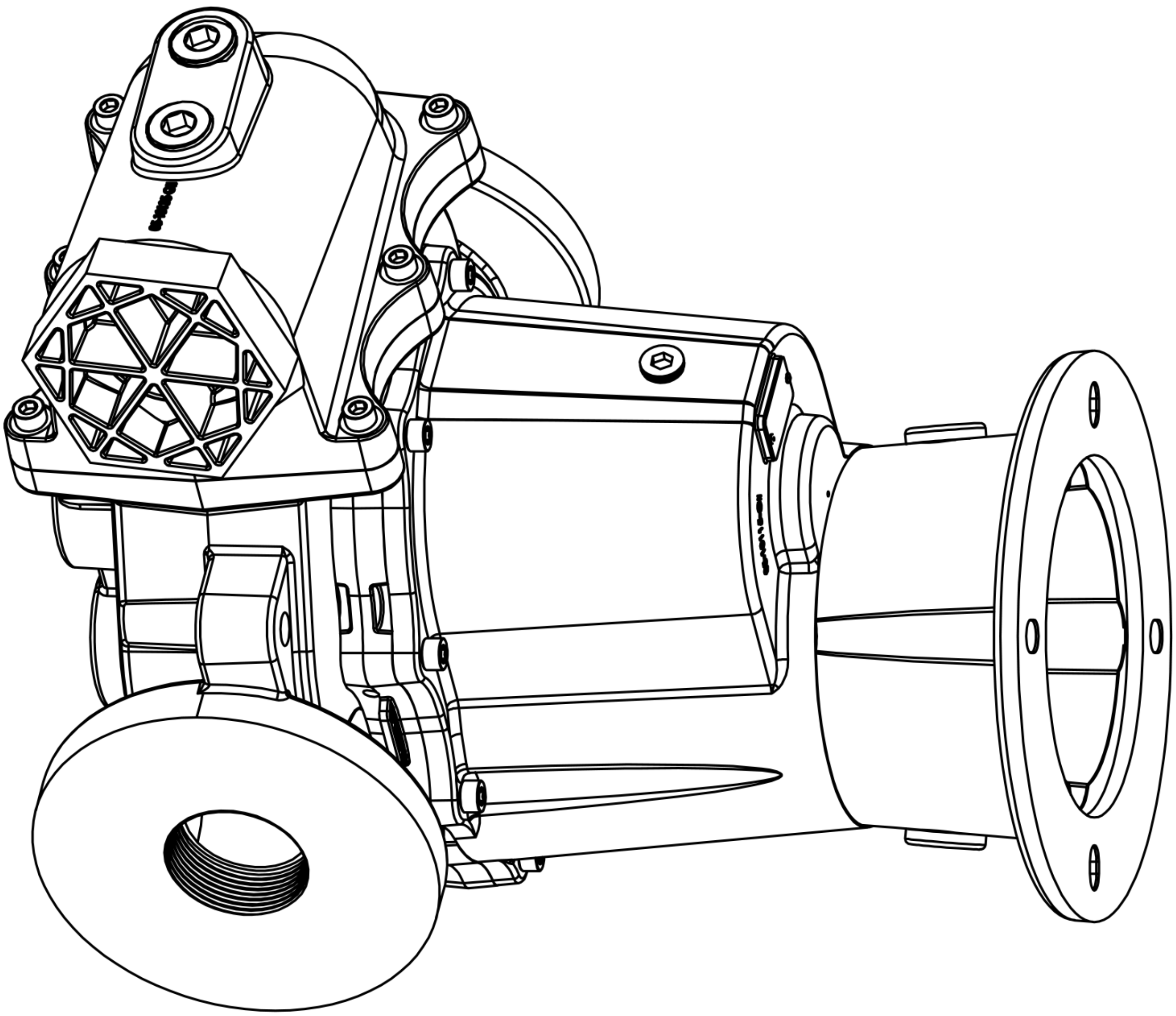

Liquiflo FTS Transfer Pump
Series Nos. FTS150 and FTS200

Safety, Installation, Operation, and Maintenance Instructions

Liquiflo® Fluid Transfer Pumps

Table of Contents

⚠ WARNING – USER RESPONSIBILITY

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

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OFFER OF SALE

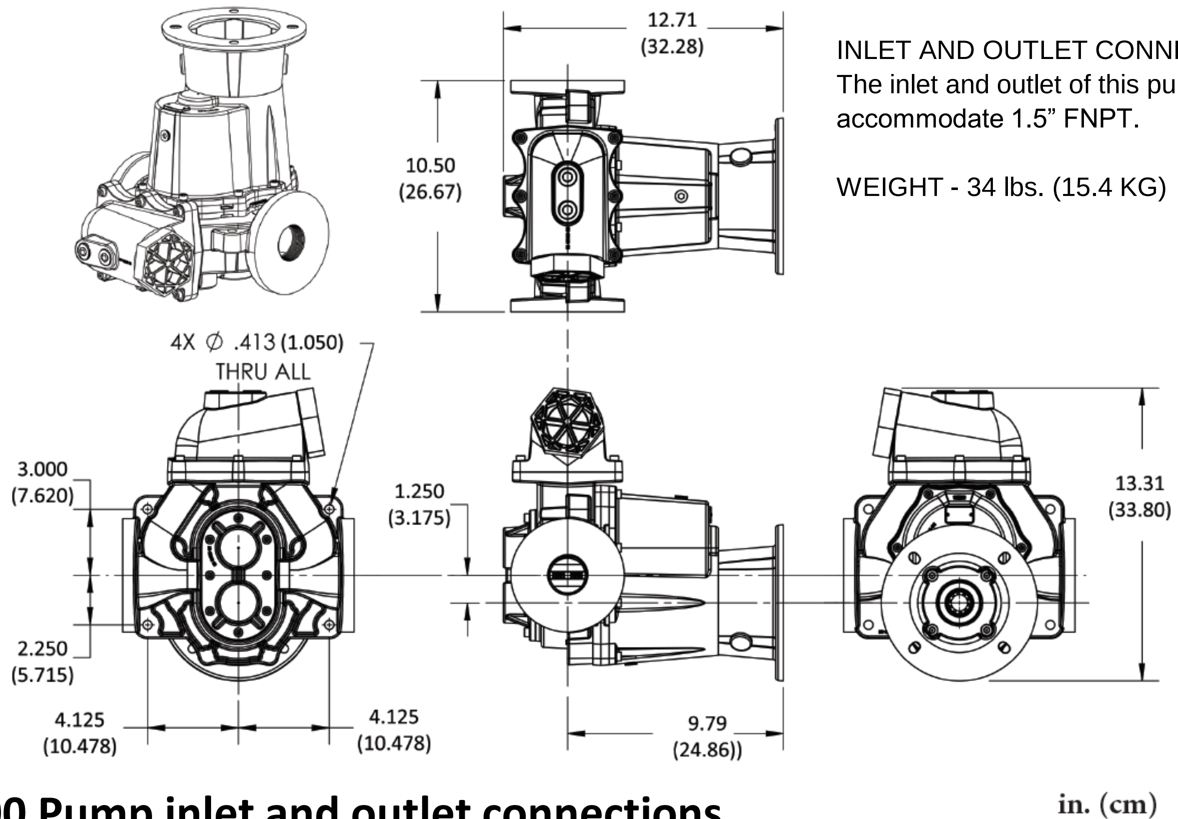
Please contact your Liquiflo FTS representative for a detailed “Offer of Sale”.

The content of this manual may be revised without prior notice. Please consult with your Liquiflo FTS representative to obtain the most up to date revision.

Liquiflo FTS Application Support contact information

Liquiflo FTS Application Support
Phone: 1 (908) 518-0777
E-mail: sales@liquiflo.com
Monday – Friday 9:00 am – 5:00 pm EST

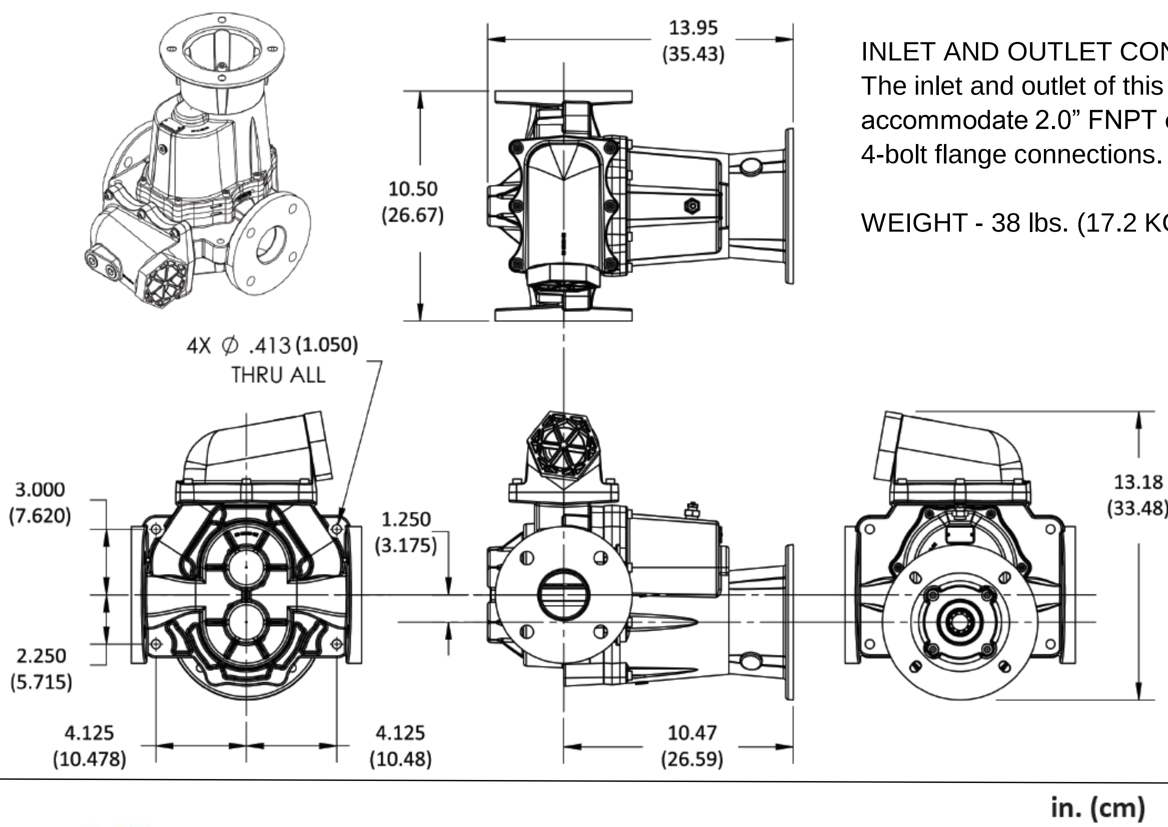
FTS150 Pump inlet and outlet connections



INLET AND OUTLET CONNECTIONS
The inlet and outlet of this pump can accommodate 1.5” FNPT.

