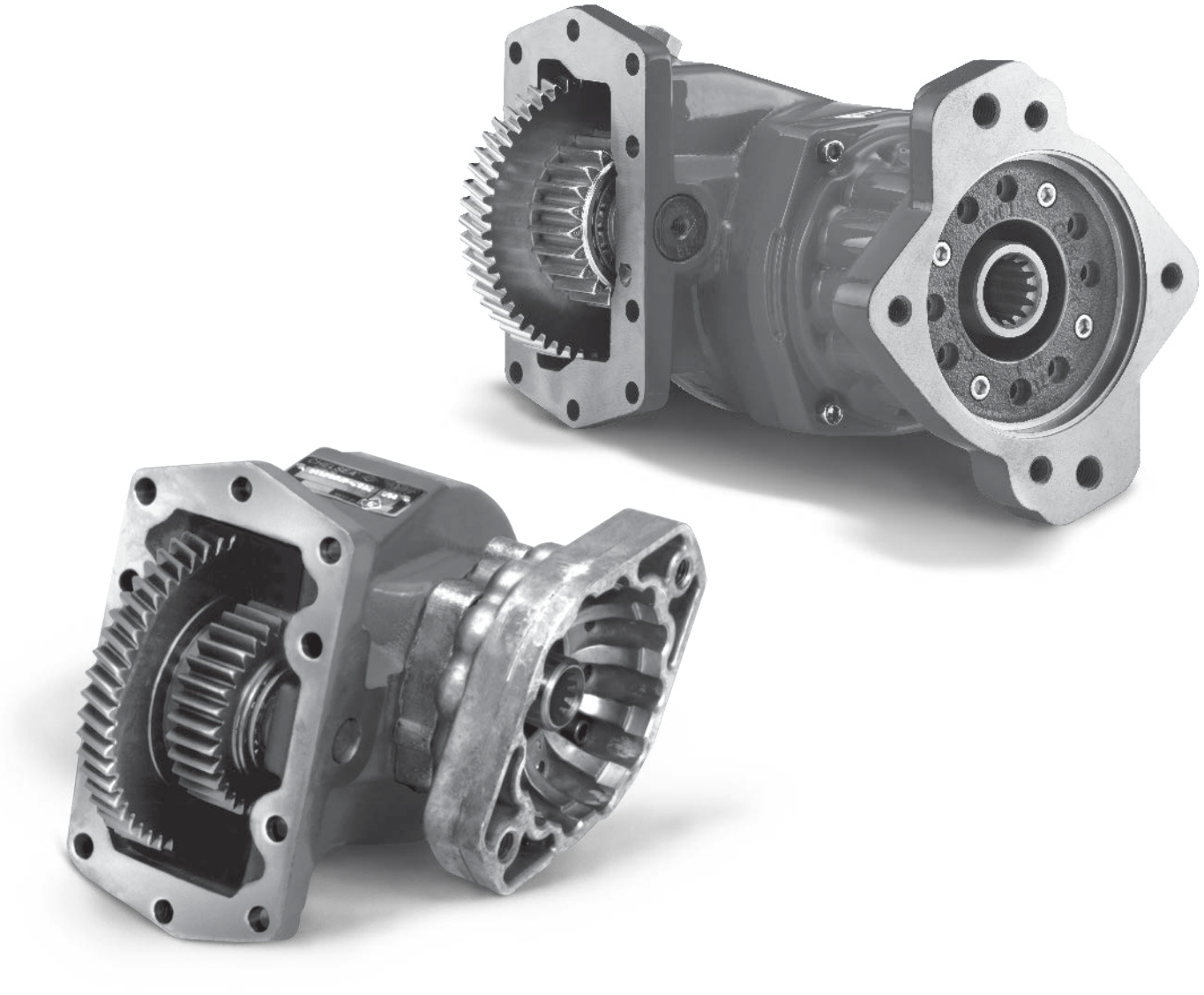
Effective: HY25-1380-M1/US March 2019
Supersedes: HY25-1380-M1/US November 2018



Power Take-Offs Owner's Manual

267, 277, 278, 280, 287, 859, 870, 877 Series

Parker Chelsea

ENGINEERING YOUR SUCCESS.

⚠ 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.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product or system options for further investigation by users having technical expertise.

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from Parker or its subsidiaries or authorized distributors.

To the extent that Parker or its subsidiaries or authorized distributors provide component or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the components or systems.

Offer of Sale

The items described in this document are hereby offered for sale by Parker Hannifin Corporation, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by the provisions stated in the “Offer of Sale”.

⚠ **WARNING:** This product can expose you to chemicals including Lead and Lead Compounds, and Di(2-ethylhexyl)phthalate (DEHP) which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov

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Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

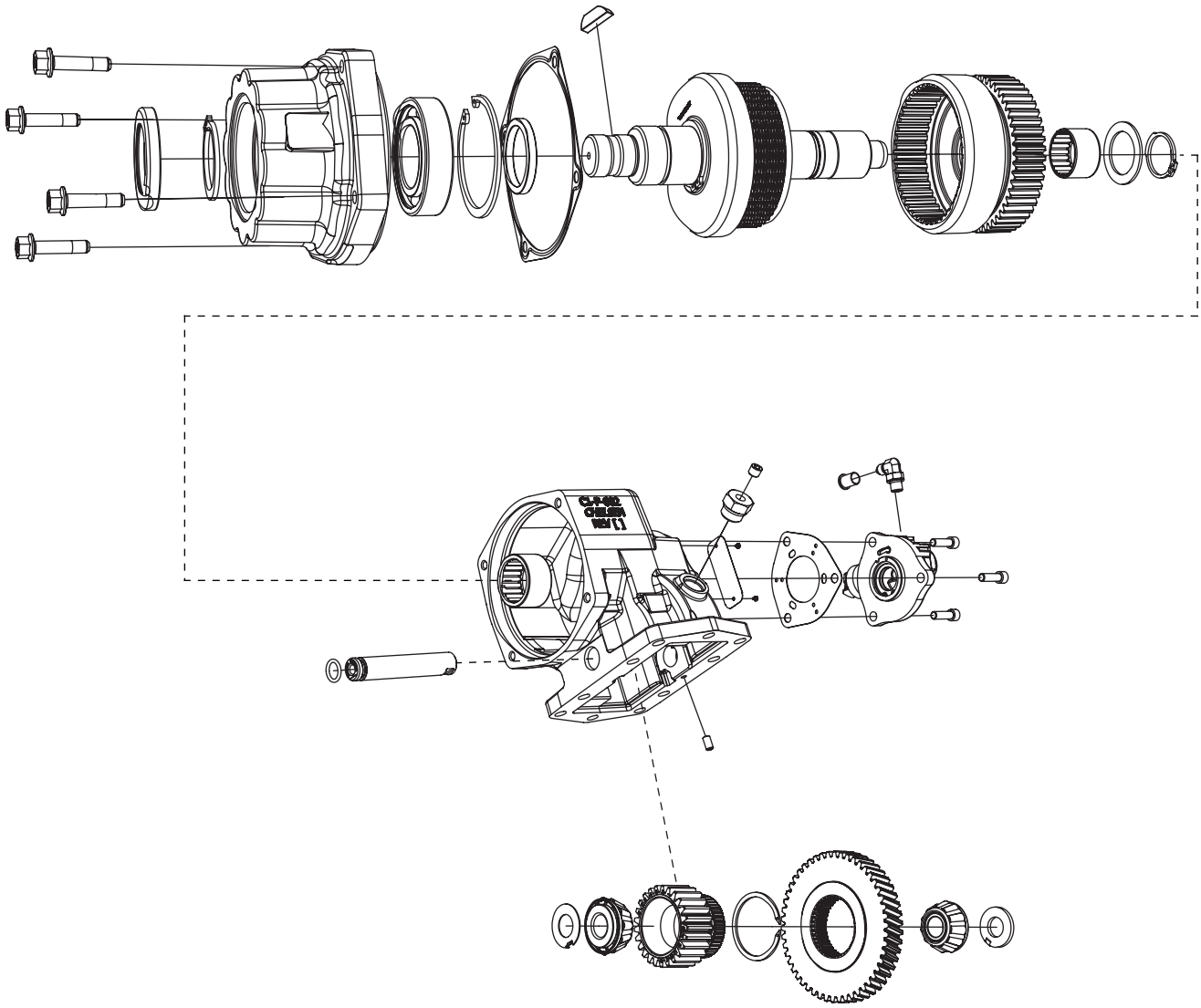
Foreword

Since our major objective is to show you how to get additional and more profitable miles from truck, tractor and trailer components, we want to provide you with information on the installation of Chelsea Power Take-Offs.

We all realize that an inadequate transmission will overwork any Power Take-Off in a very short period of time. In addition, a mismatched transmission/PTO combination can result in unsatisfactory performance of the equipment right from the start.

Before you order new trucks, be sure you're getting the right transmission/PTO combination. It is of vital importance for efficient performance to have adequate power. To help you select the proper type, size and design of PTO it is advisable to discuss your specific requirements with Chelsea PTO specialists. They know their products and have easy access to manufacturers of equipment, transmissions and Power Take-Offs. They can inform you about everything you need to know about power, at the right time, before you specify components.

Exploded View of a Typical PowerShift PTO



⚠ **This symbol warns of possible personal injury.**

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Safety Information

These instructions are intended for the safety of the installer, operator & supporting personnel. Read them carefully until you understand them.

General Safety Information

To prevent injury to yourself and/or damage to the equipment:

- Read carefully all owner's manuals, service manuals, and/or other instructions.
- Always follow proper procedures, and use proper tools and safety equipment.
- Be sure to receive proper training.
- Never work alone while under a vehicle or while repairing or maintaining equipment.
- Always use proper components in applications for which they are approved.
- Be sure to assemble components properly.
- Never use worn-out or damaged components.
- Always block any raised or moving device that may injure a person working on or under a vehicle.
- Never operate the controls of the Power Take-Off or other driven equipment from any position that could result in getting caught in the moving machinery.

Proper Matching of PTO

WARNING: A Power Take-Off must be properly matched to the vehicle transmission and to the auxiliary equipment being powered. An improperly matched Power Take-Off could cause severe damage to the vehicle transmission, the auxiliary driveshaft, and/or to the auxiliary equipment being powered. **Damaged components or equipment could malfunction causing serious personal injury to the vehicle operator or to others nearby.**

To avoid personal injury and/or equipment damage:

- Always refer to Chelsea catalogs, literature, and owner's manuals and follow Chelsea recommendations when selecting, installing, repairing, or operating a Power Take-Off.
- Never attempt to use a Power Take-Off not specifically recommended by Chelsea for the vehicle transmission.
- Always match the Power Take-Off's specified output capabilities to the requirements of the equipment to be powered.
- Never use a Power Take-Off whose range of speed could exceed the maximum.

Cold Weather Operation of PowerShift PTO

WARNING: During extreme cold weather operation [32°F (0°C) and lower], a disengaged PowerShift Power Take-Off can momentarily transmit high torque that will cause unexpected output shaft rotation. This is caused by the high viscosity of the transmission oil when it is extremely cold. As slippage occurs between the Power Take-Off clutch plates, the oil will rapidly heat up and the viscous drag will quickly decrease.

The Power Take-Off output shaft rotation could cause unexpected movement of the driven equipment resulting in serious personal injury, death, or equipment damage.

To avoid personal injury or equipment damage:

- Driven equipment must have separate controls.
- The driven equipment must be left in the disengaged position when not in operation.
- Do not operate the driven equipment until the vehicle is allowed to warm up.

Safety Information (Continued)

Rotating Auxiliary Driveshafts

WARNING: 

- Rotating auxiliary driveshafts are dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death.
- Do not go under the vehicle when the engine is running.
- Do not work on or near an exposed shaft when the engine is running.
- Shut off the engine before working on the Power Take-Off or driven equipment.
- Exposed rotating driveshafts must be guarded.

Guarding Auxiliary Driveshafts

WARNING: We strongly recommend that a Power Take-Off and a directly mounted pump be used to eliminate the auxiliary driveshaft whenever possible. If an auxiliary driveshaft is used and remains exposed after installation, it is the responsibility of the vehicle designer and PTO installer to install a guard.

Using Set Screws

WARNING: Auxiliary driveshafts may be installed with either recessed or protruding set screws. If you choose a square head set screw, you should be aware that it will protrude above the hub of the yoke and may be a point where clothes, skin, hair, hands, etc. could be snagged. A socket head set screw, which may not protrude above the hub of the yoke, does not permit the same amount of torquing as does a square head set screw. Also, a square head set screw, if used with a lock wire, will prevent loosening of the screw caused by vibration. Regardless of the choice made with respect to a set screw, an exposed rotating auxiliary driveshaft must be guarded.

Important: Safety Information and Owner's Manual

Chelsea Power Take-Offs are packaged with safety information decals, instructions, and an owner's manual. These items are located in the envelope with the PTO mounting gaskets. Also, safety information and installation instructions are packaged with some individual parts and kits. **Be sure to read the owner's manual before installing or operating the PTO** Always install the safety information decals according to the instructions provided. Place the owner's manual in the vehicle glove compartment.

WARNING: Operating the PTO with the Vehicle in Motion

Some Power Take-Offs may be operated when the vehicle is in motion. To do so, the PTO must have been properly selected to operate at highway speeds and correctly matched to the vehicle transmission and the requirements of the driven equipment.

If in doubt about the PTO specifications and capabilities, avoid operating the PTO when the vehicle is in motion. Improper application and/or operation can cause serious personal injury or premature failure of the vehicle, the driven equipment, and/or the PTO.

Always remember to disengage the PTO when the driven equipment is not in operation.

This symbol warns of possible personal injury.

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Chelsea Products Division
Olive Branch, MS 38654 USA

Chelsea PTO Safety Label Instructions

1. The two black and orange on white 5" x 7" pressure sensitive vinyl labels, part number 379274, must be placed on the vehicle frame rails (one (1) on each side), in a position that would be **HIGHLY** visible to anyone that would go under the truck near the PTO rotating shaft. If the vehicle is to be painted after these labels are installed, cover them with two (2) blank masking covers. Remove the masking covers after painting.
2. Place the one (1) black and orange on white 3.5" x 5" pressure sensitive vinyl label, part number 379275, on the visor nearest the operator of the vehicle, this must be placed near the PTO visor label.
3. Place the one (1) red and white with black lettering 3.5" x 7" pressure sensitive vinyl label, part number 379915, on the opposite side of the visor from the above label part number 379275.
4. Place the one (1) white and black heavy duty card, part number 379276, in the vehicle glove box in a position highly visible to the operator. For example, try to place this card on top of whatever may be in the glove box.

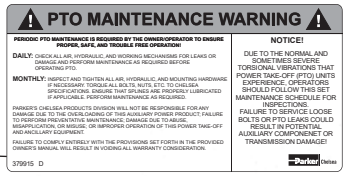
If you require labels, please order part number 328946X at no charge from your local Chelsea Warehouse or send request direct to:

Parker Hannifin Corporation
Chelsea Products Division
8225 Hacks Cross Road
Olive Branch, MS 38654
Customer Service: (662) 895-1011

Part #379276

Part #379275

Part #379915



Part #379274

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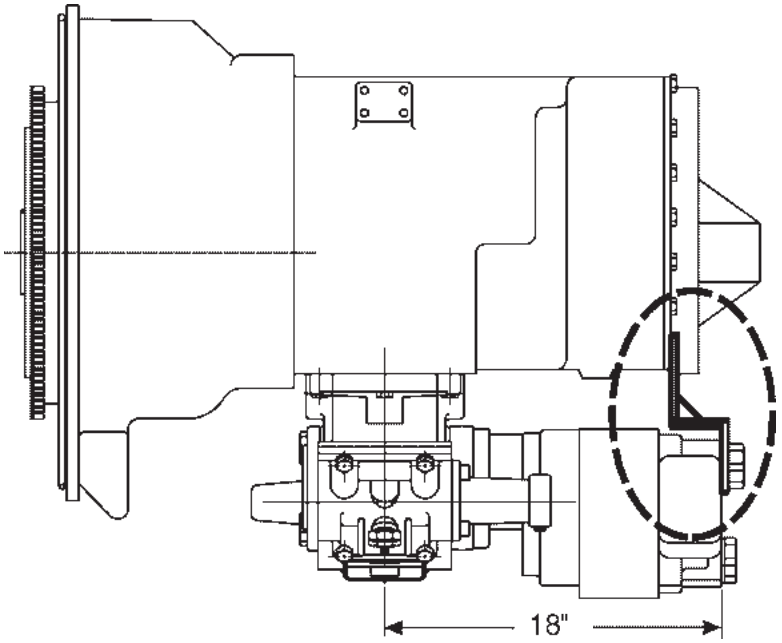
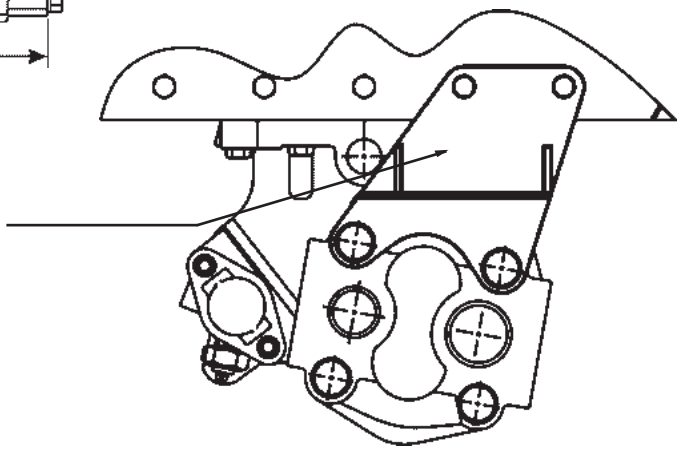
Direct Mount Pump Support Requirements (Universal)



NOTE:
For Proper Bracketing, Attach at 2 or More Transmission Bolt Locations and 2 or More Pump Locations. Contact Transmission Manufacturer for Proper Bracket Mounting Locations.



