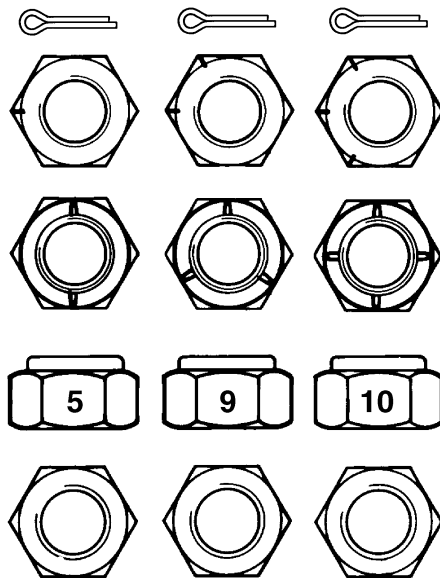


METRIC AND INCH (SAE) FASTENERS



HM210064

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FASTENER TORQUE TABLES

Table 5. Torque Values for Metric Fasteners*

| Size and Pitch | Property Class 5.8 ¹ | | Grade 8.8 ² | | Grade 10.9 ³ | |
|--|---|---|---|---|---|---|
| | N•m | lbf ft | N•m | lbf ft | N•m | lbf ft |
| M3 × 0.5 M3.5 × 0.6 M4 × 0.7 M5 × 0.8 M6 × 1 | 0.62 0.97 1.44 2.91 4.94 | 0.5 0.7 1.1 2.1 3.6 | 0.99 1.55 2.30 4.65 7.90 | 0.7 1.1 2.1 3.6 6 | 1.34 2.11 3.13 6.33 10.8 | 1.0 1.6 2.3 4.7 8 |
| M8 × 1.25 M8 × 1 M10 × 1.5 M10 × 1.25 | 12.0 12.8 23.8 25.1 | 9 9 18 19 | 19.2 20.5 38.0 40.1 | 14 15 28 30 | 26.1 27.9 52 55 | 19 21 38 41 |
| M12 × 1.75 M12 × 1.25 M14 × 2 M14 × 1.5 | 41.4 45.3 66 72 | 31 33 49 53 | 66 72 105 115 | 49 53 77 85 | 90 98 145 155 | 66 72 105 115 |
| M16 × 2 M16 × 1.5 M20 × 2.5 M20 × 1.5 | 105 110 200 225 | 77 81 150 165 | 165 175 320 355 | 122 130 235 260 | 225 240 435 485 | 165 175 320 360 |
| M24 × 3 M24 × 2 M27 × 3 M27 × 2 | 345 375 505 550 | 255 275 370 405 | 555 605 810 875 | 410 445 600 645 | 755 820 1,100 1,190 | 560 605 810 880 |
| M30 × 3.5 M30 × 3 M30 × 2 M33 × 3.5 M33 × 2 | 690 715 765 940 1,030 | 510 530 565 695 760 | 1,100 1,140 1,220 1,500 1,640 | 810 840 900 1,100 1,210 | 1,500 1,550 1,660 2,040 2,240 | 1,100 1,140 1,230 1,510 1,660 |
| M36 × 4 M36 × 3 M39 × 4 M39 × 3 | 1,200 1,280 1,560 1,640 | 885 945 1,150 1,210 | 1,930 2,040 2,490 2,630 | 1,430 1,510 1,840 1,940 | 2,620 2,780 3,390 3,570 | 1,940 2,050 2,500 2,640 |
| M42 × 4.5 M42 × 3 M45 × 4.5 M45 × 3 M48 × 5 M48 × 3 | 1,930 2,070 2,410 2,580 2,900 3,160 | 1,430 1,530 1,780 1,910 2,140 2,330 | 3,080 3,320 3,850 4,120 4,630 5,040 | 2,280 2,450 2,840 3,040 3,420 3,720 | 4,200 4,510 5,240 5,610 6,300 6,860 | 3,100 3,330 3,870 4,140 4,650 5,060 |
| * Unless otherwise specified ¹ Approximately equal to Grade 2 ² Approximately equal to Grade 5 ³ Approximately equal to Grade 8 | | | | | | |

Table 6. Torque Values for Inch Fasteners*

| Size and Pitch | Grade 2 ¹ | | Grade 5 ² | | Grade 8 ³ | |
|---|----------------------|-------|----------------------|-------|----------------------|-------|
| | lbf ft | N•m | lbf ft | N•m | lbf ft | N•m |
| 1/4 1/4 20 UNC 28 UNF | 4 5 | 6 6 | 6 7 | 9 10 | 9 10 | 12 14 |
| 5/16 5/16 18 UNC 24 UNF | 8 9 | 11 13 | 13 14 | 18 20 | 18 20 | 25 28 |
| 3/8 3/8 16 UNC 24 UNF | 15 17 | 20 23 | 23 26 | 31 36 | 33 37 | 44 50 |
| 7/16 7/16 14 UNC 20 UNF | 24 27 | 33 36 | 37 41 | 50 56 | 52 58 | 71 79 |
| * Unless otherwise specified ¹ Approximately equal to metric Property Class 5.8 ² Approximately equal to metric Property Class 8.8 ³ Approximately equal to metric Property Class 10.9 | | | | | | |

General

THREADED FASTENERS

Threaded fasteners, like bolts, nuts, capscrews, and studs, are made to specifications that describe the mechanical strength and hardness of the fastener. A fastener used in a design application is selected according to its specifications. Yale® Company buys parts from many countries. Parts that are purchased must be to Yale® Company standards. There are several standards used by these countries in the manufacture of threaded fasteners. Many of these fasteners are similar, but cannot be used as a direct replacement. To make sure that you have the correct fastener, order fasteners and parts through the Yale® Parts Depot.

Service persons must use replacement fasteners that have the same specifications. Fasteners made to each specification have identification marks for that specification. This specification is commonly called "Grade" for SAE standards and "property class" for metric standards. This section describes the identification of some common fasteners.

The metric system used by Yale® Company is described as SI (Le Systeme d'Unites or the International System of units, also called SI in all languages). The SI System of measurement is described in ISO Standard 1000, 1973. A conversion table of common measurements is shown in Table 7.

The diameter of the shank of the fastener is shown first in the series [M12 = 12 mm, M20 = 20 mm (1/2 = 1/2 in., 3/4 = 3/4 in.)].

The number of threads per inch is normally not shown for inch nomenclature and only the UNC (Unified National Coarse) or UNF (Unified National Fine) is shown. This number of threads per inch is not shown because a UNC or UNF fastener has a standard number of threads per inch for a specific diameter. Metric fasteners show the number of threads per millimeter.

The length of the shank is often indicated as part of the description of a fastener. This length is shown in inches for inch fasteners and in millimeters for metric fasteners.

A capscrew will have the following description:

| Metric | Inch |
|-----------------|--|
| M12 x 1.75 x 50 | 1/2 x 13 UNC x 1-1/2 |
| A B C | A B C D |
| A = Thread Size | A = Shank Diameter |
| B = Pitch | B = Number of Threads Per Unit of Length |
| C = Length | C = type of Thread |
| | D = Shank Length |

NOMENCLATURE, THREADS

The thread design is specified by a series of numbers and letters for inch and metric fasteners. See Figure 1.

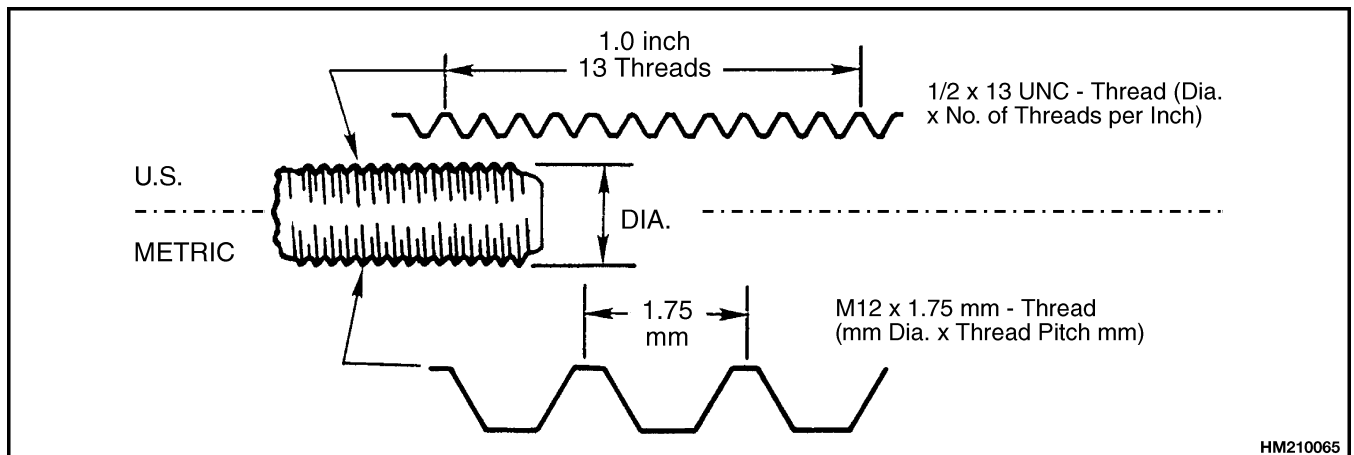
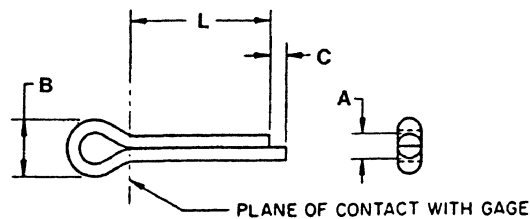


Figure 1. Thread Design

Table 10. Cotter Pin Dimensional Data (Continued)

| Nominal Length L | Length Range | | Nominal Size - Part Numbers | | | | |
|-------------------------|-------------------------|-------------------------|-----------------------------|------------------------|------------------------|------------------------|------------------------|
| | max | min | 4.00 mm (0.156 in.) | 5.00 mm (0.188 in.) | 6.30 mm (0.250 in.) | 8.00 mm (0.312 in.) | 9.52 mm (0.375 in.) |
| 25.4 mm (1.000 in.) | 26.9 mm (1.060 in.) | 23.9 mm (0.940 in.) | 0015233 | 0015242 | 0015251 | 0015261 | |
| 31.75 mm (1.250 in.) | 33.3 mm (1.310 in.) | 29.2 mm (1.150 in.) | 0015234 | 0015243 | 0015252 | 0015262 | 0221884 |
| 38.1 mm (1.500 in.) | 40.9 mm (1.610 in.) | 36.6 mm (1.440 in.) | 0015235 | 0015244 | 0015253 | 0015263 | 0221885 |
| 44.45 mm (1.750 in.) | 46.0 mm (1.810 in.) | 42.9 mm (1.690 in.) | 0015236 | 0015245 | 0015254 | 0015264 | 0221886 |
| 50.8 mm (2.000 in.) | 52.3 mm (2.060 in.) | 49.3 mm (1.940 in.) | 0015237 | 0015246 | 0015255 | 0015265 | 0015271 |
| 57.15 mm (2.250 in.) | 58.7 mm (2.310 in.) | 55.1 mm (2.170 in.) | 0015238 | 0015247 | 0015256 | 0221880 | 0221887 |
| 63.5 mm (2.500 in.) | 65.0 mm (2.560 in.) | 62.0 mm (2.440 in.) | 0015240 | 0015248 | 0015257 | 0221881 | 0015273 |
| 69.85 mm (2.750 in.) | 72.1 mm (2.840 in.) | 68.3 mm (2.690 in.) | 0015280 | 0015249 | 0015258 | 0221882 | 0015286 |
| 76.2 mm (3.000 in.) | 81.3 mm (3.200 in.) | 74.7 mm (2.940 in.) | 0015283 | 0015250 | 0015259 | 0015267 | 0015272 |
| 88.9 mm (3.500 in.) | 91.4 mm (3.600 in.) | 87.4 mm (3.440 in.) | | 0015239 | 0015284 | 0015266 | 0015274 |
| 101.6 mm (4.000 in.) | 113.3 mm (4.460 in.) | 98.8 mm (3.890 in.) | | 0015301 | 0015260 | 0128754 | 0015275 |
| 127.0 mm (5.000 in.) | 128.5 mm (5.060 in.) | 123.7 mm (4.870 in.) | | | | 0221883 | 0015277 |
| 152.4 mm (6.000 in.) | 153.9 mm (3.060 in.) | 5.460 mm (138.7 in.) | | | | | 0221888 |



EXTENDED PRONG

HM211587

Legend for Figure 1.

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. HEATER SECTION 2. INCHING PEDAL 3. BRAKE PEDAL 4. ACCELERATOR PEDAL 5. STEERING COLUMN 6. FRONT, REAR, AND TOP WINDOWS | <ol style="list-style-type: none"> 7. FRONT, REAR, AND TOP WIPER ASSEMBLIES 8. INTEGRATED OVERHEAD GUARD 9. OPERATOR'S CONSOLE, CONTROLS, AND ARMREST 10. AIR CONDITIONING CONDENSER, DRYER, AND FAN ASSEMBLY (OPTIONAL) 11. SEAT |
|--|--|

Tilting the Cab**Raising**

NOTE: If the cab will not fully tilt/raise, lower the cab until the cab locks in the partially open position, and check the oil level in the pump. Refer to the section Oil Filling for Cab Tilt System.

**WARNING**

Make sure no one and no body parts are under the cab when raising or lowering the cab, or serious personal injury may occur.

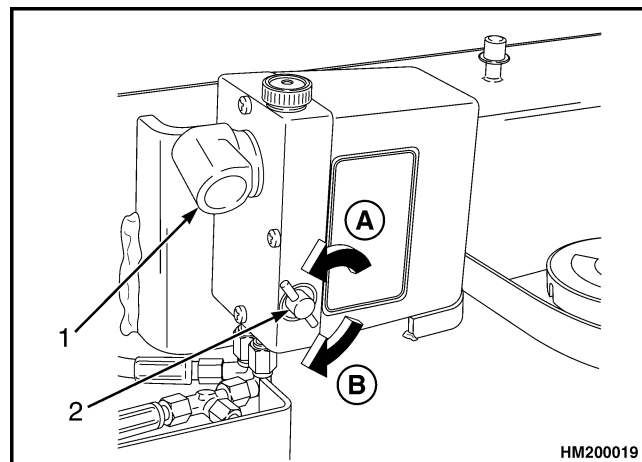
**WARNING**

Before doing any work under the cab, always make sure the cab is fully tilted/raised, or if partially open, is locked with the tilt latch, or serious personal injury may occur.

**CAUTION**

Cab damage may occur if the mast is not completely tilted forward.

1. Tilt the mast fully forward.
2. Put the ignition switch in the **OFF** position.
3. Apply the park brake.
4. Remove all unsecured items from the cab.
5. Close and securely latch the left-hand and right-hand cab doors.
6. Clear all obstacles from the right-hand side of the lift truck. Provide a minimum of 2 m (7 ft) clearance space.
7. Use the pump lever to turn the pump directional valve clockwise to the "Tilt/Raise" position. See Figure 2.



- A. LOWER POSITION
B. RAISE POSITION

1. PUMP LEVER CONNECTION
2. PUMP DIRECTIONAL VALVE

Figure 2. Pump and Direction Valve

8. Operate the pump with the pump lever (or push-button, if equipped with an electric pump), until the cab locks in the partially open position. See Figure 3.

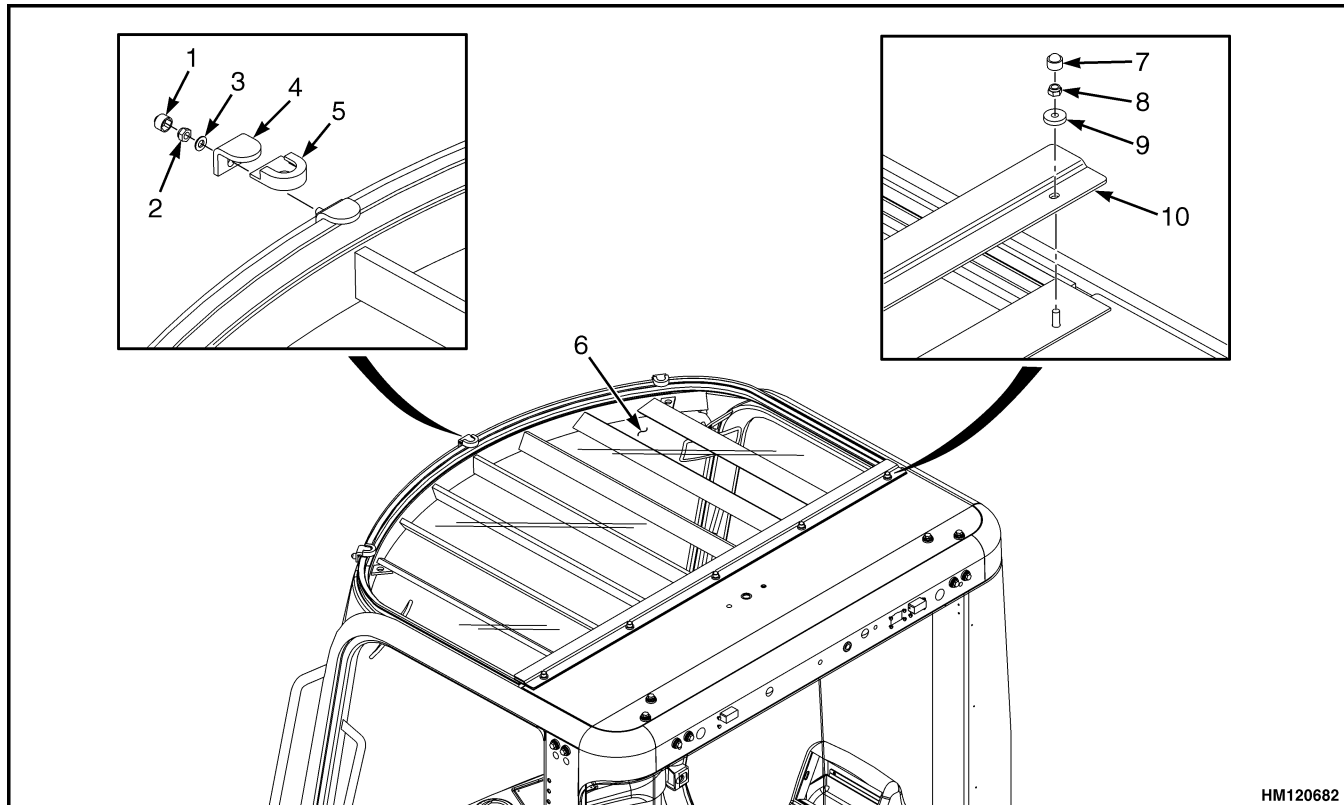
NOTE: Just before the fully open position is reached, movement becomes gravity-controlled by the weight of the cab.

9. Pull the latch release handle and continue to tilt/raise the cab to the fully open position.

Top Window**Remove**

1. Remove the top window wiper assembly. Refer to the section Window Wiper Assembly Replacement.

2. Remove the five protecting caps, nuts, and washers from the window clip. See Figure 15.



1. PROTECTIVE CAP
2. NUT
3. PLASTIC WASHER
4. ROOF CLIP
5. ROOF CLIP COVER

6. TOP WINDOW
7. PROTECTIVE CAP
8. NUT
9. WASHER
10. WINDOW CLIP AND SEAL

Figure 15. Top Window

3. Remove the window clip and seal.
4. Remove the three protective caps, nuts, and plastic washers that retain the roof clips to the cab.
5. Remove the three roof clips and roof clip covers.
6. Remove the top window from the operator's compartment opening.

Install

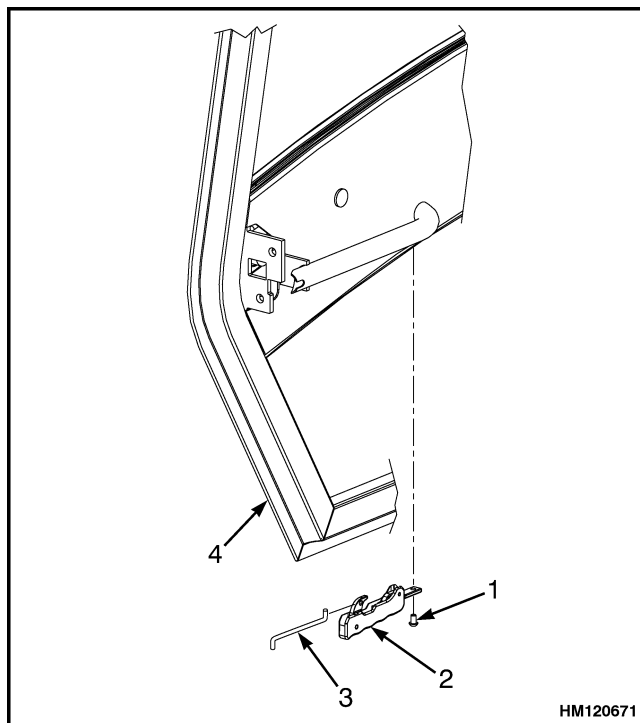
1. Clean the window opening and seal located under the window clip.
2. Install a new adhesive seal to the top window.
3. Position the top window onto the operator's compartment opening. See Figure 15 .
4. Position the window clip and seal over the thread ends and install the five nuts and washers, hand tighten.

2. Install the washer and large nut on the release button side of the door handle.
3. Install the washer and capscrew through the hole from the plastic plug.
4. Install the plastic plug at the inside of the door frame.
5. Install the latch. Refer to the section Door Latch.
6. Make sure the locking system functions correctly.

Door Release

Remove

1. Remove the door latch. Refer to the section Door Latch.
2. Remove the capscrew that retains the door release inside the bar located at the inside of the door frame. See Figure 28.



1. CAPSCREW
2. DOOR RELEASE
3. CONNECTOR ROD
4. CAB DOOR

Figure 28. Door Release

3. Remove the connector rod and door release from inside the bar.
4. Disconnect the connector rod from the door release.

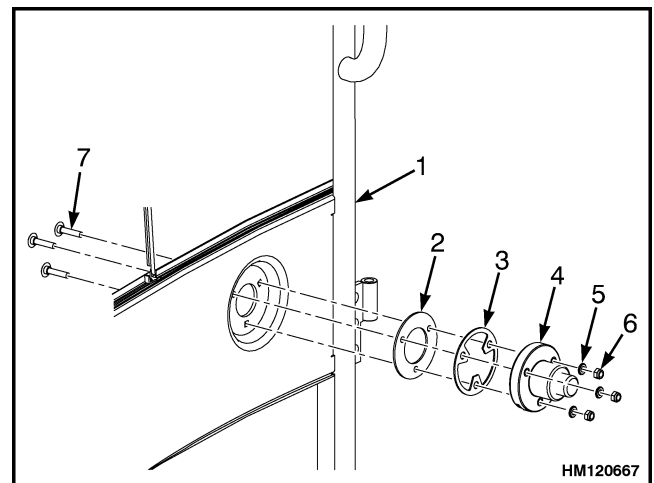
Install

1. Connect the connector rod to the door release. See Figure 28.
2. Install the connector and door release inside the bar, located at the inside of the door frame.
3. Install the capscrew that retains the door release inside the bar.
4. Install the door latch. Refer to the section Door Latch.

Door Push Button

Remove

1. Remove the three plastic caps from the nuts located at the inside of the door frame. See Figure 29.



1. CAB DOOR
2. WASHER
3. SEAL
4. DOOR HOLDER (PUSH BUTTON)
5. WASHER
6. NUT
7. CAPSCREW

Figure 29. Door Push Button

2. Remove the three nuts, washers, and capscrews that retain the door holder (push button), washer, and seal to the door frame.

NOTE: The ground cable is attached with the capscrew at the right rear corner of the suspension.

5. Connect the battery ground cable.

SEAT COMPONENTS

Seat Cushion

Remove

Refer to Figure 38 for the following procedures.

1. Slide the seat forward.
2. Adjust the steering wheel upward to its maximum height position.
3. Remove and discard the screw from the front right side.
4. Remove and discard the three clips from the cushion front.
5. Slide the seat fully backward.
6. Grip the seat cushion on the front right corner.
7. Lift the seat cushion until the guide block becomes detached.
8. Rotate the seat cushion clockwise.
9. Lift the cushion upward to detach the front of the seat cushion.
10. Grip the seat cushion at about the halfway point toward the rear of the cushion.

NOTE: Increase the lifting force until the rear of the cushion detaches.

11. Lift the seat cushion from right to left.
12. Cut the cable tie securing the connector block to the seat cushion.
13. Disconnect the spade connectors from the connector block.
14. Remove and discard the seat cushion.

Install

1. Feed the cables of the new cushion through the hole in the armrest bracket.

2. Connect the spade connectors to the connector block.
3. Use a cable tie to attach the connector block to the seat cushion.
4. Locate the rear tab on the underside of the seat cushion over the rectangular hole in the metal pan.
5. Apply downward pressure over the tab.
6. Slide the cushion around until the tab is partially located in the rectangular hole.
7. With the cushion angled at approximately 35° to 45°, apply a sharp blow to the front of the seat cushion. The tab will enter the hole with an audible click.
8. Pull the cushion upward to make sure the cushion is correctly locked into position.
9. Install three new clips to the cushion front.
10. Install a new screw to the front right side.

Back Cushion

Remove

Refer to the section Figure 38 for the following procedures.

1. Slide the seat assembly to the maximum forward position.
2. If equipped, remove the headrest out of the two guides.
3. Remove the two guides, located at the top side of the back cushion, that retain the back cushion to the back pan.
4. Remove the two screws that retain the back cushion to the back pan.
5. Remove the back cushion.

Install

1. Position the back cushion.
2. Install the two screws that retain the back cushion to the back pan.

STEP 20.

Install the pivot shaft nut and tighten to 38 to 56 N•m (28 to 41 lbf ft).

**STEP 21.**

Remove the wooden block from the suspension.

STEP 22.

For air seats: Install the retaining screws for the air bladder.

**STEP 23.**

Install the boot. Refer to the section Boot Replacement.

STEP 24.

Install the seat suspension in the cab. Refer to Seat Suspension Replacement.

STEP 25.

Install the seat. Refer to the section Seat Assembly.

Electrical Levers

Remove

NOTE: For lift trucks with hydraulic control levers, the remove and replace instructions are shown in the model specific Hydraulic System. Refer to **Hydraulics** 1900YRM2149 .

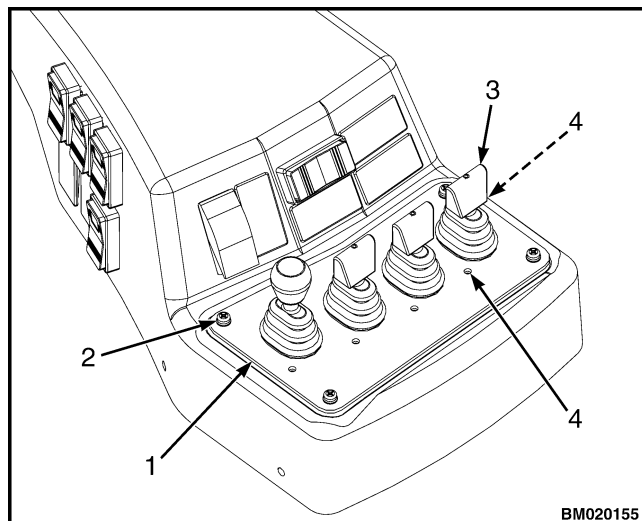
1. Remove the four screws that retain the cover with the levers to the power assist armrest. See Figure 41.

NOTE: Most connectors are equipped with symbol labels for identification.

2. If necessary, tag the electrical connector(s) for identification.
3. Disconnect the electrical connector(s) from the lever(s).
4. Remove the two screws that retain the lever to the cover.
5. Remove the lever from the underside of the cover.

Install

1. Install the lever from the underside to the cover.
2. Install the two screws to retain the lever to the cover.
3. Connect the electrical connector(s) to the lever(s).
4. Install the four screws that retain the cover with the levers to the power assist armrest.
5. Calibrate the lever. See the model specific Hydraulic System. Refer to **Hydraulics** 1900YRM2149 .



1. COVER
2. COVER SCREWS
3. LEVER
4. LEVER SCREWS

Figure 41. Levers Removal

Armrest Rocker Switches

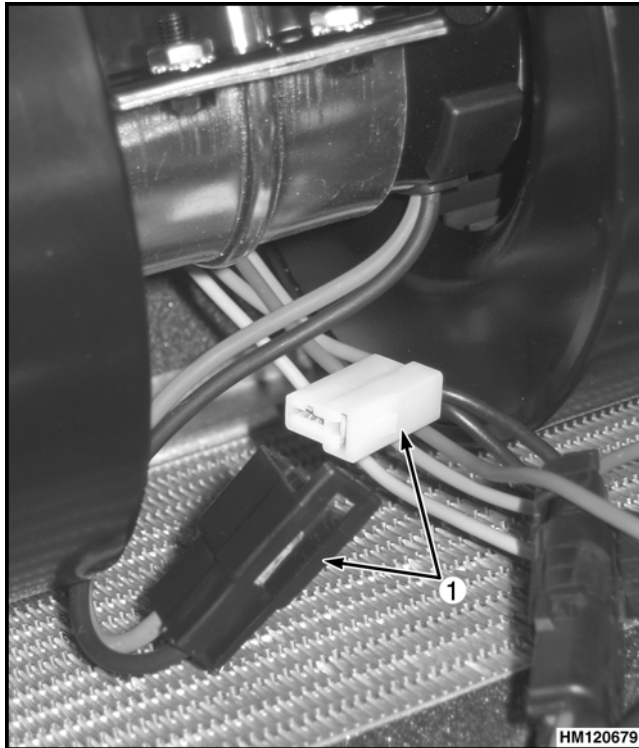
Remove

NOTE: If a failed switch is to be replaced by a new one, use a screw driver to force the failed switch out of the panel. The switch may suffer additional damage beyond repair. Remove the electrical connector from the failed switch and connect it to the replacement switch. Install the switch by pressing it into the opening in the panel until the holding clips of the switch are seated.

1. Remove six screws that retain the bottom plate and lower the plate.
2. Press the holding clips on the switches and push the rocker switch out of the armrest.
3. Disconnect the electrical connector.

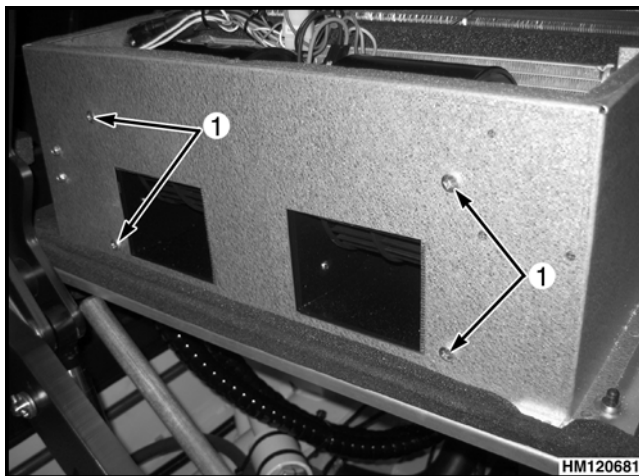
Install

1. Connect the electrical connector to the rocker switch.
2. Install the switch by pressing it into the opening of the panel until the holding clips of switch are seated.
3. Install the bottom plate using six retaining screws.



1. ELECTRICAL CONNECTOR

Figure 53. Blower Electrical Connector

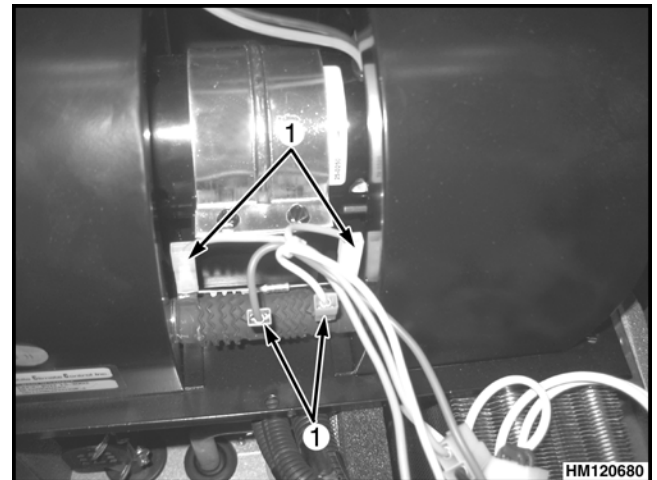


1. BLOWER RETAINING CAPSCREWS

Figure 54. Blower Retaining Screws

7. Partially remove the blower assembly from the heater assembly housing and tag and disconnect the four electrical wires from the blower assembly. See Figure 55.

8. Remove the blower assembly from the heater assembly housing.



1. ELECTRICAL WIRE CONNECTION

Figure 55. Blower Electrical Wire Connection

Install

1. Connect the electrical wires to the blower assembly. See Figure 55.
2. Position the blower assembly into the heater assembly housing.
3. Install the four screws to retain the blower to the heater assembly housing. See Figure 54.
4. Connect the electrical connector to the blower assembly. See Figure 53.
5. Position the top cover on the heater assembly.
6. Install the 10 screws to retain the top cover to the heater assembly.
7. Swing the heater assembly up toward the cab and install the three capscrews to retain the heater assembly to the cab. See Figure 50 for the location of the capscrews.
8. Lower the cab to the fully lowered and latched position. Refer to Operator's Cab Assembly, Lowering.
9. Make sure the blower functions correctly.