WEIGHT - 34 lbs. (15.4 KG)

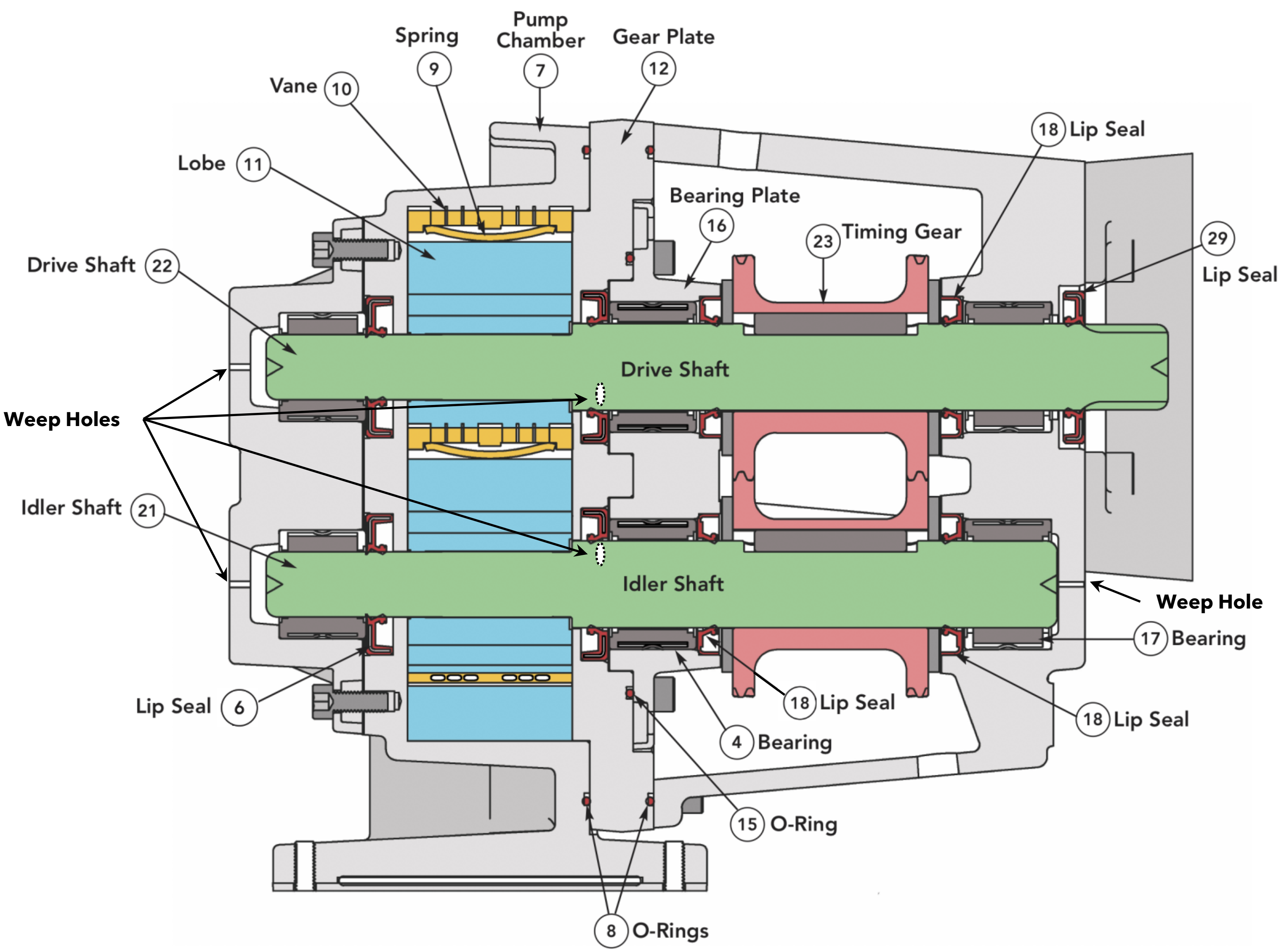
FTS200 Pump inlet and outlet connections



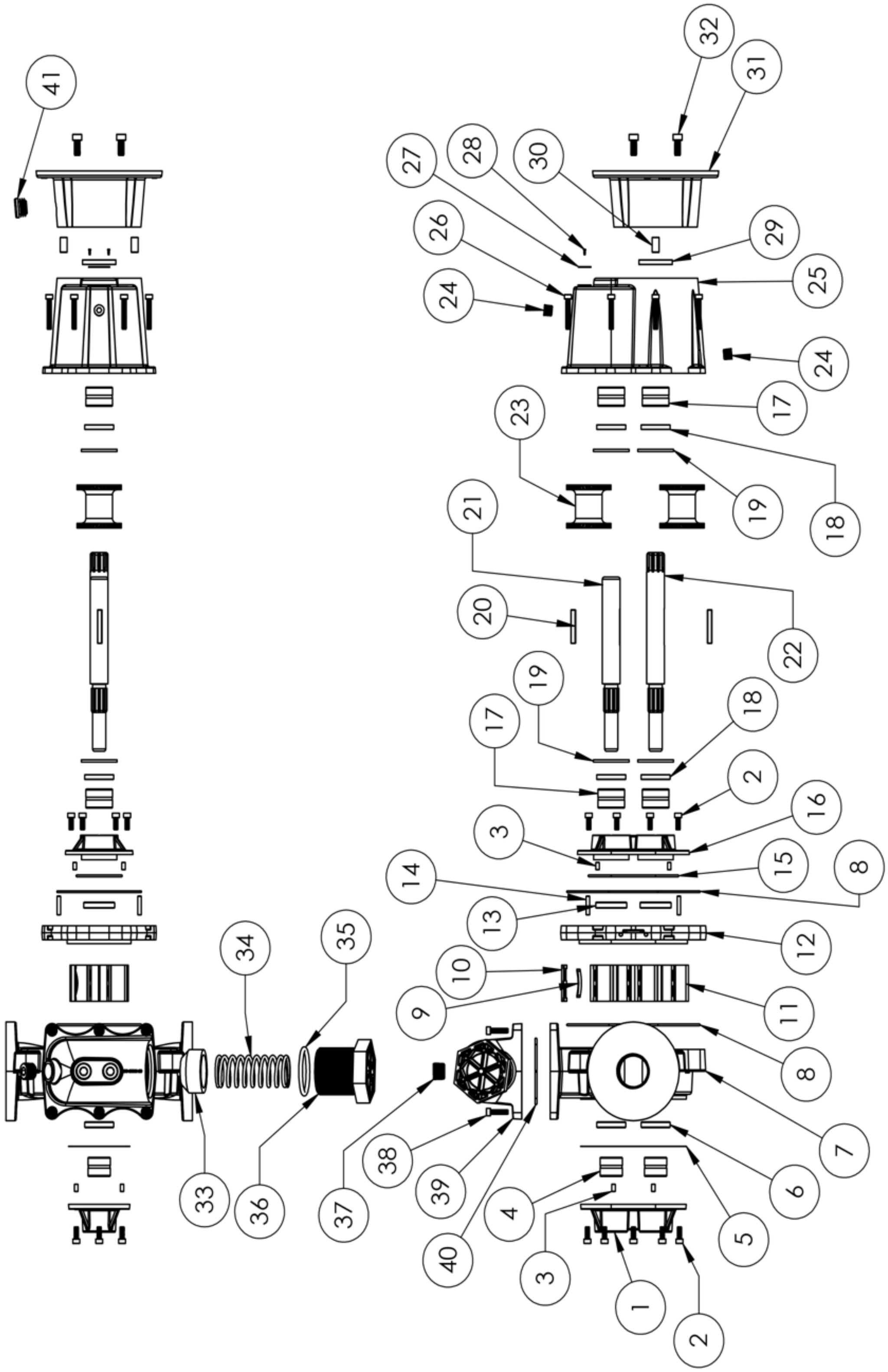
INLET AND OUTLET CONNECTIONS
The inlet and outlet of this pump can accommodate 2.0” FNPT or (optional) 4-bolt flange connections.

WEIGHT - 38 lbs. (17.2 KG)

