Power Take-Offs Owner’s Manual
210 Series
WARNING — User Responsibility

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

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

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

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

Offer of Sale

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

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

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).
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.

<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**

<table>
<thead>
<tr>
<th>Joint Series</th>
<th>1000</th>
<th>1100</th>
<th>1280</th>
<th>1310</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque Rating</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<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)**

| Rectangular Type | 3.500" | 3.500" | 3.875" | 3.875" |

**Bolt Holes - Flange Yoke**

| Circle | 2.750" | 2.750" | 3.125" | 3.125" |
| Diameter | .312" | .312" | .375" | .375" |
| Number | 4 | 4 | 4 | 4 |
| Male Pilot Dia. | 2.250" | 2.250" | 2.375" | 2.375" |

**Distance Across Lugs**

| Snap Ring | 2.188" | 2.656" | 3.469" | 3.469" |
| Construction | 2.188" | 2.656" | 3.469" | 3.469" |

**Bearing Diameter**

| .938" | .938" | 1.062" | 1.062" |

---

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

<table>
<thead>
<tr>
<th>Tubing Dia. &amp; Wall Thickness</th>
<th>Max. Installed Length in Inches for Given RPM Centerline to Centerline of Joints for a Two Joint Assembly or Centerline of Joint to Centerline of Center Bearing for a Joint &amp; Shaft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid Shaft Diameter</td>
<td>--------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diameter</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>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diameter</th>
<th>500</th>
<th>1000</th>
<th>1500</th>
<th>2000</th>
<th>2500</th>
</tr>
</thead>
<tbody>
<tr>
<td>.750&quot;</td>
<td>60&quot;</td>
<td>42&quot;</td>
<td>35&quot;</td>
<td>30&quot;</td>
<td>27&quot;</td>
</tr>
<tr>
<td>.812&quot;</td>
<td>62&quot;</td>
<td>44&quot;</td>
<td>36&quot;</td>
<td>31&quot;</td>
<td>28&quot;</td>
</tr>
<tr>
<td>.875&quot;</td>
<td>65&quot;</td>
<td>46&quot;</td>
<td>37&quot;</td>
<td>32&quot;</td>
<td>29&quot;</td>
</tr>
<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>77&quot;</td>
<td>55&quot;</td>
<td>45&quot;</td>
<td>39&quot;</td>
<td>35&quot;</td>
</tr>
</tbody>
</table>
TorqShift® 10R140 Transmission – Stationary Elevated Idle Control (SEIC)
PTO Operating Modes

Models Affected
Super Duty – MY2020

General System Behavior

Purpose to explain functions of the (SEIC) system as well as Power Take-Off (PTO) operating modes. Always reference fordbbas.com for the most up to date information.

Overview – SEIC and Transmission PTO

• 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 Super Duty Trucks.

Customer Access Wires for SEIC and VSO/CTO/PARK Signals

• Located in cabin, tagged and bundled behind the passenger side kick Panel. Pass thru wires are in the same location.

• The final stage manufacturer or up-fitter is required to supply the customer interface equipment.

Transmission PTO Gear and Port

• Available on F-250/350/450/550/600

• Available for TorqShift® automatic transmissions by ordering “Transmission Power Take-Off Provision.”

• 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 300 Lbs-ft [406 Nm] of torque (w/ Diesel) and 250 Lbs-ft [338 Nm] of torque (w/ 6.2L and 7.3L Gas) to the Chelsea PTO, and can manage the heat of 60 HP (Diesel) and 40 HP (Gas) continuously. Higher horsepower can be delivered, but for shorter durations depending on the amount of power required.

