Power Take-Offs Owner’s Manual
Ford “F” Series
247, 249, 249V, 272-FORD Series
WARNING — User Responsibility

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Foreword

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

It is important that you be sure that you are getting the right transmission/PTO combination when you order a new truck. An inadequate transmission will overwork any PTO in a short period of time. In addition, 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® Auxiliary Power Specialist. 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 installer, operator & supporting personnel. Read them carefully until you understand them.

General Safety Information

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

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

Proper Matching of PTO

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

To avoid personal injury and/or equipment damage:

- Always refer to Chelsea catalogs, literature, and owner’s manuals and follow Chelsea recommendations when selecting, installing, repairing, or operating a Power Take-Off.
- Never attempt to use a Power Take-Off not specifically recommended by Chelsea for the vehicle transmission.
- Always match the Power Take-Off’s specified output capabilities to the requirements of the equipment to be powered.
- Never use a Power Take-Off whose range of speed could exceed the maximum.
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 Power Take-Off output shaft rotation could cause unexpected movement of the driven equipment resulting in serious personal injury, death, or equipment damage.

To avoid personal injury or equipment damage:

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

Rotating Auxiliary Driveshafts

WARNING:

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

Guarding Auxiliary Driveshafts

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

Using Set Screws

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

IMPORTANT: Safety Information and Owner's Manual

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

This symbol warns of possible personal injury.
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. To do so, the PTO must have been properly selected to operate at highway speeds and correctly matched to the vehicle transmission and the requirements of the driven equipment.

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

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

**Chelsea PTO Safety Label Instructions**

1. The two black and orange on white 5” x 7” pressure sensitive vinyl labels, part number 379274, must be placed on the vehicle frame rails (one (1) on each side), in a position that would be HIGHLY visible to anyone that would go under the truck near the PTO rotating shaft. If the vehicle is to be painted after these labels are installed, cover them with two (2) blank masking covers. Remove the masking covers after painting.

2. Place the one (1) black and orange on white 3.5” x 5” pressure sensitive vinyl label, part number 379275, on the visor nearest the operator of the vehicle, this must be placed near the PTO visor label.

3. Place the one (1) red and white with black lettering 3.5” x 7” pressure sensitive vinyl label, part number 379915, on the opposite side of the visor from the above label part number 379275.

4. Place the one (1) white and black heavy duty card, part number 379276, in the vehicle glove box in a position highly visible to the operator. For example, try to place this card on top of whatever may be in the glove box.

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

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

**This symbol warns of possible personal injury.**
Direct Mount Pump Support Requirements (Universal)

![Diagram of pump support requirements]

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

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

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

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

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

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

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

⚠️ This symbol warns of possible personal injury.
Function of Auxiliary Power Shafts

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

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

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

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

Determining Shaft Type

1. Solid or tubular?
   a. In applications requiring more than 1000 RPM or where the application necessitates a highly balanced auxiliary power shaft, a tubular shaft should be used.
   b. Spicer’s solid shafting auxiliary power joints are designed for 1000 or less RPM intermittent service such as:
      - Driving small hydraulic pumps
      - Driving winches
      - Driving low speed product pumps

2. Joint Series should be determined using the chart on the following page.

### SPICER® UNIVERSAL JOINT OPERATING ANGLES

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3000</td>
<td>5° 50'</td>
<td>1500</td>
<td>11° 30'</td>
</tr>
<tr>
<td>2500</td>
<td>7° 00'</td>
<td>1000</td>
<td>11° 30'</td>
</tr>
<tr>
<td>2000</td>
<td>8° 40'</td>
<td>500</td>
<td>11° 30'</td>
</tr>
</tbody>
</table>

Above based on angular acceleration of 100 RAD/SEC²
## Spicer® Universal Joint Engineering Data

### Torque Rating

<table>
<thead>
<tr>
<th>Joint Series</th>
<th>1000</th>
<th>1100</th>
<th>1280</th>
<th>1310</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive (Gas or Diesel Engine) lbs-ft Continuous</td>
<td>50</td>
<td>54</td>
<td>95</td>
<td>130</td>
</tr>
</tbody>
</table>

### Tubing

<table>
<thead>
<tr>
<th>Diameter</th>
<th>1.750&quot;</th>
<th>1.250&quot;</th>
<th>2.500&quot;</th>
<th>3.00&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall Thickness</td>
<td>.065&quot;</td>
<td>.095&quot;</td>
<td>.083&quot;</td>
<td>.083&quot;</td>
</tr>
<tr>
<td>W = Welded S = Seamless</td>
<td>W</td>
<td>S</td>
<td>W</td>
<td>W</td>
</tr>
</tbody>
</table>

### Flange Diameter (Swing Diameter)

<table>
<thead>
<tr>
<th>Joint Series</th>
<th>1000</th>
<th>1100</th>
<th>1280</th>
<th>1310</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectangular Type</td>
<td>3.500&quot;</td>
<td>3.500&quot;</td>
<td>3.875&quot;</td>
<td>3.875&quot;</td>
</tr>
</tbody>
</table>

### Bolt Holes - Flange Yoke

<table>
<thead>
<tr>
<th>Diameter</th>
<th>2.750&quot;</th>
<th>2.750&quot;</th>
<th>3.125&quot;</th>
<th>3.125&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>.312&quot;</td>
<td>.312&quot;</td>
<td>.375&quot;</td>
<td>.375&quot;</td>
</tr>
<tr>
<td>Male Pilot Dia.</td>
<td>2.250&quot;</td>
<td>2.250&quot;</td>
<td>2.375&quot;</td>
<td>2.375&quot;</td>
</tr>
</tbody>
</table>

### Distance Across Lugs

<table>
<thead>
<tr>
<th>Diameter</th>
<th>2.188&quot;</th>
<th>2.656&quot;</th>
<th>3.469&quot;</th>
<th>3.469&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>2.188&quot;</td>
<td>2.656&quot;</td>
<td>3.469&quot;</td>
<td>3.469&quot;</td>
</tr>
</tbody>
</table>

### Bearing Diameter

<table>
<thead>
<tr>
<th>Diameter</th>
<th>2.812&quot;</th>
<th>3.125&quot;</th>
<th>3.500&quot;</th>
<th>3.500&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Pilot Dia.</td>
<td>-</td>
<td>-</td>
<td>85&quot;</td>
<td>76&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Solid Shaft Diameter</th>
<th>60&quot;</th>
<th>42&quot;</th>
<th>35&quot;</th>
<th>30&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>.750&quot;</td>
<td>62&quot;</td>
<td>44&quot;</td>
<td>36&quot;</td>
<td>31&quot;</td>
</tr>
<tr>
<td>.812&quot;</td>
<td>65&quot;</td>
<td>46&quot;</td>
<td>37&quot;</td>
<td>32&quot;</td>
</tr>
<tr>
<td>.875&quot;</td>
<td>69&quot;</td>
<td>49&quot;</td>
<td>40&quot;</td>
<td>35&quot;</td>
</tr>
<tr>
<td>1.000&quot;</td>
<td>72&quot;</td>
<td>55&quot;</td>
<td>45&quot;</td>
<td>39&quot;</td>
</tr>
<tr>
<td>1.250&quot;</td>
<td>77&quot;</td>
<td>55&quot;</td>
<td>45&quot;</td>
<td>39&quot;</td>
</tr>
</tbody>
</table>

---

### Maximum Operating Speed * By Tube Size, Solid Shaft Size, and Length *(For speed below 500 RPM or over 2500 RPM, contact your Chelsea Distributor)*

<table>
<thead>
<tr>
<th>Tubing Dia. &amp; Wall Thickness</th>
<th>Max. Installed Length in Inches for Given RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint &amp; Shaft (W=Welded S=Seamless)</td>
<td>Centerline to Centerline of Joints for a Two Joint Assembly</td>
</tr>
<tr>
<td></td>
<td>or</td>
</tr>
<tr>
<td></td>
<td>Centerline of Joint to Centerline of Center Bearing for a Joint &amp; Shaft</td>
</tr>
<tr>
<td></td>
<td>RPM - Revolutions per Minute</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tubing Dia. &amp; Wall Thickness</th>
<th>500</th>
<th>1000</th>
<th>1500</th>
<th>2000</th>
<th>2500</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.750&quot; x .065&quot; W</td>
<td>117&quot;</td>
<td>82&quot;</td>
<td>67&quot;</td>
<td>58&quot;</td>
<td>52&quot;</td>
</tr>
<tr>
<td>1.250&quot; x .095&quot; S</td>
<td>91&quot;</td>
<td>64&quot;</td>
<td>52&quot;</td>
<td>45&quot;</td>
<td>40&quot;</td>
</tr>
<tr>
<td>2.500&quot; x .083&quot; W</td>
<td>122&quot;</td>
<td>87&quot;</td>
<td>70&quot;</td>
<td>62&quot;</td>
<td>55&quot;</td>
</tr>
<tr>
<td>3.000&quot; x .083&quot; W</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>85&quot;</td>
<td>76&quot;</td>
</tr>
<tr>
<td>Solid Shaft Diameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>.750&quot;</td>
<td>60&quot;</td>
<td>42&quot;</td>
<td>35&quot;</td>
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<td>27&quot;</td>
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<td>28&quot;</td>
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<tr>
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<td>65&quot;</td>
<td>46&quot;</td>
<td>37&quot;</td>
<td>32&quot;</td>
<td>29&quot;</td>
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<tr>
<td>1.000&quot;</td>
<td>69&quot;</td>
<td>49&quot;</td>
<td>40&quot;</td>
<td>35&quot;</td>
<td>31&quot;</td>
</tr>
<tr>
<td>1.250&quot;</td>
<td>72&quot;</td>
<td>55&quot;</td>
<td>45&quot;</td>
<td>39&quot;</td>
<td>35&quot;</td>
</tr>
</tbody>
</table>
# TorqShift ® 5R110 Transmission – Stationary Elevated Idle Control (SEIC) 6.7L Diesel and 6.8L Gas

## Models Affected
- Medium Duty – MY2009-MY2010

## Overview
**SEIC**
- A Powertrain Control Module (PCM) strategy that provides elevated engine speed to drive auxiliary commercial equipment such as hydraulic pumps, generators, air compressors; or maintain vehicle battery charge under extreme electrical demands.

## SEIC Enable/Disable Conditions

<table>
<thead>
<tr>
<th>Vehicle Conditions to Enable SEIC (all are required)</th>
<th>Vehicle Conditions that Disable SEIC (any one required)</th>
<th>SEIC</th>
<th>Mobile Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking brake applied.</td>
<td>Parking brake disengaged.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Foot off of service brake</td>
<td>Depressing service brake</td>
<td>Yes (1)</td>
<td>No (2)</td>
</tr>
<tr>
<td>Vehicle in PARK (automatic trans.)</td>
<td>Vehicle taken out of PARK</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Foot off of accelerator pedal</td>
<td>Accelerator pedal depressed</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Vehicle speed is 0 mph (stationary)</td>
<td>Vehicle speed is not 0 mph (stationary)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Brake lights functional</td>
<td>Brake light circuit disconnected</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Engine at a stable base idle speed</td>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Transmission oil Temp above 20°F</td>
<td>Transmission Oil Temperature (TOT) Limit exceeds 240°F on Diesel and 250°F on Gas</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Eng Coolant Temp above 20°F (3)</td>
<td>Engine Coolant Temperature (ECT) above 234°F</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Eng Coolant Temp above 140°F</td>
<td>Engine Coolant Temperature (ECT) above 220°F</td>
<td>Yes (1)</td>
<td>No</td>
</tr>
<tr>
<td>Catalyst Temperature Limit</td>
<td></td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

(1) A “Change-of-State” at the “PTO-Request” circuit is required to re-invoke SEIC. When a disabler is seen by the PCM, the “PTO-Indicator” circuit changes from “Ground-Source” to an “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 proceeds below 1200 RPM. To re-initiate SEIC the operator must turn off the aftermarket PTO switch (removing command voltage to the “PTO-Mode” circuit) and then turn it back on again.

(2) SEIC is automatically re-activated after approximately 3 seconds after the disabling condition is removed.

(3) MY2013 Gas Engine Applications Engine Coolant Temperature above 30°F.

Reference Ford Body Builder website for year specific information at https://www.fleet.ford.com/truckbbas/
Transmission Overview

**TorqShift® 5R110 Transmission – Stationary Elevated Idle Control (SEIC) (Continued)**

**6.7L Diesel and 6.8L Gas**

**Models Affected**
Medium Duty – MY2009-MY2010

**General System Behavior**

- To guarantee full advertised torque capability at the automatic transmission PTO gear and through the aftermarket PTO clutch, the transmission torque converter must be locked, and the hydraulic line pressure serving the aftermarket PTO clutch must be elevated. Applying battery voltage to the PTO circuit is the signal to the transmission to enter SEIC strategy and command these two important functions. This applies to both stationary and mobile PTO 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 “PTO-Request” circuit, and back on again to re-invoke SEIC and PTO operation.
  - DIESEL engines do not require a “change-of-state” at the “PTO” 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 RPM, 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 RPM 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.

- The Transmission Control Module (TCM) will turn off the PTO system when Transmission Oil Temperature (TOT) reaches 240°F on Diesel and 250°F on Gas.

- SEIC/PTO 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 RPM / second.
  - DIESEL engines: When first applying battery voltage to the PTO circuit the PCM directs the engine to go to the initial target that it sees at the RPM circuit at 200 RPM / second (1200 RPM if there is no resistor in the RPM circuit – open circuit). If resistance is subsequently changed at the RPM 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 PTO system designer uses to command SEIC through the “PTO” or “PTO-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.

Reference Ford Body Builder website for year specific information at https://www.fleet.ford.com/truckbbas/
TorqShift® 5R110 Transmission – Stationary Elevated Idle Control (SEIC) (Continued)
6.7L Diesel and 6.8L Gas

Models Affected
Medium Duty – MY2009-MY2010

General System Behavior (Continued)

- Correlation between engine speed and resistor values (Continued):
  - 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.
  - GAS Engine Only:
    - Normal base engine calibration allows approximately +/-50 RPM fluctuation. If any factory vehicle accessories are used during SEIC, e.g. a/c, defroster, etc., then that fluctuation may increase to approximately +/-100 RPM or more.
    - The sudden loss of aftermarket PTO hydraulic pressure during SEIC/PTO operation, like a ruptured hose, may send SEIC engine speed to near 3000 RPM. It is recommended that a hydraulic pressure switch linked to SEIC/PTO be added to disable SEIC/PTO 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 PTO-Mode and PTO-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 PTO Operation (TorqShift® Automatic or M6 manual Transmission)
Always apply battery voltage to the PTO 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 PTO 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 RPM 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 RPM. If ALT-CAL sets the idle at 700 RPM 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.

