

Fire Pump Models S100 and S101 Installation Instructions

Waterous Fire Pumps may be ordered with a variety of accessories.
Refer to the following separate installation instructions as necessary:

Auto Tank Fill System

Butterfly Valves

CAF System

Discharge Valves

Drain Valves

Foam System:

Foam Pump

Foam Pump Flush Kit

Foam Fill

Dual Foam Injection Kit

Dual Tank Selector

Overboard Foam Pick-up

Remote Start Kit

Overheat Protection Manager (OPM)

Pump Shift (Pneumatic)

Pressure Control System:

Discharge Relief Valve

Intake Relief Valve

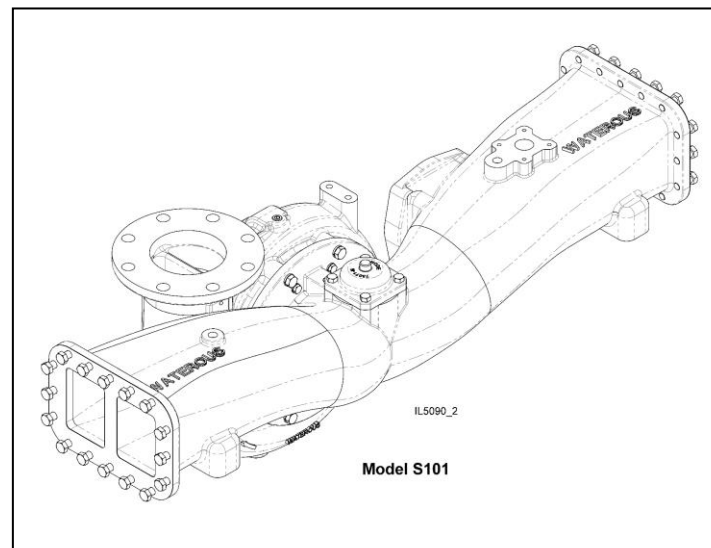
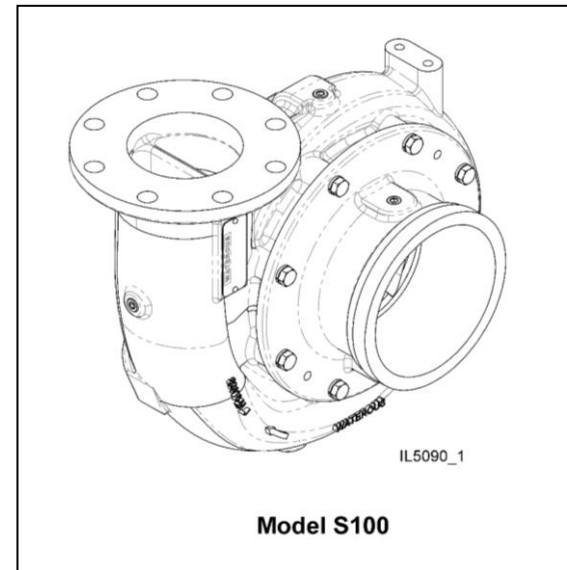
Pressure Governor

Priming System



**Read through safety information
and installation instructions
carefully before installing your
Waterous Fire Pump.**

Note that Instructions are subject to change
without notice.



F-1031, Section 3017
Revised: 9/29/23

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Safety Information



Read through and communicate safety information to the end user of this Waterous Fire Pump.



WARNING

Death or serious personal injury might occur if proper operating procedures are not followed. The pump operator, as well as individuals connecting supply or discharge hoses to the apparatus must be familiar with these pump operating instructions as well as other operating instructions and manuals for the apparatus, water hydraulics and component limitation.



WARNING

Pressure Hazard. May result in personal injury.

Prior to connection or removal of hoses, caps or other closures with pump intake or pump discharge connections, relieve pressure by opening drains or bleeder valves. Bleeder valves should also be used while filling a hose connected to an intake with water.



WARNING

Scalding Water Hazard. May result in serious burns.

When operating the pump, be sure to open at least one discharge valve slightly to prevent the pump from overheating. If the pump runs for a few minutes completely closed, it may heat the water enough to scald someone when the valve is opened. Overheating can damage the packing, seals and other pump parts. If the apparatus builder has installed a by-pass system or other provision designed to prevent overheating, opening a discharge valve may be unnecessary.



WARNING

Rotating Parts Hazard or Unexpected Truck Movement. May result in serious personal injury or death.

Stop the engine, set parking brake and chock the wheels before going under the truck to adjust packing or to check packing gland temperature.

OEM Installation Warnings



WARNING

Unexpected Truck Movement. May result in serious personal injury or death.

Failure to properly install the pump shift control and pump shift indicator system in the apparatus or failure to incorporate in the Pump Operator's Panel Engine Speed Interlock System may result in unexpected truck movement which may result in serious personal injury or death.



WARNING

Inability to Pump Water. May result in serious personal injury or death.

Failure to properly install the pump shift control and pump shift indicator system in the apparatus or failure to incorporate in the Pump Operator's Panel Engine Speed Interlock System may result in the inability to pump water which may result in serious personal injury or death.



WARNING

Exceeding Power Train Torque Ratings. May result in inability to pump water causing serious personal injury or death.

This fire pump may have the capability under certain pumping conditions to exceed the torque rating of the power train.

A means to control the engine output to a torque level no greater than the power train's continuous-duty torque rating must be considered when specifying power train components and engine control system parameters.

Introduction

This instruction covers the installation of Waterous S100 Series single stage fire pumps. The S100 Series can be rated at 1250, 1500, 1750 or 2000 GPM.

Two different S100 models are available as follows:

Model	Intake	Discharge
S100	8 in. Victaulic® End Suction	4 in. ANSI Flange or 5 in. ANSI Flange
S101	Crosspipe which is mounted directly to chassis frame rails.	or Discharge Manifold

(See the next page for diagrams of pumps)

The S100 pump is available with the following transmissions:

- **C20 and C22 Series:** The C20 and C22 transmissions are an aluminum, split-shaft, chain driven transmission that transmits power from the truck's transmission to either the fire pump or the drive axle of the truck.
- **PA Series:** The PA transmission an aluminum chain drive transmission designed to be driven off the ten-bolt power take-off (PTO) provision available on the left side of the Allison MD or HD automatic transmission.
- **D Series:** Direct drive from a power take-off (PTO).
- **QC Series:** Direct engine mount.

The following installation instructions are available:

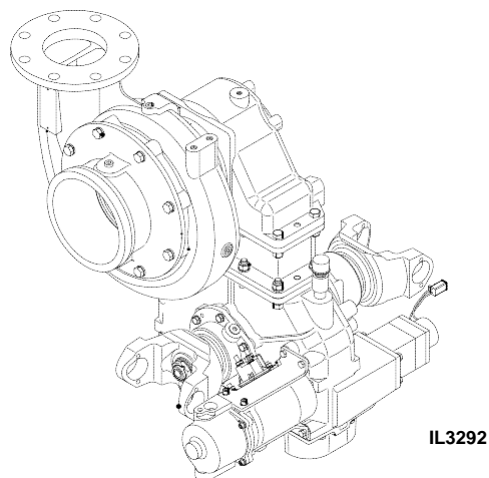
Instruction Name		Instruction Number
Monarch™ Intake Valve (BFV)		F-1031, Section 2318
Drain Valves		F-1031, Section 3008
Pressure Control System		F-1031, Section 3010
Overheat Protection Manager (OPM)		F-1031, Section 3015
Foam Manager™ Systems	FoamPro® System	F-1031, Section 3012
	Advantus® System	F-1031, Section 3026
	Aquis™ System	F-1031, Section 3031
Eclipse™ ES CAFSystem		F-1031, Section 3021
Priming Systems		F-1031, Section 3023
Shift Unit		F-1031, Section 3030

Before proceeding with the installation of your pump, read the following instructions carefully. Check the appropriate dimensional drawings in the Engineering Manual as necessary.

