



**WICHITA PLANT #2
O&M**

PO#: 120038-005

Submitted to:

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Submitted by:

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Date Received: _____

- A – Approved
- B – Approved as Noted
- C – Partial Approval, Resubmit as needed
- D – Revise and Resubmit
- E – For Reference/No Acceptance

500 W. 5th Street, Kansas City, MO 64105
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Table of Contents

SUBMITTAL	DESCRIPTION
1	VeloDyne Polymer Blending Equipment



VeloBlend

Polymer Activation & Hydration Technologies

Operations & Maintenance Manual

February 04, 2021

Project: Wichita Plant 2

Equipment: VeloBlend Model: VM-15P-2400-D-0-A-1
Liquid Polymer Blending System

Quantity: 4

Sales Order Number: 6308

Serial Numbers: 1120-6308-3405
1120-6308-3406
1120-6308-3407
1120-6308-3408

VeloDyne Contact: Service Manager
Bob Dunkerson
303.530.3298 x205
bdunkerson@velodynesystems.com
www.velodynesystems.com

Manufacturer's Representative: Tim Hunt
Fluid Equipment
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1. System Information/Specifications

1.1 The VeloBlend VM Series Blending Technology

Applying high, non-damaging mixing energy to the polymer during the blending process has proven to optimize polymer performance. The VeloBlend VM series accomplishes this in two ways: first, by creating a high velocity water jet that impinges on the polymer as it is metered into the mixing chamber when high water pressure (30 psid or greater) is available. This high velocity water jet maintains high, non-damaging mixing energy over the full flow range as long as the differential pressure between the incoming water pressure and mixing chamber pressure remains high; secondly, when high water pressure is not available or to control the amount of mixing energy applied, the VeloBlend induces hydro-mechanical mixing energy through the specially designed, variable speed mixing impeller.

1.2 Information on Pressure, Differential Pressure and Pressure Loss

The VeloBlend VM Series is a hydro-mechanical device. Its mixing energy is derived from the pressure drop across its water control valve and through the specially designed mixing impeller. The pressure drop is measured by the inlet pressure minus the mixing chamber pressure.

NOTE: A 30 psid pressure (differential) is recommended as a minimum, even though the system will operate with differential pressures lower than this.

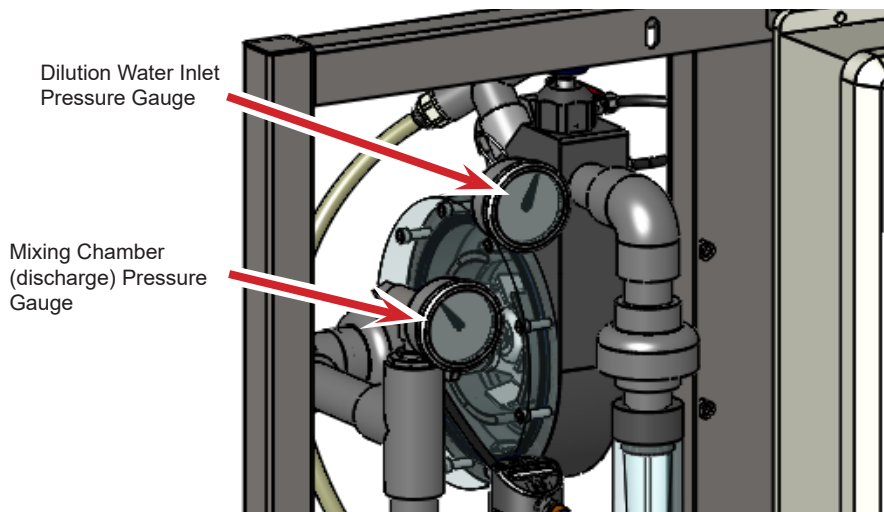
The higher the differential pressure the more mixing energy that is applied to the polymer.

Where does pressure come from?

Dilution water inlet pressure is the available pressure at the water control valve, after any pressure loss through pipes, fittings, and valves up stream of the polymer blending unit.

The mixing chamber pressure is the pressure down stream of the polymer blending unit. The pressure is a result of pressure drop through the polymer solution piping, valves and other devices, such as injection rings or sludge mixing valves, for example. It is also the pressure of the pipe or device the polymer is being injected into, such as a sludge pipe feeding a dewatering device or an influent pipe going to a clarifier.

In the case where polymer is being fed to an open-to-air diffuser or a tank, there may be little or no mixing chamber pressure.



1.3 Equipment Summary

PROJECT:	Wichita Plant 2
EQUIPMENT:	VeloBlend Model VM-15P-2400-D-0-A-1
QUANTITY:	4
CONTROLS:	Level D
SELECTOR SWITCHES:	System ON/OFF (reset)/REMOTE Ten-Turn Potentiometer—Metering Pump Control One-Turn Potentiometer—Mixer Speed Control
INDICATION LIGHTS:	System Running Indication Power ON Indication LED Display Metering Pump Rate Low Water Differential Pressure Alarm Low Polymer Flow Alarm
DISCRETE INPUTS:	Remote Start/Stop (discrete dry contact)
ANALOG INPUTS:	Pacing Signal Based on Process Flow (4-20mA)
DISCRETE OUTPUTS:	System Running (discrete dry contact) Remote Mode (discrete dry contact) Common Alarm (discrete dry contact)
ANALOG OUTPUTS:	None
FUNCTIONS / MODES:	ON—System Starts OFF—System Shuts-down REMOTE—System starts and stops when remote dry contacts are closed
MAXIMUM PRESSURE:	100psi
DILUTION WATER FLOW:	240 to 2400 GPH
POLYMER FLOW RANGE:	0.75 to 15 GPH

COMMONLY ORDERED PARTS		
ITEM	DESCRIPTION	QTY
182-0002	Pressure Gauge (0-160 psi), S.S., liquid filled	2
200-0047	Water Control Orifice	1
216-0150	Metering Pump Spare Parts Kit	1
221-0007	Mixing Chamber Mechanical Seal	1
248-0077	VeloCheck© Check Valve	1
221-0007	Mechanical Seal, Mixing Chamber	1
182-0081	Flow Meter, Rotameter	1

FOR ALL EQUIPMENT SERVICE REQUIREMENTS AND PART AVAILABILITY, CONTACT VELODYNE:

**VELOCITY DYNAMICS
543 SOUTH PIERCE AVENUE
LOUISVILLE, CO 80027
303.530.3298
WWW.VELODYNESYSTEMS.COM**

EQUIPMENT NAMEPLATE

VELODYNE

MODEL: VM-15P-2400-D-0-A-1
SERIAL NUMBER 1120-6308-3405

VELOCITY DYNAMICS, LLC. - LOUISVILLE, CO USA
FOR SERVICE CALL 303.530.3298

VELODYNE

MODEL: VM-15P-2400-D-0-A-1
SERIAL NUMBER 1120-6308-3406

VELOCITY DYNAMICS, LLC. - LOUISVILLE, CO USA
FOR SERVICE CALL 303.530.3298

VELODYNE

MODEL: VM-15P-2400-D-0-A-1
SERIAL NUMBER 1120-6308-3407

VELOCITY DYNAMICS, LLC. - LOUISVILLE, CO USA
FOR SERVICE CALL 303.530.3298

VELODYNE

MODEL: VM-15P-2400-D-0-A-1
SERIAL NUMBER 1120-6308-3408

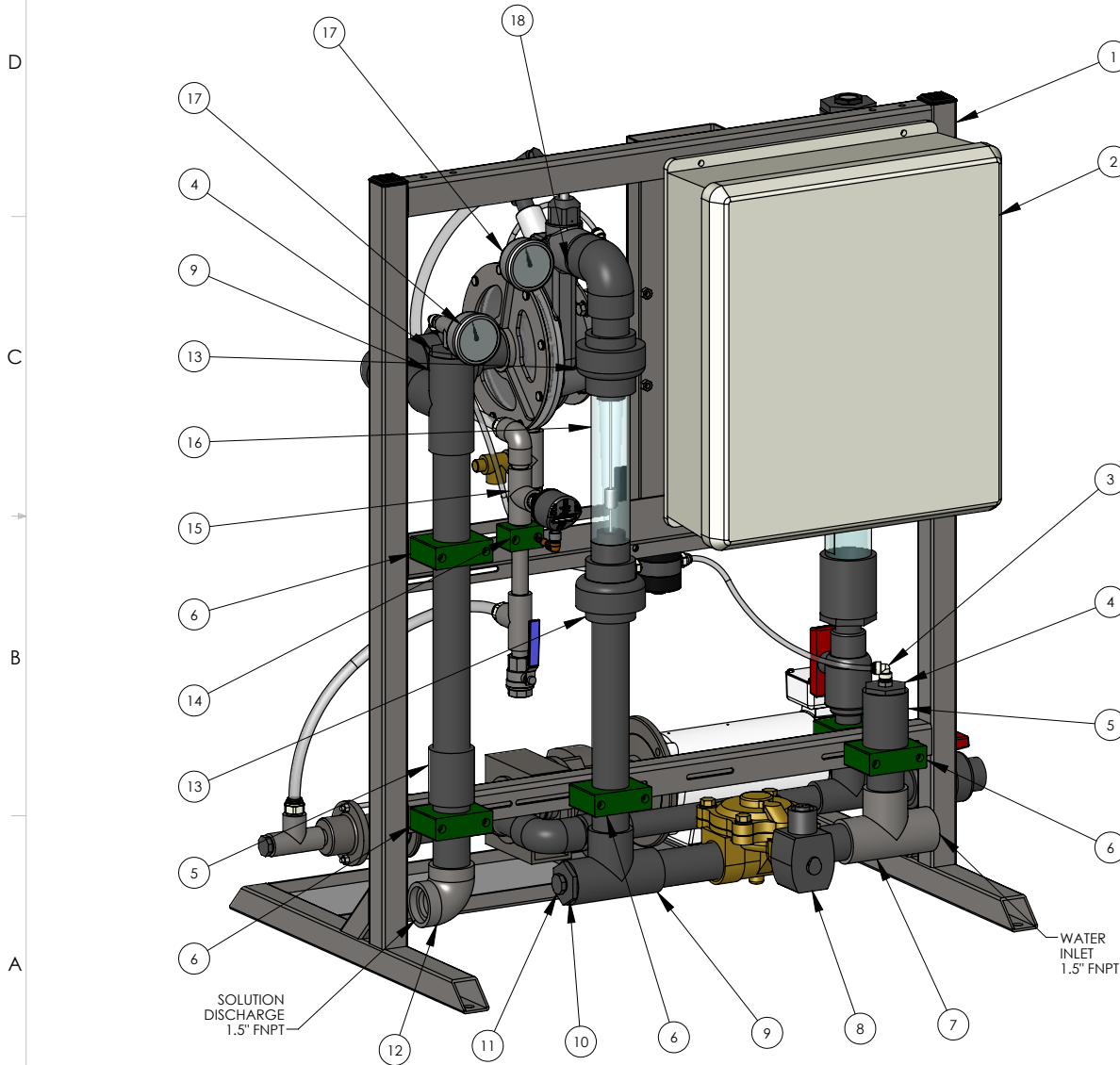
VELOCITY DYNAMICS, LLC. - LOUISVILLE, CO USA
FOR SERVICE CALL 303.530.3298

2. Mechanical

2.1 System Drawings

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REVISIONS				
REV	ECO	DESCRIPTION	DATE	APPROVED
A		INITIAL RELEASE	7/30/20	WBV



NOTES -

- 1) APPROXIMATE DRY WEIGHT 250 LBS
- 2) FOLLOW O&M PROCEDURES FOR DRAINING PRIOR TO STORAGE OR SHIPMENT
- 3) FRAME MATERIAL IS 304 SS AND HARDWARE IS 18-8 SS UNLESS OTHERWISE NOTED

ITEM #	NUMBER	DESCRIPTION	QTY
1	158-1353	FRAME, VELOBLEND, COMPACT, 3 SPAN, 18X16	1
2	120CP-DFRP12P	CTRL PNL, STND, D LEVEL	1
3	194-1326	ELBOW, 1/4" TUBE - 1/4 MNPT, PP	2
4	194-2392	REDUCER, BUSHING, 1.5" X 1/4", SXT, SR, SCH 80, PVC	2
5	194-0121	COUPLING, 1 1/2", SXS, SCH 80, PVC	2
6	194-0026	CLAMP, PIPE, 1.5", STAUFF	4
7	194-0485	TEE, 1 1/2" NPT, FEMALE, T X T X T, 304	1
8	248-0577	VALVE, SOLENOID, 1.5" FNPT, BRASS/NBR, 120 VAC, ASCO	1
9	194-0315	TEE, 1.5" SOC, SCH 80, PVC	2
10	194-1011	REDUCER, BUSHING, 1.5" X 1/2", SXT, SCH 80, PVC	1
11	194-0407	PLUG, 1/2", T, SCH 80, PVC	3
12	194-0256	ELBOW, 90, 1.5", TXT, SCH 80, 304	1
13	194-1156	UNION, 1.5", SXT, PVC/VITON	2
14	194-0029	CLAMP, PIPE, 1/2", STAUFF	1
15	182-0462	SENSOR ASSY, FLOW, THERMAL, SI5006, AC, 1/2"	1
16	182-0081	FLOW METER, ROTAMETER, 40 GPM, 1.5" MNPT, ACRYLIC	1
17	182-0002	GAUGE, PRESSURE, 2.5", 160 PSI, SS/BRASS, 1/4" MNPT, BACK MNT, GLYCERINE FILL	2
18	194-0137	ELBOW, 90 DEG, 1 1/2" SOC, PVC	2

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
DECIMALS ANGLES
.XX = ±0.15 ± 1°
.XXX = ±0.005
63 / MINIMUM
FILET RADI TO BE .005 MAXIMUM
BREAK ALL EDGES .005/.010
MATERIAL

CAD GENERATED DRAWING, INTERPRET
DRAWING PER ASME Y14.5M - 2009
APPROVALS DATE
MODELED WBV 7/30/2020
DRAWN WBV 7/30/2020
PROJECT MGR
PURCHASING MGR
QUAL ENG

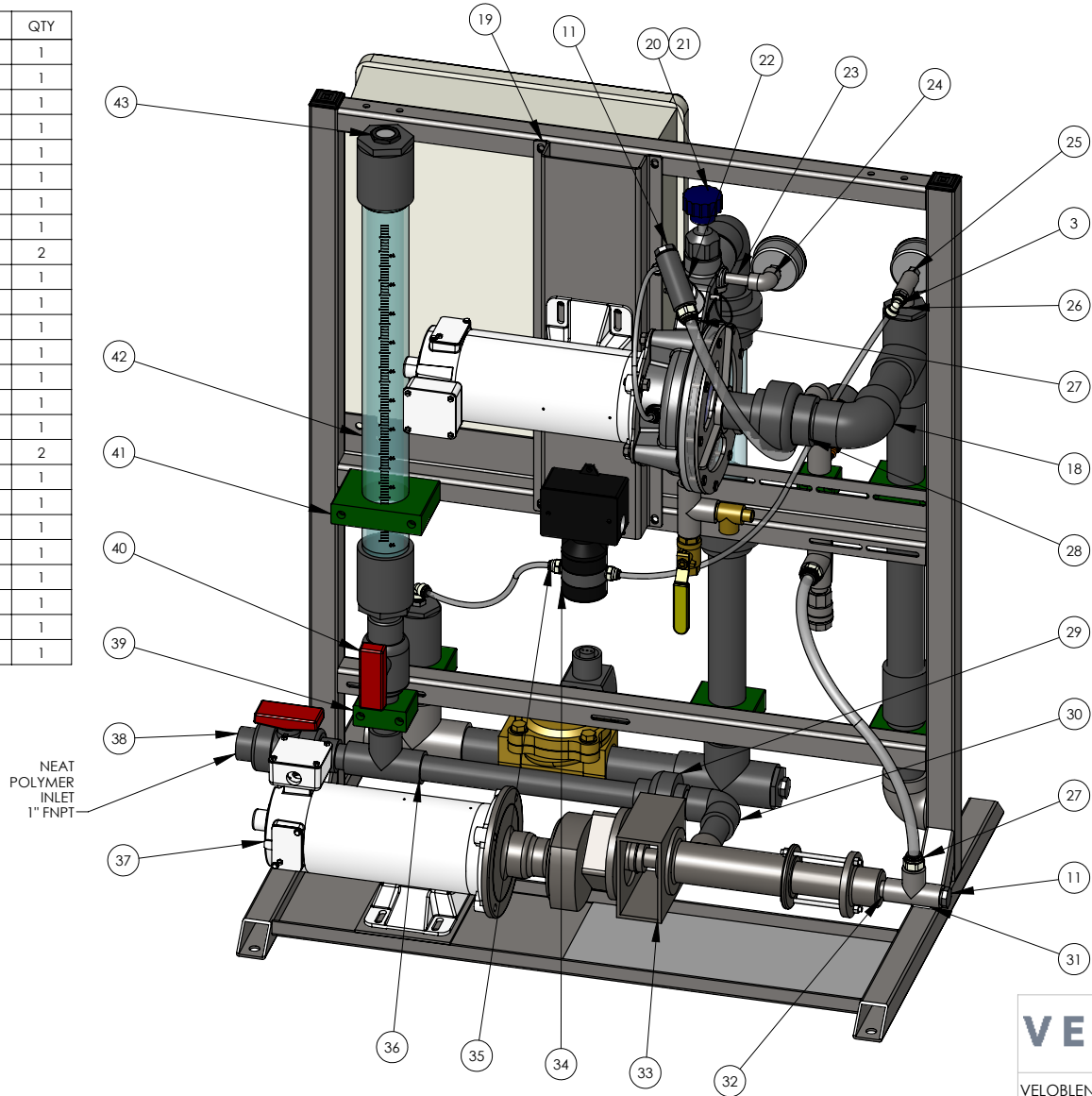


VELOBLEND, MECH MIX, 15 GPH POLY,
40 GPM H2O, D CTRL, 120V, COMPACT

SIZE DWG. NO. REV. A
B 120VB-15P240D0A1
SCALE 1:6 CAD FILE: SHEET 1 OF 3

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ITEM #	NUMBER	DESCRIPTION	QTY
19	158-0426	BRACKET, MIXER MOUNT, VELOBLEND, UNIVERSAL	1
20	200-0399	VELOBLEND, 6", ACTIVE, CF16F, 1/2 HP, 90VDC	1
21	200-0047	ORIFICE, THROTTLE VALVE, .545", 40 GPM, 6" BLENDER	1
22	194-0304	TEE, 1/2", T X T X T, SCH 80, PVC	1
23	194-0634	NIPPLE, 1/4" X 2.00 L, 304	1
24	194-0055	ELBOW, 90, 1/4", TXT, 304	1
25	194-0587	TEE, 1/4", T X T X T, 304	1
26	194-0023	NIPPLE, 1/4" X CLOSE, 304	1
27	194-0638	ADAPTER, 1/2" TUBE - 1/2 MNPT, ACETAL	2
28	194-0089	UNION, 1.5", SXS, PVC/VITON	1
29	194-0642	UNION, 1", SXS, PVC/VITON	1
30	194-0621	ELBOW, 90, 1", S X S, SCH 80, PVC	1
31	194-0021	TEE, 1/2" FNPT, 304	1
32	194-0049	NIPPLE, 1/2" X CLOSE, 304	1
33	215-0127	PUMP, PROG CAV, .75 - 15 GPH, 5:1, SS/VITON	1
34	182-0272	SWITCH, PRESSURE DIFF, ASHCROFT, D4-24-B-60PSI	1
35	194-0641	ADAPTER, 1/4" TUBE - 1/4 MNPT, ACETAL	2
36	194-0314	TEE, 1" SOC, SCH 80, PVC	1
37	191-0001	MOTOR, 1/2 HP, 1750 RPM, 90 VDC, 56 C, WASH DOWN	1
38	248-0004	VALVE, BALL, 1" SOC - 1" FNPT, TRUE UNION, PVC/VITON	1
39	194-0027	CLAMP, PIPE, 1", STAUFF	1
40	248-0012	VALVE, BALL, 1" SOC, COMPACT, PVC/VITON	1
41	194-0025	CLAMP, PIPE, 2", STAUFF	1
42	110-0004	CALIBRATION COLUMN, 1000 ML, 1" FNPT	1
43	194-1976	VENT, BREATHER, POLYPROPYLENE, 1" MNPT	1

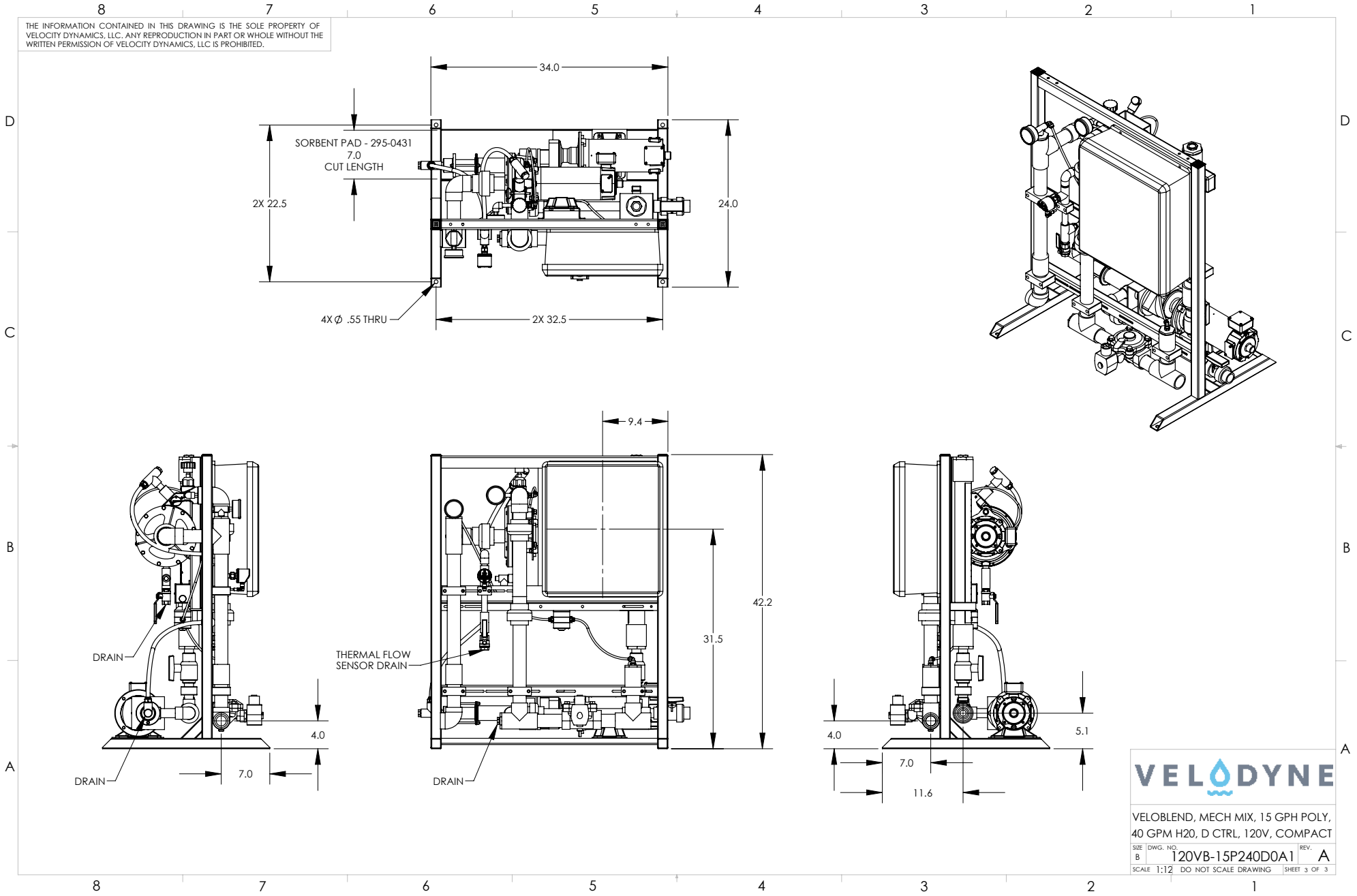


VELOCITY DYNAMICS

VELOBLEND, MECH MIX, 15 GPH POLY,
40 GPM H2O, D CTRL, 120V, COMPACT

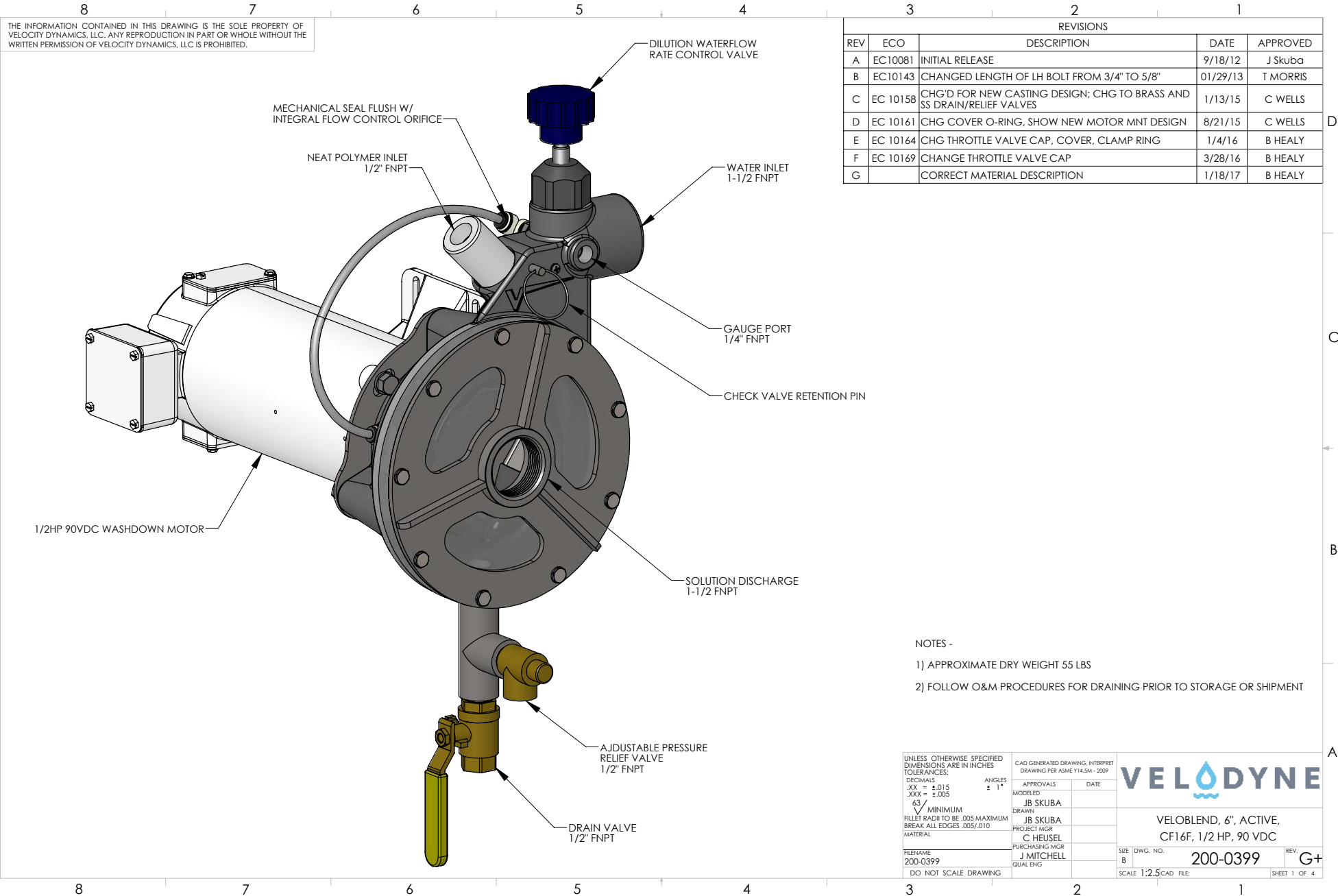
SIZE DWG. NO. REV.
B 120VB-15P240DA1 A
SCALE 1:8 DO NOT SCALE DRAWING SHEET 2 OF 3

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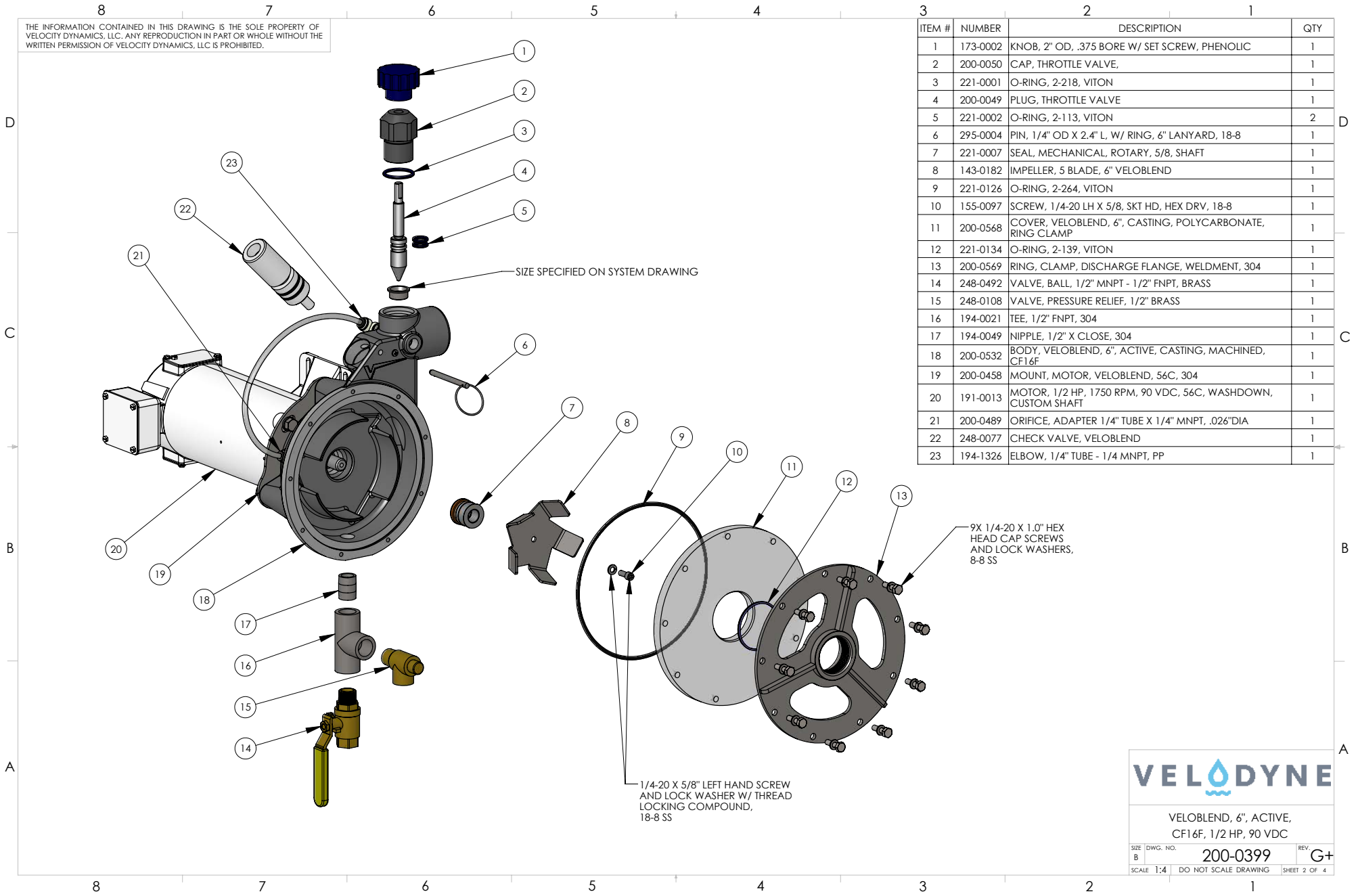


VELOBLEND, MECH MIX, 15 GPH POLY,
 40 GPM H2O, D CTRL, 120V, COMPACT
 SIZE DWG. NO. REV.
 B 120VB-15P240D0A1 A
 SCALE 1:12 DO NOT SCALE DRAWING SHEET 3 OF 3

2.2 Mixing Chamber



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ITEM #	NUMBER	DESCRIPTION	QTY
1	173-0002	KNOB, 2" OD, .375 BORE W/ SET SCREW, PHENOLIC	1
2	200-0050	CAP, THROTTLE VALVE,	1
3	221-0001	O-RING, 2-218, VITON	1
4	200-0049	PLUG, THROTTLE VALVE	1
5	221-0002	O-RING, 2-113, VITON	2
6	295-0004	PIN, 1/4" OD X 2.4" L, W/ RING, 6" LANYARD, 18-8	1
7	221-0007	SEAL, MECHANICAL, ROTARY, 5/8, SHAFT	1
8	143-0182	IMPELLER, 5 BLADE, 6" VELOBLEND	1
9	221-0126	O-RING, 2-264, VITON	1
10	155-0097	SCREW, 1/4-20 LH X 5/8, SKT HD, HEX DRV, 18-8	1
11	200-0568	COVER, VELOBLEND, 6", CASTING, POLYCARBONATE, RING CLAMP	1
12	221-0134	O-RING, 2-139, VITON	1
13	200-0569	RING, CLAMP, DISCHARGE FLANGE, WELDMENT, 304	1
14	248-0492	VALVE, BALL, 1/2" MNPT - 1/2" FNPT, BRASS	1
15	248-0108	VALVE, PRESSURE RELIEF, 1/2" BRASS	1
16	194-0021	TEE, 1/2" FNPT, 304	1
17	194-0049	NIPPLE, 1/2" X CLOSE, 304	1
18	200-0532	BODY, VELOBLEND, 6", ACTIVE, CASTING, MACHINED, CF16F	1
19	200-0458	MOUNT, MOTOR, VELOBLEND, 56C, 304	1
20	191-0013	MOTOR, 1/2 HP, 1750 RPM, 90 VDC, 56C, WASHDOWN, CUSTOM SHAFT	1
21	200-0489	ORIFICE, ADAPTER 1/4" TUBE X 1/4" MNPT, .026" DIA	1
22	248-0077	CHECK VALVE, VELOBLEND	1
23	194-1326	ELBOW, 1/4" TUBE - 1/4 MNPT, PP	1

