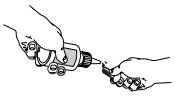
PTO INSTALLATION GUIDE

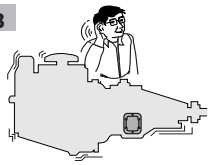
1 • General rules for PTO installation

1 

For correct installation of PTOs and all related accessories, it is very important to follow these general rules.
- Always check the PTO instruction manual and any further specific instruction sheets included in the PTO package.
- Always operate taking into account the gearbox operating manual (pict. 1).
- Use the appropriate tools and instruments such as torque wrenchs, gauges and thickness gauges (pict. 1).
- Use only gaskets supplied by the Manufacturer. Use paste gasket only if recommended.
- Mastic is forbidden if used together with paper gaskets.
- It is advisable to use medium thread locking fluid for locking bolts and studs (pict. 2).
- Perform all installation operations with the vehicle standing on a level surface, otherwise oil levels cannot be checked.
- Operate with engine and gearbox at ambient temperature.
- Check that the PTO is equipped with the correct mounting kit.
- Check that clutch works properly, otherwise adjust it. The transmission should stop rotating within 5 to 6 seconds.
- Check that the gearbox has no unusual noises or vibrations (pict. 3).
- Accurately check that the gearbox aperture face is clean. The installation should be carried out in clean conditions.

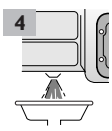
Important! In case of a connection to an ISO flange pump: if the coupling kit isn't provided with the oil seal and the pump is already fitted with it, then the pump must be installed before filling the gearbox with oil.

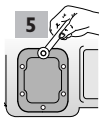
2 

3 

2 • Use of the PTO

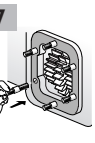
IMPORTANT: when engaging and disengaging the PTO, always press the clutch pedal!
WORKING TEMPERATURE AND LOAD CONDITIONS
The temperature depends on the way the PTO is used and it is recommended to keep it between the following values.
Short duration (less than 15 minutes) max. 120 °C, long duration (more than 15 minutes) max. 100 °C.
The PTO temperature is affected by various factors; it is possible to reduce overheating by:
- Changing the oil more often in case of heavy duty system
- When the PTO is side mounted, ensuring that the gear backlash is accurately checked
- When the PTO is rear mounted, considering to provide the PTO with a supplementary lubrication kit.

4 

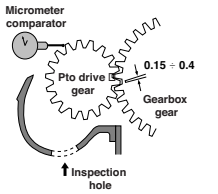
5 

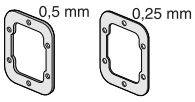
3 • Side mounted PTO installation

6 

7 

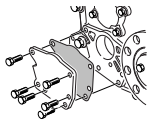
- Empty or reduce the gearbox oil level, check cleanliness. If oil is dirty or contaminated it should be replaced. (pict. 4).
  Notice: in some applications (for example automatic Allison gearboxes) it is not necessary to empty gearbox. Always check gearbox service manual.
- Remove gearbox aperture cover and accurately clean the gearbox aperture surface (pict. 5).
- Check gearbox gear teeth and the gear backlash (pict 6).
- Open the PTO package. Use PTO specific mounting kit and if necessary spacers.
- Studs for mounting onto the gearbox:
  - Accurately check that the holes in the gearbox are threaded. Be careful that studs do not interfere with gears.
  - Fit the studs. Picture no. 7 shows a typical mounting example.
- Backlash check between gear tooth and spacer insertion:
  To get a backlash of 0.15 ÷ 0.4 mm, fit spacers between PTO and gearbox as necessary.
  Backlash checking can be carried out in two ways:
  - In case of PTOs equipped with inspection plug, check by hand, (rocking the gear to get the "feel" for gear backlash) or by means of a dial gauge (pict. 8). The use of a dial gauge is recommended as it is much more accurate.
  - In case of PTOs without inspection plug, adjustment is carried out in stages. The PTO has to be checked against the transmission flange by adding spacers until there is no backlash. After that, another 0.5 mm spacer should be added and the nuts tightened.
- Recommendations on seal and spacer use.
  - Remember that once the nuts have been tightened, the seal thickness reduces, resulting in a similar backlash reduction.
    The backlash therefore has to be checked even after tightening.
  - Available seals (pict. 9) have a thickness of 0.5 and 0.25 mm (special series).
  - When a spacer is fitted, use a gasket to ensure tightness (at least one on both sides).
  - In order to avoid the seals sticking to each other, use grease.
    NEVER use adhesive fluid when the PTO mounting kit requires special gasket.
    USE adhesive fluid only when the PTO mounting kit DOESN'T involve any gasket.
- Once the suitable thickness has been determined, tighten the nuts with a torque wrench (see tightening torque par. 7).
  Notice: Once the nuts have been tightened, the backlash has to be rechecked and if necessary the shiming operation may be repeated.
- When the installation operation has been completed, fill the gearbox with oil (pict. 10).
  Notice: In case of applications with separate lubrication (for example on Allison transmission) an external lube kit is needed to be fitted.
- After installing operations, proceed with the checks (see par. 9).

