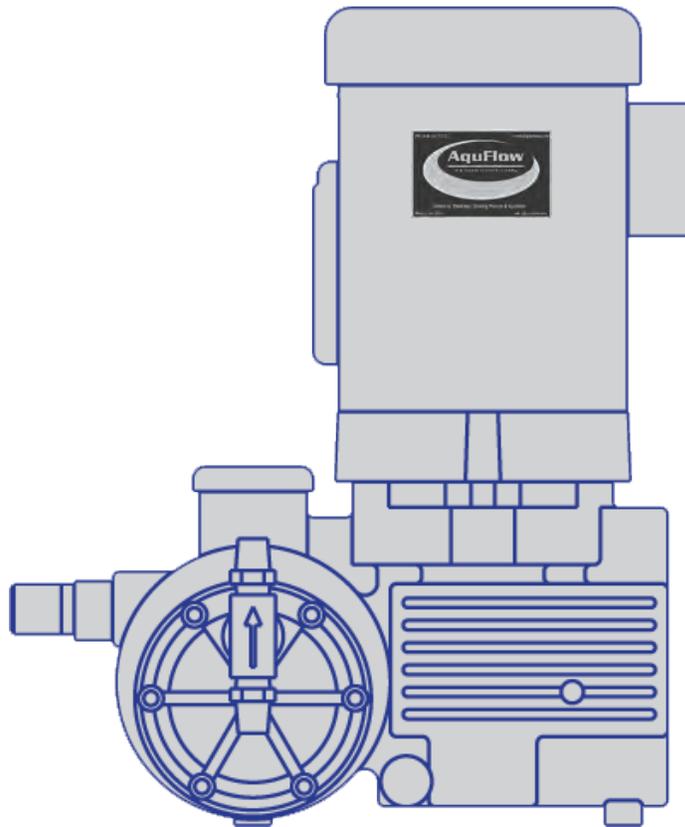


AquFlow Series 1000

Hydraulically Actuated Diaphragm Metering Pump



INSTALLATION, OPERATION, & MAINTENANCE MANUAL

AquFlow

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Warning

These complete installation and operating instructions are also available on www.aquflow.com.

Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.



1. General information

1.1 Introduction

These installation and operating instructions contain all the information required for starting up and handling the hydraulic diaphragm dosing pump.

If you require further information or if any problems arise, which are not described in detail in this manual, please contact AquFlow.

1.2 Service documentation

If you have any questions, please contact the nearest AquFlow distributor or factory directly.

1.3 Applications

The AquFlow pump is suitable for liquid, non-abrasive and non-inflammable media strictly in accordance with the instructions in this manual.

Note

Explosion-proof pumps are identified from the pump and motor nameplates.

Warning

To operate a pump which has been identified as an explosion-proof pump for the dosing of inflammable media or for operation in potentially explosive operating sites, consult factory with details.



Warning

Other applications or the operation of pumps in ambient and operating conditions, which are not approved, are considered improper and are not permitted. AquFlow accepts no liability for any damage resulting from incorrect use.



1.4 Warranty

Warranty in accordance with our general terms of sale and delivery is only valid

- if the pump is used in accordance with the information within this manual.
- if the pump is not dismantled or incorrectly handled.
- if repairs are carried out by authorized and qualified personnel.

2. Safety

This manual contains general instructions that must be observed during installation, operation and maintenance of the pump. This manual must therefore be read by the installation engineer and the relevant qualified personnel/operators prior to installation and start-up, and must be available at the installation location of the pump at all times.

It is not only the general safety instructions given in this "Safety" section that must be observed, but all special safety instructions given in the other sections.

2.1 Identification of safety instructions in this manual

If the safety instructions or other advice in this manual are not observed, it may result in personal injury or malfunction and damage to the pump. The safety instructions and other advice are identified by the following symbols:

Warning signs	Type of danger
	Warning – hand injuries.
	Warning – high-voltage.
	Warning – flammable substances.
	Warning – hot surface.
	Warning – danger zone.

2.2 Qualification and training of personnel

The personnel responsible for the operation, maintenance, inspection and installation must be appropriately qualified for these tasks. Areas of responsibility, levels of authority and the supervision of the personnel must be precisely defined by the operator.

If the personnel do not have the necessary knowledge, the necessary training and instruction must be given. If necessary, training can be performed by the manufacturer/supplier at the request of the operator of the pump. It is the responsibility of the operator to make sure that the contents of this manual are understood by the personnel.

2.3 Risks when safety instructions are not observed

Non-observance of the safety instructions may have dangerous consequences for the personnel, the environment and the pump. If the safety instructions are not observed, all rights to claims for damages may be lost. Non-observance of the safety instructions may lead to the following hazards:

- failure of important functions of the pump/system
- failure of specified methods for maintenance
- harm to humans from exposure to electrical, mechanical and chemical influences
- damage to the environment from leakage of harmful substances.

2.4 Safety-conscious working

The safety instructions in this manual, applicable national health and safety regulations and any operator internal working, operating and safety regulations must be observed.

2.5 Safety instructions for the operator/user

Hazardous hot or cold parts on the pump must be protected to prevent accidental contact.

Leakages of dangerous substances (e.g. hot, toxic) must be disposed of in a way that is not harmful to the personnel or the environment. Legal regulations must be observed.

Damage caused by electrical energy must be prevented.

2.6 Safety instructions for maintenance, inspection and installation work

The operator must ensure that all maintenance, inspection and installation work is carried out by authorised and qualified personnel, who have been adequately trained by reading this manual.

All work on the pump should only be carried out when the pump is stopped. The procedure described in this manual for stopping the pump must be observed.

Pumps or pump units which are used for media that are harmful to health must be decontaminated.

All safety and protective equipment must be immediately restarted or put into operation once work is complete.

Observe the points described in the initial start-up section prior to subsequent start-up.

Warning



Make sure that the pump is suitable for the actual dosing medium! Observe the chemical manufacturer's safety instructions when handling chemicals! Do not operate the pump next to closed valves (dead head).

Warning



The pump housing, control unit and sensors must only be opened by personnel authorised by AquFlow! Repairs must only be carried out by authorised and qualified personnel! Wear protective clothing (gloves and goggles) when working on the dosing head, connections or lines! Before removing the dosing head, valves and lines, empty any remaining medium in the dosing head into a drip tray by carefully unscrewing the suction valve.

Caution

The resistance of the parts that come into contact with the media depends on the media, media temperature and operating pressure. Ensure that parts in contact with the media are chemically resistant to the dosing medium under operating conditions!

2.7 Unauthorised modification and manufacture of spare parts

Modification or changes to the pump are only permitted following agreement with the manufacturer. Original spare parts and accessories authorised by the manufacturer are safe to use. Using other parts can result in liability for any resulting consequences. Additionally, it voids the warranty immediately.

2.8 Improper operating methods

The operational safety of the supplied pump is only ensured if it is used in accordance with section 3. *Technical data*. The specified limit values must under no circumstances be exceeded.

Note

Explosion-proof pumps are identified from the pump and motor nameplates. An EC declaration of conformity is provided in accordance with the EC directive 94/9/EC, the so-called ATEX directive. This declaration of conformity replaces the declaration of conformity in this manual.



Warning
To operate a pump which has been identified as an explosion-proof pump for the dosing of inflammable media or for operation in potentially explosive operating sites in accordance with the EC directive 94/9/EC, refer to the enclosed manual "ATEX-approved pumps" in addition to this manual.

If the assumption is made that a safe operation is no longer possible, switch off the pump and protect it against unintentional operation.

This action should be taken

- if the pump has been damaged.
- if the pump no longer seems to be operational.
- if the pump has been stored for an extended period of time in poor conditions.

2.9 Safety of the system in the event of a failure in the dosing system

AquFlow dosing pumps are designed according to the latest technologies and are carefully manufactured and tested. However, a failure may occur in the dosing system. Systems in which dosing pumps are installed must be designed in such a way that the safety of the entire system is still ensured following a failure of the dosing pump. Provide the relevant monitoring and control functions for this.

PRECAUTIONS

The following precautions should be taken when working with metering pumps.

Please read this section carefully prior to installation.

Protective Clothing



ALWAYS wear protective clothing, face shield, safety glasses and gloves when working on or near your metering pump. Additional precautions should be taken depending on the solution being pumped. Refer to **Material Safety Data Sheets** for the solution being pumped.

Hearing Protection



It is recommended that hearing protection be used if the pump is in an environment where the time-weighted average sound level (TWA) of 85 decibels is exceeded. (as measured on the A scale -- slow response)

Electrical Safety



- Remove power and ensure that it remains off while maintaining pump.
- **DO NOT FORGET TO CONNECT THE PUMP TO EARTH**
- Electric protection of the motor (Thermal protection or by means of fuses) is to correspond to the rated current indicated on the motor data plate.

Liquid Compatibility



Verify if the materials of construction of the wetted components of your pump are recommended for the solution (chemical) to be pumped.

Pumps Water "Primed"



All pumps are tested with water at the factory. If your process solution is not compatible with water, flush the **Pump Head Assembly** with an appropriate solution before introducing the process solution.

Plumbing and Electrical Connections



Always adhere to your local plumbing and electrical codes.

Line Depressurization



To reduce the risk of chemical contact during disassembly or maintenance, the suction and discharge lines should be depressurized before servicing.

Over Pressure Protection



To ensure safe operation of the system it is recommended that some type of safety/pressure-relief valve be installed to protect the piping and other system components from damage due to over-pressure.

Lifting



This manual should be used as a guide only - Follow your company's recommended lifting procedures. It is not intended to replace or take precedence over recommendations, policies and procedures judged as safe due to the local environment than what is contained herein. Use lifting equipment that is rated for the weight of the equipment to be lifted.

WARNING:
**LOCKOUTS ARE REQUIRED BEFORE
 SERVICING THIS EQUIPMENT**

SAFETY INSTRUCTIONS:
 Shut off/Lockout pump power before servicing.
 Be certain isolation valves are closed-chemical is shut off.
 Bleed pressure before servicing.

3. Technical Data

SERIES 1000

Features

- Flow capacities up to 61 GPH (Simplex), 123 GPH (Duplex)
- Pressure Up to 4,000 PSI
- Unibody Design – Less Parts
- Metering accuracy +/- 1%
- Easy capacity controls – manual/auto
- Built in safety – Internal relief valve
- Available in duplex to double flow capacity
- Ability to handle difficult liquids like slurries, off-gasing, and high viscosities

Specifications

Flow capacity adjustment – 0-100%
While the pump is running or stopped

<i>Turndown Ratio</i>	<i>Metering Accuracy</i>
Stroke length – 10:1	Steady state - +/- 1 %
Stroke frequency – 10:1	Linearity - +/- 1%
Combined – 100:1	Combined - +/- 1%

Maximum process fluid temperature

Custom engineered metallic liquid end: 500F
Metallic liquid end/PTFE diaphragm: 250F (121C)
Plastic Head: 140F (60C)
Plunger stroke length: 0.75
Hydraulic oil capacity: 2qts (simplex) 3qts (Duplex)

Displacement per stroke - by plunger size

3/8" - 0.08257 cu. in. (1.353 ml)
9/16" - 0.18595 cu. in. (3.047 ml)
3/4" - 0.33073 cu. in. (5.419 ml)
7/8" - 0.450246 cu. in. (7.378 ml)
1-1/8" - 0.78649 cu. in. (12.888 ml)
1-5/8" - 1.5537 cu. in. (25.461 ml)

Liquid End Material Options

316SS, Alloy 20, Hastelloy C, PVC, PVDF, and PTFE

Series 1000 Performance Table:

AquFlow Model Number	Capacity GPH (LPH)	Pressure PSIG (bars)	Speed (SPM)	Plunger Diameter
CA4T 3829-0X013	0.55 (2.1)		29	3/8"
CA4T 3858-0X013	1.10 (4.2)		58	
CA4T 3897-0X013	1.85 (7.0)		97	
CA4T 3812-0X013	2.25 (8.5)	4,000 (275)	117	
CA4T 3814-0X013	2.70 (10.2)		140	
CA4T 3817-0X013	3.28 (12.4)		170	
CJ4T 5629-0X014	1.25 (4.7)		29	9/16"
CJ4T 5658-0X014	2.50 (9.5)		58	
CJ4T 5697-0X014	4.20 (15.9)		97	
CJ4T 5612-0X014	5.10 (19.3)	2,000 (75)	117	
CJ4T 5614-0X014	6.09 (23.1)		140	
CJ4T 5617-0X014	7.40 (28.0)		170	
CJ4T 7529-0X014	2.25 (8.5)		29	3/4"
CJ4T 7558-0X014	4.50 (17.1)		58	
CJ4T 7597-0X014	7.50 (28.4)		97	
CJ4T 7512-0X014	9.05 (34.3)	1,100 (75)	117	
CJ4T 7514-0X014	10.8 (40.9)		140	
CJ4T 7517-0X014	13.1 (49.6)		170	
CJ4T 8729-0X014	3.05 (11.5)		29	7/8"
CJ4T 8758-0X014	6.10 (23.0)		58	
CJ4T 8797-0X014	10.2 (38.6)		97	
CJ4T 8712-0X014	12.5 (47.3)	700 (48)	117	
CJ4T 8714-0X014	14.7 (55.6)		140	
CJ4T 8717-0X014	17.9 (67.8)		170	
CJ4T 11329-0X014	5.33 (20.2)		29	1-1/8"
CJ4T 11358-0X014	10.6 (40.1)		58	
CJ4T 11397-0X014	17.8 (67.4)		97	
CJ4T 11312-0X014	22.0 (83.3)	425 (48)	117	
CJ4T 11314-0X014	25.7 (97.3)		140	
CJ4T 11317-0X014	31.1 (117.7)		170	
CJ4T 16229-0X018	10.5 (39.7)		29	1-5/8"
CJ4T 16258-0X018	21.0 (79.5)		58	
CJ4T 16297-0X018	35.3 (133.6)		97	
CJ4T 16212-0X018	42.5 (160.9)	200 (13)	117	
CJ4T 16214-0X018	50.8 (192.3)		140	
CJ4T 16217-0X018	61.7 (233.5)		170	

4. Transport and Delivery

4.1 Delivery

Your new AquFlow metering pump will be shipped mounted on a 3/4" thick plywood inside a master carton with a cardboard insert for both strength of the carton, but also to prevent the pump from moving inside the carton during transportation.

Carefully check the packaging for any signs of damages. Take pictures if necessary and have the delivery driver sign for these damages when submitting transportation damage claims.

4.2 Unpacking

Your pump will have at least the following:

- Pump unit mounted on a 3/4" plywood
- 2 qt. of Hydraulic oil
- Instruction manual

Check the pump's label to make sure that the model and capacity is exactly what you ordered. Check the motor's nameplate for the correct voltage according to your specification and that it matches with the supply voltage to run the motor installed on your pump.



Please visit www.aquflowpumps.com/videos to view the unpacking procedure.