Pump Models

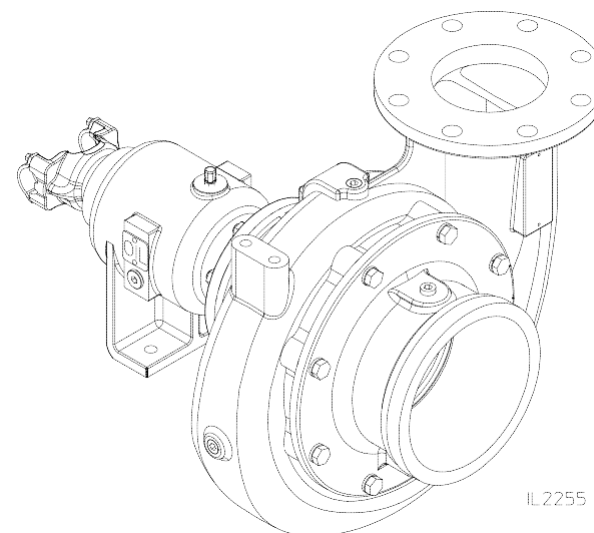
S100C10 Series

End Suction Intake
C10, C20 or C22 Series Chain Drive Transmission



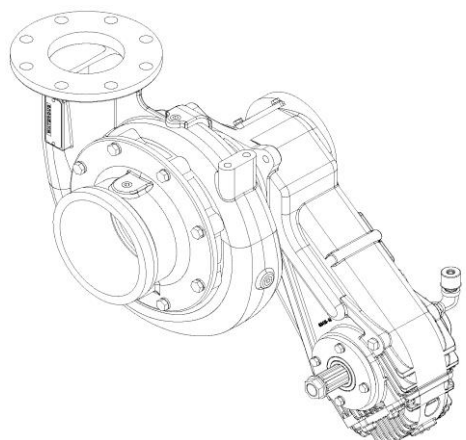
S100D Series

End Suction Intake
Direct Drive



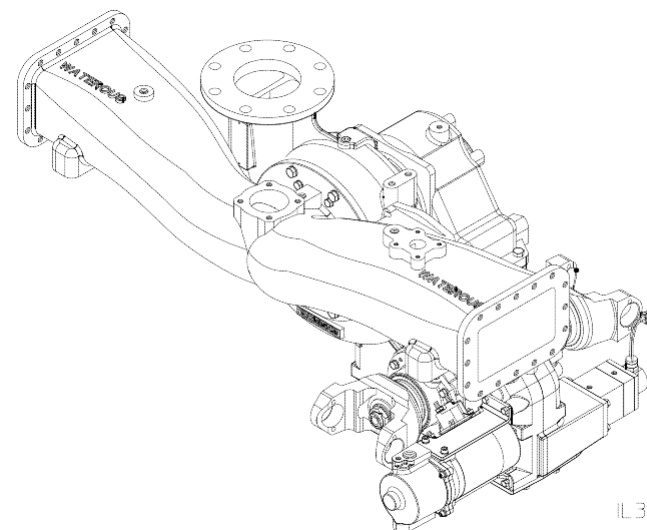
S100PA Series

End Suction Intake
PA Series Chain Drive Transmission



S101C20 Series

Crosspipe Intake
C20 or C22 Series Chain Drive Transmission



Pump Mounting

S100 Series End Suction Pump with C20 or C22 Series Transmission

NOTE: Remove shipping brackets and discard. Do Not use for mounting pump. Refer to the Pump Dimensional Drawing for details specific to your pump.

Drop Dimensions

Select a mounting location which will make the pump and its accessories readily accessible for maintenance and which will make the pump driveshaft parallel with the output shaft of the chassis transmission or bearing housing. Also, select the location so that when the apparatus is loaded, the universal joints on the propeller shaft will have a proper working angle. Note that the C20 and C22 Series transmissions are available with a range of drop sizes (see Table 1 and Figure 1, Dimension "C").

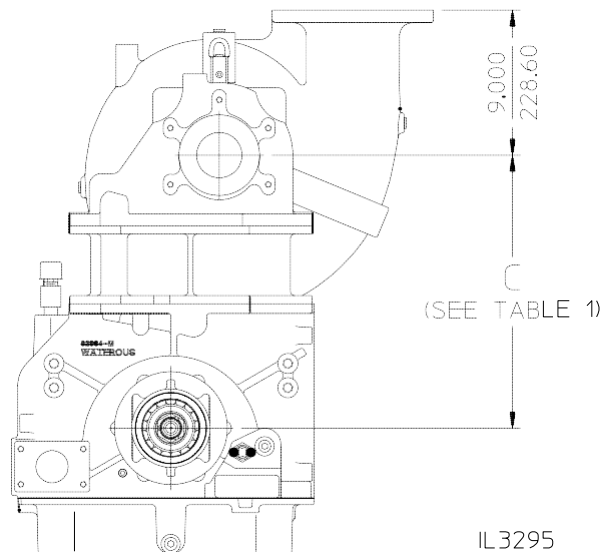
Table 1. C20 and C22 Series Transmission Drop Ranges

Table 1. C20 Series Transmission Drop Ranges

Model	Dim C. (IN/mm)
C20B, C22B	12.240 / 310.90
C20C, C22C	13.811 / 350.80
C20D, C22D	14.856 / 377.34
C20E, C22E	16.920 / 429.77
C20F, C22F	18.971 / 481.86

*NOTE: 2.27 ratio drop values shown. Drop values vary for other output ratios, see dimensional drawings for specific drops by ratio.

Figure 1. Drop Size Dimensions



Drive Line Angles

Table 2 gives maximum universal joint angles for installations where propeller shaft flanges are parallel and yokes are aligned. Refer to this table when positioning a pump to determine proper shaft angles. Be sure to keep at least a minimum of 1° U-joint operating angle, but do not exceed those specified in the table. This is the preferred method of propeller shaft installation. For additional information on this method, or for alternative methods, see driveshaft installation guidelines such as Spicer® / Driveshaft Installation Techniques.

CAUTION

Be sure the propeller shafts used are of the slip-joint design. Frame deflection, temperature changes and similar factors may cause a propeller shaft without slip-joints to produce severe axial loads on the bearings and damage the pump / transmission.

Table 2. Maximum U-joint Operating Angles

Driveshaft RPM	Maximum Operating Angle
5000	3.2°
4500	3.7°
4000	4.2°
3500	5.0°
3000	5.8°
2500	7.0°
2000	8.7°
1500	11.5°

Pump Mounting

Select a mounting location which will make the pump and its accessories readily accessible for maintenance and which will make the pump driveshaft parallel with the output shaft of the chassis transmission or transfer case. Also, select the location so that when the apparatus is loaded, the universal joints on the propeller shaft will have a proper working angle. Be sure the propeller shaft used are of the slip-joint design. Frame deflection, temperature changes and similar factors may cause a propeller shaft without slip-joints to produce severe axial loads on the bearings and damage the pump.

Driveline End Yokes and Companion Flanges

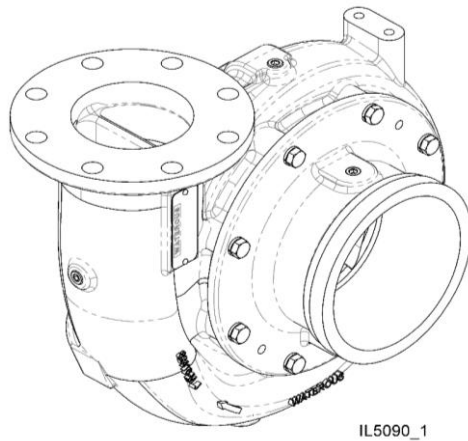
Anti seize should be applied to the shaft threads before installing end yoke or companion flange. Do not reuse self-locking nuts, torque to 475-525 lb-ft. Brackets must be fabricated to attach to the mounting points of the pump body and transmission and the chassis frame. Tighten the mounting hardware to standard torque specifications. Note that Waterous does not furnish the brackets.