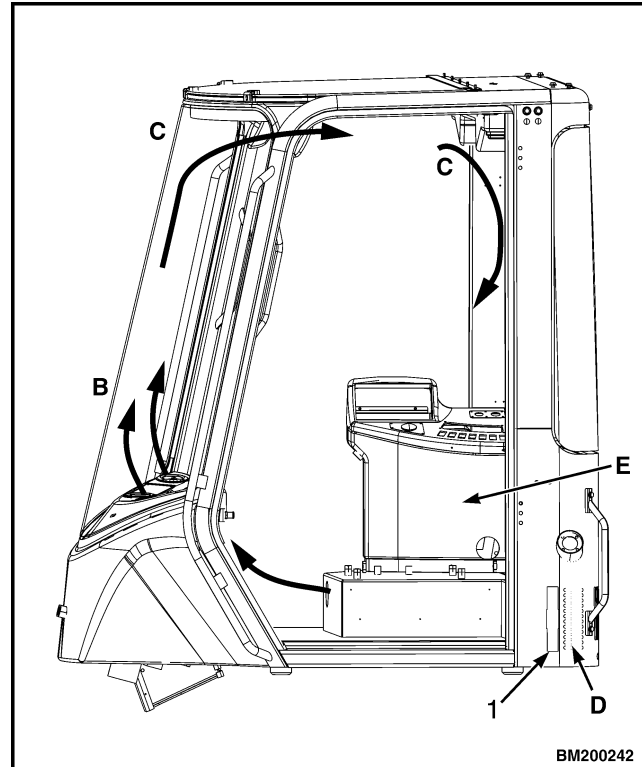
11. Swing the heater/air conditioner assembly up toward the cab and install the three capscrews that retain the heater/air conditioner assembly to the cab. See Figure 56.
12. Lower the cab to the fully lowered and latched position. Refer to Operator's Cab Assembly, Lowering.
13. Start the engine and check for leaks. Add coolant as needed. Depending on your lift truck see **Periodic Maintenance 8000YRM2147** for the correct coolant specifications.
14. Turn the heat control knob a few times from the fully open position to the fully closed position to be sure that the heating system functions properly. Refer to Figure 36.

FILTRATION

Fresh Air Filter

Remove

1. Locate the fresh air filter. See Figure 62.
2. Press the latches and pull the filter housing from the side of the cab.
3. Loosen the two bolts and remove the filter from the housing.



- A. OPTIONAL AIR VENT
 B. AIR TO FRONT WINDOW
 C. CAB AIR FLOW
 D. FRESH AIR ENTRY
 E. RECIRCULATION AIR ENTRY (REAR SIDE)

1. CAB AIR FILTER

Figure 62. Ventilation

Install

1. Install the new fresh air filter. See Figure 62. Tighten the bolts.
2. Press the latches and insert the filter housing into the cab.

Recirculation Air Filter

Remove

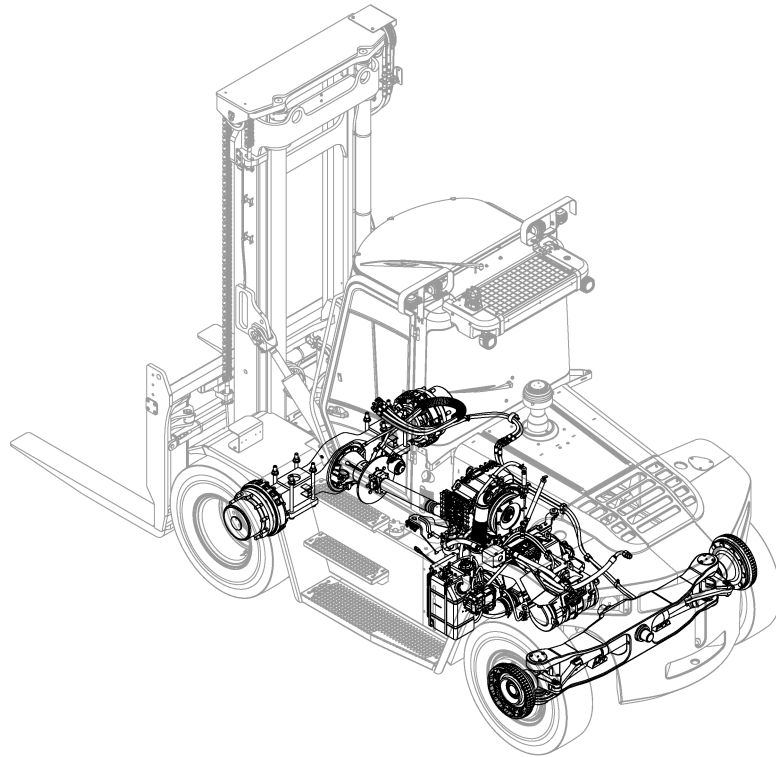
1. Locate the recirculation air filter. See Figure 63.



Maintenance

DRIVE TRAIN

SERVICE MANUAL



Install



WARNING

Use caution when using lifting devices. When using a lifting strap, inspect the strap for damage before use. **DO NOT** use a lifting strap to shock load or drop load a component. Serious personal injury and damage to components may occur.



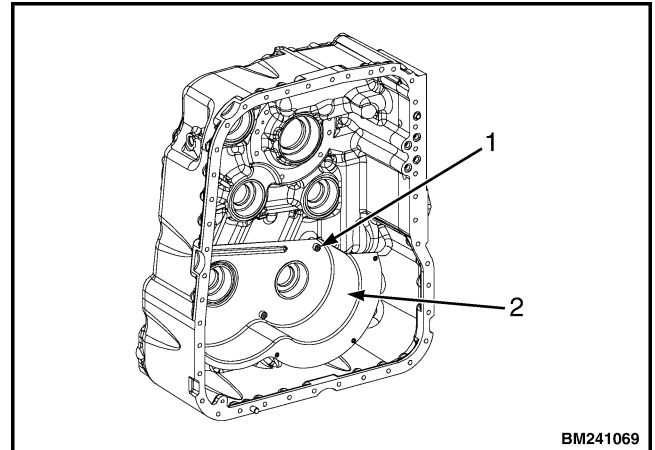
CAUTION

The drive shaft weighs approximately 25 kg (55 lb). Dents or damage to the drive shaft can cause premature failure.

1. Place the drive shaft in position at the underside of the lift truck.
2. Attach a sling to each end of the drive shaft. Use a lifting device to raise the drive shaft into place. See Figure 2.
3. Apply Loctite[®] 271 to the threads of the capscrews.
4. Install the capscrews at each end of the drive shaft that retain the universal joints to the drive axle flange and transmission flange. Torque the capscrews to 120 to 136 N•m (90 to 100 lbf ft).
5. Install the drive shaft catch.
6. Lower the cab until it is in the fully seated and latched into position.

STEP 2.

Install screen and new capscrews into the front transmission cover. Insert oiled cap screws and tighten to 23 N•m (17 lbf ft).



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1. CAPSCREW
2. SCREEN

**WARNING**

To prevent the possibility of injury to personnel, use a lifting device of sufficient lifting capacity while performing Step 3.

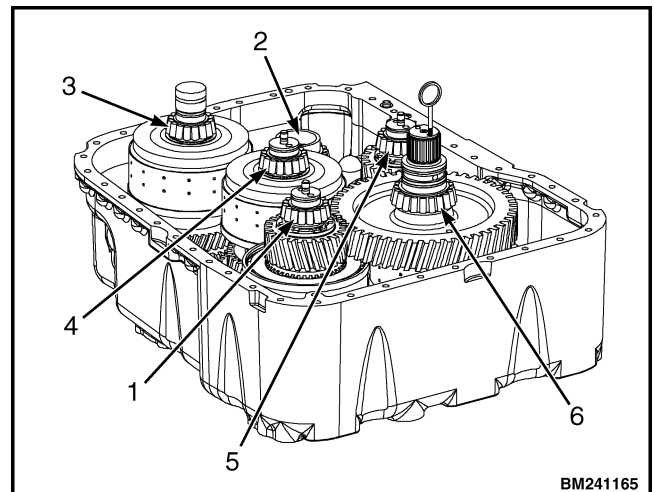
**CAUTION**

During installation of the clutch packs, make sure that the piston rings are properly aligned. If they are not properly aligned, serious damage to the transmission will occur.

STEP 3.

To help insure proper installation, make sure the piston rings are aligned, and use Vaseline to keep them in place.

Install the clutch packs in the order given in the legend.



BM241165

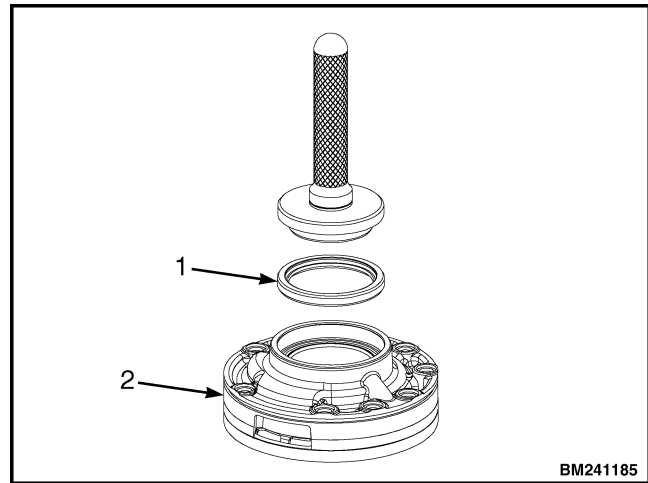
1. CLUTCH K1, 1ST SPEED
2. INPUT SHAFT
3. CLUTCH KV, FORWARD
4. CLUTCH KR, REVERSE
5. CLUTCH K2, 2ND SPEED
6. CLUTCH K3, 3RD SPEED/OUTPUT

Assemble

NOTE: Lubricate the shaft seal with mineral spirits on the outside.

STEP 1.

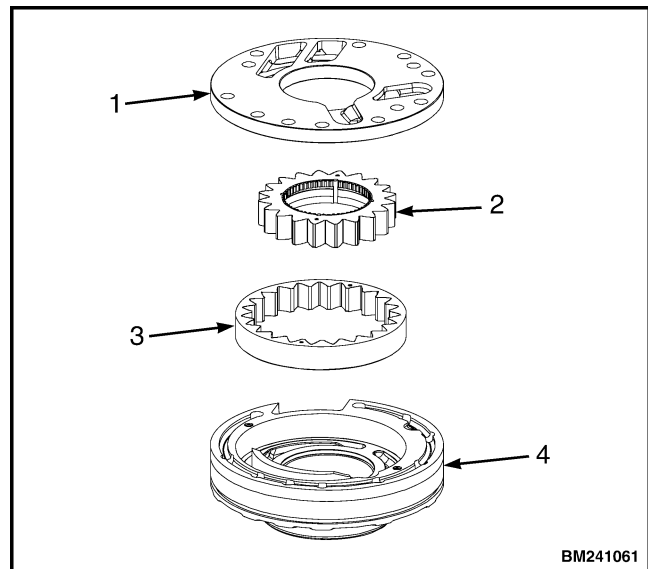
Using pump seal mounting tool Yale P/N 582013812 with handle Yale P/N 582013811, install the new shaft seal, lip facing down, into the oil pump housing. See Special Tools.



1. SHAFT SEAL
2. OIL PUMP HOUSING

STEP 2.

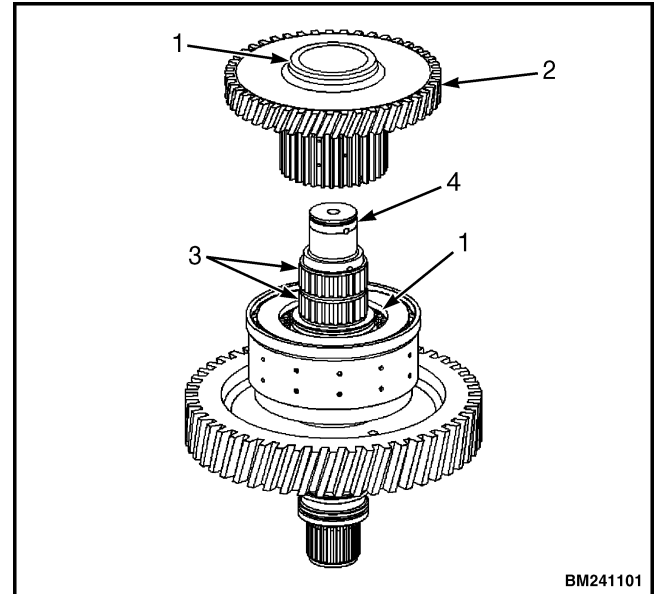
Install the outer rotor with the chamfer facing down, inner rotor with the threads facing up, and cover on the oil pump housing.



1. COVER
2. INNER ROTOR
3. OUTER ROTOR
4. OIL PUMP HOUSING

STEP 16.

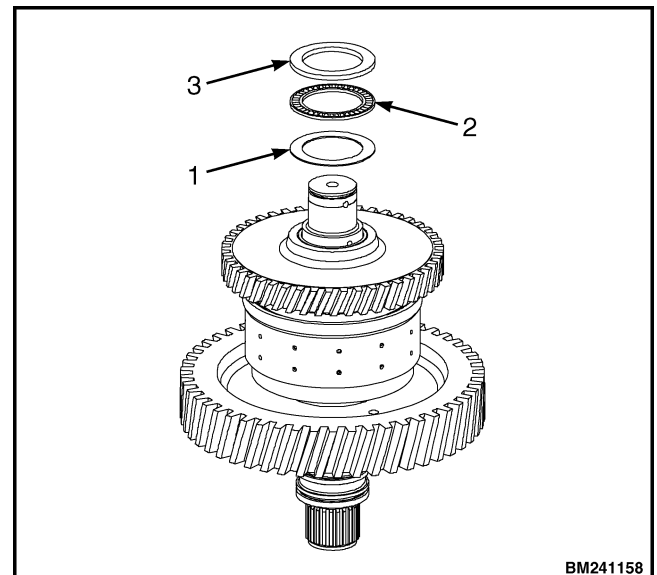
Install the two needle bearings and idler gear on the clutch shaft, rotating the idler gear left and right small amounts to achieve final alignment with the clutch pack.



1. AXIAL BEARING ASSEMBLY
2. NEEDLE BEARING
3. IDLER GEAR
4. CLUTCH SHAFT

STEP 17.

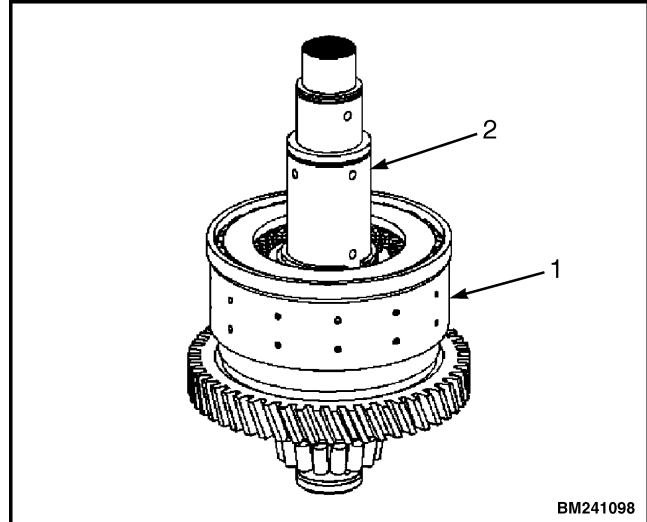
Install the axial washer, axial bearing, and running disc chamfer side down on the clutch shaft.



1. AXIAL WASHER
2. AXIAL BEARING
3. RUNNING DISC

STEP 13.

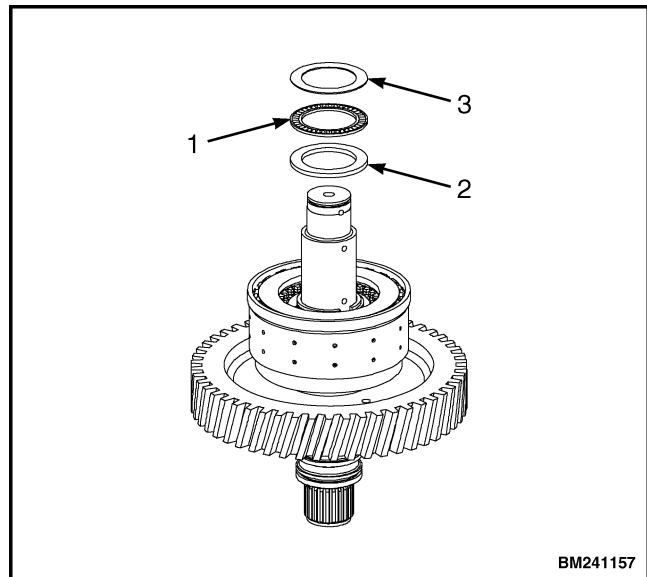
Install the clutch pack carrier until it bottoms out.



1. CLUTCH PACK CARRIER
2. CLUTCH SHAFT

STEP 14.

Install the running disk chamfer side up, axial bearing, and axial washer on the clutch shaft.



1. AXIAL BEARING
2. RUNNING DISK
3. AXIAL WASHER

NOTE: Prior to installation, the inner and outer friction discs must be coated with clean automatic transmission fluid.

STEP 6.

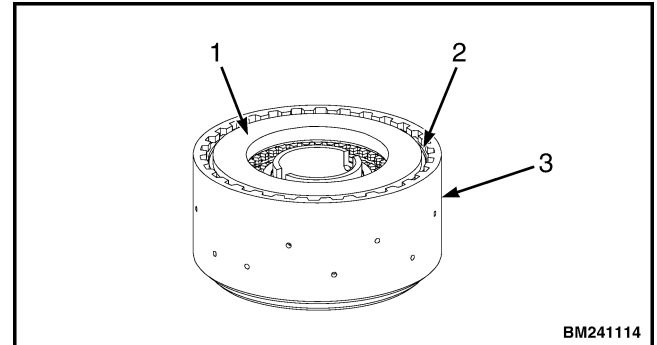
Install the inner discs and friction discs into the clutch pack carrier as shown in Figure 13.

STEP 7.

Install the friction disk, uncoated side up, into the clutch pack carrier. See Figure 13.

STEP 8.

Install the end shim and retaining ring into the clutch pack carrier.

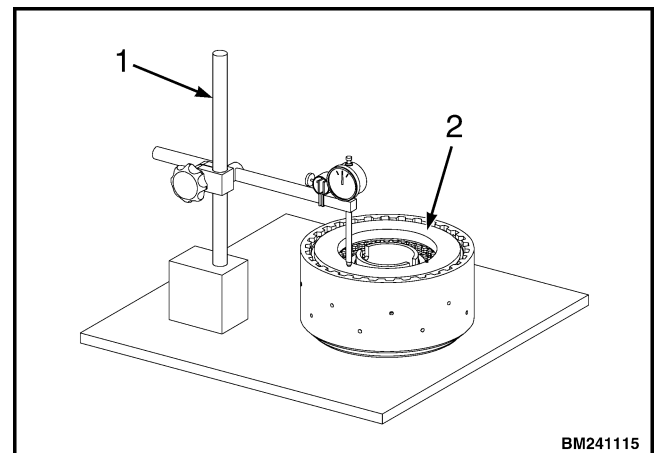


BM241114

1. END SHIM
2. RETAINING RING
3. CLUTCH PACK CARRIER

STEP 9.

Install a dial indicator as shown, and depress the end shim with a force of 100 N (23 lbf). Set the dial indicator to zero.



BM241115

1. DIAL INDICATOR
2. END SHIM

Clutch KV, Forward, Assemble

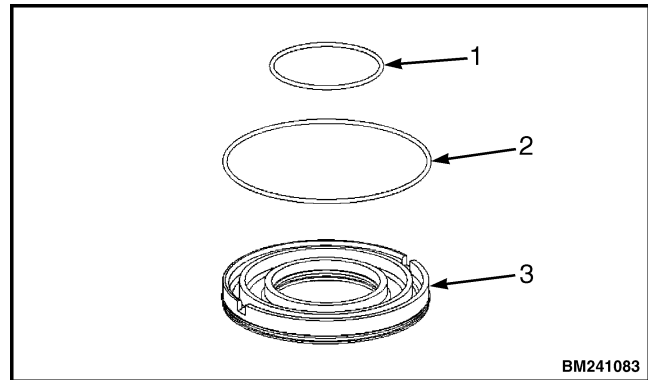
**CAUTION**

Make sure that the O-rings are not deformed during installation, and **DO NOT** roll the O-rings onto the piston.

NOTE: Prior to installing O-rings, coat with transmission oil to make installation easier.

STEP 1.

Install new inner and outer O-rings on the piston.

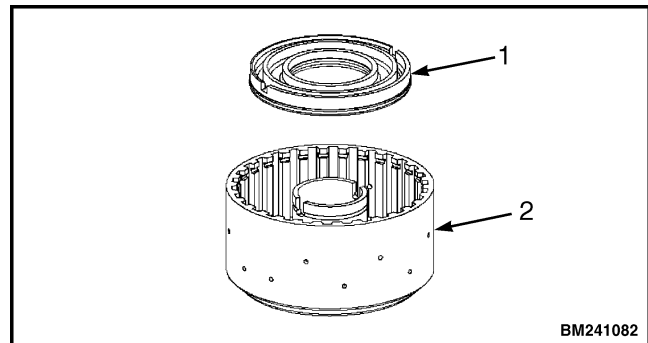


1. INNER O-RING
2. OUTER O-RING
3. PISTON

NOTE: Check piston relief valve functionality prior to installation of the piston.

STEP 2.

Using the spring compression tool, Yale P/N 582013808 , install the piston into the clutch pack carrier, as noted during disassembly, until it bottoms out.

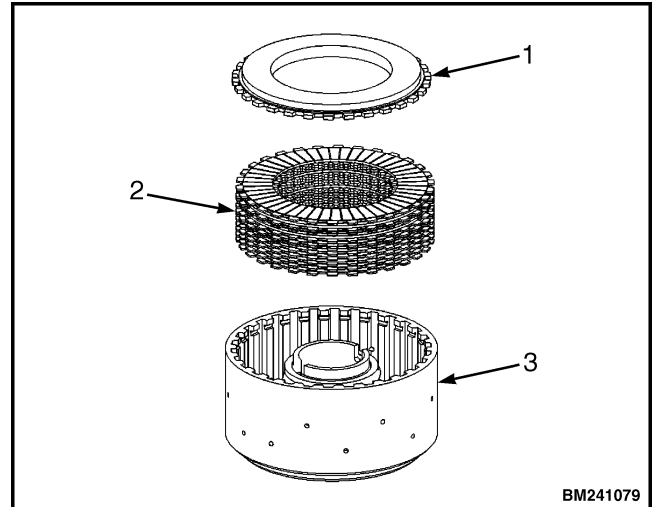


1. PISTON
2. CLUTCH PACK CARRIER

NOTE: Installation tool, Yale P/N 582013809 , consists of two parts; an inner installer and pressure piece.

STEP 7.

Remove the end shim and disc set from the clutch pack carrier.



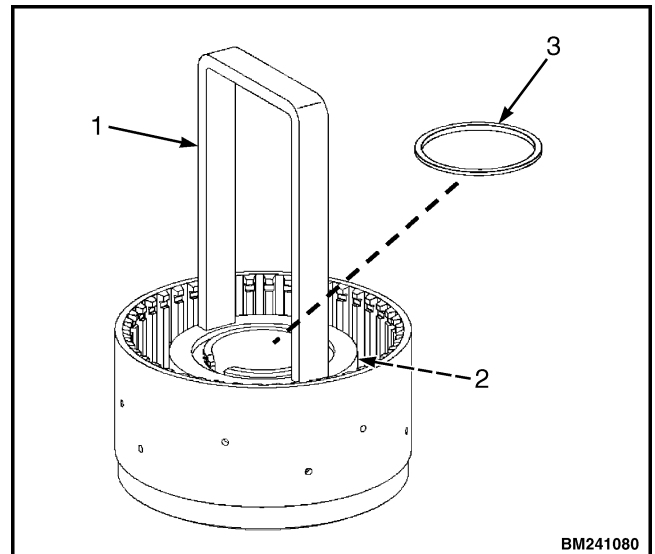
1. END SHIM
2. DISC SET
3. CLUTCH PACK CARRIER

**WARNING**

The spring has a force of 580 ± 72 N (130 ± 16 lbf).

STEP 8.

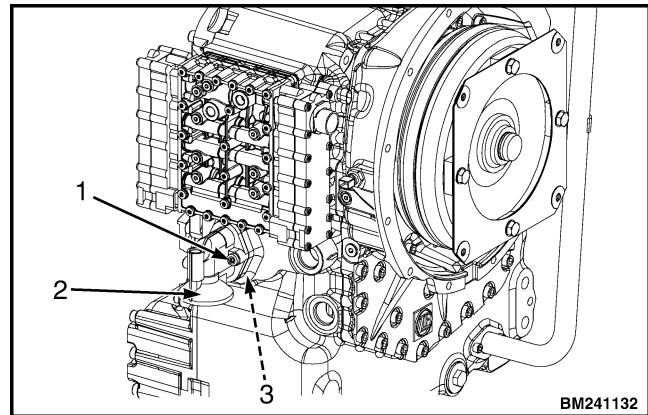
Using a spring compression tool, Yale P/N 582013808, compress the spring and remove the snap ring.



1. COMPRESSION TOOL
2. COMPRESSION SPRING
3. SNAP RING

Install**STEP 1.**

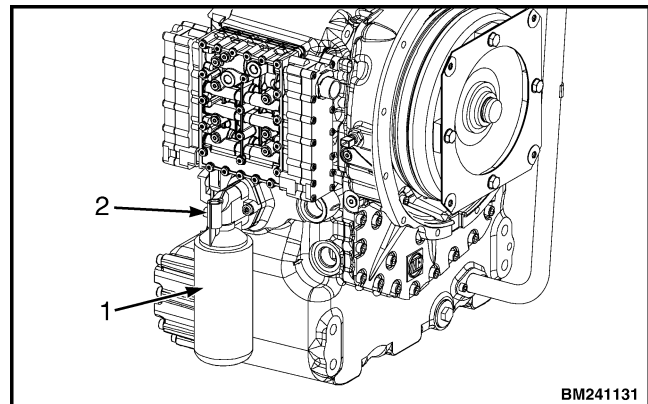
Coat two new O-rings with clean transmission oil and install into the transmission oil filter head. Using two capscrews mount the transmission oil filter head on the transmission. Tighten capscrews to 23 N•m (21 lbf ft).



1. CAPSCREW
2. TRANSMISSION OIL FILTER HEAD
3. O-RING

STEP 2.

Coat the gasket located on the top of the transmission oil filter with a light coat of transmission oil. Install transmission oil filter on the transmission oil filter head, by hand, until the gasket fully contacts the transmission oil filter head and tighten 1/3 to 1/2 turn more.



1. TRANSMISSION OIL FILTER
2. TRANSMISSION OIL FILTER HEAD

Transmission Control Valve

NOTE: For replacing the control valve only use the Remove and Install instructions only.

Remove**STEP 1.**

Disconnect the vehicle negative battery terminal.

STEP 2.

Disconnect the electrical connector from the transmission control valve.

Stall Test

The stall test provides indications for the condition of the engine, transmission clutches, and torque converter. The stall test is performed with the transmission engaged and operating the engine at full throttle while blocking the drive wheels. The stall speed is engine specific for the different Cummins Diesel Engines and should be between:

- 1950 - 2110 rpm for QSB 6.7 Tier 3/Stage IIIA
- 2050 - 2210 rpm for QSB 4.5 Tier 4F/Stage IV
- 2050 - 2210 rpm for QSB 6.7 Tier 4F/Stage IV

Stall Test Procedure



CAUTION

Do not hold the throttle open for more than 15 seconds at a time. Permit the engine to operate at high idle speed for two minutes, with the transmission in neutral, between tests.



CAUTION

Release the accelerator immediately if the engine speed for Cummins Diesel Engines increases to its governed speed:

- 2330 rpm for QSB 4.5 Tier 4F/Stage IV
- 2330 rpm for QSB 6.7 Tier 3/Stage IIIA
- 2300 rpm for QSB 6.7 Tier 4F/Stage IV



CAUTION

Performing a stall test in 1st gear may damage the internal parts of the drive axle.

Perform the stall test in 2nd gear only (gear selector position 3).

1. Connect a laptop computer to the diagnostic connector in the side console. Select the screen (Speeds/Torque Monitor) to read the engine speed.
2. Put a capacity load on the forks to prevent the wheels from turning.
3. Put the lift truck against an object that cannot move.
4. Select 2nd gear forward by moving the gear selector forward in position 3.

5. Push the accelerator pedal to full throttle.
6. Read the engine (stall) speed and release the throttle pedal.
 - If the **stall speed is 50 to 200 rpm below the specification**, the engine is not operating at full power. Check if engine fault codes are present and rectify any indicated problems.
 - If the **stall speed is higher than specification**, the engaged clutch(es) may not be holding or the torque converter is damaged. Check if transmission fault codes are present and rectify any indicated problems.
 - If no **transmission fault codes are present and the stall speed is much higher than specification**, remove the torque converter for inspection or replacement.
 - If **stall speed is only slightly higher than specification**, consider service life of the torque converter and the option to replace the torque converter immediately or at a later point in time.

Inch Pedal Calibration

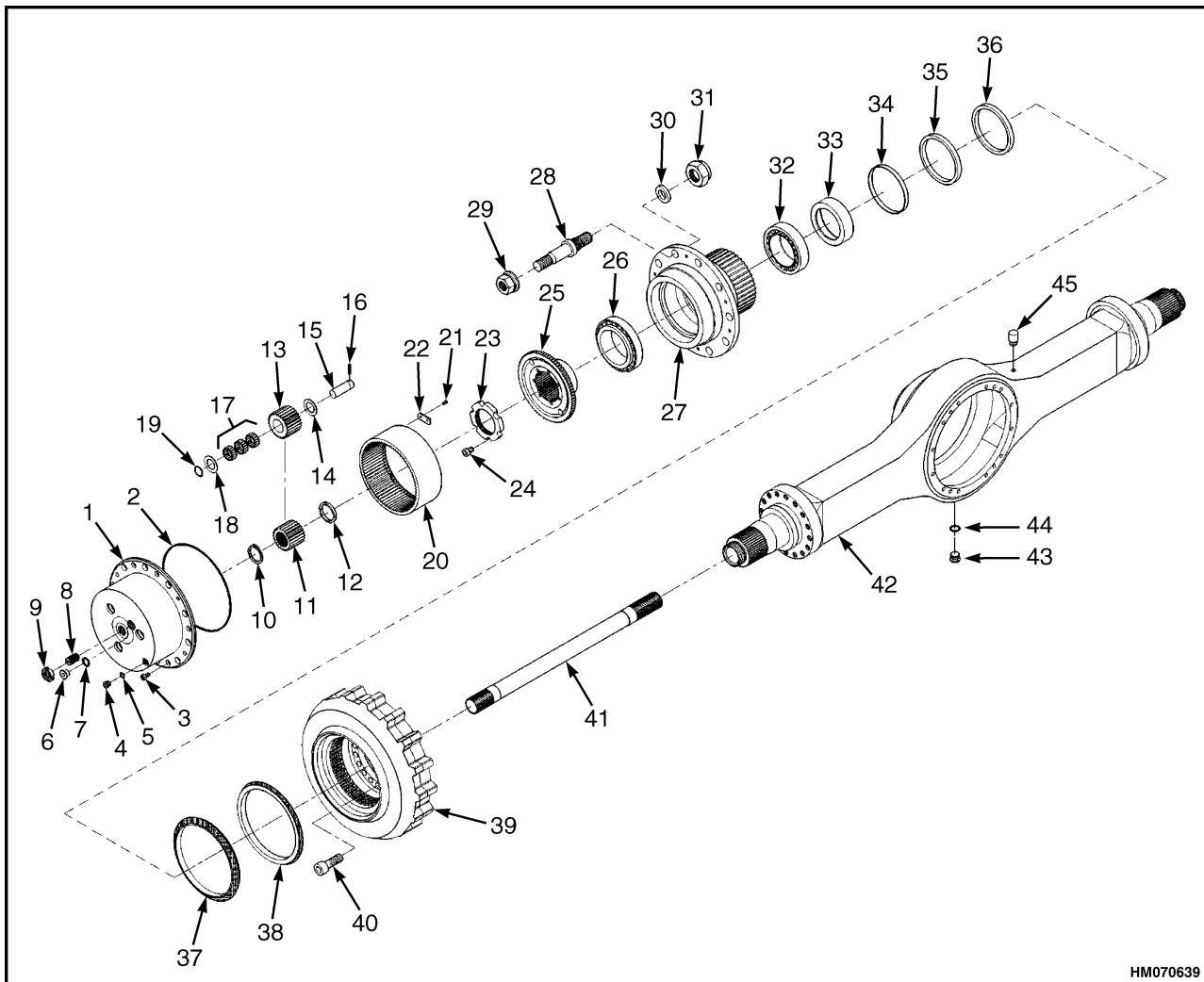
Inching is a controlled traction and braking mode. It enables higher engine speeds for increased hydraulic function speeds, while truck travel speed remains low. The inching function is obtained by relating the inching pedal position to clutch pressure. This relation results in a natural reaction of the operator to depress the inch pedal further when actual truck speed is too high. Further depressing the inch pedal increases service brake pressure and also causes pressure to drop in the inching clutch, which reduces truck speed independent of engine speed.

For correct inching operation the controller needs to have the exact sensor tension values entered for the inch pedal positions “completely released” and “completely depressed”. The controller assumes that the pedal position “completely released” will correspond with a value between 0.8 and 0.9 Volt and the position “completely depressed” will correspond with a value between 3.7 and 3.9 volt. The actual resistance values are entered during the calibration procedure. The controller generates a fault code when the actual value falls outside of the accepted range.

Inch pedal calibration is required when a new controller is installed, or when inching sensor adjustment has been changed. If the inch pedal is not calibrated, the truck will not move and a fault code is shown on the LCD display.

