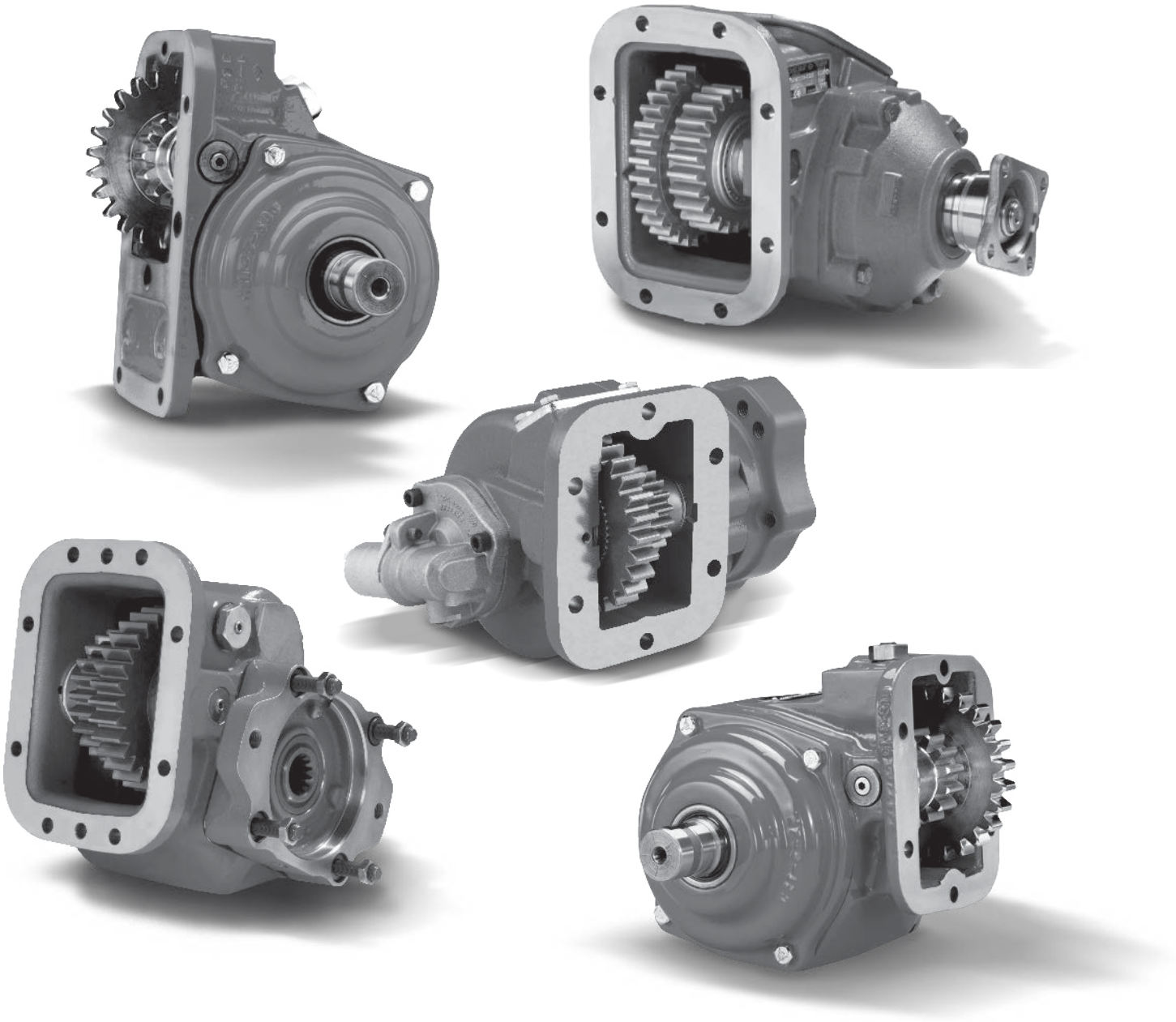
Effective: HY25-1240-M1/US July 2024
Supersedes: HY25-1240-M1/US March 2024



Power Take-Offs Owner's Manual

230, 231, 236, 238, 270, 271, 272, 282, 800, 852, 885 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

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

General Information

General Installation

Pressure Lube Connections

GM PTO Connectors

Installation Sketches

AISIN Installation

Installation Sketches

Continued on Next Page

Parker Chelsea
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Chelsea Products Division
Olive Branch, MS 38654 USA

Foreword

This booklet will provide you with information on correct installation of Chelsea® Power Take-Offs (PTOs). Proper installation and setup procedures can help you get additional and more profitable hours from your truck equipment and components.

It is important that you be sure that you are getting the right transmission and PTO combination when you order a new truck. A mismatched transmission and PTO combination can result in unsatisfactory performance of your auxiliary power system from the start.

If you have questions regarding correct PTO and transmission combination, please contact your local Chelsea® representative. They can help you select the properly matched components to ensure correct and efficient applications.

Safety Information

These instructions are intended for the safety of the system designer, installer, operator, and supporting personnel. If you have any additional questions after reading the instructions below, please reach out to your local Chelsea representative.

General Safety Information

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

- Carefully read all owner's manuals, service manuals, and/or other instructions.
- Always follow procedures using proper tools and safety equipment.
- Ensure proper training is received prior to attempting to install equipment.
- Always block any raised or moving device that may injure a person working on or under a vehicle.
- Never work alone while under a vehicle, repairing equipment, or maintaining equipment.
- Always use proper components in applications for which they are approved.
- Never use worn-out or damaged components.
- Never operate the controls of the PTO 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's catalogs, literature, and owner's manuals.
- Follow Chelsea's recommendations when selecting, installing, repairing, or operating a PTO.
- Never attempt to use a PTO that is not specifically recommended by Chelsea for the vehicle, transmission, and application.
- Always match the PTO's specified output capabilities with the requirements of the equipment to be powered.
- Never exceed the maximum speed listed in Chelsea's Applications Catalog.

This symbol warns of possible personal injury.

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

Safety Information (Continued)

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 rotation of the PTO's output shaft 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.

Rotating Auxiliary Driveshafts

WARNING: 

- Rotating auxiliary driveshafts can cause serious injury or death by snagging clothes, skin, hair, hands etc.
- 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 PTO 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 to specify guard(s) and PTO installer to install guard(s).

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

WARNING: Chelsea Power Take-Offs are packaged with warning labels, 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 and safety information 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.

This symbol warns of possible personal injury.

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

Safety Information (Continued)

WARNING: Operating the PTO with the Vehicle in Motion

Some Power Take-Offs may be operated when the vehicle is in motion. PTOs must be properly selected to operate at highway speeds, correctly matched to the vehicle's transmission, as well as 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 as well as premature failure of the vehicle, driven equipment, and PTO.

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

PTO Safety Label Instructions

1. The two black and orange on white 5" x 7" pressure sensitive vinyl labels (PN 379274) must be placed one on each side of the vehicle 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 blank masking covers. Remove the masking covers after painting.
2. Place the one black and orange on white 3.5" x 5" pressure sensitive vinyl label (PN 379275) on the sun visor nearest the operator of the vehicle.
3. Place the one red and white with black lettering 3.5" x 7" pressure sensitive vinyl label (PN 379915) on the sun visor next to the above label (PN 379275).
4. Place the one white and black heavy-duty card (PN 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 representative or send request direct to:

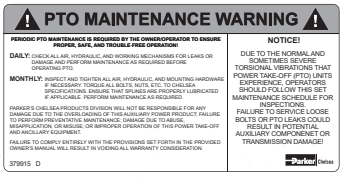
Parker-Hannifin Corporation
Chelsea Products Division
8225 Hacks Cross Road
Olive Branch, MS 38654

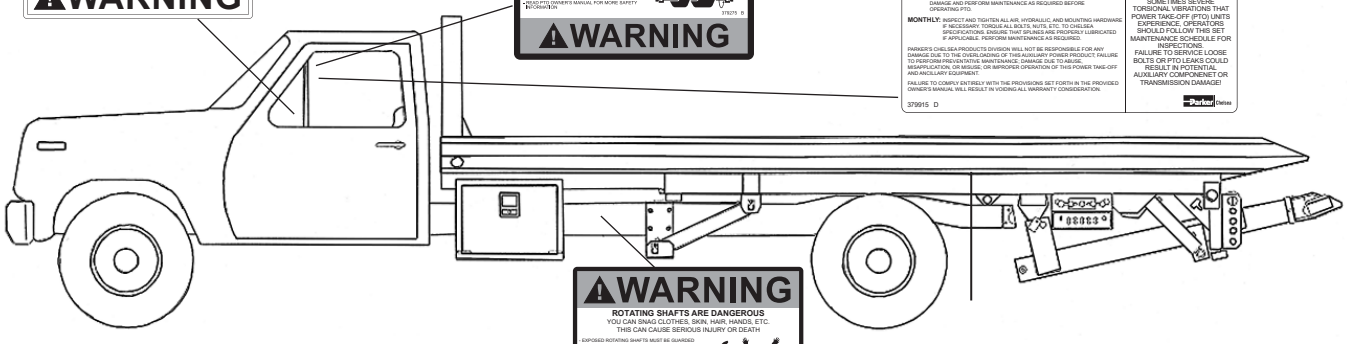
Phone: +1 (662) 895-1011
Email: chd_support@support.parker.com

Part #379276

Part #379275

Part #379915





Part #379274

This symbol warns of possible personal injury.

Pump Bracketing Best Practices

With changes in emissions standards, truck systems are experiencing more vibration and vibration related issues. Due to the changes, Parker Chelsea finds it necessary to discuss the importance of pump bracketing and the effects it can have on the mounted PTO. Parker Chelsea has made updates to the pump bracketing support guidelines listed in all PTO Owner's Manuals. This bulletin will discuss the importance of bracketing and the best practices to keep in mind when mounting a pump.

Please note, due to the high variance of applications and the increasing severity of vibration found in modern diesel engines Parker Chelsea's pump bracketing best practices cannot consider all factors affecting the PTO and Pump bracketing. Please use the following information as a GUIDELINE ONLY when installing pump bracketing.

Potential causes of bracket failures that can damage a PTO and/or Pump:

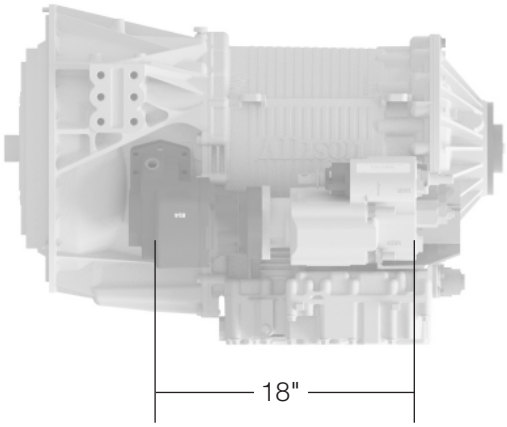
- Excessive preload from poor bracket design, fabrication, and installation.
- Excessive vibration from the vehicle's normal driving operation leading to high loads on the PTO bolts.
- Torque spikes from extreme vibration could be intense enough to break bolts in the bracketing. The worst cases occur while the truck is operating at highway speeds.

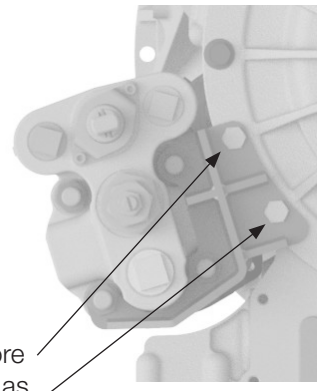
In addition to the conditions listed above, Chelsea requires the use of support brackets in all applications to ensure the Maximum Bending Moment (MBM) of the PTO and pump assembly is not exceeded. Exceeding the MBM can result in damage to PTO, transmission, driven equipment, and/or personnel. It is 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.

Use **CAUTION** to ensure the support bracket does not pre-load PTO and pump mounting. Prior to mounting, pumps must be fully supported by a jack until it is properly secured with support bracket(s). This will ensure the PTO is not being stressed by the bracket. Brackets must be designed to adequately eliminate deflections from weight, vibration, and truck movements.

PTO warranty will be voided if support brackets are not used when one of the following conditions apply:

- Combined weight of the pump, fittings, hoses, and oil exceeds 40 lbs [18.14 kg]
- Combined length of the PTO and pump is greater than 18 inches [45.72 cm]
- Pumps should have a support bracket when mounted onto a on a non-extended shaft PTO
- Extended Shaft PTOs: Please see applicable owner's manual for additional guidance





To ensure proper bracketing, brackets must attach at two or more transmission bolt locations as well as two or more pump (bolt) locations. Please reach out to your transmission manufacturer for proper bracket mounting locations.

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Olive Branch, MS 38654 USA

Pump Bracketing Best Practices (Continued)

An installed PTO/Pump bracket needs to be properly aligned. Misalignment in the X direction **(Fig. 1)** is substantially more impactful than misalignment in the Y or Z direction **(Fig. 2)**. To prevent this, installing a fixture-built bracket is preferred. This allows the PTO/Pump to be installed prior to making the final welds on the bracket.

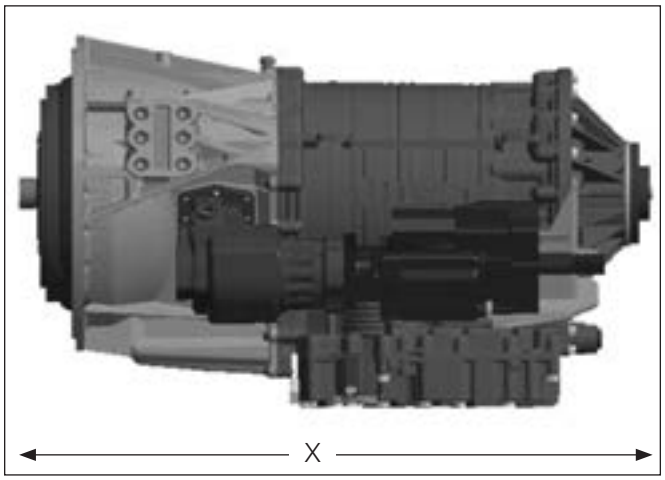


Figure 1

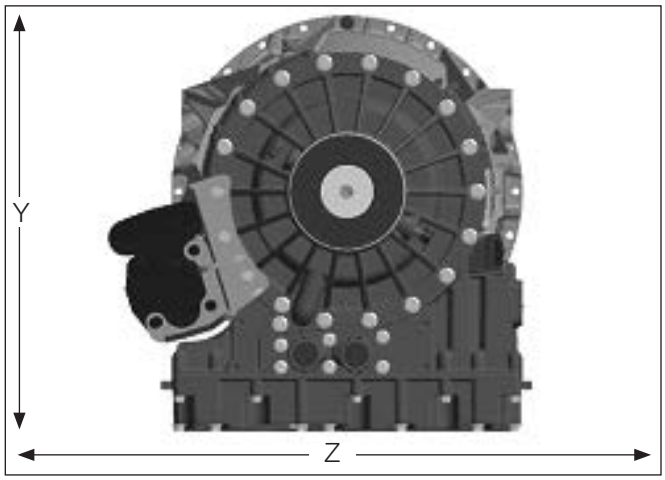
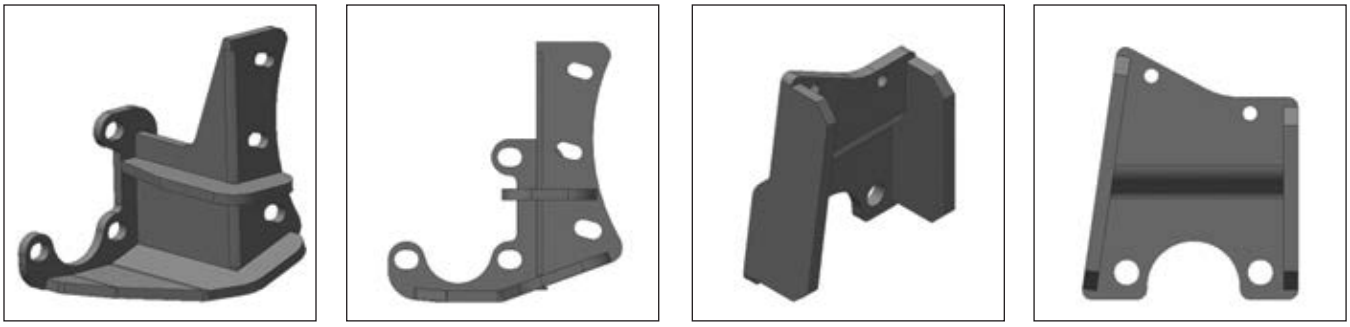


Figure 2

- The PTO/Pump should be treated as engine mounted components and installed per the engine manufacturer's published guidelines for engine mounted components when applicable.
- For proper bracketing, attach the bracket at two or more transmission bolt locations and two or more pump locations. Whenever possible, three attachment points in either (or both) locations is suggested. Please contact the transmission manufacturer for proper bracket mounting locations.
- Brackets should contain at least one gusset, preferably two. The gussets should be 3/8" thick and at least 1" deep. 3/8" steel is suggested particularly with gussets and in areas with reduced cross section.
- Please refer to the transmission and pump manufacturer's approved pump bracket support locations.



These best practices should be followed for optimal results. Please note, each bracketing situation is different so this bulletin must only be used as a guideline. For further bracketing assistance please refer to your PTO Owner's Manual or contact your Chelsea PTO representative for questions.

If you have any technical questions, contact us at:

Phone: +1 (662) 895-1011

Email: chd_support@support.parker.com

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

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 in the chart below.

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			

This information is limited to 1000 through 1310 series applications. For applications requiring a series larger than 1310, please contact your driveline specialist.

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 shaft auxiliary power joints are designed for intermittent service at 1000 or less RPM. Examples include driving of small hydraulic pumps, low speed product pumps, and winches.
2) Joint Series should be determined using the chart on the following page.

WARNING: direct customer to driveline manuf/spec.

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Spicer® Universal Joint Engineering Data

Joint Series	**1000**	**1100**	**1280**	**1310**
Torque Rating				
Automotive (Gas or Diesel Engine) lb-ft Continuous	50	54	95	130
Tubing				
Diameter	1.750"	1.250"	2.500"	3.000"
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"

[1, 2] Maximum Operating Speed for Tube or Solid Shaft Diameter and Length					
Tube	RPM - Revolutions per Minute				
OD x Wall Thickness (Joint Type)	**500**	**1000**	**1500**	**2000**	**2500**
1.750" x .065" (Welded)	117"	82"	67"	58"	52"
1.250" x .095" (Seamless)	91"	64"	52"	45"	40"
2.500" x .083" (Welded)	122"	87"	70"	62"	55"
3.000" x .083" (Seamless)	-	-	-	85"	76"
Solid Shaft	RPM - Revolutions per Minute				
Diameter	**500**	**1000**	**1500**	**2000**	**2500**
.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"

[1] The numbers expressed above represent the maximum installed length for tubing or solid shaft in both two joint assemblies and joint shaft applications.
[2] Please contact your Chelsea representative for applications with speeds below 500 RPM and over 2500 RPM.

WARNING: direct customer to driveline manuf/spec.

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PTO Shifting Procedure & Precautions

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 PTO

Engage the PTO with the engine at idle speed.

NOTE: PowerShift PTO: 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 PTO

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 rotation of the PTO's output shaft 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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Power Take-Off Maintenance

Due to the normal and sometime severe torsional vibrations that PTOs experience, operators should follow a set maintenance schedule for inspections. Failure to service loose bolts or PTO 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 and 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's specifications. If applicable, ensure that splines are properly lubricated. Perform maintenance as required.

With regards to the direct mounted pump splines, the PTO requires the application of a specially formulated anti-fretting grease. This grease must be specified for both high pressure and high temperature applications. The addition of the grease has been proven to reduce the effects of torsional vibrations, which result in fretting corrosion on the PTO's internal splines as well as the pump's 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. Continuous duty applications with light loads require frequent regreasing due to the higher number of running hours, an example of this is utility trucks. It is important to note that service intervals will vary for every application and they are the responsibility of the end user of the product. Chelsea also recommends that you consult your pump's owner's manual 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 anti-fretting grease to our customers in two package sizes:

- 5/8 fluid ounce tube (PN 379688) - Provided with PTO where applicable
- 14-ounce grease cartridge (PN 379831)

Warranty: Failure to comply entirely with the provisions set forth in the appropriate owner's manual will result in voiding of warranty consideration.

Mounting the PTO
230, 236, 238, 270, 272, 282, 800, 852 and 885 Series

1. Remove the PTO aperture cover plate (**Fig. 3**).

2. Discard the cover plate and cover plate gasket, then clean the aperture pad using a putty knife or wire brush (**Fig. 4**).

3. Install the proper studs in the PTO aperture pad using a stud driver or wrench (**Fig. 5**).

4. Install the studs until the shoulder of the stud is flush with the transmission mounting surface. **DO NOT** install studs with shank below the aperture surface. Install studs with hand tools. **DO NOT** use power tools to install studs (**Fig. 6**).

NOTE: DO NOT use gasket maker or sealant with automatic transmissions. Always check to be sure that the studs do not interfere with transmission gears.

CAUTION: Over tightening of the studs or running the shoulder past the transmission mounting surface may damage stud and/or Transmission threads. Use of air impact tools is not recommended.

5. For the 230, 236, 238, 272, 282, 800, and 852 Series on manual transmissions, place one thick gasket .020" (.50 mm) and one thin gasket .010" (.25 mm) over the studs.

   For the 230, 270 and 272 Series with the AJ gear pitch designation (i.e.: 272XBAJP-B3XD) use the special 35-P-41 gasket that comes with the PTO. When the 35-P-41 gasket is installed, the need for backlash adjustment is greatly reduced (**Fig. 7**).

NOTE: For 282 Series with AJ gear pitch designation, use 8-A-032 filler block (order separately) with a gasket on each side.

When mounting a PTO use gaskets between all mounting surfaces:

- Do not stack more than 3 gaskets together.
- Usually, one thick gasket .020" (.50 mm) will be required.
- Remember the lubricant in the transmission also lubricates the PTO, therefore, a gasket must always be used.

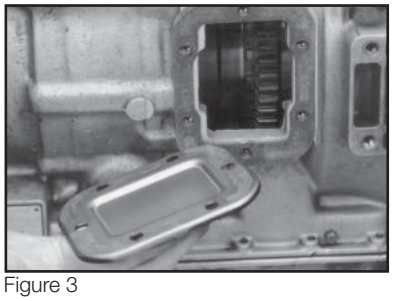
Figure 3

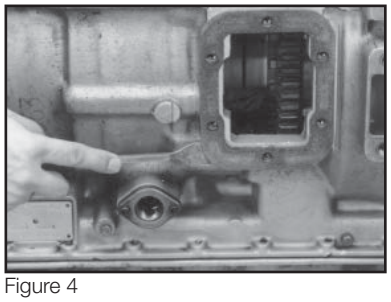
Figure 4

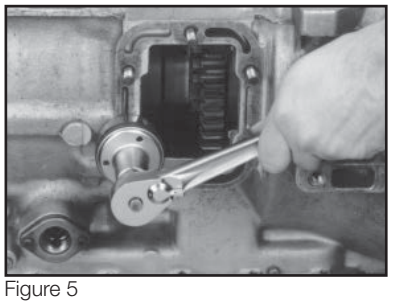
Figure 5

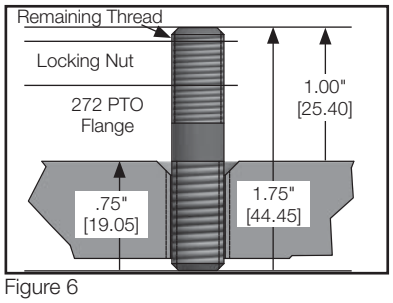

Figure 6

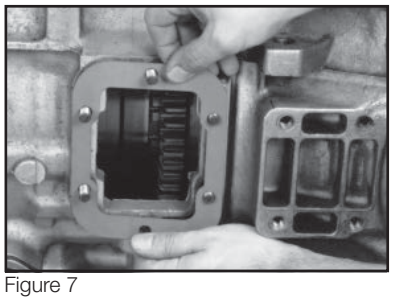
Figure 7

WARNING: Ensure all fasteners and fittings are torqued according to their manufacturer's specification.

Mounting the PTO (Continued)
230, 236, 238, 270, 272, 282, 800, 852 and 885 Series

6. Secure PTO to the transmission:
   - Use self-locking nuts provided with PTO (**Fig. 8**).

NOTE: Self-locking nuts do not require lock washers (**Fig. 9**).

7. Fasten the PTO to the transmission. Torque the fasteners to their proper specifications (**Fig. 10**):

   Self-Locking Nuts:
   - (3/8"-24) for 6-Bolt applications 35-40 lb-ft [47-54 N-m]
   - (7/16"-20) for 8-Bolt applications 55-60 lb-ft [75-81 N-m]

   Cap Screws:
   - (3/8") for 6-Bolt to 30-35 lb-ft [40-47 N-m]
   - (7/16") for 8-Bolt to 45-50 lb-ft [60-61 N-m]

7a. The 236, 238, 272 and 282 Series have an inspection plate that can be removed to check for proper backlash. Refer to page 15 for checking backlash procedure.

8. There are two (2) large drilled and tapped holes on the 230, 270 and 800 Series PTO housing (See **Fig. 11**). These two holes come with plugs installed (**Fig. 11**). The 852 Series has one (1) drilled and tapped hole in the inspection plate.

   One of the plugs will be used for the dump line from the solenoid to the housing of the 270, 272*****, 800, and 852 Series. The 230, 272***** and 885 Series are air shifted and do not require the dump line. The one hole in the 852 will be used for the dump line from the hydraulic solenoid valve.

***** NOTE: the dump line is only required for 272 Series PTOs with hydraulic remote shift options G and H.


Figure 8

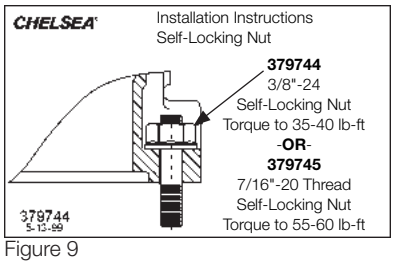

Figure 9

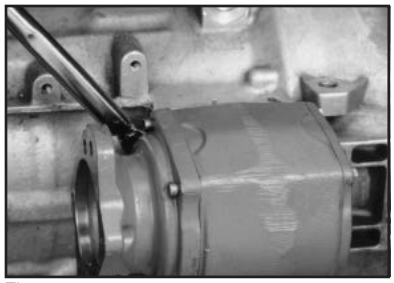
Figure 10


Figure 11

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Mounting the PTO (Continued)
230, 236, 238, 270, 272, 282, 800, 852 and 885 Series

The second plug, which is positioned over the input gear, must be removed and replaced with a transducer if you are using the Chelsea Electronic Overspeed Control. If you are not using an Electronic Overspeed Control, the plug will remain in the housing (**Fig. 12**). After checking backlash, continue with the plumbing and wiring of the controls.

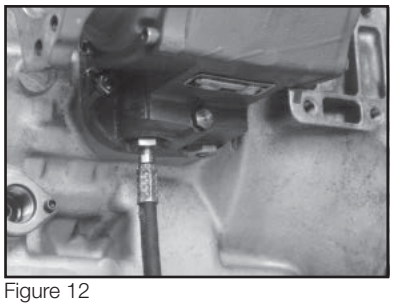
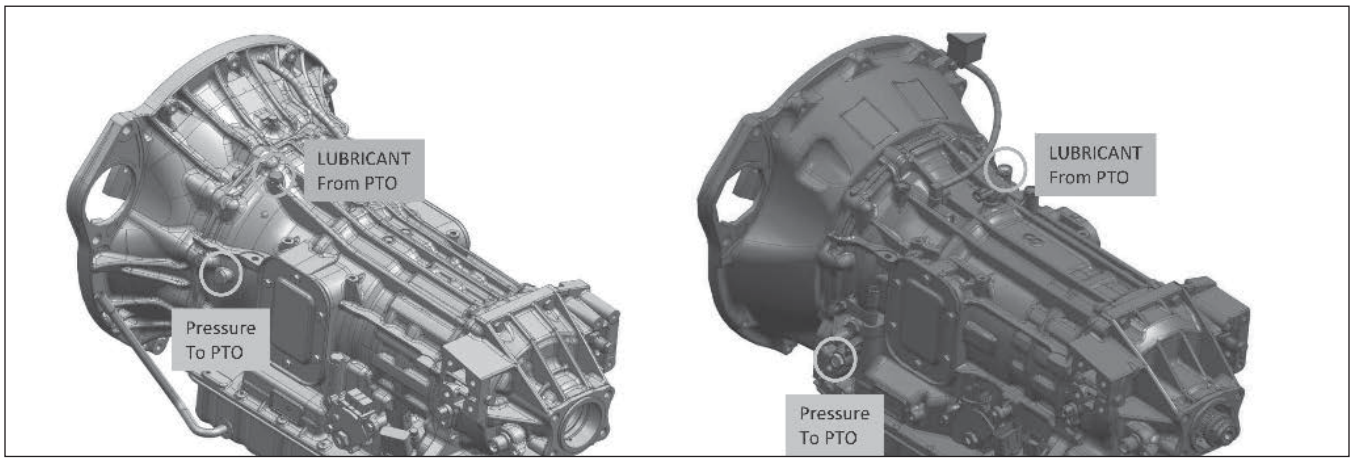


Figure 12

PTO Pressure and Lubrication Port Comparison – Aisin

Applies to both Hino A465HD and Isuzu A465ID

A465 vs. A465id



A465 **A465id**

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Mounting the PTO
231, 271, 272M and 272N Series

1. Remove the 6-Bolt cover and gasket from the 6-Bolt aperture. Clean the 6-Bolt aperture as in step 2 on page 10 (**Fig. 13**).

2. Place the 6-Bolt rubber coated gasket (35-P-69) on the transmission. The beaded (raised) surface should be facing the special mounting plate (**Fig. 14**).

3. Next, fasten the special mounting plate onto the opening with the three (3) socket head bolts. The three socket head bolts always go in the three holes closest to the two (2) welded-on nuts. Figure 13 shows the plate position for a PTO with a 5 assembly arrangement. Torque the three socket head bolts to 25-30 lb-ft [34-41 N-m]. **DO NOT** exceed 30 lb-ft (**Fig. 15**).

4. Place the special gasket (35-P-84) on the plate (**Fig. 16**). See step 3.

5. Place the PTO on the plate (**Fig. 17**). There are 5 (five) cap screws that hold the 231, 271, 272M and 272N to the transmission and plate. Make sure all 5 cap screws go through the plate and into the transmission.

6. All 5 cap screws can be tightened and torqued with a 3/8" drive socket wrench (**Fig. 17**). Torque all cap screws to 32-37 lb-ft [43-50 N-m].

NOTE: The low-profile adapter plate will typically only fit upward due to transmission interference (as shown in **Fig. 15**).

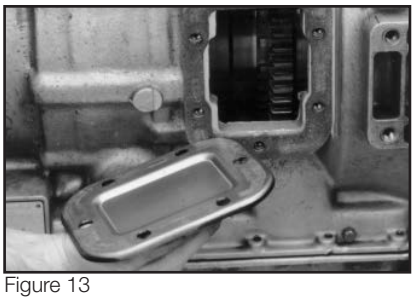
Figure 13

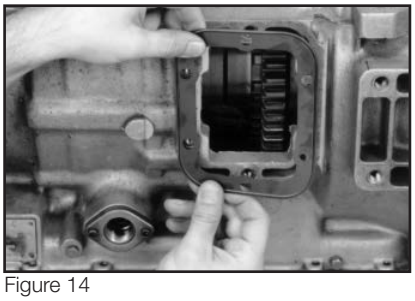
Figure 14

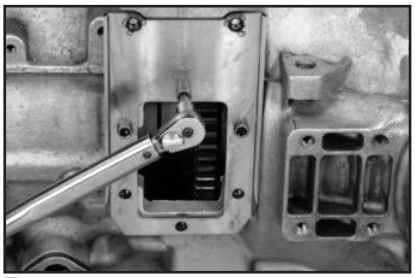
Figure 15

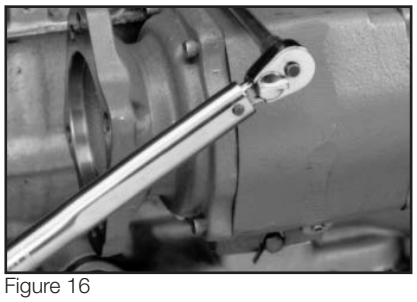
Figure 16

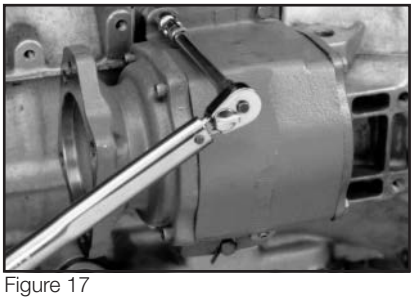
Figure 17

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Mounting the PTO (Continued)
231, 271, 272M and 272N Series

7. There are two (2) large drilled and tapped holes on the 231, 271, 272M and 272N Series PTO housing (**Fig. 17**). These two holes come with plugs installed.

   One of the plugs will be used for the dump line from the solenoid to the housing of the 271 and 272 (Remote Mount) Series. The 231 and 272 Air Shift Series do not require the dump line.

NOTE: See pages 20 and 21 plumbing schematics for more details.

   The second plug, which is positioned over the input gear, must be removed and replaced with a transducer when using the Chelsea Electronic Overspeed Control. If you are not using an Electronic Overspeed Control, the plug will remain in the housing (**Fig. 19**). After checking backlash, continue with the plumbing and wiring of the controls.

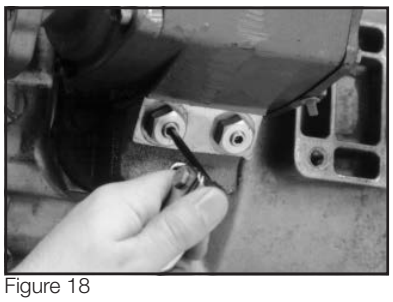
Figure 18

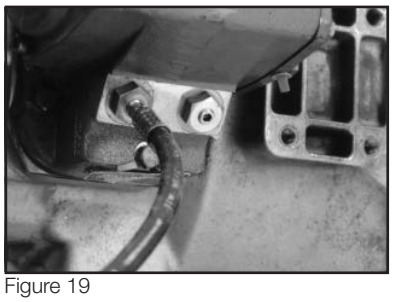
Figure 19

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Checking Backlash (PTO with access covers)

To check for proper backlash on PTO with shift cover:

1. Remove PTO inspection plate.

2. Mount the dial indicator so that it registers movement of the input gear (driven gear) of the PTO (**Fig. 20**).

NOTE: See **Fig. 21** for proper location of dial indicator contact point (two common type dial indicators shown).

3. Hold the PTO driver gear in transmission with a screwdriver or bar and rock the PTO input gear (driven gear) back and forth with your hand. Note the total movement on the dial indicator.

4. Establish backlash at .006"-.012" [.15 mm-.30 mm] by adding or subtracting gaskets.

   General rule: A Chelsea .010" gasket will change backlash approx. .006". A .020" gasket changes backlash approx. .012".

5. Replace inspection plate and re-torque (4) four cap screws to 9-11 lb-ft [12-15 N-m].

NOTE: Apply a drop of Loctite 290 on each cap screw before reinstalling. Cap screws that are furnished with a conversion kit and are being installed for the first time do not require the drop of Loctite.

