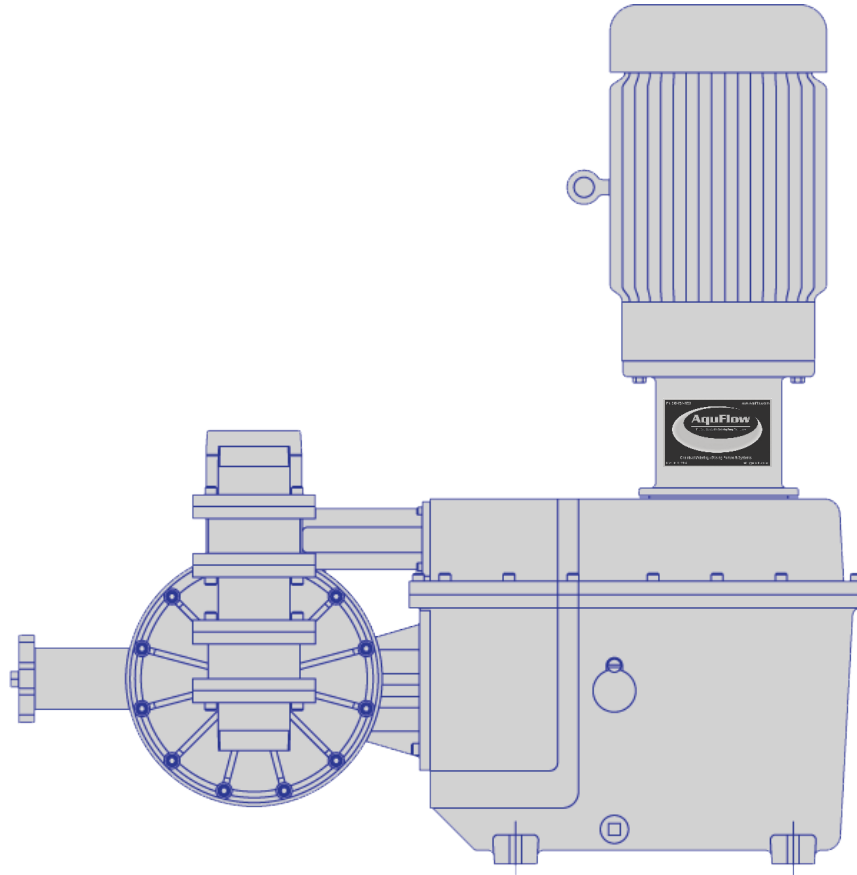


AquFlow Series 4000

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 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-gassing, 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 – 480:1	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)	3,500 (241)	44	7/8"
GNIT 0770-0X01A	36.0 (136.3)		70	
GNIT 0788-0X01A	45.0 (170.3)		88	
GNIT 0714-0X01A	72.0 (272.5)		140	
GNIT 0944-0X01A	38.5 (145.7)	2,000 (138)	44	1-1/8"
GNIT 0970-0X01A	61.5 (232.8)		70	
GNIT 0988-0X01A	77.0 (291.5)		88	
GNIT 0914-0X01A	123 (465.6)		140	
GNIT 1344-0X01F	79.5 (300.9)	1,000 (69)	44	1-9/16"
GNIT 1370-0X01F	126 (477.0)		70	
GNIT 1388-0X01F	159 (601.9)		88	
GNIT 1314-0X01F	253 (957.7)		140	
GNIT 2044-0X01F	210 (794.9)	370 (26)	44	2-1/2"
GNIT 2070-0X01F	335 (1,268.1)		70	
GNIT 2088-0X01F	421 (1,593.7)		88	
GNIT 2014-0X01F	671 (2,540.0)		140	
GNIT 2444-0X01H	304 (1,150.8)	295 (20)	44	3"
GNIT 2470-0X01H	485 (1,835.9)		70	
GNIT 2488-0X01H	609 (2,305.3)		88	
GNIT 2414-0X01H	970 (3,671.8)		140	
GNIT 3244-0X01H	554 (2,097.1)	160 (11)	44	4"
GNIT 3270-0X01H	882 (3,338.7)		70	
GNIT 3288-0X01H	1,109 (4,198.0)		88	
GNIT 3214-0X01H	1,765 (6,681.2)		140	

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 pallet
- 52 qts. (or 13 gal.) 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.

AquFlow®	
CHEMICAL METERING PUMP	
MODEL	GNIT 1344-0401F
SERIAL	1234567
CAPACITY	79.5 GPH
PRESSURE	1000 PSIG
Phone: 949-757-1753	
sales@aquflow.com www.aquflow.com	

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

Series 1000	Series 3000
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"

Series 2000	Series 4000
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 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)	4,000 (275)	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)		117	
CA4T 3814-0X013	2.70 (10.2)		140	
CA4T 3817-0X013	3.28 (12.4)		170	
CJ4T 5629-0X014	1.25 (4.7)	2,000 (75)	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)		117	
CJ4T 5614-0X014	6.09 (23.1)		140	
CJ4T 5617-0X014	7.40 (28.0)		170	
CJ4T 7529-0X014	2.25 (8.5)	1,100 (75)	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)		117	
CJ4T 7514-0X014	10.8 (40.9)		140	
CJ4T 7517-0X014	13.1 (49.6)		170	
CJ4T 8729-0X014	3.05 (11.5)	700 (48)	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)		117	
CJ4T 8714-0X014	14.7 (55.6)		140	
CJ4T 8717-0X014	17.9 (67.8)		170	
CJ4T 11329-0X014	5.33 (20.2)	425 (48)	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)		117	
CJ4T 11314-0X014	25.7 (97.3)		140	
CJ4T 11317-0X014	31.1 (117.7)		170	
CJ4T 16229-0X018	10.5 (39.7)	200 (13)	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)		117	
CJ4T 16214-0X018	50.8 (192.3)		140	
CJ4T 16217-0X018	61.7 (233.5)		170	

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)	1,800 (124)	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)		117	
CD3T 0514-0X014	19.2 (51.9)		140	
CD3T 0519-0X014	26.2 (70.8)		191	
CD3T 0629-0X014	4.7 (17.8)	1,000 (69)	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)		117	
CD3T 0614-0X014	22.7 (85.6)		140	
CD3T 0619-0X015	31.0 (117.3)		191	
CD3T 0829-0X014	7.68 (28.8)	360 (25)	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)		117	
CD3T 0814-0X015	37.09 (138.9)		140	
CD3T 0819-0X015	50.61 (189.3)		191	
CD3T 1029-0X014	12.67 (45.4)	210 (14)	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)		117	
CD3T 1014-0X018	61.18 (227.1)		140	
CD3T 1019-0X018	83.47 (302.8)		191	
CD3T 1229-0X014	16.0 (53.0)	195 (13)	29	1-1/2"
CD3T 1258-0X015	32.07 (106.0)		58	
CD3T 1297-0X018	53.63 (177.9)		97	
CD3T 1212-0X018	64.68.0 (212.0)		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)	700 (48)	44	1"
CNIT 0858-0X018	31.9 (120.7)		58	
CNIT 0888-0X018	48.0 (181.7)		88	
CNIT 0812-0X018	64.0 (242.3)		117	
CNIT 0814-0X018	76.0 (287.7)		140	
CNIT 1044-0X018	37.8 (94.6)	405 (28)	44	1-1/4"
CNIT 1058-0X018	50.0 (189.3)		58	
CNIT 1088-0X018	75.7 (286.5)		88	
CNIT 1012-0X018	100 (378.5)		117	
CNIT 1014-0X018	120 (454.2)		140	
CNIT 1244-0X018	54.4 (135.9)	265 (18)	44	1-1/2"
CNIT 1258-0X018	71.8 (271.8)		58	
CNIT 1288-0X018	109 (412.6)		88	
CNIT 1212-0X018	145 (548.9)		117	
CNIT 1214-0X01A	173 (654.9)		140	
CNIT 1444-0X018	74 (185.1)	180 (12)	44	1-3/4"
CNIT 1458-0X018	97.8 (370.2)		58	
CNIT 1488-0X018	148 (560.2)		88	
CNIT 1412-0X01A	197 (745.7)		117	
CNIT 1414-0X01A	236 (893.4)		140	
CNIT 1644-0X018	96.8 (241.9)	130 (9)	44	2"
CNIT 1658-0X018	128 (484.5)		58	
CNIT 1688-0X01A	194 (724.4)		88	
CNIT 1612-0X01B	258 (976.6)		117	
CNIT 1614-0X01B	308 (1,165.9)		140	
CNIT 1844-0X018	122.4 (305.9)	95 (6)	44	2-1/4"
CNIT 1858-0X018	161 (609.5)		58	
CNIT 1888-0X01A	245 (927.4)		88	
CNIT 1812-0X01B	326 (1,234.0)		117	
CNIT 1814-0X01C	389 (1,476.3)		140	
CNIT 2044-0X018	145 (378.5)	75 (5)	44	2-1/2"
CNIT 2058-0X01A	191 (757.1)		58	
CNIT 2088-0X01B	291 (1,135.6)		88	
CNIT 2012-0X01C	387 (1,514.2)		117	
CNIT 2014-0X01C	463 (1,824.6)		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)	3,000 (200)	29	3/16"
DM3T 1958-0X013	0.28 (1.06)		58	
DM3T 1997-0X013	0.47 (1.78)		97	
DM3T 1912-0X013	0.56 (2.12)		117	
DM3T 1914-0X013	0.67 (2.54)		140	
DM3T 1917-0X013	0.82 (3.10)	3,000 (200)	170	1/4"
DM3T 2529-0X013	0.24 (0.91)		29	
DM3T 2558-0X013	0.49 (1.85)		58	
DM3T 2597-0X013	0.82 (3.10)		97	
DM3T 2512-0X013	1.00 (3.79)		117	
DM3T 2514-0X013	1.19 (4.50)	3,000 (200)	140	3/8"
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)		97	
DM3T 3812-0X013	2.24 (8.48)	3,000 (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 old temperatures, insulation and heat tracing maybe required.

