



CM and CS Series Centrifugal Fire Pumps Installation Instructions

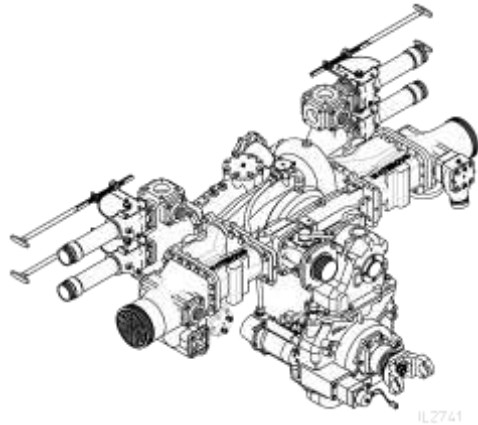


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NOTE: Instructions subject to change without notice.

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 and manuals for the apparatus, water hydraulics and component limitations.

WARNING

Pressure Hazard. May result in personal injury.

Pressure 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 burn.

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 unexpected truck movement 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 parameter.

Introduction

This instruction covers the installation of Waterous CM/CS Series fire pumps, including the CMU/CSU Series. The CM is designed for midship mounting and is available in capacities ranging from 500 to 2250 gpm (1900 to 8550 l/m). The CM series pump is a multi-stage centrifugal fire pump. The CS is designed for midship mounting and is available in capacities ranging from 750 to 2250 gpm (2850 to 8550 l/m). The CS series pump is a single stage centrifugal fire pump. Both the CM and CS pumps are available as direct driven pump or with the following transmissions:

C20 Series - The C20 transmission is an aluminum split-shaft, chain driven transmission that transmits power from the truck's transmission either to the fire pump or to the drive axle of the truck, see Figure 3.

K Series - The K transmission is designed primarily to be driven by a power take-off or power divider. The heavy duty K transmission is intended mainly for larger pumps rated at 500 gpm (1900 l/m) through 1250 gpm (4750 l/m). An extra heavy duty K series transmission is available for pumps rated above 1250 gpm (4750 l/m), see Figure 5.

PA Series - The PA transmission is designed to drive a Waterous pump using the ten bolt power take-off (PTO) provision available on the left side of the Allison MD or HD automatic transmissions, see Figure 7.

Also refer to the following installation instructions based on optional accessories ordered:

Monarch Intake Valve: 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™ System

- FoamPro® System: F-1031, Section 3012
- Advantus® System: F-1031, Section 3026
- Aquis™ System: F-1031, Section 3031

Eclipse™ CAFSystem: F-1031, Section 3025

Priming System: F-1031, Section 3023

Shift Unit: F-1031, Section 3030

Instructions for mechanical/electronic tachometer drives are covered in this instruction (see Page 26).

Before proceeding with the installation of the CM/CS, read the following instructions carefully. Check the appropriate dimensional drawings in the Engineering Manual as needed.

Iron Pump Mounting with C20 Series Transmission

Select a mounting location which will make the pump and its accessories readily accessible for maintenance (see Figures 1 & 2) 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. Note that the C20 transmission is available with a range of drop sizes (see Table 1 and Figure 1, Dimension C).

Table 1. C20 Series Transmission Drop Ranges for CM/CS Pumps

Model	Dimension C (IN/mm)
C20B	12.240/310.90
C20C	13.811/350.80
C20D	14.856/377.34
C20E	16.920/429.77
C20F	18.972/481.99

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

Table 2 gives maximum universal joint angles for installation 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.

NOTICE

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.

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°

NOTE: The angles shown in the table above are the maximum U-joint operating angles recommended by Waterous and are directly related to the speed of the driveshaft. Any U-joint operating angle greater than 3° will lower the U-joint life and may cause vibration¹.

¹From Spicer® Driveshaft Installation Techniques, Form J-3311.

Figure 1. Required Working Space for Optional Mechanical Seal and C20 Series Transmission Removal

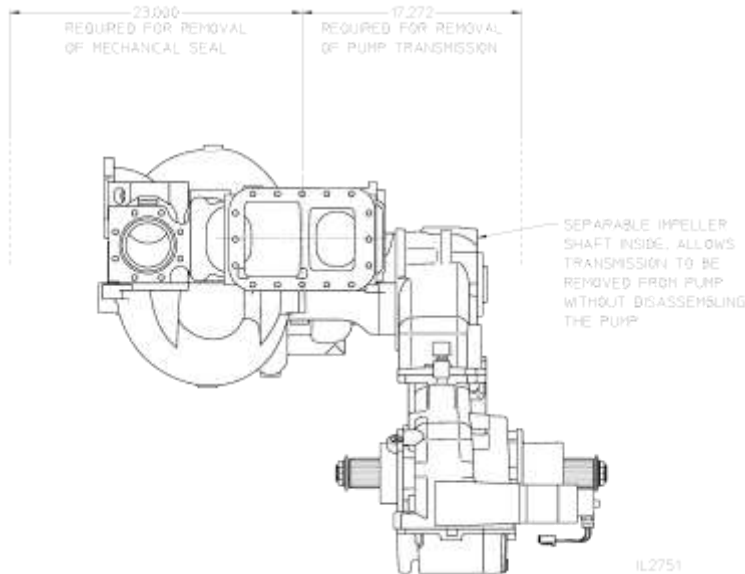
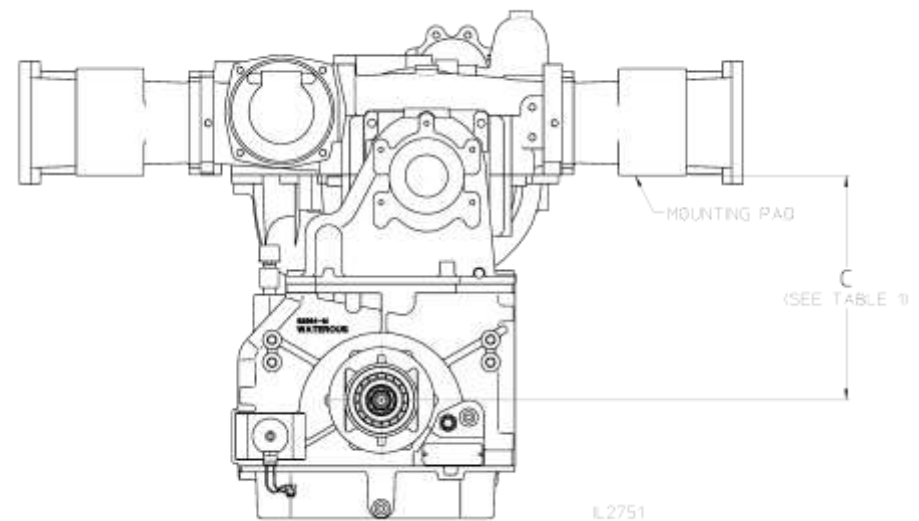


Figure 2. Drop Size Dimensions



Iron Pump Mounting with C20 Series Transmission (Continued)

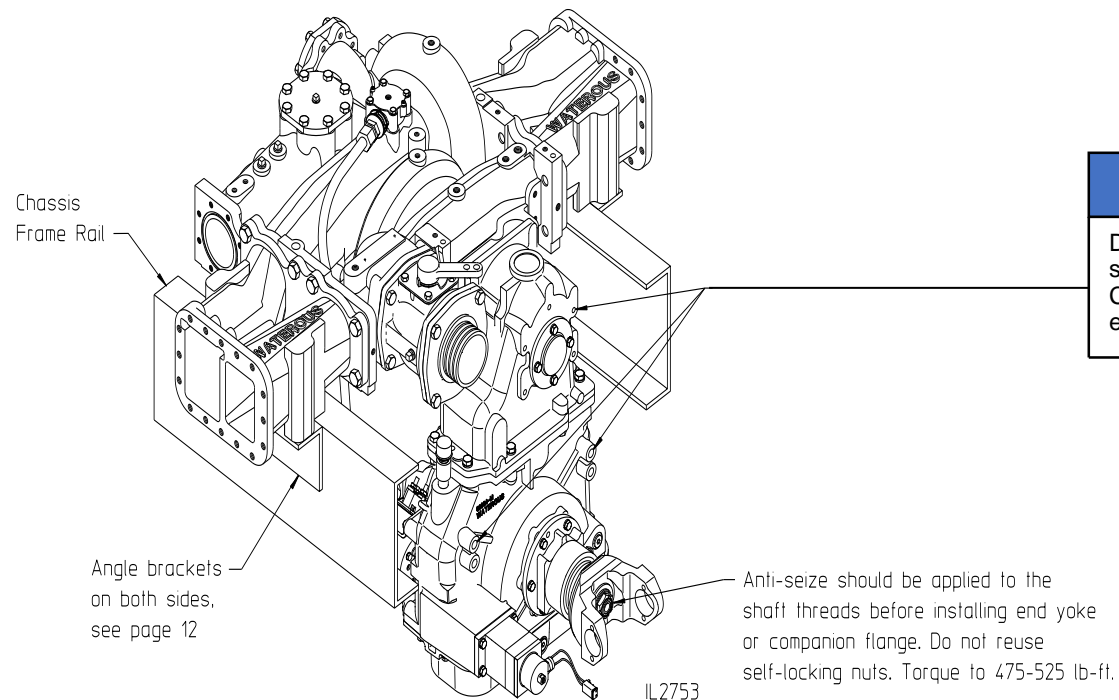
The figure below shows a typical installation of an iron CMC20 & CSC20 where the pump is mounted on angle brackets attached to the outside of the chassis frame rails. To mount the pump, create angle brackets that will attach the pump to the vehicle's chassis. The iron CMC20 & CSC20 are equipped with four tapped holes (1/2-13 UNC-2B x 1.13 deep) in each intake adapter. To help create the angle brackets, See Pages 11, 12 and 13 which show pump mounting hole layout in angle brackets. Drill a suitably sized hole in the angle bracket where the corresponding tapped hole in the intake adapter is located. Using only one tapped hole on each side of the adapter, fasten the angle bracket to the pump. Repeat this procedure for each side of the pump. Fasten the angle brackets to the chassis frame rails using a 3-point mounting technique shown on Page 14. This mounting technique allows for slight truck frame twist.

NOTE: Tighten the mounting screws to standard torque specifications.

NOTICE

Do not use the threaded holes on the output shaft side of the C20 case for mounting CS/CSU and CM/CMU model pumps to prevent excess stress on the transmission case.

Figure 3. CMC20 / CSC20 Series Mounting Diagram



NOTICE

Do not use the threaded holes on the output shaft side of the C20 case for mounting CS/CSU and CM/CMU model pumps in the vehicle to prevent excess stress on the transmission case.

Iron Pump Mounting with C20 Front Drive Transmission

Select a mounting location which will make the pump and its accessories readily accessible for maintenance (see Figures 1 & 2) 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. Note that the C20 Series transmission is available with a range of drop sizes (see Table 1 and Figure 1, Dimension C).

Table 1. C20 Series Transmission Drop Ranges for CM/CS Pumps

Model	Dimension C (IN/mm)
C20B	12.240/310.90
C20C	13.811/350.80
C20D	14.856/377.34
C20E	16.920/429.77
C20F	18.972/481.99

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

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 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.

NOTICE

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.

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°

NOTE: The angles shown in the table above are the maximum U-joint operating angles recommended by Waterous and are directly related to the speed of the driveshaft. Any U-joint operating angle greater than 3° will lower the U-joint life and may cause vibration¹.

¹From Spicer® Driveshaft Installation Techniques, Form J-3311.

Figure 1. Required Working Space for Optional Mechanical Seal and C20 Series Transmission Removal

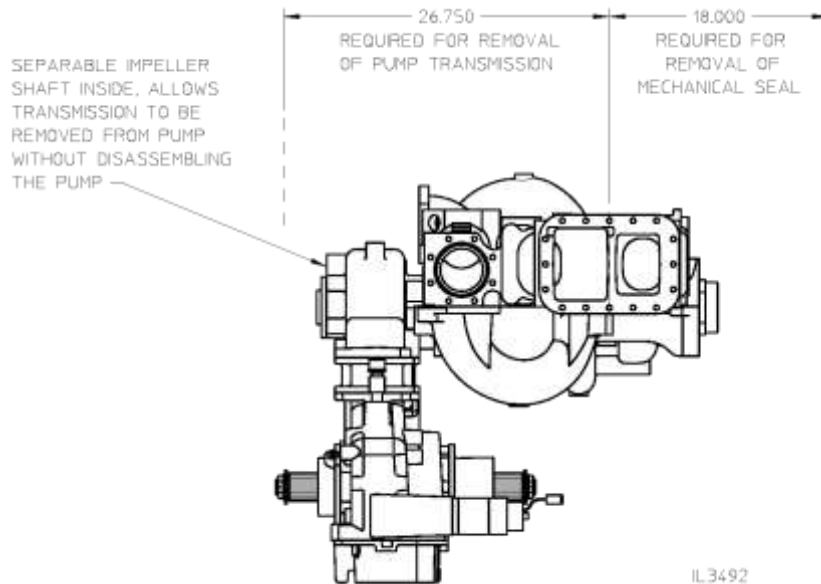
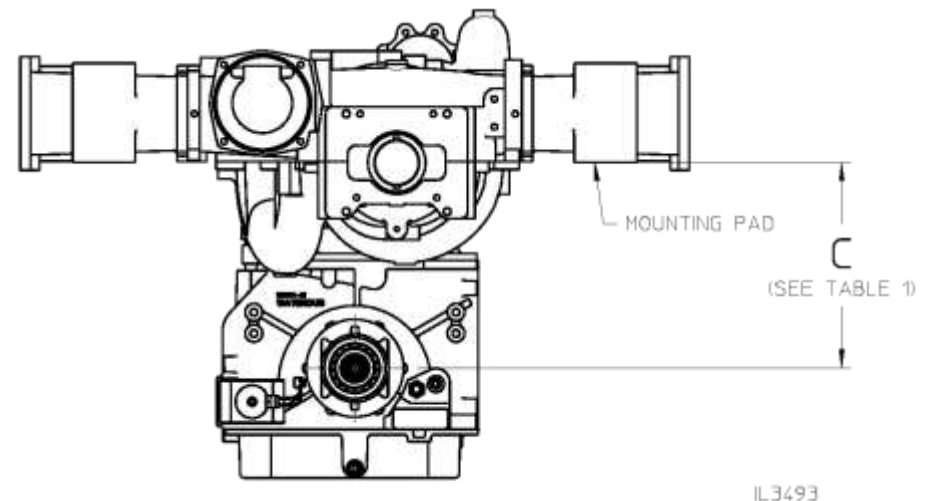


Figure 2. Drop Size Dimensions



Iron Pump Mounting with C20 Front Drive Transmissions (Continued)

The figure below shows a typical installation of an iron CMC20 & CSC20 Series where the pump is mounted on angle brackets attached to the outside of the chassis frame rails. To mount the pump, create angle brackets that will attach the pump to the vehicle's chassis. The iron CMC20 & CSC20 Series are equipped with four tapped holes (1/2-13 UNC-2B x 1.13 deep) in each intake adapter. To help create the angle brackets, See Pages 11, 12 and 13 which show pump mounting hole layout in angle brackets. Drill a suitably sized hole in the angle bracket where the corresponding tapped hole in the intake adapter is located. Using only one tapped hole on each side of the adapter, fasten the angle bracket to the pump. Repeat this procedure for each side of the pump. Fasten the angle brackets to the chassis frame rails using a 3-point mounting technique shown on Page 14. This mounting technique allows for slight truck frame twist.