Mounting Locations on Pump Intake Adapter

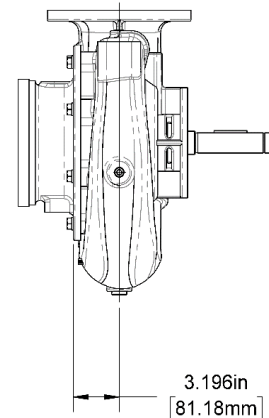
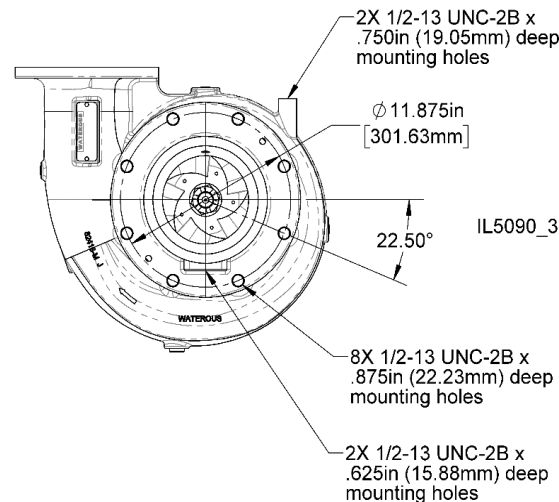
Use the pump intake adapter screws for attaching the bracket. Remove the screws furnished with the pump and use 1/2 in. longer screws to compensate for the bracket thickness. To mount the pump/transmission to the vehicle chassis, attach brackets (not supplied by Waterous) on either side of the transmission.

Three Point Mounting for Pump with C20 or C22 Transmission

Refer to pages 5 and 6 for three point mounting points on the S100C20 or S100C22 model. Position the pump/transmission within the vehicle frame rails, blocking temporarily to provide correct shaft angularity. With the pump/transmission in the correct position, secure the brackets (not supplied) to the vehicle frame using a three point mounting technique. The bracket on one side of the transmission shall use only one bolt when attaching to the rail. The brackets on the other side of the transmission should be attached to the chassis rail using two bolts. This three point technique will allow for slight vehicle frame twist without undo stress on the pump/transmission assembly. The transmission cap also contains five (5) mounting holes for further support of the S100C20 or S100C22. Support the pump by fashioning a bracket (not supplied by Waterous) and mount it to the intake side of the pump using the existing intake mounting screws holes.



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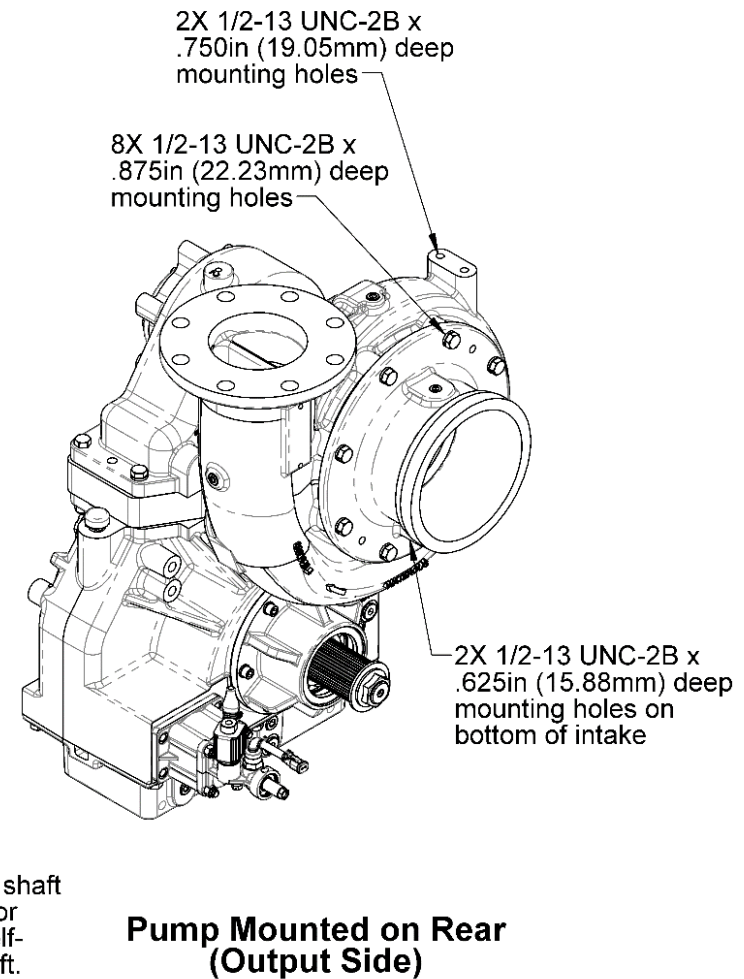
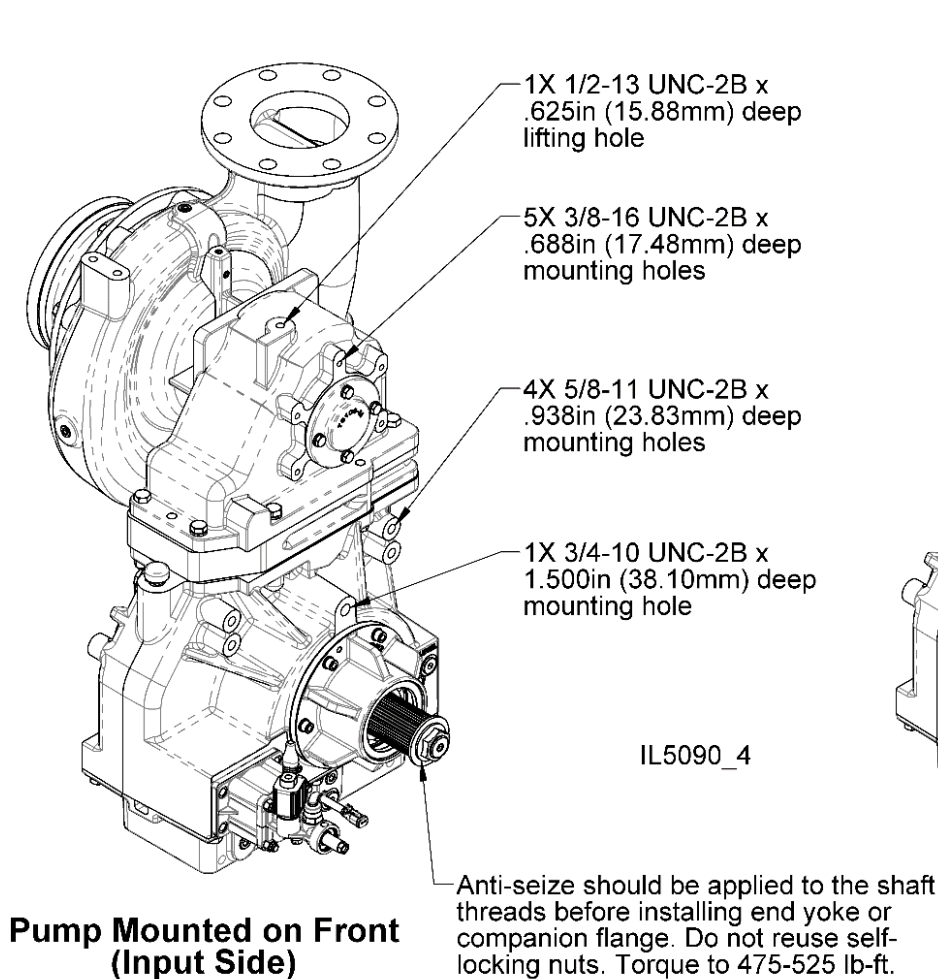


Mounting Locations - With C20 or C22 Series Transmission

Pump Mounted on Front (Input Shaft Side) or Rear (Output Shaft Side) of Transmission