FTS150/200 Internal View



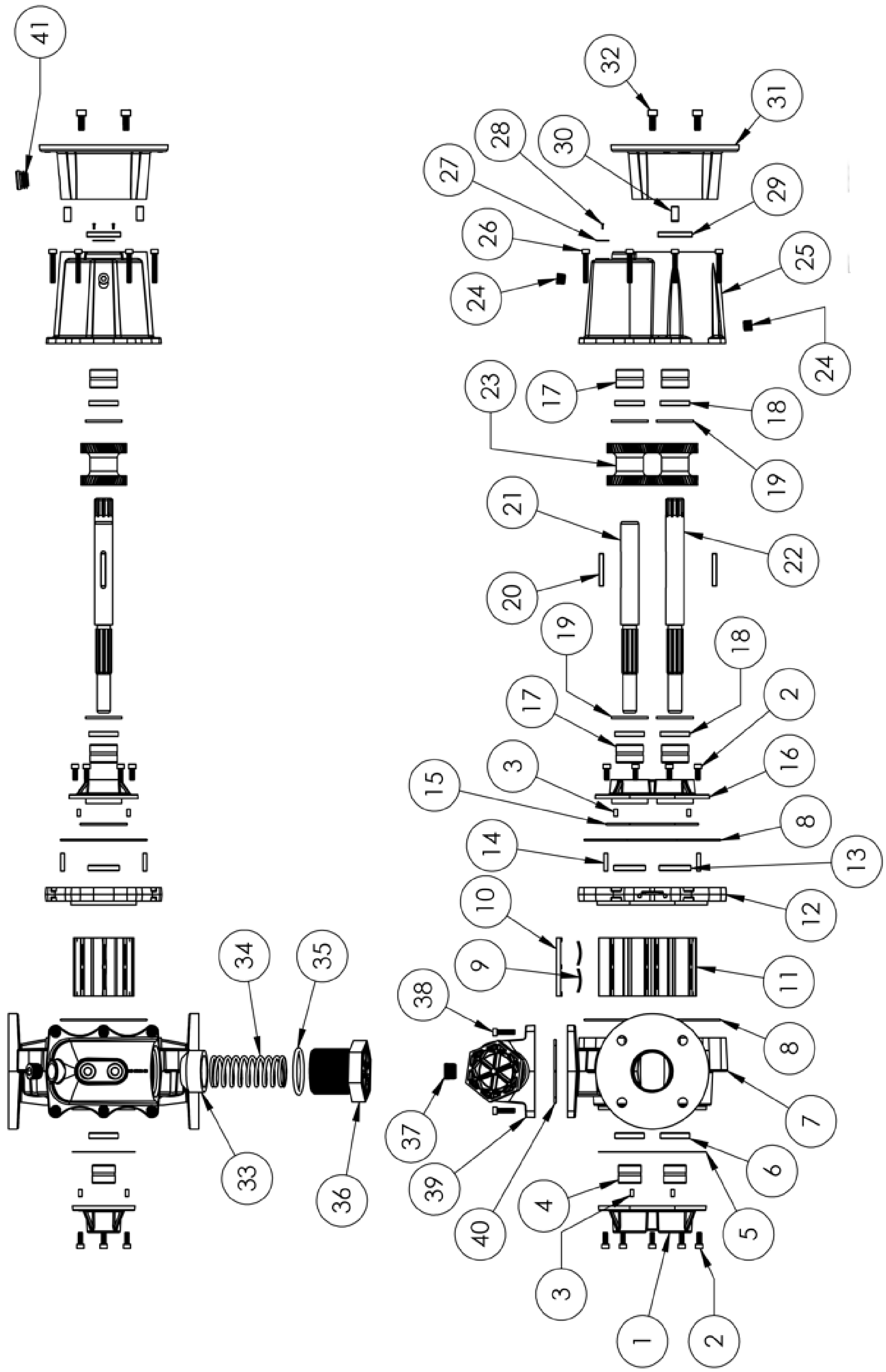
FTS150 Parts description



FTS150 Parts description

Item No.	Description	Part No	QTY.
1	1.5-2.5 PUMP CHAMBER BEARING HOUSING, MACHINED	05-10225-GII	1
2	SHCS 6mm x 1.0 x 16 12.9	20-00202	16
3	DOWEL PIN 5mm x 10	20-00195-GII	4
4	BEARING 1.25 O.D. x .75 I.D.	80-55015	2
5	1.5-2.5 GASKET, BEARING PLATE HOUSING, PUMP CHAMBER	80-70180-GII	1
6	SEAL 1.625 O.D. x .75 I.D. VITON 200 PSI 1.5-2.0	80-60120-2	2
6	SEAL 1.625 O.D. x .75 I.D. BUNA 100 PSI 1.5-2.0	80-60135	2
7	1.5 PUMP CHAMBER, WASHERLESS, MACHINED	05-10125-GII	1
8	1.5-2.0, O'RING, GEAR CHAMBER-CENTER PLATE	80-70135-GII	2
9	1.5 SPRING WIPER BLADE	80-40210-GII	18
10	1.5 WIPER BLADE	80-40300-GII	18
11	1.5 IMPELLER, MACHINED	80-40150-GII	2
12	1.5-2.5 CENTER PLATE, WASHERLESS, MACHINED	05-10105-GII	1
13	SEAL 1.75 O.D. x 1.0 I.D. VITON 200 PSI 1.5-2.0	80-60130-2	2
13	SEAL 1.75 O.D. x 1.0 I.D. BUNA 100 PSI 1.5-2.0	80-60115	2
14	DOWEL PIN 5mm x 25	20-00191-GII	2
15	1.5-2.5 O'RING, BEARING HOUSING PLATE,CENTER PLATE	80-70175-GII	1
16	1.5-2.5 BEARING PLATE HOUSING,CENTER PLATE, MACHINED	05-10215-GII	1
17	BEARING 1.5 O.D. x 1.0 I.D.	80-55010	4
18	SEAL 1.625 O.D. x 1.0 I.D. BUNA 1.5-2.0	80-60133-1	4
19	THRUST WASHER, 1.5-2.0	80-80120	4
20	KEY, TIMING GEARS, 1.5-2.0	80-00100-GII	2
21	SHAFT SHORT 1.5	80-01010-GII	1
22	SHAFT LONG 1.5	80-01020-GII	1
23	TIMING GEAR .25 FACE	80-02020	1
23	TIMING GEAR .50 FACE	80-02000	1
23	TIMING GEAR .75 FACE	80-02010	1
24	HEX SOCKET DRAIN PLUG 1/4 NPT	20-13000	2
25	1.5-2.0 GEAR CHAMBER, MACHINED	05-10115-GII	1
26	SHCS 6mm x 1.0 x 40 12.9	20-00206-GII	8
27	2.0 PUMP HEAD SERIAL NUMBER PLATE	45-00020	1
28	RIVOT SERIAL PLATE	45-32223	2
29	SEAL 1.875 O.D. x 1.0 I.D. BUNA 1.5-2.0	80-60110	1
30	DOWEL PIN 10mm x 20	20-00192-GII	2
31	1.5-2.0 C-FLANGE ADAPTER, 1, MACHINED	05-10150-GII	1
32	SHCS 8mm x 1.25 x 20 12.9	20-00301-GII	4
33	BYPASS PLUNGER 1.5-2.0	80-01075-B2	1
34	SPRING BYPASS 1.5-2.0 20lb	80-04010	1
34	SPRING BYPASS 1.5-2.0 50lb	80-04030	1
34	SPRING BYPASS 1.5-2.0 75lb	80-04040	1
34	SPRING BYPASS 1.5-2.0 100lb	80-04050	1
35	O"RING BYPASS CAP VITON 1.5-2.0	80-70155	1
36	BYPASS CAP 1.5-2.0	80-01065-B2	1
37	HEX SOCKET DRAIN PLUG 1/2 NPT	20-12955	3
38	SHCS 6mm x 1.0 x 25 12.9	20-00211-GII	6
39	1.5-2.0 BYPASS, MACHINED	05-10135-GII	1
40	O'RING PUMP CHAMBER-BYPASS 1.5-2.0	80-70130-GII	1
41	ROUND TUBE INSERT 1.0	20-14050	1
42	8 oz., 626 OIL	45-4000	1

FTS200 Parts description



FTS200 Parts description

Item No.	Description	Part No	QTY.
1	1.5-2.5 PUMP CHAMBER BEARING HOUSING, MACHINED	05-10225-GII	1
2	SHCS 6mm x 1.0 x 16 12.9	20-00202	16
3	DOWEL PIN 5mm x 10	20-00195-GII	4
4	BEARING 1.25 O.D. x .75 I.D.	80-55015	2
5	1.5-2.5 GASKET, BEARING PLATE HOUSING, PUMP CHAMBER	80-70180-GII	1
6	SEAL 1.625 O.D. x .75 I.D. VITON 200 PSI 1.5-2.0	80-60120-2	2
6	SEAL 1.625 O.D. x .75 I.D. BUNA 100 PSI 1.5-2.0	80-60135	2
7	2.0 PUMP CHAMBER, MACHINED	05-10205-GII	1
8	1.5-2.0, O'RING, GEAR CHAMBER-CENTER PLATE	80-70135-GII	2
9	2.0 SPRING WIPER BLADE	80-40220-GII	36
10	2.0 WIPER BLADE	80-40400-GII	18
11	2.0 IMPELLER, MACHINED	80-40450-GII	2
12	1.5-2.5 CENTER PLATE, WASHERLESS, MACHINED	05-10105-GII	1
13	SEAL 1.75 O.D. x 1.0 I.D. VITON 200 PSI 1.5-2.0	80-60130-2	2
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14	DOWEL PIN 5mm x 25	20-00191-GII	2
15	1.5-2.5 O'RING, BEARING HOUSING PLATE,CENTER PLATE	80-70175-GII	1
16	1.5-2.5 BEARING PLATE HOUSING,CENTER PLATE, MACHINED	05-10215-GII	1
17	BEARING 1.5 O.D. x 1.0 I.D.	80-55010	4
18	SEAL 1.625 O.D. x 1.0 I.D. BUNA 1.5-2.0	80-60133-1	4
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20	KEY, TIMING GEARS, 1.5-2.0	80-00100-GII	2
21	SHAFT SHORT 2.0	80-00310-GII	1
22	SHAFT LONG 2.0	80-00300-GII	1
23	TIMING GEAR .50 FACE	80-02000	2
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34	SPRING BYPASS 1.5-2.0 75lb	80-04040	1
34	SPRING BYPASS 1.5-2.0 100lb	80-04050	1
35	O"RING BYPASS CAP VITON 1.5-2.0	80-70155	1
36	BYPASS CAP 1.5-2.0	80-01065-B2	1
37	HEX SOCKET DRAIN PLUG 1/2 NPT	20-12955	3
38	SHCS 6mm x 1.0 x 25 12.9	20-00211-GII	6
39	1.5-2.0 BYPASS, MACHINED	05-10135-GII	1
40	O'RING PUMP CHAMBER-BYPASS 1.5-2.0	80-70130-GII	1
41	Round Tube Insert 1.0	20-14050	1
42	8 oz., 626 OIL	20-00211-GII	1

Piping guidelines

- All piping MUST be independently supported and MUST not rely on the Transfer Pump for support.
- If there is no bypass valve option on your Transfer Pump, you MUST provide a bypass valve in the process piping on any discharge side of the Transfer Pump; since the Transfer Pump is reversible, this may be on both sides of the Transfer Pump depending on your application. It is recommended that the bypass return be routed back to the tank to prevent an over-temperature condition in the pumping fluid.
- For best performance, allow for at least five straight-pipe diameters free of any bends or valves at any Transfer Pump inlet; since the Transfer Pump is reversible, this may be on both sides of the Transfer Pump depending on your application.
- If there is more than one Transfer Pump installed on the same fluid source, ensure that each Transfer Pump has an independent suction line to the fluid source.
- Install appropriate isolation valves in the process piping around the Transfer Pump so that it may be properly drained and/or removed for service. Size the valves in accordance with the process piping – valves that are too small will reduce Transfer Pump performance.
- Ensure that all piping and joints are free of leaks, including vacuum leaks which may ingest air and reduce pump performance and may reduce the pump's ability for suction and lift.
- It is good practice to minimize both the major and minor pressure losses in the piping system. To do so, minimize the total number of elbow fittings, valves, and pipe bends; keep the length of the total piping system as short as is practical; and use an appropriately large diameter pipe size in relation to the total length of piping.
- It is the responsibility of the user's qualified personnel to assess the need for filtration in the pumping application. The Transfer Pump should be installed with a 300-micron filter/strainer or finer. Keep in mind that since the pump is reversible, you may need to install a filter on both sides of the Transfer Pump, depending on your application. When any filter is installed, you should monitor the filter for life to make sure it does not become clogged during operation, as clogged filters will significantly reduce pumping performance. Filters that are especially fine will negatively impact pumping performance even when new.
- It is recommended that suction and discharge pressure gauges be installed at the inlet and outlet locations.
- Ensure that the suction piping is fully submerged below the surface of the fluid and not too close to the surface as the high flow of the pump will disturb the fluid surface and prevent proper operation.

CAUTION

Ensure that the installation has adequate Net Positive Suction Head Available (NPSH) for the fluid to be pumped. See Pump Data Package. For assistance with calculating appropriate $NPSH_A$, contact Liquiflo FTS Application Support

CAUTION

If your Transfer Pump does not include the bypass valve option, bypass valve(s) MUST be installed in your process piping. A bypass valve is REQUIRED for each flow direction in which the pump will be operated.

CAUTION

The FTS150/200 pumps are intended for use with clean liquids only. Abrasives and other solids with reduce the life of the pump. A 300-micron strainer is recommended on the inlet side of the pump.

CAUTION

Care must be taken when installing NPT connections into aluminum. This type of pipe connection is considered permanent and not removable. The FTS200 pump can be purchased with an optional 4 bolt flange connection

CAUTION

Do not suspend the pump by its flanges – it should be securely mounted to the floor or other suitable surface. Do not allow flanges to support the weight of the piping – ensure that all piping is properly suspended or supported independently of the Transfer Pump.

General operation procedures

The FTS150/200 pump is a positive displacement pump – never dead head the pump (operating against a closed valve or plug). If the Transfer Pump is being used for a dispensing application, a bypass valve must be installed in correct position – see page 13. The FTS150 and FTS200 pumps are reversible. The performance in Direction 1 – Forward (clockwise) is the same as the performance in Direction 2 – Reverse (counterclockwise).

WARNING

The standard internal bypass valve will not relieve pressure when operated in the reverse direction. For proper pressure relief/bypass in reverse operation, an external bypass must be installed to relieve pressure when the discharge side of the pump is blocked or closed.

Flushing the Transfer Pump

1. Purge the suction and discharge lines – The Transfer Pump can be run dry, so there is no danger of damaging it if the pump is used to clear the lines.
2. Safely isolate the fluid media source once the suction and discharge lines are purged.
3. DO NOT CLOSE ANY DISCHARGE VALVE(S) WHILE THE PUMP IS OPERATING. This will cause a DEAD HEAD condition in the pump and will result in immediate damage to the pumping mechanism.

Storage

If the unit is not going to be installed immediately, it should be stored indoors, covered with a waterproof sheet, and with all open ports plugged. If long-term storage is expected (six months or more), it is recommended that the pump be completely filled with a clean, non-corrosive fluid to prevent the entry of moisture. Acceptable fluids are commonly available hydraulic oils or oil-based lubricant fluids. DO NOT USE WATER.