NOTICE

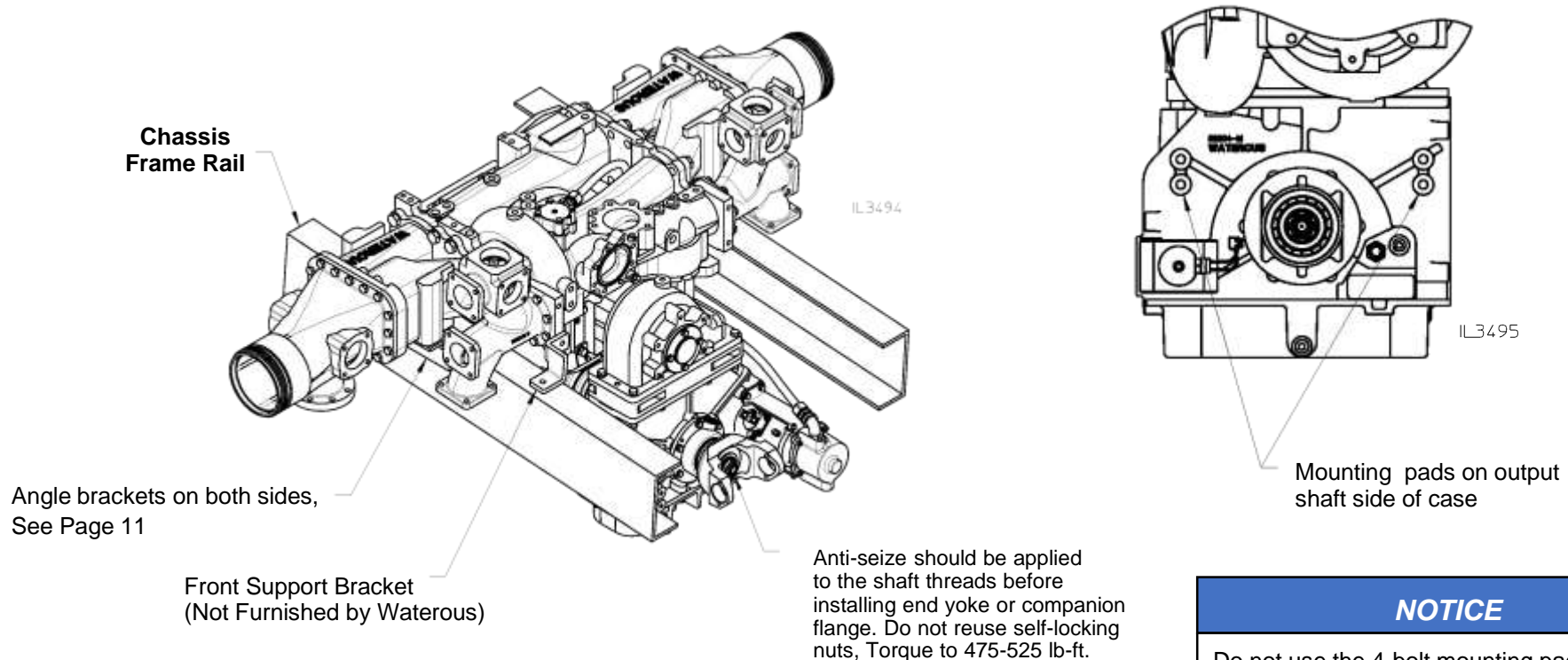
C20 Series Front Drive Transmissions require an additional front support bracket (not furnished by Waterous) mounted between the front of the CM Series or CS Series pump body and chassis frame rails (see Figure3). Fasten the front support bracket to the chassis frame rail using the mounting technique shown on page 13.

NOTE: Tighten the mounting screws to standard torque specifications.

NOTICE

Do not use the 4-bolt mounting pads on the output shaft side of the C20 case for mounting CS/CSU and CM/CMU model pumps to prevent excess stress on the transmission case.

Figure 3. CMC20 / CSC20 Series Mounting Diagram



NOTICE

Do not use the 4-bolt mounting pads on the output shaft side of the C20 case for mounting CS/CSU and CM/CMU model pumps to prevent excess stress on the transmission case.

Iron Pump Mounting with K Series Transmission

Select a mounting location which will make the pump and its accessories readily accessible for maintenance (see Figure 4) 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 (see table below).

NOTICE

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.

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°

NOTE: The angles shown in the table above are the maximum U-joint operating angles recommended by Waterous and are directly related to the speed of the driveshaft. Any U-joint operating angle greater than 3 will lower the U-joint life and may cause vibration¹.

¹ From Spicer© Driveshaft Installation Techniques, Form J-3311.

Figure 4. Required Working Space for Optional Mechanical Seal and K Series Transmission Removal

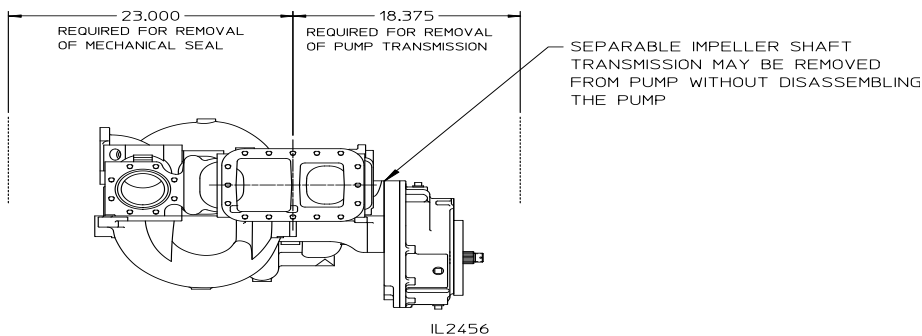
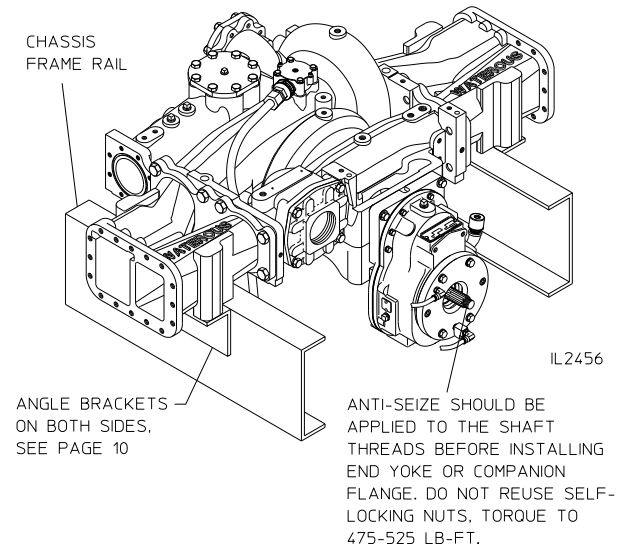


Figure 5 shows a typical installation of an iron CMK & CSK where the pump is mounted on angle brackets attached to the outside of the chassis frame rails. To mount the pump, create angle brackets that will attach the pump to the vehicle's chassis. The iron CMK & CSK are equipped with four tapped holes (1/2-13 UNC-2B x 1.13 deep) in each intake adapter. To help create the angle brackets, See Pages 11, 12 and 13 which show pump mounting hole layout in angle brackets.

Drill a suitably sized hole in the angle bracket where the corresponding tapped hole in the intake adapter is located. Using only one tapped hole on each side of the adapter, fasten the angle bracket to the pump. Repeat this procedure for each side of the pump. Fasten the angle brackets to the chassis frame rails using a 3-point mounting technique shown on Page 14. This mounting technique allows for slight truck frame twist.

NOTE: Tighten the mounting screws to standard torque specifications.

Figure 5. CMK / CSK Mounting Diagram



Iron Pump Mounting with PA Series Transmission

Select a mounting location which will make the pump and its accessories readily accessible for maintenance (see Figure 6) 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 (see table below).

NOTICE

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.

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°

NOTE: The angles shown in the table above are the maximum U-joint operating angles recommended by Waterous and are directly related to the speed of the driveshaft. Any U-joint operating angle greater than 3 will lower the U-joint life and may cause vibration¹.

¹ From Spicer© Driveshaft Installation Techniques, Form J-3311.

Figure 6. Required Working Space for Optional Mechanical Seal and PA Series Transmission Removal

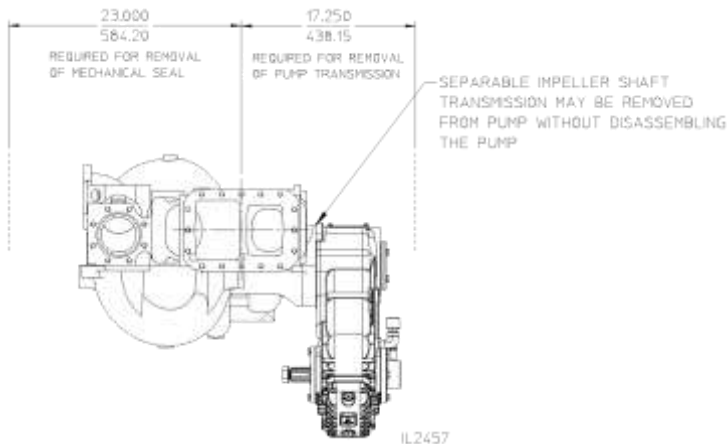
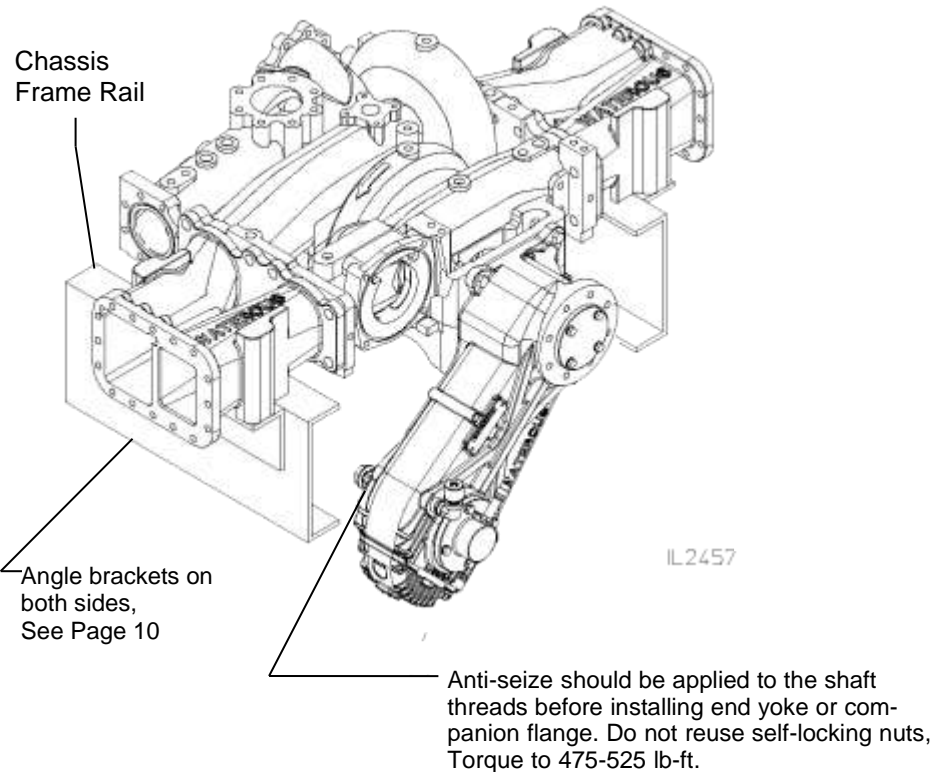


Figure 7 shows a typical installation of an iron CMPA & CSPA where the pump is mounted on angle brackets attached to the outside of the chassis frame. To mount the pump, create angle brackets that will attach the pump to the vehicle's chassis. The iron CMPA & CSPA are equipped with four tapped holes (1/2-13 UNC-2B x 1.13 deep) in each intake adapter. To help create the angle brackets, See Pages 9 and 10 which show pump mounting hole layout in angle brackets. Drill a suitably sized hole in the angle bracket where the corresponding tapped hole in the intake adapter is located. Using only one tapped hole on each side of the adapter, fasten the angle bracket to the pump. Repeat this procedure for each side of the pump. Fasten the angle brackets to the chassis frame rails using a 3-point mounting technique shown on Page 14. This mounting technique allows for slight truck frame twist.

Figure 7. CMPA / CSPA Series Mounting Diagram



Iron Pump Mounting with D Series (Direct Drive) Transmission

Select a mounting location which will make the pump and its accessories readily accessible for maintenance (see Figure 8) 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 (see table below).

NOTICE

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.

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°

NOTE: The angles shown in the table above are the maximum U-joint operating angles recommended by Waterous and are directly related to the speed of the driveshaft. Any U-joint operating angle greater than 3 will lower the U-joint life and may cause vibration¹.

¹ From Spicer© Driveshaft Installation Techniques, Form J-3311.

