6 & 8-Bolt Installation Instructions
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Safety Information

General Safety Information
Proper Matching of P.T.O.
Safety Information
  Using set screws
  Owners Manual
Operating a P.T.O. with Vehicle in Motion
Pump Installation Precautions
Remember to use Chelsea’s P.T.O. Safety Label Instructions
Details in Owner’s Manual
Proper Matching of a P.T.O.

⚠️ WARNING: A Power Take-Off must be properly matched to the vehicle transmission and to the auxiliary equipment being powered. An improperly matched Power Take-Off could cause severe damage to the vehicle transmission, the auxiliary driveshaft, and/or 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 safe speed of the equipment to be powered.

⚠️ This symbol warns of possible personal injury.
Use a bracket to support the pump to the transmission if:
- The pump weighs **40 pounds** or more.
- The combined length of the P.T.O. and pump is **18 inches** or more from the P.T.O. centerline to the end of the pump.

Also remember to pack the female pilot of the P.T.O. pump flange with grease before installing the pump on the P.T.O.

**CAUTION:** When installing the 489 Series P.T.O. several direct mount pump flange options may interfere with the mounting fasteners directly under the flange. The nut must be threaded far enough onto the stud before the remaining (6) six capscrews and other nut are tightened to prevent interference with the flange and possible breakage of the P.T.O. housing.
Use caution to ensure that bracket does not pre-load pump/P.T.O. mounting

Chelsea strongly recommends the use of pump supports (Support Brackets) in all applications.

P.T.O. warranty will be void if a pump bracket is not used when:

1. The combined weight of pump, fittings and hose exceed 40 pounds.

2. The combined length of the P.T.O. and pump is 18 inches or more from the P.T.O. centerline to the end of the pump.

Remember to pack the female pilot of the P.T.O. pump shaft with grease before installing the pump on the P.T.O. (reference Chelsea grease pack 379688)
For 6 or 8-Bolt Applications

1. Drain the oil from the transmission and remove the P.T.O. aperture cover plate (Fig. 1).

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

**NOTE:** Stuff a rag in the aperture opening to prevent dirt from entering the transmission while you are cleaning it.

**Fig. 1**

**Fig. 2**
For 6 or 8-Bolt Applications (Cont’d)

3. Using your hand, rock the P.T.O. driver gear in the transmission (Fig. 3) and the driven gear in the P.T.O. assembly (Fig. 4). Rocking the gears provides two important factors.

- It shows you the amount of backlash that has been designed into each unit.
- It is helpful in establishing the proper backlash when installing the P.T.O.
For 6 or 8-Bolt Applications (Cont’d)

4. Install the proper studs (furnished with P.T.O.) in the P.T.O. aperture pad using a stud driver. Studs may have either interference fit threads (plain) or preapplied locking/sealing compound (See Figure 5 for installation method).

5. Where holes are tapped through the transmission case, use studs with preapplied locking & sealing compound Locktite 290 to prevent leaks.

NOTE: Avoid contact of Permatex with automatic transmission fluid in automatics. Always check to be sure that the studs do not interfere with transmission gears.
6 & 8-Bolt Installation Instructions
Mounting the P.T.O. on the Transmission

For 6 or 8-Bolt Applications (Cont’d)

6. Tighten studs securely and torque to
   17-19 Lbs. ft. (23-26 N.m.) for 6-Bolt and
   19-21 Lbs. ft. (26-28 N.m.) for 8-Bolt.

CAUTION: Overtightening of studs may
damage stud and/or transmission threads
(Fig. 6).
For 6 or 8-Bolt Applications (Cont’d)

7. Place the correct number of gaskets over studs (Fig. 7). Do not use Permatex between gaskets because you may want to add or subtract gaskets to obtain proper backlash.
   - When mounting a P.T.O. use gaskets between all mounting surfaces.
   - Do not stack more than 3 gaskets together.
   - Usually one thick gasket .020 (.50mm) will be required.
   - Remember the lubricant in the transmission also lubricates the P.T.O. Therefore, at least one gasket must always be used on either side of filler blocks, adapter assemblies or adapter plates. More gaskets may be required when establishing proper backlash.

