Operation & Maintenance Manual

ENCORE® 700
DIAPHRAGM METERING PUMP

MANUAL NO. CF.440.400.001.IM.0417

UGSI Chemical Feed
SOLUTIONS

ENCORE® 700
DIAPHRAGM
METERING PUMP

MANUAL NO. CF.440.400.001.IM.0417

EQUIPMENT SERIAL NO. _____

DATE OF START-UP _____

START-UP BY _____

Prompt service available from nationwide authorized service contractors.

ORDERING INFORMATION

In order for us to fill your order immediately and correctly, please order material by description and part number, as shown in this manual. Also, please specify the serial number of the equipment on which the parts will be installed.
Statements and instructions set forth herein are based upon the best information and practices known to UGSI Chemical Feed, Inc. at the time of publication, but it should not be assumed that every acceptable safety procedure is contained herein. UGSI Chemical Feed, Inc. does not guarantee that actions in accordance with such statements and instructions included in this manual will result in the complete elimination of hazards and it assumes no liability for accidents that may occur.

WARRANTY

(a.) Limited Product Warranty Statements. For each Product purchased from Seller or an authorized reseller, Seller makes the following limited warranties: (i) the Product is free from defects in material and workmanship, (ii) the Product materially conforms to Seller's specifications that are attached to, or expressly incorporated by reference into, these terms, and (iii) at the time of delivery, Seller has title to the Product free and clear of liens and encumbrances (collectively, the "Limited Warranties"). Warranties with respect to software which may be furnished by Seller as part of the Product, if any, are expressly set forth elsewhere in these terms. The Limited Warranties set forth herein do not apply to any software furnished by Seller.
(b.) Conditions to the Limited Warranties. The Limited Warranties are conditioned on (i) the Product being stored, installed, operated and maintained in accordance with Seller's instructions, (ii) no repairs, modifications or alterations being made to the Product other than by Seller or its authorized representatives, (iii) the Product being used in compliance with any conditions or parameters set forth in specifications that are attached to, or expressly incorporated by reference into, these terms, (iv) use of the Product being discontinued after the Buyer or user has, or should have had, knowledge of any defect in the Product, (v) Buyer providing prompt written notice of any warranty claims within the warranty period described below, (vi) at Seller's discretion, Buyer either removing and shipping the Product or non-conforming part thereof to Seller, at Buyer's expense, or Buyer granting Seller access to the Products at all reasonable times and locations to assess the warranty claims, and (vii) Buyer not being in default of any payment obligation to Seller.
(c.) Exclusions from Limited Warranty Coverage. The Limited Warranties specifically exclude any equipment comprising part of the Product that is not manufactured by Seller or not bearing its nameplate. To the extent permitted, Seller herby assigns any warranties made to Seller for such equipment. Seller shall have no liability to Buyer under any legal theory for such equipment or any related assignment of warranties. Additionally, any Product that is described as being experimental, developmental, prototype, or pilot is specifically excluded from the Limited Warranties and is provided to Buyer "as is" with no warranties of any kind. Also excluded from the Limited Warranties are normal wear and tear items including any expendable items that comprise part of the Product, such as fuses, light bulbs and lamps.
(d.) Limited Warranty Period. Buyer shall have 12 months from initial operation of the Product or 18 months from shipment, whichever occurs first, to provide Seller with prompt, written notice of any claims of breach of the Limited Warranties. Continued use or possession of the Product after expiration of the warranty period shall be conclusive evidence that the Limited Warranties have been fulfilled to the full satisfaction of Buyer and user, unless Buyer has previously provided Seller with notice of a breach of the Limited Warranties.
(e.) Remedies for Breach of Limited Warranty. Buyer's sole and exclusive remedies for any breach of the Limited Warranties are limited to Seller's choice of repair or replacement of the Product, or non-conforming parts thereof, or refund of all or part of the purchase price for the subject Product or part. The warranty on repaired or replaced Product or parts is limited to the remainder of the original warranty period. Buyer shall be responsible for any labor required to gain access to the Product so that Seller can assess the available remedies and (ii) Buyer shall be responsible for all costs of installation of repaired or replaced Products or parts. All Products or parts replaced under this Limited Warranty will become the property of Seller.
(f.) Transferability. The Limited Warranties shall be transferable during the warranty period to the initial end-user of the Product.
THE LIMITED WARRANTIES SET FORTH IN THIS SECTION ARE Seller's SOLE AND EXCLUSIVE WARRANTIES AND ARE SUBJECT TO THE LIMITS OF LIABILITY SET FORTH IN SECTION 8 BELOW. Seller MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OR ANY WARRANTIES THAT MIGHT ARISE FROM COURSE OF DEALING AND USAGE OF TRADE.

INTRODUCTION

This manual provides installation, operating, and maintenance instructions for the UGSI Chemical Feed, Inc. Encore® 700 Diaphragm Metering Pumps, here in after referred to as the "pump" or "metering pump". The pump provides accurate metering and transfer of a wide variety of chemicals. It is available in six head sizes, three gear ratios, direct and pulley drive configurations, and a single or double simplex configuration. A non-loss-of-motion stroke adjustment is used to vary the stroke for a smoother pumping action. Non-loss-of-motion is achieved through the use of a variable eccentric mechanism. Stroke adjustment is accomplished either manually or with an optional electric stroke length positioner.

An optional Silicon Control Rectifier (SCR) controls drive motor speed variations through a signal received from an external source.

When an electric stroke length positioner and/or variable speed drive is used with the pump, a separate instruction manual for each will be furnished.

WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR DAMAGE TO THE EQUIPMENT, THIS EQUIPMENT SHOULD BE INSTALLED, OPERATED AND SERVICED ONLY BY TRAINED, QUALIFIED PERSONNEL WHO ARE THOROUGHLY FAMILIAR WITH THE ENTIRE CONTENTS OF THIS INSTRUCTION MANUAL. WHEN DEALING WITH HAZARDOUS MATERIAL IT IS THE RESPONSIBILITY OF THE EQUIPMENT USER TO OBTAIN AND FOLLOW ALL SAFETY PRECAUTIONS RECOMMENDED BY THE MATERIAL MANUFACTURER/SUPPLIER. AVOID CONTACTING ELECTRICALLY HOT METER POSTS AND CIRCUIT BOARD COMPONENTS WHILE MAKING METER ADJUSTMENTS.

NOTE: When submitting correspondence always specify model and serial number of apparatus.

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VERY IMPORTANT SAFETY PRECAUTIONS

This page provides very important safety information related to safety in installation, operation, and maintenance of this equipment.

WARNING

TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, OBSERVE THE FOLLOWING:

THIS EQUIPMENT SHOULD BE INSTALLED, OPERATED AND SERVICED ONLY BY TRAINED, QUALIFIED PERSONNEL WHO ARE THOROUGHLY FAMILIAR WITH THE ENTIRE CONTENTS OF THIS INSTRUCTION MANUAL.

WHEN HAZARDOUS CHEMICALS ARE BEING PUMPED, AND/OR ELEVATED PRESSURE/TEMPERATURES ARE ENCOUNTERED, RIGID PIPE IS RECOMMENDED. WHEN WORKING WITH RIGID PIPING COMPONENTS, LATERAL AND TORSIONAL FORCES IN THE METERING PUMP SUCTION AND DISCHARGE FITTINGS MUST BE AVOIDED. THESE FORCES CAN LEAD TO COMPONENT FAILURE, WHICH COULD RELEASE HAZARDOUS CHEMICALS THAT COULD PRESENT A PERSONAL HAZARD AS WELL AS AN ENVIRONMENTAL HAZARD. IN RARE CASES, THESE FORCES CANNOT BE ELIMINATED THROUGH THE APPLICATION OF PROPER PIPING PRACTICES AND/OR PIPING SUPPORT SYSTEMS. IN THESE CASES UGSI CHEMICAL FEED, INC. SHOULD BE CONSULTED TO AID IN THE SELECTION OF AN APPROPRIATE FLEXIBLE CONNECTOR.

DUE TO THE SINUSOIDAL FLUID DELIVERY CHARACTERISTICS OF A RECIPROCATING METERING PUMP, ADDITIONAL PRESSURE IS CREATED IN THE SUCTION AND DISCHARGE LINE TO OVERCOME THE INERTIA OF THE FLUID AT REST IN THE LINES. INERTIAL PRESSURE ENCOUNTERED IN THE LINES IS A FUNCTION OF SEVERAL FACTORS (LINE SIZE AND LENGTH, VISCOSITY OF THE FLUID, STROKING SPEED, FLUID DELIVERY RATE, ETC.). THE SUCTION AND DISCHARGE LINES MUST BE SIZED TO THE PRESSURE SURGES DEVELOPED IN THE LINES. INERTIAL PRESSURE SURGE CAN CREATE STRESSES IN THE PIPING THAT COULD LEAD TO COMPONENT FAILURE. IF THE PULSING EFFECTS OF THIS PHENOMENON CANNOT BE CONTROLLED BY PROPER LINE SIZING, THEN ENGINEERING CONTROLS SUCH AS VENTED RISERS, PULSATION DAMPENERS, OR HEADBOXES CAN BE EMPLOYED TO MINIMIZE THE STRESSES PRODUCED IN THE PIPING SYSTEM CAUSED BY THE PRESSURE SURGES. IT IS IMPORTANT TO NOTE THAT THESE ENGINEERING CONTROLS REQUIRE PERIODIC MAINTENANCE. ADDITIONALLY, THE OPERATORS AND SERVICE PERSONNEL OF THIS EQUIPMENT MUST HAVE A WORKING UNDERSTANDING OF THE ENGINEERED CONTROL DEVICES FUNCTION, AND THE CONSEQUENCES OF MISAPPLICATION AND/OR INADEQUATE MAINTENANCE.

IT IS THE RESPONSIBILITY OF THE OWNER TO ENSURE THAT THE INSTALLATION, OPERATION, AND MAINTENANCE OF THIS EQUIPMENT AND ITS ASSOCIATED COMPONENTS ARE IN COMPLIANCE WITH ALL FEDERAL, STATE, AND LOCAL REGULATIONS.

AVOID CONTACTING ELECTRICALLY HOT METER POSTS AND CIRCUIT BOARD COMPONENTS WHILE MAKING METER ADJUSTMENTS.

WHEN DEALING WITH HAZARDOUS MATERIALS, IT IS THE RESPONSIBILITY OF THE EQUIPMENT USER TO OBTAIN AND FOLLOW ALL SAFETY PRECAUTIONS RECOMMENDED BY THE HAZARDOUS MATERIAL MANUFACTURER/SUPPLIER.

VERY IMPORTANT SAFETY PRECAUTIONS (CONT'D)

CONSULT YOUR UGSI CHEMICAL FEED, INC. REPRESENTATIVE IF THE PUMP IS TO BE USED UNDER CONDITIONS OTHER THAN ORIGINALLY SPECIFIED AND IF THERE IS ANY QUESTION REGARDING THE SIZE OF THE DISCHARGE LINE.

USE RIGID PIPE WHEN HAZARDOUS CHEMICALS ARE PUMPED AND/OR ELEVATED PRESSURE/ TEMPERATURES ARE ENCOUNTERED.

USE EXTREME CARE TO AVOID CONTACT WITH THE MATERIAL AND POSSIBLE SEVERE PERSONAL INJURY. CONSULT YOUR CHEMICAL SUPPLIER FOR INSTRUCTIONS IN THE PREPARATION OF SOLUTIONS AND THE HANDLING OF CHEMICALS. OBSERVE ALL RECOMMENDED SAFETY PRECAUTIONS.

DO NOT SPILL SOLUTION. IF ANY SOLUTION IS SPILLED, DILUTE OR WASH AWAY WITH WATER IMMEDIATELY OR FOLLOW SUPPLIER'S INSTRUCTIONS FOR HAZARDOUS MATERIALS.

AVOID BEING SPRAYED WITH LIQUID UNDER PRESSURE. PRIOR TO DISASSEMBLY OF PIPE CONNECTIONS REFER TO SERVICE SECTION FOR DETAILED INSTRUCTIONS ON RELIEVING PRESSURE AND DRAINING. ALLOW SYSTEM TO DRAIN FULLY BEFORE ATTEMPTING TO DISASSEMBLE PIPING AND REMOVING VALVES AND/OR HEAD.

SINCE THE STORAGE AND HANDLING OF SODIUM CHLORITE PRESENTS VERY SPECIFIC HAZARDS, THE USER MUST SEEK THE ADVICE OF THE SODIUM CHLORITE SUPPLIER WITH REFERENCE TO STORAGE FACILITIES, HANDLING PRECAUTIONS AND HEALTH HAZARDS.

SODIUM CHLORITE, WHEN FINELY DIVIDED IN THE PRESENCE OF ORGANIC COMPOUNDS, IS A POSSIBLE FIRE HAZARD. FOR THIS REASON, EXTREME CARE MUST BE EXERCISED TO PREVENT SOLUTIONS FROM DRYING OUT IN THE THREADED PORTIONS OF THE PUMP BODY AND RELATED PARTS. OBSERVE CAREFULLY THE MANUFACTURER/SUPPLIER'S RECOMMENDED SAFETY PROCEDURES AND THE HANDLING AND STORAGE PROCEDURES IN THIS MANUAL.

WHEN SERVICING HEADS AND/OR VALVES, FOLLOW PROCEDURES IN THE SERVICE SECTION FOR DISASSEMBLY.

USE EXTREME CARE TO AVOID CONTACT BECAUSE LIQUID IS PRESENT BETWEEN DISCHARGE DRAIN VALVE AND UNION ELBOW. FLUSH SPILLED LIQUID IMMEDIATELY.

USE EXTREME CARE TO AVOID CONTACT WITH THE MATERIAL AND POSSIBLE SEVERE PERSONAL INJURY. WHEN USING HAZARDOUS MATERIAL, OBSERVE ALL SAFETY PRECAUTIONS RECOMMENDED BY THE HAZARDOUS MATERIAL MANUFACTURER/SUPPLIER. USE APPROPRIATE PROTECTIVE CLOTHING AND EYE PROTECTION WHEN HANDLING HAZARDOUS MATERIAL.

USE EXTREME CARE TO AVOID CONTACT WITH LIQUID PRESENT IN HEAD. ALLOW SUCTION VALVE TO FALL INTO SUITABLE CONTAINER AND CATCH LIQUID.

TURN POWER OFF BEFORE SERVICING.

VERY IMPORTANT SAFETY PRECAUTIONS (CONT'D)

DO NOT RUN THE PUMP WITH THE BELT GUARD REMOVED.

USE ONLY UGSI CHEMICAL FEED, INC. LISTED PARTS EXCEPT FOR COMMERCIALLY AVAILABLE PARTS WHICH ARE IDENTIFIED BY COMPLETE DESCRIPTION ON PARTS LIST. THE USE OF UNLISTED PARTS CAN RESULT IN EQUIPMENT MALFUNCTIONS HAVING HAZARDOUS CONSEQUENCES.

THIS EQUIPMENT SHOULD BE INSTALLED, OPERATED AND SERVICED ONLY BY TRAINED, QUALIFIED PERSONNEL WHO ARE THOROUGHLY FAMILIAR WITH THE ENTIRE CONTENTS OF THE INSTRUCTION MANUAL.

DO NOT DISCARD THIS INSTRUCTION MANUAL UPON COMPLETION OF INSTALLATION. INFORMATION PROVIDED IS ESSENTIAL FOR PROPER AND SAFE OPERATION AND MAINTENANCE.

ADDITIONAL OR REPLACEMENT COPIES OF THIS INSTRUCTION MANUAL ARE AVAILABLE FROM:

UGSI CHEMICAL FEED, INC.
1901 WEST GARDEN ROAD
VINELAND, NEW JERSEY 08360
PHONE: (856) 896-2160
FAX: (856) 457-5920

NOTE

Minor part number changes may be incorporated into UGSI Chemical Feed, Inc. products from time to time that are not immediately reflected in this instruction manual. If such a change apparently has been made in your equipment and does not appear to be reflected in your instruction manual, contact your local UGSI Chemical Feed, Inc. sales office for information.

Please include the equipment serial number in all correspondence. It is essential for effective communication and proper equipment identification.

PREVENTIVE MAINTENANCE SCHEDULE AND RECORD OF PERFORMANCE

This equipment should receive preventive maintenance on a one (1) year cycle.* It is recommended that the following table be used to plan, schedule, and record this important work.

Date of Installation	

Preventive Maintenance Log	
Schedule Date	**Date Performed**

***NOTE: This is the recommended cycle. Your local operating conditions may call for more frequent preventive maintenance.**

PROTECT YOUR EQUIPMENT INVESTMENT

MINIMIZE DOWNTIME

ORDER A PREVENTIVE MAINTENANCE KIT NOW ...
KEEP ONE ON HAND

NOTES ON PROTECTIVE EQUIPMENT AND CLOTHING

The following Warning appears in several locations in this manual. It is general in nature due to the variety of hazardous liquids this equipment is capable of handling.

WARNING: WHEN DEALING WITH HAZARDOUS MATERIAL, IT IS THE RESPONSIBILITY OF THE EQUIPMENT USER TO OBTAIN AND FOLLOW ALL SAFETY PRECAUTIONS RECOMMENDED BY THE HAZARDOUS MATERIAL MANUFACTURER/SUPPLIER.

It is good general practice to make use of protective equipment when handling any hazardous material.

IT IS RECOMMENDED THAT SUCH PROTECTIVE EQUIPMENT BE USED BY ALL PERSONS SERVICING THIS PUMP, ASSOCIATED PIPING, TUBING, VALVES, AND ACCESSORIES, WHEN THE EQUIPMENT IS HANDLING ANY HAZARDOUS MATERIAL.

1. Goggles, flexible fitting, hooded ventilation (per ANSI Z87.1)	
2. Face Shield (per ANSI Z87.1)	
3. Chemical Apron	
4. Chemical Gloves	

NOTE: (1) ANSI Z87.1 "practice for occupational.....eye and face protection" recommends goggles (#1 above) as the "preferred protection" when handling chemicals that present a hazard from splash, acid burns or fumes; for severe exposure, a face shield (#2 above) over the goggles is recommended.

(2) An eye flushing fountain and a deluge-type shower may be recommended or required by insurance carriers or governmental safety agencies, which should be consulted for specific requirements.

Quality Equipment	+	Preventive Maintenance	=	Dependable Operation Minimum Downtime

There's no question about it.
Equipment that is properly maintained is dependable equipment.
It will give optimum performance with minimum unscheduled downtime.

UGSI Chemical Feed, Inc. manufactures quality equipment designed for performance and reliability. Each product is carefully tested and inspected before shipment to ensure that it meets our high standards.

Our equipment is engineered for easy maintenance. To ensure maximum service life and minimize unscheduled repairs, we recommend a program of regular preventive maintenance, as described in the Service section of this manual. To support this program, we developed standard parts kits. These kits can also be used for minor emergency repairs to minimize downtime.

We recommend that these kits be available in your stock at all times. When the complete kit or any of its parts are used, the kit should be replaced immediately.

Preventive maintenance kits may be ordered directly from the company that supplied your equipment, or they may be ordered directly from UGSI Chemical Feed, Inc. for ordering numbers, refer to the parts list at the rear of this manual.

UGSI CHEMICAL FEED, INC. HEADQUARTERS

INSTALLATION, OPERATION, MAINTENANCE, AND SERVICE INFORMATION

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

UNITED STATES

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

ENCORE® 700 METERING PUMP

SECTION 1 - TECHNICAL DATA

List of Contents

1.1 Technical Data

The overall technical characteristics of the Encore® 700 Series Metering Pumps are listed in Table 1.1.

1.2 Material Identification/Composition

The chemical composition of materials used in the manufacture of the metering pump is listed in Table 1.2.

1.3 Pump Capacity

The pump capacity for the direct and pulley drive configurations are listed in Table 1.3.

1.4 Pump Compatibility

The compatibility of the metering pump with various liquid materials are listed on Dwg. 440.050.190.010A-F, located at the end of this section. The table identifies the various materials that can enter and come into contact with component materials in the wetted end of the pump and their effects on pump performance.

Table 1.1 - Encore® 700 Series Metering Pump - Technical Data

Pump Type	Non-Loss Motion, Mechanical Diaphragm Metering pump. Simplex and double simplex capabilities.
Diaphragm Type	PTFE-faced single piece mechanical diaphragm, Six sizes: 1-3/8", 2", 3", 4", 5" and 6-1/2".
Service	Metering of mild to very corrosive chemicals; polyelectrolytes and slurries.
Drive Unit	Directly coupled or pulley coupled motor. Three stroking speeds 36, 72, 144 spm. Four step pulley coupled motor provides 4:1 turn down for each speed - 36, 72, 144 spm. Refer to Table 1.3 for additional information.
Variable Speed	AC and DC speed control available.
Capacity Range	Up to 317 gph with single head. Up to 634 gph with double simplex or Duplex*. Refer to Table 1.3 for additional information.
Pressure Range	Up to 175 psi. Refer to Table 1.3 for additional information.
Stroke Length	10 turn stroke control. Adjustable over 10:1 range.
Accuracy	± 2% full scale over 10:1 range under constant suction and discharge conditions.
Suction Lift	Up to 10 feet water lift.
Motor Voltage	115/230 VAC, 50/60 Hz
Ambient Temperature Limits	35 to 125°F (2 to 52°C)
Process Fluid Temperature Limits	125°F (52°C) max; 180°F (83°C) for PVDF liquid ends.
Viscosity Limits for Polyelectrolytes	5000 centipoise @ 144 strokes per minute (SPM)
Viscosity Limits for Slurries	Hydrated Lime: Up to 3.8 lbs/gallon of water. Activated Carbon: Up to 1.1 lbs/gallon of water Diatomaceous Earth: Up to 1.7 lbs/gallon of water (36 SPM minimum)
Lubrication	Bel-Ray Worm Gear Oil 460 (Product Code 11000), 2 Quarts required
Weight	110 lbs (average)

* For Duplex information- Refer to Instruction Manual supplied with the pump

Table 1.2 - Encore® 700 Series Metering Pump – Material Identification/Composition

COMMON TERM	COMPOSITION
Ceramic	99% aluminum oxide.
CSPE (Hypalon®*)	Chlorosulphonated polyethylene.
PVDF (Kynar®**)	Polyvinylidene fluoride.
PVC	Polyvinyl chloride.
Stainless 316	AISI 316 - Cr 16-18% Ni 10-14%, C 0.08%, Mn 2% Si 1%, P 0.045%, S 0.03% Mo 2-3%
PTFE (Teflon®*)	Fluorocarbon resin of tetrafluoroethylene polymer.
FKM (FPM,Viton®*)	Copolymer of vinylidene fluoride and hexafluoropropylene.
* Trade names of E.I. DuPont de Nemours & Co., Inc. ** Trade name of Arkema, Inc.	

Table 1.3 -Encore® 700 Series Metering Pump – Capacity Specification

	Direct Drive						Pulley Drive						Maximum Discharge Pressure						
	60 Hz 1725 RPM			50 Hz 1450 RPM			*	60 Hz 1725 RPM			50 Hz 1450 RPM		psi			bar			Connection
Diaphragm Size	Stroke Frequency	Capacity		Stroke Frequency	Capacity		Pulley	Stroke Frequency	Capacity		Stroke Frequency	Capacity		Motor Horsepower @1725 RPM Induction (Variable Speed)			Motor Kilowatts @1450 RPM Induction (Variable Speed)			Cartridge Valves
inches	strokes/min	gph	lph	strokes/min	gph	lph	step	strokes/min	gph	lph	strokes/min	gph	lph	1/4 (1/2)	1/2 (3/4)	3/4 (1)	0.18 (0.37)	0.37 (0.55)	0.55 (0.75)	
1-3/8	36	1.25	4.7	30	1.04	3.9	4	9	0.31	1.18	8	0.26	0.99	175			12			1/2" NPT or 1/2" SOC. PVC or R 1/2"
							3	18	0.63	2.4	15	0.52	1.97							
							2	27	0.94	3.5	23	0.78	3.0							
							1	36	1.25	4.7	30	1.04	3.9							
	72	2.5	9.5	60	2.08	7.9	4	18	0.63	2.4	15	0.52	1.97	175			12			
							3	36	1.25	4.7	30	1.04	3.9							
							2	54	1.88	7.1	45	1.56	5.9							
							1	72	2.5	9.5	60	2.1	7.9							
	144	5.0	18.9	120	4.17	15.8	4	36	1.25	4.7	30	1.04	3.9	175			12			
							3	72	2.5	9.5	60	2.1	7.9							
							2	108	3.8	14.2	90	3.1	11.8							
							1	144	5.0	18.9	120	4.2	15.8							
				144	5.0	18.9	4				36	1.25	4.7				12			
							3				72	2.5	9.5							
							2				108	3.8	14.2							
							1				144	5.0	18.9							
2	36	6.5	25	30	5.4	21	4	9	1.63	6.2	8	1.35	5.1	175			12			1/2" NPT or 1/2" SOC. PVC or R 1/2"
							3	18	3.3	12.3	15	2.7	10.3							
							2	27	4.9	18.5	23	4.1	15.4							
							1	36	6.5	25	30	5.4	21							
	72	13	49	60	10.8	41	4	18	3.3	12.3	15	2.7	10.3	175			12			
							3	36	6.5	25	30	5.4	21							
							2	54	9.8	37	45	8.1	31							
							1	72	13.0	49	60	10.8	41							
	144	26	98	120	21.7	82	4	36	6.5	25	30	5.4	21	175			12			
							3	72	13.0	49	60	10.8	41							
							2	108	19.5	74	90	16.3	62							
							1	144	26	98	120	22	82							
				144	26	98	4				36	6.5	25				12			
							3				72	13.0	49							
							2				108	19.5	74							
							1				144	26	98							

NOTE: *Pulley Step 1 is the top position of the belt.

Table 1.3 - Encore® 700 Series Metering Pump – Capacity Specification (Cont'd)

	Direct Drive						Pulley Drive						Maximum Discharge Pressure						
	60 Hz 1725 RPM			50 Hz 1450 RPM			*	60 Hz 1725 RPM			50 Hz 1450 RPM		psi			bar			Connection
Diaphragm Size	Stroke Frequency	Capacity		Stroke Frequency	Capacity		Pulley	Stroke Frequency	Capacity		Stroke Frequency	Capacity	Motor Horsepower @1725 RPM Induction (Variable Speed)			Motor Kilowatts @1450 RPM Induction (Variable Speed)			Cartridge Valves
inches	strokes/min	gph	lph	strokes/min	gph	lph	step	strokes/min	gph	lph	strokes/min	gph	1/4 (1/2)	1/2 (3/4)	3/4 (1)	0.18 (0.37)	0.37 (0.55)	0.55 (0.75)	
3	36	12.5	47	30	10.4	39	4	9	3.1	11.8	8	2.6	9.9	150			10			1/2" NPT or 1/2" SOC. PVC or R 1/2"
							3	18	6.3	24	15	5.2	19.7						
							2	27	9.4	35	23	7.8	30						
							1	36	12.5	47	30	10.4	39						
	72	25	95	60	21	79	4	18	6.3	24	15	5.2	19.7	100	150		8	10	
							3	36	12.5	47	30	10.4	39						
							2	54	18.8	71	45	15.6	59						
							1	72	25	95	60	21	79						
	144	50	189	120	42	158	4	36	12.5	47	30	10.4	39	50	120	150	4	8	10
							3	72	25	95	60	21	79						
							2	108	38	142	90	31	118						
							1	144	50	189	120	42	158						
				144	50	189	4				36	12.5	47				4	8	10
							3				72	25	95						
							2				108	38	142						
							1				144	50	189						
4	36	19.3	73	30	16	61	4	9	4.8	18.2	8	4.0	15.2	130			9			3/4" NPT or 3/4" SOC. PVC or R 3/4"
							3	18	9.6	36	15	8.0	30						
							2	27	14.4	55	23	12.0	46						
							1	36	19.3	73	30	16.0	61						
	72	39	146	60	32	121	4	18	9.6	36	15	8.0	30	75	130		6	9	
							3	36	19.3	73	30	16.0	61						
							2	54	29	109	45	24	91						
							1	72	39	146	60	32	121						
	144	77	291	120	64	243	4	36	19.3	73	30	16.0	61	30	75	130	2	6	9
							3	72	39	146	60	32	121						
							2	108	58	219	90	48	182						
							1	144	77	291	120	64	243						
				144	77	291	4				36	19.3	73				2.5	5	9
							3				72	39	146						
							2				108	58	219						
							1				144	77	291						

NOTE: *Pulley Step 1 is the top position of the belt.

Table 1.3 - Encore® 700 Series Metering Pump – Capacity Specification (Cont'd)

	Direct Drive						Pulley Drive						Maximum Discharge Pressure							
	60 Hz 1725 RPM			50 Hz 1450 RPM			*	60 Hz 1725 RPM			50 Hz 1450 RPM			psi			bar			Connection
Diaphragm Size	Stroke Frequency	Capacity		Stroke Frequency	Capacity		Pulley	Stroke Frequency	Capacity		Stroke Frequency	Capacity		Motor Horsepower @1725 RPM Induction (Variable Speed)			Motor Kilowatts @1450 RPM Induction (Variable Speed)			Cartridge Valves
inches	strokes/min	gph	lph	strokes/min	gph	lph	step	strokes/min	gph	lph	strokes/min	gph	lph	1/4 (1/2)	1/2 (3/4)	3/4 (1)	0.18 (0.37)	0.37 (0.55)	0.55 (0.75)	
5	36	45	170	30	38	142	4	9	11.3	43	8	9.4	36	75			5			1" NPT or 1" SOC. PVC or R 1"
							3	18	23	85	15	18.8	71							
							2	27	34	128	23	28	107							
							1	36	45	170	30	38	142							
	72	90	341	60	75	284	4	18	23	85	15	18.8	71	40	75		3	5		
							3	36	45	170	30	38	142							
							2	54	68	256	45	56	213							
							1	72	90	341	60	75	284							
	144	180	681	120	150	568	4	36	45	170	30	38	142	20	40	75	1.5	3.0	5	
							3	72	90	341	60	75	284							
							2	108	135	511	90	113	426							
							1	144	180	681	120	150	568							
				144	180	681	4				36	45	170				1.5	3	5	
							3				72	90	341							
							2				108	135	511							
							1				144	180	681							
6-1/2	36	83	312	30	69	260	4	9	21	78	8	17.2	65	45			3			1-1/2" NPT or 1-1/2" SOC. PVC or R 1-1/2"
							3	18	41	156	15	34	130							
							2	27	62	234	23	52	195							
							1	36	83	312	30	69	260							
	72	165	625	60	138	520	4	18	41	156	15	34	130	25	45		1.7	3		
							3	36	83	312	30	69	260							
							2	54	124	468	45	103	390							
							1	72	165	625	60	138	520							
	144	330	1249	120	275	1041	4	36	83	312	30	69	260	15	25	45	1	1.7	3	
							3	72	165	625	60	138	520							
							2	108	248	937	90	206	781							
							1	144	330	1249	120	275	1041							
				144	330	1249	4				36	83	312				1	1.7	3	
							3				72	165	625							
							2				108	248	937							
							1				144	330	1249							

NOTE: *Pulley Step 1 is the top position of the belt.

LIQUID	REF. NO.	316 S.S.	HYPALON	VITON	PVC	TFE	KYNAR 150°F	CERAMIC
ACETALDEHYDE	57	A	C	C	C	A	C	A
ACETATE SOLVENTS	57	A	C	C	C	A	A	A
ACETIC ACID, CRUDE	57	A	C	C	C	A	A	A
ACETIC ACID, PURE	57	A	C	C	C	A	A	A
ACETIC ACID (10%)	3	A	B	C	A	A	A	A
ACETIC ACID (80%)	57	B	C	C	C	A	A	A
ACETIC ANHYDRIDE		B	A	C	C	A	C	A
ACETONE		A	C	C	C	A	C	A
ACETYLENE		A	B	A	A	A	A	N
ACRYLONITRILE	58	A	C	C	A	N	A	N
ALUMINUM CHLORIDE	5	B	A	A	A	A	A	A
ALUMINUM HYDROXIDE	6	A	A	A	A	A	A	N
ALUMINUM NITRATE		A	B	C	A	A	A	A
ALUMINUM SULFATE	3	A	A	A	A	A	A	A
ALUMS		B	A	C	A	A	A	A
AMINES		A	C	C	A	A	N	N
AMINES (FILMINE) B		A	C	C	A	A	N	N
AMMONIA ANHYDROUS (LIQ.)		A	B	C	A	A	C	A
AMMONIA SOLUTIONS		A	B	B	A	A	A	N
AMMONIUM CARBONATE		A	A	A	A	A	A	A
AMMONIUM CHLORIDE	7	B	A	A	A	A	A	N
AMMONIUM DIPHOSPHATE	9	A	A	A	A	A	A	A
AMMONIUM HYDROXIDE	8	A	A	A	A	A	A	A
AMMONIUM MONOPHOSPHATE	9	A	A	A	A	A	A	A
AMMONIUM NITRATE		A	A	A	A	A	A	A
AMMONIUM SULFATE	10	A	A	A	A	A	A	A
AMMONIUM SULFIDE		A	A	A	A	A	A	A
AMMONIUM TRIPHOSPHATE	9	A	A	A	A	A	A	A
AMYL ACETATE	58	A	C	C	C	A	A	A
AMYL ALCOHOL	11,12	A	A	A	B	A	A	A
AMYL CHLORIDE		A	C	C	C	A	A	A
ANILINE	13	A	C	A	C	A	B	A
ANILINE DYES		A	B	B	C	A	N	A
ARSENIC ACID	14	B	C	A	A	A	A	N
BARIUM CARBONATE	15	B	A	A	A	A	A	A
BARIUM CHLORIDE		A	B	A	A	A	A	A
BARIUM HYDROXIDE	14,5	A	B	A	A	A	A	N
BARIUM SULFATE		A	A	A	A	A	A	A
BARIUM SULFIDE		B	A	A	A	A	A	A
BEER		A	A	A	A	A	A	A
BEET SUGAR LIQUORS		A	C	A	A	A	A	A
BENZALDEHYDE		A	C	C	C	A	B	A
BENZENE OR BENZOL	13,14	A	C	B	C	A	B	A
BENZOIC ACID		A	C	A	A	A	A	A
BLACK SULFATE LIQUOR	57	A	B	A	A	A	A	A
BORAX (SEE SODIUM BORATE)		-	-	-	-	-	-	-
BORIC ACID	16	A	A	A	A	A	A	A
BUTANE		A	A	B	A	A	A	A
BUTADIENE		A	B	B	A	A	A	A
BUTYL ACETATE		A	C	N	B	A	C	N

WARNING: WHEN DEALING WITH HAZARDOUS MATERIALS, IN ALL CASES THE HAZARDOUS MATERIAL SUPPLIERS OR MANUFACTURERS' RECOMMENDATIONS FOR SAFETY PROCEDURES MUST BE OBTAINED AND FOLLOWED.