DRIVE AXLE COMPONENTS

Planetary Gear Assembly



HM070639

- | | | |
|-------------------------|----------------------------|-----------------------------|
| 1. PLANETARY HOUSING | 16. LOCKING PIN | 31. HEXAGON NUT |
| 2. O-RING | 17. NEEDLE BEARING | 32. TAPERED ROLLER BEARING |
| 3. HEXAGON SOCKET SCREW | 18. THRUST WASHER | 33. SPACER RING |
| 4. PLUG SCREW | 19. O-RING | 34. RING |
| 5. SEALING RING | 20. RING GEAR | 35. RADIAL SEAL RING |
| 6. PLUG SCREW | 21. HEXAGON SCREW | 36. RADIAL SEAL RING |
| 7. SEALING RING | 22. RETAINER | 37. FACE SEAL |
| 8. ADJUSTING SCREW | 23. WHEEL BEARING | 38. FACE SEAL |
| 9. SLOTTED NUT | 24. HEXAGON SOCKET SCREW | 39. WET MULTIPLE DISK BRAKE |
| 10. CIRCLIP | 25. RING GEAR CARRIER | 40. HEXAGON SOCKET SCREW |
| 11. SUN GEAR | 26. TAPERED ROLLER BEARING | 41. AXLE SHAFT |
| 12. THRUST RING | 27. WHEEL HUB | 42. AXLE HOUSING |
| 13. PLANETARY GEAR | 28. WHEEL STUD | 43. PLUG SCREW |
| 14. THRUST WASHER | 29. WHEEL NUT | 44. SEALING RING |
| 15. PLANETARY PIN | 30. DISK | 45. BREATHER |

Figure 24. Planetary Gear Assembly

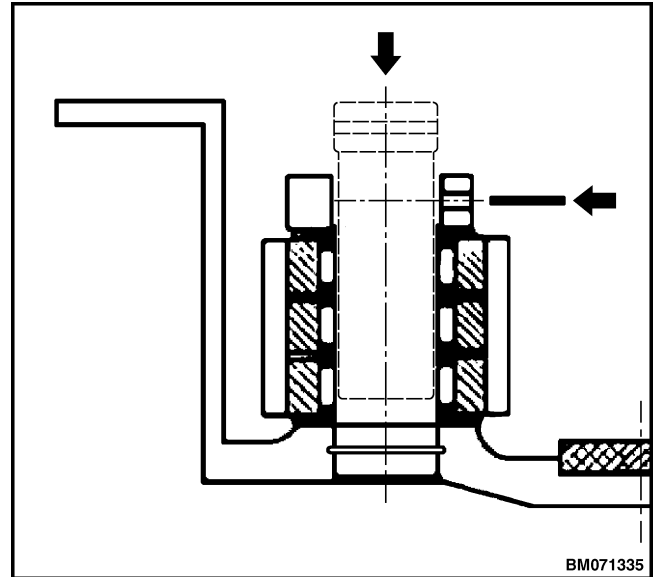
STEP 5.

Grease the new O-ring and insert it in the groove of the planetary housing.

Align the hole in the planetary pin with the drill-hole in the housing.

Press in the planetary pin in the direction of the arrow.

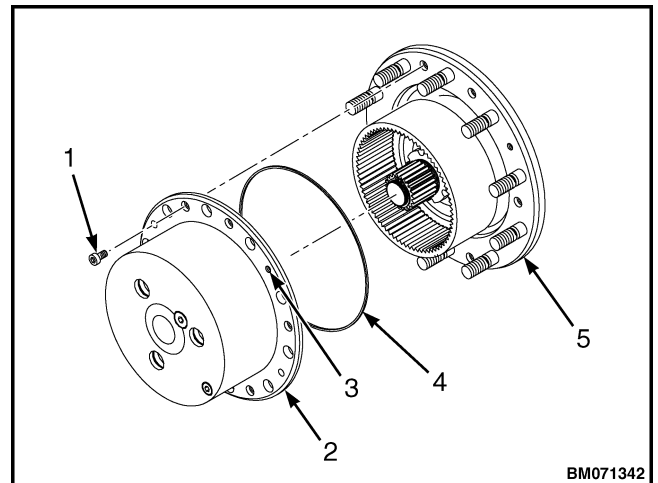
Lock the planetary pin with the locking pin. Press in the locking pin until it is flush with the housing.

**STEP 6.**

Remove the three screws that retain the planetary housing to the wheel hub. Insert two bolts in the threaded holes, to separate the planetary housing from the wheel hub. Take the O-ring out of the planetary housing and discard the O-ring.

Insert a new O-ring in the groove of the planetary housing. Align the planetary housing with the relevant drill holes in the wheel hub. Push the prepared planetary unit over the wheel studs.

Refill the Planetary Gear Assembly with oil. See Oil Drain and Refill Procedures.



1. HEXAGON SOCKET SCREW
2. PLANETARY HOUSING
3. THREADED HOLE
4. O-RING
5. WHEEL HUB

 **WARNING**

Use caution when using lifting devices. When using a lifting strap, inspect the strap for damage before use. **DO NOT** use a lifting strap to shock load or drop load a component. Serious personal injury and damage to components may occur.

 **CAUTION**

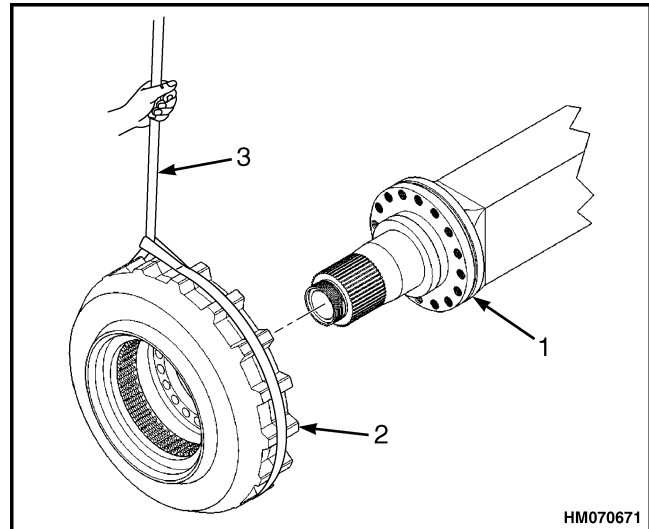
DO NOT damage the spindle when installing the brake assembly.

STEP 3.

Using a lifting device, support the brake assembly. Make sure the lifting device has the rated capacity to lift the brake assembly.

NOTE: Observe the correct position of the connections! (The position was marked during disassembly.)

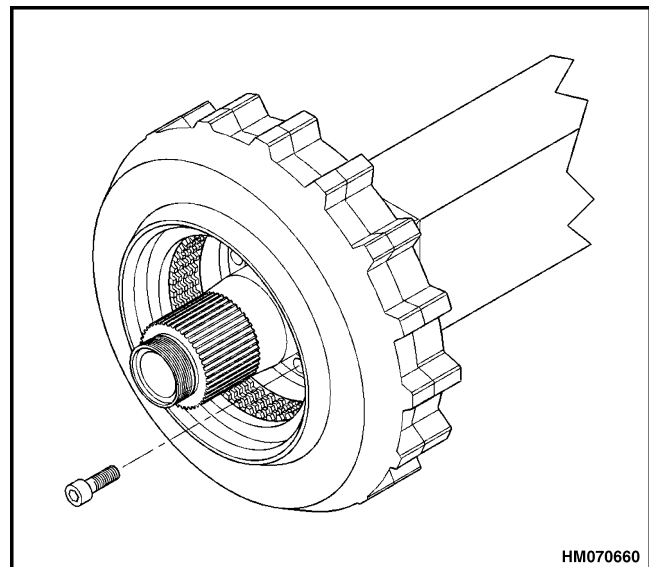
Lift the brake assembly onto the axle spindle not damaging the spindle axle threads.

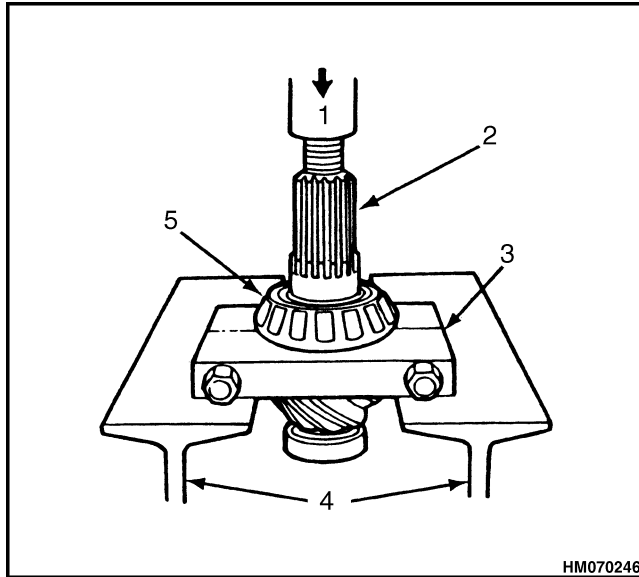


1. SPINDLE
2. BRAKE ASSEMBLY
3. LIFTING DEVICE

STEP 4.

Align the screw holes and install the capscrews. Tighten the capscrews to 310 N•m (228.6 lbf ft).

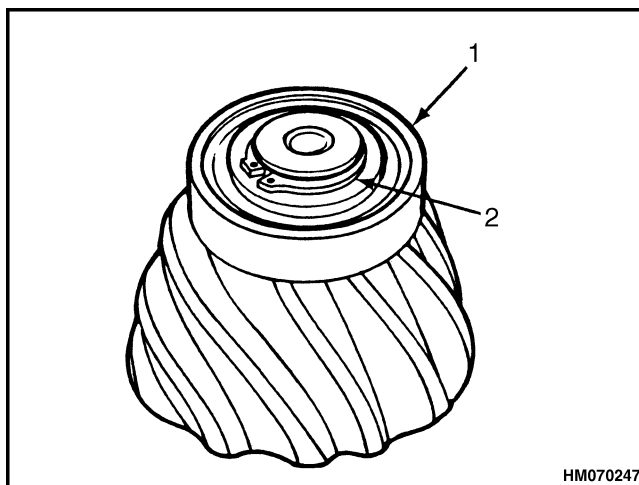




1. PRESS
2. DRIVE PINION
3. BEARING PULLER
4. SUPPORTS
5. INNER BEARING CONE

Figure 50. Inner Pinion Bearing Cone Removal

7. If the nose bearing needs to be replaced, remove the snap ring from the end of the drive pinion. Place the drive pinion in a vise. Install a soft metal cover over each vise jaw to protect the drive pinion. See Figure 51.

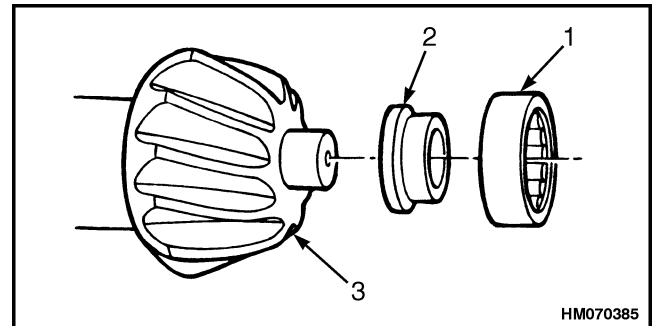


1. NOSE BEARING
2. SNAP RING

Figure 51. Snap Ring Removal

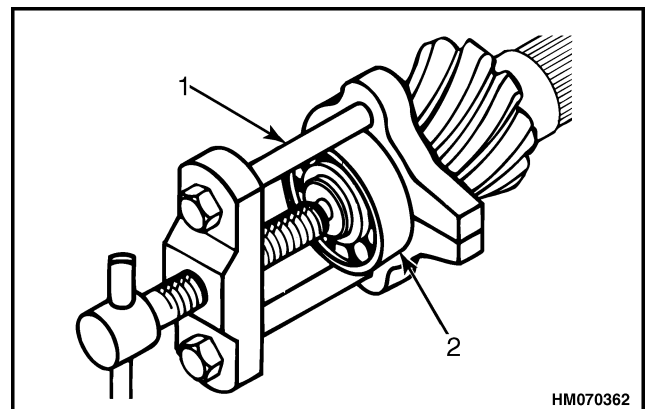
NOTE: Some nose bearings are a two-piece assembly. Remove the inner race from the pinion with a bearing puller. Remove the outer race/roller assembly from the pinion carrier with a drift or a press. See Figure 52.

8. Remove the nose bearing from the drive pinion with a bearing puller. See Figure 53.



1. OUTER RACE AND ROLLER ASSEMBLY
2. INNER RACE
3. DRIVE PINION

Figure 52. Two-Piece Nose Bearing



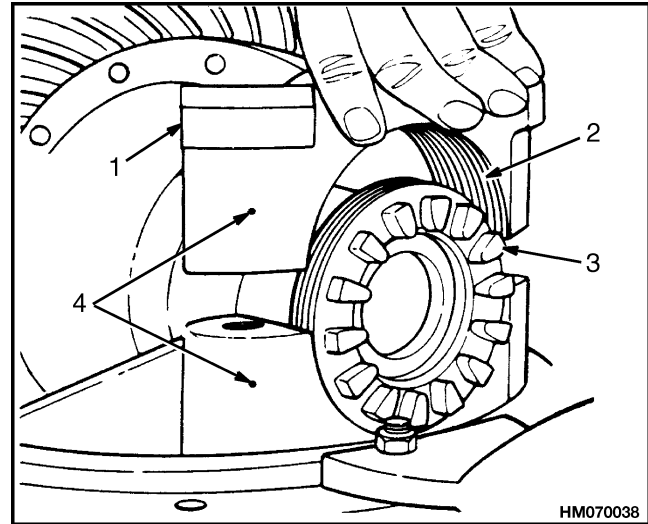
1. BEARING PULLER
2. NOSE BEARING

Figure 53. Nose Bearing Removal

**WARNING**

Use caution when using lifting devices. When using a lifting strap, inspect the strap for damage before use. **DO NOT** use a lifting strap to shock load or drop load a component. Serious personal injury and damage to components may occur.

5. Use a lifting device that has the capacity to lift the weight of the differential assembly and install the assembly into the differential carrier. The bearing cups must be flat against the bores between the differential carrier legs. See Figure 78.
6. Install both bearing adjustment rings into position between the differential carrier legs. Turn each adjustment ring until hand tight against the bearing cups. See Figure 79.
7. Install the bearing caps over the bearings and adjustment rings in the correct location as marked before removal.



1. BEARING CAP
2. BEARING BORE
3. ADJUSTMENT RING
4. ALIGNMENT MARKS

Figure 79. Bearing Caps Installation

Parking Brake Caliper Pads

Remove

1. Place the lift truck on a solid, level surface.
2. Place blocks in front of and behind the tires to prevent movement of the lift truck.
3. Raise (side tilt) the cab to the fully open position to gain access to the parking brake. Refer to the manual **Operator's Cab** 0100YRM2151 .
4. Remove the screw cap from the pressure ring.
5. Loosen the lock nut.
6. Turn the adjustment screw counterclockwise until the parking brake is released.
7. Use a screwdriver to push the parking brake pads away from the parking brake disc to create clearance for the new parking brake caliper pads.

NOTE: Only one guide bolt needs to be removed to replace the parking brake caliper pads.

8. Remove the cotter pin that retains the castle nut in place on the guide bolt.
9. Remove the castle nut from the guide bolt.
10. Remove the guide bolt from the parking brake and parking brake bracket.
11. Remove the parking brake caliper pads from the parking brake in the same direction that the guide bolt was removed.

Install

1. Install the new parking brake caliper pads to the parking brake.
2. Install the guide bolt that retains the parking brake caliper pads to the parking brake.
3. Install the castle nut to the guide bolt.
4. Install the cotter pin that retains the castle nut to the guide bolt.

5. Lower the cab until it is in the fully lowered and latched position. Refer to the manual **Operator's Cab** 0100YRM2151 .
6. Adjust the parking brake. Refer to the section Parking Brake Pads Adjustment.
7. Operate the parking brake and check for leaks.

DRIVE AXLE CHECKS AND ADJUSTMENTS

Oil Drain and Refill Procedures

Differential

Drain

1. Make sure the drive axle and the brake housings are in a level position.
2. Turn the wheel ends with the drain plugs or the drain/fill plugs to the lowest position.
3. Place a suitable container under the magnetic drain plug of the axle housing and remove the magnetic drain plug to drain the gear oil from the axle housing. See Figure 96.
4. Clean and install the magnetic drain plug into the bottom of the axle housing and tighten to 60 N•m (44 lbf ft).

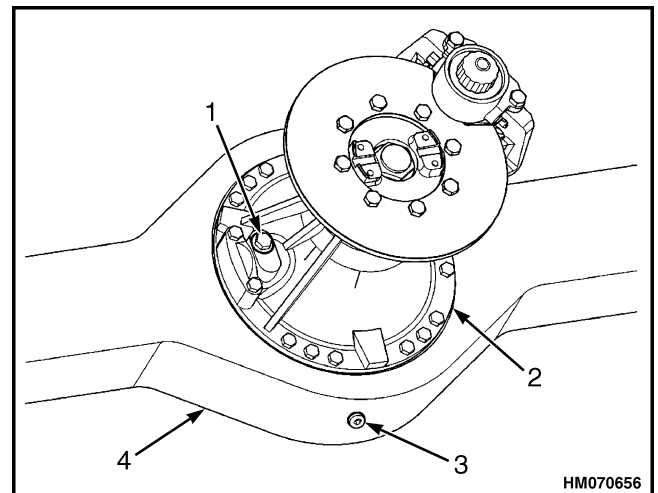


Figure 96. Differential Fill and Drain Plugs

NOTE: The hub assembly for this truck model weighs 58 to 63 kg (128 to 139 lb). Use a lifting device when installing the hub assembly on the spindle.

3. Use a lifting device to position the hub on the spindle.
4. Install the outer bearing cone, washer and castle nut
5. Install washer and castle nut. Tighten castle nut to 203 N•m (150 lbf ft) while rotating wheel hub in both directions to properly seat the bearings. Loosen castle until wheel hub turns freely with no end play.
6. Tighten castle nut to 34 N•m (25 lbf ft) and lock in place, with cotter pin, at first alignment position that occurs at or above 34 N•m (25 lbf ft). If cotter pin cannot be installed tighten castle nut to first alignment position where the cotter pin can be installed.
7. Completely fill hub cap with grease and install in hub.



WARNING

Add air to the tires only in a safety cage. Inspect safety cage for damage before use. When adding air, use a clip on chuck with enough hose to let the operator stand clear of the cage.

8. Install wheel on hub. Be careful not to damage threads on studs.
9. Start with wheel nut at the top and tighten nuts to 65 to 130 N•m (48 to 96 lbf ft) in sequence shown. Make sure there is no dirt between wheel and hub. The wheel must fit over the pilot surface and be tight against the hub. Tighten nuts to 615 to 710 N•m (454 to 524 lbf ft). See Figure 103.

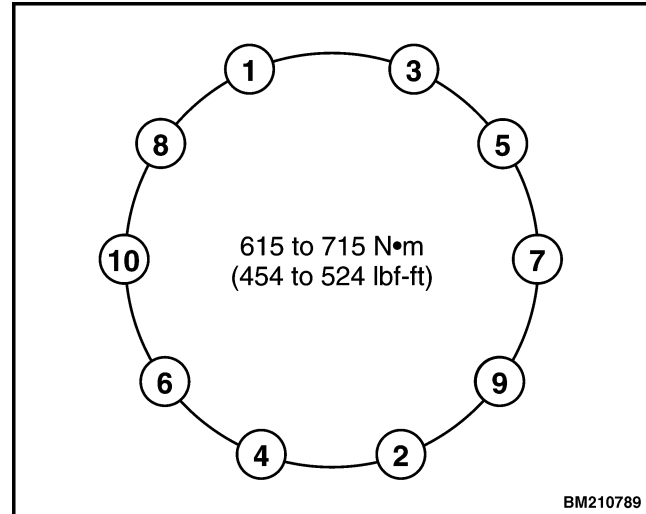


Figure 103. Wheel Nut Tightening Sequence

Spindle

Remove

1. Remove wheel, tie rod and hub as described in Wheel, Remove, Tie Rod, Remove and Wheel Hub, Remove.
2. Remove three cap screws, three washers, grease plate and O-ring from upper steering frame. Discard O-ring.
3. Remove three cap screws and three washers from bearing cap and shims located on the lower steering frame. See Figure 101 If necessary, remove bearing cup from bearing cap. See Figure 104.

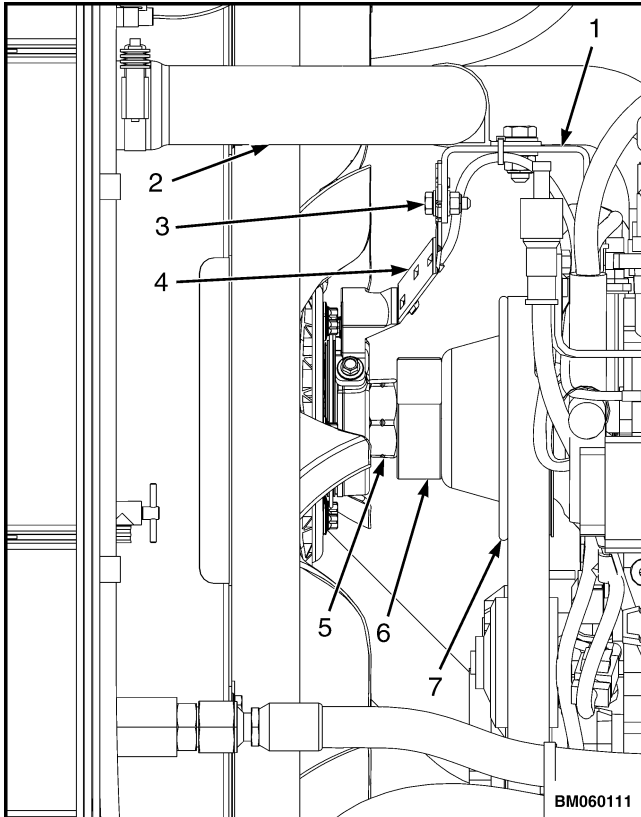
NOTE: The spindle weighs 26.7 kg (58.9 lb) Use a lifting device when removing or installing the spindle.

4. Tilt spindle and lift spindle from axle.

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This section is for the following models:



1. SUPPORT BRACKET
2. ENGINE CORE SUPPLY HOSE
3. BRACKET BOLT
4. ANTI-ROTATION BRACKET
5. HEXAGON NUT
6. FAN ADAPTER
7. FAN PULLEY

Figure 9. Fan Clutch Assembly (Tier 4F/Stage IV only)

BELT TENSIONER

Inspect

1. Look for signs of slippage at the alternator pulley.
2. Put a spanner on the nut at the alternator pulley and try to rotate the alternator clockwise.
If the alternator pulley slips, judge whether the spring force of the belt tensioner is still sufficient.
3. Use a tool to pivot the belt tensioner counterclockwise.
4. Remove the belt from the water pump pulley and tensioner pulley.

Inspect the tensioner pulley for play and smooth rotation.

Inspect the pivot of the tensioner for play.

5. Install a new tensioner if it fails the inspection for the spring, pulley, or pivot.

Remove

1. Remove the drive belt. See Drive Belt.
2. Remove the mounting bolt for the tensioner, and the tensioner.

Install

1. Install the tensioner and lock it in position on the engine block.
2. Install the capscrew and tighten to 43 N•m (32 lbf ft).
3. Install the drive belt. See Drive Belt.

WATER PUMP

Inspect

1. Pivot the belt tensioner counterclockwise to release the tension in the drive belt, and remove the belt.
2. Perform the following checks:
 - Pressurize the cooling system and verify if the water pump leaks at the weep hole. An existing droplet at the weep hole is acceptable. Continuously escaping droplets are not acceptable. See Figure 10.
 - Rotate the water pump pulley and verify its smooth rotation.
 - Establish that the water pump bearings have no play.
3. Replace the water pump if it fails any of the above tests. The water pump is serviced as an assembly only.
4. Re-install the drive belt if the pump still functions properly. See Drive Belt.

Remove

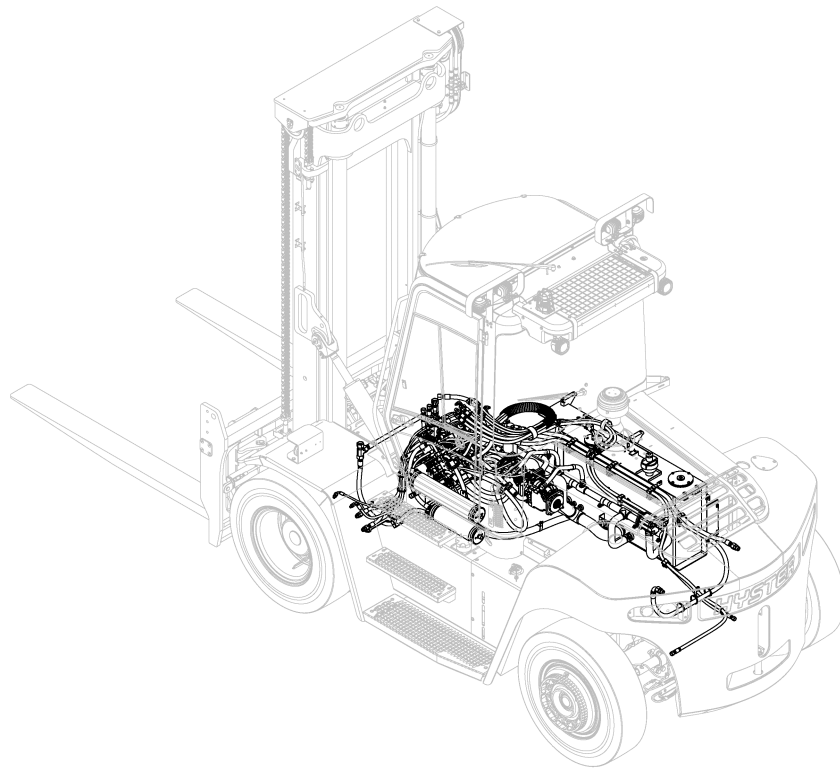
1. Drain the engine cooling system. See Draining the Engine Cooling System.
2. Remove the drive belt. See Drive Belt.

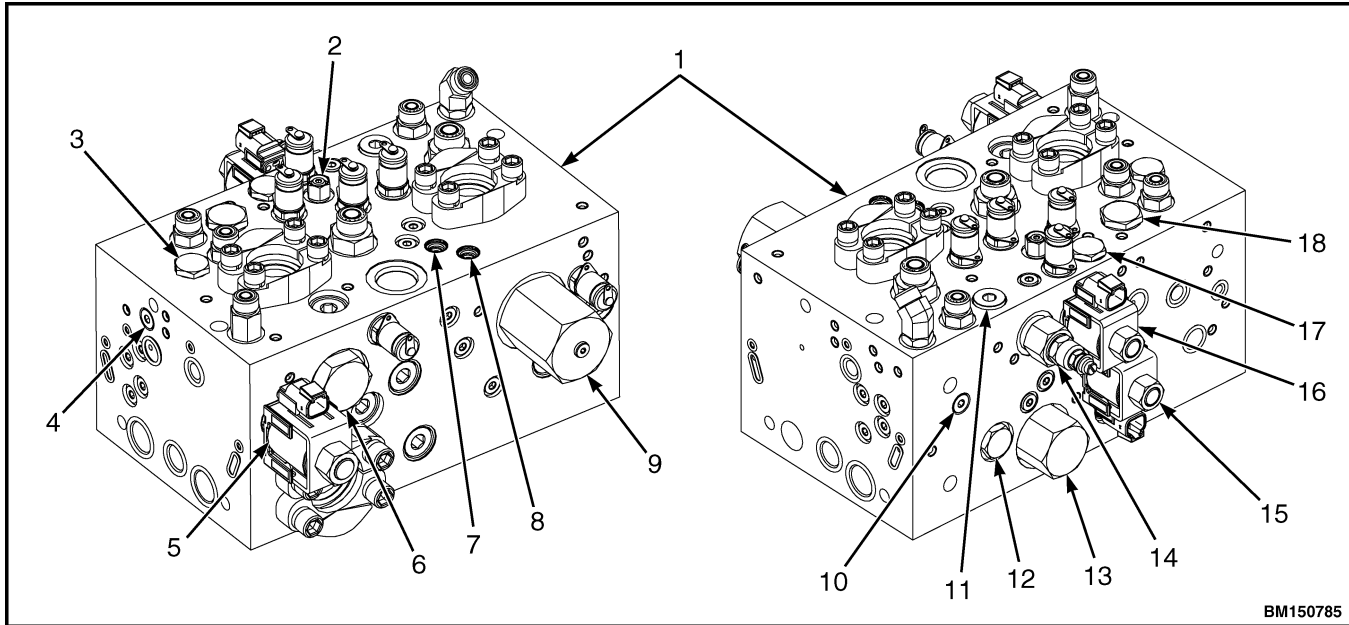


Maintenance

HYDRAULICS

SERVICE MANUAL





1. MAIN CONTROL VALVE MID SECTION
2. SCREEN CARTRIDGE (O)
3. SHUTTLE VALVE (M)
4. ORIFICE (P)
5. 2ND PUMP CONTROL VALVE (E)
6. CHECK VALVE (I)
7. LOAD SENSE RELIEF VALVE (H)
8. FULL FLOW RELIEF VALVE (C) (RELIEF SPOOL)
9. PRIORITY VALVE (A)
10. ORIFICE (R)
11. CHECK VALVE (Q)
12. PILOT PRESSURE REDUCER VALVE (F)
13. CHECK VALVE (K)
14. FULL FLOW RELIEF VALVE (G) (PILOT VALVE)
15. TRANSMISSION CALIBRATION VALVE (D)
16. EMERGENCY PILOT PRESSURE VALVE (B)
17. LOGIC VALVE (N)
18. SHUTTLE VALVE (L)

Figure 3. Component Location for Removal and Repair

Install

1. Position the carriage valve assembly onto the carriage and align mounting points.
2. Install and hand tighten the three cap screws and washers. Torque to 20 N•m (15 lbf ft).

1. Place the lift truck on a solid, level surface.
2. Tilt the mast to the maximum forward position.
3. Raise the cab to the fully open position to gain access to the tilt lock manifold with counterbalance valves.

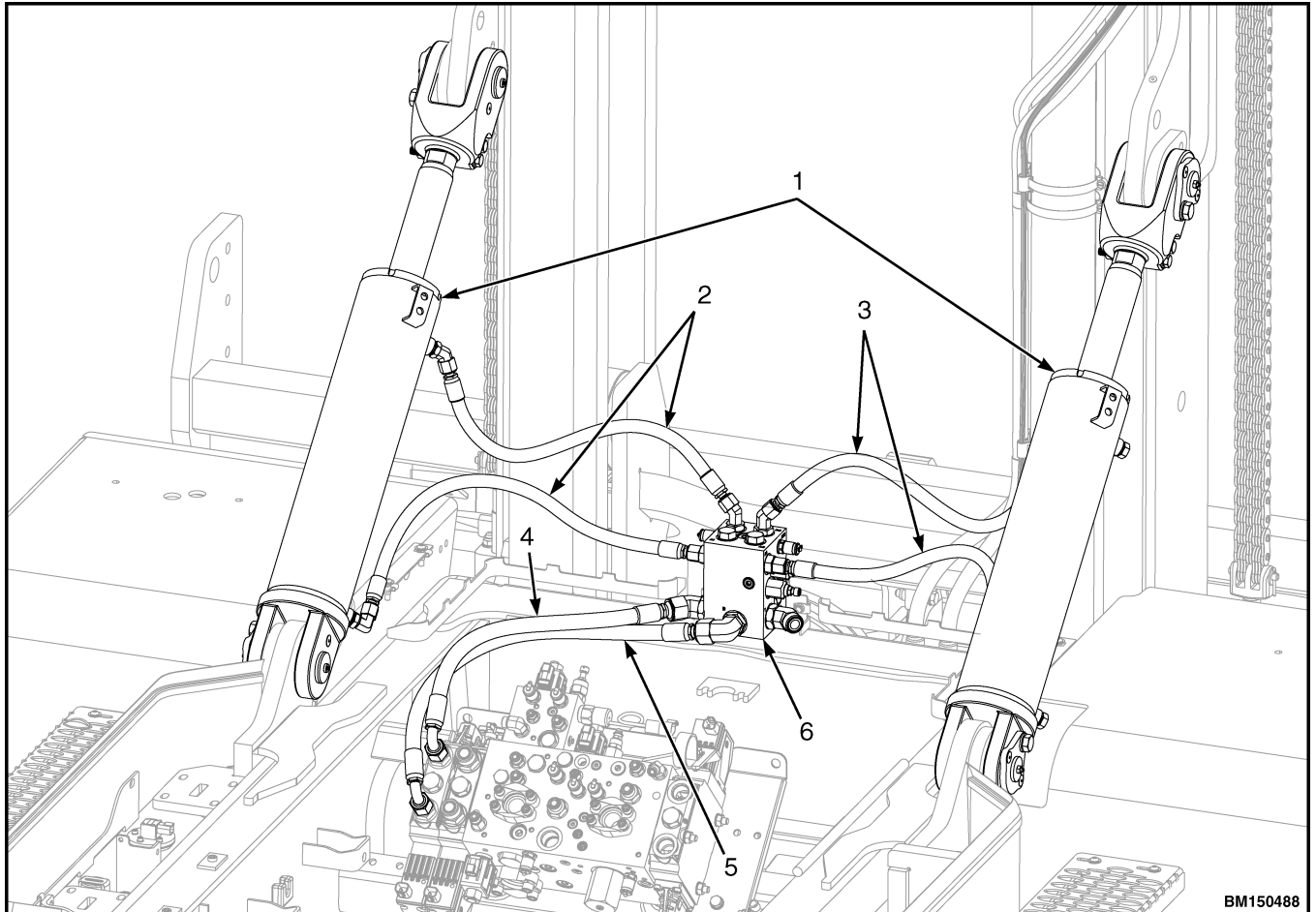
TILT LOCK VALVE**Remove****WARNING**

Make sure the carriage is lowered before disconnecting any parts of the hydraulic system.

