



DT12 PTO Installation Requirements

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1. REAR PTO

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.

NOTE: This rear facing PTO is approved for stationary & launch gear use only.

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™.

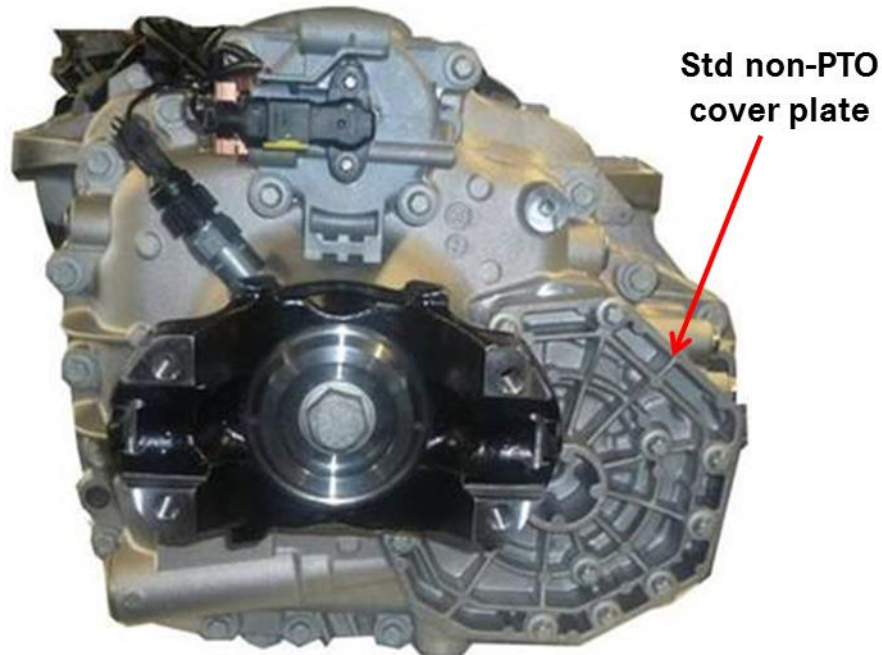


Figure 1: Rear of DT12 without PTO (cover plate only).

CONFIGURATIONS AVAILABLE

There are 3 main DT12 Rear PTO hardware configurations:

- 1) Hydraulic Pump
- 2) Driveshaft
- 3) PTO Prep only

1.1 Hydraulic Pump Configuration

The Existing DT12 Rear PTO has an SAE-B mounting for 2 or 4 bolt configurations and an SAE B-B 15 tooth spline as shown below:

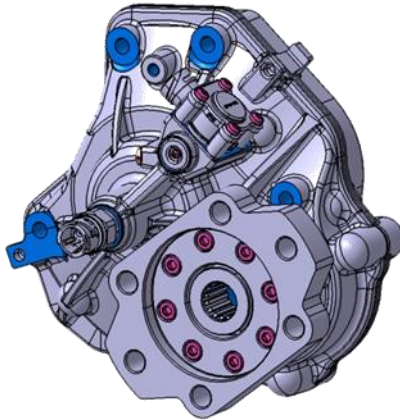


Figure 2: PTO drive assembly shown with SAE-B 2 or 4 bolt configuration.

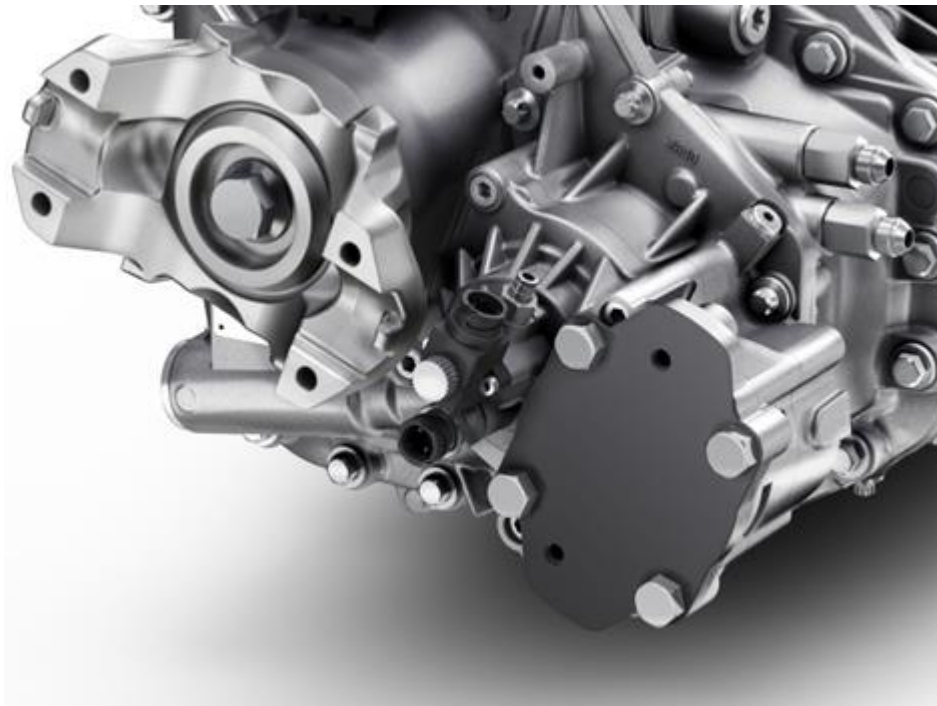


Figure 3: Rear DT12 PTO drive assembly with cover plate.

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 (35-41 Nm) for the fasteners mounting the pump to the PTO drive assembly.

The above info for the Rear PTO with Hydraulic Pumps is offered in 1:1 and 1:1.32 engine/pto ratios.

However, there is a new DT12 Rear PTO with a 1:1.83 engine/PTO ratio now available for the DT12-DHL (DB), DT12-OHL (OB), DT12-OHE/OV (OC), DT12-DHE (DC), and DT12-OVX (OD) transmission variants

Additional info on this PTO is as follows:

- SE DIN 5462 Pump Connection Profile

- 4 bolt connection pad

- 8 x 32 x 36 spline

- 1:1.83 engine/PTO ratio

- Uses Spicer 1400,1300, and 1120 flange kits, but they have a different splined shaft for the DIN 5462 vs the standard SAE-BB 15 tooth shaft used for the other Rear PTO ratios.

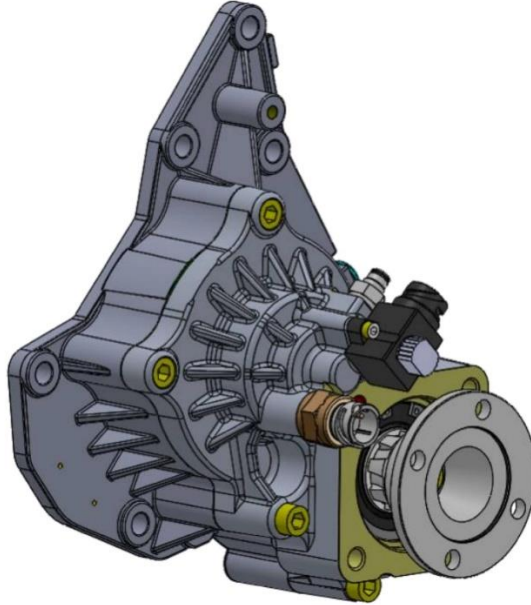


Figure 4: New DT12 Rear PTO with 1:1.83 drive ratio

With this hydraulic pump configuration:

- A transmission cooler will be added to DT12 configuration in SpecPro (if not already required)
- 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 GHG14/17 DDEC13 A&I Manual (DDC-SVC-MAN-0127) for CPC parameterization
- Consult Spec-Pro for the options offered on the various Freightliner and Western Star vehicles

1.2 Driveshaft Configuration

It is also possible to order a Rear PTO configuration for a driveshaft instead of a hydraulic pump. From a transmission and PTO hardware perspective, it is similar to the pump configuration except the driveshaft allows for more clearance on the chassis around the PTO. When this option is ordered, the customer must order the following parts from the DTNA PDC:

- Spicer 1400 and 1300 flange kit. The two available Spicer flange kit part numbers for the 1:1 and 1:1.32 ratio are:
 - a. Spicer 1400 Flange: A 947 260 03 17 (See Figure 9 for the dimensions)
 - b. Spicer 1300 Flange: A 947 260 04 17 (See Figure 10 for the dimensions)

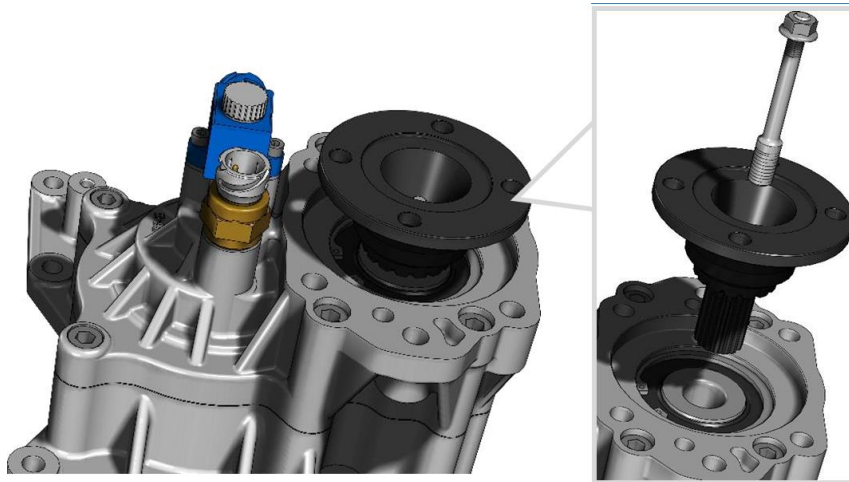


Figure 5: Rear DT12 PTO driveshaft assembly with driveshaft mount.

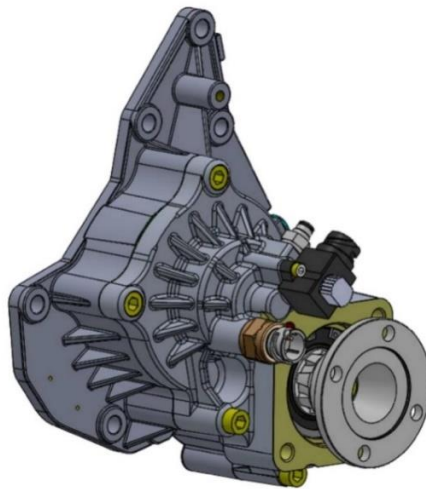


Figure 6: Rear DT12 PTO driveshaft assembly with the 1:1.83 ratio

For the DIN5462 connection with the 1:1.83 ratio, the part numbers for the Spicer flange kit are:

- Spicer 1400 Flange Kit: A 947 260 09 17 (See Figure 9 for the dimensions)
- Spicer 1300 Flange Kit: A 947 260 06 17 (See Figure 10 for the dimensions)
- Spicer 1120 Flange Kit: A 947 260 08 17

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



Figure 7: Installation of configuration #2 as seen from the rear of the vehicle

With this driveshaft configuration:

- 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 GHG14/17 DDEC13 A&I Manual (DDC-SVC-MAN-0127) for CPC parameterization
- Consult Spec-Pro for the options offered on the various Freightliner and Western Star vehicles

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

1. Remove cover plate on DT12 Rear 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)

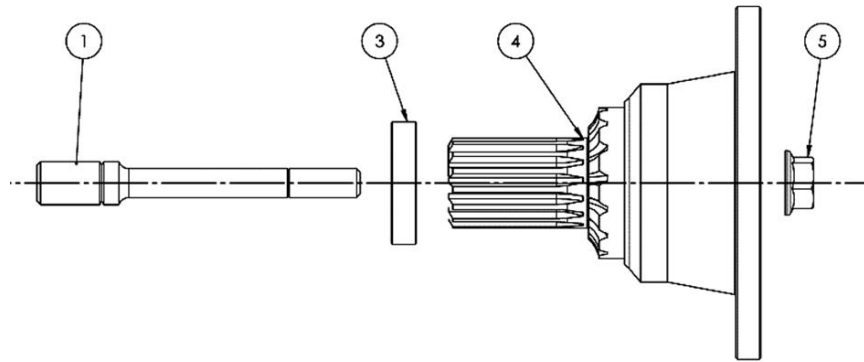


Figure 8: Installation of the 1350/1410 and 1310 series flange adapter kits to the DT12 Rear PTO.

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 adapter flange are not included in either of the Spicer kits. Use standard torque values to attach bolts to adapter flange based on hardware material and grade.

See Figure 8 above for the installation of the 1400 and 1300 series flange adapter kits to the DT12 Rear PTO.

1.3 PTO Prep Configuration

If ordering a Rear PTO “Prep” configuration for a hydraulic pump, the customer must also order the following parts from the DTNA PDC for the transmission adaptation:

- DT12 PTO drive assembly
 - Assembly p/n A 947 260 08 05 for the 1:1 PTO ratio
 - Assembly p/n A 947 260 09 05 for the 1:1.32 PTO ratio
 - Assembly p/n A 947 260 10 05 for the 1:1.83 PTO ratio
- Shaft kit for attaching the rear-mount DT12 PTO drive assembly
 - P/N A 947 260 24 92 for the following transmissions:
 - DT12-DH (DA),
 - DT12-OH (OA),
 - DT12-DHE/DV (DC),
 - DT12-OHE/OV (OC),
 - DT12-OVX (OD)
 - P/N A 947 260 21 92 for the following transmission variants:
 - DT12-DHL (DB),
 - DT12-OHL (OB)
- Transmission Top 5 shim kit, p/n A 389 262 50 56
 - Required for the following transmissions only:
 - DT12-DH (DA),
 - DT12-OH (OA),
 - DT12-DHL (DB),
 - DT12-OHL (OB)

- Spicer flange kit
 - 1400: A 947 260 03 17 (1:1 and 1:1.32 ratios)
A 947 260 09 17 (1:1.83 ratio)
 - 1300: A 947 260 04 17 (1:1 and 1:1.32 ratios)
A 947 260 06 17 (1:1.83 ratio)
 - 1120: A 947 260 08 17 (1:1.83 ratio)

With this configuration:

- A transmission cooler will be added to DT12 configuration in SpecPro (if not already required)
- 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 GHG14/17 DDEC13 A&I Manual (DDC-SVC-MAN-0127) for CPC parameterization
- Consult Spec-Pro for the options offered on the various Freightliner and Western Star vehicles

See the Detroit Transmission Workshop Manual, DDC-SVC-MAN-0140, Section 4.14, Installation of the Power Take-Off, for more detailed instructions on installing the DT12 Rear PTO and the pneumatic line referenced above. Please note that the oil pump and controller valve are located on the front of the DT12-DHE/DV (DC), -OHE/OV (OC), and -OVX (OD) transmissions, so some of the steps shown may not be relevant.

The dimensions for the Spicer 1400 and 1300 series PTO flanges are listed in the figures below.