Figure 8. Required Working Space for Optional Mechanical Seal (Direct Drive)

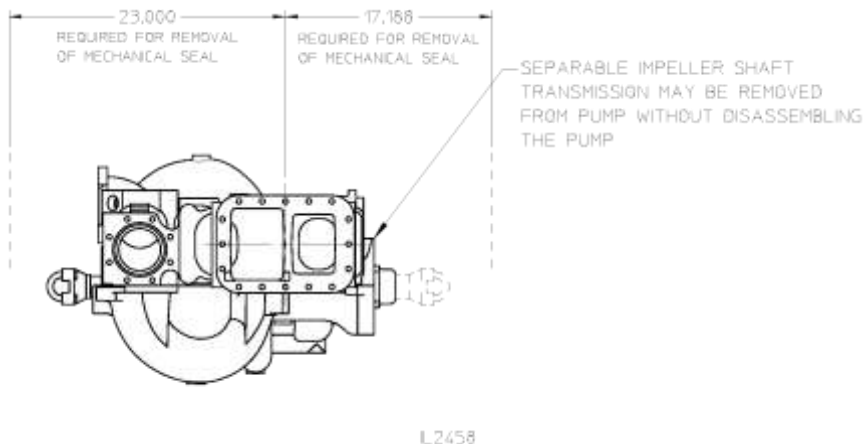
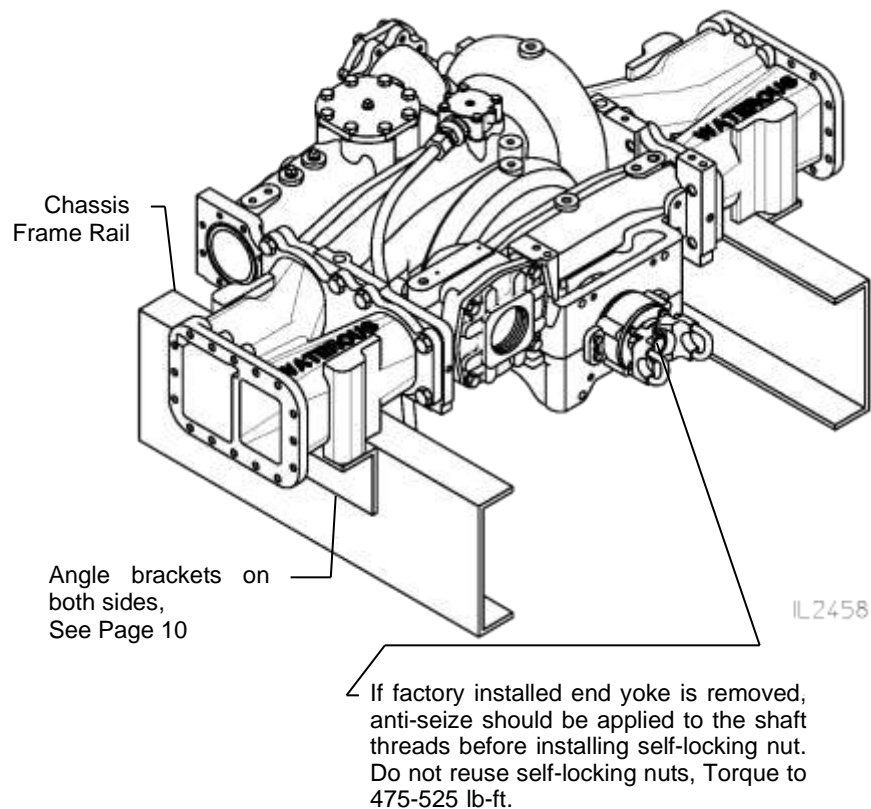


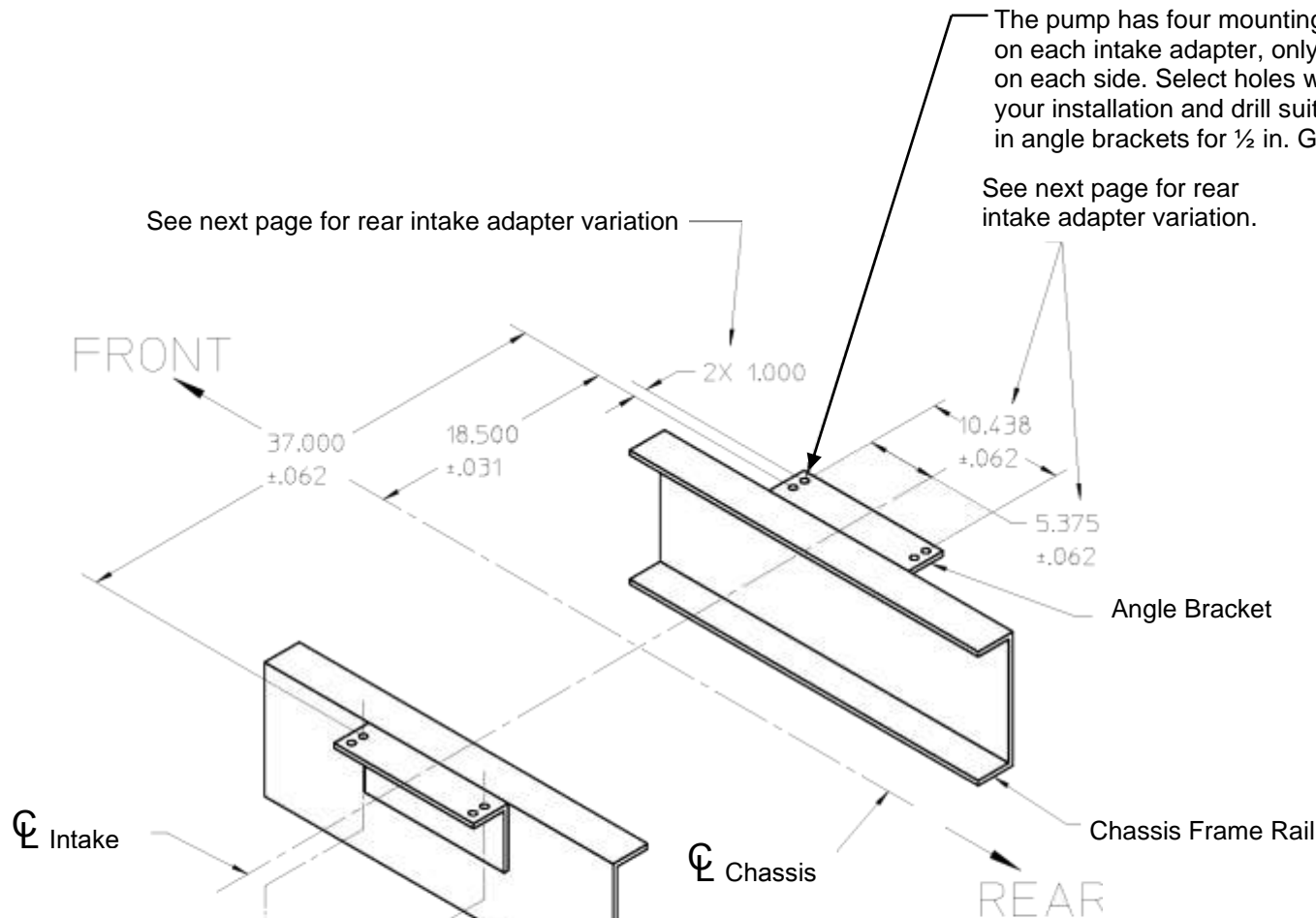
Figure 9 shows a typical installation of an iron CMD & CSD where the pump is mounted on angle brackets attached to the outside of the chassis frame. To mount the pump, create angle brackets that will attach the pump to the vehicle's chassis. The iron CMD & CSD are equipped with four tapped holes (1/2-13 UNC-2B x 1.13 deep) in each intake adapter. To help create the angle brackets, See Pages 11, 12 and 13 which show pump mounting hole layout in angle brackets. Drill a suitably sized hole in the angle bracket where the corresponding tapped hole in the intake adapter is located. Using only one tapped hole on each side of the adapter, fasten the angle bracket to the pump. Repeat this procedure for each side of the pump. Fasten the angle brackets to the chassis frame rails using a 3-point mounting technique shown on Page 10. This mounting technique allows for slight truck frame twist.

Figure 9. CMD / CSD Series Mounting Diagram



Iron Pump Mounting - Mounting Pump on Chassis Frame Rails

Pump Mounting Holes in Angle Brackets: Non-Rear Intake Adapter Hole Pattern



The pump has four mounting hole locations on each intake adapter, only two to be used on each side. Select holes which best suit your installation and drill suitably sized holes in angle brackets for 1/2 in. Grade 5 screws.

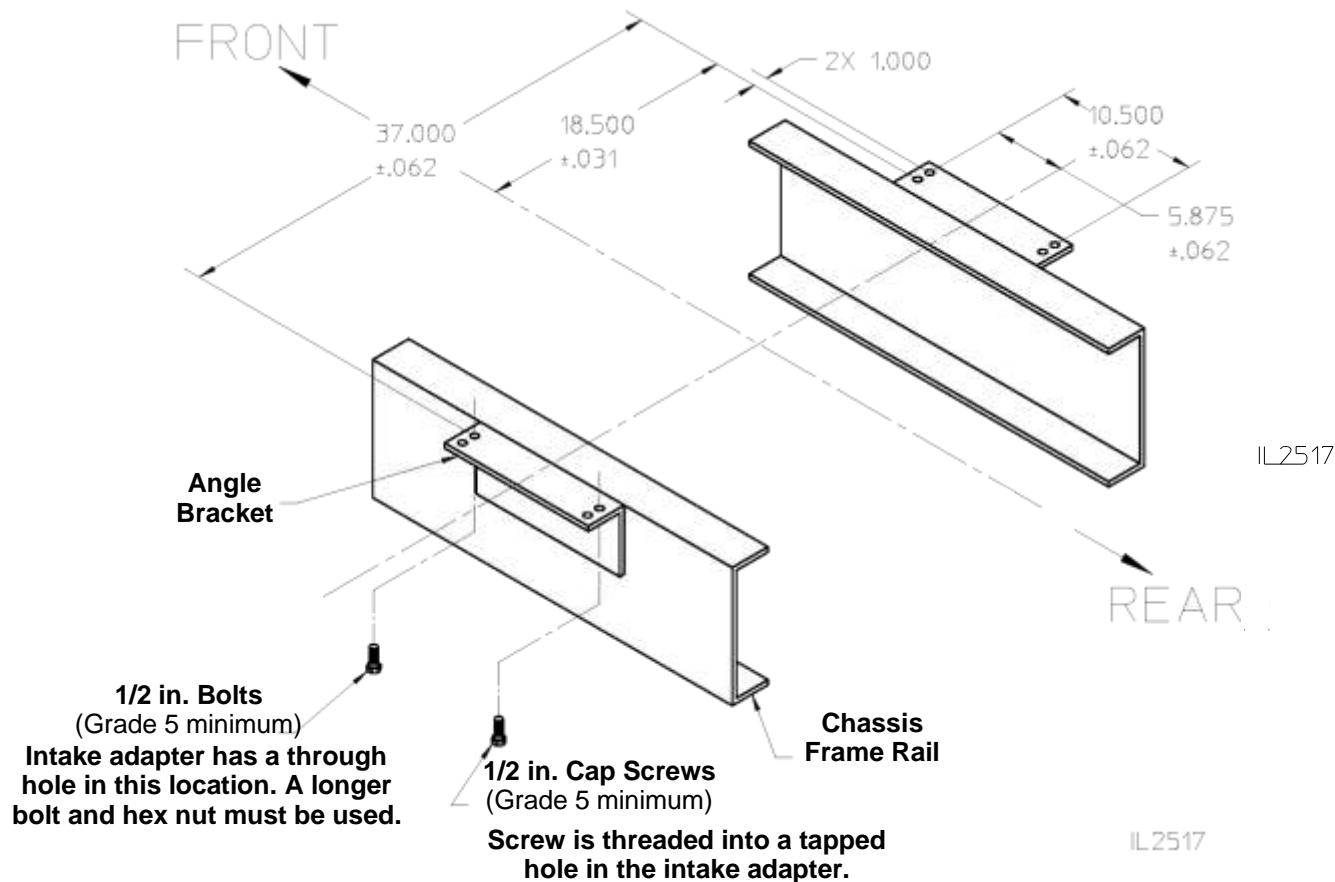
See next page for rear intake adapter variation.

See next page for rear intake adapter variation

1/2 in. Cap Screws
(Grade 5 minimum)
(Two required on each side)
Screws are threaded into tapped holes in 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 screw (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.**

Pump Mounting Holes in Angle Brackets: Rear Intake Adapter Hole Pattern



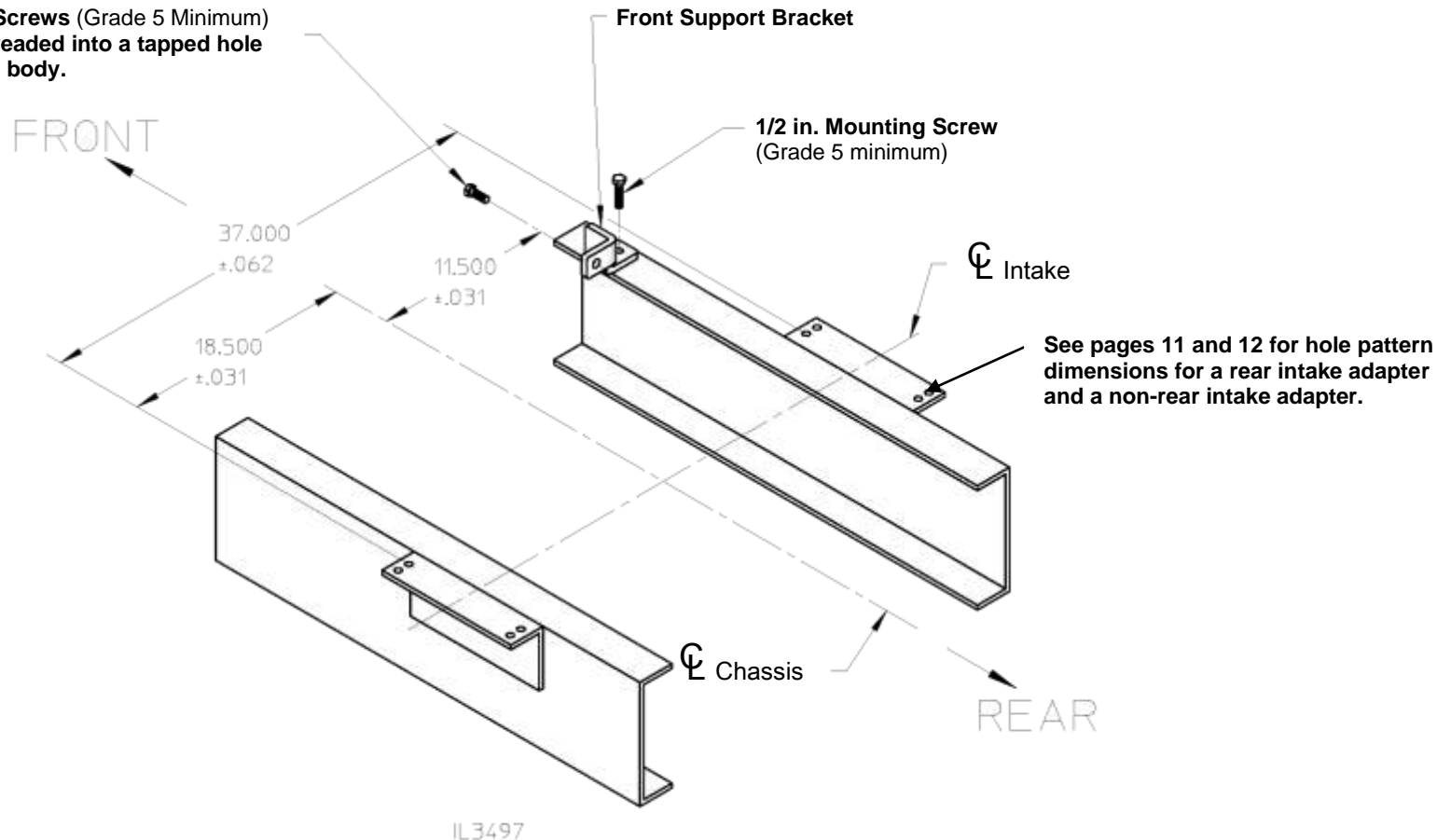
Mounting Hardware Used to Attach Pump to Chassis Frame Rails

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.
2. Provide a method to restrain the bolts (lock washers and / or thread-locking compound).
3. Tighten hardware to standard torque specifications for 1/2 in. bolts and cap screws.