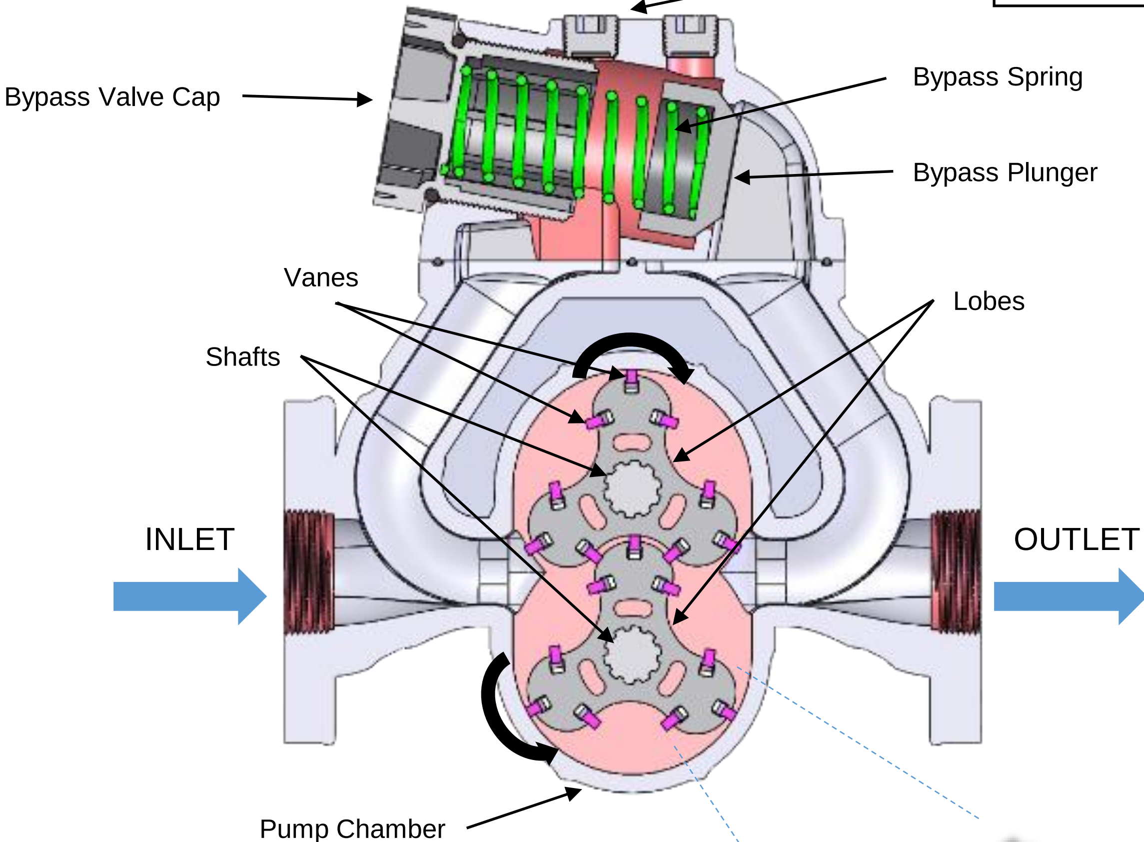
Pump Operation

Mechanical Bypass

- When the outlet pressure of the pump increases above the bypass valve pressure setting, the bypass valve will begin to open and recirculate the fluid into the pump chamber until the outlet pressure is reduced. When the pressure drops below the bypass setpoint, the valve will close, and normal pumping operation will continue.
- Available in multiple pressure settings – 20, 50, 75, and 100 psi
- Adjustable bypass valves also available

WARNING

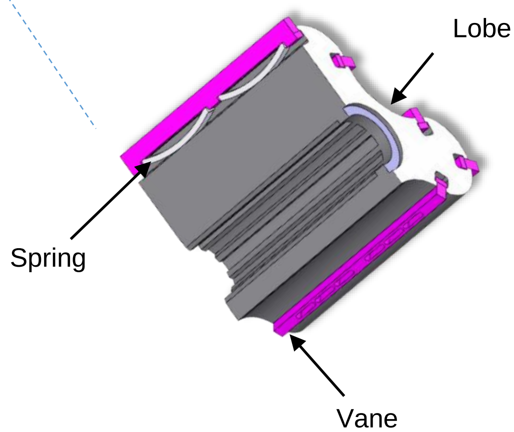
Do NOT allow the pump to run in bypass mode continuously. The fluid can build up heat rapidly and pose a risk to the equipment and people nearby



Tri-lobe Rotors

As the lobes rotate, they create areas of expanding volume on the inlet side of the pump. The liquid travels through these pockets and is forced through the outlet

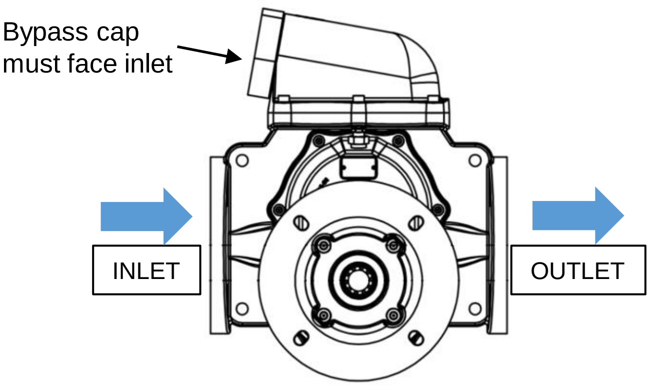
- Engineered resins and design enable pump to self-prime and run dry without damage
- Spring loaded vanes ensure a tight seal with the pump cavity to develop high volumetric efficiency and enable high suction lift
- FTS150/200 pumps can be run in the reverse direction without loss of flow



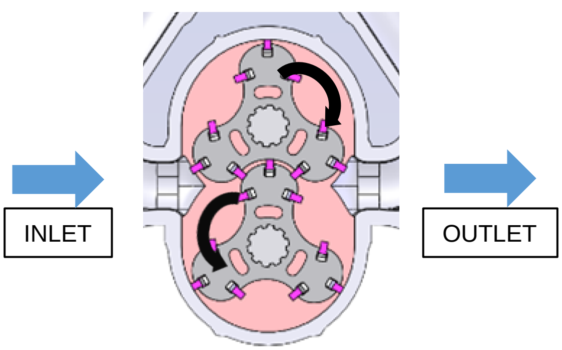
Pump Operation

The FTS150 and FTS200 pumps can operate in either forward or reverse direction. Make sure that the pump is oriented correctly, based on application. Ensure that the bypass valve is installed with the cap facing the inlet.

Forward Direction
Standard applications
(Electric Motors – shaft turns clockwise)

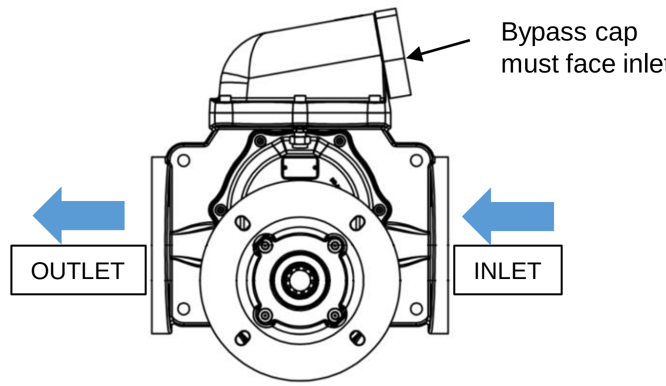


Exterior View - Front of Pump

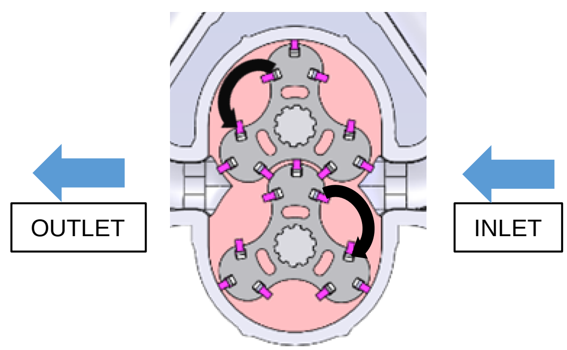


Interior View – Front of Pump
Top impeller turns clockwise

Forward Direction
Non-standard applications
(Diesel/gas engines – shaft turns counter-clockwise)

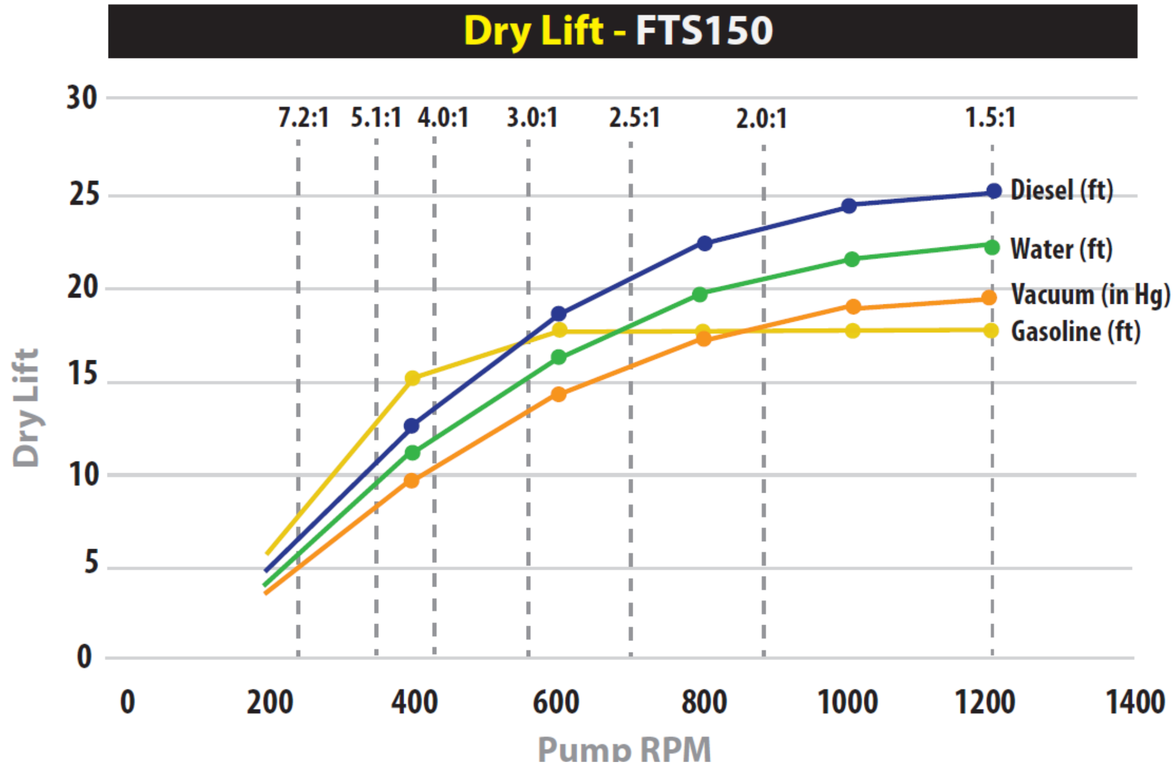


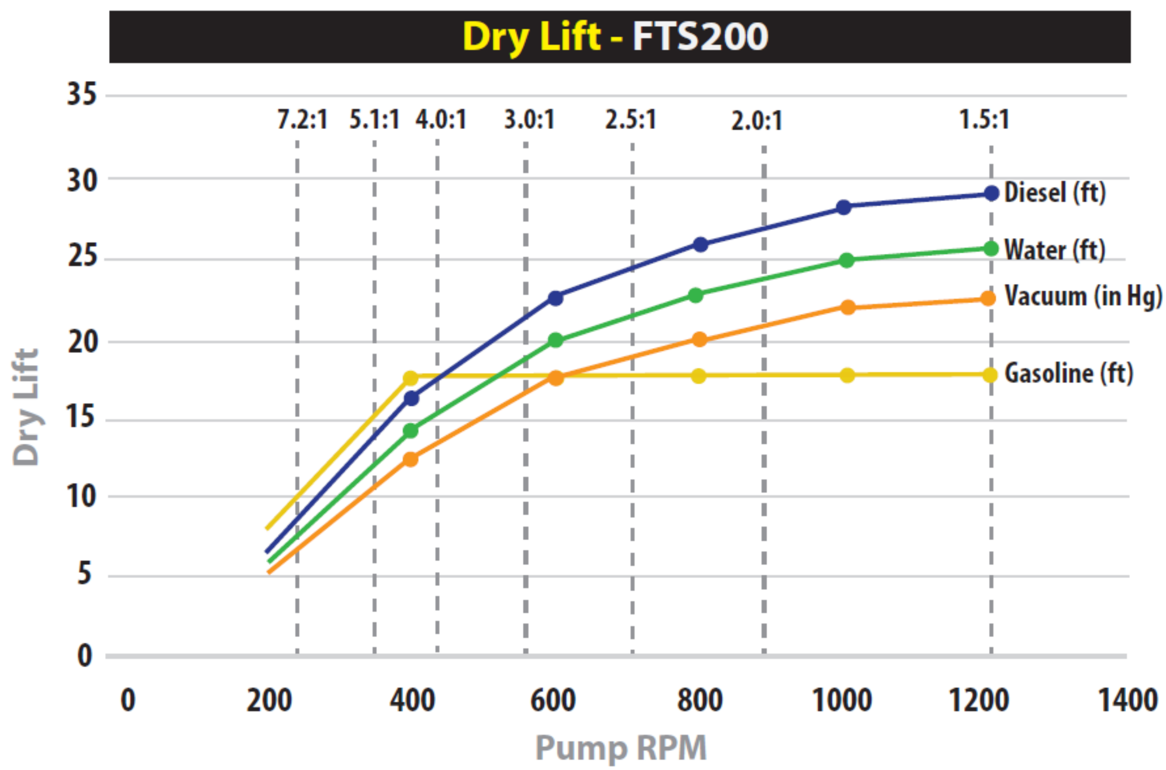
Exterior View - Front of Pump



Interior View – Front of Pump
Top impeller turns counter-clockwise

Application overview





Application overview

Pump technology

FTS150/200 systems feature patented Tri-Lobe positive displacement impeller technology that provides continuous dry-run, high suction lift, and improved flow performance.