Maximum Loads at PTO (Summary)

<table>
<thead>
<tr>
<th>Engine</th>
<th>Stationary Mode</th>
<th>Mobile Mode</th>
<th>Split Shaft Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.7L Diesel</td>
<td>300 Lbs-ft [406 Nm]</td>
<td>150 Lbs-ft [203 Nm]</td>
<td>N/A</td>
</tr>
<tr>
<td>7.3L Gas</td>
<td>250 Lbs-ft [338 Nm]</td>
<td>125 Lbs-ft [169 Nm]</td>
<td>–</td>
</tr>
<tr>
<td>6.2L Gas</td>
<td>250 Lbs-ft [338 Nm]</td>
<td>115 Lbs-ft [155 Nm]</td>
<td>–</td>
</tr>
</tbody>
</table>

Reference 2020 BBLB – Super Duty F-Series at fordbbas.com
Transmission Overview

TorqShift® 10R140 Transmission – Stationary Elevated Idle Control (SEIC)
PTO Operating Modes (Continued)

Models Affected
Super Duty – MY2020

General System Behavior (Continued)

<table>
<thead>
<tr>
<th>SEIC Enable/Disable Conditions</th>
<th>Vehicle Conditions to Enable SEIC (all are required)</th>
<th>Vehicle Conditions that Disable SEIC (any one required)</th>
<th>SEIC</th>
<th>Split-Shaft (Diesel Only)</th>
<th>Mobile Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking brake applied.</td>
<td>Parking brake disengaged.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Foot off of service brake</td>
<td>Depressing service brake</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (2)</td>
<td>No</td>
</tr>
<tr>
<td>Vehicle in PARK (automatic trans.)</td>
<td>Vehicle taken out of PARK</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (2)</td>
<td>No</td>
</tr>
<tr>
<td>Foot off of accelerator pedal</td>
<td>Accelerator pedal depressed</td>
<td>Yes</td>
<td>Yes</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>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Engine at a stable base idle speed</td>
<td></td>
<td>Yes</td>
<td>Yes</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 (1)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Eng Coolant Temp above 20°F  (6.7L Diesel)</td>
<td>Engine Coolant Temperature (ECT) Limit</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Eng Coolant Temp above 40°F  (6.2L or 7.3L Gas)</td>
<td>Engine Coolant Temperature (ECT) Limit</td>
<td>Yes (1)</td>
<td>Yes (1)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Catalyst Temperature Limit</td>
<td></td>
<td>Yes (1)</td>
<td>Yes (1)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

(1) A “Change-of-State” at the “PTO-REQ1” input (for Stationary Elevated Idle Control non-Split-Shaft), or for both “PTO REQ1 and PTO REQ2” inputs (for Stationary Elevated Idle Control Split-Shaft) is required to re-invoke Stationary Elevated Idle Control. When a disable is seen by the PCM, the Stationary Elevated Idle Control function is de-activated, the “PTO RELAY” output circuit changes from a “ground-source” to “open-circuit” and engine speed returns to base idle. To reactivate Stationary Elevated Idle Control, the operator must open the PTO Switch to the “PTO REQ1” and “PTO REQ2” inputs, then close the PTO Switch again to the “PTO REQ1” or “PTO REQ1 and PTO REQ2” inputs.

(2) See Split-Shaft Mode description under Operating Modes.

(3) Brake pedal must remain depressed for a minimum of **3 seconds** after moving gear shifter into DRIVE position in order to enable Split-Shaft Mode.

Reference 2020 BBLB – Super Duty F-Series at fordbbas.com
TorqShift® 10R140 Transmission – Stationary Elevated Idle Control (SEIC)
PTO Operating Modes (Continued)

Models Affected
Super Duty – MY2020

General System Behavior (Continued)

Stationary Elevated Idle Control (SEIC)

- Operates with transmission in “Park” at elevated engine speeds. 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 CAN signal is zero.

- Includes a PTO_RELAY 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.

- Engine speed ramp-rates are configurable, by means of an IOS tool, for all powertrains.
  - Default ramp-rate for all powertrains is 200 RPM/second.
  - Configurable ramp rates are as follows:

  **Diesel:** 100 – 800 RPM/sec (in 100 RPM/sec increments)
  **Gas:** 100 – 1000 RPM/sec (in 100 RPM/sec increments)

**NOTE:** Chelsea PTO output speed should not exceed 2500 RPM. The PTO output speed is 144% of engine speed. **DO NOT** exceed 1,736 engine RPMs with Chelsea PTO installed without Chelsea engineering approval.