**WARNING**

Relieve the trapped or stored hydraulic pressure from the hydraulic system, or serious personal injury may occur.

4. Use a drain pan to collect oil from the disconnected hoses. See Figure 18.



- | | |
|-------------------------------|--------------------------------|
| 1. TILT CYLINDERS | 4. PORT A HOSE - TILT FORWARD |
| 2. HYDRAULIC HOSES LEFT SIDE | 5. PORT B HOSE - TILT BACKWARD |
| 3. HYDRAULIC HOSES RIGHT SIDE | 6. TILT LOCK VALVE ASSEMBLY |

Figure 18. Tilt Lock Valve Assembly

Assemble and Install**CAUTION**

DO NOT damage the seals, O-rings, wipers, or backup rings during installation.

NOTE: Always use new seals, O-rings, rod wipers, wear rings, and backup rings. Make sure all parts are clean.

1. Lubricate the piston seal and two guide rings with clean hydraulic oil and install onto the piston. See Figure 28.
2. Lubricate the seals, wipers, O-rings, and backup rings with clean hydraulic oil and install onto the end caps.

**CAUTION**

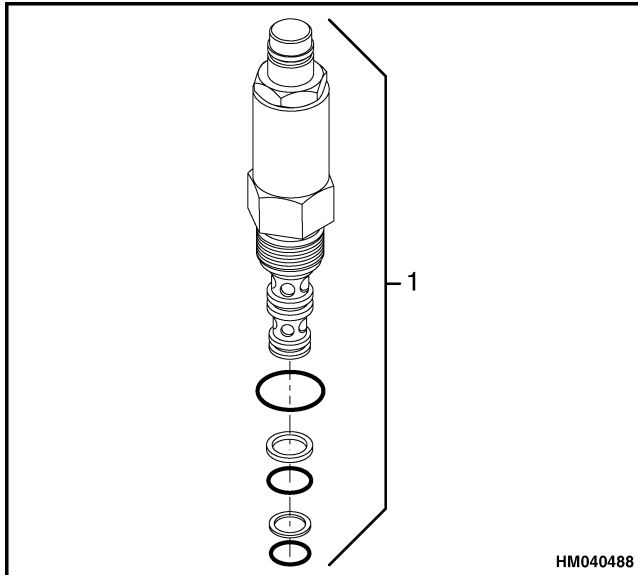
Use caution when installing the piston rod into the cylinder shell or damage to the cylinder shell may occur.

3. Slide piston rod into cylinder shell. Keep piston rod in center of cylinder shell during installation.
4. Slide end caps over piston rod, into cylinder shell. Slide other end cap over piston rod and into cylinder shell.

5. Install steering cylinder to steering axle frame and install washers and cap screw. Tighten cap screws to 435 N•m (321 lbf ft).
6. Remove plastic caps from fittings on steering cylinder at end caps. Also remove plugs from hydraulic hoses.
7. Connect hydraulic hoses to steering cylinder.
8. Rotate the tie rods with seals and spacers to align with the steering cylinder tie rod pin holes.
9. Install tie rod pins with grease fitting facing downward, install anchor pins and secure with cap screws. Tighten cap screws to 30 N•m (22 lbf ft).
10. Start engine, and operate steering system to remove air from steering cylinder and system. Turn steering wheel several times from one wheel stop to the other wheel stop.
11. Shut down the engine and visually check for signs of hydraulic leaks.

STEERING SYSTEM TORQUE SPECIFICATIONS

| Steering Control Unit | |
|---------------------------------------|------------------------------------|
| Capscrews, Cover (Final Torque Value) | 30 N•m (265 lbf in) |
| Capscrews, Manifold Block | 40 N•m (30 lbf ft) |
| Steering Axle | |
| Capscrews, Bearing Cap | 77 N•m (56.8 lbf ft) |
| Castle Nut (Final Torque Value) | 3 N•m (25 lbf in) |
| Capscrews, Steer Axle Mount | 270 N•m (199 lbf ft) |
| Wheel Nuts | |
| Drive Wheels (Final Torque Value) | 615 to 710 N•m (454 to 524 lbf ft) |
| Steer Wheels (Final Torque Value) | 615 to 710 N•m (454 to 524 lbf ft) |
| Steering Cylinder | |
| Capscrews, Steer Cylinder Mount | 435 N•m (321 lbf ft) |



1. UNLOADING VALVE

Figure 39. Unloading Valve (B)

Assemble

NOTE: Always use new seals.

1. Install a new seal kit on the unloading valve (B). See Figure 39.



CAUTION

DO NOT exceed the maximum torque when tightening the unloading valve (B) as damage can occur.

2. Install the unloading valve (B) into the brake control manifold. Tighten the unloading valve (B) to 41 to 47 N•m (30 to 35 lbf ft).

Screen

Disassemble

1. Remove the Screen cartridge from the mid inlet. Visually inspect the screen for damage and/or contamination.

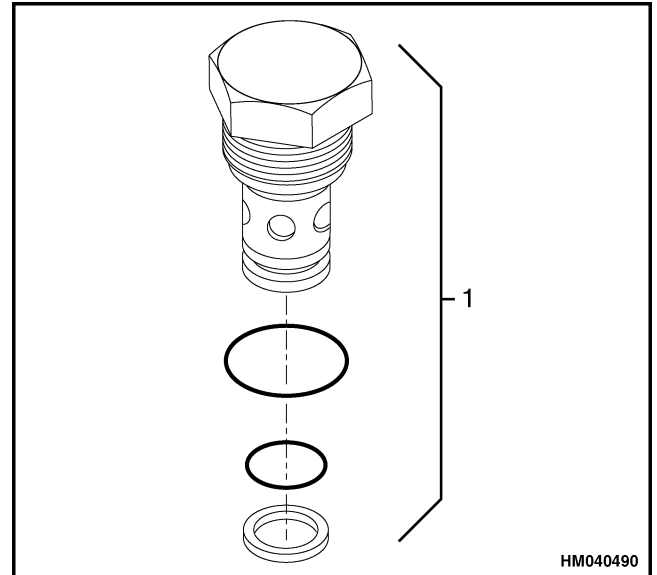
Assemble

1. Clean the screen or replace it.

Check Valve (E)

Disassemble

1. Remove the check valve (E) from the brake control manifold. See Figure 38.
2. Remove the seals from the check valve (E). See Figure 40.



1. CHECK VALVE

Figure 40. Check Valve (E)

Assemble

NOTE: Always use new seals.

1. Install a new seal kit on the check valve (E). See Figure 40.



CAUTION

DO NOT exceed the maximum torque when tightening the check valve, as damage can occur.

2. Install the check valve into the brake control manifold. Tighten the check valve to 27 to 34 N•m (20 to 25 lbf ft).

6. Remove gland from piston rod.
7. Remove and discard piston seal from piston.
8. Remove and discard wiper, seal, back-up ring and O-ring from gland.

Clean and Inspect



WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety precautions.

1. Clean all parts in a cleaning solvent and dry them with compressed air.
2. Inspect parts of cylinder for damage, rust, or wear. Inspect rod surface closely to make sure it is free of dents and scratches.
3. Make sure that internal stroke surface of cylinder shell and grooves for seals do not show any nicks, scratches, or other damage.
4. Replace parts as needed.

Assemble

1. Place O-rings and seals in hydraulic oil.
2. Install wiper, seal, back-up ring and O-ring to gland.
3. Install seal to piston.
4. Lubricate piston rod with hydraulic oil and install gland onto piston rod.
5. Install spacer onto piston rod.
6. Install piston onto piston rod.
7. Install piston end onto piston rod.
8. Apply thread lock to the locking bolt and install the bolt in the rod.
9. Tighten locking bolt to 100 N•m (73.8 lbf ft).



CAUTION

Keep the piston rod aligned with the center line of the cylinder shell during installation to prevent damage to the parts.

10. Carefully slide piston rod and gland into cylinder shell.
11. Insert a pin face spanner into holes of gland and install gland into cylinder shell. Tighten gland to 300 N•m (221.5 lbf ft).

Tilt Cylinders

Disassemble

1. Put tilt cylinder in a vise with soft jaws, in a horizontal position.
2. Disassemble and remove rod end by removing two locking bolts/nuts. See Figure 48.
3. Loosen gland from shell.



CAUTION

Be careful not to damage the smooth surface of the piston rod when removing the piston rod from the cylinder shell in a horizontal position (parallel to the cylinder shell).

4. Pull piston rod assembly with gland out of cylinder shell.



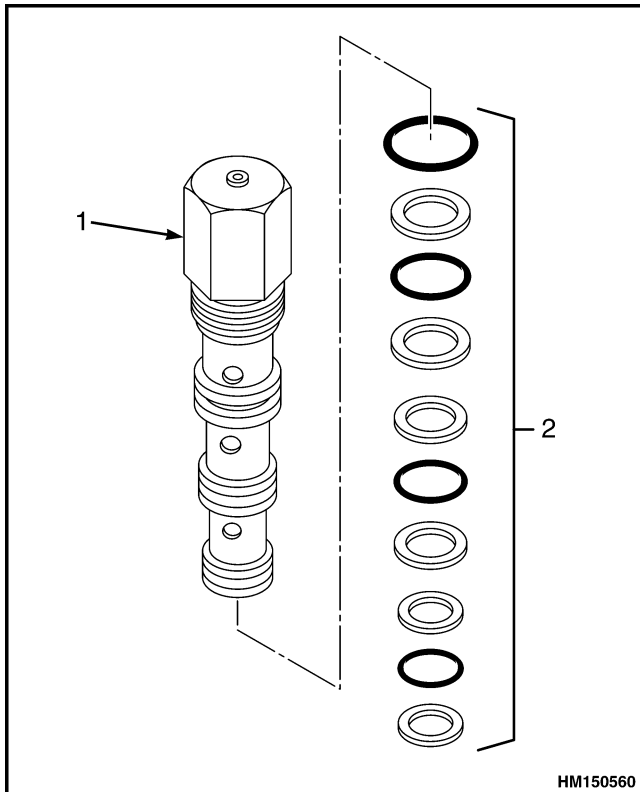
CAUTION


Be careful not to damage the grooves when removing seals, wipers, and wear rings.

5. DO NOT remove piston from rod unless there is a reason to replace seal between piston and rod.
6. Disassemble and remove all seals, wipers, and wear rings.

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 217 to 231 N•m (160 to 170 lbf ft)

1. PRIORITY VALVE (A)
2. O-RINGS

Figure 4. Priority Valve (A)

Inspect

1. Inspect Priority Valve (A) for damage or abnormal wear. If none is found, replace all O-rings. See Figure 4.

Component Functionality Test

With a clean, suitable tool, press the priority spool into the cartridge. If the priority spool moves smoothly against the spring, the Priority Valve is functioning properly and may be reinstalled.

Install

1. Reinstall Priority Valve (A) back into the Main Control Valve. Tighten by hand.
2. Torque Priority Valve (A) to 217 to 231 N•m (160 to 170 lbf ft).

CHECK VALVE (K)

Remove

1. Remove Check Valve (K) from the Main Control Valve Mid Section. See Figure 3.

Clean

1. Clean Check Valve (K) remove all old O-rings. See Figure 5.

Inspect

1. Inspect Check Valve (K) for damage or abnormal wear. If none is present, replace all O-rings. See Figure 5.

Component Functionality Test

With a clean, suitable tool, press the spool into the cartridge. If the spool moves smoothly against the spring and no visual damages are shown on the spool and seat, the Check Valve is functioning properly and may be reinstalled.

Install

1. Reinstall Check Valve (K) back into the Main Control Valve. Tighten by hand.
2. Torque Check Valve (K) to 27 to 34 N•m (20 to 25 lbf ft).

CHECK VALVE (I)

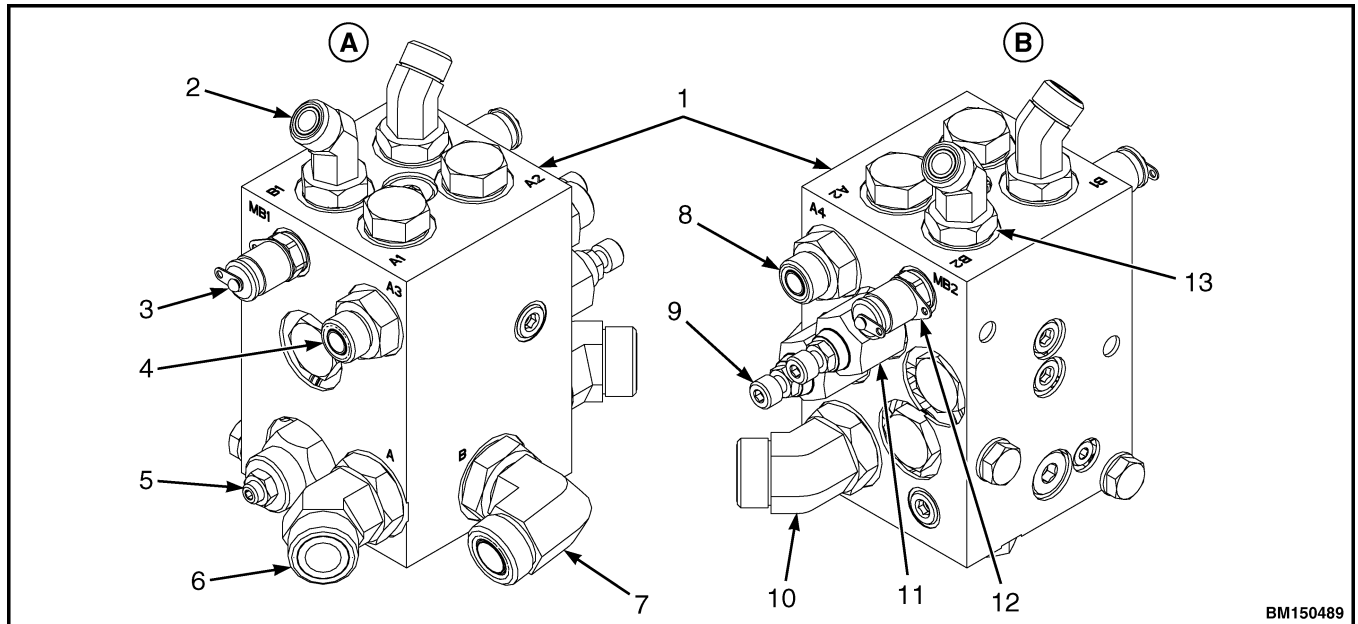
Remove

1. Remove Check Valve (I) from the Main Control Valve Mid Section. See Figure 3.

Clean

1. Remove the old O-rings and clean the valve with a petroleum based solvent. See Figure 5.

- Remove the tilt lock valve from the frame.



- | | |
|--|---|
| <ol style="list-style-type: none"> TILT LOCK VALVE PORT B1, TO ROD SIDE LH CYLINDER CHECK VALVE (NON-RETURN VALVE) PORT A3, TO PISTON SIDE LH CYLINDER 30 MPA COUNTERBALANCE VALVE PORT A, TILT FORWARD PORT B, TILT BACKWARD | <ol style="list-style-type: none"> PORT A4, TO PISTON SIDE RH CYLINDER 19 MPA PRESSURE RELIEF VALVE PORT T, RETURN TO TANK 19 MPA PRESSURE RELIEF VALVE CHECK VALVE (NON-RETURN VALVE) PORT B2, TO ROD SIDE RH CYLINDER |
|--|---|

Figure 19. Tilt Lock Valve Connections

Clean

Make sure to remove all old O-rings. Clean the ports from where the valves were removed.

Inspect

Inspect the threads and valves for damage and abnormal wear.

Assemble

Replace O-rings on the valve.

Install

- Reinstall the tilt lock valve on the bracket.

NOTE: Maximum tilt speed is available at idle, it is NOT necessary to increase engine RPM to achieve maximum tilt speed.

- Start the lift truck and operate the tilt function check for leaks.

- Switch the engine OFF and check the oil level in the hydraulic tank. If necessary top off the hydraulic tank with clean hydraulic oil as specified in the maintenance tables of the **Periodic Maintenance** 8000YRM2147 .

LOWERING CONTROL VALVE

Remove

- Place the lift truck on a solid, level surface.
- Tilt the mast to the maximum forward position.
- Lower the mast completely.
- Place drain pan underneath the hoses you will be disconnecting from the lift cylinders.
- Remove the main hose from the bottom of the lift cylinder.

6. Operate the brake treadle valve and check for leaks.

BRAKE SYSTEM ACCUMULATOR

Remove

1. Place the lift truck on a solid, level surface.
2. Apply the parking brake.
3. Lower the carriage until the lift cylinders are approximately 25 cm (10 in.) before the completely retracted position.
4. Tilt the mast to the maximum forward position.
5. Shut down the engine.
6. Place blocks in front of and behind the tires to prevent movement of the lift truck.
7. Turn the key switch to the **ON** position.
8. Operate the tilt function backward to remove the hydraulic pressure from the tilt system.



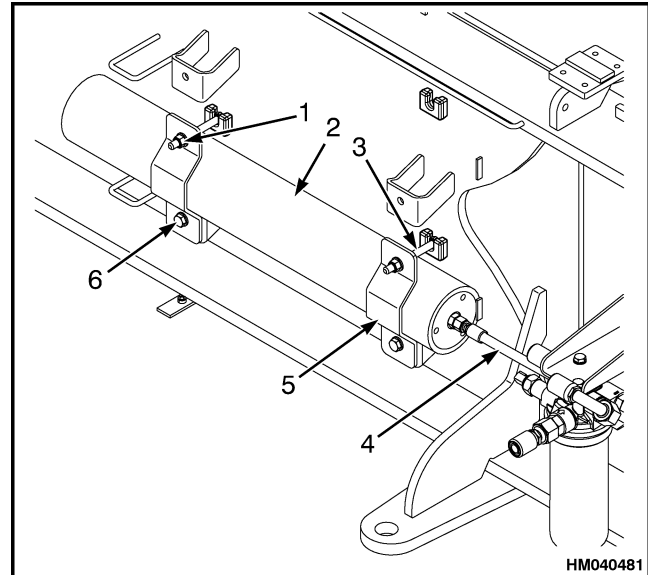
WARNING

Step 8, Step 9, and Step 10 must be performed to relieve the trapped or stored hydraulic pressure from the hydraulic system, or serious personal injury may occur.

9. Push brake pedal fully down until pedal resistance is gone.
10. Open the emergency lowering valve and operate the lowering function to remove the hydraulic pressure from the lift system. Make sure the lift cylinders are completely retracted.
11. Turn the key switch to the **OFF** position.
12. Raise (side tilt) the cab to the fully open position to gain access to the brake accumulator. Refer to the manual **Operators Cab** 0100YRM2151 .

NOTE: Slowly disconnect the hydraulic hose to release any hydraulic pressure.

13. Tag and disconnect the hydraulic hose from the accumulator located at the left inside of the frame. See Figure 30.



1. NUT
2. ACCUMULATOR
3. CAPSCREW
4. HYDRAULIC HOSE
5. BRACKET
6. CAPSCREW

Figure 30. Accumulator

14. Place a cap on the hydraulic hose and the open port of the accumulator.
15. Loosen the capscrews and nuts that retain the two brackets to the frame. See Figure 30.
16. Remove the accumulator from the frame.

Gas Filling Procedure

1. Close the bleed valve on the gauge assembly. See Figure 31.

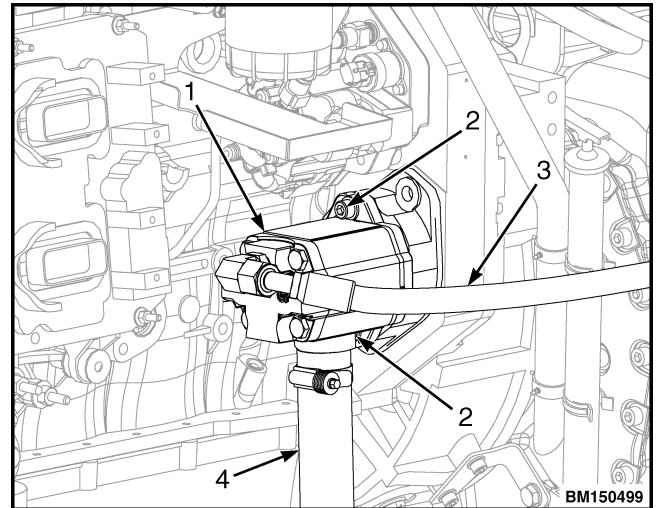
**CAUTION**

DO NOT exceed the maximum torque when tightening the park brake selector valve coil nut, as damage can occur.

3. Install the park brake selector valve coil and nut. Tighten the nut to 4 to 6 N•m (35 to 53 lbf in).

Install

1. Install the two capscrews that retain the brake control manifold to the main control valve.
2. Connect the three hydraulic hoses to the brake control manifold, according to the identification tags. Refer to the section Brake System Torque Specifications for the correct torque procedure.
3. Connect the electrical connector to the low pressure brake switch.
4. Lower the cab until it is in the fully lowered and latched position. Refer to the manual **Operators Cab 0100YRM2151** .
5. Apply the parking brake several times.
6. Make sure the parking brake functions properly.
7. If necessary, bleed the parking brake. Refer to the section Parking Brake Bleed.

GEAR PUMP**Remove**

1. HYDRAULIC OIL COOLING PUMP
2. CAP SCREW AND WASHER
3. OUTLET
4. INLET

Figure 43. Hydraulic Oil Cooling Pump

**WARNING**

Make sure the carriage is lowered before disconnecting any parts of the hydraulic system.

NOTE: Worn or damaged seals are the most common cause of pump failure. The pump bearings, gears, and shafts also wear. Many service persons do not repair a worn pump because the cost of repairs can be greater than the cost of a new pump. The seals can be replaced in the hydraulic pump. If the pump will be rebuilt, the following general procedures are for repairing gear pumps.

1. Remove the breather and install a plug instead. This action prevents too fast draining of the tank when the inlet line is disconnected.
2. Disconnect hoses from pump. Put caps on all fittings. Be careful so inlet hose is not damaged during removal.

**WARNING**

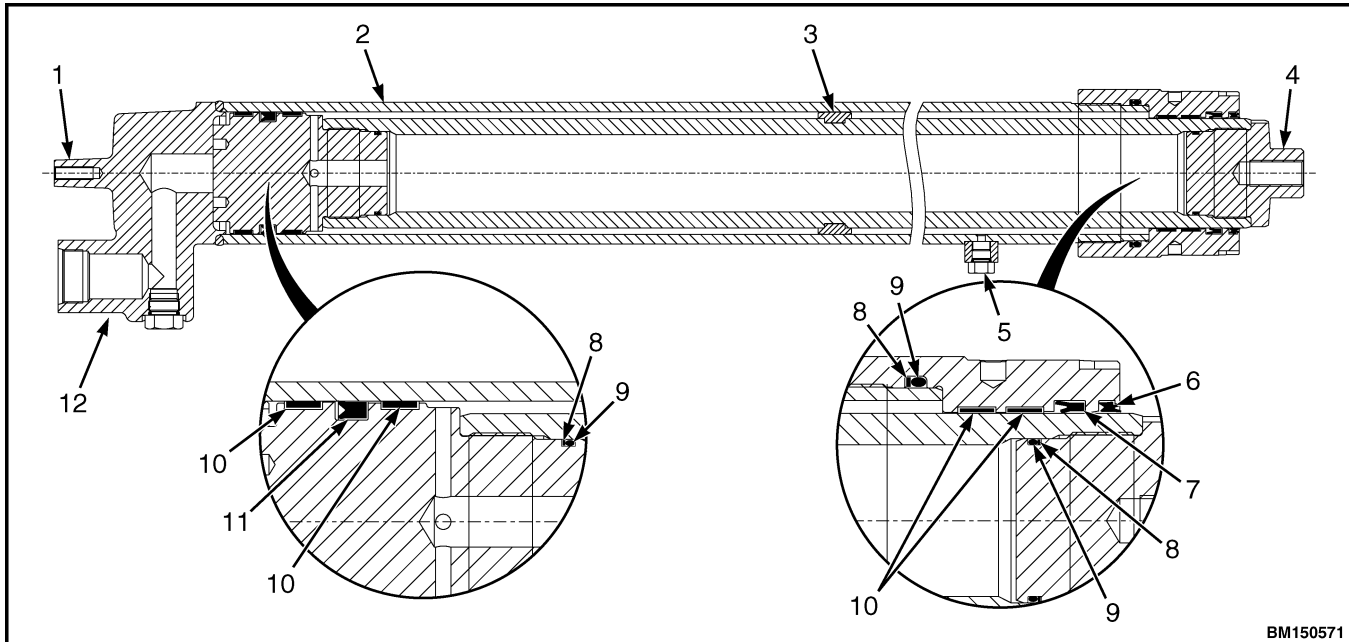
Some of the hydraulic pumps are very heavy. Use a lifting device when removing or installing the pump.

4. Push gland onto cylinder shell. Lubricate threads of cylinder shell with clean oil and tighten gland to 550 to 600 N•m (400 to 450 lbf ft).
5. Assemble rod end onto rod.
2. Use a tool to remove gland from cylinder shell. See Figure 49.

Lift Cylinders

Disassemble

1. Place lift cylinder on clean, horizontal surface.



- | | |
|-------------------------|---------------------------------|
| 1. PISTON END | 7. ROD SEAL |
| 2. CYLINDER SHELL | 8. O-RING |
| 3. STOP RING | 9. BACKUP RING |
| 4. ROD END | 10. WEAR BAND |
| 5. HYDRAULIC CONNECTION | 11. SEAL |
| 6. WIPER | 12. LOWERING CONTROL VALVE PORT |

Figure 49. Lift Cylinder Assembly

CAUTION

Keep the piston rod aligned in the center of the cylinder shell during removal to avoid damage to the cylinder parts.

3. Keep rod aligned with cylinder and pull piston rod out of cylinder shell.
4. Remove gland from piston rod. See Figure 49.

NOTE: Mark each seal and ring location and position to aid in assembly.

5. Remove wear band and seal from piston rod.
6. Remove O-ring, backup ring, wear band, rod seal, and wiper from gland.

Series Code / Model Designation Reference Table

This section is for the following models:

| Series Code | European Model | Americas Model |
|-------------|----------------|----------------|
| H876 | GDP80-120DC | GDP190-280DC |
| H877 | GDP130-160EC | GDP300-360EC |

General

The **Electric, Software and Controls** manual for H876/H877 trucks contains repair and replace procedures and checks and adjustments for the sections:

- **Electric**
- **Software**
- **Controls**

Section 1 - Electrical

GENERAL FAULT FINDING

This procedure is a guideline to facilitate fault finding in electrical circuits. The procedure is not suited for electronic circuits like CANbus, which requires specific knowledge and software. Fortunately, defective electric components and connections that are part of a CANbus circuit will generate a fault code in the controller. The fault code guide provides further detail about the defect. Always verify presence of fault codes.

Preparation

1. Have the Electrical Schematic available. See **Diagrams** 8000YRM2159 .
2. Identify the symptoms of the defect.
3. Establish how the relevant switches and levers should operate. See the **Operating Manual**.
4. Observe the condition of the truck. Look for signs of mechanical damage, overheating, unusual sounds, burn smells.

Define the Problem Area

1. Determine the schematic location of the failed function. See Table 17.

2. Establish which sections of the failed function operate correctly. Identify these sections on the schematic.

Identify Possible Causes of Malfunction

Make a list of every possible fault. Use your initial observations to help you writing down these faults.

Determine the Most Probable Cause

1. Prioritize each of the listed possible faults.
2. Perform a Fuse Check, a Wiring Check and a Component Check for each of the listed faults.

Fuse Check

- Determine which fuse protects the component in the failed circuit. See Table 17 to look up the related page of the schematic and find the fuse reference number.
- Investigate if an overload condition or a short circuit caused the fuse to fail. First make repairs to solve the short circuit or overload condition. See Wiring Check.
- Replace the fuse after the repair has been made. The actual location of the fuse is indicated on Figure 19.

Armrest Harness Connectors

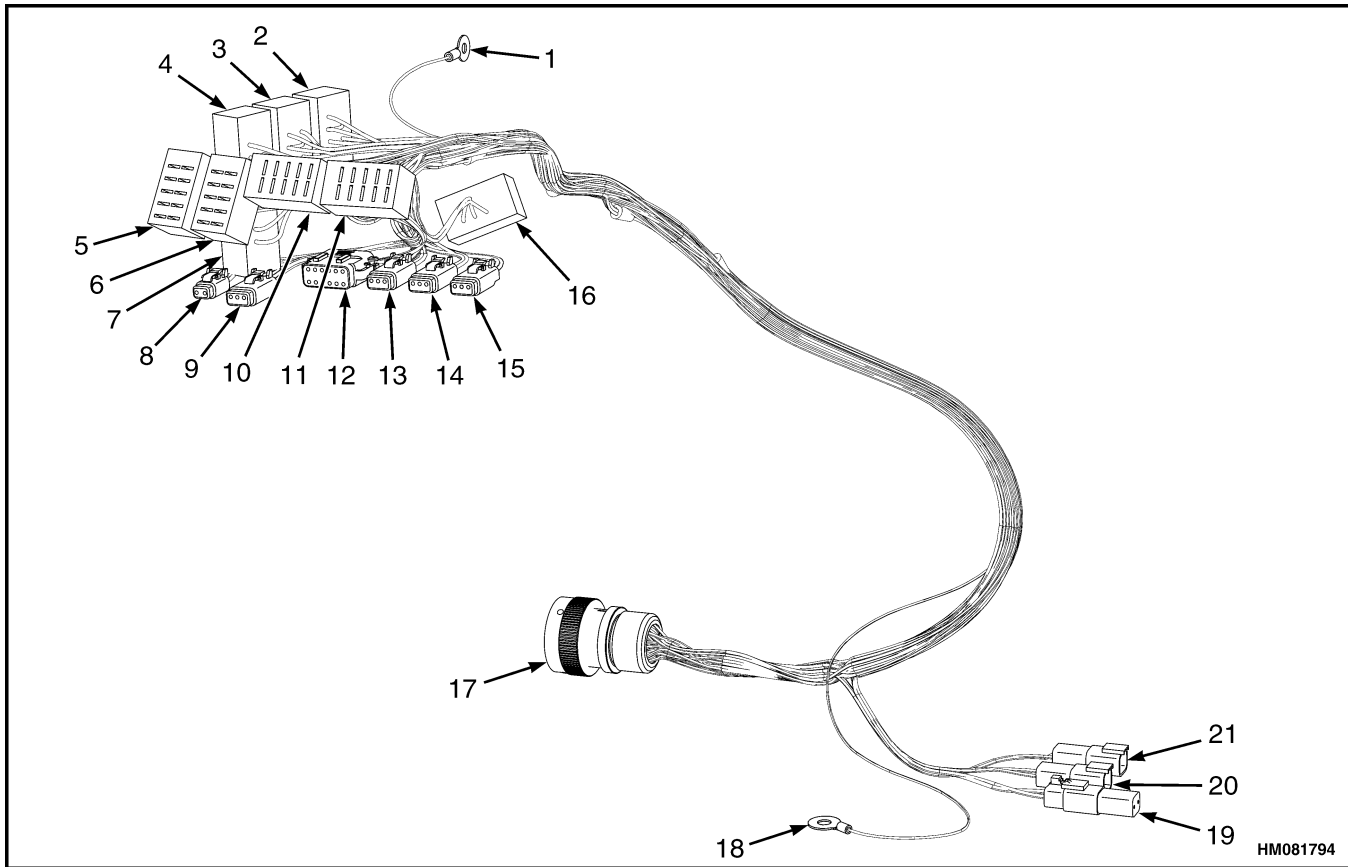


Figure 7. Armrest Harness Connectors

Table 6. Legend for Armrest Harness Connectors

| Item | Connector | Description |
|------|-----------|--------------------------|
| 1 | TS102 | Armrest Ground |
| 2 | CPS91 | Rear Wiper/Washer Switch |
| 3 | CPS90 | Roof Wiper/Washer Switch |
| 4 | CPS86 | Front Wiper Switch |
| 5 | CPS80 | Horn Switch Armrest |
| 6 | CPS118 | Twist Locks |
| 7 | CPS89 | Front Washer Switch |
| 8 | CPS179 | Inhibit Auxiliary 1 |
| 9 | CPS09 | Auxiliary 1 Lever |
| 10 | CPS137 | Auxiliary 2 |
| 11 | CPS138 | Auxiliary 3 |
| 12 | CPS135 | Switches Joystick |
| 13 | CPS114 | Auxiliary 0 Lever |

Table 17. Connector Overview (Continued)

| Connector | Description | Location | Harness |
|-----------|-----------------------------|---|-------------------------|
| CPS69 | RH Tail Lights | [88,I] | REAR |
| CPS71 | Wiper Timer | [151,E] | SIDECONSOLE |
| CPS72 | LH Tail Lights | [88,J] | REAR |
| CPS73 | Sped | [168,H] | SIDECONSOLE |
| CPS74 | Side Console – Wiper Rear | [150,G] | SIDECONSOLE |
| CPS75 | Roof Wiper | [153,J] | CLOSED CAB/ OPEN CAB |
| CPS76 | Flasher Unit | [91,B] | SIDECONSOLE |
| CPS77 | Hazard Switch | [91,D], [92,D] | SIDECONSOLE |
| CPS78 | Front Wiper | [155,J] | CAB UNDERFLOOR |
| CPS80 | Horn Switch Armrest | [168,B], [169,B] | ARMREST |
| CPS81 | Armrest – Side Console | [122,G], [124,I], [136,G], [143,D], [156,D], [167,A] | ARMREST |
| CPS82 | Diode Horn | [163,D] | CAB UNDERFLOOR |
| CPS83 | Horn Button | [160,B] | STEER COLUMN |
| CPS84 | Seat Switch/Horn Relay | [134,I], [166,C] | SIDECONSOLE |
| CPS86 | Front Wiper Switch | [157,B], [158,B] | ARMREST |
| CPS87 | Regen Enable/Disable Switch | [42,A], [43,A] | SIDECONSOLE |
| CPS88 | WIF Sensor | [36,F] | FRAME |
| CPS89 | Front Washer Switch | [157,D], [158,D] | ARMREST |
| CPS90 | Roof Wiper/Washer Switch | [157,E], [158,E] | ARMREST |
| CPS91 | Rear Wiper/Washer Switch | [157,G], [158,G] | ARMREST |
| CPS92 | Wiper Rear | [151,I] | REAR WIPER EXTENSION |
| CPS93 | Hoist Pressure | [133,J] | FRAME |
| CPS94 | Instrument Cluster | [117,B] | SIDECONSOLE |
| CPS95 | Washer Rear | [158,H] | WASH PUMPS |
| CPS96 | Map Light | [72,G] | SIDECONSOLE |
| CPS97 | Air Filter | [110,A] | hoodspine |
| CPS98 | Park Brake Solenoid | [128,B] | FRAME |
| CPS100 | Brake Light | [82,I] | CAB UNDERFLOOR |
| CPS101 | Lift Solenoid 1 | [133,J] | FRAME |
| CPS103 | Coolant Level | [33,E] | hoodspine |
| CPS105 | Side Console – Twist Module | [102,E] | SIDECONSOLE |
| CPS106 | Twist Module | [101,I] | TWISTMODULE |
| CPS107 | DC/DC Convertor | [168,J] | SIDECONSOLE |

Flyback Diodes

Always check functionality of a flyback diode when a switch or relay has failed. In most cases a failed diode

will not conduct at all. Sometimes a failed diode causes a short circuit.