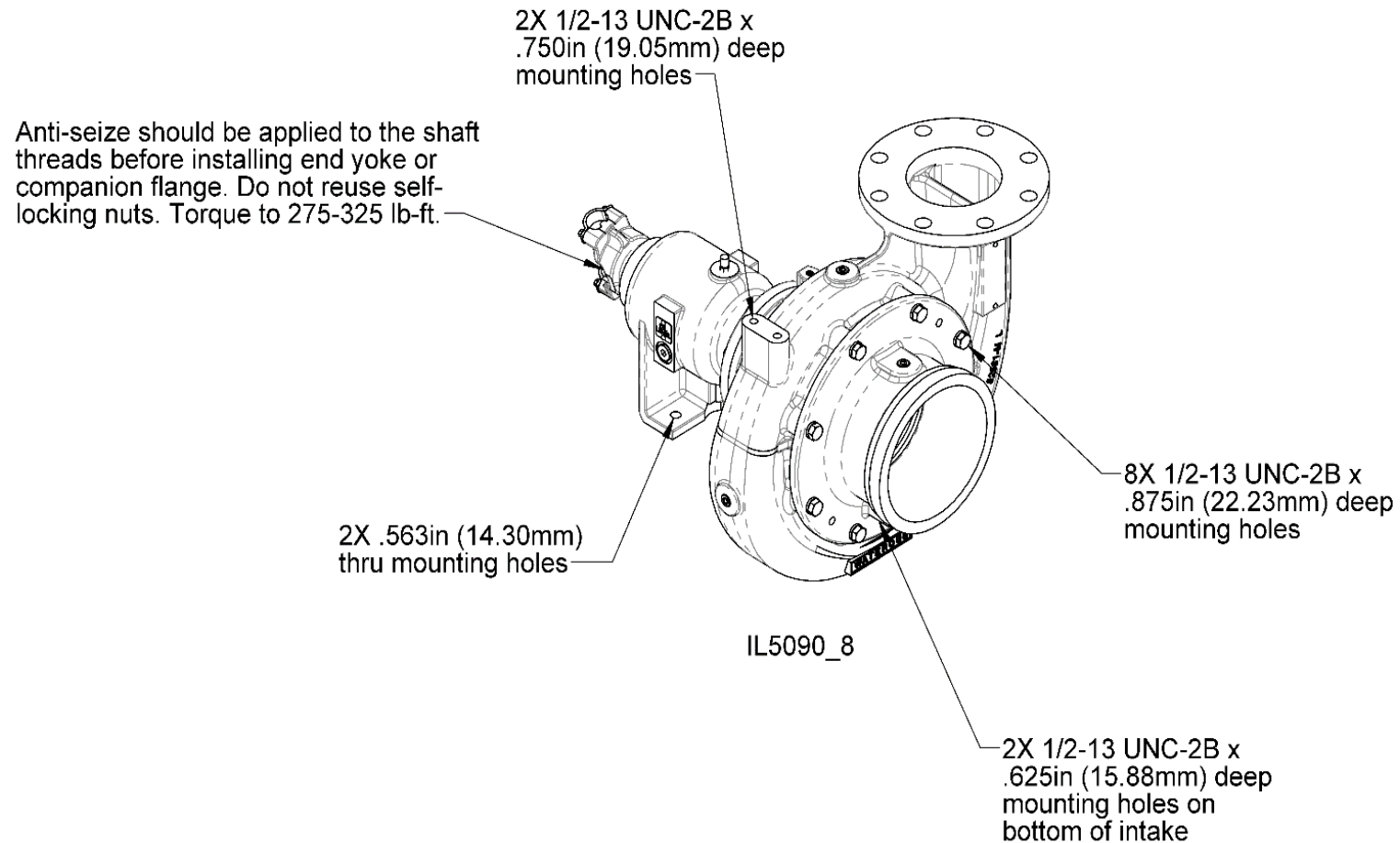
Note that the Pump Discharge may be positioned Up, Right or Left. The Transmission may only be mounted Vertical.

Refer to the Pump Dimensional Drawing for details specific to your pump.



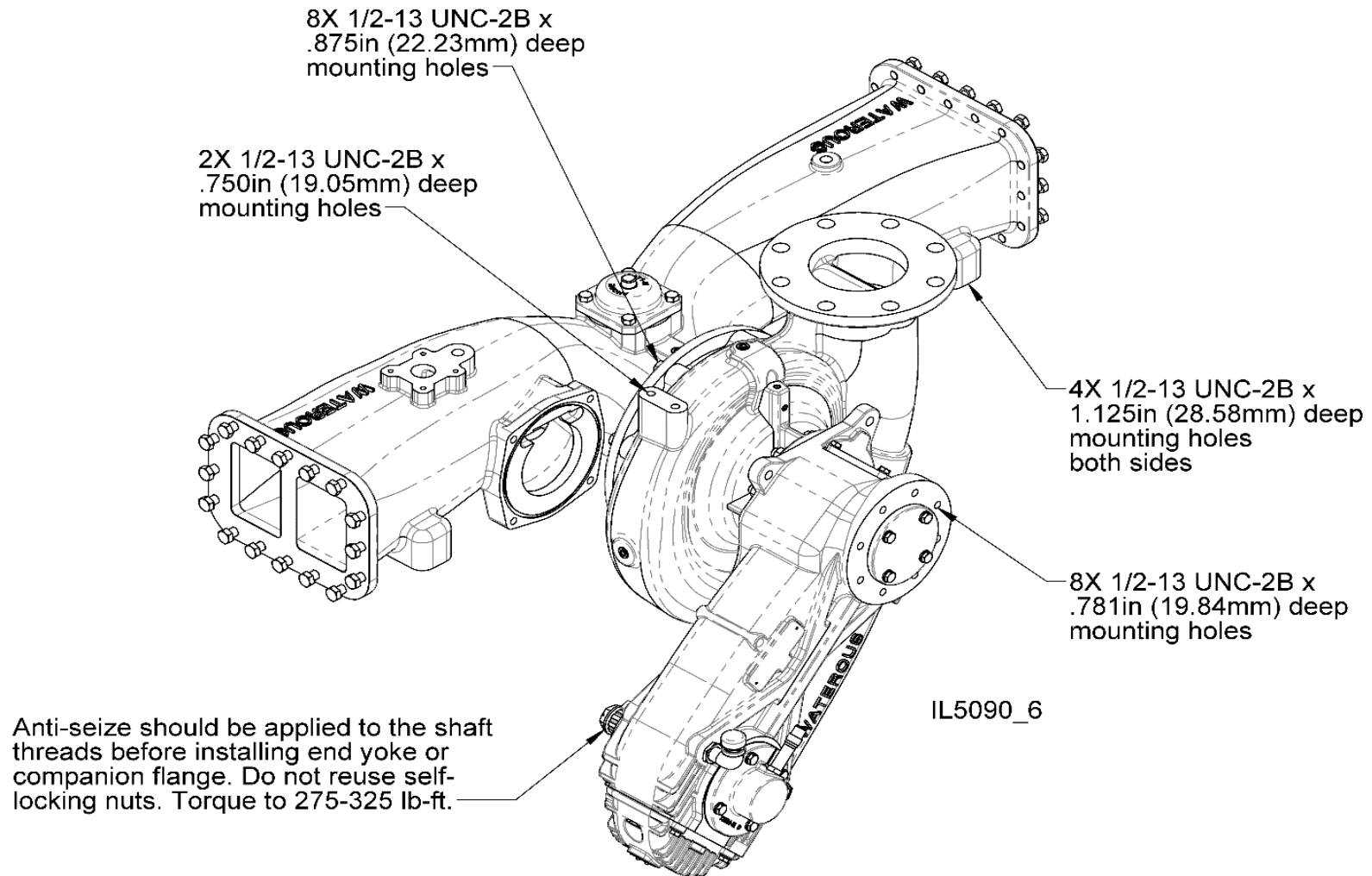
Mounting Locations - With Direct Drive, No Transmission

Note that the Pump Discharge may be positioned Up, Right or Left. The Bearing Housing Bracket may be Vertical (shown) or Inverted. Refer to the Pump Dimensional Drawing for details specific to your pump.