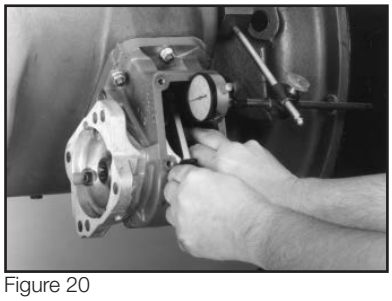

Figure 20

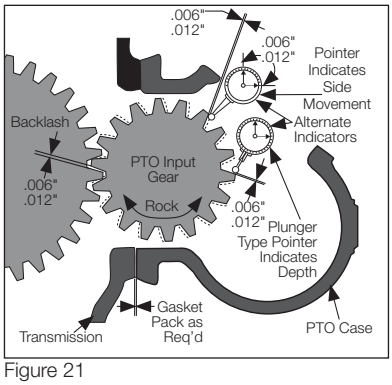

Figure 21

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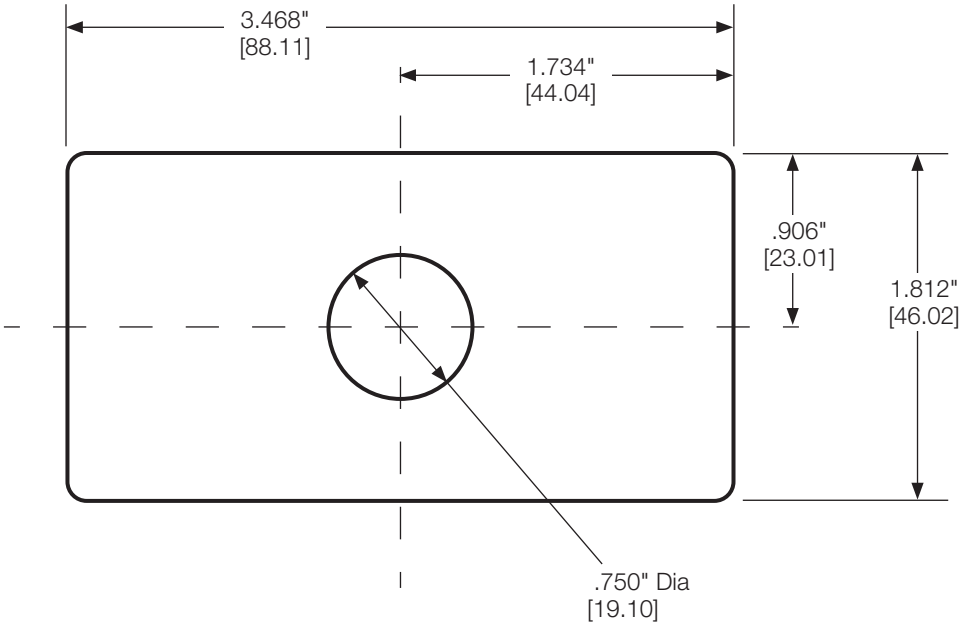
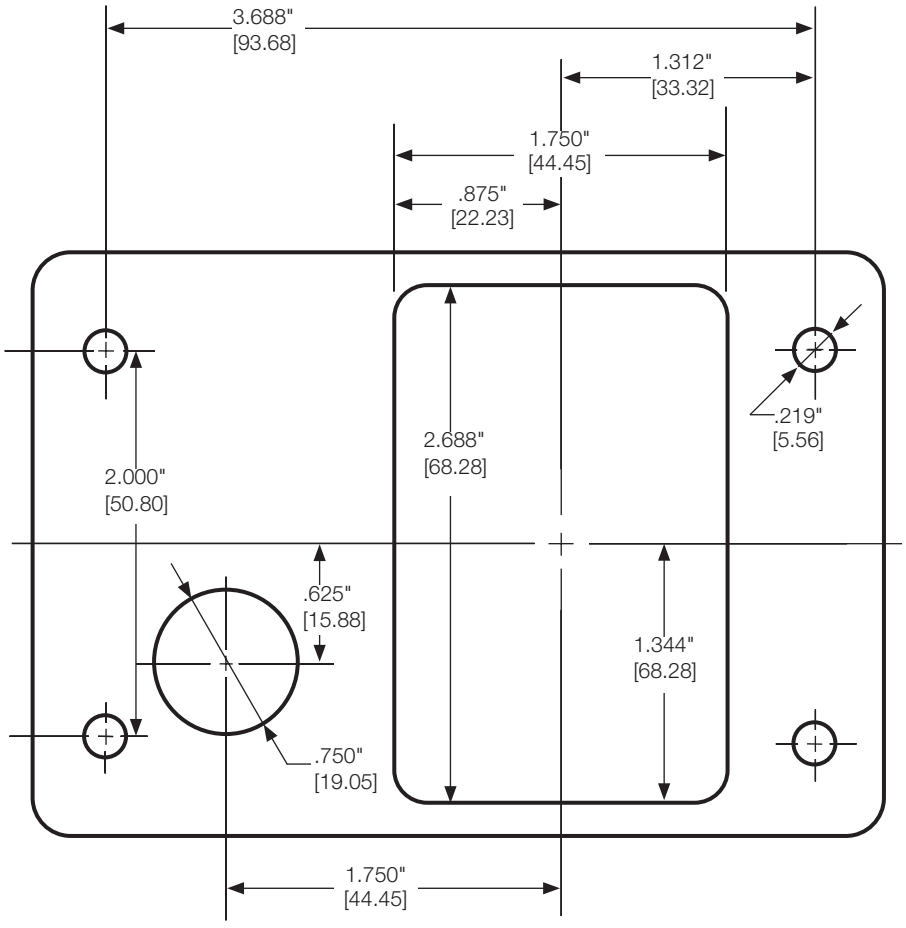
Dash Drilling Template Indicator Light Part Number 68-P-18 (SK-168 Rev A)



Dash Drilling Template for 6 & 8 Bolt Air Shift Valve (SK-204 Rev C)



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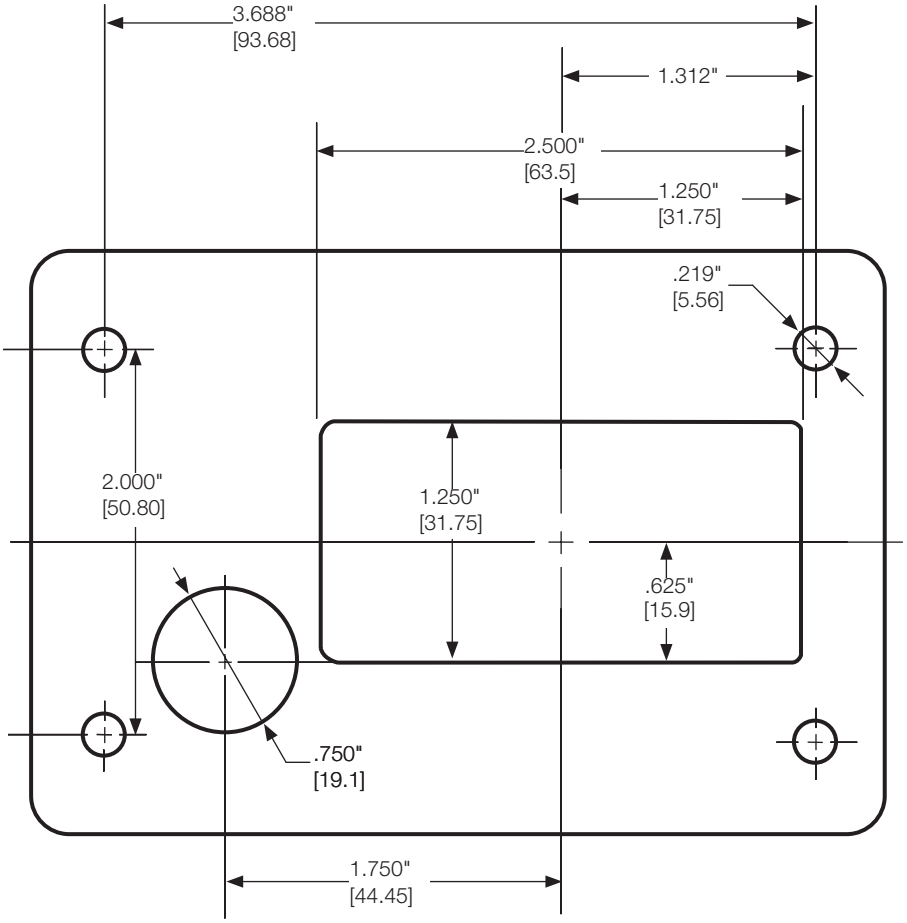
Dash Drilling Template for 6 & 8 Bolt Air Shift Valve (Continued) (SK-204 Rev C)



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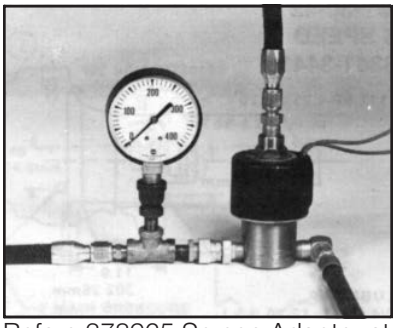
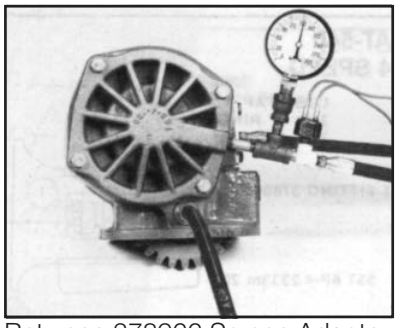
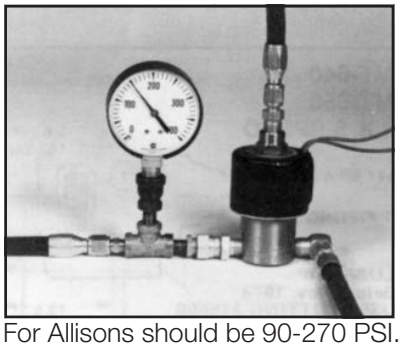
Circuit Check for PowerShift PTO for Automatic Transmissions 270/271, 272/282 (Remote), 800 and 852 Series

Perform the following steps. Record the results when installing the PTO originally, as a replacement, or while troubleshooting.

1. Install 2 Pressure Gauges in the circuit as shown: 300-400 PSI Gauges for Allison transmissions.
2. With the Solenoid Valve Off, record the pressures at inlet to Solenoid Valve for the transmission both cold (ambient) and at the operating temperature for engine idle RPM and engine maximum RPM.


Before 378965 Screen Adapter at In Port of Solenoid Valve.


Between 378966 Screen Adapter and PTO Port.


For Allisons should be 90-270 PSI.

RPM	Transmission Cold (Ambient)	Transmission At Operating Temperature
Engine Idle	PSI	PSI
Engine Maximum	PSI	PSI

3. With the Solenoid Valve On, record the corresponding pressures at the 2 gauges with the transmission both cold (ambient) and at the operating temperature for engine idle RPM and engine maximum RPM.

Engine RPM	Transmission Cold (ambient)		Transmission At Operating Temperature	
	Into Solenoid	Into PTO	Into Solenoid	Into PTO
Idle	PSI	PSI	PSI	PSI

If at any time the above pressures are below 90 PSI or there is a 50 PSI or more difference in two of the corresponding readings in Part 3:

(a) Check the circuit for correct installation.
(b) Check hoses and screens for obstruction.

4. Remove the B line from the PTO with the Solenoid Valve On. No oil should appear from the line. Then turning the Solenoid Valve to Off should dump the oil from the PTO Clutch Pack through this line (**Fig. 22**).
5. Remove the C line from the PTO Idler Shaft end, and confirm that oil is running to this shaft for lubrication (**Fig. 23**).

Retain the findings of these tests for future comparison. Re-check the oil level in the transmission after testing is complete. This concludes your installation and circuit checks. Make sure all lines are reconnected (lube lines and pressure solenoid lines).

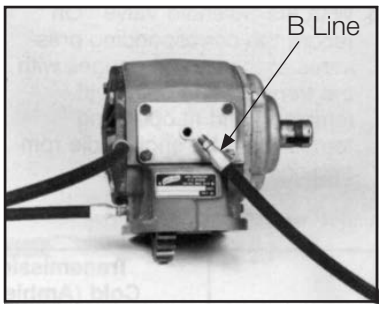


Figure 22

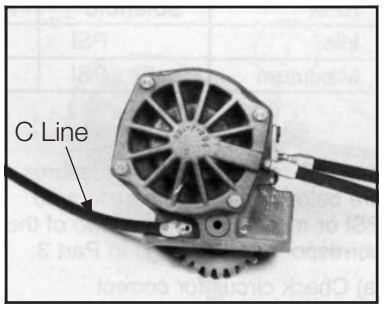


Figure 23

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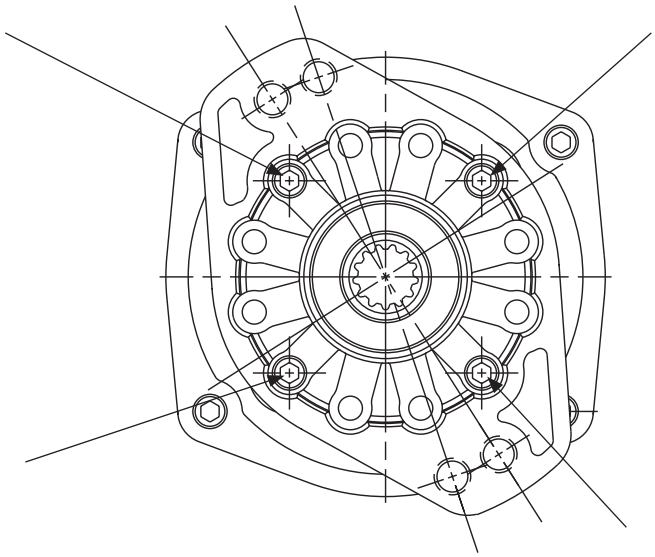
Rotatable Flanges Installation and Torque Specifications

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 cap screws provided in the bag kit. Bag kit number 328170-207X (6-Bolt family) will contain (3) cap screws (378447-6) and 328170-208X (230, 231, 236, 238, 270, 271, 272 and 282 Series) will contain (4) cap screws for attaching the flange to the PTO bearing cap. After installing the cap screws make sure to torque the screws to 24-28 lb-ft. Consideration should be taken on the size and weight of the pump being installed (see pages 4-5).



RA Flange Shown

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 tolerance.

Parker Hannifin Corporation
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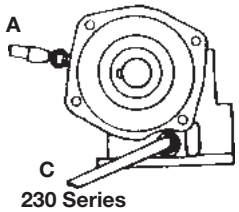
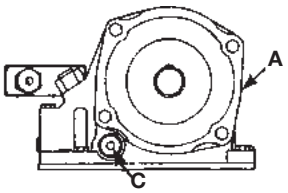
PowerShift
PTO Hose Connection Illustrations

A. Air Pressure Line from Valve.
C. Lubrication Line from Transmission. Attach to Either End of IDLER Shaft.



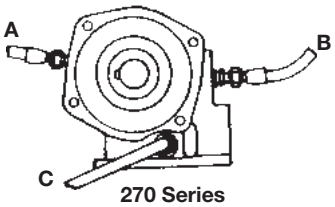
230 Series

A. Air Pressure Line from Valve.
C. Lubrication Line from Transmission. Attach to Either End of IDLER Shaft.



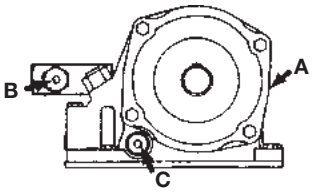
231 Series

A. High Pressure Line from Valve.
B. Dump Line to PTO from 3 Way Valve.
C. Lubrication Line from Transmission. Attach to Either End of IDLER Shaft.



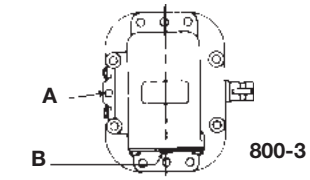
270 Series

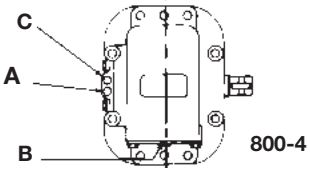
A. High Pressure Line from Valve.
B. Dump Line to PTO from 3 Way Valve.
C. Lubrication Line from Transmission. Attach to Either End of IDLER Shaft.



271 Series

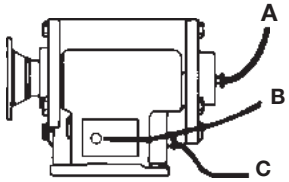
A. High Pressure Line from Valve.
B. Dump Line to PTO from 3 Way Valve.
C. Lubrication Line from Transmission.





800 Series

A. High Pressure Line from Valve.
B. Dump Line to PTO from 3 Way Valve.
C. Lubrication Line from Transmission. Attach to Either End of IDLER Shaft.



852 Series

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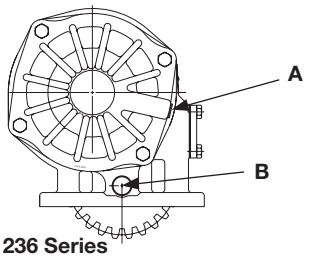
PowerShift
PTO Hose Connection Illustrations (Continued)

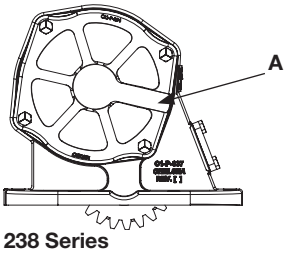
A. Air Pressure Line from Valve.

B. Lubrication Line from Transmission. Attach to Either End of IDLER Shaft.



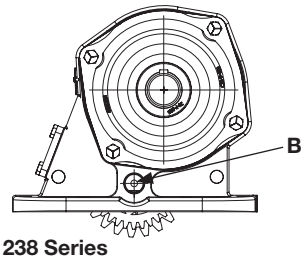
236 Series

A. Air Pressure Line from Valve.



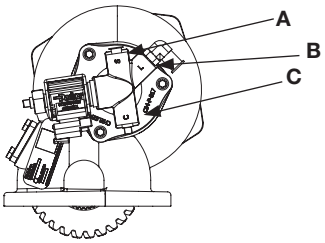
238 Series

B. Lubrication Line from Transmission.



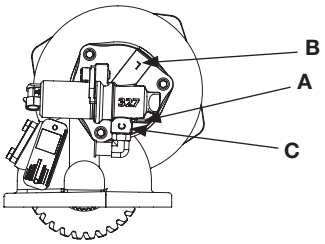
238 Series

A. S = Pressure Switch
B. L = Lube Line
C. C = To Clutch



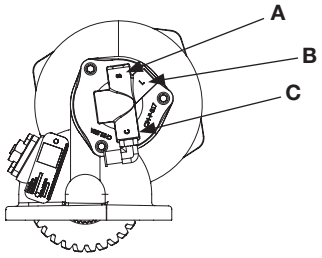
272 Series Air Shift

A. S = Pressure Switch
B. L = Lube Line
C. C = To Clutch



272 Series Hydraulic

A. S = Pressure Switch
B. L = Lube Line
C. C = To Clutch



272 Series Remote

NOTE: Reference pages 50-52 for Allison Transmission port locations and convertor Housing Fittings.

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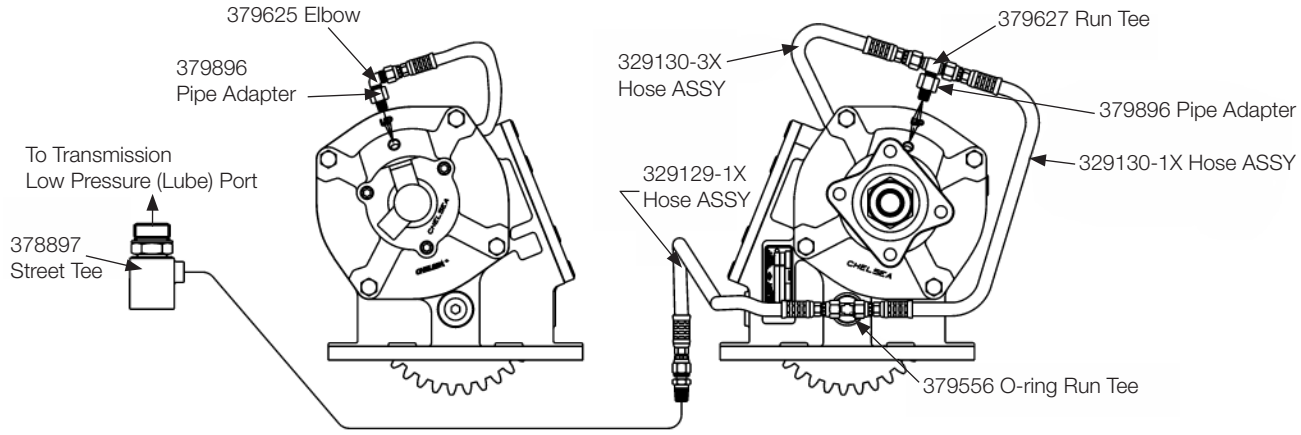
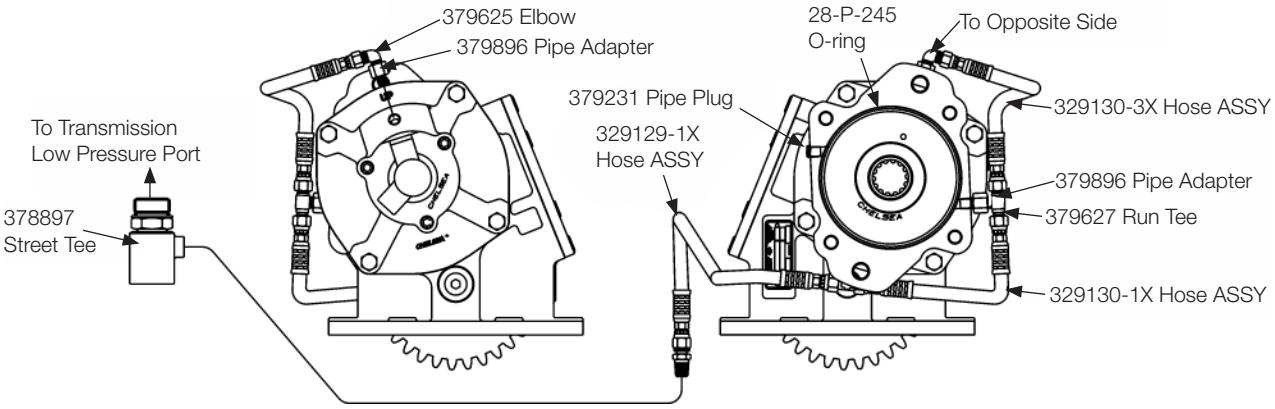
Pressure Lube Installation Schematic 885 Series

(SK-336 Rev C)

XV & AB Output

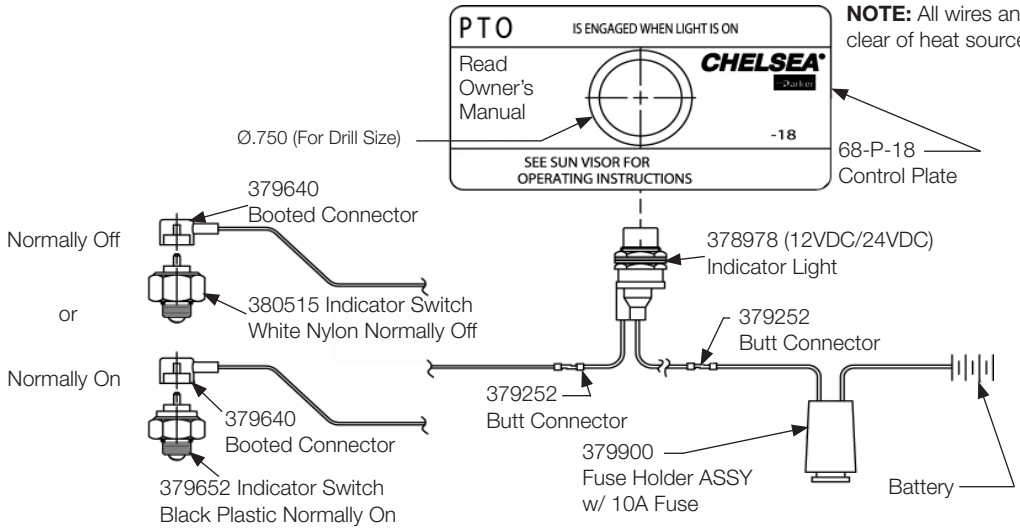


XS Output



Indicator Light Installation

(SK-286 Rev G)



NOTE: All wires and cables must be clear of heat sources and moving parts.

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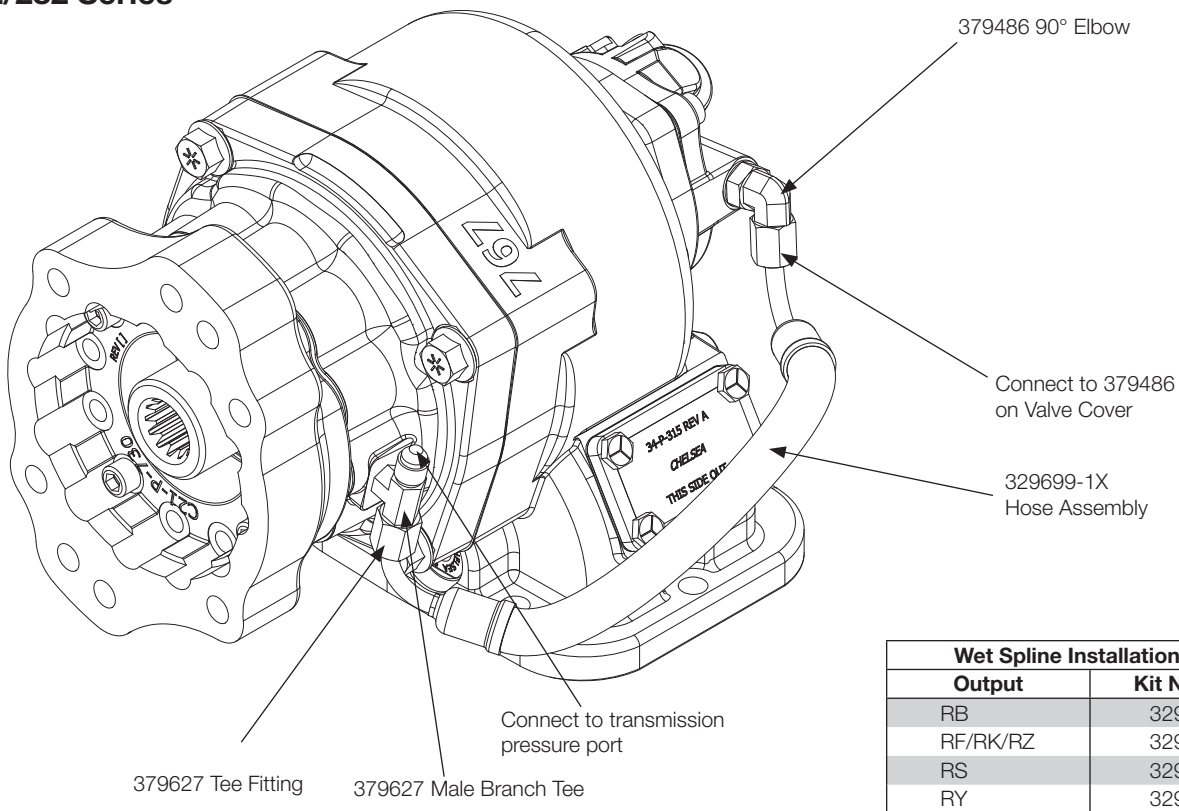
Wet Spline Installation
RB, RF, RK, RS, RY & RZ Output Options
272/282 Series

(SK-508 Rev C)



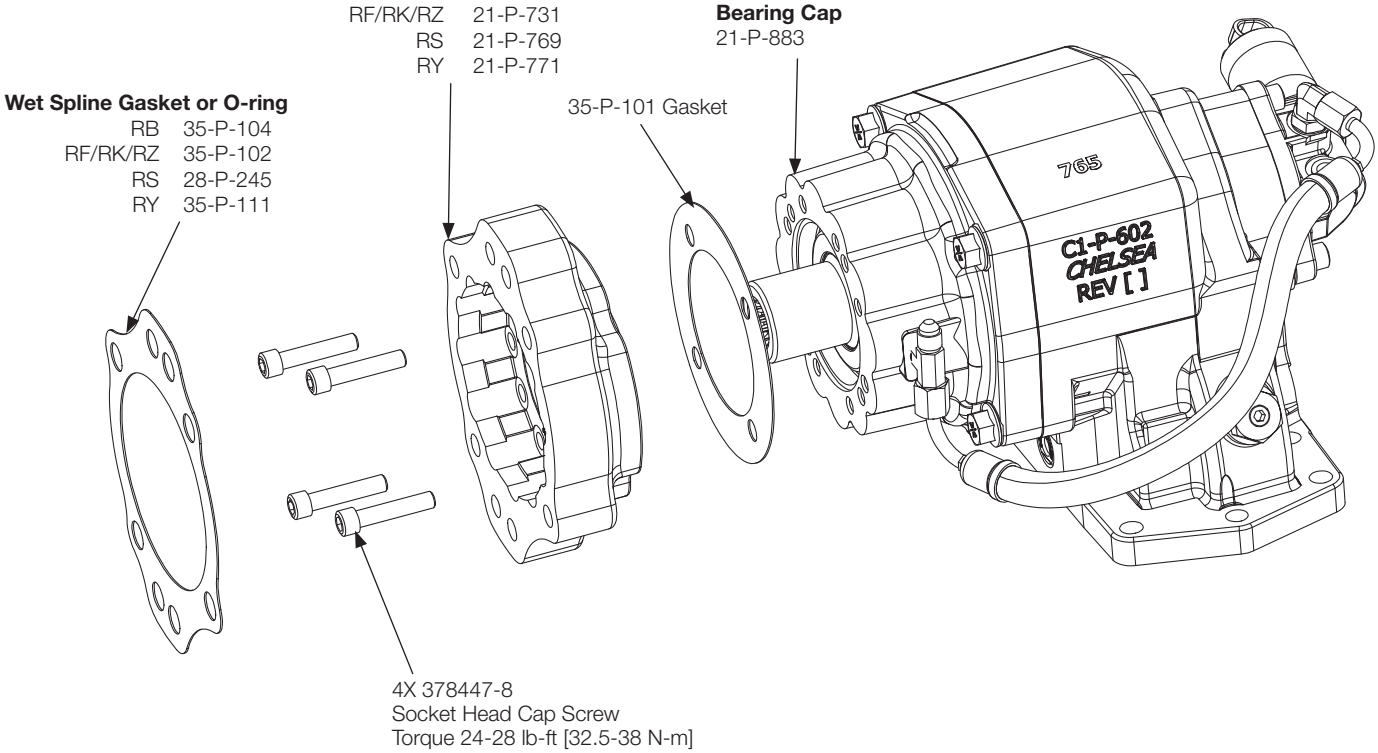
Wet Spline Installation Kits	
Output	**Kit Number**
RB	329959X
RF/RK/RZ	329700X
RS	329744X
RY	329742X
NOTE: Not all output options may be available on Series listed above.	

Flange
RB 21-P-894
RF/RK/RZ 21-P-731
RS 21-P-769
RY 21-P-771

Wet Spline Gasket or O-ring
RB 35-P-104
RF/RK/RZ 35-P-102
RS 28-P-245
RY 35-P-111

Bearing Cap
21-P-883

35-P-101 Gasket



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

GM C Series PTO Wiring Harness

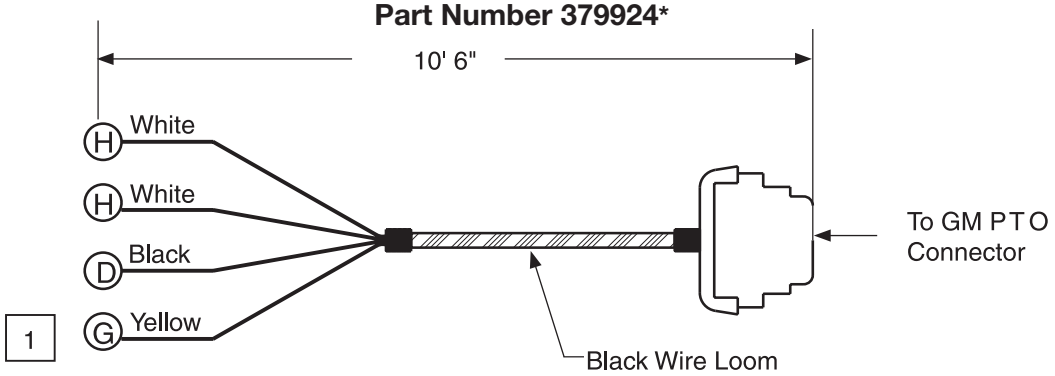
For model year 2003-2010 GM C Series 4500, 5500, 6500, 7500 and 8500 trucks may be equipped with the Allison 1000, 2000/2500 transmissions. In these vehicles GM Truck has integrated a PTO connector, located in the right-hand engine compartment area. A Power Take-Off switch has also been incorporated 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 PTO Non EOC applications only.

The main purpose of the wiring harness on the Allison 1000, 2000/2500 transmissions will be to engage the torque converter lock-up clutch. The harness will also allow the end-user to utilize the stalk-mounted cruise control to control Power Take-Off RPM.

See wiring harness part number 379924***** for the 270 and 230 Series Power Take-Offs.

Model year 2003 - 2010 GM C Series Wiring Harness for 270 Series
Part Number 379924*



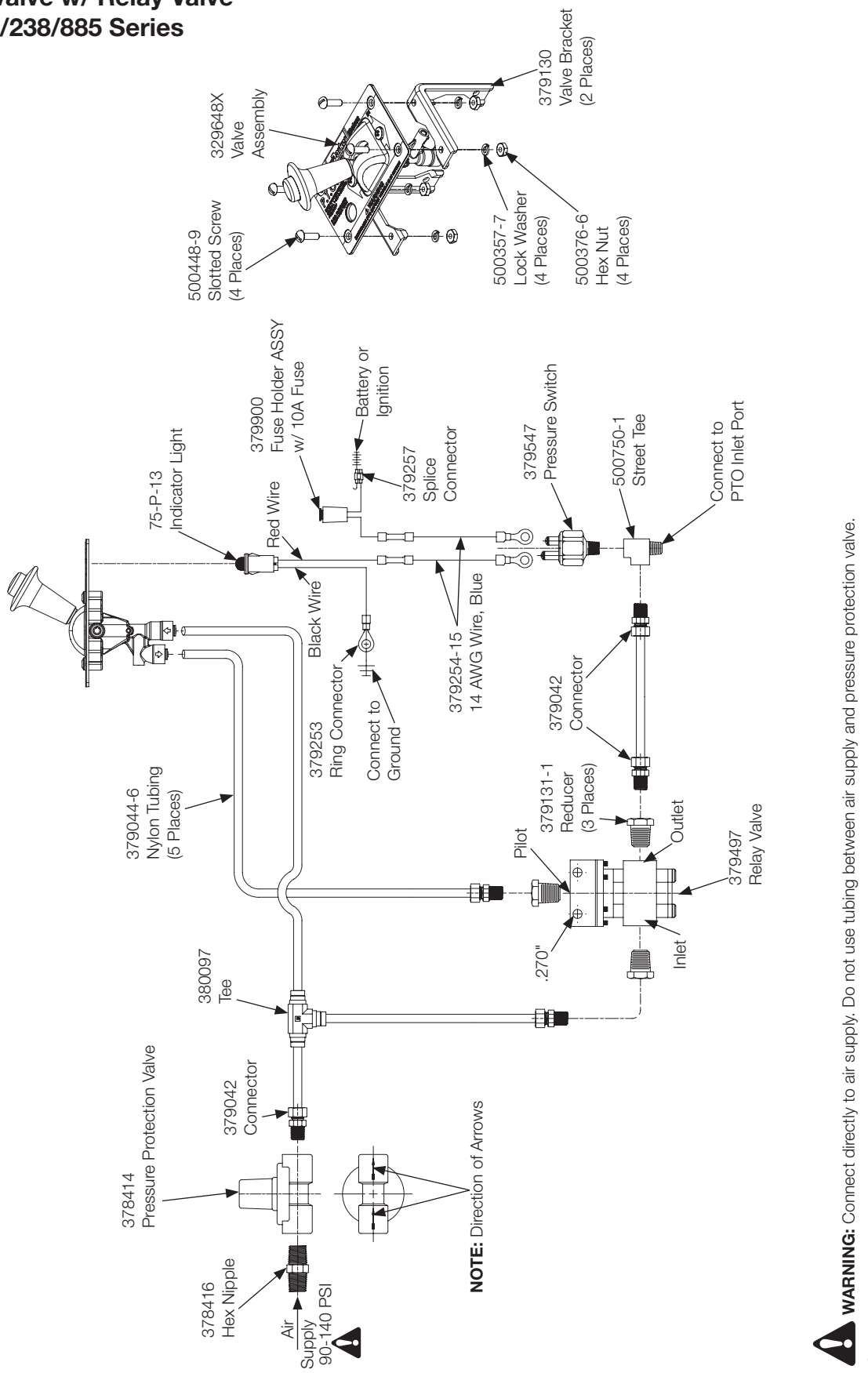
1 Connect the YELLOW wire and a WHITE wire to the Pressure switch.
Connect the BLACK wire and a WHITE wire to the solenoid valve.
There are no polarity issues for either of the connectors.

NOTE: For 2006 Model Year Chev. Kodiak and GMC Topkick C4500-C7500 Series with 6.6L Diesel or 8.1L Gas engines and Allison 1000/2200/2300 Series transmission. The PTO may not operate properly due to a GM change in feedback logic in the TCM. Please refer to GM UI Bulletin#76 REV. 1 dated 6/09/2006 or latest revision for complete details.

*** NOTE:** PN 379924 is obsolete. Contact customer service for assistance.

Shift Option A
Manual Air Valve w/ Relay Valve
230/231/236/238/885 Series

(SK-463 Rev A)



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.

See SK-204 Drilling Template for Control Plate in HY25-1240-M1/US Owner's Manual

Installation Kit: 328388-99X

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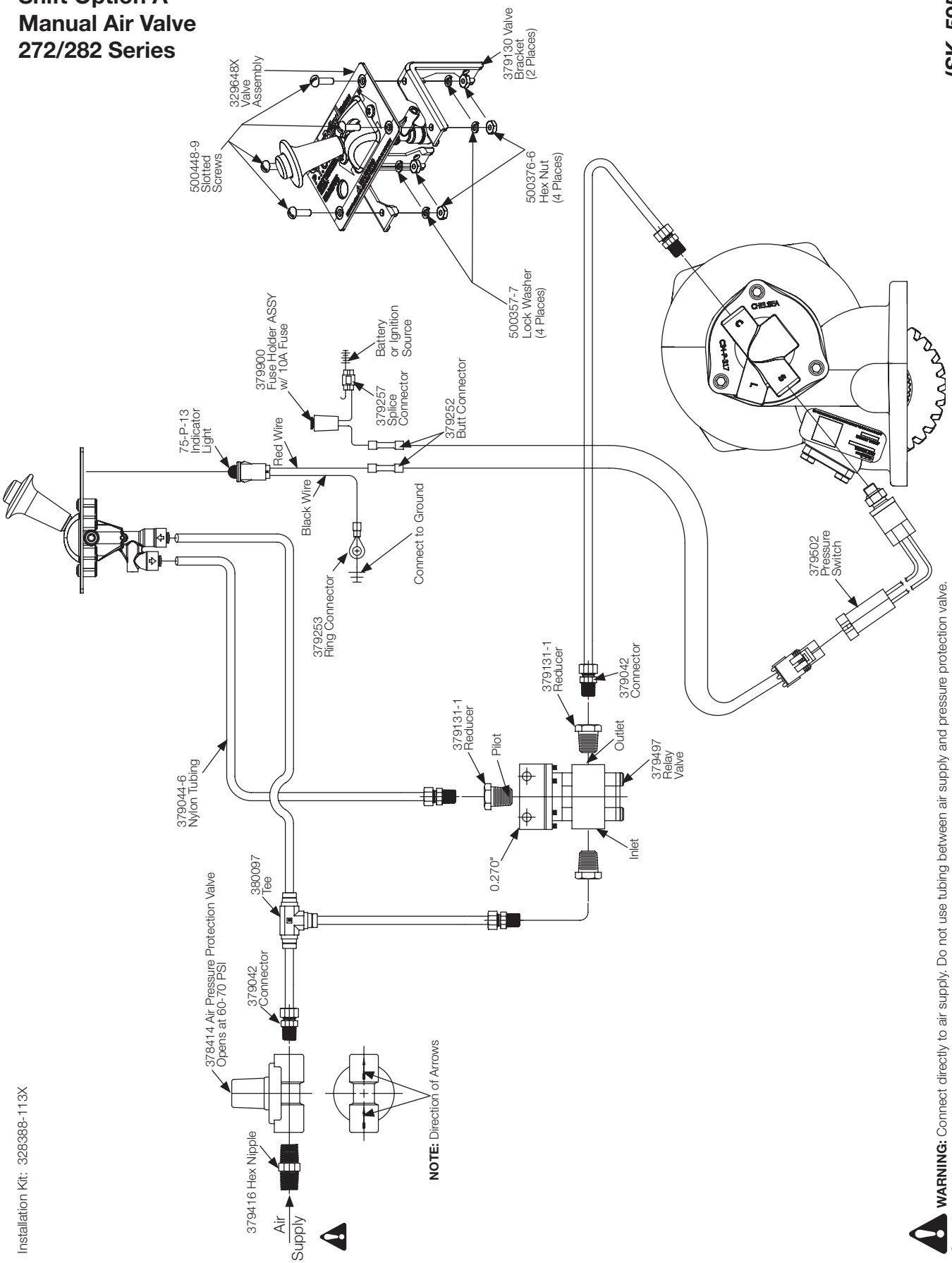
Shift Option A
Manual Air Valve
272/282 Series

(SK-595)



Installation Kit: 328388-113X

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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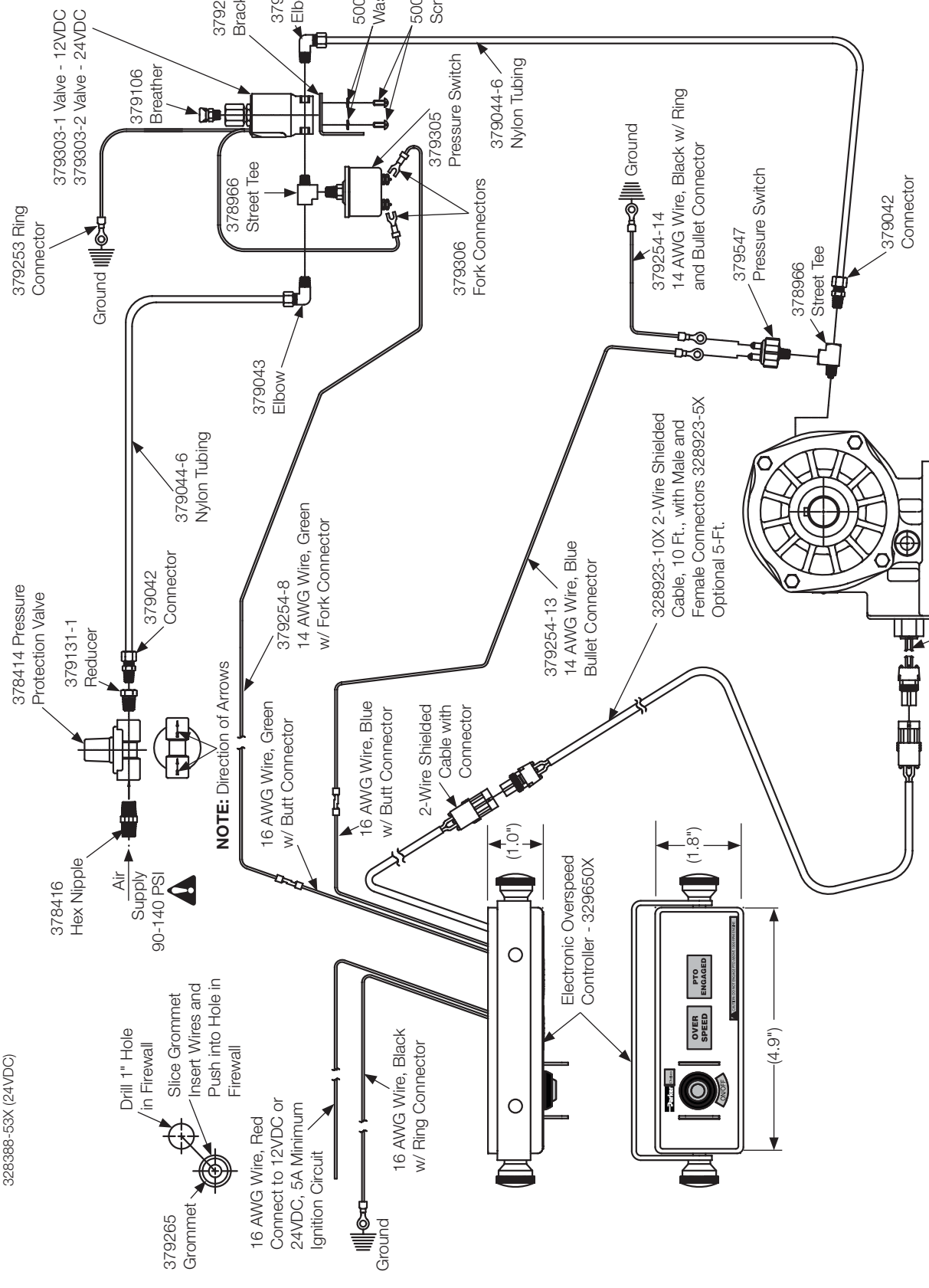
Shift Option N (12VDC) & J (24VDC)
Elec/Air w/ EOC
230/231 Series

(SK-467 Rev A)



Installation Kits: 328388-52X (12VDC)
328388-53X (24VDC)

WARNING: Connect directly to air supply. Do not use tubing between air supply and pressure protection valve.
NOTE: Strip Wire Ends 0.25" Prior to Installing Connector.

