

# Chapter 11

## POWER TAKE OFF (P.T.O.)

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1. TRANSMISSION P.T.O.
2. SPLIT SHAFT P.T.O.
3. TRANSMISSION MODEL OPTIONS
4. OTHER NOTICES
5. MOUNTING POSITION OF TRANSMISSION P.T.O. ASSY
6. ENGINE REV. CONTROL FOR MOUNTING OF BODY OR EQUIPMENT
7. SIGNAL FOR ALLISON TRANSMISSION

## 1. TRANSMISSION P.T.O.

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When Power Take Off (PTO) mounting is necessary contact a Hino authorized dealer or authorized transmission sales and service center.

## 2. SPLIT SHAFT P.T.O.

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Be sure to observe the following precautions to prevent malfunction of vehicle control system when installing split shaft P. T. O..

### **Precaution for Installing or Modifying Split Shaft P.T.O.**

Do not modify parking brake or parking brake warning buzzer. If modified park brake and warning buzzer may not operate correctly.

Do not modify vehicle to operate PTO while moving.

Should connect the P.T.O. switch circuit to the common rail ECU circuit for diagnosis of P.T.O. operating condition.

Refer to "COMMON RAIL CIRCUIT" in Chapter 7 and "CONNECTORS" in Chapter 12 for the connection destination and used connector of P.T.O. switch 1.

