



DETROIT™

DT12 PTO Installation Requirements

Beginning in late 2016, the DT12 will be available with a rear-facing Power Take-Off (PTO). This PTO is a mechanical drive that attaches to the rear of the transmission and is used to transfer power produced by the engine to an auxiliary component.

The interface is normally closed by a cover plate when not offered. However, when the DT12 PTO is ordered by the OEM/Dealer, the DT12 Transmission will arrive with the PTO hardware preinstalled from DETROIT™.



Figure 1: Rear of DT12 without PTO (cover plate only).

CONFIGURATIONS AVAILABLE

The 6 different SpecPro DT12 PTO configurations available from DETROIT™ are shown below:

1. *362-2HB DT12 Hydrocar P89 Rear Mounted PTO for Hydraulic Pump (1:1.32 PTO Ratio)*

In this configuration, the cover plate shown in Figure 1 above is replaced by a PTO drive assembly as shown in Figures 2 & 3 below.



Figure 2: Rear DT12 PTO drive assembly (option 362-2HB) with cover plate.

With the access cover removed, the PTO drive assembly mounting flange offers SAE-B mounting for 2 or 4 bolt configurations and an SAE B-B 15 tooth spline as shown below:

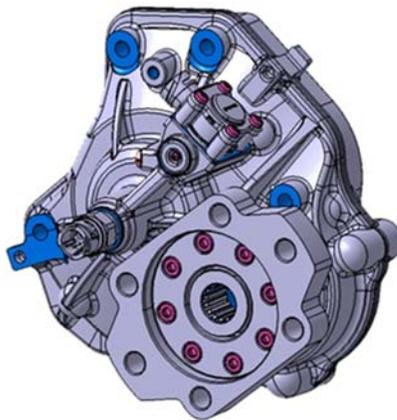


Figure 3: PTO drive assembly shown with SAE-B 2 or 4 bolt configuration.

The thread type for the 2 or 4 bolt pattern is M14 x 2.0 with a depth of 20mm. It is recommended to use a bolt length that allows for thread engagement of 1-1.5 times the diameter of the bolt used to connect the hydraulic pump. Unless otherwise specified by the pump manufacturer, use a bolt torque of 26-30 lb-ft (35-40 Nm) for the fasteners mounting the pump to the PTO drive assembly.

With option 362-2HB:

- A transmission cooler will be added to DT12 configuration in SpecPro
- Some exhaust configurations are not compatible with DT12 PTO. Please consult with your local vehicle representative to obtain specifics.
- Harnesses and controls are included for PTO operation
- The pneumatic line is installed
- The PTO is ready for operation via dashboard mounted switch
- Consult Section 8.28 of the DDEC13 A&I Manual (DDC-SVC-MAN-0127) for CPC parameterization

2. 362-318 DT12 Hydrocar P89 Rear Mounted PTO for Driveshaft (1:1.32 PTO Ratio).

This configuration is for applications utilizing a driveshaft in place of a direct mounted hydraulic pump. From a transmission and PTO hardware perspective, it is identical to configuration #1 above. However, the difference in the options is that the prep for driveshaft allows for more clearance on the chassis around the PTO. Also with this option, the customer must order and install the correct flange kit part from the DTNA PDC to adapt to their driveshaft. The two available Spicer flange kit part numbers are:

- Spicer 1350/1410 Flange: A9472600317 (See Figure 6 for the dimensions)
- Spicer 1310 Flange: A9472600417 (See Figure 7 for the dimensions)

