



## Chelsea PTO 247 Owner's Manual

Pro Gear Chelsea 247 Series PTO owner's manual to assist in identifying the parts for your Chelsea Power Take Off unit.

If you need any assistance identifying the correct Power Take Off unit for your truck and equipment, contact your Chelsea replacement part specialists at Pro Gear and Transmission.

Pro Gear stocks every part for your Parker Chelsea PTO including: PTO housings, mounts, driveshafts, gears, bearings, gaskets, cable shift cover assembly, post and plate assembly, brackets, stud kits, seal kits, lever control assembly, air shift cover assembly, direct mount pump conversion kits, stud kits including English and metric references, CAT D&H parts and much more.

Pro Gear Transmission has same day shipping and 1000's of products in stock and ready to ship internationally for your next project.

For parts or service contact the Chelsea specialists at Pro Gear & Transmission, Inc.

1 (877) 776-4600  
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# **CHELSEA®**

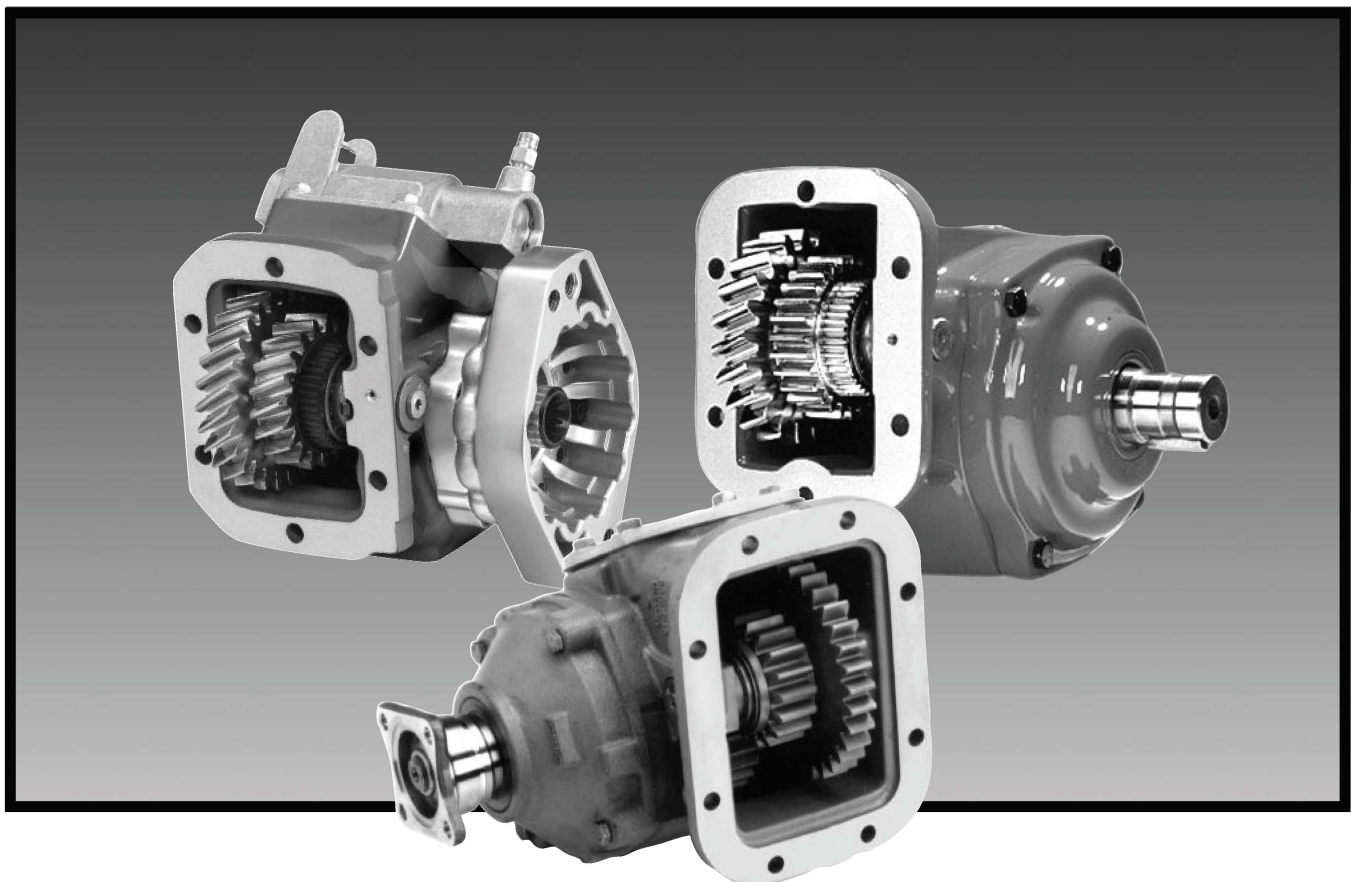
**247 Series**

Bulletin HY25-1715-M1/US

## **Owner's Manual Power Take-Offs**

Effective: June 2010

Supersedes: HY25-1715-M1/US December 2009



**Parker**



### **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".

### **Patent Information**

The Chelsea® Power Take-Off or its components shipped with this owner's manual may be manufactured under one or more of the following U.S. patents:  
4610175 5228365 4597301 5645363 6151975 6142274 6260682 7159701 B2 7510064 US7690450 B2  
Other patents pending.

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## Safety Information

These instructions are for your safety and the safety of the end user. Read them carefully until you understand them.

### General Safety Information

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

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

#### Proper Matching of P.T.O.



**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 the auxiliary equipment being powered. **Damaged components or equipment could malfunction causing serious personal injury to the vehicle operator or to others nearby.**

#### To avoid personal injury and/or equipment damage:

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

#### Cold Weather Operation of Powershift P.T.O.



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

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

#### To avoid personal injury and/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.



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

## Safety Information

### Rotating Auxiliary Driveshafts



#### **WARNING:**



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

### Guarding Auxiliary Driveshafts



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

### Using Set Screws



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

### **IMPORTANT: Safety Information and Owner's Manual**

Chelsea Power Take-Offs are packaged with safety information decals, instructions, and an owner's manual. These items are located in the envelope with the P.T.O. mounting gaskets. Also, safety information and installation instructions are packaged with some individual parts and kits. **Be sure to read the owner's manual before installing or operating the P.T.O.** Always install the safety information decals according to the instructions provided. Place the owner's manual in the vehicle glove compartment.



#### **WARNING: Operating the P.T.O. with the Vehicle in Motion**

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

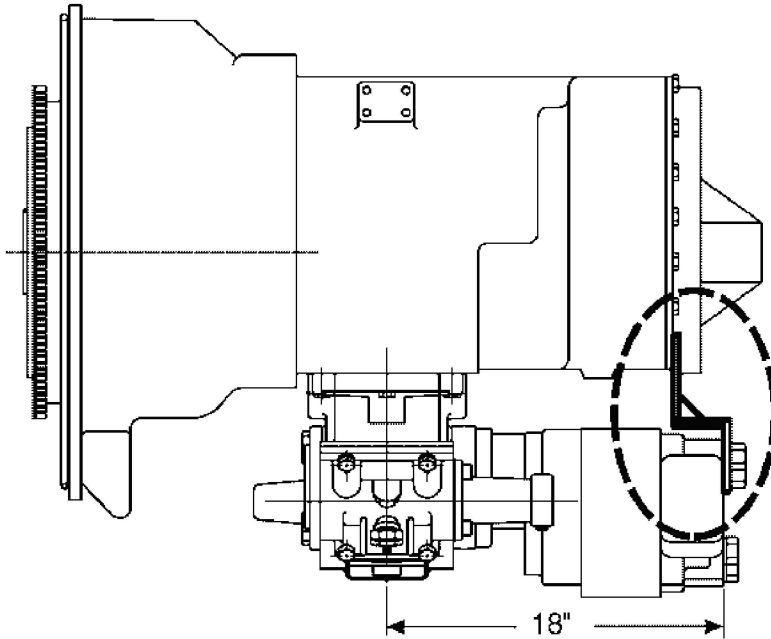
If in doubt about the P.T.O.'s specifications and capabilities, avoid operating the P.T.O. when the vehicle is in motion. Improper application and/or operation can cause serious personal injury or permanent failure of the vehicle, the driven equipment, and/or the P.T.O.

Always remember to disengage the P.T.O. when the driven equipment is not in operation.