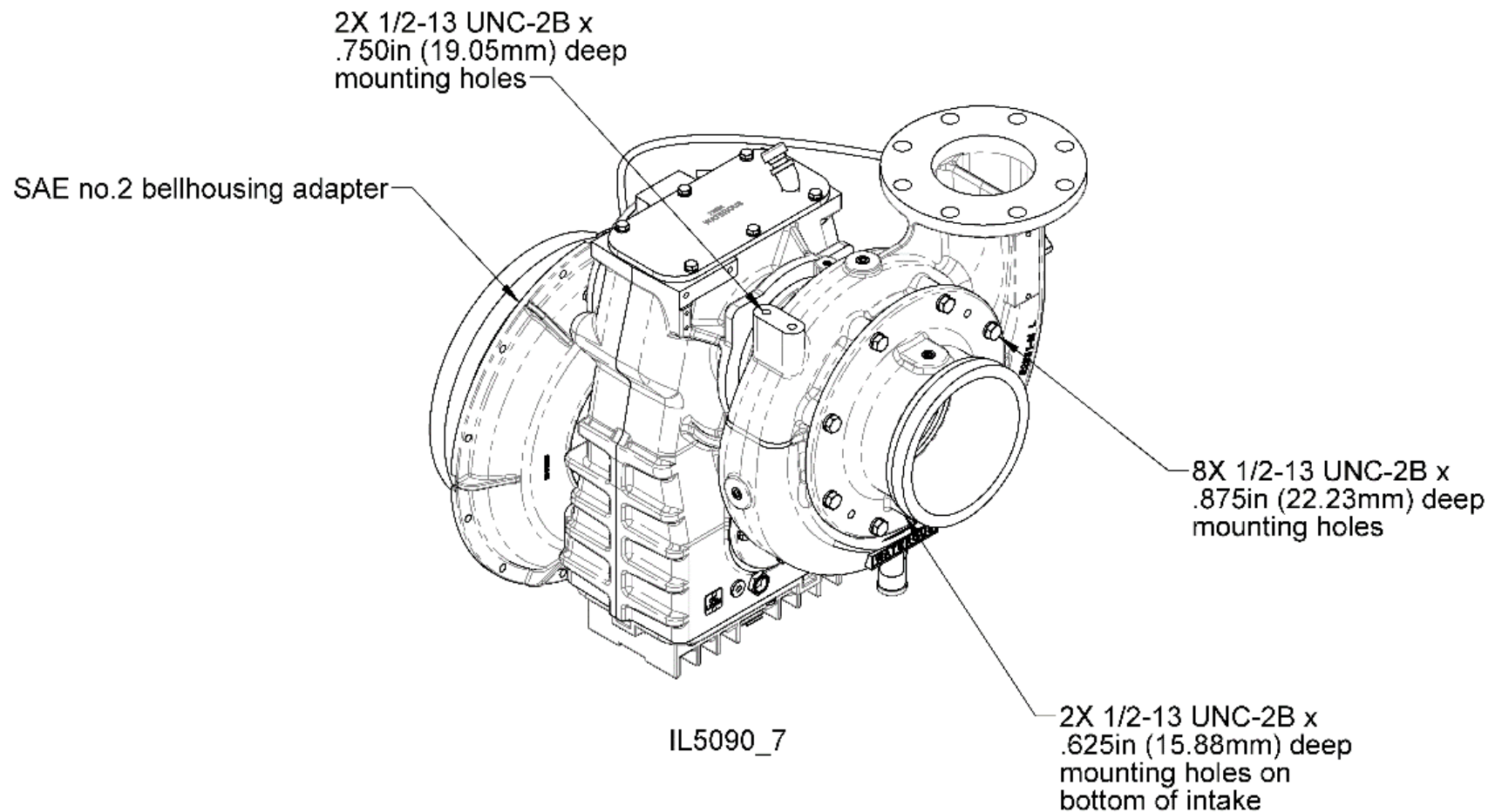
Mounting Locations - With PA Model Transmission

Note that the Pump Discharge may only be positioned Up. The Transmission may only be mounted Vertical (Right). Refer to the Pump Dimensional Drawing for details specific to your pump.



Mounting Locations - With QC Series Transmission (Direct Engine Mount)

Note that the Pump Discharge may be positioned Up, Right or Left. The Transmission may be mounted Vertical or Inverted. Refer to the Pump Dimensional Drawing for details specific to your pump.



Pump Mounting

S101 Series Midship Pump with C20 or C22 Series Transmission
Refer to the Pump Dimensional Drawing for details specific to your pump.

Drop Dimensions

Select a mounting location which will make the pump and its accessories readily accessible for maintenance and which will make the pump driveshaft parallel with the output shaft of the chassis transmission or bearing housing. Also, select the location so that when the apparatus is loaded, the universal joints on the propeller shaft will have a proper working angle. Note that the C20 Series transmission is available with a range of drop sizes (see Table 3 and Figure 6, Dimension "C").

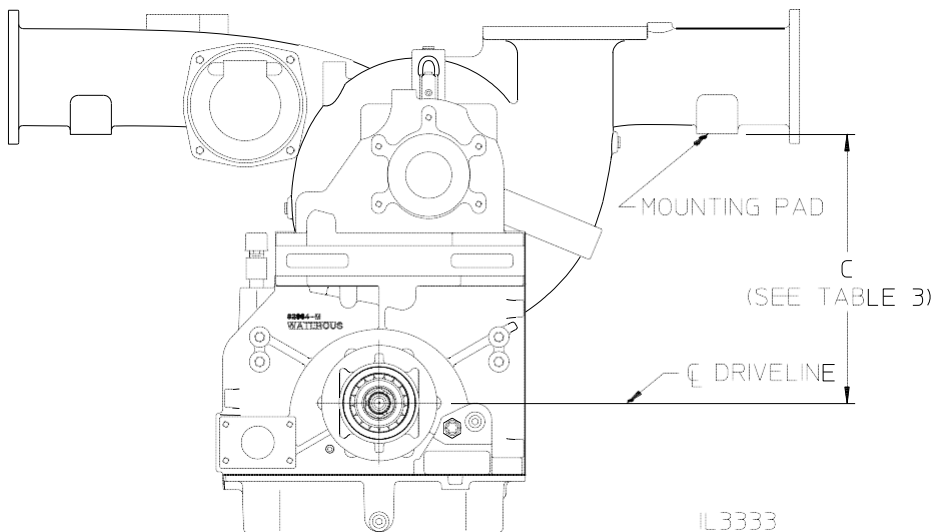
Table 3. C20 and C22 Series Transmission Drop Ranges

Table 3. C20 Series Transmission Drop Ranges

Model	Dim C. (IN/mm)
C20C, C22C	16.331 / 414.80
C20D, C22D	17.376 / 441.34
C20E, C22E	19.440 / 493.77
C20F, C22F	21.491 / 545.86

***NOTE:** 2.27 ratio drop values shown. Drop values vary for other output ratios, see dimensional drawings for specific drops by ratio.

Figure 6. Drop Size Dimensions



Drive Line Angles

Table 4 gives maximum universal joint angles for installations where propeller shaft flanges are parallel and yokes are aligned. Refer to this table when positioning a pump to determine proper shaft angles. Be sure to keep at least a minimum of 1° U-joint operating angle, but do not exceed those specified in the table. This is the preferred method of propeller shaft installation. For additional information on this method, or for alternative methods, see driveshaft installation guidelines such as Spicer® /Driveshaft Installation Techniques.

CAUTION

Be sure the propeller shafts used are of the slip-joint design. Frame deflection, temperature changes and similar factors may cause a propeller shaft without slip-joints to produce severe axial loads on the bearings and damage the pump / transmission.

Table 4. Maximum U-joint Operating Angles

Driveshaft RPM	Maximum Operating Angle
5000	3.2°
4500	3.7°
4000	4.2°
3500	5.0°
3000	5.8°
2500	7.0°
2000	8.7°
1500	11.5°