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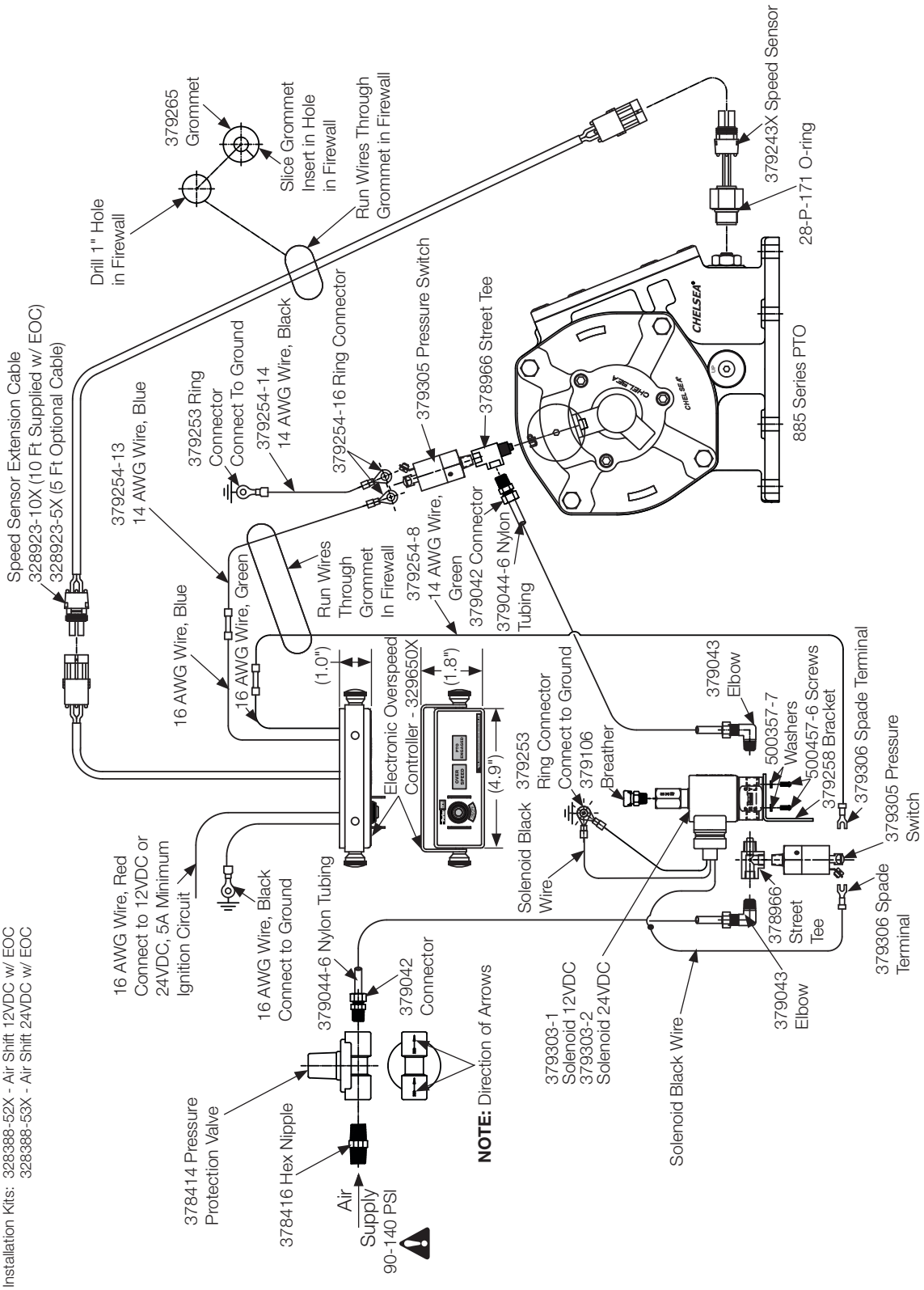
Chelsea Products Division
Olive Branch, MS 38654 USA

Shift Option N (12VDC) & J (24VDC)
Elec/Air w/ EOC
885 Series

(SK-468 Rev B)

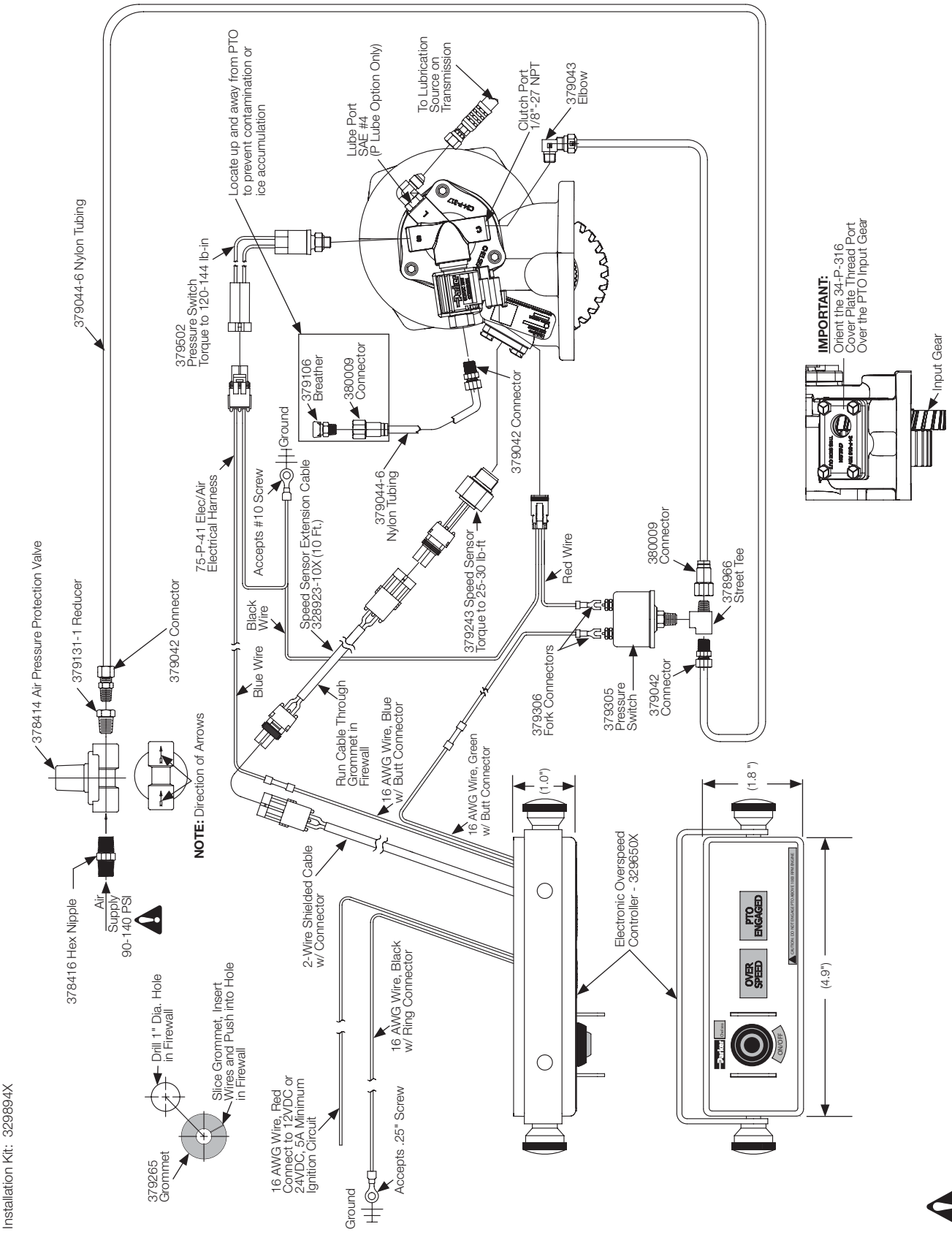


WARNING: Connect directly to air supply. Do not use tubing between air supply and pressure protection valve.
NOTE: Strip Wire Ends .25" Prior to Installing in Connectors.

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

Shift Option J (12VDC) & 3 (24VDC) Elec/Air w/ EOC (Integral Air Valve) 272/282 Series

(SK-590 Rev A)

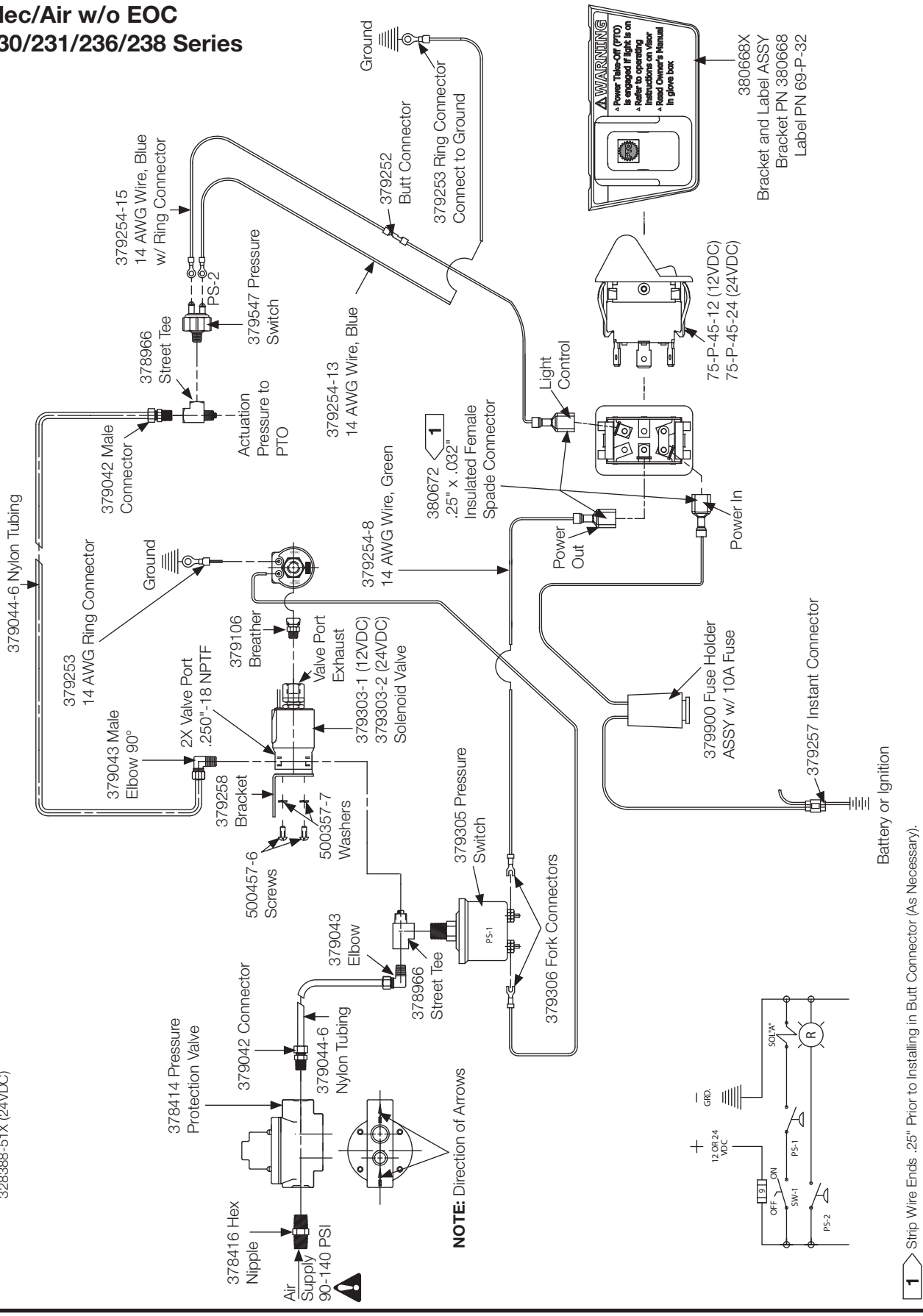


WARNING: Connect directly to air supply. Do not use tubing between air supply and pressure protection valve.
NOTE: Strip Wire Ends .25" Prior to Installing in Spade Terminal or Butt Connector (As Necessary).

Installation Kit: 329894X

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

Shift Option P (12VDC) & Q (24VDC) Elec/Air w/o EOC 230/231/236/238 Series



(SK-226 Rev H)

Installation Kits: 328388-50X (12VDC)
328388-51X (24VDC)

1 Strip Wire Ends .25" Prior to Installing in Butt Connector (As Necessary).

WARNING: Connect directly to air supply. Do not use tubing between air supply and pressure protection valve.

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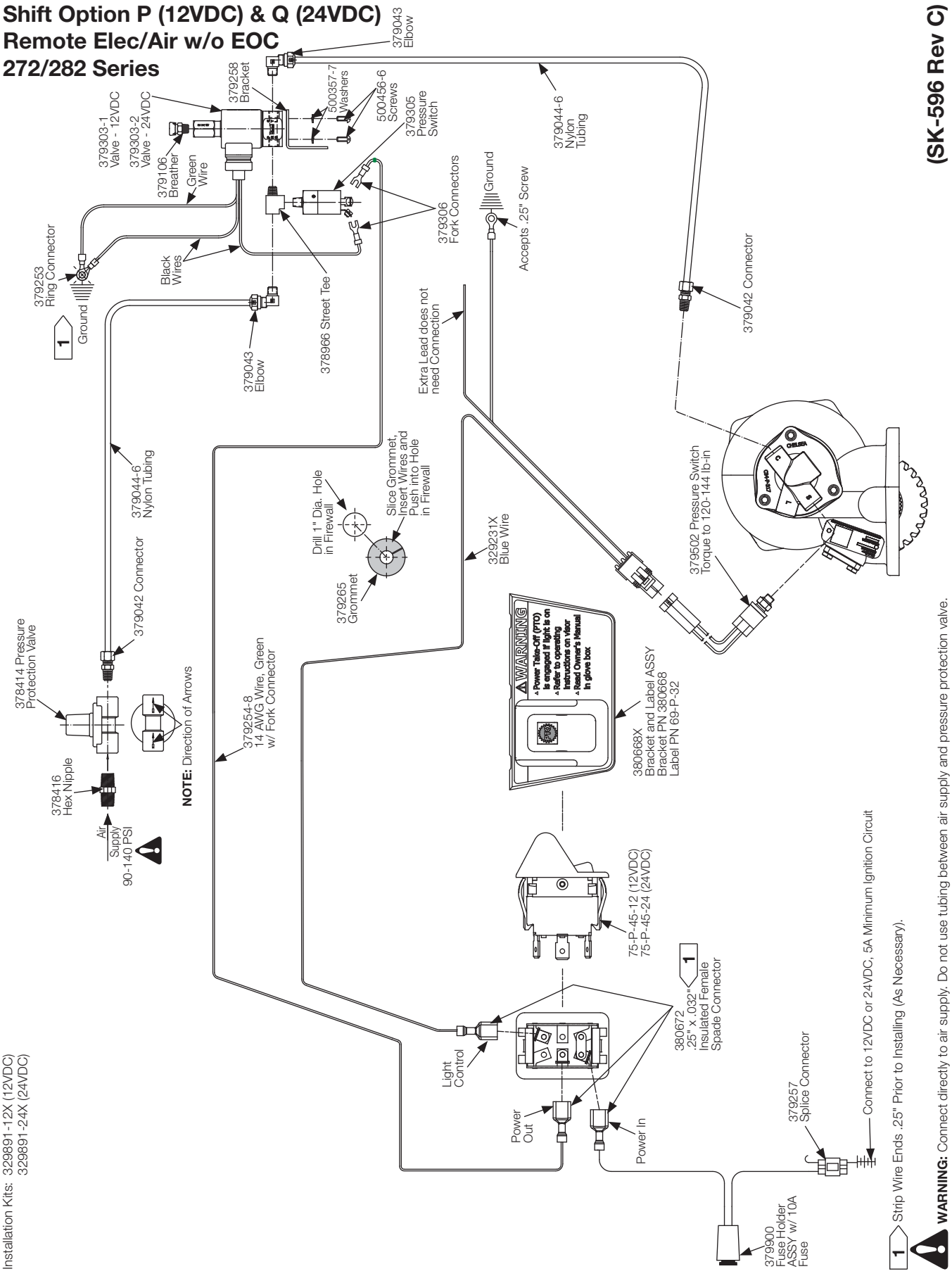
Shift Option P (12VDC) & Q (24VDC)
Remote Elec/Air w/o EOC
272/282 Series

(SK-596 Rev C)



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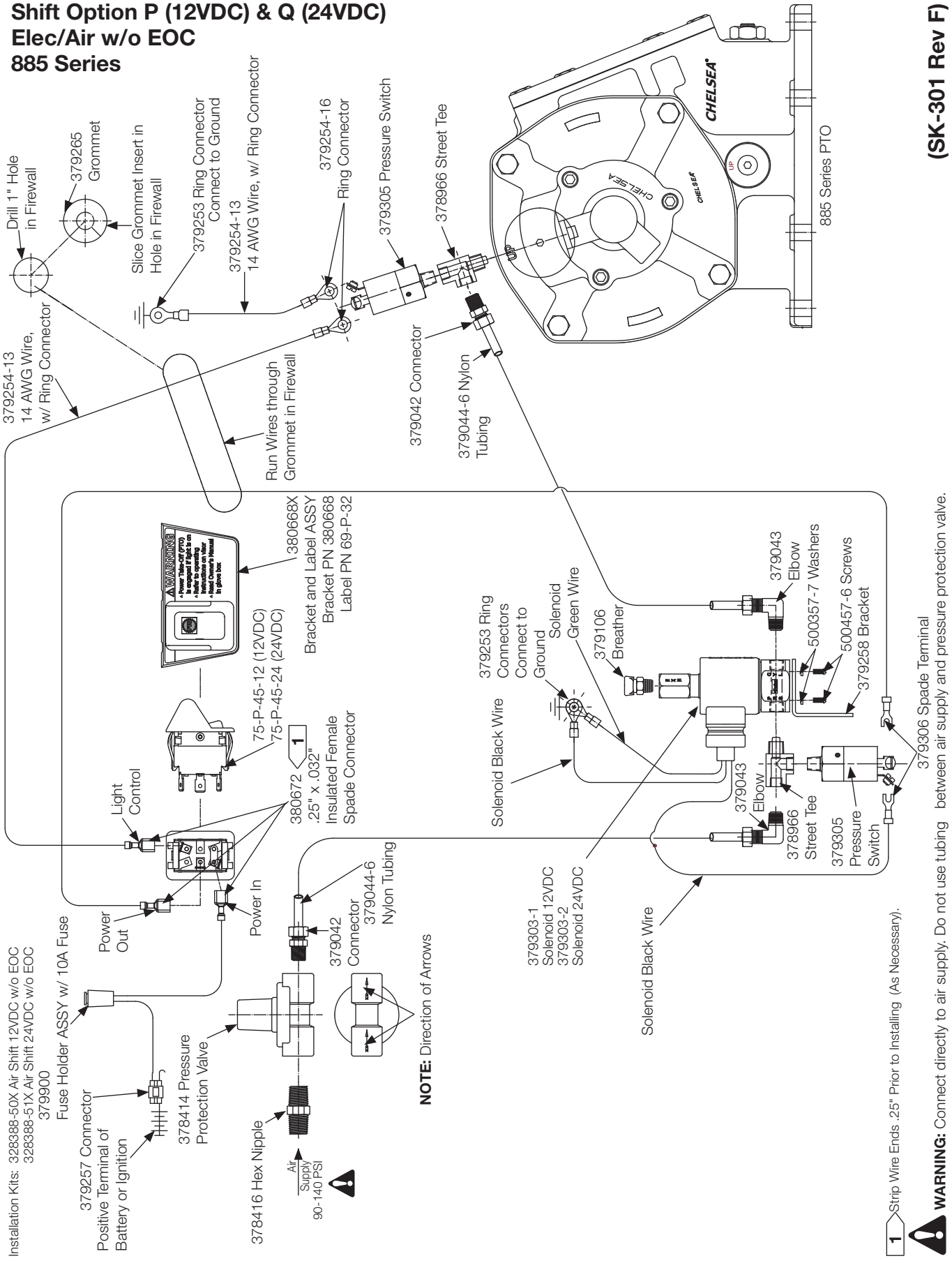
Shift Option P (12VDC) & Q (24VDC) Elec/Air w/o EOC 885 Series

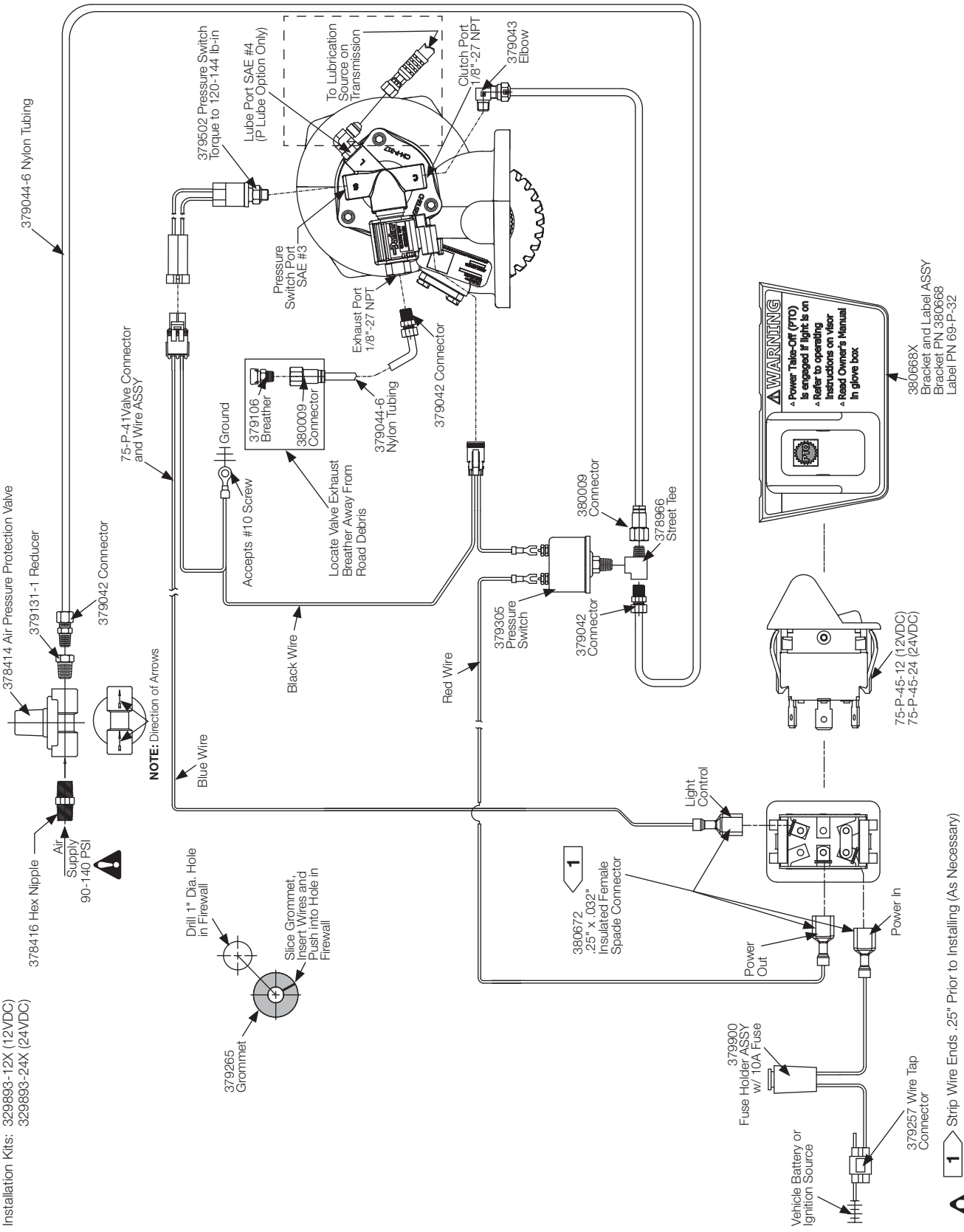


(SK-301 Rev F)

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

Shift Option 1 (12VDC) & 2 (24VDC)
Elec/Air w/o EOC (Integral Air Valve)
272/282 Series

(SK-589 Rev C)



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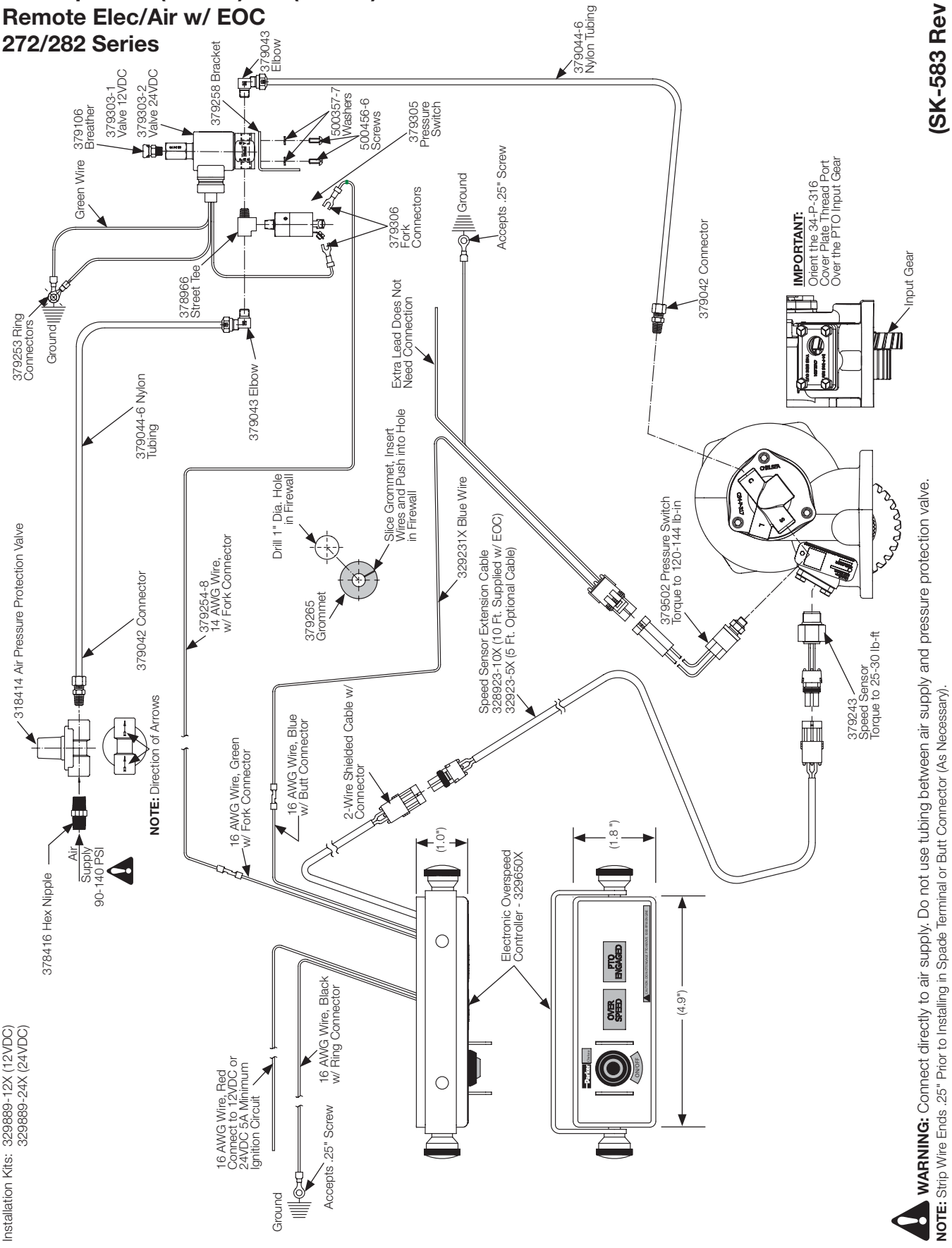
Chelsea Products Division
Olive Branch, MS 38654 USA

Shift Option R (12VDC) & 4 (24VDC)
Remote Elec/Air w/ EOC
272/282 Series

(SK-583 Rev B)



WARNING: Connect directly to air supply. Do not use tubing between air supply and pressure protection valve.

NOTE: Strip Wire Ends .25" Prior to Installing in Spade Terminal or Butt Connector (As Necessary).

Parker Chelsea

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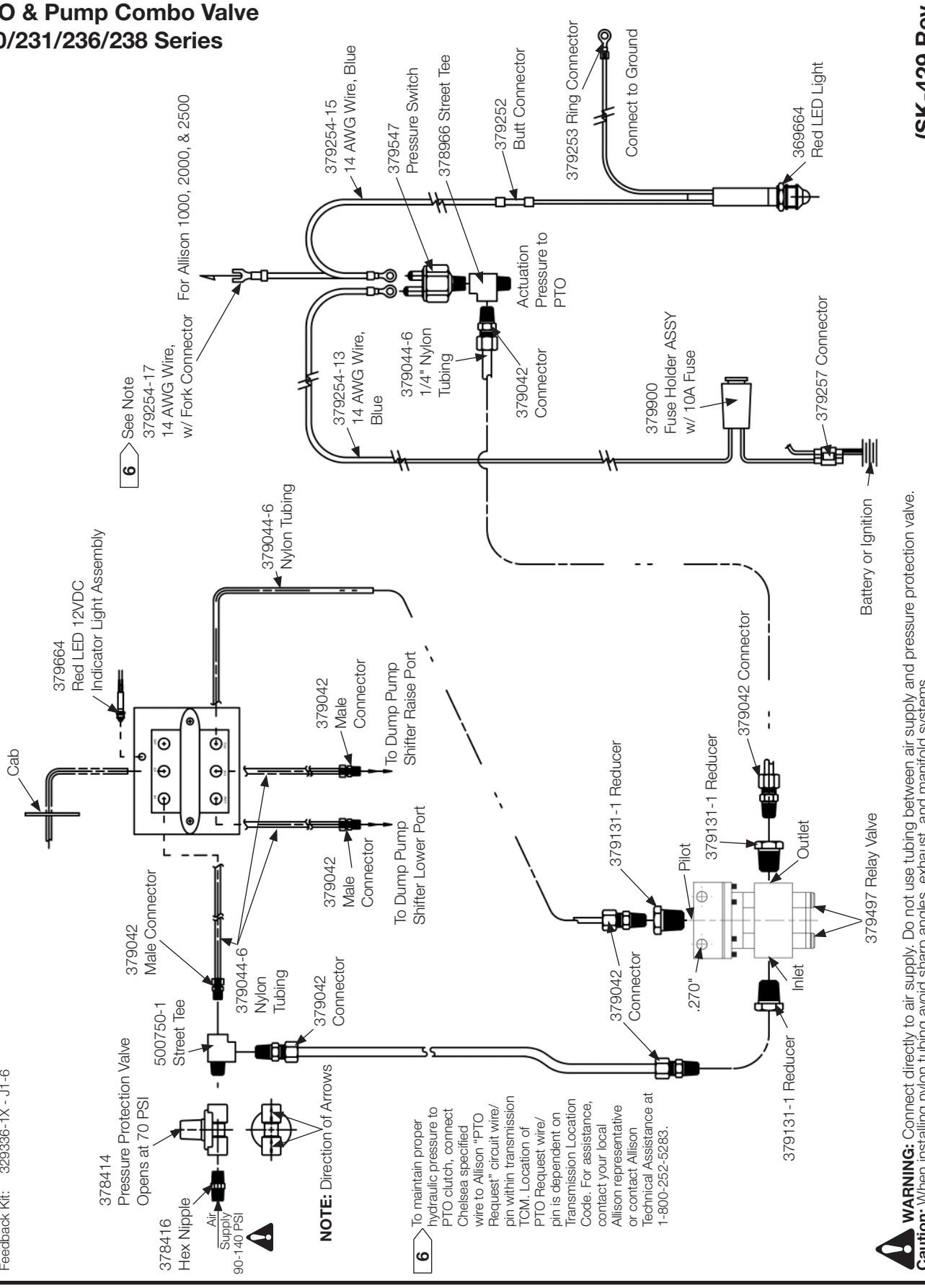
Olive Branch, MS 38654 USA

Shift Option S (12VDC) & T (24VDC)
PTO & Pump Combo Valve
230/231/236/238 Series

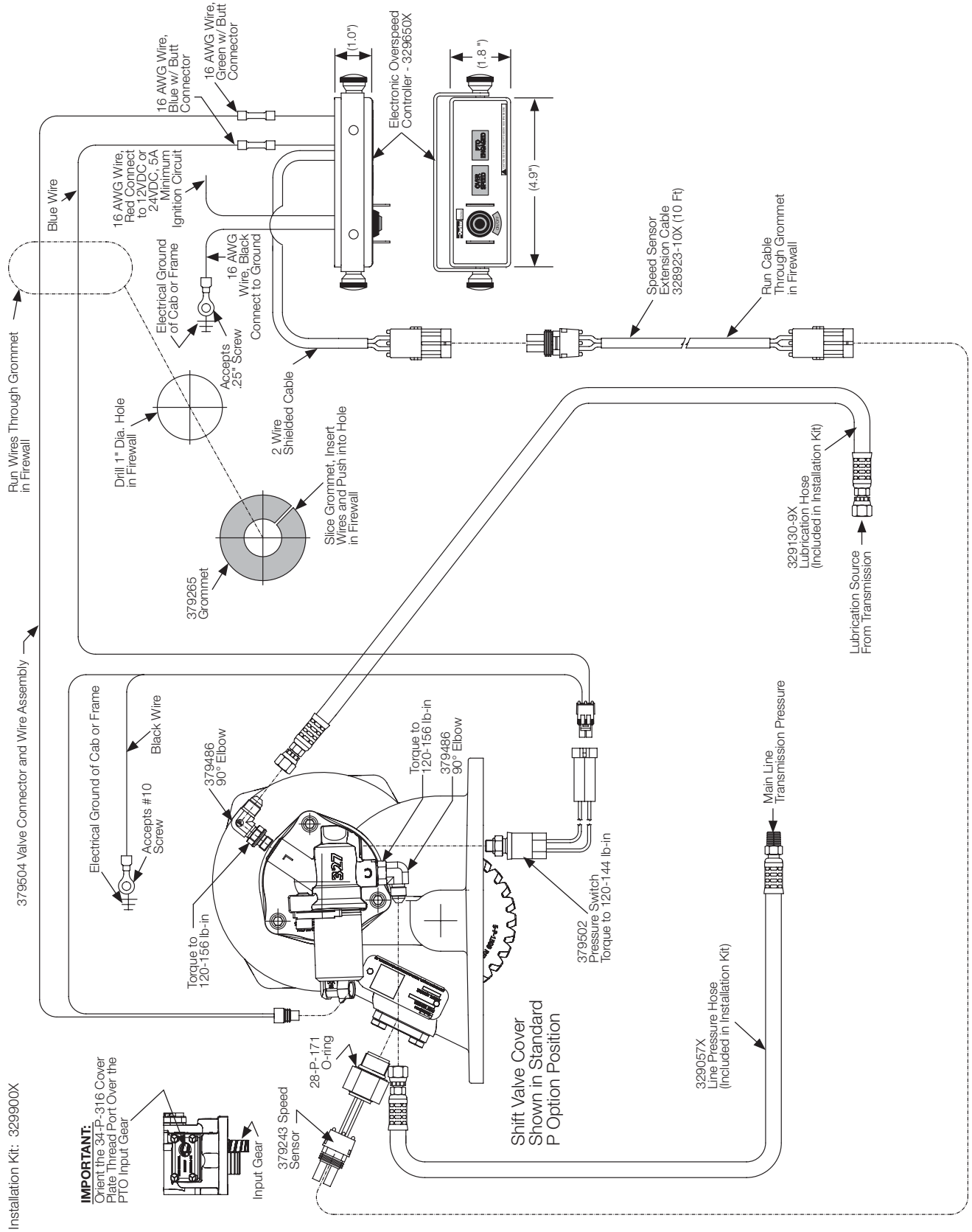
(SK-429 Rev C)



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

Shift Option K (12VDC) & L (24VDC) Elec/Hyd w/ EOC 272/282 Series

(SK-598)



NOTE: Strip Wire Ends .25" Prior to Installing in Spade Terminal or Butt Connector (As Necessary).