Performance – flow and pressure

Flow and pressure performance depends on the speed of the pump shaft and the available horsepower (HP) provided by the power unit. Higher pump shaft speed results in higher flows, and higher HP results in higher pressures. The flow and pressure performance specifications for these units can be found in the product data package.

Suction Lift and Performance

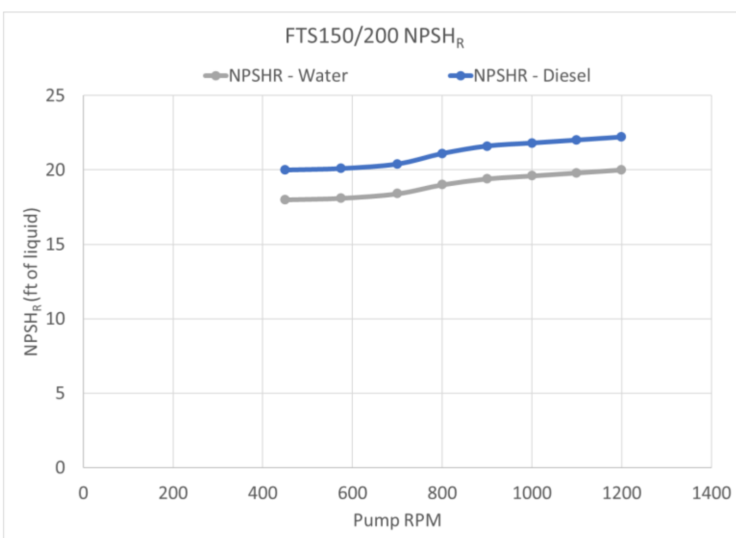
A key benefit of the FTS150/200 pumps is their ability to pull a strong vacuum. As shown in the figures to the left, these pumps can generate roughly 20 in Hg of vacuum. This allows them to deliver high lift of fluids. Some fluids are also shown in the figures along with common gear ratios are highlighted.

Suction lift performance depends on many factors, but atmospheric pressure is a key driver of suction lift performance and elevation of the pumping location must be considered. It will be easier to lift fluid through the pump at sea level than at higher elevations.

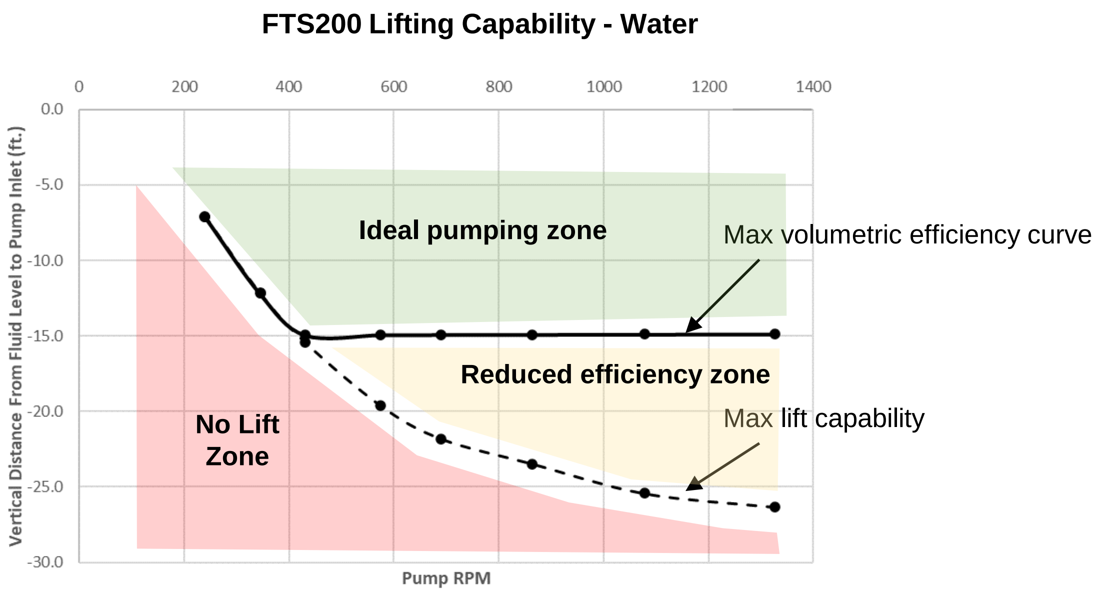
Additionally, the vapor pressure of the fluid is a key factor in how high a pump will lift fluid from below the pump inlet. High vapor pressure fluids are more difficult to lift from below the pump intake. For example, the dry lift of gasoline is especially sensitive to vapor pressure. For summer fuel gasoline (RVP=9), the dry lift is limited to 18 feet due to its very high vapor pressure.

Cavitation occurs when the liquid in a pump turns to a vapor at low pressure. It occurs because there is not enough pressure at the suction end of the pump, or insufficient Net Positive Suction Head available ($NPSH_A$). When cavitation takes place, air bubbles are created at low pressure. When available head falls below the required head for the pump, the flow output will be reduced, and the resultant flow will be a combination of liquid and gas.

The Net Positive Suction Head required ($NPSH_R$) for the FTS150/200 pumps is shown below.



Application overview



Considerations when lifting fluids

In the figure above, the solid line shows how high you can lift water without cavitation at atmospheric pressure at sea level. You can see that as you pump faster, you are limited to roughly 15 feet of lift without losing any volumetric efficiency. Since atmospheric pressure is = 34 feet of water, after you subtract the pump required head of 19 feet, you are lift with 15 feet. Does this mean that you can only lift 15 feet of water? No, you will be able to lift roughly 26 feet at 1200 rpm. The dotted line represents that maximum lift that the pump can provide at reduced efficiency.

Ideally, you want your pumping setup to place you above the solid line- this gives you the most efficient flow. If you are between the solid and dotted lines, you will still be able to pump the fluid, but you will see reduced volumetric efficiency. As you get closer to the dotted line, your efficiency will decrease. If you are below the dotted line, you will not able to lift the fluid.

Note that for real world conditions, you will need to consider losses from piping, altitude, fluid type and vapor pressure. The next section illustrates an example of how to calculate the available net positive suction head.

Pumping Considerations

Net Positive Suction Head

Net Positive Suction Head (NPSH) is the absolute pressure at the pump suction port. This is typically noted as $NPSH_A$ (available) or $NPSH_R$ (required).

$NPSH_A$ is a function of the system and has to be determined based on the layout of the system
$NPSH_R$ is a property of the pump and is provided with performance curves from the manufacturer

$$NPSH_A = H_A \pm H_Z - H_F - H_{VP}$$

H_A	Absolute pressure on the liquid surface
H_Z	Vertical distance between the lowest liquid level of the supply vessel and the centerline of the pump inlet
H_F	Friction loss in the inlet pipe system
H_{VP}	Vapor pressure of the liquid at the pumping temperature

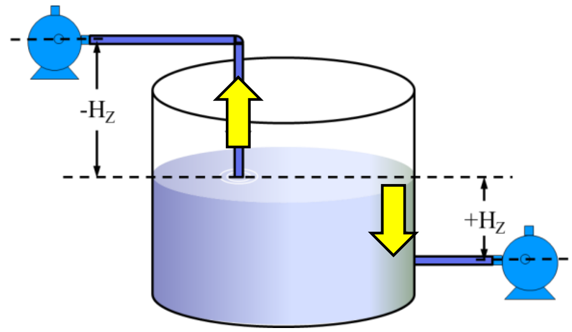
To calculate the $NPSH_A$ of the system, use the equation above. Be careful to keep all the pressure values in the same units. Typically, these are expressed as feet of water or feet of liquid that is being pumped. The following table shows some common unit conversions.

Multiply →	By →	To Obtain
Inches of HG	0.491	PSI
Inches of HG	1.13	Feet of Water
PSI	2.04	Inches of Hg
PSI	2.31	Feet of Water
BAR	1.0197	Kg/cm^2
BAR	14.5038	PSI
Atmospheres	14.7	PSI
Atmospheres	33.9	Feet of Water
Atmospheres	29.9	Inches of Hg
Feet of Water	0.433	PSI
Feet of Water	0.883	Inches of Hg
Feet of liquid	specific gravity	Feet of Water
To Obtain ←	By ←	Divide

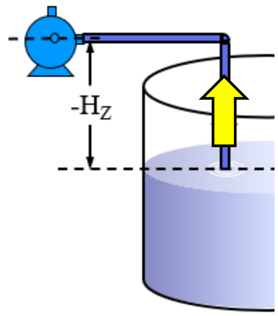
The first term H_A determines how much pressure is on the surface of the liquid. For vented tanks, this is usually atmospheric pressure, but be sure to correct for altitude. If the vessel is closed, determine if it is pressurized or under vacuum. If it is a pressure vessel, H_A = vapor pressure of liquid at vessel temperature or pressure supplied from outside source. If is a vacuum vessel, H_A = typical low barometric pressure minus the vacuum gauge reading.

Pumping Considerations

The second term H_Z = pressure due to the height of the liquid above or below the centerline of the pump. As seen from the adjacent figure, this may be positive or negative.

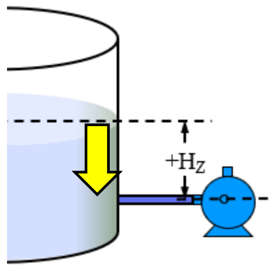


Suction Lift Condition



In the case of a static suction lift, the liquid level is below the inlet of the pump, and H_Z is negative. Be sure to measure to the lowest fluid level. Note: Be aware of the maximum lift capability of the pump. Maximum suction lift refers to how high the pump can lift. i.e. the pump may be able to prime when the tank is full and the level is close to the pump inlet, but as the tank empties this level may exceed the lift capability.

Suction Head Condition



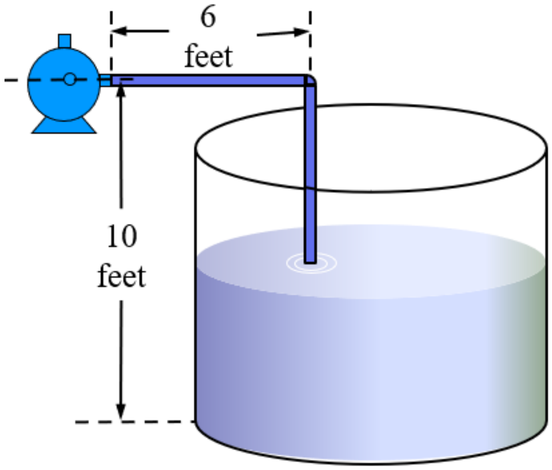
In the case of a static suction head, the liquid level is above the inlet of the pump, and H_Z is positive. Be sure to measure to the lowest fluid level. This is the preferred orientation of the pump when possible.