6.3 Piping

1. The Aquflow® Series 4000 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.

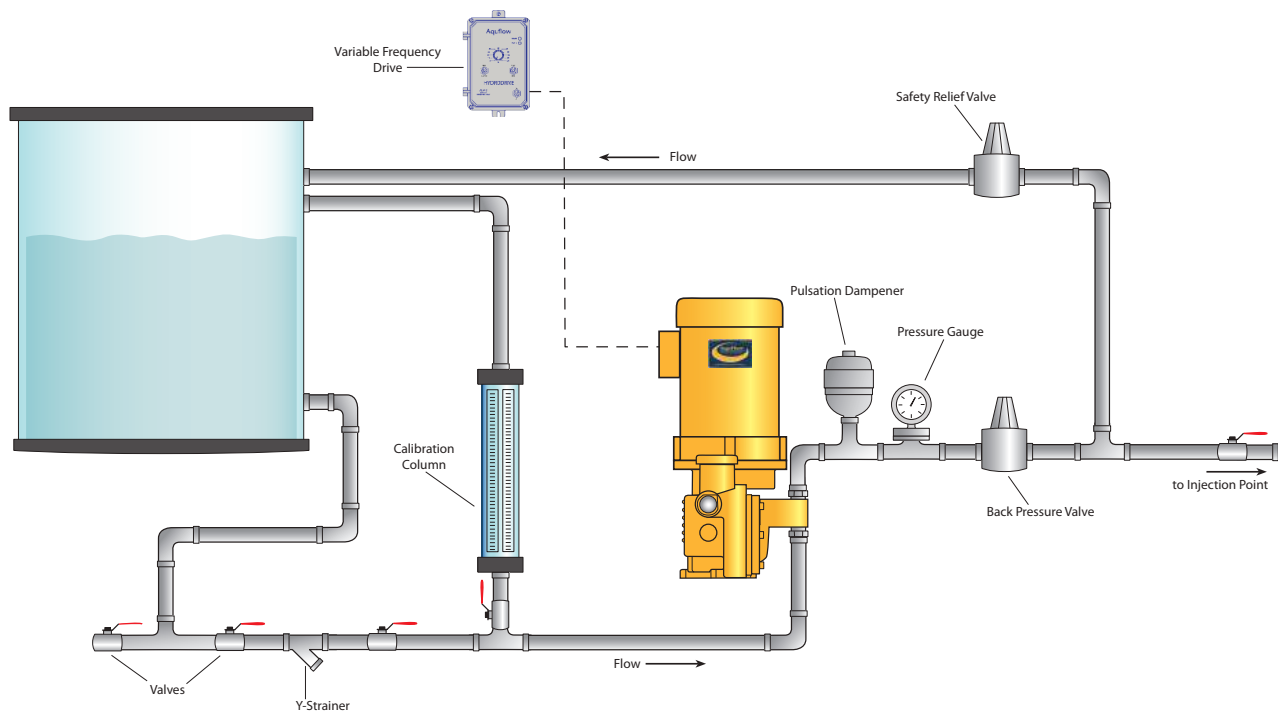


Figure 3. Typical Metering Pump Installation

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 4000 pumps are shipped with hydraulic oil supplied separately in 1-quart or 1-gallon containers.

Note

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



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. Make certain that suction and discharge valves are open prior to pump start-up.
7. 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.
8. 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.

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 4000 pump effective; it will meter chemicals precisely within $\pm 1\%$ 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.



AquFlow Series 4000 pumps require lifting equipment/devices to disassemble and handle parts that may be too heavy.

9.1 Preventative Maintenance

The Series 4000 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
- (1) Diaphragm O-Ring
- (2) Check Valve Balls
- (2) Check Valve Seats
- (3) Stroke O-Rings
- (2) Gear Shaft O-Rings
- (2) Drive Lubricant

Note

1. Multiplex pumps require one (1) Spare Parts Pak for each liquid end.

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 4000 is Zurn E.P. #95, for normal operation. 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 applications with different ambient or fluid temperatures, please consult factory for alternate lubricant recommendations.

9.4 Check valves

1. AquFlow® check valve assemblies utilize oversized balls, are designed to be self-cleaning, and should seldom need service.
2. Fouled metallic check valves can usually be cleaned in a mild solvent solution, followed by a clean water flush. Blow check valve assembly dry using clean compressed air. The check valve ball should be free falling within the valve body.
3. Plastic check valves must be disassembled to facilitate cleaning. It is recommended that new o-rings be installed during reassembly.
4. Repair or replace any check valve components that exhibit damage or wear from chemical corrosion. Ball check valves can be tested for proper sealing by filling ball/seat area with water. For the check valve to be usable it must hold a five foot column of water for 30 seconds without leaking.

DISASSEMBLY

1. Close ant suction and discharge isolation valves. Disconnect the piping from the suction and discharge check valves.
2. Rinse all residual process chemical from the pump using an appropriate neutralizing agent.
3. Remove the two bolts (4121) and remove the connector (4112) and the disc valve assembly (4113).
4. Clean and inspect the O-ring face of the disc valve poppet and the chamfered face of the seat for excessive wear or damage. Also check the valve bushings (4115) for excessive wear or damage. These bushings are slit to facilitate installation. This should not be considered as damage.
5. If the check valve seat faces are worn beyond use, interchanging suction and discharge components items (4111) and (4112) will prevent unused seat surfaces and will prolong check valve assembly life provided there was no chemical erosion of the unused faces. Refer to cross section drawing C-15756.

Note

Interchanging suction and discharge valve components will allow some loss of intermediate fluid. To replenish this fluid refer to step 12 Section I of reassembly.

6. Clean all reusable parts and lay them out for reassembly.

REASSEMBLY

1. Replace any O-rings and damaged parts as required.
2. Assemble the check valves in reverse order of disassembly making sure the lighter spring is used in the suction check valve. It is recommended to use a light silicone grease on all the static O-rings to prevent damage and promote ease of assembly. Torque the check valve bolts to 100 foot-pounds. Refer to cross section drawing C-15756 for component location.

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**

RETURNING TO SERVICE

1. Reconnect suction and discharge piping.
2. Remove the internal relief valve (4015) and fill the pump housing with oil. Refer to drawing 15545 for the correct oil level. Use Zurn E.P. Lube #150 for any oil replacement (item no.4043). Replace the internal relief valve.
3. Open the suction and discharge valves.
4. Vent the discharge to atmosphere to fill the tubular diaphragm.
5. Apply power to the pump motor and slowly adjust the capacity setting up and down while checking for proper operation.

6. Turn off pump motor, correct any leaks and recheck the hydraulic oil level (4043) reference Drawing 15545, adjust as necessary.
7. Secure all covers in place to maintain NEMA integrity.
8. Return the pump to service.



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 eyeshielding for protection.
2. Disconnect and lockout electrical power to the pump and drain hydraulic oil.
3. Isolate and disconnect the piping from the suction and discharge check valves.
4. Flush process fluid from liquid end, using a suitable neutralizing agent.
5. Remove the bolts from the liquid end and remove it from the drive housing. Note the orientation of the check valve cartridges prior to removing the diaphragm head, as they must be in the same position when 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

1. Set oil side contour plate in displacement chamber.
2. Set new diaphragm in head over contour plate.
3. Mount diaphragm head assembly to displacement chamber with bolts. If necessary, hold diaphragm and contour plate in place using a thin, flat, smooth tool such as a machinists' ruler until head is positioned on the displacement chamber.
4. Remove tool carefully while holding head in place.
5. Refill hydraulic system with oil by filling reservoir chamber to recommended level.
6. Reconnect suction and discharge lines.
7. Follow the "Start Up Inspection" procedure as outlined earlier. Run the pump; check for leaks.
8. Return the pump to service.