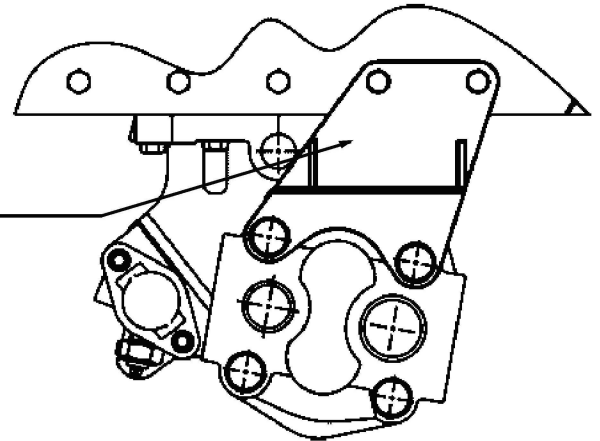
**This symbol warns of possible personal injury.**

## Direct Mount Pump Support Recommendations



**NOTE:**

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



**Use caution to ensure that bracket does not pre-load pump P.T.O. mounting**

Chelsea strongly recommends the use of pump supports (Support Brackets) in all applications. P.T.O. warranty will be void if a pump bracket is not used when:

- 1) The combined weight of pump, fittings and hose exceed 40 pounds [18.14 kg].
- 2) The combined length of the P.T.O. and pump is 18 inches [45.72 cm] or more from the P.T.O. centerline to the end of the pump.

**ALSO:** Remember to pack the female pilot of the P.T.O. pump shaft with grease before installing the pump on the P.T.O. (reference Chelsea grease pack 379688).



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



## **Foreword**

This booklet will provide you with information on correct installation of Chelsea® Power Take-Offs (P.T.O.s). Proper installation and set up procedures will help you get additional and more profitable miles from your truck equipment and components.

It is important to be sure that you are getting the right transmission/P.T.O. combination when you order a new truck. An inadequate transmission will overwork any P.T.O. in a short period of time. In addition, a mismatched transmission and P.T.O. combination can result in unsatisfactory performance of your auxiliary power system from the start.

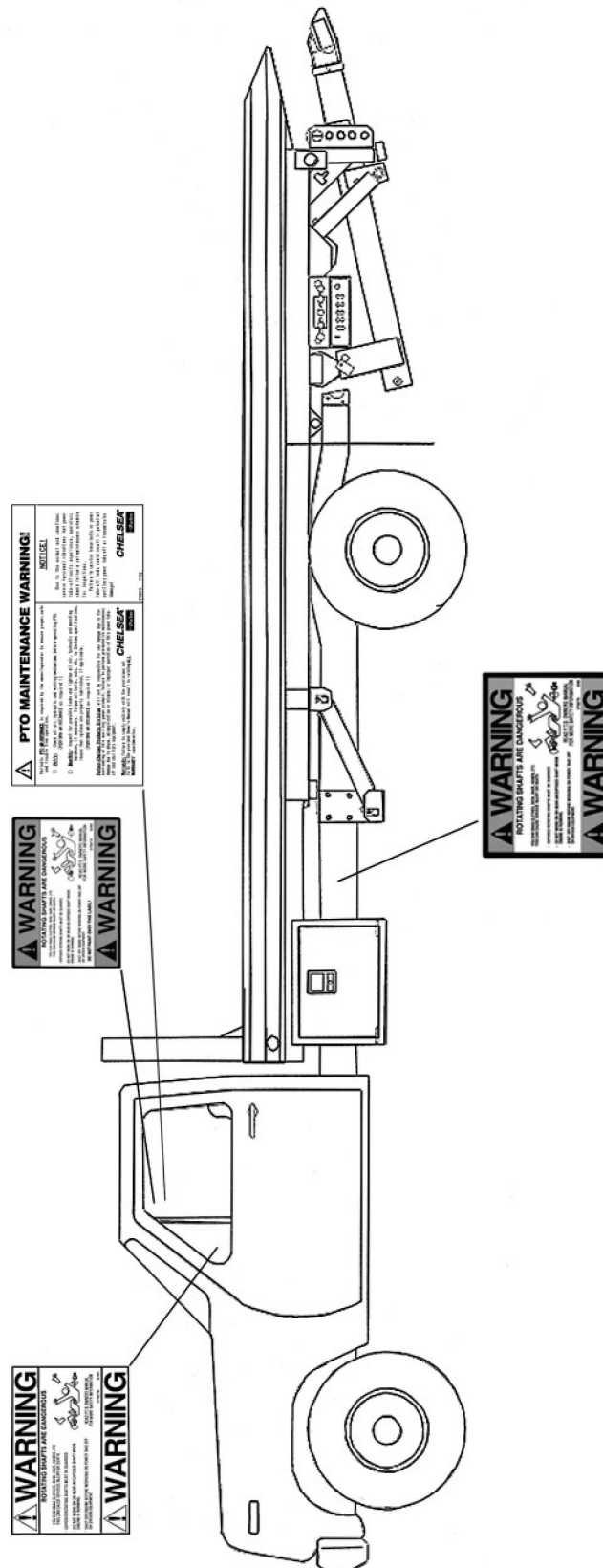
If you have questions regarding correct P.T.O. and transmission combination, please contact your local Chelsea® Auxiliary Power Specialist. They can help you select the properly matched components to ensure correct and efficient applications.

## **Chelsea P.T.O. Safety Label Instructions**

1. The two black and orange on white 5" x 7" pressure sensitive vinyl labels, part number 379274; must be placed on the vehicle frame rails (one (1) on each side), in a position that would be HIGHLY visible to anyone that would go under the truck near the P.T.O. rotating shaft. If the vehicle is to be painted after these labels are installed, cover them with two (2) blank masking covers. Remove the masking covers after painting.
2. Place the one (1) black and orange on white 3.5" x 5" pressure sensitive vinyl label, part number 379275, on the visor nearest the operator of the vehicle, this must be placed near the P.T.O. visor label (Item #3).
3. Place the one (1) red and white with black lettering 3.5" x 7.5" pressure sensitive vinyl label, part number 379915, on the opposite side of the visor from the above label # 379275.
4. Place the one (1) white and black heavy duty card, part number 379276, in the vehicle glove box. Again in a position highly visible to the operator, for example: try to place this card on top of whatever may be in the glove box.

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

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



## 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 R.P.M. required of the accessory, plus any shock loads that develop.

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

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

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

### Determining Shaft Type

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

| Spicer® Universal Joint Operating Angles |                             |                    |                             |
|--|-----------------------------|--------------------|-----------------------------|
| Prop. Shaft R.P.M.                       | Max. Normal Operating Angle | Prop. Shaft R.P.M. | 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<sup>2</sup>

**Spicer® Universal Joint Engineering Data**

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

| <b>Maximum Operating Speed * By Tube Size, Solid Shaft Size, and Length</b><br><b>*(For speed below 500 R.P.M. or over 2500 R.P.M., contact your Chelsea Distributor)</b> |   |             |             |             |             |
|---|---|-------------|-------------|-------------|-------------|
| Tubing Dia. &<br>Wall Thickness<br>Joint & Shaft<br>(W=Welded<br>S=Seamless)  | Max. Installed Length in Inches for Given R.P.M.<br>Centerline to Centerline of Joints for a Two Joint Assembly<br>or<br>Centerline of Joint to Centerline of Center Bearing for a Joint & Shaft<br>R.P.M. - Revolutions per Minute |             |             |             |             |
|   | <b>500</b>  | <b>1000</b> | <b>1500</b> | <b>2000</b> | <b>2500</b> |
| 1.750" X .065" W  | 117"  | 82"         | 67"         | 58"         | 52"         |
| 1.250" X .095" S  | 91"   | 64"         | 52"         | 45"         | 40"         |
| 2.500" X .083" W  | 122"  | 87"         | 70"         | 62"         | 55"         |
| 3.000" X .083" W  | -   | -           | -           | 85"         | 76"         |
| <b>Solid Shaft<br/>Diameter</b>   |   |             |             |             |             |
| .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"         |



**2008-2010 SEIC Enable/Disable Conditions**

| <b>Vehicle Conditions to Enable SEIC (all are required)</b> | <b>Vehicle Conditions that Disable SEIC (any one required)</b> | <b>Gas Engine</b>   | <b>Diesel Engine</b> |
|---|--|---------------------|----------------------|
| Parking brake applied.                                      | Parking brake disengaged                                       | Yes                 | Yes                  |
| Foot off of service brake                                   | Depressing service brake                                       | Yes<br>(See NOTE 1) | Yes<br>(See NOTE 2)  |
| Vehicle in PARK (automatic trans.)                          | Vehicle taken out of PARK                                      | Yes                 | Yes                  |
| Foot off of clutch (manual trans.)                          | Clutch depressed   | Yes                 | Yes<br>(See NOTE 2)  |
| Foot off of accelerator pedal                               |  | Yes                 | Yes                  |
| Vehicle speed is 0 mph (stationary)                         |  | Yes                 | Yes                  |
| Brake lights functional                                     | Brake light circuit disconnected                               | Yes                 | Yes                  |
| Engine at a stable base idle speed                          |  | Yes                 | Yes                  |
|   | Transmission Oil Temperature (TOT) Limit exceeds 240 degrees F | Yes<br>(See NOTE 1) | No                   |
|   | Engine Coolant Temperature Limit (ECT)                         | Yes<br>(See NOTE 1) | No                   |
|   | Catalyst Temperature Limit                                     | Yes<br>(See NOTE 1) | No                   |

**NOTE 1:** A “change-of-state” at the “P.T.O.-Request” circuit is required to re-invoke SEIC. When a disabler is seen by the PCM the “P.T.O.-Indicator” circuit changes from “ground-source” to “open-circuit”. After approximately 3 seconds SEIC drops out, returning the engine speed to base idle. For vehicle-stationary operation, the automatic transmission torque converter unlocks as engine speed drops below 1200 R.P.M. To re-initiate SEIC the operator must turn off the aftermarket P.T.O. switch (removing command voltage to the “P.T.O.-Mode” circuit) and turn it back on again.