⚠ Use CAUTION to ensure the support bracket does not pre-load pump / PTO mounting. When mounting the pump, it should be fully supported by a jack until the support bracket is secured in place, then the jack can be released. This will make sure the PTO is not being stressed by the bracket.

Chelsea requires the use of pump supports (Support Brackets) in all applications to ensure the Maximum Bending Moment (MBM) of the PTO / Pump assembly is not exceeded. Exceeding the MBM can result in damage to PTO, transmission, driven equipment, and / or personnel. It is the responsibility of the installer to ensure that adequate support is implemented. All applications are unique and it is important to consider all parameters in designing a proper support bracket.

PTO warranty will be void if a pump bracket is not used when one of the following conditions are present:

1. The combined weight of pump, fittings and hose exceed 40 pounds [18.14 kg].

2. The combined length of the PTO and pump is 18 inches [45.72 cm] or more from the PTO centerline to the end of the pump.

ALSO: Remember to pack the female PTO shaft with grease before installing the pump on the PTO (reference Chelsea grease pack 379688).

⚠ This symbol warns of possible personal injury.

Function of Auxiliary Power Shafts

An auxiliary power shaft transmits torque from the power source to the driven accessory. The shaft must be capable of transmitting the maximum torque and RPM required of the accessory, plus any shock loads that develop.

An auxiliary power shaft operates through constantly relative angles between the power source and the driven accessory. Therefore, the length of the auxiliary power shaft must be capable of changing while transmitting torque. This length change, commonly called slip movement , is caused by movement of the power train due to torque reactions and chassis deflections.

Joint operating angles are very important in an auxiliary power joint application. In many cases, the longevity of a joint is dependent on the operating angles. (See chart below)

This information is limited to 1000 through 1310 series applications. For applications requiring a series larger than 1310, contact your local Chelsea distributor**.**

Determining Shaft Type

1) Solid or tubular?
   a) In applications requiring more than 1000 RPM or where the application necessitates a highly balanced auxiliary power shaft, a tubular shaft should be used.
   b) Spicer's solid shafting auxiliary power joints are designed for 1000 or less RPM intermittent service such as:
      Driving small hydraulic pumps
      Driving winches
      Driving low speed product pumps
2) Joint Series should be determined using the chart on the following page.

SPICER® UNIVERSAL JOINT OPERATING ANGLES			
Prop. Shaft RPM	**Max. Normal Operating Angle**	**Prop. Shaft RPM**	**Max. Normal Operating Angle**
3000	5° 50'	1500	11° 30'
2500	7° 00'	1000	11° 30'
2000	8° 40'	500	11° 30'
Above based on angular acceleration of 100 RAD/SEC^2			

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Spicer® Universal Joint Engineering Data

Joint Series	**1000**	**1100**	**1280**	**1310**
Torque Rating				
Automotive (Gas or Diesel Engine) lbs-ft Continuous	50	54	95	130
Tubing				
Diameter	1.750"	1.250"	2.500"	3.00"
Wall Thickness	.065"	.095"	.083"	.083'
W = Welded S = Seamless	W	S	W	W
Flange Diameter (Swing Diameter)				
Rectangular Type	3.500"	3.500"	3.875"	3.875"
Bolt Holes - Flange Yoke				
Circle	2.750"	2.750"	3.125"	3.125"
Diameter	.312"	.312"	.375"	.375"
Number	4	4	4	4
Male Pilot Dia.	2.250"	2.250"	2.375"	2.375"
Distance Across Lugs				
Snap Ring	2.188"	2.656"	3.469"	3.469"
Construction	2.188"	2.656"	3.469"	3.469"
Bearing Diameter	.938"	.938"	1.062"	1.062"

Maximum Operating Speed * By Tube Size, Solid Shaft Size, and Length *(For speed below 500 RPM or over 2500 RPM, contact your Chelsea Distributor)					
Tubing Dia. & Wall Thickness Joint & Shaft (W=Welded S=Seamless)	Max. Installed Length in Inches for Given RPM Centerline to Centerline of Joints for a Two Joint Assembly or Centerline of Joint to Centerline of Center Bearing for a Joint & Shaft RPM - Revolutions per Minute				
	500	**1000**	**1500**	**2000**	**2500**
1.750" x .065" W	117"	82"	67"	58"	52"
1.250" x .095" S	91"	64"	52"	45"	40"
2.500" x .083" W	122"	87"	70"	62"	55"
3.000" x .083" W	-	-	-	85"	76"
Solid Shaft Diameter					
.750"	60"	42"	35"	30"	27"
.812"	62"	44"	36"	31"	28"
.875"	65"	46"	37"	32"	29"
1.000"	69"	49"	40"	35"	31"
1.250"	77"	55"	45"	39"	35"

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Recommended Tools

Drivers
Although not necessary, a compact drill/impact driver can help run in bolts to reduce muscle fatigue (**Fig 1**).

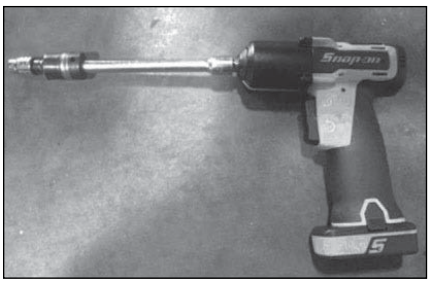


Fig. 1

Caution: Be careful not to cross-thread or damage threads with this tool. It is recommended to start bolts by hand for a few threads before using cordless driver.

Wrenches
Standard 3/8" Torque Wrench – 35-50 lbs-ft (**Fig 2**).

Fig. 2

Ratcheting Flex-Head – 10MM, 12 PT (**Fig 3**).

Fig. 3

Extension
3/8" Extension 6" Long (**Fig 4**).

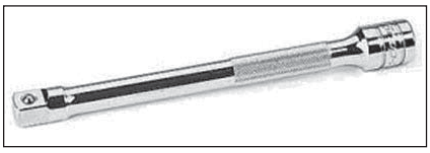


Fig. 4

Sockets
Flank Drive Swivel 3/8" Socket – 12 PT (**Fig 5**).

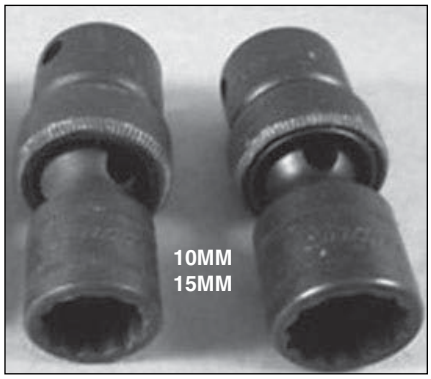


Fig. 5

Adapter
Torque Adapter – 10MM, 12 PT (**Fig 6**). Extremely necessary for difficult to reach bolts.

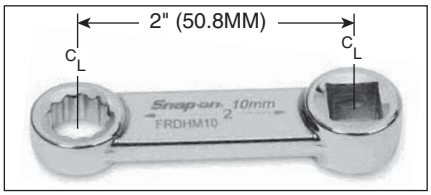
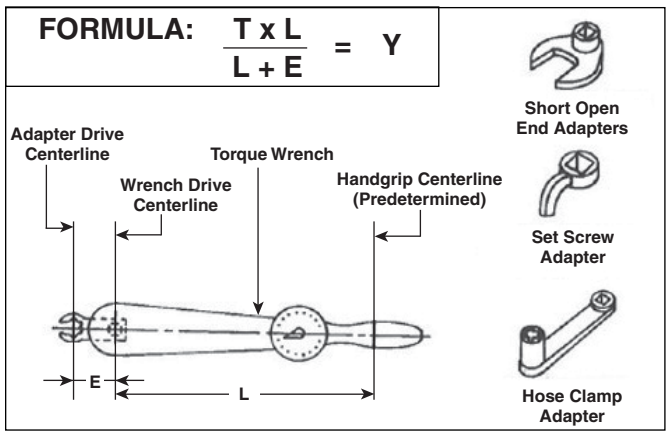


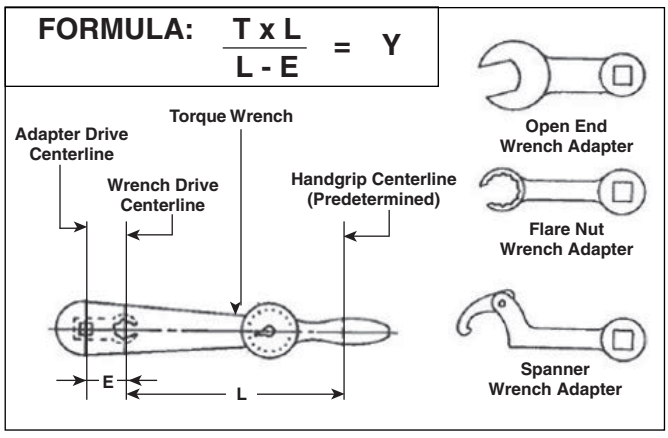
Fig. 6

Corrected Torque

When using a torque wrench adapter, which changes the distance from the torque drive to the adapter drive, apply the following formula to obtain torque rating.

T = Actual (desired) torque • **Y =** Applied (indicated) torque • **L =** Effective length lever • **E =** Effective length of extension





Example with a Plus Dimension

$$\frac{50 \text{ lbs-ft} \times 1 \text{ ft}}{1 + .167 \text{ ft}} = 42.84 \text{ lbs-ft}$$

Example with a Minus Dimension

$$\frac{50 \text{ lbs-ft} \times 1 \text{ ft}}{1 - .167 \text{ ft}} = 60.02 \text{ lbs-ft}$$

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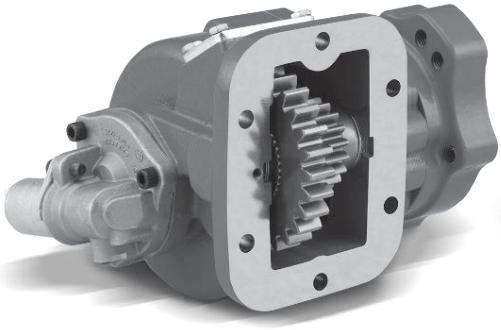
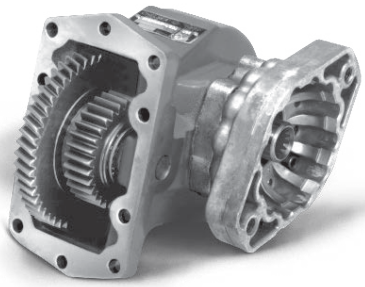
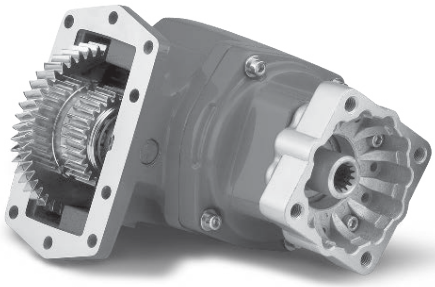
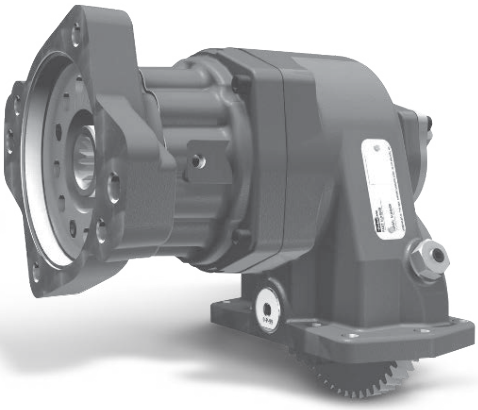
ALLISON









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Direct Mount Pump Support Requirements For Allison SG102 Bracket

With the release of Parker Hannifin's new SG102 Dump Pump, Parker Chelsea is pleased to release direct mount support brackets for use with Allison 3000 and 4000 Series families of transmissions utilizing 280 Series Power Take-Offs (PTOs).

As noted in the safety section of Chelsea's Applications Catalog, Chelsea requires the use of pump support brackets in all applications in which a) the combined weight of the pump fittings and hose exceeds 40 pounds (18.14 kg) or b) the combined length of the PTO and pump is 18" (45.72 cm) or more from the PTO centerline to the end of the pump. These requirements are to ensure the Maximum Bending Moment (MBM) of the PTO+pump is not exceeded, potentially causing damage to the PTO, transmission, driven equipment and/or personnel.

Transmission Series	Transmission Mounting Location	Bracket Kit Part Number	Component	Description	QTY
3000 Series	Left Side	329972-1X	50-P-171	Bracket	1
			379433-5	Capscrews	2
4000 Series	Left Side and Right-Top	329972-2X	50-P-175	Bracket	1
			379433-5	Capscrews	2

Mounting Rotatable (RK) Flange to 280 Series PTO

1. For proper pump orientation with pump support brackets, use holes on the output of the PTO. (**Fig. 7**).
2. For proper pump orientation with pump support brackets, please note the angle of RK output pump flange. (**Fig. 8**).
3. Torque capscrews mounting flange to PTO to 24-28 lbs-ft [32-38 Nm].

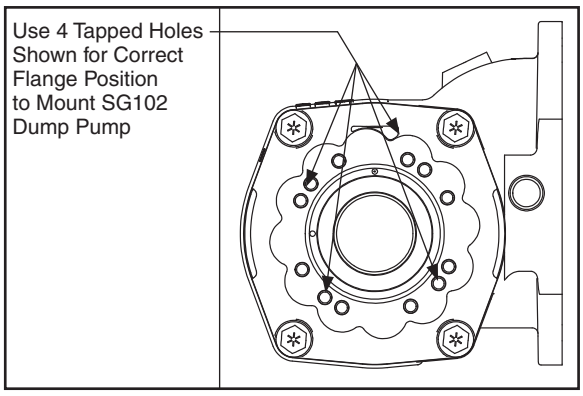
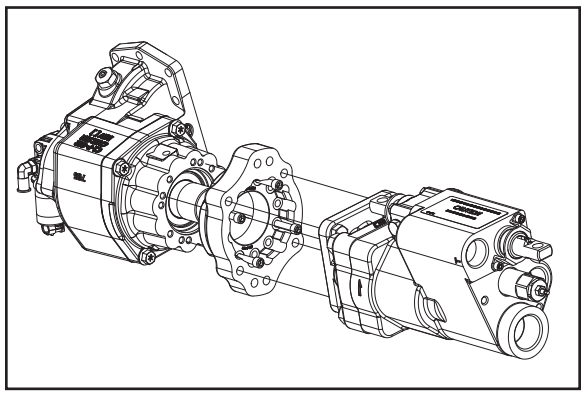


Fig. 7



280 PTO RK Flange Installed

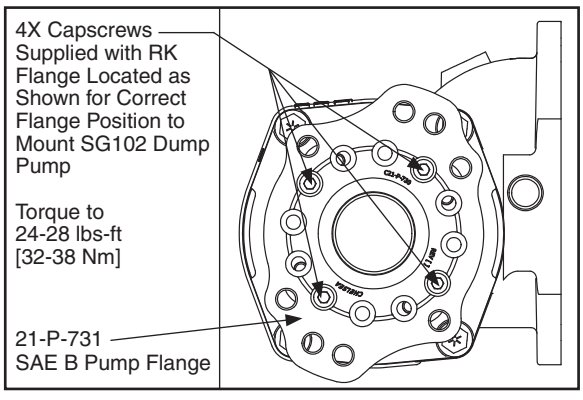


Fig. 8

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Direct Mount Pump Support Requirements For Allison SG102 Bracket (Continued)

Allison 3000 Series Installation

1. Install 280 Series PTO and SG102 pump to the transmission in the PTO aperture. Support pump when brackets are not installed.

2. Install bracket to transmission using the existing transmission bolts in approved locations (**Fig. 9**). Slightly tighten, but do not fully torque to allow alignment of all mounting holes.

2. Install bracket capscrews into back of SG102 and torque to spec of 30-35 lbs-ft [47-54 Nm].

3. Torque transmission bolts locations to spec 66-81 lbs-ft [90-110 Nm].

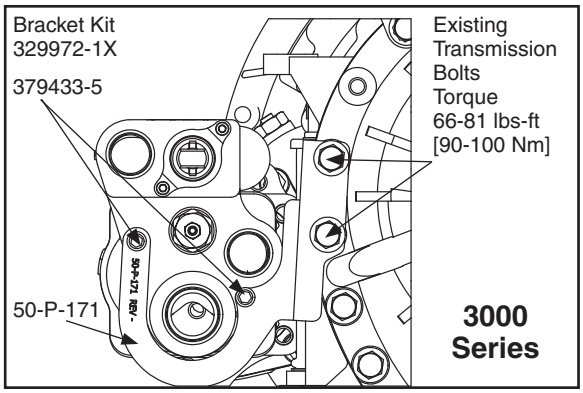

Fig. 9

Allison 4000 Series Installation

1. Install 280 Series PTO and SG102 pump to the transmission in the PTO aperture. Support pump when brackets are not installed.

2. Install bracket to transmission using the existing transmission bolts in approved locations (**Fig. 10**) and (**Fig. 11**). Slightly tighten, but do not fully torque to allow alignment of all mounting holes.

