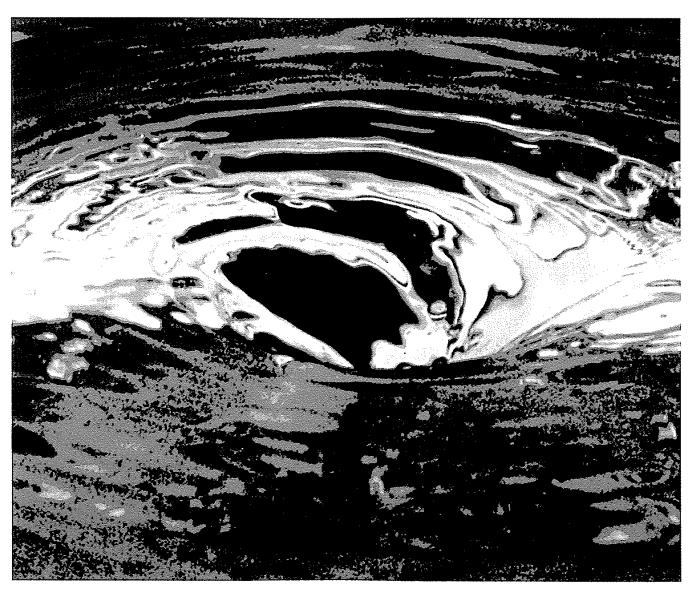
CHECK MOTOR AMPERAGE

CHECK ROTATION AFTER ELECTRICAL WORK

**OTHER** 

# ENVIREQUIP

# MIX-TECH DYNAMIC MIXERS





**MIX-TECH... GOOD PEOPLE TO MIX WITH** 

# ENVIREQUIP

## MIX-TECH MIXERS - WARRANTY - SERVICE

#### WARRANTY

**ENVIREQUIP** offers a 2 Year warranty against defects on materials and workmanship and a process warranty providing that the process information provided at the time on which the mixer selection was based is correct.

#### **SERVICE**

MIX-TECH have shipped mixers to many parts of the world. MIX-TECH provide sales and service in North America through our own staff and through our network of distributors and representatives. For the MIX-TECH Series EVG mixers, the drives are Nord Gear. Because MIX-TECH do not remove the nameplates from the original Nord drive, our clients have the original serial numbers of the drive(s). For any problems or for new applications, please contact us directly toll free at 1-866-819-6123 or fax us at 1-613-874-2629.

Additionally, Nord provide sales and service in hundreds of locations in most countries worldwide. You are never far from service anywhere in the world.

#### **CONTACT US**

From all of us at **ENVIREQUIP**, we thank our clients very much for your interest in our equipment and for your patronage. We promise to continue to manufacture top quality, rugged equipment, that is energy-efficient, feature-packed, at a reasonable price. Contact us toll free at 1-866-819-6123, fax us at 1-613-874-2629, send e-mails to: envireqp@glen-net.ca or visit our web site at www.envirequip-wtem.com

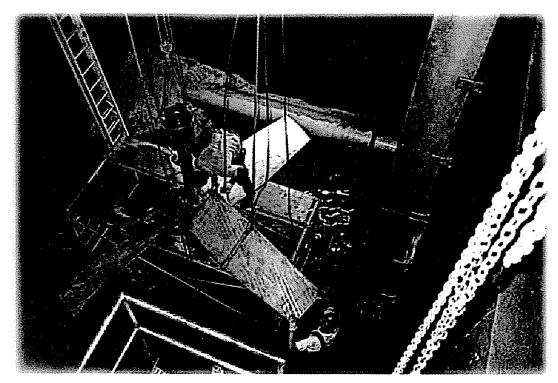
Or contact Vivendi one of our licensees for water and waste water applications at 1-514-334-7230.

For a mixer selection and quotation, please call, fax, e-mail, check our web site, or write to us, and we will be pleased to provide you with a prompt energy-efficient mixer quotation.

#### **REPRESENTED BY:**

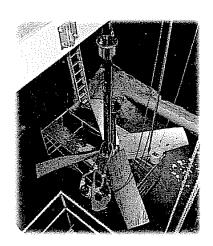


# DYNAMIC MIXERS EVG & EVG-FP SERIES 1/4 TO 200 HP



#### **MIX-TECH FEATURES:**

- Large service factors on gear drives minimum 2.5.
- Shaft stress to 9000 psi maximum.
- Impeller / Hub / Coupling 6000 psi maximum.
- All drives are capable of reverse rotation.
- Optional pedestal with shaft catcher design, that allows removal of the gear drive without disturbing the wet end.
- "FP" Option: The reducer is totally isolated from the random hydraulic loads imposed by the shaft & impeller assembly.
- Large shaft capability operating at 65% of the shaft's 1st Harmonic frequency or Critical Speed.
- Mounting options: Steel base, pedestals and custom.
- Seal options: HPLRSB, LPSB, Lip seals, Single, Double, Dry-Running or Cartridge seals.
- Motor options: Nord integral Standard; Nema motors, hydraulic & pneumatic motors also available.
- Full range of impellers including ENVIROFOIL.



## **MIX-TECH... GOOD PEOPLE TO MIX WITH**

# ENVIREQUIP MIX-TECH MIXERS - WARRANTY - SERVICE

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#### **CONTACT US**

From all of us at ENVIREQUIP, we thank our clients very much for your interest in our equipment and for your patronage. We promise to continue to manufacture top quality, rugged equipment, that is energy-efficient, feature-packed, at a reasonable price Contact us toll free at 1-866-819-6123, fax us at 1-613-874-2629, send e-mail to:envireqp@glen-netca or visit our web site at www.envirequip-wtem.com

Or contact Vivendi one of our licensees for water and waste water applications at 1-514-334-7230

For a mixer selection and quotation, please call, fax, e-mail, check our web site, or write to us, and we will be pleased to provide you with a prompt energy-efficient mixer quotation.

#### **REPRESENTED BY:**



MIX-TECH... GOOD PEOPLE TO MIX WITH

# **JOHN MEUNIER**

Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference: NC01

# MIXERS GEAR REDUCERS



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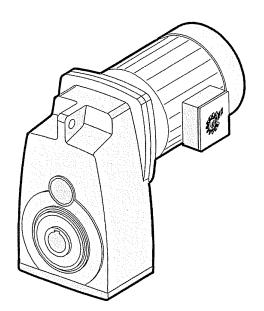
#### Betriebs- und Wartungsanleitung Operating and Maintenance Instruction Instructions de conduite et d'entretien

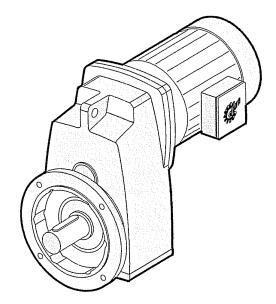
**B** 1021

08/2000

Diese Sicherheitshinweise sind aufzubewahren. These safety instructions must be kept available. Ces instructions de sécurité doivent être observées.

 $(D)(\overline{GB})(\overline{F})$ 





Flachgetriebe und NORDBLOC-Flachgetriebe

Helical Shaft Mounting Gearboxes and NORDBLOC Helical Shaft Mounting Gearboxes

Réducteurs à arbres parallèles et NORDBLOC Réducteurs à parallèles

∆ Warnung

Es wird vorausgesetzt, daß die grundsätzlichen Planungsarbeiten der Anlage sowie Transport, Montage, Installation, Inbetriebnahme, Wartung und Reparaturen von qualifiziertem Personal ausgeführt bzw. durch verantwortliche Fachkräfte kontrolliert werden. Bei Arbeiten am Getriebemotor muß garantiert sein, daß keinerlei Spannung anliegt, und dieser gegen Wiedereinschaltung

∆ Warnung

Veränderungen gegenüber dem Normalbetrieb (höhere Leistungsaufnahme, Temperaturen, Schwingungen, Geräusche usw. oder Ansprechen der Überwachungseinrichtungen) lassen vermuten, daß die Funktion beeinträchtigt ist. Zur Vermeidung von Störungen, die ihrerseits mittelbar oder unmittelbar schwere Personen-Sachschäden bewirken könnten, muß das zuständige Wartungspersonal dann umgehend verständigt werden.

Δ Im Zweifelsfall die entspechenden Betriebsmittel sofort abschalten!

Aufstellung, Vorbereitung

- -Transportösen am Getriebe sind für das Gewicht des Antriebs ausgelegt -Fundamente ausreichend bemessen und
- schwingungsfrei ausführen

   Getriebe oder -motor fest verspannung montieren

   ausreichende Belüftung vorsehen fest und ohne

- serienmäßiges Innengewinde nach DIN-EN 332 zum Aufziehen von Verbindungselementen auf die Wellen benutzen Schläge auf die Wellen v
- Schläge auf die Wellen vermeiden (Lagerbeschädigung!) Maschine und Getriebe möglichst mit elastischen Kupplungen verbinden vor dem Einschalten Abtriebselemente
- aufziehen bzw. Paßfeder sichern
- -bei Aufsteckgetrieben mit Drehmomentstütze Gummipuffer verwenden

#### Elektrischer Anschluß

- Motoranschluß nach Schaltbild vornehmen
- Übereinstimmung von Netzspannung und Frequenz mit den Typenschild-Daten sicherstellen
- Sichere Schutzleiterverbindung herstellen
- evtl. falsche Drehrichtung korrigieren durch Vertauschen von 2 Phasen
- Nicht benötigte Kabeleinführungsöffnungen und den Kasten selbst staub- und wasserdicht verschließen
- Überbelastung und Phasenausfall durch Schutzschalter vorbeugen Einstellen des Motorschutzschalters auf
- Nennstrom
- Schaltbilder auf der letzten Seite

#### Inbetriebnahme

- längeren Lagerzeiten besondere Vorkehrungen treffen (siehe Werknormblatt
- Vorkehrungen ...
  "Langzeitlagerung")
  der Ölstandschraube
  entspre nach Lage Bauformtabellen entsprechenden Kataloges feststellen - Prüfen des Ölstandes
- Entfernen des Verschlußstopfens vor Inbetriebnahme (Überdruck!), ggf. Druck-entlüftungsschraube montieren Normale Erstbefüllung: siehe Schmier-
- stofftabelle
- Luftgekühlte Motoren sind für Umgebungs-temperaturen von 20°C bis +40°C sowie Aufstellungshöhen å 1.000 m über NN
- Der Einsatz im Ex-Bereich ist nicht zulässig, sofern nicht ausdrücklich hierfür vorgesehen

#### ∧ Caution

It is presumed that fundamental project work as well as all work with regard to transport, as well as all work with regard to transport, assembly, installation, starting-up, maintenance and repair is performed by qualified personnel or supervised by skilled labour taking overall responsibility. Make absolutely sure that no voltage is applied at all while work is being done on the grant mater. while work is being done on the geared motor. Drive must also be secured against switching

#### **∆** Caution

Any deviation from normal operating conditions (increased power consumption, temperature, vibrations, noise etc.) or warning signals by monitoring equipment suggest the responsible the malfunction. Inform responsible maintenance personnel at once to prevent the trouble from getting worse and causing, directly or indirectly, serious physical injury or material damage.

Δ In case of doubt disconnect the machine immediately!

#### Preparing and performing installation

- Lifting devices on the drive are designed to carry the drive weight
- the foundation (base) should be of adequate size and vibration-proof
  -install gear unit or geared motor rigid and

ensure sufficient ventilation

- make use of tapped hole (DIN-EN 332) to suit fastening to the shaft end
- avoid shocks on shafts (bearing damage!)
   preferably use flexible coupling between output shaft and driven machine
- fit output elements to shaft end or secure feather key before starting the motor

  - use torque arm with rubber buffer on shaft
- mounting gearboxes

#### Connection of motor

- Connect motor according to diagram
- -make sure that mains voltage/frequency are in accordance with nameplate information make secure protective conductor conection
- -if motor is running in reverse direction, interchange two phases
- Close unused cable entrances holes and the box itself in a dust- and watertight manner.
- install protective switches overload and phase failure prevent to
- set motor protection switch to nominal current
- wiring diagrams on the last page

- Starting up
  -in case of long-time storage take special precautions (as provided in works standard sheet "Extended Storage")
- check position of oil-level plug with help of mounting position tables catalogue
- check oil-level
- prior to starting-up, remove vent plug from vent screw if necessary

  if not specified otherwise, first oil filling as is
- shown in list of lubricants
- air-cooled motors are designed for ambient temperautres between -20°C and +40°C and for installation at altitudes â 1.000 m above
- Their use in hazardous areas is prohibited unless they are expressly intended for such use (follow additional instructions)

#### ∆ Avertissement

Il est impératif que les travaux fondamentaux de l'installation, ainsi que tous les travaux de transport, montage, installation, mise en exploitation, entretien et réparation soient accomplis par du personnel qualifié et contrólés par des techniciens spécialisés dans ce domaine. Avant toute intervention sur le motoréducteur, il faut s'assurer que celui-ci n'est plus sous tension et que la remise sous tension soit interdite.

#### ∆ Avertissement

Si en utilisation normale, des modifications de fonctionnement apparaissent telles que puissance absorbée trop élevée, température élevée, vibrations fortes, bruit intense etc. ou en rapport avec les contrôles techniques, cela laisse supposer que différentes fonctions de l'appareil peuvent être détériorées. Pour éviter ensuite des problèmes, qui pourraient entraîner de graves accidents corporels ou de graves dégats matériels, le personnel d'entretien compétent doit immédiatement être informé.

Δ Si vous êtes dans le doute, coupez immédiatement l'alimentation!

#### Mise en place, préparation

- Le matériel utilisé pour la manutention doit tenir compte du poids de l'équipement
- prendre largement les dimensions embases et les réaliser exemptes de vibrations
- -monter les réducteurs et motoréducteurs solidement et sans haubanage
- prévoir une aération suffisante
- prévoir le taraudage conforme à la norme DIN-EN 332 pour monter des accouplements sur les arbres d'entrée et de sortie éviter de donner des coups sur les arbres
- (cela pourrait détériorer le roulement!)
- lier autant que possible la machine et le réducteur avec des accouplements élastiques
- avant la mise en service, enlever l'élément d'accouplement ou/et fixer la clavette
- utiliser pour l'exécution arbre creux avec bras de réaction une butée en caoutchouc

#### Branchements électriques

- brancher le moteur selon le schéma
- -s'assurer que la tension du réseau et la réquence correspondent aux données inscrites sur la plaque signalétique

  - Le cable de raccordement doit être protégé

  - corriger un éventuel mauvais sens de
- rotation par une inversion de deux phases
- Les entrées de câbles non utilisées doivent être obturées, la boîte elle-même devant être fermée de façon à être étanche à l'eau et à la poussiére
- prévoir une protection électrique contre les surcharges, court-circuit et défaut de phases régler la protection électrique suivant
- regler la protection electrique suivar
   l'intensité nominale du moteur
   schéma de branchement à la derniére page

#### Mise en fonctionnement

- si un stockage longue durée du réducteur est prévu, il faut prendre les dispositions nécessaires (voir spécification "Stockage longue durée")
- vérifier que la vis de niveau d'huile corresponde à la position de montage du réducteur (voir catalogue)
- contrôler le niveau d'huile
- enlever la mèche de la vis d'évent avant la mise en route (pour éviter une surpression) ou fixer le clapet d'évent sur le réducteur
- pour le premier remplissage voir le tableau des lubrifiants
- les moteurs autoventilés sont dimensionnés pour des températures ambiantes comprises entre -20°C et +40°C, ainsi que pour une altitude â 1000 mètres au-dessus du niveau
- Leur utilisation dans des atmosphères explosives est interdite, à moins qu'elles ne soient expressément prévues à cet effet (respecter les indications supplémentaires)

# Wartung MOTOR

- Staubablagerungen entfernen (Überhitzung!)
- Wälzlager ausbauen, reinigen und einfetten
   Es ist zu beachten, daß der gesamte Freiraum um das Lager ca. 1/3 mit Fett
- gefüllt ist Schmierstoffsorten siehe nächste Seite

#### **GETRIEBE**

- regelmäßige Ölstandskontrolle
- -Wechseln des Schmierstoffes alle 10.000 Betriebsstunden oder spätestens nach 2
- -Doppelte Fristen bei synthetischen Pro-
- dukten

   Verkürzung der Schmierstoffwechselintervalle bei extremen Betriebsbedingungen
  (hohe Luftfeuchtigkeit, aggressive Umgebung und hohe Temperaturschwankungen)
- Verbinden des Schmierstoffwechsels mit gründlicher Reinigung des Getriebes

Bei den Getrieben SK 0282 NB und SK 1382 NB mit Lebensdauerschmierung sind diese Arbeiten nicht notwendig.

Δ Synthetische und mineralische Schmierstoffe nicht miteinander mischen! Das gilt auch für die Entsorgung der Schmierstoffe!

#### Maintenance MOTOR

- remove dust deposit (overheating)
   dismount anti-friction bearings for cleaning and refill with grease
- ensure that the bearing cage is packed to about 1/3 with grease, distribute evenly select proper type of lubricating grease from
- following table

#### **GEARBOX**

- -regular oil level check
- change lubricant every 10.000 working hours or after two years at the latest.
- combine the lubricant change with thorough
- cleaning of gear unit

   lubricant changing intervals will be twice as long if synthetic products are used
- long it synthetic products are used extreme working conditions (high air humidity, aggressive media and large temperature variations) call for reduced lubricant changing intervals

The gearboxes SK 0282 NB and SK 1382 NB are supplied with lifetime-lubrication. Therefore they do not require the a.m. maintenance for gearboxes.

Δ Synthetic and mineral lubricants must not be mixed either for filling or for disposal!

# Entretien DU MOTEUR

- enlever poussière la du moteur (échauffement)
- démonter les roulements, les nettoyer et les regraisser
- -la cage des roulements doit être remplie au 1/3 environ
  - lubrifiant voir tableau ci-après

#### DU REDUCTEUR

- vérifier régulièrement le niveau d'huile
  vidanger le lubrifiant après 10.000 heures de fonctionnement ou au plus tard après 2 ans d'utilisation.
- profiter de la vidange pour effectuer un nettoyage approfondi du réducteur pour des lubrifiants synthétiques, ce délai
- peut être doublé
- réduire les intervalles entre les vidanges dans des conditions d'utilisation extrêmes (hygrométrie élevée, ambiance agressive ou variations importantes des températures)

Pour le réducteurs SK 0282 NB et SK 1382 NB lubrifiés à vie, ces préconisations d'entretien ne sont pas nécessaires.

 $\Delta$  Des lubrifiants synthétiques et minéraux ne doivent pas étre mélangés! Ceci s'applique également pour le retraitement des lubrifiants!

ÖLFÜ	LLMENGE	[cm <sup>3</sup> ]		CAPAC	ITY [cm <sup>2</sup>	³]		QUANT	TITE DE I	_UBRIFI	ANT [cm	<sup>3</sup> ]
Bauform Mounting					1	agerechte Horizonta Position h	l position	າ	· Vor annual	····		***
position	Flac	hgetriebe		Helical Sh					rs à arbre	s paralléle	· S	
		stufig		double red		g would			ains d'eng			
Positions de montage	0282NB	1282	2282	3282	4282	5282	6282	7282	8282	9282	10282*	11282
H1	700	900	1.650	3.150	4.700	7.500	17.000	25.000	37.000	74.000	90.000	165.00
H2	800	900	1.900	3.250	4.750	7.500	12.000	20.000	30.000	55.000	40.000	145.00
НЗ	900	950	1.800	3.150	4.700	7.200	14.000	21.000	31.000	59.000	82.000	140.00
H4	900	950	1.800	3.150	4.700	7.200	10.000	16.000	31.000	69.000	60.000	100.00
Bauform					Se	nkrechte		ng				
							position					
Mounting	-					Position		5/1				
position		hgetriebe		Helical Sh	att Mount	ing Gearb	oxes			s paralléle	S	
Positions de		stufig		double red	auction			a deux tra	ains d'eng	renages		
montage	0282NB	1282	2282	3282	4282	5282	6282	7282	8282	9282	10282*	1128
H5	1.100	1.200	2.000	4.100	5.400	8.800	17.500	27.000	41.000	72.000	90.000	195.00
H6	1.000	1.300	2.400	4.100	6.100	8.800	14.000	21.000	33.000	70.000	90.000	160.00
Bauform						agerechte						
Mounting						Horizonta Position h						
position	Float	haetriebe		Haliant Ch					>	0 (1)		
position	dreis			Helical Sh triple redu		ing Geard	oxes		irs a arbre ins d'engr	s paralléle	·S	
Positions de		V							·			
montage	1382NB	1382	2382	3382	4382	5382	6382	7382	8382	9382	10382*	1138
H1	1.300	1.450	1.700	4.100	5.900	12,500	16.500	22.000	34,000	73.000	85,000	160.00
H2	1.400	1.150	1.900	3.300	4.900	6.700	9.600	16.000	25.000	45.000	38.000	140.00
НЗ	1.900	1.100	1.500	3.300	4.900	8.300	12.500	19,000	30.000	60.000	80.000	135.00
H4	2.000	1.100	1.500	3.300	4.900	8.300	14.000	23.000	35.000	65.000	80.000	155.00
Bauform				······································	Se	nkrechte	Anordnu	ng				
						Vertical	position	•				
Mounting							verticale					
position	Flac	hgetriebe		Helical Sh	aft Mount	ing Gearb	oxes	Réducteu	ırs à arbre	s paralléle	S	
	dreis	stufig		triple redu				à trois tra	ins d'engr	enages		
	1382NB	1382	2382	3382	4382	5382	6382	7382	8382	9382	10382*	1138
	1											
Positions de montage H5	2.100	1.700	3.100	5.600	8.300	14.000	18.000	25.000	38.000	74.000	80.000	210.0

- Die Getriebetypen SK 10282 / SK 10382 und SK 11282 / SK 11382 werden im Normalfall ohne Öl geliefert. Types SK 10282 / SK 10382 and SK 11282 / SK 11382 are supplied without lubricant as a standard.

Les réducteurs SK 10282 / SK 10382 et SK 11282 / SK 11382 sont livrés sant huile.

Die Normalbefüllung der Getriebe ist Mineralöl. Synthetisches Öl ist gegen Mehrpreis lieferbar. Standard lubricant for the gearboxes is mineral-oil. Synthetic oil is available at a surcharge.

Les réducteurs sont remplis d'huile minérale. Ils peuvent être remplis d'huile synthétique contre supplément de prix

#### HINWEIS / REMARK / REMARQUE:

Ölfüllmengen sind ca. Angaben. Ölniveau anhand der Ölkontrollschrauben prüfen.

Filling quantities are approx. figures. Oil level must be checked according to oil-level plugs.

Les quantités d'huile sont données à titre indicatif. Vérifier la quantité d'huile grâce à la vis de niveau d'huile.

# Hinweis:

Diese Tabelle stellt vergleichbare Schmierstoffe unterschiedlicher Hersteller dar. Innerhalb einer Viskosität und Schmierstoffsorte kann der Ölhersteller gewechselt werden. Beim Wechsel der Viskosität bzw. der Schmierstoffsorte muß Rücksprache mit uns gehalten werden, da sonst keine Gewährleistung für die Funktionstüchtigkeit unserer Getriebe übernommen werden kann.

# Note:

This table lists compatible iubricants of different suppliers. Within the same viscosity class and type of lubricant the supplier can be chosen freely. In case you change the viscosity class resp. the type of lubricant you should contact us in advance as otherwise we cannot assure the proper function of our drive and the warranty becomes void.

# Indication

Ce tableau présente les lubrifiants comparables des différents fabricants. Si l'on respecte les critères de viscosité et le type de lubrifiant, on peut uiliser n'importe quelle marque d'huile après ne vidange. Afin de pouvoir garantir un bon fonctionnement de nos réducteurs, veuillez nous consulter avant de remplacer un lubrifiant par un autre possédant des caractéristiques différentes de viscosité et de type.

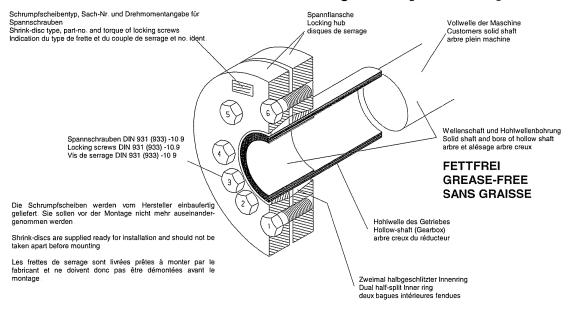
				Schmierstoff	arten / Type	of lubricant	mierstoffarten / Type of lubricant / Type de lubrifiant	iant				
Schmierstoffart Type of Iubricant Type de Iubrifiant	Umgebungstemp. Ambient temp. Temp. ambiante	ARA	(BP)	Gestro	TE DEA	ESSO	FUCHS	KLUBER	Mobil	Optimol	Shell	Tribol
Mineralöl Mineral oil Hulle minérale	Schneckengetriebe 0 40°C ISO VG 680	Degol BG 680 Degol BG 680 plus	_	Alpha SP 680	Falcon CLP 680	-	Renolin CLP 680 CLP 680 Plus	Klüberoil GEM 1-680	Mobilgear: - 636 - XMP 680	Optigear BM 680	Shell Omala 680	Tribol 1100/680
	ISO VG 220 - 5 40°C (normal)	Degol BG 220 BG 220 plus	Energol GR-XP 220	Alpha SP 220 Alpha MW220 Alpha MAX 220	Falcon CLP 220	Spartan EP 220	Renolin CLP 220 Renolin CLP 220 Plus	Klüberoil GEM 1-220	Mobilgear 630 Mobilgear XMP 220	Optigear BM 220	Shell Omala 220	Tribol 1100 / 220
	ISO VG 100 - 15 25°C	Degoi BG 100 BG 100 plus	Energol GR-XP 100	Alpha SP 100 Alpha MW 100 Alpha MAX 100	Falcon CLP 100	Spartan EP 100	Renolin CLP 100 Renolin CLP 100 Plus	Klüberoil GEM 1-100	Mobilgear: - 627 - XMP 110	Optigear BM 100	Shell Omala 100	Tribol 1100 / 100
	ISO VG 15 - 45 15°C *	Vitamol 1010	Bartran HV 15	Hyspin AWS 15 Hyspin SP 15 Hyspin ZZ 15	Astron HVLP 15	Univis J13	Renolin B 15 HVI	Isoflex MT 30 rot	Mobil DTE 11 M	Ultra 10	Shell Tellus T 15	Tribol 943 AW 22
Synthetisches Öl Synthetic oil Hulle synthétique	Schneckengetriebe -5 60°C ISO VG 680	Degol GS 680	Energol SG-XP 680				Renolin PG 680	Klübersynth GH-6-680	Glygoyle HE 680	Optiflex A 680	Shell Tivela S 680	Tribol 800 / 680
	ISO VG 220 -25 80°C *	Degol GS 220	Enersyn SG-XP 220	Alphasyn PG 220	Polydea PGLP 220	Glycolube 220	Renolin PG 220	Klübersynth GH-6-220	Glygoyle HE 220	Optiflex A 220	Shell Tivela WB Tivela S 220	Tribol 800/ 220
Biologisch abbaubares Öl Biodegradable oil	Schneckengetriebe ISO VG 680 -5 40°C	1					Plantogear CLP 680				1	
Hulles biodégradables	ISO VG 220 -5 40°C	Degol BAB 220	Biogear SE 220	Carelub GES 220	Ergon ELP 220	-	Plantogear CLP 220	Klüberbio GM2-220	1	Optisynt BS 220	-	Tribol BioTop 1418 / 220
Lebensmittel- verträgliches Öl <sup>1)</sup> Food-grad oil <sup>1)</sup> Huiles pour	Schneckengetriebe -5 40°C ISO VG 680	•	1		1		Bel-Ray No-Tox Synt.Worm Gear Oil 680	Klüberoil 4 UH1-680 Klübersynth UH1 6-680	1	Optileb GT 680	Shell Cassida Fluid GL680	Tribol FoodProof 1800 / 680
environnement alimentaire <sup>1)</sup>	ISO VG 220 -25 40°C	Eural Gear 220	1	Vitalube GS 220	1	Gear Oil FM 220	Bel-Ray No-Tox Gear Oil 90 Synt.Gear Oil 220	Klüberoil 4 UH1-220 Klübersynth UH1 6-220	Mobil DTE FM 220	Optileb GT 220	Shell Cassida Fluid GL220	Tribol FoodProof 1810 / 220 oder 1800 / 220
Synth. Fließfett Synth. fluid grease Graisse fluide synthétique	- 25 60°C	Aralub BAB EP0	Enersyn GSF	Alpha Gel 00	1	Fließfett S 420	Renolit LX-PG 00	Klübersynth GE 46-1200 Klübersynth UH1 14-1600 <sup>1</sup>	Glygoyle Grease 00	Obeen UF 00	Tivela Comp. A Tivela GL 00	Tribol 800 / 1000

	Schmierst	Schmierstoffarten für Wälzlager / Type	Välzlager /		cant for anti	friction bear	of lubricant for anti friction bearings / Type de librifiant pour roulements à rouleaux	librifiant po	ur rouleme	nts à roules	xnx	
Schmierstoffart Type of Iubricant Type de Iubrifiant	Umgebungstemp. Ambient temp. Temp. ambiante		BP	Castro	TE DEA	OSSE	FUCHS	KALOBER	Mobil	Optimol	Shell	Tribol dabemesmacomur
Fett (Mineralölbasis) Grease (mineral	- 30 60°C (normal)	Aralub HL 2	Ener- grease LS 2	Spheerol AP 2 LZV-EP	Glissando 20	Mehr- zweckfett Beacon2	Renolit FWA 160	Klüberplex BEM 41-132	Mobilux 2	Longtime PD 2	Shell Alvania R2	Tribol 4020/220-2
oil basis) Graisse (base huile minérale)	* - 50 40°C	Aralub SEL 2	1	Spheerol EPL2	1	ı	Renolit JP 1619		ı	Longtime PD 1	Shell Alvania RL 2	Tribol 3785
Synthetisches Fett Synthetic grease Graisse synthétique	* - 25 80°C	Aralub SKL 2	-	Product 783/46	Discor B EP 2 LF	Beacon 325	Renolit S 2 Renolit HLT 2	Isoflex Topas NCA 52 Isoflex Topas NB 52	Mobiltemp SHC 32	Optitemp LG 2	Aero Shell Grease 16 oder 7	3499
Biologisch abbaubares Fett Biodegradable Grease Graisse biodégradables	- 25 40°C	Aralub BAB EP 2	BP Bio- grease EP 2	Biotec	Dolon E EP 2	1	Plantogel 2 S	Klüberbio M 32-82	Schmierfett UE 100 B	EF 584	Shell Alvania RLB 2	Molub-Alloy BioTop 9488
Lebensmittelver- trägliches Fett <sup>1)</sup> Food-grade grease <sup>3)</sup> Graisse pour environnement	- 25 40°C	Eural Grease EP 2	BP Energreas e FM 2	Vitalube HT Grease 2	Tamix FRA 1	330 330	Renolit G 7 FG 1	Klübersynth UH1 14-151	Mobil- grease FM 102	Obeen UF 2	Shell Cassida RLS 2	Molub-Alloy Food-Proof 823-2 FM

<sup>\*</sup> Bei Umgebungstemperaturen unterhalb -30°C und oberhalb 60°C sind Wellendichtringe in besonderer Werkstoffqualität einzusetzen 
\* With ambient temperatures below -30°C and above approx. 60°C shaft sealing rings of a special material quality must be used 
\* Lors d'une température ambiante inférieure à -30°C ou supérieure à environ 60°C, il y a lieu d'utiliser des joints d'étanchéité spéciaux

<sup>&</sup>lt;sup>1)</sup> Lebensmittelverträgliche Öle + Fette nach Vorschrift H1 / FDA 178.3570 <sup>1)</sup> Food grade lubricants with USDA-H1 approval FDA 178.3570 <sup>1)</sup> Huiles pour environnement alimentaire + graisses suivant prescription H1 / FDA 178.3570

#### Hohlwelle mit Schrumpfscheibe - Montage - Demontage und Wartungshinweise Hollow shaft with shrink-discs - Assembly - Dismantling suggestions and maintenance Exécution des arbres creux avec frette de serrage - Montage - Démontage et entretien



#### Montageablauf:

- 1 Entfernen der Transportsicherung zwischen den Flanschen, falls vorhanden.
- 2. Anziehen der Spannschrauben (leicht von Hand) bis das Spiel zwischen den Flanschen und dem Innenring beseitigt ist. Der Innenring muß noch leicht
- 3. Einfetten der Bohrung des Innenringes, dadurch leichte Montage der Schrumpfscheibe auf die Getriebehohlwelle.
- Aufsetzen der Getriebehohlwelle Maschinenwelle

Maschinenwellenschaft und Hohlwellenbohrung müssen im Bereich der Schrumpfverbindung absolut fettfrei sein.

Die Maschinenwelle vor der Montage im Bereich, welche später Kontakt mit der Bronzebuchse der Hohlwelle hat, einfetten. Die Bronzebuchse nicht einfetten, um bei der Montage eine Befettung des Schrumpfsitzes zu vermeiden.

- Durch leichtes Anziehen der Spannschrauben positionieren sich die Spannflansche automatisch.
   Festziehen der Spannschrauben der Reihe nach im
- Uhrzeigersinn über mehrere Umläufe überkreuz - 1/4 bis 1/2 Schraubenumdrehung pro Spannschrauben Umlauf.Die mit einem Drehmoment- schlüssel bis zu dem auf der Schrumpfscheibe oder in der Maßtabelle angegebenen Anzugsdrehmoment anziehen.

#### Demontageablauf:

- 1. Spannschrauben der Reihe nach über mehrere Umläufe lösen, pro Umlauf ca. 1/4 Umdrehung. Spannschrauben nicht aus ihrem Gewinde entfernen - Unfallgefahr!!
- 2. Die Spannflansche sind vom Konus des Innenringes
- 3. Abnehmen des Getriebes von der Maschinenvollwelle.

#### Wartung der Schrumpfscheiben:

Eine montierte Schrumpfscheibe ist wartungsfrei. War eine Schrumpfscheibe längere Zeit im Einsatz und wurde demontiert, dann ist sie vor der erneuten Montage zu zerlegen und zu reinigen. Nach der Reinigung sind die Kegelflächen (Konus) der Spannflansche und des Innenringes mit Molykote G-Rapid Plus oder vergleichbarem Schmierstoff einzustreichen. Schrauben sind im Gewinde und Kopfauflage mit normalem Fett zu behandeln.

#### Installation instructions:

- 1. Remove transportation spacers (if provided) located between outer collars.
- 2. Lightly handtighten locking screws to eliminate play between outer collars and inner ring. You should still be able to easily turn inner ring.
- 3. Lightly lubricate the bore of the shrink-disc to facilitate easy mounting onto hollow-shaft of reducer.
- 4. Fit shrink-disc onto hollow-shaft and mount hollowshaft reducer onto solid shaft.

Hollow- and solid shaft must be clean and free from any lubricant.

Exception: Grease solid shaft at end where it will make contact with bronze bushing of the hollowshaft when it is mounted. Never grease the front of the solid shaft which makes contact under the shrink-disc. Tighten locking screws only after mounting the hollowshaft onto the solid shaft.

- 5. Now tighten locking screws only lightly to position outer collars.
- 6. Use torque wrench and equally tighten all screws one after another (never cross wise) in a clockwise or counter clockwise sequence by approximately 1/4 to 1/2 turn until specified tightening torque (per table) is

- 1. Loosen locking screws in sequence in several steps by using approximately 1/4 turns. Danger - Do not remove locking screws completely
- 2. Loosen the outer collars from the double tapered inner ring.
  3. Remove hollow-shaft reducer from solid shaft.

#### Maintenance:

An installed shrink-disc is maintenance free Before reinstalling (after prolonged use) it should be taken apart and thorougly cleaned. Relubricate the taper of the outer collars and of the inner ring with Molycote G-Rapid plus or equivalent. Regrease screw threads and head contact area with mulitpurpose grease

#### Procédure de Montage:

- 1. Les éventuelles protections de transport placées entre les surfaces de serrage doivent être retirées.
- 2. Les vis de serrage doivent être légèrement serrées à la main, jusqu'à ce qu'il n'y ait plus de jeu entre les surfaces de serrage. L'anneau intérieur doit toutefois pouvoir encore être tourné aisément.
- 3 L'alésage (D1) de la bague intérieure de la frette doit être légèrement graissé. De la sorte, le montage de la frette sur l'arbre creux est facilité.
- 4 Positionner l'arbre creux réducteur sur l'arbre machine.

L'arbre machine et l'arbre creux doivent absolument être e x e m p t - de - g r a isse - au niveau de la liaison par frette.

Préalablement au montage, l'arbre machine doit être graissé à l'endroit du position-nement prévu de la baque bronze de l'arbre creux. Ne pas graiss e r la baque bronze, pour éviter un graissage du siège de la frette lors du montage.

- 5. Serrer légèrement les vis de serrage de la frette, afin que les surfaces de serrage se positionnent automatiquement.
- Serrer les vis dans le sens des aiguilles d'une montre les unes après les autres, en plusieurs fois, en faisant à chaque fois d' 1/4 à 1/2 tour de vis. Ne pas serrer en diagonale! Utiliser une clef dynamométrique pour le serrage. Les couples de serrage sont indiqués sur les frettes, ou doivent être relevés sur les plans.

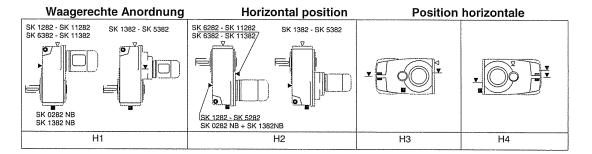
#### Procédure de démontage:

- 1. Les vis de serrage doivent être desserrées dans l'ordre, les unes après les autres, en plusieures fois, avec environ 1/4 de tour par vis à chaque fois. Ne pas sortir les vis du filetage. Risque d'accident!!
- Le plan de serrage doit être écarté du cône de la baque intérieure.
- 3. Retirer le réducteur de l'arbre machine

#### Entretien des frettes de serrage:

Une frette de serrage montée ne nécessite aucun entretien. Si une frette utilisée depuis un certain temps est demontée, un nettoyage préalable à toute nouvelle utilisation est nécessaire. Après nettovage, les surfaces coniques de serrage et la bague intérieure doivent être enduites de Molykote G-Rapid Plus ou d'un type de graisse analogue. Les filetages et têtes de vis doivent être graissés normalement.

## **BAUFORMEN MONTING POSITIONS POSITIONS DE MONTAGE**

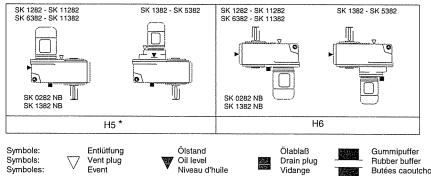




#### **Vertical Position**

#### Position verticale

Butées caoutchouc



- Symboles: \* Bauform H5 mit Ölausgleichsbehälter (siehe Katalog G1000)
- \* Mounting position H5 with lubricant expansion unit (see catalogue G1000)
- \* Position de montage H5 avec réservoiur de compensation de niveau d'huile (voir catalogue G1000)

Event

Die Getriebe SK 0282 NB und SK 1382 NB sind mit mineralischen Ölen befüllt. Es gibt keine Entlüftungs- oder Ölablaßschrauben.
Die Getriebe SK 1282 – SK 11382 sind ebenfalls mit Mineralöl befüllt. Diese Getriebe haben Entlüftungs-, Ölstand- und Ölablaßschrauben. (siehe Bauformen)

Niveau d'huile

The Gear Units SK 0282 NB and SK 1382 NB are lubricated with mineral-oil. There are no vent or drain plug.

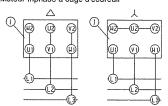
The standard-lubrication for sizes SK 1282 - SK 11382 is also mineral-oil. There are vent and drain plugs (see mounting positions)

Les réducteurs SK 0282 NB sont remplis d'huile minérale. Il n'y a aucune vis ni clapet d'évent.

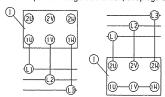
Les réducteurs SK 1282 - SK 11382 sont remplis d'huile minérale (voir positions de montage).

#### Schaltbilder / Wiring diagrams / Schémas de branchement

Drehstrom-Motor mit Kurzschlußanker Three phase squirrel-cage motor Moteur triphasé à cage d'écureull



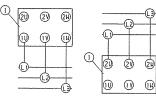
Drehstrom-Motor mit Kurzschlußanker, in Dahlander-Schaltung Three phase squirrel-cage motor, Dahlander connection Moteur triphasé à cage d'écrureull, couplage Dahlander



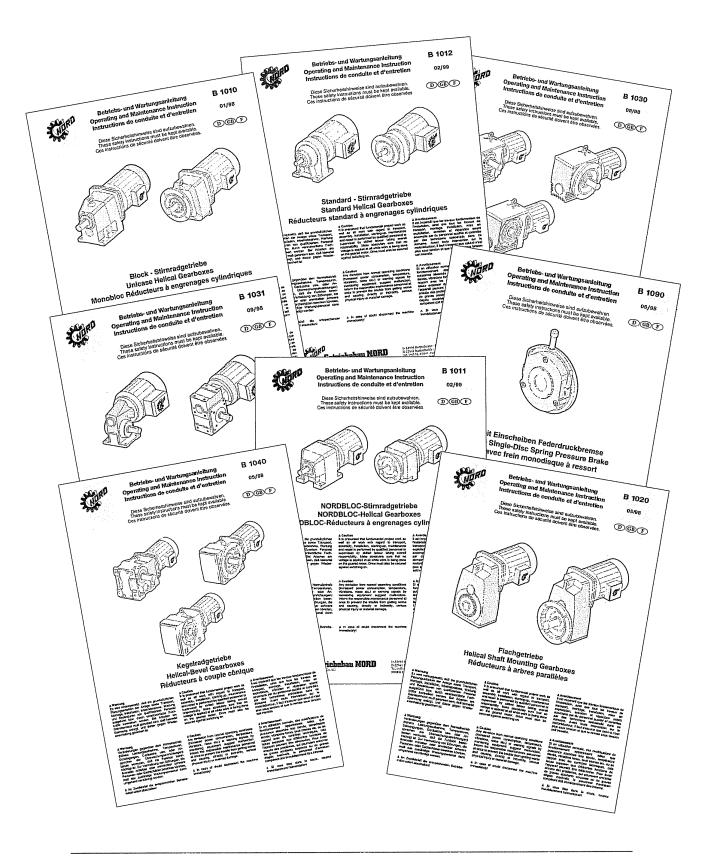
- niedrige inférieure
- Drehzahl
- speed - vitesse
- hohe
- high - supérieure

- I) Klemmbrett Terminal board Plaque à bornes
- II) Schalter Switch Démarreur

Drehstrom-Motor, polumschaltbar, zwei getrennte Wicklungen Three phase motor, polechanging, two separate windings, two speeds Moteur triphasé à commutation de pôles, deux bobinages séparés,



- niedrige low
- inférieure
- Drehzahl - speed
- vitesse
- hohe - high
- supérieure



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# **JOHN MEUNIER**

Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference: NC01

# MIXERS MOTORS



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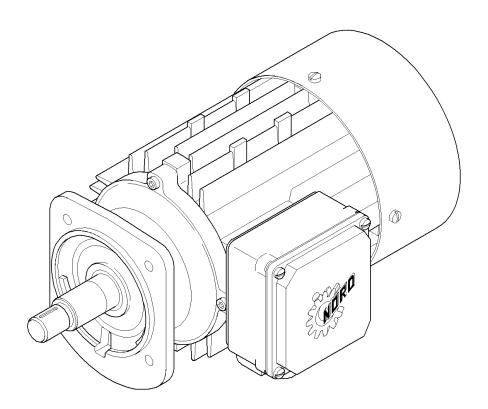






# CDN

# MOTORS AC Induction, Single and Polyphase Installation and Maintenance Instructions



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# **NOTES**

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#### INTRODUCTION

#### 1. General

This manual includes general motor description and operation, inspection, testing and fault isolation procedures and information, general lubrication instructions and materials, general installation, removal, and handling instructions, and general repair and parts information.

#### 2. Related Publications

The related publications listed in Table 1 provide additional information to support maintenance and fault isolation of the motor and its installation.

Publication Number	Publication Title
BIM 1001	Hollow Shrink Disc Shaft
BIM 1002	Hollow Keyed Shaft and Fixing Element
BIM 1003	Expansion Chambers
BIM 1004	Motors AC Induction, Single Phase and Polyphase
BIM 1009	NORD Gearbox Inputs (Motor Adapters and Couplings)
BIM 1010	UNICASE® Helical Gearboxes
BIM 1011	NORDBLOC® Helical Gearboxes
BIM 1012	Standard Helical Inline Gearboxes
BIM 1020	UNICASE <sup>®</sup> Shaft Mount Gearboxes
BIM 1030	UNICASE® Helical Worm Gearboxes
BIM 1031	MINICASE® Worm Gearboxes
BIM 1033	SI Design UNIBLOC® Worm Gearboxes
BIM 1040	UNICASE® 90.1 Helical Bevel Gearboxes
BIM 1090	Motor Brakes
BIM 1142	NORDBLOC® 92 Series Helical Bevel Gearboxes
BIM 4010	Titan Mechanical Adjustable Speed Drives
BIM 4020	NORDISC® Friction Disc Mechanical Adjustable Speed Drives

Table 1. Related Publications

#### **DESCRIPTION AND OPERATION**

#### General

This manual provides general installation and maintenance information for the NORD family of motors described in this section.

#### 2. Description

The NORD motors covered in this manual are single phase and poly-phase motors (refer to Table 2), can be single speed or two-speed, and may include the options listed in the Motor Options Section. Motor options, electrical requirements, performance characteristics, and motor data are identified on the motor nameplate. The nameplate drawing is provided in Figure 1. Definition of each entry field is provided in Table 2.

#### 3. Operation

The motors described in this manual are alternating current (AC) induction motors, single speed or two-speed, and convection-cooled, fan cooled, or blower cooled. The motors may use single phase or three phase alternating current.

Cooling options include convection cooling (TENV), fan cooling (TEFC), and blower cooling (TEFB). Because the fan is mounted on the motor shaft, the fan speed is identical to the motor speed, and the cooling capacity varies with the motor speed. The blower uses its own motor and a separate power supply to provide a specific airflow and cooling capacity. The blower power data are provided in Table 8.

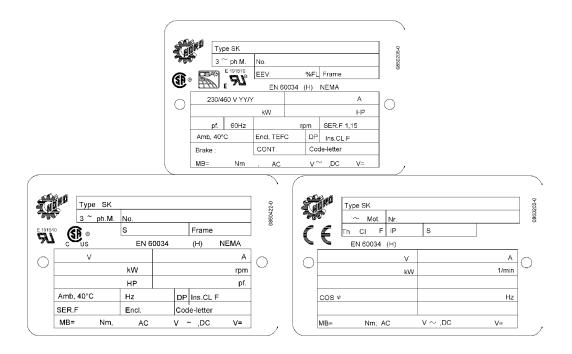


Figure 1. Motor Nameplates

Field	Definition	Field	Definition
Type	Model Number	DP	Drip Proof
3∼ph.M.	Number of Motor Phases	Ins. Cl	Insulation Class
No.	Motor Number	SER. F	Service Factor (allowable horsepower loading)
S	Duty Cycle (i.e. S1, S3-40%)	Encl.	Enclosure Description
Frame	Motor Frame Size	Code	NEMA Code Letter
V	Motor Voltage	EEV	
A	Motor Full-Load Amperage	COS φ	Power Factor
HP	Motor Horsepower	MB=	Motor Brake Force (Newton Meters)
rpm	Motor Speed	AC	Alternating Current
pf.	Power Factor	V~	AC Voltage
Amb	Maximum Ambient Temperature	V=	DC Voltage
Hz	Motor Power Frequency		

Table 2. Nameplate Data

## **INSPECTION**

1. Inspection Interval
Inspect the motor after every 500 operating hours.

2. Inspection Criteria
Inspect the motor according to the criteria in Table 3.

CAUTION: IF IT IS NECESSARY TO CLEAN THE MOTOR EXTERIOR, DO NOT USE SHOP AIR. SHOP AIR CAN FORCE CONTAMINANTS INTO THE MOTOR, AND CAN CAUSE THE BLOWN CONTAMINANTS TO AFFECT OTHER COMPONENTS.

Inspect	Check	Action
Motor exterior	Check the external surfaces for contamination. Accumulation of dirt and fibrous deposits must be removed.	Clean the motor external surfaces using clean, lint-free cloths.
	norous deposits must be removed.	Clean deposits from between cooling fins using a vacuum cleaner and a stiff-bristled nylon brush.
	Check the external surfaces for oil film and greasy deposits.	Clean the oil film and greasy deposits from the motor surface using clean, lint-free cloths.
		If necessary, moisten the cloth with an approved non-flammable, residue-free solvent. Do not pour solvent on the motor.
	Check for evidence of damage or overheating.	If the motor has physical damage, replace the motor.
Motor mountings	Make sure the mounting hardware is secure.	If the mounting hardware is not secure, check the motor/gearbox alignment, and tighten the mounting hardware.
Motor electrical connections	Check that all electrical connections are secure.	If the electrical connections are not secure, tighten them.
	Check the electrical connections for evidence of arcing.	Loose electrical connections can cause arcing, which is evident by discoloration and charring. If you find evidence of arcing, replace the damaged connections.
Insulation resistance	Using an ohmmeter, check and record the resistance of motor winding insulation.	Compare the current resistance reading to previous readings. If the resistance drops significantly, perform an internal inspection for insulation damage or deterioration.
Motor Brake	On motors that have a brake, use a feeler gauge to check the air gap in between the brake pad and the rotor according to NORD Gear Corporation Manual BIM-1090, Motor Brakes Installation and Maintenance Instructions.	If the air gap exceeds the maximum allowed for that brake configuration provided in the manual, adjust the air gap or replace the brake pad according to the instructions in NORD Gear Corporation Manual BIM-1090, Motor Brakes Installation and Maintenance Manual.

Table 3. Motor Inspection Criteria

#### **TESTING AND FAULT ISOLATION**

#### 1. General

NOTE:

NORD electric motors do not require periodic testing. However, if a motor is removed from its installation, NORD recommends that the motor be checked according to the static and dynamic testing provided below before it is reinstalled. Finding a condition that will require future repair before the motor is reinstalled decreases the overall maintenance time.

This section provides general test information and functional checks for the types of motors covered by this manual. All tests provided below may not apply to all motor types and models. Read and understand the tests and checks before performing them on your motor. Understand how the test or check is to be performed and the pass/fail criteria.

Record and date all measurements taken. Retain the measurements in a file. Comparing current and previous measurements is useful in tracking motor condition and brake wear, if the motor is equipped with a brake.

If the motor fails any of the test procedures provided below, use the fault isolation procedures to determine the motor problem. Refer to the REPAIR section to determine if the failure is a repairable failure.

#### 2. Testing

#### A. Static Testing

- 1. The motor can only be static tested if it is disconnected from the component it drives and securely mounted on a fixture or mounting plate. These tests are usually conducted when a motor has been removed for any reason other than failure
- 2. Turn the motor shaft slowly by hand. Feel and listen for evidence of a failed bearing, which is indicated by a rough feel as the shaft rotates, and by noise.
- 3. Check for smooth rotation, with no evidence of binding or catching. If the shaft does not rotate smoothly, or binds or catches, the bearings are worn or failing, lack lubrication, or are contaminated.
- 4. Check the motor shaft for side play by applying pressure at right angles to the shaft in several places around the circumference. If the shaft moves perceptibly, the front bearing is worn.
- 5. If the motor shaft feels rough as it is turned or makes unusual noise, the motor bearings are failing, lack lubrication, or are contaminated. Replace the motor bearings, or clean and re-lubricate the bearings, as applicable. Refer to the REPAIR section.
- 6. If the bearing shaft shows play in the bearing, the bearing is worn or failing. Replace the motor bearings according to the REPAIR section.

#### B. Dynamic Testing

- 1. Find the motor voltage and rated load current values as listed on the motor nameplate.
- 2. Using a volt-ohmmeter, verify that the motor power supply is in the correct range.
- 3. Run the motor with no load. As the motor is operating, listen for unusual motor noise and check for excessive vibration. Vibration and motor noise are indications of bearing contamination, lack of lubrication, damage, or failure.
- 4. Use an ammeter to measure the no-load current. Record the no-load current for comparison with previous readings, and for reference during future testing.
- 5. If the motor passes the no-load test, operate the motor at rated load and check and record the current.
- 6. Check the motor operating temperature at rated load. If the motor operates at a higher than normal temperature, the motor is failing.
- 7. If the motor has an integral brake, check the brake operating temperature. If the brake operates at a higher than normal temperature, the brake is not releasing completely. Refer to the REPAIR section.

#### 3. Fault Isolation

If the motor has failed or does not meet the requirements of any of the tests described above, use the fault isolation procedures provided in Table 4, Motor Fault Isolation. The table is based on the assumption that the motor has been operating correctly, and that a problem has occurred. If a newly installed motor does not operate correctly, the problem is an installation problem.

Fault	Check	Corrective Action
Motor doesn't	Check the circuit breaker.	The breaker has tripped. Reset the breaker.
operate		If the breaker trips immediately, the motor windings have shorted. Replace the motor.
	Check the motor and the gearbox separately to determine which has failed.	Replace the motor or the gearbox, as applicable.
	If the breaker has not tripped, check the power circuitry to the motor.	If the power circuitry has opened, repair the power circuitry.
	Check for an open in the motor windings.	If the motor windings have an open circuit, replace the motor.
Motor is noisy	Separate the motor from its gearbox and check the shaft bearings by hand according to the TEST instructions.	If the bearings feel rough, replace the bearings according to the instructions in REPAIR.
Motor thermal protection trips	Check the motor exterior for an excessive accumulation of oil and dirt that can	If the motor exterior is excessively dirty, clean the motor surface using clean, lint-free cloths.
	inhibit cooling.	If the motor has a finned casing, use a vacuum cleaner and a stiff-bristled nylon brush to remove dirt and debris from between the fins.
	If the motor has a vented enclosure, check the vent openings to make sure they are clear.	If necessary, clean the vent openings.
	Visually check for heat-discolored paint, which is evidence of a motor overheat.	If the motor casing shows heat discoloration, the motor is failing. Replace the motor.
	Check the system load.	If the load applied to the system is above rated load, it should be reduced, if possible, to avoid affecting motor life.
Motor slows during operation	Check for increased load.	If the load has increased beyond rated load, correct the overload condition to prevent damage to the motor.
	Check for supply voltage drop.	Supply voltage must be within 10 percent of nominal voltage. If the supply voltage is less than 90 percent of rated voltage, correct the supply voltage to avoid damage to the motor.
	Check the gearbox and the motor bearings for wear and drag that increases	If the gearbox drag increases during operation, repair the gearbox.
	as the system temperature rises.	If the motor bearing drag increases as the motor operates, replace the bearings according to REPAIR.

Table 4. Motor Fault Isolation

#### **LUBRICATION**

#### 1. General

NORD motor frame sizes 63 up to and including 225 are prelubricated, therefor require no lubrication during normal operation.

Frame sizes 250 and larger will have grease fittings for regreasing the motor bearings. Relubricate bearings every six months (more often if conditions require) using a polyurea base grease, No. 2 consistency & stabilized against oxidation.

#### REMOVAL, INSTALLATION, AND HANDLING

#### 1. General

Removing, installing, and handling any NORD electric motor follow the same general procedures. Follow the general procedures provided below. Observe all WARNINGs and CAUTIONs.

If you have any questions about the procedure to use to handle, install, or remove a specific motor, call NORD Gear Corporation. Please read the following WARNINGS & CAUTIONS prior to any work on the motor.

**WARNING:** 



IF THE MOTOR HAS AN INTEGRAL BRAKE, VERIFY THAT THERE IS NO LOAD ON THE GEARBOX BEFORE RELEASING THE BRAKE. THIS WILL PREVENT POSSIBLE INJURY AND POTENTIAL EQUIPMENT DAMAGE FROM A DROPPED LOAD.

**WARNING:** 



THE MOTOR ELECTRICAL POWER HAS DANGEROUS CURRENT LEVELS. TO PREVENT SERIOUS INJURY, SHUT DOWN THE POWER TO THE MOTOR AT ITS CIRCUIT BREAKER OR POWER SWITCH BEFORE REMOVING OR INSTALLING ANY MOTOR. LOCK OUT THE BREAKER OR SWITCH AND POST IT WITH AN "OUT OF SERVICE" PLACARD.

WARNING:



LARGE MOTORS ARE HEAVY, EASY TO UNBALANCE, AND ARE AWKWARD TO LIFT AND MOVE. EVEN SMALLER MOTORS ARE HEAVY. HAVE ASSISTANCE WHEN LIFTING AND MOVING HEAVY MOTORS. IF NECESSARY, USE APPROPRIATE LIFTING DEVICES TO LIFT AND MOVE HEAVY MOTORS.

**CAUTION:** 

TO PREVENT DAMAGE TO THE MOTORSHAFT, BEARINGS, AND THE MATING HUB/SHEAVE IN THE GEARBOX, MAINTAIN SHAFT ALIGNMENT WHILE REMOVING THE MOTOR FROM ITS GEARBOX.

#### 2. Removal

- A. Drain the oil from the mating gearbox, or rotate the motor/gearbox assembly so that the motor is up, to prevent oil from spilling from the gearbox when the motor is removed.
- B. Shut down the power to the motor at the main circuit breaker or power switch. Lock out the breaker or switch and place an "OUT OF SERVICE" placard on the breaker or switch.
- C. Disconnect the wiring to the motor. Tag each wire as it is disconnected.
- D. Prepare the motor for removal by supporting the motor appropriately. For smaller motors, use assistance to steady the motor or support it. For larger motors, use mechanical lifting or support devices to steady and support the motor.
- E. Remove the bolts and washers securing the motor to the its mounting.
- F. Maintain motor shaft alignment, and move the motor away from its mounting pad until the motor shaft clears its mating hub/sheave or gearmesh. If the motor shaft is a keyed shaft, keep the drive key with the motor.
- G. Remove and discard the flange gasket. Clean the gasket material from the flange.

#### 3. Installation with NEMA and IEC Flanges

Refer to NORD Gearbox Inputs Installation and Maintenance Instructions in BIM1009.

- A. Make sure the flanges are clean and free of gasket material. Install a new gasket between the mating flanges, if applicable.
- B. Carefully move the motor to insert the motor shaft and its hub/sheave into the adapter spline, making sure the shaft key enters the mating keyway.
- C. Seat the motor flange against the mating flange. Install the mounting bolts and tighten them securely.
- D. Reconnect the wiring to the motor. Refer to Figure 2 for the motor and options connection diagrams.

#### 4. Removing and Replacing C-Face Motors

- A. Shut off the power to the motor and post the shutoff with an "OUT OF SERVICE" placard. Disconnect the wiring to the motor. Tag each wire as it is disconnected.
- B. Support the motor. Remove four bolts securing the motor to the NEMA or IEC adapter.

NOTE: The bolts securing the motor to the adapter are retained using a medium strength thread locker such as blue Loctite.

- C. Pull the motor straight out from the adapter.
- D. Measure and record the dimension from the coupling to the motor flange. Use this dimension to locate the coupling on the replacement motor.
- E. Install a new drive key in the keyway, staking the key or using Loctite to retain the key in the keyway, according to the following instructions:
  - If the drive key is not trapped in the keyway (the keyway is open at both ends), stake and install the drive key as follows:
    - a. Make sure the keyway is free of contamination so that the drive key will seat properly.
    - b. Add a few drops of an approved lubricant to the keyway.
    - c. Place the drive key on an appropriate surface with the shaft side of the drive key up. Stake the key in two places near each long edge to deform the edge outward.

# CAUTION: SUPPORT THE MOTOR SHAFT BEFORE STAKING THE KEY TO PREVENT DAMAGE TO THE MOTOR BEARINGS.

- d. Support the motor shaft in V-blocks. Place the key with the staked surface down over the key slot. Place a sheet of copper shimstock, or equivalent, on the drive key and tap it into the keyway using a hammer.
- e. Check the key to make sure it is fully seated and securely retained.
- 2) Install and Loctite the drive key as follows:
  - a. Make sure the keyway is clean of old Loctite and is free of oil film.
  - b. Apply Loctite primer and medium strength (blue) Loctite to the surface of the key and keyway according to the Loctite instructions.

# CAUTION: IF THE DRIVE KEY IS TO BE LOCTITED IN PLACE, CLEAN ALL THE LOCTITE FROM THE SURFACE OF THE DRIVE KEY AND THE MOTOR SHAFT TO PREVENT POSSIBLE BONDING OF THE COUPLING AND SPLINE SHAFT TO THE DRIVE KEY.

 Install the drive key and center it in the keyway. Cure the Loctite according to Loctite instructions.

- F. Clean all contamination and corrosion from the mating flanges.
- G. Support the motor and mount it to the adapter.
- H. Apply a medium strength thread locking compound such as blue Loctite to the bolt threads according to the instructions. Install the bolts and tighten them securely.
- I. Reconnect the wiring to the motor. Refer to Figure 2 for the motor and options connection diagrams.

#### 5. Removing and Replacing Integral Motors

- A. Shut off the power to the motor and post the shutoff with OUT OF SERVICE. Disconnect the wiring to the motor. Tag each wire as it is disconnected.
- B. Support the motor and remove the bolts securing the motor to the gearbox.
  - NOTE: Most integral motor installations have mounting bolts accessible from the motor exterior. If the bolts are not visible, unbolt the input flange from the gearbox. Remove four bolts that mount the motor. Remove and discard the Dubo gaskets from the bolts.
- C. Remove the motor from the gearbox.
- D. Clean the gasket faces on the motor and gearbox, making sure no cleaning debris enters the gearbox.
- E. Check the replacement motor to make sure the motor flange, motor shaft, and motor pinion are identical to the motor that was removed.
- F. Place a new gasket between the gearbox and new motor.
- G. Position the motor on the gearbox, making sure the input pinion meshes with the input gear. Rotate the motor as necessary to align the bolt holes and seat the motor flange. Make sure the gasket remains properly aligned and seated.
- H. Apply a medium strength thread locking compound such as blue Loctite to the bolt threads according to the instructions. Install the bolts and tighten them securely.

NOTE: If the motor/gearbox installation uses an input flange, mount the input flange to the motor using four mounting bolts and new Dubo gasket. Tighten the bolts securely.

#### CAUTION: DO NOT TO MIX TYPES OF OIL.

- I. Check the gearbox oil level. If necessary fill the gearbox or add oil to bring the gearbox oil to the correct level. Check the installation and maintenance manual for your gearbox to find the correct oil for the gearbox.
- J. Reconnect the wiring to the motor. Refer to Figure 2 for the motor and options connection diagrams.

#### 6. Handling and Lifting

- A. Before lifting any motor, disconnect all electrical connections. Tag each wire as it is disconnected.
- B. Disconnect the motor from the gearbox. Do not lift the motor while it has other equipment attached to it.
- C. If the motor has provisions for a lifting eye, turn in an appropriately sized lifting eye and lock it in place with the locking nut. Lift the motor by the lifting eye using an appropriate lifting device.
- If the motor does not have provisions for a lifting eye, seek assistance or use appropriate lifting devices as necessary.

#### 7. Storage

If the motor is not in service, store it according to the following conditions:

- A. Cover the motor and store it in a clean warehouse environment protected from dust and fluids.
- B. If the motor has internal heaters, power the heaters during storage if the storage environment is extremely humid. The heaters will prevent moisture buildup in the motor interior.
- C. Before placing the motor in service, visually inspect the motor exterior for evidence of deterioration during storage. Turn the motor shaft by hand to make sure the shaft turns smoothly and freely.

#### **CONNECTION DIAGRAMS**

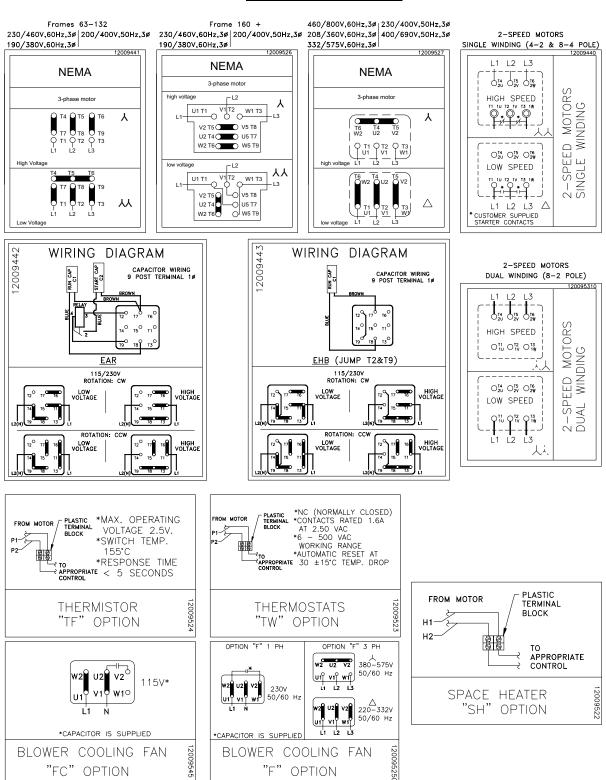


Figure 2. Motor Connection and Wiring Diagrams

#### **REPAIR**

#### 1. General

These instructions can be generally applied to NORD motor applications. The exploded view provided in the PARTS INFORMATION section shows the parts orientation for NORD motors.

To procure replacement parts from NORD, contact NORD's customer service department (refer to INTRODUCTION). Provide NORD with the motor part number and serial number, and the item reference number and nomenclature from the parts information figure, which will identify the part for your motor application.

- A. The following parts must be replaced if they are removed:
  - Oil seal (904), Oil seal (933)
  - Gasket (909), Gasket (910), Gasket (921)
  - Gasket on plug (961)
  - Self-locking screws (907-1, 908-1, 923, 932-1, 940-1)
- B. If the following parts are removed, inspect them, and replace them if they are deformed:
  - Retaining ring (919), Retaining ring (947), Retaining ring (948)
  - Fan clip (952)
- C. Disassemble the motor according to the general exploded view in PARTS INFORMATION. Disassemble only as far as necessary to replace the failed parts.
- D. Whenever the motor is disassembled, clean all dust and contamination from the motor interior using a vacuum cleaner and a soft-bristled nylon brush.

## **PARTS LIST**

## 1. General

Refer to Figure 4 for parts information. If you are ordering a part, provide the model and serial number of your motor. This will determine the part number you need.

