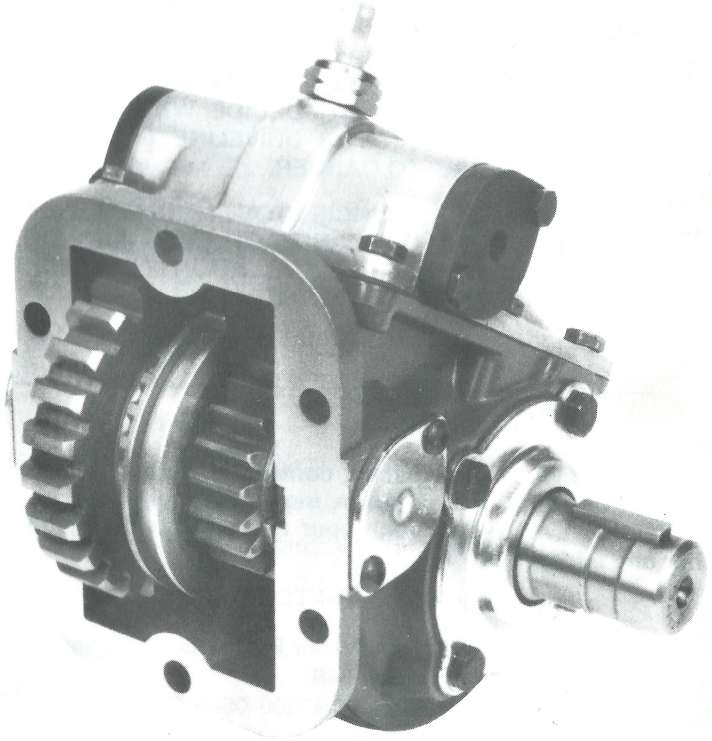
KEEP IN VEHICLE
READ OPERATING INSTRUCTIONS
INSIDE BEFORE OPERATING PTO

PTO INSTALLATION and OWNER'S MANUAL

FOR ALL 6-BOLT AND 8-BOLT MOUNT SERIES OF MUNCIE PTOS



MUNCIE

Muncie® Power Products

WARNING

DO NOT ATTEMPT TO INSTALL OR SERVICE ANY POWER TAKE-OFF WITH THE TRUCK ENGINE RUNNING. PUT THE IGNITION KEYS IN YOUR POCKET BEFORE GETTING UNDER THE TRUCK.

DO NOT ALLOW TRUCK ENGINE TO BE STARTED WHILE WORKERS ARE UNDER THE TRUCK.

IMMOBILIZE TRUCK WHEELS WITH SUITABLE CHOCKS BEFORE WORKING UNDER TRUCK.

BE SURE TO BLOCK ANY RAISED BODY OR MECHANISM BEFORE WORKING ON OR UNDER THE EQUIPMENT.

INSTALLED POWER TAKE-OFFS MUST NEVER BE SHIFTED IN OR OUT OF GEAR BY ANY MEANS EXCEPT BY THE CONTROLS IN THE CAB OF THE TRUCK.

STAY CLEAR OF SPINNING DRIVESHAFTS TO AVOID BECOMING ENTANGLED AND INJURED.

IT SHALL BE THE RESPONSIBILITY OF THE INSTALLER OF A MUNCIE POWER TAKE-OFF TO DECIDE WHETHER TO INSTALL GUARDS IN THE PTO AND/OR DRIVELINE AREA BECAUSE OF POTENTIAL EXPOSURE TO DANGER.

THIS IS BECAUSE MOST MUNCIE PTOS ARE INSTALLED BY EQUIPMENT DISTRIBUTORS OR MANUFACTURERS AND THEREFORE, THE RESPONSIBILITY OF THE INSTALLATION IS BEYOND THE CONTROL OF MUNCIE POWER PRODUCTS.

The PTO is supplied with a packet containing warning labels. If you did not receive any, or if you need extra, you may order them, no charge, by phone or mail. They are available through your nearest Muncie distributor or at the number and address below:

1-800-FOR-PTOS (367-7867)

Muncie Power Products, Inc.
P.O. Box 548
Muncie, IN 47308-0548

info@munciepower.com

PTO OWNER'S MANUAL

FOR ALL 6-BOLT AND 8-BOLT MOUNT MUNCIE PTOS

TABLE OF CONTENTS

SECTION 1
PTO INSTALLATION

PTO INSTALLATION INSTRUCTIONS

Always wear safety glasses. Read entire manual before starting installation.

1. There is a packet with the PTO which contains 4 WARNING LABELS. Before adhering the labels, make sure the surfaces are free of dirt and grease. Place the labels supplied as follows:

There are two (2) labels which measure approximately 4" x 8" which are to be placed on the outside of the vehicle frame rail, making them easy to be seen by anyone who might go under the truck or near the PTO. One label is to be placed on each side of the vehicle.

Should the body installed on the chassis cover the frame rail, place the label on the body in a position easily visible by anyone who might go under the vehicle or near the PTO. **Do not paint over labels.**

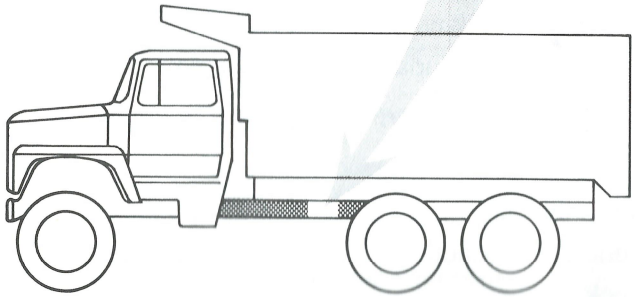


Figure 1.1

There are two (2) 4" X 8" labels supplied and one is to be placed on each side of the vehicle.

2. The 2" x 3" PTO Equipped Caution Label is to be placed within the ca the vehicle and in easy view of the vehicle operator. It should be located the PTO control, when the control is installed in the vehicle dash (See F 1.2). This label directs the operator to read the PTO operating instructio the "Visor Label". The Visor Label 5 1/2" x 8 1/2" is to be placed on the on the operator's side of the vehicle (See Figure 1.2).

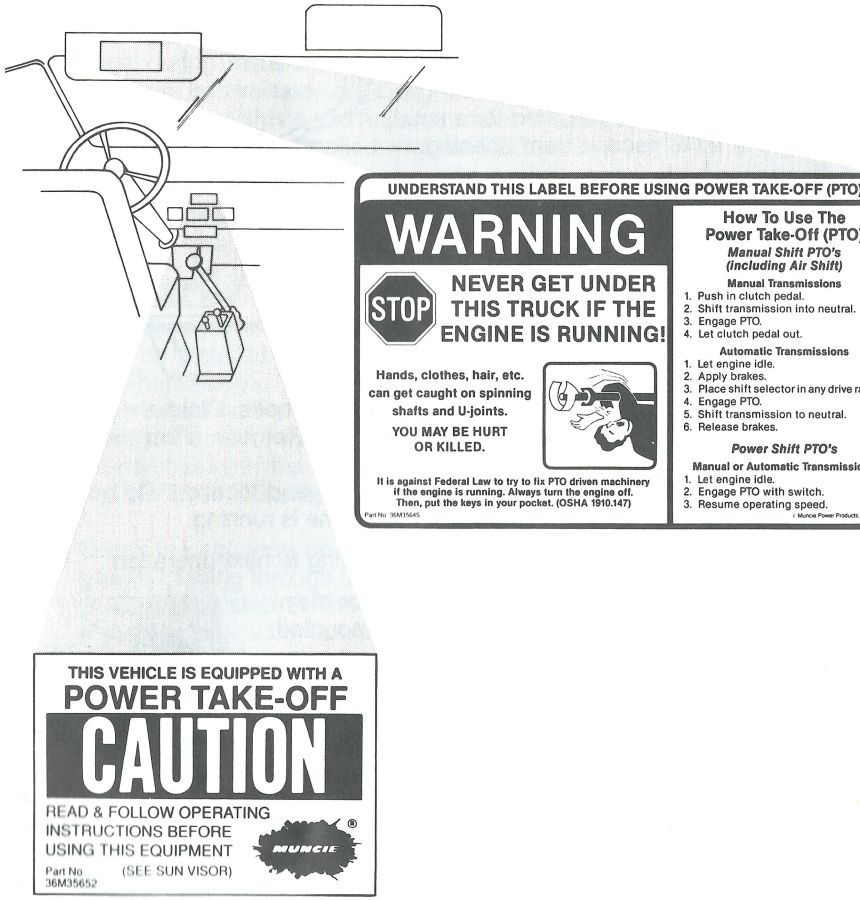
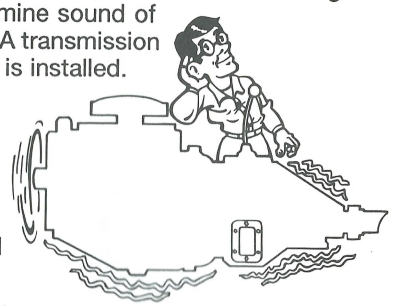


Figure 1.2

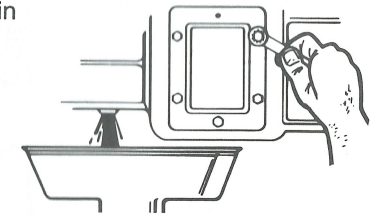
3. Manual Transmissions: While driving the truck into the work bay note if a delay is required between depressing the clutch and shifting the main transmission gear selection. If the gear does not come to a complete stop within a few seconds, the clutch linkage on the truck must be adjusted before installing the PTO. Run transmission in neutral. Determine sound of transmission before the PTO is installed. A transmission noise may be more noticeable after PTO is installed.



Stop engine.

4. For manual shift transmissions, drain transmission fluid. For Allison automatic transmissions, do ***not*** drain transmission fluid, but be prepared for a small amount of oil to escape from opening.

Remove cover plate. Place a shop towel in the opening to prevent dirt from getting in the transmission.



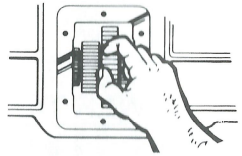
Examine cover plate. If there is a magnet attached to the inside, reinstall this cover on the other opening.

Clean mounting pad. Inspect bolt holes in aperture for thread sealant used on OEM bolts. Clean these internal threads with wire brush to clear the material. **Remove shop towel.**

5. Check transmission for proper PTO driver gear and location. Do not place anything in or near PTO opening while the engine is running.

Stop engine and remove keys before proceeding to next operation.

Check PTO driver gear for condition. A nick or blemish may cause excessive noise when PTO is mounted.



6. Rock transmission gears by hand to get "feel" for gear backlash manufactured into transmission gear set.

7. Open the PTO carton and find the mounting kit (studs and cap screws) enclosed with your PTO. Visual inspection of the PTO will indicate which mounting holes in the PTO will not accept cap screws. Install the enclosed studs in the transmission housing holes that correspond to those PTO holes which will not accept cap screws. Additional instructions may be found on pages 2.12 - 2.14 or on supplement sheet enclosed with PTO. Install adapter gear at this point if it is required. (Go to page 1.9 if adapter gear is used.)

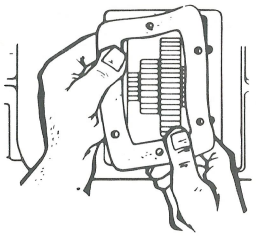
8. Install the studs until the barrel of the stud is even with the transmission pad. This typically requires a torque limit of 30-35 lbs.-ft. (6 bolt pad) or 45-50 lbs.-ft. (8 bolt pad). If more torque is required to install the stud to the barrel or to the depth shown in the below table then remove the lock patch from the stud and the transmission mounting holes and use a liquid loctite in its place (#242).

The studs should be engaged to the minimum depth as shown in the chart:

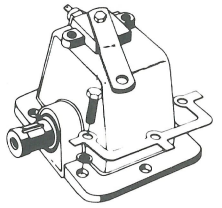
Stud Dia.	No. Threads	Approx. Depth
3/8"	7 - 8	1/2"
7/16"	8 - 9	5/8"
10mm	9 - 10	1/2"

9. Remove the shifter cover or the inspection cover plate from the PTO by removing the hex head cap screws on the cover plate. With PTOs which do **NOT** have an inspection cover plate, hold the output shaft and rock input gear to get the "feel" of backlash built into the PTO. This "feel" will be helpful when fitting PTO to transmission. (Step 12)

10. Place mounting gasket/shim from your kit over the studs already installed on the transmission. A thin coating of approved transmission oil is recommended on gasket/shims to help seal and to hold them in place during installation. The PTOs for the Eaton Lightning Transmission are designed to be mounted without gasket/shims and require the use of a gasket eliminator which is supplied with the PTO.