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

9.5 Tubular/disc diaphragms

DISASSEMBLY

1. Follow disassembly procedures for "check valves" under DISASSEMBLY.
2. Remove the internal relief valve assembly (4015) reference drawing D-15545. This will relieve any squeezing forces applied to the tube by the plunger.
3. Place a suitable container under the tubular housing (3903). Remove the eight bolts (3906) retaining the flange adaptors (3905) to the tubular housing. Remove both suction and discharge flange adaptors. Pull back on the flange at the suction side of the tube to drain the intermediate fluid.
4. Squeeze the flanged opening together and push the tube out of the housing, inspect the tubes for cracks or damage. If the condition of the tube is questionable, replace the tube.
5. Remove the sixteen bolts (3907) retaining the tube housing to the adapter plate (3910). Care should be taken not to damage the machined surfaces of this housing. Damaged areas are potential leakage paths. Remove and discard the O-ring (3908).

6. Drain the oil from the pump into a suitable container. The oil may be reused if it is strained and has not been contaminated. This pump holds 13-1/2 gallons of oil. Size the container accordingly.
7. Mark the adaptor plate (3910) relative to the mounting plate (4101) for correct positioning during reassembly. Remove the twelve bolts (3911) retaining the adapter plate (3910) to the mounting plate (4101). Care should be taken not to damage the machined surfaces of these two plates. Damaged areas are potential leakage paths. Remove and discard the diaphragm (4105) and O-ring (4139). Remove and clean both the backup plate (4103) and the contour plate (4104). Be sure to identify these two plates so they can be reinstalled in their correct locations.
8. Check the area in and around the diaphragm cavity for damage, chemical attack or wear.
9. Clean and lay out reusable and replacement parts for reassembly.

REASSEMBLY

1. Reinstall the oil side backup plate. Position this plate so one of the holes at the outer edge is at the twelve o'clock position.
2. Set the capacity adjuster at 100% and rotate the input shaft to bring plunger to the forward most (discharge) position. This position can be determined by observing the plunger movement through the internal relief valve port. Now reinstall the internal relief assembly (4015) reference Drawing D-15545.
3. Wet the diaphragm O-ring with a film of hydraulic oil and place this new O-ring (4139) in the O-Ring groove on the outer face of the mounting plate (4101). See drawing C-15756.
4. Set the new disc diaphragm in place over the backup plate and O-ring in the diaphragm cavity.
5. Depress the center of the diaphragm to create a suction effect. This will hold the diaphragm in place during reassembly.
6. Reinstall the contour plate (4104) into the adapter plate (3910). Position this plate so one of the holes at the outer edge is at the twelve o'clock position as installed on the pump. Position the adapter plate over the diaphragm while aligning your assembly in place using the twelve 1/2-13 socket head screws (3911). These screws should be lubricated with a thin film of anti-seize compound prior to assembly. Care must be taken to assure the diaphragm has not moved out of position.
7. Tighten these twelve adapter plate screws diagonally across the bolting pattern in a clockwise fashion. The bolts should be taken up evenly in steps to prevent warpage to a final torque value of 100 foot-pounds.
8. Squeeze the flange of the tube (3904) and insert the tube through the end of the housing (3903). Both tube flanges must be positioned over the outside of the housing when installed. See Drawing C-15756. Care must be taken not to damage the tube during installation. The use of screwdrivers and other sharp objects is not recommended.
9. Place a new housing O-ring (3908) in the O-ring groove of the tube housing (3903). See Drawing C-15756. Position this housing over the adapter plate (3910) and retain this housing in place using the 16 3/8-16 socket head screw (3907). There are two lengths of these screws; the shorter screws are used on the horizontal (counter border) bolt holes. Tighten these bolts in steps to prevent damage or warpage to a final torque value of 40 foot-pounds.
10. Position the suction and discharge flange adaptors (3906) over the tube flange. Retain these two adapters in place using the eight 1/2-13 socket head cap screws (3906). These bolts should be tightened evenly across the bolt pattern in steps, with a final torque value of 100 foot-pounds.
11. See previous section for Check Valve Reassembly.
12. To fill the intermediate chamber, remove the internal relief valve assembly (4015) Drawing D-15545 and follow the supplementary instructions - filling intermediate chamber double diaphragm pumps.
13. See previous section for Returning to Service.

9.7 Adjusting the 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. Never set the value higher than 15% above maximum discharge pressure.

1. Wear suitable protective clothing and eye protection.
2. To access the internal relief valve, remove the oil reservoir cover by loosening the cover screw or turning cover counterclockwise.
3. To adjust relief valve, first operate pump against system operating pressure.
4. Stop pump.
5. Install a pressure gauge, with a range of 50% higher than the desired relief pressure, at the pump discharge connection.
6. Install a shut off valve downstream from the pressure gauge.
7. Open the shut off valve and start pump. Pump process liquid to drain or other safe place to establish proper pumping action.
8. Set pump capacity control at 100%.
9. Close shut off valve, thus "deheading" the pump, and closing watch pressure increase on the pressure gauge. If the pressure exceeds the desired relief setting, quickly open the shut off valve to relieve the pressure in the line.
10. Loosen relief valve adjusting screw by turning counterclockwise in small increments, and repeat step 8 until the maximum gauge reading equals the desired relief valve pressure setting.
11. After setting the relief valve, be certain shut off valve is fully open. Remove pressure gauge and place pump in routine service.



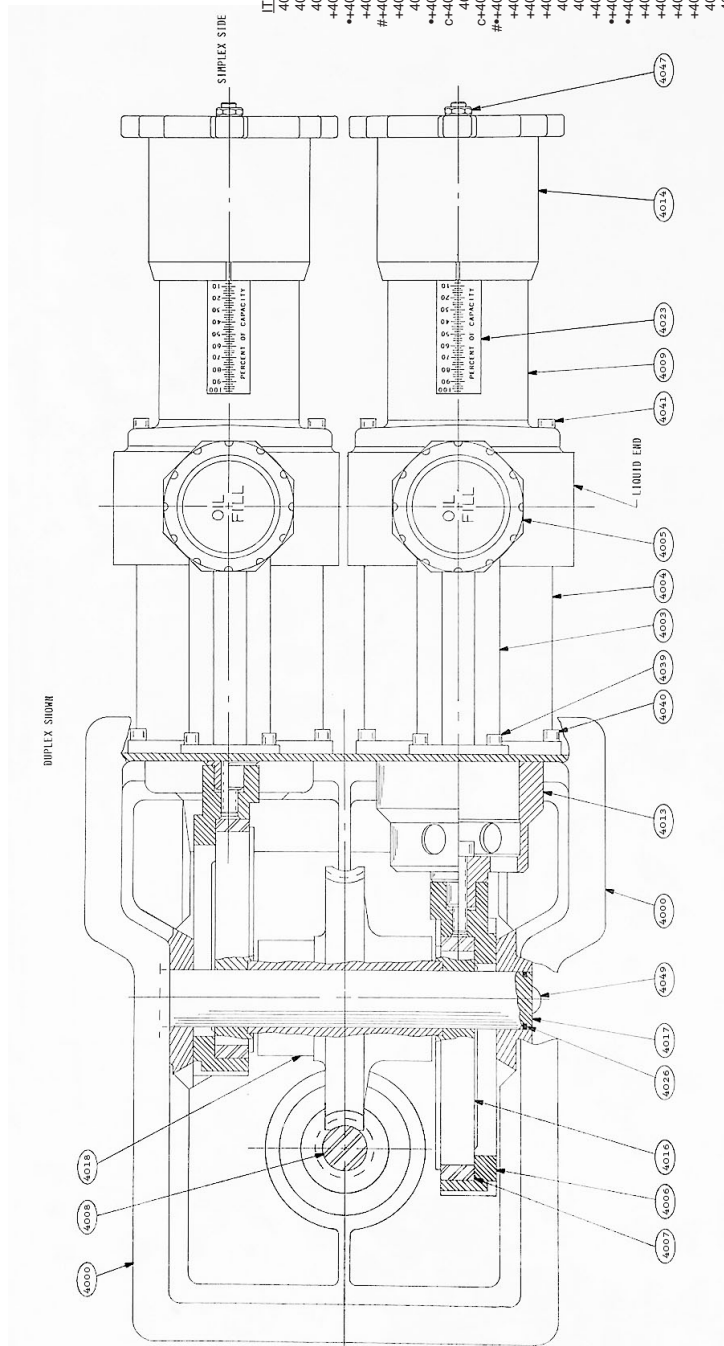
Please visit www.aquflowpumps.com/videos to view a demonstration of an internal relief valve adjustment.