4.3 Intermediate storage

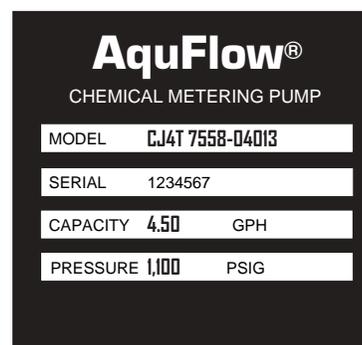
1. If the pump is to be stored for a period not exceeding six months, leave the pump in its original packaging in upright position, but fill the pump with hydraulic oil to capacity to protect internal components from moisture contamination.
2. Store the pump in a dry environment.
3. If storing the pump for more than 6 months, run the pump for a few minutes every 6 months to prevent oil deposit from forming.

4.4 Returning the unit to the factory for repair or evaluation

1. Call the factory and get an RMA (Return Material Authorization) number. The factory or its agent will send you an RMA form to fill out. This form will be required to be e-mailed back.
2. Drain the oil from the pump and replace the drain plug.
3. Remove and do not send the motor if instructed by the factory or its agent to save on freight cost.
4. Completely drain and flush the process fluid from the pump, neutralizing the fluid with water. Failure to do so could result in your pump being rejected by the factory and returned to you at your cost. No traces of any chemical should be left in the pump being returned.
5. Pack the unit properly.
6. Attach the RMA form and any MSDS of the liquid used on your pump.
7. Ship the pump and advise the factory of the tracking number. If the pump is damaged through shipping, the customer will be responsible for that damage.

AQUFLOW PUMP LABEL

Always have the complete pump model and serial number available when contacting Aquflow for parts or service. This model number can be found on the data plate mounted on the back of the pump housing.



5. Product Overview

AQUFLOW HYDRAULIC METERING PUMP MODEL CODE

Typical AquFlow Model:

AAAB CC(C)DD--EEFFGH(HP)

AAA: AquFlow Pump Series Identifier

Series 900 - DM3 (Standard), DL4, DL3, etc.
 Series 1000 - CJ4 (Standard), CA4, CJ3, etc.
 Series 2000 - CD3 (Standard), CR3, CQ3, CL3, etc.
 Series 3000 - CNI (Standard), KBI, HFI, CMI etc.
 Series 4000 - GNI (Standard), GMI etc

B: Main Pumping Element

T = Single PTFE Disc Diaphragm
 W = Double PTFE Disc Diaphragm
 A = Single Hypalon Tube
 B = Single Viton Tube

CC/CCC: Plunger Diameter

<i>Series 1000</i>	<i>Series 3000</i>
38 = 3/8"	08 = 1"
56 = 9/16"	10 = 1-1/4"
75 = 3/4"	12 = 1-1/2"
87 = 7/8"	14 = 1-3/4"
113 = 1-1/8"	16 = 2"
162 = 1-5/8"	18 = 2-1/4"
	20 = 2-1/2"
<i>Series 2000</i>	<i>Series 4000</i>
05 = 5/8"	07 = 7/8"
06 = 3/4"	09 = 1-1/8"
08 = 1"	13 = 1-9/16"
10 = 1-1/4"	20 = 2-1/2"
12 = 1-1/2"	24 = 3"
	32 = 4"

DD: Strokes Per Minute

29 = 29 SPM
 44 = 44 SPM
 58 = 58 SPM
 88 = 88 SPM
 97 = 97 SPM
 12 = 117 SPM
 14 = 140 SPM
 17 = 170 SPM
 19 = 190 SPM

EE: Liquid End Material

04 = 316 Stainless Steel
 05 = Alloy 20
 06 = Hastelloy C
 08 = PVC
 0A = Kynar (PVDF)

FF: Configuration Code

01 = Simplex Manual Adjustment
 02 = Duplex Manual Adjustment
 03 = Simplex Pneumatic Adjustment
 04 = Duplex Pneumatic Adjustment
 05 = Simplex Electronic (4-20mA)
 06 = Duplex Electronic (4-20mA)

G: Valve Ball Size

3 = 1/4"	8 = 7/8"	D = 2" Disc Valve
4 = 3/8"	9 = 1"	E = 2-1/4" Disc Valve
5 = 1/2"	A = 1-1/4"	F = 2-1/2" Disc Valve
6 = 5/8"	B = 1-1/2"	G = 3" Disc Valve
7 = 3/4"	C = 1-3/4"	H = 4" Disc Valve
V = 1/2" Double	W = 7/8" Double	Z = 3/8" Double
Ball Valve Check	Ball Valve Check	Ball Valve Check

H: Liquid Connection

Blank = NPT F = Flange X = Other

I: Degassing Valve

Blank = No degassing valve D = Degassing valve

HP: High Pressure For a high pressure pump, add (HP) to model code

AquFlow Also Offers: SERIES 2000

Features

- Flow capacities up to 180 GPH (Duplex)
- Pressure Up to 1,800 PSI
- Modular design in aluminum housing
- Metering accuracy +/- 1%
- Easy capacity controls – manual/auto
- Built in safety – Internal relief valve
- Available in duplex to double flow capacity
- Ability to handle difficult liquids like slurries, off-gasing, and high viscosities

Specifications

Flow capacity adjustment – 0-100%
 While the pump is running or stopped

<i>Turndown Ratio</i>	<i>Metering accuracy</i>
Stroke length – 20:1	Steady state - +/- 1 %
Stroke frequency – 20:1	Linearity - +/- 1%
Combined – 200:1	Combined - +/- 1%

Maximum process fluid temperature

Custom engineered metallic liquid end: 500F
 Metallic liquid end/PTFE diaphragm: 250F (121C)
 Plastic Head: 140F (60C)
 Plunger stroke length: 1-1/2"
 Hydraulic oil capacity: 4 qts (Simplex & Duplex)

Displacement per stroke - by plunger size

5/8" - 0.2938 cu. in. (4.81 ml)
 3/4" - 0.6976 cu. in. (11.43 ml)
 1" - 1.1334 cu. in. (18.57 ml)
 1-1/4" - 1.8757 cu. in. (30.74 ml)
 1-1/2" - 2.0797 cu. in. (34.08 ml)

Liquid End Material Options

316SS, Alloy 20, Hastelloy C, PVC, PVDF, and PTFE

Series 2000 Performance Table:

AquFlow Model Number	Capacity GPH (LPH)	Pressure PSIG (bars)	Speed (SPM)	Plunger Diameter
CD3T 0529-0X014	3.98 (10.6)		29	5/8"
CD3T 0558-0X014	7.97 (21.2)		58	
CD3T 0597-0X014	13.3 (36.0)		97	
CD3T 0512-0X014	16.07 (43.2)	1,800 (124)	117	
CD3T 0514-0X014	19.2 (51.9)		140	
CD3T 0519-0X014	26.2 (70.8)		191	
CD3T 0629-0X014	4.7 (17.8)		29	3/4"
CD3T 0658-0X014	9.4 (35.6)		58	
CD3T 0697-0X014	15.7 (59.8)		97	
CD3T 0612-0X014	19.0 (71.9)	1,000 (69)	117	
CD3T 0614-0X014	22.7 (85.6)		140	
CD3T 0619-0X015	31.0 (117.3)		191	
CD3T 0829-0X014	7.68 (28.8)		29	1"
CD3T 0858-0X014	15.37 (57.5)		58	
CD3T 0897-0X014	25.7 (96.1)		97	
CD3T 0812-0X015	31.0 (115.8)	360 (25)	117	
CD3T 0814-0X015	37.09 (138.9)		140	
CD3T 0819-0X015	50.61 (189.3)		191	
CD3T 1029-0X014	12.67 (45.4)		29	1-1/4"
CD3T 1058-0X014	25.35 (90.8)		58	
CD3T 1097-0X018	42.39 (151.4)		97	
CD3T 1012-0X018	51.13 (185.5)	210 (14)	117	
CD3T 1014-0X018	61.18 (227.1)		140	
CD3T 1019-0X018	83.47 (302.8)		191	
CD3T 1229-0X014	16.0 (53.0)		29	1-1/2"
CD3T 1258-0X015	32.07 (106.0)		58	
CD3T 1297-0X018	53.63 (177.9)		97	
CD3T 1212-0X018	64.68 (212.0)	195 (13)	117	
CD3T 1214-0X018	77.4 (253.6)		140	
CD3T 1219-0X018	105.6 (340.6)		191	

AquFlow Also Offers: SERIES 3000

Features

- Flow capacities up to 920 GPH (Duplex)
- Pressure Up to 700 PSI
- Modular design in aluminum housing
- Metering accuracy +/- 1%
- Easy capacity controls – manual/auto
- Built in safety – Internal relief valve
- Available in duplex to double flow capacity
- Ability to handle difficult liquids like slurries, off-gasing, and high viscosities

Specifications

Flow capacity adjustment – 0-100%
While the pump is running or stopped

<i>Turndown Ratio</i>	<i>Metering Accuracy</i>
Stroke length – 36:1	Steady state - +/- 1 %
Stroke frequency – 36:1	Linearity - +/- 1%
Combined – 360:1	Combined - +/- 1%

Maximum process fluid temperature

Custom engineered metallic liquid end: 500F
Metallic liquid end/PTFE diaphragm: 250F (121C)
Plastic Head: 140F (60C)
Plunger stroke length: 3"
Hydraulic oil capacity: 12 qts

Displacement per stroke - by plunger size

1" - 2.3469 cu. in. (38.46 ml)
1-1/4" - 3.6738 cu. in. (60.20 ml)
1-1/2" - 5.2906 cu. in. (86.70 ml)
1-3/4" - 7.2063 cu. in. (118.09 ml)
2" - 9.4102 cu. in. (154.21 ml)
2-1/4" - 11.9023 cu. in. (195.04 ml)
2-1/2" - 14.1561 cu. in. (231.98 ml)

Liquid End Material Options

316SS, Alloy 20, Hastelloy C, PVC, PVDF, and PTFE

Series 3000 Performance Table:

AquFlow Model Number	Capacity GPH (LPH)	Pressure PSIG (bars)	Speed (SPM)	Plunger Diameter
CNIT 0844-0X018	24.1 (60.2)		44	1"
CNIT 0858-0X018	31.9 (120.7)		58	
CNIT 0888-0X018	48.0 (181.7)	700	88	
CNIT 0812-0X018	64.0 (242.3)	(48)	117	
CNIT 0814-0X018	76.0 (287.7)		140	
CNIT 1044-0X018	37.8 (94.6)		44	1-1/4"
CNIT 1058-0X018	50.0 (189.3)		58	
CNIT 1088-0X018	75.7 (286.5)	405	88	
CNIT 1012-0X018	100 (378.5)	(28)	117	
CNIT 1014-0X018	120 (454.2)		140	
CNIT 1244-0X018	54.4 (135.9)		44	1-1/2"
CNIT 1258-0X018	71.8 (271.8)		58	
CNIT 1288-0X018	109 (412.6)	265	88	
CNIT 1212-0X018	145 (548.9)	(18)	117	
CNIT 1214-0X01A	173 (654.9)		140	
CNIT 1444-0X018	74 (185.1)		44	1-3/4"
CNIT 1458-0X018	97.8 (370.2)		58	
CNIT 1488-0X018	148 (560.2)	180	88	
CNIT 1412-0X01A	197 (745.7)	(12)	117	
CNIT 1414-0X01A	236 (893.4)		140	
CNIT 1644-0X018	96.8 (241.9)		44	2"
CNIT 1658-0X018	128 (484.5)		58	
CNIT 1688-0X01A	194 (724.4)	130	88	
CNIT 1612-0X01B	258 (976.6)	(9)	117	
CNIT 1614-0X01B	308 (1,165.9)		140	
CNIT 1844-0X018	122.4 (305.9)		44	2-1/4"
CNIT 1858-0X018	161 (609.5)		58	
CNIT 1888-0X01A	245 (927.4)	95	88	
CNIT 1812-0X01B	326 (1,234.0)	(6)	117	
CNIT 1814-0X01C	389 (1,476.3)		140	
CNIT 2044-0X018	145 (378.5)		44	2-1/2"
CNIT 2058-0X01A	191 (757.1)	75	58	
CNIT 2088-0X01B	291 (1,135.6)	(5)	88	
CNIT 2012-0X01C	387 (1,514.2)		117	
CNIT 2014-0X01C	463 (1,824.6)		140	

AquFlow Also Offers: SERIES 4000

Features

- Flow capacities up to 3530 GPH (Duplex)
- Pressure Up to 3,500 PSI
- Modular design in aluminum housing
- Metering accuracy +/- 1%
- Easy capacity controls – manual/auto
- Built in safety – Internal relief valve
- Available in duplex to double flow capacity
- Ability to handle difficult liquids like slurries, off-gasing, and high viscosities

Specifications

Flow capacity adjustment – 0-100%
While the pump is running or stopped

<i>Turndown Ratio</i>	<i>Metering Accuracy</i>
Stroke length – 48:1	Steady state - +/- 1 %
Stroke frequency – 48:1	Linearity - +/- 1%
Combined – 48 0:1	Combined - +/- 1%

Maximum process fluid temperature

Custom engineered metallic liquid end: 500F
Metallic liquid end/PTFE diaphragm: 250F (121C)
Plastic Head: 140F (60C)
Plunger stroke length: 4.01"
Hydraulic oil capacity: 52 qts

Displacement per stroke - by plunger size

7/8" - 2.2698 in (37.19 ml)
1-1/8" - 3.8013 in (62.29 ml)
1-9/16" - 7.6453 in (125.29 ml)
2-1/2" - 19.63 in (321.77 ml)
3" - 28.1989 in (462.12 ml)
4" - 50.34 (824.99 ml)

Liquid End Material Options

316SS, Alloy 20, Hastelloy C, PVC, PVDF, and PTFE

Series 4000 Performance Table:

AquFlow Model Number	Capacity GPH (LPH)	Pressure PSIG (bars)	Speed (SPM)	Plunger Diameter
GNIT 0744-0X01A	22.6 (85.5)		44	7/8"
GNIT 0770-0X01A	36.0 (136.3)		70	
GNIT 0788-0X01A	45.0 (170.3)	3,500	88	
GNIT 0714-0X01A	72.0 (272.5)	(241)	140	
GNIT 0944-0X01A	38.5 (145.7)		44	1-1/8"
GNIT 0970-0X01A	61.5 (232.8)		70	
GNIT 0988-0X01A	77.0 (291.5)	2,000	88	
GNIT 0914-0X01A	123 (465.6)	(138)	140	
GNIT 1344-0X01F	79.5 (300.9)		44	1-9/16"
GNIT 1370-0X01F	126 (477.0)		70	
GNIT 1388-0X01F	159 (601.9)	1,000	88	
GNIT 1314-0X01F	253 (957.7)	(69)	140	
GNIT 2044-0X01F	210 (794.9)		44	2-1/2"
GNIT 2070-0X01F	335 (1,268.1)		70	
GNIT 2088-0X01F	421 (1,593.7)	370	88	
GNIT 2014-0X01F	671 (2,540.0)	(26)	140	
GNIT 2444-0X01H	304 (1,150.8)		44	3"
GNIT 2470-0X01H	485 (1,835.9)		70	
GNIT 2488-0X01H	609 (2,305.3)	295	88	
GNIT 2414-0X01H	970 (3,671.8)	(20)	140	
GNIT 3244-0X01H	554 (2,097.1)		44	4"
GNIT 3270-0X01H	882 (3,338.7)		70	
GNIT 3288-0X01H	1,109 (4,198.0)	160	88	
GNIT 3214-0X01H	1,765 (6,681.2)	(11)	140	