**NOTE 2:** SEIC is automatically re-activated after approximately 3 seconds after the disabling condition is removed

**NOTE 3:** If SEIC can not be invoked on gas or diesel chassis. Make sure that the message center on the dash does not display 'Transport Mode'. If it does, the dealer failed to turn it off and SEIC will not work until Transport Mode is disabled.

**Reference: Ford QVM Bulletin Q-162R1 dated 11/6/2007 or latest revision**

**SEIC / P.T.O. – General System Behavior**

- To guarantee full advertised torque capability at the automatic transmission P.T.O. gear and through the aftermarket P.T.O. clutch, the transmission torque converter must be locked, and the hydraulic line pressure serving the aftermarket P.T.O. clutch must be elevated. Applying battery voltage to the P.T.O. circuit is the signal to the transmission to enter SEIC strategy and command these two important functions. This applies to both stationary and mobile P.T.O. operations.
- If an SEIC disabler occurs:
  - GAS engines will require a “change-of-state”, meaning the operator is required to turn off voltage to the “P.T.O.-Request” circuit, and back on again to re-invoke SEIC and P.T.O. operation.
  - DIESEL engines do not require a “change-of-state” at the “P.T.O.” circuit. Once the disabling condition is removed, the strategy re-invokes SEIC after approximately 3 seconds, automatically returning the engine speed back to what was commanded by the operator prior to the disabling condition.
- Battery Charge Protection (BCP): A diesel-only function. When it is switched on the engine speed goes immediately to 1200 R.P.M., and stays there even if the battery is fully charged. From this state it uses system voltage as well as ambient air temp., engine oil temperature information to raise engine speed higher to maintain a certain battery charge. Maximum engine speed in BCP mode is 2400 R.P.M. The BCPSW circuit may be wired to circuit to Ignition-Hot-in-Run to make it “automatic” for ambulance. Park-Brake-Set is one of the enablers of BCP.
- If the Transmission Oil Temperature (TOT) sensor reaches 240°F, then the TorqShift™ torque converter may disengage, preventing torque from being delivered to the transmission P.T.O. gear.
- SEIC / P.T.O. strategy function in the PCM is not affected by the loss of vehicle battery electrical power.
- SEIC Ramp Rate (fixed, not programmable):
  - GAS engines: 400 R.P.M./second.
  - DIESEL engines: When first applying battery voltage to the P.T.O. circuit the PCM directs the engine to go to the initial target that it sees at the R.P.M. circuit at 200 R.P.M./second (1200 R.P.M. if there is no resistor in the R.P.M. circuit – open circuit). If resistance is subsequently changed at the R.P.M. circuit then the ramp rate to this second speed target is virtually instantaneous (as fast as the diesel engine can get there).
- Correlation between engine speed and resistor values:
  - The external voltage source that the aftermarket P.T.O. system designer uses to command SEIC through the “P.T.O.” or “P.T.O.-Request” circuits must be the same as that used by the PCM internally for predictable SEIC function. Reasoning is that a fully-charged vehicle battery fluctuates with ambient temperature.
  - The correlation will be better for diesel engines since the diesel engine SEIC system offers buffered PCM voltage and ground circuits to complete the resistor circuits for engine speed, while the gas engine system forces the SEIC circuit installer to use chassis voltage and ground.
  - If there is a high electrical demand on the chassis battery, such as from aftermarket inverters or generators, etc., the actual elevated idle engine speed may vary with that demand for any given resistance in the SEIC circuit. More so for gas engine systems than diesel since gas engine uses chassis battery voltage as a reference.

**Reference: Ford QVM Bulletin Q-162R1 dated 11/6/2007 or latest revision**

**SEIC / P.T.O. – General System Behavior, continued**

- GAS Engine Only:
  - Normal base engine calibration allows approximately +/-50 R.P.M. fluctuation. If any factory vehicle accessories are used during SEIC, e.g. a/c, defroster, etc., then that fluctuation may increase to approximately +/-100 R.P.M. or more.
  - The sudden loss of aftermarket P.T.O. hydraulic pressure during SEIC / P.T.O. operation, like a ruptured hose, may send SEIC engine speed to near 3000 R.P.M. It is recommended that a hydraulic pressure switch linked to SEIC / P.T.O. be added to disable SEIC / P.T.O. when a hose ruptures.
  - Because of a service brake circuit characteristic at engine-start, invoking SEIC may cause the diagnostic error code FFG\_BOO to get flagged (recorded in the PCM). To avoid this, simply tap the service brake pedal sometime after engine-start and prior to invoking SEIC. Once the code is set, SEIC may not be available until it is erased.
  - Gas engines require a “change-of-state” at the P.T.O.-Mode and P.T.O.-Engage circuits whenever a disabler turns off SEIC (remove battery voltage signal and re-apply).
  - For aftermarket remote engine start-stop: a change-of-state is required to get SEIC to function again.

**Special Situations****Mobile P.T.O. Operation (TorqShift™ Automatic or M6 manual Transmission)**

Always apply battery voltage to the P.T.O. wire to keep SEIC active. Engine speed is no longer commanded by SEIC, instead it is controlled by the foot throttle. The increased line pressure and torque converter commands must remain active to protect the automatic transmission. Convert P.T.O. solenoid power to direct-battery instead of through the SEIC circuit suggested in this bulletin, possibly using the VSO signal circuit. A slightly harsher automatic transmission shift can be expected but is harmless.

**Alternative Calibration**

All new Ford light trucks have an "Alternative Calibration" or ALT-CAL installed in the PCM that conditions the powertrain during its early lifetime. It may increase the PARK-idle or drive-idle speed of the engine, by as small as 50 R.P.M. or by several hundred. It affects SEIC initiation by not letting it activate, because one of the SEIC enablers is having a steady, base, idle speed, generally near 650 R.P.M. If ALT-CAL sets the idle at 700 R.P.M. then SEIC activation will be prevented. ALT-CAL is normally removed after 50 key-on starts, or by driving over 5 continuous miles; it is also sometimes erased by disconnecting the battery for a minute or so.

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**Reference: Ford QVM Bulletin Q-162R1 dated 11/6/2007 or latest revision**

## In Cab P.T.O. Switch Installation

Before starting your electrical wiring installation, locate a position in the cab for mounting the P.T.O. switch and mounting bracket. The shaded area in **Figure 1** shows the Occupant Protection Zone of the deployed air bags that are available in these vehicles.



**WARNING:** To avoid personal injury or equipment damage: Do not install any item from a Chelsea Power Take-Off (ie: P.T.O. switch or mounting bracket) in the Occupant Protection Zone.

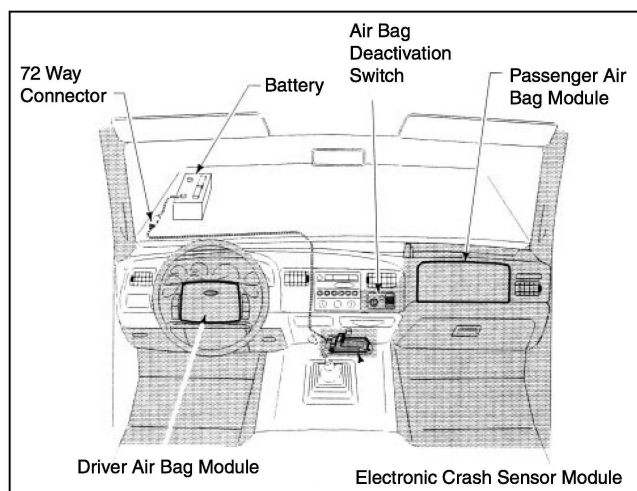


Figure 1

**NOTE:** Before starting installation of the electrical wiring, disconnect the battery cables from the battery and secure to prevent accidental contact.

**CAUTION:** Before drilling any holes, make sure there is adequate clearance on both sides.

For electrical installation see installation sketch on [page 18](#) for Non E.O.C. and [page 20](#) for E.O.C.



Figure 2

Customer Access Panel

1. Locate suitable location to install P.T.O. Switch.
2. Locate and remove the customer access panel located on the lower left portion of the instrument panel (driver's side). (**Figure 2**)
3. After determining the location of the P.T.O. switch, run wiring assembly over to the area under the vehicle steering column. We are now ready to attach the wires from the Chelsea wiring harness (329598X).