CHEMICAL COMPATIBILITY OF METERING PUMPS - PERFORMANCE

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LIQUID	REF. NO.	316 S.S.	HYPALON	VITON	PVC	TFE	KYNAR 150°F	CERAMIC
BUTYL ALCOHOL	17	A	A	A	A	A	A	A
BUTYRIC ACID	14	A	A	B	B	A	A	A
CALCIUM BISULFITE		A	A	A	A	A	A	A
CALCIUM CARBONATE	15	A	A	A	A	A	A	B
CALCIUM CHLORATE		A	A	A	A	A	A	A
CALCIUM CHLORIDE	18	B	A	A	A	A	A	A
CALCIUM HYDROXIDE	15	A	A	A	A	A	A	C
CALCIUM HYPOCHLORITE		C	A	A	A	A	A	B
CALCIUM NITRATE		A	A	A	A	A	A	A
CALCIUM SULFATE		A	A	A	A	A	A	N
CANE SUGAR LIQUORS	14	A	C	B	N	A	A	A
CARBOLIC ACID (PHENOL)	11,14,57	A	C	A	A	A	A	A
CARBON BISULFIDE		A	C	A	A	N	N	N
CARBONIC ACID	14,57	A	A	A	A	A	A	N
CARBON TETRACHLORIDE	13,3	A	C	A	C	A	A	A
CHLORACETIC ACID		C	C	C	A	A	C	A
CHLOROBENZENE (DRY)		A	C	A	C	A	A	A
CHLOROFORM		A	C	A	C	A	A	A
CHLORSULPHONIC ACID		B	C	C	A	A	C	A
CHROMIC ACID	19,58	A	A	A	A	A	A	A
CITRIC ACID	20	A	A	A	A	A	A	A
COPPER ACETATE		A	C	C	A	A	A	N
COPER CHLORIDE	5	C	B	A	A	A	A	A
COPPER CYANIDE	3	A	A	A	A	A	A	N
COPPER NITRATE	3	A	A	A	A	A	A	A
COPPER SULFATE	21	A	A	A	A	A	A	A
CREOSOTE	3	A	C	A	C	A	A	A
CRESYLIC ACID (50%)		A	C	A	A	A	A	N
CYCLOHEXANE		A	C	A	C	A	A	A
DETERGENT		N	A	A	A	A	N	A
DIETHYLAMINE	57	A	C	C	C	N	A	A
DIETHYLENE GLYCOL		A	A	A	A	A	N	A
DOWTHERMS		A	C	A	C	N	N	N
ETHERS (ETHYL)		A	C	B	C	A	B	A
ETHYL ACETATE		A	C	C	C	A	C	A
ETHYL ALCOHOL	12	A	A	A	A	A	A	A
ETHYL CHLORIDE		A	C	A	C	A	A	A
ETHYLENE CHLORIDE	22	A	C	B	C	A	A	N
ETHYLENE GLYCOL	12	A	A	A	A	A	A	A
ETHYL MERCAPTAN		A	C	N	N	N	N	N
ETHYLENE OXIDE		A	C	C	C	A	C	A
FATTY ACIDS	14	A	C	A	A	A	A	A
FERRIC CHLORIDE	6	C	A	A	A	A	A	A
FERRIC NITRATE		A	A	A	A	A	A	A
FERRIC SULFATE	24	B	A	A	A	A	A	A
FERROUS CHLORIDE		C	A	A	A	A	A	A
FERROUS SULFATE	14	B	A	A	A	A	A	A
FILTER AID	15	A	A	A	C	A	A	A
FLUOSILICIC ACID	6,25,26	B	A	A	A	A	A	C
FORMALDEHYDE		A	A	C	A	A	A	A
FORMIC ACID	3,58	A	A	B	B	A	A	A
FRUIT JUICES		A	C	A	A	A	A	A
FURFURAL	57	A	C	C	C	A	A	A
GALLIC ACID (5%)		A	C	A	A	A	B	A
GASOLINE		A	C	A	A	A	A	A

CHEMICAL COMPATIBILITY OF METERING PUMPS - PERFORMANCE

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LIQUID	REF. NO.	316 S.S.	HYPALON	VITON	PVC	TFE	KYNAR 150°F	CERAMIC
GLUCOSE		A	A	A	A	A	A	A
GLYCEROL (GLYCERIN)	6,11,27	A	A	A	A	A	A	A
HEPTANE, HEXANE		A	A	A	C	A	A	A
HYDRAZINE (35%)	28	A	B	C	N	N	A	B
HYDROBROMIC ACID	29	C	A	A	A	A	A	A
HYDROCHLORIC ACID (37%)	5,30	C	A	A	A	A	A	A
HYDROCYANIC ACID		A	A	A	A	A	A	A
HYDROFLUORIC ACID	6,26,25	C	A	A	A	A	A	C
HYDROFLUOSILICIC ACID	6,25,26,57	B	A	A	A	A	A	C
HYDROGEN PEROXIDE	31,59	B	A	A	A	A	A	A
HYDROGEN SULFIDE	11,3	A	A	A	A	A	A	A
INKS	19	A	A	A	A	A	N	N
IODINE SOLUTION		C	B	A	C	A	A	A
KEROSENE		A	C	A	A	A	A	A
LACTIC ACID	32,57	A	A	A	A	A	A	A
LEAD ACETATE		A	C	C	A	A	A	A
LIME SLURRIES	15	A	A	A	A	A	A	N
LINSEED OIL		A	A	A	A	A	A	A
MAGNESIUM CARBONATE		A	A	A	A	A	A	A
MAGNESIUM CHLORIDE	6,34	C	A	A	A	A	A	A
MAGNESIUM HYDROXIDE	6,15	A	A	A	A	A	A	N
MAGNESIUM NITRATE		A	A	A	A	A	A	A
MAGNESIUM SULFATE	14,5	A	A	A	A	A	A	A
MALEIC ACID (DILUTE)	5,14	A	C	A	A	A	A	A
MALIC ACID	14	A	B	A	A	A	A	A
MELAMINE RESINS		A	C	N	A	A	N	A
MERCURIC CHLORIDE	5	C	A	A	A	A	A	A
MERCURIC CYANIDE		A	A	A	A	A	A	N
MERCURY		A	A	A	A	A	A	A
METHYL ACETATE	57	A	C	C	N	A	A	N
METHYL ACETONE		A	C	C	C	N	N	N
METHYL ALCOHOL	35	A	A	B	A	A	A	A
METHYLAMINE		A	C	C	N	N	C	N
METHYL BROMIDE		A	C	A	C	N	A	N
METHYL CELLOSOLVE		A	C	C	N	A	A	A
METHYL CHLORIDE (LIQ.)		A	C	C	C	A	A	A
METHYLETHYL KETONE		A	C	C	C	A	C	A
METHYLENE CHLORIDE	36,14	A	C	B	C	A	C	A
MOLASSES		A	A	A	A	A	A	N
MONOCHLORACETIC ACID		C	N	N	A	A	A	A
MORPHOLINE	57	A	C	C	A	A	A	A
NAPHTHA	13	A	C	A	A	A	A	A
NAPHTHALENE	11	A	C	A	C	A	A	A
NICKEL CHLORIDE		A	A	A	A	A	A	A
NICKEL NITRATE	14	A	A	A	A	A	A	A
NICKEL SULFATE	14	A	A	A	A	A	A	A
NICOTINIC ACID		A	C	A	A	N	A	A
NITRIC ACID (10%)	60	A	A	A	A	A	A	A
NITRIC ACID (70%) TO 100*F	60	B	C	B	A	A	A	A
NITROBENZENE		A	C	C	C	A	B	A
OILS, ANIMAL		A	C	A	A	A	A	A
OIL, COTTONSEED	11,58	A	A	A	A	A	A	A
OILS, FUEL	37,14	A	A	A	A	A	A	A
OLEIC ACID	3	A	C	C	A	A	A	A
OLEUM (20-25%)		A	C	B	C	A	C	A

CHEMICAL COMPATIBILITY OF METERING PUMPS - PERFORMANCE

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LIQUID	REF. NO.	316 S.S.	HYPALON	VITON	PVC	TFE	KYNAR 150°F	CERAMIC
OXALIC ACID		B	A	A	A	A	A	A
PALMITIC ACID	3	A	C	A	A	A	A	N
PERCHLORIC ACID (10%)		C	B	N	B	N	A	N
PERCHLOROETHYLENE (DRY)	11	A	C	A	C	N	A	N
PHENOL (CARBOLIC ACID)	11	A	C	A	A	A	A	A
PHOSPHORIC ACID	6,11,39	A	A	A	A	A	A	A
PHOSPHORUS TRICHLORIDE		N	C	A	C	A	A	A
PICRIC ACID	57	A	A	A	C	N	A	N
POTASSIUM BICARBONATE		A	A	A	A	N	A	A
POTASSIUM BROMATE		N	N	N	A	N	A	N
POTASSIUM BROMIDE		A	A	A	A	A	A	A
POTASSIUM CARBONATE	40	A	A	A	A	A	A	A
POTASSIUM CHLORATE	3	A	A	A	A	A	A	A
POTASSIUM CHLORIDE	5,41	B	A	A	A	A	A	A
POTASSIUM CHROMATE		A	A	A	A	A	A	N
POTASSIUM CYANIDE		A	A	A	A	A	A	N
POTASSIUM DIPHOSPHATE		A	N	A	A	N	N	N
POTASSIUM HYDROXIDE	42	A	A	C	A	A	A	C
POTASSIUM MONOPHOSPHATE		A	A	A	A	N	N	N
POTASSIUM NITRATE		A	A	A	A	A	A	A
POTASSIUM PERMANGANATE	5,43	A	A	A	A	A	A	A
POTASSIUM SULFATE	41,5	A	A	A	A	A	A	N
POTASSIUM SULFIDE		A	N	A	A	A	A	A
POTASSIUM SULFITE		A	B	A	A	N	N	N
POTASSIUM TETRABORATE		N	N	N	A	N	N	N
PROPANE (LIQ.)		A	A	B	A	A	A	A
PROPYL ALCOHOL	12,58	A	A	A	B	A	A	N
PROPYLENE GLYCOL		A	A	A	C	A	A	A
RESINS & ROSINS		A	N	A	N	N	N	N
SEA WATER		B	A	A	A	A	A	A
SILVER NITRATE		A	A	A	A	A	A	A
SOAP SOLUTIONS (STEARATES)	6,57	A	A	A	A	A	A	A
SODIUM ACETATE		A	C	A	A	A	A	A
SODIUM ALUMINATE 27Be		A	A	A	B	A	A	A
SODIUM BICARBONATE		A	A	A	A	A	A	A
SODIUM BISULFATE (TO 100°F)		A	A	A	A	A	A	A
SODIUM BISULFITE (TO 100°F)		A	A	A	A	A	A	A
SODIUM BORATE	14	A	A	A	A	A	A	N
SODIUM CARBONATE	44	A	A	A	A	A	A	A
SODIUM CHLORATE	14	A	A	A	A	A	A	A
SODIUM CHLORIDE	3	B	A	A	A	A	A	A
SODIUM CHLORITE (TO 20%)	45	C	N	N	C	N	A	A
SODIUM CHROMATE		A	N	A	A	A	A	N
SODIUM CYANIDE		A	A	A	A	A	A	A
SODIUM DI- OR TRIPHOSPHATE		A	A	A	A	A	A	A
SODIUM FLUORIDE	25,46	B	A	A	A	A	A	C
SODIUM HYDROXIDE 20%	5,3,6	A	A	C	A	A	A	C
SODIUM HYDROXIDE 50%	5,3,6	A	A	C	A	A	A	C
SODIUM HYPOCHLORITE	30,13,47	C	A	B	A	A	A	N
SODIUM MONOPHOSPHATE		A	A	A	A	A	A	A
SODIUM NITRATE	48	A	A	A	A	A	A	A
SODIUM PERBORATE		A	B	A	B	A	N	N
SODIUM PEROXIDE	6	A	A	A	B	A	A	A
SODIUM POLYPHOSPHATE		A	B	A	A	A	A	A
SODIUM SILICATE	49	A	A	A	B	A	A	A

CHEMICAL COMPATIBILITY OF METERING PUMPS - PERFORMANCE

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LIQUID	REF. NO.	316 S.S.	HYPALON	VITON	PVC	TFE	KYNAR 150°F	CERAMIC
SODIUM SULFATE	50	A	A	A	A	A	A	A
SODIUM SULFIDE	1,48	A	A	A	B	A	A	N
SODIUM SULFITE	44	A	A	A	A	A	A	A
SODIUM THIOSULFATE (HYPO)	51	B	A	A	B	A	A	A
STARCH		A	A	A	A	A	N	A
STEARIC ACID	37	A	B	A	A	A	A	A
SUGAR SOLUTIONS	14	A	B	N	A	A	A	A
SULFUR CHLORIDE	57	C	A	A	N	A	A	A
SULFUR MOLTEN		A	C	A	A	A	A	A
SULFURIC ACID (0-40%)	5	C	A	A	A	A	A	A
SULFURIC ACID (40-95%)	5,58	C	A	A	A	A	A	A
SULFURIC ACID (95-100%)	58	A	B	A	A	A	A	A
SULFUROUS ACID		B	A	A	A	A	A	A
TANNIC ACID	52	A	A	A	A	A	N	A
TARTARIC ACID	6,44	A	A	A	A	A	A	A
TITANIUM DIOXIDE		A	A	A	B	A	N	N
TOLUOL & TOLUENE	36	A	C	A	C	A	B	A
TRICHLORETHYLENE	57	A	C	A	C	A	A	A
TURPENTINE	13	A	C	A	A	A	A	A
UREA FORMALDEHYDE		A	N	N	N	A	A	A
VARNISH & SOLVENTS	14	A	C	A	N	A	N	A
VINEGAR		A	A	N	A	A	N	A
VINYL ACETATE		A	C	C	C	A	A	A
WATER, DEIONIZED		A	A	A	A	A	A	A
WATER, SALT		B	A	A	A	A	N	A
WHISKEY AND WINES	58	A	A	A	A	A	A	A
XYLENE OR XYLOL	13	A	C	A	C	A	A	A
ZINC CHLORIDE	6,53	C	A	A	A	A	A	A
ZINC HYDROSULFITE		B	N	A	A	A	N	N
ZINC SULFATE		A	A	A	A	A	A	A

WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY AND/OR DAMAGE TO EQUIPMENT WHEN DEALING WITH ANY CHEMICAL, IT IS THE RESPONSIBILITY OF THE EQUIPMENT USER TO OBTAIN AND FOLLOW THE SAFETY PRECAUTIONS OF THE MANUFACTURER OF THE CHEMICAL.

RATING KEY

A ACCEPTABLE
B SATISFACTORY WHERE MINOR ATTACK IS ACCEPTABLE
C SHOULD NOT BE USED
N INFORMATION LACKING

UNLESS OTHERWISE NOTED, CONCENTRATION OF AQUEOUS SOLUTIONS ARE SATURATED. ALL RATINGS ARE AT ROOM TEMPERATURE UNLESS OTHERWISE SPECIFIED.

CHEMICAL COMPATIBILITY OF METERING PUMPS - PERFORMANCE

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1. WARNING: DRIED RESIDUE OF SPILLED SOLUTIONS IS EXPLOSIVE.
3. SS TO180°F
5. PVC TO 125°F
6. HYPALON TO 180°F
7. SS TO 125°F 10%, PVC TO 125°F
8. PVC TO 125°F, 29%, SS TO 180°F, 29%
9. SS TO 70°F, 5%
10. PVC TO 105°F, 40%, SS TO 180°F SAT
11. VITON TO 180°F
12. PVC TO 100°F PURE
13. VITON TO 158°F
14. SS TO 140°F
15. USE SLURRY VALVES
16. PVC TO 105°F, SS TO 180°F
17. PVC TO 100°F, SS TO 100°F
18. SS TO 70°F DILUTE, PVC TO 125°F
19. PVC TO 100°F, 50%, SS TO 70°F, 5%
20. PVC TO 100°F, 25%, SS TO 180°F, 50%
21. PVC TO 100°F, SS TO 160°F
22. VITON TO 120°F
24. PVC TO 125°F, 36%, SS TO 180°F 10%
25. FLUORIDATION REQUIRES AN ANTI-SYPHON PUMP INSTALLATION CONSULT LOCAL REGULATIONS FOR DETAILS.
26. PVC TO 30%
27. PVC TO 125°F, 50%, SS TO 70°F, 5%
28. MAY CAUSE SURFACE PITTING TO SS
29. PVC TO 125°F, 48%
30. HYPALON TO 130°F
31. PVC TO 100°F, 50%, SS TO 100°F, 50%
32. PVC TO 70°F, 10%, SS TO 70°F, 10%
34. SS TO 70°F, 5%, PVC 125°F SAT
35. PVC TO 100°F, SS TO 70°F
36. VITON TO 100°F
37. HYPALON TO 150°F
38. SS TO 70°F, 10%
39. PVC TO 125°F, 80%, SS TO 70°F, 80%
40. PVC TO 100°F, SAT, SS TO 180°F, 50%
41. SS TO 180°F, 5%
42. PVC TO 70°F, 50% OR TO 125°F, 30%, SS TO 180°F, 50%
43. SS TO 140°F, 10%
44. SS TO 180°F, 50%
45. PVC TO 105°F
46. PVC TO 125°F, 4%, SS TO 70°F, 5%
47. PVC TO 125°F, 15%, SS TO 70°F, 5%
48. SS TO 125°F
49. PVC TO 125°F, 41 Be, SS TO 140°F, 41 Be
50. PVC TO 125°F, 30%
51. PVC TO 125°F, 50%, SS TO 70°F, 50%
52. PVC TO 100°F, 10%, SS TO 150°F
53. PVC TO 100°F, SS TO 180°F, 70%
57. KYNAR TO 70°F
58. KYNAR TO 120°F
59. KYNAR TO 120°F, 30%
60. KYNAR TO 100°F

Statements and suggestions set forth herein are based upon the best information and practices known to UGSI Chemical Feed, Inc. However, it should not be assumed either that information is complete on the subjects covered or that all possible circumstances, safety measures, precautions, etc., have been included. These statements and suggestions are not intended to reflect state, municipal, or insurance requirements or national safety codes; where applicable, those sources should be consulted directly. Moreover, since the conditions of use are beyond its control, UGSI Chemical Feed, Inc. makes no guarantee of results and assumes no liability in connection with the information contained herein.

When dealing with the installation, operation or maintenance of a specific UGSI Chemical Feed, Inc. product, the manuals and data sheets pertaining to that product should be studied carefully. In case of any doubt about a specific installation, direct inquiries to your local UGSI Chemical Feed, Inc. representative.

CHEMICAL COMPATIBILITY OF METERING PUMPS - PERFORMANCE

440.050.190.010F
ISSUE 0 8-95

SECTION 2 - INSTALLATION

List of Contents

2.1 General Information

To provide satisfactory service, the metering pump must be installed in accordance with the instructions that follow. Operational difficulties, lack of accuracy, and possible damage to the pump mechanism may occur if these instructions are not followed properly.

2.2 Unpacking

When the pump is unpacked, check all items against the packing list to make sure that no parts are discarded with the packaging material. Whenever possible, unpack the equipment at the installation site.

2.3 Mounting the Pump

Pump location is important to the operation of the pump. Select a place that is dry and that provides a level base for the pump. Allow work space around the pump for inspection, adjustments, and servicing (refer to Dwgs. 440.400.110.010 or 440.400.110.020). Be sure it is near a power supply and located where the discharge line may be conveniently run to the point of application. The pump may be installed with a flooded suction arrangement (refer to Dwg. 440.400.110.040). A carefully considered and correct installation will help provide satisfactory performance.

When installing the equipment, proceed as follows:

a. Select the appropriate dimension and/or installation drawing to be sure the location selected will meet all requirements. Refer to Dwgs. 440.400.110.010, 020, 030, and 040.

b. Mount the pump on the bench, shelf, or level pad on which it will be located.

c. Connect to a power supply matching the characteristics specified on the motor nameplate and in accordance with local electrical code requirements. Sufficient flexibility must be provided in the connection to permit adjustments. Be sure to provide a shut-off switch in the power supply.

NOTE: Field wiring must conform to local electrical codes.

WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR DAMAGE TO THE EQUIPMENT CONSULT YOUR UGSI CHEMICAL FEED, INC. REPRESENTATIVE IF THE PUMP IS TO BE USED UNDER CONDITIONS OTHER THAN ORIGINALLY SPECIFIED OR IF THERE IS ANY QUESTION REGARDING THE SIZE OF THE DISCHARGE LINE.

d. If a pulsation dampener is required to reduce pressure peaks, install it in the discharge line. Refer to Dwgs. 440.400.110.010, 020, 030, and 040. The dampener will minimize vibrations and reduce wear due to long lines and/or high stroking speeds.

NOTE: Take care not to drip pipe primer or cement into valves. This could damage ball checks and seats.

e. Connect rigid pipe to the suction connection on the pump and run a line without traps to the bottom of the solution container. Install a strainer.

2.4 Pipe Line Diameter

To determine the proper diameter of the suction and discharge lines, take the following into consideration:

- Cavitation
- Overloading (elbow, valves, tees, etc.)

To avoid cavitation for shorter runs of pipe (less than 10 feet), use pipe with a diameter at least equal to the valve connection. To avoid cavitation for longer runs of pipe (greater than 10 feet), use pipe with a diameter at least one size larger than the valve connection.

The following formula can be used to compute the fluid velocity in meters/second:

$$\text{Velocity} = \frac{\{\text{Discharge (Q)} \times 0.35\}}{d^2}$$

where Q = feed rate in liters/hour
d = inside diameter of pipe in mm

Select an appropriate pipe diameter that keeps the velocity in the suction line from exceeding 0.2 meters/second.

2.5 Installation

The Typical Installation drawings (Dwgs. 440.400.110.010, .020, .030, and .040) and the associated wiring diagram (Dwg. 440.400.130.010) for the various pump configurations are located at the end of this section.

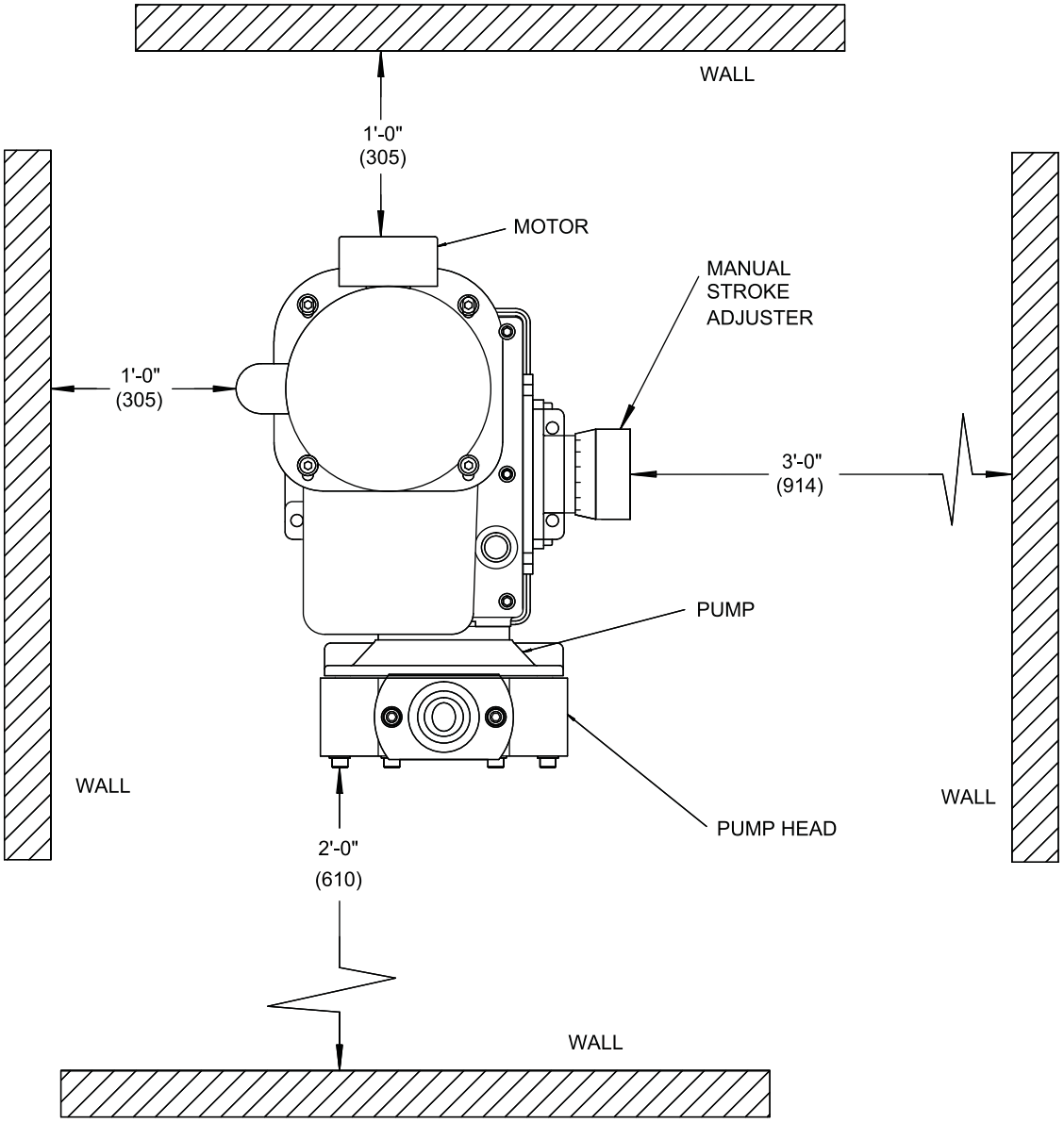
NOTE: Some chemicals (such as sodium hypochlorite) emit gas and could cause "air binding." Follow installation Dwg. 440.400.110.050 and consult publication TA1055-A for additional tips.

Avoid operating problems by preventing the following:

- Unnecessary restrictions in piping
- Thin-walled hose, which may collapse due to a small cross-sectional area during suction stroke, thereby causing both a high pressure drop and velocity
- Difficult to vent bends in the line, where air may be trapped, impairing the accuracy of feed rate

If a storage container is used, the suction line should be connected above the container's bottom to avoid any deposits on the bottom that can enter the suction line. Such deposits may damage the pump valves and impair the function of the pump.

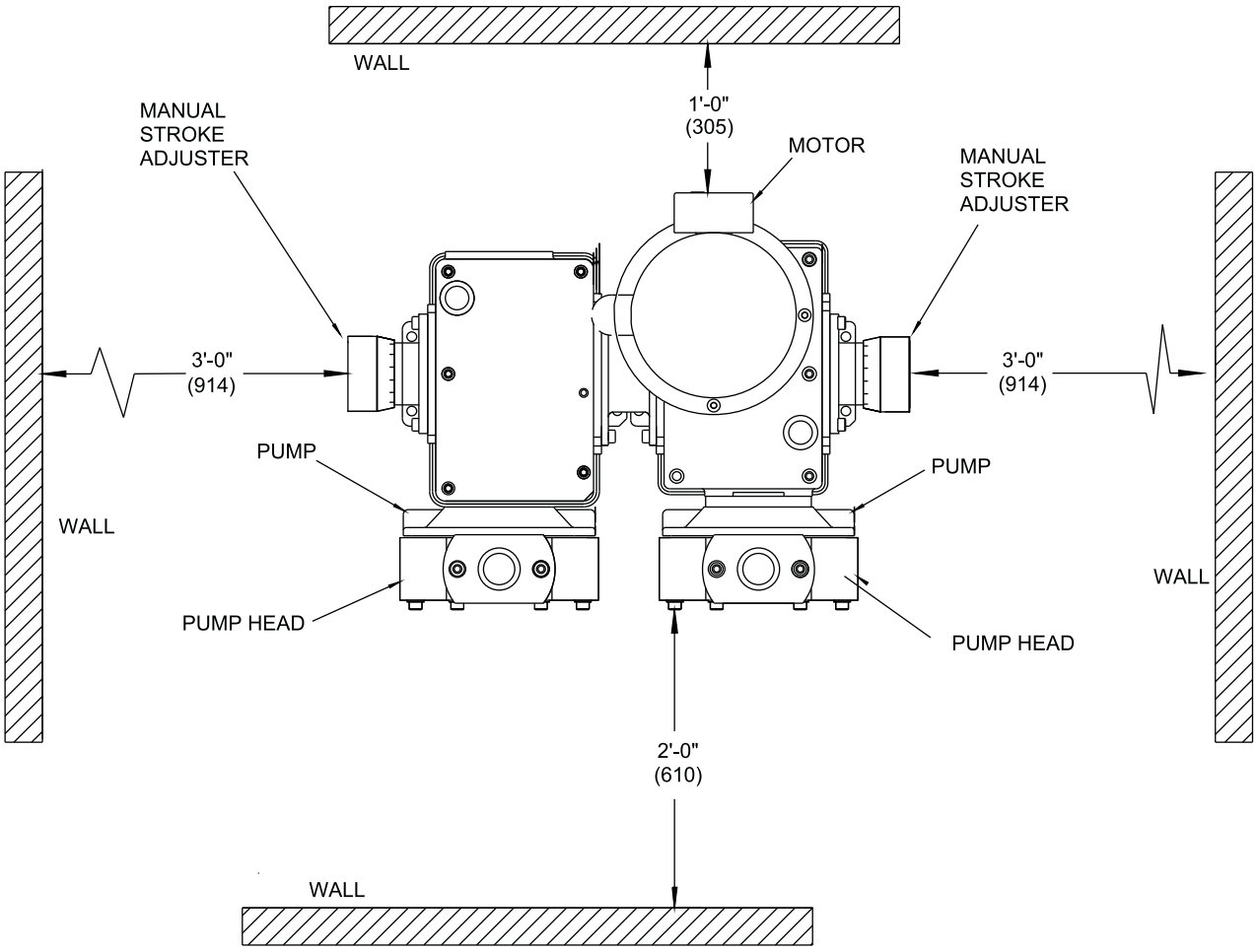
If the liquid to be pumped contains undissolved particles, install an adequately dimensioned strainer (preferably one size larger than the pipe diameter) in the suction line.



NOTES: ( ) INDICATES DIMENSIONS IN MILLIMETERS.
RECOMMENED MINIMUM HEIGHT FROM FLOOR TO VALVE CONNECTIONS SHOULD BE 12" (305).

SIMPLEX MANUAL ARRANGEMENT - SPACE RECOMMENDATIONS

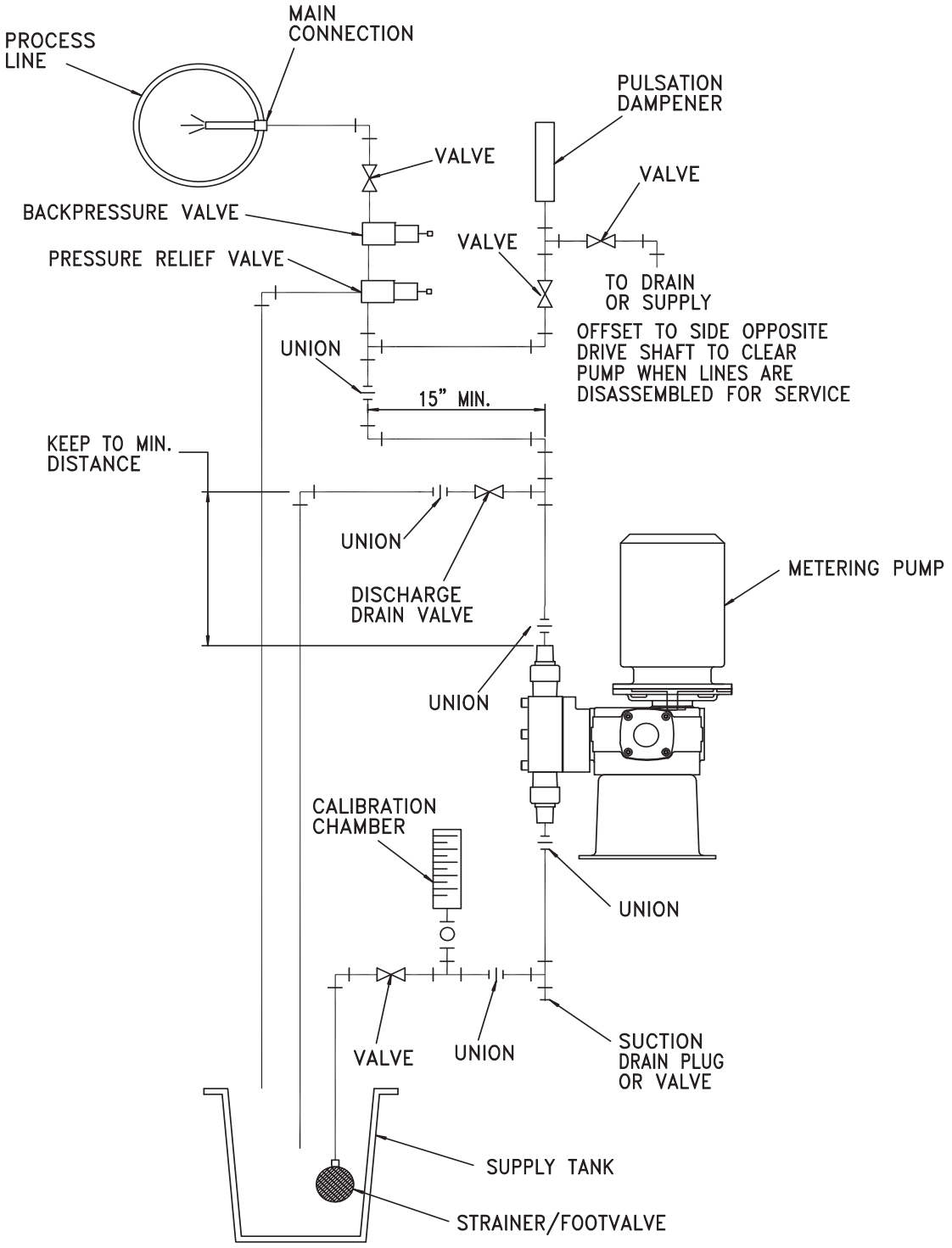
440.400.110.010
ISSUE 2 2-98



NOTES: ( ) INDICATES DIMENSIONS IN MILLIMETERS.
RECOMMENED MINIMUM HEIGHT FROM FLOOR TO VALVE CONNECTIONS SHOULD BE 12" (305).