Front Support Bracket Mounting: C20 Front Drive Transmissions Only

1/2 in. Cap Screws (Grade 5 Minimum)
Screw is threaded into a tapped hole
in the pump body.



Front Support Bracket Mounting Hardware Used to Attach Front of Pump to Chassis

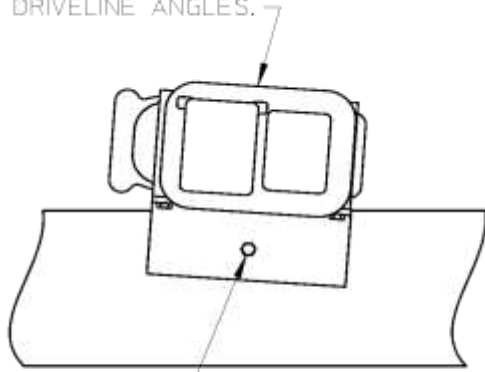
NOTE: Waterous does not provide front support bracket or hardware used to mount the bracket. OEM must provide mounting bracket and hardware as follows:

1. Use (1) 1/2 in. (Grade 5 min) cap screw to attach bracket to pump.
2. Use (1) 1/2 in. (Grade 5 min) cap screw to attach bracket to frame rail.
3. Provide a method to restrain cap screws (lock washers and/or thread-locking compound).
4. Tighten cap screws to standard torque specifications for 1/2 in. cap screws.

Angle Bracket Mounting on Frame Rails Recommended Three-Point Suspension

C20 Rear Drive Transmissions Only, Driver Side

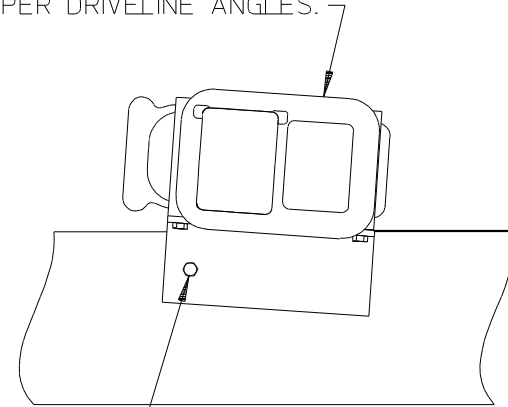
ADJUST PUMP ANGLE TO ACHIEVE PROPER DRIVELINE ANGLES.



3/4" MOUNTING SCREWS, GRADE 5 MINIMUM. USE SINGLE SCREW ON DRIVER'S SIDE.

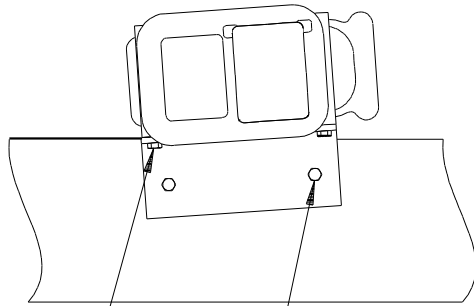
C20 Front Drive Transmissions Only, Drivers Side

ADJUST PUMP ANGLE TO ACHIEVE PROPER DRIVELINE ANGLES.



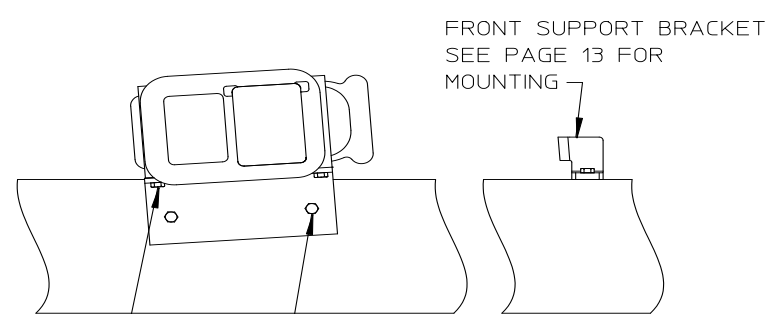
3/4" MOUNTING SCREWS, GRADE 5 MINIMUM. USE SINGLE SCREW ON DRIVER'S SIDE.

C20 Rear Drive Transmissions Only, Passenger Side



3/4" MOUNTING SCREWS, GRADE 5 MINIMUM.
1/2" MOUNTING SCREWS, GRADE 5 MINIMUM. ONE BOLT ON EACH SIDE OF ADAPTER - 4 PER PUMP.

C20 Front Drive Transmissions Only, Passenger Side



FRONT SUPPORT BRACKET SEE PAGE 13 FOR MOUNTING
3/4" MOUNTING SCREWS, GRADE 5 MINIMUM.
1/2" MOUNTING SCREWS, GRADE 5 MINIMUM. ONE BOLT ON EACH SIDE OF ADAPTER - 4 PER PUMP.

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Bronze Pump Mounting with C20 Series Transmission

Select a mounting location which will make the pump and its accessories readily accessible for maintenance (see Figures 10 & 11) 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. Note that the C20 Series transmission is available with a range of drop sizes (see Table 3 and Figure 11, Dimension C).

Table 3. C20 Series Transmission Drop Ranges for CM/CS Pumps

Model	Dimension C (IN/mm)
C20B	12.365/314.07
C20C	13.936/353.97
C20D	14.981/380.52
C20E	17.045/432.94
C20F	19.096/485.04

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

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 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.

NOTICE

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.

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°

NOTE: The angles shown in the table above are the maximum U-joint operating angles recommended by Waterous and are directly related to the speed of the driveshaft. Any U-joint operating angle greater than 3° will lower the U-joint life and may cause vibration¹.

¹From Spicer® Driveshaft Installation Techniques, Form J-3311

Figure 10. Required Working Space for Optional Mechanical Seal and C20 Series Transmission Removal

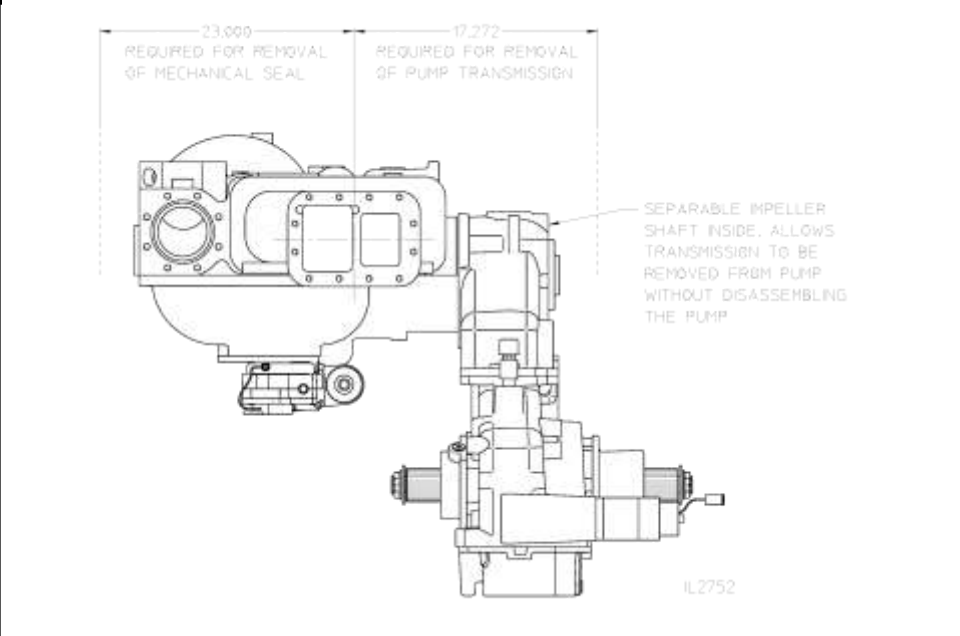
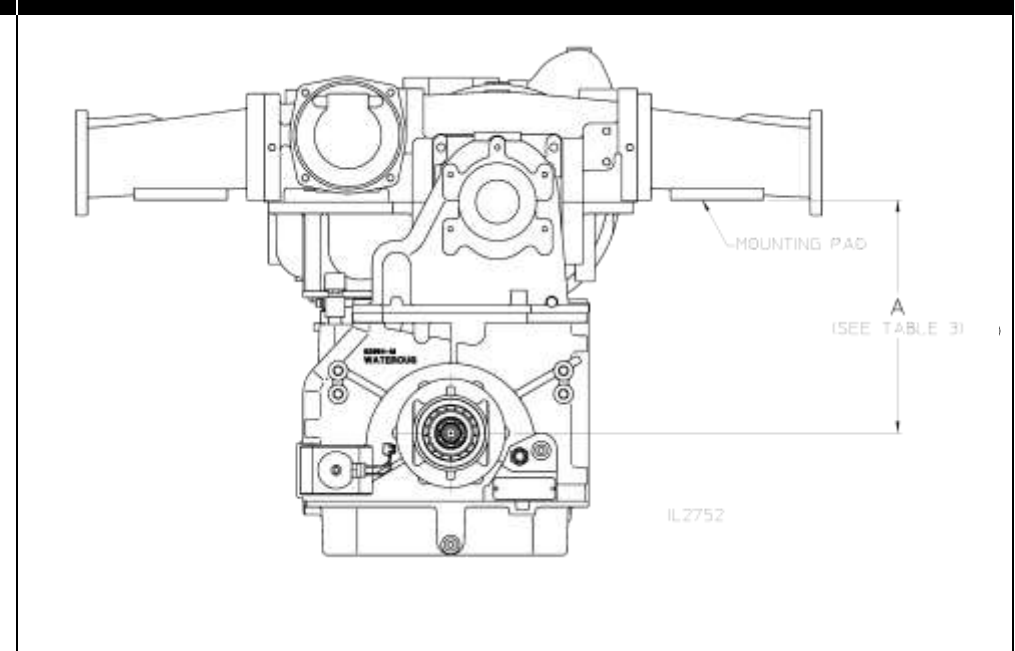


Figure 11. Drop Size Dimensions



Bronze Pump Mounting with C20 Series Transmission (Continued)

The figure below shows a typical installation of a bronze CMC20 & CSC20 where the pump is mounted on angle brackets attached to the outside of the chassis frame rails. To mount the pump, create angle brackets that will attach the pump to the vehicle's chassis. The bronze CMC20 & CSC20 Series are equipped with through holes in each intake adapter. To help create the angle brackets, See Pages 20 and 21 which show pump mounting hole layout in angle brackets. Drill a suitably sized hole in the angle bracket where the corresponding tapped hole in the intake adapter is located. Using only one hole on each side of the adapter, fasten the angle bracket to the pump. Repeat this procedure for each side of the pump. Fasten the angle brackets to the chassis frame rails

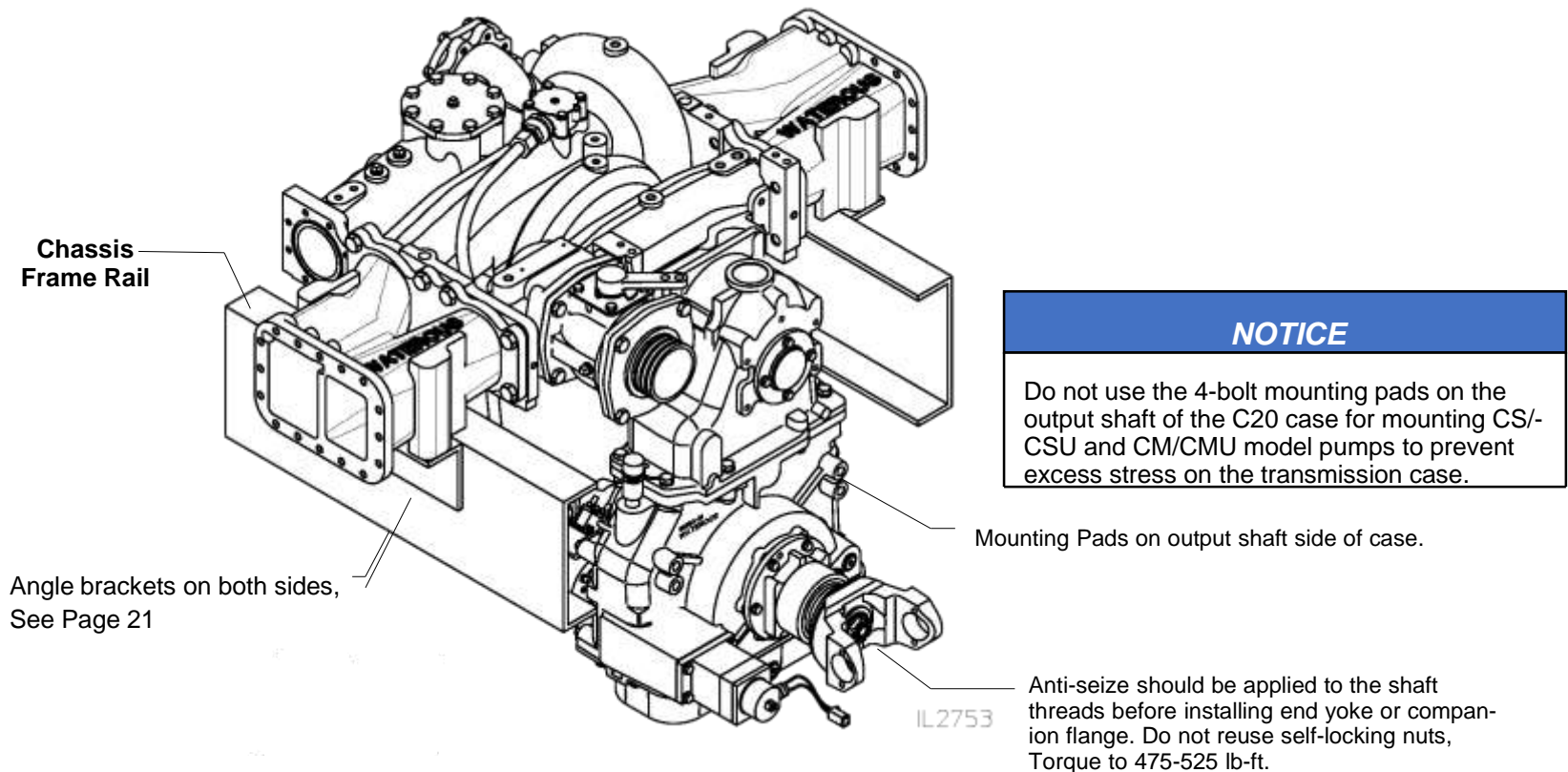
using a 3-point mounting technique shown on Page 21. This mounting technique allows for slight truck frame twist.

NOTE: Tighten the mounting screws to standard torque specifications.