**NOTE:** Wiring Strategy is slightly different between the Gas and Diesel engines. Use the charts listed on [pages 19 and 21](#) for complete wiring chart information for prior years when using Chelsea wiring harness 329598X.



This symbol warns of possible personal injury.



4. Located in the cabin, tagged and bundled above the parking brake assembly (**Figure 3**) are the wires needed to connect the Chelsea P.T.O. wiring harness to the Ford SEIC strategy. Wires that will be connected at this bundle from the Chelsea wiring harness are the Black, Orange, Yellow, White and Red wires. All have butt connector ends. Connect these wires using Wiring Charts page 19 or 21 of this manual.



Figure 3

5. Now locate Ford circuit # 294 (White w/light blue) or for MY2008 circuit CBP44 (purple). This wire can be found under-dash on the right side of the customer access and is blunt cut. Connect Chelsea wire that is White w/ Light Blue stripe using a butt connector to this Ford wire. The only wire left to connect at this location is the black ground wire. Attach the ground wire with ring terminal on its end, to one of the screws located on the right side of the access area dash frame (**Figure 4**). Reference Wiring Charts on [page 19 or 21](#) of this manual.



Figure 4

**NOTE:** It is important to remember that a solid electrical connection is essential when installing any electrical device or option. A proper crimp is shown in **Figure 5**.

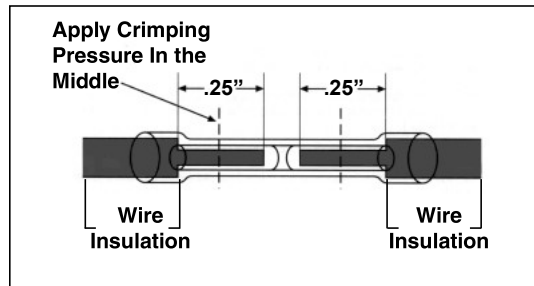


Figure 5

6. Find a suitable location to route the wiring harness out of the cab area and to the location of the manifold. Make sure wiring is clear of driveline and exhaust.

**CAUTION:** Apply battery voltage to the Diesel "P.T.O." or "Gas P.T.O. - Mode" (Circuit 2242), MY2008 (CE912) wire is what the transmission looks for to initiate commands. Failing to do so may show up as low or oscillating hydraulic line pressure and low or no P.T.O. torque or pump flow output. Any attempt to operate the Power Take-Off at elevated idle without these commands may result in under-capacity P.T.O. clutch wear, resulting in rapid contamination of transmission fluid and internal transmission damage. This applies to both stationary and mobile automatic transmission P.T.O. operations. Reference Wiring charts on [pages 19 or 21](#).

**Mounting the P.T.O. to the Transmission**

**CAUTION:** When installing the P.T.O., always wear protective clothing and safety glasses.

Installation of a 247 P.T.O. will be faster and easier if several steps are completed before mounting the unit to the transmission. On a clean secure work surface complete the following steps.

7. There are two split dowels that will act as guides when installing the P.T.O. to the transmission. Gently squeeze the dowel together and install in the top and lower right side mounting hole of the P.T.O. as shown in **Figure 6**. The dowel should be flush with the side away from the mounting face (**Figures 6 and 7**) and protrude into the corresponding mounting holes of the transmission aperture when installing the P.T.O.

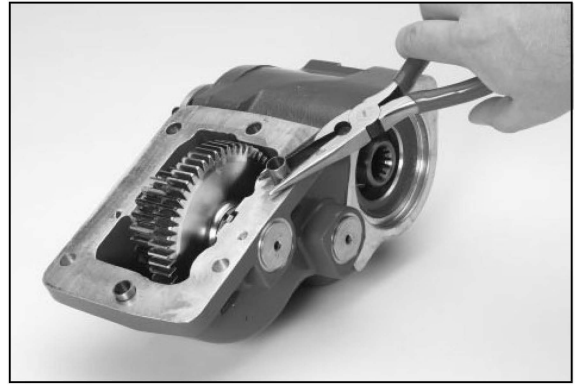


Figure 6

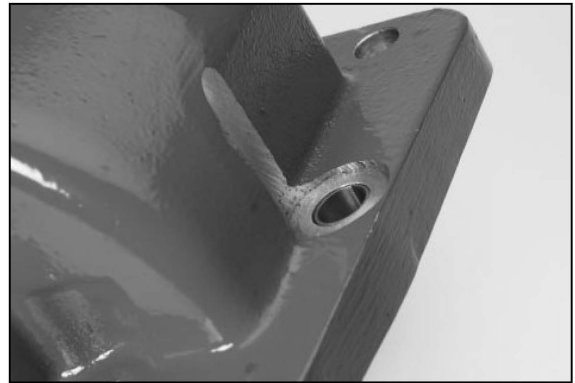


Figure 7

8. We are now ready to move to the installation of the P.T.O., but before installing the unit we will need to remove the shift cable bracket that is to the right side of the P.T.O. aperture. Use a 14mm wrench to remove the two capscrews. Remove the cable from the transmission range selector by pulling it straight off. Place the bracket and cable on the top of the transmission to allow easier installation of the P.T.O.

**NOTE:** On some early production Ford Super Duties the shifter bracket design was changed by about 3mm. The increase in size of the bracket interfered with the Power Take-Off. See [page 23](#) for Ford approved modification of this bracket for P.T.O. clearance.

**This transmission does not require the oil to be drained for the P.T.O. installation, but expect some oil to weep when covers and plugs are removed.**

**! WARNING:** Oil may be hot. Use extreme caution to assure that you do not accidentally come in contact with hot oil.

9. Remove the pipe plug from the transmission pressure port (**Figure 8**) and install the 90° male elbow (379698) in the opening. Position the fitting (**Figure 9**) at a 10 o'clock position as you look at the fitting.

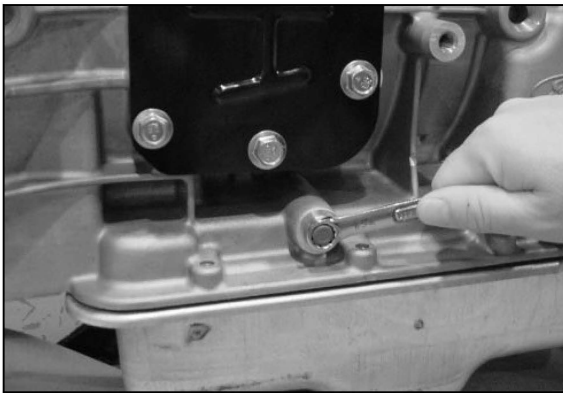


Figure 8

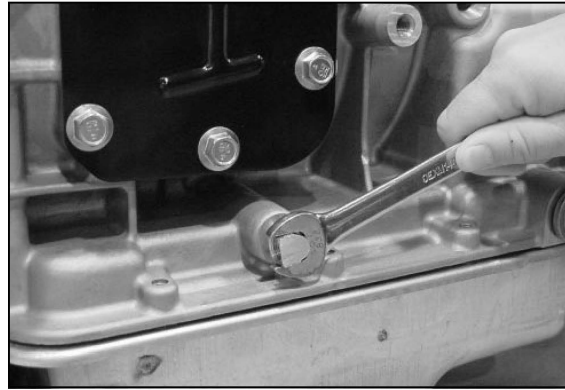


Figure 9

10. Remove the P.T.O. aperture cover plate and gasket (**Figure 10**).

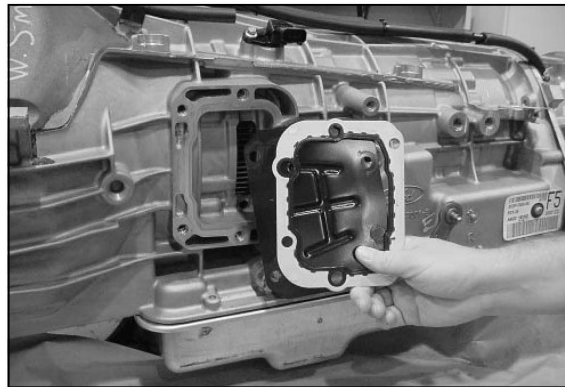


Figure 10

**IMPORTANT:** Discard the gasket. It will NOT be used when installing the P.T.O. on the transmission.

**NOTE:** All hose routing described herein is the recommended routing for the 6.8L gas engine. Other hose routing options may be required depending on the chassis model (4 x 2 or 4 x 4) and or engine selection (6.8L Gas or 6.0L Diesel)

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

11. Connect hose 329232-1X (Transmission to Hydraulic Valve) to the fitting on the transmission. Route as shown in **Figure 11**. Hold hose fitting in desired position and tighten lock nut with a wrench until solid feeling is encountered. From that point, apply one-sixth turn.