Split Shaft Mode (Diesel Only)
To install Split-Shaft mode, wire according to the diagram shown on page 14 of Ford BBAS Bulletin Q-256. 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 PTO 1 and PTO 2 circuits.

Split Shaft Engagement Procedure

1. Ensure the following: engine is running and the engine coolant temp is above 20° F.
2. Apply park brake.
3. Disconnect vehicle drivetrain (transmission in NEUTRAL, 4x4 DISENGAGED) and engage PTO load.
4. With foot off both the service brake and accelerator pedals, turn Split-Shaft PTO on.
5. While pressing the service brake, shift transmission into drive and continue holding brake for a minimum of 3 more seconds.
6. The system will shift the transmission into 7th gear, lock the converter and then ramp up to the target idle speed in a controlled manner. Release the service brake*.  

*If vehicle unexpectedly lurches or moves upon releasing service brake, immediately depress brake pedal and shift transmission into PARK or NEUTRAL to secure vehicle. Contact Upfitter immediately.
TorqShift® 10R140 Transmission – Stationary Elevated Idle Control (SEIC)
PTO Operating Modes (Continued)

Models Affected
Super Duty – MY2020

General System Behavior (Continued)

Battery Charge Protect (BCP)
Available on vehicles equipped with the TorqShift® 10R (10-speed) transmission. When 12V is applied to the BCP SW circuit, the engine speed goes immediately to 600. From this state, the PCM uses battery voltage as well as ambient air temp and engine oil temperature information to raise engine speed higher to maintain battery charge. Max engine speed in BCP mode is 1200 rpm. Loss of an operating condition after BCP is engaged will require the BCP switch to be cycled before BCP will re-engage.

- BCP CANNOT BE ACTIVE WHEN SEIC OR PTO MODES ARE ACTIVE
- A Resistor must be installed between DIESEL PTO REF (GAS PTO-VREF for 7.3L) and PTO-RPM for both Diesel and Gas engines.

Mobile Mode

Operates in all gears and all vehicle speeds. The engine idle speed is elevated to 750 RPM when the Mobile Mode is initiated. Engine RPM is controlled by the driver through the throttle pedal but peak engine speed is not limited beyond normal operating ranges. There is no built-in provision to limit engine speed to a pre-set RPM. To prevent over-speed damage to attached pumps and equipment, an additional aftermarket RPM-limiter will be required.

Engine Speed Limiting (ESL feature) will be available on all 3 powertrains: ESL feature controls the engine speed in Mobile Mode below a selectable maximum threshold. Maximum RPM is determined by the resistor installed between the PTO_REF and PTO-RPM circuits. See Ford BBLB (fordbbas.com) for RPM / resistor values.

- Transmission behavior changes in Mobile Mode due to upshifting performance; e.g. it is possible for a customer to reach max. RPM in a lower gear, and the transmission is unable to accelerate – or upshift – to the next gear.

- If this action is not desired, the operator can:
  a. Ease up on the accelerator pedal and receive an upshift, or
  b. Put the transmission in manual mode and select the gears manually.

- Selected target RPM has a margin of +/- 15% based on transient conditions (for example, descending a grade).

- Mobile PTO may overshoot selected the RPM by 100-200 RPM for drivability.
TorqShift® 10R140 Transmission – Stationary Elevated Idle Control (SEIC)
PTO Operating Modes (Continued)

Models Affected
Super Duty – MY2020

General System Behavior (Continued)

Mobile Mode (Continued)

NOTE: Parker Chelsea Electronic Overspeed Control (EOC) should be optioned with the PTO to prevent over speed damage to attached pumps and equipment.

NOTE: If the PTO feature is used for extended periods of time without vehicle movement it is recommended to switch to Stationary Mode.

NOTE: In Mobile Mode, there is no engine speed limiter unless the Engine Speed Limiter (ESL) feature is enabled via the resistor chart provided in Ford BBLB.

NOTE: While in Mobile Mode, when using a Chelsea PTO harness, the factory ESL function will limit the engine’s maximum RPM based on potentiometer setting (clockwise to decrease, counter-clockwise to increase).