AquFlow Also Offers: SERIES 900

Features

- Flow capacities up to 6.5 GPH (Duplex)
- Pressure Up to 3,000 PSI
- Modular design in aluminum housing
- Metering accuracy +/- 1%
- Easy capacity controls – manual/auto
- Built in safety – Internal relief valve
- Available in duplex to double flow capacity
- Ability to handle difficult liquids like slurries, off-gasing, and high viscosities

Specifications

Flow capacity adjustment – 0-100%
While the pump is running or stopped

<i>Turndown Ratio</i>	<i>Metering Accuracy</i>
Stroke length – 10:1	Steady state - +/- 1 %
Stroke frequency – 10:1	Linearity - +/- 1%
Combined – 100:1	Combined - +/- 1%

Maximum process fluid temperature

Custom engineered metallic liquid end: 500F
Metallic liquid end/PTFE diaphragm: 250F (121C)
Plastic Head: 140F (60C)
Plunger stroke length: 0.754"
Hydraulic Oil Type F capacity: 1 qts
Gear Oil capacity: 1 qts

Displacement per stroke - by plunger size

3/16" - 0.0207 in (0.33 ml)
1/4" - 0.0368 in (0.60 ml)
3/8" - 0.0828 in (1.35 ml)

Liquid End Material Options

316SS, Alloy 20, Hastelloy C, PVC, PVDF, and PTFE

Series 900 Performance Table:

AquFlow Model Number	Capacity GPH (LPH)	Pressure PSIG (bars)	Speed (SPM)	Plunger Diameter
DM3T 1929-0X013	0.14 (0.53)		29	
DM3T 1958-0X013	0.28 (1.06)		58	
DM3T 1997-0X013	0.47 (1.78)	3,000	97	3/16"
DM3T 1912-0X013	0.56 (2.12)	(200)	117	
DM3T 1914-0X013	0.67 (2.54)		140	
DM3T 1917-0X013	0.82 (3.10)		170	
DM3T 2529-0X013	0.24 (0.91)		29	
DM3T 2558-0X013	0.49 (1.85)		58	
DM3T 2597-0X013	0.82 (3.10)	3,000	97	1/4"
DM3T 2512-0X013	1.00 (3.79)	(200)	117	
DM3T 2514-0X013	1.19 (4.50)		140	
DM3T 2517-0X013	1.44 (5.45)		170	
DM3T 3829-0X013	0.55 (2.08)		29	
DM3T 3858-0X013	1.11 (4.20)		58	
DM3T 3897-0X013	1.86 (7.04)	3,000	97	3/8"
DM3T 3812-0X013	2.24 (8.48)	(200)	117	
DM3T 3814-0X013	2.69 (10.18)		140	
DM3T 3817-0X013	3.25 (12.30)		170	

6. Installation

Note

If pump is not going to be installed immediately, but will be placed in storage for a period not exceeding 6 months, see Section 4.3 for instructions.

6.1 General information on installation

Prior to shipment, each pump is factory tested under application hydraulic conditions, using water. The internal relief valve is preset to meet the operating conditions specified on the purchase order, and the pump is fully assembled and ready for installation.

Protective caps are used to cover the suction and discharge check valves during shipment, and containers of hydraulic oil have been included in the shipping carton.

When unpacking the pump, make certain that no loose components are accidentally discarded. Examine the pump for shipping damage. If damage has occurred, a claim must be filed with the freight carrier within 24 hours.

6.2 Location

1. The pump installation site should provide easy access for capacity adjustment, routine maintenance, and where possible, to protect the pump from the elements and from leaks or drips from other process equipment.
2. The pump should be located on a level surface. While not required, it is suggested that the pump be bolted on a concrete pad or slightly raised platform above floor level to protect pump from washdowns.
3. Pumps installed outdoors should be shaded from direct sunlight and protected from the elements. Direct sunshine and ambient temperatures above 90°F could cause excessive hydraulic oil and motor temperatures.

Installations with ambient temperatures outside 50-100°F require changing the oil to a different viscosity index to assure reliable performance. In extreme cold temperatures, insulation and heat tracing maybe required.

6.3 Piping

1. The Aquflow® Series 1000 is a reciprocating motion type pump. Therefore, size the piping system to accommodate peak instantaneous flow which is 3.14 times pump capacity (example: 60gph x 3.14 = 188 gph). Failure to do so may restrict fluid flows, resulting in erratic pump performance.
2. Piping materials selected must be resistant to corrosion by the liquid being pumped, and rated to withstand maximum pressure and temperatures of the system.
3. When determining pipe size, be certain that it is equal to, or the next size larger than, the pump check valve connections.
4. When selecting fittings for use with flexible hose or tubing, be certain that the I.D. is equal to or larger than that of the tubing. Failure to do so may restrict fluid flows, resulting in erratic pump performance.
5. Use pipe sealant(s) sparingly. Excess sealant could dislodge and impede proper check valve operation. Be particularly careful when making pipe connections to plastic pump heads, since use of excessive sealant and/or overtightening may crack plastic pump heads.
6. Shut-off valves and unions installed in the suction and discharge pipelines will facilitate pump servicing. Please refer to Figure 3 for a typical installation.

6.4 Suction piping

1. Before connecting the pump, be certain that the suction piping is completely clean by flushing thoroughly. Failure to do so may result in foreign matter entering and damaging the pump.
2. Keep the suction line as short and straight as possible. A flooded suction or gravity feed of the process fluid to the pump inlet is preferred. A suction line strainer is highly recommended to prevent foreign matter from entering and damaging the pump.

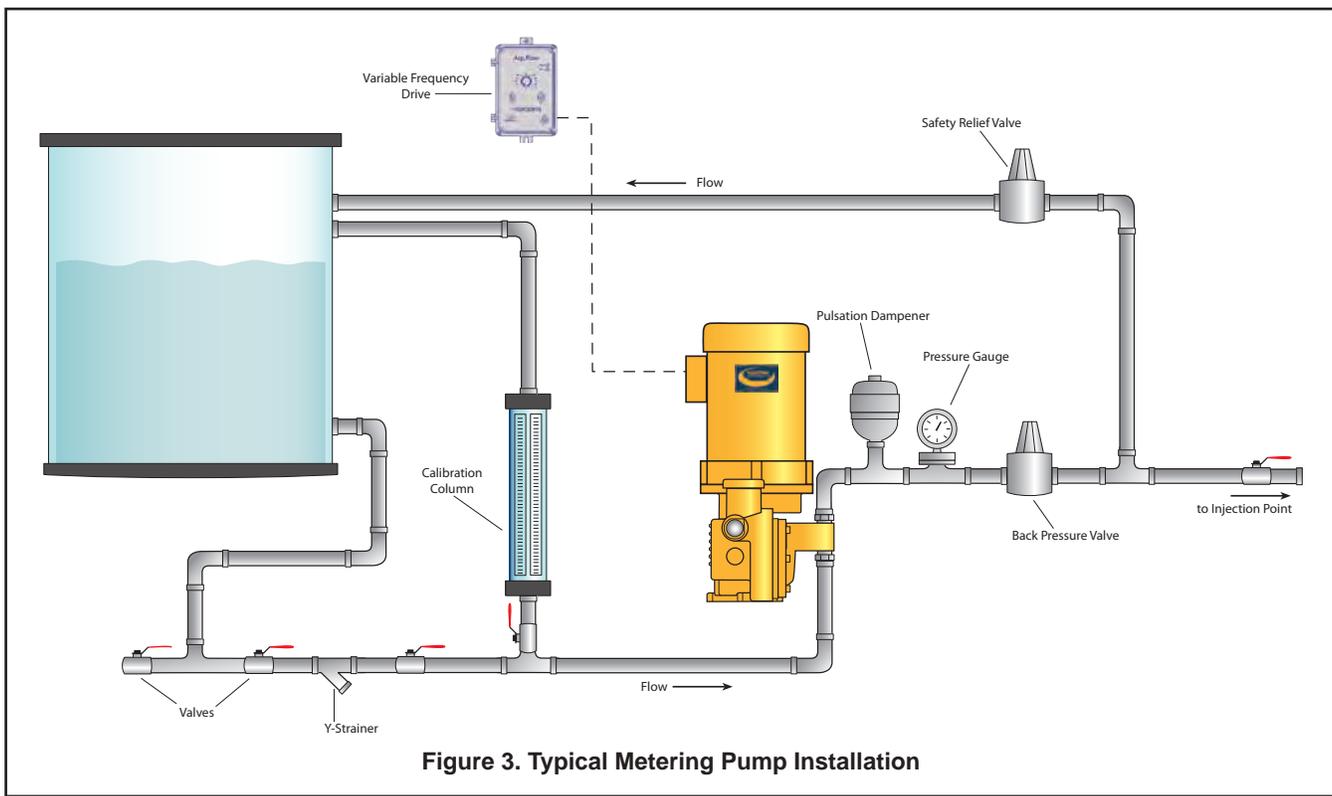


Figure 3. Typical Metering Pump Installation

Note

Please consult factory for suction lift application. Some chemicals tend to off gas more in suction lift. Suction lift applications require the use of a foot valve and strainer to prevent loss of prime and to prevent foreign material from entering the pump.

3. Suction piping must be absolutely airtight to assure accurate pumping. If air or gas is allowed to accumulate inside the pump head, the output will become erratic or stop altogether.
4. Piping should be sloped to prevent the formation of vapor pockets, which could eventually accumulate inside the pump head resulting in erratic pump delivery.
5. Provide necessary pipe supports to avoid placing strain on the pump connections. Flexible connections can be used if pressure permits. If flexible suction line is used, be sure that selection and installation will prevent wall collapse and thus a starved suction condition.
6. Provision should be made in the system to avoid the possibility of running the pump dry. Typically this is accomplished by wiring a low-level shut-off switch mounted in the supply tank to the pump motor starter.
7. Where pump fluids may solidify, crystallize, etc., provision should be made to flush the pump and piping regularly, especially prior to shutdown.

6.5 Discharge piping

1. Install adequately sized pipe with a pressure rating in excess of the pressure relief valve setting.
2. A minimum positive pressure differential of 25 psi between the suction and discharge valves is recommended for proper hydraulic bypass operation and seating of the ball checks. Should normal discharge pressure be less than the suction pressure, an artificial discharge pressure must be created to prevent siphoning. This can be accomplished by the use of a back pressure valve installed in the discharge piping.
3. A properly sized pulsation dampener installed in the discharge pipeline between the pump and back pressure valve will smooth out flow peaks, reduce "water hammer" and protect downstream instrumentation.
4. AquFlow suggests placing a pressure gauge with isolator close to the discharge of the pump to visually see the proper functioning of the pump.

Caution

The internal relief valve is designed only to protect the pump and drive components in the event the piping system is restricted or blocked while the pump is in operation. If there are other sources of pressure or hydraulically isolated sections of piping in the system, an external safety relief valve must be installed in the pump discharge line as close to the pump as possible, and BEFORE any isolation valve. The safety relief valve should be piped back to the suction tank or safety drain as shown in Figure 3.

5. We also strongly suggest that the back pressure valve be located as close to the discharge valve of the pump as possible (in the range of 10 to 20 times the pipe diameter).

7. Electrical Connections

7.1 Power connections

1. Check the nameplate rating of the motor and any auxiliary electrical equipment against the available power supply before making connections. Direction of rotation of the motor is important, and must be clockwise when viewing the motor from the top. Jog the motor to check rotation.
2. Standard wiring and conduit piping practice in accordance with local electrical codes should be followed. A motor starter with properly sized thermal overload heater is recommended.
3. Provide adequate ventilation for the drive motor.

Caution

Motor starters with properly sized thermal overload are recommended for motor protection.

Note

Motors are warranted by the motor manufacturer. You can obtain prompt local service by consulting the motor manufacturer's authorized service station nearest you, as listed on the Internet or in the yellow pages. AquFlow can also assist you in locating this information.



All electrical connections must be done by a qualified electrician!



Please ensure that the nearby environment does not have any flammable liquids/fumes.

8. Start-up/shutdown

8.1 Start-up inspection

Several items should be checked after the pump has been installed and prior to initial start-up.

1. Series 1000 pumps are shipped with hydraulic oil supplied separately in 1-quart containers.

Note

The oil shipped with the pump is for the typical application - operation at ambient temperatures from 50-100°F.

Note

For low displacement (3/8" plunger) pumps, use Type F Hydraulic Fluid which is less viscous.



Please visit www.aquflowpumps.com/videos to view how to load oil into the pump.

- Remove the reservoir cover and slowly pour in the hydraulic oil until it reaches the level mark shown on the pump housing.
2. Check to be certain that accessory components and fittings have been installed in the proper orientation and sequence as shown in Figure 3.
3. Check to be certain that the electrical supply matches the pump nameplate electrical characteristics.
4. Make certain that suction and discharge valves are open prior to pump start-up.
5. Jog motor to assure proper clockwise rotation.
6. After initial filling, run the pump for 15 minutes with micrometer knob set at 0% to allow hydraulic oil to completely fill all pump cavities, then recheck level and add oil as necessary. Smaller plunger size pumps may require longer running at 0% micrometer setting to fully vent entrained air from the hydraulic oil.
7. It is important that pump suction and discharge lines are free of entrained air. To assure proper start-up, start the pump without any discharge pressure (vented to atmosphere) and with the micrometer set at 0% capacity. Slowly turn the micrometer towards 100% capacity to fill the pumping system with process fluid.

Note

On suction lift applications, it may be necessary to prime the pump by first wetting the ball check valves, and starting the pump without any discharge pressure (vented to atmosphere). Suction lift applications require the use of a footvalve strainer to prevent loss of prime.

8.1A Purging the air from the hydraulic side

It is very important to ensure that there is no trapped air of even the smallest volume on the hydraulic side of the pump. Any trapped air on the hydraulic or process side of the pump will prevent the pump from working accurately. It will use the displacement to compress and expand air instead of pushing the liquid.

Note

Small displacement pumps require special attention to purging air from hydraulic as well as process side!

An effective way of eliminating air on the hydraulic side is as follows:

1. Start the pump with all valves on the discharge side open while ensuring the capacity adjuster is at 0%.
2. After running so for 15 minutes, slowly turn the capacity adjuster (micrometer) knob to 100%. Smaller plunger pumps may need to run longer.
3. Add oil through the chimney if you see the oil has dropped below the marking.
4. Turn down the capacity adjuster to 70% for 5-10 minutes and then bring it back up to 100%.