DOUBLE SIMPLEX MANUAL ARRANGEMENT - SPACE RECOMMENDATIONS

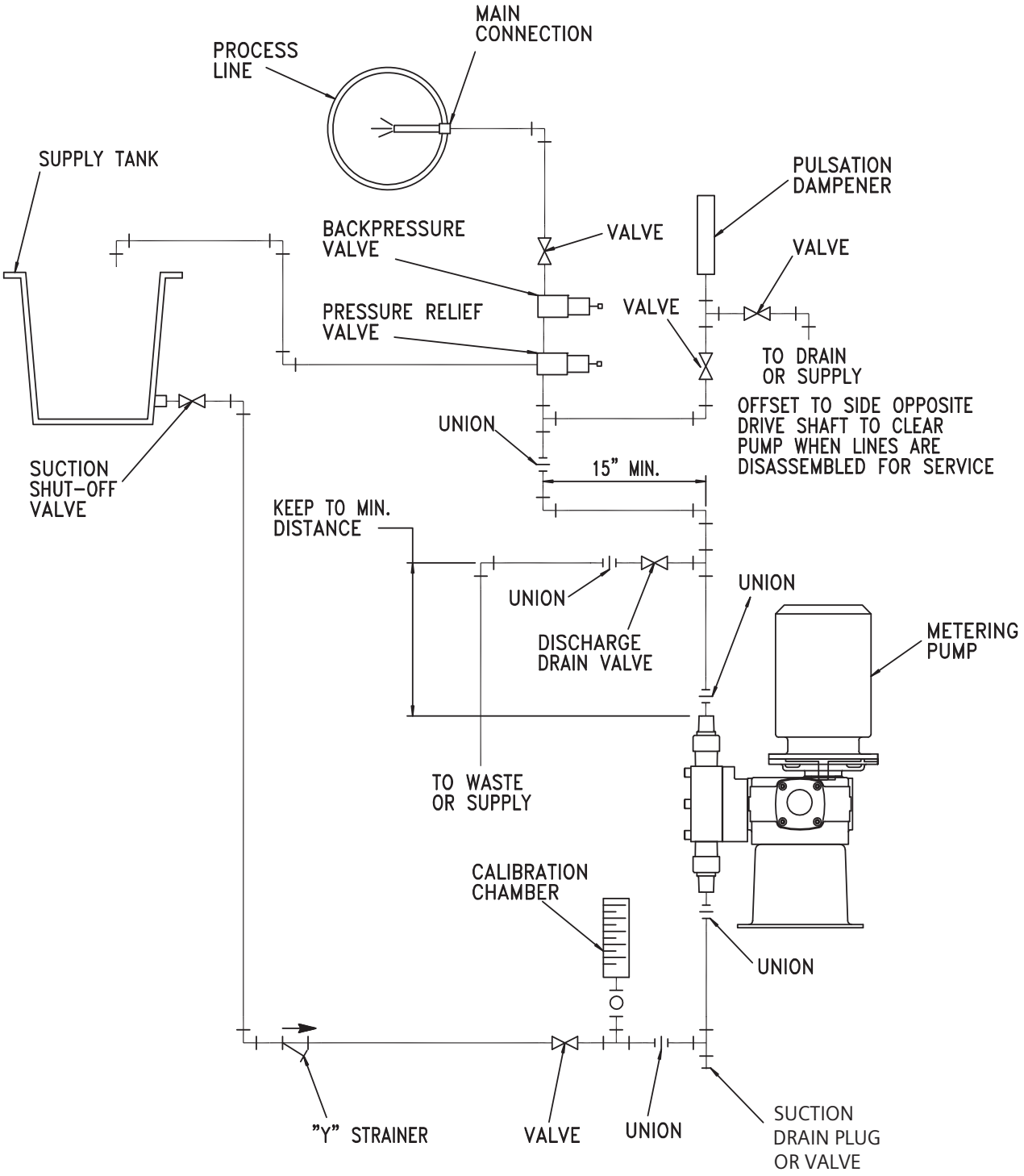
440.400.110.020
ISSUE 2 2-98



WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY, WHEN HAZARDOUS CHEMICALS ARE PUMPED AND/OR ELEVATED TEMPERATURES/PRESSURES ARE ENCOUNTERED, USE RIGID PIPE.

METERING PUMPS - TYPICAL INSTALLATION
- Suction Lift

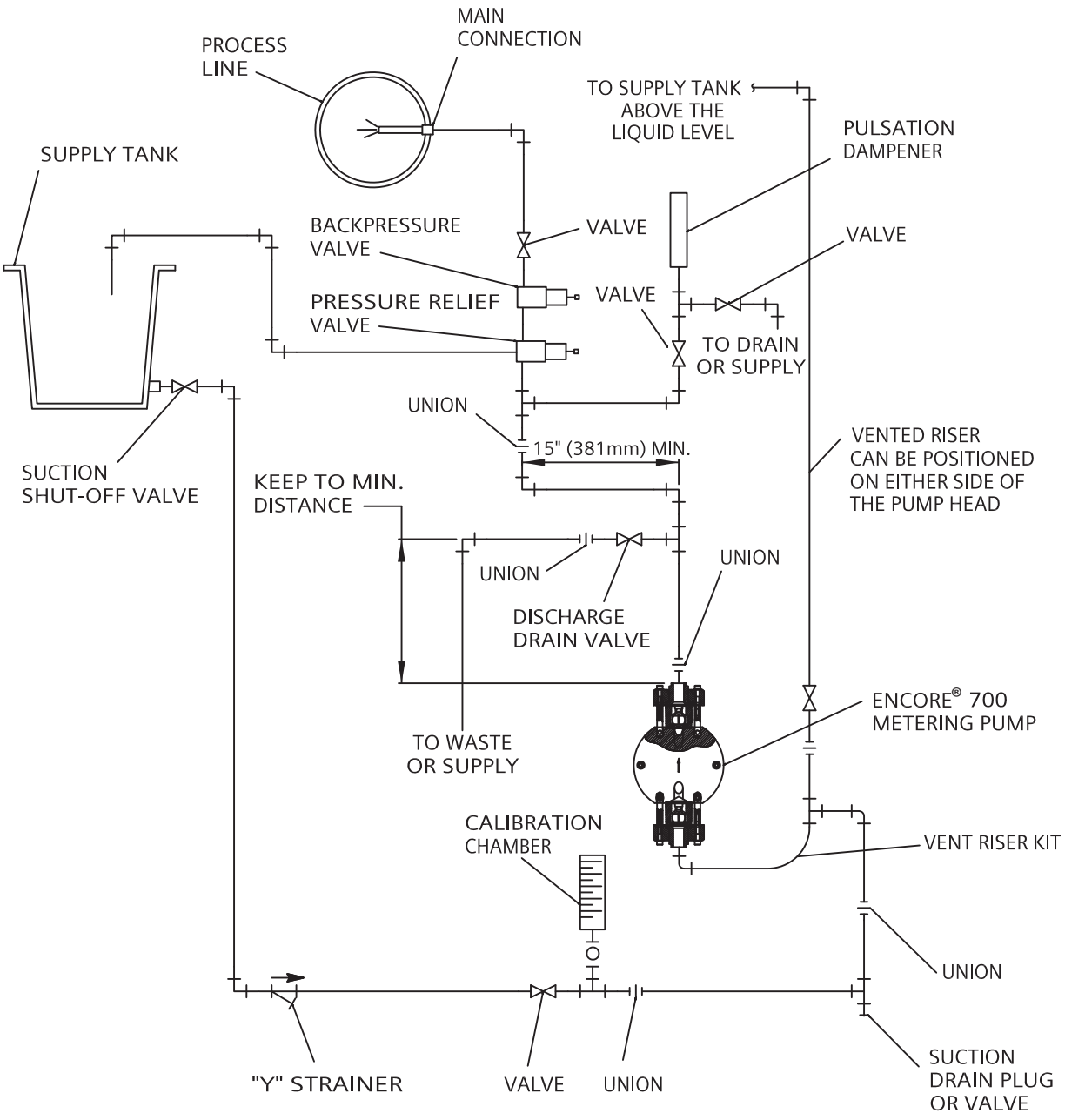
440.400.110.030
ISSUE 1 2-98



WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY, WHEN HAZARDOUS CHEMICALS ARE PUMPED AND/OR ELEVATED TEMPERATURES/PRESSURES ARE ENCOUNTERED, USE RIGID PIPE.

METERING PUMPS - TYPICAL INSTALLATION
- Flooded Suction

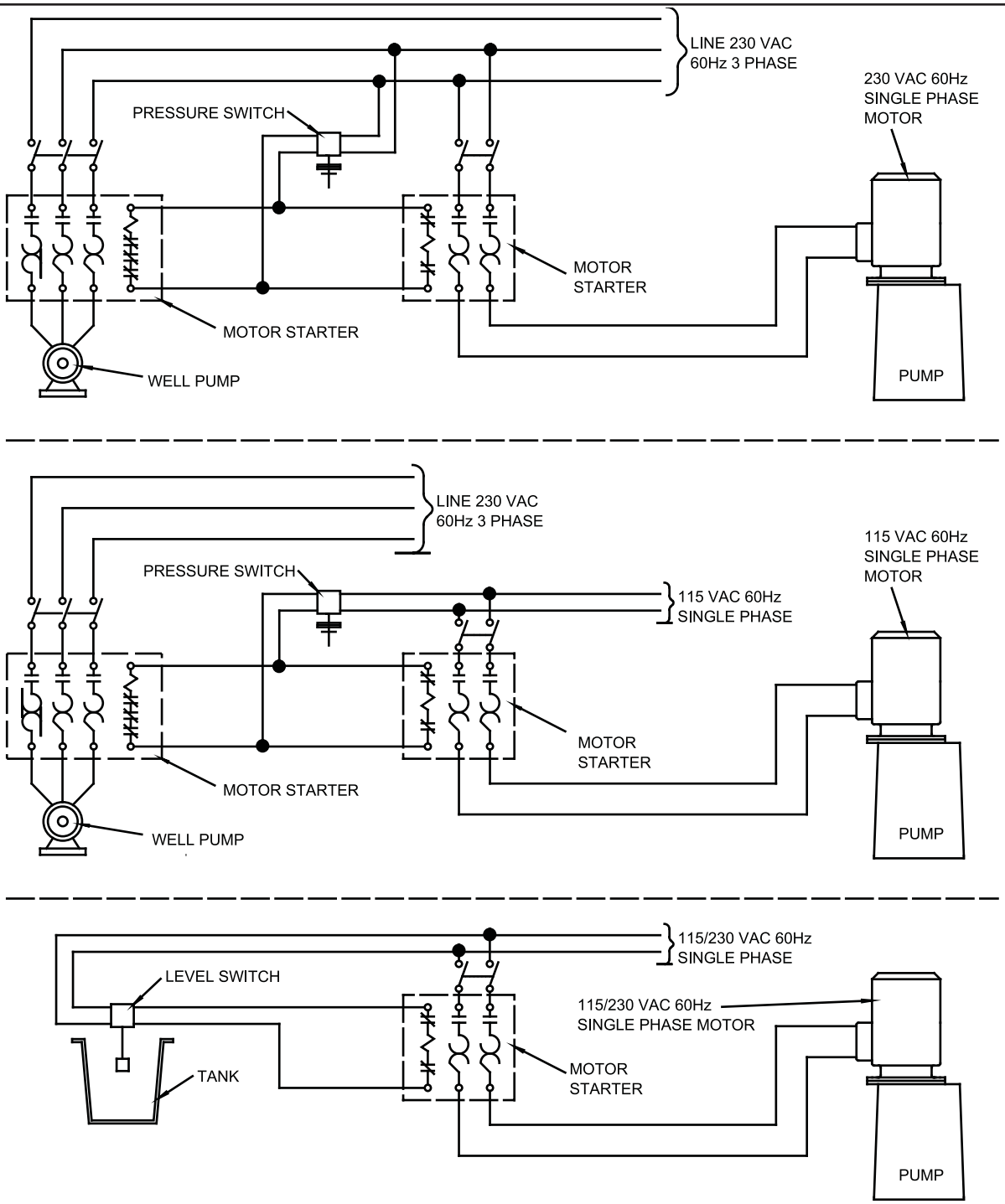
440.400.110.040
ISSUE 1 2-98



WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY, WHEN HAZARDOUS CHEMICALS ARE PUMPED AND/OR ELEVATED TEMPERATURES/PRESSURES ARE ENCOUNTERED, USE RIGID PIPE.

METERING PUMPS - TYPICAL INSTALLATION
- Flooded Suction & Vent Riser

440.400.110.050
ISSUE 2 4-17



NOTES: —— FIELD WIRING (NOT BY UGSI CHEMICAL FEED, INC.) MUST CONFORM TO LOCAL ELECTRICAL CODES. ALL VOLTAGES SHOULD BE 50/60 HZ.

METERING PUMPS - INSTALLATION WIRING
- For Intermittent Start-Stop Operation

440.400.130.010
ISSUE 3 4-09

SECTION 3 - OPERATION

List of Contents

3.1 Preparation for Operation

a. Fill the solution container with solution.

WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY, USE EXTREME CARE TO AVOID CONTACT WITH THE MATERIAL. CONSULT YOUR CHEMICAL SUPPLIER FOR INSTRUCTIONS IN THE PREPARATION OF SOLUTIONS AND THE HANDLING OF CHEMICALS.

NOTE: Unless otherwise indicated, drawings referenced in this section are located in Section 5.

b. Remove the plug on top of the gearbox and replace it with breather cap (26, Dwg., 440.400.001.020A).

NOTE: Depending on the method of shipment, the pump may have been shipped with the gearbox already filled with oil. If not, the oil has been shipped separately. Be sure that the gearbox has been filled properly before operating the pump.

CAUTION: To avoid possible severe damage to the pump mechanism, do not run the pump without the gearbox filled with oil. The oil level must be up to the oil check hole.

c. Refer to Table 1.3 (in Section 1) to identify the belt location on the pulley to obtain the desired feed rate. Pumps delivered from the factory will have the belt located on the first step (top step of the pulley), which is the maximum speed setting. Install the belt guard before operating the equipment.

WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY, DO NOT RUN THE PUMP WITH THE BELT GUARD REMOVED.

d. Start the motor and operate the pump at a stroke setting of 100% of the scale until it is primed and ready for operation. The pump is designed to self-prime under a no backpressure condition; however, if difficulty is encountered in priming, check that the suction valve is not adhering to the suction valve seat. Refer to Section 4 - Service if the pump does not prime.

3.2 Starting and Stopping the Pump

Turn the power supply to the pump on or off as needed.

3.3 Intermittent Start-Stop Operation (Refer to Dwg. 440.400.130.010 In Section 2)

Intermittent start-stop operation, also called semi-automatic operation, is simply the starting and stopping of the treatment (pump) in synchronism with an intermittent flow. This is accomplished by interrupting the electric current to stop the pump. The usual example calls for treating the discharge from a pumping system that starts and stops in response to predetermined variations in elevation or pressure of the liquid being treated.

3.4 Adjustment of Feed Rate

The feed rate of the pump is governed by the frequency of the pump stroke, the length of the pump stroke, and the strength of the solution to be fed.

3.4.1 Frequency of the Pump Stroke

The frequency of the pump stroke is determined by the gear ratio of the speed reducer. Available speeds for the Encore 700 are listed in Table 3.1:

Table 3.1 - Pump Gear Ratios and Speeds

Available Gear Ratios	Number of Strokes at 1725 rpm, 60 Hz
10:1	144 spm (50 Hz)
12:1	144 spm
24:1	72 spm
48:1	36 spm

If the pump is a pulley drive arrangement, each stroking speed can be further turned down. Refer to Table 1.3 (in Section 1) for further details on stroking speeds. If the pump is equipped with a variable speed drive, refer to the applicable instruction manual.

3.4.2 Length of the Pump Stroke

<u>CAUTION</u>: To avoid equipment damage, do not force the stroke control above 100% or below the 0% position. If it is hard to turn, have the pump operating and then turn the stroke control knob.

- Manual Positioning: Pump stroke length is adjusted by turning the stroke control knob (47, Dwg. 440.400.000.010B). Percent stroke length is shown on the micrometer scale, which consists of a linear scale and a circular scale. Ten turns of the knob covers 0 to 100% of the stroke length. Numbers on the scale represent percent stroke. Each full turn of the knob will result in a 10% change of the stroke length. Each graduation on the circular scale

on the knob is equal to 0.25%.

- Automatic Positioning: Pump can be equipped with an electric stroke positioner. If applicable, refer to the separate instruction manual provided with the equipment.

3.4.3 Strength of the Solution

Appropriate dilution of the solution will modify the concentration and, therefore, the feed rate. This will increase or decrease the amount of solution to be pumped per unit time. Adjusting the solution concentration can match the feed rate with the pump's capabilities and enhance the metering repeatability.

WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY, USE EXTREME CARE TO AVOID CONTACT WITH THE MATERIAL. CONSULT YOUR CHEMICAL SUPPLIER FOR INSTRUCTIONS IN THE PREPARATION OF SOLUTIONS AND THE HANDLING OF CHEMICALS.

3.5 Calibrating the Pump

Perform calibration on the suction side of the pump against actual back pressure, so that piping will not have to be disturbed nor the pumping process interrupted. Refer to Dwgs. 440.400.110.030 and 440.400.110.040.

To calibrate the pump, proceed as follows:

a. Close the chamber valve of the calibration chamber and fill the chamber to the top.

b. With the pump running, close the in-line valve upstream of the chamber and, at the same time, open the chamber valve.

c. Using a stopwatch, note the length of time required to drop the calibration chamber contents from the uppermost graduated line to a suitable graduated line lower on the chamber. Open the in-line valve and close the chamber valve to prevent air from being sucked into the suction line and interrupting the pumping cycle.

d. Divide the quantity withdrawn from the chamber in cc by the elapsed time in minutes to obtain the pump rate in cc/minute.

(cc / minute) x 0.38 = gallons per day (gpd)
or
(cc / minute) x 1.44 = liters per day

3.6 Theory of Operation

The theory of operation for the Encore® 700 Mechanical Diaphragm Metering Pump is addressed by discussing the operation and interrelationships of the following assemblies:

- Pump Drive Mechanism
- Speed Reducer
- Stroke Control Mechanism
- Liquid Ends (including head, valves, and connections)

The Encore® 700 metering pump is comprised of a liquid end and a pump drive mechanism. The stroke length can be varied either manually or with an optional electric stroke positioner. The pump is driven by an electric motor that can be coupled either directly to the worm shaft (refer to Dwg. 440.400.001.010A) or indirectly by a pulley drive arrangement (refer to Dwg. 440.400.001.020A). The pulley drive arrangement provides a wide range of stroking speeds with the same gear ratio and, therefore, a wide range of capacities. A double simplex arrangement is also available (refer to Dwg. 440.400.000.020A).

3.6.1 Pump Drive Mechanism (Refer to Dwg. 440.400.000.010B)

The pump drive mechanism is contained within the gearbox. The motor rotates the worm wheel through the worm shaft. Worm wheel is coupled to the variable eccentric non-loss-motion mechanism, which rotates along with it, converting the rotational motion into the reciprocating motion of the crosshead (27) through a connecting rod (31). The crosshead provides a link between the connecting rod and the liquid end. Stroke length of the pump can be changed from 0 to 100 % by turning the stroke control knob (47).

3.6.2 Speed Reducer (Refer to Dwgs. 440.400.000.010A)

The pump stroking speed is obtained through gear ratios, which provide 36 spm, 72 spm, and 144 spm. Each stroking speed is available in a pulley drive configuration or a direct drive configuration. The four-step pulley combination provides additional stroking speed with each gear ratio.

3.6.3 Stroke Control Mechanism (Refer to Dwg. 440.400.000.010B)

The stroke control mechanism consists of a round knob (47) secured to the bearing carrier (22), which is bolted to the eccentric shaft (45) and turns on threads through a double row bearing (19) inside the stroke control housing (25). The stroke control housing has a linear scale showing 0 to 100%. This scale indicates the percent stroke length of the pump. Combination of a linear scale (0 to 100%) on the stroke control housing and a circular scale (0 to 10) provides an accurate micrometer-type setting of the stroke, with a resolution of 0.25%.

3.6.4 Liquid Ends

NOTE: Refer to the List of Contents for Section 5 - Illustrations to identify the applicable drawings.

The Encore® 700 metering pump offers six different sizes of liquid ends to provide a wide range of capacities and pressures. The simplex arrangement has a capacity up to 317 gph and pressure up to 175 psi. PTFE-faced diaphragms are used as pumping diaphragms to provide metering accuracy as well as chemical compatibility. Six sizes of PTFE-faced diaphragms are available: 1-3/8", 2", 3", 4", 5", and 6-1/2". A variable eccentric mechanism is mechanically connected to the PTFE-faced diaphragm by a crosshead. A secondary seal mounted on the crosshead isolates the gearbox from the liquid end. Table 1.3 (in Section 1) provides further details on capacity and pressure capabilities for each liquid end. Cartridge valves are used on all the liquid ends to provide ease of service and field maintenance. Clear valve housings assist in checking the valve performance, providing built-in sight flow indication (except for the 6-1/2" head).

SECTION 4 - SERVICE

List Of Contents

WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE FROM BEING SPRAYED WITH LIQUID UNDER PRESSURE, PRIOR TO DISASSEMBLY OF PIPE CONNECTIONS, REFER TO DETAILED INSTRUCTIONS ON RELIEVING PRESSURE AND DRAINING.

4.1 General

Routine maintenance of the metering pump consists of two operations:

- Periodic cleaning: To remove contaminants and deposits formed on parts in contact with the solution.
- Periodic preventive maintenance: To disassemble, inspect, clean, and replace recommended parts.

Corrective maintenance is performed (as required, at unscheduled intervals) to correct a discrepant operating or non-operating condition. A troubleshooting table (refer to Table 4.3) lists possible fault conditions and corrective actions as a guide for service personnel.

4.2 Periodic Cleaning

4.2.1 Cleaning Pumping Head Parts

If difficulty is encountered in pumping the solution where hard water is known to have been used in the preparation of the solution, remove the pumping head parts for cleaning (refer to paragraph 4.3.4). The effects of hard water are indicated by a white coating on all parts in contact with the solution. This coating is most easily removed by soaking the parts in 5% hydrochloric acid. The commercial grade of hydrochloric acid—known as muriatic acid—is also suitable for this purpose. Where the above condition is known to exist, pump the acid solution through the pump head for approximately five minutes as a periodic preventive maintenance procedure.

WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY, USE EXTREME CARE TO AVOID CONTACT WITH THE MATERIAL. CONSULT YOUR CHEMICAL SUPPLIER FOR INSTRUCTIONS IN THE PREPARATION OF SOLUTIONS AND THE HANDLING OF CHEMICALS.

4.2.2 Cleaning Clogged Solution Tube

Where solution joins water being treated and that water contains considerable hardness, there may be a deposit formed inside the solution tube at the point of application. In time, this can completely plug this tube and the deposit must be removed. The best method is by dissolving the deposit as described in paragraph 4.2.1. Where this condition is known to exist, clean the solution tube as a part of routine maintenance.

4.3 Periodic Preventive Maintenance

To minimize unscheduled shut down and ensure maximum service life, perform periodic maintenance at specified intervals while the equipment is in satisfactory condition. Table 4.1 lists the intervals, maintenance operation, and the preventive maintenance kits required. Before starting the work, ensure that the appropriate preventive maintenance kits are in stock. Refer to Section 6 - Preventive Maintenance Kits and Spare Parts List for the appropriate maintenance kit.

NOTE: Although all parts are designed for long service life, it is recommended that routine maintenance be performed to safeguard against unexpected downtime.

Table 4.1 - Scheduled Maintenance Index

Interval	Maintenance Operation	Preventive Maintenance Kit
Annually	Replace PTFE diaphragm, PTFE disc (between diaphragm and back-up ring), and crosshead bellow seal.	Diaphragm Maintenance Kit
	Replace valve sets, which include the seat, ball, retainer/guide, and O-rings.	Valve Kit (Double ball valves: 2 kits required)
	Lubricate (refer to paragraph 4.3.1).	Bel-Ray Worm Gear Oil 460, (Product Code 11000), 2 quarts required.
	Replace belt.	APS4857
Six Months	For slurry application or other abrasive chemical, replace valve sets every six months.	Valve Kit (Double ball valves: 2 kits required)

4.3.1 Gearbox Lubrication (Refer to Dwg. 440.400.000.010)

The gearbox is filled with approximately two quarts of Bel-Ray Worm Gear Oil 460, (Product Code 11000). This lubricant must be replaced annually to realize optimum performance of the mechanism. The first oil change is recommended after six months of operation.

NOTE: Do not mix oils.

To drain and replace the gearbox oil, perform the following steps:

a. Remove the oil drain plug (33) located at the bottom of the side wall of the gearbox (toward the stroke control knob). Catch the oil with an appropriate container.

b. Let the oil drain completely and flush the gearbox using suitable detergents.

c. Apply PTFE tape to the oil drain plug and install it to the gearbox.

d. Remove the breather cap (44) located at the top of the gearbox cover and the oil check plug (36) located at the center of the gearbox side wall (toward the stroke control knob)

e. Fill the gearbox with oil (U40003) until the oil flows out of the oil check hole.

f. Apply PTFE tape to the oil check plug; thread and tighten.

g. Install the breather cap.

4.3.2 Priming Troubles or Loss of Suction

Difficulties in priming are usually encountered when there is an air leak in the suction line or when the valves are obstructed. Air leaks in the suction line may be due to a loose valve, O-ring damage, cracked tubing, or leaking joints in the pipe thread connections. Obstruction on the valves may be caused by foreign material or by deposits on the pumping head parts.

Where liquid is withdrawn from containers that are replaced when they are empty, or if the level in a fixed tank occasionally falls below the suction line inlet, air will be introduced into the pump. If the pump is discharging against atmospheric pressure (or only slightly above), the pump may be expected to re-prime itself if the liquid supply is replenished and it is operated briefly at full stroke. If discharging against greater pressures, the pump will not re-prime itself due to compression and re-expansion of the air trapped in the pump head.

If the system is installed in accordance with Dwgs. 440.400.110.030 or

440.400.110.040 (located in Section 2 – Installation) using a backpressure valve and/or pressure relief valve, the discharge drain valve may be opened to allow the pump to prime against atmospheric pressure. Once primed, close the discharge drain valve to resume normal operation.

If no backpressure and/or pressure relief valve are used, re-priming is greatly simplified if a three-way valve is installed in the discharge line close to the pump outlet. This valve normally passes the pump output to the downstream tubing or pipe. When re-priming is desired, the valve is turned to divert the pump output back to the liquid container, the downstream pressure is blocked off, and the pump operates at atmospheric discharge pressure. When a flow of liquid is observed returning to the source container, the pump is re-primed. The three-way valve is then turned back to its normal position and pump delivery can continue.

If an appropriate three-way valve is unavailable, the same result can be achieved by using two conventional shut-off valves. One is placed in the discharge line and other on the side opening of a tee located immediately upstream of the line valve.

4.3.3 Hazardous Properties of Sodium Chlorite ($NaClO_2$)

<u>WARNING</u>: TO AVOID POSSIBLE SEVERE PERSONAL INJURY, AS THE STORAGE AND HANDLING OF SODIUM CHLORITE PRESENTS VERY SPECIFIC HAZARDS, THE USER MUST SEEK THE ADVICE OF THE CHEMICAL SUPPLIER WITH REFERENCE TO STORAGE FACILITIES, HANDLING PRECAUTIONS, AND HEALTH HAZARDS.

Sodium chlorite is a dry, flaked salt that, because of its powerful oxidizing nature, is shipped in steel drums bearing a DOT "yellow" label classification. It is stable when sealed or in solution, but is very combustible in the presence of organic material. For this reason do not allow the solution to dry out on floors. Mop up the solution with technical sulfite solution.

Technical sodium chlorite is a white, flaked salt with a density of approximately 56 lbs per cubic foot. It is a very powerful oxidizing agent.

Sodium chlorite in contact with acid will react with rapid evolution of chlorine dioxide gas. When heated above 347ºF, sodium chlorite will decompose rapidly, liberating oxygen with the evolution of sufficient heat to make the decomposition self-sustaining. If this decomposition is confined, as in closed containers, the effect is explosive. Therefore, it must be protected at all times from exposure to heat.

Sodium chlorite dissolves easily in water at ordinary temperatures to form a cloudy, white solution. This solution is chemically stable under ordinary conditions of temperature and pressure.

When received in loose flake form in metal containers, sodium chlorite will stand considerable rough handling. In scooping or weighing out the material, avoid contact with eyes, skin, mucous membranes, and clothing. Wash contaminated clothing quickly and thoroughly with water to avoid fire.

The danger lies in the fact that sodium chlorite in contact with or mixed with organic substances, such as clothing, cloth gloves, cotton waste, sawdust, mops, brooms, etc., becomes extremely sensitive to any agent, such as heat, friction, or impact, and these exposed organic substances will ignite readily when any of these are applied accidentally or otherwise. The finer the sodium chlorite is sub-divided, as is the case when sodium chlorite solution is left to evaporate and the more intimately it is mixed with the organic substance, the more sensitive to heat it becomes. Although, in practice, spontaneous ignition of such mixture is unlikely, it is theoretically possible for such a reaction to occur. Therefore, extreme care must be used to prevent sodium chlorite flakes or sodium solution from coming in contact with combustible material, especially fibrous or finely divided material.

4.3.4 Cleaning the Pump - Sodium Chlorite Applications - Special Precautions

WARNING: SODIUM CHLORITE, WHEN FINELY DIVIDED IN THE PRESENCE OF ORGANIC COMPOUNDS, IS A POSSIBLE FIRE HAZARD. FOR THIS REASON, EXTREME CARE MUST BE EXERCISED TO PREVENT SOLUTIONS FROM DRYING OUT IN THE THREADED PORTIONS OF THE PUMP BODY AND RELATED PARTS. OBSERVE CAREFULLY THE MANUFACTURER/SUPPLIER'S RECOMMENDED SAFETY PROCEDURES AND THE HANDLING AND STORAGE PROCEDURES IN THIS MANUAL.

Perform pump cleaning procedures in accordance with the following steps. When procedures require pump disassembly, refer to paragraph 4.4.1 - Removing Pump From Service. Refer to Dwg. 440.400.150.010 as a guide during this procedure.

a. Transfer the suction line to a container of water and pump water until all the sodium chlorite in the pump and discharge lines has been replaced by water.

b. Place a container under the pump head, then remove the suction line.

c. Shut-off the discharge line valve.

d. Relieve the pressure and drain the discharge line between the pump and the discharge line shut-off valve.

e. Remove the pump head. Flush away any spilled solution not caught in the

container with ample quantities of water.

f. Immerse the pump head, valves, and lines that were removed in lukewarm water for two minutes.

g. Unscrew the threaded parts under water.

h. Rinse all the parts in fresh water before reassembly.

i. Use water to prime the pump, then transfer the suction line to the sodium chlorite solution container.

4.3.5 Inspection

After the disassembled parts are cleaned and prior to reassembly perform the following procedure:

a. Check for physical damage of removed parts (chipped, cracked, damaged threads, etc.). Replace damaged parts.

b. Discard and replace all removed O-rings, seals, and gaskets.

c. Check diaphragms for chafing or cracking. Replace damaged diaphragms.

4.4 Corrective Maintenance

WARNING: TO AVOID CONTACT WITH THE MATERIAL AND POSSIBLE SEVERE PERSONAL INJURY WHEN SERVICING HEADS AND/OR VALVES, FOLLOW THE PROCEDURES IN THIS SECTION FOR DISASSEMBLY.

WARNING: USE EXTREME CARE TO AVOID CONTACT WITH THE MATERIAL AND POSSIBLE SEVERE PERSONAL INJURY. WHEN HANDLING HAZARDOUS MATERIAL, OBSERVE ALL SAFETY PRECAUTIONS RECOMMENDED BY THE MATERIAL MANUFACTURER/SUPPLIER.

CAUTION: To prevent possible equipment damage, the solution must never be allowed to freeze in the pump. If freezing conditions are present when pump is shut off, drain pump head and all solution lines.

Corrective maintenance is performed as required to correct a discrepant operating or non-operating condition. A troubleshooting table is provided to guide service personnel in diagnosing and correcting most common troubles.

Routine maintenance procedures include the elimination of solution leaks when they are found, to avoid corrosion damage. Flush away spilled solution with water and wipe the parts clean and dry.

Maintain gasket joints in good condition. Keep an adequate supply of gaskets and O-rings available so that repair of leaks can be accomplished without delay. It is a good practice to discard used gaskets and O-rings, replacing them with new material each time a joint is broken.

4.4.1 Removing Pump From Service and Disassembling Valves, Head, and Diaphragms

WARNING: USE EXTREME CARE TO AVOID CONTACT WITH THE MATERIAL AND TO AVOID POSSIBLE SEVERE PERSONAL INJURY WHEN USING HAZARDOUS MATERIAL. OBSERVE ALL SAFETY PRECAUTIONS, INCLUDING USING APPROPRIATE PROTECTIVE CLOTHING AND EYE PROTECTION WHEN HANDLING HAZARDOUS MATERIAL.

Procedures for the assembly and disassembly of parts for pump corrective maintenance are referenced in the following paragraphs.

4.4.2 Draining System of Hazardous Material

WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY FROM BEING SPRAYED BY LIQUID UNDER PRESSURE, ALLOW THE SYSTEM TO DRAIN FULLY BEFORE ATTEMPTING TO DISASSEMBLE PIPING AND REMOVING VALVES AND/OR HEAD.

a. Disconnect power from the pump.

b. Close the discharge shutoff valve.

c. For flooded suction, close the suction shutoff valve to prevent the backflow of liquid when suction lines are opened. (Refer to Dwg. 440.400.110.040 in Section 2.)

d. Open the suction drain valve and drain the suction line of liquid.

e. Open the discharge drain valve to relieve pressure and drain the discharge line.

f. Open the bypass valve in the pressure relief valve.

g. If a pulsation dampener is used, close off its valve when pressure has reached zero.

4.4.3 Removing Suction and Discharge Valves

WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY, USE EXTREME CARE TO AVOID CONTACT WITH LIQUID PRESENT IN THE HEAD. ALLOW THE SUCTION VALVE TO FALL INTO A SUITABLE CONTAINER AND CATCH THE LIQUID.

WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY, USE EXTREME CARE TO AVOID CONTACT WITH THE LIQUID PRESENT BETWEEN THE DISCHARGE DRAIN VALVE AND THE UNIT BELOW. FLUSH ANY SPILLED LIQUID IMMEDIATELY.

- Cartridge Type Valve (refer to the Cartridge Liquid End parts drawings in Section 5):

  a. Loosen the two screws located on the clamping block.

  b. Slide the clamping block up.

  c. Pull the valve cartridge out.

  d. Slide the seat out of the cartridge to remove the ball.

NOTE: On the 1-3/8", 2", 3", 4", and 5" heads, the solution valve, guide, and retainer are molded as one piece. Slurry valves and spring-loaded polymer valves have a separate guide assembled inside the clear PVC retainer. On the 6.5" head, the retainer is machined and is opaque.