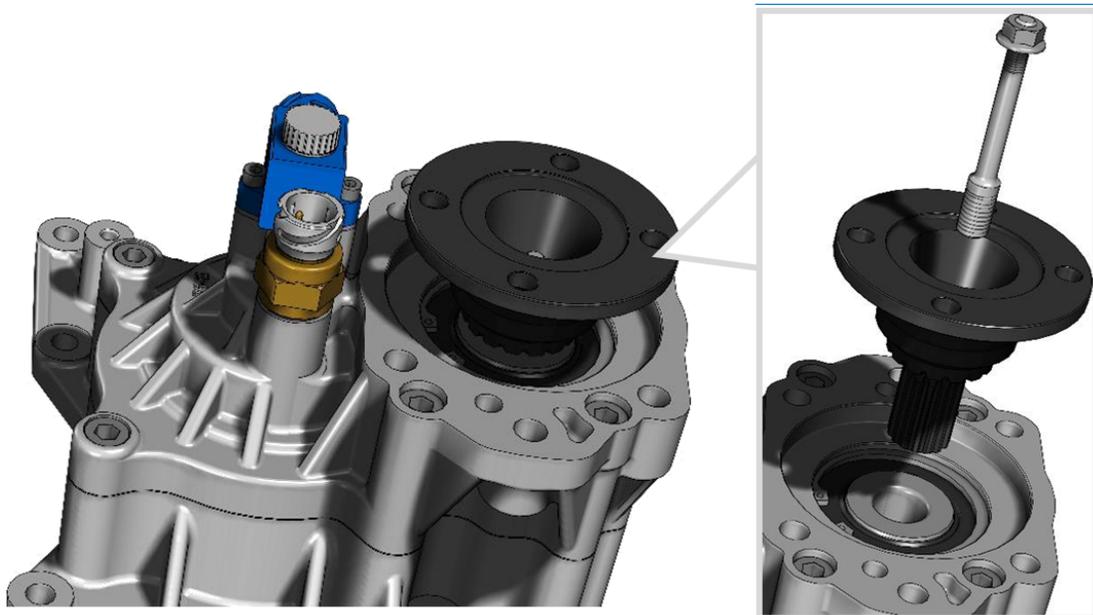


Figure 4: Rear DT12 PTO driveshaft assembly with driveshaft mount.

An example of a successfully installed Spicer flange per option #2 can be seen in the following figure.



Figure 5: Installation of configuration #2 as seen from the rear of the vehicle

With option 362-318:

- A transmission cooler will be added to DT12 configuration in SpecPro
- Some exhaust configurations are not compatible with DT12 PTO. Please consult with your local vehicle representative to obtain specifics.
- Harnesses and controls are included for PTO operation
- The pneumatic line is installed
- The PTO is ready for operation via dashboard mounted switch
- Consult Section 8.28 of the DDEC13 A&I Manual (DDC-SVC-MAN-0127) for CPC parameterization

To correctly install a Spicer flange kit onto the DT12 PTO:

1. Remove cover plate on DT12 PTO housing
2. Insert the stud "1" into the center of the splined PTO drive on the DT12
3. Tighten stud to a torque of 11 ± 1.5 lb-ft (15 ± 2 Nm)
4. Install the spacer "3" on the back of the flange "4"
5. Apply grease "OKS 200" on the profile spline of the flange "4"
6. Install flange "4" into the PTO gear, then install nut "5" and torque to 26 ± 3.5 lb-ft (35 ± 5 Nm)

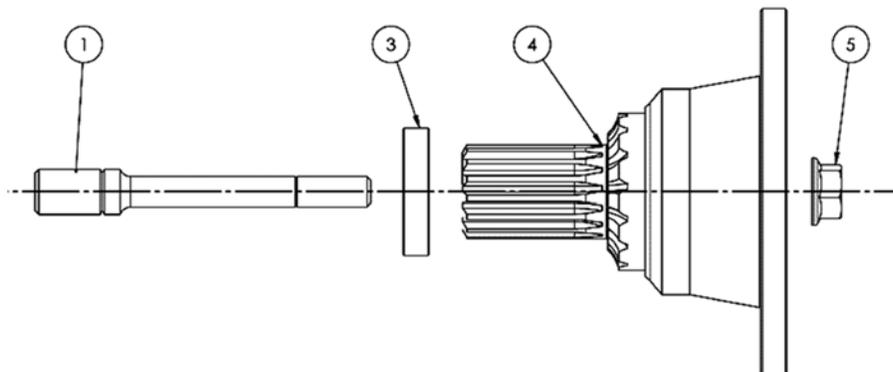


Figure 6: Installation of the 1350/1410 and 1310 series flange adaptor kits to the DT12 PTO.

With this configuration the PTO drive shaft angle must be in the range of 1° to 6°. Bolts and nuts for attaching the driveshaft to this adaptor flange are not included in either of the Spicer kits. Use standard torque values to attach bolts to adaptor flange based on hardware material and grade.

3. 362-424 DT12 Hydrocar P89 Rear Mounted PTO with Prep for Hydraulic Pump (1:1 PTO Ratio).