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!***

Drawing D-15545 Gear Housing Parts List & Cross Section p. 1 of 2

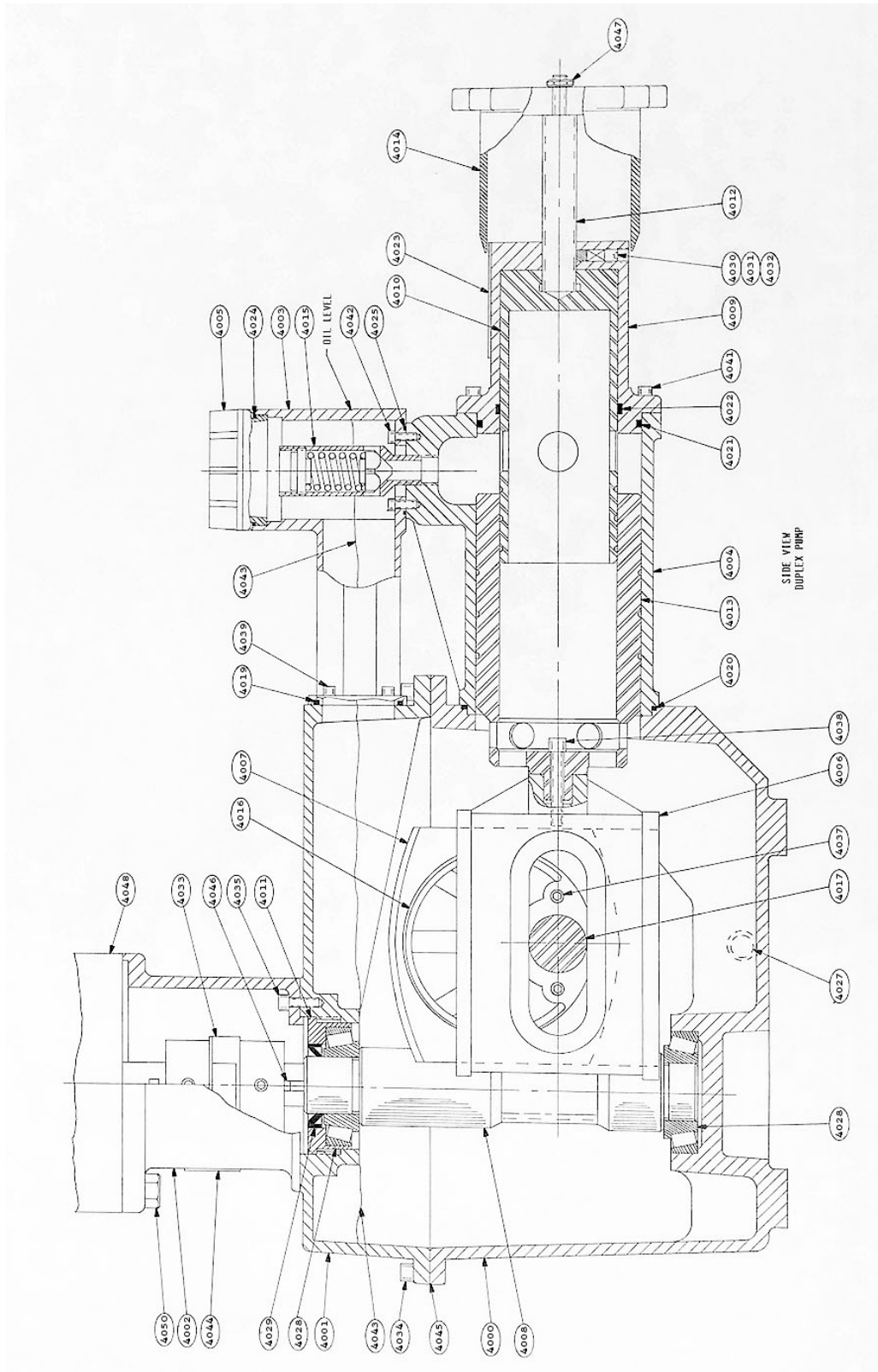


ITEM	QTY	DESCRIPTION
4000	1	HOUSING, LOWER
4001	1	HOUSING, UPPER
4002	1	ADAPTER, MOTOR 182T-2151
4003	1	PRESSURE HOUSING RETURN
4004	1	PRESSURE CHAMBER
4005	1	COVER, OIL FILL
4006	1	CROSS-HEAD
4007	1	BEARING
4008	1	WORMSHAFT
4009	1	CAPACITY ADJUSTER HOUSING
4010	1	CAPACITY ADJUSTER
4011	1	BEARING ADJUSTER
4012	1	LEAD SCREW
4013	1	PLUNGER
4014	1	MICROMETER ADJUSTER
4015	1	RELIEF VALVE ASSEMBLY
4016	1	CAM
4017	1	GEARSHAFT
4018	1	GEAR ASSEMBLY
4019	1	ORING, PRESSURE HOUSING RETURN
4020	1	ORING, PRESSURE CHAMBER
4021	1	ORING, CAPACITY ADJUSTER HOUSING
4022	1	ORING, CAPACITY ADJUSTER
4023	1	CAPACITY PLATE
4024	1	ORING, COVER OIL FILL
4025	1	ORING, PRESSURE CHAMBER RETURN
4026	2	ORING, GEARSHAFT
4027	2	PLUG, DRAIN
4028	2	BEARING, ROLLER
4029	1	OIL SEAL
4030	1	PLUNGER, LOCKING
4031	1	SPRING, LOCKING
4032	1	SET SCREW, LOCKING
4033	1	COUPLING
4034	22	BOLTS, HOUSING
4035	4	BOLTS, MOTOR ADAPTER
4036	2	BOLTS, CAM
4037	1	BOLTS, CROSS-HEAD
4038	1	BOLTS, PRESSURE HOUSING RETURN
4039	4	BOLTS, PRESSURE CHAMBER
4040	4	BOLTS, CAPACITY ADJUSTER HOUSING
4041	4	BOLTS, CAPACITY ADJUSTER HOUSING
4042	2	BOLTS, PRESSURE HOUSING RETURN
4043	1	HYDRAULIC OIL
4044	1	CAP MOTOR ADAPTER
4045	A/R	SILICONE
4046	1	KEY, COUPLING
4047	1	NUT, MICROMETER ADJUSTER
4048	1	MOTOR
4049	2	SCREW, GEARSHAFT
4050	4	BOLTS, MOTOR

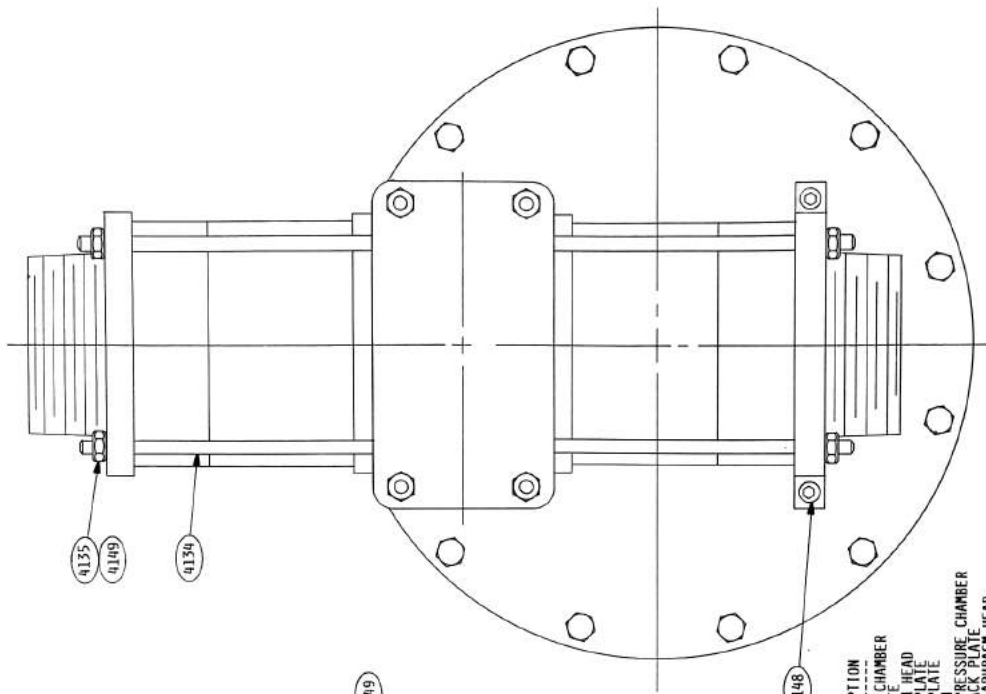
• = SIZE VARIES
+ = DOUBLE FOR DUPLEX
= SOLD AS AN ASSEMBLY
C = SOLD AS AN ASSEMBLY