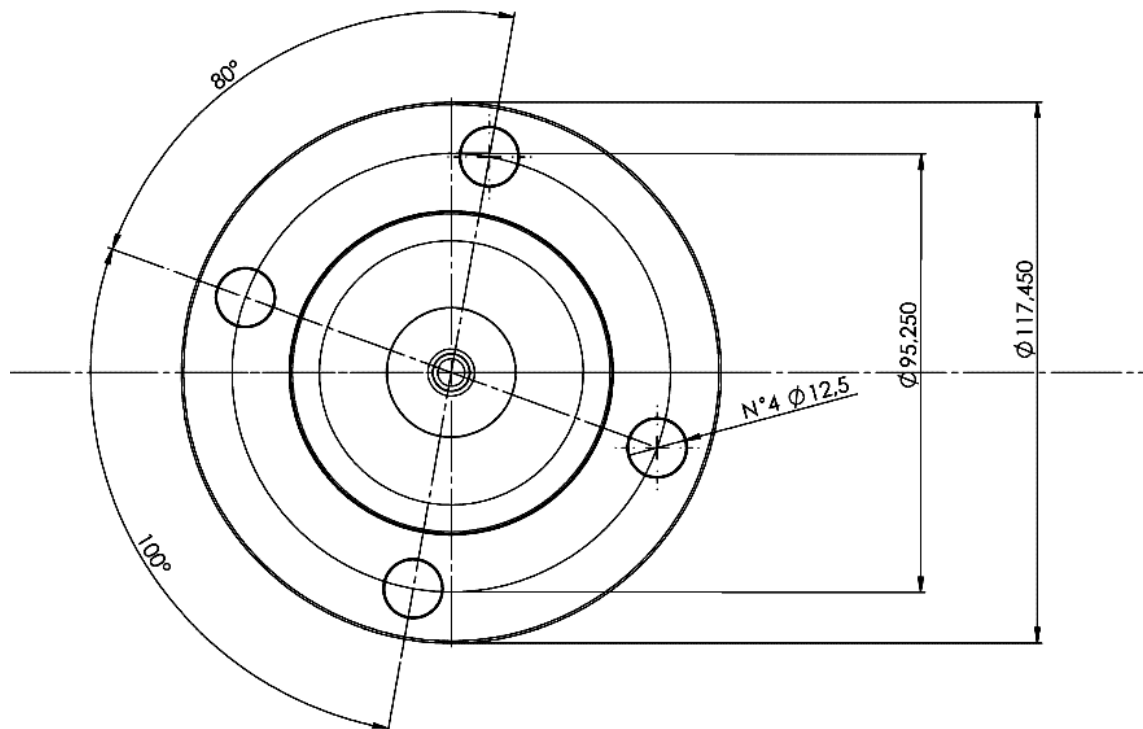


Figure 9: Spicer 1400 series adapter flange

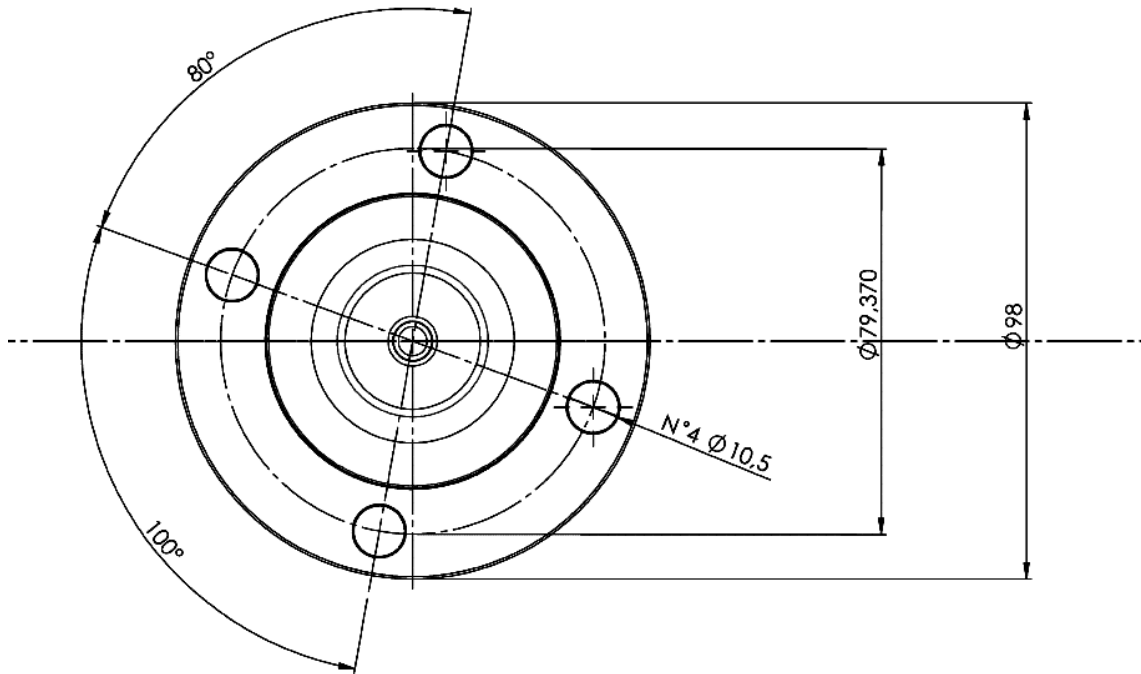


Figure 10: Spicer 1300 adapter flange

The following are approved Rear PTO's for use with the DT12-Transmission:

Series	IPH/Muncie (factory)	Bezares
	P89	120
PTO Location	Rear	Rear
Max Torque Continuous	317 lb-ft	305 lb-ft
Max Torque Intermittent	317 lb-ft	406 lb-ft
PTO Ratios (Engine:PTO)	1:1 (M1 Ratio) 1:1.32 (M2 Ratio) 1:1.83 (M3 Ratio)	— 1:1.30 —
Weight	23 lbs	33 lbs
Shift Concept	Dog Clutch	Dog Clutch

Table 1: DT12 Approved Rear PTO's

1.4 Rear PTO Technical Information / Installation Requirements

- Engine speed: 850 - 2080 rpm
- Vehicle speed during Rear PTO Operation: 1) 0 mph (vehicle is stationary)
2) Launch gear only operation
- Rear PTO output speed (rounded to the nearest 25rpm):
 - 1 : 1 PTO Ratio (M1 Ratio):

Direct Drive Split Low	650 - 1625 rpm
Direct Drive Split High	850 - 2225 rpm
Over Drive Split Low	775 - 2175 rpm
Over Drive Split High	1000 - 2675 rpm
 - 1 : 1.32 PTO Ratio (M2 Ratio):

Direct Drive Split Low	900 - 2350 rpm
Direct Drive Split High	1150 - 3025 rpm
Over Drive Split Low	1050 - 2825 rpm
Over Drive Split High	1375 - 3650 rpm
 - 1 : 1.83 PTO Ratio (M3 Ratio):

Direct Drive Split Low	1250 - 3275 rpm
Direct Drive Split High	1600 - 4225 rpm
Over Drive Split Low	1475 - 3925 rpm
Over Drive Split High	1900 - 5075 rpm
- Max Rear PTO output torque: 317 lb·ft (430 N·m) [For 1:1 and 1:1.32 ratios]
295 lb·ft (400 N·m) [For 1:1.83 ratio]
- PTO drive shaft angle 1° to 6°
- Interface (mount) 2 or 4 bolt SAE B pad mount (1:1 and 1:1.32 ratios)
SE DIN 5462 4 bolt connection pad (1:1.83 ratio)
- Interface (shaft) SAE BB 15 tooth spline drive (1:1 and 1:1.32 ratios)
8 x 32 x 36 spline (1:1.83 ratio)
- Interface (flange drive) Spicer 1400 and 1300 (1:1, 1:1.32, and 1:1.83 ratios)
- Rear PTO rotation Counterclockwise (CCW) looking from rear of DT12
(Requires CW input pump)

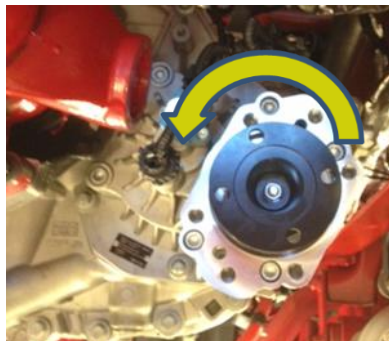


Figure 11: Rear PTO rotation direction

- 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 Rear PTO variant availability All DT12 variants (oil cooler is required)
- The maximum bending moment 29.5 lb-ft (40 Nm)
- Rear PTO retrofit capability Requires GHG17 or newer powertrain applications.
R19.11 or newer software for CPC501T.
R36_00_000A or newer software for CPC04T.
27.23.00 or newer software for CPC302T.

NOTES: 1) The transmission should have a PTO Prep Kit, otherwise the cost and complexity will increase dramatically.
2) Please consult 22CSA-09Rev from Powertrain Service Engineering for additional information on the resources available for adding a transmission PTO, what information is required when requesting a PTO Technical Modification or additional support for PTO integration support, and who should be contacted for additional support.

1.5 Launch Gear Only Rear PTO Operation

NOTE: Launch gear PTO operation requires Citrine CEAA+ level software or newer. Older levels of software are NOT capable of utilizing this vehicle operation mode.

This configuration is only allowed when launching from a complete stop, utilizing the vehicle’s launch gear.

To operate in this manner:

- Make sure the transmission is in neutral,
- Engage the Rear PTO,
- Shift transmission into gear with foot on the service brake,
- Release brake to get the vehicle moving.
- To disengage the PTO, unload the PTO/system first.
- Then disengage the PTO while moving or stopped.

NOTE: The transmission may not shift gears while the vehicle is being driven with the Rear PTO engaged. Manually shifting gears with the Rear PTO engaged is also not allowed.

For the Rear PTO’s, the following are the available launch gears:

DT12 Rear PTO
All Variants
1 - 2 - 3 - 4 - 5

Table 2: DT12 Rear PTO Launch Gears

1.6 Bending Moment Calculation

NOTES: 1) The maximum bending moment of the Rear PTO to the transmission mounting surface must be calculated including the length of unsupported hydraulic hoses, and the weight of the fittings and hydraulic fluid. Support brackets are NOT allowed!
2) The maximum bending moment allowed between the Rear PTO and the DT12 transmission is 29.5 lb-ft (40 N-m).

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 3: 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.

1.7 PTO Output Speed Calculation

Since the DT12 Rear 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 Rear 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 Rear 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 GHG14/17 DDEC13 Electronic Controls Application and Installation Manual (DDC-SVC-MAN-0127) Section 8.28 Throttle Control/Governors via www.portal-dtna.prd.freightliner.com for specific parameter programming information.

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

DT12 Rear PTO Output Speed Chart		Slow		Medium		Fast	
		PTO Ratio 1:1 362-424 or 362-425		PTO Ratio 1:1.32 362-2HB or 362-318		PTO Ratio 1:1.83 362-577	
DT-12 Variant	"Split"	Engine : PTO	Percent	Engine : PTO	Percent	Engine : PTO	Percent
DT12-DHL (DB)	Split Low 85P-001	1:0.78	78%	1:1.06	106%	1:1.47	147%
	Split High 85P-002	1:1	100%	1:1.36	136%	1:1.89	189%
DT12-OHL (OB)	Split Low 85P-001	1:1	100%	1:1.36	136%	1:1.89	189%
	Split High 85P-002	1:1.28	128%	1:1.76	174%	1:2.42	242%
DT12-DH (DA)	Split Low 85P-001	1:0.78	78%	1:1.06	106%	1:1.47	147%
	Split High 85P-002	1:1	100%	1:1.36	136%	1:1.89	189%
DT12-OH (OA)	Split Low 85P-001	1:1	100%	1:1.36	136%	1:1.89	189%
	Split High 85P-002	1:1.29	129%	1:1.76	176%	1:2.44	244%
DT12-DHE/DV (DC)	Split Low 85P-001	1:0.71	71%	1:0.97	97%	1:1.34	134%
	Split High 85P-002	1:0.92	92%	1:1.25	125%	1:1.73	173%
DT12-OHE/OV (OC)	Split Low 85P-001	1:0.92	92%	1:1.25	125%	1:1.73	173%
	Split High 85P-002	1:1.18	118%	1:1.61	161%	1:2.23	223%
DT12-OVX (OD)	Split Low 85P-001	1:0.94	94%	1:1.28	128%	1:1.78	178%
	Split High 85P-002	1:1.21	121%	1:1.65	165%	1:2.29	229%

Ratios Greater than 1:1, or over 100% -> PTO spins faster than engine

Table 4: Rear PTO output speed summary table.

For example, the Rear PTO speed with a DT12-DA (DH) Split Low with the 1:1 PTO Ratio would be:
(Engine RPM) x (Engine:PTO Ratio) = 850 rpm x 0.78 = 663 rpm

Similarly, the Rear PTO speed with a DT12-OC (OHE & OV) Split High with the 1:1.32 PTO Ratio would be
(Engine RPM) x (Engine:PTO Ratio) = 850 rpm x 1.61 = 1369 rpm

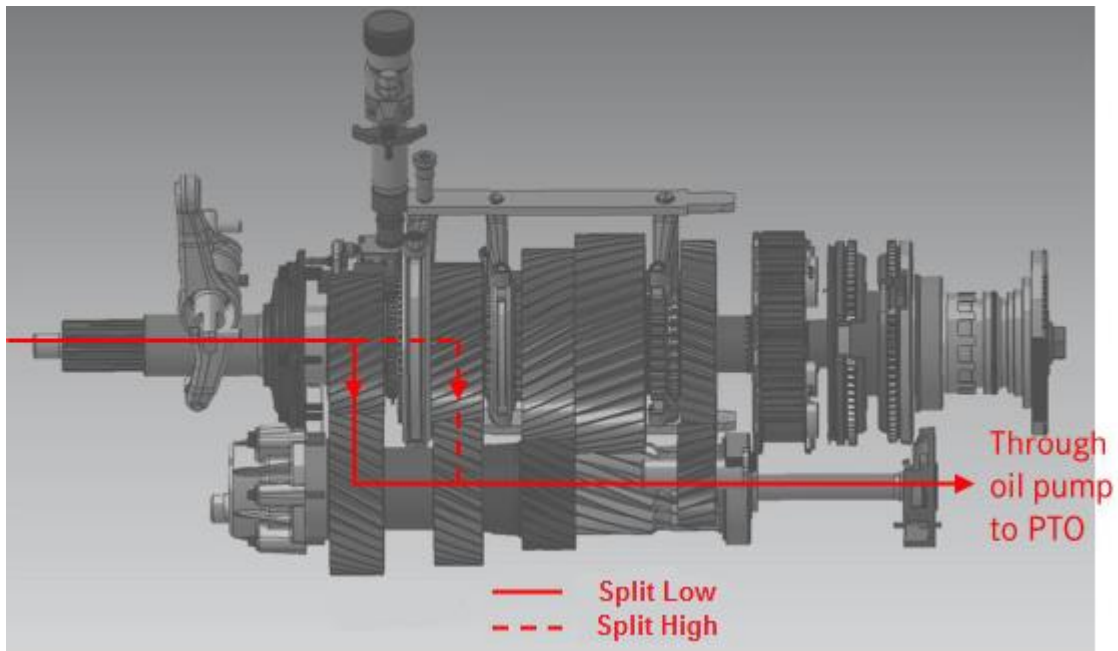


Figure 12: Example of PTO Power Flow through a Direct Drive DT12-DA (DH) or DT12-DB (DHL)

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

2. BOTTOM PTO's

Auxiliary equipment require power take-offs, either when the truck is stationary or when it is in motion. Various power take-off alternatives can be chosen, depending on the bodywork. The work is generally carried out by equipment which is powered by a hydraulic motor. The hydraulic motor, together with a pump and associated equipment, form the basis of the hydraulic system. The pump, which provides the hydraulic pressure and flow to the motor, is the heart of the hydraulic system. Below are guidelines for Bottom PTO operation with the new DT12 variants:

- ❖ PTOs are not designed to handle axial or radial forces. No direct installation of belt pulley or sprocket on PTO output shaft is allowed.
- ❖ Due to the risk of PTO overloading, overload protection must be installed.
- ❖ Engine speed with the PTO engaged and under load must follow the instructions "Torque – Restriction (engine speed)".
- ❖ Whole number ratios are not acceptable because of risk to built-up resonance vibrations (contact PTO supplier).
- ❖ Beside the torque capacity of the PTO, its retrievable output torque (lowest torque result of the following three situations) depends on the torque reduction values for
 - shock loads (dynamic torque)
 - high bending angle of driveshaft
 - power split

The new DT12 Bottom PTO is being released to the following DT12 variants:

- DT12-DHE/DV (DC) with Chelsea PTO's only
- DT12-OHE/OV (OC) with both Chelsea & Muncie PTO's
- DT12-OVX (OD) with both Chelsea & Muncie PTO's

The following DT12 variants will only have the Rear PTO available:

- DT12-DHL (DB)
- DT12-OHL (OB)
- DT12-DH (DA) [NOTE: this transmission variant is no longer available from the factory]
- DT12-OH (OA)

BOTTOM PTO ROTATION DIRECTION

The direction of rotation of all Bottom PTO's (Chelsea and Muncie) is shown below:

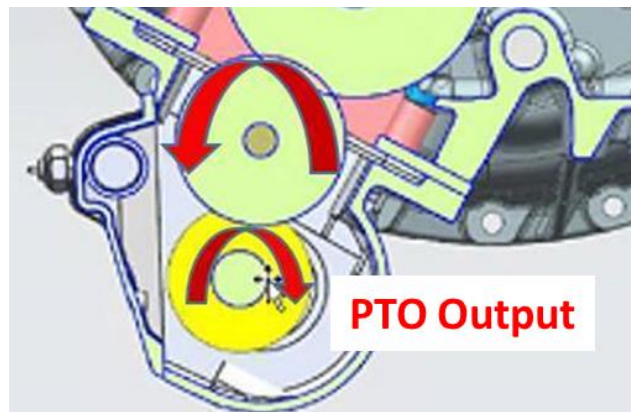


Figure 13: Bottom PTO rotation direction, as seen from the rear of the vehicle.

2.1 Bottom PTO Modes Of Operation

There are three basic modes of Bottom PTO Operation:

- 1) Running the Bottom PTO during normal vehicle operation (Friction Clutch Operation).

Operation of the Bottom PTO during normal vehicle operation (while driving the vehicle with the transmission staying in the same gear) is ALLOWED.

NOTE: There is not a limit on the specific gears in which the Friction Clutch PTO can be operated. However, shifting gears of the transmission with the PTO engaged is NOT ALLOWED - the PTO will automatically disengage.

See the Friction Clutch Operation section beginning on page 35 for further information on this mode of operation.

- 2) Launching the vehicle with Bottom PTO engaged (Launch Gear Use).

NOTE: Launch gear PTO operation requires Citrine CEAA+ level software or newer. Older levels of software are NOT capable of utilizing this vehicle operation mode.

This configuration is allowed when launching from a complete stop, utilizing the vehicle's launch gear (example: roll-off application).

To operate in this manner:

- Make sure the transmission is in neutral,
- Engage the Bottom PTO,
- Shift transmission into gear with foot on the service brake,
- Release brake to get the vehicle moving.
- To disengage the PTO, unload the PTO/system first.
- Then disengage the PTO while moving or stopped.