Part Number	Part Description	Qty per Assembly
900	Rotor Assembly	1
902	A-Endbell	1
904	Oil Seal	1
905	Bearing	1
906	Preload Spring	1
907	T-Box Frame	1
907-1	Screw	4
908	T-Box Cover	1
908-1	Screw	4
909	T-Box Frame Gasket	1
910	T-Box Cover Gasket	1
916	Stator Assembly	1
918	Drive Key	1
919	Retaining Ring	1
920	Oil Plug	1
921	Gasket	1
923	Screw	4
929	Bearing	1
932	B-Endbell	1
932-1	Screw	4
933	Oil Seal	1
939	Fan	1
940	Fan Cowl	1
940-1	Screw	4
947	Retaining Ring	1
948	Retaining Ring	1
952	Fan Clip	1
960	NPT Thread Adapter	1
961	Plug (includes O-ring)	1
***	Spur Drive Gear (alternate to integral bevel gear)	AR
TBLK	Terminal Block	1
TBLK-1	Screw, Terminal Block Mounting	2
ØØØ	Jumper Bar (not illustrated)	AR

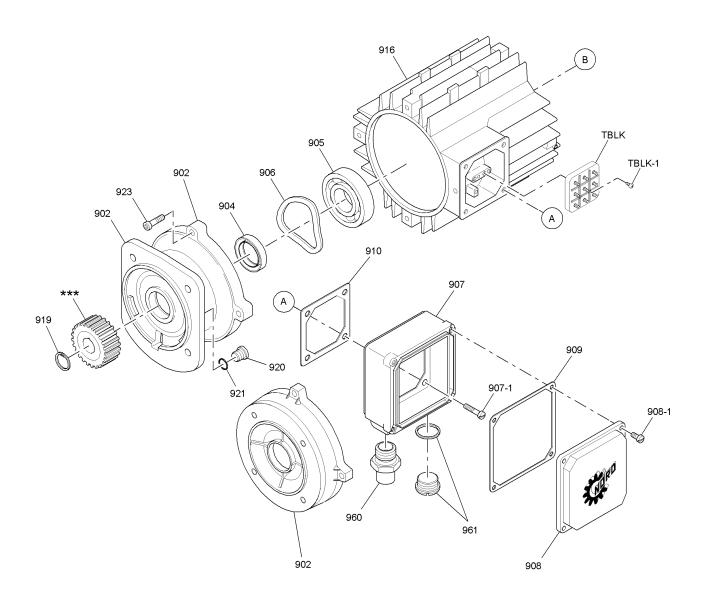


Figure 3. General Motor Exploded View and Generic Parts List (Sheet 1 of 2)

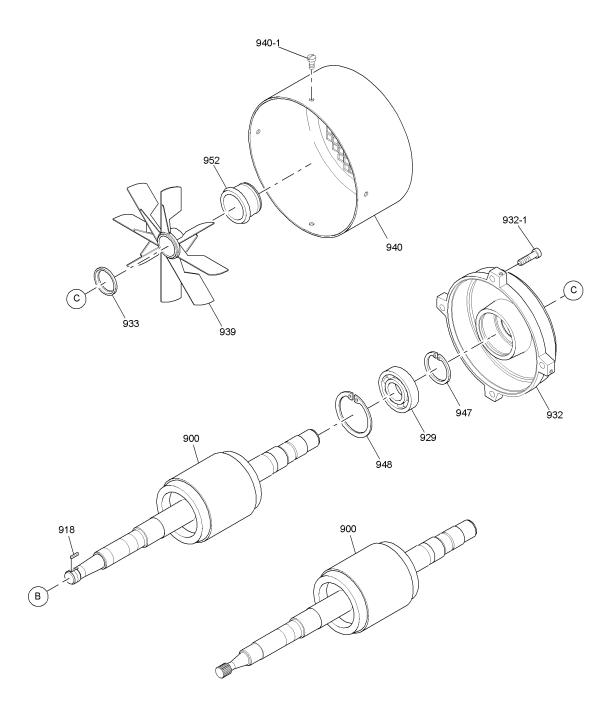


Figure 3. General Motor Exploded View and Generic Parts List (Sheet 2 of 2)

#### **MOTOR OPTIONS & NOMENCLATURE**

#### General 1.

NORD offers many options for its motors. The option code will be shown in the motor nomenclature. Below are the available options

Code		Description	Code	Description
BRE		With Brake	OL	TENV Motor – Without Fan
RG	Φ_	Brake – Corrosion Protected	OL/H	TENV Motor - Without Fan & Cover
SR	35 36 36	Brake – Dust Protected	RD	Canopy Cover
HL	See Brake BIM1090	Brake – Manual Hand Release	RDD	Double Canopy Cover
FHL	ee B}	Brake – Lockable Manual Release	RLS	Backstop
MIK	0, -	Brake – Microswitch	SH	Motor Space Heater
IR		Brake – Current Sensing Relay	TF	Thermistor
KD	Conde	ensation Holes	TW	Thermostat
KB	Condensation Holes - Plugged		WE	2 <sup>nd</sup> Motor Shaft End
MS	Powe	r Plug Connector	WU	High Slip Rotor
NSD+	NORE	O Severe Duty Plus Protection	Z	High Inertia Motor Ran
EHBU		Phase, Run Capacitor	Н	Energy Efficient
EARU	Single	Phase, Start Cap/Run Cap	IP66	IP66 Environmental Protection
F	Blowe	er Cooling Fan - 3ph & 1ph	ISO H	Class H Insulation
FC	Blowe	er Cooling Fan - 1ph	EP	Epoxy Dipped Windings
IG	Increr	mental Encoder	FK	Over Running Clutch
VR	5:1 C	onstant Torque Rated Motor	VN	10:1 Constant Torque Rated Motor
VW	20:1 0	Constant Torque Rated Motor	VZ-F	1000+:1 Constant Torque Rated Motor

Table 5. Motor Option Codes

	M	otor N	omencla	ature	
M	oto	r	Mot	or Option	ons
100L	/	4	BRE	40	
Frame Size		No. of Poles	Brake	Brake size Nm	Other Options

#### Examples

90SH/4 IG SH

Energy Efficient, 1 Speed, Encoder & Space Heater

100L/4-2 WE RDD 2 speed, 2<sup>nd</sup> Motor Shaft & Double Canopy Cover

132M/4 BRE100 HL IR TW

Brake, Hand Release, Current Sensor & Thermostat

Technical information follows for THERMISTORS, THERMOSTATS, SPACE HEATERS (Table 6), ENCODERS (Table 7) & BLOWER COOLING FAN (Table 8).

#### **Thermistors (Option TF)**

- Connection Diagram shown on Page 12
- Three PTC (Positive Temperature Coefficient) temperature sensitive resistors are wired in series
- One PTC on each phase of the stator winding
- The leads will be labeled P1 and P2 in the terminal box
- This unit must be connected to a Motor Control Protection module such as a Kriwan INT69 or a Variable Frequency Drive with PTC inputs

All wiring must be done by qualified personnel and adhere to all local codes.

WARNING: Thermistors will automatically reset.

Thermistor Ratings:

- ➤ Switching temperature 310°F(155°C)
- Maximum operating voltage 2.5 volts
- Resistance at 25°C less than or equal to 300 Ohms
- ➤ Response time < 5 seconds

#### **Thermostats (Option TW)**

- Connection Diagram shown on Page 12
- Three temperature sensitive, bimetallic switches with normally closed contacts wired in series
- One switch on each phase of the stator winding
- The leads will be labeled P1 and P2 in the terminal box

All wiring must be done by qualified personnel and adhere to all local codes.

WARNING: Thermistors will automatically reset.

#### Thermostat Ratings:

- > Switching temperature 310°F (155°C)
- Switch contacts 1.6A at 250 VAC
- > Permissible working 6 to 500 VAC
- Automatically resetting with  $30 \pm 15^{\circ}$ C drop below switching temperature
- $\triangleright$  Resistance less than 50 m $\Omega$
- > Switch rebound less than 1 millisecond
- ➤ 10g shock in all directions
- > 2,000 VAC Insulation rating
- ➤ 10,000 cycles
- Normally closed

#### Space Heaters (Option SH)

- Connection Diagram shown on Page 12
- Space Heaters are mounted directly on the motor winding
- The leads are brought into the terminal box and labeled H1 and H2
- They require a separate voltage supply and must not be energized when the motor is energized
- The heaters will keep the winding of the motor approximately 5°C above the surrounding ambient

FRAME SIZE	WATTAGE	VOLTAGES	HEATER P/N	HEATER STRIPS/MTR
		110V	18900770	
63 & 71	18W	230V	18900780	1
		460V	18900790	
		110V	18900820	
80	25W	230V	18900800	1
		460V	18900810	
		110V	18900820	
90 - 112	50W	230V	18900800	2
		460V	18900810	
		110V	18900830	
132-180	100W	230V	18900840	2
		460V	18900850	
		110V	18900860	
200 & 225	120W	230V	18900870	2
		460V	18900880	

Table 6. Space Heater Data

## **Encoder (Option IG)**

- Standard encoder manufacturer is Heidenhain (www.heidenhain.com)
- All encoders will be enclosed inside the fan shroud
- Incremental, Quadrature, Differential, Marker Channel
- IP 64 Protection
- IG1 = 1024PPR, IG2 = 2048PPR, IG4 = 4096PPR
- RS422 & Push/Pull available
- 5V or 10-30V available

Color	Si	gnal	Pin (optional	Heidenhain	Explanation			
	Push-pull	RS 422	mating plug)	Callouts	· 			
Pink		B (B-)	1	U <sub>a2</sub>	Signal line			
Blue		Sensor (+)	2	U <sub>P</sub>	Sense Supply Voltage			
Red	R (R+)	R (R+)	3	$U_{a0}$	Signal line (Marker)			
Black		R-	4	U <sub>a0</sub>	Signal line			
Brown	A (A+)	A (A+)	5	U <sub>a1</sub>	Signal line			
Green		A (A-)	6	$U_{a1}$	Signal line			
Violet		Spare	7	U <sub>aS</sub>	Spare			
Gray	B (B+)	B (B+)	8	U <sub>a2</sub>	Signal line			
Yellow			9	Shield	Spare			
White/ Green	0 V	0 V	10	0 V / U <sub>N</sub>	Common			
White	0 V	Sensor (–)	11	0 V / Sensor	Sense Common			
Brown/ Green	Vs	Vs	12	$U_P$	Supply Voltage			

Table 7. Encoder Wiring Designations

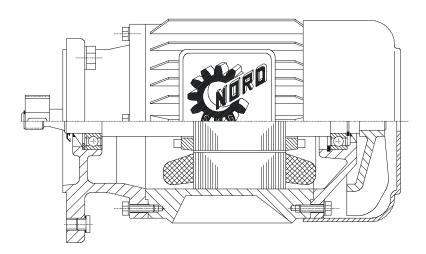
## **BLOWER COOLING FAN (Option F & FC)**

- Connection Diagram shown on Page 12 Option FC is 1 phase 115V only
- Option F has capability of 1 phase or 3 phase by connecting a supplied capacitor

			60 Hz Ratings		50 Hz Ratings				
Motor Frame		Voltage [V]	ltage [V] Current [A] Power [W		Voltage [V]	Current [A]	Power [W]		
Single Phase Connection - $1 \sim \Delta$	FC63	100-135	0.23	42	100-135	0.30	42		
	FC71	100-135	0.23	47	100-135	0.30	44		
	FC80	100-135	0.27	57	100-135	0.30	43		
	FC90	100-135	0.46	102	100-135	0.57	78		
Sir	FC100	100-135	0.53	105	100-135	0.54	78		
ŭ	FC112	100-135	0.60	115	100-135	0.55	80		
no	F63	230-332	0.11	38	230-277	0.10	27		
ecti	F71	230-332	0.12	41	230-277	0.10	28		
onn	F80	230-332	0.13	44	230-277	0.11	29		
ise C $1\sim \Delta$	F90	230-332	0.25	88	230-277	0.26	72		
Pha	F100	230-332	0.28	88	230-277	0.26	70		
Single Phase Connection $1 \sim \Delta$	F112	230-332	0.31	107	230-277	0.26	73		
Sin	F132	230-332	0.27	89	230-277	0.29	82		
_	F63	230-332	0.08	23	230-290	0.10	27		
tion	F71	230-332	0.08	24	230-290	0.10	28		
nnec	F80	230-332	0.08	25	230-290	0.10	29		
Three-Phase Low Voltage Connection	F90	230-332	0.21	64	230-290	0.28	86		
	F100	230-332	0.21	66	230-290	0.27	86		
	F112	230-332	0.23	70	230-290	0.27	85		
	F132	230-332	0.25	74	230-290	0.32	96		
ase I	F160	230-332	0.49	165	230-290	0.53	155		
Three-Ph	F180	230-332	0.49	165	230-290	0.53	155		
	F200	230-332	0.49	165	230-290	0.53	155		
	F225	230-332	0.49	165	230-290	0.53	155		
n	F63	380-575	0.04	23	380-500	0.05	29		
Three-Phase High Voltage Connection 3~Y	F71	380-575	0.04	25	380-500	0.05	30		
	F80	380-575	0.04	26	380-500	0.05	29		
	F90	380-575	0.12	62	380-500	0.16	82		
	F100	380-575	0.12	66	380-500	0.16	83		
	F112	380-575	0.13	70	380-500	0.16	82		
	F132	380-575	0.14	75	380-500	0.18	96		
ase	F160	380-575	0.28	165	380-500	0.30	155		
-Ph	F180	380-575	0.28	165	380-500	0.30	155		
hree	F200	380-575	0.28	165	380-500	0.30	155		
L	F225	380-575	0.28	165	380-500	0.30	155		

Table 8. Blower Cooling Fan Data





#### **Standards**

All motors are in accordance with existing standards and regulations, such as the electrical characteristics in accordance with NEMA MG 1 and IEC 34.1, part 5, 6, 7, 8, and 9.



NORD motors carry the CE mark in accordance with the Low Voltage Directive and if installed properly the Electromagnetic Compatibility Directive (EMC). The CE mark is required for instillation in European Union (EU) member states.



NORD motors from frame size 63 to 132M are an Underwriters Laboratories Recognized component per UL standard 1004. Motors from frame size 160 and larger will be UL recognized components in the future.



NORD motors are Canadian Standards Association approved according to CSA Standard C22.2 No. 100-92. This approval is necessary for most installations in Canada. CSA is also a Nationally Recognized Testing Laboratory (NRTL) in the United States.

#### **EPAct**

The NORD high efficiency line of motors conform to the efficiency levels as defined in The Energy Policy and Conservation Act (EPAct) of 1992. The NORD high efficiency line of motors also conforms to the required efficiency levels in Canada as defined in Canada's Energy Efficiency Regulations.

#### Inverter/Vector Duty

NORD motors are Inverter/Vector Duty. The construction of the NORD motors insulating system takes into account the non-sinusoidal waveforms produced by variable frequency drives. NORD uses high grade insulating components and the uses extra first turn protection to ensure long service life when connected to inverters. NORD motors can produce full torque at zero speed if properly sized, selected, and controlled.

#### Low Inertia

The motor inertia in all NORD motors is extremely low. This allows for a much more dynamic motor control. NORD motors can cycle more frequently and require less mechanical energy to start than standard NEMA frame motors. This leaves more energy to start the load. Low motor inertia is a particularly advantage when using NORD motors with inverters or vector controllers.

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#### **High Torque**

The NORD motor design produces higher motor starting torque. This is achieved through improved rotor design and construction.

#### Non Sparking Fan

The standard NORD motors fan is a non-sparking design. The fan will also provide proper airflow in either direction of rotation.

#### **Terminal Block**

Each NORD motor uses a terminal block. A terminal block is a superior method of wire termination as compared to pigtail leads. A terminal block ensures long term reliability of the power connections.

#### **Insulation Class**

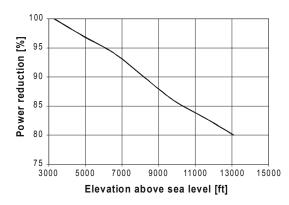
NORD motors are constructed with a thermal class F insulating system. The motors are also designed for a class B temperature rise (80 °C). The use of class F insulation with a class B temperature rise provides increased operating life. Motors constructed with class H insulation are also available as an option.

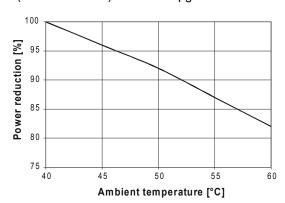
#### **Ambient Temperature**

NORD motors are designed to operate as standard with a maximum ambient temperature of 40°C (104°F). If the motors operating environment exceeds 40°C the motor either needs to be de-rated (see table below) or use an upgraded insulation.

#### **Elevation**

NORD motors are designed to operate at an elevation of up to 3300-ft (1000 m) above sea level. If the motors installation elevation exceeds this the motor either needs to be de-rated (see table below) or use an upgraded insulation.







#### **Duty Classes**

All motor ratings in this catalog are based on continuous duty operation (S1), i.e. operation with a constant load state whose duration is sufficient to reach the thermal steady state condition. S2 is a short-time operation, meaning operation with a constant load for a specified limited time followed by a pause until the motor is completely cooled down to ambient.

S3 is a periodic operation not under the influence of the start-up, consisting of repeated similar cycles each comprised of a period with constant load and a pause. The starting current should not noticeably affect the warming-up. For duty types S2 and S3 it is necessary to determine the duration of the operation time and the cycle time, moments of inertia of driven machine and its speed required torque on starting breaking method.

If a motor is designed for 100% continuous duty, S1, and shorter cycle duration factor is required; the motor power can be increased according to the table:

Duty class		Power increase factor
S2	Operation time: 60 min	1.1
	30 min	1.2
Short-time	10 min	1.4
S3	Duty cycle, ED: 60%	1.1
	40%	1.15
	25%	1.3
Periodic	15%	1.4

$$\%ED = \frac{Sum\ of\ operation\ periods}{Cycle\ time} \times 100$$

#### **Service Factor**

Motors rated 230/460V-60Hz and 330/575V-60Hz have a service factor of 1.15. All other motors have a service factor of 1.0.

#### **Available Voltages**

Standard voltages for North America:

230/460V-60Hz 330/575V-60Hz

Standard international voltages:

230/400V-50Hz (3hp and smaller) – usable on 380-415V supply voltages 400/690V-50Hz (larger than 3hp) – usable on 380-415V supply voltages

Other voltages are available

#### **Tolerances Voltage and Frequency**

Voltage tolerance  $\pm 10\%$  based on rated voltage. Line frequency tolerance of  $\pm 5\%$ . Combined variation in voltage and frequency of  $\pm 10\%$ . In accordance with NEMA standard MG 1.

#### **Enclosure**

Standard enclosure type: Totally Enclosed Fan Cooled (TEFC) with an IP55 enclosure rating. Other enclosure ratings are available including Totally Enclosed Non-Ventilated (TENV), Totally Enclosed Blower Cooled (TEBC), and IP65.

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#### NORD Severe Duty (NSD) - optional

NORD offers a protection package for the motors know as NORD Severe Duty (NDS). This additional motor protection is for wet and corrosive environments. The additional motor protection will ensure that the motor has a long trouble free service life in harsh operating environments. The following additional protections are provide with the NDS package:

- Internal coating for additional electrical insulation and moisture protection (windings, rotor and internal surfaces)
- Condensation weep holes in motor and conduit box low points
- Corrosion resistant hardware
- Additional top coat of Stainless Steel Paint

#### Epoxy Dipped Windings - optional

For additional protection in extremely wet environments the motor windings can be dipped in epoxy for improved moisture protection. The motor is also treated with the standard NORD Severe Duty (NSD) protection package.

#### Tropical Protection - optional

For hot tropical wet environments the motor can be treated to prevent fungus from growing inside the motor. This treatment includes an anti-fungal epoxy dip and the NORD Severe Duty (NSD) treatment

#### **Overload Protection**

Current-controlled motor-protection must be set according to rated current shown on the motor nameplate. Operation involving high starting frequency, short-term duty or large temperature-differences should be covered by internal motor thermal measuring devices.

## Thermostat (TW) - optional

Upon reaching the limit temperature this device automatically cuts the control-circuit. After the temperature has fallen below the trip limit the thermostat switch will re-set. Contact-rating: 250 VAC, 1.6 A.

#### Thermistor Sensors (TF) - optional

Thermistors require external tripping-device. Upon reaching the limit temperature the thermistors change their resistance suddenly. In connection with a tripping device this property is employed to monitor the motor temperature. The relay built into the tripping-device has a make-and-break-contact, which is used in the control wiring.

#### High Inertia Fan (Z) - optional

An optional cast iron motor cooing fan is available. This fan is used as a mechanical soft start and/or soft stop. This fan adds inertial to the motor. The high inertial fan can also be used for a flywheel effect, to store mechanical energy. This can be helpful where the are rapid load changes that need to be smoothed. The cast iron fan replaces the standard plastic motor fan.

#### Canopy Drip Cover (RD) - optional

For installations where the fan end of the motor is mounted up allowing water to fall into the motor's fan guard, NORD offers a canopy drip cover to block this falling water.

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#### **Starting Frequency**

One major advantage of NORD motors and brakemotors is the ability to operating in high start-stop applications. Due to the motors optimized design, NORD motors can, under some conditions, cycle thousands of times an hour. This means that a NORD brake motor can often be used to replace a clutch brake system.

If the motor or brakemotor is used with an Inverter or Vector drive the motors cycling capacity can be increased even more.

Following factors have to be considered when calculating the permissible starting frequency:

Z<sub>O</sub> no-load starting frequency [starts/hour]

Z<sub>zul</sub> permissible starting frequency [starts/hour]

J<sub>mot</sub> moment of inertia of motor [Lb-in<sup>2</sup>]

J<sub>red</sub> external moment of inertia reduced to motor shaft [Lb-in<sup>2</sup>]

T<sub>a</sub> required starting torque [Lb-in]

T<sub>1</sub> load torque after starting [Lb-in]

The permissible frequency of switching may be calculated as follows.

$$Z_{zul} = \frac{1 - \frac{T_l}{T_a}}{1 + \frac{J_{red}}{J_{mot}}}$$

Blower Cooling Fan- optional



Energy efficient, 1.15 Service factor

Inverter duty, TEFC

Synchronous speed 1800rpm @ 60Hz, 4-pole Voltages: 230/460 & 330/575 – 60Hz, Three-phase Continuos Duty, 40°C Ambient, up to 3300ft Elevation

Class B temperature rise, Class F insulation



Frame	HP	kW	n <sub>n</sub>	Full-load current In		$I_a/I_n$	Code	Tn	T <sub>a</sub> /T <sub>n</sub>	T <sub>k</sub> /T <sub>n</sub>	pf	Eff.	J <sub>m</sub>	
Size			Full	230V	460V	575V		Letter						Inertia
			Load											
			rpm	Α	Α	Α	%		lb-in				%	lb-ft <sup>2</sup>
80LH/4	1.0	0.75	1750	3.88	1.94	1.50	600	L	36.0	4.6	4.3	0.59	82.5	0.0489
90SH/4	1.5	1.1	1740	4.3	2.15	1.75	630	J	54.3	3.5	3.8	0.76	84.0	0.0817
90LH/4	2.0	1.5	1745	6.3	3.15	2.45	670	K	72.4	4.3	4.5	0.71	84.0	0.0929
100LH/4	3.0	2.2	1765	8.6	4.30	3.4	790	L	107	3.6	4.7	0.73	87.5	0.1781
112LH/4	5.0	3.7	1770	14.4	7.20	5.6	810	L	179	4.4	4.3	0.74	87.5	0.3491
132SH/4	7.5	5.5	1780	20.9	10.5	8.3	820	L	266	4.3	4.6	0.74	89.5	0.7529
132MH/4	10	7.5	1770	27.0	13.5	10.8	730	J	356	3.2	4.0	0.78	89.5	0.8408
160MH/4 *	15	11	1765	35.8	17.9	14.3	930	K	536	2.6	3.2	0.85	91	1.235
160LH/4 *	20	15	1765	49.0	24.5	19.6	960	L	714	2.8	3.5	0.85	91	1.354
180MH/4 *	25	18.5	1770	61	30.5	24.0	910	K	890	2.8	3.6	0.83	92.4	3.563
180LH/4 *	30	22	1770	72	36	28.8	990	L	1068	3.1	3.9	0.83	92.4	4.513
200LH/4 *	40	30	1770	94	47	37.6	910	K	1424	3.0	3.6	0.86	93	7.600
225SH/4 *	50	37	1778	118	59	47.2	800	J	1772	2.9	3.6	0.85	93	10.45
225MH/4 *	60	45	1780	142	71	57	810	J	2124	3.0	3.7	0.85	93.6	12.35
250MH/4 *	75	55	1784	174	87	70	760	Н	2650	3.0	2.8	0.86	94.1	18.76
280SH/4 *	100	75	1784	228	114	91	730	Н	3530	2.4	2.8	0.87	94.5	33.25
280MH/4 *	125	90	1786	288	144	115	770	Н	4410	2.8	3.1	0.86	94.5	38.00
315SH/4 *	150	110	1790	352	176	141	780	J	5280	2.7	2.8	0.84	95	52.3
315MH/4 *	175	132	1792	414	207	166	820	J	6150	3.4	3.1	0.83	95	64.1
315LH/4 *	200	160	1792	462	231	185	800	J	7030	3.3	2.7	0.85	95	76.0

<sup>\* -</sup> Underwriter Laboratories Recognition - pending

#### Abbreviations

 $egin{array}{lll} oldsymbol{n}_n & - & \mbox{Full-load speed} \\ oldsymbol{I}_n & - & \mbox{Full-load current} \end{array}$ 

 $I_a/I_n$  - Locked-rotor current ratio (percentage)

 $T_n$  - Full-load torque

 $\begin{array}{lll} T_a/T_n & - & \text{Locked-rotor torque ratio} \\ T_k/T_n & - & \text{Break-down torque ratio} \end{array}$ 

pf - Power factor
 Eff. - Nominal efficiency
 J<sub>m</sub> - Motor inertia



#### **MOTOR**

Standard efficiency, 1.15 Service factor

Inverter duty, TEFC

Synchronous speed 1800rpm @ 60Hz, 4-pole Voltages: 230/460 & 330/575 - 60Hz, Three-phase Continuos Duty, 40°C Ambient, up to 3300ft Elevation

Class B temperature rise, Class F insulation



Frame	HP	kW	n <sub>n</sub>	Full-le	oad cur	rent I <sub>n</sub>	I <sub>a</sub> /I <sub>n</sub>	Code	Tn	T <sub>a</sub> /T <sub>n</sub>	T <sub>k</sub> /T <sub>n</sub>	pf	Eff.	J <sub>m</sub>
Size			Full	230V	460V	575V		Letter				_		Inertia
			Load											
			rpm	Α	Α	Α	%		lb-in				%	lb-ft <sup>2</sup>
63S/4	0.16	0.12	1700	0.88	0.44	0.35	300	Н	5.93	2.7	3.5	0.66	52	0.00499
63L/4	0.25	0.18	1680	1.12	0.56	0.45	300	G	9.38	2.3	2.5	0.71	57	0.00665
71S/4	0.33	0.25	1710	1.56	0.78	0.62	340	Н	12.3	2.3	3.0	0.64	63	0.0133
71L/4	0.50	0.37	1720	1.90	0.95	0.76	400	G	18.3	2.2	2.7	0.69	71	0.0173
80S/4	0.75	0.55	1710	2.70	1.35	1.08	400	Н	27.6	2.2	2.3	0.71	72	0.0304
80L/4	1.0	0.75	1650	3.65	1.83	-	280	D	38.2	2.1	2.2	0.64	70	0.0623
90S/4	1.5	1.1	1660	4.83	2.42	-	320	D	57.0	2.6	2.5	0.68	73	0.0887
90L/4	2.0	1.5	1660	6.33	3.17	-	340	D	75.9	2.5	2.4	0.70	74	0.1182
100L/4	3.0	2.2	1700	9.04	4.52	-	350	D	111	2.2	2.5	0.70	75	0.1699
100L/40	5.0	3.7	1725	15.2	7.62	-	510	G	183	2.7	3.1	0.75	81	0.2831
1325/4	7.5	5.5	1730	19.8	9.91	-	380	С	273	2.2	2.6	0.71	85	0.8796
132M/4	10	7.5	1730	25.7	12.9	-	440	Е	364	2.7	3.0	0.73	87	1.197
160M/4 *	15	11	1760	36.8	18.4	-	820	K	537	2.8	3.3	0.85	88	1.187
160L/4 *	20	15	1760	49	24.5	-	800	J	716	2.8	3.3	0.86	89	1.661
180M/4 *	25	18.5	1750	60	30.0	-	740	Н	900	2.6	3.0	0.87	89	3.085
180L/4 *	30	22	1755	71	35.5	-	800	J	1080	2.9	3.3	0.87	89.5	3.560
200L/4 *	40	30	1755	91	45	-	580	F	1440	2.6	2.6	0.89	92	10.68
225S/4 *	50	37	1755	124	62	-	670	Н	1800	2.2	2.2	0.83	91	13.29
225M/4 *	60	45	1760	143	71	-	700	Н	2150	2.8	2.8	0.86	91	16.85
250M/4 *	75	55	1760	170	85	-	700	Н	2690	2.6	2.6	0.89	90	19.93
280S/4 *	100	75	1770	223	111	-	670	G	3560	2.6	2.6	0.87	91	37.02
280M/4 *	125	90	1775	290	145	-	650	G	4440	2.6	2.6	0.86	91	42.71
315S/4 *	150	110	1775	345	173	-	750	Н	5330	3.1	3.1	0.87	90	80.68
315M/40 *	200	150	1775	445	223	-	750	Н	7100	3.2	3.2	0.86	93	125.8
* - Underwrite	r Labor	atories	Recogni	tion - p	endina									

#### Abbreviations

 $n_n$  - Full-load speed

In - Full-load current
Ia/In - Locked-rotor current ratio (percentage)
Tn - Full-load torque

 $T_a/T_n$  - Locked-rotor torque ratio  $T_k/T_n$  - Break-down torque ratio

- Power factor Eff. Nominal efficiency  $J_{m}$ Motor inertia

Data subject to change without notice

3/03/00-working

www.nord.com

6



#### **MOTOR**

Dimensions

Connection diagrams

Options

Canopy 2WE Space heaters Epoxy dipped windings IEEE 45 Harting plug connector

Vents

Brakes (& connections)

Backstop Backstop Overrunning clutch

**Encoders** 

Inverter selections / thermals



Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference: NC01

#### MICROSAND RECIRCULATION PUMP ST-101



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REV.	ITEM	QTE/	QTE/QTY. Unit. ITotal	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	N/d	
	NC01ST-101- 1	2		4 MICROSAND RECIRCULATION PUMP	P2-011	B56		Œ		
				Type:	P2-012					
				Dry seal, Vertical, Centrifugal	P2-021					
				Manufacturer:	P2-022					
				Linatex						
				Model:						
				Linapump IIIr 50X50						
				Pump weight:						
				326 kg (718 lb)						
				Pump + motor Weight						
				156 kg (344 lb)						
				Base:						
				Painted steel						
				PUMP PERFORMANCES AT OPERATION POINT						
				Capacity						
				34 m³/h at 17 m (24 psi)						
				Absorbed power(BHP):						
				4,66 kW (6,26 Hp)						
				Rotational pump speed						
				1759 rpm						

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ļ		Unit.	. Total		I.D./TAG	ACCPAC		SITE		
				IMPELLER						
				Type:						
				Linatex						
				Diameter						
				200 mm (7.9 in)						
				Material						
				Field remplaceable molded Linatex						
				PUMP CASING						
				Casing						
				Cast iron						
				Wetted parts						
				Field remplaceable molded Linatex						
				Suction:						
				50 mm (2 in), flange #150						
				Discharge						
				50 mm (2 in), flange #150						
				Drive:						
				pulleys and belts complete with safeguard						
				Packing:						
				« Dry Gland » Type D						

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		5	010	MOTOR				5		
				Manufacturer:						
				Weg						
				Туре:						
				Squirrel cage						
				Service:						
				continuous						
				Efficiency						
				92,4%						
				Frame						
				TEFC / 215T						
				Speed						
				1765 rpm						
				Power						
				10 HP						
				Electrical feed						
				575 V / 3 ph / 60 Hz						
				Enclosure:						
				IP55 with Class F insulation tropical protection						
				Paint protection						
				Manufacturer standard						

# XNV78 4451

200 Wall Street, Hollidaysburg PA 16648 USA Tel: 814-695-9807 Fax: 814-695-6684



585 Airport Road Gallatin TN 37066 USA Tel: 615-451-4440

Fax: 615-451-4461

May 15, 2009

John Meunier Inc. 4105 Rue Sartelon Ville St-Laurent, QC H4S 2B3 Canada

To Whom It May Concern:

Thank you for your recent purchase. Please find the following Installation & Operations Manuals for your purchase order # NC01-042950 referencing our Sales Order # 61395. If you have any questions or concerns, please give our office a call at the phone number provided below.

Sincerely,

Karen Fleming Administrative Assistant McLanahan Corporation (615) 451-4440

ref: 2X2D-McL



# This Manual Covers the 2" x 2" LPT Pump with Dry Gland P/N 09101002011

Supplied to: John Meunier Inc.

Date: 05.15.09

Order Number: 61395

Customer P.O. Number: NC01-042950

Serial Numbers: 20093041, 20093042,

20093043, 20093044

Should you have any questions regarding the installation and/or operation of the equipment you have purchased, please contact our Process Equipment Department at (615) 451-4440.



#### Dear Gentlemen:

The accompanying manual and parts lists are for the 2" x 2" LPT Pump with Dry Gland you recently purchased. We suggest you become familiar with the enclosed literature to assure the proper installation of this equipment.

We also recommend you purchase the replacement parts listed on the enclosed proposal. Having these recommended spare parts at your plant will assure minimum down time in order to perform periodic maintenance and will also eliminate the expense of air freight of critical parts. Should you require other parts not listed, they are available for immediate shipment from our inventory.

If any additional information regarding your LPT equipment is required, please feel free to call.

Sincerely,

McLanahan Corporation

ref: 2X2D-McL



#### LPT FINES RECOVERY EQUIPMENT

#### **EQUIPMENT FURNISHED:**

#### (1) 2" x 2" LPT Pump complete with:

- Field replaceable molded rubber casing liners and impeller
- Dry Gland
- Grease lubricated bearing housing assembly
- Adjustable overhead motor table



#### **RECOMMENDED SPARE PARTS**

#### 2" x 2" LPT

#### **PUMP WITH DRY GLAND**

Description	Item #	Part #	Quantity
Gland Repair Kit	GD13	09110002321	1.00
Suction Casing Liner	04	09110002106	1.00
Gland Casing Liner	06	09110002109	1.00
Impeller	08	09110002110	1.00
End Bearing	B05	09110002205	1.00
Front Bearing	B06	09110002206	1.00
Tab Washer	B07	09110002207	1.00
Lock Nut	B08	09110002208	1.00
End Grease Seal	B09	09110002209	1.00
Front Grease Seal	B10	09110002210	1.00

#### <u>LPT PUMP MANUAL - APPENDIX I</u> <u>Long Term Storage</u>

#### **General:**

The following are recommendations in reference to long term storage of LPT Pumps and Drives, LPT does not accept liability for components under these conditions. Documentation and photographic evidence is necessary for warranties to apply.

#### **Preventive Maintenance for Stored Rotating Spares**

In the absence of data on premature bearing failures and armature/shaft sag and imbalance, we recommend a general procedure as follows:

The motor shaft targets should generally be used on any motor of 50 HP or higher. They also should be used on fans and any other large rotating equipment that sits in storage for lengthy periods of time. By rotating these shafts monthly (or more depending on the floor vibrations), you are preventing armature and shaft sag as well as false brinelling of the bearings into the races.

You may also find some other smaller motors that have premature bearing failures after prolonged storage in your facility. This would be evidence to apply the shaft targets and rotation to smaller motors.

The motor shaft targets should be attached to the shafts with double-stick foam tape. A monthly color chart should be hung on the wall in the equipment storage area to indicate the "color of the month."

#### What is False Brinelling?

"This condition can occur whenever a non-rotating bearing is subjected to external vibration. (Note: There is another type of brinelling called true brinelling that occurs in rotating bearings.) When the bearing isn't turning, a protective oil film cannot form between the races and the rotating elements. Thus, there can be metal-to-metal contact between the races and rotating elements, and the small, relative motion between these parts causes wear marks on both races at the location of each rotating element. False brinelling can occur during transportation (typically truck or rail) and during motor storage if the storage area is subject to vibration. False brinelling occurs frequently with the bearings of motors installed on "spare" or "backup" systems in the plant. A typical example of this is parallel motor/pumps where one system is considered to be the primary system and the other system only a backup. The primary system may run for weeks, months, or even longer before the backup system is ever energized. The problem is that even though the backup is not running, it is actually "piped" into the system. Vibrations associated with the running system are being constantly transmitted to the backup system. Thus, severe false brinelling can occur on both the backup motor and pump bearings."

Extract from Office of Industrial Technologies Web Site

#### Pump:

It is recommended that the Pump is stored in a clean, dry, vibration free environment. The shaft should be manually rotated every 3 months (or at the same interval as recommended by the electric motor manufacturer). The natural rubber linings and components should be protected in keeping with the recommendations below.

#### LPT PUMP MANUAL - APPENDIX I Long Term Storage

#### **Electric Motor**

The following information is reprinted from the WEG "Installation and Maintenance Manual for NEMA low Voltage Electric Motors"

#### 2.3 Storage

Motors should be raised by their eyebolts and never by their shafts. It is important that high rating three-phase motors be raised by their eyebolts. Raising and lowering must be steady and joltless, otherwise bearings may be harmed. When motors are not immediately installed, they should be stored in their normal upright position in a dry even temperature place, free of dust, gases and corrosive atmosphere. Other objects should not be placed on or against them. Motors stored over long periods are subject to loss of insulation resistance and oxidation of bearings.

Bearings and lubricant deserve special attention during prolonged periods of storage. Depending on the length and conditions of storage it may be necessary to regrease or change rusted bearings. The weight of the rotor in an inactive motor tends to expel grease from between the bearing surfaces thereby removing the protective film that impedes metal-to-metal contact. As a preventive measure against the formation of corrosion by contact, motors should not be stored near machines which cause vibrations, and every 3 month their shafts should be rotated manually.

Insulation resistance fluctuates widely with temperature and humidity variations and the cleanliness of components. When a motor is not immediately put into service it should be protected against moist, high temperatures and impurities, thus avoiding damage to insulation resistance. If the motor has been in storage more than six month or has been subjected to adverse moisture conditions, it is best to check the insulation resistance of the stator winding with a megohmeter. If the resistance is lower than ten megohms the windings should be dried in one of the two following ways:

1) Bake in oven at temperatures not exceeding 194 degrees F until insulation resistance becomes constant.
2) With rotor locked, apply low voltage and gradually increase current through windings until temperature measured with thermometer reaches 194 degrees F. Do not exceed this temperature.

If the motor is stored for an extensive period, the rotor must be periodically rotated.

Should the ambient conditions be very humid, a periodical inspection is recommended during storage. It is difficult to prescribe rules for the true insulation resistance value of a machine as resistance varies according to the type, size and rated voltage and the state of the insulation material used, method of construction and the machine's insulation antecedents. A lot of experience is necessary in order to decide when a machine is ready or not to be put into service. Periodical records are useful in making this decision.

The following guidelines show the approximate values that can be expected of a clean and dry motor, at 40°C test voltage in applied during one minute.

Insulation resistance Rm is obtained by the formula:

Rm = Vn + 1

Where: Rm - minimum recommended insulation resistance in

 $M\Omega$  with winding at 40°C

Vn - rated machine voltage in kV

In case the test is carried out at a temperature other than 40°C, the value must be corrected to 40°C using an approximated curve of insulation resistance v.s temperature of the winding with the aid of Figure 2.1; it's possible verify that resistance practically doubles every 10°C that insulating temperature is lowered.

Example:

Ambient temperature =  $50^{\circ}$ C Motor winding resistence at  $50^{\circ}$ C =  $1.02 \text{ M}\Omega$ Correction to  $40^{\circ}$ C

#### <u>LPT PUMP MANUAL - APPENDIX I</u> <u>Long Term Storage</u>

 $R_{40^{\circ}C} = R_{50^{\circ}C} \times K_{50^{\circ}C}$   $R_{40^{\circ}C} = 1.02 \times 1.3$  $R_{40^{\circ}C} = 1.326 M\&$ 

The minimum resistance Rm will be:

Rm = Vn + 1Rm = 0.440 + 1Rm =  $1.440 M\Omega$ 

On new motors, lower values are often attained due to solvents present in the insulating varnishes that later evaporate during normal operation.

This does not necessarily mean that the motor is not operational, since insulating resistance will increase after a period of service. On motors which have been in service for a period of time much larger values are often attained. A comparison of the values recorded in previous tests on the same motor under similar load, temperature and humidity conditions, serves as a better indication of insulation condition than that of the value derived from a single test. Any substantial or sudden reduction is suspect and the cause determined and corrective action taken.

Insulation resistance is usually measured with a MEGGER.

In the event that insulation resistance is inferior to the values derived from the above formula, motors should be subjected to a drying process.

#### 2.3.1 Drying the windings

This operation should be carried out with maximum care, and only by qualified personnel. The rate of temperature rise should not exceed 5°C per hour and the temperature of the winding should not exceed 105°C. An overly high final temperature as well as a fast temperature increase rate can each generate vapour harmful to the insulation.

Temperature should be accurately controlled during the drying process and the insulation resistance measured at regular intervals. During the early stages of the drying process, insulation resistance will decrease as a result of the temperature increase, but the resistance will increase again when the insulation becomes dryer.

The drying process should be extended until successive measurements of insulation resistance indicate that a constant value above the minimum acceptable value has been attained. It is extremely important that the interior of the motor be well ventilated during the drying operation to ensure that the dampness is really removed.

Heat for drying can be obtained from outside sources (an oven), energization of the space heater (optional), or introducing a current through the actual winding of the motor being dried.

Electric machines should be installed in order to allow an easy access for inspection and maintenance. Should the surrounding atmosphere be humid, corrosive or contain flammable substances or particles, it is essential to ensure an adequate degree of protection. The installation of motors in environments where there are vapours, gases or dusts, flammable or combustible materials, subject to fire or explosion, should be undertaken according to appropriate and governing codes, such as NEC Art. 500 (National Electrical Code) and UL-674 (Underwriters Laboratories, Inc.) Standards.

Under no circumstances can motors be enclosed in boxes or covered with materials which may impede or reduce the free circulation of ventilating air. Machines fitted with external ventilation should be at least 50cm from the wall to permit the passage of air. The opening for the entry and exit of air flow should never be obstructed or reduced by conductors, pipes or other objects. The place of installation should allow for air renewal at a rate of 700 cubic feet per minute for each 75 HP motor capacity.

#### LPT PUMP MANUAL - APPENDIX I Long Term Storage

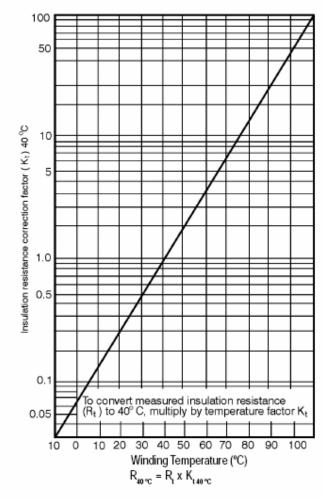


Figure 2.1

- Extract from WEG Manual

#### **Rubber Products:**

Rubber products in storage can be adversely affected by the following: temperature, humidity, ozone, sunlight, oils, solvents, corrosive liquids and fumes, insects and rodents, and radiation.

The warehousing area should be relatively cool, dark, and free from dampness and mildew. All rubber products should be used on a first-in, first-out basis since even under these conditions an unusual length of time in storage can result in the deterioration of certain products.

The ideal storage temperature for rubber products is 50 to 70 degrees F (10 to 21 degrees C) with a maximum limit of 100 degrees F (38 degrees C.) If stored below 32 degrees F (0 degrees C) some products may become stiff and should be warmed before being placed in service. Rubber products should not be stored near sources of heat, such as radiators and base heaters.

#### LPT PUMP MANUAL - APPENDIX I Long Term Storage

Rubber products should not be stored under conditions of high or low humidity.

To protect against the adverse effects of ozone, rubber products should not be stored near electrical equipment that may generate ozone and should not be stored for any lengthy period in geographical areas of known high ozone concentrations. Exposure to direct and reflected sunlight should also be avoided.

Whenever feasible, rubber products should be stored in their original shipping containers, especially when such containers are wooden crates or cardboard cartons, since this will provide protection against the deteriorating effects of oils, solvents, and corrosive liquids and will also afford some protection against ozone and sunlight.

Since certain rodents and insects thrive on rubber products, adequate protection should be provided against them.

## ATTENTION PLANT OPERATORS HANG NEAR YOUR PUMP

#### LPT Model IIIr Centrifugal Pump

#### fitted with

#### Dry Gland "D" Type

#### 1. BEFORE STARTING THE PUMP:

The belts are not installed at the factory. Make sure that the motor has been wired to provide the correct direction of rotation. Bump the motor with <u>the belts removed</u> when running for the first time or after electrical work to ensure correct direction of rotation. Failure to remove the belts can result in the impeller unscrewing and damaging the pump if rotation is in wrong direction.

#### 2. STARTING UP AND RUNNING THE PUMP:

With the pump full of water, start the pump. The pump should immediately start pumping. UNDER NO CIRCUMSTANCE SHOULD THE PUMP BE ALLOWED TO CONTINUE RUNNING IF THERE IS NO PUMPED DISCHARGE, DUE TO THE HEAT BUILD UP THAT CAN RESULT.

If by accident the pump has run without pumped discharge for more than two or three minutes, it must be stopped immediately and the cause of the problem investigated. Should the pump wet end be opened up after such an occurrence, care must be exercised as there could be high temperatures present in the pump casing.

#### 3. PRIMING:

The LPT centrifugal pump is NOT self priming. For this reason the pump must be installed with a flooded suction, or with the appropriate system for suction lift.

#### 4. ADJUSTING THE "D" TYPE DRY GLAND:

Adjustment of the gland should be done with the pump in operation, when first installed or after new gland parts have been fitted. On starting, it is common for the gland to leak. In fact, if it does not leak, back off the Adjusting Nuts slightly until it does leak with a generous flow and then retighten the Adjusting Nuts until the leak reduces to a few drips a minute. (2 to 5 drops per minute is

normal.) Care must be exercised not to over tighten, which could damage the face seal.

#### 5. STOPPING THE PUMP:

Before stopping the pump, it is advisable to run the pump on clear water before turning it off, to prevent solids from settling out in the pump casing.

#### 6. LUBRICATION

Comes from the factory fully greased. The Shaft Bearings should be greased with the correct grade of grease

(i.e. "Shell Alvania Grease 3" or equivalent). Every 1000 hours of operation, inject grease by six strokes of a regular size (2" diameter body) grease gun.

#### 7. MAINTENANCE:

Except for attention to the gland while the pump is in operation, there is no daily maintenance required on the pump. It is essential, however, that routine inspections be carried out, with the first such inspection taking place approximately three months from startup. This inspection should provide some idea of the wear rate, which will be a guide for scheduling future inspections and maintenance. For dismantling and reassembly of the pump, see the Instruction Manual supplied with the pump.

#### 8. SPARES:

Recommended spare parts are listed in the Instruction Manual. It is recommended that a supply of the wear parts listed be kept in stock so as to minimize down time in the event of failure of the part.

### Assembly of Dry Gland - Hard Wear Face & Gland Adjuster (2" x 2" shown)



1. Check all components



2. Extrude epoxy from package & mix thoroughly



3. Apply epoxy to outer rim of Hard Wear Face (D11)



4. Place 'O' Ring (D10) on outer rim of Hard Wear Face (D11). Position 'O' Ring at leading edge.



5. Position Hard Wear Face & 'O' Ring into Gland Adjuster (D03U)



6. Using a slight twisting motion Carefully push Hard Wear Face into Adjuster



7. Wipe off excess epoxy



8. Place a heavy object on top of the assembly until dry (min 30 minutes)



Poulies Maska Inc. 180,Boul. Gagnon Ste-Claire, Qc GOR 2V0 (418) 883-3322 (418) 883-5015 sales@maskapulleys.com

-Project #

Q2603



Sel	lection	Parameter	

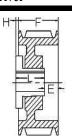
Driver	Driven	Pitch	ı Diameter Li		Max. Hu	h I aadı	9999
Dilvei	Dilveil	Driver	Minimum 1.55	Maximum		of Grooves:	
<b>Rpm:</b> 1765	Rpm Minimum 1706	Driver	1.55	71.00	MIII. NDF	of Grooves:	2
	1	Driven	1.55	71.00	Max. Nbr	of Grooves:	15
Horsepower: 10.00	Rpm Maximum 1812	Service Fact	tor:	1.6	Min. Rim	Speed (FPM):	900
Shaft diameter:	Shaft diameter:	Center Dista	ance Minimu	<b>m:</b> 13.00	Max. Rim	Speed (FPM):	6500
1.3750 Inch	40.0000 mm	Center Dista	ance Maximu	<b>m:</b> 13.70	<b>Belts:</b>	B, BX,	

#### **Actual Drive Values:**

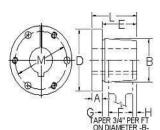
Rpm Driven 1765 Center Distance: 13.4 Deflection (in):0.21 \*Deflection Force (lbs):3.5 \*Hub Loads (lbs):169

Service Factor: 1.62 H.P. / Belts: 8.12

#### Driver

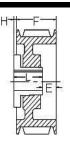


Driver Sheave: 2B70 Weight: 9.05 Lb P.D.:7.35 D.D.:7 Price: 72.00\$ E: 1/4" F: 1 3/4" H: 3/8" L: 1 7/8" O. D.: 7.35"

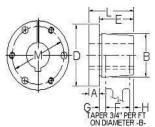


Driver Bushing: SKX1-3/8 Weight: 3 Lb Price: 26.80\$ Bolt Circle - M: 3 5/16" A: 1/2" B: 2 13/16" D: 3 7/8" E: 1 3/8" F: 1 1/4" G: 5/16" H: -3/16" L: 1 7/8"

#### Driven



Driven Sheave: 2B70 Weight: 9.05 Lb P.D.:7.35 D.D.:7 Price: 72.00\$ E: 1/4" F: 1 3/4" H: 3/8" L: 1 7/8" O. D.: 7.35"



Driven Bushing: SKX40MM Weight: 2.8 Lb Price: 26.80\$ Bolt Circle - M: 3 5/16" A: 1/2" B: 2 13/16" D: 3 7/8" E: 1 3/8" F: 1 1/4" G: 5/16" H: -3/16"

L: 1 7/8"

Recommended Drive Selections are designed for use with Maska components (sheaves, bushings and V-belts) which meet or exceed MPTA & RMA standards. The use of lesser quality products could affect life expectancy of drive. Selections and Pricing are as accurate as possible; Maska is not responsible for ANY pricing or design errors. Price shown are for standard products only. For non-standard products or products that need dynamic balancing, contact Maska for pricing.

Selections and Pricing are as accurate as possible, but Maska is not responsible for ANY pricing or design errors.

Version 2.5.5



Poulies Maska Inc. 180,Boul. Gagnon Ste-Claire, Qc GOR 2V0 (418) 883-3322 (418) 883-5015 sales@maskapulleys.com

-Project #

Q2603

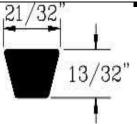


Driver	Driven	Pitcl	Diameter Li	imits	Max. Hub Load: 9999
		Driver	Minimum 1.55	Maximum 71.00	Min. Nbr of Grooves: 2
Rpm: 1765 Horsepower: 10.00	Rpm Minimum 1706 Rpm Maximum 1812	Driven	1.55	71.00	Max. Nbr of Grooves: 15
Shaft diameter:	Shaft diameter:	Service Fact	tor:	1.6	Min. Rim Speed (FPM): 900
1.3750 Inch	40.0000 mm		ance Minimu	15.00	Max. Rim Speed (FPM): 6500
1.5750	40.0000	Center Dista	ance Maximu	<b>m:</b> 13.70	Belts: B, BX,

#### **Actual Drive Values:**

Rpm Driven 1765 Center Distance: 13.4 Deflection (in):0.21 \*Deflection Force (lbs):3.5 \*Hub Loads (lbs):169

Service Factor: 1.62 H.P. / Belts: 8.12



Belts: VBB47 Weight: 0.5 Lb

Qty: 2

\*Deflection Force (lbs):3.5 Deflection (in):0.21 \*Hub Loads (lbs):169

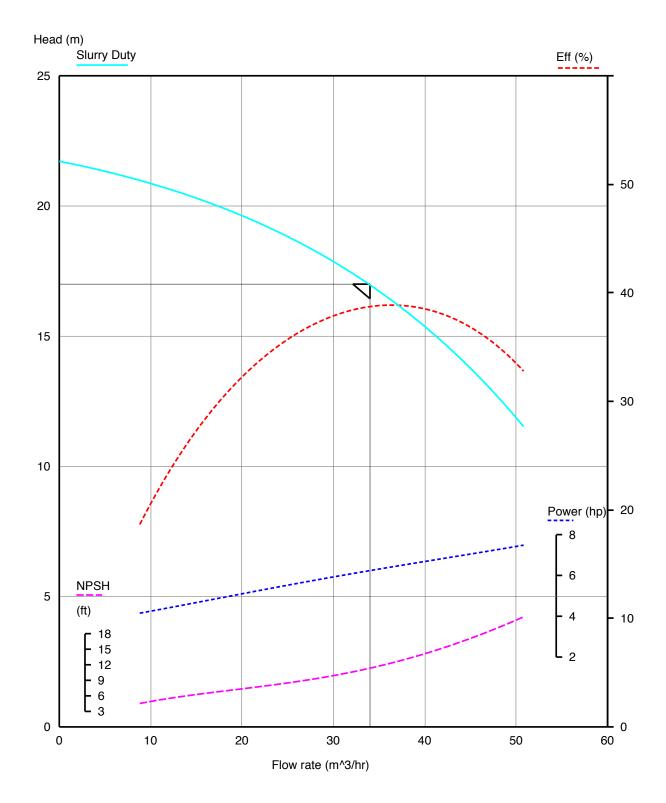
Note: This Hub Loads value is calculated after 24 hours of utilisation. (\*These values are calculated with a service factor equal to 1.0)

Recommended Drive Selections are designed for use with Maska components (sheaves, bushings and V-belts) which meet or exceed MPTA & RMA standards. The use of lesser quality products could affect life expectancy of drive. Selections and Pricing are as accurate as possible; Maska is not responsible for ANY pricing or design errors. Price shown are for standard products only. For non-standard products or products that need dynamic balancing, contact Maska for pricing.

Selections and Pricing are as accurate as possible, but Maska is not responsible for ANY pricing or design errors.

Version 2.5.5

Mcl anahan	LP III r 50	/50	1759 RPM			
CORPORATION	Flow 34 m^3/hr Head 17 m	Efficiency	6.263 hp 38.73 %	Stages 1 Max Spd 2600 RPM		
Date / /	SG 1.150 d50 0.1 in.	_	52 % 18.42 m/s	Qbep 94 % Head Corr 0.974		
Ref Q2560 REV 2	NPSHr 2.862 m		7.874 in.	Eff Corr 0.974		



Pump Selection Technical Report Quote Ref No: Q2560 REV2 Date : / / Project Name JMI Thompson Creek

Customer Address

Telephone

Fax

Flow rate	34.0	m^3/hr
Head	17.0	m
Speed Head	17.5	m

SG Solid	2.700	Solids Flow	9.10 Tons/hr
SG Liquid	1.000	% Solid Wt	20.7 %
SG Slurry	1.150	% Solid Vol	8.8 %
Head Ratio	0.97	D50 Size	0.1000 mm
Eff Ratio	1.00	Max Size	0.0500 in.

<b>-</b>	_		
No of pumps	1		
Pump Model	50/50	Supplier	McLanahan
Flow rate	34.0 m <sup>3</sup> /hr	Power Abs	6.26 hp
Head	17.0 m	Power Req	7.20 hp
Pump speed	1759 RPM	Motor size	10 hp
NPSHr	2.9 ft	Efficiency	38.7 %
Impeller D	7.874 in.	BEP	38.8 %



# INSTALLATION AND MAINTENANCE MANUAL FOR NEMA LOW VOLTAGE ELECTRIC MOTORS



he electric motor is the item of equipment most widely used by man in his pursuit of progress, as virtually all machines and many renowned inventions depend upon it.

By virtue of the prominent role the electric motor plays in the comfort and welfare of mankind, it must be regarded and treated as a prime power unit embodying features that merit special attention, including its installation and maintenance.

This means that the electric motor should receive proper attention.

Its installation and routine maintenance require specific care to ensure perfect operation and longer life of the unit.

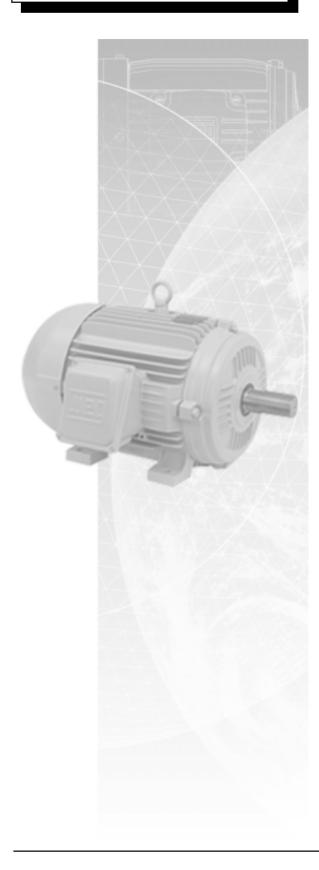
THE WEG ELECTRIC MOTOR INSTALLATIONAND MAINTENANCE MANUAL provides the necessary information to properly install, maintain and preserve the most important component of all equipment:

THE ELECTRIC MOTOR!

WEG



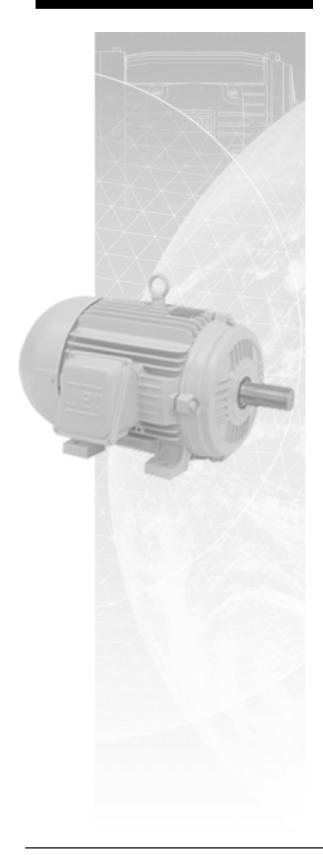
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#### 1. Introduction



his manual covers all the three-phase and single-phase asynchronous squirrel-cage induction motors, from 140T to 580T frame sizes.

The motors described in this manual are subject to continuous improvement and all information is subject to change without notice.
For further details, please consult WEG.



#### 2. Basic Instructions

#### 2.1 Safety Instructions

All personnel involved with electrical installations, either handling, lifting, operation and maintenance, should be well-informed and upto-date concerning the safety standards and principles that govern the work and carefully follow them.

Before work commences, it is the responsibility of the person in charge to ascertain that these have been duly complied with and to alert his personnel of the inherent hazards of the job in hand. It is recommended that these tasks be undertaken only by qualified personnel and they should be instructed to:

- avoid contact with energized circuits or rotating parts,
- avoid by-passing or rendering inoperative any safeguards or protective devices,
- avoid extended exposure in close proximity to machinery with high noise levels,
- use proper care and procedures in handling, lifting, installing, operating and maintaining the equipment, and
- follow consistently any instructions and product documentation supplied when they do such work.

Before initiating maintenance procedures, be sure that all power sources are disconnected from the motor and accessories to avoid electric shock.

Fire fighting equipment and notices concerning first aid should not be lacking at the job site; these should be visible and accessible at all times.

#### 2.2 Delivery

Prior to shipment, motors are factory-tested and balanced. They are packed in boxes or bolted to a wooden base.

Upon receipt, we recommend careful handling and a physical examination for damage which may have occurred during transportation.

In the event of damage and in order to guaranty insurance coverage, both the nearest WEG sales office and the carrier should be notified without delay.

#### 2.3 Storage

Motors should be raised by their eyebolts and never by their shafts. It is important that high rating three-phase motors be raised by their eyebolts. Paising and lowering must be steady and joltless, otherwise bearings may be harmed.

When motors are not immediately installed, they should be stored in their normal upright position in a dry even temperature place, free of dust, gases and corrosive atmosphere.

Other objects should not be placed on or against them. Motors stored over long periods are subject to loss of insulation resistance and oxidation of bearings.

Bearings and lubricant deserve special attention during prolonged periods of storage. Depending on the length and conditions of storage it may be necessary to regrease or change rusted bearings. The weight of the rotor in an inactive motor tends to expel grease from between the

bearing surfaces thereby removing the protective film that impedes metal-to-metal contact.

As a preventive measure against the formation of corrosion by contact, motors should not be stored near machines which cause vibrations, and every 3 month their shafts should be rotated manually.

Insulation resistance fluctuates widely with temperature and humidity variations and the deanliness of components. When a motor is not immediately put into service it should be protected against moist, high temperatures and impurities, thus avoiding damage to insulation resistance.

If the motor has been in storage more than six month or has been subjected to adverse moisture conditions, it is best to check the insulation resistance of the stator winding with a megohmeter. If the resistance is lower than ten megohms the windings should be dried in one of the two following ways:

- Bake in oven at temperatures not exceeding 194 degrees F until insulation resistance becomes constant.
- With rotor locked, apply low voltage and gradually increase current through windings until temperature measured with thermometer reaches 194 degrees F. Do not exceed this temperature.

If the motor is stored for an extensive period, the rotor must be periodically rotated.

Should the ambient conditions be very humid, a periodical inspection is recommended during storage. It is difficult to prescribe rules for the true insulation resistance value of a machine as resistance varies according to the type, size and rated voltage and the state of the insulation material used, method of construction and the machine's insulation antecedents. Alot of experience is necessary in order to decide when a machine is ready or not to be put into service. Periodical records are useful in making this decision.

The following guidelines show the approximate values that can be expected of a clean and dry motor, at 40°C test voltage in applied during one minute.

Insulation resistance Pmis obtained by the formula:

Where: Pm - minimum recommended insulation resistance in  $M\Omega$  with winding at  $40^{\circ}C$ 

Vn - rated machine voltage in kV

In case the test is carried out at a temperature other than 40°C, the value must be corrected to 40°C using an approximated curve of insulation resistance v.s temperature of the winding with the aid of Figure 2.1; it's possible verify that resistance practically doubles every 10°C that insulating temperature is lowered.



#### Example:

Ambient temperature =  $50^{\circ}$ C Motor winding resistence at  $50^{\circ}$ C =  $1.02 M\Omega$  Correction to  $40^{\circ}$ C

$$R_{40^{\circ}C} = R_{50^{\circ}C} \times K_{50^{\circ}C}$$
  
 $R_{40^{\circ}C} = 1.02 \times 1.3$ 

$$R_{40^{\circ}C} = 1.326 M\Omega$$

The minimum resistence Rmwill be:

Rm=Vn+1 Rm=0.440+1 Rm=1.440 MΩ

Onnewmotors, lower values are often attained due to solvents present in the insulating varnishes that later evaporate during normal operation. This does not necessarily mean that the motor is not operational, since insulating resistance will increase after a period of service. On motors which have been in service for a period of time much larger values are often attained. A comparison of the values recorded in previous tests on the same motor under similar load, temperature and humidity conditions, serves as a better indication of insulation condition than that of the value derived from a single test. Any substantial or sudden reduction is suspect and the cause determined and

corrective action taken.
Insulation resistance is usually measured with a MEGGER.
In the event that insulation resistance is inferior to the values derived from the above formula, motors should be subjected to a drying process.

#### 2.3.1 Drying the windings

This operation should be carried out with maximum care, and only by qualified personnel. The rate of temperature rise should not exceed  $5^{\circ}\text{C}$  per hour and the temperature of the winding should not exceed  $105^{\circ}\text{C}$ . An overly high final temperature as well as a fast temperature increase rate can each generate vapour harmful to the insulation. Temperature should be accurately controlled during the drying process and the insulation resistance measured at regular intervals. During the early stages of the drying process, insulation resistance will decrease as a result of the temperature increase, but the resistance will increase again when the insulation becomes dryer.

The drying process should be extended until successive measurements of insulation resistance indicate that a constant value above the minimum acceptable value has been attained. It is extremely important that the interior of the motor be well ventilated during the drying operation to ensure that the dampness is really removed.

Heat for drying can be obtained from outside sources (an oven), energization of the space heater (optional), or introducing a current through the actual winding of the motor being dried.

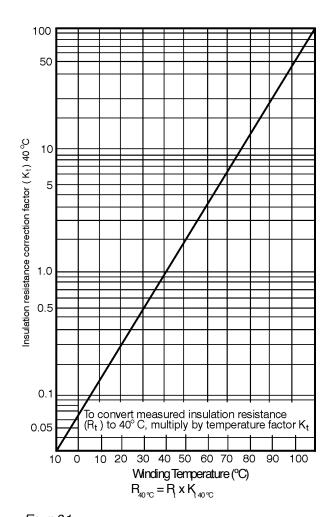


Figure 2.1



#### 3. Installation

Electric machines should be installed in order to allow an easy access for inspection and maintenance. Should the surrounding atmosphere be humid, corrosive or contain flammable substances or particles, it is essential to ensure an adequate degree of protection.

The installation of motors in environments where there are vapours, gases or dusts, flammable or combustible materials, subject to fire or explosion, should be undertaken according to appropriate and governing codes, such as NECArt. 500 (National Electrical Code) and UL-674 (Underwriters Laboratories, Inc.) Standards.

Under no circumstances can motors be enclosed in boxes or covered with materials which may impede or reduce the free circulation of ventilating air. Machines fitted with external ventilation should be at least 50cm from the wall to permit the passage of air.

The opening for the entry and exit of air flow should never be obstructed or reduced by conductors, pipes or other objects.

The place of installation should allow for air renewal at a rate of 700 cubic feet per minute for each 75 HP motor capacity.

#### 3.1 Mechanical Aspects

#### 3.1.1 Foundation

The motor base must be levelled and as far as possible free of vibrations. Aconcrete foundation is recommended for motors over 100 HP. The choice of base will depend upon the nature of the soil at the place of erection or of the floor capacity in the case of buildings. When dimensioning the motor base, keep in mind that the motor may occasionally be run at a torque above that of the rated full load torque. Based upon Figure 3.1, foundation stresses can be calculated by using the following formula:

 $F1 = 0.2247 (0.009 \times g \times G - 213 \text{ Tmáx/A})$ 

 $F2 = 0.2247 (0.009 \times g \times G + 213 \text{Tmax/A})$ 

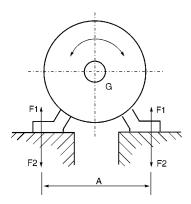


Figure 3.1 - Base stresses

#### Where:

F1 and F2 - Lateral stress (Lb)

g - Force of gravity (32.18 ft/s2)

G-Weight of motor (Lb)

Tmax - Maximum torque (Lb. Ft)

A-Obtained from the dimensional drawing of the motor (in)

Sunken bolts or metallic base plates should be used to secure the motor to the base.

#### 3.1.2 Types of Bases

#### a) Slide Rails

When motor drive is by pulleys the motor should be mounted on slide rails and the lower part of the belt should be pulling.

The rail nearest the drive pulley is positioned in such a manner that the adjusting bolt be between the motor and the driven machine.

The other rail should be positioned with the bolt in the opposite position, as shown in Figure 3.2.

The motor is bolted to the rails and set on the base. The drive pulley is aligned such that its center is on a plane with the center of the driven pulley and the motor shaft and that of the machine be parallel.

The belt should not be overly stretched, see Figure 3.11. After the alignment, the rails are fixed.

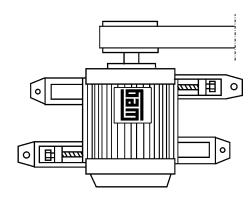


Figure 3.2 - Positioning of slide rails for motor alignment

#### FOR NEMA LOW VOLTAGE ELECTRIC MOTORS



#### b) Foundation Studs

Very often, particularly when drive is by flexible coupling the motor is anchored directly to the base with foundation studs.

It is recommended that shimplates of approximately 0.8 inches be used between the foundation studs and the feet of the motor for replacement purposes. These shimplates are useful when exchanging one motor for another of larger shaft height due to variations allowed by standard tolerances.

Foundation studs should neither be painted nor rusted as both interfere with to the adherence of the concrete, and bring about loosening. After accurate alignment and levelling of the motor, the foundation studs are cemented and their screws tightened to secure the motor.

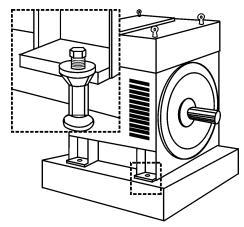


Figure 3.3 - Motor mounted on a concrete base with foundation studs

#### 3.1.3 Alignment

The electric motor should be accurately aligned with the driven machine, particularly in cases of direct coupling. An incorrect alignment can cause bearing failure vibrations and even shaft rupture. The best way to ensure correct alignment is to use dial gauges placed on each coupling half, one reading radially and the other exially-Figure 3.5.

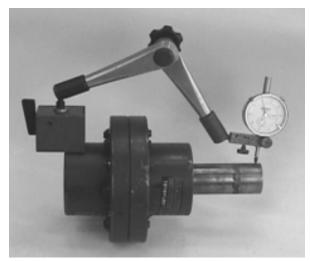
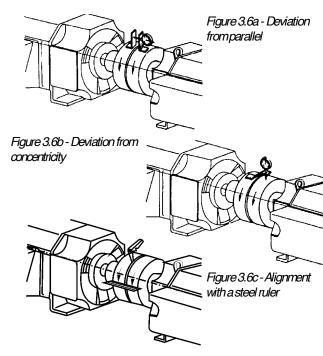


Figure 3.5 - Alignment with dial gauges

Thus, simultaneous readings are possible and allow for checking for any parallel (Figure 3.6a) and concentricity deviations (Figure 3.6b) by rotating the shafts one turn.

Gauge readings should not exceed 0.02 inches. If the installer is sufficiently skilled, he can obtain alignment with feeler gauges and a steel ruler, providing that the couplings are perfect and centered Figure 3.6c.



#### 3.1.4 Coupling

#### a) Direct Coupling

Direct coupling is always preferable due to its lower cost, space economy, no belt slippage and lower accident risk.

In the case of speed ratio drives, it is also common to use a direct coupling with a reducer (gear box).

CAUTION: Carefully align the shaft ends using, whenever feasible, a flexible coupling.



Figure 3.7-A type of direct coupling

#### b) Gear Coupling

Poorly aligned gear couplings are the cause of jerking motions which bring about the vibration of the actual drive and vibrations within the motor.



Therefore, due care must be given to perfect shaft alignment: exactly parallel in the case of straight gears, and at the correct angle for bevel or helical gears.

Perfect gear engagement can be checked by the insertion of a strip of paper on which the teeth marks will be traced after a single rotation.

#### c) Belt and Pulley Coupling

Belt coupling is most commonly used when a speed ratio is required. Assembly of Pulleys: To assemble pulleys on shaft ends with a keyway and threaded end holes the pulley should be inserted halfway up the keyway merely by manual pressure.