This option is the same as option #1 (362-2HB), except that the PTO Drive ratio here is 1:1.

With Option #3 (362-424):

- The PTO drive assembly mounting flange offers SAE-B mounting for 2 or 4 bolt configurations and an SAE B-B 15 tooth spline as shown in Figure 3 above.
- The thread type for the 2 or 4 bolt pattern is M14 x 2.0 with a depth of 20mm. It is recommended to use a bolt length that allows for thread engagement of 1-1.5 times the diameter of the bolt used to connect the hydraulic pump. Unless otherwise specified by the pump manufacturer, use a bolt torque of 26-30 lb-ft (35-40 Nm) for the fasteners mounting the pump to the PTO drive assembly.
- A transmission cooler will be added to DT12 configuration in SpecPro.
- Some exhaust configurations are not compatible with DT12 PTO. Please consult with your local vehicle representative to obtain specifics.
- Harnesses and controls are included for PTO operation.
- The pneumatic line is installed.
- The PTO is ready for operation via dashboard mounted switch.
- Consult Section 8.28 of the DDEC13 A&I Manual (DDC-SVC-MAN-0127) for CPC parameterization.

4. 362-425 DT12 Hydrocar P89 Rear Mounted PTO for Driveshaft (1:1 PTO Ratio).

This configuration is for applications utilizing a driveshaft in place of a direct mounted hydraulic pump. From a hardware perspective, it is identical to configuration #2 above (362-318), except that the PTO Drive ratio here is 1:1 instead of the 1:1.32 of option #2 (362-318) above.

With configuration #4 (362-425):

- The customer must order and install the correct flange kit part from the DTNA PDC to adapt to their driveshaft. See Figure 4-5 above for installation pics of the driveshaft adaptor. The two available Spicer flange kit part numbers are:
 - Spicer 1350/1410 Flange: A9472600317 (See Figure 6 for the dimensions)
 - Spicer 1310 Flange: A9472600417 (See Figure 7 for the dimensions)
- A transmission cooler will be added to DT12 configuration in SpecPro
- Some exhaust configurations are not compatible with DT12 PTO. Please consult with your local vehicle representative to obtain specifics.
- Harnesses and controls are included for PTO operation
- The pneumatic line is installed
- The PTO is ready for operation via dashboard mounted switch
- Consult Section 8.28 of the DDEC13 A&I Manual (DDC-SVC-MAN-0127) for CPC parameterization

To correctly install a Spicer flange kit onto the DT12 PTO:

1. Remove cover plate on DT12 PTO housing
2. Insert the stud "1" into the center of the splined PTO drive on the DT12
3. Tighten stud to a torque of 11 ± 1.5 lb-ft (15 ± 2 Nm)
4. Install the spacer "3" on the back of the flange "4"
5. Apply grease "OKS 200" on the profile spline of the flange "4"
6. Install flange "4" into the PTO gear, then install nut "5" and torque to 26 ± 3.5 lb-ft (35 ± 5 Nm)

With this configuration the PTO drive shaft angle must be in the range of 1° to 6°. Bolts and nuts for attaching the driveshaft to this adaptor flange are not included in either of the Spicer kits. Use standard torque values to attach bolts to adaptor flange based on hardware material and grade.

See Figure 6 above for the installation of the 1350/1410 and 1310 series flange adaptor kits to the DT12 PTO.

5. *362-822 PTO Prep Kit for DT12 Hydrocar P89 Rear Mounted PTO Prep for Driveshaft.*

This is the same as option # 2 (262-318) and option #4 (362-425) above, except the PTO drive assembly is NOT installed on the DT12 transmission as delivered. When this option is ordered, the customer must order the following parts from the DTNA PDC:

- DT12 PTO drive assembly
- Shaft kit for attaching the rear-mount DT12 PTO drive assembly
- Spicer 1400 or 1300 flange kit

See DTNA PTO installation guideline document for installation instructions and torque specifications for installing the DT12 PTO drive housing.