NOTE: The transmission may not shift gears while the vehicle is being driven with the Bottom PTO engaged. Manually shifting gears with the Bottom PTO engaged is also not allowed.

For the Bottom PTO's, the following are the available launch gears:

Bottom PTO Starting Gears		
Direct Drive	1, 3, 5	R1
Over Drive	2, 4	R2

Table 5: DT12 Bottom PTO Launch Gears

- 3) Stationary Operation:

Bottom PTO's from both Chelsea & Muncie are available for use with the DT12 and stationary operation. See the information below which details the specifics regarding each since their limits, features, and adaptation to the transmission are different.

NOTES: Maximum output shaft speed for Chelsea Bottom PTO's is 2000rpm. (If higher rpms are needed, special approval is needed directly from Chelsea.) Maximum output shaft speed for Muncie Bottom PTO's is 2500rpm. Higher Bottom PTO output speeds can lead to PTO and/or vehicle equipment damage.

2.2 Chelsea Bottom PTO'S – Stationary & Launch Mode Operation

See the table below for the maximum allowed torque for permanent and intermittent operation.



Series	Chelsea			
	823	880	680	489
Max Torque Continuous	525 lb-ft	350 lb-ft	263 lb-ft	175 lb-ft
Max Torque Intermittent	750 lb-ft	500 lb-ft	375 lb-ft	250 lb-ft
Weight	76 lbs	37 lbs	28 lbs	30 lbs
Shift Type	Dog clutch	Dog clutch	Dog clutch	Dog clutch

Table 6: Info table on released Chelsea Bottom PTO variants

CHELSEA MODEL NUMBER CHARTS

The Chelsea PTO model number provides a lot of information about the application where the PTO will be used. This information includes:

- PTO model number,
- Mounting type / transmission for which the PTO is designed,
- Gear ratio of the PTO as a percentage of engine speed (percentages > 100% indicate a PTO speed faster than the engine speed, while percentages < 100% indicate a PTO speed slower than the engine speed),
- Input gear designator for which the PTO is designed,
- Pressure lubrication status,
- Shifter type,
- Output designation (bolt pump mount, flange type, din spec).

Following are the model charts for the Chelsea 823 PTO for the various DT12 variants.

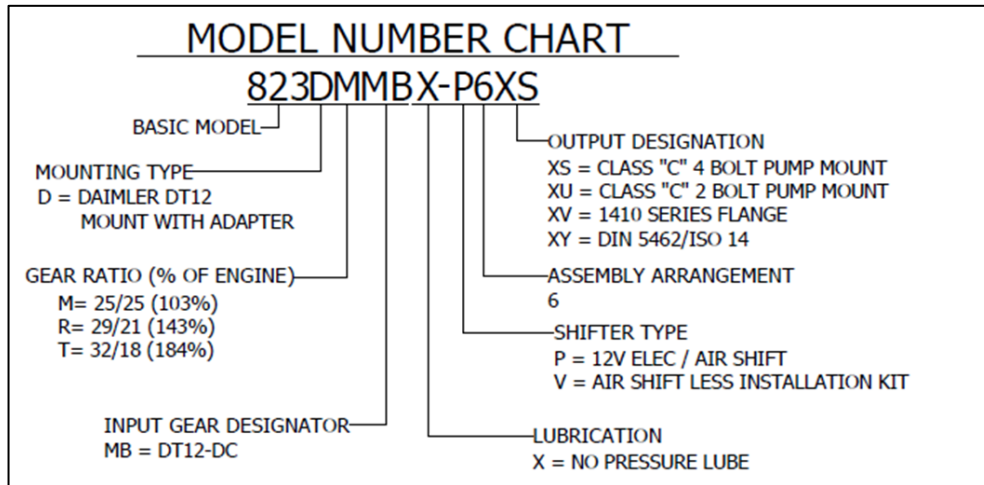


Figure 14: Model Chart for the Chelsea 823 PTO and the DT12-DHE/DV (DC).

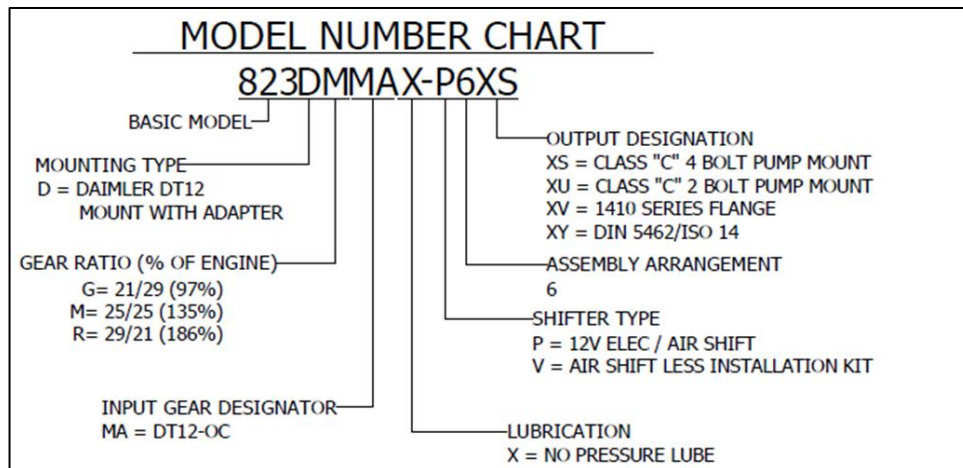


Figure 15: Model Chart for the Chelsea 823 PTO and the DT12-OHE/OV (OC).

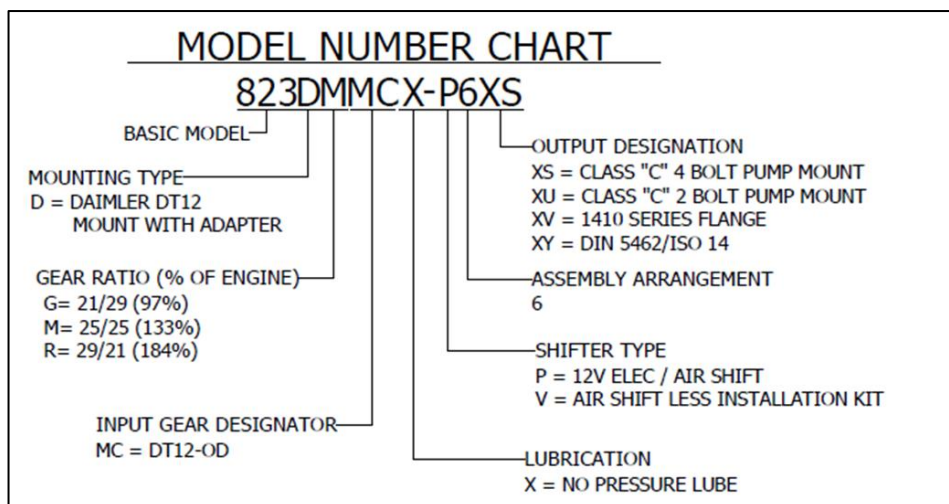


Figure 16: Model Chart for the Chelsea 823 PTO and the DT12-OVX (OD).

Below are the model charts for the Chelsea 880 PTO for the various DT12 variants.

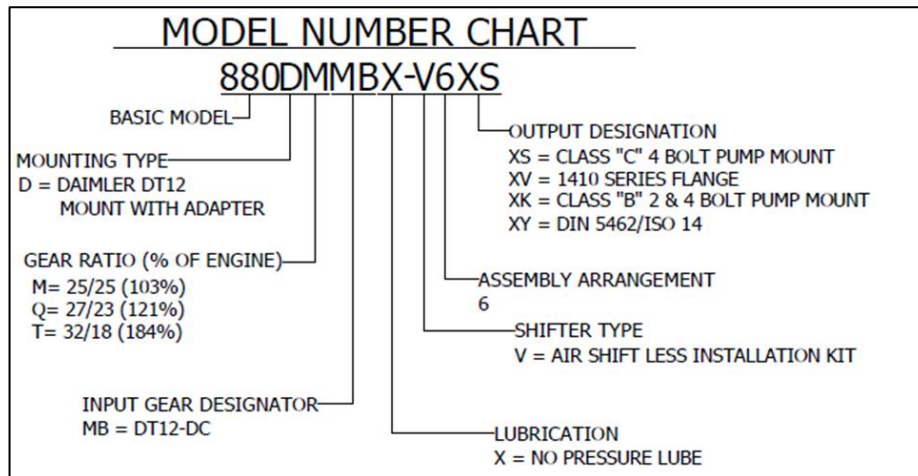


Figure 17: Model Chart for the Chelsea 880 PTO and the DT12-DHE/DV (DC).

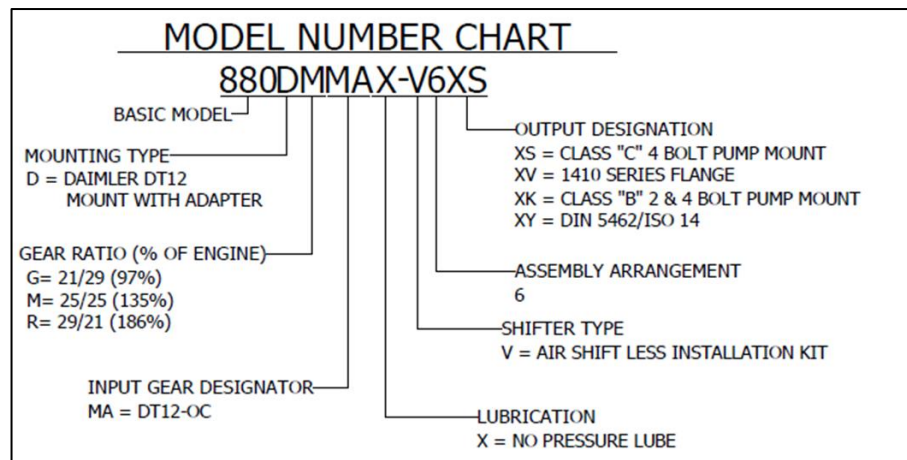


Figure 18: Model Chart for the Chelsea 880 PTO and the DT12-OHE/OV (OC).

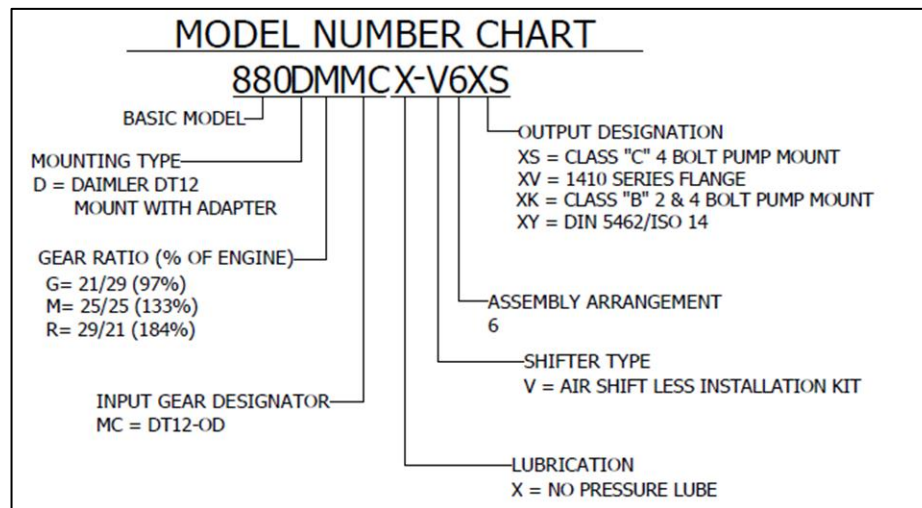


Figure 19: Model Chart for the Chelsea 880 PTO and the DT12-OVX (OD).

Below are the model charts for the Chelsea 680 PTO for the various DT12 variants.

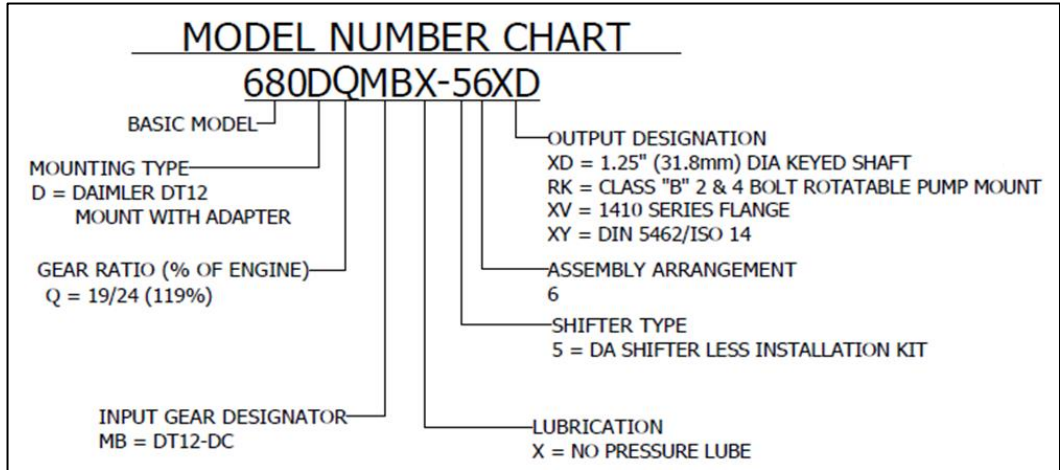


Figure 20: Model Chart for the Chelsea 680 PTO and the DT12-DHE/DV (DC)

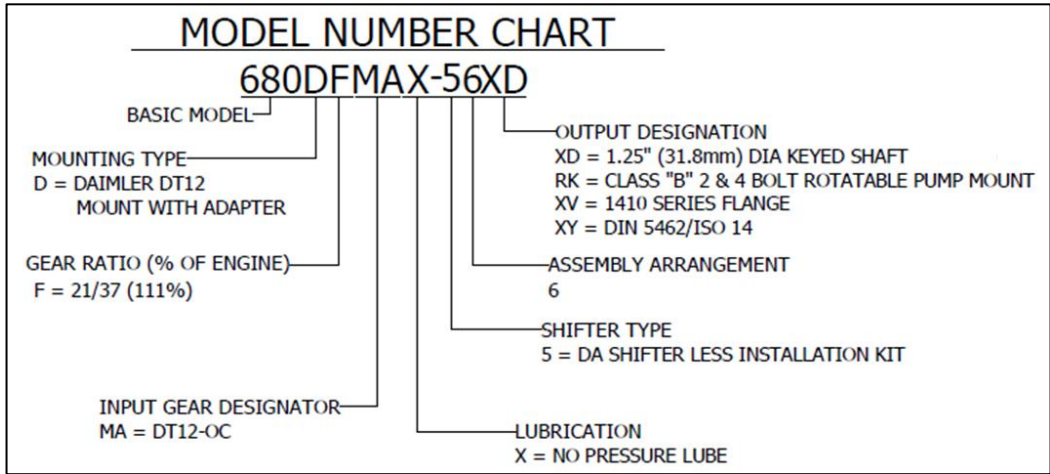


Figure 21: Model Chart for the Chelsea 680 PTO and the DT12-OHE/OV (OC).

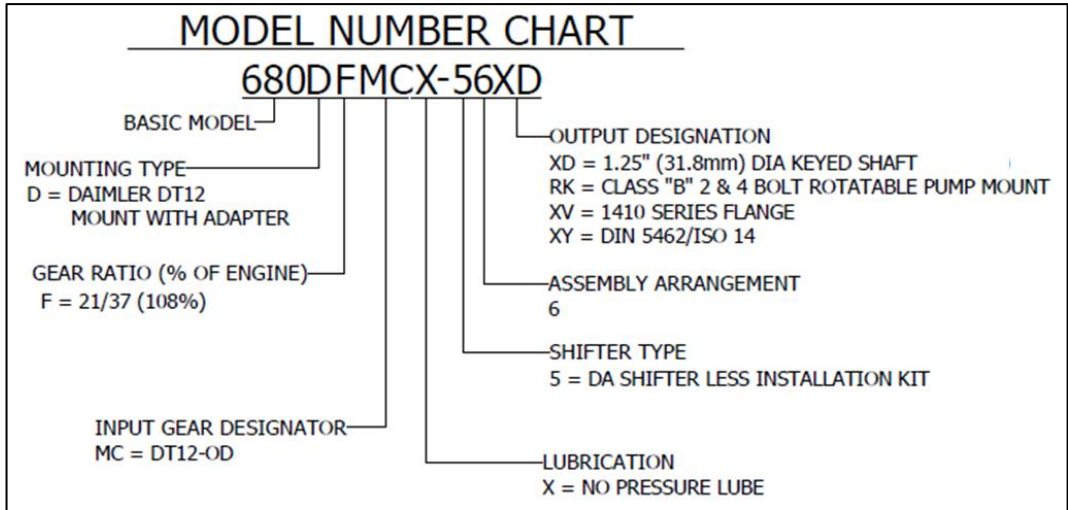


Figure 22: Model Chart for the Chelsea 680 PTO and the DT12-OVX (OD).

Below are the model charts for the Chelsea 489 PTO for the various DT12 variants.