On shafts without threaded end holes the heating of the pulley to about 80°C is recommended, or alternatively, the devices illustrated in Figure 3.8 may be employed.

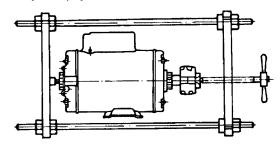


Figure 3.8 - Pulley mounting device

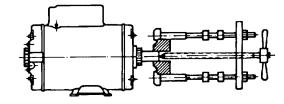


Figure 3.8a - Pulley extractor

Hammers should be avoided during the fitting of pulleys and bearings. The fitting of bearings with the aid of hammers leaves blemishes on the bearing races. These initially small flaws increase with usage and can develop to a stage that completely impairs the bearing.

The correct positioning of a pulley is shown in Figure 3.9.

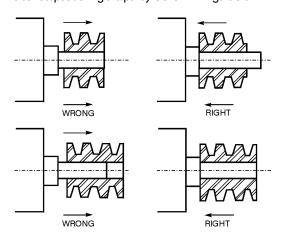


Figure 3.9 - Correct positioning of pulley on the shaft

RUNNING: To avoid needless radial stresses on the bearings it is imperative that shafts are parallel and the pulleys perfectly aligned. (Figure 3.10).

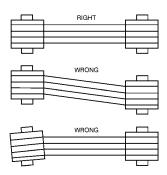


Figure 3.10 - Correct pulley alignment

Laterally misaligned pulleys, when running, transmit alternating knocks to the rotor and can damage the bearing housing. Belt slippage can be avoided by applying a resin (rosin for example).

Belt tension should be sufficient to avoid slippage during operation (Figure 3.11).

Pulleys that are too small should be avoided; these cause shaft flexion because belt traction increases in proportion to a decrease in the pulley size. Table 1 determines minimum pulley diameters, and Tables 2 and 3 refer to the maximum stresses acceptable on motor bearings up to frame 580. Beyond frame size 600, an analysis should be requested from the WEG engineering.

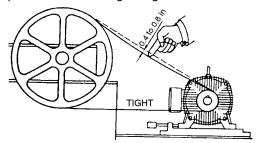


Figure 3.11 - Belt tensions



Table 1 - Minimum pitch diameter of pulleys

			Ball	bearings			
Frame	Danisa			Size X	Inches		
	Bearing	0.79	1.57	2.36	3.15	3.94	4.72
140	6205-Z	1.7	1.85	2			
W180	6206-Z	3.03	3.23	3.46			
180	6307-Z	1.69	1.81	1.93			
W210	6308-Z		2.86	3.00	3.16		
210	6308-Z		2.90	3.06	3.22		
W250	6309C3		4.37	4.54	4.72	4.92	
250	6309C3		4.41	4.59	4.77	4.97	
280	6311 C3			5.08	5.19	5.47	5.65
320	6312C3			7.44	7.76	7.94	8.18
360	6314C3			8.73	9.00	9.28	9.57

			Е	Ball Bearing			Roller Bearing						
Frame	Poles	Dooring	Size X Inches			Dooring	Size X Inches						
		Bearing	1.97	3.15	4.33	5.51	Bearing	1.97	3.15	4.33	5.51	6.69	8.27
400	II	6314C3	7.3	7.62	7.94	8.24		-	-	-	-	-	-
400	IV-VI-VII	6314C3					NU 316	4.13	4.31	4.49	4.67	4.85	-
440	II	6314C3	11.75	1216	1261	13.08		-	-	-	-	-	-
440	IV-VI-VIII	6319C3					NU 319	4.02	4.17	4.32	4.47	4.62	4.82
	II	6314C3	23.54	24.34	25.12	25.87		-	-	-	-	-	-
500	IV-VI-VIII	6319C3					NU 319	6.52	6.73	6.95	7.17	7.39	7.67
rm	II	6314C3	44.66	45.79	46.98	48.23		-	-	-	-	-	-
5008	IV-VI-VIII	6322C3					NU 322	8.73	8.95	9.96	11.34	1287	14.82
	II	6314C3	57	58	59	60		-	-	-	-	-	-
580	IV-VI-VIII	6322C3					NU 322	10.72	10.91	11.11	11.31	11.50	11.76

Important:

- 1) Peripheral speeds for solid grey cast iron pulleys FC 200 is V = 115 ft/s. 2) Use steel pulleys when peripheral speed is higher than 115 ft/s.
- 3) V-belt speed should not exceed 115 ft/s.

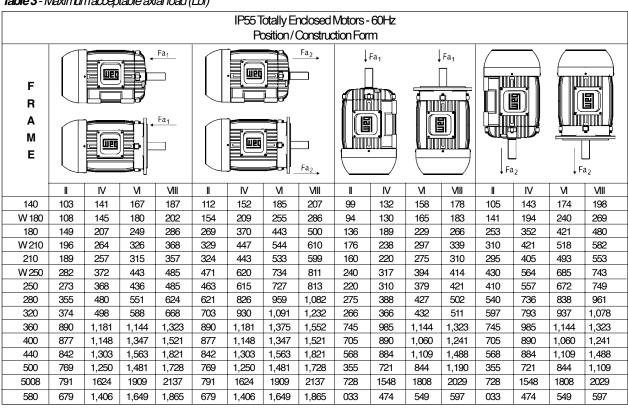
Table 2 - Maximum acceptable radial load (Lbf)

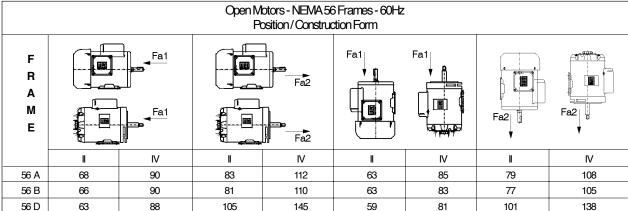
Nema 56 Motors								
		Radial Force (Lbf)						
Frame	Doloo		Distance X					
	Poles	1	1,18	2				
56A	II	88	-	59				
	IV	88	-	59				
56B	II	88	-	59				
	IV	86	-	59				
-m	II	127	-	70				
56D	IV	141	-	70				

Saw Arbor Motors						
80 LMS	II	-	355	-		
80 MMS	II	-	359	-		
80 SMS	II	-	357	-		
90 LMS	II		427	-		
	IV	_	5555	-		



**Table 3** - Maximum acceptable axial load (Lbf)







The maximum radial load for each frame are determined, by graphs.

### INSTRUCTIONS ON HOW TO USE THE GRAPHS

- 1 Maximum radial load on shaft.
- 2 Maximum radial load on bearings.

Where: X - Half of pulley width (inches)

Fr- Maximum radial load in relation to the diameter and pulley width.

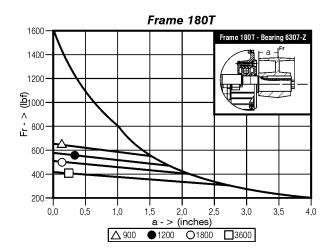
### Example:

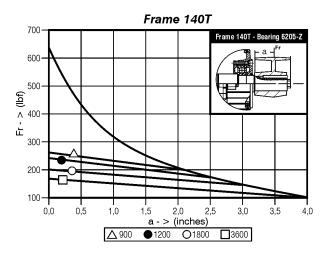
Verify whether a 2HP motor, II Pole, 60Hz with stands a radial load of 110Lb, considering a pulley width of 4 inches.

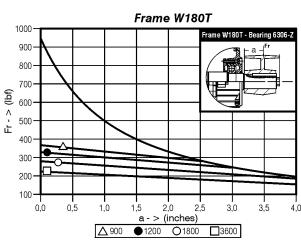
Frame: 145T Fr: 110Lb X:2inches

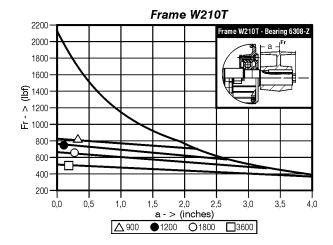
- 1 Mark the distance X
- 2-Find out line N=3600 for bearing

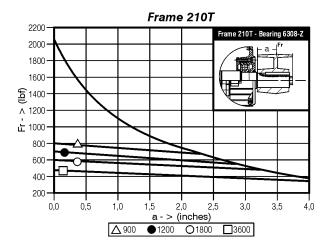
Based on the above, this bearing withstands a radial load of 130Lb.



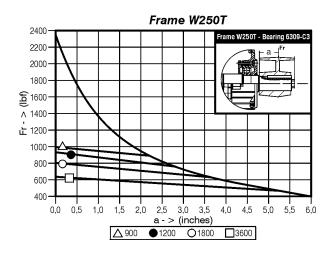


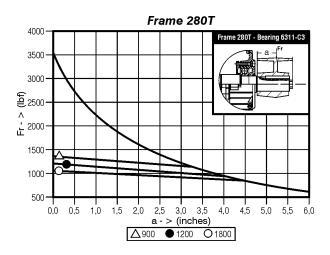


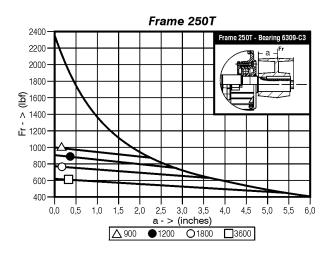


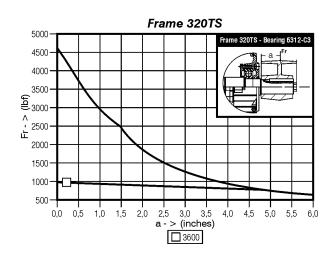


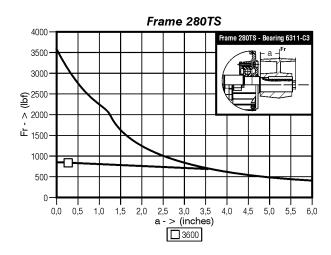


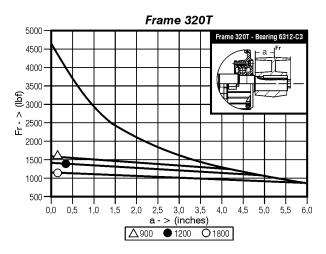




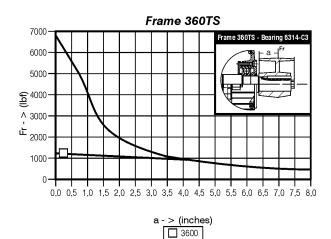


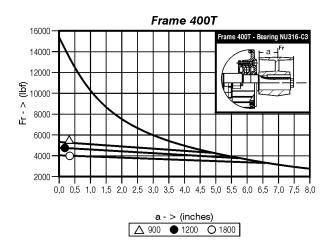


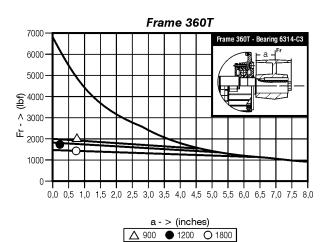


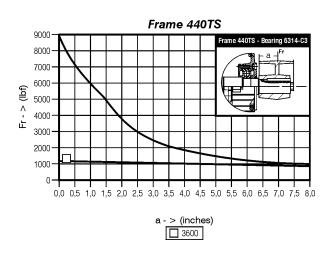


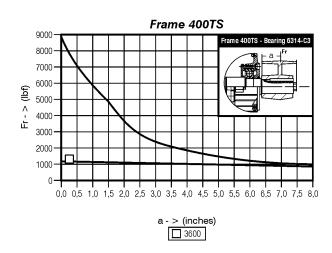


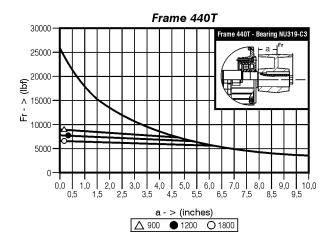




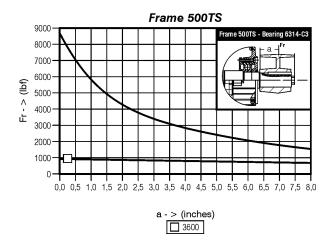


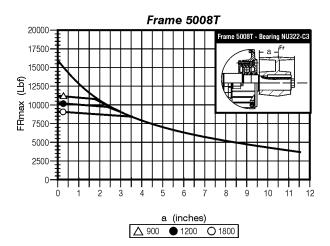


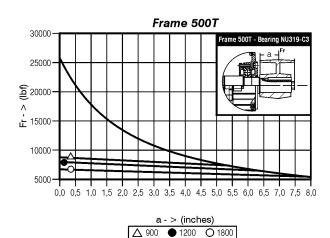


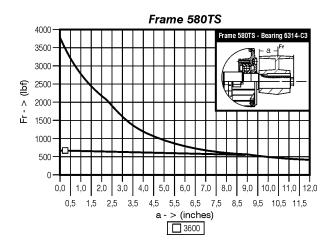


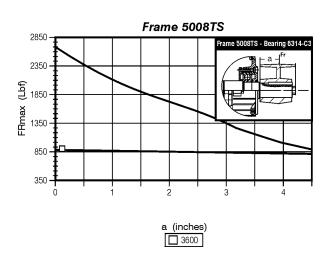


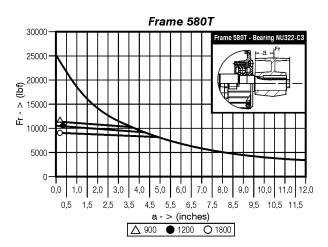












**Note:** For frames 600 and above, consult your engineering representative.



### 3.2 Electrical Aspects

### 3.2.1 Feed System

Proper electric power supply is very important. The choice of motor feed conductors, whether branch or distribution circuits, should be based on the rated current of the motors as per NFPA-70 Standard article 430.

Tables 4, 5 and 6 show minimum conductor gauges sized according to maximum current capacity and maximum voltage drop in relation to the distance from the distribution center to the motor, and to the type of installation (Overhead or in ducts).

### To determine the conductor gauge proceed as follows:

a) Determine the current by multiplying the current indicated on the motor nameplate by 1.25 and then locate the resulting value on the corresponding table.

If the conductor feeds more than one motor, the value to be sought on the table should be equal 1.25 times the rated current of the largest motor plus the rated current of the other motors.

In the case of variable speed motors, the highest value among the rated currents should be considered.

When motor operation is intermittent, the conductors should have a current carrying capacity equal or greater, to the product of the motor rated current times the running cycle factor shown on Table 7.

**Table 7** - Running cycle factor

### Motor Short

Motor short time rating  Duty  Classification	5min	15min	30 at 60min	Continuos
Short (operating valves, activating contacts etc)	1.10	1.20	1.50	-
Intermittent (passenger or freight elevators, tools, pumps, rolling bridges etc)	0.85	0.85	0.90	1.40
Cyclic (rolling mills,mining machines etc)	0.85	0.90	0.95	1.40
Variable	1.10	1.20	1.50	2.00

b) Locate the rated voltage of the motor and the feed network distance in the upper part of the corresponding table. The point of intersection of the distance column and the line referring to current will indicate the minimum required gauge of the conductor.

### Example:

Size the conductors for a 15 HP, three-phase, 230V, 42A, motor located 200 feet from the main supply with cables laid in conduits.

- a) Ourrent to be located:  $1.25 \times 42A = 52.5A$
- b) Closest value on table 6:55A
- c) Minimum gauge: 6AWG

### 3.2.2 Starting of Electric Motor

Induction motors can be started by the following methods:

### **Direct Starting**

Whenever possible a three-phase motor with a squirrel cage rotor should be started directly at full supply voltage by means of a contactor (Connection diagrama). This method is called Direct-on-Line (DOL) starting.

There are DOL starter assemblies available combining a three-pole contactor, a bimetal relay (overload protection device), and a fuse (short circuit protection on branch circuit).

DOL starting is the simplest method, only feasible however, when the locked rotor current (LPC) does not influence the main electric supply lines.

Initial locked rotor current (LRC) in induction motors reach values six to eight times the value of the full load current. During starting by the DOL method, starting current can reach these high levels. The main electrical supply should be rated sufficiently, such that during the starting cycle no supply disturbance to others on the power network is caused by the voltage drop in the main supply.

This can be achieved under one of the following situations:

- The rated main supply current is high enough for the locked rotor current not to be proportionally high.
- b) Motor locked rotor current is low with no effect on the networks.
- c) The motor is started under no-load conditions with a short starting cycle and, consequently, a lowlocked rotor current with a transient voltage drop tolerable to other consumers.

### Starting with a compensating switch (auto-transformer starting)

Should direct on line starting not be possible, either due to restrictions imposed by the power supply authority or due to the installation itself, reduced voltage indirect starting methods can be employed to lower the locked rotor current. The single line connection diagram (C) shows the basic components of a compensating switch featuring a transformer (usually an auto-transformer) with a series of taps corresponding to the different values of the reduced voltage. Only three terminals of the motor are connected to the switch, the other being interconnected as per diagram, for the indicated voltage.

### Star-Delta starting

It is fundamental to star-delta starting that the three-phase motor has the necessary numbers of leads for both connections:

6 leads for  $Y/\Delta$  or 12 leads for  $YY/\Delta\Delta$ 

All the connections for the various voltages are made through terminals in the terminal box in accordance with the wiring diagram that accompanies the motor. This diagrammay be shown on the nameplate or in the terminal box.

The star-delta connection is usually used only in low-voltage motors due to normally available control and protection devices. In this method of starting the locked rotor current is approximately 30% of the original LRC. The locked rotor torque is reduced proportionally as well. For this reason, it is very important before deciding to use



**Table 4** - Wire and cable gauges for single-phase motor installation (voltage drop < 5%) (in conduits)

				•		•			, ,					
Supply Voltage		Distance of motor from distribution centre (feet)												
115	34	51	69	85	102	137	171	205	240	273	308	342	428	514
230	69	102	138	170	204	274	342	410	480	546	616	684	856	1028
460	138	204	276	340	408	548	684	820	960	1092	1232	1368	1712	2056
575	170	250	338	420	501	670	840	1010	1181	1342	1515	1680	2105	2530
Current (A)						Cat	le gauge	(conduc	ctor)					
5	14	14	14	14	14	14	14	12	12	12	12	10	10	8
10	14	14	14	14	12	12	10	10	10	8	8	8	6	6
15	12	12	12	12	12	10	8	8	6	6	6	6	4	2
20	12	12	12	10	10	8	8	6	6	6	4	4	4	2
30	10	10	10	8	8	6	6	6	4	4	2	2	2	1/0
40	8	8	8	8	6	6	4	4	2	2	2	2	1/0	2/0
55	6	6	6	6	6	4	4	2	2	1/0	1/0	1/0	1/0	2/0
70	4	4	4	4	4	2	2	2	1/0	1/0	2/0	2/0	2/0	2/0
95	2	2	2	2	2	2	1/0	1/0	1/0	2/0	3/0	3/0	4/0	250M

Table 5 - Wire and cable gauges for three-phase motor installation - aerial conductors with 25cm spacing (voltage drop < 5%)

Supply Voltage					Distan	ce of mo	tor from	distributi	on centre	e (feet)				
115	51	69	85	102	137	171	205	240	273	308	342	428	514	685
230	102	138	170	204	274	342	410	480	546	616	684	856	1028	1370
460	204	276	340	408	547	684	820	960	1092	1232	1368	1712	2056	2740
575	250	338	420	501	670	840	1010	1181	1342	1515	1680	2105	2530	3350
Current (A)						Cab	ole gauge	(conduc	ctor)					
15	14	14	14	12	12	10	10	10	8	8	8	6	6	4
20	14	14	12	12	10	10	8	8	8	6	6	4	4	2
30	14	12	10	8	8	8	6	6	4	4	4	2	2	1/0
40	12	10	10	8	8	6	4	4	4	2	2	2	1/0	2/0
55	10	10	8	8	6	4	4	2	2	2	1/0	2/0	3/0	
70	8	8	6	6	4	2	2	2	1/0	1/0	2/0	3/0		
100	6	6	4	4	2	2	1/0	2/0	3/0	4/0	4/0			
130	4	4	4	2	1/0	1/0	2/0	4/0						
175	2	2	2	1/0	2/0	3/0								
225	1/0	1/0	1/0	2/0	3/0									
275	2/0	2/0	2/0	4/0										
320	3/0	3/0	3/0	4/0										

**Table 6** - Wire and cable gauges for three-phase motor installation (voltage drop < 5%) (in conduits)

Supply Voltage				Dis	stance of	motor from	distributio	n centre (	feet)			
115 230 460 575	85 170 340 420	102 204 408 501	120 240 480 590	137 274 548 670	171 342 684 840	205 410 820 1010	240 480 960 1181	273 546 1092 1342	308 616 1232 1515	342 684 1368 1680	428 856 1712 2105	514 1028 2056 2530
Current (A)					C	Cable gaug	e (conduc	tor)				
15	12	12	12	10	10	8	8	8	6	6	6	4
20	12	10	10	10	8	8	6	6	6	6	4	4
30	10	8	8	8	6	6	6	4	4	4	2	2
40	8	8	6	6	6	4	4	4	2	2	2	1/0
55	6	6	6	4	4	4	2	2	2	1/0	1/0	1/0
70	4	4	4	4	2	2	2	1/0	1/0	1/0	2/0	2/0
95	2	2	2	2	2	1/0	1/0	1/0	1/0	2/0	3/0	4/0
125	1/0	1/0	1/0	1/0	1/0	1/0	2/0	2/0	3/0	3/0	4/0	250M
145	2/0	2/0	2/0	2/0	2/0	2/0	2/0	3/0	3/0	4/0	250M	300M
165	3/0	3/0	3/0	3/0	3/0	3/0	3/0	3/0	4/0	4/0	250M	350M
195	4/0	4/0	4/0	4/0	4/0	4/0	4/0	4/0	250M	250M	300M	350M
215	250M	250M	250M	250M	250M	250M	250M	250M	250M	300M	350M	400M
240	300M	300M	300M	300M	300M	300M	300M	300M	300M	300M	400M	500M
265	350M	350M	350M	350M	350M	350M	350M	350M	350M	350M	500M	500M
280	400M	400M	400M	400M	400M	400M	400M	400M	400M	400M	400M	
320	500M	500M	500M	500M	500M	500M	500M	500M	500M	500M	500M	

Note: The above indicated values are orientative. For guaranteed values, contact the Local Power Company.

### FOR NEMA LOW VOLTAGE ELECTRIC MOTORS

star-delta starting to verify if the reduced locked rotor torque in "STAR" connection is enough to accelerate the load.

### 3.2.3 Motor Protection

Motor circuits have, in principle, two types of protection: motor overload, locked rotor and protection of branch circuit from short circuits. Motors in continuous use should be protected from overloading by means of a device incorporated into the motor, or by an independent device, usually a fixed or adjustable thermal relay equal or less than to the value derived from multiplying the rated feed current at full load by:

- 1.25 for motors with a service factor equal or superior to 1.15 or;
- 1.15 for motors with service factor equal to 1.0.

Some motors are optionally fitted with overheating protective detectors (in the event of overload, locked rotor, lowvoltage, inadequate motor ventilation) such as a thermostat (thermal probe), thermistor (PTC), RTD type resistance which dispense with independent devices.

THERMOSTAT (THERMAL PROBE): Bimetallic thermal detectors with normally closed silver contacts. These open at pre-determined temperatures. Thermostats are series connected directly to the contactor coil circuit by two conductors.

THERMISTORS: Semi-conductor heat detectors positive temperature coeficient (PTC) that sharply change their resistance upon reaching a set temperature. Thermistors, depending upon the type, are series or parallel-connected to a control unit that cuts out the motor feed, or actuates an alarm system, in response to the thermistors reaction.

RESISTANCE TEMPERATURE DETECTORS (RTD) - PT 100: The resistance type heat detector (RTD) is a resistance element usually manufactured of copper or platinum.

The RTD operates on the principle that the electrical resistance of a metallic conductor varies linearly with the temperature. The detector terminals are connected to a control panel, usually fitted with a temperature gauge, a test resistance and a terminal changeover switch.

Subject to the desired degree of safety and the client's specification, three (one per phase) or six (two per phase) protective devices can be fitted to a motor for the alarm stems, circuit breaker or combined alarmand circuit breaker, with two leads from the terminal box to the alarm or circuit breaker system and four for the combined system (alarmand circuit breaker).

Table 9 compares the two methods of protection.

### 3.3 Start-up

### 3.3.1 Preliminary Inspection

Before starting a motor for the first time, it will be necessary to:

- a) Remove all locking devices and blocks used in transit and check that the motor rotates freely;
- b) Check that the motor is firmly secured and that coupling elements are correctly mounted and aligned.;

- c) Ascertain that voltage and frequency correspond to those indicated on the nameplate. Motor performance will be satisfactory with main supply voltage fluctuation within ten per cent of the value indicated on the nameplate or a frequency fluctuation within five per cent or, yet, with a combined voltage and frequency variance within ten per cent;
- d) Check that connections are in accordance with the connection diagram shown on the nameplate and be sure that all terminal screws and nuts are tight;
- e) Check the motor for proper grounding. Providing that there are no specifications calling for ground-insulated installation, the motor must be grounded in accordance with prevalent standard for grounding electrical machines. The screwidentified by the symbol
   should be used for this purpose.

This screw is generally to be found in the terminal box or on one foot of the frame:

- Check that motor leads connecting with the mains, as well as the control wires and the overload protection device, are in accordance with Nema Standards;
- g) If the motor has been stored in a damp place, or has been stopped for sometime, measure the insulating resistance as recommended under the item covering storage instructions;
- h) Start the motor uncoupled to ascertain that it is turning in the desired direction. To reverse the rotation of a three-phase motor, invert two terminal leads of the mains supply.
  - High voltage motors bearing an arrow on the frame indicating rotation direction can only turn in the direction shown.

### 3.3.2 The First Start-up

Three-Phase Motor with Cage Rotor:

After careful examination of the motor, follow the normal sequence of starting operations listed in the control instructions for the initial start-up.

### 3.3.3 Operation

Drive the motor coupled to the load for a period of at least one hour while watching for abnormal noises or signs of overheating.

Compare the line current with the value shown on the nameplate.

Under continuous running conditions without load fluctuations this should not exceed the rated current times the service factor, also shown on the nameplate.

All measuring and control instruments and apparatus should be continuously checked for anomalies, and any irregularities corrected.

### 3.3.4 Stopping

Warning:

To touch any moving part of a running motor, even though



disconnected, is a danger to life and limb.

Three-phase motor with cage rotor:

Open the stator circuit switch. With the motor at a complete stop, reset the auto-transformer, if any, to the "start" position.

 Table 9 - Comparison between motor protection system

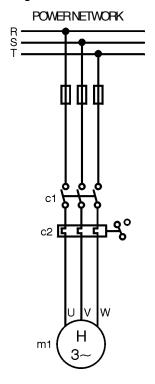
Course of		t-based ection	Protection with
Causes of overheating	Fuse only	Fuse and thermal protector	probe thermistor in motor
	# Is-	-#-  @-	
Overload with 1.2 times rated current	0	•	•
2. Duty cycles S1 to S8 IEC 34, EB 120	0	•	•
Brakings, reversals     and frequent starts	0	•	•
Operating with more than 15 starts p/hour	0	•	•
5. Locked rotor	•	•	
6. Fault on one phase	0	•	•
Execessive voltage fluctuation	0	•	•
Frequency fluctuation     on main supply	0	•	•
Excessive ambient temperature	0	•	•
10. External heating caused by bearings, belts, pulleys etc.	0	0	•
11. Obstructed ventilation	0	0	•

Caption: unprotected
partially protected
totally protected

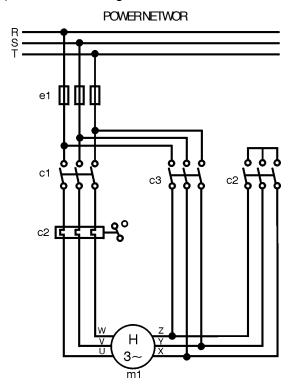


### **CONNECTION DIAGRAMS**

### a) Direct starting



### b) Star-Delta starting



### c) Auto-transformer starting

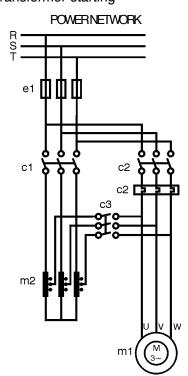




Table 11 - Bearing specifications by type of motor

NEMA	N.A. retire e	Be	earings
Frames	Mounting	Front (D.E.)	Rear (O.D.E.)
	Openo	drip proof motors	
B48 and C48		6203Z	6202Z
56 and A56	S	6203Z	6202Z
B56 and C56	L FORMS	6203Z	6202Z
D56and	<u> </u>	6204Z	6202Z/
F56H/G56H	₹	02012	6203Z
FSOFICEOUT	Tatally and a	l sed fan cooled moto	
4.40T	iolally a lac		
143T		6205ZZ	6204 <i>ZZ</i>
145T		6205ZZ	6204 <i>ZZ</i>
182T		6307ZZ	6206ZZ
184T		6307ZZ	6206ZZ
W182T W184T		6206 <i>ZZ</i>	6205ZZ
		6206ZZ	6205ZZ
213T		6308 <i>ZZ</i>	6207ZZ
215T W213T		6308ZZ	6207 <i>ZZ</i>
W213T		6308ZZ	6207ZZ
W215T 254T		6308ZZ	6207 <i>ZZ</i> 6209 <i>Z</i> -C3
256T		6309-C3 6309-C3	6209Z-C3
<u>∠</u> 361 W254T		6309-C3	6209Z-C3
W256T		6309-C3	6209Z-C3
			6211 Z-C3
284 Tand TS 286 Tand TS		6311-C3 6311-C3	6211Z-C3
324 Tand TS		6312-C3	6212Z-C3
326 Tand TS		_	6212Z-C3
		6312-C3	_
364 Tand TS 365 Tand TS	"	6314-C3 6314-C3	6314-C3 6314-C3
404T	L FORMS	NU 316-C3	6314-C3
404 TS	È	6314-C3	6314-C3
405T	Ⅎ	NU 316-C3	6314-C3
405TS	٩	6314-C3	6414-C3
444T		NU 319-C3	6316-C3
444TS		6314-C3	6314-C3
445T		NU 319-C3	6316-C3
445TS		6314-C3	6314-C3
447T		NU 319-C3	6316-C3
447 TS		6314-C3	6314-C3
449T		NU 322-C3	6319-C3
449TS		6314-C3	6314-C3
504T		NU 319-C3	6316-C3
504TS		6314-C3	6314-C3
505T		NU 319-C3	6316-C3
505TS		6314-C3	6314-C3
5008T		NU 322-C3	6319-C3
5008TS		6314-C3	6314-C3
586T		NU 322-C3	6319-C3
586TS		6314-C3	6314-C3
587T		NU 322-C3	6319-C3
587TS		6314-C3	6314-C3
Saw Arbor			parings
motor	Mounting		
frame		Front (D.E.)	Rear (O.D.E.)
80 S MS		6307ZZ	6207ZZ
80 M MS	<b>D</b> 0	6307 <i>Z</i> Z	6207ZZ
80 L MS	B3	6307ZZ	6207ZZ
90 L MS		6308ZZ	6208ZZ

ODP Motors Nema-T	Mounting	Bea	arings
frames	Woorking	Front (D.E.)	Rear (O.D.E.)
E143/5T		6205ZZ	6204 <i>Z</i> Z
F143/5T		6205ZZ	6204 <i>Z</i> Z
182T		6206ZZ	6205 <i>Z</i> Z
184T		6202 <i>Z</i> Z	6205ZZ
213/5T		6208ZZ	6206ZZ
254T		6309 Z-C3	6209 Z-C3
256T		6309 Z-C3	6209Z-C3
284T		6311 Z-C3	6211 Z-C3
284TS	≱	6311 Z-C3	6211 Z-C3
286T	Ó	6311 Z-C3	6211 Z-C3
286TS	2	6311 Z-C3	6211 Z-C3
324T	\ \	6312Z-C3	6212Z-C3
324TS	ğ	6312Z-C3	6212Z-C3
326T	<u>_</u>	6312Z-C3	6212Z-C3
326TS	É	6312Z-C3	6212Z-C3
364T	Z <b>Z</b>	6314C3	6314C3
364TS	-CAZONTAL MOUNTING ONLY	6314C3	6314C3
365T	_	6314C3	6314C3
365TS		6314C3	6314C3
404T		NU 316 C3	6314C3
404TS		6314C3	6314C3
405T		NU 316 C3	6314C3
405TS		6314C3	6314C3
444T		NU 319 C3	6316C3
444TS		6314C3	6314C3
445T		NU 319 C3	6316C3
445TS		6314C3	6314C3

IEC	No estino	Bea	arings					
frame	Mounting	Front (D.E.)	Rear (O.D.E.)					
Totally endosed fan cooled motors								
63		6201 <i>Z</i> Z	6201 <i>Z</i> Z					
71		6203ZZ	6202 <i>7</i> Z					
80		6204ZZ	6203ZZ					
90 S-L		6205 <i>Z</i> Z	6204 <i>Z</i> Z					
100L		6206ZZ	6205ZZ					
112M		6307ZZ	6206ZZ					
132 S - M		6308ZZ	6207ZZ					
160 M - L		6309-C3	6209 Z-C3					
180 M - L	B3	6311-C3	6211 Z-C3					
200 M-L		6312-C3	6212Z-C3					
225 S/M		6314-C3	6314-C3					
250 S/M		6314-C3	6314-C3					
280 S/M		6314-C3	6314-C3					
		6316-C3	6316-C3					
315 S/M		6314-C3	6314-C3					
		6319-C3	6316-C3					
355 M/L		6314-C3	6314-C3					
		NU 322-C3	6319-C3					



Table 12 - Bearing lubrication intervals and amount of grease

				I	BALL BE	ARINGS	- Series (	62/63					
			Relu	brication	intervals	(running h	ours-ho	rizontal po	osition)				
	Пр	xole	IVp	oole	VIpo	ole	VIII pole		Xpole		XII	pole	Amount of grease
						Se	rie 62						
Bearing	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	(g)
6209	18400	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	9
6211	14200	16500	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	11
6212	12100	14400	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	13
						Serie	63						•
Bearing	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	(g)
6309	15700	18100	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	13
6311	11500	13700	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	18
6312	9800	11900	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	21
6314	3600	4500	9700	11600	14200	16400	17300	19700	19700	20000	20000	20000	27
6316	-	-	8500	10400	12800	14900	15900	18700	18700	20000	20000	20000	34
6319	-	-	7000	9000	11000	13000	14000	17400	17400	18600	18600	20000	45
6322	-	-	5100	7200	9200	10800	11800	15100	15100	15500	15500	19300	60

Table 13 – Bearing lubrication intervals and amount of grease

				I	BALL BE	ARINGS	- Series	NU3					
	Relubrication intervals (running hours—horizontal position)												
	Пр	II pole IV pole		VIpo	ole	VIII pole		Xpole		XII pole		Amount of grease	
Bearing	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	(g)
NU 309	9800	13300	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	13
NU311	6400	9200	19100	20000	20000	20000	20000	20000	20000	20000	20000	20000	18
NU312	5100	7600	17200	20000	20000	20000	20000	20000	20000	20000	20000	20000	21
NU 314	1600	2500	7100	8900	11000	13100	15100	16900	16900	19300	19300	20000	27
NU316	-	-	6000	7600	9500	11600	13800	15500	15500	17800	17800	20000	34
NU 319	-	-	4700	6000	7600	9800	12200	13700	13700	15700	15700	20000	45
NU 322	-	-	3300	4400	5900	7800	10700	11500	11500	13400	13400	17300	60
NU 324	-	-	2400	3500	5000	6600	10000	10200	10200	12100	12100	15000	72

### Notes:

- The ZZ bearings from 6201 to 6307 do not require relubrication as its life time is about 20,000 hours.
- Tables 1 and 2 are intended for the lubrication period under bearing temperature of 70°C (for bearings up to 6312 and NU 312) and temperature of 85°C (for bearings 6314 and NU 314 and larger).
- For each 15°C of temperature rise, the relubrication period is reduced by half.
- The relubrication periods given above are for those cases applying Polyrex® EM grease.
- When motors are used on the vertical position, their relubrication interval is reduced by half if compared to horizontal position motors.

### Compatibility of Polyrex® EM grease with other types of grease:

Containing polyurea thickener and mineral oil, the Polyrex® EMgrease is compatible with other types of grease that contain:

- Lithium base or complex of lithium or polyurea and highly refined mineral oil.
- Inhibitor additive against corrosion, rust and anti-oxidant additive.

### Votes:

- Although Polyrex® EM is compatible with types of grease given above, we do no recommended to mix it with any other greases.
- If you intend to use a type of grease different than those recommended above, first contact WEG.
- On applications (with high or low temperatures, speed variation, etc), the type of grease and relubrification interval are given on an additional nameplate attached to the motor.



### 4. Maintenance

A well-designed maintenance program for electric motors can be summed up as: periodical inspection of insulation levels, temperature rise, wear, bearing lubrication and the occasional checking of fan air flow

Inspection cycles depend upon the type of motor and the conditions under which it operates.

### 4.1 Cleanliness

Motors should be kept clean, free of clust, debris and oil. Soft brushes or clean cotton rags should be used for cleaning. Ajet of compressed air should be used to remove non-abrasive clust from the fan cover and any accumulated grime from the fan and cooling fins.

Oil or damp impregnated impurities can be removed with rags soaked in a suitable solvent.

Terminal boxes fitted to motors with IP55 protection should be cleaned; their terminals should be free of oxidation, in perfect mechanical condition, and all unused space dust-free.

Motors with IPW 55 protection are recommended for use under unfavourable ambient conditions.

### 4.2 Lubrication

Proper lubrication extends bearing life.

### **Lubrication Maintenance Includes:**

- a) Attention to the overall state of the bearings;
- b) Cleaning and lubrication;
- c) Critical inspection of the bearings.

Motor noise should be measured at regular intervals of one to four months. Awell-tuned ear is perfectly capable of distinguishing unusual noises, even with rudimentary tools such as a screw driver, etc., without recourse to sophisticated listening aids or stethescopes that are available on the market.

Auniform hum is a sign that a bearing is running perfectly. Bearing temperature control is also part of routine maintenance.

Constant temperature control is possible with the aid of external thermometers or by embedded thermal elements. WEG motors are normally equipped with grease lubricated ball or roller bearings. Bearings should be lubricated to avoid metallic contact of the moving parts, and also for protection against corrosion and wear. Lubricant properties deteriorate in the course of time and mechanical operation: furthermore, all lubricants are subject to contamination under working conditions.

For this reason lubricants must be renewed and any lubricant consumed needs replacing from time to time.

### 4.2.1 Periodical Lubrication

WEG motors are supplied with sufficient grease for a long running period. Lubrication intervals, the amount of grease and the type of bearing used in frames 140T to 580T are to be found in Tables 11, 12 and 13.

Lubrication intervals depend upon the size of the motor, speed, working conditions and the type of grease used.

### 4.2.2 Quality and Quantity of Grease

### Correct lubrication is important!

Grease must be applied correctly and in sufficient quantity as both insufficient or excessive greasing are harmful.

Excessive greasing causes overheating brought about by the greater resistance encountered by the rotating parts and, in particular, by the compacting of the lubricant and its eventual loss of lubricating qualities.

This can cause seepage with the grease penetrating the motor and dripping on the coils.

### GREASES FOR MOTOR BEARINGS

For operating temperatures from -30 to 170°C							
Туре	<u>Supplier</u>						
Polyrex® EM	Polyrex® EM Esso						

### 4.2.3 Lubricating Instructions

### a) Frame 140T to 210T motors

Frame 140T to 210T size motors are not fitted with grease nipples. Lubrication is carried out during periodical overhauls when the motor is taken apart.

### Cleaning and Lubrication of Bearings

With the motor dismantled and without extracting the bearings from the shaft, all existing grease should be removed and the bearings deaned with Diesel oil, kerosene or other solvent, until thoroughly dean

Refill the spaces between the balls or rollers and the bearing cages with grease immediately after washing. Never rotate bearings in their dry state after washing.

For inspection purposes apply a few drops of machine oil. During these operations maximum care and cleanliness is recommended to avoid the penetration of any impurities or dust that could harm the bearings. Clean all external parts prior to reassembly.

### b) Frame 360T to 580T Motors

Motors above 360T frame size are fitted with regreasable bearing system

The lubrication system from this frame size upwards was designed to allow the removal of all grease from the bearing races through a bleeder outlet which at the same time impedes the entry of dust or other contaminants harmful to the bearing.

This outlet also prevents injury to the bearings from the well-known problem of over-greasing.

### FOR NEMA LOW VOLTAGE ELECTRIC MOTORS

WEG

It is advisable to lubricate while the motor is running, to allow the renewal of grease in the bearing case.

Should this procedure not be possible because of rotating parts in the proximity of the nipple (pulleys, coupling sleeves, etc.) that are hazardous to the operator the following procedure should be followed: - Inject about half the estimated amount of grease and run the motor at full speed for approximately a minute; switch off the motor and inject the remaining grease.

The injection of all the grease with the motor at rest could cause penetration of a portion of the lubricant through the internal seal of the bearing case and hence into the motor.

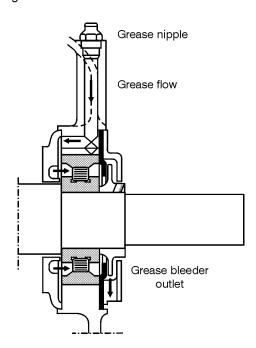


Figure 4.1 - Bearings and lubrication system

Nipples must be clean prior to introduction of grease to avoid entry of any alien bodies into the bearing.

For lubricating use only a manual grease gun.

### **Bearing Lubrication Steps**

- Cleanse the area around the grease nipples with clean cotton fabric.
- 2 With the motor running, add grease with a manual grease gun until the lubricant commences to be expelled from the bleeder outlet, or until the quantity of grease recommended in Tables 12 or 13 has been applied.
- 3. Allow the motor to run long enough to eject all excess grease.

### 4.2.4 Replacement of Bearings

The opening of a motor to replace a bearing should only be carried out by qualified personnel.

Damage to the core after the removal of the bearing cover can be avoided by filling the gap between the rotor and the stator with stiff paper of a proper thickness.

Providing suitable tooling is employed, disassembly of a bearing is not difficult.

The extractor grips should be applied to the sidewall of the inner ring to be stripped, or to an adjacent part.

To ensure perfect functioning and to prevent injury to the bearing parts, it is essential that the assembly be undertaken under conditions of complete cleanliness and by competent personnel.

New bearings should not be removed from their packages until the moment of assembly.

Prior to fitting a new bearing, ascertain that the shaft has no rough edges or signs of hammering.

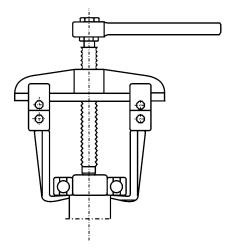


Figure 4.2 - Abearing extractor

During assembly bearings cannot be subjected to direct blows. The aid used to press or strike the bearing should be applied to the inner ring.

### 4.3 Air Gap Checking (Large Rating Open Motors)

Upon the completion of any work on the bearings check the gap measurement between the stator and the rotor using the appropriate cazes.

The gap variation at any two vertically opposite points must be less than 10% of the average gap measurement.

### 4.4 Explosion Proof Motor Repair Steps

### 4.4.1 Objective

In view of the heavy liability associated with burning of motors of this type, this product has been designed and manufactured to high technical standards, under rigid controls. In addition, in many areas it is required that explosion proof motors ONLY be repaired by licensed personnel or in licensed facilities authorized to do this type of work. The following general procedures, safeguards, and guidelines must be followed in order to ensure repaired explosion proof motors operate as intended.

### 4.4.2 Repair Procedure and Precautions

Dismantle the damaged motor with appropriate tools without hammering and/or pitting machined surfaces such as enclosure joints, fastening



holes, and all joints in general.

The position of the fan cover should be suitably marked prior to removal so as to facilitate reassembly later on.

Examine the motor's general condition and, if necessary, disassemble all parts and clean them with kerosene. Under no circumstances should scrapers, emery papers or tools be used that could affect the dimensions of any part during cleaning.

Protect all machined parts against oxidation by applying a coating of vaseline or oil immediately after cleaning.

### STRIPPING OF WINDINGS

This step requires great care to avoid knocking and/or denting of enclosure joints and, when removing the sealing compound from the terminal box, damage or cracking of the frame.

### **IMPREGNATION**

Protect all frame threads by inserting corresponding bolts, and the joint between terminal box and frame, by coating it with a non-adhesive varnish (ISO 287 - ISOLASIL).

Protective varnish on machined parts should be removed soon after treating with impregnating varnish. This operation should be carried out manually without using tools.

### **ASSEMBLY**

Inspect all parts for defects, such as cracks, joint incrustations, damaged threads and other potential problems.

Assemble using a rubber headed mallet and a bronze bushing after ascertaining that all parts are perfectly fitted.

Bolts should be positioned with corresponding spring washers and evenly tightened.

### TESTING

Potate the shaft by hand while examining for any drag problems on covers or fastening rings.

Carry out running tests as for standard motors.

### MOUNTING THE TERMINAL BOX

Prior to fitting the terminal box all cable outlets on the frame should be sealed with a sealing compound ( $I^{st}$  layer) and an Epoxy resin (ISO 340) mixed with ground quartz ( $2^{rd}$  layer) in the following proportions:

340A resin50 parts340B resin50 partsGround quartz100 parts

Drying time for this mixture is two hours during which the frame should not be handled and cable outlets should be upwards.

When dry, see that the outlets and areas around the cables are perfectly sealed.

Mount the terminal box and paint the motor.

### 4.4.3 Miscellaneous Recommendations

 Any damaged parts (cracks, pittings in machined surfaces, defective threads) must be replaced and under no circumstances should attempts be made to recover them.

- Upon reassembling explosion proof motors IPW55 the substitution of all seals is mandatory.
- Should any doubts arise, consult WEG.



### 5. Malfunctioning



Most malfunctions affecting the normal running of electric motors can be prevented by maintenance and the appropriate precautions.

While ventilation, cleanliness and careful maintenance are the main factors ensuring long motor life, a further essential factor is the prompt attention to any malfunctioning as signalled by vibrations, shaft knock, declining insulation resistance, smoke or fire, sparking or unusual slip ring or brush wear, sudden changes of bearing temperatures.

When failures of an electric or mechanical nature arise, the first step to be taken is to stop the motor and subsequent examination of all mechanical and electrical parts of the installation.

In the event of fire, the installation should be isolated from the mains supply, which is normally done by turning off the respective switches. In the event of fire within the motor itself, steps should be taken to restrain and suffocate it by covering the ventilation vents.

To extinguish a fire, dry chemical or  ${\rm CO_2}$  extinguishers should be used - never water.

### 5.1 Standard Three-Phase Motor Failures

Owing to the widespread usage of asynchronous three-phase motors in industry which are more often repaired in the plant workshops, there follows a summary of possible failures and their probable causes, detection and repairs.

Motors are generally designed to Class B or F insulation and for ambient temperatures up to  $40^{\circ}\text{C}$ .

Most winding defects arise when temperature limits, due to current overload, are surpassed throughout the winding or even in only portions thereof. These defects are identified by the darkening or carbonizing of wire insulation.

### 5.1.1 Short Circuits Between Turns

A short circuit between turns can be a consequent of two coinciding insulation defects, or the result of defects arising simultaneously on two adjacent wires. As wires are randomly tested, even the best quality wires can have weak spots. Weak spots can, on occasion, tolerate a voltage surge of 30% at the time of testing for shorting between turns, and later fail due to humidity, dust or vibration.

Depending on the intensity of the short, a magnetic hum becomes audible.

In some cases, the three-phase current imbalance can be so insignificant that the motor protective device fails to react. Ashort circuit between turns, and phases to ground due to insulation failure is rare, and even so, it nearly always occurs during the early stages of operation.

### 5.1.2 Winding Failures

### a) One burnt winding phase

This failure arises when a motor runs wired in delta and current fails in one main conductor.

Ourrent rises from 2 to 2.5 times in the remaining winding with a simultaneous marked fall in speed. If the motor stops, the current will increase from 3.5 to 4 times its rated value.

In most instances, this defect is due to the absence of a protective switch, or else the switch has been set too high.

### b) Two burnt winding phases

This failure arises when current fails in one main conductor and the motor winding is star-connected. One of the winding phases remains currentless while the others absorb the full voltage and carry an excessive current.

The slip almost doubles.

cause of the trouble.

### c) Three burnt winding phases *Probable cause 1*

Motor only protected by fuses; an overload on the motor will be the

Consequently, progressive carbonizing of the wires and insulation culminate in a short circuit between turns, or a short against the frame

A protective switch placed before the motor would easily solve this problem.

### Probable cause 2

Motor incorrectly connected. For example: A motor with windings designed for 230/400V is connected through a star-delta switch to 400V connection.

The absorted current will be so high that the winding will burn out in a few seconds if the fuses or a wrongly set protective switch fail to react promptly.

### Probable cause 3

The star-delta switch is not commutated and the motor continues to run for a time connected to the star under overload conditions.

As it only develops 1/3 of its torque, the motor cannot reach rated speed. The increased slip results in higher ohmic losses arising from the Joule effect. As the stator current, consistent with the load, may not exceed the rated value for the delta connection, the protective switch will not react.

Consequent to increased winding and rotor losses the motor will overheat and the winding burn out.

### Probable cause 4

Failures from this cause arise from thermal overload, due to too many starts under intermittent operation or to an overly long starting cycle. The perfect functioning of motor operating under these conditions is only assured when the following values are heeded:

- a) number of starts per hour;
- b) starting with or without load;
- c) mechanical brake or current inversion;
- d) acceleration of rotating masses connected to motor shaft;
- e) load torque vs. speed during acceleration and braking.

The continuous effort exerted by the rotor during intermittent starting brings about heavier losses which provoke overheating. Under certain circumstances with the motor idle there is a possibility

that the stator winding is subjected to damage as a result of the



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heating of the motor. In such a case, a slip ring motor is recommended as a large portion of the heat (due to rotor losses) is dissipated in the rheostat.

### 5.1.3 Rotor Failures

If a motor running under load conditions produces a noise of varying intensity and decreasing frequency while the load is increased, the reason, in most cases, will be an unsymmetrical rotor winding.

In squirrel-cage motors the cause will nearly always be a break in one or more of the rotor bars; simultaneously, periodical stator current fluctuations may be recorded. As a rule, this defect appears only in molded or die cast aluminum cages.

Failures due to spot heating in one or another of the bars in the rotor stack are identified by the blue coloration at the affected points.

Should there be failures in various contiguous bars, vibrations and shuddering can occur as if due to an unbalance, and are often interpreted as such. When the rotor stack acquires a blue or violet coloration, it is a sign of overloading.

This can be caused by overly high slip, by too many starts or overlong starting cycles. This failure can also arise from insufficient main voltage.

### 5.1.4 Bearing Failures

Bearing damage is a result of overloading brought about by an overly taut belt or axial impacts and stresses.

Underestimating the distance between the drive pulley and the driven pulley is a common occurrence.

The arc of contact of the belt on the drive pulley thus becomes inadmissibly small and thereby belt tension is insufficient for torque transmission.

In spite of this it is quite usual to increase belt tension in order to attain sufficient drive.

Admittably, this is feasible with the latest belt types reinforced by synthetic materials.

However, this practice fails to consider the load on the bearing and the result is bearing failure within a short time.

Additionally there is the possibility of the shaft being subjected to unacceptably high loads when the motor is fitted with a pulley that is too wide.

### 5.1.5 Shaft Fractures

Although bearings traditionally constitute the weaker part, and the shafts are designed with wide safety margins, it is not beyond the realmof possibility that a shaft may fracture by fatigue from bending stress brought about by excessive belt tension.

In most cases, fractures occur right behind the drive end bearing. As a consequence of alternating bending stress induced by a rotating shaft, fractures travel inwards from the outside of the shaft until the point of rupture is reached when resistance of the remaining shaft cross-section no longer suffices.

Avoid additional drilling the shaft (fastening screw holes) as such operations tend to cause stress concentration.

### 5.1.6 Unbalanced V-Belt Drives

The substitution of only one of a number of other parallel belts on a drive is frequently the cause of shaft fractures, as well as being malpractice.

Any used, and consequently stretched belts retained on the drive, especially those closest to the motor, while new and unstretched belts are placed on the same drive turning farther from the bearing, can augment shaft stress.

### 5.1.7 Damage Arising from Poorly Fitted Transmission Parts or Improper Motor Alignment

Damage to bearing and fracture in shafts often ensue from inadequate fitting of pulleys, couplings or pinions. There parts "knock" when rotating. The defect is recognized by the scratches that appear on the shaft or the eventual scalelike flaking of the shaft end.

Keyways with edges pitted by loosely fitted keys can also bring about shaft failures.

Poorly aligned couplings cause knocks and radial and axial shaking to shaft and bearings.

Within a short while these malpractices cause the deterioration of the bearings and the enlargement of the bearing cover bracket located on the drive end side.

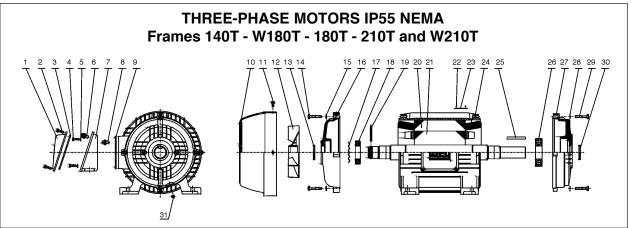
Shaft fracture can occur in more serious cases.



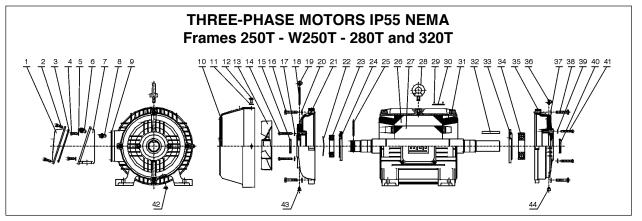
### 5.2 Troubleshooting chart

FAILURE	PROBABLE CAUSE	CORRECTIVE MEASURES
Motor fails to start	No voltage supply Low voltage supply  Wrong control connections  Loose connection at some terminal lug Overload	Check feed connections to control systemand from this to motor. Check voltage supply and ascertain that voltage remains within 10% of the rated voltage shown on the motor nameplate. Compare connections with the wiring diagram on the motor nameplate. Tighten all connections.  Try to start motor under no-load conditions. If it starts, there may be an overload condition or a blocking of the starting mechanism. Reduce load to rated load level and increase torque.
High noise level	Unbalance  Distorted shaft Incorrect alignment Uneven air gap Dirt in the air gap Extraneous matter stuck between fan and motor casing Loose motor foundation Wombearings	<ul> <li>Vibrations can be eliminated by balancing rotor. If load is coupled directly to motor shaft, the load can be unbalanced.</li> <li>Shaft key bent; check rotor balance and eccentricity.</li> <li>Check motor aligment with machine running.</li> <li>Check shaft for warping or bearing wear.</li> <li>Dismantle motor and remove dirt or clust with jet of dry air.</li> <li>Dismantle motor and clean. Remove trash or debris from motor vicinity.</li> <li>Tighten all foundation studs. If necessary, realign motor.</li> <li>Check lubrication. Replace bearing if noise is excessive and continuous.</li> </ul>
Overheating of bearings	Excessive grease     Excessive axial or radial strain on belt     Deformed shaft     Rough bearing surface     Loose or poorly fitted motor end shields     Lack of grease     Hardened grease cause locking of balls     Foreign material in grease	Remove grease bleeder plug and run motor until excess grease is expelled.     Reduce belt tension.     Have shaft straightened and check rotor balance.     Replace bearings before they damage shaft.     Check end shields for close fit and tightness around circumference.     Add grease to bearing.     Replace bearings.     Replace bearings.
Intense bearing vibration	Unbalanced rotor Dirty or worn bearing  Bearing rings too tight on shaft and/or bearing housing  Extraneous solid particles in bearing	<ul> <li>Balance rotor statically and dynamically.</li> <li>If bearing rings are in perfect condition, clean and relubricate the bearing, otherwise, replace bearing.</li> <li>Before altering shaft or housing dimensions, it is advisable to ascertain that bearing dimensions correspond to manufacturer's specifications.</li> <li>Take bearing apart and clean. Peassemble only if rotating and support surfaces are unharmed.</li> </ul>
Overheating of motor	Obstructed cooling system Overload  Incorrect voltages and frequecies  Frequent inversions Potor dragging on stator Unbalanced electrical load (burnt fuse, incorrect control)	<ul> <li>Clean and dry motor; inspect air vents and windings periodically.</li> <li>Check application, measuring voltage and current under normal running conditions.</li> <li>Compare values on motor nameplate with those of mains supply. Also check voltage at motor terminals under full load.</li> <li>Exchange motor for another that meets needs.</li> <li>Check bearing wear and shaft curvature.</li> <li>Check for unbalanced voltages or operation under single-phase condition.</li> </ul>

### 6. Spare Parts and Component Terminology

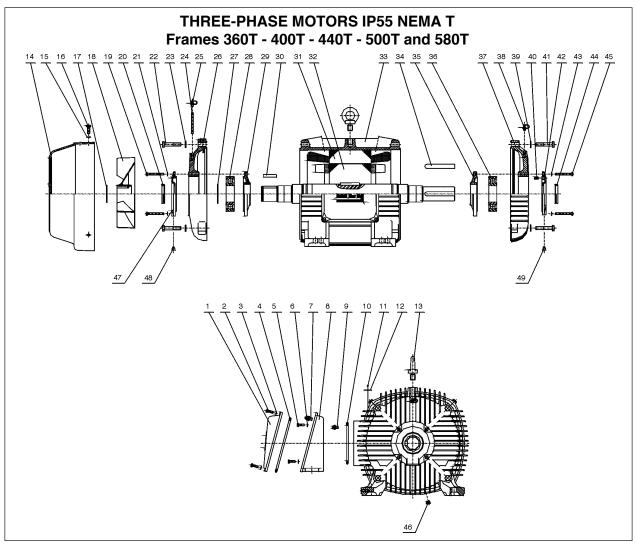


Part Nr.	Description	Part Nr.	Description	Part Nr.	Description
1	Terminal box cover	13	V'Ring	25	Shaft kev
2	Terminal box cover fixing bolt	14	Non-drive end endshield fixing bolt	26	Drive end bearing
3	Terminal box cover gasket	15	Non-drive end endshield washer	27	Drive endshield
4	Terminal box fixing bolt	16	Non-drive endshield	28	Drive endshield washer
5	Terminal box fixing washer	17	Spring washer	29	Drive end endshield fixing bolt
6	Terminal box grounding lug	18	Non-drive bearing	33	V'Ring
7	Terminal box	19	Fan fixing pin	31	Drain plug
8	Frame grounding lug	20	Wound stator		1 13
9	Terminal box o'ring gasket	21	Rotor / shaft assembly		
10	Fan cover	22	Nameplate fixing rivet		
11	Fan cover fixing bolt	23	Nameplate		
12	Fan	24	Frame		



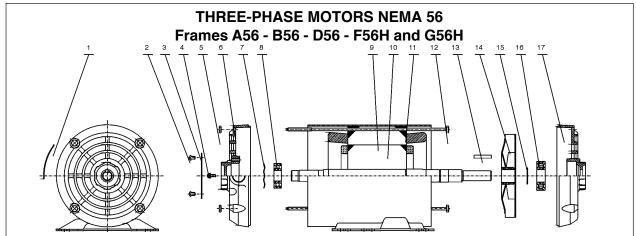
Part Nr.	Description	Part Nr.	Description	Part Nr.	Description
1	Terminal box cover	16	Non-drive end endshield fixing	30	Nameplate
2	Terminal box cover fixing bolt		bolt	31	Frame
3	Terminal box cover gasket	17	Non-drive end bearing cap washer	32	Shaft key
4	Terminal box fixing bolt	18	Non-drive end grease nipple	33	Drive end bearing cap
5	Terminal box fixing washer	19	Non-drive end grease nipple cover	34	Drive end bearing
6	Terminal box grounding lug	20	Non-drive end endshield washer	35	Drive andshield
7	Terminal box	21	Non-drive endshield	36	Drive end grease nipple cover
8	Frame grounding lug	22	Spring washer	37	Drive endshield washer
9	Terminal box o'ring gasket	23	Non-drive end bearing	38	Drive end endshield fixing bolt
10	Fan cover	24	Non-drive end bearing cap	39	Drive end bearing cap washer
11	Fan cover washer	25	Fan fixing pin	40	V'Ring
12	Fan cover fixing bolt	26	Wound stator	41	Drive end bearing cap fixing bolt
13	Fan	27	Rotor and shaft	42	Drain plug
14	Non-drive end bearing cap bolt	28	Eyebolt	43	Non-drive and grease relief
15	V'Ring	29	Nameplate fixing rivet	44	Drive end grease relief



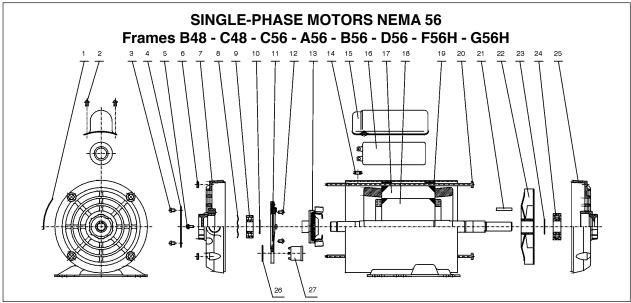


Part Nr.	Description	Part Nr.	Description	Part Nr.	Description
1	Terminal box cover	18	Fan	34	Shaft key
2	Terminal box cover fixing bolt	19	Non-drive end bearing cap bolt	35	Internal drive end bearing cap
3	Terminal box cover washer	20	V'Ring	36	Drive end bearing
4	Terminal box cover gasket	21	Non-drive end bearing cap washer	37	Drive endshield
5	Terminal box fixing bolt	22	Non-drive end endshield fixing	38	Drive end grease nipple cover
6	Terminal box fixing washer		bolt	39	Drive endshield washer
7	Terminal box grounding lug	23	Non-drive end endshield washer	40	Pre-load spring
8	Terminal box	24	Non-drive end grease nipple	41	Drive end endshield fixing bolt
9	Frame grounding lug	25	Non-drive end grease nipple cover	42	External drive end bearing cap
10	Terminal box o'ring gasket	26	Non-drive enshield	43	Drive end bearing cap washer
11	Nameplate fixing rivet	27	Bearing cap	44	V'Ring
12	Nameplate	28	Non-drive bearing	45	Drive end bearing cap fixing bolt
13	Evebolt	29	Internal non-drive end bearing cap	46	Drain plug
14	Fan cover	30	Fan fixing key	47	External non-drive end bearing
15	Fan cover washer	31	Wound stator		cap
16	Fan cover fixing bolt	32	Rotor / shaft assembly	48	Non drive end grease relief
17	Fan fixing ring	33	Frame	49	Non-drive end grease relief





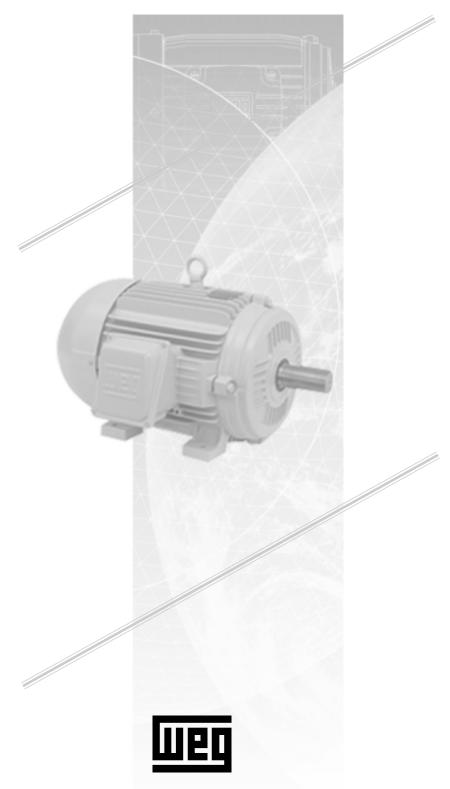
Part Nr.	Description	Part Nr.	Description	Part Nr.	Description
1	Sticker	8	Non-drive end bearing	14	Fan
2	Terminal box cover fixing bolt	9	Wound stator	15	Drive end bearing fastening
3	Terminal box cover	10	Rotor / shaft assembly		washer
4	Grounding lug	11	Frame	16	Drive end bearing
5	Through bolt fastening nut	12	Through bolt	17	Drive endshield
6	Non-drive endshield	13	Shaft key		
7	Spring washer	I			



Part Nr.	Description	Part Nr.	Description	Part Nr.	Description
1	Sticker	12	Stationary switch fastening bolt	23	Drive end bearing fastening
2	Capacitor cover fixing bolt	13	Centrifugal switch		washer
3	Terminal box cover fixing bolt	14	Rubber ring for lead passing hole	24	Drive end bearing
4	Terminal box cover		to capacitor	25	Drive endshield
5	Grounding lug	15	Capacitor cover	26	Overload thermal protector fixing
6	Through bolt fastening nut	16	Capacitor		ring
7	Non-drive endshield	17	Wound stator	27	Overload thermal protector
8	Spring washer	18	Rotor / shaft assembly		·
9	Non-drive and bearing	19	Frame		
10	Non-drive and bearing fastening	20	Through bolt		
	washer	21	Shaft key		
11	Stationary switch	22	Fan		

**Note:** For F56H and G56H frame motors: 1) Part nr. 2 = 3 pieces; 2) Part nr. 15 and 16 = 2 pieces

# INSTALLATION AND MAINTENANCE MANUAL FOR NEMA LOW VOLTAGE ELECTRIC MOTORS NOTES:



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### **LPT Model IIIr Pump**Operation and Maintenance Manual

### Contents

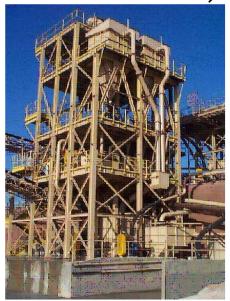
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### 1. Introduction

Aggregate Processing Division of McLanahan, is a major manufacturer of process plants for the minerals industry. The LPT Model IIIr is the latest generation of successful abrasion/corrosion resistant slurry handling Pumps.

This manual should be carefully read before attempting to install or operate this LPT Model IIIr Pump.





### **Total Service**

From design to installation and beyond, McLanahan engineers are available to give advice on your slurry pumping needs and problems.

The LPT Model IIIr range has been designed to offer a wide choice of pump sizes to suit most slurry pumping applications. A standard questionnaire is available to ensure that the most complex installation, as well as the more straightforward pumping application, receives individual consideration.

McLanahan can also advise on the ancillary components within the pumping system. The provision of low head loss valves, gland feed pumps, priming devices and flexible bends, all incorporating application specific linings for trouble-free life, are an important aspect of ensuring a totally successful pump installation

### **Design Specifications and Options**

The LPT Model Illr standard casing is designed for a maximum working pressure of 88 psi (6 bar). A high pressure casing is available, rated at 272 psi (18.5 bar). Please contact McLanahan for pressures higher than this.

The pump units in the LPT Model Illr range are designated by the size of suction and discharge ports. Units up to 4" (100mm) have equal size suction and discharge, above this the Model Illr has a larger suction than discharge. Size is given in inches (mm) i.e. 8"/6" (200/150) Model Illr has an 8" (200mm) suction port and a 6" (150mm) discharge port.

Suction and discharge flanges are universal and are available in ASA150 drilling patterns as standard. Other drilling patterns (metric & BS4504) are available to special order. Orientation of discharge to 4 positions according to installation requirements.

The LPT Model IIIr pump components are designed and manufactured in accordance with appropriate International Quality Standards, such as ISO9000.

### 2. Your Pump

Company Name:			
Address:		Tel:	
		Fax:	
Supplier:	Type of Industry:		
	Pump Model:		Size:
	Serial No:		Flange Type:
Contact Person:	Gland Size:		Drive Style:
Start up date/remarks:			

### **Important Notes**

- > The maintenance of rotating machinery should be done by experienced mechanics.
- > Protective clothing and proper tools and lifting equipment, all in good condition, must be used.
- > Do not lift heavy weights without mechanical aids.
- > Do not take any risks with your health and safety.
- > If a pump has run without discharge, the fluid temperature and pressure may be dangerously high. Refer to paragraph 17.1 and 17.11 c.
- > The casing suspension arm is fitted as a maintenance aid only. Refer to Note 3, page 17.
- > The installer must ensure that guards are fitted in accordance with national & local regulations.