HYDRAULIC OIL - EP 85 OR EQUAL
SIMPLEX - 12 GALLONS
DUPLEX - 13 1/2 GALLONS

Drawing D-15545 Gear Housing Parts List & Cross Section p. 2 of 2

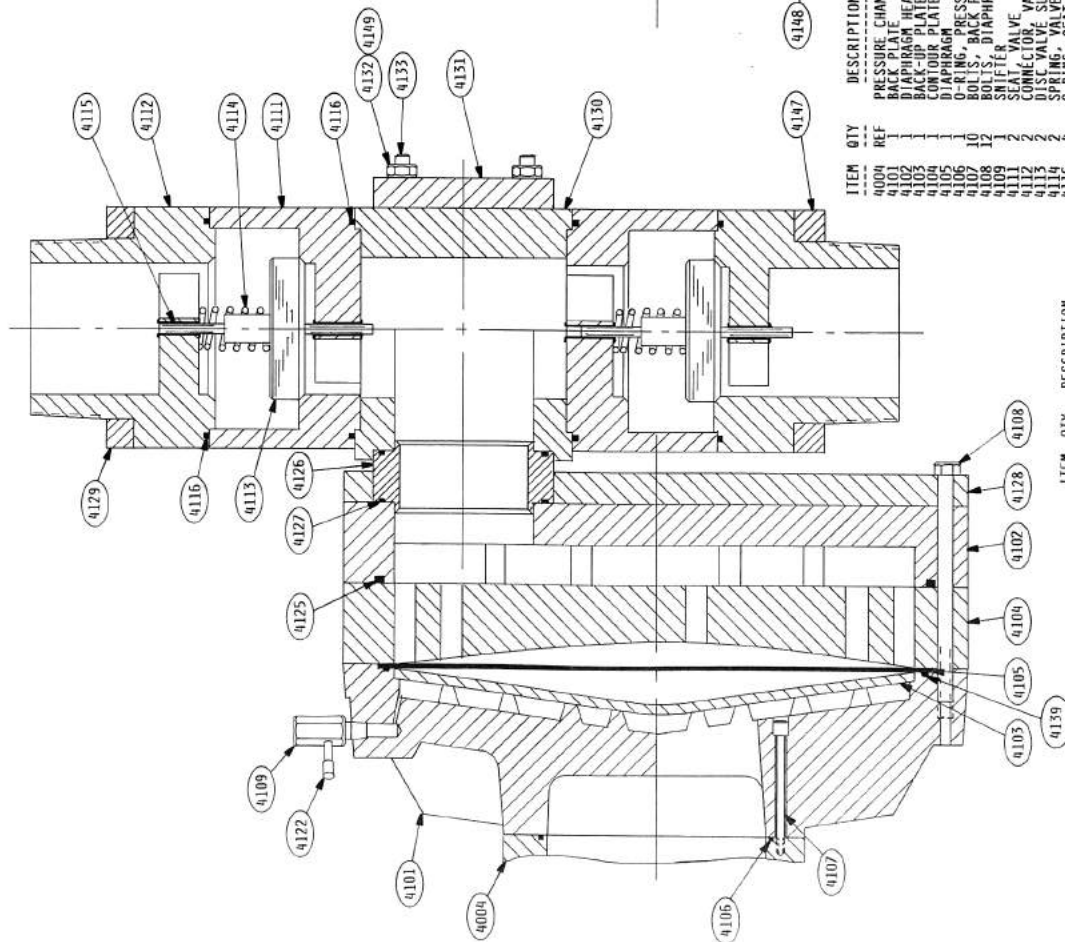


Drawing C-15653 Liquid End - Plastic 3" & 4" Plunger Size w/ Disc Valves



NOTES:
PUMP MODEL AND SERIAL NUMBERS ARE REQUIRED TO
SPECIFY PARTS WHICH VARY BY SIZE AND MATERIAL

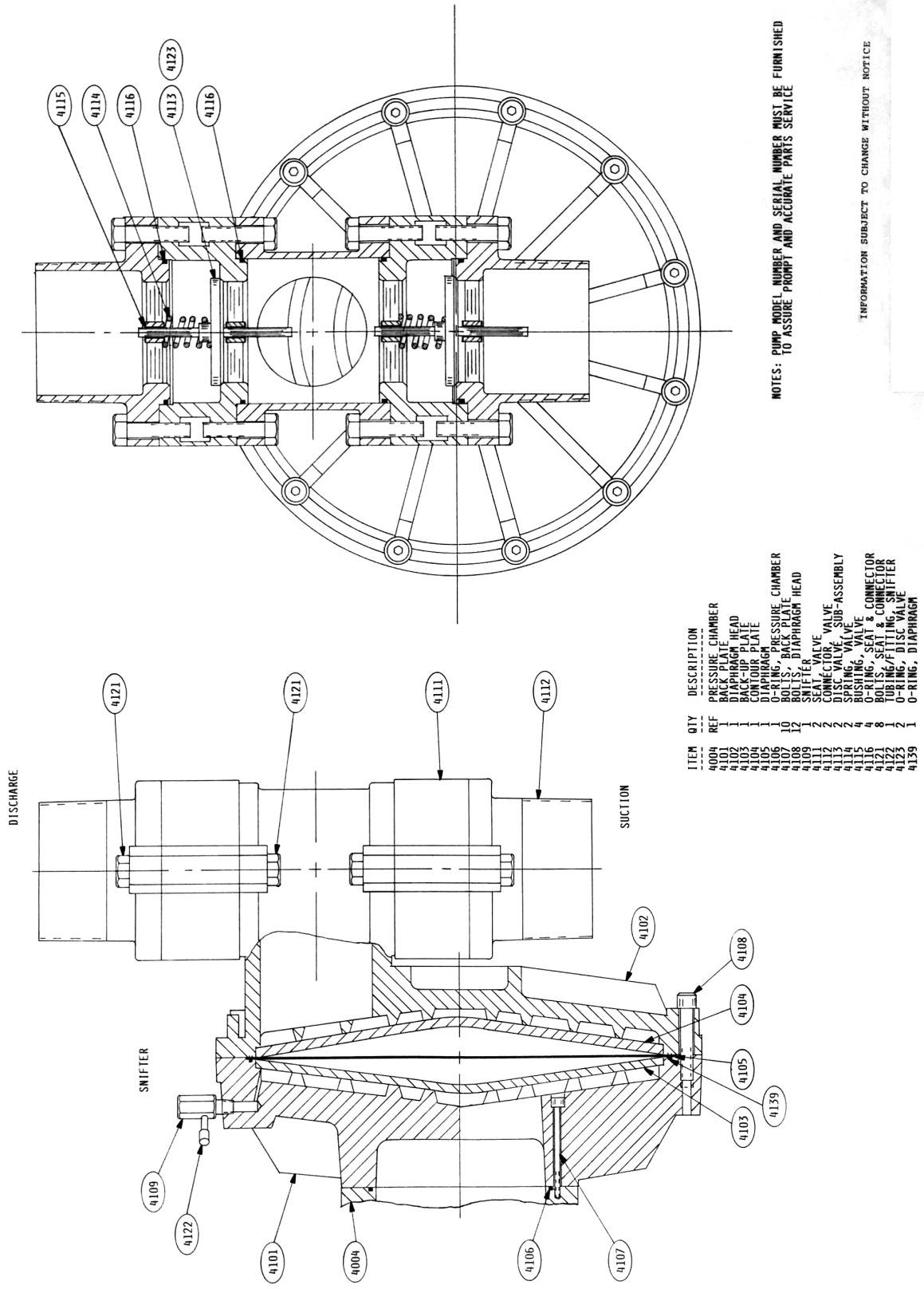
INFORMATION SUBJECT TO CHANGE WITHOUT NOTICE



ITEM	QTY	DESCRIPTION
4004	1	PRESSURE CHAMBER
4101	1	BACK PLATE
4102	1	DIAPHRAGM HEAD
4103	1	BACK-UP PLATE
4104	1	DIAPHRAGM HEAD
4105	1	O-RING, PRESSURE CHAMBER
4106	1	BOLTS, BACK PLATE
4107	12	BOLTS, DIAPHRAGM HEAD
4108	1	SWIFTER
4109	1	CONNECTOR VALVE
4110	1	CONNECTOR VALVE
4111	2	DISC VALVE SUB-ASSEMBLY
4112	2	SPRING, VALVE
4113	2	TOBING/FITTINGS, SNIFTER
4114	1	O-RING, DIAPHRAGM HEAD
4115	1	O-RING, DIAPHRAGM HEAD
4116	1	O-RING, DIAPHRAGM HEAD
4117	1	YOKES
4118	1	YOKES
4119	1	YOKES
4120	1	YOKES
4121	1	YOKES
4122	1	YOKES
4123	1	YOKES
4124	1	YOKES
4125	1	YOKES
4126	1	YOKES
4127	1	YOKES
4128	1	YOKES
4129	1	YOKES
4130	1	YOKES
4131	1	YOKES
4132	1	YOKES
4133	1	YOKES
4134	1	YOKES
4135	1	YOKES

ITEM	QTY	DESCRIPTION
4115	4	BUSHING VALVE
4116	4	YOKES
4117	4	YOKES
4118	4	YOKES
4119	4	YOKES
4120	4	YOKES
4121	4	YOKES
4122	4	YOKES
4123	4	YOKES
4124	4	YOKES
4125	4	YOKES
4126	4	YOKES
4127	4	YOKES
4128	4	YOKES
4129	4	YOKES
4130	4	YOKES
4131	4	YOKES
4132	4	YOKES
4133	4	YOKES
4134	4	YOKES
4135	4	YOKES