Reference Ford Body Builder website for year specific information at https://www.fleet.ford.com/truckbbas/
TorqShift® 6R140 Transmission – Stationary Elevated Idle Control (SEIC)

6.7L Diesel

Models Affected
Super Duty – MY2011-MY2018
Medium Duty – MY2016-MY2018

Overview
SEIC
- A Powertrain Control Module (PCM) strategy that provides elevated engine speed to drive auxiliary commercial equipment such as hydraulic pumps, generators, air compressors; or maintain vehicle battery charge under extreme electrical demands.

### SEIC Enable/Disable Conditions

<table>
<thead>
<tr>
<th>Vehicle Conditions to Enable SEIC (all are required)</th>
<th>Vehicle Conditions that Disable SEIC (any one required)</th>
<th>SEIC</th>
<th>Mobile Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking brake applied.</td>
<td>Parking brake disengaged.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Foot off of service brake</td>
<td>Depressing service brake</td>
<td>Yes (1)</td>
<td>No (2)</td>
</tr>
<tr>
<td>Vehicle in PARK (automatic trans.)</td>
<td>Vehicle taken out of PARK</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Foot off of accelerator pedal</td>
<td>Accelerator pedal depressed</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Vehicle speed is 0 mph (stationary)</td>
<td>Vehicle speed is not 0 mph (stationary)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Brake lights functional (Select model years)</td>
<td>Brake light circuit disconnected</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Engine at a stable base idle speed</td>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Transmission Oil Temp above 20°F</td>
<td>Transmission Oil Temperature (TOT) Limit exceeds 240°F on Diesel and 250°F on Gas</td>
<td>Yes (1)</td>
<td>Yes</td>
</tr>
<tr>
<td>Eng Coolant Temp above 20°F (3)</td>
<td>Engine Coolant Temperature (ECT) Limit</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Eng Coolant Temp above 40°F (Select model years)</td>
<td>Engine Coolant Temperature (ECT) Limit</td>
<td>Yes (1)</td>
<td>No</td>
</tr>
<tr>
<td>Catalyst Temperature Limit</td>
<td></td>
<td>Yes (1)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

(1) A “Change-of-State” at the “PTO-Request” circuit is required to re-invoke SEIC. When a disabler is seen by the PCM, the “PTO-Indicator” circuit changes from “Ground-Source” to an “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 proceeds below 1200 RPM. To re-initiate SEIC the operator must turn off the aftermarket PTO switch (removing command voltage to the “PTO-Mode” circuit) and then turn it back on again.

(2) SEIC is automatically re-activated after approximately 3 seconds after the disabling condition is removed.

(3) MY2013 Gas Engine Applications Engine Coolant Temperature above 140°F.
Transmission Overview

TorqShift® 6R140 Transmission – Stationary Elevated Idle Control (SEIC) (Continued)
6.7L Diesel

Models Affected
Super Duty – MY2011-MY2018
Medium Duty – MY2016-MY2018

General System Behavior

- To guarantee full advertised torque capability at the automatic transmission PTO gear and through the aftermarket PTO clutch, the hydraulic line pressure serving the aftermarket PTO clutch must be elevated. Applying battery voltage to the PTO circuit is the signal to the transmission to enter SEIC strategy and this important function. This applies to both stationary and mobile PTO operations.

- If an SEIC disabler occurs:
  - ALL engines will require a “change-of-state”, meaning the operator is required to turn off voltage to the “PTO-Request” circuit, and back on again to re-invoke SEIC and PTO operation.

- Battery Charge Protection (BCP):
  - When it is switched on the engine speed goes immediately to 600 RPM 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 1200 RPM.

- Auto Entry:
  - The BCP and Live-Drive operation modes allow PTO to engage automatically once the engine started provided the input switch is left in the on position prior to starting the engine. However, loss of an operating condition after PTO is initially engaged will require the switch to be cycled before PTO will re-engage.

- The Transmission Control Module (TCM) will turn off the PTO system when Transmission Oil Temperature (TOT) reaches 240°F on Diesel and 250°F on Gas.

- SEIC/PTO strategy function in the PCM is not affected by the loss of vehicle battery electrical power.

- SEIC Ramp Rate (fixed, not programmable):
  - When first applying battery voltage to the PTO circuit the PCM directs the engine to go to the initial target that it sees at the RPM circuit at 200 RPM/sec.
  - 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.
  - 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.

Reference Ford Body Builder website for year specific information at https://www.fleet.ford.com/truckbbas/
Transmission Overview

TorqShift® 6R140 Transmission – Stationary Elevated Idle Control (SEIC) (Continued)
6.7L Diesel

Models Affected
Super Duty – MY2011-MY2018
Medium Duty – MY2016-MY2018

General System Behavior (Continued)

Special Situations

Stationary mode, Live Drive and Split Shaft operation are supported.

Stationary Mode
Operates in Park at elevated engine speed. The maximum load at the transmission PTO gear is 250 lbs-ft.

Mobile Mode
Operates in all gears and all vehicle speeds. The engine idle speed is slightly elevated, but peak engine speed is not limited beyond normal operating ranges. An additional rev limiter may be required to prevent over speed damage to attached pumps and equipment. The maximum load allowable for mobile mode is 150 lbs-ft at the transmission PTO gear. If the PTO feature is used for extended periods of time without vehicle movement it is recommended to switch to Stationary Mode.

Split Shaft Mode
NOTE: Split Shaft mode engagement procedure has changed for MY2013.

To install Split Shaft mode, wire according to the diagram shown on page 7 of Ford SVE Bulletin Q-180R4. Select elevated idle speed by installing a resistor (which provides voltage to PTO RPM input) as indicated in the wiring diagram. Split-Shaft mode requires that supply voltage (nominal 12VDC) be applied to both the PTORS1 and PTORS2 circuits.

Adaptive Cooling
This PCM strategy is new for 2011 6.7L diesel engine. It automatically restricts engine power when it senses an over-temperature condition, and may interrupt the SEIC-PTO operation. Typically, the over-temperature condition it reacts to will also show up on the temperature gage on the instrument panel. Elevated engine speed, typical of SEIC operation, may help avoid Adaptive Cooling occurrence due to the resultant additional engine and transmission coolant flow. However, depending on the auxiliary PTO power being demanded, 900 RPM may not be enough to prevent the power train from entering Adaptive Cooling mode, but 1500 RPM may.

Reference Ford Body Builder website for year specific information at https://www.fleet.ford.com/truckbbas/
Transmission Overview

TorqShift® 6R140 Transmission – Stationary Elevated Idle Control (SEIC)
6.8L Gas

Models Affected
Super Duty – MY2017-MY2018
Medium Duty – MY2013-MY2018

General System Behavior

Purpose to explain changes and functions of the (SEIC) system for Power Take-Off (PTO) applications.

Overview – SEIC and Transmission PTO (6.8L only)
• A powertrain control module (PCM) strategy that provides elevated engine speed to drive auxiliary commercial equipment such as hydraulic pumps, generators, air compressors; or maintain vehicle battery charge under extreme electrical demands.

• SEIC is standard in all PCMs for F650 with the 6.8L gas engine.

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<td>Foot off of service brake</td>
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<tr>
<td>Vehicle in PARK (automatic trans.)</td>
</tr>
<tr>
<td>Foot off of accelerator pedal</td>
</tr>
<tr>
<td>Vehicle speed is 0 mph (stationary)</td>
</tr>
<tr>
<td>Brake lights functional (Select model years)</td>
</tr>
<tr>
<td>Engine at a stable base idle speed</td>
</tr>
<tr>
<td>Transmission Oil Temp above 20°F</td>
</tr>
<tr>
<td>Eng Coolant Temp above 20°F (3)</td>
</tr>
<tr>
<td>Eng Coolant Temp above 40°F (Select model years)</td>
</tr>
<tr>
<td>Catalyst Temperature Limit</td>
</tr>
</tbody>
</table>

(1) A “Change-of-State” at the “PTO-Request” circuit is required to re-invoke SEIC. When a disabler is seen by the PCM, the “PTO-Indicator” circuit changes from “Ground-Source” to an “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 proceeds below 1200 RPM. To re-initiate SEIC the operator must turn off the aftermarket PTO switch (removing command voltage to the “PTO-Mode” circuit) and then turn it back on again.

(2) SEIC is automatically re-activated after approximately 3 seconds after the disabling condition is removed.

(3) MY2013 Gas Engine Applications Engine Coolant Temperature above 140°F.

Reference Ford Body Builder website for year specific information at https://www.fleet.ford.com/truckbbas/
Transmission Overview

TorqShift® 6R140 Transmission – Stationary Elevated Idle Control (SEIC) (Continued)
6.8L Gas

Models Affected
Super Duty – MY2017-MY2018
Medium Duty – MY2013-MY2018

General System Behavior (Continued)

Customer Access Wires for SEIC and VSO/CTO/PARK Signals
- Located under hood, below left (passenger) side engine cowl.
- The final stage manufacturer or up-fitter is required to supply the customer interface equipment.

Transmission PTO Gear and Port
- Available on 6.8L F650.
- Available for TorqShift® 6-speed automatic transmission.
- The PTO gear is direct-splined to the torque converter cover and thus able to deliver power any time the engine is running, (i.e. no internal PTO clutch).
- NEVER use any sealer, especially silicone-based, on the PTO port gasket.
- The PTO gear delivers up to 250 lbs-ft torque to the aftermarket PTO, and can manage the heat of 40 HP continuously. Higher horsepower can be delivered, but for shorter durations depending on the amount of power required.

Product Descriptions/Special Situations
SEIC
- Intended to be commanded ONLY by applying battery voltage to certain customer-access blunt-cut wire circuits, and adding a target-speed resistor, and is only available when the vehicle road speed signal is zero.
- Includes a link circuit which changes from open-circuit to ground when enablers are met, that may be used to turn on an indicator lamp, while providing battery power to an aftermarket PTO clutch or solenoid.
- Ramp rates are fixed and cannot be altered by the customer.
- Maximum engine speed is 2400 RPM without PTO installed.

NOTE: Chelsea PTO output speed should not exceed 2500 RPM. The PTO is 124% of engine speed. DO NOT exceed 2,016 engine RPMs with Chelsea PTO installed.

- Minimum engine speed – Gas engine: 910 RPM approximately. Gas engine has a 900 RPM “stand-by” speed that it first goes to when SEIC is initiated to step it away from stall speed that it could dip to as PTO load is applied. This is an unusable speed for any application. However, a resistor can be chosen that sets the useable target speed for carrying an auxiliary load to just above 900 RPM This is mainly intended for applications using a FEAD-driven PTO device like a clutch-pump, because the TorqShift® torque converter cannot fully lock until 900 RPM engine speed RPM.

WARNING: Using the TorqShift® PTO below 900 RPM for the 6.8L risks transmission damage from overheating, or aftermarket PTO clutch slippage debris.

This symbol warns of possible personal injury.

Reference Ford Body Builder website for year specific information at https://www.fleet.ford.com/truckbbas/
TorqShift® 6R140 Transmission – Stationary Elevated Idle Control (SEIC) (Continued)
6.8L Gas

Models Affected
Super Duty – MY2017-MY2018
Medium Duty – MY2013-MY2018

General System Behavior (Continued)

To guarantee full advertised torque capability at the 6.8L automatic transmission PTO gear and through the aftermarket PTO clutch, the transmission torque converter must be locked, and the hydraulic line pressure serving the aftermarket PTO clutch must be elevated. Applying battery voltage to the PTO circuit is the signal to the transmission to enter SEIC strategy and command these two important functions.

• If an SEIC enabling condition is not met upon SEIC initialization:
  - SEIC will not initialize. SEIC will require a “change-of-state” (voltage to both the “PTO_REQUEST” and “PTO_ENGAGE” circuits removed completely.) The enabling conditions must be met, and then SEIC and PTO operation may be initiated.

• If an SEIC disabler occurs:
  - GAS engines will require a “change-of-state”, meaning the operator is required to turn off voltage to both the “PTO_REQUEST” and “PTO_ENGAGE” circuits, and back on again to re-invoke SEIC and PTO operation.
  - The Transmission Control Module (TCM) will turn off the PTO system when Transmission Oil Temperature (TOT) reaches 240°F on Diesel and 250°F on Gas.
  - SEIC/PTO strategy function in the PCM is not affected by the loss of vehicle battery electrical power.

• SEIC Ramp Rate Max (Not programmable and approximate):
  - 400 RPM/second up and 200 RPM/second down.

• Correlation between engine speed and resistor values:
  - The external voltage source that the aftermarket PTO system designer uses to command SEIC through the “PTO_REQUEST” or “PTO_ENGAGE” 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.
  - 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. This has a greater effect on gas engine systems than it does on diesel since gas engine uses chassis battery voltage as a reference.

Product Descriptions/Special Situations
SEIC (Continued)
- Normal base engine calibration allows approximately +/-50 RPM fluctuation. If any factory vehicle accessories are used during SEIC, e.g. a/c, defroster, etc., then that fluctuation may increase to approximately +/-100 RPM or more.
- The sudden loss of aftermarket PTO hydraulic pressure during SEIC/PTO operation, like a ruptured hose, may send SEIC engine speed to near 3000 RPM It is recommended that a hydraulic pressure switch linked to SEIC/PTO be added to disable SEIC/PTO when a hose ruptures.
- Because of a service brake circuit characteristic at engine-start, invoking SEIC may cause the diagnostic error code FFG_BO0 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 PTO_REQUEST and PTO_ENGAGE circuits whenever a disabler turns off SEIC (remove battery voltage signal and re-apply).

Reference Ford Body Builder website for year specific information at https://www.fleet.ford.com/truckbbas/
247 Series

FORD TorqShift®
5R110 Transmission

Super Duty F250-550
6.7L Diesel MY2009-MY2010
6.8L Gas MY2009-MY2016
In-Cab PTO Switch Installation

NOTE: Before starting installation of the electrical wiring:

1. Disconnect the battery cables from the battery and secure to prevent accidental contact.

2. Locate a position in the cab for mounting the PTO switch and mounting bracket. The shaded area in Fig. 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: PTO switch or mounting bracket) in the Occupant Protection Zone.

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

For electrical installation, see installation sketch on page 24 for Non-EOC and page 26 for EOC.

1. Locate suitable location to install PTO switch.

2. Locate and remove the customer access panel located on the lower left portion of the instrument panel (driver's side) (Fig. 2).

3. After determining the location of the PTO switch, run wiring assembly over to the area under the vehicle steering column. You are now ready to attach the wires from the Chelsea wiring harness.