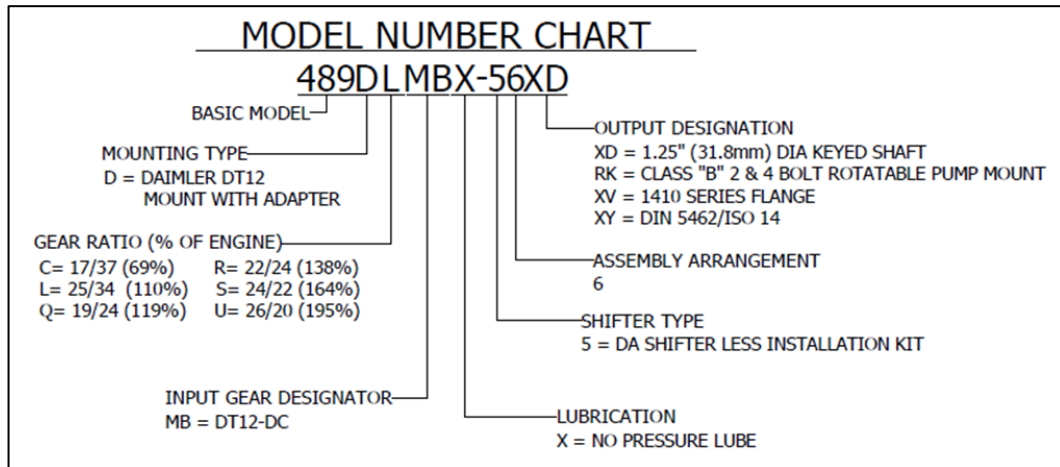


Figure 23: Model Chart for the Chelsea 489 PTO and the DT12-DHE/DV (DC).

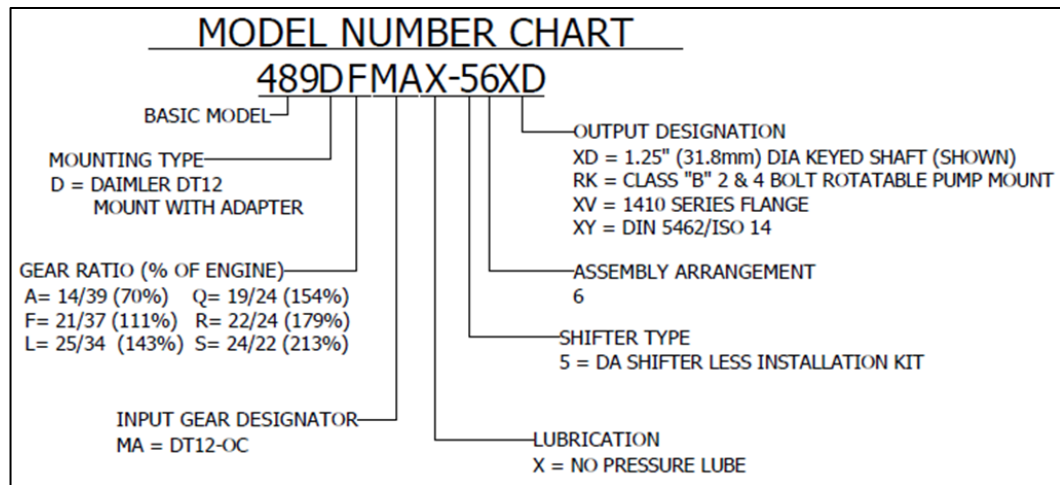


Figure 24: Model Chart for the Chelsea 489 PTO and the DT12-OHE/OV (OC).

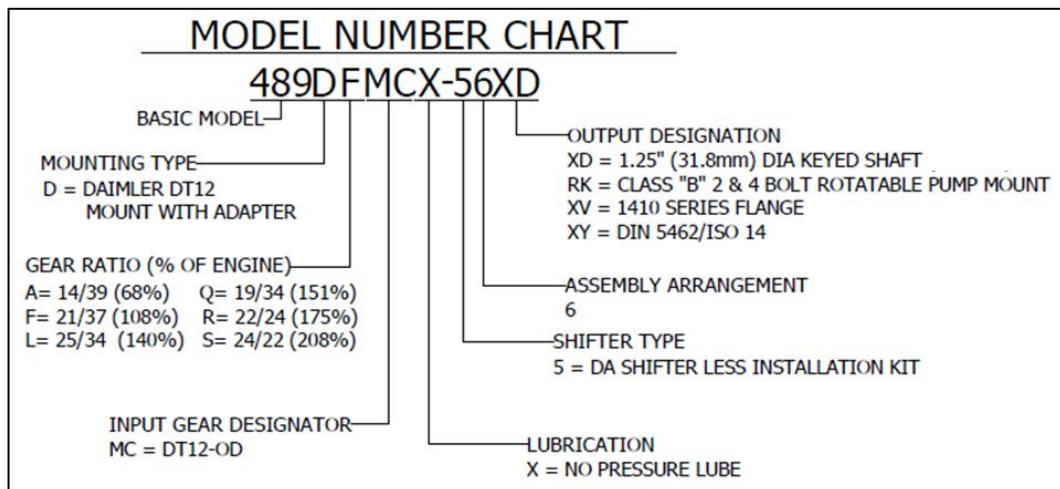


Figure 25: Model Chart for the Chelsea 489 PTO and the DT12-OVX (OD).

2.3 Chelsea Bottom PTO_Stationary & Launch Mode Assembly & Installation

1. PTO Adapter Selection

The Chelsea Bottom PTO needs a separate adapter to mate the Bottom PTO to the transmission input shaft. This adapter is different for each of the transmission variants; there is also one for low power and another for high power Bottom PTO's. Below is a summary of the Bottom PTO adapters.

PTO Adapter Chart

PTO Output	Transmission	PTO Type	Adaptor Assy p/n
Low Power	DC (DHE & DV)	489	329954X
Low Power	OC (OHE & OV)	489	329932X
Low Power	OD (OVX)	489	329955X
High Power	DC (DHE & DV)	823 / 880 / 680	330033X
High Power	OC (OHE & OV)	823 / 880 / 680	330032X
High Power	OD (OVX)	823 / 880 / 680	330034X

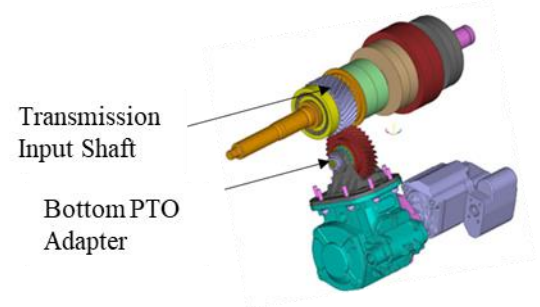


Table 7: Chelsea Bottom PTO adapter variants

The DT12 Bottom PTO hardware is available through your Chelsea PTO parts provider. The Bottom PTO adapter, which adapts the standard Chelsea PTO's approved for use to the Chelsea PTO, can be provided by your DTNA service parts representative.

NOTE: It is critical to use the correct Bottom PTO Adapter Assembly – part failure could result due to the use of the wrong adapter! The Low Power adapter must only be combined with the Low Power PTO, but the High Power Adapter can be used with both the High Power & Low Power PTO.

There are features designed/machined into the Low Power Adapter and Low Power PTO housing to ensure that the rating of the adapter is correctly matched with that of the Bottom PTO Housing as shown below.

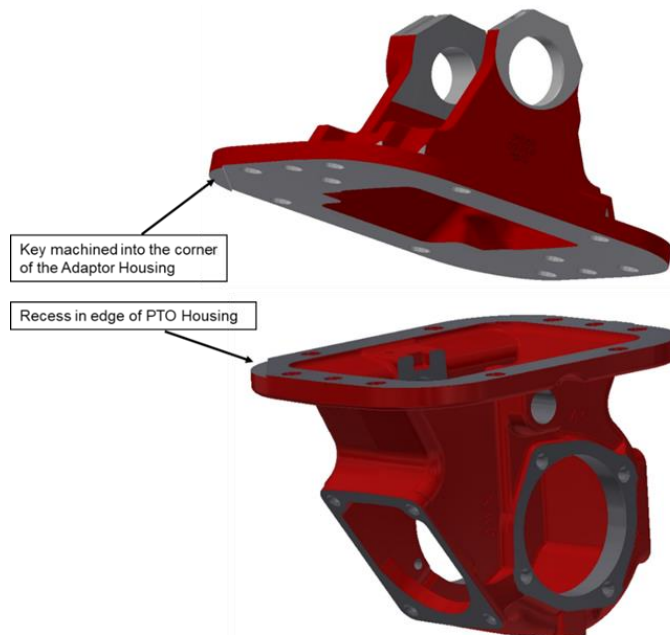


Figure 26: Low Power Bottom PTO adapter to Low Power PTO housing poka-yoke

2. Studs

Below is the detail on the studs as well as the information on how to install them for use with the DT12 Bottom PTO:

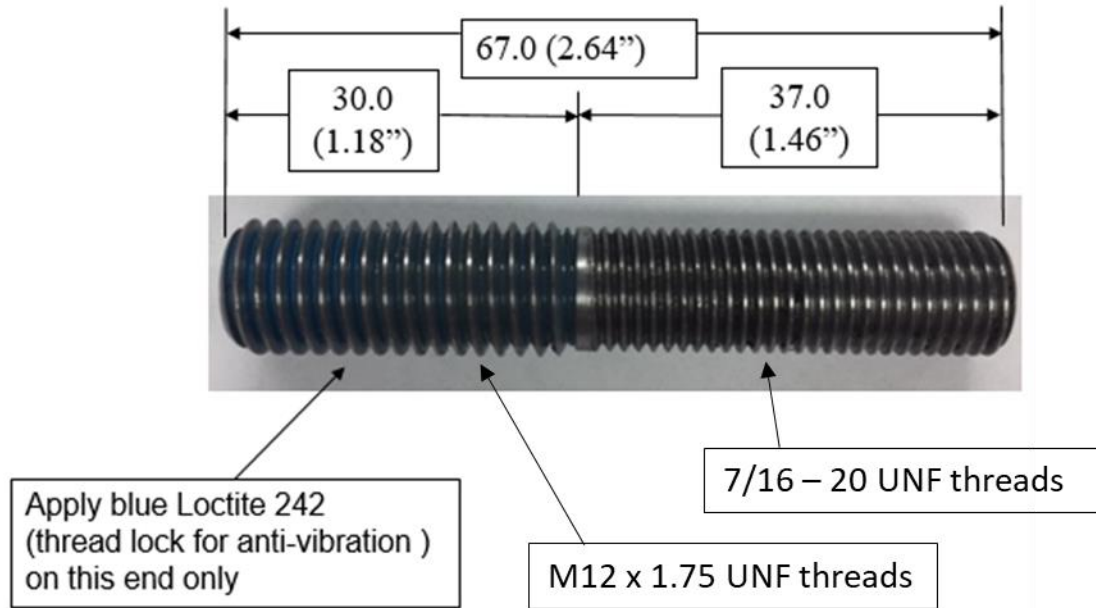


Figure 27: Stud detail information

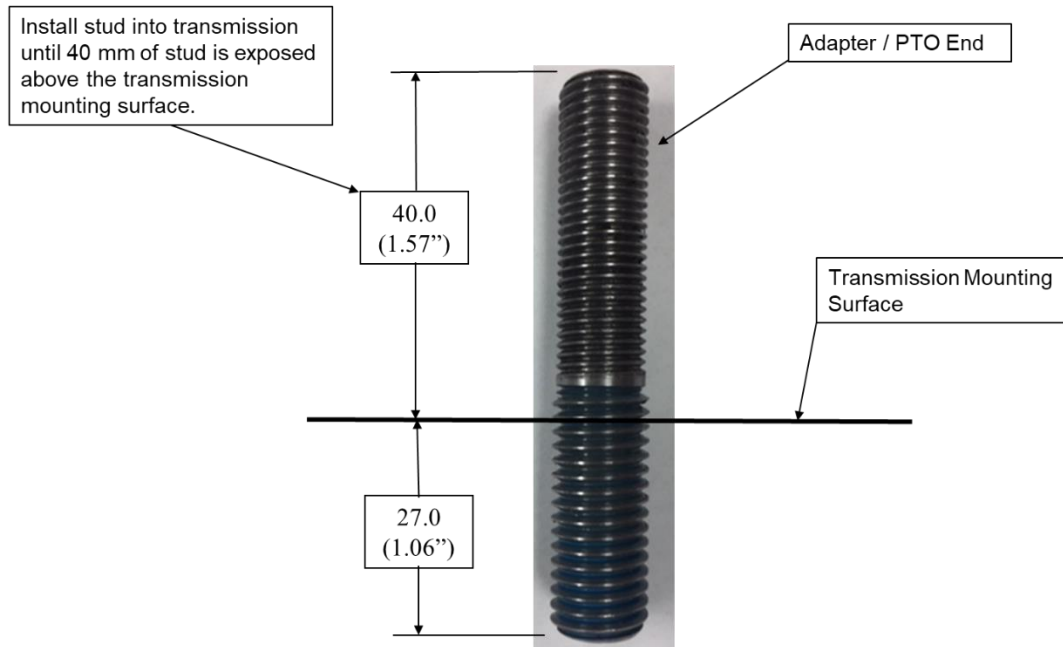


Figure 28: Stud installation information

3. Dowel Pins

Below is the detail on the dowel pins as well as the information on how to install them for use with the DT12 Bottom PTO:

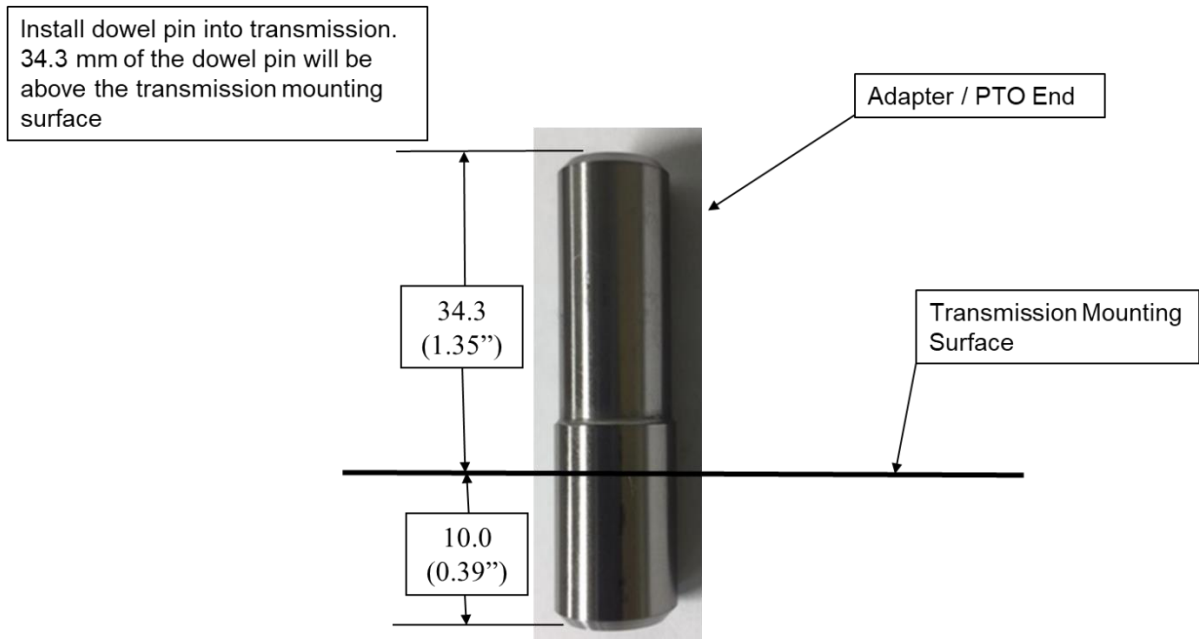


Figure 29: Stud installation information

Install the studs and dowel pins into the Bottom PTO interface of the DT12 transmission per the diagram below:

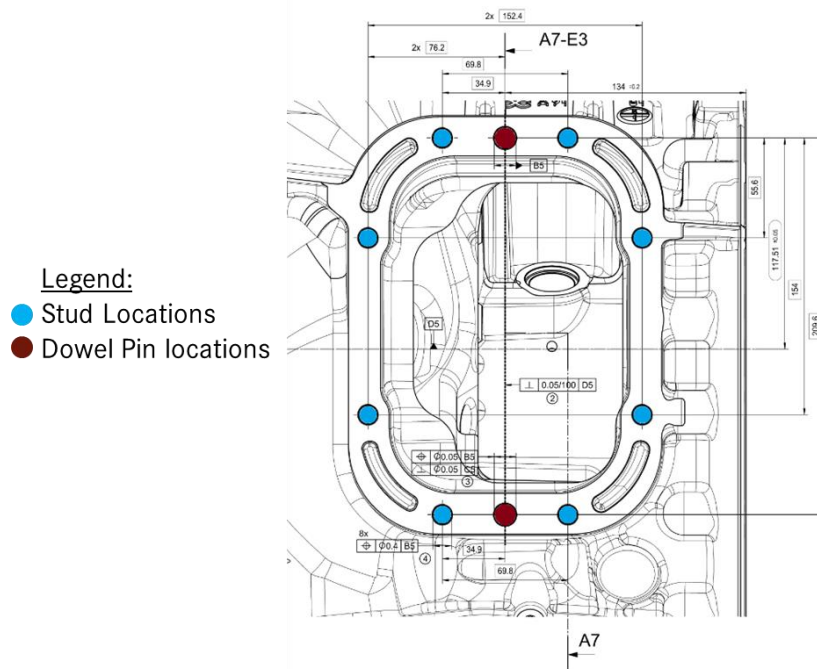


Figure 30: Stud and dowel pin installation locations

4. PTO Gasket, PTO Adapter, and PTO Installation & Gear Lash Adjustment

For proper installation of the PTO Gasket(s), PTO Adapter, and PTO as well as gear lash adjustment, please consult Section 26 of the Vehicle Workshop Manual, which contains detailed instructions.