### 2.1. Design Condition (To be filled in by distributor or owner)

The following data should be completed as a record of the duty for which the pump was originally sold. During its lifetime the pumping requirements may change, if so, the new speed and operating conditions must be carefully engineered. McLanahan engineers are able to assist you in doing this if required. US units are used unless otherwise noted

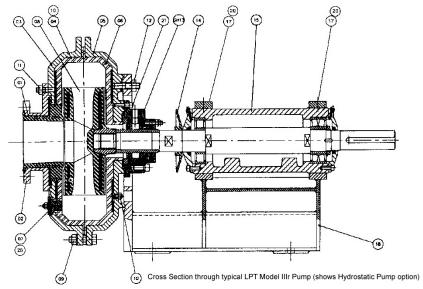
Details of Solids
Description of Solids =
Specific Gravity Solids: S = Quantity of Solids M =dry Tons/hr.
Particle Size: Topsize =mesh.(mm) 50% passing size = mesh.(mm)
Details if Liquor
Description of Liquor =
Specific Gravity of Liquor: Sl =
Details of Slurry
Specific gravity of Slurry: Sm =
% of solids by volume in slurry: Cv =
% of solids by weight in slurry: Cm =
Flow rate of slurry :Q =gpm.(l/s, m³/Hr)
Calculated Design Data
Total Head = ft. (m) Maximum working Head =ft. (m)
NPSHa = ft. (m)
Pump Speed on Slurry =rpm. Derate factor for Slurry =
Motor Data
Motor Power rating =HP (kW)
Motor Frame size =
Motor Speed =rpm.
Motor Shaft size =in. (mm)
Vee-Belt Drive Data
Motor pulley O.D. =in. (mm) Pump pulley O.D. =in. (mm)
Taper lock Bush No =
Vee-belt =No off No of grooves/pulley =
Gland Water Requirements (H and P glands only)
Quantity: =gpm (l/s)
Pressure: =psi (m)
Technical Data
Pump Mass =lbs. (kg)
Motor Mass =lbs. (kg)
Pump Shaft Size =mm
Noise level =db(A) (see page 12)

### 3. Performance Curve – see Appendix

### 4. Pump Range – Typical Sectional Arrangements

### 4.1. Pump Assembly

The actual sectional arrangement drawing for your pump is to be found in the Appendix.

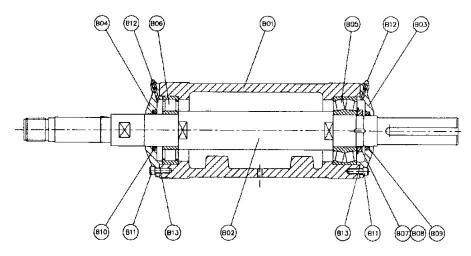


Pump Parts List					
Part No.	Description				
*01	Suction Bush Liner				
*02	Suction Bush				
03	Suction Side Casing				
04	Suction Side Liner				
05	Gland Side Casing				
06	Gland Side Liner				
07	Drain Plug				
08	Impeller				
09	Casing Bolt Set				
10	Liner Nut Set				
11	Suction Bush Stud Set				
12	Casing to Pedestal Stud Set				
13	Gland Assembly ("H" Type shown)				
14	Flinger				
15	Bearing Assembly				
16	Motor Platform Assembly (not shown)				
17	Pedestal Caps				
18	Pedestal				
19	Axial Positioning Jack (not shown)				
20	Pedestal Cap Screws				
21	Gland Holding Screw Set				
23	Eyebolt - Casing (not shown)				
24	Inside Gland Cover (not shown)				
25	S & D Flang Stud Set (not shown)				
26	Drain Plug Stud Set (not shown)				
31	Shaft Gland (not shown)				

Optional Parts (not shown)						
Part N	0.	Description				
	C01	Suspension Arm				
	C02	Crawl				
28	C03	Supporting Disc				
	C04	Supporting Bracket				
	C05	Eyebolt				
	M01	C01				
	M02	C02				
16	03	C03				
	M04	C04				
	M05	Crossbar Support Collar				
29		Belt Guard				
30	•	Shaft Spanner				

<sup>\*</sup>Removable suction bush & liner from LP6x5 (150/125) upwards.

### 4.2. Bearing Housing Assembly



Cross Section Through Bearing Assembly

Bearing Assembly Parts List						
√o.	Description					
B01 B02 B03 B04 B05 B06 B07 B08 B09 B10 B11 B12 B13	Bearing Housing Shaft End Cover Front Cover End Bearing Front Bearing Tab Washer Lock Nut End Grease Seal Front Grease Seal Bearing Cover Set Screws Grease Nipples Bearing Housing Cover Seals					
	B01 B02 B03 B04 B05 B06 B07 B08 B09 B10 B11 B12					

### 5. Parts List and Part Reference Numbers

### **Spare Parts**

The part is fully identified by the number on the cross section drawing followed by the discharge branch size. For example an impeller for the 2"/2" (50/50) rubber pump is Part Number 08-050. The material description must also be given i.e. Linatex, nitrile, etc.

Description	1½x1½	2x2	3x3	4x4	6x5	8x6	10x8	12x10
General Pump Parts								
Suction Bush Liner	-	-	-	-	01-125	01-150	01-200	01-250
Suction Bush – MM	-	-	-	-	02-125	02-150	02-200	02-250
Suction Bush - UNC	-	-	-	-	02-125A	02-150A	02-200A	02-250A
Suction Side Casing - MM	03-035	03-050	03-080	03-100	03-125	03-150	03-200	03-250
Suction Side Casing - UNC	03-035A	03-050A	03-080A	03-100A	03-125A	03-150A	03-200A	03-250A
Suction Side Liner c/w Drain Plug	04-035	04-050	04-080	04-100	04-125	04-150	04-200	04-250
Gland Side Casing – MM	05-035	05-050	05-080	05-100	05-125	05-150	05-200	05-250
Gland Side Casing – UNC	05-035A	05-050A	05-080A	05-100A	05-125A	05-150A	05-200A	05-250A
Gland Side Liner	06-035	06-050	06-080	06-100	06-125	06-150	06-200	06-250
Drain Plug	07-050	07-050	07-080	07-100	07-125	07-150	07-200	07-250
Impeller	08-035	08-050	08-080	08-100	08-125	08-150	08-200	08-250
Casing Bolt Set	09-035	09-050	09-080	09-100	09-125	09-150	09-200	09-250
Suction Bush Stud Set	-	-	-	-	11-125	11-150	11-200	11-250
Casing to Pedestal Stud Set	12-050	12-050	12-080	12-100	12-125	12-150	12-200	12-250
Gland Assembly	13-050	13-050	13-080	13-100	13-125	13-150	13-200	13-250
Finger	14-050	14-050	14-080	14-100	14-125	14-150	14-200	14-250
Bearing Assembly	15-050	15-050	15-080	15-100	15-125	15-150	15-200	15-250
Motor Support Assembly	16-050	16-050	16-080	16-100	16-125	16-150	16-200	16-250
Pedestal Caps	17-050	17-050	17-080	17-100	17-125	17-150	17-200	17-250
Pedestal	18-050	18-050	18-080	18-100	18-125	18-150	18-200	18-250
Axial Positioning Jack	19-050	19-050	19-080	19-100	19-125	19-150	19-200	19-250
Pedestal Cap Screw Set	20-050	20-050	20-080	20-100	20-125	20-150	20-200	20-250
Gland Holding Screw Set	21-050	21-050	21-080	21-100	21-125	21-150	21-200	21-250
Eyebolt - Casing	-	-	23-080	23-100	23-125	23-150	23-200	23-250
Inside Gland Cover	-	-	-	-	-	•	24-200	24-250
Suct. & Disch. Flange Stud Set - MM	25-050	25-050	25-080	25-100	25-125	25-150	25-200	25-250
Suct. & Disch. Flange Stud Set -UNC	25-050A	25-050A	25-080A	25-100A	25-125A	25-150A	25-200A	25-250A
Drain Plug Stud Set	26-050	26-050	26-080	26-100	26-125	26-150	26-200	26-250
Crane & Crawl Assembly	-	-	28-080	28-100	28-125	28-150	28-200	-
Belt Guard	29-050	29-050	29-080	29-100	29-125	29-150	29-200	29-250
Shaft Spanner	-	-	30-080	30-100	30-125	30-150	30-200	30-250
Shaft Guard	31-050	31-050	31-080	31-100	31-125	31-150	31-200	31-250
Name Plate	32-050	32-050	32-080	32-100	32-125	32-150	32-200	32-250
Logo Plate	33-050	33-050	33-080	33-100	33-125	33-150	33-200	33-250

Description	1½x1½	2x2	3x3n	4x4	6x5	8x6	10x8	12x10
Bearing Assembly								
Bearing Housing	B01-050	B01-050	B01-080	B01-100	B01-125	B01-150	B01-200	B01-250
Shaft	B02-050	B02-050	B02-080	B02-100	B02-125	B02-150	B02-200	B02-250
End Cover	B03-050	B03-050	B03-080	B03-100	B03-125	B03-150	B03-200	B03-250
Front Cover	B04-050	B04-050	B04-080	B04-100	B04-125	B04-150	B04-200	B04-250
End Bearing	B05-050	B05-050	B05-080	B05-100	B05-125	B05-150	B05-200	B05-250
Front Bearing	B06-050	B06-050	B06-080	B06-100	B06-125	B06-150	B06-200	B06-250
Tab Washer	B07-050	B07-050	B07-080	B07-100	B07-125	B07-150	B07-200	B07-250
Lock Nut	B08-050	B08-050	B08-080	B08-100	B08-125	B08-150	B08-200	B08-250
End Grease Seal	B09-050	B09-050	B09-080	B09-100	B09-125	B09-150	B09-200	B09-250
Front Grease Seal	B10-050	B10-050	B10-080	B10-100	B10-125	B10-150	B10-200	B10-250
Bearing Cover Set Screws	B11-050	B11-050	B11-080	B11-100	B11-125	B11-150	B11-200	B11-250
Grease Nipples	B12-050	B12-050	B12-080	B12-100	B12-125	B12-150	B12-200	B12-250
Bearing Housing Cover	B13-050	B13-050	B13-080	B13-100	B13-125	B13-150	B13-200	B13-250
Seals								
Complete Assembly	15-050	15-050	15-080	15-100	15-125	15-150	15-200	15-250

Description	1½x1½	2x2	3x3n	4x4	6x5	8x6	10x8	12x10
Dry Gland Assembly	.1							
Gland Housing	D01-050	D01-050	D01-080	D01-100	D01-125	D01-150	D01-200	D01-250
Gland Cover	D02-050	D02-050	D02-080	D02-100	D02-125	D02-150	-	-
Adjusting Sleeve	D03-050	D03-050	D03-080	D03-100	D03-125	D03-150	D03-200	D03-250
Linatex Washer	D04-050	D04-050	D04-080	D04-100	D04-125	D04-150	D04-200	D04-250
Gland Seal	D05-050	D05-050	D05-080	D05-100	D05-125	D05-150	D05-200	D05-250
Adjusting Stud Set	D06-050	D06-050	D06-080	D06-100	D06-125	D06-150	D06-200	D06-250
Sleeve O-Ring	D07-050	D07-050	D07-080	D07-100	D07-125	D07-150	D07-200	D07-250
Gland Sleeve	D08-050	D08-050	D08-080	D08-100	D08-125	D08-150	D08-200	D08-250
Linatex Face Seal	D09-035	D09-050	D09-080	D09-100	D09-125	D09-150	D09-200	D09-250
Face O-Ring	D10-050	D10-050	D10-080	D10-100	D10-125	D10-150	D10-200	D10-250
Wearing Face	D11-050	D11-050	D11-080	D11-100	D11-125	D11-150	D11-200	D11-250
Impeller O-Ring	D12-050	D12-050	D12-080	D12-100	D12-125	D12-150	D12-200	D12-250
Gland Locating Ring	-	-	-	D13-100	-	-	-	-
Gland Cover Set Screw	D14-050	D14-050	D14-080	-	D14-125	D14-150	D14-200	D14-250
Spacer Ring	-	-	-	-	-	-	D15-200	D15-250
Complete Assembly	GD13-035	GD13-050	GD13-080	GD13-100	GD13-125	GD13-150	GD13-200	GD13-250
Hydrostatic Gland As	sembly		•	•	•		•	
Gland Housing	H01-050	H01-050	H01-080	H01-100	H01-125	H01-150	H01-200	H01-250
Gland Cover	H02-050	H02-050	H02-080	H02-100	H02-125	H02-150	-	-
Adjusting Gland	H03-050	H03-050	H03-080	H03-100	H03-125	H03-150	H03-200	H03-250
Resilient Gasket	H04-050	H04-050	H04-080	H04-100	H04-125	H04-150	H04-200	H04-250
Gland Seal	H05-050	H05-050	H05-080	H05-100	H05-125	H05-150	H05-200	H05-250
Adjusting Stud Set	H06-050	H06-050	H06-080	H06-100	H06-125	H06-150	H06-200	H06-250
Sleeve O-Ring	H07-050	H07-050	H07-080	H07-100	H07-125	H07-150	H07-200	H07-250
Gland Sleeve	H08-050	H08-050	H08-080	H08-100	H08-125	H08-150	H08-200	H08-250
Axial Expeller	-	-	H10-080	H10-100	H10-125	H10-150	-	H10-250
Lantern Ring	-	-	-	-	-	-	-	H11-250
Impeller O-Ring	H12-050	H12-050	H12-080	H12-100	H12-125	H12-150	H12-200	H12-250
Gland Locating Ring	H13-050	H13-050	H13-080	H13-100	H13-125	H13-150	H13-200	-
Gland Cover Set Screw	H14-050	H14-050	H14-080	H14-100	H14-125	H14-150	H14-200	H14-250
Complete Assembly	GH13-050	GH13-050	GH13-080	GH13-100	GH13-125	GH13-150	GH13-200	GH13-250

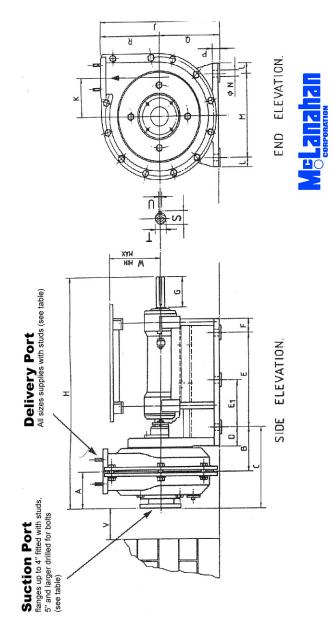
Description	1½x1½	2x2	3x3n	4x4	6x5	8x6	10x8	12x10
Packed Gland Assem	bly	l						
Gland Housing	P01-050	P01-050	P01-080	P01-100	P01-125	P01-150	P01-200	P01-250
Lantern Ring	P02-050	P02-050	P02-080	P02-100	P02-125	P02-150	P02-200	P02-250
Adjusting Gland	P03-050	P03-050	P03-080	P03-100	P03-125	P03-150	P03-200	P03-250
Packing Rings	P04-050	P04-050	P04-080	P04-100	P04-125	P04-150	P04-200	P04-250
Gland Seal	P05-050	P05-050	P05-080	P05-100	P05-125	P05-150	P05-200	P05-250
Adjusting Stud Set	P06-050	P06-050	P06-080	P06-100	P06-125	P06-150	P06-200	P06-250
Sleeve O-Ring	P07-050	P07-050	P07-080	P07-100	P07-125	P07-150	P07-200	P07-250
Gland Sleeve	P08-050	P08-050	P08-080	P08-100	P08-125	P08-150	P08-200	P08-250
Axial Expeller	-	-	P10-080	P10-100	P10-125	P10-150	-	P10-250
Backing Ring	-	-	-	-	-	-	P11-200	P11-250
Impeller O-Ring	P12-050	P12-050	P12-080	P12-100	P12-125	P12-150	P12-200	P12-250
Gland Locating Ring	-	-	P13-080	P13-100	P13-125	P13-150	P13-200	-
Gland Cover Set Screw	-	-	-	-	-	-	P14-200	P14-250
Complete Assembly	GP13-050	GP13-050	GP13-080	GP13-100	GP13-125	GP13-150	GP13-200	GP13-250
Motor Table & Other	s Parts							
Motor Platform	M01-050	M01-050	M01-080	M01-100	M01-125	M01-150	M01-200	M01-250
Motor Platform Stud	M02-050	M02-050	M02-080	M02-100	M02-125	M02-150	M02-200	M02-250
Motor Support Crossbar	M03-050	M03-050	M03-080	M03-100	M03-125	M03-150	M03-200	M03-250
Crossbar Support Stud	M04-050	M04-050	M04-080	M04-100	M04-125	M04-150	M04-200	M04-250
Crossbar Support Collar	M05-050	M05-050	M05-080	M05-100	M05-125	M05-150	M05-200	M05-250
Complete Assembly	16-050	16-050	16-080	16-100	16-125	16-150	16-200	16-250
Suspension Arm	-	-	C01-080	C01-100	C01-125	C01-150	C01-200	C01-250
Crawl Assy.	-	-	C02-080	C02-100	C02-125	C02-150	C02-200	C02-250
Supporting Disc	-	-	C03-080	C03-100	C03-125	C03-150	C03-200	C03-250
Supporting Bracket	-	-	C04-080	C04-100	C04-125	C04-150	C04-200	C04-250
Evebolt	-	-	C05-080	C05-100	C05-125	C05-150	C05-200	C05-250
Complete Assembly			28-080	28-100	28-125	28-150	28-200	28-250

## 6. Pump Dimensions

1bs 344 344 719			i : :		MADS ALL DIMENSIONS IN INCITES CONVENTED FROM MELINIC	ا ا															:	
344	В	U	D	ш	П	ш	9	т	r	×	٦	٧	z	۵	ď	ď	S	⊢	n	>	NIM	MAX
344	5 5.394	8.819	1.949 12.205	12.205		1.811	2.756	28.543	18.346	4.370	0.787	11.220	0.709	699.0	9.843	8.504	1.693	1.575	0.472	8.661	6.496	8.661
719	2 5.197	8.839	1.949	12.205		1.811	2.756	28.543	19.331	4.744	0.787	11.220	0.709	699.0	9.843	9.488	1.693	1.575	0.472	8.661	6.496	8.661
	7.087	11.811	2.559 13.976	13.976		1.969	4.724	36.024	23.425	6.614	1.181	14.173	998.0	0.945	11.811	11.614	1.909	1.772	0.551	9.449	9.843	12.205
4x4" 971 5.197	6.654	11.850 2.244	2.244	18.110		1.575	2.000	39.311	25.984	7.244	1.181	15.748	0.945	998.0	13.228	12.756	2.520	2.362	0.709	10.236	10.709	14.646
6x5   1341   8.307	7 9.213	17.520	4.331 18.858	18.858		3.937	7.441	50.630	29.843	8.268	1.181	18.898	0.945	1.102	15.354	14.488	2.736	2.559	0.709	13.780	13.386	17.323
8x6 1623 8.563	3 8.780	15.768 3.543 18.425	3.543	18.425		2.598	6.850	51.673	32.362	8.740	1.378	19.291	0.945	1.102	16.850	15.512	2.933	2.756	0.787	17.323	13.583	17.520
10x8 2757 12.165	5 10.630	22.795 4.252 25.984 12.992	4.252	25.984		2.992	7.874	62.992	37.638	12.638	1.575	25.984	0.945	1.299	21.654	15.984	3.756	3.543	0.984	19.685	16.929	23.031
12×10 4313 12.500 11.220 23.720 2.756 25.197 12.598 2.75	0 11.220	23.720	2.756	25.197	12.598	2	7.874	66.831	42.638	14.488	1.575	29.528	1.102	1.181	23.622	19.016	4.173	3.937	1.102	25.984		

		4	ASA Inch			
		РСБ	Stud Dia.	Hole Dia.	No. Off	Stud Lgth *
1½ × 1½	Suction	3 //8	1/2		4	1-34
	Discharge	3 //8	1/2		4	1-34
2x2	Suction	4 3%	8/5		4	1-34
	Discharge	4 %	8/5	-	4	1-3/4
3x3	Suction	9	8/5		8	1-3/4
	Discharge	9	8/5	-	8	1-3/4
4×4	Suction	7 1/2	8/5	-	8	7
	Discharge	7 1/2	8/5	-	8	1-3/4
6x5	Suction	6 1/2		8/,	8	
	Discharge	8 1/2	3/4	-	8	7
9x8	Suction	11 3/4		8/,	8	
	Discharge	6 1/2	3%	-	8	7
10x8	Suction	14 1/4		1	17	
	Discharge	11 34	3/4	-	8	7
12×10"	Suction	17		1	12	
	Discharge	14.25	8/,	-	17	2 1/4

<sup>\*</sup> stud length protruding



### 7. Gland Options & Part Numbers

### **Gland Seals**

The Gland is usually the weakest point on any Pump and requires most attention and maintenance. All glands need cooling and lubrication between the sliding surfaces, so a drip from the glands is normal. All glands must be finally adjusted while the pump is running.

The LPT Glands have been developed to try to minimise the attention and service needed, but this depends on the pressure of the fluid being pumped, the size and shape of the solid particles and the concentration of the solid particles in the liquid. Three unique seal arrangements have been developed and McLanahan engineers can give advice regarding the optimum selection for a specific duty.

### 7.1. "H" and "P" Glands

The Slurry pressure at the gland is reduced by back pump out vanes on the impeller, and when fitted the Rubber axial expeller, which is a stretch fit on the shaft of the "H" and "P" glands.

The solids are restrained by the outward Centrifugal swirl behind the impeller, the axial expeller and the restricted path to the seal interface.

With the "H" Gland, the adjusting gland must be eased **outwards** to increase the sealing pressure. The geometric shape of the Gland Seal is carefully designed to give a good seal, while limiting the amount of "digging" onto the gland sleeve.

The gland sealing water must be as clean as possible and at a pressure of about 3 - 5 psi (2 - 4m water gauge) above the discharge pressure. With a high flushing water pressure you get greater water use and greater dilution of the pumped slurry without any benefit to the seal.

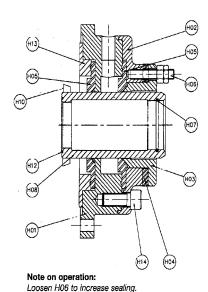
### 7.2. "D" Gland

This is a unique type of mechanical seal. The Face Seal runs against the hard Wearing Face.

The Face Seal acts as a spring and if any grit particles get between the rotating rubber and stationary Wear Face it is pressed into the Rubber. The Face Seal is a stretch fit on the shaft sleeve. As the gland pressure increases, so the rubber extends axially and increases the pressure at the rubbing interface. So great care must be taken not to over tighten the adjusting sleeve.

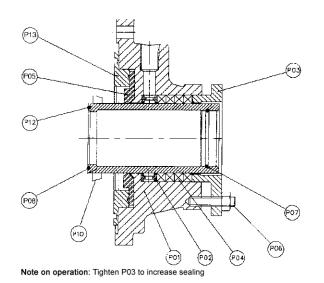
When the pump is first started, ensure that the adjusting nuts are finger tight. When the pump runs, adjust the gland nuts so that there are approximately 5 drops per minute from the gland. This should reduce to 1 drop occasionally, and run satisfactorily for up to a year without further attention in a good application.

### 7.3. Sectional Arrangement – "H" Gland Assembly



Hydrostatio	Gland Assembly
Part No.	Description
H01	Gland Housing
	Hose Connector
H02	Gland Cover
H03	Adjusting Gland
H04	Resilient Gasket
H05	Gland Seal
H06	Adjusting Stud Set
H07	Sleeve O-Ring
H08	Gland Sleeve
H10	Axial Expeller
H11	Lantern Ring (not shown)
	12"/10" (300/250) only
H12	Impeller O-Ring
H13	Gland Locating Ring
H14	Gland Cover Set Screw

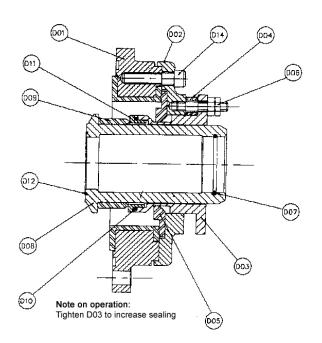
### 7.4. Sectional arrangement – "P" Gland Assembly



Packed Glai	nd Assembly
Part No.	Description
P01	Gland Housing
	Hose Connector
P02	Lantern Ring
P03	Adjusting Gland
P04	Packing Rings
P05	Gland Seal
P06	Adjusting Stud Set
P07	Sleeve O-Ring
P08	Gland Sleeve
P10	Axial Expeller
P11*	Backing Ring (not shown)
P12	Impeller O-Ring
P13	Gland Locating Ring
P14*	Gland Cover Set Screw Set

<sup>\*</sup>used on 10x8 (250/200) and 12x10 (300/250)

### 7.5. Sectional Arrangement - "D" Gland Assembly



D Gland Ass	sembly
Part No.	Description
D01	Gland Housing
D02	Gland Cover
D03	Adjusting Sleeve
D04	Linatex Washer
D05	Gland Seal
D06	Adjusting Stud Set
D07	Sleeve O-Ring
D08	Gland Sleeve
D09	Linatex Face Seal
D10	Face O-Ring
D11	Wearing Face
D12	Impeller O-Ring
D13	Gland Locating Ring
	(not shown) only on (4"/4"
D14	(100/100)
D15	Gland Cover Set Screw
	Spacer Ring (not shown)
	Only on 10"/8" (250/200) and
	12"/10" (300/250)

Do not overtighten the adjusting nuts part D06

# 8. "Pumptec" Computer Software

Many complex calculations are needed In order to

- size a pump
- establish the optimum pipeline carrying velocity
- de-rate the pump for a slurry duty
- calculate pipeline friction head losses
- calculate power absorbed,
- analyze the system head

To perform these calculations, McLanahan Corporation uses unique software named "Pumptec".

Where McLanahan Corporation has selected the Pump using Pumptec, a printout of the operating conditions; pipe configuration and curve is included in the Appendix of this manual.

When any change of duty is envisaged, the pump can usually accommodate it with a change of V-belt sheave ratios and a different speed, but it is essential to recalculate all the duty parameters and to check that the motor and drive will not be overloaded under any normal operating condition.

When making any change to your pump system, please refer these changes to McLanahan Corporation so the correct combination of speed and power is selected.

### Input criteria required:

- Volume to be pumped
- Percent solids
- Gradation of solids (top size & 50% passing size)
- Specific Gravity of Solids
- Specific Gravity of Liquid
- Temperature of Liquid
- Elevation above sea level
- Height of liquid level in tank
   (if negative suction, height from liquid surface to centre line of pump inlet)
- Vertical height from Pump inlet to discharge point
- Pressure required at delivery point
- Pipe diameter (inside diameter important)
- Pipe material
- Pipe fittings type and quantity

# 9. General Pump Suction Requirements

A pump does not "suck" as fluid has no tensile strength. The centrifugal expulsion of fluids creates a low pressure area at the eye of the impeller, and atmospheric pressure, plus any static head, pushes fluid into the pump. It is therefore essential that suction systems do not restrict flow from the sump into the pump. With slurries, this is even more important as the solids themselves can settle and cause obstructions to flow.

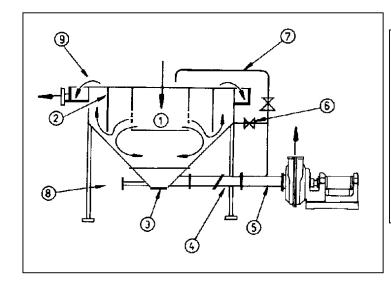
Short unobstructed pipelines with facilities for easy draining, removal and cleaning are essential.

A trap to remove tramp material is desirable.

Air entrained in the slurry reduces the pump's capacity and head, and an air vent pipe on the suction pipe close to the pump inlet is often essential.

The pump will operate best if the flow velocity approaching the impeller is evenly distributed across the suction eye, and is sensibly axial and without swirl. Intake conditions in the sump, such as the formation of vortices, or in the suction pipeline, such as a sharp bend just before the pump, cause an uneven flow over the eye of the impeller, and impair pump performance.

The Desliming and Feed Regulating Sump shown below incorporates the best features in good sump design.



- 1. Feed Distribution Box/Tramp Material Trap.
- 2. Anti-Turbulence/Air Release Baffles.
- 3. Replaceable Lined Suction Box.
- 4. Removable Split Pipe or Flexible Hose to facilitate maintenance.
- Short Simple Suction Piping.
- 6. Start Up Suction Line (Optional)
- Air Vent Line (Optional).
- 8. Injection Water Line (Optional) or Drain/Dump Port.

# 10. Installation

The following notes cover most situations, but certain installations will require additional checks.

## 10.1. Noise

Because of its heavy construction, rigid bearing housing and the sound attenuation due to the rubber lining, the noise generated by a bare shaft LPT pump is low, less than 70dB(A).

The noise emission from a complete pump and drive unit will be dependent upon various factors including that from the motor, its fan and the V-belt drive. To obtain an indication of the noise level generated by a specific complete unit take the highest component noise level, generally the motor, and multiply by 1.15. I.e. dB (A) pump + dB (A) motor + dB (A) drive  $= 1.15 \times dB$  (A) motor.

Other factors, including the piping system and hydraulically generated noise as well as any reflected noise, will affect the final installed figure.

## 10.2. Foundations

Holding down bolts, bolt holes in steel work or pockets in concrete must be checked for location and dimension to match the pump certified drawing. The foundations must be rigid.

The pump base must be set level in its final position, and be rigidly supported at each holding down bolt before the holding down bolts are tightened. It is unacceptable to twist the base by uneven tightening of the holding down bolts.

# 10.3. Pipe work

The suction and delivery pipe work must be independently supported, and the pump must not be used as an anchor to pull the pipes into position.

Provision for simple removal of suction and delivery pipe work to facilitate unblocking and servicing the pump, and dumping solids in an emergency situation should be checked.

Areas that could cause restriction on the suction side should be checked.

The possibility of thermal expansion in the pipe work causing undue loads on the pump should be checked.

Check that the pipe work matches up to the pump without strain.

The lining on the LPT Model IIIr is continued out to form gaskets on the suction and discharge flanges, therefore the use of joint rings or additional gaskets is not necessary. Connections to the pump should be made using flat faced flanges only.

When fitting LPT pumps to rubber-lined equipment such as valves, hose or lined pipe, a steel gasket must be used.

## 10.4. Power

Check that the motor voltage, power and starter rating and supply match.

## 10.5. Gland Services

If gland sealing water is required, the quantity, quality and availability should be checked.

## 10.6. Access

Crane capacity and access routes from the delivery point should be checked. Access for maintenance, protection from flooding, and ventilation for motor cooling must be checked.

## 10.7. Impeller Adjustment Axially

The position of the rotating element must be set so that there is a minimum running clearance, approximately 1mm, between the suction bush and the impeller, the bearing housing must then be locked in position. This clearance should be checked by bolting a dummy flange or stub pipe to the suction flange this ensures any movement of the rubber lining on connection is allowed for. Once connected to suction and delivery lines, the unit should be checked for free rotation.

## 10.8. Coupling Alignment

The pump and motor couplings must be aligned in accordance with good engineering practice and axial or radial run out must be less than 0.05 mm total indicated reading on a clock gauge. With Vee-belt pulleys, the faces of the couplings must be exactly in line, and the shafts must be parallel to each other. A check with a straight edge or string line across the pulley faces should have no visible gap.

### 10.9. Motor Rotation

Before the belts are fitted or the couplings are connected, the direction of rotation of the motor must be checked. Incorrect motor rotation can cause the impeller to screw off and destroy the pump.

## 10.10. Tension V-belts

When the motor's direction of rotation is correct, fit the V-belts and tension them in accordance with the maker's recommendation. In general, a quarter to a half twist of the belt will be possible at the centre of the belt using a finger and a thumb. Check the tension again after a few hours running.

### 10.11. Belt Guard

The belt guard provided with this pump unit is manufactured with the shaft aperture fully closed with mesh. On installation of the vee belt drive and determination of pulley centres, the shaft guard is offered up and the mesh relieved locally to allow the shafts to pass through. Allowance may be required for movement of shafts when belt tensioning.

The mesh should be relieved and a guard should be fitted in a manner which prevents accidental contact with the rotating parts of the drive assembly.

The installer must ensure the guard is installed in the accordance with national and local regulations.

### 10.12. Gland Service

Check that gland water supply and protection systems are working, when these are fitted.

# 10.13. Greased Bearings

The pump bearings will have been greased at the factory and over greasing can cause them to overheat, so check the bearings, but do not over grease them. Suitable grease types are Shell Alvania 3, Mobil EP2, Caltex LS3 or their equivalents.

## 10.14. Final Checks

Check that all nuts and bolts are tight; the gland adjusting nuts are finger tight; that no loose material is lying around the pump set; that the guards are securely fitted and the pump is safe to start.

# THE RUNNING SPEED OF THE PUMP MUST NOT EXCEED THE FOLLOWING:

Pump	1½x1½	2x2	3x3n	4x4	6x5	8x6	10x8	12x10
MAX RPM.	2750	2400	2100	1600	1400	1200	1200	900

## 10.15. Electrical Installation

This equipment must be installed and controlled in accordance with applicable national and local regulations.

# 11. Gland Services

On the hydrostatic gland and also on the packed gland, it is usually necessary to have a clean water flushing supply to the gland.

The pressure should be 3 - 5 psi (2 - 4 m) water gauge above the pump discharge pressure (remember to include the S.G. of the slurry) and the flow rate should be approximately in accordance with the table below.

Pump	units	1½x1½	2x2	3x3n	4x4	6x5	8x6	10x8	12x10
Water flow.	USgpm	1	1	1	2	2	2	3	4
Water flow.	liter/sec	0.04	0.04	0.05	0.07	0.07	0.09	0.1	0.2

The gland flushing water should be clean. The life of the gland and gland sleeve is related to the cleanliness of the flushing water, and although a few particles will not do instant damage, the seal life will be reduced. Slurry must not be used.

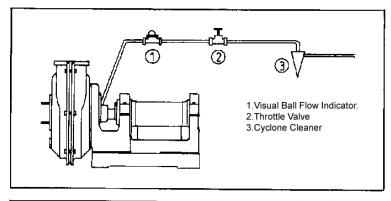
There are many combinations of flow control devices which may be used, and a few of these are shown on the next diagram. The objective is to maintain a secure supply of clean flushing water to extend the gland life

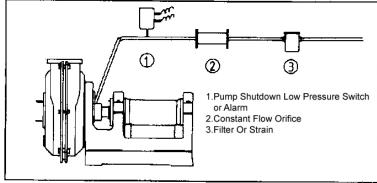
With pumps in series, there are three main ways of supplying gland service water.

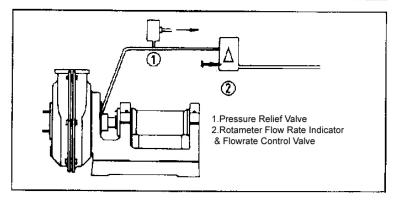
- Individual dedicated pumps at the correct pressure and flow rate.
- One large pump at the highest pressure throttling down the supply to each pump in the series.
- One multi-stage pump tapping off a supply at a different stage to each pump in the series.

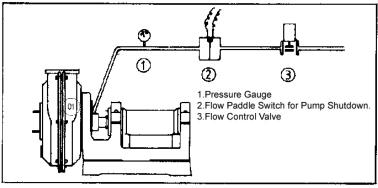
# 11.1. Gland Service Water Systems

Below are some typical Gland Service systems. Any selection of items may be combined.









# 12. Lubrication and Cooling

The bearings are grease lubricated and additional grease need only be added about twice a year. Do not over grease the bearings.

The bearing assemblies are all checked in the factory to prove that they are correctly assembled

The bearings are designed to run at high temperatures, maximum  $120^{\circ}$  C, and the grease has to be compatible with this operating condition. Clean grease must be used.

If water gets into the bearings, the assembly must be stripped, thoroughly dried and regreased, and any seal failure corrected.

Recommended greases are Shell Alvania 3, Mobile EP2, Caltex LS3 or their equivalents.

# 13. Start up Procedure

It is recommended to follow this routine every time a pump is started although it is appreciated that many units will be operated remotely.

- a. Check the free rotation of the pump.
- b.
- c. Check gland services water is running, if required.
- А
- At first start, or after any work on the electric motor terminal box, check direction of rotation\_WITH DRIVE BELTS REMOVED
- f.
- g. Check the pump is primed.
- h.
- i. Check that all guards are in place and that the pump is safe to run.
- j.
- k. Start the pump.
- ι.
- m. If the pipeline is empty and there is no discharge valve (i.e. due to abrasive nature of the product), the pump motor may be overloaded for a period and the pump may cavitate. This condition should be examined to evaluate the possible long term effect on the equipment.
- n.
- o. Check the pump for noise, vibration or any hot spots.
- p.
- q. Adjust the gland to maintain a drip, which is necessary for lubrication and for cooling.

# 14. Shutdown Procedure

This depends ultimately on the system and process flow requirements, but the following procedure is recommended.

- a. Stop the flow of solids into the sump.
- b. Turn the sluicing water or run system on water only to wash out the pump and delivery pipeline.
- c. Shut down the pump.
- d. Shut down the gland service water system

In cold weather, the pump and auxiliary equipment should be drained to prevent freezing damage.

# 15. Disassembly Procedure

Check that all power is switched off and isolated, and that it is safe electrically and mechanically to work the pump.

The following sequence is a general guide to stripping the pump for inspection. Refer to Cross Section drawings in Appendix. Where a gland part is mentioned the part for the H gland is referred to.

On sizes up to the 4x4 (100/100) there is no separate suction bush and liner.

- a. Remove the suction pipe and inspect for wear.
- Check the suction bush liner 01 for wear, noting any uneven wear pattern and position. Check the axial clearance
- c. Between the suction bush liner **01** and the eye of the impeller **08** (or on smaller pumps between the casing liner and eye of the impeller.)
- d. Remove nuts 11 and suction bush 02. The suction bush liner 01 is pushed out of the suction bush 02 from the suction side. Some water spread under the lip of the suction bush liner 01 will lubricate its passage out of suction bush 02.
- e. Remove casing bolts **09** having supported the suction side casing **03**. Lift off the suction side casing **03**. A crane is necessary on the larger pumps.
- f. Remove liner nuts **10** and inspect the suction side liner **04**. Note unusual wear patterns, cracks, tears or deterioration of the lining.
- g. The impeller **08** is exposed for inspection. Hold the shaft **B02** using a spanner, which is a good fit, on the flats between the gland **13** and the flinger **14**. The impeller **08** is screwed onto the shaft **B02** with an Acme right hand thread. The impeller **08** may be very tightly locked onto the shaft **B02** and may need an impact force or a long lever to loosen it. If the impeller is to be used again, protect the rubber against damage. Inspect the impeller **08** and note unusual wear patterns in the flow passages and back or front pump out vanes. Check that the "O" ring behind the impeller **08** has sealed against the gland sleeve **H08** and slurry has not corroded the impeller or shaft thread. This "O" ring **H12** should be replaced at every strip-down.
- h. Remove the axial expeller **H10**, which is a stretch fit on the gland sleeve **H08**. If 'D' gland is fitted the gland sleeve should be removed at this point.
- Support the gland side casing 05, undo the casing to pedestal nuts 12 and remove casing half along with the gland assembly 13. Undo the gland holding screws 21 and remove the gland assembly 13. Undo liner nuts 10, the casing liner can now be removed for inspection, note any unusual wear patterns.
- j. Remove bearing pedestal caps 17, and fixings 20 and unfasten the axial positioning jack 19, to enable bearing assembly to be removed.
- k. To disassemble the bearing assembly, remove the gland sleeve H08, the flinger 14 and the bearing covers B03 and B04. The bearings can be inspected at this stage. If there is no sign of damage, the bearings should not be disturbed, and the bearings should merely be washed out with mild solvent oil and regreased.
- Press the shaft B02 with the bearing B05 still fitted out of the bearing housing B01. Push the shaft from the impeller side out of the bearing housing. The inner ring of front bearing B06 will still be attached to the shaft and can be removed later.
- m. The remainder of the front bearing **B06** can then be withdrawn from housing **B01**.
- n. Loosen the tab washer B07 undo locknut B08 and pull the end bearing B05 off the shaft.

## Notes:

- 1. The 2x2 (50/50), 3x3 (80/80) and 4x4 (100/100) pumps do not have a loose suction bush liner **01** and suction bush **02**.
- 2. The 10x8 (250/200) and larger sizes have an Inside Gland Cover 24 which is held in position by H14 / P14 / D14. Undo H14 and withdraw the Inside Gland Cover 24 from the impeller side.
- 3. The Casing Suspension Arm is fitted as a maintenance aid ONLY and as such may be used to support singularly, either of the Casing Halves and its associated liner, or the Impeller. It must not be used for any other purpose. (Suspension arm not fitted to 1½x1½ and 2x2 (50/50) pump.)

#### Wear and Replacement of Parts

To obtain the best service and performance from the pump, periodic routine inspections should be carried out and the pump has been particularly designed for this purpose. It is not possible to state at what intervals these inspections should be made because the rate of wear varies considerably from one application to the next. However, it is suggested that initially the pump be allowed to run for a period of say, three months, and an examination of the pump will then give some idea of the length of life which may be expected from the rubber covered parts.

# 16. Assembly Procedure

Before assembly, ensure all parts are clean and free of old grease and dirt. The new bearings or replacement bearings should be generously filled with grease between the rollers. Check the Neoprene grease seals **B09** and **B10** are sound, and not soft or distorted. Replace if necessary.

- a. Clamp the shaft B02 horizontally in a vice. Heat the spherical roller end bearing B05 in an oil bath or induction heater to 240°F (115°C) and fit it to the drive end of the shaft B02 using clean insulated gloves. Ensure the inner ring of the bearing B05 is hard against its seat by tapping it with a brass pin. Fit the tab washer B07 and the lock nut B08.
- b. Fit the inner ring of the front bearing **B06** to the impeller end of the shaft **B02** ensuring that it is hard against its seat, by tapping with a brass pin.
- c. Clamp bearing housing **B01** securely, grease bearing **B05**. Fit shaft **B02** and end bearing **B05** assembly into housing. Ensure outer race of bearing **B05** is hard against seat.
- d. Fit neoprene seal **B09** and bearing cover seal **B13** to end cover **B03** and fix to bearing housing **B01** using set screws **B11**.
- e. Mount bearing housing **B01** vertically with front end upwards and wedge shaft **B02** so it is central in the housing. Fill front bearing **B06** with grease and carefully tap outer ring into bearing housing **B01**.
- f. Fit neoprene seal B10 and bearing seal cover B13 to front cover B04 and fix to bearing housing B01 using set screws B11. Fit V-Ring Seal B17 to Shaft B02 and place with slight tension against Front Cover B04. Fit Flinger Ring 14 to Shaft B02 and locate in position using Screw Clamp supplied with Flinger Ring.
- g. Set bearing housing assembly into pedestal 18 and loosely assemble bearing pedestal caps 17 with pedestal cap screws 20 and fit axial positioning jack 19. Very occasionally, shims are required for shaft alignment; if factory fitted, the thickness of shim required will be stamped on the vertical face of the pedestal adjacent to the pedestal cap stud.
- h. If 'D' gland is to be fitted Loosely assemble gland components as shown on page 10 taking care not to damage the wearing face when fitting, leaving out at this stage the gland sleeve **D08**, 'O' rings **D12** and **D07** and face seal **D09**. Fit the gland side liner **06** into the gland side casing **05** securing with liner nuts **10**. Bolt the gland assembly loosely to the casing **05**. Fit the casing **05** and gland assembly to the pedestal **18** using fixings **12**, taking care not to damage the wearing face against the shaft **B02** on assembly. Fit the 'O' rings **D12**, **D07** and face seal **D09** to gland sleeve **D08** and slide home onto shaft, through casing and into the gland assembly. Carefully align gland components (specifically check concentricity of gland parts relative to the shaft) and tighten all fixings.
- i. If 'H' or 'P' gland is to be fitted Fit 'O' rings H12 / P12 and H07 / P07 to gland sleeve H08 / P08 and slide home on to the shaft. Loosely assemble gland components as shown on pages 9 and 10, slide over shaft B01 and onto the gland sleeve. Fit the gland side liner 06 into the gland side casing 05 securing with liner nuts 10. Fit the casing 05 to the pedestal 18 using fixings 12. Carefully align the components of the gland assembly (specifically check concentricity of gland parts relative to the shaft) and fit to the casing 05. The axial expeller H10 / P10 a stretch fit over the gland sleeve can then be fitted.
- j. Smear the Impeller thread on the shaft **B02** with protective long life graphite grease before screwing on the impeller, ensuring that the Impeller 'O' ring is fitted into the Gland Sleeve.
- k. Fit the suction side liner **04** in the suction side casing **03** using liner nuts **10**.
- l. Fit the suction bush liner **01** inside the suction bush **02** (using soapy water assists this process) and bolt it to the suction side casing **03** using the bolts **11**. Match up the suction side casing to the gland side casing, and bolt the two side casings together. Check the two half liners match up, and press back the liners into the casings to ensure a minimum mismatch at the joint line and at the delivery flange.
- m. Check the concentricity of the fit between suction bush liner 01 and the impeller 08.

- n. Using the axial positioning jack 19 adjust the impeller 08 towards the suction bush liner 01 keeping the holding down studs 20 loose. Check the axial clearance between the impeller and the suction bush liner 01. A steel ring or dummy flange should be bolted to the suction flange to simulate any distortion in the suction bush liner 01 when connected to the suction pipe, before the axial clearance is checked. This clearance should be set at approximately 1/32" (1mm). Rotate the shaft to ensure effective clearance.
- o. Tighten the bearing holding down nuts 20 and the axial positioning jack 19.

# 17. Troubleshooting

IF A PUMP FAILS TO PUMP THROUGH A BLOCKAGE SWITCH OFF IMMEDIATELY AND READ THESE FAULT FINDING NOTES CAREFULLY TO RECTIFY THE SITUATION.

TAKE EXTREME CARE AS THE PUMP MAY BE FILLED WITH SCALDING STEAM AND SOLIDS AT A HIGH PRESSURE.

# 17.1. No Discharge When Pump Runs

THE PUMP MUST NOT BE ALLOWED TO RUN IF IT DOES NOT DISCHARGE. If by mischance the pump has been allowed to run for more than a few minutes without discharge then STOP IT AT ONCE.

TAKE EXTREME CARE IN DISMANTLING AFTER SUCH AN OCCURRENCE DUE TO HIGH TEMPERATURE AND PRESSURE WHICH MAY BE PRESENT IN THE PUMP CASING. DO NOT REMOVE THE DRAIN PLUG UNTIL THE FLUID TEMPERATURE IN THE PUMP HAS DROPPED. (SEE 17.11c).

#### a. Air Lock

The commonest cause of failure of a newly installed pump to discharge when run for the first time is an air lock in the casing. Even when a pump is well below water level, (drawing from a Feed Regulating Sump for instance), it may retain a large bubble inside the casing which prevents the start of pumping. This phenomenon is far more likely with horizontal undershot discharge branch arrangements than any other practical configuration. It is least likely with horizontal overshot arrangements.

If you suspect air lock as the cause of failure to pump, start and stop pump several times to drive the air out, a fraction at a time. When using this procedure ensure that you do not damage the motor starter or burn out the motor itself by trying too many starts in a short period of time. The number of permissible attempts will vary with the equipment installed but usually it is safe to try one start every three to four minutes.

## b. Inadequate Prime

In installations where the pump has to be primed, either by jet or venturi effect in the suction pipe, or by vacuum pump on the delivery side, failure to pump may be caused by inadequate prime. This is usually rectified, by allowing more time for priming to occur.

It is possible when "jet priming" to have such a small amount of priming water that the pump will never prime, and in this case more water for the priming operation will be needed.

Usually, the diameter of the priming branch should be at least one third of the diameter of the suction pipe [2" (50mm) will prime 6" (150mm), 3" (80mm) will prime 8" (200mm) etc.], and the minimum water required is about 30% of the **Pump** capacity.

If priming is by vacuum pump there must be a valve or at least an air-lock on the delivery side and the vacuum pump must be able to "beat" the air leakage through the gland. To assist in this, always attempt to prime with the gland water running - no matter what style of priming is being attempted.

## c. Installation Faults

Failure to discharge on start-up can be caused by installation faults of which the commonest is inadequate sump capacity. The result of installing a sump with inadequate capacity is to risk repeated air-locks of the pump. This can happen when the pump reduces the water level, either allowing a vortex to form - which air-locks the pump - or (when water is introduced to the sump) it entrains so much air that it produces the same effect.

A small sump can easily prevent any discharge reaching the end of the pump discharge line. The only remedy is to extend the sump capacity. We recommend sumps of at least one minute's pumping time as a minimum. (This recommendation does not apply to feed regulating sumps in sand plants where greater capacity is required).

Other installation faults are more obvious - such as tramp material lodged over a pump suction or a kinked suction hose.

# 17.2. Brief Discharge Only

#### a. Air Lock

A pump with a suction lift and partial air lock will often start to pump at a greatly reduced rate after each start, then give up altogether. At the discharge end of the pipe this may appear as a brief surge followed by failure.

This problem can only be overcome by closer attention to the priming system.

#### b. Obstructed Suction

If the suction line is obstructed either by tramp material or a delaminated suction hose lining, the pump may start well but when the discharge rate rises the suction obstruction so throttles the pump that it quickly fails by gross cavitation.

Detection of this sort of condition is difficult, and generally the only certain way of finding out what is happening is the use of a vacuum gauge immediately before the pump suction. An obstructed suction line will be indicated by a sudden increase in vacuum reading immediately before the failure.

### c. Lack of Delivery Resistance

A pump which is required to pump with a suction lift or with a fair length of suction pipe, but with practically no resistance on the delivery side, (e.g. short, open-ended, discharge branch or nozzle), may pump briefly then fail. The reason for this is that centrifugal pumps on open discharge need positive pressure on the suction eye to prevent gross cavitation. If the installation does not provide sufficient positive pressure on the suction side the pump will fail.

Usually, the easiest way to overcome this difficulty is to artificially create resistance on the delivery side, by extending the pipe work or introducing a valve or other resistance, such as an orifice.

## 17.3. Pumps Water But Not Solids

## a. Air Leaks on Suction Side

Badly made joints in the suction line or air entrainment with feed into a sump may be insufficient in themselves, to prevent a pump from pumping water satisfactorily. However, when solids are introduced -particularly, coarse solids - the pump has a more arduous duty; it has to entrain the solids into the fast moving stream in the suction pipe. In effect it has to "dredge" the solids into the stream. Even if the solids were already moving in the right general direction, they must be accelerated up to the water velocity and thus they act as a suction resistance for the pump.

The result of the introduction of solids into an aerated system, which the pump can only marginally handle, when pumping water alone, will cause failure.

Air leaks can usually be detected as water leaks when the pump is not running; where water can get out air can get in. Air entrainment with the feed can sometimes be overcome by the use of baffles in the sump, such that the air bubbles have time to rise to the surface before being drawn down to the suction.

#### b. Poor Suction Line

A long suction line, or a line of too small a diameter, or a line with a restriction (sudden step-downs in diameter are the worst) may allow a pump to appear to handle water adequately, but not allow it to handle solids. The reasons for this are explained in 17.3(a) above.

Rework of the suction line is the only solution to this problem. If the line is increased in diameter it should be brought to the pump inlet diameter by a specially rolled flanged taper pipe. It must not be stepped down by a mismatch.

#### c. Electric Motor Wrongly Wired

Most Squirrel Cage Induction motors can be wired in two ways: "Star" or "Delta". In order to reduce the surge in current when a motor is brought "on line", some users start their motors in "Star" because this mode gives good starting torque and a reduced starting current surge, and then change to running their motors in "Delta" once smooth starting has been achieved. The "Delta" mode of powering the motor increases the speed close to synchronous speed - which is maximum - and maintains practically a constant speed under variations in load.

If a motor is left to run continuously in "Star" it will vary its speed dramatically with load. Hence, if a mistake has been made in the wiring of the motor it may well appear that the pump pumps water but will not pick up solids, the reason being that on "Star" the motor speed drops when the solids load comes on.

To detect this fault the easiest method is to check the speed of the motor shaft and compare it with the Nameplate rating. There should not be more than a few RPM difference between Nameplate RPM rating and actual speed - no matter what load the pump is pulling.

Correction of this fault is a matter for an electrician.

# 17.4. Overloads for Motor Trip Out

## a. Wrong Pump Speed

The power drawn by a centrifugal pump discharging through a given delivery system is approximately proportional to the cube of its speed. If the speed is changed by, say 20% to 1.2 times the original speed, you can expect its power demand to rise by the cube of 1.2, i.e. 1.728, or nearly 73% above the original. Even a rise in speed of 10% to 1.1 times the original speed, will give a rise of 33% in power demanded by the pump.

The relationship is not exact but is close enough for field calculations purposes.

If a pump is run at the wrong speed it can make a very considerable difference to the load drawn from the motor.

Calculation of the correct pump speed is based on:

- Flow rate to be pumped;
- Difference in height between pump and discharge points;
- Length, diameter, and inner surface of pipeline through which pump must deliver;
- Number of elbows, bends, valves, other fittings in pipeline;
- Equipment at end of pipeline such as hydrocyclones, pressurised distributors, jets etc.;
- Grading, tonnage, and specific gravity of solids to be pumped;
- Pump performance curves.

As far as fault finding is concerned, the actual RPM of a pump should be compared with the RPM specified. Corrections to pump speed can be made by pulley changes.

#### b. Changed Pipeline System

It is not uncommon for a pump speed to be calculated on the basis of a pipeline system intended to be used at the time of the negotiations for the purchase of the pump, but to be commissioned into service with a very different pipeline system. A client may say "But, it's not such a high lift so the pump does not have to work so hard". Unfortunately, at a given pump speed a pump will pump a larger gallon age through a shorter pipeline, (or lesser vertical height), and will take more power - not less.

When confronted with this situation, the only thing to do is to calculate the correct Head and RPM and make a pulley change. The affinity rule explained under 17.4 a) can be used or the drive recalculated.

#### c. Low Voltage

The power consumed by an electric motor is the product of the voltage, amperage and power factor for the motor. Without going too deeply into the matter, if a pump demands a certain power from the motor, the motor in turn will demand corresponding amperage from the electric supply system. If, however, the voltage of the electric supply system happens to be lower than normal, then the motor will draw extra amps to meet the pump's power demand. In this way the power consumed by the motor, (the product of voltage, amperage and power factor) remains unchanged.

The sort of circumstances where lower than standard voltages might be encountered are:

- When power supply is from a generator set
- At the end of a long trailing cable;
- At the end of an electric supply system remote from the nearest transformer substation;
- In an area where very heavy start-up loads can occur, such as near large crusher stations or long conveyor installations.

Low voltage can readily cause a motor overload by drawing higher than expected amps, this being in no way related to the pump.

If low voltage is suspected as the cause of motor overload, a qualified electrician should be called in.

## d. Wrongly Set Overload Protection

All motor starting equipment has some form of overload protection equipment built into the system so that a burnt out motor or locked-rotor motor does not cause more extensive damage. If a motor repeatedly drops out on overload, and there is no other readily apparent reason, the electrical overload protection equipment should be checked.

### e. Mechanical Fault in Pump

The pump shaft should be free to turn by hand. Remove the Vee-belts and check the pump shaft for freedom to turn. If there is no resistance the fault must be in the motor. If a jarring or resistance can be felt when attempting to turn the pump shaft, drop off the suction pipe and check the clearance between the impeller and suction plate, and for blockages.

If this proves clear, then remove the suction bush and look for marks on the surface of the impeller which might indicate if the impeller has been rubbing. If this proves clear rotate the shaft again to ascertain if the resistance is still present and if it is then remove the impeller, and inspect the gland side liner. If there is still no evidence of rubbing, rotate the shaft by hand again to check that the resistance is still present, then remove the gland sleeve. If the resistance can still be felt by hand it can only be the bearings of the pump.

The remedy for the faults which may be revealed by this step-by-step approach are:

- Impeller rubs on suction bush: release bearing housing, set impeller to suction bush clearance by
  adjusting position of bearing housing until impeller runs free. Tighten bearing housing. Replace
  suction pipe. Realign belt drive.
- Impeller rubs on gland half lining; reset the suction bush clearance. Check for movement of casing liner.
- Seizure in the gland area. Strip and inspect.
- Shaft tight in bearings; there is no simple field remedy if the pump shaft is found to be tight in the bearings, the rotating assembly must be removed and stripped for inspection of the bearings and grease seals.

#### f. Air Entrainment

In sump-fed pump systems air entrainment with the pump feed can produce periodic overloads on the motor by the following sequence of events:

- Air entrainment with feed gives the pump a "spongy" pulp which reduces the pump throughput and power.
- Flow through the sump is reduced allowing air in the feed now entering the sump to escape to surface. Solids, of course, reach the pump suction.
- The pump now has a largely de-aired pulp of far greater percentage solids than intended, and the power demand rises. At this stage the pump may choke. This is a dangerous condition.
- Pump entrains the accumulated solids into suction pipeline and begins to pump normally again, increasing throughput through sump.
- Air entrainment begins to reach pump suction again and sequence repeats.
- Air entrainment can permanently reduce slurry throughput and make it appear as if the pump is not working.

In small installations this surge may be repeated at three minute intervals, and in large installations it may take as long as five minutes for the full cycle to be completed. If the cycle terminates at stage (3) the pump may explode, if allowed to run blocked.

# 12.1 Pump Handles Only A Limited Percentage Solids

# g. Pump Speed Incorrect

With increasing solids feed into a pumping system three major factors will limit the percentage solids handled:

- Friction resistance increases leaving less pressure on the delivery side to maintain the velocity in the pipeline;
- Critical (settling) velocity for the pulp in the pipeline increases;
- Pump performance "drops" so that the total head generated by the pump diminishes.

Clearly if the pump speed has been calculated for water only, then increasing tonnages of solids are fed into the system, the combination of factors (1) & (3) above may soon produce a situation where the pipeline velocity is too low to maintain movement of the solids (factor 2). See 17.11c).

#### h. Air Entrainment

Under 17.3(a) above there is an explanation of how a pump can handle water, but fails when solids are introduced to the system, due to air entrainment. The same fault can sometimes explain why a pump performs apparently satisfactorily on pulp up to a certain percentage solids, then "gives up" when this is passed. See previous.

#### i. Poor Suction Line

A suction line layout as described in 17.3 b) is far worse as the percentage solids is increased and can become completely blocked. See 17.11c).

#### i. Cavitation

If a pump is expected to draw relatively coarse solids from a sump below the pump centreline, depending on the speed of the pump and its capacity in relation to the flow rate being handled, it may suffer from cavitation. When this happens, (and the onset is often quite sudden and sharp), the total head generated by the pump diminishes dramatically. As described previously, the conditions for blocking a line are suddenly created, namely; reduced delivery pressure for maintaining flow combined with increased requirement for velocity in the pipeline.

Generally, if cavitation is the source of the trouble there is ample evidence: audible cavitation "rattle" in the pump or from the bearings, sudden reduction in power demand, the gland leaks or draws air, and there is a dramatic drop in delivery pressure.

The solution to the problem is to make the suction arrangements as smooth as possible without restrictions, and to arrange for the feed to come gradually up to load without sudden surges of solids. If these measures do not overcome the problem it may be necessary to change the suction line to a size larger and fit a flat topped taper-piece to the pump suction. If trouble persists, a larger pump will have to be installed. Something effective must be done as the situation is potentially dangerous.

# 17.5. Gland Will Not Seal Adequately

## a. Poor Adjustment

The outer seal of a Hydrostatic gland assembly must be allowed to rub lightly on the gland sleeve for an effective seal to be maintained. If the gland adjuster is pushed in too far this will lift the seal off the sleeve and the gland will leak profusely. Most people when seeing a leaking gland immediately think to "tighten it up". With the Hydrostatic gland the gland adjuster must be moved outwards to reduce leakage.

Type D and P glands, should be tightened for reduction of leakage in the same way as standard packed glands in water pumps. Over tightening should be avoided, especially on 'D' glands as a drip is always necessary to lubricate the rubber face seal.

## b. Dry Running

The glands will not be damaged by a few seconds running without lubrication and cooling by water, but if either gland is run for any length of time without water in the pump there is danger of melting the rubber seals. If a Type D gland has been correctly adjusted this is a fairly remote danger because without hydraulic pressure to force the rubber seal against the gland seat, the seal should run without touching the seat. However, in general terms, do not run a Linatex pump in dry conditions because of the danger of damaging the gland seals.

Once seals have been damaged in this way they have to be replaced.

## c. Too Much Sealing Pressure

Too much water pressure in either type of gland can make the glands almost impossible to seal reliably. With Hydrostatic glands the solution to the problem is to insert a pressure control in the gland water line. With Type D glands the problem usually only arises with pumps being run in series or as booster pumps. In either case, the only solution is to convert the pump over to H gland or P gland and provide suitably pressured gland water.

### d. Inadequate Prime

The "snore" condition for operating a pump is very difficult to seal without unacceptable leakage. Under this condition a pump continuously receives a good proportion of air drawn in with the pulp from the sump, in which the level is too low, or the sump has inadequate capacity, or both. The sump should contain a minimum of one minute's pumping time.

## 17.6. Excessive Heat in Drive

#### a. Slack V-belts

The commonest cause for generation of heat in the drive to a newly installed pump is undoubtedly lack of tension in the V-belts. All V-belts should be tensioned periodically, and newly commissioned drives should be re-tensioned an hour or so after start up.

This fault is easily detected, (pulleys are the hottest part of the drive), as the belts will have been slipping.

#### b. Hot Pump Bearings

On high speed duties it is to be expected that the bearings will run hotter than on low speed duties. Providing the shaft is free spinning by hand, the heat generated while running under power is probably immaterial. At 150°F (65°C) the assembly will be uncomfortable to the hands for more than a second or two, but this is not unduly hot for the bearing assemblies. If the bearing is failing the shaft will not run free.

### c. Inadequate Lubrication of Pump Bearings

The bearings will be charged with grease before despatch from the factory. Details of lubricants are given in this Manual. See section 12.

Addition of grease should be tried if bearings become very hot or noisy. Excess greasing should be avoided.

#### d. Motor Runs Hot

The usual reason for motors running hot is that they are intended to! With Continuous Maximum Rated motors the temperature rises are surprising and are allowed for in the design of the motor and the selection of the insulation in it.

Generally, heat from a motor can be safely ignored provided the amperage drawn is lower or equal to the nameplate rating. Many motors are fitted with Thermistors in the windings, which sense the temperature rise and are wired to operate a cut-out relay if the temperature exceeds a safe limit.

If a pump is choked when the motor starts the protection must trip out the supply to the motor.

Bearing troubles in motors are generally indicated by noise as well as heat, and can sometimes be detected by use of a long-stemmed screwdriver. The blade of the screwdriver is pushed against the bearing cover and the ear of the investigator pushed up to the handle. With a limited amount of experience bearing "rumble" can quite easily be detected.

# 17.7. Sudden Reduction in Discharge

# a. Change in Feed Conditions

Operators do not always recognise a pump as simply one element in a complete system and any change in that system will bear on all the parts of it. For instance, if a screen, rejecting plus ¼" (6 mm) material is worn and passes 1" (25 mm) stones, this affects the pump performance. The suction resistance of the larger stones will cause the suction pressure to reduce and have less head available for pushing the pulp through the delivery side piping.

At the pump, the larger stones will make a significant difference to the pump performance, decreasing flow and potentially causing damage to Impeller and Linings.

In the pipeline, the large stones will probably progress by "saltation", that is, leaping along the bottom of the pipe. The rest of the pulp is fully in suspension and has to flow past these slow moving obstacles. Overall this means the resistance of the pipeline to flow has increased. Thus again reducing flow.

So a simple fault like a screen cloth with a hole in it can cause a sudden reduction in discharge. If it causes the pipeline to block, the condition is potentially dangerous. See 17.11 c).

Other changes in the feed conditions which must be investigated are; increased tonnage of solids, change of grading of solids, change in manner of introduction of solids to pump system. On this last count, a plant which was started up in summer, and is bin-fed via a vibrating feeder, will perform differently in winter, when the wetter feed "hangs up" in the feed bin and collapses down onto the feeder intermittently in larger dollops.

#### b. Air Leaks on the Suction Pipe

A pipe which has been steadily wearing away from the inside may break through to the open air near a flange, (in a welded area), at the bottom of the pipe, (where the coarsest solids run). In a suction pipe this will almost certainly allow air into the pipe with all the resultant ills described elsewhere

Frequently, a pinhole leak will not let enough air into a pump for any of the five faults listed to become critical. So operators, being human, postpone the repair or replacement of the worn pipe. The last chapter of the saga occurs surprisingly quickly and usually on nightshift - when fault produces a blocked pipeline.

#### c. Suction Blockage

In dredging applications there is always the danger that the pump suction will be suddenly submerged in collapsed solids from the surrounding pit contours. When pumping from a sump the same thing can happen when solids, which have been clinging precariously to the steel sides of the sump, subside and momentarily block the pump suction.

If the pump is feeding a fair length of delivery piping, it will not be possible for the long column of pulp in that piping to come instantly to rest when the suction gets blocked. It will be appreciated that the pulp in an 8" (200 mm) pipe, way 1000 ft (300 m) long, moving at 10ft/sec (3 m/sec) has considerable momentum. It just cannot be stopped dead in the same short length of time it takes to block the suction.

The result is a massive reduction in pressure throughout the system. It can cause a massive "water hammer" and surges that can split the pump casing, valves and piping. This can cause hoses to collapse - delivery as well as suction, and almost invariably leads to a great gulp of air being sucked through the pump gland. Usually this is sufficient to air lock the pump.

Often, operators attribute the pump failure to the gland, instead of to the conditions at the end of the suction pipe, and this seems the logical explanation to a person standing beside a pump, who heard the air hiss into gland, and then has to contend with the resultant air-lock. However, the trouble starts at the end of the suction pipe, the gland collapse occurs afterwards.

In dredging applications the answer is to exercise better control over the pit development. In sump-fed systems, the feed pulp can sometimes be directed to flush away any build-up of solids on the sides or valleys of the sump. If this is not possible, a larger capacity take-off box at the base of the sump must improve the situation. The blocked pipeline situation is potentially dangerous. See 17.11c)

## d. Tramp Material

The simplest explanations of a fault should never be overlooked. If the complaint is a sudden reduction in discharge: drain the sump and before removing any pipe work or dismantling the pump in any way, have a look at the take-off box at the base of the sump. Loose rubber, house bricks, steel off-cuts have all been found at the outlet to the pump at one time or another. Plastic garden hose inside the impeller passages was found to have a dramatic effect on pump capacity, in an installation which had given satisfaction for the previous three years.

## 12.2 Sudden Increases in Power Demand

## e. Damage Inside Pump

If a client has not had occasion to open his pump before he may not realise what can happen to the inside of his pump as it wears away day by day. The following list gives the results of abrasion which will give an increase in power demand, in order of frequency of occurrence.

- Excessive gap between impeller and suction bush.
- Cut or ripped rubber in suction bush or casing gland rubbing against impeller.
- Worn out cutwater.
- Worn out or broken casing liners.
- Impeller worn through back shroud.
- Impeller passages worn significantly wider than intended.

### f. Change in Pipeline System

Clients may alter a discharge pipe layout so the static lift is reduced or the length of pipe shortened, thinking to themselves "the pump won't have to work so hard now". Actually, in these circumstances the pump pumps a larger gallonage and takes more power not less.

#### g. Low Voltage

A new installation near the pump site can make a significant difference to the voltage available, depending on the electric distribution system in the area. Lower volts mean higher current for the same power output of the motor.

#### h. Changed Pump Speed

It has been known for electricians who have been called in to do maintenance on a motor to dismount both pump and motor pulleys, then when reassembling the pumpset, to mistakenly interchange the pulleys. Depending on the pulley ratio this may have spectacular results.

#### i. Air Entrainment

In sump-fed pump systems air entrainment can produce cyclic pump overload as explained in 17.4f). This fault can be caused by a change in the gallonage fed to sump, or the direction in which it is fed to a sump. It can also be caused by a casual change to the feed type baffle arrangement in the sump.

# 17.8. Rapid Component Wear

#### a. Air Entrainment

As an experiment place some sand in an empty bottle, fill the bottle to the very top with water, place the palm of one hand over the top and shake the bottle. You will find it difficult to move the sand vigorously against your hand. Now tip out a third of the water, and repeat the test. You will undoubtedly feel the sand in the air-water froth hitting your palm.

The point of the experiment is to show how much more readily sand can move around in froth than it can in water without air bubbles. Therefore any air leaks in the suction side accelerate abrasion.

If air entrainment is severe enough to produce an air lock in the presence of solids and water, the result is an escalation of the abrasion rate.

Air entrainment can also cause severe abrasion indirectly. As explained in 17.2, with cyclic changes in pulp density due to air, the pump may have to handle, periodically, far denser pulp than intended. This also is an abrasive accelerator.

#### b. Properties of the Solids

Some solids have worse properties from the point of view of abrasion than others.

- Sharp edged particles are worse than round particles, so crushed materials are generally worse than natural sands.
- Course gradings are worse than fines.
- The specific gravity of the material makes a difference.

When confronted with a rapid abrasion problem, always reduce pump speed if possible. A larger pump with its larger diameter impeller will be rotating slower at the suction eye of the impeller for a given head than a smaller pump. So, if wear on the leading edge of the vanes is a problem, a larger pump would help.

## c. Change in Feed Conditions

If a pump operates satisfactorily for some time then suddenly begins to wear out components in quick succession, look for some change in feed conditions. Extra tonnage, coarser grading, higher proportion of crushed material, and so on. Sometimes an operator is unaware that conditions have changed for the pump.