Table 20. Flyback Diodes

| Connector | Diode Description | Location | Harness Name |
|-----------|---------------------|------------------------|------------------|
| CPS196 | Diode Calibration | [24,C], [62,D], [75,J] | SIDECONSOLE |
| CPS236 | Diode Cab Tilt Pump | [108,F] | POWERED CAB TILT |
| CPS54 | Backup Diode | [87,G] | REAR |
| CPS82 | Diode Horn | [163,D] | CAB UNDERFLOOR |

CANBUS CIRCUIT

Most controllers have a memory that retains codes for situations that occurred within their own controlled circuit. Also faults in the controller itself are stored as a fault code. Both the IFAK cable and the instrument cluster contain a controller that makes these codes visible on a lap top computer, respectively on the hour meter display. The explanation of these codes is shown on the different fault code tables for engine, transmission, hydraulic system and Electronic Climate Control.

The CANbus connection itself can be verified by checking continuity of the data inverse wires 900 (green) and the data wires 901 (yellow), and by checking the 120 Ohm resistance value of the end resistor. For schematic location and actual location see Table 17.

Diagnostics of a faulty CANbus system requires thorough knowledge and specific software. As controllers cannot be repaired, there is no other option than to replace a controller if it is found to be defective.



BM150512

1. PART NUMBER AND REVISION OF THIS SERVICE TOOL
2. CONTINUE BUTTON
3. LANGUAGE SELECTION

Figure 34. Warning screen

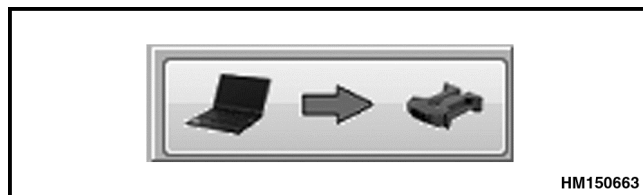
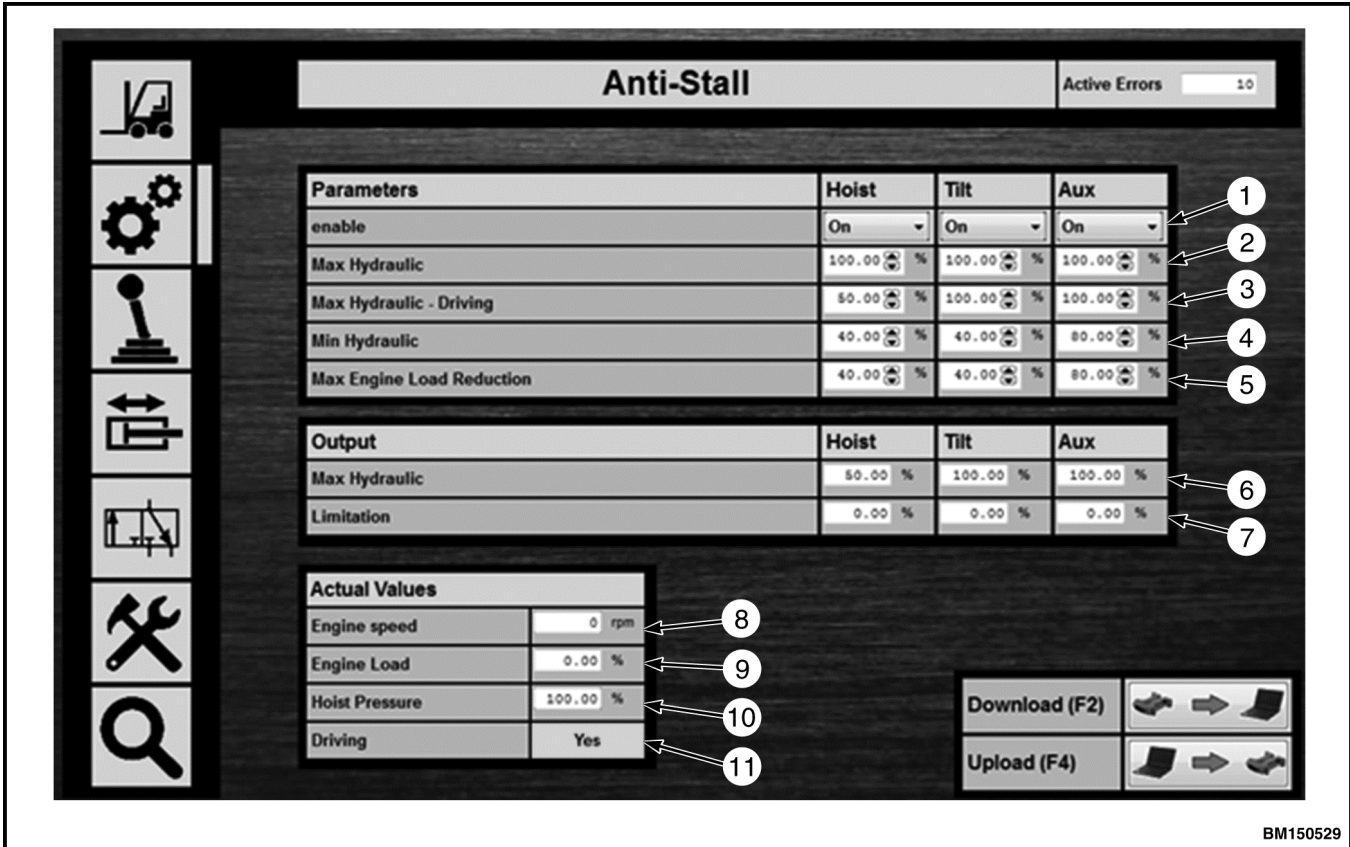


Figure 35. Upload button

The language can be selected by pressing the language button (3). A pop-up appears (Figure 36), and you can select the desired language. Apply the setting by pressing the “OK” button.



Figure 36. Language selection



1. ENABLE. IT IS POSSIBLE TO ENABLE/DISABLE THE ANT STALL FUNCTION FOR HOIST, TILT OR AUXILIARY SYSTEMS.
2. MAX HYDRAULIC OUTPUT. IT DETERMINES THE MAXIMUM HYDRAULIC OUTPUT ALLOWED TO PREVENT THE ENGINE STALL FOR EACH SYSTEM.
3. MAX HYDRAULIC OUTPUT WHILE DRIVING. IT DETERMINES THE MAXIMUM HYDRAULIC OUTPUT ALLOWED DURING DRIVING TO PREVENT THE ENGINE STALL FOR EACH SYSTEM.
4. MIN HYDRAULIC OUTPUT AT 0% ENGINE LOAD. IT DETERMINES THE MINIMUM HYDRAULIC OUTPUT WHEN THE VEHICLE IS NOT LOADED TO PREVENT THE ENGINE STALL FOR EACH SYSTEM.
5. ADDITIONAL REDUCTION AT 100% ENGINE LOAD. IT REDUCES THE HYDRAULICS WHEN THE ENGINE IS FULLY LOADED TO PREVENT THE ENGINE STALL.
6. MAXIMUM HYDRAULIC OUTPUT ACTIVE ON EACH SYSTEM.
7. PARAMETERS OF EACH SYSTEM WHERE THE OUTPUT IS LIMITED TO THE SPECIFIED VALUE.
8. ACTUAL ENGINE SPEED (RPM).
9. ACTUAL ENGINE LOAD (%).
10. ACTUAL HOIST PRESSURE (%).
11. DRIVING STATUS.

Figure 53. Hoist/Tilt Anti-Stall

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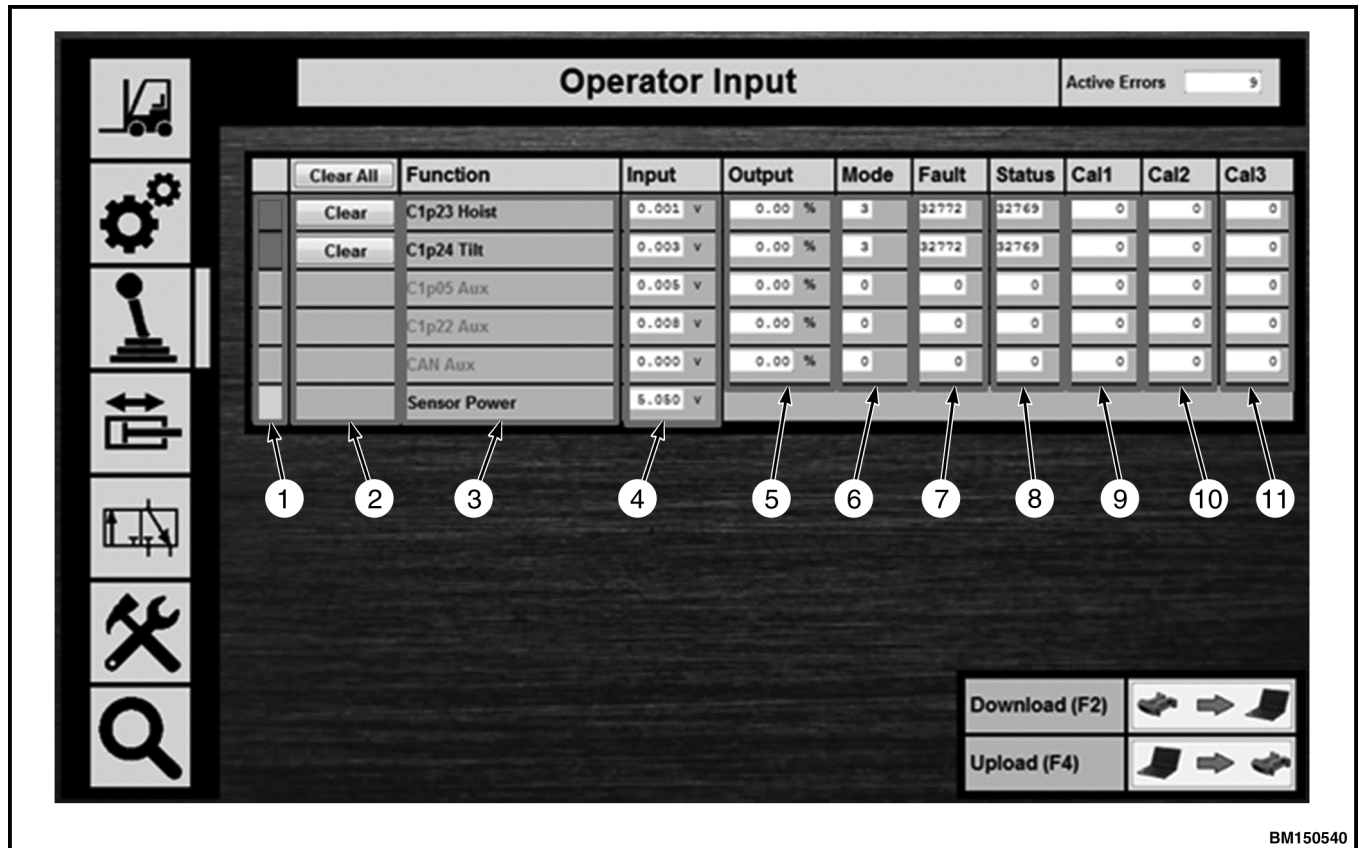
- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

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Auto Calibration

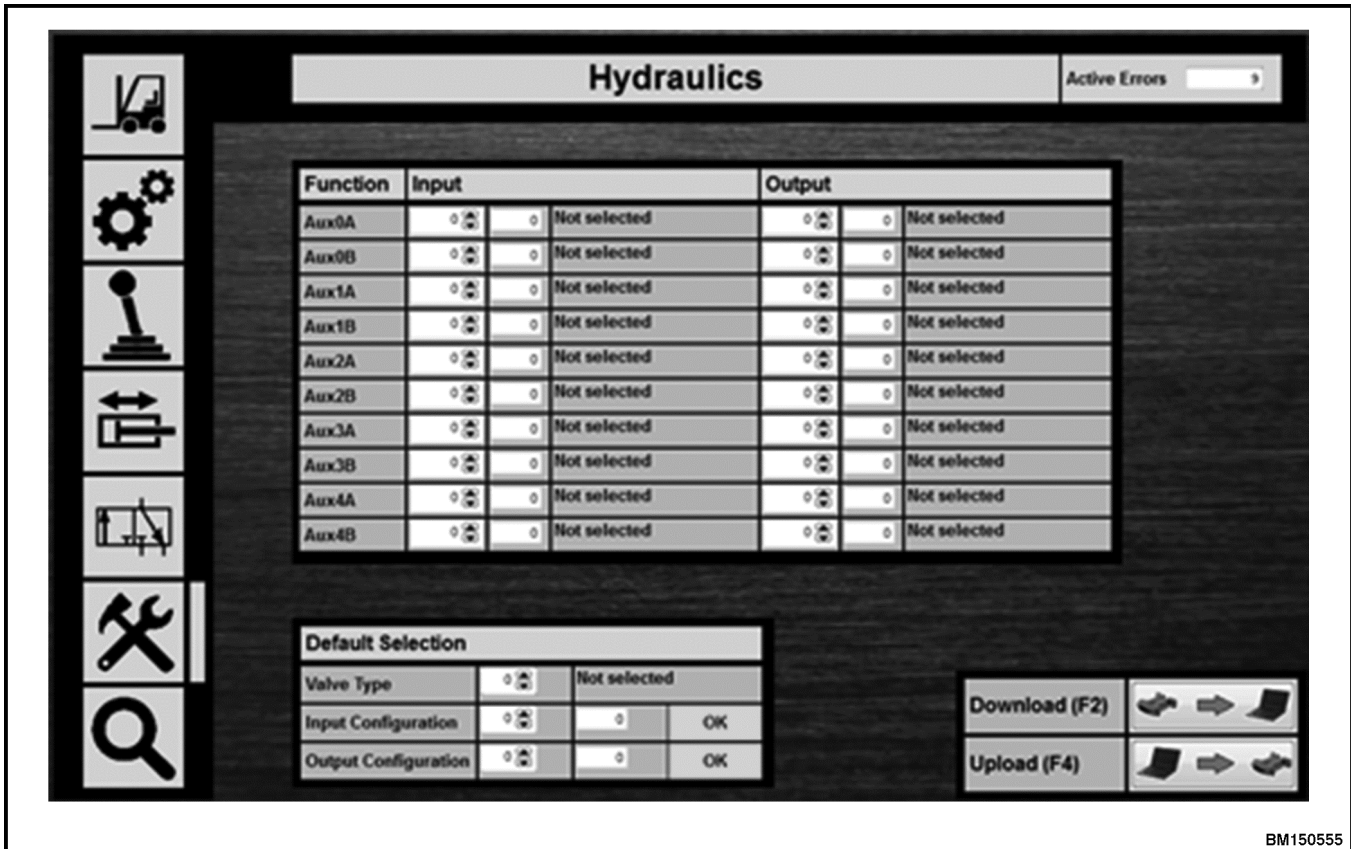
The auto Calibration screen (Figure 64) shows the parameters and measurements coming out of each

available function during the calibration mode of the hydraulic system. Finally, it is possible to observe the behavior of the calibration in Figure 65.



1. STATUS OF THE CALIBRATION. RED=NOT POWERED, GREEN=POWERED.
2. CLEAR CALIBRATED PARAMETERS BUTTON.
3. FUNCTION NAME.
4. INPUT VOLTAGE FOR CALIBRATION.
5. OUTPUT OF THE FUNCTION.
6. CALIBRATION MODE.
7. FAILURE STATUS (0=OK, 1=FAILURE).
8. CALIBRATION STATUS.
9. FIRST CALIBRATION VALUE.
10. SECOND CALIBRATION VALUE.
11. THIRD CALIBRATION VALUE.

Figure 64. Auto Calibration



BM150555

Figure 79. Hydraulics page

Active Errors

In the Hydraulic Controller Faults screen (Figure 80) it is shown a list of current errors found by the hydraulic controller giving the error code (1), name of the component with the error (2) and the failure mode (3).

This information is important during troubleshooting in case that the hydraulic controller shows failures during the daily use. For an overview of hydraulic controller faults, see **Troubleshooting and Error Codes** 8000YRM2163 .

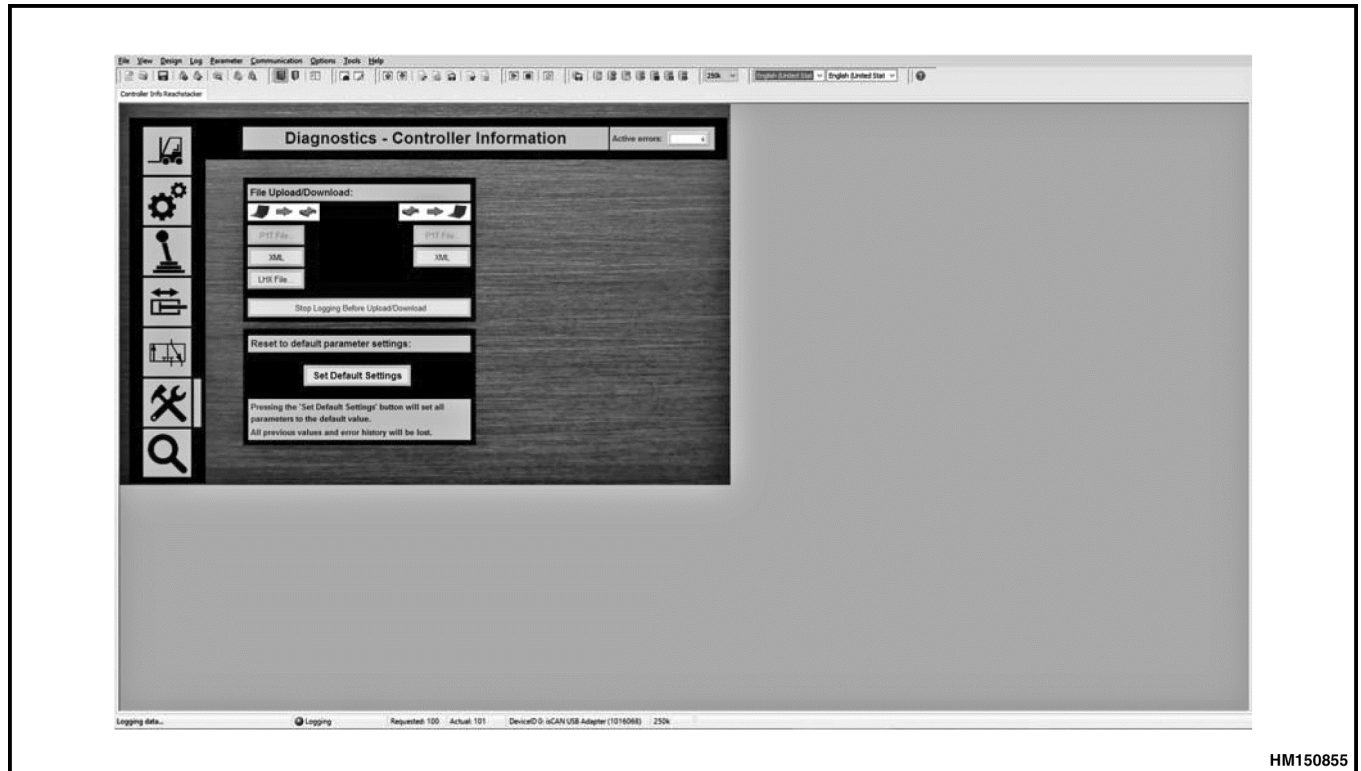


Figure 92. Download a P1T Parameter-file

Click the 'Stop Logging Before Upload/Download' button.

To download a P1T file into the HCU select the left 'P1T' file button.

Select the P1T file you want to download and click 'open'. The P1T file will now be downloaded. If an error occurs the P1T file is not matching the application software. Please contact your Service Department.

Download a ROP file

Go to the 'Controller Information' screen.

Select the 'LHX File' button.

Select the file you want to download and select 'Open'.

Now the download screen is openend. Select 'Start Download'.

Table 24. Pin Descriptions (Continued)

| Pin | Description |
|-----|---|
| 20 | Engine Air Filter Restriction Warning Light input |
| 21 | NOT USED |
| 22 | NOT USED |
| 23 | NOT USED |
| 24 | Fuel Level Gauge input |

FAULT CODES ON LCD DISPLAY

If a control system detects an error, the LCD display switches between Hour Meter and Error Mode every 2 seconds. Fault codes start with a character that relating to the controller fault signal. Fault codes can be defined by engine, transmission or hydraulics errors.

Fault Code Mode

Fault codes start with a character referring to the specific controller. Codes starting with 'E' refer to engine, 'T' to transmission and 'H' to hydraulics.

Explanation and suggested corrective action for the fault codes is provided in below manuals:

- **Engine** fault codes starting: **Cummins Engine Fault Code Guide** 0600YRM1101
- **Transmission** fault codes: **Drive Train** 0900YRM2150, section **Drive Train**
- **Hydraulics** fault codes: refer to **Section 2: Software**.

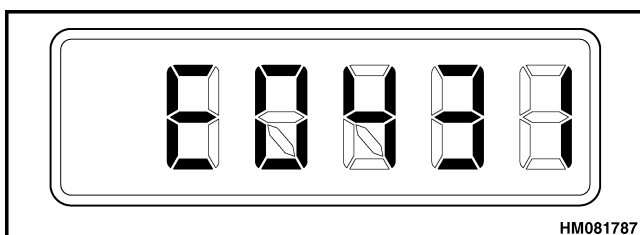


Figure 99. LCD Display Engine Fault Code

Transmission Calibration

Some transmission calibration and test procedures can be done through the display code. For explanation on the procedures refer to:

- **Transmission** fault codes: **Drive Train** 0900YRM2150, section **Drive Train**

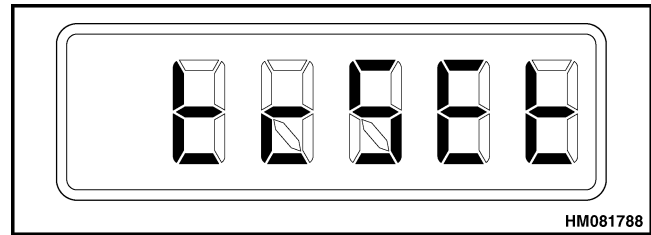


Figure 100. LCD Display Transmission Calibration

Fault Code Log Mode

The instrument panel stores all fault codes received from the engine, transmission and hydraulic controller. The instrument panel **DOES NOT** store calibration and exceed codes from the transmission. Faults that have occurred can be reviewed at a later point in time by entering into the Fault Code Log Mode. The display will show 'Err_H'. See Figure 101.

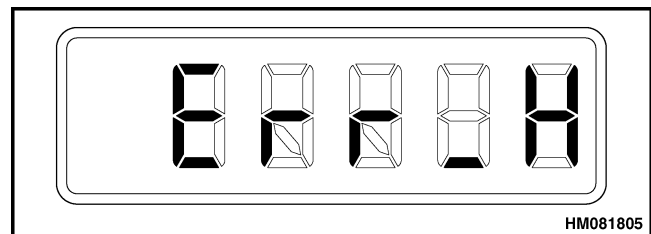
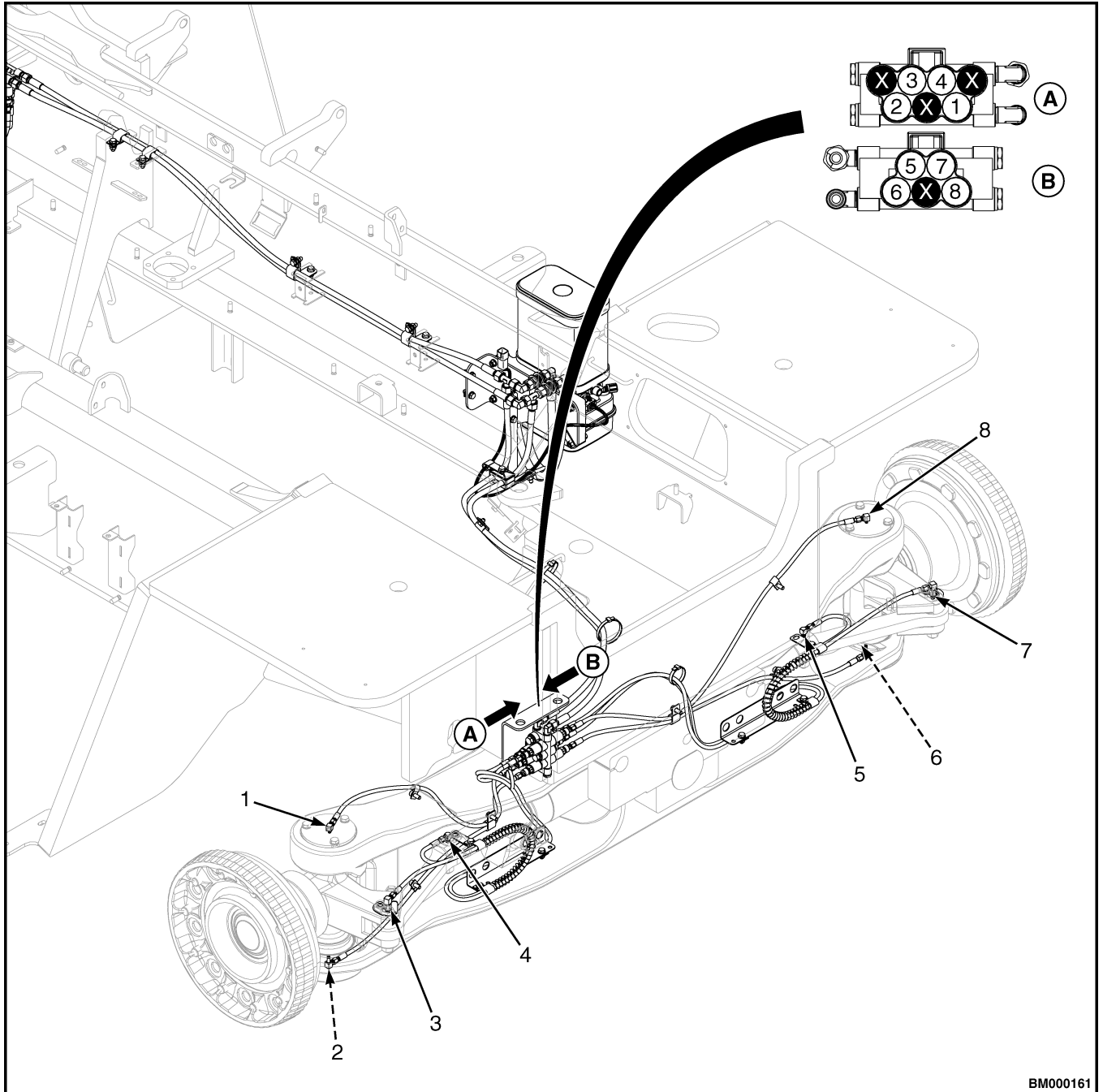


Figure 101. LCD Display Fault Log Mode

Get Access to the Fault Code Log

1. Apply the parking brake.
2. Turn the key switch into the **ON** position, but **DO NOT** start the engine.
3. Press and release the service switch 3 times.

Press approximately for one second and release for one second. After each press-and-release cycle the display will show a number that increases with each



BM000161

- | | | |
|---------------------------|----------------------------|---------------------------|
| 1. LH KING PIN UPPER | 4. LH TIE ROD CYLINDER END | 7. RH TIE ROD SPINDLE END |
| 2. LH KING PIN LOWER | 5. RH TIE ROD CYLINDER END | 8. RH KING PIN UPPER |
| 3. LH TIE ROD SPINDLE END | 6. RH KING PIN LOWER | |

Figure 4. Greasing Lines Steering Axle

STEP 4.

Remove the four socket head screws and remove the pump.



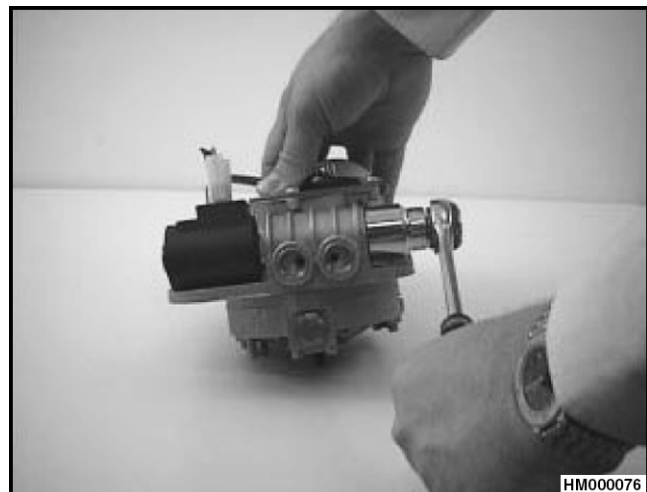
STEP 5.

Check the gasket between the pump assembly and the pump housing.



STEP 6.

Remove the nut and take out the solenoid valve.



STEP 7.
Install new O-ring.



STEP 8.
Install the pump assembly into the pump housing.
Torque to 10 N•m (88 lbf in).



THREAD ADAPTER

Remove

1. Using a 19mm socket, remove the thread-adapter. Discard O-ring.

Replace

STEP 1.
Apply a small amount of grease to new O-ring,
place O-ring on thread adapter.

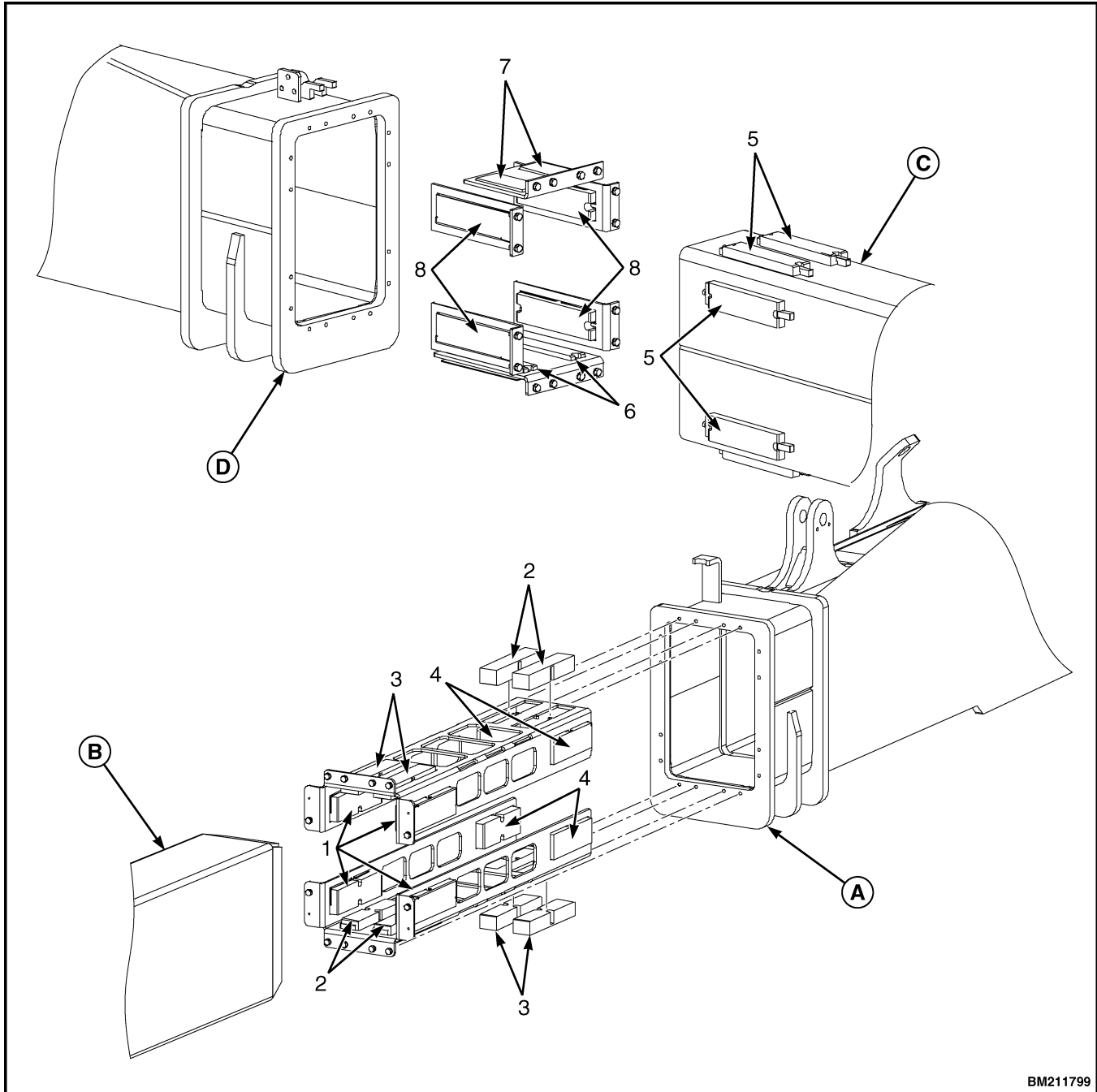
STEP 2.
Replace thread adapter.