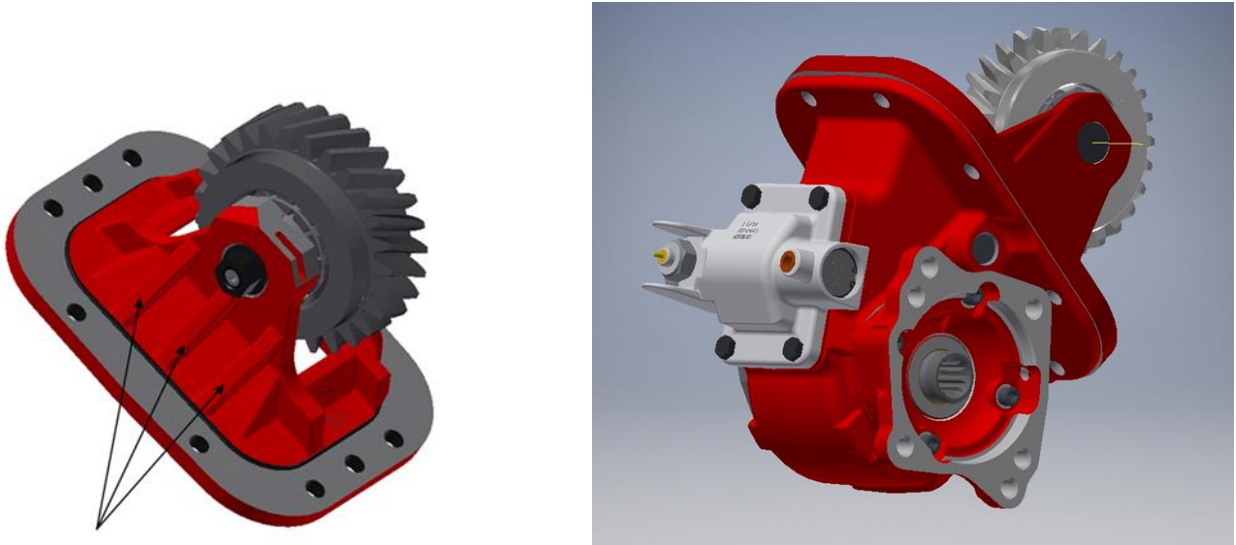


Figure 31: PTO Adapter and Adaptor/PTO housing assembly

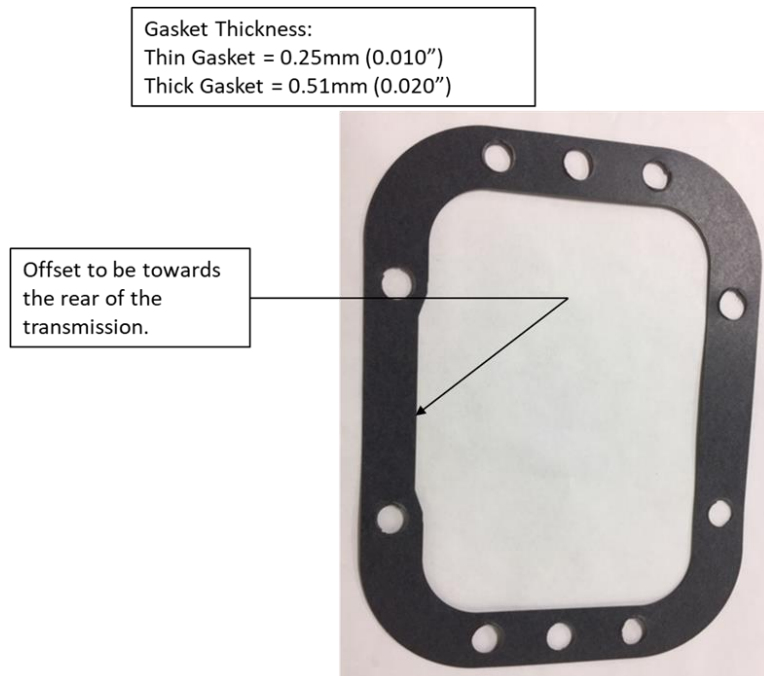
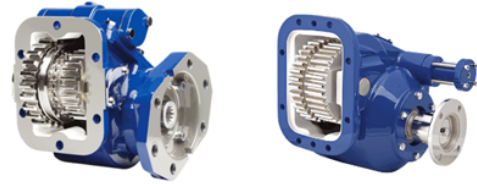


Figure 32: Bottom PTO adapter/transmission gasket installation

2.4 Muncie Bottom PTO'S_Stationary & Launch Mode Operation

See the table below for the maximum allowed torque for permanent and intermittent operation.



Series	Muncie	
	TG 8S	82 8S
Max Torque Continuous	200 lb-ft	350 lb-ft
Max Torque Intermittent	285 lb-ft	500 lb-ft
Theoretic Speed ratio (engine to PTO out)	53% - 253%	57% - 95%
Weight	22 lb	85 lb
Shift Concept	Dog clutch	Dog clutch

Table 8: Info table on released Muncie Bottom PTO variants

The Muncie PTO model number provides a lot of information about the PTO and how it is configured in the application. This information includes:

- PTO type,
- Mounting type / transmission for which the PTO is designed,
- Speed ratio of the PTO as a percentage of engine speed (Percentages > 100% indicate a PTO speed faster than the engine speed, while percentages < 100% indicate a PTO speed slower than the engine speed),
- Shifter type,
- Assembly arrangement,
- Output types,
- Special features.

Please consult the Muncie documentation for the TG and 82 Series Power Take-Off's for additional information on PTO torque & horsepower ratings at the different speed ratios, PTO dimensions, and output options.

NOTES: Maximum output shaft speed for Muncie Bottom PTO's is 2500rpm. Higher PTO output speeds can lead to PTO and/or vehicle equipment damage.

Muncie Bottom PTO's are only available on the following DT12 variants only:

- DT12-OHE & -OV (OC)
- DT12-OVX (OD)

Below are the model number charts for the Muncie Bottom PTO's for the DT12 variants.

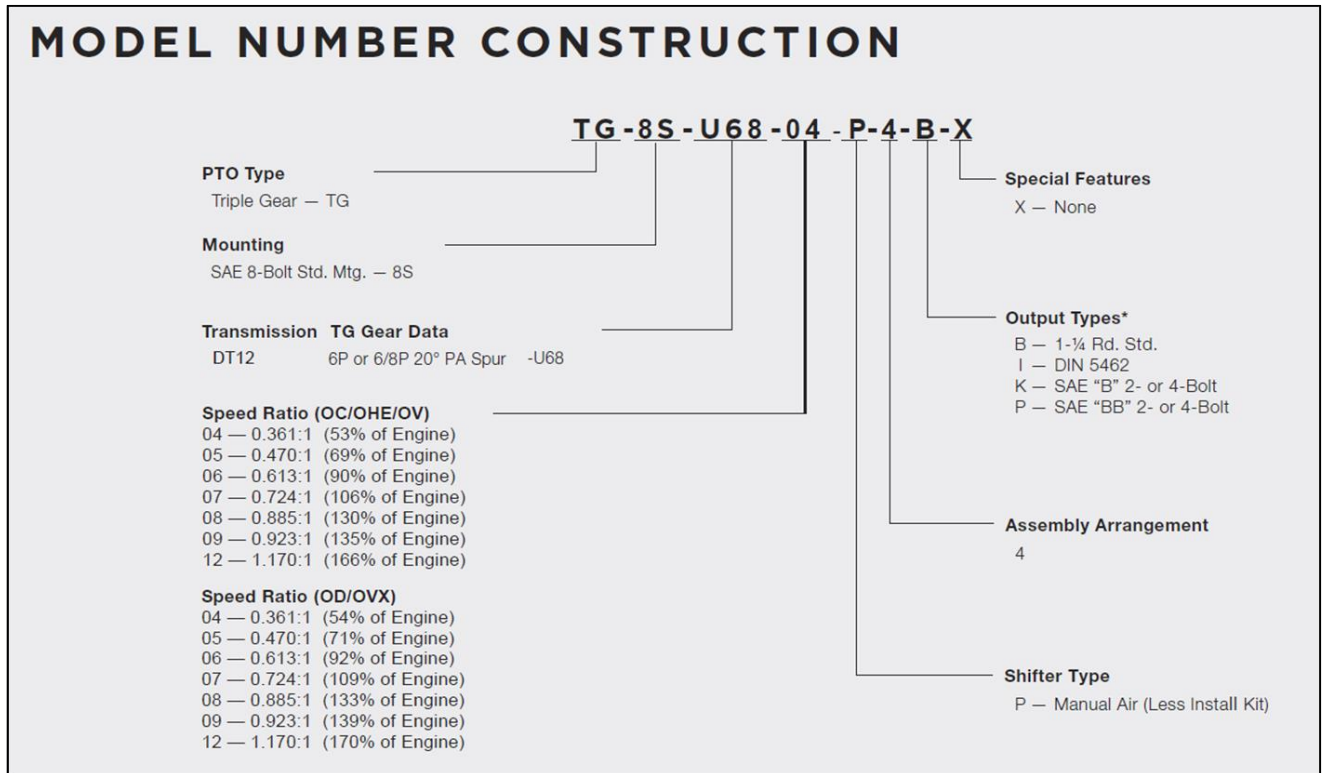


Figure 33: Model Chart for the Muncie TG 8S Bottom PTO

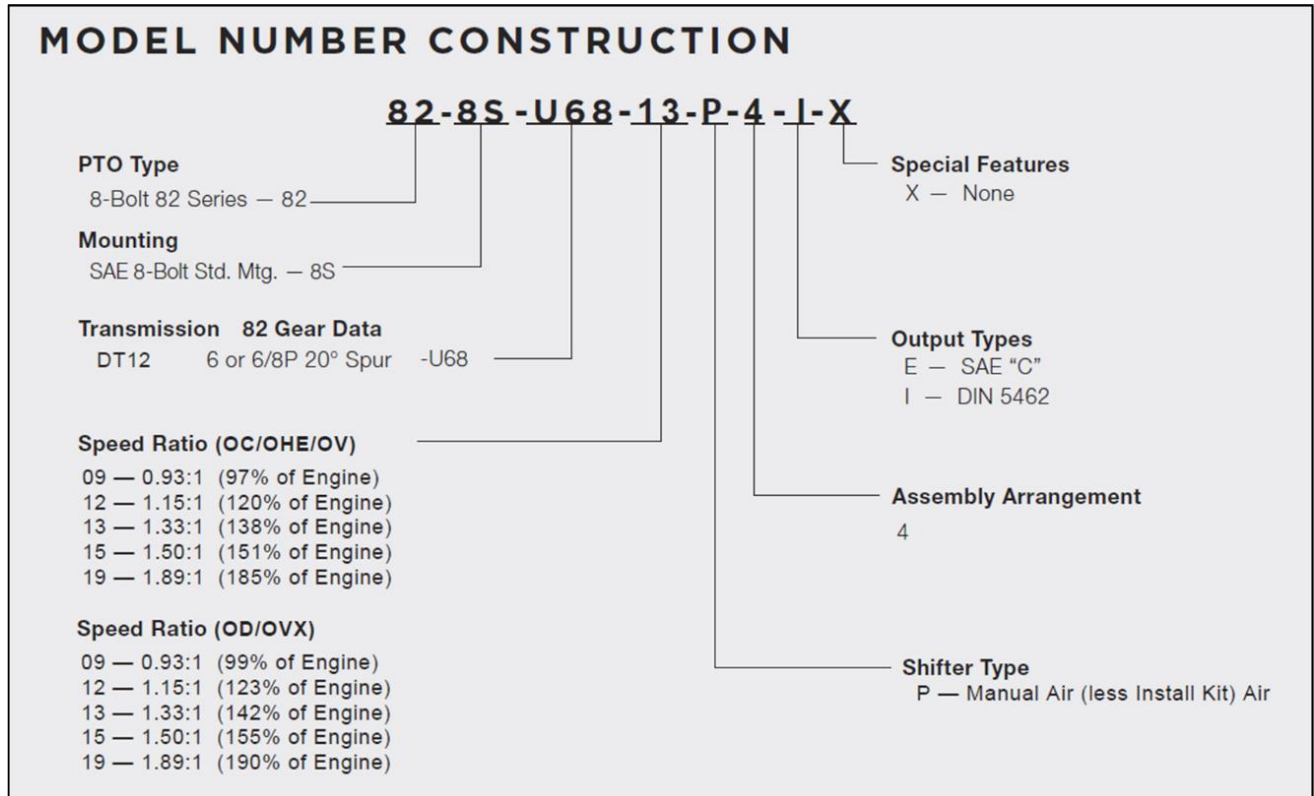


Figure 34: Model Chart for the Muncie 82 8S Bottom PTO

2.5 Muncie Bottom PTO'S_Stationary & Launch Mode Assembly & Installation

1. PTO Adapter Selection

The Muncie Bottom PTO needs a separate adapter to mate the PTO to the transmission input shaft. This adapter is different for the different transmission variants. Below is a summary of the Muncie Bottom PTO adapters.

Transmission	Adapter	Adapter Gear P/N
DC (DHE & DV)	No option available	N/A
OC (OHE & OV)	40TA6479	05T64697
OD (OVX)	40TA6480	05T64698

Table 9: Muncie Bottom PTO adapter variants

The DT12 Bottom PTO hardware and Installation Kits are available through your Muncie Power parts provider.

2. Adapter to Transmission Installation

Use the below procedure to properly mate the PTO Adapter to the DT12 transmission.

- Drain the transmission fluid from the transmission by removing the drain plug. Measure the amount of fluid removed if it will not be re-used. Follow manufacturers recommendation for fluid replacement or re-fill/re-use of the drained oil.
- Remove the PTO cover plate and gasket from the Bottom PTO opening on the transmission. You will NOT be re-using these components.
- Locate the 2 alignment pins/dowels in the installation kit and install the pins at the 6 and 12 o'clock positions in the adapter.

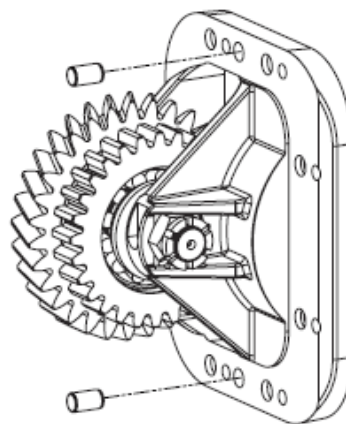


Figure 35: Installation of the dowel pins into the Muncie Bottom PTO Adapter

- Apply a thin coating of approved transmission oil on both sides of the gasket to be installed between the transmission and the PTO adapter – this will help hold it in place during the installation process.
- Install the adapter on the transmission using the thicker gasket (0.020") included with the installation kit and torque the qty=8 M12x30 cap screws to 50 lb-ft (68 N-m).