Parker Chelsea

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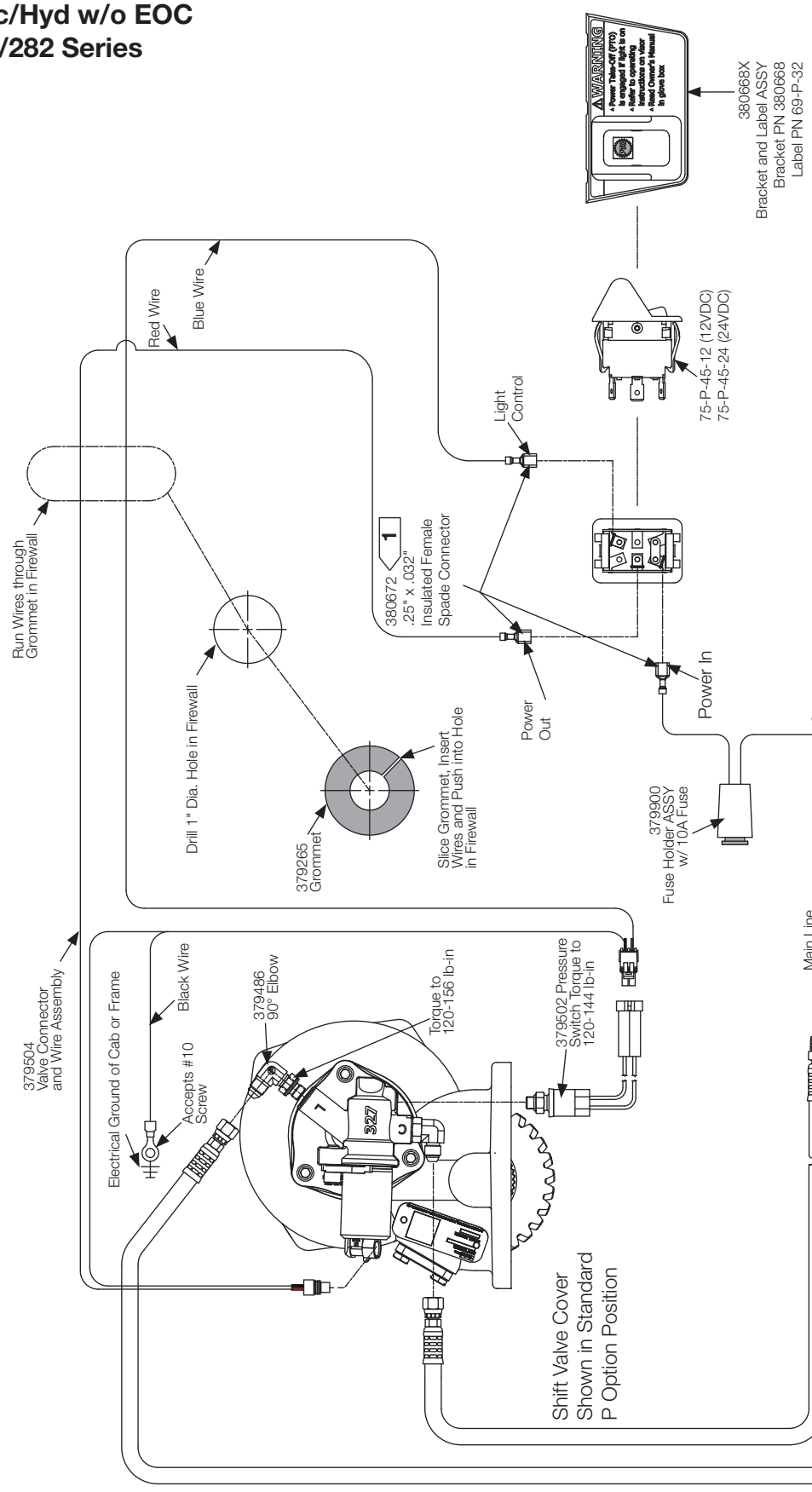
Chelsea Products Division
Olive Branch, MS 38654 USA

Shift Option B (12VDC) & D (24VDC)
Elec/Hyd w/o EOC
272/282 Series

(SK-572 Rev A)



Installation Kits: 329024-12X (12VDC)
329024-24X (24VDC)

1 Strip Wire Ends .25" Prior to Installing in Spade Terminal (As Necessary).

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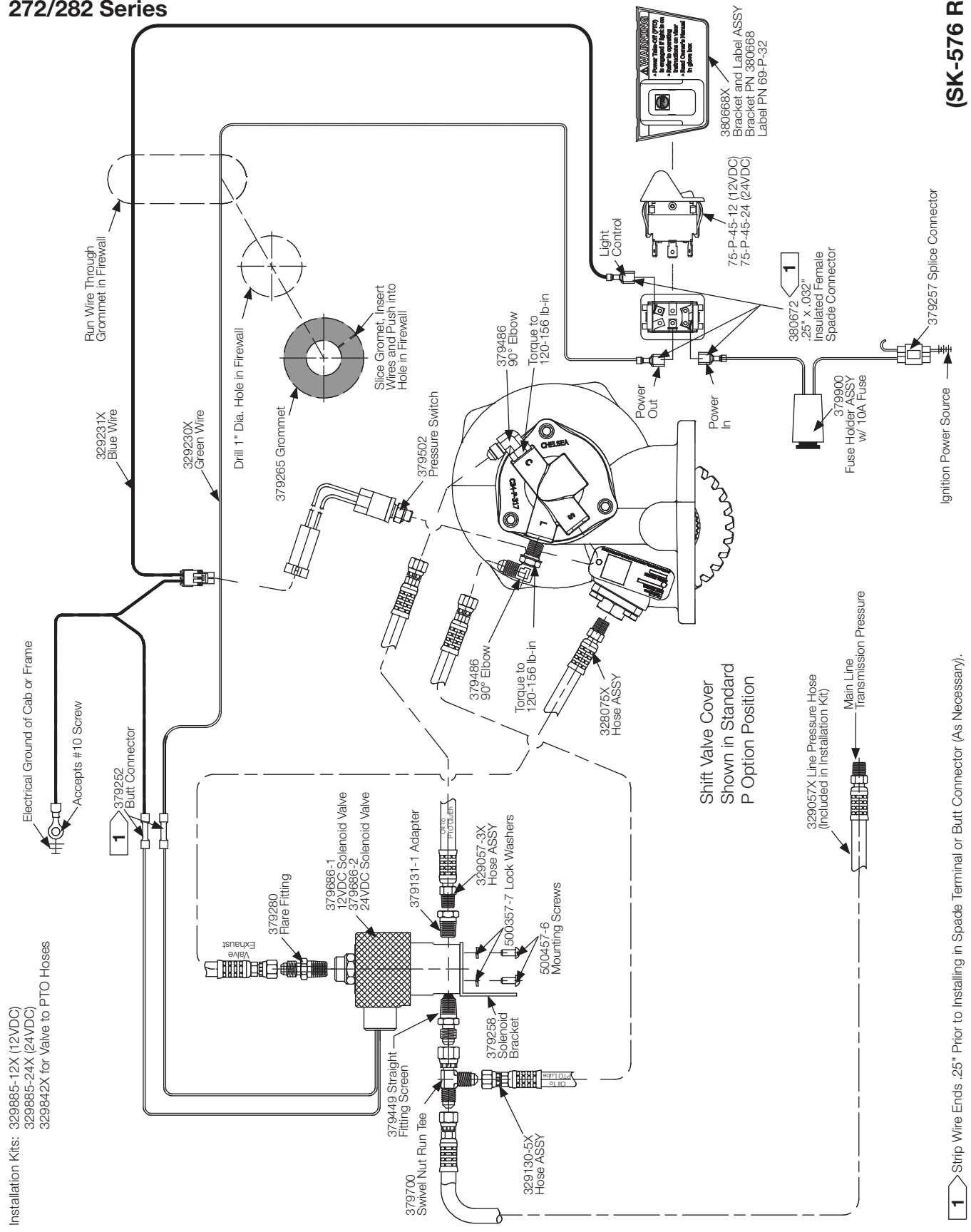
Shift Option G (12VDC) & H (24VDC) Remote Elec/Hyd w/o EOC 272/282 Series

NOTE: Do not use for Allison Transmissions

(SK-576 Rev D)



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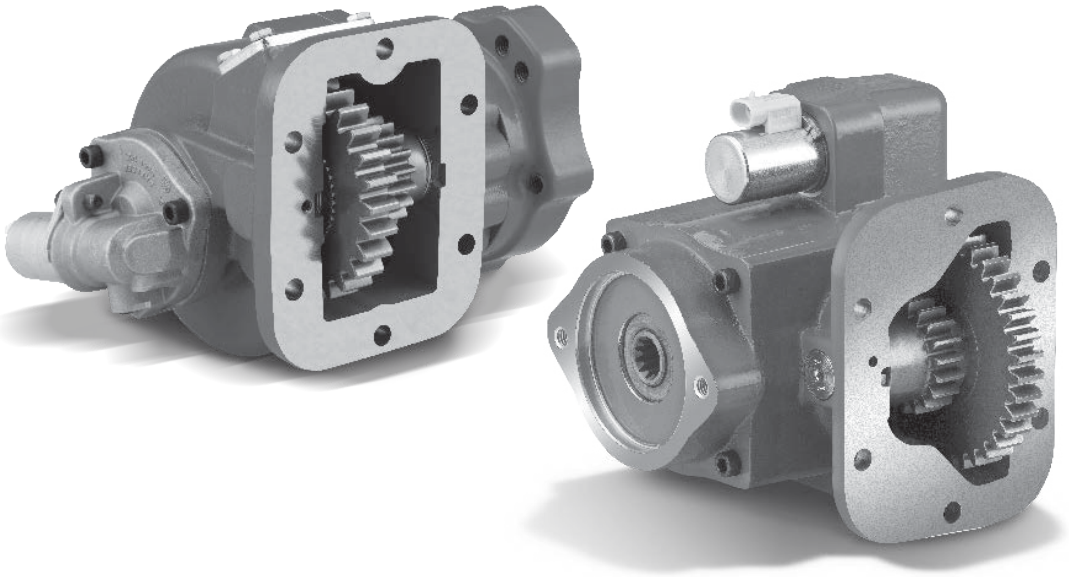
Olive Branch, MS 38654 USA

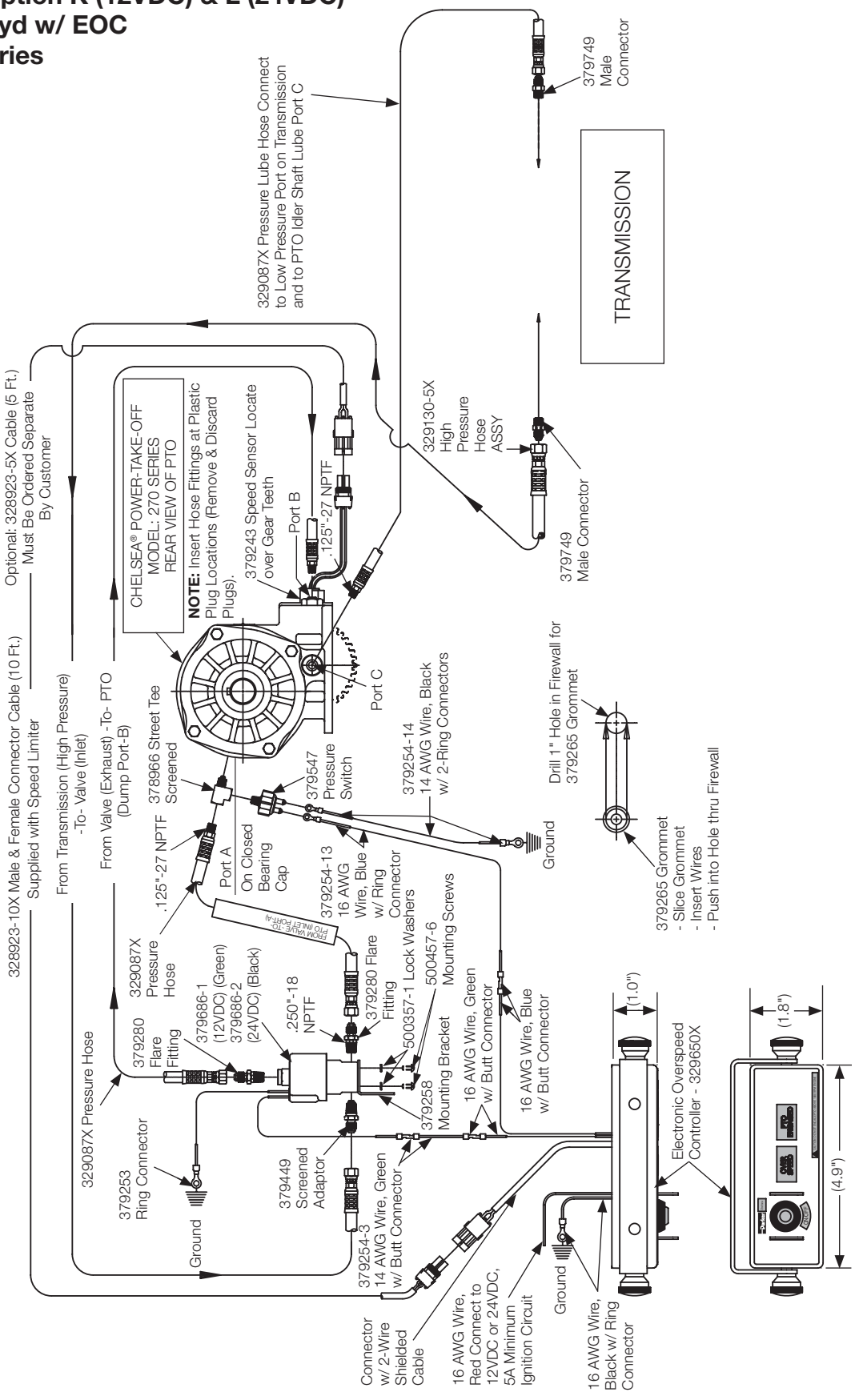
AISIN



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

AISIN Transmission Models A443, A445, & A450-43LE
Shift Option K (12VDC) & L (24VDC)
Elec/Hyd w/ EOC
270 Series

(SK-469 Rev A)



Installation Kits: 328929-12X
328929-24X
Fitting Kit: 329049X

NOTES: Strip Wire Ends 0.25" Prior to Installing Connector.
→ Direction of Oil Flow.

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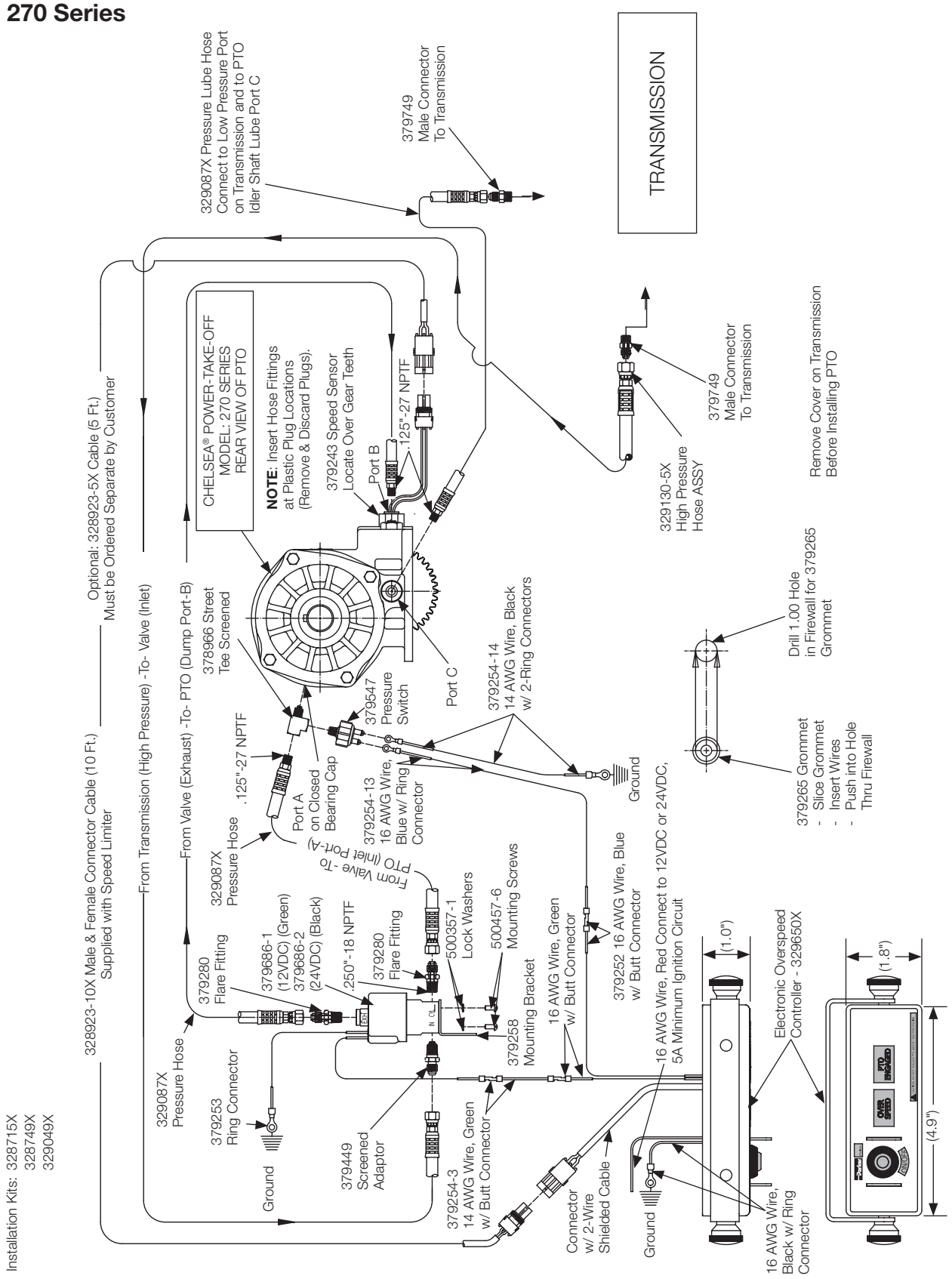
AISIN Transmission Models A460 & A465
Shift Option K (12VDC) & L (24VDC)
Elec/Hyd w/ EOC
270 Series

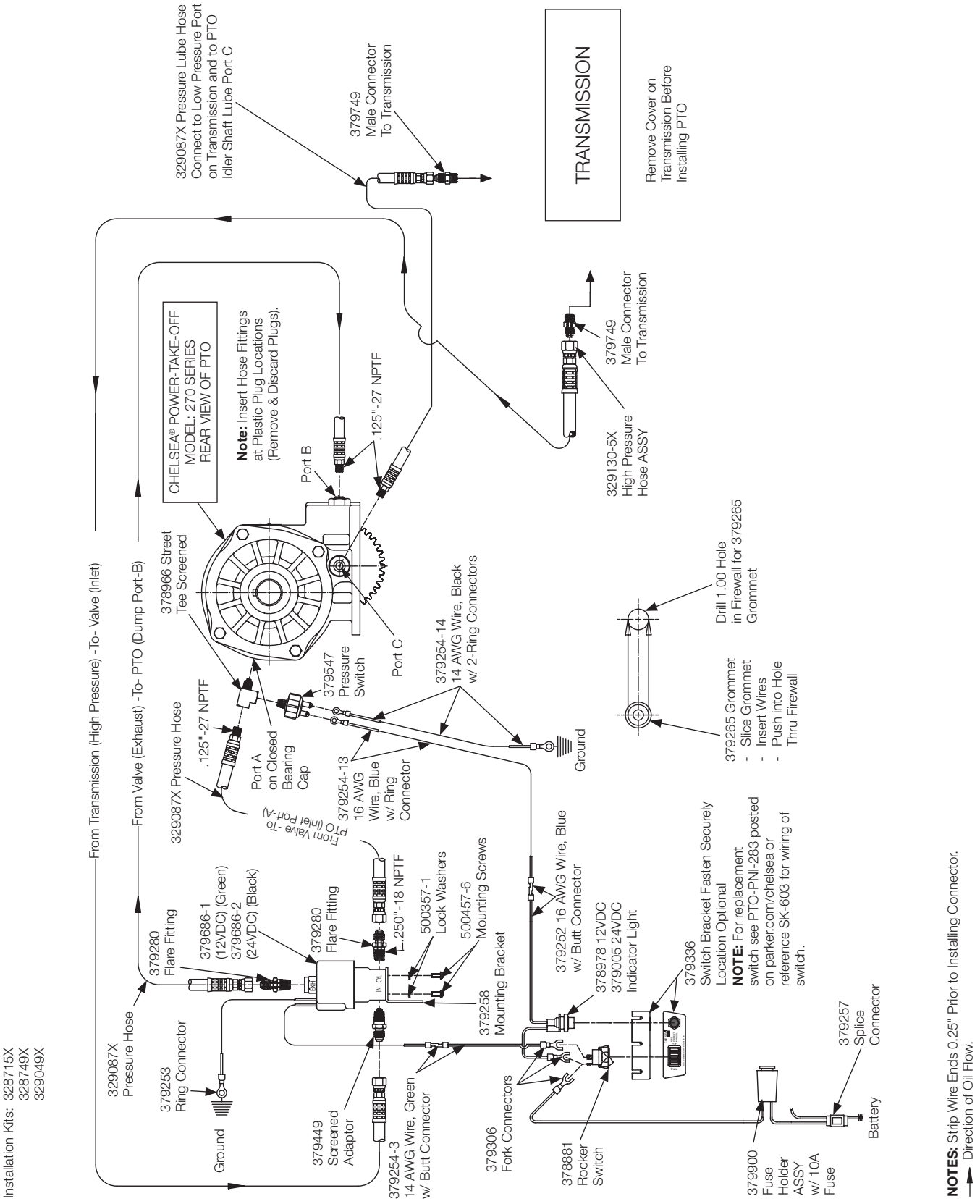
(SK-557 Rev A)



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

AISIN Transmission Models A460 & A465
Shift Option B (12VDC) & D (24VDC)
Elec/Hyd w/o EOC
270 Series

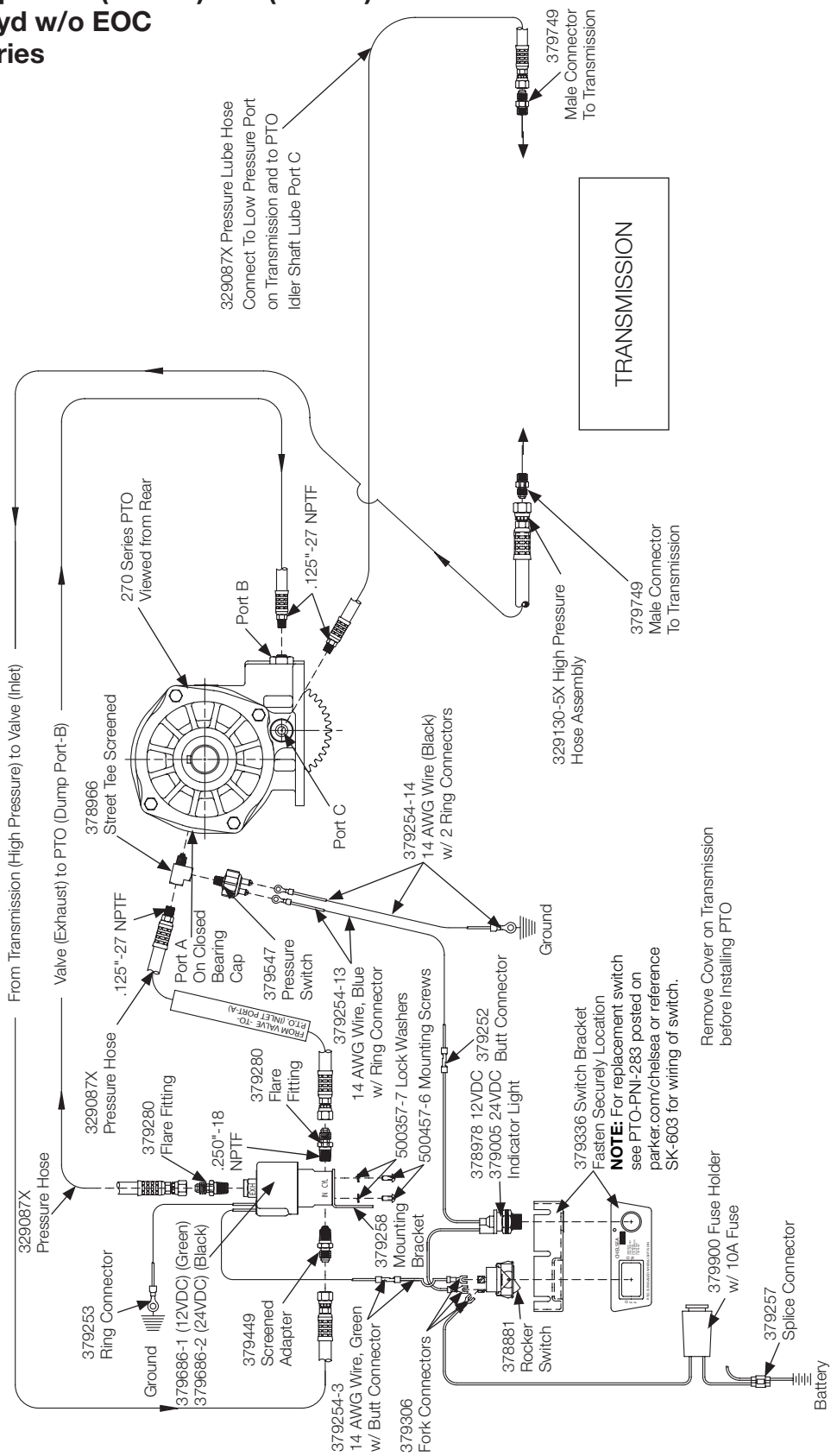
(SK-556)



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

AISIN Transmission Models A443, A445, & A450-43LE
Shift Option B (12VDC) & D (24VDC)
Elec/Hyd w/o EOC
270 Series

(SK-320 Rev E)



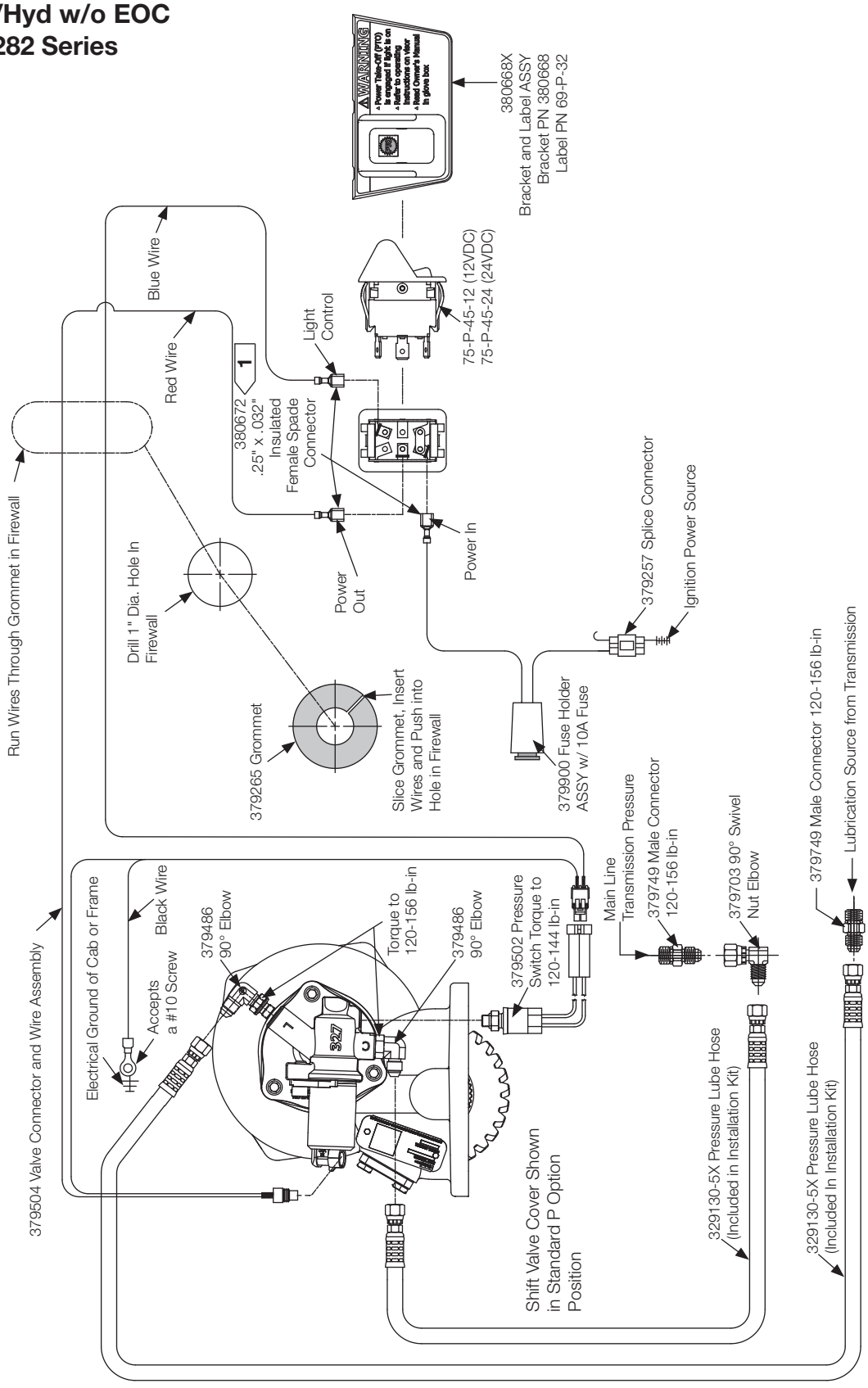
Installation Kits: 328715X
328749X
329049X

→ Direction of Oil Flow.

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

AISIN Transmission Models MY400, MY600, A445, A443E MO35A4, A460, A465
Non-Dodge/RAM
Shift Option B (12VDC) & D (24VDC)
Elec/Hyd w/o EOC
272/282 Series

(SK-603 Rev B)



Installation Kits: 329907-12X (12VDC)
329907-24X (24VDC)

1 Strip Wire Ends .25" Prior to Installing in Spade Terminal (As Necessary).

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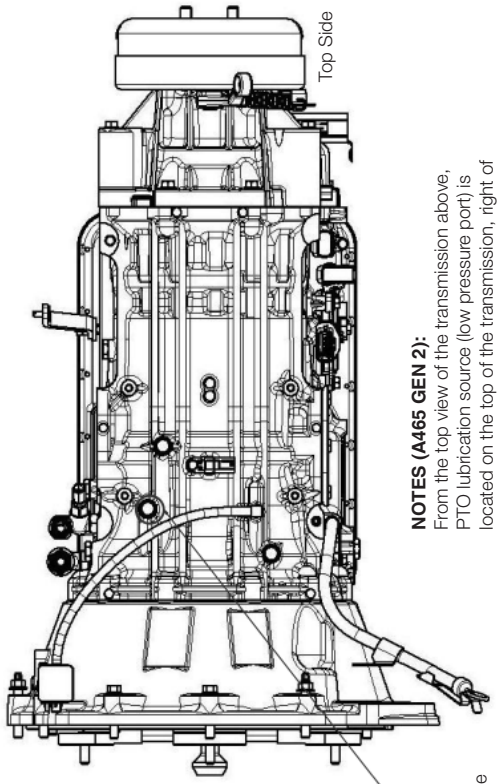
Chelsea Products Division
Olive Branch, MS 38654 USA

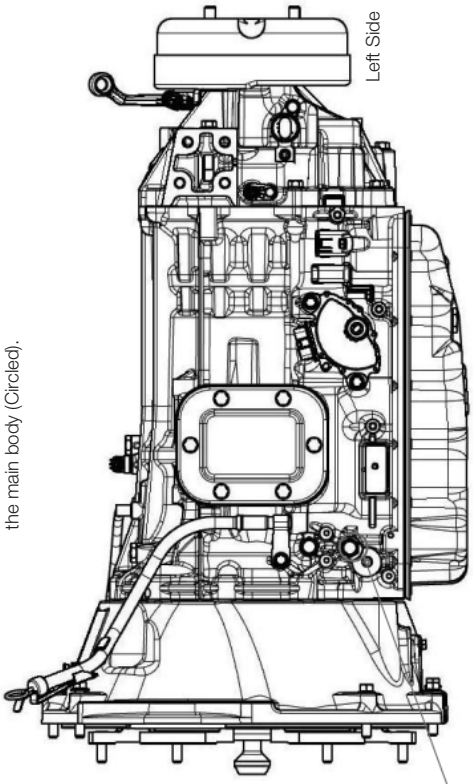
AISIN Transmission Models MY400, MY600, A445, A443E MO35A4, A460, A465 (Cont'd)
Non-Dodge/RAM
Shift Option B (12VDC) & D (24VDC)
Elec/Hyd w/o EOC
272/282 Series

(SK-603 Rev B)

A465ID OR A465HD GEN 2
MY(2020-PRESENT)



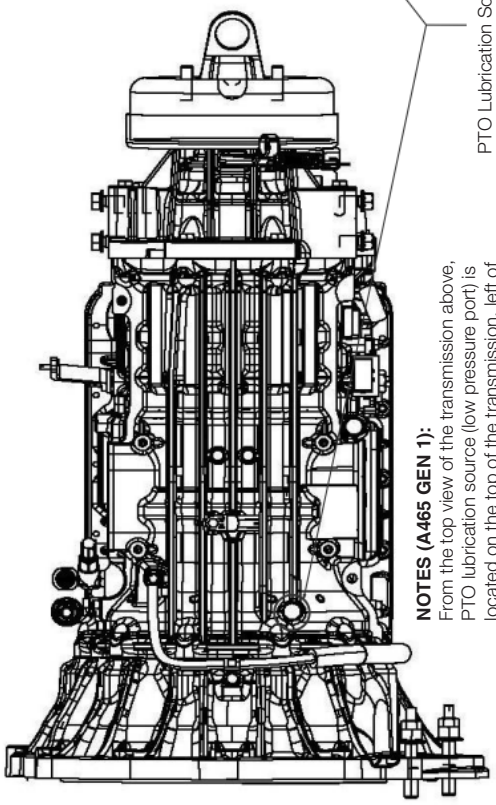
NOTES (A465 GEN 2):
From the top view of the transmission above, PTO lubrication source (low pressure port) is located on the top of the transmission, right of the transmission centerline, towards the front of the main body (Circled).



NOTES (A465 GEN 2):
From the left side view of the transmission above, PTO pressure source (high pressure port) is located on the left-hand side of the transmission, left of the PTO opening, just below transmission PTO opening, towards the front of the main body. (Lower port in cluster) (Circled).

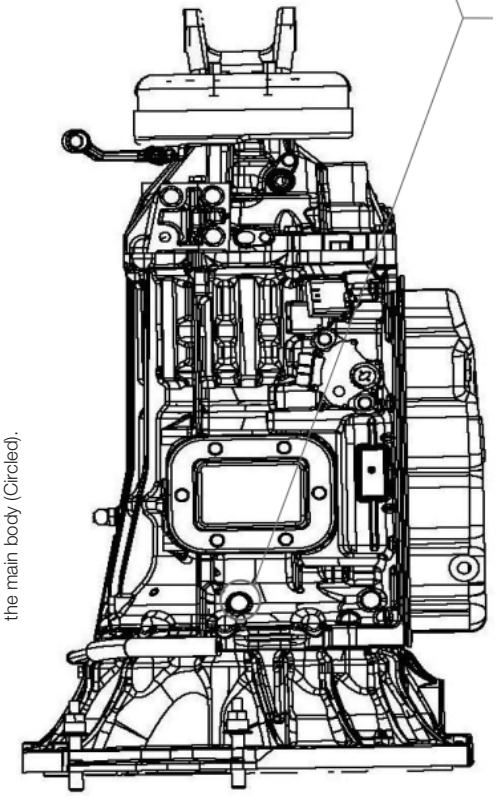
PTO Lubrication Source
(Low Pressure)

A465 GEN 1
MY(PRE-2020)



NOTES (A465 GEN 1):
From the top view of the transmission above, PTO lubrication source (low pressure port) is located on the top of the transmission, left of the transmission centerline, towards the front of the main body (Circled).

PTO Pressure Source
(High Pressure)



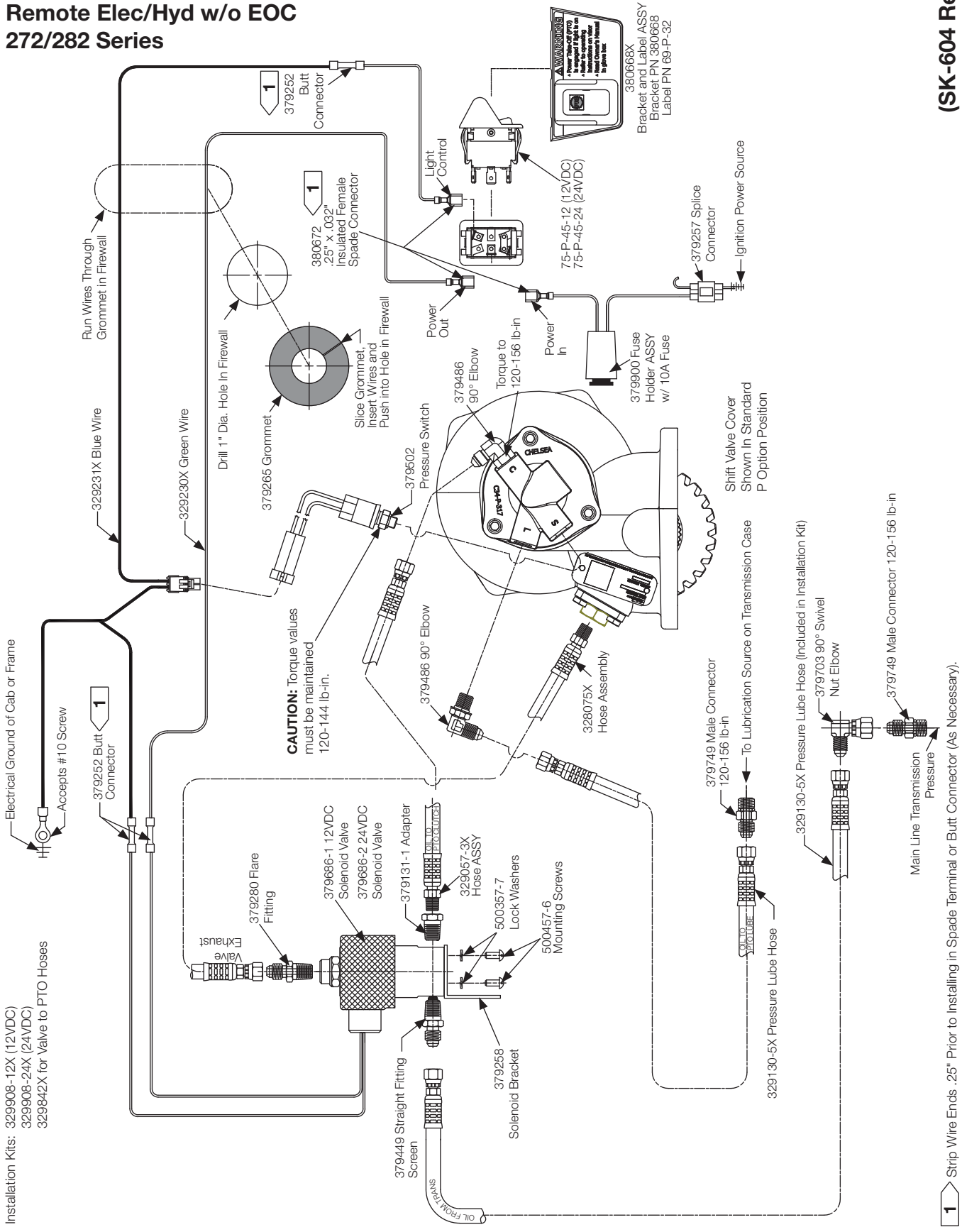
NOTES (A465 GEN 1):
From the left side view of the transmission above, PTO pressure source (High pressure port) is located on the left-hand side of the transmission, left of the PTO opening, just above transmission centerline, towards the front of the main body (Circled).

Parker Chelsea

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

AISIN Transmission Models MY400, MY600, A445, A443E MO35A4, A460, A465
Non-Dodge/RAM Shift Option G (12VDC) & H (24VDC)
Remote Elec/Hyd w/o EOC
272/282 Series

(SK-604 Rev C)



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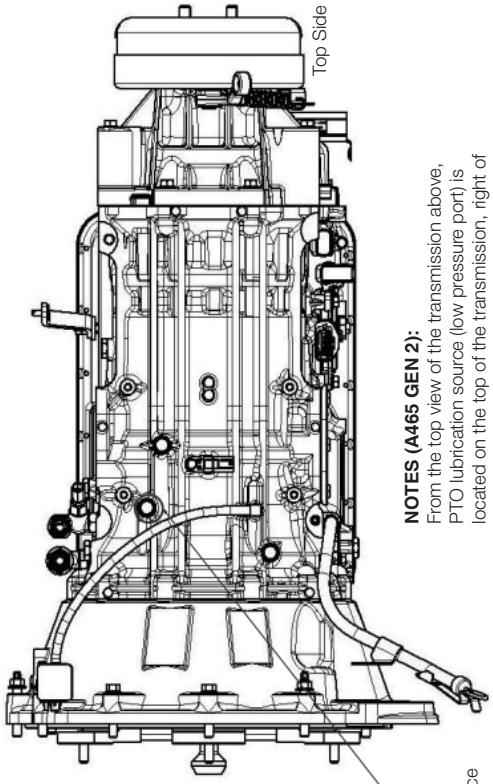
Chelsea Products Division
Olive Branch, MS 38654 USA

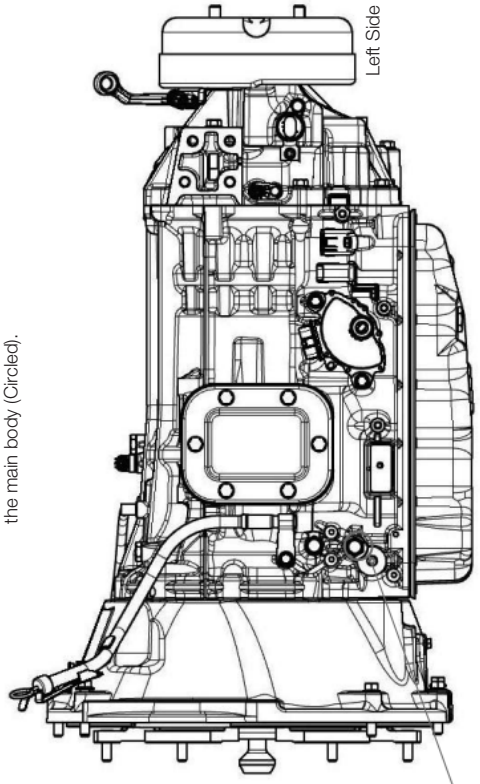
AISIN Transmission Models MY400, MY600, A445, A443E MO35A4, A460, A465 (Cont'd)
Non-Dodge/RAM
Shift Option G (12VDC) & H (24VDC)
Remote Elec/Hyd w/o EOC
272/282 Series

(SK-604 Rev C)

A465ID OR A465HD GEN 2
MY(2020-PRESENT)



NOTES (A465 GEN 2):
From the top view of the transmission above, PTO lubrication source (low pressure port) is located on the top of the transmission, right of the transmission centerline, towards the front of the main body (Circled).