2. Install bracket capscrews into back of SG102 and torque to spec of 30-35 lbs-ft [47-54 Nm].

3. Torque transmission bolts locations to spec 74-89 lbs-ft [100-120 Nm].

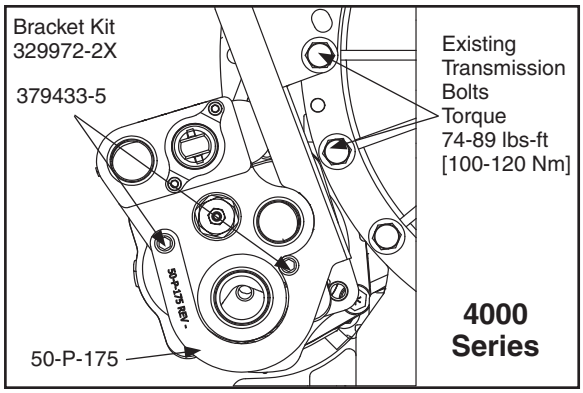

Fig. 10

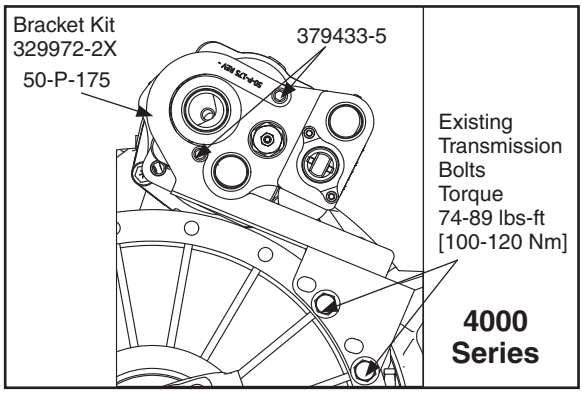

Fig. 11

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Pre Installation of PTO

1. Install PTO pressure switch, part #379502, into port on Hydraulic Valve Cap. Torque between 120-140 In-lbs [14-16 Nm] (**Fig 12**).

2. If unit has a wetspline output option, install tee fitting (379627) into output bearing cap (**Fig 13**).

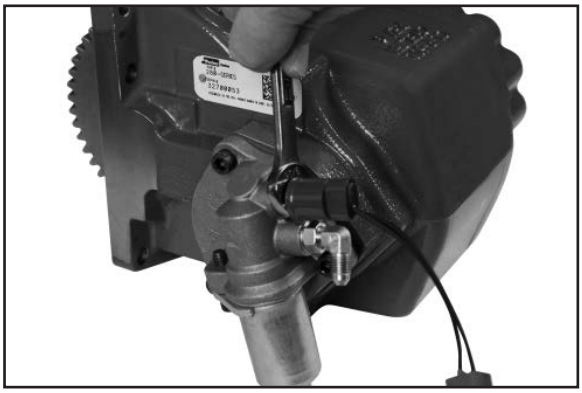
Fig. 12


Fig. 13

PTO Installation

When installing a PTO, always wear protective clothing and safety glasses.

1. Begin by draining the oil from the transmission. Use caution, since the oil may be hot (**Fig. 14**).

NOTE: Installation shown is for Left Side (Street Side) of transmission.

2. Remove the PTO aperture plate with a 15mm socket (**Fig. 15**).

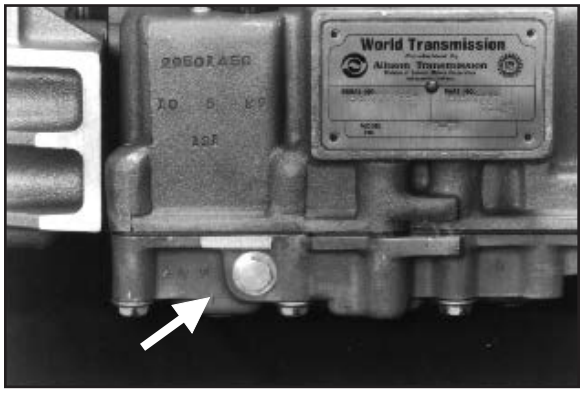

Fig. 14

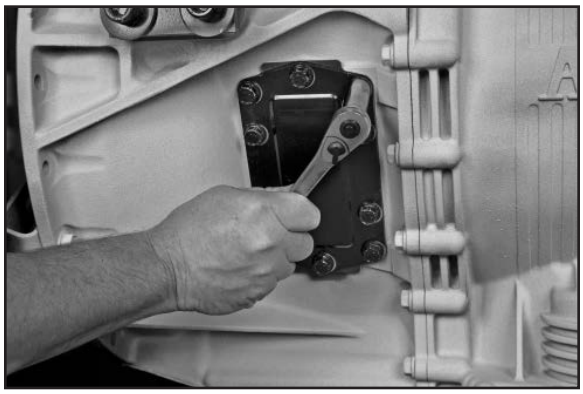
Fig. 15

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PTO Installation (Continued)

3. Remove the gasket and clean the aperture surface (**Fig. 16**).

NOTE: Do not reuse the gasket that comes with the transmission.

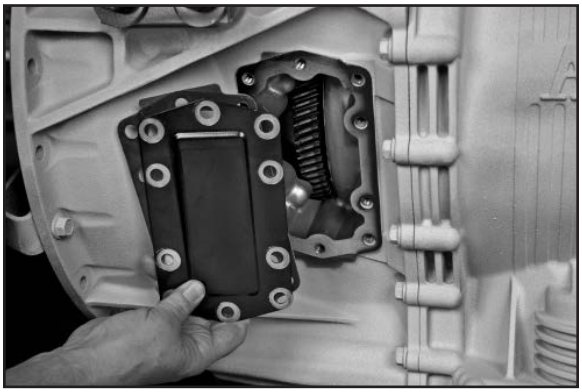
Fig. 16

4. Using a screwdriver, install the guide pins until they bottom out (**Fig. 17**).

NOTE: See page 37 for dowel pin locations.

NOTE: Do not use sealing compounds because they are generally incompatible with automatic transmission fluid.

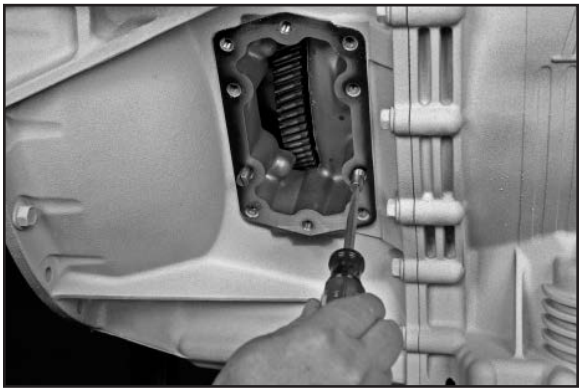
Fig. 17

5. Install the special gasket over the guide pins. The ribbed surface should face outward, toward the installer (**Fig. 18**).

NOTE: To ensure proper backlash and sealing of PTO to transmission, only use gasket furnished with the PTO.


Fig. 18

6. Position the PTO and secure it with the top capscrew (**Fig. 19**).

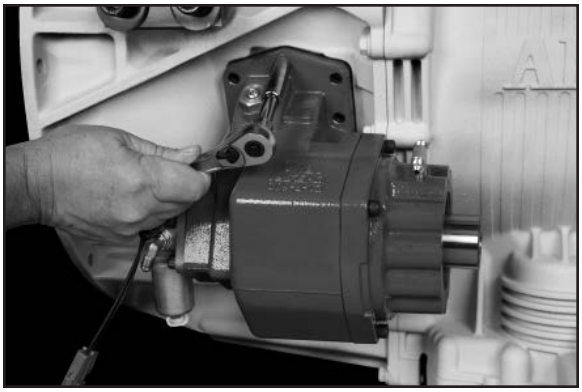
Fig. 19

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PTO Installation (Continued)

7. Install the remaining capscrews. Torque all to 40-50 lbs-ft [54-68 Nm] (**Fig. 20**).

NOTE: Always use a crossing pattern with tightening capscrews.

A list of recommended tools can be found on: www.phtruck.com/Chelsea/Catalogs/Recommended Tools

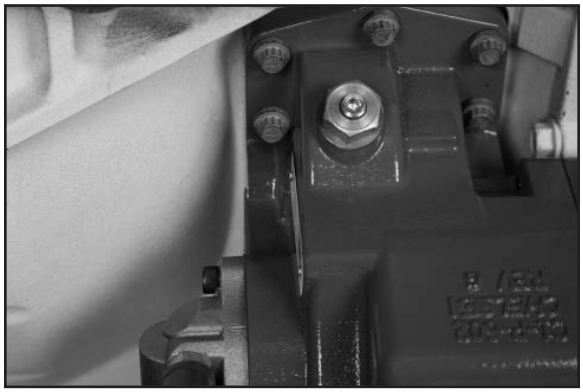

Fig. 20

8. If installing a wet spline output, attach hose to tee fitting on output flange. If Non-Wet Spline Option, attach hose to fitting at PTO valve (**Fig. 21**).

Fig. 21

9. Remove the Transmission High Pressure port plug and securely install the 90° elbow fitting (379486) supplied with the PTO (**Fig. 22**). See page 16 for pressure port locations on Allison transmissions.

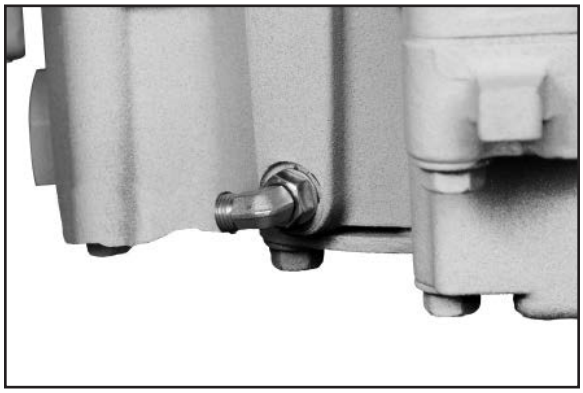

Fig. 22 (Left side shown)

10. Wet Spline Option - Connect the pressure hose between the tee fitting on the output bearing cap and high pressure port on the transmission. Non-Wet Spline Option - Attach hose between PTO valve fitting and High Pressure Port on the transmission (**Fig. 23**).

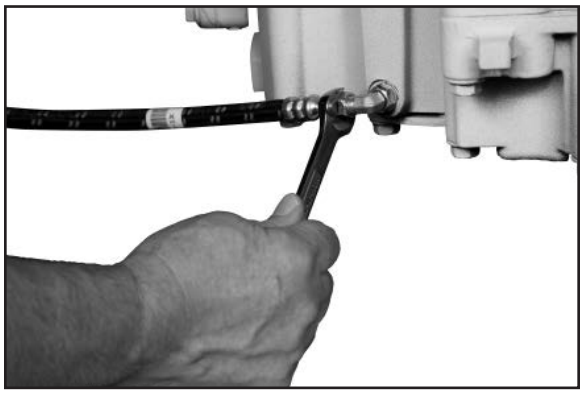

Fig. 23

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PTO Installation (Continued)

11. After determining the position of the rotatable flange/pump, install the flange with the gasket and capscrews supplied with the PTO (**Fig. 24**).

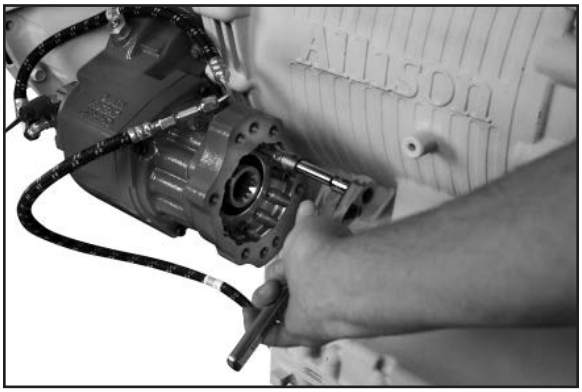


Fig. 24

Installing Rotatable Flanges
The rotatable flange is shipped loose with the PTO units for ease of installation. After determining the flange position, attach the flange to the PTO bearing cap using the capscrews provided in the bag kit. After installing the capscrews make sure to torque the screws to 24-28 lbs-ft [33-39 Nm]. Consideration should be taken on the size and weight of the pump being installed. (see page 5)

CAUTION: If not installing direct mount pump at this time, install gasket, cover plate, and bolts to Wet Spline Output Option to prevent transmission fluid from leaking out of PTO flange if truck engine is turned "ON" (**Fig. 25**).

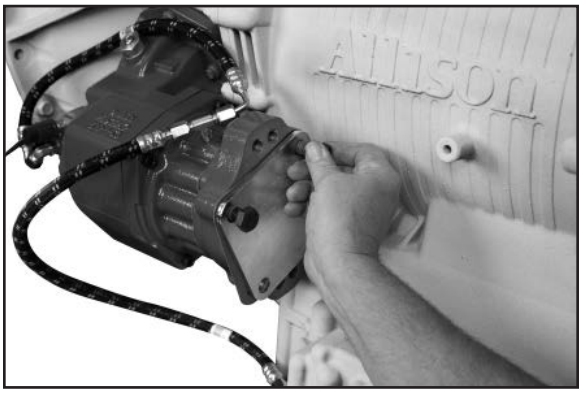


Fig. 25

NOTE: Also see pages 31-36 for Wet Spline information.

12. Complete the assembly by installing the electrical connection to the valve assembly (**Fig. 26**) and the pressure switch (379502) (**Fig. 27**). Not available for the 287 Series Installations.

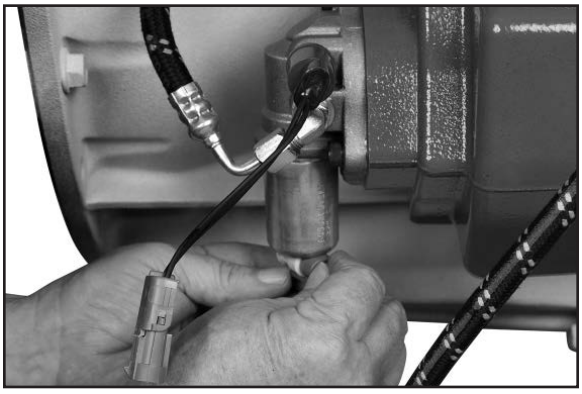


Fig. 26

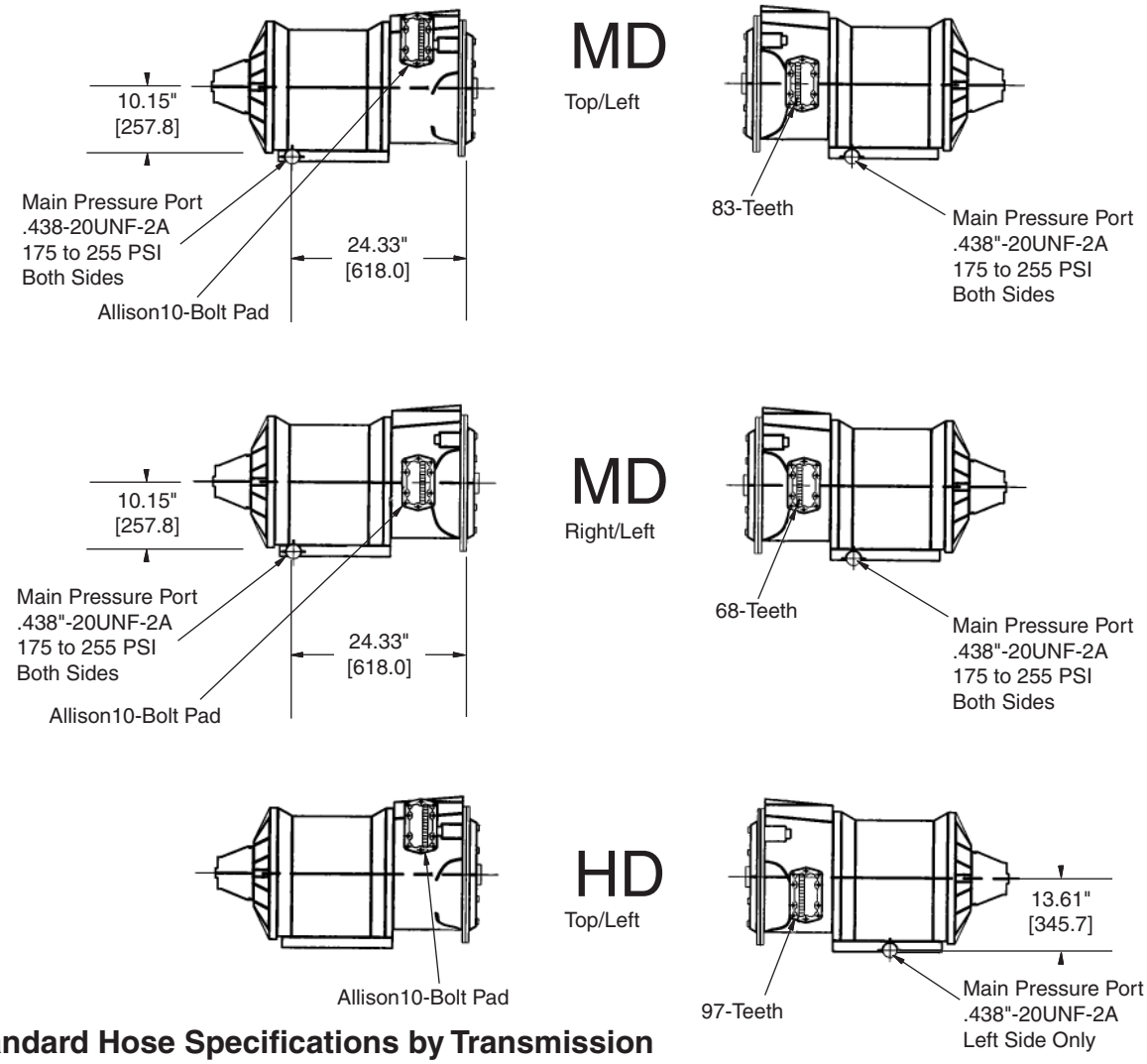
13. Reference SK-Drawings in this book for complete installation information.