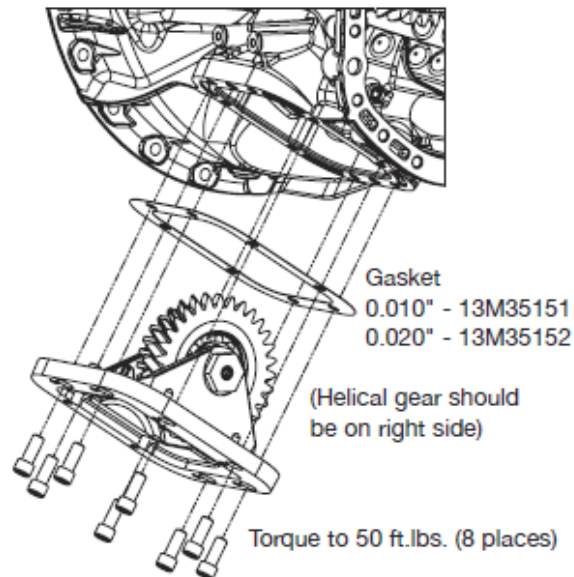


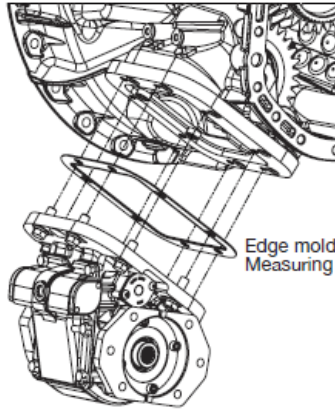
Figure 36: Installation of the Muncie Bottom PTO Adapter to the transmission

- Measure the backlash between the adapter and transmission gears. Correct backlash should be 0.006"-0.012" (0.15mm – 0.30mm). Adjust as necessary using a second gasket. A thinner gasket, one that measures 0.010" (0.25mm) thick, is available and is shown in Figure 35 above. Additional gaskets are available through your Muncie Power parts provider.
- Now prep the PTO for installation onto the PTO adapter.
 - For the TG Series PTO's, use stud kit 20MK8801 which includes 6 cap screws, 2 studs & nuts, and 8 lock washers. Lock washers should be used on each fastener (8 places).
 - For the 82 Series PTO's (not the 15 and 19 ratios), use stud kit 20MK8815 which includes 8 studs & nuts along with 8 lock washers.
 - For the 82 Series PTO's (with the 15 or 19 ratio), use stud kit 20MK8817, which is similar to the 20MK8815 above, but includes longer studs to accommodate the required spacer.
- Install the PTO onto the adapter.
 - Use the edge molded gasket between the adapter and the PTO, or between the adapter and any spacer plates required for PTO installation.
 - Backlash measurement is not required between the PTO and adapter if no spacers are used between these two components during installation. If a shim is used, the gear backlash between PTO and adapter gears specification is 0.006" -0.012" (0.15mm – 0.30mm).
 - Torque the cap screws (TG Series) or nuts (82 Series) to 50 lb-ft (68 N-m)

NOTE: It is critical that the edge-molded gasket is used against the PTO Adapter – failure to do so may result in oil leakage!

TG Series, 82 Series 05 - 13 ratios

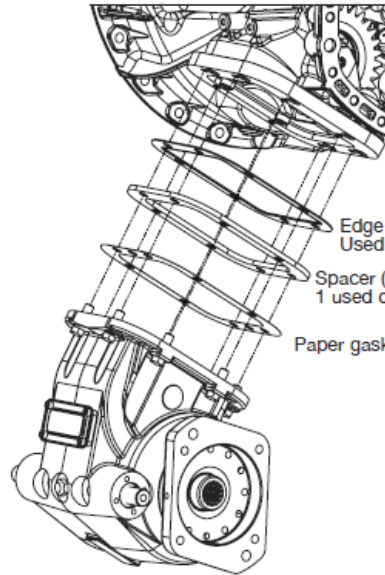
Setting backlash between PTO and adapter NOT required



Edge molded gasket - P/N 13T65089
Measuring backlash not required

82 Series 15 and 19 ratios only

Backlash must be set between PTO and adapter!



Edge molded gasket P/N 13T65089
Used between adapter and spacer

Spacer (2 used on 828S-U6815,
1 used on 828S-U6819)

Paper gasket

Figure 37: Installation of the Muncie PTO to the PTO Adapter and transmission

NOTES: See Muncie PTO Operators Manual, IN84-03, for further PTO Installation details, activation kit instructions, as well as warranty and maintenance information.

- Fill the transmission with oil removed, or new oil per manufacturers recommendations

2.6 Friction Clutch Bottom Mount PTO's

Friction Clutch PTO's on the DT12 transmissions are Bottom Mount PTO's that are capable to be used while the vehicle is in motion.

These new DT12 Friction Clutch Bottom PTO's are only available on the following DT12 transmissions:

- DT12-DC (DHE & DV), Chelsea model only
- DT12-OC (OHE & OV), both Chelsea & Muncie models
- DT12-OD (OVX), both Chelsea & Muncie models

Friction Clutch PTO Parameterization

The various PTO's are expected to use a dash switch for activation. Using this logic, the following are the various parameter settings for the different PTO types:

- Rear Mounted PTO is expected to use Array #0 (parameter u80)
ptconf_p_PTO_PTOType_u80=3
- Bottom PTO is expected to use Array #1 (parameter u81)
ptconf_p_PTO_PTOType_u81=1 (std bottom PTO)
ptconf_p_PTO_PTOType_u81=2 (shift on-the-fly operation bottom PTO)
- Driveline PTO's/Aux Trans PTO's/Split Shaft PTO's are expected to use Array #2 (parameter u82)
ptconf_p_PTO_PTOType_u82=4 (trans case Aux PTO)
ptconf_p_PTO_PTOType_u82=6 (split shaft PTO)
- Engine PTO's are expected to use Array #3 (parameter u83)
ptconf_p_PTO_PTOType_u83=5

The above parameters are all Level 2 parameters, so they are accessible by Dealers and Distributors.

However, the Single SAM (SSAM) and XMC (optional) are also required for the PTO's to work since they are the brains and input/output of the PTO devices.

NOTE: Friction Clutch PTO has been approved for operation in both Split-Hi and Split-Lo gear selections.

FRICITION CLUTCH PTO OPERATION

Running Bottom PTO while the vehicle is in motion

Engaging and operating the Friction Clutch PTO while the vehicle is in motion is approved. However, shifting gears with the PTO engaged while moving is NOT ALLOWED.

The engagement engine rpm speeds must be limited based on the inertia of the PTO load driven. See the requirements below:

- For inertia loads <5 lb-ft², no engagement rpm limit (already limited to up to 1600rpm)
- For inertia loads 5-10 lb-ft², engagement rpm must be at/below 1200rpm
- For inertia loads >10 lb-ft², engagement rpm must be at/below 800rpm

NOTES: 1) Exceeding these engagement limits may result in damage to the PTO or transmission that will NOT be covered by the transmission warranty.

2) This mode of operation is not approved for transmission shifting. If the transmission is shifted, the Friction Clutch PTO will automatically disengage.

2.7 Chelsea Friction Clutch Bottom PTO

See the table below for the maximum allowed torque for permanent and intermittent operation.



Chelsea Friction Clutch PTO	
Model	238
Max Torque Continuous	175 lb-ft
Max Torque Intermittent	250 lb-ft
Weight	49 lbs
Shift Type	Friction Clutch

Table 10: Info table on released Chelsea Friction Clutch Bottom PTO variant

NOTES: Maximum output shaft speed for Chelsea Bottom PTO's is 2000rpm. (If higher rpms are needed, special approval is needed directly from Chelsea.
Maximum output shaft speed for Muncie Bottom PTO's is 2500rpm.
Higher Bottom PTO output speeds can lead to PTO and/or vehicle equipment damage.

CHELSEA MODEL NUMBER CHARTS

The Chelsea PTO model number provides a lot of information about the application where the PTO will be used. This information includes:

- PTO model number,
- Mounting type / transmission for which the PTO is designed,
- Gear ratio of the PTO as a percentage of engine speed (percentages > 100% indicate a PTO speed faster than the engine speed, while percentages < 100% indicate a PTO speed slower than the engine speed),
- Input gear designator for which the PTO is designed,
- Lubrication options,
- Output options,
- Assembly arrangement,
- Shift options (pilot valve, electric w/o E.O.C, air shift less install kit, etc)

Please consult the Chelsea documentation for additional specifications and dimensions of the 238 Series Power Take-Off's.

Below are the model charts for Chelsea 238 Friction Clutch PTO for the offered DT12 models:

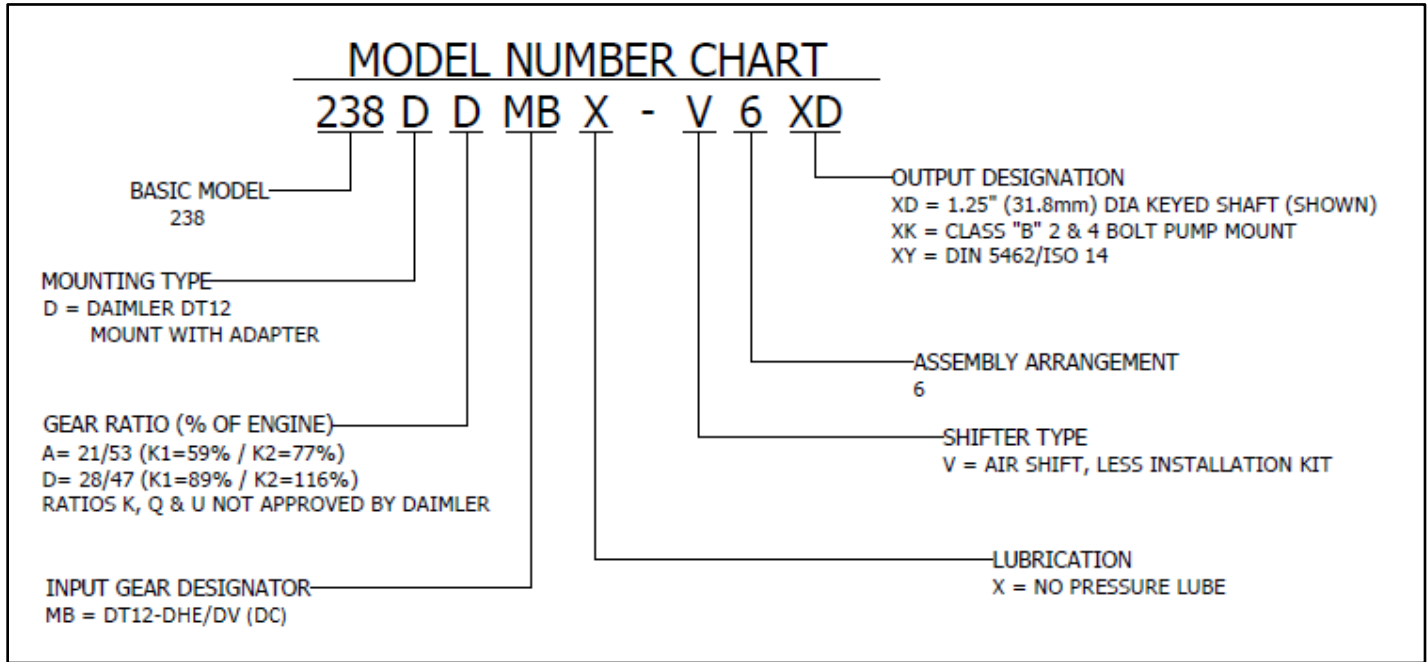


Figure 38: Chelsea 238 PTO model chart for DT12-DHE/DV (DC)

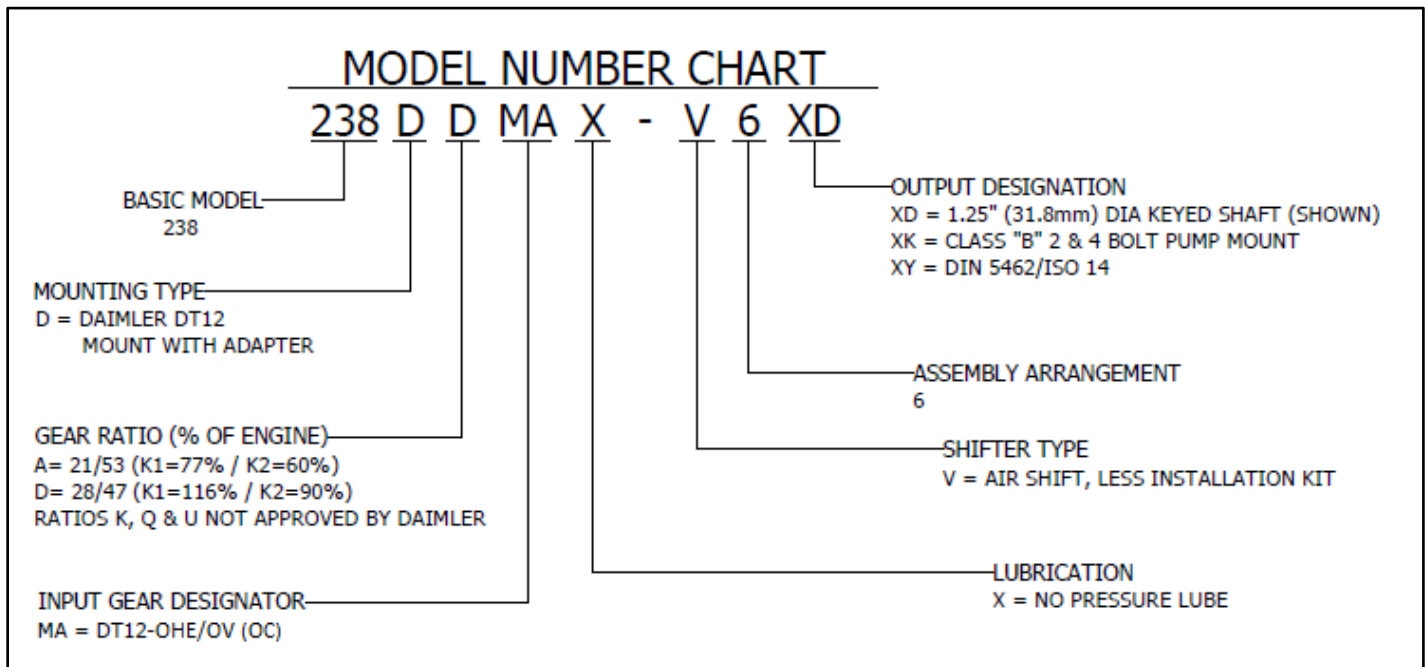


Figure 39: Chelsea 238 PTO model chart for DT12-OHE/OV (OC)

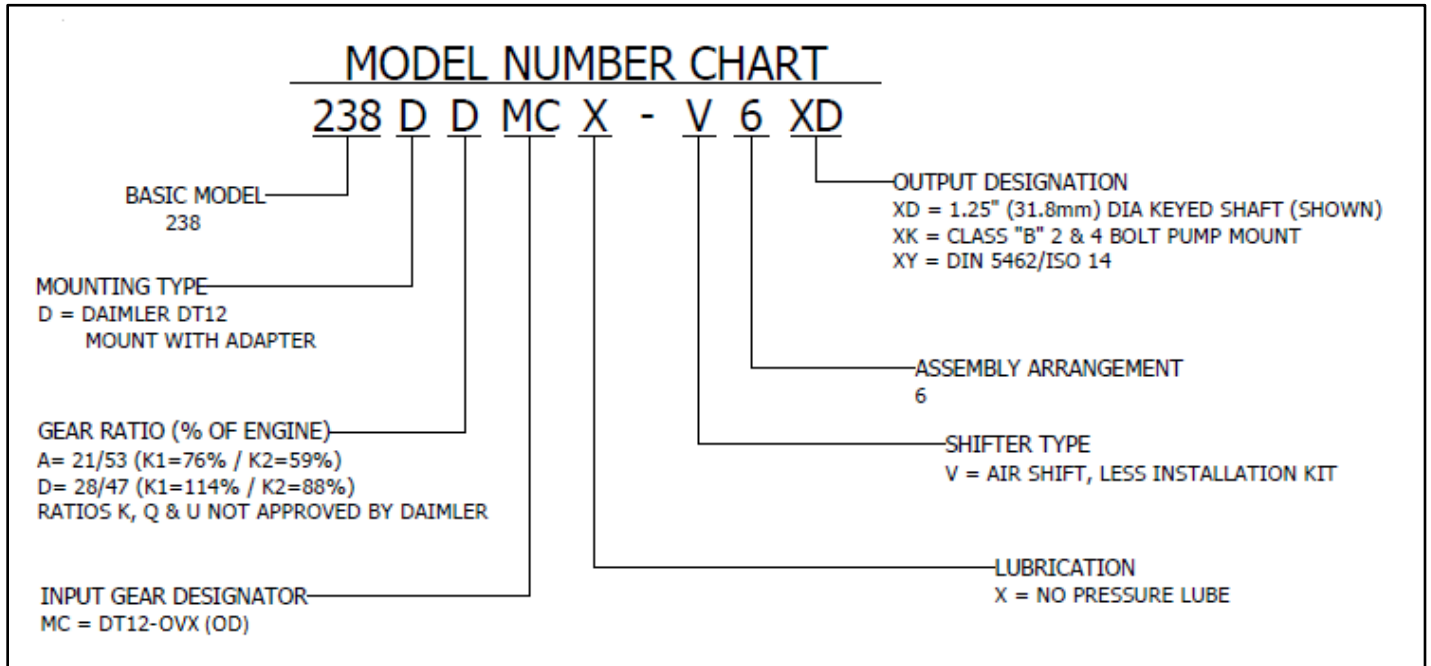


Figure 40: Chelsea 238 PTO model chart for DT12-OVX (OD)

NOTE: Chelsea Bottom Friction Clutch Assembly & Installation will use same mounting and adapter hardware as the Chelsea 489 series.

2.8 Muncie Friction Clutch Bottom PTO

See the table below for the maximum allowed torque for permanent and intermittent operation.