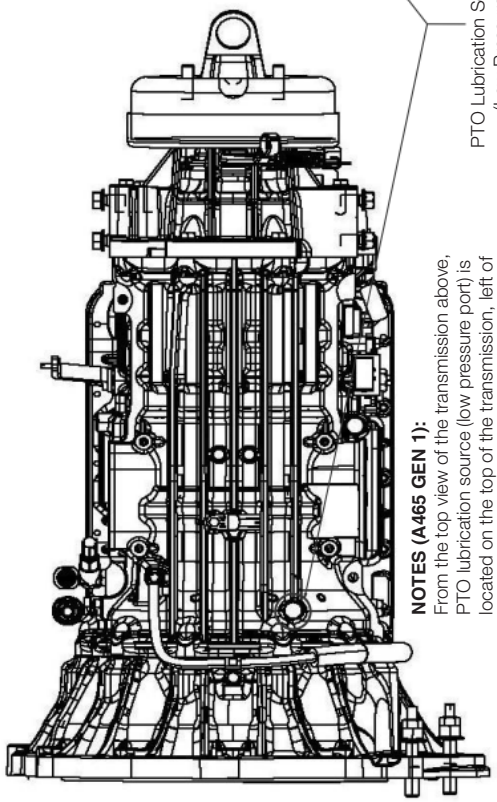


NOTES (A465 GEN 2):
From the left side view of the transmission above, PTO pressure source (high pressure port) is located on the left-hand side of the transmission, left of the PTO opening, just below transmission PTO opening, towards the front of the main body. (Lower port in cluster) (Circled).

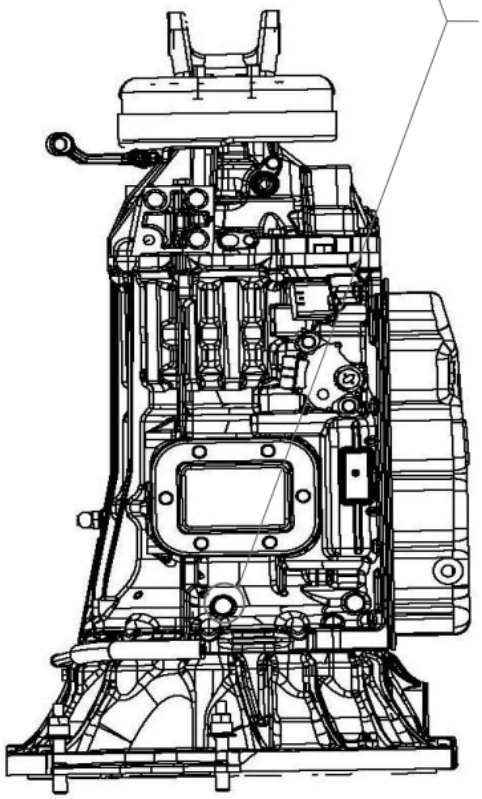
PTO Lubrication Source
(Low Pressure)

PTO Pressure Source
(High Pressure)

A465 GEN 1
MY(PRE-2020)



NOTES (A465 GEN 1):
From the top view of the transmission above, PTO lubrication source (low pressure port) is located on the top of the transmission, left of the transmission centerline, towards the front of the main body (Circled).



NOTES (A465 GEN 1):
From the left side view of the transmission above, PTO pressure source (High pressure port) is located on the left-hand side of the transmission, left of the PTO opening, just above transmission centerline, towards the front of the main body (Circled).

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

Notes

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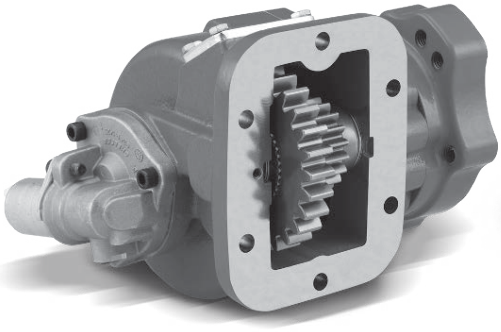
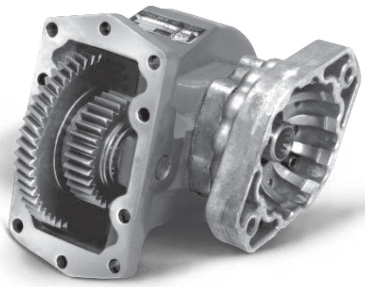
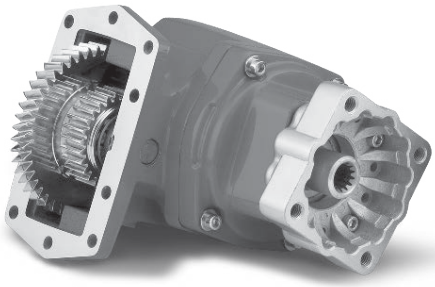
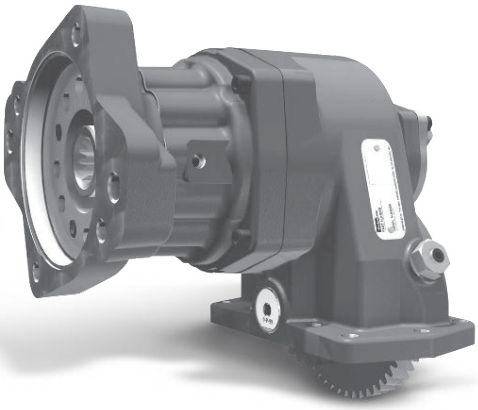
Chelsea Products Division
Olive Branch, MS 38654 USA

ALLISON









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Chelsea Products Division
Olive Branch, MS 38654 USA

PTO Openings

Allison Series Converter Housing Options
Pressure Lube Hose Connection

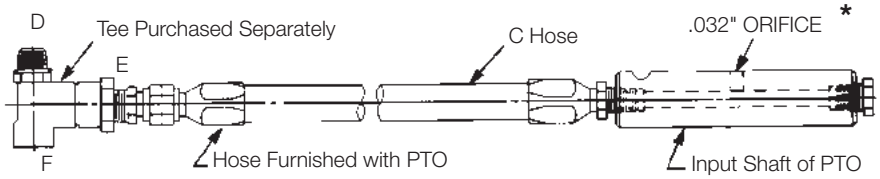


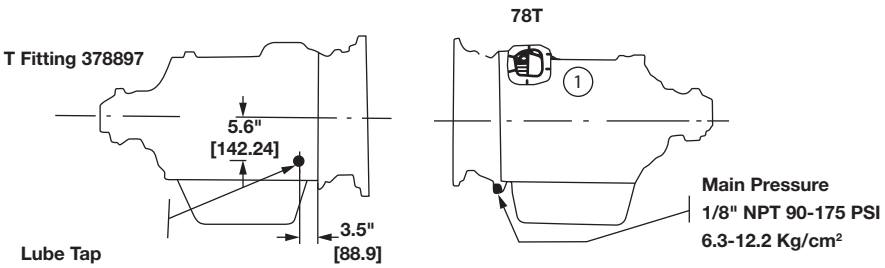
Chart I

Dimensional Information				
Tee Fitting	**378840**	**378880 - NLA**	**378970**	**378897**
D	.750"-16 U.N.F. 2A	.875"-14 U.N.F. 2A	1.062"-12 U.N.F. 2A	1.312"-12 U.N.F. 2A
E	.250"-18 NPTF	.250"-18 NPTF	.250"-18 NPTF	.250"-18 NPTF
F	.750"-16 U.N.F. 2B	.875"-14 U.N.F. 2B	1.062"-12 U.N.F. 2B	1.312"-12 U.N.F. 2B

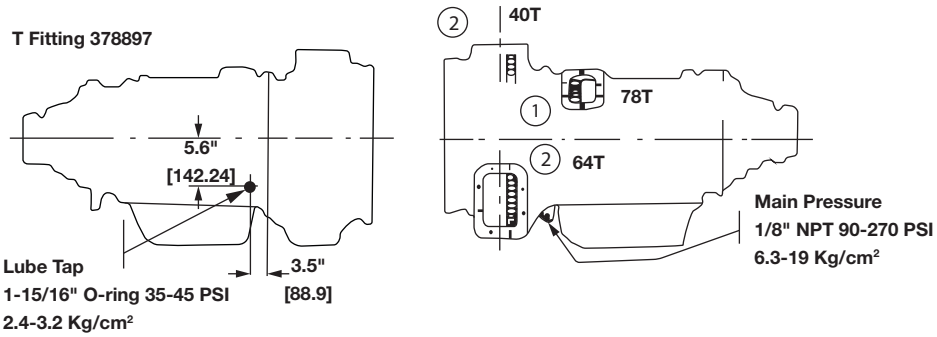
*** NOTE:** The .032" [0.81 mm] orifice is built into all pressure lubed idler shafts. No additional orifices are required when using these pressure lubed shafts.

NOTE: Check Thread Size on Cooler Return Port Fitting to Determine Correct T Fitting.

HT-740
HT-750D



CLT-750



1. Converter Driven PTO Drive Gear.
2. Engine Driven PTO Drive Gear.

Parker Chelsea
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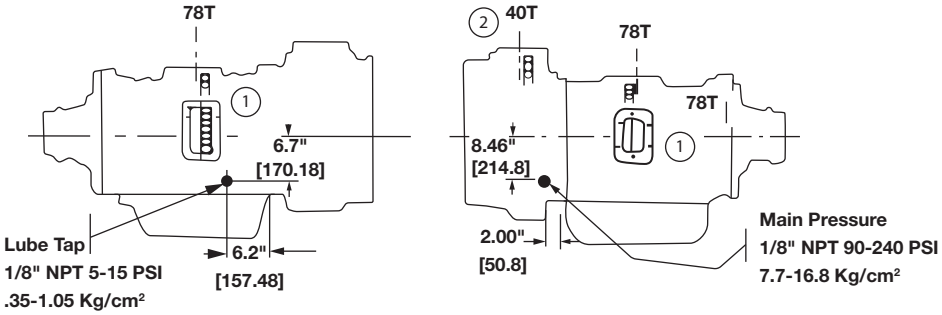
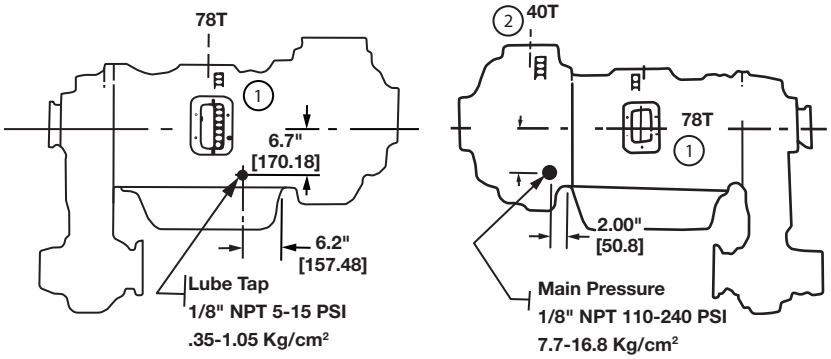
PTO Openings (Continued)

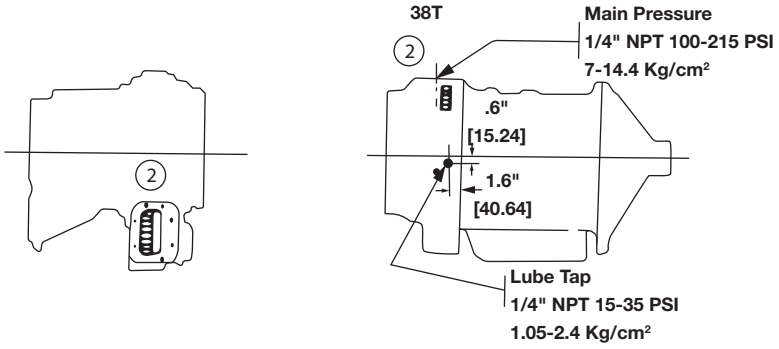
HT-70



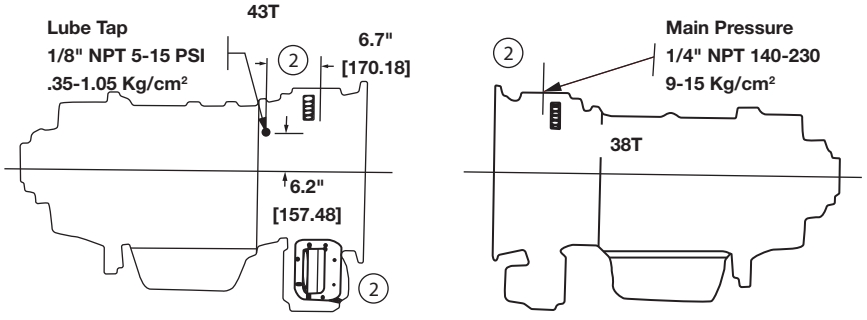
4460



5000 Series



8000 Series

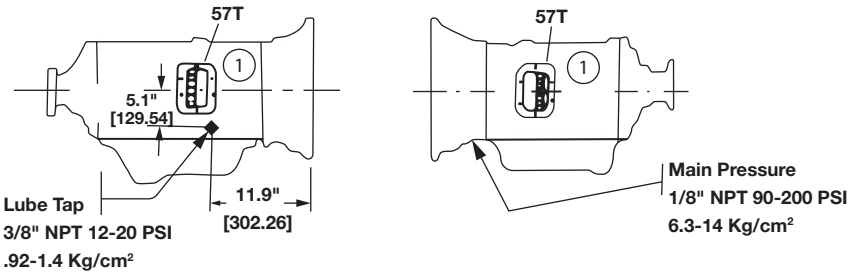


1. Converter Driven PTO Drive Gear.
2. Engine Driven PTO Drive Gear.

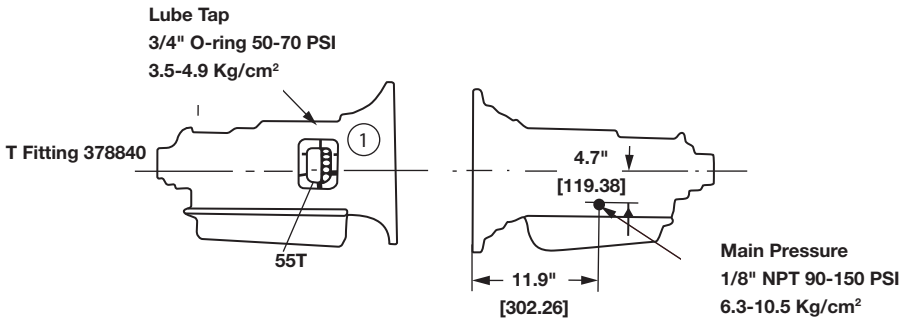
Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

PTO Openings (Continued)

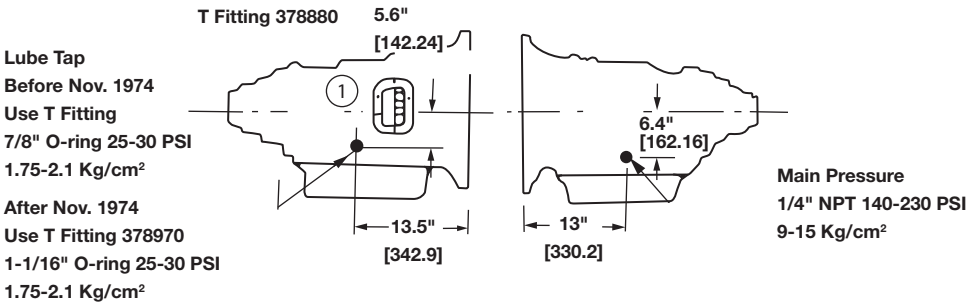
MT-30-42
6 Speed
3341-3441



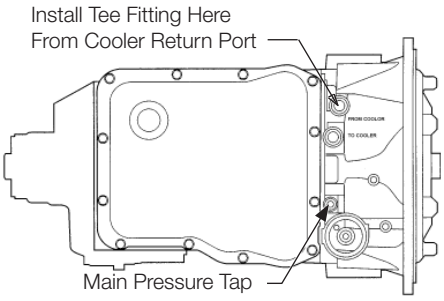
AT-540
4 Speed



MT-640, MT-650 (64 Teeth) 4 & 5 Speed



Allison 1000, 2000/2500 (64 Teeth)



NOTE: Use cooler return port for PTO lubrication. The T fitting is to be installed in the port that is coming from the cooler back to the transmission.

1. Converter Driven PTO Drive Gear.
2. Engine Driven PTO Drive Gear.

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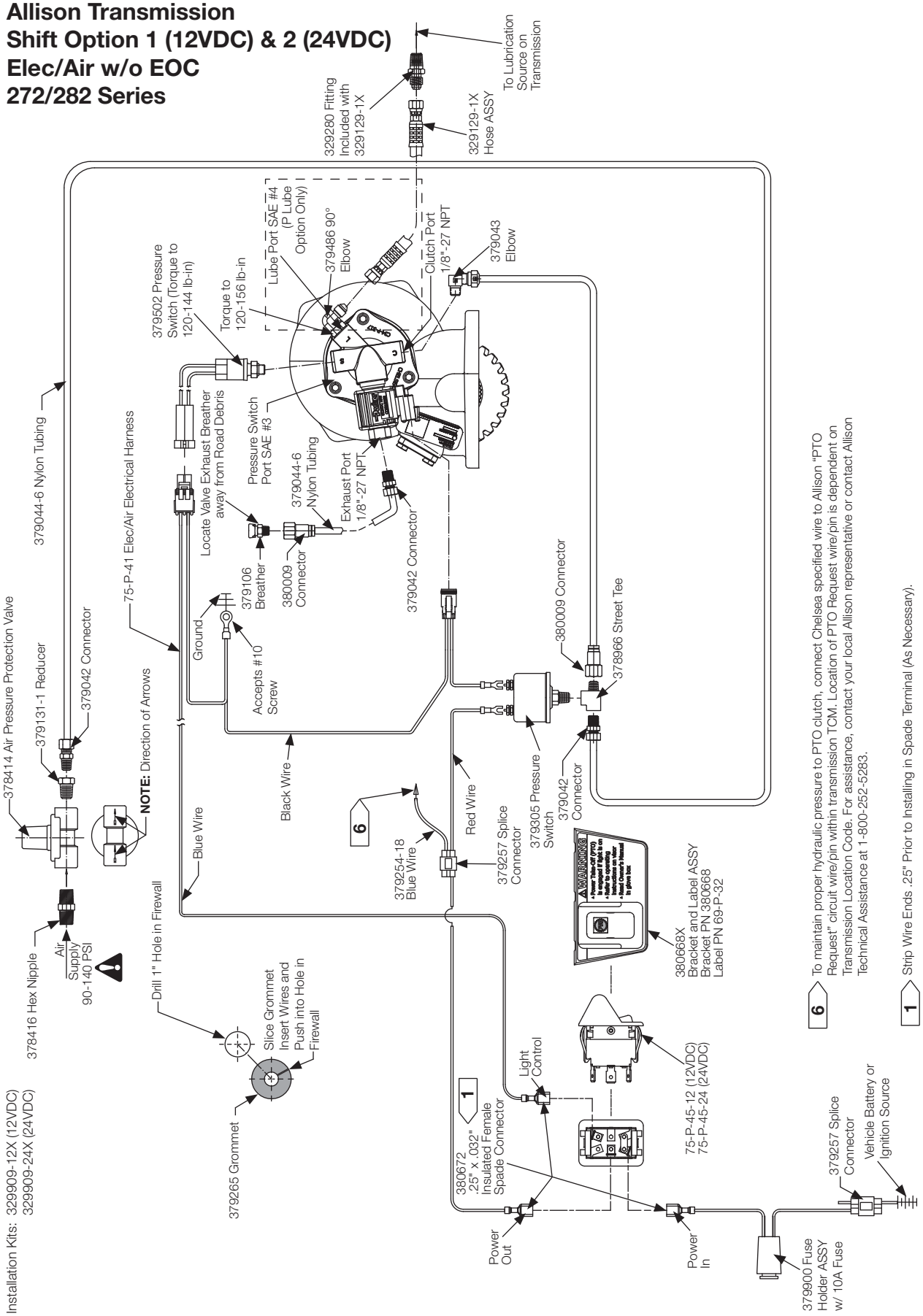
Chelsea Products Division
Olive Branch, MS 38654 USA

Allison Transmission
Shift Option 1 (12VDC) & 2 (24VDC)
Elec/Air w/o EOC
272/282 Series

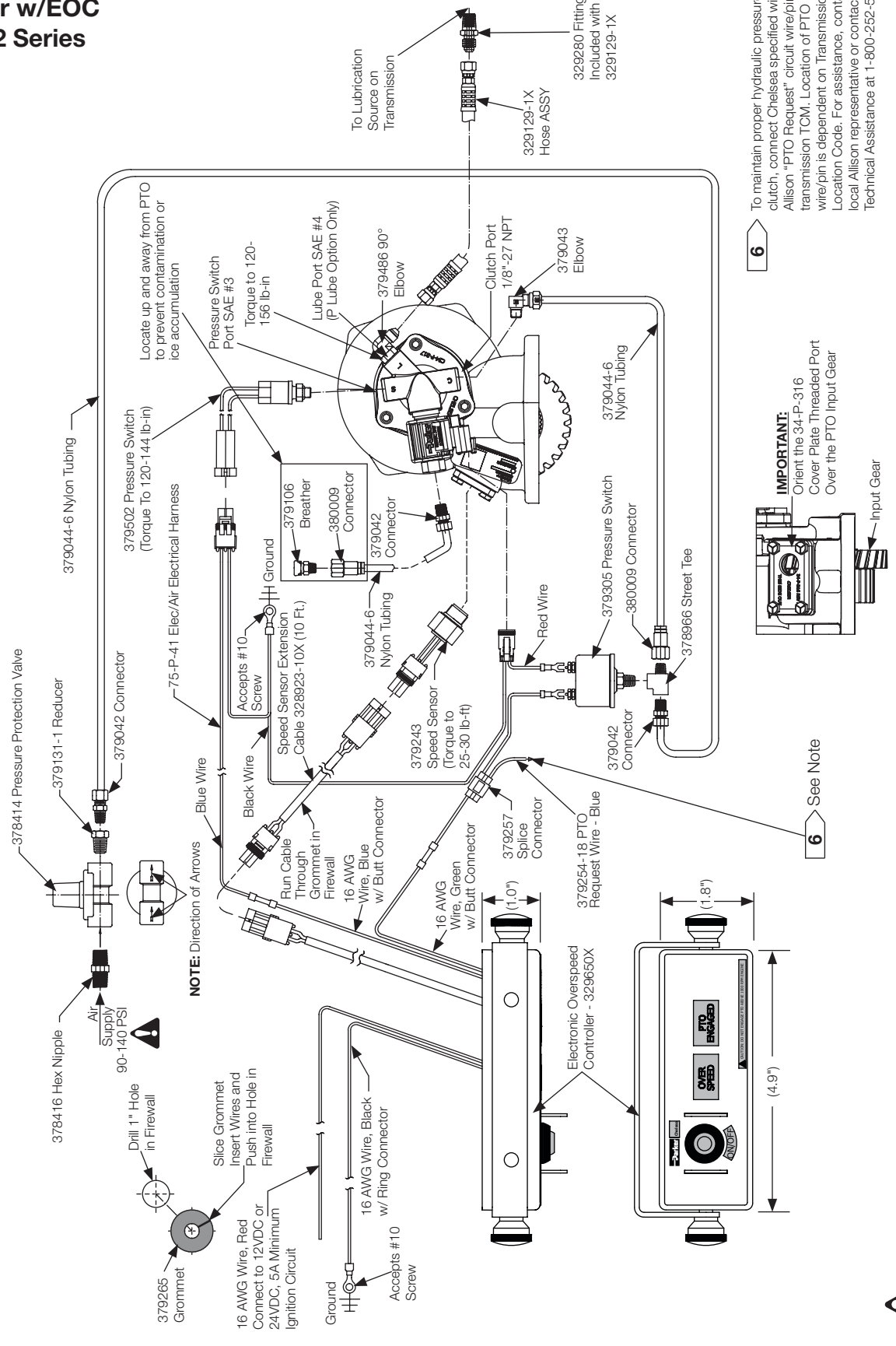
(SK-605 Rev A)



WARNING: Connect directly to air supply. Do not use tubing between air supply and pressure protection valve.

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

Allison Transmission
Shift Option J (12VDC) & 3 (24VDC)
Elec/Air w/EOC
272/282 Series



(SK-606 Rev A)

WARNING: Connect directly to air supply. Do not use tubing between air supply and pressure protection valve.

NOTE: Strip Wire Ends .25" Prior to Installing Fork and Butt Connectors.

Installation Kits: 329911X (12VDC/24VDC)

Parker Chelsea

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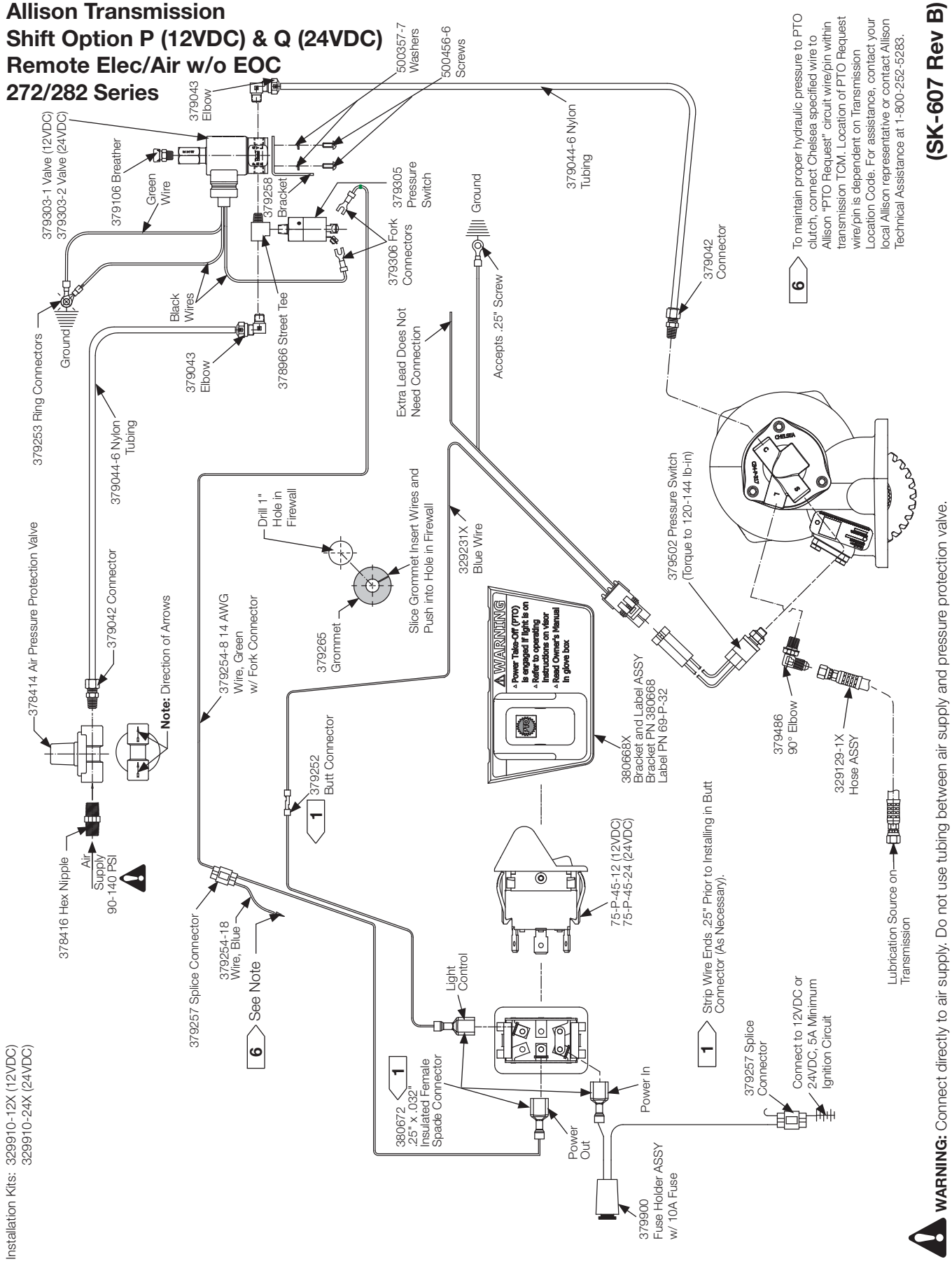
Chelsea Products Division
Olive Branch, MS 38654 USA

Allison Transmission
Shift Option P (12VDC) & Q (24VDC)
Remote Elec/Air w/o EOC
272/282 Series



(SK-607 Rev B)

Installation Kits: 329910-12X (12VDC)
329910-24X (24VDC)

WARNING: Connect directly to air supply. Do not use tubing between air supply and pressure protection valve.

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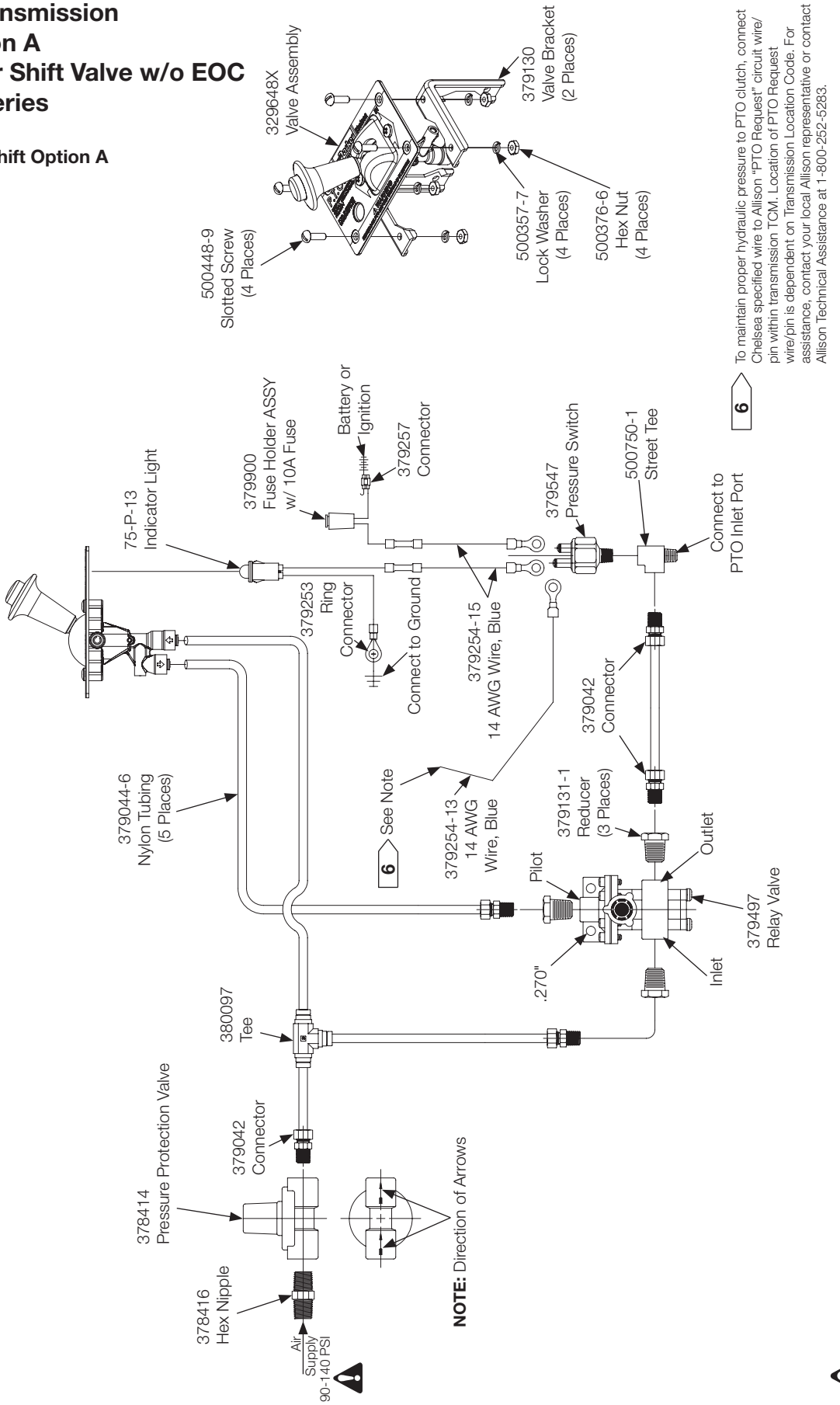
Olive Branch, MS 38654 USA

Allison Transmission
Shift Option A
Manual Air Shift Valve w/o EOC
230/231 Series

For 272/282 Shift Option A
See page 26



(SK-464 Rev A)

Installation Kit: 328388-99X
J1-6 Feed Back Kit: 329336-3X (order separately)

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.

See SK-204 Drilling Template for Control Plate.

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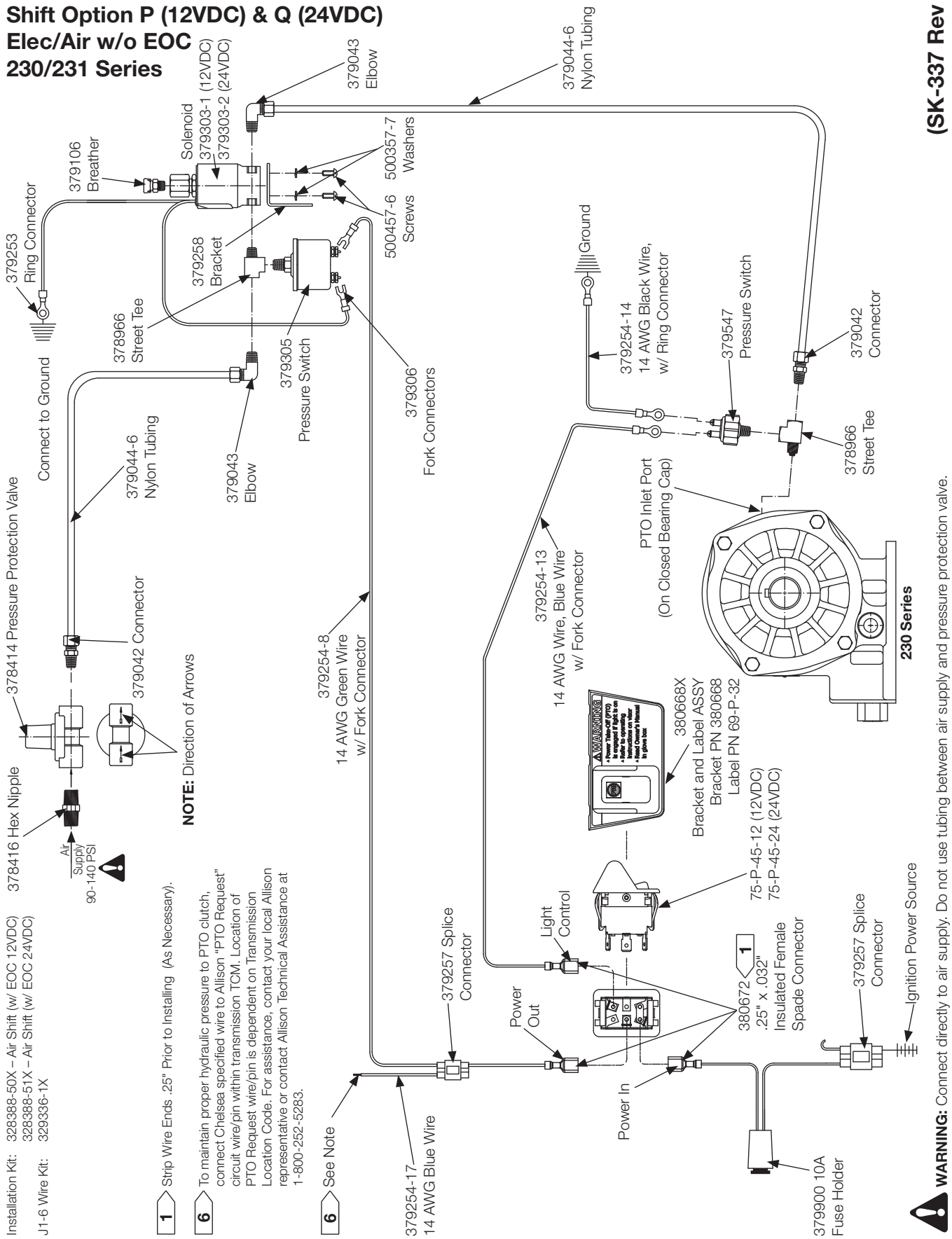
Allison Transmission
Shift Option P (12VDC) & Q (24VDC)
Elec/Air w/o EOC
230/231 Series

(SK-337 Rev F)



WARNING: Connect directly to air supply. Do not use tubing between air supply and pressure protection valve.

Parker Chelsea

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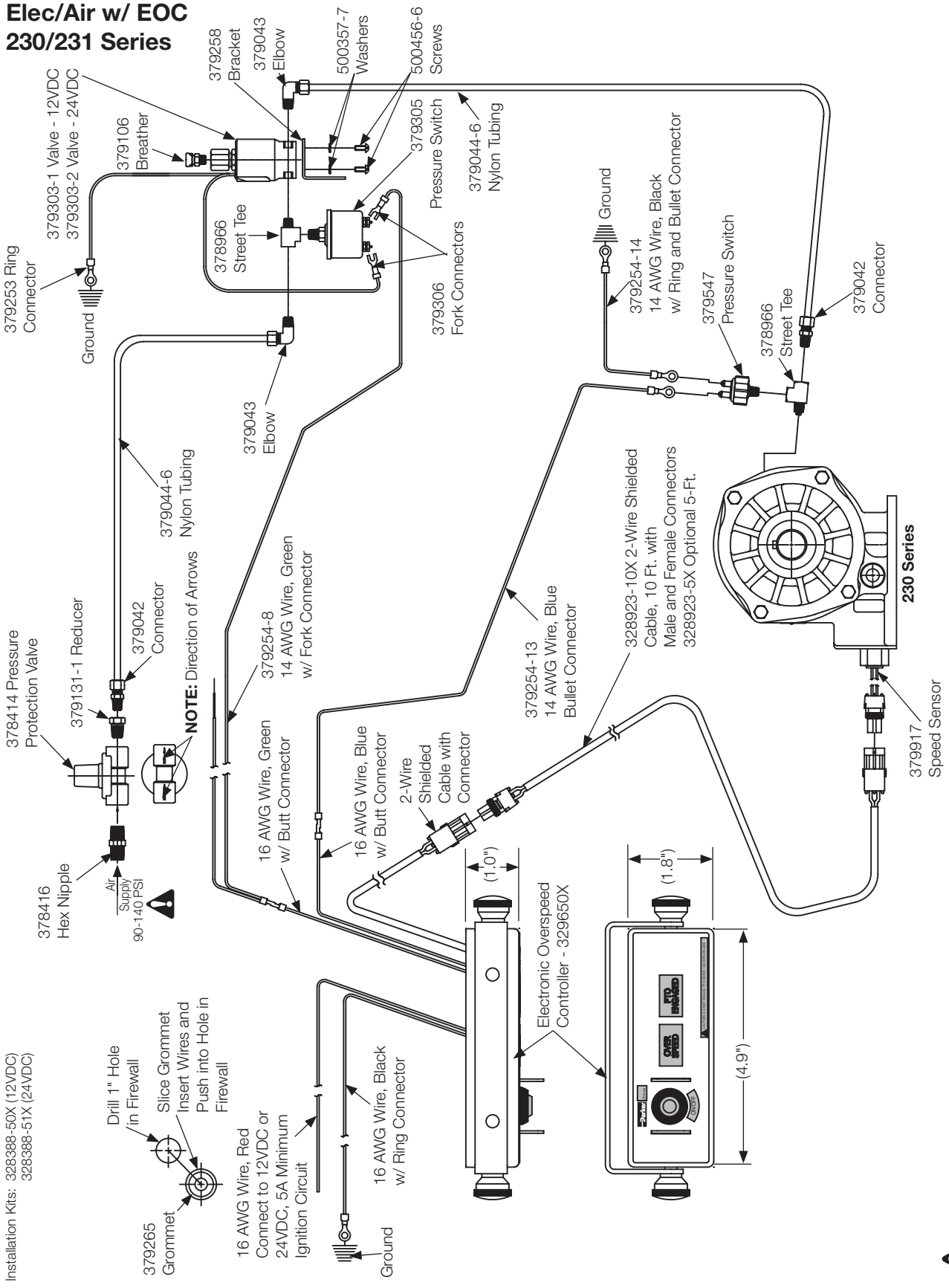
Chelsea Products Division
Olive Branch, MS 38654 USA

Allison Transmission
Shift Option N (12VDC) & J (24VDC)
Elec/Air w/ EOC
230/231 Series

(SK-471 Rev A)



WARNING: Connect directly to air supply. Do not use tubing between air supply and pressure protection valve.

