

UGSI CHEMICAL FEED

A cleanwater¹ Company

Intrenchment Creek, GA WWTP
Liquid Polymer Feed System
PolyBlend[®] MM1200-P12AA-L

UGSI Chemical Feed # 556131

Eco-Tech PO # 21043-152

UGSI Chemical Feed, Inc.

OPERATIONS & MAINTENANCE MANUAL

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Prepared Date: 8/15/2023

POLYBLEND®

MM1200-P12AA-L

PROJECT 556131

EQUIPMENT SERIAL NO. _____

DATE OF START-UP _____

START-UP BY _____

Prompt service available from nationwide authorized service contractors.

ORDERING INFORMATION

In order for us to fill your order immediately and correctly, please order material by description and part number, as shown in this manual. Also, please specify the serial number of the equipment on which the parts will be installed.

Statements and instructions set forth herein are based upon the best information and practices known to UGSI Chemical Feed, Inc. at the time of publication, but it should not be assumed that every acceptable safety procedure is contained herein. UGSI Chemical Feed, Inc. does not guarantee that actions in accordance with such statements and instructions included in this manual will result in the complete elimination of hazards and it assumes no liability for accidents that may occur.

WARRANTY

UGSI Chemical Feed, Inc. Product Warranty

UGSI Chemical Feed, Inc. ("Seller") warrants for 12 months from initial operation of each product it supplies (each, a "Product") or 18 months from shipment, whichever occurs first (the "Warranty Period") that the Product is free from defects in material and workmanship. Seller's warranty is transferable during the Warranty Period by the initial purchaser thereof ("Buyer") to the initial end-user of the Product. Seller's warranty is conditioned on (i) the Product being stored, installed, operated and maintained in accordance with Seller's instructions, (ii) no repairs, modifications or alterations being made to the Product other than by Seller or its authorized representatives, (iii) Buyer providing prompt written notice of any warranty claims within the Warranty Period, and (iv) at Seller's request, Buyer either removing and shipping the Product or non-conforming part thereof to Seller, at Buyer's expense, or Buyer granting Seller access to the Products at all reasonable times and locations to assess the warranty claims. Seller's warranty does not apply to software and does not cover ordinary wear and tear.

Buyer's sole remedy for breach of warranty is limited to Seller's choice of repair or replacement of the Product or non-conforming parts thereof FOB jobsite, or refund of the purchase price for the subject Product or part. The warranty on repaired or replaced Products or component parts is limited to the remainder of the original Warranty Period.

THE WARRANTY SET FORTH ABOVE IS INTENDED TO BE SELLER'S SOLE AND EXCLUSIVE WARRANTY AND SELLER'S WARRANTY IS SUBJECT TO THE LIMITATION OF LIABILITY PROVISION IN THE CONTRACT BETWEEN SELLER AND BUYER FOR THE SALE OF THE PRODUCT (THE "LIMITATION OF LIABILITY"). SELLER MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OR ANY WARRANTIES THAT MIGHT ARISE FROM COURSE OF DEALING OR USAGE OF TRADE. NOTWITHSTANDING THE FOREGOING, IF IT IS ALLEGED OR DETERMINED THAT SELLER HAS MADE ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BY COURSE OF DEALING OR USAGE OF TRADE, SUCH OTHER WARRANTIES SHALL BE SUBJECT TO ALL THE CONDITIONS, LIMITATIONS, AND PROCEDURES SET FORTH ABOVE AND TO THE LIMITATION OF LIABILITY.

UGSI CHEMICAL FEED, INC. HEADQUARTERS

INSTALLATION, OPERATION, MAINTENANCE, AND SERVICE INFORMATION

Direct any questions concerning this equipment that are not answered in this instruction book to the reseller from whom the equipment was purchased. If the equipment was purchased directly from UGSI Chemical Feed, Inc., Vineland, NJ, contact the office indicated below.

UNITED STATES

1901 West Garden Road
Vineland, NJ 08360
Tel: (856) 896-2160
Fax: (856) 457-5920

TABLE OF CONTENTS

<u>SECTION</u>	<u>DESCRIPTION</u>
1	Overview, Installation
2	Operation
3	Maintenance, Troubleshooting
4	Part Components, Appendix <ul style="list-style-type: none">- Pressure Relief Valve- Check Valve Information- Solenoid Valve Information- Flow Meter- Differential Pressure Switch- Loss of Polymer Thermal Flow Switch- A-Controller
5	VFD Information
6	Motor Information
7	Polymer Pump Information
8	Mechanical and Electrical Drawings

PolyBlend®

Model #MM1200-P5AA-L

INSTALLATION, OPERATION, AND MAINTENANCE INFORMATION

READ THIS MANUAL BEFORE YOU
INSTALL, OPERATE, OR SERVICE THIS UNIT.

INSTALLATION

OVERVIEW

SAFETY PRECAUTIONS

Ensure that the control panel is grounded to avoid possible electrical shock or damage to equipment.

Before servicing, turn off all power and assure power “lockout” to avoid possible electric shock.

Disconnect external power to the control panel before removing or replacing fuses.

SPECIFICATIONS

Pump	Progressive Cavity
Inlet	1” FPT, Water Supply
	1/2” FPT, Polymer Supply
Outlet	1-1/2” FPT, Solution Discharge
Water Capacity	600 GPH Primary
	600 GPH Post Dilution
Polymer Capacity	12 GPH
Working Pressure	100 PSI Maximum
Electrical Supply	120/1/60, 19 Amps
Dimensions	41” W x 28” D x 51” H
Weight	345 lbs.
Motor(s)	(1) 1/2 HP, 120 VAC
	(1) 1/2 HP, 240 VA

LOCATION

Select a location that provides:

- Electrical Supply
- Potable Water (Clean)
- Proximity to the Point of Use
- Easy Handling and Storage of Polymer
- Access to Unit
- Protection against Severe Weather

UNPACKING

Examine package contents for damage. Report any to freight forwarder. Check plastic bag(s) for contents against individual packing list(s).

NOTE: Disregard any moisture; this unit was wet tested.

CONNECTIONS

- Use Teflon tape on threads. Use joint compound (pipe dope) in small amounts, if necessary.
- Do not over-tighten fittings.
- Insure that supply water pressure is less than 100 psi.
- Install water isolation valve with unions.
- Insure that neat polymer feed line has a flooded suction.

NOTE: To enhance performance, reduce the number of piping turns and elevation changes.

STORAGE

Store in atmosphere controlled environment. Protect from extreme temperature (above 110°F, 52°C, below 32°F, 0°C) and wide ambient temperature fluctuations.

Protect from direct weather exposure, i.e., sun, rain, high wind, etc.

OPERATION

This PolyBlend® unit will perform the following functions: meter polymer dosage, regulate mixing water, provide uniform dilution and activation, operate on-line continuously, and feed solution to the point of use.

Neat polymer from the metering pump and dilution water controlled by the solenoid valve enter the mixing chamber. Dilution and activation occur, yielding prepared solution ready for use.

Neat polymer dosage rate is adjusted at pump face or at electronic controller (REM-1F, SCR, etc.). Primary dilution and post dilution water are controlled by individual globe valves.

START-UP

Step 1: Turn pump SCR controller to Off/Stop.

Step 2: Prime polymer pump, using priming kit provided with unit.

Step 3: Place unit On-Off-Remote switch in Off position.

Step 4: Energize power circuit that feeds unit.

Step 5: Place unit On-Off-Remote switch in On position. Solenoid opens; water flow is established.

Step 6: Insure pump power hand switch (located in back of unit) is in On position. After water flow is established, mixing chamber motor starts.

Step 7: Access SCR controller to turn pump On/Off. Polymer output can be adjusted with the potentiometer.

Step 8: Adjust water flow at mixing chamber by turning globe valve. The other globe valve should be turned for post-dilution adjustment.

NOTE: Do not run polymer pump unless water flow is established. Polymer alone can plug discharge plumbing

SOLUTION OUTPUT

Unit output is determined by setting pump speed with the SCR controller potentiometer together with setting dilution water flow. Establish desired solution volume and solution concentration, then proceed.

EXAMPLE: 450 GPH (1710 LPH) Of 10% polymer solution desired. A 60 GPH (228 LPH) pump is used.

— Determine neat polymer requirement.

$(450 \text{ GPH}) \times (.10) = 45 \text{ GPH neat polymer}$
 $(1710 \text{ LPH}) \times (.10) = 171 \text{ LPH neat polymer}$

— Determine pump usage.

$(45 \text{ GPH}) \div (60 \text{ GPH}) = 75\% \text{ pump capacity}$
 $(171 \text{ LPH}) \div (228 \text{ LPH}) = 75\% \text{ pump capacity}$

— Set Controls

A 60 GPH (228 LPH) pump @ 75% output will deliver 45 GPH (171 LPH). Set dilution water @ 405 GPH (1539 LPH).

NOTE: Do not exceed polymer concentrations of 1% in the PolyBlend®.

MAINTENANCE

If out of service more than one week, flush mixing chamber.

- Turn pump off.
- Place unit power switch in On position to establish water flow for five minutes.

If out of service for more than two weeks, flush pump and mixing chamber.

- Connect pump suction to a container of mineral oil (not water).
- Place unit power switch in On position to establish water flow.
- Turn pump on and run for three minutes.
- Turn pump off.
- Continue water flow for five additional minutes.
- Drain water from chamber and piping to prevent freezing.

MAINTENANCE

1. Clean ancillary water and / or polymer strainers weekly.
2. Flush system monthly following one-week procedure.
3. Refer to the appendix for specific information on drawings, part identification, and components.

SPECIAL TOOLS

No special tools are needed for operation, maintenance, and repair of components.

LUBRICATION

No lubrication is required, equipment is self-lubricating.

PREDICTED LIFE SPAN

There is no predicted life span of wear parts as each application and operation varies.

OPERATING PROCEDURES

For normal operation, once settings are adjusted based on operation parameters, the system can simply be turned ON or OFF. Special operating instructions for Seasonal operation do not apply.

EMERGENCY OPERATING INSTRUCTIONS

Emergency operating instructions do not apply to UGSI Chemical Feed, Inc. Products equipment. In case of an emergency, TURN OFF POWER TO STOP RUNNING.

DISASSEMBLY, REPAIR, & REASSEMBLY

This equipment is an open-frame design. It allows for easy removal of all components. There are no special procedures for removal of parts. If assistance is required, contact UGSI Chemical Feed, Inc.

RECOMMENDED SPARE PARTS

<u>QTY.</u>	<u>PART #</u>	<u>DESCRIPTION</u>
1	8450020	Pump Stator
1	7802918	Chamber Mechanical Seal
1	9572322	Polymer check Valve
2	6091801	O-Rings, Mix Chamber

PUMP REPLACEMENT

<u>QTY.</u>	<u>PART #</u>	<u>DESCRIPTION</u>
1	7136036	12 GPH Pump

TO ORDER PARTS

You may order parts by calling, faxing or mailing your order.

Phone Customer Service @ 856.896.2160
Hours are 8 a.m. to 5 p.m., Eastern Time, Monday - Friday.
Fax Fax number is 856.457.5920
Web www.ugsichemicalfeed.com
Address UGSI Chemical Feed, Inc.
1901 W. Garden Rd.
Vineland, NJ USA 08360

TROUBLESHOOTING

Symptom	Possible Cause	Corrective Action
No Water Flow	<ul style="list-style-type: none"> ● Closed Valve on Water Supply ● Blocked Solenoid Valve ● Closed or clogged discharge line ● Rate Control Valve Closed 	<ul style="list-style-type: none"> ● Make sure valve is open ● Dis-assemble and clean valve ● Remove any blockages or open any closed valves ● Make sure valve is open
Pump won't pump Chemical	<ul style="list-style-type: none"> ● Pump is turning backwards ● Pump is turned OFF ● No Water Flow ● Blocked Pump Discharge Line ● Back Pressure is too high ● Not enough water flow 	<ul style="list-style-type: none"> ● Make sure pump is rotating in the correct direction ● Make sure pump is in ON position ● Make sure all water valves (supply and discharge) are open ● Take discharge line apart, check for blockage and clean if necessary ● Reduce Back pressure on unit ● Increase water flow or adjust water monitoring device (flow switch, DP Switch, etc.) setpoint lower than the desired flow rate
Clogged Injection Check Valve	<ul style="list-style-type: none"> ● Debris or Clumps in Polymer ● Valve is stuck open allowing water into polymer line 	<ul style="list-style-type: none"> ● Check polymer supply for contamination ● Remove valve from chamber and clean it
Pump won't stop	<ul style="list-style-type: none"> ● Water flow is still established 	<ul style="list-style-type: none"> ● Shut off water valve or power to the unit

Part Components

Pressure Relief Valve



Griffco Valve Inc.
6010 N. Bailey Ave., Suite 1B
Amherst, NY 14226
Phone: 1 716 835-0891
Fax: 1 716 835-0893

M-Series Instruction Manual

Back Pressure Valves
Pressure Relief Valves

Call: 1 - 800 – GRIFFCO

Website: www.griffcovalve.com

INSM-1003-R0610 Revision Date: 06/22/10



INTRODUCTION

GRIFFCO diaphragm back pressure valves are used to enhance the performance of chemical feed pumps and systems by providing a constant discharge head pressure. These valves also function as an anti-siphon valve. The diaphragm is held against the seat by the internal spring. Back pressure is adjustable from 10 - 150 psi via the adjustment screw. When the inlet pressure exceeds the preset pressure the diaphragm lifts off the seat and the chemical flows to the injection point. After each discharge stroke of the pump, as the pressure drops, the diaphragm reseats itself.

GRIFFCO diaphragm pressure relief valves are designed to protect chemical feed pumps and systems from overpressure caused by defective equipment or blockages in the chemical line. The 3 port design allows chemical to flow through the valve via an internal chamber. When the pressure in the chemical line exceeds the preset pressure of the valve the diaphragm lifts off the seat and the chemical then flows out the bottom port back to the chemical tank. Relief pressure is adjustable from 10 - 150 psi via the adjustment screw in the top of the valve.

INSTALLATION

Back Pressure Valve:

Generally, the back pressure valve can be installed anywhere in the discharge line, provided there is some downstream pressure at the dosage point. If there is no downstream pressure the back pressure valve should be installed at the dosage point to prevent siphoning and drainage of the chemical line. All **GRIFFCO** valves are factory set at 50 psi, unless otherwise specified. Field adjustment is possible with the adjustment screw, (approximate 25 psi/revolution with a 10-150 psi rated spring).

Back pressure valve performance will be enhanced with the installation of a pulsation dampener to smooth out the discharge / suction cycles of the pump. Thus, the diaphragm is free to float inside the valve chamber, minimizing the wear on the stress points of the diaphragm. Pulsation dampeners will also reduce the pressure drop across the valve by reducing peak flows. Backpressure valves should be installed downstream of the dampener. For most applications diaphragm type dampeners are required. Generally speaking 5 to 10% dampening is sufficient. Consult with your pump manufacturer to get his recommendations.

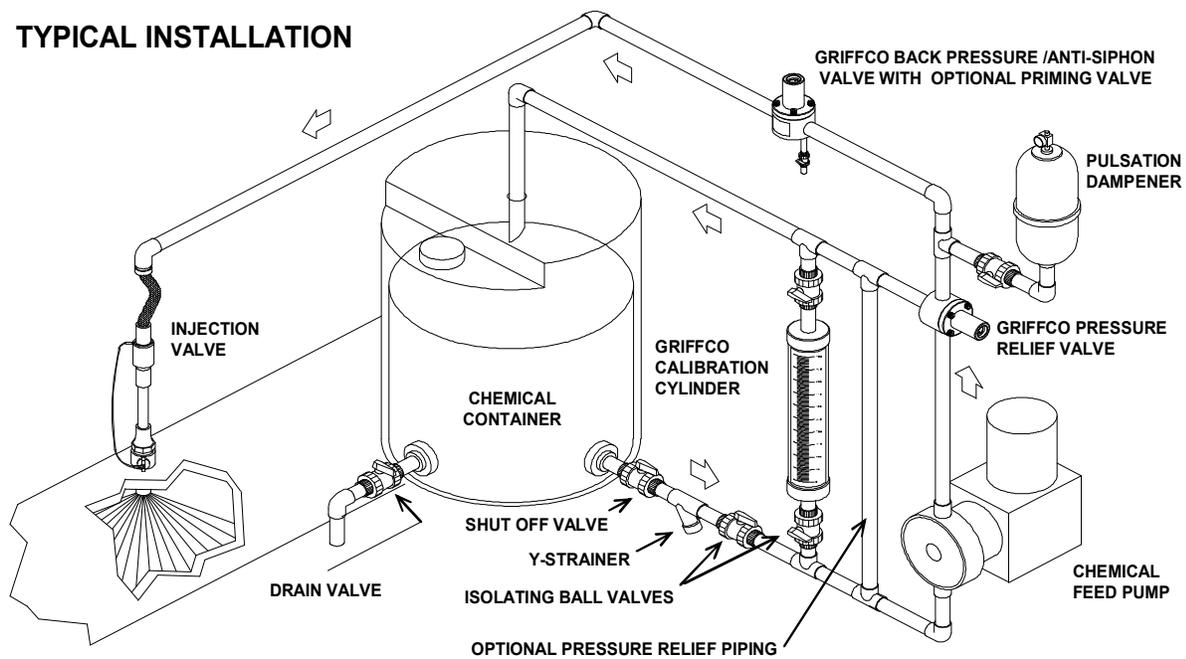
Pressure Relief Valve:

Installation should be made as close to the chemical pump discharge valve as possible, without any equipment, especially shut-off valves, between the valve and the pump. Direction of flow must be across the valve; however the side of entry is not important. All **GRIFFCO** valves are factory set at 50psi, however field adjustment is possible with the adjustment screw.

The optimum installation for the relief valve is to vent the relief port back to the chemical tank, or directly to a containment area. However if this is not possible, the relief port can be piped back into the suction side of the pump. This will apply the suction head to the relief port. To compensate, divide the NPSH by 4 and add this pressure to the relief valve setting.

Do not install shut-off valves in the relief line.

TYPICAL INSTALLATION



MAINTENANCE:

The pressure relief and back pressure valves were designed with minimizing the amount of maintenance required to keep the valves in operation. However, periodic replacement of the diaphragm is required. A parts kit can be purchased from your local Griffco Valve distributor. To facilitate inspection and replacement, the valve layout is such that removal of the diaphragm can be done without taking the valve out of the chemical line.

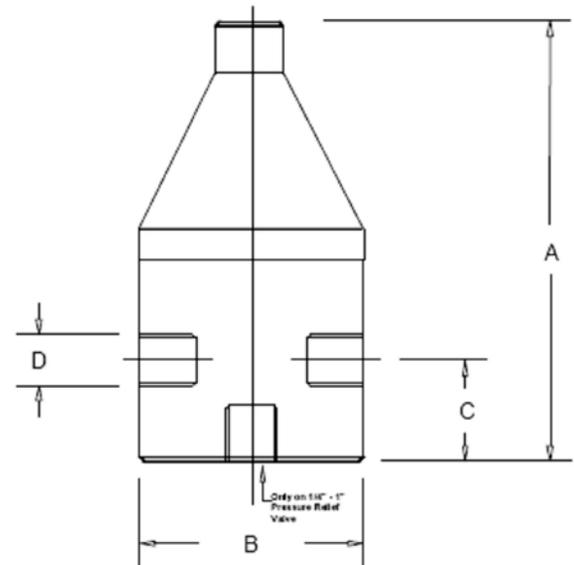
Caution: Ensure the system is not under pressure and that the chemical lines are flushed with water before disassembly.

Unscrew the pressure adjustment screw to remove the pressure from the spring. Remove the 4 bolts and lift off the valve top.

Inspect the valve seat and diaphragm, replace the diaphragm if necessary (White PTFE side down). Check the adjustment spring to make sure there is no rust or corrosion, replace if necessary. Place the support disc and the spring onto the diaphragm and place the top back over the four bolt holes.

Tighten the 4 bolts, and then replace the adjustment screw. Turn the adjustment screw clockwise to approximately the same position as it was prior to disassembly. If an exact pressure setting is required or a different pressure is desired a pressure gauge should be used to verify the setting. Turning the adjustment screw clockwise will increase pressure.

DIMENSIONS:



D	A (in)	B (in)	C (in)
1/4" (P)	3.55	2.35	0.75
1/4" (M)	3.55	2.35	0.75
3/8" (P)	3.55	2.35	0.75
3/8" (M)	3.55	2.35	0.75
1/2" (P)	4.25	2.35	1.08
1/2" (M)	4.25	2.35	1.08

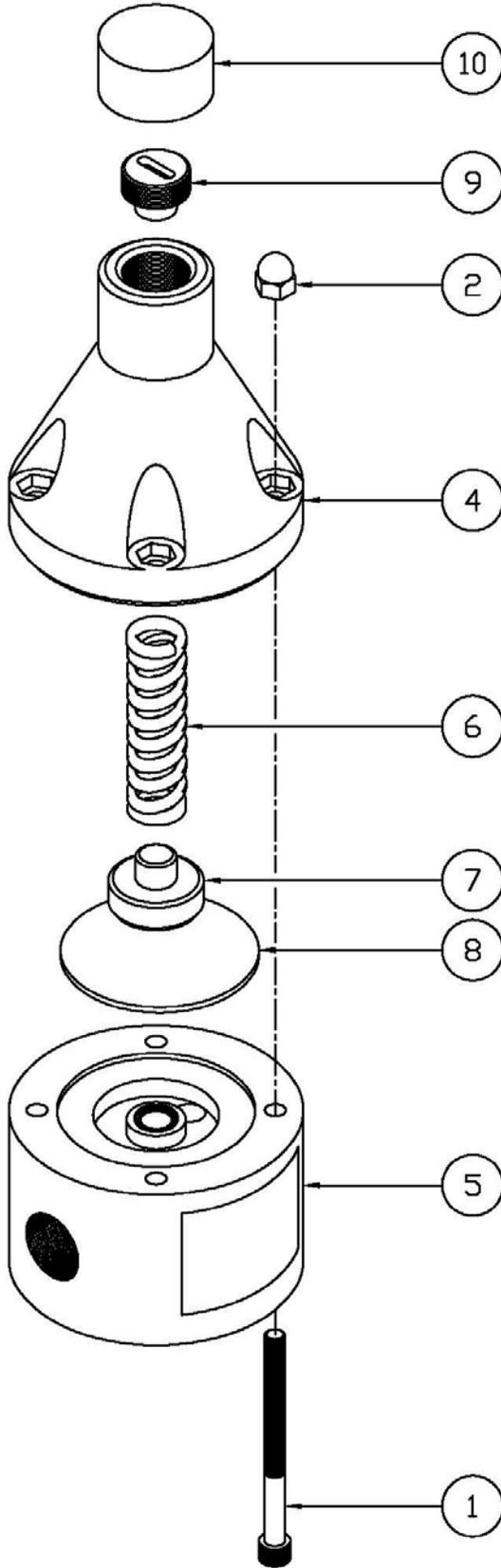
Note: "P" denotes Plastic body type, "M" denotes metal

Warranty:

GRIFFCO Valve, Inc. warrants its products against defects in workmanship or materials for one year under normal use or 18 months from date of shipment whichever occurs first. All obligations and liabilities under this warranty are limited to repair or replacement (at our option), FOB our plant such allegedly defective units as are returned to our factory transport prepaid. Repairs or replacements are made subject to inspection of returned items.

This warranty does not extend to damage by corrosion or erosion. The materials of construction offered are recommendations subject in all cases to acceptance by the customer. These recommendations, based on previous experience and best available information, do not constitute guarantees against wear or chemical action. Expressly excluded from this warranty are defects caused by misuse, abuse or improper application, installation or operation of the unit. No liability for consequential damages or reinstallation labor is accepted. **GRIFFCO Valve, Inc.** will not assume responsibility for contingent liability for alleged failure of its products.

PARTS LIST



ITEM	DESCRIPTION	PART #	
1	10/32 X 2 1/2" Bolt - M-Series 1/2" Plastic Valves	PV-00113	
	10/32 X 1 3/4 Bolt - M-Series 1/4" - 3/8" Plastic Valves	PV-00106	
	10/32 X 3/4" Bolt - M-Series Metal Valves	PV-00107	
2	10/32 Cap Nut - SS	PV-00201	
3	10/32 Flat Washer (For Metal Valves with Metal tops)	PV-00301	
4	1/4" - 1/2" Valve Top - Noryl, Black	PV-004040	
	1/2" - External Adjustment Valve Top - PVC (Tiberian)	PV-004029	
	1/4" - 1/2" Valve Top - 316 SS	PV-00403	
		BPV #	PRV #
5	1/4" Valve Body PVC	BPM-00501	PRM-00501
	1/4" Valve Body PP	BPM-00502	PRM-00502
	1/4" Valve Body PTFE	BPM-00503	PRM-00503
	1/4" Valve Body PVDF	BPM-00504	PRM-00504
	1/4" Valve Body 316 SS	BPV-00505	PRV-00505
	1/4" Valve Body Alloy 20	BPV-00506	PRV-00506
	1/4" Valve Body Hast C	BPV-00507	PRV-00507
	1/4" Valve Body CPVC	BPM-00508	PRM-00508
	3/8" Valve Body PVC	BPM-00561	PRM-00561
	3/8" Valve Body PP	BPM-00562	PRM-00562
	3/8" Valve Body PTFE	BPM-00563	PRM-00563
	3/8" Valve Body PVDF	BPM-00564	PRM-00564
	3/8" Valve Body 316 SS	BPV-00565	PRV-00565
	3/8" Valve Body Alloy 20	BPV-00566	PRV-00566
	3/8" Valve Body Hast C	BPV-00567	PRV-00567
	3/8" Valve Body CPVC	BPM-00568	PRM-00568
	1/2" Valve Body PVC	BPM-00511	PRM-00511
1/2" Valve Body PP	BPM-00512	PRM-00512	
1/2" Valve Body PTFE	BPM-00513	PRM-00513	
1/2" Valve Body PVDF	BPM-00514	PRM-00514	
1/2" Valve Body 316 SS	BPV-00515	PRV-00515	
1/2" Valve Body Alloy 20	BPV-00516	PRV-00516	
1/2" Valve Body Hast C	BPV-00517	PRV-00517	
1/2" Valve Body CPVC	BPM-00518	PRM-00518	
6	Pressure Spring - 1/4" - 1/2" Valve; 150 psi	PV-00601	
	Pressure Spring - 1/4" - 1/2" Valve; 50 psi	PV-006011	
	Pressure Spring - 1/4" - 1/2" Valve; 250 psi	PV-006013	
	Pressure Spring - 1/4" - 1/2" Valve; 350 psi (Metal Valves w/Metal tops)	PV-006012	
Pressure Spring - 1/4" - 1/2" Valve; 100 psi, 316 SS	PV-00601S		
7	Support Disc - 1/4" - 1/2" Valve, PVC	PV-00701	
	Support Disc - 1/4" - 1/2" Valve, 316 SS	PV-00702	
8	Diaphragm - 1/4" - 1/2" Valve - PTFE / EPDM	PV-00800	
	Diaphragm - 1/4" - 1/2" Valve - Viton	PV-00802	
	Diaphragm - 1/4" - 1/2" Valve - PTFE / Viton (High Temperature)	PV-00803	
9	Adjustment Screw - 1/4" - 1/2" Valve PET (White)	PV-00906	
	Adjustment Screw - 1/4" - 1/2" Valve Coated Steel	PV-00903	
10	Protective Vinyl Cap - Small (For Valves w/ OSS & MSS options)	PV-01001	
	Protective Vinyl Cap - X-small	PV-010011	

Check Valve



Installation Instructions for Series CK and **CKM** Diaphragm Check Valves

1. *IMPORTANT - BEFORE INSTALLING*

Series CK and CKM check valves will open when forward pressure is applied, and when properly installed and used within the recommended ranges of pressure, temperature, and chemical compatibility. The ultimate determination of material compatibility is previous successful use in the same application.

Caution: Plastic materials will degrade in ultraviolet (UV) light or sunlight.

Caution: Polypropylene and PVDF (Kynar) often look similar. Do not install in your system if you are not sure.

2. INSTALLATION

The check valve will operate mounted in any position. Be careful to install the valve in the correct flow direction.

Threaded Connections: A suitable thread sealant (ex. Teflon® tape) should be applied to male tapered threads to assure a "leak-tight" seal. The assembly need only be made "hand-tight" followed by a quarter (1/4) turn with a strap wrench. Do not over tighten or use pipe wrenches on plastic pipe and components.

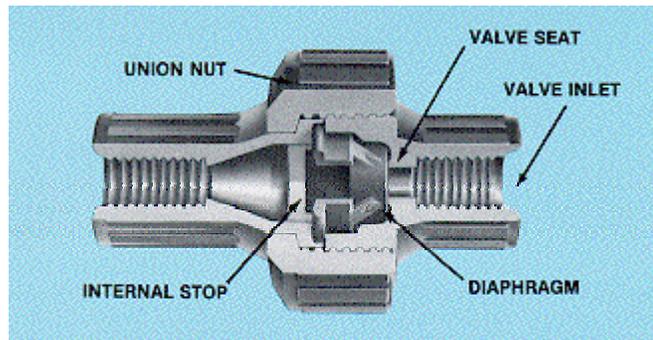
Caution: Teflon® tape will "string" as pipe threads are joined. Loose "strings" could lay across the seating surface and prevent the check valve from completely closing. To avoid this problem, clean out the old tape, and do not apply tape to the first thread.

Caution: Connections should be made only to plastic fittings; metal pipe should only be installed with an intervening plastic nipple. Metal pipe and straight threaded pipe tend to cut, stretch, and distort the plastic bodies, which could result in cracking or leaking over time.

Non-Threaded Connections: For solvent cementing or heat fusion, follow instructions supplied with the cement or fusion equipment, or contact your distributor.

3. MAINTENANCE

Plast-O-Matic recommends keeping a spare diaphragm available for repairs. Seal life will vary in applications due to cycles, temperatures, pressures, chemicals, and concentration. Based on the application, a periodic inspection and maintenance plan should be established.



DIAPHRAGM PART NUMBERS			
CKM050 (1/2 ")	CKM (3/4" & 1")	CK (3/4" & 1")	
MOLDED BODY	MOLDED	MACHINED	
1021B	4054B	0721B	Buna Diaphragm
1021EP	4054EP	0721EP	EPDM Diaphragm
1021V	→ 4054V	0721V	Viton Diaphragm

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FAIL-DRY® is a registered trademark of Plast-O-Matic Valves, Inc.

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Solenoid Valve

STC Process Valves

Installation and Operation Procedures

This Installation and Operation Procedures apply to the solenoid valves shown below.

Valve Type	Stainless Steel	Brass
<p>Direct Acting</p> <p>Normally Closed</p> <p>Action: Plunger Type</p>	<p>2S025-2S040 SERIES</p> 	<p>2W025-2W040 SERIES</p> 
<p>Direct Acting/Lift</p> <p>Normally Closed</p> <p>Action: Diaphragm Type</p>	<p>2S160-2S500 SERIES</p> 	<p>2W160-2W500 SERIES ←</p> 
<p>Direct Acting/Lift</p> <p>Normally Open</p> <p>Action: Diaphragm Type</p>	<p>2SO160-2SO500 SERIES</p> 	<p>2WO160-2WO500 SERIES</p> 
<p>Direct Acting/Lift</p> <p>Normally Closed</p> <p>Action: Plunger Type</p>	<p>2LS170-2LS500 SERIES</p> 	<p>2L170-2L500 SERIES</p> 

Electrical Connection of Solenoid Coils

To connect Grommet coil:

1. For DC Coil, connect the RED wire to Positive, and the BLACK wire to Negative.
2. For AC Coil, connect the BLACK wire to HOT wire, and the WHITE wire to Neutral wire.
3. Tighten the screw that secures the coil to the valve. If the screw nut is plastic, hand tighten only. If the screw nut is metal, hand tighten, and tighten 1/4 to 1/2 with a wrench. Do not over-tighten, it may damage the valve!

To connect DIN coil (refer to diagram shown below for more detail):

1. Remove the Philip screw from the plastic DIN housing and unplug it from the DIN coil and remove the gasket.
2. From the screw opening, use the screw to push the Terminal Block out of the plastic DIN housing.
3. Note the 1, 2 and ground markings on underside of Terminal Block.
4. For DC DIN Coil, Connect 1 to Positive, 2 to Negative.
5. For AC DIN Coil, connect 1 to HOT wire, 2 to Neutral wire, and if required, connect ground to ground wire.
6. Thread the wires through and out off the strain-relief opening of the plastic DIN housing, and re-inert the Terminal Block into the plastic DIN house in the desire orientation.
7. Re-install the gasket onto the DIN coil, plug the wired DIN enclosure into the DIN coil, and reinstall the Philip screw.
8. Tighten the screw that secure the coil to the valve. If the screw is plastic, hand tighten only. If the screw is metal, hand tighten, and tighten 1/4 to 1/2 with a wrench. Do not over-tighten!

Coils with DIN connections



[1] Remove the Philip screw from the plastic DIN housing.

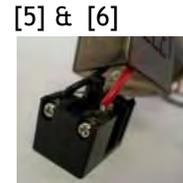
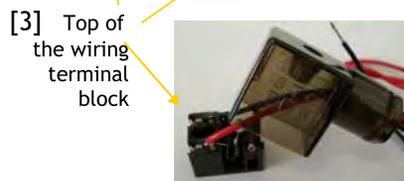
[2] Unplug the plastic DIN housing from the DIN coil.

[3] From the screw opening, use the screw to push the terminal block out of the plastic DIN housing.

[4] Note the 1, 2, and ground markings on underside of DIN enclosure.

[5] For DC DIN coil, connect 1 to positive, 2 to negative.

[6] For AC DIN coil, connect 1 to HOT wire, 2 to neutral wire, and if required connect ground to ground wire.



Installation of Solenoid Valves

Connection of Pipe to Solenoid Valve:

1. Follow the arrow mark on the solenoid valve for installation of inlet and outlet, for valve that can be used for vacuum applications and is to be connected for vacuum applications, reverse the direction inlet and outlet installation.
2. Apply the appropriate sealant to the pipe thread, screw the pipe into the solenoid valve, tighten the pipe by hand, then turn it 2 to 3 turns with a pipe-wrench until it reaches the desire torque listed.
3. For the 2L series valves, the coil/armature tube must be installed **vertically** and with flow in the **horizontal** direction.
4. The coil generate heat, install the solenoid valve in a well ventilated location and away from flammable materials.
5. Provide the solenoid valve with secure mechanical support through the piping structure.
6. Make sure the valve is installed properly and make sure there is no leak in all the connections.
7. Test the solenoid valve to make sure it operates properly before putting the solenoid valve into service.

Recommendation of Torque for Tightening Pipes		
Fitting Thread Size	Torque, lb-ft	Torque, kgf/cm
10-32, M5 -M6	1.0 -1.5	14 -21
NPT 1/8, R 1/8	5 -6.5	70 -90
NPT 1/4, R 1/4	8.5 -10	120 -140
NPT 3/8, R 3/8	16 -17.5	220 -240
NPT 1/2, R 1/2	20 -21.5	280 -300
NPT 3/4, R 3/4	Depends on user's requirements and applications	
NPT 1, R 1		
NPT 1 1/4, R 1 1/4		
NPT 1 1/2, R 1 1/2		
NPT 2, R 2		

Operation and Maintenance of Solenoid Valves

Operation:

1. Follow the current industrial safety standards when using the solenoid valve in pressurized air, gas or liquid, and when high electrical voltage is used to operate the solenoid valve.
2. Make sure the materials to be used are compatible with the solenoid valve.
3. Do not exceed the operation limits of the solenoid valve.
4. The coil generates heat, to prevent the coil from overheating, keep the solenoid valve well ventilated and away from flammable materials.
5. The opening or closing of solenoid valve is controlled by the electrical power supplied to the solenoid valve.

Maintenance:

1. Keep the valve clean, and inspect for leak after installation and on a regular interval.
2. If it is a diaphragm valve, the diaphragm needs to be replaced on a regular interval - depending on the usage and the usage conditions.

Maintenance Spare Parts:

1. Solenoid Coil
2. Diaphragm for diaphragm valve
3. Plunger and Plunger Spring
4. O-ring

Diaphragm is the only spare part available from Fluid Dynamics.
3-2014

Safety Precautions:

1. Follow the current industrial safety standards when using the solenoid valves in pressurized air, gas or liquid, and when high electrical voltage is used to operate the solenoid valves.
2. Make sure the materials to be used are compatible with the solenoid valve.
3. Do not exceed the operation limits of the solenoid valves.
4. The coils generate heat, install the solenoid valves in well ventilated locations and away from flammable materials.

Flow Meter

Exploded View and Parts List

F-400 Parts List 1/4", 3/8" and 1/2" FPT

Item	Catalog	Description	Amount
1	F-4019	1/4" FPT Adapter PP	2
1	76000-708	3/8" FPT Adapter PP	2
1	76000-707	1/2" FPT Adapter PP	2
2	90003-119	O-ring, 127, Viton	2
3	F-4005	Wire holder, 1/4" PSF	2

F-410 Parts List 3/4" and 1" FPT

Item	Catalog	Description	Amount
1	F-4009	3/4" FPT Adapter PP	2
1	F-4011	1" FPT Adapter PP	2
2	F-4010K	O-ring, 127, Viton	2
3	F-4013PP	Wire holder, .75 - 1.0 PP	2
4	-	Float	1
5	F-4004	Guide Wire, .125 x 8.5 SS	1
6	-	Meterbody	1

Note: Shaded items (float and meterbody) are not sold separately

Maintenance

The "Exploded View" drawing illustrates assembly of the F-400N series meter. If your flowmeter needs to be cleaned refer to this drawing when reassembling the unit. The tapered tube may be cleaned with a soft bottle brush. Use a MILD soap and water solution for cleaning purposes. Hard water deposits can be removed with a 5% acetic acid solution (vinegar). Note the floats "up" position.

BLUE-WHITE INDUSTRIES LIMITED WARRANTY

FLOWMETERS are warranted to be free of defects in material and workmanship for up to 12 months from the date of factory shipment. Warranty coverage is limited to repair or replacement of the defective flowmeter only. Blue-White Industries does not assume responsibility for any other damage that may occur.

This warranty does not cover damage to the flowmeter that results from misuse or alterations, nor damage that occurs as a result of: meter misalignment, improper installation, over tightening, use of non-recommended chemicals, use of non-recommended adhesives or pipe dopes, excessive heat or pressure, or allowing the meter to support the weight of related piping. Flowmeters are tested and calibrated with water and air only. Although meters may be suitable for other chemicals, Blue-White cannot guarantee their suitability.

Flowmeters are repaired at the factory only. Call or write the factory to receive a Return Authorization Number, carefully pack the flowmeter to be returned, including a brief description of the problem. Note the RA number on the outside of the carton.

Website: www.Blue-White.com
 E-mail: Sales@Blue-White.com | Techsupport@Blue-White.com
 Phone: 714-893-8529 | Fax: 714-894-0149

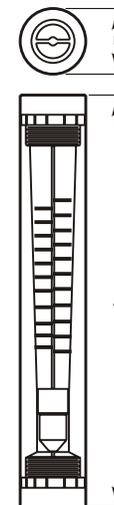
Blue-White
Industries, Ltd.

5300 Business Drive
Huntington Beach, CA 92649

Installation Instructions F-400 & F-410

Specifications

- Meter Body:** Acrylic, clear
- Floats:** #316 Stainless Steel or Hastelloy C-276
- Adapters:** Polypropylene with aluminum stress rings
- O-Rings:** Viton
- Scale:** Permanent Silkscreen
- Max. Pressure:** 150 PSIG / 10.3 BAR (see graph)
- Max. Temperature:** 150°F / 65.6°C (see graph)



Model	A In. (mm)	B In. (mm)
F-40250N	8-3/16" (208.0mm)	1-1/4" (31.75mm)
F-40375N	8-3/16" (208.0mm)	1-1/4" (31.75mm)
F-40376N	8-3/16" (208.0mm)	1-1/4" (31.75mm)
F-40377N	8-3/16" (208.0mm)	1-1/4" (31.75mm)
F-40500N	8-3/16" (208.0mm)	1-1/4" (31.75mm)
F-40750N	11" (279.4mm)	1-3/4" (44.45mm)
F-41017N	11" (279.4mm)	1-3/4" (44.45mm)
F-41000N	11" (279.4mm)	1-3/4" (44.45mm)

Your Blue-White® F-400 / F410 Series In-Line Flowmeter

- Your Blue-White® flowmeter was designed to be easy to install.
- Please read the Instruction Guideline on the next page before installing your flowmeter.
- This flowmeter is an instrument, special care should be taken when handling and installing.

Inspection of the Flowmeter and Compatibility

- Carefully inspect the meter for any damage that may have occurred during shipping.
- Remove the plastic tubing that has been inserted during packaging for shipping reasons.
- Make sure your pressure, temperature, fluid and other requirements are compatible with the meter before installation.
- The maximum temperature capability decreases as the pressure increases. The max PSI decreases as the temperature increases. See the chart on the following page.
- Although the meter may be suitable for other chemicals, Blue-White® meters are tested with water and air only. If you are unsure of the meters compatibility with your chemical, please consult the factory.
- Blue-White® warranties the flowmeter for use with air and water only.

Blue-White
Industries, Ltd.

Installation Guideline

Please use the following steps to guide you through the installation.

Caution: Follow these steps to avoid failure

Danger: Wear eye protection when installing or removing the flowmeter.

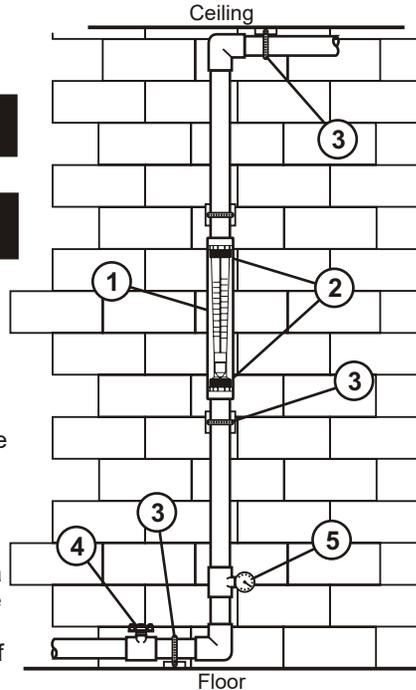
1. The flowmeter must be installed in an exact vertical plane to ensure accuracy.

2. Use Teflon® tape (or similar) on all pipe threads. Acrylic and other exotic plastics cannot tolerate PVC Glue and/or pipe dope. Even fumes can cause crazing. If you are installing your flowmeter to a glued pipe installation, install the flowmeter *after* all glued fittings are dried and lines are purged of all fumes. Never hold the meter with pliers or like tools. **DO NOT OVER-TIGHTEN!**

3. Wall, floor and ceiling mounts are to be carefully aligned and sturdy. Wall, floor and ceiling supports are recommended as needed. This is to maintain pipe alignment and to prevent vibration.

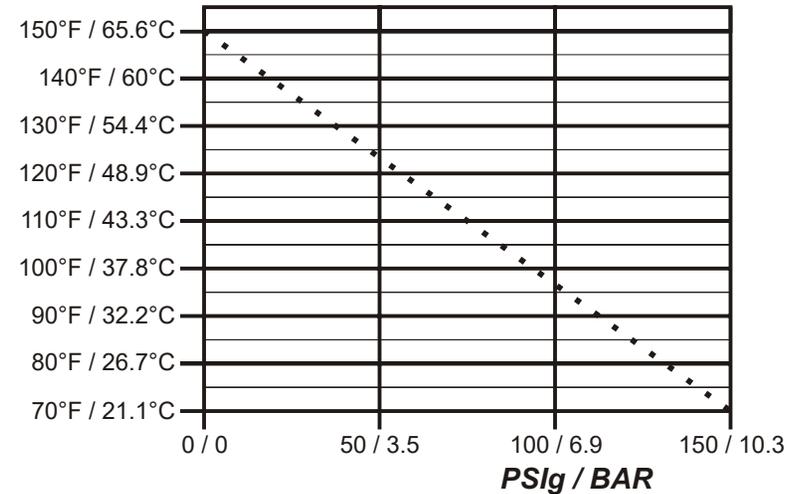
4. Valves - **Avoid a system that will impose a sudden burst of flow to the meter.** Such a burst will cause the float to impact the float stop with destructive force which may damage the flowmeter. Solenoid valves, or other quick opening valves cannot be used unless meter is protected against sudden bursts of flow. (If necessary a surge chamber should be installed. This will also be useful in high pressure start-up situations) The flowmeter is not warranted against this type of damage.

5. Maximum working pressure not to exceed recommended psi at fluid temperature (see Temperature Vs. Pressure chart).



Temperature vs. Pressure

Temperature



Pressure and Temperature

Pressure and temperature limits are inversely proportional. At the maximum suggested pressure the temperature should approach 70°F / 21.1°C; at the maximum suggested temperature the pressure should approach zero psi. We cannot guarantee our flowmeters will not be damaged either at or below the suggested limits simply because of many factors which influence meter integrity; stress resulting from meter misalignment, damage due to excessive vibration and/or deterioration caused by contact with certain chemicals as well as direct sunlight. These situations and others tend to reduce the strength of the materials from which the meters are manufactured.

Application Note

Flowmeters are tested and calibrated for water or air only.

Although meters may be suitable for other chemicals, Blue-White cannot guarantee their suitability. It is the responsibility of the user to determine the suitability of the flowmeter in their application.

Differential Pressure Switch

Differential Pressure Switch

Location of Differential Pressure Switch

The high pressure port connects to the inlet manifold between the solenoid valve and the rotameter/rate-adjusting valve. The low pressure port connects to the discharge side of the rotameter.

Function of Differential Pressure Switch

The differential pressure switch ensures sufficient water flow is present before the polymer pump is energized. This integral, automatic safety feature eliminates the problem of overfeeding neat polymer to an application without proper dilution.

In operation, the rate valve is adjusted to produce the desired flow through the system. This causes a pressure drop to occur across the valve which is applied to the differential pressure switch.

If supply pressure decreases enough to affect flow rate or if back pressure between the PolyBlend and the point of solution application increases enough to affect flow rate, the differential pressure across the rotameter and valve decreases. This causes power to be interrupted to the polymer pump and prevents damage to the mixing system caused by extremely high viscosity developing in the mixing chamber.

<p>NOTICE: If system pressure or flow are <u>not adequate</u>, investigate the cause of lack of flow. (For example, inadequately sized piping can produce inadequate flow.) To avoid undesirable water dilution conditions and damage to equipment, do not bypass or adjust the differential pressure switch for a lower pressure/flow setting.</p>
--

Question: *Why doesn't the polymer pump turn off when I turn the water off using the rotameter?*

The differential pressure switch senses flow on either side of a pressure drop. Because the rotameter is the sensing point, the rotameter closing is the only cause of loss of flow that the differential pressure switch cannot see.

Test the differential switch by turning off the source water or the discharge flow. (See step 5 on the next page.)

Differential Pressure Switch

Adjusting the Differential Pressure Switch

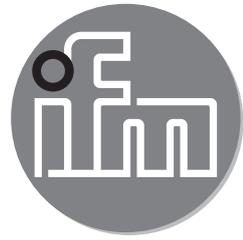
Adjust the PolyBlend differential pressure switch only if pressure and flow to the system **are adequate**.

The adjustment logic is the **opposite** of what you might expect. The PolyBlend differential pressure switches have a red light (on the left side) that lights up whenever source water flow is too low and the polymer pump is disabled. The pump stops pumping when the flow is too low. Low flow may be from lack of incoming water or from too much back pressure on the outgoing side.

	Adjustment		System Reaction
1.	Turn the PolyBlend rotameter until water flow is at maximum on the flow gauge.		
2.	Screw in the <i>differential pressure knob</i> until the red alarm light goes on.		Polymer pump is disabled.
3.	Back off the differential pressure knob until the red alarm light goes off.		The pump starts again.
4.	4a. If you want very close control of flow, leave the knob at this setting. <i>At this setting, any loss of flow (as observed by the rotameter) results in the pump being disabled.</i>	4b. If you want to make the system "more forgiving" prior to shutdown, continue to turn the knob another 1-2 turns. <i>The further you turn the knob, the more flow can be lost before the pump is disabled.</i>	Step 4 determines how "forgiving" the system is before it shuts down due to inadequate flow.
5.	To test sensitivity and operation, turn off the water at the source or the solution at the discharge. The float in the flow meter will fall more for the control knob setting described in step 4) than, for 4a (above).		As the source or discharge is turned off, the float in the flow meter falls and the pump is disabled.
6.	Set the rotameter for the desired flow.		Retest (as in step 5).

Loss of Polymer Thermal Flow Switch

ifm electronic



Operating instructions
Flow monitors

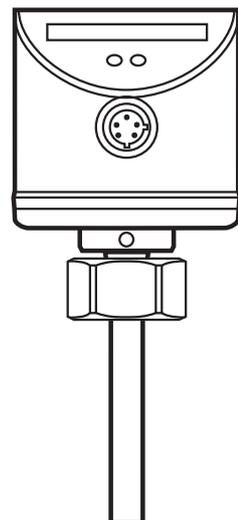
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Contents

1	Preliminary note.....	3
1.1	Symbols used	3
2	Safety instructions	3
3	Functions and features	4
3.1	Application area	4
3.2	Operating principle flow monitoring	4
4	Installation.....	5
4.1	Installation location	5
4.2	Sources of interference in the pipe system	6
4.3	Mounting operation.....	6
5	Electrical connection.....	7
6	Operating and display elements	8
7	Set-up and settings for water.....	8
7.1	Change the switch point (optional)	9
7.2	High flow adjustment (optional)	9
8	Additional settings (optional).....	10
8.1	Low flow adjustment	10
8.2	Configure the switching output	10
8.3	Restore the factory setting (reset)	10
8.4	Lock / unlock the unit.....	10
9	Error during adjustment	11
10	Operation.....	12
11	Maintenance	12
12	Scale drawing	13
13	Technical data.....	14

1 Preliminary note

1.1 Symbols used

▶ Instruction

> Reaction, result

[...] Designation of buttons, switches or indications

→ Cross-reference



Important note

Non-compliance can result in malfunctions or interference.

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2 Safety instructions

- Please read the product description prior to set-up of the unit. Ensure that the product is suitable for your application without any restrictions.
- The unit conforms to the relevant regulations and EC directives.
- Improper or non-intended use may lead to malfunctions of the unit or to unwanted effects in your application.
- That is why installation, electrical connection, set-up, operation and maintenance of the unit must only be carried out by qualified personnel authorised by the machine operator.

3 Functions and features

3.1 Application area

The unit monitors the flow of liquid and gaseous media.

3.2 Operating principle flow monitoring

- The unit detects the flow speed to the calorimetric measuring principle and switches the output:
 - output closed if medium is flowing / output open if no medium is flowing.This applies to the unit on delivery: output = normally open. In case of need you can change the output to normally closed (→ 8.2). It then applies: output open if medium is flowing.
- If the flow speed increases, the switching status changes when the switch point is reached.
- If the flow speed falls again, the switching status changes if the value "SP minus hysteresis" is reached.
The hysteresis changes with the flow speed and it is essentially influenced by the set monitoring range.
It is 2...5 cm/s for the setting 5...100 cm/s (= factory setting), it increases with higher flow speeds.
- The typical response time of the unit is 1...10 s. It can be influenced by the setting of the switch point:
 - Low switch point = quick reaction with rising flow.
 - High switch point = quick reaction with falling flow.

4 Installation

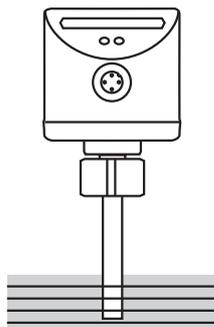
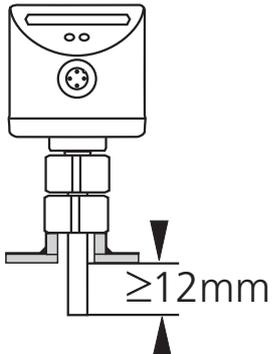
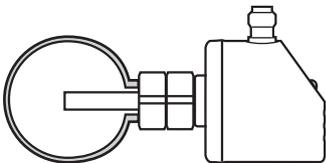
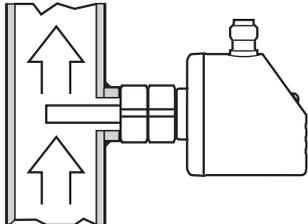
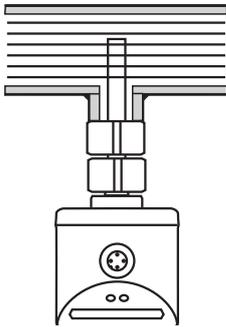
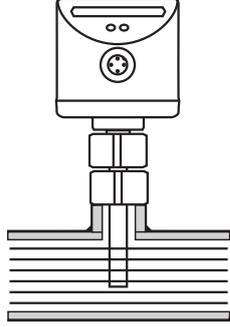
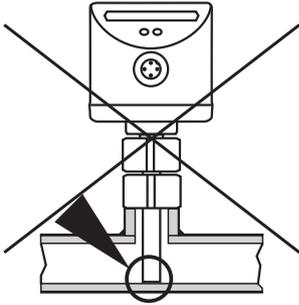
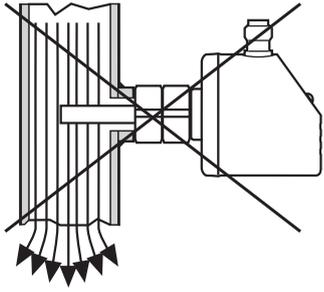
Using process adapters the unit can be adapted to different process connections.