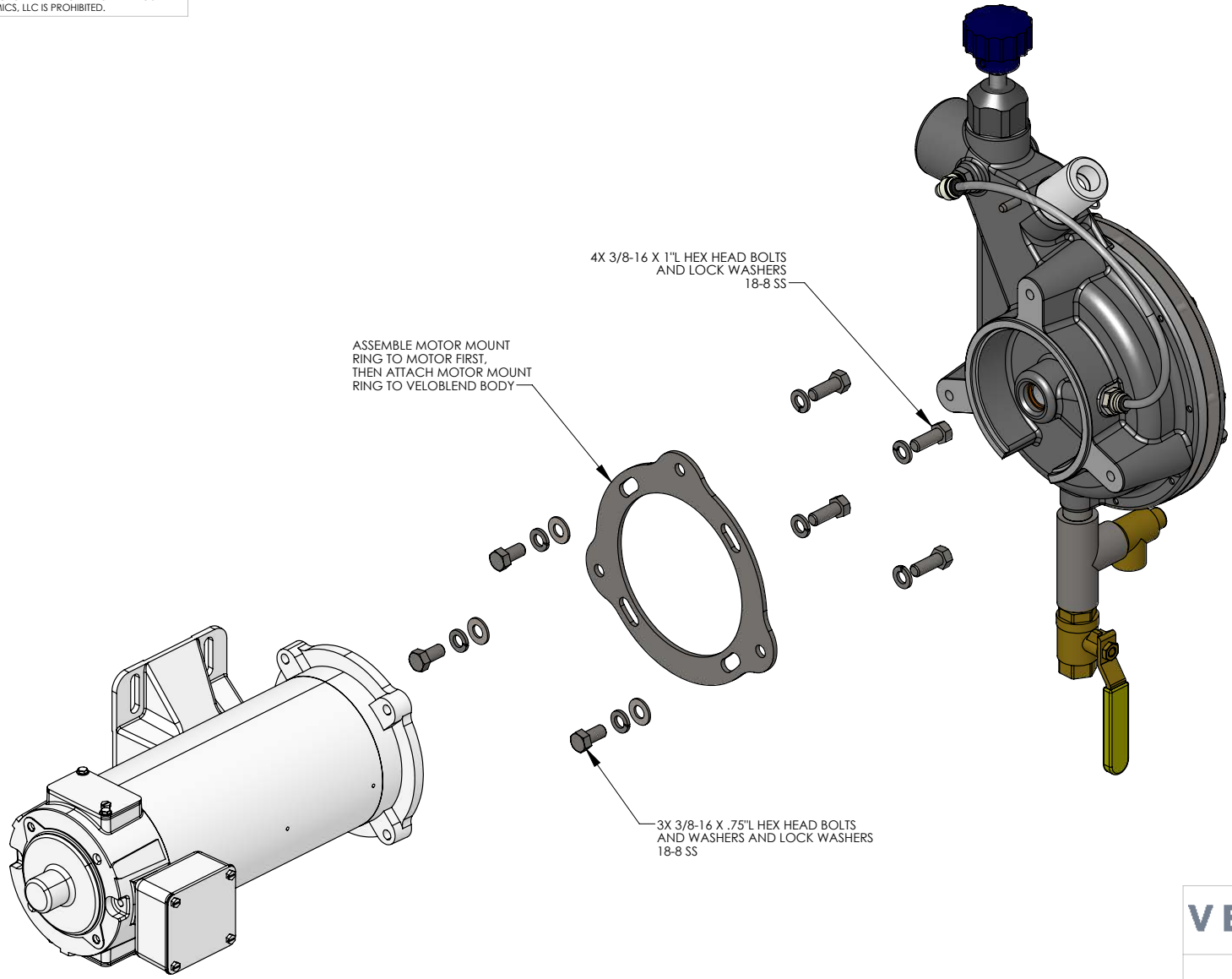
VELODYNE

VELOBLEND, 6", ACTIVE,
CF16F, 1/2 HP, 90 VDC

SIZE DWG. NO. **200-0399** REV. **G+**

SCALE 1:4 DO NOT SCALE DRAWING SHEET 2 OF 4

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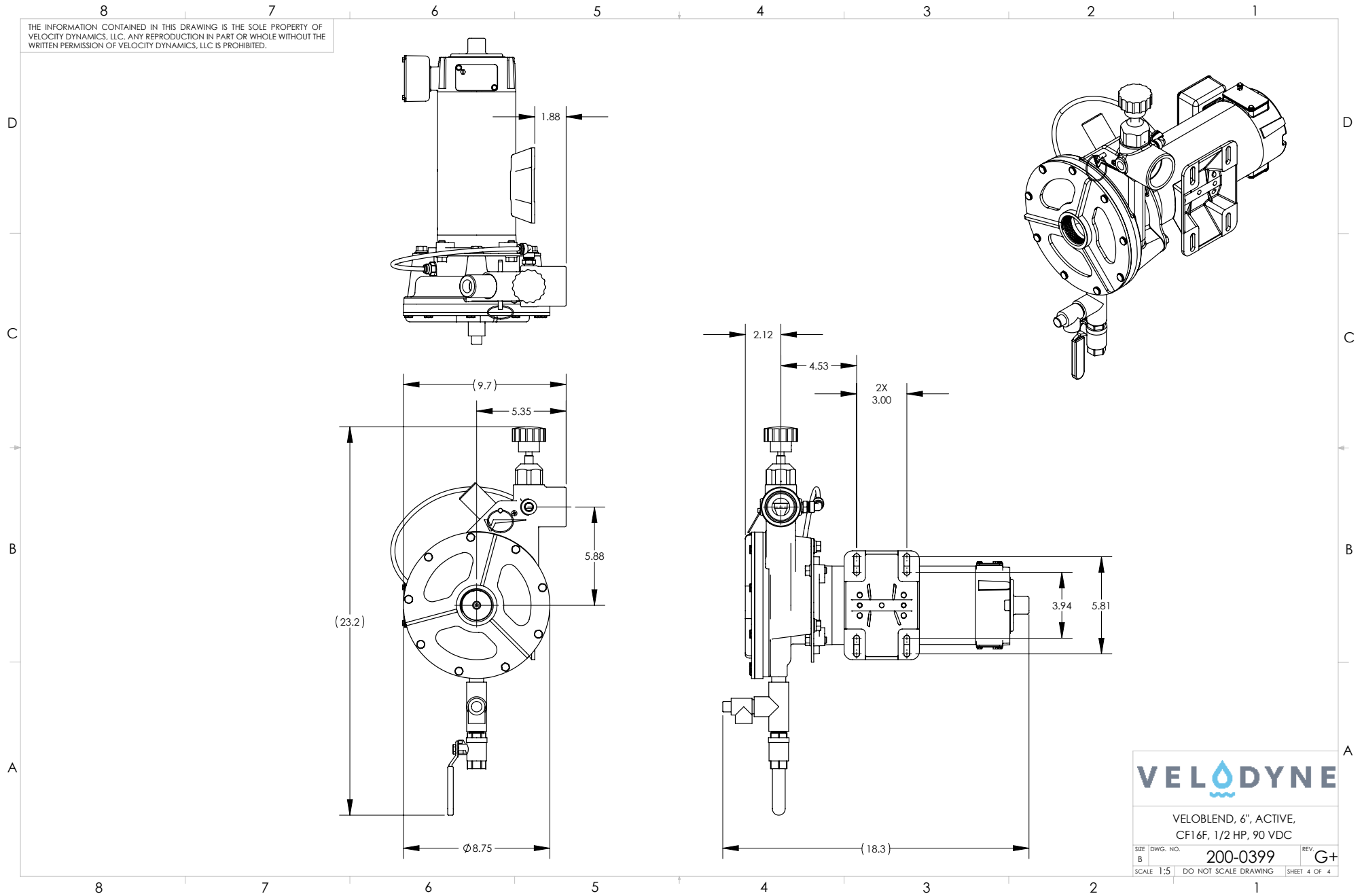


VELOBLEND, 6", ACTIVE,
CF16F, 1/2 HP, 90 VDC

SIZE	DWG. NO.	REV.
B	200-0399	G+

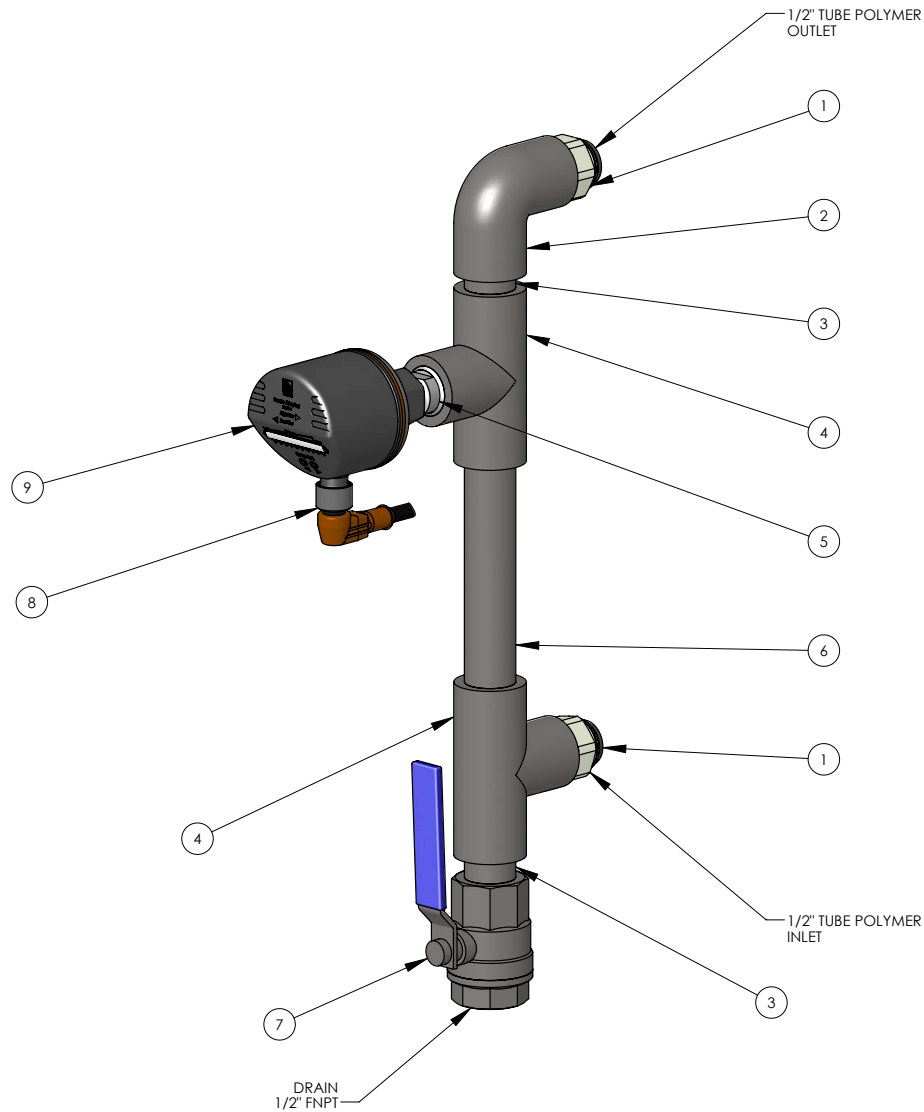
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2.3 Assembly, Thermal Flow Sensor

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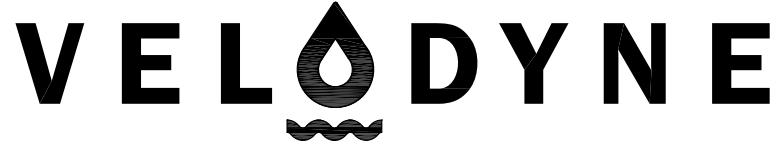
E				
REV	ECO	DESCRIPTION	DATE	APPROVED
A		INITIAL RELEASE	4/23/14	C WELLS
B		CORRECT BOM TO AC SENSOR	5/21/14	C WELLS
C		ELBOWS CHANGED TO STAINLESS STEEL	6/29/15	B HEALY
D		ADDED DRAIN VALVE	2/24/16	B HEALY
E		ADJUSTED NIPPLE LENGTH	4/6/18	WBV
F		CHANGED VALVE TO FULL PORT	4/13/18	WBV

ITEM #	NUMBER	DESCRIPTION	QTY
1	194-0638	ADAPTER, 1/2" TUBE - 1/2 MNPT, ACETAL	2
2	194-0034	ELBOW, 90, 1/2", TXT, 304	1
3	194-0049	NIPPLE, 1/2" X CLOSE, 304	2
4	194-0021	TEE, 1/2" FNPT, 304	2
5	182-0068	ADAPTER, THERMAL FLOW SENSOR, 1/2" MNPT	1
6	194-0877	NIPPLE, 1/2" X 4.50 L, 304	1
7	248-0730	VALVE, BALL, 1/2" FNPT, 304, FULL PORT	1
8	182-0125	CABLE, IFM, 1/2" RIGHT ANGLE, 4M, 5 WIRE, AC	1
9	182-0012	SENSOR, FLOW, THERMAL, SI5006 AC	1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: DECIMALS .XX = ±.015 .XXX = ±.005 ANGLES ± 1° 63° MINIMUM FILLET RADI TO BE .005 MAXIMUM BREAK ALL EDGES .005/.010 MATERIAL	CAD GENERATED DRAWING. INTERPRET DRAWING PER ASME Y14.5M - 2009 APPROVALS DATE C WELLS 4/23/2014 C WELLS 4/23/2014 PROJECT ARCH C HEUSEL 4/23/2014 PURCHASING MGR D RICARDO 4/23/2014 QUAL ENG	VELOCITY DYNAMICS
FILENAME: 182-0462 DO NOT SCALE DRAWING	SIZE DWG. NO. 182-0462 SCALE 1:2 CAD FILE:	SENSOR ASSY, FLOW, THERMAL, SI5006, AC, 1/2"
	REV. F+	SHEET 1 OF 1

3. Electrical

3.1 Control Panel



543 SOUTH PIERCE AVE.
LOUISVILLE, CO
PHONE: 303-530-3298 / FAX: 303-530-3368

VELOBLEND LIQUID POLYMER SYSTEM VM-xP-D-0-A-1
DRAWING NUMBER: 120CP-DFRP12P

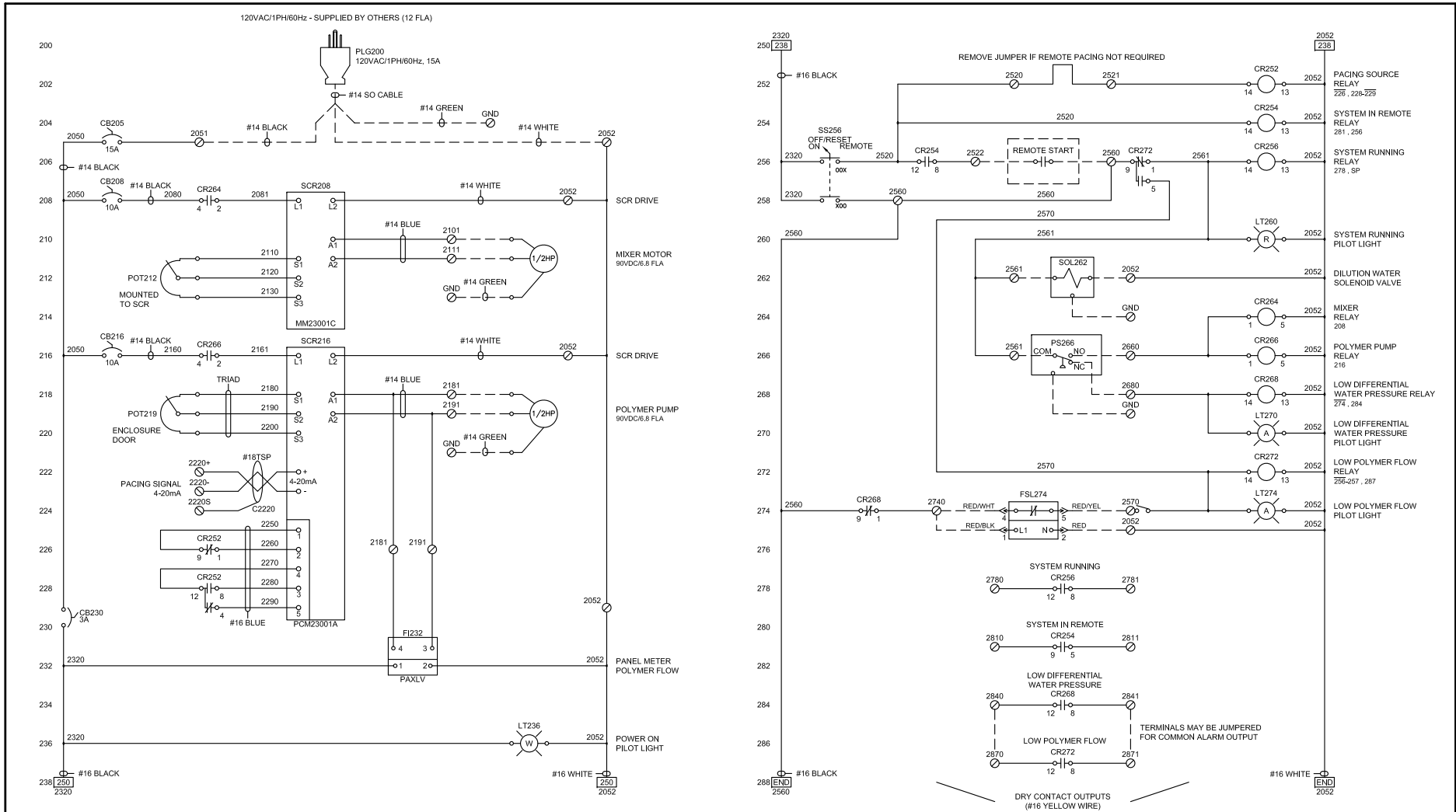
TABLE OF CONTENTS		
SHEET #	DRAWING #	SHEET DESCRIPTION
SHEET 1	120CP-DFRP12P	TITLE PAGE & NOTES
SHEET 2	120CP-DFRP12P	120VAC POWER & CONTROL CIRCUITS
SHEET 3	120CP-DFRP12P	LAYOUT & DETAIL
SHEET 4	120CP-DFRP12P	BILL OF MATERIAL

NOTES:

1. VELODYNE TO PROVIDE ONLY THOSE ITEMS EXPRESSLY NOTED ON THESE DRAWINGS.
2. WIRE NUMBERS CORRESPOND TO TERMINAL NUMBERS.
3. DASHED LINES REPRESENTS WIRES TERMINATED IN THE FIELD AND/OR FIELD COMPONENTS.
4. ALL WIRE TO BE MTW TYPE INSIDE CONTROL ENCLOSURES.
5. ALL WIRES (INTERNAL & EXTERNAL) TO BE LABELED AT EACH TERMINATION POINT.
6. ALL FIELD WIRING TO BE THHN TYPE UNLESS OTHERWISE NOTED.
7. ALL CONDUIT TO BE RIGID GALVANIZED STEEL AND/OR NON-METALIC LIQUIDTIGHT FLEX WITH STAINLESS STEEL HANGERS & HARDWARE.

<p>VELOCITY DYNAMICS, LLC 543 SOUTH PIERCE AVE. LOUISVILLE, CO 80027 P: 303-530-3298 WWW.VELODYNESYSTEMS.COM</p>	<p>** NOTICE **</p> <p>THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF VELOCITY DYNAMICS, LLC. ANY REPRODUCTION IN PART OR IN WHOLE WITHOUT WRITTEN PERMISSION OF VELOCITY DYNAMICS, LLC IS PROHIBITED</p>					<p>VELOBLEND LIQUID POLYMER SYSTEM VM-P-D-0-A-1</p> <p>LOCAL CONTROL PANEL TITLE PAGE & NOTES</p>																					
		<table border="1"> <thead> <tr> <th>NO.</th> <th>REVISION DESCRIPTION</th> <th>DATE</th> <th>BY</th> <th>CHK'D</th> <th>DATE</th> <th>DRFTR</th> <th>SHEET</th> <th>DRAWING NUMBER</th> <th>REV</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>INITIAL RELEASE</td> <td>06/5/20</td> <td>TH</td> <td></td> <td>06/5/20</td> <td>TH</td> <td>1 OF 4</td> <td>120CP-DFRP12P</td> <td>A</td> </tr> </tbody> </table>				NO.	REVISION DESCRIPTION	DATE	BY	CHK'D	DATE	DRFTR	SHEET	DRAWING NUMBER	REV	A	INITIAL RELEASE	06/5/20	TH		06/5/20	TH	1 OF 4	120CP-DFRP12P	A		
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A	INITIAL RELEASE	06/5/20	TH		06/5/20	TH	1 OF 4	120CP-DFRP12P	A																		

3.2 Electrical Schematic



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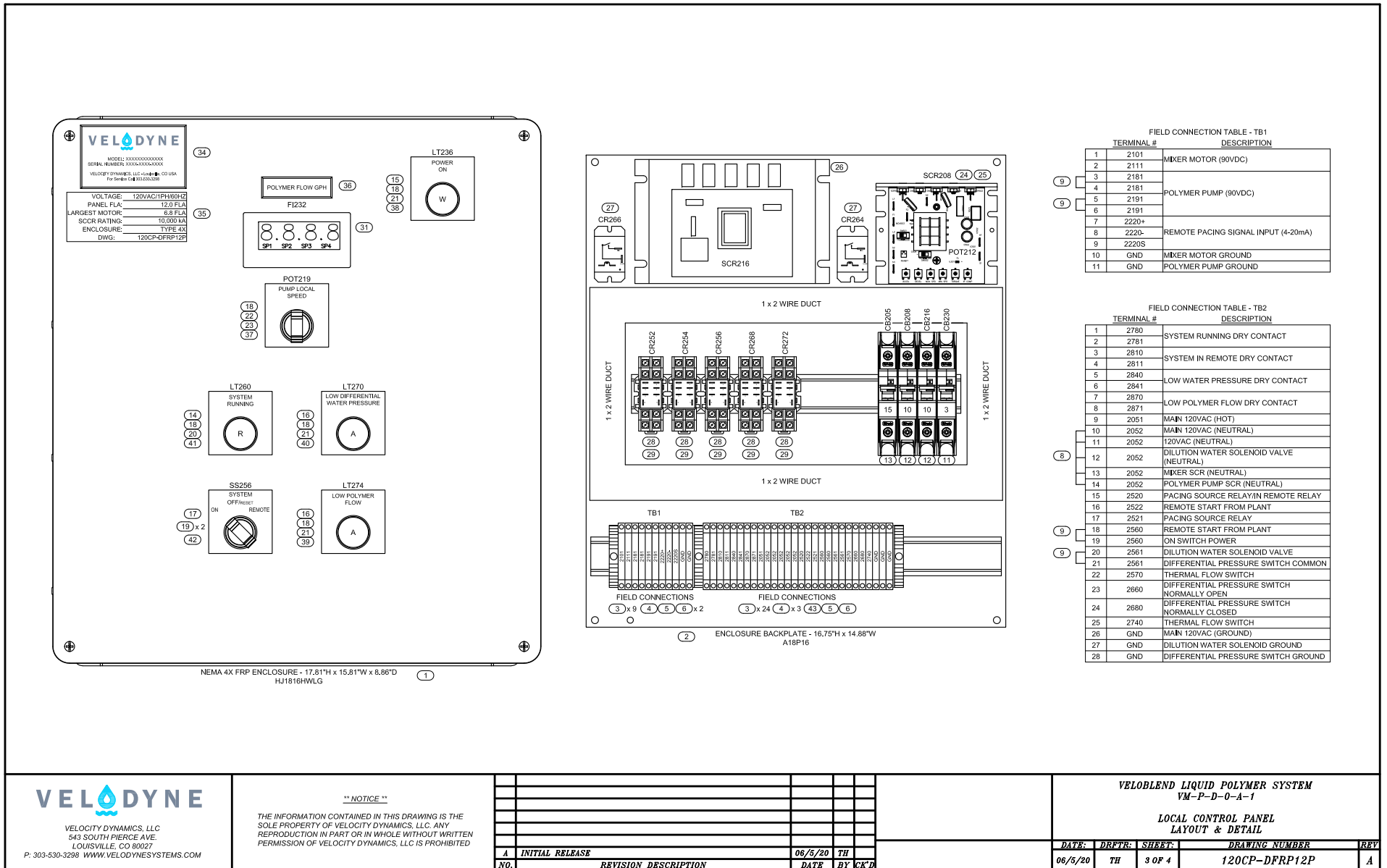
NO.	REVISION DESCRIPTION	DATE	BY	CHK'D
A	INITIAL RELEASE	06/5/20	TH	

**VELOBLEND LIQUID POLYMER SYSTEM
VM-P-D-0-A-1**

**LOCAL CONTROL PANEL
120VAC POWER & CONTROL CIRCUITS**

DATE	DRFTR	SHEET	DRAWING NUMBER	REV
06/5/20	TH	2 OF 4	120CP-DFRP12P	A

3.3 Control Panel Layout



VELOCITY DYNAMICS, LLC
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NO.	INITIAL RELEASE	REVISION DESCRIPTION	DATE	BY	CHK'D
			06/5/20	TH	

VELOBLEND LIQUID POLYMER SYSTEM
 VM-P-D-0-A-1
LOCAL CONTROL PANEL
 LAYOUT & DETAIL

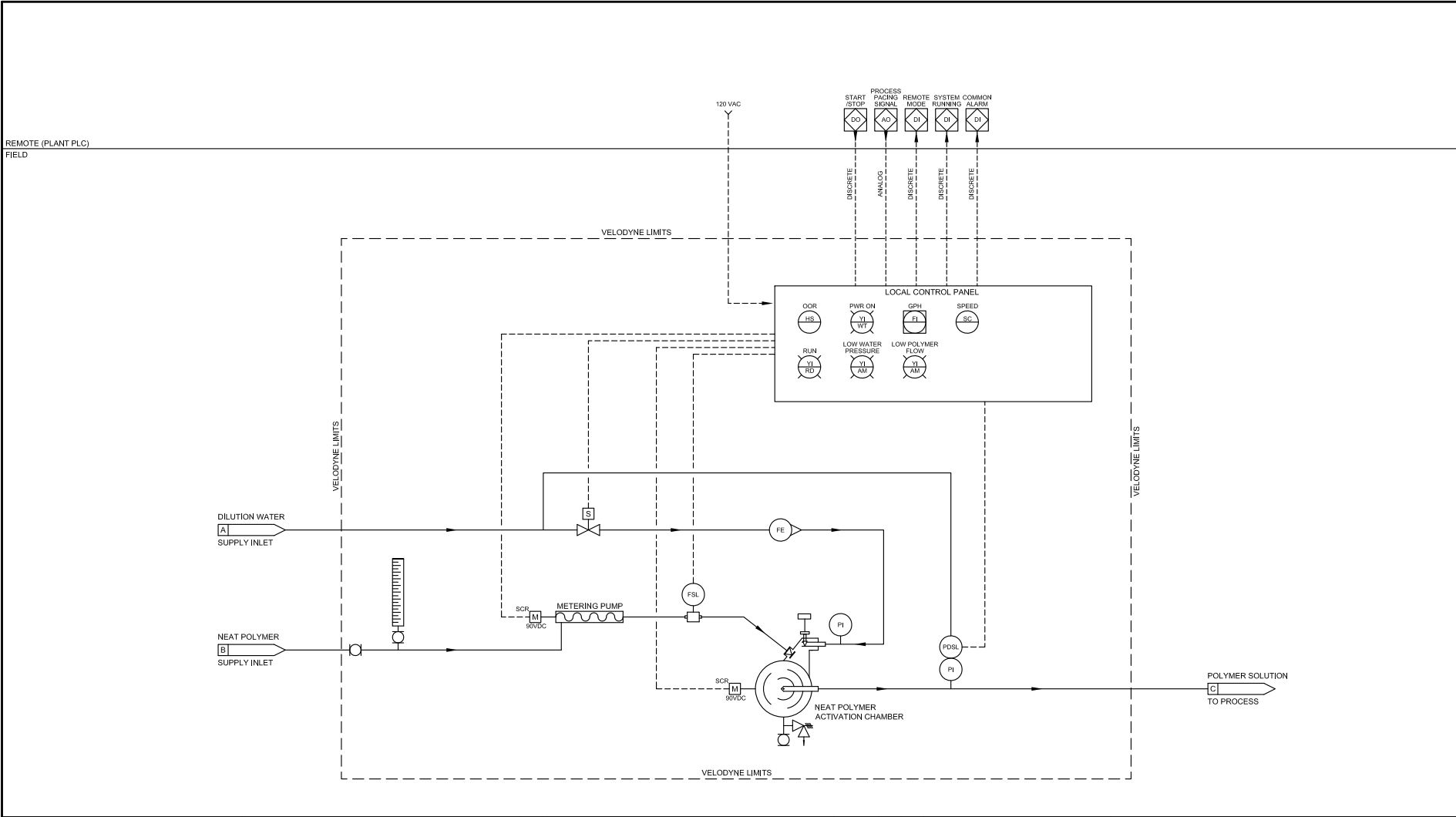
DATE:	DRFTR:	SHEET:	DRAWING NUMBER	REV
06/5/20	TH	3 OF 4	120CP-DFRP12P	A

3.4 Bill of Materials

BILL OF MATERIAL					
ITEM	QUANTITY	VDI #	DESCRIPTION	CATALOG #	MANUFACTURER
1	1	152-0094	Enclosure, Wall Mount, Continuous Hinge, FRP, NEMA 4X, 17.81"H x 15.81"W x 8.86"D	HJ1816HVLG	Hoffman
2	1	152-0017	Enclosure Subplate, Steel, 16.75"H x 14.88"W	A18P16	Hoffman
3	33	700-0000	Terminal, Din Style, 6mm, 30 AMP, Grey	1492-J4	Allen Bradley
4	5	700-0010	Terminal, Grounding, Din Style, 6mm, Green/Yellow	1492-JG4	Allen Bradley
5	2	700-0015	Terminal End Barrier, Din Style, 2mm, Gray	1492-EBJ3	Allen Bradley
6	3	700-0016	Terminal End Anchor, Din Style, 6mm, Gray	1492-EAJ35	Allen Bradley
7	2	700-0030	Terminal Marker Card, 6mm, 120/Card, Blank	1492-M6X12	Allen Bradley
8	1	700-0018	Terminal Center Jumper, 6 mm Center to Center, 10-Pole	1492-CJ6-10	Allen Bradley
9	4	700-0021	Terminal Center Jumper, 6 mm Center to Center, 2-Pole	1492-CJ6-2	Allen Bradley
10	1	290-0138	Din Rail, Low Rise, 35mm x 7.5mm x 1M long	1492-DR5	Allen Bradley
11	1	720-0004	UL 1489 Circuit Breaker, 277VAC - 48VDC Max Voltage, Trip C, 1-Pole, 3 AMP	1489-M1C030	Allen Bradley
12	2	720-0010	UL 1489 Circuit Breaker, 277VAC - 48VDC Max Voltage, Trip C, 1-Pole, 10 AMP	1489-M1C100	Allen Bradley
13	1	720-0012	UL 1489 Circuit Breaker, 277VAC - 48VDC Max Voltage, Trip C, 1-Pole, 15 AMP	1489-M1C150	Allen Bradley
14	1	740-0006	22.5mm, Pilot Light Lens, Red	800FP-P4	Allen Bradley
15	1	740-0007	22.5mm, Pilot Light Lens, Clear	800FP-P7	Allen Bradley
16	2	740-0004	22.5mm, Pilot Light Lens, Amber	800FP-PO	Allen Bradley
17	1	740-0012	22.5mm, Selector Switch, 3 Position, Maintained	800FP-SM32	Allen Bradley
18	5	741-0001	22.5mm, Mounting Latch	800F-ALP	Allen Bradley
19	2	741-0002	22.5mm, Contact Block, NO	800F-X10	Allen Bradley
20	1	741-0009	22.5mm, LED Module, 120VAC, Red	800F-NSR	Allen Bradley
21	3	741-0011	22.5mm, LED Module, 120VAC, White	800F-NSW	Allen Bradley
22	1	741-0052	Black Plastic Pot Operator Knob Without Resistor	KT-100B	ABB
23	1	743-0004	Potentiometer, 10k ohm, 10 Turn, 2W, Requires Operator	534-1-1-103	Vishay
24	1	743-1010	Potentiometer Assembly for SCR Drive	743-1010	Velodyne
25	1	767-0000	SCR Drive, DC, 1/8 to 2HP, Input Voltage 115/230VAC, Output Voltage 0-90/0-180VDC	MM23001C	Minarik
26	1	767-0001	SCR Drive, DC, 1/8 to 2HP, 4-20mA Input, Input Voltage 115/230VAC, Output Voltage 0-90/0-180VDC	PCM23001A	Minarik
27	2	731-1000	Relay, SPST, Form A, 30 Amp	AZ2280-1A-120-AF	American-Zettler
28	5	730-0000	Control Relay, RH Series, DPDT, 10 AMP Contacts, 120VAC Coil, Indicator	RH2B-UL-AC110-120V	IDEC
29	5	734-0000	Control Relay Socket, Standard DIN Rail Mount, 2-Pole	SH2B-05	IDEC
30	1	711-0500	Plug, 3 Prong, 15 Amp	LEV-515PV	Leviton
31	1	747-0004	Panel Meter, LED Display, DC Voltage Input, 115/230VAC Supply	PAXLV	Red Lion
32	5	290-0145	Wire Duct- 1" X 2" - Narrow Slot - Light Gray - Per Foot	FIX2LG6	Panduit
33	5	290-0140	Wire Duct Cover - 1.0" - Light Gray - Per Foot	CLG6	Panduit
34	1	131-0003	Plaque, Veloblend S/N, 3.75" x 2.25", White With Black Text	131-0003	Velodyne
35	1	131-0126	Plaque, Panel Ratings, 4.25" x 1.75", White With Black Text	131-0120	Velodyne
36	1	131-0059	Plaque, "POLYMER FLOW GPH", 2.50" x 0.75", White With Black Text	131-0059	Velodyne
37	1	131-0061	Plaque, "PUMP LOCAL SPEED", 2.25" x 2.25", 0.88" Hole, White With Black Text	131-0061	Velodyne
38	1	131-0063	Plaque, "POWER ON", 2.25" x 2.25", 0.88" Hole, White With Black Text	131-0063	Velodyne
39	1	131-0064	Plaque, "LOW POLYMER FLOW", 2.25" x 2.25", 0.88" Hole, White With Black Text	131-0064	Velodyne
40	1	131-0067	Plaque, "LOW DIFFERENTIAL WATER PRESSURE", 2.25" x 2.25", 0.88" Hole, White With Black Text	131-0067	Velodyne
41	1	131-0068	Plaque, "SYSTEM RUNNING", 2.25" x 2.25", 0.88" Hole, White With Black Text	131-0068	Velodyne
42	1	131-0069	Plaque, "SYSTEM ON/OFF(RESET)/REMOTE", 2.25" x 2.25", 0.88" Hole, White With Black Text	131-0069	Velodyne
43	1	700-0011	Isolation Terminal Block, 22 Amp, Grey	1492-JKD4	Allen Bradley
44					
45					
46					
47					
48					
49					
50					

 <p>VELOCITY DYNAMICS, LLC 543 SOUTH PIERCE AVE. LOUISVILLE, CO 80027 P. 303-630-3288 WWW.VELOCITYDYNAMICS.COM</p>	<p align="center">** NOTICE **</p> <p align="center">THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF VELOCITY DYNAMICS, LLC. ANY REPRODUCTION IN PART OR IN WHOLE WITHOUT WRITTEN PERMISSION OF VELOCITY DYNAMICS, LLC IS PROHIBITED</p>					<p align="center">VELOBLEND LIQUID POLYMER SYSTEM VM-P-D-0-A-1</p> <p align="center">LOCAL CONTROL PANEL BILL OF MATERIAL</p>													
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06/5/20	TH	4 OF 4	120CP-DFRP12P	A															

3.5 Process & Instrumentation Diagram



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						<p>PIPING & INSTRUMENTATION DIAGRAM</p>					
		<p>A FOR SUBMITTAL APPROVAL</p>		<p>6/5/20 TH</p>		<p>6/5/20 TH</p>		<p>1 OF 1</p>		<p>120CP-DFRP12P</p>	
NO.	REVISION DESCRIPTION			DATE	BY	CHKD	DATE	TH	SHEET	DRAWING NUMBER	REV

4. Installation

4.1 Handling and Receiving

Unpacking:

A forklift must be utilized to remove the crate from the delivery truck. After opening the crate, check for signs of physical damage to the system caused during shipping. Notify VeloDyne immediately if any damage is discovered. (VeloDyne main phone # 303-530-3298).

If ordered, two u-bolts located at the top of the skid frame can be used to easily move the system to its desired location. Thread a chain through the bolts and move the system with a forklift, hoist, or crane. Once lifted, the system will tilt. This is expected and will not cause damage to the system. The system can then be lowered and easily pushed into place.

Equipment Placement & Mounting:

Use appropriate hardware for mounting and assembly. All hardware must be stainless steel unless otherwise specifically indicated.

Equipment placement is at the discretion of the Owner.

NOTE: The minimum maintenance clearance requirements for the polymer activation system are:

- **18 inches from the back of the skid.**
- **10 inches from the sides of the skid.**
- **Unobstructed access to the front of the skid.**

Environmental Conditions:

Temperature: 10°C - 40°C (50°F - 104°F)

Humidity: 5% - 95% (without condensation)

DO NOT ALLOW EQUIPMENT TO FREEZE.

NOTE: Operating equipment outside of above specified ranges may cause damage to system components.

4.2 Storage — Before Commissioning

If the system will not be commissioned for a period of 3 months or more, perform the following procedures on the progressive cavity pump:

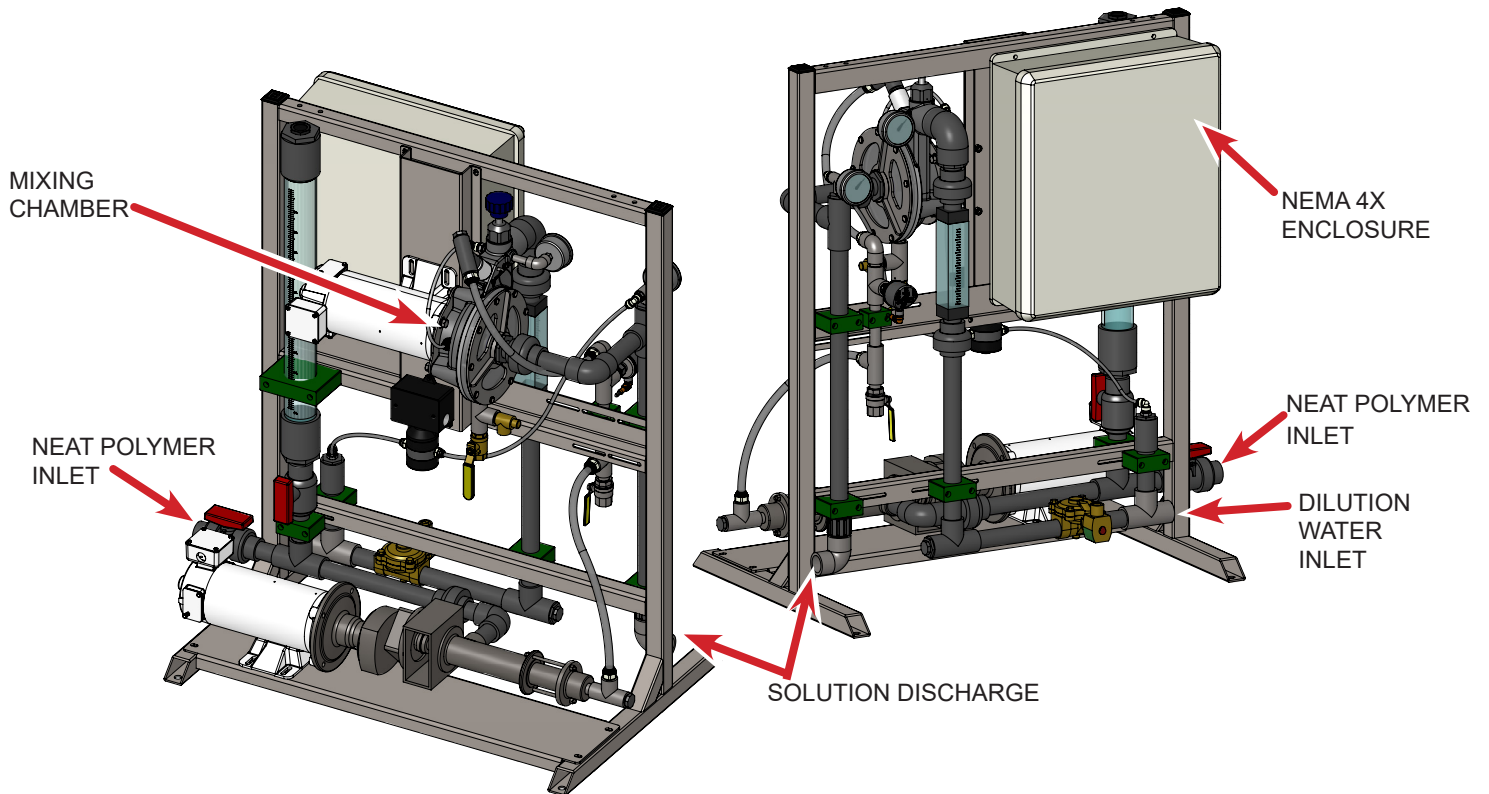
1. Remove the stator. This is to prevent the rotor from damaging (flattening) the stator.
2. Cover the joint sleeves in foil.
3. Completely fill the gear box with the proper type of lubrication/oil.
4. Remove foil, replace the stator and restore the gear box oil to the proper operating level before commissioning.