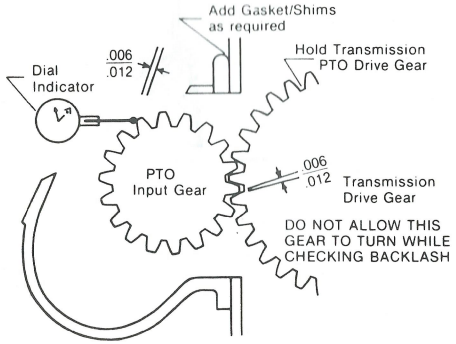
Do **not** use a permanent sealant on gasket/shims because you may need to change them later. Use approved transmission oil only!



11. Mount the PTO to the studs with the copper washers, lock tabs and nuts provided. NOTE: The copper washers must be installed between the PTO housing and the lock tabs. Check for gaps between the PTO and transmission and make sure gear teeth are properly meshed before tightening nuts. Tighten the top and bottom nuts or cap screws. On some transmission models the TG Series PTO may encounter interference with the idler shaft cap. Special clearance caps may be used and are listed in the application catalog where known interference exists.

12. Check the backlash on the input gear (gear that meshes with transmission gear) by feeling through the inspection hole or shift cover opening previously uncovered in step 9. The amount of rotational movement of the PTO gear should be only .006" to .012". As a reference, the thin gasket/shim in your installation kit is .010" thick. The thin gasket/shim (.010" thick) will change the backlash approx. .006". The amount of movement of the input gear would only be about the same distance as this gasket/shim thickness. At least one gasket/shim ***must*** be used. Do not stack more than (4) gasket/shims together. On Allison transmissions (Series AT-500, MT-600, HT-700, 1000, 2000, 2400 only) the single .030" gasket/shim (13M13541) should be required and is supplied with PTO. The CS6B-A6807 Series uses the 23M60270 spacer and requires gasket/shims and backlash checks as described below.

Notice: For some Warner W80 applications, a maximum of one thin gasket/shim (.010") is required. If backlash is too excessive, remove the gasket/shim and use Loctite Gasket Eliminator™ sealant Muncie #13M51717. A .20 ounce tube has been supplied with the PTO for these applications.



Use of a dial indicator can greatly improve the quality of the installation. Mount the indicator so that the plunger aligns with a tooth on the PTO input gear. Hold the transmission gear with screw driver or bar and rock the PTO gear back and forth with your hand. The

total movement on the dial indicator should be between .006" - .012". Check the backlash at different points around drive gear to find the worst condition.

NOTE: Never use silicone type sealant on PTO/transmission mounting surface as proper backlash cannot be attained.

13. Torque all the mounting cap screws or nuts to 30-35 lb-ft (6-bolt pad) or 45-50 lb-ft (8-bolt pad). Approximating the torque would be required for stud locations where a torque wrench can not be applied. This can be accomplished by the installer comparing the tightness of an accessible cap screw or nut. Tighten this nut with the wrench to be used on the hard-to-reach nut. Check the torque. Repeat until the installer "gets the feel" of this torque. Then tighten the hard-to-reach nut so that it approximates this torque.

Recheck the backlash.

The PTO gear should not move more than .012 or less than .006 when all mounting nuts or bolts have been torqued.

14. Replace shifter cover or inspection cover plate on the PTO. Torque cap screws to 14-18 lb.-ft. Double check to make sure the shifter fork is in groove on gear or shift collar before tightening cap screws.

15. Start the truck engine (with transmission and PTO in neutral) for a few seconds and listen for unnatural noises. Stay clear of rotating components. A whine noise indicates the PTO is mounted too tight. Stop engine and add a gasket/shim. A clatter noise indicates a loose mount. Stop engine and remove a gasket/shim. Add sealant (Loctite gasket eliminator™) if no gasket is used.

A PTO will not always make these noises.

Do Not adjust backlash by noise alone, always visually check backlash.

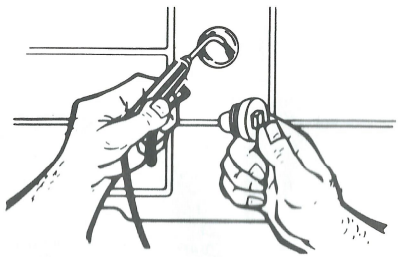
Sometimes filling the transmission with lube is the only way to reduce the noise.

A tight mounted PTO will cause under cutting of gears and result in premature PTO failure, including gear or housing breakage.

If OK, repeat test with PTO engaged.

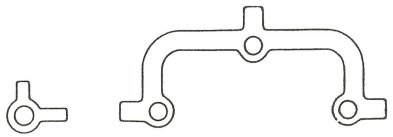
Caution: Keep PTO/transmission running time as short as possible until transmission is refilled with lube. Do not drive the truck without transmission lube.

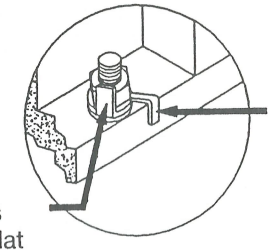
16. Refill transmission with manufacturer's approved fluid and run engine for 5 to 10 minutes to check for leaks. ***Stay clear of rotating components.*** **Stop Engine! Inspect the cap screws, nuts, and studs to make sure they are properly tightened.** Bend the lock tabs to insure that the nuts will not back off. Single hole tabs require bending one tab up tightly against the nut and the other tab down tightly against the housing. Three hole tabs are to be bent up tightly against the nut. All mounting bolts and nuts should be checked on a regular basis (for tightness).



LOCK TABS

LOCK TABS are recommended for all 6-bolt PTO installations. They are inexpensive and provide maximum protection from mounting parts working loose. Lock Tabs are included in all Muncie 6-bolt mounting kits.





Use flat tip screwdriver and hammer to tap this tab tightly against the housing.

Use flat tip screwdriver and hammer to tap this tab tightly against the flat of the nut or cap screw.

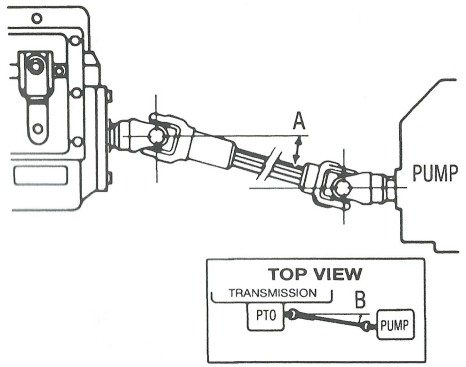
Note: *When tabs can't be reached easily to bend, then use of Loctite 242 is a recommended alternative.*

17. Install the appropriate shifter kit components, including the supplied PTO shift indicator light. Refer to page 2.1 for lever shift, page 2.2 thru 2.7 for cable shift, page 2.8 for the Lectra Shift TG series PTO, pages 2.9 thru 2.11 for air shift PTOs, and pages 2.15 thru 2.17 for Clutch Shift PTOs.

On air system only, you will not receive any air through the pressure protection valve to the PTO system until your main tank pressure exceeds 65 PSI.

18. If your system utilizes a driveline between the PTO and another device and if you have noise in your system that was not there before, the angularity or phasing of your driveline may be the cause. Check driveline angularity and reduce total angularity per recommendation on chart and be sure the PTO shaft is parallel within 1.5° to the pump shaft (or driven unit). Drivelines must be in phase, that is, the yoke ears on the PTO and pump shafts must be in alignment, as illustrated below.

Max. Speed (RPM)	Max. TJA "A"
3500*	5°
3000*	5°
2500	7°
2000	8°
1500	11°
1000	12°



** For speeds over 2500 RPM contact Muncie for Approval.*

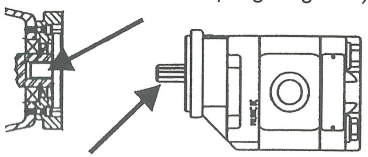
For installations with angles in the top and side views use this formula to compute the true joint angle (TJA):

$$TJA = \sqrt{A^2 + B^2}$$

PTO WITH DIRECT COUPLE HYDRAULIC PUMP INSTALLATION

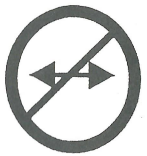
Before bolting the pump to the PTO, place non-seizing compound or grease on the PTO shaft and pump shaft.

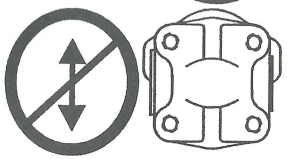
(Do not force spline couplings together)



All Muncie direct mount PTOs are supplied with the appropriate grease. Reusing an existing pump will require inspection of the pump splines. Clean any old grease from pump prior to installation.

When mounting hydraulic pumps weighing over 40 lbs.*, exceeding 12" in length, or for tandem or multiple section pumps, a rigid support bracket must be installed. It should be attached to the rear of the pump and to the transmission to support the pump and to inhibit movement in all directions.



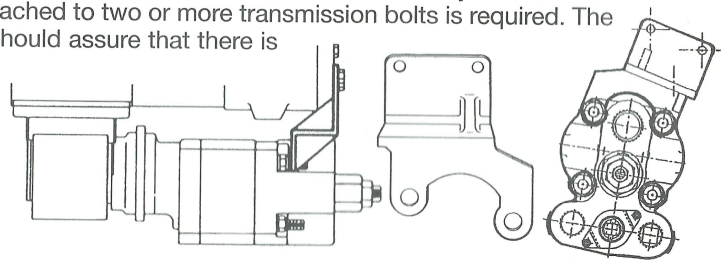


**Weight includes fittings, oil, and unsupported hose sections.*

This requirement does not take into account the system duty cycles, vehicle vibrations, application, terrain, and other external influences. We recommend that direct mounted components of any size or weight be supported when these conditions are extreme or unknown.

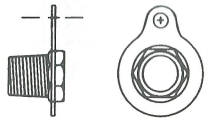
This recommendation is based upon our experiences to date. Bracket design illustrations and pump recommendations is to be used as a GUIDELINE ONLY. Bracket design shown is representative and is not to be duplicated for all applications. Any failure as a result of damage caused by unsupported weight attached to the PTO will affect any warranty considerations.

The drawings below are examples of how the bracket may be constructed. A bracket attached to two or more transmission bolts is required. The bracket design should assure that there is no stress or force exerted on the pump or PTO shaft.



If the vertical supports are greater than 20 degrees off of perpendicular with the transmission main shaft then a reinforced "Z" bracket must be used. Reinforce horizontal members to prohibit flexing at bend or weld. Attach the bracket at the pump bolt closest to the center of gravity of the pump.

Pumps without attaching holes or studs are sometimes supported by welding an eyelet to a hose adapter fitting, installing this into the pump port, and then attaching your bracket to it.



Most Muncie direct mount flanges offer multiple mounting bolt holes which allow the flange to be rotated to multiple locations on the PTO for improved port location or clearance. Be sure to torque the cap screw to 18 ft.lb., and it is advisable to use a thread locker to secure the cap screws (Loctite 241 or NyLoc or equivalent).

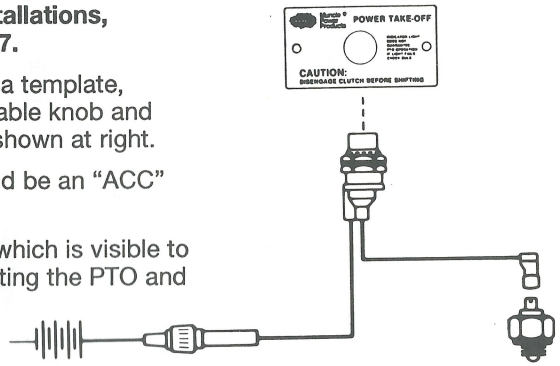
19. FOR CABLE OR LEVER SHIFT INSTALLATIONS ONLY.

For CLUTCH SHIFT installations, skip to pages 2.12 - 2.17.

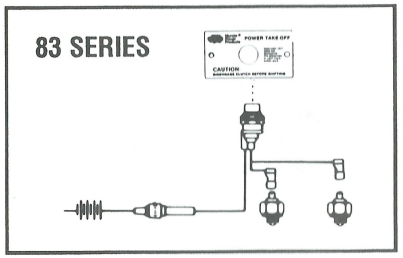
Using the metal plate as a template, drill holes in dash near cable knob and attach indicator light as shown at right.

Battery connection should be an "ACC" tap on fuse panel.

Install light in a position which is visible to the operator when operating the PTO and the vehicle.



The indicator light is to be connected so that when the PTO is engaged the light is "ON" and the light is "OFF" when the PTO is disengaged.

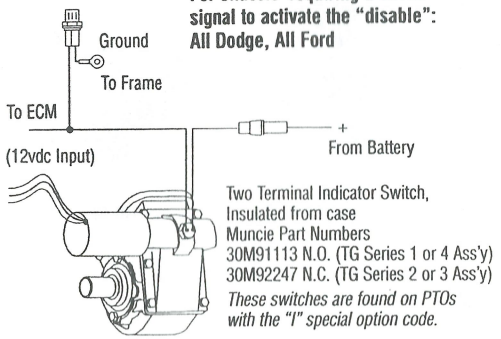


Do not install any other electrical devices to Muncie indicator switches, or to pressure switches. See page 2.12 for wiring indicator switch to the Eaton Fuller CEEMAT transmissions.