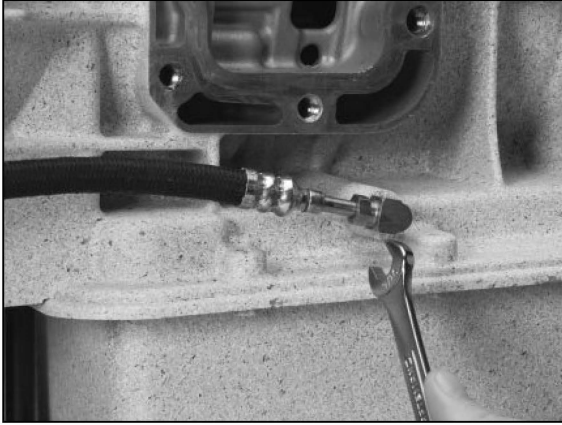


Figure 11

12. Six fasteners (**Figure 12**) are used to attach the P.T.O. to the transmission opening. The longest bolt requires an O-Ring (28-P-200) on it to ensure a positive seal. Slide this on now after applying lube to the O-Ring.



Figure 12

13. Slide the special gasket (22-P-120) supplied with the P.T.O. over the split dowels (**Figure 13**) installed in the P.T.O. This is the controlled compression gasket that is used to eliminate the setting of the gear backlash between the P.T.O. and transmission.

**NOTE:** Do not use sealing compounds because they are generally incompatible with automatic transmission fluids and could possibly contaminate valve bodies in the transmission.

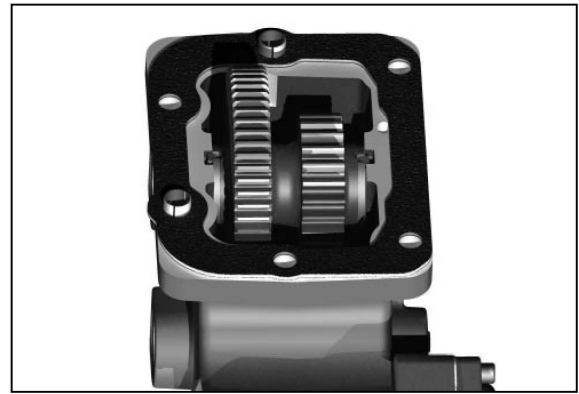


Figure 13

14. Install the one stud from the stud kit (8000-19X) to the top hole on the transmission P.T.O. aperture pad. (**Figure 14**)

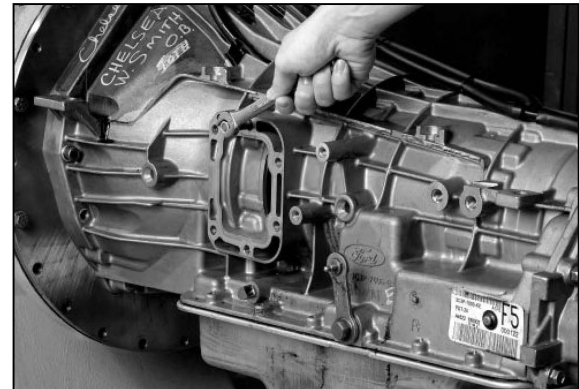


Figure 14

15. Tighten the stud and torque to 17-19 Lbs. ft. (23-26 N.m.)

**CAUTION:** Overtightening of the stud may damage stud and/or Transmission threads.

16. Mount the Power Take-Off to the transmission at this time by sliding the top P.T.O. mounting hole w/dowel pin over the shoulder stud. Guide other dowel pin into hole. (**Figure 15**)



Figure 15



17. Attach the self locking nut to the shoulder stud. Do not tighten down at this time. **(Figure 16)**

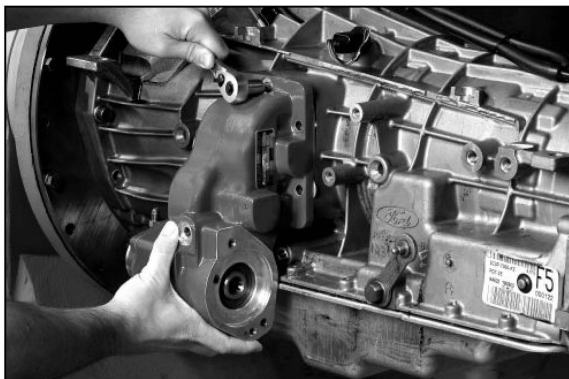


Figure 16

18. Make sure the O-Ring (28-P-200) from the stud kit is still on the longer hex head capscrew. Install this hex head capscrew and O-Ring in the bottom mounting hole and finger tighten. **(Figure 17)**

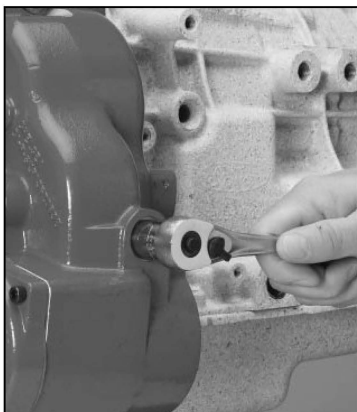


Figure 17

**IMPORTANT:** Make sure the O-Ring is positioned in the counter bore.

19. Finish fastening the P.T.O. to the transmission using the remaining 4 flanged hex head bolts.
20. Torque all 5 capscrews **(Figure 18)** to 25 Lbs. ft. [34 N.m.] and torque the self locking nut to 35-40 Lbs. ft. [48-54 N.m.]



Figure 18

21. Reinstall the cable to the transmission selector and reattach the bracket that was removed in Step 14. Torque Capscrews to 22-29 Lbs. ft. [30-40 N.m.]
22. Install Transmission to Solenoid hose (329232-3X) to the Hydraulic Valve Bearing Cap 90° Elbow fitting. **(Figure 19)**



Figure 19

23. Install P.T.O. Pressure Switch, part# 379502, into port on Hydraulic Valve Cap. Torque to 120-140 In. Lbs. **(Figure 20)**

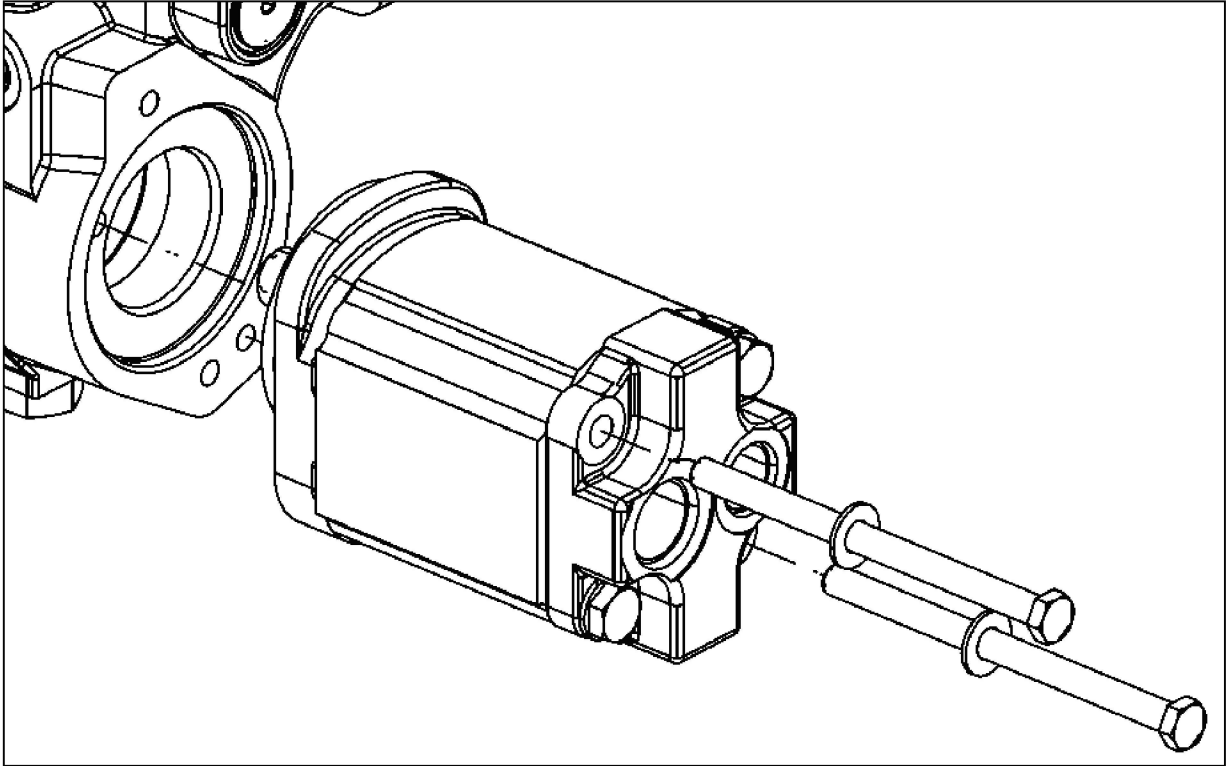


Figure 20

**Pump Installation**

The Parker/Chelsea CGP-P11 pumps listed below have a special pump flange designed to mount the pump to the 247 Series P.T.O. without modifying the pump flange. This allows the same pump to be installed on either 4 x 2 or 4 x 4 applications.