The vehicle system will not operate properly because the vehicle speed sensor is judged to be faulty if the operating condition of the P.T.O. cannot be confirmed.

Customizing common rail ECU is required when installing Split Shaft P.T.O., please consult HMC for the detail.

### 3. TRANSMISSION MODEL OPTIONS

MODEL			NEC1	NFC1	NJC1	NVC1	NHC1
TRANSMISSION	AUTO	STD	Allison 2200HS (B6.7:240HP)  Allison 2500RDS (B6.7:260HP)	Allison 2500RDS (B6.7:260HP)	Allison 2200HS (B6.7:240HP)  Allison 2500RDS (B6.7:260HP)	Allison 3000RDS	Allison 3000RDS
		OPT	Allison 2200HS (B6.7:260HP)  Allison 2200RDS  Allison 2500RDS (B6.7:240HP)  Allison 2500HS  Allison 3000RDS (B6.7:260HP)	Allison 2500HS	Allison 2200HS (B6.7:260HP)  Allison 2200RDS  Allison 2500RDS (B6.7:240HP)  Allison 2500HS  Allison 3000RDS (B6.7:260HP)	Allison 2500RDS  Allison 3500RDS  Allison 2500HS  Allison 3000HS	Allison 3500RDS  Allison 3000HS

### 4. OTHER NOTICES

If a P.T.O. is installed make sure it works properly and meets the respective manufacturers guidelines for application, installation, and operation.

NOTE : 2200HS, 2500HS and 3000HS do not have P.T.O. gear.

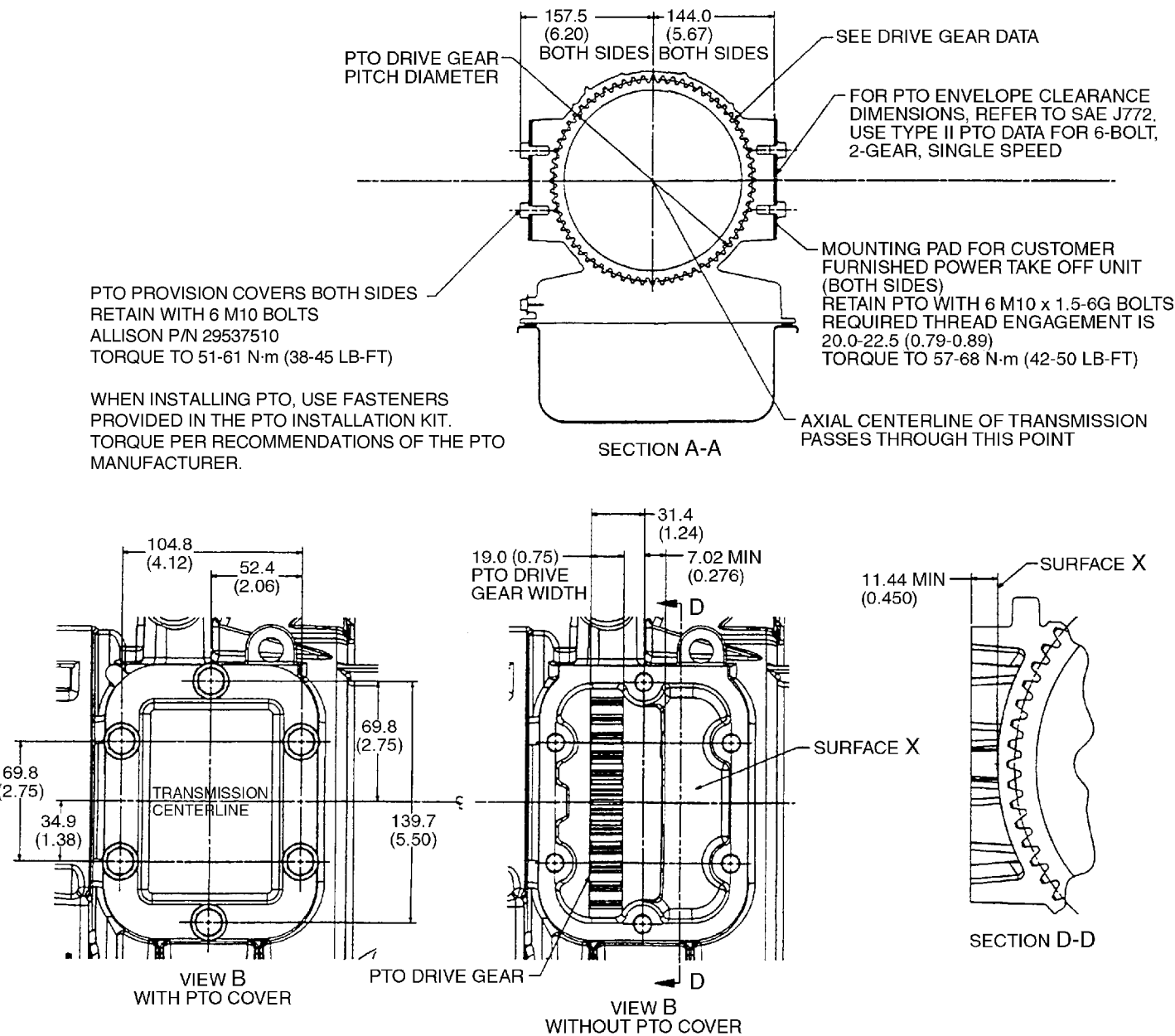
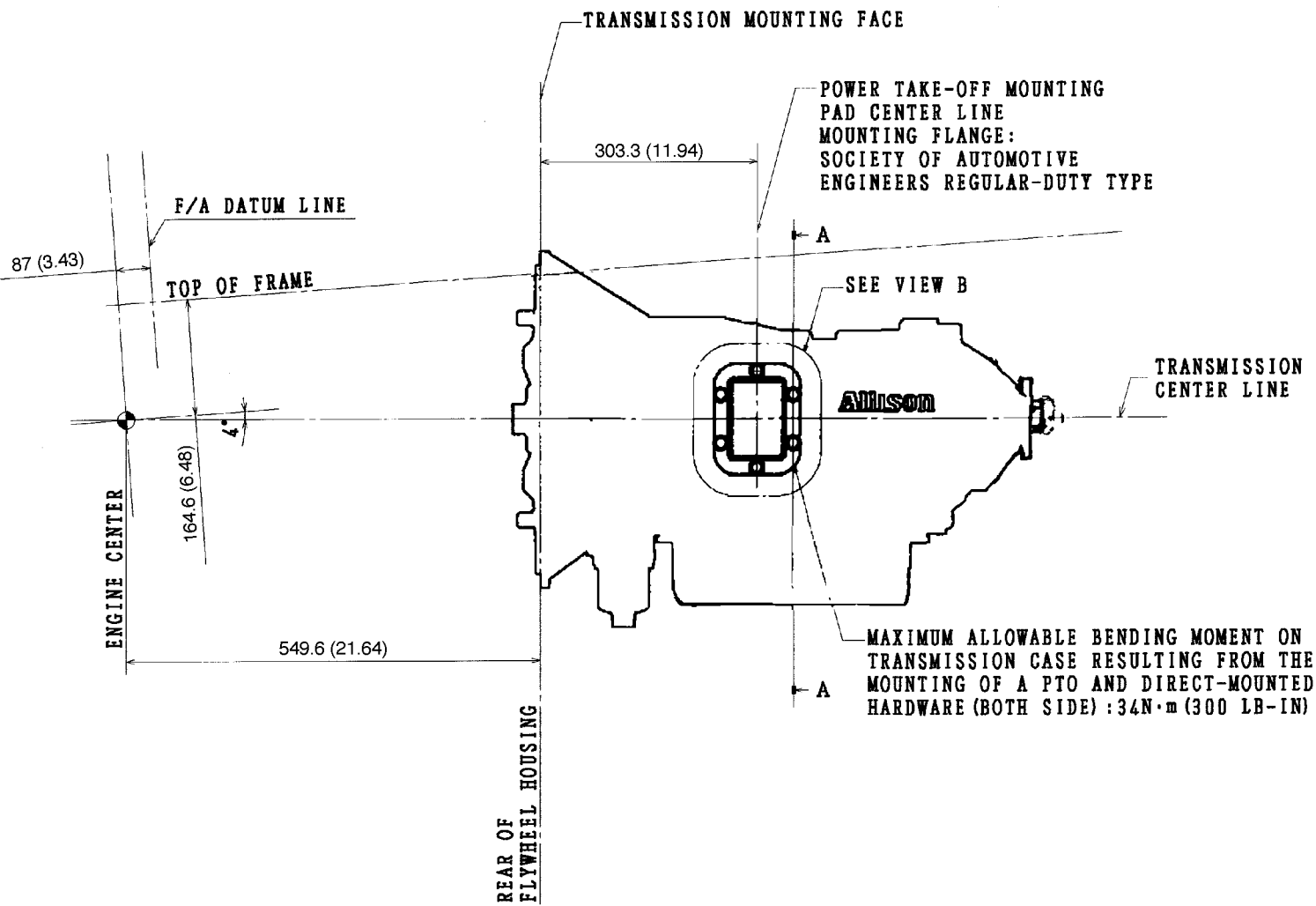
For installing P.T.O. , please contact HMC.