NOTE: Without application approval from Chelsea Engineering, maximum PTO output speed is 2500 RPM (or an engine RPM of 1736).
Super Duty F250-600 – MY2020+ – ALL 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 20 for Non-EOC and page 21 for EOC.

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

   a. MY2020+ F250-600 blunt cut wires located at passenger side kick panel.

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 (Fig. 2).

5. Connect the Chelsea wiring harness to the FORD blunt cut wires per the wiring charts on pages 22-23 and 24-25. Butt connectors are provided on the Chelsea wiring harness.

This symbol warns of possible personal injury.
Super Duty F250-600 – MY2020+ – ALL
In-Cab PTO Switch Installation (Continued)

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 (Fig. 3).

- 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. 3).

6. Attach the ground wire black with ring terminal (3/8”) on its end to a confirmed ground location. Reference wiring charts on pages 22-23 and 24-25 of this manual.

7. Wiring harness should be routed through fire wall using Chelsea provided grommet. Make sure wiring is clear of driveline and exhaust.

CAUTION: A 12V ignition 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 22-23 and 24-25.

NOTE: Chelsea wiring harness includes a potentiometer factory set to maximum resistance which defaults to the minimum engine RPM established by Ford. See FordBBAS.com for resistor values.
Super Duty F250-600 – ALL
PTO Installation – Overview

1. Refer to pages 14-19 of this manual for PTO installation.

2. Gas applications require a heat shield to protect PTO and connected components.

3. Directly connected hoses must be routed away from exhaust and rotating components.

4. After wiring harness is connected to PTO solenoid valve and pressure switch, ensure harness has sufficient clearance to exhaust pipe and all rotating components.

PTO Installation – Pre-work

CAUTION: Always wear suitable Personal Protective Equipment (PPE) when installing the PTO. Safety glasses and gloves are recommended.

Overview: The 210 Series PTO has a single housing for all configurations. There is no separate geared adapter.

1. If NVH Cover is installed over PTO opening, cut away portion of the cover as described in Ford SVE Bulletin Q-300 (available at www.fordbbs.com, see Fig. 4). Exercise caution when removing cover. Avoid any damage or severing of transmission, wiring and/fluid lines.

2. Install the PTO pressure switch onto port on the hydraulic valve cap. Torque to 10-12 Lbs-ft [13-16 Nm] (Fig. 5).
PTO Installation – Pre-work (Continued)

3. Remove the O-ring mounting seal from the PTO installation kit and align it with the groove on the PTO flange. Press firmly along the length of the seal until the seal is firmly seated in the groove. O-ring lubrication compound may assist the installation of the seal into the housing. (Fig. 6 and Fig. 7).

NOTE: Inspect the seal for damage before and after assembly. If there is any uncertainty about its condition, replace with a new seal (PN 28-P-397).

NOTE: Do not use sealing compounds because they are generally incompatible with automatic transmission fluids and may contaminate transmission valve bodies.

NOTE: For 4x4 applications, the 4WD auxiliary driveshaft will need to be dropped to allow for PTO installation. For most installations, the electrical bulkhead connector located near the rear of the transmission does not need to be removed.

This transmission does not require the oil to be drained for PTO installation, however minor drainage should be expected when covers and plugs are removed.

WARNING: Oil may be hot. Use extreme caution during installation and removal of PTO to prevent accidental contact with hot fluid.
PTO Installation – Pre-work (Continued)

4. Remove the plug from the transmission pressure port (Fig 8) and install fitting 380569 in the opening (Fig 10). Torque to 10-12 Lbs-ft [13-16 Nm]. See (Fig. 9) for recommended fitting orientation.

**IMPORTANT:** Both washers (captive and loose) and the O-ring must be present at installation. The second washer must fit around the O-ring for proper seal (Fig. 10).

5. Remove and discard the PTO aperture cover plate and gasket. Do not use this gasket when installing the PTO (Fig. 12) & (Fig. 13).