NOTE: Strip Wire Ends 0.25" Prior to Installing Connector.

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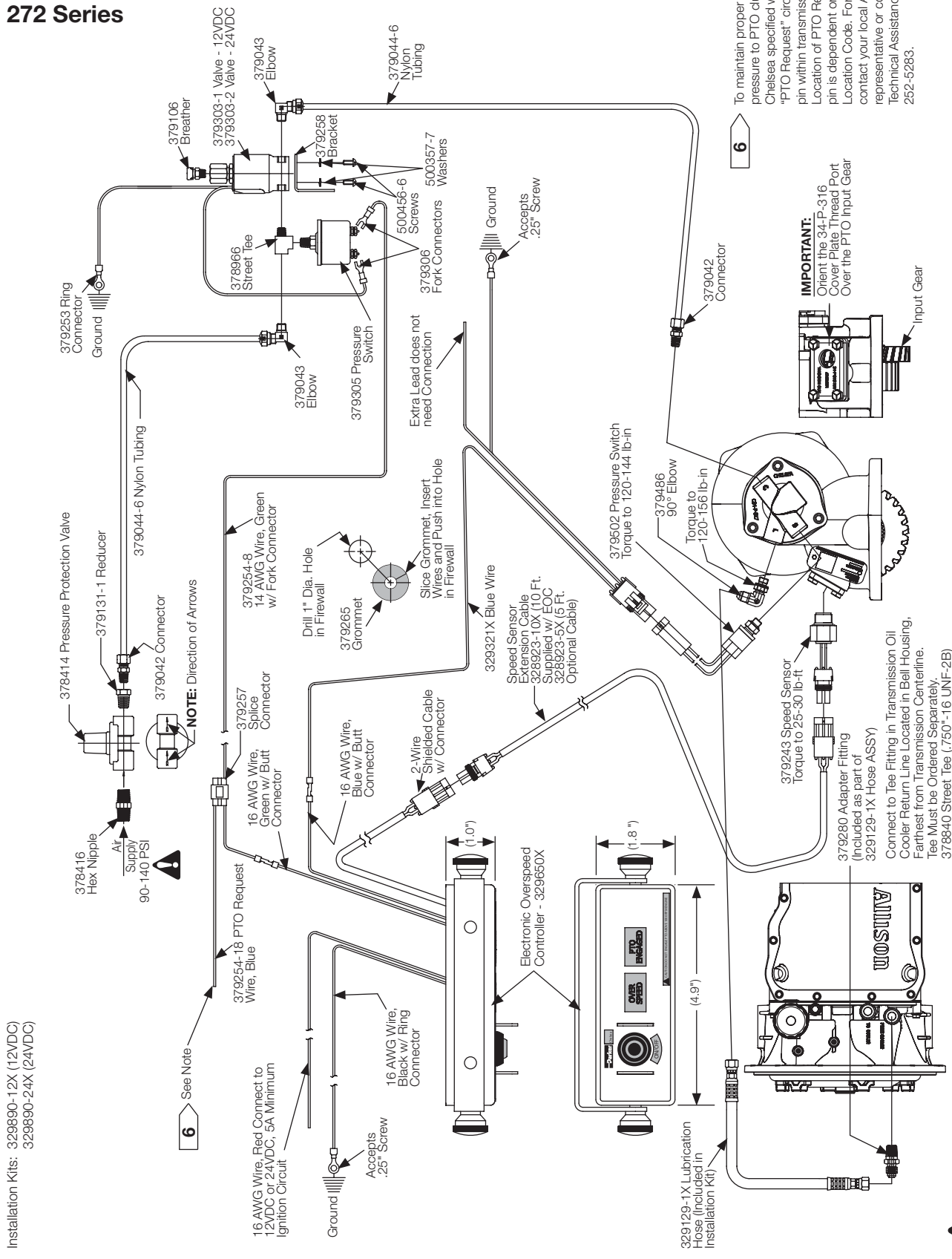
Olive Branch, MS 38654 USA

Allison Transmission
Shift Option R (12VDC) & 4 (24VDC)
Remote Elec/Air w/ EOC
272 Series

(SK-584 Rev A)



Parker Chelsea

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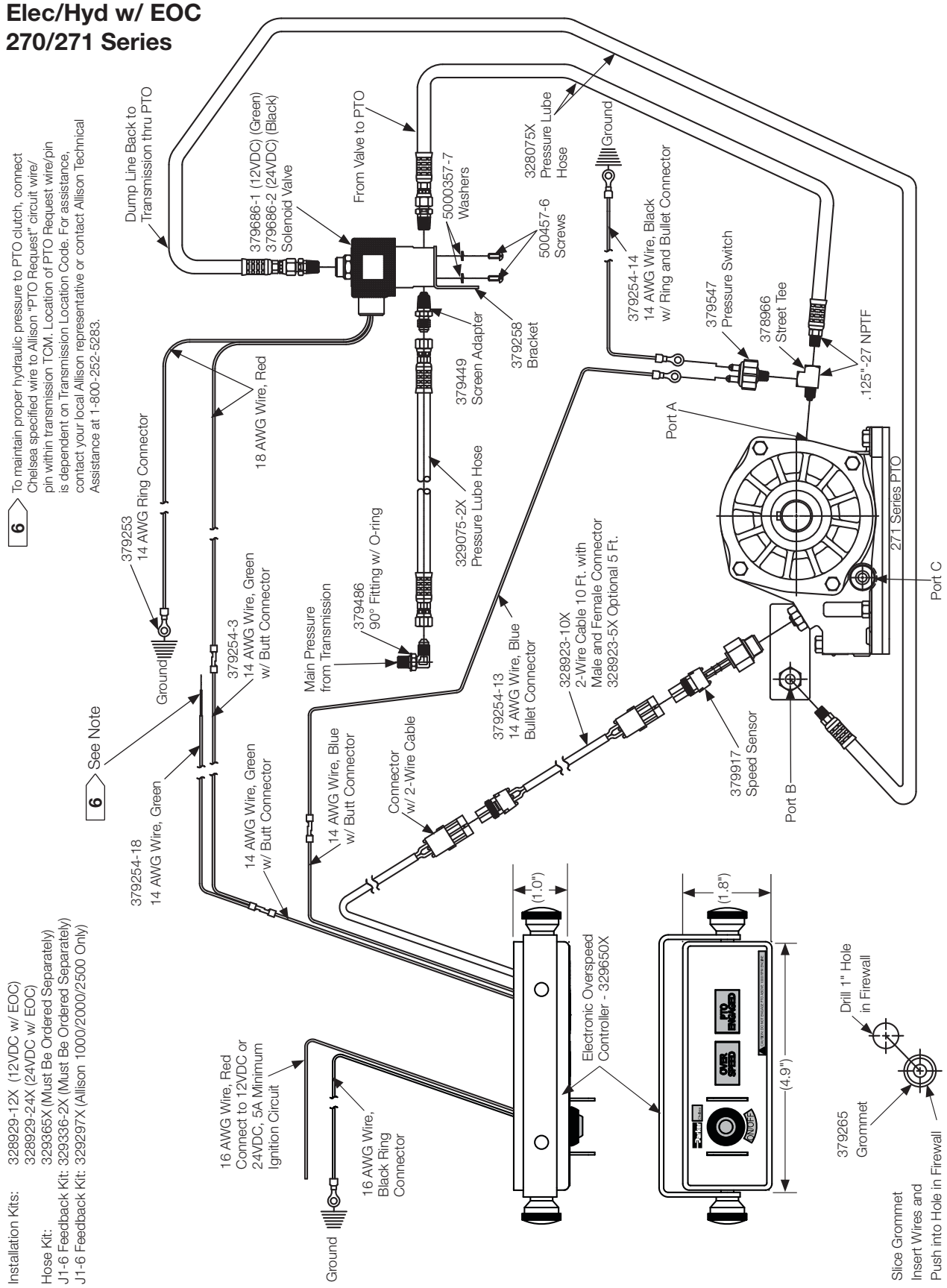
Chelsea Products Division
Olive Branch, MS 38654 USA

Allison Transmission
Shift Option K (12VDC) & L (24VDC)
Elec/Hyd w/ EOC
270/271 Series

(SK-470 Rev A)



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 dependent on Transmission Location Code. For assistance, contact your local Allison representative or contact Allison Technical Assistance at 1-800-252-5283.

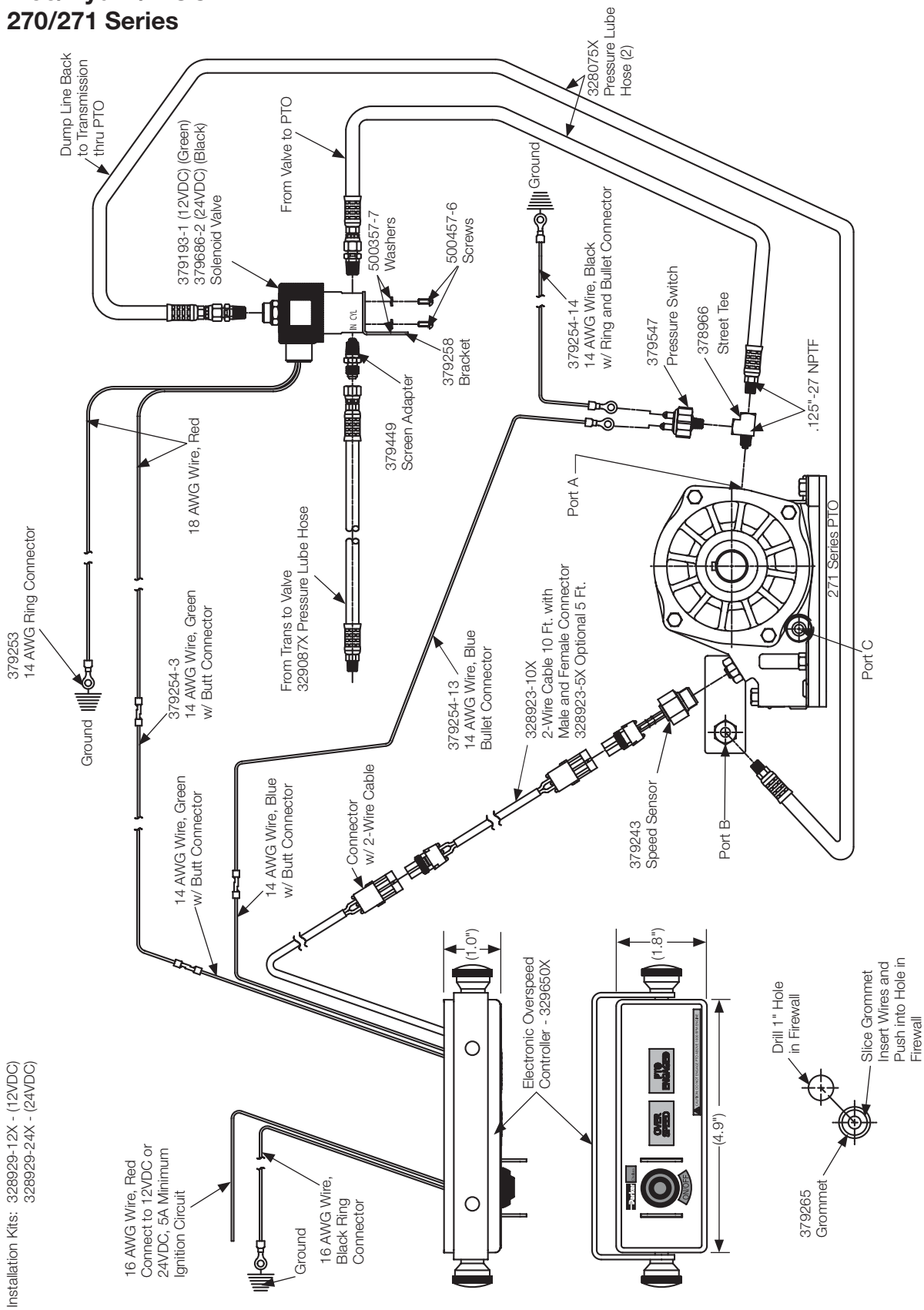
Installation Kits: 328929-12X (12VDC w/ EOC)
328929-24X (24VDC w/ EOC)
Hose Kit: 329365X (Must Be Ordered Separately)
J1-6 Feedback Kit: 329336-2X (Must Be Ordered Separately)
J1-6 Feedback Kit: 329297X (Allison 1000/2000/2500 Only)

NOTES: Strip Wire Ends 0.25" Prior to Installing Connector.

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

Allison Transmission M & S 5000, M & S 6000, OFS, CLT, HT and CLBT Series
Shift Option K (12VDC) & L (24VDC)
Elec/Hyd w/ EOC
270/271 Series

(SK-466 Rev A)



NOTE: Strip Wire Ends 0.25" Prior to Installing into Connector.

Parker Chelsea

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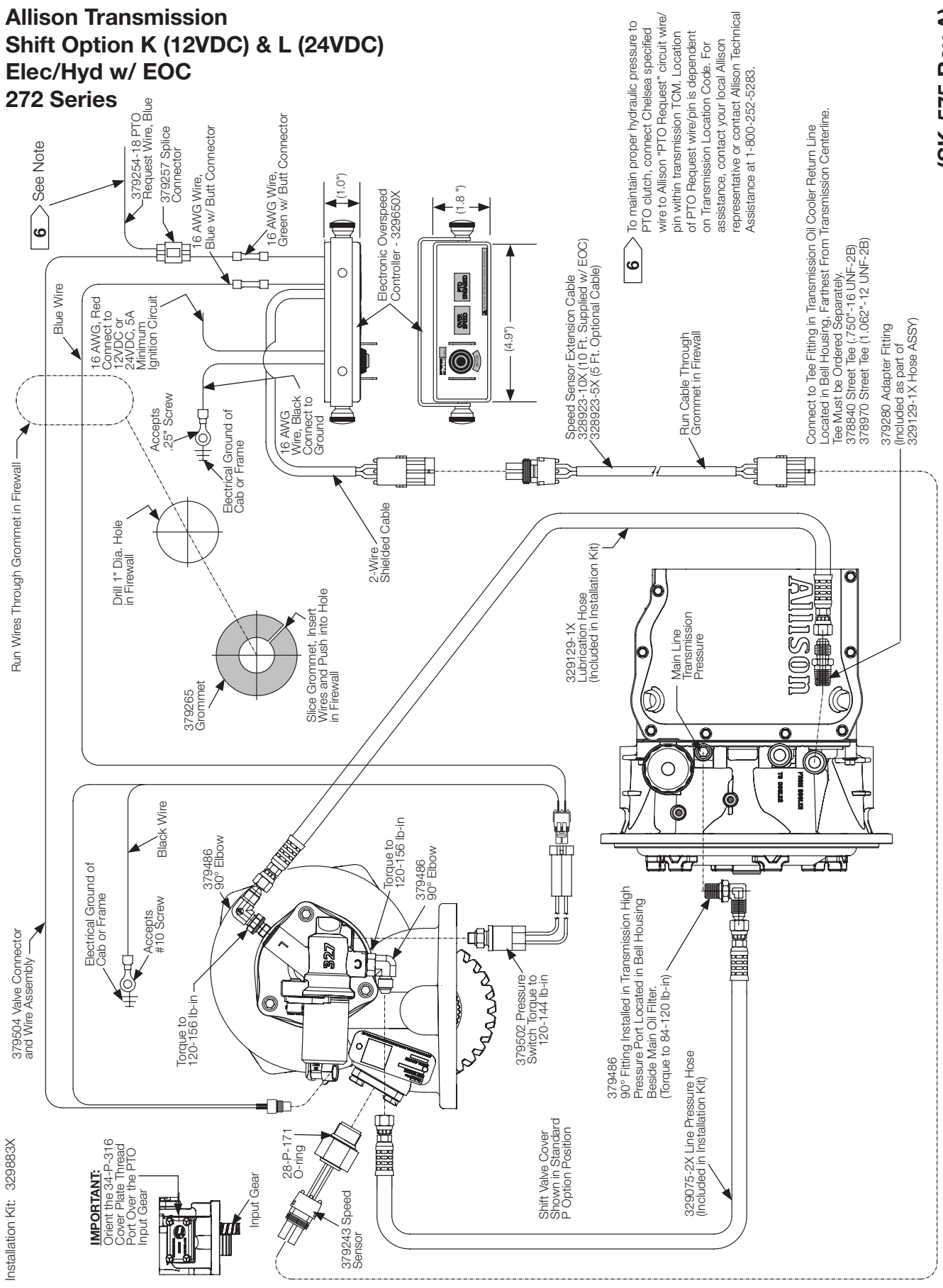
Chelsea Products Division
Olive Branch, MS 38654 USA

Allison Transmission
Shift Option K (12VDC) & L (24VDC)
Elec/Hyd w/ EOC
272 Series

(SK-575 Rev A)



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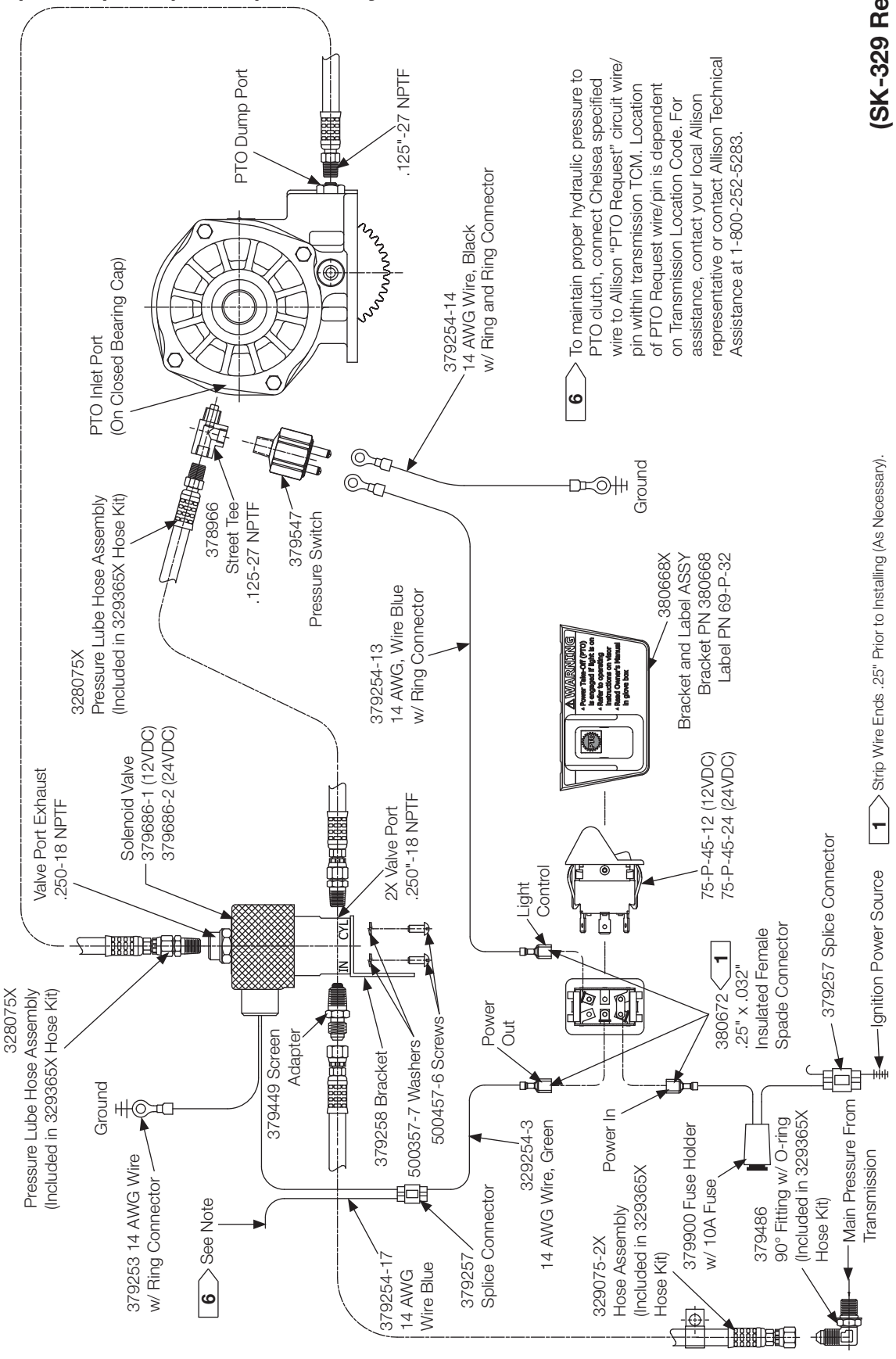
Olive Branch, MS 38654 USA

Allison Transmission Models M & S 5000, M & S 6000, OFS, CLT, HT & CLBT Series Shift Option B (12VDC) & D (24VDC) – Elec/Hyd w/o EOC 270/271 and 852 Series

(SK-329 Rev M)



Installation Kits: 328715X (12VDC) - Electric Shift (12VDC w/o EOC)
328749X (24VDC) - Electric Shift (24VDC w/o EOC)
Hose Kit: 329365X
J1-6 Feed Back Kit: 329336-1X

Parker Chelsea

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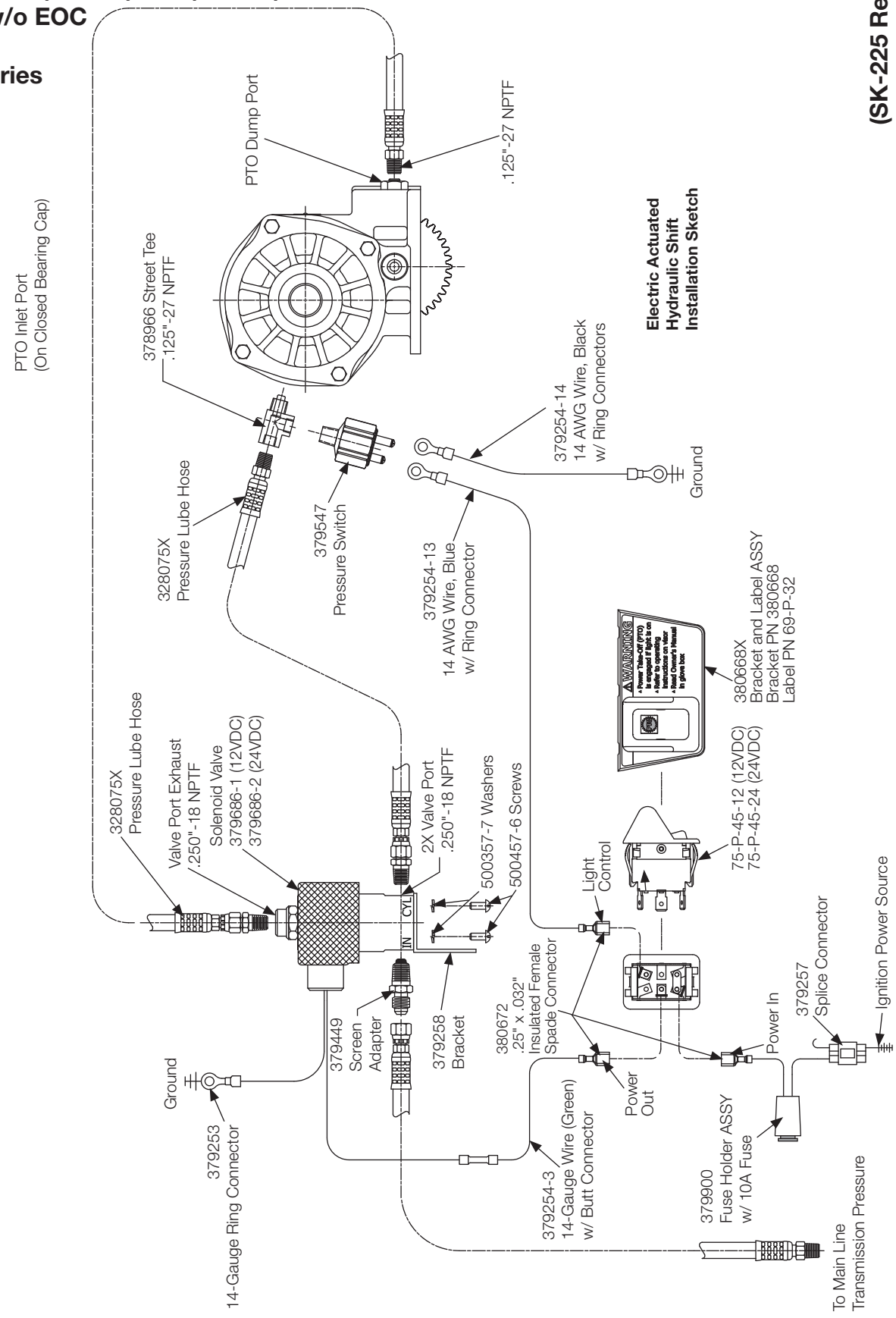
Chelsea Products Division
Olive Branch, MS 38654 USA

Allison Transmission Models AT, MT, WT, CLBT Series
Shift Option B (12VDC) & D (24VDC)
Elec/Hyd w/o EOC
270/271
and 852 Series

(SK-225 Rev M)



Installation Kits: 328715X (12VDC)
328749X (24VDC)

Parker Chelsea

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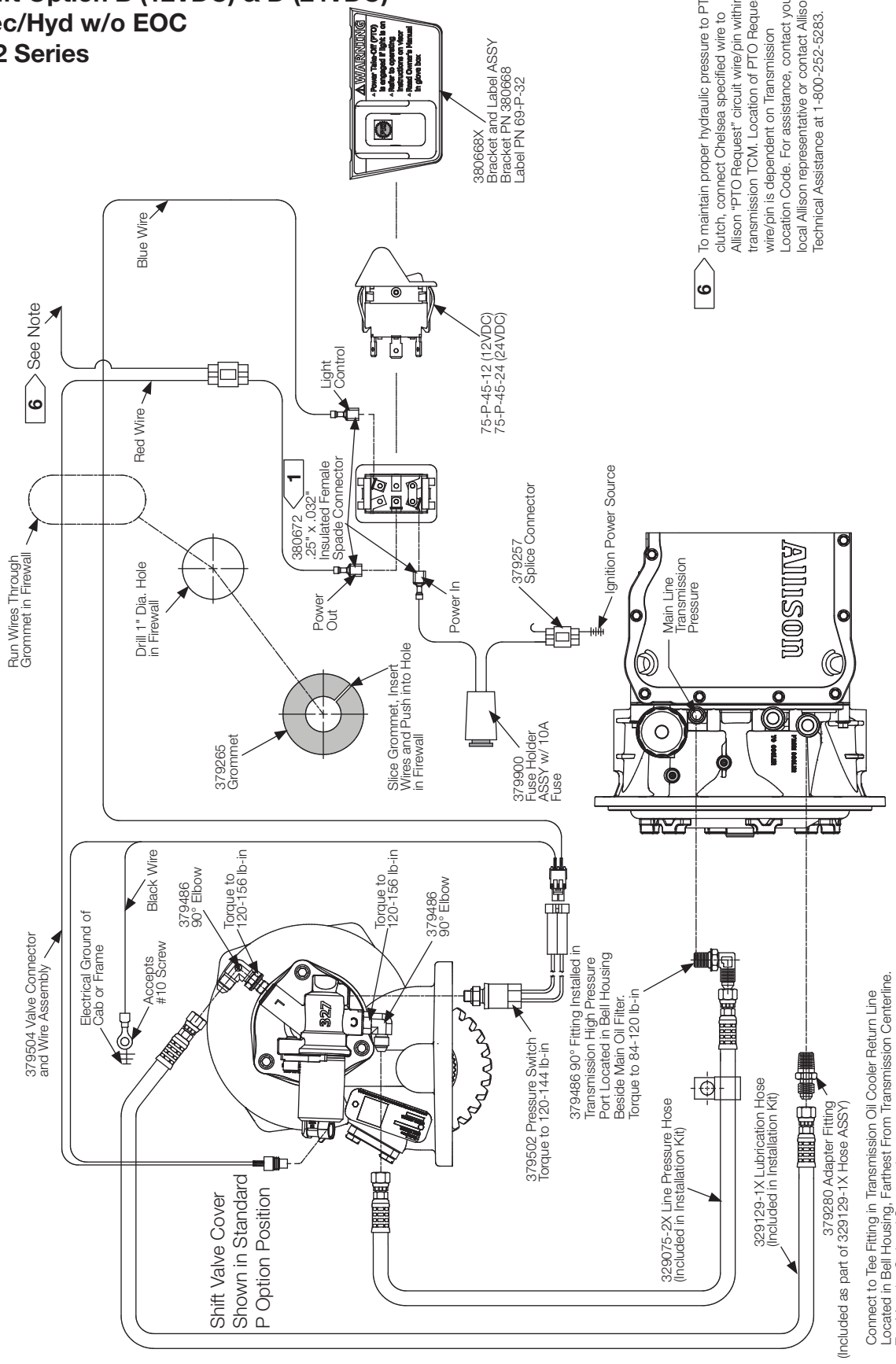
Chelsea Products Division
Olive Branch, MS 38654 USA

Allison Transmission
Shift Option B (12VDC) & D (24VDC)
Elec/Hyd w/o EOC
272 Series

(SK-574 Rev A)



Installation Kits: 329882-12X (12VDC)
329882-24X (24VDC)

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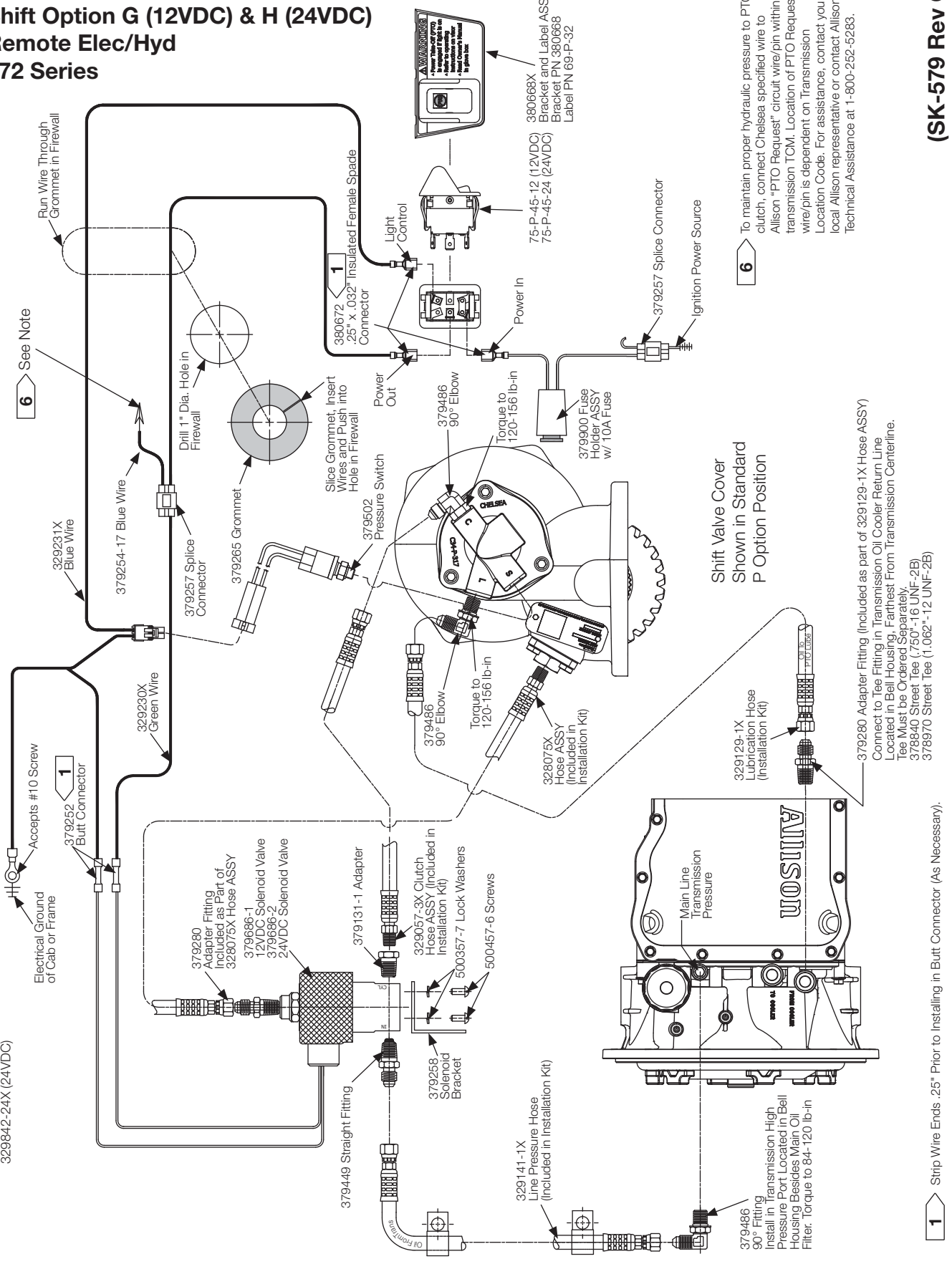
Chelsea Products Division
Olive Branch, MS 38654 USA

Allison Transmission
Shift Option G (12VDC) & H (24VDC)
Remote Elec/Hyd
272 Series

(SK-579 Rev C)



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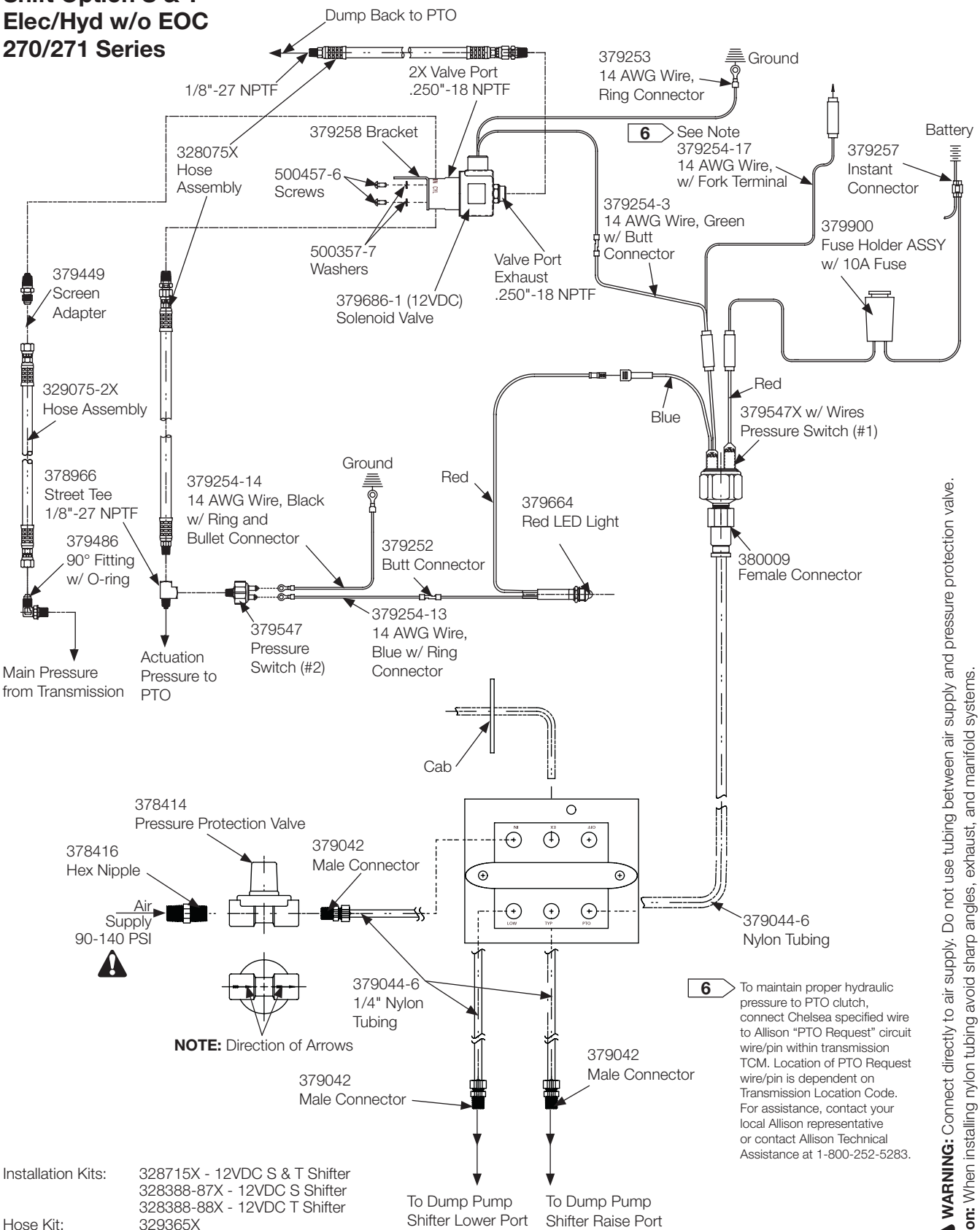
Chelsea Products Division
Olive Branch, MS 38654 USA

Allison Transmission Shift Option S & T Elec/Hyd w/o EOC 270/271 Series

(SK-428 Rev C)



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 dependent on Transmission Location Code. For assistance, contact your local Allison representative or contact Allison Technical Assistance at 1-800-252-5283.

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.