NOTE: Refer to pump manufacturer's IOM in Section 8 for stator removal information.

4.3 Mechanical Connections

The system drawing shows the dilution water inlet, polymer inlet, and solution outlet connections.

Avoid decreasing the solution discharge line size from the connection size provided on the unit.



To install the mechanical connections:

1. Ensure the plant's main water supply is functioning.
2. Connect the plant water line to the Dilution Water Inlet.
3. Connect the plant polymer supply line to the Polymer Inlet.
4. Connect the plant solution line to the Solution Outlet.

4.4 Electrical Connections

Refer to the electrical diagram and the terminal block legend for electrical connections.

1. Ensure the plant's main power supply is functioning.
2. Locate the control panel.
3. Connect the polymer unit terminal block connections to the plant main control panel per the Electrical Schematic Terminal Block, Section 3.

5. Operation

5.1 Safety Precautions

CAUTION: Polymer can be a harmful chemical and is a slip hazard.

Refer to chemical manufacturers' MSDS sheets for recommended safety precautions and information on treatment if skin or eyes are exposed to polymer or if polymer is ingested. It is always recommended to wear goggles and gloves when working around polymer.

Thoroughly clean polymer spills immediately. It is recommended that polymer spills first be cleaned up with an absorbent such as sand or pet litter. Use wash-down water only as a last resort. A stiff brush and large volume of water combined with absorbent is recommended for final clean-up.

Routine safety precautions should be observed for handling fine-particle-size polymer.

Such precautions may include equipment grounding and bonding, adequate ventilation, good housekeeping, etc.

Store all polymer in a dry, dark, cool area. This keeps excessive moisture away and increases the standard shelf life.

Do not store in direct sunlight.

Do not freeze.

Avoid dust formation. Avoid breathing dust particles.

Sweep up all spills. Avoid using water for clean up as polymer will become extremely slippery. Completely remove spills with sand or binders.

Wear appropriate protective clothing: goggles, gloves and masks.

May be harmful if inhaled. May cause respiratory tract irritation.

May be harmful if swallowed.

May be harmful if absorbed through skin. May cause skin irritations. (Flush thoroughly with water.)

May cause eye irritation. (Flush thoroughly with water.)

WARNING: The equipment supplied may start automatically. Heightened caution must be used when working on or around equipment.

Use proper lock-out procedures before performing maintenance on equipment.

Disconnect power before performing maintenance.

(1) Notify all affected employees that servicing or maintenance is required on a machine or equipment and that the machine or equipment must be shut down and locked out to perform the servicing or maintenance.

(2) If the machine or equipment is operating, shut it down by the normal stopping procedure (depress the stop button, open switch, close valve, etc.).

(3) Ensure that the equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, then verify the isolation of the equipment by operating the push button or other normal operating control(s) or by testing to make certain the equipment will not operate.

5.2 Initial Start-Up Procedures

Prior to start-up verify the following:

VELOBLEND® CHECK LIST

Complete the following check list before starting the equipment.

PLUMBING

- Water Inlet Plumbing Complete
- Solution Discharge Plumbing Complete
- Polymer Inlet Plumbing Complete
- Verify Water Supply Flow Over Full Flow Meter Range Using Control Valve on Mixing Chamber
- Verify Water Supply Pressure at Maximum Water Flow – Ideally >25psi
- Verify Plumbing is Leak-Free

MECHANICAL

- All fasteners verified tightened
- Motors Aligned
- Motor Direction Verified
- All guards are in place and securely fastened

ELECTRICAL

- Power Connected and Verified
- Inter-connecting wiring connected and verified (if applicable)
- Inputs (if applicable):
 - Remote Start / Stop Dry Contact
 - 4-20mA Polymer Pump Pacing
 - Level Sensor(s) (batching systems only)
- Outputs (if applicable):
 - System Running
 - Remote Mode
 - Alarms
 - Low Water Differential Pressure
 - Loss of Polymer Flow
 - 4-20mA Proportional to Polymer Pump

MISCELLANEOUS

- Is Polymer supply on site?
- Check Gear Reducer Oil Level (if applicable)

WARNING: DO NOT RUN PROGRESSIVE CAVITY PUMPS DRY. DO NOT INTRODUCE WATER TO NEAT POLYMER PIPING OR CALIBRATION COLUMNS. FAILURE TO FOLLOW THESE REQUIREMENTS WILL VOID YOUR WARRANTY.

5.2.1 Optimizing Polymer Solution: VeloBlend Mixing Chamber

The Hydro-Mechanical VM Series VeloBlend produces mixing energy by the pressure drop across its water control valve and by the mechanical impeller. The recommended differential pressure range is from 30 to 100 psid. The pressure is not controlled, but rather is the result of the available water pressure and the pressure down stream of the system. Therefore, simply setting the desired rate of water flow then verifying that adequate differential pressure is available is all that is required to operate the mixing chamber. In the event inadequate pressure exists, the impeller can be utilized by turning on the Mixer and adjusting the speed. The Mixer is turned on by turning the speed potentiometer for the mechanical mixer. The speed potentiometer is located inside the control panel.

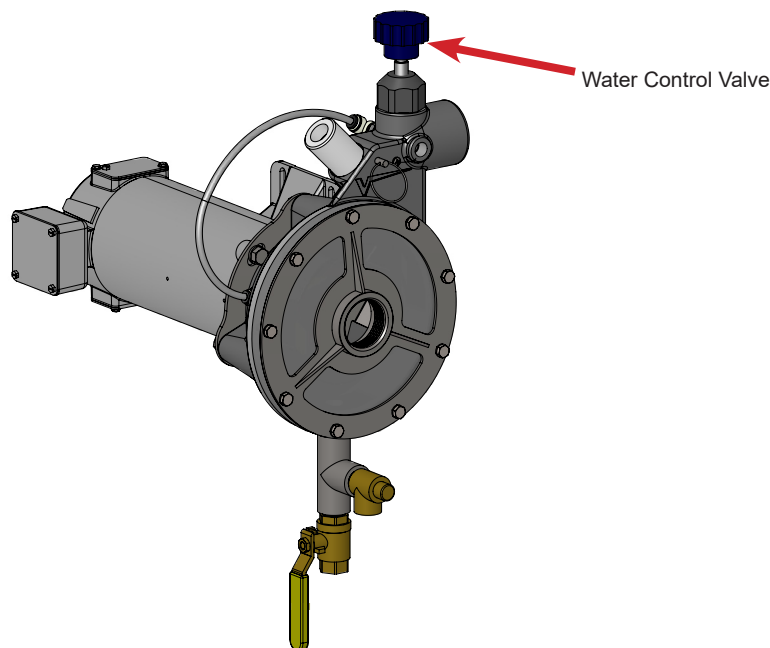
The need and benefit of the impeller must be verified by trial and error. After the system is set up for desired water and polymer flow rate, turn the impeller and set at approximately 10% of the impeller speed by gradually turning the potentiometer on the inside of the control panel. Allow the system to run for enough time to adjust to the changed setting. If the polymer flow rate can be reduced then the impeller is enhancing performance. Continue to increase impeller speed 10% at a time until the performance begins to decline. Your polymer system is optimized.

Step 1:

Set desired water flow using water control valve.

Step 2:

Verify 30 to 100 psid is available—the difference between the two pressure gauges (note: the mixing chamber pressure may read 0).



Step 3:

Pump Calibration:

1. Fill the calibration column just above the start line at the top of the cylinder (mineral oil can be used as a substitute to polymer – **never use water**).
2. Start the pump.
3. Start timing when the polymer reaches the start line.
4. Record the draw-down in GPH from the direct reading scale or for a more accurate calibration, record milliliters after a one minute draw-down.
5. Convert ml's over a one minute draw-down to GPH:

a. _____ (ml) ÷ 3786 ml per gallon = _____ GPM

b. _____ gallons per minute * 60 = _____ GPH

Example:

Draw-Down Volume: 438 milliliters in one minute.

$$438 \div 3786 \text{ (per gallon)} = 0.115 \text{ gpm}$$

$$0.115 \text{ gpm} * 60 = 6.94 \text{ gph}$$

NOTE: If polymer is not available, use mineral oil to prime and calibrate the pump. Never use water as this will cause the polymer to gel and will plug the pump, hose and piping.

NOTE: Please see section 8.1 for original manufacturers' Operation & Maintenance (O&M) Manual for the metering pump.

5.3 Shut-Down Procedures

The system may be shut down by turning the pump off via the **Pump Speed** potentiometer on the control panel; however, this method will cause the mixing chamber to need to be reset.

Once the mixing chamber has been set and the polymer solution fully optimized, the system may be shut-down by turning the **System** selector switch to the "Off" position. The system may then be restarted when desired by turning the **System** selector switch back to the "On" position. When the system is in the **Remote** mode, it may be started and shut-down in the same manner from the main control panel.

6. Maintenance & Troubleshooting

6.1 Preventative Maintenance

6.1.1 Preventative Maintenance Log Sheet

Equipment Model: VM-15P-2400-D-0-A-1

Serial Number: 1120-6308-3405

Overall System ___ Housekeeping Clean any polymer spills with sand or binders.		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
NOTES:	Week 1													
	Week 2													
	Week 3													
	Week 4													
Polymer Check Valve ___ Inspect/Clean Check Valve (Refer to Section 6 in O&M for instructions.)		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
NOTES:	Week 1													
	Week 2													
	Week 3													
	Week 4													
Thermal Flow Sensor (If Applicable) ___ Clean sensor tip using a soft cloth. Build up can be removed using a vinegar cleaning agent. Recalibrate each time a new polymer type is used. (Refer to Section 6 in O&M for calibration instructions.)			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NOTES:	Week 1													
	Week 2													
	Week 3													
	Week 4													
Motor Brushes (DC Motors) ___ Inspect motor brushes. Clean or replace motor brushes every 6-12 months depending on motor usage. During high usage, clean or replace the brushes every 6 months. During low usage, clean or replace the brushes every 12 months. Replace the brushes if worn half of original length. (Refer to the motor IOM in Section 8 for more information.)			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NOTES:	Week 1													
	Week 2													
	Week 3													
	Week 4													
Polymer Pump Packing ___ Clean and Adjust. Periodically check gland packings for leaks while the pump is running. If oil is seeping through the packing or if neat polymer is seeping through the packing set, adjustment to the packing set may be necessary. (Refer to Section 6, Maintenance, and pump IOM in Section 8.)			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NOTES:	Week 1													
	Week 2													
	Week 3													
	Week 4													

NOTE: Disconnect power before performing any maintenance.

Equipment Model: VM-15P-2400-D-0-A-1

Serial Number: 1120-6308-3406

Overall System ___ Housekeeping Clean any polymer spills with sand or binders.		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NOTES:	Week 1												
	Week 2												
	Week 3												
	Week 4												
Polymer Check Valve ___ Inspect/Clean Check Valve (Refer to Section 6 in O&M for instructions.)		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NOTES:	Week 1												
	Week 2												
	Week 3												
	Week 4												
Thermal Flow Sensor (If Applicable) ___ Clean sensor tip using a soft cloth. Build up can be removed using a vinegar cleaning agent. Recalibrate each time a new polymer type is used. (Refer to Section 6 in O&M for calibration instructions.)													
NOTES:		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Week 1												
	Week 2												
	Week 3												
	Week 4												
Motor Brushes (DC Motors) ___ Inspect motor brushes. Clean or replace motor brushes every 6-12 months depending on motor usage. During high usage, clean or replace the brushes every 6 months. During low usage, clean or replace the brushes every 12 months. Replace the brushes if worn half of original length. (Refer to the motor IOM in Section 8 for more information.)													
NOTES:		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Week 1												
	Week 2												
	Week 3												
	Week 4												
Polymer Pump Packing ___ Clean and Adjust. Periodically check gland packings for leaks while the pump is running. If oil is seeping through the packing or if neat polymer is seeping through the packing set, adjustment to the packing set may be necessary. (Refer to Section 6, Maintenance, and pump IOM in Section 8.)													
NOTES:		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Week 1												
	Week 2												
	Week 3												
	Week 4												

Equipment Model: VM-15P-2400-D-0-A-1

Serial Number: 1120-6308-3407

Overall System ___ Housekeeping Clean any polymer spills with sand or binders.		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NOTES:	Week 1												
	Week 2												
	Week 3												
	Week 4												
Polymer Check Valve ___ Inspect/Clean Check Valve (Refer to Section 6 in O&M for instructions.)		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NOTES:	Week 1												
	Week 2												
	Week 3												
	Week 4												
Thermal Flow Sensor (If Applicable) ___ Clean sensor tip using a soft cloth. Build up can be removed using a vinegar cleaning agent. Recalibrate each time a new polymer type is used. (Refer to Section 6 in O&M for calibration instructions.)													
NOTES:		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Week 1												
	Week 2												
	Week 3												
	Week 4												
Motor Brushes (DC Motors) ___ Inspect motor brushes. Clean or replace motor brushes every 6-12 months depending on motor usage. During high usage, clean or replace the brushes every 6 months. During low usage, clean or replace the brushes every 12 months. Replace the brushes if worn half of original length. (Refer to the motor IOM in Section 8 for more information.)													
NOTES:		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Week 1												
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	Week 3												
	Week 4												
Polymer Pump Packing ___ Clean and Adjust. Periodically check gland packings for leaks while the pump is running. If oil is seeping through the packing or if neat polymer is seeping through the packing set, adjustment to the packing set may be necessary. (Refer to Section 6, Maintenance, and pump IOM in Section 8.)													
NOTES:		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Week 1												
	Week 2												
	Week 3												
	Week 4												

Equipment Model: VM-15P-2400-D-0-A-1

Serial Number: 1120-6308-3408

Overall System ___ Housekeeping Clean any polymer spills with sand or binders.		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NOTES:	Week 1												
	Week 2												
	Week 3												
	Week 4												
Polymer Check Valve ___ Inspect/Clean Check Valve (Refer to Section 6 in O&M for instructions.)		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NOTES:	Week 1												
	Week 2												
	Week 3												
	Week 4												
Thermal Flow Sensor (If Applicable) ___ Clean sensor tip using a soft cloth. Build up can be removed using a vinegar cleaning agent. Recalibrate each time a new polymer type is used. (Refer to Section 6 in O&M for calibration instructions.)													
NOTES:		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Week 1												
	Week 2												
	Week 3												
	Week 4												
Motor Brushes (DC Motors) ___ Inspect motor brushes. Clean or replace motor brushes every 6-12 months depending on motor usage. During high usage, clean or replace the brushes every 6 months. During low usage, clean or replace the brushes every 12 months. Replace the brushes if worn half of original length. (Refer to the motor IOM in Section 8 for more information.)													
NOTES:		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Week 1												
	Week 2												
	Week 3												
	Week 4												
Polymer Pump Packing ___ Clean and Adjust. Periodically check gland packings for leaks while the pump is running. If oil is seeping through the packing or if neat polymer is seeping through the packing set, adjustment to the packing set may be necessary. (Refer to Section 6, Maintenance, and pump IOM in Section 8.)													
NOTES:		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Week 1												
	Week 2												
	Week 3												
	Week 4												

6.1.2 Preventative Maintenance Chart

RECOMMENDED PREVENTATIVE MAINTENANCE & LUBRICATION	
MAINTENANCE RECOMMENDATIONS	FREQUENCY / LUBRICATION
Polymer Check Valve: Periodically check and clean polymer check valve.	The frequency will depend on the polymer being used. Once per week is recommended during equipment commissioning until a well established frequency schedule can be determined. If a different polymer or polymer supplier is used, then it is recommended that a frequency schedule be re-established. Refer to Section 6 for maintenance procedures.
Thermal Flow Sensor: Clean and Recalibrate (If Applicable).	The thermal flow sensor is the most accurate when cleaned and calibrated regularly and often. Due to the various characteristics seen in different neat polymers, it is recommended the thermal flow sensor be cleaned once a week. This schedule may be adjusted once the polymer build-up frequency is observed. Clean the sensor tip using a soft cloth. Stubborn build up can be removed using a common vinegar cleaning agent. Always recalibrate the thermal flow sensor before introducing polymer for the first time, each time a different polymer supplier is used or a different polymer type is introduced to the system. Refer to the Troubleshooting and Maintenance section for more information.
Motor Brushes: Inspect motor brushes (DC Motors Only).	Clean or replace motor brushes every 6-12 months depending on motor usage. During high usage, clean or replace the brushes every 6 months. During low usage, clean or replace the brushes every 12 months. Replace the brushes if worn half of original length. Refer to the motor IOM in Section 8 for more information.
Browning Gear Reducer Acceptable Lubricants: Cofran—Sintogear 125 MOBIL—SHC 150 Shell—Omala HD 150 Quantity: 1.26 Pints	In the case of synthetic oil, the lubricant does not require changing, but it is recommended that proper oil level be checked periodically. Change oil only when performing maintenance that requires gearbox disassembly. Refer to the Gear Reducer IOM in Section 8 for more information.
Polymer Pump Packing: Check and Adjust.	Periodically check gland packings for leaks while the pump is running. If oil is seeping through the packing or if neat polymer is seeping through the packing set, adjustment to the packing set may be necessary. Refer to Section 6, Maintenance and the pump IOM in Section 8 for more information.
Pump Calibration	Depending on system usage, regular calibration of the pump should be performed to monitor the condition of the pump. For heavy usage (12 or more hours per day), every 90 days is recommended. Significant variations in pump calibration results may indicate damage to the pump.

6.1.3 Storage — Long-Term Shut-Down

6.1.3.1 Mineral Oil Procedure

If the system is to be shut down for a prolonged period (two weeks or more), completely flush the polymer lines, calibration column and metering pump using the following mineral oil flushing procedure:

1. Fill the calibration column with a non-water heavy based laxative or food grade type fluid, such as mineral oil.
2. Energize the system and run normally until the mineral oil has evacuated all polymer from the pump suction assembly and pump discharge to the mixing chamber.
3. At the same time, continue flushing the mixing chamber with water until all of the mineral oil is dispersed; at least 5 minutes.
4. Refill the calibration column and repeat as necessary.
5. Completely drain all piping and the mixing chamber.
6. Leave the calibration column empty when complete.
7. Clean the mixing chamber polymer check valve after the flushing procedure is complete.

Do not let pump sit filled with a water solution.

Turn main pump shaft at least two full rotations every four weeks.

Store removed stator in a cool, dark, dry place, coat the metal components with a light oil or rust preventative.

6.1.3.2 Recirculation Procedure

If the system is to be shut down for a prolonged period (two weeks or more) and has not received proper regular maintenance, perform the following mineral oil recirculation procedure:

1. Remove the polymer pump discharge hose and install a hose from the pump discharge to the top of the calibration column.
2. Fill the calibration column with mineral oil.
3. Throttle the water flow control knob until the water flow is at 0 flow and close the seal flush kit valve.
4. Disable the low flow water and low flow polymer alarms using the HMI, if applicable.
5. Operate the system in Manual mode with the polymer pump at maximum speed allowing the mineral oil to recirculate through the pump and calibration column assembly for several hours or overnight.
6. Reconnect the pump discharge to the mixing chamber.
7. Re-enable the low water flow and low polymer flow alarms.
8. Reset the mechanical seal flush kit then open the water flow control knob.
9. Perform the mineral oil flush procedure as described in Section 4.3.1.

NOTE: The piping and mixing chamber may crack in freezing weather if not properly drained.

6.2 Corrective Maintenance Procedures

6.2.1 Replacing the Mechanical Seal

The mechanical seal will require replacement if the seal is run dry or damaged.

To replace the seal:

1. Disconnect union from the solution discharge piping near the flow meter.
2. Remove the nine (9) bolts securing the clear mixing chamber cover. Remove cover.
3. Remove the left-hand threaded bolt on the end of the shaft (to remove, turn clock-wise).
4. Remove the impeller.

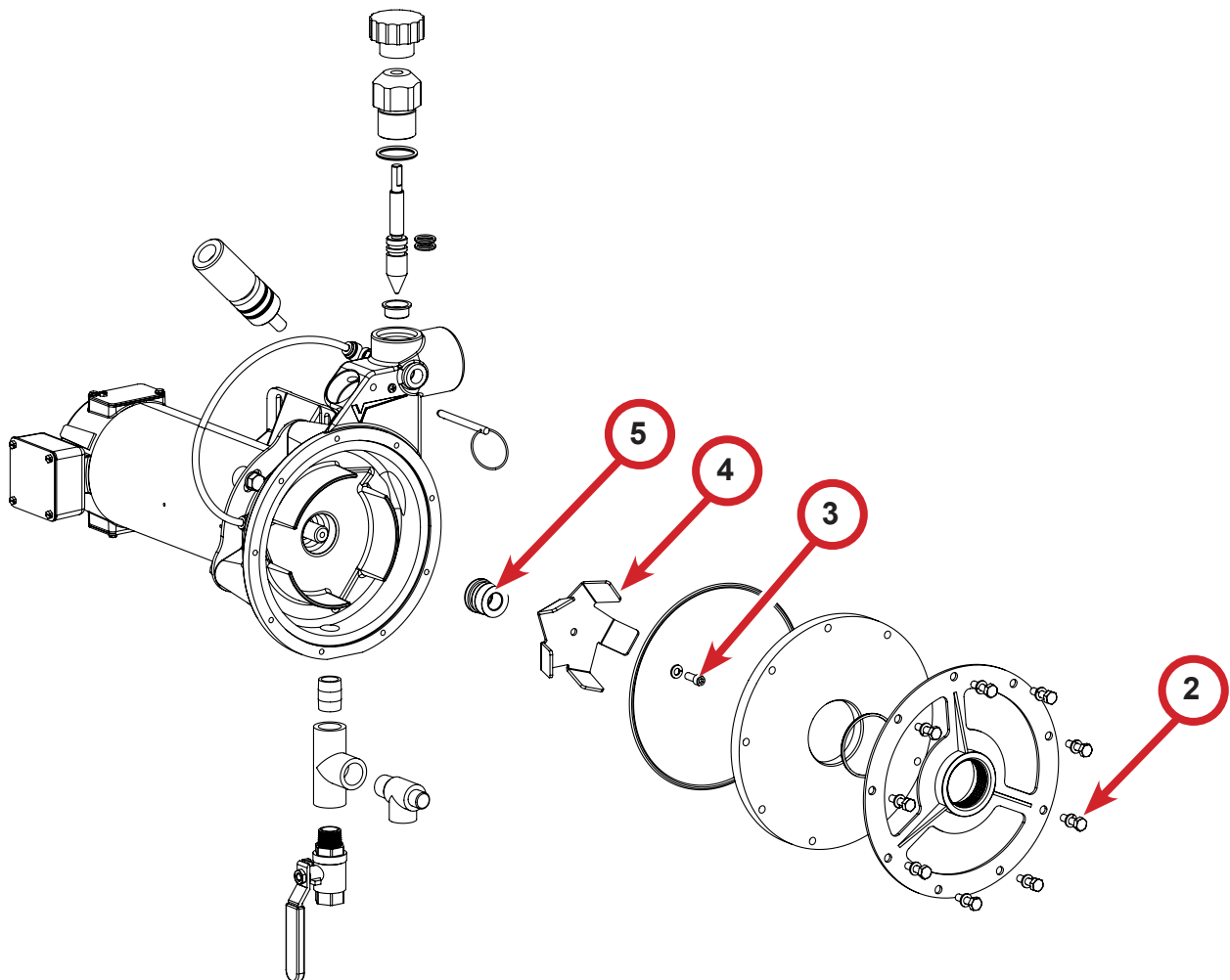
NOTE: Impeller is very sharp. Take proper precautions to avoid injury.



5. Remove the rotary mechanical seal. Replace seal, ensuring all flanged sides in the spring portion are free from obstruction and can be compressed freely in one hand.

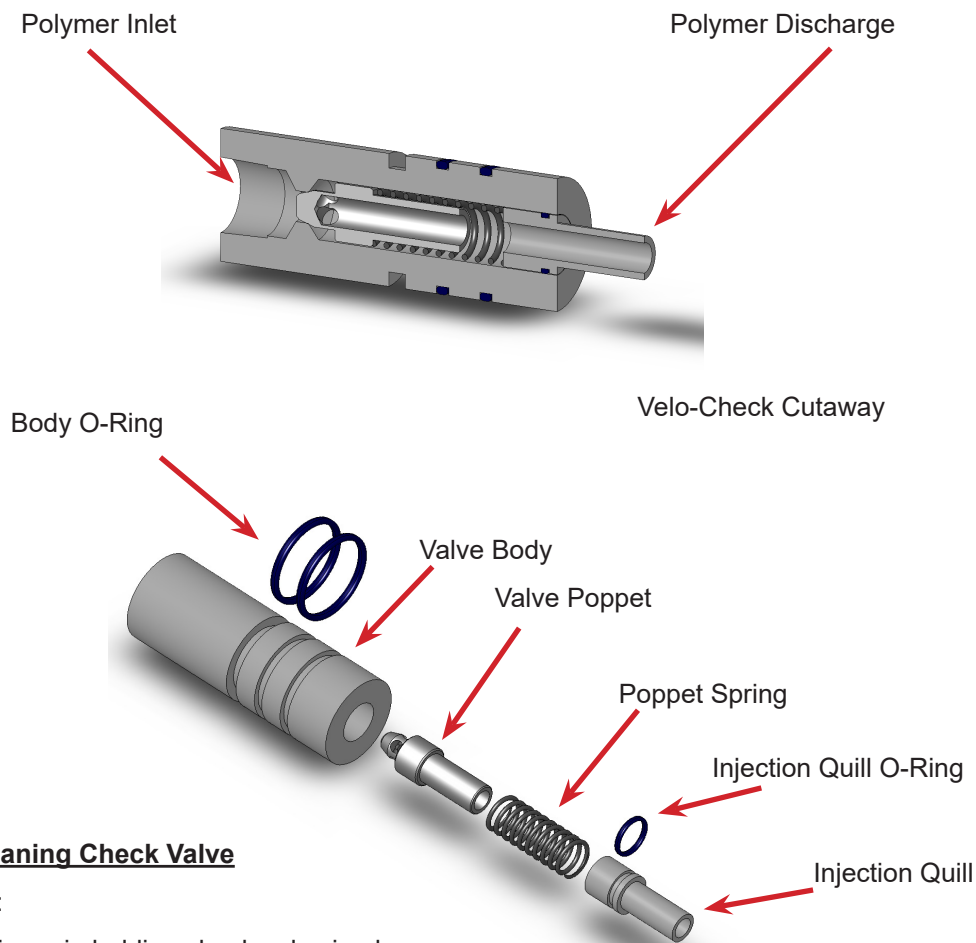
NOTE: If the spring portion of the seal is obstructed on any side, serious damage to the mixing chamber will occur. The spring should freely compress on all sides when squeezed in one hand.

6. Replace impeller and left-hand (reverse) threaded bolt, applying loctite to the bolt.
7. Replace clear cover and nine (9) bolts, making sure the o-ring in the cover is properly seated. Always first snug and then tighten the bolts in a crisscross pattern, using no less than 40 inch pounds torque.
8. Reconnect the union on the solution discharge piping.



6.2.2 Polymer Check Valve, Inspect & Clean

The VeloBlend technology incorporates a specially designed polymer check valve, the Velo-Check[®], designed to enhance polymer performance and check valve reliability and to allow for quick and easy removal, cleaning, and re-installation.



Inspecting / Cleaning Check Valve

Removing Valve:

1. Pull retainer pin holding check valve in place.
2. Pull check valve from mixing chamber body.

Valve Disassembly:

1. Carefully remove injection quill from end of check valve.
2. Remove spring and poppet valve.

Valve Cleaning:

1. Wipe poppet valve and spring clean of any polymer debris.
2. Avoid using water if possible. If rinsing is required, use hot water.

NOTE: Be sure to completely dry all parts that were rinsed with water before reinstalling. Installing wet parts will cause premature polymer build-up on valve.

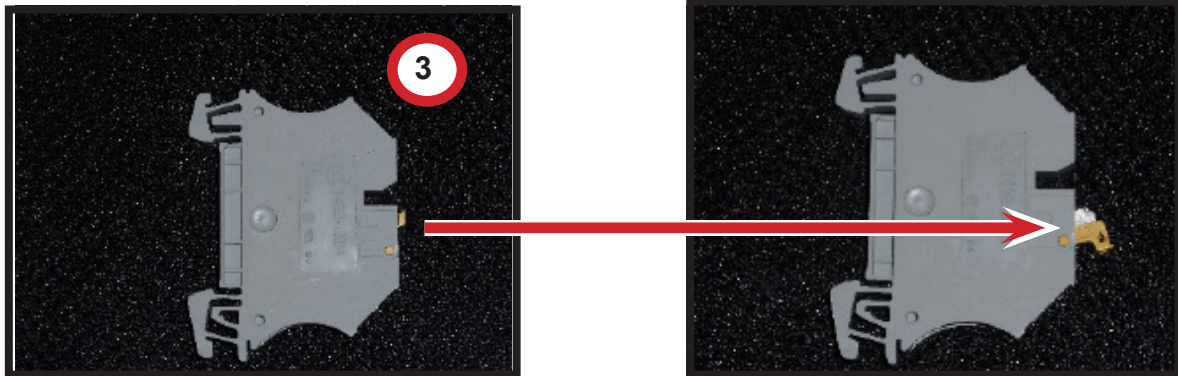
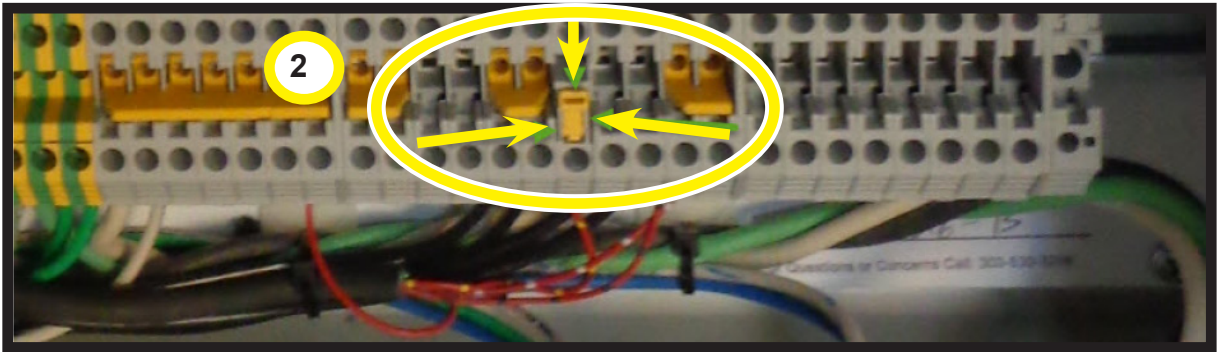
Valve Re-Installation:

1. Place spring over poppet valve.
2. Re-insert Flow Insert & spring, conical end first, into Inlet Body.
3. Insert injection quill, o-ring end first, into Inlet Body.
4. Insert Valve into Mixing Chamber.
5. Replace retaining pin.

6.2.3 Calibrating the Thermal Flow Sensor

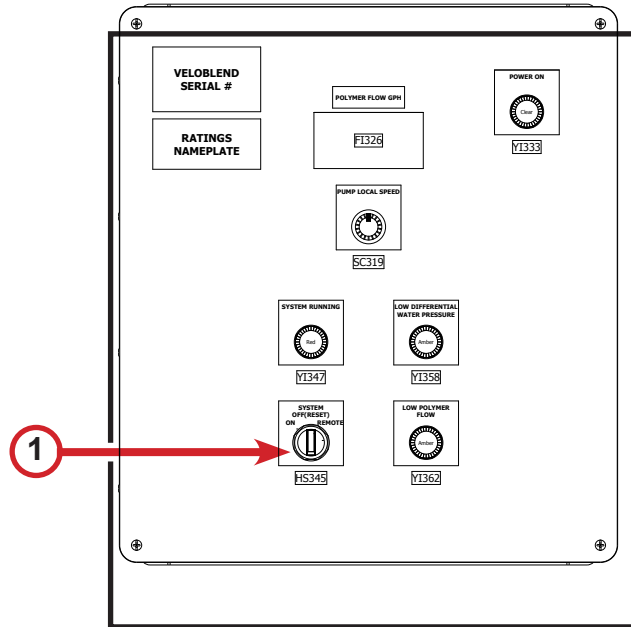
6.2.3.1 Disable Flow Alarm - Standard Discrete Control Level Systems

1. Make sure the system is without power.
2. Open the control panel cabinet door and locate the isolation terminal block on the bottom rail.
3. Disable the discrete flow alarm wire by disconnecting the knife switch.
4. Close the control panel cabinet door.
5. Restore system power.

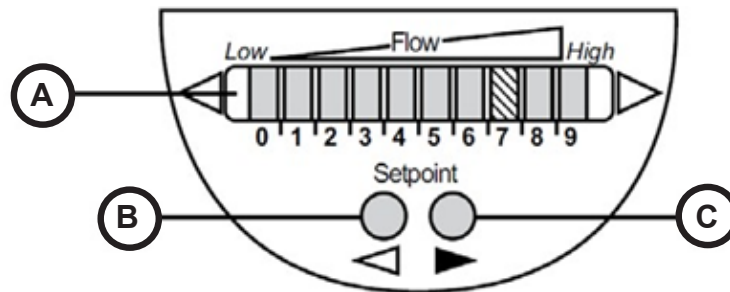


6.2.3.2 Set High Flow Setting

1. For Standard discrete control level systems: set the SYSTEM selector switch on the control panel to the ON position.
2. Run the system at normal operating flow.
3. Let the flow settle out for approximately 1 minute.



NOTE: For the next procedural steps, a small screw driver or other device will be needed to depress the Thermal Flow Switch setpoint buttons.



THERMAL FLOW SENSOR DISPLAY LEGEND	
A.	Operation Display <ul style="list-style-type: none"> • The green LEDs indicate the current flow. The LED numbers 0 through 9 define the range between no flow (0) and maximum flow (9). • The color of the LED indicator defines the position of the switch point (orange=output closed, red=output open).
B.	Setpoint button for adjustment and configuration (lower flow).
C.	Setpoint button for adjustment and configuration (higher flow).

4. Once the flow has settled, hold the “High Teach” setpoint button (C) down for approximately 5 seconds. The number 9 LED light should currently be solid.
5. When the number 9 LED light starts to flash, release the “High Teach” setpoint button (C).

6.2.3.3 Set Low Flow Setting

1. Run the system in hand mode at 10% of high flow set point or at zero flow if less than .05 GPH.
2. Let the flow settle out for approximately 1 minute.
3. Once the flow has settled, hold the “Low Teach” setpoint button (B) down for approximately 5 seconds. The number 0 LED light should currently be solid.
4. When the number 0 LED light starts to flash, release the “Low Teach” setpoint button (B).

NOTE: When adjusting and calibrating the Thermal Flow Sensor, it is always best to set both the high and low point flow settings together; setting the high flow first.

NOTE: Depending on the electrical logic of the system, the switch point delay and switch point state may need adjustment.

6.2.3.4 Set Switch Point Delay

NOTE: The initial set point should be set to 7 for quick pump protection. Only set lower if alarms are being triggered easily and need a longer delay.

1. The red/orange LED light is the switch point LED.
2. For a longer alarm delay of switch point, decrease the position of the red/orange LED light by pressing setpoint button B (<).
3. For a shorter alarm delay of switch point, increase the position of the red/orange LED light by pressing setpoint button C (>).

6.2.3.5 Change Switch Point State

NOTE: This alarm state should be set according to the electrical schematic to either N.O or N.C.

1. Hold the “Low Teach” setpoint button (B) for no less than 15 seconds. Currently, number 9 LED light is solid.
2. After 5 seconds, number 9 LED light starts to flash.
3. After 10 seconds, current setting is displayed and LED lights 5 through 9 display orange.
4. After 15 seconds, current setting is displayed and LED lights 0 through 4 flash orange.
5. Release the “Low Teach” setpoint button (B).

6.2.3.6 Return System Settings

1. For standard discrete control level systems:
 - Make sure the system is without power.
 - Open the control panel cabinet door and locate the isolation terminal block on the bottom rail.
 - Enable the discrete flow alarm wire by connecting the knife switch.
 - Close the control panel cabinet door.
 - Restore system power.

6.2.4 Polymer Pump Packing Adjustment and Maintenance

The Seepex pumps supplied have 4 packing rings installed at time of shipment. The packing set is adjusted at the test center and the pump is run at maximum capacity for a minimum of 1 hour. The packing set is readjusted prior to shipment if they have shown signs of “seating” indicated by seepage of mineral oil from the packing set.

NOTE: At any time polymer is not available or needed, use mineral oil for testing and calibrating.

Do not adjust the packing ring if oil is seeping through the packing gland into the pump lantern (the black square spacer open on 2 sides that exposes the packing gland adjustment, slinger ring and gearbox / pump shaft). This is normal and expected. Only cleaning is required.

Adjust the packing set if neat, raw white polymer is seeping through the packing set as shown below.



- Use a 7 MM box end wrench to turn the packing set adjustment screws $\frac{1}{4}$ to $\frac{1}{2}$ turn and wait 24 hours for results, cleaning any oil or polymer from the lantern.
- Now that an adjustment has been made, the polymer and oil has been compressed in the packing set and oil will leak while polymer has been captured in the Teflon rope, best described as a coffee filter, allowing oil to continue but capturing the polymer.
- Any and all polymer captured in the packing set is now subject to friction heat based on RPM to the pump. This normally causes polymer to “cook” on the packing set and when pressure buildup is high, forces its way out of the packing assembly; looking very much like hardened off, cracked graphite to dark brown/ black cooked hardened rubber.
- It is impossible for this material to be a seal failure as there is no seal, and is actually polymer attaching to the graphite dry lubricant and being forced out of the packing set by pressure and heat. The rate at which it discharges is based on RPM to the pump and back pressure.