5. MOUNTING POSITION OF TRANSMISSION P.T.O. ASSY

• TRANSMISSION MODEL : ALLISON 2200RDS

Allison 2200RDS The lockup point for PTO operation is turbine speed Min. 900.

Unit : mm (in.)



• POWER TAKE OFF DRIVE GEAR RATINGS

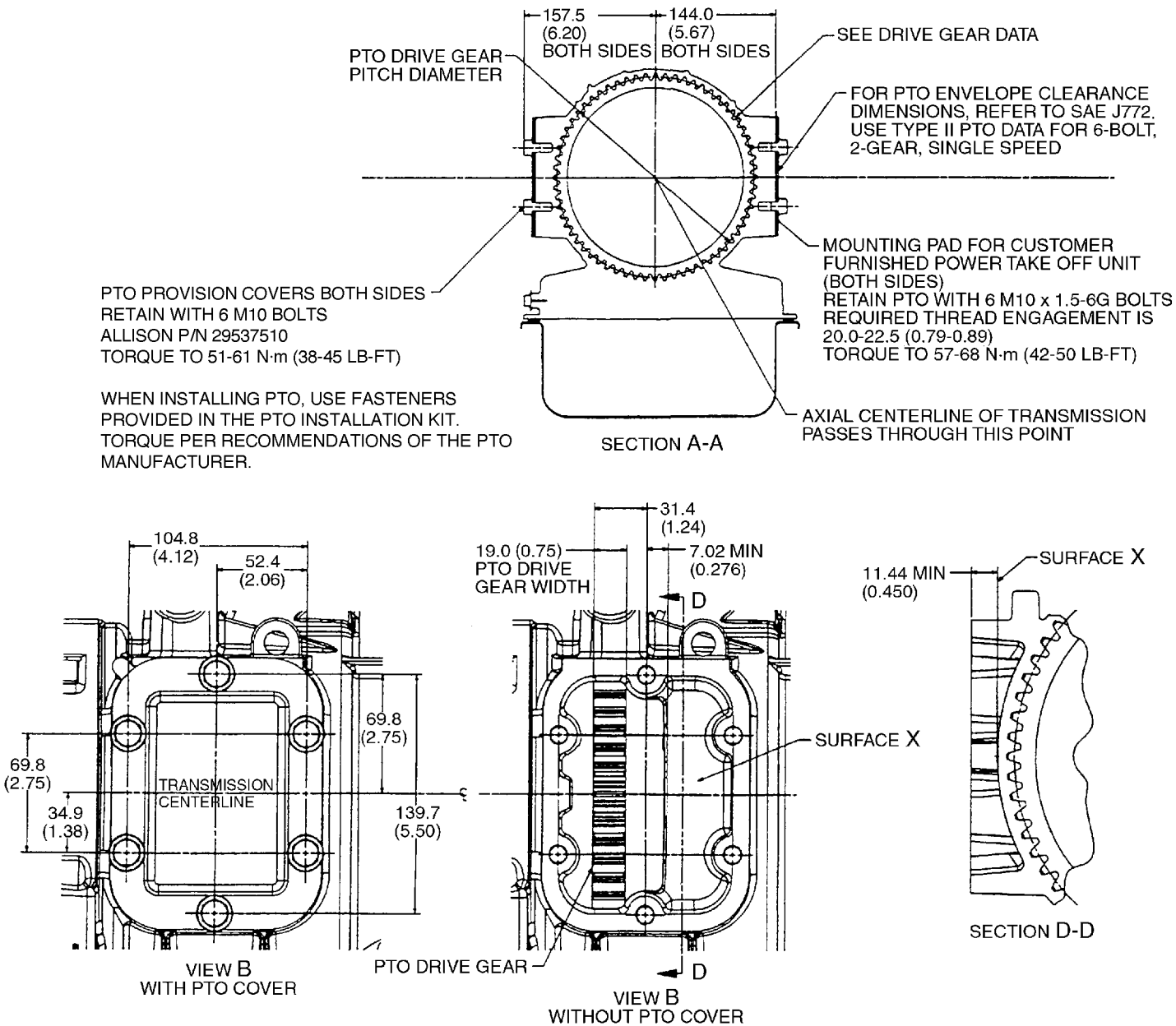
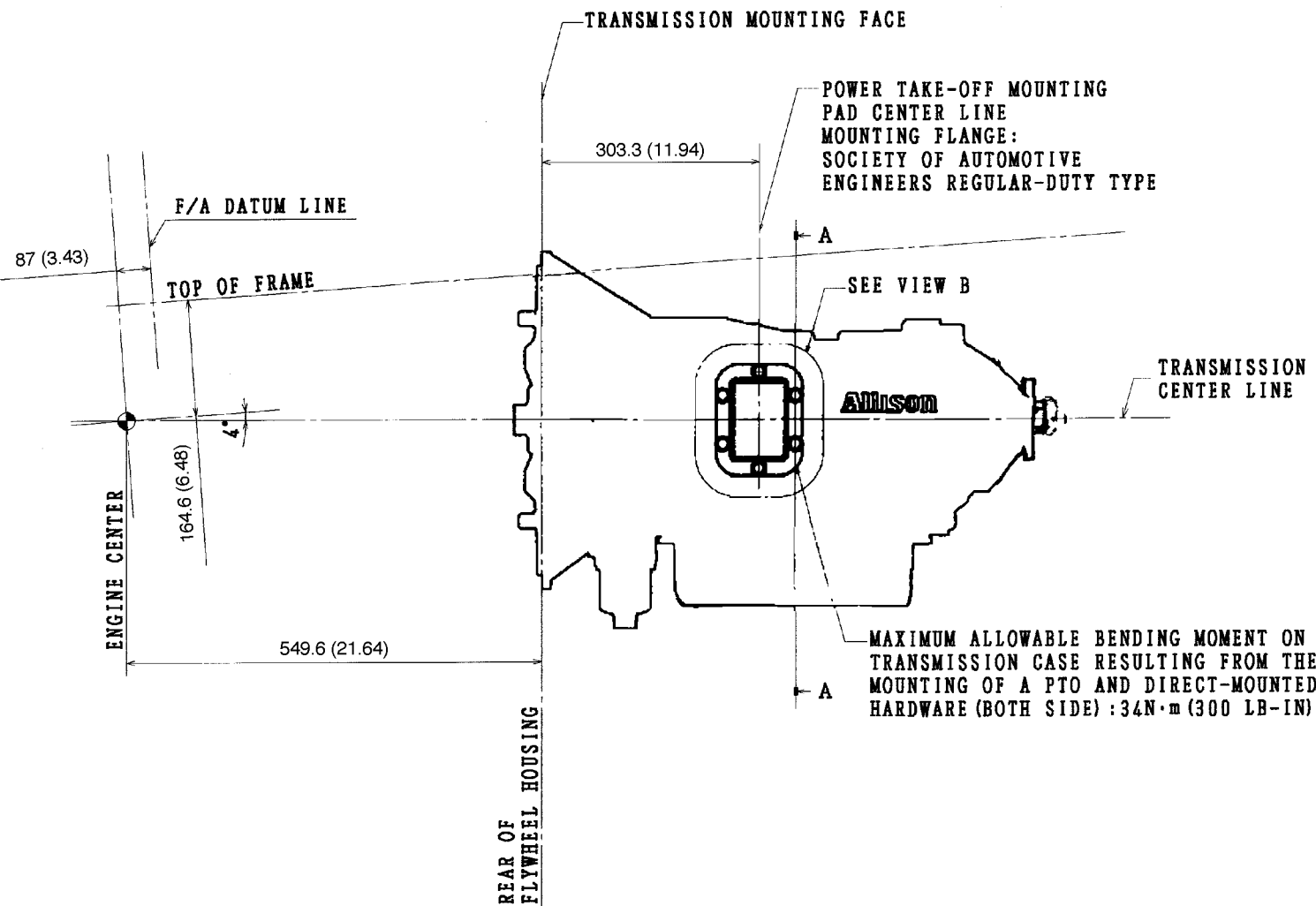
TRANSMISSION CONFIGURATION	VALUE	UNIT
With P.T.O. on One Pad (Continuous)	339 (250)	N·m (pound-foot)
With a P.T.O. on Both Pads Simultaneously – Each, Continuous	271 (200)	N·m (pound-foot)

DRIVE GEAR DATA DIMENSIONS IN INCHES		DRIVE GEAR SPEED	
TEETH 64		NEUTRAL = TURBINE SHAFT SPEED (SPEED VARIES WITH P.T.O. LOAD. SEE INSTALLATION MANUAL FOR COMPLETE SPEED RELATIONSHIP)	
PITCH 6.865		2200 SERIES	
PRESSURE ANGLE 20°		1st GEAR	3.10 x OUTPUT SHAFT SPEED
NORMAL MODULE 3.7		2nd GEAR	1.81 x OUTPUT SHAFT SPEED
PITCH DIAMETER 9.32283		3rd GEAR	1.41 x OUTPUT SHAFT SPEED
0.006-0.029 NORMAL OPERATING BACKLASH AFTER P.T.O. IS INSTALLED		4th GEAR	1.00 x OUTPUT SHAFT SPEED
		5th GEAR	0.71 x OUTPUT SHAFT SPEED
		6th GEAR	0.61 x OUTPUT SHAFT SPEED
		REVERSE GEAR	4.49 x OUTPUT SHAFT SPEED

• TRANSMISSION MODEL : ALLISON 2500RDS

Allison 2500RDS The lockup point for PTO operation is turbine speed Min. 900.

Unit : mm (in.)