Please visit www.aquflowpumps.com/videos to view a demonstration of the bleeding air procedure.

8.1B Purging air from the process side

It is very important to ensure that there is no trapped air of even the smallest volume on the process side of the pump. Any trapped air on the hydraulic or process side of the pump will prevent the pump from working accurately. It will use the displacement to compress and expand air instead of pushing the liquid.

An effective way of eliminating air on the process side is as follows:

1. While you were removing air from the hydraulic side in 8.1A, you had all valves open on the process discharge piping.
2. Run the pump at 100% stroke and 100% speed for 5-10 minutes.
3. Slowly close the Back Pressure Valve to start building pressure.
4. Monitor the pressure on the pressure gauge until it reaches the design pressure.
5. If you do not see the design pressure or the rated flow, open the Back Pressure Valve to let the air out and away.
6. Repeat the opening and closing of the Back Pressure Valve a couple of more time if necessary.
7. If the pump still does not give the rated flow, turn the capacity adjuster (micrometer) knob down to 0%. Then again, slowly increase it back up to 100%.

8.2 Pump calibration

Each pump is tested at the factory prior to shipment to assure proper operation at the capacity and discharge pressure specified. For precise capacity control in the field, a calibration test under actual pumping and piping conditions is recommended.

This can be accomplished by allowing the pump to operate at full capacity for a minimum of 30 minutes. This will clear any air out of the pump.

Pump calibration can be accomplished by measuring the decrease in liquid level pumped from a calibration column installed in the suction line as shown in Figure 3 on page 9. Follow the calibration instructions provided by the cylinder manufacturer.

An alternate method of calibration for non-hazardous applications is to collect and measure the fluid metered from the pump discharge port into a graduated cylinder or tank.

Typically, test samples are collected at 25%, 50%, 75% and 100% capacity settings. A straight line results when these points are plotted on a graph. This graph can then be used for intermediate settings, assuming suction and discharge conditions remain constant.



Use extreme care when performing calibration test using open cylinder or tank method, and be extremely careful when working in the presence of hazardous substances. Wear suitable protective clothing and eyeshielding for protection.

It is important to realize that the samples at 50% will not necessarily be exactly 1/2 of that at 100%, nor will any other sample points be a specific percentage of the 100% value. But, the sample value will lie along a straight line that can be used for intermediate settings, and the pump will give repetitive samples at the same setting. This last characteristic is what makes the AquFlow® Series 1000 pump effective; it will meter chemicals precisely within ±1% of capacity set point over long periods of time.

Also, as operating discharge pressures increase, there are additional hydraulic system losses which are constant for any given discharge pressure.

This results in a small decrease in the maximum capacity output of the pump. All AquFlow® capacity/pressure charts used for pump selection have a base pressure rating of 100 psig. For higher discharge pressure decrease maximum capacity by 1.25% for every 100 psig increase.

9. Maintenance and repair w/ parts breakdown



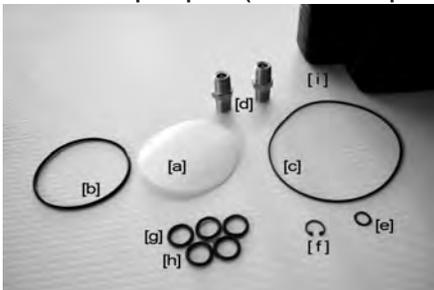
Disconnect and lockout power to the pump before performing service or disassembling the pump.

9.1 Preventative Maintenance

The Series 1000 metering pump is designed for continuous service with maximum reliability and minimum downtime. However, good maintenance procedures dictate that certain visual periodic checks be made to assure that operating problems have not developed.

1. Check the hydraulic oil level periodically, to be sure it is at the proper level mark, and adjust as necessary.
2. Inspect the liquid end assembly, including the suction and discharge connections for any indication of leakage, and correct as necessary.
3. Hydraulic oil should be replaced once a year following the procedures outlined under "Oil Change."

9.2 Recommended spare parts (for metallic liquid end)



To minimize downtime, the following spare parts should be inventoried to support each pump. These spare parts are available in vacuum-sealed packaging, which provides infinite shelf life when properly stored.

- (1) Diaphragm [a]
- (1) Diaphragm O-Ring [b]
- (1) Motor O-Ring [c]
- (2) Check Valve Balls* [d]
- (2) Check Valve Seats* [d]
- (1) Control Spool Wave Washer^a [e]
- (1) Control Spool Retaining Ring^a [f]
- (3)^b Control Spool O-Ring^s [g]
- (2) Drive Housing Gear Shaft O-Rings [h]
- (2) 2 qts. of Lubricant [i]

Note

1. **Duplex pumps require one (1) Spare Parts Pak for each liquid end.**
2. ***3/8" and 1/4" Check Valves are supplied as complete assemblies.**
3. **^a Model specific parts, only included if required.**
4. **^b Quantity varies by Model.**

9.3 Oil change

1. Under normal operating conditions the hydraulic oil should be drained and replaced once a year. In severe applications the hydraulic oil should be changed more frequently.
2. Drain hydraulic oil using the drain plug on the side of the pump. (For convenience the drain plug can be replaced with a quick draw fitting or valve and short nipple.)



The recommended lubricant for AquFlow® Series 1000 is Zurn E.P. #95, for normal operation. Series 1000 CA4T models use gear oil. Various manufacturers' equivalent oils are listed below:

(Indoor, temperature controlled ambient)

ZURN	EP Lube #EP95
Amoco	Permagear #220
Drydene	E.P. Gear Oil #5
Exxon	Spartan #EP220
Mobil	Mobilgear #630
Shell	Omala #220
Texaco	Meropa #220
ATF	Type F Hydraulic Oil (for 3/8" plunger pump)

For applications with different ambient or fluid temperatures, please consult factory for alternate lubricant recommendations.

9.4 Check valves

9.4A Series 1000 check valve replacement - plastic

AquFlow Series 1000 models with plastic diaphragm heads (whether it is made of PVC or PVDF) have the same internal seat design inside the diaphragm head. Due to the o-rings that are on these seats removal from the diaphragm head can be tricky. The valve seats can be replaced without having to remove the diaphragm head from the pump or draining the oil, and only requires minimal tools.

TOOLS REQUIRED

- Compressed air with about 30 to 40 psiG in the tank and a blow gun attached to the air hose
- A pair of channellock pliers for removing the valve cap
- Hook pick for removing the O-rings
- One 1/2" hose adapter with 3/4" MNPT
- One 1/2" hose adapter with 1/2" MNPT
- Long nose pair of pliers
- Shop rags

The first step is to ensure that the chemical inside the pump has been thoroughly flushed with a neutralizing liquid for your own safety. Refer to the cut-away drawing on page 17 of this manual for component reference.

REMOVAL OF VALVE SEAT

1. After the pump has been completely flushed with neutralizing liquid, remove the inlet and outlet piping to the pump.
2. Remove the Discharge valve cap (2903) from the diaphragm head (2901) using a channel lock pliers by rotating the cap in CCW fashion.
3. Install the 3/4" MNPT hose adapter on the inlet side of the diaphragm head. The idea is to introduce sufficient air pressure into the inlet side of the pump just to lift the discharge check valve seat (2904) from its pocket.
4. Put the compressed air blow gun into the hose adapter and with your left index finger press firmly on the ceramic ball (2905). In some cases higher air pressure maybe required to unseat the valve seat from its pocket.
5. Introduce a quick burst of compressed air into the adapter until check valve seat is fully lifted from its pocket in the diaphragm head. Make sure you do not loose the ceramic ball in this process.
6. To remove the suction or inlet valve seat (2904), remove the valve cap (2903) from the suction side of the diaphragm head (2901) using channel lock pliers and rotate in CW fashion.

7. Replace the discharge side valve cap (2903) and install the ½" MNPT hose adapter on discharge side of the diaphragm head.
8. Using the palm of your hand cover the valve cap hole of the suction side to catch the removal of the ball and seat once a short burst of air is introduced into the hose adapter.

INSTALLATION OF NEW CHECK VALVE SEATS

Replacement of AquFlows' check valve seats on Series 1000 is very simple and can be done without having to drain the oil in the pump or removal of the diaphragm head. This instructional video assumes that the seats have been removed from the diaphragm head already and that the seat pockets have been cleaned of any debris. Refer to the cut-away drawing on page 17 of this manual for component reference.

DISCHARGE SIDE

1. Install the o-ring (2906) on the valve seat (2904) (if not already installed by the factory) drop in the check valve seat with the rounded profile facing down into the diaphragm head (2901).
2. Replace the o-ring (2907) on the valve cap (2903).
3. Place the ceramic ball (2905) on the center hole of the valve seat (2904).
4. Carefully screw in the valve cap (2903) into the diaphragm head making sure not to cross the threads. Tighten the cap with a channel lock pliers until the head of the valve cap (2903) makes contact with the diaphragm head surface.

SUCTION SIDE

1. With one hand hold the valve cap (2903) on it's knurls with the thread facing up.
2. Place the valve seat (2904) on top of the valve cap (2903).
3. Place the ceramic ball (2905) on the center hole of the valve seat (2904) and carefully insert these from below the diaphragm head pocket. Make sure that the ball does not fall out of place.
4. Screw in the valve cap into the diaphragm head making sure not to cross the thread.
5. Tighten the cap with a channel lock pliers until the head of the valve cap (2903) makes contact with the diaphragm head surface.

Run the pump following the start up procedure and check the valve cap are for any signs of liquid leaks.

9.4B Series 1000 check valve replacement - metallic

AquFlow's Series 1000 Metallic liquid end uses 4 different types and check ball sizes of check valve assemblies. The most common is the non-serviceable type (4304) which must be replaced as a complete assembly.

REMOVAL AND REPLACEMENT

1. Ensure that the pump is relieved of line pressure.
2. Wear suitable protective clothing and eye shielding for protection.
3. Flush process fluid on the pump with suitable neutralizing agent.
4. Disconnect and lockout electrical power to the pump.
5. Isolate and disconnect the piping on the suction and discharge valves.
6. Remove the valves using an 11/16" wrench and rotate CCW for the discharge valve and CW for the suction valve.
7. Before installing the new check valves clean the threads on the diaphragm head off any debris or excess sealing compounds.
8. Use thread sealant sparingly. DO NOT APPLY sealant inside the check valves as this could clog and impede in the operation of the check ball.
9. Install the new check valve and tighten accordingly.
10. Reinstall the piping and follow startup procedure.

For AquFlow pumps with serviceable type check valves (1/4", 1/2" and 7/8" ball size check) the valves assemblies consist of male (4329), and female (4325) valve body, o-ring (4326), three pieces of ball guides (4328) and ball (4327). These check valve assemblies are designed to be self cleaning and should seldom need replacement or servicing.

Note

Always wear protective clothing and eye shielding for protection and lockout electrical power to the pump.

Flush out process fluid from the pump and disconnect the piping to the suction and discharge of the pump

DISCHARGE VALVE DISASSEMBLY

1. Remove the discharge valve assembly (4304) from the diaphragm head (2901).
2. To disassemble the valve assembly, unscrew the female body (4325) from the male body (4329).
3. Remove the ball guides (4328); make note of how the ball guides and check ball are assembled in place.
4. Remove the o-ring (4326) from the female body (4325) and replace with a new one.

DISCHARGE VALVE REASSEMBLY

1. Wipe clean the internal of the male body (4329) and the female body (4325) to remove any debris. Check for cracks on the ball seat of the male body and replace if necessary.
2. Gently place the new check ball (4327) inside the male body (4329).
3. Place three ball guides (4328) over the check ball.
4. Screw in the female body (4325) with new o-ring (4326) and tighten the assembly. It maybe necessary to wet the o-ring (4326) with water to ensure this does not kink out of place while the assembly are being tightened together.
5. If replacing a complete assembly with a new set from the factory, skip steps 1 to 4 above.

SUCTION VALVE DISASSEMBLY

1. Remove the discharge valve assembly (4304) from the diaphragm head (2901).
2. Unscrew the female body (4325) from the male body (4329) and note the configuration of the check ball (4327) and ball guides (4328) inside the male body (4329)
3. Remove the ball (4327) and the ball guide (4328) from the male body (4329).
4. Remove the o-ring (4326) from the female body (4325) and replace with a new one.

SUCTION VALVE REASSEMBLY

1. Wipe clean the internal of the male body (4329) to remove any dust or debris and check for cracks on the ball seat on the female body (4325).
2. Place the three ball guides (4328) in the proper orientation and place the check ball (4327) inside the ball guides.
3. Screw in the female body (4325) with new o-ring (4326) and tighten the assembly. It maybe necessary to wet the o-ring (4326) with water to ensure this doe not kink out of place while the assembly are being tightened.

For pumps with smaller check valve with 1/4" ball the assembly consist of valve body (4329), ball (4327), guide (4328) and seat (4325).



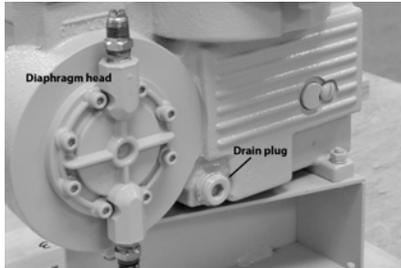
Please visit www.aquflowpumps.com/videos to view a full check valve seat replacement.

9.5 Diaphragm replacement

Except in the unlikely event of a loss in integrity, the diaphragm does not require replacement. Should a diaphragm replacement be required, the following steps must be followed:

DISASSEMBLY

1. Wear suitable protective clothing and eye shielding for protection.
2. Disconnect and lockout electrical power to the pump and drain the oil. See picture for location of the drain plug.



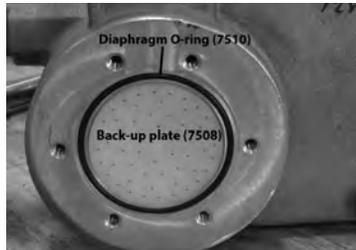
3. Disconnect and isolate all piping on the suction and discharge check valves of the pump.
4. Flush process fluid from liquid end, using a suitable neutralizing agent.
5. Remove the 6 or 8 bolts (4305) from the diaphragm head (2901) and remove it from the drive housing. Note the orientation of the check valve cartridges (4304) as they must be in the same position when the diaphragm head is reassembled.
6. Remove diaphragm, contour plate and support plate; inspect for any obvious damage.

Note To prevent leakage, never attempt to reuse the old diaphragm.

REASSEMBLY

Make sure you have the new diaphragm and new o-ring appropriate for the pump size you are working on.

1. Set the stroke length control to 100%.
2. Set the diaphragm backing plate (7508) in the diaphragm cavity within the pump drive housing (7501).
3. Place the diaphragm o-ring (7510) in its groove within the drive housing.