**PTO Pressure/Lube Fitting & Hose:**
380569 90° Adapter Fitting (1 each) (Fig 10).
329784-3X Hose Assembly (1 each) (Fig 11).
PTO Installation – Pre-work (Continued)

6. Eight bolts and two alignment pins and dowel bushings (Fig. 14) 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.

7. Install the two alignment pins to the 2 o’clock and 8 o’clock mounting positions.

**CAUTION**: Over tightening the mounting hardware may damage the transmission threads.

8. Install the dowel bushings over the alignment pins so that they are seated in the transmission counterbores (Fig. 15).

9. Align the PTO over the alignment dowels and press firmly to seat. Ensure that the mounting seal does not fall out of the groove before it is compressed against the transmission face. (Fig. 16).
PTO Installation – Pre-work (Continued)

10. Install the provided bolts to the remaining faster locations and torque to 24-28 Lbs-ft [32-37 Nm] in a crossing pattern (Fig. 17).

NOTE: Always torque fasteners in a crossing pattern (Fig. 17).

CAUTION: Over tightening the mounting hardware may damage the transmission threads.

11. Connect hose to the fitting on the transmission. Larger pumps may require the hose to be routed below the pump and PTO as shown in (Fig. 18). Smaller pumps may permit routing behind the pump and above the PTO if desired. 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.

12. Connect wiring harness as shown on page 20-21.

13. Recommended pump mounting position (Fig. 19).

14. If installing a Chelsea Pump, torque bolt to 24 Lbs-ft [32 Nm].

15. Check transmission oil level per Ford guidelines.

This symbol warns of possible personal injury.
Transmission/PTO Electrical Operation

1. When vehicle is on, power is supplied to switch via **12V IGN**

2. Switch illumination is controlled by **Light Control**. When PTO pressure switch closes (PTO is engaged), **Light Control** will be connected to ground via vehicle ground and the light will illuminate independent of on/off status of switch. A high-quality ground connection is important to prevent electrical errors that may be difficult to diagnose.

3. When switch is toggled on, power is supplied via **Power Out** to **PTO-REQ**. The relay will not actuate because the Ford power control module (PCM) has blocked the **PTO-RELAY** connection from receiving power until it is ready.

4. When the PCM gets voltage at **PTO-REQ**, initiates SEIC mode. This may include adjustment of the idle speed, cooling parameters, and transmission line pressure, depending on the selected mode. Note that the mode is selected by wiring to either Ford circuit **PTO 1** or **PTO 2**. The vehicle may fail to enter PTO mode if any of several safeguards not met. See Ford Body Builder's Guide for detailed information on these limitations.

5. If all checks are successful, transmission will enter PTO mode and increase hydraulic line pressure to 200 psi for PTO clutch operation. Engine speed will also ramp to minimum required by operational mode. If PTO mode cannot be enabled, no changes will occur.

6. For SEIC operation, the engine speed will ramp to the level determined by the potentiometer circuit. The PCM outputs a reference voltage to **PTO-VREF** and provides a ground signal at **PTO-RTN**. The trimpot is used as a voltage divider; adjusting it clockwise reduces the voltage measured at **PTO-RPM** (and vice versa). The voltage measured by the PCM at **PTO-RPM** is used to set the SEIC speed relative to the min and max speeds allowed by Ford. Consult the Ford Body Builder's Guide for correlations of voltage and SEIC rpm.

7. The PCM connects the **PTO-RELAY** connection to ground, which allows power to flow through the relay control circuit to close the relay. Once closed, the relay sends power to the PTO solenoid valve to actuate and engage the PTO.