A case in point would be a rod mill circuit producing crushed sand minus 4 mesh (5 mm) from a feed which is minus 3/8" (10 mm). If a pump is used to pump the rod mill discharge to some screening equipment and the screen oversize returns to the mill, a reduction in capacity of this screening equipment will make a big change in the duty for the pump. However, to the operator, the same tonnage rate throughput is maintained by the circuit, so the pump duty is unchanged in his mind. In fact, a reduction in screen capacity (for instance, by partial blinding, of the screen cloth) will produce an increase in circulating load and a corresponding increase in pump pulp density.

Another less involved example would be the pumping of sand from a river deposit. These deposits are notoriously variable, so the proportion of crushed sand in relation to natural can vary widely. To the

operator however, sand is sand, and the fact that the pump is now handling, say 80% crushed material, while three months ago it was 60% natural sand may not appear significant.

If there is a permanent change in feed conditions which makes component life unsatisfactory, look into modifying the pump.

If there is no suitable pump selection, the pump duty may have to be split up, and a two stage pumpset installed. Each pump will run at about 70% of the speed of a single unit for the same duty and this speed reduction will make a very significant change to the abrasion rate.

## d. Shaft Misalignment

After some years of service it occasionally happens that the saddles on the pedestal which support the bearing housing get worn and thus allow the shaft to point downwards. If this problem is severe enough the eccentricity of the shaft through the gland will be such that the gland will not seal properly. A further problem will be that there will be a misalignment between the eye of the impeller and the suction bush, which will detract from pump performance. If this happens, the best answer is to buy a new pedestal. This will almost certainly be cheaper and quicker than trying to build up the saddles and then remachining. A temporary expedient is to pack the saddles with shims, but inevitably these get lost during impeller adjustment.

## 17.9. Mechanical Failure

#### a. Broken Shaft

Typically, the only broken shafts in LPT pumps are those where there has been tramp material in the feed, or a bearing has seized, or slurry has worn through the gland sleeve and wear has weakened the shaft, in each case it is easy to see the cause.

## b. Broken Pedestal or Casing

The front bracket of the pump pedestal although quite massive to look at can be broken from the box section of the pedestal by the simple expedient of starting the pump backwards. If this is done the impeller begins to unscrew from the shaft and, as it does so, strikes the suction bush. This is immovable, being trapped by the flange of the suction pipe work. So something has to give.

Occasionally, with older shafts, the thread in the shaft is stripped instead of the pedestal being broken.

We do not recommend attempting to weld broken pedestals, alignment problems are too difficult. The cheapest and quickest way out for a customer is to buy a new pedestal.

The running backwards of a pump is an electrical problem. It is very simply overcome and no electrician worth his salt will allow this to happen as they are supposed to check motor direction of rotation prior to fitting the V-belts onto the pulleys.

#### c. Pump Explodes

The centrifugal pump - LPT or any other - can potentially explode by running it with pulp, or water, in the casing but no discharge. An example of how this can happen is in a pump drawing pulp from a sump and pumping to a cyclone or through a rising pipeline. If the pump gets a sudden surge of solids, which blocks off the suction, flow will cease. In the delivery line the solids will settle in the rising pipe, but will be unable to enter the casing because the impeller is still spinning there.

We now have a plug in the suction pipe, and in the delivery pipe, with a spinning impeller in between. The pump goes on absorbing power as the impeller rotates and the power raises the fluid temperature. Ultimately, the water will boil and the pressure generated may be enough to explode the pump head or destroy the rubber.

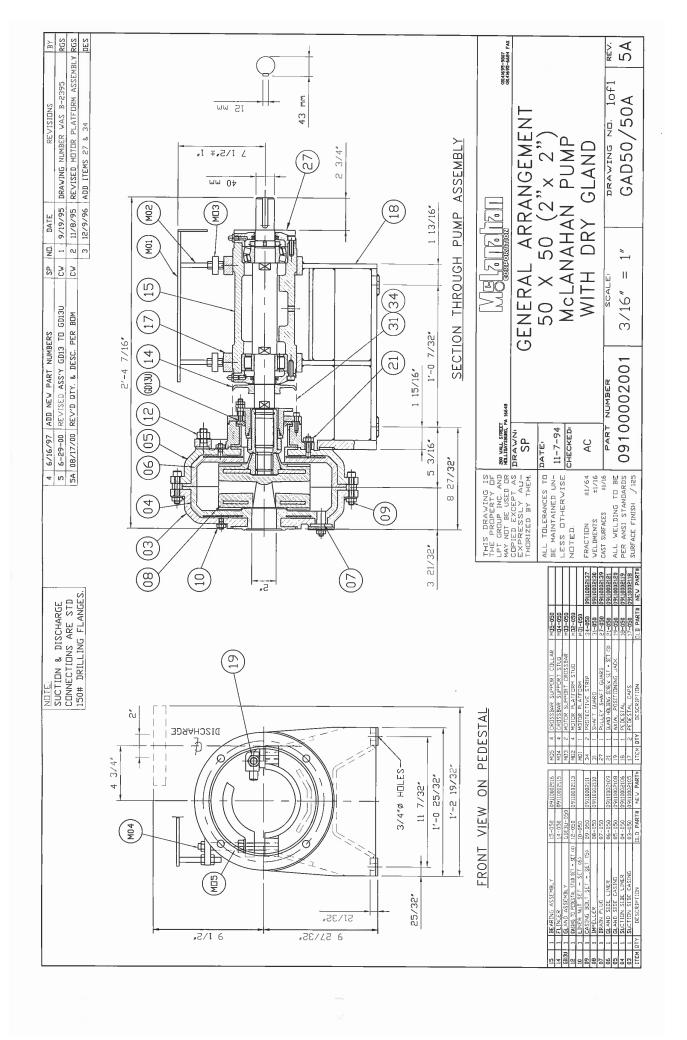
This is an extremely dangerous situation, and if a pump head feels unusually warm and is not discharging, switch off the power, immediately. Under no circumstances approach the pump until the pump head has been relieved of pressure - preferably through the suction or discharge pipe work by flushing away the

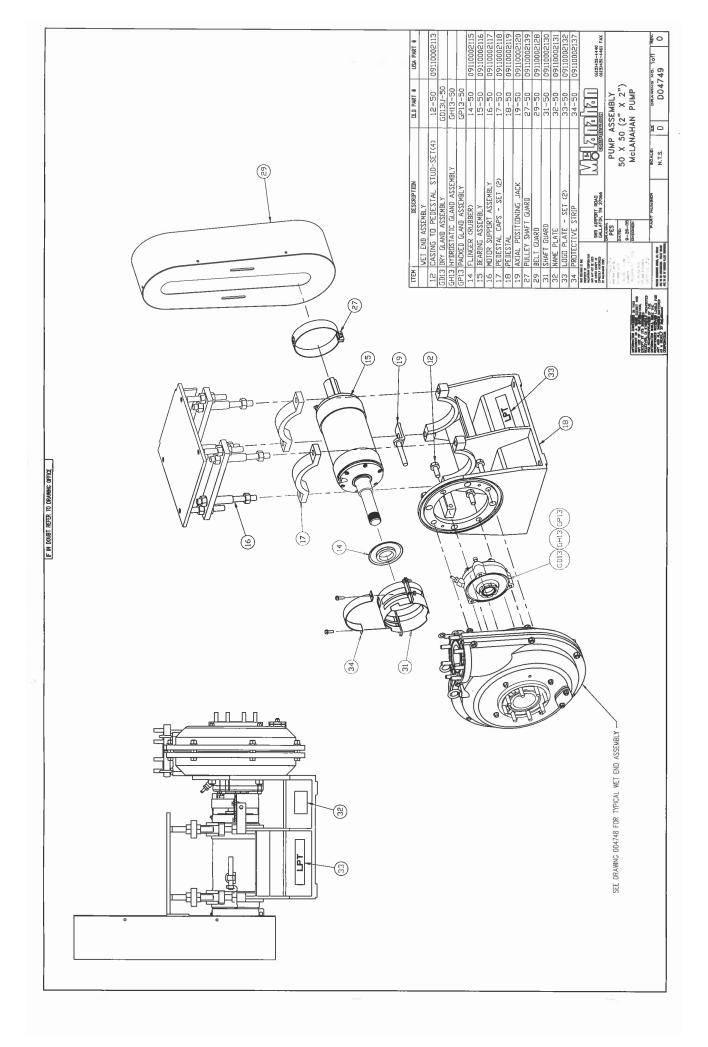
solids plugs. If a pump is going to explode, there is almost certainly considerable leakage of steam from the gland.

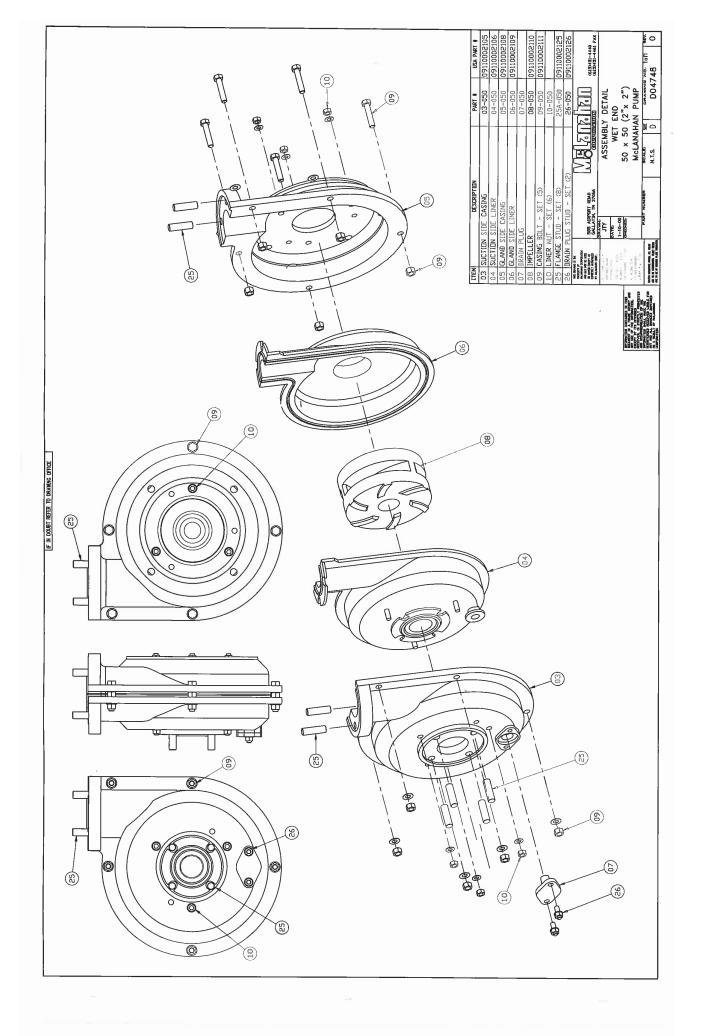
Important Note: Even if the pump does not feel hot, take extreme care when dismantling as the pump may be full of scalding water.

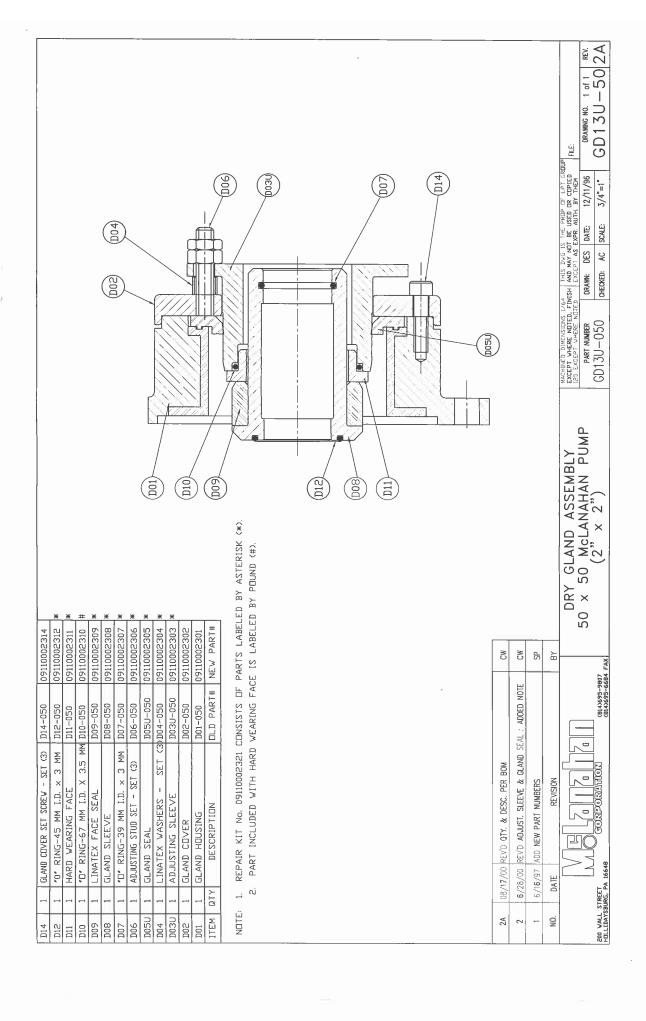
Do not remove the drain plug until certain the fluid temperature in the pump has reduced. If in doubt carefully clear blockages in manner described above.

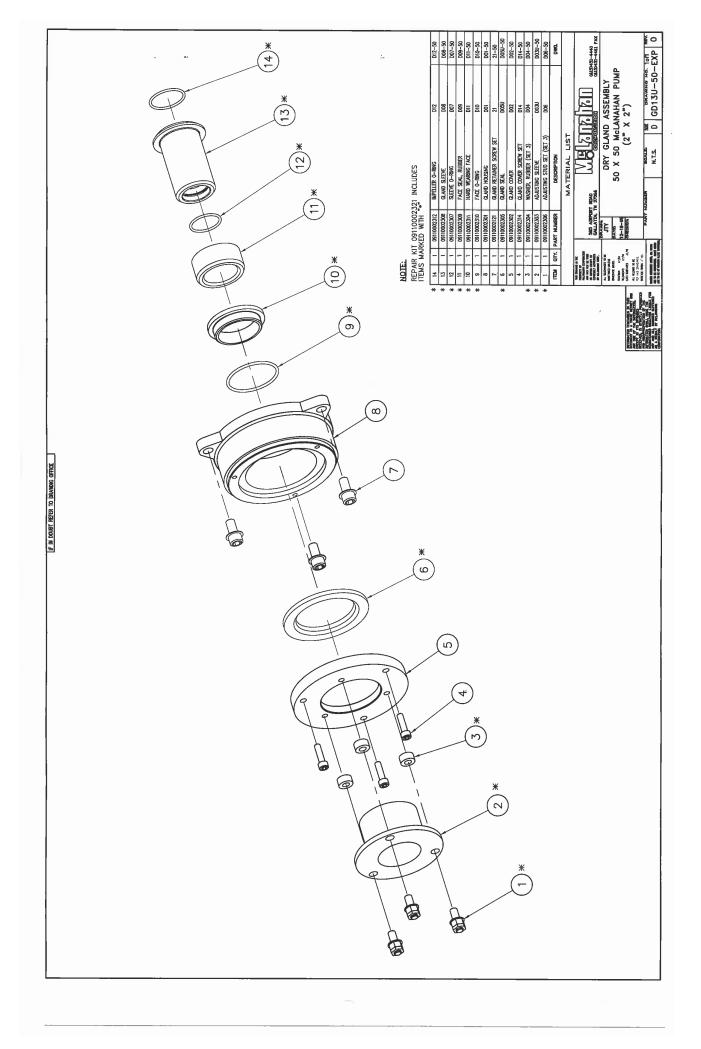
# 18. Notes

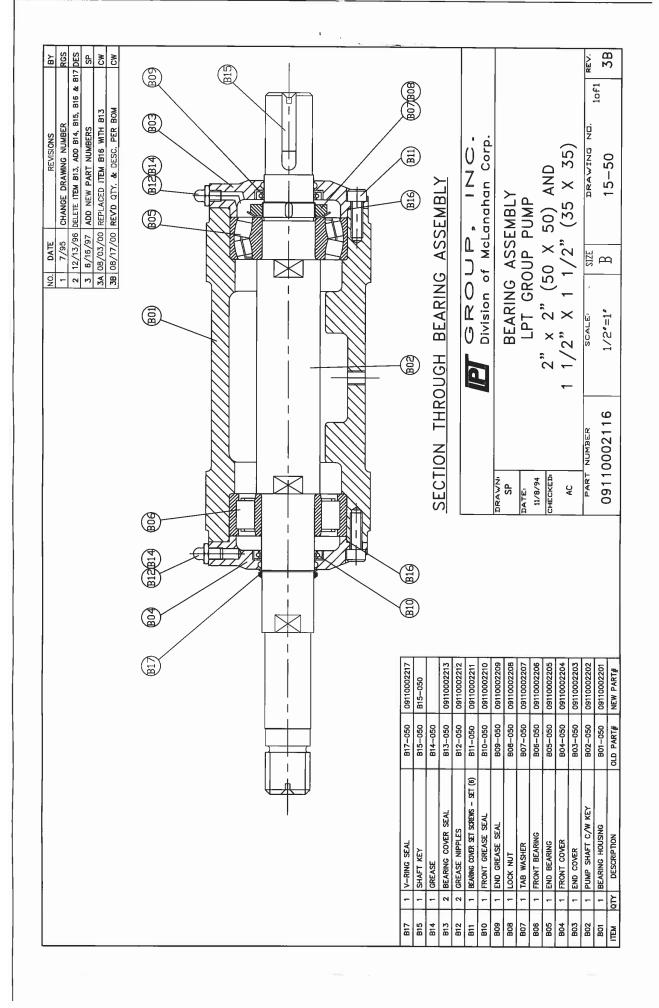



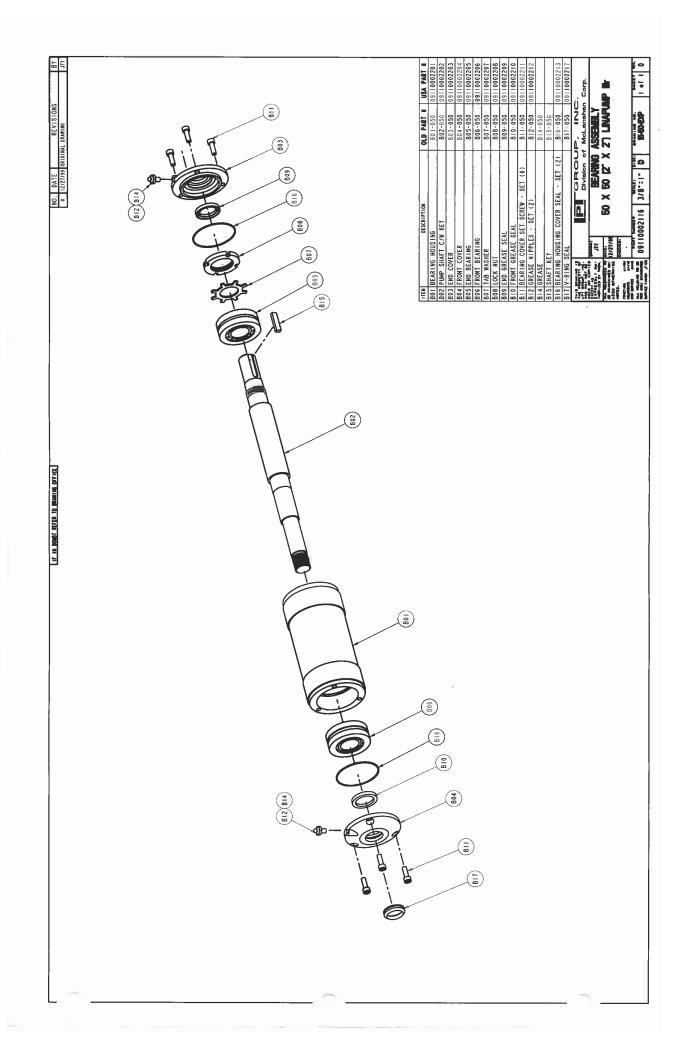






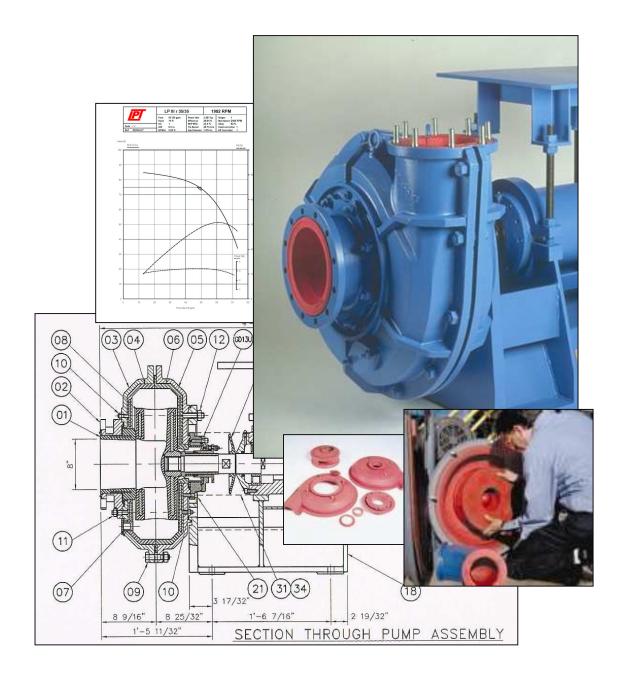








# **CENTRIFUGAL SLURRY PUMPS**



Equipment, systems & process innovation - since 1835



# **CENTRIFUGAL PUMPS**

The McLanahan 'LPT' range of horizontal spindle, centrifugal slurry pumps are ruggedly designed for the most arduous duties. Vertical configuration on special order; Vortex Flow Impellers available for fibrous materials.

# Linings:

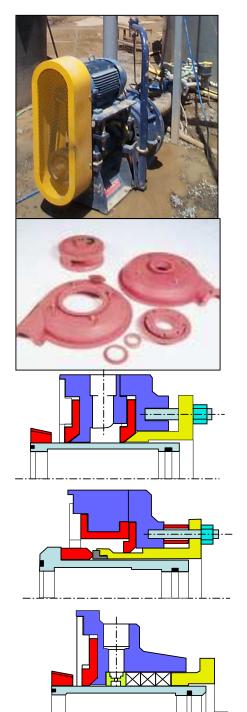
Field replaceable, wet end linings are available in Natural Rubber, white Food Grade Rubber, Nitrile and High Chrome Iron.

# Gland configurations include:

• **Dry Gland** - a unique self lubricating design that does not require an external water supply.

• Hydrostatic Gland - a simple, low maintenance design; requires minimal external flushing water.

 Packed Gland - for the traditionalist; requires external flushing water



Equipment, systems & process innovation – since 1835



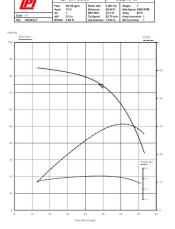


# **PUMP SERVICE**

#### **Total Service**

From design to installation and beyond, McLanahan engineers are available to give advice on your slurry pumping needs and problems. The IIIr range has been designed to offer a wide choice of pump sizes to suit most slurry pumping applications.





## **Pumptec: Computer Aided Support**

To complement and facilitate optimum selection of your slurry system, LPT uses "Pumptec".

This unique computer program:

- Analyzes the effects of changing slurry density
- Calculates the P<sub>50</sub> particle size from a sieve analysis
- Calculates settling velocities and select pipe sizes
- Calculates pipeline frictional losses in various pipe materials and pipe fittings
- Calculates the pump duty and selects a pump and drive based on input parameters
- Prints full application and selection data including NPSH, BEP, RPM, HP, etc.

Troubleshooting is made easier using Pumptec to evaluate different scenarios.



# LPT PUMP APPLICATIONS

## Sand plants

Feeding sand and water to all types of classification and dewatering plants; effluent water transfer duties.

## Coal preparation plants

For dense medium circuits; feeding hydrocyclones; filtrate pumping; handling the underflow from thickeners; disposal of effluent, etc.

## Chemical manufacturing & Environmental applications

LPT pumps, by virtue of their various rubber linings, are suitable for pumping many chemical solutions, acid or alkaline, at moderate temperatures and for the disposal of effluent.

#### Cement manufacture

Slurry feed to: tube mill circuits; thickener feed and underflow; flotation plant circuits.

### Metalliferous mining

Mill circuits; feeding hydrocyclones; cyanide plant filter residues; concentrates; tailings disposal and other pulp and slurry handling duties.

# Irrigation systems and dredging

Silt removal in dams and canal sand traps.

### Paper mills

China clay slurries; paper stock; effluent disposal.

## Steel works and manufacturing applications

Pickling acid distribution circuits in plate and wire de-scaling plants; abrasive wet scrubber blow-down.

#### Power stations

Boiler house ash disposal; de-scaling plants.

### China clay production

Feeding slurry to hydrocyclones and for general use in the preparation of china clay.

#### Glass manufacturing

Feeding polishing media; sand plants; handling effluent.

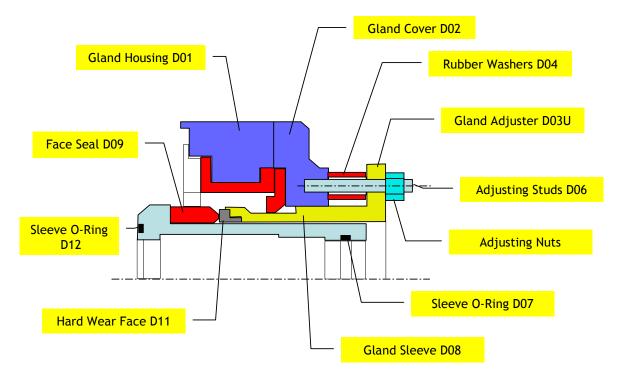


# **'DRY' GLAND**

## a.k.a. 'D' type Gland

Is a unique proprietary design and is unlike conventional mechanical seals. A rotating rubber 'Face Seal' is adjusted against a static 'Hard Wear Face'; it is 'self-lubricating' in that pressure from inside the Pump head forces small amounts of liquid between the surfaces for lubrication.

Note: The term 'dry' is derived from the fact that the gland needs no external water source to lubricate the gland, small amounts of water and fines do exit the pump and accumulate at its base.



The Face Seal acts as a spring and if any grit particles get between the rotating rubber and stationary Wear Face it is pressed into the Rubber. The Face Seal is a stretch fit on the shaft sleeve. As the gland pressure increases, so the rubber extends axially and increases the pressure at the rubbing interface.

When the pump is running, adjust the gland nuts so that there are approximately 5 drops per minute from the gland. This should reduce to 1 drop occasionally, and run satisfactorily for up to a year without further attention in a typical application.

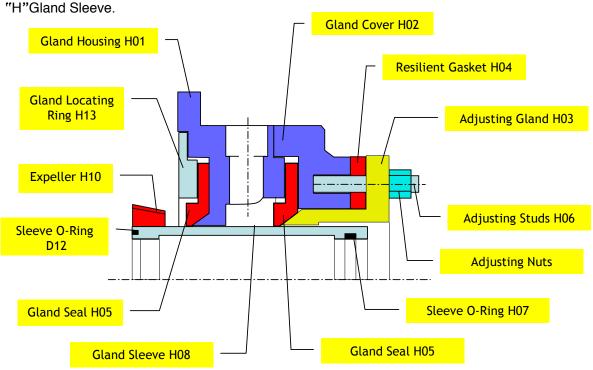
Equipment, systems & process innovation – since 1835



# **HYDROSTATIC GLAND**

# a.k.a. 'H' type Gland

Is a unique proprietary design with the lowest maintenance and longest life, the unique rubber gland seal is designed to deflect inwards to provide and effective seal. The Slurry pressure at the gland is reduced by back pump out vanes on the impeller, and, when fitted, the Rubber axial expeller, which is a stretch fit on the shaft of the



The solids are restrained by the outward centrifugal swirl behind the impeller, the axial expeller and the restricted path to the seal interface.

With the 'H' Gland, the adjusting gland must be eased outwards to increase the sealing pressure. The geometric shape of the Gland Seal is carefully designed to give a good seal, while limiting the amount of 'digging' onto the gland sleeve.

The gland sealing water must be as clean as possible at a pressure of about 5 psi (4m water gauge) above the discharge pressure and at a volume of between 1 to 5 gpm depending on pump size. With a high flushing water pressure you get greater water use and greater dilution of the pumped slurry without any benefit to the seal.

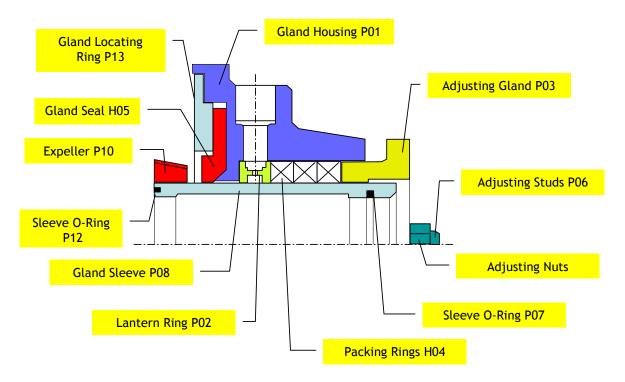
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# **PACKED GLAND**

# a.k.a. 'P' type Gland

Is a classic 'stuffing box' design where sealing is obtained by compressing the gland packing rings onto the shaft sleeve. The gland offers the capacity to seal the pump even at high pressures, for instance in series pumping.



The solids are restrained by the outward centrifugal swirl behind the impeller, the axial expeller and the restricted path to the seal interface.

With the 'P' Gland, the adjusting gland must be adjusted inwards to increase the sealing pressure. The geometric shape of the Gland Seal is carefully designed to give a good seal, while limiting the amount of "digging" onto the gland sleeve.

The gland sealing water must be as clean as possible at a pressure of about psi (4m water gauge) above the discharge pressure and at a volume of between 1 to 5 gpm depending on pump size. With a high flushing water pressure you get greater water use and greater dilution of the pumped slurry without any benefit to the seal.

A pressure fed grease supply can be used with the 'P' gland, but then care must be taken to use synthetic rubber parts which are a special order.

Equipment, systems & process innovation – since 1835

## **JOHN MEUNIER**

Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference: NC01

## STEEL TANKS ST-103



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	TITRE/ TITLE	ď	Rev. DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	Moodwobook Mining
			0 SUBMITTAL	P.Ste-Marie	P.S.M.	2009-03-26	Contract	Meadowballk Milling
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۵	DESSIN/DWG# ST-103		4				Date:	2009-03-26
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	NC01ST-103-1							
			GENERAL					
			Model: ACTIFI O ACP- 700B					
			Material:					
			Carbon Steel, G40,21M-300W					
			SURFACE PREPARATION					
			Internal:					
			SSPC-SP-10					
			External:					
			SSPC-SP-6					
			COATING					
			1 coat of Macropoxy 646 NSF, SHERWIN WILLIAMS					
			1 coat of Macropoxy 646 NSF, SHERWIN WILLIAMS					
			5 to 10 dry mils per coat - #B58WX610 Mill white					
			_					
			5 to 10 dry mils per coat - #B58LX600 Light blue					
			5 to 10 dry mils per coat - #B58LX600 Light blue					
			1 coat of UV resistant Acrolon 218 HS, B65-650 Semi- Gloss					
			SHERWIN WILLIAMS, 3 to 6 dry mils per coat					
			color #B65TL0218712					

Page 1 de/of 3

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		5	- 018	GRATING	DV / G.			5		
				Quantity:						
				covering coagulation, injection and maturation tanks also						
				give access to scraper drive						1
				FRD						T
				Manufacturer:						
				Fibergrate						
				Model:						
				Square Mesh color grey - finish grit top						
				Dimension:						
				1 1/2" x 1 1/2" x 1 1/2"						
			$\downarrow$	HANDRAIL						
				Quantity:						
				Surrounding grating except for opening for access						
				Material:						
				Galvanized Steel						
				STAIRS						
				Quantity:						
				1 set of stairs and 1 intermediate platform						
				Material:						
				Galvanized Steel with Fibergrate grating and stairs						

NOMENCLATURE/	BILL OF MATERIALS
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			0	SUBMITTAL	P.Ste-Marie	P.S.M.	2009-03-26	Contract	Weauowbalik Milling		<u>5</u>
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		Unit. Total	Total		I.D./TAG	COLAC		SITE			
			)	COLLECTION TROUGHS							
			9	Quantity:							
				4 per unit							
			~	Material:							
				Stainless Steel 304							
			7	Manufacturer:							
				John Meunier inc.							
				collection trough have non-adjustable notch							
			(U)	SCRAPER							
			J	Quantity:							
				1 per unit							
			2	Material:							
				Scraper shaft, rake arms and discharge cone scraper are in galvanized steel							
											Γ

# XNV78 4451



Industrial and Marine Coatings



Certified to ANSI/NSF 61 PART A

**MACROPOXY® 646 NSF B58WX610** PART A

B58LX600 B58VX600 **FAST CURE EPOXY** 

MILL WHITE LIGHT BLUE **H**ARDENER

4.56

#### PRODUCT INFORMATION

PART B

Revised 5/2002

MACROPOXY 646 NSF FAST CURE EPOXY is a high sol-
ids, high build, fast drying, polyamide epoxy certified by NSF
to Standard 61 as a tank lining for potable water storage tanks.
The high solids content ensures adequate protection of sharp

edges, corners, and welds. Approved by NSF to Standard 61 for potable water storage tanks of 1,500 gallons and larger and pipe interiors of 36" and greater

PRODUCT DESCRIPTION

Suitable for use in USDA inspected facilities

#### RECOMMENDED USES

- · As an interior tank lining for potable storage water tanks Immersion service - potable water tanks: Meets NSF Stan-
- dard 61 for use in potable water storage tanks
- Suitable for use with cathodic protection systems

#### PRODUCT CHARACTERISTICS

Finish: Semi-Gloss

Color: Mill White and Light Blue

Volume Solids: 72% ± 2%, mixed Mill White Weight Solids: 85% ± 2%, mixed

Mill White

VOC (EPA Method 24): Unreduced: 235 g/L; 1.96 lb/gal Reduced 10%: 290 g/L; 2.41 lb/gal mixed

Mix Ratio: 1:1 by volume

Recommended Spreading Rate per coat:

Wet mils: 7.0 - 13.5 5.0 - 10.0\* Dry mils:

Coverage: 116 - 232 sq ft/gal approximate NOTE Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

\* See Recommended Systems

#### Performance Characteristics

System Tested: (unless otherwise indicated)

Substrate: Steel Surface Preparation: SSPC-SP10

Macropoxy 646 NSF Fast Cure Epoxy @ 6.0 mils dft 1 ct.

Abrasion Resistance: Method:

ASTM D4060, CS17 wheel, 1000 cycles, 1 kg load Result: 84 mg loss

Accelerated Weathering - QUV, Zinc Clad II HS Primer: Method: ASTM D4587, QUV-A, 12,000 hours

Results: passes

Adhesion: ASTM D4541 Method:

Result: 830 psi

Corrosion Weathering, Zinc Clad II HS Primer: ASTM D5894, 36 cycles, 12,000 hours Rating 10 per ASTM D714 for blistering Method: Result:

Rating 9 per ASTM D610 for rusting

**Direct Impact Resistance:** Method: **ASTM D2794** 30 in. lb. Result: **Dry Heat Resistance:** ASTM D2485 Method: Result: 250°F **Exterior Durability:** 

1 year at 45° South Method: Result: Excellent, chalks

Flexibility:

Method: ASTM D522, 180° bend, 3/4" mandrel

Result: Passes

Immersion:

1 year fresh and salt water Method:

Result: Passes, no rusting, blistering, or loss of adhesion Irradiation-Effects on Coatings used in Nuclear Power Plants

Method: ANSI 5.12 / ASTM D4082-89

Result: Pencil Hardness: **ASTM D3363** Method: Result: 3H Permeability Rating: **ASTM D1653** 

Method: Result: 0.154 mg/cm<sup>2</sup>

esistance, Zinc Clad II HS Primer:: Salt Fog R Method: ASTM B117, 6,500 hours

Rating 10 per ASTM D610 for rusting Result: Rating 9 per ASTM D1654 for corrosion

Slip Coefficient, Mill White:

Method: AISC Specification for Structural Joints Using ASTM A325

or ASTM A490 Bolts

Class A. 0.36

Epoxy coatings may darken or discolor following application and curing.

Drying Schedule @ 7.0 mils wet and 50% RH:

@ 40°F @ 77°F @ 100°F To touch: 4-5 hours 2 hours 1½ hours To handle: 41/2 hours 48 hours 8 hours To recoat: minimum: 48 hours 8 hours 41/2 hours maximum: 3 months 3 months 3 months Cure for 10 days 7 days 4 days service: immersion: 14 days 7 days 4 days If maximum recoat time is exceeded, abrade surface before recoating. Drying time is temperature, humidity and film thickness dependent. Pot Life: 10 hours 4 hours 2 hours

30 minutes

Shelf Life: 36 months

Sweat-in-time: 30 minutes

Flash Point: 60°F, TCC, mixed Reducer/Clean Up: Reducer, R7K15

4.56 2005630 continued on back **Epoxy** 

Result:

15 minutes







Certified to ANSI/NSF 61

MACROPOXY® 646 NSF FAST CURE EPOXY

> B58WX610 B58LX600 B58VX600

MILL WHITE LIGHT BLUE HARDENER

	INDUSTRIAL & MARINE COATINGS	PRODUCT IN	IFORMATION	I
_		RECOMMENDED SYSTEMS	Surfa	CE PREPARATION
	Steel: 2 cts. Macro Steel, Shop Ar AWWA D102: 1 ct. Macro 1-2 cts. Macro Concrete/Masc 2 cts. Macro Concrete Bloc 1 ct. Kem C @ 10.0	poxy 646 NSF @ 5.0 - 10.0 mils dft/ct	all oil, dust, grease, dirt, l to ensure good adhesion	on Bulletin for detailed surface prepa-
		poxy 646 NSF @ 5.0 - 10.0 mils dft/ct		TINTING
	Maximum dry 1 Macropoxy 64 coats.	film thickness allowed by NSF for 6 NSF Fast Cure Epoxy is 20 mils for two	Tinting is not recommend	ded for immersion service.
	Atmospheric:			
	Steel: 1 ct. Recoa 2 cts. Macro	table Epoxy Primer @ 4.0 - 6.0 mils dft poxy 646 NSF @ 5.0 - 10.0 mils dft/ct		
	Steel:		<b>A</b> PPLIC	CATION CONDITIONS
	2 cts Macro	noxy 646 NSF @ 5.0 - 10.0 mils dft/ct	l <b>-</b> .	4005 : 44005 :

Part A

Part A

PART B

2 cts. Macropoxy 646 NSF @ 5.0 - 10.0 mils dft/ct 1-2 cts. Acrolon 218 Polyurethane @ 3.0 - 6.0 mils dft/ct or Hi-Solids Polyurethane @ 3.0 - 5.0 mils dft/ct

#### Steel:

2 cts. Macropoxy 646 NSF @ 5.0 - 10.0 mils dft/ct 1-2 cts. Tile-Clad HS Epoxy @ 2.5 - 4.0 mils dft/ct or Armor-Tile HS @ 2.5 - 4.0 mils dft/ct

#### Steel:

1 ct. Zinc Clad II HS @ 3.0 - 6.0 mils dft 1 ct. Macropoxy 646 NSF @ 5.0 - 10.0 mils dft 1-2 cts. Acrolon 218 Polyurethane @ 3.0 - 6.0 mils dft/ct

#### Steel:

1 ct. Zinc Clad III HS @ 3.0 - 5.0 mils dft or Zinc Clad IV HS @ 3.0 - 5.0 mils dft 1 ct. Macropoxy 646 NSF @ 5.0 - 10.0 mils dft 1-2 cts. Acrolon 218 Polyurethane @ 3.0 - 6.0 mils dft/ct

#### Aluminum:

2 cts. Macropoxy 646 NSF @ 5.0 - 10.0 mils dft/ct

#### Galvanizing:

2 cts. Macropoxy 646 NSF @ 5.0 - 10.0 mils dft/ct

The systems listed above are representative of the product's use. Other systems may be appropriate.

Temperature: 40°F minimum, 110°F maximum

(air, surface, and material) At least 5°F above dew point

Relative humidity: 85% maximum

Refer to product Application Bulletin for detailed application information.

#### **ORDERING INFORMATION**

Packaging:

Part A: 1 and 5 gallon containers Part B: 1 and 5 gallon containers

Weight per gallon:  $12.7 \pm 0.2$  lb

mixed, may vary by color

#### SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.



COATINGS

Industrial and Marine Coatings



Certified to ANSI/NSF 61 PART A

**B58WX610** Part A

Temperature:

Relative humidity:

B58LX600 B58VX600

4.56A MACROPOXY® 646 NSF

**FAST CURE EPOXY** 

40°F minimum, 110°F maximum

(air, surface, and material)

At least 5°F above dew point

MILL WHITE LIGHT BLUE **H**ARDENER

### APPLICATION BULLETIN

Part B

Revised 5/2002

CHDEA OF	PREPARATION
SURFACE	PREPARATION

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

#### Iron & Steel, Atmospheric Service:

Minimum surface preparation is Hand Tool Clean per SSPC-SP2. Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. For better performance, use Commercial Blast Cleaning per SSPC-SP6, blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2 mils). Prime any bare steel within 8 hours or before flash rusting occurs.

#### Iron & Steel, Immersion Service:

Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. Minimum surface preparation is Near White Metal Blast Cleaning per SSPC-SP10. Blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2-3 mils). Remove all weld spatter and round all sharp edges by grinding. Prime any bare steel the same day as it is cleaned.

#### Aluminum

Remove all oil, grease, dirt, oxide and other foreign material by Solvent Cleaning per SSPC-SP1.

#### **Galvanized Steel**

Allow to weather a minimum of six months prior to coating. Solvent Clean per SSPC-SP1 (recommended solvent is VM&P Naphtha). When weathering is not possible, or the surface has been treated with chromates or silicates, first Solvent Clean per SSPC-SP1 and apply a test patch. Allow paint to dry at least one week before testing adhesion. If adhesion is poor, brush blasting per SSPC-SP7 is necessary to remove these treatments. Rusty galvanizing requires a minimum of Hand Tool Cleaning per SSPC-SP2, prime the area the same day as cleaned.

#### Concrete and Masonry, Atmospheric Service:

For surface preparation, refer to NACE 6/SSPC-SP13. Surfaces should be thoroughly clean and dry. Concrete and mortar must be cured at least 28 days @ 75°F. Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement and hardeners. Fill bug holes, air pockets and other voids with a cement patching compound. Weathered masonry and soft or porous cement board must be brush blasted or power tool cleaned to remove loosely adhering contamination and to get to a hard, firm surface. Laitance must be removed by etching with a 10% muriatic acid solution and thoroughly neutralized with water.

#### Concrete and Masonry, Immersion Service:

For surface preparation, refer to SSPC-SP13/NACE 6, Section 4.3.1 or 4.3.2.

#### **Previously Painted Surfaces**

If in sound condition, clean the surface of all foreign material. Smooth, hard or glossy coatings and surfaces should be dulled by abrading the surface. Apply a test area, allowing paint to dry one week before testing adhesion. If adhesion is poor, or if this product attacks the previous finish, removal of the previous coating may be necessary. If paint is peeling or badly weathered, clean surface to sound substrate and treat as a new surface as above.

## APPLICATION EQUIPMENT

85% maximum

**APPLICATION CONDITIONS** 

The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compatible with the existing environmental and application conditions.

Reducer/Clean Up ...... Reducer R7K15

#### Airless Spray

Pump	. 30:1
Pressure	. 2800 - 3000 psi
Hose	1/4" ID
Tip	017"023"
Filter	. 60 mesh
Reduction	. as needed up to 10% by volume

#### **Conventional Spray**

Gun	DeVilbiss MBC-510
Fluid Tip	E
Air Nozzle	704
Atomization Pressure	60-65 psi
Fluid Pressure	10-20 psi
Reduction	as needed up to 10% by volume
Doguiros oil and mais	turo congratore

Requires oil and moisture separators

#### **Brush**

Brush	Nylon/Polyester or Natural Bristle
Reduction	as needed up to 10% by volume

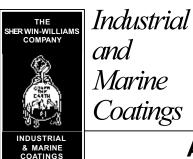
#### Roller

Cover	3/8"	woven	with	pnenoii	c core
Reduction	as n	eeded	up to	10% by	/ volume

If specific application equipment is listed above, equivalent equipment may be substituted.

4.56A 2005630A continued on back **Epoxy** 







Certified to ANSI/NSF 61

MACROPOXY® 646 NSF FAST CURE EPOXY

PART A B58WX610
PART A B58LX600
PART B B58VX600

FAST CURE EPOXY
MILL WHITE
LIGHT BLUE
HARDENER

#### **APPLICATION BULLETIN**

#### APPLICATION PROCEDURES

Surface preparation must be completed as indicated.

Mix contents of each component thoroughly with power agitation. Make certain no pigment remains on the bottom of the can. Then combine one part by volume of Part A with one part by volume of Part B. Thoroughly agitate the mixture with power agitation. Allow the material to sweat-in as indicated prior to application. Re-stir before using.

If reducer solvent is used, add only after both components have been thoroughly mixed, after sweat-in.

Apply paint to the recommended film thickness and spreading rate as indicated below:

#### Recommended Spreading Rate per coat:

Wet mils: 7.0 - 13.5 Dry mils: 5.0 - 10.0\*

Coverage: 116 - 232 sq ft/gal approximate **NOTE** Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

Pot Life:

#### Drying Schedule @ 7.0 mils wet and 50% RH:

10 hours

	@ 40°F	@ //°F	@ 100°F		
To touch:	4-5 hours	2 hours	1½ hours		
To handle:	48 hours	8 hours	4½ hours		
To recoat:					
minimum:	48 hours	8 hours	4½ hours		
maximum:	3 months	3 months	3 months		
Cure for					
service:	10 days	7 days	4 days		
immersion:	14 days	7 days	4 days		
If maximum recoat time is exceeded, abrade surface before recoating.					
Drying time is tempe	erature humidity ar	nd film thickness de	enendent		

Sweat-in-time: 30 minutes 30 minutes 15 minutes

4 hours

2 hours

Application of coating above maximum or below minimum recommended spreading rate may adversely affect coating performance

#### Performance Tips

Stripe coat all crevices, welds, and sharp angles to prevent early failure in these areas.

When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross spray at a right angle

Spreading rates are calculated on volume solids and do not include an application loss factor due to surface profile, roughness or porosity of the surface, skill and technique of the applicator, method of application, various surface irregularities, material lost during mixing, spillage, overthinning, climatic conditions, and excessive film build.

Excessive reduction of material can affect film build, appearance, and adhesion.

Do not mix previously catalyzed material with new.

Do not apply the material beyond recommended pot life.

In order to avoid blockage of spray equipment, clean equipment before use or before periods of extended downtime with Reducer R7K15.

Tinting is not recommended for immersion service.

Quik-Kick Epoxy Accelerator is acceptable for atmospheric use. Do not use Quik-Kick Epoxy Accelerator for immersion service when NSF certification is required. See data page 4.99 for details.

Refer to Product Information sheet for additional performance characteristics and properties.

#### CLEAN UP INSTRUCTIONS

# Clean spills and spatters immediately with Reducer R7K15. Clean tools immediately after use with Reducer R7K15. Follow manufacturer's safety recommendations when using any solvent.

#### SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

<sup>\*</sup> See Recommended Systems

B58W610 08 00

Section	1 PRODUCT AND COMPANY IDENTIFICATI	ON	
PRODUCT NUMBER	DATE OF PREPARATION	HMIS CODES Health	3*
B58W610	03-SEP-07	Flammability Reactivity	3 0

PRODUCT NAME

MACROPOXY® 646 Fast Cure Epoxy Coating (Part A), Mill White

MANUFACTURER'S NAME

THE SHERWIN-WILLIAMS COMPANY 101 Prospect Avenue N.W. Cleveland, OH 44115

TELEPHONE NUMBERS and WEBSITES

Product Information

www.sherwin-williams.com

Regulatory Information

(216) 566-2902 www.paintdocs.com

(216) 566-2902 Medical Emergency (216) 566-2917

Transportation Emergency for Chemical Emergency ONLY (spill, leak,

(800) 424-9300 fire, exposure, or accident)

Section 2 -- COMPOSITION/INFORMATION ON INGREDIENTS

% by WT	Section 2 CAS No.	COMPOSITION/INFORMATION ON INITS	NGREDIENTS VAPOR PRESSURE
3	100-41-4	Ethylbenzene	
		ACGIH TLV 100 ppm	7.1 mm
		ACGIH TLV 125 ppm ST	ΓEL
		OSHA PEL 100 ppm	
		OSHA PEL 125 ppm ST	rel -
15	1330-20-7	Xylene	
		ACGIH TLV 100 ppm	5.9 mm
		ACGIH TLV 150 ppm ST	ΓEL
		OSHA PEL 100 ppm	
		OSHA PEL 150 ppm ST	ΓEL
11	68410-23-1	Polyamide	
		ACGIH TLV Not Available	9
		OSHA PEL Not Available	9
9	14807-96-6	Talc	
		ACGIH TLV 2 mg/m3	as Resp. Dust
		OSHA PEL 2 mg/m3	as Resp. Dust
31	13463-67-7	Titanium Dioxide	
			as Dust
		OSHA PEL 10 mg/m3	Total Dust
		OSHA PEL 5 mg/m3	Respirable Fraction

#### Section 3 -- HAZARDS IDENTIFICATION

ROUTES OF EXPOSURE

INHALATION of vapor or spray mist.

EYE or SKIN contact with the product, vapor or spray mist.

EFFECTS OF OVEREXPOSURE

EYES: Irritation.

SKIN: Prolonged or repeated exposure may cause irritation.

INHALATION: Irritation of the upper respiratory system.

May cause nervous system depression. Extreme overexposure may result in unconsciousness and possibly death.

SIGNS AND SYMPTOMS OF OVEREXPOSURE

Headache, dizziness, nausea, and loss of coordination are indications of excessive exposure to vapors or spray mists.

Redness and itching or burning sensation may indicate eye or excessive skin exposure.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

May cause allergic skin reaction in susceptible persons. CANCER INFORMATION

For complete discussion of toxicology data refer to Section 11.

#### Section 4 -- FIRST AID MEASURES

EYES: Flush eyes with large amounts of water for 15 minutes.

Get medical attention.

SKIN: Wash affected area thoroughly with soap and water.

Remove contaminated clothing and launder before re-use.

INHALATION: If affected, remove from exposure. Restore breathing.

Keep warm and quiet.

INGESTION: Do not induce vomiting.

Get medical attention immediately.

#### Section 5 -- FIRE FIGHTING MEASURES

FLASH POINT	$_{ m LEL}$	UEL
85 F PMCC	1.0	7.0

FLAMMABILITY CLASSIFICATION

RED LABEL -- Flammable, Flash below 100 F (38 C)

EXTINGUISHING MEDIA

Carbon Dioxide, Dry Chemical, Foam

UNUSUAL FIRE AND EXPLOSION HAZARDS

Closed containers may explode when exposed to extreme heat.

Application to hot surfaces requires special precautions.

During emergency conditions overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent. Obtain medical attention.

SPECIAL FIRE FIGHTING PROCEDURES

Full protective equipment including self-contained breathing apparatus should be used.

Water spray may be ineffective. If water is used, fog nozzles are preferable. Water may be used to cool closed containers to prevent pressure build-up and possible autoignition or explosion when exposed to extreme heat.

#### Section 6 -- ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Remove all sources of ignition. Ventilate the area. Remove with inert absorbent.

#### Section 7 -- HANDLING AND STORAGE

#### STORAGE CATEGORY

DOL Storage Class IC

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Contents are FLAMMABLE. Keep away from heat, sparks, and open flame.

During use and until all vapors are gone: Keep area ventilated - Do not smoke - Extinguish all flames, pilot lights, and heaters - Turn off stoves, electric tools and appliances, and any other sources of ignition.

Consult NFPA Code. Use approved Bonding and Grounding procedures.

Keep container closed when not in use. Transfer only to approved containers with complete and appropriate labeling. Do not take internally. Keep out of the reach of children.

#### Section 8 -- EXPOSURE CONTROLS/PERSONAL PROTECTION

#### PRECAUTIONS TO BE TAKEN IN USE

Use only with adequate ventilation.

Avoid contact with skin and eyes. Avoid breathing vapor and spray mist. Wash hands after using.

This coating may contain materials classified as nuisance particulates (listed "as Dust" in Section 2) which may be present at hazardous levels only during sanding or abrading of the dried film. If no specific dusts are listed in Section 2, the applicable limits for nuisance dusts are ACGIH TLV 10 mg/m3 (total dust), 3 mg/m3 (respirable fraction), OSHA PEL 15 mg/m3 (total dust), 5 mg/m3 (respirable fraction). VENTILATION

Local exhaust preferable. General exhaust acceptable if the exposure to materials in Section 2 is maintained below applicable exposure limits. Refer to OSHA Standards 1910.94, 1910.107, 1910.108. RESPIRATORY PROTECTION

If personal exposure cannot be controlled below applicable limits by ventilation, wear a properly fitted organic vapor/particulate respirator approved by NIOSH/MSHA for protection against materials in Section 2.

When sanding or abrading the dried film, wear a dust/mist respirator approved by NIOSH/MSHA for dust which may be generated from this product, underlying paint, or the abrasive.

PROTECTIVE GLOVES

Wear gloves which are recommended by glove supplier for protection against materials in Section 2.  ${\tt EYE\ PROTECTION}$ 

Wear safety spectacles with unperforated sideshields. OTHER PRECAUTIONS

This product must be mixed with other components before use. Before opening the packages, READ AND FOLLOW WARNING LABELS ON ALL COMPONENTS.

Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal.

#### Section 9 -- PHYSICAL AND CHEMICAL PROPERTIES

PRODUCT WEIGHT 12.19 lb/gal 1460 g/l SPECIFIC GRAVITY 1.47 277 - 292 F 136 - 144 C BOILING POINT MELTING POINT Not Available VOLATILE VOLUME 29 % Slower than ether **EVAPORATION RATE** VAPOR DENSITY Heavier than air SOLUBILITY IN WATER N.A. VOLATILE ORGANIC COMPOUNDS (VOC Theoretical - As Packaged) Less Water and Federally Exempt Solvents 2.11 lb/gal 253 g/l 2.11 lb/gal 253 g/l Emitted VOC

#### Section 10 -- STABILITY AND REACTIVITY

STABILITY -- Stable
CONDITIONS TO AVOID
None known.
INCOMPATIBILITY
None known.
HAZARDOUS DECOMPOSITION PRODUCTS
By fire: Carbon Dioxide, Carbon Monoxide
HAZARDOUS POLYMERIZATION
Will not occur

#### Section 11 -- TOXICOLOGICAL INFORMATION

#### CHRONIC HEALTH HAZARDS

Ethylbenzene is classified by IARC as possibly carcinogenic to humans (2B) based on inadequate evidence in humans and sufficient evidence in laboratory animals. Lifetime inhalation exposure of rats and mice to high ethylbenzene concentrations resulted in increases in certain types of cancer, including kidney tumors in rats and lung and liver tumors in mice. These effects were not observed in animals exposed to lower concentrations. There is no evidence that ethylbenzene causes cancer in humans.

Prolonged overexposure to solvent ingredients in Section 2 may cause adverse effects to the liver, urinary and reproductive systems.

IARC's Monograph No. 93 reports there is sufficient evidence of carcinogenicity in experimental rats exposed to titanium dioxide but inadequate evidence for carcinogenicity in humans and has assigned a Group 2B rating. In addition, the IARC summary concludes, "No significant exposure to titanium dioxide is thought to occur during the use of products in which titanium is bound to other materials, such as paint."

Reports have associated repeated and prolonged overexposure to solvents with permanent brain and nervous system damage.

TOXICOLOGY DATA

CAS No.	Ingredient Name			
100-41-4	Ethylbenzene			
	LC50	RAT	4HR	Not Available
	LD50	RAT		3500 mg/kg
1330-20-7	Xylene			
	LC50	RAT	4HR	5000 ppm
	LD50	RAT		4300 mg/kg
68410-23-1	Polyamide			
	LC50	) RAT	4HR	Not Available
	LD50	RAT		8000. mg/kg
14807-96-6	Talc			
	LC50	RAT	4HR	Not Available
	LD50	) RAT		Not Available
13463-67-7	Titanium Dioxide			
	LC50		4HR	Not Available
	LD50	RAT		Not Available

Section 12 -- ECOLOGICAL INFORMATION

#### ECOTOXICOLOGICAL INFORMATION

No data available.

#### Section 13 -- DISPOSAL CONSIDERATIONS

#### WASTE DISPOSAL METHOD

Waste from this product may be hazardous as defined under the Resource Conservation and Recovery Act (RCRA)  $40~\mathrm{CFR}$  261.

Waste must be tested for ignitability to determine the applicable EPA hazardous waste numbers.

Incinerate in approved facility. Do not incinerate closed container. Dispose of in accordance with Federal, State/Provincial, and Local regulations regarding pollution.

#### Section 14 -- TRANSPORT INFORMATION

#### US Ground (DOT)

1 Gallon and Less may be Classed as CONSUMER COMMODITY, ORM-D Larger Containers are Regulated as: UN1263, PAINT, 3, PG III, (ERG#128)

DOT (Dept of Transportation) Hazardous Substances & Reportable Quantities Ethyl benzene 1000 lb RQ Xylenes (isomers and mixture) 100 lb RQ

Bulk Containers may be Shipped as (check reportable quantities):
RQ, UN1263, PAINT, 3, PG III, (XYLENES (ISOMERS AND MIXTURE)),
(ERG#128)

Canada (TDG)

UN1263, PAINT, CLASS 3, PG III, LIMITED QUANTITY, (ERG#128)

IMO

UN1263, PAINT, CLASS 3, PG III, (29 C c.c.), EmS F-E, S-E

#### Section 15 -- REGULATORY INFORMATION

SARA 313 (40 CFR 372.65C) SUPPLIER NOTIFICATION

CAS No.	CHEMICAL/COMPOUND	% by WT	% Element
100-41-4	Ethylbenzene	3	
1330-20-7	Xylene	15	

#### CALIFORNIA PROPOSITION 65

WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. TSCA CERTIFICATION

All chemicals in this product are listed, or are exempt from listing, on the TSCA Inventory.

#### Section 16 -- OTHER INFORMATION

This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

The above information pertains to this product as currently formulated, and is based on the information available at this time. Addition of reducers or other additives to this product may substantially alter the composition and hazards of the product. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information.



Industrial and Marine Coatings

## ACROLON™ 218 HS **ACRYLIC POLYURETHANE**

B65-600 PART A PART A B65-650 PART B B65V600

GLOSS SERIES SEMI-GLOSS SERIES HARDENER

INDUSTRIAL & MARINE COATINGS	PROD	DUCT INFO	RMATION	Revised 2/04	
	PRODUCT DESCRIPTION		RECOMMENDED USE	s	
ACROLON 218 HS acrylic polyurethane is a VOC compliant, polyester modified, aliphatic, acrylic polyurethane formulated specifically for in-shop applications. Also suitable for industrial applications. A fast drying, high gloss urethane that provides color and gloss retention for exterior exposure.  • Can be used directly over organic zinc rich primers (epoxy zinc primer and moisture cure urethane zinc primer)  • Suitable for use in USDA inspected facilities  • Color and gloss retention for exterior exposure  • Fast dry			Specifically formulated for in-shop applications.  For use over prepared metal and masonry surfaces in industrial environments such as:  • Structural steel • Rail cars and locomotives • Conveyors • Bridges • Offshore platforms - exploration and production		
I	PRODUCT CHARACTERISTICS		Performance Characteristics		
Finish:	High Gloss or Semi-Gl	oss System Substra	n Tested: (unless otherwise indicated ate: Steel	1)	
Color:	Wide range of colors ava	ailable Surface	Preparation: SSPC-SP10		
Volume Solids: 65% ± 2%, mixed, may vary by color Ultra White  Weight Solids: 78% ± 2%, mixed, may vary by color Ultra White			Macropoxy 646 @ 6.0 mils dft Acrolon 218 HS Gloss @ 4.0 mils on Resistance: 1		
			: ASTM D4060, CS17 wheel, 1000 cy 43 mg loss rated Weathering, with Diamond-Clad (		
VOC (EPA Metho Pure White, mix	red Reduced 10%: 336	g/L; 2.4 lb/gal g/L; 2.8 lb/gal Results g/L; 3.0 lb/gal	: 100% gloss retention on:	s	

Recommended Spreading Rate per coat: Wet mils: 4.5 - 9.0 Dry mils: 3.0 - 6.0

Mix Ratio:

Coverage: 175 - 346 sq ft/gal approximate NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

6:1 by volume, 1 gallon or 5 gallon mixes

@ 120°F

premeasured components

Drying Schedule @ 6.0 mils wet @ 50% RH: @ 50°F @ 77°F

To touch: To handle: To recoat:	2 hours 10 hours	30 minutes 6 hours	20 minutes 4 hours	
minimum:	12 hours 3 months 14 days erature, humidity,	8 hours 3 months 7 days and film thickness	6 hours 3 months 5 days dependent.	
Pot Life: (reduced 5% with F	4 hours Reducer R7K15)	2 hours	45 minutes	
Sweat in Time: none none none lf maximum recoat time is exceeded, abrade surface before recoating.				
Shelf Life:	Part A: Part B: Store i		opened	

Flash Point: 55°F, Seta, mixed

Reducer/Clean Up: Reducer R7K15 Spray Brush/Roll Reducer #132, R7K132 Adhesion: Method:

**ASTM D4541** 975 psi Result: Corrosion Weathering: 2

Method: ASTM D5894, 9 cycles, 3024 hours Rating 10 per ASTM D610, for rusting Result: Rating 10 per ASTM D714, for blistering

Direct Impact Resistance: 1 Method: **ASTM D2794** Result: 50 in. lb. Dry Heat Resistance: 1

Method: ASTM D2485, Method A

Result: 200°F Flexibility: 1

Method: ASTM D522, 180° bend, 1/8" mandrel

Result: Passes Humidity Resistance: 2

Method: ASTM D4585, 100°F, 1500 hours Result: Rating 10 per ASTM D610 for rusting

Rating 10 per ASTM D714 for blistering

Pencil Hardness:

**ASTM D3363** Method: Result: 3Н

Salt Fog Resistance: 2

Method: ASTM B117, 7000 hours

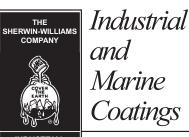
Result: Rating 10 per ASTM D610 for rusting Rating 9 per ASTM D714 for blistering

<sup>1</sup> Finish coat only tested

Zinc-Clad II HS Primer Intermediate Macropoxy 646 Finish Acrolon 218 HS

Meets the requirements of SSPC Paint No. 36, Level 3.

5.22 continued on back Polyurethane



# ACROLON™ 218 HS ACRYLIC POLYURETHANE

PART A
PART A
PART B

B65-600 B65-650 B65V600 GLOSS SERIES SEMI-GLOSS SERIES HARDENER

INDUSTRIAL & MARINE COATINGS

#### PRODUCT INFORMATION

#### RECOMMENDED SYSTEMS

Steel:

1 ct. Macropoxy 646 @ 5.0 - 10.0 mils dft 1-2 cts. Acrolon 218 HS Acrylic Polyurethane

@ 3.0 - 6.0 mils dft/ct

Steel:

1 ct. Zinc Clad II HS @ 3.0 - 5.0 mils dft 1 ct. Macropoxy 646 @ 5.0 - 10.0 mils dft 1-2 cts. Acrolon 218 HS Acrylic Polyurethane

@ 3.0 - 6.0 mils dft/ct

Steel:

1 ct. Zinc Clad IV @ 3.0 - 5.0 mils dft1-2 cts. Acrolon 218 HS Acrylic Polyurethane

@ 3.0 - 6.0 mils dft/ct

Steel:

1 ct. Corothane I - GalvaPac Zinc Primer

@ 3.0 - 4.0 mils dft

1-2 cts. Acrolon 218 HS Acrylic Polyurethane

@ 3.0 - 6.0 mils dft/ct

Steel:

1 ct. Epoxy Mastic Aluminum II @ 6.0 mils dft 1-2 cts. Acrolon 218 HS Acrylic Polyurethane

@ 3.0 - 6.0 mils dft/ct

Steel:

1 ct. Recoatable Epoxy Primer @ 4.0 - 6.0 mils dft

1-2 cts. Acrolon 218 HS Acrylic Polyurethane

@ 3.0 - 6.0 mils dft/ct

Concrete/Masonry:

1 ct. Kem Cati-Coat HS Epoxy Filler/Sealer

@ 10.0 - 20.0 mils dft

1-2 cts. Acrolon 218 HS Acrylic Polyurethane

@ 3.0 - 6.0 mils dft/ct

Aluminum/Galvanizing:

1 ct. DTM Wash Primer @ 0.7 - 1.3 mils dft

1-2 cts. Acrolon 218 HS Acrylic Polyurethane

@ 3.0 - 6.0 mils dft/ct

SURFACE PREPARATION

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

to enoure adequate adriction.

Refer to product Application Bulletin for detailed surface preparation information.

Minimum recommended surface preparation:

\* Iron & Steel: SSPC-SP6, 1-2 mils profile

\* Galvanizing: SSPC-SP1

\* Concrete & Masonry: SSPC-SP13/NACE 6

\* Primer required

TINTING

Tint with 844 Colorants.

• Extra white tints at 100% tint strength

· Ultradeep base tints at 150% tint strength

Five minutes minimum mixing on a mechanical shaker is required for complete mixing of color.

**APPLICATION CONDITIONS** 

Temperature: 40°F minimum, 120°F maximum

(air, surface, and material) At least 5°F above dew point

Relative humidity: 85% maximum

Refer to product Application Bulletin for detailed application information.

**ORDERING INFORMATION** 

 Packaging:
 1 gallon mix:
 5 gallon mix:

 Part A:
 .86 gal
 4.29 gal

 Part B:
 .14 gal
 0.71 gal

(premeasured components)

Weight per gallon:  $11.2 \pm 0.2$  lb

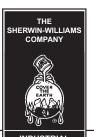
mixed, may vary with color

**SAFETY PRECAUTIONS** 

Refer to the MSDS sheet before use.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

The systems listed above are representative of the product's use. Other systems may be appropriate.



Industrial and Marine Coatings

## ACROLON™ 218 HS ACRYLIC POLYURETHANE

PART A B65-600
PART A B65-650
PART B B65V600

GLOSS SERIES SEMI-GLOSS SERIES HARDENER

& MARINE COATINGS

#### **APPLICATION BULLETIN**

Revised 2/04

#### **SURFACE PREPARATION**

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

#### Iron & Steel

Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. Minimum surface preparation is Commercial Blast Cleaning per SSPC-SP6. For better performance, use Near White Metal Blast Cleaning per SSPC-SP10. Blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (1-2 mils). Prime any bare steel the same day as it is cleaned or before flash rusting occurs.

#### **Aluminum**

Remove all oil, grease, dirt, oxide and other foreign material by Solvent Cleaning per SSPC-SP1. Primer required

#### **Galvanized Steel**

Allow to weather a minimum of six months prior to coating. Solvent Clean per SSPC-SP1. When weathering is not possible, or the surface has been treated with chromates or silicates, first Solvent Clean per SSPC-SP1 and apply a test patch. Allow paint to dry at least one week before testing adhesion. If adhesion is poor, brush blasting per SSPC-SP7 is necessary to remove these treatments. Rusty galvanizing requires a minimum of Hand Tool Cleaning per SSPC-SP2, prime the area the same day as cleaned or before flash rusting occurs.

#### Poured Concrete

#### New

For surface preparation, refer to SSPC-SP13/NACE 6. Surfaces must be clean, dry, sound and offer sufficient profile to achieve adequate adhesion. Minimum substrate cure is 28 days at 75°F. Remove all form release agents, curing compounds, salts, efflorescence, laitance, and other foreign matter by sandblasting, shotblasting, mechanical scarification, or suitable chemical means. Refer to ASTM D4260. Rinse thoroughly to achieve a final pH between 6.0 and 10.0. Allow to dry thoroughly prior to coating.

#### Old

Surface preparation is done in much the same manner as new concrete, however, if the concrete is contaminated with oils, grease, chemicals, etc., they must be removed by cleaning with a strong detergent. Refer to ASTM D4258. Form release agents, hardeners, etc. must be removed by sandblasting, shotblasting, mechanical scarification, or suitable chemical means. If surface deterioration presents an unacceptably rough surface, Kem Cati-Coat Epoxy HS Filler/Sealer is recommended to patch and resurface damaged concrete.

Fill all cracks, voids and bugholes with Sher-Plate Epoxy Patch.

Always follow the ASTM methods listed below:

ASTM D4258 Standard Practice for Cleaning Concrete.

ASTM D4259 Standard Practice for Abrading Concrete.

ASTM D4260 Standard Practice for Etching Concrete.

ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete.