- Adapters have to be ordered separately as accessories.

A correct fit of the unit and ingress resistance of the connection are only ensured using ifm adapters.

- For small flow rates ifm adapter blocks are available.

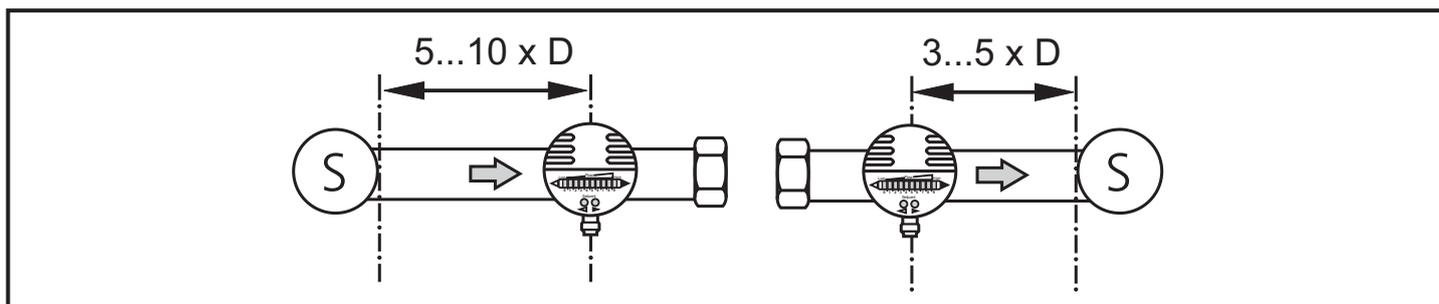
4.1 Installation location

<p>General</p> <ul style="list-style-type: none"> • The sensor tip is to be completely surrounded by the medium. • Insertion depth of the sensor: minimum 12 mm. 		
<p>Recommended</p> <ul style="list-style-type: none"> • For horizontal pipes: mounting from the side. • For vertical pipes: mounting in the rising pipe. 		
<p>Conditional</p> <ul style="list-style-type: none"> • Horizontal pipe /mounting from the bottom: if the pipe is free from build-up. • Horizontal pipe /mounting from the top: if the pipe is completely filled with medium. 		
<p>To avoid</p> <ul style="list-style-type: none"> • The sensor tip must not be in contact with the pipe wall. • Do not mount in downpipes that are open at the bottom! 		

4.2 Sources of interference in the pipe system

Components integrated in the pipes, bends, valves, reductions, etc. lead to turbulence of the medium. This affects the function of the unit.

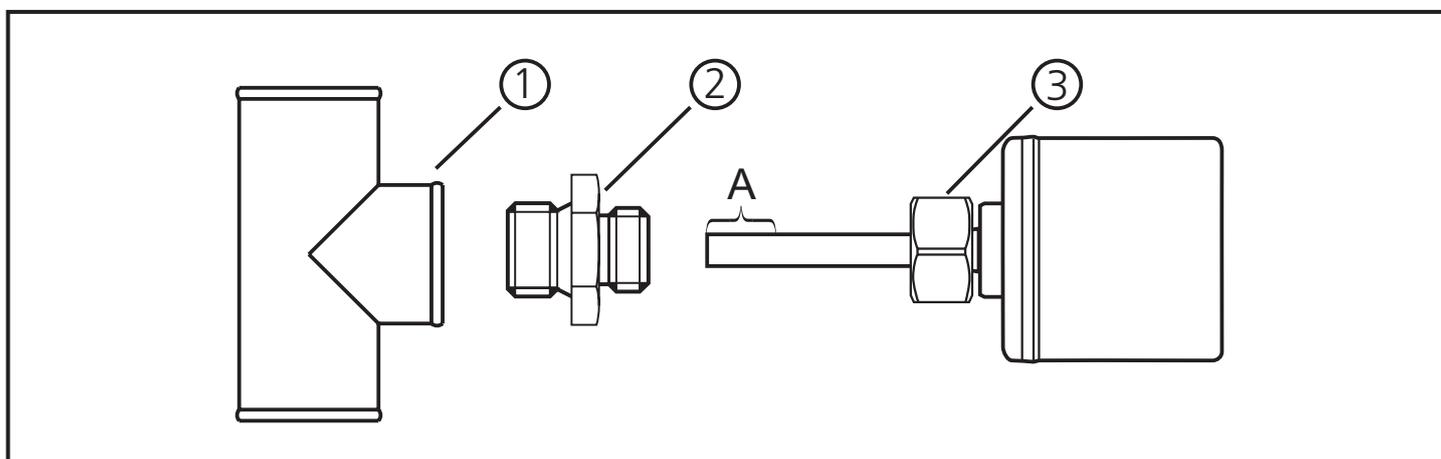
Recommendation: Adhere to the distances between sensor and sources of interference:



D = pipe diameter; S = sources of interference

4.3 Mounting operation

- ! ▶ Ensure that the system is free of pressure during installation.
- ▶ Ensure that no media can leak at the mounting location during installation.



- ▶ Grease the threads of the process connection (1), adapter (2) and nut (3).
Note: The sensor tip (A) must not be in contact with grease.
- ▶ Screw the suitable adapter into the process connection.
- ▶ Place the flow monitor onto the adapter and tighten the nut. Tightening torque 25 Nm. Ensure that the unit is correctly oriented.

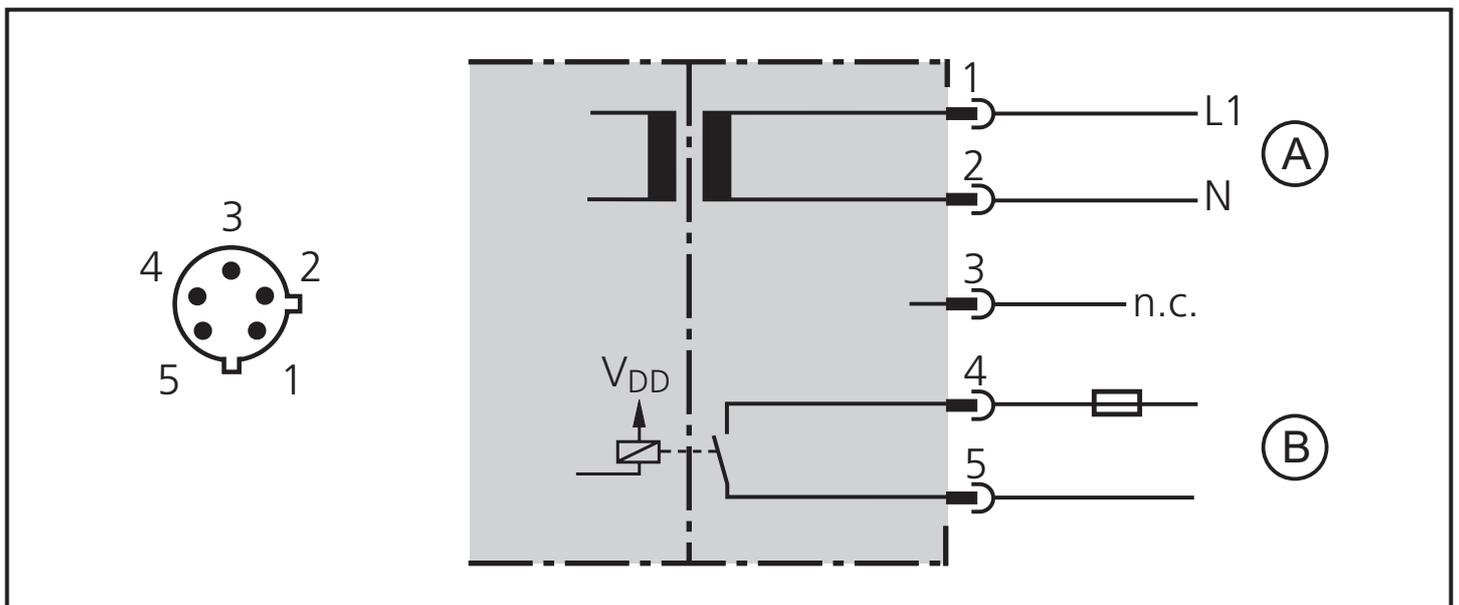
5 Electrical connection



- The unit must be connected by a qualified electrician.
- The national and international regulations for the installation of electrical equipment must be adhered to.
- Caution: For the output circuit the same protective measures as for the supply circuit must be taken.
- Insert a miniature fuse according to IEC60127-2 Sheet 1 (≤ 5 A fast acting).
- The permissible potential difference between supply and output circuit is max. 300 V.
- The equalisation of potential of metal housing parts must be ensured via the connection flange. Ensure an electrically conductive connection.
- Due to the integrated EMC filters, leakage currents of typ. < 0.5 mA can flow via the potential equalisation to the earth potential.
- If several units are used in parallel, take into account that the leakage currents add.
- The applicable standards must be adhered to.

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- ▶ Disconnect power.
- ▶ Connect the unit as follows:



A: supply circuit; B: output circuit

— — — — — : safe separation

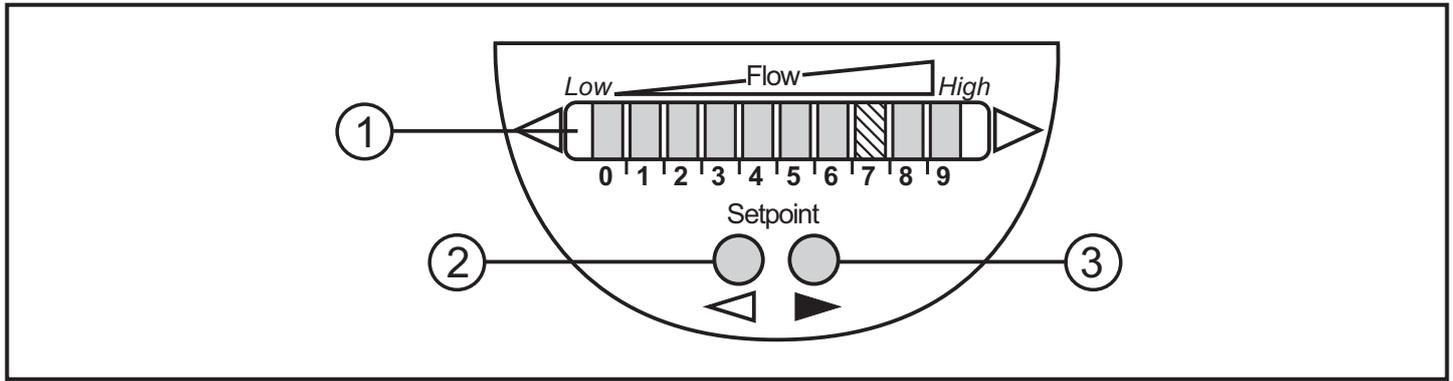
ifm-sockets are available as accessories:

Order no. E11248, E11249, E11250, E11251

Core colours of ifm sockets:

1 = BN (brown), 2 = BU (blue), 4 = BK (black), 5 = WH (white)

6 Operating and display elements



1: Operation display

- The green LEDs indicate the current flow (the LEDs 0 to 9 represent the range between no flow and maximum flow).
- A lighting LED indicates the position of the switch point (orange = output closed, red = output open).

2, 3: Setting buttons for adjustment and configuration

7 Set-up and settings for water

(For media other than water → 8.1: Low flow adjustment).

- ▶ Switch on the supply voltage.
- > All LEDs light and go out again step by step. During this time the output is closed (if configured as normally open). The unit is in the operating mode.
- ▶ Let the normal flow circulate in the installation.
- ▶ Check the display and determine further actions.

1		<p>The factory setting is suitable for the application.</p> <ul style="list-style-type: none"> ▶ No further settings are required.
2		<p>Your normal flow is below the representation range of the display.</p> <p>2 setting options:</p> <ul style="list-style-type: none"> ▶ Change the switch point (→ 7.1). ▶ Carry out high flow adjustment (→ 7.2).
3		<p>Your normal flow exceeds the representation range of the display (LED 9 flashes).</p> <ul style="list-style-type: none"> ▶ Carry out high flow adjustment (→ 7.2).

You can restore the factory setting any time. (→ 8.3).

7.1 Change the switch point (optional)

For the factory setting the switch point is at LED 7. A change makes sense in the following cases:

- the display shows example 2.
 - the flow fluctuates much or pulsates.
 - a faster response time of the unit is requested (low switch point = fast response with rising flow, high switch point = fast response with falling flow).
- ▶ Briefly press the pushbutton ◀ or ▶.
- > The switch point LED flashes.
- ▶ Press the pushbutton ◀ or ▶ as often as required. Each press of the pushbutton shifts the LED by one position in the indicated direction.

Note: If no pushbutton is pressed for 2 s, the unit returns to the operating mode with the newly set value.

7.2 High flow adjustment (optional)

The unit determines the existing flow as normal flow and adapts the display representation (all LEDs except the switch point LED light green).

- ▶ Let the normal flow circulate in the installation.
- ▶ Press the pushbutton ▶ and keep it pressed.
- > LED 9 lights, after approx. 5 s it flashes.
- ▶ Release the pushbutton.

The unit is now adapted to your flow conditions. It passes into the operating mode, the display should now show example 1.

Note: The adjustment affects the switch point: It is increased proportionally (maximum up to LED 7).

8 Additional settings (optional)

8.1 Low flow adjustment

If the unit is used in media other than water, you should additionally adapt the unit to the minimum flow.

Note: The following adjustment must only be carried out after the high flow adjustment.

- ▶ Let the minimum flow circulate in the installation or ensure flow standstill.
- ▶ Press the pushbutton  and keep it pressed.
- > LED 0 lights, after approx. 5 s it flashes.
- ▶ Release the pushbutton. The unit adopts the new value and passes into the operating mode.

8.2 Configure the switching output

The unit is delivered as normally open. In case of need you can change the output to normally closed:

- ▶ Press the pushbutton  for at least 15 s.
- > LED 0 lights, after approx. 5 s it flashes.
- > After 10 s the current setting is displayed: LEDs 5...9 light orange (= output normally open).
- > After approx. 15 s LEDs 0...4 flash orange.
- ▶ Release the pushbutton. The output is changed to normally closed operation.

For a new changeover repeat the operation.

8.3 Restore the factory setting (reset)

- ▶ Press the pushbutton  for at least 15 s.
- > LED 9 lights, after approx. 5 s it flashes.
- > After approx. 15 s LEDs 0...9 flash orange.
- ▶ Release the pushbutton. All settings are reset to the factory setting:
 - operating area: 5 ...100 cm/s for water
 - switch point: LED 7
 - output function: NO
 - unlocked.

8.4 Lock / unlock the unit

The unit can be locked electronically to prevent unintentional settings.

- ▶ Press both setting pushbuttons simultaneously for at least 10 s in the operating mode.
 - > The indication goes out, the unit locks or unlocks.
- On delivery: unlocked.

9 Error during adjustment

If no adjustment is possible, all LEDs flash red. The unit then passes into the operating mode with unchanged values.

Possible cause /aid:

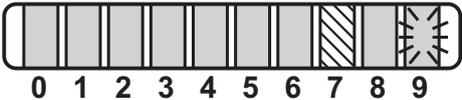
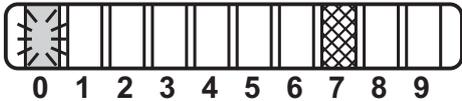
Error during installation.	▶ Read chapter 4 Installation. Check whether all requirements have been met.
The difference between maximum flow and minimum flow is too small.	▶ Increase the flow difference and carry out the adjustment once again.
The sequence high flow /low flow adjustment was not adhered to.	▶ Carry out the two adjustment operations again in the right sequence.

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10 Operation

After every power on all LEDs light and go out again step by step (during this time the output is closed if configured as normally open). The unit is then ready for operation.

In case of power failure or interruption all settings remain.

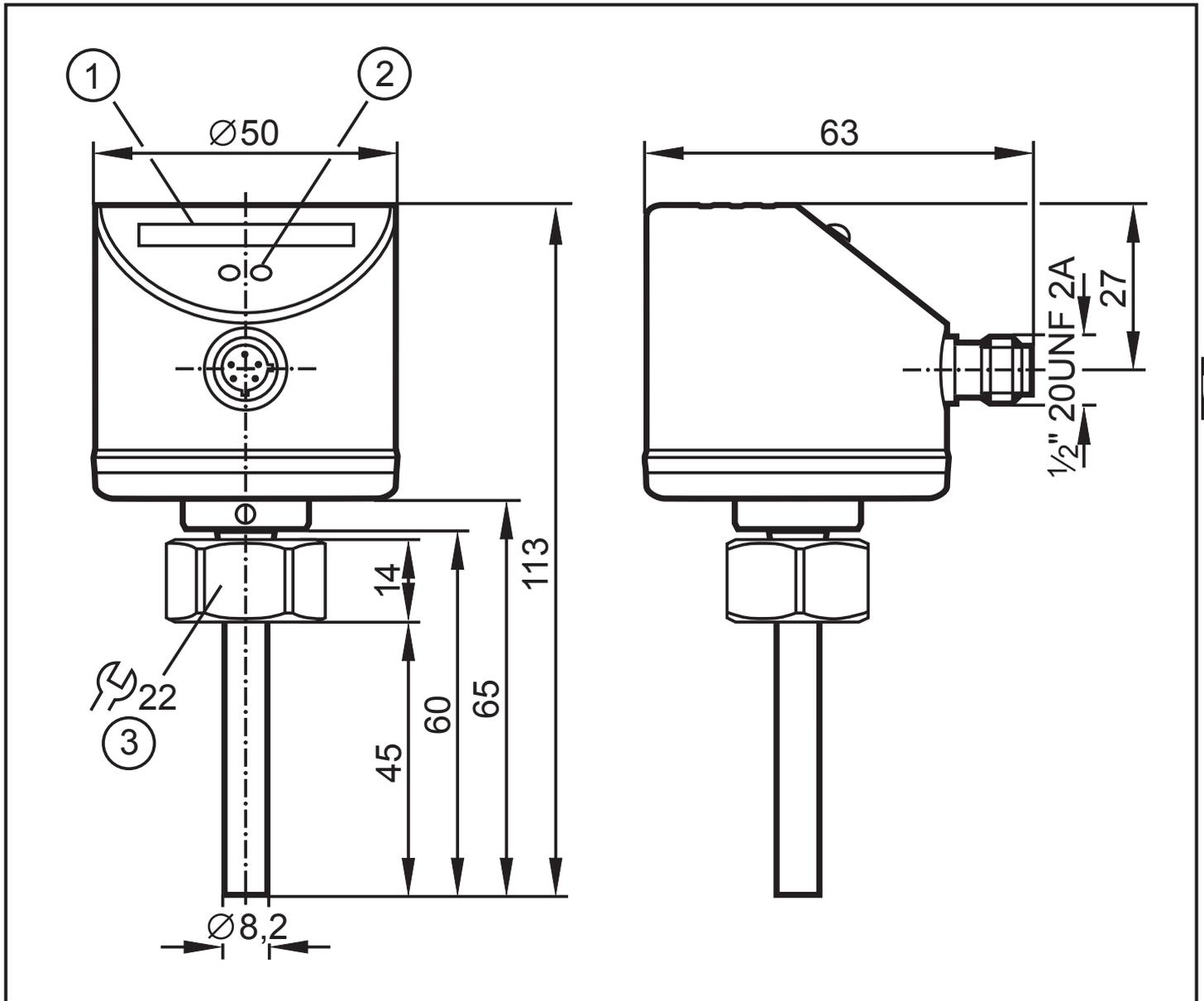
Operating indicators	
 <p>0 1 2 3 4 5 6 7 8 9</p>	<p>Green LED bar: Current flow within the representation range.</p> <p>Indication of the switch point (SP):</p> <ul style="list-style-type: none"> - LED orange: output closed. - LED red: output open.
 <p>0 1 2 3 4 5 6 7 8 9</p>	<p>LED 9 flashes: current flow above the representation range.</p>
 <p>0 1 2 3 4 5 6 7 8 9</p>	<p>LED 0 flashes: current flow far below the representation range.</p>
Interference indicators	
<p>Display OFF (no LED lights):</p>	<p>Operating voltage too low (< 85 V AC) or failed. Ensure a correct voltage supply.</p>

11 Maintenance

Recommended maintenance:

- ▶ Check the sensor tip for build-up from time to time.
- ▶ Clean it using a soft cloth. Stubborn build-up (e.g. lime) can be removed using a common vinegar cleaning agent.

12 Scale drawing



1: LED bar display

2: set button

3: tightening torque 25 Nm

13 Technical data

Application area	Liquids and gases
Nominal voltage [V]	90 ... 240 AC (45...65 Hz)
Voltage tolerance [%]	-5 / +10
Operating voltage [V]	85 ... 265 AC
Power consumption [VA]	3.5
Relay type:	contact closed at work
Switching power of relay	3 A (250 V AC / 30 V DC)
Number of switching cycles	20 million mechanically
Switching cycles with 3 A load	100.000 electrically
Power-on delay time [s]	10, optically indicated
Liquids	
Medium temperature [°C]	-25 ... +80
Setting range [cm/s]	3 ... 300
Greatest sensitivity [cm/s]	3...100
Temperature gradient [K/min]	300
Gases	
Medium temperature [°C]	-25 ... +80
Setting range [cm/s]	200 ... 3000
Greatest sensitivity [cm/s]	200 ... 800
Switch point accuracy [cm/s]	$\pm 2 \dots \pm 10^{1)}$
Hysteresis [cm/s]	2...5 ¹⁾
Repeatability [cm/s]	1...5 ¹⁾
Temperature drift [cm/s x 1/K]	0.1 ²⁾
Response time [s]	1 ... 10
Pressure resistance [bar]	300
Operating temperature [°C]	-25 ... +80
Protection rating / Protection class	IP 67 / II
Shock resistance [g]	50 (DIN / IEC 68-2-27, 11 ms)
Vibration resistance [g]	20 (DIN / IEC 68-2-6, 55-2000 Hz)
Housing materials	stainless steel 316L / 1.4404; stainless steel 304 / 1.4301; PC (Makrolon); PBT-GF 20; EPDM/X (Santoprene)
Materials (wetted parts)	stainless steel 316L / 1.4404; O-ring: FPM 8x1.5 gr 80° Shore A
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

¹⁾ for water; 5...100 cm/s; 25°C (factory setting);

²⁾ for water; 5...100 cm/s; 10...70°C

More information at www.ifm.com

A Controller

Sequence of an A controller.

There are three positions in the A controller selector switch. ON, OFF and REMOTE.

When the selector switch is placed in the "ON" position, the controller opens the solenoid valve and water flows through the float sensors and to the mix chamber. If proper water flow is detected, the controller sends out a signal to the mixer switch. Once the mixer switch is placed in the on position, polymer pump starts.

When the selector switch is placed in the "Remote" position, the controller waits for a customer supplied switch to be placed in the ON position. Once the customer supplied contact closes, the controller functions the same way as it was in "ON" position.

When the selector switch is placed in the "OFF" position, the controller closes the solenoid valve and turns off the polymer pump.

Alarm conditions.

During a normal operation if the water flow was interrupted, the flow sensor indicates the controller of loss of water flow. After a 15-30 second time delay, if the water flow does not return then the A controller shuts off the solenoid valve and turns off the polymer pump.

There is no flush timer in a standard A controller system.

The M PolyBlend with "A" Controller has 2 switches that the customer uses to operate the system. It has a 3 position on the "A" Controller and it has a "ON/OFF" switch (junction box) located on the back of the unit.

VFD Information



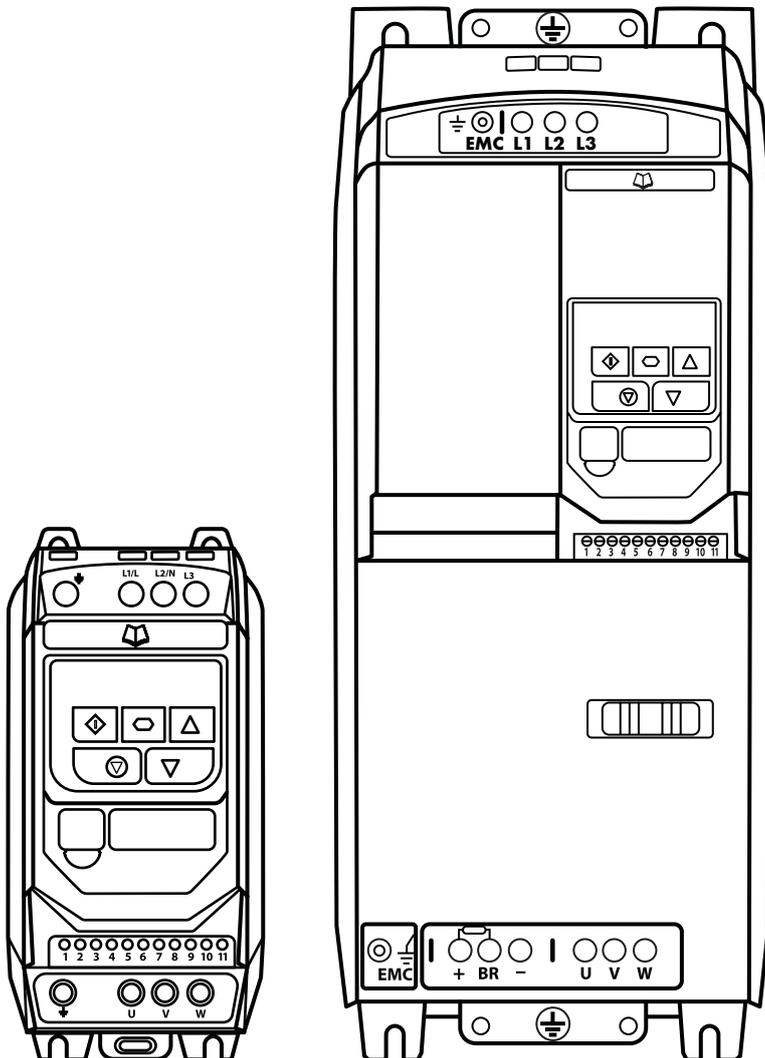
Member of **Sumitomo Drive Technologies**

OPTIDRIVE™

AC Variable Speed Drive

IP20

0.37kW – 37kW / 0.5HP – 50HP
110 – 480V Single and 3 Phase Input



Quick Start Up	1
General Information and Ratings	2
Mechanical Installation	3
Power & Control Wiring	4
Operation	5
Parameters	6
Analog and Digital Input Macro Configurations	7
Modbus RTU Communications	8
Technical Data	9
Troubleshooting	10
Energy Efficiency Classification	11

1. Quick Start Up	4	6. Parameters	18
1.1. Important Safety Information.	4	6.1. Standard Parameters.	18
1.2. Quick Start Process.	5	6.2. Extended Parameters.	20
1.3. Installation Following a Period of Storage	6	6.3. Advanced Parameters	24
2. General Information and Ratings	7	6.4. P-00 Read Only Status Parameters.	26
2.1. Identifying the Drive by Model Number.	7	7. Analog and Digital Input Macro Configurations. . .	27
2.2. Drive Model Numbers.	7	7.1. Overview	27
3. Mechanical Installation	9	7.2. Example Connection Diagrams	27
3.1. General	9	7.3. Macro Functions Guide Key	28
3.2. UL Compliant Installation	9	7.4. Macro Functions – Terminal Mode (P-12 = 0)	29
3.3. Mechanical Dimensions and Mounting – IP20 Open Units ...	9	7.5. Macro Functions - Keypad Mode (P-12 = 1 or 2)	30
3.4. Guidelines for Enclosure Mounting	10	7.6. Macro Functions - Fieldbus Control Mode (P-12 = 3, 4, 7, 8 or 9)	30
4. Power & Control Wiring	11	7.7. Macro Functions - User PI Control Mode (P-12 = 5 or 6) ..	31
4.1. Connection Diagram.	11	7.8. Fire Mode	31
4.2. Protective Earth (PE) Connection.	11	8. Modbus RTU Communications	32
4.3. Incoming Power Connection	12	8.1. Introduction.	32
4.4. Motor Connection	12	8.2. Modbus RTU Specification	32
4.5. Motor Terminal Box Connections	13	8.3. RJ45 Connector Configuration	32
4.6. Control Terminal Wiring.	13	8.4. Modbus Register Map.	32
4.7. Control Terminal Connections	13	9. Technical Data	36
4.8. Motor Thermal Overload Protection.	14	9.1. Environmental.	36
4.9. EMC Compliant Installation.	15	9.2. Rating Tables	36
4.10. Optional Brake Resistor	15	9.3. Single Phase Operation of Three Phase Drives	37
5. Operation	16	9.4. Additional Information for UL Compliance.	37
5.1. Managing the Keypad	16	9.5. EMC Filter Disconnect	38
5.2. Operating Displays.	16	10. Troubleshooting	39
5.3. Changing Parameters.	16	10.1. Fault Code Messages.	39
5.4. Read Only Parameter Access	17	11. Energy Efficiency Classification	40
5.5. Resetting Parameters.	17		
5.6. Resetting a Fault.	17		
5.7. LED Display	17		

General Information

It is the responsibility of the installer to ensure that the equipment or system into which the product is incorporated complies with all relevant legislation and codes of practice which apply in the country of use.

CE Marking

All Invertek Drives products intended for use within the European Union carry the CE mark to indicate compliance with European Directives.

A declaration of conformity is available from the website, www.invertekdrives.com

For compliance with the European EMC Directive, the necessary guidance is provided within this document and it is the responsibility of the installer to ensure this guidance is followed to ensure compliance.

UL Conformity

A list of currently listed products is available from the UL website, www.ul.com.

For compliance with UL requirements, the necessary guidance is provided within this document and it is the responsibility of the installer to ensure this guidance is followed to ensure compliance.

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2 Year Warranty

All Invertek Optidrive units carry a 2 year warranty against manufacturing defects from the date of manufacture. The manufacturer accepts no liability for any damage caused during or resulting from transport, receipt of delivery, installation or commissioning. The manufacturer also accepts no liability for damage or consequences resulting from inappropriate, negligent or incorrect installation, incorrect adjustment of the operating parameters of the drive, incorrect matching of the drive to the motor, incorrect installation, unacceptable dust, moisture, corrosive substances, excessive vibration or ambient temperatures outside of the design specification.

The local distributor may offer different terms and conditions at their discretion, and in all cases concerning warranty, the local distributor should be contacted first.

This user guide is the “original instructions” document. All non-English versions are translations of the “original instructions”.

The contents of this User Guide are believed to be correct at the time of printing. In the interest of a commitment to a policy of continuous improvement, the manufacturer reserves the right to change the specification of the product or its performance or the contents of the User Guide without notice.

This User Guide is for use with version 3.11 Firmware

User Guide Revision 1.03

Invertek Drives Ltd adopts a policy of continuous improvement and whilst every effort has been made to provide accurate and up to date information, the information contained in this User Guide should be used for guidance purposes only and does not form the part of any contract.

	When installing the drive on any power supply where the phase-ground voltage may exceed the phase-phase voltage (typically IT supply networks or Marine vessels) it is essential that the internal EMC filter ground and surge protection varistor ground (where fitted) are disconnected. If in doubt, refer to your Sales Partner for further information.
	This manual is intended as a guide for proper installation. Invertek Drives Ltd cannot assume responsibility for the compliance or the non-compliance to any code, national, local or otherwise, for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.
	This Optidrive contains high voltage capacitors that take time to discharge after removal of the main supply. Before working on the drive, ensure isolation of the main supply from line inputs. Wait ten (10) minutes for the capacitors to discharge to safe voltage levels. Failure to observe this precaution could result in severe bodily injury or loss of life.
	Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

1. Quick Start Up

1.1. Important Safety Information

Please read the IMPORTANT SAFETY INFORMATION below, and all Warning and Caution information elsewhere.



Danger: Indicates a risk of electric shock, which, if not avoided, could result in damage to the equipment and possible injury or death.

This variable speed drive product (Optidrive) is intended for professional incorporation into complete equipment or systems as part of a fixed installation. If installed incorrectly it may present a safety hazard. The Optidrive uses high voltages and currents, carries a high level of stored electrical energy, and is used to control mechanical plant that may cause injury. Close attention is required to system design and electrical installation to avoid hazards in either normal operation or in the event of equipment malfunction. Only qualified electricians are allowed to install and maintain this product.

System design, installation, commissioning and maintenance must be carried out only by personnel who have the necessary training and experience. They must carefully read this safety information and the instructions in this Guide and follow all information regarding transport, storage, installation and use of the Optidrive, including the specified environmental limitations.

Do not perform any flash test or voltage withstand test on the Optidrive. Any electrical measurements required should be carried out with the Optidrive disconnected.

Electric shock hazard! Disconnect and ISOLATE the Optidrive before attempting any work on it. High voltages are present at the terminals and within the drive for up to 10 minutes after disconnection of the electrical supply. Always ensure by using a suitable multimeter that no voltage is present on any drive power terminals prior to commencing any work.

Where supply to the drive is through a plug and socket connector, do not disconnect until 10 minutes have elapsed after turning off the supply.

Ensure correct earthing connections. The earth cable must be sufficient to carry the maximum supply fault current which normally will be limited by the fuses or MCB. Suitably rated fuses or MCB should be fitted in the mains supply to the drive, according to any local legislation or codes.

Ensure correct earthing connections and cable selection as per defined by local legislation or codes. The drive may have a leakage current of greater than 3.5mA; furthermore the earth cable must be sufficient to carry the maximum supply fault current which normally will be limited by the fuses or MCB. Suitably rated fuses or MCB should be fitted in the mains supply to the drive, according to any local legislation or codes.

Do not carry out any work on the drive control cables whilst power is applied to the drive or to the external control circuits.



Danger: Indicates a potentially hazardous situation other than electrical, which if not avoided, could result in damage to property.

Within the European Union, all machinery in which this product is used must comply with Directive 2006/42/EC, Safety of Machinery. In particular, the machine manufacturer is responsible for providing a main switch and ensuring the electrical equipment complies with EN60204-1.

The level of integrity offered by the Optidrive control input functions – for example stop/start, forward/reverse and maximum speed is not sufficient for use in safety-critical applications without independent channels of protection. All applications where malfunction could cause injury or loss of life must be subject to a risk assessment and further protection provided where needed.

The driven motor can start at power up if the enable input signal is present.

The STOP function does not remove potentially lethal high voltages. ISOLATE the drive and wait 10 minutes before starting any work on it. Never carry out any work on the Drive, Motor or Motor cable whilst the input power is still applied.

The Optidrive can be programmed to operate the driven motor at speeds above or below the speed achieved when connecting the motor directly to the mains supply. Obtain confirmation from the manufacturers of the motor and the driven machine about suitability for operation over the intended speed range prior to machine start up.

Do not activate the automatic fault reset function on any systems whereby this may cause a potentially dangerous situation.

Optidrives are intended for indoor use only.

When mounting the drive, ensure that sufficient cooling is provided. Do not carry out drilling operations with the drive in place, dust and swarf from drilling may lead to damage.

The entry of conductive or flammable foreign bodies should be prevented. Flammable material should not be placed close to the drive

Relative humidity must be less than 95% (non-condensing).

Ensure that the supply voltage, frequency and no. of phases (1 or 3 phase) correspond to the rating of the Optidrive as delivered.

Never connect the mains power supply to the Output terminals U, V, W.

Do not install any type of automatic switchgear between the drive and the motor.

Wherever control cabling is close to power cabling, maintain a minimum separation of 100 mm and arrange crossings at 90 degrees. Ensure that all terminals are tightened to the appropriate torque setting.

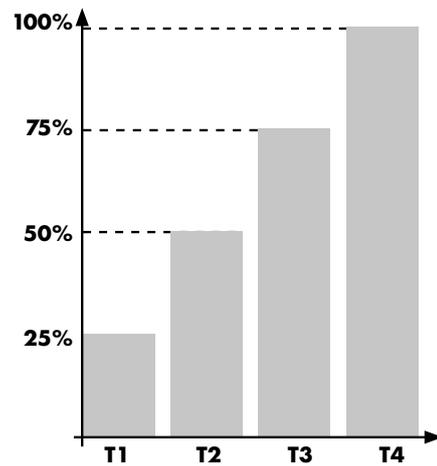
Do not attempt to carry out any repair of the Optidrive. In the case of suspected fault or malfunction, contact your local Invertek Drives Sales Partner for further assistance.

1.2. Quick Start Process

Step	Action	See section	Page
1	Identify the Enclosure Type, Model Type and ratings of your drive from the model code on the label. In particular - Check the voltage rating suits the incoming supply - Check the output current capacity meets or exceeds the full load current for the intended motor	2.1. Identifying the Drive by Model Number	7
2	Unpack and check the drive. Notify the supplier and shipper immediately of any damage.		
3	Ensure correct ambient and environmental conditions for the drive are met by the proposed mounting location.	9.1. Environmental	36
4	Install the drive in a suitable cabinet (IP20 Units) ensuring suitable cooling air is available.	3.1. General 3.3. Mechanical Dimensions and Mounting – IP20 Open Units 3.4. Guidelines for Enclosure Mounting	9 9 10
5	Select the correct power and motor cables according to local wiring regulations or code, noting the maximum permissible sizes	9.2. Rating Tables	36
6	If the supply type is IT or corner grounded, disconnect the EMC filter before connecting the supply.	9.5. EMC Filter Disconnect	38
7	Check the supply cable and motor cable for faults or short circuits.		
8	Route the cables.		
9	Check that the intended motor is suitable for use, noting any precautions recommended by the supplier or manufacturer.	4.9. EMC Compliant Installation	15
10	Check the motor terminal box for correct Star or Delta configuration where applicable.	4.5. Motor Terminal Box Connections	13
11	Ensure wiring protection is providing, by installing a suitable circuit breaker or fuses in the incoming supply line.	4.3.2. Fuse / Circuit Breaker Selection 9.2. Rating Tables	12 36
12	Connect the power cables, especially ensuring the protective earth connection is made.	4.1. Connection Diagram 4.2. Protective Earth (PE) Connection 4.3. Incoming Power Connection 4.4. Motor Connection	11 11 12 12
13	Connect the control cables as required for the application.	4.6. Control Terminal Wiring 4.9. EMC Compliant Installation 7. Analog and Digital Input Macro Configurations 7.2. Example Connection Diagrams	13 15 27 27
14	Thoroughly check the installation and wiring.		
15	Commission the drive parameters.	5.1. Managing the Keypad 6. Parameters	16 18

1.3. Installation Following a Period of Storage

Where the drive has been stored for some time prior to installation, or has remained without the main power supply present for an extended period of time, it is necessary to reform the DC capacitors within the drive according to the following table before operation. For drives which have not been connected to the main power supply for a period of more than 2 years, this requires a reduced mains voltage to be applied for a time period, and gradually increased prior to operating the drive. The voltage levels relative to the drive rated voltage, and the time periods for which they must be applied are shown in the following table. Following completion of the procedure, the drive may be operated as normal.

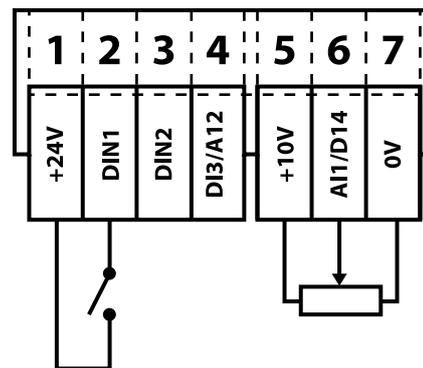


Storage Period / Power-OFF Period	Initial Input Voltage Level	Time Period T1	Secondary Input Voltage Level	Time Period T2	Third Input Voltage Level	Time Period T3	Final Input Voltage Level	Time Period T4
Up to 1 Year	100%	N/A						
1 – 2 Years	100%	1 Hour	N/A					
2 – 3 Years	25%	30 Minutes	50%	30 Minutes	75%	30 Minutes	100%	30 Minutes
More than 3 Years	25%	2 Hours	50%	2 Hours	75%	2 Hours	100%	2 Hours

1.4. Quick Start Overview

Quick Start – IP20

- Connect a Start / Stop switch between control terminals 1 & 2
 - Close the Switch to Start
 - Open to Stop
- Connect a potentiometer (5k – 10kΩ) between terminals 5, 6 and 7 as shown
 - Adjust the potentiometer to vary the speed from P-02 (0Hz default) to P-01 (50 / 60 Hz default)



2. General Information and Ratings

This chapter contains information about the Optidrive E3 including how to identify the drive.

2.1. Identifying the Drive by Model Number

Each drive can be identified by its model number, as shown in the table below. The model number is on the shipping label and the drive nameplate. The model number includes the drive and any options.

	ODE	-	3	-	1	2	0021	-	1	F	1	2		
Product Family													IP Rating	2 = IP20
Generation													Dynamic Brake Transistor	1 = Not Fitted 4 = Internal Transistor
Frame Size													Filter Type	0 = No Filter F = Internal EMC Filter
Input Voltage	1 = 110 – 115 2 = 200 – 240 4 = 380 – 480												No. Of Input Phases	Output Current x 10

2.2. Drive Model Numbers

110 – 115V ± 10% - 1 Phase Input – 3 Phase 230V Output (Voltage Doubler)					
Model Number		kW	HP	Output Current (A)	Frame Size
With Filter	Without Filter				
N/A	ODE-3-110023-1012		0.5	2.3	1
N/A	ODE-3-110043-1012		1	4.3	1
N/A	ODE-3-210058-1042		1.5	5.8	2
200 – 240V ± 10% - 1 Phase Input – 3 Phase Output					
Model Number		kW	HP	Output Current (A)	Frame Size
With Filter	Without Filter				
ODE-3-120023-1F12	ODE-3-120023-1012	0.37	0.5	2.3	1
ODE-3-120043-1F12	ODE-3-120043-1012	0.75	1	4.3	1
ODE-3-120070-1F12	ODE-3-120070-1012	1.5	2	7	1
ODE-3-220070-1F42	ODE-3-220070-1042	1.5	2	7	2
ODE-3-220105-1F42	ODE-3-220105-1042	2.2	3	10.5	2
N/A	ODE-3-320153-1042	4.0	5	15.3	3
200 – 240V ± 10% - 3 Phase Input – 3 Phase Output					
Model Number		kW	HP	Output Current (A)	Frame Size
With Filter	Without Filter				
N/A	ODE-3-120023-3012	0.37	0.5	2.3	1
N/A	ODE-3-120043-3012	0.75	1	4.3	1
N/A	ODE-3-120070-3012	1.5	2	7	1
ODE-3-220070-3F42	ODE-3-220070-3042	1.5	2	7	2
ODE-3-220105-3F42	ODE-3-220105-3042	2.2	3	10.5	2
ODE-3-320180-3F42	ODE-3-320180-3042	4.0	5	18	3
ODE-3-320240-3F42	ODE-3-320240-3042	5.5	7.5	24	3
ODE-3-420300-3F42	ODE-3-420300-3042	7.5	10	30	4
ODE-3-420460-3F42	ODE-3-420460-3042	11	15	46	4
ODE-3-520610-3F42	N/A	15	20	61	5
ODE-3-520720-3F42	N/A	18.5	25	72	5

380 – 480V ± 10% - 3 Phase Input – 3 Phase Output					
Model Number		kW	HP	Output Current (A)	Frame Size
With Filter	Without Filter				
ODE-3-140012-3F12	ODE-3-140012-3012	0.37	0.5	1.2	1
ODE-3-140022-3F12	ODE-3-140022-3012	0.75	1	2.2	1
ODE-3-140041-3F12	ODE-3-140041-3012	1.5	2	4.1	1
ODE-3-240041-3F42	ODE-3-240041-3042	1.5	2	4.1	2
ODE-3-240058-3F42	ODE-3-240058-3042	2.2	3	5.8	2
ODE-3-240095-3F42	ODE-3-240095-3042	4	5	9.5	2
ODE-3-340140-3F42	ODE-3-340140-3042	5.5	7.5	14	3
ODE-3-340180-3F42	ODE-3-340180-3042	7.5	10	18	3
ODE-3-340240-3F42	ODE-3-340240-3042	11	15	24	3
ODE-3-440300-3F42	ODE-3-440300-3042	15	20	30	4
ODE-3-440390-3F42	ODE-3-440390-3042	18.5	25	39	4
ODE-3-440460-3F42	ODE-3-440460-3042	22	30	46	4
ODE-3-540610-3F42	N/A	30	40	61	5
ODE-3-540720-3F42	N/A	37	50	72	5

3. Mechanical Installation

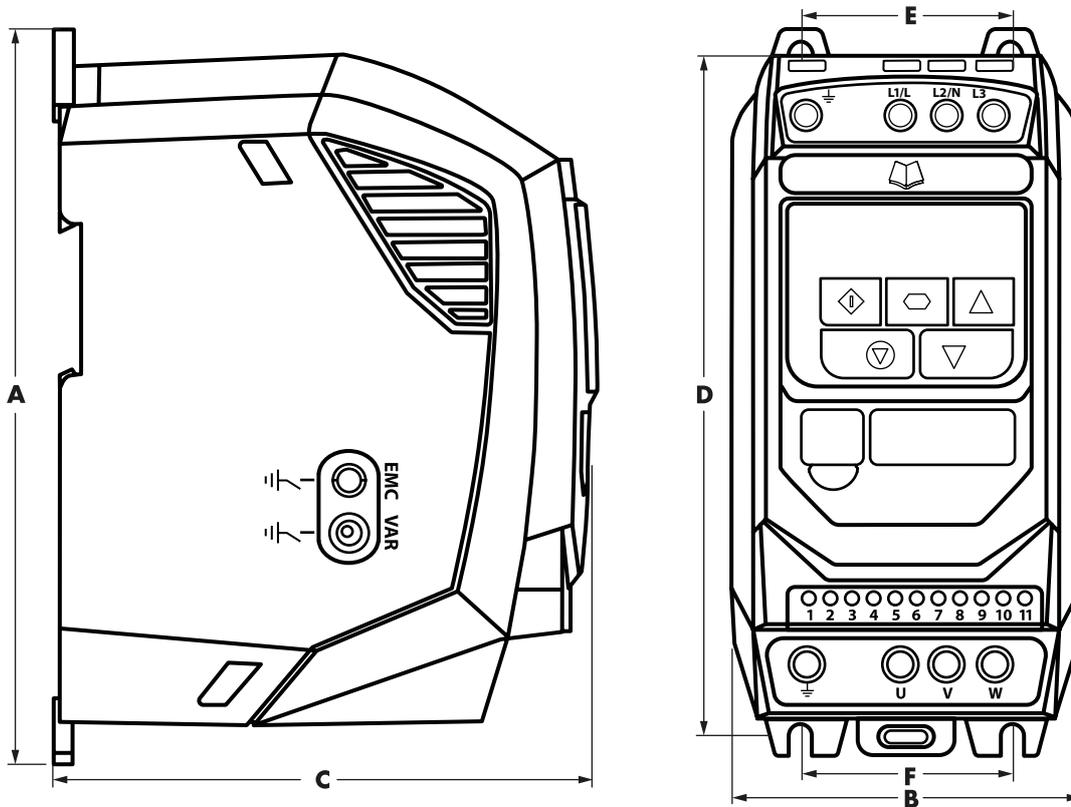
3.1. General

- The Optidrive should be mounted in a vertical position only, on a flat, flame resistant, vibration free mounting using the integral mounting holes or DIN Rail clip (Frame Sizes 1 and 2 only).
- IP20 Optidrives are designed to be installed in suitable enclosures to protect them from the environment.
- Do not mount flammable material close to the Optidrive.
- Ensure that the ambient temperature range does not exceed the permissible limits for the Optidrive given in section 9.1. *Environmental on page 36.*
- Provide suitable clean, moisture and contaminant free cooling air sufficient to fulfil the cooling requirements of the Optidrive.

3.2. UL Compliant Installation

Refer to section 9.4. *Additional Information for UL Compliance on page 37* for Additional Information for UL Compliance.

3.3. Mechanical Dimensions and Mounting – IP20 Open Units



Mechanical Installation



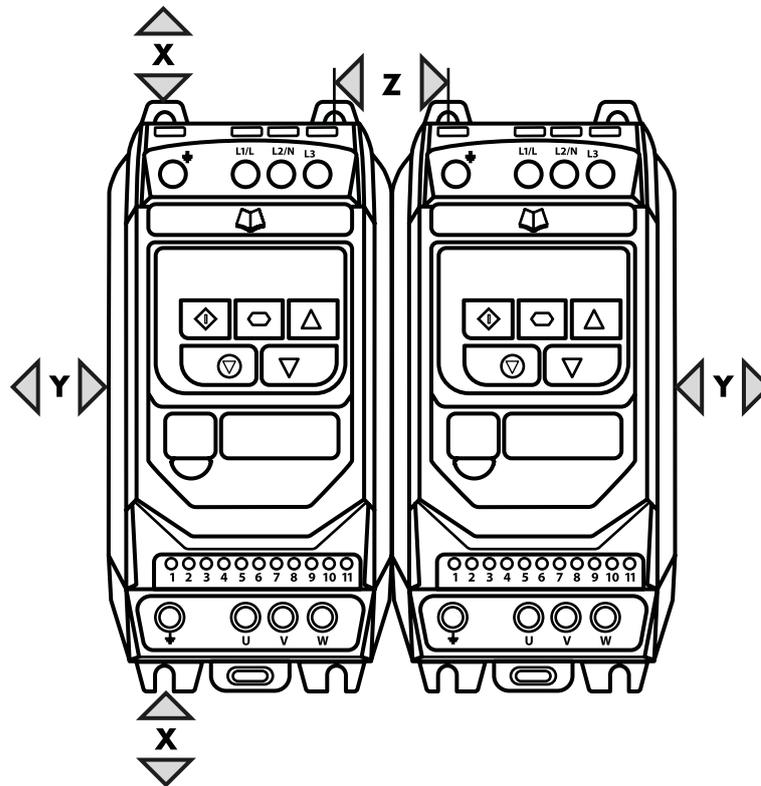
Drive Size	A		B		C		D		E		F		Weight	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	Kg	lb
1	173	6.81	83	3.27	123	4.84	162	6.38	50	1.97	50	1.97	1.0	2.2
2	221	8.70	110	4.33	150	5.91	209	8.23	63	2.48	63	2.48	1.7	3.8
3	261	10.28	131	5.16	175	6.89	247	9.72	80	3.15	80	3.15	3.2	7.1
4	420	16.54	171	6.73	212	8.35	400	15.75	125	4.92	125	4.92	9.1	20.1
5	486	19.13	222	8.74	226	8.89	463	18.22	175	6.88	175	6.88	18.1	39.9

Mounting Bolts		
Frame Size	Metric	UNF
1 - 3	4 x M5	#8
4	4 x M8	#8
5	4 x M8	#8

Tightening Torques				
	Frame Size	Required Torque		Terminal Type
Control Terminals	All	0.5 Nm	4.5 lb-in	Rising Clamp
	1 - 3	0.8 Nm	7 lb-in	Screw Clamp
Power Terminals	4	2 Nm	18 lb-in	Rising Clamp
	5	4 Nm	35.5 lb-in	Rising Clamp

3.4. Guidelines for Enclosure Mounting

- IP20 drives are designed to be installed in suitable enclosures to protect them from the environment.
- Enclosures should be made from a thermally conductive material.
- Ensure the minimum air gap clearances around the drive as shown below are observed when mounting the drive.
- Where ventilated enclosures are used, there should be venting above the drive and below the drive to ensure good air circulation. Air should be drawn in below the drive and expelled above the drive.
- In any environments where the conditions require it, the enclosure must be designed to protect the Optidrive against ingress of airborne dust, corrosive gases or liquids, conductive contaminants (such as condensation, carbon dust, and metallic particles) and sprays or splashing water from all directions.
- High moisture, salt or chemical content environments should use a suitably sealed (non-vented) enclosure.
- The enclosure design and layout should ensure that the adequate ventilation paths and clearances are left to allow air to circulate through the drive heatsink. Inverter Drives recommend the following minimum sizes for drives mounted in non-ventilated metallic enclosures:



Drive Size	X Above & Below		Y Either Side		Z Between		Recommended airflow CFM (ft ³ /min)
	mm	in	mm	in	mm	in	
1	50	1.97	50	1.97	33	1.30	11
2	75	2.95	50	1.97	46	1.81	22
3	100	3.94	50	1.97	52	2.05	60
4	100	3.94	50	1.97	52	2.05	120
5	200	7.87	25	0.98	70	2.76	104

NOTE

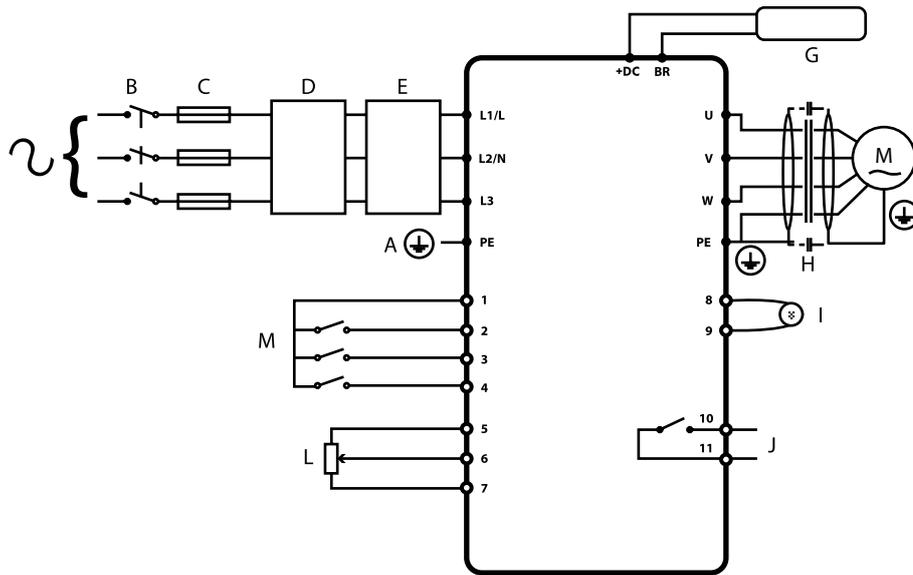
Dimension Z assumes that the drives are mounted side-by-side with no clearance.