With option 362-822:

- A transmission cooler will be added to DT12 configuration in SpecPro
- Some exhaust configurations are not compatible with DT12 PTO. Please consult with your local vehicle representative to obtain specifics.
- Harnesses and controls are included for PTO which is installed at a later time
- The pneumatic airline is NOT installed and would need to be added at the time of PTO install
- Consult Section 8.28 of the DDEC13 A&I Manual (DDC-SVC-MAN-0127) for CPC parameterization

6. *362-825 PTO Prep Kit for DT12 Hydrocar P89 Rear Mounted PTO Prep for Hydraulic Pump.*

This is the same as option # 1 (362-2HB) and option #3 (362-424) above, except the PTO drive assembly is NOT installed on the DT12 transmission as delivered. When this option is ordered, the customer must order the following parts from the DTNA PDC:

- DT12 PTO drive assembly
- Shaft kit for attaching the rear-mount DT12 PTO drive

With option 362-825:

- A transmission cooler will be added to DT12 configuration in SpecPro
- Some exhaust configurations are not compatible with DT12 PTO. Please consult with your local vehicle representative to obtain specifics.
- Harnesses and controls are included for PTO which is installed at a later time
- The pneumatic airline is NOT installed and would need to be added at the time of PTO install.
- Consult Section 8.28 of the DDEC13 A&I Manual (DDC-SVC-MAN-0127) for CPC parameterization

See DTNA PTO installation guideline document for installation instructions and torque specifications for installing the DT12 PTO drive assembly as well as the pneumatic line referenced above.

The dimensions for the Spicer 1350/1410 and 1310 series PTO flanges are listed in the figures below.

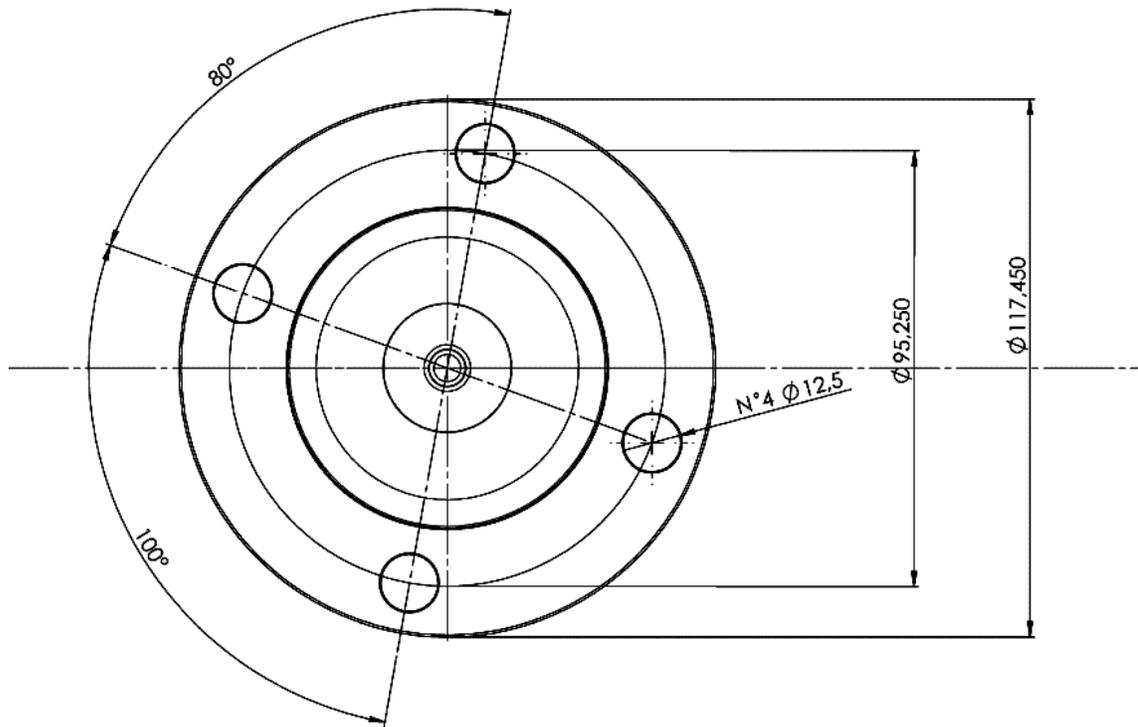


Figure 7: PTO mounting adaptor flange for Spicer 1350/1410 series, p/n A9472600317.