**NOTE:** Each Chelsea P.T.O. that features a female pump shaft will include a packet of lubricant (part number 379688). Apply this to the male end of the pump shaft before installing the pump to the P.T.O.



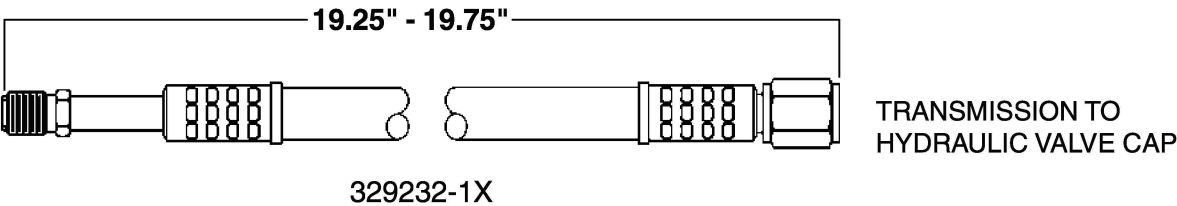
**Chelsea CGP-P11 Series Pump Bolt Specifications**

| Order Code | Chelsea Pump Model | Pump Tag Number | Bolt Number (2 per Pump) | Bolt Size .375"  | Flat Washer (Qty) |
|------------|--------------------|-----------------|--------------------------|------------------|-------------------|
| 16         | CGP-P11A016-5FC    | 334 9110 027    | 378431-30                | .375"-16 x 4.00" | 500365-26 (2)     |
| 26         | CGP-P11A026-5FC    | 334 9110 028    | 378431-31                | .375"-16 x 4.25" | 500365-26 (2)     |
| 32         | CGP-P11A032-5FC    | 334 9110 028    | 378431-32                | .375"-16 x 4.50" | 500365-26 (2)     |
| 37         | CGP-P11A037-5FC    | 334 9110 029    | 378431-32                | .375"-16 x 4.50" | 500365-26 (2)     |
| 42         | CGP-P11A042-5FC    | 334 9110 030    | 378431-33                | .375"-16 x 4.75" | 500365-26 (4)     |
| 55         | CGP-P11A055-5FC    | 334 9110 031    | 378431-34                | .375"-16 x 5.00" | 500365-26 (4)     |
| 61         | CGP-P11A061-5FC    | 334 9110 053    | 378431-34                | .375"-16 x 5.00" | 500365-26 (2)     |
| 71         | CGP-P11A071-5FC    | 334 9110 032    | 378431-35                | .375"-16 x 5.25" | 500365-26 (2)     |
| 82         | CGP-P11A082-5FC    | 334 9110 033    | 378431-36                | .375"-16 x 5.50" | 500365-26 (2)     |

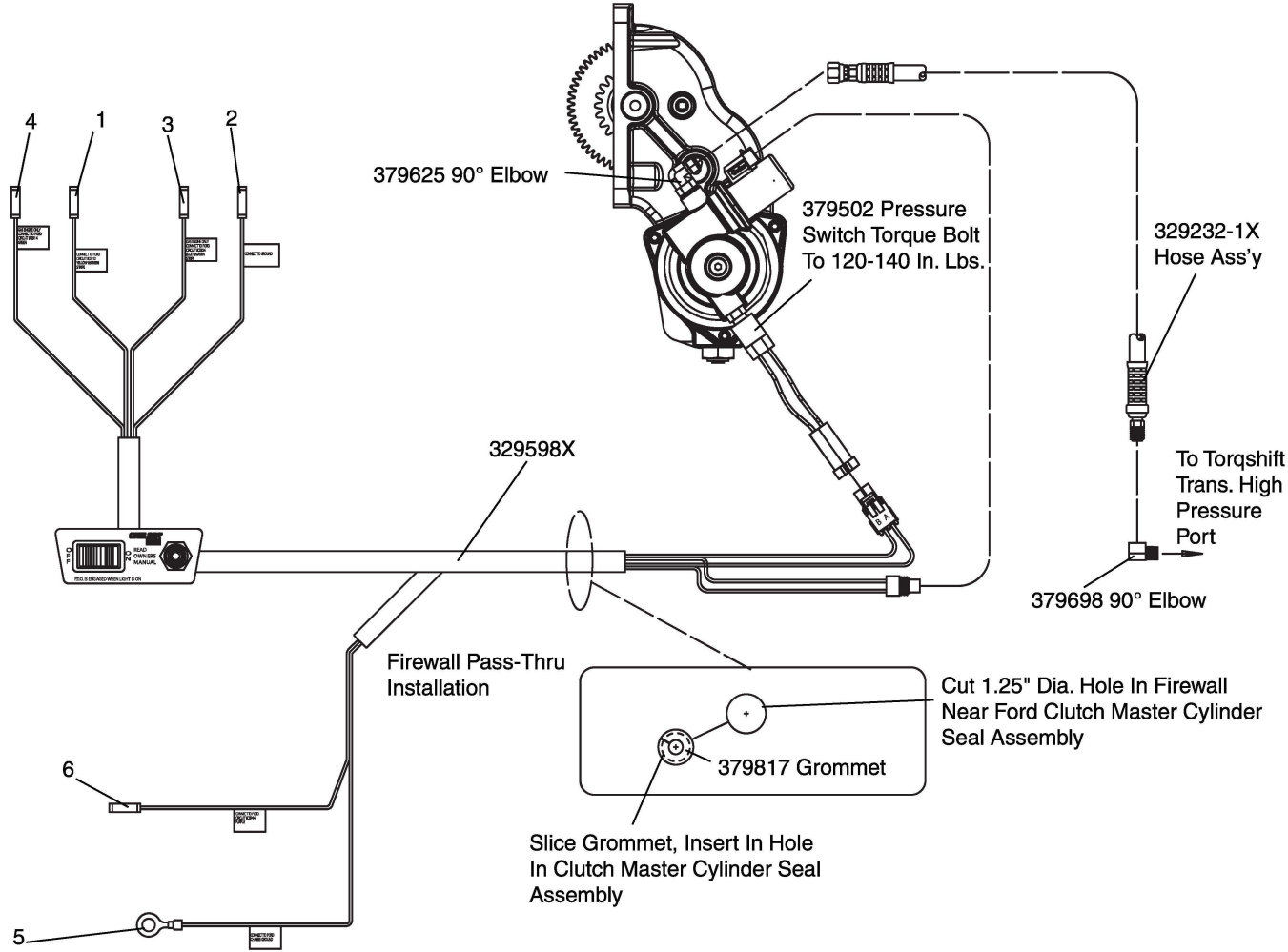
**NOTE:** Torque Pump Mounting Bolts between 35 - 38 Lbs. ft. [48 - 52 N.m.].

**CAUTION:** Failure to torque pump bolts to the correct specifications may result in poor pump performance and/or premature failure.

Hose Assembly Identification Chart



Wiring Installation Sketch without E.O.C. (SK-448 Rev A)



**Wiring Charts****247 Series****Wiring Chart without E.O.C.****Model Year 2005-2010 Ford Super Duty w/ Gas or Diesel (Stationary Mode)**

| Chelsea Wire |                           | 2005-2007 Connect to Ford Wire Number        | Gas/Diesel  | 2008-2010* Connect to Ford Wire Number    |
|--------------|---------------------------|--|-------------|---|
| 1 or         | Orange                    |  | Both        | Circuit #CE912 - Yellow w/Green Stripe    |
| 1            | Orange                    | Circuit #2242 - Orange                       | Diesel Only |   |
| 2            | Black w/Butt Connector    | (1) Circuit #2244 - Orange w/Lt. Blue Stripe | Both        | (1) Circuit # CE326 - Blue w/White Stripe |
| 3            | Yellow                    | Circuit #2243 - Orange w/White Stripe        | Gas Only    | Circuit #CE924 - Blue w/Green Stripe      |
| 4            | Red                       | Circuit #2246 - Orange w/Yellow Stripe       | Gas Only    | Circuit #CE914 - Green                    |
| 5            | Black w/Ring Terminal     | Connect to Dash Chassis Ground               | Both        | Connect to Dash Chassis Ground            |
| 6            | White w/Light Blue Stripe | Circuit #294 - White w/Blue Stripe           | Both        | Circuit #CBP44 - Purple                   |