Pump Mounting

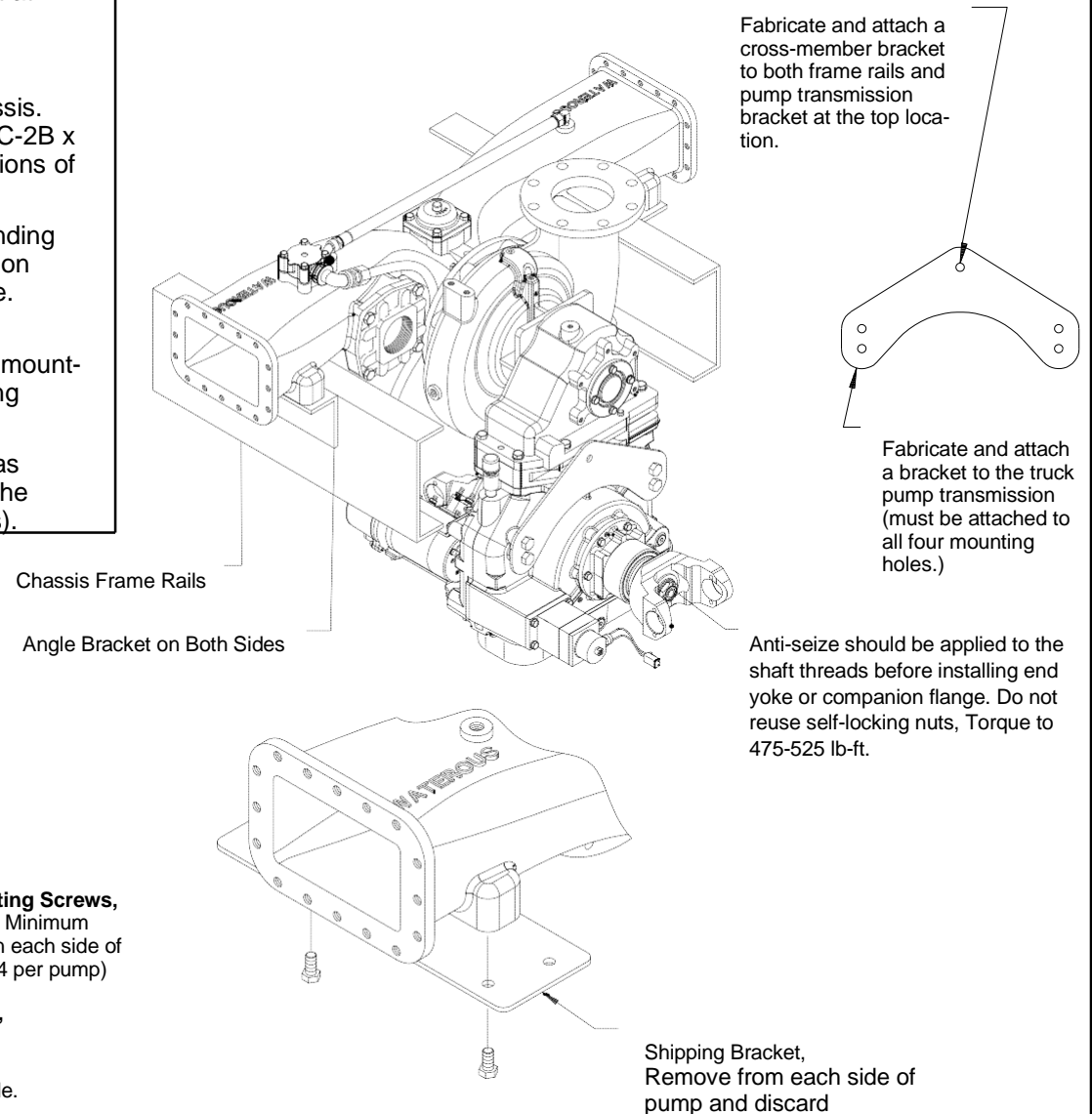
S101 Series Midship Pump with C20 or C22 Series Transmission Refer to the Pump Dimensional Drawing for details specific to your pump.

Attachment to Vehicle Frame Rails

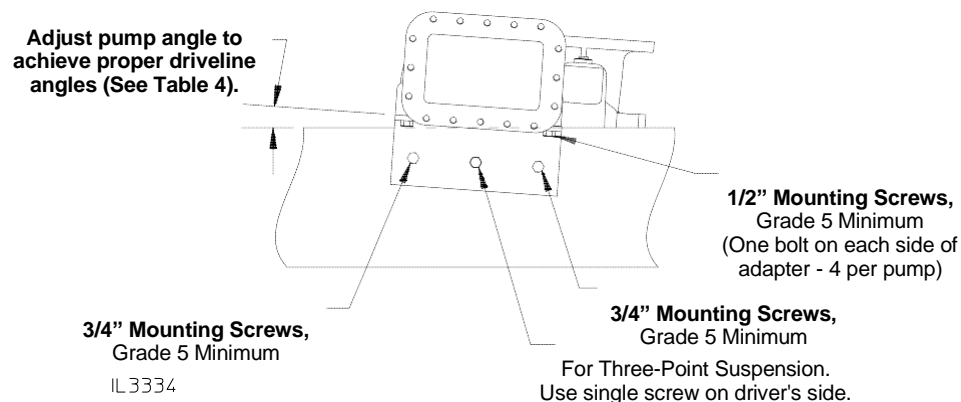
Typically the pump is mounted on angle brackets attached to the outside frame rails. The transmission also needs to be supported off of a cross bracket attached between the frame rails.

1. Remove and discard shipping brackets from both sides of pump.
2. Create angle brackets that will attach the pump to the vehicle's chassis. The S101 crosspipe is equipped with four tapped holes (1/2-13 UNC-2B x 1/13 in. deep) on each side of the crosspipe (see Page 13 for locations of tapped holes).
3. Drill a suitably sized hole in the angle brackets where the corresponding tapped hole in the crosspipe is located. Using only one tapped hole on each side of the crosspipe, fasten the angle bracket to the crosspipe. Repeat this process on the opposite side of the pump.
4. Fasten the angle brackets to the chassis frame rails using a 3-point mounting technique as shown in the 3-Point Mounting Detail. This mounting technique will allow for slight chassis frame twist.
5. Fabricate and attach a mounting bracket to the pump transmission as shown. use all four 5/8-11 UNC-2B x .938 in. deep tapped holes in the transmission (see Page 13 for location of transmission tapped holes).

Figure 7. S101C20 and S101C22 Mounting



3-Point Mounting Detail

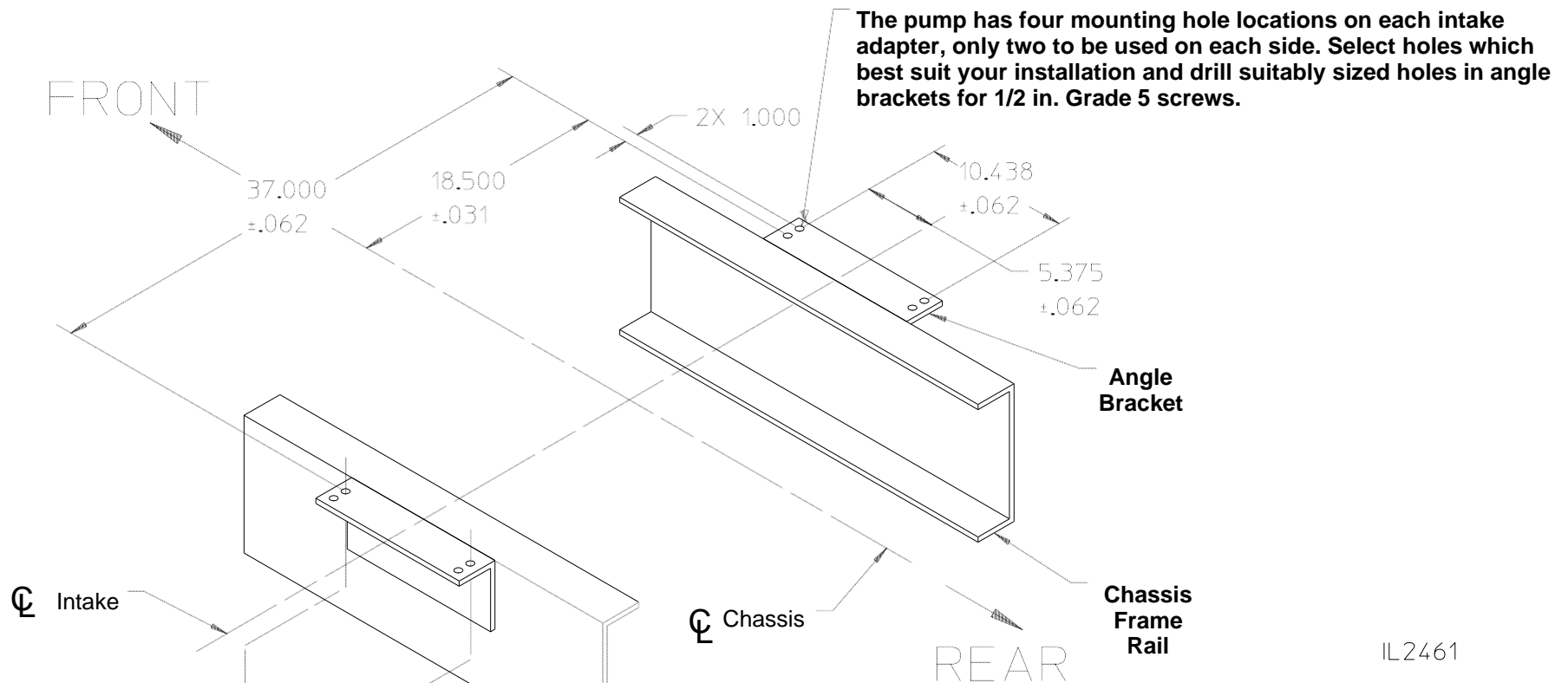


Pump Mounting

S101 Series Midship Pump with C20 or C22 Series Transmission
Refer to the Pump Dimensional Drawing for details specific to your pump.