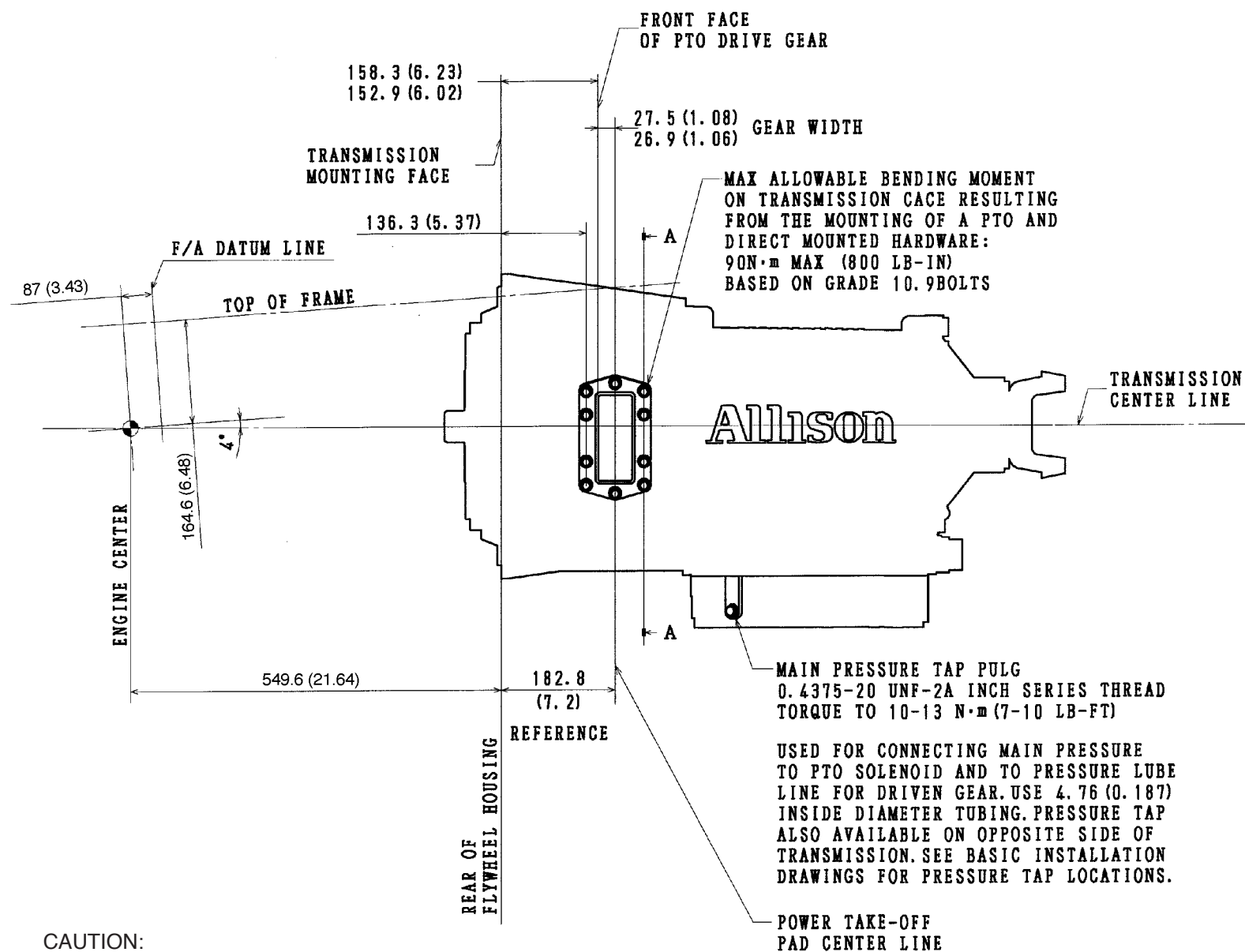


• POWER TAKE OFF DRIVE GEAR RATINGS

TRANSMISSION CONFIGURATION	VALUE	UNIT
With P.T.O. on One Pad (Continuous)	339 (250)	N·m (pound-foot)
With a P.T.O. on Both Pads Simultaneously – Each, Continuous	271 (200)	N·m (pound-foot)

DRIVE GEAR DATA DIMENSIONS IN INCHES		DRIVE GEAR SPEED	
TEETH 64		NEUTRAL = TURBINE SHAFT SPEED (SPEED VARIES WITH P.T.O. LOAD. SEE INSTALLATION MANUAL FOR COMPLETE SPEED RELATIONSHIP)	
PITCH 6.865		2500 SERIES	
PRESSURE ANGLE 20°		1st GEAR	3.51 x OUTPUT SHAFT SPEED
NORMAL MODULE 3.7		2nd GEAR	1.90 x OUTPUT SHAFT SPEED
PITCH DIAMETER 9.32283		3rd GEAR	1.44 x OUTPUT SHAFT SPEED
0.006-0.029 NORMAL OPERATING BACKLASH AFTER P.T.O. IS INSTALLED		4th GEAR	1.00 x OUTPUT SHAFT SPEED
		5th GEAR	0.74 x OUTPUT SHAFT SPEED
		6th GEAR	0.64 x OUTPUT SHAFT SPEED
		REVERSE GEAR	5.09 x OUTPUT SHAFT SPEED

• TRANSMISSION MODEL : ALLISON 3000RDS AND 3500RDS



CAUTION:

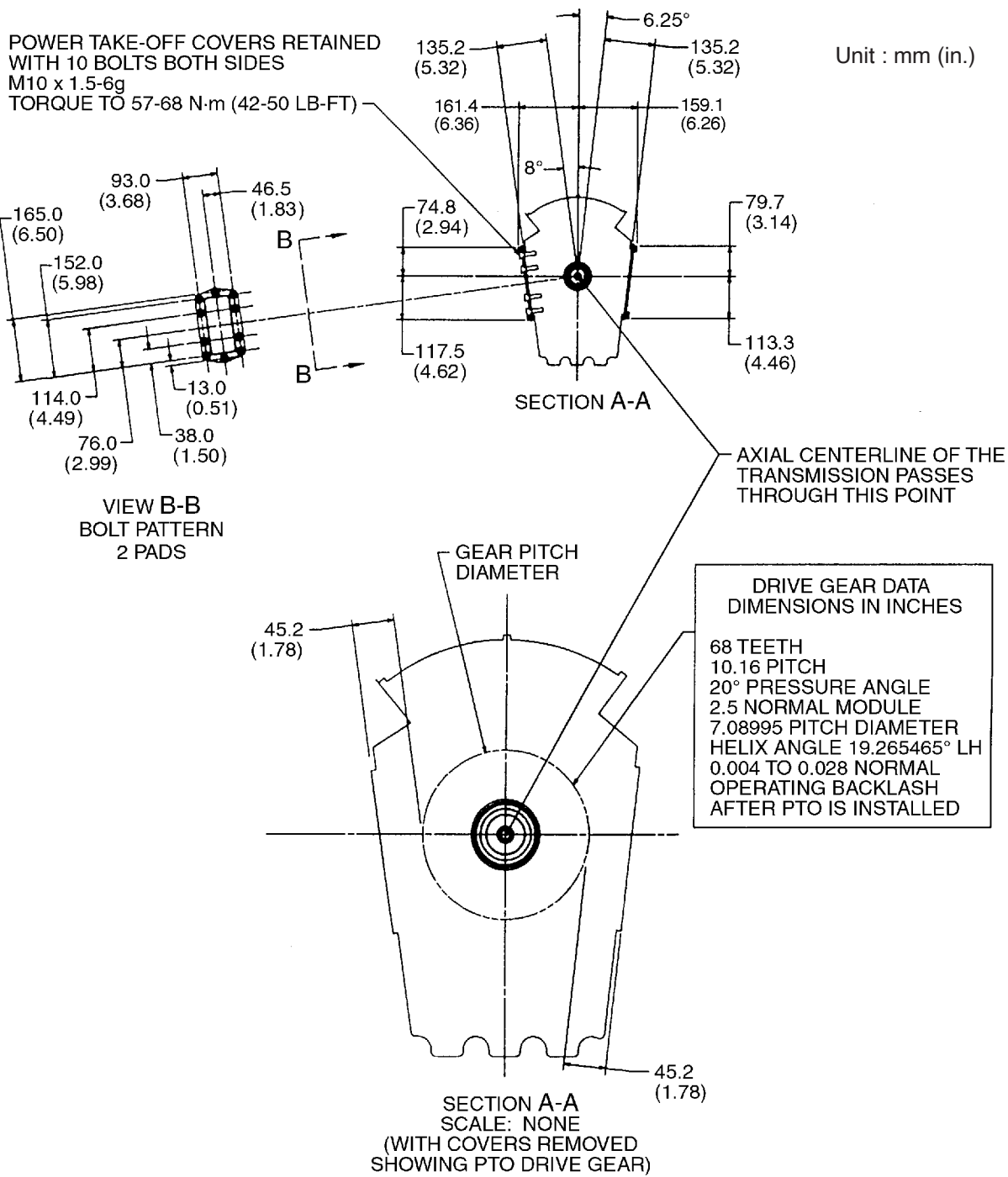
Torques shown for customer-furnished fasteners and threaded components are for plain (non-plated) threads. Torque requirements should be reviewed if plated items will be used. Consult the supplier.