Drawing C-15660 Liquid End - Metallic 3" & 4" Plunger w/ 3-1/2" Disc Valve

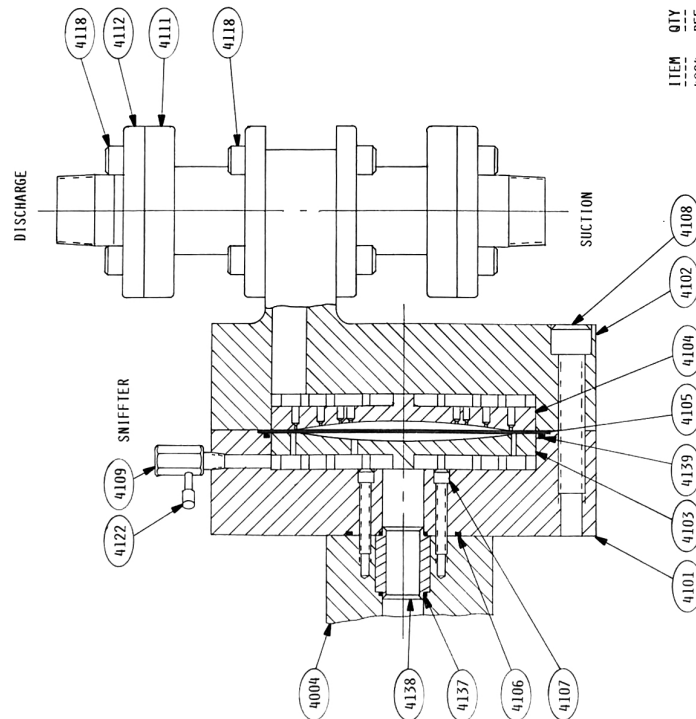
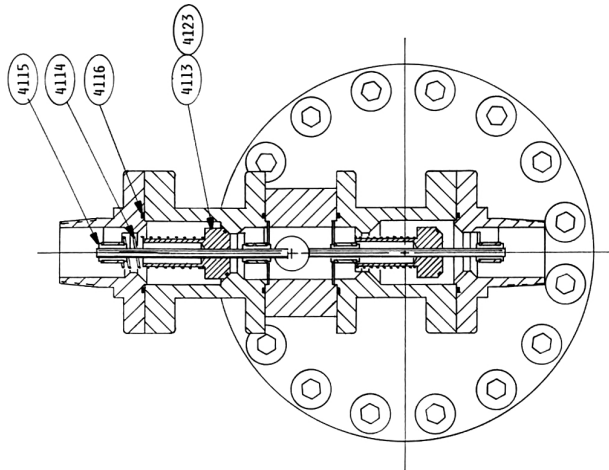


ITEM	QTY	DESCRIPTION
400N	1	PRESSURE CHAMBER
4101	1	BACK PLATE
4102	1	DIAPHRAGM HEAD
4103	1	BACK-UP PLATE
4104	1	CONTAINER PLATE
4105	1	DIAPHRAGM
4106	1	DIAPHRAGM, PRESSURE CHAMBER
4107	12	BOLTS, BACK PLATE
4108	1	DIAPHRAGM HEAD
4109	1	SNIFTER
4110	2	SEAL, VALVE
4111	2	CONNECTOR
4112	2	DISC VALVE SUB-ASSEMBLY
4113	2	SPRING, VALVE
4114	4	BUSHING, VALVE
4115	4	O-RING, SEAL & CONNECTOR
4116	8	BOLTS, SEAL & CONNECTOR
4117	2	BUSHING, SNIFTER
4118	2	O-RING, DISC VALVE
4119	1	O-RING, DIAPHRAGM

NOTES: PUMP MODEL NUMBER AND SERIAL NUMBER MUST BE FURNISHED TO ASSURE PROPER AND ACCURATE PARTS SERVICE

INFORMATION SUBJECT TO CHANGE WITHOUT NOTICE

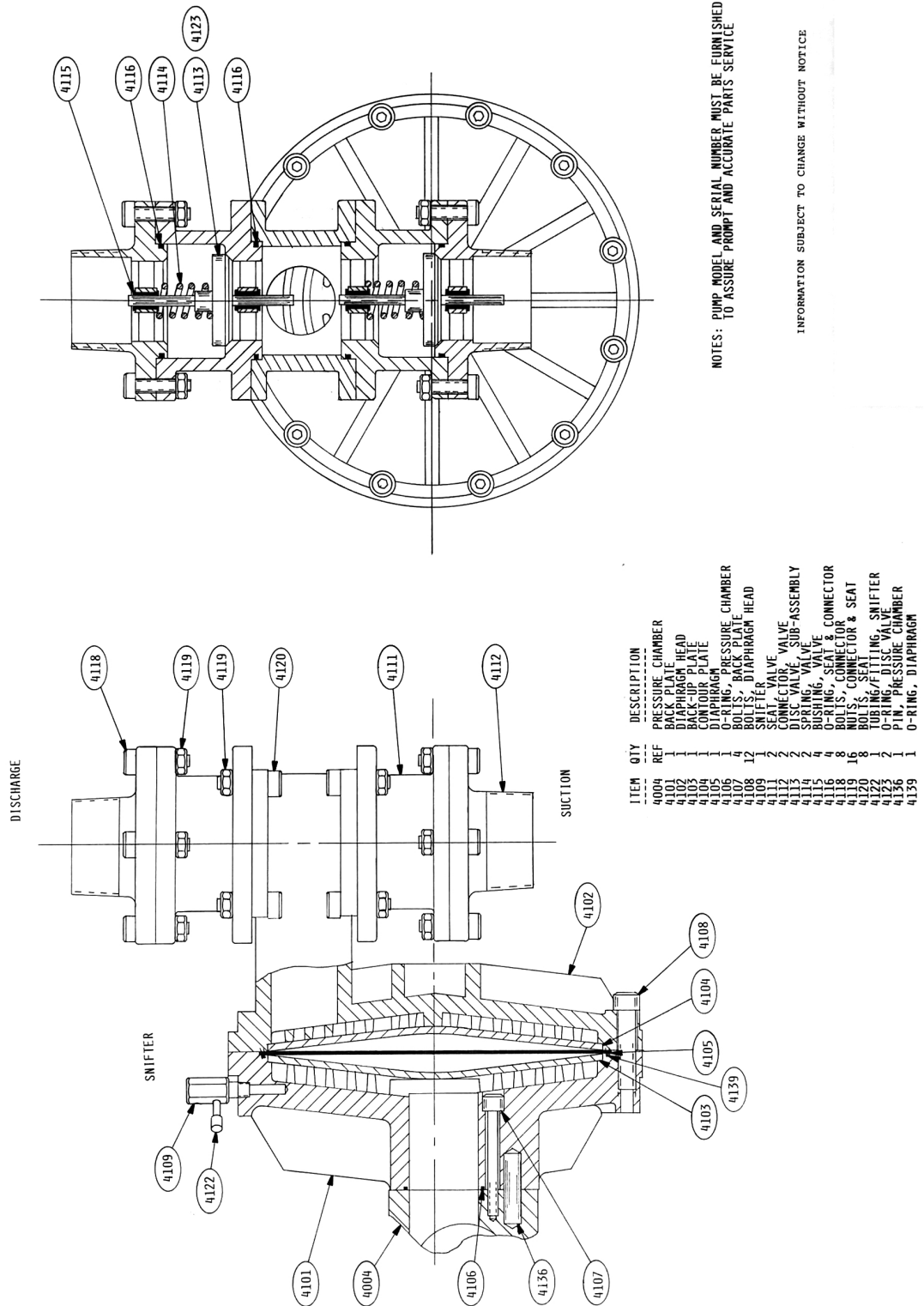
Drawing C-15661 Liquid End - Metallic .85" & 1.1" Plunger w/ 1-1/4" Disc Valve



ITEM	QTY	DESCRIPTION
4004	1	PRESSURE CHAMBER
4101	1	DISC VALVE
4102	1	DIAPHRAGM HEAD
4103	1	BACK-UP PLATE
4104	1	CONTOUR PLATE
4105	1	DIAPHRAGM PRESSURE CHAMBER
4106	1	DISC VALVE SEAT
4107	16	SCREW, MOUNTING PLATE
4108	1	SCREW, DIAPHRAGM HEAD
4109	1	SNIFTER
4111	2	SEAL VALVE
4112	2	DISC VALVE
4113	2	DISC VALVE ASSEMBLY
4114	2	SPRING, DISC VALVE
4115	4	BUSHING, DISC VALVE
4116	4	O-RING, SEAT & CONNECTOR
4118	16	SCREW, SEAT & CONNECTOR
4122	1	TUBING/FITTING, SNIFTER
4123	2	O-RING, DISC VALVE ASST
4137	2	O-RING, NIPPLE
4138	1	NIPPLE, PRESSURE CHAMBER
4139	1	O-RING, DIAPHRAGM 1.1 PLGR. ONLY