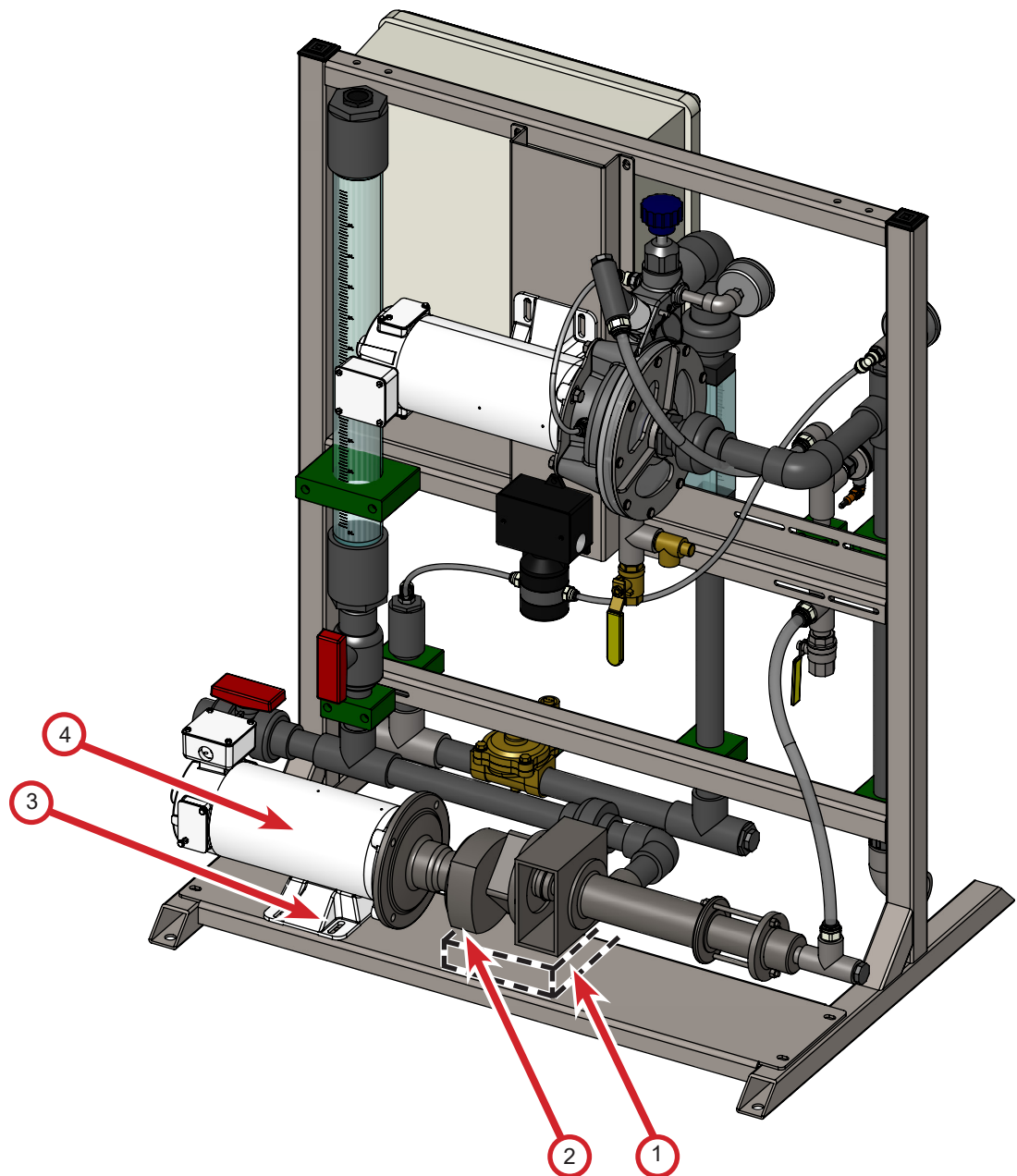
NOTE: If it becomes necessary to replace the packing rings, replace all four packing rings with the split ends offset by 90 degrees. Insert the individual rings uniformly into the gland packing chamber. Never use a pointed implement when performing this procedure, otherwise damage may result to the packing material. Perform the pump packing adjustment procedure when finished.

6.2.5 Replacing Pump Motor

1. Place support blocks under gear reducer and pump.

NOTE: Do not strain suction and discharge piping.

2. Remove four (4) bolts from gear reducer/motor. Set aside.
Remove key from motor shaft. Set aside.
3. Remove four (4) bolts from motor and shelf bracket. Set aside.
4. Remove old motor and place new motor in position.
5. Screw in four (4) bolts into motor and shelf bracket.
Replace key into motor shaft.
6. Replace four (4) bolts on gear reducer/motor.
7. Reconnect all piping connections.
8. Remove support blocks.



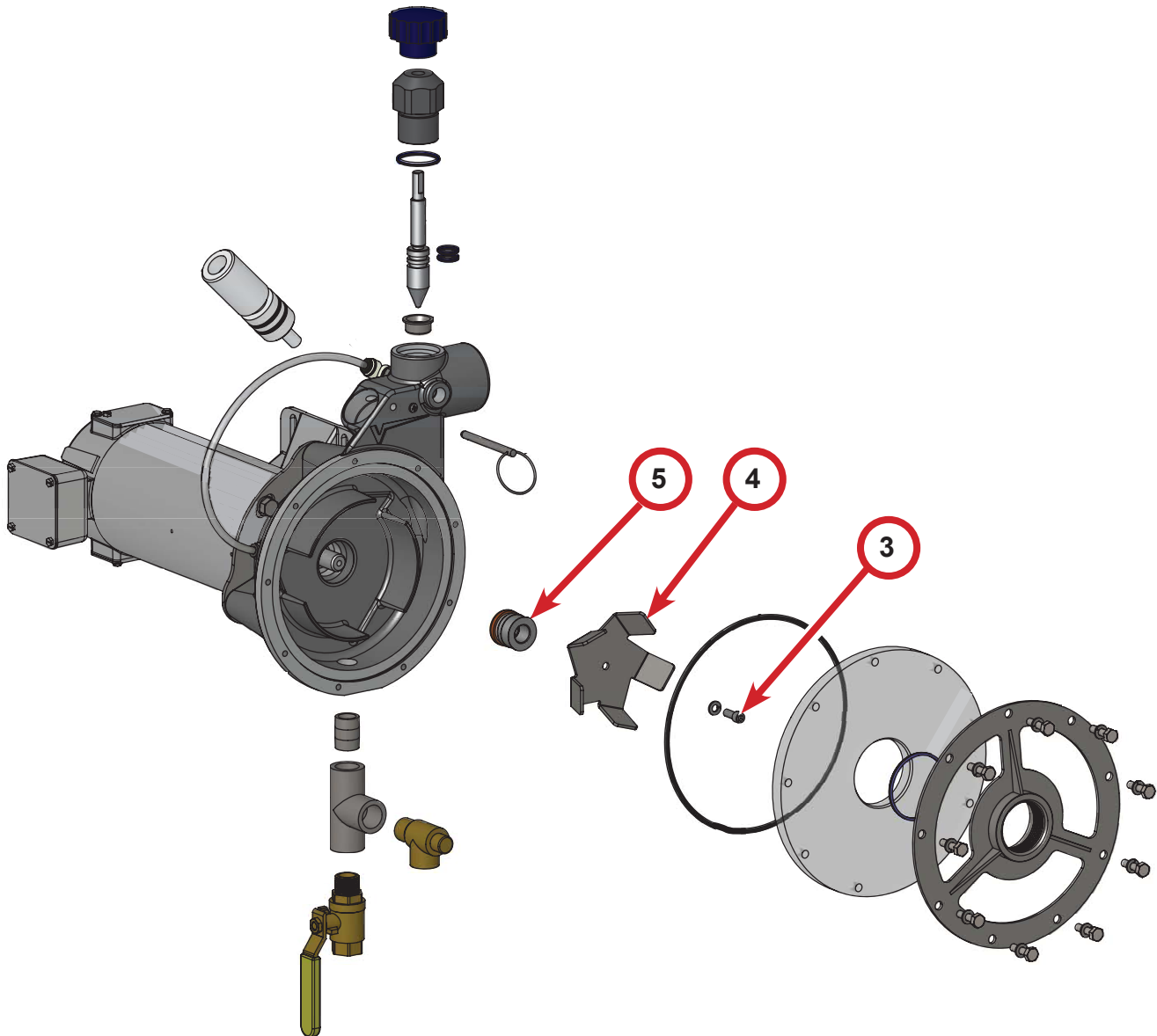
6.2.6 Replacing Mixing Chamber Motor

1. Disconnect union from the solution discharge piping near the flow meter.
2. Remove the nine (9) bolts securing the clear mixing chamber cover. Remove cover.
3. Remove the left-hand threaded bolt on the end of the shaft (to remove, turn clock-wise).
4. Remove the impeller.

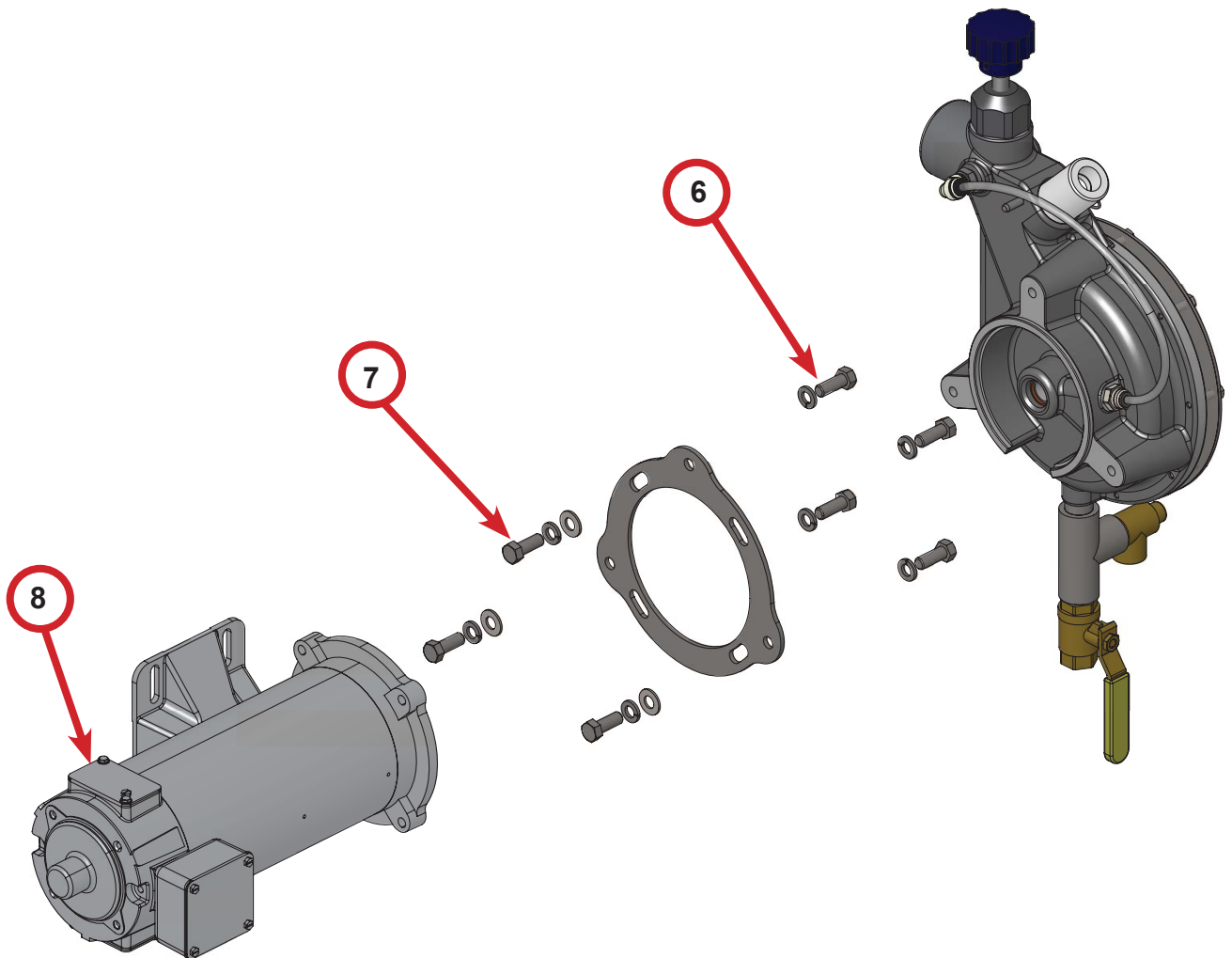
NOTE: Impeller is very sharp. Take proper precautions to avoid injury.



5. Remove the rotary mechanical seal.



6. Remove four (4) bolts on motor.
7. Remove four (4) bolts on mixer mounting bracket.
8. Remove motor.
9. Place new motor in position.
10. Screw in four (4) bolts into motor and mixer mounting bracket.
11. Replace four (4) bolts on gear reducer/motor.
12. Replace seal, ensuring all flanged sides in the spring portion are free from obstruction and can be compressed freely in one hand.
13. Replace impeller and left-hand (reverse) threaded bolt. Use Loctite on the left-hand threaded bolt.
14. Replace clear cover and nine (9) bolts, making sure the o-ring in the cover is properly seated. Always first snug and then tighten the bolts in a crisscross pattern, using no less than 40 inch pounds torque.
15. Reconnect the union on the solution discharge piping near the flow meter.



6.3 Troubleshooting

Problem	Possible Cause	Reference	Solution
Solenoid valve won't close	<ol style="list-style-type: none"> 1. Hole in diaphragm designed to equalize pressure on up & down stream side of valve is plugged. 	Refer to solenoid valve O&M manual	<ol style="list-style-type: none"> 1. Disassemble valve according to instructions. Clean hole in diaphragm to allow equalization of pressure differential.
Metering pump won't pump	<ol style="list-style-type: none"> 1. Check valve(s) 2. Air leak in suction hose / pipe 	Refer to metering pump O&M manual	<ol style="list-style-type: none"> 1. Clean check valves 2. Tighten hose clamps, check and fix leaks in piping. 3. Progressive Cavity Pump: Prime pump by filling calibration column until solution drains through suction cavity plug.
Ineffective polymer mixing	<ol style="list-style-type: none"> 1. Low water pressure 2. Excessive solution concentration 3. Too low of dilution water flow 		<ol style="list-style-type: none"> 1. Increase water pressure by opening valves upstream of system or increase available pressure by adjusting pressure regulating valve up stream of system. 2. Verify there are no obstructions or closed valves down-stream of polymer system indicated by high mixing chamber pressure. 3. Verify proper solution concentration (not to exceed 1% in most cases) 4. Increase water flow. Utilize Mechanical Impeller to make up for low water pressure.
Impeller wobbling	<ol style="list-style-type: none"> 1. Spring loaded portion of the mechanical seal is not lined up 		<ol style="list-style-type: none"> 1. Inspect the spring portion of the mechanical seal to ensure all flanged sides can compress without obstruction

NOTE: For more information on maintenance procedures, refer to the specific component IOM in Section 8 of this Operation & Maintenance manual.

7. Warranty



543 S. Pierce Avenue, Louisville, CO 80027
(PH) 303-530-3298 ♦ (F) 303-530-3368
www.velodynesystems.com

LIMITED WARRANTY

New Polymer Equipment Limited Warranty

Warranty Period: One (1) year from start-up, not to exceed 18 calendar months from date of shipment; Limited.

VeloDyne warrants each new Polymer System of VeloDyne's manufacture to be free from defects in material and workmanship, under normal use and service for one (1) year following the date of equipment start-up not to exceed 18 consecutive calendar months from the date the equipment is shipped to you. This Limited Warranty shall apply to the system's mixing chamber for life, and otherwise only to complete polymer systems of VeloDyne's manufacture; parts are covered by a separate Limited Warranty.

Equipment and accessories not of VeloDyne's manufacture are warranted only to the extent of the original manufacturer's warranty and subject to their allowance to VeloDyne (only if found to be defective by such manufacturer).

Warranty Terms

During the Limited Warranty period, any defect in material or workmanship in any warranted item of VeloDyne's Polymer System not expressly excluded below shall be repaired or replaced at VeloDyne's option without charge, provided that (a) the equipment and parts are used according to the manufacturer's recommended usage and in an ordinary manner, and (b) you give us prompt written notice within the time period set forth herein that the equipment or parts manufactured by us fail to function properly under normal and proper use.

Should your unit prove defective within the warranty period, you must contact our Service Department for a return authorization (RMA) number to submit with the returned equipment. This RMA must be noted prominently on the outside of your packaging and on any correspondence related to the return. VeloDyne's liability under this warranty is limited to the repair or replacement in kind or credit, in VeloDyne's sole option and discretion, of any items proved to be defective, provided the allegedly defective goods are returned to VeloDyne's factory located at 543 S. Pierce Avenue, Louisville, CO 80027, by Purchaser transportation prepaid.

All costs and expense related to shipping of any replacement parts or goods shall be VeloDyne's expense, but Purchaser shall pay for all installation costs. The foregoing shall not apply to equipment or parts that shall have been altered or repaired after shipment to you by anyone except VeloDyne's authorized agents and/or service employees. Purchaser is responsible for determining the suitability of VeloDyne's equipment for Purchaser's intended use, and VeloDyne shall in no event be liable in this respect. Any equipment or parts manufactured by others but furnished to you by us will be repaired or replaced only to the extent of the original manufacturer's warranty. Purchaser must provide prompt written notice to VeloDyne of any warranty issues to obtain its benefits.

Should VeloDyne determine that the reason or action giving rise to the defect or operational issue with your warranted Equipment is the result of Owner's actions (or actions of Owner's employees, agents, representatives or affiliates), then this warranty shall not apply to the repair or replacement and VeloDyne will invoice the Owner for the cost of all parts, repairs, service calls and travel expenses incurred in investigating or repairing your defective equipment.

Purchaser's Responsibility

This Limited Warranty requires proper start-up maintenance and registration, and periodic inspections of the Polymer System Equipment as indicated in the Operator & Maintenance Manual furnished with each new system. The cost of routine or required maintenance and service(s) is the responsibility of Purchaser, and Purchaser is required to keep documented evidence that routine or required maintenance services were performed.

Warranty Exclusions and Limitations

The warranties contained herein SHALL NOT APPLY TO:

- 1: New Polymer System Equipment delivered to the Purchaser in which the warranty registration has not been completed and returned to VeloDyne within thirty (30) days from the date of delivery of the Equipment to Purchaser.
- 2: Any defect which was caused (in VeloDyne's sole judgment) by other than normal use and service of the Polymer System Equipment, or by any of the following:
 - Improper handling, storage, operation, interconnection, installation, alteration or repair by anyone other than VeloDyne or those authorized by VeloDyne.
 - Parts or accessories installed on the Equipment that were not manufactured or installed by VeloDyne authorized representatives.
 - Improper voltage or wiring and/or inconsistent power supply.
 - Use of parts that are not 100% compatible with the Equipment.
 - Improper exposure to the elements.
 - Freezing water or excessive heat.
 - Water damage.
 - Water pressure surges due to owner system.
 - Accidents.
 - Damage after delivery to the Shipping Point.
 - Lack of reasonable and proper maintenance.
 - Misuse or negligence.
 - Natural calamities.
 - Overloading the system.
 - Vandalism.
- 3: Any Polymer System Equipment whose identification numbers or marks have been altered or removed.
- 4: Any Polymer System Equipment which any of the required or recommended periodic inspection or services have been performed using parts not manufactured or supplied by VeloDyne or meeting VeloDyne specifications.
- 5: Any defect which was caused (in VeloDyne's sole judgment) by operation of the Polymer System Equipment not abiding by standard operating procedures outlined in the Operator's Manual.
- 6: Transportation costs, if any, to or from an authorized VeloDyne rep or supplier.
- 7: Travel time of VeloDyne's service personnel to make a repair on the Purchaser's site or other approved location.
- 8: In no event will VeloDyne's liability under this warranty exceed the purchase price of the Polymer System Equipment or component(s).
- 9: VeloDyne will not be responsible to any person, under any circumstances, for any incidental or consequential damages (including but not limited to loss of profits, out of service time, and the like) occurring for any reason at any time.
- 10: Diagnostic and overtime labor premiums are not covered under this Limited Warranty Policy.
- 11: Depreciation damage caused by normal wear, lack of reasonable and proper maintenance, failure to follow operating instructions, misuse, or lack of proper protection during storage.
- 12: Accessory systems or electronic components not of VeloDyne's manufacture are warranted only to the extent of such manufacturer's respective Limited Warranty, if any.
- 13: Tools are not covered under this warranty.

- 14: **Consumables and Wear Items Not Covered:** Air Filters, Ball Valves, Bearings, Belts, Optional Accessories, Pressure Relief Valves, Screens, Disconnect Valves, Hoses, Rotors, Stators, Pump Diaphragms, Pump Seal Kits, and other customary consumables and wear items typically excluded from warranty coverage.
- 15: Stators are not covered under warranty if the pump is not installed properly (e.g., improper suction conditions) or is run dry.

Parts Warranty

Parts replaced during the warranty period will receive the balance of the first year New Polymer System Equipment Limited Warranty, during the first twelve (12) months.

Replacement parts after the original Equipment warranty has expired are warranted to be free from defects of material for thirty (30) days or the part will be repaired or replaced (in VeloDyne's sole judgment and option). Removal and reinstallation labor is not covered.

All parts warranty claims must be filed within ten (10) business days of initial part failure or the warranty claim will be void.

Exclusion of Other Warranties

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, OBLIGATIONS AND LIABILITIES OF ANY KIND, EXPRESS OR IMPLIED, EXCEPT AS STATED HEREIN. THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE, WHICH ARE HEREBY EXPRESSLY DISCLAIMED. VELODYNE'S OBLIGATION TO REPAIR OR REPLACE AS SET FORTH ABOVE IS OUR ENTIRE AND EXCLUSIVE LIABILITY AND YOUR EXCLUSIVE REMEDY FOR ANY CLAIM ARISING OUT OF THE GOODS OR SERVICES WE PROVIDE TO YOU, WHETHER SUCH CLAIM IS BASED ON CONTRACT, TORT OR ANY OTHER LEGAL THEORY. IN NO EVENT WILL WE BE LIABLE FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES. IF CIRCUMSTANCES CAUSE THE LIMITED REMEDY STATED HEREIN TO FAIL OF ITS ESSENTIAL PURPOSES, OUR LIABILITY FOR DAMAGES SHALL NOT EXCEED THE CONTRACT PRICE FOR THE GOODS FOR WHICH LIABILITY IS CLAIMED. ANY ACTION AGAINST US ARISING OUT OF THE GOODS OR SERVICES WE PROVIDE TO YOU SHALL BE BROUGHT WITHIN ONE YEAR OF THE DATE SUCH ACTION ACCRUES. THIS WARRANTY IS SOLELY FOR THE BENEFIT OF PURCHASER AND NO OTHERS.



WARRANTY REGISTRATION FORM

LIMITED WARRANTY

Your VeloBlend® or Hydramax® unit is warranted for one (1) year from the date of equipment start-up (not to exceed 18 months from the date your equipment was shipped to you from VeloDyne) against all defects in material and workmanship. Should your equipment prove defective within the warranty period, please contact our Service Department and service representative will create a return authorization (RMA) number for you to submit with the returned unit. If Equipment is being returned to us for repair or replacement, **please send to Velocity Dynamics, LLC, 543 S. Pierce Avenue, Louisville, CO 80027.** Package your unit carefully to avoid damage in transit. VeloDyne is not responsible for any damage caused to the unit in shipment. Shipping insurance should be available from your shipping agent. Under this warranty, VeloDyne undertakes to repair or replace any parts found to be defective. This warranty is only valid if the unit is used solely for equipment purposes in accordance with the instructions. This warranty is invalid if the unit is connected to an unsuitable electrical supply, or dismantled or interfered with in any way or damaged through misuse. You must complete the Warranty Registration Form and return it to VeloDyne to activate your warranty, which gives you specific legal rights. Please refer to your Warranty Agreement for full terms, conditions and exclusions.

This form must be completed and returned to us within thirty (30) days of delivery of your VeloDyne Products to activate your warranty. **FAILURE TO COMPLETE THIS REGISTRATION MAY VOID YOUR WARRANTY.** Please retain a copy of the completed form for your records. Purchaser acknowledges that the Start-up Equipment Test Form and Checklist items are required to validate this warranty, and regular scheduled maintenance must be performed on the Polymer System Equipment to maintain and ensure optimal performance. VeloDyne reserves the right to request maintenance records on the purchased unit to validate this warranty.

Customer Name (Company):	Contact Name (Person):
Project Name:	Equipment Serial Number:
Equipment Model #:	Equipment Delivery Date:
Location of Equipment (Address):	Service Contract Requested?

By signing below, I verify that I have read and understand the warranty policy of Velocity Dynamics, LLC, and I verify that the information contained on this form is accurate. I understand and agree that all service or start-up retainages are now due in full.

OWNER'S SIGNATURE	DATE
Velocity Dynamics, LLC, 543 S. Pierce Ave., Louisville, CO 80027 www.velodynesystems.com ♦ (PH) 303-530-3298 ♦ (F) 303-530-3368	

INTERNAL USE ONLY	Sales Order #:
Invoice #:	Extended Warranty Requested?
Inspection / Installation Date:	Start-up/ Inspection By:



WARRANTY SERVICE REQUEST FORM

In order to more systematically attend to service requests of your VeloBlend® or Hydramax® system, it is necessary that this form be used. Requests are processed in the order in which they are received. Please fill out the form as specifically as possible for a more accurate interpretation by us. Maintenance matters which are the responsibility of the system owner will not be considered. **Return this form to Velocity Dynamics, LLC, Attn: Warranty Service, 543 S. Pierce Avenue, Louisville, CO 80027 e-mail to service@velodynesystems.com or Fax to 303-530-3368.** For emergency repairs, please call our Service Manager at 303-530-3298.

Customer Name (Company):	Contact Name (Person):
Project Name:	Equipment Serial Number:
Equipment Model #:	Equipment Delivery Date:
Location of Equipment (Address):	Service Contract Requested?
List Specific Needs / Problems / Service Requested:	

By signing below, I verify that I have read and understand the warranty policy of Velocity Dynamics, LLC, and I verify that the information contained on this form is accurate.

OWNER'S SIGNATURE

DATE

Velocity Dynamics, LLC, 543 S. Pierce Ave., Louisville, CO 80027
www.velodynesystems.com ♦ (PH) 303-530-3298 ♦ (F) 303-530-3368

INTERNAL USE ONLY	Sales Order #:
Invoice #:	Extended Warranty Requested?
Inspection / Installation Date:	Start-up/ Inspection By:

8. Component Operation and Maintenance Manuals

8.1 Pump



Operating and Assembly Instruction Progressive Cavity Pump

Commission No.

861706-861710

Type

MD 006-12

Job#

P02000927

Read instructions before
beginning any work!

Always keep instructions
handy on the worksite.

Issue: 06.22.2016

Operating and Maintenance
Instructions
Progressive Cavity Pump

item	document	denomination
1.0.0	OM.GEN.01e	General
2.0.0	OM.SAF.01e	Safety
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.006-12.use	Characteristic Curves
	103-007A2	Sectional drawing
		Parts list
	OM.SEA.___e	Shaft Sealing
	OM.WPS.42e	Wearing parts and gaskets
	103-C01/M060-C-700A4	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 machiness or assemblies conveying media that are detrimental to health must be decontaminated.

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

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


2.7 Unauthorized Modification and Manufacture of Replacement Parts

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

2.8 Impermissible Modes of Operation

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

4.1 Safety

 CAUTION
<p>Damage to property/injuries due to incorrect transport. Slight injury or damage to property can occur.</p> <ul style="list-style-type: none"> ➤ Comply with the safety notes and transport notes on the packaging. ➤ Use suitable means of transport, lifting devices and tools. ➤ Use protective equipment.

4.2 Transport

4.2.1 Dimensions, weight and centre of gravity

- Note the dimensional drawing (chapter 5.6).

4.2.2 Symbol

- Meaning of symbol



Top



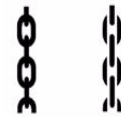
Fragile item



Against moisture protect





Centre of gravity

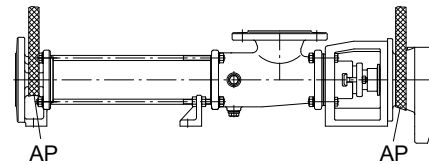


Lashing points

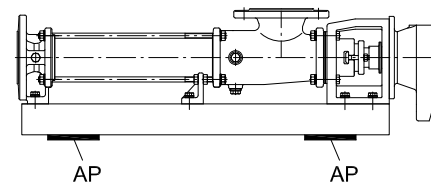
4.2.3 Lashing points (AP) for lifting devices

	 WARNING
	<p>Warning of suspended load. Death or serious injury can occur.</p> <ul style="list-style-type: none"> ➤ Use the lashing points (AP) for lifting devices. ➤ Note the centre of gravity (dimensional drawing chapter 5.6).

Lifting machine



Industrial trucks



4.2.4 Unpacking the machine

- Comply with the symbols and notices on the packaging.
- Remove the screwed connection between the machine and packaging.
- Remove the machine with a lifting machine/industrial truck.


Ausgabe issue	A / 29.08.07	Dokument document	OM.TRA.01e	Blatt sheet	1 (2)
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4.3 Temporary storage/corrosion protection

- All seepex machines have corrosion protection applied as standard prior to transport.

<i>NOTICE</i>
<p>Damage to property if corrosion protection is missing. Property damage can occur due to corrosion.</p> <ul style="list-style-type: none"> ➤ Temporary storage must be in a dry, enclosed, frost-free room in order to provide protection against ambient influences. ➤ Contact seepex regarding the necessary corrosion protection for temporary storage.

4.4 Disposal

	<table border="1"> <tr> <td style="background-color: #0000FF; color: white; text-align: center;"><i>NOTICE</i></td> </tr> <tr> <td> <p>Environmental protection. Material damage can occur.</p> <ul style="list-style-type: none"> ➤ Drain the pumping medium and dispose of it in accordance with the regulations. ➤ Dispose of the machine with regard to its composition and existing regulations. </td> </tr> </table>	<i>NOTICE</i>	<p>Environmental protection. Material damage can occur.</p> <ul style="list-style-type: none"> ➤ Drain the pumping medium and dispose of it in accordance with the regulations. ➤ Dispose of the machine with regard to its composition and existing regulations.
<i>NOTICE</i>			
<p>Environmental protection. Material damage can occur.</p> <ul style="list-style-type: none"> ➤ Drain the pumping medium and dispose of it in accordance with the regulations. ➤ Dispose of the machine with regard to its composition and existing regulations. 			

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.

2.1 General description

seepex pumps are members of the group of rotating displacement pumps.

- Characteristic features
 - Special configuration/arrangement of the rotor and stator pumping elements.
 - Motion sequence

2.2 Mode of action and pumping principle of the seepex pump

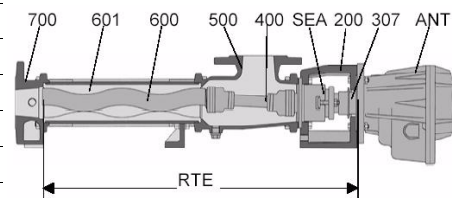
- Seal lines are created by the geometrical configuration/contact between both pumping elements.
- Seal lines provide total separation between the suction and pressure sides.

Result:


- Increased suction lift capability of the pump
- High pressure build-up irrespective of the rotation speed

2.3 Constructive design

No.	Designation
ANT	Drive
200	Lantern
307	Plug-in shaft
400	Coupling rod
SEA	Shaft seal
500	Suction casing
600	Rotor
RTE	Rotating unit
601	Stator
700	Pressure branch



5.1 Mounting tools / lifting gear

	<p>⚠ CAUTION</p>
	<p>Pump falling over. Slight injury or damage to property can occur.</p> <ul style="list-style-type: none"> ➤ Adhere to the lifting tool's starting point. ➤ Pay attention to the dimensions, weight and centre of gravity of the pump. ➤ Use suitable mounting tools/lifting gear.

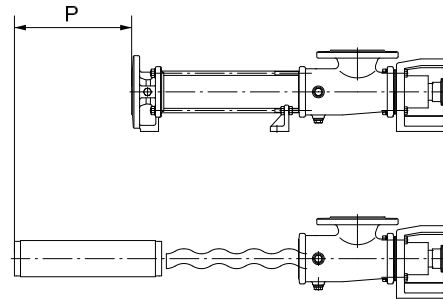
5.2 Space requirement

The required space should be determined by considering the following factors:

- Dimensions and weight.
- Requisite transport and lifting equipment.
- Pipe routing – dismantling (dimension for stator replacement).

5.2.1 Dimension for stator replacement (P)

- Refer to the dimensional drawing.



5.3 Assembly of the complete mounted pump

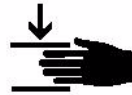
- Assemble according to technical data (chapter 3.).
- Note dimensional drawing.

Tension-free mounting of the pump



- Balance unevenness with suitable supports.
- Applies to mounting on foundations/load-bearing elements.
- Total areas of all pump bearing areas are resting on the surface.

Correct position of the drives

- All drives are set up ready for operation and mounted.
- Correct displacements of the drive during transport/installation of the pump by adjusting/fixing the drive.

	<p>⚠ CAUTION</p>
	<p>Safety protection devices. Slight injury or damage to property may result.</p> <ul style="list-style-type: none"> ➤ Connect safety protection devices and activate.

5.4 Power supply of the seepex pump

	 DANGER
	<p>Line voltage and line frequency. Death or serious injury can occur.</p> <ul style="list-style-type: none"> ➤ Note type plate on the pump. ➤ Pay attention to manufacturer's directions (chapter 13.). ➤ Pay attention to safety regulations.

5.5 Pipelines

5.5.1 Suction and pressure connection

- Refer to the dimensional drawing for the position, nominal width and standard.
- Note direction of rotation/flow direction.

5.5.2 Pipeline dimensions

- Adhere to specifications regarding pressure in the pressure respectively suction connection.
- Note technical data (chapter 3.).
- Nominal width of suction pipe = nominal width of suction connection of pumps.

5.5.3 Residue-free pipelines

<i>NOTICE</i>
<p>Damage to property through assembly residue. No claims under guarantee if violated.</p> <ul style="list-style-type: none"> ➤ Keep all pipelines free of foreign objects. ➤ Remove weld spatters, screws, steel chips etc.

5.5.4 Tension-free assembly

- Assemble pipelines and other components in a tension-free manner on the pump.

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.



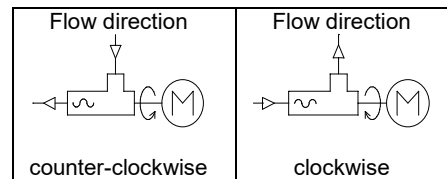
The risk of exposure to electrical hazards must be ruled out. Always observe the safety regulations valid at the site of installation.



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.

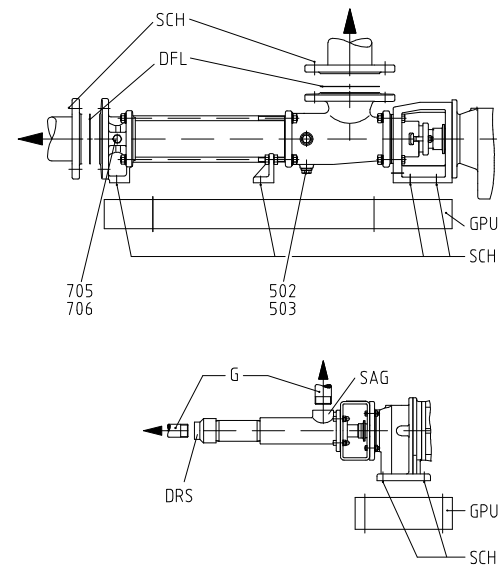


6.6.4 Disassembling the Pump

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.

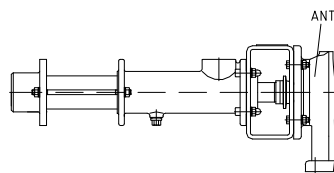
Ausgabe issue	A / 18.02.1998	Dokument document	OM.MAL42e	Blatt sheet	1 (4)
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7.3 Dismantling the seepex Progressive Cavity Pump

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

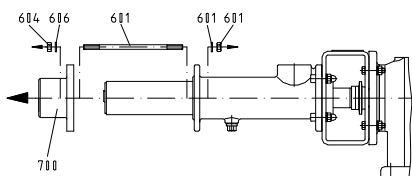
The stator (601) and the rotating pump parts can be exchanged at site. The rotating pump parts can be either dismantled as a complete rotating unit (RTE) (item 7.3.4) or as individual components (item 7.3.5).

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

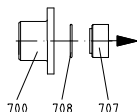


7.3.1 Pressure Branch (700) - Dismantling

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



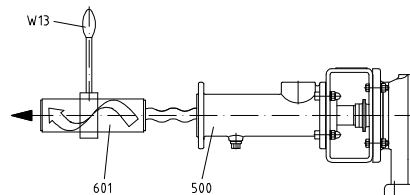
Pressure branch (700) **with** reducing unit (707)



7.3.2 Stator (601) - Dismantling

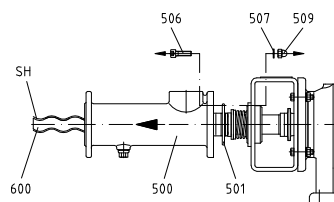
- Easier assembly:
Disassembly of the stator can be made considerably easier by first moistening the inner surface of the stator with antiseize agent (soft or liquid soap). Before removing the pressure flange (700), pour the antiseize agent into the opening between rotor and stator on the pressure flange 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.).