Typical drive heat losses are 3% of operating load conditions.

Above are guidelines only and the operating ambient temperature of the drive MUST be maintained at all times.

4. Power & Control Wiring

4.1. Connection Diagram



	Key	Sec.	Page
A	Protective Earth (PE) Connection	4.2	11
B	Incoming Power Connection	4.3	12
C	Fuse / Circuit Breaker Selection	4.3.2	12
D	Optional Input Choke	4.3.3	12
E	Optional External EMC Filter	4.10	15
F	Internal Disconnect / Isolator	4.3	12
G	Optional Brake Resistor	4.10	15
H	Motor Connection		
I	Analog Output	4.7.1	13
J	Auxiliary Relay Output	4.7.2	14
L	Analog Inputs	4.7.3	14
M	Digital Inputs	4.7.4	14

4.2. Protective Earth (PE) Connection

Grounding Guidelines

The ground terminal of each Optidrive should be individually connected DIRECTLY to the site ground bus bar (through the filter if installed). Optidrive ground connections should not loop from one drive to another, or to, or from any other equipment. Ground loop impedance must conform to local industrial safety regulations. To meet UL regulations, UL approved ring crimp terminals should be used for all ground wiring connections.

The drive Safety Ground must be connected to system ground. Ground impedance must conform to the requirements of national and local industrial safety regulations and/or electrical codes. The integrity of all ground connections should be checked periodically.

Protective Earth Conductor

The Cross sectional area of the PE Conductor must be at least equal to that of the incoming supply conductor.

Safety Ground

This is the safety ground for the drive that is required by code. One of these points must be connected to adjacent building steel (girder, joist), a floor ground rod, or bus bar. Grounding points must comply with national and local industrial safety regulations and/or electrical codes.

Motor Ground

The motor ground must be connected to one of the ground terminals on the drive.

Ground Fault Monitoring

As with all inverters, a leakage current to earth can exist. The Optidrive is designed to produce the minimum possible leakage current whilst complying with worldwide standards. The level of current is affected by motor cable length and type, the effective switching frequency, the earth connections used and the type of RFI filter installed. If an ELCB (Earth Leakage Circuit Breaker) is to be used, the following conditions apply:

- A Type B Device must be used.
- The device must be suitable for protecting equipment with a DC component in the leakage current.
- Individual ELCBs should be used for each Optidrive.

Shield Termination (Cable Screen)

The safety ground terminal provides a grounding point for the motor cable shield. The motor cable shield connected to this terminal (drive end) should also be connected to the motor frame (motor end). Use a shield terminating or EMI clamp to connect the shield to the safety ground terminal.

4.3. Incoming Power Connection

4.3.1. Cable Selection

- For 1 phase supply, the mains power cables should be connected to L1/L, L2/N.
- For 3 phase supplies, the mains power cables should be connected to L1, L2, and L3. Phase sequence is not important.
- For compliance with CE and C Tick EMC requirements, refer to section 4.9. *EMC Compliant Installation on page 15.*
- A fixed installation is required according to IEC61800-5-1 with a suitable disconnecting device installed between the Optidrive and the AC Power Source. The disconnecting device must conform to the local safety code / regulations (e.g. within Europe, EN60204-1, Safety of machinery).
- The cables should be dimensioned according to any local codes or regulations. Maximum dimensions are given in section 9.2. *Rating Tables on page 36.*

4.3.2. Fuse / Circuit Breaker Selection

- Suitable fuses to provide wiring protection of the input power cable should be installed in the incoming supply line, according to the data in section 9.2. *Rating Tables.* The fuses must comply with any local codes or regulations in place. In general, type gG (IEC 60269) or UL type J fuses are suitable; however in some cases type aR fuses may be required. The operating time of the fuses must be below 0.5 seconds.
- Where allowed by local regulations, suitably dimensioned type B MCB circuit breakers of equivalent rating may be utilised in place of fuses, providing that the clearing capacity is sufficient for the installation.
- The maximum permissible short circuit current at the Optidrive Power terminals as defined in IEC60439-1 is 100kA.

4.3.3. Optional Input Choke

- An optional Input Choke is recommended to be installed in the supply line for drives where any of the following conditions occur:
 - The incoming supply impedance is low or the fault level / short circuit current is high.
 - The supply is prone to dips or brown outs.
 - An imbalance exists on the supply (3 phase drives).
 - The power supply to the drive is via a busbar and brush gear system (typically overhead Cranes).
- In all other installations, an input choke is recommended to ensure protection of the drive against power supply faults. Part numbers are shown in the table.

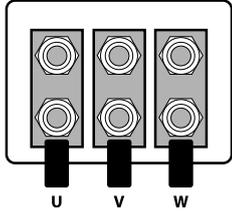
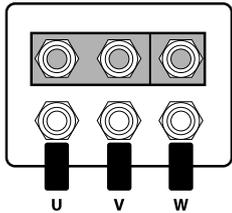
Supply	Frame Size	AC Input Inductor
230 Volt 1 Phase	1	OPT-2-L1016-20
	2	OPT-2-L1025-20
	3	N/A
400 Volt 3 Phase	1	OPT-2-L3006-20
	2	OPT-2-L3010-20
	3	OPT-2-L3036-20
	4	OPT-2-L3050-20
	5	OPT-2-L3090-20

4.4. Motor Connection

- The drive inherently produces fast switching of the output voltage (PWM) to the motor compared to the mains supply, for motors which have been wound for operation with a variable speed drive then there is no preventative measures required, however if the quality of insulation is unknown then the motor manufacturer should be consulted and preventative measures may be required.
- The motor should be connected to the Optidrive U, V, and W terminals using a suitable 3 or 4 core cable. Where a 3 core cable is utilised, with the shield operating as an earth conductor, the shield must have a cross sectional area at least equal to the phase conductors when they are made from the same material. Where a 4 core cable is utilised, the earth conductor must be of at least equal cross sectional area and manufactured from the same material as the phase conductors.
- The motor earth must be connected to one of the Optidrive earth terminals.
- Maximum permitted motor cable length for all models: 100 metres shielded, 150 metres unshielded.
- Where multiple motors are connected to a single drive using parallel cables, an output choke **must** be installed.

4.5. Motor Terminal Box Connections

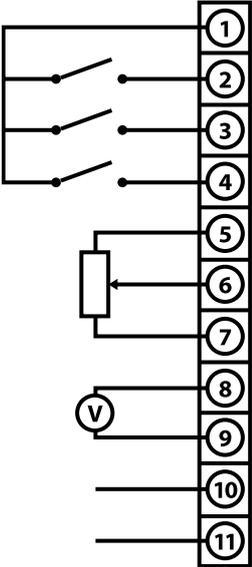
Most general purpose motors are wound for operation on dual voltage supplies. This is indicated on the nameplate of the motor. This operational voltage is normally selected when installing the motor by selecting either STAR or DELTA connection. STAR always gives the higher of the two voltage ratings.

Incoming Supply Voltage	Motor Nameplate Voltages	Connection	
230	230 / 400	Delta Δ	
400	400 / 690		
400	230 / 400	Star λ	

4.6. Control Terminal Wiring

- All analog signal cables should be suitably shielded. Twisted pair cables are recommended.
- Power and Control Signal cables should be routed separately where possible, and must not be routed parallel to each other.
- Signal levels of different voltages e.g. 24 Volt DC and 110 Volt AC, should not be routed in the same cable.
- Maximum control terminal tightening torque is 0.5Nm.
- Control Cable entry conductor size: 0.05 – 2.5mm² / 30 – 12 AWG.

4.7. Control Terminal Connections

Default Connections	Control Terminal	Signal	Description
	1	+24Vdc User Output	+24Vdc user output, 100mA.  Do not connect an external voltage source to this terminal.
	2	Digital Input 1	Positive logic
	3	Digital Input 2	"Logic 1" input voltage range: 8V ... 30V DC "Logic 0" input voltage range: 0V ... 4V DC
	4	Digital Input 3 / Analog Input 2	Digital: 8 to 30V Analog: 0 to 10V, 0 to 20mA or 4 to 20mA
	5	+10V User Output	+10V, 10mA, 1kΩ minimum
	6	Analog Input 1 / Digital Input 4	Analog: 0 to 10V, 0 to 20mA or 4 to 20mA Digital: 8 to 30V
	7	0V	0 Volt Common, internally connected to terminal 9
	8	Analog Output / Digital Output	Analog: 0 to 10V, 20mA maximum Digital: 0 to 24V
	9	0V	0 Volt Common, internally connected to terminal 7
	10	Auxiliary Relay Common	
	11	Auxiliary Relay NO Contact	Contact 250Vac, 6A / 30Vdc, 5A Intended to drive resistive load.

4.7.1. Analog Output

The analog output function may be configured using parameter P-25, which is described in section 6.2. *Extended Parameters on page 20.*

The output has two operating modes, dependent on the parameter selection:

- Analog Mode
 - The output is a 0 – 10 volt DC signal, 20mA max load current.
- Digital Mode
 - The output is 24 volt DC, 20mA max load current.

4.7.2. Relay Output

The relay output function may be configured using parameter P-18, which is described in section 6.2. *Extended Parameters on page 20.*

4.7.3. Analog Inputs

Two analog inputs are available, which may also be used as Digital Inputs if required. The signal formats are selected by parameters as follows:

- Analog Input 1 Format Selection Parameter P-16.
- Analog Input 2 Format Selection Parameter P-47.

These parameters are described more fully in section 6.2. *Extended Parameters on page 20.*

The function of the analog input, e.g. for speed reference or PID feedback for example is defined by parameters P-15. The function of these parameters and available options is described in section 7. *Analog and Digital Input Macro Configurations on page 27.*

4.7.4. Digital Inputs

Up to four digital inputs are available. The function of the inputs is defined by parameters P-12 and P-15, which are explained in section 7. *Analog and Digital Input Macro Configurations on page 27.*

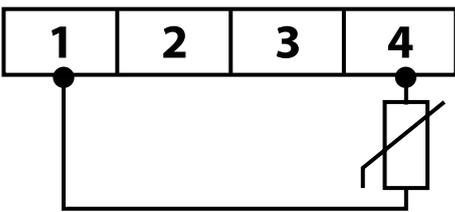
4.8. Motor Thermal Overload Protection

4.8.1. Internal Thermal Overload Protection

Optidrive E3 has internal motor overload protection / current limit set at 150% of FLA. This may be adjusted in parameter P-54. The drive has an in-built motor thermal overload function; this is in the form of an "I.t-trP" trip after delivering >100% of the value set in P-08 for a sustained period of time (e.g. 150% for 60 seconds).

4.8.2. Motor Thermistor Connection

Where a motor thermistor is to be used, it should be connected as follows:

Control Terminal Strip	Additional Information
	<p>Compatible Thermistor: PTC Type, 2.5kΩ trip level.</p> <ul style="list-style-type: none"> ▪ Use a setting of P-15 that has Input 3 function as External Trip, e.g. P-15 = 3. Refer to section 7. <i>Analog and Digital Input Macro Configurations on page 27</i> for further details. ▪ Set P-47 = "Ptc-Th"

4.9. EMC Compliant Installation

Category	Supply Cable Type	Motor Cable Type	Control Cables	Maximum Permissible Motor Cable Length
C1 ⁶	Shielded ¹	Shielded ^{1,5}	Shielded ⁴	1M / 5M ⁷
C2	Shielded ²	Shielded ^{1,5}		5M / 25M ⁷
C3	Unshielded ³	Shielded ²		25M / 100M ⁷

- ¹ A screened (shielded) cable suitable for fixed installation with the relevant mains voltage in use. Braided or twisted type screened cable where the screen covers at least 85% of the cable surface area, designed with low impedance to HF signals. Installation of a standard cable within a suitable steel or copper tube is also acceptable.
- ² A cable suitable for fixed installation with relevant mains voltage with a concentric protection wire. Installation of a standard cable within a suitable steel or copper tube is also acceptable.
- ³ A cable suitable for fixed installation with relevant mains voltage. A shielded type cable is not necessary.
- ⁴ A shielded cable with low impedance shield. Twisted pair cable is recommended for analog signals.
- ⁵ The cable screen should be terminated at the motor end using an EMC type gland allowing connection to the motor body through the largest possible surface area. Where drives are mounted in a steel control panel enclosure, the cable screen may be terminated directly to the control panel using a suitable EMC clamp or gland, as close to the drive as possible.
- ⁶ Compliance with category C1 conducted emissions only is achieved. For compliance with category C1 radiated emissions, additional measures may be required, contact your Sales Partner for further assistance.
- ⁷ Permissible cable length with additional external EMC filter.

4.10. Optional Brake Resistor

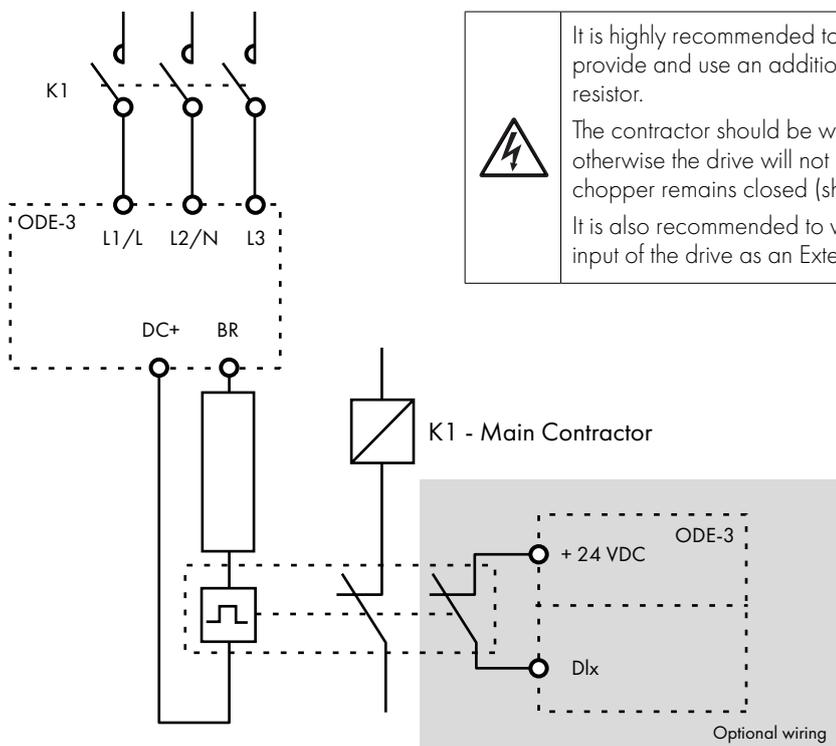
Optidrive E3 Frame Size 2 and above units have a built in Brake Transistor. This allows an external resistor to be connected to the drive to provide improved braking torque in applications that require this.

The brake resistor should be connected to the “+” and “BR” terminals as shown.

The voltage level at these terminals may exceed 800VDC.
 Stored charge may be present after disconnecting the mains power.
 Allow a minimum of 10 minutes discharge after power off before attempting any connection to these terminals.

Suitable resistors and guidance on selection can be obtained from your Invertek Sales Partner.

Dynamic Brake Transistor with Thermal Overload Protection



It is highly recommended to equip the drive with a main contractor and provide and use an additional thermal overload protection for braking resistor.
 The contractor should be wired so that it opens in case the resistor overheats, otherwise the drive will not be able to interrupt the main supply if the brake chopper remains closed (short-circuited) in a faulty situation.
 It is also recommended to wire the thermal overload protection to a digital input of the drive as an External Trip.

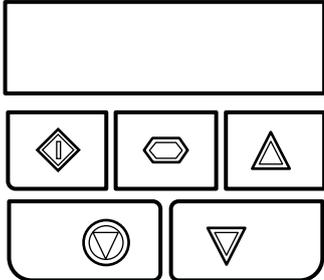
The voltage level at these terminals may exceed 800VDC.
 Stored charge may be present after disconnecting the mains power.
 Allow a minimum of 5 minutes discharge after power off before attempting any connection to these terminals.

Thermal Overload / Brake Resistor with internal Over Temperature switch

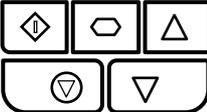
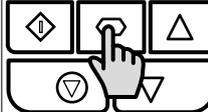
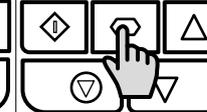
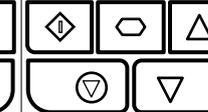
5. Operation

5.1. Managing the Keypad

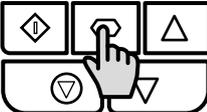
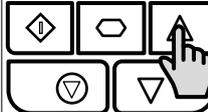
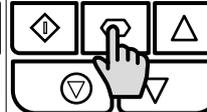
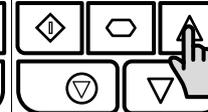
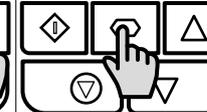
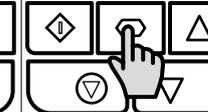
The drive is configured and its operation monitored via the keypad and display.

	NAVIGATE	Used to display real-time information, to access and exit parameter edit mode and to store parameter changes.	
	UP	Used to increase speed in real-time mode or to increase parameter values in parameter edit mode.	
	DOWN	Used to decrease speed in real-time mode or to decrease parameter values in parameter edit mode.	
	RESET / STOP	Used to reset a tripped drive. When in Keypad mode is used to Stop a running drive.	
	START	When in keypad mode, used to Start a stopped drive or to reverse the direction of rotation if bi-directional keypad mode is enabled.	

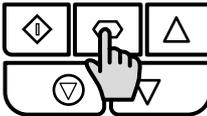
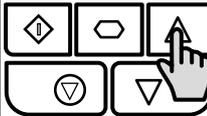
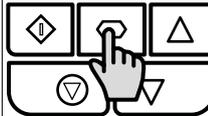
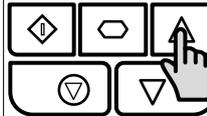
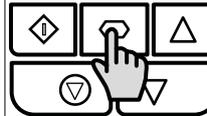
5.2. Operating Displays

<i>StoP</i>	<i>H 50.0</i>	<i>A 2.3</i>	<i>P 1.50</i>	<i>1500</i>	<i>F irE</i>
					
Drive Stopped / Disabled	Drive is enabled / running, display shows the output frequency (Hz)	Press the Navigate key for < 1 second. The display will show the motor current (Amps)	Press the Navigate key for < 1 second. The display will show the motor power (kW)	If P-10 > 0, pressing the Navigate key for < 1 second will display the motor speed (RPM)	Drive is in fire mode and can't be reset until fire mode is deactivated

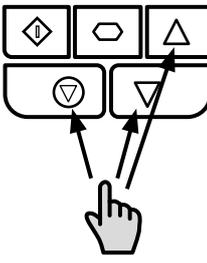
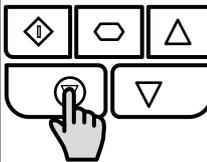
5.3. Changing Parameters

<i>StoP</i>	<i>P-01</i>	<i>P-08</i>	<i>10</i>	<i>P-08</i>	<i>P-08</i>
					
Press and hold the Navigate key > 2 seconds	Use the up and down keys to select the required parameter	Press the Navigate key for < 1 second	Adjust the value using the Up and Down keys	Press for < 1 second to return to the parameter menu	Press for > 2 seconds to return to the operating display

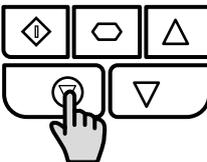
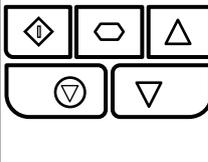
5.4. Read Only Parameter Access

StoP	P-00	P00-01	P00-08	330	StoP
					
Press and hold the Navigate key > 2 seconds	Use the up and down keys to select P-00	Press the Navigate key for < 1 second	Use the up and down keys to select the required Read Only parameter	Press the Navigate key for < 1 second to display the value	Press and hold the Navigate key > 2 seconds to return to the operating display

5.5. Resetting Parameters

P-dEF	StoP
	
To reset parameter values to their factory default settings, press and hold Up, Down and Stop buttons for > 2 seconds. The display will show "P-dEF"	Press the Stop key. The display will show "StoP"

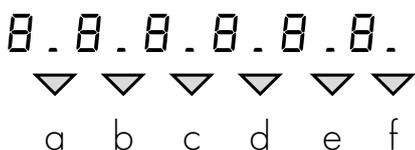
5.6. Resetting a Fault

0-1	StoP
	
Press the Stop key. The display will show "StoP"	

5.7. LED Display

Optidrive E3 has a built-in 6 Digit 7 Segment LED Display. In order to display certain warnings, the following methods are used:

5.7.1 LED Display Layout



5.7.2 LED Display Meanings

LED Segments	Behaviour	Meaning
a, b, c, d, e, f	Flashing all together	Overload, motor output current exceeds P-08
a and f	Flashing alternately	Mains Loss (Incoming AC power has been removed)
a	Flashing	Fire Mode Active

6. Parameters

6.1. Standard Parameters

Par.	Description	Minimum	Maximum	Default	Units
P-01	Maximum Frequency / Speed Limit	P-02	500.0	50.0 (60.0)	Hz / RPM
	Maximum output frequency or motor speed limit – Hz or RPM. If P-10 >0, the value entered / displayed is in RPM.				
P-02	Minimum Frequency / Speed Limit	0.0	P-01	0.0	Hz / RPM
	Minimum speed limit – Hz or RPM. If P-10 >0, the value entered / displayed is in RPM.				
P-03	Acceleration Ramp Time	0.00	600.0	5.0	s
	Acceleration ramp time from zero Hz / RPM to base frequency (P-09) in seconds.				
P-04	Deceleration Ramp Time	0.00	600.0	5.0	s
	Deceleration ramp time from base frequency (P-09) to standstill in seconds. When set to 0.00, the value of P-24 is used.				
P-05	Stopping Mode / Mains Loss Response	0	4	0	-
	Selects the stopping mode of the drive, and the behaviour in response to a loss of mains power supply during operation.				
	Setting	On Disable	On Mains Loss		
	0	Ramp to Stop (P-04)	Ride Through (Recover energy from load to maintain operation)		
	1	Coast	Coast		
	2	Ramp to Stop (P-04)	Fast Ramp to Stop (P-24), Coast if P-24 = 0		
	3	Ramp to Stop (P-04) with AC Flux Braking	Fast Ramp to Stop (P-24), Coast if P-24 = 0		
4	Ramp to Stop (P-04)	No action			
P-06	Energy Optimiser	0	3	0	-
	Motor Energy Optimisation is intended for use in applications where the motor operates for extended time periods at constant speed with light load. It should not be used in applications with large, sudden step changes in load or for PI control applications. Optidrive Energy Optimisation reduces the drive internal heat losses increasing efficiency however it may result in some vibration in the motor during light load operation. In general, this function is suited to Fan, Pump and Compressor applications.				
	Setting	Motor Energy Optimisation	Optidrive Energy Optimisation		
	0	Disabled	Disabled		
	1	Enabled	Disabled		
2	Disabled	Enabled			
3	Enabled	Enabled			
P-07	Motor Rated Voltage / Back EMF at rated speed (PM / BLDC)	0	250 / 500	230 / 400	V
	For Induction Motors, this parameter should be set to the rated (nameplate) voltage of the motor (Volts). For Permanent Magnet or Brushless DC Motors, it should be set to the Back EMF at rated speed.				
P-08	Motor Rated Current	Drive Rating Dependent			A
	This parameter should be set to the rated (nameplate) current of the motor.				
P-09	Motor Rated Frequency	10	500	50 (60)	Hz
	This parameter should be set to the rated (nameplate) frequency of the motor.				
P-10	Motor Rated Speed	0	30000	0	RPM
	This parameter can optionally be set to the rated (nameplate) RPM of the motor. When set to the default value of zero, all speed related parameters are displayed in Hz and the slip compensation (where motor speed is maintained at a constant value regardless of applied load) for the motor is disabled. Entering the value from the motor nameplate enables the slip compensation function, and the Optidrive display will now show motor speed in RPM. All speed related parameters, such as Minimum and Maximum Speed, Preset Speeds etc. will also be displayed in RPM. NOTE If P-09 value is changed, P-10 value is reset to 0.				

Par.	Description	Minimum	Maximum	Default	Units																							
P-11	Low Frequency Torque Boost	0.0	Drive Dependent	Drive Dependent	%																							
	<p>Low frequency torque can be improved by increasing this parameter. Excessive boost levels may however result in high motor current and increased risk of tripping on Over Current or Motor Overload (refer to section 10.1. <i>Fault Code Messages on page 39</i>).</p> <p>This parameter operates in conjunction with P-51 (Motor Control Mode) as follows:</p> <table border="1"> <thead> <tr> <th>P-51</th> <th>P-11</th> <th></th> </tr> </thead> <tbody> <tr> <td rowspan="2">0</td> <td>0</td> <td>Boost is automatically calculated according to autotune data.</td> </tr> <tr> <td>>0</td> <td>Voltage boost = P-11 x P-07. This voltage is applied at 0.0Hz, and linearly reduced until P-09 / 2.</td> </tr> <tr> <td>1</td> <td>All</td> <td>Voltage boost = P-11 x P-07. This voltage is applied at 0.0Hz, and linearly reduced until P-09 / 2.</td> </tr> <tr> <td>2, 3, 4, 5</td> <td>All</td> <td>Boost current level = 4 * P-11 * P-08.</td> </tr> </tbody> </table> <p>For IM motors, when P-51 = 0 or 1, a suitable setting can usually be found by operating the motor under very low or no load conditions at approximately 5Hz, and adjusting P-11 until the motor current is approximately the magnetising current (if known) or in the range shown below.</p> <p>Frame Size 1: 60 – 80% of motor rated current. Frame Size 2: 50 – 60% of motor rated current. Frame Size 3: 40 – 50% of motor rated current. Frame Size 4 & 5: 35 – 45% of motor rated current.</p>					P-51	P-11		0	0	Boost is automatically calculated according to autotune data.	>0	Voltage boost = P-11 x P-07. This voltage is applied at 0.0Hz, and linearly reduced until P-09 / 2.	1	All	Voltage boost = P-11 x P-07. This voltage is applied at 0.0Hz, and linearly reduced until P-09 / 2.	2, 3, 4, 5	All	Boost current level = 4 * P-11 * P-08.									
P-51	P-11																											
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1	All	Voltage boost = P-11 x P-07. This voltage is applied at 0.0Hz, and linearly reduced until P-09 / 2.																										
2, 3, 4, 5	All	Boost current level = 4 * P-11 * P-08.																										
P-12	Primary Command Source	0	9	0	-																							
	<p>0: Terminal Control. The drive responds directly to signals applied to the control terminals.</p> <p>1: Uni-directional Keypad Control. The drive can be controlled in the forward direction only using the internal keypad, or an external remote Keypad.</p> <p>2: Bi-directional Keypad Control. The drive can be controlled in the forward and reverse directions using the internal keypad, or an external remote Keypad. Pressing the keypad START button toggles between forward and reverse.</p> <p>3: Modbus Network Control. Control via Modbus RTU (RS485) using the internal Accel / Decel ramps.</p> <p>4: Modbus Network Control. Control via Modbus RTU (RS485) interface with Accel / Decel ramps updated via Modbus.</p> <p>5: PI Control. User PI control with external feedback signal.</p> <p>6: PI Analog Summation Control. PI control with external feedback signal and summation with analog input 1.</p> <p>7: CAN Control. Control via CAN (RS485) using the internal Accel / Decel ramps.</p> <p>8: CAN Control. Control via CAN (RS485) interface with Accel / Decel ramps updated via CAN.</p> <p>9: Slave Mode. Control via a connected Invertek drive in Master Mode. Slave drive address must be > 1.</p> <p>NOTE When P-12 = 1, 2, 3, 4, 7, 8 or 9, an enable signal must still be provided at the control terminals, digital input 1.</p>																											
P-13	Operating Mode Select	0	2	0	-																							
	<p>Provides a quick set up to configure key parameters according to the intended application of the drive. Parameters are preset according to the table.</p> <p>0: Industrial Mode. Intended for general purpose applications.</p> <p>1: Pump Mode. Intended for centrifugal pump applications.</p> <p>2: Fan Mode. Intended for Fan applications.</p> <table border="1"> <thead> <tr> <th>Setting</th> <th>Application</th> <th>Current Limit (P-54)</th> <th>Torque Characteristic</th> <th>Spin Start (P-33)</th> <th>Thermal Overload Limit Reaction (P-60 Index 2)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>General</td> <td>150%</td> <td>Constant</td> <td>0: Off</td> <td>0: Trip</td> </tr> <tr> <td>1</td> <td>Pump</td> <td>110%</td> <td>Variable</td> <td>0: Off</td> <td>1: Current Limit Reduction</td> </tr> <tr> <td>2</td> <td>Fan</td> <td>110%</td> <td>Variable</td> <td>2: On</td> <td>1: Current Limit Reduction</td> </tr> </tbody> </table>					Setting	Application	Current Limit (P-54)	Torque Characteristic	Spin Start (P-33)	Thermal Overload Limit Reaction (P-60 Index 2)	0	General	150%	Constant	0: Off	0: Trip	1	Pump	110%	Variable	0: Off	1: Current Limit Reduction	2	Fan	110%	Variable	2: On
Setting	Application	Current Limit (P-54)	Torque Characteristic	Spin Start (P-33)	Thermal Overload Limit Reaction (P-60 Index 2)																							
0	General	150%	Constant	0: Off	0: Trip																							
1	Pump	110%	Variable	0: Off	1: Current Limit Reduction																							
2	Fan	110%	Variable	2: On	1: Current Limit Reduction																							
P-14	Extended Menu Access code	0	65535	0	-																							
	<p>Enables access to Extended and Advanced Parameter Groups. This parameter must be set to the value programmed in P-37 (default: 101) to view and adjust Extended Parameters and value of P-37 + 100 to view and adjust Advanced Parameters. The code may be changed by the user in P-37 if desired.</p>																											

6.2. Extended Parameters

Par.	Description	Minimum	Maximum	Default	Units
P-15	Digital Input Function Select Defines the function of the digital inputs depending on the control mode setting in P-12. See section 7. <i>Analog and Digital Input Macro Configurations</i> on page 27 for more information.	0	19	0	-
P-16	Analog Input 1 Signal Format U 0-10 = Uni-polar 0 to 10 Volt Signal. The drive will remain at minimum speed (P-02) if the analog reference after scaling and offset are applied is ≤0.0%. 100% signal means the output frequency / speed will be the value set in P-01. b 0-10 = Uni-polar 0 to 10 Volt Signal, bi-directional operation. The drive will operate the motor in the reverse direction of rotation if the analog reference after scaling and offset are applied is <0.0%. e.g. for bidirectional control from a 0 – 10 volt signal, set P-35 = 200.0%, P-39 = 50.0%. A 0-20 = 0 to 20mA Signal. E 4-20 = 4 to 20mA Signal, the Optidrive will trip and show the fault code 4-20F 500ms after the signal level falls below 3mA. r 4-20 = 4 to 20mA Signal, the Optidrive will run at Preset Speed 1 (P-20 if the signal level falls below 3mA. E 20-4 = 20 to 4mA Signal, the Optidrive will trip and show the fault code 4-20F 500ms after the signal level falls below 3mA. r 20-4 = 20 to 4mA Signal, the Optidrive will run at Preset Speed 1 (P-20 if the signal level falls below 3mA. U 10-0 = 10 to 0 Volt Signal (Uni-polar). The drive will operate at Maximum Frequency / Speed if the analog reference after scaling and offset are applied is ≤0.0%.	See Below		U0-10	-
P-17	Maximum Effective Switching Frequency Sets maximum effective switching frequency of the drive. If "rEd" is displayed when the parameter is viewed, the switching frequency has been reduced to the level in P00-32 due to excessive drive heatsink temperature.	4	32	8	kHz
P-18	Output Relay Function Select Selects the function assigned to the relay output. The relay has two output terminals, Logic 1 indicates the relay is active, and therefore terminals 10 and 11 will be connected. 0: Drive Enabled (Running). Logic 1 when the motor is enabled. 1: Drive Healthy. Logic 1 when power is applied to the drive and no fault exists. 2: At Target Frequency (Speed). Logic 1 when the output frequency matches the setpoint frequency. 3: Drive Tripped. Logic 1 when the drive is in a fault condition. 4: Output Frequency ≥ Limit. Logic 1 when the output frequency exceeds the adjustable limit set in P-19. 5: Output Current ≥ Limit. Logic 1 when the motor current exceeds the adjustable limit set in P-19. 6: Output Frequency < Limit. Logic 1 when the output frequency is below the adjustable limit set in P-19. 7: Output Current < Limit. Logic 1 when the motor current is below the adjustable limit set in P-19. 8: Analog Input 2 > Limit. Logic 1 when the signal applied to analog input 2 exceeds the adjustable limit set in P-19. 9: Drive Ready to Run. Logic 1 when the drive is ready to run, no trip present. 10: Fire Mode Active. Logic 1 when Fire Mode is activated. 11: Output Frequency > Limit and not Fire Mode. As setting 4 however the output relay state does not change if the drive is in Fire Mode. 12: Fieldbus. Status is controlled by bit 8 of the fieldbus control word. Fieldbus type is selected by P-12.	0	12	1	-
P-19	Relay Threshold Level Adjustable threshold used in conjunction with settings 4 to 7 of P-18 and P-25.	0.0	200.0	100.0	%
P-20	Preset Frequency / Speed 1	-P-01	P-01	5.0	Hz / RPM
P-21	Preset Frequency / Speed 2	-P-01	P-01	25.0	Hz / RPM
P-22	Preset Frequency / Speed 3	-P-01	P-01	40.0	Hz / RPM
P-23	Preset Frequency / Speed 4 Preset Speeds / Frequencies selected by digital inputs depending on the setting of P-15. If P-10 = 0, the values are entered as Hz. If P-10 > 0, the values are entered as RPM. NOTE Changing the value of P-09 will reset all values to factory default settings.	-P-01	P-01	P-09	Hz / RPM
P-24	2nd Ramp Time (Fast Stop) This parameter allows a 2nd ramp time to be programmed into the drive. This ramp time is automatically selected in the case of a mains power loss if P-05 = 2 or 3. When set to 0.00, the drive will coast to stop. When using a setting of P-15 that provides a "Fast Stop" function, this ramp time is also used. In addition, if P-24 > 0, P-02 > 0, P-26=0 and P-27 = P-02, this ramp time is applied to both acceleration and deceleration when operating below minimum speed, allowing selection of an alternative ramp when operating outside of the normal speed range, which may be useful in pump and compressor applications.	0.00	600.0	0.00	s

Par.	Description	Minimum	Maximum	Default	Units
P-25	Analog Output Function Select	0	12	8	-
	Digital Output Mode. Logic 1 = +24V DC 0: Drive Enabled (Running). Logic 1 when the Optidrive is enabled (Running). 1: Drive Healthy. Logic 1 When no Fault condition exists on the drive. 2: At Target Frequency (Speed). Logic 1 when the output frequency matches the setpoint frequency. 3: Drive Tripped. Logic 1 when the drive is in a fault condition. 4: Output Frequency >= Limit. Logic 1 when the output frequency exceeds the adjustable limit set in P-19. 5: Output Current >= Limit. Logic 1 when the motor current exceeds the adjustable limit set in P-19. 6: Output Frequency < Limit. Logic 1 when the output frequency is below the adjustable limit set in P-19. 7: Output Current < Limit. Logic 1 when the motor current is below the adjustable limit set in P-19. Analog Output Mode 8: Output Frequency (Motor Speed). 0 to P-01, resolution 0.1Hz. 9: Output (Motor) Current. 0 to 200% of P-08, resolution 0.1A. 10: Output Power. 0 – 200% of drive rated power. 11: Load Current. 0 – 200% of P-08, resolution 0.1A. 12: Fieldbus Digital. Status is controlled by PDO0 Bit 9. 13: Fieldbus Analog. Analog output value set by PDO2 value, 0 – 4096.				
P-26	Skip Frequency Hysteresis Band	0.0	P-01	0.0	Hz / RPM
P-27	Skip Frequency Centre Point	0.0	P-01	0.0	Hz / RPM
<p>The Skip Frequency function is used to avoid the Optidrive operating at a certain output frequency, for example at a frequency which causes mechanical resonance in a particular machine. Parameter P-27 defines the centre point of the skip frequency band, and is used in conjunction with P-26. The Optidrive output frequency will ramp through the defined band at the rates set in P-03 and P-04 respectively, and will not hold any output frequency within the defined band. If the frequency reference applied to the drive is within the band, the Optidrive output frequency will remain at the upper or lower limit of the band.</p>					
P-28	V/F Characteristic Adjustment Voltage	0	P-07	0	V
P-29	V/F Characteristic Adjustment Voltage	0.0	P-09	0.0	Hz
<p>This parameter in conjunction with P-28 sets a frequency point at which the voltage set in P-29 is applied to the motor. Care must be taken to avoid overheating and damaging the motor when using this feature.</p>					
P-30	Start Mode, Automatic Restart, Fire Mode Operation				
	Index 1: Start Mode & Automatic Restart	N/A	N/A	Edge-r	-
	<p>Selects whether the drive should start automatically if the enable input is present and latched during power on. Also configures the Automatic Restart function.</p> <p>Edge-r: Following Power on or reset, the drive will not start if Digital Input 1 remains closed. The Input must be closed after a power on or reset to start the drive.</p> <p>Auto-0: Following a Power On or Reset, the drive will automatically start if Digital Input 1 is closed.</p> <p>Auto-1 To Auto-5: Following a trip, the drive will make up to 5 attempts to restart at 20 second intervals. The numbers of restart attempts are counted, and if the drive fails to start on the final attempt, the drive will trip with a fault, and will require the user to manually reset the fault. The drive must be powered down to reset the counter.</p>				
	Index 2: Fire Mode Input Logic	0	3	0	-
	<p>Defines the operating logic when a setting of P-15 is used which includes Fire Mode, e.g. settings 15, 16 & 17.</p> <p>0: n.C: Normally Closed (NC) Input. Fire Mode active if input is open.</p> <p>1: n.O: Normally Open (NO) Input. Fire Mode active if input is closed.</p> <p>2: F-N.C: Normally Closed (NC) Input, Fixed Speed. Fire Mode active if input is open. Fire Mode Speed is Preset Speed 4 (P-23).</p> <p>3: F-N.O: Normally Open (NO) Input, Fixed Speed. Fire Mode active if input is closed. . Fire Mode Speed is Preset Speed 4 (P-23).</p>				
Index 3: Fire Mode Input Type	0	1	0	-	
<p>Defines the input type when a setting of P-15 is used which includes Fire Mode, e.g. settings 15, 16 & 17.</p> <p>0: Off. The drive will remain in Fire Mode, only as long the fire mode input signal remains (Normally Open or Normally Closed operation is supported depending on Index 2 setting).</p> <p>1: On. Fire Mode is activated by a momentary signal on the input. Normally Open or Normally Closed operation is supported depending on Index 2 setting. The drive will remain in Fire Mode until disabled or powered off.</p>					

Par.	Description	Minimum	Maximum	Default	Units
P-31	Keypad Start Mode Select	0	7	1	-
	<p>This parameter is active only when operating in Keypad Control Mode (P-12 = 1 or 2) or Modbus Mode (P-12 = 3 or 4). When settings 0, 1, 4 or 5 are used, the Keypad Start and Stop keys are active, and control terminals 1 and 2 must be linked together. Settings 2, 3, 6 and 7 allow the drive to be started from the control terminals directly, and the keypad Start and Stop keys are ignored.</p> <p>0: Minimum Speed, Keypad Start 1: Previous Speed, Keypad Start 2: Minimum Speed, Terminal Enable 3: Previous Speed, Terminal Enable 4: Current Speed, Keypad Start 5: Preset Speed 4, Keypad Start 6: Current Speed, Terminal Start 7: Preset Speed 4, Terminal Start</p>				
P-32	DC Injection Configuration				
	Index 1: Duration	0.0	25.0	0.0	s
	Index 2: DC Injection Mode	0	2	0	-
	<p>Index 1: Defines the time for which a DC current is injected into the motor. DC Injection current level may be adjusted in P-59.</p> <p>Index 2: Configures the DC Injection Function as follows:</p> <p>0: DC Injection on Stop. DC is injected into the motor at the current level set in P-59 following a stop command, after the output frequency has reduced to P-58 for the time set in Index 1.</p> <p>NOTE If the drive is in Standby Mode prior to disable, the DC injection is disabled</p> <p>1: DC Injection on Start. DC is injected into the motor at the current level set in P-59 for the time set in Index 1 immediately after the drive is enabled, prior to the output frequency ramping up. The output stage remains active during this phase. This can be used to ensure the motor is at standstill prior to starting.</p> <p>2: DC Injection on Start & Stop. DC injection applied as both settings 0 and 1 above.</p>				
P-33	Spin Start	0	2	0	-
	<p>0: Disabled</p> <p>1: Enabled. When enabled, on start up the drive will attempt to determine if the motor is already rotating, and will begin to control the motor from its current speed. A short delay may be observed when starting motors which are not turning.</p> <p>2: Enabled on Trip, Brown Out or Coast Stop. Spin start is only activated following the events listed, otherwise it is disabled.</p>				
P-34	Brake Chopper Enable (Not Size 1)	0	4	0	-
	<p>0: Disabled</p> <p>1: Enabled With Software Protection. Brake chopper enabled with software protection for a 200W continuous rated resistor.</p> <p>2: Enabled Without Software Protection. Enables the internal brake chopper without software protection. An external thermal protection device should be fitted.</p> <p>3: Enabled With Software Protection. As setting 1, however the Brake Chopper is only enabled during a change of the frequency setpoint, and is disabled during constant speed operation.</p> <p>4: Enabled Without Software Protection. As setting 2, however the Brake Chopper is only enabled during a change of the frequency setpoint, and is disabled during constant speed operation.</p>				
P-35	Analog Input 1 Scaling / Slave Speed Scaling	0.0	2000.0	100.0	%
	<p>Analog Input 1 Scaling. The analog input signal level is multiplied by this factor, e.g. if P-16 is set for a 0 – 10V signal, and the scaling factor is set to 200.0%, a 5 volt input will result in the drive running at maximum frequency / speed (P-01).</p> <p>Slave Speed Scaling. When operating in Slave Mode (P-12 = 9), the operating speed of the drive will be the Master speed multiplied by this factor, limited by the minimum and maximum speeds.</p>				

Par.	Description	Minimum	Maximum	Default	Units	
P-36	Serial Communications Configuration	See Below				
	Index 1: Address	0	63	1	-	
	Index 2: Baud Rate	9.6	1000	115.2	kbps	
	Index 3: Communication loss protection	0	3000	† 3000	ms	
	This parameter has three sub settings used to configure the Modbus RTU Serial Communications. The Sub Parameters are:					
	<p>1st Index: Drive Address: Range: 0 – 63, default: 1.</p> <p>2nd Index: Baud Rate & Network type: Selects the baud rate and network type for the internal RS485 communication port. For Modbus RTU: Baud rates 9.6, 19.2, 38.4, 57.6, 115.2 kbps are available. For CAN: Baud rates 125, 250, 500 & 1000 kbps are available.</p> <p>3rd Index: Watchdog Timeout: Defines the time for which the drive will operate without receiving a valid command telegram to Register 1 (Drive Control Word) after the drive has been enabled. Setting 0 disables the Watchdog timer. Setting a value of 30, 100, 1000, or 3000 defines the time limit in milliseconds for operation. A 't' suffix selects trip on loss of communication. An 'r' suffix means that the drive will coast stop (output immediately disabled) but will not trip.</p>					
P-37	Access Code Definition	0	9999	101	-	
Defines the access code which must be entered in P-14 to access parameters above P-14.						
P-38	Parameter Access Lock	0	1	0	-	
	<p>0: Unlocked. All parameters can be accessed and changed.</p> <p>1: Locked. Parameter values can be displayed, but cannot be changed except P-38.</p>					
P-39	Analog Input 1 Offset	-500.0	500.0	0.0	%	
	<p>Sets an offset, as a percentage of the full scale range of the input, which is applied to the analog input signal. This parameter operates in conjunction with P-35, and the resultant value can be displayed in P00-01.</p> <p>The resultant value is defined as a percentage, according to the following: $P00-01 = (\text{Applied Signal Level}(\%) - P-39) \times P-35$.</p>					
P-40	Index 1: Display Scaling Factor	0.000	16.000	0.000	-	
	Index 2: Display Scaling Source	0	3	0	-	
	Allows the user to program the Optidrive to display an alternative output unit scaled from either output frequency (Hz), Motor Speed (RPM) or the signal level of PI feedback when operating in PI Mode.					
	Index 1: Used to set the scaling multiplier. The chosen source value is multiplied by this factor.					
	Index 2: Defines the scaling source as follows:					
	<p>0: Motor Speed. Scaling is applied to the output frequency if P-10 = 0, or motor RPM if P-10 > 0.</p> <p>1: Motor Current. Scaling is applied to the motor current value (Amps).</p> <p>2: Analog Input 2 Signal Level. Scaling is applied to analog input 2 signal level, internally represented as 0 – 100.0%.</p> <p>3: PI Feedback. Scaling is applied to the PI feedback selected by P-46, internally represented as 0 – 100.0%.</p>					
P-41	PI Controller Proportional Gain	0.0	30.0	1.0	-	
	PI Controller Proportional Gain. Higher values provide a greater change in the drive output frequency in response to small changes in the feedback signal. Too high a value can cause instability.					
P-42	PI Controller Integral Time	0.0	30.0	1.0	s	
	PI Controller Integral Time. Larger values provide a more damped response for systems where the overall process responds slowly.					
P-43	PI Controller Operating Mode	0	3	0	-	
	0: Direct Operation. Use this mode if when the feedback signal drops, the motor speed should increase.					
	1: Inverse Operation. Use this mode if when the feedback signal drops, the motor speed should decrease.					
	2: Direct Operation, Wake at Full Speed. As setting 0, but on restart from Standby, PI Output is set to 100%.					
3: Inverse Operation, Wake at Full Speed. As setting 0, but on restart from Standby, PI Output is set to 100%.						
P-44	PI Reference (Setpoint) Source Select	0	1	0	-	
	Selects the source for the PID Reference / Setpoint.					
	0: Digital Preset Setpoint. P-45 is used.					
	1: Analog Input 1 Setpoint. Analog input 1 signal level, readable in P00-01 is used for the setpoint.					
2: Fieldbus. The setpoint is determined by fieldbus PDO2 (Modbus RTU register 3) value.						
P-45	PI Digital Setpoint	0.0	100.0	0.0	%	
	When P-44 = 0, this parameter sets the preset digital reference (setpoint) used for the PI Controller as a % of the feedback signal.					

Par.	Description	Minimum	Maximum	Default	Units
P-46	PI Feedback Source Select	0	5	0	-
	<p>Selects the source of the feedback signal to be used by the PI controller.</p> <p>0: Analog Input 2 (Terminal 4) Signal level readable in P00-02.</p> <p>1: Analog Input 1 (Terminal 6) Signal level readable in P00-01.</p> <p>2: Motor Current Scaled as % of P-08.</p> <p>3: DC Bus Voltage Scaled 0 – 1000 Volts = 0 – 100%.</p> <p>4: Analog 1 – Analog 2 The value of Analog Input 2 is subtracted from Analog 1 to give a differential signal. The value is limited to 0.</p> <p>5: Largest (Analog 1, Analog 2) The larger of the two analog input values is always used for PI feedback.</p>				
P-47	Analog Input 2 Signal Format	-	-	-	U0-10
	<p>U 0-10 = 0 to 10 Volt Signal.</p> <p>A 0-20 = 0 to 20mA Signal.</p> <p>E 4-20 = 4 to 20mA Signal, the Optidrive will trip and show the fault code 4-20F 500ms after the signal level falls below 3mA.</p> <p>r 4-20 = 4 to 20mA Signal, the Optidrive will run at Preset Speed 1 (P-20) if the signal level falls below 3mA.</p> <p>E 20-4 = 20 to 4mA Signal, the Optidrive will trip and show the fault code 4-20F 500ms after the signal level falls below 3mA.</p> <p>r 20-4 = 20 to 4mA Signal, the Optidrive will run at Preset Speed 1 (P-20) if the signal level falls below 3mA.</p> <p>Ptc-τh = Use for motor thermistor measurement, valid with any setting of P-15 that has Input 3 as E-Trip. Trip level: 1.5kΩ, reset 1kΩ.</p>				
P-48	Standby Mode Timer	0.0	60.0	0.0	s
	When standby mode is enabled by setting P-48 > 0.0, the drive will enter standby following a period of operating at minimum speed (P-02) for the time set in P-48. When in Standby Mode, the drive display shows Stndby , and the output to the motor is disabled.				
P-49	PI Control Wake Up Error Level	0.0	100.0	5.0	%
	When the drive is operating in PI Control Mode (P-12 = 5 or 6), and Standby Mode is enabled (P-48 > 0.0), P-49 can be used to define the PI Error Level (E.g. difference between the setpoint and feedback) required before the drive restarts after entering Standby Mode. This allows the drive to ignore small feedback errors and remain in Standby mode until the feedback drops sufficiently.				
P-50	User Output Relay Hysteresis	0.0	100.0	0.0	%
	Sets the hysteresis level for P-19 to prevent the output relay chattering when close to the threshold.				

6.4. P-00 Read Only Status Parameters

Par.	Description	Explanation
P00-01	1st Analog input value (%)	100% = max input voltage
P00-02	2nd Analog input value (%)	100% = max input voltage
P00-03	Speed reference input (Hz / RPM)	Displayed in Hz if P-10 = 0, otherwise RPM
P00-04	Digital input status	Drive digital input status
P00-05	User PI output (%)	Displays value of the User PI output
P00-06	DC bus ripple (V)	Measured DC bus ripple
P00-07	Applied motor voltage (V)	Value of RMS voltage applied to motor
P00-08	DC bus voltage (V)	Internal DC bus voltage
P00-09	Heatsink temperature (°C)	Temperature of heatsink in °C
P00-10	Run time since date of manuf. (Hours)	Not affected by resetting factory default parameters
P00-11	Run time since last trip (1) (Hours)	Run-time clock stopped by drive disable (or trip), reset on next enable only if a trip occurred. Reset also on next enable after a drive power down
P00-12	Run time since last trip (2) (Hours)	Run-time clock stopped by drive disable (or trip), reset on next enable only if a trip occurred (under-volts not considered a trip) – not reset by power down / power up cycling unless a trip occurred prior to power down
P00-13	Trip Log	Displays most recent 4 trips with time stamp
P00-14	Run time since last enable, HH:MM:SS	Run-time clock stopped on drive disable, value reset on next enable
P00-15	DC bus voltage log (V)	8 most recent values prior to trip, 256ms sample time
P00-16	Heatsink temperature log (°C)	8 most recent values prior to trip, 30s sample time
P00-17	Motor current log (A)	8 most recent values prior to trip, 256ms sample time
P00-18	DC bus ripple log (V)	8 most recent values prior to trip, 22ms sample time
P00-19	Internal drive temperature log (°C)	8 most recent values prior to trip, 30 s sample time
P00-20	Internal drive temperature (°C)	Actual internal ambient temperature in °C
P00-21	CAN process data input	Incoming process data (RX PDO1) for CAN: PI1, PI2, PI3, PI4
P00-22	CAN process data output	Outgoing process data (TX PDO1) for CAN: PO1, PO2, PO3, PO4
P00-23	Accumulated time with heatsink > 85°C (Hours)	Total accumulated hours and minutes of operation above heatsink temp of 85°C
P00-24	Accumulated time with drive internal temp > 80°C (Hours)	Total accumulated hours and minutes of operation with drive internal ambient above 80°C
P00-25	Estimated rotor speed (Hz)	In vector control modes, estimated rotor speed in Hz
P00-26	kWh meter / MWh meter	Total number of kWh / MWh consumed by the drive
P00-27	Total run time of drive fans (Hours)	Time displayed in hh:mm:ss. First value displays time in hrs, press up to display mm:ss
P00-28	Software version and checksum	Version number and checksum. "1" on LH side indicates I/O processor, "2" indicates power stage
P00-29	Drive type identifier	Drive rating, drive type and software version codes
P00-30	Drive serial number	Unique drive serial number
P00-31	Motor current Id / Iq	Displays the magnetising current (Id) and torque current (Iq). Press UP to show Iq
P00-32	Actual PWM switching frequency (kHz)	Actual switching frequency used by drive
P00-33	Critical fault counter – O-I	These parameters log the number of times specific faults or errors occur, and are useful for diagnostic purposes
P00-34	Critical fault counter – O-Volts	
P00-35	Critical fault counter – U-Volts	
P00-36	Critical fault counter – O-temp (h/sink)	
P00-37	Critical fault counter – b O-I (chopper)	
P00-38	Critical fault counter – O-hEA _t (control)	
P00-39	Modbus comms error counter	
P00-40	CANbus comms error counter	
P00-41	I/O processor comms errors	
P00-42	Power stage uC comms errors	
P00-43	Drive power up time (life time) (Hours)	Total lifetime of drive with power applied
P00-44	Phase U current offset & ref	Internal value
P00-45	Phase V current offset & ref	Internal value
P00-46	Phase W current offset & ref	Internal value
P00-47	Index 1: Fire mode total active time Index 2: Fire Mode Activation Count	Total activation time of Fire Mode Displays the number of times Fire Mode has been activated
P00-48	Scope channel 1 & 2	Displays signals for first scope channels 1 & 2
P00-49	Scope channel 3 & 4	Displays signals for first scope channels 3 & 4
P00-50	Bootloader and motor control	Internal value

7. Analog and Digital Input Macro Configurations

7.1. Overview

Optidrive E3 uses a Macro approach to simplify the configuration of the Analog and Digital Inputs. There are two key parameters which determine the input functions and drive behaviour:

P-12 Selects the main drive control source and determines how the output frequency of the drive is primarily controlled.