NOTES: MODEL & SERIAL NUMBERS MUST BE
FURNISHED TO ASSURE PROMPT AND
ACCURATE PARTS SERVICE
INFORMATION SUBJECT TO CHANGE WITHOUT
NOTICE

Drawing C-15662 Liquid End - Metallic 2 1/2" & 1 1/16" Plunger w/ 2-1/2" Disc Valve



NOTES: PUMP MODEL AND SERIAL NUMBER MUST BE FURNISHED TO ASSURE PROMPT AND ACCURATE PARTS SERVICE

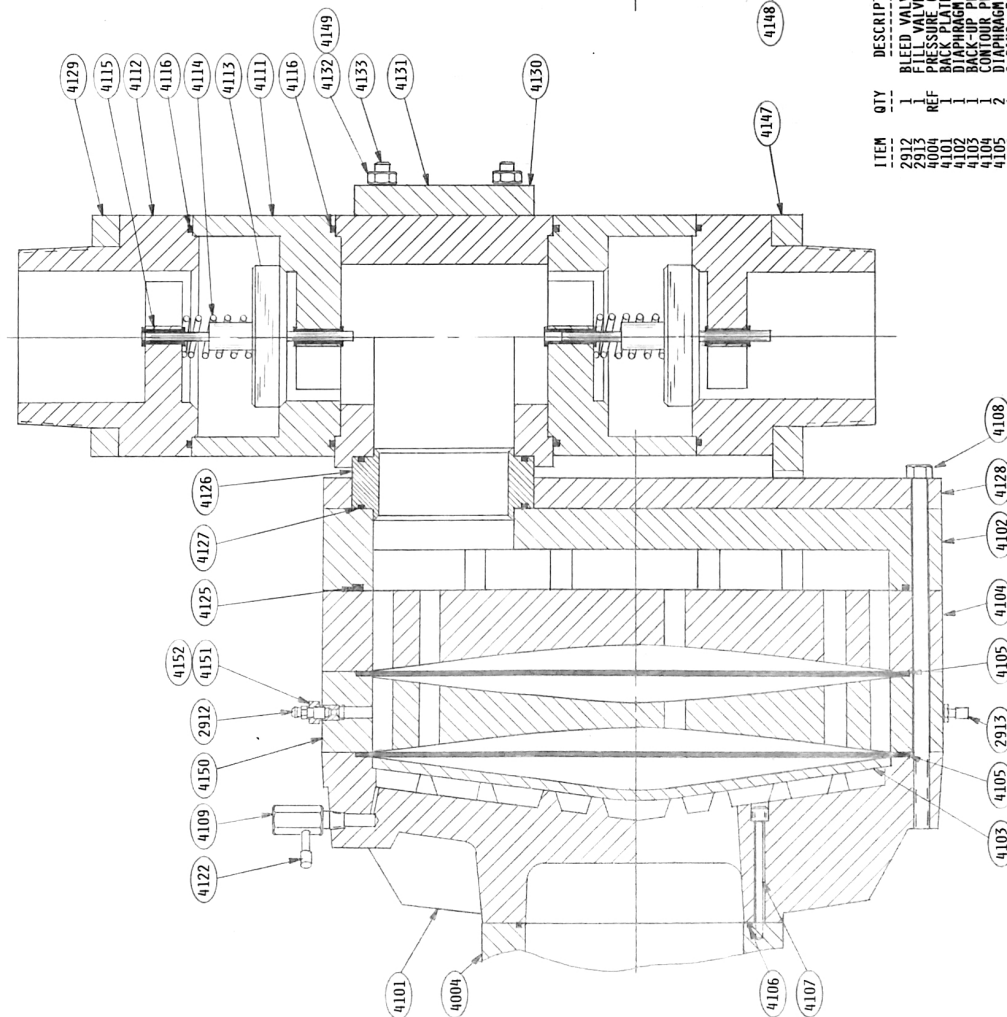
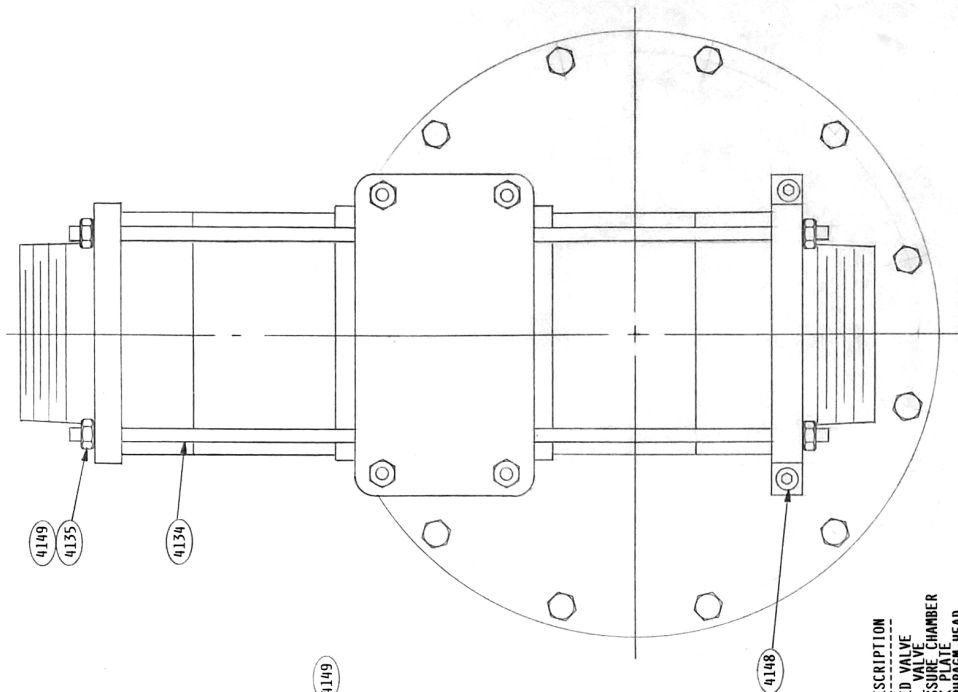
INFORMATION SUBJECT TO CHANGE WITHOUT NOTICE

ITEM	QTY	DESCRIPTION
3901	1	BACK PLATE
3902	10	BOLTS, BACK PLATE
3903	1	TUBULAR DIAPHRAGM
3904	2	TUBULAR ADAPTER
3905	18	SCREW, FLANGE
3906	18	SCREW, FLANGE
3907	18	SCREW, FLANGE
4004	1	SNIFTER
4106	1	SEAT, VALVE
4109	1	CONNECTOR, VALVE
4111	2	DISC, VALVE
4112	2	SPRING, VALVE
4113	2	BUSHING, VALVE
4114	4	SEAT & CONNECTOR
4115	4	SEAT & CONNECTOR
4116	4	SEAT & CONNECTOR
4121	4	SEAT & CONNECTOR
4122	2	O-RING, DISC VALVE
4123	2	O-RING, DISC VALVE
3908	1	O-RING, HOUSING