H_F = pressure loss due to fluid friction in the inlet piping and is always negative. It is a function of pipe diameter, pipe length, flow rate, viscosity, number / type of fittings, and pipe construction. Note: Use highest viscosity expected. Determine if the fluid experiences turbulent or laminar flow and include valve and fitting losses if turbulent flow.

H_{VP} = vapor pressure of the liquid at the operating temperature and is always negative. This value can usually be determined from chemical handbooks, customer documentation or the Material Safety Data Sheet (MSDS).

Pumping Considerations

Example - $NPSH_A$ Calculation – Static Suction Lift Condition



A customer in Cincinnati, Ohio wants to draw #2 fuel oil from a submerged storage tank to fill a day tank.

Calculate the NPSH available for this system.

Flow Rate	90gpm
Suction Piping	2 inch
Vapor Pressure	.83 in Hg
s.g.	.88
Viscosity	38 SSU

The tank is vented to atmosphere

Solution - $NPSH_A$ Calculation – Static Suction Lift Condition

We will keep all pressure values in units of feet of fuel oil

$$NPSH_A = H_A \pm H_Z - H_F - H_{VP}$$

Since tank is vented,

H_A = atmospheric pressure

Local atmospheric pressure is 14.2 PSIA

14.2 PSIA x 2.31 = 32.8 ft. of water

32.8 ft. of water / 0.88 = **37.3 ft. of fuel**

H_A = 37.3 ft

Since suction lift is required H_z is negative

Lift is 10 feet of fuel

H_z = **-10 ft. of fuel**

H_Z = -10 ft

Pumping Considerations

To calculate H_F we need to calculate the frictional losses in the pipes. The easiest method is to use an online calculator such as freecalc.com or you can estimate the losses using an engineering guide such Crane's Flow of Fluids Technical Paper No. 410. In this example, there is 16 feet of straight 2-inch pipe and 1 90º elbow. The losses in the 90º elbow can be estimated to be equivalent to 3.5 feet of straight pipe. This gives us a total of 19.5 feet of piping.

Now we need to calculate the friction based on fluid viscosity, flow rate, pipe diameter and length. This can be calculated from various sources such as engineeringtoolbox.com. For #2 fuel oil, flowing 19.5 feet in 2-inch pipe gives us 3.6 feet of head.

H_F = 1.4 PSI

1.4 PSI x 2.31 = 3.2 feet of water

3.2 feet of water / 0.88 = **3.6 feet of fuel**

H_F = 3.6 ft

H_{VP} = 0.83 in Hg

0.83 in Hg x 1.133 = 0.94 feet of water

0.94 feet of water / 0.88 = **1.1 feet of fuel**

H_{VP} = 1.1 ft

$$NPSH_A = 37.3 – 10 – 3.6 – 1.1$$

$NPSH_A$ = 22.6 ft of fuel

If $NPSH_A$ > $NPSH_R$, your system should be suitable for pumping without cavitation. If your available head is lower than the pump required head, you can try to make some changes as noted below to increase the available head. If these methods are not available, your flow rate will be diminished and if the head difference is very large, you may not be able to pump the fluid.

To improve the $NPSH_A$, consider the following options:
H_A – pressurize the vessel
H_Z – change the location of the tank or pump to increase the head (e.g./ raise the tank, lower the pump)
H_F – use larger pipes, increase the size of the ports on the pump inlet/outlet, or reduce flow rate
H_{VP} – pressurize the vessel or reduce the temperature of the fluid to decrease vapor pressure.

Vanes and springs replacement

Drain gear chamber – Figure 1

1. Turn pump over and remove bottom drain plug (Part# 20-13000 Hex socket drain plug ¾” NPT) from gear chamber, Figure 2
2. Drain the gear oil from the gear chamber, Figure 3
3. Remove the top drain plug (Part# 20-13000 Hex socket drain plug ¾” NPT) from the gear chamber, Figure 4

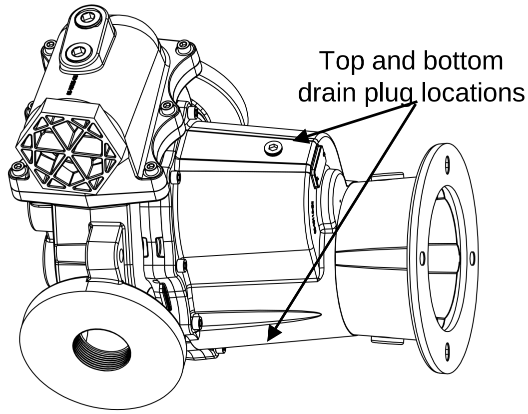


Figure 1

Remove bottom drain plug

Figure 2

Drain gear oil

Figure 3

Remove top drain plug

Figure 4

Remove gear chamber from center plate and pump chamber

1. Remove the eight socket head cap screws (Part# 20-00206-GII SHCS 6mm x 1mm x 40mm) that attach the gear chamber and center plate to the pump housing, Figure 5.
2. Carefully pull the gear chamber to remove it from the center plate.
3. If the gear chamber sticks to the center plate, find the pry slot on the center plate, Figure 6, and insert a flat head screwdriver to gently loosen the gear chamber from the center plate.

Remove screws

Figure 5

Remove gear chamber

Figure 6

Vanes and springs replacement

4. Orient the pump so that the lobe gears are accessible, Figure 7.
5. Carefully push in one of the vanes and slide the vane and spring out, Figure 8.
6. Repeat for all vanes. Turn the lobes to access every vane.

Orient pump to access vanes

Figure 7

Compress vane and slide out

Figure 8

Installing vanes

A vane service kit includes a complete set of 18 vanes and 18 springs for the FTS150 and 36 springs for the FTS200 model pump. Replace vanes and springs as an entire set.

1. Compress the first spring in the cutout on the bottom of the vane, Figure 9.
2. Slide the spring and vane into the, compressing the spring to ease it and the vane half the way into the slot, Figure 10.
3. For the FTS200, position the second spring in the vane cutout, and compress it, Figure 10.
4. Slide the vane and compressed spring into the slot until the vane end is flush with the lobe face, Figure 11.
5. Repeat step 1 through 4 above on the remaining new vanes to replace the whole set.

Compress spring up into vane channel

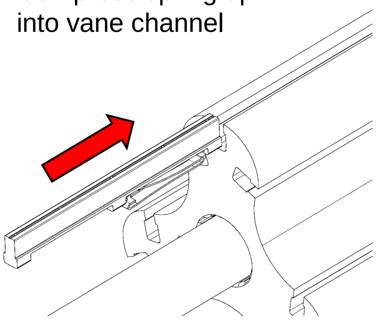


Figure 9

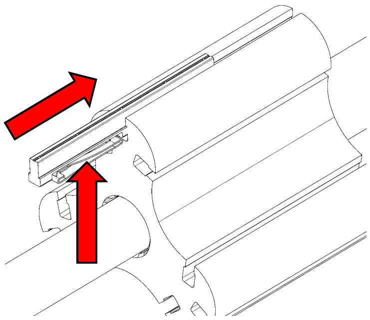


Figure 10

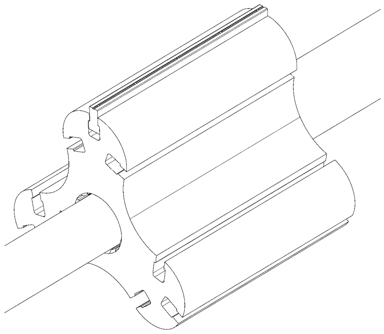


Figure 11

Vanes and springs replacement

Reassembling the pump

1. Align gear chamber. Compress vanes if necessary, to align shafts with center plate, Figure 11
2. Reseat the gear chamber, Figure 12
3. Replace socket head screws, Figure 13.
4. Tighten screws in the sequence shown in Figure 14. Torque to 100 lbs/in.
5. Replace bottom drain plug
6. Fill gear chamber with 12 ounces of Mobil SHC-626 oil, Figure 15
7. Replace top drain plug.

Align gear chamber

Figure 11

Reconnect gear chamber

Figure 12

Replace screws

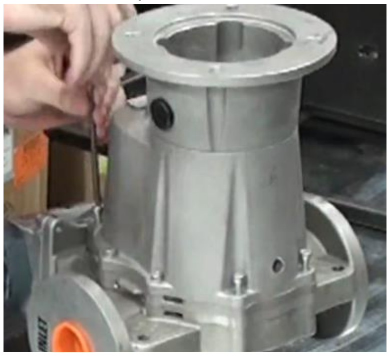


Figure 13

Tighten screws in order

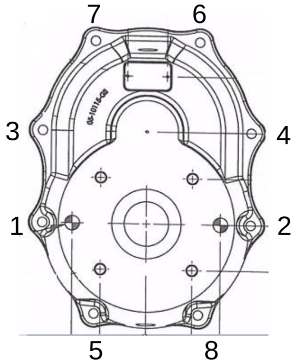


Figure 14

Fill gear chamber

Figure 15

General Maintenance Procedures

The FTS150 and FTS200 pumps require minimal maintenance and should provide trouble-free operation. Following these general maintenance procedures will provide optimal performance:

- Every 2,000 hours of operation, the gear chamber should be drained and replaced with 12-14 ounces of synthetic lubricant. The recommended lubricant type is Mobil SHC-626
- Periodically, all nuts and bolts should be checked and tightened securely to ensure maximum performance of the pump unit.
- When your flow rate or suction begins to diminish, replace the vanes and springs. These are wear items and should be replaced periodically.
- If you see red grease exiting from the weep holes (shown on pages 5 and 26), one or more of the lip seals may have been damaged. Please contact the factory for replacement and rebuild instructions.

Bypass valve replacement

Remove bypass housing from pump - Figure 16

1. Remove 6 screws (Part #20-0211 6mm x 25mm screws) from the bypass housing, Figure 17.
2. Check quality of seal (Part# 80-70130 O-Ring Buna Bypass Chamber Seal) and replace if necessary, Figure 18.
3. Coat seal with a light film of Mobil SHC-626 oil and install into groove.
4. Unscrew bypass plunger with a 3-inch socket
5. Check and clean the plunger thread, Figure 19.

Bypass valve assembly

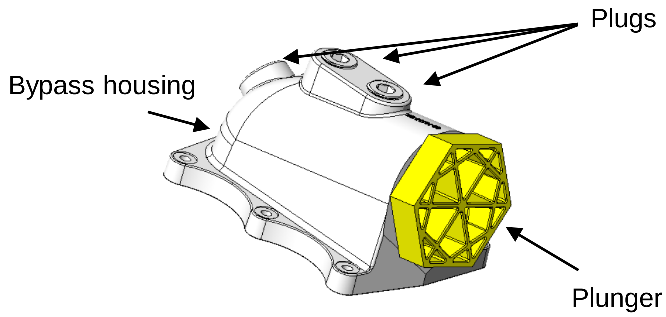


Figure 16

Remove the housing screws

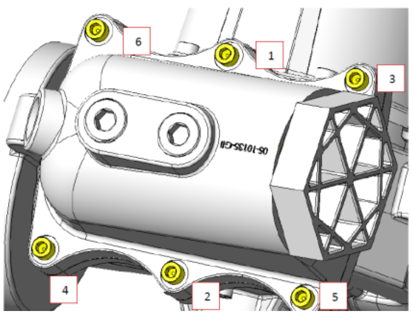


Figure 17

Replace bypass valve seal

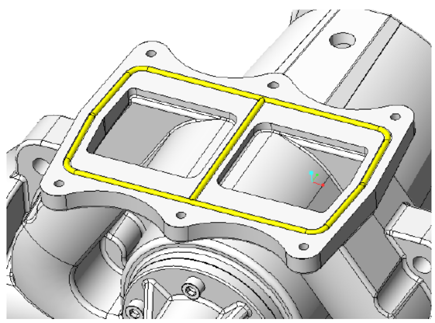


Figure 18

Check and clean threads

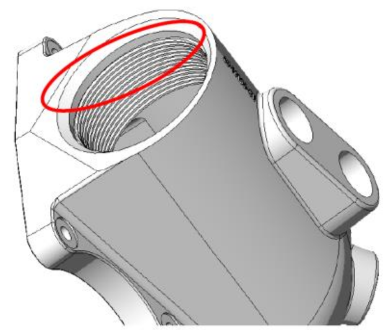


Figure 19

Disassemble the bypass valve

1. Remove cap and spring, Figure 20
2. Inspect and clean threads on plunger
3. Check quality of O-Ring seal (Part# 80-70155 Viton O-Ring Bypass Seal) and replace if needed
4. Coat O-Ring with a light film of Mobil SHC-626 oil.
5. Replace O-Ring into groove.
6. Check quality of spring and bypass cap. Ensure that spring is clean and not damaged.
7. If necessary, replace spring with appropriate pressure rating (Part# 80-040XX Spring Bypass, where XX is determined by bypass pressure setpoint. See page 11 (FTS150) and page 12 (FTS200), item #34 for specific part numbers).