8 

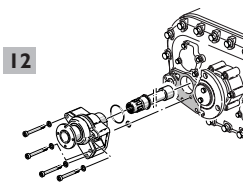
9 

10 

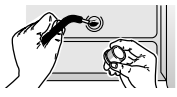
4 • Rear mounted PTO's

11 

- Empty or reduce the gearbox oil level, check cleanliness. If oil is dirty or contaminated it should be replaced.
  Notice: in some applications (for example automatic Allison gearbox) it is not necessary to empty gearbox.
- Remove gearbox aperture cover and accurately clean the gearbox aperture surface (pict. 11).
- If a shaft kit is provided for the application, carefully read the relevant mounting instructions.
- PTO mounting (see pict. 12).
  The typical way of mounting is shown in the picture. It is recommended to lock studs or bolts with locking fluid. (See tightening torque par. 7).
  Notice: In case of a connection to an ISO flange pump: if the oil seal is fitted to the pump, then the pump must be fitted to the gearbox before filling with oil.
- When the fitting operation is complete, refill gearbox with oil (pict. 13).
  Notice: In case of applications with separate lubrication, a supplementary lubrication kit should be fitted.
- When installation is completed, proceed with the checks (see par. 9).

12 

5 • Hot shift PTO use and installation

13 

Installation of a hot shift PTO is performed as a normal side mounted PTO (see par. 3). However it is recommended that the air pressure is checked: since the maximum transferred torque by the clutch is affected by air pressure, ensure that it is always between 8 and 11 bars.

Notice: Pressure setting depends on the required torque. See the PTO technical documentation.

THS
TRANSPORT
HYDRAULIC
SOLUTIONS

GENERAL INSTRUCTIONS FOR USE

Hot shift PTO can be engaged also when vehicle is in motion.

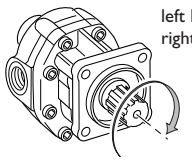
In order to preserve PTO clutch against wear, it is advisable to engage the PTO when the output shaft does not exceed 1000 RPM. It is recommended that the transmission and PTO maximum rotation speed, which affects the engagement, is determined and included as an instruction for the end user.

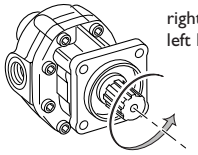
6 • General guideline for pumps installation

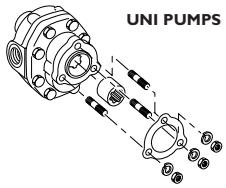
BASIC REQUIREMENT

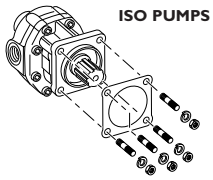
- Pump shaft must be aligned with PTO (max. allowed concentricity 0.05 mm).
- Backlash: pump and PTO shaft must have a minimum radial backlash of 0.1 mm and a axial backlash of 1 to 2 mm.
- Clean the PTO-pump contact surfaces.
- Fit the pump with its suitable coupling kit, tightening the nuts with a torque spanner. (See tightening torque table par. 7).

Notice: Always check that pump rotation matches PTO rotation. See below:







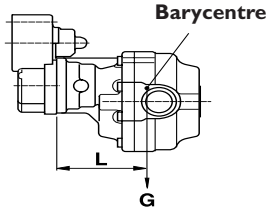


7 • Screw tightening table

Thread	Studs (tightening on gearbox)	Screws and Nuts
* M8	10 Nm	25 Nm
M10	20 Nm	50 Nm
M12	30 Nm	80 Nm
* 3/8"	10 Nm	25 Nm
7/16"	20 Nm	50 Nm

Maximum Bending Moment (BM) applicable on PTO output flanging	
Vehicles whose total mass is up to 7.5 tonnes	
*	**Mmax = 20 Nm**
Vehicles whose total mass exceeds 7.5 tonnes	
*	**for 1 axis PTO BM max = 50 Nm for 2-3 axis PTO BM max = 30 Nm for the output**

* These torque values are intended as a general guide only. Any specific torque values quoted in instruction leaflets should be used where appropriate.