NOTE: After installation is complete, refill transmission with oil as per manufacturer recommendation. Run PTO for approximately 5-10 minutes. Check for any unusual noise or vibration. Also check for leaks and/or loose fittings or fasteners. Disengage PTO and shut vehicle engine off. Repair any discrepancies found.


Fig. 27

Pressure Port and Aperture Opening Identification

These drawings represent left and right views of the MD and HD pressure ports on the transmission.



Standard Hose Specifications by Transmission

TRANS.	LUBE OPTION	LOCATION	267 Series	277/278 Series	859 Series	280/287, 870/877 Series
MD	P	Top Right (Right Press. Port)	329130-6X	329130-2X	329075-2X	329141-1X
MD	P	LH Side (Left Press. Port)	329130-1X	329130-5X	329130-5X	329141-1X
MD	P	RH Side (Right Press. Port)	329130-4X	329075-1X	329075-1X	329141-1X
HD	P	Top Right (Left Press. Port)	329130-6X	329075-2X	329075-2X	329141-1X
HD	P	LH Side (Left Press. Port)	329130-1X	329130-4X	329130-4X	329141-1X
HD[1, 2]	R , S	LH Side (Left Press. Port)	–	329130-5X	329130-5X	329141-1X
HD[1, 2]	R , S	Top Right (Left Press. Port)	–	329130-4X	329075-4X	329141-1X
MD[1, 2]	R , S	LH Side (Left Press. Port)	–	329130-5X	329130-5X	329141-1X
MD[1, 2]	R , S	RH Side (Right Press. Port)	–	329075-1X	329075-1X	329141-1X

An HD with 2 PTOs requires a 379556 T fitting and a 379703 swivel nut 90 degree elbow to attach 2 hoses to the single port on the left side.

1 Lubrication Option R , S shifter Options G and H for 277 and 870 Series

2 Lubrication Option R , S for 278 Series

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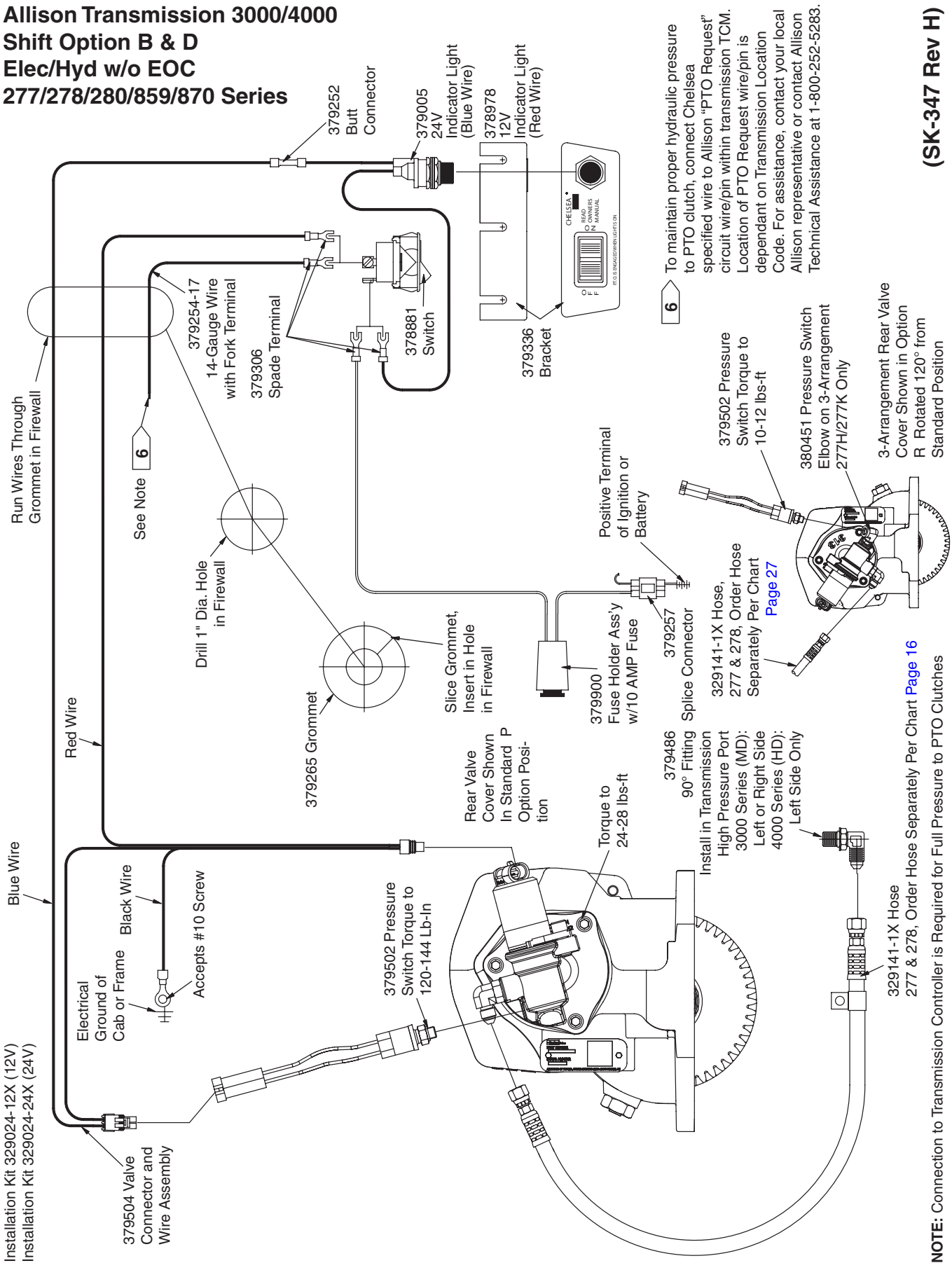
Allison Transmission 3000/4000 Shift Option B & D Elec/Hyd w/o EOC 277/278/280/859/870 Series



NOTE: Connection to Transmission Controller is Required for Full Pressure to PTO Clutches

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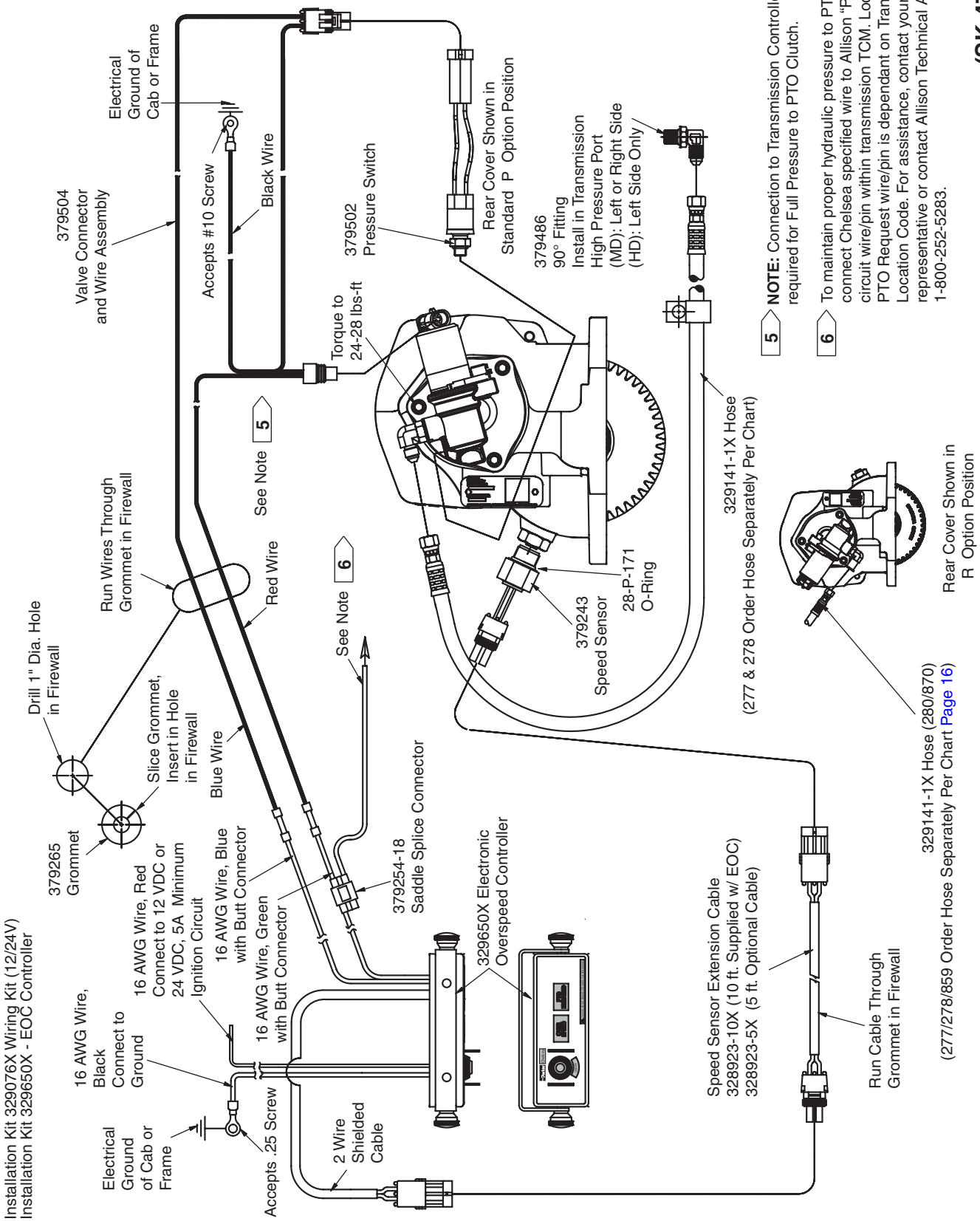
Allison Transmission 3000/4000
Shift Option K & L
Elec/Hyd w/ EOC
277/278/280/859/870 Series

(SK-472 Rev D)



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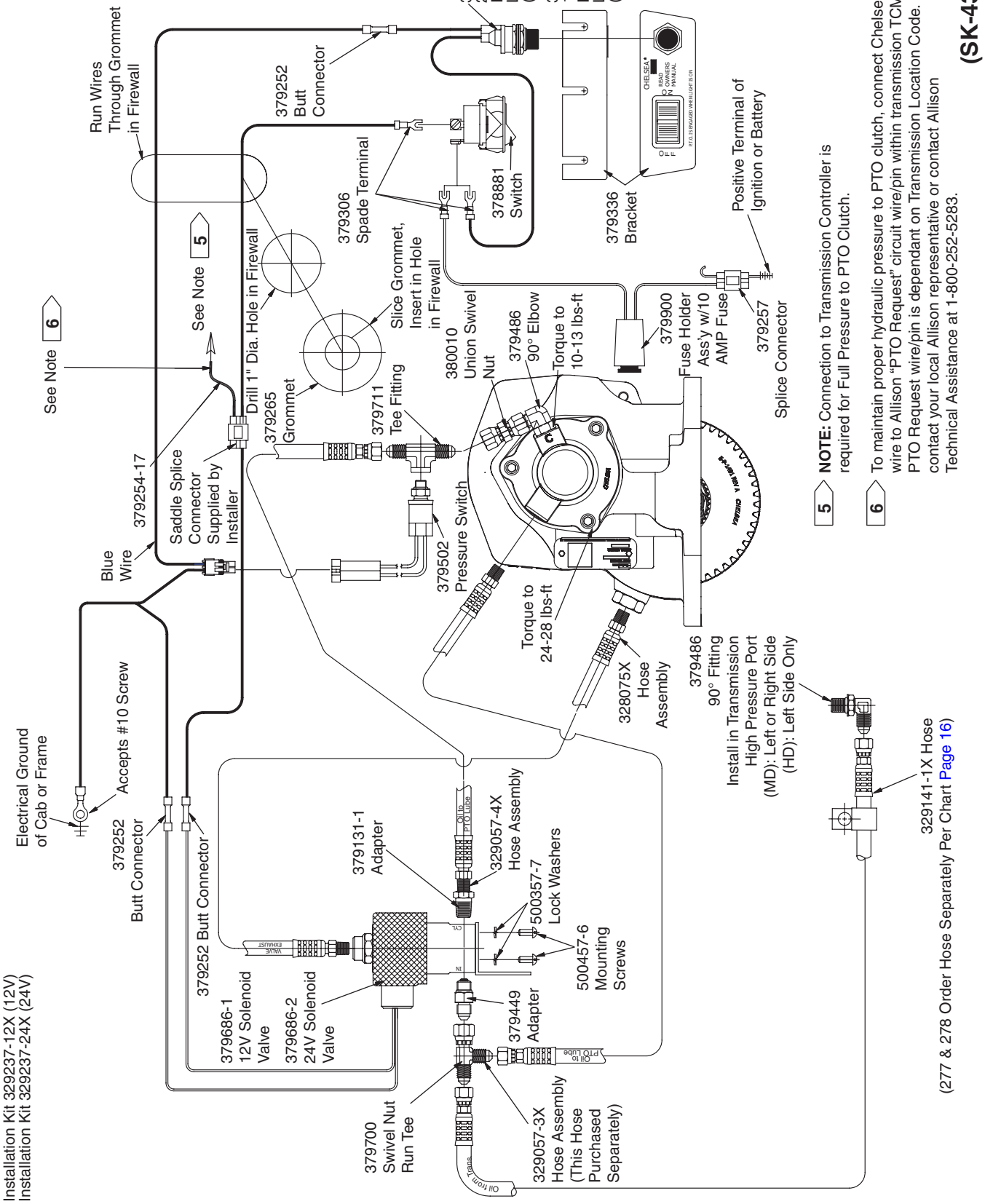
Allison Transmission 3000/4000
Shift Option G & H
Elec/Hyd w/ Remote Mount Solenoid
277/278/280/859/870 Series



5 **NOTE:** Connection to Transmission Controller is required for Full Pressure to PTO Clutch.

6 To maintain proper hydraulic pressure to PTO clutch, connect Chelsea specified wire to Allison "PTO Request" circuit wire/pin within transmission TCM. Location of PTO Request wire/pin is dependant on Transmission Location Code. For assistance, contact your local Allison representative or contact Allison Technical Assistance at 1-800-252-5283.

(SK-432 Rev G)

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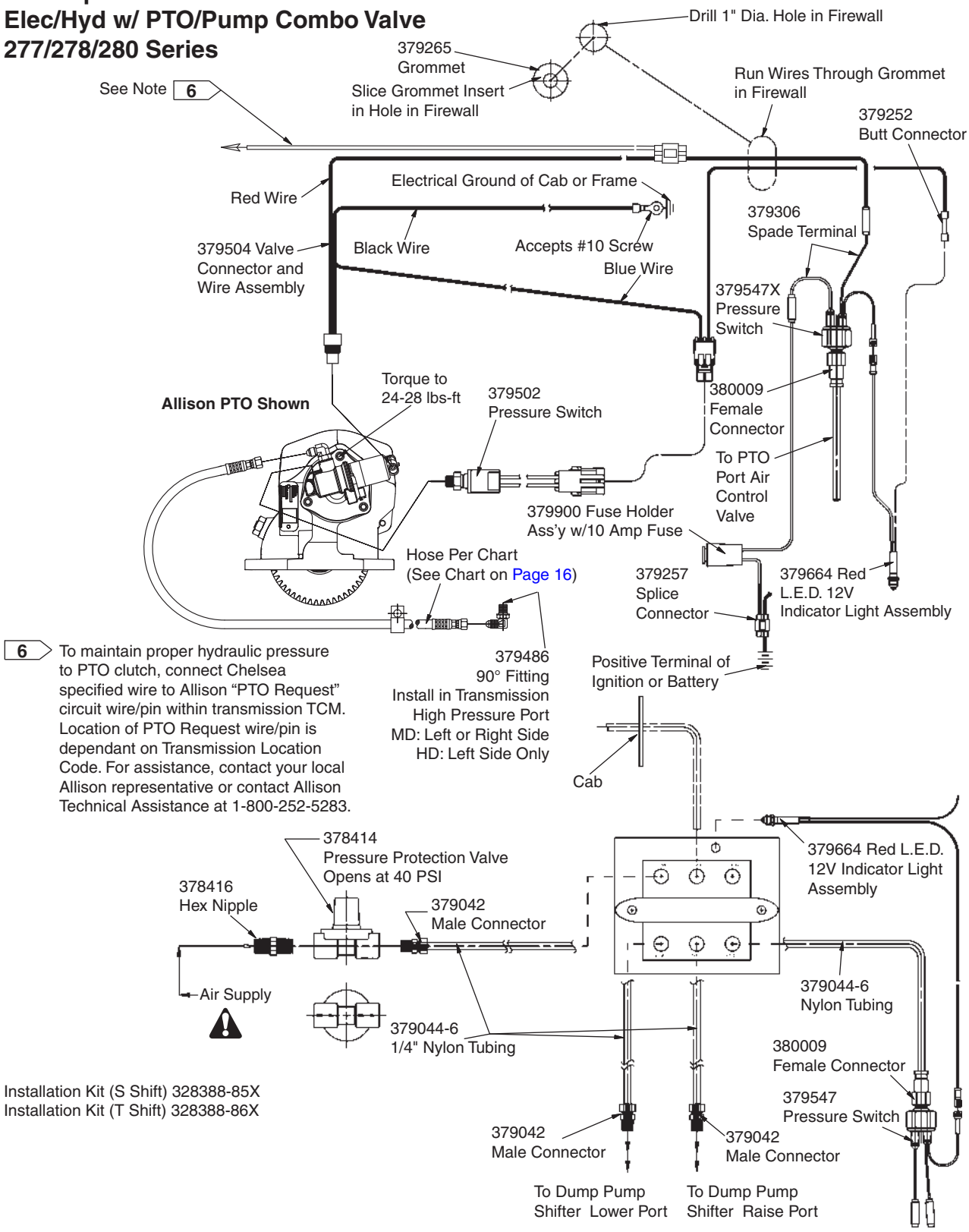
Allison Transmission 3000/4000 Shift Option S & T Elec/Hyd w/ PTO/Pump Combo Valve 277/278/280 Series

(SK-427 Rev D)



6 To maintain proper hydraulic pressure to PTO clutch, connect Chelsea specified wire to Allison "PTO Request" circuit wire/pin within transmission TCM. Location of PTO Request wire/pin is dependant on Transmission Location Code. For assistance, contact your local Allison representative or contact Allison Technical Assistance at 1-800-252-5283.