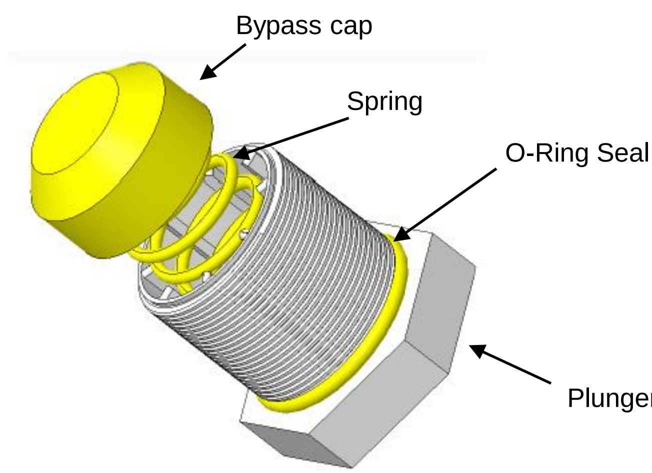


Figure 20

Bypass valve replacement

Bypass valve reassembly

1. Align the spring, cap and plunger, Figure 21
2. Screw the assembly into the housing, Figure 22. Check orientation is appropriate for your application. See Orientation section below.
3. Install bypass screws in the order shown in Figure 23. Torque to 90 lbs/in.
4. Tighten the bypass cap with a 3-inch socket

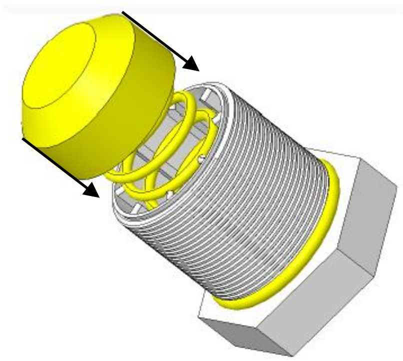


Figure 21

Install bypass assembly into housing

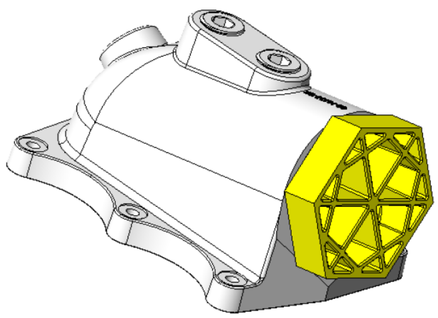


Figure 22

Replace and tighten screws in order

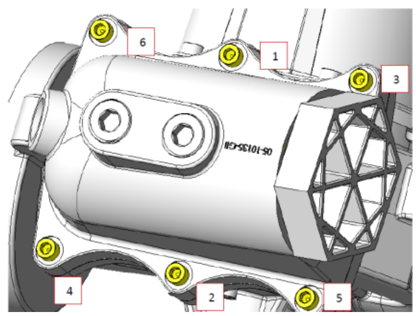


Figure 23

WARNING

The bypass valve must be oriented correctly to provide pressure protection. Make sure that the forward direction of your pump is aligned with the bypass valve. Improperly installed bypass valves will not provide protection against pressure build up in the line which could damage equipment and harm bystanders.

Bypass valve orientation

Ensure that bypass is oriented in the direction that you need pressure relief, Figure 24 and 25.

Standard applications
Lower shaft – clockwise rotation
from back of pump

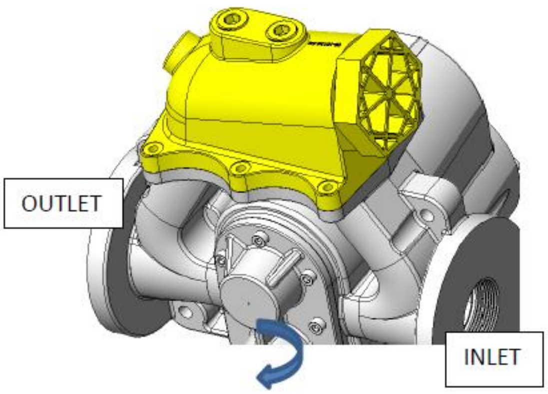


Figure 24

Diesel/gas engine application
Lower shaft – counterclockwise rotation
from back of pump

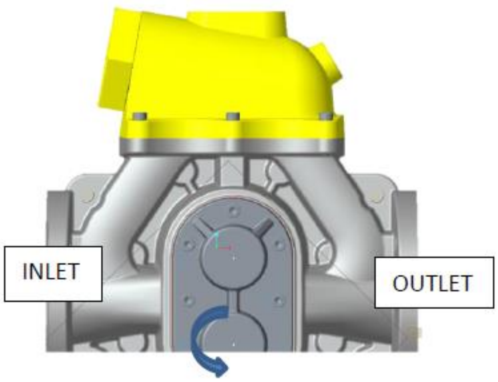


Figure 25

Weep Holes

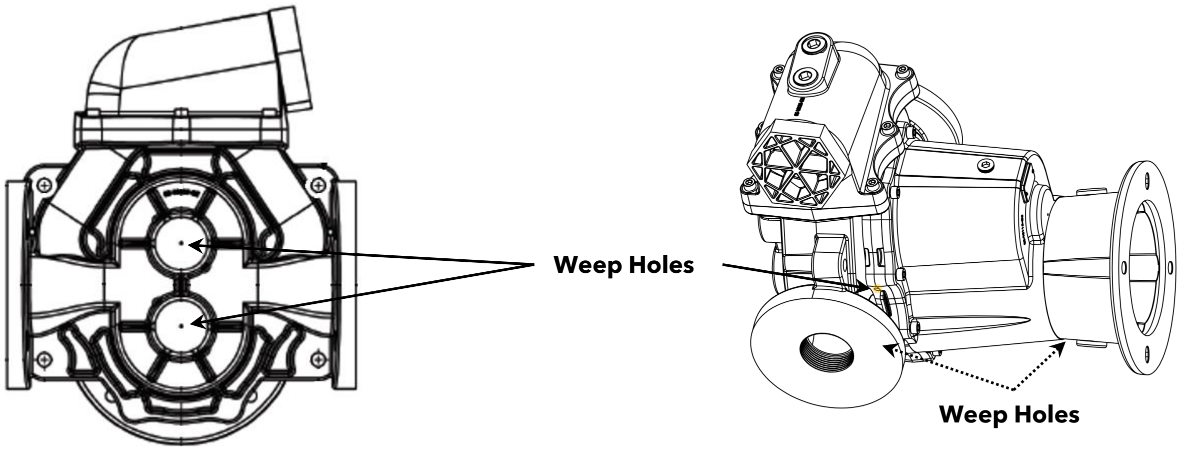


Figure 26

The FTS150 and FTS200 pumps feature weep holes, shown in Figure 26, that are located in different areas of the pump.

If you see red grease coming from these holes during the initial operation of the pump, this is normal and does not indicate adverse performance in the pump.

If process fluid begins to weep from these holes, this may be a sign that your lip seals have become damaged or worn out. This is an indicator that the seals need to be replaced. Please contact the factory for replacement and rebuild options.

Troubleshooting Guide

Pump will not turn on

- Check to ensure that the pump and motor system is properly wired.
- Check for debris in the pump. It may have caused a locked-rotor condition or damaged the pumping elements.

No flow while pump is on

- Shut down the pump and check for blockages or closed valves in the suction and discharge piping – this can cause immediate damage to pump.
- Shut down the pump and ensure that the bypass valve is installed correctly.
- Shut down the pump and check for damage to the pumping elements.
- Check to make sure that the pump is rotating in the correct direction. See page 13 for details.
- Remove bypass valve and check for any lodged objects in the spring or valve seat to see if it is stuck open.

Low flow while pump is on or pump will not prime

- Ensure that the pump suction inlet is fully submerged and has at least 1 inch of clearance on all sides
- Check for leaks or blockages in the suction and discharge lines. Leaks on the suction side of the pump may prevent the pump from priming and may introduce air into the system.
- Check that the piping layout provides enough head for pumping (e.g., pipe diameter and length, restrictions in line including valves or elbows and vertical lift height)
- Replace vanes and springs if they are worn
- Remove bypass valve and check for any lodged objects in the spring or valve seat to see if it is stuck open

Pump is leaking fluid

- Ensure that the oil drain plug is sealed properly (see pages 21-23).
- Check for leaks or blockages in the discharge lines.
- Shut down the pump and check for damage to the pumping elements.
- If fluid is exiting from the weep holes (shown on page 26), one or more of the lip seals may have been damaged. Please contact the factory for replacement and rebuild instructions.

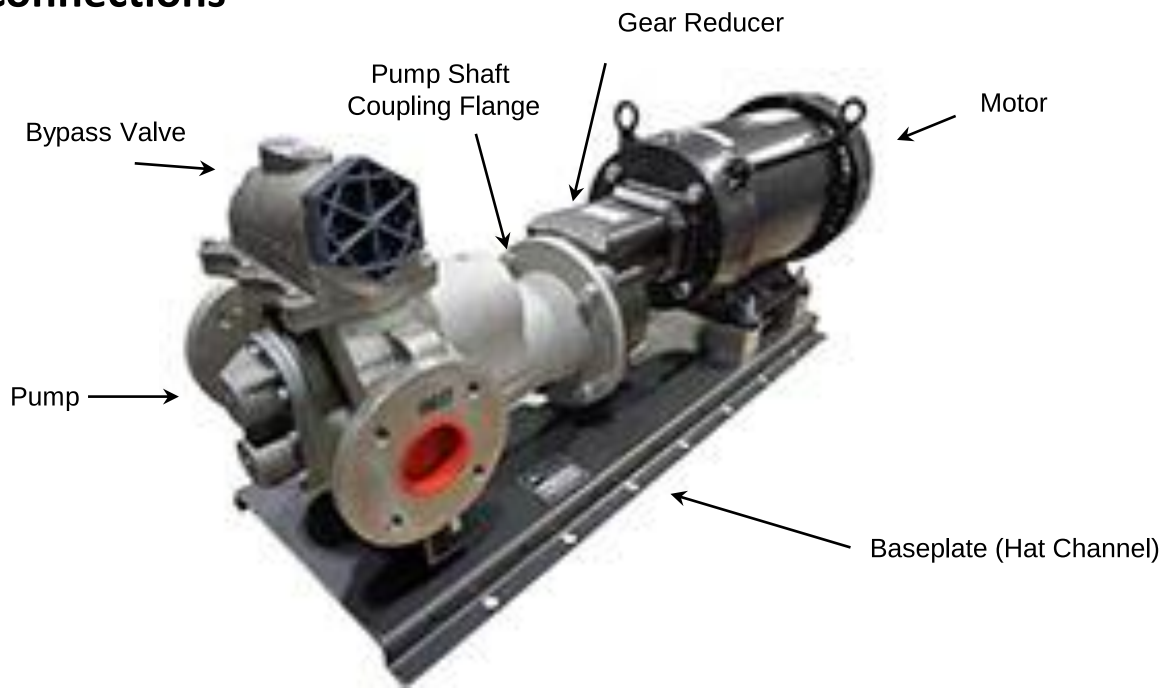
Excessive noise is coming from the pump

- Shut down the pump and check for damage to the pumping elements.
- Check to make sure that the pump is rotating in the correct direction. See page 13 for details.
- Ensure that the pump suction inlet is fully submerged.
- Remove bypass valve and check for any lodged objects in the spring or valve seat to see if it is stuck open.