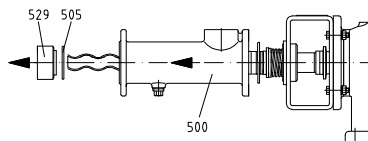


7.3.3 Suction Casing (500), Casing Gasket (501) - Dismantling

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



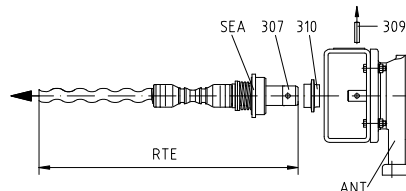
Suction casing (500) **with** reducing unit (529)



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).

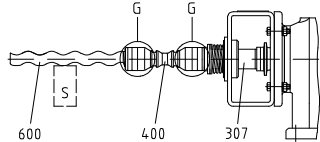


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7.3.5 Rotating Pump Parts - Dismantling

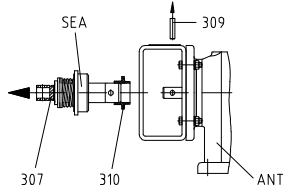
7.3.5.1 Rotor (600), Coupling Rod (400)

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.



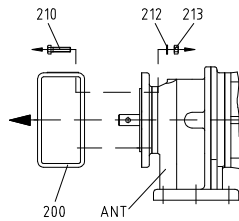
7.3.6 Dismantling of Joint

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



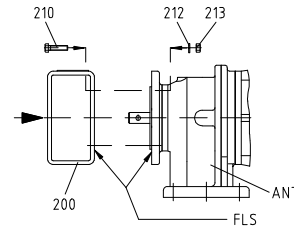
7.4 Re-assembly

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

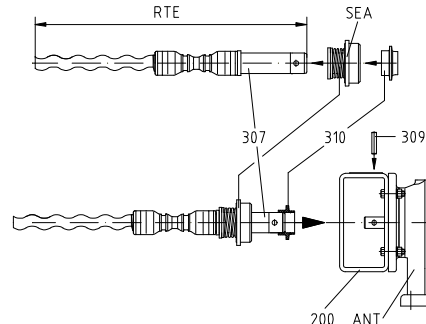
Clean flange bearing surfaces (FLS), centering diameter and output pivot of the drive (ANT).



7.4.2 Rotating Unit (RTE) - Re-assembly

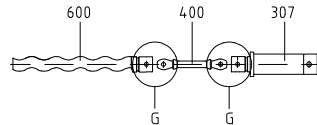
The rotating unit (RTE) has been assembled in accordance with the description in document OM.PJT.04.

- 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).



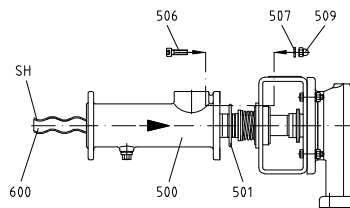
7.4.3 Rotating Pump Parts - Re-assembly

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.

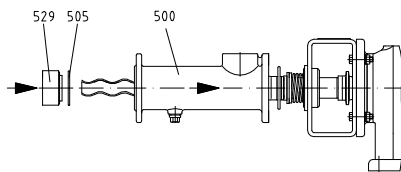


7.4.4 Suction Casing (500), Casing Gasket (501) - Re-assembly

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

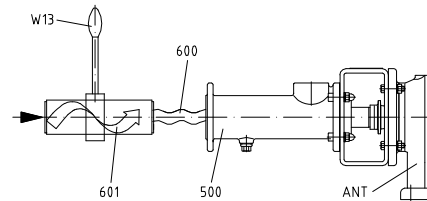


Suction casing (500) **with** reducing unit (529)



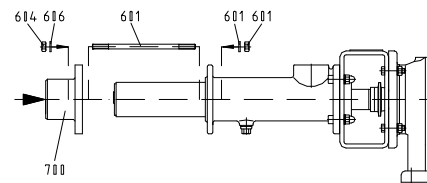
7.4.5 Stator (601) - Assembly / Re-assembly

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.

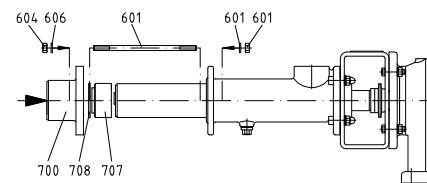


7.4.6 Pressure Flange (700) - Assembly
CAUTION

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





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



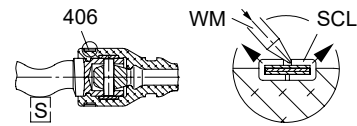
9.2 Rotating unit individual parts

9.2.1 Dismantling

9.2.1.1 Holding band (406) - dismantling

	 CAUTION
	<p>Risk of injury. Possibility of parts spinning out. Slight injury or damage to property may occur.</p> <p>➤ Wear protective goggles.</p>

- Disconnect the holding band strap (SCL).
 - Use suitable tool (WM).
- Push the strap components (SCL) out of the holding band.
- Remove the holding band (406).

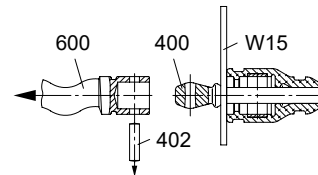
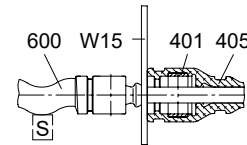


9.2.1.2 Rotor (600) - dismantling



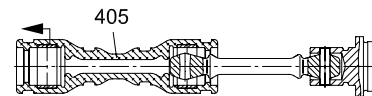
Tool (W15/mounting plate)

- Pull back the universal joint sleeve (405) with retaining sleeve (401).
- Secure tool (W15).
- Push the coupling rod bolts (402) out.
- Remove the coupling rod (400).



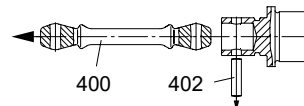
9.2.1.3 Universal joint sleeve (405) - dismantling

- Pull off the universal joint sleeve (405).



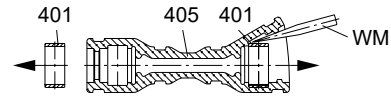
9.2.1.4 Coupling rod (400) - dismantling

- Push the coupling rod bolts (402) out.
- Remove the coupling rod (400).



9.2.1.5 Retaining sleeve (401) - dismantling

- Remove the retaining sleeve (401) from the universal joint sleeve (405).
 - Use suitable tool (WM).



9.2.2 Preparation for reassembly

9.2.2.1 Rotor (600)

- Remove any existing damage.
- Clean the rotor (600).

9.2.2.2 Coupling rod (400)

- Clean the coupling rod (400).
- Inspect the head bore for wear.
 - If wear to the head bore is detected, replace the coupling rod (400).



9.2.2.3 Plug-in shaft (307)

- Remove any existing damage.
- Clean the plug-in shaft (307).

9.2.3 Reassembly

NOTICE

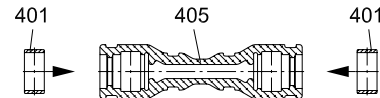
Faulty joint function

Functional deficiency and/or ruining of joints.
Damage to property may result.

- Replace coupling rod bolts (402) and coupling rod (400) in the event of wear.

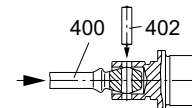
9.2.3.1 Retaining sleeve (401) - reassembly

- Moisten retaining sleeve (401) with joint grease.
- Insert the retaining sleeve (401) into the universal joint sleeve (405).



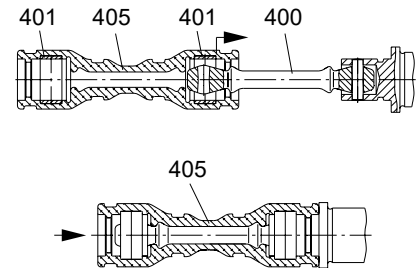
9.2.3.2 Coupling rod (400), plug-in shaft 307) - reassembly

- Fill the joint head with seepex joint grease.
- Connect the plug-in shaft (307)/coupling rod (400).
- Slide in the coupling rod bolts (402).

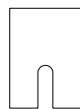


9.2.3.3 Universal joint sleeve (405) - reassembly

- Moisten the surface of the coupling rod (400) / inside of the universal joint sleeve (405) with joint grease (Maintenance Chapter 7.0).
- Slide the universal joint sleeve (405) on.

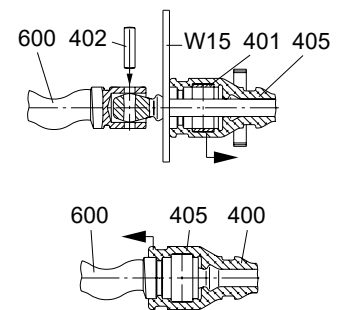


9.2.3.4 Coupling rod (400), rotor (600) - reassembly



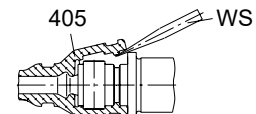
Tool (W15/mounting plate)

- Pull back the universal joint sleeve (405) with retaining sleeve (401).
- Secure tool (W15).
- Slide in the coupling rod bolts.
- Slide the universal joint sleeve (405) onto the joint head.



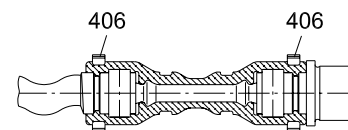
9.2.3.5 De-aerate universal joint sleeve (405)

- Remove air from the inside of the joint.
 - Use suitable tool (WS).



9.2.3.6 Holding band (406) - reassembly

- Mount the holding band (406).
 - Holding band assembly (Chapter 9._).



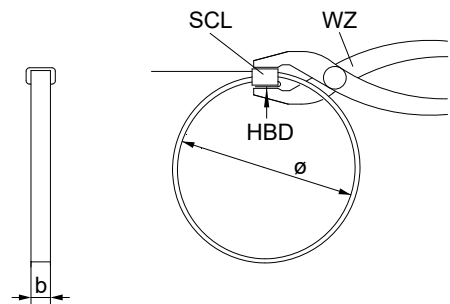
9.3 Holding band - assembly

9.3.1 Prepare the holding band

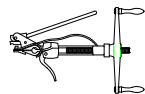
- Only use prefabricated double-band holding bands may.

9.3.2 Check the holding band

- Bent-over holding band (HBD) is in contact with holding band loop (SCL) to avoid damaging universal joint sleeve.
- Press on holding band (HBD) using tool (WZ) if necessary.

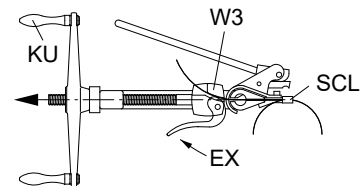


9.3.3 Assemble the holding band



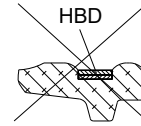
- Use tool (W3/mounting tool)

- Feed holding band into tool (W3).
- Hold ends of holding band with the eccentric lever (EX).
- Turn the crank (KU) until the holding band is strained and lies against the holding band loop (SCL).
- Carefully pull the holding band together until it is in contact with the circular groove of universal joint sleeve.



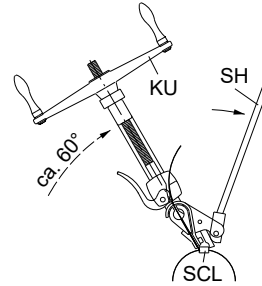
Incorrect

The holding band (HBD) is too tight, universal joint sleeve will be damaged/sheared off.



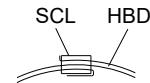
9.3.5 Cant up the holding band

- Swivel mounting tool (W3) approx. 60° upwards.
- Loosen crank (KU) by a half turn.
- Swivel cutting lever (SH) forward until the pressure piece is lying behind the holding band loop (SCL).



9.3.6 Shear the holding band (material: 1.4301; 1.4571)

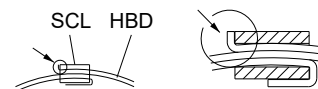
- Hit the cutting lever (SH) with the inside of your hand.
 - Cant up and shear the end of the holding band behind the loop (SCL).
 - Carefully straighten up the holding band if it rises up on the sheared side.



CAUTION
<p>Universal joint sleeve damage. Pin joint grease can emerge.</p> <p>➤ Avoid hammering or knocking.</p>

9.3.7 Check the holding band after assembly

- The holding band must lie in the groove of the universal joint sleeve.
- Replace the holding band if the holding band slips back through the loop.



Refer to technical data (chapter 3.) for application range of the pump.

Malfunction									Causes	Rectification	
Pump is not sucking	Pump pumping unevenly	Conveying capacity is not achieved	Pressure head is not reached	Pump does not start up	Pump seized / pump does not pump	Pump is loud when running	Motor gets too hot	Premature stator wear			Shaft seal is leaky
				X			X		X	Static friction between stator/rotor too great.	Apply lubricant (liquid soap) between stator and rotor.
X										Incorrect direction of rotation.	Check direction of rotation and swap over motor connections if necessary.
X	X	X			X	X				Suction pipe or shaft seal leaking.	Eliminate leaks.
X	X	X				X				Suction head too great.	Check the suction head, if necessary increase pipe cross section on suction pipe and use a larger filter, open suction-side valve fully.
X	X	X								Viscosity of conveying product too great.	Check/adapt (data sheet).
		X	X				X			Pump rotation speed incorrect.	Correct rotation speed (data sheet).
	X	X									Avoid air bubbles in the conveying product.
		X	X	X			X	X		Pressure head too great.	Check pressure head with pressure gauge, reduce pressure head by using larger pressure pipe crossed section or shortening the pressure pipe.
X	X	X			X				X	Pump running partially/ completely dry.	Check there is adequate conveying product available on the suction side. Dry running protection DRP.
						X	X			Check coupling.	If necessary, move pump in relation to drive, check wear on coupling gear, re-adjust coupling if necessary.
X		X								Rotation speed too low.	Increase rotation speed for low-viscosity media/large suction volume.

Malfunction									Causes	Rectification	
Pump is not sucking	Pump pumping unevenly	Conveying capacity is not achieved	Pressure head is not reached	Pump does not start up	Pump seized / pump does not pump	Pump is loud when running	Motor gets too hot	Premature stator wear			Shaft seal is leaky
X	X					X				Rotation speed too high.	Reduce rotation speed for high-viscosity media, risk of cavitation.
						X				Joint play too large.	Check mounting of coupling rod bushing.
X		X		X	X			X		Foreign objects in pump.	Dismantle pump, remove foreign bodies, replace defective parts.
X		X	X		X					Stator/rotor worn.	Dismantle pump and renew defective parts.
X		X			X	X				Joint parts worn.	Renew joint parts, use seepex pin joint grease.
X		X			X			X		Suction pipe blocked.	Clean the suction pipe.
X				X	X		X	X		Temperature of pumping liquid too high.	Check temperature, use an undersize rotor.
X		X		X			X		X	Gland packing too firm/worn.	Loosen packing gland or tighten. Renew unusable packing rings.
X				X	X			X		Solid content and/or grain size too great.	Reduce pump speed, install screen with permitted mesh width. Increase liquid proportion.
X				X				X	X	Sedimentation/gumming of solids when pump stationary.	Rinse through and clean the pump immediately.
X				X	X			X	X	Conveying product hardens when the temperature drops below a certain limit.	Heat the pump.
				X	X		X	X		Stator swollen and unable to withstand conveying product.	Select a suitable stator material, use an under-size rotor.
						X			X	Bearings in pump drive housing or drive unit defective.	Renew bearings.
									X	Mechanical seal defective.	Check sliprings and O-rings for wear/resistance, renew if necessary.

9.0 Auxiliary seepex documentation

Order No. P02000927
 Data sheet 861706-861710
 Version 1 Item 50

SEEPEX.
ALL THINGS FLOW

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

SEEPEX	
Order No.	P02000927
Date	6/10/2016
Commission no.	861706-861710
Customer	VeloDyne - Velocity Dynamics, Inc.
Purchase order no.	039539-00

qty.: 5 **Progressive cavity pump**
MD 006-12 / A6-J0-J0-H5-A

Application data		U 495 XXX001
Conveyed product	neat polymer	
Flowability	well flowable	
Viscosity	201-300 mPas	
Solids content	not specified	
Size of solids	not specified	
Concentration	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	24h/day	
Location	outdoor, dry atmosphere	

Performance data				
	Capacity	Pressure	Speed	
	0.7 USGPH	90 psi	22 rpm	min
	11.3 USGPH	90 psi	262 rpm	norm
	15 USGPH	90 psi	345 rpm	max
Starting torque	2.95 lb.ft			
Req. power at pump shaft	0 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	standard
Lantern - Material	1.0037 (st. 37-2)
Lantern - Flange diameter	120 mm
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 - Viton
Joint - Joint Grease	joint grease SEEPEX 30321
Coupling rod - Design	standard
Coupling rod - Material	1.6582 encapsulated

Order No. P02000927
 Data sheet 861706-861710
 Version 1 Item 50



Rotor - Design	standard
Rotor - Material	1.4404 / AISI 316L
Stator - Design	standard
Stator - Material	FPM - Viton special
Shaft sealing	packing
Design	standard
Casing - material	1.4404
Packing ring - material	K40
Plug-in Shaft - Design	standard
Plug-in Shaft - Material	1.4404 / AISI 316L
Plug-in Shaft - Drilling diameter	19
Plug-in Shaft - Drilling depth	35
Bolting - Design	stainless steel incl. locking screws
Painting - Color	Standard Painting"SEEPEX-Blue" (2K)

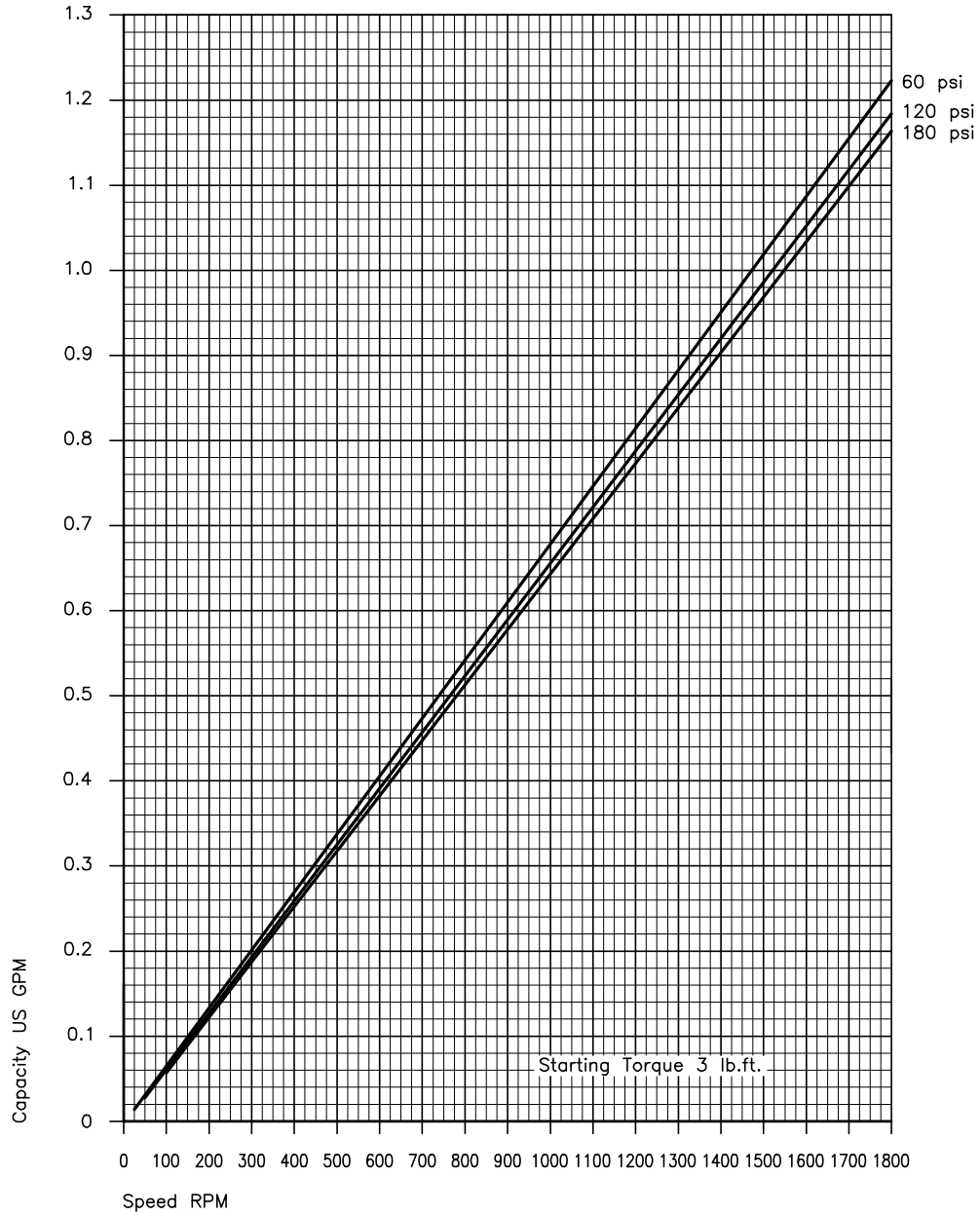
Packing

Type of packing	cardboard box (US)
------------------------	--------------------

Miscellaneous

Design	Please make sure to note on Velodyne orders to rotate and 90 degrees and have the nameplate in pos 3
---------------	--

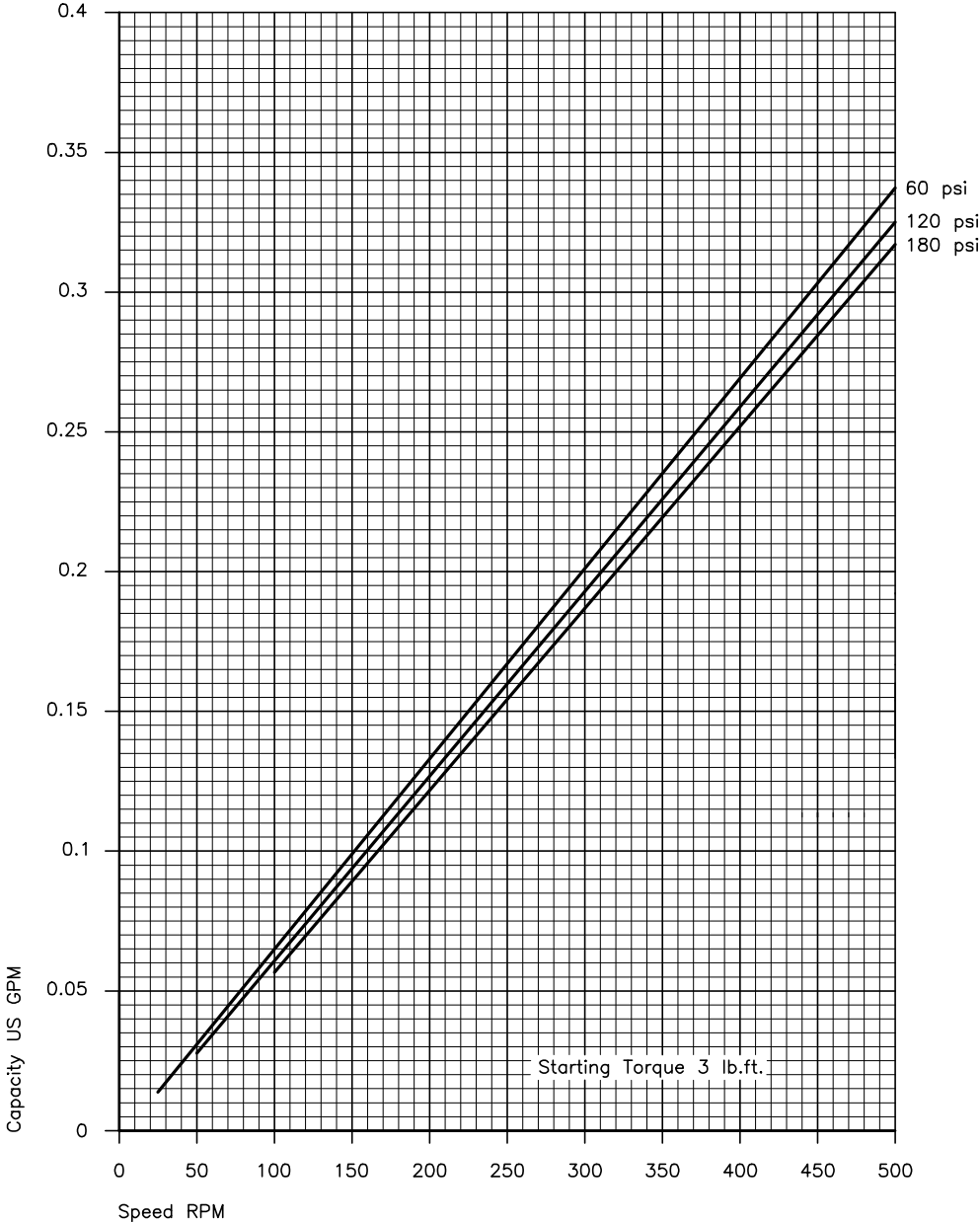
Characteristic Curves
 Size
 006-12 / RTE PVDF



Values based upon HFC 46

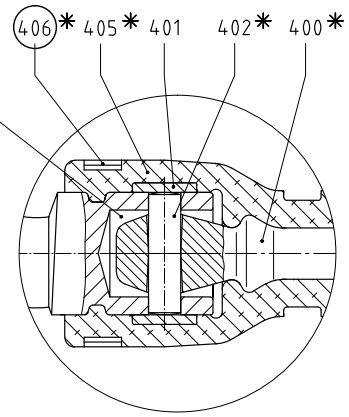
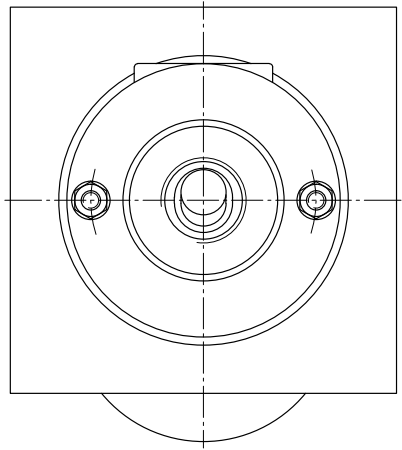
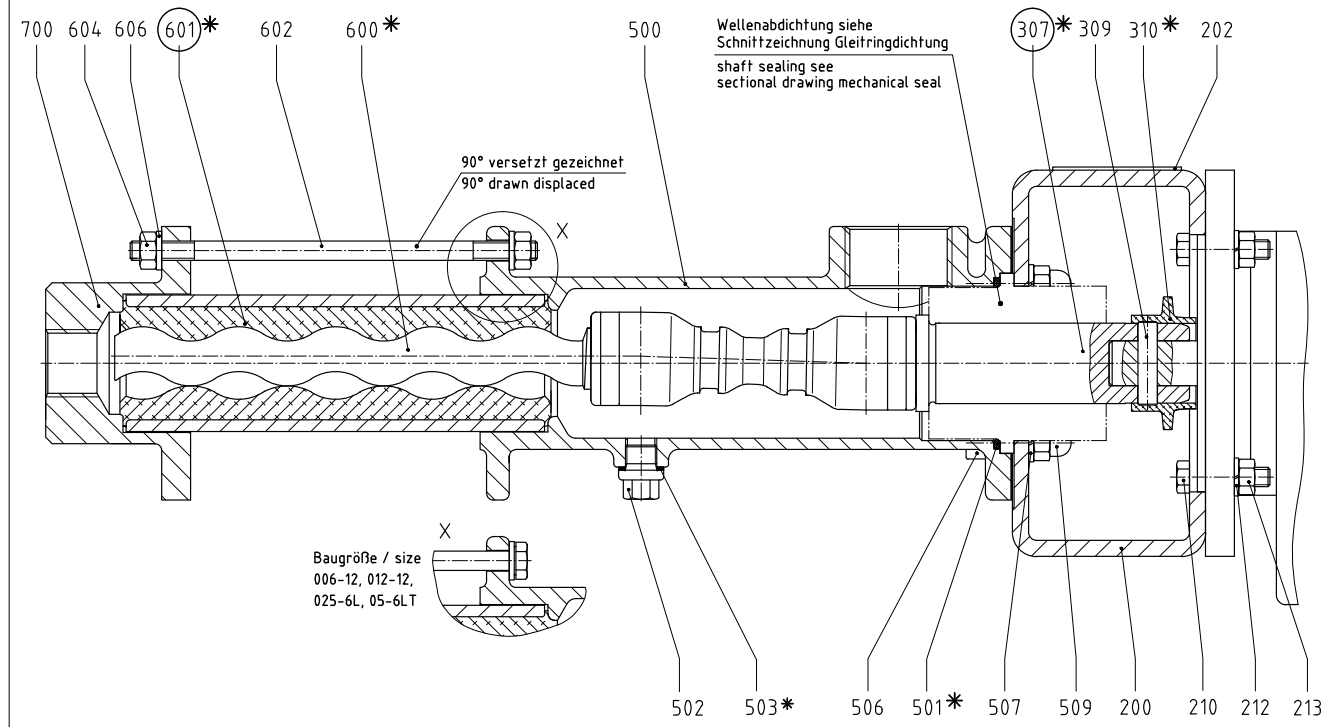
CHA.006-12_12PC, A 02.01us

Characteristic Curves
Size
006-12 / RTE PVDF



Values based upon HFC 46

CHA.006-12_12PC.s, A 02.01us



SEEPEX Gelenkfett
 Typ und Füllmenge:
 Betriebs- und Montageanleitung
 entnehmen

SEEPEX joint grease
 type and filling quantity:
 see operating and
 assembly instruction

○ Werkzeuge
 Betriebs- und Montageanleitung
 entnehmen

Tools
 see operating and
 assembly instruction

* Verschleißteile und Dichtungen
 Betriebs- und Montageanleitung
 entnehmen

Wearing parts and sealings
 see operating and
 assembly instruction


Stück Unit	Norm Standard	Pos./Item	Benennung/Denomination Zeichnungs-Nummer/Drawing-Number	Werkstoff/Material	Bemerkung/Remark	Gewicht Weight kg
SEEPEX. ALL THINGS FLOW						
Allgemeintoleranzen für Maße ohne einzelne Toleranzangabe DIN ISO 2768-mittel	Grp	Änderung Scale Modification	Name Name	Datum Date	Maßstab/Scale %	Werkstoff/Material
General tolerances for mass without individual tolerance entry DIN ISO 2768-average					Bezeichnung/Denomination	Gewicht/Weight
					Schnittzeichnung Baureihe "MD" sectional drawing range "MD"	
					mit 2 Spanschrauben with 2 tie bolts	
Rauheit für Oberflächenzeichen DIN ISO 1302 Reihe 2			Name Name	Datum Date	Zeichnungs-Nummer/Drawing-Number	
Roughness for surface finish indication DIN ISO 1302 Reihe 2	Bearbeitet/Drawn	wgj	hof	14.07.1998	103-011A2	
	Geprüft/Checked			14.07.1998	EDV-Nr./EDP-No. L:\LFDZCHNG.290\29265	
	Normiert/Standard				Ersetzt 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.

Stck.	Pos.	DE	EN	FR
		Baureihe MD	Range MD	Série MD
		Schnittzeichnung Nr. 103-011A2	sectional drawing No. 103-011A2	plan no. 103-011A2
		Benennung Stck. / Pos.	denomination Qty. / Item	désignation 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	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
4	506	Zylinderschraube	socket screw	vis à tête cylindrique
4	507	Federring	spring washer	rondelle frein
4	509	Hutmutter	cap nut	écrou borgne
1	600	Rotor	rotor	rotor
1	601	Stator	stator	stator
2	602	6kt-Schraube	hexagon bolt	vis
2	* 602	Spannschraube	tie bolt	tirant
2	604	6kt-Mutter	hexagon nut	écrou
4	* 604	6kt-Mutter	hexagon nut	écrou
2	606	Scheibe	washer	rondelle
4	* 606	Scheibe	washer	rondelle
1	700	Druckstutzen	pressure branch	bride de refoulement
	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
		Wellenabdichtung siehe Schnittzeichnung Gleitringdichtung	shaft sealing see sectional drawing mechanical seal	dispositif d' etanchéité voir vue éclatée garniture mécanique
	*	Baugröße 006-12, 012-12, 025-6L, 025-6LT, 05-6LT	size 006-12, 012-12, 025-6L, 025-6LT, 05-6LT	taille 006-12, 012-12, 025-6L, 025-6LT, 05-6LT
		versetzt gezeichnet	drawn displaced	plan séparé

9.5 Gland packing Code A

9.5.1 Safety

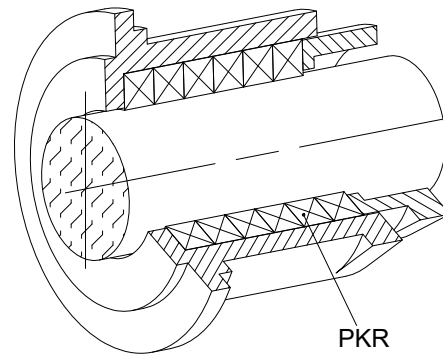
	WARNING
	<p>Shaft seal is leaky. Leakage may escape into the atmosphere.</p> <ul style="list-style-type: none"> ➤ Take safety measures to protect persons and the environment. ➤ Wear suitable protective clothing. ➤ Dispose of leakage appropriately. ➤ Note applicable regulations when handling hazardous substances.

9.5.2 Operating conditions and and material combination

- Adjust to the relevant application
 - Refer to technical data (chapter 3).

9.5.3 Design

- 6 packing rings (PKR)



9.5.4 Commissioning

NOTICE
<p>Adjusting gland packing. Damage to property due to leakage.</p> <ul style="list-style-type: none"> ➤ Packing must be adjusted on-site in accordance to the operating conditions.

Gland packing in case of overpressure in the suction chamber

- Leakage of 50-100 drops/min is permitted when starting up, the packing material settles down after 10-15 min.
- Reduce the leakage to 1-10 drops/min by retightening the packing gland evenly.
- Leakage is collected and drained away through the threaded drilling.

Gland packing in case of negative pressure in the suction chamber

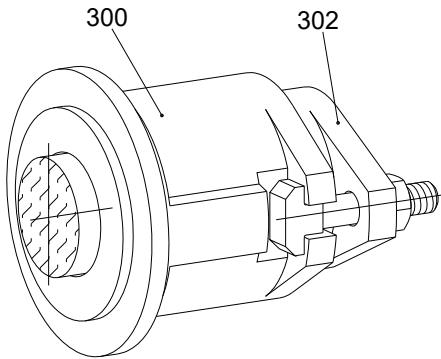
- The gland packing needs about 10-15 minutes until the packing material has settled down.
- Retighten the packing gland evenly to prevent air being sucked in from the atmosphere.

Ausgabe issue	B / 06.07.2007	Dokument document	OM.SEA.Ae	Blatt sheet	1 (3)
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9.5.5 Monitoring during operation

Checking for leaks

- If the leakage is excessive or if air is sucked in, retighten the packing gland until the permitted leakage is reached (1-10 drops/min).

NOTICE	
<p>Shaft wear. Leakage in the area of the gland packing.</p> <ul style="list-style-type: none"> ➤ Assemble new packing rings (PKR) before packing gland (302) lies against gland housing (300). 	

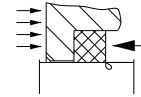
Operating error



Gland packings limit emergence of liquid.
Leakage is necessary to reduce friction and dissipate frictional heat.

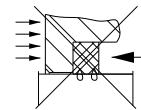
Correct

Liquid and lubricant lubrication.



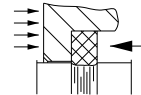
Incorrect

No liquid lubrication due to strong gland pressure; pressing out of the impregnation.



Consequence

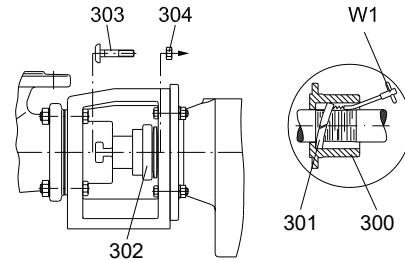
Dry running, burning of the packing. Severe shaft wear and therefore high leakage.



9.5.6 Packing rings (PKR) - dismantling

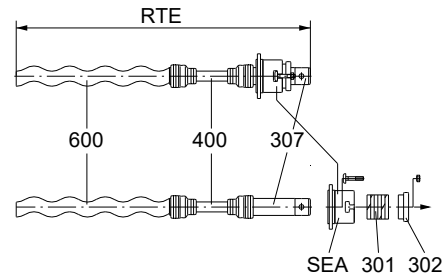


- Dismantle the gland bolts (303).
- Push back the packing gland (302).
- Remove packing rings (PKR).
 - Use tool (W1).



9.5.7 Gland packing - dismantling

- Clean the plug-in shaft (307).
- Remove projecting edges and burrs.
- Moisten plug-in shaft (307) with lubricant (thinned liquid soap).
- Pull off the shaft sealing (SEA).
- Dismantle packing gland (302).
- Remove packing rings (301).



9.5.8 Gland packing - reassembly

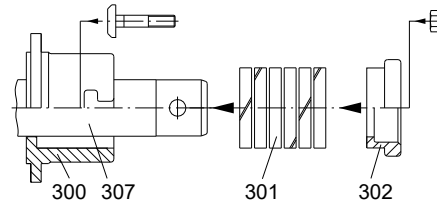


Shaft sealings are high-quality precision parts. Their installation is therefore to be undertaken with care. Careful handling and the utmost of cleanliness are prerequisites.

NOTICE

Damage of the shaft and the packing rings.
Leakage results.

- Do not use any pointed object to assemble the packing rings.
- Clean the gland housing and the shaft.
- Renew arrived shaft.
- Install the packing rings (301) with cut ends offset by 90°.
- Assemble packing gland (302).