P-15 Assigns the Macro function to the analog and digital inputs.

Additional parameters can then be used to further adapt the settings, e.g.

P-16 Used to select the format of the analog signal to be connected to analog input 1, e.g. 0 – 10 Volt, 4 – 20mA.

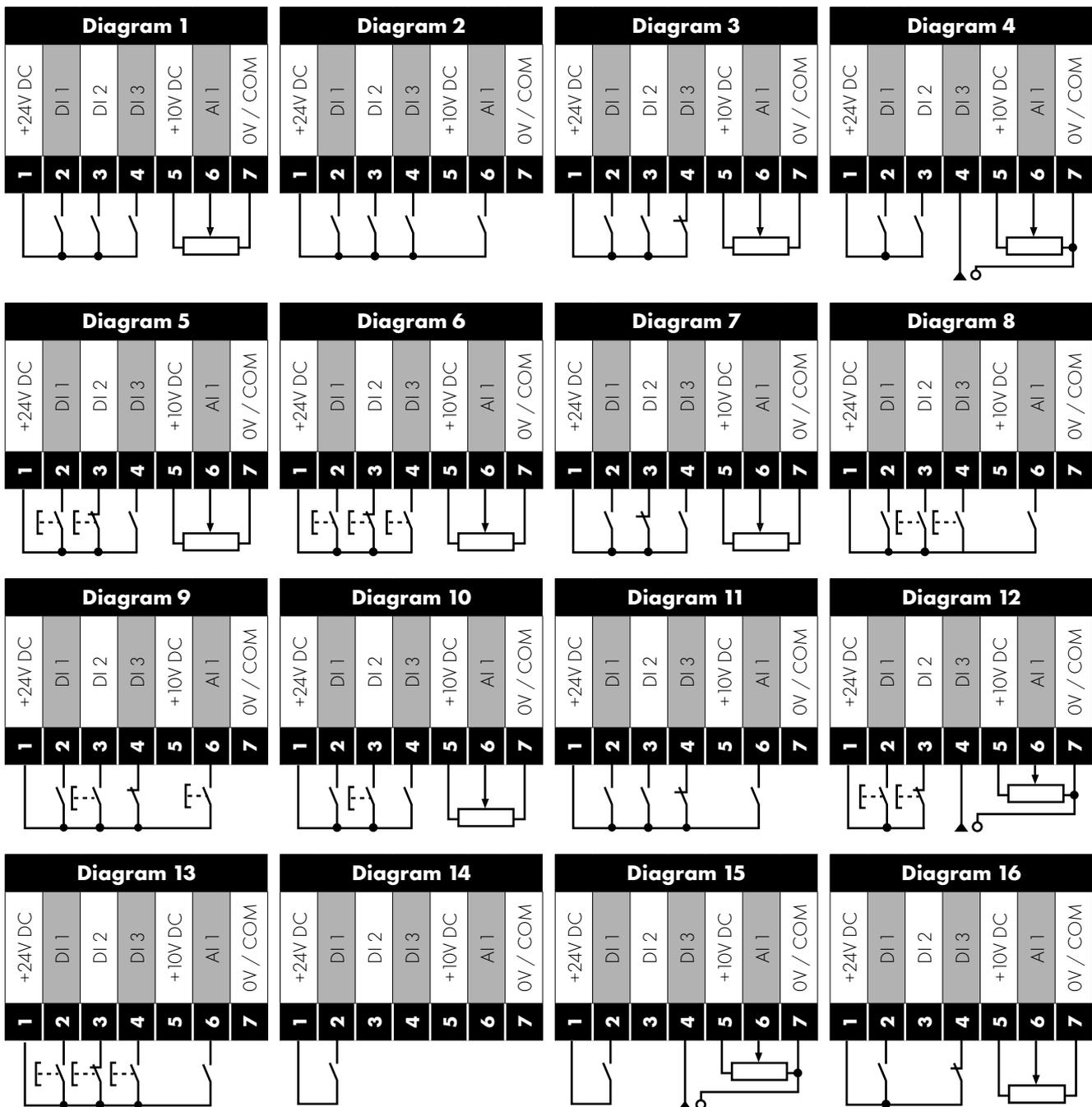
P-30 Determines whether the drive should automatically start following a power on if the Enable Input is present.

P-31 When Keypad Mode is selected, determines at what output frequency / speed the drive should start following the enable command, and also whether the keypad start key must be pressed or if the Enable input alone should start the drive.

P-47 Used to select the format of the analog signal to be connected to analog input 2, e.g. 0 – 10 Volt, 4 – 20mA.

7.2. Example Connection Diagrams

The diagrams below provide an overview of the functions of each terminal macro function, and a simplified connection diagram for each.



7.3. Macro Functions Guide Key

The table below should be used as a key on the following pages.

Function	Explanation
STOP	Latched Input, Open the contact to STOP the drive
RUN	Latched input, Close the contact to Start, the drive will operate as long as the input is maintained
FWD ↻	Latched Input, selects the direction of motor rotation FORWARD
REV ↻	Latched Input, selects the direction of motor rotation REVERSE
RUN FWD ↻	Latched Input, Close to Run in the FORWARD direction, Open to STOP
RUN REV ↻	Latched Input, Close to Run in the REVERSE direction, Open to STOP
ENABLE	Hardware Enable Input. In Keypad Mode, P-31 determines whether the drive immediately starts, or the keypad start key must be pressed. In other modes, this input must be present before the start command is applied via the fieldbus interface.
START ↑	Normally Open, Rising Edge, Close momentarily to START the drive (NC STOP Input must be maintained)
^ - START - ^	Simultaneously applying both inputs momentarily will START the drive (NC STOP Input must be maintained)
STOP ↓	Normally Closed, Falling Edge, Open momentarily to STOP the drive
START ↑ FWD ↻	Normally Open, Rising Edge, Close momentarily to START the drive in the forward direction (NC STOP Input must be maintained)
START ↑ REV ↻	Normally Open, Rising Edge, Close momentarily to START the drive in the reverse direction (NC STOP Input must be maintained)
^ - FAST STOP (P-24) - ^	When both inputs are momentarily active simultaneously, the drive stops using Fast Stop Ramp Time P-24
FAST STOP ↓ (P-24)	Normally Closed, Falling Edge, Open momentarily to FAST STOP the drive using Fast Stop Ramp Time P-24
E-TRIP	Normally Closed, External Trip input. When the input opens momentarily, the drive trips showing $E-Err$ or $P-Err$ depending on P-47 setting
Fire Mode	Activates Fire Mode
Analog Input AI1	Analog Input 1, signal format selected using P-16
Analog Input AI2	Analog Input 2, signal format selected using P-47
AI1 REF	Analog Input 1 provides the speed reference
AI2 REF	Analog Input 2 provides the speed reference
P-xx REF	Speed reference from the selected preset speed
PR-REF	Preset speeds P-20 – P-23 are used for the speed reference, selected according to other digital input status
PI-REF	PI Control Speed Reference
PI FB	Analog Input used to provide a Feedback signal to the internal PI controller
KPD REF	Keypad Speed Reference selected
FB REF	Selected speed reference from Fieldbus (Modbus RTU / CAN Open / Master depending on P-12 setting)
(NO)	Input is Normally Open, Close momentarily to activate the function
(NC)	Input is Normally Closed, Open momentarily to activate the function
INC SPD ↑	Normally Open, Rising Edge, Close momentarily to increase the motor speed by value in P-20
DEC SPD ↓	Normally Open, Rising Edge, Close momentarily to decrease the motor speed by value in P-20

7.4. Macro Functions – Terminal Mode (P-12 = 0)

P-15	DI1		DI2		DI3 / AI2		DI4 / AI1		Diagram	
	0	1	0	1	0	1	0	1		
0	STOP	RUN	FWD ↻	REV ↻	AI1 REF	P-20 REF	Analog Input AI1		1	
1	STOP	RUN	AI1 REF	PR-REF	P-20	P-21	Analog Input AI1		1	
2	STOP	RUN	DI2	DI3	PR		P-20 - P-23	P-01	2	
			0	0	P-20					
			1	0	P-21					
			0	1	P-22					
			1	1	P-23					
3	STOP	RUN	AI1	P-20 REF	E-TRIP	OK	Analog Input AI1		3	
4	STOP	RUN	AI1	AI2	Analog Input AI2		Analog Input AI1		4	
5	STOP	RUN FWD ↻	STOP	RUN REV ↻	AI1	P-20 REF	Analog Input AI1		1	
		^-----FAST STOP (P-24)-----^								
6	STOP	RUN	FWD ↻	REV ↻	E-TRIP	OK	Analog Input AI1		3	
7	STOP	RUN FWD ↻	STOP	RUN REV ↻	E-TRIP	OK	Analog Input AI1		3	
		^-----FAST STOP (P-24)-----^								
8	STOP	RUN	FWD ↻	REV	DI3	DI4	PR		2	
					0	0	P-20			
					1	0	P-21			
					0	1	P-22			
			1	1	P-23					
9	STOP	START FWD ↻	STOP	START REV ↻	DI3	DI4	PR		2	
					0	0	P-20			
					1	0	P-21			
					0	1	P-22			
			1	1	P-23					
10	(NO)	START ↑	STOP	(NC)	AI1 REF	P-20 REF	Analog Input AI1		5	
11	(NO)	START ↑ FWD ↻	STOP	(NC)	(NO)	START ↑ REV ↻	Analog Input AI1		6	
							^-----FAST STOP (P-24)-----^			
12	STOP	RUN	FAST STOP (P-24)	OK	AI1 REF	P-20 REF	Analog Input AI1		7	
13	(NO)	START FWD ↻	STOP	(NC)	(NO)	START REV ↻	KPD REF	P-20 REF	13	
							^-----FAST STOP (P-24)-----^			
14	STOP	RUN	DI2		E-TRIP	OK	DI2	DI4	PR	11
							0	0	P-20	
							1	0	P-21	
							0	1	P-22	
			1	1	P-23					
15	STOP	RUN	P-23 REF	AI1	Fire Mode		Analog Input AI1		1	
16	STOP	RUN	P-23 REF	P-21 REF	Fire Mode		FWD	REV	2	
17	STOP	RUN	DI2		Fire Mode		DI2	DI4	PR	2
							0	0	P-20	
							1	0	P-21	
							0	1	P-22	
			1	1	P-23					
18	STOP	RUN	FWD ↻	REV ↻	Fire Mode		Analog Input AI1		1	
19	STOP	RUN	AI1 REF	PR1 REF	No Function	Fire Mode	AI1		1	

NOTE When P-15 = 19, P-30 Index 2 and Index 3 have no effect. When the fire mode input is on, the drive will run regardless of whether the run input is present. Speed reference in Fire Mode is always Preset Speed 4, P-23.

7.5. Macro Functions - Keypad Mode (P-12 = 1 or 2)

P-15	DI1		DI2		DI3 / AI2		DI4 / AI1		Diagram
	0	1	0	1	0	1	0	1	
0	STOP	ENABLE	-	INC SPD ↑	-	DEC SPD ↓	FWD ↻	REV ↻	8
^-----START-----^									
1	STOP	ENABLE	PI Speed Reference						2
2	STOP	ENABLE	-	INC SPD ↑	-	DEC SPD ↓	KPD REF	P-20 REF	8
^-----START-----^									
3	STOP	ENABLE	-	INC SPD ↑	E-TRIP	OK	-	DEC SPD ↓	9
^-----START-----^									
4	STOP	ENABLE	-	INC SPD ↑	KPD REF	AI1 REF	AI1		10
5	STOP	ENABLE	FWD ↻	REV ↻	KPD REF	AI1 REF	AI1		1
6	STOP	ENABLE	FWD ↻	REV ↻	E-TRIP	OK	KPD REF	P-20 REF	11
7	STOP	RUN FWD	STOP	RUN REV ↻	E-TRIP	OK	KPD REF	P-20 REF	11
^-----FAST STOP (P-24)-----^									
8	STOP	RUN FWD ↻	STOP	RUN REV ↻	KPD REF	AI1 REF	AI1		1
14	STOP	ENABLE	-	INC SPD ↑	E-TRIP	OK	-	DEC SPD ↓	
15	STOP	ENABLE	PR REF	KPD REF	Fire Mode		P-23	P-21	2
16	STOP	ENABLE	P-23 REF	KPD REF	Fire Mode		FWD ↻	REV ↻	2
17	STOP	ENABLE	KPD REF	P-23 REF	Fire Mode		FWD ↻	REV ↻	2
18	STOP	ENABLE	AI1 REF	KPD REF	Fire Mode		AI1		1
19	STOP	RUN	KPD REF	PR1 REF	No Function	Fire Mode	AI1		1
9, 10, 11, 12, 13 = Behavior as per setting 0									
NOTE	<p>When P15=4 in keypad mode, DI2 & DI4 are edge triggered. Digital pot speed will be increased or decreased once for each rising edge. The step of each speed change is defined by the absolute value of Pre-set Speed 1 (P-20).</p> <p>Speed change only happens during normal running condition (no stop command etc.). Digital pot will be adjusted between minimum speed (P-02) and maximum speed (P-01).</p> <p>When P-15 = 19, P-30 Index 2 and Index 3 have no effect. When the fire mode input is on, the drive will run regardless of whether the run input is present. Speed reference in Fire Mode is always Preset Speed 4, P-23.</p>								

7.6. Macro Functions - Fieldbus Control Mode (P-12 = 3, 4, 7, 8 or 9)

P-15	DI1		DI2		DI3 / AI2		DI4 / AI1		Diagram
	0	1	0	1	0	1	0	1	
0	STOP	ENABLE	FB REF (Fieldbus Speed Reference, Modbus RTU / CAN / Master-Slave defined by P-12)						14
1	STOP	ENABLE	PI Speed Reference						15
3	STOP	ENABLE	FB REF	P-20 REF	E-TRIP	OK	Analog Input AI1		3
5	STOP	ENABLE	FB REF	PR REF	P-20	P-21	Analog Input AI1		1
^-----START (P-12 = 3 or 4 Only)-----^									
6	STOP	ENABLE	FB REF	AI1 REF	E-TRIP	OK	Analog Input AI1		3
^-----START (P-12 = 3 or 4 Only)-----^									
7	STOP	ENABLE	FB REF	KPD REF	E-TRIP	OK	Analog Input AI1		3
^-----START (P-12 = 3 or 4 Only)-----^									
14	STOP	ENABLE	-	-	E-TRIP	OK	Analog Input AI1		16
15	STOP	ENABLE	PR REF	FB REF	Fire Mode		P-23	P-21	2
16	STOP	ENABLE	P-23 REF	FB REF	Fire Mode		Analog Input AI1		1
17	STOP	ENABLE	FB REF	P-23 REF	Fire Mode		Analog Input AI1		1
18	STOP	ENABLE	AI1 REF	FB REF	Fire Mode		Analog Input AI1		1
2, 4, 8, 9, 10, 11, 12, 13, 19 = Behavior as per setting 0									

7.7. Macro Functions - User PI Control Mode (P-12 = 5 or 6)

P-15	DI1		DI2		DI3 / AI2		DI4 / AI1		Diagram
	0	1	0	1	0	1	0	1	
0	STOP	RUN	PI REF	P-20 REF	AI2		AI1		4
1	STOP	RUN	PI REF	AI1 REF	AI2 (PI FB)		AI1		4
3, 7	STOP	RUN	PI REF	P-20	E-TRIP	OK	AI1 (PI FB)		3
4	(NO)	START	(NC)	STOP	AI2 (PI FB)		AI1		12
5	(NO)	START	(NC)	STOP	PI REF	P-20 REF	AI1 (PI FB)		5
6	(NO)	START	(NC)	STOP	E-TRIP	OK	AI1 (PI FB)		
8	STOP	RUN	FWD \curvearrowright	REV \curvearrowleft	AI2 (PI FB)		AI1		4
9	STOP	RUN	FWD \curvearrowright	REV \curvearrowleft	PI REF	PR1 REF	AI1		1
14	STOP	RUN	-	-	E-TRIP	OK	AI1 (PI FB)		16
15	STOP	RUN	P-23 REF	PI REF	Fire Mode		AI1 (PI FB)		1
16	STOP	RUN	P-23 REF	P-21 REF	Fire Mode		AI1 (PI FB)		1
17	STOP	RUN	FWD \curvearrowright	REV \curvearrowleft	E-TRIP	-	AI1		3
18	STOP	RUN	AI1 REF	PI REF	Fire Mode		AI1 (PI FB)		1
2, 9, 10, 11, 12, 13, 19 = Behavior as per setting 0									
NOTE	P1 Setpoint source is selected by P-44 (default is fixed value in P-45, AI 1 may also be selected). P1 Feedback source is selected by P-46 (default is AI 2, other options may be selected).								

7.8. Fire Mode

The Fire Mode function is designed to ensure continuous operation of the drive in emergency conditions until the drive is no longer capable of sustaining operation. The Fire Mode input may be a normally open (Close to Activate Fire Mode) or Normally Closed (Open to Activate Fire Mode) according to the setting of P-30 Index 2. In addition, the input may be momentary or maintained type, selected by P-30 Index 3.

This input may be linked to a fire control system to allow maintained operation in emergency conditions, e.g. to clear smoke or maintain air quality within that building.

The fire mode function is enabled when P-15 = 15, 16 or 17, with Digital Input 3 assigned to activate fire mode.

Fire Mode disables the following protection features in the drive:

$\overline{O-T}$ (Heat-sink Over-Temperature), $\overline{U-T}$ (Drive Under Temperature), $\overline{Eh-FLT}$ (Faulty Thermistor on Heat-sink), $\overline{E-trIP}$ (External Trip), $\overline{4-20F}$ (4-20mA fault), $\overline{Ph-Ib}$ (Phase Imbalance), $\overline{P-Loss}$ (Input Phase Loss Trip), $\overline{SC-trIP}$ (Communications Loss Trip), $\overline{I-t-trIP}$ (Accumulated overload Trip).

The following faults will result in a drive trip, auto reset and restart:

$\overline{O-volt}$ (Over Voltage on DC Bus), $\overline{U-volt}$ (Under Voltage on DC Bus), $\overline{h-O-I}$ (Fast Over-current Trip), $\overline{O-I}$ (Instantaneous over current on drive output), $\overline{OUL-F}$ (Drive output fault, Output stage trip).

8. Modbus RTU Communications

8.1. Introduction

The Optidrive E3 can be connected to a Modbus RTU network via the RJ45 connector on the front of the drive.

8.2. Modbus RTU Specification

Protocol	Modbus RTU
Error check	CRC
Baud rate	9600bps, 19200bps, 38400bps, 57600bps, 115200bps (default)
Data format	1 start bit, 8 data bits, 1 stop bits, no parity
Physical signal	RS 485 (2-wire)
User interface	RJ45
Supported Function Codes	03 Read Multiple Holding Registers 06 Write Single Holding Register 16 Write Multiple Holding Registers (Supported for registers 1 – 4 only)

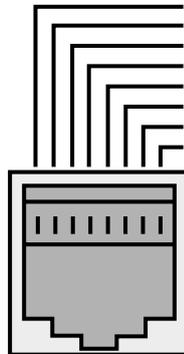
8.3. RJ45 Connector Configuration

For full MODBUS RTU register map information please refer to your Invertek Drives Sales Partner. Local contacts can be found by visiting our website:

www.invertekdrives.com

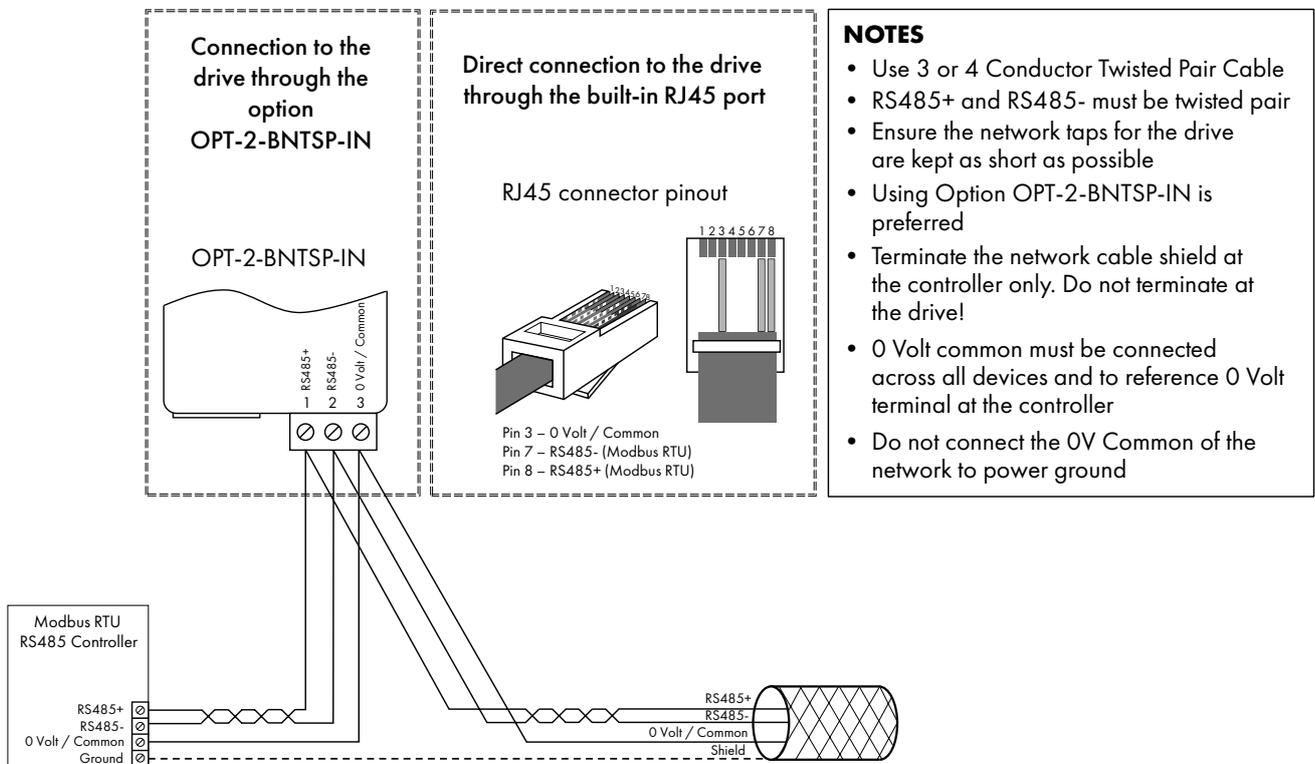
When using MODBUS control the Analog and Digital Inputs can be configured as shown in section 7.6.

Macro Functions - Fieldbus Control Mode (P-12 = 3, 4, 7, 8 or 9) on page 30.



1	CAN -
2	CAN +
3	0 Volts
4	-RS485 (PC)
5	+RS485 (PC)
6	+24 Volt
7	-RS485 (Modbus RTU)
8	+RS485 (Modbus RTU)

Warning: This is not an Ethernet connection. Do not connect directly to an Ethernet port.



NOTES

- Use 3 or 4 Conductor Twisted Pair Cable
- RS485+ and RS485- must be twisted pair
- Ensure the network taps for the drive are kept as short as possible
- Using Option OPT-2-BNTSP-IN is preferred
- Terminate the network cable shield at the controller only. Do not terminate at the drive!
- 0 Volt common must be connected across all devices and to reference 0 Volt terminal at the controller
- Do not connect the 0V Common of the network to power ground

NOTE For Master devices which use zero based addressing and therefore treat the first Register address as Register 0, it may be necessary to convert the Register Numbers detailed below by subtracting 1 to obtain the correct Register address.

8.4. Modbus Register Map

Register Number	Par.	Type	Supported Function Codes			Function		Range	Explanation
			03	06	16	Low Byte	High Byte		
1	-	R/W	✓	✓	✓	PDO0 Control Word		0..3	16 Bit Word. Bit 0: Low = Stop, High = Run Enable Bit 1: Low = Decel Ramp 1 (P-04), High = Decel Ramp 2 (P-24) Bit 2: Low = No Function, High = Fault Reset Bit 3: Low = No Function, High = Coast Stop Request Bit 8: Relay control, 0 = Open, 1 = Close Bit 9 : DO Control, 1 = Off, 0 = On
2	-	R/W	✓	✓	✓	PDO1 Frequency Setpoint		0..5000	Setpoint frequency x10, e.g. 100 = 10.0Hz
3	-	R/W	✓	✓	✓	PI Setpoint/ Analog Output Control		0..4096	0 - 4096 = 0 - 100.0%
4	-	R/W	✓	✓	✓	PDO3		0..60000	Ramp time in seconds x 100, e.g. 250 = 2.5 seconds
6	-	R	✓			Drive status	Error code		Low Byte = Drive Error Code, see section 11.1. Fault Code Messages High Byte = Drive Status as follows: 0: Drive Running 1: Drive Tripped 5: Standby Mode 6: Drive Ready
7		R	✓			Output Motor Frequency		0..20000	Output frequency in Hz x10, e.g. 100 = 10.0Hz
8		R	✓			Output Motor Current		0..480	Output Motor Current in Amps x10, e.g. 10 = 1.0 Amps
11	-	R	✓			Digital input status		0..15	Indicates the status of the 4 digital inputs Lowest Bit = 1 Input 1
20	P00-01	R	✓			Analog Input 1 value		0..1000	Analog input % of full scale x10, e.g. 1000 = 100%
21	P00-02	R	✓			Analog Input 2 value		0..1000	Analog input % of full scale x10, e.g. 1000 = 100%
22	P00-03	R	✓			Speed Reference Value		0..1000	Displays the setpoint frequency x10, e.g. 100 = 10.0Hz
23	P00-08	R	✓			DC bus voltage		0..1000	DC Bus Voltage in Volts
24	P00-09	R	✓			Drive temperature		0..100	Drive heatsink temperature in °C
2001	-	R	✓			Status Word 2			See below
2002	-	R	✓			Motor Output Speed			Speed in Hz with one decimal place
2003	-	R	✓			Motor Output Current			Current in A with one decimal place
2004	-	R	✓			Motor Output Power			Power in kW with one decimal place
2005	-	R	✓			IO Status Word			See below
2006	-	R	✓			Motor Output Torque			0.0% to +/- 200.0%
2007	P00-08	R	✓			DC Bus Voltage			0 – 1000V
2008	P00-09	R	✓			Heatsink Temperature			Temperature in °C
2009	P00-01	R	✓			Analog Input 1			0 ~ 4096 (12bits)
2010	P00-02	R	✓			Analog Input 2			0 ~ 4096 (12bits)
2011	-	R	✓			Analog Output			0.0 to 100.0%
2012	P00-05	R	✓			PI Output			0.0 to 100.0%
2013	P00-20	R	✓			Internal Temperature			Temperature in °C
2014	P00-07	R	✓			Motor Output Voltage			0 – 500V
2015	-	R	✓			IP66 Pot Input value			0 ~ 4096 (12bits)
2016	-	R	✓			Trip Code			See user guide for code definition

All user configurable parameters are accessible as Holding Registers, and can be Read from or Written to using the appropriate Modbus command. The Register number for each parameter P-04 to P-60 is defined as 128 + Parameter number, e.g. for parameter P-15, the register number is 128 + 15 = 143. Internal scaling is used on some parameters, for further details please contact your Invertek Drives Sales Partner.

8.4.1. Drive status and error code Word PD10

Bit	Function When "0"	Function When "1"
15		
14		
13		
12	In the event of a trip, the associated code is shown in this byte	
11		
10		
9		
8		
7		
6	Not Ready	Drive Ready
5		
4		
3		
2	-	Drive In Standby Mode
1	Drive OK	Drive Tripped
0	Drive Stopped	Drive Running

Bit 6: Drive Ready to Run is defined as:

- Not tripped.
- Hardware enable signal present (DI1 ON).
- No mains loss condition.

8.4.2. Register 2001 definition – New Status Word

Bit	Definition	Description
0	Ready	This bit is set if no trip and no mains loss, plus hardware enabled
1	Running	This bit is set when drive is running
2	Tripped	This bit is set when drive is under trip condition
3	Standby	This bit is set when drive is in standby mode
4	Fire Mode	This bit is set if fire mode is active
5	Reserved	Read as 0
6	Speed Set-point Reached (At Speed)	This bit is set when drive is enabled and reaches speed set point
7	Below Minimum Speed	This bit is set when drive is enabled and speed less than P-02
8	Overload	This bit is set if motor current > P-08
9	Mains Loss	This bit is set if mains loss condition happens
10	Heatsink > 85°C	This bit is set if drive heatsink temperature over 85°C
11	Control Board > 80°C	This bit is set if control PCB temperature over 80°C
12	Switching Frequency Reduction	This bit is set if PWM switching frequency foldback is active
13	Reverse Rotation	This bit is set when motor is in reverse rotation (negative speed)
14	Reserved	Read as 0
15	Live Toggle Bit	This bit will toggle each time this register is read

8.4.2. Register 2005 definition – IO Status Word

Bit	Definition	Description
0	DI1 Status	This bit is set when digital input 1 is closed
1	DI2 Status	This bit is set when digital input 2 is closed
2	DI3 Status	This bit is set when digital input 3 (AI-2) is closed
3	DI4 Status	This bit is set when digital input 4 (AI-1) is closed
4, 5	Reserved	Read as 0
6	IP66 Switch FWD	This bit is set when IP66 FWD switch is closed
7	IP66 Switch REV	This bit is set when IP66 REV switch is closed
8	Digital Output Status	This bit is set when digital output is active(24V) or Analog output > 0
9	Relay Output Status	This bit is set when user relay is closed
10, 11	Reserved	Read as 0
12	Analog Input 1 Signal Lost (4-20mA)	This bit is set when analog input 1 signal loss happens (4..20mA)
13	Analog Input 2 signal Lost (4-20mA)	This bit is set when analog input 2 signal loss happens (4..20mA)
14	Reserved	Read as 0
15	IP66 Pot Input > 50%	This bit is set when IP66 integrated pot input value > 50%

9. Technical Data

9.1. Environmental

Operational ambient temperature range	Open Drives	: -10 ... 50°C (frost and condensation free)
Storage ambient temperature range		: -40 ... 60°C
Maximum altitude		: 2000m. Derate above 1000m: 1% / 100m
Maximum humidity		: 95%, non-condensing
Environmental Conditions		: IP20 Optidrive E3 products are designed to operate in 3S2/3C2 environments in accordance with IEC 60721-3-3.

NOTE For UL compliance: the average ambient temperature over a 24 hour period for 200-240V, 2.2kW and 3HP, IP20 drives is 45°C.

9.2. Rating Tables

Frame Size	kW	HP	Input Current	Fuse / MCB (Type B)		Maximum Cable Size		Output Current A	Recommended Brake Resistance Ω
				Non UL	UL	mm ²	AWG		
110 - 115 (+ / - 10%) V 1 Phase Input, 230V 3 Phase Output (Voltage Doubler)									
1	0.37	0.5	7.8	10	10	8	8	2.3	-
1	0.75	1	15.8	25	20	8	8	4.3	-
2	1.1	1.5	21.9	32	30	8	8	5.8	100
200 - 240 (+ / - 10%) V 1 Phase Input, 3 Phase Output									
1	0.37	0.5	3.7	10	6	8	8	2.3	-
1	0.75	1	7.5	10	10	8	8	4.3	-
1	1.5	2	12.9	16	17.5	8	8	7	-
2	1.5	2	12.9	16	17.5	8	8	7	100
2	2.2	3	19.2	25	25	8	8	10.5	50
3	4	5	29.2	40	40	8	8	15.3	25
200 - 240 (+ / - 10%) V 3 Phase Input, 3 Phase Output									
1	0.37	0.5	3.4	6	6	8	8	2.3	-
1	0.75	1	5.6	10	10	8	8	4.3	-
1	1.5	2	9.5	16	15	8	8	7	-
2	1.5	2	8.9	16	15	8	8	7	100
2	2.2	3	12.1	16	17.5	8	8	10.5	50
3	4	5	20.9	32	30	8	8	18	25
3	5.5	7.5	26.4	40	35	8	8	24	20
4	7.5	10	33.3	40	45	16	5	30	15
4	11	15	50.1	63	70	16	5	46	10
5	15	20	54.6	80	70	25	2	61	10
5	18.5	25	64.8	80	80	25	2	72	10
380 - 480 (+ / - 10%) V 3 Phase Input, 3 Phase Output									
1	0.37	0.5	1.7	6	6	8	8	1.2	-
1	0.75	1	3.5	6	6	8	8	2.2	-
1	1.5	2	5.6	10	10	8	8	4.1	-
2	1.5	2	5.6	10	10	8	8	4.1	250
2	2.2	3	7.5	16	10	8	8	5.8	200
2	4	5	11.5	16	15	8	8	9.5	120
3	5.5	7.5	17.2	25	25	8	8	14	100
3	7.5	10	21.2	32	30	8	8	18	80
3	11	15	27.5	40	35	8	8	24	50
4	15	20	34.2	40	45	16	5	30	30
4	18.5	25	44.1	50	60	16	5	39	22
4	22	30	51.9	63	70	16	5	46	22
5	30	40	56.3	80	70	25	2	61	15
5	37	50	67.6	100	90	25	2	72	12

NOTE Cable sizes shown are the maximum possible that may be connected to the drive. Cables should be selected according to local wiring codes or regulations at the point of installation.

9.3. Single Phase Operation of Three Phase Drives

All drive models intended for operation from three phase mains power supply (e.g. model codes ODE-3-xxxxx-3xxx) may be operated from a single phase supply at up to 50% of maximum rated output current capacity.

In this case, the AC power supply should be connected to L1 (L) and L2 (N) power connection terminals only.

9.4. Additional Information for UL Compliance

Optidrive E3 is designed to meet the UL requirements. For an up to date list of UL compliant products, please refer to UL listing NMMS.E226333. In order to ensure full compliance, the following must be fully observed.

Input Power Supply Requirements					
Supply Voltage	200 – 240 RMS Volts for 230 Volt rated units, + /- 10% variation allowed. 240 Volt RMS Maximum.				
	380 – 480 Volts for 400 Volt rated units, + / - 10% variation allowed, Maximum 500 Volts RMS.				
Imbalance	Maximum 3% voltage variation between phase – phase voltages allowed.				
	All Optidrive E3 units have phase imbalance monitoring. A phase imbalance of > 3% will result in the drive tripping. For input supplies which have supply imbalance greater than 3% (typically the Indian sub-continent & parts of Asia Pacific including China) Invertek Drives recommends the installation of input line reactors.				
Frequency	50 – 60Hz + / - 5% Variation				
Short Circuit Capacity	Voltage Rating	Min kW (HP)	Max kW (HP)	Maximum supply short-circuit current	
				5kA RMS (AC)	100kA RMS (AC)
	115V	0.37 (0.5)	1.1 (1.5)	J-Type fuses	J-Type fuses
	230V	0.37 (0.5)	11 (15)	J-Type fuses	J-Type fuses
	230V	15 (20)	18.5 (25)	J-Type fuses	Semiconductor fuse (FWP-100 Bussmann)
	400 / 460V	0.37 (0.5)	22 (30)	J-Type fuses	J-Type fuses
	400 / 460V	30 (40)	37 (50)	J-Type fuses	Semiconductor fuse (FWP-100 Bussmann)
All the drives in the above table are suitable for use on a circuit capable of delivering not more than the above specified maximum short-circuit Amperes symmetrical with the specified maximum supply voltage when protected by fuses as shown above.					
Mechanical Installation Requirements					
All Optidrive E3 units are intended for indoor installation within controlled environments which meet the condition limits shown in section 9.1. <i>Environmental</i> .					
The drive can be operated within an ambient temperature range as stated in section 9.1. <i>Environmental</i> .					
Frame size 4 drives must be mounted in an enclosure in a manner that ensures the drive is protected from 12.7mm (1/2 inch) of deformation of the enclosure if the enclosure impacted.					
Electrical Installation Requirements					
Incoming power supply connection must be according to section 4.3. <i>Incoming Power Connection</i> .					
Suitable Power and motor cables should be selected according to the data shown in section 9.2. <i>Rating Tables</i> and the National Electrical Code or other applicable local codes.					
Motor Cable	75°C copper stranded or similar (90°C for enclosed Nema 4X type drives).				
Power cable connections and tightening torques are shown in sections 3.3. <i>Mechanical Dimensions and Mounting – IP20 Open Units</i> .					
Integral Solid State short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the national electrical code and any additional local codes. Ratings are shown in section 9.2. <i>Rating Tables</i> .					
Transient surge suppression must be installed on the line side of this equipment and shall be rated 480Volt (phase to ground), 480 Volt (phase to phase), suitable for over voltage category iii and shall provide protection for a rated impulse withstand voltage peak of 4kV.					
UL Listed ring terminals / lugs must be used for all bus bar and grounding connections.					
General Requirements					
Optidrive E3 provides motor overload protection in accordance with the National Electrical Code (US).					
<ul style="list-style-type: none"> Where a motor is not fitted, or not utilised, Thermal Overload Memory Retention must be enabled by setting P-60 Index 1 = 1. Where a motor thermistor is fitted and connected to the drive, connection must be carried out according to the information shown in section 4.8.2. <i>Motor Thermistor Connection</i>. 					

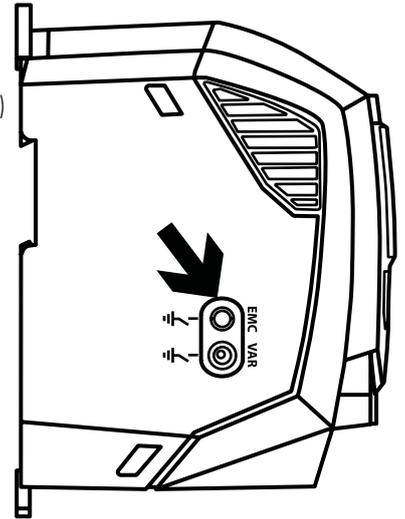
9.5. EMC Filter Disconnect

Drives with an EMC filter have an inherently higher leakage current to Ground (Earth). For applications where tripping occurs the EMC filter can be disconnected (on IP20 units only) by completely removing the EMC screw on the side of the product.

Remove the screw as indicated right.

The Optidrive product range has input supply voltage surge suppression components fitted to protect the drive from line voltage transients, typically originating from lightning strikes or switching of high power equipment on the same supply.

When carrying out a HiPot (Flash) test on an installation in which the drive is built, the voltage surge suppression components may cause the test to fail. To accommodate this type of system HiPot test, the voltage surge suppression components can be disconnected by removing the VAR screw. After completing the HiPot test, the screw should be replaced and the HiPot test repeated. The test should then fail, indicating that the voltage surge suppression components are once again in circuit.



10. Troubleshooting

10.1. Fault Code Messages

Fault Code	No.	Description	Suggested Remedy
no-FLt	00	No Fault	Not required.
Oi-b	01	Brake channel over current	Check external brake resistor condition and connection wiring.
OL-br	02	Brake resistor overload	The drive has tripped to prevent damage to the brake resistor.
O-I	03	Output Over Current	Instantaneous Over current on the drive output. Excess load or shock load on the motor. NOTE Following a trip, the drive cannot be immediately reset. A delay time is inbuilt, which allows the power components of the drive time to recover to avoid damage.
I-LEtP	04	Motor Thermal Overload (I2t)	The drive has tripped after delivering >100% of value in P-08 for a period of time to prevent damage to the motor.
O-UOLt	06	Over voltage on DC bus	Check the supply voltage is within the allowed tolerance for the drive. If the fault occurs on deceleration or stopping, increase the deceleration time in P-04 or install a suitable brake resistor and activate the dynamic braking function with P-34.
U-UOLt	07	Under voltage on DC bus	The incoming supply voltage is too low. This trip occurs routinely when power is removed from the drive. If it occurs during running, check the incoming power supply voltage and all components in the power feed line to the drive.
O-t	08	Heatsink over temperature	The drive is too hot. Check the ambient temperature around the drive is within the drive specification. Ensure sufficient cooling air is free to circulate around the drive.
U-t	09	Under temperature	The drive temperature is below the minimum limit and must be increased to operate the drive.
P-dEF	10	Factory Default parameters loaded	
E-etr iP	11	External trip	E-trip requested on digital input 3. Normally closed contact has opened for some reason. If motor thermistor is connected check if the motor is too hot.
SC-ObS	12	Optibus comms loss	Check communication link between drive and external devices. Make sure each drive in the network has its unique address.
FLt-dc	13	DC bus ripple too high	Check incoming supply phases are all present and balanced.
P-LOSS	14	Input phase loss trip	Check incoming power supply phases are present and balanced.
h O-I	15	Output Over Current	Check for short circuits on the motor and connection cable. NOTE Following a trip, the drive cannot be immediately reset. A delay time is inbuilt, which allows the power components of the drive time to recover to avoid damage.
th-FLt	16	Faulty thermistor on heatsink	
dRAr-F	17	Internal memory fault (IO)	Press the stop key. If the fault persists, consult your supplier.
4-20 F	18	4-20mA Signal Lost	Check the analog input connection(s).
dRAr-E	19	Internal memory fault (DSP)	Press the stop key. If the fault persists, consult your supplier.
F-Ptc	21	Motor PTC thermistor trip	Connected motor thermistor over temperature, check wiring connections and motor.
FAr-F	22	Cooling Fan Fault (IP66 only)	Check / replace the cooling fan.
O-HEAr	23	Drive internal temperature too high	Drive ambient temperature too high, check adequate cooling air is provided.
OUL-F	26	Output Fault	Indicates a fault on the output of the drive, such as one phase missing, motor phase currents not balanced. Check the motor and connections.
ArF-O2	41	Autotune Fault	The motor parameters measured through the autotune are not correct. Check the motor cable and connections for continuity. Check all three phases of the motor are present and balanced.
SC-F01	50	Modbus comms loss fault	Check the incoming Modbus RTU connection cable. Check that at least one register is being polled cyclically within the timeout limit set in P-36 Index 3.
SC-F02	51	CAN comms loss trip	Check the incoming CAN connection cable. Check that cyclic communications take place within the timeout limit set in P-36 Index 3.

NOTE Following an over current or overload trip (3, 4, 15), the drive may not be reset until the reset time delay has elapsed to prevent damage to the drive.

11. Energy Efficiency Classification

Please scan the QR code or visit www.invertekdrives.com/ecodesign to learn more about the Ecodesign Directive and for specific product efficiency classification and part load loss data in accordance with IEC 61800-9-2:2017.



82-E3120-IN_V1.03

Mixing Motor

BALDOR • RELIANCE

**Integral Horsepower
AC Induction Motors
ODP, WPI, WPII Enclosure
TEFC Enclosure
Explosion Proof**

Installation & Operating Manual

Table of Contents

Section 1	
General Information	1-1
Overview	1-1
Limited Warranty	1-1
Safety Notice	1-2
Receiving	1-4
Storage	1-4
Unpacking	1-4
Handling	1-4
Section 2	
Installation & Operation	2-1
Overview	2-1
Location	2-1
Mounting	2-1
Alignment	2-1
Doweling & Bolting	2-2
Power Connection	2-2
Conduit Box	2-2
AC Power	2-2
First Time Start Up	2-4
Coupled Start Up	2-4
Jogging and Repeated Starts	2-4
Section 3	
Maintenance & Troubleshooting	3-1
General Inspection	3-1
Lubrication & Bearings	3-1
Type of Grease	3-1
Relubrication Intervals	3-1
Relubrication Procedure	3-3
Accessories	3-4
Troubleshooting Chart	3-5

Section 1

General Information

Overview This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements. A Warning statement indicates a possible unsafe condition that can cause harm to personnel. A Caution statement indicates a condition that can cause damage to equipment.

Important: **This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.**

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- The National Electrical Code
- Local codes and Practices

Limited Warranty

1. Most Baldor products are warranted for 18 months from the date of shipment to Baldor's customer from Baldor's district warehouse or, if applicable, from Baldor's factory. Baldor Standard-E® standard efficient motors are warranted for 24 months. Standard-E is limited to three phase, general purpose, 1-200 HP ratings that fall under the Energy Policy Act (EPAAct). Baldor Super-E® premium efficient motors are warranted for 36 months. Baldor IEEEE841 motors are warranted for 60 months. All warranty claims must be submitted to a Baldor Service Center prior to the expiration of the warranty period.
2. Baldor will, at its option repair or replace a motor which fails due to defects in material or workmanship during the warranty period if:
 - a. the purchaser presents the defective motor at or ships it prepaid to, the Baldor plant in Fort Smith, Arkansas or one of the Baldor Authorized Service Centers and
 - b. the purchaser gives written notification concerning the motor and the claimed defect including the date purchased, the task performed by the Baldor motor and the problem encountered.
3. Baldor will not pay the cost of removal of any electric motor from any equipment, the cost of delivery to Fort Smith, Arkansas or a Baldor Authorized Service Center, or the cost of any incidental or consequential damages resulting from the claimed defects. (Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply to you.) Any implied warranty given by laws shall be limited to the duration of the warranty period hereunder. (Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.)
4. Baldor Authorized Service Centers, when convinced to their satisfaction that a Baldor motor developed defects in material or workmanship within the warranty period, are authorized to proceed with the required repairs to fulfill Baldor's warranty when the cost of such repairs to be paid by Baldor does not exceed Baldor's warranty repair allowance. Baldor will not pay overtime premium repair charges without prior written authorization.
5. The cost of warranty repairs made by centers other than Baldor Authorized Service Centers **WILL NOT** be paid unless first authorized in writing by Baldor.
6. Claims by a purchaser that a motor is defective even when a failure results within one hour after being placed into service are not always justified. Therefore, Baldor Authorized Service Centers must determine from the condition of the motor as delivered to the center whether or not the motor is defective. If in the opinion of a Baldor Authorized Service Center, a motor did not fail as a result of defects in material or workmanship, the center is to proceed with repairs only if the purchaser agrees to pay for such repairs. If the decision is in dispute, the purchaser should still pay for the repairs and submit the paid invoice and the Authorized Service Center's signed service report to Baldor for further consideration.
7. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Safety Notice:

This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment.

Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.

WARNING: Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.

WARNING: This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.

WARNING: Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.

WARNING: Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.

WARNING: Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.

WARNING: Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.

WARNING: Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.

WARNING: Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.

WARNING: Do not use non UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust. These motors are not designed for atmospheric conditions that require explosion proof operation.

Safety Notice Continued

WARNING: Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo.

Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.

WARNING: UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

Caution: To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.

Caution: Do not over-lubricate motor as this may cause premature bearing failure.

Caution: Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load from the motor shaft before moving the motor.

Caution: If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.

Caution: To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.

Caution: If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.

Receiving

Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

Storage

If the motor is not put into service immediately, the motor must be stored in a clean, dry and warm location. Several precautionary steps must be performed to avoid motor damage during storage.

1. Use a "Megger" periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
2. Do not lubricate bearings during storage. Motor bearings are packed with grease at the factory. Excessive grease can damage insulation quality.
3. Rotate motor shaft at least 10 turns every two months during storage (more frequently if possible). This will prevent bearing damage due to storage.
4. If the storage location is damp or humid, the motor windings must be protected from moisture. This can be done by applying power to the motors' space heater (if available) while the motor is in storage.

Unpacking

Each Baldor motor is packaged for ease of handling and to prevent entry of contaminants.

1. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.
2. When the motor has reached room temperature, remove all protective wrapping material from the motor.

Handling

The motor should be lifted using the lifting lugs or eye bolts provided.

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft or the hood of a WP11 motor.
2. When lifting a WP11 (Weather Proof Type 2) motor, do not lift the motor by inserting lifting lugs into holes on top of the cooling hood. These lugs are to be used for hood removal only. A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame.
3. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation. Do not lift using the motor lugs or eye bolts provided.

If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

Section 2 Installation & Operation

Overview

Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

Location

It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

1. **Open Drip-Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non-corrosive.
2. **Totally Enclosed and WPII** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service.

Mounting

The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

After installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

Alignment

Accurate alignment of the motor with the driven equipment is extremely important.

1. **Direct Coupling**

For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.

2. **End-Play Adjustment**

The axial position of the motor frame with respect to its load is also extremely important. The motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.

3. **Pulley Ratio**

The pulley ratio should not exceed 8:1.

4. **Belt Drive**

Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.

Caution: Do not over tension belts.

5. Sleeve bearing motors are only suitable for coupled loads.

Doweling & Bolting

After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor motors are designed for doweling.)

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment. Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure. Flanged nuts or bolts may be used as an alternative to washers.

Power Connection

Conduit Box

Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices.

For ease of making connections, an oversize conduit box is provided. The box can be rotated 360° in 90° increments. Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

AC Power

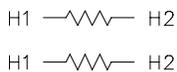
Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

1. AC power is within $\pm 10\%$ of rated voltage with rated frequency. (See motor name plate for ratings).
OR
2. AC power is within $\pm 5\%$ of rated frequency with rated voltage.
OR
3. A combined variation in voltage and frequency of $\pm 10\%$ (sum of absolute values) of rated values, provided the frequency variation does not exceed $\pm 5\%$ of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-2.

Figure 2-1 Accessory Connections

HEATERS



One heater is installed in each end of motor.
Leads for each heater are labeled H1 & H2.
(Like numbers should be tied together).

THERMISTERS



Three thermistors are installed in windings and tied in series.
Leads are labeled T1 & T2.

WINDING RTDS



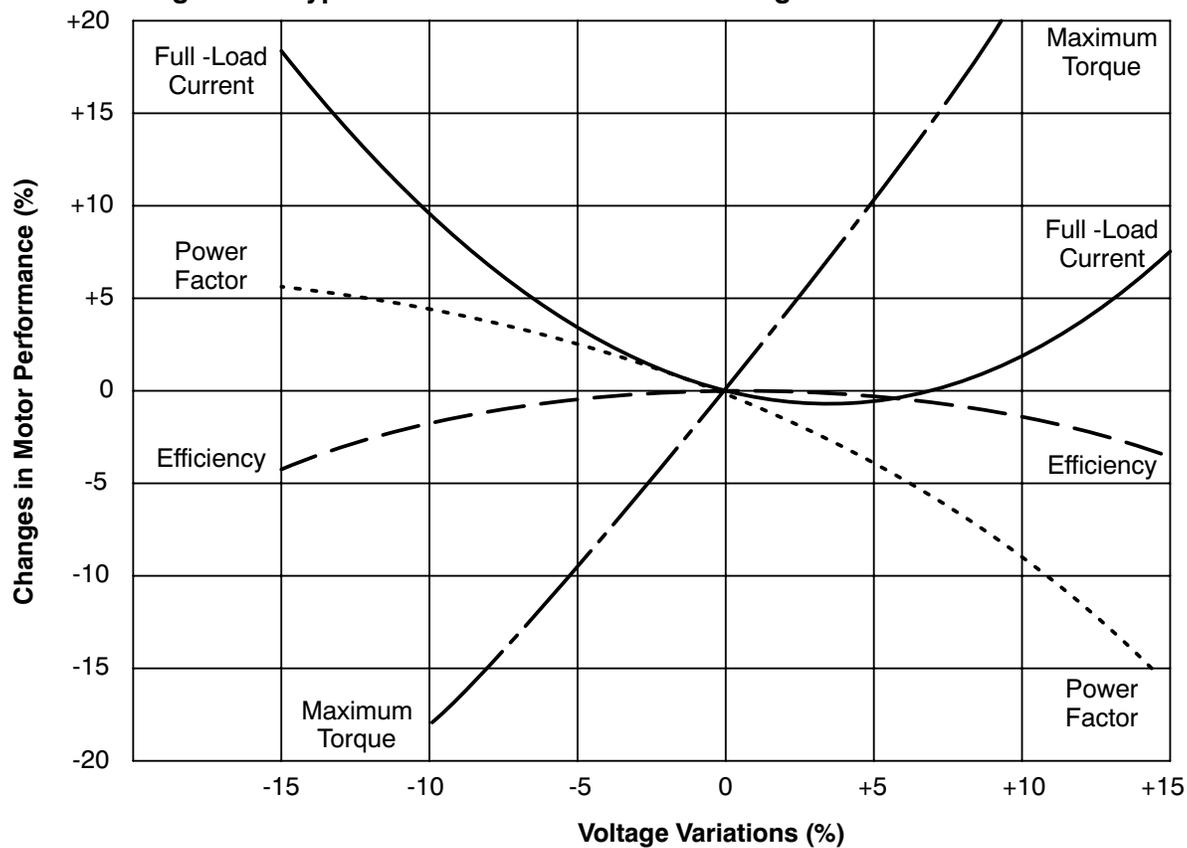
Winding RTDs are installed in windings (2) per phase.
Each set of leads is labeled W1, W2, W3, W4, W5, & W6.