SSPC-SP 13/Nace 6 Surface Preparation of Concrete.

#### **APPLICATION CONDITIONS**

Temperature: 40°F minimum, 120°F maximum

(air, surface, and material) At least 5°F above dew point

Relative humidity: 85% maximum

#### APPLICATION EQUIPMENT

The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compatible with the existing environmental and application conditions.

#### Reducer/Clean Up:

#### Airless Sprav

 Pressure
 2500 - 2800 psi

 Hose
 3/8" ID

 Tip
 .013" - .017"

 Filter
 60 mesh

Reduction ...... As needed up to 15% by volume

#### **Conventional Spray**

Reduction ...... As needed up to 15% by volume

#### Brush

Brush ...... Natural Bristle

Reduction ...... As needed up to 15% by volume

#### Roller

If specific application equipment is listed above, equivalent equipment may be substituted.

Polyurethane 5.22A continued on back



# ACROLON™ 218 HS ACRYLIC POLYURETHANE

PART A
PART A
PART B

B65-600 B65-650 B65V600 GLOSS SERIES SEMI-GLOSS SERIES HARDENER

INDUSTRIAL & MARINE COATINGS

#### **APPLICATION BULLETIN**

#### APPLICATION PROCEDURES

Surface preparation must be completed as indicated.

Mix contents of each component thoroughly with power agitation. Make certain no pigment remains on the bottom of the can. Then combine six parts by volume of Part A with one part by volume of Part B (premeasured components). Thoroughly agitate the mixture with power agitation. Re-stir before using.

If reducer is used, reduce at time of catalyzation.

Apply paint at the recommended film thickness and spreading rate as indicated below:

#### Recommended Spreading Rate per coat:

Wet mils: 4.5 - 9.0 Dry mils: 3.0 - 6.0

Coverage: 175 - 346 sq ft/gal approximate **NOTE**: Brush or roll application may require multiple coats to achieve

maximum film thickness and uniformity of appearance.

#### Drying Schedule @ 6.0 mils wet @ 50% RH:

	50°F	@ 77°F	@ 120°F
To touch:	2 hours	30 minutes	20 minutes
To handle:	10 hours	6 hours	4 hours
To recoat:			
minimum:	12 hours	8 hours	6 hours
maximum:	3 months	3 months	3 months
To cure:	14 days	7 days	5 days
Pot Life:	4 hours	2 hours	45 minutes
(reduced 5% v	vith Reducer R7	K15)	
Sweat in Time:	none	none	none

Application of coating above maximum or below minimum recommended spreading rate may adversely affect coating performance.

#### Performance Tips

Stripe coat all crevices, welds, and sharp angles to prevent early failure in these areas.

When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross spray at a right angle.

Spreading rates are calculated on volume solids and do not include an application loss factor due to surface profile, roughness or porosity of the surface, skill and technique of the applicator, method of application, various surface irregularities, material lost during mixing, spillage, overthinning, climatic conditions, and excessive film build.

Excessive reduction of material can affect film build, appearance, and adhesion.

Do not apply the material beyond recommended pot life.

Do not mix previously catalyzed material with new.

In order to avoid blockage of spray equipment, clean equipment before use or before periods of extended downtime with Reducer #132, R7K132.

Mixed coating is sensitive to water. Use water traps in all air lines. Moisture contact can reduce pot life and affect gloss and color.

E-Z Roll Urethane Defoamer is acceptable for use. See data page 5.99 for details.

Refer to Product Information sheet for additional performance characteristics and properties.

#### **CLEAN UP INSTRUCTIONS**

Clean spills and spatters immediately with Reducer #132, R7K132. Clean tools immediately after use with Reducer #132, R7K132. Follow manufacturer's safety recommendations when using any solvent.

#### SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

B65T604 09 00

Section	1 PRODUCT AND COMPANY IDENTIFICAT	ION	
PRODUCT NUMBER	DATE OF PREPARATION	HMIS CODES Health	2*
В65Т604	03-SEP-07	Flammability Reactivity	3

PRODUCT NAME

ACROLON™ 218 HS Polyurethane - Gloss (Part A), Ultradeep/Clear Tint Base

MANUFACTURER'S NAME

THE SHERWIN-WILLIAMS COMPANY 101 Prospect Avenue N.W. Cleveland, OH 44115

TELEPHONE NUMBERS and WEBSITES

Product Information

www.sherwin-williams.com

Regulatory Information

(216) 566-2902

www.paintdocs.com

Medical Emergency (216) 566-2917

Transportation Emergency

for Chemical Emergency ONLY (spill, leak,

(800) 424-9300 fire, exposure, or accident)

	30, 121 3000	iiio, empobalo, el accidenc,	
% by WT	Section 2 CAS No.	COMPOSITION/INFORMATION ON INGREDIENTS INGREDIENT UNITS VAPOR	R PRESSURE
0.4	100-41-4	Ethylbenzene	
		ACGIH TLV 100 ppm	7.1 mm
		ACGIH TLV 125 ppm STEL	
		OSHA PEL 100 ppm	
		OSHA PEL 125 ppm STEL	
2	1330-20-7		
		ACGIH TLV 100 ppm	5.9 mm
		ACGIH TLV 150 ppm STEL	
		OSHA PEL 100 ppm	
		OSHA PEL 150 ppm STEL	
1	64742-94-5	Medium Aromatic Hydrocarbons	
		ACGIH TLV Not Available	0.12 mm
		OSHA PEL Not Available	
0.2	91-20-3	Naphthalene	
		ACGIH TLV 10 ppm	1 mm
		ACGIH TLV 15 ppm STEL	
		OSHA PEL 10 ppm	
_		OSHA PEL 15 ppm STEL	
4	78-93-3	Methyl Ethyl Ketone	
		ACGIH TLV 200 ppm	70 mm
		ACGIH TLV 300 ppm STEL	
		OSHA PEL 200 ppm	
		OSHA PEL 300 ppm STEL	

10	123-86-4	n-Butyl Acetate	
		ACGIH TLV 150 ppm	10 mm
		ACGIH TLV 200 ppm STEL	
		OSHA PEL 150 ppm	
		OSHA PEL 200 ppm STEL	
6	108-65-6	1-Methoxy-2-Propanol Acetate	
		ACGIH TLV Not Available	1.8 mm
		OSHA PEL Not Available	
31	14808-60-7	<del></del>	
		ACGIH TLV 0.05 mg/m3 as Resp. Dust	
		OSHA PEL 0.1 mg/m3 as Resp. Dust	

#### Section 3 -- HAZARDS IDENTIFICATION

#### ROUTES OF EXPOSURE

INHALATION of vapor or spray mist.

EYE or SKIN contact with the product, vapor or spray mist.

EFFECTS OF OVEREXPOSURE

EYES: Irritation.

SKIN: Prolonged or repeated exposure may cause irritation.

INHALATION: Irritation of the upper respiratory system.

May cause nervous system depression. Extreme overexposure may result in unconsciousness and possibly death.
SIGNS AND SYMPTOMS OF OVEREXPOSURE

Headache, dizziness, nausea, and loss of coordination are indications of excessive exposure to vapors or spray mists.

Redness and itching or burning sensation may indicate eye or excessive skin exposure.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

May cause allergic respiratory and/or skin reaction in susceptible persons or sensitization. This effect may be delayed several hours after exposure.

CANCER INFORMATION

For complete discussion of toxicology data refer to Section 11.

#### Section 4 -- FIRST AID MEASURES

EYES: Flush eyes with large amounts of water for 15 minutes.

Get medical attention.

SKIN: Wash affected area thoroughly with soap and water.

Remove contaminated clothing and launder before re-use.

INHALATION: If any breathing problems occur during use, LEAVE THE

AREA and get fresh air. If problems remain or occur

later, IMMEDIATELY get medical attention.

INGESTION: Do not induce vomiting.

Get medical attention immediately.

#### Section 5 -- FIRE FIGHTING MEASURES

FLASH POINT	$_{ m LEL}$	$\mathtt{UEL}$
55 F PMCC	0.8	13.1

FLAMMABILITY CLASSIFICATION

RED LABEL -- Flammable, Flash below 100 F (38 C)

#### EXTINGUISHING MEDIA

Carbon Dioxide, Dry Chemical, Foam

UNUSUAL FIRE AND EXPLOSION HAZARDS

Closed containers may explode when exposed to extreme heat.

Application to hot surfaces requires special precautions.

During emergency conditions overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent. Obtain medical attention.

SPECIAL FIRE FIGHTING PROCEDURES

Full protective equipment including self-contained breathing apparatus should be used.

Water spray may be ineffective. If water is used, fog nozzles are preferable. Water may be used to cool closed containers to prevent pressure build-up and possible autoignition or explosion when exposed to extreme heat.

#### Section 6 -- ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Remove all sources of ignition. Ventilate the area. Remove with inert absorbent.

#### Section 7 -- HANDLING AND STORAGE

#### STORAGE CATEGORY

DOL Storage Class IB

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Contents are FLAMMABLE. Keep away from heat, sparks, and open flame.

During use and until all vapors are gone: Keep area ventilated - Do not smoke - Extinguish all flames, pilot lights, and heaters - Turn off stoves, electric tools and appliances, and any other sources of ignition.

Consult NFPA Code. Use approved Bonding and Grounding procedures.

Keep container closed when not in use. Transfer only to approved containers with complete and appropriate labeling. Do not take internally. Keep out of the reach of children.

#### Section 8 -- EXPOSURE CONTROLS/PERSONAL PROTECTION

#### PRECAUTIONS TO BE TAKEN IN USE

NO PERSON SHOULD USE THIS PRODUCT, OR BE IN THE AREA WHERE IT IS BEING USED, IF THEY HAVE CHRONIC (LONG-TERM) LUNG OR BREATHING PROBLEMS OR IF THEY EVER HAD A REACTION TO ISOCYANATES.

Use only with adequate ventilation.

Avoid contact with skin and eyes. Avoid breathing vapor and spray mist. Wash hands after using.

This coating may contain materials classified as nuisance particulates (listed "as Dust" in Section 2) which may be present at hazardous levels only during sanding or abrading of the dried film. If no specific dusts are listed in Section 2, the applicable limits for nuisance dusts are ACGIH TLV 10 mg/m3 (total dust), 3 mg/m3 (respirable fraction), OSHA PEL 15 mg/m3 (total dust), 5 mg/m3 (respirable fraction).

Local exhaust preferable. General exhaust acceptable if the exposure to materials in Section 2 is maintained below applicable exposure limits. Refer to OSHA Standards 1910.94, 1910.107, 1910.108.

Continued on page 4

#### RESPIRATORY PROTECTION

Where overspray is present, a positive pressure air supplied respirator (TC19C NIOSH/MSHA approved) should be worn. If unavailable, a properly fitted organic vapor/particulate respirator approved by NIOSH/MSHA for protection against materials in Section 2 may be effective. Follow respirator manufacturer's directions for use. Wear the respirator for the whole time of spraying and until all vapors and mists are gone. NO PERSONS SHOULD BE ALLOWED IN THE AREA WHERE THIS PRODUCT IS BEING USED UNLESS EQUIPPED WITH THE SAME RESPIRATOR PROTECTION RECOMMENDED FOR THE PAINTERS.

When sanding or abrading the dried film, wear a dust/mist respirator approved by NIOSH/MSHA for dust which may be generated from this product, underlying paint, or the abrasive.

PROTECTIVE GLOVES

To prevent skin contact, wear gloves which are recommended by glove supplier for protection against materials in Section 2.  $\tt EYE\ PROTECTION$ 

Wear safety spectacles with unperforated sideshields. OTHER PROTECTIVE EQUIPMENT

Use barrier cream on exposed skin.

OTHER PRECAUTIONS

This product must be mixed with other components before use. Before opening the packages, READ AND FOLLOW WARNING LABELS ON ALL COMPONENTS.

Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal.

#### Section 9 -- PHYSICAL AND CHEMICAL PROPERTIES

PRODUCT WEIGHT 10.64 lb/gal 1275 g/l SPECIFIC GRAVITY 1.28 174 - 415 F 78 - 212 C BOILING POINT Not Available MELTING POINT VOLATILE VOLUME 36 **EVAPORATION RATE** Slower than ether Heavier than air VAPOR DENSITY SOLUBILITY IN WATER N.A. VOLATILE ORGANIC COMPOUNDS (VOC Theoretical - As Packaged) 2.66 lb/gal 319 g/l Less Water and Federally Exempt Solvents Emitted VOC 2.66 lb/gal 319 g/1

#### Section 10 -- STABILITY AND REACTIVITY

STABILITY -- Stable CONDITIONS TO AVOID

None known.

INCOMPATIBILITY

None known.

HAZARDOUS DECOMPOSITION PRODUCTS

By fire: Carbon Dioxide, Carbon Monoxide

HAZARDOUS POLYMERIZATION

Will not occur

#### Section 11 -- TOXICOLOGICAL INFORMATION

#### CHRONIC HEALTH HAZARDS

Ethylbenzene is classified by IARC as possibly carcinogenic to humans (2B) based on inadequate evidence in humans and sufficient evidence in laboratory animals. Lifetime inhalation exposure of rats and mice to high ethylbenzene concentrations resulted in increases in certain types of cancer, including kidney tumors in rats and lung and liver tumors in mice. These effects were not observed in animals exposed to lower concentrations. There is no evidence that ethylbenzene causes cancer in humans.

Crystalline Silica (Quartz, Cristobalite) is listed by IARC and NTP. Long term exposure to high levels of silica dust, which can occur only when sanding or abrading the dry film, may cause lung damage (silicosis) and possibly cancer.

Methyl Ethyl Ketone may increase the nervous system effects of other solvents.

Prolonged overexposure to solvent ingredients in Section 2 may cause adverse effects to the liver, urinary, blood forming and reproductive systems.

Persons sensitive to isocyanates will experience increased allergic reaction on repeated exposure.

Reports have associated repeated and prolonged overexposure to solvents with permanent brain and nervous system damage.

TOXICOLOGY DATA					
CAS No.	Ingredient N	lame			
100-41-4	Ethylbenzene	)			
	_	LC50	RAT	4HR	Not Available
		LD50	RAT		3500 mg/kg
1330-20-7	Xylene				
	_	LC50	RAT	4HR	5000 ppm
		LD50	RAT		4300 mg/kg
64742-94-5	Medium Aroma	tic Hyd	drocarbo	ons	
		LC50	RAT	4HR	Not Available
		LD50	RAT		Not Available
91-20-3	Naphthalene				
		LC50	RAT	4HR	Not Available
		LD50	RAT		Not Available
78-93-3	Methyl Ethyl	Ketone	Э		
		LC50	RAT	4HR	Not Available
		LD50	RAT		2740 mg/kg
123-86-4	n-Butyl Acet	ate			
		LC50	RAT	4HR	2000 ppm
		LD50	RAT		13100 mg/kg
108-65-6	1-Methoxy-2-		ol Aceta	ate	
		LC50	RAT	4HR	Not Available
		LD50	RAT		8500 mg/kg
14808-60-7	Quartz				
		LC50	RAT	4HR	Not Available
		LD50	RAT		Not Available

#### Section 12 -- ECOLOGICAL INFORMATION

#### ECOTOXICOLOGICAL INFORMATION

No data available.

#### Section 13 -- DISPOSAL CONSIDERATIONS

#### WASTE DISPOSAL METHOD

Waste from this product may be hazardous as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261.

Waste must be tested for ignitability to determine the applicable EPA hazardous waste numbers.

Incinerate in approved facility. Do not incinerate closed container. Dispose of in accordance with Federal, State/Provincial, and Local regulations regarding pollution.

#### Section 14 -- TRANSPORT INFORMATION

#### US Ground (DOT)

1 Gallon and Less may be Classed as CONSUMER COMMODITY, ORM-D Larger Containers are Regulated as: UN1263, PAINT, 3, PG II, (ERG#128)

DOT (Dept of Transportation) Hazardous Substances & Reportable Quantities Xylenes (isomers and mixture) 100 lb RQ

Bulk Containers may be Shipped as (check reportable quantities): UN1263, PAINT, 3, PG II, (ERG#128)

#### Canada (TDG)

UN1263, PAINT, CLASS 3, PG II, (ERG#128)

IMO

UN1263, PAINT, CLASS 3, PG II, (13 C c.c.), EmS F-E, S-E

#### Section 15 -- REGULATORY INFORMATION

#### SARA 313 (40 CFR 372.65C) SUPPLIER NOTIFICATION

CAS No.	CHEMICAL/COMPOUND	% by WT	% Element
100-41-4	Ethylbenzene	0.4	
1330-20-7	Xylene	2	
91-20-3	Naphthalene	0.2	

#### CALIFORNIA PROPOSITION 65

WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. TSCA CERTIFICATION

All chemicals in this product are listed, or are exempt from listing, on the TSCA Inventory.

Continued on page 7

#### Section 16 -- OTHER INFORMATION

This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

The above information pertains to this product as currently formulated, and is based on the information available at this time. Addition of reducers or other additives to this product may substantially alter the composition and hazards of the product. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information.

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Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference: NC01

## **HYDROCYCLONE**

ST-150



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		0	SUBMITTAL	P.Ste-Marie P.	P.S.M. 20	2009-03-26	Contract	Weaucw Dally I	ົດ 
	Hydrogon	-							
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REV.	ITEM	ате/ату.	DESCRIPTION		CAT.	SOURCE	FA/SA FI	N/A	
	T CLY LOTOCIA	Tota					SITE		
	NC01ST-150-1	2	4 HYDROCYCLONES		R60	3)	SA		
			Manutacturer:	C2-012					
			Krebs	C2-021					
			Model:	C2-022					
			U6-10-1758						
			Material:						
			Urethane						
			Inlet (vortex finder):						
			dia. 2,25" (57,2 mm)						
			Outlet (apex):						
			dia. 1,25" (31,8 mm)						
			must include the victaulic 4" x 3" at discharge						
			PERFORMANCES						
			Anticipated performance:						
			Recovery of solids greater than						
			50 microns in diameter						
			Operating conditions :						
			Feed at 150 usgpm $(34m^3/h)$ at						
			19 psig (131 kPa) theoritical pressure						
			Feed characteristics:						
			Sludge mixture :Water, 135 microns microsand, settle						
			solids and polymers.						
			Flow split:						
			20 % at Apex (underflow)						
			80 % at vortex finder (overflow)						

# XNV78 4451

#### FLSmidth Krebs

5505 W Gillette Rd • Tucson, AZ 85743-9501 • USA Tel +1 520 744 8200 • Fax +1 520 744 8300 www.krebs.com



MAY 13, 2009

## INSTALLATION, OPERATION AND MAINTENANCE MANUAL

4 MODEL U6-10-1758 KREBS CYCLONES SERIAL NUMBERS: 114486U - 114489U FOR JOHN MEUNIER, INC. PO NUMBER: NC01-042945

SALES ENGINEER: MIKE WILKINS

mike.wilkins@flsmidth.com

Installation, Operation, Maintenance	Urethane
KREBS CYCLONES	(Rev 10/03)

### **URETHANE**



#### **GENERAL**

KREBS Cyclones are the result of an intensive research and development program initiated in 1950. Each unit represents a product of advanced design, careful engineering, quality materials and the finest workmanship.

The information in the following pages is directed toward a better understanding of cyclone principles and operation, so that the potential for every KREBS Cyclone is realized.

KREBS engineers cyclone installations by studying the operating data and customer objectives. The cyclone selections are based on the large amount of operating data accumulated by our staff of engineers and our continuing research. When data is not available or is incomplete, studies in our laboratory and pilot plant are recommended. The pilot plant is equipped for complete, full-scale cyclone classification studies. Predictable performances resulting from these studies have been proven in numerous subsequent field installations. An important part of this service is the analysis of the test results by our staff of metallurgical and chemical engineers as related to the overall plant operation.

You are invited to avail yourself of these facilities and services for the study of your classification problems.



#### Installation

Small KREBS Cyclones are crated and shipped completely assembled. When removing the cyclone from the shipping crate, care should be taken to account for all of the parts. This can be checked against the packing slip.

#### Pump, Sump and Piping

Correct design of the pump and sump is probably the most important factor in establishing an efficient cyclone operation.

Conversion of flow and velocity to kinetic energy in a cyclone is derived from the energy supplied from the pump. Each adjustment of the cyclone variables will influence the pumping to some degree. This will be discussed in the section entitled "Operation". A constant volume to the cyclone is important. Momentary fluctuations are generally the result of entrained air in the slurry.

A constant level in the sump is critical, but by no means an indication that the cyclone is receiving a constant and uniform volume of feed. If the needle of the pressure gauge fluctuates rapidly, it is a definite indication that there is entrained air in the pump discharge slurry. To correct this problem, the entering stream should be prevented from carrying entrapped air to the suction of the pump. This can be done by mounting a sloping plate in the sump, well below the normal level of the slurry. An annular opening between the plate and the edges of the sump of about one inch around its entire periphery will generally be sufficient to allow the total volume of slurry to pass from the upper compartment to the lower section.

It is permissible to return part or all of the overflow product to the sump to maintain a constant level. It must be remembered that the greater the slime content of the feed slurry to a cyclone, the more difficult it becomes to make a given separation. The use of recycled overflow product should be handled with caution, as there is always a danger of recirculating an excess quantity and consequently increasing the slime content of the feed slurry.

Where water is available and the overflow product is an important consideration, fresh water should be added as a means of volume control.

The overflow product should discharge to atmosphere as close to the cyclone as possible. If the overflow pipe is carried directly to an elevation below the inlet of the cyclone, a siphoning action can be created. This will cause coarser particles to be carried to the cyclone overflow product. The overflow should be available for sampling.

The underflow discharge should be open for visual inspection, as it is important to be able to observe the characteristics of this flow. The underflow should be maintained with a 20-30 degree spray discharge. A "rope" discharge is an indication that there is excess crowding of solids at the apex orifice. This will cause coarse oversize solids to be carried into the overflow product. The underflow product should also be available for sampling.



#### KREBS CYCLONES

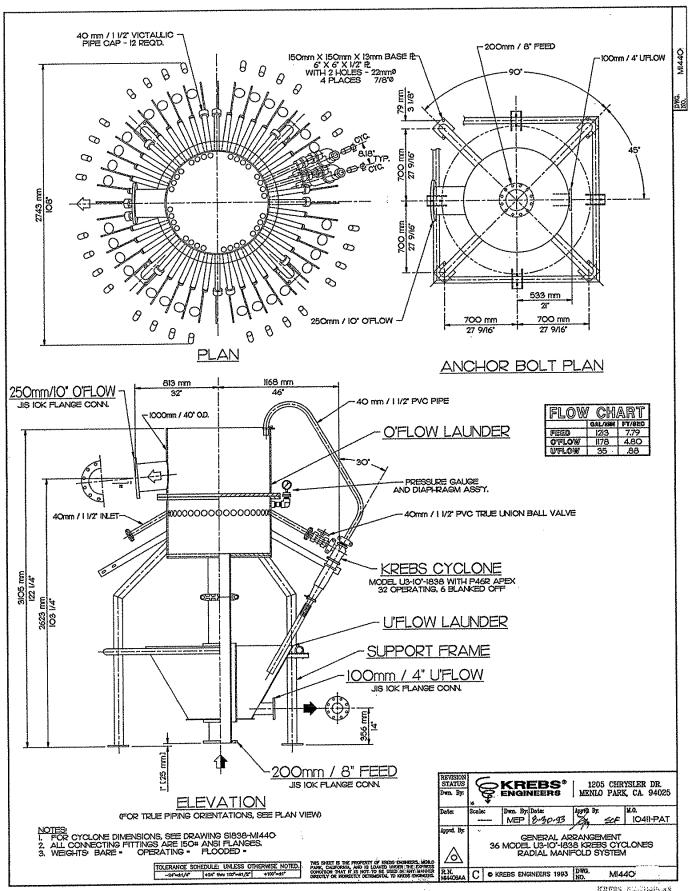
# Installation (cont'd)

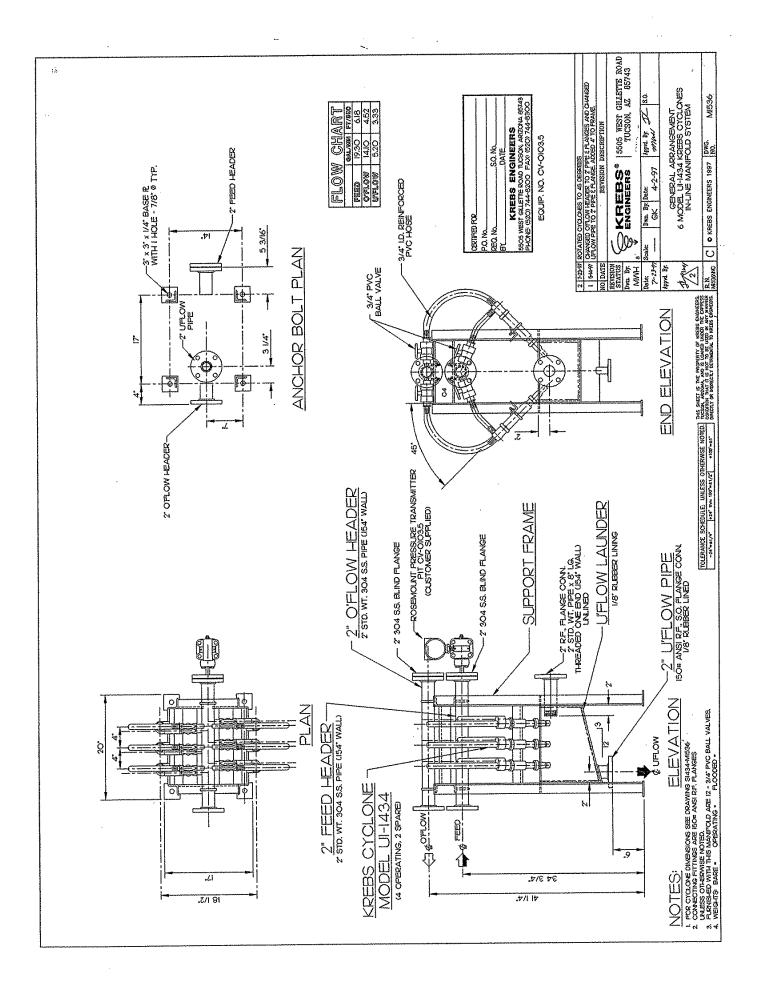
#### Multiple Installations

A radial manifold system assures an even feed distribution to each cyclone. The take-offs should be equally spaced around the perimeter of the central distribution pot. The overflow and underflow launders must be properly sized to allow for collection and distribution of the streams. KREBS ENGINEERS will design and fabricate radial manifolds. Drawing number M1440 illustrates a typical radial manifold system for small diameter cyclones.

An inline manifold system can be used if the feed is very dilute and not subject to segregating in the system. An inline system is generally easier to design and build than a radial system and consequently is less expensive. An inline system does not assure equal feed to each cyclone. Drawing number M1536 illustrates a typical inline manifold system.







KREBS CYCLONES

# Operation

The primary consideration in selecting the proper size and design of cyclone is the classification objective, not the capacity. The proper relationship between the inlet orifice the vortex finder diameter, and the apex diameter is engineered by the staff of KREBS Engineers for each specific classification objective.

There is seldom any necessity for changing the size of these orifices unless the classification objectives or plant operating conditions are altered.

Numerous factors influence the operation of a cyclone. Following is a brief discussion of some factors influencing cyclone operation (which the operator is normally able to control while the cyclone is operating).

#### Feed Dilution

Feed dilution is the most effective control available. The use of additional dilution water will always result in a finer and sharper separation. The dilution water can also be adjusted to maintain a constant level in the sump, although the operator must be aware of the potential change in the separation. For very dilute feeds, the change in the separation will be minimal.

#### Pressure Management

Pressure drop across the cyclone is the pressure differential between the cyclone inlet and overflow. When the cyclone discharges to atmosphere, a condition we usually recommend, the inlet pressure is the pressure drop.

The pressure drop is merely an indication of the energy required to force a given volume through the cyclone and not an indication of a developed force-pattern or throughput. Excessive pressure results in high pump operating and maintenance costs and should be avoided. We generally do not recommend pressure drops above 50 psi.

The higher the pressure drop, the greater the throughput capacity of the cyclone. A higher pressure drop will also produce a finer separation.

#### **Cyclone Orifices**

The following describes the effect the various orifices have on the cyclone performance. Changing the orifice requires shutting down the system.

#### Inlet Orifice

The main function of the inlet orifice is to provide a smooth flow pattern at the point of entry into the cyclone. All of KREBS Cyclones are designed with an involuted entry that preorients the solids prior to reaching the tangential point of contact with the cylinder wall. This minimizes turbulence and allows KREBS Cyclones to produce finer and sharper separations.

An increase in the inlet area will increase the capacity of the cyclone. It will also coarsen the separation slightly. All of KREBS Cyclones, three inches and smaller in diameter, have fixed inlet areas.



Urethane

(Rev 10/03)

# Operation (cont'd)

#### Vortex Finder

The vortex finder has the greatest impact on the operating results of all the orifices. The vortex finder also has a large effect on the cyclone capacity at a given pressure drop. It also affects the cyclone separation significantly.

The larger the vortex finder diameter, the greater the cyclone capacity at a given pressure drop. A larger diameter vortex finder will also coarsen the cyclone separation.

#### Apex Orifice

The only function of the apex orifice is to discharge the coarse solids in such a manner that the maximum underflow density and smoothness of discharge are obtained. The apex should be large enough to produce a 20-30 degree cone discharge, but should not be used to control the cyclone separation. The apex should never be so small that a "rope" discharge exists. A "rope" discharge is an indication that the apex is not allowing all of the coarse solids out and consequently some are being forced out the cyclone overflow. Both fixed and manually adjustable apexes are available on KREBS small diameter cyclones.



Installation, Operation, Maintenance	Urethane
KREBS CYCLONES	(Rev 10/03)

# **Maintenance**

It is important to maintain smooth surfaces on the interior of the cyclone. The cyclones should be inspected on a regular basis. When the interior surfaces become worn or uneven, the part should be replaced. After experience has been gained in operating the cyclones under given conditions, a regular maintenance schedule can be determined.

Once the apex opens more than 10% of it's original size, it should be replaced.



Urethane

(Rev 10/03)

# Common Problems and Solutions

#### Problem 1:

There are very coarse solids in the cyclone overflow.

#### Solution:

This is normally an indication that the apex is too small and coarse solids are being forced to the cyclone overflow. The apex diameter should be increased until a constant 30 degree cone angle is obtained on the discharge. The fixed apexes can be cut off to increase the diameter. An adjustable apex will have to be replaced with a larger one if it is in the full open position.

#### Problem 2:

The cyclone pressure drop fluctuates wildly.

#### Solution:

This is an indication that a constant level in the sump is not being maintained or that air is entrained in the slurry. If the pump is pumping more feed volume than is going to the slump, the sump level will go down. Eventually the pump will cavitate and the pressure drop across the cyclone will be very erratic. Slowing the pump down or increasing the dilution water to the sump will maintain a constant sump level.

Air usually enters the pump suction because the feed to the sump is pointing directly down into the pump suction. Change the feed so that it angles against a side wall of the sump or install a baffle plate as described in the installation section.

#### Problem 3:

The separation is not fine enough.

#### Solution:

Increase the dilution water to the feed. If the feed is already dilute or if diluting the feed is not possible, increase the cyclone pressure drop. This will require speeding up the pump and installing a smaller diameter vortex finder. If the separation is still not fine enough, smaller diameter cyclones will probably required.

#### Problem 4:

The underflow is too dilute.

#### Solution:

This is an indication that the apex is too large. Decrease the apex diameter until a 30 degree cone discharge is obtained. Do not decrease the apex diameter to the point of "roping" the discharge. The adjustable apexes can be decreased by tightening the worm driven clamp. The fixed apexes will have to be replaced with a smaller size.



Urethane

#### KREBS CYCLONES

(Rev 10/03)

## **Calculations**

#### **TONNAGE:**

1) Solids:

TPH = GPM SLURRY X S.G. SLURRY X % SOLIDS

Slurry:

TPH SOLIDS % SOLIDS

2) PULP SPECIFIC GRAVITY:

S.G. PULP =

100 X S.G. SOLIDS X S.G. LIQUID
100 X S.G. SOLIDS - % SOLIDS (S.G. SOLIDS - S.G. LIQUID)

3) PERCENT SOLIDS IN PULP

 $% = \frac{\text{TPH SOLIDS}}{\text{TPH SLURRY}} X 100$ 

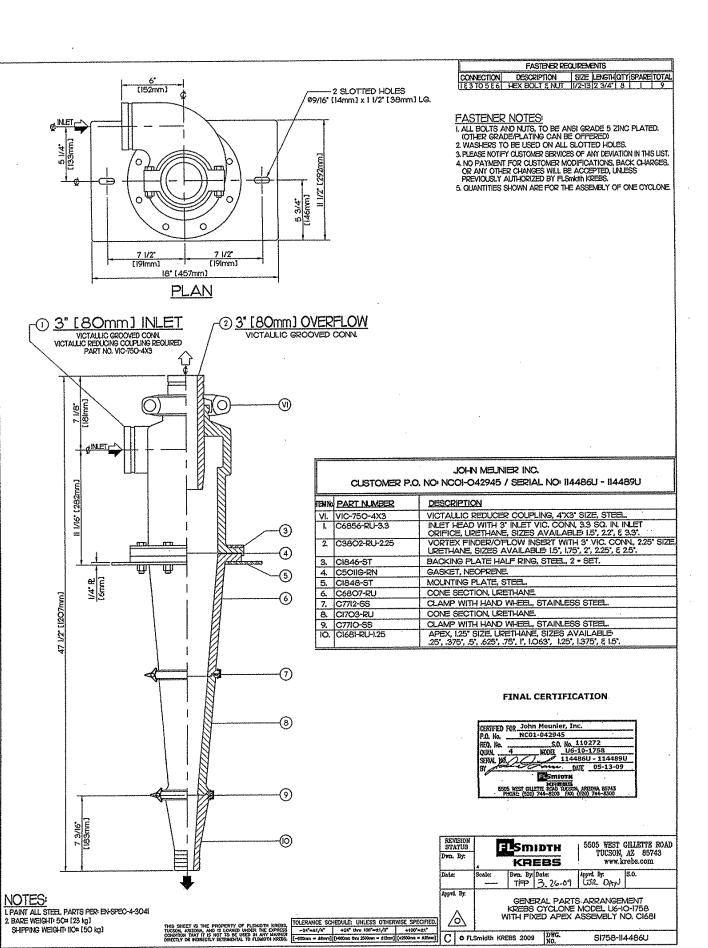
4) GALLONS PER MINUTE:

GPM SLURRY = <u>TPH SOLIDS X 4</u> S. G. SLURRY X % SOLIDS

5) % SOLIDS BY VOLUME = % SOLIDS BY WEIGHT X S.G. PULP S.G. SOLIDS

6)  $\frac{\text{GPM}}{\text{ONE TPH SOLIDS}} = \frac{4}{\text{% SOLIDS X S.G. PULP}}$ 



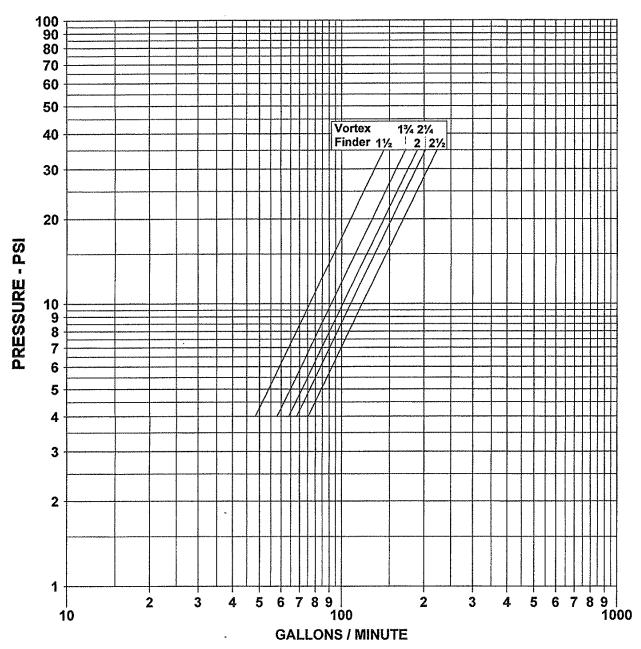


Krebs Cyclone Model No.: U6-10°

No.: U6-10°-3.3-12/02

**CAPACITY CURVE** 

#### 3.30 SQ. IN. INLET ORIFICE



CAPACITY IS BASED ON WATER AT AMBIENT TEMPERATURE AND APEX DIAMETER EQUAL TO ONE HALF THE VORTEX FINDER DIAMETER, AND MAY VARY AT DIFFERENT RATIOS

This sheet is the property of Krebs Engineers, Tucson Arizona, and is loaned under the express condition that it is not to be used in any manner directly or indirectly detrimental to Krebs Engineers

KREBS ENGINEERS 5505 West Gillette Road Tucson, AZ 85743 TEL: (520) 744-8200 FAX: (520) 744-8300 e-mail: www.krebs.com



SHEET: 1	
DATE: 06-Mar-09	
BY: BLP	

Client: John Meunier

Problem: Maximum recovery of sand to the U/F with 20% of the

feed volume in the U/F. Waste water sand.

Number, Model Krebs Cyclones: 1 operating Krebs Model U6-10 Hydrocyclone

Orifices:

Inlet Area 3.3 sq. in. Vortex Finder 2.25 in.

Apex 1.25

Pressure Drop 19 PSI

Specific Gravity: Solids: 2.7

Liquid: 1.0

Temperature: Amb. °F

Viscosity: 1 Cps

	FEED	OVERFLOW	UNDERFLOW
STPH Solids	4.9	0.0	4.9
STPH Liquids	35.7	30.0	5.7
STPH Slurry	40.6	30.0	10.6
Wt Solids	12.0	0.0	46.0
S.G. Slurry	1.082	1.000	1.408
Vol% Solids	4.8	0.0	24.0
GPM Slurry	150.0	120.0	30.0
M3/Hr. Slurry	34.1	27.3	6.8

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			FEED		0,	VERFL(	WC .	UN	IDERFL	ow	ACT.	*************
Mesh	Micron	Cum. % +	Ind. % +	STPH	Cum. %+	Ind. % +	STPH	Cum. %+	Ind. % +	STPH	REC.	
40		1.4	1.4	0.1	0.0	0.0	0.0	1.4	1.4	0.1	100.0	· ·
50	300.0	14.6	13.2	0.6	0.0	0.0	0.0	14.6	13.2	0.6	100.0	
70	212.0	47.2	32.6	1.6	0.7	0.7	0.0	47.3	32.7	1.6	100.0	
100	150.0	84.4	37.2	1.8	17.2	16.5	0.0	84.5	37.2	1.8	99.9	··
140	106.0	99.5	15.1	0.7	76.1	58.9	0.0	99.5	15.0	0.7	99.2	·····
200	75.0	99.9	0.4	0.0	83.2	7.1	0.0	99.9	0.4	0.0	96.5	
200	-75.0	100.0	0.1	0.0	100.0	16.8	0.0	100.0	0.1	0.0	67.4	
TOTAL				4.9			0.0			4.9	99.8	

KREBS ENGINEERS
5505 WEST GILLETTE ROAD TUCSON, AZ 85743
TEL: (520) 744-8200 FAX: (520) 744-8300
www.krebs.com

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Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference: NC01

# LAMELLA PACK ST-151



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TITRE/ TITLE Re						BILL OF MATERIALS
	Rev. DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	Moodwobson Mining
0	0 SUBMITTAL	P.Ste-Marie	P.S.M.	2009-03-26	Contract	Meadow Dally Milling
Cotting Ismalls modules	-					
	2				REF. No.	NC01 0
(F)	8					
ST-151 4	4				Date:	2009-01-07
ате/ату.	DESCRIPTION	P&ID	CAT. ACCPAC	SOURCE	FA/SA FI	N/A
Unit. Iotal	2 SETTLING LAMELLA	I.D./IAG	B64		SA	
	Material:				i	
	High impact Polystyrene					
	Type: Impact PS 6200					
	Model:					
	DH-35					
	Colorant:					
	Spartech 10189 BLACK (BK 21102)					
	(FDA approuved)					
	Opening:					
	35 mm (1,35 in)					
	DIMENSIONS					
	Width x length x height					
	tag A: 610 mm x 1554 mm x 762 mm					
	tag B: 580mm x 1554 mm x 762 mm					
	tag C: 507 mm x 799 mm x 762 mm					
	tag D: 507 mm x 1376 mm x 762 mm					

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# Impact PS 6200

# INEOS NOVA LLC - High Impact Polystyrene

Thursday, September 18, 2008

General Information					
General					
Material Status	Commercial: Active				
Availability	North America				
Features	<ul> <li>Good Drawdown</li> </ul>	<ul> <li>Good Toughness</li> </ul>	<ul> <li>Ultra High Impact Resistance</li> </ul>		
Uses	<ul><li>Cups</li><li>Decorative Displays</li></ul>	<ul><li>Lids</li><li>Packaging</li></ul>			
Agency Ratings	• FDA 21 CFR 177.1640 <sup>1</sup>				
Forms	• Pellets				
Processing Method	Injection Molding				

	ASTM and ISO Properties	S <sup>2</sup>	
Physical	Nominal Value (English)	Nominal Value (SI)	Test Method
Specific Gravity	1.04	1.04	ASTM D792
Melt Mass-Flow Rate (MFR) (200°C/5.0 kg)	3.0 g/10 min	3.0 g/10 min	ASTM D1238
Molding Shrinkage			ASTM D955
Flow, Injection Molded, 73°F (23°C)	0.0040 to 0.0070 in/in	0.40 to 0.70 %	
Mechanical	Nominal Value (English)	Nominal Value (SI)	Test Method
Tensile Modulus			ASTM D638
73°F (23°C), Injection Molded	310000 psi	2140 MPa	
Tensile Strength			ASTM D638
Yield, 73°F (23°C), Injection Molded	3630 psi	25.0 MPa	
Tensile Elongation			ASTM D638
Break, 73°F (23°C), Injection Molded	50 %	50 %	
Flexural Modulus			ASTM D790
73°F (23°C), Injection Molded	285000 psi	1960 MPa	
Flexural Strength			ASTM D790
73°F (23°C), Injection Molded	4930 psi	34.0 MPa	
Impact	Nominal Value (English)	Nominal Value (SI)	Test Method
Notched Izod Impact <sup>3</sup>			ASTM D256
73°F (23°C), 0.125 in (3.18 mm), Injection Molded	4.20 ft·lb/in	224 J/m	
Hardness	Nominal Value (English)	Nominal Value (SI)	Test Method
Rockwell Hardness (L-Scale)	49	49	ASTM D785
Thermal	Nominal Value (English)	Nominal Value (SI)	Test Method
Deflection Temperature Under Load			ASTM D648
264 psi (1.8 MPa), Annealed	185 °F	85.0 °C	
Vicat Softening Temperature	212 °F	100 °C	ASTM D1525
Electrical	Nominal Value (English)	Nominal Value (SI)	Test Method
Dielectric Constant (1E+6 Hz)	2.590	2.590	ASTM D150
Flammability	Nominal Value (English)	Nominal Value (SI)	Test Method
Flame Rating - UL	НВ	НВ	UL 94

Dielectric Strength, 0.125in: 500

# Impact PS 6200 INEOS NOVA LLC - High Impact Polystyrene

Thursday, September 18, 2008

	Processing Information	1	
Injection	Nominal Value (English)	Nominal Value (SI)	
Processing (Melt) Temp	374 to 525 °F	190 to 274 °C	
Mold Temperature	100 to 180 °F	38.0 to 82.0 °C	

#### **Notes**

<sup>&</sup>lt;sup>1</sup> When used unmodified for the manufacture of food contact articles, Impact PS 6200 will comply with Food Additive Regulations FDA 21 CFR 177.1640 under the U.S. Food, Drug and Cosmetic Act. Such uses are subject to good manufacturing practices and any other limitations which are part of the statute or regulations. These should be consulted for complete details.

<sup>&</sup>lt;sup>2</sup> Typical properties: these are not to be construed as specifications.

<sup>&</sup>lt;sup>3</sup> Notch Depth: 9.8 mil (0.25 mm)



# Material Name: Impact Polystyrene, Natural Grades

MSDS ID: INEOS-NOVA-0056

#### **Section 1 - Product and Company Identification**

Synonyms: Impact modified polystyrene, HIPS

Chemical Name: Benzene, ethenyl-, polymer with 1,3-butadiene

Chemical Family: Polymer

Material Use: Petrochemical industry: Plastics

Chemical Formula: (C<sub>8</sub>H<sub>8</sub> C<sub>4</sub>H<sub>6</sub>)<sub>x</sub>

#### **INEOS NOVA**

#### **EMERGENCY Telephone Numbers:**

25846 SW Frontage Road Channahon, Illinois, USA 60410

1-800-424-9300, 703-527-3887 (CHEMTREC-USA) (24 hours)

Product Information: 1-866-890-6354 MSDS Email: <a href="mailto:psinfo@ineos-nova.com">psinfo@ineos-nova.com</a>

#### **Section 2 - Hazards Identification**

HMIS Ratings: Health: 0 Fire: 1 Physical Hazard: 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe \* = Chronic hazard

NFPA Ratings: Health: 0 Fire: 1 Reactivity: 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

#### **Emergency Overview**

Product is a white, inert, solid bead or pellet with slight odor. This product is not considered flammable according to OSHA, but will burn on prolonged exposure to flame or high temperature. Slipping hazard.

#### **Potential Health Effects: Eyes**

Contact with hot or molten material may cause severe thermal injury, including in extreme contact possible blindness. Contact of powder or fines with eve may cause mechanical irritation.

#### Potential Health Effects: Skin

Contact with hot or molten material may cause severe thermal burns. Contact of powder or fines with skin may cause mild irritation, that is increased by mechanical rubbing or if skin is dry.

#### Potential Health Effects: Ingestion

Ingestion of this product is unlikely. However, ingestion of product may produce mild gastrointestinal irritation and disturbances.

#### Potential Health Effects: Inhalation

Inhalation of fine particles may cause respiratory irritation. Fumes produced during thermal processing may cause irritation to the respiratory system.

#### Section 3 - Composition / Information on Ingredients

CAS#	Component	Percent by Wt.
9003-55-8	Styrene-Butadiene polymer	94-100

#### **Additional Information**

This product may be regulated, have exposure limits or other information identified as the following: Nuisance particulates.

This product is NOT considered hazardous under 29 CFR 1910.1200 (Hazard Communication).

This material is NOT a controlled product under Canadian WHMIS regulations.

This material is NOT REGULATED as a hazardous material/dangerous goods for transportation.

See Section 8 for applicable exposure limits. See Section 11 for applicable toxicity data.

#### **Section 4 - First Aid Measures**

#### First Aid: Eyes

Remove contact lenses, if it can be done safely. Immediately flush eyes with water for at least 15 minutes, while holding eyelids open. Seek medical attention if symptoms develop or persist.

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# Material Name: Impact Polystyrene, Natural Grades

First Aid: Skin

For skin contact, wash affected area with soap and water. Seek medical attention, if symptoms develop or persist. In case of contact with molten product, cool rapidly with water and seek immediate medical attention. Do not attempt to remove molten product, or molten product that has cooled, from skin without medical assistance.

MSDS ID: INEOS-

**NOVA-0056** 

#### First Aid: Inhalation

Move affected individual to non-contaminated air. Loosen tight clothing such as a collar, tie, belt or waistband to facilitate breathing. Seek immediate medical attention if the individual is not breathing, unconscious or if any other symptoms persist.

#### First Aid: Ingestion

Material is not expected to be absorbed from the gastrointestinal tract. DO NOT INDUCE VOMITING. Loosen tight clothing such as a collar, tie, belt or waistband. Seek immediate medical attention.

#### First Aid: Notes to Physician

Burns should be treated as thermal burns. Molten resin will come off as healing occurs; therefore, immediate removal from skin is not necessary. Treatment for overexposure should be directed at controlling the symptoms and clinical condition of the patient. After adequate first aid, no further treatment is necessary, unless symptoms reappear. Ingested material should pass through the digestive system without injury.

#### **Section 5 - Fire Fighting Measures**

See Section 9: Physical Properties for flammability limits, flash point and autoignition information.

#### **General Fire Hazards**

This product is not considered flammable according to OSHA, but will burn on prolonged exposure to flame or high temperature. High concentration of airborne powders or dust may form explosive mixture with air.

#### **Explosion Hazards**

Accumulated fine dusts may form an explosive mixture with air. Take precautionary measures to prevent contact with electrostatic discharges. Risk of dust/air explosion is increased if flammable vapors are present.

#### **Hazardous Combustion Products**

Styrene, butadiene, carbon dioxide, carbon monoxide.

#### **Extinguishing Media**

Dry chemical, foam, carbon dioxide, or water fog or spray. Avoid high pressure, direct water stream that may spread molten or burning resins.

#### Fire Fighting Equipment/Instructions

Position upwind. Keep unnecessary personnel away. Move containers from fire area if you can do so without risk. Fight fire from maximum distance or use unmanned holders or monitor nozzles. Fire fighters should wear full-face, self-contained breathing apparatus and thermal protective clothing. Avoid inhaling any smoke and combustion products. Cool containers with flooding quantities of water until well after the fire is out. Control runoff waters to prevent entry into sewers, drains, underground or confined spaces and waterways.

#### Section 6 - Accidental Release Measures

#### **Evacuation Procedures**

Isolate area. Keep unnecessary personnel away.

#### Spills

Stop leak and contain spill. Prevent entry into sewers, drains, underground or confined spaces, and waterways. Spilled product may create a dangerous slipping hazard. Use appropriate tools to put the spilled solid in an appropriate recovery or waste disposal container. Reuse or recycle where possible. Meet any applicable regulations.

#### **Special Procedures**

Contact local police and appropriate emergency telephone numbers provided in Section 1. Ensure statutory and regulatory reporting requirements in the applicable jurisdiction are met.

Wear appropriate protective equipment and clothing during clean up. Individuals without appropriate protective equipment should be excluded from area of spill until cleanup has been completed.

See Section 8 for recommended Personal Protective Equipment and see Section 13 for waste disposal considerations.

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# Material Name: Impact Polystyrene, Natural Grades

MSDS ID: INEOS-NOVA-0056

#### **Section 7 - Handling and Storage**

#### **Handling Procedures**

Handle in contained and properly designed equipment systems. Use with adequate ventilation. Avoid ingestion and inhalation. Keep away from uncontrolled heat and incompatible materials. Ground all material handling and transfer equipment to dissipate build-up of static electricity. Keep handling areas free of loose pellets and dust accumulation. Mechanical operations involving this material should be done in such a manner as to prevent or minimize dust generation. Small amounts of fines or dust contained in granular resins may accumulate in material handling systems. If permitted to accumulate, these fines or dust can, under certain conditions, pose an explosion hazard. Every effort should be made to prevent suspension, concentration or accumulation of fines or dusts in, or around, material handling systems. For additional information on control of static and minimizing potential dust and fire hazards, refer to NFPA 654, "Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids, 2006 Edition." Spilled product may create a dangerous slipping hazard.

#### **Storage Procedures**

Storage area should be clearly identified, well illuminated, and clear of obstruction. Adequate security must be provided so that unauthorized personnel do not have access to product. Store in grounded, properly designed and approved vessels and away from incompatible materials. Store and use away from heat, sparks, open flame, or any other ignition source. Use non-sparking ventilation systems, approved explosion-proof equipment, and intrinsically safe electrical systems.

DO NOT enter filled bulk containers and attempt to walk over product, due to risk of slipping and possible suffocation. Use a fall arrest system when working near open bulk storage containers.

See Section 8 for recommended Personal Protective Equipment and see Section 10 for information on incompatibilities.

#### **Section 8 - Exposure Controls / Personal Protection**

#### **Exposure Guidelines**

#### **A: General Product Information**

Refer to published exposure limits - utilize effective control measures and PPE to maintain worker exposure to concentrations that are below these limits. Ensure that eyewash stations and safety showers are proximal to the workstation location.

#### **B: Component Exposure Limits**

ACGIH, OSHA, NIOSH, EPA, Alberta, and Ontario exposure limit lists have been checked for major components listed with CAS registry numbers. Other exposure limits may apply, check with proper authorities.

#### Styrene-Butadiene polymer (9003-55-8)

ACGIH: 10 mg/m3 TWA (inhalable particles, recommended); 3 mg/m3 TWA (respirable particles,

recommended) (related to Particulates (insoluble or poorly soluble) not otherwise specified (PNOS))

OSHA: 15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction) (related to Particulates not otherwise

regulated)

Alberta: 10 mg/m3 TWA (total particulate); 3 mg/m3 TWA (respirable particulate) (related to Particulates not

otherwise regulated)

Ontario: 10 mg/m3 TWAEV (inhalable); 3 mg/m3 TWAEV (respirable) (related to Particulates (insoluble or poorly

soluble) Not Otherwise Classified (PNOC))

#### **ENGINEERING CONTROLS**

Maintain worker exposure below recommended exposure limits by providing adequate local exhaust ventilation. Use non-sparking, grounded ventilation systems separate from other exhaust systems. Ensure that eyewash stations and safety showers are proximal to the workstation location.

#### PERSONAL PROTECTIVE EQUIPMENT

#### Personal Protective Equipment: Eyes/Face

Wear safety glasses during normal handling. Wear full-face shield during thermal processing if contact with molten material is likely.

#### Personal Protective Equipment: Skin/Hands/Feet

Use impervious gloves when handling product. Wear safety footwear with good traction to help prevent slipping. Work clothing that sufficiently prevents skin contact should be worn, such as coveralls and/or long sleeves and pants.

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# Material Name: Impact Polystyrene, Natural Grades

MSDS ID: INEOS-NOVA-0056

#### **Personal Protective Equipment: Respiratory**

If engineering controls and ventilation is not sufficient to prevent build up of aerosols, vapors or dusts, appropriate NIOSH/MSHA approved air-purifying respirators or self-contained breathing apparatus (SCBA) appropriate for exposure potential should be used. Air supplied breathing apparatus must be used when oxygen concentrations are low or if airborne concentrations exceed the limits of the air purifying respirators.

#### **Personal Protective Equipment: General**

Personal protective equipment (PPE) should not be considered a long-term solution to exposure control. Employer programs to properly select, fit, maintain, and train employees to use equipment must accompany PPE. Consult a competent industrial hygiene resource, the PPE manufacturer's recommendation, and/or applicable regulations to determine hazard potential and ensure adequate protection.

#### **Section 9 - Physical & Chemical Properties**

Physical State and	Solid, beads or pellets	Color:	White
Appearance:	•		
Odor:	Slight odor	pH:	Not applicable
Vapor Pressure:	Not applicable	Vapor Density @ 0°C (Air=1):	Not applicable
Melting Point:	105°C-135°C (221°F-275°F)	Boiling Point:	Not applicable
Solubility (H2O):	Insoluble	Specific Gravity (Water=1):	1.04 g/cc, 104 kg/m
Dispersion Properties:	Is not dispersed in cold water	Softening Point:	79°C-127°C (174°F-261°F)
Flash Point:	345°C-360°C (653°F-680°F)	Flammability Classification:	Not considered flammable
	(Combustible Flash Ignition	-	according to OSHA.
	Temperature)		
Flash Point Method:	Not available	Auto Ignition:	427°C (800°F)
Lower Flammable Limit (LFL):	Not available	Upper Flammable Limit (UFL):	Not available

#### Section 10 - Stability & Reactivity Information

#### **Chemical Stability**

This material is stable under normal use conditions for shock, vibration, pressure, and ambient temperature.

#### Instability

Decomposition temperature: 300°C (572°F)

#### **Chemical Stability: Conditions to Avoid**

Avoid processing material over 300°C (572°F).

#### Incompatibility

Not resistant to oxidizing agents, dissolves in organic solvents.

#### **Hazardous Polymerization**

Will not occur.

#### Corrosivity

Not expected to be corrosive.

#### **Hazardous Decomposition**

Styrene, butadiene, carbon dioxide, carbon monoxide

#### **Section 11 - Toxicological Information**

#### A: Acute Toxicity - General Material Information

Material is considered essentially inert and non-toxic. Exposure to high levels of dusts may be irritating to the eyes. Skin/eye contact with molten or heated material may cause burns. Vapors/heated fumes may be irritating to the respiratory system.

#### **B: Acute Toxicity - LD50/LC50**

No LD50/LC50's are available for this product's components.

#### C: Chronic Toxicity - General Material Information

No additional information available.

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# Material Name: Impact Polystyrene, Natural Grades

MSDS ID: INEOS-NOVA-0056

#### D: Chronic Toxicity - Carcinogenic Effects

ACGIH, EPA, IARC, OSHA, and NTP carcinogen lists have been checked for selected similar materials or those components with CAS registry numbers.

#### Styrene-Butadiene polymer (9003-55-8)

IARC: Supplement 7, 1987; Monograph 19, 1979 (Group 3 (not classifiable))

#### **Section 12 - Ecological Information**

#### **Ecotoxicity**

The information below is based on knowledge of this product's components and the ecotoxicity of similar products. Sewer/waterway obstruction: If aquatic animals ingest pellets, digestive tract obstruction may occur. Product is not expected to be toxic, but small particles may cause adverse physical effects in aquatic and terrestrial organisms.

#### **Environmental Fate/Mobility**

Sinks in water. Pellets are persistent in aquatic and terrestrial systems. Product should be recovered from water and land following spills. This product has not been found to migrate through soils.

#### Persistence/Degradability

Pellets are persistent in aquatic and terrestrial systems. Do not allow product to enter sewer or waterways. Not expected to biodegrade.

#### Bioaccumulation/Accumulation

Pellets may accumulate in the digestive systems of birds and aquatic life, causing injury and possible death due to starvation.

#### **Section 13 - Disposal Considerations**

#### U.S./Canadian Waste Number & Descriptions

#### **A: General Product Information**

This product, if discarded, is not expected to be hazardous waste according to US or Canadian regulations. Check Local, State, Federal and Provincial Environmental Regulations prior to disposal.

The recommended disposal methods for polymers in order of preference are: 1) clean and reuse if possible; 2) contact resin broker; 3) contact plastic recycler; 4) incinerate with waste heat recovery and/ or 5) landfill. Reuse, recycling, storing, transportation, and disposal must be in accordance with applicable federal, state/ provincial and local regulations. DO NOT ATTEMPT TO DISPOSE OF BY UNCONTROLLED IGNITION.

See Section 7: Handling and Storage and Section 8: Exposure Controls/Personal Protection for additional information that may be applicable for safe handling and the protection of employees.

Waste generator is advised to carefully consider hazardous properties and control measures needed for other materials that may be found in the waste.

#### **B: Component Waste Numbers**

No EPA Waste Numbers are applicable for this product's components.

#### **Section 14 - Transportation Information**

#### **Transportation Information**

This material is not regulated as a hazardous material for transportation.

#### **Section 15 - Regulatory Information**

#### A: International Regulations

The monomers are listed by EINECS for styrene-butadiene copolymer.

#### Component Analysis - International Inventory Status

Component	CAS#	US - TSCA	CANADA - DSL	EU - EINECS
Styrene-Butadiene polymer	9003-55-8	Yes	Yes	Exempt

#### **B: USA Federal & State Regulations**

Ongoing occupational hygiene, medical surveillance programs, or site emission or spill reporting may be required by Federal or State regulations. Check for applicable regulations.

Page 5 of 7 Issue Date: September 1, 2007 Revision: 1.0 Print Date: 19-Sep-07

# Material Name: Impact Polystyrene, Natural Grades

MSDS ID: INEOS-NOVA-0056

#### **USA OSHA Hazard Communication Class**

This product is not considered hazardous under 29 CFR 1910.1200 (Hazard communication).

#### **USA Right-to-Know - Federal**

None of this product's components are listed under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), or CERCLA (40 CFR 302.4).

#### **USA Right-to-Know - State**

None of this product's components are listed on the state lists from NJ or PA. Some components (including those present only in trace quantities, and therefore not listed in this document) may be included on the Right To Know lists of other U.S. states. The reader is therefore cautioned to contact his or her INEOS NOVA representative for further U.S. State Right-To-Know information.

#### C: Canadian Regulations - Federal and Provincial

Canadian Environmental Protection Act (CEPA): The components of this product are on the Domestic Substances List (DSL), or are exempt, and are acceptable for use under the provisions of CEPA.

#### WHMIS Ingredient Disclosure List (IDL)

No components are listed in the WHMIS Ingredient Disclosure List (IDL).

#### WHMIS Classification

Workplace Hazardous Materials Information Systems (WHMIS): This product has been classified in accordance with Canadian Controlled Product Regulations (CPR) hazard criteria and this MSDS contains complete CPR-required information. Not controlled under WHMIS (Canada).

#### **Provincial Regulations**

Ongoing occupational hygiene, medical surveillance programs, or site emission or spill reporting may be required by Federal or Provincial regulations. Check for applicable regulations.

#### **Section 16 - Other Information**

#### **Label Information**

PRECAUTIONS: Product is a white, inert, solid bead or pellet with slight odor. This product is not considered flammable according to OSHA, but will burn on prolonged exposure to flame or high temperature. Slipping hazard.

#### FIRST AID:

SKIN: For skin contact, wash affected area with soap and water. Seek medical attention, if symptoms develop or persist. In case of contact with molten product, cool rapidly with water and seek immediate medical attention. Do not attempt to remove molten product, or molten product that has cooled, from skin without medical assistance.

EYES: Remove contact lenses, if it can be done safely. Immediately flush eyes with water for at least 15 minutes, while holding eyelids open. Seek medical attention if symptoms develop or persist.

INHALATION: Move affected individual to non-contaminated air. Loosen tight clothing such as a collar, tie, belt or waistband to facilitate breathing. Seek immediate medical attention if the individual is not breathing, unconscious or if any other symptoms persist.

INGESTION: Material is not expected to be absorbed from the gastrointestinal tract. DO NOT INDUCE VOMITING. Loosen tight clothing such as a collar, tie, belt or waistband. Seek immediate medical attention.

IN CASE OF A LARGE SPILL: Stop leak and contain spill. Prevent entry into sewers, drains, underground or confined spaces, and waterways. Spilled product may create a dangerous slipping hazard. Use appropriate tools to put the spilled solid in an appropriate recovery or waste disposal container. Reuse or recycle where possible. Meet any applicable regulations.

#### References

Available on request.

#### Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists; BOD = Biochemical Oxygen Demand; CAS = Chemical Abstracts Service; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; CPR = Controlled Products Regulations; DOT = Department of Transportation; DSL = Domestic Substances List; EINECS = European Inventory of Existing Commercial Chemical Substances; EPA = Environmental Protection Agency; EU = European Union; FDA = Food and Drug Administration; IARC = International Agency for Research on Cancer; IDL = Ingredient Disclosure List; Kow = Octanol/water partition coefficient; LEL - Lower Explosive Limit; NIOSH = National Institute for Occupational Safety and Health; NJTSR = New Jersey Trade Secret Registry; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; RCRA = Resource Conservation and Recovery Act; SARA Superfund Amendments and Reauthorization Act; TDG = Transportation of Dangerous Goods; TSCA = Toxic Substances Control Act.

MSDS Prepared by: INEOS NOVA

MSDS Information Phone Number: 1-866-890-6354

Page 6 of 7 Issue Date: September 1, 2007 Revision: 1.0 Print Date: 19-Sep-07

# Material Name: Impact Polystyrene, Natural Grades

MSDS ID: INEOS-NOVA-0056

MSDS Information Email: psinfo@ineos-nova.com

Other Information

Notice to Reader

ALTHOUGH THE INFORMATION CONTAINED IN THIS DOCUMENT IS PRESENTED IN GOOD FAITH, BASED ON AVAILABLE INFORMATION BELIEVED TO BE RELIABLE AT THE TIME OF PREPARATION OF THIS DOCUMENT, INEOS NOVA MAKES NO WARRANTIES OR REPRESENTATIONS WITH RESPECT TO THE INFORMATION OR THE PRODUCTS DESCRIBED HEREIN, AND EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES AND CONDITIONS (INCLUDING ALL WARRANTIES AND CONDITIONS OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE). NO FREEDOM FROM INFRINGEMENT OF ANY PATENT OWNED NY INEOS NOVA OR OTHERS IS TO BE INFERRED. THIS INFORMATION IS SUBJECT TO CHANGE WITHOUT NOTICE. PLEASE CONTACT INEOS NOVA FOR THE MOST CURRENT VERSION OF THIS MSDS. INEOS NOVA DOES NOT ASSUME RESPONSIBILITY FOR MSDS OBTAINED FROM THIRD PARTY SOURCES.

RESPONSIBILITY FOR USE, STORAGE, HANDLING AND DISPOSAL OF THE PRODUCTS DESCRIBED HEREIN, WHETHER ALONE OR IN COMBINATION WITH ANY OTHER SUBSTANCE, IS THAT OF THE PURCHASER AND/OR END USER.

This is the end of MSDS # INEOS-NOVA-0056.

Page 7 of 7 Issue Date: September 1, 2007 Revision: 1.0 Print Date: 19-Sep-07



# **PRODUCT INFORMATION**

Issued: October 31, 2008

#### **DESCRIPTION**:

PRODUCT NAME: Black Polystyrene Colour Concentrate

PRODUCT CODE: 10189 BLACK (BK 21102)

#### **PHYSICAL PROPERTIES:**

**CARRIER RESIN** 

TYPE: Crystal Polystyrene

MELT INDEX 7.0 g/10 min. ASTM D-1238, Cond. 200/5

DENSITY: 1.04 g/cm<sup>3</sup>

**MASTERBATCH** 

PIGMENTATION: 25% (Nominal)

#### **FOOD APPROVAL STATUS:**

<u>FDA:</u> The ingredients in this product are regulated for use by the FDA according to the guidelines of paragraphs 177.1640, 178.3297, and 178.2010 of Title 21 of the Code of Federal Regulations.