4.4.4 Removing the Diaphragm

a. Remove the suction and discharge valves as described in paragraph 4.4.3.

b. Remove the head screws, washers, and the pump head.

c. Unscrew the diaphragm assembly by rotating it counterclockwise.

4.4.5 Valve and Diaphragm Replacement

NOTE: The 1-3/8", 2", 3", and 4"diaphragms utilize a circular back-up ring screwed on the diaphragm insert. When replacing the diaphragm, unscrew the back-up ring for reuse. A PTFE disc is inserted between the diaphragm and the back-up ring. A new PTFE disc must be used every time a new diaphragm is installed. For specific part numbers on the diaphragm, back-up ring, and PTFE disc, refer to the Spare Parts List in Section 6.

All O-rings must be lightly lubricated with silicone grease before assembly.

The assembly procedure for the cartridge valves is the reverse of the disassembly procedures described in paragraph 4.4.3. Refer to Table 4.2 under head size for the corresponding torque to tighten the clamping bolts for the cartridge valves.

Refer to Dwg. 440.050.001.030 for the 1-3/8" Diaphragm and Dwg. 440.050.001.040 for the 2" Diaphragm. Use the 2" Diaphragm drawing as reference for all other sizes.

a. After the removal of the diaphragm assembly, as described in paragraph 4.4.4, the bellow clamp (4) can be removed. On the 1-3/8" Diaphragm, the bellow clamp (3) is secured by a nut (4). The diaphragm spacer (5), if used, can also be removed.

b. Remove four screws (3) and slide out the adapter (1). On 1-3/8" Diaphragm, four long head bolts secure the adapter (1). Watch for the O-ring between the adapter and the gearbox.

c. Pry off the old bellow seal (2) from the adapter and scrape the old sealant from around the counterbore.

d. Clean the adapter thoroughly of oil with appropriate solvent, especially the counterbore where the bellow seal will be glued.

e. Apply a 1/16" bead of RTV sealant along the corner of the counterbore.

f. Install the new bellow seal carefully and avoid smearing any RTV on the folded surface of the bellow seal. Wipe off any excess RTV inside and outside of the bellow seal.

g. Set aside, face up, and let the RTV sealant cure for a minimum of three hours before continuing the assembly. **Recommended time for RTV sealant to cure before filling the gearbox with oil is 12 hours.**

NOTE: Adapters with bellow seals already glued in place and ready for assembly to the pump are available. See Table 6.2 (in Section 6) for kit number.

h. Clean the bellow clamp and remove any sharp edges along the area that makes contact with the bellow seal. Do the same to the plunger.

i. Apply silicone grease to the O-ring and position it into the gearbox.

j. Hold and centralize the plunger while inserting the adapter. Ensure that it fits freely into the gearbox.

k. Tighten the four bolts diagonally. On the 1-3/8" Diaphragm, temporarily secure the adapter in position.

l. Lubricate the bellow clamp and install it into the plunger, pressing lightly against the bellow seal. On the 1-3/8" Diaphragm, tighten the nut against the bellow clamp.

m. Install the diaphragm spacer, if used, and thread the diaphragm assembly to the plunger against the bellow clamp. Rotate the pump input shaft to extend the diaphragm for a better grip.

n. Turn the pump shaft until the diaphragm outer diameter is sitting flat, without strain, against the spacer.

o. Assemble the remaining parts in the reverse order in which they were disassembled.

Table 4.2 - Recommended Torque Values

	Recommended Torque	
Head Size	Head Screws	Cartridge Valve Clamping
1-3/8"	45 to 60 in-lbs	20 to 25 in-lbs
2"	45 to 60 in-lbs	
3"	60 to 70 in-lbs	
4"	60 to 70 in-lbs	
5"	60 to 90 in-lbs	
6-1/2"	60 to 90 in-lbs	

4.4.6 Disassembly of Complete Pump

WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, TURN POWER OFF BEFORE SERVICING.

WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY FROM BEING SPRAYED BY LIQUID UNDER PRESSURE, ALLOW SYSTEM TO DRAIN FULLY BEFORE ATTEMPTING TO DISASSEMBLE PIPING AND REMOVING VALVES OR HEADS.

The procedures below describe a simplex arrangement with manual stroke control.

All O-rings must be lightly lubricated with silicone grease before assembly.

Under normal operating conditions, disassembly of the gearbox is not required. Should disassembly be necessary, proceed as follows:

- Gearbox Cover Removal (refer to Dwg. 440.400.001.010A or Dwg. 440.400.001.020A)

  a. Remove the liquid end, which includes the valves, head, and diaphragm, as described paragraph 4.4.2.

  b. For a direct drive, refer to Dwg. 440.400.001.010A. Remove the electric motor and set aside. Do not remove the coupling flange unless it is to be replaced. Remove the motor support (5), loosen the set screws, and remove the coupling flange. Proceed to step d.

  c. For a pulley drive, refer to Dwg. 440.400.001.020A. Remove the belt guard (10), loosen the belt (9), and remove the electric motor. The pulley (2) need not be removed from the motor shaft unless it is being replaced. Loosen the set screws (8) on the worm shaft pulley (7) and pull out the pulley.

  d. Unscrew all of the M8 screws that secure the cover (1, Dwg. 440.400.001.010A, or 22, Dwg. 440.400.001.020A) and pry it open with a suitable screwdriver. The complete mechanism is now exposed.

NOTE: Two slots are provided for this purpose, one in the front and one in the back. Silicone RTV is used as a seal and it requires a gentle tap to break the seal. Note the locations of the special washer and all the screws.

- Worm Shaft and Drive Gear Removal (refer to Dwg. 440.400.000.010A&B)

a. Remove the gearbox cover, as described in step a, above.

b. Drain the gearbox oil.

c. Remove the worm shaft assembly (51) by pulling it up.

NOTE: Two bearings (6) and (7) and a shim combination (12-15) come out with the assembly.

d. Set the knob (47) to zero.

e. Remove the gear access flange (2) by unscrewing the four M8 screws (3).

f. Slide the drive gear (50) and the drive bushing assembly (4) out through the flange opening.

NOTE: Mark the position of the drive gear (50) or drive bushing (4) relative to the sheave (46) so that they can be reassembled at the same position.

g. On a bench, remove the tapered roller bearing (30) from the drive bushing (4).

h. Unscrew the five M6 screws (10) and remove the drive gear (50).

- Worm Shaft and Drive Gear Replacement (refer to Dwg. 440.400.000.010A)

a. Apply Blue Loctite thread locker (11) to the five M6 screws (10). Replace the drive gear (50) and secure with screws (10).

b. Reverse the above removal procedures for replacement of the worm shaft and the drive gear.

- Eccentric Assembly, Tapere Roller Bearings, Connecting Rod, Stroke Control Housing, and Knob Removal (refer to Dwg. 440.400.000.010A&B)

a. Follow steps a through d of the procedure for worm shaft and drive gear removal, above.

b. Remove the stroke control knob (47) by loosening the three set screws (48) just enough to slide the knob out. Do not screw all the way out, just flush with the surface of the knob.

NOTE: If the pump is equipped with an electric stroke positioner, refer to the applicable instruction manual.

NOTE: The set screws (48) are coated with Nylok™ to seal. If set screws were removed or are leaking, replace with a new one.

c. With a 6mm Allen wrench, remove one M8 screw (21) from the eccentric shaft (45), which is accessible through the carrier bearing (22) end opening. Hold the drive gear (50) to keep the eccentric assembly from turning.

NOTE: Pumps with an Electric Stroke Positioner do not have detent stroke mechanism. For pumps with an Electric Stroke Positioner, proceed to step d. For pumps with a Manual Stroke Positioner, proceed to step e.

d. Turn the carrier bearing (22) counterclockwise until it comes all the way out, then proceed to step i.

e. Refer to Dwg. 440.400.000.030 for the next three steps f, g, and h.

f. Turn the carrier bearing (22) until the two detent pawls (52) are visible.

g. Hold the two detent pawls, they are pre-loaded with springs (53), and continue to turn the carrier bearing counterclockwise until the two detent pawls are free.

h. Carefully release and remove the two pawls and two springs and set aside. The carrier bearing can now be unscrewed completely out.

NOTE: The bearing (19) and the flat washer (20) need not be removed unless they are being replaced. A special wrench (AJE5116) is needed to loosen or tighten the adjuster bearing (23).

i. Unscrew the four M8 screws (49) and remove the stroke control housing (25).

j. Unscrew the pre-load nut (17).

k. Unscrew the four M8 screws (3) and remove the gear access flange (2).

l. Slide out the drive gear (50) and the drive bushing assembly (4).

m. Holding the connecting rod assembly, slide the eccentric assembly out of the gearbox.

n. If the tapered roller bearings have to be replaced, use an appropriate tool (e.g. - a bearing puller) and follow the instructions of the tool supplier to remove the bearing cup(s).

- Eccentric Assembly, Tapered Roller Bearings, Connecting Rod,

Stroke Control Housing, and Knob Replacement (refer to Dwg. 440.400.000.010B)

Reverse the above removal procedures for the replacement of the items mentioned above; however, the following additional procedures must be adhered to:

a. Tighten the pre-load nut (17) (removed in step j above) just enough to eliminate axial movement of the eccentric assembly. The eccentric shaft (45) must slide in and out without any binding.

NOTE: Pumps with an Electric Stroke Positioner do not have detent stroke mechanism. For pumps with an Electric Stroke Positioner, proceed to step e. For pumps with a Manual Stroke Positioner, proceed to step b.

b. Refer to Dwg. 440.400.000.030 for the next two steps, c and d.

c. Screw the carrier bearing (22) to the stroke adjust housing (25) up to the edge of the two holes for the detent pawls (52). Position the two holes so that they are horizontal.

d. Lubricate with silicone grease and install the spring, followed by the pawl, into the holes and hold them in position. Continue to turn the carrier bearing clockwise to secure the pawls.

e. Turn the carrier bearing (22) clockwise until it stops. The bearing (19) must be against the eccentric shaft (45) shoulder before tightening the screw (21) (removed in step c above).

f. Set the stroke position to approximately zero by turning the carrier bearing (22) counterclockwise until it stops. Then rotate the carrier bearing one turn clockwise.

g. Place a dial indicator with a magnetic base on top of the gearbox. Set the indicator shaft to indicate the eccentricity of the sheave (46), as shown in Figure 4-1.

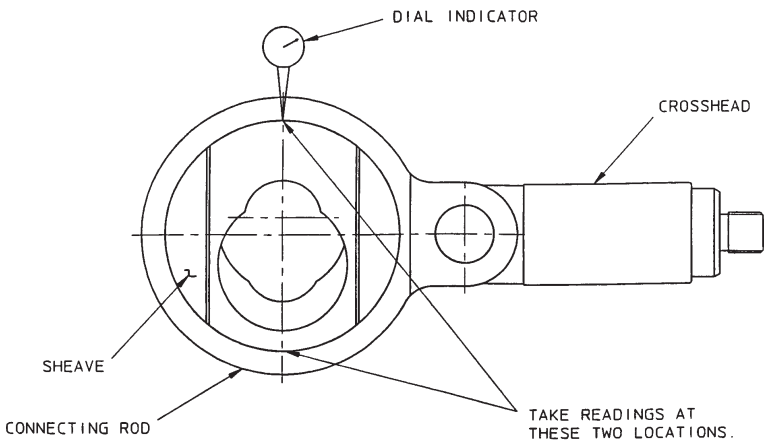


Figure 4-1. Eccentric Shaft Alignment

h. Rotate the eccentric shaft assembly (45) and take the indicator reading at two locations, 180° apart, and along the eccentric travel of the sheave.

i. Both readings must be the same. If the readings are different, turn the carrier bearing clockwise or counterclockwise until a point is found where the readings are the same.

j. If the pump is equipped with detent stroke mechanism, (for manual Stroke Positioners), turn the carrier bearing clockwise to the nearest detent.

NOTE: Do not disturb this set position until the knob is secured at zero scale indication.

k. Apply silicone grease to the O-ring and install it in the groove in the stroke control housing.

CAUTION: The carrier bearing must not be disturbed while performing the next four steps.

l. Start the three M6 screws (48), with Nylok™ patch, in the knob.

m. Position the knob (47) over the stroke control housing with the zero graduation on the knob lined up with the center line of the stroke control housing scale, as shown in Figure 4-2.

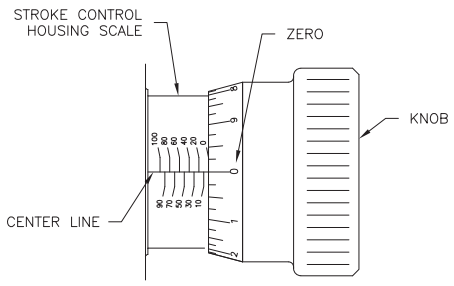


Figure 4-2. Stroke Control Alignment

n. Push the knob past the O-ring for manual position (quad-ring for automatic position) until the front edge of the knob is in line with the zero percent line on the stroke control housing scale.

o. Slide the knob, if necessary, to align the scales as shown in Figure 4-2. Tighten the three M6 set screws (48) equally. Make sure the set screws that are used have a Nylok™ patch on the threads to prevent oil leakage.

NOTE: All O-rings must be lightly lubricated with silicone grease before assembly.

- Gearbox Cover Installation for Direct Drive (refer to Dwg. 440.400.001.010 and 440.400.000.010)

  a. Position the inner assembly (cone) of the lower tapered roller bearing (7, Dwg. 440.400.000.010) onto the smaller end of the worm shaft (51, Dwg. 440.400.000.010) Install the outer race (cup) of the bearing into the gearbox. Place the bearing cone, with the worm shaft, into the bearing cup.

  b. Install shims (12,14 &15 on Dwg. 440.400.000.010) and tapered, roller bearing (6) cone onto the worm shaft.

  c. Temporarily install the cover (with bearing cup and oil seal) tightening the four bolts closest to the worm shaft.

  d. Check that end play is within .005". If not, select and install proper shims.

  e. Remove the cover and apply grease (8, Dwg. 440.400.000.010) to the top bearing.

  f. Apply 1/8" bead of RTV adhesive (3, Dwg. 440.400.001.010) around the top lip of the gearbox.

g. Install the cover and tighten all bolts.

h. Install one coupling flange, with key (6) in place to the worm shaft; tighten the two set screws.

i. Mount the motor support and secure with four M8 screws (longer screws to the outside, shorter screws to the inside).

j. Position the rubber coupling to the coupling flange.

k. Measure the distance from the top surface of the motor support to the top surface of the rubber coupling ("A" dimension) and add to this dimension the depth of the groove ("B" dimension). This groove is where the rubber coupling engages. Record this dimension ("A" + "B"). See Figure 4-3.

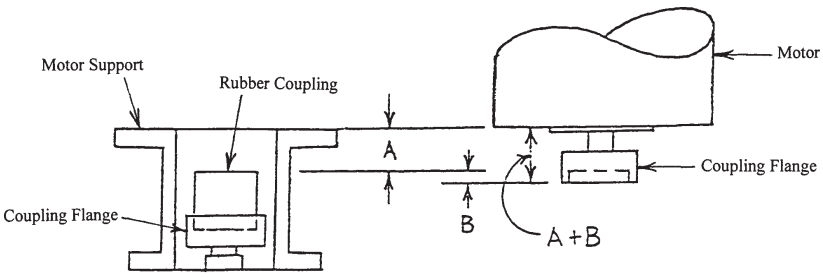


Figure 4.3 - Rubber Coupling Engagement

l. Position the other coupling flange to the motor shaft facing outward.

m. Locate the front face of the flange from the face of the motor according to the dimension ("A" + "B"), recorded above. Tighten the two set screws.

n. Carefully lower the motor to the motor support. It will drop into place once the coupling is engaged. A little twist of the motor while lowering it will help to engage the coupling.

o. Tighten the motor mounting bolts.

- Gearbox Cover Installation for Pulley Drive (refer to Dwg. 440.400.001.020 and 440.400.000.010)

a. Position the inner assembly (cone) of the lower tapered roller bearing (7, Dwg. 440.4000.000.010) onto the smaller end of the worm shaft (51, Dwg. 440.400.000.010) Install the outer race (cup) of the bearing into the gearbox. Place the bearing cone, with the worm shaft, into the bearing cup.

b. Install shims (12,14 &15 on Dwg. 440.400.000.010) and tapered roller bearing (6) cone onto the worm shaft.

c. Temporarily install the cover (with bearing cup and oil seal) tightening the four bolts closest to the worm shaft.

d. Check that end play is within .005". If not, select and install proper shims.

e. Remove the cover and apply grease (8, Dwg. 440.400.000.010) to the top bearing.

f. Apply 1/8" bead of RTV adhesive (23, Dwg. 440.400.001.020) around the top lip of the gearbox.

g. Install the cover and tighten all bolts.

h. Install the bigger pulley, smaller step on top, to the worm shaft all the way against the shoulder, and tighten the two set screws.

i. Thread the three stand-offs tight against the shoulder to the gearbox cover.

j. Mount the stand-off plate to the three stand-offs and secure with the three M8 flat head screws.

NOTE: There must be electrical continuity between the stand-offs and the stand-off plate. Scratch off the paint under one of the bolt heads if necessary.

k. Place the belt around the front pulley.

l. Install the slide plate to the motor front face.

NOTE: The orientation of the motor junction box to the pump is established here. Electrical continuity between the motor and the slide plate is necessary.

m. Install the smaller pulley to the motor shaft and snug the set screw.

n. Position the motor assembly to the stand-off plate with the adjustment screw to the back of the pump.

o. Secure the slide plate to the stand-off plate with four M8 screws, flat washers, and lock washers. Do not tighten screws.

p. Position the belt on the top step of the pulley.

q. Adjust the belt tension by tightening the adjusting screw at the back of the slide plate, tighten the jam nut. Tighten the four M8 screws.

NOTE: The proper adjustment of the belt tension is when it stops "flapping" while the motor is running. Electrical continuity between the slide plate and the stand-off plate is necessary.

r. Loosen the set screw (3mm allen wrench) on the motor pulley just enough so it will not drop.

s. With reference to Figure 4-4, adjust the motor pulley so that there is a .005"/.010" gap between the belt edge and the pulley surface on the worm shaft.

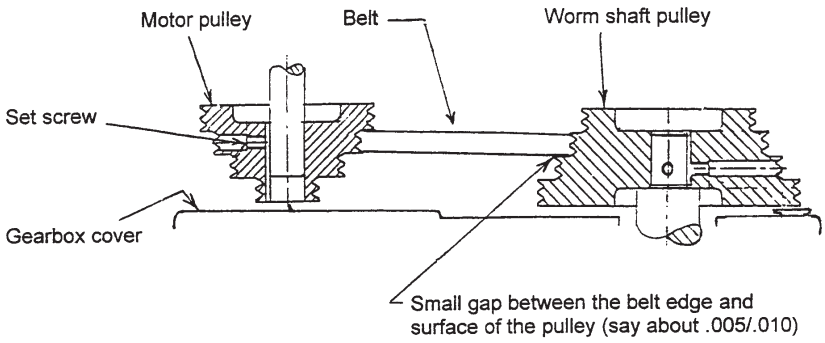


Figure 4.4 - Motor Pulley Adjustment

t. Install the rear belt guard to the pump followed by the front belt guard and screw the two side screws. Make sure that the front belt guard catches the shoulder washer in front of the pump.

u. Screw the two cap screws that hold the rear belt guard and slightly push the front belt guard against the shoulder washer and tighten the two cap screws.

4.5 Troubleshooting

Troubleshooting of the Encore 700 Series Metering Pump consists of procedures and instructions for repair and/or replacement of subassemblies and components.

The troubleshooting procedures are limited to fault isolation to a defective item. Potential problems that could be at fault and recommendations for corrective action are listed in Table 4.3. Procedures are based on potential fault conditions that may occur under normal pump operation.

Table 4.3 - Troubleshooting

Fault Condition	Possible Cause	Corrective Action
No Feed Rate or Insufficient Feed Rate.	Zero or insufficient stroke length.	Adjust to proper stroke length.
	Ball valves on suction or discharge side do not close tightly.	Replace balls in valves. Remove possible deposits in valves or pump head. Replace pump head.
	Gas in suction line or pump head.	Check for cavitation and, if necessary, use a suction line with a larger inside diameter. Dilute the liquid (sodium hypochlorite).
	Air in suction line or pump head.	Bleed the suciton line and pump head.
	Supply tank is empty.	Fill supply tank.
	Shut-off valves in suction or discharge lines are closed.	Open valves.
	Strainer is clogged.	Clean strainer.
	Damaged drive mechanism.	Check mechanism and replace defective parts.
No Feed Rate on Point of Application, Though Pump is Running.	Pressure relief valve is defective or misadjusted, so that the liquid flows back into the supply tank.	Adjust pressure relief valve to proper relief pressure.
Liquid is Emerging From Pump Head Near the Diaphragm.	Broken diaphragm or broken crosshead oil seal.	Replace diaphragm, or replace oil seal.
Pump is Pumping Erratically or Feed Rate is Inaccurate.	No back pressure.	Install back pressure valve into the discharge line. Discharge pressure must be at least 15 PSI more than the suction pressure.
Erratic Diaphragm Movement or No Movement At All. Diaphragm Movement Does Not Correspond to the Stroke Length Setting of the Knob.	Adjuster bearing (23) is loose or completely unscrewed.	Remove the knob and tighten the adjuster bearing. Clean the threads of oil and apply "Locktite 242".
Extremely Noisy or Hot Gear Box.	Insufficient lubrication or defective bearing(s).	Check oil level through oil check hole, if required, replace bearing(s).
	Incorrect worm shaft end play.	Add or remove shims to achieve proper clearance.
Motor Will Not Run.	Power off or fuse is blown.	Turn on the power. Replace the fuse after correcting the cause.

Table 4.3 - Troubleshooting (Cont'd)

Motor is Hot, But Starts When Cool.	Overload protector has opened.	Check supply voltage. Check excessive pressure at point of application. Check binding pump mechanism.
Belt is Noisy.	Worn belt. Pulley misaligned. Pulley out of round; wobbly.	Replace belt. Adjust tension by the tensioning screw. Align pulley per procedure found on in Section 4.4.6 (Gearbox Cover Installation for Pulley Drive), steps q through u.

WARNING LABELS AND TAGS

The following warning labels and tags are attached to the equipment:

AAA3769: THIS EQUIPMENT MAY HANDLE HAZARDOUS MATERIALS WHICH CAN CAUSE SEVERE PERSONAL INJURY. OBSERVE THE FOLLOWING:

THIS EQUIPMENT MUST BE INSTALLED, OPERATED, SERVICED BY TRAINED QUALIFIED PERSONNEL, WHO ARE THOROUGHLY FAMILIAR WITH THE CONTENTS OF THE INSTRUCTION BOOK.

TURN OFF POWER BEFORE SERVICING TO AVOID ELECTRICAL SHOCK.

USE RIGID PIPE WHEN PUMPING THE HAZARDOUS MATERIALS OR AT HIGH FLUID TEMPERATURE OR AT HIGH DISCHARGE PRESSURES.

REFER TO THE SAFETY PRECAUTIONS OF THE SUPPLIER OF THE HAZARDOUS MATERIAL AND THE EQUIPMENT INSTRUCTION BOOK FOR FURTHER IMPORTANT DETAILS AND PRECAUTIONS.

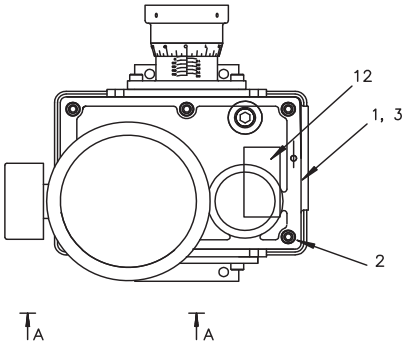
USE APPROPRIATE PROTECTIVE CLOTHING AND EYE PROTECTION, AS RECOMMENDED BY THE CHEMICAL MANUFACTURER.

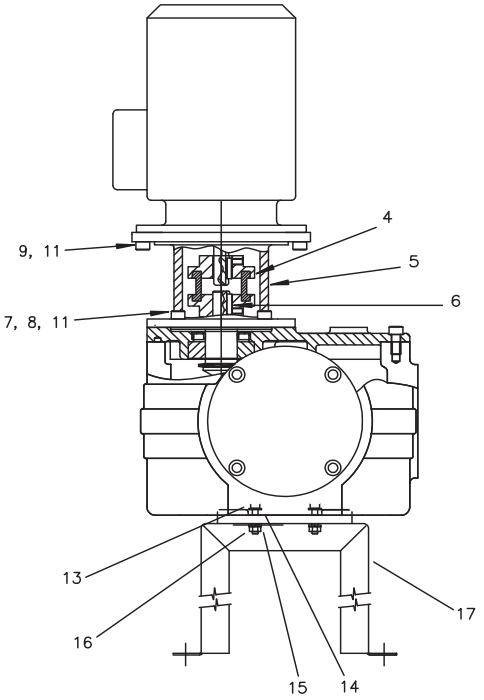
AAA3759: TO PREVENT POSSIBLE SEVERE PERSONAL INJURY DUE TO BEING SPRAYED WITH HAZARDOUS LIQUID UNDER PRESSURE DO NOT DISCONNECT DISCHARGE TUBE/PIPE/MAIN CONNECTION WITHOUT FIRST RELIEVING PRESSURE AND DRAINING DISCHARGE LINE. SEE INSTRUCTION BOOK FOR DETAILED GUIDANCE.

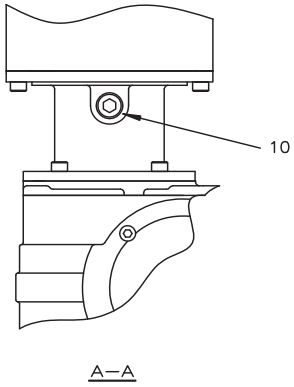
AEK3676: TO AVOID POSSIBLE SEVERE PERSONAL INJURY FROM CONTACT WITH MOVING PARTS REPLACE GUARD AFTER SERVICING EQUIPMENT.

SECTION 5 - ILLUSTRATIONS

List of Contents







NOTE: FOR PARTS LIST SEE DWG. 440.400.001.010B

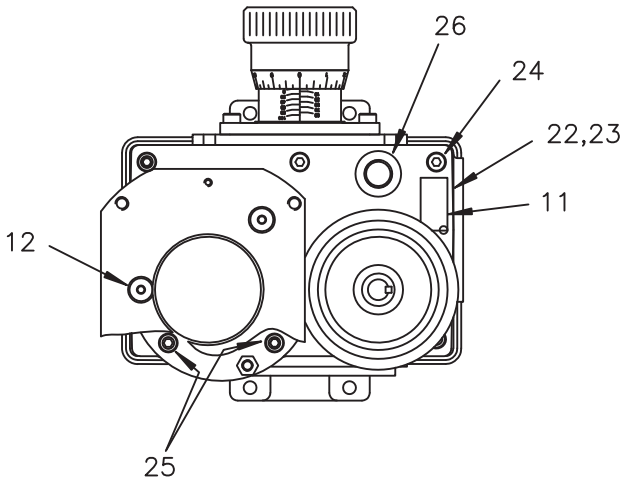
KEY NO.	PART NO.	QTY.	DESCRIPTION
1	ARQ5712	1	Cover, Simplex, Direct Drive
2	AXS3656	4	Scr., Cap, M8 x 20, Sock. Hd., 316SS
3	AAB9698	A/R	Adhesive, Silicone RTV
4	AAA9542	1	Coupling, Sure-Flex, .625"/.625", 56C
	OR		
	U19946	1	Coupling, Sure-Flex, .625"/.875", 143TC
5	AAA9554	1	Support, Motor, 56C/143TC
6	AQC3464	1	Key, 3/16 Sq. x 3/4" Lg.
7	ARE3591	2	Scr. Cap, M8 x 40 Lg., Sock. Hd., 316SS
8	AXS3656	2	Scr. Cap, M8 x 20 Lg., Sock. Hd., 316SS
9	AAA6564	4	Bolt, Sock. Hd., 3/8"-16 x 1" Lg.
10	AHS4653	1	Plug, Socket, Screw, R1/2, 316SS
11	AAA1035	A/R	Anti-Seize NI Lube 771
12	AAA1902	1	Label, Nameplate, Encore 700
13	ARE3591	4	Scr. Cap M8 x 40 Soc. Hd., 316SS
14	AWO5392	4	Washer, Flat, M8, 316SS
15	AXQ3226	4	Lockwasher, M8, 316SS
16	AAA1698	4	Nut, M8. 316SS
17	AAC7619	1	Metal Base 1-3/8", 2", 3", 4" & 5" Head (Includes Key No.'s 13, 14, 15 & 16)
	OR		
	AAC7622	1	Metal Base, 6-1/2" Head (Includes Key No.'s 13, 14, 15 & 16)

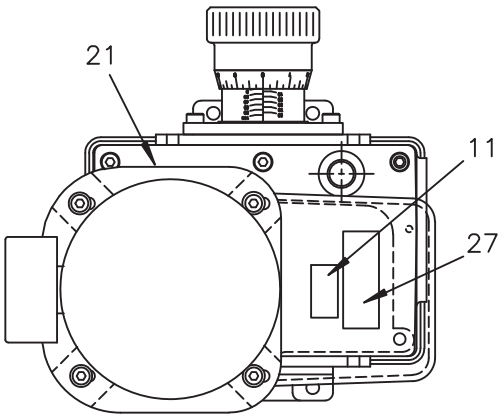
NOTE: ● Part of AAA9602
■ Part of API3492
▲ Part of AOO4751.

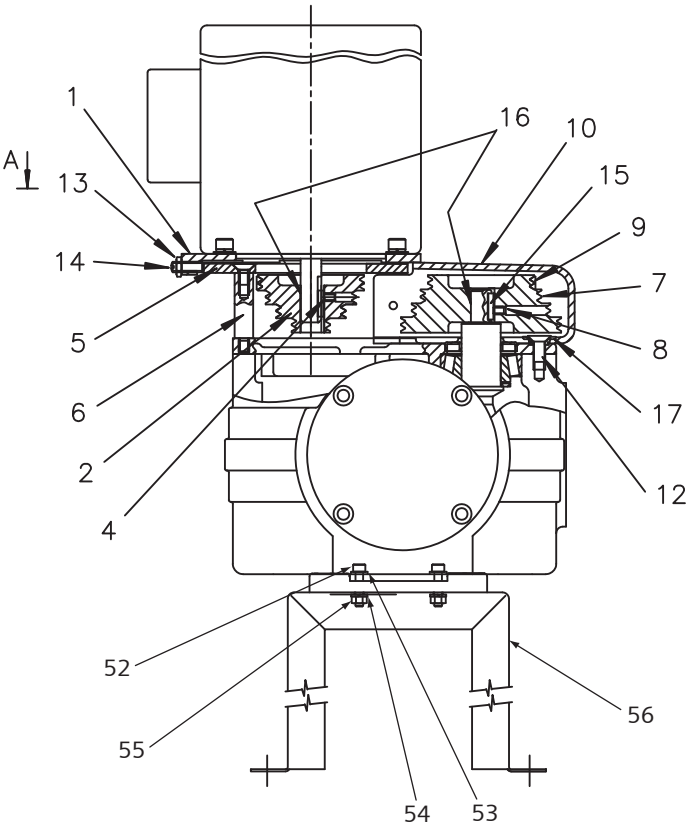
WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

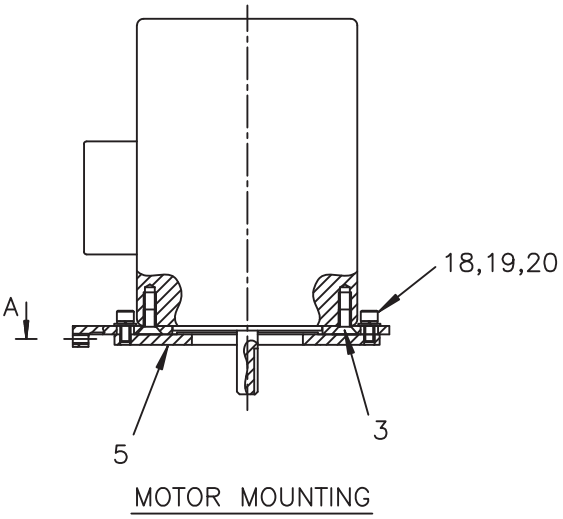
AIC3021 DIRECT DRIVE - PARTS LIST

440.400.001.010B
ISSUE 5 03/17









NOTE: FOR PARTS LIST, SEE DWG. 44.400.001.020B.