**(1) NOTE:** For Mobile Operation Only Connect Black Wire w/ Butt Connector to Chassis Ground

\* 2011 Gas Engine Only

**Wiring Chart without E.O.C.****Model Year 2011 Ford Super Duty w/6.8L Gas (Stationary Mode)**

| Chelsea Wire |                           | Gas      | 2011* Connect to Ford Wire Number         |
|--------------|---------------------------|----------|---|
| 1            | Orange                    | Gas Only | Circuit #CE912 - Yellow w/Green Stripe    |
| 2            | Black w/Butt Connector    | Gas Only | (1) Circuit # CE326 - Blue w/White Stripe |
| 3            | Yellow                    | Gas Only | Circuit #CE933 - Blue w/Orange Stripe     |
| 4            | Red                       | Gas Only | Circuit #CE914 - Green                    |
| 5            | Black w/Ring Terminal     | Gas Only | Connect to Dash Chassis Ground            |
| 6            | White w/Light Blue Stripe | Gas Only | Circuit #CDC64 Yellow w/Orange Stripe     |

**(1) NOTE:** For Mobile Operation Only Connect Black Wire w/Butt Connector to Chassis Ground

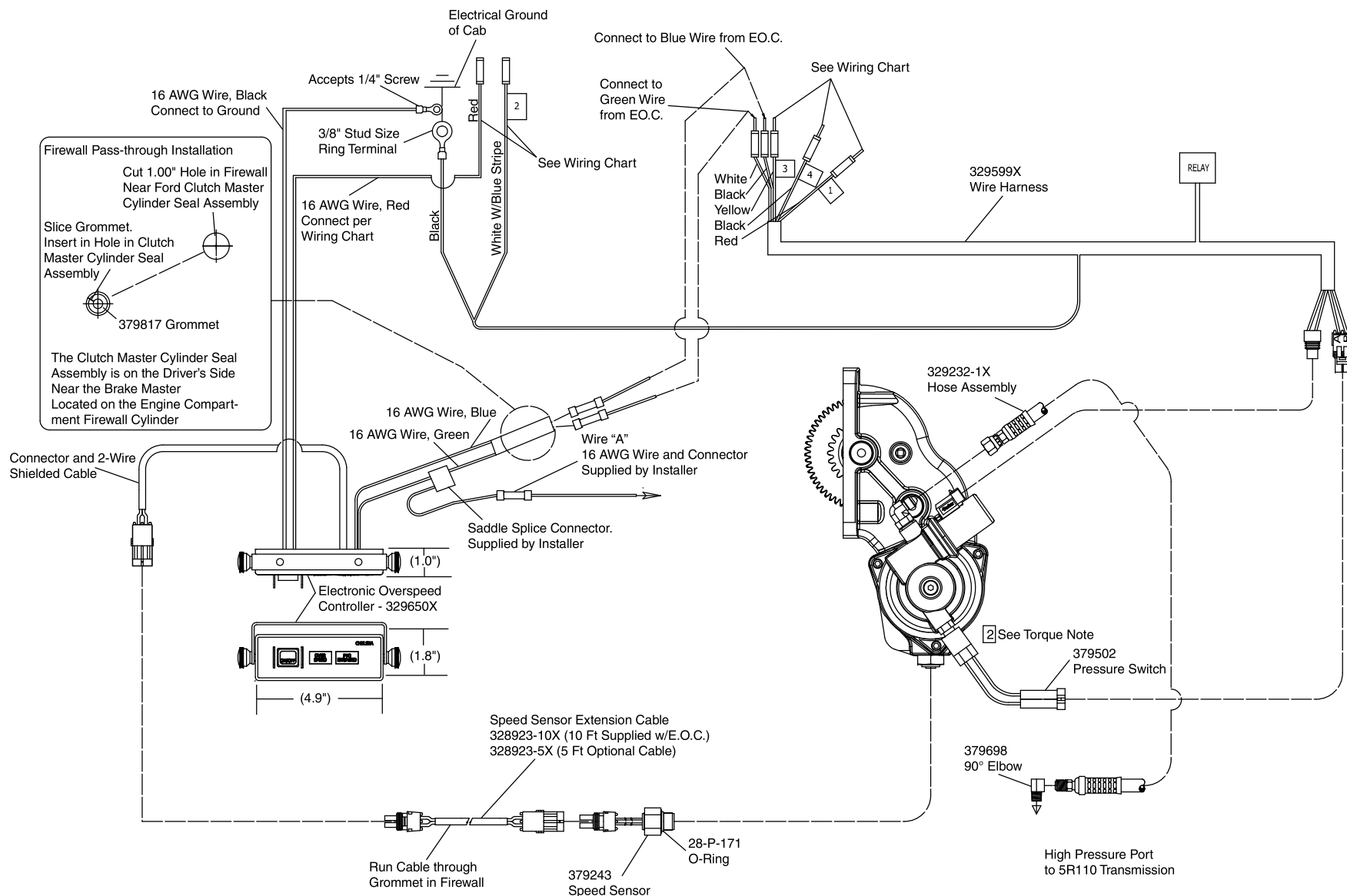
\* 2011 Gas Engine Only

**\*Model Year 2006-2010 Ford & International LCF**

| Chelsea Wire |                           | Connect to Ford Wire Number                 |
|--------------|---------------------------|---|
| 1            | Orange                    | Circuit #2335 - Purple w/Light Green Stripe |
| 1            | Orange                    | Circuit #2231 - Light Blue w/Red Stripe     |
| 1            | Orange                    | Circuit #1924 - Dark Green w/White Stripe   |
| 2            | Black w/Butt connector    | Circuit #2334 - Brown w/Yellow Stripe       |
| 3            | Yellow                    | Not Used                                    |
| 4            | Red                       | Not Used                                    |
| 5            | Black w/Ring Terminal     | Connect to Dash Chassis Ground              |
| 6            | White w/Light Blue Stripe | Circuit #1043 - Dark Green w/Yellow Stripe  |

**\* NOTE:** Installer must provide wires to connect between the vehicle blunt wire connections and the Chelsea Wiring Harness 329598X.

# Wiring Installation Sketch with E.O.C. (SK-474)



## NOTES:

- Reference Kits:  
329255-12X  
329601X
- Caution: Torque Values Must Be Maintained 120-144 In-Lb
- Strip Wire Ends 0.25" Prior to Installing Connector

**Wiring Chart****247 Series****Wiring Chart with E.O.C.**

| <b>Chelsea Wire</b>                 | <b>2005-2007 Super Duty w/6.0L Diesel</b> | <b>2005-2007 Super Duty w/6.8L Gas</b>      | <b>2008-2010 Super Duty w/6.4L Diesel</b> | <b>2008-2010 Super Duty w/6.8L Gas</b>    | <b>2005-2009 LCF w/4.5L Diesel</b>                          | <b>2011 Super Duty w/6.8L Gas</b>          |
|-------------------------------------|---|---|---|---|---|--|
| 1                                   | Not Used                                  | Ford Circuit #2246 Orange w/Yellow Stripe   | Not Used                                  | Ford Circuit #CE914 Green                 | Not Used  | Ford Circuit #CE914 Green                  |
| 2                                   | Not Used                                  | Ford Circuit #294 White w/Lt. Blue Stripe   | Not Used                                  | Ford Circuit #CBP44 Purple                | Not Used  | Ford Circuit #CDC64 Yellow w/Orange Stripe |
| 3                                   | Not Used                                  | Ford Circuit #2243 Orange w/White Stripe    | Not Used                                  | Ford Circuit #CE924 Blue w/Green Stripe   | Not Used  | Ford Circuit #CE933 Blue w/Orange Stripe   |
| 4                                   | Ground                                    | Ford Circuit #2244 Orange w/Lt. Blue Stripe | Ground                                    | Ford Circuit #CE326 Blue w/White Stripe   | Ground  | Ford Circuit #CE326 Blue w/White Stripe    |
| E.O.C. Box Lt. Blue w/Yellow Stripe | Ford Circuit #2242 Orange                 | Ford Circuit #2242 Orange                   | Ford Circuit #CE912 Yellow w/Green Stripe | Ford Circuit #CE912 Yellow w/Green Stripe | Ford/International Circuit #2335 Purple w/Lt. Green Stripe  | Ford Circuit #CE912 Yellow w/Green Stripe  |
| E.O.C. Box Red                      | Ford Circuit #294 White w/Lt. Blue Stripe | Ford Circuit #294 White w/Lt. Blue Stripe   | Ford Circuit #CBP44 Purple                | Ford Circuit #CBP44 Purple                | Ford/International Circuit #1043 Dark Green w/Yellow Stripe | Ford Circuit #CDC64 Yellow w/Orange Stripe |



**2006-2010 Ford LCF/International CF Overview**

Utilizing Chelsea wiring harness 329598X to wire a 247 Series P.T.O. into a 2006-2010 Ford LCF/International CF

**CAUTION:** Installing a transmission-mounted P.T.O. without the required P.T.O. wiring may result in transmission failure. To minimize the risk of transmission damage, P.T.O. controls must be integrated into the vehicle wiring.

**NOTE:** Installation requires the lengthening and splicing of the current Chelsea harness.

**Follow the normal P.T.O. installation instructions provided.**

1. Installer supplied wire will connect between the Chelsea supplied butt connectors (SK-448 or SK-449) and the OE supplied blunt connectors located in the blunt cut wiring bundle on the left side of the transmission.