Fig. 7

<table>
<thead>
<tr>
<th>6-Bolt</th>
<th>8-Bolt</th>
</tr>
</thead>
<tbody>
<tr>
<td>35-P-09-1 (.010)</td>
<td>35-P-15-1 (.010)</td>
</tr>
<tr>
<td>35-P-09-1 (.020)</td>
<td>35-P-15-2 (.020)</td>
</tr>
</tbody>
</table>
8. Secure P.T.O. to the transmission.
   - Use Self Locking nuts provided with P.T.O. (Fig. 8).

   **NOTE:** Self Locking nuts do not require lockwashers.

9. Fasten the P.T.O. to the transmission (Fig. 9). Torque the set of locking nuts to their proper specifications.
   - 379744-3/8"-24 for 6-Bolt applications
     35-40 Lbs. ft. (4.83-5.52 kg.m)
   - 379745-7/16"-20 for 8-Bolt applications
     55-60 Lbs. ft. (7.59-8.28 kg.m)

   Torque capscrews to their proper specifications.
   - 6-Bolt to 30-35 Lbs. ft. (4.14-4.84 kg.m)
   - 8-Bolt to 45-50 Lbs. ft. (6.22-6.91 kg.m)
6 & 8-Bolt Installation Instructions
Checking Backlash

To check for proper backlash on P.T.O.s with shift cover or inspection plate

1. Remove the P.T.O. shift housing and/or inspection plate.

2. Mount the dial indicator so that it registers movement of the input gear (driven gear) of the P.T.O. (Fig. 10).

NOTE: See Figure 11 for proper location of dial indicator contact point. (Two common type dial indicators shown).

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

Fig. 10

Fig. 11
4. Establish backlash at .006" .012" [.15mm - .30mm] by adding or subtracting gaskets.

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

5. Replace the shift housing and/or inspection plate and retorque (4) four capscrews to 16-20 Lbs. ft. (22 – 27 N.m.).

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

**NOTE:** When using a 221 or 260 Series P.T.O. with the AJ gear designation on an Allison Automatic transmission with a 6-Bolt opening, a special gasket (35-P-41) is supplied. When installed with the P.T.O. this gasket reduces the need for backlash adjustment.
An inspection hole is provided in the P.T.O. housing for feeling the mounted backlash. Rock the P.T.O. Input Gear with your hand and correlate this backlash to the unmounted backlash found in step 3. Use Gaskets to get backlash feel as close to unmounted condition as possible.

Fig. 12
Adapter plates are used to permit mounting a 6-Bolt P.T.O. on a transmission that has an 8-Bolt aperture.

**NOTE:** A wire locking stud kit is recommended when mounting a 6-Bolt P.T.O. to an adapter plate on a bottom opening.

**Filler Blocks**

Filler blocks may be required where it is necessary to use a spacer to mount the Power Take-Off to a particular transmission.
Figure 15 illustrates typical adapter assembly configurations. Some P.T.O. applications require adapter assemblies because it is impossible to reach the P.T.O. driver gear in the transmission without this assembly. An adapter assembly will change the rotation of the P.T.O. and this may be necessary for driving pumps or other accessory equipment. Obstructions, such as bulge in the transmission, exhaust pipes or motor mounts can sometimes be compensated for through the use of an adapter.

Refer to Adapter Gears Owners Manual HY25-1670-M1/US.
Installation
1. Remove the filler plug from the transmission and add recommended transmission lubricant to the level prescribed by the transmission or truck manufacturer (Fig. 22).

**NOTE:** If the P.T.O. is mounted below oil level, additional lubricant will be required.

2. Run the P.T.O. for 5-10 minutes and check for oil leaks and noise.

3. Should a quiet P.T.O. become noisy after the universal joint connection is made, check the P.T.O. driveline components for an out of phase condition, excessive or unequal joint angles or possibly worn parts in the driven accessory.
Installation
4. Re-torque all mounting bolts, nuts, cap screws and set up inspection routine of the P.T.O. driveline components and the driven auxiliary equipment.

**NOTE:** Anticipate slight increase in P.T.O. noise level as oil thins out at operating temperatures.
Automatic Transmissions
The procedure for installing a P.T.O. on an automatic is basically the same as for a mechanical transmission. Power Take-Offs for automatic transmissions are assembled with a special drilled input shaft which allows the input gear to be pressure lubricated during operation. (See pages 34 and 35).

After installing a P.T.O. on an automatic transmission, connect pressure lubrication hose to the P.T.O. and the transmission per installation instructions shown on pages 36-38 of this booklet.