AKG3009 (W2T417632) PULLEY DRIVE - PARTS

440.400.001.020A

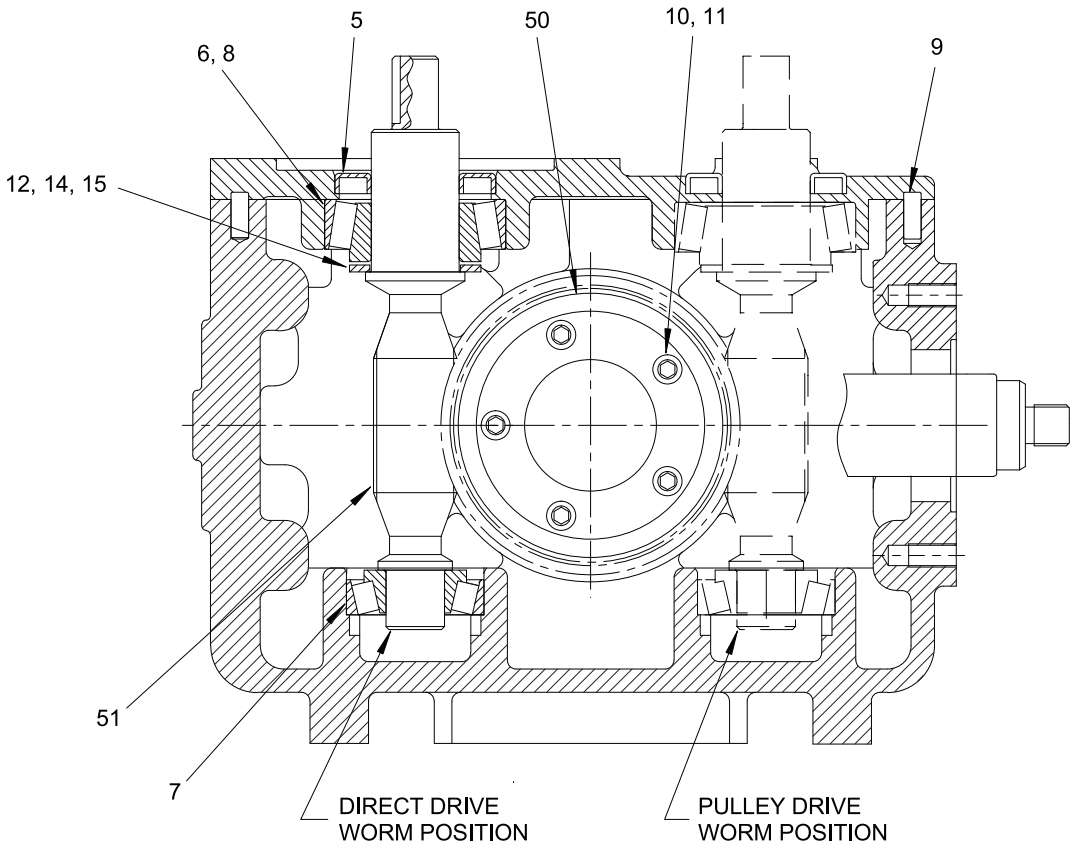
ISSUE 3 2-10

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AJA5596	1	Slide Plate, Motor 56C
2	APS3182	1	Pulley, Motor 56C, Double Groove
3	AXS3532	4	Screw, 3/8-16 x 3/4", Flat Head Cap
4	AAB2979	2	Screw, Set M6 x 12, Sock. Hd.
5	ALI3168	1	Stand Off Plate
6	AIC5131	3	Stand Off, Pulley Drive
7	AIC4746	1	Worm Pulley, Double Groove
8	AAB2979	1	Screw, Set M6 x 12 Lg.
9	APS4857	1	Joint Belt, Polyflex
10	AIC4085	1	Belt Guard
11	AEK3676	2	Label, Warning Guard
12	AQA3480	4	Scr., Flat Hd., M8 x 20, Sock., 316SS
13	AUK3630	1	Jam Nut, Hex., M8, 316SS
14	AAA3708	1	Screw, Set M8 x 25, Slotted, 316SS
15	AQC3464	1	Key, 3/16 Sq. x 3/4" Lg.
16	AAA1035	A/R	Anti-Seize NI Lubricant
17	AMK5576	1	Washer, Shoulder, Guard
18	AXS3577	4	Cap Scr., M8 x 16, Sock. Hd., 316SS
19	AWO5392	4	Washer, Flat, M8, 316SS
20	AXQ3226	4	Lock Washer, Helical, M8, 316SS
21	ATI3486	2	Cap Scr., M6 x 12, Socl. Hd., 316SS
22	ANI5724	1	Cover, Simplex Pulley Drive
23	AAB9698	A/R	Adhesive, Silicone, RTV
24	AXS3656	3	Cap Scr., M8 x 20, Sock. Hd., 316SS
25	AXS3583	2	Cap Scr., M8 x 25, Sock. Hd., 316SS
26	APP5655	1	Breather Cap
27	AAA1902	1	Nameplate, Encore 700
52	ARE3591	4	Scr. Cap M8 x 40 Soc. Hd., 316SS
53	AWO5392	4	Washer, Flat, M8, 316SS
54	AXQ3226	4	Lockwasher, M8, 316SS
55	AAA1698	4	Nut, M8. 316SS
56	AAC7619	1	Metal Base 1-3/8", 2", 3", 4" & 5" Head (Includes Key No.'s 52, 53, 54 & 55)
	OR		
	AAC7622	1	Metal Base, 6-1/2" Head (Includes Key No.'s 52, 53, 54 & 55)

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

AKG3009 (W2T417632) PULLEY DRIVE - PARTS LIST

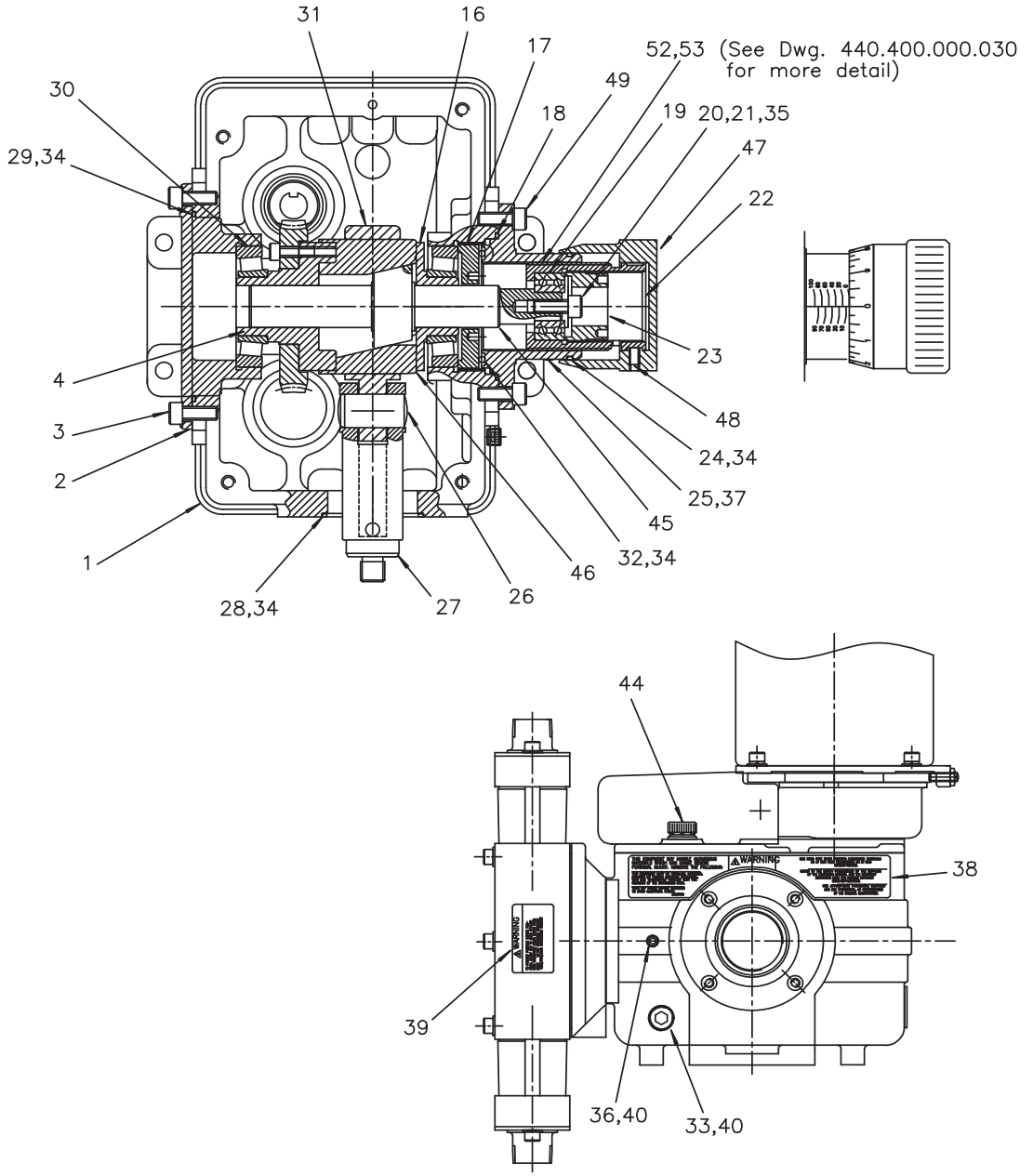
440.400.001.020B
ISSUE 4 03/17



NOTE: FOR PARTS LIST SEE DWG. 440.400.000.010C&D.

ANM4784 ENCORE® 700 METERING PUMP - PARTS
Simplex Gearbox Assembly

440.400.000.010A
ISSUE 2 2-98



NOTE: FOR PARTS LIST SEE DWGS. 440.400.000.010C&D.

ENCORE® 700 METERING PUMP - PARTS
Simplex Gearbox Assembly

440.400.000.010B
ISSUE 3 7-01

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	APQ5142	1	Gearbox, Simplex
2	AKC5702	1	Flange, Gear Access, Simplex
3	AXS3656	4	Cap Scr., M8 x 20, Sock. Hd., 316SS
4	ANM4788	1	Bushing Drive, Simplex, LMAD
5	ALI3193	1	Oil Seal, 30 x 55 x 7 , BUNA-N
6	AIC4251	1	Bearing, TPRL, 30 x 62 x 21.25mm
7	AMG3448	1	Bearing, TPRL, 20 x 47 x 15.25mm
8	AHS4651	0	Grease, (Bel-Ray Synthetic PAO Grease 2)
9	ATI3247	2	Pin, Dowel, 6 x 16, M6, Hardened
10	AUK3561	5	Cap Scr., M6 x 20, Sock. Hd., 316SS
11	AQC3041	0	"Loctite" Sealant, TL-242
12	AAA1370	●	Shim (3/32" Thk.) Wormshaft
14	AAA1373	●	Shim (1/32 Thk.) Wormshaft
15	AAA1388	●	Shim (.005 Thk.) Wormshaft
16	AIC4878	1	Bushing, Tail, LMAD
17	AKG5547	1	Nut, Preload
18	ALE4774	1	O-Ring, #152, BUNA-N
19	ARQ3426	1	Bearing, ANGC, 17 x 40 x 17.5mm
20	AVM3239	1	Washer, Oversized OD, M8
21	AXS3656	1	Cap Scr., M8 x 20, Sock. Hd., 316SS
22	AIC4016	1	Carrier, Bearing, Str. Adj.
23	AJE5116	1	Adjuster, Bearing
24	AAA3920	1	Quad-Ring #141, Auto
	OR		
	AQO4757	1	O-Ring #141 (BUNA-N) Manual
25	AKG4860	1	Housing, Stroke Adj., LMAD
26	ASG3256	1	Dowel Pin, 20 x 40mm, M8, Hardened
27	AJE4035	1	Crosshead, Diaphragm
28	ARQ4767	1	O-Ring, #138, BUNA-N
29	AJA4780	1	O-Ring, #156, BUNA-N
30	AMG3442	2	Bearing, TPRL., 35 x 72 x 18.25mm
31	ARQ5679	1	Conrod, Splex, Dplex (Mach.)
32	AKG4976	1	O-Ring, #332, BUNA-N
33	AHS4653	1	Plug, R1/2, Socket Head
34	AAA3791	0	Silicone Grease, Light
35	AQC3041	0	"Loctite" Sealant, TL-242
36	AAC4634	1	Plug, Socket, Screw R1/8, 316SS
37	AOO4043	1	Label, Str. Adj., LMAD
38	AAA3769	1	Warning Label, Gearbox
39	AAA3759	1	Warning Label, Liquid End
40	E942	0	Tape, Thread Sealant
41	AAA3726	1	Label, Dataplate, LMAD
43	AAA1902	1	Label, Nameplate, Encore 700

NOTE: ● AS REQUIRED

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

ENCORE® 700 METERING PUMP - PARTS LIST
Simplex Gearbox Assembly

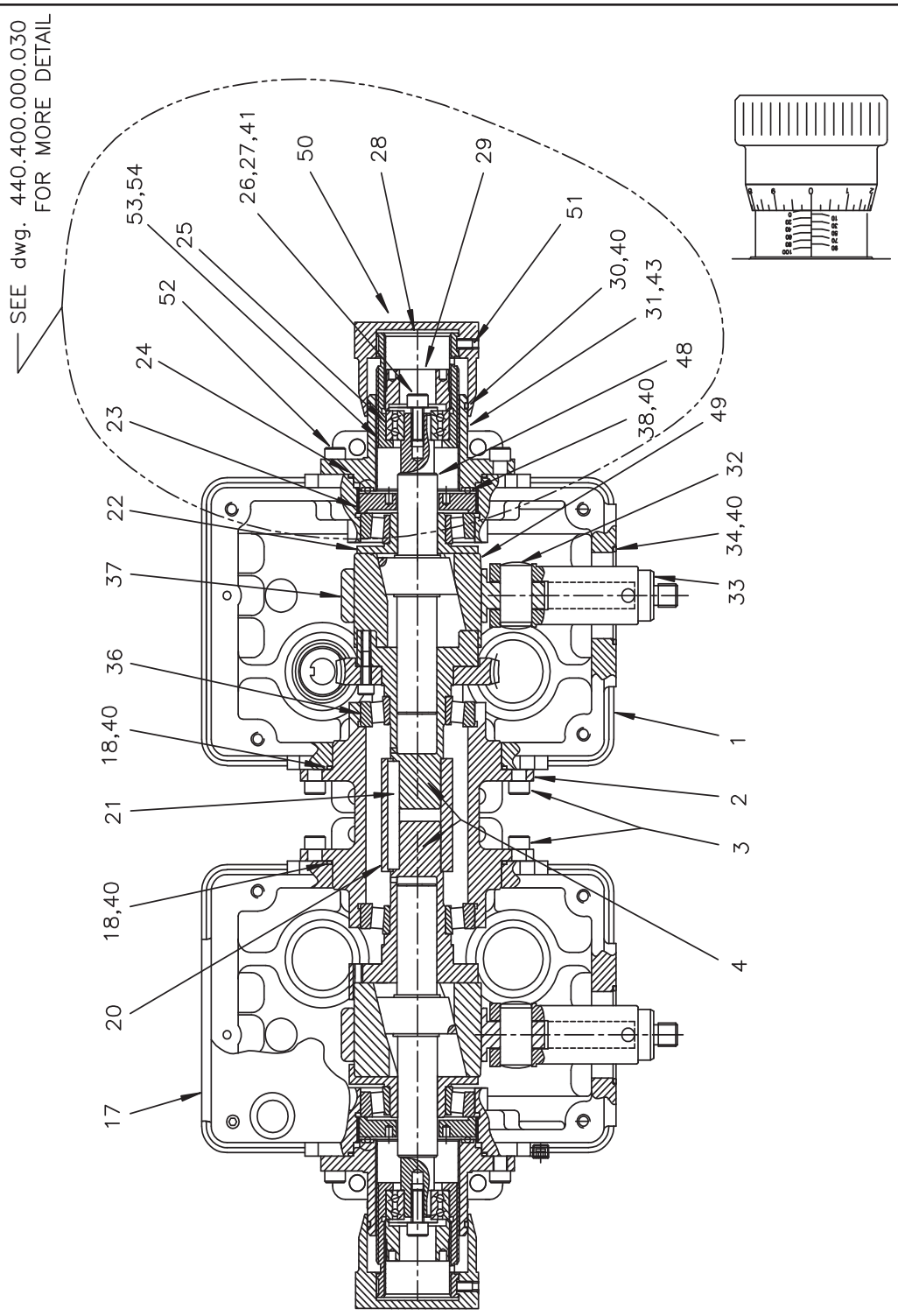
440.400.000.010C
ISSUE 4 5 03/17

KEY NO.	PART NO.	QTY	DESCRIPTION
44	APP5655	1	Breather Cap
45	APS4845	1	Shaft, Eccentric, 4.8mm Stroke (1-3/8" & 2" Liquid End Only)
	OR		
	ALI4852	1	Shaft, Eccentric, 9.6mm Stroke
46	AIA4800	1	Sheave, 4.8mm Stroke (1-3/8" & 2" Liquid End Only)
	OR		
	AIA4795	1	Sheave, 9.6mm Stroke
47	ANI4750	1	Knob, Str., Adj., LMAD (Mach.), Manual
	OR		
	AJA3455	1	Knob, Str., Adj., Auto
48	AAA2382	3	Scr., Set, M6 x 10, Flat, Skt., Nyl., 316
49	AXS3656	4	Cap., Scr., M8 x 20, Sock. Hd., 316SS
50	ASS3183	1	Drive Gear, Worm, Ratio 10 (144 SPM @ 50Hz)
	OR		
	AOK3192	1	Drive Gear, Worm, Ratio 12 (144 SPM)
	OR		
	ARQ3199	1	Drive Gear, Worm, Ratio 24 (72 SPM)
	OR		
	AKC3205	1	Drive Gear, Worm, Ratio 48 (36 SPM)
51	AAA9530	1	Worm Shaft, Ratio 10 (144 SPM @ 50Hz)
	OR		
	AAA9533	1	Worm Shaft, Ratio 12 (144 SPM @ 60Hz)
	OR		
	AAA9536	1	Worm Shaft, Ratio 24 (72 SPM)
	OR		
	AAA9539	1	Worm Shaft, Ratio 48 (36 SPM)
52	AAB5789	2	Pawl, detent (used with manual stroke adjustment only)
53	AAB5786	2	Spring, detent (used with manual stroke adjustment only)
	AAA4820	1	Plastic Base (Not Pictured) (Includes Key No.'s 52 & 53)

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

ENCORE® 700 METERING PUMP - PARTS LIST
Simplex Gearbox Assembly

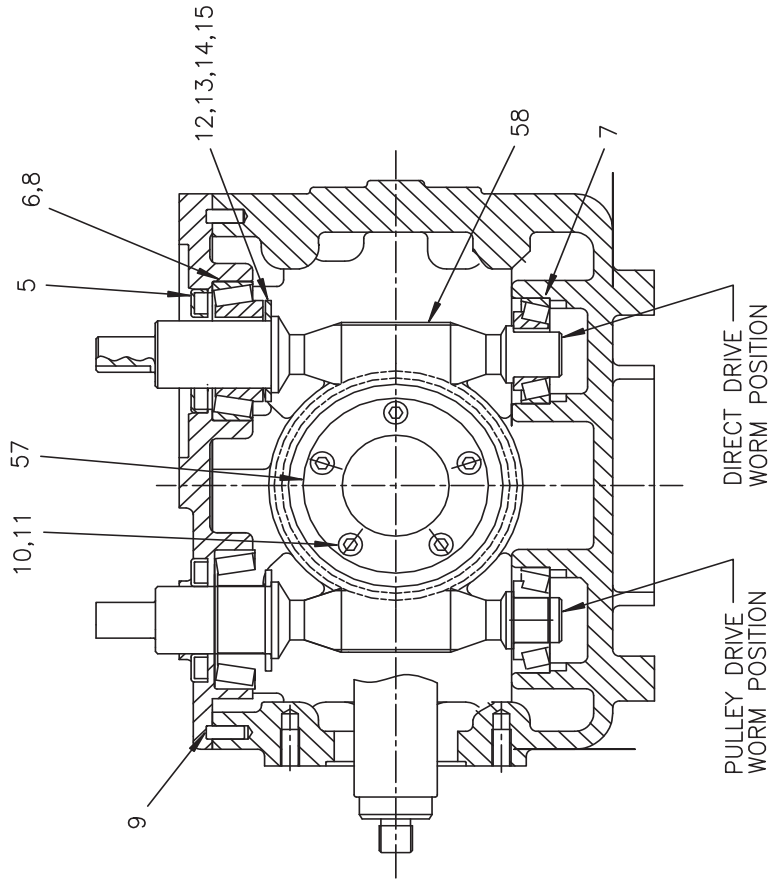
440.400.000.010D
ISSUE 6 03/17

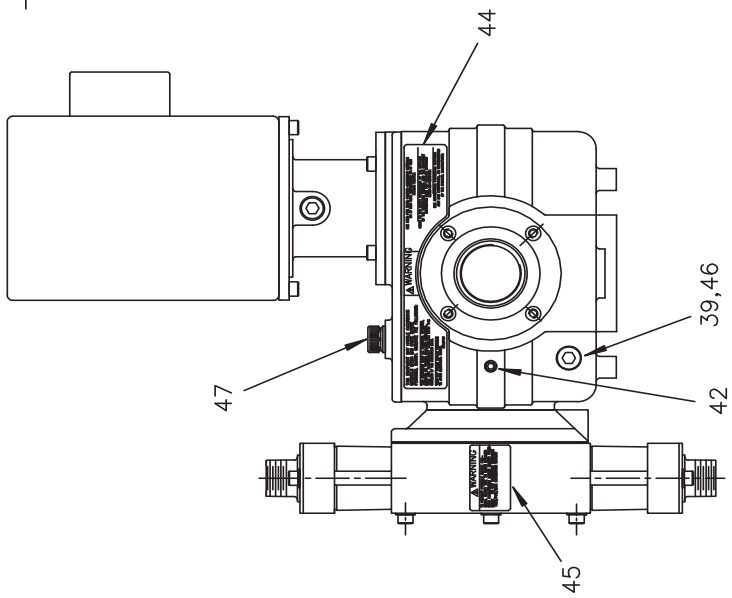


NOTE: FOR PARTS LIST SEE DWGS. 440.400.000.020C&D.

ENCORE® 700 METERING PUMP - PARTS
Double Simplex Gearbox Assembly

440.400.000.020A
ISSUE 4 03/17





NOTE: FOR PARTS LIST SEE DWGS. 440.400.000.020C&D.

ENCORE® 700 METERING PUMP - PARTS
Double Simplex Gearbox Assembly

440.400.000.020B
ISSUE 4 2-10

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	APQ5142	1	Gearbox, Simplex
2	AJA5697	1	Connection, DSplex,
3	AXS3656	8	Cap Scr., M8 x 20, Sock. Hd., 316SS
4	AKG4783	2	Bushing Drive, DSplex
5	ALI3193	1	Oil Seal, 30 x 55 x 7, BUNA
6	AIC4251	1	Bearing, TPRL, 30 x 62 x 21.25mm
7	AMG3448	1	Bearing, TPRL, 20 x 47 x 15.25mm
8	AHS4651	0	Grease, Sunaplex, #992 EP
9	ATI3247	2	Dowel Pin, 6 x 16, M6
10	AQC3041	0	"Locktite" Sealant, TL-242
11	AUK3561	5	Scr. Cap, M6 x 20, Sock. Hd., 316SS
12	AAA1373	1	Shim (.79mm Thick)
15	AAA1388	2	Shim (.13mm Thick)
17	ALI5148	1	Gearbox, Double Simplex
18	AJA4780	2	O-Ring (156) BUNA-N
20	AMK4076	1	Coupling, Rigid, DSplex
21	ATI3361	1	Key, 8 x 7/63
22	AIC4878	2	Tail Bushing
23	AKG5547	2	Preload Nut
24	ALE4774	2	O-Ring (152) BUNA-N
25	ARQ3426	2	Bearing, Angc, 17 x 40 x 17.5
26	AVM3239	2	Washer, Oversized OD, M8
27	AXS3656	2	Cap Scr., M8 x 20, Sock. Hd., 316SS
28	AIC4016	2	Carrier, Bearing
29	AJE5116	2	Adjuster, Bearing
30	AAA3920	2	Quad-Ring #141, Auto
	OR		
	AQO4757	2	O-Ring (141) BUNA-N, Manual
31	AKG4860	2	Housing
32	ASG3256	2	Dowel Pin, 20 x 40mm, M6
33	AJE4035	2	Crosshead, Diaphragm
34	ARQ4767	2	O-Ring (138) BUNA-N
36	AMG3442	4	Bearing, TPRL, 35 x 72 x 18.25
37	ARQ5679	2	Conrod
38	AKG4976	2	O-Ring (332) BUNA-N
39	AHS4653	2	Plug, R1/2 Socket Head
40	AAA3797	0	Silicone Grease, Light
41	AQC3041	-	Sealant, Loctite TL-242
42	AAC4634	2	Plug, Socket, Screw R1/8, 316SS
43	AOO4043	2	Label, Str. Adj.
44	AAA3769	2	Warning Label
45	AAA3759	2	Warning Label
47	APP5655	2	Breather Cap

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

ENCORE® 700 METERING PUMP - PARTS LIST
Double Simplex Gearbox Assembly

440.400.000.020C
ISSUE 6 03/17

KEY NO.	PART NO.	QTY	DESCRIPTION
48	APS4845	2*	Shaft, Eccentric, 4.8mm Stroke
	OR		
	ALI4852	2*	Shaft, Eccentric, 9.6mm Stroke
49	AIA4800	2*	Sheave, 4.8mm Stroke
	OR		
	AIA4795	2*	Sheave, 9.6mm Stroke
50	ANI4750	2	Knob, Str., Manual
	OR		
	AJA3455	2	Knob, Str., Adj., Auto
51	AAA2382	6	Scr., Set, M6 x 10, Flat, Skt., Nyl., 316
52	AXS3656	8	Cap., Scr., M8 x 20, Sock. Hd., 316SS
53	AAB5789	4	Pawl, Detent (Used with Manual Stroke Adjustment only)
54	AAB5786	4	Spring, Detent (Used with Manual Stroke Adjustment only)
57	ASS3183	1	Drive Gear, Worm, Ratio 10 (144 SPM @ 50Hz)
	OR		
	AOK3192	1	Drive Gear, Worm, Ratio 12 (144 SPM)
	OR		
	ARQ3199	1	Drive Gear, Worm, Ratio 24 (72 SPM)
	OR		
	AKC3205	1	Drive Gear, Worm, Ratio 48 (36 SPM)
58	AAA9530	1	Worm Shaft, Ratio 10 (144 SPM @ 50Hz)
	OR		
	AAA9533	1	Worm Shaft, Ratio 12 (144 SPM @ 60Hz)
	OR		
	AAA9536	1	Worm Shaft, Ratio 24 (72 SPM)
	OR		
	AAA9539	1	Worm Shaft, Ratio 48 (36 SPM)

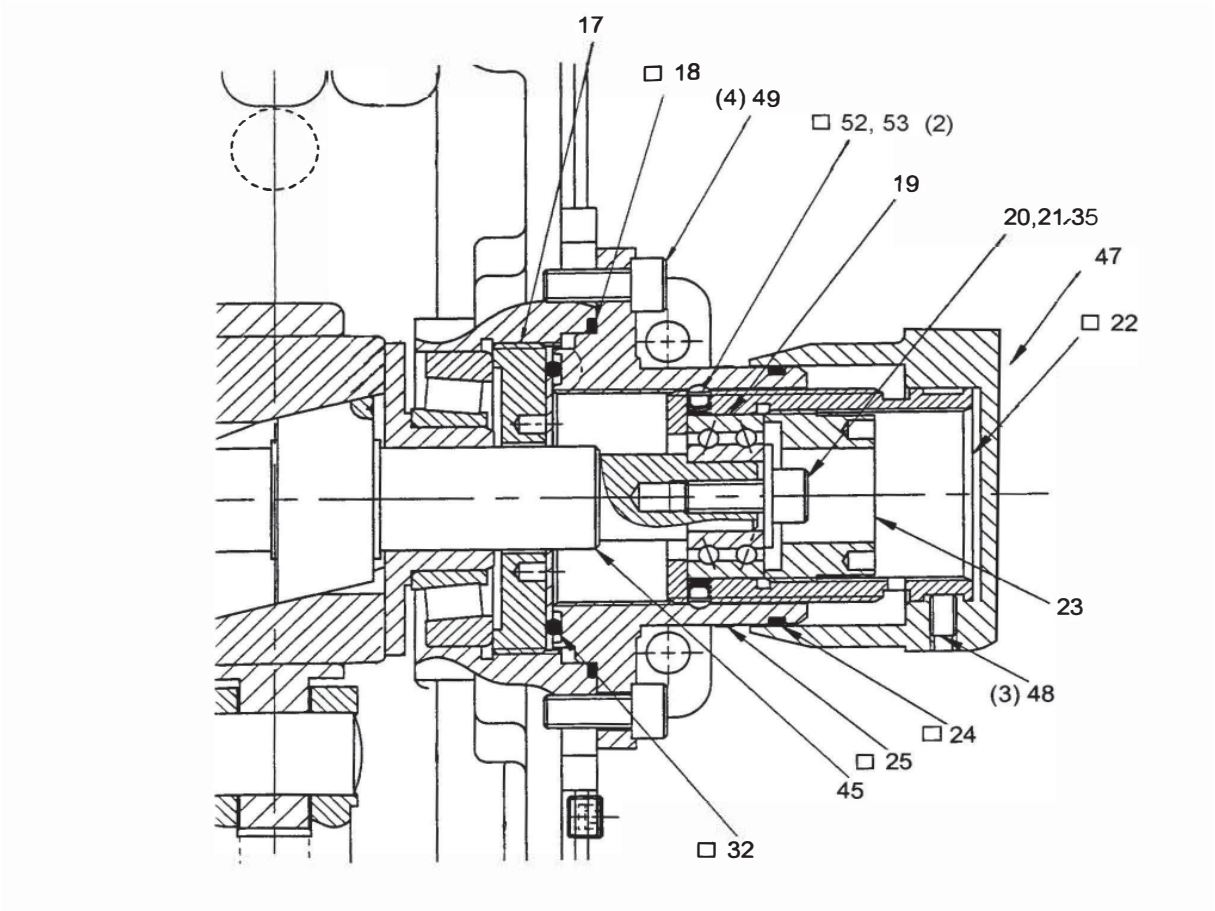
NOTES:

* TWO REQUIRED; MAY BE A COMBINATION OF ONE 4.8 MM STROKE AND ONE 9.6 MM STROKE. 1-3/8" AND 2" HEADS REQUIRE A 4.8 MM STROKE. 3", 4", 5", AND 6-1/2" HEADS REQUIRE A 9.6 MM STROKE. ECCENTRIC SHAFT AND SHEAVE MUST HAVE THE SAME STROKE.

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

ENCORE® 700 METERING PUMP - PARTS LIST
Double Simplex Gearbox Assembly

440.400.000.020D
ISSUE 6 03/17

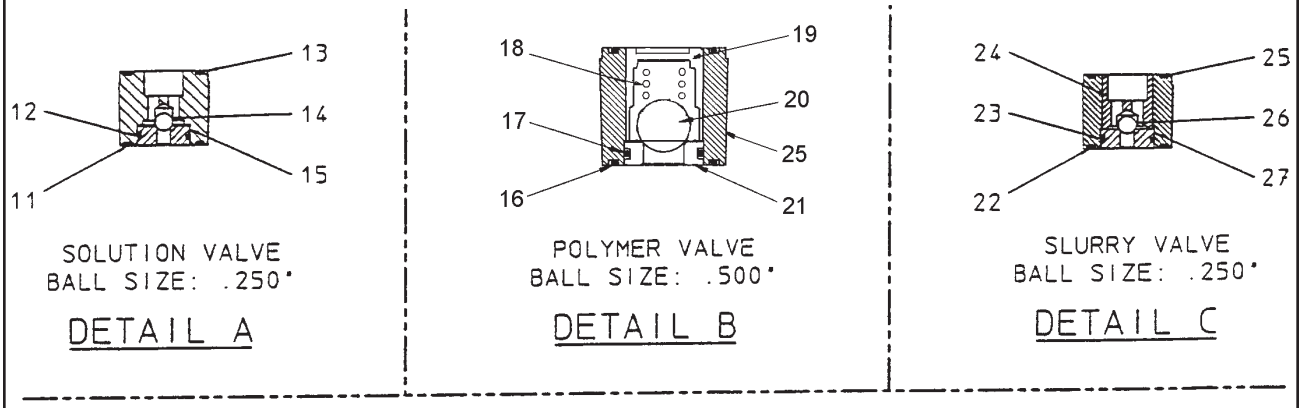


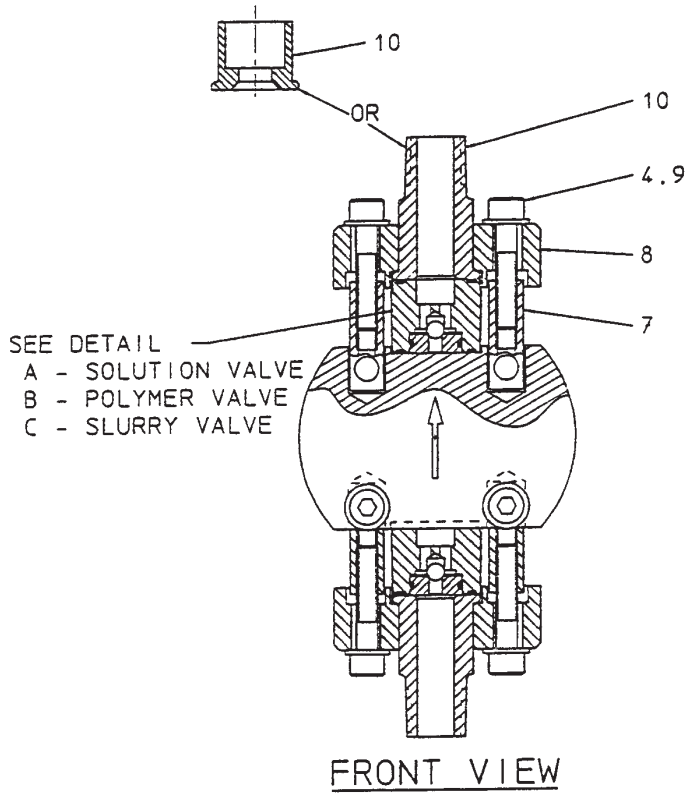
KEY NO.	PART NO.	QTY.	DESCRIPTION
17	AKG5547	1	NUT, PRELOAD
18	ALE4774	1	O-RING (#152) BUNA-N
19	ARQ3426	1	BEARING, 17 x 40 x 17.5MM
20	AVM3239	1	WASHER, OVERSIZED OD, M8
21	AXS3656	1	CAP SCR. M8 x 20, SOC. HD.
22	AIC4016	1	CARRIER BEARING, STR. ADJ.
23	AJE5116	1	ADJUSTER, BEARING
24	AQO4757	1	O-RING (#141) BUNA-N
25	AAB5783	1	HOUSING, STR. ADJ., LABELED
32	AKG4976	1	O-RING (#332) BUNA-N
35	AQC3041	-	SEALANT, LOCTITE TL-242
45	ALI4852	1	ECCENTRIC SHAFT, 9.6MM STROKE
	OR		
	APS4845	1	ECCENTRIC SHAFT, 4.8MM STROKE
47	ANI4750	1	KNOB
48	AAA2382	3	SET SCR. M6 x 10, "NYLOK"
49	AXS3656	4	CAP SCR. M8 x 20, SOC. HD.
52	AAB5789	2	PAWL, DETENT
53	AAB5786	2	SPRING, DETENT

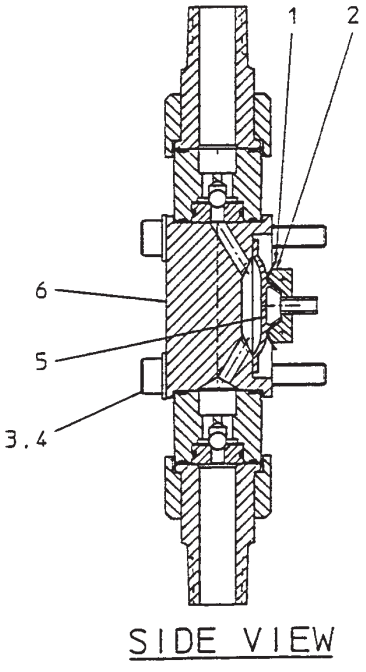
WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

DETENT STROKE ADJUSTMENT KIT - PARTS
Common to Simplex and Double Simplex

440.400.000.030
ISSUE 2 03/17





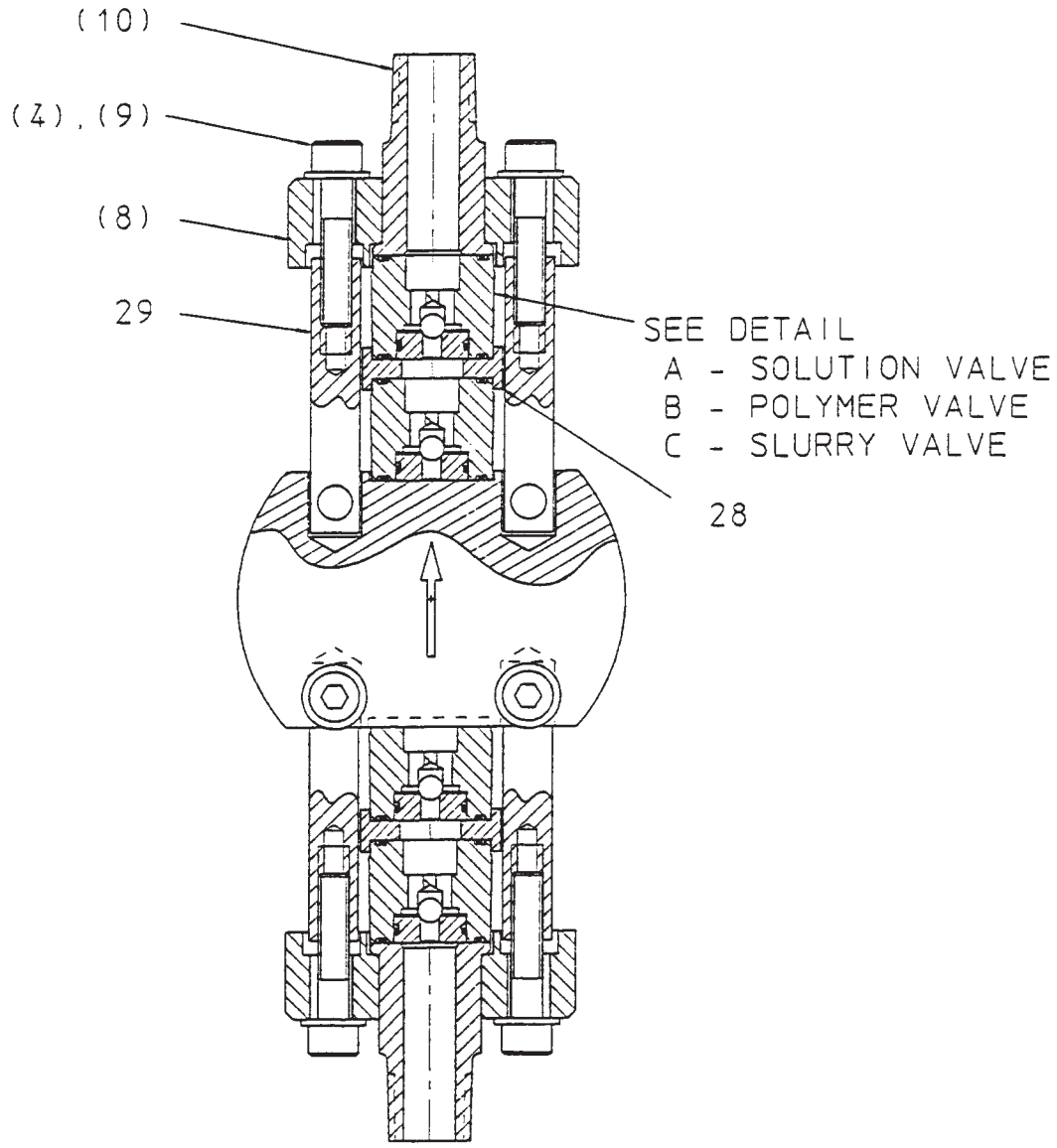


NOTE: FOR PARTS LIST SEE DWGS. 440.050.010.010C&D.