P.T.O. output speed (rpm):

Engine speed x  $\frac{\text{Drive gear}}{\text{Driven gear}} \times \frac{\text{P.T.O. input gear}}{\text{P.T.O. output gear}}$

• POWER TAKE OFF DRIVE GEAR RATINGS

TRANSMISSION CONFIGURATION	VALUE	UNIT
Drive Gear Torque (Continuous Operation)		
With P.T.O. on One Side	660 (485) Max.	N·m (pound-foot)
With P.T.O. on Both Sides	930 (685) Max.	N·m (pound-foot)



## 6. ENGINE REV. CONTROL FOR MOUNTING OF BODY OR EQUIPMENT

### Overview

The PTO feature, which includes Cab PTO, Remote PTO, maintains engine speed at an operator-selectable speed.

An engine controlled by the PTO feature is typically used to drive an on-board or off-board PTO device. The PTO feature can be split into two types; cab PTO and remote PTO.

### Operation (Cab PTO) (Please refer to the Cummins manual for details.)

#### Activation Conditions

The Cab PTO feature will not activate when any of the following conditions are true:

- The ECM has an active vehicle speed sensor fault (unless the Ignore Vehicle Speed Source in PTO parameter is enabled).
- The vehicle speed is above the PTO Maximum Vehicle Speed parameter.
- The clutch pedal is pressed (unless the PTO Clutch Override parameter is disabled).
- The service brake pedal is pressed (unless the PTO Service Brake Override parameter is disabled).
- The parking brake is not set (unless the Parking Brake Interlock parameter is set to Remote Only or None).
- The transmission is not in neutral (unless the Transmission Interlock Function parameter is disabled).

#### Deactivation

The user may manually deactivate the PTO feature by placing the CC/PTO On/Off switch to OFF.

This will typically return engine fueling control to the idle governor.

Deactivation will automatically occur when any of the following conditions are true:

- The ECM has an active vehicle speed sensor fault (unless the Ignore Vehicle Speed Source in PTO parameter is enabled).
- The vehicle speed is above the PTO Maximum Vehicle Speed parameter (unless the IgnoreVehicle Speed Source in PTO parameter is enabled).
- The clutch pedal is pressed (unless the PTO Clutch Override parameter is disabled).
- The service brake pedal is pressed (unless the PTO Service Brake Override parameter is disabled).
- The parking brake is not set (unless the Parking Brake Interlock parameter is disabled).
- The transmission is not in neutral (unless the Transmission Interlock Function parameter is disabled).

### Remote PTO (Please refer to the Cummins manual for details.)

#### Activation Conditions

The Remote PTO feature will not activate when any of the following conditions are true:

- The ECM has an active vehicle speed sensor fault (unless the Ignore Vehicle Speed Source in PTO parameter is enabled).
- The vehicle speed is above the PTO Maximum Vehicle Speed parameter.
- The parking brake is not set (unless the Parking Brake Interlock parameter is set to Cab Only or None).
- The transmission is not in neutral (unless the Transmission Interlock Function parameter is disabled).

#### Deactivation

The operator may deactivate the Remote PTO feature using the Remote PTO switch. This will typically return engine control to the idle governor.

Deactivation will automatically occur when any of the following conditions are true:

- The ECM has an active vehicle speed sensor fault (unless the Ignore Vehicle Speed Source in PTO parameter is enabled).
- The vehicle speed is above the PTO Maximum Vehicle Speed parameter (unless the Ignore Vehicle Speed Source in PTO parameter is enabled).
- The parking brake is not set (unless the Parking Brake Interlock parameter is disabled).
- The transmission is not in neutral (unless the Transmission Interlock Function parameter is disabled).



## (REMOTE ACCELERATOR OPTION)

Engine is controlled by engine control unit (ECU). Please follow the procedure below when utilizing the remote accelerator option.

The engine accelerator unit, related parts and extension wire are available from Hino authorized dealer.

Connect the connector of Engine accelerator unit with spare connector which is provided inside of right member near No.3 crossmember at chassis frame.

(Refer to chapter 7 "ELECTRICAL POWER SOURCES" for details of specifications and installed position.)

### Detail of related parts

PART NAME	PART NUMBER
Link Assy., Accelerator	78100-E0040
Lever assy., control	78130-E0010
Harness sub assy., extend	S8207-11470

### Range of control

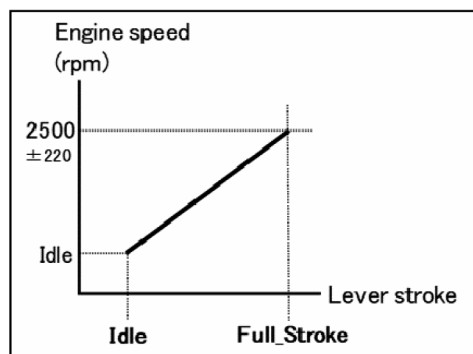
Refer to chart below showing PTO RPM range.

### Condition of operation

- Vehicle speed must be less than 20km/h (32mile/h).
- Transmission must be in neutral position.
- Engine speed must be reduced to idle.
- Engine accelerator unit must be idle position.
- P.T.O. engagement signal must be connected to Engine Control ECU.