Installation Kit (S Shift) 328388-85X
Installation Kit (T Shift) 328388-86X

NOTE: Air control valve must be fitted inside a waterproof housing when installed outside the driver's cab

WARNING: Connect directly to air supply. Do not use tubing between air supply and pressure protection valve.
Caution: When installing nylon tubing avoid sharp angles, exhaust and manifold systems.

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GM C Series Wiring Harness

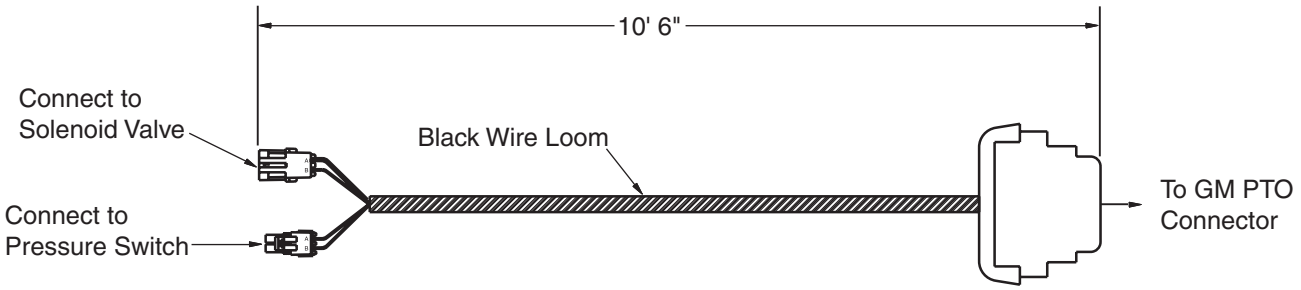
For model year 2003 GM C Series 4500, 5500, 6500, 7500 and 8500 trucks may be equipped with the Allison World (MD) transmission. In these vehicles, GM Truck has integrated a PTO connector located in the right hand engine compartment area. A Power Take-Off switch has also been incorporated into the GM dash panel to control PTO operation. With the PTO option ordered on the truck, the PTO connector and in-dash switch simplify the interface for the body builder.

In order for the customer to utilize the full capability of the PTO/transmission, Chelsea has designed a wiring harness that must be used between the GM PTO connector and the Chelsea Power Take-Off. These are for Non-EOC PTO applications only.

On the Allison World (MD) transmission the PTO drive gear is engine driven. The wiring harness is not required for the Power Take-Offs listed on the chart, but must be used if the GM supplied in-dash PTO switch is to be utilized.

See wiring harness part number 379926 for the 277/278/280/859 Series Power Take-Offs.

2003 GM C Series Wiring Harness for 277/278/280/859 Series
Part Number 379926



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Notes

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CATERPILLAR

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PTO Installation

When installing a PTO, always wear protective clothing and safety glasses.

1. Remove the PTO aperture plate with a 16mm socket (**Fig. 28**).

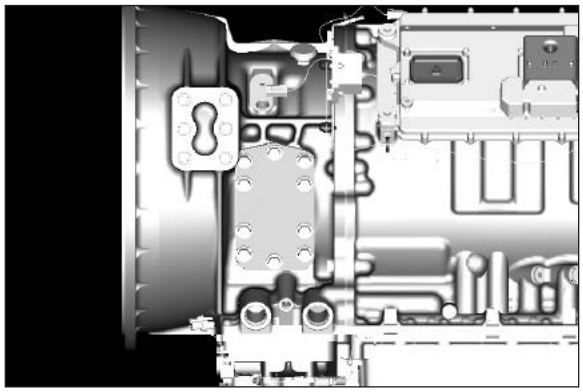

Fig. 28

2. Remove the gasket and clean the aperture surface (**Fig. 29**).

NOTE: Do not reuse the gasket that comes with the transmission.

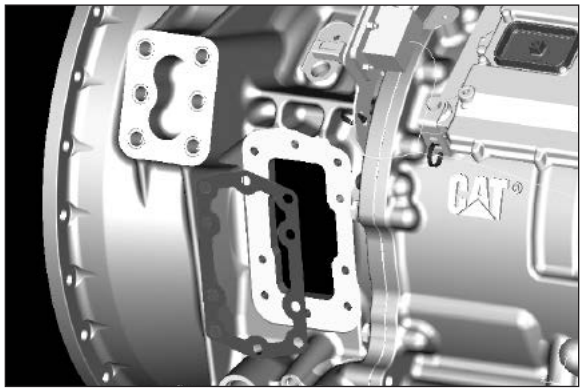

Fig. 29

3. Using a screwdriver, install the guide pins until they bottom out (**Fig. 30**) (see Page 37).

NOTE: Do not use sealing compounds because they are generally incompatible with automatic transmission fluid.

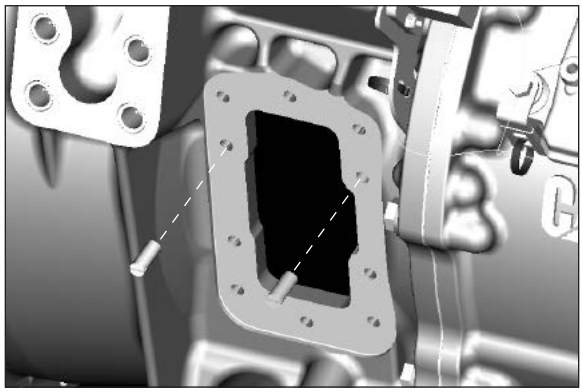

Fig. 30

4. Install the special gasket over the guide pins. The ribbed surface should face outward, toward the installer (**Fig. 31**).

NOTE: To ensure proper backlash and sealing of the PTO to the transmission, only use Gasket furnished with the PTO.

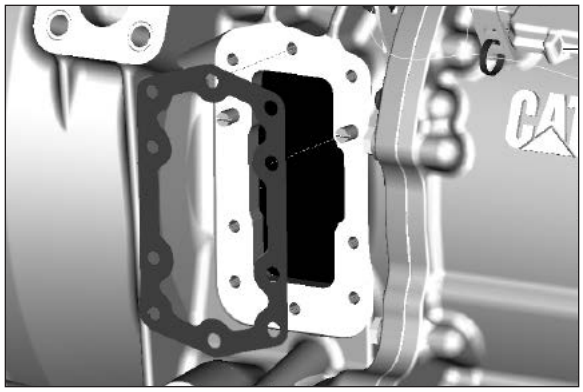

Fig. 31

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PTO Installation (Continued)

5. Position the PTO and secure it with the top capscrew provided (**Fig. 32**).

NOTE: Refer to page 37 for proper capscrew installation for the 278 Series.

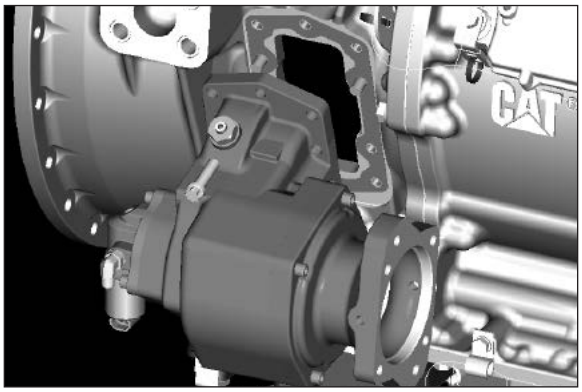

Fig. 32

6. Install the remaining capscrews. Torque them to 37-44 lbs-ft [50-60 Nm] (**Fig. 33**).

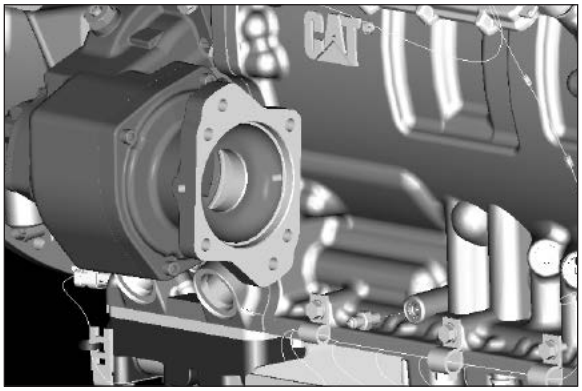

Fig. 33

Installing Rotatable Flanges
The rotatable flange is shipped loose with the PTO units for ease of installation. After determining the flange position, attach the flange to the PTO bearing cap using the capscrews provided in the bag kit. After installing the capscrews make sure to torque the screws to 24-28 lbs-ft [33-39 Nm]. Consideration should be taken on the size and weight of the pump being installed (see page 5).

7. If installing a wet spline output, attach hose to tee fitting on output flange. If non wet spline option attach hose to fitting at PTO valve (2 flats from finger tight).

NOTE: Also see pages 31-35 for Wet Spline information.

CAUTION: If not installing direct mount pump at this time install gasket, cover plate and bolts to wetspline output option to prevent transmission fluid from leaking out of PTO flange if truck engine is turned ON See Fig. 27 on page 15).

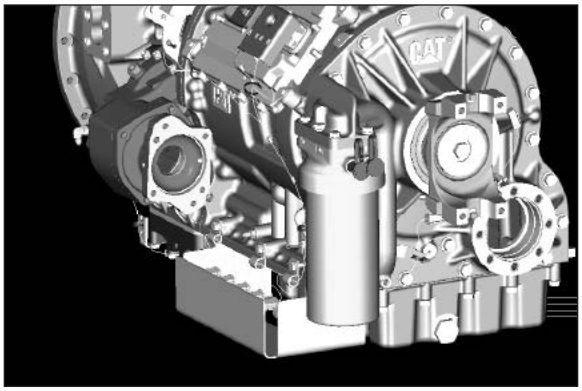

Fig. 34

NOTE: There are two (2) high pressure ports available. Use the port located on the driver's side of the transmission unless there is an interference issue with a pump or driven object (**Fig. 34**).

8. Using the special fitting (379812) to securely attach the high pressure line to the transmission. This fitting is included with the PTO Tighten to 8-10 lbs-ft [11.0-13.5 Nm] (**Fig. 35**).

   Tighten hose end fitting 2 flats from finger tight.

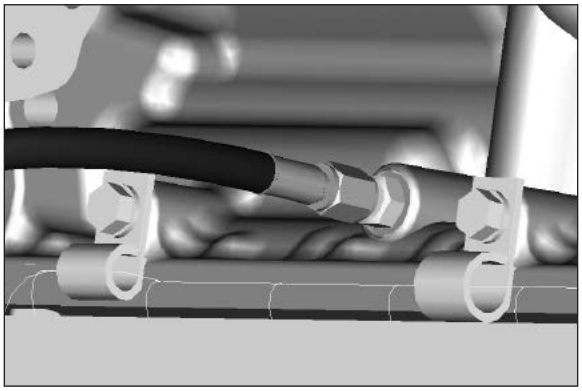
Fig. 35

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Olive Branch, MS 38654 USA

PTO Installation (Continued)

9. Securely attach the high pressure line to the valve. Tighten hose end fitting 2 flats from finger tight (**Fig. 36**). If wet spline option connect hose to tee fitting on the flange. Not available for the 287 Series Installations.

NOTE: See pages 29-30 for electrical connection drawings.

10. Complete the assembly by installing the electrical connection to the valve assembly (**Fig. 37**) and the pressure switch (**Fig. 38**).

11. Reference SK-Drawings in this book for complete installation information.

NOTE: After installation is complete refill transmission with oil as per manufacture recommendation. Run PTO for approximately 5-10 minutes. Check for any unusual noise or vibration also check for leaks and/or loose fittings or fasteners. Disengage PTO and shut vehicle engine off. Repair any discrepancies found.

NOTE: If using a rotatable flange, see page 37 for bolt torque.

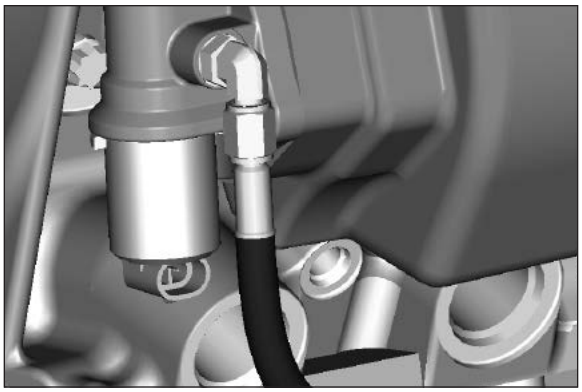

Fig. 36

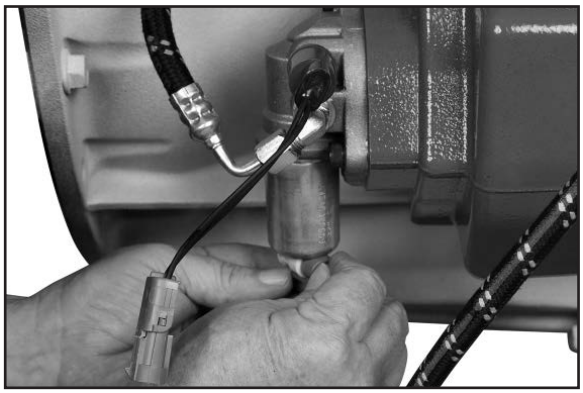

Fig. 37

Fig. 38

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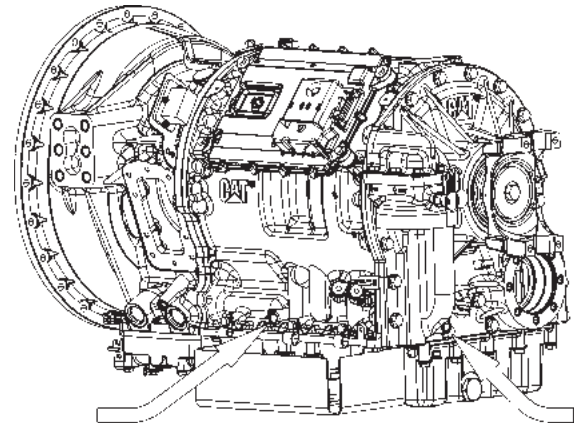
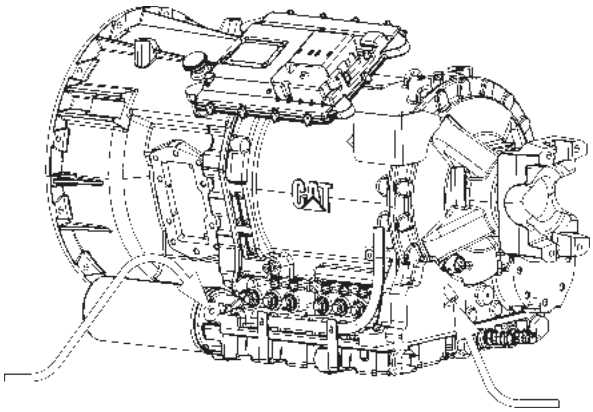
Pressure Port Locations & Hose Chart (SK-414 Rev B)



Left Side Port Rear Port

CX31
(Filter Removed for Clarity)



Left Side Port Rear Port

CX28

Both High Pressure Connections are -4 O-Ring Boss

HOSE CHART							
Trans.	**PTO**	**PTO Location**	**High Oil Pressure Location**	**PTO Valve Location**	**PTO Fitting**	**Trans. Fitting**	**Trans.-PTO Valve Hose #**
CX31 CX28	280, 287, 277, 278, 859, 870	Driver (LHS)	LHS	Attached	379486	379812	329075-1X
		Driver (LHS)	Rear				329075-5X
		Pass. (RHS)	LHS				329075-2X
		Pass. (RHS)	Rear			379486	329075-5X
		Driver (LHS)	LHS	Remote	379486	379812	329130-6X
		Driver (LHS)	Rear				329130-6X
		Pass. (RHS)	LHS				329130-6X
		Pass. (RHS)	Rear				329130-6X
	267	Driver (LHS)	LHS	N/A	379486	379812	329130-3X
		Driver (LHS)	Rear			379486	329075-5X
		Pass. (RHS)	LHS			379812	329075-2X
		Pass. (RHS)	Rear			379812	329075-5X
	877	Driver (LHS)	LHS	N/A	379486	379812	329130-3X
		Driver (LHS)	Rear				329075-5X
		Pass. (RHS)	LHS				329075-2X
		Pass. (RHS)	Rear			379486	329075-5X