NOTICE

Do not use the 4-bolt mounting pads on the output shaft of the C20 case for mounting CS/CSU and CM/CMU model pumps to prevent excess stress on the transmission case.

Figure 12. Bronze CMC20 / CSC20 Series Mounting Diagram



NOTICE

Do not use the 4-bolt mounting pads on the output shaft of the C20 case for mounting CS/CSU and CM/CMU model pumps to prevent excess stress on the transmission case.

Bronze Pump Mounting with K Series Transmission

Select a mounting location which will make the pump and its accessories readily accessible for maintenance (see Figure 13) 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 (see table below).

NOTICE

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.

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°

NOTE: The angles shown in the table above are the maximum U-joint operating angles recommended by Waterous and are directly related to the speed of the driveshaft. Any U-joint operating angle greater than 3 will lower the U-joint life and may cause vibration¹.

¹ From Spicer© Driveshaft Installation Techniques, Form J-3311.

Figure 13. Required Working Space for Optional Mechanical Seal and K Series Transmission Removal

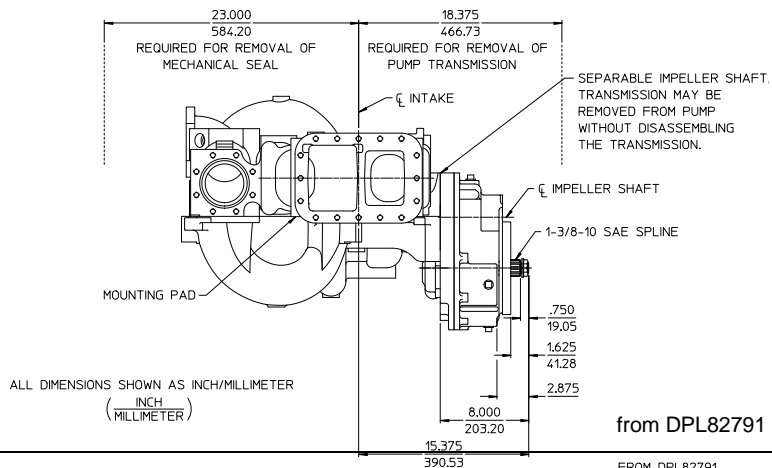
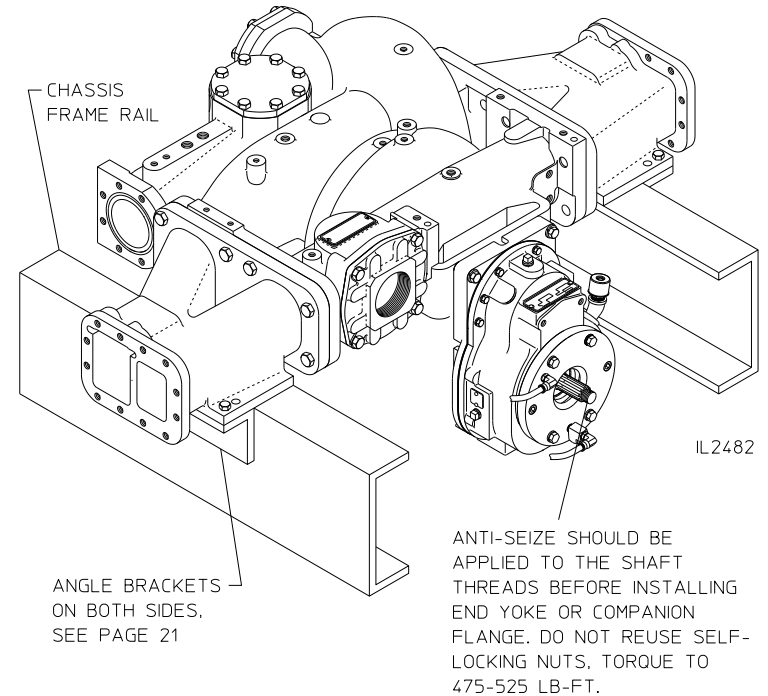


Figure 14 shows a typical installation of a bronze CMK & CSK series where the pump is mounted on angle brackets attached to the outside of the chassis frame rails. To mount the pump, create angle brackets that will attach the pump to the vehicle's chassis. The bronze CMC20 & CSC20 series are equipped with through holes in each intake adapter. To help create the angle brackets, See Pages 20 and 21 which show pump mounting hole layout in angle brackets.

Drill a suitably sized hole in the angle bracket where the corresponding tapped hole in the intake adapter is located. Using only one tapped hole on each side of the adapter, fasten the angle bracket to the pump. Repeat this procedure for each side of the pump. Fasten the angle brackets to the chassis frame rails using a 3-point mounting technique shown on Page 21. This mounting technique allows for slight truck frame twist.

NOTE: Tighten the mounting screws to standard torque specifications.

Figure 14. Bronze CMK / CSK Mounting Diagram



Bronze Pump Mounting with PA Series Transmission

Select a mounting location which will make the pump and its accessories readily accessible for maintenance (see Figure 15) 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 (see table below).

NOTICE

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.

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°

NOTE: The angles shown in the table above are the maximum U-joint operating angles recommended by Waterous and are directly related to the speed of the driveshaft. Any U-joint operating angle greater than 3 will lower the U-joint life and may cause vibration¹.

¹ From Spicer© Driveshaft Installation Techniques, Form J-3311.

Figure 15. Required Working Space for Optional Mechanical Seal and PA Series Transmission Removal

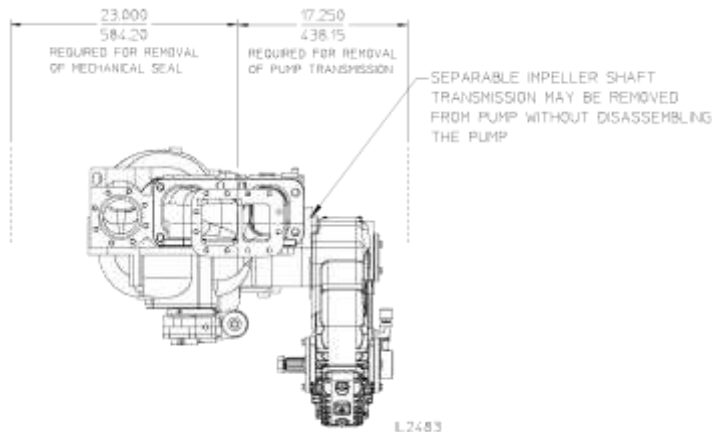
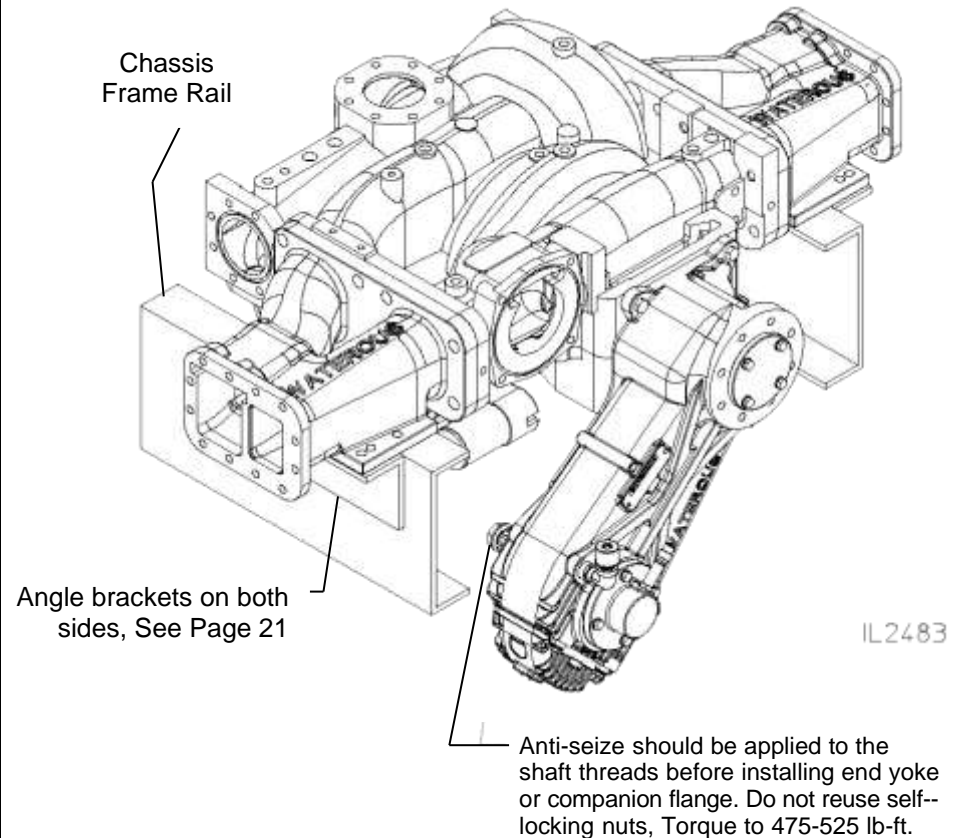


Figure 16 shows a typical installation of a bronze CMPA & CSPA where the pump is mounted on angle brackets attached to the outside of the chassis frame. To mount the pump, create angle brackets that will attach the pump to the vehicle's chassis. The bronze CMPA & CSPA are equipped with through holes in each intake adapter. To help create the angle brackets, See Pages 20 and 21 which show pump mounting hole layout in angle brackets.

Drill a suitably sized hole in the angle bracket where the corresponding tapped hole in the intake adapter is located. Using only one tapped hole on each side of the adapter, fasten the angle bracket to the pump. Repeat this procedure for each side of the pump. Fasten the angle brackets to the chassis frame rails using a 3-point mounting technique shown on Page 21. This mounting technique allows for slight truck frame twist.

Figure 16. Bronze CMPA / CSPA Mounting Diagram



Bronze Pump Mounting with D Series (Direct Drive) Transmission

Select a mounting location which will make the pump and its accessories readily accessible for maintenance (see Figure 17) 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 (see table below).

NOTICE

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.

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°

NOTE: The angles shown in the table above are the maximum U-joint operating angles recommended by Waterous and are directly related to the speed of the driveshaft. Any U-joint operating angle greater than 3 will lower the U-joint life and may cause vibration¹.

¹ From Spicer© Driveshaft Installation Techniques, Form J-3311.

Figure 17. Required Working Space for Optional Mechanical Seal (Direct Drive)

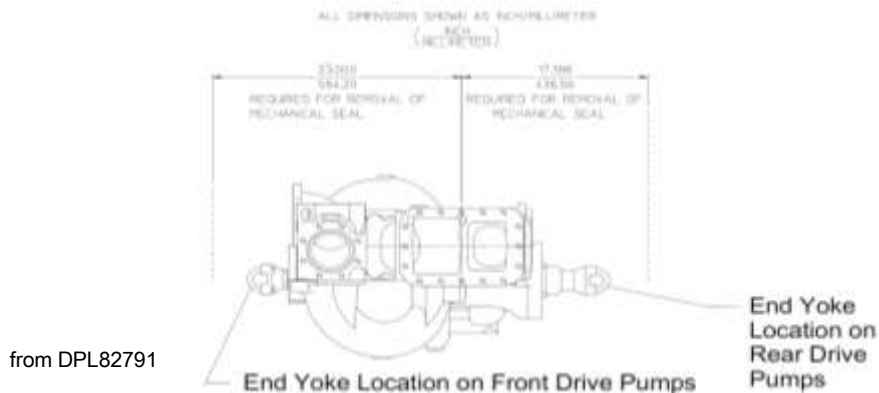
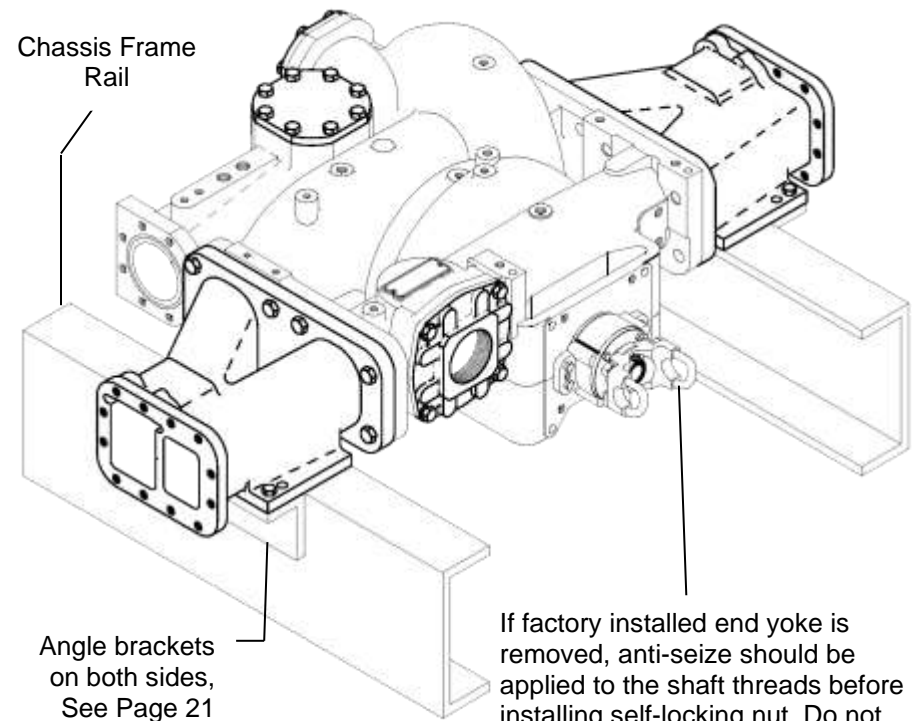


Figure 18 shows a typical installation of a bronze CMD & CSD series where the pump is mounted on angle brackets attached to the outside of the chassis frame. To mount the pump, create angle brackets that will attach the pump to the vehicle's chassis. The bronze CMPA & CSPA series are equipped with through holes in each intake adapter. To help create the angle brackets, See Pages 20 and 21 which show pump mounting hole layout in angle brackets.

Drill a suitably sized hole in the angle bracket where the corresponding tapped hole in the intake adapter is located. Using only one tapped hole on each side of the adapter, fasten the angle bracket to the pump. Repeat this procedure for each side of the pump. Fasten the angle brackets to the chassis frame rails using a 3-point mounting technique shown on Page 21. This mounting technique allows for slight truck frame twist.