IMPORTANT: 1996 and Later Full Size Light Truck

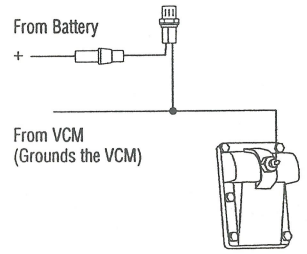
Installation of the indicator light through the "On Board Diagnostics" as required by full size light truck manufacturers. Refer to the vehicle owner's manual and body builder's manual for locations and functions.

For Chassis' requiring a 12vdc signal to activate the "disable": All Dodge, All Ford



Two Terminal Indicator Switch,
Insulated from case
Muncie Part Numbers
30M91113 N.O. (TG Series 1 or 4 Ass'y)
30M92247 N.C. (TG Series 2 or 3 Ass'y)
These switches are found on PTOs with the "I" special option code.

For GM Gas Engine, Grounding of the ECM is required.

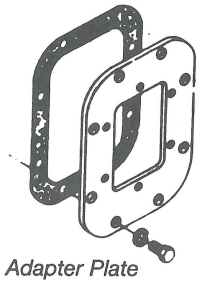


20. When installation is complete, start engine, stay clear of rotating components, depress the clutch, wait 2-3 seconds and engage PTO. If any unusual noise is heard or vibration felt through the PTO control, it is an indication that the clutch linkage may need adjusted.

21. Complete installation by placing warning labels as indicated on borders of the decals. Placement examples are illustrated on pages 1.1 and 1.2. Turn to Section 3 of Owner's Manual.

ADAPTER PLATES & ASSEMBLIES

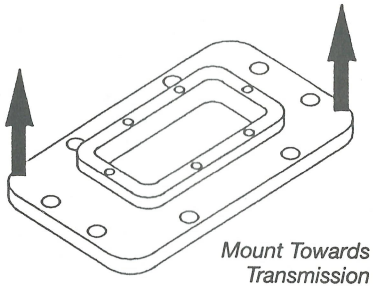
See Muncie Quick Reference Catalog for specifications.



Adapter Plate

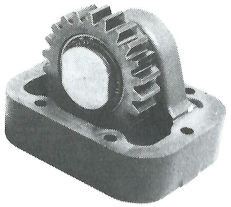
ADAPTER PLATES are used to convert an SAE 8-bolt aperture to an SAE 6-bolt aperture.

Adapter plates mount to the transmission pad with included gaskets and capscrews. The 1/4" plate has a raised pad to provide proper thread engagement. This raised pad is to be mounted toward the transmission opening and the PTO is mounted to the flush side of the plate.

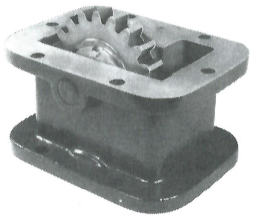


Mount Towards Transmission

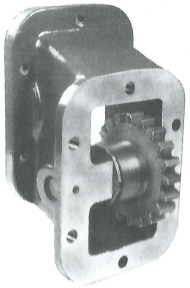
ADAPTER GEAR ASSEMBLIES are normally used to reverse the rotation of the PTO output shaft. They are also commonly specified to clear mounting obstructions. Standard adapters will move the PTO outward from the transmission approximately three inches. Adapters often reduce the application horsepower ratings and service life. Contact Muncie for specific information regarding your application.



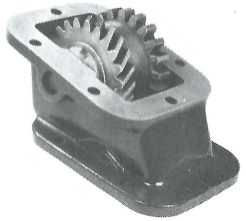
Solid Body – Single Gear



Flanged Body – Single Gear



Vertical Offset Gear



Angular Cluster Gear

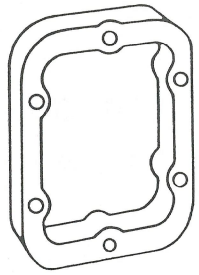
ADAPTER GEAR INSTALLATION

Before installing the adapter gear be sure to read all of the instructions in this booklet for installing a PTO. Follow all the safety instructions listed when installing the adapter as you would for installing the PTO. Make sure that the engine is turned off and wheels are immobilized before starting any installation.

1. Follow steps 1 through 7 on pages 1.1 through 1.3 of this manual.
2. Before attempting to mount adapter to transmission, bench mount the adapter to the PTO using studs or capscrews in at least the top and bottom stud holes.
3. Using gaskets and spacers (if required) adjust the backlash between the adapter and the PTO so that it is between .006" to .012" inches.
4. After spacing between PTO and adapter is adjusted remove the adapter from the PTO and carefully save the Gasket Pack you have just created. Mount the adapter to the transmission using at least the top and bottom stud holes. Adjust the backlash of the adapter to the transmission so that it is .006" to .012" inches. Refer to steps 8 through 12 on pages 1.3 and 1.4 for additional instructions on backlash.
5. Using the Gasket Packs created from earlier steps, mount the PTO to the adapter using all six studs stud holes and return to the instructions on page 1.3, step 8 and continue the installation until completed.

FILLER BLOCKS/SPACERS

FILLER BLOCKS are often required in transmission applications where it is necessary to use a spacer to adapt the PTO to a particular transmission. Two filler blocks may be used in combination with one or more gaskets between the filler block surfaces. A minimum of one (1) gasket is required between each surface. Refer to notice supplied with the filler block for more information.



SECTION 2
ACTIVATION KIT INSTALLATION

ALL INSTALLERS *MUST* READ THE FOLLOWING
ACTIVATION KIT INSTALLATION INSTRUCTIONS

IMPORTANT: Disconnect vehicle battery and bleed air tanks with engine stopped prior to installing electrical or air activation kits.

A. Vehicle manufacturers may have specific locations for the accessing of electrical power and air. The body builder manual or company representative for the vehicle chassis should be contacted prior to installing electrical or pneumatic systems.

B. Route wires and air lines away from rotating and high temperature components. Use appropriate looms and bulkhead pass-thrus wherever possible to avoid rubbing through insulation or tubing and causing an electrical short or air leak.

C. Follow all Federal Motor Vehicle Safety Standards (FMVSS) for your vehicle.

D. Where electrical grounds are indicated, be sure that they are good grounds, with straight paths to the vehicle battery ground. (Many vehicle cabs are insulated from the vehicle frame and a weak ground is a very common cause for malfunctions). Check with the vehicle manufacturers for the proper ground location or connect directly to battery.

E. When installing hydraulic components, be certain to follow common installation and testing procedures. If you are not familiar with acceptable installation procedures request instructions and guidance from the hydraulic equipment supplier.

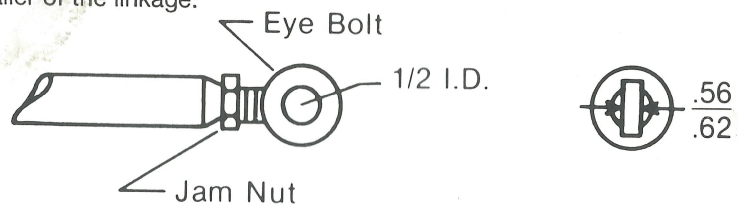
F. Note that when installing the PTO air systems the installation of a pressure protection valve is required at the air tank. This valve is not a pressure regulator, it is a pressure check valve which does not allow air to the PTO system until the system air pressure exceeds approximately 65 PSI.

LEVER SHIFT CONTROL

Install indicator light as described on page 1.8, step 19.

Muncie PTOs with lever shift options (available on SG, TG, RG, RL, RX, 82, 83 Series only) require the customer to provide the linkage and hook-up to the PTO. The PTO is provided with an eye bolt for this purpose.

The PTO is designed with detent ball and spring to locate the engage and disengage positions, but it is ***not*** designed to lock into these positions. A neutral detent to prevent unintentional or accidental engagement ***must*** be installed on the external shift linkage. This detent must be included by the installer of the linkage.



Tighten after shifting adjustments have been made.

Note: On the RX Series PTOs the indicator light will go off only in one of the two neutral positions. Refer to the Parts and Service Manual for these PTOs.

CABLE SHIFT INSTRUCTIONS

TG SERIES PTO

4HC 808

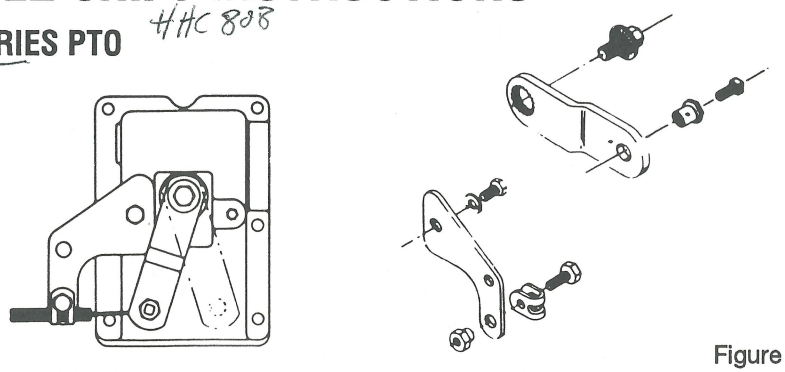


Figure 2.1

SG SERIES PTO

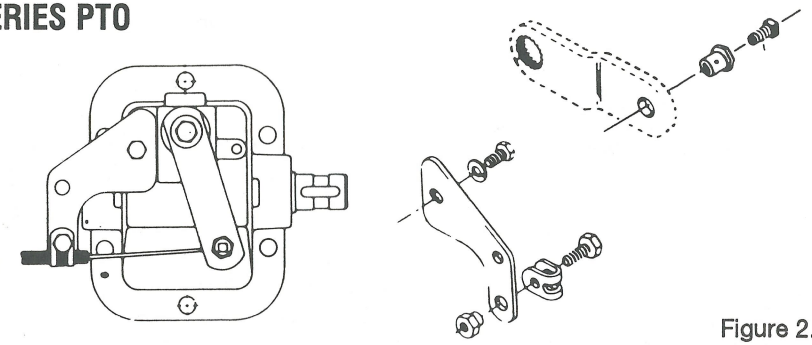


Figure 2.2

RG SERIES PTO

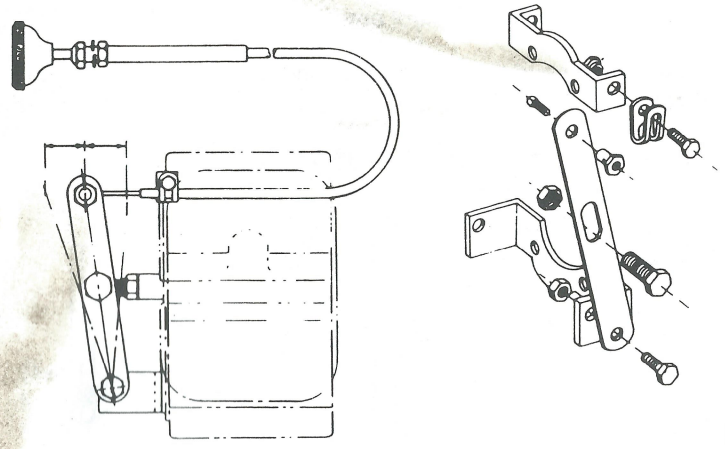
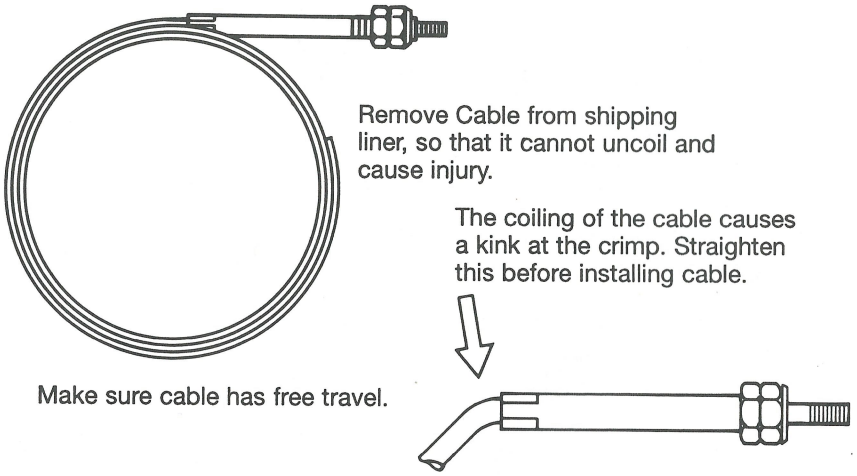


Figure 2.3

WARNING: All cable shift controlled PTOs are designed to be shifted only by wire cable. The unauthorized attachment of lever control linkage to a cable control mechanism may cause damage to shifting components and, subsequently, the transmission. The unauthorized attachment of the lever control linkage to a cable control mechanism may cause the PTO to engage unintentionally due to linkage bounce or flail.