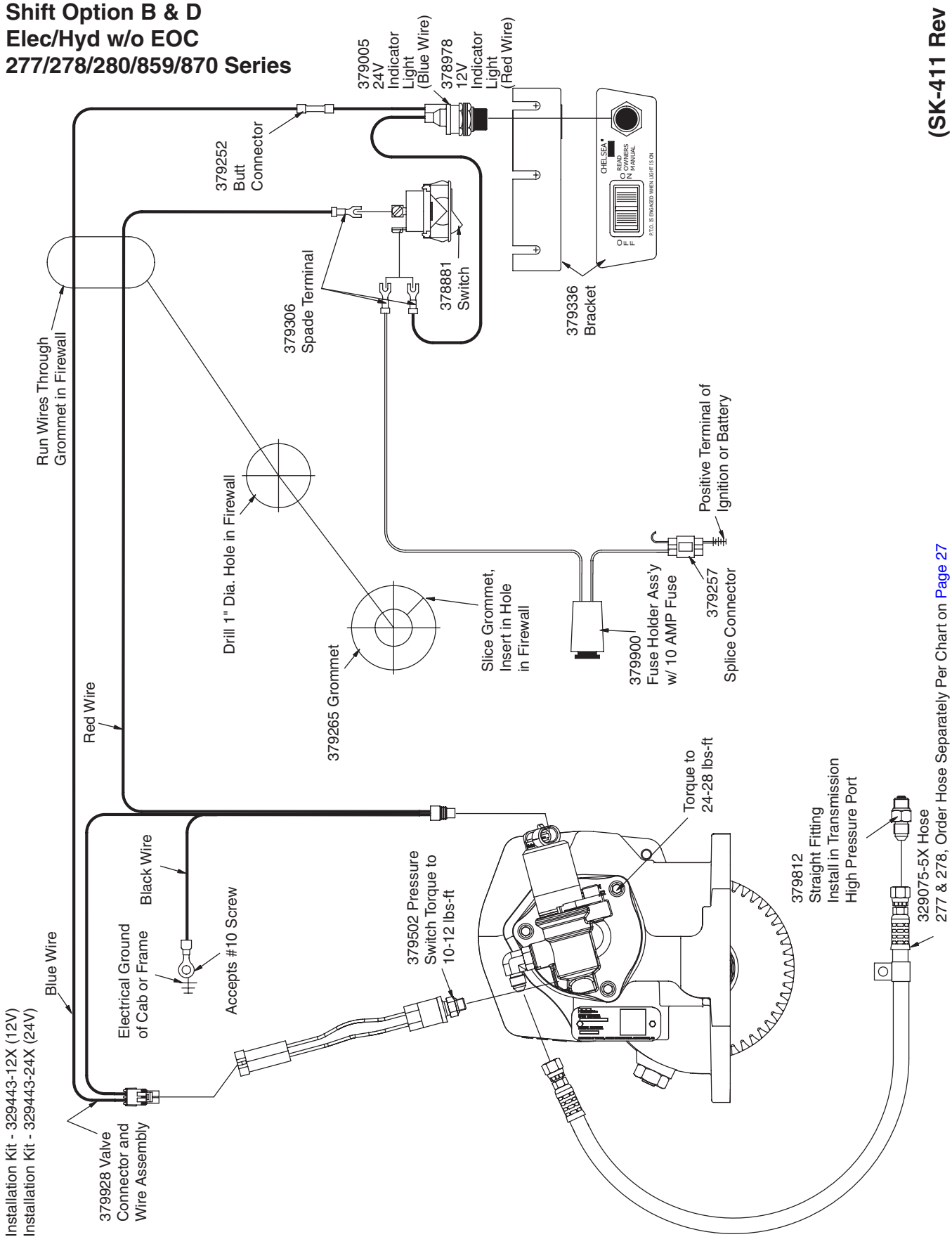
LHS = Left Hand Side of Transmission, 8 o'clock position
RHS = Right Hand Side of Transmission, 1 o'clock position

NOTES:

1. One PTO Fitting 379486 and one transmission fitting 379812 are included with the PTO unit. If using 379486 in transmission it must be purchased separately.
2. Hoses to be purchased separately, except for 280/287, 870/877 Series.
3. 379486 elbow will not install on left hand (driver) side oil port due to transmission interference.
4. If 379486 is listed as transmission fitting for rear location, route hose along right hand (passenger) side of transmission and under transmission output yoke.

Caterpillar Transmission
Shift Option B & D
Elec/Hyd w/o EOC
277/278/280/859/870 Series

(SK-411 Rev C)



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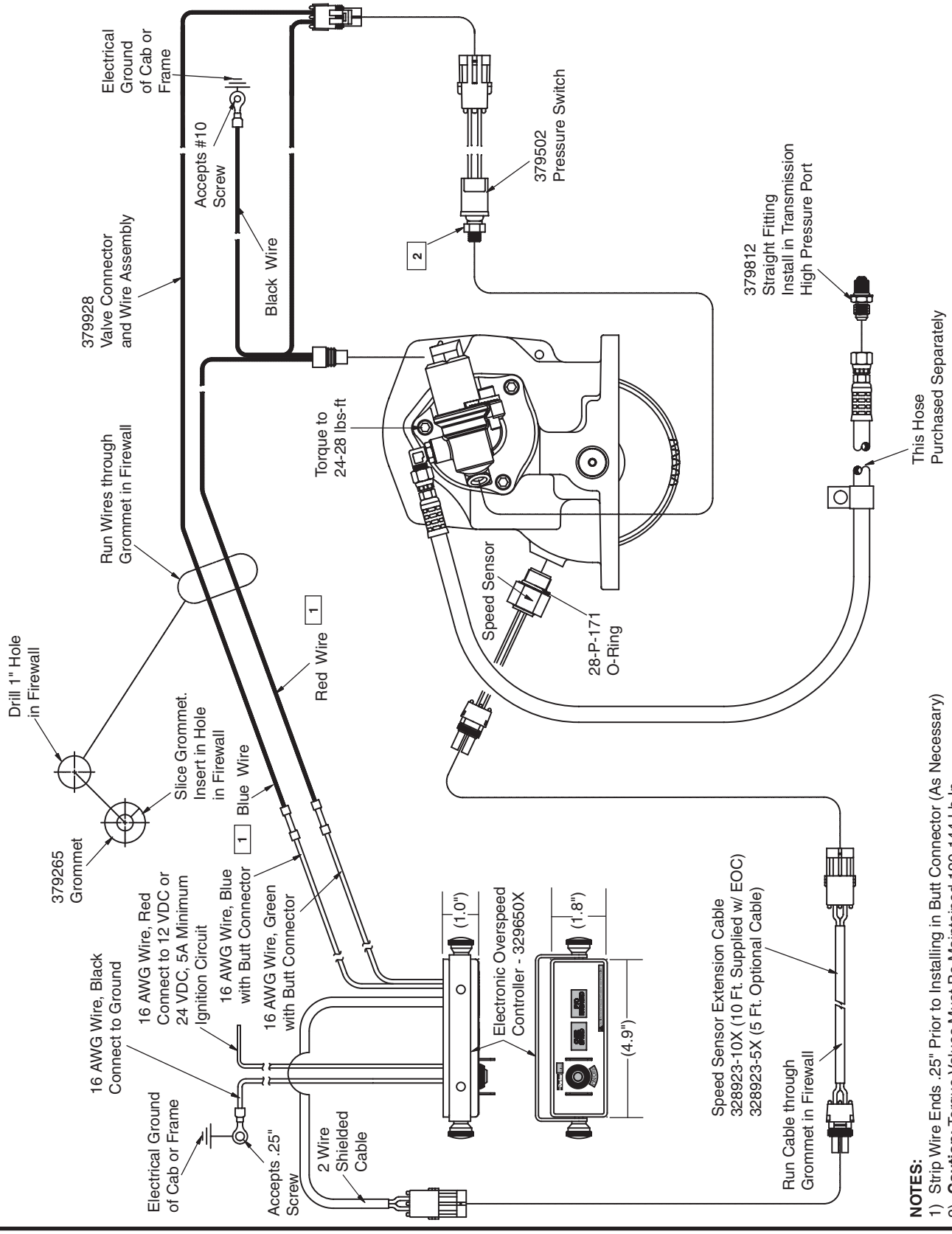
Caterpillar Transmission
Shift Option K & L
Elec/Hyd w/ EOC
277/278/280/859/870 Series

(SK-473 Rev B)



NOTES:
1) Strip Wire Ends .25" Prior to Installing in Butt Connector (As Necessary)
2) **Caution:** Torque Values Must Be Maintained 120-144 Lb In
3) Reference Kit: 329444X Installation Kit

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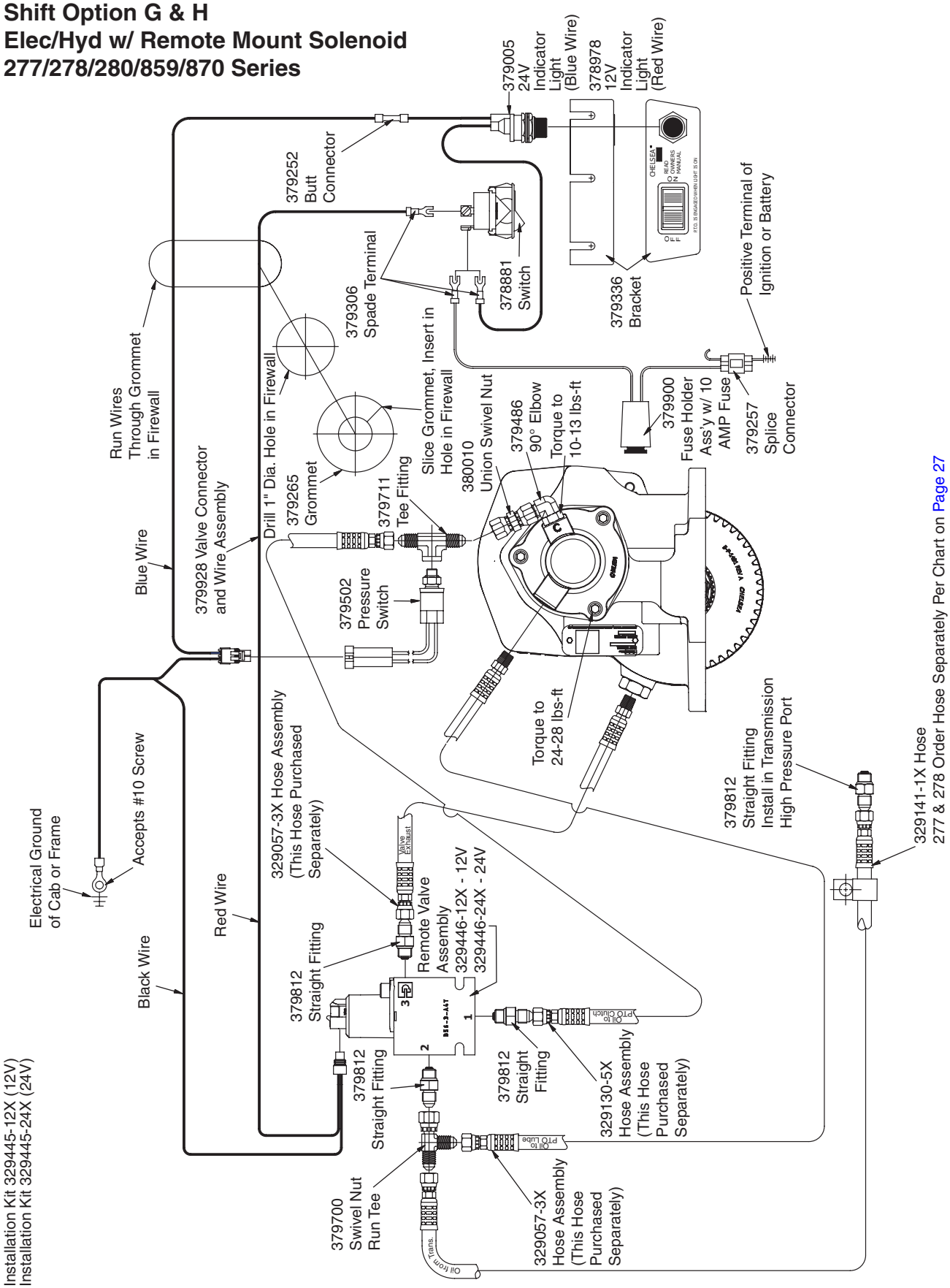
Caterpillar Transmission
Shift Option G & H
Elec/Hyd w/ Remote Mount Solenoid
277/278/280/859/870 Series

(SK-413 Rev D)



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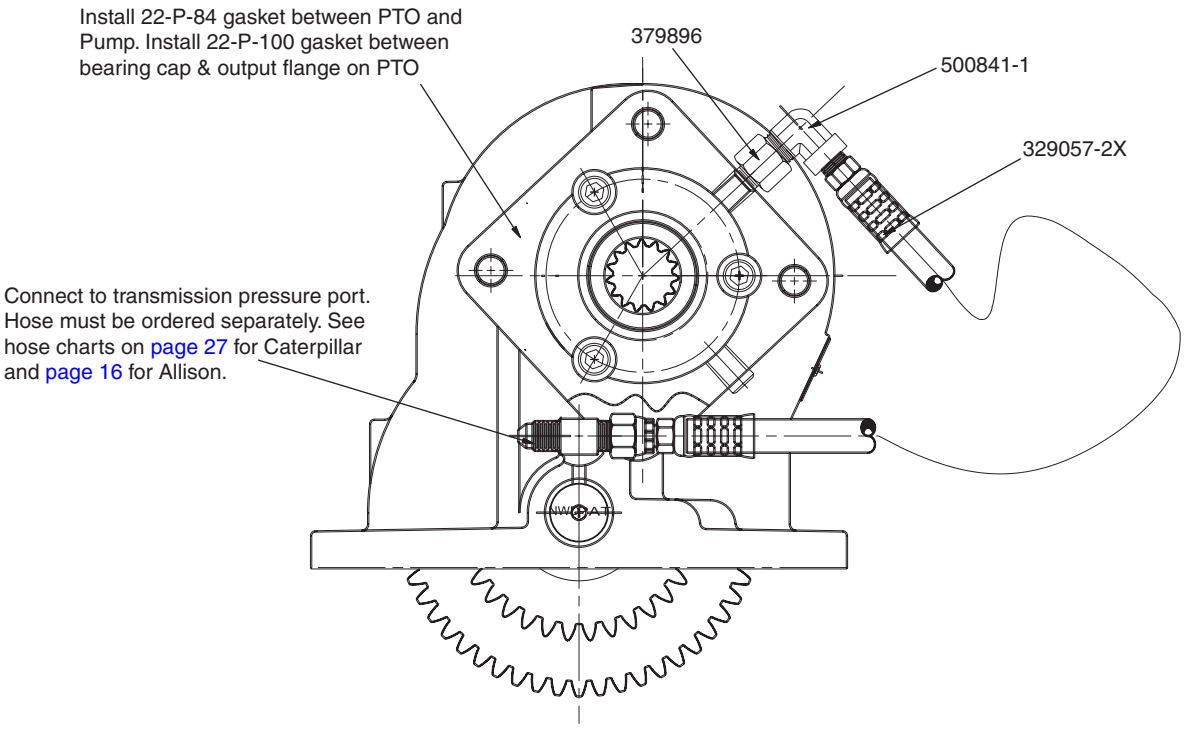
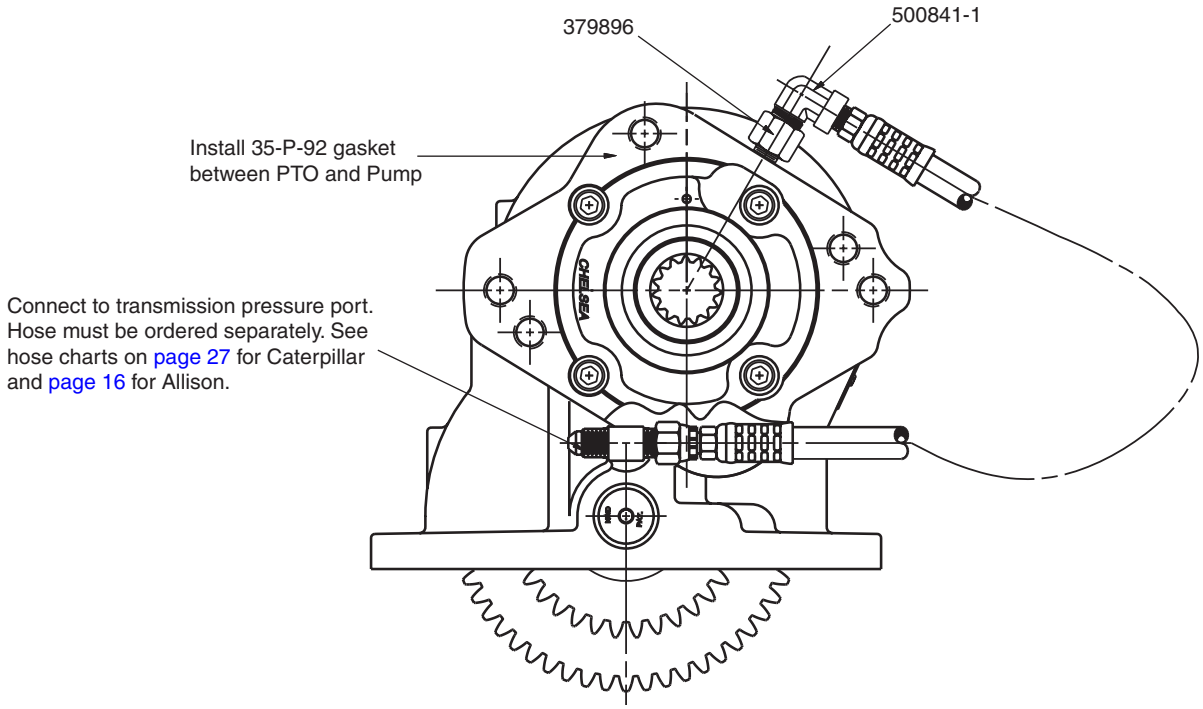
CAUTION: WET SPLINE options must be used with a pump that has a contiguous sealing surface to ensure a proper seal between pump and PTO.