NOTE: Wiring Strategy is slightly different between the Gas and Diesel engines. Use the charts listed on pages 25 and 27 for complete wiring chart information for prior years when using Chelsea wiring harness.

4. Located in the cabin, tagged and bundled above the parking brake assembly (Fig. 3), are the wires needed to connect the Chelsea PTO 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 25 or 27 of this manual.

This symbol warns of possible personal injury.

Consult Ford Body Builder SVE Q-236R3
In-Cab PTO Switch Installation (Continued)

5. 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 White w/ Light Blue stripe using a butt connector to this Ford wire. Next, connect the black ground wire with a ring terminal to one of the screws located on the right side of the access area dash frame (Fig. 4). Reference Wiring charts on page 25 or 27 of this manual.

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 Fig. 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 “PTO” or “Gas PTO - 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 PTO torque or pump flow output. Any attempt to operate the Power Take-Off at elevated idle without these commands may result in under-capacity PTO clutch wear, resulting in rapid contamination of transmission fluid and internal transmission damage. This applies to both stationary and mobile automatic transmission PTO operations. Reference Wiring charts on pages 25 or 27.

Ford LCF/International CF Overview MY2006-MY2010


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

NOTE: Installation requires the lengthening and splicing of the MY2017 Chelsea harness.

Follow the normal PTO 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. 6).

Chelsea switch panel mounting suggestion.

2. Switch panel may be located in cavity below the lighter (Fig. 7).

NOTE: Clearance cut required for fitment.

3. Relocate the relay located on the back of the Chelsea switch panel. It is adhered with double stick tape (Fig. 8).
Mounting the PTO

**CAUTION:** When installing the PTO, always wear protective clothing and safety glasses.

Installation of a 247 PTO 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.

1. There are two split dowels that will act as guides when installing the PTO to the transmission. Gently squeeze the dowel together and install in the top and lower right side mounting hole of the PTO as shown in Fig. 9. The dowel should be flush with the side away from the mounting face (Fig. 9 and 10) and protrude into the corresponding mounting holes of the transmission aperture when installing the PTO.

2. Before installing the PTO remove the shift cable bracket that is to the right side of the PTO 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 PTO.

**NOTE:** On some early production Ford Super Dutys, the shifter bracket design was changed by about 3mm. The increase in size of the bracket interfered with the Power Take-Off. See appendix for Ford approved modification of this bracket for PTO clearance.

This transmission does not require the oil to be drained for PTO 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.

3. Remove the plug from the transmission pressure port (Fig. 11) and install the 90° male elbow in the opening. Position the fitting (Fig. 12) at a 10 o’clock position as you look at the fitting.

This symbol warns of possible personal injury.
Mounting the PTO (Continued)

4. Remove the PTO aperture cover plate and gasket (Fig. 13).

**IMPORTANT:** Discard the gasket. It will NOT be used when installing the PTO 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).

5. Connect hose (Transmission-to-Hydraulic Valve) to the fitting on the transmission. Route as shown in Fig. 14. 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.

6. Six fasteners (Fig. 15) are used to attach the PTO to the transmission opening. The longest bolt requires an O-Ring on it to ensure a positive seal. Slide this on now after applying lube to the O-Ring.

7. Slide the special gasket supplied with the PTO over the split dowels (Fig. 16) installed in the PTO. This is the controlled compression gasket that is used to eliminate the setting of the gear backlash between the PTO 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.
Mounting the PTO (Continued)

8. Install the stud from the stud kit in the top hole on the transmission PTO aperture pad (Fig. 17).

9. Tighten the stud and torque to 17-19 lbs-ft [23-26 Nm].

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

10. Mount the PTO to the transmission at this time by sliding the top PTO mounting hole w/dowel pin over the shoulder stud. Guide other dowel pin into hole (Fig. 18).

11. Attach the self-locking nut to the shoulder stud. Do not tighten down at this time (Fig. 19).

12. Make sure the O-Ring 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 finger tight (Fig. 20).

**IMPORTANT:** Make sure the O-Ring is positioned in the counter bore.
13. Finish fastening the PTO to the transmission using the remaining (4) flange head hex bolts.

14. Torque all 5 capscrews (Fig. 21) to 25 lbs-ft [34 Nm] and torque the self-locking nut to 35-40 lbs-ft [48-54 Nm].

15. 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 Nm].

16. Install Transmission-to-Solenoid hose to the Hydraulic Valve Bearing Cap 90° Elbow fitting (Fig. 22).

17. Install PTO Pressure Switch into port on Hydraulic Valve Cap. Torque to 10-12 Lbs-ft (Fig. 23).

18. Install hydraulic pump or driveline as necessary. See page 50 for more pump mounting information.

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### Potentiometer Settings

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<tbody>
<tr>
<td>Super Duty F250-550</td>
<td>Gas</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart I</td>
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<td></td>
<td>Diesel</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart II</td>
<td>Chart II</td>
<td>Chart II</td>
<td>Chart II</td>
<td>Chart II</td>
<td>Chart III</td>
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</table>
247 Series Installation Sketches

Hose Assembly Identification Chart

247 Series Installation Sketches

Wiring Installation (Shift Option B)
w/o Electronic Overspeed Control (EOC)

See Chart on Page 25

See Chart on Page 25

Cut 1.25" Dia. Hole in Firewall Near Ford Clutch Master Cylinder Seal Assembly

Slice Grommet, Insert in Hole in Clutch Master Cylinder Seal Assembly

Firewall Pass-Thru Installation

379625 90° Elbow

379698 90° Elbow

329598X

379502 Pressure Switch Torque Bolt to 10-12 Lbs-ft

329232-1X Hose Ass’y

To TorqShift® Trans. High Pressure Port

P.T.O. IS ENGAGED WHEN LIGHT IS ON

See Chart on Page 25
### Wiring Installation Chart (Shift Option B)  
**w/o Electronic Overspeed Control (EOC)**  
(SK-448 Rev C)

#### MY2005-MY2010 Ford Super Duty – Diesel/Gas (Stationary Mode Only)

<table>
<thead>
<tr>
<th>Chelsea PTO Wire Harness</th>
<th>MY2005-MY2007 Connect to Ford Wire Number</th>
<th>*MY2008-MY2010 Connect to Ford Wire Number</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Ford Wire Color</td>
<td>Circuit</td>
</tr>
<tr>
<td>1 or Orange</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Orange</td>
<td>Orange</td>
<td>#2242</td>
</tr>
<tr>
<td>2 Black w/ Butt Connector</td>
<td>Orange/Lt. Blue (1)</td>
<td>#2244</td>
</tr>
<tr>
<td>3 Yellow</td>
<td>Orange/White</td>
<td>#2243</td>
</tr>
<tr>
<td>4 Red</td>
<td>Orange/Yellow</td>
<td>#2246</td>
</tr>
<tr>
<td>5 Black w/ Ring Terminal</td>
<td>Connect to Dash Chassis Ground</td>
<td></td>
</tr>
<tr>
<td>6 White/Light Blue</td>
<td>White/Blue</td>
<td>#294</td>
</tr>
</tbody>
</table>

**NOTE:** (1) For Mobile Operation Only Connect Black Wire w/ Butt Connector to Chassis Ground  
* 2011 Gas Engine Only

#### MY2011-MY2016 Ford Super Duty – 6.8L Gas (Stationary Mode Only)

<table>
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<tr>
<th>Chelsea PTO Wire Harness</th>
<th>MY2011 (1) Connect to Ford Wire Number</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Ford Wire Color</td>
</tr>
<tr>
<td>1 Orange</td>
<td>Gas Only</td>
</tr>
<tr>
<td>2 Black w/ Butt Connector</td>
<td>Gas Only</td>
</tr>
<tr>
<td>3 Yellow</td>
<td>Gas Only</td>
</tr>
<tr>
<td>4 Red</td>
<td>Gas Only</td>
</tr>
<tr>
<td>5 Black w/ Ring Terminal</td>
<td>Gas Only</td>
</tr>
<tr>
<td>6 White/Light Blue</td>
<td>Gas Only</td>
</tr>
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</table>

**NOTE:** (1) MY2011-MY2012 Gas Engine Only  
(2) Trucks built prior to May 15, 2010 this Ford wire is Yellow w/Orange Stripe

#### *MY2006-MY2010 Ford & International LCF*

<table>
<thead>
<tr>
<th>Chelsea PTO Wire Harness</th>
<th>Connect to Ford Wire Number</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Ford Wire Color</td>
</tr>
<tr>
<td>1 Orange</td>
<td>Purple/Light Green</td>
</tr>
<tr>
<td>1 Orange</td>
<td>Light Blue/Red</td>
</tr>
<tr>
<td>1 Orange</td>
<td>Dark Green/White</td>
</tr>
<tr>
<td>2 Black w/ Butt Connector</td>
<td>Brown/Yellow</td>
</tr>
<tr>
<td>3 Yellow</td>
<td>Not Used</td>
</tr>
<tr>
<td>4 Red</td>
<td>Not Used</td>
</tr>
<tr>
<td>5 Black w/ Ring Terminal</td>
<td>Connect to Dash Chassis Ground</td>
</tr>
<tr>
<td>6 White/Light Blue</td>
<td>Dark Green/Yellow</td>
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</tbody>
</table>

* **NOTE:** Installer must provide wires to connect between the vehicle blunt wire connections and the Chelsea Wiring Harness 329598X.
Wiring Installation (Shift Option K)
LCF – MY2005-MY2009
w/ Electronic Overspeed Control (EOC)

NOTE: Strip Wire Ends 0.25” Prior to Installing Connector
## Wiring Installation Chart (Shift Option K)

<table>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Not Used</td>
<td>Not Used</td>
<td>Not Used</td>
<td>Ford Circuit #CE914 Green</td>
<td>Not Used</td>
<td>Ford Circuit #CE914 Green</td>
</tr>
<tr>
<td>2</td>
<td>Not Used</td>
<td>Ford Circuit #294 White/Lt. Blue</td>
<td>Not Used</td>
<td>Ford Circuit #CBP44 Purple</td>
<td>Not Used</td>
<td>Ford Circuit #CDC64 White/Blue (1)</td>
</tr>
<tr>
<td>3</td>
<td>Not Used</td>
<td>Ford Circuit #2243 Orange/White</td>
<td>Not Used</td>
<td>Ford Circuit #CE924 Blue/Orange</td>
<td>Not Used</td>
<td>Ford Circuit #CE933 Blue/Orange</td>
</tr>
<tr>
<td>4</td>
<td>Ground</td>
<td>Ford Circuit #2244 Orange/Lt. Blue</td>
<td>Ground</td>
<td>Ford Circuit #CE326 Blue/White</td>
<td>Ground</td>
<td>Ford Circuit #CE326 Blue/White</td>
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<tr>
<td>EOC Box Wire A</td>
<td>Ford Circuit #2242 Orange</td>
<td>Ford Circuit #2242 Orange</td>
<td>Ford Circuit #CE912 Yellow/Green</td>
<td>Ford Circuit #CE912 Yellow/Green</td>
<td>Ford/International Circuit #2335 Purple/Lt. Green</td>
<td>Ford Circuit #CE912 Yellow/Green</td>
</tr>
<tr>
<td>EOC Box Red</td>
<td>Ford Circuit #294 White/Lt. Blue</td>
<td>Ford Circuit #294 White/Lt. Blue</td>
<td>Ford Circuit #CBP44 Purple</td>
<td>Ford Circuit #CBP44 Purple</td>
<td>Ford/International Circuit #1043 Dark Green/Yellow</td>
<td>Ford Circuit #CDC64 White/Blue (1)</td>
</tr>
</tbody>
</table>

**NOTE:** (1) Trucks built after May 15, 2010. Trucks built prior to May 15, 2010 this Ford wire is Yellow/Orange Stripe.
249/249V Series

FORD TorqShift®
6R140 Transmission

Super Duty F250-550
- 6.7L Diesel MY2011-MY2018
- 6.2L/6.8L Gas MY2017-MY2018

Medium Duty F650/750
- 6.7L Diesel MY2016-MY2018
- 6.8L Gas MY2013-MY2018
NOTE: Before starting installation of the electrical wiring:

1. Disconnect the battery cables from the battery and secure to prevent accidental contact.

2. Locate a position in the cab for mounting the PTO switch and mounting bracket. The shaded area in Fig. 24 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: PTO switch or mounting bracket) in the Occupant Protection Zone.

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

For electrical installation see installation sketch on page 42 for Non-EOC and page 48 for EOC.

3. Locate the Ford wiring to be connected to the Chelsea PTO harness.

   a. MY2017-MY2018 F250-550 blunt cut wires located at passenger side kick panel.

   b. All Others - Ford wiring is located behind the customer access panel located directly under the steering column (Fig. 25).

4. After determining the location of the PTO switch, run wiring assembly over to the area of the blunt cut wires. You are now ready to attach the wires from the Chelsea wiring harness to the Ford wires.

**NOTE:** For MY2017-MY2018 F250-550, all necessary wires are in the Ford wiring harness.
Medium Duty F650/750 – MY2016-MY2018 – 6.7L Diesel
In-Cab PTO Switch Installation

5. Connect the Chelsea wiring harness to the FORD blunt cut wires per the wiring chart on page 43 and 49. Butt connectors are provided on the Chelsea wiring harness (Fig. 26).

Splice/Repair
When necessary to splice wire for repair or circuit length revisions, the following guide should be followed:

- Wire ends should be stripped making sure that individual conductor strands are not damaged.
- When soldering, make sure an adequate mechanical joint exists before applying solder. Use only rosin core solder — never acid core.
- For crimp joints, use butt-type metal barrel fasteners and a proper tool (such as Motorcraft crimp tool S-9796) specifically designated for this type of work.
- Splice joints must be adequately sealed and insulated. Adhesive-lined heat shrink tubing is highly recommended to cover soldered and bare metal barrel crimp joints.
- The most durable splice joint will be bare metal barrel crimped, flow-soldered and covered with adhesive lined heat shrink tubing. This is recommended as the preferred splice joint.

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 Fig. 28.

6. Attach the ground wire Black with ring terminal (3/8") on its end to a confirmed ground location (Fig. 27). Reference Wiring Charts on page 43 or 49 of this manual.

7. 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. See page 42 and 48 for information.

CAUTION: A battery voltage to the Diesel “PTO” 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 PTO torque or pump flow output. Any attempt to operate the Power Take-Off at elevated idle without these commands may result in under-capacity PTO clutch wear, resulting in rapid contamination of transmission fluid and internal transmission damage. This applies to both stationary and mobile automatic transmission PTO operations. Reference Wiring charts on pages 43 or 49.