Series	Muncie
	CS 8S
Max Torque Continuous	210 lb-ft
Max Torque Intermittent	300 lb-ft
Theoretic Speed ratio (engine to PTO out)	38% - 102%
Weight	34 lb
Shift Concept	Friction Clutch

Table 11: Info table on released Muncie Bottom PTO variants

The Muncie PTO model number provides a lot of information about the PTO and how it is configured in the application. This information includes:

- PTO type,
- Mounting type / transmission for which the PTO is designed,
- Speed ratio of the PTO as a percentage of engine speed (Percentages > 100% indicate a PTO speed faster than the engine speed, while percentages < 100% indicate a PTO speed slower than the engine speed),
- Special features,
- Assembly arrangement,
- Output types,
- Special features,
- Shifter type

**NOTES: Maximum output shaft speed for Muncie Bottom PTO's is 2500rpm.
Higher PTO output speeds can lead to PTO and/or vehicle equipment damage.**

Muncie Friction Clutch Bottom PTO's are only available on the following DT12 variants:

- DT12-OHE/OV (OC)
- DT12-OVX (OD)

Below is the model number chart for the Muncie Friction Clutch Bottom PTO for the DT12 variants.

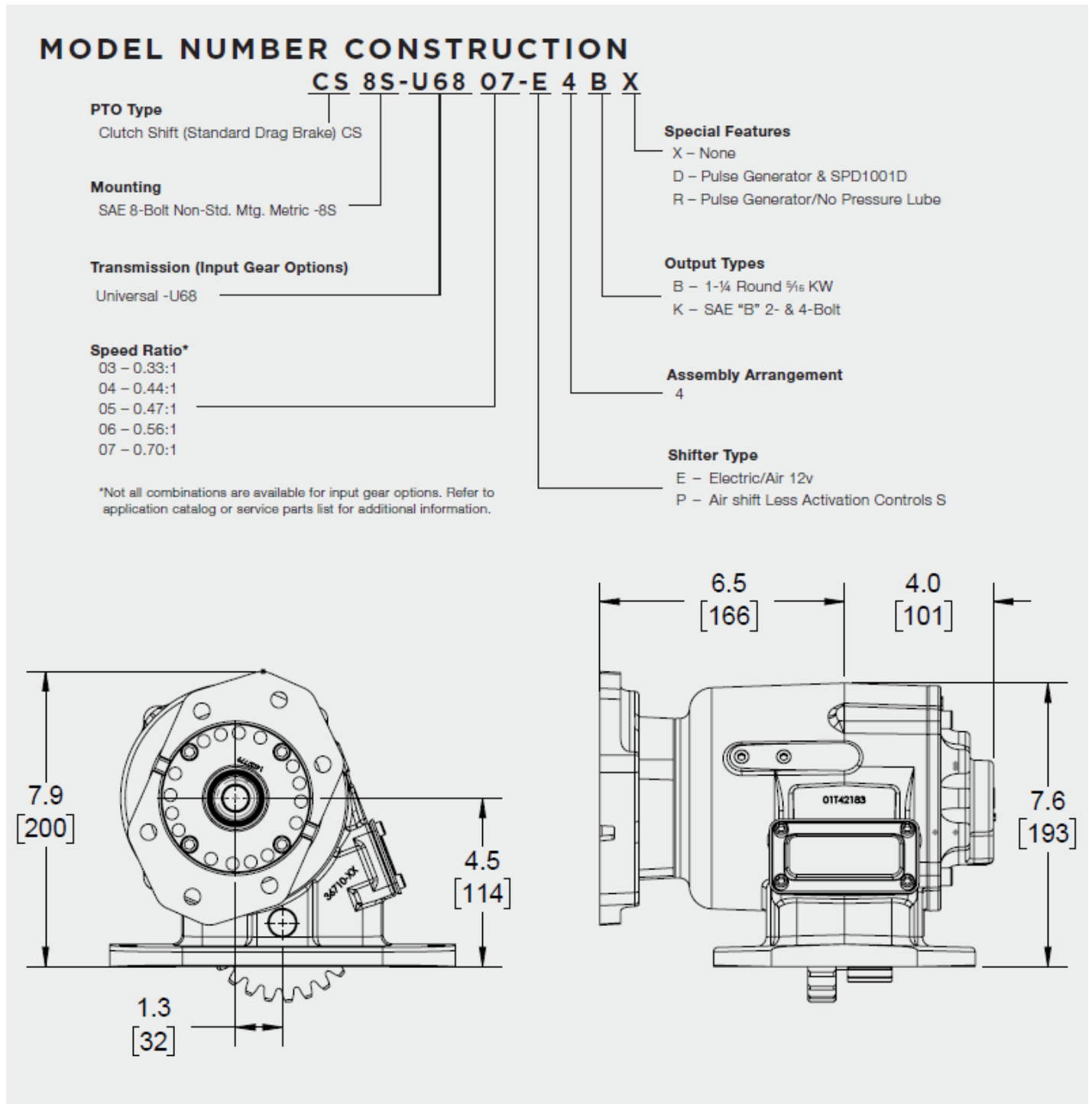


Figure 41: Muncie CS 8S Specifications & Technical Info

Below are the PTO Torque & Horsepower Ratings for the offered speed ratios:

PTO TORQUE & HORSEPOWER RATINGS						
SPEED RATIO	INTERMITTENT HP @ 1,000 RPM	INTERMITTENT TORQUE LBS.FT.	CONTINUOUS TORQUE LBS.FT.	INTERMITTENT [KW] @ 1,000 RPM	INTERMITTENT TORQUE [NM]	CONTINUOUS TORQUE [NM]
03	57	300	210	[43]	[407]	[285]
04	57	300	210	[43]	[407]	[285]
05	57	300	210	[43]	[407]	[285]
06	57	300	210	[43]	[407]	[285]
07	57	300	210	[43]	[407]	[285]

Approximate Weights: 47-49 lbs. (21.3-22.2 Kg.)

Table 12: Muncie CS 8S Torque & Horsepower rating chart

Please consult the Muncie documentation for the CS8 Series Power Take-Off's for additional information on key features, dimensions, and output option drawings.

NOTE: Muncie Bottom Friction Clutch Assembly & Installation will use same mounting and adapter hardware as the Muncie TG & 82 series.

2.9 PTO Power Split

The term PTO Power Split refers to the simultaneous operation of the Rear and Bottom PTO's. While operating at the same time, the maximum torque load distribution among the PTO's has to meet the following boundary conditions:

- Max Continuous Torque = 525 lb-ft
- Max Intermittent Torque = 750 lb-ft

The definition of "Intermittent Torque" is as follows:

Maximum torque for 1.5 minutes in a 15-minute cycle.

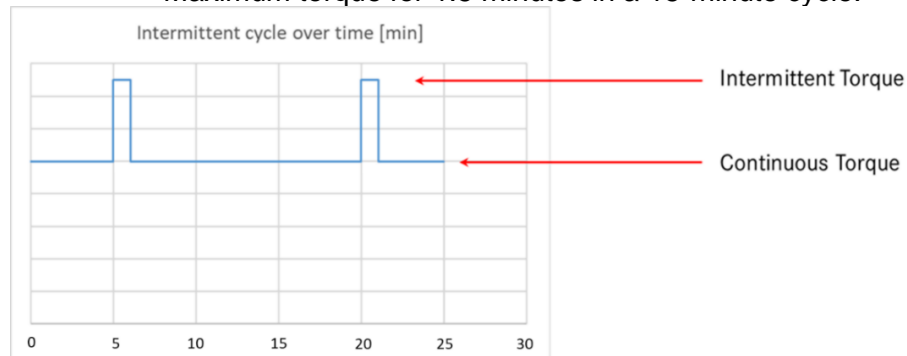


Figure 42: Torque signal showing intermittent vs Continuous Torque

2.10 Bottom Mounted PTO Support Requirements

A Bottom PTO support bracket must be used if either of the two conditions below are met:

1. The combined weight of the pump, fittings, hoses, and fluids exceeds 40 lbs (18.1 kg) . Only Bottom Mounted PTO's that are listed in this document are approved for installation on the DT12. The maximum weight listed above is the additional weight from the added pump, fittings, hoses, and fluids since the weight of the PTO is already accounted for.
2. The combined length of the PTO and pump is 18 inches or more from the PTO centerline to the end of the pump.

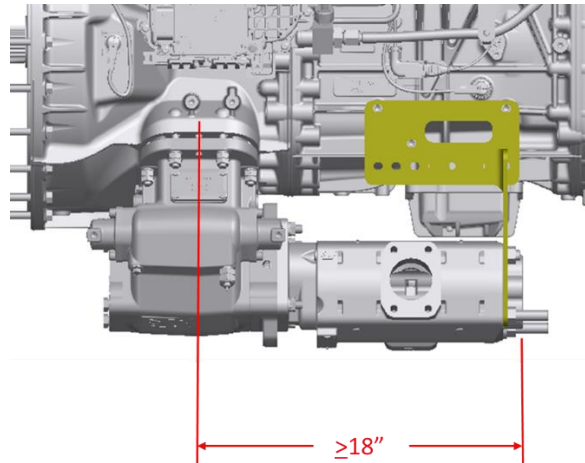


Figure 43: Combined Length Requirement for Bottom PTO Support Bracket

NOTE: The bracket must be installed without the weight of the installed pump to avoid additional stresses on the PTO mounting and the transmission-Bottom PTO interface.

Hydraulic Hoses

To reduce the impact of hose weight on the PTO assembly, bracket(s) MUST be installed to support the hoses. The minimum distance between pump fitting and the first bracket is approximately 2 ft (~600mm). Brackets installed too close to the hydraulic pump might cause additional stresses.

Also, you MUST use supporting brackets for the connections to the hydraulic oil, etc. once it is routed away from the pump or PTO connection as described above.

NOTE: The support bracket mentioned will NOT be available through DTNA, and is the responsibility of the customer.

Below is an example support bracket for mounting the Bottom PTO on the DT12 transmission mid-housing.

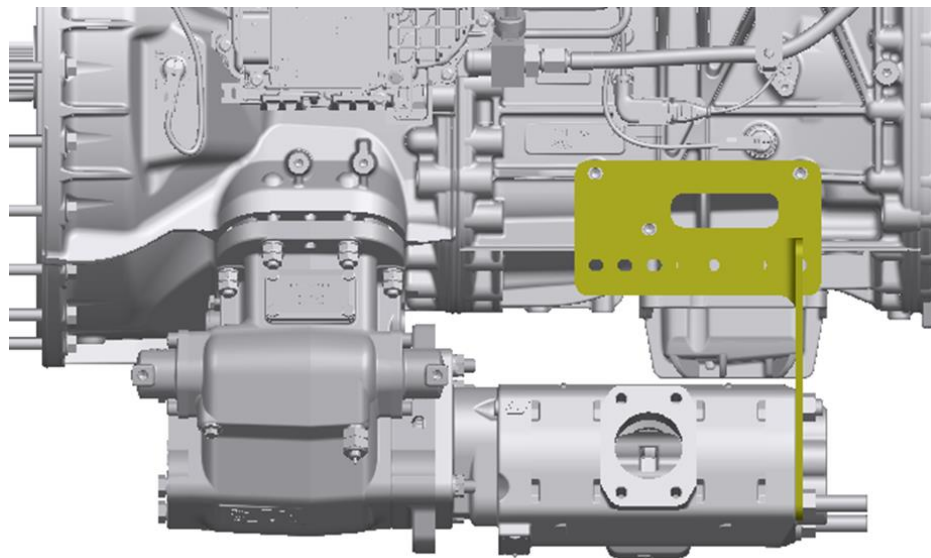


Figure 44: Example DT12 Bottom PTO support bracket

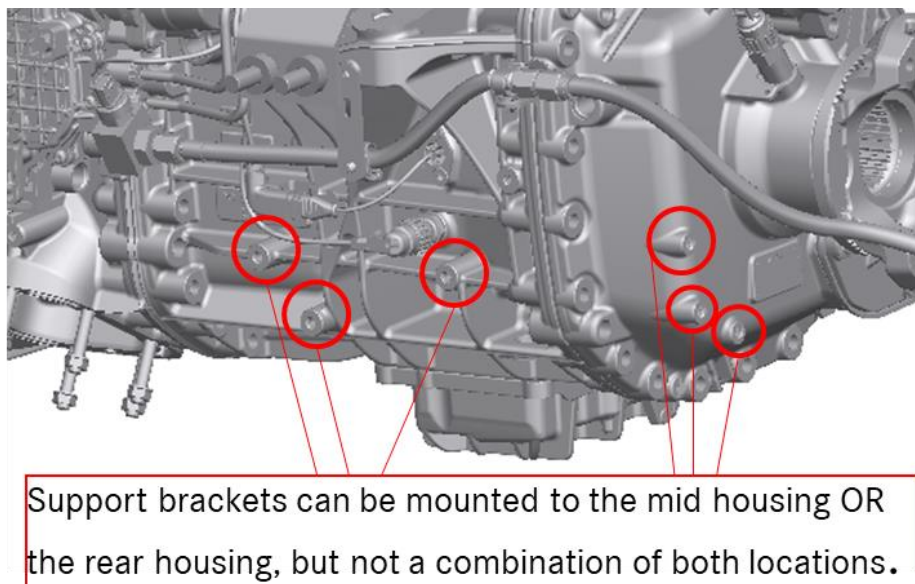


Figure 45: Bottom PTO support bracket mounting boss locations

The required size and thread pitch for the Bottom PTO support bracket bolts is M10 x 25. The thread depth in the hole in the block is 25mm, the drilled depth is 30mm. Use the M10 x 25 flange head bolt, part number N 910143 010009, with a support bracket thickness of up to 1/4" (6mm). If the support bracket is > 1/4" (6mm), use the M10 x 30 flange head bolt, part number N 910143 010012, instead. With either fastener, the recommended bolt torque is 58 Nm \pm 6 Nm (43 lb-ft \pm 4 lb-ft).

NOTE: All 3 bolt holes on either the mid or rear housing MUST be used to fasten the Bottom PTO Support Bracket to the transmission.

Below are the dimensions on the DT12 mid-housing if a support bracket is required. The available mounting hole locations are highlighted in red for clarity.

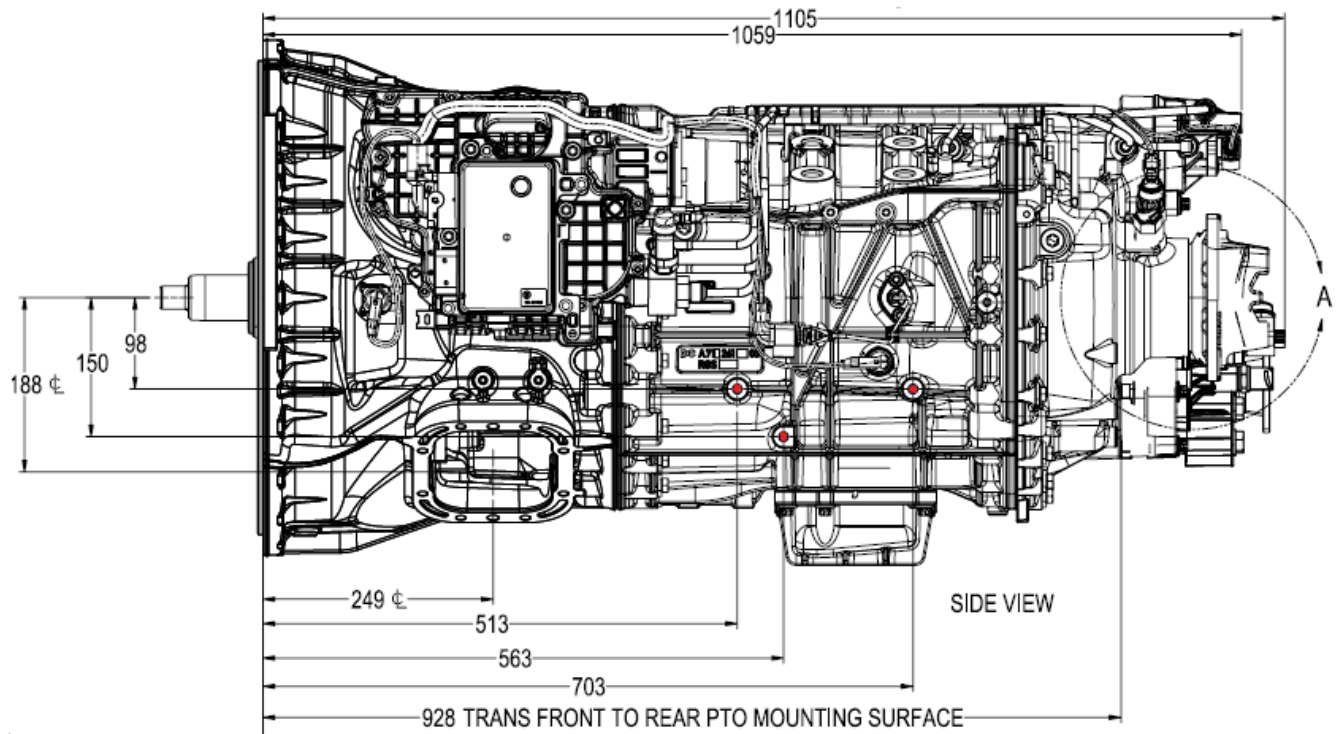


Figure 46: Mid-housing dimensions (in mm) for Bottom PTO Support Bracket

Below are the dimensions on the DT12 rear housing if a support bracket is required. The available mounting hole locations are highlighted in red for clarity

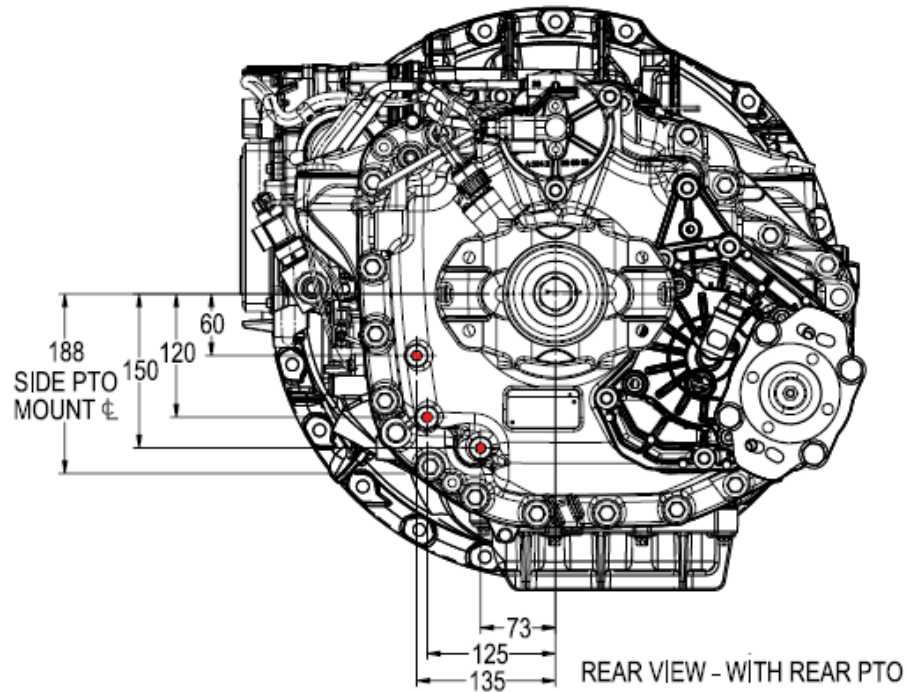


Figure 47: Rear-housing dimensions (in mm) for Bottom PTO Support Bracket

Here are examples of actual Bottom PTO support brackets:



Figure 48: Actual Bottom PTO support bracket, pic 1



Figure 49: Actual Bottom PTO support bracket, pic 2

The mating piece to the 90 degree connection off of the Bottom PTO pump shown in the above pictures must also be supported.