Engine speed can be controlled when conditions above are met.

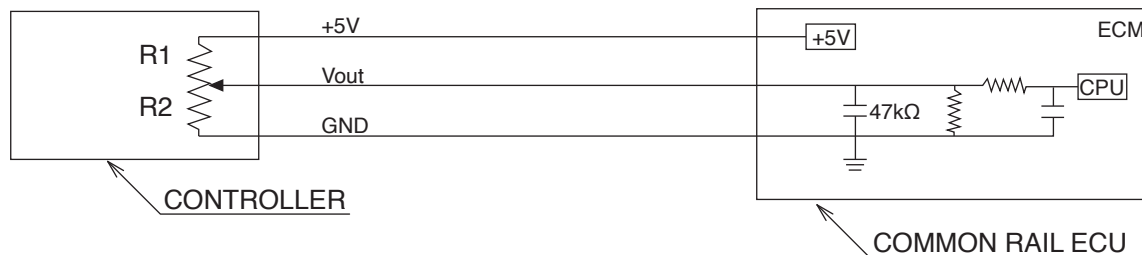
If conditions above are not met engine speed can only be controlled by accelerator pedal.





## SPECIFICATION OF THE ENGINE SPEED CONTROLLER

(MADE/PROCURED BY BODYBUILDER)



### calculation ;

$$V_{out} = 5 \times R / (R1 + R)$$

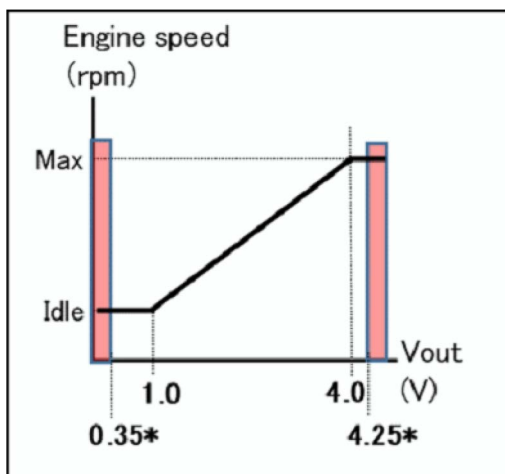
$$1/R = (1/R2) + (1/47) \text{ [k}\Omega\text{]}$$

$$\text{Note ; } R1 + R2 = 2 \text{ k}\Omega$$

R1(Ω)	R2(Ω)	Vout(V)
1650	350	0.87
1600	400	0.99
1500	500	1.24
1400	600	1.49
1300	700	1.73
1200	800	1.98
1100	900	2.23
1000	1000	2.47
900	1100	2.72
800	1200	2.97
700	1300	3.22
600	1400	3.47
500	1500	3.72
400	1600	3.97
350	1650	4.10

\*note: Vout < 0.35V / Vout > 4.25V is prohibited that cause undervoltage / overvoltage diagnosis detection.

### • The graph in relation with ENGINE SPEED and Vout (for reference)

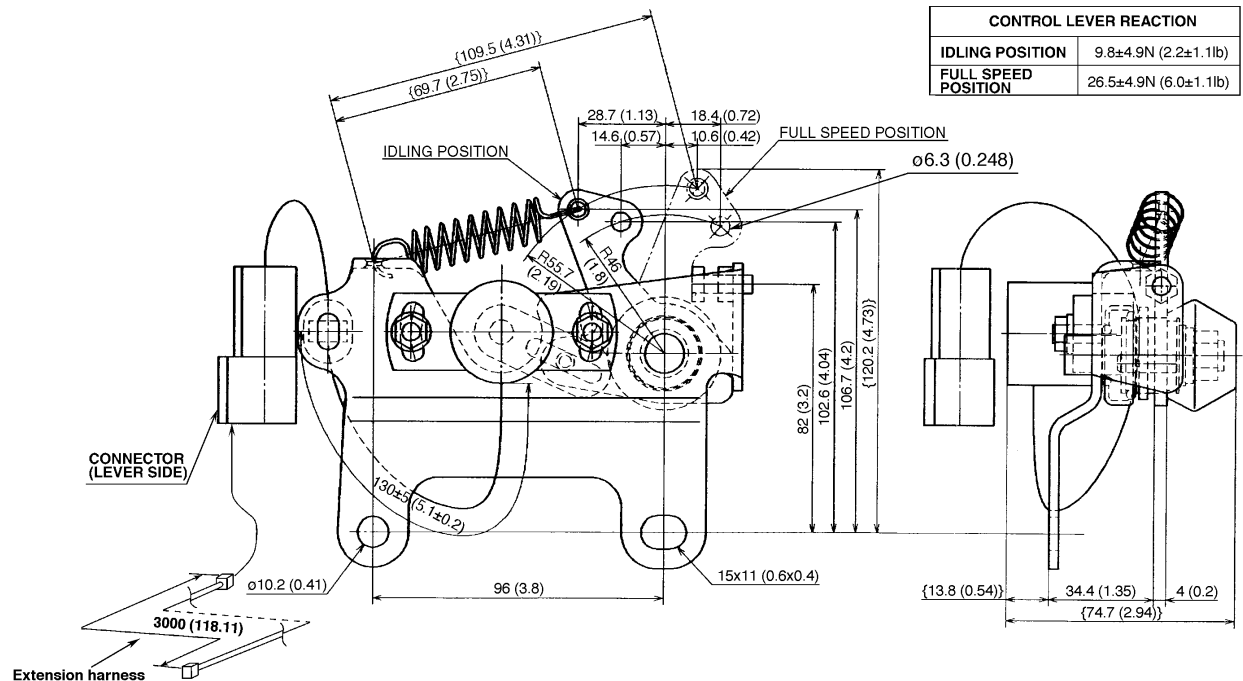


\*note: Vout < 0.35V / Vout > 4.25V is prohibited that cause undervoltage / overvoltage diagnosis detection.

## How to Install the Engine Accelerator

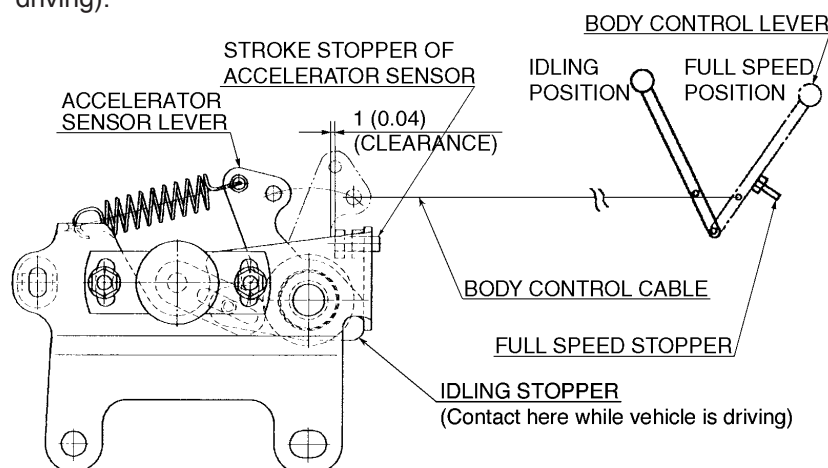
### Outline figure of Engine Accelerator

Unit : mm (in.)