Attachment to Vehicle Frame Rails

Figure 8. Pump Mounting Holes in Angle Brackets



- 1/2 in. Cap Screws
(Grade 5 minimum)
(Two required on each side)
Screws are threaded into tapped holes in the intake adapter.

Mounting Hardware Used to Attach Pump to Chassis Frame Rails
NOTE: Waterous does not provide hardware to mount the pump to frame rails.
OEM must provide mounting hardware as follows:

1. Use two (2) 1/2 in. (Grade 5 minimum) cap screws on each side of the pump.
2. Provide a method to restrain cap screws (lock washers and / or thread-locking compound).
3. Tighten cap screws to standard torque specifications for 1/2 in. cap screws.

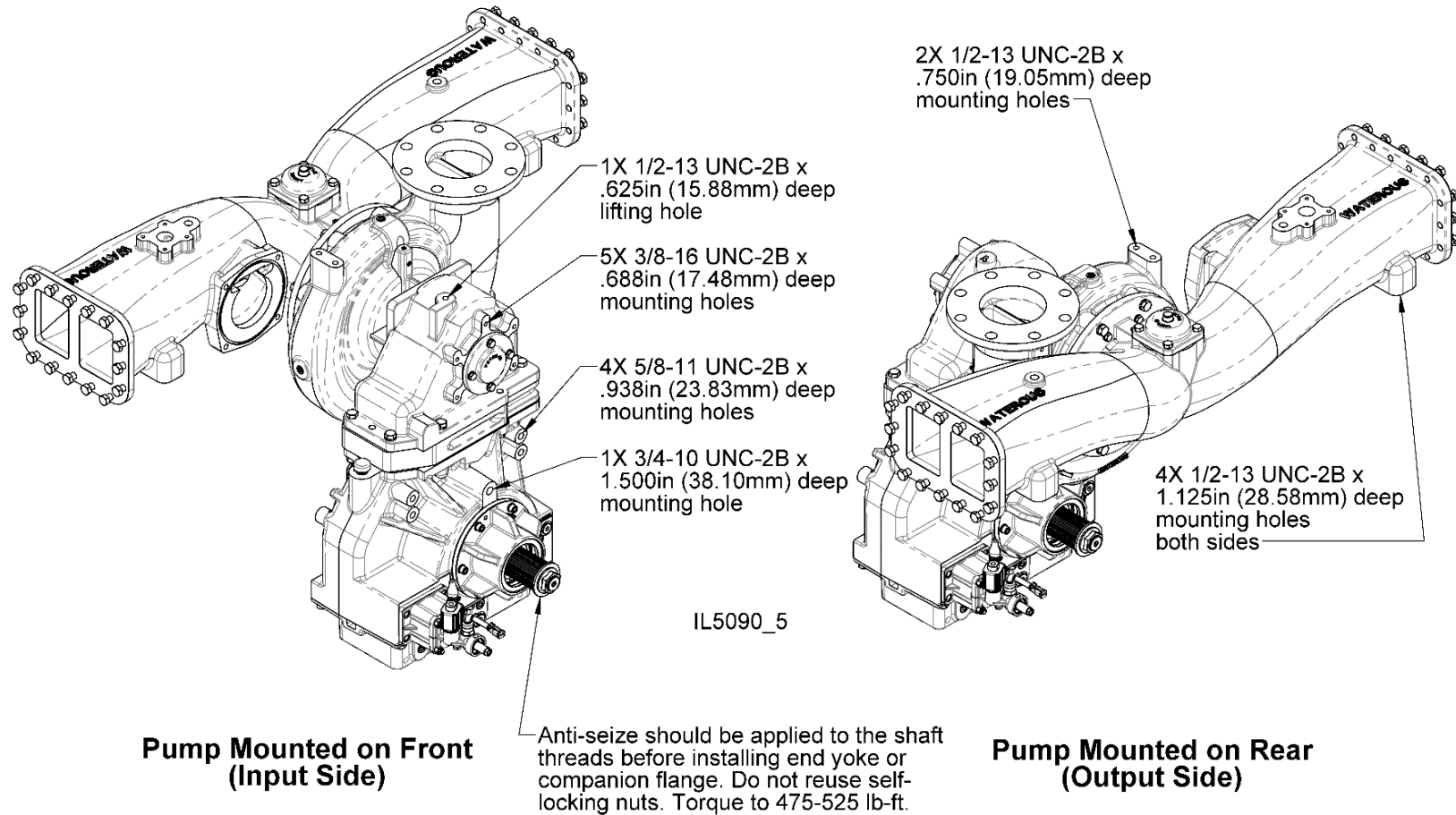
NOTE: Cap screws must be installed from the underside of the pump.

Mounting Locations - With C20 or C22 Series Transmission

Pump Mounted on Front (Input Shaft Side) or Rear (Output Shaft Side) of Transmission

Note that the Pump Discharge may only be positioned Up. The Transmission may only be mounted Vertical.

Refer to the Pump Dimensional Drawing for details specific to your pump.



Pump Mounting

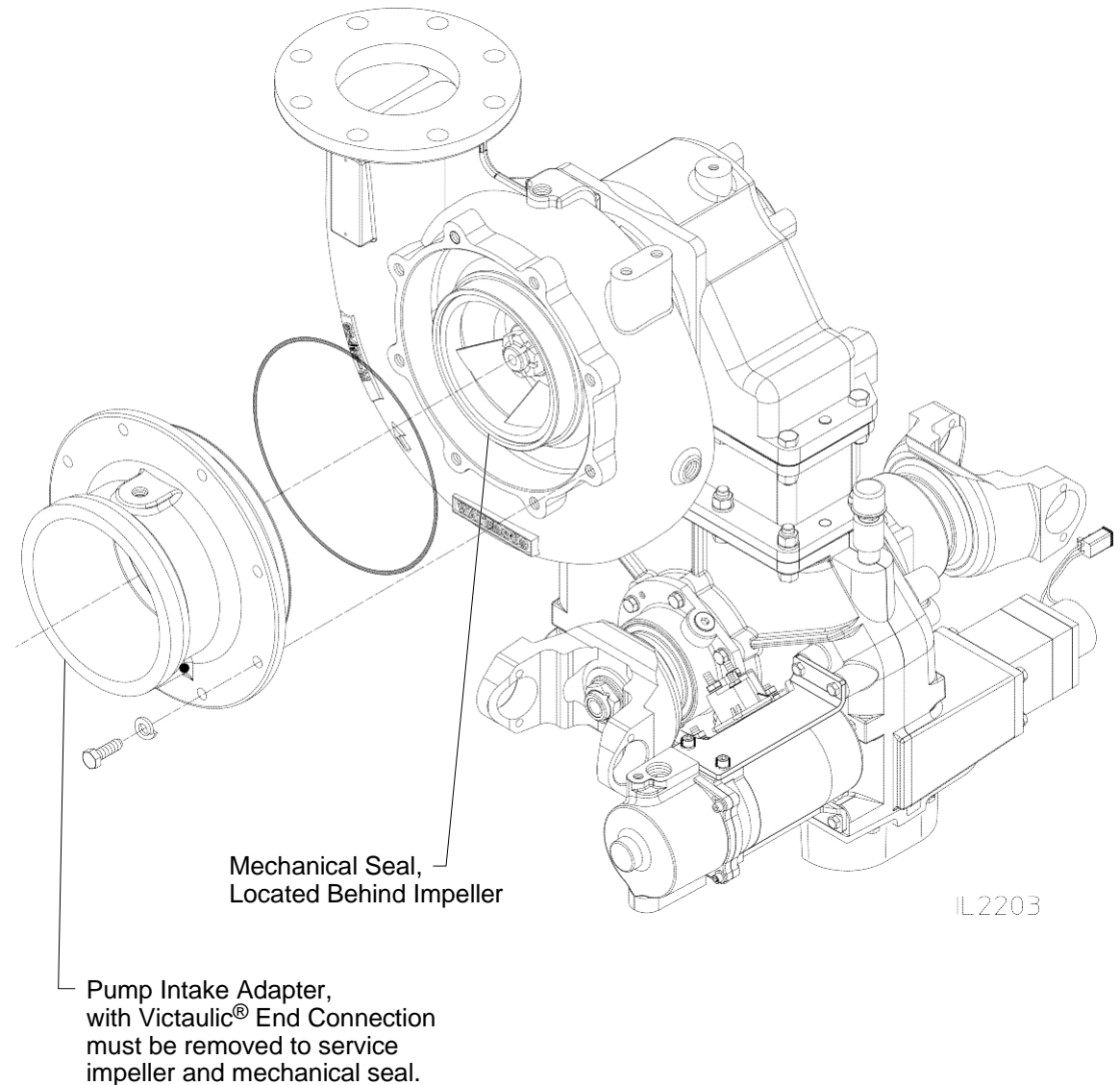
S100 Series End Suction Pump with C20 or C22 Series Transmission