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# **JOHN MEUNIER**

Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference: NC01

# **SLUDGE TANK**

ST-999

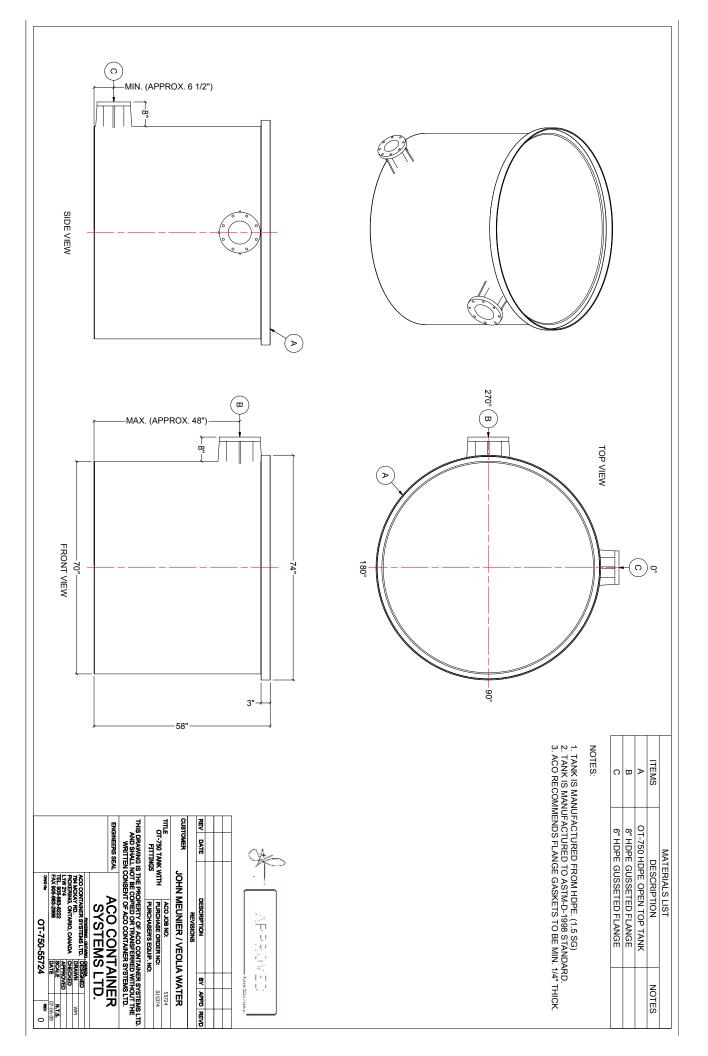


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N N N N N N N N N N N N N N N N N N N	DESCRIPTION	P&ID I.D./TAG					
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	DESCRIPTION Iyethylene	P&ID I.D./TAG			REF. No.	NC01	0
	DESCRIPTION Iyethylene	P&ID I.D./TAG					
	DESCRIPTION	P&ID I.D./TAG			Date:	2009-01-07	7
	lyethylene	I.D./TAG	CAT.	SOURCE	FA/SA FI	N/d	
N M DI LO S W N	lyethylene	T4-011	B80		SITE		
High Density Pol Supplier Aco Container Model: OT-750 Capacity: 3400L Top: Open (no lid) Dimensions: 70" diameter X 5 Weight: 250 Lbs Nozzles:	lyethylene				-		
Supplier							
Aco Container							
Model:   OT-750   Capacity:   3400L    Top:   Open (no lid)   Dimensions:   70" diameter X 5   Weight:   250 Lbs   Nozzles:							
OT-750  Capacity:							
Capacity:   3400L							
3400L  Top: Open (no lid) Dimensions: 70" diameter X 5 Weight: 250 Lbs Nozzles:							
Top:   Open (no lid)   Dimensions:   70" diameter X 5   Weight:   250 Lbs   Nozzles:							
Open (no lid) Dimensions: 70" diameter X 5 Weight: 250 Lbs Nozzles:							
Dimensions: 70" diameter X 5 Weight: 250 Lbs Nozzles:							
70" diameter X 5 Weight: 250 Lbs Nozzles:							
Weight: 250 Lbs Nozzles:	58" tall						
250 Lbs Nozzles:							
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1x 6" HDPE gus	seted flange						
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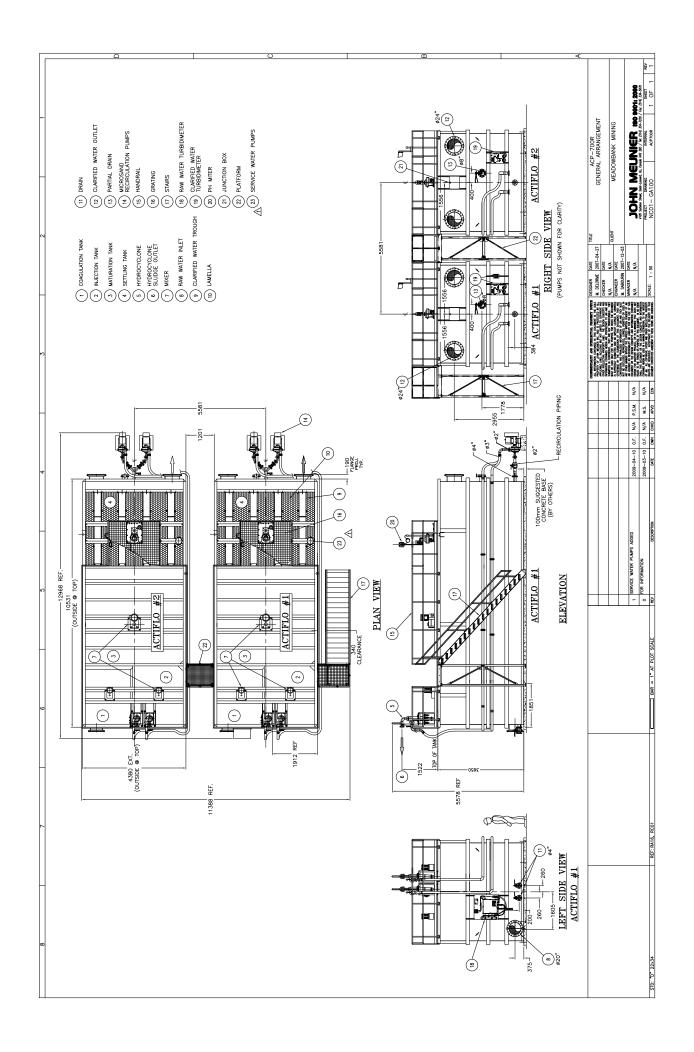


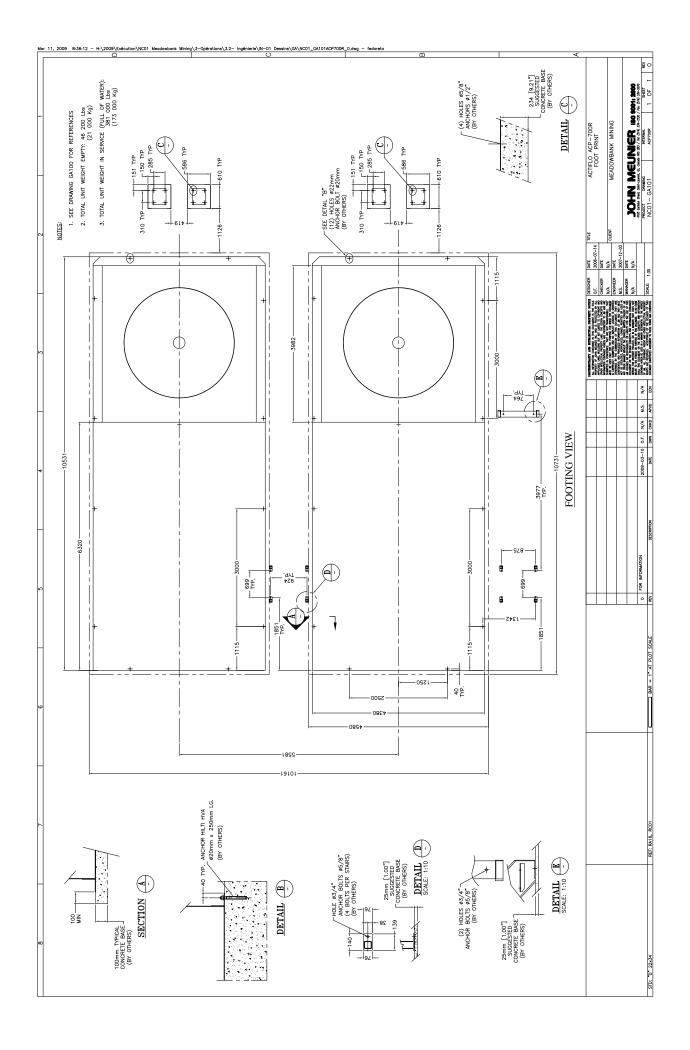


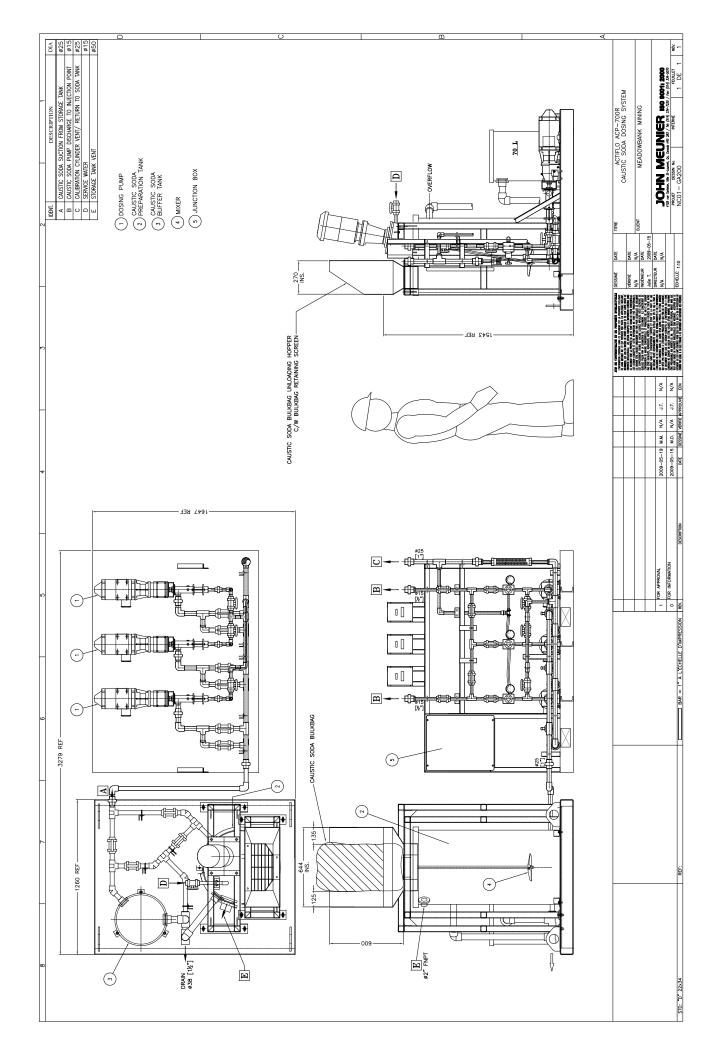
Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference: NC01

# **GENERAL ARRANGEMENT DRAWINGS**











Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference: NC01

## FIELD INSTALLATION DRAWINGS



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2	JOHN MEUNIER		IER					NOMENCLATURE/ BILL OF MATERIALS
	TITRE/TITLE	Re	Rev. DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	MEADOWBANK
٩	ACTIFLO ACP-700R		0 FOR INSTALLATION	0.F.	P.S.M.	2009-04-08	Contract	MINING
ACTI	ACTIFLO AND MICROSAND		1 ADDED ITEMS 97 & 98	O.F.	P.S.M.	2009-06-22		
-	RECIRCULATION,		2				REF. No.	NC01 Rev. 1
	INSTALLATION	.,	3					
DE	DESSIN /DWG # FI	FI100 <sup>2</sup>	4				Date:	2009-04-08
RFV	MHL	ате/ату.	IY.	P&ID	CAT.	SOURCE	FA/SA FI	2
	<u>-</u>	Unit. Total		I.D./TAG	ACCPAC		SITE	-
		(				0		
	NC01F1100-1	7 7	4 HYDROCYCLONE CHAMBER ASSEMBLY			SA150		
	NC01F1100-2		2 OCKAPER REDUCING GEAR BOX ASSEMBLE 2 ACTIEL O ACP-700 TANK ASSEMBLY			SAZ03		
	NC01FI100-4	- 2	4 RECIRCULATION PUMP INLET ADAPTER 3" x 2" DIA			FA122		
	NC01FI100-5	2	4 RECIRCULATION PUMP INLET ADAPTER 3" DIA			FA122		
	NC01FI100-6	2	4 RECIRCULATION PUMP OUTLET ADAPTER 4 3" x 2" DIA			FA121		
	NC01FI100-7	-	ADAPTER-OUTLE 3" DIA			FA120		
	NC01FI100-8	2	45° ELBOW RECIRCULATION PUMP INLET ADAPTER 3" DIA			FA123		
	NC01FI100-9	2	4 MICRISAND RECIRCULATION PUMP (LINATEX 50mm × 50mm)	P2-011, P2-012 P2-021, P2-022	B56	ST-101-1		
	NC01FI100-10	1	2 3mm FF GASKET FOR 4" DIA FLANGE #150					678100
	NC01FI100-11		16 HEX. BOLTS 5/8" DIA. X 3" LG SS 304					621620
	NC01FI100-12		32 WASHER 5/8" DIA SS 304					624095
	NC01FI100-13	80	16 HEX. NUT 5/8" DIA - SS 304					625095
	NC01FI100-14	16	32   STAINLESS STEEL T-BOLT CLAMPS (MIKALOR) 3 9/16"     X 3 13/16" W4 - ALFAGOMMA" # P-322					
	NC01FI100-15	34m 68	68m 80 mm (3") O.D. REINFORCED BLUE CHLOROBUTYL TUBE "ALFAGOMMA" #404LE076894V10					279020
	NC01FI100-16	1	2 SERVICE WATER PUMPS "AURORA" 2"x2" FLANGE	P7-001, P7-002		ST-090-1		
	NC01FI100-17	23 ,	PIPE STRAP FOR 3" PIPE- S			FA130		
	NC01FI100-18	7 6	4 RECIRCULATION SUPPORTS (250mm x 390mm) 18 RECIRCULATION SUPPORTS (150mm x 390mm)			FA124 FA119		
	NC01FI100-20		2 HANDRAIL LENGTH: 1468 mm			FA128		
	NC01FI100-21	2	2 HANDRAIL LENGTH: 1583mm			FA128		
	NC01FI100- 22	1	1 HANDRAIL LENGTH: 2575mm			FA128		
	NC01FI100-23	2				FA128		
	NC01FI100-24	2	2 HANDRAIL LENGTH: 1879mm			FA128		
	NC01FI100-25	7				FA128		
	NC01FI100-26	2	2 HANDRAIL LENGTH: 1879mm			FA128		
	NC01FI100-27	2	2 HANDRAIL LENGTH: 1041mm			FA128		
	NC01FI100-28	4 ,	4 HANDRAILLENGTH: 1751mm			FA128		
	NC01FI100-29		1 HANDKAIL LENGIH: 1983mm			FA128		000001
	NC01F1100-30	12	24 GASKE I 1/8" I HK. RUBBER (25mm x 200mm)					179026

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	TITRE/TITLE		Rev. DESCRIPTION	PAR/BY:	APPR:	DATE:	Affaire /	MEADOWBANK
	ACTIFLO ACP-700R	~	0 FOR INSTALLATION	0.F.	P.S.M.	2009-04-08	Contract	MINING
AC	ACTIFLO AND MICROSAND	AND	1 ADDED ITEMS 97 & 98	O.F.	P.S.M.	2009-06-22		
	RECIRCULATION,		2				REF. No.	NC01 Rev. 1
	INSTALLATION		3					
۵	DESSIN /DWG # FI1	FI100	4				Date:	2009-04-08
REV.	ITEM	QTE/QTY.	DESCRIPTION	P&ID	CAT.	SOURCE	FA/SA FI	Z/d
ļ	: !	Unit.	Total	I.D./TAG	ACCPAC	] ) ) )	SITE	
	NC01FI100-31	46	92 WASHER 1/4" DIA SS 304					624065
	NC01FI100-32	46	92 HEX. HUT 1/4" DIA SS304					625065
	NC01FI100-33	4 (	8 3" DIA. RECIRCULATION PIPE (HOSE - FLANGE)			FA132		
	NC01FI100-34	Ν α	4 3" DIA. RECIRCULATION PIPE (FLANGE - FLANGE) 16 3mm FF GASKET FOR 3" DIA FI ANGE #150			FA132		678075
	NC01FI100-36	32	64 HEX. BOLTS 5/8" DIA x 3" LG SS 304					621620
	NC01FI100-37	48	96 HEX. NUT 5/8" DIA - SS 304					625095
	NC01FI100-38	80	160 WASHER 5/8" DIA SS 304					624095
	NC01FI100-39							
	NC01FI100-40	4	8 HEX. BOLT 5/8" DIA. x 3" LG, - SS 304					621620
	NC01FI100-41	8	16 WASHER 5/8" - SS 304					624095
	NC01FI100-42	4						625095
	NC01FI100-43	20L 4						
	NC01FI100- 44	8	16 HEX. BOLT 5/8" DIA. x 2" LG, ASTM F593 - SS 304					
			LOAD CELLS FOR "SEW-EURODRIVE" c/w INSTALLATION ACCESSORIES SUPPLIED BY SEW-					
			EURODRIVEX					
			a-ALPHA 100LB LOAD BEAM (Q.I Y.∵1)  b-FA47/AD4 PI ATF 011011 02 A (ΩTY ·1)					
	NC01FI100-45	_	2 c-FA47/AD4 BRACKET 011011.03.A (QTY.:1)		B68	ST-010-2		
			d-HEXHEAD CAPSCREW M12x1,75-40 (QTY:2)					
			e-HEXHEAD CAPSCREW M3x0,5-5 (QTY.:1)					
			f- LOCK WASHER M12 (QTY.:1)					
			g-nexhead Carscrew Maxu,s-10 (QTY.:Z) h-HEXHEAD CAPSCREW M12x1,75-30 (QTY.:1)					
	NC01E1100_46	C	RECIRCULATION PUMP INLET ECCENTRIC PLUG	V2-012, V2-013	BAG	ST-003-5		
		1	ACTUATOR: MANUAL LEVER	V2-022, V2-023	3	-		
	NC01FI100- 47	_	NIPPEL 1" DIA × 3" LG (MNPT × MNPT), FINISH:  GALVANIZED McMASTER-CARR #4549K893					
			MANUEL VALVE FOR SLUDGE LINES/HOPPER					
	NC01FI100- 48	_	2 CLEANING TYPE: MANUEL BALLE VALVE 1" DIA, FNPT SS316					311101
	NC01FI100- 49	-	1" DIA CAM TYPE QUICK CONNECT HOSE ADAPTER 2 "ALFAGOMMA" MODEL: PART "B" MAT'L:					
	NC01FI100-50	8	16 HEX. BOLTS 1/2" DIA. X 3 1/2" LG. SS 304					621545

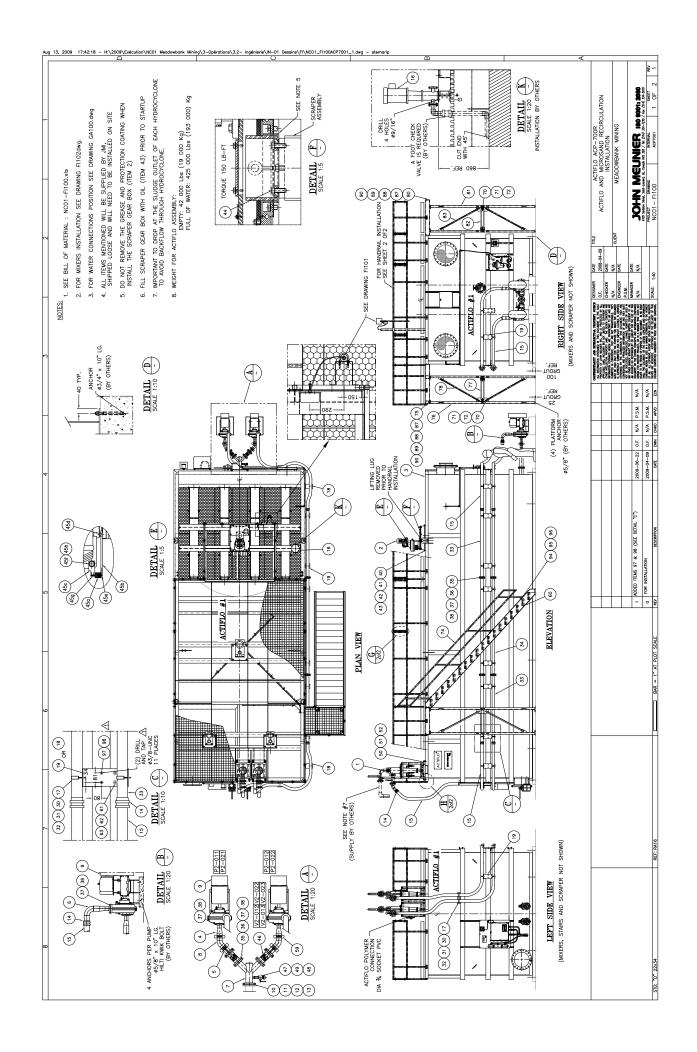
Page 2 de 4 FOR 118F Rev02

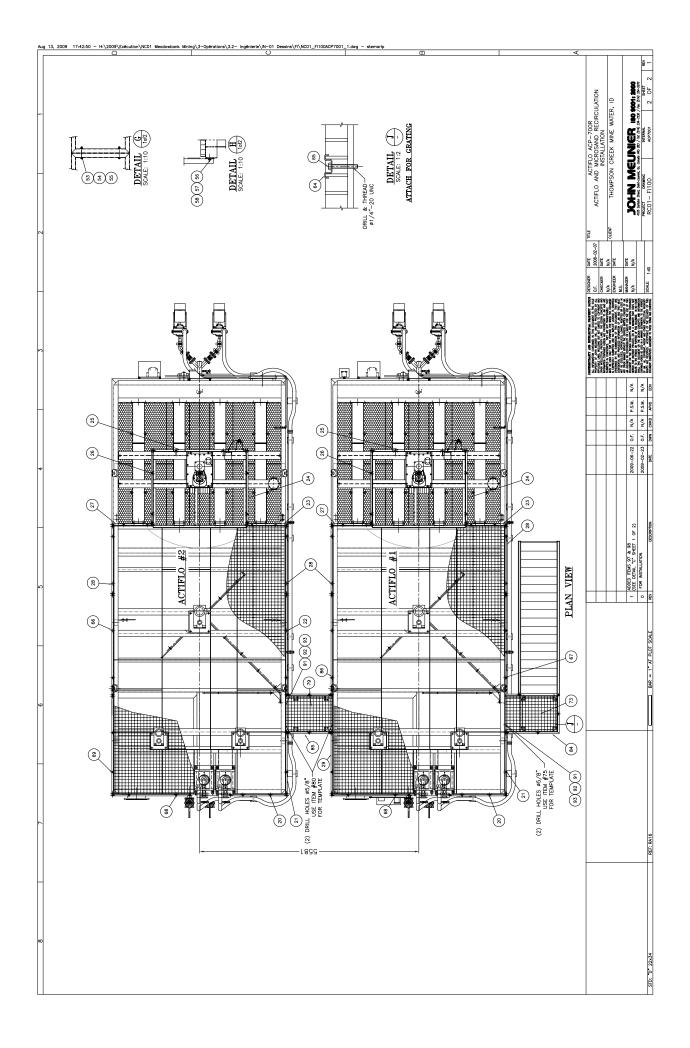
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TITRE/ TITLE		Rev. DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	MEADOWBANK
ACTIFLO ACP-700R		0 FOR INSTALLATION	0.F.	P.S.M.	2009-04-08	Contract	MINING
ACTIFLO AND MICROSAND	AND	1 ADDED ITEMS 97 & 98	0.F.	P.S.M.	2009-06-22		
RECIRCULATION,		2				REF. No.	NC01 Rev. 1
INSTALLATION		3					
DESSIN /DWG # FI1	FI100	4				Date:	2009-04-08
REV. ITEM		DESCRIPTION	P&ID	CAT. ACCPAC	SOURCE	FA/SA FI	N/ d
7	Unit	Total	I.D./TAG			SITE	604085
NC01FI100-51	<u>o</u> «	32 WASHER 1/2" DIA: 3S 304 16 HFX NUT 1/2" DIA: SS 304					625085
NC01FI100-53	26	56 HEX. BOLT 3/8" DIA. x 3 3/4" LG - SS 304					621350
NC01FI100-54	112	112 WASHER 3/8" - SS 304					624075
NC01FI100-55	207	56 HEX NUT 3/8" DIA SS 304					625075
NC01FI100-57		2					624085
NC01FI100-58		104 HEX NUT 1/2" DIA SS 304					625085
NC01FI100- 59	4	8 GROOVED PIPE COUPLING STYLE 77 3" DIA.					
NC01FI100- 60	_	1 STAIRS ASSEMBLY			SA108		
NC01FI100-61	44 8	88 WASHER 1/2" DIA. SS 304					624085
NC01FI100-62	22	44 HEX. NOT 1/2" DIA. SS 304					625085
NC01FI100-63	7.7						62129
NC01FI100- 64	∞	8 McMASTER CARR #7010T72, SS316					668001
NC01FI100- 65	8	8 HEX. BOLT 1/4" DIA. x 1 3/4" LG - SS 304					621125
NC01FI100- 66	_	1 HANDRAIL LENGTH: 2575 mm			FA128		
NC01FI100-67	_ c	1 HANDRAIL LENGTH: 25/5 mm x 3/8 mm			FA128		
NC01FI100-68	7 -	2 HANDRAIL LEINGTH: 2010 MM			FA128 FA128		
NC01FI100-70	48	48 HEX. BOLT 1/2" DIA. x 1 1/2" LG - SS 304					621520
NC01FI100-71	48	48 HEX NUT 1/2" DIA SS 304					625085
NC01FI100-72	96	WASHER 1/2" - SS 304			L		624085
NC01FI100-73		1 STAIRS HANDRAIL			FA136		
NC01FI100-75	_	1 STAIRS PLATFORM			FA137		
NC01FI100-76	2	STAIRS LEG			FA137		
NC01FI100-77	7	STAIRS PLATFORM LEG BRACE,			FA137		
NC01FI100- 78 NC01FI100- 79	4 ←	4 STAIRS PLATFORM LEG BRACE, LENGTH: 1514 mm			FA137 FA134		
NC01FI100-80	1	1 PLATFORM			FA133		
NC01FI100-81	2	2 PLATFORM LEG			FA133		
NC01FI100-82	7	2 PLATFORM LEG BRACE, LENGTH: 750 mm			FA133		
NC01FI100-83	4	4 PLATFORM LEG BRACE, LENGTH: 1497 mm			FA133		
NC01FI100-84	<del>-</del> 0	1 HANDRAIL LENGTH: 1338 mm x 1004 mm			FA128		
NC01FI100-85	7 -	2 HANDRAIL LEINGTH: 1100 MMI			FA128		
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Page 3 de 4 FOR 118F Rev02

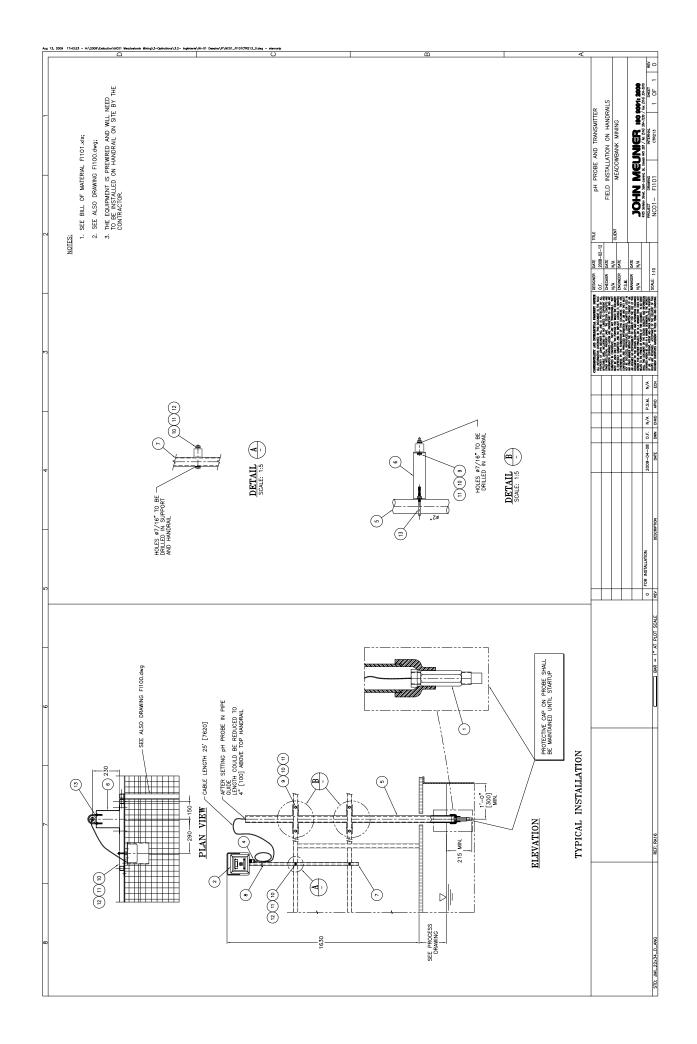
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	TITRE/ TITLE	Rev.	ev. DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	MEADOWBANK
	ACTIFLO ACP-700R		0 FOR INSTALLATION	0.F.	P.S.M.	2009-04-08	Contract	MINING
ACT	<b>ACTIFLO AND MICROSAND</b>		1 ADDED ITEMS 97 & 98	O.F.	P.S.M.	2009-06-22		
	RECIRCULATION,	2	2				REF. No.	NC01 Rev. 1
	INSTALLATION	(*)	3					
DE	DESSIN /DWG # FI1	FI100 4	<del></del>				Date:	2009-04-08
REV.	ITEM	QTE/QTY.	Y. DESCRIPTION	P&ID	CAT. ACCPAC	SOURCE	FA/SA FI	Z / d.
	NC01FI100-87	-	48 WASHER 1/2" - SS 304				5	624085
	NC01FI100-88		24 HEX NUT 1/2" DIA SS 304					625085
	NC01FI100-89	24 2	24 BEWEL WASHER 1/2"					664485
	NC01FI100-90		24 HEX. BOLTS 1/2" DIA. X 2-1/4" LG. SS 304					621533
	NC01FI100-91	9	6 HEX. BOLT 1/2" DIA. x 1 1/2" LG - SS 304					621520
	NC01FI100-92		12 WASHER 1/2" - SS 304					624085
	NC01FI100-93		6 HEX NUT 1/2" DIA SS 304					625085
	NC01FI100-94	16	16 HEX. BOLT 1/2" DIA. x 1 1/2" LG - SS 304					621520
	NC01FI100-95		32 WASHER 1/2" - SS 304					624085
	NC01FI100-96		16 HEX NUT 1/2" DIA SS 304					625085
_	NC01FI100-97	22 4	44 HEX. BOLT 3/8" DIA. x 1" LG - SS 304					621310
1	NC01FI100-98		44 WASHER 3/8" - SS 304					624075
			ITEMS NOT SHOWN					
	NC01FI100-110	2	10 of 50 lbs each)		Υ44	ST-011-1		
	NC01FI100-111	-	2 RAW WATER VALVE "BRAY" 92-2100 - 16" DIA.	V2-011, V2-021	B40	ST-003-1		
	NC01FI100-112	2	4 RECIRCULATION PUMPS DRIP PANS					7E6620
	NC01FI100- 113		1 CLARIFIED WATER TURBIDIMETER - CALIBRATION KIT		B24	ST-004-13		
	NC01FI100-114	-	1 CLARIFIED WATER TURBIDIMETER - VOLUMETRIC 1 FLASK		B24	ST-004-14		





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Ť	JOHN MEUNIER		ER					NOMENCLATURE/ BILL OF MATERIALS
	TITRE/ TITLE	Rev.	ev. DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	MEADOWBANK
			0 FOR INSTALLATION	O.F.	P.S.M.	2009-04-08	Contract	MINING
	PROBE SUPPORT &		1					
	FIELD INSTALLATION		2				REF. No.	NC01 Rev. 0
			8					
	DESSIN /DWG # FI1	FI101 4	4				Date:	2009-04-08
REV	MELL	QTE/QTY.	Y. DESCRIPTION	P&ID	CAT.	SOURCE	FA/SA FI	Z/d
		Unit. Total		I.D./TAG	ACCPAC		SITE	
	NC01FI101-1	1	2 pH PROBE	pHIT2-011		ST-004-8		
	NC01FI101-2	_	2 pH TRANSMITTER			ST-004-9		
	NC01FI101-3	0	0 NON USED					
	NC01FI101-4	_	NONMETALLIC THREADED STRAIN RELIEF PVC 2 CONNECTOR, 1/2" NPT; "IPEX" TSRC10C/W "O" RING, LOCKNUT & 6 GROMMETS FOR CABLE 3/16" @ 5/8"					529065
	NC01FI101-5	-				FA131		
	NC01FI101-6	2	4 MOUNTING BRACKET S.S. 304L FOR HANDRAIL INSTALLATION			FA131		
	NC01FI101-7	1	2 TRANSMITTER SUPPORT S.S. 304L			FA131		
	NC01FI101-8	1	2 NYLON STRAP TYPE "TY-RAP", "THOMAS & BETTS" N° TY25MX					534000
	NC01FI101-9	4	8 BTH. 3/8x2 1/2" (304)					621335
	NC01FI101- 10	, 9						624075
	NC01FI101- 11	, 9	-16UNC					625075
	NC01FI101- 12	7						621345
	NC01FI101- 13	7	U-BOLT FOR PIPE ø2" S.S. 304, c/w FLAT WASHERS AND NUTS					626406
		1						
					_	-		

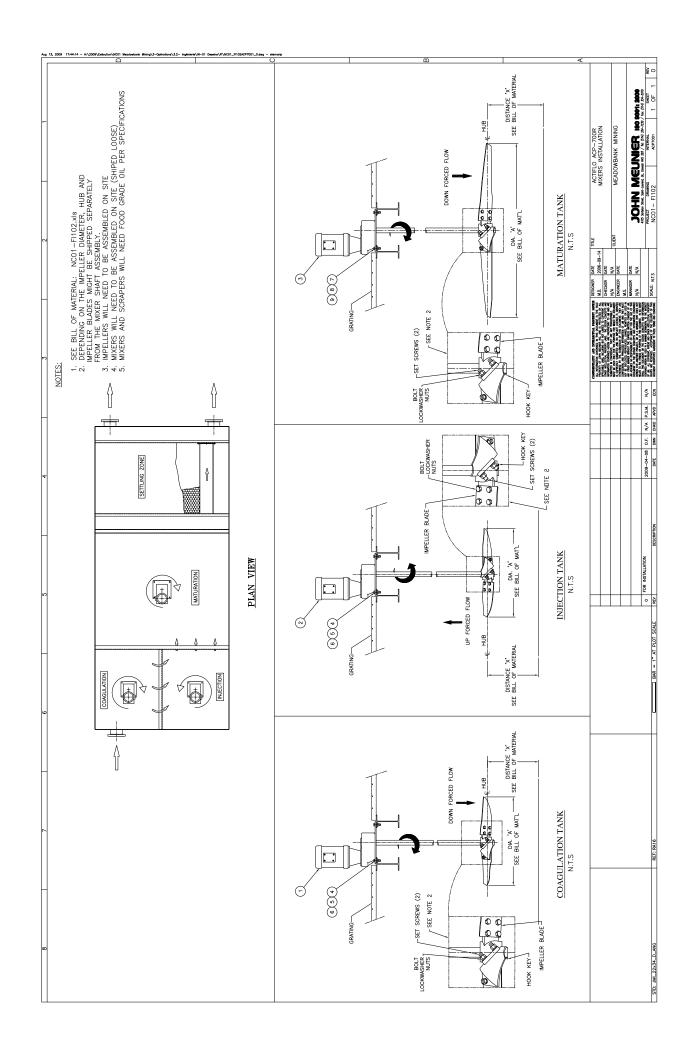


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Y	JOHN MEUNIER	EU	Z	ER					NOMENCLATURE/ BILL OF MATERIALS
	TITRE/ TITLE		Rev.	ev. DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	MEADOWBANK
			0	FOR INSTALLATION	O.F.	P.S.M.	2009-04-08	Contract	MINING
,	<b>ACTIFLO ACP-700R</b>	700R	1	1					
Σ	MIXERS INSTALLATION	ATION	2	2				REF. No.	NC01 Rev. 0
			E	3					
DE	DESSIN /DWG #	FI102	4	+				Date:	2009-04-08
REV.	ITEM	\[ \bar{2} \]	QTE/QTY. Unit.  Total	Y. DESCRIPTION	P&ID	CAT. ACCPAC	SOURCE	FA/SA FI SITE	N/d
	NC01FI102-	7-	<del>-</del>	MECHANICAL MIXER - COAGULATION TANK "ENVIREQUIP" MODEL: EVGX 4-3,0 TYPE: MIX TECH VERTICAL MOUNTED c/w 304 STAINLESS STEEL SHAFT AND IMPELLER SHAFT: DIA.: 57,1 mm (2,25 in), LENGTH: 2711 mm IMPELLER: QTY: 1, DIAMETER "A": 1252,2 mm BOTTOM CLEARANCE "X": 939 mm ROTATION DIRECTION: CW - DOWN c/w MOTOR 3 HP, 480 Vac/3 ph/60 Hz, 1765 RPM, Isolation Class F WEIGHT: 568 lb (258 kg)	M2-011 M2-021	R110	ST-100-1		
	NC01FI102-2	8	~	MECHANICAL MIXER - INJECTION TANK "ENVIREQUIP" MODEL: EVGX 4-3,0 TYPE: MIX TECH VERTICAL MOUNTED c/w 304 STAINLESS STEEL SHAFT AND IMPELLER SHAFT: DIA.: 57,1 mm (2,25 in), LENGTH: 2711 mm ROTTOM CLEARANCE "X": 939 mm ROTATION DIRECTION: CCW - UP c/w MOTOR 3 HP, 480 Vac/3 ph/60 Hz, 1765 RPM, Isolation Class F WEIGHT: 568 Ib (258 kq)	M2-012 M2-022	R111	ST-100-2		

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7	JOHN MEUNIER	IEUI	Ĭ	ER					NOMENCLATURE/ BILL OF MATERIALS
	TITRE/TITLE	,	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	MEADOWBANK
			0	FOR INSTALLATION	O.F.	P.S.M.	2009-04-08	Contract	MINING
	<b>ACTIFLO ACP-700R</b>	700R	~						
_	MIXERS INSTALLATION	-ATION	2					REF. No.	NC01 Rev. 0
			3						
	DESSIN /DWG #	FI102	4					Date:	2009-04-08
REV	V. ITEM	QTE	ατε/ατγ.	DESCRIPTION	P&ID	CAT.	SOURCE	FA/SA FI	N/d
		Unit	Unit. Total	il and the second secon	I.D./TAG	ACCEAC		SITE	
	NC01F1102-3	<u></u>	-	MECHANICAL MIXER - MATURATION TANK "ENVIREQUIP" MODEL: EVGX 6-5,0 TYPE: MIX TECH VERTICAL MOUNTED c/w 304 STAINLESS STEEL SHAFT AND IMPELLER SHAFT: DIA.: 76,2 mm (3 in), LENGTH: 2511 mm IMPELLER: QTY: 1, DIAMETER "A": 2277,9 mm BOTTOM CLEARANCE "X": 1139 mm ROTATION DIRECTION: CW - DOWN c/w MOTOR 5 HP, 480 Vac/3 ph/60 Hz, 1770 RPM, Isolation Class F WEIGHT: 1393 Ib (633 kg)	M2-013 M2-023	R112	ST-100-3		
	NC01FI102-4		8 16	16 HEX. BOLT 3/4"-UNC x 2 1/2" LG., SS 304					621715
	NC01FI102-5		16	16 LOCK NUT 3/4"-UNC, SS 304					625300
	NC01FI102-6	<b>9</b> 16		32 FLAT WASHER 3/4" NOM., SS 304					624100
	NC01FI102- 7		8	8 HEX. BOLT 7/8" x 2 3/4" LG., SS 304					621808
	NC01FI102-8		4	8 LOCK NUT 7/8", SS 304					625305
	NC01FI102-9		8	16 FLAT WASHER 7/8", SS 304					624105



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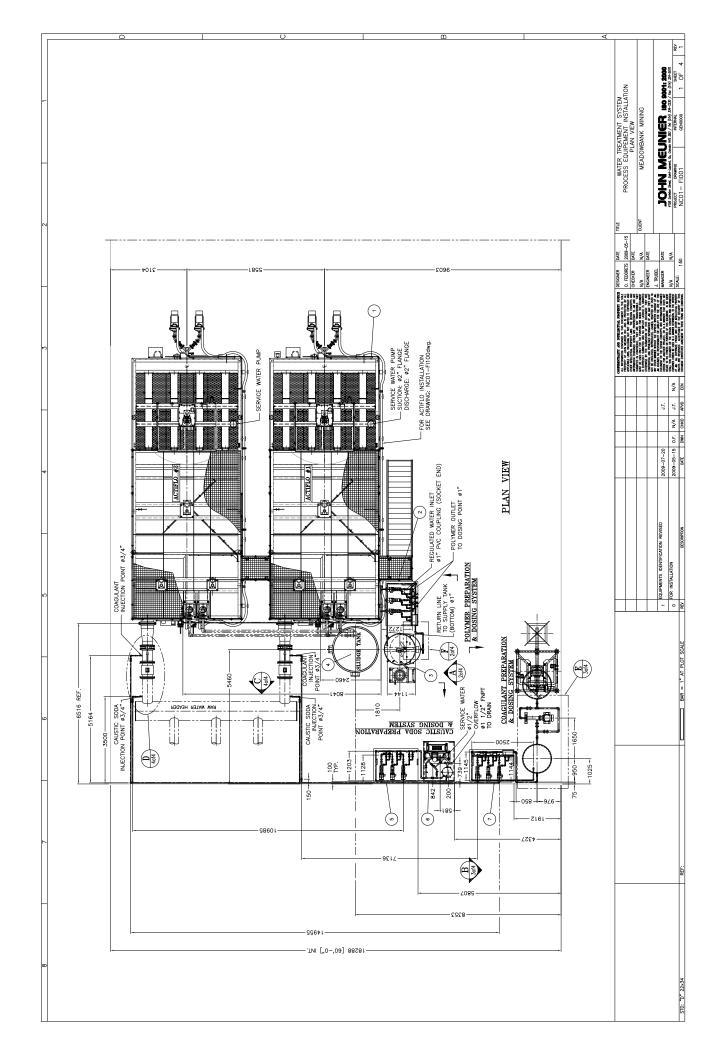
1	JOHN MEDNIER	2	CA CA					BILL OF MATERIALS
	TITRE/ TITLE	Rev.		PAR/ BY:	APPR:	DATE:	Affaire /	MEADOWBANK
		0	FOR INSTALLATION	O.F.	J.T.	2009-05-20	Contract	MINING
>	WATER TREATMENT	_	EQUIPMENTS IDENTIFICATION REVISED		J.T.	2009-07-20		
Œ	FIELD INSTALLATION	2					REF. No.	NC01 Rev. 1
•		3						
DE	DESSIN /DWG # F1001	4					Date:	2009-05-20
REV.	ITEM OT	QTE/QTY.	C. DESCRIPTION	P&ID	CAT. ACCPAC	SOURCE	FA/SA FI SITE	N/d
		7	2 ACTIFLO ACP-700R			FI100		
	NC01FI001-2		1 POLYMER DOSING SYSTEM					
	NC01F1001-3		1 POLYMER AUTOMATIC PREPARATION SYSTEM	DF9-521 T4-011	D48	ST-052-1 ST-999-1		
	NC01F1001-5		1 CAUSTIC SODA DOSING SYSTEM		8	-		
	NC01F1001-6	_	1 MANUAL CAUSTIC SODA PREPARATION SYSTEM					
	NC01F1001-7					H O		
7	NCU1FI001-8	+	Hoist			1-1c0-1s		
	P - P		Boom					
-	Ŷ		Frame (top section)					
1	p-		Frame (middle section)					
_	φ		Mixer					
-	<b>9</b> -		Feeder flexible pipe					
-	Б		Preparation tank					
-	÷.		Frame (lower section)					
-	·Ţ		Dosing tank					
	NC01F1001-9	<del>-</del>	COAGULANT TRANSFER PUMP PROGRESSIVE CAVITY PUMP "SEEPEX": 5000 L/H @ 2 BARS, 541 RPM PUMP MAX SPEED. WITH 2" NPT SUCTION, 2" NPT DISCHARGE, 1 STAINLESS STEEL WETTED CASING PARTS AND ROTOR, MECHANICAL SEAL. STARTING DIRECT ON LINE, 5 HP, 1150 RPM, 575V/3PH/60HZ.	P9-515	D56	ST-051-2		
	NC01F1001-10	8	CORPORATION STOPS MODEL:CCS-56-PVC QUILL 6", BODY PVC, BALL CHECK CERAMIC CHECK, SPRING IN SS 316 AND GLAND SEAL IN EPDM		D56	ST-051-6		
					Č	- C		
	NC01F1001-	7	<sup>2</sup> BALL CHECK CERAMIC CHECK, SPRING IN SS 316 AND GLAND SEAL IN EPDM		D64	51-054-11		
	NC01F1001-12	2	RAW WATER FLOWMETER 16" DIAMETER, 150 LBS FLANGE	FIT-2-011 FIT-2-021	A24	ST-004-6		
	NC01F1001-13	4	4 3mm FF GASKET FOR 16" DIA FLANGE #150					678260

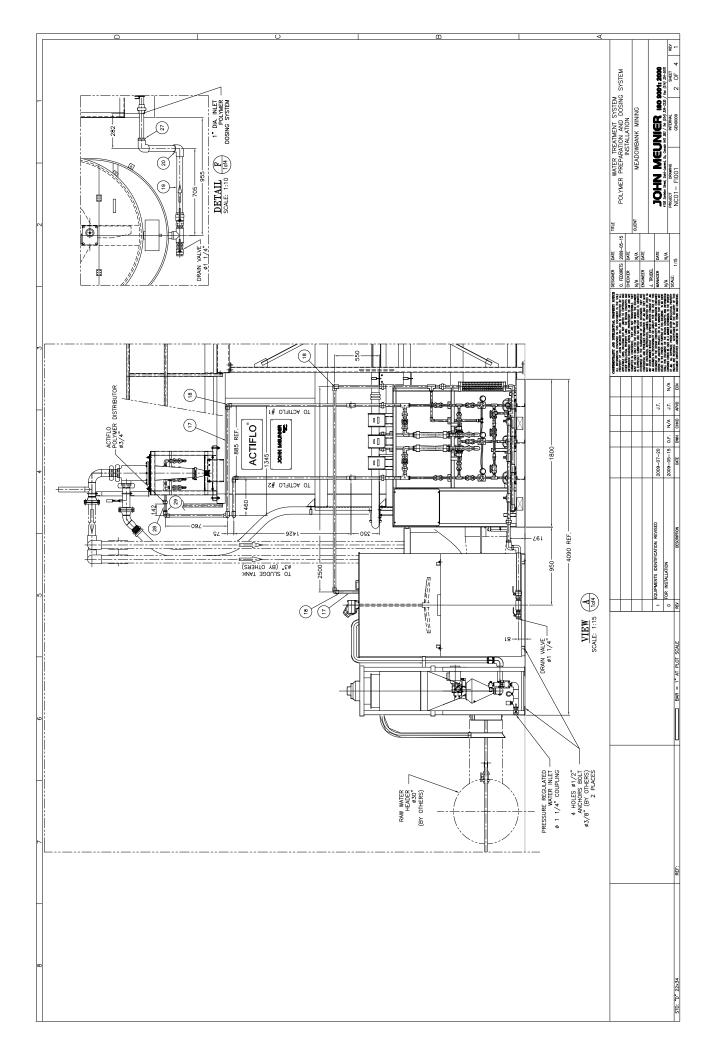
Page 1 de 2 FOR 118F Rev02

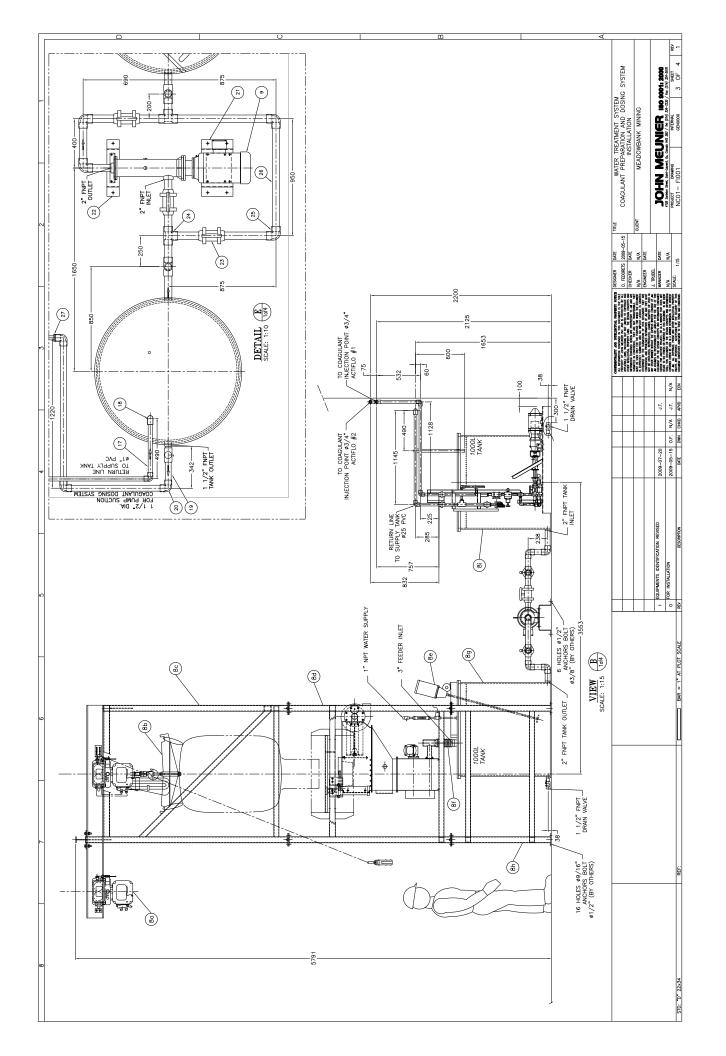
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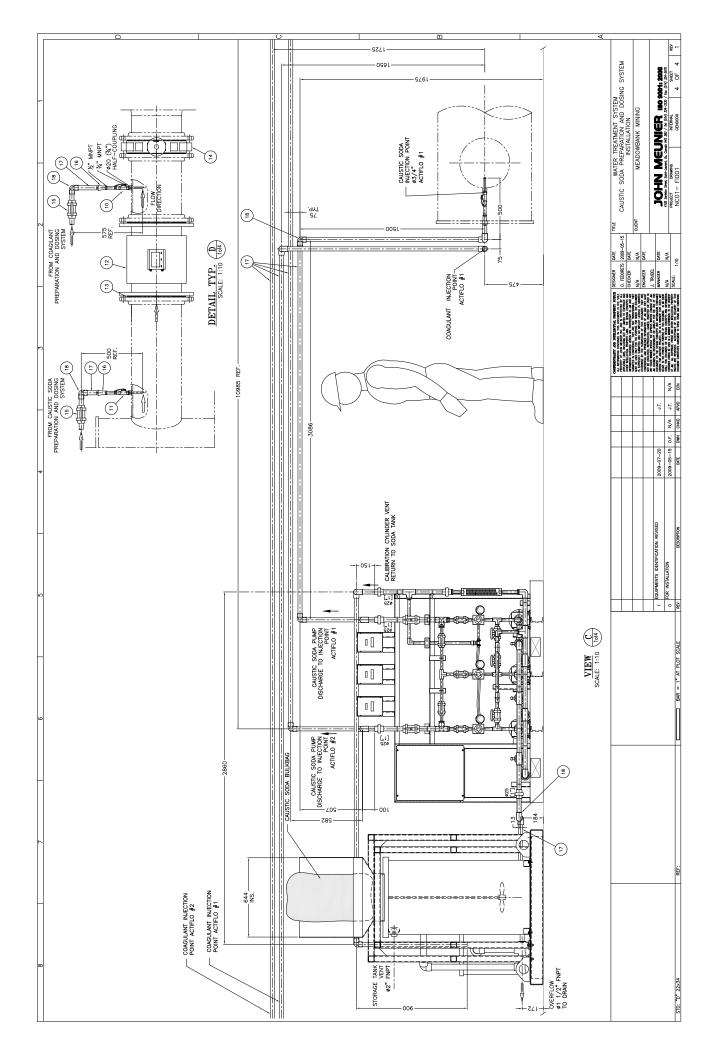
7	JOHN MEUNIER	MEL	Z	MER					NOMENCLATURE/ BILL OF MATERIALS
	TITRE/ TITLE	щ	_	Rev. DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire /	MEADOWBANK
		!		0 FOR INSTALLATION	0.F.	J.T.	2009-05-20	Contract	MINING
-	WATER TREATMENT			1 EQUIPMENTS IDENTIFICATION REVISED		J.T.	2009-07-20		
	FIELD INSTALLATION	ATION		2				REF. No.	NC01 Rev. 1
				3					
۵	DESSIN /DWG #	F1001	_	4				Date:	2009-05-20
REV.	ITEM	0  2	QTE/QTY.	QTE/QTY.  DESCRIPTION  Init Total	P&ID	CAT. ACCPAC	SOURCE	FA/SA FI SITE	N/d
	NC01FI001-14		7	RAW WATER BUTTERFLY VALVE BRAY DIA: 400 mm (16 in). MODEL: 31-119 UC	V2-011 V2-021	B36	ST-003-1		
	NC01FI001-15	-15	4						321085
	NC01FI001-16	- 16	4	4 1x1/2"FNPT REDUCER COL					275748
	NC01F1001-17	-17	_						
	NC01F1001- 18	- 18	49	4					275260
	NC01FI001-19	- 19	_	1 PVC SCH. 80 DIA. 1 1/2" PIPE -3,5m LG. APPROX.					
	NC01FI001- 20	- 20	2						275338
	NC01FI001-21	-21	1				FA001		
	NC01FI001-22	- 22	_	1 COAGULANT TRANSFER PU			FA001		
_	NC01FI001-23	-23	က	က					
	NC01FI001-24	-24	7	7					275379
	NC01FI001-25	-25	8	PVC SCH. 80 DIA. 2" ELBOW 90° SOC × SOC   PEX #36186					275377
	NC01FI001-26	- 26	1	1					
	NC01FI001-27	-27	7	2 PVC SCH. 80 REDUCER BUSHING 2 1 1/2" x 1" (M.SOC x F.SOC) IPEX #36612					275611
	NC01FI001-28	- 28	-						
	NC01FI001- 29	- 29	7	2 PVC SCH. 80 REDUCER BUSHING 1" x 3/4" (M.SOC x F.SOC) IPEX #36606					275605
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Page 2 de 2 FOR 118F Rev02







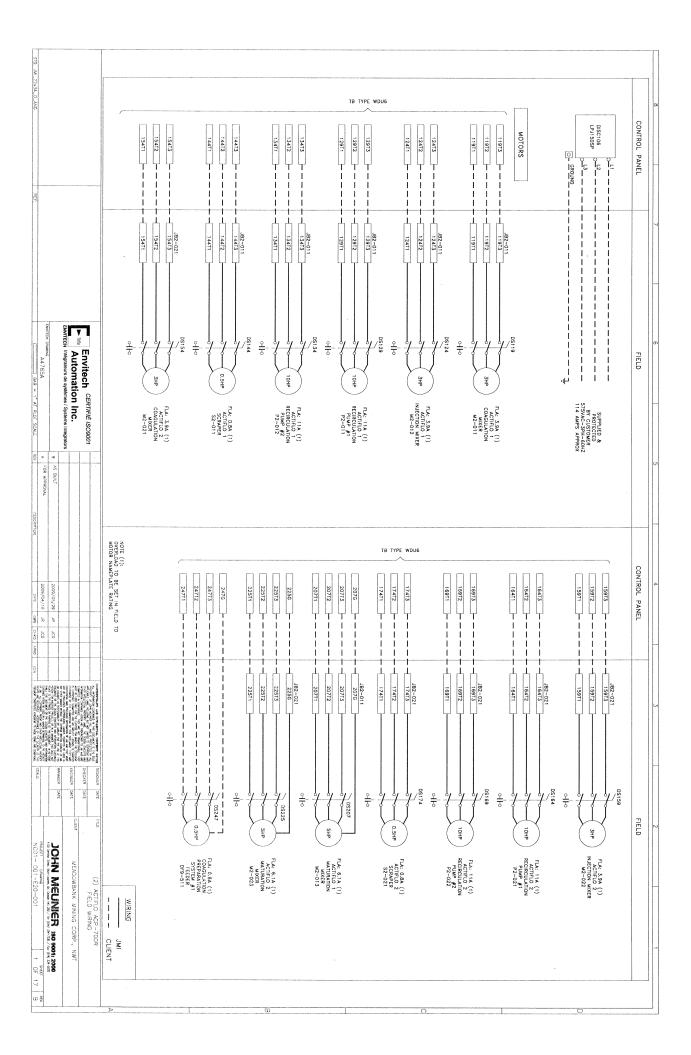




Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference: NC01

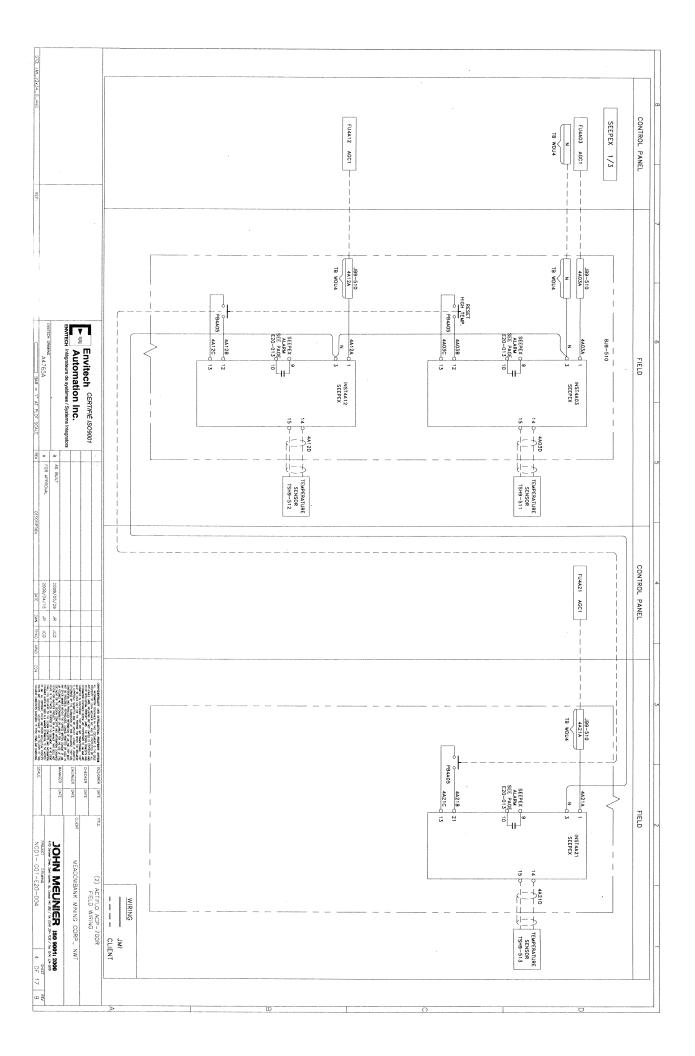
## **ELECTRICAL DRAWINGS FIELD WIRING**

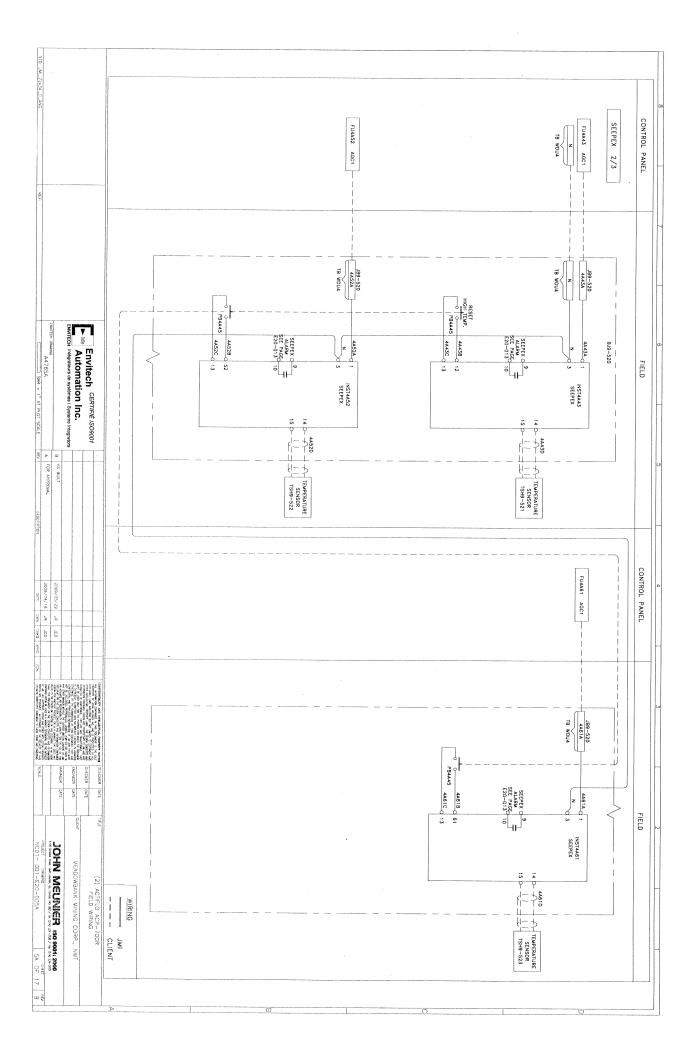


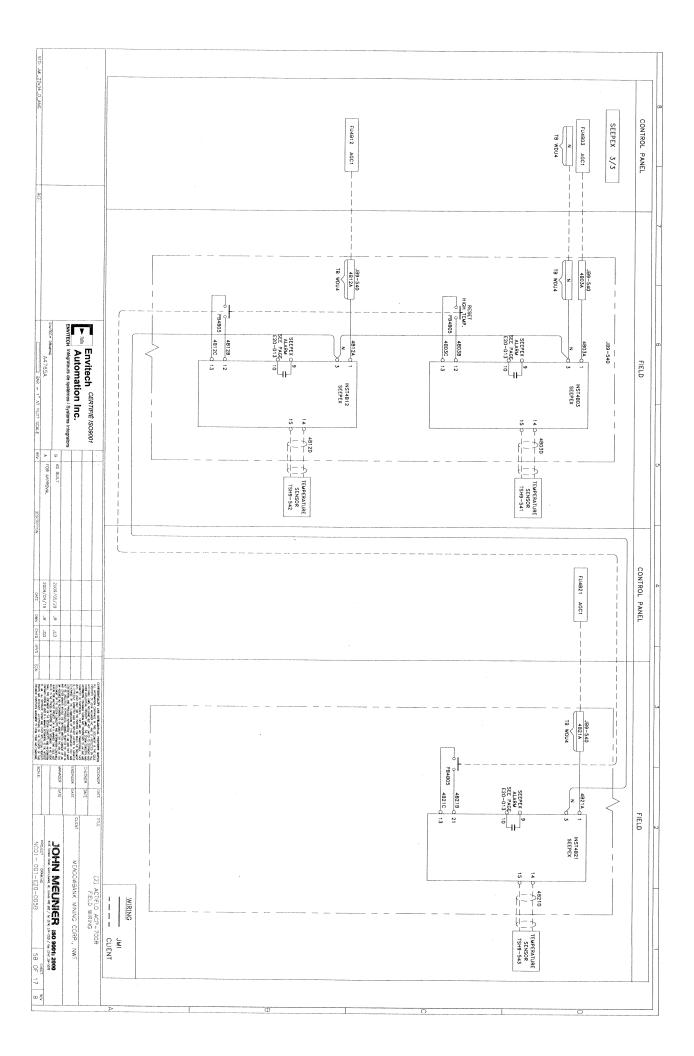


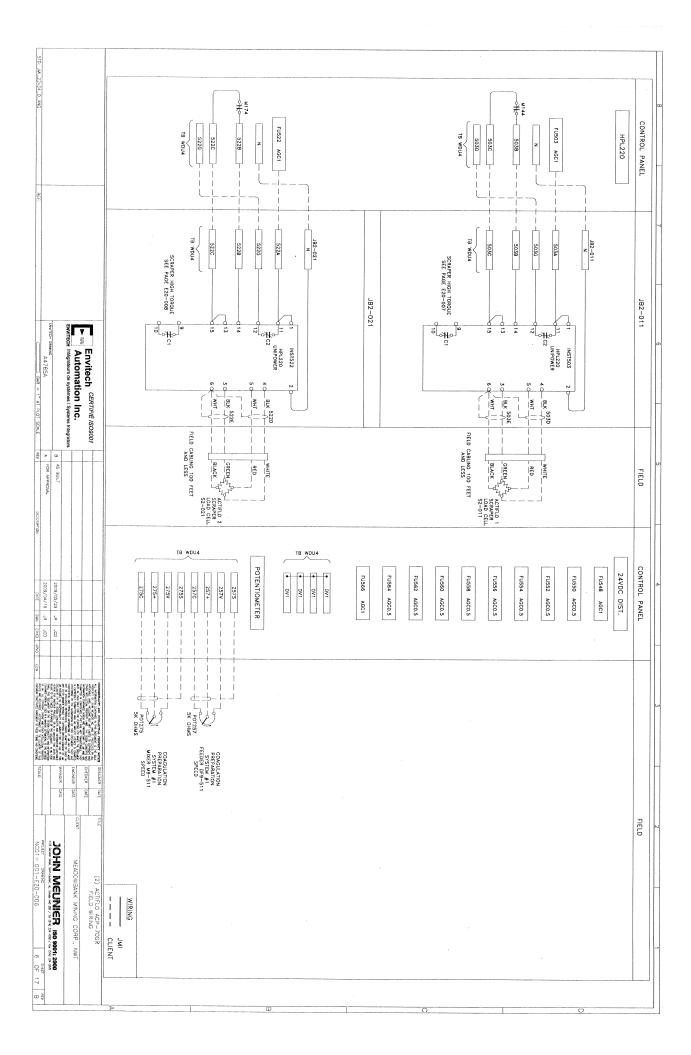
10 . M. 22.44 <u>0 .</u> ANG REF.		2A2513 —————  2A2517 ————————————————————————————————————	2A2013 — — — — — — — — — — — — — — — — — — —	221 22 22 22 23 15 15 17 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	241011 241011 241011 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2A0513 — — — — — — — — — — — — — — — — — — —	28513 — — — — — — — — — — — — — — — — — — —	CONTROL PANEL
-					J82-021 - 2A1013 - 2A1013 - 2A1011	JB2-011 2A0513 - 2A0512 - 2A0517		
Envitech CERTIFIÉ ISO9001  Automation Inc.  ENVIECH Indignaturs de systèmes / Systèmes Insgrators  ONTECH DANIE A4765A  DANIE I A1 PLOT SOLLE	NOTE (1). OVER NO.): O BE SET IN FIELD TO MOTOR NAMEPLATE BATING	052425 052425 05349 0.549 0.549 0.549 0.549 0.549 0.549 0.549 0.549 0.549 0.549 0.549 0.549 0.549 0.549 0.549	DS2A20  FLA: 2.7A (1)  COAGULATION TRANSFERT PUMP TRANSFERT PUMP TRANSFERT PUMP	0522.15    1	052A10  050A(1)  1.54P  1.54P	052A05  052A05  FLd: 9.0A (1)  SERVICE #1  F7-011	DS2555  FLA: 1.4A (1) COLOULATION PREPARATION PREPARATION WEER WHEER WHEER WHEER	FIELD
A FOR BUILT B & SOURT CONTRIBUTION CONTRIBUT	EEL IN FEELD TO							
2009/18/29 .8 .0D 2009/34/16 .8 .4/D 2009/34/16 .9 .4/D 2009 .000 .000 .000								CONTROL PANEL
717-75   1900-100								
MAGUITELO ACPTOOR  AREAD WIRNO CORP., NWT  JOHN MEADOWBANK MINING CORP., NWT  JOHN MELVINER 180 9001; 2000  AGUIT COMMON AND AREAD AND A	WIRING  CLIENT							FIELD

STD: JM_22245_D_AND REF:			FU407 AGES FU409 AGES		FU403 ACCS	o cesses sa	° ° CB315 5A	o casor sa		TB WDU6	120VAC DIST.	CONTROL PANEL
0x4750 Dawne 4755A A4755A 948 * 1* A1 P.01 SDAE	Envitech CERTIFIE ISOSOOT  Automation Inc.  ENVITED! Indepreture of experiment Systems Integrations											FIELD
Over   Over   Over   3,177   Over   Over			3436	355	TB W0U4	315 3436 3436		FU431 AGC2  FU433 AGC2	FU423 AGC2	FU417 A0C2		CONTROL PANEL
WIE DAIE	DATE CUENT		05265		182-011   05207			·	423 — — — — — — — — — — — — — — — — — — —	JB2-011		FIELD
JOHN MEUNIER   ISO 9001: 2000	(2) ACIFICA ACP-700R FIELD WIRING MEADOWBANK MINING CORP., NWT	WIRING JMI CLIENT A	COAGULATION PREPARATION, SYSTEM #1 MIXER M9-5/11 DISCONNECT SWITCH AUXILIARY CONTACT	DECOMECT SWITCH AUXILIARY DECOMECT CONFLICT COACILATION PREPARATION, SYSTEM #1 FEEDER DF9-511 DISCONNECT SWITCH AUXILIARY CONFACT	ACTIFLO 1, MATURATION MIXER  M2-013 CONTECT SWITCH AUXILLARY CONTACT  ACTIFLO 2, MATURATION MIXER  M2-013 2, MATURATION MIXER				ACTIFLO 1, RAW WATER ACTIFLO 2, RAW WATER FLOWMETER FITZ-011, OGSA ACTIFLO 2, RAW WATER FLOWMETER FITZ-021, OGSA COMO PREP. SYSTEM #1 LEPEL 0.5A COMO PREP. SYSTEM #2	ACTIFLO 1 & 2 CLARFIED WATER TURBOYNETER ATZ-021 0.330 ACTIFLO 1.2 RAW WATER TURBOYNETER ATT-011.0.33A		