NOTE: PUMP MODEL NUMBER & SERIAL NUMBER MUST BE FURNISHED TO ASSURE PROMPT AND ACCURATE PARTS SERVICE

INFORMATION SUBJECT TO CHANGE WITHOUT NOTICE

Drawing C-15685 Liquid End, Double Disc - Plastic 3" & 4" Plunger w/ Disc Valve



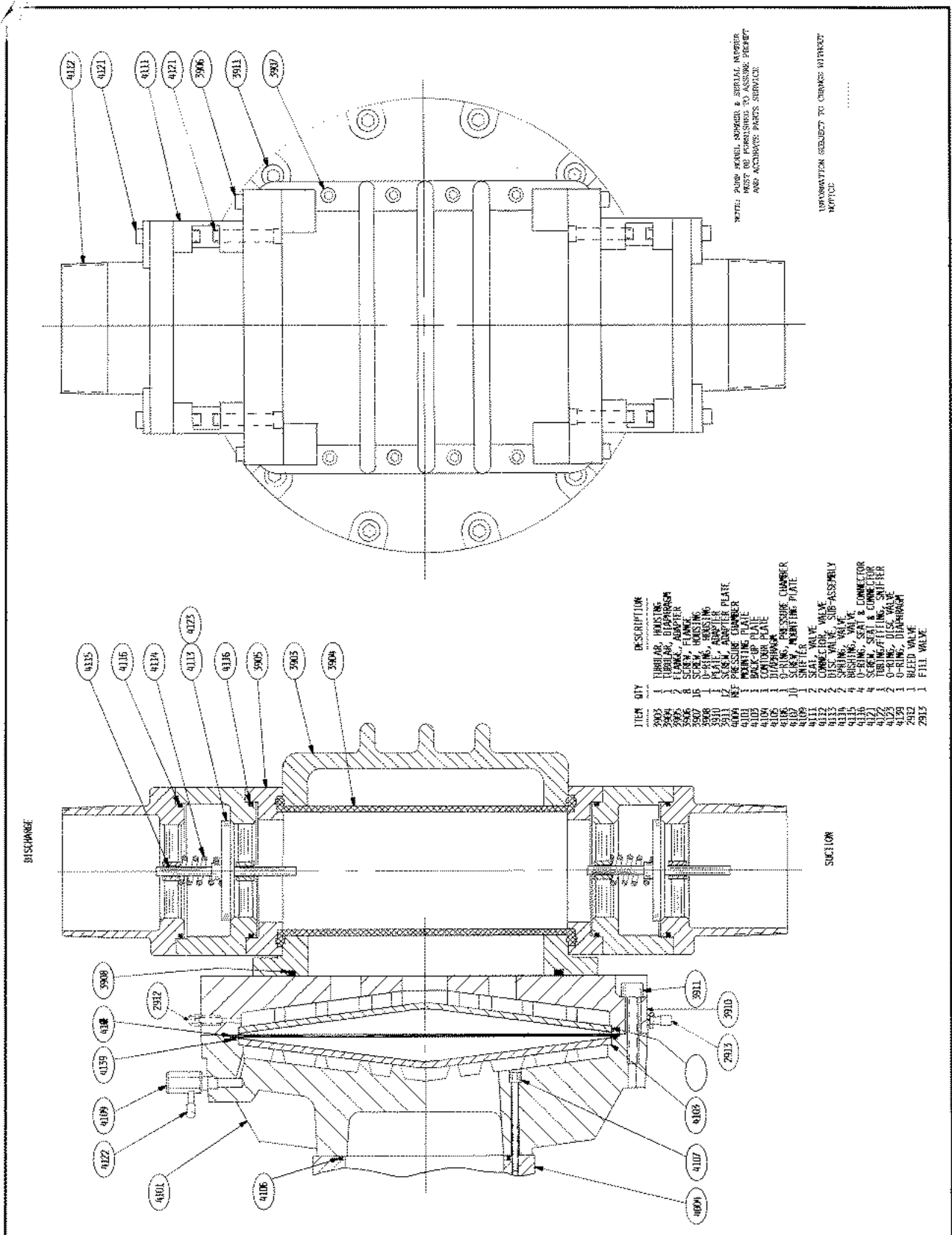
PUMP MODEL & SERIAL NUMBERS ARE REQUIRED TO
SPECIFY PARTS WHICH VARY BY SIZE & MATERIAL

INFORMATION SUBJECT TO CHANGE WITHOUT NOTICE

ITEM	QTY	DESCRIPTION
2912	1	BLEED VALVE
2913	1	VALVE
4101	1	PRESSURE CHAMBER
4102	1	BACK PLATE
4103	1	DIAPHRAGM HEAD
4104	1	CONTOUR PLATE
4105	1	PLATE
4106	1	PLATE, PRESSURE CHAMBER
4107	1	SCREEN, BACK PLATE
4108	12	BOLTS, DIAPHRAGM HEAD
4109	1	SNIFTER
4110	1	SEAT VALVE
4111	1	CONNECTION, SUB-ASSEMBLY
4112	1	CONNECTION, SUB-ASSEMBLY
4113	1	SPRING VALVE
4114	1	BUSHING, VALVE
4115	1	O-RING, SEAT & CONNECTOR
4116	1	TUBING/FITTINGS, SNIFTER
4117	1	O-RING, DIAPHRAGM HEAD
4118	1	CONNECTION, TEE
4119	1	O-RING, CONNECTOR TEE
4120	1	YOKER
4121	1	TEE
4122	1	PLATE, TEE
4123	1	PLATE, TEE
4124	1	NOTES, TEE

ITEM	QTY	DESCRIPTION
4133	4	STUD, TEE
4134	4	STUD, SEAT & CONNECTOR
4135	8	YOKER, LOWER
4136	1	YOKER, LOWER
4137	1	YOKER, LOWER
4138	1	YOKER, LOWER
4139	1	YOKER, LOWER
4140	1	YOKER, LOWER
4141	1	YOKER, LOWER
4142	1	YOKER, LOWER
4143	1	YOKER, LOWER
4144	1	YOKER, LOWER
4145	1	YOKER, LOWER
4146	1	YOKER, LOWER
4147	1	YOKER, LOWER
4148	1	YOKER, LOWER
4149	1	YOKER, LOWER
4150	1	YOKER, LOWER
4151	1	YOKER, LOWER
4152	1	YOKER, LOWER

Drawing C-15756 Liquid End, Tubular/Disc - Metallic 3" & 4" Plunger w/ 3-1/2" Disc Valve



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"> 1. Incorrect capacity setting. 2. Insufficient hydraulic oil. 3. Starved suction. 4. Internal or external relief valve set too low for system conditions. 5. Leaky suction piping. 6. Excessive suction lift. 7. Fluid close to boiling point. 8. Fluid viscosity too high. 9. Worn or dirty ball check valves. 	<ol style="list-style-type: none"> 1. Readjust capacity setting. 2. Fill to proper level. 3. Increase suction piping size or increase suction head. 4. Reset valve to correct setting. 5. Repair piping. 6. Decrease lift. 7. Cool liquid; increase suction head. 8. Reduce viscosity of fluid; change ball material; increase ball size. 9. Clean or replace.
Pump operates erratically.	<p>*Please read IMPORTANT NOTE first before proceeding.</p> <ol style="list-style-type: none"> 1. Clogged/dirty suction strainer. 2. Insufficient hydraulic oil. 3. Leak in suction piping. 4. Internal external relief valve is relieving 5. Insufficient suction pressure. 6. Worn or dirty ball check valves. 7. Fluid too close to boiling point. 8. Fluid viscosity too high. 	<ol style="list-style-type: none"> 1. Clean strainer. 2. Fill to proper level. 3. Repair piping. 4. Reset relief valve. 5. Raise tank fluid level. 6. Clean or replace. 7. Cool fluid or increase suction head. 8. Reduce viscosity of fluid; change ball material; increase ball size.
Pump delivers too much capacity.	<ol style="list-style-type: none"> 1. Insufficient discharge pressure. 2. 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"> 1. Excessive gear wear. 2. Improper lubrication. 3. 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"> 1. Replace gear set. 2. Replace with correct oil. 3. Replace bearings.
Motor overheats.	<ol style="list-style-type: none"> 1. Motor overloaded - pump operating in excess of discharge pressure rating 2. Improper wiring or low voltage. 3. Hydraulic oil too viscous. 4. High ambient temperature. 	<ol style="list-style-type: none"> 1. Limit discharge pressure to the maximum pressure specified. 2. Check power supply. 3. Drain/refill with correct oil. 4. Increase ventilation or relocate pump.
Pump leaking oil.	<ol style="list-style-type: none"> 1. Oil drain plug loose. 2. Pump overfilled with hydraulic oil. 3. Diaphragm head bolts loose. 	<ol style="list-style-type: none"> 1. Tighten. 2. Drain oil to proper level. 3. Tighten to specifications.
Pump losing oil. Hydraulic oil discolored.	Ruptured diaphragm.	<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"> 1. Insufficient hydraulic oil. 2. Clogged or blocked ball check valves, or check valves held open by solids. 3. Clogged/blocked suction strainer. 4. System discharge pressure greater than pump relief valve setting. 5. Starved suction. 	<ol style="list-style-type: none"> 1. Fill to proper level. 2. Clean or replace (suction line not flushed prior to connecting pump, permitting debris to enter and block ball check valves. 3. Clean or replace. 4. Reset internal relief valve within pump rating. 5. Insufficient NPSH_A. Shorten suction piping; increase suction pipe size; increase suction head.
Pump motor fails to start.	<ol style="list-style-type: none"> 1. Blown fuse or tripped breaker. 2. Open thermal overload. 3. Low line voltage. 4. Open circuit in limit switches, timers or other control devices in pump motor starter circuit. 5. Motor damage. 	<ol style="list-style-type: none"> 1. Replace fuse after correcting cause of overload. 2. Reset after correcting cause of overload; check heater size. 3. Determine cause and correct. 4. Reset. 5. 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"> 1. Insufficient hydraulic oil. 2. Check valve(s) lodged open by solids. 3. Worn or dirty ball check valves. 4. Suction or discharge line blocked. 5. Isolation valve closed. 6. Pump is not primed. 7. Check valves installed incorrectly. 8. Solids build-up between diaphragm and contour plate, limiting diaphragm movement. 	<ol style="list-style-type: none"> 1. Fill to proper level. 2. Clean or replace. 3. Clean or replace. 4. Clean line. 5. Open valve. 6. Allow suction line and pump head to fill with liquid before pumping against pressure. 7. Remove and reinstall correctly. 8. 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.)