Wet Spline Installation – 267 Series RY (SK-351 Rev C)



Wet Spline Installation – 267 Series AF (SK-350 Rev C)



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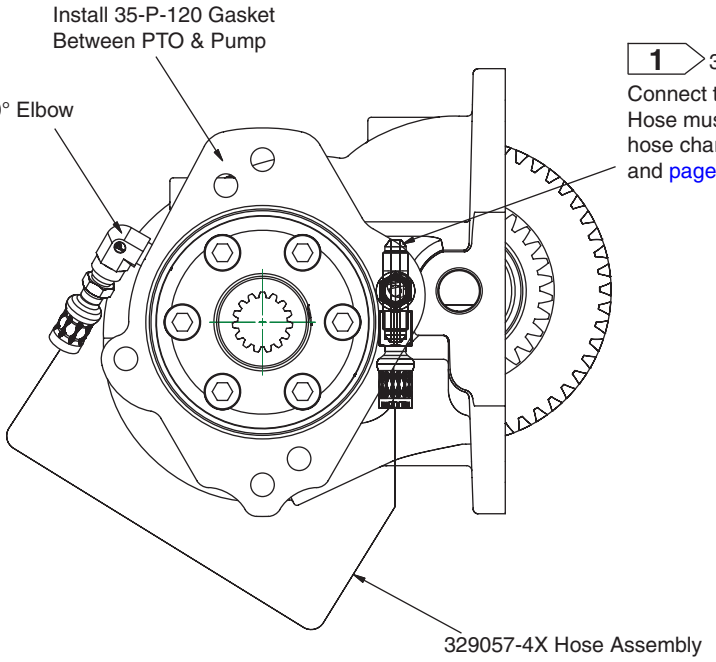
Wet Spline Installation – 267 Series RJ (SK-465 Rev B)

NOTES:

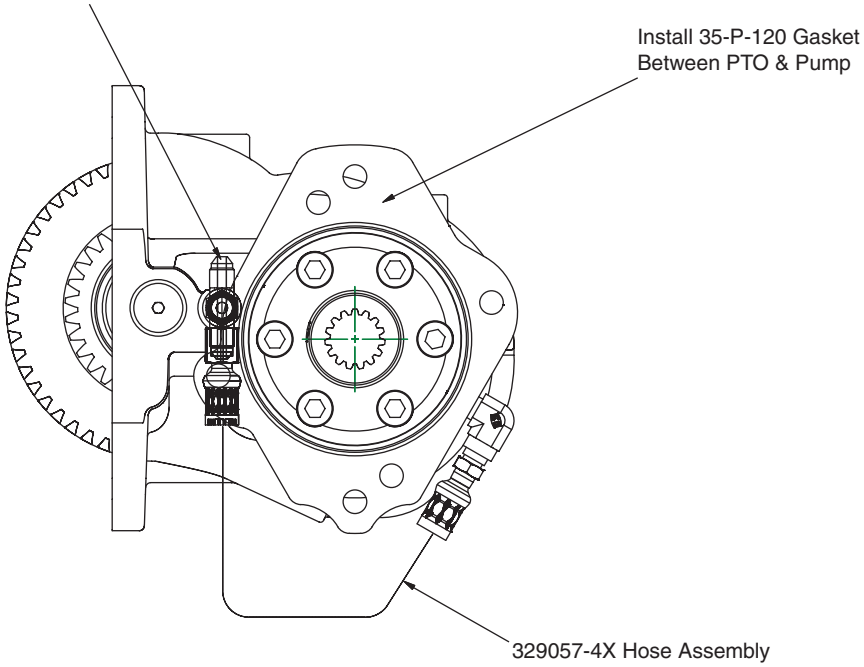
1 Connect to Transmission Pressure Port

5 Ass'y View



1 379556 Tee
Connect to transmission pressure port.
Hose must be ordered separately. See
hose charts on page 27 for Caterpillar
and page 16 for Allison.

3 Ass'y View



NOTES: Install Hose and Fittings Prior to Installing PTO on Transmission

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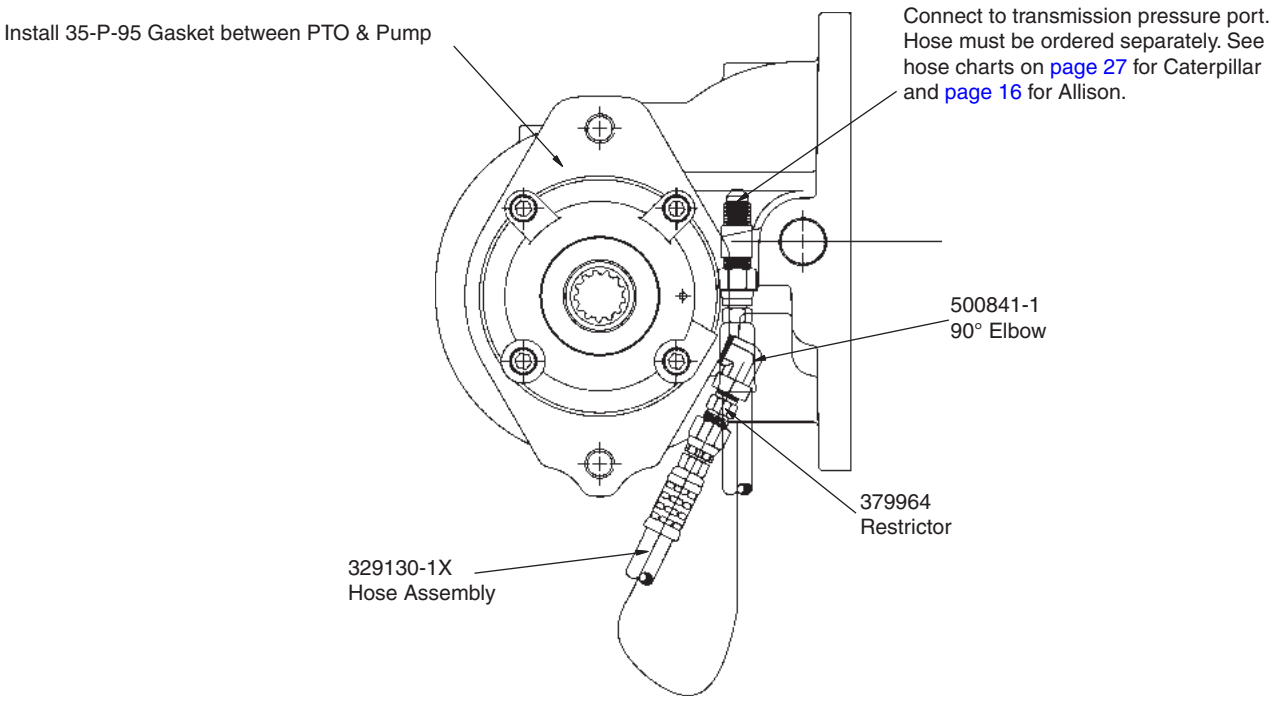
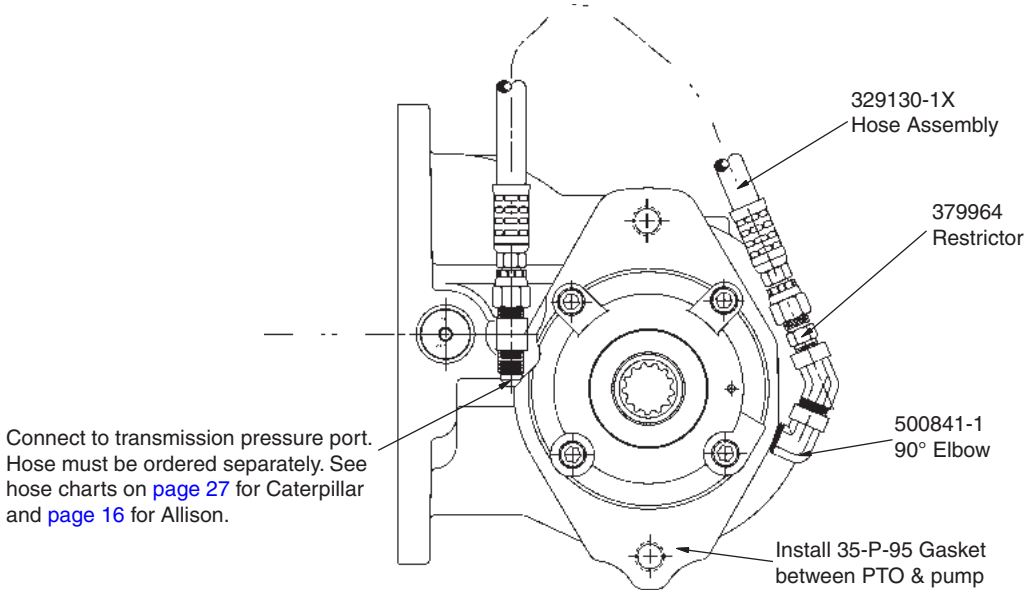
Wet Spline Installation – 267 Series AK (SK-378 Rev A)

Wet Spline Installation Components Kit – 329406X

5 Ass'y View



3 Ass'y View



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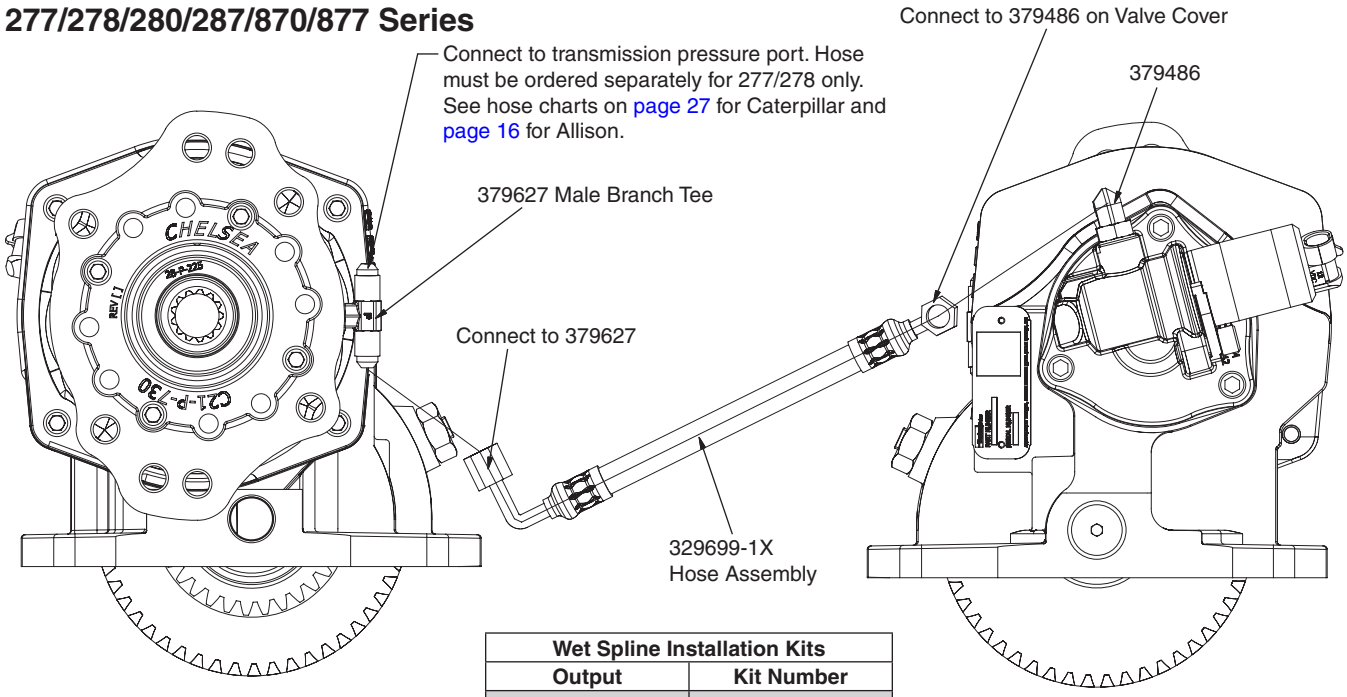
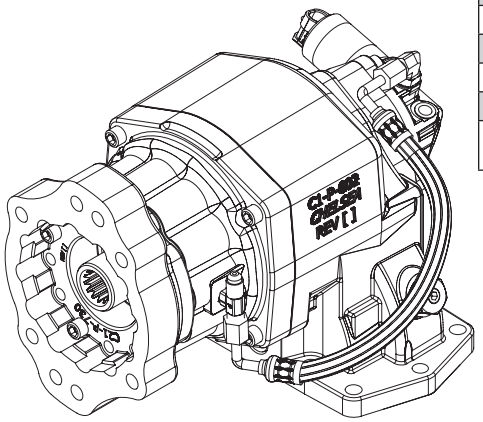
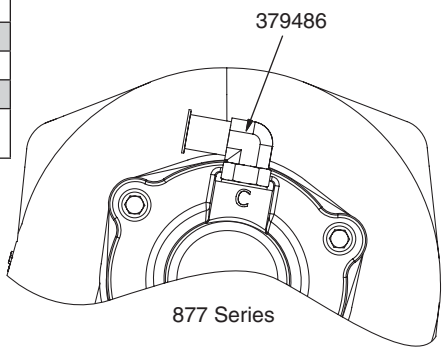
Wet Spline Installation (SK-508 Rev B)
RF, RK, RS, RY & RZ
277/278/280/287/870/877 Series



Wet Spline Installation Kits	
Output	**Kit Number**
RK	329700X
RF	329700X
RS	329744X
RY	329742X
RZ	329700X
NOTE: Not all output options may be available on Series listed above	



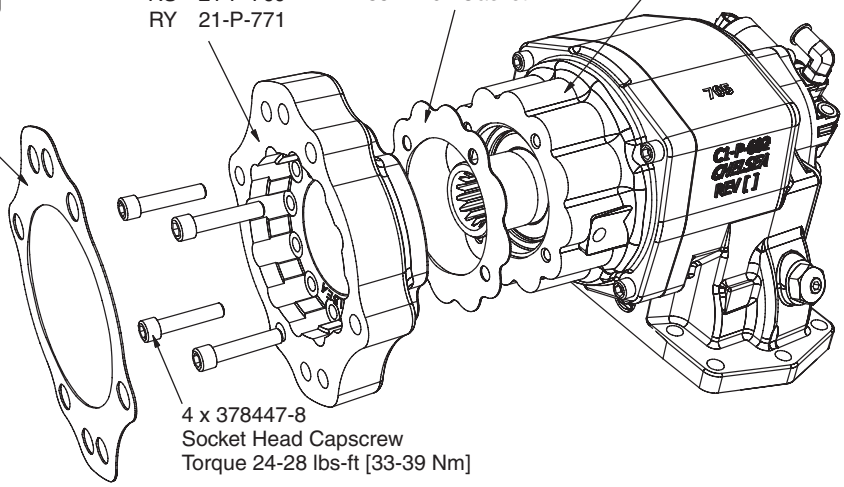


Bearing Cap
21-P-772 (5/16" bearing cap bolt holes)
21-P-883 (3/8" bearing cap bolt holes)

Flange
RF/RK/RZ 21-P-731
RS 21-P-769
RY 21-P-771

35-P-101 Gasket

Wet Spline Gasket or O-Ring
RF/RK/RZ 35-P-102
RS 28-P-245
RY 35-P-111



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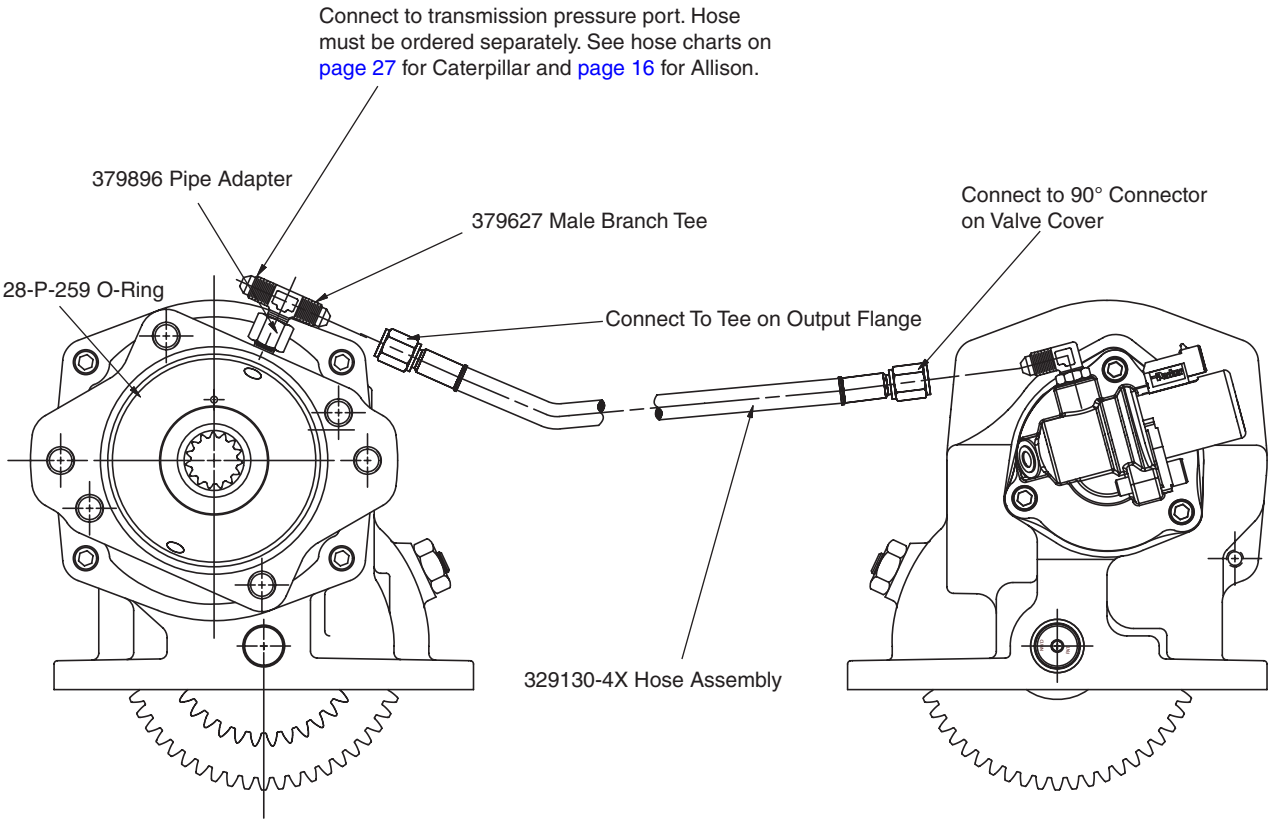
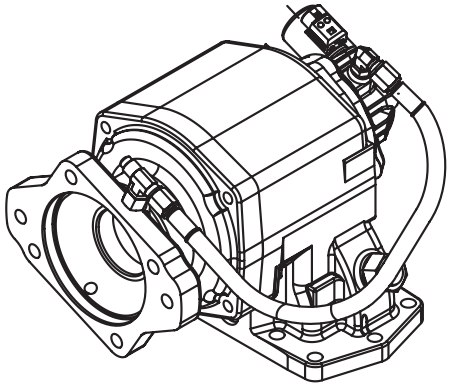
Wet Spline Installation – 277/278 Series AF & XK (SK-383 Rev E)