CABLE SHIFT INSTALLATION INSTRUCTIONS

Be sure vehicle in not running when installing or adjusting cable control. After removing the cable from shipping liner (being very careful to hold cable so that it cannot uncoil and cause injury) straighten cable at crimp that has resulted from being coiled. Make sure cable has free travel before installing.



1. Find a suitable location for the control cable and the indicator light. The cable control should be installed so that the operator has easy access to push in and pull out the control without obstruction or interference by other controls or components in the cab.
2. Drill a 1/2" hole in dash or control bracket (not provided).
3. Install the control head through the hole and attach with the lock washer and nuts provided.
4. Knob can be screwed into place, using the jam nut to secure.

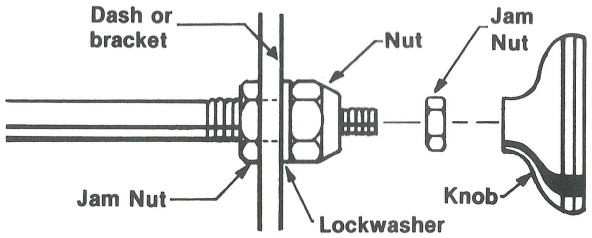
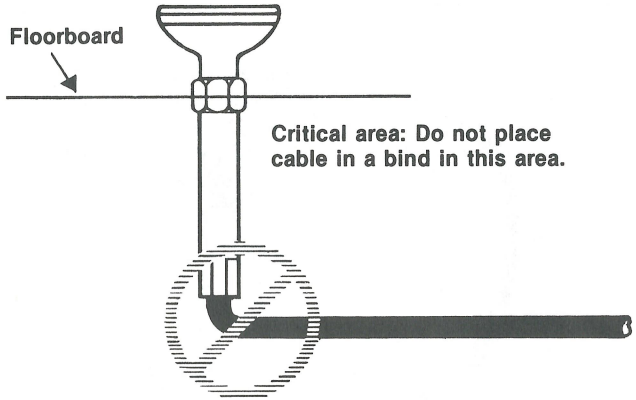
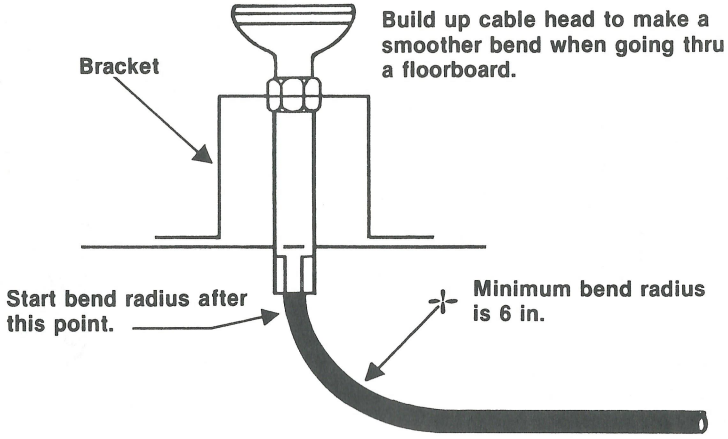


Figure 2.4

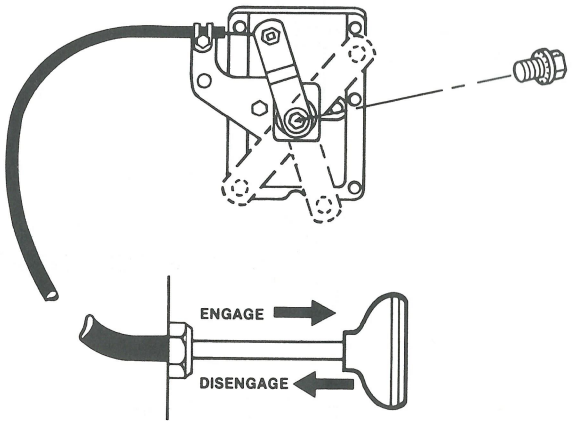
5. Route the length of cable through the floorboard or firewall and to the PTO. The cable needs to be routed clear of manifold, exhaust systems, and rotating and moving components. When routing the control cable avoid kinking the cable and do not bend to radius of less than 6".



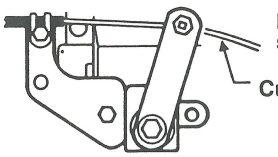


6. The lever on the PTO shifter assembly is designed so that it can be moved to allow the cable approach to be from the front or the back of the PTO. This should be determined by the routing method causing the least amount of bends and the shortest cable length.
7. The lever, also must be positioned so that when you pull on the control knob that the PTO engages. (The RG Series should have a detent position for neutral, instead of pushing all the way in for neutral.)

8. To adjust the lever, mark the position of the lever where it's engaged when the cable would pull the lever. **Remove the shift cover from the PTO.** Remove the locking capscrew from the control lever. Lift the lever from the serrated post. Line up the lever with your mark. Line up the serrated hole and post making sure that the poppet and the shift plate are in their respective positions. Replace the locking capscrew and torque to 18 ft.lb. Reinstall shift cover assembly. Double check the installation by referring back to step 7 on the previous page 2.4.



DISENGAGED



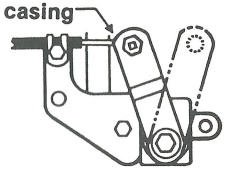
With lever in disengage position tighten Sq. head set screw.

Cut off excess wire

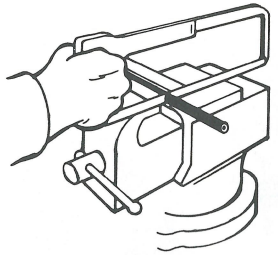
Move lever to its fully disengaged position and the cable knob to its fully disengaged position.

ENGAGED

Lever should not hit casing



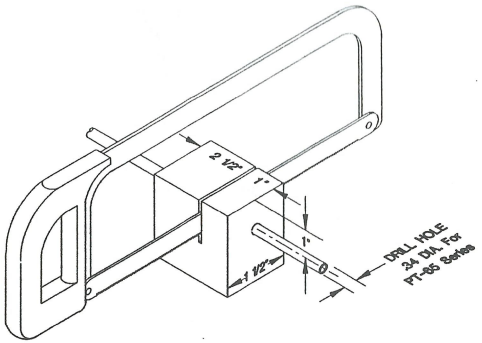
9. Referring to Figs. 2.1, 2.2, 2.3 on page 2.2, install the appropriate brackets, clamps, and hardware.



STANDARD PTO CABLE

If the cable is too long, remove the inner wire and cut casing (only) to length with a hacksaw or large side cutters.

If longer cables are required - they are available from your nearest Muncie Independent Master Warehouse.



Typical Block Dimensions Shown

DELUXE (PT-65) PTO CABLE

Abrasive power cutting equipment is recommended for shortening this type of control cable. **Do not use a bolt cutter or similar tool.** Described here is a hand method for cutting cables where abrasive power cutting equipment is not available.

Make a holding tool by using a hardwood block of any convenient length as shown in the diagram. The hole should be of a size just large enough for the conduit to easily slip through.

The hacksaw should have a fine tooth blade (no less than 32 teeth per inch). Remove the inner wire before cutting conduit by pulling the control knob end from the control head. Remove the installed cable end by unscrewing it from the cable conduit and saving it for reinstallation.

10. It is recommended that the control cable casing be securely anchored, with cable clamps, approximately every 30", to the frame and/or cab to prevent movement during shifting. Cable mounting clamps can be purchased from your nearest Muncie Independent Master Warehouse. (part no. MT306-4)

11. Install the indicator light and warning labels by referring to steps 19 & 20 on page 1.8 of this instruction booklet. The indicator light is to be "ON" when the PTO is engaged and "OFF" when the PTO is disengaged.

Do not install other electrical devices to the Muncie indicator light switch.

Install cable so that you pull to engage and fully pushed in to disengage.

The PTO indicator light must be installed so that it is visible to the operator of the vehicle while seated in the driver's seat. Additional indicator lights may need to be purchased to comply with this requirement.

INDICATOR LIGHT SWITCH CONTINUITY CHECK

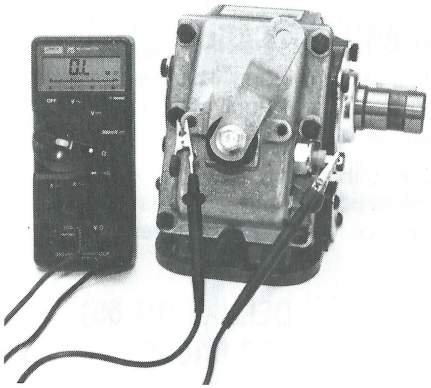


Figure 2.5

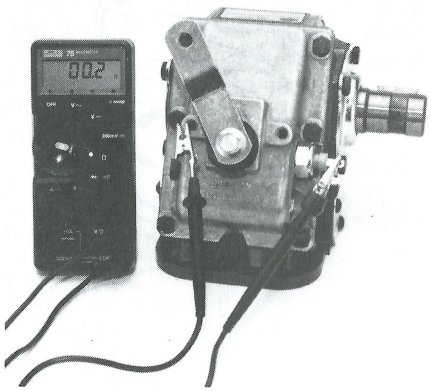


Figure 2.6

Performing a continuity check on the indicator switch will verify that the indicator switch is functioning and that the PTO is properly assembled.

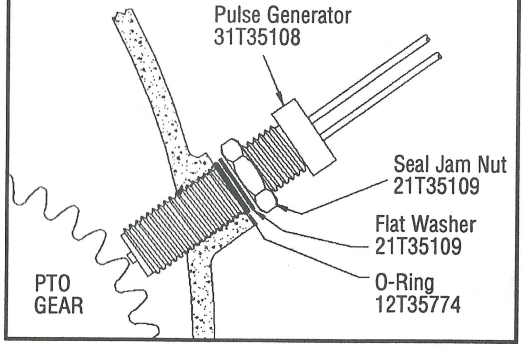
1. Using a multimeter, connect one lead to the spade terminal on the indicator switch mounted to the PTO.
2. Connect the other lead to a bare metal portion of the PTO or shifter (Figure 2.5).
3. If the PTO is mounted on a vehicle, be sure that the engine is stopped, and the vehicle is safely immobilized to prevent any movement.
4. Engage the PTO. The meter will show continuity (Figure 2.6).
5. Shift PTO to the disengage position. The meter should return to normal (Figure 2.5).

This continuity check may be performed on any Muncie PTO. Only the air shifted models will require an air source to engage the PTO.

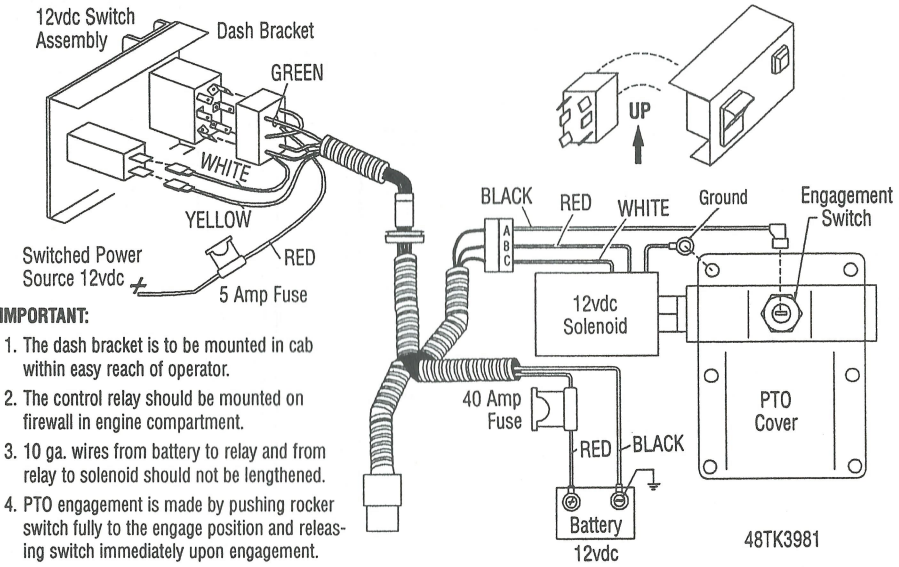
PTO EQUIPPED WITH MAGNETIC PICK-UP SENSOR

1. Mount the shift cover to the PTO (as required).
2. Align the internal gear tooth so that tip is centered in the pick-up opening.
3. Screw in the pick-up until the tip gently touches the top of the gear tooth.
4. Turn the pick-up backwards 1/2 turn. Rotate gear to make sure it clears.
5. Hold pick-up and tighten jam nut to hold in place.
6. Re-Check gear for rotation.