2. Inspect the adapter and replace if necessary.

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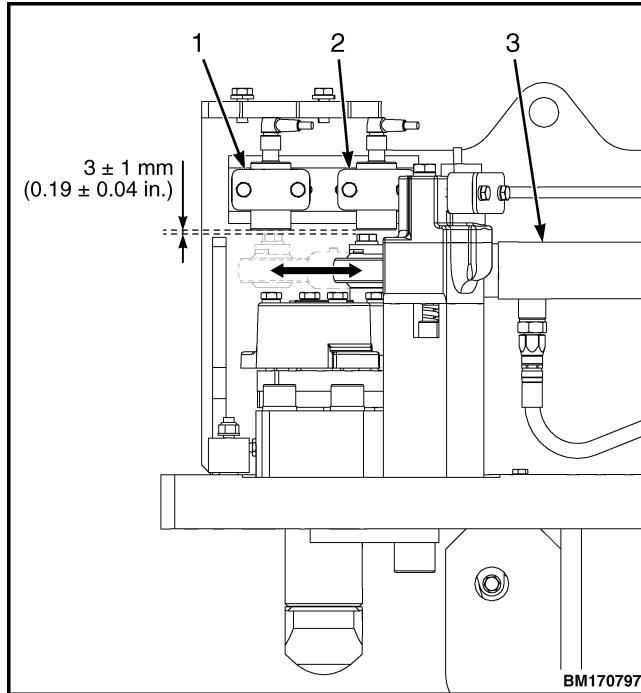
| | |
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| Extension Cylinder | 28 |
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| Install | 29 |
| End Beam | 29 |
| Remove | 29 |
| Install | 29 |
| Extension Beam | 29 |
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| Install | 47 |
| Chain Sheave | 48 |
| Remove | 48 |
| Install | 48 |
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| Remove | 48 |
| Install | 50 |
| Electric Mast Cable | 50 |
| Remove | 50 |

- e. Remove nut and washer from the back of the bracket to release the bearing block and shims on both sides of the carriage.
 - f. Remove securing bolt and bearing block.
 - g. When dividing shims, make sure that left and right hand blocks extend a similar distance from vertical carriage frame plates. Make sure that this distance is the same at the same plate.
 - h. Install a new bearing block if more than 5 shims are required for correct shimming.
 - i. When reinstalling a bearing block, tighten securing bolt to 26 N•m (230 lbf in).
6. Attach a lifting device to carriage.
 7. Lift carriage and move it in front of mast. Verify that upper and lower load rollers are parallel with mast. Correct carriage position as necessary.
 8. Start engine and operate lift cylinders to raise inner mast until mast channels are well above upper load rollers. Tilt mast backward until mast and carriage have same tilt position.
 9. Move carriage to position upper bearing blocks into inner mast channels.
 10. Use the emergency lowering valve to lower mast slowly. DO NOT damage bearing blocks when they enter mast channel.
 11. Lower mast further until lower load rollers and lower bearing blocks have entered. Lower mast completely.
 12. Reconnect lift chains to chain anchors using a new split-pin.
 13. Lower lifting device, detach and remove from carriage.
 14. Adjust chain length. See section Lift Chain, Lift Chains Adjustment.
 15. Use rope to lower header hoses and electric cable. Remove rope.
 16. Remove caps and plugs and install header hoses to fittings on carriage bracket.
 17. Maintain tension on electric mast cable while tightening cable clamp. See Figure 10.
 18. Attach electrical connector. See Figure 10.
 19. Start engine and operate hydraulic functions on carriage. Make sure that functions operate correctly. Check for leaks.
 20. Remove blocks that have been placed at both sides of tires.



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Figure 24. Extension Beam Wear Pads



1. LOCKED SENSOR
2. UNLOCKED SENSOR
3. TWIST LOCK CYLINDER

Figure 34. Twist Lock Locked/Unlocked Adjustment

Twist Lock Angle Adjustment

1. Disconnect rod from flag indicator.
2. Remove socket head screw and washer, and disconnect rod from pin.
3. Remove ring pin, socket head screw, and lockwasher. Remove pin.
4. Put piston of the twist lock cylinder in fully NOT-LOCKED position.
5. Put twist lock in fully NOT-LOCKED position.



WARNING

Twist locks can get caught in corner casting of container if twist locks have not been aligned and adjusted properly.

6. Loosen bolts at tie rod end and adjust tie rod to required length by turning rod end on cylinder assembly. Tighten bolts.

7. Insert pin.
8. Install lockwasher, socket head screw, and ring pin holding tie rod end on crank.
9. Install rod onto flag indicator and onto pin using socket head screw and washer.

NOTE: After NOT-LOCKED position is correctly set, piston range of twist lock cylinder ensures a correct LOCKED position.

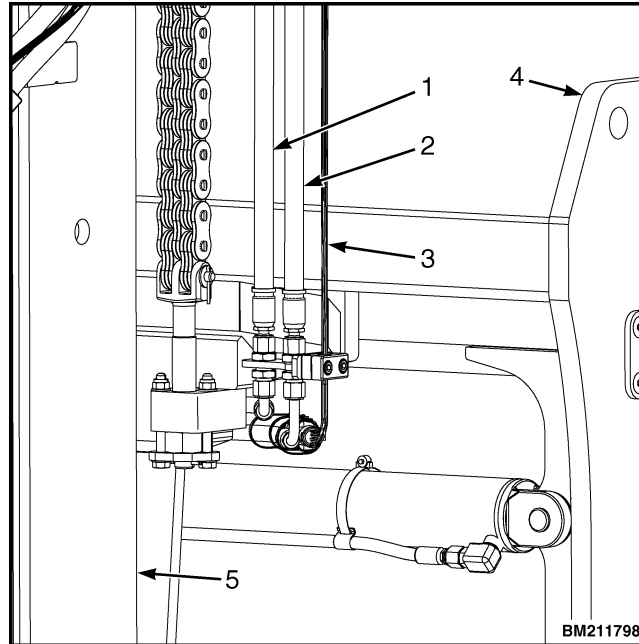
Overlowering Protection Sensor Adjustment

1. Place end beams in lowered position.
2. Loosen bolts of sensor bracket.
3. Slide the sensor away until it switches OFF.
4. Slide sensor toward activating plate until it switches **ON**.
5. Move sensor 2 mm (0.080 in.) toward plate and tighten bolts of sensor bracket.
6. Replace sensor if it has not switched **ON** 4 mm (0.157 in.) from plate.

Electrical Component Checks

The following procedures are a guideline to establish the cause of an apparent failure. Follow the procedures and compare your findings with the required functioning of the components.

1. If one of the indicator lights is flashing, adjust or repair the relevant proximity switch.
2. Determine if a mechanical problem is causing the fault. If a mechanical problem is found, repair the mechanical problem.
3. Determine if one attachment function or all attachment functions are failing. If only one function is failing, go to Step 8.
4. Verify that the lift truck electrical system and hydraulic system are functioning correctly.
5. If possible, remove the attachment from the container for easier access to the electrical box and the main direction control valve.



| Item Number | Description | Control Valve Connection | I.D. |
|-------------|----------------|--------------------------|--------------|
| 1 | Pressure | T | Yellow Strap |
| 2 | Tank | P | Green Strap |
| 3 | Electric Cable | N/A | CPS148 |
| 4 | Carriage | — | — |
| 5 | Mast | — | — |

Figure 51. Header Hose Connections

Install

1. Place hydraulic hoses over hose sheaves.
2. Install hose sheave cap, remove plugs and caps from hose fittings at carriage side.
3. Connect hydraulic hoses to fittings on carriage bracket.
4. Connect hydraulic hoses to fittings on lower mast hose bracket.
5. Lift mast to remove blocks under carriage. Lower carriage.
6. Put tension on hoses and reinstall clamps at upper mast bracket. See Figure 50.

7. Install hose clamps which retain hoses to right hand lift cylinder and right hand side of the outer mast.

Electric Mast Cable

Remove

1. Turn engine **OFF** and disconnect battery cables.
2. Disconnect electric mast cable from frame harness.
3. Open hose clamps retaining electric cable to right hand lift cylinder and the right hand side of the outer mast.
4. Remove cable clamp at upper mast bracket. See Figure 50.
5. Remove hose sheave cap.

- Torque the securing nuts to 66 N•m (460 lbf in).

Header Hose Tension Adjustment

- Make sure that lift chains are tensioned and correctly adjusted.
- Adjust bulkhead fitting.
- Verify that header hoses are in good condition. Un-tensioned hoses are to be of equal length. Replace any defective hose.
- Pull and tension hoses which are clamped on same bracket. The required elongation is between 1% and 2%.
- Tighten capscrew to clamp hoses.

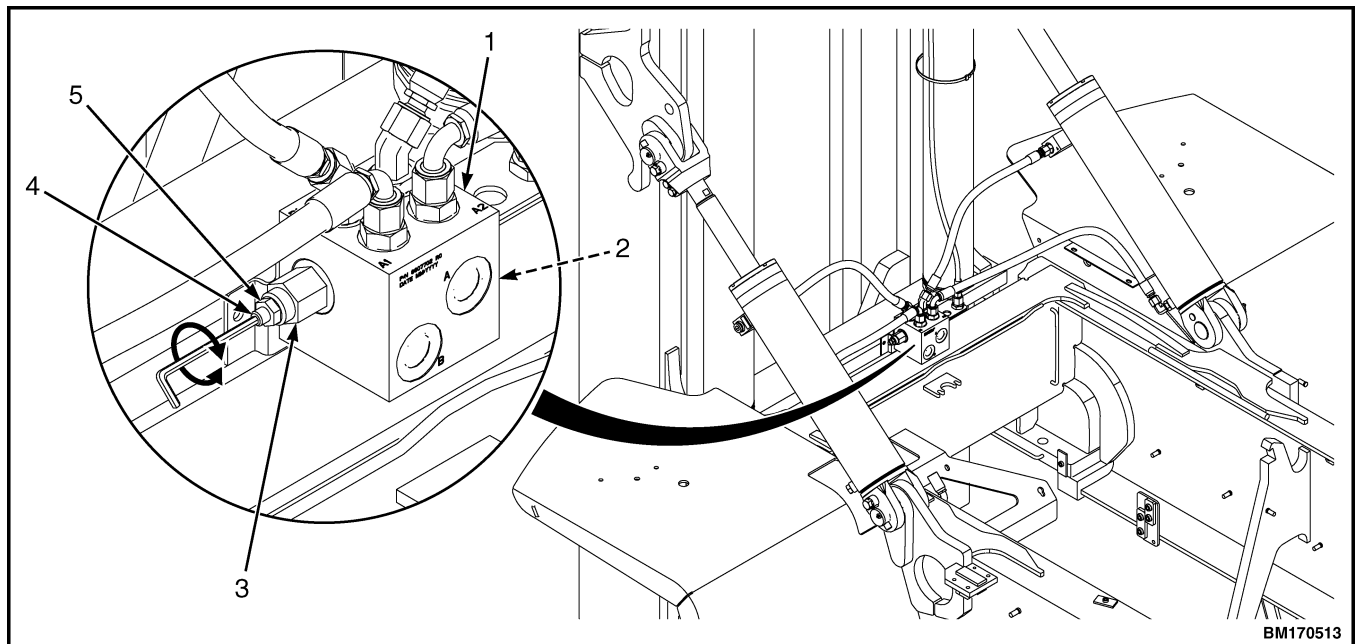
Electric Mast Cable Tension Adjustment

- Make sure that lift chains are tensioned and correctly adjusted.
- Loosen cable clamp at carriage bracket.
- Pull and hold cable at same tension as header hoses.

- Tighten cable clamp at carriage bracket.

Tilt Lock Valve Adjustment

- Establish which tilt cylinder moves out first. See section Tilt Lock Valve Check .
- Adjust the tilt lock valve which is at the opposite side of the valve connection for cylinder moving out first. See Figure 66.
- Adjust the valve by loosening the adjustment nut one full turn and subsequently rotate the setscrew ¼ turn counter clockwise.
- Retighten adjustment nut by using a 17 mm wrench.
- Check again simultaneous cylinder movement. See section Tilt Lock Valve Check .
- Repeat adjustment procedure until both tilt cylinders start moving simultaneously when tilting forward.



- | | |
|--------------------------------|--------------|
| 1. COUNTERBALANCE VALVE | 4. LOCK NUT |
| 2. VALVE TO ADJUST LH CYLINDER | 5. SET SCREW |
| 3. VALVE TO ADJUST RH CYLINDER | |

Figure 66. Tilt Lock Valve Adjustment

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Table 6. Inspect and Adjust (Continued)

| Inspect and Adjust | Procedure | Page |
|---|---|-------------|
| Automatic Greasing System (Optional) | <ul style="list-style-type: none"> • Check functionality of the system. • Check pump and grease lines for damage and leakage. • Check presence of grease at the grease points. Add grease to reservoir as necessary. | See Page 17 |
| Every 1,000 Hours | | |
| Fork Guide bearing blocks Dual Function Carriage | <ul style="list-style-type: none"> • Check clearance. Shim bearing blocks if clearance exceeds 2 mm (0.08 in.). | See Page 33 |
| Hydraulic Tank Breather | <ul style="list-style-type: none"> • Read scale on restriction indicator. Replace element as required. See Parts Manual. | See Page 38 |
| Every 2,000 Hours | | |
| Transmission Clutch Calibration | <ul style="list-style-type: none"> • Perform clutch calibration at each transmission oil change. | See Page 47 |
| Inching Pedal Sensor Calibration | <ul style="list-style-type: none"> • Check calibration value and adjust as required. | See Page 39 |
| Every 3,000 Hours | | |
| Drive Wheel Bearings | <ul style="list-style-type: none"> • Check bearing pre-load check. Adjust to 450 N•m (332 lbf ft). See Drive Train 0900YRM2150. | See Page 24 |
| Every 5,000 Hours | | |
| Engine Valve Adjustment | <ul style="list-style-type: none"> • Check valve clearance. See engine identification plate for valve adjustment. | See Page 30 |

Annual Inspection

Table 7. Annual Inspection

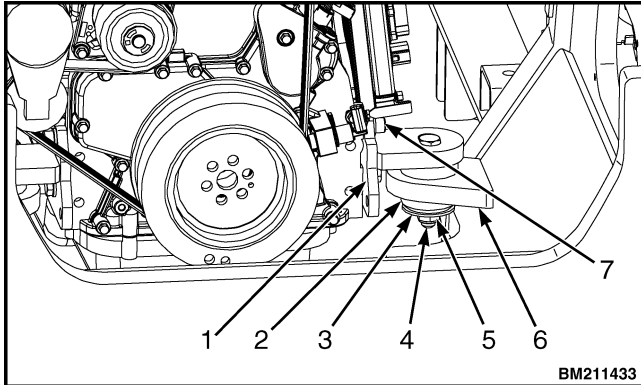
| Inspect and Adjust | Procedure | Page |
|---|--|-------------|
| Warning and Safety Labels | <ul style="list-style-type: none"> • Check for presence and readability. For position and replacement, see Parts Manual. | See Page 49 |
| Operator Restraint System | <ul style="list-style-type: none"> • Check condition and operation of seat belt, seat rails and steering column latch. Repair as required. | See Page 43 |
| Horn, Gauges, Lights, Alarms and Control System | <ul style="list-style-type: none"> • Visual and audible verification. Repair as required. | See Page 36 |
| Fault Codes | <ul style="list-style-type: none"> • Check fault code warning lights. The display should be free of fault codes. Diagnose and repair the cause of any fault code. | See Page 32 |
| Control Levers, Switches, and Pedals | <ul style="list-style-type: none"> • Check operation as described in the Operating Manual. Repair as required. | See Page 20 |
| Operator Presence System | <ul style="list-style-type: none"> • Check operation. Repair as required. | See Page 43 |


ENGINE AND TRANSMISSION MOUNTS

Annual

Inspect all rubber mounts for ageing and damage. Look for traces, which indicate excessive relative movement between the frame supports and the engine and transmission brackets.

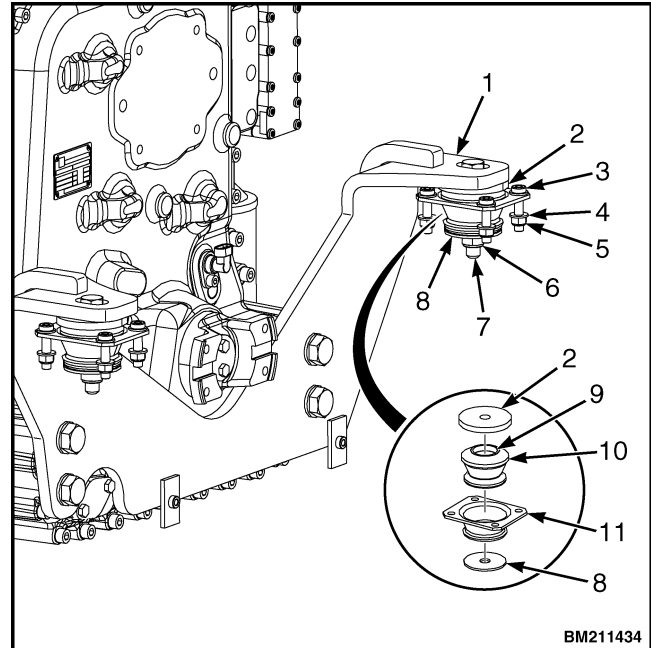
Check that mounting bolts are torqued to 165 N•m (122 lbf ft). Replace any damaged part. See Figure 21 and Figure 22.




 (4) 165 N•m (122 lbf ft)

1. MOUNTING BRACKET
2. RUBBER MOUNT
3. LARGE WASHER
4. NUT
5. CAP SCREW
6. FRAME BRACKET

Figure 21. Engine Mounts



 (7) 165 N•m (122 lbf ft)

1. MOUNTING BRACKET
2. WASHER
3. CAP SCREW
4. WASHER
5. NUT
6. NUT
7. BOLT
8. WASHER
9. METAL CORE
10. RUBBER MOUNT
11. BRACKET

Figure 22. Transmission Mounts

ENGINE COMPARTMENT

Daily and Every 250 Hours

Open the hood and check for leaks and abnormal conditions. Clean any oil or fuel spills. Make sure all surfaces are free of oil, lubricants, fuel, and organic dust or fibers (paper, wood, cotton, wool, etc.).

Remove all foreign materials.

ENGINE DRIVE BELT

Annual

Check that the key is in the **OFF** position and the engine is stopped. Check the drive belt for wear and damage. Small cracks that run across the belt are acceptable. A drive belt with cracks that run the length

INCHING PEDAL SENSOR CALIBRATION

Every 2,000 Hours

Calibrate the inching pedal sensor to compensate for normal wear.

Normal wear may cause that the signal from the sensor to the transmission controller moves outside of the acceptable range. This causes the controller to shift the transmission into neutral and to show fault code t0211 on the display.

See **Drive Train** 0900YRM2150 for calibration procedure.

LIFT CHAINS

Check and Lubricate Lift Chains



WARNING

Lower the lift mechanism completely. Never allow anyone under a raised carriage. DO NOT put any part of your body in or through the lift mechanism unless all parts of the mast are completely lowered and the engine is STOPPED.

Before making any repairs, use chains to secure the mast weldments and carriage into position so that they cannot move. Make sure the moving parts are attached to a part that does not move.

DO NOT repair a worn lift chain. Replace both lift chains when one or both lift chains are worn.



WARNING

Adjustment or repair of the lift chains must be done by authorized personnel.

Daily

Check that the oil film on the outside of the lift chains is intact and that the oil at the links is still free flowing. Make sure both chains are slack during parking.

If oil is not sufficiently present, or if lift chains produce noises under operation, there is an increased risk for chain failure. Call a mechanic to have the lift chains inspected and re-lubricated.

When the oil film is still intact, check absence of following conditions:

- 1 Broken, damaged or missing chain link plates.
- 2 Damaged, turned or protruding link pins.

Have both lift chains replaced if any of the above conditions is observed.

Check the chain anchors and chain pins for cracks and damage. Replace if cracked or damaged.

First 100 Hour inspection and Every 250 Hours

Lubricate both lift chains:

- 1 Slacken the chains. This may require setting the forks or attachment on a support such as a wooden block or container.
- 2 Clean the chains as necessary to allow penetration of oil into the chain links. Remove debris, grease and thick oil.
- 3 Make sure that any trapped water or condensation is removed.
- 4 Apply engine oil onto the chains. Do not use grease.
- 5 Allow sufficient time for the oil to penetrate before the chains are put under tension again.
- 6 Wipe excess oil.

Adjust Lift Chains

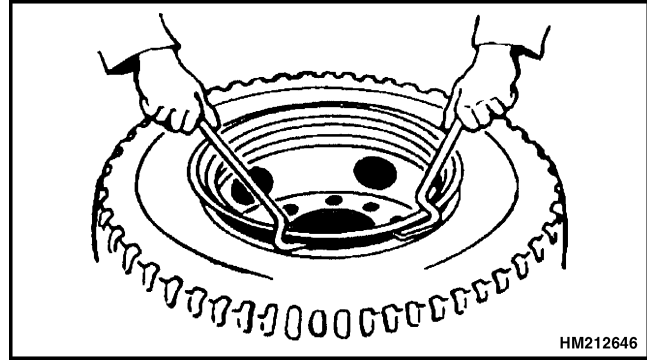
First 100 Hour inspection and Every 250 Hours

Adjust the lift chains as necessary to align the carriage with the inner mast and correct the fork height.

- 1 Put mast in a vertical position and lower carriage completely.
- 2 Side shift the carriage until it is at the center line of the mast.
- 3 Move both forks into maximum extended position.
- 4 Remove cap screws and retainer plate. See Figure 43.
- 5 Turn large nuts on both chain anchors. Make sure that both forks have at least 1 cm (0.40 in.) clearance with ground.
- 6 Align the vertical carriage bar with the inner mast channel by tightening the large nut of the anchor chain that is in lowest position. Make sure that the vertical carriage bar runs parallel with the inner mast channel. Apply an accuracy of 0.5 mm per 50 cm (0.025 in. per 2 feet). See Figure 44.
- 7 Adjust fork height by turning both chain anchor nuts with the same angle until the required ground clearance has been obtained. Make sure that the ground clearance of both forks is between 10 and 20 mm (0.4 and 0.8 in.).
- 8 After adjustments are completed, install retainer plate and tighten cap screws.

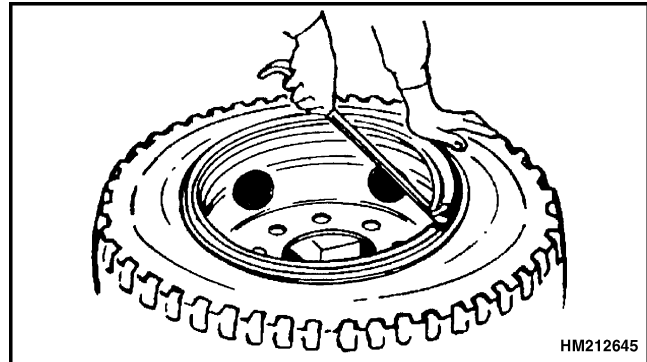
STEP 2.

Loosen the tire bead from the side ring and/or lock ring.



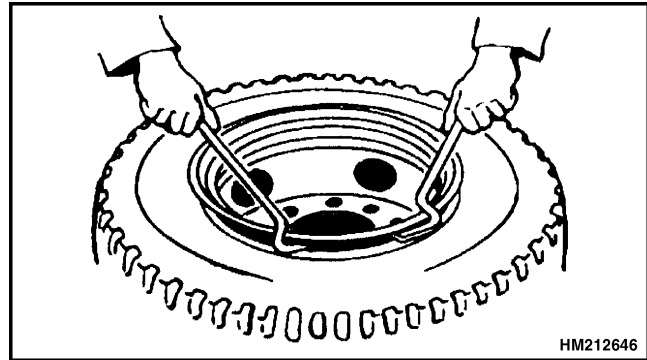
STEP 3.

Put the tire tool into the slot between the side ring and/or lock ring and the wheel rim. Remove the side ring and/or lock ring.



STEP 4.

Turn the tire over. Separate the tire from the wheel rim.

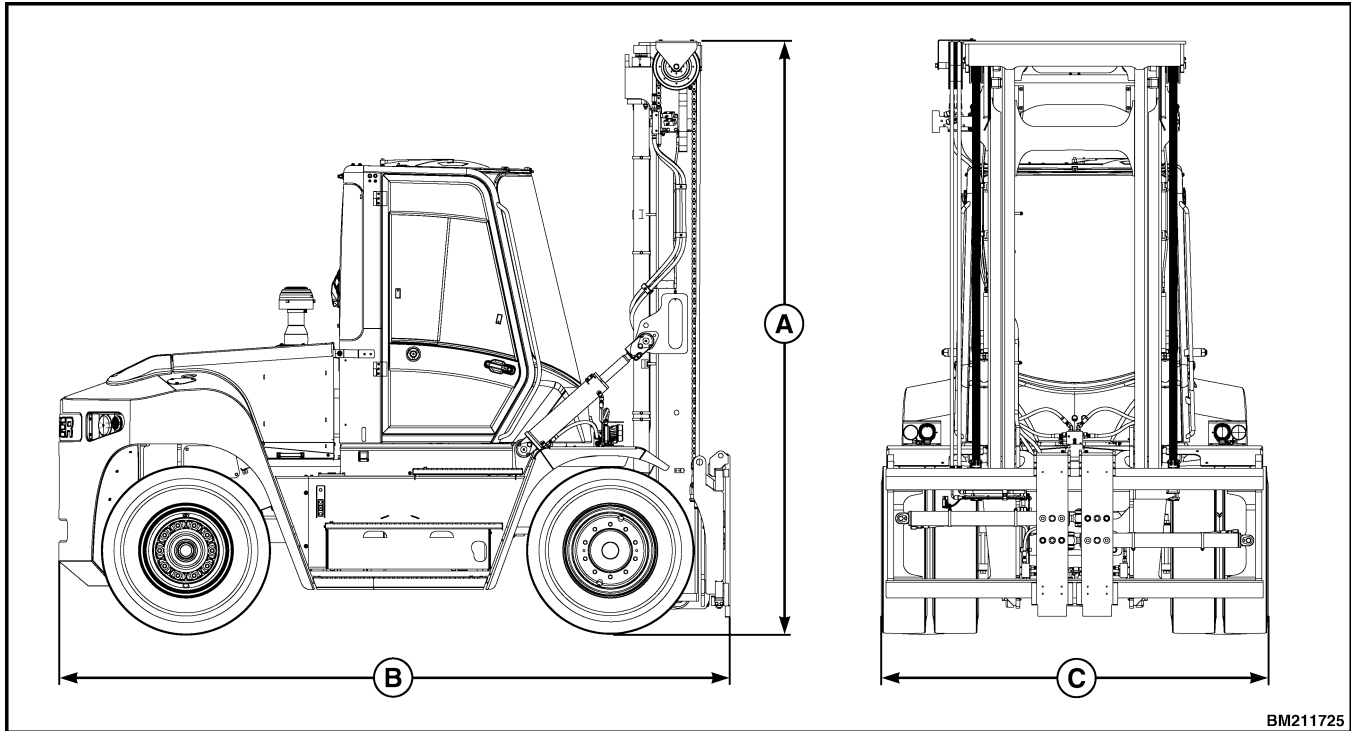


STEP 5.

For tires with an inner tube, push the air valve through the rim opening into the tire.

Table 11. Legend for Main Electrical Supply

| | | | |
|----------------------------|--------------------------------|--------------|-------------------------|
| 1. | BATTERY DISCONNECT SWITCH | | |
| 2. | BATTERY DISCONNECT SWITCH LOCK | | |
| 3. | BATTERY | | |
| 4. | POWERBOARD | | |
| | Name | Value | Description |
| 5. | F1 | 125A | ALTERNATOR |
| 6. | R1 | — | RELAY GRID HEATER |
| 7. | F2 | 125A | CAB SUPPLY |
| *8. | F4 | 15A | DEF HOSE HEATING |
| 9. | F3 | 150A | GRID HEATER |
| 10. | F5 | 10A | SPARE |
| *11. | F6 | 10A | DEF UNIT |
| 12. | F7 | 7.5A | SPARE |
| 13. | F8 | 10A | SPARE |
| 14. | F11 | 15A | SPARE |
| *15. | R4 | — | RELAY DEF HOSE 3 |
| *16. | R5 | — | RELAY DEF MODULE HEATER |
| *17. | R3 | — | RELAY DEF HOSE CPS 141 |
| *18. | R2 | — | RELAY DEF HOSE CPS 140 |
| 19. | F10 | 30A | ENGINE ECM SUPPLY |
| 20. | F9 | 30A | CAB TILT |
| * Tier 4F / Stage IV only. | | | |



- A. HEIGHT
- B. LENGTH SEE NOTES IN TABLE 2
- C. WIDTH

Figure 2. Complete Truck Height, Length and Width

NOTE: For the total height (A) add the distance between mast and ground 158 mm (6.22 in.) to the mast height. See Mast (Table 3 to Table 7), column Truck Height.

Table 2. Complete Truck

| Model | Carriage | Length (B) | Width (C) |
|-------------------------|---------------------|-------------------------|------------------------|
| GDP80-100 GDP190-210 | Standard Pin-Type | 4,308 mm (169.6 in.) | 2,465 mm (97.0 in.) |
| | Side Shift Carriage | 4,308 mm (169.6 in.) | 2,465 mm (97.0 in.) |
| | DFSSFP Carriage | 4,240 mm (166.6 in.) | 2,465 mm (97.0 in.) |
| GDP230-280 | Standard Pin-Type | 4,508 mm (177.4 in.) | 2,465 mm (97.0 in.) |
| | Side Shift Carriage | 4,508 mm (177.4 in.) | 2,465 mm (97.0 in.) |
| | DFSSFP Carriage | 4,440 mm (174.8 in.) | 2,465 mm (97.0 in.) |

Legend for Figure 8.

1. COUNTERWEIGHT LIFTING POINTS
2. MAST LIFTING POINTS

Driving a Truck off a Trailer

When the truck will be driven from a trailer make sure to have read and understood the Starting Procedures as described in the **Operating Manual**.

1. Make sure the parking brake is applied.
2. Disconnect the straps or chains that attach the truck to the trailer.
3. Remove the wheel blocks.
4. Start the truck, release the park brake and let a assistant provide directions when driving off the trailer.
5. Park the truck. Apply the hand brake and turn the ignition **OFF**.

See the procedures under Moving a Disabled Lift Truck if the truck cannot be started and must be moved.

See the procedures under Adding Air Pressure to the Tires if air pressure in one of the tires is less than 80% of the pressure as indicated on the nameplate.

UNLOADING DISASSEMBLED COMPONENTS

To lift the components from a transport either use a fork lift or attach hooks and/or slings to the lifting eyes

and slinging points as indicated on Figure 7 through Figure 8.

**WARNING**

DO NOT use the bores for the mast pivot and the tilt cylinder mounting as a slinging point.

Use rear lifting eyes in combination with mast lifting eyes when lifting complete truck. DO NOT lift basic truck with mast removed.

For the required capacity of the lifting device, see Table 1 through Table 11 for the weights of the components.

Use blocks to support the component when temporarily storing the component on the ground.

The blocks for the attachment must be high enough to keep the twistlocks from the ground.

The blocks for the carriage must be high enough to keep the fork guides from the ground.

REMOVAL OF FORKS ATTACHED TO A BASIC TRUCK

1. Put blocks under the tips of the forks. See Figure 9.
2. Support the plate under the forks and remove the four attaching nuts and capscrews. Remove the plate.

12. Repeat Step 1 through Step 11 to install the remaining fork.
13. Apply grease to the brackets of the fork hanger and the fork positioning cylinder.

Adjust Carriage

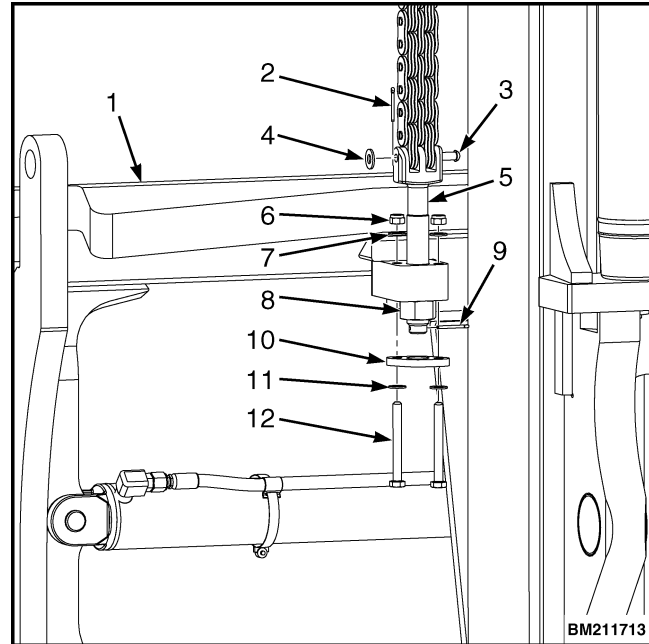


CAUTION

The carriage can be set higher and lower on the lift chain anchor, however the carriage load rollers must remain within the inner mast channel both in the lowest and in the highest carriage positions to avoid damage to the lift truck.