⚠️ WARNING: Adapter assemblies are never used on an automatic transmission unless specified on the application page because they do not have pressure lubricated design features.

⚠️ WARNING: Use only wire control with P.T.O. made for wire cable control. If lever is desired, order P.T.O. for lever control. The internal shifting mechanism for wire is not designed for heavy forces usually encountered with lever control linkage.
An auxiliary power shaft transmits torque from the power source to the driven accessory. The shaft must be capable of transmitting the maximum torque and R.P.M. required of the accessory, plus any shock loads that develop.

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

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

This information is limited to 1000 through 1310 Series applications. For applications requiring a series larger than 1310, contact your local Chelsea distributor.
## 6 & 8-Bolt Installation Instructions
### Spicer® Universal Joint Operating Angles

<table>
<thead>
<tr>
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</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
379639 and 379652 Indicator Switches

In order to insure that the switch is functioning properly, the following procedure can be used with the unit on a bench, or installed.

1. Use a continuity checker, battery type, either meter or light. Attach one (1) probe to the screw on the 379639 or 379652 Indicator Switch.

**NOTE:** Make sure 379639 and 379652 Indicator Switches in the P.T.O. shifter or housing are torqued to 10-15 Lbs. ft. (14-21 N.m.).

2. With the other probe, make contact with the shifter cover or housing (Fig. 23).
379639 and 379652 Indicator Switches

3. Actuate shifting device and the meter or light* should be actuated when P.T.O. gear is engaged (Fig. 24).

4. Shift unit out of gear and the meter or light* should return to normal as shown.

This test procedure can be used to check Chelsea wire, lever, and air shifter covers, although an air source would be necessary for the latter.

* If a meter is not available the light in the 328751-1X can be used. A six volt battery is all that is necessary for a power source.

**CAUTION:** Indicator switches are capable of 0.5 amps maximum.
1. Find a suitable area on the dash to install the cable control (328346-10X) and the control plate (68-P-18) indicator light.

Optional Location: As an option the control cable and knob can be located through floor. Using this option the control plate and indicator light should still be located on dash, in close proximity.

NOTE: The location of the cable control and the control plate should be as close to each other as possible and easily accessible by the driver or operator, but should not be an obstacle to driver movement nor interfere with other controls, instruments, or equipment.

* All 6-Bolt wire shifts with the exception of the reversible, dual shift units, and some gear boxes.
Pressure Lube for Allison 1000, 2000/2400 Series (SK-382 Rev B)

- 379896 (442*FHVP)
- 379594 (442*BHVP)
- 500841-1 (90O Elbow Pipe)
- 328075X Hose Assembly

See Chart previous Slide

442 Series
6 & 8-Bolt Installation Instructions
Automatic Transmissions

P.T.O. Openings for Automatic Transmissions Allison Models

**8000 Series**
- Lube Tap: 3/8 N.P.T. 16-60 P.S.I., 1.1-4.2 Kg/cm²
- Main Pressure: 1/4 N.P.T. 140-230 P.S.I., 9.9-15 Kg/cm²

**MT-30-42 (57 Teeth) 6 Speed**
- Main Pressure: 1/8 N.P.T. 90-200 P.S.I., 6.3-14 Kg/cm²

**1000, 2000/2400 Series**
- Install Tee Fitting Here: “From” Cooler Return Port
- Lube Tap: 3/4 O-Ring 50-70 P.S.I., 3.5-4.9 Kg/cm²
- T Fitting 378840

1. Converter driven P.T.O. Drive Gear.
2. Engine driven P.T.O. Drive Gear.
P.T.O. Shifting Procedure & Precautions

This vehicle is equipped with a POWER TAKE-OFF
Consult Operating Instructions Before Using. (See Sun Visor)

POWER TAKE-OFF OPERATION VEHICLE STATIONARY

• Manual Transmission
  - A Power Take-Off is, and should be, operated as an integral part of the main transmission.
  - Before shifting the Power Take-Off into or out of gear disengage the clutch and wait for transmission or P.T.O. gears to stop rotating.

• Automatic Transmission with Manual Shift P.T.O. (Includes Air Shift)
  On automatic transmissions, the gears in the transmission turn when the transmission is in neutral, therefore, gear clashing will occur if the Power Take-Off is shifted into gear at this time.