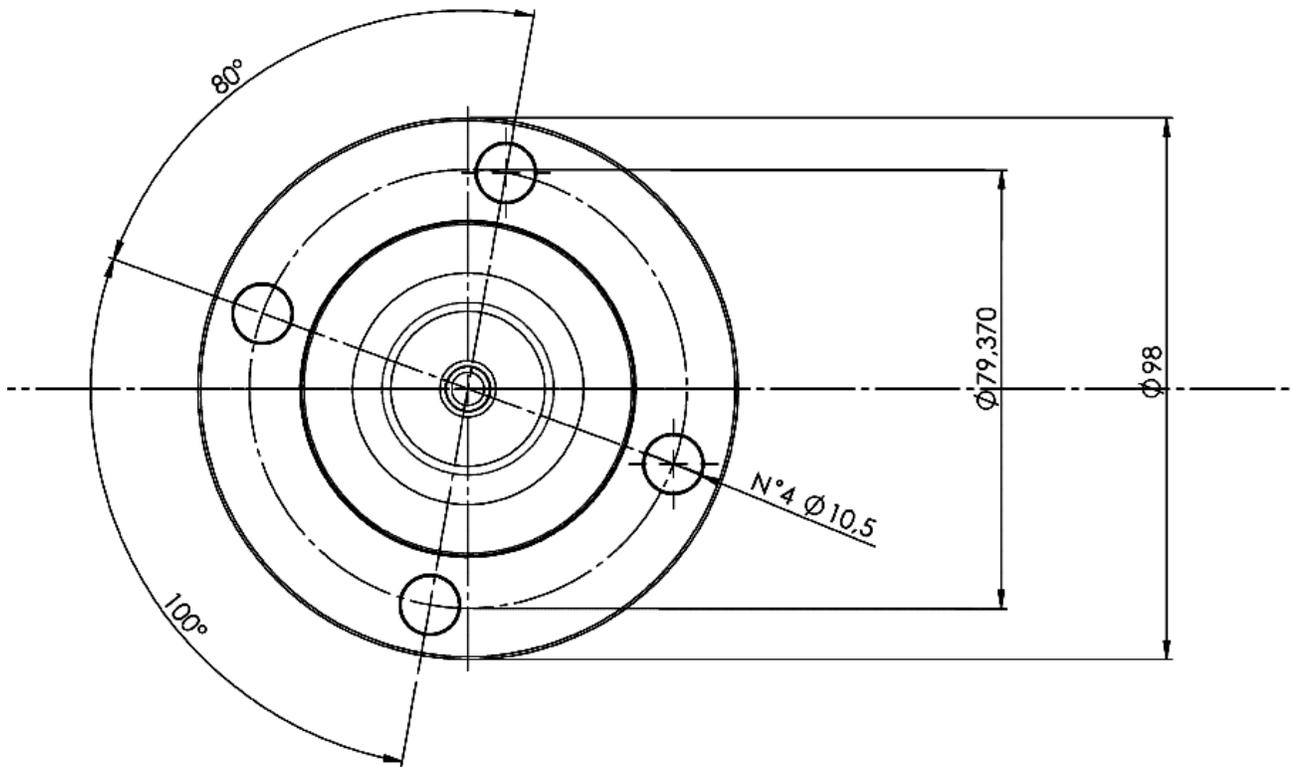


Figure 8: PTO mounting adaptor flange for Spicer 1310 flange, p/n A9472600417.

TECHNICAL INFORMATION / INSTALLATION REQUIREMENTS

- Engine speed: 850 - 2080 rpm
- PTO output speed:
 - 1 : 1.32 PTO Ratio:

Direct Drive Split Low	900 - 2250 rpm
Direct Drive Split High	1150 - 2850 rpm
Over Drive Split Low	1150 - 2850 rpm
Over Drive Split High	1500 - 3700 rpm
 - 1 : 1 PTO Ratio:

Direct Drive Split Low	650 - 1600 rpm
Direct Drive Split High	850 - 2100 rpm
Over Drive Split Low	850 - 2100 rpm
Over Drive Split High	1100 - 2700 rpm
- Max PTO output torque: 295 lb·ft (400 N·m)
384 lb ft (520 N·m) max. shock load
- PTO drive shaft angle 1° to 6°
- Interface (mount) 2 or 4 bolt SAE B pad mount
Interface (shaft) SAE BB 15 tooth spline drive
Interface (flange drive) Spicer 1350/1410 and Spicer 1310 flange drives
- PTO rotation Counterclockwise (CCW) looking from rear of DT12
(Requires CW input pump)