8. PTO will continue to operate until any safeguard is violated and PTO mode is forcibly disabled by the PCM, or the PTO switch is toggled to cut power to the PTO system. If PTO mode is forcibly disabled, the PTO switch will need to be toggled after the error is resolved to re-enter PTO mode.
Installation Sketches

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

**NOTE:**
Chelsea Installation Sketch SK-656 on pages 22-23.
Ford BBaS Body Builders Guide

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**Connect to Pressure Switch**
Ref Delphi 12019378

**Connect to Solenoid Valve**
Ref Delphi 12162197

Slice Grommet Insert and Insert to Hole in Firewall

Cut Ø1.25" Hole in Firewall at Desired Wiring Pass-Through Location

385096 Grommet

Firewall Pass-Through Detail

<table>
<thead>
<tr>
<th>Component</th>
<th>Connection/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>379502 Pressure Switch</td>
<td>Torque to 120-144 Lb-In</td>
</tr>
<tr>
<td>379486 90° Elbow - JIC4</td>
<td>Torque Hose Connections to 10-12 Lb-ft [13-16 Nm]</td>
</tr>
<tr>
<td>380569 90° Elbow JIC4 to M10X1 ORR</td>
<td>To 10R140 Transmission High Pressure Port</td>
</tr>
<tr>
<td>329784-3X 90° JIC4 Swivel to Straight JIC4 Hose 17&quot; Length</td>
<td>Refer to pages 22-23 (SK-656) for Connection Information</td>
</tr>
</tbody>
</table>

SEIC Speed Control Potentiometer

Wiring Harness Assembly
(Includes Wiring Harness, Mounting Bracket, and Illuminated Switch)

Diesel Harness: 329616X
Gas Harness: 75-P-39 (Includes High-Temp Harness Loom)

---

**Hose Connections**

- 329784-3X 90° JIC4 Swivel to Straight JIC4 Hose 17" Length

---

**Harmonis**

**NOTE:**
Integration Kit: 330007-2X (Included in 330008X)
Harness: 329616X (Diesel Only)
Harness: 75-P-39 (Gas Only)
Wiring Installation (Shift Option K)
210 w/ Electronic Overspeed Control (EOC)

Installation Sketches

NOTE: Chelsea Installation Sketch SK-656 on pages 24-25.
Ford BBaS Body Builders Guide

Cut Ø1.25" Hole in Firewall at Desired Wiring Pass-Through Location
Connect to Pressure Switch Ref Delphi 12015378
Connect to Solenoid Valve Ref Delphi 12162197
379486 90° Elbow - JIC4 - 17" Length
380569 0° Elbow JIC4 to M10X1 ORR
To 10R140 Transmission High Pressure Port
380596 Grommet

NOTE:
Chelsea Installation Sketch
SK-656 on pages 24-25.
Ford BBaS Body Builders Guide
**Wiring Chart PTO to Ford**


210 Diesel / Gas w/o Electronic Overspeed Control (EOC)

---

<table>
<thead>
<tr>
<th>FORD CIRCUIT NUMBER</th>
<th>FORD WIRE COLOR</th>
<th>FORD INTERFACE CONNECTOR PIN</th>
<th>FORD CIRCUIT DESCRIPTION</th>
<th>CHELSEA DIESEL HARNESS WIRE COLOR</th>
<th>CHELSEA GAS HARNESS WIRE COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBP22</td>
<td>GREEN/ORANGE</td>
<td>2</td>
<td>12V</td>
<td>PURPLE</td>
<td>YELLOW/GRAY</td>
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<tr>
<td>LE434 (DIESEL) / LE424 (GAS)</td>
<td>WHITE/BROWN (DIESEL) / YELLOW/GREEN (GAS)</td>
<td>10 (DIESEL) / 18 (GAS)</td>
<td>DIESEL/GAS PTO REF</td>
<td>YELLOW/GRAY</td>
<td>GRAY</td>
</tr>
<tr>
<td>RE327 (DIESEL) / RE407 (GAS)</td>
<td>GRAY/VIOLET (DIESEL) / YELLOW/VIOLET (GAS)</td>
<td>6 (DIESEL) / 16 (GAS)</td>
<td>DIESEL/GAS PTO RTN</td>
<td>YELLOW/GRAY</td>
<td>GRAY</td>
</tr>
</tbody>
</table>

---

Additional Information:

- Power Control Module (PCM)
- SVDC
- D0?