NOTE: Chelsea Wiring Harness includes a potentiometer factory set to Maximum Resistance which defaults to the minimum engine RPM established by Ford. See pages 73-74 for more information.
Super Duty F250-550 – MY2017-MY2018 – 6.2L/6.8L Gas
Medium Duty F650/750 – MY2013-MY2018 – 6.8L Gas
In-Cab PTO Switch Installation

**NOTE:** Before starting installation of the electrical wiring:

1. Disconnect the battery cables from the battery and secure to prevent accidental contact.

2. Locate a position in the cab for mounting the PTO switch and mounting bracket. The shaded area in **Fig. 29** 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 (i.e.: PTO switch or mounting bracket) in the Occupant Protection Zone.

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

For electrical installation see installation sketch on page 44 for Non-EOC.

3. Locate the Ford wiring to be connected to the Chelsea PTO harness.
   a. MY2017-MY2018 F250-550 blunt cut wires located at passenger side kick panel.
   b. All Others - Locate and remove the customer access panel located directly under the steering column (**Fig. 31**)

4. Run the wiring assembly over to the area of the located Ford wiring. You are now ready to attach the wires from the Chelsea wiring harness.

5. Next locate the Ford ignition switch wire. Connect the Chelsea 12V wire to the Ford ignition wire (**Fig. 32**).

**NOTE:** For F250-550 MY2017-MY2018, all necessary wires are in the Ford wiring harness.
6. Remove the kick panel in front of the door just above the floor board for F650-750 only (Fig. 33).

7. Connect the Chelsea Black wire w/ring connector (3/8") to the Ford ground screw that is located in an area that is paint free (Fig. 34).

**NOTE:** Chelsea Wiring Harness includes a potentiometer factory set to Maximum Resistance. See pages 73-74 for more information.

**Splice/Repair**
When necessary to splice wire for repair or circuit length revisions, the following guide should be followed:

- Wire ends should be stripped making sure that individual conductor strands are not damaged.
- When soldering, make sure an adequate mechanical joint exists before applying solder. Use only rosin core solder — never acid core.
- For crimp joints, use butt-type metal barrel fasteners and a proper tool (such as Motorcraft crimp tool S-9796) specifically designated for this type of work.
- Splice joints must be adequately sealed and insulated. Adhesive-lined heat shrink tubing is highly recommended to cover soldered and bare metal barrel crimp joints.
- The most durable splice joint will be bare metal barrel crimped, flow-soldered and covered with adhesive lined heat shrink tubing. This is recommended as the preferred splice joint.

**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 (Fig. 35).

8. Find a suitable location to route the blunt cut and PTO connector wiring harnesses out of the cab area.

**F650/750 only**
9. The Ford SEIC blunt-cut customer service wires are located under hood, on the right (passenger) side of the engine compartment, below the cowl (Fig. 36).
PTO Installation – Overview

1. Refer to pages 34-39 of this manual for PTO installation.

2. PTO installation is the same basic installation as on the Ford Super Duty Vehicles. But, on the 6.8L Gas, a heat shield is required to protect the PTO and accessories such as the PTO electrical wiring and the transmission-to-PTO hydraulic hose.

3. Hose Routing – It is critical that the hose be routed to ensure it does not touch the exhaust.
   - The PTO fitting should be indexed at 90 degrees and the transmission fitting indexed at 45 degrees. Route the hose as shown in (Fig. 37).

4. Electrical – Solenoid and pressure switch connections.
   - Route the wiring harness with heat resistant wire guard to connect the solenoid and pressure switch. Position so the harness is not in contact with the exhaust pipe. Zip tie the harness to the Ford shift linkage cable after the connections to the PTO are complete.

PTO Installation – Pre-work

CAUTION: When installing the PTO, always wear protective clothing and safety glasses.

Overview: The 249 Series comes in two main sections.

1. A geared adapter section (Fig. 38).

2. Main PTO housing. This unique design allows for time saving installation on both 4 x 2 and 4 x 4 Super Duty applications (Fig. 39 and Fig. 40).

NOTE: There are two split dowels that will act as guides when installing the adapter to the transmission. These come pre-installed in the adapter (Fig. 41).
PTO Installation

IMPORTANT: MY2017-MY2018 F250-550 4x4 with manual transfer case shifter - the manual shift cable has a bracket connected to the PTO aperture that needs to be relocated as it will interfere with PTO installation. Contact your local Ford Dealer or Ford Body Builders Advisory Service at 877-840-4338 or https://www.fleet.ford.com/truckbbas/

NOTE: Dropping the 4WD auxiliary shaft will provide more room for installation, but it is not required for all applications.

NOTE: The removal of the transmission electrical connection plug will aid in the installation of the PTO (Fig. 42) (249V).

This transmission does not require the oil to be drained for the PTO 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.

3. Remove the plug from the transmission pressure port (Fig. 43) and install fitting in the opening (Fig. 44).

IMPORTANT: Both Washers and the O-Ring must be present at installation. The second Washer must fit around the O-Ring for proper seal (Fig. 44).

PTO Pressure/Lube Fitting & Hose:
380569 90° Adapter Fitting (1 each) (Fig. 44).
329130-3X Hose Assembly (1 each) (Fig. 45).

⚠️ This symbol warns of possible personal injury.
PTO Installation (Continued)

4. Remove the PTO aperture cover plate and gasket (Fig. 46 & 46a). DO NOT Discard the gasket. It will be used when installing the adapter on the transmission.

**IMPORTANT**: Inspect the gasket for rips, tears, and deformities that may cause leaks. If there are any questions about the integrity of the gasket, replace with a new gasket.

**NOTE**: PTO installation may be easier if the shifter lever and bracket are removed. Hold PTO in position to see if the PTO/Pump can be installed without removing the transmission shifter. If shifter or bracket needs to be removed (see pages 77-80) (249V).

5. Six fasteners (Fig. 47 or 48) are used to attach the PTO to the transmission opening.

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

6. **249** - Install the three studs from stud kit (Fig. 47). Install the two longer studs at 12 o’clock and 6 o’clock and the shorter stud at the 8 o’clock location on the transmission aperture pad (Fig. 49).

**249V** - Install the six studs from stud kit (Fig. 48). Install the two shorter studs at 4 o’clock and 8 o’clock and the longer studs in the other locations on the transmission aperture pad.

**CAUTION**: Over tightening of the studs or running the shoulder past the transmission mounting surface may damage stud and/or Transmission threads (249).

7. **249** - Install the three studs until the shoulder of the stud is flush with the transmission mounting surface.

**249V** - Tighten the stud and torque to 17-19 lbs-ft [23-26 Nm].
PTO Installation (Continued)

CAUTION: Overtightening of the stud may damage stud and/or Transmission threads (249V).

8. Slide the gasket supplied with the transmission over the dowel pins on the geared adapter (Fig. 50).

9. Install the geared adapter into the transmission aperture and over the studs (Fig. 51).

10. Install the gasket supplied with the PTO over the studs and against the geared adapter (Fig. 52).

11. Install the PTO over the studs and attach the self-locking nuts to the top shoulder stud and left top shoulder stud. DO NOT tighten down at this time (Fig. 53).
PTO Installation (Continued)

12. Install the bottom two self-locking nuts. DO NOT tighten down at this time (Fig. 54).

13. **249** - Next, install the three remaining hex capscrews in the remaining holes (Fig. 55).

**249V** - Next, install the two remaining locking nuts on the top and middle right side studs (Fig. 55).

14. Torque all capscrews (Fig. 56) to 25 lbs-ft [34 Nm] and torque the self-locking nuts to 35-40 lbs-ft [48-54 Nm].

**NOTE:** Always torque fasteners in a crossing pattern (Fig. 56).

15. Connect hose (Transmission-to-PTO Valve) to the fitting on the transmission. Route as shown in Fig. 57. 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. Next, connect the other end of the hose to fitting on the PTO valve cap. Tighten until solid feeling is encountered. From that point, apply one-sixth turn.

**WARNING:** Oil may be hot. Use extreme caution to assure that you do not accidentally come in contact with hot oil.
PTO Installation (Continued)

16. Install the PTO pressure switch onto port on the Hydraulic Valve Cap. Torque to 10-12 Lbs-ft (Fig. 58).

17. Connect wiring harness as shown on pages 42-49.

18. If installing a Chelsea Pump, see page 50 for pump installation and bolt torque specifications (249).

19. Reinstall the transmission electrical connection plug. Verify that the connector has a tactile click when reinstalling the connector. Failure to properly reinstall the connector can lead to transmission issues (Fig. 59) (249V).

20. Connect hydraulic hoses to pump inlet and pressure ports. Fill hydraulic tank with recommended hydraulic oil. Follow start up instructions on page 51.

249V Pump Porting
Inlet = SAE 24 ORB
Pressure = SAE 16 ORB

CAUTION: Do NOT start engine with 249V PTO and pump installed unless hydraulic system is connected and filled with oil. Failure to follow these instructions may result in PTO and pump damage.

Heat Shield Installation
Instructions for installing the Heat Shield are located in the Appendix on page 75.
Medium Duty F650 – MY2013-MY2015 – 6.8L Gas
249G Special Installation Instructions

Wiring Outside the Cab – Engine Compartment

1. Route the Chelsea blunt-cut wiring harness along the Ford main wiring harness in the engine compartment fire wall to the Ford blunt-cut SEIC customer access circuits (Fig. 60).

2. See pages 44 and 45 for complete blunt-cut wiring instructions.

3. Route the PTO solenoid connection and pressure switch connection wires parallel to the transmission linkage cable.

4. Make sure wiring is clear of driveline and exhaust.

Potentiometer Settings

Charts are located in the Appendix on pages 73-74.

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<thead>
<tr>
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<td>F250-550</td>
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<td>Chart III</td>
<td>Chart IV</td>
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<tr>
<td></td>
<td>Diesel</td>
<td></td>
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</tbody>
</table>
Hose Assembly Identification Chart

249F

20.25" +/- .25"

Transmission-to-PTO

Valve Cap

JIC4

329130-3X

JIC4

Wiring Installation (Shift Option B)

Medium Duty F650/750 – MY2016-MY2018 – 6.7L Diesel

249F w/o Electronic Overspeed Control (EOC)
Mobile to Stationary Switch

1. If required for your application a Single Pole Double Throw (SPDT) switch can be installed in the cab to control PTO function between Mobile Mode and SEIC Stationary Mode. Connect the Chelsea YELLOW wire as illustrated below.

Switching Between Stationary and Mobile

To switch between Mobile & Stationary Mode – Install a Single Pole Double Throw (SPDT) switch as shown:
Hose Assembly Identification Chart

249G

Transmission-to-PTO Valve Cap

Wiring Installation (Shift Option B)
Medium Duty F650 – MY2013-MY2015 – 6.8L Gas
249G w/o Electronic Overspeed Control (EOC)

Installation Kits:
- 329789X (Included)
- 329804X (249 Series)
- 329838X (249V Series)

Please Refer to pages 73-74 for Potentiometer Adjustment of Stationary Elevated Idle

329130-1X Hose Assembly
To 6R140 Transmission
High Pressure Port

385096 Grommet

380569 90° Elbow
To Solenoid Valve
To Pressure Switch

379502 Pressure Switch
Torque between 10-12 Lbs-ft.

329130-3X Hose Assembly
To 6R140 Transmission
High Pressure Port

FIREWALL PASS-THRU INSTALLATION

Slice Grommet & Insert in Hole Near Brake Fluid Reservoir Assembly

Purple Wire
Blue Wire
Black Wire
White Wire

Please Refer to page 45 for the Installation of the Connectors to the Truck

Black Wire w/ 3/8" Stud Size Ring Terminal Connect to Electrical Ground of Cab
Torque to 13-15 Lbs-ft.

Please Refer to page 45 for the Installation of the Connectors to the Truck
OUTSIDE CAB
INSIDE CAB

329789X Wiring Harness Assembly (Includes Wiring Harness, Mounting Bracket and Switch Indicator Light)

Installation Kits: 329789X (Included) 329804X (249 Series) 329838X (249V Series)
## Wiring Interface Configurations

<table>
<thead>
<tr>
<th>Chelsea PTO Wire Harness</th>
<th>Stationary Mode (Mobile Mode Not Available)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under Hood</td>
<td></td>
</tr>
<tr>
<td>Purple w/ Butt Connector (80&quot;)</td>
<td>Violet/Yellow</td>
</tr>
<tr>
<td>Purple w/ Ring Terminal (80&quot;)</td>
<td>Battery Junction Box Battery Connection Post</td>
</tr>
<tr>
<td>Under Dash</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>Ford Ground Circuit Black</td>
</tr>
<tr>
<td>Blue</td>
<td>12V Blue/Green</td>
</tr>
<tr>
<td>Purple</td>
<td>Violet/Yellow</td>
</tr>
<tr>
<td>White</td>
<td>Chelsea White Wire on 329789X Main Harness</td>
</tr>
</tbody>
</table>

### Under Hood

<table>
<thead>
<tr>
<th>75-P-38 Power Connection Harness</th>
<th>329789X Main Harness</th>
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</thead>
<tbody>
<tr>
<td>Green</td>
<td>PTO RPM</td>
</tr>
<tr>
<td>Blue/White</td>
<td>PTO RLY</td>
</tr>
<tr>
<td>Blue</td>
<td>PTO REQ2</td>
</tr>
<tr>
<td>Yellow</td>
<td>PTO REQ1</td>
</tr>
</tbody>
</table>

### Under Dash

| Black w/ Ring Terminal           | Chassis Ground In Dash |

See Appendix for more year specific wiring information.
Hose Assembly Identification Chart
249H

20.25" +/- .25"

Transmission-to-PTO Valve Cap

JIC4

329130-3X

JIC4

Wiring Installation Chart (Shift Option B)
Medium Duty F650/750 – MY2016-MY2018 – 6.8L Gas
249H w/o Electronic Overspeed Control (EOC)

Installation Kits:
329651X (249 Series)
329836X (249V Series)

Torque to 13-15 Lbs-ft

329130-3X Hose Assembly
Torque to 10-12 Lbs-ft

To 6R140 Transmission
High Pressure Port

Transmission-to-PTO Valve Cap

To Valve

Firewall Pass-Thru Installation
Slice Grommet, Insert in Hole in Clutch Master Cylinder Seal Assembly
Cut 1-3/8" Dia. Hole in Firewall Near Ford Clutch Master Cylinder Seal Assembly