1-3/8" CARTRIDGE LIQUID END - PARTS

440.050.010.010A

ISSUE 2 4-09



SOLUTION
DOUBLE BALL VALVE
BALL SIZE: .250"

NOTE: ( ) INDICATES REFERENCED PARTS.

1-3/8" CARTRIDGE LIQUID END - PARTS

440.050.010.010B
ISSUE 0 6-95

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AKG5103	1	Disc, Backing, 1.375" Diaphragm
2	ALI5124	1	Ring, Backup, 1.375" Diaphragm
3	AQA3639	4	Screw, Cap, M8 x 100, Sock. Hd., 316SS
4	AWO5392	8	Washer, Flat M8, 316SS
5	AQO4074	1	Diaphragm, 1.375"
6	APS4346	1	Head, 1.375" Diaphragm, PVC
	OR		
	AIC4339	1	Head, 1.375" Diaphragm, PVDF
	OR		
	AAB2525	1	Head, 1.375" Diaphragm, 316SS
7	APS5528	4	Eyenut, Valve, SB, 1.375" & 2" Head
8	AMK5551	2	Clamp, 1.375" & 2" Head, PVC
	OR		
	AAB2720	2	Clamp, 1.375" & 2" Head, SST
9	ARE3591	4	Screw, Cap, M8 & 40, Soc. Hd., 316SS
10	ALI4883	2	Conn., M, 1.375" & 2" Head, 1/2" NPT, PVC
	OR		
	ALI4896	2	Conn., M, 1.375" & 2" Head, 1/2" NPT, PVDF
	OR		
	AAB2732	2	Conn., M, 1.375" & 2" Head, 1/2" NPT, 316SS
	OR		
	AIA4890	2	Conn., M, 1.375" & 2" Head, R 1/2 BSP, PVC
	OR		
	AOO4969	2	Conn., Sock. 1.375" & 2" Head, 1/2" Pipe, PVC
11	AMK5913	4	O-Ring (022) Viton, 25.12 ID x 1.78mm
	OR		
	AIA5772	4	O-Ring (022) Hypalon, 25.12 ID x 1.78mm
	OR		
	AAC6254	4	O-Ring (022) EPDM, 25.12 ID x 1.78mm
12	AMK5919	2	O-Ring (016) Viton, 15.60 ID x 1.78mm
	OR		
	AMK5705	2	O-Ring (016) Hypalon, 15.60 ID x 1.78mm
	OR		
	AAC6251	2	O-Ring (016) EPDM, 15.60 ID x 1.78mm
13	AIA5148	2	Guide, Ret., .250" Ball, PVC Mold.
	OR		
	AOO5141	2	Guide, Ret., .250" Ball, PVDF
	OR		
	AAC5375	2	Guide, Ret., .250" Ball, 316SS
14	AFM5842	2	Ball, .250" 316SS
	OR		
	AHQ5882	2	Ball, .250" PTFE
	OR		
	ACG3695	2	Ball, .250" Ceramic
15	APQ5049	2	Seat, .250" Ball 316SS
	OR		
	AJE5015	2	Seat, .250" Ball PVC
	OR		
	ANM5023	2	Seat, .250" Ball Ceramic

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

1-3/8” CARTRIDGE LIQUID END - PARTS LIST

440.050.010.010C

ISSUE 6 03/17

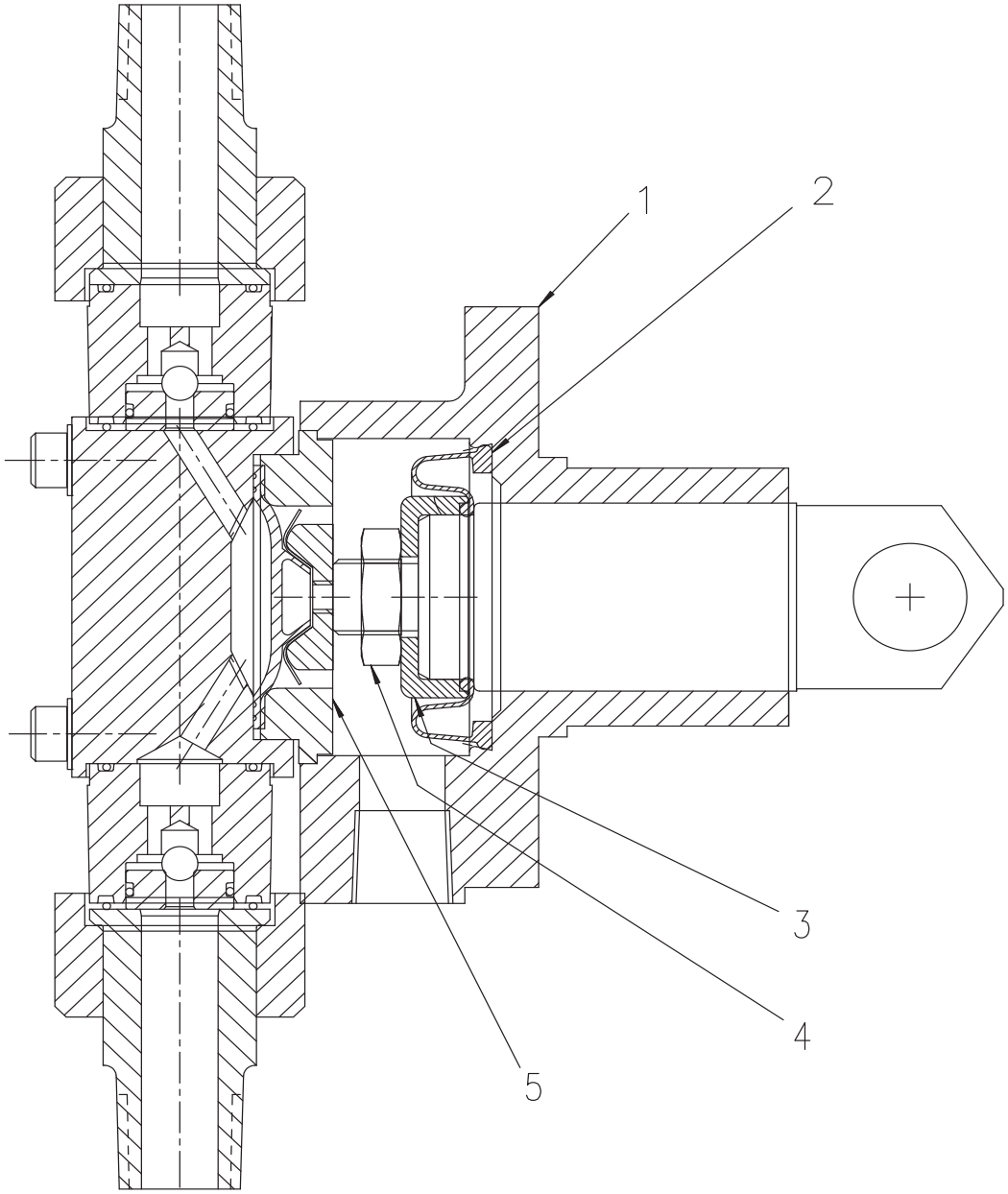
KEY NO.	PART NO.	QTY.	DESCRIPTION
16	AMK5913	4	O-Ring (022) Viton, 25.121 ID x 1.78mm
17	AMK5919	2	O-Ring (016) Viton, 15.60 ID x 1.78mm
18	AOO4265	2	Spring, .50" Ball
19	AAB9599	2	Guide, Polymer, .500" Ball, PVC
20	AAA5905	2	Ball, .500" PTFE
21	ANM4382	2	Seat, .500" Ball, PVC
22	AIA5772	4	O-Ring (022) Hypalon, 25.121 ID x 1.78mm
23	AMK5705	2	O-Ring (016) Hypalon, 15.60 ID x 1.78mm
24	AMK5077	2	Guide, Slurry, .250" Ball, Lift 1.5mm SST
25	APS4995	2	Retainer, PVC
26	AFM3749	2	Ball, .250" Polyurethane
27	AOO5055	2	Seat, .250" Ceramic
28	APS4954	2	Adapter, .250" & .500" Ball, PVC
	OR		
	AAA5801	2	Adapter, .250" & .500" Ball, 316 SS
	OR		
	AJE4961	2	Adapter, V, .250" & .500" Ball, PVDF
29	APQ5533	4	Eyenut, Valve, DB, 1.375" & 2" Head

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

1-3/8” CARTRIDGE LIQUID END - PARTS LIST

440.050.010.010D

ISSUE 2 03/17



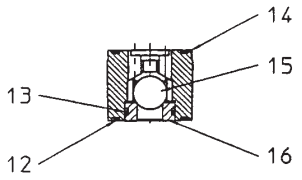
KEY NO.	PART NO.	QTY.	DESCRIPTION
1	ALE4874	1	ADAPTER, 1.375" DIAPHRAGM
2	AAB7205	1	SEAL, BELLOW, CROSSHEAD
3	AJA5915	1	CLAMP, DIAPHRAGM, BELLOW
4	AMK4863	1	NUT, M14 x 1
5	AIA5111	1	SPACER, 1.375" DIAPHRAGM

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

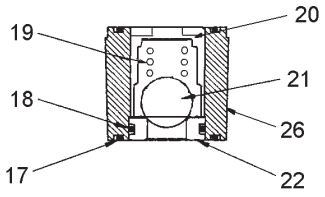
1-3/8” LIQUID END ADAPTER - PARTS

440.400.001.030

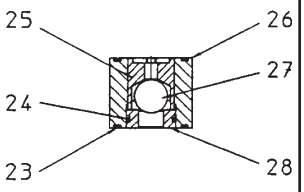
ISSUE 2 1-10



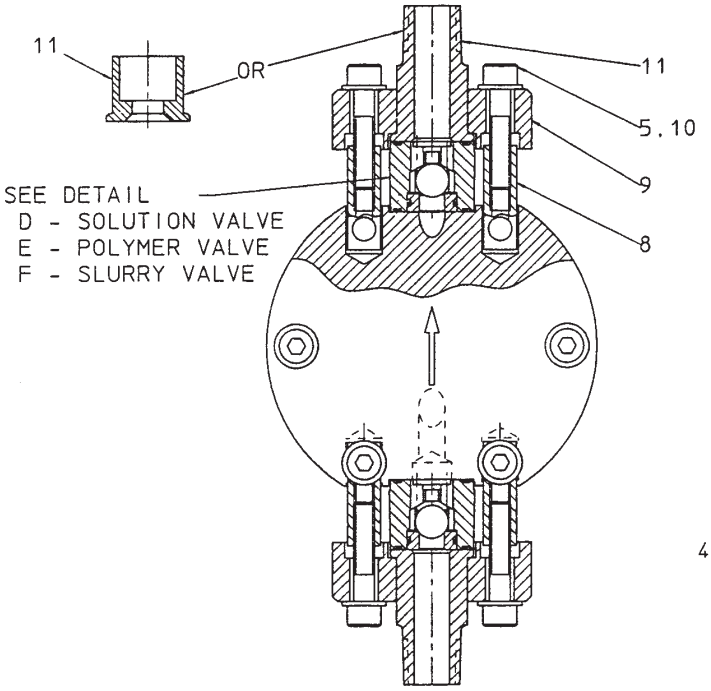
SOLUTION VALVE
BALL SIZE: 0.5"
DETAIL D



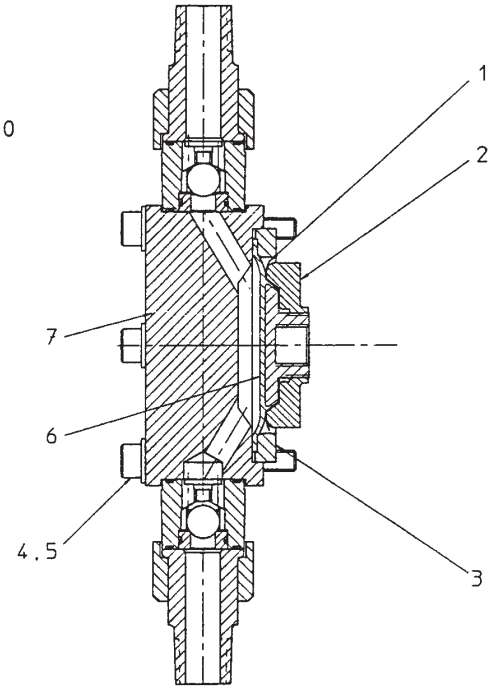
POLYMER VALVE
BALL SIZE: 0.5"
DETAIL E



SLURRY VALVE
BALL SIZE: 0.5"
DETAIL F



FRONT VIEW

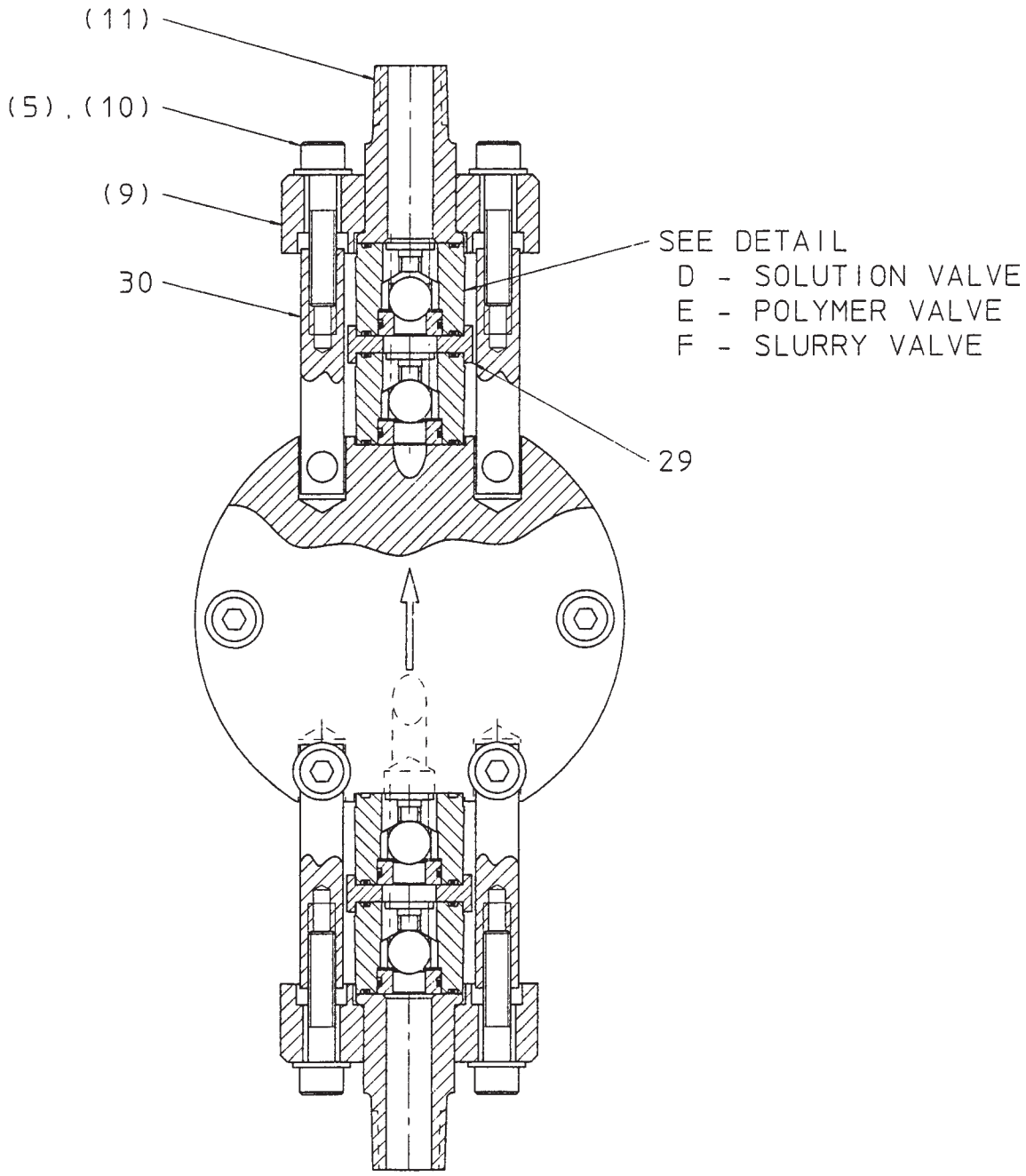


SIDE VIEW

NOTE: FOR PARTS LIST SEE DWGS. 440.050.010.030C&D.

2" CARTRIDGE LIQUID END - PARTS

440.050.010.030A
ISSUE 2 4-09



NOTE: ( ) INDICATES REFERENCED PARTS.

2" CARTRIDGE LIQUID END - PARTS

440.050.010.030B

ISSUE 0 6-95

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AAA3323	1	Disc, Backing, 2" Diaphragm
2	AJE4030	1	Ring, Backup, 2" Diaphragm
3	AIC5296	1	Spacer, 2" Diaphragm
4	AVM3618	6	Screw, Cap, M8 x 60, Sock. Hd., 316SS
5	AWO5392	10	Washer, Flat M8, 316SS
6	AMG4773	1	Diaphragm, 2"
7	AOO5277	1	Head, 2" Diaphragm, PVC
	OR		
	APQ5281	1	Head, 2" Diaphragm, Kynar
	OR		
	AAB2528	1	Head, 2" Diaphragm, 316SS
8	APS5528	4	Eyenut, Valve, SB, 1.375" & 2" Head
9	AMK5551	2	Clamp, 1.375" & 2" Head, PVC
	OR		
	AAB2720	2	Clamp, 1.375" & 2" Head, SST
10	ARE3591	4	Screw, M8 & 40, Sock. Hd., 316SS
11	ALI4883	2	Conn., M, 1.375" & 2" Head, 1/2" NPT, PVC
	OR		
	ALI4896	2	Conn., M, 1.375" & 2" Head, 1/2" NPT, Kynar
	OR		
	AAB2732	2	Conn., M, 1.375" & 2" Head, 1/2" NPT, 316SS
	OR		
	AIA4890	2	Conn., M, 1.375" & 2" Head, R 1/2 BSP, PVC
	OR		
	AOO4969	2	Conn., Sock., 1.375" & 2" Head, 1/2" Pipe, PVC
12	AIA5772	4	O-Ring (022) Hypalon, 25.12 ID x 1.78mm
	OR		
	AMK5913	4	O-Ring (022) Viton, 25.12 ID x 1.78mm
	OR		
	AAC6254	4	O-Ring (022) EPDM, 25.12 ID x 1.78mm
13	AMK5705	2	O-Ring (016) Hypalon, 15.60 ID x 1.78mm
	OR		
	AMK5919	2	O-Ring (016) Viton, 15.60 ID x 1.78mm
	OR		
	AAC6251	2	O-Ring (016) EPDM, 15.60 ID x 1.78mm
14	AKG5133	2	Guide, Retainer, .500" Ball, PVC
	OR		
	AOO5050	2	Guide, Retainer, .500" Ball, Kynar
	OR		
	AAC5378	2	Guide, Retainer, .500" Ball, 316SS
15	ABE5824	2	Ball, .500" 316SS
	OR		
	AAA5905	2	Ball, .500" PTFE
	OR		
	AAC3580	2	Ball, .500" Ceramic
16	AIC4369	2	Seat, .500" Ball, 316SS
	OR		
	ANM4382	2	Seat, .500" Ball, PVC
	OR		
	AIC4376	2	Seat, .500" Ball, Kynar

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

2” CARTRIDGE LIQUID END - PARTS LIST

440.050.010.030C

ISSUE 6 03/17

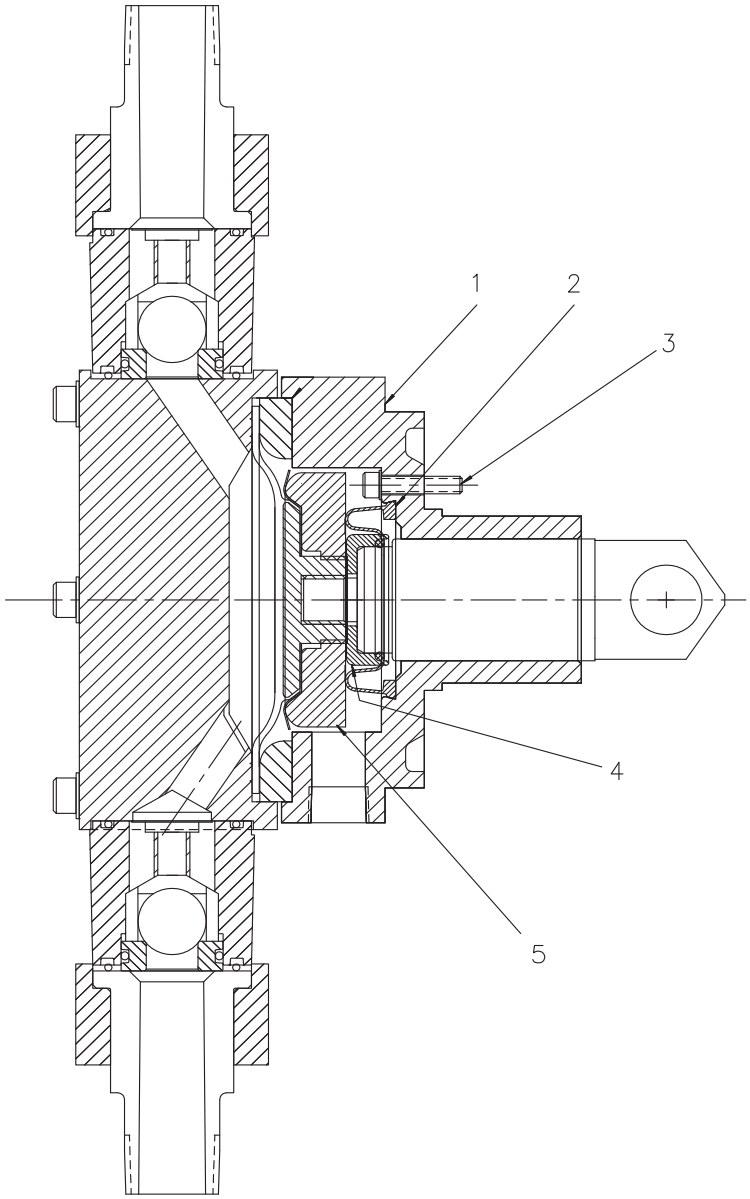
KEY NO.	PART NO.	QTY.	DESCRIPTION
17	AMK5913	4	O-Ring (022) Viton, 25.121 ID x 1.78mm
18	AMK5919	2	O-Ring (016) Viton, 15.60 x 1.78mm
19	AOO4265	2	Spring, .50" Ball
20	AAB9599	2	Guide, Polymer, .500" Ball, PVC
21	AAA5905	2	Ball, .500" PTFE
22	ANM4382	2	Seat, .500" Ball, PVC
23	AIA5772	4	O-Ring (022) Hypalon, 25.121 ID x 1.78mm
24	AMK5705	2	O-Ring (016) Hypalon, 15.60 ID x 1.78mm
25	AIA5317	2	Guide, Slurry, .500" Ball, 316SS
26	APS4995	2	Retainer, PVC
27	AEK5764	2	Ball, .500" Polyurethane
28	AMK4354	2	Seat, .500" Ball Ceramic
29	APS4954	2	Adapter, .250" & .500" Ball, PVC
	OR		
	AAA5801	2	Adapter, .250" & .500" Ball, 316 SS
	OR		
	AJE4961	2	Adapter, V, .250" & .500" Ball, Kynar
30	APQ5533	4	Eyenut, Valve, DB, 1.375" & 2" Head

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

2” CARTRIDGE LIQUID END - PARTS LIST

440.050.010.030D

ISSUE2 03/17



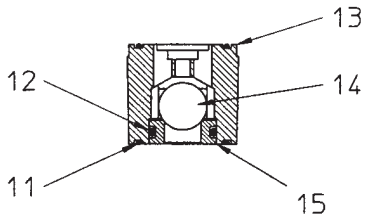
KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AQO5451	1	ADAPTER, 2" DIAPHRAGM
2	AAB7205	1	SEAL, BELLOW, CROSSHEAD
3	AXS3583	4	SCREW, CAP, M8 x 25, SOCK. HD., 316SS
4	AJA5915	1	CLAMP, DIAPHRAGM, BELLOW
5	AIC5296	1	SPACER, 2" DIAPHRAGM

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

2” LIQUID END ADAPTER - PARTS

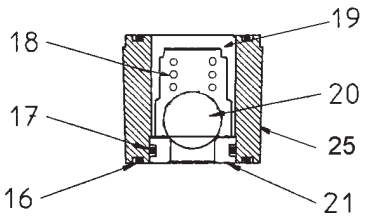
440.400.001.040

ISSUE 2 1-10



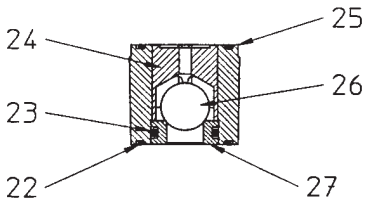
SOLUTION VALVE
BALL SIZE: .625"

DETAIL G



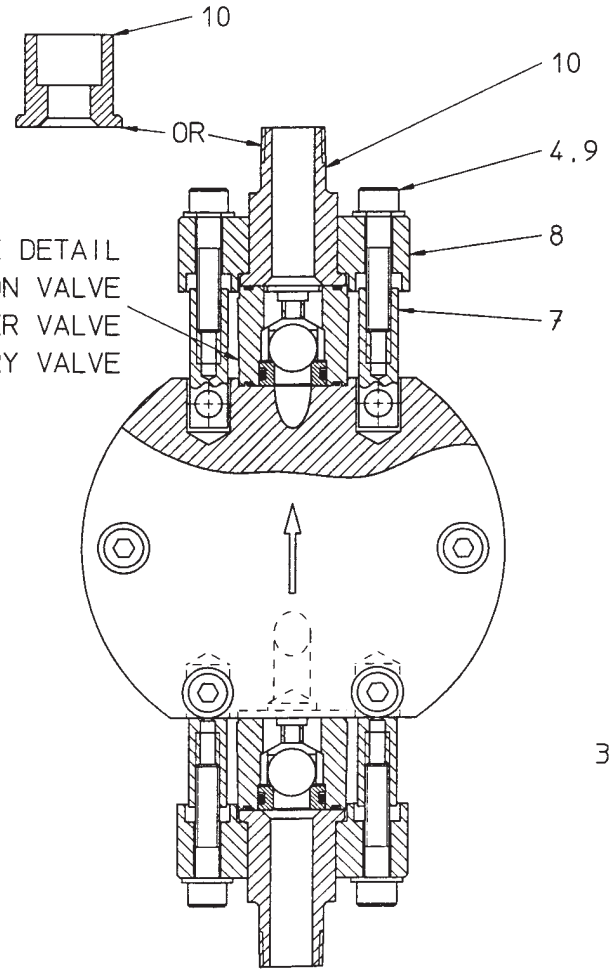
POLYMER VALVE
BALL SIZE: .625"

DETAIL H

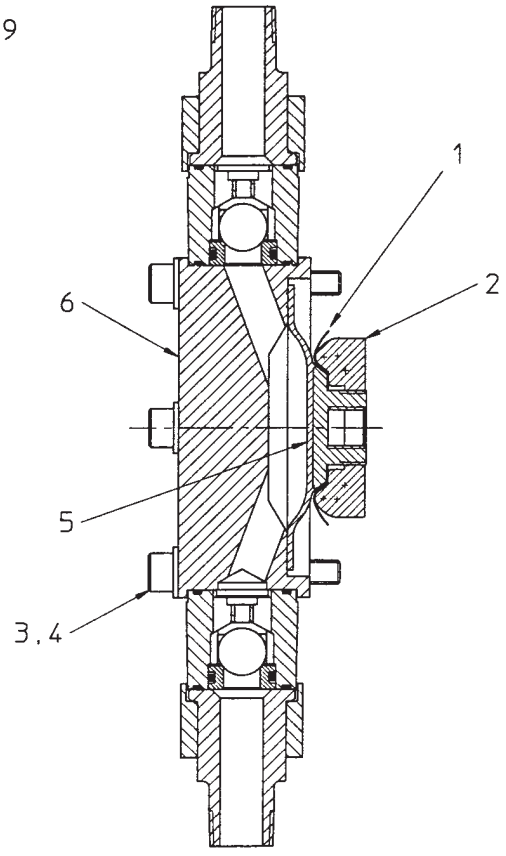


SLURRY VALVE
BALL SIZE: .625"

DETAIL J



FRONT VIEW



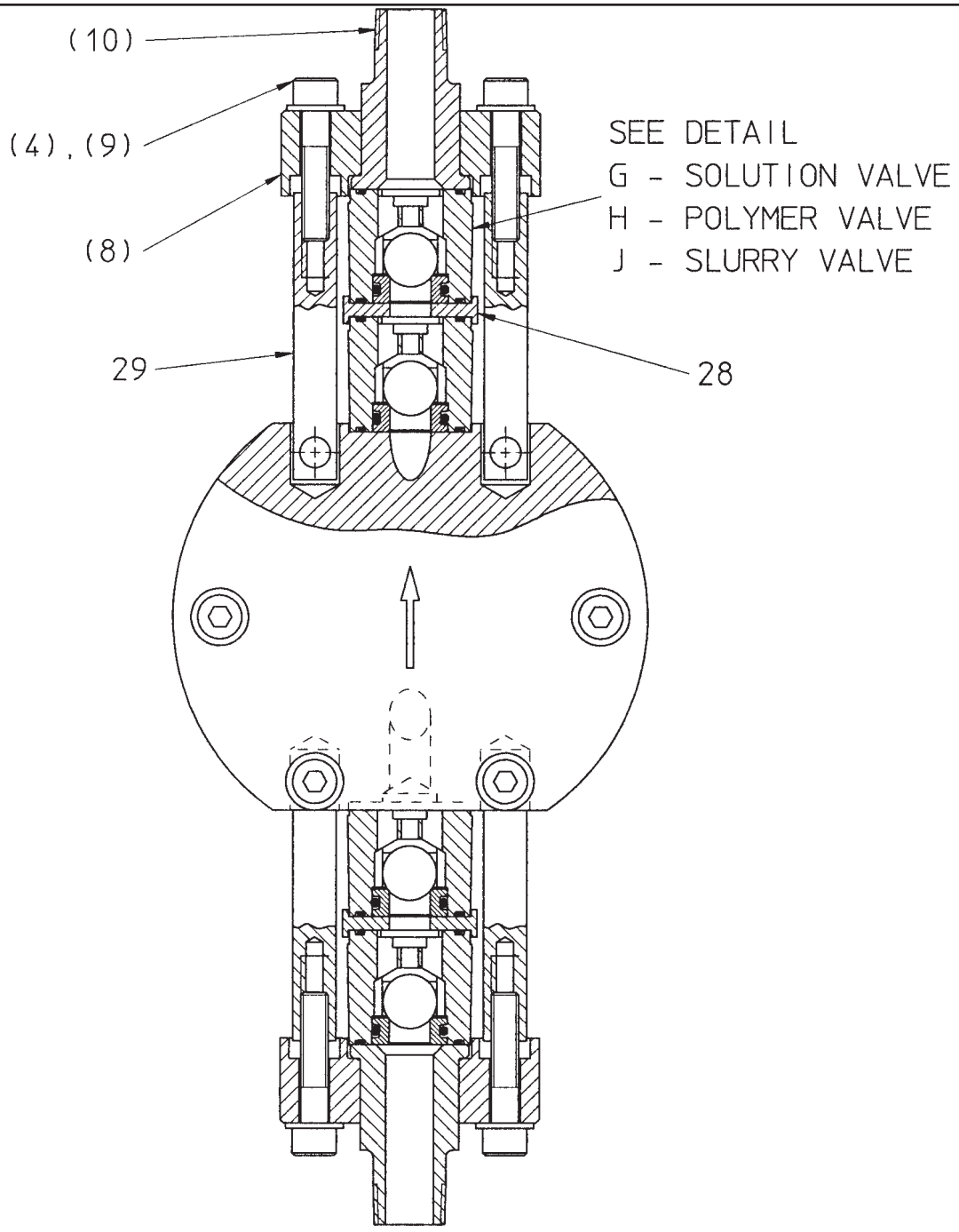
SIDE VIEW

NOTE: FOR PARTS LIST SEE DWGS. 440.400.010.010C&D.