Figure 18. Bronze CMD/CSD Mounting Diagram

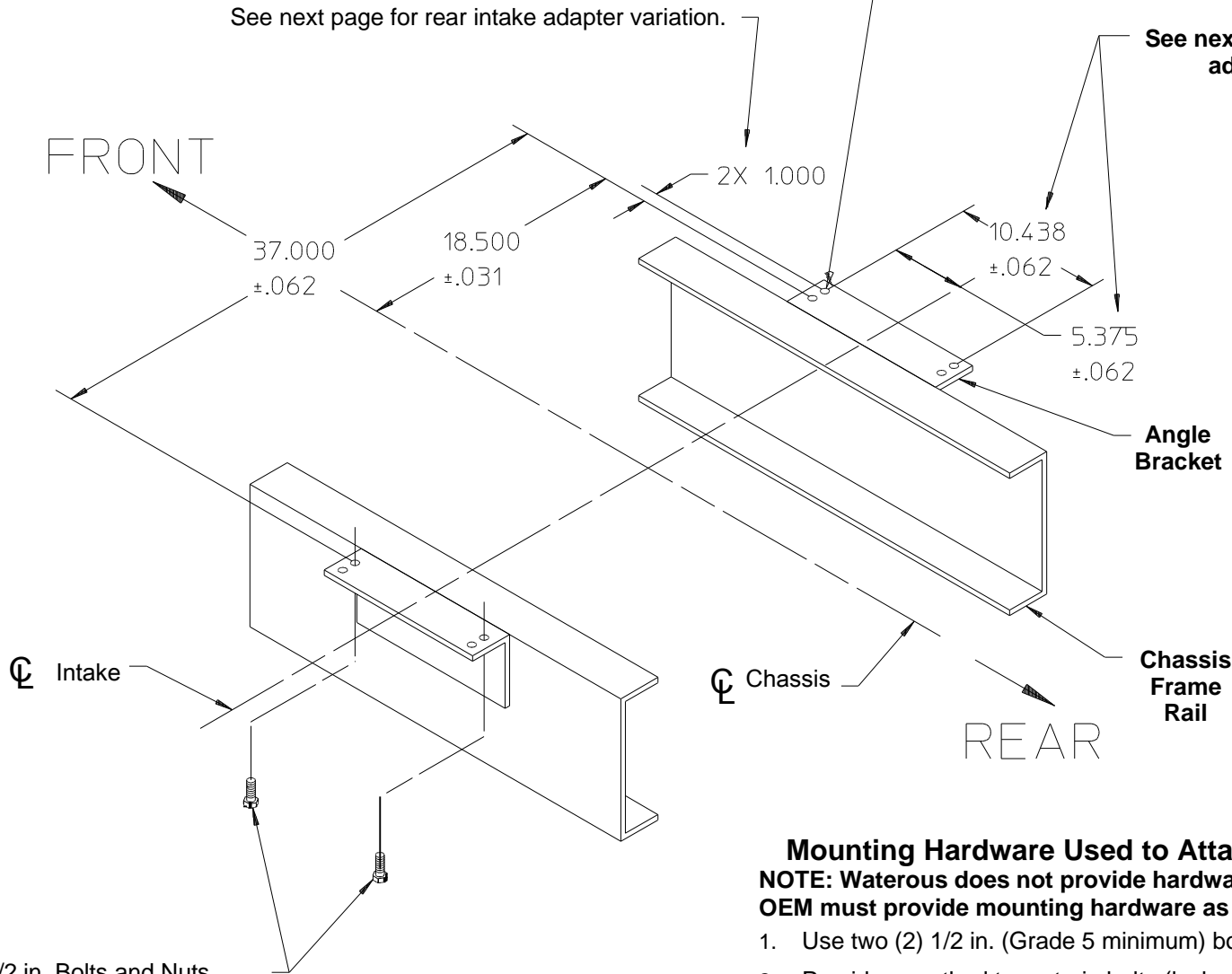


If factory installed end yoke is removed, anti-seize should be applied to the shaft threads before installing self-locking nut. Do not reuse self-locking nut. Do not reuse self-locking nuts. Torque to 475-525 lb-ft.

Bronze Pump Mounting - Mounting Pump on Chassis Frame Rails

Pump Mounting Holes in Angle Brackets: Non-Rear Intake Adapter Hole Pattern

The pump has four mounting hole locations on each intake adapter, only two to be used on each side. Select holes which best suit your installation and drill suitably sized holes in angle brackets for 1/2 in. Grade 5 screws.



IL2461

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

NOTE: Bolts must be installed from the underside of the pump.

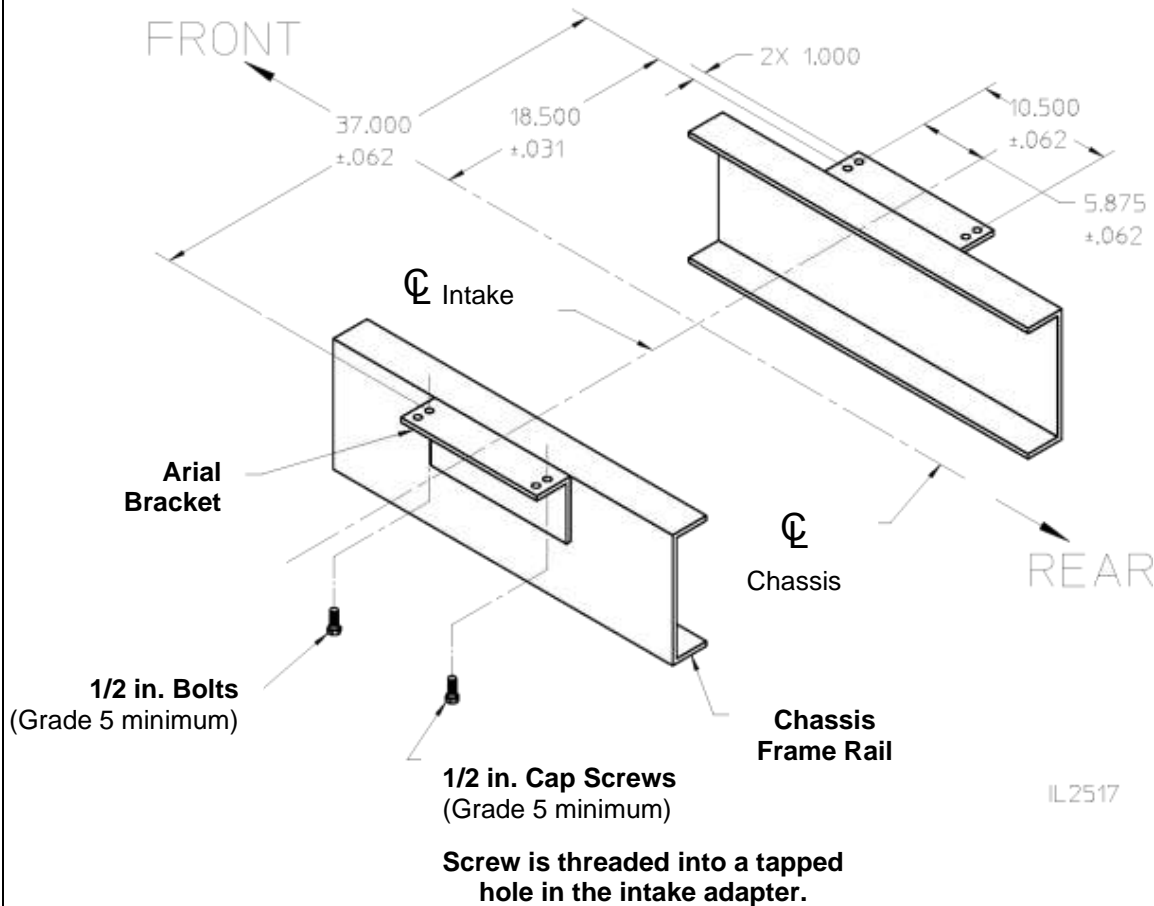
1/2 in. Bolts and Nuts

**(Grade 5 minimum)
(Two required on each side)**

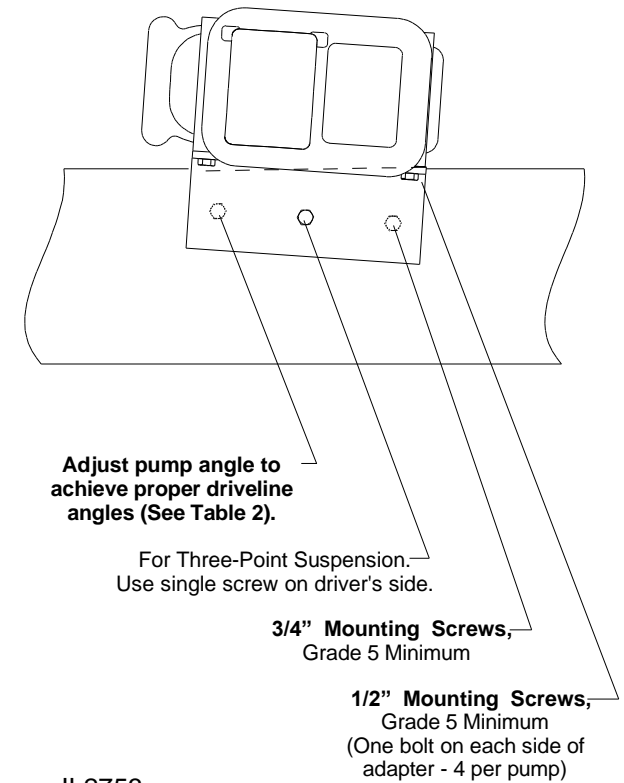
Bolts must be of sufficient length to pass through angle bracket and intake adapter flange.

Bronze Pump Mounting - Mounting Pump on Chassis Frame Rails (Continued)

Pump Mounting Holes in Angle Brackets: Rear Intake Adapter Hole Pattern



Angle Bracket Mounting on Frame Rails



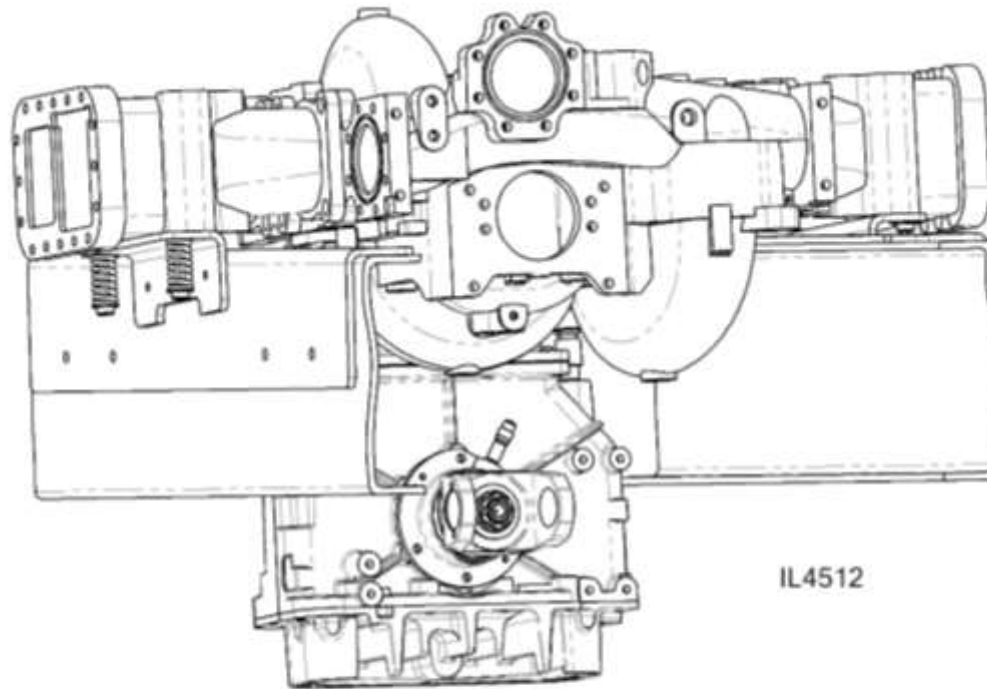
Left Side Shown. Dimensions also apply if rear intake adapter is mounted on the right side.

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 1/2 in. (Grade 5 minimum) bolts with hex nuts and cap screws.
2. Provide a method to restrain the bolts (lock washers and / or thread-locking compound).
3. Tighten hardware to standard torque specifications for 1/2 in. bolts and cap screws.

Optional Die Spring Mounting



IL4512

Shoulder Bolt and Die Spring Mount Option

1. Pumps can be mounted with a shoulder bolt and die spring configuration.
 - a. The maximum truck frame twist must not exceed the die spring travel.

The configuration shown allows for approximately 2 degrees of frame twist.
 - b. The use of a sub-frame is recommended to minimize the amount of frame twist.
 - c. The spring configuration should be used on the passenger/curb side.

Installation of Transfer Valve Actuator - CM Series Pumps Only

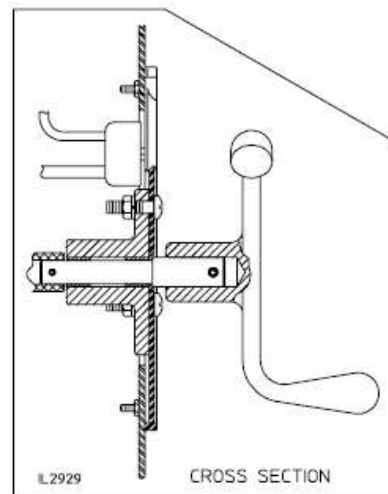
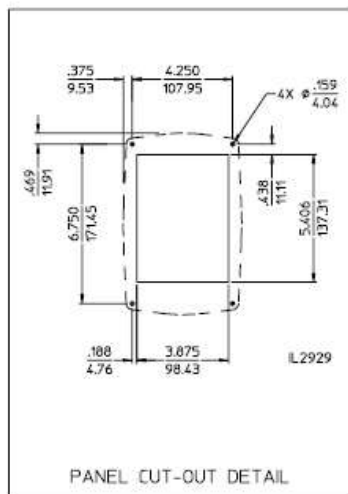
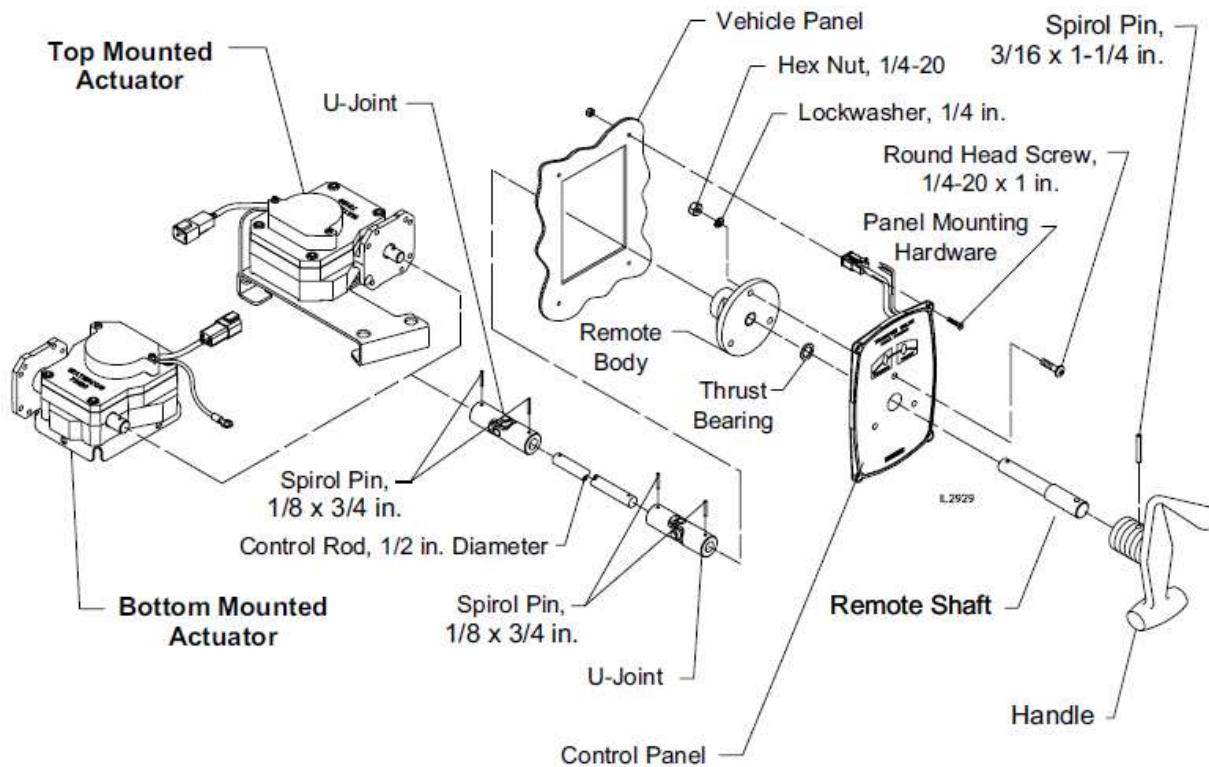
Manual Actuator – Control Panel Installation