NOTE: The purpose of carriage adjustment is to align the carriage in the inner mast and to position the forks or the attachment at the required height when completely lowered. Carriage alignment is required when chains, chain anchors or carriage is replaced. Carriage alignment is also required when carriage does not lift and lower smoothly. A symptom is that one of the chains has a lower tension and shows bigger deflection compared with the other chain. Incorrect carriage alignment causes premature wear of bearing blocks. Alignment of the carriage is obtained by adjusting two chain anchors individually.

1. Put the mast in a vertical position and lower the carriage completely.
2. Side shift the carriage until it is at the center line of the mast.
3. Move both forks/the attachment into the maximum extended position.
4. Move the two cap screws to release the securing plate. See Figure 23.



1. CARRIAGE
2. SPLIT PIN
3. CHAIN PIN
4. WASHER
5. CHAIN ANCHOR
6. NUT
7. WASHER
8. LARGE NUT
9. SPLIT PIN
10. SECURING PLATE
11. WASHER
12. CAP SCREW

Figure 23. Chain Anchor on Carriage

5. Make sure that the clearance between the forks or the attachment and the ground has at least 1 cm (0.40 in.). Turn the large nuts on both chain anchors if necessary.
6. Measure that the vertical carriage bar runs parallel with the inner mast channel. Apply an accuracy of 0.5 mm (0.006 in.). See Figure 24.
7. Tighten the large nut of the chain anchor that is in the lowest position to align the vertical carriage bar with the inner mast channel.
8. Install the securing plate with the two cap screws.

INSTALL WHEELS ON LIFT TRUCK

Align and Install the wheel(s) and tire(s) on the hub. Tighten the nuts according to Wheel Nuts on Drive and Steer Wheels.

Wheel Nuts on Drive and Steer Wheels



CAUTION

Check all wheel nuts after 2 to 5 hours of operation, when new lift trucks begin operation, and on all lift trucks when the wheels have been removed and installed. Tighten the nuts as shown in Figure 30. When the nuts stay tight for 8 hours, the interval for checking the torque can be extended to 250 hours.

Start with the wheel nut at the top and tighten the nuts to 68 to 136 N•m (50 to 100 lbf ft) in the sequence shown in Figure 30. Check to make sure that the wheel(s) is tight against the hub, then tighten the nuts to 615 to 710 N•m (454 to 524 lbf ft).

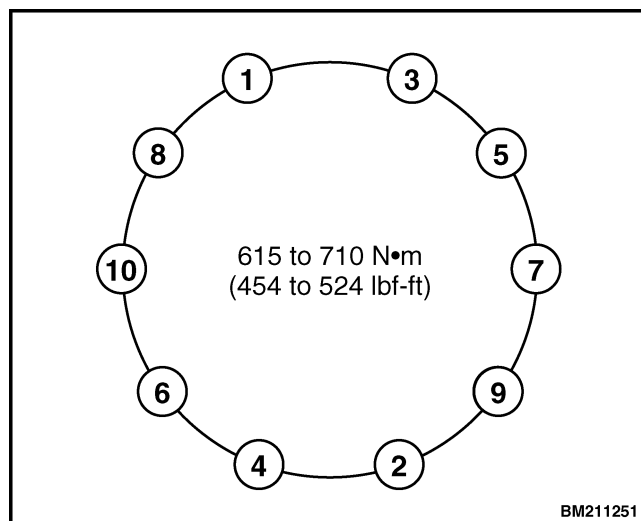


Figure 30. Wheel Nut Tightening Sequence

Pre-Delivery

ADJUST TIMING FOR AUTOMATIC ENGINE SHUT DOWN

The engine will automatically shut down 15 minutes after the operator has left the truck seat. Verify which timing for engine shut down has been ordered by the customer and adjust the timer accordingly. The timer for empty seat engine shut down is located in the side console. Remove the fuse panel cover and unhook the relay from its bracket. See Figure 31 for its location. Adjust the relay by turning the phillips screw that is visible through the top cover of the relay.

The relay can be adjusted between 30 seconds in the farthest anti-clockwise position and 15 minutes in the farthest clockwise position. Never adjust the shut down time to a value lower than 5 minutes to make sure that the engine turbo will cool down sufficiently before the engine is turned off automatically. Measure and eventually re-adjust the shut down time. Reposition the timer and close the fuse cover.

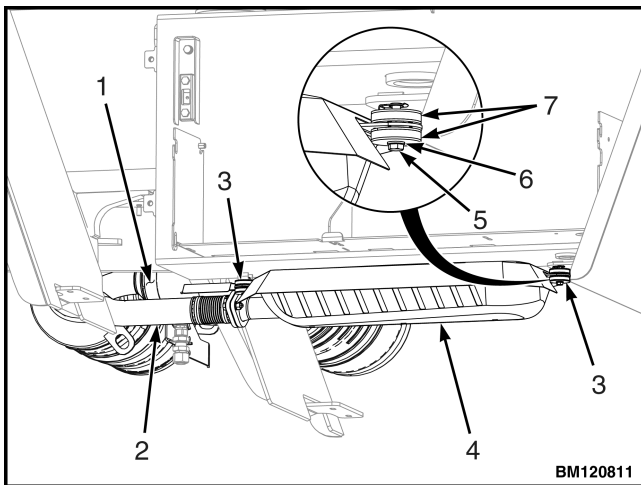
Exhaust Pipes and Diffuser Low Mount

Remove

1. Remove the clamp from the Selective Catalytic Reducer (SCR) outlet. See Figure 6.
2. Place a support under the diffuser.
3. Remove the cap screws and washers.
4. Remove the diffuser and exhaust assembly towards the back of the truck, out of the SCR outlet.

Install

1. Install the diffuser and exhaust assembly by inserting the exhaust assembly in the SCR outlet.
2. Install the isolators, washer and cap screws to the bottom side of the hydraulic tank and tighten the cap screws to 35 N•m (26 lbf ft).
3. Tighten clamp to 54 - 81 N•m (40 - 60 lbf ft).

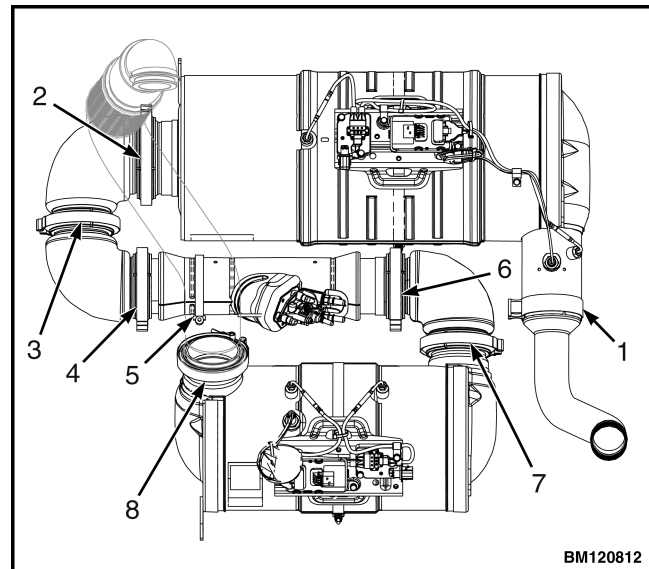


1. CLAMP
2. EXHAUST PIPE ASSEMBLY
3. ISOLATOR MOUNTS
4. DIFFUSER
5. CAP SCREW
6. WASHER
7. ISOLATOR

Figure 6. Exhaust Pipe Connections Low Mount (Tier 4F/Stage IV)

Exhaust Seal Rings

In the high pressure part of the exhaust system, the tubes and pipes are sealed by means of metal seal rings. These seal rings deform when V-clamps are tightened and will stick to one of the exhaust components at disassembly. Remove the used seal and replace by a new one at re-assembly. Pay attention to the different sizes and shapes of seals at the different locations. Pay attention to the different torque value of the V-clamp at the connection with the turbo. See Figure 7.



1. BAND CLAMP
2. V-CLAMP AND SEAL RING 5" – SPHERICAL
3. V-CLAMP AND SEAL RING 4" – SPHERICAL
4. V-CLAMP AND SEAL RING 4" – SPHERICAL
5. BAND CLAMP
6. V-CLAMP AND SEAL RING 4" – SPHERICAL
7. V-CLAMP AND SEAL RING 4" – SPHERICAL
8. V-CLAMP AND SEAL RING 4" – STANDARD

Figure 7. Exhaust Seal Rings

NOTE: To make repositioning possible, do not tighten the clamps until the correct and final position of exhaust components has been obtained.

31. Remove the fuel tank breather and plug the tank opening to prevent the breather from getting damaged. See Figure 18.

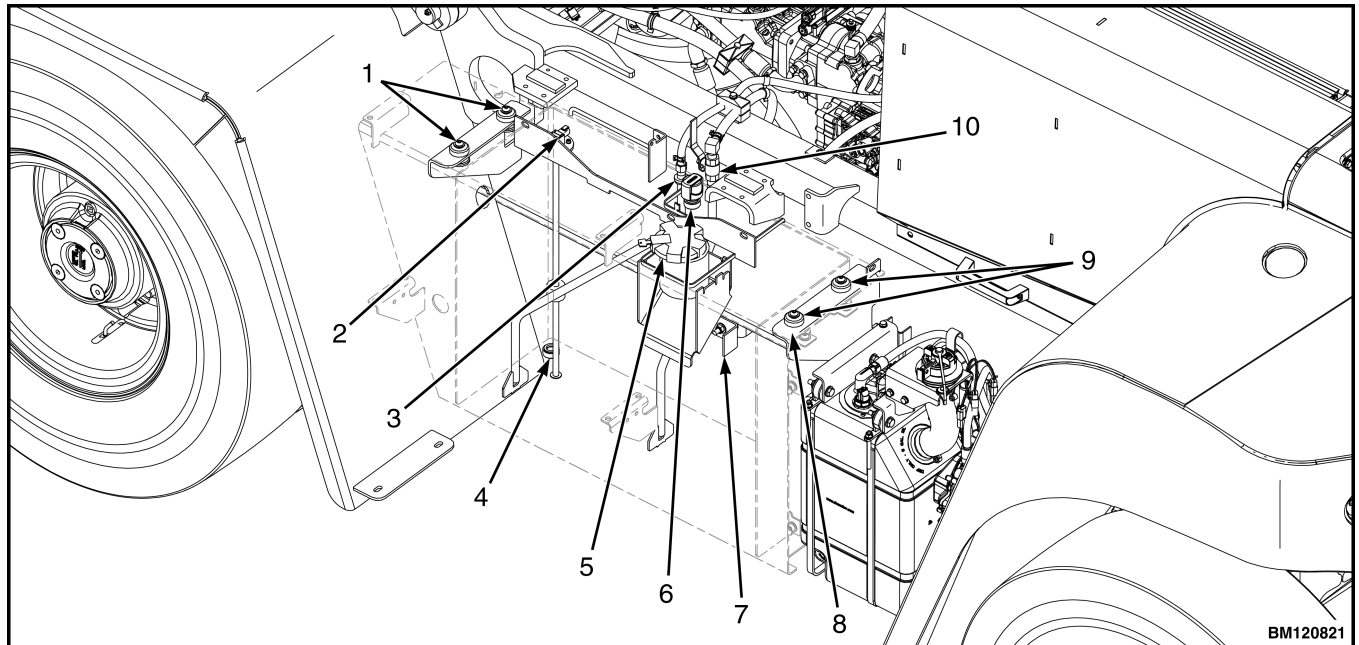
The clean and repair procedures for the fuel tank are similar to the clean and repair procedures for the hydraulic tank. See Hydraulic Tank, Clean and Hydraulic Tank, Repair.

Clean and Repair



WARNING

DO NOT use tools that can make sparks, heat, or static electricity. The vapors in the tank can cause an explosion.



- | | |
|---------------------------|------------------------|
| 1. TANK TO FRAME HARDWARE | 6. FUEL TANK BREATHER |
| 2. FUEL SENDER | 7. FRAME BRACKET |
| 3. CHECK VALVE | 8. FRAME SUPPORTS |
| 4. DRAIN PLUG | 9. ISOLATORS |
| 5. FILL CAP | 10. FUEL SHUTOFF VALVE |

Figure 18. Fuel Tank Assembly

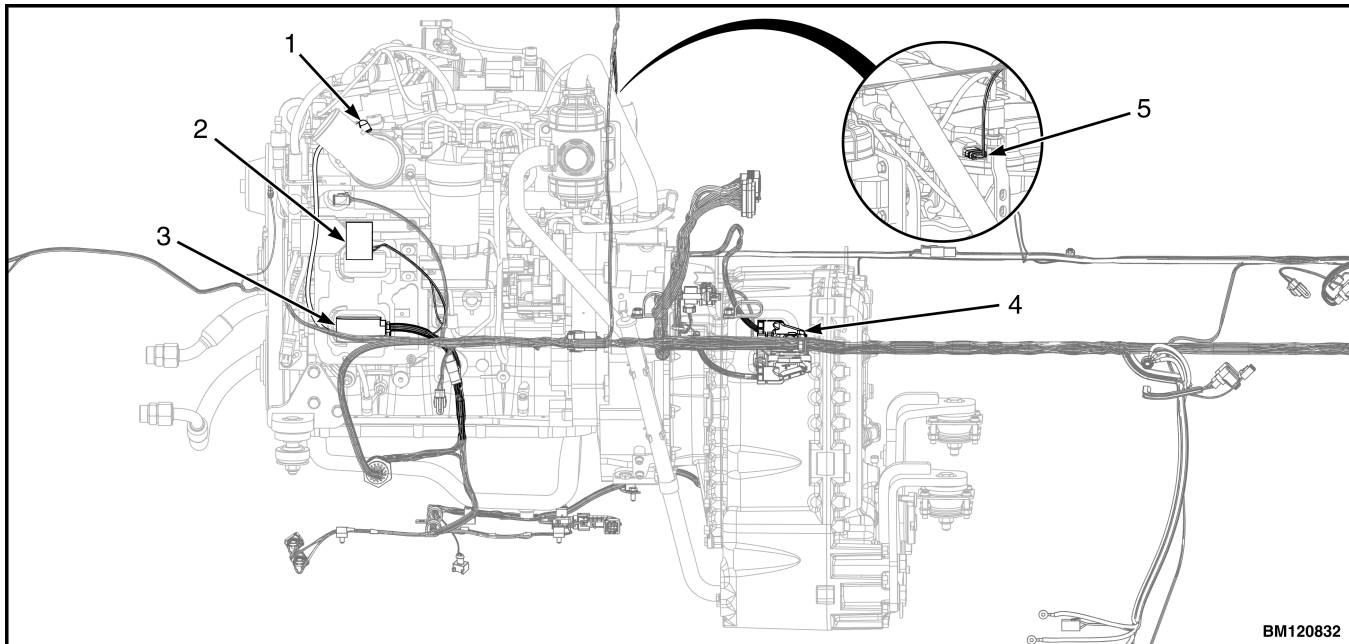
Install



WARNING

The fuel tank weighs 225 kg (496 lb). Install the fuel tank using lifting equipment.

- Place the fuel tank on lifting equipment.
- Carefully move the fuel tank in place and position the tank brackets on the frame supports.
- Lift the fuel tank slightly and install the isolators.
- Lower the tank on the isolators and install the cap screws and washers that secure the fuel tank to the frame supports. Tighten to 66 N•m (49 lbf ft).
- Remove the lifting device.
- Install the running board and the step.
- Install the shut off valve and fuel sender.
- Connect the connector to the fuel sender.
- Connect fuel lines to the tank.



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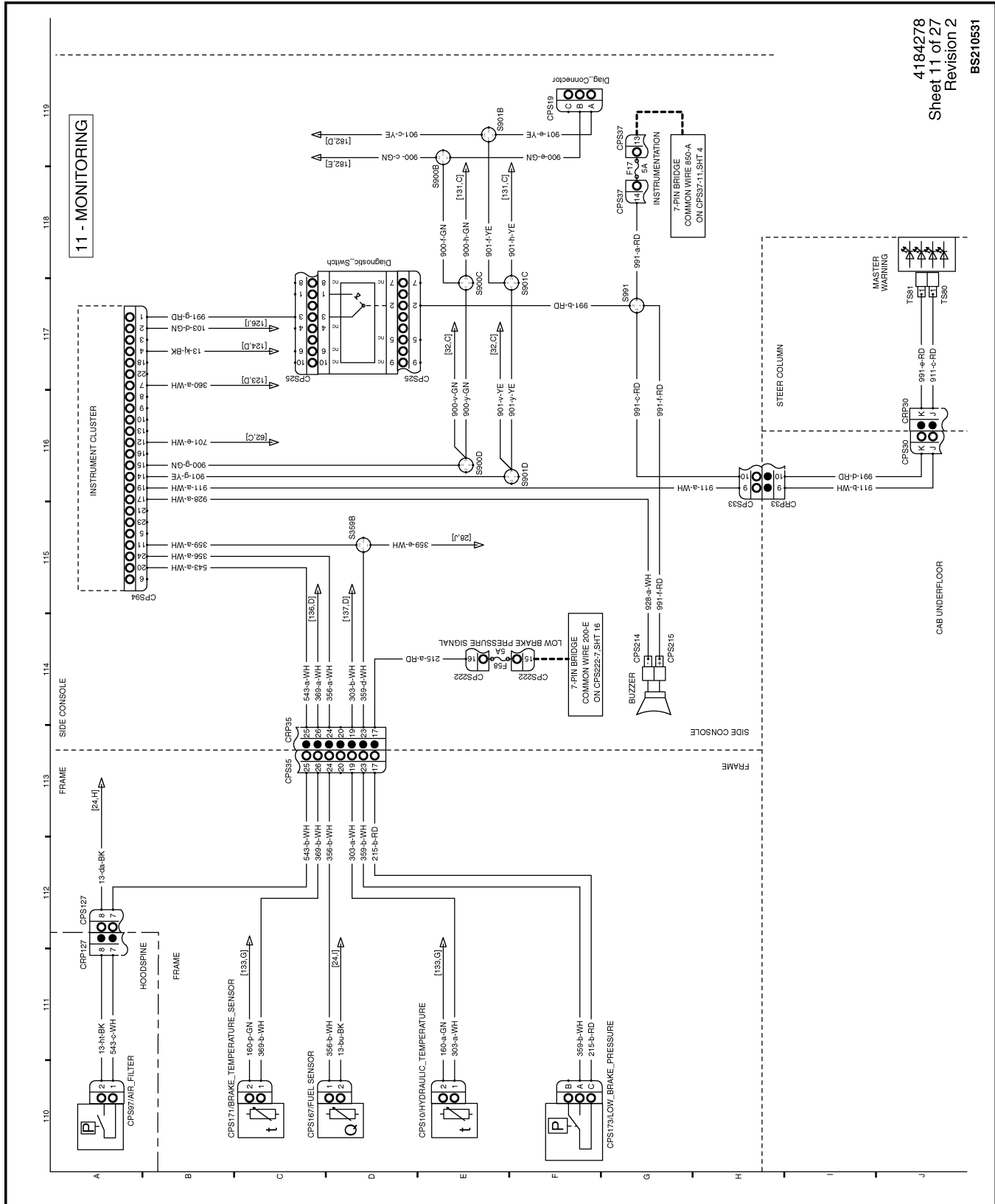
- | | |
|---------------------------|-----------------------------|
| 1. TS19 - GRID HEATER | 4. CPS02 - FRAME-POWERTRAIN |
| 2. CRP12 - ECM CROSS-OVER | 5. CPS127 - FRAME-HOODSPINE |
| 3. CRP03 - ECM T4 | |

Figure 31. Engine Electrical Connections Right-Hand Side (Tier 4F/Stage IV)

- | | |
|--|---|
| <p>12. Disconnect the ECM/EAS harness from the attached parts according to Figure 31.</p> <p>13. Disconnect the Frame Harness from the Alternator from the attached parts according to Figure 30.</p> <p>14. Attach the remaining cables to the engine and transmission to prevent the cables from getting damaged.</p> <p>15. The drive shaft weighs 20.5 kg (45 lb). Connect a lifting device to the drive shaft. Remove the bolts from the drive shaft flanges and remove the drive shaft.</p> <p>16. Remove the dipstick tube from the transmission and plug the opening.</p> <p>17. Disconnect the electric connector of the fan clutch.</p> <p>18. Remove the bolt that connects the anti-rotation bracket to the support bracket. See Figure 32.</p> | <p>19. Remove tie-wrap(s) from the electric cable of the fan clutch, except those around the anti-rotation bracket.</p> <p>NOTE: The hexagon nut that connects the fan clutch to the fan spacer has LEFT HAND THREAD.</p> <p>20. Hold the fan spacer with a spanner, and unscrew the hexagon nut by turning it CLOCKWISE.</p> <p>21. Put the fan clutch assembly inside the shroud.</p> |
|--|---|

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Figure 1. Electrical Schematic T3/T4 Final (Sheet 11 of 27)

| 24 - WIRE LIST | | | | | | |
|----------------|---------------------------|---------------------------|----------|-----------|---------------------------|--------------------------------------|
| full_name | harness | function | location | full_name | harness | function |
| 13-dk | FRONT DRIVE LIGHT | Heavy (non-signal) ground | [87 F] | 13-by | TWISTMODULE | Heavy (non-signal) ground |
| 13-di | FRONT DRIVE LIGHT | Heavy (non-signal) ground | [86 E] | 244-k | TWISTMODULE | Fused B+ Hydraulic system |
| 13-dp | FRONT DRIVE LIGHT | Heavy (non-signal) ground | [86 E] | 600-a | TWISTMODULE | Lift Interrupt Signal (TWIST Module) |
| 13-dq | FRONT DRIVE LIGHT | Heavy (non-signal) ground | [87 A] | 600-b | TWISTMODULE | Lift Interrupt Signal (TWIST Module) |
| 13-dn | FRONT DRIVE LIGHT | Heavy (non-signal) ground | [87 C] | 606-a | TWISTMODULE | Lowering Interrupt Signal |
| 13-dm | FRONT DRIVE LIGHT | High Beam2 front lights | [86 D] | 607-d | TWISTMODULE | Function Override |
| 780-e | FRONT DRIVE LIGHT | High Beam2 front lights | [86 C] | 712-c | TWISTMODULE | Twistlock YELLOW |
| 789-h | FRONT DRIVE LIGHT | Tail/Marker Lights | [86 D] | 712-d | TWISTMODULE | Twistlock GREEN |
| 789-i | FRONT DRIVE LIGHT | Tail/Marker Lights | [86 C] | 714-c | TWISTMODULE | Twistlock RED |
| 790-x | FRONT DRIVE LIGHT | Turn Signal Left | [86 C] | 715-c | TWISTMODULE | Twistlock YELLOW |
| 790-y | FRONT DRIVE LIGHT | Turn Signal Right | [86 D] | | | |
| 791-l | FRONT DRIVE LIGHT | Turn Signal Right | [86 D] | | | |
| 13-ee | POWERED CAB TILT | Heavy (non-signal) ground | [106 F] | 13-aa | WASH_PUMPS | |
| 13-du | POWERED CAB TILT | Heavy (non-signal) ground | [106 F] | 13-ab | WASH_PUMPS | Heavy (non-signal) ground |
| 13-ee | POWERED CAB TILT | Heavy (non-signal) ground | [107 F] | 13-ac | WASH_PUMPS | Heavy (non-signal) ground |
| 13-hh | POWERED CAB TILT | Heavy (non-signal) ground | [108 F] | 827-a | WASH_PUMPS | Heavy (non-signal) ground |
| 13-hm | POWERED CAB TILT | Heavy (non-signal) ground | [108 F] | 827-b | WASH_PUMPS | Heavy (non-signal) ground |
| 233-c | POWERED CAB TILT | Supply Cab Tilt | [107 G] | 931-c | WASH_PUMPS | Front Washer Motor |
| 233-d | POWERED CAB TILT | Supply Cab Tilt | [107 G] | 935-c | WASH_PUMPS | Rear Washer Motor |
| 43-a | POWERED CAB TILT | Cab Tilt Signal | [107 G] | | | |
| 43-b | POWERED CAB TILT | Cab Tilt Signal | [106 H] | | | |
| 43-c | POWERED CAB TILT | Cab Tilt Signal | [107 J] | | | |
| 43-d | POWERED CAB TILT | Cab Tilt Signal | [108 H] | | | |
| 43-e | POWERED CAB TILT | Cab Tilt Signal | [107 H] | | | |
| 43-f | POWERED CAB TILT | Cab Tilt Signal | [108 J] | | | |
| 13-dv | REAR WIPER EXTENSION | Heavy (non-signal) ground | [151 J] | | | |
| 785-d | REAR WIPER EXTENSION | Wiper - Rear | [150 H] | | | |
| 833-c | REAR WIPER EXTENSION | Rear Wiper Motor return | [150 H] | | | |
| 834-e | REAR WIPER EXTENSION | Rear Wiper Power supply | [150 J] | | | |
| 13-ar | REAR | Heavy (non-signal) ground | [87 H] | 13-ia | STEER COLUMN | Heavy (non-signal) ground |
| 13-ca | REAR | Heavy (non-signal) ground | [86 H] | 13-ib | STEER COLUMN | Heavy (non-signal) ground |
| 13-cb | REAR | Heavy (non-signal) ground | [86 H] | 25-a | STEER COLUMN | HORN button |
| 13-cc | REAR | Heavy (non-signal) ground | [88 J] | 548-b | STEER COLUMN | 12 volt Supply - Switched |
| 13-cd | REAR | Heavy (non-signal) ground | [86 J] | 549-b | STEER COLUMN | XMSN Shift Lever Neutral |
| 787-b | REAR | Back-up lights | [86 G] | 550-d | STEER COLUMN | XMSN Shift Lever 2 (J2/C2) |
| 787-c | REAR | Back-up lights | [86 J] | 553-f | STEER COLUMN | XMSN Shift Lever 2 (J2/C2) |
| 787-d | REAR | Back-up lights | [86 J] | 554-b | STEER COLUMN | XMSN Shift Lever F (J2/H2) |
| 787-e | REAR | Back-up lights | [86 J] | 556-b | STEER COLUMN | XMSN Shift Lever R (J2/H2) |
| 787-f | REAR | Back-up lights | [86 J] | 791-a | STEER COLUMN | XMSN Shift Lever Automatic (J1/B3) |
| 788-f | REAR | Stop Lights | [86 J] | 825-e | STEER COLUMN | Telemetry FM1 TX |
| 788-g | REAR | Stop Lights | [86 J] | 826-e | STEER COLUMN | Telemetry FM1 TX |
| 789-h | REAR | Tail/Marker Lights | [86 J] | 911-c | STEER COLUMN | Fused IGN Instruments |
| 789-i | REAR | Tail/Marker Lights | [86 J] | 911-e | STEER COLUMN | Fused IGN Instruments |
| 789-j | REAR | Tail/Marker Lights | [87 J] | 921-a | STEER COLUMN | Fused IGN Instruments |
| 790-l | REAR | Turn Signal Left | [85 J] | 922-l | STEER COLUMN | Fused IGN XMSN |
| 790-m | REAR | Turn Signal Right | [85 J] | | | |
| 244-k | CONTAINER POS. SPEED RED. | Heavy (non-signal) ground | [103 A] | 13-ia | STEER COLUMN | Heavy (non-signal) ground |
| 302-e | CONTAINER POS. SPEED RED. | Heavy (non-signal) ground | [103 A] | 13-ib | STEER COLUMN | Heavy (non-signal) ground |
| 302-f | CONTAINER POS. SPEED RED. | Fork Tilt Sensor | [103 A] | 13-ic | CONTAINER POS. SPEED RED. | Fused B+ Hydraulic system |
| 302-g | CONTAINER POS. SPEED RED. | Fork Tilt Sensor | [103 B] | 244-z | CONTAINER POS. SPEED RED. | Fused B+ Hydraulic system |
| 552-a | CONTAINER POS. SPEED RED. | XMSN REDUCED SPEED ON | [103 B] | 552-b | CONTAINER POS. SPEED RED. | XMSN REDUCED SPEED ON |
| 552-b | CONTAINER POS. SPEED RED. | Twistlock GREEN | [103 B] | 552-c | CONTAINER POS. SPEED RED. | Twistlock GREEN |
| 713-l | CONTAINER POS. SPEED RED. | Twistlock RED | [103 B] | 713-k | CONTAINER POS. SPEED RED. | Twistlock RED |

Figure 1. Electrical Schematic T3/T4 Final (Sheet 24 of 27)

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SAFETY PRECAUTIONS

MAINTENANCE AND REPAIR

- The Service Manuals are updated on a regular basis, but may not reflect recent design changes to the product. Updated technical service information may be available from your local authorized Yale® dealer. Service Manuals provide general guidelines for maintenance and service and are intended for use by trained and experienced technicians. Failure to properly maintain equipment or to follow instructions contained in the Service Manual could result in damage to the products, personal injury, property damage or death.
- When lifting parts or assemblies, make sure all slings, chains, or cables are correctly fastened, and that the load being lifted is balanced. Make sure the crane, cables, and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand, use a lifting mechanism.
- Wear safety glasses.
- DISCONNECT THE BATTERY CONNECTOR before doing any maintenance or repair on electric lift trucks. Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See HOW TO PUT THE LIFT TRUCK ON BLOCKS in the **Operating Manual** or the **Periodic Maintenance** section.
- Keep the unit clean and the working area clean and orderly.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **YALE APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure all nuts, bolts, snap rings, and other fastening devices are removed before using force to remove parts.
- Always fasten a DO NOT OPERATE tag to the controls of the unit when making repairs, or if the unit needs repairs.
- Be sure to follow the **WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG), and Diesel fuel are flammable. Be sure to follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area is well ventilated.

NOTE: The following symbols and words indicate safety information in this manual:



WARNING

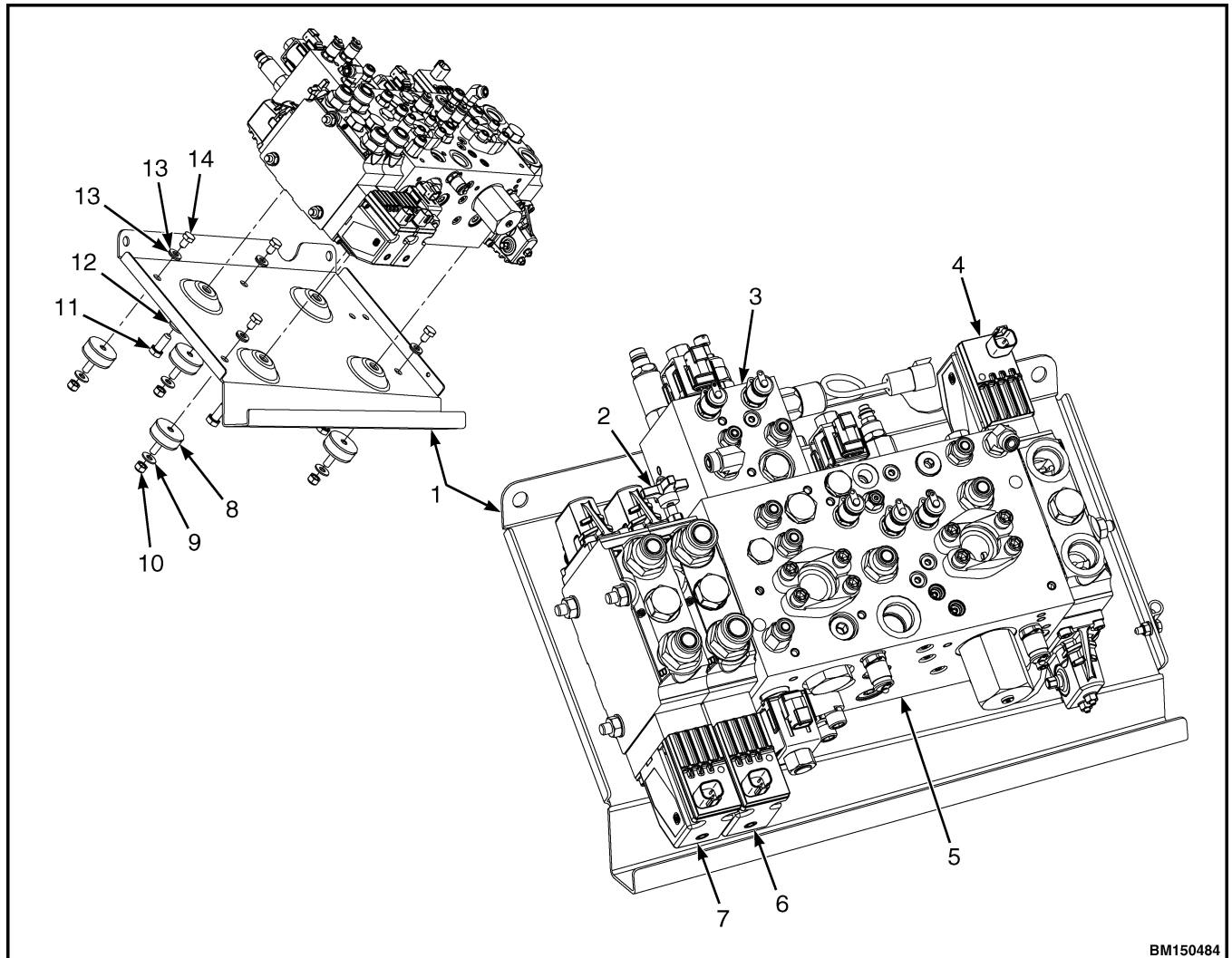
Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury and property damage.

On the lift truck, the **WARNING** symbol and word are on orange background. The **CAUTION** symbol and word are on yellow background.