BEARING RTD



- * One bearing RTD is installed in Drive endplate (PUEP), leads are labeled RTDDE.
- * One bearing RTD is installed in Opposite Drive endplate (FREPE), leads are labeled RTDODE.
- * Note RTD may have 2-Red/1-White leads; or 2-White/1-Red Lead.

Figure 2-2 Typical Motor Performance VS Voltage Variations



First Time Start Up

Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity with a Megger.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.

Coupled Start Up

This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor through the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor distributor or Baldor Service Center.

Section 3 Maintenance & Troubleshooting

WARNING: UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

General Inspection

Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Use a "Megger" periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

Relubrication & Bearings

Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a 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. Good results can be obtained if the following recommendations are used in your maintenance program.

Type of Grease

A high grade ball or roller bearing grease should be used. Recommended grease for standard service conditions is Polyrex EM (Exxon Mobil).

Equivalent and compatible greases include:

Texaco Polystar, Rykon Premium #2, Pennzoil Pen 2 Lube and Chevron SRI.

Relubrication Intervals

Recommended relubrication intervals are shown in Table 3-1. It is important to realize that the recommended intervals of Table 3-1 are based on average use.

Refer to additional information contained in Tables 3-2, 3-3 and 3-4.

Table 3-1 Relubrication Intervals *

NEMA / (IEC) Frame Size	Rated Speed - RPM					
	10000	6000	3600	1800	1200	900
Up to 210 incl. (132)	**	2700 Hrs.	5500 Hrs.	12000 Hrs.	18000 Hrs.	22000 Hrs.
Over 210 to 280 incl. (180)		**	3600 Hrs.	9500 Hrs.	15000 Hrs.	18000 Hrs.
Over 280 to 360 incl. (225)		**	* 2200 Hrs.	7400 Hrs.	12000 Hrs.	15000 Hrs.
Over 360 to 5800 incl. (300)		**	*2200 Hrs.	3500 Hrs.	7400 Hrs.	10500 Hrs.

* Relubrication intervals are for ball bearings.

For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

Table 3-2 Service Conditions

Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination
Standard	8	40° C	Clean, Little Corrosion
Severe	16 Plus	50° C	Moderate dirt, Corrosion
Extreme	16 Plus	>50° C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration
Low Temperature		<-29° C **	

* Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

Table 3-3 Relubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

Table 3-4 Bearings Sizes and Types

Frame Size NEMA (IEC)	Bearing Description (These are the "Large" bearings (Shaft End) in each frame size)			
	Bearing	Weight of Grease to add * oz (Grams)	Volume of grease to be added	
			in ³	teaspoon
56 to 140 (90)	6203	0.08 (2.4)	0.15	0.5
140 (90)	6205	0.15 (3.9)	0.2	0.8
180 (100-112)	6206	0.19 (5.0)	0.3	1.0
210 (132)	6307	0.30 (8.4)	0.6	2.0
250 (160)	6309	0.47 (12.5)	0.7	2.5
280 (180)	6311	0.61 (17)	1.2	3.9
320 (200)	6312	0.76 (20.1)	1.2	4.0
360 (225)	6313	0.81 (23)	1.5	5.2
400 (250)	6316	1.25 (33)	2.0	6.6
440 (280)	6319	2.12 (60)	4.1	13.4
5000 to 5800 (315-450)	6328	4.70 (130)	9.2	30.0
5000 to 5800 (315-450)	NU328	4.70 (130)	9.2	30.0
360 to 449 (225-280)	NU319	2.12 (60)	4.1	13.4
AC Induction Servo				
76 Frame 180 (112)	6207	0.22 (6.1)	0.44	1.4
77 Frame 210 (132)	6210	0.32 (9.0)	0.64	2.1
80 Frame 250(160)	6213	0.49 (14.0)	0.99	3.3

* Weight in grams = .005 DB of grease to be added

Note: Not all bearing sizes are listed. For intermediate bearing sizes, use the grease volume for the next larger size bearing.

Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.

Relubrication Procedure Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

Caution: Do not over-lubricate motor as this may cause premature bearing failure.

With Grease Outlet Plug

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.

Caution: Over-lubricating can cause excessive bearing temperatures, premature lubrication breakdown and bearing failure.

3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed. This allows excess grease to purge.
5. Re-install grease outlet plug.

Without Grease Provisions

Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed explosion proof motor to maintain it's UL/CSA listing.

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.

Sample Relubrication Determination

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

1. Table 3-1 list 9500 hours for standard conditions.
2. Table 3-2 classifies severity of service as "Severe".
3. Table 3-4 shows that 1.2 in³ or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

Table 3-5 Troubleshooting Chart

Symptom	Possible Causes	Possible Solutions
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter.	Check source of power. Check overloads, fuses, controls, etc.
Excessive humming	High Voltage.	Check input line connections.
	Eccentric air gap.	Have motor serviced at local Baldor service center.
Motor Over Heating	Overload. Compare actual amps (measured) with nameplate rating.	Locate and remove source of excessive friction in motor or load. Reduce load or replace with motor of greater capacity.
	Single Phasing.	Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation.	Check external cooling fan to be sure air is moving properly across cooling fins. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage.	Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator.	Check air gap clearance and bearings.
		Tighten "Thru Bolts".
	Over voltage or under voltage.	Check input voltage at each phase to motor.
	Open stator winding.	Check stator resistance at all three phases for balance.
	Grounded winding.	Perform dielectric test and repair as required.
	Improper connections.	Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram.
Bearing Over Heating	Misalignment.	Check and align motor and driven equipment.
	Excessive belt tension.	Reduce belt tension to proper point for load.
	Excessive end thrust.	Reduce the end thrust from driven machine.
	Excessive grease in bearing.	Remove grease until cavity is approximately $\frac{3}{4}$ filled.
	Insufficient grease in bearing.	Add grease until cavity is approximately $\frac{3}{4}$ filled.
	Dirt in bearing.	Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately $\frac{3}{4}$ filled.
Vibration	Misalignment.	Check and align motor and driven equipment.
	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Rotor out of balance.	Have rotor balance checked and repaired at your Baldor Service Center.
	Resonance.	Tune system or contact your Baldor Service Center for assistance.
Noise	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.
Growling or whining	Bad bearing.	Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately $\frac{3}{4}$ filled.

Suggested bearing and winding RTD setting guidelines

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80°C) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

Winding RTDs - Temperature Limit In °C (40°C Maximum Ambient)

Motor Load	Class B Temp Rise ≤ 80°C (Typical Design)		Class F Temp Rise ≤ 105°C		Class H Temp Rise ≤ 125°C	
	Alarm	Trip	Alarm	Trip	Alarm	Trip
≤ Rated Load	130	140	155	165	175	185
Rated Load to 1.15 S.F.	140	150	160	165	180	185

- Note:
- Winding RTDs are factory production installed, not from Mod-Express.
 - When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

Bearing RTDs - Temperature Limit In °C (40°C Maximum Ambient)

Bearing Type Oil or Grease	Anti-Friction		Sleeve	
	Alarm	Trip	Alarm	Trip
Standard*	95	100	85	95
High Temperature**	110	115	105	110

- Note: * Bearing temperature limits are for standard design motors operating at Class B temperature rise.
** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as "standard" lubricants) include the following:

- Texaco Polystar
- Mobilith SHC-100
- Darmex 707
- Rykon Premium #2
- Pennzoil Pennzlube EM-2
- Darmex 711
- Chevron SRI #2
- Chevron Black Pearl
- Petro-Canada Peerless LLG

See the motor nameplate for replacement grease or oil recommendation.
Contact Baldor application engineering for special lubricants or further clarifications.

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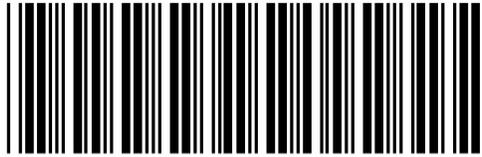
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3.0.0	OM.TRA.01e	Transport and Intermediate Storage/Long Term Preservation
4.0.0	OM.DES.01e	Description of the seepex pump and Accessories
5.0.0	OM.INS.01e	Assembly and Installation
6.0.0	OM.COM.01e	Commissioning/De-commissioning
7.0.0	OM.MAI.42e	Service and Maintenance
	OM.PJT.04e	Pin Joint Assembly
	OM.HBD.01e	Holding Band Re-assembly
8.0.0	OM.REC.01e	Breakdown, reasons, remedies
9.0.0	OM.ACC.01e	Auxiliary seepex documentation
9.0.0	Comm.-no.	Data sheet
	CHA.0015-24.use	Characteristic Curves
	103-006B2	Sectional drawing
		Parts list
	OM.SEA.___e	Shaft Sealing
	103-0GA/M120-0-122A4	Sectional drawing shaft sealing
	OM.WPS.42e	Wearing parts and gaskets
	103-C36/M030-C-207A4	Dimensional drawing
	OM.SPT.01e	Tools
		Accessories
10.0.0	OM.MDS.01e	Manufacturer's documents from sub-supplier
99.0.0	OM.ADR.01e	seepex Subsidiaries

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

1.2.1 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.

1.2.3 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/EEC.

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.

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 characteristics 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

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 operating 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.

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 machines 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 equipment 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 provide 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.

1 Scope

- **Size:** 0005-24 ... 500-6L
- **Range:** BN, NS, N, MD
- **Storage period:** > 3 months ≤ 24 months
- **Preservation/storage**
 - Pump components at risk of corrosion, per pt. 2.1.1
 - Pump components not at risk of corrosion, per pt. 2.1.2

2 Description

Pumps intended for a storage period of > 3 months are prepared for long-term storage before delivery by means of appropriate preservation actions. The following chapters are to be observed for storage at the customer's location.

2.1 Preservation/storage

Storage period: > 3 months ≤ 24 months

Correctly stored and with the preservation actions taken, the pump can be stored up to a maximum of 24 months.



When storing elastomers, changes in size and shore grade may occur.

The function of the pump can be affected.

2.1.1 Pump components at risk of corrosion

Characteristic features of preservation

- Pump is completely assembled.
- Casing parts are protected from corrosion with wax spray.
- Coupling rod, plug-in shaft or drive shaft and exposed surfaces of the coupling (if present) are protected from corrosion with wax spray.
- Rotor is installed in the stator and protected from corrosion with silicone oil or glycerine (for EPDM stators). Abutting surface is protected from corrosion with wax spray.
- Casing openings are closed with a plastic cover.
- In the case of an adjustable belt drive the belts are delivered separately.

Storage at customer's location

- **Storage of the pump/pump parts**

- In dry, enclosed, frost-free spaces.
- Low vibration.

- **Protection measures for pump and drive**

To protect pump components and drive components, e.g. rotor, stator, shaft seal and bearing:

- Remove the fan cover on the motor and turn the fan shaft.
- Change the position of the rotor/stator every month by means of a 1/4 turn of the pump shaft.

NOTICE

Damage to fan shaft/fan wheel.

Function of the drive can be impaired.

- If necessary, remove fan wheel; protect shaft from damage.



Particular environmental influences must be specified by the customer and checked and approved by seepex before storage.

Recommissioning



- Before recommissioning, observe the pump's operating instructions.
 - Remove protective materials/coverings.
 - Make sure that the disassembled/separately stored components are correctly reassembled.

2.1.2 Pump components not at risk of corrosion (stainless steel/coated components)

Characteristic features of preservation

- Pump is completely assembled.
- Casing openings are closed with a plastic cover.
- Exposed surfaces of the coupling (if present) are protected from corrosion with wax spray.
- In the case of an adjustable belt drive the belts are delivered separately.

Storage at customer's location

- **Storage of the pump/pump parts**
 - In dry, enclosed, frost-free spaces.
 - Low vibration.
- **Protection measures for pump and drive**

To protect pump components and drive components, e.g. rotor, stator, shaft seal and bearing:

 - Remove the fan cover on the motor and turn the fan shaft.
 - Change the position of the rotor/stator every month by means of a 1/4 turn of the pump shaft.

NOTICE

Damage to fan shaft/fan wheel.

Function of the drive can be impaired.

- If necessary, remove fan wheel; protect shaft from damage.



Particular environmental influences must be specified by the customer and checked and approved by seepex before storage.

Recommissioning



- Before recommissioning, observe the pump's operating instructions.
 - Remove protective materials/coverings.
 - Make sure that the disassembled/separately stored components are correctly reassembled.

3 Notes and comments

When storing the pump for over 24 months, because of potential corrosion and natural aging of elastomers, greases and oils, we recommend having seepex Customer Service assess the pump before recommissioning it.

4 Documents

seepex internal manufacturing instructions for long-term storage/preservation: HA.LKO.01

5 Revision service

This document is subject to the revision service of the Technical Division (TE) and the respective valid version will be released by Quality Assurance (QA). Change requests shall be processed and checked by the technical department.

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

5.2.1 Inspection Prior to Commencement of Assembly

5.2.1.1 Location

The place of installation for the pump must conform 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:

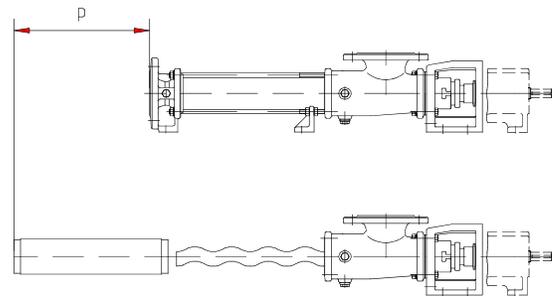
- dimensions and weight of the machine
- required transport and hoisting equipment
- possible piping layout with allowance for the space allowing disassembly of the rotor as defined in 5.2.1.3
- freedom of movement to:
 - operate the drive / speed regulation
 - read speed and pressure indicators
 - adjust 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 dismantled 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, displacements 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.

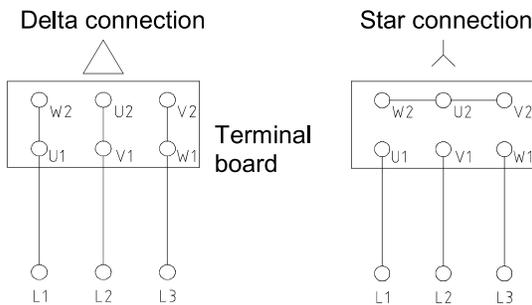


- Switch on electric motor direct-on-line

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 frequency-controlled 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.

**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

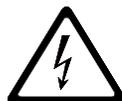
Before switching on the pump, fill the suction-sided pump casing with fluid so that the first rotations will lubricate the conveying elements immediately. A small quantity of fluid is sufficient for lubrication; the subsequent operation of the pump is self-priming, even if an air column up to the liquid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

**6.2.4
Electric/Hydraulic Connections**

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

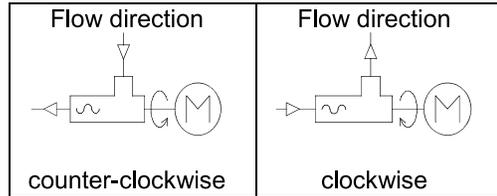


The risk of exposure to electrical hazards must be ruled out. Always observe the safety regulations valid at the site of installation.



**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 regulations 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 deactivate 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.

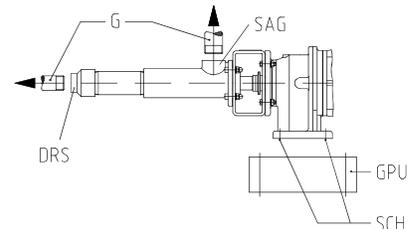
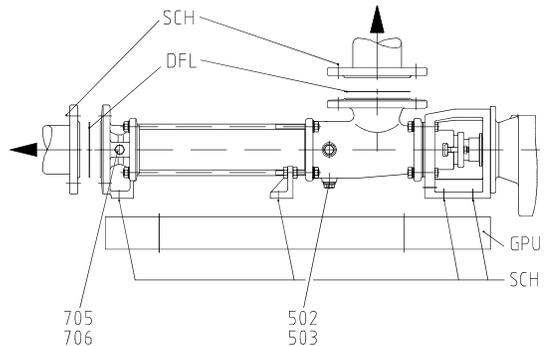


6.6.4 Disassembling the Pump

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 flange-mounted 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/tie bolt design) size 0015-24 to 012-24

7. 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 items 7.3 and 7.4 can be found in item 9.

7.1 General Instructions

A requirement for the reliable operation of any pump is service and maintenance carried out 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 from 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 product.

7.2.1.2 Shaft Sealing

Consult document OM.SEA.___ for information on shaft sealing lubrication.

7.2.1.3 Pin Joint

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

CAUTION

Usage of other grease types will lead to premature joint failure and excludes 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, item 10.

7.2.2 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, item 10.



7.2.4 Supervision during Operation

7.2.4.1 Shaft Sealing

See document OM.SEA.___.

7.2.4.2 Optional Extras

To be monitored in accordance with the separate documents, item 9/item 10.

7.2.4.3 Drive Engines

To be monitored in accordance with the separate manufacturer's documents, item 10.

7.2.5 Preventive Measures

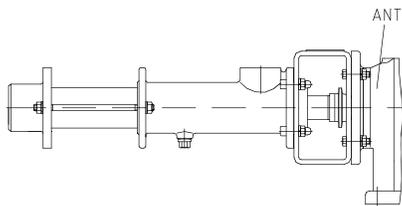
To avoid expenses incurred by lengthy stop periods of the pump, seepex recommends the acquisition of a set of wearing parts and a set of gaskets. The scope is listed in document OM.WPS.42.

7.3 Dismantling the seepex Progressive Cavity Pump

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

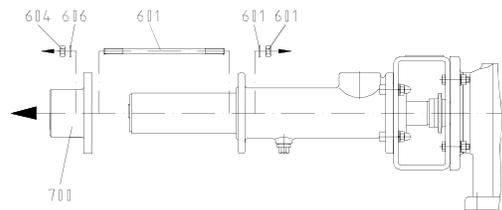
The stator (601) and the rotating pump parts can be exchanged at site. The rotating pump parts can be either dismantled as a complete rotating unit (RTE) (item 7.3.4) or as individual components (item 7.3.5).

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

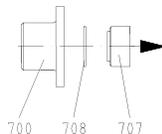


7.3.1 Pressure Branch (700) - Dismantling

Prior to dismantling see item 7.3.2
Pressure branch (700) **without** reducing unit (707)



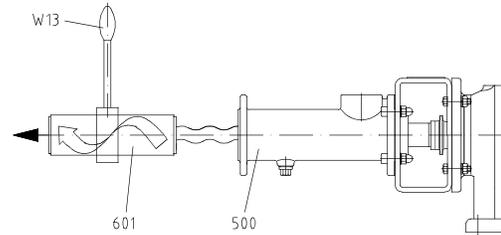
Pressure branch (700) **with** reducing unit (707)



7.3.2 Stator (601) - Dismantling

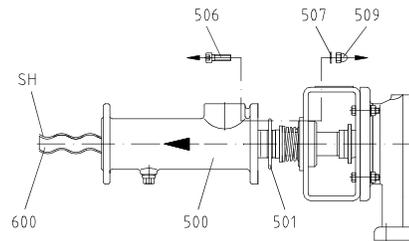
- Easier assembly:
Disassembly of the stator can be made considerably easier by first moistening the inner surface of the stator with antiseize agent (soft or liquid soap). Before removing the pressure flange (700), pour the antiseize agent into the opening between rotor and stator on the pressure flange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

- Lock drive shaft against rotation.
Dismantling of the stator (601) with tool (W13/see item 9.).

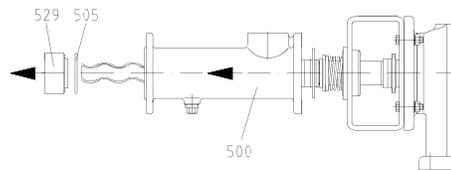


7.3.3 Suction Casing (500), Casing Gasket (501) - Dismantling

Provide the rotor (600) with a protective cover (SH). Suction casing (500) **without** reducing unit (529)



Suction casing (500) **with** reducing unit (529)

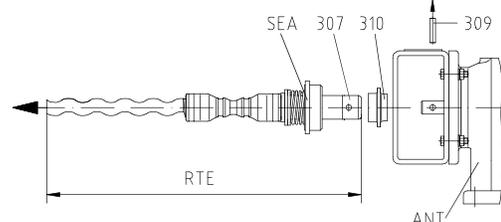


7.3.4 Rotating Unit (RTE) - Dismantling

CAUTION

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

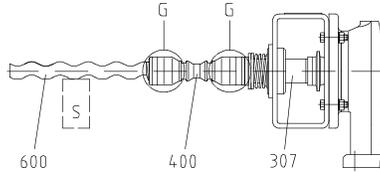
- Remove flushing connections at shaft seal housing (SEA).
- Raise/shift splash ring (310) and eject plug-in shaft pin (309) in horizontal direction.
- Remove rotating unit (RTE)/plug-in shaft (307), together with shaft seal (SEA) from output shaft of the drive (ANT). See Document OM.SPT.01, item 9 for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



7.3.5 Rotating Pump Parts - Dismantling

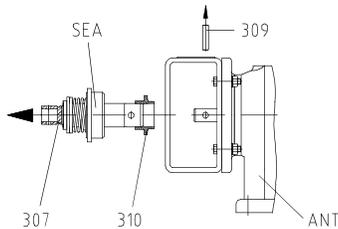
7.3.5.1 Rotor (600), Coupling Rod (400)

Detach the rotor (600) and coupling rod (400) from the plug-in shaft (307) by dismantling the joint (G) in accordance with item 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 item 7.3.4.



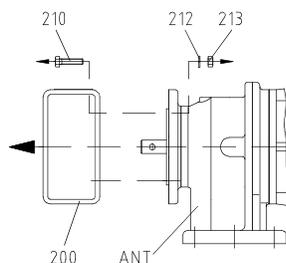
7.3.6 Dismantling of Joint

see document OM.PJT.04 item 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



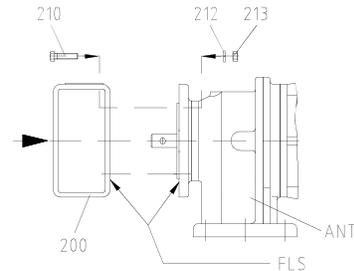
7.4 Re-assembly

Before commencing the re-assembly, fasten the lantern (200) in such a way that the drive and the pump components cannot tip or fall down during the re-assembly.



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

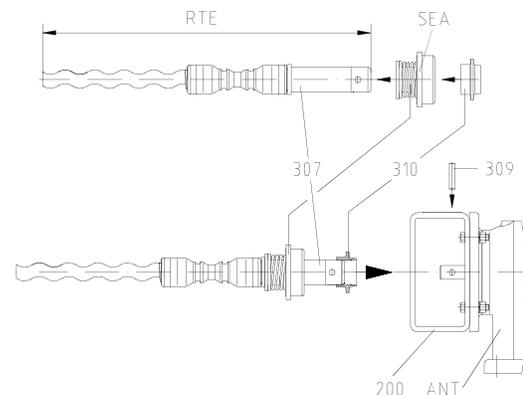
Clean flange bearing surfaces (FLS), centering diameter and output pivot of the drive (ANT).



7.4.2 Rotating Unit (RTE) - Re-assembly

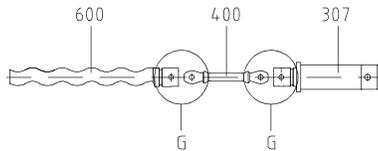
The rotating unit (RTE) has been assembled in accordance with the description in document OM.PJT.04.

- Mount shaft seal (SEA) on plug-in shaft (307) as described in document OM.SEA.___ , see item 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 on 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).



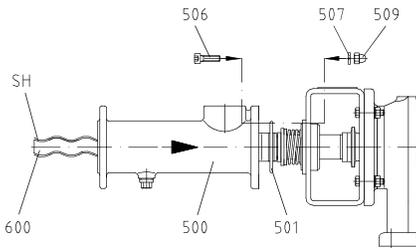
7.4.3 Rotating Pump Parts - Re-assembly

Prepare main components:
 Prepare rotor (600), coupling rod (400) and plug-in shaft (307) as described in document OM.PJT.04 item 2 to 2.3
 Joint (G) re-assembly as described in document OM.PJT.04 item 3.

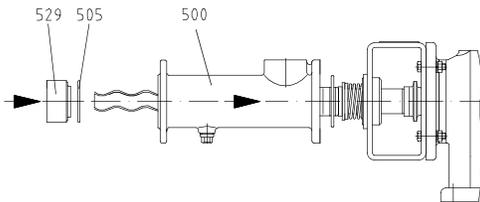


7.4.4 Suction Casing (500), Casing Gasket (501) - Re-assembly

Lay protective cover (SH) over rotor (600).
 Assemble casing gasket (501) and suction casing (500).
 Suction casing (500) **without** reducing unit (529)

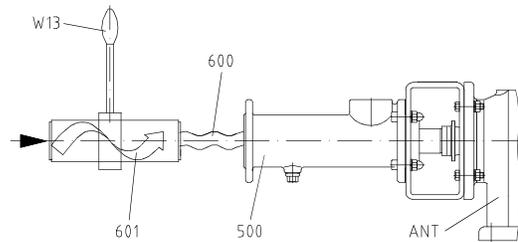


Suction casing (500) **with** reducing unit (529)



7.4.5 Stator (601) - Assembly / Re-assembly

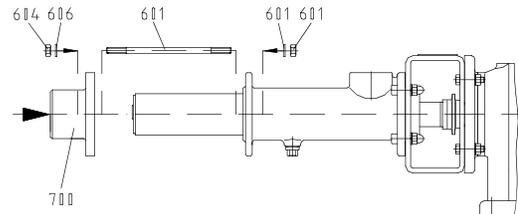
Easier assembly:
 Assembly of the stator can be much facilitated by moistening the stator (601) and rotor (600) with an antiseize agent (soft or liquid soap) prior to assembly. The antiseize agent is evenly distributed on the inner surface of the stator and on the rotor. By this, the friction between rotor and stator is considerably reduced.
 Lock drive (ANT) shaft against rotation.
 Turn stator (601) to the right using a tool (W13/see item 9) and slip it onto rotor (600) at the same time.



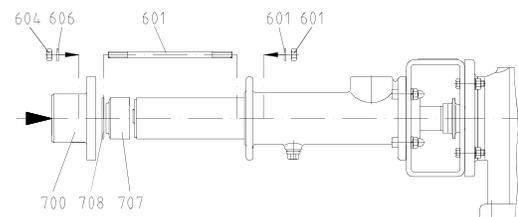
7.4.6 Pressure Flange (700) - Assembly

CAUTION

Tighten tie bolts (602 and 603) equally.
 Pressure flange (700) **without** reducing unit (707)



Pressure flange (700) **with** reducing unit (707)



**1.0
Dismantling of Joint**

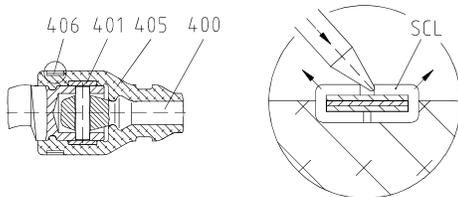
**1.1
Holding Band (406) - Dismounting**

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).

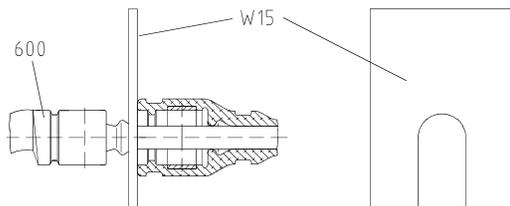


Remove holding band (406).



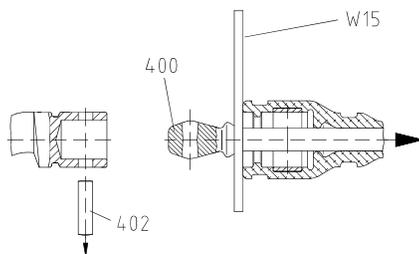
**1.2
Rotor (600) - Dismantling**

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)

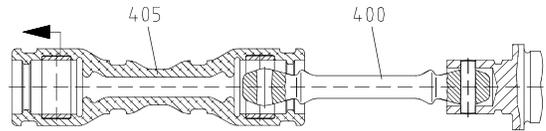


Separation of Joint

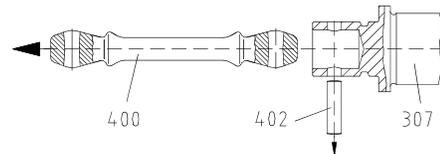
Eject coupling rod pins (402). Pull coupling rod (400) out of joint top.



**1.3
Universal Joint Sleeve (405)**

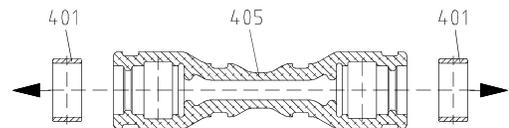


**1.4
Coupling Rod (400)**



**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.

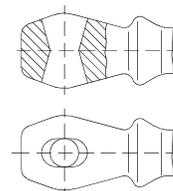
If the hole for the coupling rod pin (402) has worn out, a new rotor (600) has to be installed.

**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.

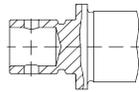
**3.0
Joint - Re-assembly**

CAUTION

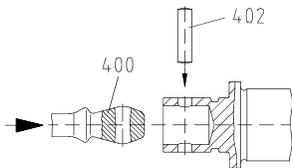
To ensure a perfect operation of the joints, coupling rod pins (402) and coupling rods (400) showing wear should be replaced. Refer to Point 2.2

**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)

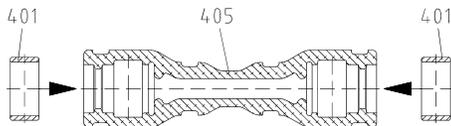


**3.2
Coupling Rod (400)**



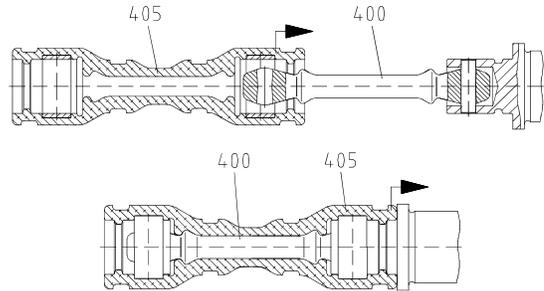
**3.3
Retaining Sleeve (401)**

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



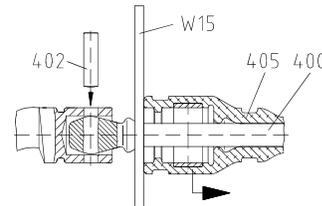
**3.4
Universal Joint Sleeve (405)**

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)**

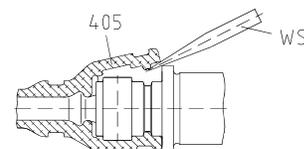
Push back universal joint sleeve (405) at rotor side towards coupling rod (400) and fix it using the relevant tool (W15/refer to document OM.SPT.01).



Slip universal joint sleeve (405) onto joint head.

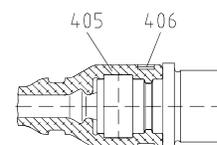
**3.6
Universal Joint Sleeve - Deaeration**

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

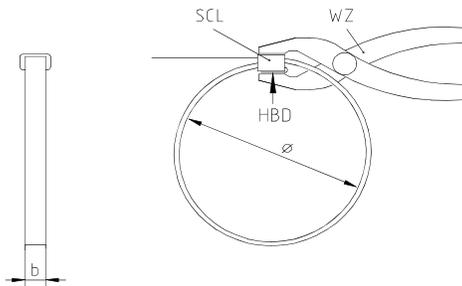
Tools required for the re-assembly, see document OM.SPT.01.

▮ Prepare holding band

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

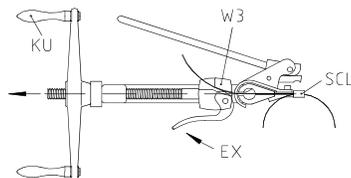
▮ Test holding band

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

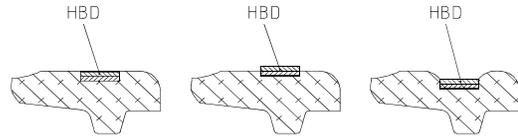


▮ Assembly of holding band

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)



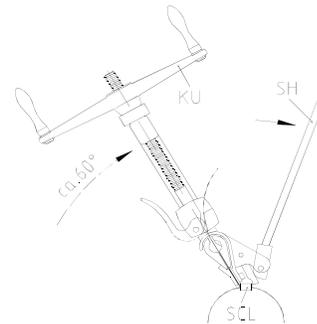
Correct
Holding band (HBD) has slightly contracted outer form of universal joint sleeve and is stuck in position.

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).

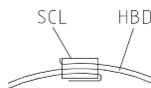


- ▮ Shearing off holding band (HBD) made of material AISI 304 and AISI 316

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.

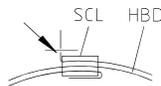
CAUTION

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.



Breakdown										Reasons / Remedies	
1	2	3	4	5	6	7	8	9	10		
				X			X			a	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 .
X										b	Check rotational direction of the pump per data sheet and nameplate. In case of wrong direction, change wiring of motor.
X	X	X			X	X				c	Suction pipe or shaft sealing leak. Eliminate the leakage.
X	X	X				X				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.
X	X	X								e	Viscosity of the liquid too high. Check and accommodate per data sheet.
		X		X			X			f	Wrong pump speed. Correct pump speed per data sheet.
	X	X								g	Avoid inclusions of air in the conveying liquid.
		X		X	X		X	X		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	X	X			X			X		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.
X		X								k	Speed too low. Increase the speed when high suction performances are required and when the liquid is very thin.
X	X					X				l	Speed too high. Reduce the speed when pumping products with high viscosities - danger of cavitation.
						X				m	Check the axial play in the coupling rod linkage. Check that the bush has been installed correctly see document OM.PJT._____.
X		X		X	X			X		n	Check for foreign substances in the pump. Dismantle the pump, remove foreign substances and replace worn parts.
X		X	X		X					o	Stator or rotor worn. Dismantle the pump and replace defective parts.
X		X			X	X				p	Joint parts worn. Replace worn parts and fill with special pin joint grease .
X		X			X			X		q	Suction pipework partially or completely blocked. Clean suction pipework.
X				X	X		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.
X		X		X			X		X	s	Gland packing too strongly tightened or worn. Ease or tighten stuffing box. Replace defective packing rings.
X				X	X			X		t	Solid contents and/or size of solids too large. Reduce pump speed and install perhaps a screen with suitable meshes. Increase fluid share.
X				X				X	X	u	When the pump is non operational the solids settle out and become hard. Clear and flush the pump immediately.
X				X	X			X	X	v	The liquid becomes hard when temperature falls below a certain limit. Heat the pump.
				X	X		X	X		w	Stator swollen and unsuitable for the pumped liquid. Select a suitable stator material. Use perhaps rotor with diameter smaller than specified.
						X			X	x	The bearing in the drive casing of the pump or in the drive engine is defective. Replace bearing.
									X	y	Mechanical seal defective. Check seal faces and O-rings. If necessary replace corresponding defective parts.

9.0

Auxiliary seepex documentation

7/10/2017

Item 10

qty.: 1

Progressive cavity pump

MD 006-12 / A6-J0-J0-H5-GA

Application data

Conveyed product	polymer
Flowability	flowable
Viscosity	low viscosity (<500 cP/mPas)
Solids content	not specified
Size of solids	not specified
Specific gravity	unknown, 1 kg/dm ³ assumed
product temperature	32°F - 113°F
pH value	5-9
Kind of operation	continuous
Operating hours	8h/day
Location	indoor, dry atmosphere

Performance data

	Capacity	Pressure	Speed	
	0.7 USGPH	100 psi	24 rpm	min
	15 USGPH	100 psi	348 rpm	max
Starting torque	4 lb.ft			
Req. power at pump shaft	0.09 HP			
Inlet pressure	flooded suction (up to 0,5bar)			
NPSHr	6.72 ft			

Tolerances according to SEEPEX standards.

Materials and executions

Installation	horizontal
Direction of rotation	counter clockwise (left)
Lantern - Design	with plastic covers
Lantern - Material	1.0037 (st. 37-2)
Suction casing - Design	standard
Suction casing - Material	1.4408 / AISI 316
Pressure branch - Design	standard
Pressure branch - Material	1.4408 / AISI 316
Position of branch	position 1
Suction connection	1" NPT
Pressure connection	1/2" NPT
Joint - Design	pin joint with joint sleeve, grease filled
Joint - Material	standard
Joint - Universal joint sleeve: material	FPM
Coupling rod - Design	standard
Coupling rod - Material	1.6582 encapsulated
Rotor - Design	standard
Rotor - Material	1.4404 / AISI 316L
Stator - Design	standard
Stator - Material	FPM special
Shaft sealing	mechanical seal
Code	single acting mech. seal - GA
Shaft diameter	25 mm
Make	Burgmann
Rotating/stationary seal face	SiC SiC
Elastomers	FPM - Viton
Spring	1.4571 / AISI 316Ti
Metal parts	1.4571 / AISI 316Ti
Type	MG1-G60 Q1Q1 VGG
Casing - material	1.4404 / AISI 316L

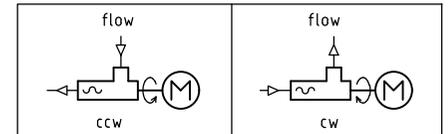
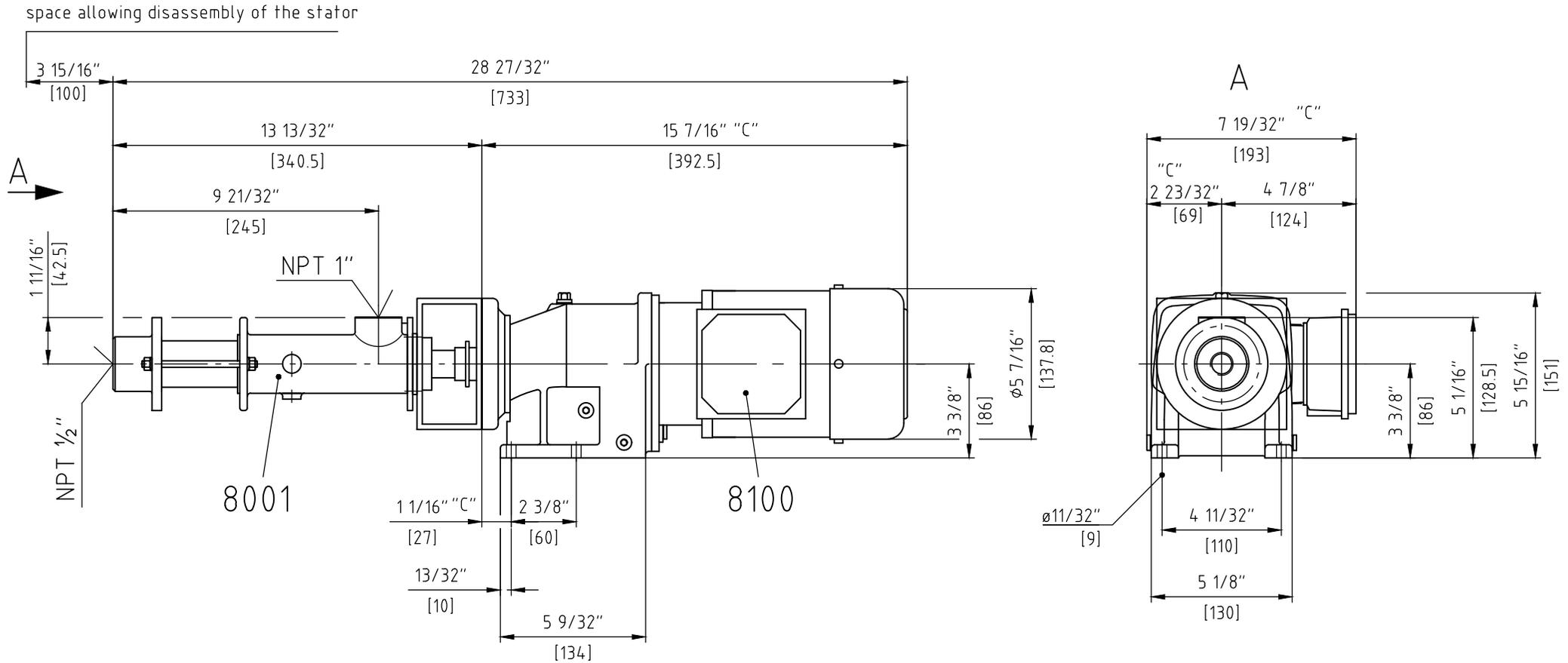
Casing - connection standard	without
Plug-in Shaft - Design	standard
Plug-in Shaft - Material	1.4404 / AISI 316L
Bolting - Design	stainless steel incl. locking screws
Painting - Number of colors	single-colored standard
Painting - Painted components	1 complete combination
Painting - Color	Standard Enamel (SEEPEX Blue)

From the second quarter of 2015, SEEPEX will replace the material 1.4571 (AISI 316Ti) by the similar material 1.4404 (AISI 316L), step by step.
 Depending on actual stock levels during the transition period the material delivered may differ from the material offered.

Drive

Type	Gear motor at freq. inv.		
Make	Nord		
Model	SK02XF/71L4		
Mounting position	B3/B5		
Ratio (i)	4.82		
Speed	352 rpm		
	Norm	Min	Max
Speed	352 rpm	24 rpm	348 rpm
Motor speed	1700 rpm	117 rpm	1676 rpm
Frequency	60 Hz	4 Hz	59 Hz
Rated output	0.5 HP		
Rated speed	1700 rpm		
Starting	direct on frequency inverter		
Efficiency class	standard efficiency		
Terminal box position acc. to supplier	1		
Cable entry position acc. to supplier	I		
Voltage	3x230/460V		
Frequency	60Hz		
Enclosure	IP55		
Thermal class	F		
Other	20:1 CT option		

The frequency inverter has to follow a linear U/f characteristic curve (constant torque).
 It's essential to have a minimum overload capability of 150% for at least 3 seconds. (see technical data sheet)



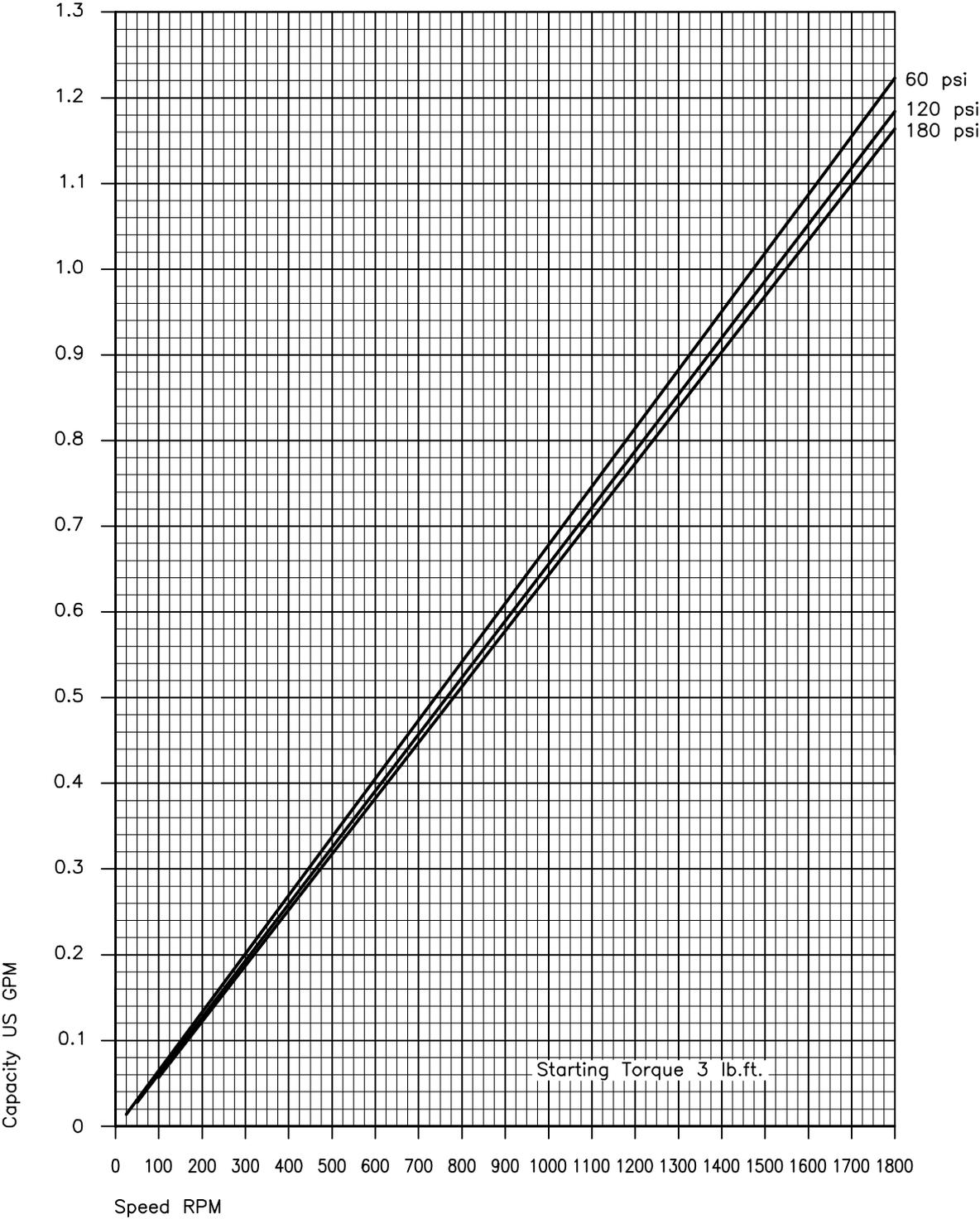
dimensions in [...] are in millimeter

1	drive: Nord SK02XF-71.	8100				14
1	pump: MD 006-12	8001				4
Quant.	Denomination	Item	Material	Note		Weight / kg

SEPEX.
ALL THINGS FLOW

2002	Name	Day	Scale	Weight	Denomination
Drawn	goe	02.10.	1:5	18 kg	dimensional drawing
Checked	kos	02.10.	EDP-No. 51853.dwg		Drawing-no. 103-C36/M060-C-205C4

Characteristic Curves
Size
006-12 / RTE PVDF



Values based upon HFC 46

Stck.	Pos.	DE	EN	FR
		Baureihe MD	range MD	série MD
		Schnittzeichnung Nr. 103-006B2	sectional drawing No. 103-006B2	plan no. 103-006B2
Stck. / Pos.	Benennung	denomination	désignation	
Qty. / Item	Qté. / Poste			
1	200	Laterne	lantern	lanterne
1	202	Typenschild	type plate	plaque signalitique
4	210	6kt-Schraube	hexagon bolt	vis
4	212	Federring	spring washer	rondelle frein
4	213	6kt-Mutter	hexagon nut	écrou
1	307	Steckwelle	plug-in shaft	arbre à broche
1	309	Steckwellenbolzen	plug-in shaft pin	cheville pour arbre à broche
1	310	Spritzring	splash ring	bague de projection
1	330	Gleitringdichtung	mechanical seal	garniture mécanique
1	333	Gleitringdichtungsgehäuse	mechanical seal casing	carter de la garniture mécanique
1	372	Stützring	support ring	bague d'appui
1	400	Kuppelstange	coupling rod	barre d'accouplement
2	401	Gelenkhülse	retaining sleeve	douille d'articulation
2	402	Kuppelstangenbolzen	coupling rod pin	axe d'articulation
1	405	Manschette	universal joint sleeve	manchette
2	406	Halteband	holding band	collier de serrage
1	500	Sauggehäuse	suction casing	carter d'aspiration
1	501	Sauggehäusedichtung	casing gasket	étanchéité du carter d'aspiration
3	502	Verschlussschraube	screwed plug	bouchon de vidange
3	503	Dichtring	sealing ring	joint d'étanchéité
1	505	O-Ring	o-ring	joint torique
4	506	Zylinderschraube	socket screw	vis à tête cylindrique
4	507	Federring	spring washer	rondelle frein
4	509	Hutmutter	cap nut	écrou borgne
1	529	Reduzierstück	reducing unit	réducteur
1	600	Rotor	rotor	rotor
1	601	Stator	stator	stator
2	602	6kt-Schraube	hexagon bolt	vis
2	604	6kt-Mutter	hexagon nut	écrou
2	606	Scheibe	washer	rondelle
1	700	Druckstutzen	pressure branch	bride de refoulement
1	707	Reduzierstück	reducing unit	réducteur
1	708	O-Ring	o-ring	joint torique
	098	SEEPEX Gelenkfett Typ und Füllmenge: Betriebs- und Montageanleitung entnehmen	SEEPEX joint grease type and filling quantity: see Operating and Assembly Instruction	SEEPEX graisse d' articulations sommaire pour type et quantité: voir instructions de montage et de fonctionnement
		Verschleißteile und Dichtungen: Betriebs- und Montageanleitung entnehmen	Wearing parts and sealings: see Operating and Assembly Instruction	pièces d'usure et étanchéités: voir instructions de montage et de fonctionnement
		Werkzeuge: Betriebs- und Montageanleitung entnehmen	Tools: see Operating and Assembly Instruction	Outils: voir instructions de montage et de fonctionnement
		versetzt gezeichnet	drawn displaced	plan séparé

1.0 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.

2.0 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.

3.0 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.

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

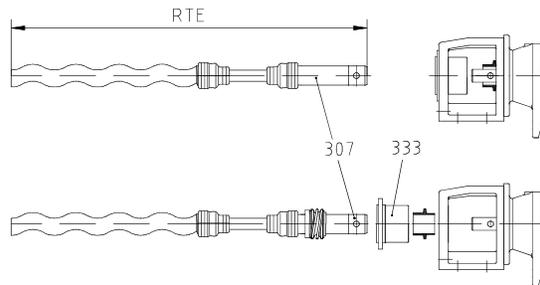
Regardless of the pump's operating status, the conveying medium to be sealed must always be in liquid form at the mechanical seal. This particularly applies to the pump's commissioning and its placing out of service.

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 plug-in 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).