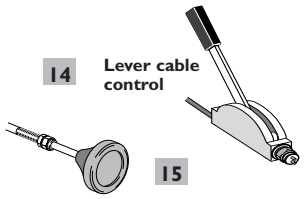


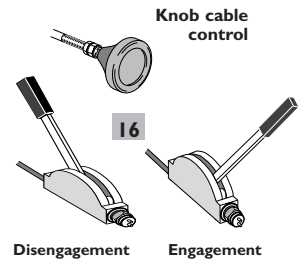
where $M_{(Nm)} = G_{(Nm)} \times L_{(m)}$

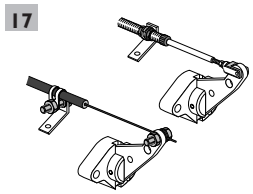
The above values refer to vehicles moving on smooth surfaces (not bumpy roads). If this is not the case stirrup is needed at pumps change. Please refer to our customer service centre.

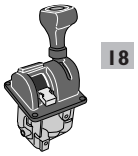
ATTENTION: in order to avoid the risk of unscrewing (due to vibration), the driving torques of nuts and stud bolts provided with the assembly kit must be regularly checked. The disregard of this rule and/or of the assembly instructions may result in the invalidation of the warranty for damages to the PTO/Pump unit and/or the change gear.

8 • In cab controls installation









It is possible to fit several kind of controls into the truck cab. Since the control type depends on the system used, a complete detailed installation procedure cannot be listed. Some specific instructions are mentioned here.

8.1 • Controls location - safety requirement

- A control has to be placed in a visible place, and **in a position where it cannot be accidentally operated**.
- The control has to perform only one function.
- Identification: in case of electric controls, don't fit them among the standard switches on the dashboard, to avoid possible confusion.
- Controls have to be reliable and strong. They must be resistant to stress and reliable overtime in service.

8.2 • Mechanical cable control installation

All PTO's can be supplied with a bracket kit suitable for the mechanical cable control.
Cable controls can be provided with different kinds of lever (pict. 14) or knob (pict. 15) controls.

- Take into account, when fitting the lever into a suitable place that there is sufficient clearance to allow unrestricted lever movement. PTO's are usually **DISENGAGED** when the **KNOB IS PUSHED** or the **LEVER IS LOWERED** (see pict. 16).
- When the cable is installed, avoid tight bends. Choose as a straight aline as possible for the cable. A very tortuos line means greater operating forces and backlash.

SETTING

This operation has to be carried out with the PTO movement determining the two end stroke positions. Check the positions of the control lever and set the cable in such a way that movement of the lever/knob gives full PTO engagement/disengagement.
Notice: PTO engagement has to be complete. Partial engagement may lead to a PTO breakdown.
It is recommended that the cable bolt is locked with loctite 242 or similar product in order to avoid possible slackening. Examples of cable connection (pict. 17).

8.3 • Air controls

The following recommendations only refer to the PTO engagement-disengagement control (pict. 18).

- Lamp and pressure switch: even though air controls are equipped with a pressure switch, this device doesn't signal that the PTO is engaged, just that the air line is pressurised. It is therefore recommended to use a PTO equipped with switch kit.
- Air treatment: For efficient operation air controls require clean and dry air. Check the technical features of the air controls and the air treatment device available on the vehicle.
- Check that the air pressure in the PTO air connector is between 6 ÷ 11 bar.
- Electro-pneumatic controls: are pneumatic controls operated by an electric solenoid. Follow procedures for general air and electric installations.

8.4 • Electrical controls and devices

There is quite a wide range of electrical controls not included in the scope of this manual. Please refer to electric circuits manuals.
Main recommendations concerning electrical controls are:

- Always protect the circuit with fuses (10 A).
- Clearly identify the controls; this is valid for those controls fitted on the dashboard in order to avoid unintentional operation.