Installation Kits:	328715X - 12VDC S & T Shifter 328388-87X - 12VDC S Shifter 328388-88X - 12VDC T Shifter
Hose Kit:	329365X
J1-6 Feedback Kit:	329366-1X
Fitting Kit:	329297X (Allison 1000, 2000/2500 only)

Notes

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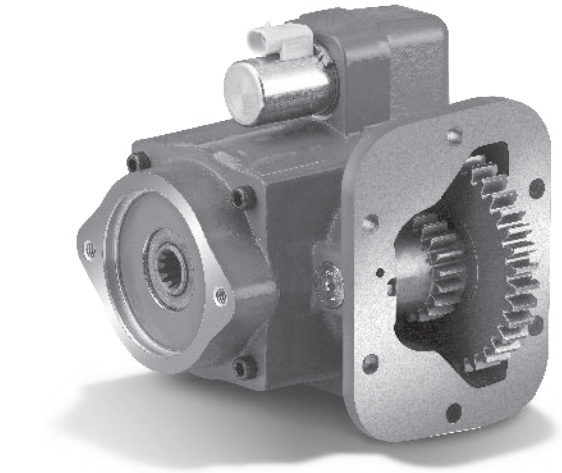
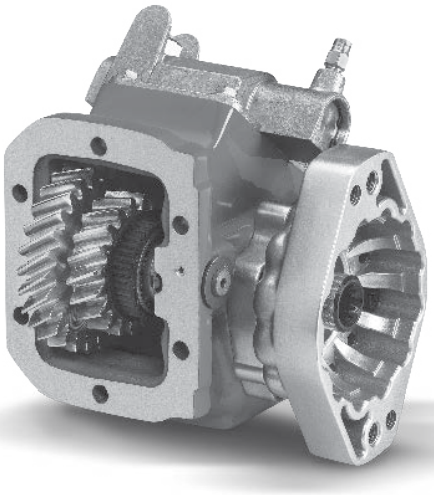
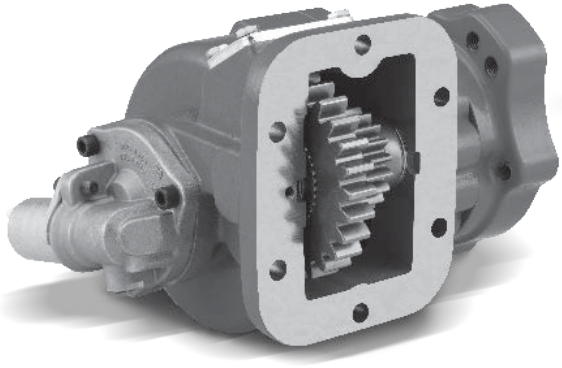
Olive Branch, MS 38654 USA

DODGE/RAM







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

Overview (MY2010 & Prior)

PTO Operation

The 3500/4500/5500 Dodge Chassis Cab vehicle, when equipped with either the automatic AISIN 6-speed or manual G-56 6-speed transmissions, will allow for an aftermarket upfit with a transmission driven PTO (Power Take-Off). The customer will have the ability to operate the PTO in either a stationary or mobile mode. The vehicles will be factory set to the stationary mode. In order to select the mobile mode a Daimler Chrysler Dealership is required to modify the vehicles settings using their proprietary Dealer service tool.

Stationary Mode

To operate the PTO in this mode the vehicle must meet the following conditions:

- Be in park positions (vehicles equipped with automatic transmission)
- Up fitter provider (on/off) switch has been activated
- Parking brake applied (vehicles equipped with manual transmission)
- Vehicle must be running
- No vehicle, brake, or clutch switch faults present
- PTO must be correctly installed using the vehicle provided circuits

The customer has the choice to operate the PTO by utilizing the cruise control switches or by utilizing a remote control (provided by the PTO supplier). To operate the feature using the cruise control switches the customer must first activate the up fitter provided on/off switch. Next, the cruise control on switch is selected. Following this step the set switch must be depressed. The vehicle is now in the PTO mode and is ready for use. In order to increase or decrease the engine idle speed, to optimize the PTO function, the accel and decel cruise switches can be used respectively. To disengage PTO operation and return to standard vehicle operation simply turn the up fitter provided on/off switch to the off position.

To operate the PTO via a remote switch the customer must make sure the above conditions are met. It is vital for proper operation that the PTO and remote have been installed correctly paying special attention to ensure the vehicle provided wiring has been connected properly. This is the responsibility of the installer of the PTO and switches/ remote system. It is the responsibility of the PTO manufacturer to ensure that their electrical (switches and remote) system is compatible with the vehicle's electrical architecture and software functionality.

Mobile Mode

To operate the PTO in this mode the vehicle must meet the following conditions:

- Dealer selected mobile mode activated via Dealer proprietary service tool
- Up fitter provider (on/off) switch has been activated
- Vehicle must be in park or drive position (vehicles equipped with automatic transmission)
- Parking brake must not be applied
- No vehicle, brake, or clutch switch faults present
- Vehicle must be running
- PTO must be correctly installed using the vehicle provided circuits

The customer may choose to use the PTO while the vehicle is moving. To do so the PTO function must be activated prior to taking the vehicle out of park. This is accomplished by activating the up fitter provided PTO on/off switch. At this point the customer may place the vehicle in a forward or reverse gear and have PTO operation. To disengage PTO operation and return to standard vehicle operation simply turn the up fitter provided on/off switch to the off position.

NOTE: For application specific information with respect to PTO and pump requirements and additional vehicle information (wiring schematics, preset idle values, engine speed limits, and vehicle hardware and software requirements) please refer to the Dodge Body Builders Guide by accessing Wiring Diagrams and choosing the appropriate links.

Overview (MY2011 & MY2012)

PTO Operation

The 3500/4500/5500 RAM Chassis Cab vehicle, when equipped with either the automatic AISIN 6-speed or manual G-56 6-speed transmissions, will allow for an aftermarket upfit with a transmission driven PTO (Power Take-Off). The customer will have the ability to operate the PTO in either a "stationary" or "mobile" mode. The vehicles will be factory set to the "stationary" mode. In order to select the "mobile" mode a Chrysler Group LLC Dealership is required to modify the vehicles settings using their proprietary Dealer service tool. Under normal operation the vehicle will go to a 900 RPM when PTO is engaged. By utilizing the cruise switches the idle speed can then be adjusted to between 900 and 2000 RPMs.

Stationary Mode

This feature interacts with the transmission to utilize an auxiliary shaft to drive equipment. Activated by a switch inside the cab, this feature operates only when the vehicle is stationary. The input is switched to ground. Once active, the engine speed increased by holding the RES ACCEL button on the steering wheel or decreased by holding the COAST button. Stationary PTO is available only when the vehicle is stationary. When the truck is equipped with an automatic transmission, it must be in Park and the service brake must be released and functional. When the truck is equipped with a manual transmission, the Parking Brake must be Set and the service brake must be released and functional.

To operate the PTO in this mode the vehicle must meet the following conditions:

- Be in park position (vehicles equipped with automatic transmission)
- Upfitter provider (on/off) switch has been activated
- Parking brake applied (vehicles equipped with manual transmission)
- Clutch not depressed (clutch interlock switch)
- Vehicle must be running
- No transmission, engine, accelerator, brake, or clutch switch faults present
- PTO must be correctly installed using the vehicle provided circuits

The customer has the choice to operate the PTO by utilizing the cruise control switches or by utilizing a remote control (provided by the PTO supplier). To operate the feature using the cruise control switches the customer must first activate the up fitter provided on/off switch. The vehicle is now in the PTO mode and is ready for use. In order to increase or decrease the engine idle speed, to optimize the PTO function, the accel and decel cruise switches can be used respectively. To disengage PTO operation and return to standard vehicle operation simply turn the up fitter provided on/off switch to the off position.

To operate the PTO via a remote switch the customer must make sure the above conditions are met. It is vital for proper operation that the PTO and remote have been installed correctly paying special attention to ensure the vehicle provided wiring has been connected properly. This is the responsibility of the installer of the PTO and switches/remote system. It is the responsibility of the PTO manufacturer to ensure that their electrical (switches and remote) system is compatible with the vehicle's electrical architecture and software functionality.

Overview (MY2011 & MY2012) (Continued)

Mobile Mode

This feature interacts with the transmission auxiliary shaft. The feature is activated by a switch (closed to ground) in the cab after selected by a service tool. When active, this feature limits engine speed and road speed to calibrated values. When this feature is selected stationary PTO and Remote PTO features are not available.

To operate the PTO in this mode the vehicle must meet the following conditions:
- Dealer selected mobile mode activated via Dealer proprietary service tool
- Upfitter provider (on/off) switch has been activated
- Vehicle must be in park or drive position (vehicles equipped with automatic transmission)
- Parking brake must not be applied
- Clutch not depressed (clutch interlock switch)
- No transmission, engine, accelerator, brake, or clutch switch faults present
- Vehicle must be running
- PTO must be correctly installed using the vehicle provided circuits

The customer may choose to use the PTO while the vehicle is moving. To do so the PTO function must be activated prior to taking the vehicle out of park. This is accomplished by activating the up fitter provided PTO on/off switch. At this point the customer may place the vehicle in a forward or reverse gear and have PTO operation. To disengage PTO operation and return to standard vehicle operation simply turn the up fitter provided on/off switch to the off position.

Remote Stationary mode

This feature interacts with the transmission to utilize an auxiliary shaft to drive equipment. Activated by a switch outside of the cab, this feature operates only when the vehicle is stationary. The input is switched to ground. Once active, the engine speed is changed when the switch changes from Off (open circuit) to On (closed to ground) or toggled in less than ½ second. Toggling the switch On-Off-On triggers the engine to change to the next calibrated engine speed. This can be repeated for up to five engine speed settings. Repeated toggles cycles through the engine speed 1-2-3-4-5-1-2 and so on. Remote PTO can be calibrated for one to five selectable engine speeds. The engine speeds are also calibrated. Remote PTO feature has a higher priority than Idle Up. If the Remote PTO feature is active the Idle Up switches are ineffective. The Idle Up or Stationary PTO feature cannot be activated until the Remote PTO relinquishes control.

To operate the PTO in this mode the vehicle must meet the following conditions:
- Be in park position (vehicles equipped with automatic transmission)
- Upfitter provider (on/off) switch has been activated
- Parking brake applied (vehicles equipped with manual transmission)
- Clutch not depressed (clutch interlock switch)
- Vehicle must be running
- No transmission, engine, accelerator, brake, or clutch switch faults present
- PTO must be correctly installed using the vehicle provided circuits

NOTE: For application specific information with respect to PTO and pump requirements and additional vehicle information (wiring schematics, preset idle values, engine speed limits, and vehicle hardware/software requirements) please refer to the current RAM Body Builder's Guide PTO Operation and Installation Guide.

Parker Chelsea
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Overview (MY2013 & Later)

PTO Operation

The 3500/4500/5500 RAM Chassis Cab vehicle, when equipped with either the automatic AISIN 6-speed or manual G-56 6-speed transmissions (manual transmission option MY2013 thru MY2018 only), will allow for an aftermarket upfit with a transmission driven PTO (Power Take-Off). The customer will have the ability to operate the PTO in either a "stationary" or "mobile" mode. Under normal operation the vehicle will go to a 900 RPM when PTO is engaged. By utilizing the cruise switches the idle speed can then be adjusted to between 900 and 2000 RPMs.

Stationary Mode

This feature interacts with the transmission to utilize an auxiliary PTO to drive equipment. Activated by a switch inside the cab, this feature operates only when the vehicle is stationary.

Once active, the engine speed may be increased by holding the RES ACCEL button on the steering wheel or decreased by holding the COAST button.

This is the factory programmed setting. If you need a single set speed, you will now be able to program it (and disable the cruise switches) via the Electronic Vehicle Information Center (EVIC) screen in the center of the cluster.

Stationary PTO is available only when the vehicle is stationary. When the truck is equipped with an automatic transmission, it must be in Park and the service brake must be released and functional. When the truck is equipped with a manual transmission (not available MY2019+), the parking brake must be set and the service brake must be released and functional.

To operate the PTO in this mode the vehicle must meet the following conditions:

- Be in park position (vehicles equipped with automatic transmission)
- PTO switch has been activated
- Parking brake applied (vehicles equipped with manual transmission, MY2013 thru MY2018)
- Clutch not depressed (clutch interlock switch, vehicles equipped with manual transmission, MY2013 thru MY2018)
- Vehicle must be running
- No transmission, engine, accelerator, brake, or clutch switch faults present
- PTO must be correctly installed using the vehicle provided circuits

To operate the PTO via a remote switch the customer must make sure the above conditions are met. It is vital for proper operation that the PTO and remote have been installed correctly paying special attention to ensure the vehicle provided wiring has been connected properly. This is the responsibility of the installer of the PTO and switches/remote system. It is the responsibility of the PTO manufacturer to ensure that their electrical (switches and remote) system is compatible with the vehicle's electrical architecture and software functionality.

Overview (MY2013 & Later) (Continued)

Mobile Mode

Mobile mode allows for use of the PTO when the vehicle is in motion. This feature, when activated by the menu available on the Electronic Vehicle Information Center (EVIC) screen in the center of the cluster, will allow you to enter mobile PTO mode when you press the PTO switch on the dash. When this feature is selected stationary PTO and Remote PTO features are not available.

To operate the PTO in this mode the vehicle must meet the following conditions:

- PTO switch has been activated
- Vehicle must be in park position (vehicles equipped with automatic transmission)
- Parking brake must not be applied
- Clutch not depressed (clutch interlock switch, vehicles equipped with manual transmission, MY2013 thru MY2018)
- No transmission, engine, accelerator, brake, or clutch switch faults present
- Vehicle must be running
- PTO must be correctly installed using the vehicle provided circuits

The customer may choose to use the PTO while the vehicle is moving. To do so the PTO function must be activated prior to taking the vehicle out of park. This is accomplished by activating the PTO on/off switch. At this point the customer may place the vehicle in a forward or reverse gear and have PTO operation.

The PTO will also function in park and neutral but without an increase in idle speed. However, the accelerator pedal can be used to increase PTO speed. Mobile mode does not provide the exact same capability as a 'live drive' i.e. you cannot have PTO capability at zero vehicle speed in drive. However, some customers have had success with shifting the vehicle into neutral and allowing the vehicle to coast.

To disengage PTO operation and return to standard vehicle operation simply turn the up fitter provided on/off switch to the off position.

Remote Mode Features

Remote mode allows the use of an aftermarket auxiliary switch to actuate the PTO. Presumably this will be from a location other than the cab of the truck, or some automated/relay driven method to turn on the PTO is required.

Remote PTO can be calibrated for one to three selectable engine speeds.

Remote mode also is the only method that accommodates multiple PTO speeds. Up to three different PTO speeds can be programmed. These speeds are programmed via the Electronic Vehicle Information Center (EVIC) screen in the center of the cluster. The circuits that enable these multiple speeds are contained in the Vehicle System Interface Module (VSIM). The VSIM module is located under the dash on the driver's side. The connecting wires are contained in the upfitter wiring kit and VSIM wiring kit.

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Overview (MY2013 & Later) (Continued)

Remote PTO feature has a higher priority than Idle Up. If the Remote PTO feature is active the Idle Up switches are ineffective. The Idle Up or Stationary PTO feature cannot be activated until the Remote PTO relinquishes control.

To operate the PTO in this mode the vehicle must meet the following conditions:

- Be in park position (vehicles equipped with automatic transmission)
- Upfitter provided (on/off) switch has been activated
- Parking brake applied if feature is enabled (vehicles equipped with manual transmission)
- Clutch not depressed (clutch interlock switch, vehicles equipped with manual transmission, MY2013 thru MY2018)
- Vehicle must be running
- No transmission, engine, accelerator, brake, or clutch (manual transmission) switch faults present
- PTO must be correctly installed using the vehicle provided circuits

NOTE: For application specific information with respect to PTO and pump requirements and additional vehicle information (wiring schematics, preset idle values, engine speed limits, and vehicle hardware/software requirements) please refer to the current RAM Body Builder's Guide PTO Operation & Installation Guide.

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Pre-Installation Overview

The current Power Take-Off (PTO) installation is from under the vehicle, an alternative method for Dodge has been developed with the help of Chelsea Products that allows the installation from above by removing the PTO patch panel in the floor.

The installation instructions below are shown using a Dodge 4500 crew cab for installation, but applies to all Dodge work trucks. See Dodge upfitter web site for any changes to this installation information.


Figure 24

1. Unbolt the seat and move it to the rear of the cabin (**Fig. 24**).


Figure 25

2. Remove the sill guards (rocker panel covers) passenger side to allow the floor mat to be lifted. They are removed by prying straight up to disengage metal clips (**Fig. 25**).


Figure 26

3. Lift the floor mat and fold it rearward and towards the driver side to expose the patch panel (**Fig. 26**).

4. Remove the fasteners and sealer from around the patch panel. Cut away the sound deadener pad to expose the transmission PTO access (**Fig. 27**).


Figure 27

5. See installation of the PTO for complete PTO installation instructions on pages 10-14 of this manual.

6. To assemble, reverse the above procedure (1-4) using RTV to reseal the PTO floor pan patch panel.

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Pre-Installation Overview (Continued)

Under Vehicle Installation

1. To access the PTO aperture on the right (passenger) side of the transmission, the exhaust pipe will need to be removed (**Fig. 28**).

2. To make this process easier the following information is provided.
   The front end of the exhaust pipe at the turbo charger is secured with a V band clamp part number 52121895AB. It is tightened to a torque value of 150 lb-in.
   At the rear of the pipe the M10 x 1.5 nuts are torqued to 43 lb-ft.
   The part number for the gasket that is located between the front pipe and the catalytic converter/ particulate filter (if it is damaged or lost) is 52122213AB.
   More specific instructions on removing and installing the exhaust pipe are available in the Dodge Truck service manual.
   If there are any additional questions related to this procedure please contact the Dodge Truck Body Builder Hotline at (866) 205-4102 or dodgebbg@dcx.com.

3. Install Power Take-Off as described on pages 10-14 of this manual.

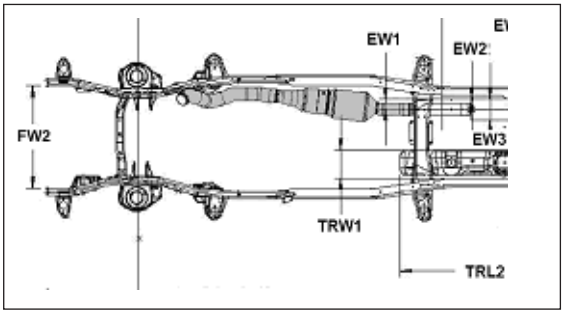

Figure 28

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Heavy-Duty Chassis Cab PTO Installation

1. Before mounting the PTO remove the high pressure port plug located on the left side (driver's side of transmission) and install part number 379749 male connector fitting into port. Also install the 90° swivel nut (part number 379703) onto the male connector (379749) See **Fig. 29** chart for correct installation drawing.

Model Year	Installation Sketch's	Page
MY2010 and prior	SK-426	79-80
MY2011 and MY2012	SK-496	84
MY2013 and later	SK-569	85

Figure 29

2. Next remove the low pressure port plug located on the right side (passenger side of transmission) and install part number 379479 male connector fitting into port (**Fig. 30**).

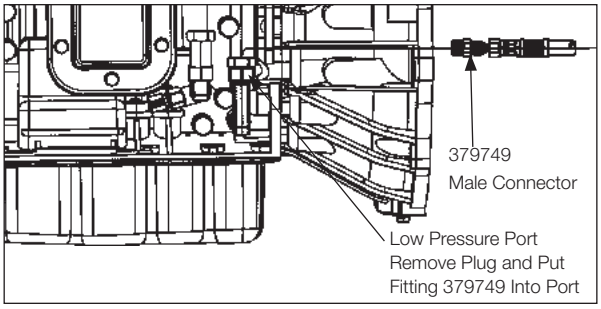

Figure 30

3. One recommendation for installation of the PTO. Remote Solenoid Valve is to locate it at the bottom forward area of the transmission housing (**Fig. 31**).

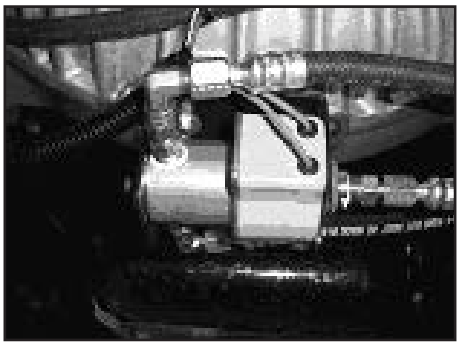

Figure 31

4. Refer to Installation Instructions pages 10-14 of

5. the owner's manual for proper PTO mounting procedure.

6. After PTO has been mounted connect hoses as shown for the chassis/transmission model year. See SK-426, 496 or 569.

NOTE: After proper installation, when PTO is engaged, if there is an objectionable noise from the PTO, the backlash may need to be altered to reduce the noise on Aisin transmissions.

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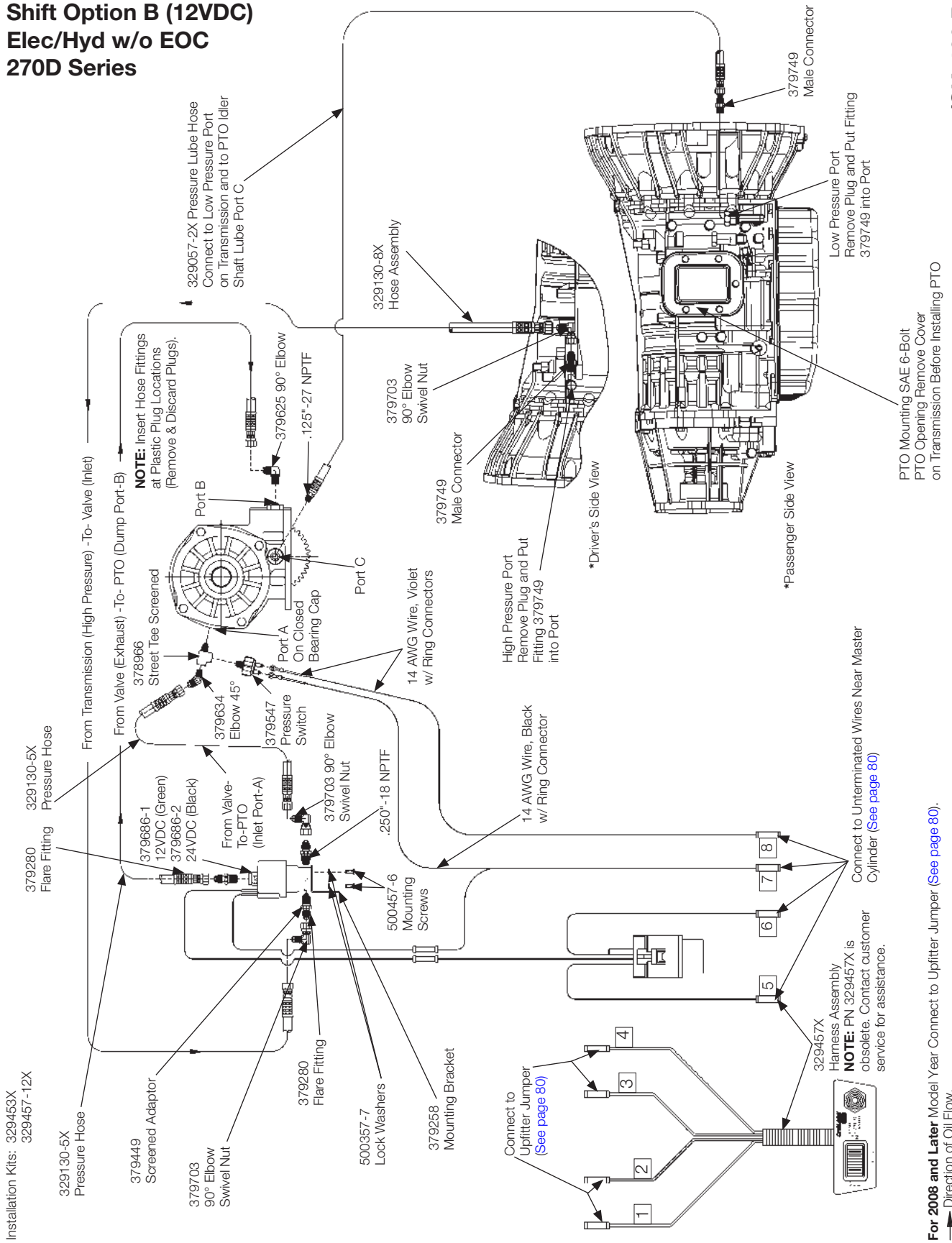
Dodge Sterling Cab/Chassis MY2007 - MY2010
AISIN (AS68RC) Transmission
Shift Option B (12VDC)
Elec/Hyd w/o EOC
270D Series

(SK-426 Rev D)



For 2008 and Later Model Year Connect to Upfitter Jumper (See page 80).
→ Direction of Oil Flow.
*As Viewed from the Rear Looking to the Front of the Vehicle.

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Dodge Cab/Chassis (SK-426 Rev D)
6.7L Diesel w/ AISIN Transmission
Wiring Chart - 270D Series PTO

MY2007 Wiring Chart Reference

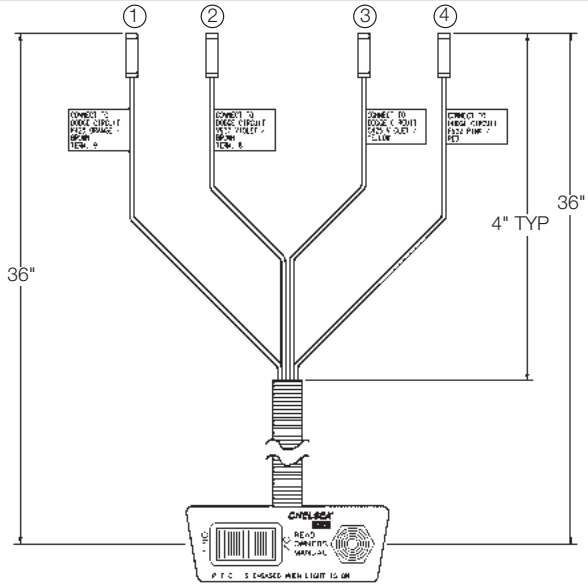
	Chelsea Wire	Connected to Dodge Wire	Location
1	Orange	*K425 Orange w/ Brown Stripe	Terminal #9, 10-way Connector on Bellhousing
2	Violet 1	*V937 Violet w/ Brown Stripe	Terminal #8, 10-way Connector on Bellhousing
3	Violet 2	G425 Violet w/ Yellow Stripe	**Upfitter Jumper Connector
4	Pink	F922 Pink w/ Red Stripe	**Upfitter Jumper Connector
5	Orange	K427 Orange w/ Lt. Green Stripe	Unterminated Wires Near Master Cylinder
6	Pink	F922C Pink w/ Red Stripe	Unterminated Wires Near Master Cylinder
7	Black	Z914 Black	Unterminated Wires Near Master Cylinder
8	Violet	G425 Violet w/ Yellow Stripe	Unterminated Wires Near Master Cylinder
	Chelsea Wire	**Connected to**	**Location**
9	Black w/ ring Terminal	Pressure Switch	PTO
10	Violet w/ ring Terminal	Pressure Switch	PTO
11	Black w/ Butt Connector	PTO Solenoid - Black Wire	Remotely Mounted On Vehicle
12	Red w/ Butt Connector	PTO Solenoid - Red Wire	Remotely Mounted On Vehicle

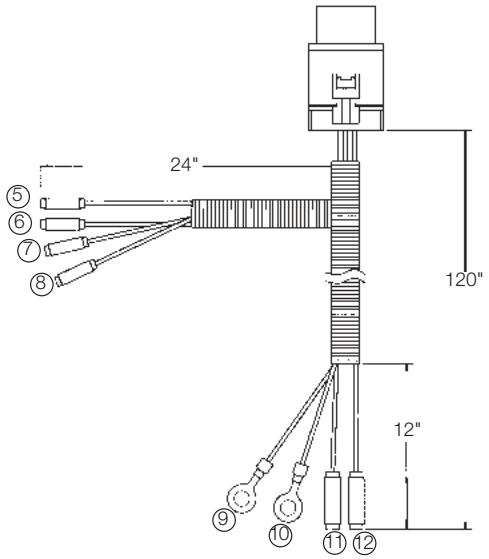
* **NOTE:** These two wires must be cut from Dodge 10-way connector. Do not cut any other wires.
** **NOTE:** Stored in Vehicle Glove Box. Connect to Mating Plug under Instrument Panel Near Grommet.

MY2008 - MY2010 Wiring Chart Reference

	Chelsea Wire	Connected to Dodge Wire	Location
1	Orange	K425 Pink w/ Yellow Stripe	Upfitter Jumper Connector
2	Violet 1	V937 Violet w/ Brown Stripe	Upfitter Jumper Connector
3	Violet 2	G425 Violet w/ Yellow Stripe	Upfitter Jumper Connector
4	Pink	F922 Pink w/ Red Stripe	Upfitter Jumper Connector
5	Orange	K427 Orange w/ Lt. Green Stripe	Unterminated Wires Near Master Cylinder
6	Pink	F922C Pink w/ Red Stripe	Unterminated Wires Near Master Cylinder
7	Black	Z914 Black	Unterminated Wires Near Master Cylinder
8	Violet	G425 Violet w/ Yellow Stripe	Unterminated Wires Near Master Cylinder
	Chelsea Wire	**Connected to**	**Location**
9	Black w/ ring Terminal	Pressure Switch	PTO
10	Violet w/ ring Terminal	Pressure Switch	PTO
11	Black w/ Butt Connector	PTO Solenoid - Black Wire	Remotely Mounted On Vehicle
12	Red w/ Butt Connector	PTO Solenoid - Red Wire	Remotely Mounted On Vehicle

NOTE: Wire Numbers on the Chelsea Wiring Chart are for reference only.
NOTE: Upfitter Connector is shipped loose with vehicle and is stored behind seat.





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RAM Cab/Chassis MY2011 & Later Wiring Reference

Glove Compartment

1. Separate Upfitter Jumper kit RAM P/N 68049501AB found in glove compartment:
   - Wiring harnesses with plastic connectors are to be used in the cab.
   - Eight 12-wires with pins connected are to be utilized for wiring near Auxiliary Control Box (Aux Box) in engine compartment (**Fig. 32**).
   - Eight 20-wires with pins connected are to be utilized for wiring into Transmission Connector Upfitter located near transmission (not used for basic PTO install).

2. Of the eight 12-wires with pins connected, separate the following four loose wires (**Fig. 33**):
   - K427 (Orange w/ Light Green Stripe) Function = Aux_PTO_Control
   - F928 (Pink w/ Yellow Stripe) Function = Aux_PTO_Power Output
   - Z907 (Black) Function = Ground
   - G425 (Violet w/ Yellow Stripe) Function = Indicator


Figure 32

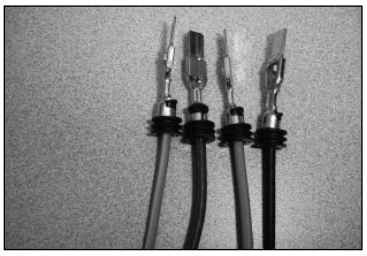


Figure 33

Engine Compartment Reference

3. Location of K427 Wire (**Fig. 34**).

4. Light Gray 4 PIN Connector (**Fig. 35**).

5. Light Gray 4 PIN connector connection references (**Fig. 36**).

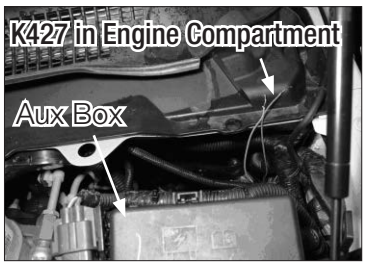


Figure 34

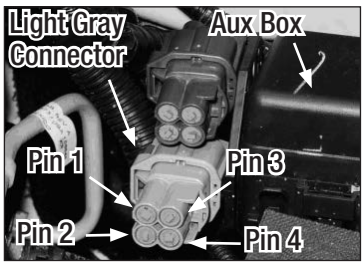


Figure 35

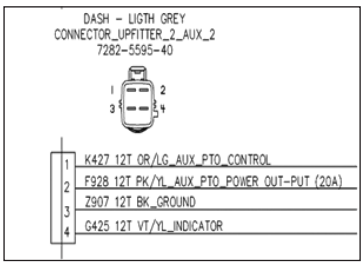


Figure 36

Under Dash in Cab Reference

6. There are two open connectors underneath the dash, located on the driver's side by the parking brake that will be used for basic PTO wiring installation. One 6-pin White connector and one 6-pin Light Gray connector (**Fig. 37**).

7. The White connector will attach to the wiring harness with the 6-pin black connector found in the glove compartment as part of the Upfitter Jumper kit RAM P/N 68049501 AB.

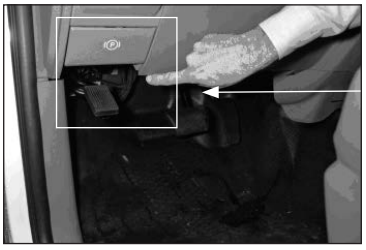
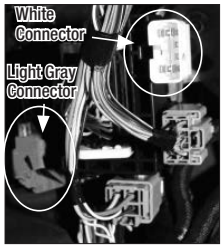


Figure 37



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RAM Cab/Chassis MY2011 & Later
6.7L Diesel w/ AISIN Transmission
Wiring Chart – 270R Series

UNDER DASH CHELSEA SWITCH

Wire #	Chelsea Wire			RAM Loose Wire Harness			RAM Connector			RAM Circuit		
	* 2011-2012	** 2013-2018	*** 2019+	* 2011-2012	** 2013-2018	*** 2019+	* 2011-2012	** 2013-2018	*** 2019+	* 2011-2012	** 2013-2018	*** 2019
1	Orange Wire from PTO Activation Switch			Orange/Brown Wire on Black Connector in Upfitter Harness	Pink Wire on Black Connector in Upfitter Harness		6-Pin Off-White/Natural Connector Found Behind VSIM Module		6-Pin Black Connector Found Behind VSIM Module	K425 - Signal Wire to Diesel ECM Orange/ Brown	F425 - Remote PTO Switch to Diesel ECM Pink	
2	Violet Wire from PTO Activation Switch			Violet/Brown Wire on Black Connector in Upfitter Harness	Black Wire on Black Connector in Upfitter Harness	Violet/ Brown Wire on Black Connector in Upfitter Harness				V937 - Signal Wire to Diesel ECM Violet/ Brown	Z905 - Ground Black	V937 - Ground Violet/Brown
3	Yellow Wire from PTO Indicator Lamp			Violet/Yellow Wire on Gray Connector in Upfitter Harness			6-Pin Gray Connector Found Behind VSIM Module	6-Pin Light Gray Connector Found Behind VSIM Module **(NOTE 1)**	6-Pin Light Gray Connector Found Behind VSIM Module **(NOTE 2)**	G425 - PTO Indicator Signal from Pressure Switch Violet/Yellow **(NOTE 1)**	G425 - PTO Indicator Signal from Pressure Switch Violet/ Yellow **(NOTE 2)**	
4	Red Wire from PTO Indicator Lamp			Splice to Pink/ Yellow Loop in Gray Connector in Upfitter Harness	Splice to Pink/Orange Loop in Gray Connector in Upfitter Harness		6-Pin Gray Connector Found Near Parking Brake	6-Pin Light Gray Connector Found Behind VSIM Module		F922 - 12VDC Ignition Power Source Pink/ Yellow	F606 - 12VDC Ignition Power Source (Do not cut, splice only) Pink/Orange	

UNDER HOOD

RAM Wire												
6	Red Wire - Power to PTO Solenoid			Connect to Wire/Weather Seal - Pink/Yellow			Light Gray 4-Pin Connector/ Pin 2 Bottom/Left			F928 - AUX_ PTO_OUTPUT Pink/Yellow	F605- AUX_ PTO_OUTPUT Pink/Violet	F607- AUX_ PTO_ OUTPUT Pink/Yellow
7	Black Wire Ground Wire from PTO Solenoid and Pressure Indicator Switch			Connect to Wire/Weather Seal - Black			Light Gray 4-Pin Connector/ Pin 3 - Top/Right			Z907 - Ground Black	Z907- Ground Black/Brown	Z907- Ground Black
8	Violet Wire Pressure Indicator Signal from Pressure Switch			Connect to Wire/Weather Seal - Violet Yellow			Light Gray 4-Pin Connector/ Pin 4 - Bottom/Right			G425 - PTO Indicator Violet/Yellow		

RAM Wire	Not Applicable (RAM Wiring)	RAM Orange/ Green Wire behind Fuse Box (PTO Installer to Complete)	Pre-Wired when PTO Option Ordered	Light Gray 4-Pin Connector Pin 1 - Top/Left	Pre-Wired when PTO Option Ordered	K427 - Signal Wire from TCM to Relay for PTO Power	Pre-Wired when PTO Option Ordered

See Page 83 for Notes

* For Model Year 2011/12 refer to SK-496
** For Model Year 2013 and Later refer to SK-569
*** Due to operator safety (which includes a positive indicator the PTO is engaged) for MY2019 Parker Chelsea will only support Chelsea Switch and Light (PN 329664X)
Refer to RAM Body Builder Web Site for changes and/or updates to wiring information

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RAM Cab/Chassis MY2011 & Later (Continued)
6.7L Diesel w/ AISIN Transmission
Wiring Chart – 270R Series

NOTE 1: **For MY2011 thru MY2018**, the ground signal from the pressure switch must be connected to the VSIM - Circuit W708. If there is no signal from the pressure switch within 30 seconds from when the PTO solenoid is given power, the RAM system will turn the PTO off.

The VSIM is located near the parking brake and has four connections for four different wiring harnesses to interface with. The W708 Circuit utilizes the Brown RAM upfitter harness supplied with the truck. The W708 is cavity #8 and is an Orange/Brown wire. The order code for VSIM is XXS.

An upfitter supplied wire must be used to join the G425 (Violet/Yellow) Circuit to the W708 (Orange/Brown) Circuit in the Brown VSIM harness. Do not cut the G425 wires.

NOTE 2: **For MY2019+**, use Chelsea switch to activate the PTO per FCA's "Remote Mode" instructions found in their "PTO Quick Start Menu". See FCA body builder instruction at www.ramtrucks.com.

NOTE 3: When installing the PTO wiring using RAM's remote mode, the default engine speed once the PTO is engaged is 900 engine RPM. In order to operate the truck at higher speeds, the electronic vehicle information center (EVIC) must be programmed for up to (3) additional speeds. See RAM's body builder guide for details related to the programming of the various speeds as well as what circuits need to be grounded to actuate the multi speed function.

NOTE 4: **For MY2013 thru MY2018**, the RAM cab chassis is equipped with an OEM supplied PTO switch in the center dash. This OEM switch allows for the engine speed to be adjusted using the cruise control buttons during PTO operation. Also, a single set speed can be programmed to operate the PTO at a higher speed than the default of 900 engine RPM. This is the only setup for adjusting the engine speed during PTO operation using the cruise controls. See the RAM body builder guide for additional instructions and guidelines.

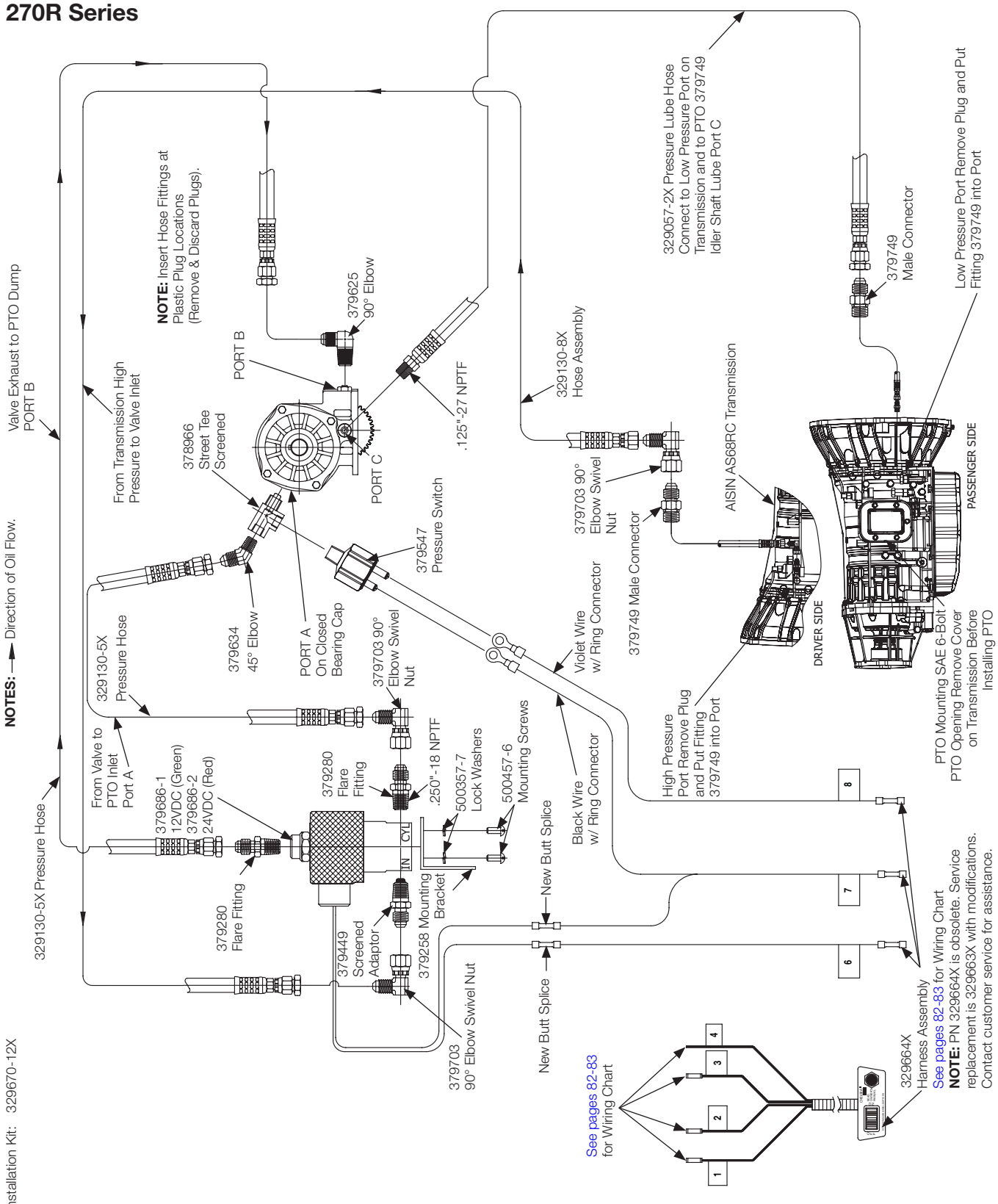
As with all PTO installations, a PTO engagement warning light must be utilized and be clearly visible to the operator. When utilizing the RAM supplied switch the warning light is in the switch itself. It will blink when activated and become solid once a signal is received from the PTO pressure switch. The pressure indicator signal must be wired to RAM W708 Circuit in the truck's VSIM for the system to properly operate the PTO. For completion of the pressure indicator signal, a minimum of 14 wire is to be used.