31TK3833 OR 31TK3873 SPEED SENSOR KIT



TG SERIES LECTRA SHIFT SYSTEM

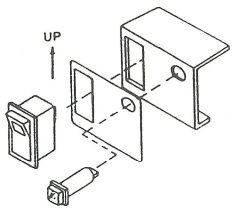


IMPORTANT:

1. The dash bracket is to be mounted in cab within easy reach of operator.
2. The control relay should be mounted on firewall in engine compartment.
3. 10 ga. wires from battery to relay and from relay to solenoid should not be lengthened.
4. PTO engagement is made by pushing rocker switch fully to the engage position and releasing switch immediately upon engagement.
5. Excessive repeated shifting of PTO can overheat solenoid and prevent engagement until allowed to cool down.
6. Drill .625 dia. hole in firewall near where control relay is mounted. Install black plastic grommet (P/N 37T35674) in hole and run the four wire connector through the grommet and plug into cab harness portion of harness. Plug the rocker switch receptacle onto the switch so that the green wire is up (matching the position of the green light on the rocker switch.)

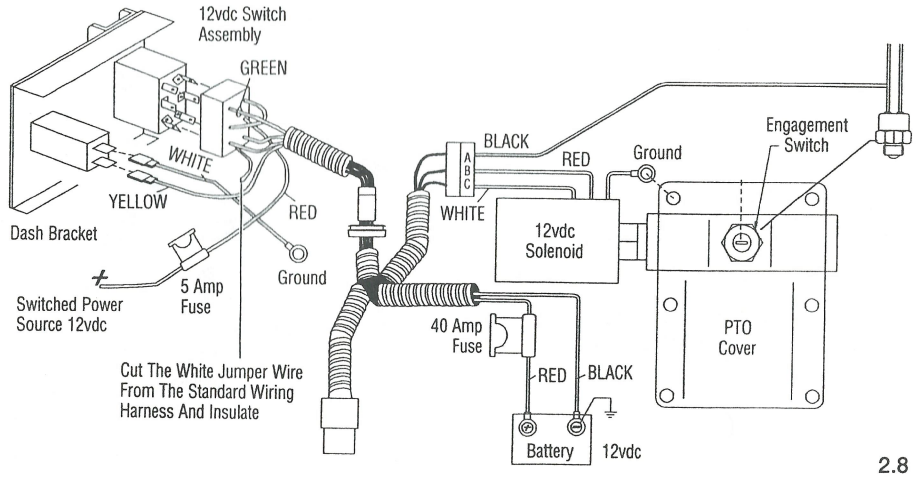
SWITCH AND LIGHT INSTALLATION

1. Remove protective film from faceplate.
2. Lay faceplate on switch bracket and push switch into faceplate and bracket so that the green lens on the rocker is up.
3. Insert the indicator by aligning the flat with the hole in the faceplate and bracket, then push the light into place.



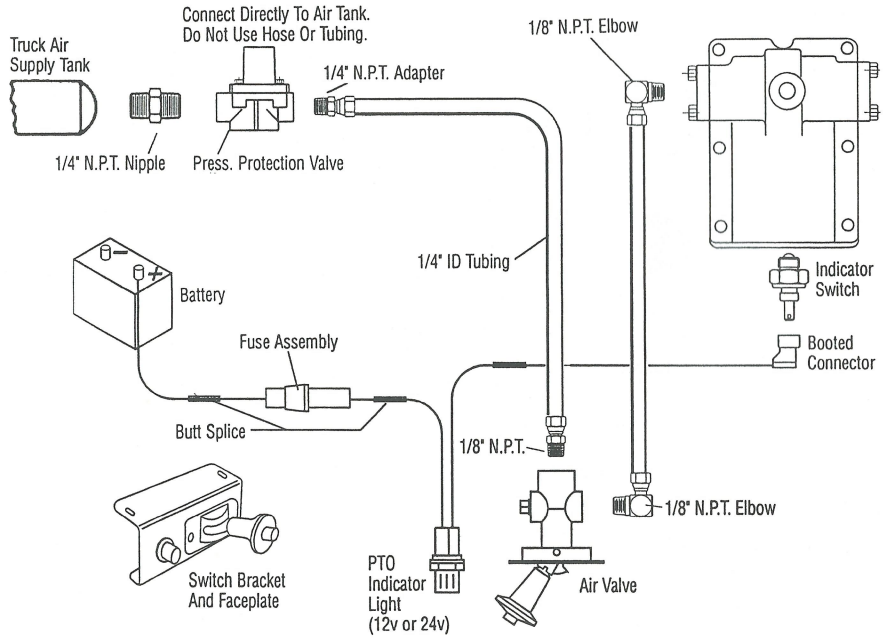
LECTRA SHIFT INSTALLATION WITH EATON FULLER CEEMAT

48MK1434-14 (1 or 4 Assembly) • 48MK1434-23 (2 or 3 Assembly)



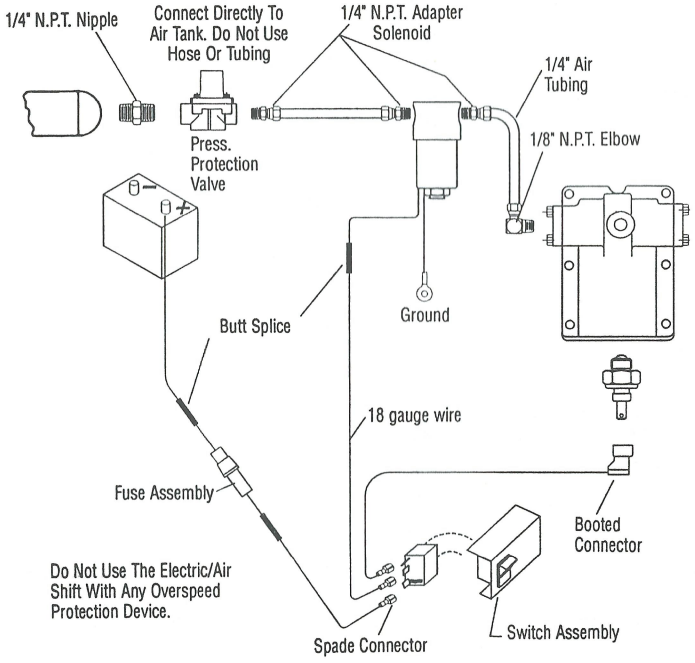
TG SERIES STANDARD AIR SHIFT SYSTEM

48M61250-A (12V Light)
48M62450-A (24V Light)



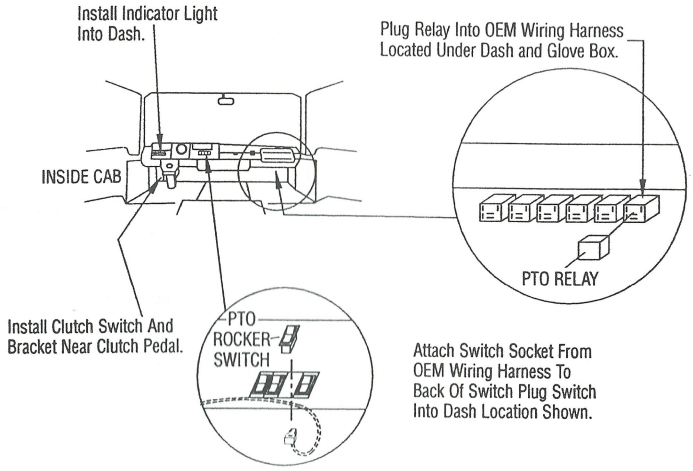
TG SERIES ELECTRIC/AIR SHIFT SYSTEM

48M61200-A (12V Solenoid & Switch)
48M62400-A (24V Solenoid & Switch)

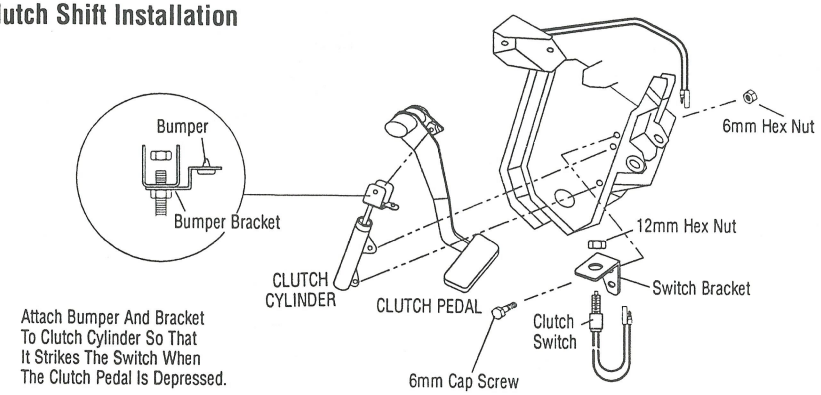


TG SERIES AIR SHIFT SYSTEM FOR NISSAN MLS-61A OR B

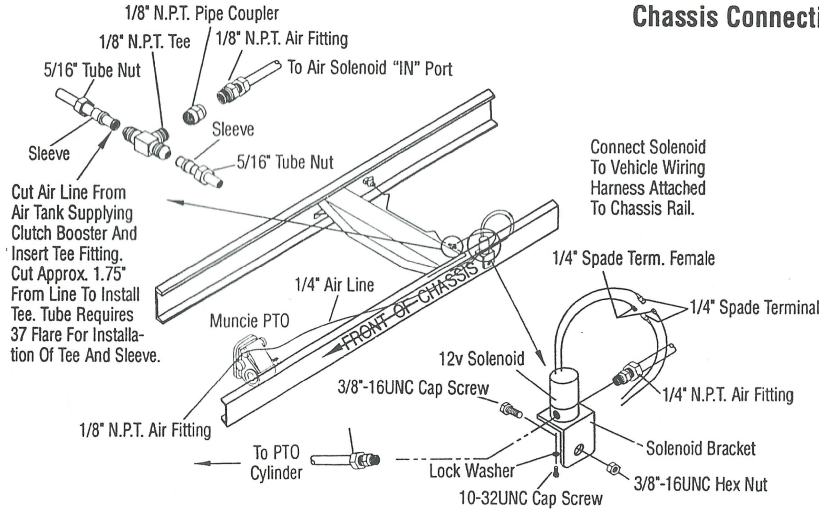
48TK4027 "N" Shift Option – Vehicles 1999 & Aft



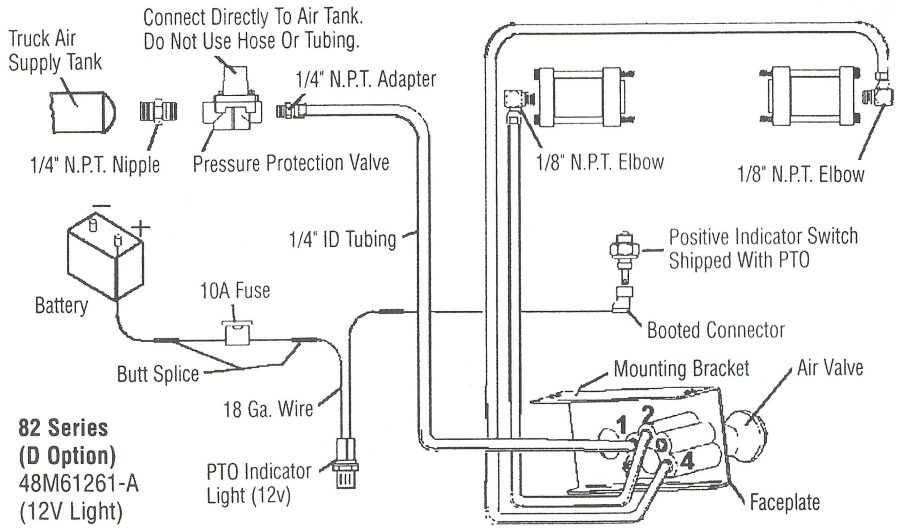
Clutch Shift Installation



Chassis Connection

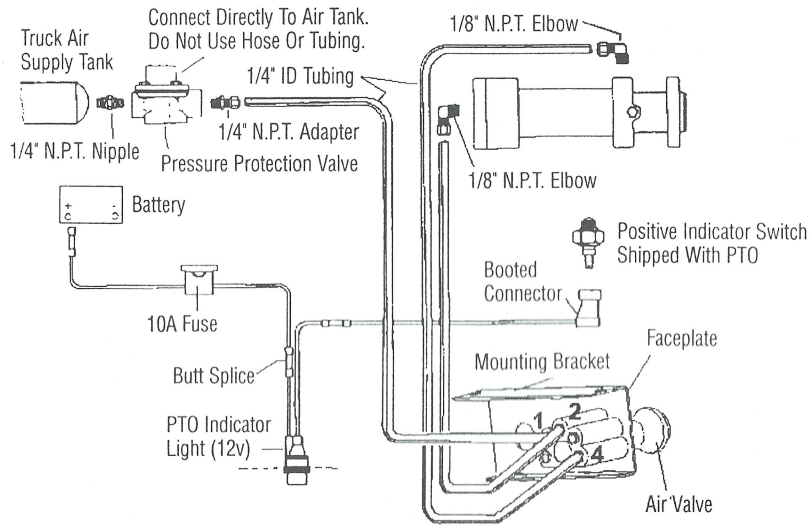


82 SERIES DOUBLE ACTING AIR SHIFT SYSTEM (D OPTION)

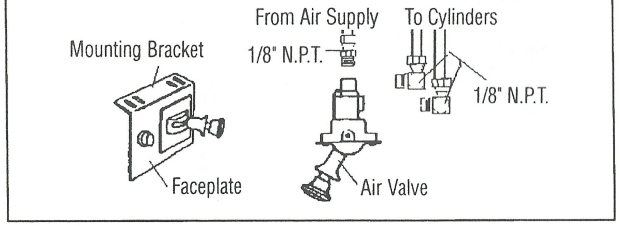


82 Series (D Option) 48M61261-A (12V Light)

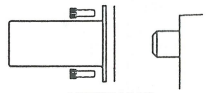
82 SERIES DOUBLE ACTING AIR SHIFT SYSTEM (Q OPTION)