Installation of Intake Piping

Provisions must be made in the intake piping to allow for the removal of the intake adapter and impeller while the pump is mounted in the vehicle. This is necessary to provide access to the pump mechanical seal for maintenance.

Failure to provide access for removal of the intake adapter will result in the end user having to remove the entire pump and transmission from the vehicle to service the mechanical seal.

Figure 10. Installation of Intake Piping

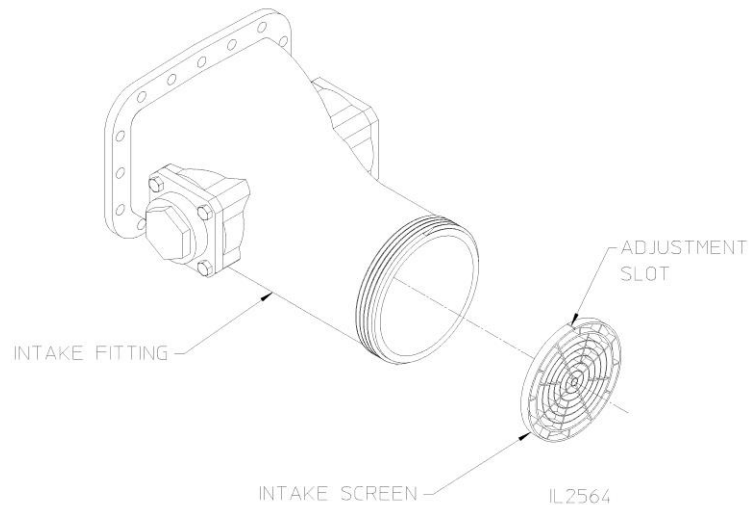


Optional Corrosion Protection

Intake Screens

Waterous offers intake screens that fit 4, 4-1/2, 5 and 6 inch intake fittings sizes. The screen is designed to fit in the counter bore in the inside diameter of the fittings. There must be a strong electrical contact between the screen and the intake fitting. Remove any corrosion, debris or paint from the counter bore that will insulate the screen from the intake fitting. If the screen does not fit tightly, adjust the gap of the slot on the outside diameter of the screen to ensure a tight fit.

NOTE: Intake screens are die-cast which results in a slight taper from one side to the other. Install the screen with the thinner cross-section facing out to minimize flow restriction.



Anodes

Anodes may be mounted in the intake piping or, if no intake pads are available, in the discharge piping.

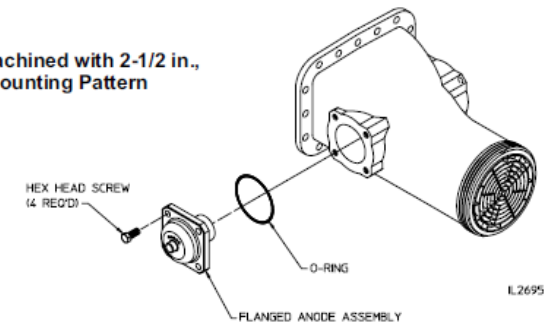
NOTE: The replaceable elements must make contact with water to be effective. Do not paint or use any other coating on the replaceable elements.

Anodes are available for the following:

- Pads machined with 2-1/2 in., 4-bolt mounting patterns
- Pads machined with 2-1/2 in. or 3 in. NPT taps.

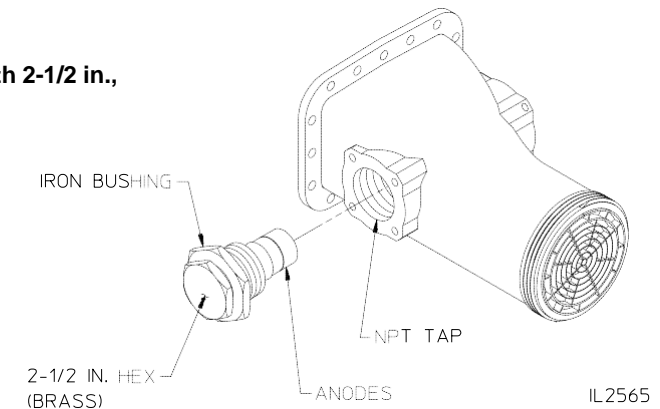
Anodes - Bolt On

Pads Machined with 2-1/2 in., 4-bolt Mounting Pattern



Anodes - Threaded

Pads Machined with 2-1/2 in., or 3 in. NPT Taps



Tachometer	Final Checks (Cont'd)
<p>Electronic Tachometer Drive <i>(Optional on C20 Series, not available on C22 Series or QC Series, Standard on PA Series Transmissions)</i></p> <p>The magnetic pick-up in the transmission mates with an Amphenol connector (P/N MS3106A-10SL-4S). This connector should be wired to a wall mount receptacle on the operator's panel. Cable assembly 63033 available from Watrous.</p> <p>C20 Series Transmissions: <i>To verify the rotational speed of the drive shaft, the frequency (Hz) reading from the tachometer sensor should be multiplied by 10.</i> $\text{Hz} \times 10 = \text{RPM}$</p> <p>PA Series Transmissions: <i>To verify the rotational speed of the drive shaft, the frequency (Hz) reading from the tachometer sensor should be multiplied by 6.</i> $\text{Hz} \times 6 = \text{RPM}$</p> <p>Frequency reading can be measured with hand held multimeter. Cable connector assembly V 3398 available for connecting wall mount receptacle to multimeter.</p>	<p>C20 and C22 Series Transmission Add any type of automatic transmission fluid (ATF) through the fluid level hole or by removing the breather. Approximately 6 quarts is required to fill the transmission when completely drained. The fluid should be level with bottom of the fluid level hole.</p> <p>S100D Bearing Housing Add any type of automatic transmission fluid (ATF) or SAE 30 oil through the fluid level hole or by removing the breather. Approximately 1/2 quart is required to fill the bearing housing when completely drained. Fill to the bottom of the threads.</p> <p>PA Series Transmission Add any type of automatic transmission fluid (ATF) through the fluid level hole or by removing the breather. Approximately 3 quarts is required to fill the transmission when completely drained. The fluid should be level with bottom of the fluid level hole.</p> <p>QC Series Transmission Add any type of automatic transmission fluid (ATF) through the fluid fill level hole or by removing the breather. Vertical, 22.5° from vertical and 45° from vertical mountings require approximately 4 quarts to fill the transmission when completely drained. Inverted mounting requires approximately 3 quarts.</p>
Final Checks	Testing
<p>After the pump, accessories, piping and miscellaneous connections are completely installed, check the items listed below:</p>	<p>Perform the tests listed in F-1031, Section 1000, "<i>Centrifugal Fire Pump Principles of Operation, Inspection Tests and Troubleshooting Guide.</i>" During the running tests, monitor the smoothness of operation, listen for unusual noises and check for leaks.</p>
<p>Lubrication</p>	
	<p>C20 and C22 Transmission Temperature Specifications</p>
<p>CAUTION</p>	
<p>Failure to properly lubricate the pump and transmission may result in serious damage to the equipment.</p>	<p>The maximum temperature permitted at transmission external surfaces is 250° F (121° C)</p>