Per Chelsea's owner's manual, all PTO warning labels and safety devices must be utilized. Failure to do so puts the operator at risk which would be the responsibility of the PTO installer.

NOTE 5: Trucks coming from the factory are shipped in ship mode. In order to cancel ship mode, a RAM dealer must flash the cancellation command.

RAM Cab/Chassis MY2011 - MY2012
AISIN (AS68RC) Transmission
Shift Option B
Elec/Hyd w/o EOC
270R Series

(SK-496)



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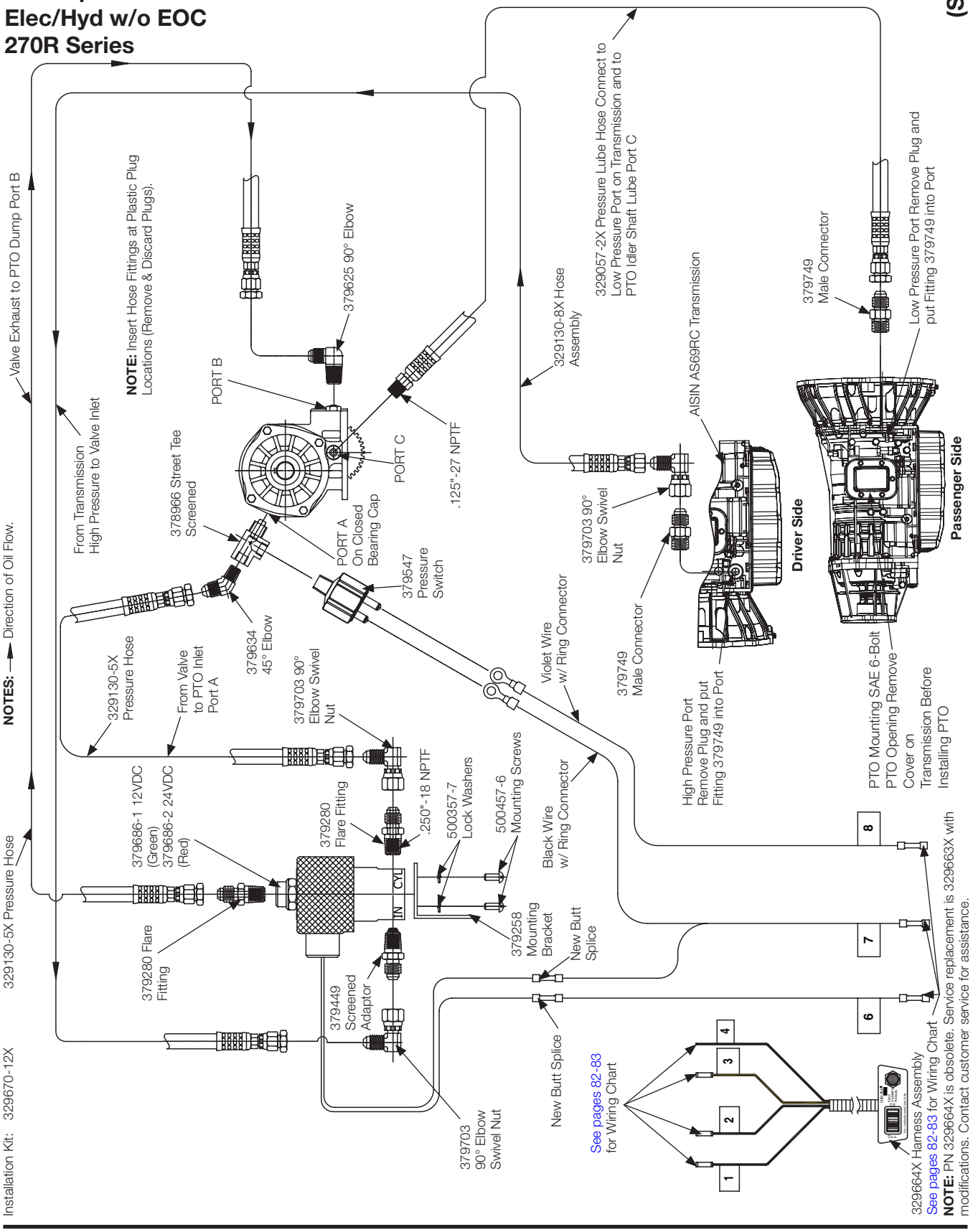
RAM Cab/Chassis MY2013 & Later
AISIN (AS69RC/AS66RC) Transmission
Shift Option B
Elec/Hyd w/o EOC
270R Series

(SK-569)



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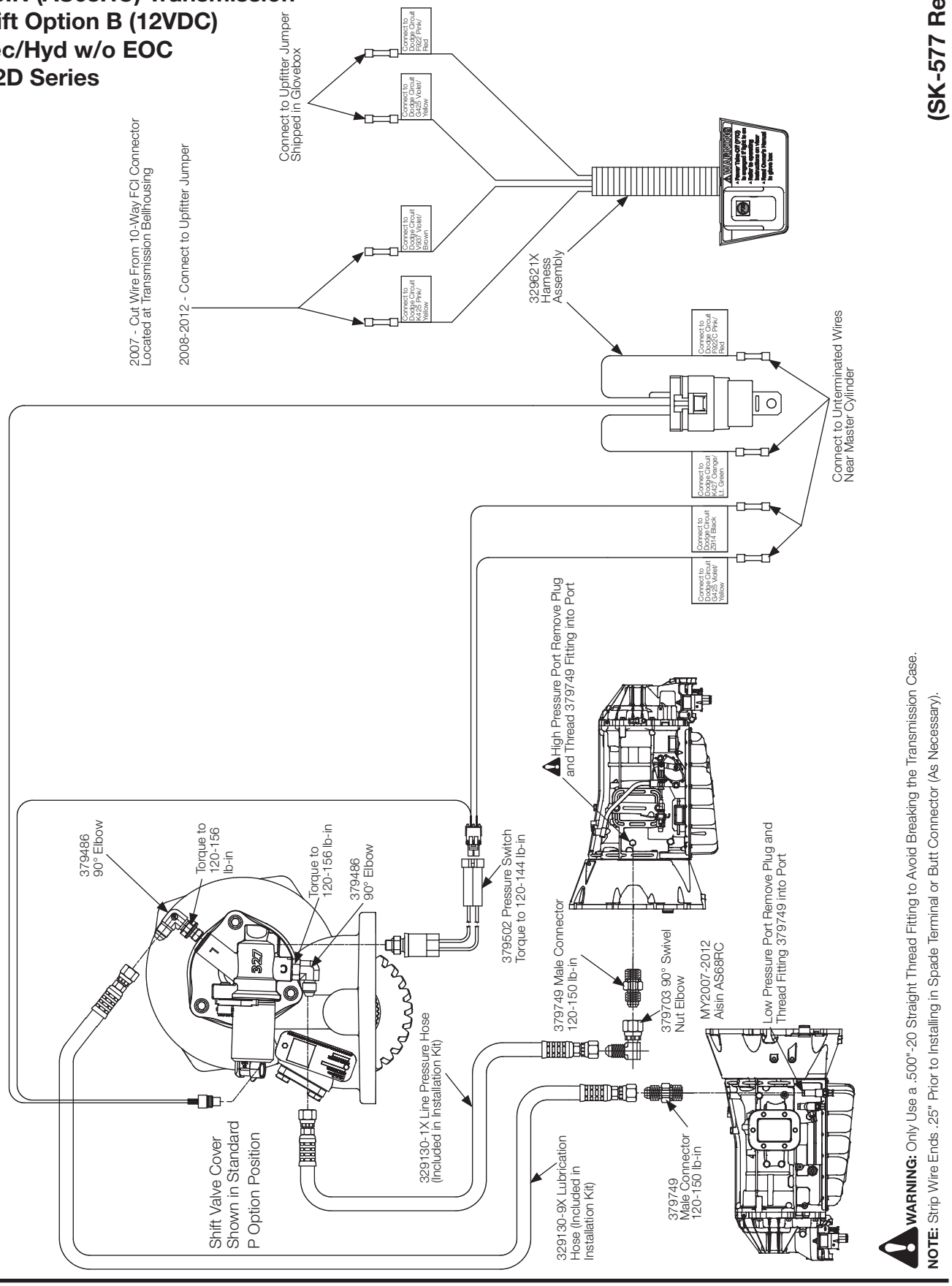
Dodge Cab/Chassis MY2007 - MY2012
AISIN (AS68RC) Transmission
Shift Option B (12VDC)
Elec/Hyd w/o EOC
272D Series

(SK-577 Rev A)



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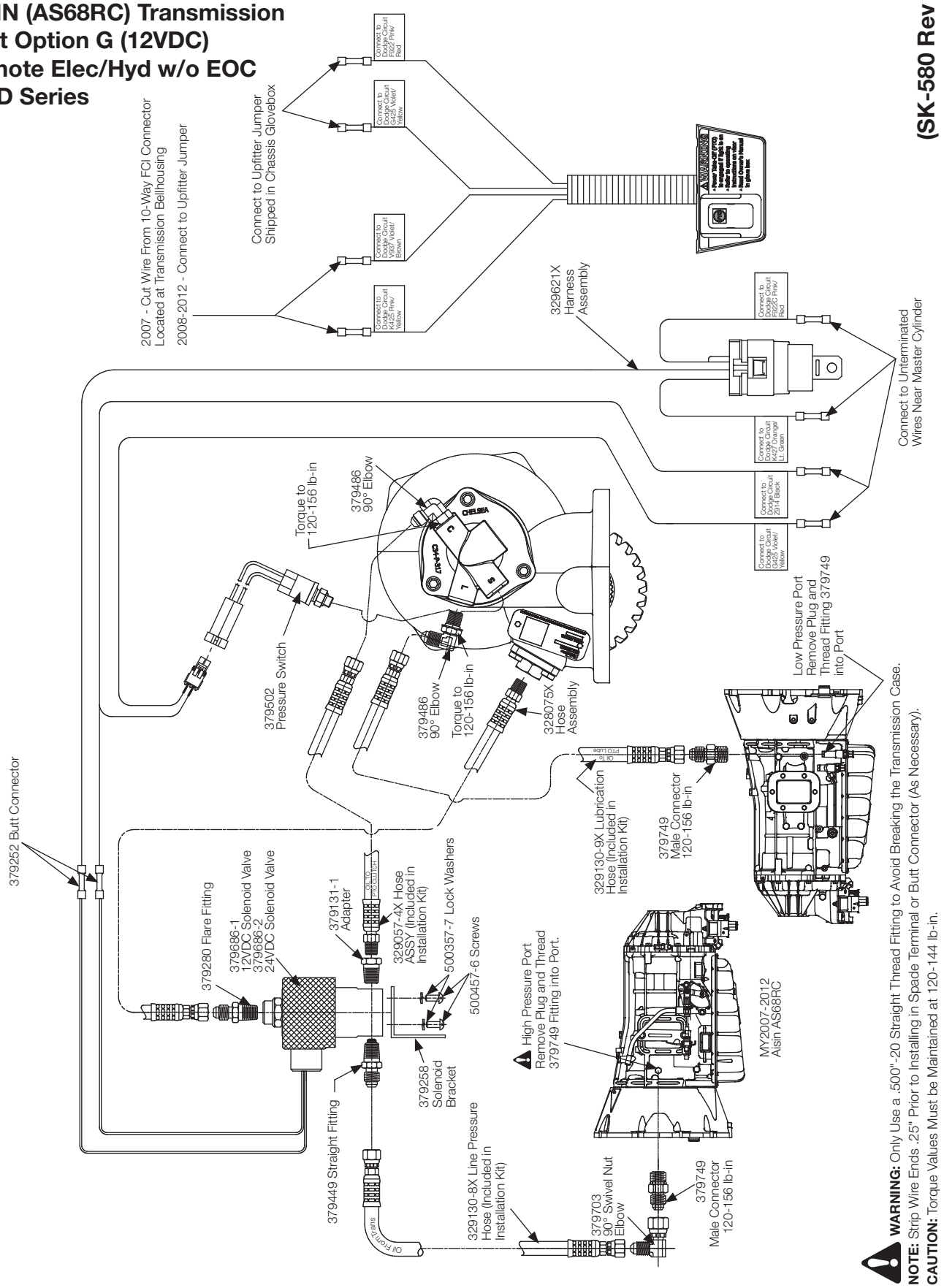
Dodge Cab/Chassis MY2007 - MY2012
AISIN (AS68RC) Transmission
Shift Option G (12VDC)
Remote Elec/Hyd w/o EOC
272D Series

(SK-580 Rev B)



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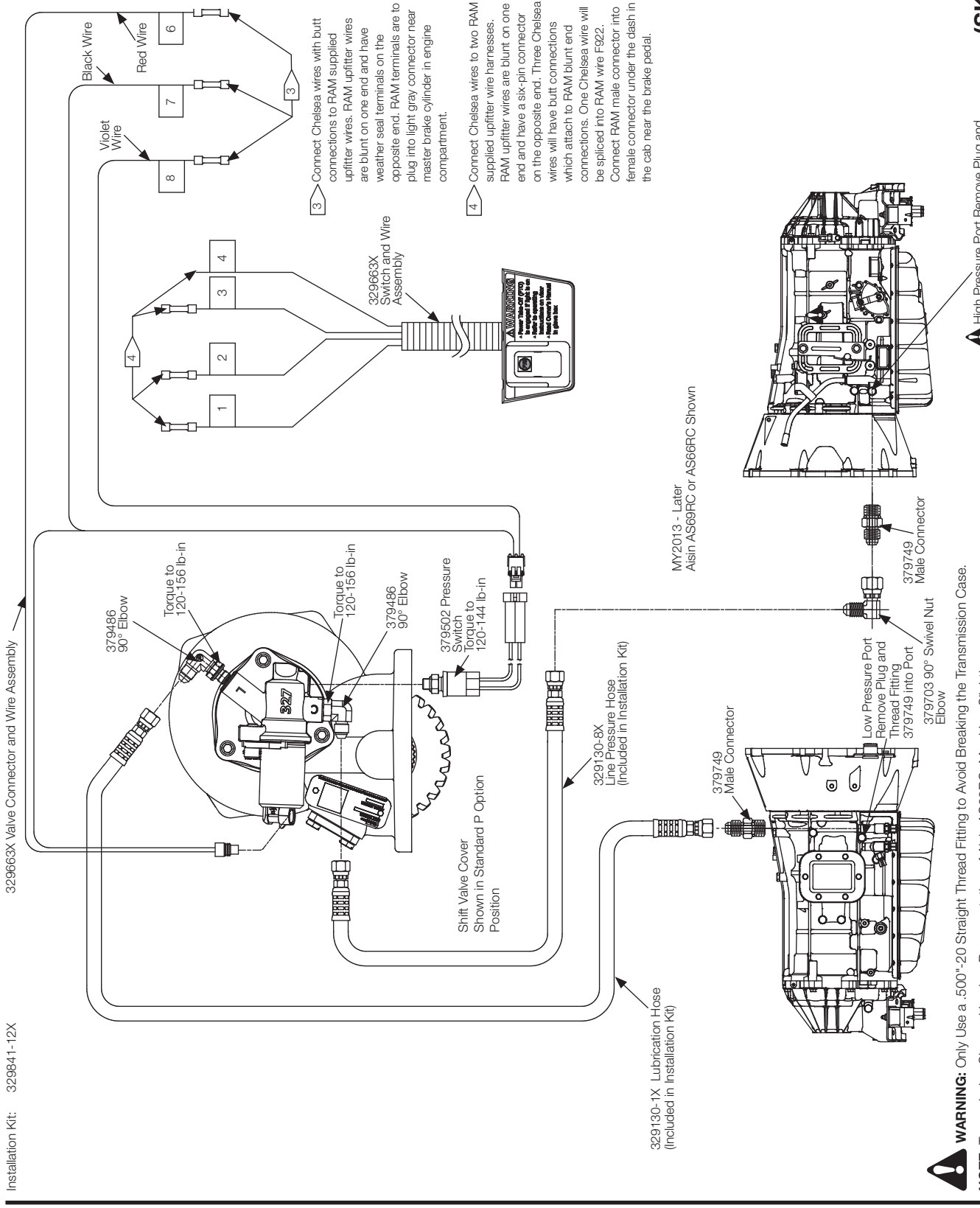
RAM Cab/Chassis MY2013 & Later
AISIN (AS69RC/AS66RC) Transmission
Shift Option B (12VDC)
Remote Elec/Hyd w/o EOC
272R Series

(SK-581 Rev C)



Installation Kit: 329841-12X

WARNING: Only Use a .500"-20 Straight Thread Fitting to Avoid Breaking the Transmission Case.

NOTE: Transmission Shown, Used as Representation of Aisin AS69RC, May Vary Slightly.

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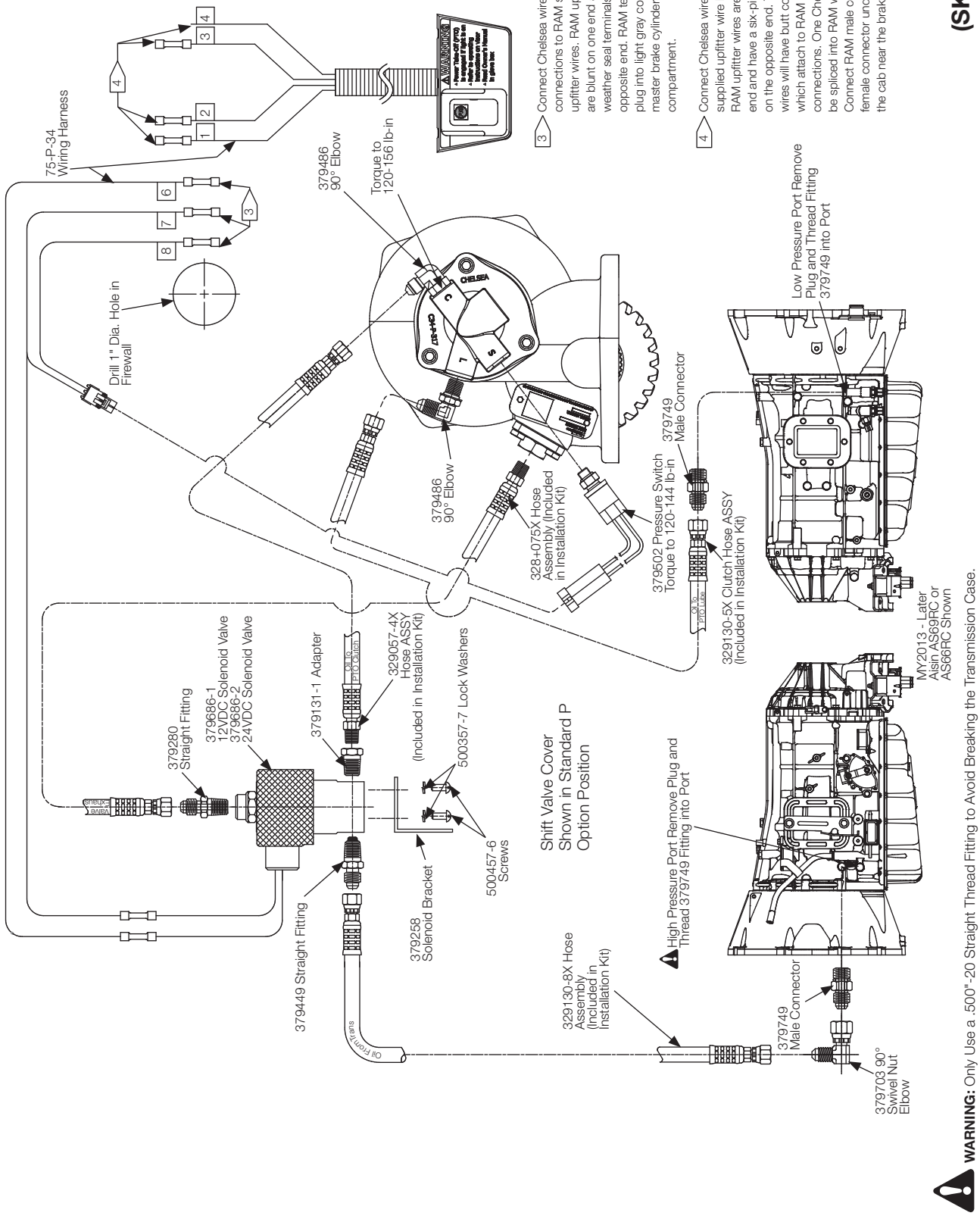
RAM Cab/Chassis MY2013 & Later
AISIN (AS69RC/AS66RC) Transmission
Shift Option G (12VDC)
Remote Elec/Hyd w/o EOC
272R Series

(SK-582 Rev D)



3 Connect Chelsea wires with butt connections to RAM supplied upfitter wires. RAM upfitter wires are blunt on one end and have weather seal terminals on the opposite end. RAM terminals are to plug into light gray connector near master brake cylinder in engine compartment.

4 Connect Chelsea wires to two RAM supplied upfitter wire harnesses. RAM upfitter wires are blunt on one end and have a six-pin connector on the opposite end. Three Chelsea wires will have butt connections which attach to RAM blunt end connections. One Chelsea wire will be spliced into RAM wire F922. Connect RAM male connector into female connector under the dash in the cab near the brake pedal.

WARNING: Only Use a .500"-20 Straight Thread Fitting to Avoid Breaking the Transmission Case.

Installation Kit: 329887-12X

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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

1. Definitions. As used herein, the following terms have the meanings indicated.

Buyer: means any customer receiving a Quote for Products.

Buyer's Property: means any tools, patterns, plans, drawings, designs, specifications materials, equipment, or information furnished by Buyer, or which are or become Buyer's property.

Confidential Information: means any technical, commercial, or other proprietary information of Seller, including, without limitation, pricing, technical drawings or prints and/or part lists, which has been or will be disclosed, delivered, or made available, whether directly or indirectly, to Buyer.

Goods: means any tangible part, system or component to be supplied by Seller.

Intellectual Property Rights: means any patents, trademarks, copyrights, trade dress, trade secrets or similar rights.

Products: means the Goods, Services and/or Software as described in a Quote.

Quote: means the offer or proposal made by Seller to Buyer for the supply of Products.

Seller: means Parker-Hannifin Corporation, all divisions, subsidiaries and businesses selling products under these terms.

Seller's IP: means patents, trademarks, copyrights, or other intellectual property rights relating to the Products, including without limitation, names, designs, images, drawings, models, software, templates, information, any improvements or creations or other intellectual property developed prior to or during the relationship contemplated herein.

Services: means any services to be provided by Seller.

Software: means any software related to the Goods, whether embedded or separately downloaded.

Special Tooling: means equipment acquired by Seller or otherwise owned by Seller necessary to manufacture Goods, including but not limited to tools, jigs, and fixtures.

Terms: means the terms and conditions of this Offer of Sale.

2. Terms. All sales of Products by Seller will be governed by, and are expressly conditioned upon Buyer's assent to, these Terms. These Terms are incorporated into any Quote provided by Seller to Buyer. Buyer's order for any Products whether communicated to Seller verbally, in writing, by electronic data interface or other electronic commerce, shall constitute acceptance of these Terms. Seller objects to any contrary or additional terms or conditions of Buyer. Reference in Seller's order acknowledgement to Buyer's purchase order or purchase order number shall in no way constitute an acceptance of any of Buyer's terms or conditions of purchase. Any Quote made by Seller to Buyer shall be considered a firm and definite offer and shall not be deemed to be otherwise despite any language on the face of the Quote. Seller reserves all rights to accept or reject any purported acceptance by Buyer to Seller's Quote if such purported acceptance attempts to vary the terms of the Quote. If Seller ships Products after Buyer issues an acceptance to the Quote, any additional or different terms proposed by Buyer will not become part of the parties' business relationship unless agreed to in a writing that is signed by an authorized representative of Seller, excluding email correspondence. If the transaction proceeds without such agreement on the part of Seller, the business relationship will be governed solely by these Terms and the specific terms in Seller's Quote.

3. Price; Payment. The Products set forth in the Quote are offered for sale at the prices indicated in the Quote. Unless otherwise specifically stated in the Quote, prices are valid for thirty (30) days and do not include any sales, use, or other taxes or duties. Seller reserves the right to modify prices for any reason and at any time by giving ten (10) days prior written notice. Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2020). All sales are contingent upon credit approval and full payment for all purchases is due thirty (30) days from the date of invoice (or such date as may be specified in the Quote). Under any circumstances, Buyer may not withhold or suspend payment of any amounts due and payable as a deduction, set-off or recoupment of any amount, claim or dispute with Seller. Unpaid invoices beyond the specified payment date incur interest at the rate of 1.5% per month or the maximum allowable rate under applicable law. Seller reserves the right to require advance payment or provision of securities for first and subsequent deliveries if there is any doubt, in Seller's sole determination, regarding the Buyer's creditworthiness or for other business reasons. If the requested advance payment or securities are not provided to Seller's satisfaction, Seller reserves the right to suspend performance or reject the purchase order, in whole or in part, without prejudice to Seller's other rights or remedies, including the right to full compensation. Seller may revoke or shorten any payment periods previously granted in Seller's sole determination. The rights and remedies herein reserved to Seller are cumulative and in addition to any other or further rights and remedies available at law or in equity. No waiver by Seller of any breach by Buyer of any provision of these terms will constitute a waiver by Seller of any other breach of such provision.

4. Shipment; Delivery; Title and Risk of Loss. All delivery dates are approximate, and Seller is not responsible for damages or additional costs resulting from any delay. All deliveries are subject to our ability to procure materials from our suppliers. Regardless of the manner of shipment, delivery occurs and title and risk of loss or damage pass to Buyer, upon placement of the Products with the carrier at Seller's facility. Unless otherwise agreed prior to shipment and for domestic delivery locations only, Seller will select and arrange, at Buyer's sole expense, the carrier and means of delivery. When Seller selects and arranges the carrier and means of delivery, freight and insurance costs for shipment to the designated delivery location will be prepaid by Seller and added as a separate line item to the invoice. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions. Buyer shall not return or repackage any Products without the prior written authorization from Seller, and any return shall be at the sole cost and expense of Buyer.

5. Warranty. The warranty for the Products is as follows: (i) Seller warrants that all products sold 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; (ii) Services shall be performed in accordance with generally accepted practices and using the degree of care and skill that is ordinarily exercised and customary in the field to which the Services pertain and are warranted for a period of six (6) months from the date of completion of the Services; and (iii) Software is only warranted to perform in accordance with applicable specifications provided by Seller to Buyer for ninety (90) days from the date of delivery or, when downloaded by a Buyer or end-user, from the date of the initial download. All prices are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **EXEMPTION CLAUSE; DISCLAIMER OF WARRANTY, CONDITIONS, REPRESENTATIONS: THIS WARRANTY IS THE SOLE AND ENTIRE WARRANTY, CONDITION, AND REPRESENTATION, PERTAINING TO PRODUCTS. SELLER DISCLAIMS ALL OTHER WARRANTIES, CONDITIONS,**

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Parker Chelsea

Parker Hannifin Corporation
Chelsea Products Division
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Offer of Sale (Continued)

AND REPRESENTATIONS, WHETHER STATUTORY, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THOSE RELATING TO DESIGN, NONINFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE. SELLER DOES NOT WARRANT THAT THE SOFTWARE IS ERROR-FREE OR FAULT-TOLERANT, OR THAT BUYER'S USE THEREOF WILL BE SECURE OR UNINTERRUPTED, UNLESS OTHERWISE AUTHORIZED IN WRITING BY SELLER, THE SOFTWARE SHALL NOT BE USED IN CONNECTION WITH HAZARDOUS OR HIGH-RISK ACTIVITIES OR ENVIRONMENTS. EXCEPT AS EXPRESSLY STATED HEREIN, ALL PRODUCTS ARE PROVIDED "AS IS".

6. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon receipt. No claims for shortages will be allowed unless reported to Seller within ten (10) days of delivery. Buyer shall notify Seller of any alleged breach of warranty within thirty (30) days after the date the non-conformance is or should have been discovered by Buyer. Any claim or action against Seller based upon breach of contract or any other theory, including tort, negligence, or otherwise must be commenced within twelve (12) months from the date of the alleged breach or other alleged event, without regard to the date of discovery.

7. LIMITATION OF LIABILITY. IN THE EVENT OF A BREACH OF WARRANTY, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE THE NON-CONFORMING PRODUCTS, RE-PERFORM THE SERVICES, OR REFUND THE PURCHASE PRICE PAID WITHIN A REASONABLE PERIOD OF TIME. IN NO EVENT IS SELLER LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING ANY LOSS OF REVENUE OR PROFITS, WHETHER BASED IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE PAID FOR THE PRODUCTS.

8. Confidential Information. Buyer acknowledges and agrees that Confidential Information has been and will be received in confidence and will remain the property of Seller. Buyer further agrees that it will not use Seller's Confidential Information for any purpose other than for the benefit of Seller and shall return all such Confidential Information to Seller within thirty (30) days upon request.

9. Loss to Buyer's Property. Buyer's Property will be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer ordering the Products manufactured using Buyer's Property. Also, Seller shall not be responsible for any loss or damage to Buyer's Property while it is in Seller's possession or control.

10. Special Tooling. Seller may impose a tooling charge for any Special Tooling. Special Tooling shall be and remain Seller's property. In no event will Buyer acquire any interest in the Special Tooling, even if such Special Tooling has been specially converted or adapted for manufacture of Goods for Buyer and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller has the right to alter, discard or otherwise dispose of any Special Tooling or other property owned by Seller in its sole determination at any time.

11. Security Interest. To secure payment of all sums due from Buyer, Seller retains a security interest in all Products delivered to Buyer and, Buyer's acceptance of these Terms is deemed to be 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 Seller's security interest.

12. User Responsibility. Buyer, through its own analysis and testing, is solely responsible for making the final selection of the Products and assuring that all performance, endurance, maintenance, safety and warning requirements of the application of the Products are met. Buyer must analyze all aspects of the application and follow applicable industry standards, specifications, and any technical information provided with the Quote or the Products, such as Seller's instructions, guides and specifications. If Seller provides options of or for Products based upon data or specifications provided by Buyer, Buyer is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products. In the event Buyer is not the end-user of the Products, Buyer will ensure such end-user complies with this paragraph.

13. Use of Products, Indemnity by Buyer. Buyer shall comply with all instructions, guides and specifications provided by Seller with the Quote or the Products. If Buyer uses or resells the Products in any way prohibited by Seller's instructions, guides or specifications, or Buyer otherwise fails to comply with Seller's instructions, guides and specifications, Buyer acknowledges that any such use, resale, or non-compliance is at Buyer's sole risk. Further, Buyer shall indemnify, defend, and hold Seller harmless from any losses, claims, liabilities, damages, lawsuits, judgments and costs (including attorney fees and defense costs), whether for personal injury, property damage, intellectual property infringement or any other claim, arising out of or in connection with: (a) improper selection, design, specification, application, or any misuse of Products; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of Buyer's Property; (d) damage to the Products from an external cause, repair or attempted repair by anyone other than Seller, failure to follow instructions, guides and specifications provided by Seller, use with goods not provided by Seller, or opening, modifying, deconstructing, tampering with or repackaging the Products; or (e) Buyer's failure to comply with these Terms, including any legal or administrative proceedings, collection efforts, or other actions arising from or relating to such failure to comply. Seller shall not indemnify Buyer under any circumstance except as otherwise provided in these Terms.

14. Cancellations and Changes. Buyer may not cancel or modify, including but not limited to movement of delivery dates for the Products, any order 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 and any additional expense. Seller, at any time, may change features, specifications, designs and availability of Products.

15. Assignment. Buyer may not assign its rights or obligations without the prior written consent of Seller.

16. Force Majeure. Seller is not liable for delay or failure to perform any of its obligations by reason of any events or circumstances beyond its reasonable control. Such circumstances include without limitation: accidents, labor disputes or stoppages, government acts or orders, acts of nature, pandemics, epidemics, other widespread illness, or public health emergency, cyber related disruptions, cyber-attacks, ransomware sabotage, delays or failures in delivery from carriers or suppliers, shortages of materials, sudden increases in the price of raw material or components, shutdowns or slowdowns affecting the supply of raw materials or components, or the transportation thereof, oil shortages or oil price increases, energy crisis, energy or fuel interruption, war (whether declared or not) or the serious threat of same, riots, rebellions, acts of terrorism, embargoes, fire or any reason whether similar to the foregoing or otherwise. Seller will resume performance as soon as practicable after the event of force majeure has been removed. All delivery dates affected by an event of force majeure shall be tolled for the duration of such event of force majeure and rescheduled for mutually agreed dates as soon as practicable after the event of force majeure ceases to exist. The right to allocate capacity is in the Seller's sole discretion. An event of force majeure shall not include financial distress, insolvency, bankruptcy, or other similar conditions affecting one of the parties, affiliates and/or subcontractors. An event of force majeure in the meaning of these Terms means any circumstances beyond Seller's control that permanently or temporarily hinders performance, even where that circumstance was already foreseen. Buyer shall not be entitled to cancel any orders following its claim of an event of force majeure.

17. Waiver and Severability. Failure to enforce any provision of these Terms will not invalidate that provision; nor will any such failure prejudice either party's right to enforce that provision in the future. Invalidation of any provision of these Terms shall not

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invalidate any other provision herein and, the remaining provisions will remain in full force and effect.

18. Duration. Unless otherwise stated in the Quote, any agreement governed by or arising from these Terms shall: (a) be for an initial duration of one (1) year; and (b) shall automatically renew for successive one-year terms unless terminated by Buyer with at least 180-days written notice to Seller or if Seller terminates the agreement pursuant to Section 19 of these Terms.

19. Termination. Seller may, without liability to Buyer, terminate any agreement governed by or arising from these Terms for any reason and at any time by giving Buyer thirty (30) days prior written notice. Seller may immediately terminate, in writing, if Buyer: (a) breaches any provision of these Terms, (b) becomes or is deemed insolvent, (c) appoints or has appointed a trustee, receiver or custodian for all or any part of Buyer's property, (d) files a petition for relief in bankruptcy on its own behalf, or one is filed against Buyer by a third party, (e) makes an assignment for the benefit of creditors; or (f) dissolves its business or liquidates all or a majority of its assets.

20. Ownership of Rights. Buyer agrees that (a) Seller (and/or its affiliates) owns or is the valid licensee of Seller's IP and (b) the furnishing of information, related documents or other materials by Seller to Buyer does not grant or transfer any ownership interest or license in or to Seller's IP to Buyer, unless expressly agreed in writing. Without limiting the foregoing, Seller retains ownership of all Software supplied to Buyer. In no event shall Buyer obtain any greater right in and to the Software than a right in a license limited to the use thereof and subject to compliance with any other terms provided with the Software. Buyer further agrees that it will not, directly or through intermediaries, reverse engineer, decompile, or disassemble any Software (including firmware) comprising or contained within a Product, except and only to the extent that such activity may be expressly permitted, either by applicable law or, in the case of open-source software, the applicable open-source license.

21. Indemnity for Infringement of Intellectual Property Rights. Seller is not liable for infringement of any Intellectual Property Rights except as provided in this Section. 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 a third-party claim that one or more of the Products infringes the Intellectual Property Rights of a third party in the country of delivery of the Products by Seller to Buyer. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of any such claim, and Seller having sole control over the defense of the claim including all negotiations for settlement or compromise. If one or more Products is subject to such a claim, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Products, replace or modify the Products to render them non-infringing, or offer to accept return of the Products and refund the purchase price less a reasonable allowance for depreciation. Seller has no obligation or liability for any claim of infringement: (i) arising from information provided by Buyer (including Seller's use of Buyer's Property); or (ii) directed to any Products for which the designs are specified in whole or part by Buyer; or (iii) resulting from the modification, combination or use in a system of any Products. The foregoing provisions of this Section constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for claims of infringement of Intellectual Property Rights.

22. Governing Law. These Terms, the terms of any Quote, and the sale and delivery of all Products are 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 the sale and delivery of the Products.

23. Entire Agreement. These Terms, along with the terms set forth in the Quote, forms the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale and purchase. In the event of a conflict between any term set forth in the Quote and these Terms, the terms set forth in the Quote shall prevail. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter shall have no effect. No modification to these Terms will be binding on Seller unless agreed to in a writing that is signed by an authorized representative of Seller, excluding email correspondence, 'clickwrap' or other purported electronic assent to different or additional terms. Sections 2-25 of these Terms shall survive termination or cancellation of any agreement governed by or arising from these Terms.

24. No 'Wrap' Agreements/No Authority to Bind. Seller's clicking any buttons or any similar action, such as clicking "I Agree" or "Confirm," to utilize Buyer's software or webpage for the placement of orders, is NOT an agreement to Buyer's Terms and Conditions. **NO EMPLOYEE, AGENT OR REPRESENTATIVE OF SELLER HAS THE AUTHORITY TO BIND SELLER BY THE ACT OF CLICKING ANY BUTTON OR SIMILAR ACTION ON BUYER'S WEBSITE OR PORTAL.**

25. Compliance with Laws. Buyer agrees to comply with all applicable laws, regulations, and industry and professional standards, including those of the United States of America, and the country or countries in which Buyer may operate, including without limitation the U.S. Foreign Corrupt Practices Act ("FCPA"), the U.S. Anti-Kickback Act ("Anti-Kickback Act"), U.S. and E.U. export control and sanctions laws ("Export Laws"), the U.S. Food Drug and Cosmetic Act ("FDCA"), and the rules and regulations promulgated by the U.S. Food and Drug Administration ("FDA"), each as currently amended. Buyer agrees to indemnify, defend, and hold harmless Seller from the consequences of any violation of such laws, regulations and standards by Buyer, its employees or agents. Buyer represents that it is familiar with all applicable provisions of the FCPA, the Anti-Kickback Act, Export Laws, the FDCA and the FDA and certifies that Buyer will adhere to the requirements thereof and not take any action that would make Seller violate such requirements. Buyer represents and agrees that Buyer will not make any payment or give anything of value, directly or indirectly, to any governmental official, foreign political party or official thereof, candidate for foreign political office, or commercial entity or person, for any improper purpose, including the purpose of influencing such person to purchase Products or otherwise benefit the business of Seller. Buyer further represents and agrees that it will not receive, use, service, transfer or ship any Products from Seller in a manner or for a purpose that violates Export Laws or would cause Seller to be in violation of Export Laws. Buyer agrees to promptly and reliably provide Seller all requested information or documents, including end-user statements and other written assurances, concerning Buyer's ongoing compliance with Export Law.

09/22

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Pan Am, Miami
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PN: HY25-1240-M1/US
Rev: 07/24