2.11 Resonance Frequencies & PTO Operation Speeds

Beside the torsional excitation of the system by engine combustion or driveshafts the resonance frequency of the system is also a major concern. To avoid critical operation conditions and/or damages of powertrain components the PTO operation rpm must stay away from natural frequencies. The recommended PTO Torque by engine speed is shown in the graph below.

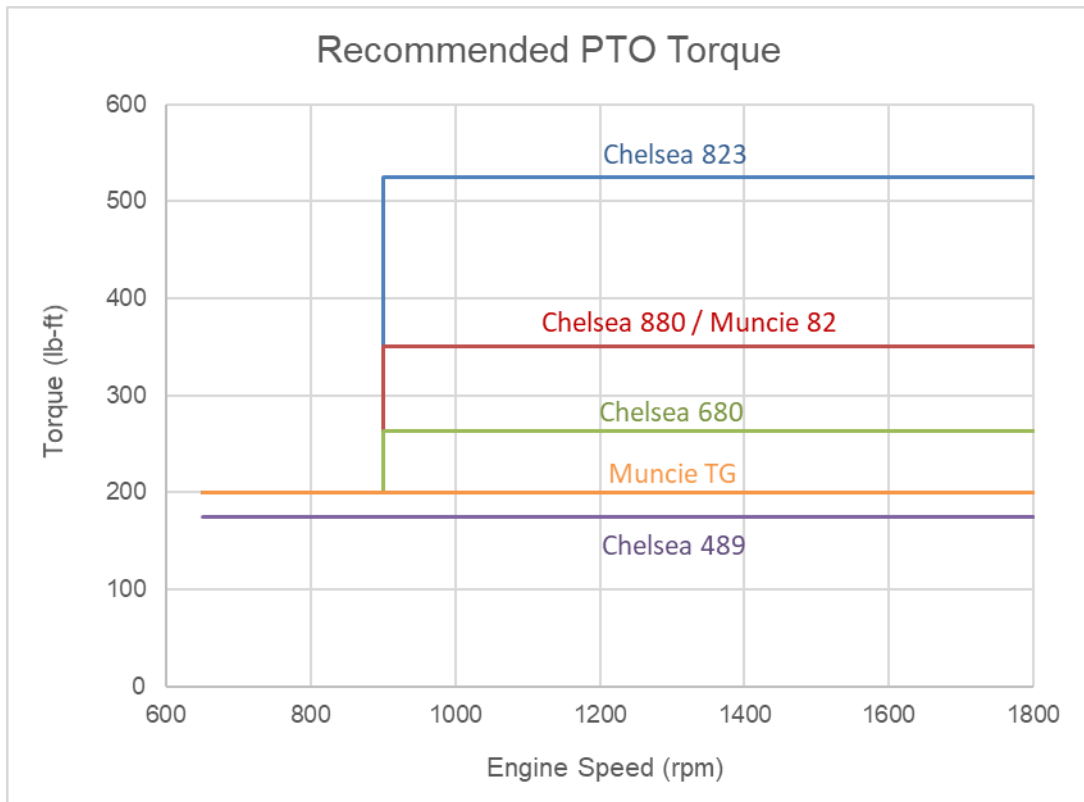


Figure 50: Recommended Bottom PTO Torque by engine speed and PTO type

To avoid uncomfortable resonances and noises in high torque applications, it is recommended to operate the PTO above 900 rpm engine speed.

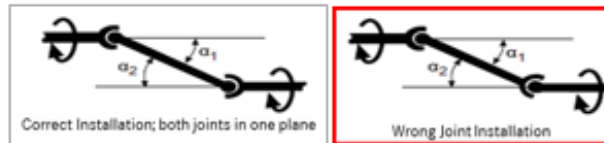
In addition to the maximum PTO output torque recommendations shown above, proper PTO setup must also keep PTO output speeds below maximum limit by the PTO Manufacturer.

**NOTES: Maximum output shaft speed for Chelsea Bottom PTO's is 2000rpm. (If higher rpms are needed, special approval is needed directly from Chelsea.)
Maximum output shaft speed for a Muncie Bottom PTO is 2500rpm.**

3. PTO DRIVESHAFT INSTALLATION

Maximum torque can only be applied if the operation is completely oscillation and shock free. To keep the excitation as low as possible, the following requirements must be met.

- Bending angles $\alpha_1 = \alpha_2 / \Delta\alpha \leq \pm 1^\circ$
- Both driveshaft joint in one plane



- Drive shaft installation; either Z - or W - pattern

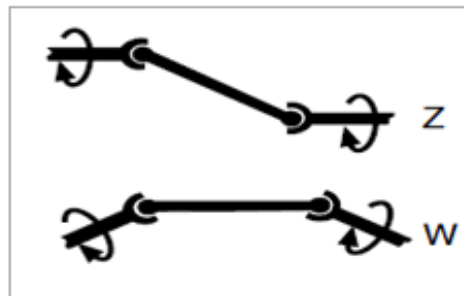


Figure 51: Driveshaft installation angle requirements

In the case of three dimensional driveshaft installation, when the lines of the input and output shafts are crossing each other with an offset (combined cases of Z = and W – pattern), the following conditions must be met to avoid additional excitation.

- Bending angles $\beta_1 = \beta_2 / \Delta\beta \leq \pm 1^\circ$
- The inner driveshaft joint forks have to be twisted until they in the planes A and B.

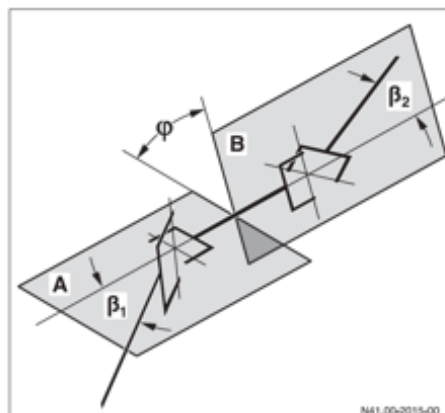


Figure 52: Driveshaft installation angle requirements when in 2 planes

In either of the above driveshaft angle configurations, if a driveshaft bend angle $> 6^\circ$ is not avoidable, follow the instructions below for large Joint Bend Angles.

3.1 Joint Bend Angles

In addition to the driveshaft installation pattern, the joint bend angle significantly effects the driveshaft acceleration and additional dynamic torque load. The minimum bend angle requirement is shown below.

A minimum bending angle of 1° is required.

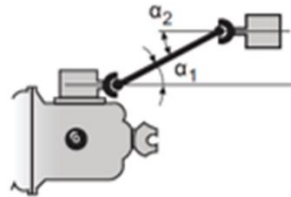


Figure 53: Minimum bend angle requirement

When bending angles $> 6^\circ$ the maximum PTO torque load must be reduced per the figure below.

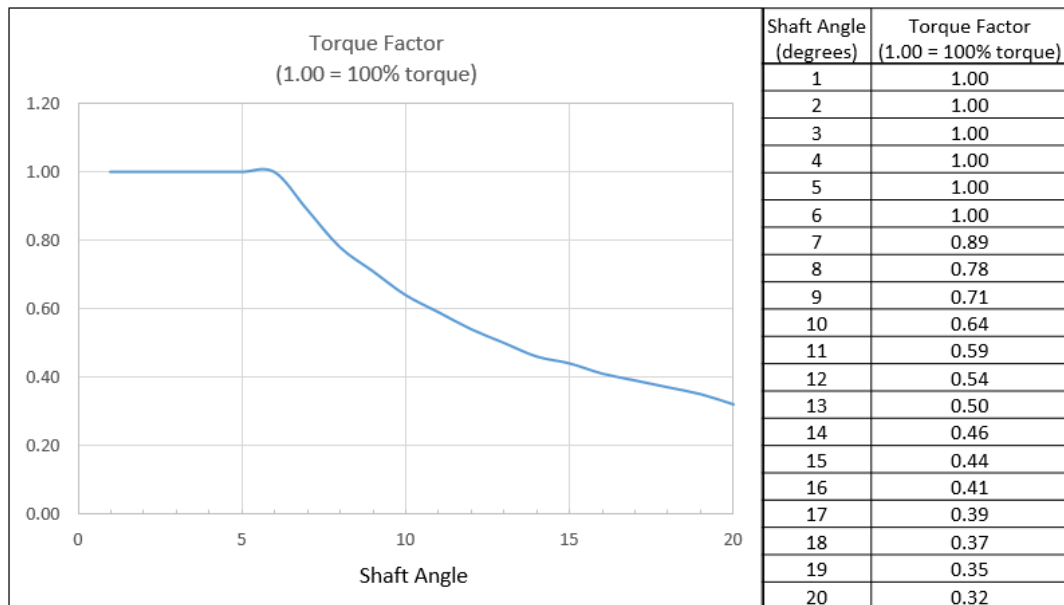


Figure 54: Torque Reduction when bend angles > 6 degrees.

4. SHOCK LOAD (DYNAMIC TORQUE)

Maximum torque can only be applied if the operation is completely oscillation and shock free. The dynamic torque or shock load varies by application, but the system has to be dimensioned and set-up to handle the highest combination of static plus dynamic torque.

The following overview is only an example, please verify the specifics of your application meet the appropriate dynamic factor.

The Operation Torque plus the shock overload **MUST** be less than the PTO torque limit.

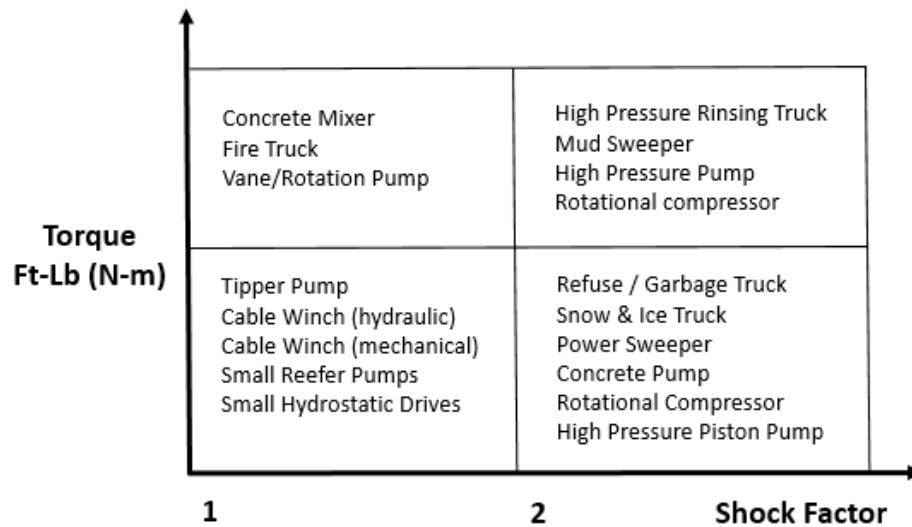


Figure 55: PTO Shock Load Factor

5. BOTTOM PTO RETROFIT CAPABILITY

Bottom PTO's can ONLY be added to the following vocational transmissions:

- DT12-DHE (DC)
- DT12-OHE (OC)
- DT12-OV (OC)
- DT12-OVX (OD)

NOTES: 1) The transmission should have a PTO Prep Kit, otherwise the cost and complexity will increase dramatically.
 2) Please consult 22CSA-09Rev from Powertrain Service Engineering for additional information on the resources available for adding a transmission PTO, what information is required when requesting a PTO Technical Modification or additional support for PTO integration support, and who should be contacted for additional support.

Engineering Change Log			
Technical Content / Publisher Owner	Rev. #	Rev. Date	Description of Revisions
C. Grissom	R01	12OCT16	Initial release.
C.Grissom	R02	27OCT16	Added notes to PTO configurations 1 & 2. Added Figure 5 showing option #2 installed in truck. Updated torque values on Spicer flange kit installation. Modified torque values to show English units first. Clarified verbiage for Table 1.
C.Grissom	R03	07DEC16	Updated footer and added note regarding CPC parameterization for each configuration offered.
C.Grissom	R04	19DEC16	Corrected PTO rotation direction on page 7.
C.Grissom	R05	23JAN17	Corrected PTO drive shaft angular requirement on page 6; clarified split low/high verbiage on page 9.
C.Grissom	R06	08APR17	Modified document name, revised Technical Information on page 7 including rotation direction, added Table 2 on page 9.
C.Grissom	R07	03MAY17	Updated/inserted/labeled Figure 9 on page 7.
C.Grissom	R08	19MAY17	Added note to page 7 regarding pump input direction
C.Grissom	R09	25OCT17	Updated Figures 9 & 10.
C.Grissom	R10	16APR18	Inserted 2 new PTO configurations (#3 & #4) and corresponding configuration information, then renumbered existing configurations to #5 & #6. Removed previous Table 1, inserted new Table 1, inserted and modified verbiage in PTO output speed calculation section.
C.Grissom / J.Adelsperger	R11	10JUL20	Added part numbers for the Rear PTO prep kits, clarified examples on how to calculate PTO speed after Table 2, added entire Side PTO section for new option on Transmission 2020 releases.
C.Grissom / J.Adelsperger	R12	31MAR21	Changed all Side PTO verbiage to Bottom PTO verbiage. Updated ratios in Table 2. Added Muncie Bottom PTO information.
C.Grissom / J.Adelsperger	R13	30SEP21	Updated model charts for Chelsea Bottom PTO's (Figures 11-22).Updated Figure 44.
K.Rudd / C.Grissom	R14	31DEC22	Re-wrote Rear PTO Configuration section while adding new 1:1.83 ratio info; added Tables 1 & 4 showing available launch gears for rear & bottom PTO's; added 1:1.83 ratio rpm info to Installation Requirements; added 1:1.83 Rear PTO ratio info to Table 3; added Table of Contents; modified Chelsea Bottom PTO install & gear lash procedures; added Friction Clutch Bottom PTO section.
K.Rudd / C.Grissom	R15	31JAN23	Updated Rear PTO Ratios for DT12-DHE/DV (DC) in Table 3.
K.Rudd / C.Grissom	R16	APR24	Added info to Rear PTO 1:1.83 configuration on pages 4-5; Corrected PTO Drive Assembly part numbers & added note on shim kit on page 7; added Table 1 of Approved Rear PTO's and re-numbered all subsequent tables; added new 1:1.83 Rear PTO Max Torque value in Section 1.4; revised nomenclature throughout to show DTNA first, then DETROIT; updated Max Rear PTO output torque on page 10; revised verbiage on max weight allowed before a support bracket is required and note on availability of support bracket on page 38 in Bottom Mounted PTO Support Requirements section.
K.Rudd / C.Grissom	R17	JUN24	Updated Table 4 for 1:1.83 ratio speeds; added verbiage for Rear/Bottom PTO retrofit capability; added oil fill verbiage to Muncie Bottom PTO assembly procedures.

Engineering Change Log

Technical Content / Publisher Owner	Rev. #	Rev. Date	Description of Revisions
K.Rudd / C.Grissom	R18	31JUL24	Updated DT12 PTO drive assembly part numbers on page 7 and Spicer flange kit part numbers on page 8.