4. Place the new diaphragm (2631) over the diaphragm o-ring centering the diaphragm in its cavity. Depress the center of the diaphragm to create a vacuum (suction) to hold the diaphragm in place.
5. Place the contour plate (4302) inside the diaphragm head and place the diaphragm head and contour plate assembly over the drive housing bolt holes. Care must be taken not to move the diaphragm out of center. Retain the assembly in place using the 6 or 8 bolts (4305).
6. Tighten the bolts in steps using diagonal and clockwise pattern to a final torque of 130-150 in-lbs for metallic or 45 in-lbs for plastic liquid end.
7. Replace the drain plug and refill the pump with the appropriate hydraulic oil.
8. Reconnect the suction and discharge lines.
9. Follow the "Start Up Inspection" procedure as outlined earlier. Run the pump and check for leaks.
10. Return the pump to service.



Please visit www.aquflowpumps.com/videos to view a demonstration of a diaphragm replacement.

9.6 Adjusting internal relief valve

The internal relief valve is factory set to open at a pressure slightly higher than the discharge pressure indicated on the pump data plate. Unless otherwise indicated, when the pump is ordered the internal relief valve is set to open at the greater of 25 psig or 25% above the discharge pressure.

1. Wear suitable protective clothing and eye protection.
2. Install a pressure gauge in the discharge line of the metering pump with a range 50% greater than the desired internal relief valve setting.
3. Install an adjustable safety relief valve downstream from the pressure gauge.
4. Remove the oil reservoir cap assembly (2618). The brass internal relief adjuster (2615) is located on a cast-in boss just under the cover. The adjuster requires a 5/16" hexagonal type "Allen" wrench.

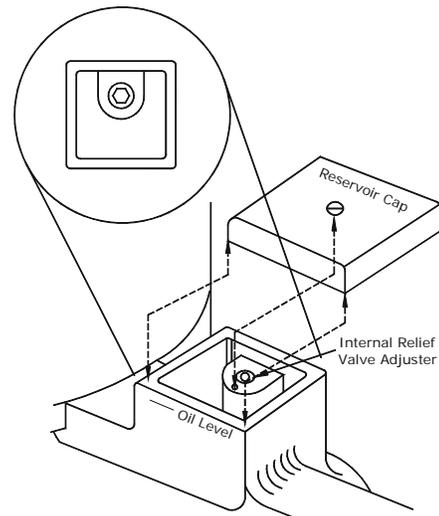


Figure 4. Relief Valve & Oil Fill Port

5. Set the capacity adjuster to 100%, back off the adjustment to the safety relief valve so it opens at zero psig and start the pump. Continue to run the pump long enough to establish good pumping action.
6. Increase the seating of the SRV until the pump starts to build pressure. Carefully and continually observe the pressure indicated on the gauge. Gradually increase the safety relief valve setting until the pump internal relief valve actuates.
7. Rotate the internal relief valve adjuster CCW to decrease the pressure and CW to increase the pressure. Adjustments should be made in 1/4 turn increments. After each adjustment, relieve the discharge pressure by opening the safety relief valve. Observe the pressure gauge and repeat the adjustment as described until the desired internal relief valve pressure is indicated on the pressure gauge.
8. After adjustments are complete, return the safety relief valve to its appropriate setting.
9. Return pump to service.



Please visit www.aquflowpumps.com/videos to view a demonstration of an internal relief valve adjustment.

Do not run pump with relief valve adjuster "bottomed out," as severe damage to pump may result!

Never exceed pressure rating of pump or any component of the system or piping!

When the relief valve is actuated, particularly in the larger plunger size or high-speed units, oil may be ejected at high velocity through the bypass port. Routine precautions should be taken to prevent oil from splashing the operator of the surrounding area!



9.7 Replacing control valve o-ring

Control spool o-rings are included in the spare parts kit, and they can be easily replaced during routine pump maintenance.

1. Disconnect and lockout electrical power to the pump and drain hydraulic oil.
2. Remove the (2) bolts (7504) holding the motor and remove motor from pump. Be careful not to lose the shaft key.
3. Remove the (2) actuator screws (2629), and slide the actuator (2610) off the bypass tube (Note the orientation of actuator before removal).
4. Remove the control valve locking screw (2641) from housing (the screw at front of capacity plate).
5. Turn control valve counterclockwise until fully released.
6. Pull the control valve from pump housing.
7. Replace the (3) control valve o-rings (2623).
8. Remove control spool from micrometer knob by using snap ring pliers to remove the snap ring (2628).
9. Replace spring washer (2636).
10. Insert the control spool into the micrometer knob and retain in place using the new snap ring.
11. Apply a thin film of hydraulic oil to the control spool o-rings and carefully slide assembly back into pump housing. The bypass tube should be in the control spool and left extended about 1.5".
12. Thread the control spool to 100% capacity setting.
13. Reinstall the retaining screw (2641) in housing.
14. Replace actuator (2610) in the correct orientation and reinstall screws (2629).
15. Replace the motor, then refill housing with hydraulic oil to proper level.
16. Restart pump.

9.8 Replacing gear shaft o-rings



1. Disconnect and lockout electrical power to the pump (Note: If this procedure is done carefully, it may not be necessary to drain hydraulic oil).
2. Remove the (2) gear shaft screws (2643) from the housing - one on each side of the housing.
3. Slide gear shaft approximately 1/2" in either direction; DO NOT REMOVE IT FULLY.
4. Remove and replace exposed o-ring (2642).
5. Apply a thin film of oil to the o-ring and slide gear shaft back into housing. Replace opposite side o-ring using the same procedure.
6. Slide gear shaft to its original position and reinstall (2)

retaining screws (2643), using Loctite® part no. 24241 or equal.

7. Recheck the hydraulic oil level and add oil as necessary.
8. Restart pump.

9.9 Series 1000 worm gear replacement

The worm gear set on all AquFlow pumps are made from turned steel worm shaft and grey cast iron worm gear. If the pump is well maintained with periodic oil changes, the gear set should last throughout the life of the pump without ever having to be replaced. However, in the event that the gear set needs to be replaced follow the steps below.

DISASSEMBLY

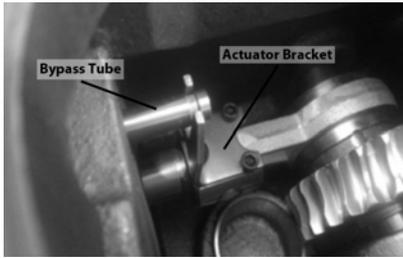
1. Wear suitable protective clothing and eye shielding for protection. Disconnect and lockout the electrical power to the pump and drain the oil.
2. Release the process fluid pressure from the pump, and close all ball valves on the inlet and outlet of the pump.
3. Remove the two motor screws (7504) and washers (7503) and carefully lift the electric motor (7502) from the drive housing (7501).
4. Remove the motor o-ring (7509).
5. Remove the worm shaft (2600) from the drive housing or separate this from the motor. Be careful not to lose the motor spring (7506) and shaft key (7507).
6. Remove the two gear shaft screws (2643).
7. Remove the two actuator screws (2629) and remove the actuator, bypass (2610) from the spool valve (2605).
8. Push the gear shaft (2620) towards the worm gear and allow the gear to fall into the drive housing. Be careful not to lose the gear spacer (2644). It is not necessary to fully remove the gear shaft out of the drive housing.
9. Lift the worm gear from inside the drive housing and slide this out of the connecting rod in the plunger assembly (2604).
10. Inspect both the worm shaft and gear shaft for excessive wear or broken gear teeth.

REASSEMBLY

1. Clean out the inside of the drive housing with solvent just sufficient to wash out any metallic debris that can potentially damage the new gear set.
2. Replace the o-rings (2642) on the gear shaft.
3. Insert the gear shaft (2620) through the right side of the drive housing and the install the gear spacer (2644) on the gear shaft from the inside of the drive housing.



4. Lift the connecting rod of plunger assembly (2604) from within the drive housing and install the worm gear into the connecting rod.
5. Lower the worm gear (2600) into the drive housing and align the center hole to the gear shaft.
6. Slowly push the gear shaft through the drive housing and through the worm gear until the gear shaft is fully flush on both sides of the drive housing.
7. Align the notch on one side of the gear shaft to the screw hole and install the gear shaft screw (2643). Make sure to use Loctite on the thread of these screws.
8. Install the actuator (2610) on the tube of the control valve assembly (2605). See photo.
9. Install the new worm shaft with bearing into the drive housing



and rotate this a few times to ensure that the two gears are aligned correctly with each other.

10. Place the motor spring (7506) inside the worm shaft.
11. Set the motor o-ring (7509) on its groove on the drive housing.
12. Place the key (7507) on the motor shaft and carefully install the motor shaft to the gear shaft. Make sure that the o-ring (7509) does not come out of its groove.
13. Align the motor screw hole and hold this in place with the two screws and washer (7504) and (7503). Torque to 100 in-lbs.
14. Replace the drain plug and refill the pump with the appropriate hydraulic oil to the correct level and follow the start-up inspection described in section 8.1 of this manual.

9.10 Synchronizing the diaphragms for dosing head with double disk diaphragms, or disk with tubular diaphragms (with or without conductivity probe leak detection)

Note

Due to specialized equipment required for synchronizing these disk or tubular diaphragms AquFlow recommends that the pump should be sent back to the factory for necessary repairs. Contact AquFlow direct or your local distributor for assistance.

With AquFlow's mineral oil filling chamber P/N AQP70000 readily available and by following these steps below this task can be achieved. Refer to double disk diaphragm pump and Tubular/disk diaphragm parts cross section page of this manual for parts reference.

DISASSEMBLY

1. Drain the oil from the drive housing's drain plug (2625).
2. Remove the electric motor from the pump and set aside. Locate the motor O-ring (7509) and set aside.
3. Remove and set aside the worm shaft (2600) assembly. Be careful not to lose the motor spring and shaft key.
4. Remove the bleed valve (2912), and Schrader valve (2913) from the intermediate plate (2911) and set aside.
5. Remove the 6 or 8 screws (4305) from the diaphragm head (4301) and carefully remove the intermediate chamber (2911) from the drive housing (7501). Take special attention to the orientation and locations of the intermediate plate (2911), backing plate (7508), contour plate (4302).
6. Remove the o-ring (7510) and diaphragm (2631) and clean all metallic parts and inspect for chemical attack or any imperfections and replace if necessary.

REASSEMBLY

Note

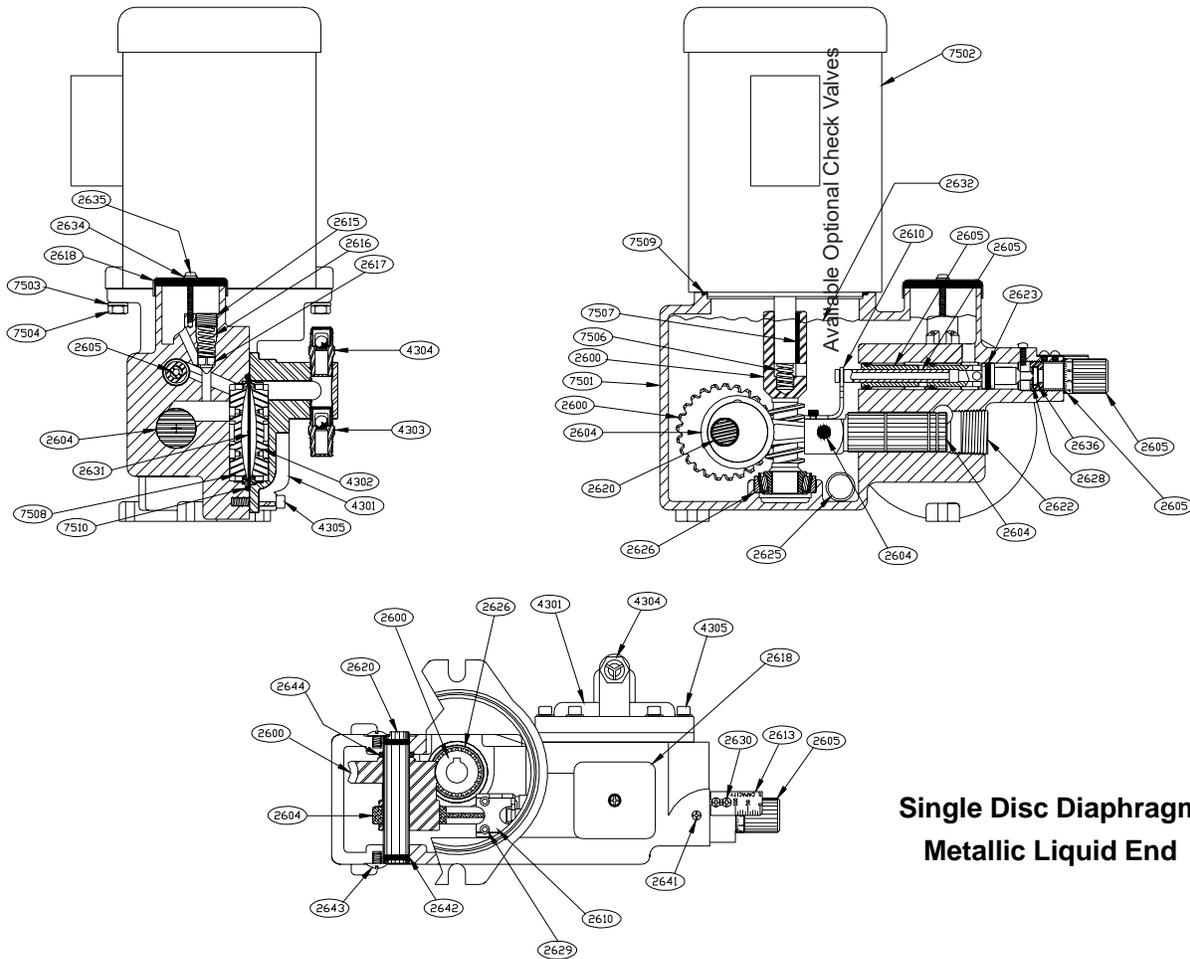
Never attempt to reuse an old diaphragm and diaphragm o-ring's. Before any attempts to carry this repair, new parts should be available on hand to avoid undue delays.

Equipment and fittings required:

- Pressure vessel for refilling the intermediate chamber with mineral oil (Aquflow P/N AQP70000)
- Regulated compressed air capable of up to 50 psig
- 1/4" NPT or 3/8" NPT Pipe cap
- 1/4" NPT or 3/8" NPT Female pipe coupling with suitable quick connect hose fitting
- 2 pcs 1/4-20 x 6" long (min) threaded rods to be used as diaphragm head and intermediate chamber guides.