## How to install

- Ensure that the body control lever is equipped with a full speed stopper, in order to control the stroke of the sensor lever.
- Adjust the body control lever so that the full speed stopper makes contact earlier than the stroke stopper of accelerator sensor.
- Ensure that the accelerator sensor lever will be in contact with the idling stopper by adjusting the speed control lever when the P.T.O. or equipment is not operating (during normal driving).

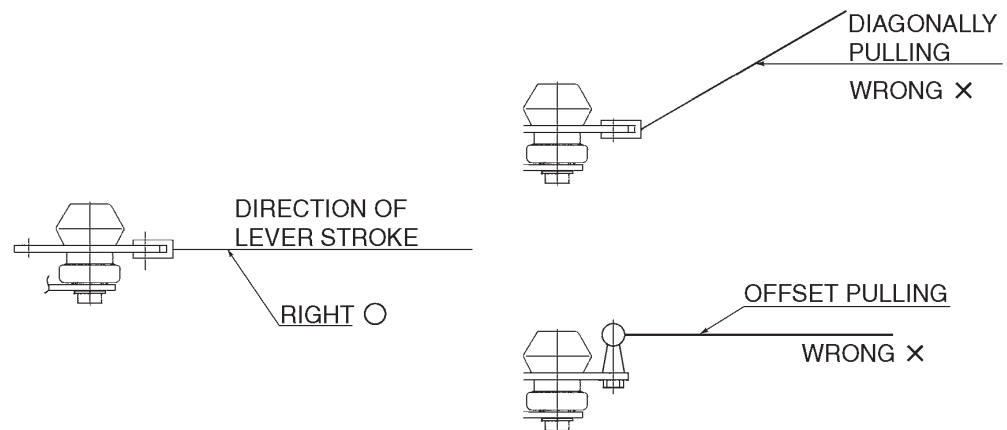


[NOTE]

The clearance specified for the accelerator sensor stroke stopper is for reference only. If the sensor side stopper comes into contact earlier, stresses will be imposed upon the sensor shaft and may result in damage to the parts.

Also, if the sensor lever does not come into contact with the idling stopper, it may result in improper engine operation during normal driving conditions.

- When installing the cable on the accelerator sensor lever, ensure that the cable pulls in a parallel direction to the lever stroke so that an imbalanced load is not applied to the sensor shaft. See the following figure.



### Cautions when installing the engine accelerator sensor

- Do not attempt to disassemble the sensor.
- Do not drop or otherwise shock the sensor, as this will lead to malfunction.
- Prevent water intrusion or direct splash.
- The sensor operating range is  $-30^{\circ}\text{C}$  to  $80^{\circ}\text{C}$  ( $-22^{\circ}\text{F}$  to  $176^{\circ}\text{F}$ ) and should only be used in that range.
- Avoid mounting the sensor in an area that may receive casual impacts.
- The sensor must be located in an area free of oil, dust, humidity, chemicals and vibration.
- If a well protected location is not available, then a cover must be installed.
- Install the wiring harness so that it is secure and not able to twist or bend.
- Refer to the Chapter 7 for instructions regarding installation of the harness.
- If the sub-harness is not long enough, extending the harness must be completed using the same type of wire.

## 7. SIGNAL FOR ALLISON TRANSMISSION

A connector for P.T.O. control is provided.

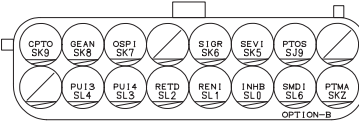
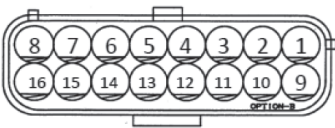
Should connect the connector for P.T.O. information to transmission control ECU when installing P.T.O. to Allison transmission.

For control system data and other technical data related P.T.O. installation, contact Allison Transmission distributors or dealers.

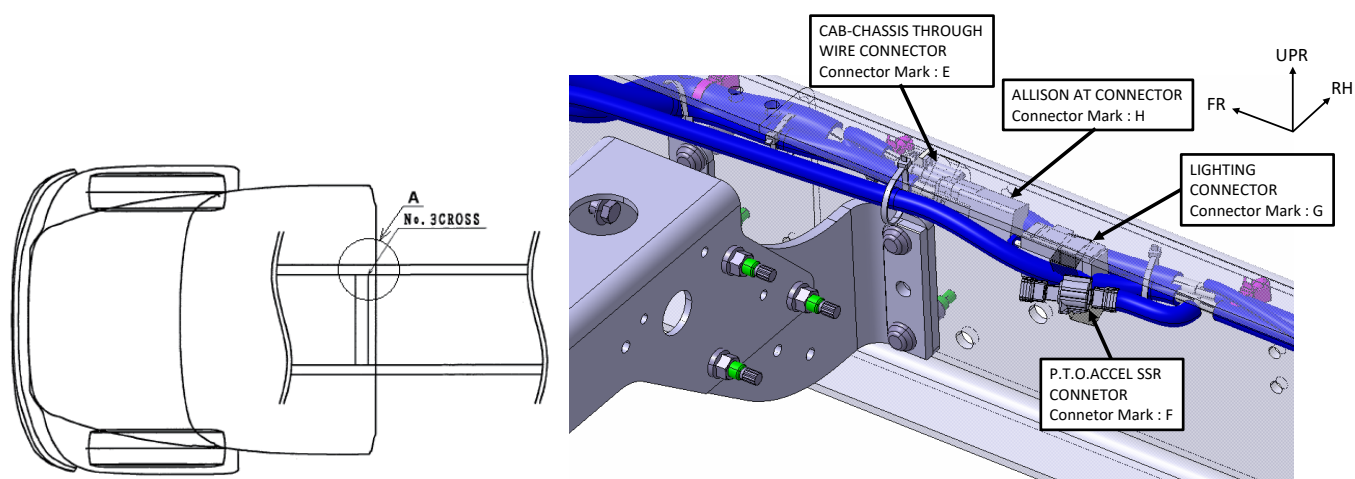
### Detail of Allison Transmission connector as shown in the table