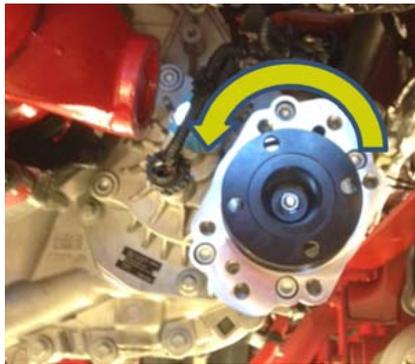


Figure 9: PTO rotation direction

- Transmission Oil temperature range: average 80°C (176°F)
max. 100°C (212°F)
- Ambient operating conditions -40°C (-40°F) to 45°C (113°F)
- Transmission PTO variant availability All DT12 variants (oil cooler is required)
- The maximum bending moment 29.5 lb-ft (40 Nm)

NOTE: Maximum bending moment of the transmission PTO on the mounting surface must be calculated including the length of unsupported hydraulic hoses, and the weight of the fittings and hydraulic fluid.

Unless specific information is available on the pump mounting hardware, please use the following formulas and weights provided below.

- Hydraulic hose fittings: 1.18 lbs each
- Weight of hydraulic fluid:

$$= (\# \text{ of hydraulic hoses}) * (0.0361) * [(3.142) * ((\text{Hose ID}/2)^2) * (\text{Length of hoses to first clipping point})]$$
- Weight of hydraulic hose

$$= (\# \text{ of hydraulic hoses}) * (\text{Hose weight}/\text{ft}) * (\text{length in feet of hoses to 1}^{\text{st}} \text{ clipping point})$$
- Hydraulic hose weight estimation chart:

Hydraulic Hose Chart Estimation	
Hose I.D.	lbs/ft
1/4	0.16
3/8	0.23
1/2	0.35
5/8	0.44
3/4	0.58
1	0.79
1 -1/4	1.5

Table 1: Typical hydraulic hose weight estimation chart.

$$\text{Max Bending Moment} = M_{\text{pump}} + M_{\text{ftgs}} + M_{\text{fluid}} + M_{\text{hoses}}$$

where

$$M_{\text{pump}} = \text{Bending Moment of the hydraulic pump (lb-ft)}$$

$$= (\text{weight of pump in lbs}) * [(\text{distance from pump center of gravity to PTO mounting surface in inches})/12]$$

If center of gravity is not known, assume this is at 1/2 the total length of the pump

$$M_{\text{ftgs}} = \text{Bending moment of the hydraulic line fittings (lb-ft)}$$

$$= (\# \text{ of fittings}) * (\text{weight of fittings in lbs}) * [(\text{distance of fittings from pump mounting surface in inches}) / 12]$$

$$M_{\text{fluid}} = \text{Bending moment due to the hydraulic fluid (lb-ft)}$$

$$= (\# \text{ of hydraulic hoses}) * (\text{weight of fluid}) * [(1/2 * \text{length of hoses until first clipping point}) + (\text{distance of pump center of gravity to PTO mounting surface})]$$

$$M_{\text{hoses}} = \text{Bending moment due to the hydraulic hoses (lb-ft)}$$

$$= (\# \text{ of hydraulic hoses}) * (\text{weight of hoses in lbs}) * [(1/2 * \text{length of hoses until first clipping point}) + (\text{distance of pump center of gravity to PTO mounting surface})] / 12$$

If the calculated Bending Moment exceeds the 29.5 lb-ft limit, try shortening the length of the hydraulic hoses to the first clipping/support point.

PTO OUTPUT SPEED CALCULATION

Since the DT-12 PTO is driven by the countershaft inside the transmission, there are two effective gear ratios possible, low neutral or high neutral. The low neutral and high neutral are referred to as “split low” and “split high” respectively.

There is a data code module in SpecPro that allows for operation to be set to either “split low” or “split high”. This functionality allows the operator to engage the PTO at the desired gear ratio for proper operation. The PTO ratio, once chosen, will be active at the time of the PTO engagement, Split Low/High cannot be changed by the driver in the cab.

The default data code for the DT12 PTO is “split low” upon PTO activation.