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

8.1.1 Gear Reducer

Browning

CbN Series 3000 Gearmotors and Reducers Installation and Maintenance Manual

Power Transmission Solutions
Regal Beloit America, Inc.
7120 New Buffington Road
Florence, KY 41042
Application Engineering: 800 626 2093
www.RegalPTS.com

FORM
8772E
Revised
October 2016

⚠ WARNING

- Read and follow all instructions carefully.
- Disconnect and lock-out power before installation and maintenance. Working on or near energized equipment can result in severe injury or death.
- Do not operate equipment without guards in place. Exposed equipment can result in severe injury or death.

⚠ CAUTION

- Periodic inspections should be performed. Failure to perform proper maintenance can result in premature product failure and personal injury.

Safety First

High voltage and rotating parts can cause serious or fatal injury. Safe installation, operation and maintenance must be performed by qualified personnel. Familiarization with and adherence to NEMA MG2, the National Electric Code and local codes is recommended. It is important to observe safety precautions to protect personnel from possible injury. Personnel should be instructed to:

1. Avoid contact with energized circuits or rotating parts.
2. Disconnect all power sources before initiating any maintenance or repair.
3. Act with care in accordance with prescribed procedures in handling and lifting this equipment.
4. Be sure the unit is electrically grounded in accordance with code requirements.
5. Be sure equipment is properly enclosed to prevent access by children or other unauthorized personnel in order to prevent possible accidents.
6. Be sure shaft key is fully captive before unit is energized.
7. Avoid contact with capacitors until safe discharge procedures have been completed.
8. Most units are shipped with oil. Always be sure oil lubricated units are filled with correct oil to proper level before operating.
9. Provide proper safeguards for personnel against rotating parts and applications involving high inertia loads, which can cause overspeed.
10. Avoid extended exposure to equipment with high noise levels.
11. Be familiar with the equipment and read all instructions thoroughly before installing or working on equipment.

Installation Instructions

Start-Up

Before operating the reducer or gearmotor, the following must be done:

- Install the drive on a rigid and vibration-free surface.
- Remove the protective coating on the shaft and flange. Use solvent if necessary.
- Carefully install coupling, sheaves, sprockets, or pinions on shaft. Mount as close to the shaft shoulder as possible.
- It is preferable to use heat instead of force. **Do not hammer on shaft!**
- Check shaft alignment when using direct coupling.
- Check shaft parallelism when using belt or chain drive.

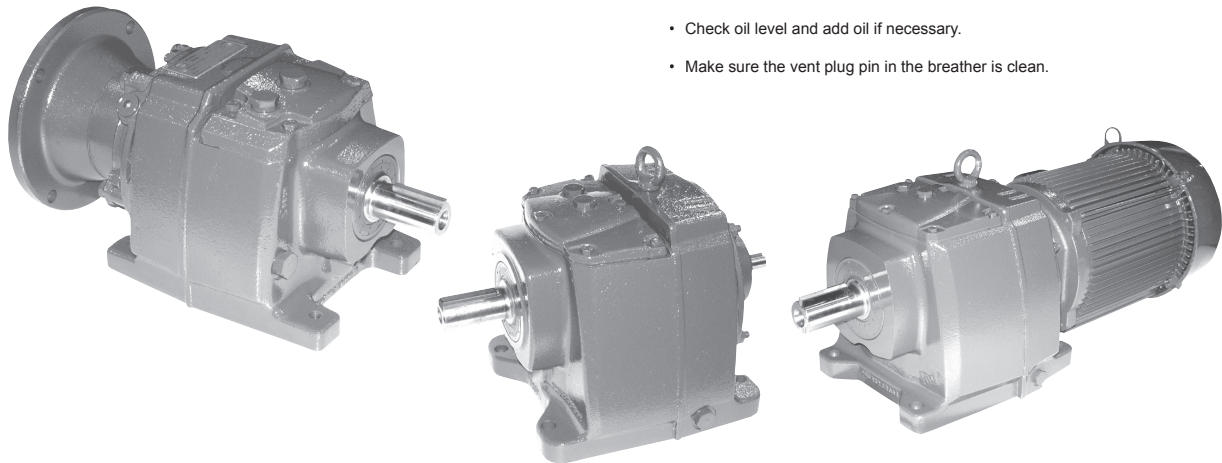
CAUTION: Refer to belt manufacturer's recommendation for belt tension. (Tension should not be applied on chain drives.)

- Check oil level in oil lubricated reducer.
- Install breather plug in the plug hole per recommendations shown on page (5, 7, or 9) for sizes larger than frame 30.

Maintenance

Safe operation and product performance is improved with periodic inspections. It is recommended the reducer or gearmotor be inspected every 50 hours of operating time.

- Check mounting bolts and belt tension (if applicable).
- Note:** The preventative maintenance list below should be performed every 5000 hours of operating time:
- Check oil level and add oil if necessary.
 - Make sure the vent plug pin in the breather is clean.



REGALTM

Lubrication

Series 3000 CbN gearing is shipped with one of the following synthetic lubricants per the table below and fitted with a magnetic drain. Each reducer is filled according to the mounting position specified when ordered. Refer to the unit nameplate and the chart to the right for the mounting position arrangement for your unit.

In the case of synthetic oil, the lubricant does not require changing, but it is recommended that proper oil level be checked periodically.

Standard Synthetic Gear Oil (Non-Food Grade)

No Backstop	
Manufacturer	-25° F to 125° F (-30° C to 50° C)
Fuchs *	Sintogear 125
Mobil *	Mobilgear SHC 150
Shell *	Omala Fluids HD 150

With Backstop (1)	
Manufacturer	-25° F to 125° F (-30° C to 50° C)
Shell *	Omala RL 100
Mobil *	SHC 629

Standard Synthetic Gear Oil (H1 Rated Food Grade Requirements)

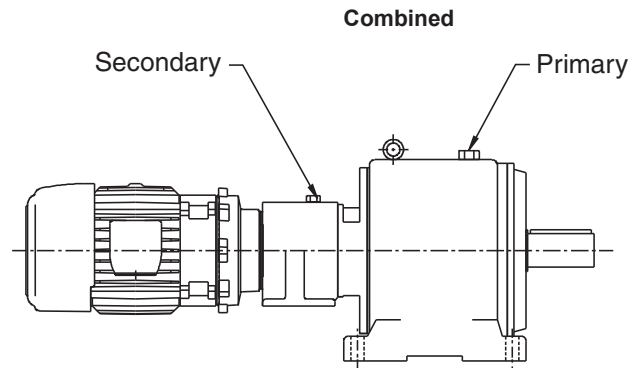
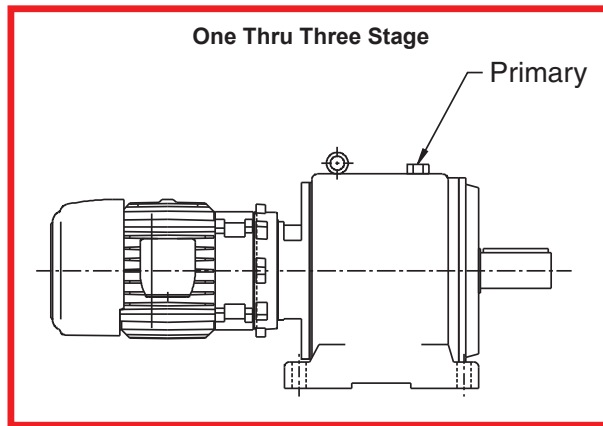
No Backstop	
Manufacturer	22° F to 125° F (-20° C to 50° C)
Mobil *	SHC Cibus 150

CAUTION!

- Never mix synthetic oil and mineral oil.
- Never use extreme pressure (EP) oil in a reducer with a backstop.

Acceptable Mineral Oil Lubricants

Ambient Range of Installation					
-4°F to 14°F (-20°C to 10°C)	14°F to 122°F (-10°C to 50°C)				122°F and Above (50°C +)
	No Backstop		With Backstop		
ISO VG 68	ISO VG 100	ISO VG 150	ISO VG 220	ISO VG 150	ISO VG 320



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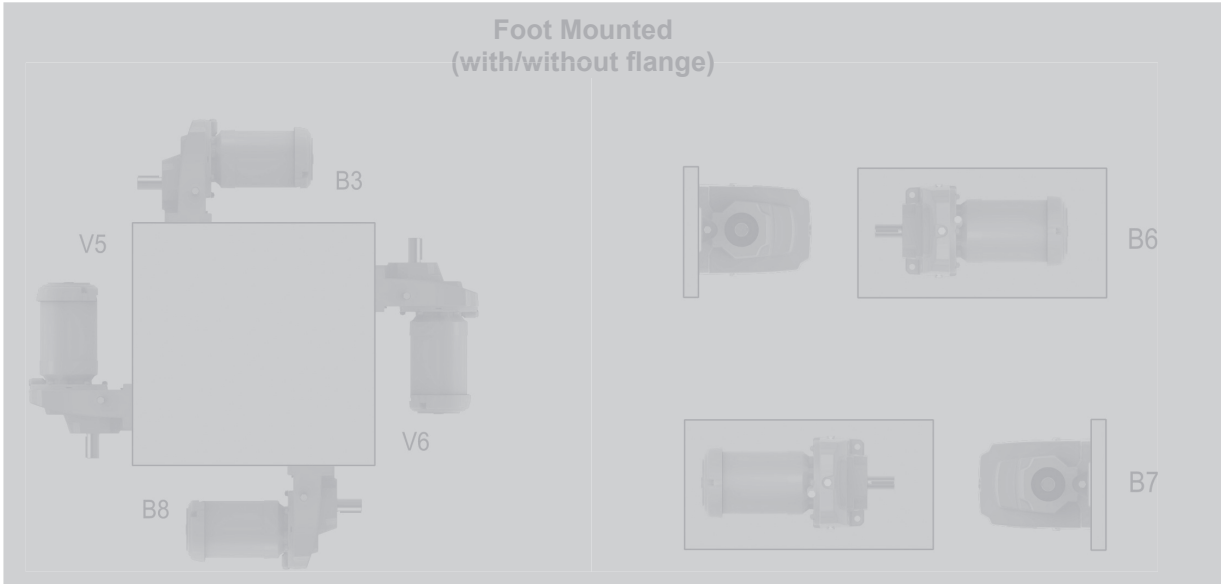
Lubrication
Oil Capacities (U.S. Quarts)

One to Three Reduction

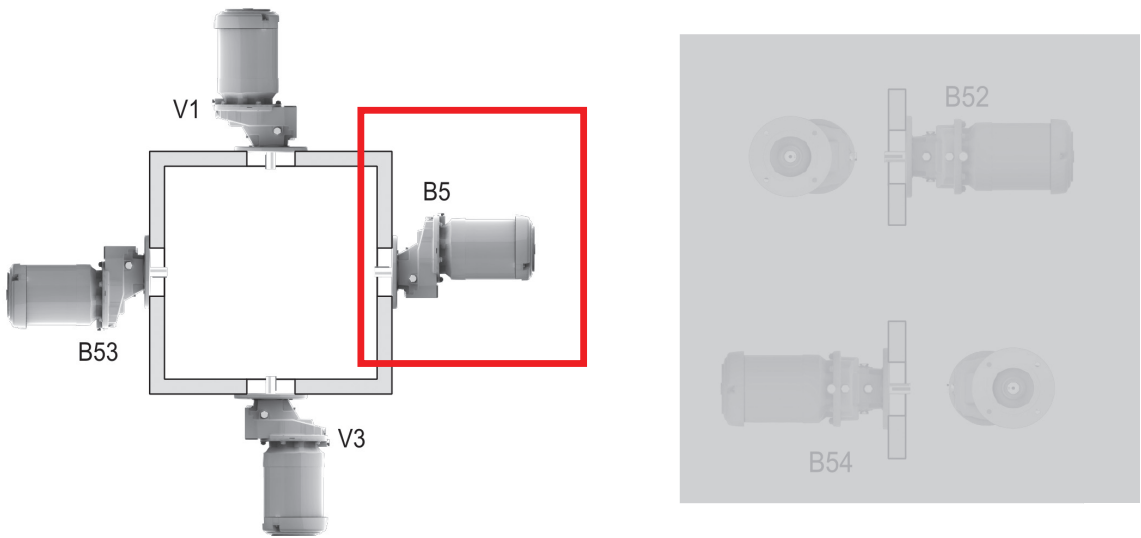
Stages	Gear Frame	Mounting Positions *											
		B3	B5	B6	B7	B8	B52	B53	B54	V1	V3	V5	V6
ONE (single reduction)	30	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
	31	0.53	0.53	0.53	0.53	0.74	0.53	0.74	0.53	0.58	1.06	0.58	1.06
	32	0.26	0.26	0.58	0.58	0.79	0.58	0.79	0.58	0.63	0.84	0.63	0.84
	33	0.95	0.95	1.48	1.48	2.01	1.48	2.01	1.48	2.22	2.22	2.22	2.22
	34	2.11	2.11	3.17	3.38	4.44	3.17	4.44	3.38	4.02	3.17	4.02	3.17
35	3.38	3.38	5.49	5.28	7.71	5.49	7.71	5.28	6.13	5.81	6.13	5.81	
TWO (Double Reduction)	30	0.63	0.63	0.63	0.63	0.63	-	-	-	0.63	0.63	0.63	0.63
	31	0.63	0.63	1.00	0.90	1.16	-	-	-	1.22	1.48	1.22	1.48
	32	1.00	1.00	1.85	1.64	2.38	-	-	-	2.38	2.85	2.38	2.85
	33	1.69	1.69	3.49	3.12	4.70	-	-	-	4.75	4.65	4.75	4.65
	34	3.49	3.49	7.40	4.97	7.08	-	-	-	7.93	7.93	7.93	7.93
	35	5.49	5.49	10.46	8.98	13.95	-	-	-	15.53	14.48	15.53	14.48
	36	8.45	8.45	12.69	19.02	23.77	-	-	-	25.36	25.89	25.36	25.89
	37	13.74	13.74	22.19	33.81	40.15	-	-	-	44.91	43.85	44.91	43.85
38	17.96	17.96	26.42	53.89	61.30	-	-	-	68.68	64.46	68.68	64.46	
THREE (Triple Reduction)	30	0.74	0.74	0.74	0.74	0.74	-	-	-	0.74	0.74	0.74	0.74
	31	0.63	0.63	1.30	0.90	1.16	-	-	-	1.22	1.48	1.22	1.48
	32	1.00	1.00	2.43	1.64	2.38	-	-	-	2.38	2.85	2.38	2.85
	33	1.69	1.69	4.62	3.12	4.70	-	-	-	4.75	4.65	4.75	4.65
	34	3.49	3.49	7.40	4.97	7.08	-	-	-	7.93	7.93	7.93	7.93
	35	5.49	5.49	13.21	8.98	13.95	-	-	-	15.53	14.48	15.53	14.48
	36	8.45	8.45	15.85	19.02	23.77	-	-	-	25.36	25.89	25.36	25.89
	37	13.74	13.74	28.50	33.81	40.15	-	-	-	44.91	43.85	44.91	43.85
38	17.96	17.96	45.44	53.89	61.30	-	-	-	68.68	64.46	68.68	64.46	

* refer to page illustrating mounting positions based on reduction stage(s) and gear frame to be checked or filled

**Single Reduction Mounting Positions
Frames 31 Thru 35**



Flange Mounted (Footless)



Single Reduction Plug Location and Assignments Frames 31 Thru 35

Foot Mount - S, SB14, SBS, SBD2

Mounting Position	Plug Function	Type Unit		
		Input Shaft	C-Face	Gearmotor
B3	Breather	1 or 6	8	8
	Level	2 or 3	2 or 3	2 or 3
	Drain	4	4	4
	Filling	1	1	1
B6	Breather	3	3 or 8	3 or 8
	Level	1 or 4	1 or 4	1 or 4
	Drain	2	2	2
	Filling	3	3	3
B7	Breather	2	2 or 8	2 or 8
	Level	1 or 4	1 or 4	1 or 4
	Drain	3	3	3
	Filling	2	2	2

Mounting Position	Plug Function	Type Unit		
		Input Shaft	C-Face	Gearmotor
B8	Breather	4 or 5	4 or 5	4 or 5
	Level	2 or 3	2 or 3	2 or 3
	Drain	1	1	1
	Filling	4 or 5	4 or 5	4 or 5
V5	Breather	5	5 or 8	5 or 8
	Level	1	1	1
	Drain	4	4	4
	Filling	5	5	5
V6	Breather	4	4	4
	Level	2 or 3	2 or 3	2 or 3
	Drain	1	8	8
	Filling	4	4	4

* Frame 32 only

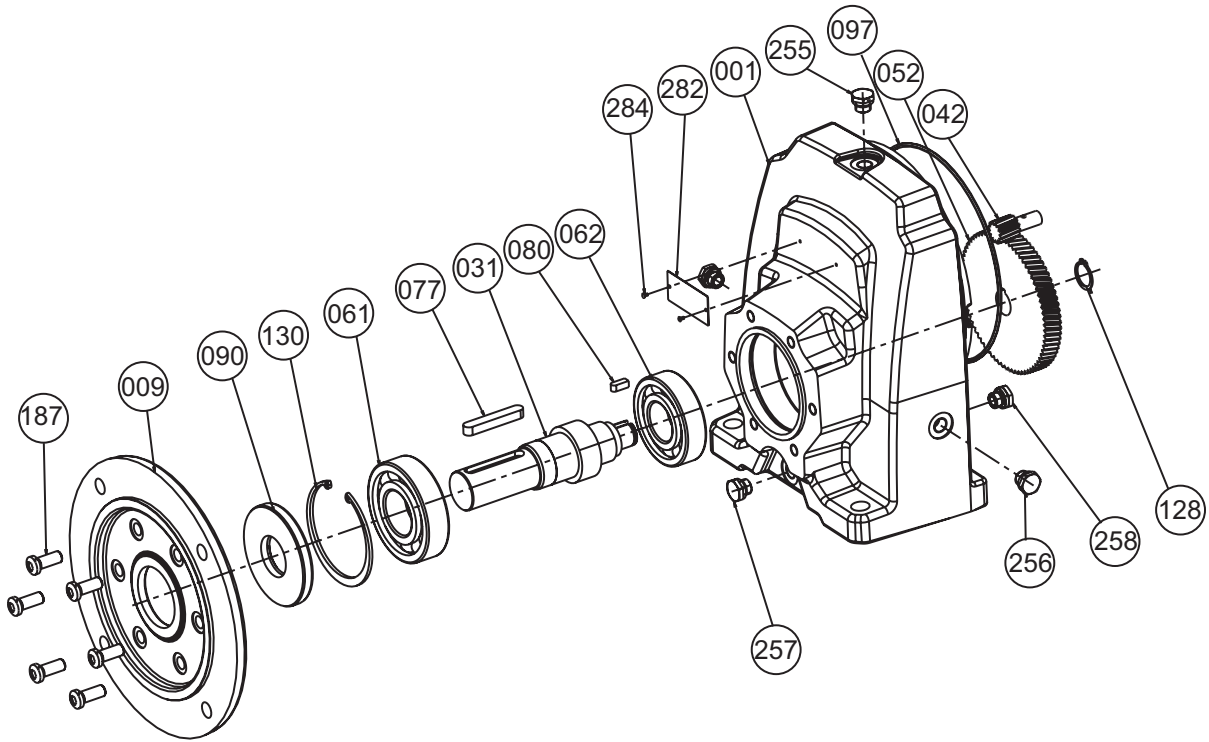
Flange Mounted - Footless

Mounting Position	Plug Function	Type Unit		
		Input Shaft	C-Face	Gearmotor
B5	Breather	1 or 6	8	8
	Level	2 or 3	2 or 3	2 or 3
	Drain	4	4	4
	Filling	1	1 or 8	1 or 8
B52	Breather	3	3 or 8	3 or 8
	Level	1 or 4	1 or 4	1 or 4
	Drain	2	2	2
	Filling	3	3	3
B54	Breather	2	2 or 8	2 or 8
	Level	1 or 4	1 or 4	1 or 4
	Drain	3	3	3
	Filling	2	2	2

Mounting Position	Plug Function	Type Unit		
		Input Shaft	C-Face	Gearmotor
B53	Breather	4 or 5	4 or 5	4 or 5
	Level	2 or 3	2 or 3	2 or 3
	Drain	1	1	1
	Filling	4 or 5	4 or 5	4 or 5
V1	Breather	5	5	5
	Level	1	1	1
	Drain	4	4	4
	Filling	5	5 or 8	5 or 8
V3	Breather	4	4	4
	Level	2 or 3	2 or 3	2 or 3
	Drain	5	8	8
	Filling	4	4	4

* Frame 32 only

Single Reduction Parts Lists
CbN 30 - 35



Gear Frame	Item Description by Location		
	Bearings		Seal (mm)
	061	062	090
30	6205 ZZ	6005	25 x 52 x 7 DL, nitrile
31	6205 1RS	6304	25 x 52 x 7 DL, nitrile
32	6206 RS	6305	30 x 62 x 7 DL, nitrile
33	6308 RS	6307	40 x 90 x 8 DL, nitrile
34	6309 ZZ BHT C3	6308	45 x 100 x 8 DL, nitrile
35	6310 RS	6309	50 x 110 x 12 DL, nitrile

**Single Reduction Parts Lists
CbN 30 - 35**

CbN 30 - 35 (Quantity Per Unit)

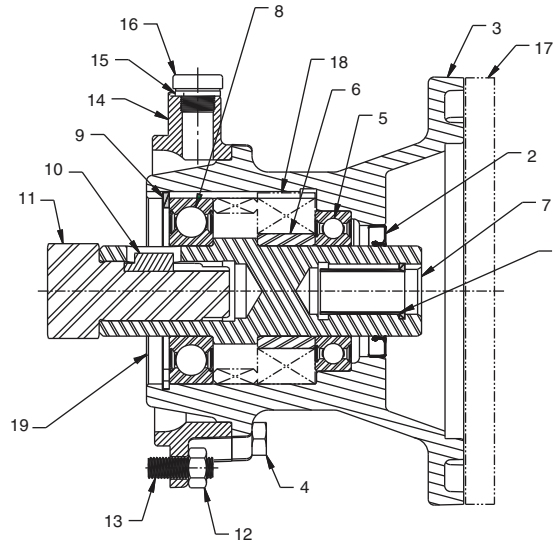
Rep	Description	30	31	32	33	34	35
001	Housing	1	1	1	1	1	1
009	Output Flange Ring	1	1	1	1	1	1
031	Output Shaft	1	1	1	1	1	1
042	Pinion	1	1	1	1	1	1
052	Gear	1	1	1	1	1	1
061	Bearing Front	1	1	1	1	1	1
062	Bearing Back	1	1	1	1	1	1
077	Output Shaft Key	1	1	1	1	1	1
080	Gear Key	1	1	1	1	1	1
090	Oil Seal	1	1	1	1	1	1
097	Input "O" Ring Seal (optional)	1	1	1	1	1	1
127	Bearing Snap Ring*	1	0	0	0	0	0
128	Gear Snap Ring	0	1	1	1	1	1

Rep	Description	30	31	32	33	34	35
130	Bearing Snap Ring	1	1	1	1	1	1
140	Gear Spacer*	0	1**	1**	0	0	0
175	Screw for Face-Plate*	4	0	0	0	0	0
185	Washer for Gear*	1	0	0	0	0	0
186	Screw Washer*	1	0	0	0	0	0
187	Bolt	4	4	4	6	6	6
213	Flange Dowel Pin*	0	1	1	1	1	1
255	Breather Plug	0	1	1	1	1	1
256	Level Plug	0	2	2	2	2	2
257	Drain Plug	0	1	1	1	1	1
258	Drain Plug	0	1	1	1	1	1
282	Nameplate	1	1	1	1	1	1
284	Nameplate Pin	0	2	2	2	2	2

* Not illustrated.

** Design revision 4/03.

C-Face Input Parts Lists (Quantity Per Unit)
CbN 30 - 38



No.	Description	56C	140TC	180TC	210TC	250TC	280TC	320TC◆
1	Non-Metallic Liner	1	1	1	1	1	1	1
2	Seal	1	1	1	1	1	1	1
3	Motor Adapter	1	1	1	1	1	1	1
4	Capscrew	6	6	6	6	6	6	6
5	Bearing	1	1	1	1	1	1	1
6	Spacer	1 †	1 †	1	1	1	1	1
7	Input Shaft	1	1	1	1	1	1	1
8	Bearing	1	1	1	1	1	1	1
9	Internal Snap Ring	1	1	1	1	1	1	1
10	Key*	1	1	1	1	1	1	1
11	Pinion	1	1	1	1	1	1	1
12	Nuts†	**	**	**	**	**	**	**
13	Studs†	**	**	**	**	**	**	**
14	Adapter Flange	1 †	1 †	1	1	1	1	1
15	Gasket	1 †	1 †	1	1	1	1	1
16	Plug (1/4")	1 †	1 †	1	1	1	1	1
17	Motor Adapter Flange	N/A	N/A	N/A	N/A	1***	1	N/A
18	Backstop Kit (option)	1 †	1 †	1	1	1	1	1
19	Seal	0	0	0	0	0	1	1

* Pin used with 9mm, 12mm, 15mm and 18mm pinion.
 ** Depending on gear frame size: 31 = 4, 32 = 5, 33 = 6, 34 = 4, 35 = 8.
 ***Applicable to size 33.
 † Not applicable to size 30.
 ◆ Not applicable to sizes 36 and 37

Gear Frame (s)	Motor Frame (s)	Bearings		Oil Seal (inches)
		5	8	9
30	56C, 140TC	6006 2RS	6004 2RS	55 X 30 X 10 (mm)
31 to 36	56C, 140TC	6007 ZZ C3	6207 ZZ C3	2 X 1.375 X .312
31 to 37	180TC	6012 ZZ C3	6210 ZZ C3	4 X 2.250 X .468
32 to 37	210TC	6012 ZZ C3	6210 ZZ C3	4 X 2.250 X .468
38	210TC	6014 ZZ C3	NJ210	4.438 X 2.625 X .437
34 to 38	250TC , 280TC	6014 ZZ C3	NJ210	4.438 X 2.625 X .437
35 *	320TC	6216 ZZ C3	NJ310	140 X 90 X 12 (mm)

* For 36 through 38 frame with 320TC input, refer to opposing page

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8.2 Motor, DC

AC & DC Motor Installation & Maintenance

Safety Notice: Be sure to read and understand all of the Safety Notice statements in MN408 or Product Specific manual for your motor. A copy is available at: http://www.baldor.com/support/product_manuals.asp

ACCEPTANCE

Thoroughly inspect this equipment before accepting shipment from the transportation company. If any damage or shortage is discovered do not accept until noted on the freight bill. Report all damage to the freight carrier.

SAFETY

Eye bolts, lifting lugs or lifting openings, if provided, are intended only for lifting the motor and motor mounted standard accessories not exceeding, in total 30% of the motor weight. These lifting provisions should never be used when lifting or handling the motor and driven equipment. Eye bolt lifting capacity rating is based on a lifting alignment coincident with eye bolt center line. Eye bolt capacity reduces as deviation from this alignment is increased. Be sure eye bolts are tight and prevented from turning before lifting.

INSTALLATION OUTSIDE THE USA:

Refer to MN408 and MN1383 for Compliance with European Directives. Copies are available at: http://www.baldor.com/support/product_manuals.asp

MOTOR ENCLOSURE

ODP, Open drip proof motors are intended for use in clean, dry locations with adequate supply of cooling air. These motors should not be used in the presence of flammable or combustible materials. Open motors can emit flame and/or molten metal in the event of insulation failure. TEFC, totally enclosed motors are intended for use where moisture, dirt and/or corrosive materials are present in indoor and outdoor locations.

Explosion protected motors, as indicated by a Nationally Recognized Testing Laboratory Certification mark and marking with Class, Division and Temperature Code are intended for installation in hazardous locations as described in Article 500 of the NEC. Refer to MN408 for more details.

MOUNTING

Foot mounted machines should be mounted to a rigid foundation to prevent excessive vibration. Shims may be used if location is uneven.

Flange mounted machines should be properly seated and aligned. Note: If improper rotation direction is detrimental to the load, check rotation direction prior to coupling the load to the motor shaft.

For V-belt drive, mount the sheave pulley close to the motor housing. Allow clearance for end to end movement of the motor shaft. Do not overtighten belts as this may cause premature bearing failure or shaft breakage.

Direct coupled machines should be carefully aligned and the shaft should rotate freely without binding.

GENERAL

The user must select a motor starter and overcurrent protection suitable for this motor and its application. Consult motor starter application data as well as the National Electric Code and/or applicable local codes. Special motors for use by United States Government including special specifications, master plans, etc. refer to the applicable master plans and specifications involved. On motors received from the factory with the shaft blocked, remove blocking before operating the motor. If motor is to be reshipped alone or installed to another

piece of equipment, the shaft block must be installed to prevent axial movement and prevent brinelling of the bearings during shipment.

TESTING

If the motor has been in storage for an extensive period or has been subjected to adverse moisture conditions, check the motor insulation resistance with a meg ohm meter. Depending on storage conditions it may be necessary to regrease or change rusted bearings. Contact Baldor District Office if resistance is less than 5 meg ohms.

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury.

WARNING: Be sure the system is properly grounded before applying power. Electrical shock can cause serious or fatal injury.

INSTALLATION

This motor must be installed in accordance with National Electric Code, NEMA MG-2, IEC standards or local codes.

WIRING

Connect the motor as shown in the connection diagrams. If this motor is installed as part of a motor control drive system, connect and protect the motor according to the control manufacturers diagrams. Refer to MN408 for additional details on lead marking. The wiring, fusing and grounding must comply with the National Electrical Code or IEC and local codes. When the motor is connected to the load for proper direction of rotation and started, it should start quickly and run smoothly. If not, stop the motor immediately and determine the cause. Possible causes are: low voltage at the motor, motor connections are not correct or the load is too heavy. Check the motor current after a few minutes of operation and compare the measured current with the nameplate rating.

GROUNDING

Ground the motor according to NEC and local codes. In the USA consult the National Electrical Code, Article 430 for information on grounding of motors and generators, and Article 250 for general information on grounding. In making the ground connection, the installer should make certain that there is a solid and permanent metallic connection between the ground point, the motor or generator terminal housing, and the motor or generator frame. In non-USA locations consult the appropriate national or local code applicable.

ADJUSTMENT

The neutral is adjustable on some DC motors. AC motors have no adjustable parts.

Noise

For specific sound power or pressure level information, contact your local Baldor representative.

VIBRATION

This motor is balanced to NEMA MG1, Part 7 standard.

BRUSHES (DC Motors)

Periodically, the brushes should be inspected and all brush dust blown out of the motor. If a brush is worn 1/2, (length specified in renewal parts data), replace the brushes.

WARNING: Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.

Reassemble and seat the new brushes using a brush seating stone. Be sure the rocker arm is set on the neutral mark.

INSPECTION

Before connecting the motor to an electrical supply, inspect for any damage resulting from shipment. Turn the shaft by hand to ensure free rotation. Motor leads must be isolated before the shaft will turn freely on permanent magnet motors.

DRAIN PLUGS

One or more condensation drain plugs are provided on each endplate for various motor mounting configurations. For Washdown and totally enclosed, fan cooled or non-ventilated motors, the plugs in the lowest portion of the ends shields should be removed for operation (unless the motor has special stainless steel drains). All drains are located in the lowest portion of the ends shields.

MOUNTING

Mount the motor on a foundation sufficiently rigid to prevent excessive vibration. Grease lubricated ball bearing motors may be mounted with the feet at any angle. After careful alignment, bolt motor securely in place. Use shim to fill any unevenness in the foundation. Motor feet should sit solidly on the foundation before mounting bolts are tightened.

IP (Ingress Protection)

IP designations include two numerals, the first characteristic numeral is for ingress solid bodies and from dust. The second for ingress protection from liquid - water. Motors marked less than IP23 require additional protection from water.

GUARDING

After motor installation is complete, a guard of suitable dimensions must be constructed and installed around the motor/gearmotor. This guard must prevent personnel from coming in contact with any moving parts of the motor or drive assembly but must allow sufficient cooling air to pass over the motor. If a motor mounted brake is installed, provide proper safeguards for personnel in case of brake failure. Brush inspection plates and electrical connection cover plates or lids, must be installed before operating the motor.

STARTING

Before starting motor remove all unused shaft keys and loose rotating parts to prevent them from flying off. Check direction of rotation before coupling motor to load. The motor should start quickly and run smoothly and with little noise. If the motor should fail to start the load may be too great for the motor, the voltage is low or the motor has been miswired. In any case immediately shut motor off and investigate the cause.

ROTATION

To reverse the direction of rotation, disconnect and lockout power and interchange any two of the three AC power leads for three phase motors. For two-phase four wire, disconnect and lockout power and interchange the AC line leads on any one phase. For two phase three wire, disconnect and lockout power and interchange phase one and phase two AC line leads.

Maintenance Procedures

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury.

WARNING: Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. Protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.

Lubrication Information

Refer to motor nameplate for recommended lubricant. If none is shown, the recommended lubricant for anti-friction bearings (-15°F to 120°) is POLYREX EM. For Min Start Temp -100°F use AEROSHELL #7. For roller bearings is ExxonMobil SHC-220.

Relubrication Intervals

(For motors with regrease capability)

New motors that have been stored for a year or more should be relubricated. Lubrication is also recommended at Table 1 intervals.

LUBRICATION INSTRUCTIONS

Cleanliness is important in lubrication. Any grease used to lubricate anti friction bearings should be fresh and free from contamination. Properly clean the grease inlet area of the motor to prevent grease contamination.

1. Select service conditions from Table 2.
2. Select lubrication interval (Table 1).
3. Adjust lubrication interval with multiplier from Table 3.
4. Select volume of grease from Table 4.

LUBRICATION PROCEDURE

Bearings should be lubricated while stationary and the motor is warm.

1. Locate the grease inlet, clean the area, and replace the pipe plug with a grease fitting.
2. Locate and remove the grease drain plug, if provided.
3. Add the recommended volume of recommended grease or add grease until clean grease appears at the grease drain, at the grease relief, or along the shaft opening.
4. Replace the grease inlet plug and run the motor for 15 minutes.
5. Replace the grease drain plug.

SPECIAL APPLICATIONS

For special temperature applications, consult your Baldor District Office.

Relubrication Intervals

Recommended relubrication intervals are shown in Table 1. It is important to realize that the recommended intervals of Table 2 are based on

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

Table1 Relubrication Interval

NEMA (IEC) Frame Size	Rated Speed (RPM)			
	3600	1800	1200	900
Up to 210 incl. (132)	5500Hrs.	12000Hrs.	18000Hrs.	22000Hrs.
Over 210 to 280 incl. (180)	3600Hrs.	9300Hrs.	15000Hrs.	18000Hrs.
Over 280 to 360 incl. (225)	2200Hrs.	7400Hrs.	12000Hrs.	15000Hrs.
Over 360 to 5800 incl. (400)	2200Hrs.	3500Hrs.	7400Hrs.	10500Hrs.

* 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.

Table2 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).

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

Note: Different grease types are generally incompatible and should not be mixed. Mixing different types can cause lubricant and bearing failure. Thoroughly clean bearing and cavity before changing grease type.

Table3 Lubrication 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).

Table4 Amount of Grease to Add

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 (5.9)	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)	6318	1.52(40)	2.5	8.2
440 (280)	6319	2.12 (60)	4.1	13.4
5000 to 5800 (315–400)	6328	4.70 (130)	9.2	30.0
5000 to 5800 (315–400)	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

Typical IEC vs NEMA Lead Marking

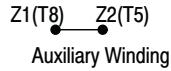
Single Phase Non-Reversible

Refer to the connection diagram provided on the Baldor motor.



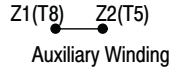
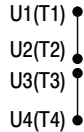
Single Phase Reversible

Main Winding



Dual Voltage Reversible

Main Winding

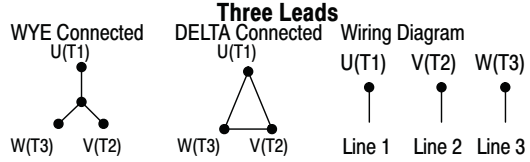


Three Phase

For single winding 3 phase motors, lead markings can be directly translated between IEC and NEMA designations.

For these motors, the lead markings are:
 U1=T1 U2=T4 U3=T7 U4=T10
 V1=T2 V2=T5 V3=T8 V4=T11
 W1=T3 W2=T6 W3=T9 W4=T12

Refer to the connection diagram provided on the Baldor motor. Some examples are as follows:

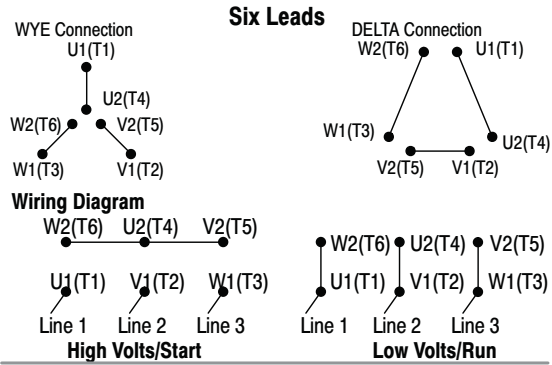


DC Motors

Lead markings can be translated between IEC and NEMA designations as follows:

	NEMA	IEC
Armature	A1, A2	A1, A2
Series Field	S1, S2	D1, D2
Shunt Field	F1, F2	E1, E2

Refer to the connection diagram provided on the Baldor motor.