1. Lay the pump drive housing flat on its side on top a stable work bench with the diaphragm machined surface facing up.
2. Use two 1/4-20 x 6" long threaded rods, hand tight these on two opposite screw holes of the diaphragm mounting face. These will be used as guides for aligning the intermediate chamber and diaphragm head in place.
3. Set the new diaphragm o-ring (7510) on the groove on the drive housing and apply a small amount of oil on the o-ring.
4. Set the backing plate (7508) in its pocket in the drive housing with the contoured face facing up.
5. Set one of the diaphragms (2631) over the o-ring (7510) and backing plate (7508). Make sure that the diaphragm is centered in its location.
6. Install (hand tight) the bleed valve (2912) and Schrader valve (2913) on the intermediate chamber (2911).
7. Align the intermediate chamber assembly (2911) so that the bleed valve (2912) is aligned with the oil cover or oil chimney of the drive housing, and the Schrader valve (2913) is towards the feet of the drive housing. Insert the intermediate chamber assembly through the two threaded screws and lower this on top of the diaphragm. Be careful not to move the diaphragm out of place.
8. Place the second diaphragm o-ring (7510) on the groove of the intermediate chamber.
9. Place the diaphragm (2631) centered on top of the o-ring.
10. Place the contour plate (4302) on top of the diaphragm with the contoured side facing the diaphragm.
11. Align the diaphragm head's screw holes making sure the orientation of the check valves are in line with the oil cover or the oil chimney of the drive housing before placing the diaphragm head assembly into the drive housing.
12. Retain this assembly in place using the 6 or 8 screws (4305) and tighten in steps using diagonal clockwise pattern to a final torque of 130-150 in-lbs.
13. Tighten the Schrader valve (2913) on the intermediate chamber and remove the dust cap and set aside.
14. Set the pump upright. Using Aquflow's mineral oil filling chamber (P/N AQP70000) install the filling hose Schrader valve coupler to the Schrader valve on the pump.
15. Fill the oil filling chamber with mineral oil. Open the outlet ball valve at the bottom of the chamber and open the Schrader valve coupler by turning this clockwise.
16. Install a 1/4" NPT or 3/8" NPT pipe cap on the discharge side check valve (4304).
17. Assemble a 1/4" or 3/8" NPT coupling with a suitable air hose quick connect on the suction side check valve (4304)
18. Pressurize the diaphragm head through the suction side check valve to a maximum of 50 psi of regulated compressed air – maintained.
19. Set the capacity adjuster to 0%.
20. Pressurize the filling chamber to a maximum of 10 psi of regulated compressed air. Open the bleed valve (2912) on the pump. Maintain this pressure until the all the air bubbles are fully evacuated out of the intermediate chamber (2911).
21. Once satisfied that all air has been evacuated out of the intermediate chamber, close the bleeder valve (2912).
22. Release the air from the AQP70000 filling chamber, close the close the ball valve on the filling chamber, and then close the Schrader valve adapter before decoupling this from the pump's Schrader valve. Replace the dust cap on the Schrader valve.
23. Release the air pressure from the suction side check valve, remove the coupling and pipe cap.
24. Install the worm shaft assembly (2600), the motor spring (7506) and motor o-ring (7509) on the drive housing.
25. Install the motor with shaft key retain the motor with the motor screws and torque to 100 in-lbs.
26. Replace the oil drain plug (2625) and refill the pump with hydraulic oil to its proper level.
27. Pump is now ready for service. Follow the startup procedure outlined in this manual.

Basic Drive Spare Parts - Cross Section



**Single Disc Diaphragm
Metallic Liquid End**

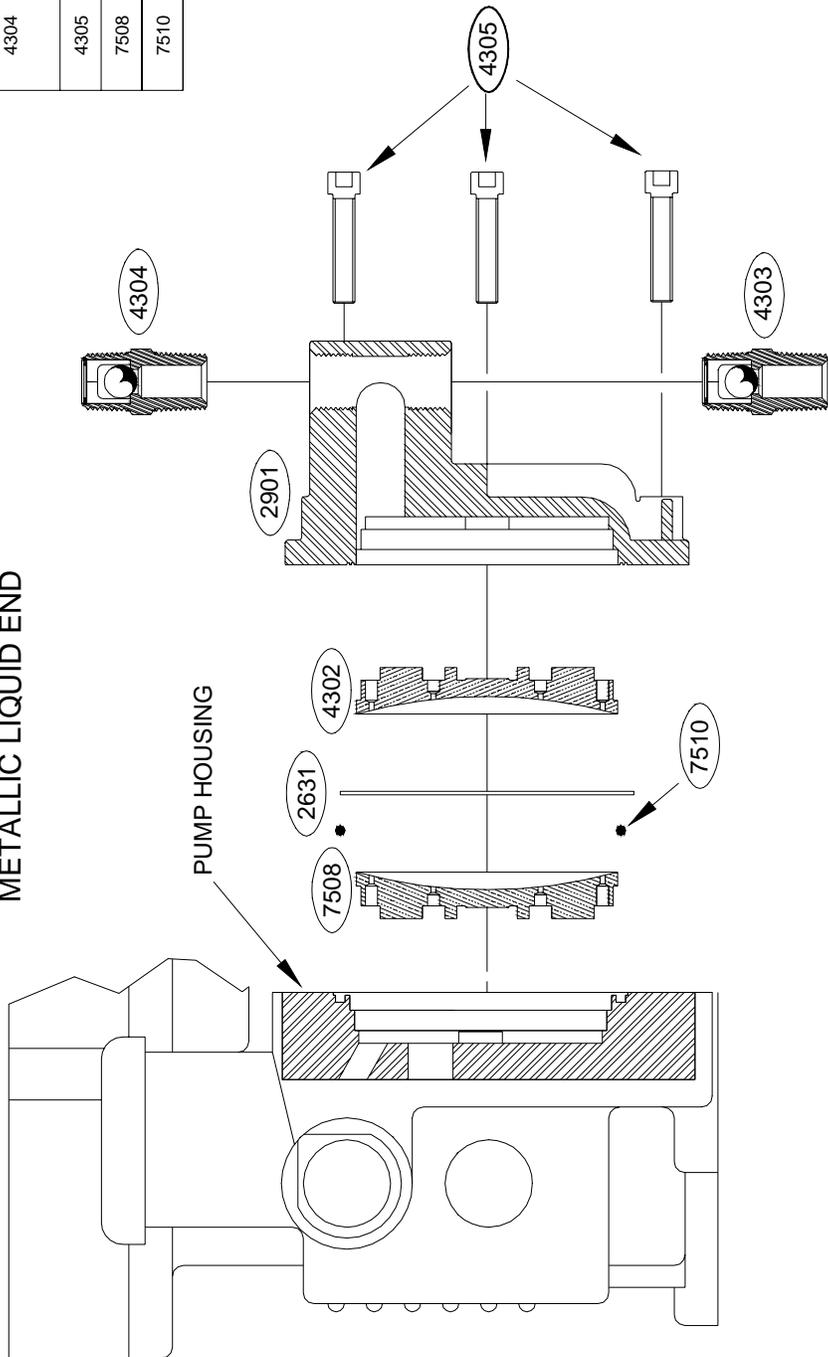
Item	Qty.	Description	Item	Qty.	Description	Item	Qty.	Description
2600	1	Set, Simplex Gear	2630	2	Screw, Capacity Plate	4302	1	Plate, Contour
2601	1	Set, Duplex Gear (not shown)	2631	1	Diaphragm	4303	1	Ass'y, Check Valve Suction
2604	1	Ass'y, Plunger Crosshead	2632	2-3	Oil, Hydraulic; Quart	4304	1	Ass'y, Check Valve Discharge
2605	1	Assembly, Control Valve	2633	1	Baffle (not shown)	4305	6-8	Bolt, Liquid End
2610	1	Actuator, Bypass	2634	1	Washer, Reservoir Cover	7501	1	Housing, Drive
2613	1	Plate, Capacity	2635	1	Screw, Reservoir Cover	7502	1	Motor
2615	1	Adjuster, Hyd. Relief Valve	2636	1	Washer, Spring Control Valve	7503	2	Washer, Motor Mounting
2616	1	Spring, Hyd. Relief Valve	2640	1	Base (optional-not shown)	7504	2	Bolt, Motor Mounting
2617	1	Poppet, Hyd. Relief Valve	2641	1	Screw, Control Valve	7506	1	Spring, Worm Shaft
2618	1	Assembly, Reservoir Cover	2642	2	O-Ring, Gearshaft	7507	1	Key, Motor to Worm Shaft
2620	1	Shaft, Gear	2643	2	Screw, Gearshaft	7508	1	Plate, Diaphragm Backing
2621	1	Wristpin	2644	1	Spacer, Gear, Simplex	7509	1	O-Ring, Motor Sealing
2622	1	Plug, Plunger Bore	2645	1	O-Ring, 1-5/8 Plunger Bore Plug (N/A - not shown)	7510	1	O-Ring, Diaphragm
2623	3	O-Ring, Control Valve	2646	2	Screw, 1-5/8 Plunger Bore Plug (N/A - not shown)	7511	1	Plate, Metric Motor Adaptor (not shown)
2625	1	Plug, Oil Drain	4301	1	Liquid End	7515	3	Bolts, Drive Housing to Base (not shown)
2626	1	Bearing, Worm Shaft						
2628	1	Ring, Snap, Control Valve						
2629	2	Screw, Actuator						

* Most items vary in size, configuration and materials of construction by pump model number. Pump model and serial numbers are required to order replacement parts.

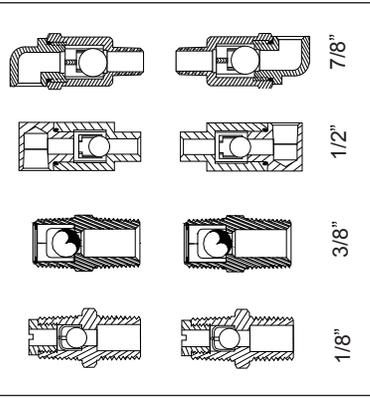
Liquid End Spare Parts - Disc Diaphragm - Metallic

ITEM	DESCRIPTION	QTY
2631	DIAPHRAGM	1
2901	LIQUID END	1
4302	PLATE, CONTOUR	1
4303	ASSY, SUCTION CHECK VALVE	1
4304	ASSY, DISCHARGE CHECK VALVE	1
4305	BOLT, HEAD	6-8
7508	PLATE, BACKUP	1
7510	O-RING, DIAPHRAGM	1

SINGLE DISC DIAPHRAGM METALLIC LIQUID END



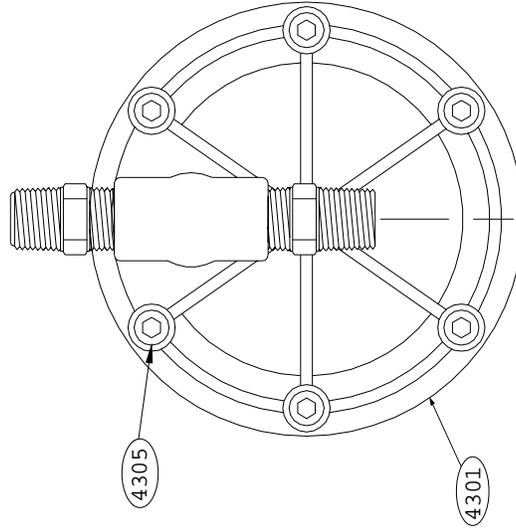
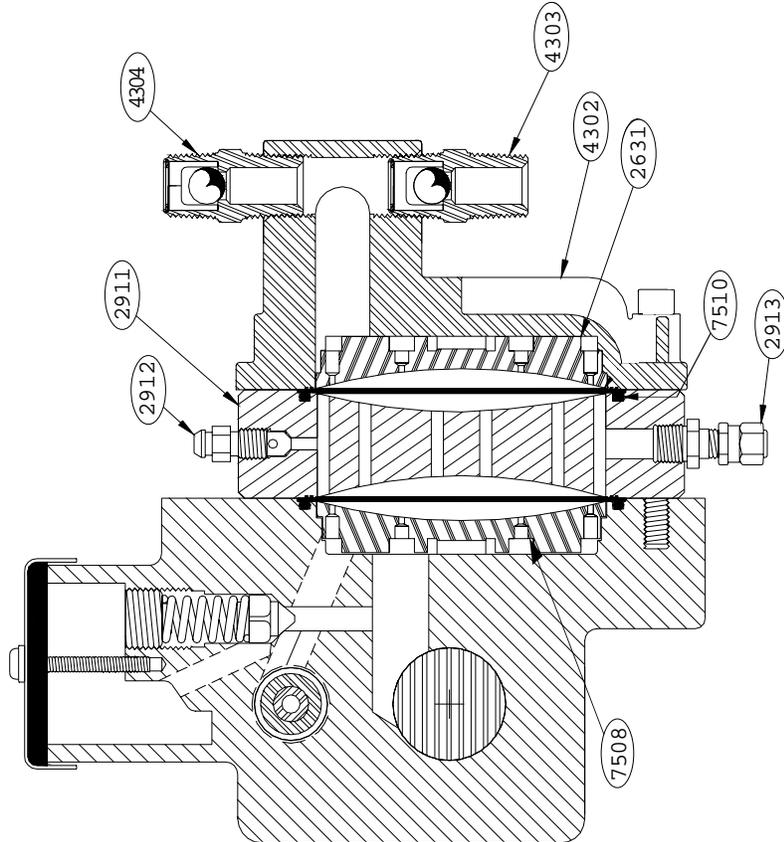
Available Optional Check Valves