Installation Steps:

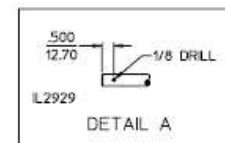
1. Install the Remote Body on the Control Panel with the four (4) 1/4-20 x 1 in. screws, lockwashers and nuts provided.
2. Install Control Panel/Remote Body:
 - a. Make a cut-out in the vehicle panel per the "Panel Cut-out Detail" and deburr all holes and openings.
 - b. Install Control Panel/Remote Body Assembly on the vehicle panel with the four (4) screws and nuts provided.
3. Install Handle:
 - a. Slide Thrust Bearing on Remote Shaft.
 - b. Install Remote Shaft in Control Panel Hole and through the Remote Body.
 - c. Install the Handle on the Remote Shaft using spirol pin furnished.
4. Install Control Rod Between Control Panel and Actuators
 - a. Determine length of 1/2 in. diameter Control Rod and cut to length. Drill one 1/8 in. hole in each end per Detail A. (NOTE: Control Rod is optional from Waterous, if not ordered, OEM must furnish).
 - b. Install Universal Joint on Remote Shaft and Control Rod using the spirol pins furnished.
5. **NOTE: Universal Joint on Actuator must be installed as follows for proper operation of Control Panel Lights**

Top Mounted Actuator: Connect to Actuator Shaft on the flange side.

Bottom Mounted Actuator: Connect to Actuator Shaft opposite the flange side.
6. See the next page.



ALL DIMENSIONS SHOWN AS INCH/MILLIMETER
(INCH / MILLIMETER)



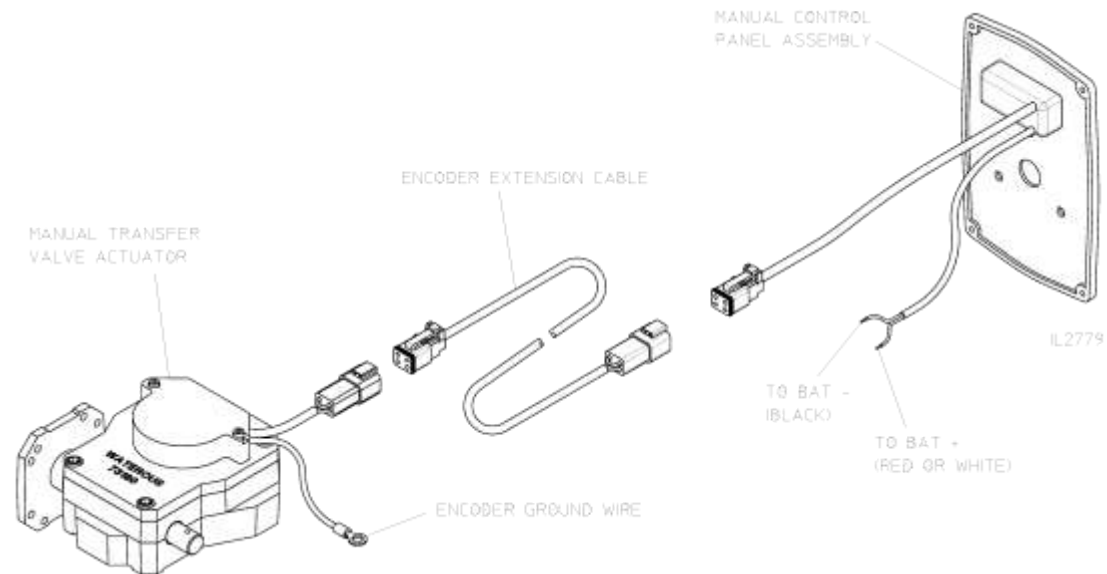
Installation of Transfer Valve Actuator - CM Series Pumps Only (Continued)

Manual Actuator - Electrical Connections and Wiring Schematic

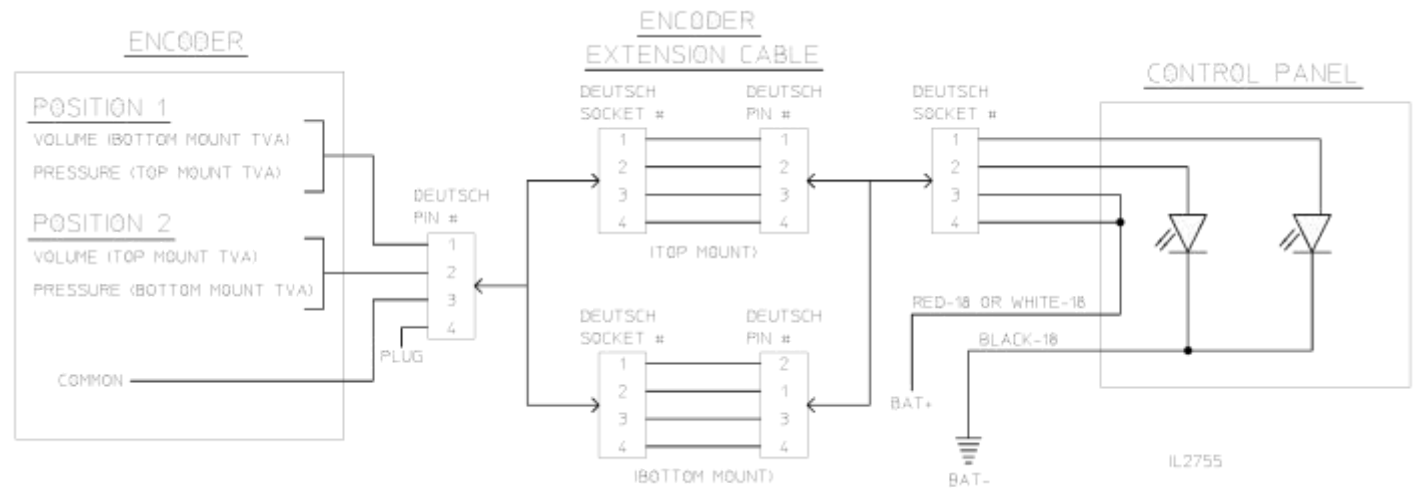
Installation Steps Continued:

6.. Complete Electrical Connections (Use 18 GA Wire):

- a. Connect cables between panel and actuator per diagram.
- b. Make power and ground connections to the Control Panel LED Module.



Wiring Schematic

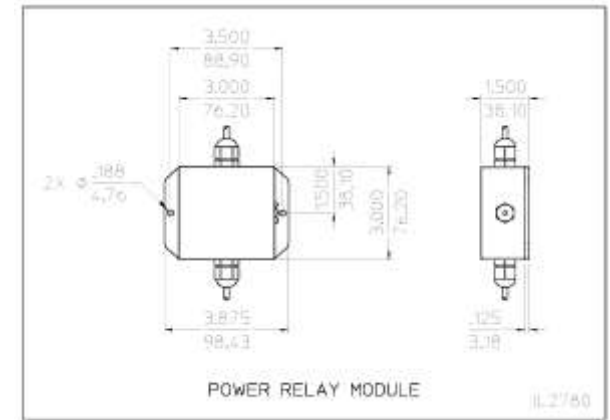
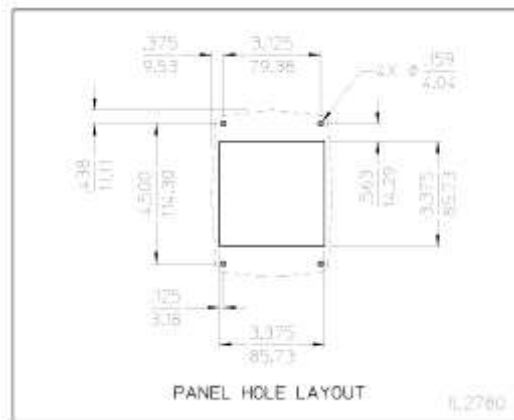
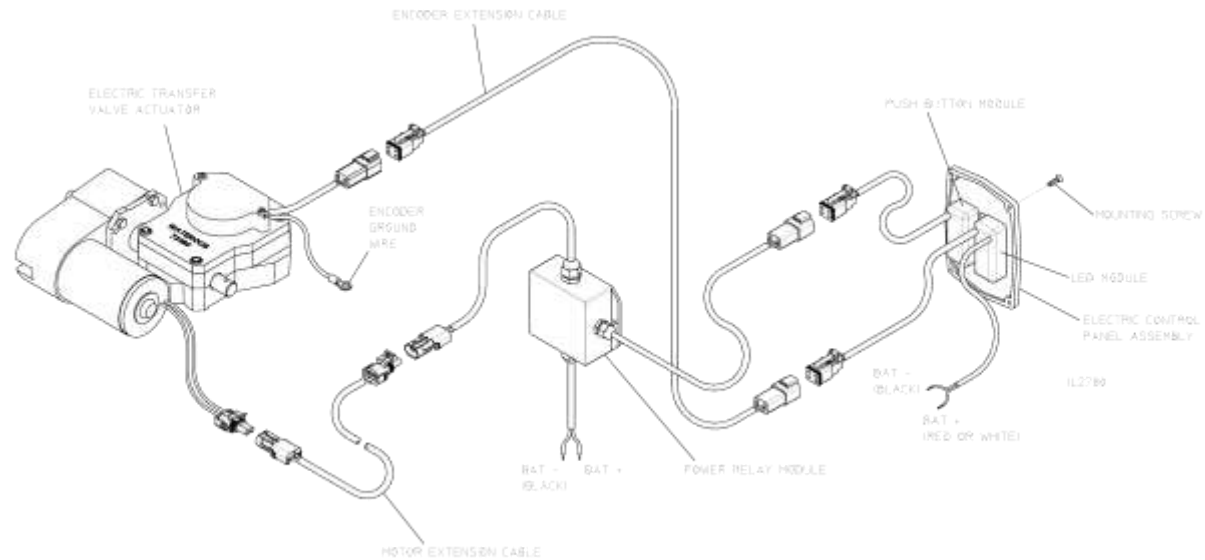


Installation of Transfer Valve Actuator - CM Series Pumps Only (Continued)

Electric Actuator - Control Panel and Relay Installation

Installation Steps:

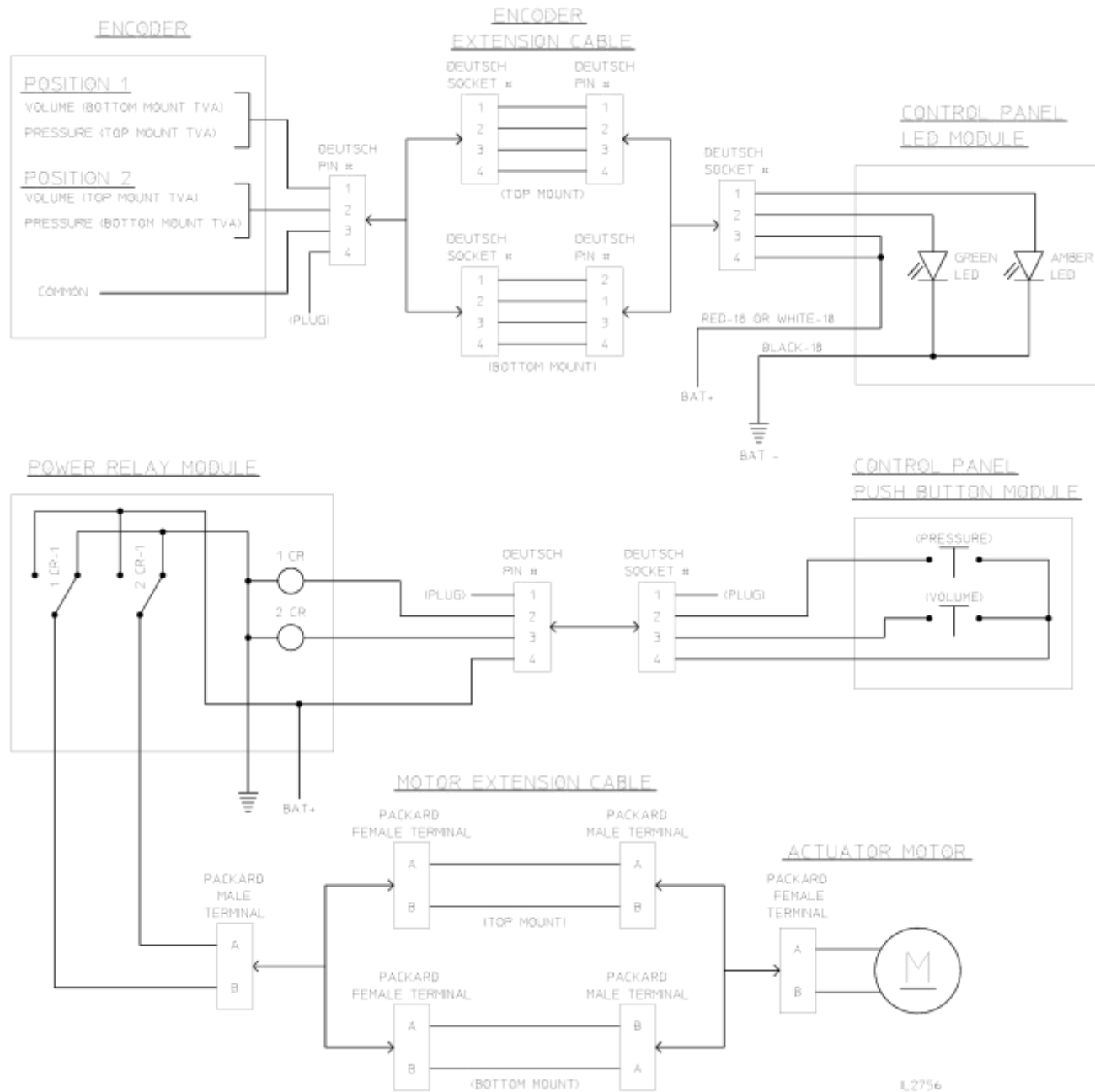
1. Install Control Panel:
 - a. Make a cut-out in the vehicle panel per the "Panel Cut-out Detail" and deburr all holes and openings.
 - b. Install Control Panel with the four (4) screws and nuts provided.
2. Install the Power Relay Module on the vehicle. See Power Relay Module detail for dimensions. Note that Waterous does not furnish mounting hardware, use two (2) 1/8 in. screws.
3. Complete Electric Connections (*See the next page for Wiring Schematic*):
 - a. Connect cables between panel, actuator and relay per diagram.
 - b. Make power and ground connections to the Control Panel LED Module and Power Relay Module. Use 18 GA wire.
4. Optional Manual Override: If a manual override was ordered, install per instruction I-1743 furnished with the Manual Override Loose Parts Kit.