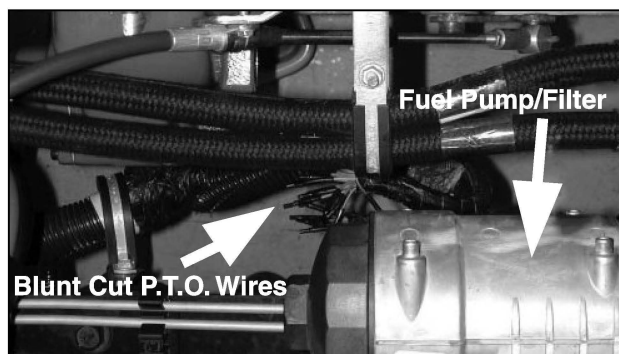


Fig. 1

**Chelsea switch panel mounting suggestion.**

2. Switch panel may be located in cavity below the lighter.

**NOTE:** Clearance cut required for fitment.

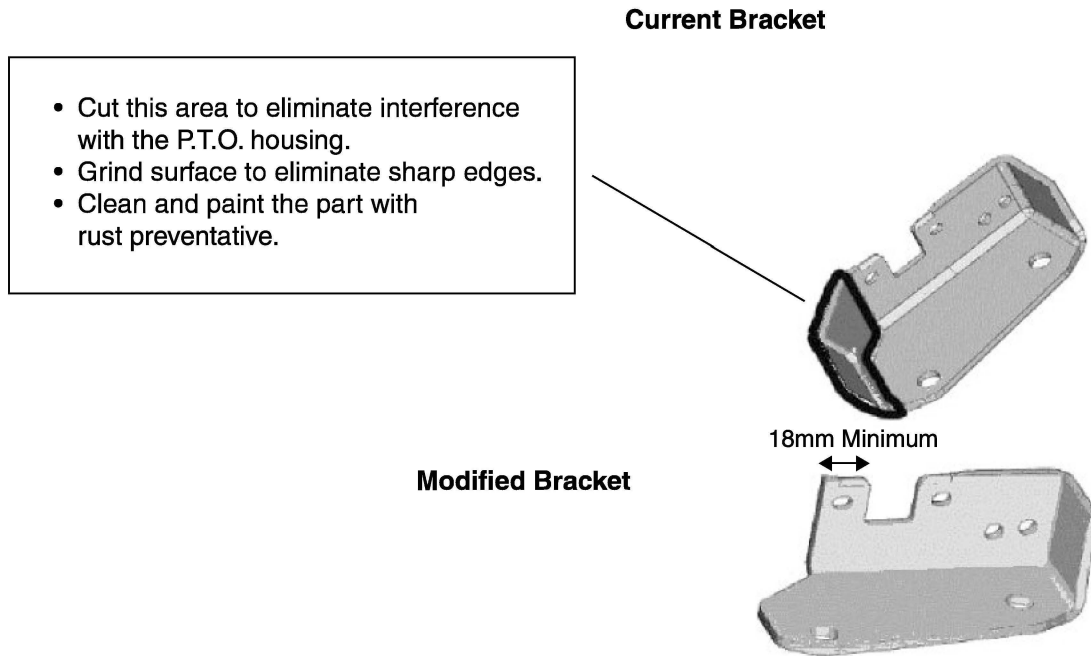


Fig. 2

3. Relocate the relay located on the back of the Chelsea switch panel. It is adhered with double stick tape



Fig. 3

**2005 Model Year TorqShift™ Shift Bracket – Field Modification**

**Models Affected:** 2005 Model Year F250/350/450/550 with TorqShift™ 5-Speed Automatic Transmission with P.T.O. Provision Option.

**Background:** The shift bracket holding the shift linkage in position was revised for 2005 model year. That change resulted in the bracket interfering with the Chelsea and Muncie P.T.O.s by approximately 2.8 mm, preventing installation of the aftermarket P.T.O.s.

**Recommendation:** Grind or cut away a portion of the bracket to gain clearance. The illustration in the attachment to this bulletin depicts how much material may be removed without deteriorating the strength and reliability of the bracket and transmission gearshift function. Affected vehicles built approximately November 15<sup>th</sup>, 2004, will incorporate a revised shift bracket that provides clearance to the aftermarket P.T.O.

**Warning:** The modification shown is the only one supported. No modifications to the bracket mounting holes are acceptable.

For additional questions please contact the Ford Truck Body Builders Advisory Service at toll-free number 1-877-840-4338, or by e-mail at [bbasga@ford.com](mailto:bbasga@ford.com). QVM Bulletins can be found at [www.fleet.ford.com/truckbbas](http://www.fleet.ford.com/truckbbas).

Ref: Ford SVE Bulletin Q-112 dated October 15, 2004

## This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There is no text or other content on the page.

This image shows a full page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. At the top left corner, the word "Notes" is printed in a bold, black font. Below the title, there is a thick black horizontal line that spans the entire width of the page. This is followed by several more thin horizontal lines, creating a series of rows for writing. The overall appearance is that of a standard notebook page.

**Power Take-Off Maintenance**

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**Power Take-Off Maintenance**

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

Periodic P.T.O. 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  
P.T.O. Perform maintenance as required.

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

With regards to the direct mounted pump splines, the P.T.O. requires the application of a specially formulated anti-fretting, high pressure, high temperature grease. The addition of the grease has been proven to reduce the effects of the torsional vibrations, which result in fretting corrosion on the P.T.O. internal splines as well as the pump external splines. Fretting corrosion appears as a "rusting and wearing" of the pump shaft splines. Severe duty applications, which require long P.T.O. running times and high torque may require more frequent regreasing. Applications such as Utility Trucks that run continuously and are lightly loaded also require frequent regreasing due to the sheer hours of running time. It is important to note that service intervals will vary for each and every application and is the responsibility of the end user of the product. Chelsea also recommends that you consult your pump owner's manuals and technical services for their maintenance guidelines. Fretting corrosion is caused by many factors and without proper maintenance; the anti-fretting grease can only reduce its effects on components.

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

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

## Offer of Sale

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

**1. Terms and Conditions of Sale:** All descriptions, quotations, proposals, offers, acknowledgments, acceptances and sales of Seller's products are subject to and shall be governed exclusively by the terms and conditions stated herein. Buyer's acceptance of any offer to sell is limited to these terms and conditions. Any terms or conditions in addition to, or inconsistent with those stated herein, proposed by Buyer in any acceptance of an offer by Seller, are hereby objected to. No such additional, different or inconsistent terms and conditions shall become part of the contract between Buyer and Seller unless expressly accepted in writing by Seller. Seller's acceptance of any offer to purchase by Buyer is expressly conditional upon Buyer's assent to all the terms and conditions stated herein, including any terms in addition to, or inconsistent with those contained in Buyer's offer. Acceptance of Seller's products shall in all events constitute such assent.

**2. Payment:** Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the maximum rate permitted by law for each month or portion thereof that the Buyer is late in making payment. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer's receipt of the shipment.

**3. Delivery:** Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller's plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller's delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.

**4. Warranty:** Seller warrants that certain Products, namely PTOs, SEMs, and Wet Line Kits sold hereunder shall be free from defects in material or workmanship for a period of twenty four months from the date of delivery to Buyer. Seller warrants that certain Products namely Pumps, and Hydraulic Accessories shall be free from defects in material or workmanship for a period of eighteen months from the date of delivery to the Buyer. The prices charged for Seller's products are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **DISCLAIMER OF WARRANTY: THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED HEREUNDER. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

**5. Limitation Of Remedy: SELLER'S LIABILITY ARISING FROM OR IN ANYWAY CONNECTED WITH THE ITEMS SOLD OR THIS CONTRACT SHALL BE LIMITED EXCLUSIVELY TO REPAIR OR REPLACEMENT OF THE ITEMS SOLD OR REFUND OF THE PURCHASE PRICE PAID BY BUYER, AT SELLER'S SOLE OPTION. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY KIND OR NATURE WHATSOEVER, INCLUDING BUT NOT LIMITED TO LOST PROFITS ARISING FROM OR IN ANY WAY CONNECTED WITH THIS AGREEMENT OR ITEMS SOLD HEREUNDER, WHETHER ALLEGED TO ARISE FROM BREACH OF CONTRACT, EXPRESS OR IMPLIED WARRANTY, OR IN TORT, INCLUDING WITHOUT LIMITATION, NEGLIGENCE, FAILURE TO WARN OR STRICT LIABILITY.**

**6. Changes, Reschedules and Cancellations:** Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modification or cancellation shall be at Seller's discretion, and shall be upon such terms and conditions as Seller may require.

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

**8. Buyer's Property:** Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

**9. Taxes:** Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

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

If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

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

**12. Entire Agreement/Governing Law:** The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of the sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.

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