379817 Grommet

3/8" Stud Size Ring Terminal

To Pressure Switch

Please Refer to Page 47 for the Installation of the Connectors to the Truck

379502 Pressure Switch Torque Bolt to 120-140 Lbs. In.

380569 90° Elbow

Torque to 13-15 Lbs-ft

22-P-124 Gasket

38" Stud Size Ring Terminal

Electrical Ground of Cab

249/249V Series Installation Sketches

GAS
**Wiring Installation Chart (Shift Option B)**

**Super Duty F250-550 – MY2017-MY2018 – 6.2/6.8L Gas**

**Medium Duty F650/750 – MY2016-MY2018 – 6.8L Gas**

249H w/o Electronic Overspeed Control (EOC)

---

**Super Duty F250-550 – (starting w/ MY2017)**

<table>
<thead>
<tr>
<th>Chelsea PTO Wire Harness</th>
<th>Passenger Side Kick Panel</th>
<th>Mobile Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stationary Mode</td>
<td>Mobile Mode</td>
</tr>
<tr>
<td></td>
<td>Function</td>
<td>Ford Wire Color</td>
</tr>
<tr>
<td>Yellow/Gray</td>
<td>12V Power</td>
<td>Green/Orange</td>
</tr>
<tr>
<td>Yellow/Blue</td>
<td>PTO REQ1</td>
<td>Yellow/Green</td>
</tr>
<tr>
<td></td>
<td>PTO REQ2</td>
<td>NOT USED</td>
</tr>
<tr>
<td>Yellow/Green</td>
<td>PTO VREF</td>
<td>Yellow/Green</td>
</tr>
<tr>
<td>Green</td>
<td>PTO RPM</td>
<td>Green</td>
</tr>
<tr>
<td>Yellow/Violet</td>
<td>PTO RTN</td>
<td>Yellow/Violet</td>
</tr>
<tr>
<td>Blue/White</td>
<td>PTO RELAY</td>
<td>Blue/White</td>
</tr>
</tbody>
</table>

**Medium Duty F650/750**

<table>
<thead>
<tr>
<th>Chelsea PTO Wire Harness</th>
<th>Driver Side behind Data Link</th>
<th>Mobile Mode (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stationary Mode</td>
<td>Mobile Mode</td>
</tr>
<tr>
<td></td>
<td>Function</td>
<td>Ford Wire Color</td>
</tr>
<tr>
<td>Yellow/Gray</td>
<td>12V Power</td>
<td>Yellow/Gray</td>
</tr>
<tr>
<td>Yellow/Blue</td>
<td>PTO REQ1</td>
<td>Yellow/Blue</td>
</tr>
<tr>
<td></td>
<td>PTO REQ2</td>
<td>2016 - Blue/Orange or Red (2)</td>
</tr>
<tr>
<td>Yellow/Green</td>
<td>PTO VREF</td>
<td>Yellow/Green</td>
</tr>
<tr>
<td>Green</td>
<td>PTO RPM</td>
<td>Green</td>
</tr>
<tr>
<td>Yellow/Violet</td>
<td>PTO RTN</td>
<td>Yellow/Violet</td>
</tr>
<tr>
<td>Blue/White</td>
<td>PTO RELAY</td>
<td>Blue/White</td>
</tr>
</tbody>
</table>

**NOTE:** The Blue wire in the Chelsea harness is not used in these model year chassis.

**NOTE:** (1) Mobile Mode is not available on the 2016 GAS Trucks.

**NOTE:** (2) Blue/Orange prior to March 2016. Blue/Red after March 2016.

See Appendix for more year specific wiring information.

**NOTE:**
Some early build 2016 6.8L gas F650/750 vehicles have 2 identically colored wires for PTO, which are located in the blunt cut harness under the driver side dash. They are Yellow/Green stripes. Use a voltmeter to identify which circuit you need:

- One wire has 0V to ground (PCM Pin C1551B-84 Circuit #CE912)
- One has +5V to ground (PTO VREF, PCM Pin 01551B-52 Circuit #LE424)
- Circuit CE912 will be changing to Yellow/Blue in later production.

**NOTE:**
Early build 2016 6.8L gas F650/750 vehicles (built before 10/22/15) have an incorrectly pinned customer access circuit. Circuit #CE326 is pinned in PCM connector #C175B PIN 96. This circuit should be located at PIN 98.

**SYMPTOMS:**
6.8L gas vehicles built before October 22, 2015 and not entering PTO mode due to circuit #CE326 not going to ground when all enabling conditions are met.

**CORRECTIVE ACTION:**
Upfitters and body builders who have a 6.8L gas vehicle built before October 22, 2015 and find that SEIC is exhibiting the symptoms above are advised to contact their local Ford Service center for corrective action per TSB 15-0180. The dealer will be able to determine if this TSB is applicable to the vehicle.

Vehicles built after 10/22/15 will have this circuit in the correct PCM connector cavity.
Wiring Installation (Shift Option K)

Medium Duty F650/750 – MY2016-MY2018 – 6.7L Diesel
Medium Duty F650/750 – MY2017-MY2018 – 6.8L Gas

249F/249H w/ Electronic Overspeed Control (EOC)
#Ford “F” Series

##249F w/ Electronic Overspeed Control (EOC)

<table>
<thead>
<tr>
<th>Chelsea PTO Wire Harness</th>
<th>Stationary Mode</th>
<th>Mobile Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Function</td>
<td>Ford Wire Color</td>
</tr>
<tr>
<td>White</td>
<td>PTO REF</td>
<td>White/Brown</td>
</tr>
<tr>
<td>Gray</td>
<td>PTO RTN</td>
<td>Gray/Violet</td>
</tr>
<tr>
<td>Green</td>
<td>PTO RPM</td>
<td>Green</td>
</tr>
<tr>
<td>Blue/White</td>
<td>PTO RLY</td>
<td>Blue/White</td>
</tr>
<tr>
<td>Black w/Ring Terminal</td>
<td></td>
<td>Chassis Ground</td>
</tr>
<tr>
<td>Yellow</td>
<td>PTO REQ1</td>
<td>Yellow/Green</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yellow/Green F250-550</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yellow/Blue F650/750</td>
</tr>
<tr>
<td>Blue</td>
<td>Chelsea EOC Blue Wire</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>Chelsea EOC Green Wire</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** (1) Early MY2011 Product Units may come with two Blunt Cut Blue w/Gray stripe wires. One wire will be for PTO Function (PTORS2) the other will be a Customer Wire for “Park Only Output” (TRO-P).

##Wiring Installation Chart (Shift Option K)


Medium Duty F650/750 – MY2016-MY2018 – 6.7L Diesel

<table>
<thead>
<tr>
<th>Chelsea PTO Wire Harness</th>
<th>Stationary Mode</th>
<th>Mobile Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Function</td>
<td>Ford Wire Color</td>
</tr>
<tr>
<td>White</td>
<td>PTO REF</td>
<td>Yellow/Green</td>
</tr>
<tr>
<td>Gray</td>
<td>PTO RTN</td>
<td>Yellow/Violet</td>
</tr>
<tr>
<td>Green</td>
<td>PTO RPM</td>
<td>Green</td>
</tr>
<tr>
<td>Blue/White</td>
<td>PTO RLY</td>
<td>Blue/White</td>
</tr>
<tr>
<td>Black w/Ring Terminal</td>
<td></td>
<td>Chassis Ground in Dash</td>
</tr>
<tr>
<td>Yellow</td>
<td>PTO REQ1</td>
<td>Yellow/Green F250-550</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yellow/Blue F650/750</td>
</tr>
<tr>
<td>Blue</td>
<td>Chelsea EOC Blue Wire</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>Chelsea EOC Green Wire</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** (1) Early MY2011 Product Units may come with two Blunt Cut Blue/Gray stripe wires. One wire will be for PTO Function (PTORS2) the other will be a Customer Wire for “Park Only Output” (TRO-P). 

##12V Power

<table>
<thead>
<tr>
<th>Chelsea EOC Wire</th>
<th>F250-550</th>
<th>F650/750</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ford Wire Color</td>
<td>Circuit</td>
</tr>
<tr>
<td>Red</td>
<td>2011-2016 12V White/Blue</td>
<td>#CDC64</td>
</tr>
<tr>
<td></td>
<td>2017-2018 12V Green/Orange</td>
<td>#CBP22</td>
</tr>
<tr>
<td>Black w/Ring Terminal</td>
<td>Ford Chassis Ground in Dash</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** (2) For Super Duty Trucks built after May 15, 2010. Super Duty Trucks built prior to May 15, 2010 this Ford wire is Yellow/Orange. Refer to Ford Body Builders website for more on this subject.

---

**Refer to Ford Body Builders website for more on this subject.**
Mounting CGP-P11 Pumps to PTO

The Parker/Chelsea CGP-P11 pumps listed below have a special pump flange designed to mount the pump to the 249 Series PTO 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 PTO 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 PTO.

45° hydraulic fittings are recommended to prevent shifter linkage interference.

329667X Kit

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Chelsea Pump Model</th>
<th>Pump Tag Number</th>
<th>Pump Mounting Kit</th>
<th>Bolt Number 2 per Pump</th>
<th>Bolt Size</th>
<th>Flat Washer (Qty.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>CGP-P11A016-5GC</td>
<td>334 9110 027</td>
<td>329418-2X</td>
<td>378431-31</td>
<td>.375&quot;-16 x 4.25&quot;</td>
<td>500365-26 (2)</td>
</tr>
<tr>
<td>26</td>
<td>CGP-P11A026-5GC</td>
<td>334 9110 028</td>
<td>329418-3X</td>
<td>378431-32</td>
<td>.375&quot;-16 x 4.50&quot;</td>
<td>500365-26 (2)</td>
</tr>
<tr>
<td>32</td>
<td>CGP-P11A032-5GC</td>
<td>334 9110 068</td>
<td>329665-3X</td>
<td>378431-33</td>
<td>.375&quot;-16 x 4.75&quot;</td>
<td>500365-26 (2)</td>
</tr>
<tr>
<td>37</td>
<td>CGP-P11A037-5GC</td>
<td>334 9110 029</td>
<td>329665-3X</td>
<td>378431-33</td>
<td>.375&quot;-16 x 4.75&quot;</td>
<td>500365-26 (2)</td>
</tr>
<tr>
<td>42</td>
<td>CGP-P11A042-5GC</td>
<td>334 9110 030</td>
<td>329418-6X</td>
<td>378431-34</td>
<td>.375&quot;-16 x 5.00&quot;</td>
<td>500365-26 (2)</td>
</tr>
<tr>
<td>55</td>
<td>CGP-P11A055-5GC</td>
<td>334 9110 031</td>
<td>329418-7X</td>
<td>378431-35</td>
<td>.375&quot;-16 x 5.25&quot;</td>
<td>500365-26 (2)</td>
</tr>
<tr>
<td>61</td>
<td>CGP-P11A061-5GE</td>
<td>334 9110 097</td>
<td>329418-8X</td>
<td>378431-36</td>
<td>.375&quot;-16 x 5.50&quot;</td>
<td>500365-26 (2)</td>
</tr>
<tr>
<td>71</td>
<td>CGP-P11A071-5GE</td>
<td>334 9110 098</td>
<td>329665-7X</td>
<td>378431-37</td>
<td>.375&quot;-16 x 5.75&quot;</td>
<td>500365-26 (2)</td>
</tr>
<tr>
<td>82</td>
<td>CGP-P11A082-5GE</td>
<td>334 9110 099</td>
<td>329665-8X</td>
<td>378431-38</td>
<td>.375&quot;-15 x 6.00&quot;</td>
<td>500365-26 (2)</td>
</tr>
<tr>
<td>87</td>
<td>CGP-P11A087-5GE</td>
<td>334 9110 100</td>
<td>329665-8X</td>
<td>378431-38</td>
<td>.375&quot;-15 x 6.00&quot;</td>
<td>500365-26 (2)</td>
</tr>
</tbody>
</table>

NOTE: Torque Pump Mounting Bolts between 35-36 lbs-ft [48-52 Nm]

CAUTION: Failure to Torque pump bolts to the correct specifications may result in poor pump performance and/or premature failure.
General
All DENISON by Parker vane pumps & motors are individually tested to provide the best quality & reliability. Modifications, conversions & repairs can only be done by authorized dealers or OEM to avoid invalidation of the guarantee.

The pumps & motors are to be used in the design limits indicated in all the sales bulletins.

Do not modify or work on the pump under pressure or when the engine is on. Qualified personnel are required to assemble and set-up hydraulic devices.

Always conform to regulations (safety, electrical, environment).

The following instructions are important to follow to obtain good service life from the unit.

Rotation & Ports Indication
■ The rotation and ports orientation are viewed from the shaft end.
■ CW stands for clockwise, right-hand rotation.
■ CCW stands for counter-clockwise, left-hand rotation.

Start-Up Check-Up
Check that the assembly of the power unit is correct:
The distance between the suction pipe & the return lines in the tank should be as great as possible.

A bevel on both suction & return lines is recommended to increase the surface and so lower the velocity. We suggest a 45° minimum angle.

Velocities:
inlet $0.5 < x < 1.9$ m/s $(164 < x < 6.23$ ft per sec.)
return $x < 6$ m/s $(x < 19.7$ ft per sec.)

Always insure that all return and suction lines are under the oil level to avoid forming aeration or vortex effect. This should be done under the most critical situation (all cylinders extended for example). Straight and short pipes are the best.

$$V = \frac{Q \text{ (Lpm)}}{6 \pi x r^2 \text{ (cm)}} = \text{m/s}$$
$$V = \frac{Q \text{ (GPM)}}{3.12 \pi x r^2 \text{ (in)}} = \text{ft/s}$$

The size of the air filter should be 3 times greater than the max. instant return flow (all cylinders in movement for example).

DENISON does not recommend inlet strainers. If needed, a 100 mesh (149 microns) is the finest mesh recommended.

Make sure that all protective plugs & covers have been removed.
Start-Up Instructions (249V Series Only) (Continued)

Start-up:
- The tank has been filled up with a clean fluid in proper conditions.
- Flushing the system with an external pump prior to the start-up is good.
- To allow a good priming of the pump, the air should be bled off.
- The first valve on the circuit should be open to tank.
- Air bleed off valves are available on the market place.
- It is possible to bleed off the air by creating a leak in the P port of the pump.

**WARNING:** This has to be done in low pressure mode as it could create a dangerous fluid leak. Make sure that the pressure cannot rise (open center valve to tank, pressure relief valve unloaded).

- When oil free of air appears, tighten the connectors to the correct torque.
- The pump should prime within a few seconds. If not, please read the troubleshooting guide (pages 59-62).
- If the pump is noisy, please troubleshoot the system.
- Never operate the pump at top speed and pressure without checking the completion of pump priming.