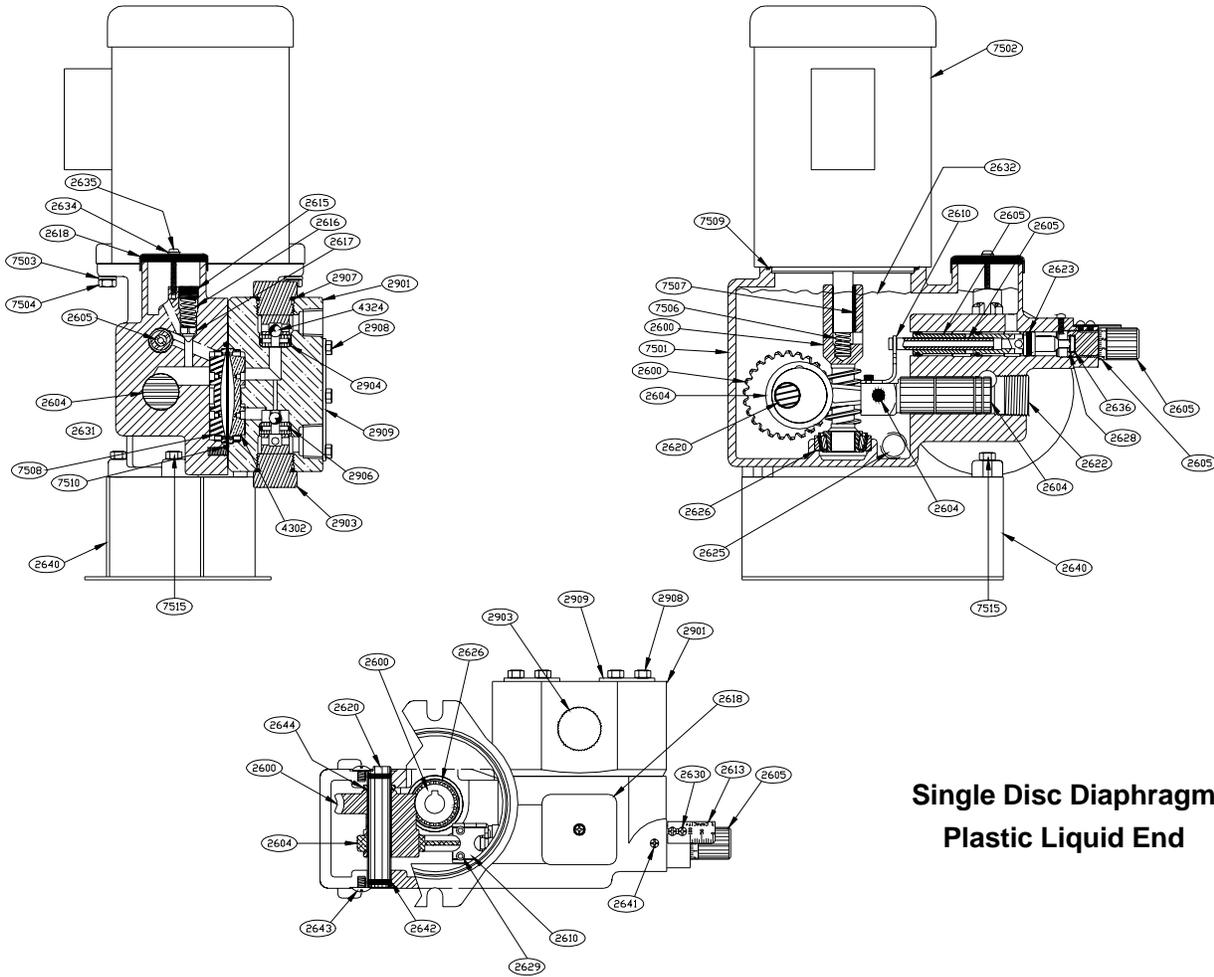
Liquid End Spare Parts - Double Disc - Metallic

DOUBLE DISC DIAPHRAGM PUMP HEAD METALLIC LIQUID END

ITEM	DESCRIPTION	QTY
2631	DIAPHRAGM	2
2911	INTERMEDIATE CHAMBER	1
2912	BLEED VALVE	1
2913	SCHRADER VALVE	1
4301	HEAD, DIAPHRAGM	1
4302	PLATE, CONTOUR	1
4303	ASS'Y, SUCTION CHECK VALVE	1
4304	ASS'Y, DISCHARGE CHECK VALVE	1
4305	HEX HEAD CAP SCREW, HEAD	6
7508	PLATE, DIAPHRAGM BACKING	1
7510	O-RING, DIAPHRAGM	1



Basic Drive Spare Parts - Cross Section



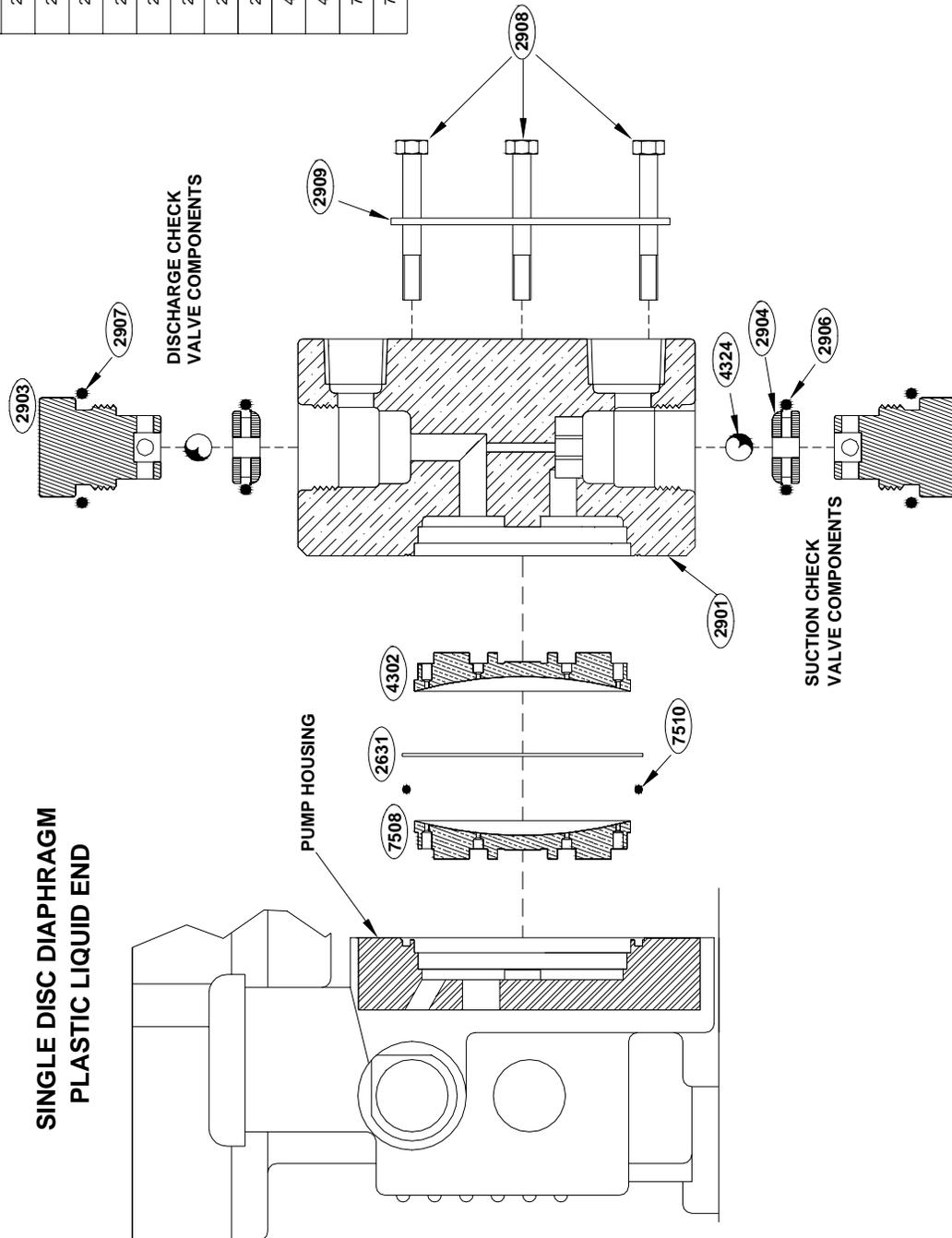
**Single Disc Diaphragm
Plastic Liquid End**

Item	Qty.	Description	Item	Qty.	Description	Item	Qty.	Description
2600	1	Set, Simplex Gear	2631	1	Diaphragm	2906	2	O-Ring, Check Valve Seat
2601	1	Set, Duplex Gear (not shown)	2632	2-3	Oil, Hydraulic; Quart	2907	2	O-Ring, Check Valve Cap
2604	1	Ass'y, Plunger Crosshead	2633	1	Baffle (not shown)	2908	6	Bolt, Liquid End
2605	1	Assembly, Control Valve	2634	1	Washer, Reservoir Cover	2909	2	Plate, Liquid End Bolting
2610	1	Actuator, Bypass	2635	1	Screw, Reservoir Cover	4302	1	Plate, Contour
2613	1	Plate, Capacity	2636	1	Washer, Spring, Control Valve	4324	2	Ball, Check Valve
2615	1	Adjuster, Hyd. Relief Valve	2640	1	Base	7501	1	Housing, Drive
2616	1	Spring, Hyd. Relief Valve	2641	1	Screw, Control Valve	7502	1	Motor
2617	1	Poppet, Hyd. Relief Valve	2642	2	O-Ring, Gearshaft	7503	2	Washer, Motor Mounting
2618	1	Assembly, Reservoir Cover	2643	2	Screw, Gearshaft	7504	2	Bolt, Motor Mounting
2620	1	Shaft, Gear	2644	1	Spacer, Gear, Simplex	7506	1	Spring, Worm Shaft
2621	1	Wrist Pin	2645	1	O-Ring, 1-5/8" Plunger Bore Plug (N/A - not shown)	7507	1	Key, Motor to Worm Shaft
2622	1	Plug, Plunger Bore	2646	2	Screw, 1-5/8" Plunger Bore Plug (N/A - not shown)	7508	1	Plate, Diaphragm Backing
2623	3	O-Ring, Control Valve	2901	1	Head, Diaphragm	7509	1	O-Ring, Motor Sealing
2625	1	Plug, Oil Drain	2903	2	Cap, Check Valve	7510	1	O-Ring, Diaphragm
2626	1	Bearing, Worm Shaft	2904	2	Seat, Check Valve	7511	1	Plate, Metric Motor Adaptor (not shown)
2628	1	Ring, Snap, Control Valve				7515	3	Bolts, Drive Housing to Base
2629	2	Screw, Actuator						
2630	2	Screw, Capacity Plate						

* Most items vary in size, configuration and materials of construction by pump model number. Pump model and serial numbers are required to order replacement parts.

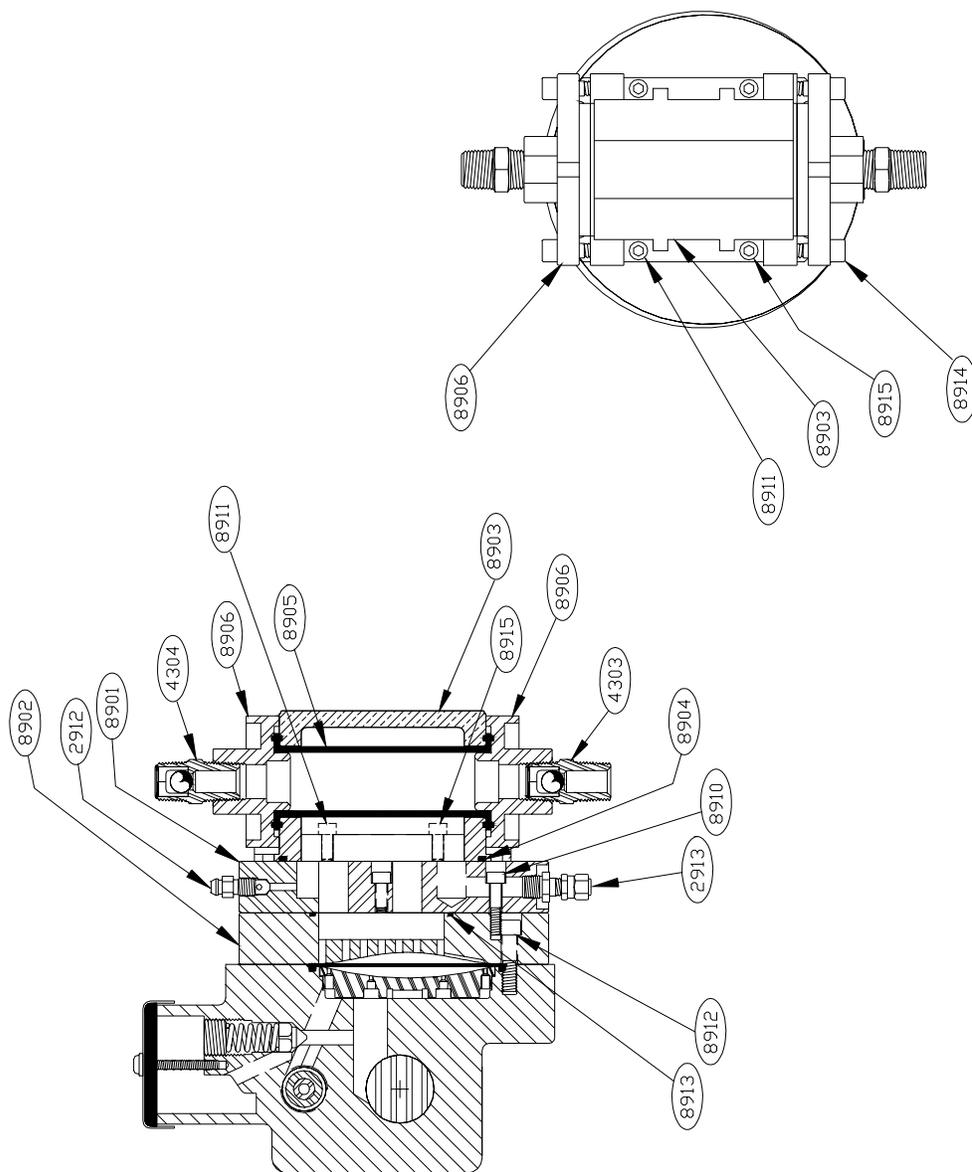
Liquid End Spare Parts - Disc Diaphragm - Plastic

ITEM	DESCRIPTION	QTY
2631	DIAPHRAGM	1
2901	LIQUID END	1
2903	CAP, CHECK VALVE	2
2904	SEAT, CHECK VALVE	2
2906	O-RING, CHECK VALVE SEAT	2
2907	O-RING, CHECK VALVE CAP	2
2908	BOLT, LIQUID END	6
2909	PLATE, LIQUID END BOLTING	2
4302	PLATE, CONTOUR	1
4324	BALL, CHECK VALVE	2
7508	PLATE, BACKUP	1
7510	O-RING, DIAPHRAGM	1



**TUBULAR/DISC DOUBLE DIAPHRAGM
METALLIC LIQUID END**

ITEM	DESCRIPTION	QTY
2912	VALVE, BLEED	1
2913	VALVE, FILL INTERMEDIATE (SCHRADER TYPE)	1
4303	ASSY, SUCTION CHECK VALVE	1
4304	ASSY, DISCHARGE CHECK VALVE	1
8901	PLATE, MOUNTING	1
8902	PLATE, ADAPTOR	1
8903	HOUSING, TUBULAR DIAPHRAGM	1
8904	O-RING, HOUSING - PLATE SEAL	1
8905	DIAPHRAGM, TUBULAR	1
8906	FLANGE, TUBE	2
8910	BOLT, MOUNTING PLATE	3
8911	BOLT, TUBE HOUSING (SHORT)	4
8912	BOLT, ADAPTOR PLATE	6
8913	O-RING, ADAPTOR - MOUNTING SEAL	1
8914	BOLT, TUBE FLANGE	4
8915	BOLT, TUBE HOUSING (LONG)	4

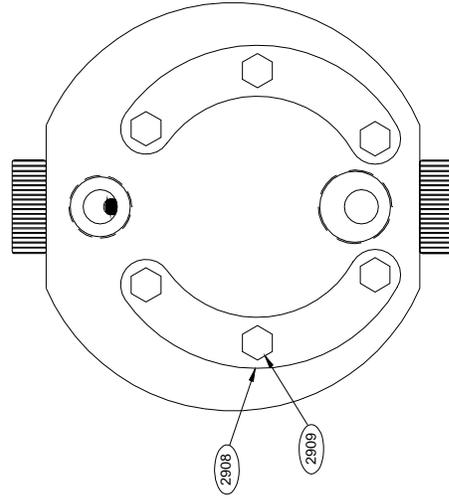
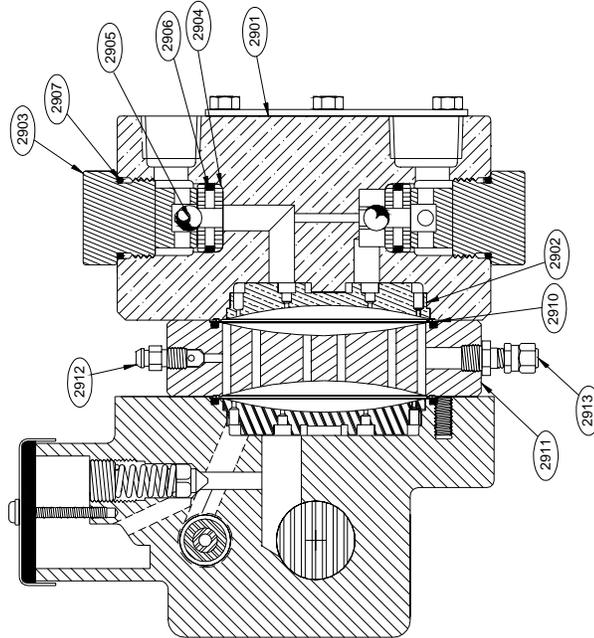


Liquid End Spare Parts - Double Disc - Plastic

DOUBLE DISC DIAPHRAGM PUMP HEAD PLASTIC LIQUID END

The following spare parts cover plastic check valve components only. Refer to the previous page for the common liquid end components.