Connector Mark	Pole Code	Circuit	Max Capacity [A]	Wire Size & Color	Connector Part No.	Coupling Connector Part No.	Allison transmission		Description	
							2200/2500	3000	Circuit name	Wire code
H	SK9	P.T.O DRIVE INPUT	—	0.85 L-B	Delphi PART No.54241631 (HINO PART No.S8281-E0M20)	Delphi PART No.54241601 (HINO PART No.S8281-E0M30)	○	○	P.T.O DRIVE INTERFACE 1 SYNCHRONIZED PTO DRIVE INTERFACE FOR MECHANICAL SHIFT PTO FULL ELECTRIC	143
	SK8	RANGE INDICATOR	—	0.85 B-R			○	○	AUTOMATIC NEUTRAL – SINGLE INPUT FOR P.T.O (OUTPUT)	145
	SK7	OUTPUT SPEED INDICATOR	—	0.85 B-G			○	○	OUTPUT SPEED INDICATOR A SYNCHRONIZED PTO DRIVE INTERFACE FOR MECHANICAL SHIFT PTO FULL ELECTRIC	105
	SK6	SIGNAL RETURN	—	0.85 B-Y			○	○		103
	SK5	SECONDARY MODE INDICATOR	—	0.85 G-R			—	○	TRANSMISSION SERVICE INDICATOR	113
	SJ9	P.T.O DRIVE INTERFACE 1 INDICATOR	—	0.85 P-			○	—	P.T.O DRIVE INTERFACE 1 SYNCHRONIZED PTO DRIVE INTERFACE FOR MECHANICAL SHIFT PTO FULL ELECTRIC	150
	SL4	DIRECTION CHANGE ENABLE INPUT	—	0.85 R-G			○	○	DIRECTION CHANGE ENABLE INPUT SYNCHRONIZED PTO DRIVE INTERFACE FOR MECHANICAL SHIFT PTO FULL ELECTRIC	122
	SL3	NEUTRAL AT STOP	—	0.85 R-L			○	○	P.T.O DRIVE INTERFACE 1 NEUTRAL AT STOP INPUT – STANDARD OR PREMIUM ①INTEGRATED WITH BRAKE SYSTEM COMPONENTS P.T.O DRIVE INTERFACE 1 ②INTEGRATED WITH PROGRAMMABLE LOGIC CONTROLLER(PLC)	123
	SL2	SUMP TEMPERATURE	—	0.85 V-			○	○	SUMP/RETARDER TEMPERATURE INDICATOR	164
	SL1	AUTO Matic NEUTRAL	—	0.85 BR-			—	○	AUTO Matic NEUTRAL – SINGLE INPUT FOR P.T.O (INPUT)	117
	SL0	RANGE INHIBIT INPUT	—	0.85 L-R			○	○	AUXILIARY FUNCTION RANGE INHIBIT – SINGLE INPUT	101
	SL6	HOLD INPUT	—	0.85 L-			—	○	P.T.O DRIVE INTERFACE 1 AUXILIARY HOLD INPUT	142
	SKZ	P.T.O DRIVE OUTPUT	—	0.85 B-R			—	○	P.T.O DRIVE INTERFACE 1 SYNCHRONIZED PTO DRIVE INTERFACE FOR MECHANICAL SHIFT PTO FULL ELECTRIC	130

## Detail of connector

MARK	CONNECTOR	
	VEHICLE SIDE	COMPANION SIDE
H		
	Delphi PART No. 54241631 (HINO PART No.S8281 - E0M20)	Delphi PART No. 54241601 (HINO PART No.S8281 - E0M30)

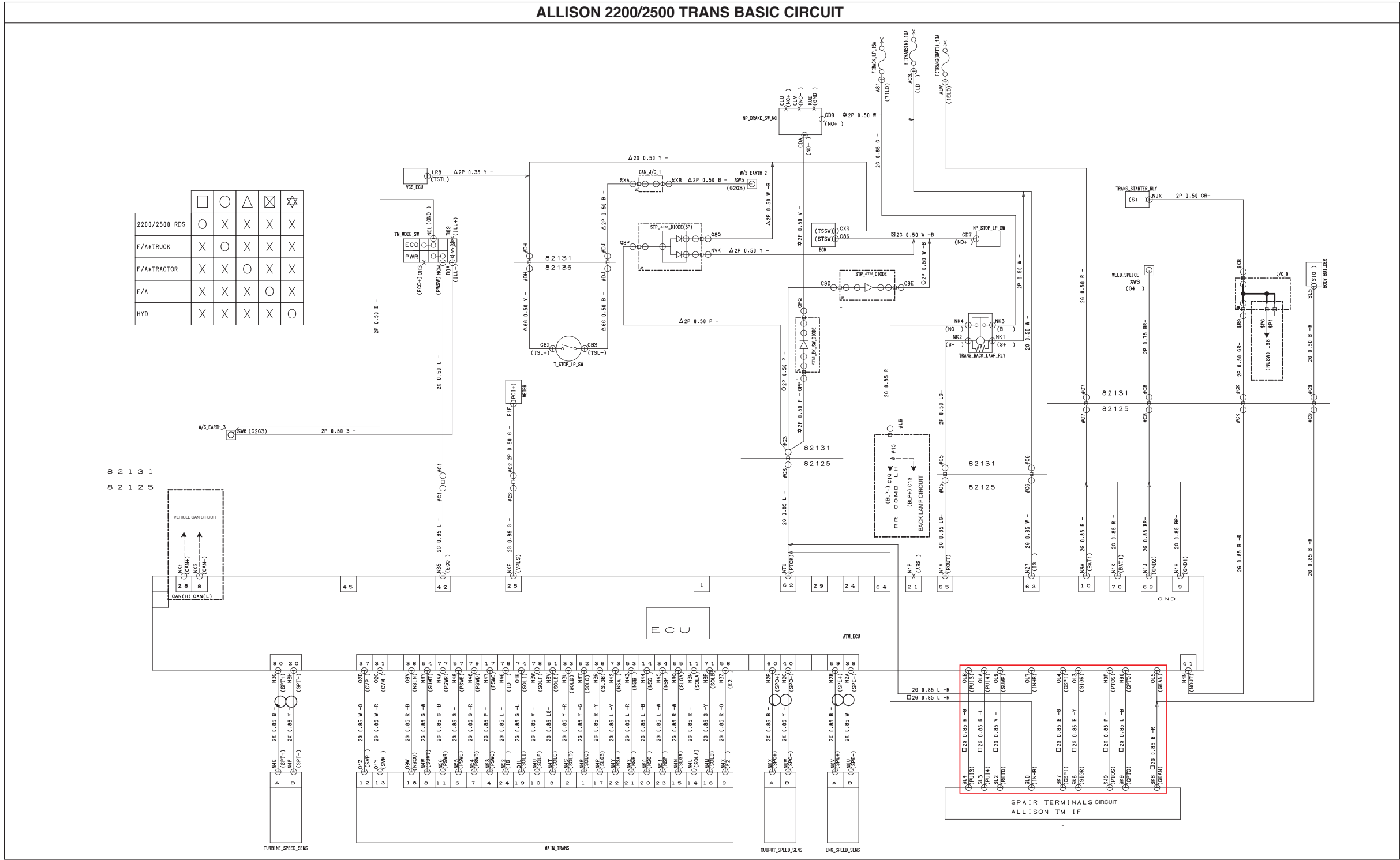
## Installing position of connector



Enlarged A above

DETAIL OF WIRING DIAGRAM

Allison transmission 2200/2500 series



Allison transmission 3000/3500 series