3" LIQUID END - PARTS

440.400.010.010A

ISSUE 3 4-09



NOTE: FOR PARTS LIST SEE DWGS. 440.400.010.010C&D.

3" LIQUID END - PARTS

440.400.010.010B

ISSUE 2 4-09

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AAA3320	1	Disc, Backing
2	APP4035	1	Ring, Backup
3	AVM3599	6	Cap Screw, M8 x 55, Sock. Hd., 316SS
4	AWO5392	10	Washer, Flat, M8, 316SS
5	AQO5748	1	3" Diaphragm
6	ALI5254	1	Head, PVC
	OR		
	APQ5268	1	Head, Kynar
	OR		
	AAB2531	1	Head, 316SS
7	APQ5538	4	Eyenut, Valve, SB
8	AIC5568	2	Clamp, PVC
	OR		
	AAB2723	2	Clamp, SST
9	ARE3591	4	Cap Screw, M8 & 40, Sock. Hd., 316SS
10	AIA4133	2	Conn., M, 1/2" NPT, PVC
	OR		
	ANM4255	2	Conn., M, 1/2" NPT, Kynar
	OR		
	AAB2738	2	Conn., M, 1/2" NPT, 316SS
	OR		
	APQ4176	2	Conn., M, R 1/2 BSP, PVC
	OR		
	AMK4974	2	Conn., Sock., 1/2" Pipe, PVC
11	AJE5881	4	O-Ring (024) Hypalon, 28.3 ID x 1.78mm
	OR		
	AOO5871	4	O-Ring (024) Viton, 28.3 ID x 1.78mm
	OR		
	AAC6257	4	O-Ring (024) EPDM, 28.3 ID x 1.78mm
12	AOO5683	2	O-RIng, (115) Hypalon, 17.12 ID x 2.62mm
	OR		
	APQ5924	2	O-RIng, (115) Viton, 17.12 ID x 2.62mm
	OR		
	AAC6260	2	O-RIng, (115) EPDM, 17.12 ID x 2.62mm
13	AMK5020	2	Guide, Retainer, .625" Ball, PVC
	OR		
	AOO5014	2	Guide, Retainer, .625" Ball, Kynar
	OR		
	AAC5381	2	Guide, Retainer, .625" Ball, 316SS
14	AFM5802	2	Ball, .625" 316SS
	OR		
	AEK5860	2	Ball, .625" PTFE
	OR		
	AAC3514	2	Ball, .625" Ceramic
15	ANM4397	2	Seat, .625" Ball, 316SS
	OR		
	AIC4409	2	Seat, .625" Ball, PVC
	OR		
	AIA4403	2	Seat, .625" Ball, Kynar

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

3” LIQUID END - PARTS LIST

440.400.010.010C

ISSUE 4 1-10

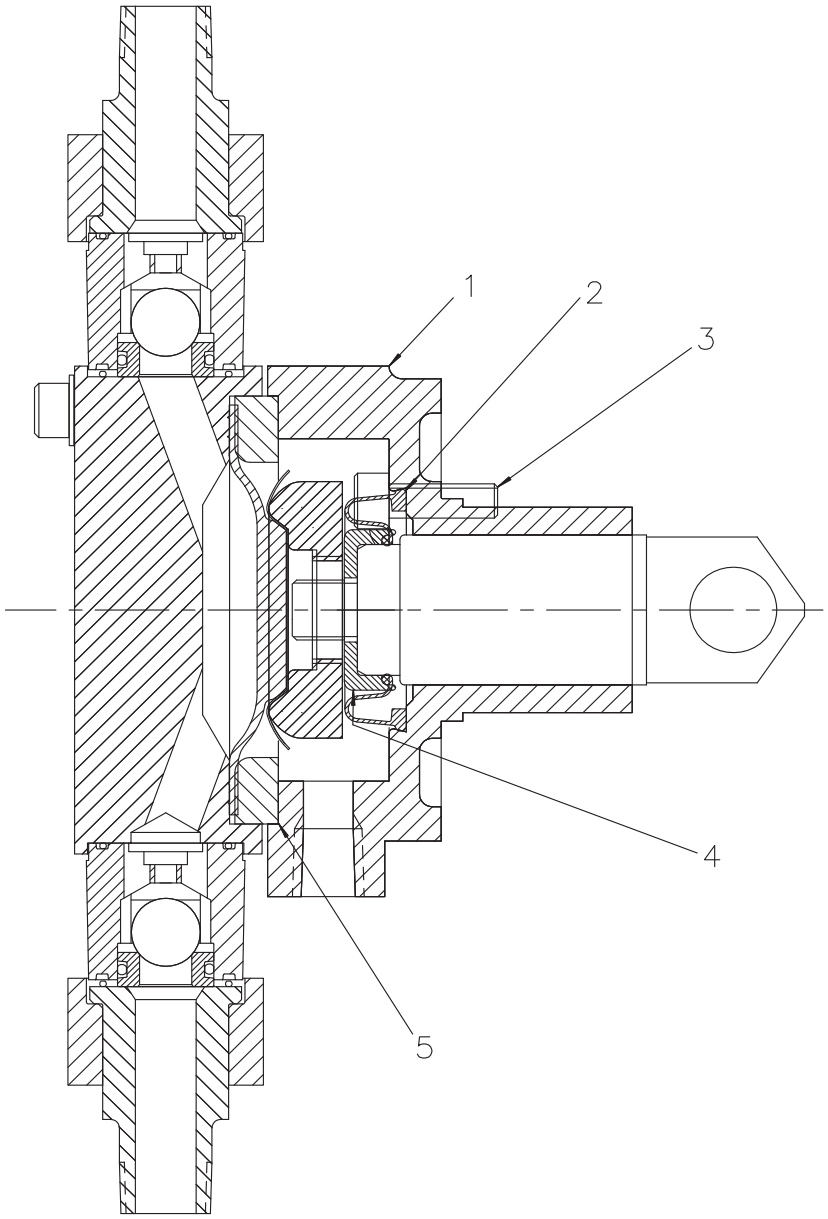
KEY NO.	PART NO.	QTY.	DESCRIPTION
16	AOO5871	4	O-Ring (024) Viton, 28.3 ID x 1.78mm
17	APQ5924	2	O-Ring (115) Viton, 17.12 x 2.62mm
18	ANM4215	2	Spring, .625" Ball
19	AAB9602	2	Guide, Polymer, .625" Ball, PVC
20	AEK5860	2	Ball, .625" PVC
21	AIC4409	2	Seat, .625" Ball, PVC
22	AJE5881	4	O-Ring (024) Hypalon, 28.3 ID x 1.78mm
23	AOO5683	2	O-Ring (115) Hypalon, 17.12 ID x 2.62mm
24	ALI5332	2	Guide, Slurry, .625" Ball, 316SS
25	AIC4989	2	Retainer, .625" Ball, PVC
26	AEK5786	2	Ball, .625" Polyurethane
27	AKG4390	2	Seat, .625" Ball Ceramic
28	APS4943	2	Adapter, V, .625" Ball, PVC
	OR		
	AAA5798	2	Adapter, V, .625" Ball,316 SS
	OR		
	APQ4948	2	Adapter, V, .625" Ball, PVDF
29	APQ5542	4	Eyenut, Valve, DB

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

3” LIQUID END - PARTS LIST

440.400.010.010D

ISSUE 2 03/17



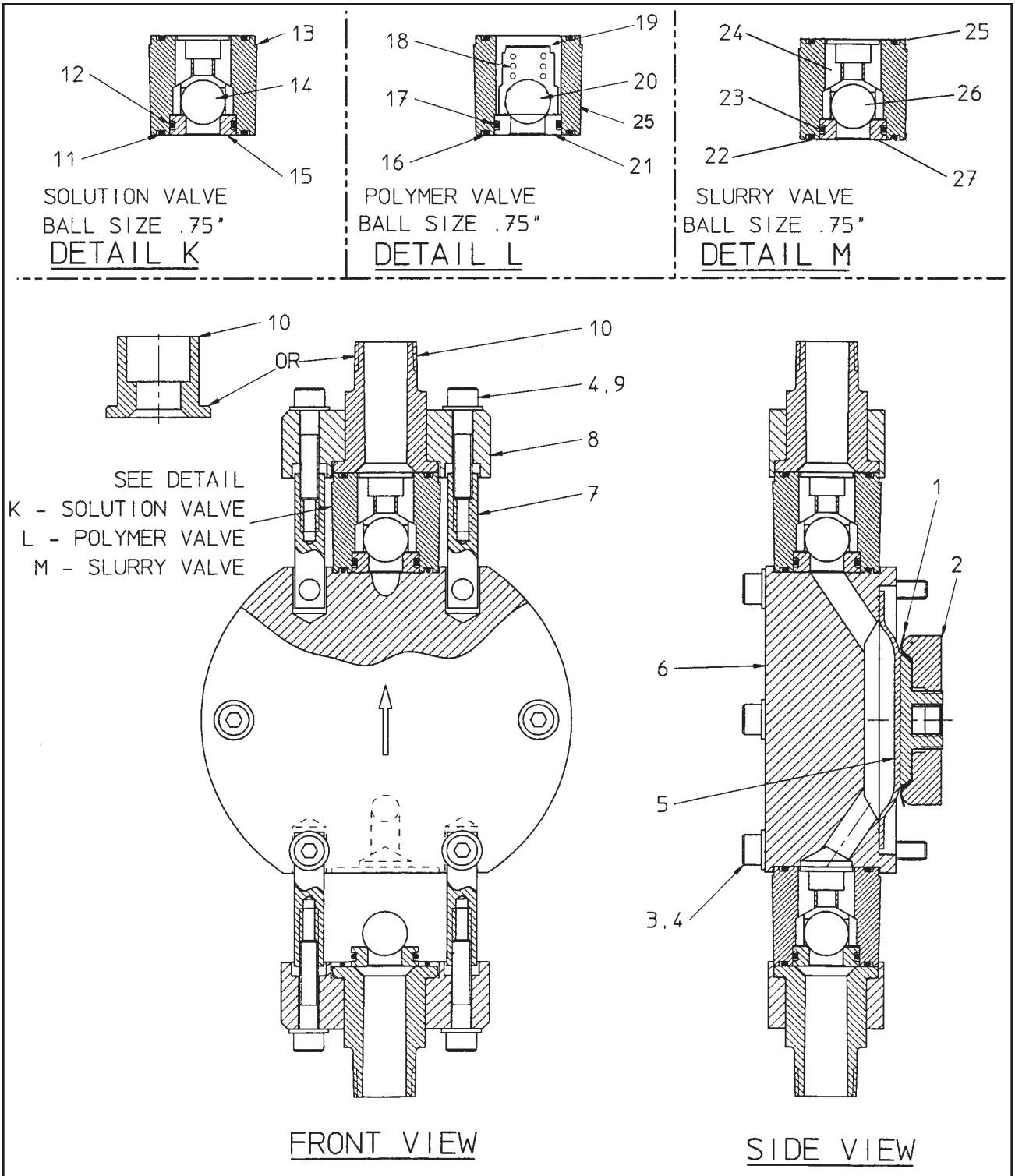
KEY NO.	PART NO.	QTY.	DESCRIPTION
1	APM5645	1	ADAPTER, 3" DIAPHRAGM
2	AAB7205	1	SEAL, BELLOW, CROSSHEAD
3	AXS3583	4	SCREW, CAP, M8 x 25, SOCK. HD., 316SS
4	AJA5915	1	CLAMP, DIAPHRAGM, BELLOW
5	AJE5301	1	SPACER, 3" DIAPHRAGM

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

3” LIQUID END ADAPTER - PARTS

440.400.001.050

ISSUE 3 03/17

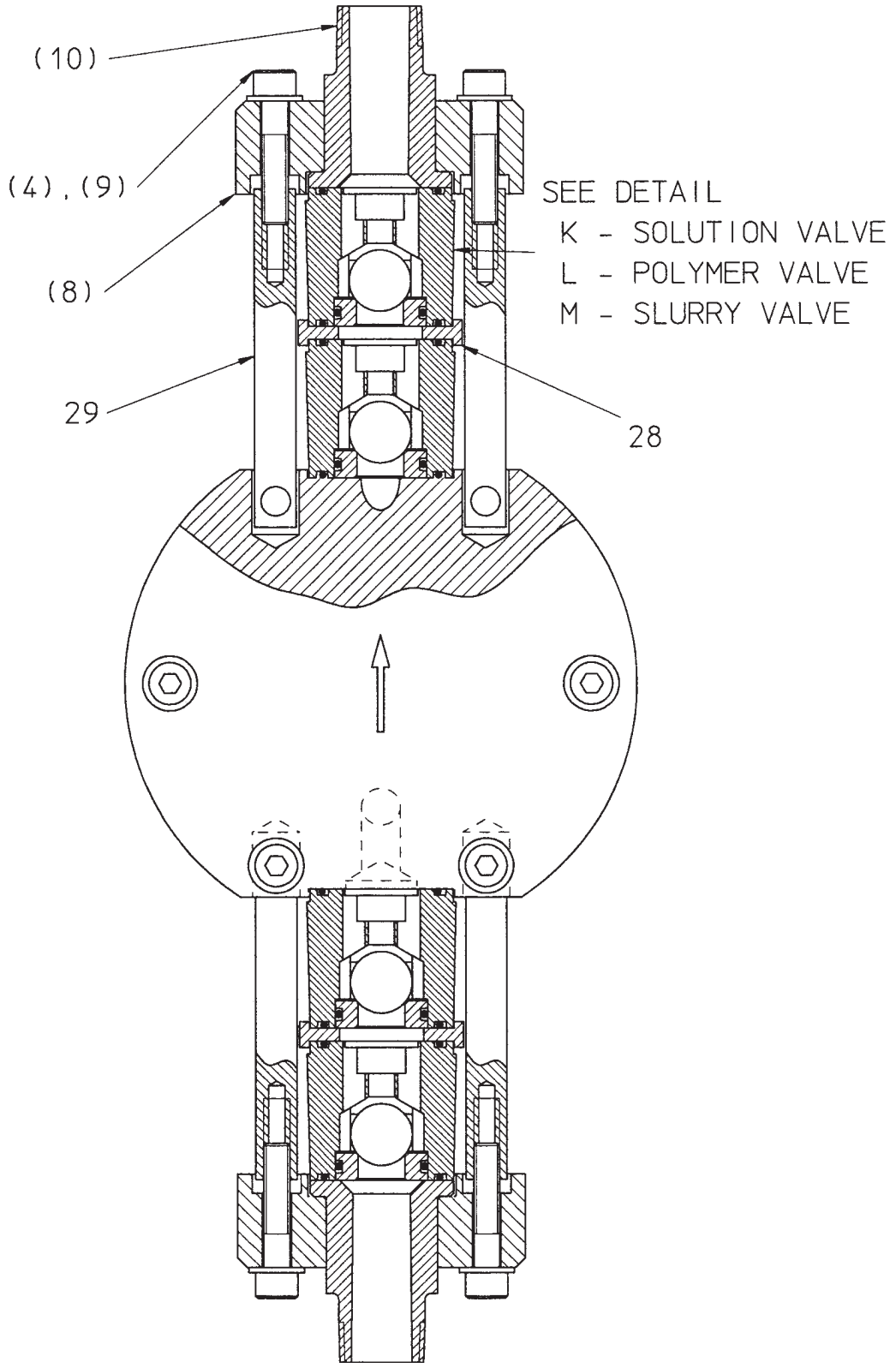


NOTE: FOR PARTS LIST SEE DWGS. 440.400.010.020C&D.

4" LIQUID END - PARTS

440.400.010.020A

ISSUE 3 4-09



NOTE: FOR PARTS LIST SEE DWGS. 440.400.010.020C&D.

4" LIQUID END - PARTS

440.400.010.020B

ISSUE 2 4-09

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AJE4048	1	Disc, Backing
2	ALJ4039	1	Ring, Backup
3	ARE3624	6	Cap Screw, M8 x 70, Sock. Hd., 316SS
4	AWO5392	10	Washer, Flat, M8, 316SS
5	ARQ5736	1	4" Diaphragm
6	APQ5186	1	Head, PVC
	OR		
	ANM5205	1	Head, Kynar
	OR		
	AAB2534	1	Head, 316SS
7	AJE5494	4	Eyenut, Valve
8	AIA5558	2	Clamp, PVC
	OR		
	AAB2726	2	Clamp, SST
9	ARE3591	4	Cap Screw, M8 & 40, Sock. Hd., 316SS
10	AIC4106	2	Conn., M, 3/4" NPT, PVC
	OR		
	AIA4119	2	Conn., M, 3/4" NPT, Kynar
	OR		
	AAB2744	2	Conn., M, 3/4" NPT, 316SS
	OR		
	AKG4112	2	Conn., M, R 3/4 BSP, PVC
	OR		
	APQ4991	2	Conn., Sock., 3/4" Pipe, PVC
11	ALI5643	4	O-Ring (126) Hypalon, 34.59 ID x 2.62mm
	OR		
	AMK5934	4	O-Ring (126) Viton, 34.59 ID x 2.62mm
	OR		
	AAC6263	4	O-Ring (126) EPDM, 34.59 ID x 2.62mm
12	AMK5655	2	O-RIng, (119) Hypalon, 23.47 ID x 2.62mm
	OR		
	AMK5929	2	O-RIng, (119) Viton, 23.47 ID x 2.62mm
	OR		
	AAA5549	2	O-RIng, (119) EPDM, 23.47 ID x 2.62mm
13	AIC5037	2	Guide, Retainer, .75" Ball, PVC
	OR		
	AOO5029	2	Guide, Retainer, .75" Ball, Kynar
	OR		
	AAC5384	2	Guide, Retainer, .75" Ball, 316SS
14	AHQ3932	2	Ball, .75" 316SS
	OR		
	ACG3819	2	Ball, .75" PTFE
	OR		
	AAA3656	2	Ball, .75" Ceramic
15	APQ4708	2	Seat, .75" Ball, 316SS
	OR		
	APS4721	2	Seat, .75" Ball, PVC
	OR		
	AIA4715	2	Seat, .75" Ball, Kynar

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

4” LIQUID END - PARTS LIST

440.400.010.020C

ISSUE 5 1-10

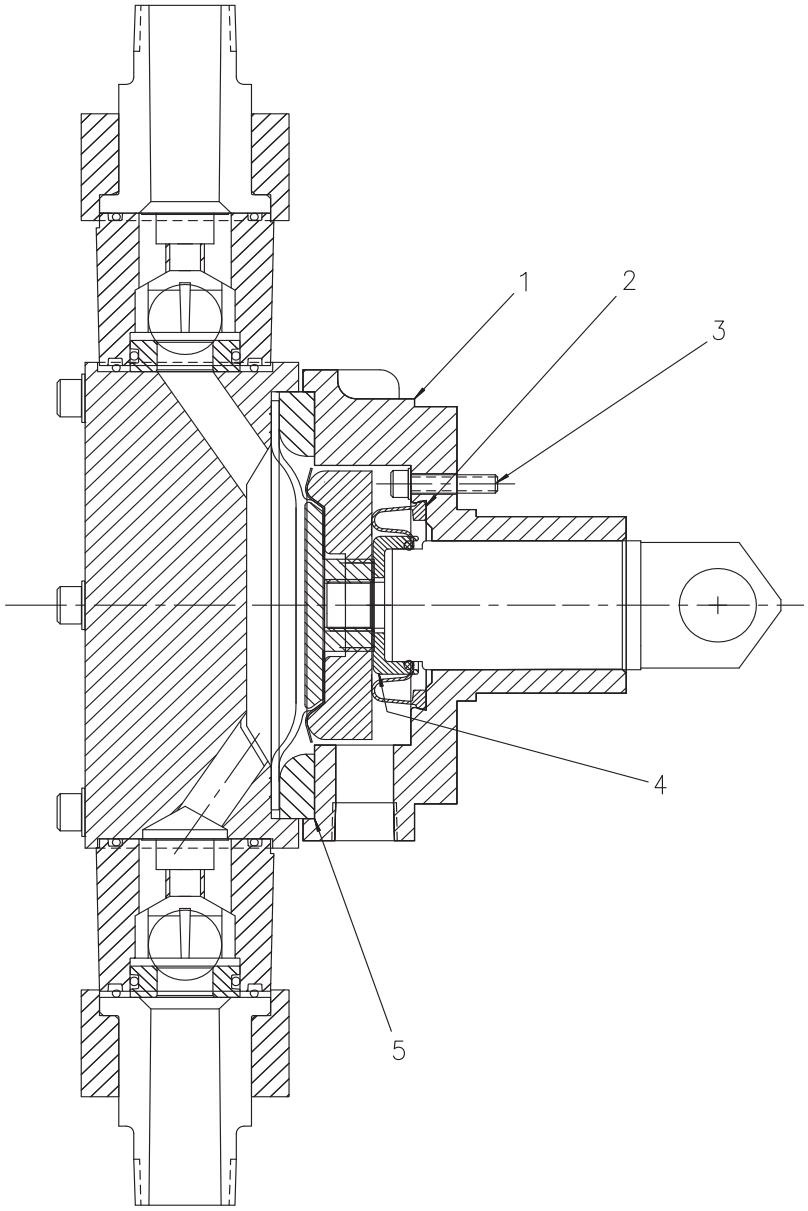
KEY NO.	PART NO.	QTY.	DESCRIPTION
16	AMK5934	4	O-Ring (126) Viton, 34.59 ID x 2.62mm
17	AMK5929	2	O-Ring (119) Viton, 23.47 x 2.62mm
18	AAB9218	2	Spring, .75" Ball
19	AAB9221	2	Guide, Polymer, .75" Ball, PVC
20	ACG3819	2	Ball, .75" PVC
21	APS4721	2	Seat, .75" Ball, PVC
22	ALI5643	4	O-Ring (126) Hypalon, 34.59 ID x 2.62mm
23	AMK5655	2	O-Ring (119) Hypalon, 23.47 ID x 2.62mm
24	APQ5338	2	Guide, Slurry, .75" Ball, 316SS
25	ANM4983	2	Retainer, .75" Ball, PVC
26	AFM3860	2	Ball, .75" Polyurethane
27	AMK4698	2	Seat, .75" Ball Ceramic
28	AKG4927	2	Adapter, V, .75" Ball, PVC
	OR		
	AIC4938	2	Adapter, V, .75" Ball,316SS
	OR		
	AKG4933	2	Adapter, V, .75" Ball,PVDF
29	AIA5499	4	Eyenut, Valve, DB

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

4” LIQUID END - PARTS LIST

440.400.010.020D

ISSUE 2 03/17



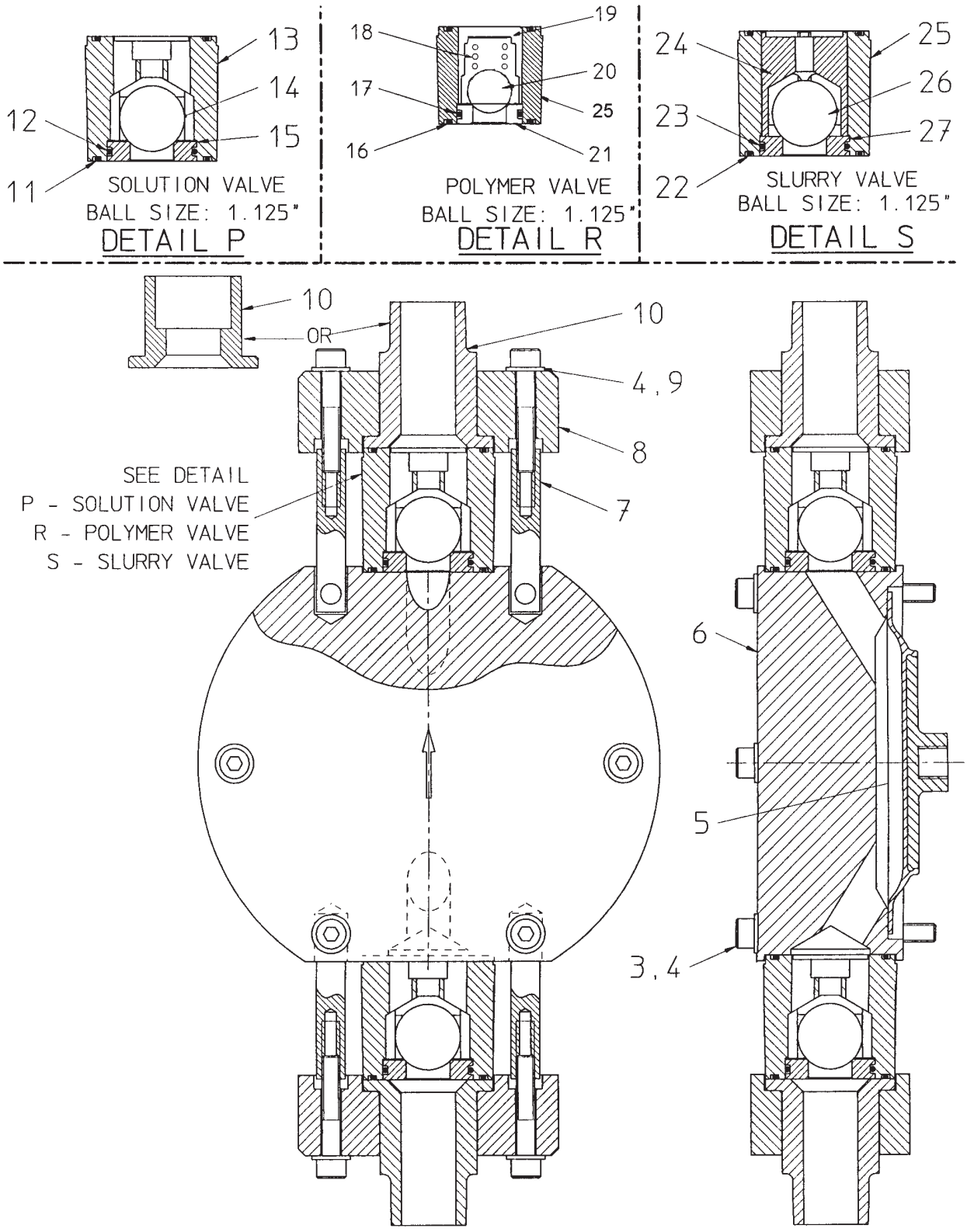
KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AKC5653	1	ADAPTER, 4" DIAPHRAGM
2	AAB7205	1	SEAL, BELLOW, CROSSHEAD
3	AXS3583	4	SCREW, CAP, M8 x 25, SOCK. HD., 316SS
4	AJA5915	1	CLAMP, DIAPHRAGM, BELLOW
5	AJE5306	1	SPACER, 4" DIAPHRAGM

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

4” LIQUID END ADAPTER - PARTS

440.400.001.060

ISSUE 3 1-10

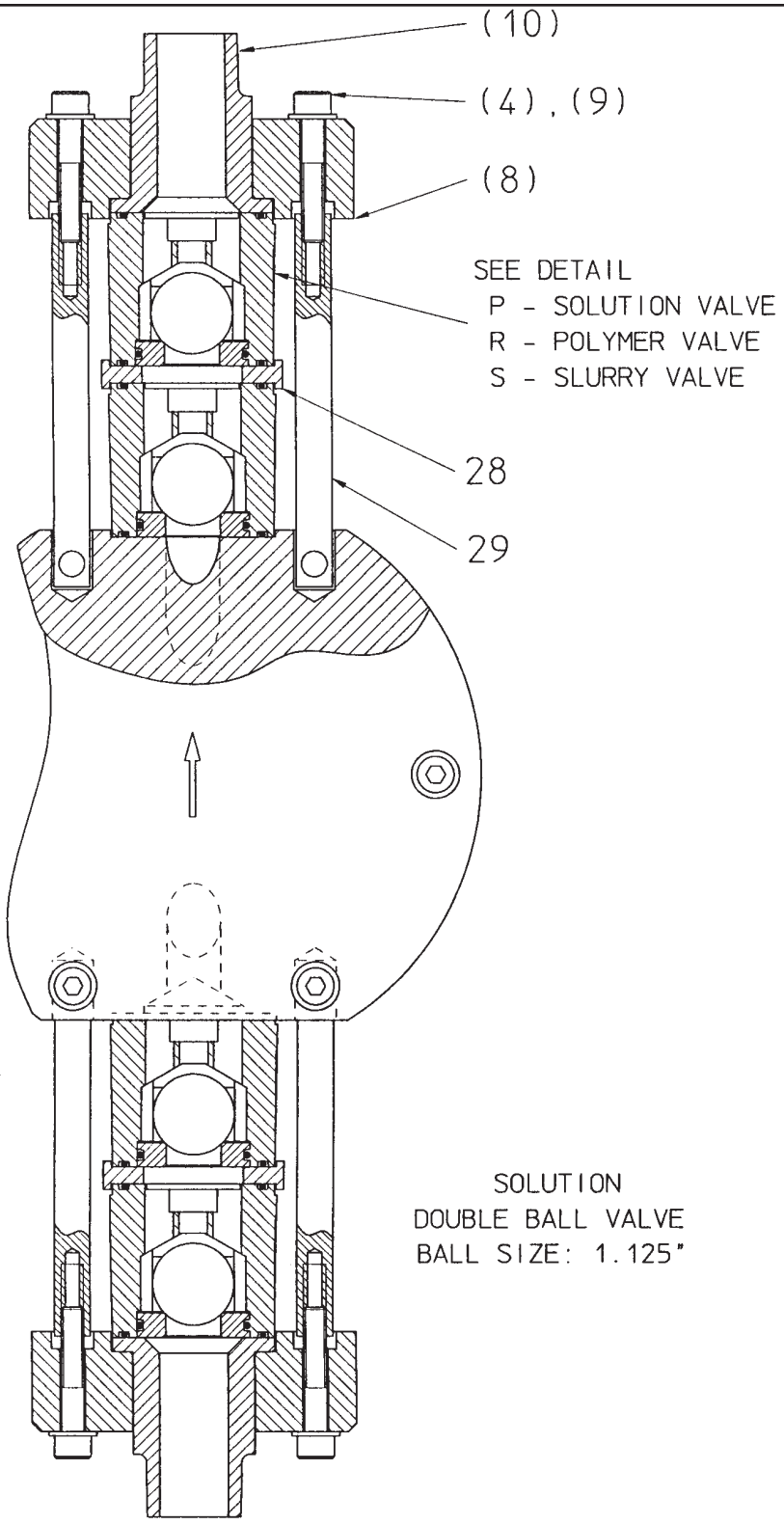


NOTE: FOR PARTS LIST SEE DWGS. 440.400.010.030C&D.

5" LIQUID END - PARTS

440.400.010.030A

ISSUE 3 4-09



NOTE: FOR PARTS LIST SEE DWGS. 440.400.010.030C&D.