Wet Spline Installation Kit – 329337-6X





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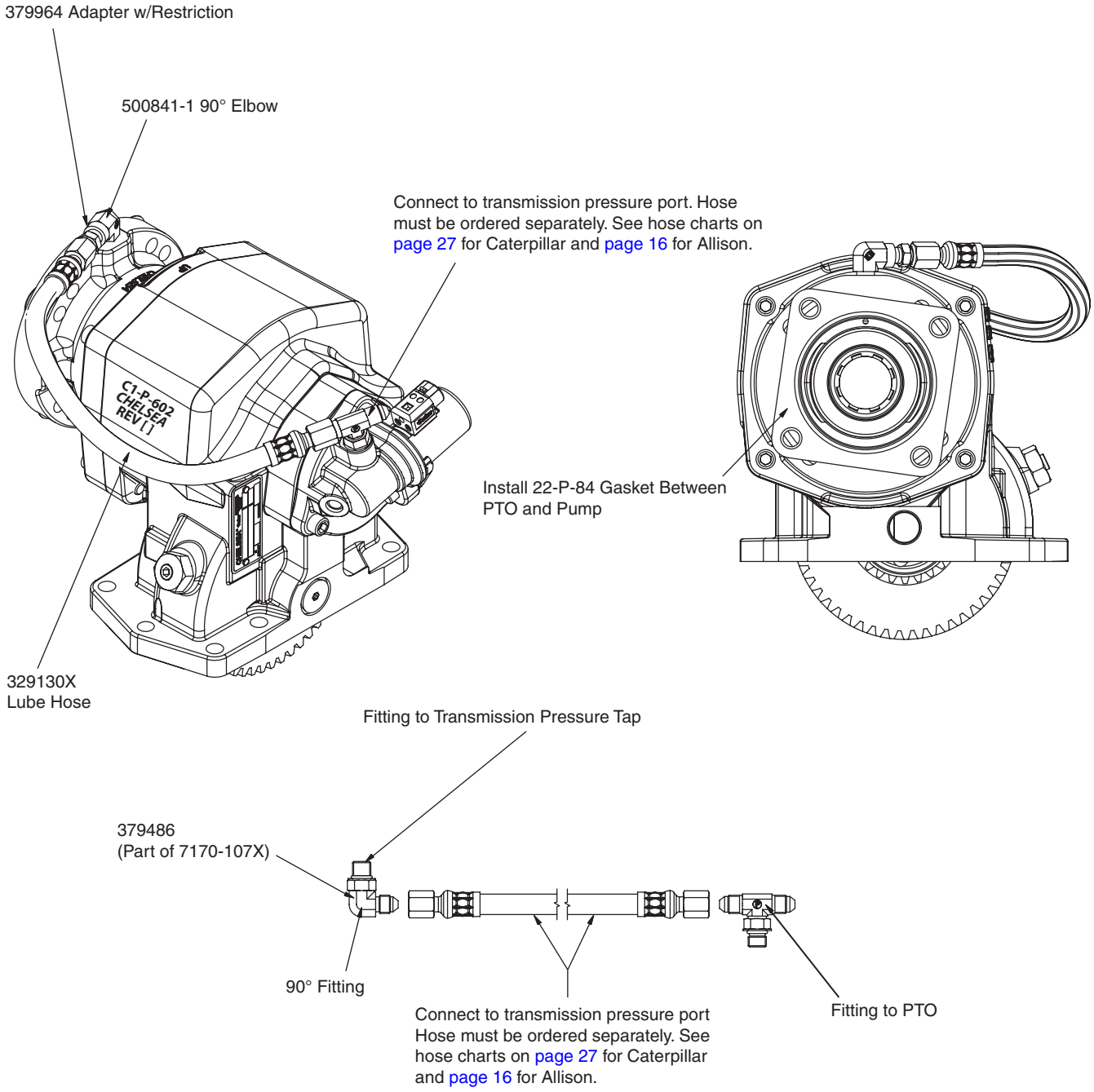
Wet Spline Installation – 277/278 Series ZY (SK-454 Rev A)



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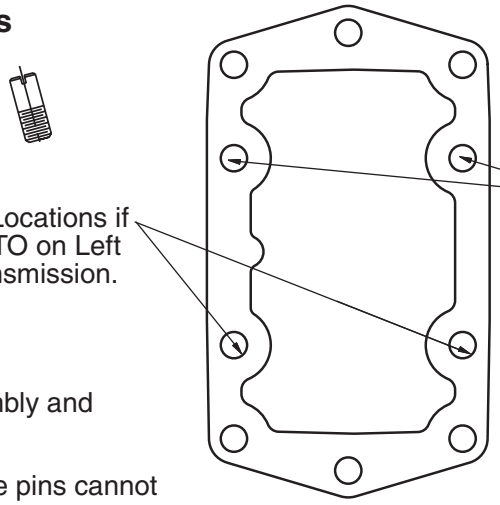
Installation Mounting Kit Instructions (SK-355 Rev C)
277/278/280/287/870/877 Series



LEFT SIDE
Dowel Pin Locations if installing PTO on Left Side of Transmission.

RIGHT SIDE
Dowel Pin Location if installing PTO on Right Side of Transmission.

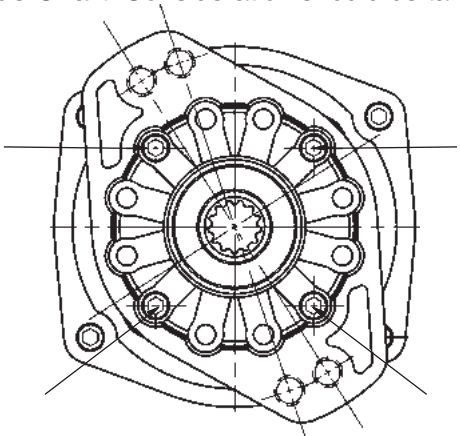
NOTE: PTO Models 278 Guide pins 379451 may be removed after assembly and replaced with 379453-10 capscrews.

NOTE: Models 267, 277, & 859 guide pins cannot be removed.

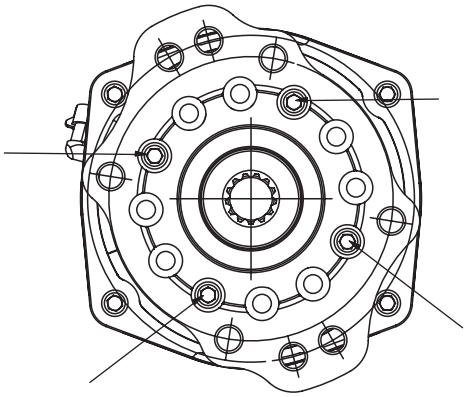
NOTE: If included, install two shorter 379453-8 capscrews under barrel of PTO housing in either hole depending on housing orientation.

Installing Rotatable Flanges

The rotatable flange is shipped loose with the PTO units for ease of installation. After determining the flange position, attach the flange to the PTO bearing cap using the capscrews provided in the bag kit. After installing the capscrews make sure to torque the screws to the correct torque values stated in the Torque Chart. Consideration should be taken on the size and weight of the pump being installed.



RA Flange Shown
267/277/278



RK Flange Shown
280/287/870/877

Outputs	PTO Series	Output Flange to Bearing Cap Capscrew P/N	Qty.	Size Capscrew	Capscrew Bag Kit	Recommended Capscrew Torque
PA, PF, RA, RB, RF, RG	277/278 280/287	378447-6	4	0.312"-18 x 1.000"	328170-208X	24-28 lbs-ft [33-39 Nm]
RK, RM, RS, RY, RZ	277/278 280/287 870/877	378447-8	4	0.312"-18 x 1.500"	328170-216X	24-28 lbs-ft [33-39 Nm]
RJ	267	379740-6	6	M10-1.50" x 0.984"		35-40 lbs-ft [47-54 Nm]

NOTE: Reinstalling or tightening of a rotatable flange after it has become loose is not recommended. If a PTO has run for a length of time after the flange has become loose, the flange and/or bearing cap may not be to manufacturing tolerances and could cause PTO failure.

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CAUTION: This vehicle is equipped with a Power Take-Off. Shut engine off before working on the Power Take-Off or getting below the vehicle. Consult the operating instructions before using the PTO (See sun visor).

POWER TAKE-OFF OPERATION — VEHICLE STATIONARY

Automatic Transmission with PowerShift PTOs

Engage the PTO with the engine at idle speed.

NOTE: PowerShift PTOs: The engine must be at idle or below 1000 RPM when the PTO is engaged. See the transmission manufacturer's instructions for special procedures.

IMPORTANT:

Failure to follow the proper shifting or operating sequences will result in premature PTO failure with possible damage to other equipment.

WARNING: Cold Weather Operation of PowerShift PTOs

During extreme cold weather operation [32° F (0° C) and lower], a disengaged PowerShift Power Take-Off can momentarily transmit high torque that will cause unexpected output shaft rotation. This is caused by the high viscosity of the transmission oil when it is extremely cold. As slippage occurs between the Power Take-Off clutch plates, the oil will rapidly heat up and the viscous drag quickly decreases.

The Power Take-Off output shaft rotation could cause unexpected movement of the driven equipment, resulting in serious personal injury, death, or equipment damage.

To avoid personal injury or equipment damage:

- Driven equipment must have separate controls.
- Driven equipment must be left in the disengaged position when not in operation.
- Driven equipment must not be operated until the vehicle is allowed to warm up.

This symbol warns of possible personal injury.

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Due to the normal and sometime severe torsional vibrations that Power Take-Off units experience, operators should follow a set maintenance schedule for inspections. Failure to service loose bolts or Power Take-Off leaks could result in potential auxiliary Power Take-Off or transmission damage.

Periodic PTO MAINTENANCE is required by the owner/operator to ensure proper, safe and trouble free operation.

Daily: Check all air, hydraulic and working mechanisms before operating PTO Perform maintenance as required.

Monthly: Inspect for possible leaks and tighten all air, hydraulic and mounting hardware, if necessary. Torque all bolts, nuts, etc. to Chelsea specifications. Ensure that splines are properly lubricated, if applicable. Perform maintenance as required.

With regards to the direct mounted pump splines, the PTO requires the application of a specially formulated anti-fretting, high pressure, high temperature grease. The addition of the grease has been proven to reduce the effects of the torsional vibrations, which result in fretting corrosion on the PTO internal splines as well as the pump external splines. Fretting corrosion appears as a rusting and wearing of the pump shaft splines. Severe duty applications, which require long PTO running times and high torque may require more frequent regreasing. applications such as Utility Trucks that run continuously and are lightly loaded also require frequent regreasing due to the sheer hours of running time. It is important to note that service intervals will vary for each and every application and are the responsibility of the end user of the product. Chelsea also recommends that you consult your pump owners manuals and technical services for their maintenance guidelines. Fretting corrosion is caused by many factors and without proper maintenance the anti-fretting grease can only reduce its effects on components.

Chelsea offers the grease to our customers in two packages. The first is a 5/8 fluid ounce tube (379688), which is included with every applicable PTO, and the second is a 14-ounce grease cartridge (379831).

Warranty: Failure to comply entirely with the provisions set forth in the appropriate Owner's Manual will result in voiding of ALL Warranty consideration.

Notes

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Notes

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Notes

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Offer of Sale

WARNING: This product can expose you to chemicals including Lead and Lead Compounds, and Di(2-ethylhexyl)phthalate (DEHP) which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov

The items described in this document and other documents and descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors ("Seller") are hereby offered for sale at prices to be established by Seller. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any item described in its document, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer. All goods, services or work described will be referred to as "Products".

1. Terms and Conditions. Seller's willingness to offer Products, or accept an order for Products, to or from Buyer is subject to these Terms and Conditions or any newer version of the terms and conditions found on-line at www.parker.com/saleterms/. Seller objects to any contrary or additional terms or conditions of Buyer's order or any other document issued by Buyer.

2. Price Adjustments; Payments. Prices stated on Seller's quote or other documentation offered by Seller are valid for 30 days, and do not include any sales, use, or other taxes unless specifically stated. Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2010). Payment is subject to credit approval and is due 30 days from the date of invoice or such other term as required by Seller's Credit Department, after which Buyer shall pay interest on any unpaid invoices at the rate of 1.5% per month or the maximum allowable rate under applicable law.

3. Delivery Dates; Title and Risk; Shipment. All delivery dates are approximate and Seller shall not be responsible for any damages resulting from any delay. Regardless of the manner of shipment, title to any products and risk of loss or damage shall pass to Buyer upon placement of the products with the shipment carrier at Seller's facility. Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment of shipment at Buyers' request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions.

4. Warranty. Seller warrants that all products sold, other than the 590 Series, conform to the applicable Parker Chelsea standard specification for the lesser period of 2 years (24 Months) from date of service or 2-1/2 years (30 Months) from date of build (as marked on the product name plate). Seller warrants that the 590 Series will conform to the applicable Seller standard specification for the lesser period of 2 years (24 Months) from date of service or 2000 hours of usage. The prices charged for Seller's products are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **DISCLAIMER OF WARRANTY: THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED HEREUNDER. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING DESIGN, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

5. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon delivery. No claims for shortages will be allowed unless reported to the Seller within 10 days of delivery. No other claims against Seller will be allowed unless asserted in writing within 30 days after delivery. Buyer shall notify Seller of any alleged breach of warranty within 30 days after the date the defect is or should have been discovered by Buyer. Any action based upon breach of this agreement or upon any other claim arising out of this sale (other than an action by Seller for an amount due on any invoice) must be commenced within 12 months from the date of the breach without regard to the date breach is discovered.

6. LIMITATION OF LIABILITY. UPON NOTIFICATION, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE. IN NO EVENT SHALL SELLER BE LIABLE TO BUYER FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLIGENT, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.

7. User Responsibility. The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application and follow applicable industry standards and Product information. If Seller provides Product or system options, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.

8. Loss to Buyer's Property. Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, will be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer ordering the items manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Special Tooling. A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

10. Buyer's Obligation; Rights of Seller. To secure payment of all sums due or otherwise, Seller shall retain a security interest in the goods delivered and this agreement shall be deemed a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest.

11. Improper use and Indemnity. Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, lawsuits, and costs (including attorney fees), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Product; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

12. Cancellations and Changes. Orders shall not be subject to cancellation or change by Buyer for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change product features, specifications, designs and availability with notice to Buyer.

13. Limitation on Assignment. Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.

14. Force Majeure. Seller does not assume the risk and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller's reasonable control.

15. Waiver and Severability. Failure to enforce any provision of this agreement will not waive that provision nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

16. Termination. Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days written notice of termination. Seller may immediately terminate this agreement, in writing, if Buyer: (a) commits a breach of any provision of this agreement (b) appointments a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or by a third party (d) makes an assignment for the benefit of creditors, or (e) dissolves or liquidates all or a majority of its assets.

17. Governing Law. This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.

18. Indemnity for Infringement of Intellectual Property Rights. Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this Agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

19. Entire Agreement. This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged.

20. Compliance with Law, U. K. Bribery Act and U.S. Foreign Corrupt Practices Act. Buyer agrees to comply with all applicable laws and regulations, including both those of the United Kingdom and the United States of America, and of the country or countries of the Territory in which Buyer may operate, including without limitation the U. K. Bribery Act, the U.S. Foreign Corrupt Practices Act ("FCPA") and the U.S. Anti-Kickback Act (the "Anti-Kickback Act"), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees or agents. Buyer acknowledges that they are familiar with the provisions of the U. K. Bribery Act, the FCPA and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer shall not make any payment or give anything of value, directly or indirectly to any governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase products or otherwise benefit the business of Seller.

07/14

Parker Chelsea

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Olive Branch, MS 38654 USA

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