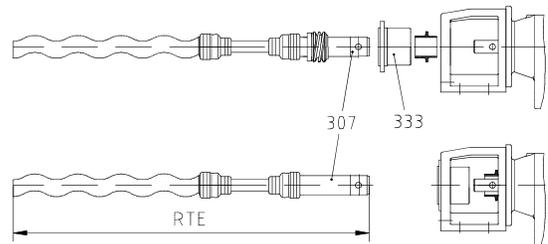
**7.2****Reassembly****ATTENTION**

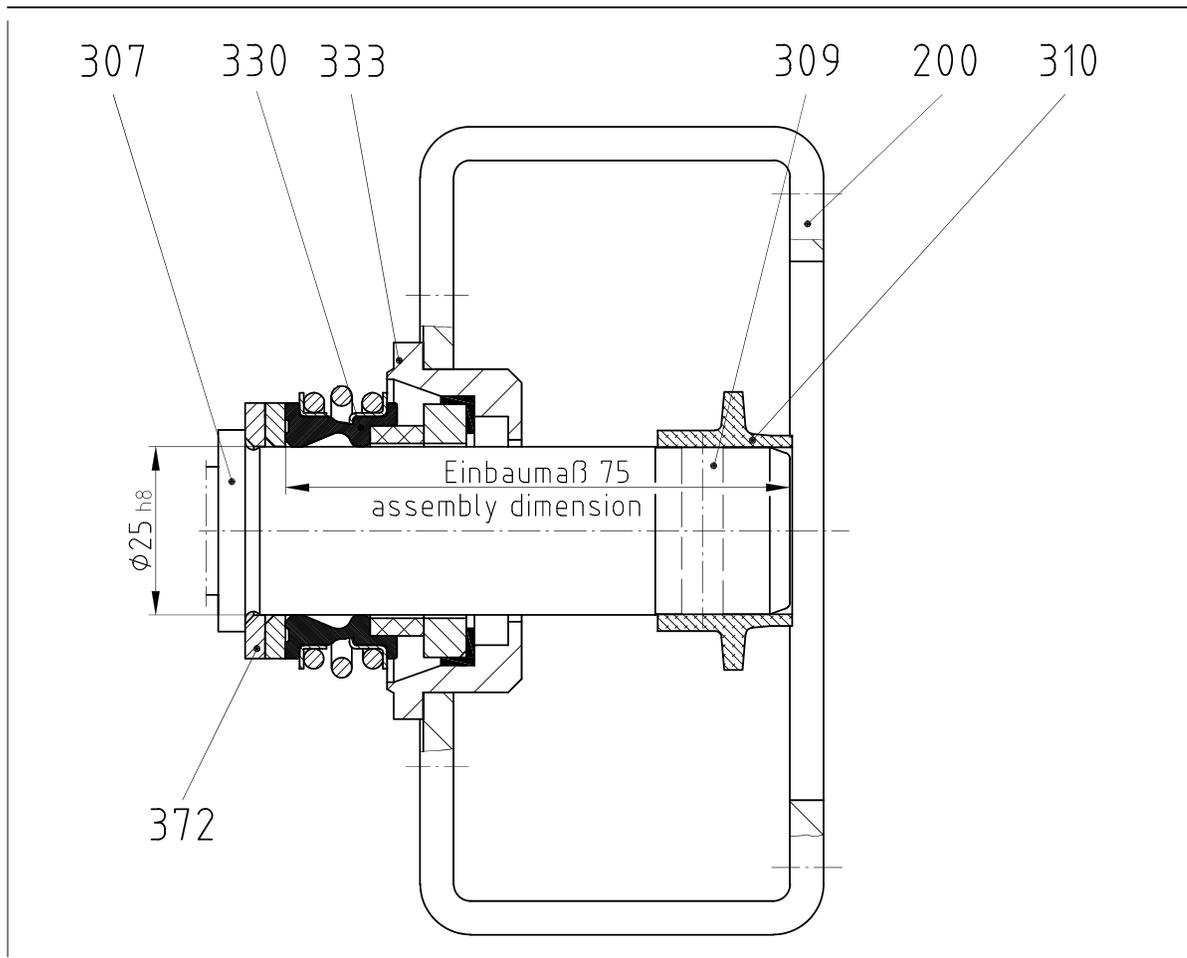
Mechanical seals are precision parts of high quality. Therefore, the installation must be effected with care. Gentle handling and extreme neatness are essential.

- 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 ensure 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 installing 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).





2	372	Stützring / support ring 062-372/M120-0-030B4				
1	333	GLRD-Gehäuse / mechanical seal casing 103-333/M120-0-005A4				
1	330	GLRD / mechanical seal GA φ25			Fabrikat / make : seepex	
1	310	Spritzring / splash ring 062-310/M120-0-001A4				
1	309	Steckwellenbolzen / plug-in shaft pin 062-309/M120-0-001A4				
1	307	Steckwelle / plug-in shaft 103-307/M120-0-304E4				
1	200	Laferne / lantern 103-200/M120-0-				
Stück Unit	Norm Standard	Pos./Item	Benennung/Denomination Zeichnungs-Nummer/Drawing-Number	Werkstoff/Material	Bemerkung/Remark	Gewicht Weight kg

seepex.com

Allgemeintoleranzen für Maße ohne einzelne Toleranzeintragung DIN ISO 2768-mittel	Ausgabe Issue	Änderung Modification	Name Name	Datum Date	Maßstab/Scale 1:1	Werkstoff/Material	Gewicht/Weight
General tolerances for mass without individual tolerance entry DIN ISO 2768-average					Bezeichnung/Denomination GLRD Schnittzeichnung mechanical seal sectional drawing seepex GA- 025 erhöhte Vorspannung		
Rauheit für Oberflächenzeichen DIN ISO 1302 Reihe 2	Bearbeitet/Drawn	Geprüft/Checked	Name Name	Datum Date	Zeichnungs-Nummer/Drawing-Number 103-0GA/M120-0-122A4	EDV-Nr./EDP-No. L:\LFDZCHNG.1370\137421.dwg	
Roughness for surface finish indication DIN ISO 1302 Reihe 2					Ersatz für/Replacement for:	Ersetzt durch/Replacement by:	
	Gedruckt/Printed						

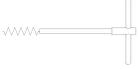
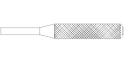
Urheberrechtsschutz: Diese Zeichnung ist unser Eigentum und uns nach dem Gesetz über Urheberrecht und verwandte Schutzrechte geschützt.
Protection of Copyright: This drawing is our property and is protected acc. to the law referring to copyright and related protective laws.

Range: MD, MDT
Design: stainless steel / tie bolts

To avoid 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 table below shows the type and quantity of parts contained in these sets.

Part designation	small set of wearing parts	big set of wearing parts	set of gaskets	Item number acc. to sectional drawing of pump and parts list	
				Number	
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)			4		571, 726
Sealing ring			1		503
Splash ring			1		310
O-ring 4)			1		572
O-ring			1/1		505, 708
Plug-in shaft 2)		1			307
Special joint grease				098	1 cart. 300 gr (c. 315cm ³) grease quantity per pin joint, see tech.
Tool					Essential for assembly, see item 9, document OM.SPT.01

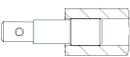
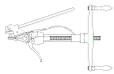
- 2) see tools item 9., document OM.SPT.01
 3) Item 330 and item 301 (as an alternative) depend on the pump design. With regard to the pump design, refer to the appertaining data sheet and the sectional drawing. See item 9.
 4) for pump with double jacket

Allgemeine normierte Werkzeuge / Standardized tools							
Werkzeug Nr. tool No.	W1	W2	W5	W6	W9	W11	W13
zur Montage von: tool for mounting of:	Packung packing	Stator stator	Gelenk joint	Lager bearing	allgemein general	Mutter für Teflonmanschette nut for teflon universal joint sleeve	Stator Stator 1)
Benennung: denomination:	Packungszieher packing lever	Ketten-Rohrzange + Ersatzkette chain pipe wrench + replacement chain	Durchschlag drift	Bolzen pin	Montierhebel mounting lever	Bandschlüssel strap wrench	Bandschlüssel strap wrench
Baugröße size							
0005-24, 0015-24 003-12/-24 006-12/-24 012-12/-24 025-6L 025-12T, 05-6LT	PKZ XX 000 0000 0 X35M0	Siehe W 13 see W 13					WKZ BDS 027 0 430
025-12, 025-24 05-12, 1-6L			DHS XX 020 0000 0 A2620				
05-24, 01-48, 025-48, 1-12, 2-6L 1-24, 1-12V 2-12, 5-6L 2-24, 2-12V	PKZ XX 000 0000 0 X0FQ0	KRZ XX Z55 0250 0 00000 KEZ XX Z55 0250 0 00000	DHS XX 050 0000 0 A2620	BLZ XX 020 0008 0 A2619			
5-12, 8-12T 10-6L, 15-6LT 05-48	PKZ XX 000 0000 0 XOHV0		DHS XX 050 0000 0 A2620	BLZ XX 020 0010 0 A2619			
5-24, 5-12V			DHS XX 100 0000 0 A2620	BLZ XX 020 0010 0 A2619			
10-12, 17-6L, 30-6LT, 15-12T, 10-24R, 1-48							
14-12, 26-6L, 40-6LT		KRZ XX Z55 0300 6 00000					WKZ BDS 027 0 430
10-24, 10-12V							
17-12, 35-6L, 26-12, 52-6L, 55-6LT, 75-6LT 30-12T, 10-24, 17-24R 2-48		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		
17-24, 17-12V							
35-12, 52-12, 70-6L, 100-6L, 110-6LT, 55-12T 34-24R 5-48	PKZ XX 000 0000 0 XA01A	KRZ XX Z55 0300 8 00000 KEZ XX Z55 0300 8 00000	DHS XX 160 0200 0 A2620	BLZ XX 030 0012 0 A2619			
35-24, 35-12V							
70-12, 130-6L, 200-6L, 110-12T 70-24R, 10-48 200-6L			DHS XX 200 0200 0 A2620	BLZ XX 035 0012 0 A2619			
130-12, 202-6L, 300-6L, 200-12T 70-18, 100-18, 130-18 70-24, 70-12V 130-24R 17-48		KRZ XX Z55 0301 2 00000 KEZ XX Z55 0301 2 00000	DHS XX 240 0250 0 A2620	BLZ XX 040 0015 0 A2619			
240-12, 300-12T 130-18, 130-24 35-48/70-48							

1) Gilt nur für Pumpen in Edelstahl Ausführung / only valid for pumps in special steel design

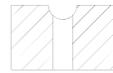
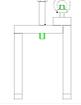
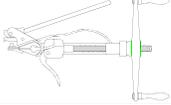
Empfohlene seepex Werkzeuge Aufgrund der Ausführung für bestimmte Montagen empfohlen, durch allgemeine normierte Werkzeuge bedingt ersetzbar. Recommended seepex tools Due to the design recommended for certain repairs, these tools partially replace the standardized tools.									
Werkzeug Nr. tool No.	W4	W7	W8	W10	W12	W14	W15	W16	
zur Montage von: Gelenk	Lager	Schmier-nippel	Steckwelle	Teflon-manschette	Kuppelstangen-buchsen	Manschette	Lippendichtung		
tool for mounting of: joint	bearing	lubrication nipple	plug-in shaft	teflon universal joint sleeve	coupling rod bushing	universal joint sleeve	lip seal		
Benennung: Montagedorn	Montage-hülse	Einschlag-hülse	Demontage-werkzeug	Montage-werkzeug	Presswerkzeug	Montageplatte	Montagehülse		
denomination: assembly mandrel	mounting sleeve	drive-in sleeve	dismantling tool	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	ESH N0 000 0000 0 A01A4	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 2-24, 2-12V	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			
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 10-24, 10-12V	MTD L2 060 0140 0 XXXXX	MTH M8 060 0140 0 XXXXX		AZV B2 262 0170 0 XF5XX		PWZ C6 060 1400 0 XXXXX			
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		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		

2) entfällt ab Pumpen-Herstellungsdatum 01.04.93 / can be omitted as from 01.04.93 (pump manufacturing date)

	Empfohlene seepex Werkzeuge Aufgrund der Ausführung für bestimmte Montagen empfohlen, durch allgemeine normierte Werkzeuge bedingt ersetzbar.								Spezial- werkzeuge
	Recommended seepex tools Due to the design recommended for certain repairs, these tools partially replace the standardized tools.								Special tools
Werkzeug Nr. tool No.	W17	W18	W19	W20	W22	W23	W24	W25	W3
zur Montage von: tool for mounting of:	Lippendichtung lip seal	Gleitlager- buchse plain bearing bush	Wellen- schonhülse shaft securing sleeve	Cartridge- Einheit cartridge- unit	Wellen- dichtring lip seal	Wellen- dichtring lip seal	Antriebs- gehäuse drive casing	Steckwellen- bolzen plug-in shaft pin	Halteband holding band
Benennung: denomination:	Schlagzylinder Zentriertorn Montagebolzen cylinder centering mandrel mounting pin	Montagedorn mounting mandrel	Montagehülse mounting sleeve	Aufnahme intake	Montage- werkzeug mounting tool	Montage- werkzeug mounting tool	Aufhänge- vorrichtung suspension device	Montagedorn mounting mandrel	Montage- werkzeug mounting tool
Baugröße size									
0005-24, 0015-24 003-12/-24 006-12/-24 012-12/-24 025-6L, 025-12T, 05-6LT	ZSH B7 703 M120 0 W0171 ZDR B7 703 M120 0 W0172 MBL A7 703 M120 0 W0173								
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								MTD L8 703 0050 0 SXX0J	
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, 26-12, 52-6L, 55-6LT, 75-6LT 30-12T, 10-24, 17-24R, 2-48			SPT B4 703 0170 0 01000	SPT M8 703 0170 0 00900	SPT B4 703 0170 0 01100			MTD L8 703 0170 0 SXX0J	MHB WH A00 1WHV 0 01000
17-24, 17-12V									
35-12, 52-12, 70-6L, 100-6L, 110-6LT, 55-12T 34-24R, 5-48								MTD L8 703 0350 0 SXX0J	
35-24, 35-12V									
70-12, 130-6L, 200-6L, 110-12T 70-24R, 10-48, 200-6L		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	
130-12, 202-6L, 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		

BIG Baugrößen / BIG sizes

Allgemeine normierte Werkzeuge / Standardized tools					
Werkzeug Nr. tool No.	W1	W2	W5	W6	W9
zur Montage von: tool for mounting of:	Packung packing	Stator stator	Gelenk joint	Lager bearing	allgemein general
Benennung: denomination:	Packungszieher packing lever	Ketten-Rohrzange + Ersatzkette chain pipe wrench +replacement chain	Durchschlag drift	Bolzen pin	Montierhebel mounting lever
Baugröße size					
240-6C	PKZ XX 000 0000 0 XA01A	KRZ XX Z55 0301 2 00000 KEZ XX Z55 0301 2 00000	DHS XX 240 0250 0 A2620	BLZ XX 040 0015 0 A2619	2 Stück 2 pieces MHL XX SA 610
300-3TR					
400-3TN					
500-3LA					
240-9C					
300-9TR					
400-6TN					
400-6TR					
500-6LA					
240-12C					
300-12TR					
240-18L					
400-12TR					
300-18TU					
300-24TV					
300-27TH					
400-18TU					

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.							Spezialwerkzeuge Special tools
Werkzeug Nr. tool No.	W4	W7	W8	W14	W24	W25	W3
zur Montage von: tool for mounting of:	Gelenk joint	Lager bearing	Schmiernippel lubrication nipple	Kuppelstangen- buchsen coupling rod bushing	Antriebs- gehäuse drive casing	Steckwellen- bolzen plug-in shaft pin	Halteband holding band
Benennung: denomination:	Montagedorn assembly mandrel	Montagehülse mounting sleeve	Einschlaghülse drive-in sleeve	Presswerkzeug pressing tool	Aufhänge- vorrichtung suspension device	Montagedorn mounting mandrel	Montagewerkzeug mounting tool
Baugröße size							
240-6C	MTD L2 060 1300 0 XXXXX	MTH M8 060 1300 0 XXXXX	ESH N0 000 0000 0 A01A4	PWZ C6 060 1300 0 XXXXX	SPT M8 703 130B 0 01400	MTD L8 703 1300 0 SXX0J	MHB WH A00 1WHV 0 01000
300-3TR							
400-3TN							
500-3LA							
240-9C							
300-9TR							
400-6TN							
400-6TR							
500-6LA							
240-12C							
240-12L							
300-12TU							
300-12TR							
240-18L							
400-12TR							
300-18TU							
300-24TV							
300-27TH							
400-18TU							

10.0

Manufacturer s documents from sub-supplier

OPERATING MANUAL

SEEPEX MECHANICAL SEAL

Type GA-60

These instructions are intended for assembly, operating and control personnel and should be kept 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 SEEPEX!

Table of Contents

Keywords and Symbols.....3

GENERAL SAFETY NOTES.....4
Instructions for worker's protection.....5

TRANSPORT / STORAGE.....6
Transport.....6
Packing and storage.....6

INFORMATION ABOUT THE PRODUCT9
Type designation9
Designated use9
Operating limits.....9
Materials10
Description and function10
Supply of M.S.10
Emissions11

INSTALLATION.....12
Assembly utilities.....12
Preparation for assembly.....12
Assembly / installation.....13

OPERATION.....15
Instructions for safe operation15
Instructions for start-up15

SERVICING.....16
Maintenance.....16
Directives in case of failure.....16
Disassembly / removal.....16
Disposal of the SEEPEX mechanical seal.....17
Required details for inquiries and orders.....18

Keywords and Symbols

The following symbols are used for particularly important information:



"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 SEEPEX Mechanical Seal must read and understand this instruction manual and in particular the safety notes.

SEEPEX Mechanical Seals are manufactured on a high quality level, 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 pump has to be set up in such a way that seal leakage can be led off and disposed of 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.

Unauthorized modifications or alterations are not permitted as they affect the operational safety of the mechanical seal.

SEEPEX mechanical seals must be installed, operated, maintained, removed or repaired by authorized, 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 pressurized.

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 to 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, the SEEPEX 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 incoming 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 SEEPEX mechanical seals which have been supplied and stored in their undamaged original packaging, as well as to seals which have been installed in the pump but have not yet been put into operation.

SEEPEX mechanical seals and spare parts are super finished and repeatedly tested machine elements. For storage, special conditions have to be followed.

Sliding materials and elastomers are subject to material-specific and time-based alterations (distortion, aging) 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.

The best suited environment for storing mechanical seals is characterized as follows:

- 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.

Duly stored mechanical seal:

- Lasts 3 years after delivery of the mechanical seal

▪ **M.S. installed into the machine**

ATTENTION!

A preservation of SEEPEX mechanical seals is not allowed.

In the case of preservation of complete machines with mechanical seals installed, SEEPEX must 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 its installation and start up may exceed the period of 2-3 years.

Page 8

If planned start-up of the plant is after 3 years of storage, a replacement seal may need to be considered.

Damages caused by improper storage may not be claimed with reference to the standard SEEPEX warranty.

INFORMATION ABOUT THE PRODUCT

Type designation

SEEPEX Mechanical Seal Type GA-60

Designated use

This mechanical seal is exclusively designed for the use in the specified application. A different utilization or a utilization 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, SEEPEX 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 SEEPEX).

Shaft diameter	(dw)	: 25 - 100 mm
Pressure to be sealed	(p1)	: 10 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 the risk of a sudden seal failure endangering men and environment.

The selection of the mechanical seal (type, suitability, materials) should be done by SEEPEX staff or other authorized persons.

Further information about the operating conditions can be found in the SEEPEX pump data sheets.

Materials

The materials of the mechanical seal depend on the application and are fixed in the order.

Description and function

- single seal
- unbalanced
- bi-directional
- rubber cup seat
- stationary seal face
- rotating seal face
- elastomeric bellows
- cylindrical single spring
- no glued joints
- for media containing solids (e.g. sewage applications)
- rotating, torsion-free elastomeric bellows serving as
 - face housing
 - secondary sealing element
 - drive collar

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 SEEPEX.

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 to 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 of 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

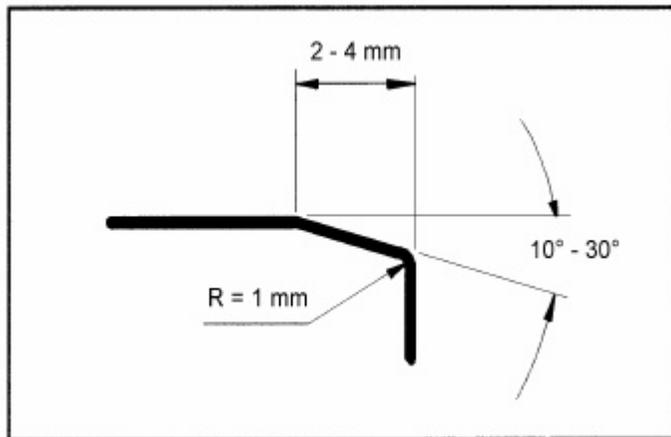
- ethyl alcohol
- cellulose-tissue (no rag, no cloth!)
- o-ring lifter
- water and washing up liquid
- cardboard discs

Preparation for assembly

ATTENTION!

The seal should remain packed until the following working steps have been completely terminated.

Check the parts of the pump for:



- **chamfered edges**
(sliding cones i.e. 2 mm / 30° or in accordance with EN 12756)
- radiused transition
- **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 pump:

- 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 non-required tool, cuttings, dirty cleaning wool etc.
- Cover the work bench with a piece of clean, non-fibrous cardboard.

Assembly / installation

SEEPEX 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!

Never force the seal during installation.

ATTENTION!

Avoid unnecessary rotation of the shaft (damage of the sliding faces is possible).

ATTENTION!

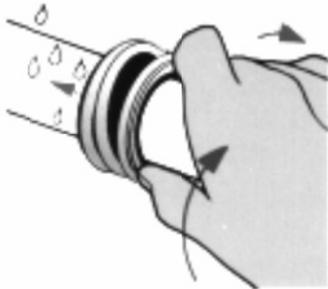
Avoid knocking the seal! Damage to mechanical seals has an adverse effect on their safe operation.

Possible installation order:

- Feed the degreased sealing element (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 pump in accordance with the instructions from SEEPEX.

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 pump at any time. Otherwise the pump will suck in air via the sliding faces, which will result in dry-running 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 pump is started or stopped.

If the medium to be pumped builds deposits or tends to solidify during cooling down or standstill of the pump 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.

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 SEEPEX 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 pump 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 recognizable, please immediately contact SEEPEX.

Disassembly / removal



- Stop the pump as instructed, allow to cool, depressurize and ensure that pressure cannot build up again.
- Work on the M.S. is only permitted when the pump is at a standstill and depressurized.
- There must be no product on the M.S. ⇒ if necessary drain the pump and rinse it out.
- Isolate the pump 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

- Remove the seal in the reverse sequence as described for assembly (set up).

Disposal of the SEEPEX mechanical seal

Usually, the SEEPEX mechanical seals can be easily disposed of 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 recognized 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.

Page 18

Required details for inquiries and orders

For inquiries and orders the following details are required:

- SEEPEX pump commission no.
- Part item no., designation, material, number of pieces with reference to the drawing if available

seepex Inc.
511 Speedway Drive
Enon, OH 45323
USA

Phone: 1-937-864-7150
Fax: 1-937-864-7157



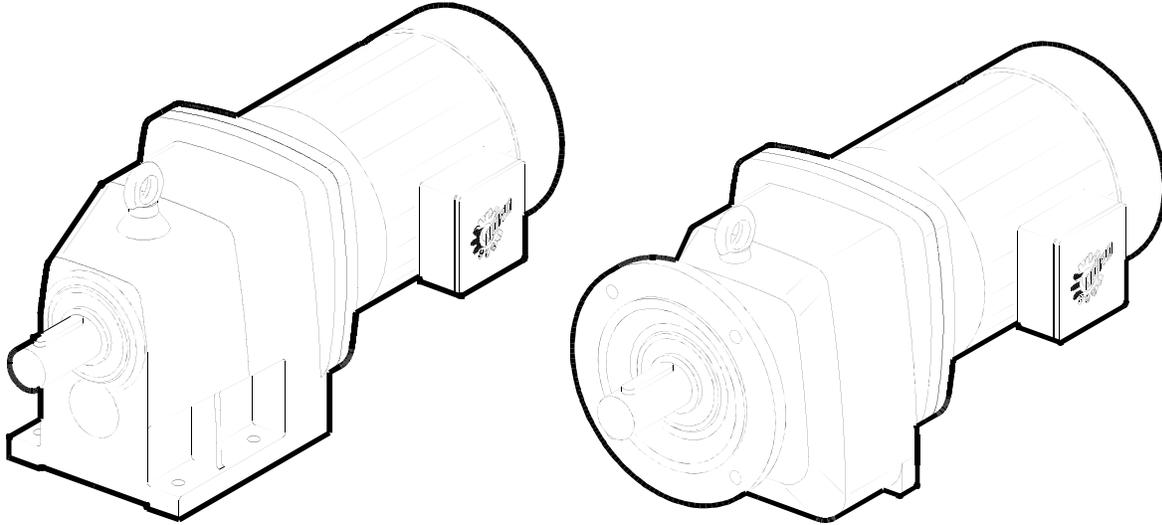
UNICASE[®] Helical Inline Gearboxes Installation and Maintenance Instructions

BIM 1010

USA

CDN

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)

- > $\varnothing 50 \leq \varnothing 80 = +0.012/-0.007$
- > $\varnothing 80 \leq \varnothing 120 = +0.013/-0.009$
- > $\varnothing 120 \leq \varnothing 180 = +0.014/-0.011$
- > $\varnothing 180 \leq \varnothing 230 = +0.016/-0.013$
- > $\varnothing 230 \leq \varnothing 315 = +0.000/-0.032$
- > $\varnothing 315 \leq \varnothing 400 = +0.000/-0.036$
- > $\varnothing 400 \leq \varnothing 500 = +0.000/-0.040$

Inch

- > $\varnothing 1.969 \leq \varnothing 3.150 = +0.005/-0.0003$
- > $\varnothing 3.150 \leq \varnothing 4.724 = +0.005/-0.0004$
- > $\varnothing 4.724 \leq \varnothing 7.087 = +0.006/-0.0004$
- > $\varnothing 7.087 \leq \varnothing 9.055 = +0.006/-0.0005$
- > $\varnothing 9.055 \leq \varnothing 12.402 = +0.000/-0.0013$
- > $\varnothing 12.402 \leq \varnothing 15.748 = +0.000/-0.0014$
- > $\varnothing 15.748 \leq \varnothing 19.685 = +0.000/-0.0016$

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)

- $\leq \varnothing 18 = +0.012/+0.001$
- > $\varnothing 18 \leq \varnothing 30 = +0.015/+0.002$
- > $\varnothing 30 \leq \varnothing 50 = +0.018/+0.002$
- > $\varnothing 50 \leq \varnothing 80 = +0.030/+0.011$
- > $\varnothing 80 \leq \varnothing 120 = +0.035/+0.013$
- > $\varnothing 120 \leq \varnothing 180 = +0.040/+0.015$

Inch

- $\leq \varnothing 1.750 = +0.0000/-0.0005$
- > $\varnothing 1.750 = +0.0000/-0.0010$

Output and Input shaft Drill and tap shaft end

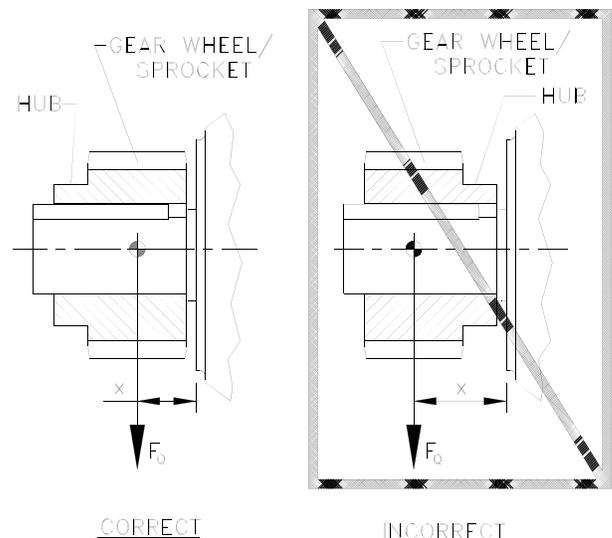
Metric (mm)

- $\leq \varnothing 16 = M5$
- > $\varnothing 16 \leq \varnothing 21 = M6$
- > $\varnothing 21 \leq \varnothing 24 = M8$
- > $\varnothing 24 \leq \varnothing 30 = M10$
- > $\varnothing 30 \leq \varnothing 38 = M12$
- > $\varnothing 38 \leq \varnothing 50 = M16$
- > $\varnothing 50 \leq \varnothing 85 = M20$
- > $\varnothing 85 \leq \varnothing 130 = M24$

Inch

- $\leq \varnothing 0.438 = \#10-24 \times 0.4 \text{ deep}$
- > $\varnothing 0.438 \leq \varnothing 0.813 = \#1/4-20 \times 0.6 \text{ deep}$
- > $\varnothing 0.813 \leq \varnothing 0.938 = 5/16-18 \times 0.7 \text{ deep}$
- > $\varnothing 0.938 \leq \varnothing 1.125 = 3/8-16 \times 0.9 \text{ deep}$
- > $\varnothing 1.125 \leq \varnothing 1.375 = 1/2-13 \times 1.1 \text{ deep}$
- > $\varnothing 1.375 \leq \varnothing 1.875 = 5/8-11 \times 1.4 \text{ deep}$
- > $\varnothing 1.875 \leq \varnothing 3.250 = 3/4-10 \times 1.7 \text{ deep}$
- > $\varnothing 3.250 = 1-8 \times 2.2 \text{ deep}$

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
2. Properly install couplings suitable for the application and connected equipment.
3. Ensure accurate alignment with other equipment.
4. 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;

5. 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.



WARNING:

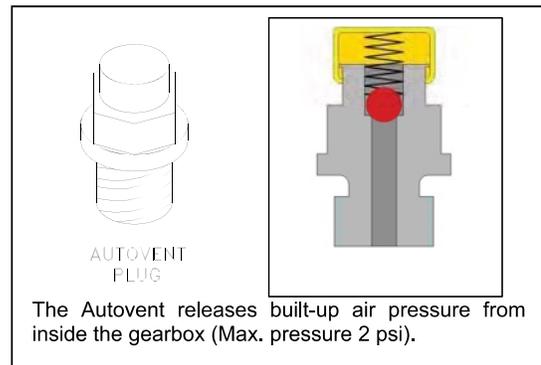
LOCK OUT POWER before any maintenance is performed. Make absolutely sure that no voltage is applied while work is being done on the gearbox.

START-UP

1. Ensure that switches, alarms, heaters, coolers and other safety and protection devices are installed and operational for their intended purpose.
2. 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.

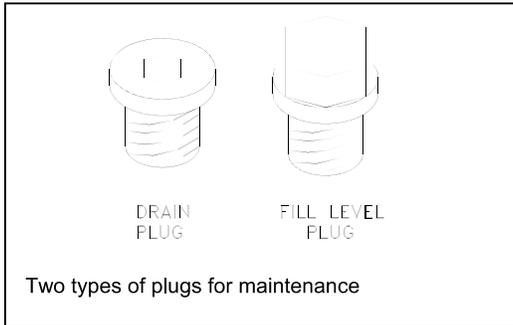
AUTOVENT PLUG

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

1. Operate the equipment as it was intended to be operated
2. Do not overload.
3. Run at correct speed.
4. Maintain lubricant in good condition and at proper level.
5. Dispose of used lubricant in accordance with applicable laws and regulations.
6. Apply proper maintenance to attached equipment at prescribed intervals recommended by the manufacturer.
7. Perform periodic maintenance of the gear drive as recommended by NORD.

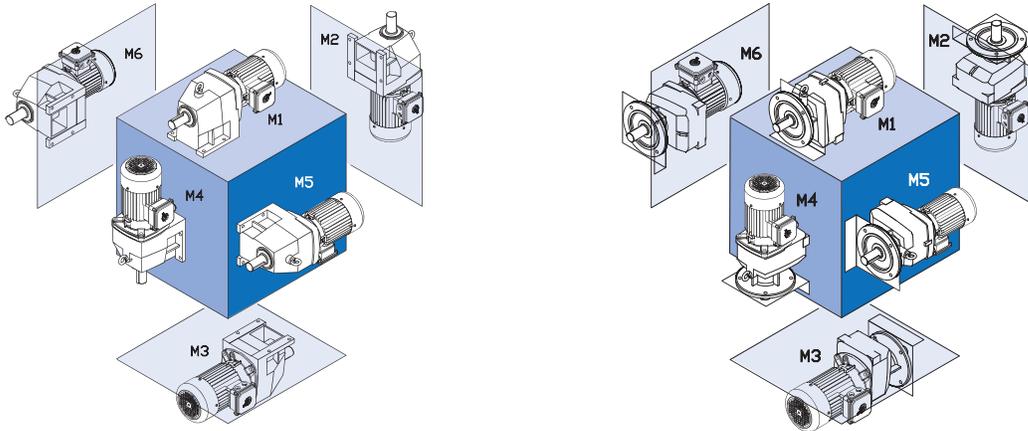
Mounting Positions



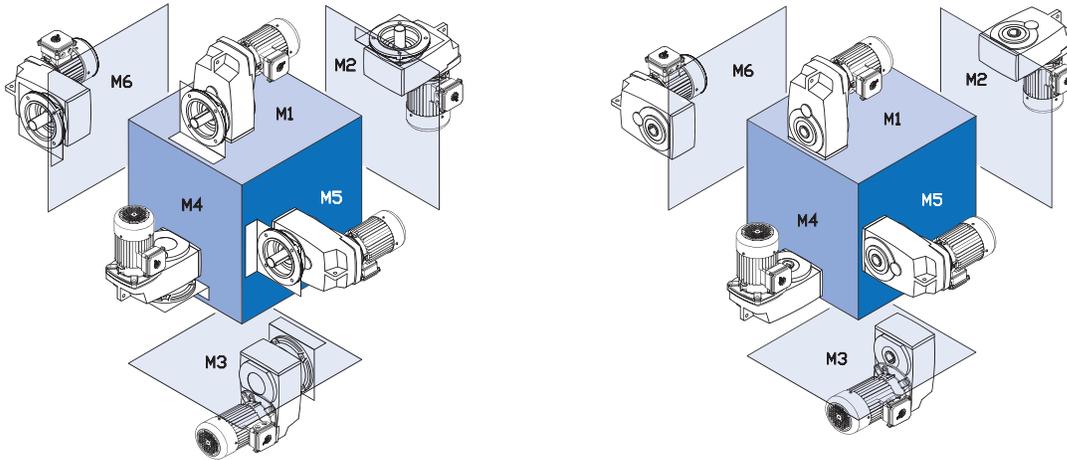
Mounting Positions

The reducer mounting position determines the approximate oil fill level and the appropriate vent location. In some cases mounting position may dictate possible variation in final reducer assembly. If considering any mounting positions that are not shown as catalog-standard options, it is critical that the customer consult with NORD prior to ordering.

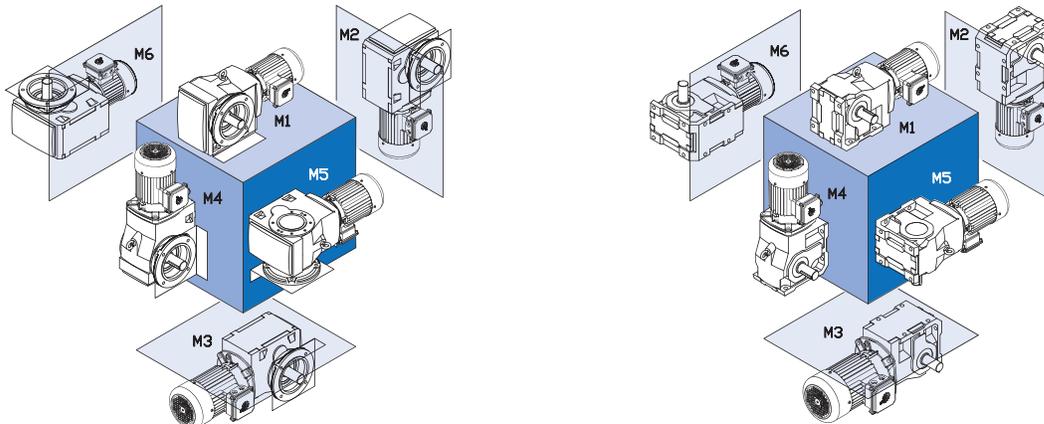
In-line



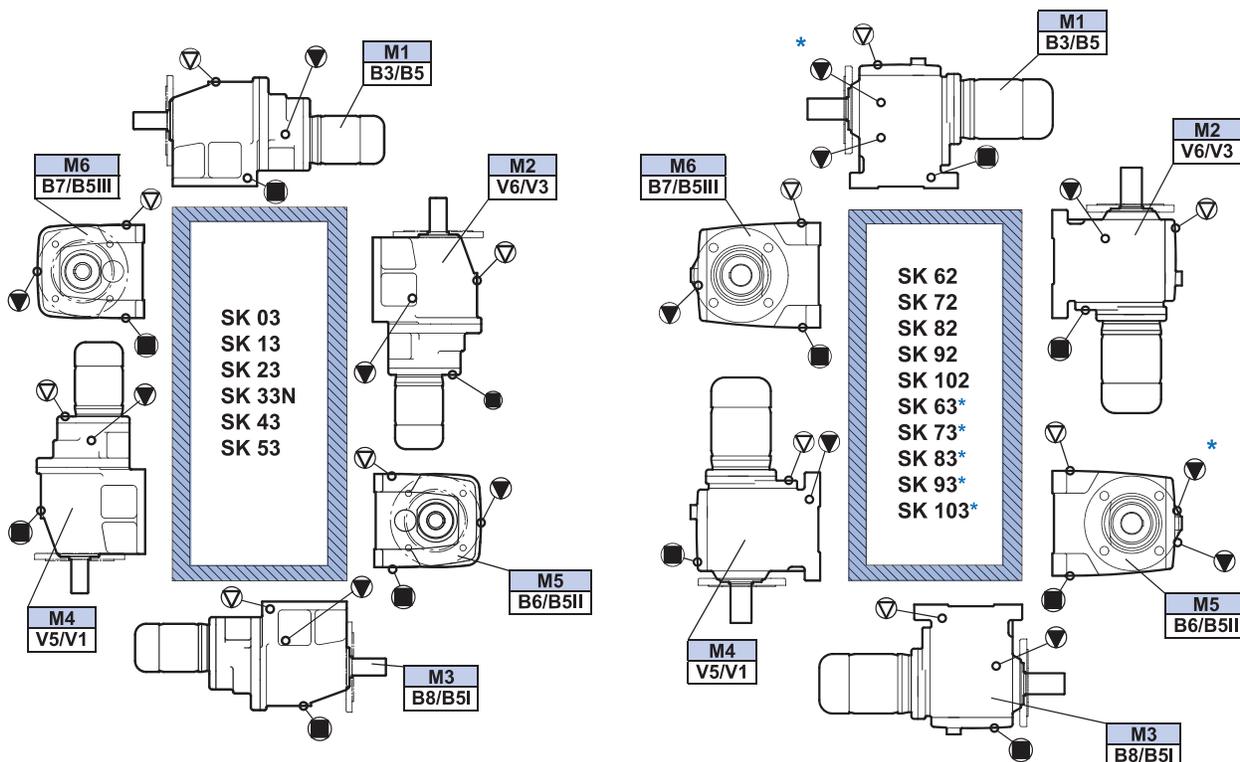
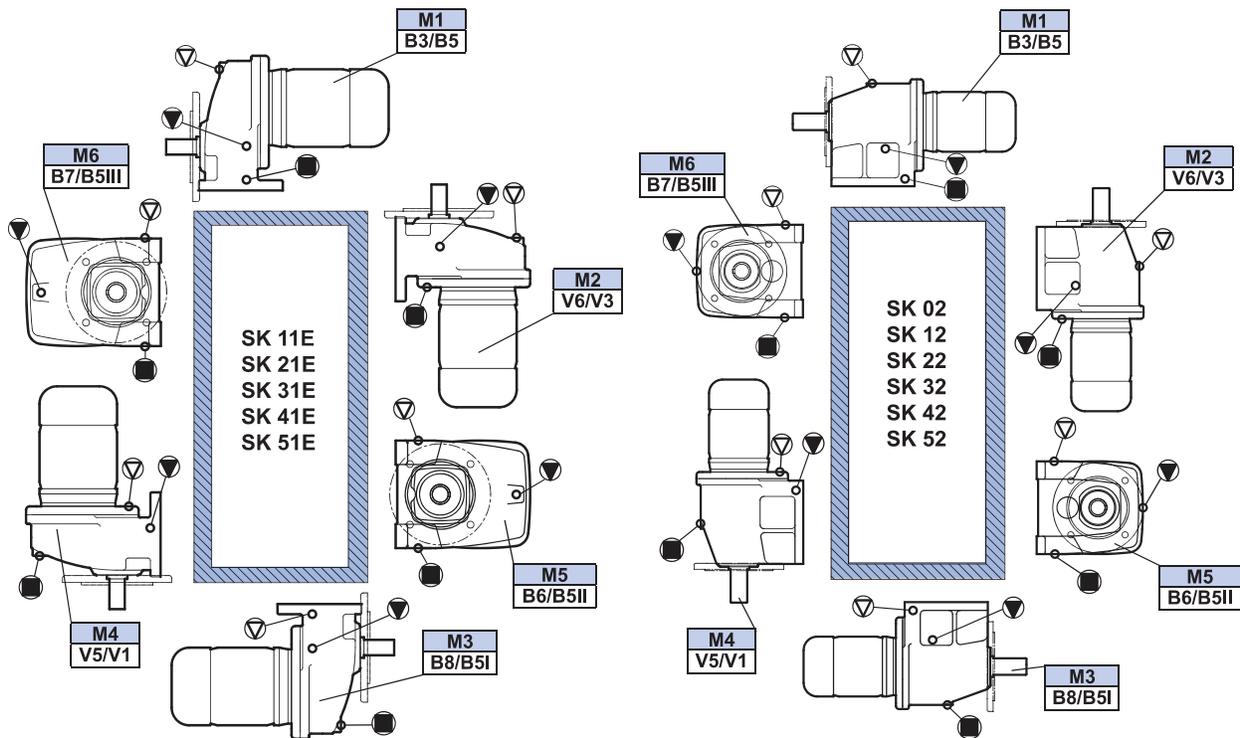
Clincher™



Right-Angle



Oil Plugs



▽ = Vent

▼ = Oil Level

■ = Oil Drain

SERVICE

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

Viscosity ISO NLGI	Formulation	Service Temperature Range						
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
	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
	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
	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 & VG 100	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
	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 +77°F	Mobilgear 626	Omala 68	2EP	Klüberoil GEM 1-68	Energol GR-XP 68	Tribol 1100/68
	Synthetic PAO	-40°C to +10°C -40°F to +50°F	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

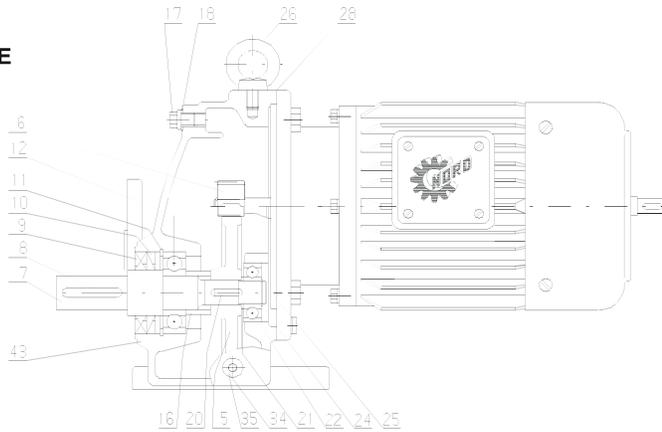
Each reducer has the oil level and oil quantity adjusted according to the mounting position shown in the tables. When replacing the oil, consult the tables below to determine the proper amount of oil to be installed according to the reducer size and mounting position. Note that this is approximate and the final level will be adjusted when the reducer is installed. Acceptable oil fill level is within 1/2 inch of the bottom of the fill plug threads.

LUBRICATION CAPACITY – HELICAL INLINE GEARBOXES													
Mounting position		Horizontal position								Vertical position			
		single reduction											
		B 3	B 6	B 7	B 8	B 5	B 5I	B 5II	B 5III	V 1	V 3	V 5	V 6
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	0.53
	liters	0.25	0.35	0.35	0.55	0.30	0.50	0.40	0.40	0.30	0.35	0.40	0.50
SK 21E	quarts	0.63	1.06	1.06	1.27	0.53	1.16	0.95	0.95	0.74	1.48	1.06	1.27
	liters	0.60	1.00	1.00	1.20	0.50	1.10	0.90	0.90	0.70	1.40	1.00	1.20
SK 31E	quarts	1.16	1.80	1.80	2.32	0.85	1.74	2.11	2.11	1.16	1.37	2.43	2.85
	liters	1.10	1.70	1.70	2.20	0.80	1.65	2.00	2.00	1.10	1.30	2.30	2.70
SK 41E	quarts	1.80	2.75	2.75	3.49	1.06	2.96	3.49	3.49	1.69	2.75	2.64	2.75
	liters	1.70	2.60	2.60	3.30	1.00	2.80	3.30	3.30	1.60	2.60	2.50	2.60
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	4.65
	liters	2.20	3.40	3.40	4.70	1.80	4.10	3.80	3.80	3.00	3.50	4.00	4.40
Mounting position		double reduction											
		B 3	B 6	B 7	B 8	B 5	B 5I	B 5II	B 5III	V 1	V 3	V 5	V 6
		SK 02	quarts	0.16	0.42	0.42	0.74	0.26	0.63	0.53	0.53	0.63	0.63
liters	0.15		0.40	0.40	0.70	0.25	0.60	0.50	0.50	0.60	0.60	0.60	0.60
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	0.79
	liters	0.25	0.50	0.50	0.85	0.35	0.90	0.60	0.60	0.90	0.85	0.75	0.75
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	1.90
	liters	0.50	1.35	1.35	2.00	0.70	2.00	1.55	1.55	1.80	2.00	1.80	1.80
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	2.64
	liters	0.90	2.00	2.00	3.00	1.30	3.30	2.40	2.40	3.10	2.90	2.90	2.50
SK 42	quarts	1.37	3.38	3.38	4.76	1.90	4.76	3.91	3.91	4.23	4.65	4.54	6.13
	liters	1.30	3.20	3.20	4.50	1.80	4.50	3.70	3.70	4.00	4.40	4.30	5.80
SK 52	quarts	2.64	5.39	5.39	7.19	3.17	6.55	5.92	5.92	7.82	7.19	7.19	7.40
	liters	2.50	5.10	5.10	6.80	3.00	6.20	5.60	5.60	7.40	6.80	6.80	7.00
SK 62	quarts	6.87	15.85	15.85	13.74	7.40	14.79	16.91	16.91	19.55	15.85	16.91	15.85
	liters	6.50	15.00	15.00	13.00	7.00	14.00	16.00	16.00	18.50	15.00	16.00	15.00
SK 72	quarts	9.51	24.30	24.30	19.02	10.57	19.55	24.30	24.30	29.59	24.30	27.47	24.30
	liters	9.00	23.00	23.00	18.00	10.00	18.50	23.00	23.00	28.00	23.00	26.00	23.00
SK 82	quarts	14.79	33.81	33.81	28.53	15.85	30.64	36.46	36.46	47.55	39.10	46.49	36.98
	liters	14.00	32.00	32.00	27.00	15.00	29.00	34.50	34.50	45.00	37.00	44.00	35.00
SK 92	quarts	26.42	54.95	54.95	49.66	27.47	49.66	54.95	54.95	82.42	77.14	80.31	77.14
	liters	25.00	52.00	52.00	47.00	26.00	47.00	52.00	52.00	78.00	73.00	76.00	73.00
SK 102	quarts	38.04	75.02	75.02	69.74	42.27	69.74	76.08	76.08	109.90	85.59	107.78	83.48
	liters	36.00	71.00	71.00	66.00	40.00	66.00	72.00	72.00	104.00	81.00	102.00	79.00
Mounting position		triple reduction											
		B 3	B 6	B 7	B 8	B 5	B 5I	B 5II	B 5III	V 1	V 3	V 5	V 6
		SK 03	quarts	0.32	0.63	0.63	0.85	0.53	0.95	0.85	0.85	1.16	0.86
liters	0.30		0.60	0.60	0.80	0.50	0.90	0.80	0.80	1.10	0.81	0.90	1.25
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	1.32
	liters	0.60	0.70	0.70	1.10	0.80	1.20	0.95	0.95	1.20	1.20	1.20	1.25
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	2.54
	liters	1.30	1.60	1.60	2.30	2.50	1.50	2.80	2.80	2.80	2.60	2.35	2.40
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	3.06
	liters	1.60	2.30	2.30	3.20	1.90	3.50	2.60	2.60	4.40	3.40	4.20	2.90
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	5.92
	liters	3.00	3.60	3.60	5.20	3.50	5.00	4.10	4.10	6.10	5.70	6.60	5.60
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	9.19
	liters	4.50	6.00	6.00	7.70	5.20	7.00	6.70	6.70	8.90	8.40	8.70	8.70
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	15.32
	liters	10.00	13.00	13.00	11.00	11.00	12.00	14.00	14.00	18.00	14.00	16.00	14.50
SK 73	quarts	14.79	21.13	21.13	18.49	14.79	19.02	21.13	21.13	29.06	23.78	28.53	21.13
	liters	14.00	20.00	20.00	17.50	14.00	18.00	20.00	20.00	27.50	22.50	27.00	20.00
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	32.76
	liters	22.00	33.00	33.00	26.00	23.00	27.00	34.00	34.00	40.00	34.00	37.00	31.00
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	73.97
	liters	40.00	49.00	49.00	44.00	40.00	44.00	49.00	49.00	74.00	70.00	72.00	70.00
SK 103	quarts	58.12	70.80	70.80	58.12	58.12	62.34	70.80	70.80	104.61	82.42	102.50	75.02
	liters	55.00	67.00	67.00	55.00	55.00	59.00	67.00	67.00	99.00	78.00	97.00	71.00

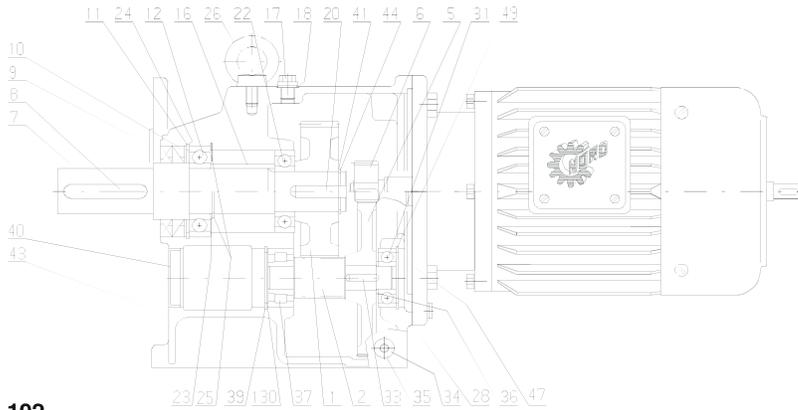
Note: Filling quantities are approximate figures. Oil level must be checked according to oil level plug after final installation. Acceptable oil fill level is within 1/2 inch of the bottom of the fill plug threads. For mounting angles not shown, consult factory.

PARTS LIST

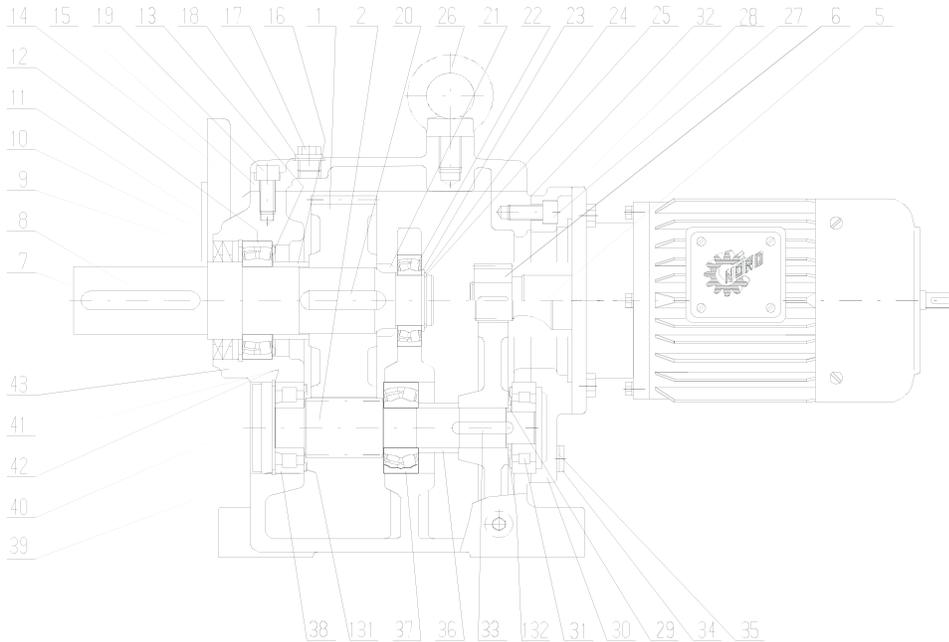
SK 11 E - SK 51 E



SK 02 - SK 52



SK 62 - SK 102



- 1 Driven gear
- 2 Pinion shaft
- 5 Driving gear
- 6 Driving pinion
- 7 Output shaft
- 8 Key
- 9 Shaft seal
- 10 Shaft seal
- 11 Circlip
- 12 Output shaft bearing
- 13 NILOS ring
- 14 Seal
- 15 Gearcase cover
- 16 Spacer
- 17 Vent plug
- 18 Seal
- 19 Socket head screw
- 20 Key
- 21 Spacer
- 22 Output shaft bearing
- 23 Supporting disc
- 24 Shim
- 25 Circlip
- 26 Flanged eye bolt
- 27 Bolt
- 28 Seal
- 29 Spacer
- 30 Gearbox cover
- 31 Pinion shaft bearing
- 32 Seal
- 33 Key
- 34 Drain plug
- 35 Seal
- 36 Spacer
- 37 Pinion shaft bearing
- 38 Pinion shaft bearing
- 39 Circlip
- 40 Locking cap
- 41 Shim
- 42 Supporting disc
- 43 Gear case
- 44 Circlip
- 47 Shim
- 49 Circlip
- 130 Shim
- 131 NILOS ring
- 132 NILOS ring

RECOMMENDED SPARE PARTS

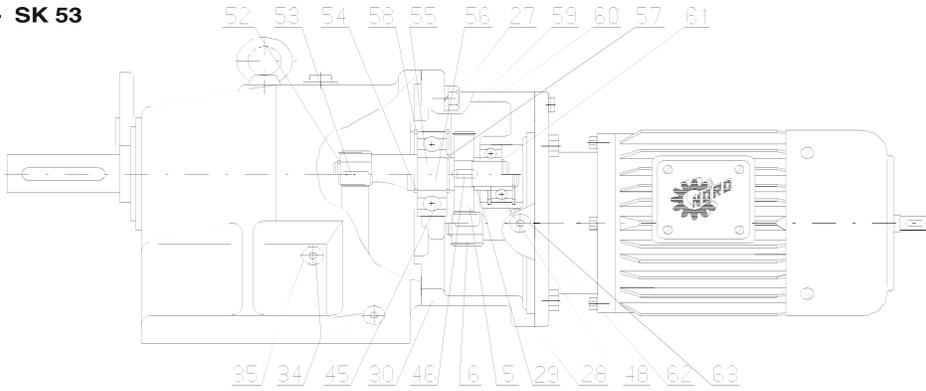
Bearings – *all* Gaskets – *all* Shims – *all*
 Seals – *all* Seal Plugs – *all*

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.