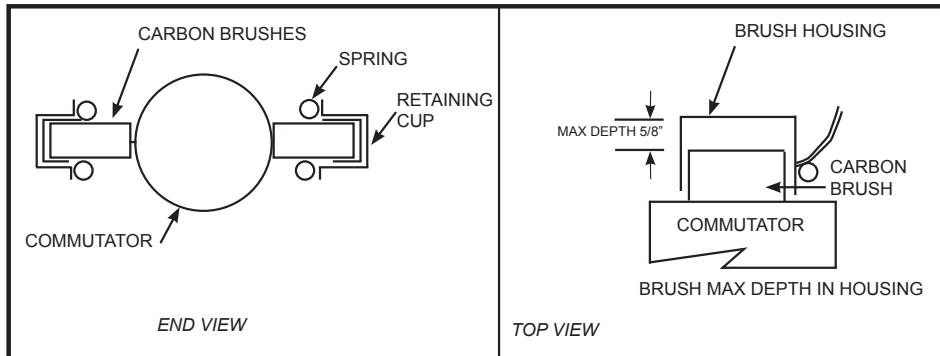
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 www.baldor.com

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 MN416

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 10/13

DC MOTOR BRUSH REPLACEMENT

Standard Baldor brushes have an initial length of 1 1/4". When brushes are worn to a length of 5/8" they and the brush springs should be replaced. **Operation of a motor with brushes shorter than this will cause the brushes to jam in the brush housing, arcing and wearing the commutator. A worn or damaged commutator will accelerate brush wear and further damage your motor.** It is normal for one brush to wear more than the other. Check them both.



Tip: In a new motor with new brushes the back of the brush will be flush with the brush housing, as the brush wears the distance into the housing will increase. (See top view drawing below.) A quick measurement of the depth will be sufficient. When the brush is 5/8" into the holder it will need replacement. If in doubt change the brushes. Carry spares.

When changing brushes, be sure the Phillips screw holding the brush wire **and power** lead is tightened properly to assure a good electrical connection.

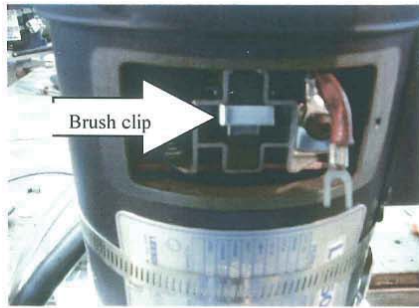
Commutator wear can be measured by installing new brushes and measuring the depth in the housing. A properly maintained motor will show little wear here (brush end flush with the housing). A worn commutator may need to be resurfaced to prevent excessive and rapid wear of replacement brushes.



- ◆ Remove brush covers, one on each side of the motor.



- ◆ Loosen screw next to the brush assembly.
- ◆ DO NOT REMOVE THE SCREW; just loosen it enough to remove the fork terminal.



- ◆ Carefully remove wire from motor case.



- ◆ Push inward and down to release the brush clip, then slowly allow clip to slide outward and set it aside.



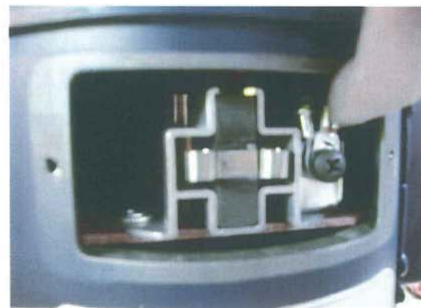
- ◆ Slide brush assembly out of housing.



- ◆ Corrosion block will help lubricate and seal out water.



- ◆ Clean or replace brushes as needed. Use corrosion block on all motor parts to seal from corrosion and keep brushes from sticking.



- ◆ Re-install brush assembly and install fork terminal on screw.



- ◆ Re-install brush clip by pushing in then up and slowly releasing and it will clip into place.

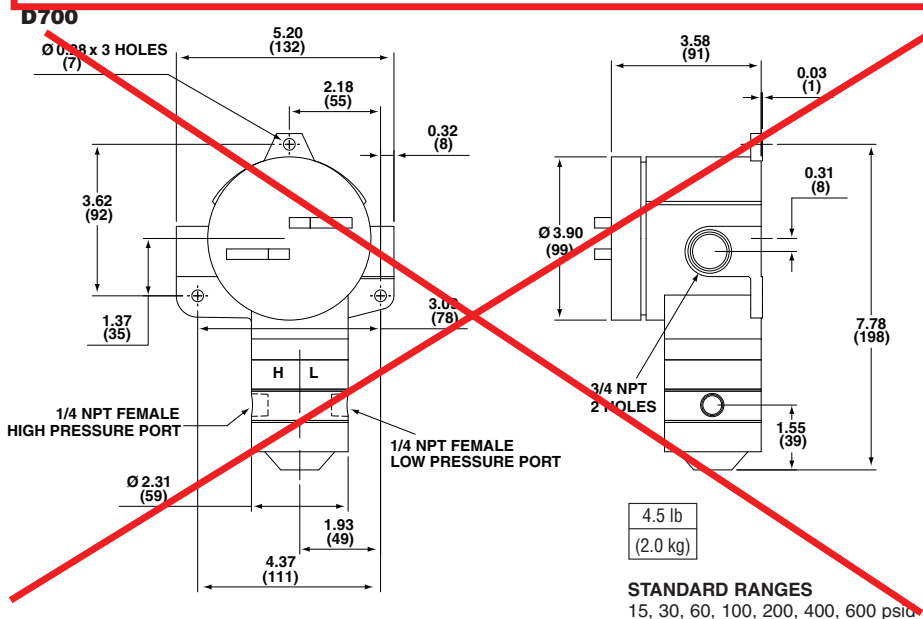
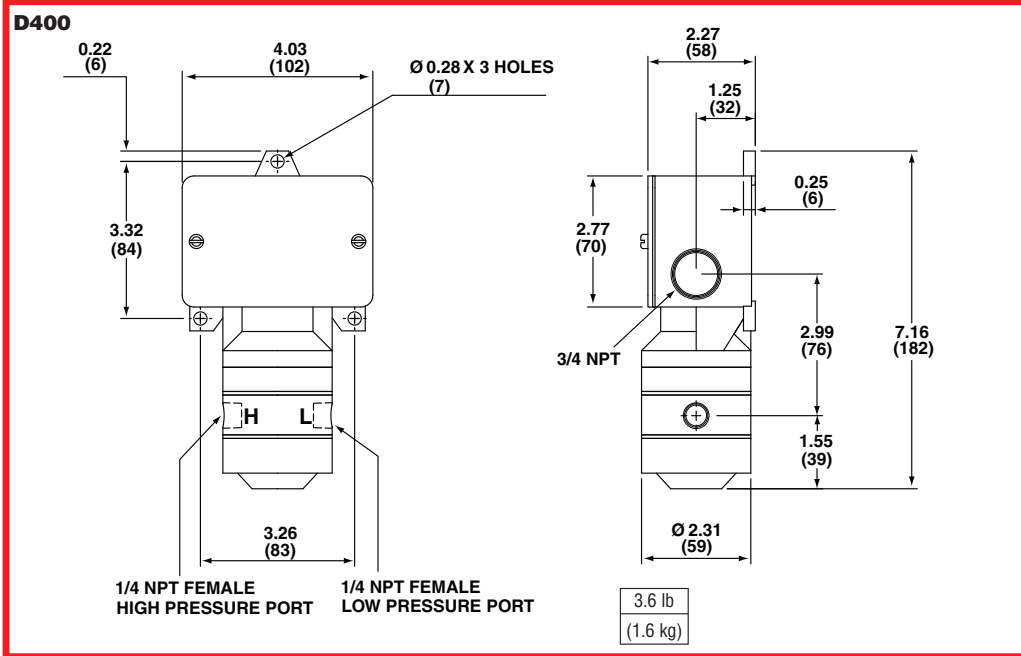


- ◆ Re-install brush cover and spray it with corrosion block to keep moisture out.

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8.3 Differential Pressure Switch

Installation and Maintenance Instructions for D400 & D700 ASHCROFT® Snap Action Switches for Differential Pressure Control



INTRODUCTION

The Ashcroft® differential pressure switch is a precision built U.L. and C.S.A. approved control device which features a mechanical snap action switch. Controllers are available for operation on various pressure differentials with fixed or variable switching differentials. Also, manual reset types are available for operation on increasing or decreasing pressure. The manual reset types remain tripped until reset by pressing a button on the top of the enclosure. The standard electrical switch is SPDT and is avail-

able with various electrical characteristics. Two SPDT switch elements mounted together are available except on variable dead-band and manual reset types. Various wetted material constructions for compatibility with a wide range of pressure media may be obtained.

The Ashcroft snap action temperature switch is furnished in the standard NEMA 4 and explosion proof NEMA 7 and 9 enclosure styles. Both enclosures are epoxy coated aluminum castings.

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All sales subject to standard terms and conditions of sale. I&M009-10007- (250-2248E) 10/12

Installation and Maintenance Instructions for D400 & D700 ASHCROFT® Snap Action Switches for Differential Pressure Control



INSTALLATION

These controls are precision instruments and should never be left with internal components exposed. After installation ensure that covers are in place and conduit openings are closed.

MOUNTING D400 AND D700 SERIES

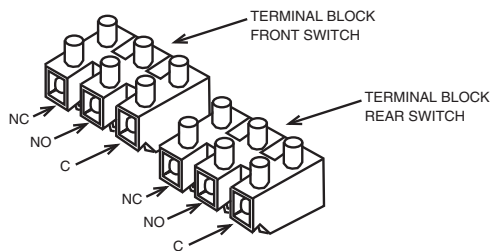
There are three holes external to the enclosures for surface mounting. The locations of these holes is shown on the general dimension drawing. The controls may also be mounted directly on the pressure line using the pressure connections.

ELECTRICAL CONNECTIONS

Remove cover

D400 Series – two screws hold cover to enclosure

D700 Series – cover unscrews



CONDUIT CONNECTIONS

Note – It is recommended that Teflon® tape or other sealant be used on conduit, bushing or plug threads to ensure integrity of the enclosure.

D400 Series standard – one ¼ NPT conduit hole right side.

D700 Series standard – two ¼ NPT conduit holes with one permanent plug. *NEMA 7 & 9 enclosures require proper conduit seals and breathers as per the National Electrical Code.*

D400 & WT700 Series – XJL variation – two ¼ NPT conduit holes with two ¼ to ½ NPT reducing bushings.

D400 Series – XJK variation – two ¼ NPT conduit holes.

D400 SERIES

SPDT – Wire directly to the switch according to circuit requirements. On controls with pilot lights, wire lights according to circuit diagram on the inside of the cover. See special wiring instruction tag for single switches with two pilot lights and dual switches with one or more pilot lights.

2-SPDT – Dual switching elements consist of two SPDT switches mounted together in a bracket. The switches are calibrated to have simultaneous operation within 1% of range either on increasing or decreasing pressure, but not in both directions. Wire directly to the front and rear switch according to circuit requirements. Leads provided on rear switch and leads provided for hermetically sealed switch components are color coded as follows:

Common – White
Normally Closed – Red
Normally Open – Blue

See SPDT instructions for pilot light hook-up.

D700 SERIES

SPDT – Wire directly to the switch according to circuit requirements.

2-SPDT – Wire to front switch terminal block (left) and rear switch terminal block (right) as marked. Strip insulation ¼", insert in proper terminal connector and tighten clamping screw to secure.

ADJUSTMENT OF SETPOINT

D400 & D700 Series – A single setpoint adjustment nut (7/8") is located centrally at the bottom on the inside of the enclosure. The direction of turning is indicated on a label affixed to the inside of the control enclosure.

A typical calibration procedure would be as follows:

Static Working Pressure – 600 psig
Adjustable Differential Range – 30/200 psid
Differential Setpoint – 150 psi above static working pressure

Simultaneously raise the high and low side pressure to 600 psig. Maintain the low side pressure at 600 psig. Raise the high side pressure to 750 psig to obtain 150 psi differential.

Turn the adjustment nut until the switch changes mode at 150 psi differential. When the setpoint has been achieved, raise and lower the high side pressure to ensure that the differential setpoint is correct.

D450 and D750 VARIABLE DEADBAND SWITCHES

Deadband is varied by rotating the wheel on the precision switch. When viewed from the front of the enclosure, rotation to the left increases deadband – rotation to the right decreases deadband. Letters on the wheel may be used as a reference. Deadbands obtainable will vary from 2% to 9% of pressure range depending on range segment and the type of diaphragm.

ADJUSTMENT OF SETPOINT

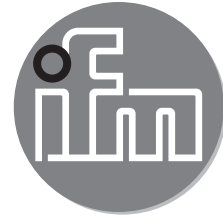
As received, the differential pressure switch will normally be set to approximately 90% of range. Rotate the wheel on the MICRO SWITCH all the way to the right. This will provide the smallest deadband. Pressurize the system to the required setpoint and turn the adjustment nut until the switch changes mode. Lower the pressure to reset the switch. Rotate the wheel on the MICRO SWITCH until the desired deadband is obtained. The upper setpoint will be changing upward with this adjustment. Lower the pressure to reset the switch. Increase the pressure to the desired setpoint and turn the adjustment nut until the switch changes mode. Lower the pressure and check the reset point and deadband.

Note – As indicated above, adjustment of setpoint is made by use of 7/8" nut. The precision switch element mounting screws and bracket adjusting screw are factory sealed and should not be tampered with.

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8.4 Thermal Flow Sensor

ifm electronic



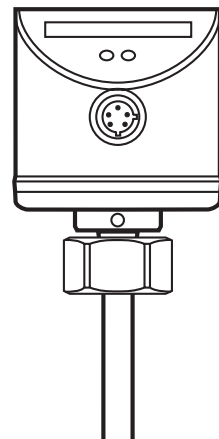
Operating instructions
Flow monitors

efector300

SI5006

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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.

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

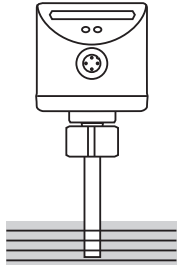
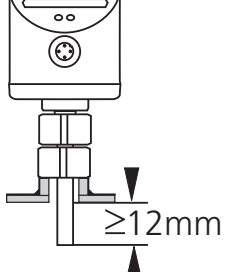
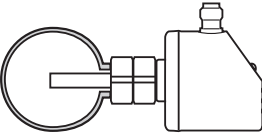
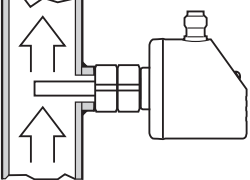
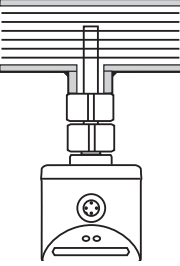
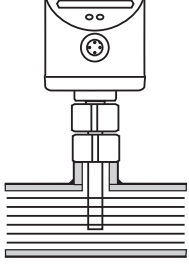
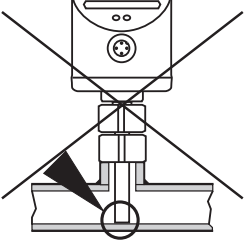
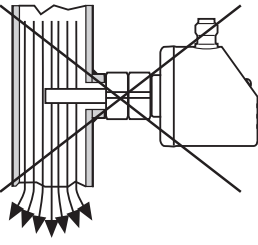
Using process adapters the unit can be adapted to different process connections.

- 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.

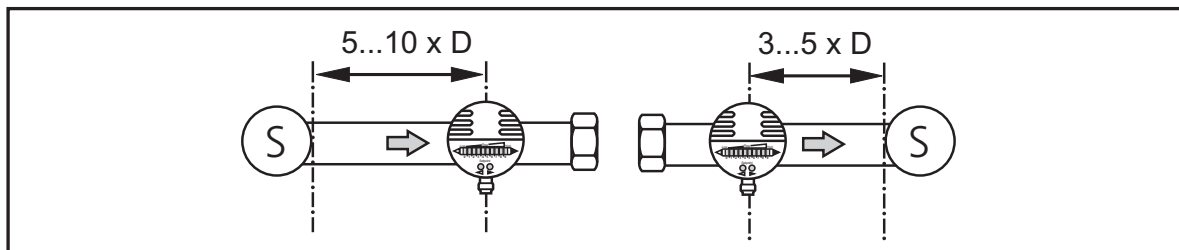
4.1 Installation location

<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.

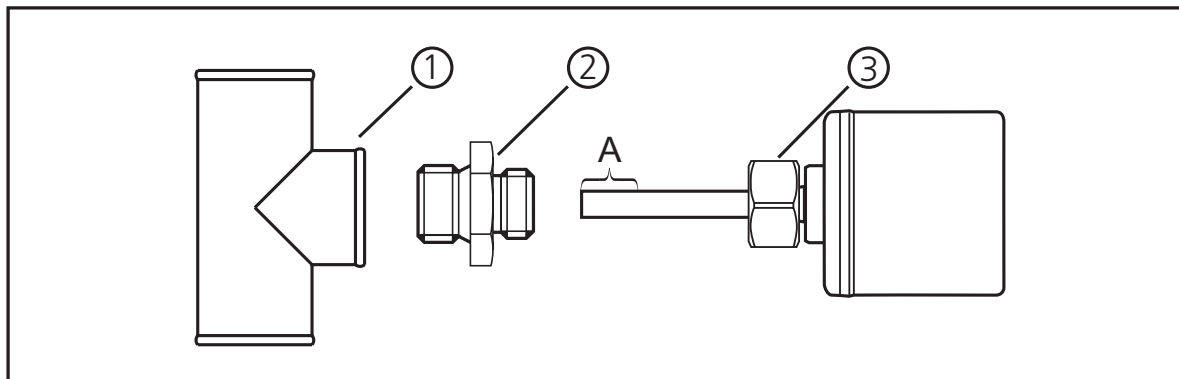
Recommendation: Adhere to the distances between sensor and sources of interference:



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.

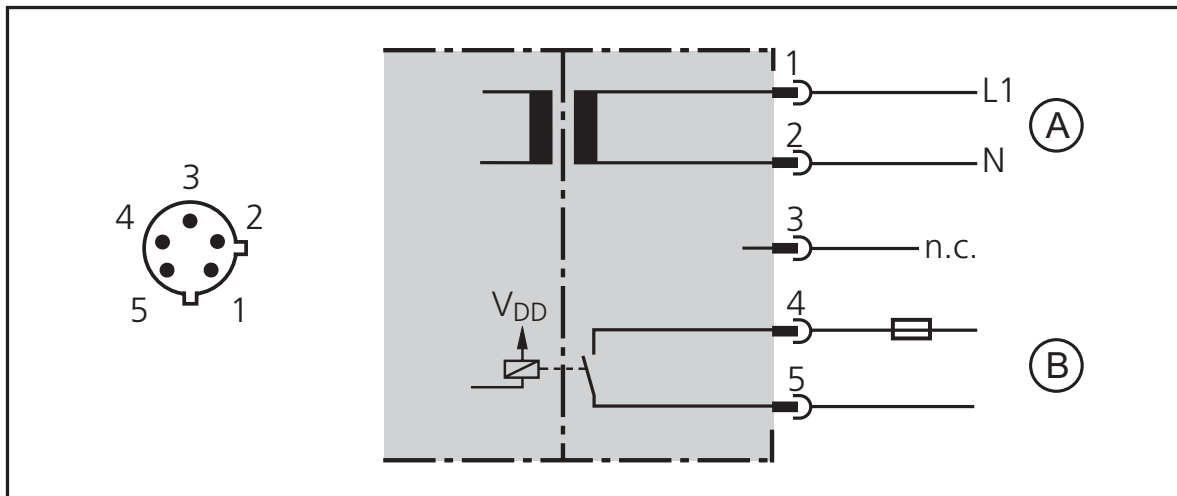
5 Electrical connection



- 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.

► Disconnect power.

► Connect the unit as follows:



A: supply circuit; B: output circuit

— · — · — · — : safe separation

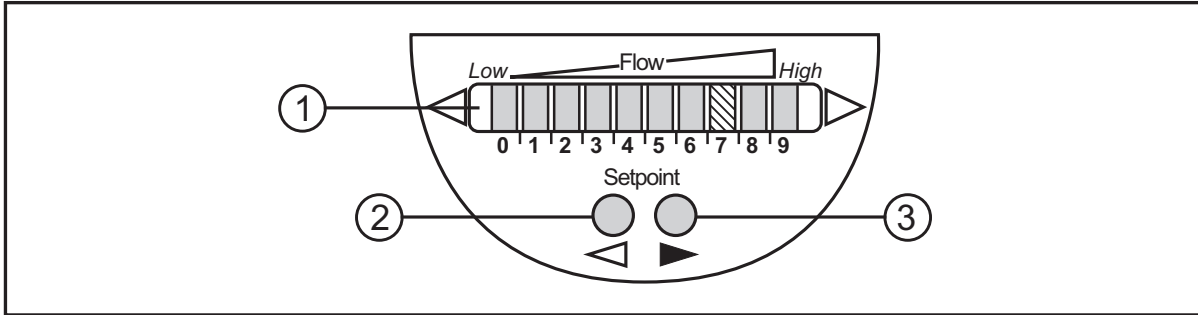
ifm-sockets are available as accessories:

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.


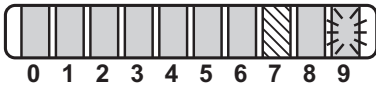

Possible cause /aid:

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.

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.

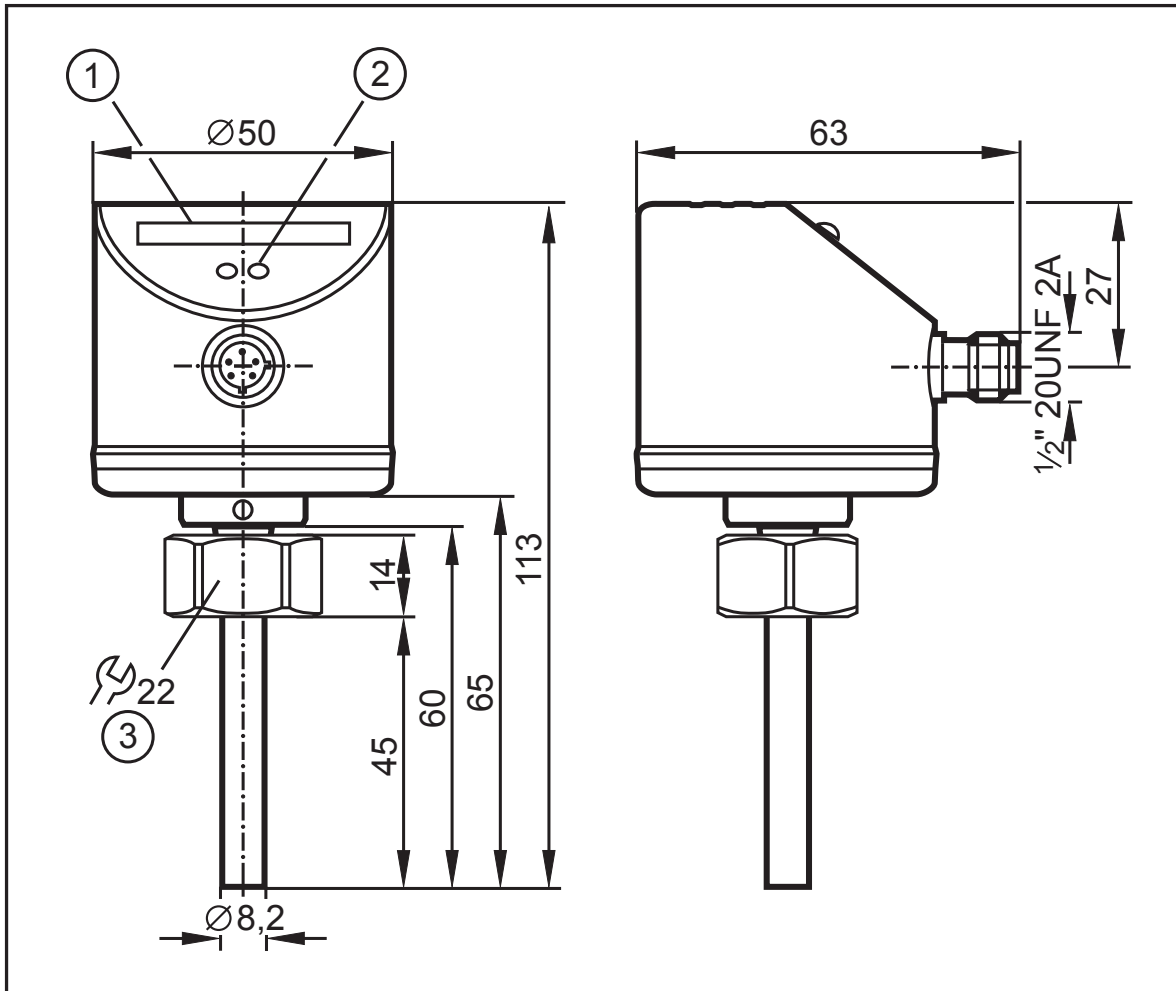
Operating indicators	
 <p>0 1 2 3 4 5 6 7 8 9</p>	<p>Green LED bar: Current flow within the representation range.</p> <p>Indication of the switch point (SP):</p> <ul style="list-style-type: none"> - LED orange: output closed. - LED red: output open.
 <p>0 1 2 3 4 5 6 7 8 9</p>	<p>LED 9 flashes: current 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

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8.5 Flow Meter, Rotameter

7200 Series

Installation Instructions



FLOW METER LIMITED WARRANTY

Meters are warranted against defects in materials and workmanship to the original user for a period of thirteen (13) months from the date of factory shipment, provided the meter is installed, operated and maintained in accordance with King Instrument Company's instructions and recommendations.

This warranty does not apply if failure is caused or contributed to by any of the following: improper handling, improper storage, abuse, unsuitable application of the product, lack of reasonable and necessary maintenance, use exceeding suggested pressure and temperature maximums, improper packaging for return, or repairs made or attempted to be made by anyone other than King Instrument Company, Inc.

KING INSTRUMENT COMPANY, INC. MAKES NO WARRANTY AS TO THE FITNESS OF ITS PRODUCTS FOR SPECIFIC APPLICATIONS.

This warranty is valid for the original end-user only and does not apply to products that have been damaged or modified. This warranty is non-transferrable and is limited to replacement or repair. The liability of King Instrument Company arising out of its supply of the products, or their use, shall not in any case exceed the cost of correcting defects in the products as set forth above.

THIS WARRANTY IS A LIMITED WARRANTY AND SHALL BE IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO OTHER WARRANTIES WHICH EXIST BEYOND THE DESCRIPTION OR FACE HEREOF.

IN NO EVENT SHALL KING INSTRUMENT COMPANY BE LIABLE FOR LOSS OF PROFITS, INDIRECT, CONSEQUENTIAL OR INCIDENTAL DAMAGES.

Products should be returned, prepaid, to King Instrument Company, Inc. with proof of purchase. Call factory for Return Merchandise Authorization (RMA) number and return instructions.

THIS IS IMPORTANT INFORMATION. READ IT CAREFULLY BEFORE BEGINNING WORK.

- 1) Inspect meter for damage that may have occurred during shipping. Report any damage to the container to the freight carrier immediately.
 - 2) Make sure your pressure, temperature, fluid and other requirements are compatible with the meter.
 - 3) Select a suitable location for installation to prevent excess stress on the meter which may result from:
 - a) Misaligned pipe.
 - b) The weight of related plumbing.
 - c) "Water Hammer" which is most likely to occur when flow is suddenly stopped as with quick closing solenoid operated valves. (If necessary, a surge chamber should be installed. This will also be useful in pressure start-up situations.)
 - d) Thermal expansion of liquid in a stagnated or valve isolated system.
 - e) Instantaneous pressurization which will stress the meter and could result in tube failure.
- NOTE:** In closed thermal transfer or cooling systems, install the meter in the cool side of the line to minimize meter expansion and contraction and possible fluid leaks at the threaded connections.
- 4) Handle the meter carefully during installation.
 - a) Use an appropriate amount of teflon tape on external pipe threads before making connections. Do not use paste or stick type thread sealing products.
 - b) Extreme caution should be exercised when using PVC solvent cement around acrylic. Solvents can cause acrylics to stress crack.
 - c) Over tightening of plastic connections may result in fitting damage period.
 - 5) Install the meter vertically with the inlet port at the bottom.
 - 6) Meters with stainless steel fittings will support several feet of pipe as long as significant vibration or stress resulting from misaligned pipe are not factors.
 - 7) Meters with plastic fittings must be installed so that fittings are not made to support any part of the associated plumbing. In addition, meter frame should be fastened to bulkhead, panel or column.
 - 8) Meters used in gas service should have suitable valves plumbed in at the inlet and outlet of the meter. These valves should be no more than 1-1/2 pipe diameters from the meter ports. The valve at the outlet should be used to create back pressure as required to prevent float bounce. It should be set initially and then left alone. The inlet valve should be used for throttling purposes. Depending on the installation, valves may not be essential, but they are most useful in many installations. Remember: To get a correct reading of flow in gas service, it is necessary to know the pressure right at the outlet of the meter (before the valve).
 - 9) Pressure and temperature maximums must never be exceeded.

Maximum Non-Shock Pressure and Temperature		
Fluid	Temperature	Pressure
Water	130° F	150 psig
Air	100° F	100 psig
Ambient Temp. 33° F -125° F		

CAUTION

- 7200 meters are not oxygen cleaned. Use with incompatible fluids may cause o-rings to swell and break.
- O-rings should be replaced if meter is disassembled after it has been in service.
- Extra caution must be exercised when meters are used in high pressure gas cylinder applications. Pressure regulators should be installed at the cylinder and at the inlet of the meter.
- Serious property damage and great personal injury could occur as the result of a meter misused or used in an unsuitable application.

CLEANING

Carefully remove the flowmeter from piping system. Remove the threaded outlet fitting and withdraw the float from the top. All necessary instrument components are now fully accessible for cleaning with a bottle brush and appropriate mild soap solution*. Before the meter is reassembled, inspect all parts for damage. O-rings should be replaced during meter maintenance and cleaning.

To reassemble, carefully guide the float back into the tube. When installing float/guide assembly make certain that the end of the guide fully engages the inlet and/or outlet float stop. Reinstall and tighten fittings in appropriate ports. Reinstall the instrument into the plumbing system after removing the old teflon tape (with a wire brush) and replacing with fresh teflon tape.

*Do not use cleaning agents that will damage float, tube or o-rings.

Meters should be cleaned with a mild soap solution. This will be an effective cleaner of rust stains. Caution must be used so that materials of construction are not damaged by cleaning solutions. Hard water deposits can be removed with 5% acetic acid solution (vinegar).

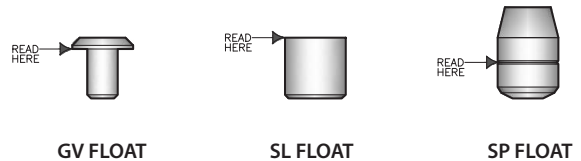
REPAIR

7200 meters that require repair should be sent to the factory. Please call for a Return Merchandise Authorization (RMA) number and return instructions.

WARNING:

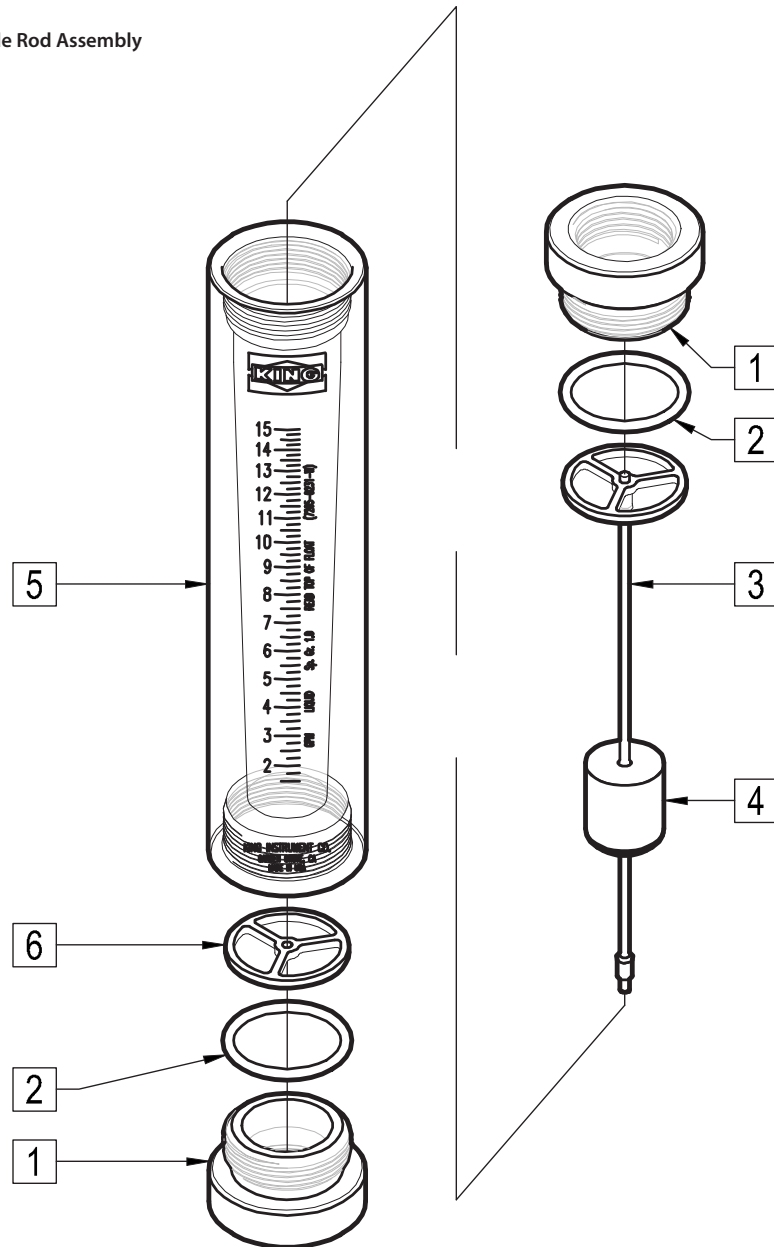
Pressure and temperature ratings are based on a study of the engineering data for particular materials used in construction and on the design of individual models. This information is supplemented by destructive test results. Meters with stainless enclosures must never be operated without shields securely in place. Meters exposed to difficult environments such as those created by certain chemicals, excessive vibration or other stress inducing factors could fail at or below the suggested maximums. Never operate meters above pressure and temperature maximums. It is strongly recommended that all meter installations utilize an appropriate pressure relief valve and/or rupture disc. The pressure settings and locations of these devices should be such that meters cannot be over pressurized. Meter failure could result in damage to equipment and serious personal injury. Always use suitable safety gear, including OSHA approved eye protection when working around meters in service. We are happy to pass along chemical compatibility information that has been published by the manufacturer's of raw materials used in our products; however, this information should not be construed as a recommendation made by King Instrument Company, Inc. for a specific application.

FLOAT TYPES AND ORIENTATIONS



7200 SERIES ASSEMBLY PARTS LIST:

1. End Fitting
2. End Fitting O-Ring
3. Outlet Float Stop/Guide Rod Assembly
4. Float
5. Acrylic Meter Tube
6. Inlet Float Stop



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8.6 SCR Drive, Mixer Motor

To download complete manual, visit:
<https://www.minarikdrives.com/documents/250-0086.pdf>



MM23000 Series

MM23001C

MM23001C

User's Manual



SCR, Adjustable Speed Drives
for DC Brush Motors

(Some inapplicable pages have been removed.)

Specifications

Model	Max. Armature Current (Amps DC)	HP Range @ 90 VDC	HP Range @ 180 VDC	Enclosure
MM23011C	1.5	1/20 - 1/8	1/10 - 1/4	Chassis
MM23111C				NEMA 1
MM23211C				NEMA 1 w/ Reversing
MM23411C				NEMA 4X
MM23072A				Chassis
MM23001C *	10	1/8 - 1	1/4 - 2	Chassis
MM23101C **				NEMA 1
MM23201C **				NEMA 1 w/ Reversing
MM23401C				NEMA 4X
MM23071A *				Chassis

* Heat sink kit 223-0159 must be used when the continuous output current is above 5 amps.

** Heat sink kit 223-0174 must be used when the continuous output current is above 5 amps.

AC Line Voltage	115 VAC or 230 VAC \pm 10%, 50/60 Hz, single phase
Armature Voltage (115 VAC Input)	0–90 VDC
Armature Voltage (230 VAC Input)	0–180 VDC
Form Factor	1.37 at base speed
Field Voltage (115 VAC Input)	50 VDC (F1 to L1); 100 VDC (F1 to F2)
Field Voltage (230 VAC Input)	100 VDC (F1 to L1); 200 VDC (F1 to F2)
Max. Field Current	1 ADC
Accel. Time Range:	
for 0–90 VDC Armature Voltage	0.5–11 seconds
for 0–180 VDC Armature Voltage	0.5–22 seconds
Decel. Time Range:	
for 0–90 VDC Armature Voltage	coast to a stop–13 seconds
for 0–180 VDC Armature Voltage	coast to a stop–25 seconds
Analog Input Voltage Range (signal must be isolated; S1 to S2):	
for 0–90 VDC Armature Voltage	0–1.4 VDC
for 0–180 VDC Armature Voltage	0–2.8 VDC

Specifications (Continued)

Input Impedance (S1 to S2)	100K ohms
Load Regulation	1% base speed or better
Vibration	0.5G max (0–50 Hz) 0.1G max (>50 Hz)
Safety Certification	UL Listed Equipment, file # E132235 UL Overload Protection CSA Certified Component, file # LR41380
Ambient Temp. Range (chassis drive)	10°C–55°C
Ambient Temp. Range (cased drive)	10°C–40°C

Suffix Definitions

- A: Basic drive with power LED and trim pots are perpendicular to board.
- C: Basic drive.
- C-H: Basic drive with inhibit style connector for meter.
Available on model MM23001C.
- C-Q: Basic drive with power LED and quick disconnect terminal.
Available on models MM23001C and MM23011C.

Troubleshooting

Warning

Dangerous voltages exist on the drive when it is powered. When possible, disconnect the drive while troubleshooting. High voltages can cause serious or fatal injury.