The available options in SpecPro are:

- 85P-001: PTO LOW NEUTRAL
- 85P-002: PTO HIGH NEUTRAL
- 85P-998: NO PTO NEUTRAL GEAR SELECTION

The default operation for the DT12 PTO is “split low” upon PTO activation. However, parameterization in the CPC allows for operation to be set to either “split low” or “split high”. See the GHG17 DDEC13 Electronic Controls Application and Installation Manual (DDC-SVC-MAN-0127) Section 8.28 Throttle Control/Governors via DDCSN.com for specific parameter programming information.

PTO speed can be calculated by using the PTO output speed summary table below:

DT-12 A & B Box	"Split"	PTO Ratio (1 : 1.32)		PTO Ratio (1 : 1)	
		Engine : PTO	Percent	Engine : PTO	Percent
DT12- Direct Drive	Split Low	1 : 1.07	107%	1 : 0.78	78%
	Split High	1 : 1.36	136%	1 : 1	100%
DT12- Over Drive	Split Low	1 : 1.36	136%	1 : 1	100%
	Split High	1 : 1.76	176%	1 : 1.29	129%

NOTE: Ratios Greater than 1:1, or over 100% → PTO spins faster than engine

Table 1: PTO output speed summary table.

For example, the PTO speed with a DT12 Direct Drive Split Low with the 1:1 PTO Ratio would be:

$$(\text{Engine RPM}) \times (\text{Engine:PTO Ratio}) = 850\text{rpm} \times 0.78 = 663\text{rpm}$$

Similarly, the PTO speed with a DT12 Overdrive Split High the 1:1.32 PTO Ratio would be

$$(\text{Engine RPM}) \times (\text{Engine:PTO Ratio}) = 850\text{rpm} \times 1.76 = 1496\text{rpm}$$

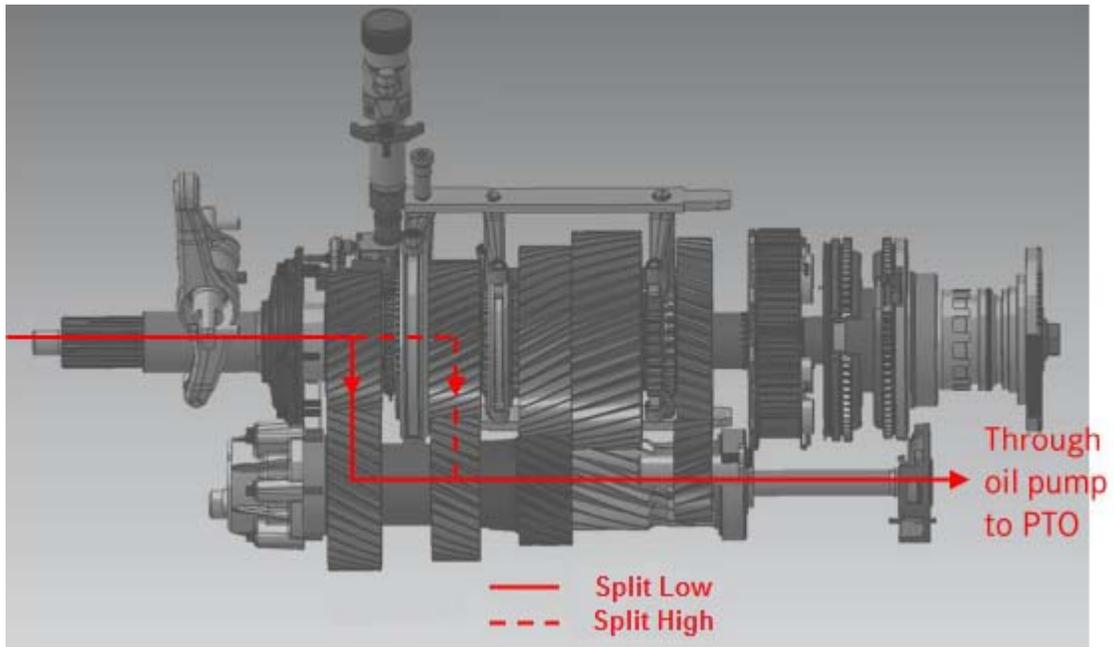


Figure 10: Example of PTO Power Flow through a Direct Drive DT12

For a complete list of programming options for the DT12 PTO, please see the DETROIT™ Transmissions Electronic Application and Installation Manual (DDC-SVC-MAN-0128) via DDCSN.com.