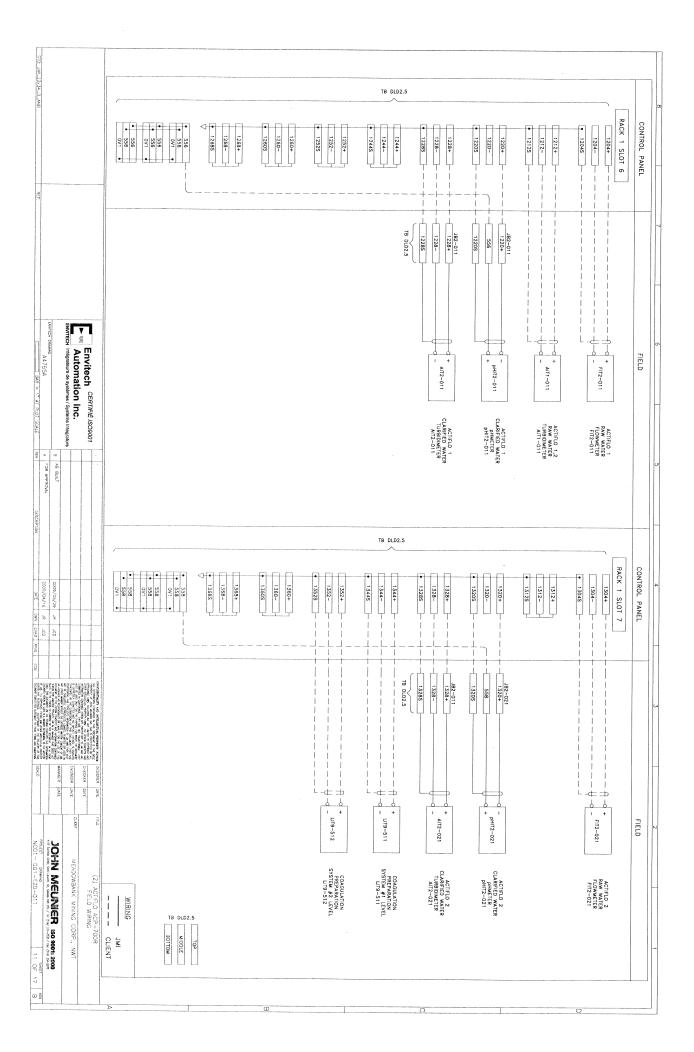


SID, W. 275. M. DAVIG	TB WDU4  TB	CONTROL PANEL
Envitech CERTIFIE (SOS001  Automation Inc.  ENVIECH indignatura de systèmes l'objetents linegrations    Avident   Av	LSL3-510  LSL3-510  LSL3-510  LSL3-510  LSL3-510  LSL3-510  LSL3-511  LSL3-510  LSL3-510  LSL3-510  LSL3-510  LSL3-510  LSL3-511  LSL3-510  LSL3-5	FIELD
0.00   0.00	TB WDU4    RACK 1 SLOT 2	CONTROL PANEL
CONTRIBUTION OF THE PARTY NAME AND ADDRESS OF THE CONTRIBUTION OF	PRECO	FIELD

10. 27. 34. D. ANG		932	925	TB W0U4	904	RACK 1 SLOT 3	0000000
		JB2-021 - 554 932	928		182-021 		
Envitech CERTIFIE ISO9001  Automation Inc.  BMTECH Indignature de systèmes (Systèmes Indignators  AAT 555 A		МОТЕ 2 1857522.01 МОТЕ 2 2 1450 МАН 2-02.1		REM START 2  REM START 2  REM START 2  REMOTE START 2  REMOTE MATERIAL			718.00
1 WOODHAN 803 9		ACTIFID 2 SCALES HIGH TORQUE WARZ-021	ACTICO 2  RECORCILATION PUMP #1 AUTO P2-021-A  ACTICO 2  RECORCILATION PUMP #2 AUTO P2-022-A	PUMP #2 A	L SWITCH		
2009/05/29 JR CCO							CONTROL TANEL
Commence of the commence of th							
PROPER DATE THE COMMENT OF THE COMME							FIELD
WIRING  WIRING  CLIENT  (2) ACTIFLO ACP-700R  FIELD WIRING  MEADOWBANK MINING CORP NWT  JOHN MEUNICR 180 9001; 2000  100 5000 900 600-1000 (100 100 100 100 100 100 100 100 10							

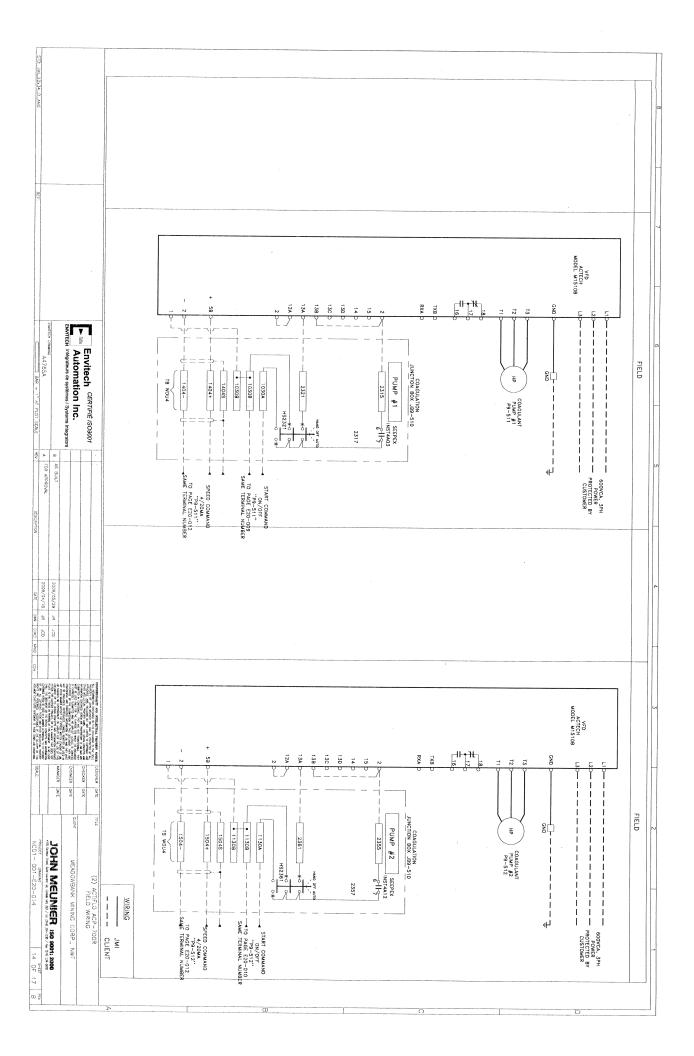
STD: JM. 272.34. J. ANG		1018A — — — 1018A 1018B		1014B	CR1014	TB WDU4		C81008	1006	RACK 1 SLOT 4	CONTROL PANEL
Envitech CERTIFIÉ ISO3001  Automation Inc.  EWITECH Integrateurs de systèmes l'Système longrators  MATRICH DAMPIN AUTOMATICA B. AS SULT  INVITED D		ACIFLO ACIFLO INJECTION MIXER M2-012 INJECTION MIXER M2-012 LOCAL DISCONNECT AUX. CONTACT	OHO CONGLUTION MIXER M2-011 COCAL DISCONNECT AUX. CONTACT COCAL DISCONNECT AUX. CONTACT COCAL DISCONNECT AUX. CONTACT	1		SPARE (DRY CONTACT)	COMMON GENERAL ALARM (DRY CONTACT)			-	. FIELD
2009/05/29 & 000 2009/05/29 & 000 2009/05/29 & 000 2009/05/29 & 000	z	CR1036	CR1034	1032A	CF1030 CHOY 1030A	TB WDU4	1026	10248	1022	CONIROL PANEL	CONTROL PANEL
1700   1700				J89-520 0.25A		10288 OF 1028A	10268 052.05 1026A	J82-011 D5144 O∏O	1022 0519 1022A	FIELD	F1F17
(2) ACTIFLO ACP-700R FELD WIRNO MEADOWBANK MINING CORP., NWT  JOHN MEUNICR 150 9001; 2000 15 USD AND ACTION OF 10 9001; 2000 15 USD AND ACTION OF 10 9001; 2000 16 USD AND ACTION OF 10 9001; 2000 16 USD AND ACTION OF 10 9001; 2000	le.	POLYMER POLYMER POLYMER POLYMER POLYMER POLYMER POLYMER SAME TERNINAL NUMBER	POLYMER POLYMER POLYMER POLYMER POLYMER POLYMER SAME TERMANAL NUMBER SAME TERMANAL NUMBER	POLYMER TRANSPORT WATER VALVE #1 V9-521	COAGULANT PLUMP #1 REMOTE START PLUMP #1 REMOTE START TO PAGE E20-014 SAME TERMINAL NUMBER	ACTIFLO 1 RECIRCULATION PUMP #2 P2-012 LOCAL DISCONNECT AUX. CONTACT	SERVICE WATER PLUP #1 P7-011 LOCAL DISCONNECT AUX. CONTACT	ACTIFLO 1 2-011 SCRAFER S2-011 LOCAL DISCONNECT AUX. CONTACT	ACTIFUD 1 RECHECULATION PUMP #1 P2-011 LOCAL DISCONNECT AUX. CONTACT		,

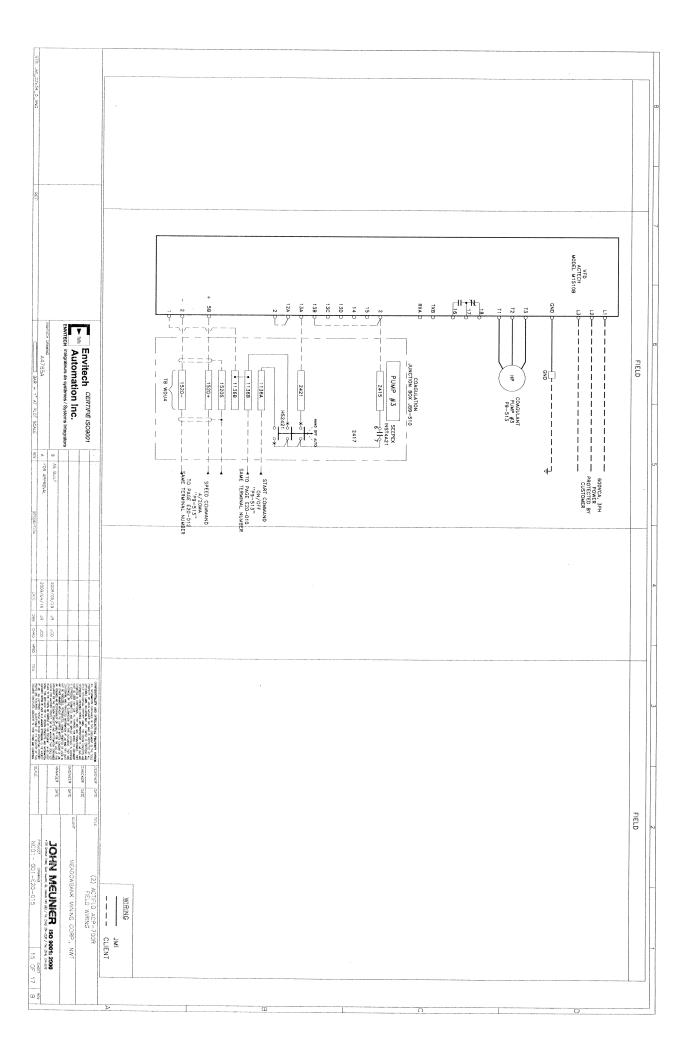
M. 223-34, U. J. WG	88111 1118A	CB1014	TB WOU4  CR1110  11108  11108	CR1106 	CONTROL PANEL RACK 1 SLOT 5
Envitech CERTIFIE ISO9001  Automation Inc.  EWITECH Independs to systems i Systems integrators  A 1/55A  But = 1 'A P.00' SCAL RV  A 1/55A	182-021  DS159  ACTEO 2  NECTION MIXER M2-022  OCAL DISCONNECT AUX. CONTACT	ACTELO 2   RUNNING   RUN	DRY CONIACT)	SPARE (DRY CONTACT)	FIELD
16 50 50 50 50 50 50 50 50 50 50 50 50 50	NHACT  CR1134   OHO  11348  NTACT  CR1136   CR1136  OHO  11388   11388	CR11.50	11268 11268 11269 11289	1122 11228 1122 11228 11228 11228 11240 11240	CONTROL PANEL .
	POLYMER BUND #3 READTE START BOUND #3 READTE START TO PAGE E20-017A SAME TERMINAL NUMBER COAGULANT DO PAGE E20-015 TO PAGE E20-015	COADUANT P9-512  0.25A  0.25A  P0.45R  P0.45R  P0.45R  P0.44R  P0.44R		1122	FIELD

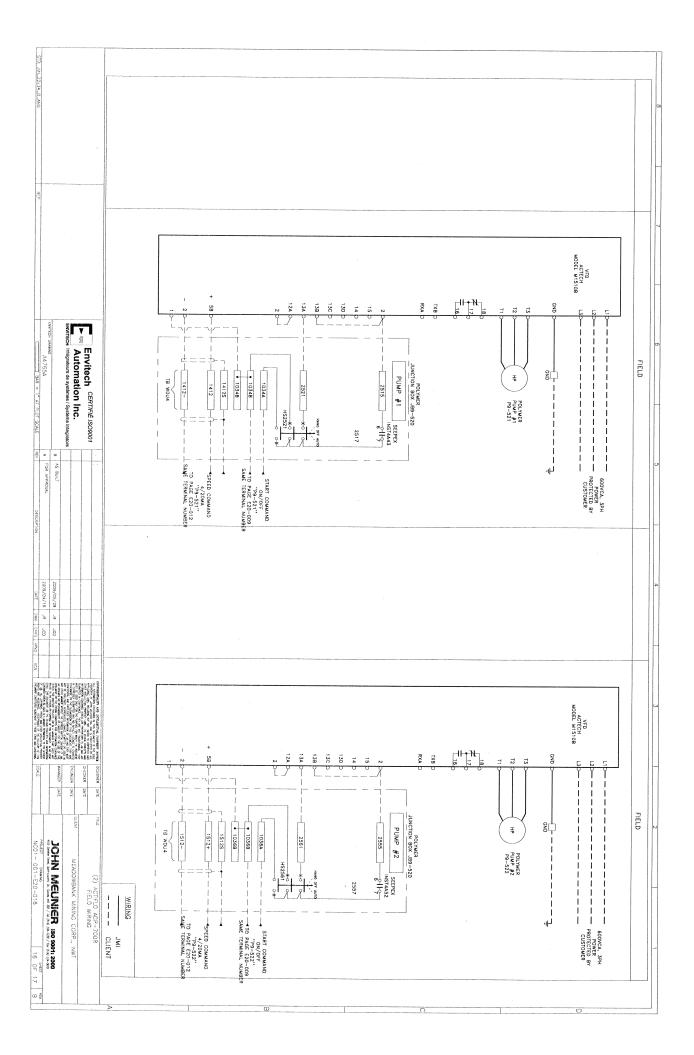


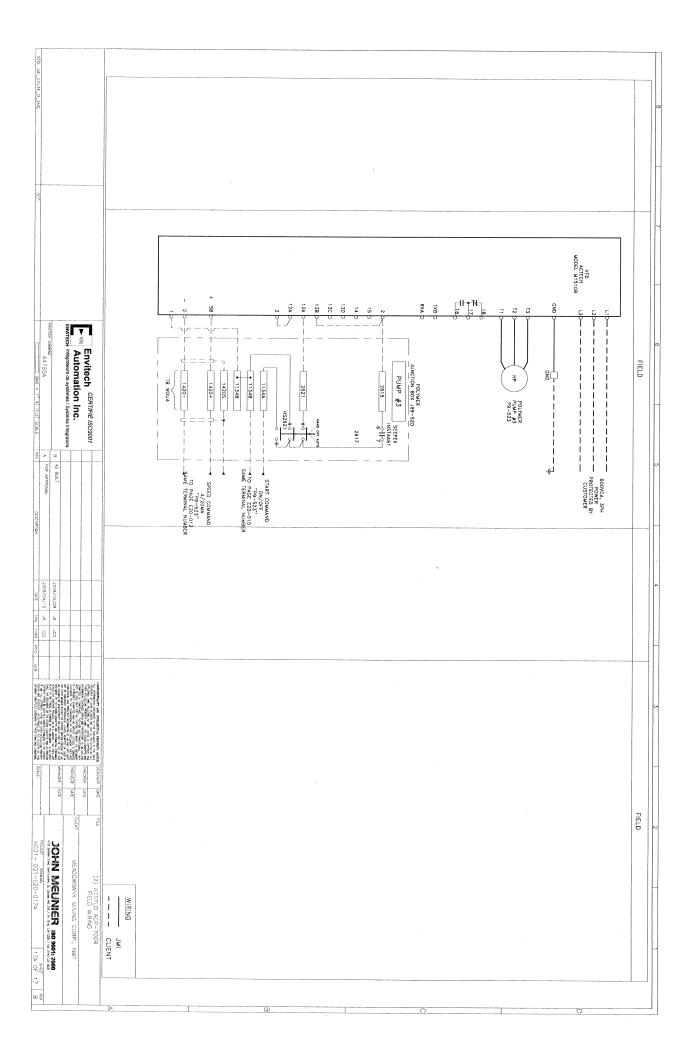
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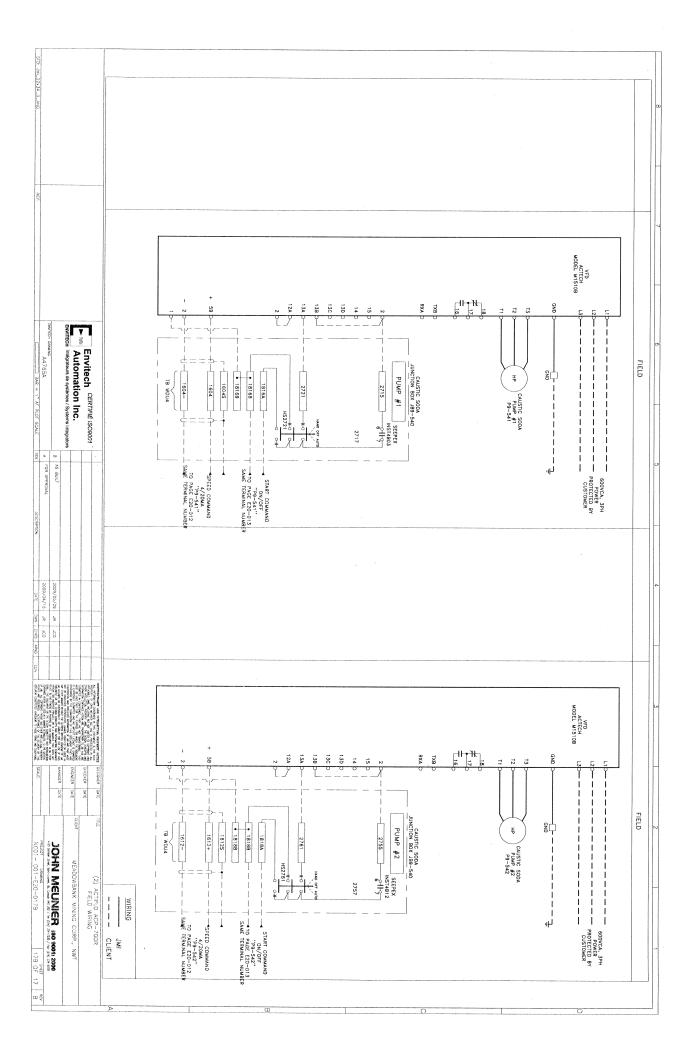
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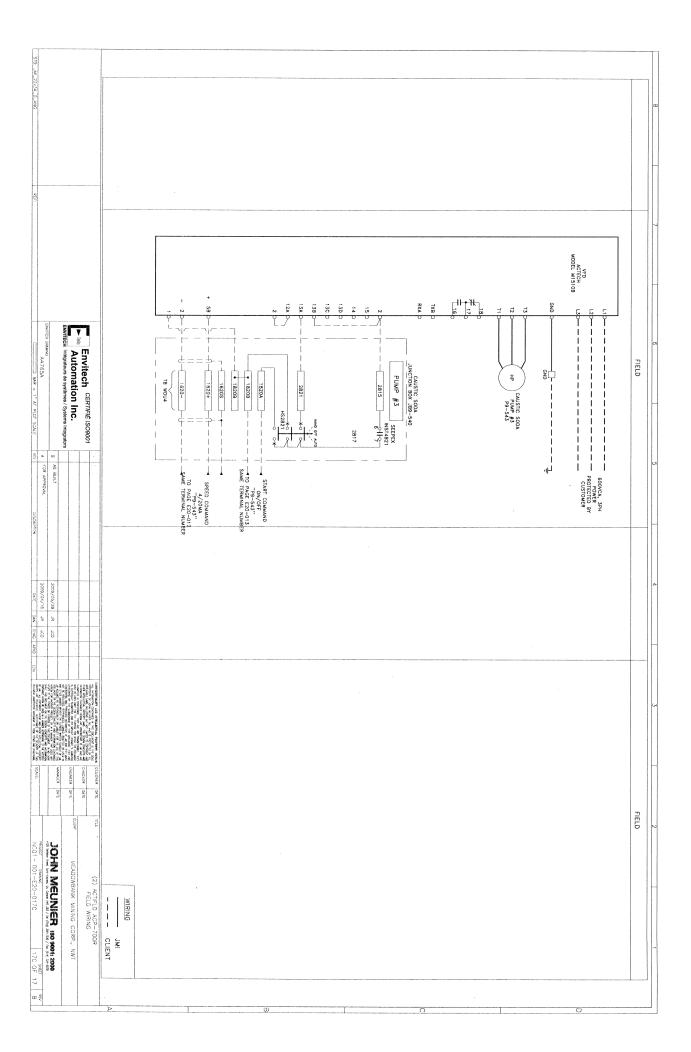


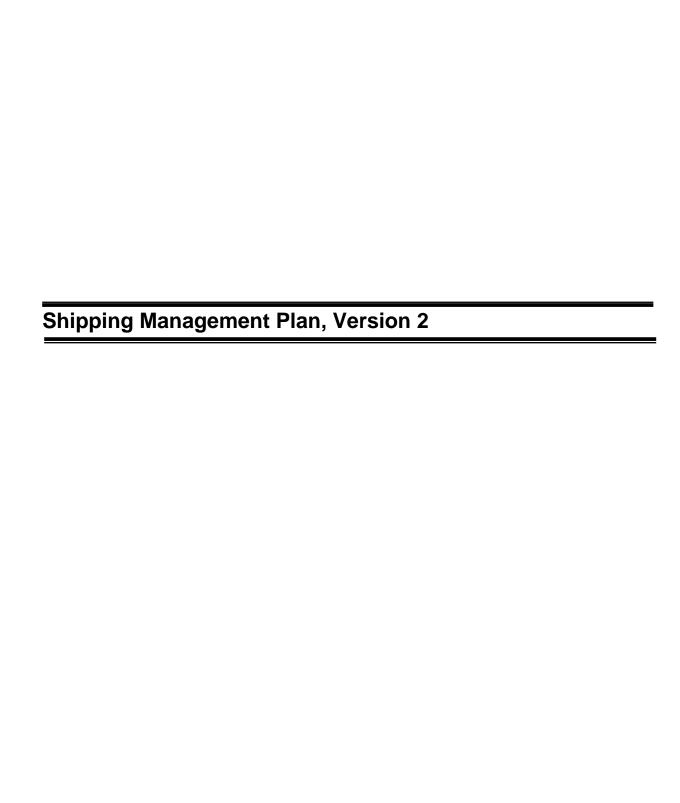














**WHALE TAIL PIT** 

**Shipping Management Plan** 

**APRIL 2018** 

**VERSION 2** 

#### **EXECUTIVE SUMMARY**

The Shipping Management Plan for the Whale Tail Pit Project (the Project) was developed in accordance with federal legislation, notably the *Canada Shipping Act* and the *Arctic Waters Pollution Prevention Act*, and associated regulations. It also recognizes the international conventions and protocols signed by Canada. Agnico Eagle Mines Limited (Agnico Eagle) will provide the necessary human, material, and financial resources to meet or exceed the legal requirements attributable to the company that arise from shipping-related activities. Shipping contractors will be encouraged to do the same. Agnico Eagle and its shipping contractors will carry third party liability insurance.

All shipping will be carried out during the open water season and will follow recommended shipping routes for the annual sea lift to Baker Lake and other Kivalliq Region communities. There will not be any ice breaking to extend the shipping season.

Dry cargo multipurpose vessels and fuel tankers will arrive at a lightering point near Helicopter island where they will anchor approximately 1 kilometre (km) from the island. Dry cargo will be lightered onto tug-assisted barges and fuel will be lightered onto smaller shuttle tankers for transport through the Baker Lake access passage (Chesterfield narrows, south channel) to the Meadowbank Mine barge unloading facilities and laydown area in Baker Lake.

It is Agnico Eagle's intent to prioritize the road transport of hazardous materials, including explosive-related materials, to the Project site to avoid having such cargo remain in storage in Baker Lake. Other contingency measures associated with shipping-related activities include the Project's Spill Contingency Plan, Emergency Response Plan, and Oil Pollution Emergency Plan (OPEP). Risk and hazard assessments of shore-based marine response activities will be undertaken as part of training the Emergency Response Team.

Navigation through the Labrador Sea, Hudson Strait, and Hudson Bay is not challenging during the open water season. Navigation through Chesterfield Inlet also does not represent a major risk with exception of two locations; at Deer Island and Target Rock where passages are narrow and have strong currents. No major hazards are identified along the shipping and tug-barge routes under normal conditions.

All ship, tug and tanker Masters will use electronic charts and other electronic navigational aids to provide safety in transit, reduce the risk of accidents, remain within recommended shipping routes and follow their internal navigation charts and guides (e.g., Navigation Arctic Guide) based on their experience. In addition, there are some Project-specific measures concerning navigation in Chesterfield Inlet, including careful assessment of the conditions before entering the inlet, travelling during daytime when possible and good visibility, and making bound-up travel with tidal flood when possible.



Passage through locations with shipping and boating traffic will be coordinated to avoid shipping conflicts, and speed will be reduced where possible to ensure safety. To maximize the safety of the persons travelling in boats near Chesterfield Inlet, Agnico Eagle or the shipping contractor will inform the community of the shipping activities, promote actions that will allow the ship and the small boats to see one another, and, through the Community Liaison Committee, will recommend that all those in small boats wear personal floatation devices.

On board waste management (solid and hazardous wastes, sewage) will be the responsibility of shipping contractors. Agnico Eagle will require the shipping contractors to conform to the *Ballast Management Control and Management Regulations*, which should reduce the risk of invasive species being introduced as a result of shipping activities. Agnico Eagle expects to contract vessels that meet applicable environmental requirements in addition to being reliable and having a superior safety record.

Care will be taken to avoid disturbing marine mammals within the shipping lanes as much as possible and a Marine Mammal and Seabird Observer (MMSO) will be assigned to the ship crew. Ship crew will monitor the shipping lane for marine mammals during transits in Hudson Strait up to the lightering point near Helicopter Island. As in the past, monitoring will continue using Inuit Marine Wildlife Monitoring aboard the vessels between Helicopter Island and Baker Lake, in accordance with NIRB Project Certificate Condition 36 (NIRB 2006). Mitigation measures may comprise, if safe to do so, slowing the ship and maintaining a safe distance from marine mammals.

Vessels contracted by Agnico Eagle will be required to have an approved Shipboard Oil Pollution Emergency Plan (SOPEP). If an environmental emergency occurs along the shipping routes, the SOPEP will be activated. If needed, close coordination will be maintained with Agnico Eagle's shore-based supervisors who can activate Agnico Eagle's Emergency Response Plan and OPEP to provide assistance to a vessel. Accidents or malfunctions during transit will be reported to Transport Canada. Spills would also be reported to the Environmental Emergencies 24-Hour Report Line and, if necessary, advice would be requested from the Regional Environmental Emergencies Team. Assistance could be sought from nearby ships and the Canadian Coast Guard.



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# **DOCUMENT CONTROL**

Versi on	Date	Section	Page	Revision	Author
1	June 2016	All	All	First draft of plan prepared as part of the FEIS submission.	Golder Associates Ltd.
2	April 2018	All	All	Comprehensive review to ensure plan reflects most up to date information and incorporates Project Certificate 008 Conditions.	Agnico Eagle Mines Ltd.



## **ACRONYMS**

AWPPA Arctic Waters Pollution Prevention Act
BWMP Ballast Water Management Plan

CCG Canadian Coast Guard
ERP Emergency Response Plan
ERT Emergency Response Team

IMO International Marine Organization

MARPOL International Convention for the Prevention of Pollution from Ships

MLA Marine Liability Act

MMSO Marine Mammal and Seabird Observer

OPEP Oil Pollution Emergency Plan

REET Regional Environmental Emergencies Team

SOLAS International Convention for the Safety of Life at Sea

SOPEP Shipboard Oil Pollution Emergency Plan



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#### **SECTION 1 • INTRODUCTION**

Agnico Eagle Mines Limited – Meadowbank Division (Agnico Eagle) has gained extensive experience in shipping fuel and dry cargo to the Meadowbank Mine since its construction began in 2008 and commercial production in 2010. The extension of the Meadowbank mine through the Whale Tail Pit Project (the Project) will utilize shipping arrangements already in use for the Meadowbank Mine and will not incur a net increase in shipping volume within Hudson Bay and Hudson Strait, or a change in shipping procedures (Figure 1-1).

This plan was prepared to comply with the Whale Tail Pit NIRB Project Certificate 008 Condition 37 (NIRB 2018).

## 1.1 Shipping Needs

A total of approximately 60,000 tonnes of dry cargo (equipment and supplies) and 66.8 million litres of diesel fuel will be required annually for the operations of the Project. To meet these needs, a total of three to eight vessels will annually deliver dry goods, and two to three tankers will annually deliver diesel fuel for the Project.

All shipping will be carried out during the open water season (typically from July to late October) and will follow recommended shipping routes<sup>1</sup> that are presently in use for the annual sea lift to Chesterfield Inlet, Baker Lake and other communities.

The priorities in shipping dry cargo and fuel will be:

- the protection of the crew and others in small boats that the ship may come across;
- · the protection of the marine environment; and
- the preservation of the ship and its cargo.

All ships, tugs, and tankers will be equipped with electronic navigational aids. Ships will not be serviced in Chesterfield Inlet and will arrive with enough fuel for the return voyage south.

## 1.2 Shipping Routes

The marine transport of dry cargo will be comprised of five main segments, all within established shipping lanes:

- Bécancour, Québec on the St. Lawrence River, along the coast of Labrador to Hudson Strait;
- through Hudson Strait to Hudson Bay (see Appendix A for marine hydrographic charts showing the shipping lanes);



 $<sup>^1</sup>$  Agnico Eagle's shipping routes within Nunavut are non-compulsory pilotage areas during the ice free shipping season.

- across Hudson Bay to the mouth of Chesterfield Inlet;
- through Chesterfield Inlet to an anchorage point at Helicopter Island at the head of Chesterfield Inlet; and
- through Chesterfield Narrows to the hamlet of Baker Lake (located on northwest shore of Baker Lake).

Dry cargo will be loaded on multipurpose (MPP) vessels, class: GL + 100 A5 E3 (LOA 138.98 m, draft 8 m, freight capacity ~ 19,000 m³) in eastern ports, almost exclusively Bécancour, and delivered directly to the lightering point near Helicopter Island by Nunavut Sealink and Supply Inc. (NSSI). Currently, the contracted vessels supply cargo to both Agnico Eagle operations and the nearby communities. The first vessels of the year will normally arrive in July or early August. As these ships are too large to navigate Chesterfield Narrows (navigational passage between Chesterfield Inlet and Baker Lake), they will anchor near Helicopter Island (Figure 1-1) at the head of Chesterfield Inlet, where the dry cargo will be lightered onto barges for transport to Baker Lake. Up to eight MPP vessels will arrive throughout the open water shipping season delivering dry cargo. All ships will be equipped with complete electronic navigation aids for navigation in restricted waters.

Fuel (diesel (USLD) and Jet A) will be loaded on marine fuel tankers (LOA 130 m, draft 8 m, freight capacity ~ 10 million litres) and delivered to the lightering point near Helicopter Island by Petro-Nav inc. a subsidiary of Groupe Desgagnes. Once the fuel tankers are securely anchored, fuel is transferred to smaller shuttle tankers (LOA ~110 m, draft 4.6 m, fuel capacity ~2,900 m³ diesel). The shuttle tankers then transport the fuel shipment through Chesterfield Narrows to the Meadowbank Mine fuel storage area in Baker Lake. Shuttle tankers will do approximately 13 trips in July or August (delivering 50 million litres total) and 5 trips in October (delivering 16.8 million litres total). On average, up to four million litres of fuel is delivered per tanker shipment.

# 1.3 Lightering Procedures

#### 1.3.1 Dry Cargo

After dry cargo vessels have anchored at Helicopter Island, dry cargo will be lightered onto barges in preparation for transportation to the Meadowbank barge unloading facilities in Baker Lake. During lightering onto the barges, attention will be directed to ensuring the barges are secured alongside or anchored, with due consideration being given to the prevailing and expected wind, weather, and tide conditions.

The tug-assisted barge used to ferry dry cargo to Baker Lake will be highly manoeuvrable and capable of transiting the access passage with its changing current patterns. Navigation will proceed at a slow speed in periods of low visibility. Traffic through the access passage will be coordinated through communication between the tugs to avoid shipping conflicts and to ensure safety.



WHALE TAIL PIT SHIPPING MANAGEMENT PLAN

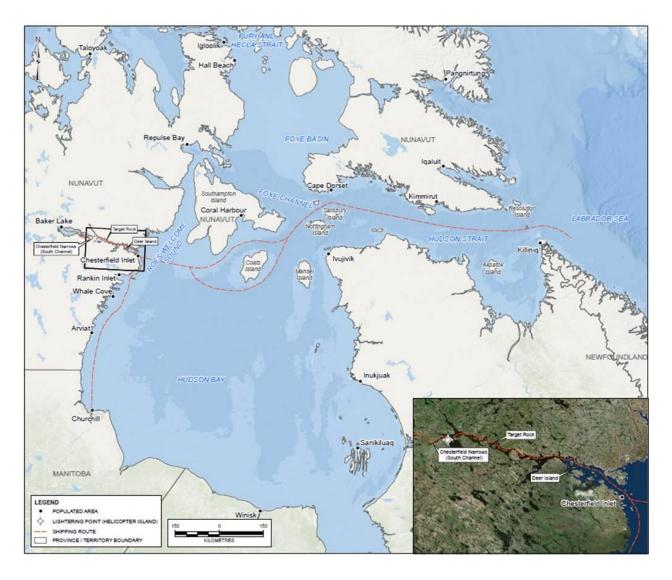


Figure 1-1 Shipping Route

The Master of each vessel (including tugs, barges, large and small tankers, and cargo ships) will be responsible for safe navigation of their vessels between the port of departure and point of destination (Helicopter Island and Baker Lake). For tugs, this also includes responsibility for navigational safety of the barge they are towing or pushing. When a barge is laid alongside a dry cargo vessel for lightering containers or equipment, a loading supervisor on the ship will take charge of the barge.

Outgoing containers, cargo and materials will be loaded on barges in Baker Lake, and then transported to Helicopter Island where it will be loaded onto the cargo ship for the return trip to southern ports. Outgoing cargo could include construction equipment being demobilized following the completion of construction and/or hazardous or other waste being sent to a certified waste management facility for treatment, recycling and/or disposal in another provincial or territorial jurisdiction.

#### 1.3.2 Diesel Fuel

It is expected that the large tankers delivering diesel fuel will anchor in the same general location as the dry cargo vessels (i.e., near Helicopter Island; Figure 1-1). Transfer of fuel will occur from the tanker to a smaller shuttle tanker that can navigate the passage between Helicopter Island and Baker Lake. The shuttle tanker will be offloaded at the Meadowbank Mine barge unloading facilities and the fuel will be transported to the Meadowbank Mine tank farm. Contingency measures related to the transfer of fuel are described in the Oil Pollution Emergency Plan (OPEP).

# 1.3.3 Explosives and Hazardous Materials

A minimum amount of explosives will be stored at the Whale Tail Pit site. The existing emulsion plant at the Meadowbank Mine will be maintained with deliveries on an as need basis during operations. The Project will primarily use emulsion based explosives during construction and operations to minimize the use of ammonium nitrate/fuel oil (ANFO).

It is Agnico Eagle's intent to prioritize the road transport of hazardous materials, including explosive-related materials, to the Project site to avoid having such cargo remain in storage at Baker Lake. Sensitive products such as explosives, boosters and caps will be transported directly to the Project site. However, in the eventuality of a delay in their transit to the mine site, these products will be temporarily stored at the Meadowbank Mine laydown area in Baker Lake according to applicable regulations which include locked storage under constant surveillance. All handling, transport, storage, manufacture and use of explosives will be subject to federal approval under the *Explosives Act*, and the *Nunavut Mine Health and Safety Act*.

Sodium cyanide is used to optimize gold recovery from the ore. This product will continue to be used at the Project. Due to transportation restrictions, normally a full year's supply of sodium cyanide will be transported and stored on site. The product will be transported, stored, handled, transferred and used in compliance with appropriate legislation and applicable Best Management Practices. Agnico Eagle is a signatory to the International Cyanide Management Code.



Hazardous waste and contaminated soil will be managed on a yearly basis; consequently there will be little to no accumulation of such wastes at the Project site during operations, subject to seasonal shipping considerations. Hazardous waste will not be incinerated but returned south via a dry-cargo vessel for treatment, recycling and/or disposal in a certified waste management facility. Agnico Eagle will contract shipping companies that are certified under the IMDG code (International Maritime Dangerous Goods).

#### **SECTION 2 • RELATED DOCUMENTS**

The Shipping Management Plan (the Plan) covers the scope of shipping activities for the Project.

Management and monitoring plans for the Project that provided input to the Shipping Management Plan include the following:

- Spill Contingency Plan;
- Emergency Response Plan;
- · Oil Pollution Emergency Plan; and
- Shipboard Oil Pollution Emergency Plan (shipping companies).

# 2.1 Spill Contingency Plan

The cornerstone of spill contingency planning for Agnico Eagle is the Spill Contingency Plan covering all spills on land, water, and ice. The Spill Contingency Plan, coupled with the Emergency Response Plan, describes the processes to be followed when responding to a spill to the environment.

# 2.2 Emergency Response Plan

The Emergency Response Plan (ERP) focuses on responding to all emergencies in a timely and adequate manner. It commits Agnico Eagle to being prepared for and providing adequate resources - qualified personnel and equipment - to handle a wide variety of emergency situations.

Risk and hazard assessments of shore-based marine response activities will be undertaken as part of training for the Agnico Eagle Emergency Response Team (ERT).

## 2.3 Oil Pollution Emergency Plan

The Oil Pollution Emergency Plan complements the Spill Contingency Plan and should not be construed as superseding it. The OPEP only provides contingency planning for storage of hydrocarbon products at the Meadowbank Mine laydown area in Baker Lake.

The OPEP complies with the requirements for procedures, equipment and resources as set out in the *Canada Shipping Act* (s.s. 660.2(4)) specific to the fuel handling facility, the bulk incoming transfer of fuel from ship-to-shore and spill scenarios directly relating to this operation. Further, the OPEP provides direction to Agnico Eagle personnel and/or contractors, and to Agnico Eagle's ERT in emergency spill response situations. It also contributes in developing oil pollution scenarios, defining the roles and responsibilities of management and responders, and outlining the measures taken to prevent spills. The OPEP seeks to minimize potential health and safety hazards, environmental damage, and cleanup costs.



Spills resulting from ship-to-ship fuel transfer will be the responsibility of the shipping companies contracted by Agnico Eagle and the vessel's Master. Agnico Eagle will provide assistance wherever possible in the event of a spill in these instances.

## 2.4 Shipboard Oil Pollution Emergency Plan

The Shipboard Oil Pollution Emergency Plan (SOPEP) will contain all information and operational instructions as required by the International Marine Organization's "Guidelines for the Development of the Shipboard Marine Pollution Emergency Plan". Vessels contracted by Agnico Eagle will be required to have an approved SOPEP. The preparation of the SOPEP is the responsibility of the shipping company and is maintained by the vessel's Master. However, close coordination will be maintained with Agnico Eagle's shore-based supervisors who can activate the ERP and OPEP in providing assistance to a vessel in the near-shore area. These two plans will have close links to the SOPEP and, as required, will include training exercises at regular intervals to ensure ship and shore can cooperate in responding to any spill of fuel or any other hazardous product. Shipboard Oil Pollution Emergency Plans will be required to include how vessel contractor(s) will maintain spill equipment, and the frequency and framework for training vessel personnel in vessel-based spill response. This may include, but not be limited to:

- spill equipment audits;
- maintaining posted list of spill equipment;
- requirements for spill response drills; and
- on-going training refreshers (e.g., annual renewals).

Accidents or malfunctions during transit will be reported to Transport Canada. If the accident involves the loss of fuel or chemicals, the SOPEP would be activated and on-board spill response materials and equipment put to use. Spills would also be reported to the Government of Nunavut Spill Line and to the Environmental Emergencies 24-Hour Report Line and, if necessary, advice would be requested from the Regional Environmental Emergencies Team. Assistance could be sought from nearby ships and the Canadian Coast Guard (CCG). Spill response resources such as those maintained by the CCG at select locations along the Kivalliq Region coast could be dispatched to the spill site.

Outside help could be requested for major accidents such as accidental grounding/stranding of a vessel. Under these circumstances, the safety of the crew and maintaining the integrity of the vessel would be the first priority.



# SECTION 3 • APPLICABLE FEDERAL ACTS, REGULATIONS AND GUIDELINES

The Shipping Management Plan was prepared in accordance with federal legislation outlined in Table 3-1. Numerous regulations exist under the *Canada Shipping Act* and these can be found at <a href="https://www.tc.gc.ca">www.tc.gc.ca</a>. The regulations included here are most relevant to the environment and the Plan.

Table 3-2 lists international conventions and protocols signed by Canada. Canada is a signatory to International Maritime Organization (IMO) International Convention for the Prevention of Pollution from Ships (MARPOL) and International Convention for the Safety of Life at Sea (SOLAS). As such, Canadian marine laws, regulations and guidelines rules are a reflection of these international conventions, protocols and agreements.

At this time, Agnico Eagle has contracted NSSI and Petro-Nav to be used in Project shipping to Baker Lake. However, the shipping companies could change over the construction, operations and closure phases of the Project. It is required that the shipping contractors to be used by Agnico Eagle abide by Canadian laws and regulations, applicable MARPOL 73/70 annexes, and international conventions. This is also a requirement of NIRB Project Certificate 008 Condition 43. Inspections carried by federal inspectors will ensure that all applicable statutes are followed. This could include the review of required plans (SOPEP), an audit of the emergency response equipment carried by the vessel, and the means to prevent the discharge of any oil, oily water or other hazardous waste in Arctic waters.

All vessels transiting through and operating in Canadian Arctic waters are required to comply with the *Arctic Waters Pollution Prevention Act* (AWPPA), the *Canada Shipping Act* 2001 (CSA 2001), the *Marine Liability Act* (MLA) and their associated regulations, including requirements for vessel construction and operations (see Table 3-1). While the provisions of the CSA 2001 apply in all Canadian waters, vessels in Arctic waters north of 60°N and out to the 200 nautical mile limit of Canada's Exclusive Economic Zone are also subject to the provisions of the AWPPA. The AWPPA prohibits discharges of oil, chemicals, garbage and other wastes generated onboard vessels. It does allow for the discharge of untreated sewage<sup>2</sup>. The MLA sets out a regime that requires vessels operating in Canadian jurisdiction, including Arctic waters, to carry insurance to pay for damages from oil spills.

Two vessel control systems are established under the *Arctic Shipping Pollution Prevention Regulations* – the Zone/Date System and the Arctic Ice Regime Shipping System, which provide for operational safety by taking into account the vessel's capability to operate safely by virtue of ice strengthening, and the ice conditions it will encounter<sup>3</sup>.

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 $<sup>^2</sup>$  Ships are to only discharge gray water and treated sewage when the ship is at least 50 km from Chesterfield Inlet.

<sup>&</sup>lt;sup>3</sup> Agnico Eagle will only ship dry goods and fuel during the open water season.

Vessels servicing the Project will be required to comply with the AWPPA and regulations while in a Shipping Safety Control Zone.

The various shipping companies contracted by Agnico Eagle must have an approved SOPEP, and verify that equipment and operating procedures are consistent with Canadian Marine laws, regulations and guidelines, and with IMO agreements to which Canada is a signatory. It is the responsibility of the Master of the ship to ensure safe passage through Canadian waters and to maintain up-to-date charts and publications<sup>4</sup>.

Agnico Eagle will provide the necessary human, material, and financial resources to meet or exceed the legal requirements attributable to the company that arise from shipping. Shipping contractors will be encouraged to do the same.

Table 3-1 Applicable Acts, Regulation, and Guidelines

Acts	Regulations	Guidelines
Federal Legislation		
Canada Shipping Act, 2001 (S.C. 2001, c. 26) [An Oil Pollution Emergency Plan is required under the Act (168(1)d)]	Response Organizations and Oil Handling Facilities Regulations (SOR/95-405) Pollutant Discharge Reporting Regulations, 1995 (SOR/95-351) Environmental Response Arrangements Regulations (SOR/2008-275) Ballast Water Control and Management Regulations (SOR/2006-129) Vessel Pollution and Dangerous Chemicals Regulations	Oil Handling Facilities Standards – TP12402 Environmental Prevention and Response National Preparedness Plan 2008 – TP13585 Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants – TP9834E 2009 Arctic Waters Oil Transfer Guidelines, 1997 - TP10783E Response Organizations Standards – TP 12401E 1995 Guidelines for the Control of Ballast Water
Canadian Transportation Accident Investigation and Safety Board Act (S.C. 1989, c. 3)	Transportation Safety Board Regulations (SOR/92-446)	Discharge from Ships in Waters under Canadian Jurisdiction (TP 13617)
Marine Liability Act (S.C. 2001, c. 6)	Marine Liability Regulations (SOR/2002- 307)	
Arctic Waters Pollution Prevention Act (R.S.C., 1985, c. A- 12)	Arctic Waters Pollution Prevention Regulations (C.R.C., c. 354) Arctic Shipping Pollution Prevention Regulations (C.R.C., c. 353)	

<sup>&</sup>lt;sup>4</sup> Transport Canada is not the source to provide up-to-date information on changing sea levels or on emergence of new reefs or shoals.

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AGNICO EAGLE

Acts	Regulations	Guidelines
Transportation of Dangerous Goods Act (1992, c.34)	Transportation of Dangerous Goods Regulations (SOR/2001-286)	
Safe Containers Convention Act (R.C.C. 1985, c. S-1)		
Oceans Act (S.C. 1996, c. 31)		
Navigable Waters Protection Act (R.S. 1985 c. N-22)		
Canada Water Act (1985 c.11)		
Fisheries Act (R.S.C. c. F-14)	Marine Mammal Regulations (SOR/93-56)	
	Marine Mammal Regulations (SOR/93-56)	
Species at Risk Act (2002 c.29)		Species at Risk Policies
Canadian Environmental Protection Act (1999 c.33)	Environmental Emergency Regulations (SOR/2003-307) Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2002-301)	
	Release and Environmental Emergency Notification Regulations Storage Tank Systems for Petroleum Products and Allied Petroleum Products	
	Regulations (SOR/2008-197	

Table 3-2 International Conventions and Protocols Signed by Canada

Conventions		
International Convention for the Prevention of Pollution from Ships		
MARPOL 73/78 Annexe	S	
	Objective of Annex is to Prevent Pollution from:	
Annex 1	Oil from ships	
Annex 2	Noxious liquid substances carried in bulk	
Annex 3	Harmful substances carried by ships in packaged form	
Annex 4	Sewage treatment and disposal	
Annex 5	Garbage handling	
Annex 6	Air Pollution from Ships	
International Maritime Dangerous Goods Code		
International Convention for the Safety of Life at Sea, 1974, SOLAS 74		



#### **SECTION 4 • MARINE WILDLIFE**

Marine mammals have been the basis of the Inuit economy for over 4,000 years. They provide meat, fat, oil, leather, tools and materials for fabrication of arts and crafts. The top layers of the skin yield "muktuk", which is still highly prized as a food rich in vitamin C and high in energy content. (Fisheries and Oceans Canada http://www.dfo-mpo.qc.ca/Science/publications/uww-msm/articles/beluga-eng.htm)

The reaction of marine wildlife to vessel traffic is predicted to not be significant and, providing mitigation measures are employed, marine vessel traffic associated with the Project should not lead to any residual effects to marine wildlife (see Volume 3, Appendix 3-A). Agnico Eagle will include in its contracts that ships must remain mindful of marine areas having a high density of marine mammals and birds. Agnico Eagle request ships provide their ship track data for inclusion in annual reporting.

#### 4.1 Interactions and Potential Effects

Vessel discharges (sewage, solid wastes, ballast water), the sight of the vessels and their movement, vessel noise, as well as accidental spills and releases have the potential to interact with and disturb marine wildlife and affect life cycle activities. Possible interactions between shipping and marine wildlife can have the following potential effects:

- marine mammals may retreat to the water should a vessel pass too close to an island or reef where they have pulled themselves out of the water;
- the foraging of marine birds and mammals may be interrupted when vessels approach and pass them in the shipping lanes;
- the improper treatment and release of ballast water, grey water and bilge water could alter the water quality and contaminate the food supply;
- mammal mortalities may result from collisions with the ship; and
- fuel and/or oil spills could result in mortalities and, for marine birds, could lead to the loss of foraging and brood rearing habitat.

#### 4.2 Mitigation Measures

As part of shipping companies' standard operating procedures, ship crews will monitor for marine mammals from Hudson Strait to the lightering point near Helicopter Island. Since 2010, the Meadowbank division has implemented a vessel-based Marine Mammal and Seabird Observer (MMSO) program which will continue to be implemented during all routine project shipping activities along the shipping route (Volume 3, Appendix 3-A), in accordance with Meadowbank Mine NIRB Project Certificate Condition 36 (NIRB 2006). The ship's Master will be notified if there is a concern of the ship striking a marine mammal. Ship personnel will make a decision if actions are required to avoid

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a possible collision. This may include, if safe to do so, slowing the ship until the animal has travelled clear of the ship's course. Subject to vessel and human safety considerations, ship personnel shall take every precaution to avoid disturbance, harassment, injury or mortality of marine wildlife by implementation of the following mitigation measures:

- adherence to monitoring requirements as outlined in the vessel-based MMSO program (Appendix B);
- ships will, when possible, maintain a straight course and constant speed, and avoid erratic behaviour;
- use a routing south of Coats Island as the primary shipping route (Figure 1-1)<sup>5</sup>;
- marine mammals will be given right of way as safe navigation allows; under no circumstances, other than in the case of an emergency, will ships approach within 300 m of a walrus or polar bear observed on sea ice<sup>6</sup>;
- ships will maintain a setback distance of at least 500 metres from colonies and aggregations
  of seabirds and marine mammals during Project shipping transiting through Hudson Strait,
  Hudson Bay, and Chesterfield Inlet<sup>7</sup>;
- if marine mammals approach within 500 m of a ship, the vessel will reduce its speed and, if possible, cautiously move away from the animal;
- if it is not possible for the ship to move away from or detour around a stationary marine mammal or group of marine mammals, the ship will reduce its speed and wait until the animal(s) move to the side and remain at least 500 m from the ship prior to resuming speed;
- when marine mammals appear to be trapped or disturbed by ship movements, the ship will implement appropriate measures to mitigate disturbance, including stoppage of movement until the marine mammal has moved away from the immediate area;
- the ship will not be operated in such a way as to separate an individual member(s) of a group of marine mammals from other members of the group;
- when weather conditions require, such as when visibility decreases, the ship will adjust its speed accordingly to avoid the likelihood of the ship striking an animal;
- barge-tug or shipping vessels would only travel through the near shore islands and reefs when there is good visibility or adjust their speed according to the conditions;
- monitoring and reporting procedures for ship-bird collisions will be implemented, and any incidents of bird mortalities associated with ship operations will be recorded and reported to Environment and Climate Change Canada (Canadian Wildlife Services);
- ballast water will only be released in designated areas and if there is no marine wildlife in the area; and

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<sup>5</sup> In accordance with Condition 38 of NIRB Project Certificate 008

<sup>6</sup> As all shipping will occur during the open water season, collision with young seals in liars will not happen.

<sup>7</sup> In accordance with Condition 39 of NIRB Project Certificate 008

• bilge water, grey water and sewage will be properly treated and only released in areas where no marine wildlife is present.

Marine wildlife could be negatively affected by coming in contact with any petroleum product spilled from ships in transit. In the event of a spill, the ship personnel will discourage marine wildlife from coming in contact with the spilled material. The product most likely to be spilled from Project related shipping would be diesel fuel, which floats on the water surface and has a high rate of evaporation. However, these occurrences are expected to be rare and the activation of the SOPEP would significantly reduce their impact. Preventive and contingency measures already in place substantially reduce the risk to marine wildlife from spills.

Adaptive management will allow mitigation measures to be modified in response to new information arising from monitoring carried out by the vessel crews and from traditional knowledge.

#### 4.3 Monitoring and Reporting

As in the past, monitoring will continue using Inuit Marine Wildlife Monitoring aboard the vessels between Helicopter Island and Baker Lake, in accordance with Meadowbank Mine NIRB Project Certificate 004 Condition 36 and Whale Tail Pit NIRB Project Certificate 008 Condition 42. In addition, as per Condition 40 of Project Certificate 008, a vessel-based MMSO program will be implemented during all Project routine shipping activities in the shipping route. This program, described in further details in Appendix B, will be executed by assigned observers stationed on-board Project vessel(s). Agnico Eagle will continue to report the observations annually to the Nunavut Impact Review Board (NIRB).



#### **SECTION 5 • NAVIGATIONAL SAFETY**

The most likely areas where interactions may occur between small boats and barges-tugs and/or ships or vessels are:

- 1. Chesterfield Inlet;
- 2. the passage between Chesterfield Inlet and Baker Lake; and
- 3. where the ship is transiting through the near shore islands and reefs offshore of Chesterfield Inlet.

Mitigation measures to safeguard the safety of those in small boats will include the following:

- Agnico Eagle and/or the shipping operator will consult with the community members mooring
  or beaching their boats in Chesterfield Inlet regarding scheduled ship transits throughout the
  Regional Study Area, including Hudson Bay and Chesterfield Inlet<sup>8</sup>; protocols will be
  developed to minimize the interaction between barge-tug or ship and small boats;
- vessels would only travel through the near shore islands and reefs when there is good visibility
  or adjust their speed according to the conditions, which would allow the ship and the small
  boats to be in visual contact;
- vessels will restrict themselves to the recommended shipping routes thereby not surprising any small boat travelling outside the shipping lanes; and
- vessels will sound its horn if a small boat seems unaware of its presence and hasn't responded to communication attemps.



<sup>8</sup> In accordance with Condition 41 of NIRB Project Certificate 008

#### **SECTION 6 • ON BOARD WASTE MANAGEMENT**

The six annexes of MARPOL promote the elimination of deliberate, negligent or accidental discharge of ship-source pollutants into the marine environment (see also Transport Canada 2009). The list of harmful ship-source discharges includes: oil, noxious liquid substances and dangerous chemicals, sewage, garbage and air pollution. Canadian laws and regulations mirror the MARPOL annexes and conventions.

Agnico Eagle will contract vessels that meet applicable environmental requirements in addition to being reliable and having a superior safety record.

#### 6.1 Sewage

Vessels are to have an approved sewage treatment plant meeting Canadian standards<sup>9</sup>. Holding tanks with the capacity for all grey and treated sewage while in port are expected to be part of the ship's infrastructure. Agnico Eagle will advise ships that disposal of waste water into the environment is to be avoided within 50 km of Chesterfield Inlet.

Sewage sludge from the sewage treatment plant can be incinerated in the on-board incinerator.

#### 6.2 Solid Waste

If deemed necessary by the carrier, solid waste materials are to be incinerated on board, disposed of in an approved landfill or shipped south for safe disposal to a certified waste management facility. No solid waste materials will be disposed of in the marine environment.

The design and operation of shipboard incinerators in Canada are specified under the International Marine Organization, Marine Environmental Pollution Committee 76 (40), Annex V. Standard specifications for shipboard incinerators allow for the incineration of solid wastes approximating in composition to household waste and liquid wastes arising from the operation of the ship, e.g., domestic waste, cargo-associated waste, maintenance waste, operational waste, cargo residues, and fishing gear. Operating temperatures are similar to those for the incinerator at the Project, and flue gases are cooled rapidly to limit the *in vivo* formation of dioxins.

Tugs will remain in Baker Lake for the duration of the shipping season. Their waste will be incinerated with the ash stored in containers, which will be shipped south at the end of the shipping season for treatment, recycling and/or disposal in a certified waste management facility.

Hazardous waste will not be incinerated but returned south for treatment, recycling and/or disposal in a certified waste management facility.



<sup>&</sup>lt;sup>9</sup> If all sewage is to be incinerated, there will not be any need for sewage treatment.

#### **SECTION 7 • BALLAST WATER MANAGEMENT**

Ballast water is essential to control trim, list, draught, stability, and/or stresses on a vessel. Ballast water control and management regulations protect waters under Canadian jurisdiction from non-indigenous aquatic organisms and pathogens that can be harmful to ecosystems. The *Ballast Management Control and Management Regulations* are intended to minimize the probability of introduction of harmful aquatic organisms and pathogens from vessels' ballast water while also protecting the safety of vessels (Transport Canada 2007).

While an exemption exists in the regulations for vessels operating exclusively in waters under Canadian jurisdiction or certain adjacent waters, any Canadian vessel that has operated outside these waters may carry harmful aquatic organisms or pathogens in their residual ballast and, as such, is not eligible to exemption.

Agnico Eagle expects to use vessels largely active in the coastal trade that operate almost exclusively in waters under Canadian jurisdiction. However, these vessels do on occasion venture into waters outside Canadian jurisdiction and, as such, will require a Ballast Water Management Plan (BWMP). The regulations require the preparation and carriage of a BWMP for each vessel, and for copies to be submitted to Transport Canada. The BWMP will be specific to the vessel and will be a requirement of the carrier.

If Agnico Eagle were to contract vessels originating from waters outside the jurisdiction of Canada, a BWMP would be required. All BWMP (reviewed by the National Administration) carried on ships of foreign origin would be based on the following international guidelines and guiding principles:

- IMO Resolution A.868(20): Guidelines for the Control and Management of Ships Ballast Water to Minimize the Transfer of Harmful Aquatic Organisms and Pathogens, in particular Section 7.1;
- The *Model Ballast Water Management Plan* developed by the International Chamber of Shipping and the International Association of Independent Tanker Owners;
- Regulation B-1 of the IMO's Regulations for the Control and Management of Ships' Ballast Water and Sediments; and
- Part B of the Annex to Resolution MEPC.127 (53): Guidelines for Ballast Water Management and Development of Ballast Water Management Plans.

Agnico Eagle will require contracted vessels not eligible for exemption to provide Agnico Eagle with a copy of their BWMP.



# 7.1 Ballast Water Exchange

It is recognised by the IMO that the exchange of ballast water in deep ocean areas or open seas offers a means of limiting the probability of harmful aquatic organisms and pathogens being transferred to the marine environment via vessel ballast water. If it is necessary to take on and discharge ballast water in the same port to facilitate safe cargo operations, care will be taken to avoid unnecessary discharge of ballast water that has been taken up in another port as this could introduce harmful aquatic organisms. In particular, sediment found in the vessel's ballast tanks should be disposed of at sea in areas outside 200 nautical miles (370 km) from land and in water depths exceeding 2,000 m.

Vessels take on ballast water in segregated chambers for the main purpose of stabilizing the vessels by adding the weight of the water and maintaining a specified draught. Vessels laden with dry cargo or fuel will take on less ballast water than empty vessels. As all ships on the inward voyage to Chesterfield Inlet will be laden, they will have a minimum of ballast water. However, on the outward journey, these vessels will take on ballast water.

In the event that a ship is contracted from waters outside jurisdiction of Canada, ballast exchange is to occur at least 200 nautical miles from shore where the water is at least 2,000 m deep. If the foreign vessel undertakes this ballast exchange outside Canadian waters, it can undertake further ballast water exchanges within Canadian waters. If safety or other reasons dictates that the ballast exchange cannot occur outside waters under Canadian jurisdiction, an alternate designated area is available in Hudson Strait, east of 70°west longitude, where the water is over 300 m deep.

In the case of non-transoceanic navigation, and where ballast water is taken on-board outside waters of Canadian jurisdiction, the water is to be exchanged before entering Canadian waters at a location at least 50 nautical miles offshore, in water at least 500 m deep. If this is not possible due to safety or other reasons, the ballast water exchange can occur in the alternate designated area in Hudson Strait, east of 70°west longitude, where the water is over 300 m deep.

All coastal trade vessels will in all likelihood not venture more than 200 nautical miles from shore and will not exchange ballast water outside waters of Canadian jurisdiction. All the same, ballast water exchanges for all vessels operating in waters under Canadian jurisdiction are expected to meet the provisions of the Regulations, and to follow Part A of the IMO *Guidelines for Ballast Water Management and Development of Ballast Water Management Plans*, and the IMO *Guidelines for Ballast Water Exchange*.

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## **SECTION 8 • SAFETY**

Safety is a top priority for Agnico Eagle. It begins with all personnel (Agnico Eagle, contracted employees and contractors) wearing the appropriate personal protection equipment suitable for the task at hand and for the weather conditions at the time. Secondly, personnel must understand the hazards associated with the task, the safe procedures in carrying it out, and how not to place oneself in harm's way. Accident prevention will be supported by a proactive program to identify and correct potential hazards before an accident occurs.

Agnico Eagle or contracted supervisors will ensure that the interactions between ship and shore are carried out with the safety and the health of the employees first in mind.



#### SECTION 9 • HAZARD IDENTIFICATION ANALYSIS OF MARINE ROUTES

**Hazard**: Anything that has the potential to cause harm.

**Likelihood**: The probability/chance of harm occurring as a result of exposure to a hazard.

**Severity**: The level of harm that may occur as a result of exposure to or contact with a hazard.

**Risk**: The likelihood of harm occurring combined with the potential severity to produce a level of risk or risk rating.

Navigation through the Labrador Sea, Hudson Strait and Hudson Bay is not challenging during the open water season. Navigation through Chesterfield Inlet also does not represent a major risk with the exception of two locations; at Deer Island and Target Rock where passages are narrow and have strong current. No major hazards were identified along the shipping and tug-barge routes under normal conditions. Electronic charts combined with electronic navigation aids for the recommended shipping routes ensure the vessel remains on course where bathymetry and physical hazards are known.

Subject to ship and human safety considerations, the average speed of the vessels in open waters is expected to be less than 14 knots (26 km/h). Shipping can be carried out without pilotage as the shipping lanes entail minor hazards that do not significantly reduce ship safety. Any actions required by the crews of the ships and tugs are expected to be well within their capabilities.

At the anchor point, cargo will be lightered from the ships onto barges and be delivered to Meadowbank Mine barge unloading facilities in Baker Lake via the access passage (Chesterfield Narrows). The tugs-barges will be highly manoeuvrable and capable of transiting the access passage with its changing currents and will not require pilotage. Navigation will proceed with extra caution in periods of low visibility. Traffic through the access passage will be coordinated to avoid shipping conflicts and to ensure safety.

However, the following out of the ordinary events have been identified that could increase the level of hazard and necessitate associated mitigation measures:

- mechanical failure occurring on the ship or tug thereby placing it in jeopardy in the shipping lane;
- vessel running aground due to a navigational error or mechanical failure;
- loss or damage to sea cans in heavy seas;
- barge tow line breaking in heavy seas;



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- collision of a vessel carrying dry cargo and fuel to Baker Lake through the access passage;
- vessel sinking upon hitting ice; and
- vessel colliding with a small boat.

The access passage between Chesterfield Inlet and Baker Lake deserves special attention as it contains a series of narrow passages and, although two-way traffic is theoretically possible, it raises the risk of collisions and groundings.



#### **SECTION 10 • RISK ANALYSIS OF MARINE ROUTES**

All ships, tugs, and tankers use electronic charts and other electronic navigational aids to provide safety in transit, reduce the risk of accidents, and remain within recommended sea routes. Also, shipping companies likely to be employed by Agnico Eagle commonly sail in Hudson Bay and to Chesterfield Inlet, are aware of its marine hazards, and have their own navigation manuals and guides (e.g., Navigation Arctic Guide).

Risk is defined as the likelihood of harm posed by a hazard combined with its potential severity. The potential severity of shipping hazards<sup>10</sup> cannot be changed in most circumstances; what can be reduced is their likelihood. This is possible through the application of mitigation measures. The objective is, through the use of mitigation measures, to reduce the risk as low as practically possible. Residual risk is what remains after mitigation measures have been applied; those having the highest potential residual risk would be aggressively managed. The following mitigation/safety measures will be implemented:

- where available, electronic navigation aids will be used in all instances;
- subject to ship and human safety considerations ship speeds in open water are to remain less than 14 knots in the absence of marine mammals;
- shipping will only carried out during the ice free season; should ice be encountered, the vessel will either sail around it at a reduced speed or proceed slowly through the ice;
- vessels will remain within recommended shipping routes;
- vessels will be double hulled;
- weather warnings will be consulted when updates are provided;
- traffic through the access passage will be coordinated to avoid conflicts and ensure safety;
- · communication between tugs will coordinate movement through the access passage;
- Agnico Eagle will provide emergency response equipment and materials as outlined in the OPEP if necessary; tug or ship will also provide their own emergency response equipment;
- crews will follow standard operating procedures and adherence to these will be monitored;
- tug-barge or ship crews are to be trained for responses to hazards that can normally be expected in northern waters;
- before entering Chesterfield Inlet the Master of the ship is to make a careful assessment of the conditions (wind, waves, tides, currents, visibility, ship characteristics, crew experience and etc.):
- after the assessment, the ship is to proceed in the safest way according to the assessment and surrounding conditions;
- the ship's speed will be adjusted according to the current;
- the tug-barges will always proceed in good visibility conditions; and

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<sup>&</sup>lt;sup>10</sup> One hazard that can be reduced is shipping when ice is present. Agnico Eagle has opted to only ship during the ice-free season thereby greatly reducing this hazard.

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the vessel Master will make up-bound travel with tidal flood (starting at low water at the
entrance to Chesterfield Inlet) whenever possible. This allows to take advantage of tidal
current and weaker freshwater discharge current at narrow passages at Deer Island and
Target Rock.

#### SECTION 11 • SOCIO-ECONOMIC IMPACT OF SHIPPING

Agnico Eagle does not believe that Project related shipping activities will result in an increased demand on local public service providers (i.e., fire, police, ambulance, medical, and maintenance) in Chesterfield Inlet. In most circumstances, any emergency response will be undertaken by Agnico Eagle personnel and/or the ship's crew. Agnico Eagle personnel and the Master of the ship will be responsible for security matters related to the shipping-related activities.

Shipping may impact socio-economic activities in Chesterfield Inlet and Baker Lake. The following mitigation measures will be employed to minimize negative socio-economic effects:

- communication between tugs will coordinate movement through the access passage to avoid conflicts and ensure safety;
- Agnico Eagle has a separate laydown and storage area from the community in Baker Lake;
   and
- Agnico Eagle and the shipping contractor will work alongside to ensure security procedures are followed. This includes restricting the transport of prohibitive substances.

Positive socio-economic effects will continue as a result of the extension of the Meadowbank Mine and the associated number of dry cargo and fuel tankers coming to the communities. The crews of these ships could come ashore when the boat is anchored and contribute to the local economy through the:

- use of restaurants, hotels and stores in the community;
- purchase of local Inuit art; and
- guided tours to the barrens for fishing and wildlife experiences.



#### **SECTION 12 • PUBLIC AND MEDIA COMMUNICATIONS**

When an environmental emergency occurs, the public will be provided with timely and accurate information as to the nature of the incident, the steps being taken to correct the problem, and, if necessary, what citizens should do to protect themselves. This information is intended to protect the overall community wellbeing, including human health; to provide timely information amongst the public,; to ensure cooperation from all interested parties; and to reduce the spread of concern or alarm through the dissemination of inaccurate information.

Each agency involved in a major spill event may provide its own media communications, and may designate spokespersons for such; however, from the Arctic REET's (Regional Environmental Emergencies Team) perspective, a coordinated response is preferable. To that end, the government lead Agency is expected to act as the official spokesperson for the response, with support provided by personnel within the Arctic REET, as required.

In the unlikely event of an environmental emergency relating to Project shipping, Transport Canada guidelines will be followed to ensure proper authorities are informed without delay so that appropriate action may be taken when:

- any incident occurs involving the loss, or likely loss, of dangerous goods into the marine environment; or
- any incident occurs giving rise to pollution or threat of pollution to the marine environment;
   or
- any oil pollution incident occurs involving the loading or unloading of fuel to or from tankerto-tanker and from tanker to the Oil Handling Facility.



## **REFERENCES**

- NIRB. 2006. Project Certificate NIRB [NO.: 004] issued December 30, 2006 by the Nunavut Impact Review Board to Meadowbank Mining Corporation (assigned to Agnico Eagle Mines Limited)
- NIRB. 2018. Project Certificate NIRB [NO.: 008] issued March 15, 2018 by the Nunavut Impact Review Board to Agnico Eagle Mines Limited for the development of Whale Tail Pit
- Transport Canada. 2007. A Guide to Canada's Ballast Water Control and Management Regulations.

  Guideline TP 13617E
- Transport Canada. 2009. Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants. Guideline TP 9834E.

## **APPENDIX A • MARINE HYDROGRAPHIC CHARTS**

Chart 5002 Hudson Bay and Hudson Strait

Chart 5620 Entrance to Chesterfield Inlet

Chart 5621 Rockhouse Island to Centre Island

Chart 5622 Centre Island to Farther Hope Point

Chart 5623 Farther Hope Point to Terror Point

Chart 5624 Terror Point to Schooner Harbour

Chart 5625 Schooner Harbour to Baker Lake

Chart 5626 Baker Lake