Before troubleshooting

Perform the following steps before starting any procedure in this section:

1. Disconnect AC line voltage from the drive.
2. Check the drive closely for damaged components.
3. Check that no conductive or other foreign material has become lodged on the printed circuit board.
4. Verify that every connection is correct and in good condition.
5. Verify that there are no short circuits or grounded connections.
6. Check that the voltage selection switch settings match the AC line and output voltages.
7. Check that the drive's rated armature and field outputs are consistent with the motor ratings.

For additional assistance, contact your local Minarik Drives distributor or the factory direct at: Tel.: 1-800-MINARIK (646-2745) or Fax: 1-800-394-6334

Problem	Possible Causes	Suggested Solutions
Line fuse blows.	<ol style="list-style-type: none"> 1. Line fuse is the wrong size. 2. Motor cable or armature is shorted to ground. 3. Nuisance tripping caused by a combination of ambient conditions and high-current spikes (i.e. reversing). 	<ol style="list-style-type: none"> 1. Check that the line fuse is correct for the motor size. 2. Check motor cable and armature for shorts. 3. Add a blower to cool the drive components; decrease TORQUE settings, or resize motor and drive for actual load demand, or check for incorrectly aligned mechanical components or "jams". See page 44 for information on adjusting the TORQUE trimpot.

Problem	Possible Causes	Suggested Solutions
Line fuse does not blow, but the motor does not run.	<ol style="list-style-type: none"> 1. Speed adjust pot or speed reference voltage is set to zero speed. 2. INHIBIT terminals are jumpered. 3. S2 is shorted to S1. 4. Drive is in current limit. 5. Drive is not receiving AC line voltage. 6. Motor is not connected. 	<ol style="list-style-type: none"> 1. Increase the speed adjust pot or speed reference voltage setting. 2. Remove jumper from the INHIBIT terminals. 3. Remove short. 4. Verify that motor is not jammed. Increase TORQUE setting if they are set too low. See page 44. 5. Apply AC line voltage to L1 and L2. 6. Connect motor to A1 and A2.
Motor does not stop when the speed adjust potentiometer is full CCW.	MIN SPD setting is too high.	Calibrate MIN SPD. See page 43.
Motor runs in the opposite direction (non-reversing drives).	Motor connections to A1 and A2 are reversed.	Reverse connections to A1 and A2.

60 Troubleshooting

Problem	Possible Causes	Suggested Solutions
Motor runs too fast.	<ol style="list-style-type: none"> 1. MAX SPD and MIN SPD are set too high. 2. Motor field connections are loose (shunt wound motors only). 	<ol style="list-style-type: none"> 1. Calibrate MAX SPD and MIN SPD. See page 43. 2. Check motor field connections.
Motor will not reach the desired speed.	<ol style="list-style-type: none"> 1. MAX SPD setting is too low. 2. IR COMP setting is too low. 3. TORQUE setting is too low. 4. Motor is overloaded. 	<ol style="list-style-type: none"> 1. Increase MAX SPD setting. See page 43. 2. Increase IR COMP setting. See page 44. 3. Increase TORQUE setting. See page 44. 4. Check motor load. Resize the motor and drive if necessary.
Motor pulsates or surges under load.	<ol style="list-style-type: none"> 1. IR COMP is set too high. 2. Motor bouncing in and out of current limit. 	<ol style="list-style-type: none"> 1. Adjust the IR COMP setting slightly CCW until the motor speed stabilizes. See page 45. 2. Make sure motor is not undersized for load; adjust TORQUE trimpot CW. See page 44.

Unconditional Warranty

A. Warranty - Minarik Drives warrants that its products will be free from defects in workmanship and material for twelve (12) months or 3,000 hours, whichever comes first, from date of manufacture thereof. Within this warranty period, Minarik Drives will repair or replace, at its sole discretion, such products that are returned to Minarik Drives, 14300 De La Tour Drive, South Beloit, IL 61080 USA.

This warranty applies only to standard catalog products, and does not apply to specials. Any returns for special controls will be evaluated on a case-by-case basis. Minarik Drives is not responsible for removal, installation, or any other incidental expenses incurred in shipping the products to and from the repair point.

B. Disclaimer - The provisions of Paragraph A are Minarik Drives's sole obligation and exclude all other warranties of merchantability for use, express or implied. Minarik Drives further disclaims any responsibility whatsoever to the customer or to any other person for injury to the person or damage or loss of property of value caused by any product that has been subject to misuse, negligence, or accident, or misapplied or modified by unauthorized persons or improperly installed.

C. Limitations of Liability - In the event of any claim or breach of any of Minarik Drives's obligations, whether express or implied, and particularly of any other claim or breach of warranty contained in Paragraph A, or of any other warranties, express or implied, or claim of liability that might, despite Paragraph B, be decided against Minarik Drives by lawful authority, Minarik Drives shall under no circumstances be liable for any consequential damages, losses, or expense arising in connection with the use of, or inability to use, Minarik Drives product for any purpose whatsoever.

An adjustment made under warranty does not void the warranty, nor does it imply an extension of the original 12-month warranty period. Products serviced and/or parts replaced on a no-charge basis during the warranty period carry the unexpired portion of the original warranty only.

If for any reason any of the foregoing provisions shall be ineffective, Minarik Drives's liability for damages arising out of its manufacture or sale of equipment, or use thereof, whether such liability is based on warranty, contract, negligence, strict liability in tort, or otherwise, shall not in any event exceed the full purchase price of such equipment.

Any action against Minarik Drives based upon any liability or obligation arising hereunder or under any law applicable to the sale of equipment or the use thereof, must be commenced within one year after the cause of such action arises.



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Document number 250-0091, Revision 9
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An American Control Electronics Brand

PCM23000A Series

USER MANUAL

PCM23001A

PCM23411A

PCM23401A

To download complete manual, visit:

<https://www.minarikdrives.com/documents/250-0104.pdf>

www.minarikdrives.com

Section 1. Specifications

<i>Model</i>	<i>Maximum Armature Current (ADC)</i>	<i>HP Range with 90 VDC Motor</i>	<i>HP Range with 180 VDC Motor</i>	<i>Enclosure</i>
PCM23411A	1.5	1/20 - 1/8	1/10 - 1/4	NEMA 4X
PCM23001A	10.0	1/8 - 1	1/4 - 2	Chassis
PCM23401D				NEMA 4X

AC Line Voltage 115/230 VAC ± 10%, 50/60 Hz, single phase

DC Armature Voltage
 with 115 VAC Line Voltage 0 - 90 VDC
 with 230 VAC Line Voltage 0 - 180 VDC

Field Voltage
 with 115 VAC Line Voltage 50 VDC (F1 to L1); 100 VDC (F1 to F2)
 with 230 VAC Line Voltage 100 VDC (F1 to L1); 200 VDC (F1 to F2)

Maximum Field Current 1 ADC

Acceleration & Deceleration Time 1 second

Analog Input Range 0 - 10 VDC, 4 - 20 mA

Input Impedance (S1 to S2) 1K ohms

Form Factor 1.37 at base speed

Load Regulation 1% base speed or better

Speed Range 60:1

Vibration 0.5G maximum (0 - 50 Hz)
 0.1G maximum (> 50 Hz)

Safety Certifications UL/cUL Recognized Equipment, File # E132235 (not PCM23411A)
 CSA Certified Component, File # LR41380

Ambient Temperature Range
 Chassis Drive 10°C - 55°C
 Cased Drive 10°C - 40°C

Section 7. Troubleshooting



Dangerous voltages exist on the drive when it is powered. When possible, disconnect the drive while troubleshooting. High voltages can cause serious or fatal injury.

Before Troubleshooting

Perform the following steps before starting any procedure in this section:

1. Disconnect AC line voltage from the drive.
2. Check the drive closely for damaged components.
3. Check that no conductive or other foreign material has become lodged on the printed circuit board.
4. Verify that every connection is correct and in good condition.
5. Verify that there are no short circuits or grounded connections.
6. Check that the selection switch settings are correctly set.
7. Check that the drive's rated armature is consistent with the motor ratings.

For additional assistance, contact your local Minarik Drives distributor or the factory direct:

(800) MINARIK or FAX: (800) 394-6334

PCM23000A Series

PROBLEM	POSSIBLE CAUSE	SUGGESTED SOLUTIONS
Line fuse blows.	1. Line fuse is the wrong size.	1. Check that the line fuse is correct for the motor size.
	2. Motor cable or armature is shorted to ground.	2. Check motor cable and armature for shorts.
	3. Nuisance tripping caused by a combination of ambient conditions and high-current spikes (i.e. reversing).	3. Add a blower to cool the drive components, decrease TORQUE settings, resize motor and drive for actual load demand, or check for incorrectly aligned mechanical components or “jams”. See page 27 for information on adjusting the TORQUE trim pot.
Line fuse does not blow, but the motor does not run.	1. Speed adjust potentiometer or input signal is set to zero speed.	1. Increase the speed adjust potentiometer setting or input signal.
	2. S2 is shorted to S1.	3. Remove the short.
	3. Drive is in current limit.	4. Verify that the motor is not jammed. Increase TORQUE setting if set too low.
	4. Drive is not receiving AC line voltage.	5. Apply AC line voltage.
	5. Motor is not connected.	6. Remove power. Connect the motor to A1 and A2. Reapply power.
Motor does not stop when the speed adjust potentiometer is full CCW.	1. MIN SPD is set too high.	1. Calibrate MIN SPD.

PROBLEM	POSSIBLE CAUSE	SUGGESTED SOLUTIONS
Motor runs in the opposite direction	1. Motor connections to A1 and A2 are reversed.	1. Remove power. Reverse connections to A1 and A2. Reapply power.
Motor runs too fast.	1. MAX SPD is set too high.	1. Calibrate MAX SPD.
Motor will not reach the desired speed.	1. MAX SPD setting is too low.	1. Increase MAX SPD setting.
	2. IR COMP setting is too low.	2. Increase IR COMP setting.
	3. TORQUE setting is too low.	3. Increase TORQUE setting.
	4. Motor is overloaded.	4. Check motor load. Resize the motor and drive if necessary.
Motor pulsates or surges under load.	1. IR COMP is set too high.	1. Adjust the IR COMP setting slightly CCW until the motor speed stabilizes.
	2. Motor bouncing in and out of current limit.	2. Make sure motor is not undersized for load; adjust TORQUE trim pot CW.

Unconditional Warranty

A. Warranty

American Control Electronics warrants that its products will be free from defects in workmanship and material for twelve (12) months or 3000 hours, whichever comes first, from date of manufacture thereof. Within this warranty period, American Control Electronics will repair or replace, at its sole discretion, such products that are returned to American Control Electronics, 14300 De La Tour Drive, South Beloit, Illinois 61080 USA.

This warranty applies only to standard catalog products, and does not apply to specials. Any returns of special controls will be evaluated on a case-by-case basis. American Control Electronics is not responsible for removal, installation, or any other incidental expenses incurred in shipping the product to and from the repair point.

B. Disclaimer

The provisions of Paragraph A are American Control Electronics's sole obligation and exclude all other warranties of merchantability for use, expressed or implied. American Control Electronics further disclaims any responsibility whatsoever to the customer or to any other person for injury to the person or damage or loss of property of value caused by any product that has been subject to misuse, negligence, or accident, or misapplied or modified by unauthorized persons or improperly installed.

C. Limitations of Liability

In the event of any claim for breach of any of American Control Electronics's obligations, whether expressed or implied, and particularly of any other claim or breach of warranty contained in Paragraph A, or of any other warranties, expressed or implied, or claim of liability that might, despite Paragraph B, be decided against American Control Electronics by lawful authority, American Control Electronics shall under no circumstances be liable for any consequential damages, losses, or expenses arising in connection with the use of, or inability to use, American Control Electronics's product for any purpose whatsoever.

An adjustment made under warranty does not void the warranty, nor does it imply an extension of the original 12-month warranty period. Products serviced and/or parts replaced on a no-charge basis during the warranty period carry the unexpired portion of the original warranty only.

If for any reason any of the foregoing provisions shall be ineffective, American Control Electronics's liability for damages arising out of its manufacture or sale of equipment, or use thereof, whether such liability is based on warranty, contract, negligence, strict liability in tort, or otherwise, shall not in any event exceed the full purchase price of such equipment.

Any action against American Control Electronics based upon any liability or obligation arising hereunder or under any law applicable to the sale of equipment or the use thereof, must be commenced within one year after the cause of such action arises.



PCM23001A



PCM23401A



PCM23411A



An American Control Electronics Brand

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250-0104 Rev 10

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8.8 Display

Phone +1 (717) 767-6511
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Bulletin No. PAXLI/V-F
 Drawing No. LP0566
 Released 2016-07-21

Model PAXLI - PAX Lite Current Meters & Model PAXLV - PAX Lite Voltmeters



- FOUR MULTI-RANGE UNITS COVER:
 199.9 μ A to 1.999 A *, 199.9 mV (AC or DC)
 1.999 V to 300 V (AC or DC)
- 3 1/2-DIGIT, 0.56" (14.2 mm) HIGH RED LED DISPLAY W/
 POLARITY
- BUILT-IN SCALING PROVISIONS
- SELECTABLE DECIMAL POINT LOCATION
- AUTO ZEROING CIRCUITS
- OVER-RANGE INDICATION
- NEMA 4X/IP65 SEALED FRONT BEZEL
- OPTIONAL CUSTOM UNITS OVERLAY W/BACKLIGHT

* Accessory Shunts Available For Higher Current Ranges.

GENERAL DESCRIPTION

PAX Lite Current and Volt Meters are premium quality instruments designed for tough industrial applications. With multi-range capability, built-in provision for scaling, and DIP switch selectable decimal points, these meters offer the ultimate in application flexibility. Four models cover your voltage and current indicator needs. The meter can provide direct readout from pressure, speed or flow transducers, or any other variable that can be translated to voltage or current. The built-in scaling allows the display to be scaled to the desired engineering unit.

The 3 1/2 -digit bi-polar display (minus sign displayed when current or voltage is negative) features a 0.56" high, 7-segment LEDs for easy reading. The meter is also available with custom units label capability. Using the PAX label kit (PAXLBK30), the selected label is installed behind the panel, keeping it safe from washdown or other environmental conditions. A DIP switch is used to control the backlight for the units label.

The meters have a NEMA 4X/IP65 sealed bezel and extensive testing of noise effects to CE requirements, allowing the meter to provide a tough yet reliable application solution

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the literature or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

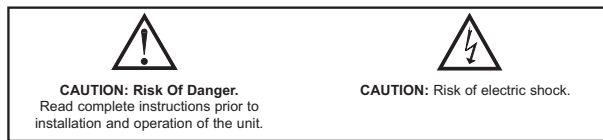
DEFINITION OF TERMS

INSTALLATION CATEGORY (overvoltage category) I, (CAT I):

Signal level, special equipment or parts of equipment, telecommunication, electronic, etc. with smaller transient overvoltages than Installation Category (overvoltage category) II. (See IEC 664 & IEC 61010)

INSTALLATION CATEGORY (overvoltage category) II, (CAT II):

Local level, appliances, portable equipment, etc. with smaller transient overvoltages than Installation Category (overvoltage category) III. (See IEC 664 & IEC 61010)



DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4) H x 5.0" (127) W.

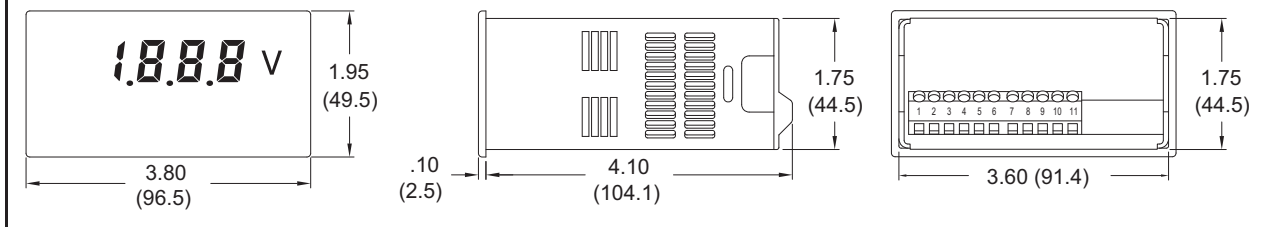
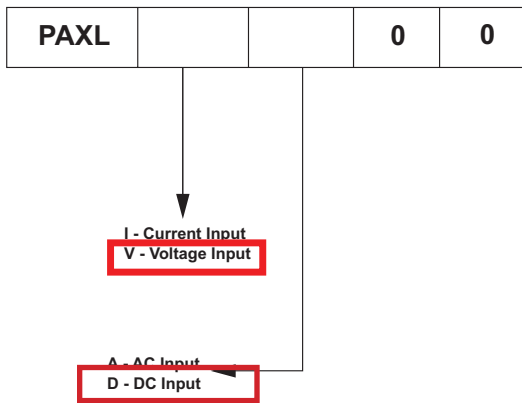


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ORDERING INFORMATION

Meter Part Numbers



GENERAL METER SPECIFICATIONS

1. **DISPLAY:** 3 1/2-digit, 0.56" (14.2 mm) high, 7-segment red LED, (-) minus sign displayed when current or voltage is negative. Decimal points inserted before 1st, 2nd, or 3rd least significant digits by DIP switch selection.
2. **POWER:** 115/230 VAC, switch selectable. Allowable power line variation $\pm 10\%$, 50/60 Hz, 6 VA.
Isolation: 2300 Vrms for 1 min. between input and supply
Working Voltage: 300 V max., CAT II
3. **INPUT RANGE/RESOLUTION:** (Selectable by jumper connections.):
Input Impedance:
Voltage: All ranges $1M\Omega$
Current:

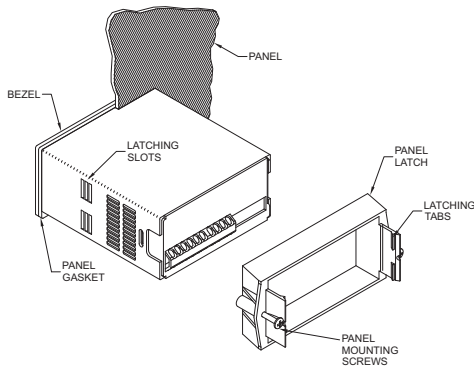
199.9 μ A	1000.1 K Ω
1.999 mA	100.1 Ω
19.99 mA	10.1 Ω
199.9 mA	1.1 Ω
1.999 A	0.1 Ω

Working Voltage: 300 V max., CAT II
4. **ACCURACY:**
AC Voltmeters: $\pm(0.1\%$ of Reading + 3 digits) (45-500 Hz)
AC Current Meters (45-500 Hz):
199.9 μ A/199.9 mV, 1.999 mA, 19.99 mA: $\pm(0.1\%$ of Reading + 3 digits)
199.9 mA: $\pm(0.15\%$ of Reading + 3 digits)
1 A: $\pm(0.5\%$ of Reading + 3 digits)
DC Voltmeters: $\pm(0.1\%$ of Reading + 1 digit)
DC Current Meters:
199.9 μ A/199.9 mV, 1.999 mA, 19.99 mA: $\pm(0.1\%$ of Reading + 1 digit)
199.9 mA: $\pm(0.15\%$ of Reading + 1 digit)
1.999 A: $\pm(0.5\%$ of Reading + 1 digit)
Note: Any individual range may be recalibrated (scaled) to 0.1% accuracy with appropriate calibration equipment.
5. **OVER-RANGE INDICATION:** on all modes is indicated by blanking 3 least significant digits.
6. **MAX. VOLTAGE ON LOWEST INPUT RANGE:** 75 VAC or DC (Both voltmeters and current meters).
7. **MAX. VOLTAGE ON TERMINAL BLOCK:** 300 VAC or DC (Both voltmeters and current meters).
8. **MAX. CURRENTS (FOR CURRENT METERS):**
199.9 μ A through 19.99 mA: 10 times max. range current
199.9 mA: 1 A
1.999 A: 3 A
Caution: In circuits where fault currents can exceed the maximum shunt current, a fast-blow fuse should be installed in series with the input signal. Otherwise, a slow blow 10 amp fuse is recommended that will allow for start-up over current situations, while still protecting the instrument.
9. **TEMPERATURE COEFFICIENTS:**
Current meters Voltmeters
DC: ± 100 PPM/ $^{\circ}$ C DC: ± 75 PPM/ $^{\circ}$ C
AC: ± 200 PPM/ $^{\circ}$ C AC: ± 150 PPM/ $^{\circ}$ C
10. **ENVIRONMENTAL CONDITIONS:**
Operating Temperature: 0 $^{\circ}$ to 60 $^{\circ}$ C
Storage Temperature: -40 $^{\circ}$ to 80 $^{\circ}$ C
Operating and Storage Humidity: 85% max. relative humidity (non-condensing)
Vibration to IEC 68-2-6: Operational 5 to 150 Hz, 2 g.
Shock to IEC 68-2-27: Operational 30 g.
Altitude: Up to 2000 meters
11. **RESPONSE TIME TO STEP CHANGE INPUT:** 1 sec. nominal
12. **READING RATE:** 2.5 readings/sec., nominal
13. **NORMAL MODE REJECTION:** 50 dB 50/60 Hz (DC units only)
14. **COMMON MODE REJECTION:** 110 dB DC or 50/60 Hz (DC units only)
15. **COMMON MODE VOLTAGE (COMM. TO EARTH):** 350 volt peak
16. **CERTIFICATIONS AND COMPLIANCES:**
CE Approved
EN 61326-1 Immunity to Industrial Locations
Emission CISPR 11 Class B
Safety requirements for electrical equipment for measurement, control, and laboratory use:
EN 61010-1: General Requirements
EN 61010-2-030: Particular Requirements for Testing and Measuring Circuits
RoHS Compliant
UL Listed: File #E137808
Type 4X Enclosure rating (Face only)
IP65 Enclosure rating (Face only)
IP20 Enclosure rating (Rear of unit)
17. **CONNECTIONS:** High compression cage-clamp terminal block
Wire Strip Length: 0.3" (7.5 mm)
Wire Gage: 30-14 AWG copper wire
Torque: 4.5 inch-lbs (0.51 N-m) max.
18. **CONSTRUCTION:** This unit is rated for Type 4X/IP65 outdoor use. Installation Category II, Pollution Degree 2. One piece bezel/case. Flame resistant. Panel gasket and mounting clip included.
19. **WEIGHT:** 0.65 lbs. (0.24 Kg)

1.0 INSTALLING THE METER

INSTALLATION

The PAX meets NEMA 4X/IP65 requirements when properly installed. The unit is intended to be mounted into an enclosed panel. Prepare the panel cutout to the dimensions shown. Remove the panel latch from the unit. Slide the panel gasket over the rear of the unit to the back of the bezel. The unit should be installed fully assembled. Insert the unit into the panel cutout.



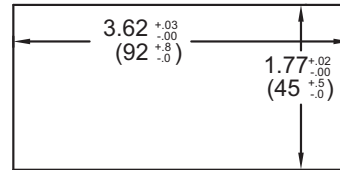
While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug in the panel (Torque to approximately 7 in-lbs [79N-cm]). Do not over-tighten the screws.

INSTALLATION ENVIRONMENT

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

PANEL CUT-OUT



2.0 SETTING THE JUMPERS AND SWITCHES

The meter has an input jumper and switches, which must be checked and/or changed prior to applying power. To access the input jumper and switches, remove the meter base from the case by firmly squeezing and pulling back on the side rear finger tabs. This should lower the latch below the case slot (which is located just in front of the finger tabs). It is recommended to release the latch on one side, then start the other side latch.

Power Selection Switch



Caution: Insure the AC power selection switch is set for the proper voltage before powering the meter. The meter is shipped from the factory in the 230 VAC position.

Input Range Jumper

A jumper is used for selection of the voltage or current input range. Select the proper input range that will be high enough to avoid input signal overload. It is important that only one jumper position is used at a time. Avoid placing a jumper across two different input ranges.

Set-Up DIP Switches

A DIP switch is located inside the meter. It is used for the selection of decimal points, backlight annunciator, and scaling. Selecting the "ON" position enables the function.

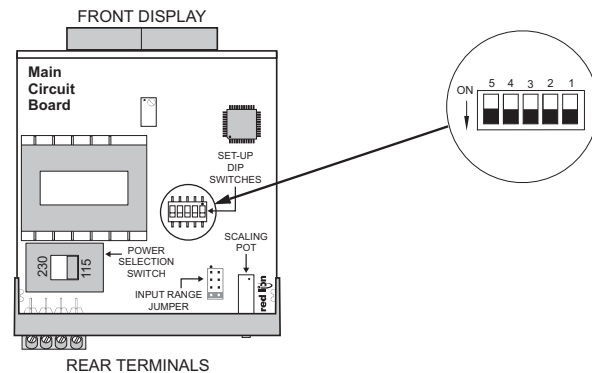
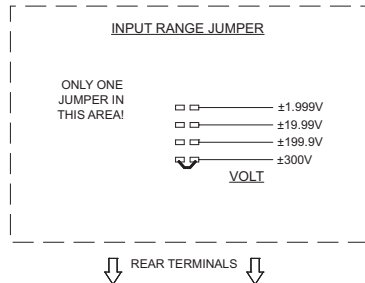
SWITCH	FUNCTION
1	Decimal Point 1 (000.0)
2	Decimal Point 2 (00.00)
3	Decimal Point 3 (0.000)
4	Backlight Annunciator for Units Label
5	Enables the Scaling Pot

* Turn scaling pot fully clockwise (25 turns max.) when scaling is disabled. Factory setting is the fully clockwise position.

PAXLV Jumper Selection

JUMPER SELECTIONS

The indicates factory setting.



3.0 WIRING THE METER

WIRING OVERVIEW

Electrical connections are made via screw-clamp terminals located on the back of the meter. All conductors should conform to the meter's voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the meter (AC) be protected by a fuse or circuit breaker.

When wiring the meter, compare the numbers embossed on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.3" (7.5 mm) bare lead exposed (stranded wires should be tinned with solder). Insert the lead under the correct screw-clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.)

EMC INSTALLATION GUIDELINES

Although Red Lion Controls Products are designed with a high degree of immunity to Electromagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into a unit may be different for various installations. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed are some EMI guidelines for a successful installation in an industrial environment.

- A unit should be mounted in a metal enclosure, which is properly connected to protective earth.
- Use shielded cables for all Signal and Control inputs. The shield connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
 - Connect the shield to earth ground (protective earth) at one end where the unit is mounted.
 - Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is over 1 MHz.
- Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors, feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run through metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter. Also, Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.

4. Long cable runs are more susceptible to EMI pickup than short cable runs.

5. In extremely high EMI environments, the use of external EMI suppression devices such as Ferrite Suppression Cores for signal and control cables is effective. The following EMI suppression devices (or equivalent) are recommended:

Fair-Rite part number 0443167251 (RLC part number FCOR0000)

Line Filters for input power cables:

Schaffner # FN2010-1/07 (Red Lion Controls # LFIL0000)

6. To protect relay contacts that control inductive loads and to minimize radiated and conducted noise (EMI), some type of contact protection network is normally installed across the load, the contacts or both. The most effective location is across the load.

a. Using a snubber, which is a resistor-capacitor (RC) network or metal oxide varistor (MOV) across an AC inductive load is very effective at reducing EMI and increasing relay contact life.

b. If a DC inductive load (such as a DC relay coil) is controlled by a transistor switch, care must be taken not to exceed the breakdown voltage of the transistor when the load is switched. One of the most effective ways is to place a diode across the inductive load. Most RLC products with solid state outputs have internal zener diode protection. However external diode protection at the load is always a good design practice to limit EMI. Although the use of a snubber or varistor could be used.

RLC part numbers: Snubber: SNUB0000

Varistor: ILS11500 or ILS23000

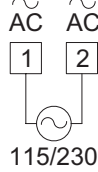
7. Care should be taken when connecting input and output devices to the instrument. When a separate input and output common is provided, they should not be mixed. Therefore a sensor common should NOT be connected to an output common. This would cause EMI on the sensitive input common, which could affect the instrument's operation.

Visit RLC's web site at <http://www.redlion.net/emi> for more information on EMI guidelines, Safety and CE issues as they relate to Red Lion Controls products.

3.1 POWER WIRING

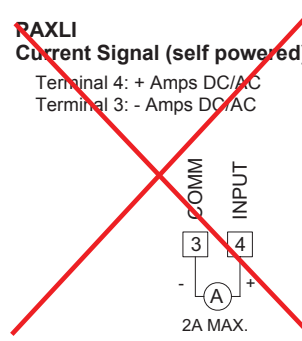
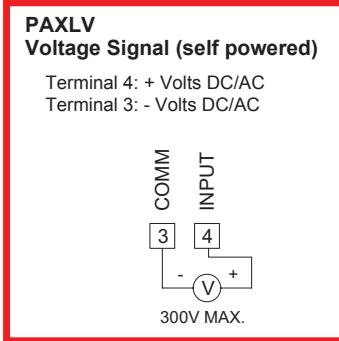
AC Power

Terminal 1: VAC
Terminal 2: VAC



3.2 INPUT SIGNAL WIRING

Before connecting signal wires, the Input Range Jumper should be verified for proper position.



4.0 SCALING THE METER

PAXLV

DIRECT VOLTMETER READOUT

When the application requires direct voltmeter readout, the Scale Switch should be set in the "OFF" position and the Input Range Jumper set to the voltage range being applied. To reduce display resolution, the jumper can be set to a higher range than the input range being applied. Set the Decimal Point switches according to the resolution of the selected Input Range.

SCALING VOLTMETER READOUT

In many industrial applications, a voltmeter is required to display a reading in terms of PSI, RPM, or some other unit of measure. The voltage signal being measured can be generated by a transducer that senses the variations and delivers a linear output voltage. To provide the desired readout at the specified voltage, the voltmeter must be scaled.

Place the Scale Switch in the "ON" position. This enables the Scale Potentiometer which is accessible from the back of the meter. (Enabling the Scale Potentiometer does NOT affect the calibration of the meter.) Place the Decimal Point Switches to the proper location. To properly set the Input Range Jumper, the Division Factor must be determined by first using the below formula. After the Division Factor is calculated, use the Division Factor Range Selection Chart to choose the proper Input Range Jumper setting. Apply the meter power and the voltage signal. Adjust the Scale Potentiometer to the desired value.

This scaling only effects the span. There is no offset scaling. This means that only zero voltage input can produce a display value of zero.

DIVISION FACTOR FORMULA:

$$\frac{VT \times D.D.P.}{D.R.} = D.F.$$

WHERE:

- VT = Maximum Transducer Output
- D.D.P = Display Decimal Point
- D.F. = Division Factor
- D.R. = Desired Reading (without regard for decimal point)
Display of x.xxx = D.R. of xxxx

D.D.P.	
0.000 = 1	The Display Decimal Point
00.00 = 10	(D.D.P.) is determined by
000.0 = 100	the desired decimal point
0000 = 1000	placement in the readout.

After the Division Factor for the application has been calculated, the

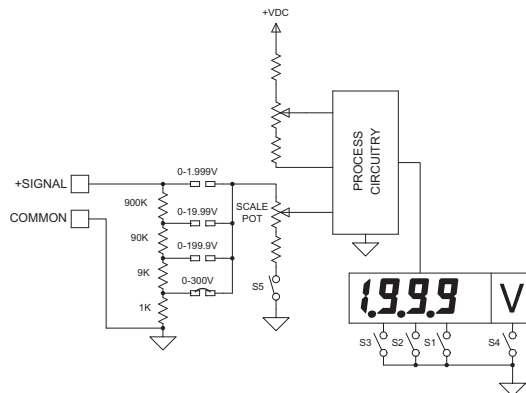
proper voltage range jumper can be selected. Use the "Division Factor Range Selection Chart" to choose the proper jumper setting.

DIVISION FACTOR RANGE SELECTION CHART

D.F.	Use Input Position
0.1 to 1.2	Pos 1: 0-1.999 VDC
1.2 to 10.5	Pos 2: 0-19.99
10.5 to 100.5	Pos 3: 0-199.9
100.5 to 1300	Pos 4: 0-300

Note: Only one voltage jumper should be selected. Install the jumper before the voltage signal is applied.

BLOCK DIAGRAM PAXLV



EXAMPLE: A relative humidity transducer delivers a 7.0 VDC voltage at a relative humidity of 75%.

$$D.F. = \frac{VT \times D.D.P.}{D.R.} = \frac{7.0 \times 1000}{75} = 93.3$$

This Division Factor is between 10.5 and 100.5, therefore jumper position 3 (199.9 V) is selected. The Scaling Potentiometer is then adjusted for the desired readout at a known relative humidity.

PAXLI**DIRECT CURRENT METER READOUT**

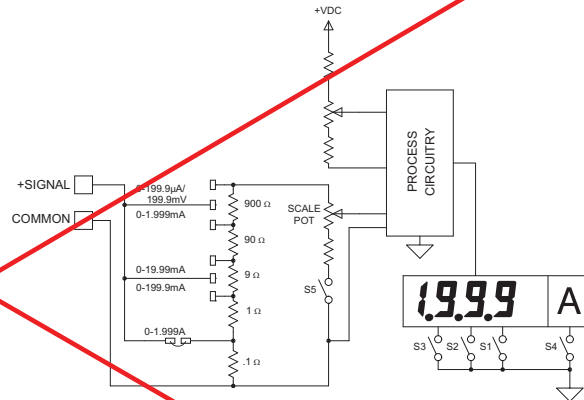
When the application requires direct current meter readout, the Scale Switch should be set in the "OFF" position and the Input Range Jumper set to the current range being applied. To reduce display resolution, the jumper can be set to a higher range than the input range being applied. Set the Decimal Point switches according to the resolution of the selected Input Range.

SCALING CURRENT METER READOUT

In many industrial applications, a current meter is required to display a reading in terms of PSI, RPM, or some other unit of measure. The current signal being measured can be generated by a transducer that senses the variations and delivers a linear output current. To provide the desired readout at the specified current, the current meter must be scaled.

Place the Scale Switch in the "ON" position. This enables the Scale Potentiometer which is accessible from the back of the meter. (Enabling the Scale Potentiometer does NOT affect the calibration of the meter.) Place the Decimal Point Switches to the proper location. The Input Range Jumper is set to the current range being applied. Apply the meter power and the current signal. Adjust the Scale Potentiometer to the desired value. Scaling to obtain a numerical readout higher than the normal value of the current can also be accomplished, in most cases, by selecting a lower current range. However, the maximum current for the range must not be exceeded. (See Specifications for maximum input currents.)

This scaling only effects the span. There is no offset scaling. This means that only zero current input can produce a display value of zero.

BLOCK DIAGRAM PAXLI

EXAMPLE: The PAX Current Meter has been connected to measure a circuit current to 120.0 mA maximum. However, in this application, the display is to indicate percent of load current with 120.0 mA equivalent to 100.0 percent. The scale potentiometer is adjusted to reduce the normal 120.0 mA signal input display reading of 120.0 to indicate the desired reading of 100.0 on the display. Scaling to obtain a numerical readout higher than the normal value of the current can also be accomplished in most cases by selecting a lower current range. However, the maximum current for the range must not be exceeded. (See Specifications for maximum input currents.)

5.0 TROUBLESHOOTING

PROBLEM	REMEDIES
NO DISPLAY	CHECK: Power switch and line voltage
INCORRECT DISPLAY	CHECK: Input jumper position CHECK: Scaling adjustment pot DIP switch position ADJUST: Scaling pot VERIFY: Input Signal
OVER-RANGE INDICATION	CHECK: Input jumper position VERIFY: Input signal

6.0 CALIBRATION

The meter has been fully calibrated at the factory. Scaling to convert the input signal to a desired display value is performed by enabling the scale pot DIP switch. If the meter appears to be indicating incorrectly or inaccurately, refer to Troubleshooting before attempting to calibrate the meter.

When recalibration is required (generally every 2 years), it should only be performed by qualified technicians using appropriate equipment.

Input Calibration

WARNING: Calibration of this meter requires a signal source with an accuracy of 0.01% or better and an external meter with an accuracy of 0.005% or better.

Before starting, verify that the Input Range Jumper is set for the range to be calibrated. Also verify that the precision signal source is connected and ready. Allow a 30 minute warm-up period before calibrating the meter.

Then perform the following procedure:

1. Place jumper in 2 V range (PAXLV) or 2 mA range (PAXLI).
2. Set the DIP switch off to disable the scaling pot.
3. Apply half scale input signal.
4. Adjust calibration potentiometer as necessary for the display to read 1000 (ignore decimal point).
5. Apply zero signal and ensure display reads zero.
6. Apply full scale signal and ensure display reads 999.

Note: Any individual range may be recalibrated to 0.1% accuracy with appropriate calibration equipment.

LIMITED WARRANTY

(a) Red Lion Controls Inc., Sixnet Inc., N-Tron Corporation, or Blue Tree Wireless Data, Inc. (the "Company") warrants that all Products shall be free from defects in material and workmanship under normal use for the period of time provided in "Statement of Warranty Periods" (available at www.redlion.net) current at the time of shipment of the Products (the "Warranty Period"). **EXCEPT FOR THE ABOVE-STATED WARRANTY, COMPANY MAKES NO WARRANTY WHATSOEVER WITH RESPECT TO THE PRODUCTS, INCLUDING ANY (A) WARRANTY OF MERCHANTABILITY; (B) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; OR (C) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.** Customer shall be responsible for determining that a Product is suitable for Customer's use and that such use complies with any applicable local, state or federal law.

(b) The Company shall not be liable for a breach of the warranty set forth in paragraph (a) if (i) the defect is a result of Customer's failure to store, install, commission or maintain the Product according to specifications; (ii) Customer alters or repairs such Product without the prior written consent of Company.

(c) Subject to paragraph (b), with respect to any such Product during the Warranty Period, Company shall, in its sole discretion, either (i) repair or replace the Product; or (ii) credit or refund the price of Product provided that, if Company so requests, Customer shall, at Company's expense, return such Product to Company.

(d) THE REMEDIES SET FORTH IN PARAGRAPH (c) SHALL BE THE CUSTOMER'S SOLE AND EXCLUSIVE REMEDY AND COMPANY'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH IN PARAGRAPH (a).





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