---

**Diagram Notes:**

- 75-P-45-12 Illuminated Rocker Switch
- 3X 380672 .250” x .032” Insulated Female Spade Connector
- Power Out: Yellow Wire
- Power in: Purple Wire
- 5000 ohm Trimpot

**To Change SEIC Setpoint:**
- Turn Clockwise to Decrease Speed
- Turn Counterclockwise to Increase Speed

2500 RPM Maximum PTO Output

Speed without Application Approval

---

**Connection Points:**

- Ford Chassis
- Power Control Module (PCM)
- Chelsea Harness
- Diesel: 329616X
- Gas: 75-P-39
Installation Sketches

Wiring Chart PTO to Ford (Continued)
210 Diesel / Gas w/o Electronic Overspeed Control (EOC)

(SK-656 Rev B)

NOTES:
1) All Chelsea Harness Wire is 18 Awg
2) Potentiometer is Preset to Furthest Clockwise Position (Minimum Speed)
3) Relay is Secured to Reverse of Bracket (Non EOC Only)
4) Refer to Ford SVE Bulletin Q-256

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

23
210 Diesel / Gas w/ Electronic Overspeed Control (EOC)

(SK-656 Rev B)

<table>
<thead>
<tr>
<th>FORD CIRCUIT NUMBER</th>
<th>CBP22</th>
<th>LE434 (DIESEL) / LE424 (GAS)</th>
<th>RE327 (DIESEL) / RE407 (GAS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORD WIRE COLOR</td>
<td>GREEN/ORANGE</td>
<td>WHITE/BROWN (DIESEL) / YELLOW/GREEN (GAS)</td>
<td>GRAY/VIOLET (DIESEL) / YELLOW/VIOLET (GAS)</td>
</tr>
<tr>
<td>FORD INTERFACE CONNECTOR PIN</td>
<td>2</td>
<td>10 (DIESEL) / 18 (GAS)</td>
<td>6 (DIESEL) / 16 (GAS)</td>
</tr>
<tr>
<td>FORD CIRCUIT DESCRIPTION</td>
<td>12V</td>
<td>DIESEL/GAS PTO REF</td>
<td>DIESEL/GAS PTO RTN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHELSEA EOC HARNESS WIRE COLOR</th>
<th>RED</th>
<th>WHITE</th>
<th>GRAY</th>
</tr>
</thead>
</table>

- 5000 Ohm Trimpot
- To Change SEIC Setpoint:
  - Turn Clockwise to Decrease Speed
  - Turn Counterclockwise to Increase Speed
- 2500 RPM Maximum PTO Output Speed without Application Approval

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA
Wiring Chart PTO to Ford (Continued)
210 Diesel / Gas w/ Electronic Overspeed Control (EOC)

<table>
<thead>
<tr>
<th>CE914</th>
<th>CE912</th>
<th>CE933</th>
<th>CE326</th>
</tr>
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<tbody>
<tr>
<td>GREEN</td>
<td>YELLOW/GREEN</td>
<td>BLUE/ORANGE</td>
<td>BLUE/WHITE</td>
</tr>
<tr>
<td>9</td>
<td>7</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>PTO RPM</td>
<td>PTO 1</td>
<td>PTO 2</td>
<td>PTO RLY</td>
</tr>
</tbody>
</table>

FORD CIRCUIT NUMBER
CBP22 LE434 (DIESEL) / LE424 (GAS) RE327 (DIESEL) / RE407 (GAS) CE914 CE912 CE933 CE326

FORD WIRE COLOR
GREEN/ORANGE WHITE/BROWN (DIESEL)
YELLOW/GREEN (GAS)
GRAY/VIOLET (DIESEL)
YELLOW/VIOLET (GAS)
GREEN YELLOW/GREEN BLUE/ORANGE BLUE/WHITE

FORD INTERFACE CONNECTOR PIN
2 10 (DIESEL) / 18 (GAS) 6 (DIESEL) / 16 (GAS) 9 7 11 4

FORD CIRCUIT DESCRIPTION
12V DIESEL/GAS PTO REF DIESEL/GAS PTO RTN PTO RPM PTO 1 PTO 2 PTO RELAY CHASSIS GROUND

CHELSEA EOC HARNESS WIRE COLOR
RED WHITE GRAY GREEN YELLOW YELLOW BLUE/WHITE

Installation Sketches
Wiring Chart PTO to Ford (Continued)
(SK-656 Rev B)