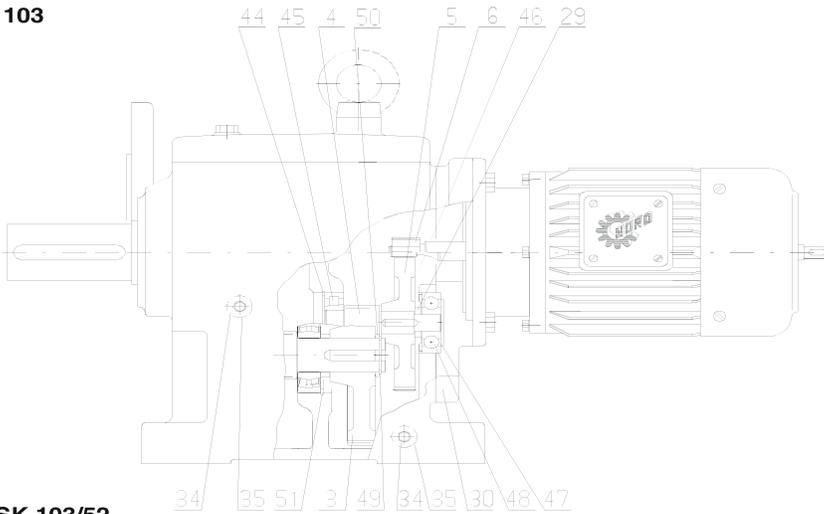
PARTS LIST

SK 03 - SK 53

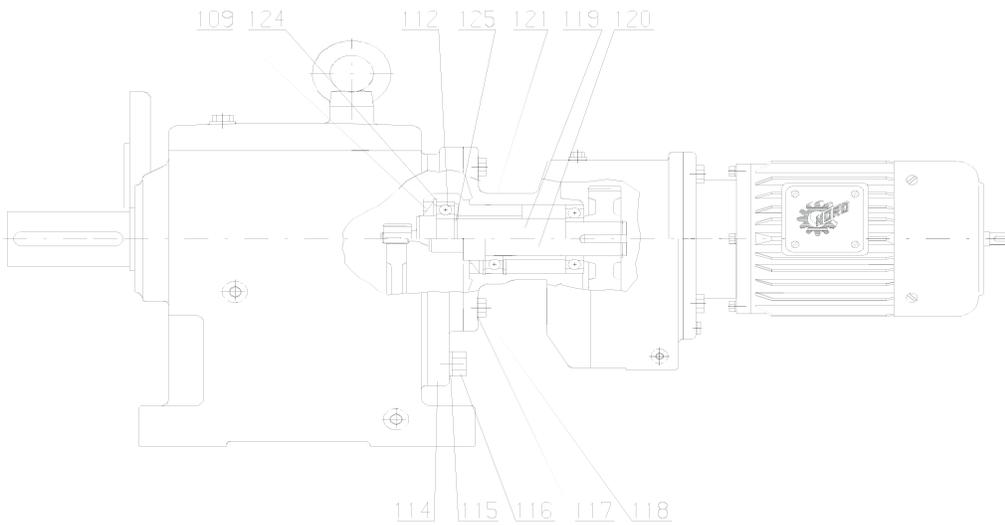


- 3 Driven gear
- 4 Pinion shaft
SK 63 - SK 103
- 5 Driving gear
- 6 Driving pinion
- 7 Fixing bolt
- 28 Seal
- 29 Spacer
- 30 Third reduction gearcase
- 34 Drain plug
- 35 Seal
- 44 Circlip
- 45 Ball bearing
- 46 Key
- 47 Shim
- 48 Ball bearing
- 49 Circlip
- 50 Supporting disc
- 51 Circlip
- 52 Circlip
- 53 Key
- 54 Circlip
- 55 Intermediate shaft, plain
- 56 Intermediate shaft, gearcut
- 57 Circlip
- 58 Circlip
- 59 Shim
- 60 Circlip
- 61 Circlip
- 62 Oil-plug
- 63 Seal
- 109 Shaft seal
- 112 Ball bearing
- 114 Intermediate flange
- 115 Spring washer
- 116 Bolt
- 118 Bolt
- 119 Intermediate shaft, plain
- 120 Intermediate shaft, gearcut
- 121 Bearing sleeve
- 124 Circlip
- 125 Circlip

SK 63 - SK 103



SK 12/02 - SK 103/52



TROUBLE SHOOTING

PROBLEM WITH THE REDUCER		POSSIBLE CAUSES	SUGGESTED REMEDY
Runs Hot	Overloading	Load exceeds the capacity of the reducer	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce load
	Improper lubrication	Insufficient lubrication	Check lubricant level and adjust up to recommended levels
		Excessive lubrication	Check lubricant level and adjust down to recommended levels
		Wrong lubrication	Flush out and refill with correct lubricant as recommended
Runs Noisy	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
	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.	
Output Shaft Does Not Turn	Internal parts are broken	Overloading of reducer can cause damage.	Replace broken parts. Check rated capacity of reducer.
		Key missing or sheared off on input shaft.	Replace key.
		Coupling loose or disconnected.	Properly align reducer and coupling. Tighten coupling.
Oil Leakage	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.
		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 Corporation

National Customer Service Toll Free 888-314-6673

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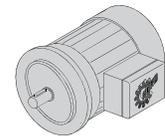
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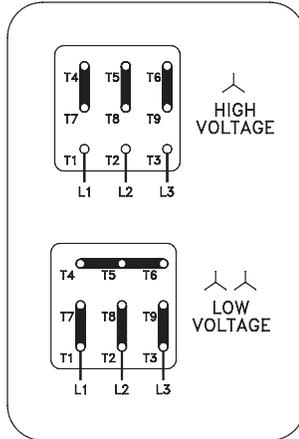
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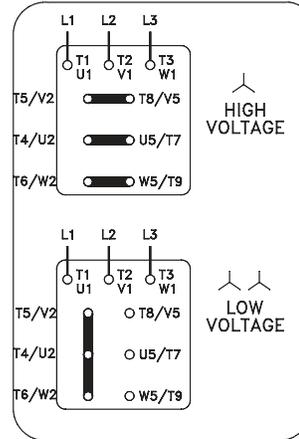
Connections



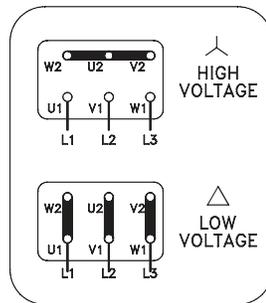
Frame 63 - 132
230/460V - 60 Hz



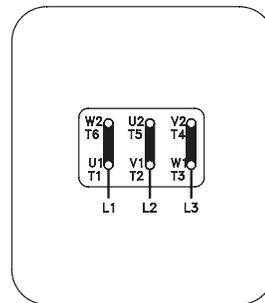
Frame 160 +
230/460V - 60 Hz



332/575V - 60 Hz
230/400V - 50 Hz
400/690V - 50 Hz

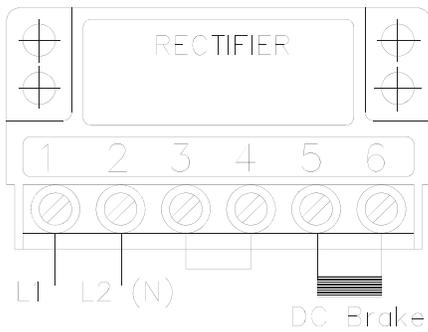


460 V Δ - 60 Hz



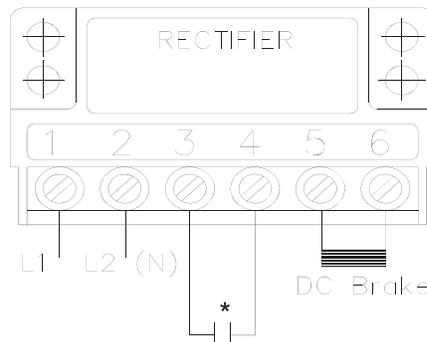
General Brake Connection

Normal brake reaction time
(AC-Switching)



L1/L2 - Brake voltage (AC)

Rapid brake reaction time
(DC-Switching)



* The normally-open contact (NO) is not supplied by nord. It must close at the same time power is supplied to the brake.



BIM 1004

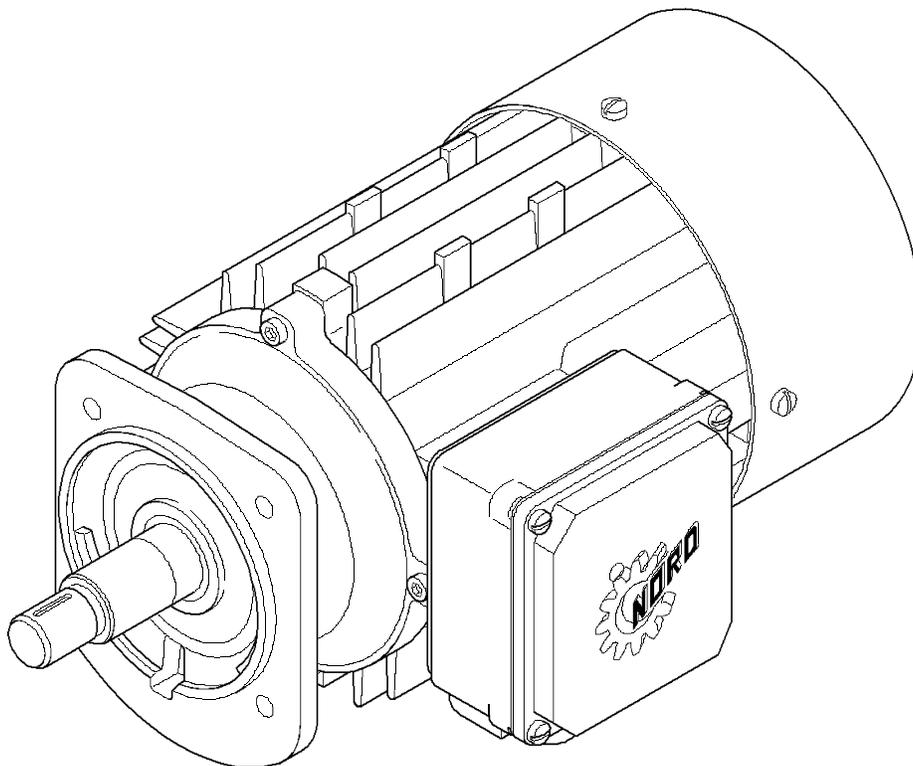
USA

CDN

MOTORS

AC Induction, Single and Polyphase

Installation and Maintenance Instructions



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TABLE OF CONTENTS

<u>Subject</u>	<u>Page</u>
Introduction.....	4
Description and Operation	4
Inspection.....	6
Testing and Fault Isolation.....	7
Lubrication.....	9
Removal, Installation, and Handling.....	9
Connection Diagrams.....	12
Repair.....	13
Parts List	14
Motor Options & Nomenclature	17

LIST OF ILLUSTRATIONS

<u>Figure No.</u>	<u>Figure Title</u>	<u>Page</u>
Figure 1	Motor Nameplates.....	5
Figure 2	Motor & Options Connection Diagrams.....	12
Figure 3	General Motor Exploded View and Generic Parts List (2 pages).....	15

LIST OF TABLES

<u>Table No.</u>	<u>Table Title</u>	<u>Page</u>
Table 1	Related Publications	4
Table 2	Nameplate Data.....	5
Table 3	Motor Inspection Criteria.....	6
Table 4	Motor Fault Isolation	8
Table 5	Motor Option Codes & Nomenclature.....	17
Table 6	Space Heater Data.....	19
Table 7	Encoder Wiring Designations.....	19
Table 8	Blower Cooling Fan Data	20

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 [®] 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

1. 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.

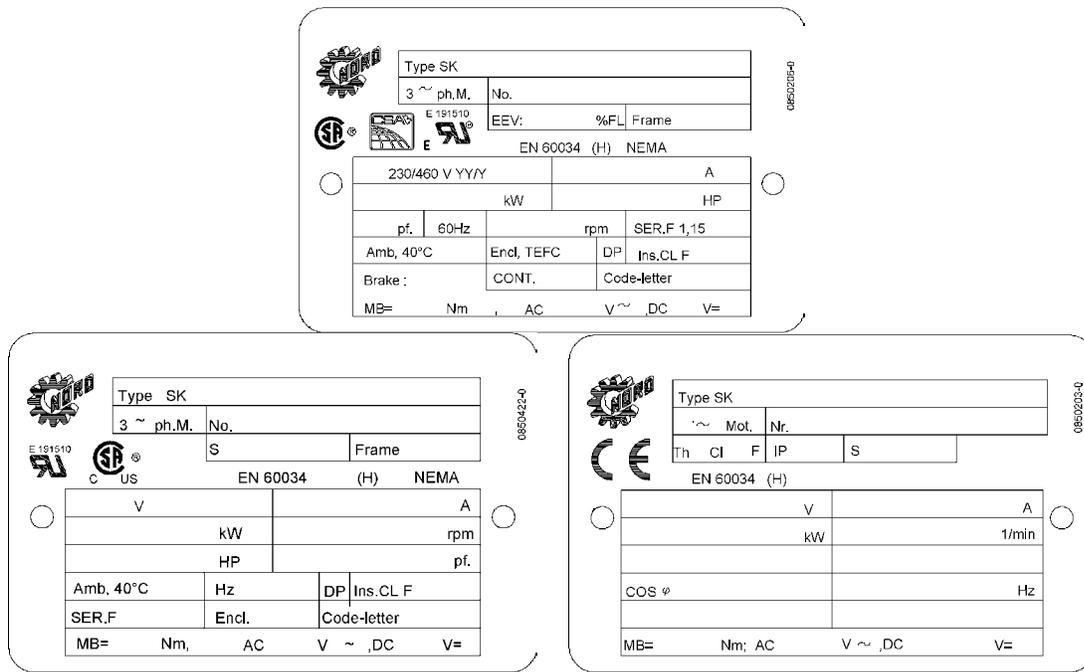


Figure 1. Motor Nameplates

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. 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 operate	Check the circuit breaker.	The breaker has tripped. Reset the breaker. 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 inhibit cooling.	If the motor exterior is excessively dirty, clean the motor surface using clean, lint-free cloths. 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 as the system temperature rises.	If the gearbox drag increases during operation, repair the gearbox. 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, therefore 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:

- 1) 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.

- c. 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.
- D. 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

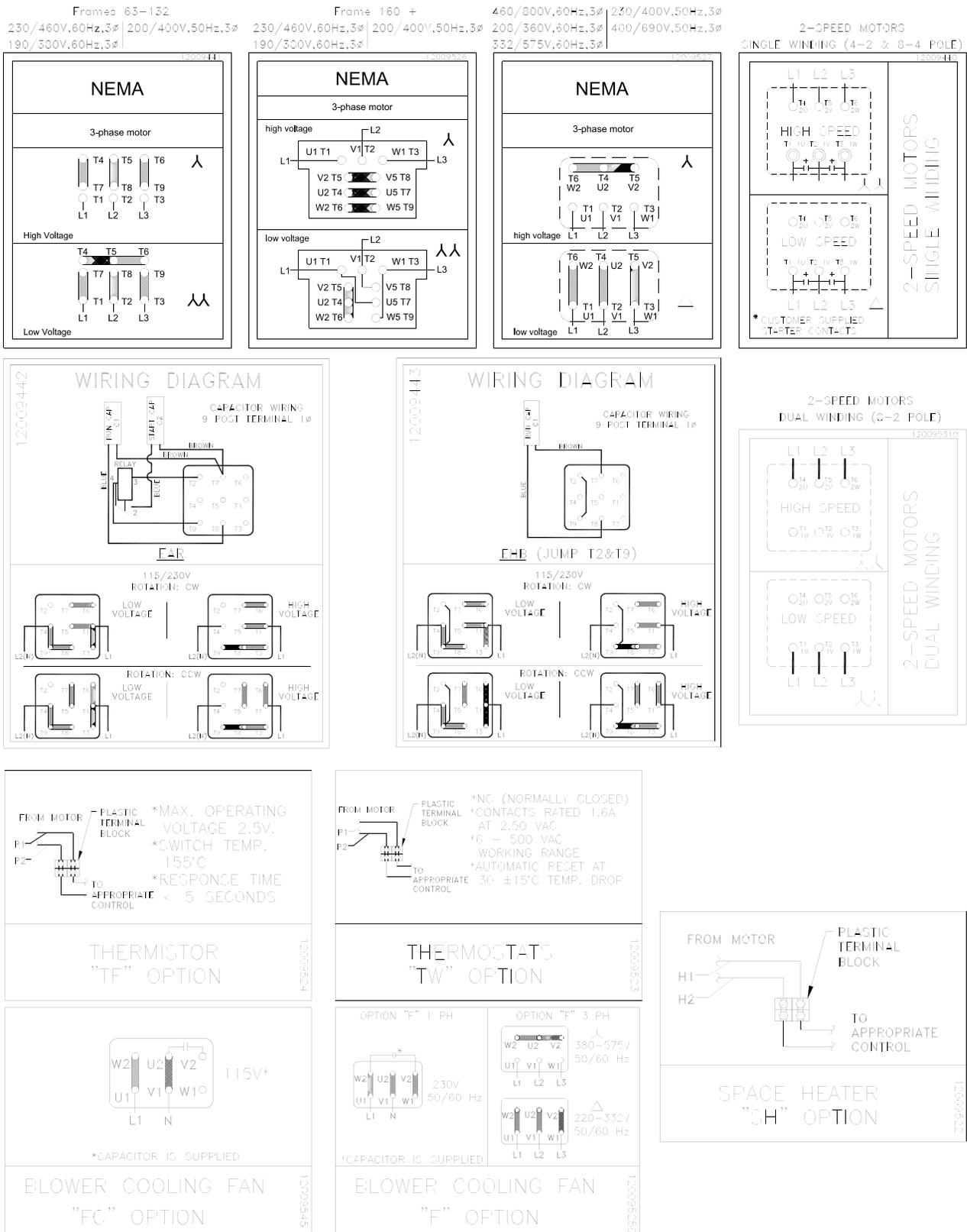


Figure 2. Motor Connection and Wiring Diagrams

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
∅ ∅ ∅	Jumper Bar (not illustrated)	AR

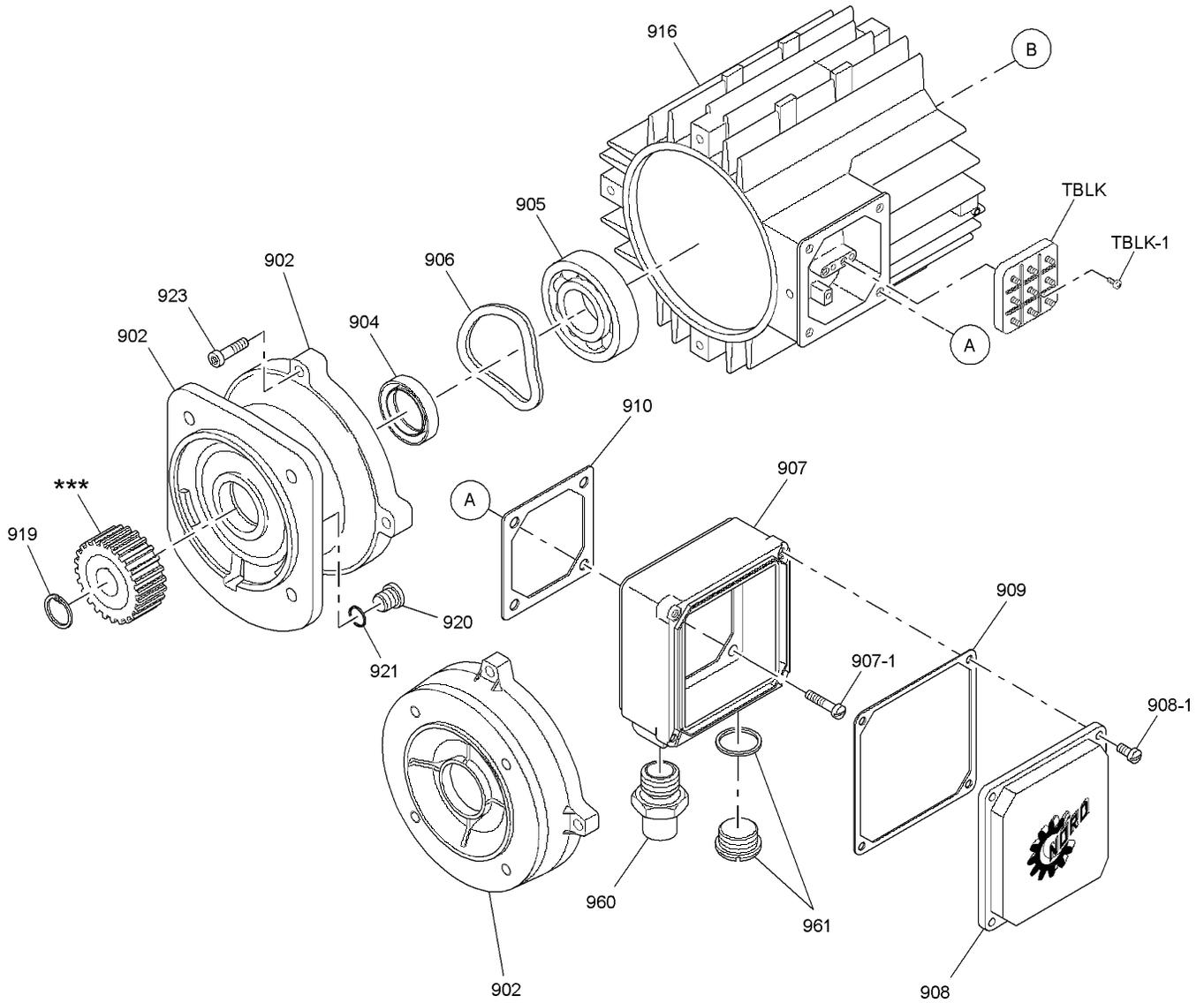


Figure 3. General Motor Exploded View and Generic Parts List (Sheet 1 of 2)

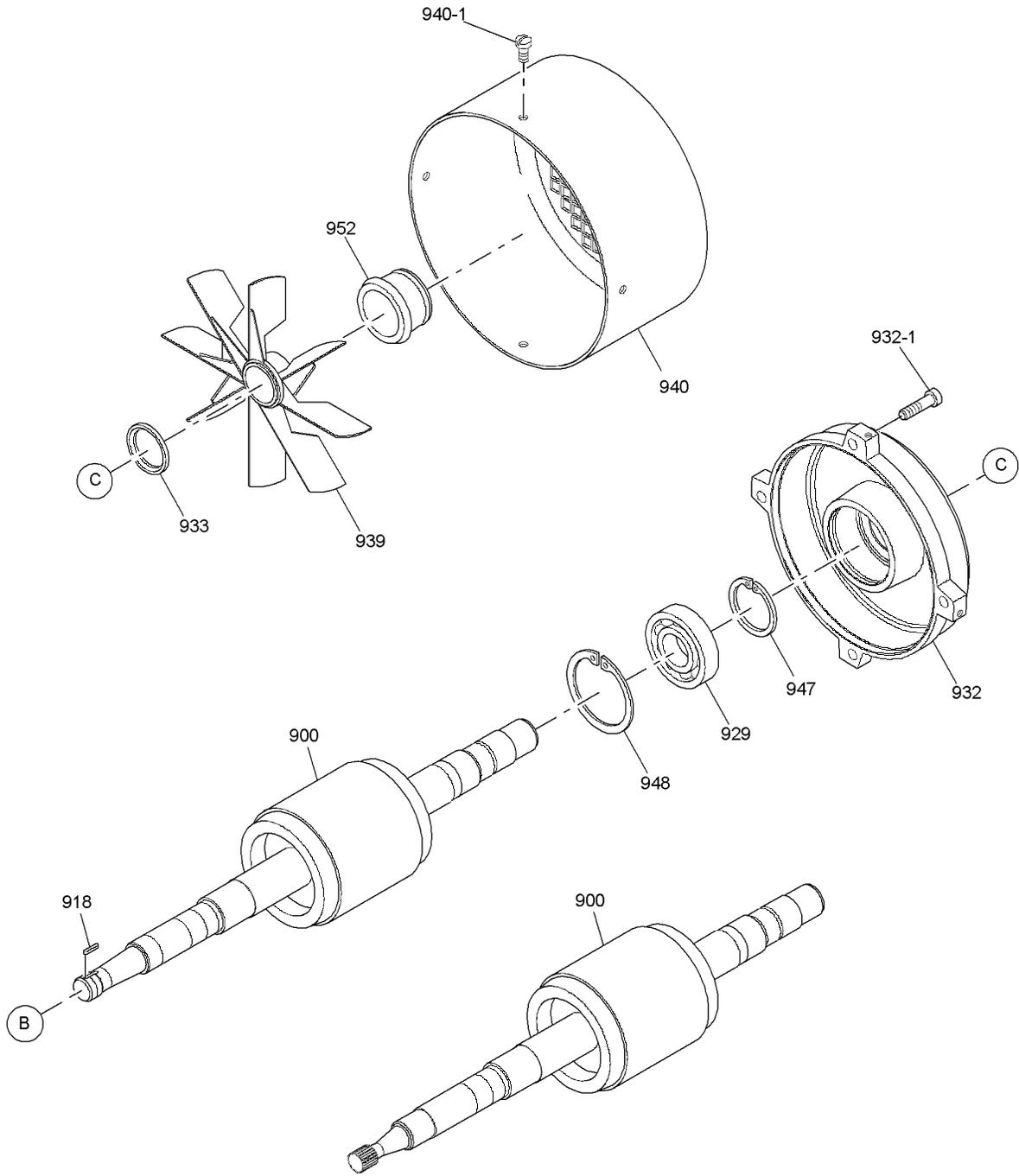


Figure 3. General Motor Exploded View and Generic Parts List (Sheet 2 of 2)

MOTOR OPTIONS & NOMENCLATURE

1. General

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	Brake – Corrosion Protected	OL/H	TENV Motor - Without Fan & Cover
SR	Brake – Dust Protected	RD	Canopy Cover
HL	Brake – Manual Hand Release	RDD	Double Canopy Cover
FHL	Brake – Lockable Manual Release	RLS	Backstop
MIK	Brake – Microswitch	SH	Motor Space Heater
IR	Brake – Current Sensing Relay	TF	Thermistor
KD	Condensation Holes	TW	Thermostat
KB	Condensation Holes - Plugged	WE	2 nd Motor Shaft End
MS	Power Plug Connector	WU	High Slip Rotor
NSD+	NORD Severe Duty Plus Protection	Z	High Inertia Motor Ran
EHBU	Single Phase, Run Capacitor	H	Energy Efficient
EARU	Single Phase, Start Cap/Run Cap	IP66	IP66 Environmental Protection
F	Blower Cooling Fan - 3ph & 1ph	ISO H	Class H Insulation
FC	Blower Cooling Fan - 1ph	EP	Epoxy Dipped Windings
IG	Incremental Encoder	FK	Over Running Clutch
VR	5:1 Constant Torque Rated Motor	VN	10:1 Constant Torque Rated Motor
VW	20:1 Constant Torque Rated Motor	VZ-F	1000+:1 Constant Torque Rated Motor

Table 5. Motor Option Codes

Motor Nomenclature					
Motor			Motor Options		
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, 2nd 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



Motor Thermistors

"TF" Option

Installation and Maintenance Instructions

BIM-1093a/2003

USA

CDN

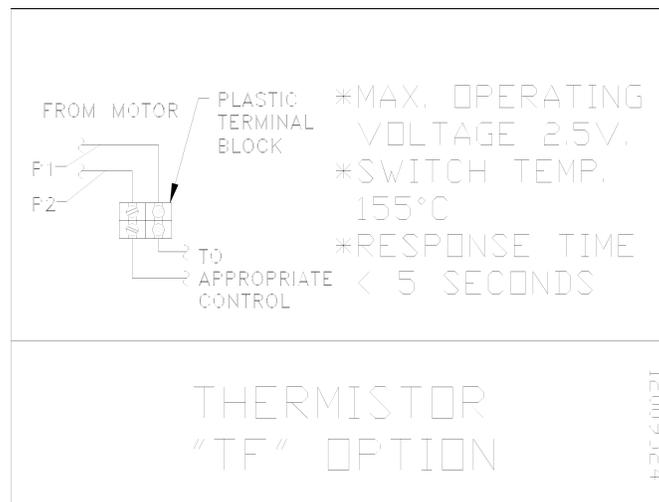
Retain These Safety Instructions For Future Use

NORD Gear's thermistor option is three PTC (Positive Temperature Coefficient) temperature sensitive resistors. They are wired in series, with one on each phase of the stator winding. The leads will be labeled P1 and P2 in the terminal box.

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

Connection Diagram



All wiring must be done by qualified personnel and adhere to all local codes.

WARNING: Thermistors will automatically reset.

This unit must be connected to a Motor Control Protection module such as a Kriwan INT69 or a Variable Frequency Drive with PTC inputs.

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www.nord.com

NORD Gear Limited

Toll Free in Canada 800-668-4378

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SOUTH

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Phone 704-529-1255
Fax 888-259-6673

CANADA

41 West Drive
Brampton, Ontario L6T 4A1
Phone 905-796-3606
Fax 905-796-8130

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.

Terms

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.

Security

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:

- a) the merchandise covered by this contract, and
- b) 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.

Cancellation

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.

Return

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

- a) **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.
- b) **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 changes 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 quotation.
- c) **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.
- d) **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

- a) **New Articles:** We guarantee articles of our manufacture against defects in material and/or workmanship for a period of three (3) years from date of acceptance, providing that the articles have been installed, maintained, and operated in accordance with our recommendations and instructions.
- b) **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.

- c) **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 whatsoever.

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 deliver

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And what can we get flowing for you?
Your nearest contact:

More seepex sales partners in Europe,
America, Asia, Africa and Oceania
you will find on our website

Or visit www.seepex.com

Calibration Cylinder

General Description

For the most efficient use of your PolyBlend® unit, you should periodically monitor the polymer input rate to determine the need for metering pump adjustment (calibration). The PolyBlend® Calibration Cylinder is ruggedly constructed with a slip-on cap for top filling.

The cap has a convenient pipe thread on top for vent piping, fill piping, etc. Calibration cylinder and fittings are made of inert PVC. Label is polycarbonate with calibration marks protected from environment.

Installation

To seal threads use teflon tape when installing.

Operation

Equipment required: Watch with second hand.

1. To calibrate pump, open Valve B and fill calibration cylinder. Verify pump suction line is full of chemical by running pump until chemical exits pump discharge.
2. Close Valve A. Start pump and simultaneously begin timing.
3. Allow pump to run for at least 30 seconds.
4. Stop pump and timing, observe level of chemical in cylinder.
5. Change in cylinder level divided by time period is actual pump rate.
6. Close Valve B and open Valve A to resume normal operation.



A

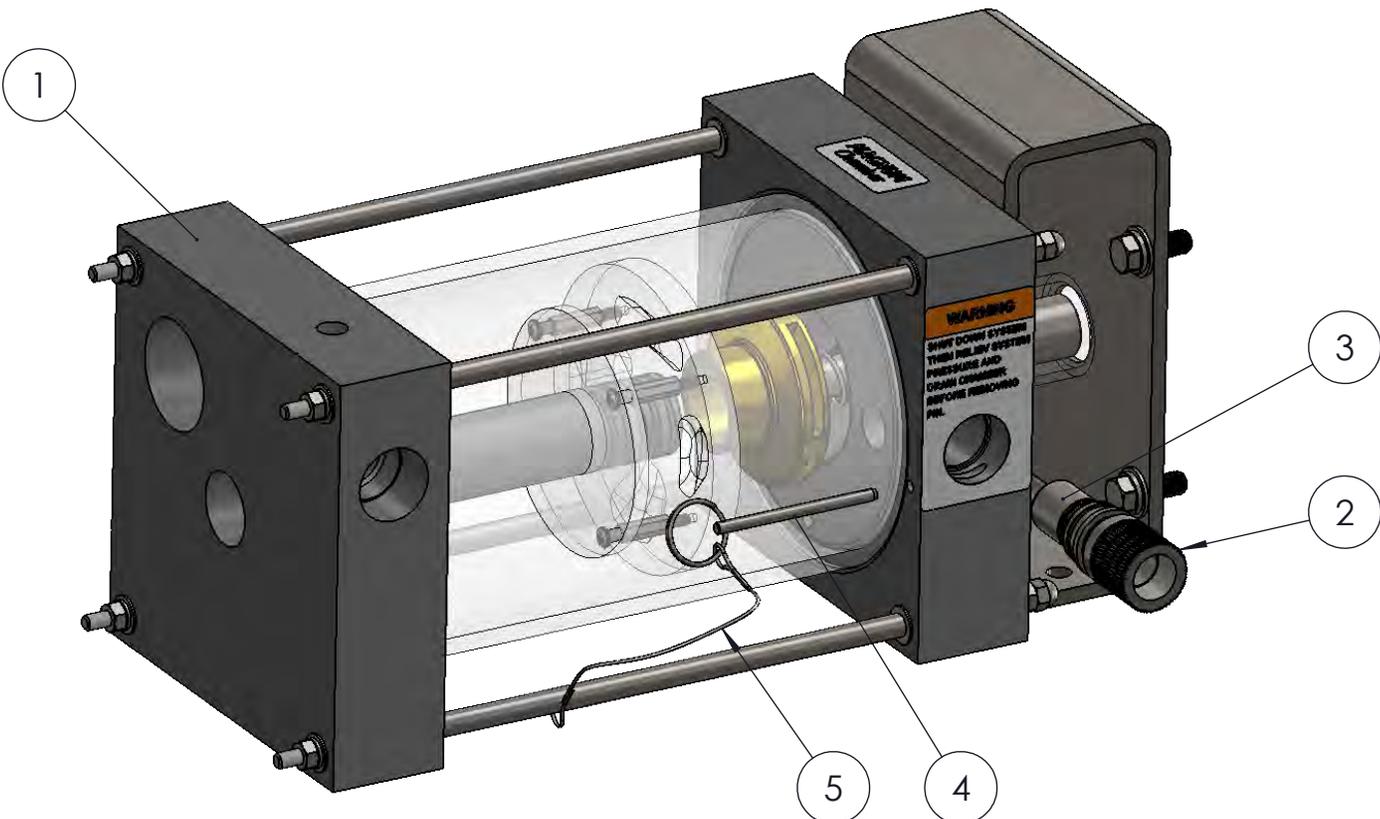
B

C

D

E

F



QUICK DISCONNECT PURPOSE - TO ALLOW THE CUSTOMER TO REMOVE CHECK VALVE WITHOUT THE USE OF TOOLS.

BEFORE REMOVING PIN TO TAKE ADAPTER CHECK VALVE OUT, SEE WARNING BELOW.

WARNING!! - SHUT DOWN SYSTEM, THEN RELIEF SYSTEM PRESSURE AND DRAIN CHAMBER BEFORE REMOVING PIN.

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	2345413	MAGNUM MIX CHAMBER W/DIRECT DRIVE, M240-2400	1
2	1048405	CHECK VALVE ADAPTER, W/O-RING	1
3	9572322	CHECK VALVE, 1/2" MPT, 304SS	1
4	6530010	PIN, BALL LOCK	1
5	6530011	NYLON TETHER 3/32" x 12", MIX CHAMBER-PIN	1

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MATERIAL: .

TITLE: **MAGNUM CHAMBER QUICK DISCONNECT ASSEMBLY**

UGSI Chemical Feed, Inc.
 Vineland, NJ - USA - 856.896.2160
 www.ugsichemicalfeed.com

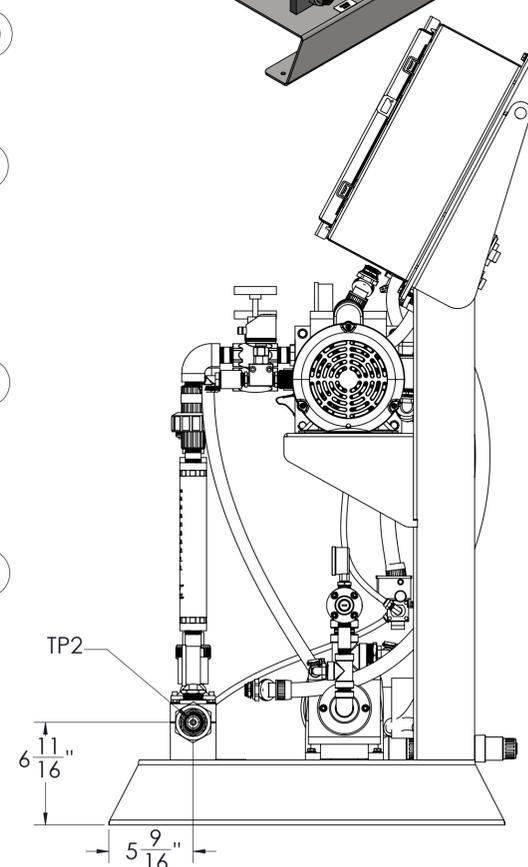
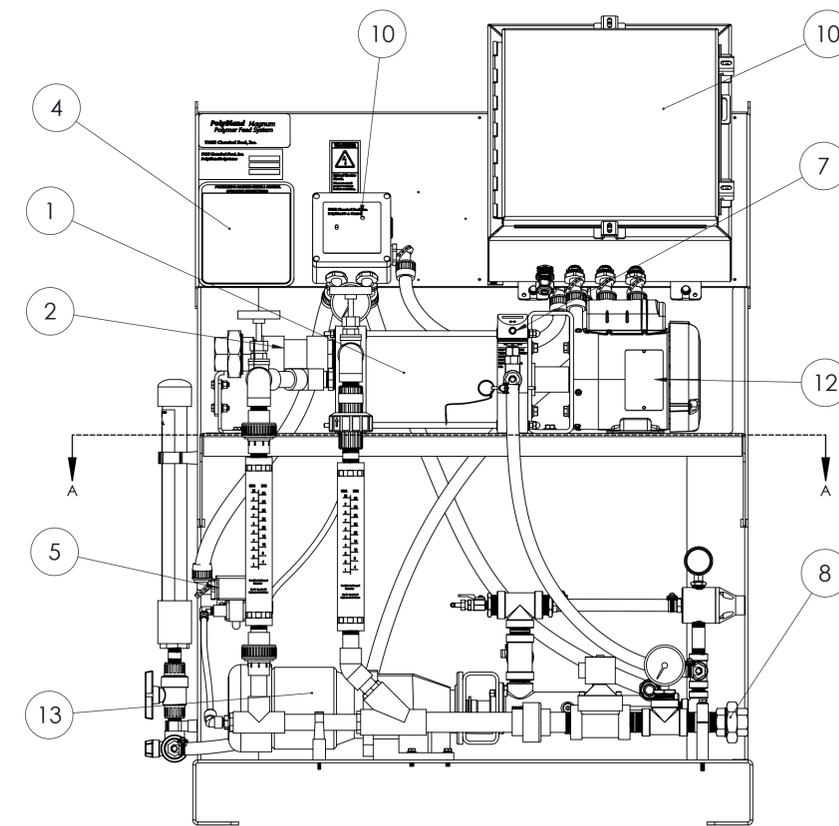
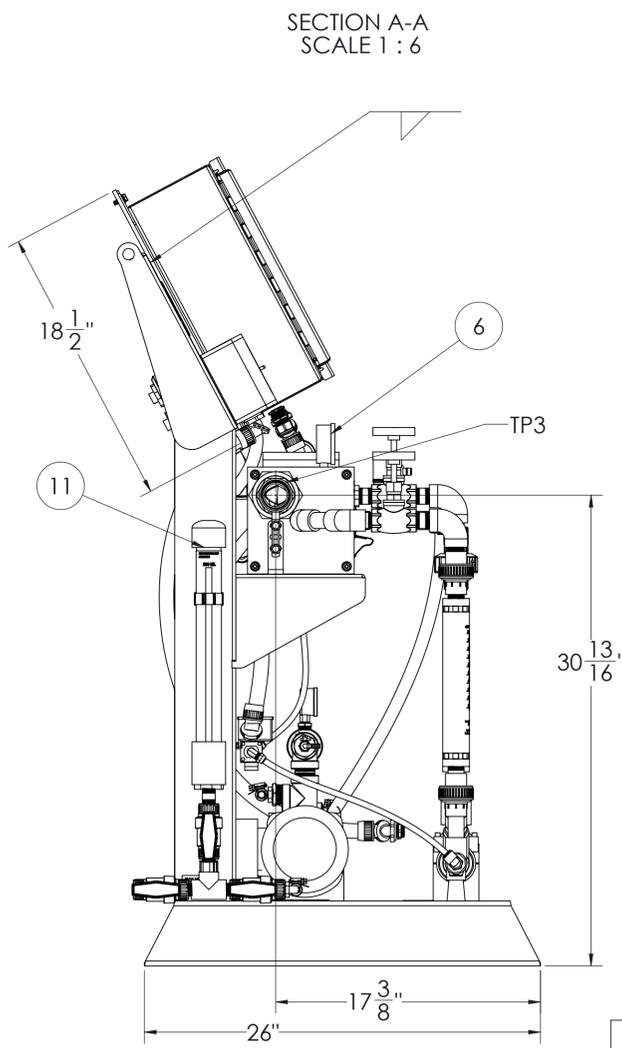
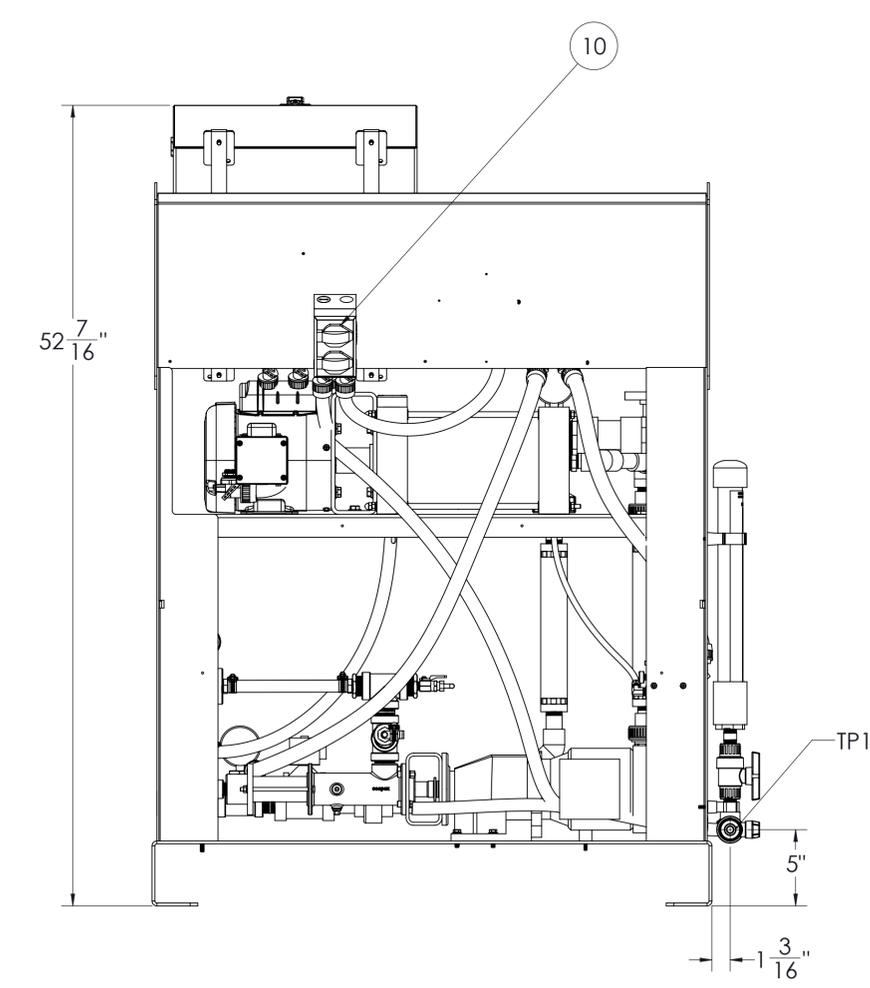
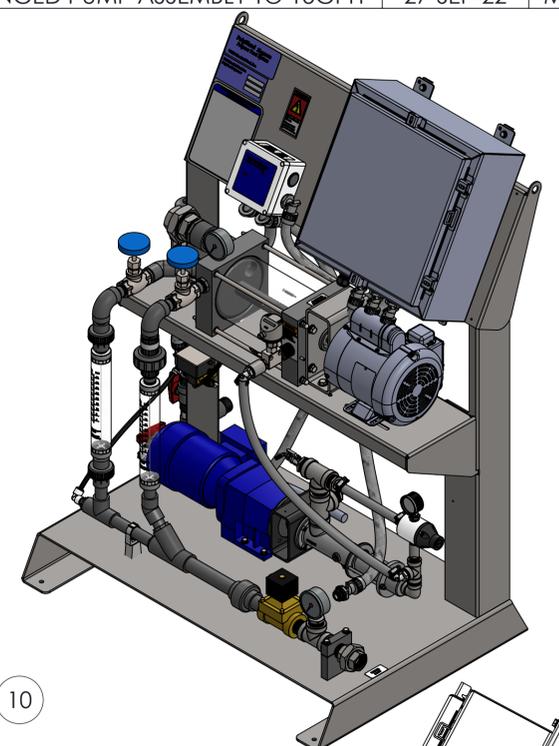
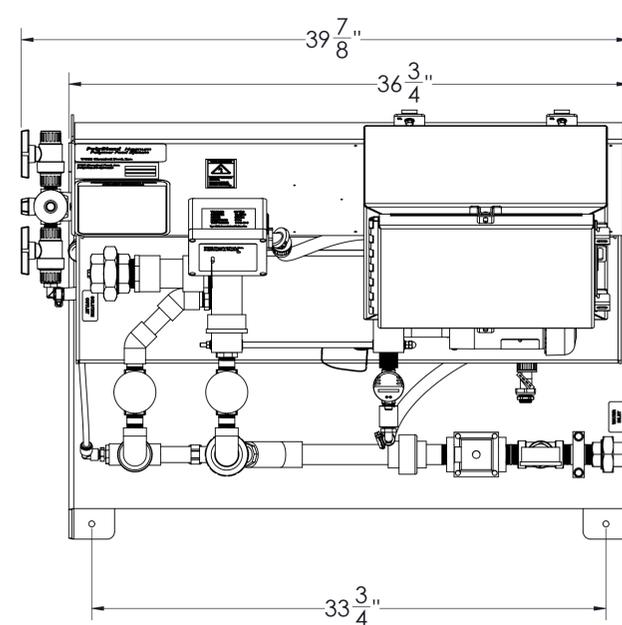
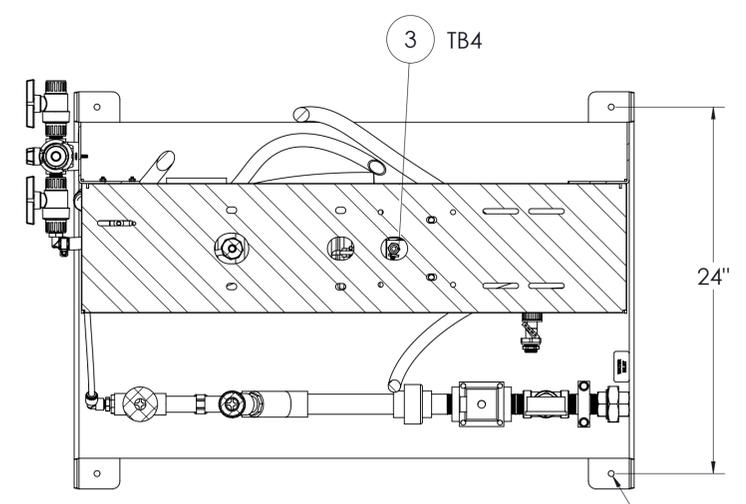
1		21MAR18
REV.	CHANGE No.	DATE
SCALE: 1:3	DR'N: MSM	CH'K:
RELEASED:	ENG:	Q.A.:

DRAWING NUMBER:
F00001

THIRD ANGLE PROJECTION	DESIGN CENTER: USA	WEIGHT:	SHEET: 1 OF 1
MODEL:	DWG:	TOLERANCES TO F937.400	A © 2014

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	2345413	MAGNUM MIX CHAMBER W/DIRECT DRIVE, MM240-2400	1
2	5860304	STATIC MIXER ASSY, M601-2400, 1.5"	1
3	9570201	VALVE, BALL, .250 FPT X .250 MPT	1
4	5559035	LABEL, POLYBLEND MAGNUM, A CONTROL OPERATING INSTRUCTIONS	1
5	H6111	M-SERIES "A" CONTROL, MIXING CHAMBER, DPS PARTS	1
6	FD0130202	GAUGE, 0-160PSI, 2.5" DIA, 304SS, BRASS	1
7	K8727903	LOSS OF POLYMER FLOW SWITCH, 1/2" NPT	1
8	556131-SA2	WATER INLET PIPING ASSEMBLY, MM1200 A-CONTROL, PVC, 1"	1
9	556131-SA4	M240-2400 MAGNUM CHAMBER BASE FRAME ASSEMBLY, 316SS	1
10	556131-SA5	ELECTRICAL ASSEMBLY, MM1200/P-PUMP, A-CONTROL, 115V	1
11	K2342013	250mL CALIBRATION COLUMN ASSEMBLY	1
12	5903426	MOTOR, 1/2HP, WASHDOWN, 1 PHASE, 3600 RPM, 115/208-230 V, 56C FRAME, TEFC	1
13	H6112	PROGRESSIVE CAVITY PUMP ASSEMBLY, PRV, 15 GPH	1

REVISIONS			
REV.	DESCRIPTION	DATE	BY
2	CHANGED PUMP ASSEMBLY TO 15GPH	27-SEP-22	MSM



TERMINATION POINT	DESCRIPTION	CONNECTION
TP1	POLYMER INLET	1/2"
TP2	DILUTION INLET	1"
TP3	SOLUTION OUTLET	1-1/2"
TP4	DRAIN OUTLET	1/4"
TP5	RELIEF OUTLET	-

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UGSI Chemical Feed SOLUTIONS
www.ugsichemicalfeed.com

TOLERANCES UNLESS OTHERWISE SPECIFIED

FRACTION	TWO PLACE DECIMAL	THREE PLACE DECIMAL
$\frac{1}{64}$.010	.005

ANGULARITY: MACHINED $\pm 1/2^\circ$ OTHER $\pm 1^\circ$ SURFACE FINISH $125\sqrt{64}$