1. With Converter Driven Gear:
   - Shift transmission lever into any of the drive positions (this will stop transmission gear from turning).
   - Shift Power Take-Off into gear.
   - Shift transmission into neutral (this will start gears turning).
P.T.O. Shifting Procedure & Precautions (Cont’d)

2. With Engine Driven Gear:
   - Shift P.T.O. into gear before starting engine. This procedure should eliminate gear clash.

   • **Automatic Transmission with Powershift P.T.O.**
     Engage P.T.O. with engine at idle speed. Power Shift P.T.O.s: Engine must be at idle when P.T.O. is engaged. See transmission manufacturer’s instructions for special procedures.

**IMPORTANT:** Failure to follow proper shifting or operating sequences will result in premature P.T.O. failure with possible damage to other equipment.

**WARNING:** Use only wire control with P.T.O. made for wire cable control. If lever control is desired, order P.T.O. for lever control. The internal shifting mechanism for wire is not designed for heavy forces usually encountered with lever control linkage.

Do not attempt to work on an installed Power Take-Off with the engine running.

Make sure to block any moving or raised device that may injure a person working on or under the truck. A lever or its linkage may be accidentally moved causing movement of the device which could cause injury to a person near the device.
6 & 8-Bolt Installation Sketch

NOTE: When this installation is used on vehicles with automatic transmissions the P.T.O. drive must be stopped before shifting.

CAUTION: When installing nylon tubing avoid sharp angles, exhaust and manifold systems.
The rotatable flange is shipped loose with the P.T.O. units for ease of installation. After determining the flange position, attach the flange to the P.T.O. bearing cap using the capscrews provided in the bag kit. Bag kit number 328170-207X (6-Bolt family) will contain (3) capscrews (378447-6) and 328170-208X (277 Series) will contain (4) capscrews for attaching the flange to the P.T.O. bearing cap.

After installing the capscrews make sure to torque the screws to 16-20 Lbs. ft. (22-27 N.m.)

Consideration should be taken on the size and weight of the pump being installed. (see pages 4 and 5)

NOTE: Reinstalling or tightening of a rotatable flange after it has become loose is not recommended. If a P.T.O. has run for length of time after the flange has become loose, the flange and / or bearing cap may not be to manufacturing tolerance.
# 6 & 8-Bolt Installation Instructions

## Rotatable Flanges

### Torque Chart

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Family</th>
<th>Pump Flange to Bearing Cap Capscrew P/N</th>
<th>Qtr.</th>
<th>Size Capscrew</th>
<th>Capscrew Bag Kit</th>
<th>Recommended Capscrew Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>“GA”, “GB”, “PA”, “PF”, “RA”, “RB”, “RE” &amp; “RF”</td>
<td>6-Bolt</td>
<td>378447-6</td>
<td>3</td>
<td>0.312&quot; - 18 x 1.000&quot;</td>
<td>328170-207X</td>
<td>16 - 20 Lbs. ft.</td>
</tr>
<tr>
<td>“RC”, “RD” &amp; “RH”</td>
<td>6-Bolt</td>
<td>378446-4</td>
<td>6</td>
<td>0.250&quot; - 20 x 0.750&quot;</td>
<td>328170-210X</td>
<td>8 - 12 Lbs. ft.</td>
</tr>
</tbody>
</table>
6 & 8-Bolt Installation Instructions
Power Take-Off Maintenance

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

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

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

**Monthly:** Inspect for possible leaks and tighten all air, hydraulic and mounting hardware, if necessary. Torque all bolts, nuts, etc. to Chelsea specifications. Ensure that splines are properly lubricated, if applicable. Perform maintenance as required.
With regards to the direct mounted pump splines, the P.T.O. requires the application of a specially formulated anti-fretting, high pressure, high temperature grease. The addition of the grease has been proven to reduce the effects of the torsional vibrations, which result in fretting corrosion on the P.T.O. internal splines as well as the pump external splines. Fretting corrosion appears as a “rusting and wearing” of the pump shaft splines. Severe duty applications, which require long P.T.O. running times and high torque may require more frequent regreasing. Applications such as Utility Trucks that run continuously and are lightly loaded also require frequent regreasing due to the sheer hours of running time. It is important to note that service intervals will vary for each and every application and is the responsibility of the end user of the product. Chelsea also recommends that you consult your pump owners manuals and technical services for their maintenance guidelines. Fretting corrosion is caused by many factors and without proper maintenance, the anti-fretting grease can only reduce its effects on components.

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

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