RG, RL SERIES STANDARD AIR SHIFT SYSTEM



NOTE: Protective Cap For Shift Rail



16TK3896 Kit Included With Above

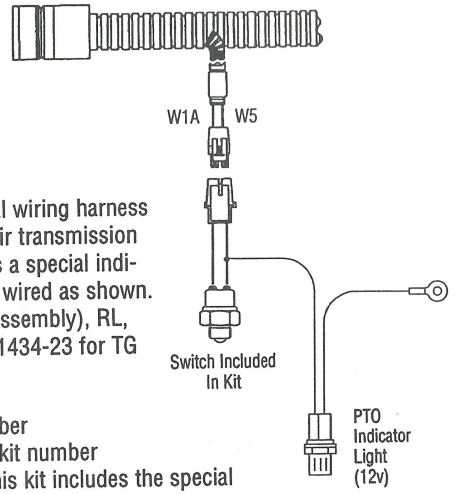
82 Series (Q Option) 48M61261-A (12V Light) **RG, RL Series** 48M61260-A (12V Light)

EATON FULLER CEEMAT TRANSMISSIONS

TG, RG, RL, 82 & 83 Series PTOs

Right Side Or Bottom Mount Openings (Not for Engine Driven PTO Opening).

Use In Addition To The Shift System Components Supplied With The PTO.

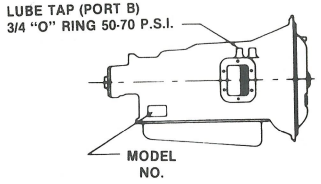
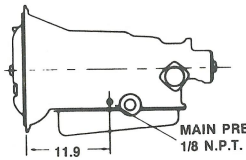
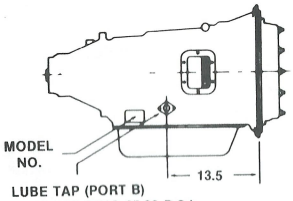
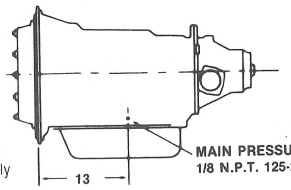
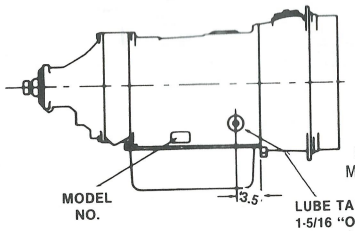
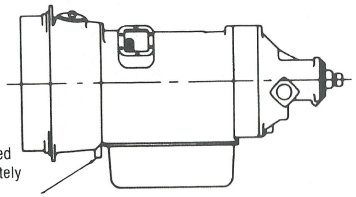


Eaton Fuller requires the installation of a special wiring harness for PTO indication used in conjunction with their transmission wiring harness. The Muncie add-on kit includes a special indicator switch and wiring harness which is to be wired as shown. Use kit number 48MK1434-14 For TG (1 or 4 assembly), RL, RG, 82 (all assemblies). Use kit number 48MK1434-23 for TG (2 or 3 assembly), and 83 Series PTOs.

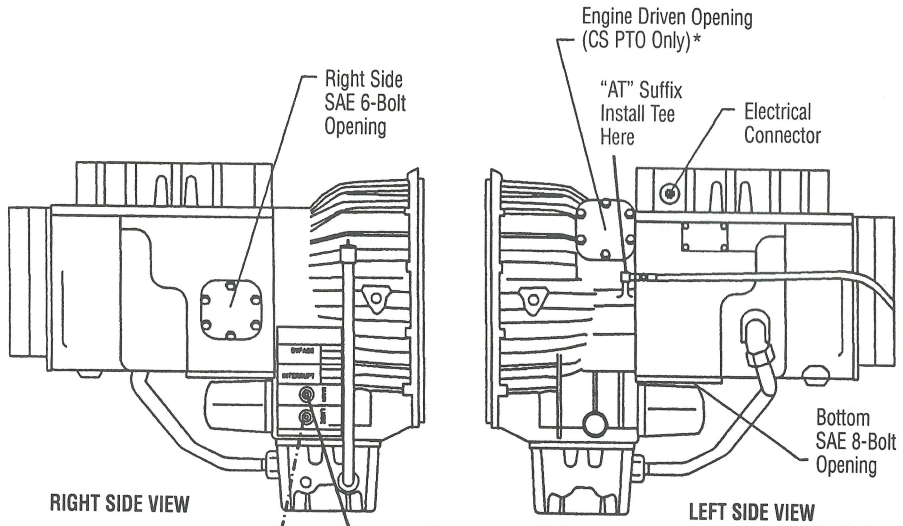
For Electric/Air Shift System PTOs use kit number 48MK1435-14 TG Series (1 or 4 assembly) or kit number 48MK1435-23 TG Series (2 or 3 assembly). This kit includes the special indicator switch, wiring harness, indicator light and face plate.

AUTOMATIC TRANSMISSION DIAGRAMS
APPLICATION INFORMATION

ALLISON TRANSMISSION

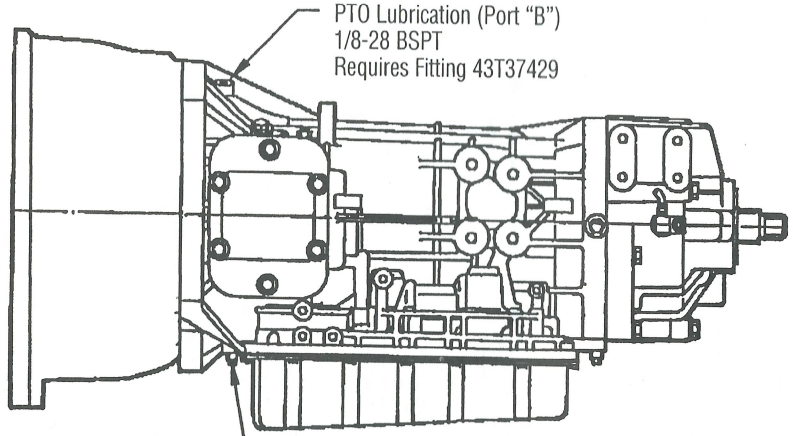
RIGHT PROFILE	MODEL	LEFT PROFILE
	**AT-540 4 SPEED** Lube Fitting No. 43M78840 Required Must be ordered separately	
	**MT-600 4 & 5 SPEED SERIES** Lube Fitting No. 43M78970 Required Must be ordered separately	
	**HT-740 HT-750D** Lube Fitting No. 43M78897 Required Must be ordered separately	