Motor trips the circuit breaker or overload protector shuts down the motor

- Check the required amperage and voltage for the motor. The power supply should be sized properly.
- There may be too much flow resistance for the motor to overcome. Size the bypass valve to prevent motor overload or reduce speed.
- Increase pipe diameter to decrease backpressure.
- The fluid may be too viscous, especially at cold temperatures.

Motor Connections



Standard assembly includes pump with internal bypass valve, shaft coupling flange, gear reducer and motor mounted on a baseplate

Pump
All systems include either a 1.5" FTS150 or 2.0" FTS200 pump head with a bypass valve and shaft coupling flange.

Gear Reducer
A gear reducer is a mechanical transmission device that connects a motor to a driven load. It is also known as a gearbox. It allows you to modify the torque and speed between a motor and a load. Find your target flow rate and the appropriate gear reducer ratio will be selected in the following tables.

Motor
Motors used on FTS skids are 4-pole motors which run at 1750 rpm. A gear reducer is required to adjust the flow rate by slowing down the pump speed. The horsepower required to operate the pump is based on a combination of the flow rate and bypass pressure selected. For a given flow rate, the power requirement will increase if a higher bypass pressure is selected. Doubling the discharge pressure or flow rate will double the required power.

If the system operates at 115 Volts using a common 15 Amp outlet, the largest practical motor size is limited to 1.5HP. The standard selection of gear reducers and bypass valve combinations will limit the maximum amperage draw on the 1.5 HP to roughly 12 Amps, which will limit the chance of tripping the circuit breaker.

Circuit breakers in factories are commonly 20 Amps for 115 Volt outlets. In this situation, a 2HP single phase motor can be used to achieve higher pressures or flow rates.

Baseplate
Also known as a "Hat Channel", this is where the motor and pump system are mounted.

PERFORMANCE – FLOW AND PRESSURE

TYPICAL PERFORMANCE DATA (Flow Rate For 3 cSt Fluid At 80% of Bypass Pressure)

1.5" Pump — FLOW (GPM) / BYPASS PRESSURE (PSI)

EP	PH	Hz	HP	"H"	GR: 1.3 : 1	1.6 : 1	2.0 : 1	2.5 : 1	3.0 : 1	4.1 : 1	5.0 : 1	7.2 : 1	"B"	"F"
NO	1	60	1.5	0.0				50/20	40/50	30/50	20/75	13/100*	7.1	27.6
NO	1	60	2.0	0.0						30/75	20/100		7.1	27.6
NO	1	60	3.0	6.9		85/20	65/50	50/50	40/75	30/100*			7.1	28.2
NO	1	60	5.0	7.4			65/75	50/100*	40/100*				7.1	31.0
NO	1	60	7.5	8.4	100/75	80/100	65/100						7.8	33.5
NO	3	60	2.0	5.6			65/20	55/20	40/50	30/75	20/100	13/100*	7.1	26.6
NO	3	60	3.0	6.4		85/20		50/50	40/75	30/100	20/100*		7.1	27.7
NO	3	60	5.0	6.4			65/75	50/100*	40/100*				7.1	28.6
NO	3	60	7.5	7.8		80/100	60/100*						7.8	34.9
NO	3	60	10.0	7.8	100/100	85/100*								
YES	1	60	1.5	7.7			65/20	50/20	40/20	30/50	20/75	13/100*	7.1	29.8
YES	1	60	2.0	8.5					40/50	30/75	20/100		7.1	31.0
YES	1	60	3.0	8.4		85/20	70/20	50/50	40/75	30/100*			7.8	32.6
YES	1	60	5.0	8.4			60/75	50/100*	40/100*				7.8	34.2
YES	3	60	2.0	8.3			70/20	50/50	40/50	30/75	20/100	13/100*	7.1	28.0
YES	3	60	3.0	10.0		85/20	70/50		40/75	30/100	20/100*		7.1	29.8
YES	3	60	5.0	10.0		85/50	65/75	50/100*					7.1	32.3
YES	3	60	7.5	11.2		85/100	60/100*						7.8	32.9
YES	3	60	10.0	11.2										

2.0" Pump — FLOW (GPM) / BYPASS PRESSURE (PSI)

EP	PH	Hz	HP	1.3 : 1	1.6 : 1	2.0 : 1	2.5 : 1	3.0 : 1	4.1 : 1	5.0 : 1	7.2 : 1	"B"	"F"
NO	1	60	1.5					70/20	55/20	45/20	30/50	7.1	29.0
NO	1	60	2.0					75/20	50/50	40/50	30/75	7.1	29.0
NO	1	60	3.0			115/20	90/20	70/50	50/50	40/75	25/100*	7.1	29.5
NO	1	60	5.0		140/20	115/20	85/50	70/75	50/100*			7.1	32.4
NO	1	60	7.5	175/20	140/50	110/75	70/100*					7.1	35.4
NO	3	60	2.0					70/20	50/50	40/50	30/75	7.1	28.0
NO	3	60	3.0			110/20	90/20	70/50	50/50	40/75	30/100*	7.1	29.1
NO	3	60	5.0		140/20	110/20	85/50	70/75	50/100*			7.1	30.0
NO	3	60	7.5	175/20	140/50	110/75	85/100	65/100*				7.8	36.8
NO	3	60	10.0	175/50	138/75	100/100	85/100*					7.8	35.5
YES	1	60	1.5					75/20	50/20	45/20	30/50	7.1	31.1
YES	1	60	2.0				90/20		50/50	40/50	30/75	7.1	32.4
YES	1	60	3.0			110/20		70/50	50/75	40/75	25/100*	7.8	34.0
YES	1	60	5.0		140/20	110/50	85/75	70/75	50/100*			7.8	35.6
YES	3	60	2.0				90/20	70/20	50/50	40/50	30/75	7.1	29.4
YES	3	60	3.0			110/20		70/50	50/75	40/75	25/100*	7.1	31.2
YES	3	60	5.0		140/20	110/50	85/75	70/75	50/100*			7.1	33.7
YES	3	60	7.5	175/20	140/50		85/100	65/100*				7.8	34.8
YES	3	60	10.0	175/50	140/75	110/100*						7.8	37.8

EP = Explosion-Proof, PH = Phase, Hz = Herz, HP = Horse Power

*Pump can generate more pressure, but external bypass is required

WEIGHT

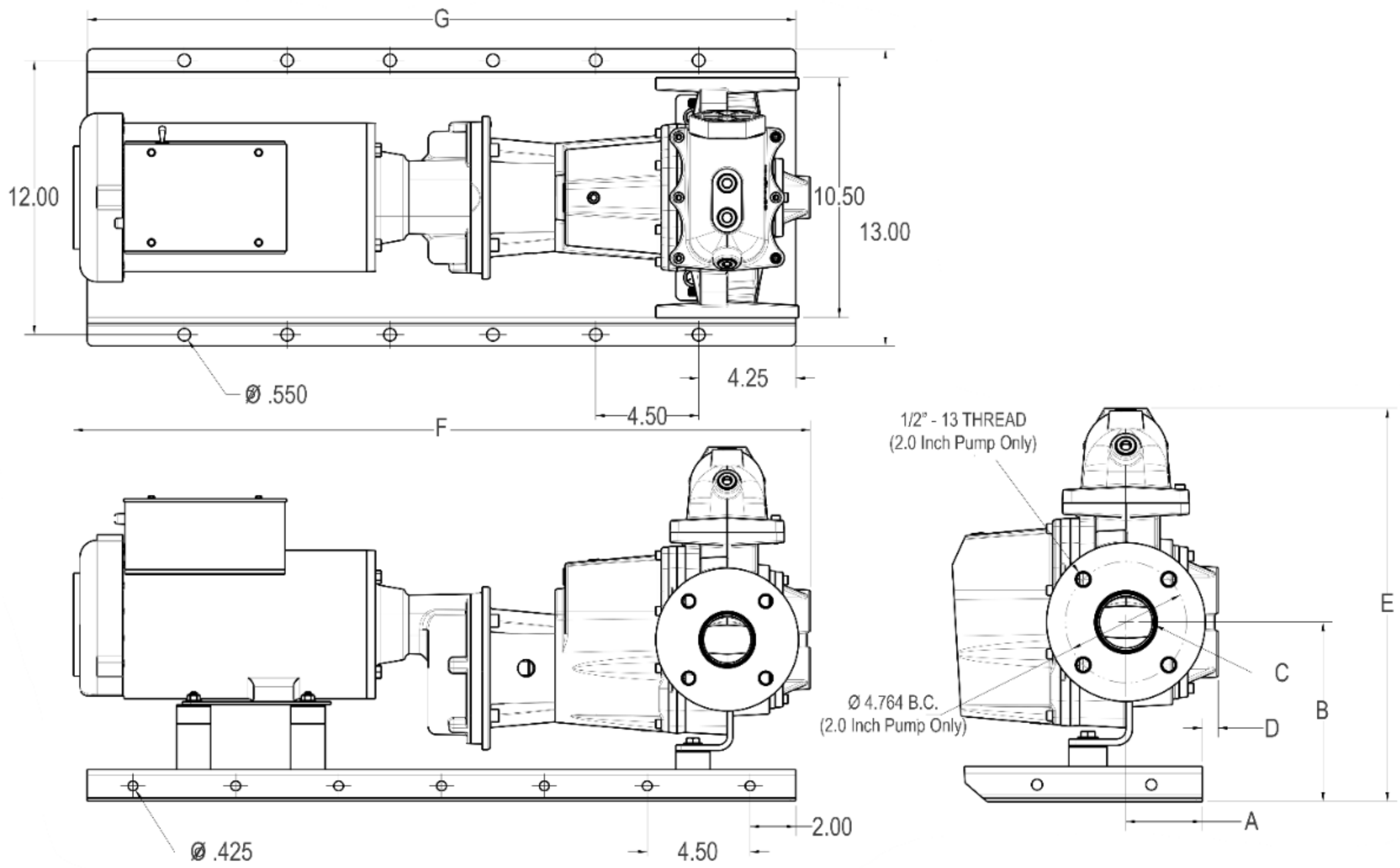
TOTAL SYSTEM WEIGHT (Lbs.)

	1.5" Pump						2.0" Pump					
Type	1.5 HP	2.0 HP	3.0 HP	5.0 HP	7.5 HP	10 HP	1.5 HP	2.0 HP	3.0 HP	5.0 HP	7.5 HP	10 HP
w/ EP SINGLE Phase Motor	115	134	186	216			126	145	190	220		
w/ EP THREE Phase Motor	109	128	161	196	206	306	120	139	165	200	210	310
w/ TEFC SINGLE Phase Motor	111	109	138	169	199		122	120	142	173	203	
w/ TEFC THREE Phase Motor	109	105	141	153	181	216	120	116	145	157	185	220

Liquiflo Fluid Transfer Pumps

DIMENSIONS (in Inches)

1.5 Hp Non-Explosion-Proof (TEFC) Model Shown for Reference



A = 3.0"
B = See "B" in "Performance Table" above
C = 1.5" for 1.5" Pump, 2.0" for 2.0" Pump
D = 0.0" for 1.5" Pumps, and 0.6" for 2.0" Pumps
E = 15.4" for Models with "B"= 7.1"
E = 16.2" for Models with "B"= 7.8"
F = See "F" in "Performance Table" above
G = 31.0" for 1.5 and 2.0 Hp Pumps
G = 35.5" for 3.0, 5.0, 7.5, and 10.0 HP Pumps

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