Choose Connection Based On Mode Of PTO Operation
Stationary Mode Only
Mobile Mode Only

Butt Splice Connectors (Provided)

3/8" Stud Ring Terminal
CONNECTOR REAR VIEW (WIRE SIDE)

CONNECTOR FRONT VIEW (TERMINAL SIDE)
Ford Interface Connector Detail
Male Connector (Shown)
Provided with Vehicle

Delphi Connector #12015378
Delphi Connector #12162197

1/4" Stud Ring Terminal
Black Wire
Speed Sensor Connector
Shielded Blue Cable
Delphi Connector #12010973

NOTES:
1) All Chelsea Harness Wire is 18 Awg
2) Potentiometer is Preset to Furthest Clockwise Position (Minimum Speed)
3) Relay is Secured to Reverse of Bracket (Non EOC Only)
4) Refer to Ford SVE Bulletin Q-256
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. 20).

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. 20).
1. Terms and Conditions. Seller's willingness to offer Products, or accept an order for Products, to or from Buyer is subject to these Terms and Conditions or any newer version of the terms and conditions found on-line at www.parker.com/saleterms/. Seller objects to any contradictory or additional terms or conditions of Buyer's order or any other documents issued by Buyer. The following shall apply:

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. Buyer which Seller shall have the right to return or disposition of any unclaimed items 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. Seller's statement of shipment at Buyer's request will not constitute a representation that the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional charges incurred by the carrier. Seller's acts or omissions.

4. Warranty. Seller warrants that all products sold, other than the 590 Series, conform to the applicable Parker Hannifin Standards specification for the lesser of period of 2 years (24 Months) from date of service or 2-1/2 years (30 Months) from date of build (as marked on the product). Seller's sole warranty is that the product will conform to the Sellers Standard normal usage of the products and systems. Provided hereunder, SELLER DISCLAIMS ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

5. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon delivery. No claims for shortages will be allowed unless reported to the Seller within 10 days of delivery. No other claims against Seller, unless asserted in written within 30 days after delivery. Buyer shall notify Seller of any alleged breach of warranty within 20 days after the claim is received or otherwise. Buyer shall have the sole right to terminate this agreement, in writing, if Buyer: (a) commits a breach of any provision of this agreement between Buyer and Seller for the benefit of creditors, or (e) dissolves or liquidates all or a majority of its assets.

11. Improper use and Indemnity. Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, losses, 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 from or in connection with Seller's improvement 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, Buyer's employees, or any other person; (d) the failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

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

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

14. Force Majeure. Seller does not assume the risk that Seller 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 will include: accident, accident, act of God, strikes or labor disputes, acts of any government or 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 Severability. Failure to enforce any provision of this agreement will not waive that provision nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or judicial rule of law shall not invalidate any other provisions herein. The remaining provisions of this agreement will remain in full force and effect.

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

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

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

19. Entire Agreement. This agreement contains the entire agreement between the Buyer and Seller, and supersedes all previous agreements or negotiations with respect to the subject matter are herein merged. This agreementcontains the entire agreement between the Buyer and Seller, and supersedes all previous agreements or negotiations. This agreement shall be governed by the laws of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.

20. Compliance with Law. U.S. Corrupt Practices Act; U.S. Foreign Corrupt Practices Act. Buyer agrees to comply with all applicable laws and regulations, including both those of the United Kingdom and the United States of America, and of the country or territories of the Country in which Buyer may operate, including without limitation the U.K. Bribery Act, the U.S. Anti-Kickback Act; the “Anti-Kickback Act”), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees, or any of its agents. Buyer will be bound by the United States Foreign Corrupt Practices Act, the U.K. Bribery Act, the FCPA and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer shall not make any payment or give anything of value, directly or indirectly, to any foreign governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase products or otherwise benefit the business of Seller.
<table>
<thead>
<tr>
<th>Country</th>
<th>City</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
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