EATON FULLER CEEMAT TRANSMISSION

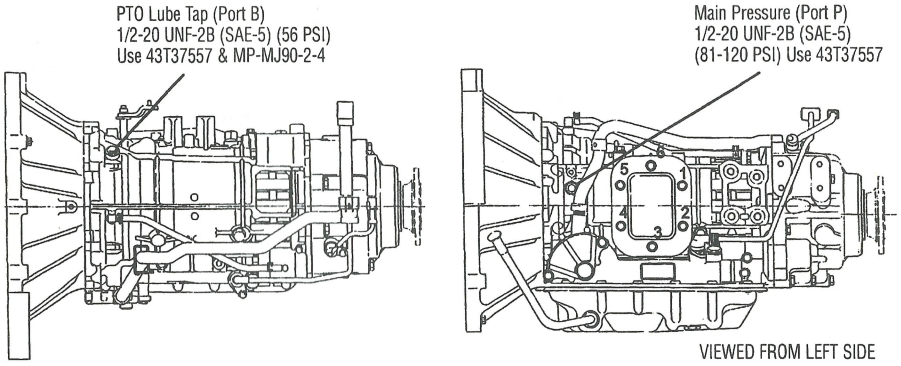


*43TK4004 Dual Lube Kit Required for Continuous Duty or High Cycle Applications

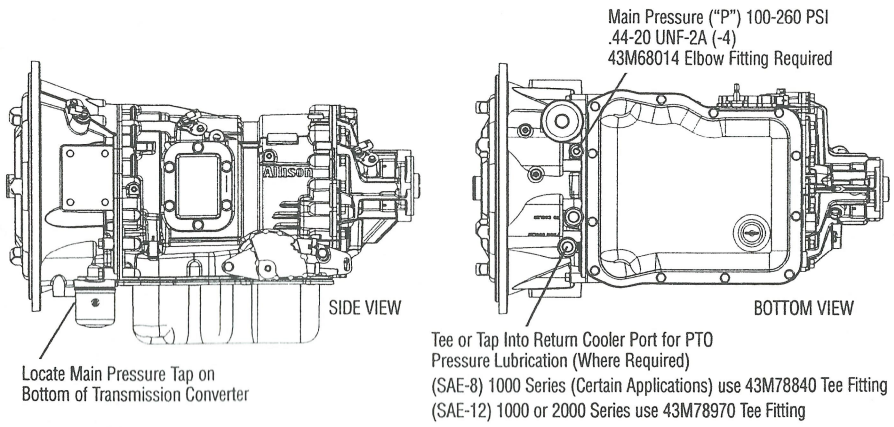
JATCO AUTOMATIC TRANSMISSION



AISIN AUTOMATIC TRANSMISSION
MODELS 450-43LE, A443, A445

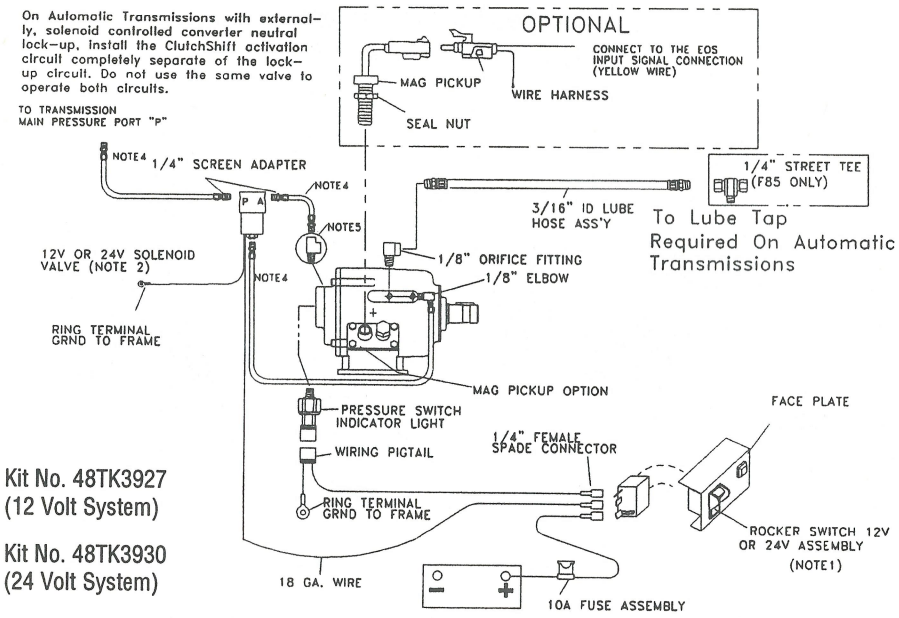


ALLISON AUTOMATIC TRANSMISSION
1000 SERIES™, 2000 SERIES™, AND 2400 SERIES™



CLUTCH SHIFT ELECTRIC/HYDRAULIC SHIFT SYSTEM

For Hydraulic Shifting CLUTCH SHIFT Series PTO on Automatic Transmissions

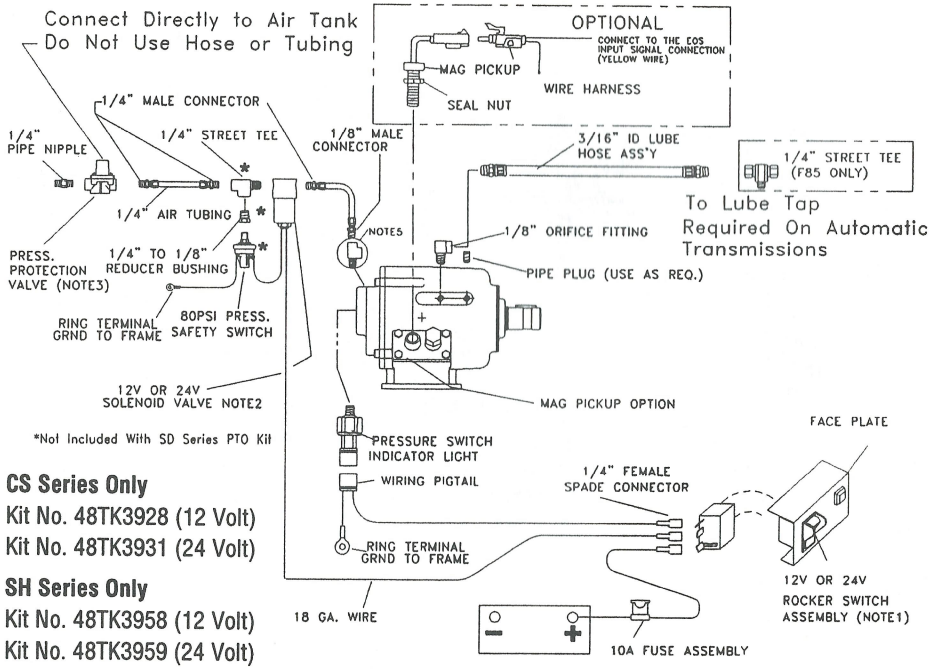


Kit No. 48TK3927
(12 Volt System)

Kit No. 48TK3930
(24 Volt System)

CLUTCH SHIFT & SUPER HEAVY ELECTRIC/AIR SHIFT SYSTEM

For Use When Air Shifting CLUTCH SHIFT or SUPER HEAVY Series PTOs



CS Series Only

Kit No. 48TK3928 (12 Volt)

Kit No. 48TK3931 (24 Volt)

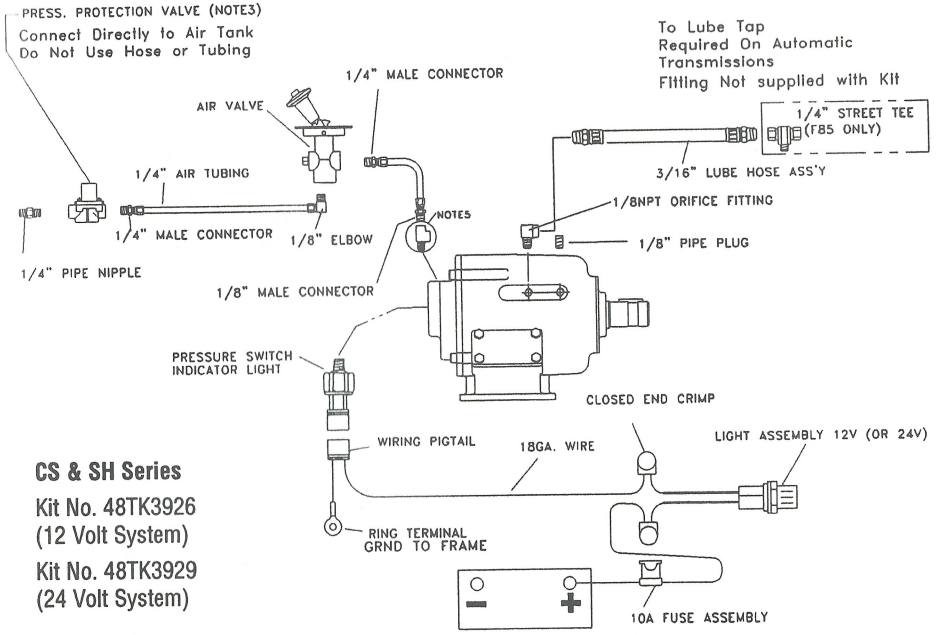
SH Series Only

Kit No. 48TK3958 (12 Volt)

Kit No. 48TK3959 (24 Volt)

CLUTCH SHIFT & SUPER HEAVY STANDARD AIR SHIFT SYSTEM

For Use When Air Shifting CLUTCH SHIFT or SUPER HEAVY Series PTOs



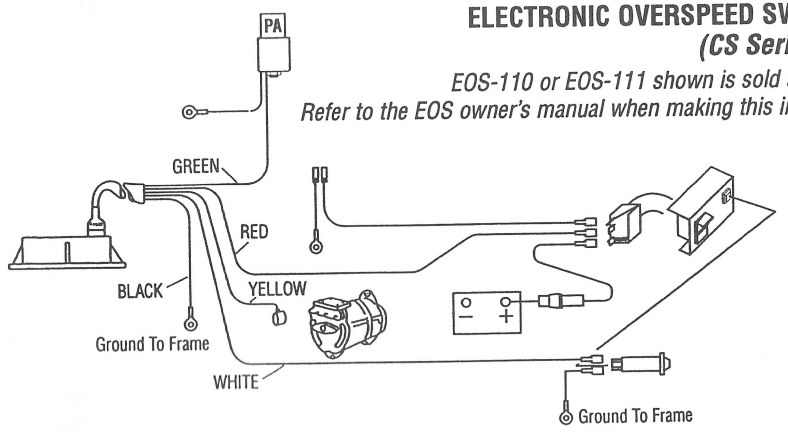
CS & SH Series

Kit No. 48TK3926
(12 Volt System)

Kit No. 48TK3929
(24 Volt System)

ELECTRONIC OVERSPEED SWITCHES *(CS Series Only)*

EOS-110 or EOS-111 shown is sold separately.
Refer to the EOS owner's manual when making this installation.



FOOTNOTES

1. Green light in rocker switch is to turn "ON" when PTO is engaged and to turn "OFF" when PTO is disengaged.
2. Solenoid valve should be mounted on firewall to protect it from corrosive environment.
3. Air System Users...You will not receive any air through the pressure protection valve to the PTO system until your main tank pressure exceeds 65 PSI. Some chassis' have dual air systems. Be sure to connect to the MAIN air supply tank or to the connection specified by the vehicle manufacturer.
4. Hydraulic hoses and hose ends not supplied with standard installation kit. Order Muncie 131-2-0001 separately.
5. Street Tee provided for clearance mount of pressure switch or for CS6G installation, be sure to plug unused port(s).

CLUTCH SHIFT INSTRUCTIONS & TESTS

1. Install the appropriate shifter kit components described on pages 2.15 & 2.16.

   On Allison, Eaton Fuller CEEMAT and JATCO Automatic installations be sure that the lube orifice fitting is installed in the housing port as shown on 2.15 & 2.16. Use only the fitting supplied with your kit to assure proper transmission function.

   Allison transmissions with neutral lock-up should be installed on a circuit separate of PTO shift circuit. The circuits are supplied by the transmission main pressure and should be teed together at, and closest to, the main pressure port (port P) on 2.13.

2. With ignition switch on (but engine not running) turn on the PTO control switch and listen for solenoid valve. You should be able to hear valve snap open. If not, check for a poor ground connection. The ground must be a bare metal contact to frame.

3. Start engine and engage PTO with switch. If PTO fails to operate or will not develop enough torque to operate your equipment, check pressures as follows:

   a. Stop engine.

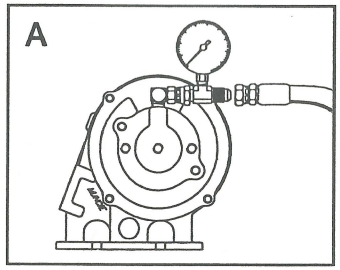
   b. Install 400 PSI pressure gauge at PTO piston port. (Fig. A) (150 PSI gauge for air systems).

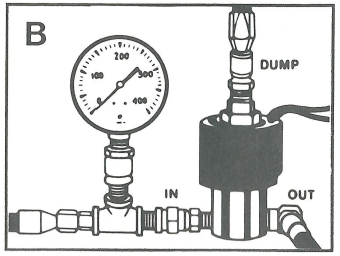
   c. Install a second 400 PSI pressure gauge in front of screen adapter at solenoid valve. (Fig. B) (150 PSI gauge for air systems).

   d. Start engine. Stay clear of rotating components. Place PTO switch in engage position.

   e. If either gauge registers less than 90 PSI, or if there is more than 50 PSI difference at any engine speed, check for obstructions in the hoses or the screen adapter.

   f. On the hydraulic system if gauge (Fig. B) registers 50 PSI or less, you may be connected to the wrong port on the transmission. Recheck the transmission information for the main pressure tap location on your model.





4. **Complete installation by placing warning labels as indicated on borders of the decals. Placement examples are illustrated on pages 1.1 and 1.2.**

Upon installation, the Clutch Shift output shaft may operate in the off position. If this occurs, double check plumbing for restrictions in the lines. If OK, adjustment of the drag brake may be required. Clutch Shift requires a minimal load on the output shaft.

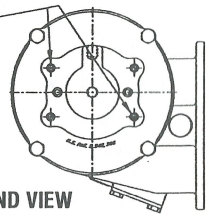
The CS6 & CS8 PTO is equipped with an internal drag brake as standard. The brake is adjustable, should the output shaft continue to turn once PTO is disengaged. **Note:** This brake will **not** stop shaft if there is a catastrophic failure with PTO clutch pack. See page 3.8 for more information.

Drag Brake Adjustment Procedure:

1. **Stop engine.**
2. Locate adjustment screws on the end cover per the diagram.
3. Using 3/16" Allen wrench turn each of the set screws 1/4 turn clockwise.
4. Move away from under the vehicle and away from possible moving components and restart the engine. Look for the output shaft to stop turning. If the shaft continues, then **shut the engine off** and repeat steps 2 thru 4.

For U60, F85, I84 & I85 PTOs install 1 spring per hole in these 2 holes. No springs in other holes. **(Mark these 2 screws with red paint.)**

For all other ratios install 1 spring per hole in all 4 holes. **(Do not paint these screws.)**



COVER END VIEW

SECTION 3
OWNER'S MANUAL

POWER TAKE-OFF WARRANTY

The Muncie Power Take-Off is warranted to be free of defects in material or workmanship and to meet Muncie's standard written specifications at the time of sale. Muncie's obligation and liability under this warranty is expressly limited to repairing or replacing, at Muncie's option, within one year after date of original installation any defective part or parts or any product not meeting the specifications.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. MUNCIE MAKES NO WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR ANY PARTICULAR PURPOSE. MUNCIE'S OBLIGATION UNDER THIS WARRANTY SHALL NOT INCLUDE ANY TRANSPORTATION CHARGES OR COSTS OF INSTALLATION OR ANY LIABILITY FOR DIRECT, INDIRECT SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OR DELAY. THE REMEDIES SET FORTH HEREIN ARE EXCLUSIVE, AND MUNCIE'S LIABILITY WITH RESPECT TO ANY CONTRACT OR SALE OR ANYTHING DONE IN CONNECTION THEREWITH, WHETHER IN CONTRACT, IN TORT, UNDER ANY WARRANTY, OR OTHERWISE, SHALL NOT, EXCEPT AS EXPRESSLY PROVIDED HEREIN, EXCEED THE PRICE OF THE PRODUCT OR PART ON WHICH SUCH LIABILITY IS BASED.

If requested by Muncie, products or parts for which a warranty claim is made are to be returned transportation prepaid to a Muncie Service Center. Any installation or use not in accordance with catalogue or package instructions, other improper use, operation beyond capacity, substitution of parts not approved by Muncie, use with equipment other than the equipment on which the Power Take-Off is first installed, or alteration or repair made to the Power Take-Off other than at a Muncie Service Center shall void this warranty. No employee or representative of Muncie is authorized to change this warranty in any way or to grant any other warranty.

PTO SHIFTING PROCEDURE & PRECAUTIONS

POWER TAKE-OFF OPERATION - VEHICLE STATIONARY

WARNING

STATIONARY OPERATION REQUIREMENTS:

- **PARKING BRAKE MUST ALWAYS BE SET**
- **VEHICLE'S WHEELS MUST ALWAYS BE CHOCKED**
- **TRANSMISSION MUST ALWAYS BE IN NEUTRAL OR PARK**

AN OPERATOR MUST ALWAYS BE IN THE DRIVER'S SEAT WHENEVER THE ENGINE IS RUNNING AND THE TRANSMISSION IS IN GEAR, IN ORDER TO PREVENT OR STOP ANY UNEXPECTED MOVEMENT OF THE VEHICLE WHICH MAY CAUSE INJURIES TO THE OPERATOR OR OTHERS IN THE VICINITY.