CONCENTRICITY: MAX. T.I.R. .005" TOLERANCES TO F937.400

BREAK ALL SHARP EDGES AND REMOVE ALL BURRS

TITLE: POLYBLEND MM1200-P12AA-L ASSEMBLY

DRAWING NUMBER: 556131-SA1

PROJECT NO.: 556131 CH'K: WM

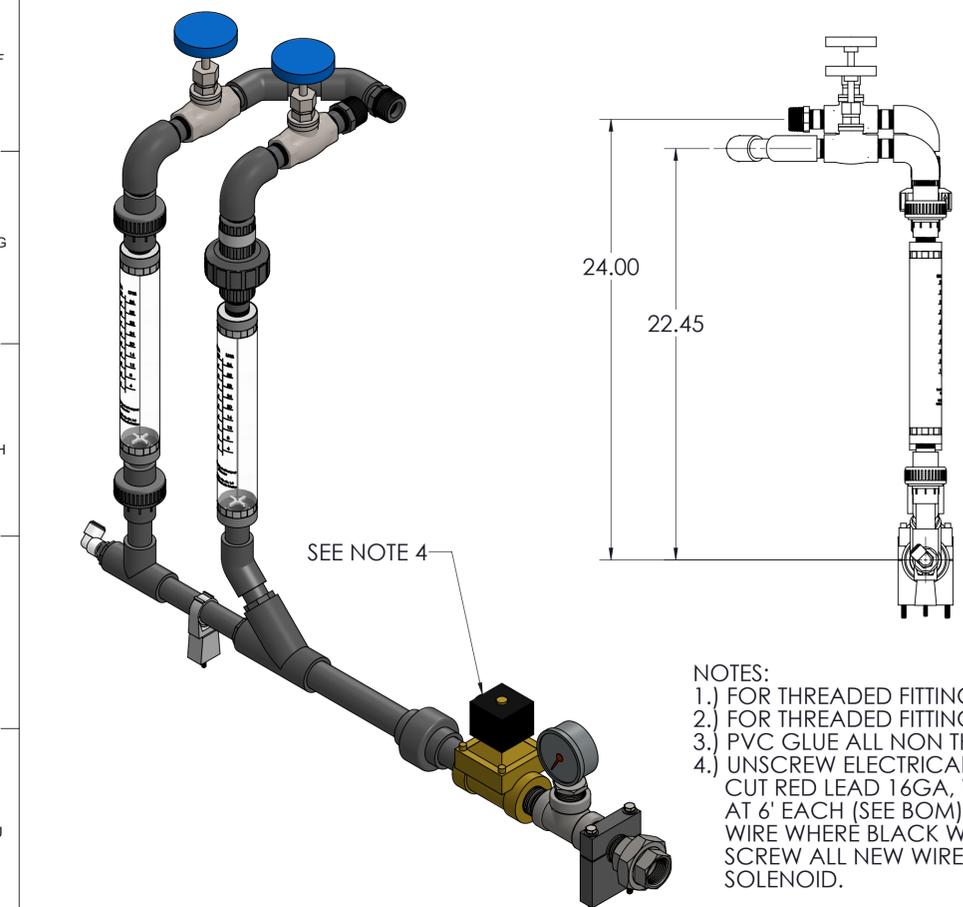
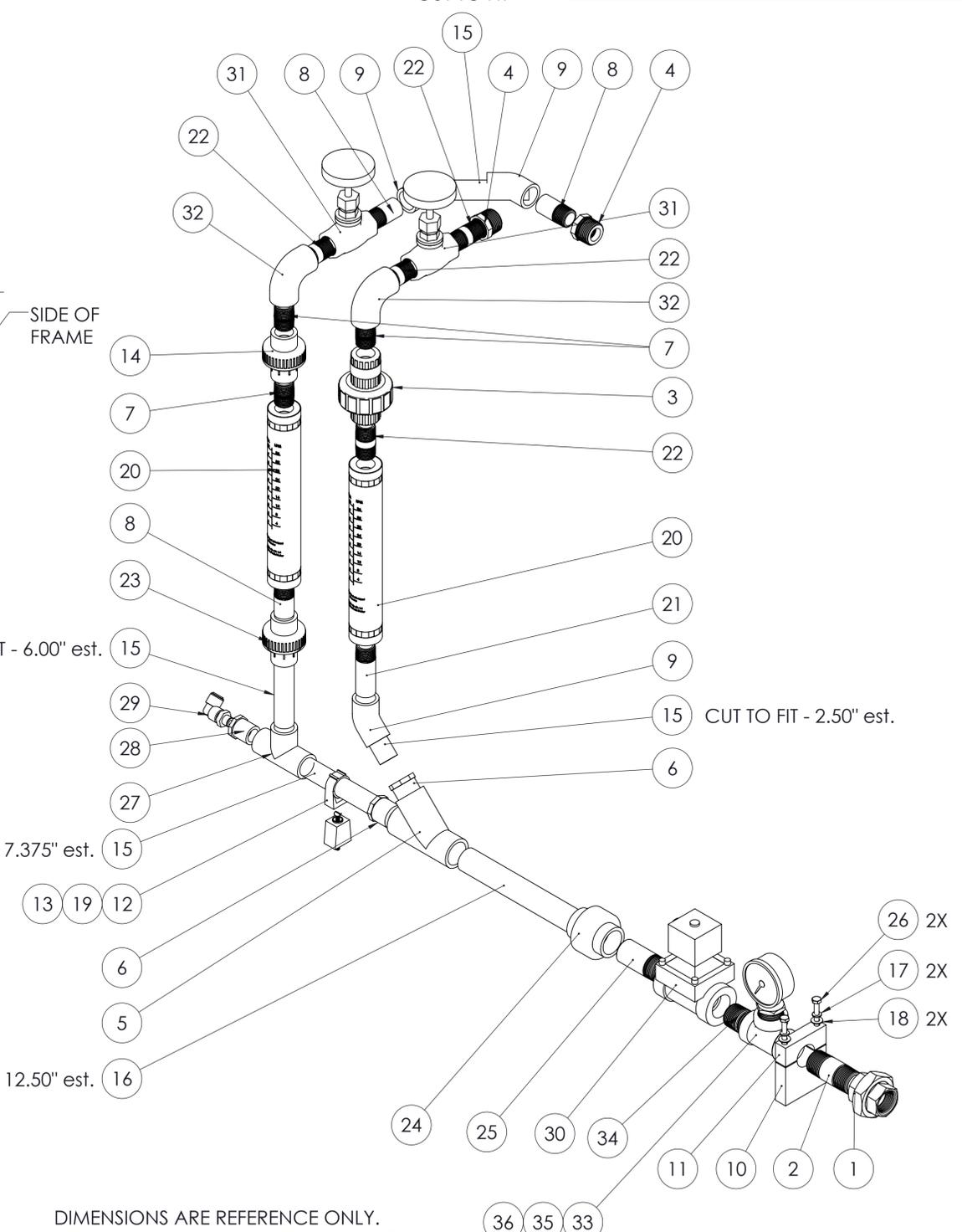
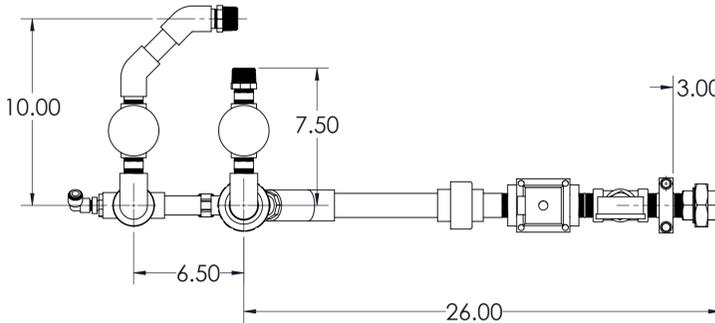
DATE: 27-SEP-22 DR'N: MSM SCALE: 1:10

REV.: 2 PM: MA WEIGHT:

THIRD ANGLE PROJECTION SHEET: 1 OF 1 SIZE D

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	9509423	UNION, 1" 304SS, TxT, W/O-RING	1
2	5963106	PIPE NIPPLE, 304SS, 1" x 3", TBE	1
3	9572033	PVC BALL CHECK VALVE, T-U, TXT, 3/4"	1
4	1930015	PVC BUSHING RED., TxT, 1" x 3/4", SCH 80	2
5	9901061	PVC PIPE WYE, 45 DEG., 1", SCH. 80, SxSxS	1
6	1931015	BUSHING, REDUCING, PVC, 1" x 3/4", SxS, SCH 80	2
7	5960081	PVC PIPE NIPPLE, SCH 80, 3/4" x CLOSE, TBE	3
8	5960805	PVC PIPE NIPPLE, TOE, SCH-80, 3/4" x 2", SxT	3
9	3571025	PVC, SCH. 80, ELBOW, 45 DEG, 3/4", SxS	3
10	1692001	BLOCK, PIPE, PVC, BOTTOM, 1" SCH 80	1
11	1692000	BLOCK, PIPE, PVC, TOP, 1", SCH 80	1
12	2502036	CLAMP, PIPE, 3/4", NYLON, "CLIC"	1
13	W2T539290	CLAMP, CLIC, SPACER, 35mm	1
14	9500005	PVC SCH 80. UNION, 3/4" TxT, VITON	1
15	RM6600081	PVC PIPE, SCH. 80, 3/4" SIZE	4FT
16	RM6600101	PVC PIPE, 1", SCH 80	1FT
17	9740315	LOCK WASHER, 1/4", 316SS	2
18	9740300	1/4" SMALL OD FLAT WASHER, 316SS	2
19	7772504	#10-24 x 2-1/4" SLOTTED PAN HD MACH. SCREW, 316SS	1
20	4292113	FLOWMETER, BLUE & WHITE, 10 GPM, 3/4" NPT	2
21	5960808	PVC PIPE NIPPLE, SCH 80, 3/4" x 3" TOE, SxT	1
22	5960088	PVC PIPE NIPPLE, SCH. 80, 3/4" x 2", TxT	4
23	9501005	PVC SCH 80. UNION, 3/4" SxS, VITON	1
24	9501006	PVC PIPE UNION, SCH. 80, 1" SxS, VITON	1
25	5960809	PVC PIPE TOE NIPPLE, 1" MPT x 3", SCH.80	1
26	1600340	BOLT, H.H., 316SS, 1/4-20 x 4-1/2	2
27	8851005	PVC SCH 80, TEE, 3/4", SxSxS	1
28	1930065	BUSHING REDUCER, 3/4" SOC x 1/4" (F)NPT, SCH. 80, PVC	1
29	3581234	ELBOW, QUICK DISCONNECT, 90 DEGREE	1
30	FD107654	SOLENOID VALVE 1" NPT, BRASS, STC	1
31	9576024	GLOBE VALVE, 316SS, 3/4" NPT, IN-LINE	2
32	3570005	PVC PIPE, ELBOW, 90, SCH. 80, TxT, 3/4"	2
33	8850406	PIPE TEE, 304SS, 1" NPT	1
34	5963104	PIPE NIPPLE, 304SS, 1" x 2"	1
35	1930412	BUSHING, REDUCING, 1.00 MPT X .250 FPT	1
36	FD0130202	GAUGE, 0-160PSI, 2.5" DIA, 304SS, BRASS	1

REVISIONS			
REV.	DESCRIPTION	DATE	BY



NOTES:
 1.) FOR THREADED FITTINGS UP TO 3/4" NPT, FOLLOW PROCEDURE F20071.
 2.) FOR THREADED FITTINGS 1" NPT AND ABOVE, FOLLOW PROCEDURE F20072.
 3.) PVC GLUE ALL NON THREADED PVC FITTINGS.
 4.) UNSCREW ELECTRICAL BOX OFF SOLENIOD, TAKE OUT EXISTING WIRES. CUT RED LEAD 16GA, WHITE LEAD 16GA. AND GREEN LEAD 16GA. WIRE AT 6' EACH (SEE BOM). STRIP OFF EACH WIRE AT 1/8" LENGTH, PLACE RED WIRE WHERE BLACK WIRE WAS, WHITE TO WHITE AND GREEN TO GREEN. SCREW ALL NEW WIRES BACK IN. SCREW ELECTRICAL BOX BACK ON SOLENIOD.

DIMENSIONS ARE REFERENCE ONLY.
 CUT PIPING, ARE ESTIMATE LENGTHS ONLY.

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TOLERANCES UNLESS OTHERWISE SPECIFIED		
FRACTION	TWO PLACE DECIMAL	THREE PLACE DECIMAL
±1/64	.010	.005
ANGULARITY: MACHINED ± 1/2° OTHER ± 1°		SURFACE FINISH $\sqrt{25}$
CONCENTRICITY: MAX. T.I.R. .005"		TOLERANCES TO F937.400

BREAK ALL SHARP EDGES AND REMOVE ALL BURRS

TITLE: WATER INLET PIPING ASSEMBLY, MM1200 A-CONTROL, PVC, 1"

DRAWING NUMBER: 556131-SA2

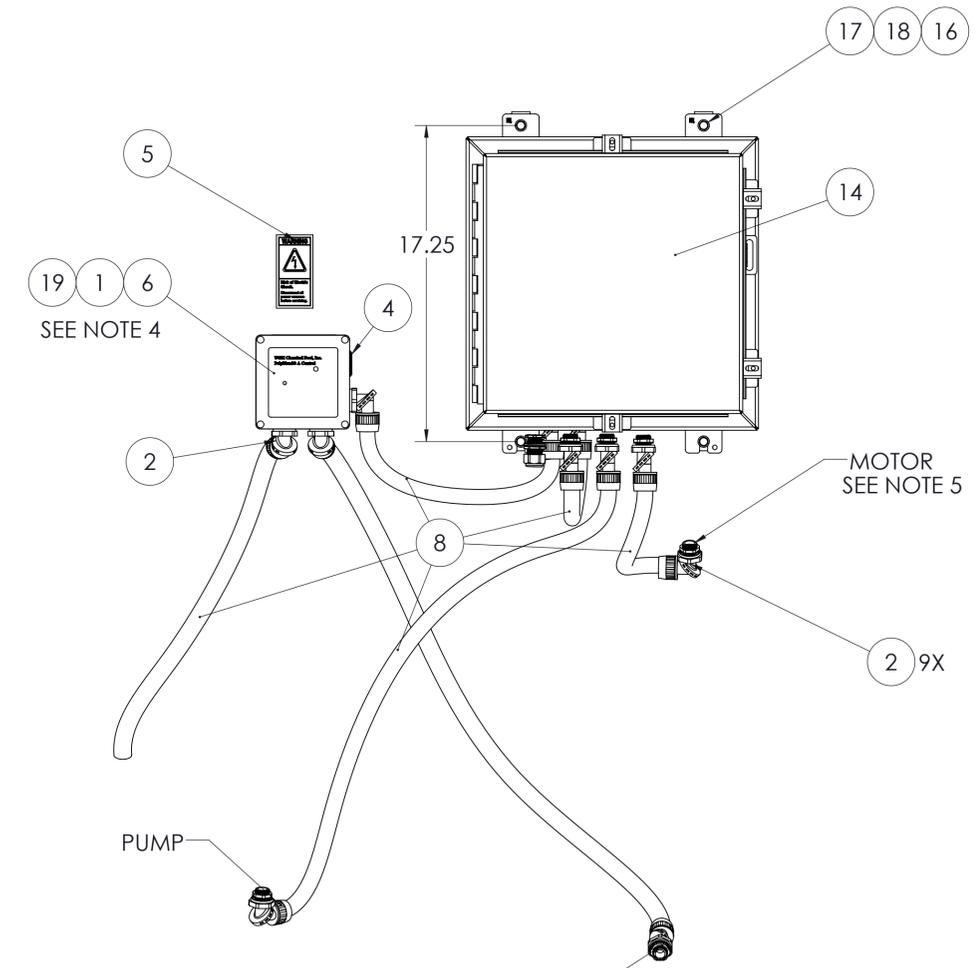
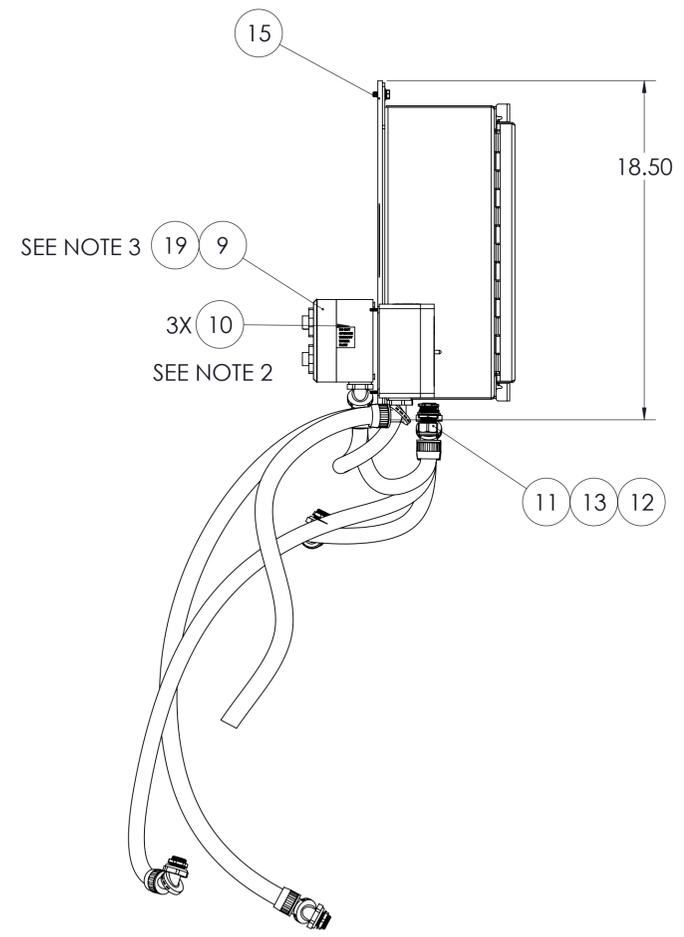
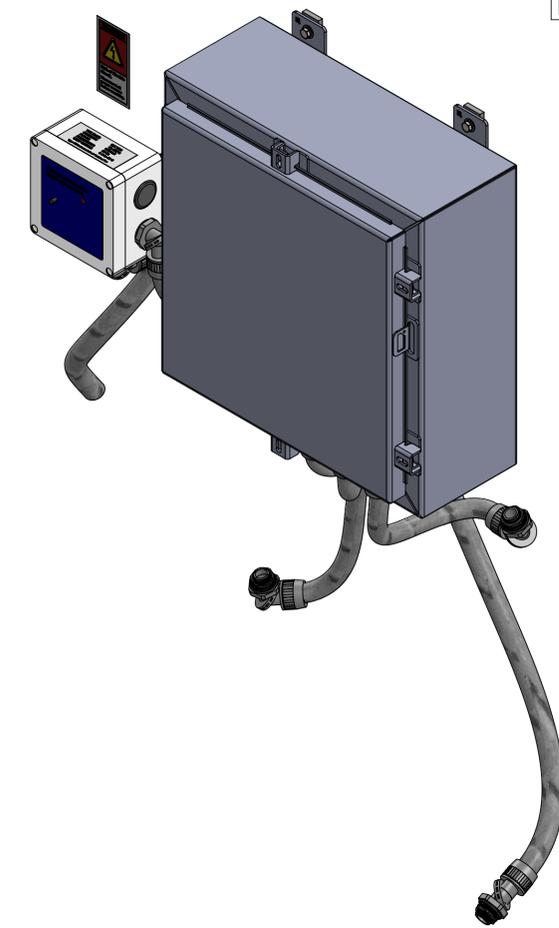
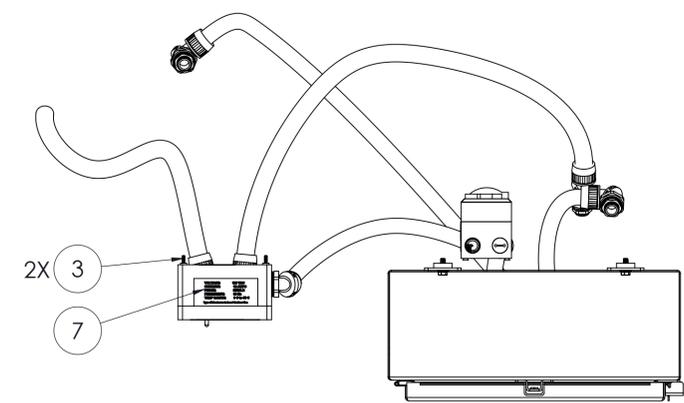
PROJECT NO.: 556131 CH'K: WM

DATE: 10-AUG-22 DR'N: MSM SCALE: 1:4

REV.: 1 PM: AG WEIGHT:

THIRD ANGLE PROJECTION SHEET: 1 OF 1 SIZE D

REVISIONS			
REV.	DESCRIPTION	DATE	BY



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	5130001	INHIBITOR, CORROSION, IMPREG.	1
2	2727590	1/2" FLEX CONDUIT CONNECTOR, HUBBELL	9
3	7770958	PHILLIPS PAN HD SCREW, #6-32 x 1/2" 316SS	2
4	6733018	PLUG, HOLE, KNOCKOUT W/SEAL COMP	1
5	5551364	LABEL, WARNING, ADH BACK, SHOCK	1
6	6389521	PANEL ASSY, ON-OFF-REMOTE (A CONTROL)	1
7	5559021	A-CONTROL VOLTAGE/AMP LABEL, M20-1200	1
8	RM2701081	1/2" ELECTRICAL CONDUIT	15 FT
9	1672030	JUNCTION BOX ASSEMBLY, SWITCH, REC. 2 CONNECTIONS	1
10	P47539	TERMINAL INSULATED SPADE, #8, 14-16 AWG, BLUE	3
11	2726564	CONNECTOR, CORD GRIP, 1/2" MPT	1
12	P12655	CONDUIT LOCK NUT, 1/2"	1
13	U22760	SEAL RING, CONDUIT, 1/2"	1
14	556131-SA50	CONTROL PANEL	1
15	RM8553002	1"x.25" THK 304SS STRAP, CUT TO FIT	2
16	1600312	HEX CAP SCREW, 1/4"-20 x 3/4", 316SS	4
17	9740300	1/4" SMALL OD FLAT WASHER, 316SS	4
18	9740315	LOCK WASHER, 1/4", 316SS	4
19	WIRE NUT	YELLOW WIRE NUT (NON-INVENTORY) #18 SIZE	2

- NOTES:
- 1.) WIRE LENGTHS - CUT ALL WIRES AS NEEDED.
 - 2.) THREE BLUE TERMINALS (ITEM 8) ARE USED INSIDE THE JUNCTION BOX.
 - 3.) ONE YELLOW WIRE NUT IS USED INSIDE THE JUNCTION BOX, TO TIE GROUND WIRES (SEE SCHEMATIC).
 - 4.) ONE YELLOW WIRE NUT IS USED INSIDE THE MOTOR CONTROL PANEL TO TIE THE GREEN GROUND WIRES TOGETHER. (SEE SCHEMATIC).
 - 5.) ONE YELLOW, ORANGE AND RED WIRE NUT ARE USED INSIDE MOTOR, TO CONNECT WIRES TO MOTOR WIRES.
 - 6.) FOLLOW ELECTRICAL SCHEMATIC (556131-SA50) FOR POINT TO POINT WIRING.
 - 7.) DRILL 3 HOLES (Ø .875) IN PANEL (556131-SA50) FOR CONDUIT CONNECTORS. SEE SECTION A-A FOR DETAIL.

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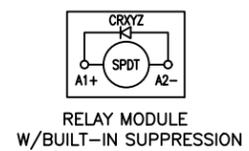
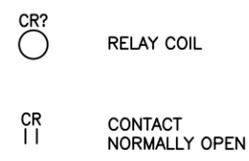
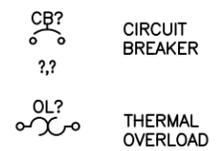
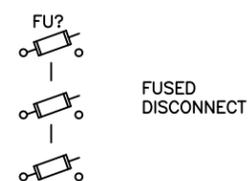
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TOLERANCES UNLESS OTHERWISE SPECIFIED		
FRACTION ±1/64	TWO PLACE DECIMAL .010	THREE PLACE DECIMAL .005
ANGULARITY: MACHINED ± 1/2° OTHER ±1°		SURFACE FINISH 125/
CONCENTRICITY: MAX. T.I.R. .005"		TOLERANCES TO F937.400
BREAK ALL SHARP EDGES AND REMOVE ALL BURRS		

TITLE: ELECTRICAL ASSEMBLY, MM1200/P-PUMP, A-CONTROL, 115V		
DRAWING NUMBER: 556131-SA5		
PROJECT NO.: 556131	CH'K: WM	
DATE: 10-AUG-22	DR'N: MSM	SCALE: 1:10
REV.: 1	PM: AG	WEIGHT:
THIRD ANGLE PROJECTION		SHEET: 1 OF 1

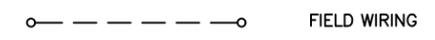
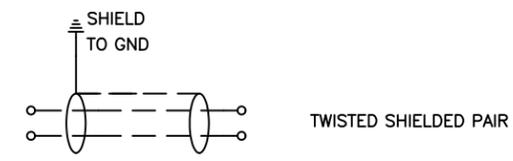
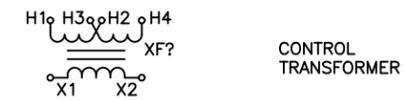
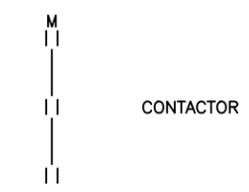
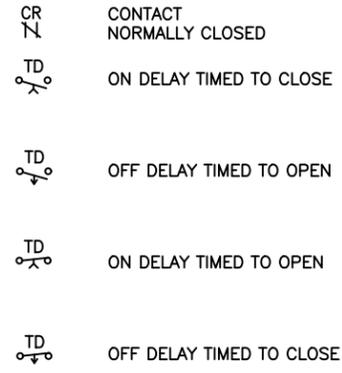
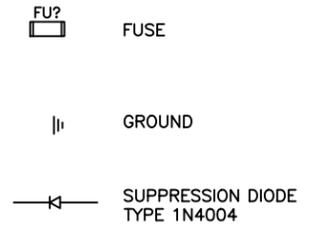
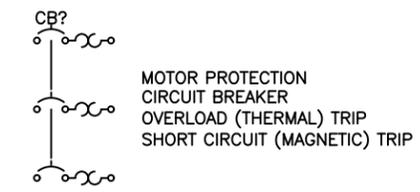
SYMBOL LEGEND



NOTES:

- XX = UGSI INTERCONNECTION TERMINALS.
 (XX) = COMPONENT TERMINALS.
 ■ = CUSTOMER CONNECTION TERMINALS.
 □ = JUNCTION BOX TERMINALS.
- DASHED LINES BETWEEN TERMINALS REPRESENT WIRING TO COMPONENTS NOT MOUNTED IN CONTROL PANEL.
- ALL POWER WIRING TO BE 14 AWG MINIMUM THWN OR MTW 90°C UNLESS OTHERWISE NOTED. ALL CONTROL WIRING TO BE 16 AWG THWN OR MTW 90°C UNLESS OTHERWISE NOTED.
- WIRE COLORS TO BE AS SHOWN IN TABLE, ALL NUMBERED AS SHOWN.

WIRE COLOR CODE	
AC POWER	BLACK
AC CONTROL	RED
AC NEUTRAL	WHITE
DC POSITIVE	BLUE
DC NEGATIVE	BLU/WHT
DRY CONTACT	ORANGE
GROUND	GREEN
4-20mA +	BLACK
4-20mA -	WHITE



DRAWING NUMBER	DRAWING TITLE	ISSUE DATE	REVISION DESCRIPTION					
			11/18/21	7/21/22	8/11/22	11/21/22	11/30/22	As Built
(Sheet 1)	Title Page		A	B	1	2	3	
(Sheet 2)	Electrical Schematic		A	B	1	2	3	
(Sheet 3)	Electrical Layout		A	B	1	2	3	
(Sheet 4)	Control Panel & Terminal Layout		A	B	1	2	3	
(Sheet 5)	Bill of Material and Nameplates		A	B	1	2	3	

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MATERIAL: .

TITLE:
INTRENCHMENT CREEK WPCP
EAST AREA WQCF
MM1200-P12AA-L

REV. 3 CHANGE No. DATE: 11/30/22

SCALE: N/A DRN: SPS CH'K: WDM

RELEASED: . ENG: . Q.A.: .

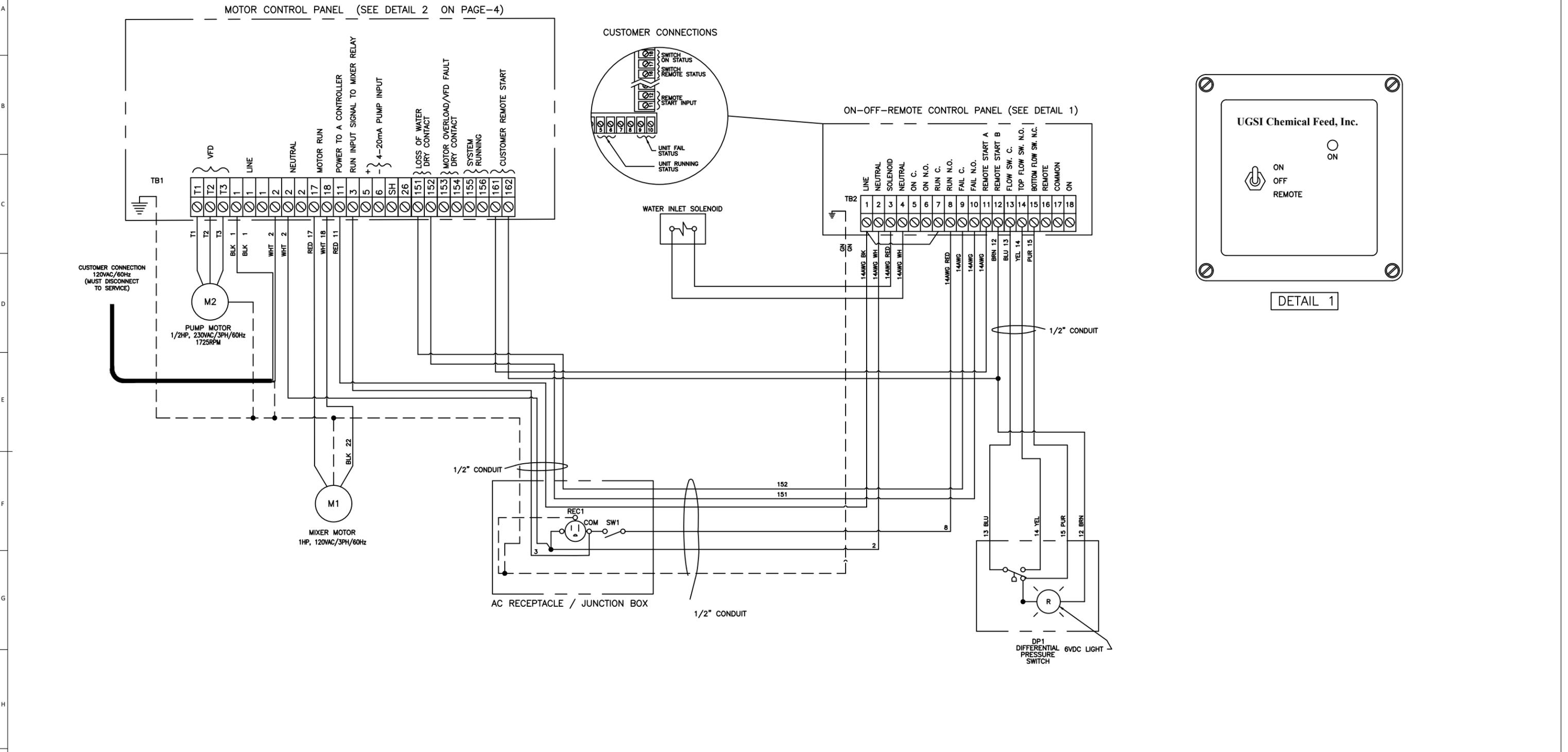
UGSI Chemical Feed, Inc.
 Vineland, NJ - USA - 856.896.2160
 www.ugsichemicalfeed.com

NUMBER: **556131-SA50**

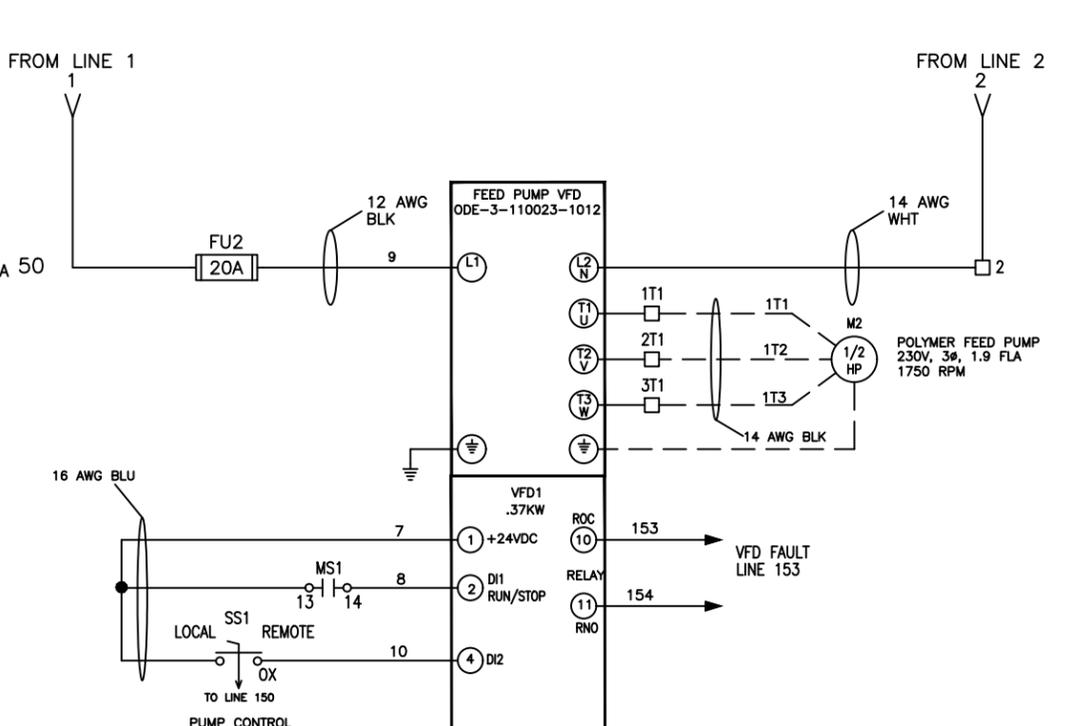
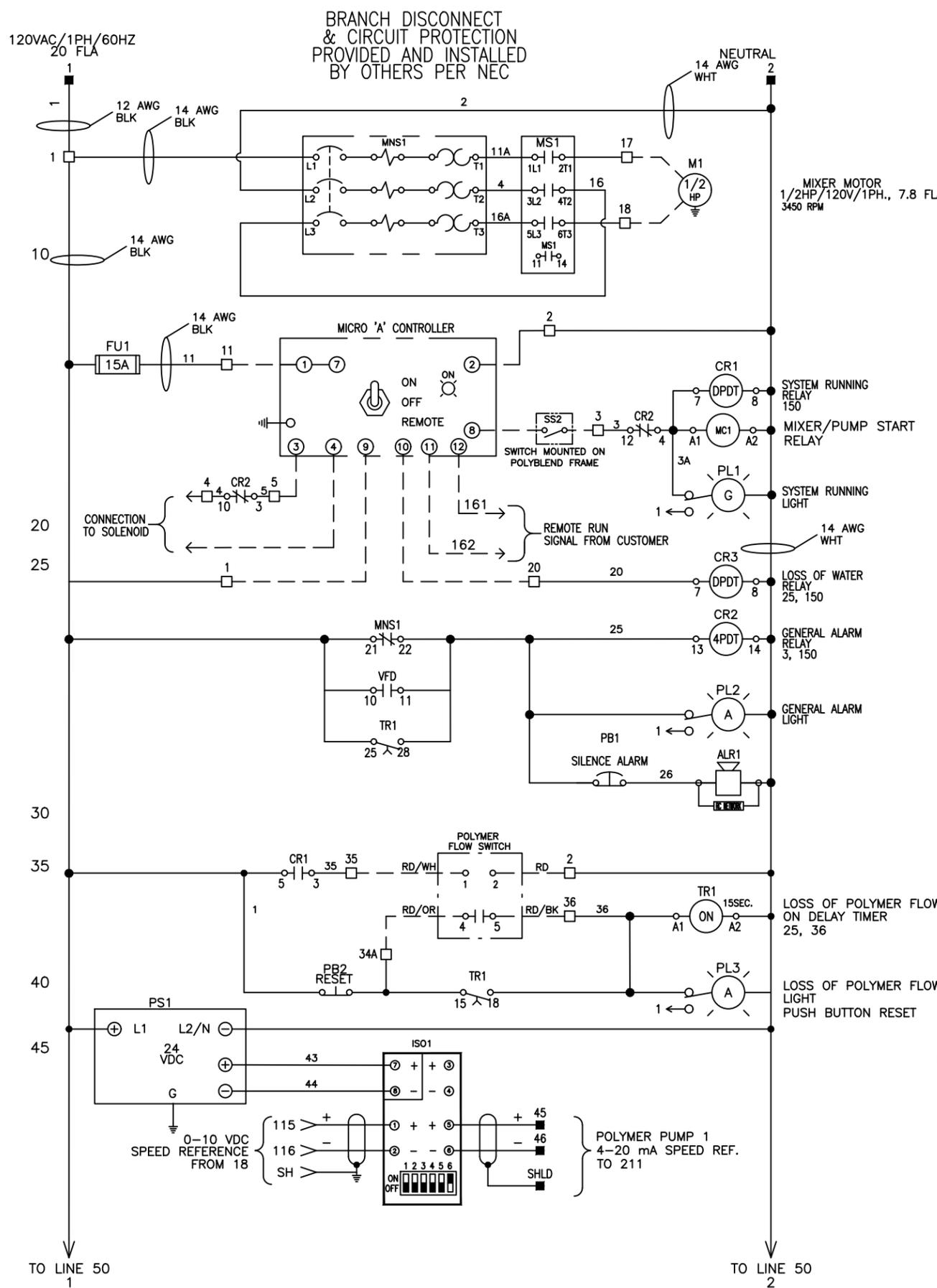
THIRD ANGLE PROJECTION

DESIGN CENTER: USA SHEET 1 OF 5

MODEL: . DWG: . TOLERANCES TO F937.400 D © 2021



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		REV. 3	CHANGE No.	DATE: 11/30/22
		SCALE: N/A	DRN: SPS	CH'K: WDM
RELEASED:	ENG:	Q.A.:		
UGSI Chemical Feed, Inc. Vineland, NJ - USA - 856.896.2160 www.ugsichemicalfeed.com		NUMBER: 556131-SA50		
THIRD ANGLE PROJECTION	DESIGN CENTER: USA	SHEET 2 OF 5		
MODEL: .	DWG.: .	TOLERANCES TO F937.400	D © 2021	

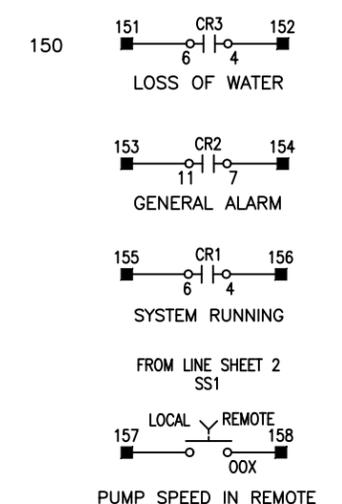


PUMP INVERTEK VFD PARAMETER SETTINGS (NON-DEFAULT VALUES)

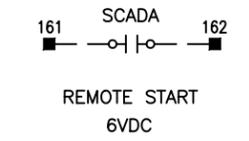
PARAMETER	SETTING	DESCRIPTION
P-01	60	MAXIMUM FREQUENCY
P-02	0	MINIMUM FREQUENCY
P-03	5.0 SEC	INCREASE RAMP
P-04	5.0 SEC	DECREASE RAMP
P-07	230	MOTOR RATED VOLTAGE
P-08	1.9	MOTOR FLA
P-09	60	MOTOR Hz
P-10	1750	MOTOR RATED SPEED (RPM)
P-12	2	COMMAND SOURCE
P-13	0	MODE
P-15	4	MACRO
P-16	r 4-20	ANALOG INPUT1
P-18	3	RELAY OUTPUT
P-20	0	PRESET SPEED 1
P-25	8	AO FUNCTION
P-31	3	KEYPAD START MODE
P-47	r 4-20	ANALOG INPUT2

REFER TO DRIVE MANUAL FOR A DESCRIPTION OF SETTINGS

CUSTOMER DRY CONTACTS
CONTACTS RATED AT 8 AMPS @ 120VAC. DISCONNECT AND BRANCH CIRCUIT PROTECTION PROVIDED AND INSTALLED BY OTHERS.



CUSTOMER WET CONTACTS

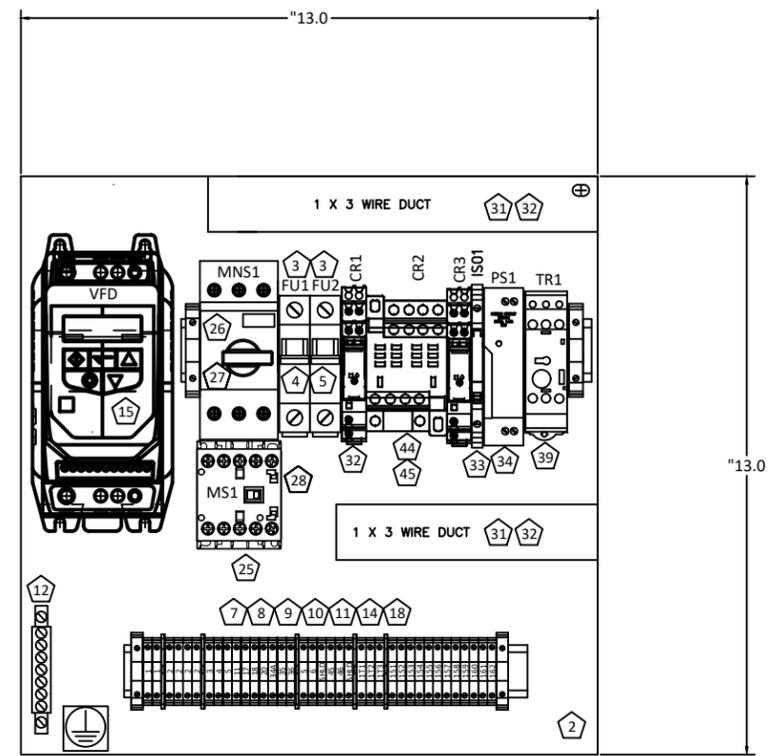
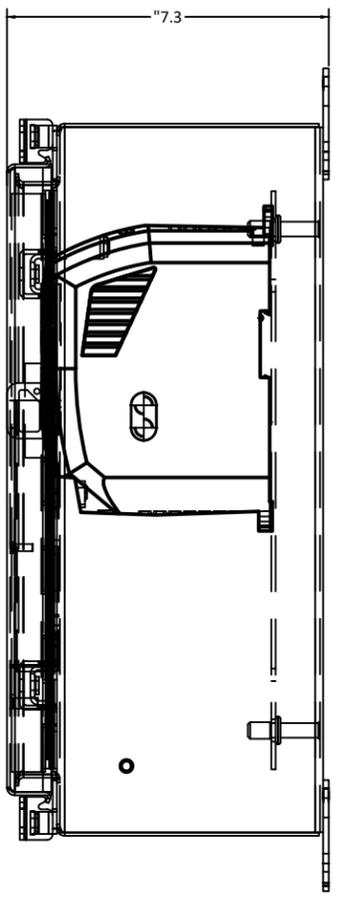
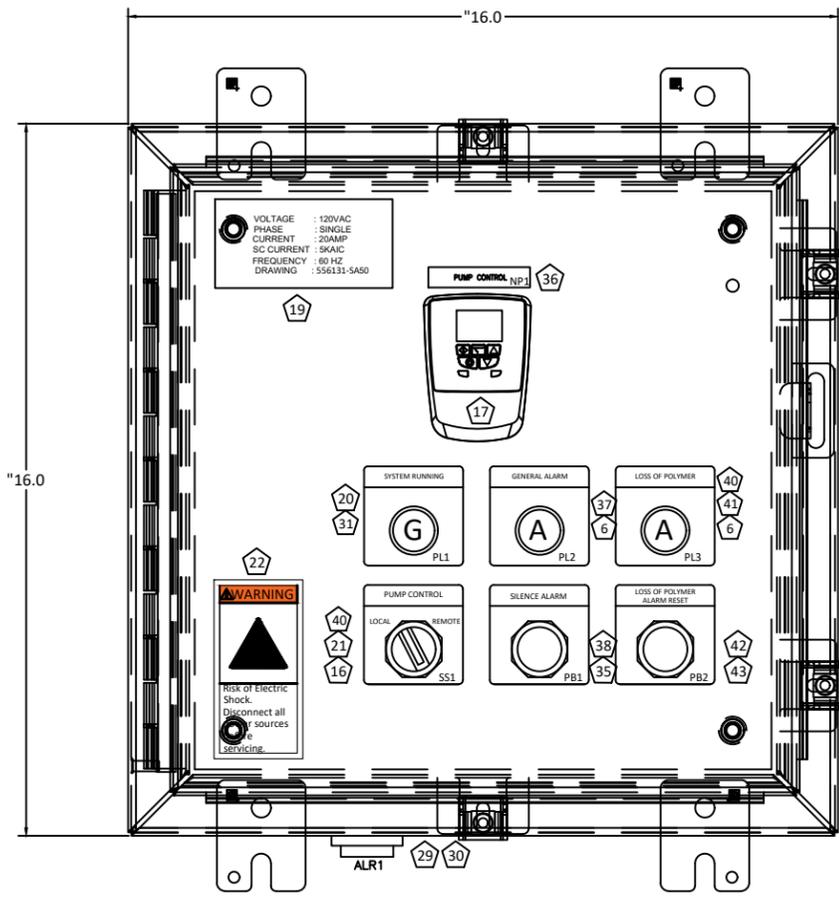


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MATERIAL:	-	-	-
TITLE:	INTRENCHMENT CREEK WPCP EAST AREA WQCF MM1200-P12AA-L		
REV:	3	CHANGE No.	DATE: 11/30/22
SCALE:	N/A	DRN:	SPS
RELEASED:		ENG:	
NUMBER:	556131-SA50		
DESIGN CENTER:	USA	SHEET 3 OF 5	
TOLERANCES:	F937.400	D	© 2021

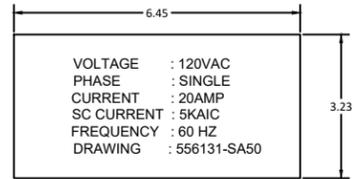
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www.ugsichemicalfeed.com



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
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		REV. 3	CHANGE No.	DATE: 11/30/22
		SCALE: N/A	DRN: SPS	CH'K: WDM
UGSI Chemical Feed, Inc. Vineland, NJ - USA - 856.896.2160 www.ugsichemicalfeed.com		NUMBER: 556131-SA50		
THIRD ANGLE PROJECTION		DESIGN CENTER: USA	SHEET 4 OF 5	
MODEL: .	DWG: .	TOLERANCES TO F937.400	D © 2021	

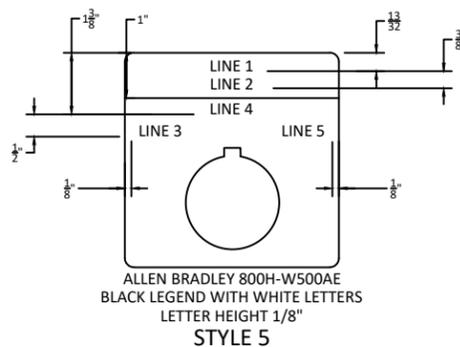
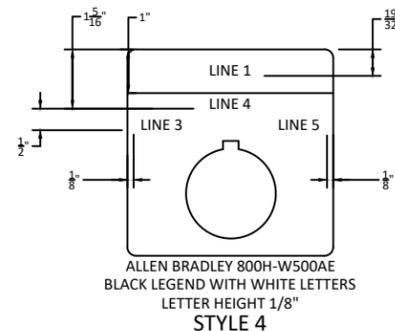
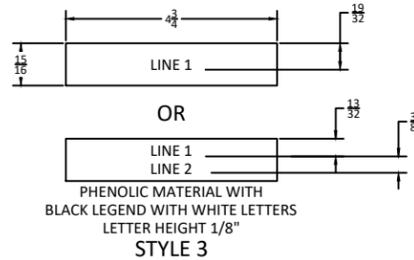
1 QTY. PART NO.
2" X 4", 0.125" TEXT



GLOSS BLACK WITH WHITE LETTERING

FUSE REPLACEMENT CHART			
COMP.	AMPS	TYPE	DESCRIPTION
FU1	15	Class CC	Branch Circuit Protection
FU2	20	Class CC	Branch Circuit Protection

LEGEND/NAMEPLATES			
LOCATION	INSCRIPTION		
	LINE 1	LINE 2	STYLE
	LINE 3	LINE 4	LINE 5
NP1	PUMP CONTROL		STYLE 3
SS1	PUMP CONTROL LOCAL	REMOTE	STYLE 4
PL1	SYSTEM RUNNING		STYLE 4
PL2	GENERAL ALARM		STYLE 4
PL3	LOSS OF POLYMER		STYLE 5
PB1	SILENCE ALARM		STYLE 4
PL2	LOSS OF POLYMER FLOW RESET		STYLE 5



NOTE : IF NOT SPECIFIED BY CUSTOMER, UGSI WILL SUPPLY STANDARD COMPONENTS. IF A COMPONENT IS NOT AVAILABLE AT THE TIME OF FABRICATION THEN, COMPONENT WILL BE SUBSTITUTED WITH AN "EQUAL" COMPONENT.

NINE MILE WWTP, CLERMONT-OH - M2400-P24-AA					
Bill of Materials					
No.	Qty.	Description	Manufacturer	Model No.	
1	1	Wallmount Hinged with NEMA Clamps Type 4X, 16x16x6, Brushed, SS 316	HOFFMAN	A16H1606SS6LP	3650054
2	1	Panel Size: 13.00 x 13.00 in	HOFFMAN	A16P16	6271028
3	2	1 Pole Class CC Finger-safe Fuse Holder	Littelfuse	LPSC001	4962010
4	1	15Amp 600V Class CC Time Delay Fuse	Littlefuse	KLDR015	4420578
5	1	6Amp 600V Class CC Time Delay Fuse	Littlefuse	KLDR006	4420544
6	2	Amber 30.5mm Type 4X PTT Pilot Light, LED, 12-130V AC/DC	Allen Bradley	800H-QRTH2A	5640079
7	25	Grey Terminal Block Type UK5N	Phoenix	3004362	8895025
8	4	Terminal End Anchors	Phoenix Contact	800886	8895011
9	50	Terminal Blank Marking Strips	Phoenix	1051003	AAD1946
10	1	10-Section Blank Terminal Marker Strip - 10 pcs.	Phoenix Contact	1051003	AAD1949
11	2	DIN Rail Angle Mounting Bracket	Phoenix	1201099	1692019
12	1	Grounding Bar with Screws	ILSCO	D167-10	5732004
13	1	3" x 1" x 6' Wireway with cover	Panduit	F1X3LG6	9391005
14	6	Single Tier End Section	Phoenix Contact	3047028	FD127125
15	1	VFD (Invertek OptiDrive E3) - 0.5 HP, 115 VAC 1Ø IN, 200-240 VAC 3Ø OUT, 4.3 A, IP20	INVERTEK	ODE-3-110023-1012	2803055
16	1	2-Position Selector Switch	Allen Bradley	800H-HR2A	8720102
17	1	Remote Keypad, Invertek Optidrive E3/P2/Eco with Multi-Language TFT Screen And 9' RJ45 Cable	INVERTEK	OPT-2-OPPAD-IN	5400015
18	1	DIN RAIL	Allen Bradley	199-DR1	7180001
19	1	2 X 4 X 0.125 TEXT LABEL (SEE LABEL)			556131-S55
20	1	Lable 30 mm - SYSTEM RUNNING			5559079
21	1	Lable 30 mm - PUMP SPEED CONTROL LOCAL / REMOTE			5559086
22	1	Label, Warning, Adhesive Backed		H6010-448WVPK	5551364
23	1	Label, Ground			5551251
24	1	Fuse Replacement Chart, 3"X5"			556131-S56
25	1	Motor Starter 22 Amp, 3-Pole , 120 Volt AC Coil, 1 N.O. AUX	WEG	CWC016-10-30V18	8420029
26	1	Motor Protector/Overload	WEG	MPW40-3-U016	2470134
27	1	Motor Protector/Overload AUX Contact	WEG	ACBF-11	8420031
28	1	Motor Contactor/Overload Mechanical Link	WEG	ECCMP-40B38	1470132
29	1	Enclosure Mounted Alarm Horn	Mallory-Sonalert	SC110N	FD0330109
30	1	Type 4X Gasket for Alarm Horn	Mallory-Sonalert	ACC03	FD0330110
31	1	Green 30.5mm Type 4X PTT Pilot Light, LED, 12-130V AC/DC	Allen Bradley	800H-QRTH2G	FD0291104
32	3	2-Pole Relay, 120 VAC	Finder	38.52.0.120.0060	FD0310287
33	1	Power Supply DC, 30 Watts	Phoenix	2902991	6922000
34	1	Signal Converter	Phoenix	2864176	2875500
35	1	Push Button, Push-Pull, Mushroom, 30mm, Red, NEMA 4X/13	Allen Bradley	800H-FX6D2	8720154
36	1	Lable 0.75 x 1.5 - PUMP CONTROL			5550033
37	1	Lable 30 mm - GENERAL ALARM			5559073
38	1	Lable 30 mm - SILENCE ALARM			5559120
39	1	On-Delay Time Delay Relay	Allen Bradley	700-FSA4UU23	7374003
40	2	NO-NC Contact Block	Allen Bradley	800T-XA	1470001
41	1	Lable 30 mm - LOSS OF POLYMER FLOW RESET			5559084
42	1	Lable 30 mm - LOSS OF POLYMER			5559116
43	1	Push Button, Momentary, Flush, 30mm, Black, NEMA 4X/13	Allen Bradley		8720111
44	1	4 Pole 120VAC 10A Control Relay	Allen Bradley	700-HF34A1	7374000
45	1	4 Pole Relay Socket	Allen Bradley	700-HN139	7374001

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		REV. 3	CHANGE No.	DATE: 11/30/22
		SCALE: N/A	DRN: SPS	CH'K: WDM
RELEASED:	ENG:	Q.A.:		
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