<table>
<thead>
<tr>
<th>Model Code</th>
<th>Chelsea Number</th>
<th>Displacement in³/rev</th>
<th>GPM (D)</th>
<th>Pump (D) HP</th>
<th>Max Pressure PSI</th>
<th>Speed RPM</th>
<th>Max Speed RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>08</td>
<td>380418-08</td>
<td>1.61</td>
<td>9.33</td>
<td>19</td>
<td>400</td>
<td>3500</td>
<td>400 2880 2015</td>
</tr>
<tr>
<td>10</td>
<td>380418-10</td>
<td>2.08</td>
<td>12.06</td>
<td>25</td>
<td>400</td>
<td>3500</td>
<td>400 2880 2015</td>
</tr>
<tr>
<td>12</td>
<td>380418-12</td>
<td>2.26</td>
<td>13.10</td>
<td>27</td>
<td>400</td>
<td>3500</td>
<td>400 2880 2015</td>
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<td>14</td>
<td>380418-14</td>
<td>2.81</td>
<td>16.29</td>
<td>33</td>
<td>400</td>
<td>3500</td>
<td>400 2880 2015</td>
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<tr>
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<td>20.64</td>
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<td>3500</td>
<td>400 2880 2015</td>
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<tr>
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<td>22.55</td>
<td>46</td>
<td>400</td>
<td>3500</td>
<td>400 2880 2015</td>
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<tr>
<td>22</td>
<td>380418-22</td>
<td>4.29</td>
<td>24.87</td>
<td>51</td>
<td>400</td>
<td>3500</td>
<td>400 2880 2015</td>
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<tr>
<td>25</td>
<td>380418-25</td>
<td>4.84</td>
<td>28.06</td>
<td>57</td>
<td>400</td>
<td>3500</td>
<td>400 2880 2015</td>
</tr>
</tbody>
</table>

(A) GPM & Pump Input HP @ 1200 Engine RPM (1488 PTO Output RPM - 124% Ratio) & Continuous Pressure Rating with 90% efficiency rating considered.
(B) Max Engine Speed = (Max Pump Speed) / (1.24) for PTO Ratio Increase. Max Speed determined by Max PTO output speed of 2500.
(D) GPM & Pump Input HP @ 1200 Engine RPM (1488 PTO Output RPM - 124% Ratio) & 2000 PSI Continuous Pressure Rating.

CAUTION: 249V Pump Options: The PTO drive gear delivers up to 250 Lbs. ft. torque to the aftermarket PTO, and can manage the heat of 60 HP continuously. Higher horsepower can be delivered, but for shorter durations depending on the amount of power required. Ref: Ford Body Builders Manual; TorqShift Automatic Transmission.


FORMULAS:
GPM = Cu. In. x .004329 = G/Rev x 1488 RPMs x .90 efficiency
HP = (GPM x Max PSI) / 1714
Torque = (HP x 5252) / 1488 RPMs

This symbol warns of possible personal injury.
Minimum Inlet Pressure
Please read the charts in the sales leaflets as the minimum requested inlet pressure varies versus the displacement and the speed. Never go under 0.8 bar Absolute (-0.2 bar relative) 11.6 PSI Absolute (-2.9 PSI G).

Maximum Inlet Pressure
It is recommended to always have at least 1.5 bar (22 PSI) differential between inlet and outlet. Standard shaft seals are limited to 0.7 bar (10 PSI G) but some allow 7 bar (100 PSI G).

Minimum Allowable Inlet Pressure (PSI Absolute)

<table>
<thead>
<tr>
<th>Cartridge Size</th>
<th>1200</th>
<th>1500</th>
<th>1800</th>
<th>2100</th>
<th>2200</th>
<th>2300</th>
<th>2500</th>
</tr>
</thead>
<tbody>
<tr>
<td>08</td>
<td>11.6</td>
<td>11.6</td>
<td>11.6</td>
<td>11.6</td>
<td>11.6</td>
<td>12.3</td>
<td>13.7</td>
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<td>11.6</td>
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<td>13.0</td>
<td>13.7</td>
<td>13.7</td>
<td>15.2</td>
</tr>
</tbody>
</table>

Inlet pressure is measured at inlet flange with petroleum base fluids at viscosity between 60 and 300 SUS. The difference between inlet pressure at the pressure at the pump flange and atmosphere pressure must not exceed 2.9 PSI to prevent aeration.

Multiply absolute pressure by 1.25 for HF-3, HF-4 fluid by 1.35 for HF-5 fluid by 1.10 for ester or rapeseed base.

Minimum Outlet Pressure
It is recommended to always have at least 1.5 bar (22 PSI) differential between inlet and outlet.

Fluids:

DENISON Classifications
Types of fluids: For all types of fluids, DENISON’s products have different pressures, speeds & temperature limits. Please refer to the sales leaflets for a DENISON T6C Vane Pump.

- HF-0 = Anti-wear petroleum base.
- HF-1 = Non anti-wear petroleum base.
- HF-2 = Anti-wear petroleum base.
- HF-3 = Water-in-oil invert emulsions.
- HF-4 = Water glycol solutions.
- HF-5 = Synthetic fluids.

Filtration Recommendations
- NAS 1638 class 8 or better.
- ISO 18 / 14 or better.

Inlet strainers: DENISON does not recommend inlet strainers. If requested, a 100 mesh (149 microns) is the finest mesh recommended.
Recommended Fluids
Petroleum based antiwear R & O fluids. These fluids are the recommended fluids for pumps & motors. Maximum catalog ratings and performance data are based on operation with these fluids. These fluids are covered by DENISON Hydraulics HF-0 and HF-2 specifications.

For optimum performance, Chelsea recommends Parker DuraClean™ Premium Hydraulic Fluid available from Parker Hydraulic Filter Division. For more information about DuraClean, visit www.Parker.com or contact Hydraulic Filter Division by email at HFDinsideSales@parker.com.

Acceptable Alternate Fluids
The use of fluids other than petroleum based antiwear R & O fluids requires that the maximum ratings of the pumps will be reduced. In some cases the minimum replenishment pressures must be increased.

Viscosity

<table>
<thead>
<tr>
<th>Max. (cold start, low speed &amp; pressure)</th>
<th>Mobile</th>
<th>Industrial</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 cSt - 9400 SUS</td>
<td>860 cSt - 3900 SUS</td>
<td></td>
</tr>
<tr>
<td>Max. (full speed &amp; pressure)</td>
<td>108 cSt - 500 SUS</td>
<td>108 cSt - 500 SUS</td>
</tr>
<tr>
<td>Optimum (max. life)</td>
<td>30 cSt - 140 SUS</td>
<td>30 cSt - 140 SUS</td>
</tr>
<tr>
<td>Min. (full speed &amp; pressure for HF-1, HF-3, HF-4 &amp; HF-5 fluids)</td>
<td>18 cSt - 90 SUS</td>
<td>18 cSt - 90 SUS</td>
</tr>
<tr>
<td>Min. (full speed &amp; pressure for HF-0 &amp; HF-2 fluids)</td>
<td>10 cSt - 60 SUS</td>
<td>10 cSt - 60 SUS</td>
</tr>
</tbody>
</table>

Viscosity Index
90 min. Higher values extend the range of operating temperatures.

Temperatures
The usual limiting factor of temperature (low or high) comes from the obtained viscosity. The seals are sometimes the limit: standard seals range from -30° C to 90° C (-9.4° F to 194° F).

<table>
<thead>
<tr>
<th>Maximum fluid temperature (Ø)</th>
<th>° C</th>
<th>° F</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF-0, HF-1, HF-2</td>
<td>+100</td>
<td>+212</td>
</tr>
<tr>
<td>HF-3, HF-4</td>
<td>+50</td>
<td>+122</td>
</tr>
<tr>
<td>HF-5</td>
<td>+70</td>
<td>+158</td>
</tr>
<tr>
<td>Biodegradable fluids (esters &amp; rapeseed base)</td>
<td>+65</td>
<td>+149</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Minimum fluid temperature (Ø) (also depend on max. viscosity)</th>
<th>° C</th>
<th>° F</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF-0, HF-1, HF-2, HF-5</td>
<td>-18</td>
<td>-0.4</td>
</tr>
<tr>
<td>HF-3, HF-4</td>
<td>+10</td>
<td>+50</td>
</tr>
<tr>
<td>Biodegradable fluids (esters &amp; rapeseed base)</td>
<td>-20</td>
<td>-4</td>
</tr>
</tbody>
</table>

Over or under these values, please contact DENISON.

Water Contamination in the Fluid
Maximum acceptable content of water:
- 0.10 % for mineral base fluids.
- 0.05 % for synthetic fluids, crankcase oils, biodegradable fluids.
If the amount of water is higher, then it should be drained off the circuit.
WARNING: The purpose of the two screws is just to hold the cartridge together. When tightening them, check the rotation of the rotor & vane assembly.
Start-Up Instructions (249V Series Only) (Continued)

Cartridge Replacement

Removal

1. Lay the PTO/Pump on the table (Fig. 61).

**NOTE:** PTO must be supported on table.

![Figure 61](image)

2. Unscrew the 4-Bolts (Fig. 62).

![Figure 62](image)

3. Remove the housing (Fig. 63).

![Figure 63](image)

**WARNING:** This seal can sometimes stay in the housing.

This symbol warns of possible personal injury.
Cartridge Replacement (Continued)

4. Disassemble the cartridge / front cap with an extractor (Fig. 64).

5. Remove cartridge from shaft (Fig. 65).

**WARNING:** If you want to reassemble a new cartridge (Fig. 66).

Installation

6. Fit the cartridge into the housing (Fig. 66).
7. Check if the dowel pin is in its position in the housing by trying to rotate the cartridge (Fig. 67).

⚠️ **WARNING:** Put some grease on the seals to prevent them from moving. If the cartridge does rotate, the dowel pin is not in the hole. Take the cartridge out and try again.

If the cartridge does not fit in the housing correctly, check the concentricity of the three elements = port plates (rear & pressure) & cam ring.

⚠️ **WARNING:** Never use a hammer. The cartridge is to fit into the housing without any tools (Fig. 68).

8. Assemble the front cap ass’y on the housing & cartridge ass’y (Fig. 69).

⚠️ **WARNING:** Position the shaft / front cap ass’y only if the cartridge is well positioned, dowel pin in the housing dowel pin hole. Put some grease on the seals to prevent them from moving.

9. Final ass’y (Fig. 70).
   a. Always check if the shaft rotates freely. If not, disassemble and go back to the previous step.
   b. Flip/rotate the pump to fit the 4 screws.
   c. Fix the pump to the PTO before tightening the pump’s bolts.
   d. Check the porting configuration.
   e. Tighten the 4-Bolts. Step by step to avoid damaging the seals (Fig. 71).
   f. Always check if the shaft rotates freely. If not, disassemble and go back to the previous step.

**Torque Requirements.**

| 80-85 lbs-ft | 108-115 Nm |

⚠️ This symbol warns of possible personal injury.
Vane Pump Troubleshooting Guide

1. No flow, no pressure
   a. Is the pump rotating?
      a-1. Check if the coupling is rotating. If not, check the rotation of the electric motor.
      a-2. Check the keys of the pump and E motor shaft.
      a-3. Check if the shaft is not broken.
   b. Is the rotation in the correct direction?
      b-1. Check if the rotation of the pump corresponds to the arrow on the name plate.
      b-2. Check if the wiring of the electric motor is correct.
   c. Is the air bleed-off done?
      c-1. Check that no air is still located in the pressure line. Loosen a connector.
   d. How are the inlet conditions?
      d-1. Check if the inlet gate valve is not closed.
      d-2. Check the oil level.
      d-3. Check if the inlet hose in the tank is under the oil tank level.
      d-4. Check if an air intake is not disturbing the inlet (missing inlet flange seal, air trapped in suction line as examples).
      d-5. Check if the pump is not located too high above the oil level.
      d-6. Check if the tank is not completely sealed. Then the lack of atmospheric pressure will not allow the pump to prime.
      d-7. Check if all connections and seals are air-tight.
   e. Is the Viscosity not too high?
      e-1. Check if the oil characteristics are not incompatible with the temperature and the pumps requirements. Too high Viscosity will “stick” the vane fluid and enable the pump to suck the oil correctly.
   f. Is the pump flow not going somewhere else?
      f-1. Check the hydraulic circuit and the main sequences. Doing so, you will check if all the valves are set or work properly.
      f-2. Check if the main relief valve is not set at an extremely low pressure and therefore bringing all the flow back to the tank.
      f-3. Check if in the directional valves the spools are not sticking in a position that brings the flow back to the tank.
      f-4. Check if the check valve is not mounted “upside down”.
   g. Is the receptor working correctly?
      g-1. Check if the motor does not let all the flow leak internally.
      g-2. Check if the cylinder inner seals are not ruined.
   h. Is the speed high enough?
      h-1. Check if the minimum speed is reached. Mobile pumps require 400 RPM and industrial pumps require 600 RPM.
Vane Pump Troubleshooting Guide (Continued)

2. Not enough flow (or not the flow required)
   a. Are the components OK?
      a-1. Check the displacement of the pump.
      a-2. Check if the speed of the pump is not too low or too high (E motor or thermic engine sized too small so dropping the speed too low).
      a-3. Check if the main relief valve is not set at an extremely low pressure and therefore venting some flow back to the tank.
      a-4. Check if in the directional valves the spools are not sticking in a position that brings part of the flow back to the tank.
      a-5. Check if the hydraulic motor is not leaking internally due to a bad efficiency, low viscosity.
      a-6. Check if the cylinder inner seals are not ruined and therefore allow internal leakage.

   b. Is the connection from the tank to the pump correct?
      b-1. Check if there is no air intake between the pump and the inlet pipe (bad seals for example).
      b-2. Check if the inlet hose is convenient for the required velocity (0,5 < V < 1,9 m/s).
      b-3. Check if the pump is not too high compared to the oil level or if the pump is not too far from the tank (check the inlet absolute pressure with the catalog values).
      b-4. Check if the gate valve is not semi-open.
      b-5. Check if the inlet strainer is sized correctly (250 m mesh mini.) or not clogged.

   c. Is the tank design correct?
      c-1. Check if the oil level is correct.
      c-2. Check if the suction pipe is under the oil level during the complete cycle of the machine.
      c-3. Check if the inlet hose fitted in the tank is cut with an angle wider than 45°.
      c-4. Check if this inlet hose is not too close to the tank wall or to the bottom of the tank and therefore limits the “vane flow”.
      c-5. Check if the suction hose is not located near the return line and therefore sucking a lot of air coming from these turbulences.
      c-6. Check if baffles are required to allow correct aeration of the fluid.
      c-7. Check if the air filter is not clogged or undersized (not well dimensioned).
      c-8. Check if the tank is not fully tight, not allowing the atmospheric pressure to apply.

   d. Is the oil convenient?
      d-1. Check if the oil characteristics are not incompatible with the pumps requirements.
      d-2. Check if the viscosity is not too high, therefore “sticking” some vanes in the rotor or blocking the vane fluid.
      d-3. Check if the high temperature does not destroy the viscosity of the fluid. Doing so, the internal leakage will “consume” the flow.
Vane Troubleshooting Guide (Continued)

3. No pressure
   a. Is the hydraulic circuit correctly designed?
      a-1. Check the hydraulic circuit schematic.

   b. Is the circuit correctly piped?
      b-1. Compare the schematic to the piped circuit.

   c. Are the components working properly?
      c-1. Check the main sequences. Doing so, you will check if all the valves are set or work properly.
      c-2. Check if the main relief valve is not set at an extremely low pressure and therefore bringing all the flow back to the tank.
      c-3. Check if in the directional valves the spools are not sticking in a position that brings the flow back to the tank.