1. Mechanical Transmission

A. A power take-off is, and should be, operated as an integral part of the main transmission.

B. Before shifting the Power Take-Off into or out of gear disengage the clutch and wait for transmission or PTO gears to stop rotating.

2. Automatic Transmission with Manual Shift PTOs (includes Air Shift) — Manual Shift PTOs include SG, TG, SH, RL, RG, RX, 82, 83 Series PTOs — 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*** or ***out of gear*** at this time.

With Converter Driven Gear:

A. Engine idle. With the operator seated in the driver's seat and while activating the vehicle's brake, shift transmission lever into any of the drive positions. (This will stop transmission gear from turning.)

B. Shift power take-off into or out of gear.

C. If the PTO does not engage release the PTO to the disengage position, shift the transmission to neutral and repeat the above steps from step A.

D. Shift transmission into park or neutral. (This will start transmission gears turning.) If you hear a grinding or ratcheting sound turn PTO off and repeat these procedures from step A.

3. Automatic Transmission/Transfer Case Mounted PTO

A. Shift transmission into park.

B. Caution: Apply parking brake and block wheels. Note: Applying parking brake does not insure that vehicle will not move when transfer case is in neutral.

C. Shift transfer case into neutral.

D. Engage PTO.

E. Shift transmission into drive to activate PTO output shaft. Caution: Do not place the transmission selector in park or reverse while PTO is operational as damage to PTO or driven unit may occur.

To Disengage PTO:

F. ***Shut off*** engine with transmission in drive mode.

G. Disengage PTO.

H. Shift transmission selector to park.

I. Restart engine.

J. Remove wheel blocks and release parking brake.

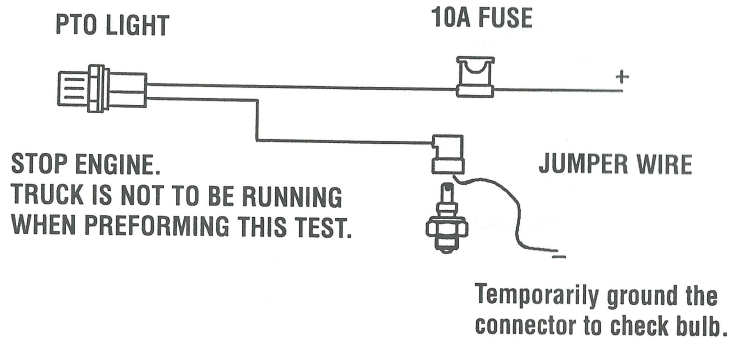
K. Shift transfer case into engaged mode.

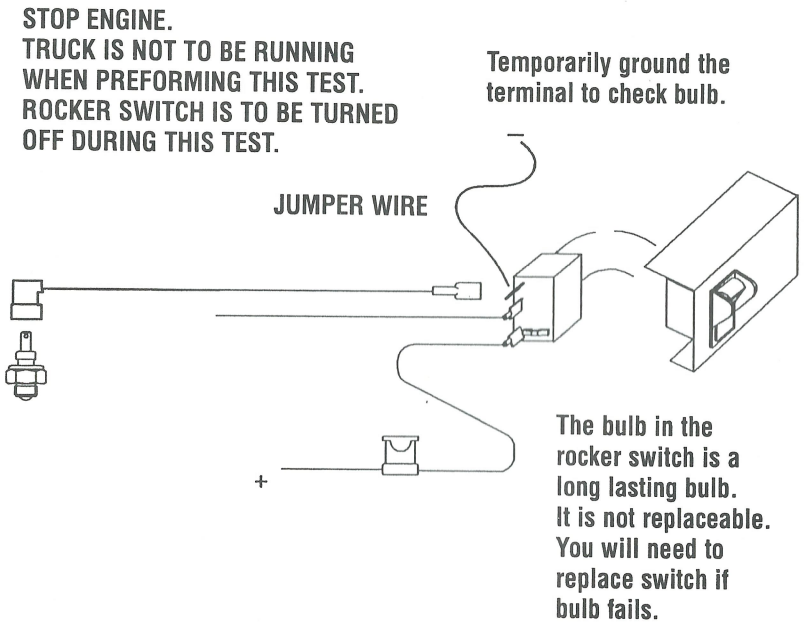
L. Vehicle can now be driven.

Failure to follow proper shifting or operating sequences will result in premature PTO failure with possible damage to the equipment.

INDICATOR LIGHT CHECK

Procedure for checking the PTO Indicator Switch is found on Page 2.7





CLUTCH SHIFT OPERATING NOTES

CLUTCH SHIFT PTOs should not be engaged (turned "ON") under heavy load and/or at engine speeds over 1200 RPM. If your operators are careless or negligent in this respect, you can safeguard your equipment with one or more Muncie protective systems.

Consult your Muncie product literature or call your nearest Muncie Power Center for information on the EOS-110 or EOS-111 Electronic Overspeed Switch which prevents engagement of your CLUTCH SHIFT PTO above safe speeds.

The red overspeed light on the control switch panel is for use with the EOS-110 or EOS-111 and will indicate an overspeed condition when wired according to instructions in the EOS-110 Installation Manual.

Upon installation, CLUTCH SHIFT output shaft may rotate while in the off position. If this occurs, recheck plumbing for restrictions in the lines. If OK, adjustment of drag brake will be required. The Clutch Shift requires a minimal load on the output shaft. See your PTO installer or refer to page 2.17 for adjustment instructions.

PTO MAINTENANCE

The Power Take-Off, being an integral part of the transmission, should be serviced at the same intervals as the transmission. Transmission fluid changes should follow the interval recommended by the vehicle manufacturer for severe service. Transmission oil level is important. Checking for PTO leaks and checking the transmission oil level should be done on a regular basis.

The Power Take-Off is also part of a *system*. The PTO system may include the activation control parts, a driveshaft, or hydraulic pump. This PTO system requires periodic checks and service. Typically the interval for maintenance checks of the PTO system depends on the application of the system. Every time the chassis is lubricated or a mechanic is under the vehicle the PTO system should be checked and serviced. For severe duty PTO system applications, it is recommended that the system be checked for service every 100 hours of use (this guideline can be adjusted based on past service history once you have it established). Service should include checking and lubricating direct mount pump shaft connections. PTO gears can be checked for wear by removing the inspection or shifter cover. If pitting, galling, cracking, or deformation of the gears or splines has occurred, then the PTO needs to be rebuilt or replaced.

Within the first week of use, recheck the installation of the PTO. Check for leaks and loose mounting hardware (studs, cap screws, nuts). Recheck the cable or lever connections for proper adjustment and tighten any loose connections. At regular maintenance intervals, check adjustments and lubricate moving parts, tighten and repair the connections, mounting hardware, cable or lever linkages.

Pumps that are mounted directly to the PTO output require the application of an anti-seize or a high temperature, high pressure grease. (Muncie PTOs are initially supplied with the required grease.) The purpose of this grease is to help make the PTO easier to service and to reduce the effects of fretting corrosion on the mating PTO and pump shafts. PTO applications under severe duty cycles and/or high torque requirements may require servicing this shaft connection by periodically re-greasing the shafts. Vehicles with low speed diesel engines are also severe applications due to the vibrations inherent in these vehicles. Fretting corrosion cannot be stopped by applying grease, the grease is only a deterrent.

PTO TORQUE & HORSEPOWER RATINGS

Intermittent service refers to an On-Off operation under load. If maximum horsepower and/or torque is used for extended periods of time, (5 minutes or more) this is considered "Continuous Service" and the horsepower rating of the PTO should be reduced by multiplying the value below by .70.

PTO SERIES	SPEED RATIO	INTERMIT. HP@1000 RPM	INTERMIT. KW@1000 RPM	TORQUE LBS.FT.	TORQUE NM	MAX. SPEED
SG	10	25	18.6	130	176	2500
TG	04	54	40.3	285	386	2500
	05	51	38	270	366	2500
	06	47	35	245	332	2500
	07	44	32.8	230	312	2500
	08	44	32.8	230	312	2500
	09	39	29	205	278	2500
	12H	40	29.8	210	285	2500
	13H	40	29.8	210	285	2500
	15H	37	27.6	195	264	2500
	18H	33	24.6	175	237	2500
SH	05	76	57	400	542	2500
	07	76	57	400	542	2500
	09	71	53	375	508	2500
	12	62	46	325	441	2500
	13	62	46	325	441	2500
CS	03	57	42.5	300	407	2500
	04	57	42.5	300	407	2500
	05	57	42.5	300	407	2500
	07	57	42.5	300	407	2500
	09	52	38.8	275	373	2500
	12	52	38.8	275	373	2500
	14	52	38.8	275	373	2500
RG	13	26	19.4	140	190	2500
RL	03	38	28.3	200	271	2500
	05	38	28.3	200	271	2500
RX	ALL	26	19.4	140	190	2500
82	05	95	70.8	500	678	2500
	08	85	63.4	450	610	2500
	09	78	58.2	410	556	2500
	10	78	58.2	410	556	2500
	12	71	52.9	375	508	2500
	13	71	52.9	375	508	2500
	15	67	49.9	350	475	2500
	19	57	42.5	300	407	2500
83	05	95	70.8	500	678	2500
	06	95	70.8	500	678	2500
	12	71	52.9	375	508	2500

PTO TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	REMEDY	PREVENTION
CABLE SHIFT PTOS			
Hard Shifting	Cable inner member frozen	Thaw in garage	Route cable away from road spray and seal end from moisture
	Sharp bend in cable	Straighten inner member or replace cable	Keep bends larger than the minimum bend radius. Avoid short cable runs
	Improper shifting	Make sure vehicle clutch is adjusted to allow the PTO drive gear to stop before shifting or that the proper shift procedure is followed	See page 3.2
	Worn or damaged shift control	Repair or replace components	Do not connect lever rod to cable shifters
Delayed or partial engagement	Loose linkage or attachment. Loose or missing cable clamps	Repair or replace	Routine maintenance
AIR SHIFT PTOS			
PTO doesn't engage	Contaminated air lines	Remove contaminants from air cylinder	Bleed air system more often
	Air pressure not high enough	Wait until system pressure is above 65 psi before engaging PTO	Systems are designed wit a pressure protection valv which does not allow air t the PTO until the system pressure exceeds 65 psi
	Improper method of shifting causing damage to the PTO shift collar	Make sure vehicle clutch is adjusted to allow the PTO drive gear to stop before shifting or that the proper shift procedure is followed	See page 3.2
	Worn or damaged shift control	Repair or replace components	
	Shift fork is out of shift collar	Reassemble onto PTO correctly.	
PTO doesn't disengage	Faulty air valve	Repair or replace	Usually a result of conta mination or dirty valve. Keep air system bled an valves free of dirt
	Worn or damaged shift control	Repair or replace components	
	Shift fork is out of shift collar	Reassemble onto PTO correctly.	

PTO TROUBLESHOOTING GUIDE *Continued*

PROBLEM	POSSIBLE CAUSE	REMEDY	PREVENTION
LECTRA SHIFT PTOS			
PTO doesn't engage	Loose connection	Review wiring diagram on Page 2.8	Make sure wires are properly supported and connections are properly made
	Poor/improper grounding of electrical circuit	Make all grounds to the vehicle battery	Control module is very sensitive to proper ground
	Blown fuse	Replace fuse with proper rating	Make proper connections
	Improper shifting	Make sure vehicle clutch is adjusted to allow the PTO drive gear to stop before shifting or that the proper shift procedure is followed	See page 3.2
	Worn or damaged shift control	Repair or replace components	
CLUTCH SHIFT PTOS			
PTO doesn't engage	Contaminated air lines	Remove contaminants from air cylinder	Bleed air system more often
	Air pressure not high enough	Wait until system pressure is above 65 psi before engaging PTO or 80 psi for the Electric/Air system	Electric/Air systems are designed with a pressure protection switch which does not allow current to the PTO valve until system pressure exceeds 80 psi
	Air lines are too long	Re-route lines directly to air tanks	Follow installation diagrams
	Hydraulic line connected to wrong port	Review installation diagrams on Pgs 2.15-2.16	
	Burned or extremely worn clutch pack	Replace worn components	
	Engine RPM too high (EOS)	Adjust EOS per IN88-01	
PTO doesn't disengage	Hydraulic or air lines connected to wrong ports on valve control	Re-route lines	Refer to installation diagram on pgs 2.15-2.16
	Faulty air or hydraulic valve	Repair or replace	Sometimes a result of contamination or dirty valve. Keep air system bled and valves free of dirt
	Burned or extremely worn clutch pack	Repair or replace components	Follow proper engagement procedures. See page 3.5
	Misadjusted drag brake	Adjust per page 2.17	