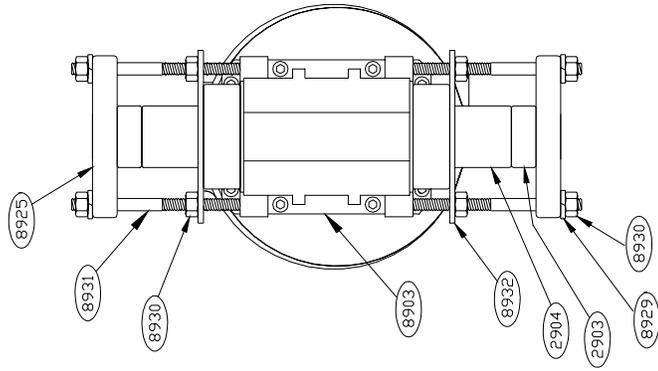
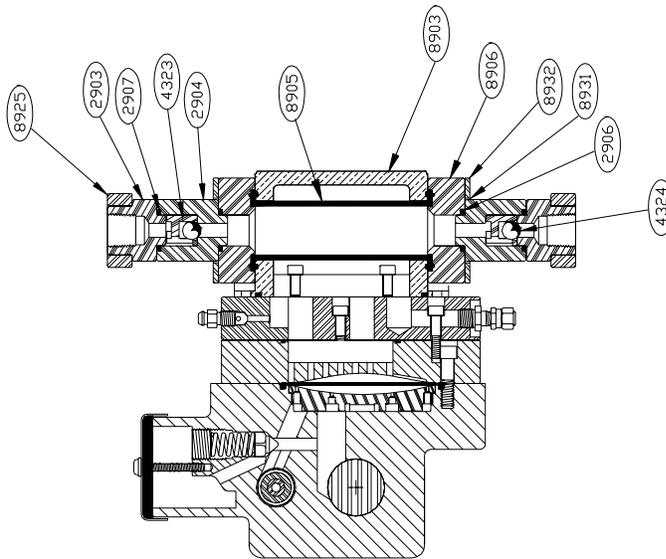
ITEM	DESCRIPTION	QTY
2901	DIAPHRAGM HEAD	1
2902	PLATE, CONTOUR	1
2903	CAP, CHECK VALVE	2
2904	SEAT, CHECK VALVE	2
2905	BALL, CHECK VALVE	2
2906	O-RING, SEAT	2
2907	O-RING, CAP	2
2908	BOLTING PLATE	2
2909	BOLT, DIAPHRAGM HEAD	6
2910	DIAPHRAGM	1
2911	INTERMEDIATE CHAMBER	1
2912	VALVE, BLEED	1
2913	VALVE, FILL INTERMEDIATE (SCHRADER TYPE)	1



Liquid End Spare Parts - Tubular Diaphragm - Plastic

TUBULAR/DISC DOUBLE DIAPHRAGM PLASTIC LIQUID END

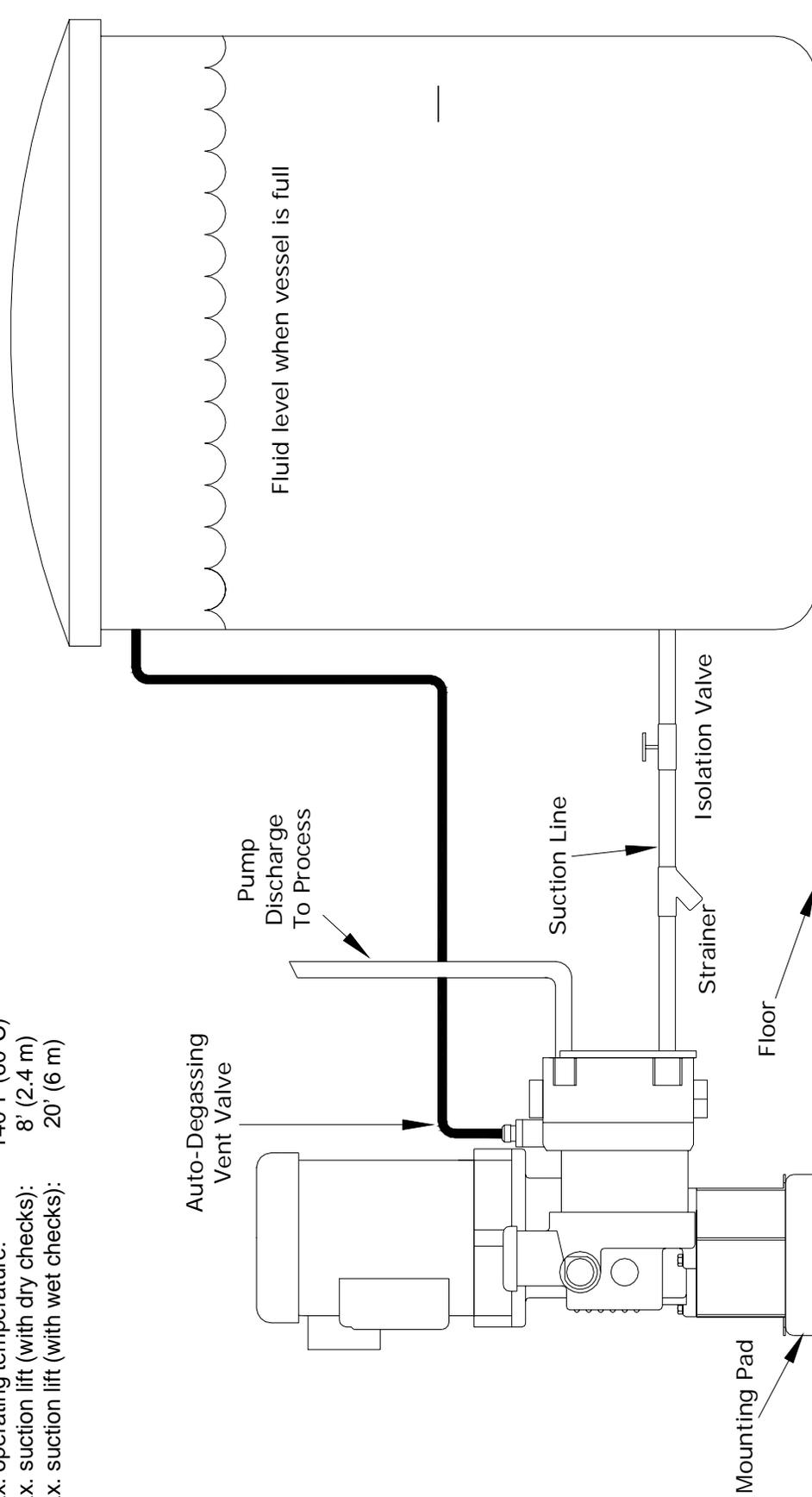
ITEM	DESCRIPTION	QTY
4323	GUIDE, BALL	2
4324	BALL, CHECK VALVE	2
8903	HOUSING, TUBULAR DIAPHRAGM	1
8905	DIAPHRAGM, TUBULAR	1
8906	FLANGE, TUBE	2
8923	SEAT, CHECK VALVE	2
8924	ACTUATOR BRACKET	2
8925	YOKE, CHECK VALVE	2
8928	O-RING, CHECK VALVE SEAT	4
8929	WASHER, LOCK	4
8930	NUT	8
8931	STUD	4
8932	PLATE, FLANGE	2



Installation Schematic - Degassing Head Pump

This typical installation drawing shows the Aquiflow Series 1000 with auto-degassing head installed in a flooded suction condition. The pump can also be installed in a suction-lift condition using a similar piping arrangement. The auto-degassing vent valve must be discharged to atmospheric pressure, and vent tubing should be routed back to the supply vessel or to a drain.

Max. operating discharge pressure: 150 PSIG (1.03 Mpa)
 Max. operating temperature: 140°F (60°C)
 Max. suction lift (with dry checks): 8' (2.4 m)
 Max. suction lift (with wet checks): 20' (6 m)



Pump Troubleshooting Chart

The following charts cover common problems, probable cause and remedies as related to metering pump operation, and will serve as a basis to help isolate and remedy these problems. Each section lists probable causes and remedies in systematic order of probability.

	PROBABLE CAUSE	REMEDIES
Pump fails to deliver rated capacity.	<p>*Please read IMPORTANT NOTE first before proceeding.</p> <ol style="list-style-type: none"> Incorrect capacity setting. Insufficient hydraulic oil. Starved suction. Internal or external relief valve set too low for system conditions. Leaky suction piping. Excessive suction lift. Fluid close to boiling point. Fluid viscosity too high. Worn or dirty ball check valves. 	<ol style="list-style-type: none"> Readjust capacity setting. Fill to proper level. Increase suction piping size or increase suction head. Reset valve to correct setting. Repair piping. Decrease lift. Cool liquid; increase suction head. Reduce viscosity of fluid; change ball material; increase ball size. Clean or replace.
Pump operates erratically.	<p>*Please read IMPORTANT NOTE first before proceeding.</p> <ol style="list-style-type: none"> Clogged/dirty suction strainer. Insufficient hydraulic oil. Leak in suction piping. Internal external relief valve is relieving Insufficient suction pressure. Worn or dirty ball check valves. Fluid too close to boiling point. Fluid viscosity too high. 	<ol style="list-style-type: none"> Clean strainer. Fill to proper level. Repair piping. Reset relief valve. Raise tank fluid level. Clean or replace. Cool fluid or increase suction head. Reduce viscosity of fluid; change ball material; increase ball size.
Pump delivers too much capacity.	<ol style="list-style-type: none"> Insufficient discharge pressure. Too much suction pressure. 	<p>Increase discharge pressure (pump discharge pressure must be 25-30 psig greater than suction pressure to assure proper ball check valve operation).</p>
Noisy operation.	<p>Ball check valves.</p> <ol style="list-style-type: none"> Excessive gear wear. Improper lubrication. Worn bearings. 	<p>Ball valves makes a clicking sound as they operate - rattling noises may also be heard. Under certain conditions these noises are amplified by the natural resonance of piping. These noises are normal and should not cause concern.</p> <ol style="list-style-type: none"> Replace gear set. Replace with correct oil. Replace bearings.
Motor overheats.	<ol style="list-style-type: none"> Motor overloaded - pump operating in excess of discharge pressure rating. Improper wiring or low voltage. Hydraulic oil too viscous. High ambient temperature. 	<ol style="list-style-type: none"> Limit discharge pressure to the maximum pressure specified. Check power supply. Drain/refill with correct oil. Increase ventilation or relocate pump.
Pump leaking oil.	<ol style="list-style-type: none"> Oil drain plug loose. Pump overfilled with hydraulic oil. Diaphragm head bolts loose. 	<ol style="list-style-type: none"> Tighten. Drain oil to proper level. Tighten to specifications.
Pump losing oil. Hydraulic oil discolored.	<p>Ruptured diaphragm.</p>	<p>Replace diaphragm after correcting cause of failure. Hydraulic oil must be discarded and the pump gearbox thoroughly flushed of all traces of process fluid. Replace with fresh hydraulic oil.</p>

***IMPORTANT NOTE: The single most important cause of hydraulic diaphragm pumps not performing or under-performing is the entrapment of air, either on the hydraulic oil side or process liquid side or both. Please make sure that the last tiny bubbles of air are purged from both sides. THIS PROBLEM IS ESPECIALLY CRITICAL IN SMALL FLOW PUMPS.**

	PROBABLE CAUSE	REMEDIES
Most problems that arise during or shortly after startup are a result of improper pump installation. Each AquFlow pump is tested and in good working order when shipped. Before making adjustments to, or disassembling any part of the pump, check the following.	<ol style="list-style-type: none"> Insufficient hydraulic oil. Clogged or blocked ball check valves, or check valves held open by solids. Clogged/blocked suction strainer. System discharge pressure greater than pump relief valve setting. Starved suction. 	<ol style="list-style-type: none"> Fill to proper level. Clean or replace (suction line not flushed prior to connecting pump, permitting debris to enter and block ball check valves. Clean or replace. Reset internal relief valve within pump rating. Insufficient NPS_A. Shorten suction piping; increase suction pipe size; increase suction head.
Pump motor fails to start.	<ol style="list-style-type: none"> Blown fuse or tripped breaker. Open thermal overload. Low line voltage. Open circuit in limit switches, timers or other control devices in pump motor starter circuit. Motor damage. 	<ol style="list-style-type: none"> Replace fuse after correcting cause of overload. Reset after correcting cause of overload; check heater size. Determine cause and correct. Reset. Check motor for physical damage that may hinder operation.
Pump runs but fails to deliver.	<p>*Please read IMPORTANT NOTE first before proceeding.</p> <ol style="list-style-type: none"> Insufficient hydraulic oil. Check valve(s) lodged open by solids. Worn or dirty ball check valves. Suction or discharge line blocked. Isolation valve closed. Pump is not primed. Check valves installed incorrectly. Solids build-up between diaphragm and contour plate, limiting diaphragm movement. 	<ol style="list-style-type: none"> Fill to proper level. Clean or replace. Clean or replace. Clean line. Open valve. Allow suction line and pump head to fill with liquid before pumping against pressure. Remove and reinstall correctly. Remove and clean liquid end, replace diaphragm. An infrequent occurrence when pumping fluid that contains particles that settle out. (A tubular diaphragm liquid end recommended.)