(INCH)
(MILLIMETER)

Installation of Transfer Valve Actuator - CM Series Pumps Only (Continued)

Electric Actuator - Wiring Schematic



Electronic Tachometer Drive

(Optional on C20 Series, Standard on PA Series)

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 Waterous.

C20 Series Transmissions:

To verify the rotational speed of the drive shaft, the frequency (Hz) reading from the tachometer sensor should be multiplied by 10.

$$\text{Hz} \times 10 = \text{RPM}$$

PA Series Transmissions:

To verify the rotational speed of the drive shaft, the frequency (Hz) reading from the tachometer sensor should be multiplied by 6.

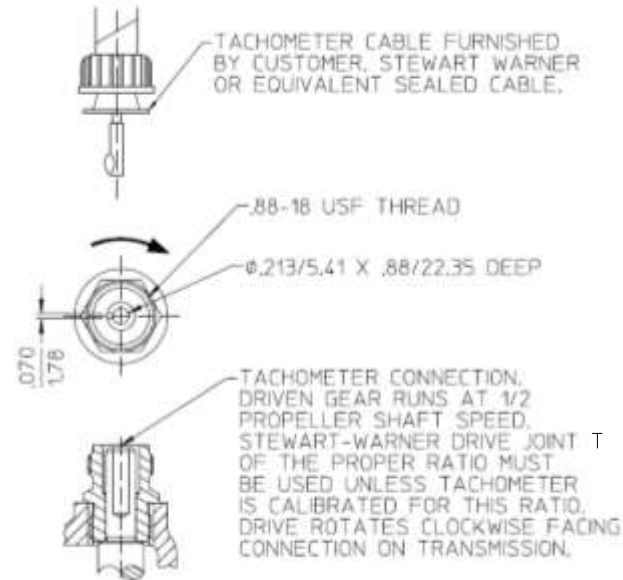
$$\text{Hz} \times 6 = \text{RPM}$$

NOTE: Frequency reading can be measured with hand held multimeter. Cable connector assembly Part No. V 3398 is available from Waterous for connecting panel mounted receptacle to multimeter.

Optional Mechanical Tachometer Drive

(K Transmissions Only)

Install a cable from the tachometer take-off on the driveshaft (front housing of the transmission).

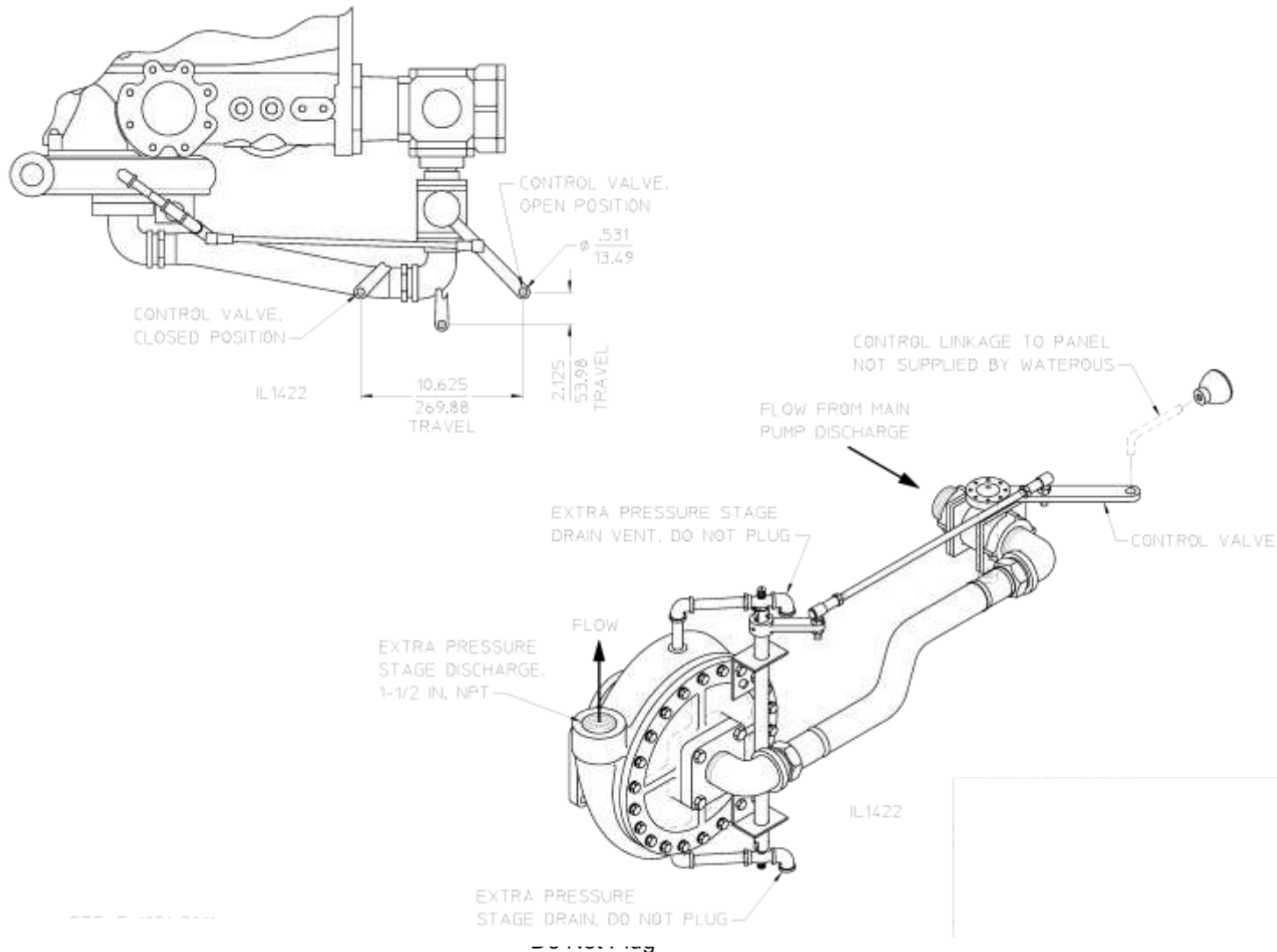


from DPL82074

Extra Pressure Stage - CMH and CSH Series Pumps Only

Discharge Piping and Control Rod Installation

1. Connect discharge piping to 1-1/2 in. NPT tap in extra pressure stage volute body.
2. Fabricate and install control linkage to control valve. Use 1/2 in. diameter rod (not furnished by Waterous).
Note that connections must accommodate the travel arc of the control valve arm as it moves from OPEN to CLOSED.
 - a. Control Valve End: Use a suitable ball joint or 90 degree bend with retaining ring.
 - b. Vehicle Panel End: Waterous does not furnish a panel plate but does furnish a knob (3/8-16 UNC-2 Thread).

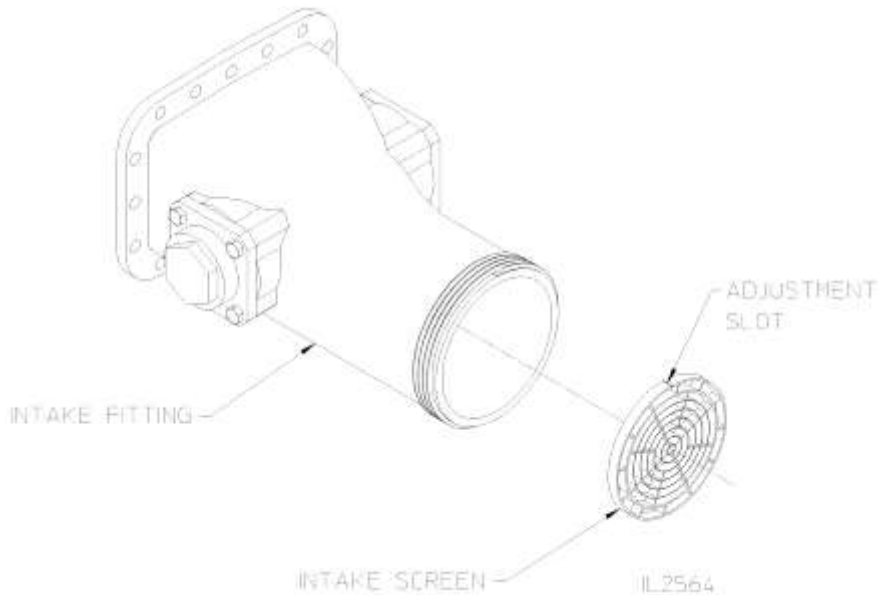


Optional Corrosion Protection

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.

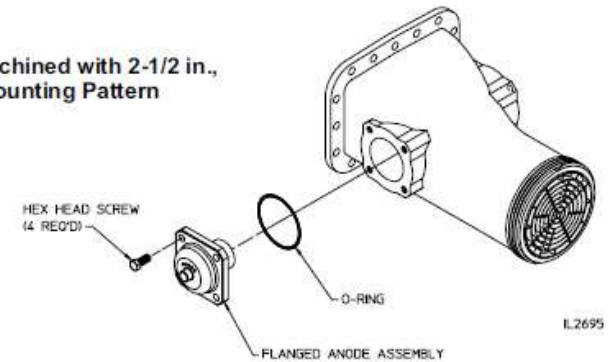
Anodes are available for the following:

Pads machined with 2-1/2 in., 4-bolt mounting patterns

Pads machined with 2-1/2 in. or 3 in. NPT taps.

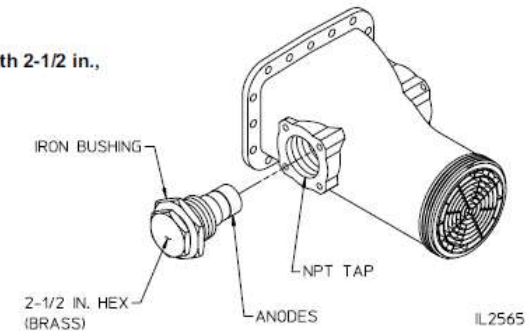
Anodes - Bolt On

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



Final Checks

After the pump, accessories, piping and miscellaneous connections are completely installed, check the items listed on Pages 24 through 25.

Lubrication	Testing
<p>Fire Pump Outboard Bearing</p> <p>The outboard bearing is located at the end of the pump opposite the drive end of pump.</p> <p>CMD/CMUD and CSD/CSUD Models Only</p> <p>Add a good quality, medium consistency, ball bearing grease through the lubrication fitting until it comes out of the relief fitting. Add grease after every 100 hours of pump operation, or every six months, whichever comes first.</p> <p>On All Other Models</p> <p>The outboard bearing is sealed and no lubrication is required.</p> <p>C20 Series Transmission</p> <p>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>K Series Transmission</p> <p>Add any type of SAE 80W-90 gear oil through the fluid level hole or by removing the breather. Approximately 1 quart is required to fill the transmission when completely drained. The fluid should be level with bottom of the fluid level hole.</p> <p>PA Series Transmission</p> <p>Add any type of automatic transmission fluid (ATF) through the fluid level hole or by removing the breather. Approximately 1 quart is required to fill the transmission when completely drained. The fluid should be level with bottom of the fluid level hole.</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. Although the equipment was thoroughly tested at Waterous, the pump packing (if equipped) may have dried up or loosened during transportation or storage. See the instructions on Page 26 for adjusting the pump packing.</p>
	<p>C20 Transmission Temperature Specifications</p>
	<p>The maximum temperature permitted at transmission external surfaces is 250° F (121° C)</p>
<p>NOTICE</p>	
<p>Failure to properly lubricate the pump and transmission may result in serious damage to the equipment.</p>	

Final Checks (Continued)

Packing Adjustment (If equipped)

The pump packing is designed and adjusted to drip slightly during operation. This is to cool and lubricate the packing. It is desirable to adjust the stuffing box to maintain a leakage rate of 10 to 120 drops per minute when operating at a discharge pressure of 150 psi (10.3 bar).

Leakage through the braided flexible graphite (BFG) packing may be at zero or diminish to zero leakage and may not respond to loosening of the packing nuts to restore leakage, see Adjustment Step 3. While the packing gland and stuffing box and pump body may reach high temperatures during this time, the impeller shaft will be protected from heat damage.

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.

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.

NOTICE

**Pump overheating hazard.
May cause damage to the pump.**

Circulate enough water through the pump to prevent overheating.

WARNING

**Truck movement hazard.
May cause serious personal injury.**

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

1. Engage pump per appropriate operating instructions. Operate the pump at the capacity pressure shown on the serial plate for ten (10) minutes.

NOTICE

Observe the stuffing box drip rate from the side of the truck.

2. Observe leakage. Normal leakage is 10-120 drops per minute.

WARNING

Packing Gland and Pump Body Temperature Hazard. May result in serious burns.

Heat is dissipated through the cross-section of the packing, transferring the heat to the packing gland and pump body.

3. If drip rate is considered high, stop the engine and tighten the packing gland nuts 1/2 to 1 flat (maximum of 1/6 of a revolution). Make appropriate adjustments starting with 1 flat, when approaching the final adjustment reduce to 1/2 flat. This reduces the possibility of over tightening. **Tighten the gland nuts equally to ensure that the packing gland goes on straight.** Gradually reducing leakage during the first hour of operation will result in a better seal over a longer period of time. Adjust the drip rate on one stuffing box until the appropriate rate is obtained, then proceed to the other end of the pump.

NOTICE

Stopping the leakage entirely at this point will cause the packing to overheat.

4. Operate the pump at the capacity pressure shown on the serial plate for two (2) minutes to let packing run in, then observe the drip rate.
5. Repeat steps 3 and 4 until the drop rate is acceptable.

NOTE: After adjusting the packing, the pump must pass a vacuum test (Refer to Form No. 1031, Section 1000).