4. Not enough pressure
   a. Check as when “no pressure” 3.

   b. Is the system well dimensioned?
      b-1. Check if the flow required is not over the available flow and therefore cannot build-up pressure.

   c. Is there an internal leakage somewhere that maintains a certain pressure?
      c-1. Check all the possible faulty components, from the pump to all the receptors and intermediates (high pressure seals, mechanical wear).

5. Uncommon noise level
   a. Is the noise coming from the pump?
      a-1. Check the mechanical link of the pump shaft: alignment, balancing of the coupling or Universal joint, key properly fastened.
      a-2. Check if the air bleed has been done correctly.
      a-3. Check if there is no air intake from the tank to the pump (nor through the shaft seal).
      a-4. Check if the hose strain force does not create this noise.
      a-5. Check if the oil level is correct.
      a-6. Check if the oil in the tank is not aerated.
      a-7. Check if the strainer is not clogged or under-dimensioned.
      a-8. Check if the inlet pipe is under the oil level.
      a-9. Check if the air filter is not clogged or too small.
      a-10. Check if the speed is not incompatible with the catalog values.
      a-11. Check if the oil is compatible with the catalog recommendations.
      a-12. Check if the inlet pressure is not higher than the outlet pressure.

   b. Is the noise coming from the surroundings?
      b-1. Check the hoses and see if the noise in not coming back to the pump this way.
      b-2. Check the pressure piping and see if its length dumps or amplifies the noise.
      b-3. Check if the structure of the tank is stiff enough to avoid amplification / resonance.
      b-4. Check the E motor fan.
      b-5. Check the balancing of the E motor.
      b-6. Check the water cooler and its theoretical limits.
      b-7. Check the filtration unit, its capacity and if the noise does not come from the opened by-pass valve.
Vane Troubleshooting Guide (Continued)

6. Unusual heat level
   a. Does the heat appear when the pump is running without pressure?
      a-1. Check the oil level and the suction pipe. Is the oil coming to the pump (check the length of the pipe, its internal diameter, all that could influence the inlet pressure)?
      a-2. Check if the air bleed has been done correctly.
      a-3. Check if the flow versus the volume of oil in the tank is correct to obtain a good cooling effect.
      a-4. Check if a cooler is required or, if there is one, if it is well dimensioned.
      a-5. If there is a cooler, check if it is working (example for water cooler: is the water flow open or sufficient).
      a-6. Check if the hydraulic circuit is not bringing back the flow directly to the inlet port. Doing so, it would create a very small closed circuit not able to cool down the fluid.
      a-7. Check the quality of the fluid.
      a-8. Check the velocity of the fluid.
      a-9. Check the filtration unit, its capacity and if the heat does not come from the open by-pass valve or if it is under-dimensioned (bigger delta P).

   b. Does the heat appear when the pump is running with pressure?
      b-1. Check the viscosity.
      b-2. Check the pressure rating.
      b-3. Check if the cooler is working correctly or well dimensioned.
      b-4. Check if the relief valve is not creating this heat because always open.
      b-5. Check if any other component in the system is not creating this heat due to an internal defect.
      b-6. Check if there is a big temperature differential between the inlet and the outlet.

7. Shaft seal leakage
   a. Is the seal destroyed?
      a-1. Check the alignment and the correct power transmission (non homokinetic movement, high radial force as examples).
      a-2. Check the inlet pressure and compare it to the catalog values.
      a-3. Check if the bad suction conditions do not create a vacuum that could even reverse the seal lip.
      a-4. Check if the external environment is not too dirty and therefore ruining the seal.

   b. Is the seal only leaking?
      b-1. Check the alignment of the front shaft and check if there is not any radial load.
      b-2. Check if seal lip has not been cut during a maintenance operation.
      b-3. Check if the inlet pressure is not over or under the catalog values. This has to be done for the whole cycle because the inlet pressure can vary from time to time.
      b-4. Check if the seal material has not been modified because of a too warm environment. The seal can vulcanize and stop sealing correctly.
      b-5. Check the acidity of the oil that can “burn” the seals material. It will therefore destroy the elasticity of the sealing.
      b-6. Check if the chosen seal (high pressure seal for example) is not too stiff for the use. If the environment requires some elasticity due to a gentle misalignment, a high pressure seal will not be able to follow the movement and therefore leak.
272-FORD

FORD TorqShift®
6R140 Transmission

Medium Duty F650/750
6.7L Diesel MY2016-MY2018
6.8L Gas MY2016-MY2018
Mounting the PTO

1. Remove the PTO aperture cover plate (Fig. 72).

2. Discard the cover plate and set gasket aside. Ensure aperture surface is clean (Fig. 73).

3. Install the studs (Fig. 74) hand tight in the PTO aperture pad using a stud driver. Do not use air tools to install studs.

**CAUTION:** Over tightening of the studs or running the shoulder past the transmission mounting surface may damage stud and/or transmission threads (Fig. 75).

**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.

4. Slide the gasket supplied with the transmission over the dowels on to the geared adapter.

5. Install the geared adapter into the transmission aperture over the studs (Fig. 76).

6. Install the gasket supplied with the PTO over the studs and against the geared adapter (Fig. 76a).
Mounting the PTO (Continued)

7. Install the PTO over the studs and secure the PTO with the self-locking nuts provided with the PTO (Fig. 77).

NOTE: Self-locking nuts do not require lock washers (Fig. 78).

8. Torque the self-locking nuts in a crossing pattern to their proper specifications (Fig. 79).

TORQUE SPECS:
Self-Locking Nuts - 35-40 lbs-ft [47-54 Nm]

Hose Assembly Identification

![Hose Assembly Diagram](image-url)
Wiring Chart (Shift Option B)
Medium Duty F650/750 – MY2016-MY2018 – 6.7L Diesel
Medium Duty F650/750 – MY2016-MY2018 – 6.8L Gas
272F & 272H w/o Electronic Overspeed Control (EOC)
Mobile to Stationary Switch

1. If required for your application a Single Pole Double Throw (SPDT) switch can be installed in the cab to control PTO function between Mobile Mode and SEIC Stationary Mode. Connect the Chelsea YELLOW wire as illustrated below.

Switching Between Stationary and Mobile

To switch between Mobile & Stationary Mode – Install a Single Pole Double Throw (SPDT) switch as shown:
Wiring Chart (Shift Option K)
Medium Duty F650/750 – MY2016-MY2018 – 6.7L Diesel
Medium Duty F650/750 – MY2017-MY2018 – 6.8L Gas
272F & 272H w/ Electronic Overspeed Control (EOC)
### Wiring Installation Chart (Shift Option K)  
**Medium Duty F650/750 – MY2016-MY2018 – 6.7L Diesel**  
**272F w/ Electronic Overspeed Control (EOC)**

<table>
<thead>
<tr>
<th>Chelsea PTO Wire Harness</th>
<th>Stationary Mode</th>
<th>Mobile Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Ford Wire Color</td>
<td>Circuit</td>
</tr>
<tr>
<td><strong>White</strong> PTO REF</td>
<td>White/Brown</td>
<td>#LE434</td>
</tr>
<tr>
<td><strong>Gray</strong> PTO RTN</td>
<td>Gray/Violet</td>
<td>#RE327</td>
</tr>
<tr>
<td><strong>Green</strong> PTO RPM</td>
<td>Green</td>
<td>#CE914</td>
</tr>
<tr>
<td><strong>Blue/White</strong> PTO RLY</td>
<td>Blue/White</td>
<td>#CE326</td>
</tr>
</tbody>
</table>

| Black w/Ring Terminal    | Chassis Ground  | Chassis Ground | **Blue/Orange** (Before March 2016) | Chassis Ground  | Chassis Ground |
| **Yellow** PTO REQ1      | Yellow/Green    | #CE912        | **PTO REQ2**              | Blue/Orange     | #CE933       |

**NOTE:** Early MY2011 Product Units may come with two Blunt Cut Blue/Gray Stripe wires. One wire will be for PTO Function (PTORS2) the other will be a Customer Wire for “Park Only Output” (TRO-P).

**NOTE:** EOC not available for MY2016 & Prior. Refer to Ford Body Builders web site for more on this subject.

---

### Wiring Installation Chart (Shift Option K)  
**Medium Duty F650/750 – MY2017-MY2018 – 6.8L Gas**  
**272H w/ Electronic Overspeed Control (EOC)**

<table>
<thead>
<tr>
<th>Chelsea PTO Wire Harness</th>
<th>Stationary Mode</th>
<th>Mobile Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Ford Wire Color</td>
<td>Circuit</td>
</tr>
<tr>
<td><strong>White</strong> PTO REF</td>
<td>Yellow/Green</td>
<td>#LE424</td>
</tr>
<tr>
<td><strong>Gray</strong> PTO RTN</td>
<td>Yellow/Violet</td>
<td>#RE407</td>
</tr>
<tr>
<td><strong>Green</strong> PTO RPM</td>
<td>Green</td>
<td>#CE914</td>
</tr>
<tr>
<td><strong>Blue/White</strong> PTO RLY</td>
<td>Blue/White</td>
<td>#CE326</td>
</tr>
</tbody>
</table>

| Black w/Ring Terminal    | Chassis Ground  | Chassis Ground | **Blue/Orange** (↑) | Chassis Ground  | Chassis Ground |
| **Yellow** PTO REQ1      | Yellow/Green   | #CE912        | **PTO REQ2**              | Blue/Orange     | #CE933       |

**NOTE:** Early MY2011 Product Units may come with two Blunt Cut Blue w/Gray Stripe wires. One wire will be for PTO Function (PTORS2) the other will be a Customer Wire for “Park Only Output” (TRO-P).

**NOTE:** EOC not available for MY2016 & Prior. Refer to Ford Body Builders web site for more on this subject.

<table>
<thead>
<tr>
<th>12V Power</th>
<th>Stationary Mode or Mobile Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chelsea EOC Wire</td>
<td>F650/750</td>
</tr>
<tr>
<td>Red Wire</td>
<td>2016-2018 #CBB35 Yellow/Gray</td>
</tr>
<tr>
<td>Black w/Ring Terminal</td>
<td>Chassis Ground</td>
</tr>
</tbody>
</table>
Wiring Chart (Shift Option B)
Medium Duty F650 – MY2012-MY2015 – 6.8L Gas
272J w/o Electronic Overspeed Control (EOC)
### Wiring Interface Configurations

<table>
<thead>
<tr>
<th>Chelsea PTO Wire Harness</th>
<th>Stationary Mode (Mobile Mode Not Available)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under Hood</td>
<td></td>
</tr>
<tr>
<td>Purple w/ Butt Connector (80&quot;)</td>
<td>Violet/Yellow #870</td>
</tr>
<tr>
<td>Purple w/ Ring Terminal (80&quot;)</td>
<td>Battery Junction Box Battery Connection Post</td>
</tr>
<tr>
<td>Under Dash</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>Ford Ground Circuit Black #57</td>
</tr>
<tr>
<td>Blue</td>
<td>12V Blue/Green</td>
</tr>
<tr>
<td>Purple</td>
<td>Violet/Yellow #870</td>
</tr>
<tr>
<td>White</td>
<td>Chelsea White Wire on 329789X Main Harness</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>75-P-38 Power Connection Harness</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Under Hood</td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td>PTO RPM Ford Circuit (Green) #CE914</td>
</tr>
<tr>
<td>Blue/White</td>
<td>PTO RLY Ford Circuit (Blue/White) #CE326</td>
</tr>
<tr>
<td>Blue</td>
<td>PTO REQ2 Blue/Orange or Blue/Red (eff. March 2016) #CE933</td>
</tr>
<tr>
<td>Yellow</td>
<td>PTO REQ1 Yellow/Green #CE912</td>
</tr>
</tbody>
</table>

| Under Dash                       |                                                     |
| Black w/ Ring Terminal           | Chassis Ground                                      |

See Appendix for more year specific wiring information.
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 PTO MAINTENANCE is required by the owner/operator to ensure proper, safe and trouble free operation.

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

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

With regards to the direct mounted pump splines, the PTO requires the application of a specially formulated anti-fretting, high pressure, high temperature grease. The addition of the grease has been proven to reduce the effects of the torsional vibrations, which result in fretting corrosion on the PTO internal splines as well as the pump external splines. Fretting corrosion appears as a “rusting and wearing” of the pump shaft splines. Severe duty applications, which require long PTO running times and high torque may require more frequent regreasing. Applications such as Utility Trucks that run continuously and are lightly loaded also require frequent regreasing due to the sheer hours of running time. It is important to note that service intervals will vary for each and every application and are the responsibility of the end user of the product. Chelsea also recommends that you consult your pump 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 PTO, and the second is a 14-ounce grease cartridge (379831).

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

### Chart I

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Super Duty</td>
<td>Gas</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart III</td>
<td>Chart IV</td>
</tr>
<tr>
<td>F250-550</td>
<td>Diesel</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart II</td>
<td>Chart II</td>
<td>Chart II</td>
<td>Chart II</td>
<td>Chart II</td>
<td>Chart III</td>
<td>Chart IV</td>
</tr>
<tr>
<td>Medium Duty</td>
<td>Gas</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart I</td>
<td>Chart III</td>
<td>Chart IV</td>
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<td>Diesel</td>
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#### Engine Target Speed (RPM) | Resistor (Ohms) | Voltage (Volts)
--- | --- | ---
650 (Base) | Open Circuit* | 
900 | 3.9K | 3.61 |
912 | 2.7K | 4.18 |
1024 | 1.8K | 4.8 |
1056 | 1.5K | 5.39 |
1184 | 1.0K | 6.76 |
1264 | 820 | 7.43 |
1536 | 680 | 8.06 |
1648 | 560 | 8.7 |
1712 | 470 | 9.25 |
1792 | 380 | 9.89 |
1904 | 330 | 10.27 |
2000 | 279 | 10.75 |
2064 | 220 | 11.2 |
2128 | 180 | 11.6 |
2160 | 150 | 11.9 |
2206 | 120 | 12.23 |
2256 | 100 | 12.46 |
2320 | 0 (Closed Circuit) | 13.77 |

* TorqShift automatic transmission only; manual transmission requires a resistor.