5" LIQUID END - PARTS

440.400.010.030B

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KEY NO.	PART NO.	QTY.	DESCRIPTION
3	ASG3633	6	Cap Screw, M8 x 80, Sock. Hd., 316SS
4	AWO5392	10	Washer, Flat, M8, 316SS
5	APM5758	1	5" Diaphragm
6	ALI5285	1	Head, PVC
	OR		
	AMK5290	1	Head, Kynar
	OR		
	AAB2537	1	Head, 316SS
7	AOO5518	4	Eyenut, Valve, SB
8	AIA5573	2	Clamp, PVC
	OR		
	AAB2729	2	Clamp, SST
9	AAA2028	4	Cap Screw, M8 x 45, Sock. Hd., 316SS
10	AJE4298	2	Conn., M, 1" NPT, PVC
	OR		
	AOO4311	2	Conn., M, 1" NPT, Kynar
	OR		
	ALI4282	2	Conn., M, 1" NPT, 316SS
	OR		
	AKG4304	2	Conn., M, R1 BSP, PVC
	OR		
	AMK4997	2	Conn., Sock., 1" Pipe, PVC
11	AMK3876	4	O-Ring (134) Hypalon, 47.29 ID x 2.62mm
	OR		
	AJE3882	4	O-Ring (134) Viton, 47.29 ID x 2.62mm
	OR		
	AAC6266	4	O-Ring (134) EPDM, 47.29 ID x 2.62mm
12	ALI5643	2	O-Ring (126) Hypalon, 34.59 ID x 2.62mm
	OR		
	AMK5934	2	O-Ring (126) Viton, 34.59 ID x 2.62mm
	OR		
	AAC6263	2	O-Ring (126) EPDM, 34.59 ID x 2.62mm
13	AKG5002	2	Guide, Retainer, 1.125" Ball, PVC
	OR		
	AIA5008	2	Guide, Retainer, 1.125" Ball, Kynar
	OR		
	AAC5387	2	Guide, Retainer, 1.125" Ball, 316SS
14	ABE3904	2	Ball, 1.125", 316SS
	OR		
	ABE3796	2	Ball, 1.125", PTFE
	OR		
	AEK3629	2	Ball, 1.125", Ceramic
15	AIC4733	2	Seat, 1.125" Ball, 316SS
	OR		
	AIC3361	2	Seat, 1.125" Ball, PVC
	OR		
	ANM3369	2	Seat, 1.125" Ball, Kynar

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

5” LIQUID END - PARTS LIST

440.400.010.030C

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KEY NO.	PART NO.	QTY.	DESCRIPTION
16	AJE3882	4	O-Ring (134) Viton, 47.29 ID x 2.62mm
17	AMK5934	2	O-Ring (126) Viton, 34.59 x 2.62mm
18	ALI4222	2	Spring, 1.125" Ball
19	AAB5987	2	Guide, Polymer, 1.125" Ball, PVC
20	ABE3796	2	Ball, 1.125" PTFE
21	AIC3361	2	Seat, 1.125" Ball, PVC
22	AMK3876	4	O-Ring (134) Hypalon, 47.29 ID x 2.62mm
23	ALI5643	2	O-Ring (126) Hypalon, 34.59 ID x 2.62mm
24	AOO5311	2	Guide, Slurry, 1.125" Ball, 316SS
25	APS4977	2	Retainer, 1.125" Ball, PVC
26	ABE3839	2	Ball, 1.125" Polyurethane
27	AOO4728	2	Seat, 1.125" Ball Ceramic
28	APQ4909	2	Adapter, V, 1.125" Ball, PVC
	OR		
	AKG4922	2	Adapter, V, 1.125" Ball,316SS
	OR		
	ANM4915	2	Adapter, V, 1.125" Ball, Kynar
29	AIC5522	4	Eyenut, Valve, DB

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

5” LIQUID END - PARTS LIST

440.400.010.030D

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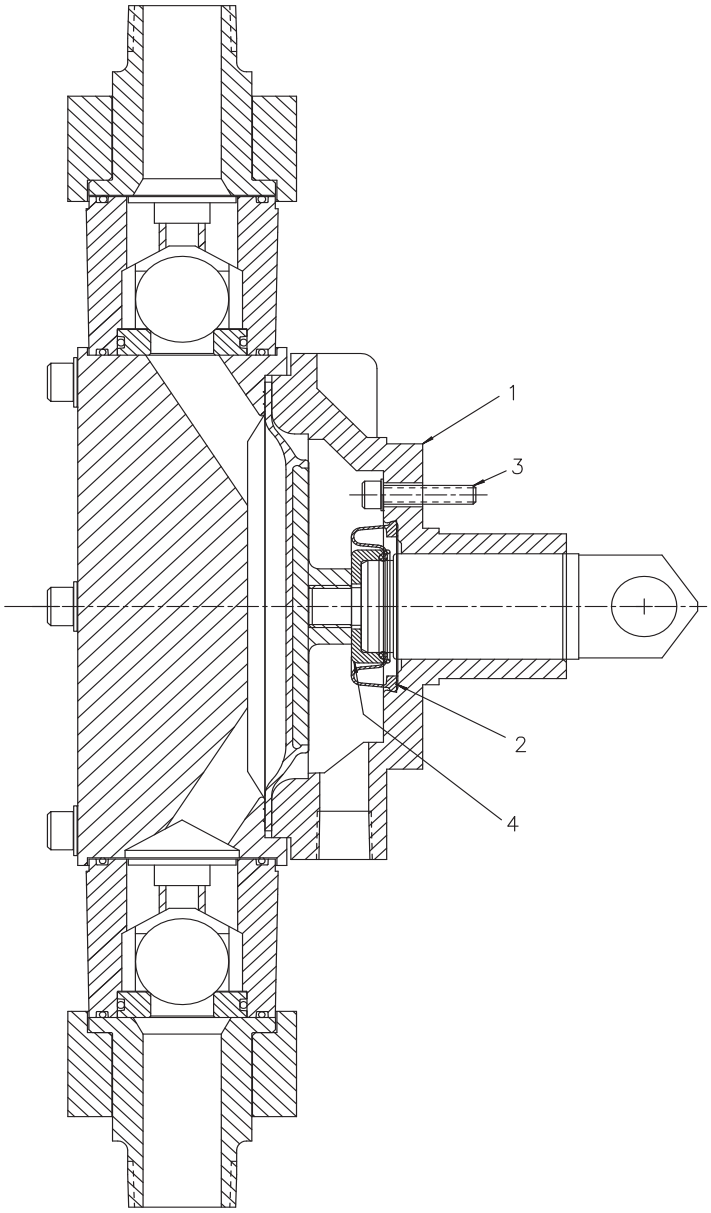

Key No.	PART NO.	QTY.	DESCRIPTION
1	AJA5631	1	ADAPTER, 5" DIAPHRAGM
2	AAB7205	1	SEAL, BELLOW, CROSSHEAD
3	AXS3583	4	SCREW, CAP, M8 x 25, SOCK. HD., 316SS
4	AJA5915	1	CLAMP, DIAPHRAGM, BELLOW

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

5” LIQUID END ADAPTER - PARTS

440.400.001.070

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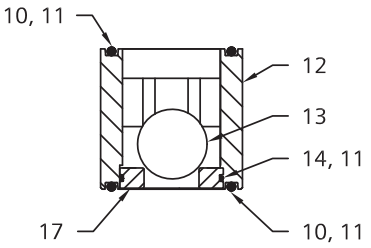
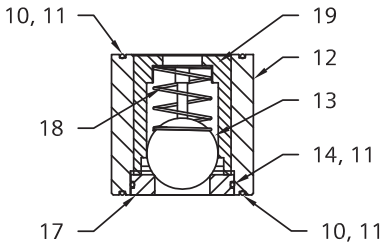
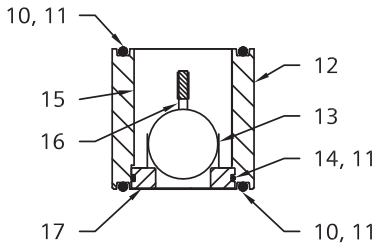


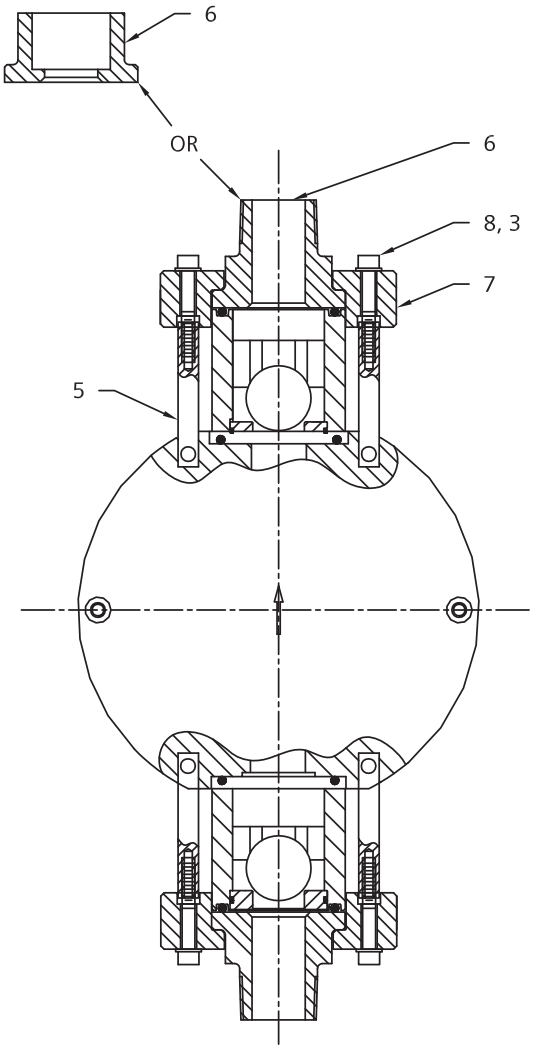
SOLUTION VALVE
DETAIL T

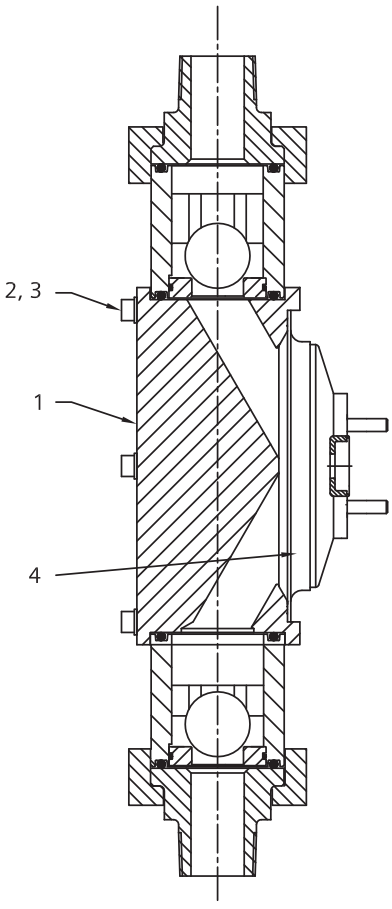


POLYMER VALVE
DETAIL U



SLURRY VALVE
DETAIL V





NOTE: FOR PARTS LIST SEE DWGS. 440.400.010.040C&D.

6-1/2" LIQUID END - PARTS

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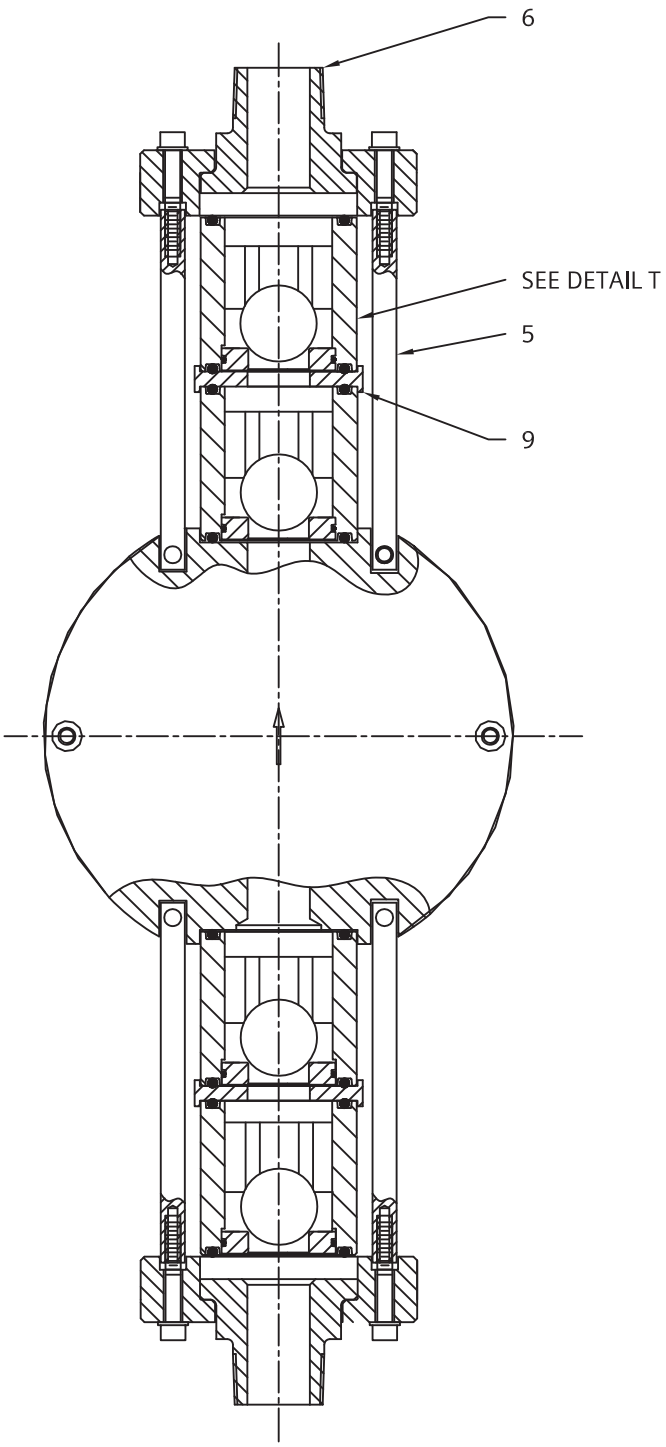

NOTE: FOR PARTS LIST SEE DWGS. 440.400.010.040C&D.

6-1/2" LIQUID END - PARTS

440.400.010.040B

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KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AAA9089	1	Head, PVC
	OR		
	AAA9116	1	Head, Kynar
	OR		
	AAA9137	1	Head, 316SS
2	AAA5283	6	Screw, Cap M8 x 120, Sock. Head, 316SS
3	AWO5392	10	Flat Washer, M8, 316SS
■ 4	AAA9077	1	Diaphragm, 6.5" PTFE Faced
5	AAA9383	4	Eyenut, Single Ball
	OR		
	AAA9380	4	Eyenut, Double Ball
6	AIC3543	2	1-1/2" NPT Connection, PVC
	OR		
	ALI3579	2	1-1/2" NPT Connection, Kynar
	OR		
	AJE3531	2	1-1/2" NPT Connection, SS
	OR		
	APQ3649	2	R1-1/2" Connection, PVC
	OR		
	APQ3666	2	R1-1/2" Connection, Kynar
	OR		
	AJE3640	2	R1-1/2" Connection, SS
	OR		
	AKG3698	2	1-1/2" Socket Connection, PVC
7	AAA9377	2	Clamp, PVC
	OR		
	AAA9410	2	Clamp, Kynar
	OR		
	AAA9413	2	Clamp, SS
8	AVM3599	4	Screw, Cap M8 x 55, Sock. Head, 316SS
9	APQ3953	2	Double Valve Adapter, 1.625" Ball, PVC
	OR		
	ANM3962	2	Double Valve Adapter, 1.625" Ball, Kynar
	OR		
	AKG3946	2	Double Valve Adapter, 1.625" Ball, SS
10	AIC5182	4	#147 O-Ring, 67.95 ID x 2.62mm, Hypalon
	OR		
	AKG5710	4	#147 O-Ring, 67.95 ID x 2.62mm, Viton
	OR		
	AAC6272	4	#147 O-Ring, 67.95 ID x 2.62mm, EPDM
11	AAA3797	A/R	Light Silicone Grease

■ PART OF AAA9407

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

6-1/2” LIQUID END - PARTS LIST

440.400.010.040C

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KEY NO.	PART NO.	QTY.	DESCRIPTION
12	AAC6437	2	Retainer/Guide, PVC, For Solution Only
	OR		
	AAC6440	2	Retainer/Guide, Kynar, For Solution Only
	OR		
	AAC5390	2	Retainer/Guide, SS, For Solution Only
	OR		
	AJE3930	2	Retainer/Guide, PVC, For Slurry & Polymer
	OR		
	ALI3938	2	Retainer/Guide, Kynar, For Slurry & Polymer
	OR		
	ANM3922	2	Retainer/Guide, SS, For Slurry & Polymer
13	ACG5578	2	Ball, 1.625", SS
	OR		
	AAA5536	2	Ball, 1.625", PTFE
	OR		
	AAC5452	2	Ball, 1.625", Ceramic
	OR		
	ABE5509	2	Ball, 1.625", Polyurethane
14	ANM5190	2	#139 O-Ring, 55.25 ID x 2.62mm, Hypalon
	OR		
	ANM5700	2	#139 O-Ring, 55.25 ID x 2.62mm, Viton
	OR		
	AAC6269	2	#139 O-Ring, 55.25 ID x 2.62mm, EPDM
15	AAB4715	2	Top Guide, SS, Slurry Valve Only
16	AAB4703	2	Bottom, Guide, SS, Slurry Valve Only
17	ALI4362	2	Seat, SS
	OR		
	APQ4371	2	Seat, PVC
	OR		
	AIC4366	2	Seat, Kynar
	OR		
	AOO4357	2	Seat, Ceramic
18	ALI4260	2	Spring, Comp., Cob., 1.34 OD x .06 W x 1.68
19	AMK3904	2	Guide, PVC Polymer

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

6-1/2” LIQUID END - PARTS LIST

440.400.010.040D

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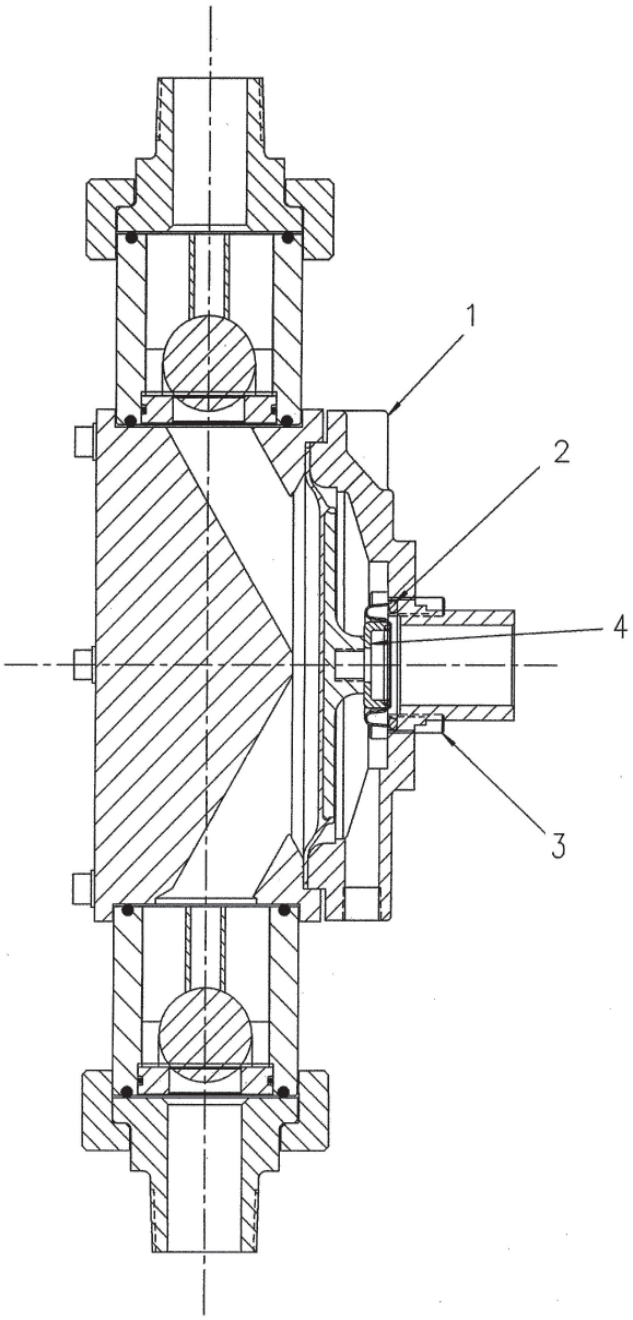

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AAA9098	1	ADAPTER, 6-1/2" DIAPHRAGM
2	AAB7205	1	SEAL, BELLOW, CROSSHEAD
3	AXS3583	4	SCREW, CAP, M8 x 24, SOCK. HD., 316SS
4	AJA5915	1	CLAMP, DIAPHRAGM, BELLOW

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

6-1/2” LIQUID END ADAPTER - PARTS

440.400.001.080

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SECTION 6 - PREVENTIVE MAINTENANCE KITS AND SPARE PARTS LIST

List of Contents

TABLE NO.

Table 6.1 - Spares For Encore 700

Description	Used On	Part Number
Diaphragm Maintenance Kit	1-3/8" Head	AAA1136
	2" Head	AAA1118
	3" Head	AAA1121
	4" Head	AAA1124
	5" Head	APM5758 Diaphragm Only
	6-1/2" Head	AAA9077 Diaphragm Only
Valve Kit ❖	1-3/8" Head	Refer to Table 6.1.1
	2" Head	Refer to Table 6.1.2
	3" Head	Refer to Table 6.1.3
	4" Head	Refer to Table 6.1.4
	5" Head	Refer to Table 6.1.5
	6-1/2" Head	Refer to Table 6.1.6
Diaphragm Backup Ring	1-3/8" Head	ALI5124
	2" Head	AJE4030
	3" Head	APP4035
	4" Head	ALJ4039
Head, PVC (Cartridge Valves)	1-3/8" Head	APS4346
	2" Head	AOO5277
	3" Head	ALI5254
	4" Head	APQ5186
	5" Head	ALI5285
	6-1/2" Head	AAA9089
Head, PVDF (Cartridge Valves)	1-3/8" Head	AIC4339
	2" Head	APQ5281
	3" Head	APQ5268
	4" Head	ANM5205
	5" Head	AMK5290
	6-1/2" Head	AAA9116
Head, Stainless Steel (Cartridge Valves)	1-3/8" Head	AAB2525
	2" Head	AAB2528
	3" Head	AAB2531
	4" Head	AAB2534
	5" Head	AAB2537
	6-1/2" Head	AAA9137
Oil Seal (Worm Shaft)	Common to all gearboxes.	ALI3193
Belt	Common to all pulley driven gearboxes.	APS4857
Oil (2 quarts required)	Gearbox	U40003 (1 Gallon)

NOTES: ❖ Each valve kit consists of two valve sets, one for suction and one for discharge. For double ball valves, order a quantity of two kits per head.

Table 6.1.1 - 1-3/8" Maintenance Kit, Cartridge Valves

1-3/8"	Guide Retainer Material	Guide Material	Seat Material	Ball Material	Spring Material	O-Ring Material	Qty. ❖	PART NUMBER
Solution	PVC	---	316SS	316SS	---	Hypalon	1	APS4297
	PVC	---	316SS	316SS	---	Viton	1	AJE4302
	PVC	---	PVC	PTFE	---	Hypalon	1	API4307
	PVC	---	PVC	PTFE	---	Viton	1	ALI4333
	PVC	---	PVC	PTFE	---	EPDM	1	AAC6299
	PVC	---	PVC	Ceramic	---	Hypalon	1	ANM4337
	PVC	---	PVC	Ceramic	---	Viton	1	APS4341
	PVDF	---	316SS	316SS	---	Hypalon	1	AIC4345
	PVDF	---	316SS	316SS	---	Viton	1	ANM4352
	PVDF	---	PVDF	PTFE	---	Hypalon	1	AOO4356
	PVDF	---	PVDF	PTFE	---	Viton	1	AJE4360
	PVDF	---	PVDF	Ceramic	---	Hypalon	1	AKG4364
	PVDF	---	PVDF	Ceramic	---	Viton	1	ALI4368
	316SS	---	316SS	316SS	---	Hypalon	1	AAC6302
	316SS	---	316SS	316SS	---	Viton	1	AAC6305
	316SS	---	316SS	316SS	---	EPDM	1	AAC6308
Slurry	PVC	316SS	Ceramic	Polyuret.	---	Hypalon	1	AKG4374
Slurry	PVC	316SS	316SS	316S	---	Viton	1	U40010
Polymer	PVC	PVC	PVC	PTFE	Elgiloy	Viton	1	APQ4379

NOTE: ❖ Each valve kit consists of two valve sets, one for suction and one for discharge. For double ball valves, order a quantity of two kits per head.

NOTE: Always change diaphragms and valves at the same time, annually, for optimum performance.

NOTE: This table shows the material the parts are made of and not the content of the kit.

Table 6.1.2 - 2" Maintenance Kit, Cartridge Valves

2"	Guide Retainer Material	Guide Material	Seat Material	Ball Material	Spring Material	O-Ring Material	Qty.❖	PART NUMBER
Solution	PVC	---	316SS	316SS	---	Hypalon	1	AJE4773
	PVC	---	316SS	316SS	---	Viton	1	AIC4778
	PVC	---	PVC	PTFE	---	Hypalon	1	AJE4781
	PVC	---	PVC	PTFE	---	Viton	1	APQ4786
	PVC	---	PVC	PTFE	---	EPDM	1	AAC6311
	PVC	---	PVC	Ceramic	---	Hypalon	1	ALI4789
	PVC	---	PVC	Ceramic	---	Viton	1	ALI4793
	PVDF	---	316SS	316SS	---	Hypalon	1	ANM4797
	PVDF	---	316SS	316SS	---	Viton	1	AMK4801
	PVDF	---	PVDF	PTFE	---	Hypalon	1	AKG4804
	PVDF	---	PVDF	PTFE	---	Viton	1	ANM4809
	PVDF	---	PVDF	Ceramic	---	Hypalon	1	ALI4812
	PVDF	---	PVDF	Ceramic	---	Viton	1	AIA4817
	316SS	---	316SS	316SS	---	Hypalon	1	AAC6314
	316SS	---	316SS	316SS	---	Viton	1	AAC6317
	316SS	---	316SS	316SS	---	EPDM	1	AAC6320
Slurry	PVC	316SS	Ceramic	Polyuret.	---	Hypalon	1	APQ4826
Slurry	PVC	316SS	316SS	316S	---	Viton	1	U40011
Polymer	PVC	PVC	PVC	PTFE	Elgiloy	Viton	1	APQ4379

NOTE: ❖ Each valve kit consists of two valve sets, one for suction and one for discharge. For double ball valves, order a quantity of two kits per head.

NOTE: Always change diaphragms and valves at the same time, annually, for optimum performance.

NOTE: This table shows the material the parts are made of and not the content of the kit.

Table 6.1.3 - 3" Maintenance Kit, Cartridge Valves

3"	Guide Retainer Material	Guide Material	Seat Material	Ball Material	Spring Material	O-Ring Material	Qty. ❖	PART NUMBER
Solution	PVC	---	316SS	316SS	---	Hypalon	1	AOO4862
	PVC	---	316SS	316SS	---	Viton	1	AIA4866
	PVC	---	PVC	PTFE	---	Hypalon	1	AMK4870
	PVC	---	PVC	PTFE	---	Viton	1	APS4873
	PVC	---	PVC	PTFE	---	EPDM	1	AAC6335
	PVC	---	PVC	Ceramic	---	Hypalon	1	AKG4877
	PVC	---	PVC	Ceramic	---	Viton	1	AOO4881
	PVDF	---	316SS	316SS	---	Hypalon	1	ALI4884
	PVDF	---	316SS	316SS	---	Viton	1	AIC4887
	PVDF	---	PVDF	PTFE	---	Hypalon	1	AJE4891
	PVDF	---	PVDF	PTFE	---	Viton	1	APQ4896
	PVDF	---	PVDF	Ceramic	---	Hypalon	1	ALI4900
	PVDF	---	PVDF	Ceramic	---	Viton	1	AMK4904
	316SS	---	316SS	316SS	---	Hypalon	1	AAC6338
	316SS	---	316SS	316SS	---	Viton	1	AAC6341
	316SS	---	316SS	316SS	---	EPDM	1	AAC6344
Slurry	PVC	316SS	Ceramic	Polyuret.	---	Hypalon	1	ANM4908
Slurry	PVC	316SS	316SS	316S	---	Viton	1	U40012
Polymer	PVC	PVC	PVC	PTFE	Elgiloy	Viton	1	ALI4912

NOTE: ❖ Each valve kit consists of two valve sets, one for suction and one for discharge. For double ball valves, order a quantity of two kits per head.

NOTE: Always change diaphragms and valves at the same time, annually, for optimum performance.

NOTE: This table shows the material the parts are made of and not the content of the kit.

Table 6.1.4 - 4" Maintenance Kit, Cartridge Valves

4"	Guide Retainer Material	Guide Material	Seat Material	Ball Material	Spring Material	O-Ring Material	Qty. ❖	PART NUMBER
Solution	PVC	---	316SS	316SS	---	Hypalon	1	AJE5023
	PVC	---	316SS	316SS	---	Viton	1	AOO5028
	PVC	---	PVC	PTFE	---	Hypalon	1	APQ5032
	PVC	---	PVC	PTFE	---	Viton	1	AJE5036
	PVC	---	PVC	PTFE	---	EPDM	1	AAC6392
	PVC	---	PVC	Ceramic	---	Hypalon	1	ALI5040
	PVC	---	PVC	Ceramic	---	Viton	1	AKG5045
	PVDF	---	316SS	316SS	---	Hypalon	1	AOO5051
	PVDF	---	316SS	316SS	---	Viton	1	AJE5057
	PVDF	---	PVDF	PTFE	---	Hypalon	1	AIA5160
	PVDF	---	PVDF	PTFE	---	Viton	1	APQ5164
	PVDF	---	PVDF	Ceramic	---	Hypalon	1	ALI5168
	PVDF	---	PVDF	Ceramic	---	Viton	1	AOO5172
	316SS	---	316SS	316SS	---	Hypalon	1	AAC6395
	316SS	---	316SS	316SS	---	Viton	1	AAC6398
	316SS	---	316SS	316SS	---	EPDM	1	AAC6401
Slurry	PVC	316SS	Ceramic	Polyuret.	---	Hypalon	1	AIA5176
Slurry	PVC	316SS	316SS	316S	---	Viton	1	U40013
Polymer	PVC	PVC	PVC	PTFE	Elgiloy	Viton	1	APQ5180

NOTE: ❖ Each valve kit consists of two valve sets, one for suction and one for discharge. For double ball valves, order a quantity of two kits per head.

NOTE: Always change diaphragms and valves at the same time, annually, for optimum performance.

NOTE: This table shows the material the parts are made of and not the content of the kit.

Table 6.1.5 - 5" Maintenance Kit, Cartridge Valves

5"	Guide Retainer Material	Guide Material	Seat Material	Ball Material	Spring Material	O-Ring Material	Qty. ❖	PART NUMBER
Solution	PVC	---	316SS	316SS	---	Hypalon	1	ANM5211
	PVC	---	316SS	316SS	---	Viton	1	APS5215
	PVC	---	PVC	PTFE	---	Hypalon	1	ALI5218
	PVC	---	PVC	PTFE	---	Viton	1	AKG5223
	PVC	---	PVC	PTFE	---	EPDM	1	AAC6416
	PVC	---	PVC	Ceramic	---	Hypalon	1	AKG5228
	PVC	---	PVC	Ceramic	---	Viton	1	APQ5233
	PVDF	---	316SS	316SS	---	Hypalon	1	APS5237
	PVDF	---	316SS	316SS	---	Viton	1	ALI5242
	PVDF	---	PVDF	PTFE	---	Hypalon	1	AIC5272
	PVDF	---	PVDF	PTFE	---	Viton	1	AIA5276
	PVDF	---	PVDF	Ceramic	---	Hypalon	1	AJE5280
	PVDF	---	PVDF	Ceramic	---	Viton	1	AKG5283
	316SS	---	316SS	316SS	---	Hypalon	1	AAC6419
	316SS	---	316SS	316SS	---	Viton	1	AAC6422
	316SS	---	316SS	316SS	---	EPDM	1	AAC6425
Slurry	PVC	316SS	Ceramic	Polyuret.	---	Hypalon	1	AIC5287
Slurry	PVC	316SS	316SS	316S	---	Viton	1	U40014
Polymer	PVC	PVC	PVC	PTFE	Elgiloy	Viton	1	ALI5292

NOTE: ❖ Each valve kit consists of two valve sets, one for suction and one for discharge. For double ball valves, order a quantity of two kits per head.

NOTE: Always change diaphragms and valves at the same time, annually, for optimum performance.

NOTE: This table shows the material the parts are made of and not the content of the kit.

Table 6.1.6 - 6-1/2" Maintenance Kit, Cartridge Valves

6-1/2"	Guide Retainer Material	Guide Material	Seat Material	Ball Material	Spring Material	O-Ring Material	Qty. ❖	PART NUMBER
Solution	PVC	---	316SS	316SS	---	Hypalon	1	AAA4982
	PVC	---	316SS	316SS	---	Viton	1	AAA4985
	PVC	---	PVC	PTFE	---	Hypalon	1	AAA4988
	PVC	---	PVC	PTFE	---	Viton	1	AAA4991
	PVC	---	PVC	PTFE	---	EPDM	1	AAC6443
	PVC	---	PVC	Ceramic	---	Hypalon	1	AAA4994
	PVC	---	PVC	Ceramic	---	Viton	1	AAA4997
	PVDF	---	316SS	316SS	---	Hypalon	1	AAA5000
	PVDF	---	316SS	316SS	---	Viton	1	AAA5003
	PVDF	---	PVDF	PTFE	---	Hypalon	1	AAA5006
	PVDF	---	PVDF	PTFE	---	Viton	1	AAA5009
	PVDF	---	PVDF	Ceramic	---	Hypalon	1	AAA5012
	PVDF	---	PVDF	Ceramic	---	Viton	1	AAA5015
	316SS	---	316SS	316SS	---	Hypalon	1	AAA5018
	316SS	---	316SS	316SS	---	Viton	1	AAA5021
	316SS	---	316SS	316SS	---	EPDM	1	AAC6446
Slurry	PVC	316SS	Ceramic	Polyuret.	---	Hypalon	1	AAA5024
Slurry	PVC	316SS	316SS	316S	---	Viton	1	U40015
Polymer	PVC	PVC	PVC	PTFE	Elgiloy	Viton	1	AAA5027

NOTE: ❖ Each valve kit consists of two valve sets, one for suction and one for discharge. For double ball valves, order a quantity of two kits per head.

NOTE: Always change diaphragms and valves at the same time, annually, for optimum performance.

NOTE: This table shows the material the parts are made of and not the content of the kit.

Table 6.2 - Adapter and Bellow Seal Kit

Pump Size	Adapter With Pre-Installed Bellow Seal
	PART NUMBER
1-3/8"	AAB9305
2"	AAB9302
3"	AAB9299
4"	AAB9308
5"	AAB9311
6-1/2"	AAB9314

Table 6.3 - Electric Motors

Part Number	Motor Description	Baldor Model Type
AAA3743	Motor, 56C, .25hp, 115/230Vac, 60Hz, TEFC	3414LC
AAA3746	Motor, 56C, .25hp, 115/230Vac, 60Hz, TENV	3421LC
AAA3749	Motor, 56C, .25hp, 115/230Vac, 60Hz, XPFC	X3414L
AAA4361	Motor, 56C, .50hp, 115/230Vac, 60Hz, TEFC	3424L
AAA4364	Motor, 56C, .50hp, 115/230Vac, 60Hz, TENV	3528LC
AAA4367	Motor, 56C, .50hp, 115/230Vac, 60Hz, XPFC	X3428L
AAA4370	Motor, 56C, .75hp, 115/230Vac, 60Hz, TEFC	3528LC
AAA4373	Motor, 56C, .75hp, 115/230Vac, 60Hz, TENV	3540LC
AAA4376	Motor, 56C, .75hp, 115/230Vac, 60Hz, XPFC	X3535L
AAA3755	Motor, 56C, .50hp, 90Vdc, TEFC	3428P
AAA3758	Motor, 56C, .50hp, 90Vdc, XPFC	X3435P
AAA4379	Motor, 56C, .75hp, 90Vdc, TEFC	3435P
AAA4382	Motor, 56C, .75hp, 90Vdc, XPFC	X3536P
AAA4427	Motor, 56C, 1 hp, 90Vdc, TEFC	3536P
AAA4430	Motor, 56C, 1 hp, 90Vdc, XPFC	X3548P

SECTION 7 - CAPACITY TEST DATA

CONFIGURATION:		SERIAL #:
PISTON SIZE:		GPH:
SPM:	GEAR RATIO:	
BACK PRESSURE (PSI):		
MOTOR TYPE:		

STROKE LENGTH %	CAPACITY IN GPH AT FULL RATED PRESSURE	
	PUMP 1	
100		
75		
50		
25		

CHECK LIST	PASSED (Y/N)
VALVE SEALING (NO EXTERNAL LEAKS):	
DIAPHRAGM SEALING (NO EXTERNAL LEAKS):	
GREASE SEAL (NO EXTERNAL LEAKS):	
WARNING LABELS (ALL ATTACHED):	
TEST TAG (COMPLETED AND ATTACHED):	
PAINT (FULL COVERAGE):	
VALVE (INSTALL CAPS):	
CLEAN (EXTERNALS FREE OF GREASE, DIRT):	
OIL IN PUMP:	

PRODUCT COMPLIES WITH DESIGN, ASSEMBLY, MANUFACTURING AND TESTING PROCEDURES.

QUALITY CONTROL _____

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REMARKS: DATE: _____