#### Chart II

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<tr>
<td>1200</td>
<td>20K</td>
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* Voltage Reading - Chelsea Wiring Harness “PTO_RPM” Green Wire
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### Chart III (Continued)

<table>
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</thead>
<tbody>
<tr>
<td>680 (Base)</td>
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<tr>
<td>700</td>
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<td>2800</td>
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**NOTE:** Voltages are exact to achieve RPM shown. Resistors are standard 5% values (1 watt) and yield RPM values +/- 32 rpm.
Installing the PTO Heat Shield – GAS Engines ONLY (After April 2017)

Heat Shield A
1. Locate and unplug the O₂ sensor.
2. Install heat shield (A) with the hole over the O₂ sensor.
3. Wrap heat shield around the exhaust pipe overlapping the seam. Seam should be facing the ground.
4. Make sure heat shield is snug against the bend at the forward end of the heat shield.
5. Install (8) clamps as shown in (Fig. 72).

Heat Shield B
1. Install piece (B) on the downward bend of the exhaust pipe adjacent to heat shield (A).
2. Lap ears of heat shield (B) over the ears of heat shield (A).
3. Seam of heat shield (B) should be facing forward of the truck.
4. Install (4) clamps as shown in (Fig. 72).

Installing the PTO Heat Shield – GAS Engines ONLY (Prior to April 2017)

1. Locate the Ford O₂ sensor located on the inside of the vertical exhaust pipe, located on the PTO side (approximately 3-4 inches above the top of the PTO) (Fig. 73).
2. Wrap the top of the heat shield material around the pipe just below the O₂ sensor, with the open end of the heat shield opposite the PTO (Fig. 74).
3. Secure (1) stainless steel clamp around the top of the heat shield, leaving approximately 1.0" of heat shield material exposed at the top of the clamp (Fig. 74).
4. Secure the second clamp at the 90 degree bend of the pipe. Insure that the heat shield material is tight with the seam (split) remaining on the back side of the pipe opposite the PTO.
5. Install the third clamp equal distance between the 1st clamp and the 2nd clamp (elbow clamp).
6. Secure the fourth clamp approximately 8.0" to the right of the 90° elbow.
7. Attach the fifth clamp approximately 8.0" from clamp #4.

NOTE: The heat shield should end right at the pipe weld. There should be at least 1.0" of heat shield material exposed between the clamp and the pipe weld.
TorqShift® Bracket – Field Modification MY2005

- Cut this area to eliminate interference with the PTO housing.
- Grind surface to eliminate sharp edges.
- Clean and paint the part with rust preventative.


Background: The shift bracket holding the shift linkage in position was revised for MY2005. That change resulted in the bracket interfering with the Chelsea and Muncie PTOs by approximately 2.8 mm, preventing installation of the aftermarket PTOs.

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 15th, 2004, will incorporate a revised shift bracket that provides clearance to the aftermarket PTO.

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 bbasqa@ford.com. QVM Bulletins can be found at www.fleet.ford.com/truckbbas.

Ref: Ford SVE Bulletin Q-112 dated October 15, 2004
Ford Shifter & Bracket Removal and Installation MY2016 & Prior

Removal

1. Next the vehicle selector lever cable and bracket must be removed to help in the installation (Fig. 82).

2. The following instructions are Ford’s recommended instructions for removal of the lever cable and bracket for PTO installation on the TorqShift® 6 transmission.

<table>
<thead>
<tr>
<th>Item</th>
<th>Ford Part Number</th>
<th>Description</th>
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<tbody>
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<td>Selector lever cable bracket bolts (2 required)</td>
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<tr>
<td>5</td>
<td>7B229</td>
<td>Selector lever cable bracket</td>
</tr>
<tr>
<td>6</td>
<td>7H181</td>
<td>Retaining clip</td>
</tr>
</tbody>
</table>

NOTICE: To prevent selector lever cable damage, do not apply force to the selector lever cable assembly between the manual control lever and the selector lever cable bracket.

3. Position the vehicle selector lever into the drive position.

4. Disconnect the selector lever cable from the manual control lever (Fig. 83).

5. Remove and discard the selector lever cable retaining clip.

- Lift the lock tabs on the retaining clip arms to release the clip.
- Pull the clip and selector lever cable from the selector lever cable bracket (Fig. 84).
Ford Shifter & Bracket Removal and Installation MY2016 & Prior (Continued)

Installation

6. Move the manual control lever all the way forward into the LOW position, then move it 3 detents rearward (Fig. 85).

**NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place. Press the selector lever cable into the bracket and listen for the cable to click in place. Pull back on the selector lever cable to make sure that it is locked into the bracket.

Install the selector lever cable into the selector lever cable bracket and install a new retaining clip.

7. Correct the selector lever cable onto manual control lever (Fig. 86).

8. Slide the adjuster tab in place to lock the selector lever cable (Fig. 87).
Ford Shifter & Bracket Removal and Installation MY2017-MY2018

1. Clean the cable adjuster lock (Fig. 88).

2. Open the adjuster lock (Fig. 89).

3. Disconnect the selector lever from the transmission manual lever (Fig. 90).

4. Remove the selector lever retainer bolt (Fig. 91).

5. Remove the clip and the selector lever cable (Fig. 92).

**Installation**

1. If necessary, open the adjustor lock (Fig. 93).

**NOTICE:** To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.
Ford Shifter & Bracket Removal and Installation MY2017-MY2018 (Continued)

2. Install the selector lever cable and the clip (Fig. 94).

3. Install the selector lever retainer bolt. 
   Torque to 62 lb.in [7 Nm] (Fig. 95).

4. Verify the selector lever is in D (Fig. 96).

5. Position the manual lever in D.
   a. Rotate the manual lever clockwise until it stops.
   b. Rotate the manual lever counterclockwise
      3 detents (Fig. 97).

6. Connect the selector lever cable to the
   transmission manual lever (Fig. 98).

7. Close the adjuster lock (Fig. 99).

8. Verify the vehicle starts in P and N only and that
   the reverse lamps illuminate in R.
## Chelsea PTO Ford Application Chart – PTO w/o EOC

<table>
<thead>
<tr>
<th></th>
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<td>5R110</td>
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* Wiring Harness is included in the installation kit unless otherwise noted.
## Appendix

### Chelsea – Ford Wiring Chart Diesel

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<th>Year</th>
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<th>Ford Wire Color</th>
<th>Ford Function</th>
<th>Chelsea Wire Color</th>
<th>Chelsea Function</th>
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<td>PTO REQUEST 1</td>
<td>Yellow/Orange (Early)</td>
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<td>Yellow/Blue (Pin 3)</td>
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<td>PTO REQUEST 2</td>
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<td>MEDIUM DUTY F650/750</td>
<td>Yellow/Blue</td>
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<thead>
<tr>
<th>Chassis Ground</th>
<th>SUPER DUTY F250-550</th>
<th>MEDIUM DUTY F650/750</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow/Green</td>
<td>Yellow/Orange</td>
<td>Yellow/Orange</td>
</tr>
<tr>
<td>Yellow/Orange</td>
<td>Blue/Orange</td>
<td>Blue/Orange</td>
</tr>
<tr>
<td>Yellow/Orange</td>
<td>Blue/Orange</td>
<td>Blue/Orange</td>
</tr>
<tr>
<td>Yellow/Orange</td>
<td>Blue/Orange</td>
<td>Blue/Orange</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6.7L Diesel Harness P/N</th>
<th>329616X</th>
</tr>
</thead>
<tbody>
<tr>
<td>12V SOURCE</td>
<td>Purple</td>
</tr>
<tr>
<td>PTO REQUEST 1</td>
<td>Yellow</td>
</tr>
<tr>
<td>PTO REQUEST 2</td>
<td>Yellow</td>
</tr>
<tr>
<td>PTO RELAY</td>
<td>Blue/White</td>
</tr>
<tr>
<td>PTO VREF</td>
<td>White</td>
</tr>
<tr>
<td>PTO RPM</td>
<td>Green</td>
</tr>
<tr>
<td>PTO SIGHTN</td>
<td>Gray</td>
</tr>
<tr>
<td>GROUND</td>
<td>Black w/Ring</td>
</tr>
</tbody>
</table>

Ford “F” Series DIESEL
## Chelsea – Ford Wiring Chart Gas

<table>
<thead>
<tr>
<th>Chassis Group</th>
<th>6.8L Gas Wire Color</th>
<th>Ford Circuit</th>
<th>PTO Request 1</th>
<th>PTO Request 2</th>
<th>PTO Relay</th>
<th>PTO VREF</th>
<th>PTO RPM</th>
<th>SIGRTN</th>
<th>GROUND</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD</td>
<td>White/Blue (247)</td>
<td>White Wire to Relay Harness attached to Manufacturing, and then to Battery Source</td>
<td>Yellow/Blue</td>
<td>Yellow/Blue</td>
<td>Blue White</td>
<td>Blue White</td>
<td>Blue White</td>
<td>Blue White</td>
<td>Ground</td>
</tr>
<tr>
<td>MD - MY13-15</td>
<td>Yellow/Gray</td>
<td>Yellow/Gray</td>
<td>Yellow/Orange (PTO_request 1)</td>
<td>Blue/Brown</td>
<td>Blue White</td>
<td>Blue White</td>
<td>Blue White</td>
<td>Yellow/Violet</td>
<td>Ground</td>
</tr>
<tr>
<td>MD - MY16-17</td>
<td>Yellow/Orange</td>
<td>Yellow/Orange</td>
<td>Yellow/Orange (PTO_request 2)</td>
<td>Black/Red</td>
<td>Blue White</td>
<td>Blue White</td>
<td>Blue White</td>
<td>Yellow/Violet</td>
<td>Ground</td>
</tr>
<tr>
<td>MD - MY17-18</td>
<td>Yellow/Orange</td>
<td>Yellow/Orange</td>
<td>Yellow/Orange</td>
<td>Blue/Red</td>
<td>Blue White</td>
<td>Blue White</td>
<td>Blue White</td>
<td>Yellow/Violet</td>
<td>Ground</td>
</tr>
</tbody>
</table>

**Note:**
- SD = Super Duty (F250-550) / MD = Medium Duty (F650/750)
Offer of Sale

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

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

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

3. Delivery Dates; Title and Risk; Shipments. All delivery dates are approximate and Seller shall not be responsible for any damages resulting from any delay. Regardless of the manner of shipment, title to any products and risk of loss or damage shall pass to Buyer upon placement of the products with the shipping carrier at Seller’s facility. Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. Notice of shipment at Buyer’s request will be furnished, but the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for all duties and taxes incurred by Seller due to Buyer’s acts or omissions.

4. Warranty. Seller warrants that all products sold, other than the 590 Series, conform to the applicable Parker Chelsea standard specification for the lesser of period 2 years (24 Months) from date of sale or 12 years (144 Months) from date of build (as marked on the product). Seller’s sole obligation and remedies for warranties that the 590 Series will conform to the Parker standard specification for the lesser of 2 years (24 Months) from date of sale or 2000 hours of usage. The prices charged for Seller’s products are based upon reasonable allowances expected to be made for any alleged breach of warranty. Seller reserves the right to alter, discard or otherwise dispose of any special manufacture Products. Such special tooling shall be and remain Seller’s property.

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

6. LIMITATION OF LIABILITY. Upon notification, Seller will at its option, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE. NO EVENT SHALL SELLER BE LIABLE TO BUYER FOR ANY INCIDENTAL, INDIRECT, CONSEQUENTIAL OR CONSEQUENTIAL DAMAGES OR LOSS ARISING OUT OF OR AS THE RESULT OF THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF SELLER ARISING OUT OF SELLER’S WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLECTFUL, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER’S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.

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

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

9. Special Tooling. A tooling charge may be imposed for any special tooling, including tooling necessary to keep tooling, dies, fixtures, patterns, and patterns acquired to manufacture Products. Such special tooling shall be and remain Seller’s property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in any tooling, dies, fixtures, patterns, and patterns acquired to manufacture Products. Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

10. Buyer’s Obligation; Rights of Seller. To secure payment of all sums due or otherwise, Seller shall retain a security interest in the goods delivered and this agreement is subject to the Security Agreement which is incorporated by reference. Seller shall be entitled to the Security Agreement Code. Seller authorizes Seller as its attorney to execute and file on Buyer’s behalf all documents Seller deems necessary to perfect its security interest.

11. Improper use and Indemnity. Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, lawsuits, and costs (including attorney fees), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer’s employees, or any other person, arising out of improper installation or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller’s use of patterns, plans, drawings, or specifications furnished by Buyer, Credit Department, Olive Branch, Ms. Credit may be stopped at the rate of 1.5% per month or the maximum allowable rate under applicable law.

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

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

14. Force Majeure. Seller does not assume the risk as it 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, but not be limited to: accidents, acts of God, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller’s reasonable control.

15. War and Severality. Failure to enforce any provision of this agreement will not waive that provision nor will it any such failure prejudice Seller’s right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation will not affect the rate of law shall act and shall not and upon the following provisions remain. The remaining provisions of this agreement will remain in full force and effect.

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

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

18. Indemnity for Infringement of Intellectual Property Rights. Seller shall have no liability for infringement of any patents, copyrights, trademarks, design and availability with notice to Buyer.

19. Entire Agreement. This agreement contains the entire agreement between the Buyer, Seller and constitutes the final, complete and exclusive expression of the understanding and agreement of Buyer and Seller and constitutes the final, complete and exclusive expression of the understanding and agreement of Buyer and Seller with respect to the subject matter are herein merged.

20. Governing Law. The offer and acceptance of this offer is controlled by and governed by the laws of the United States of America, and the laws of the State of Ohio, and the laws of the State of California.

21. Governing Law. This agreement is subject to the laws of the United States of America and the United States as a whole, and the Courts of the State of Ohio, Columbus and Cuyahoga County, Ohio.

22. Governing Law. This agreement is subject to the laws of the United States of America and the United States as a whole, and the Courts of the State of Ohio, Columbus and Cuyahoga County, Ohio.