MAIN CONTROL VALVE

BM150484

- | | |
|-----------------------------|---------------|
| 1. VALVE MOUNTING PLATE | 8. ISOLATOR |
| 2. EMERGENCY LOWERING VALVE | 9. WASHER |
| 3. BRAKE CONTROL MANIFOLD | 10. NUT |
| 4. AUXILIARY SECTION | 11. CAP SCREW |
| 5. MAIN CONTROL VALVE | 12. WASHER |
| 6. LIFT SECTION | 13. WASHER |
| 7. TILT SECTION | 14. CAP SCREW |

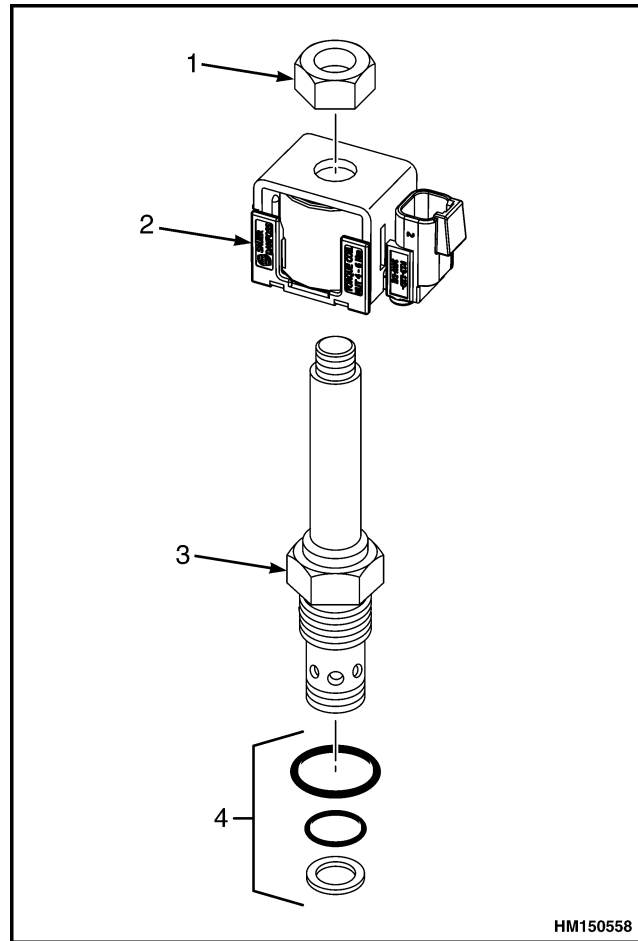
Figure 3. Main Control Valve**Introduction**

The main control valve is based on a closed center load sense principle.

The main control valve contains a manifold and three directional control valve sections, each controlling one main function.

Flow Path

Oil flow to the Main Control valve is provided by the Primary and Secondary variable Displacement pumps.

LOAD SENSE SELECTOR VALVE (D)

1. NUT
2. COIL
3. LOAD SENSE SELECTOR VALVE (D)
4. O-RINGS

Figure 15. Load Sense Selector Valve (D)

Function Description

Load Sense Selector Valve (D) when activated will disable the Steer and Brake Accumulator Charge functions by dumping the Load Sense pressure of these functions to tank.

The Load Sense Selector Valve (D) is operated by the Engine start up sequence and the Calibration switch in the side console of the cabin.

Component Functionality Test

To functionally test this component, see the repair manual for component removal, inspection, functionality test and re-install information.

DIRECTIONAL CONTROL VALVE SECTION

The Directional Control Valve sections (DCV) used for the lift, tilt, and auxiliary functions is an electric hydraulic controlled load independent proportional control valve.

Description

The priority valve is used to prioritize the required flow to the steering system and brake accumulator charging system above flow requirements of other functions.

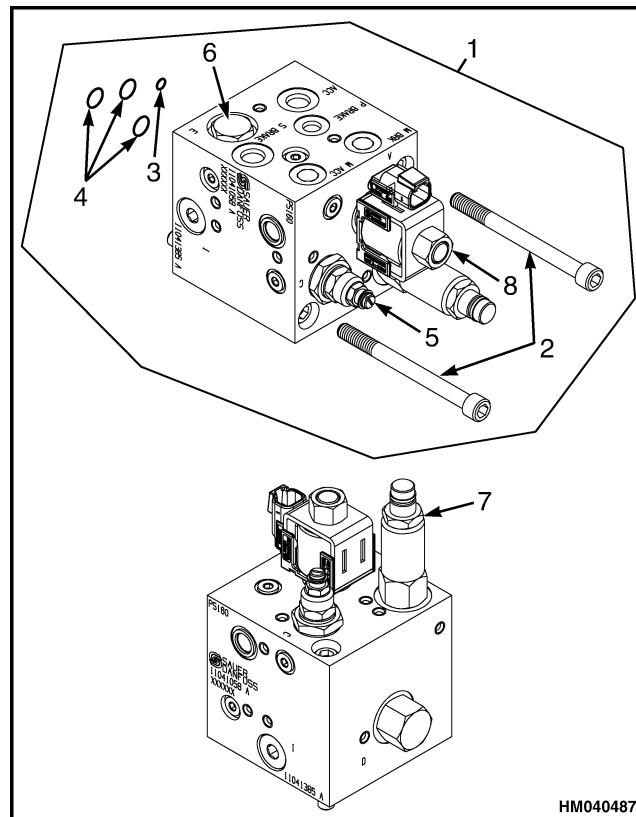
Operation

The primary variable displacement pump will supply the flow that is required by the hydraulic system. The priority valve will divide the flow between the priority functions and other hydraulic functions. The priority valve will guarantee that the required flow is supplied to the priority functions.

The selection (position) of the priority spool is directly related with the output flow to the priority functions. This spool selection is controlled by the pressure differential between the pressure directly behind the priority spool and the LS signal (function pressure of the priority function that is active), to the priority valve.

When more flow is supplied by the variable displacement pump to the priority valve than required for the priority function, the pressure differential will not be in balance with the priority valve setting (spring) and the priority spool will shift to relieve the excessive flow to the pressure gallery of the main control valve. For additional information on the main control valve, refer to **Hydraulics** 1900YRM2149 .

Brake Control Manifold



- | | |
|---------------------------|----------------------------|
| 1. HIC, BRAKE/ACCUMULATOR | 5. PRESSURE REDUCING VALVE |
| 2. SCREW | 6. CHECK VALVE |
| 3. O-RING | 7. UNLOADING VALVE |
| 4. O-RING | 8. SOLENOID VALVE |

Figure 24. Brake Control Manifold

Operation

The steering control valve provides flow to the hand pump. The hand pump displaces flow at a fixed rate through the steering control valve, based on the movement and direction of the steering wheel. The rotation speed of the hand pump is limited by the flow supplied by the priority valve.

LS Relief Valve***Fundamental***

The LS relief valve is a direct-acting relief valve based on a pressure control valve.

Operation

When the Steer Control Unit is selected, the LS line is connected to the steering function pressure and if the pressure is greater than the LS relief valve setting, the LS relief valve will open a line to the hydraulic tank and control the maximum steering pressure. When the LS relief valve is opening (active), the flow from the variable displacement pump will also be affected.

By relieving the LS pressure to the hydraulic tank, required flow for the steering system will be returned to zero and if no other hydraulic functions are being operated, the variable displacement pump will return to zero output flow.

Shock Valve***Fundamental***

The shock valve is a direct-acting relief valve based on a pressure control valve.

Operation

The shock valve has two pressure relief valves, one positioned at each of the steering cylinder lines. When an external impact creates a pressure greater than the relief valve settings, the relief valves will open to relieve the pressure and the flow will be directed to the opposite side of the steering cylinder.

Check valves are positioned in the steering cylinder lines to prevent the flow through these lines when the relief valves are closed.

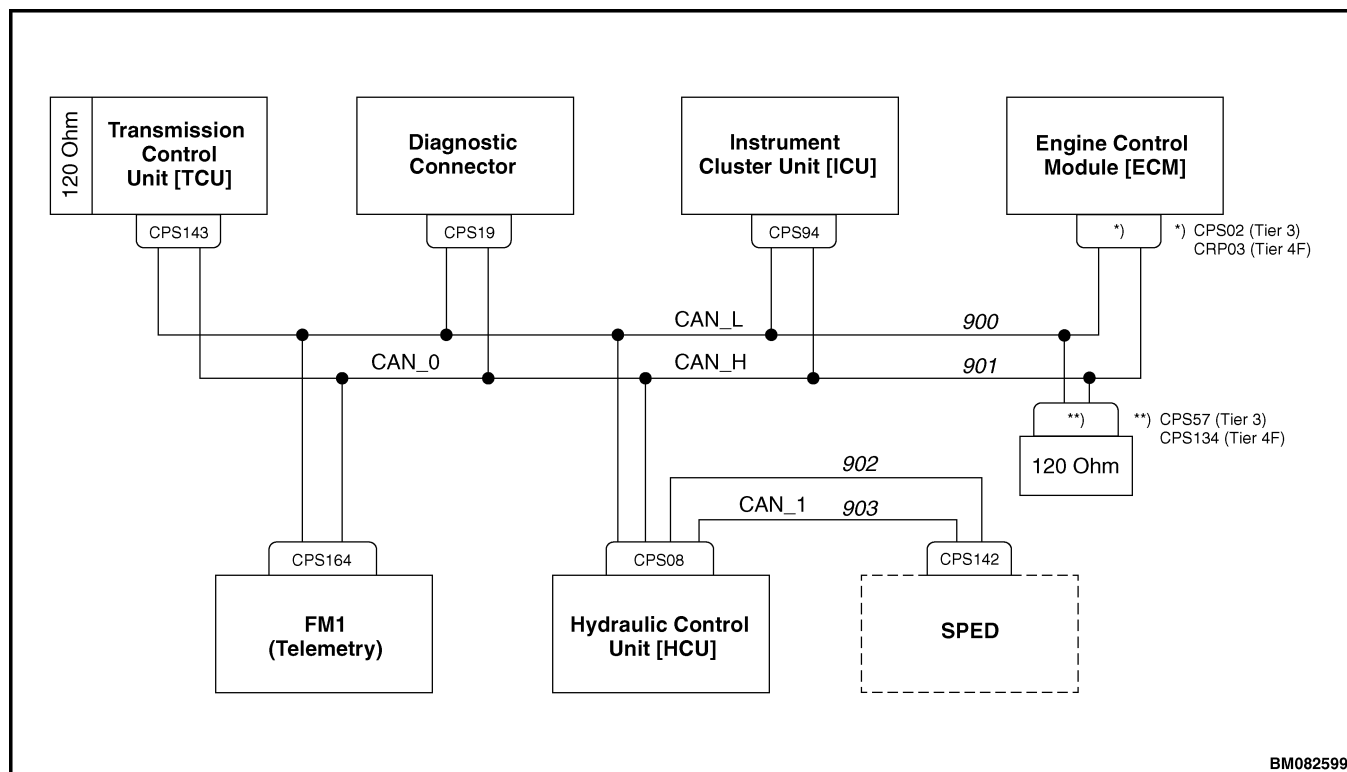


Figure 39. CANbus Circuit

Troubleshooting

Most controllers have a memory that retains codes for situations that occurred within their own controlled circuit. Also faults in the controller itself are stored as a fault code. Both the IFAK cable and the instrument cluster contain a controller that makes these codes visible on a lap top computer, respectively on the hour meter display. The explanation of these codes is shown on the different fault code tables for engine, transmission, hydraulic system and Electronic Climate Control.

The can bus connection itself can be verified by checking continuity of the data inverse wires 900 (green) and the data wires 901 (yellow), and by checking the 120 Ohm resistance value of the end resistor. For schematic location and actual location see **Electric, Software and Controls 2200YRM2153** .

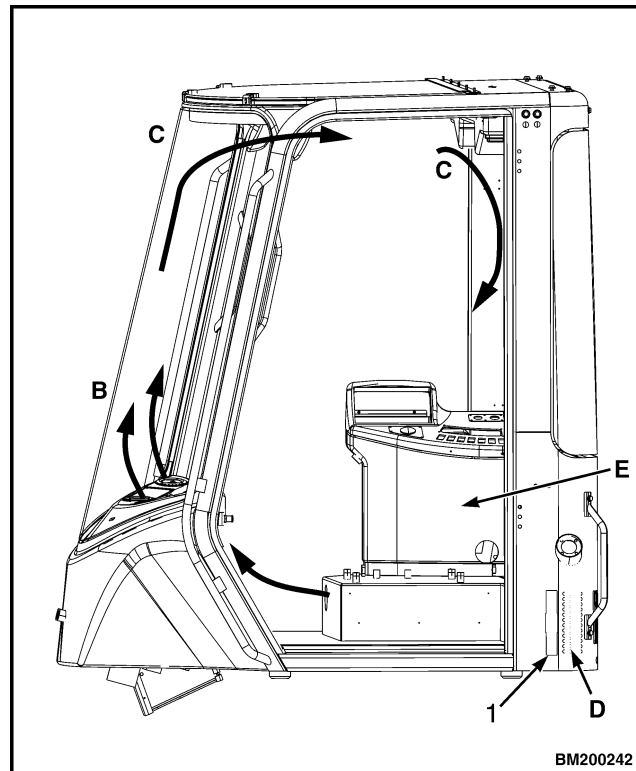
Diagnostics of a faulty CAN bus system requires thorough knowledge and specific software. As controllers cannot be repaired, there is no other option than to replace a controller if it is found to be defective.

INSTRUMENT PANEL

The lights and instruments that are shaded in Figure 40 and Figure 41 are controlled by CANbus signals. The legend also shows the related pin numbers for connector CPS94.

To test functionality of the individual warning lights, switch the ignition from **OFF** to **ON**. All lights should light up for one second. As there are no serviceable components, the entire instrument panel must be replaced if found defective.

position of the heat control knob. On standard units the knob and valve are connected mechanically, on units with an Air Conditioning system there is an electronic connection.



- A. OPTIONAL AIR VENT
- B. AIR TO FRONT WINDOW
- C. CAB AIR FLOW
- D. FRESH AIR ENTRY
- E. RECIRCULATION AIR ENTRY (REAR SIDE)

- 1. CAB AIR FILTER

Figure 52. Ventilation

Air Conditioning

General

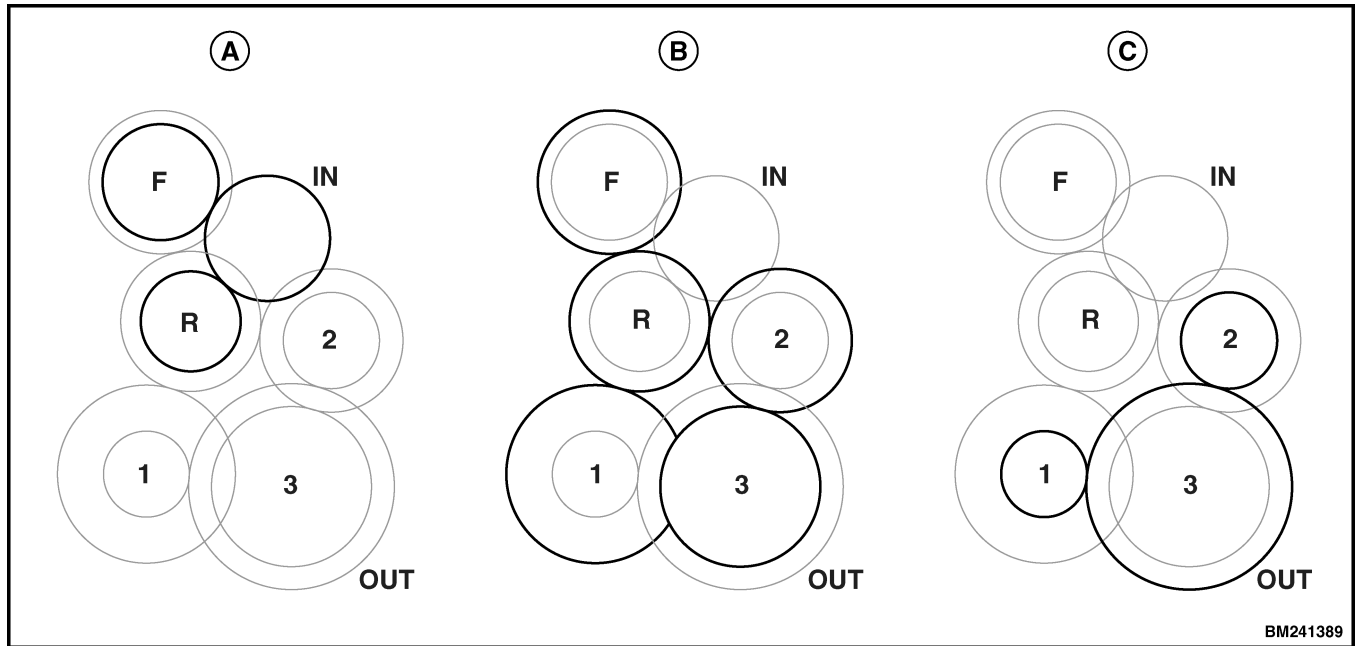


CAUTION

Replacement, installation, and repairs to air conditioning units that require discharging and/or refilling of the refrigeration fluid may only be performed by a certified technician.

The air conditioning system consists of a compressor with an electromagnetic clutch, condenser, dryer, evaporator, and interconnected sensors and switches. See Figure 53.

The engine drives the compressor when the clutch at the compressor has been activated. Activation of the clutch is determined by several sensors and switches that are connected in series. The operator must switch **ON** the button for the air conditioning system and select one of the fan switch speeds. Refer to the electrical schematic **Manual** pertaining to each lift truck, for the schematic locations and interconnections of the sensors and switches.



BM241389

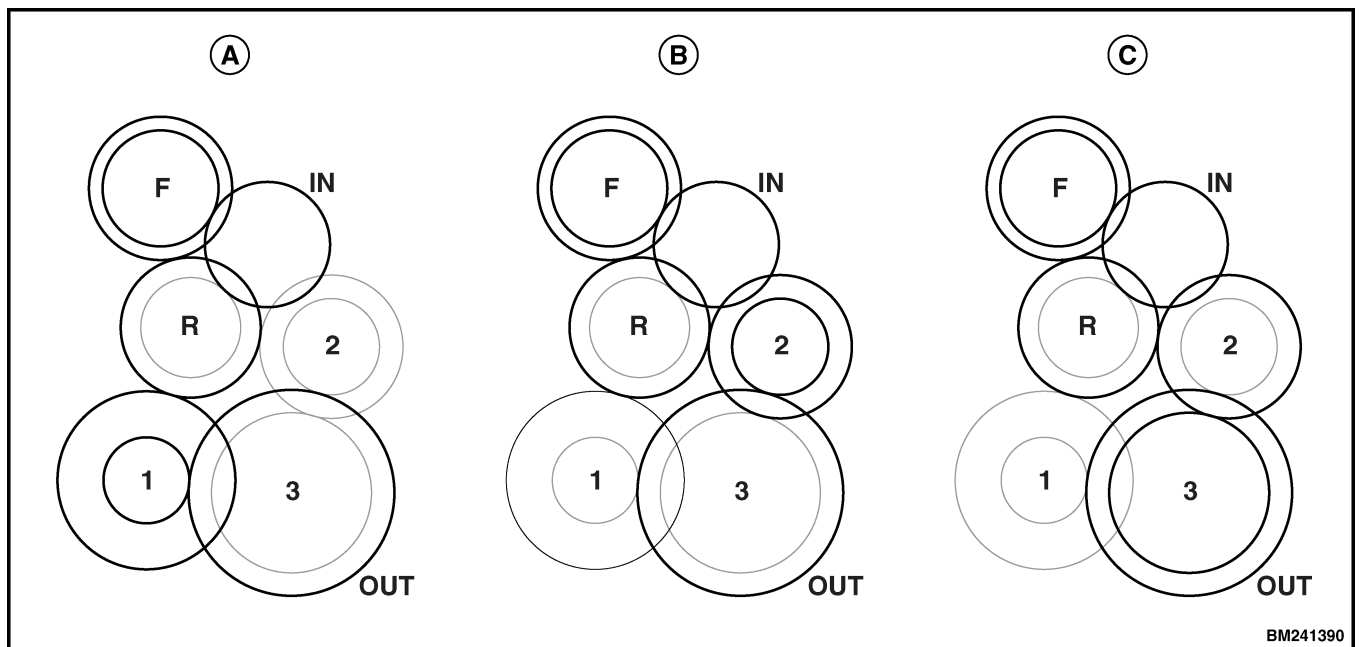
A. INPUT GEARS

B. INTERCONNECTING GEARS

C. OUTPUT GEARS

Figure 64. Gear Engagement

The different speeds are obtained by engaging either the forward or reverse clutch, and by engaging either one of the clutches for the 1st, 2nd, and 3rd speed. When the transmission is in NEUTRAL, all clutches are disengaged. See Figure 65.



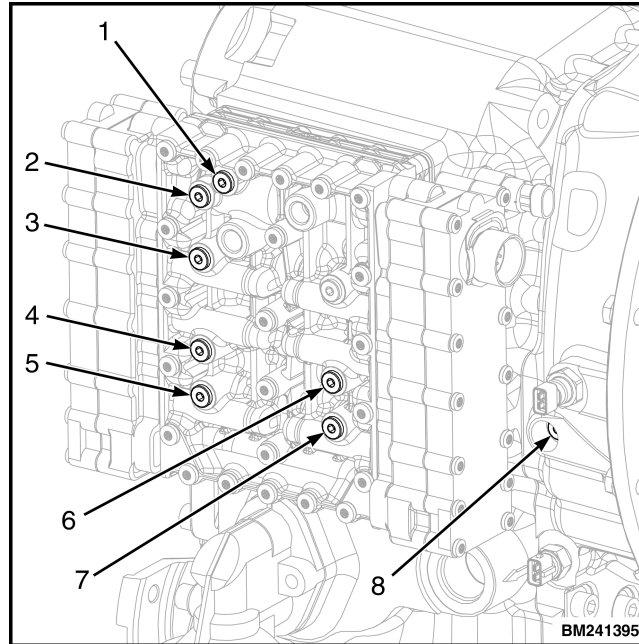
BM241390

A. FORWARD 1ST GEAR

B. FORWARD 2ND GEAR

C. FORWARD 3RD GEAR

Figure 65. Gear Engagement for Selected Speeds



| Item | Port Number | Description | Relief Pressure | Normal Pressure |
|------|-------------|----------------------------------|---------------------------|----------------------------|
| 1 | 51 | Torque Converter In | 11-13 bar (159-188 psi) | 5 bar (72.5 psi) @ 1500RPM |
| 2 | 65 | System Pressure | 16-18.5 bar (232-268 psi) | System Pressure |
| 3 | 57 | 2nd Gear Clutch | 16-18 bar (232-261 psi) | System Pressure |
| 4 | 53 | Forward Clutch | 16-18 bar (232-261 psi) | System Pressure |
| 5 | 58 | 3rd Gear Clutch | 16-18 bar (232-261 psi) | System Pressure |
| 6 | 55 | Reverse Clutch | 16-18 bar (232-261 psi) | System Pressure |
| 7 | 56 | 1st Gear Clutch | 16-18 bar (232-261 psi) | System Pressure |
| 8 | 52/63 | Converter Pressure Back Up Valve | 4.3-7.3 bar (62-106 psi) | 2.5 bar (36 psi) |

Figure 75. Check Ports, Control Valve

Pressure Specifications

Temperature of the oil must be 80 to 90°C (180 to 199°F) for correct pressure measurement.

In the cooling and lubrication circuit the torque converter causes additional flow resistance with increasing speed difference between engine and transmission input shaft.

The screenshot shows a 'Truck configuration' window with two tabs: 'Configuration' and 'Limitations'. The 'Configuration' tab is active and contains the following fields:

- Unit code: J007
- Model: H12M-6 / H280HD
- Tire size: 10.00-20 14PR
- Inching enabled:
- Direction control option:
 - Monotrol
 - Forward / Reverse lever
- Truck serial number: J007E01501H
- Transmission serial number: 0000000000

An 'Accept' button is located at the bottom right of the configuration fields.

The 'Limitations' tab is visible below the configuration fields and contains a table of adjustable parameters:

| | |
|--|-----------------|
| Tire radius | 519 |
| Axle ratio | 14,04 |
| Gearbox type | 3WG 161 |
| Model | H12M-6 / H280HD |
| Vehicle speed - Max. [km/h] | 40 |
| Direction change - Max. vehicle speed [km/h] | 5 |
| Reduced vehicle speed - Max. [km/h] | 5 |
| Direction change - Max. engine speed [rpm] | |
| Gear encasement - Max. engine speed [rpm] | 1800 |

The ID 'BM241236' is located at the bottom right corner of the window.

Figure 81. Testman Configuration Screen

NOTE: The truck configuration screen opens with default fields and does not retrieve information from the controller other than the truck serial number and Transmission serial number. Stored values can be found in the Truck Information menu. **Only hit "ACCEPT" in the configuration screen when a new controller is installed or the controller is reprogrammed.** Accepting incorrect Configuration leads to wrong drive program selection or loss of TCU configuration.

Configuration

In the Truck configuration menu, Unit Code, Model, Tire Size, Direction Control Option, Truck Serial Number and Transmission Serial Number are mandatory fields. All fields have to be set during the configuration in order to activate the correct drive program for the truck.

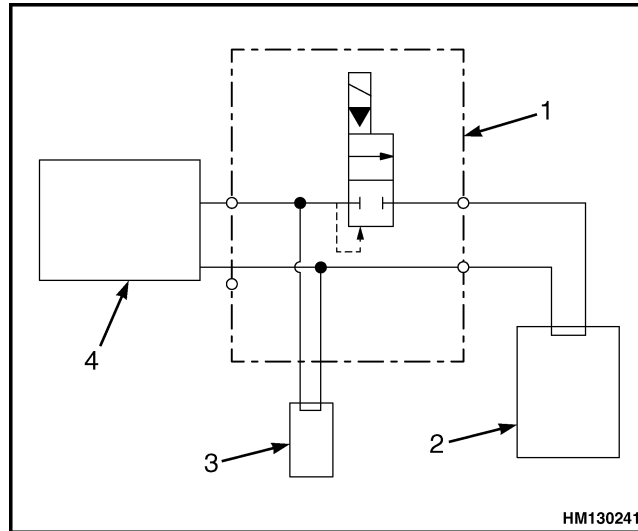
Inching is default enabled but can be disabled at customer request. Disabling inching will activate declutch mode in the controller.

Limitations

Testman offers the ability to adjust certain default maximum values to meet customer specific requirements. The values in the controller can be adjusted within a fixed threshold.

The default values can be adjusted with Testman, using the Limitations Tab in the Truck Configuration menu. See Figure 82.

Engine coolant flow to the DEF manifold is controlled by the DEF tank heating valve. This valve is normally closed to direct coolant flow from the cylinder head to the DEF Dosing Valve for cooling. When activated, the DEF tank heating valve opens to provide a coolant flow to both the DEF tank unit and to the DEF Dosing Valve. Because of the bigger hose diameter to the DEF tank unit, the DEF tank unit will receive a larger coolant flow compared with the flow to the DEF Dosing Valve. See Figure 92.



- | | |
|---------------------------|-----------------|
| 1. DEF TANK HEATING VALVE | 3. DOSING VALVE |
| 2. DEF TANK | 4. ENGINE |

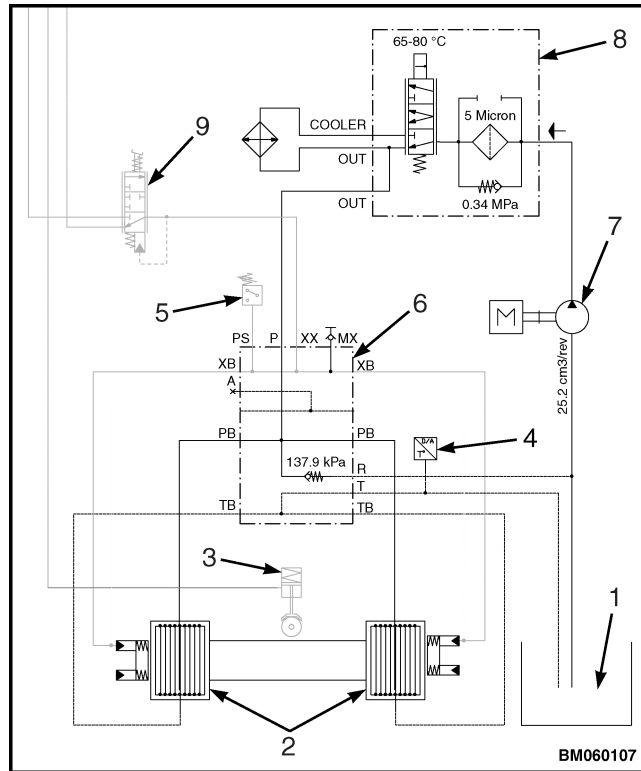
Figure 92. DEF Tank Heating Valve

When starting the engine at temperatures below -4°C (25°F), the empty (purged) DEF lines and empty DEF pump are electrically heated. Any DEF particles still present will be defrosted. Pre-heating DEF lines and DEF pump will prevent that DEF from the tank freezes when DEF enters these components during initial priming.

While the engine heats up, warm engine coolant will defrost DEF in the tank. After the DEF temperature sensor in the tank suction manifold has reached -4°C (25°F), the ECM can give a signal to the DEF pump to start priming.

After the system has primed, the system will cycle the electrical heating system ON and OFF as long as the temperature at the TBAP sensor is below -4°C (25°F).

The DEF tank heating valve will be re-activated when DEF temperature in the tank gets below -4°C (25°F). See Figure 93.



- | | |
|-----------------------|-----------------------------|
| 1. HYDRAULIC TANK | 6. BRAKE MANIFOLD |
| 2. SERVICE BRAKES | 7. GEAR PUMP |
| 3. PARK BRAKE | 8. HYDRAULIC COOLING FILTER |
| 4. TEMPERATURE SENDER | 9. BRAKE TREADLE VALVE |
| 5. BRAKE LIGHT SWITCH | |

Figure 104. Hydraulic Cooling System

When the cylinder extends, the increasing air pressure between shell and rod pushes the oil through the holes into the inside of the rod. When the cylinder retracts, the reducing air pressure at the shell side allows oil to return from the rod inside to the highest possible position on the rod outside.

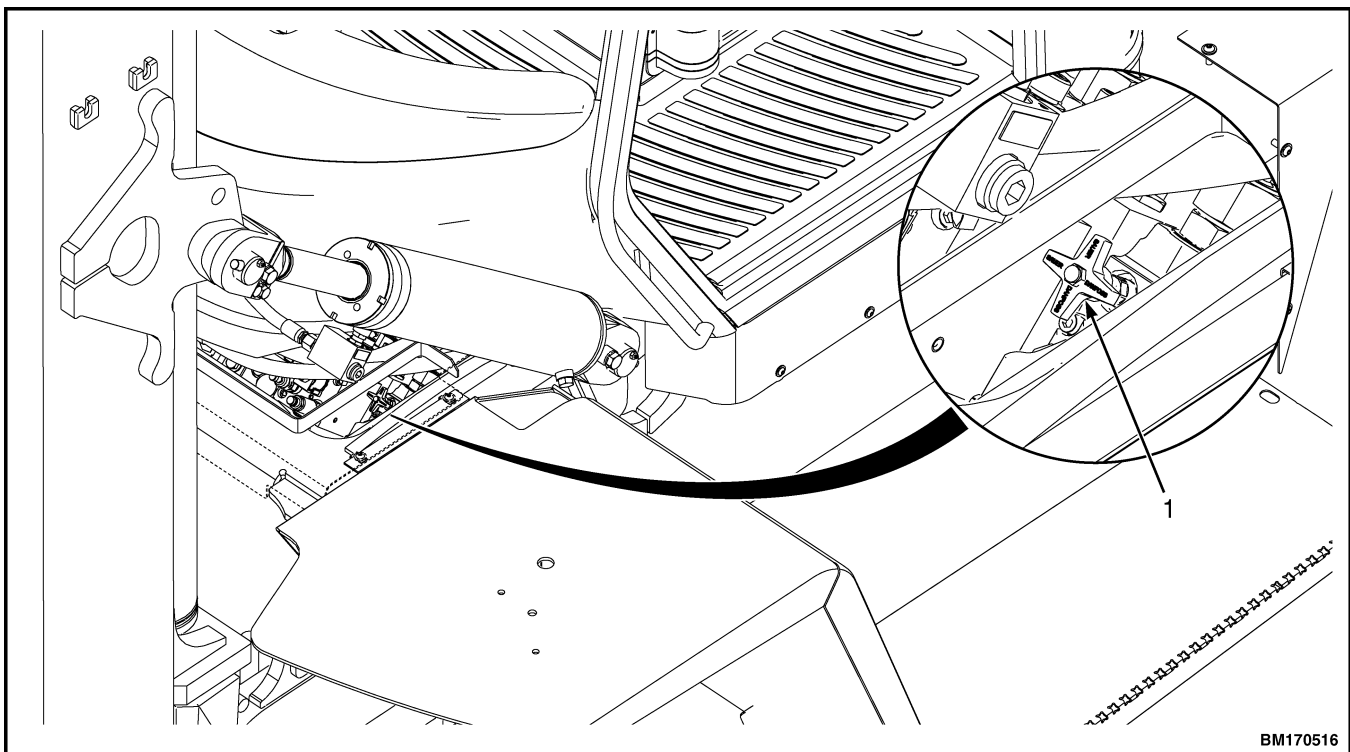
Emergency Lowering Valve

The lift cylinders will NOT lower if lift cylinder pressure is insufficient to overcome the combined force of the spring and the oil pressure at the pilot side of check valve. This situation occurs for instance, when the weight of carriage has been removed from lift cylinders. The emergency lowering valve provides the possibility to manually relieve lift cylinder pressure to tank.

The emergency lowering valve combines three functions in one assembly. The anti-cavitation valve opens when lift cylinder pressure is lower than tank pressure. The shock valve opens when (under extreme conditions) lift cylinder pressure exceeds 35 MPa (5076 psi). Turning the hand wheel clock wise, opens the shock valve against spring force. See Figure 115.

Operation

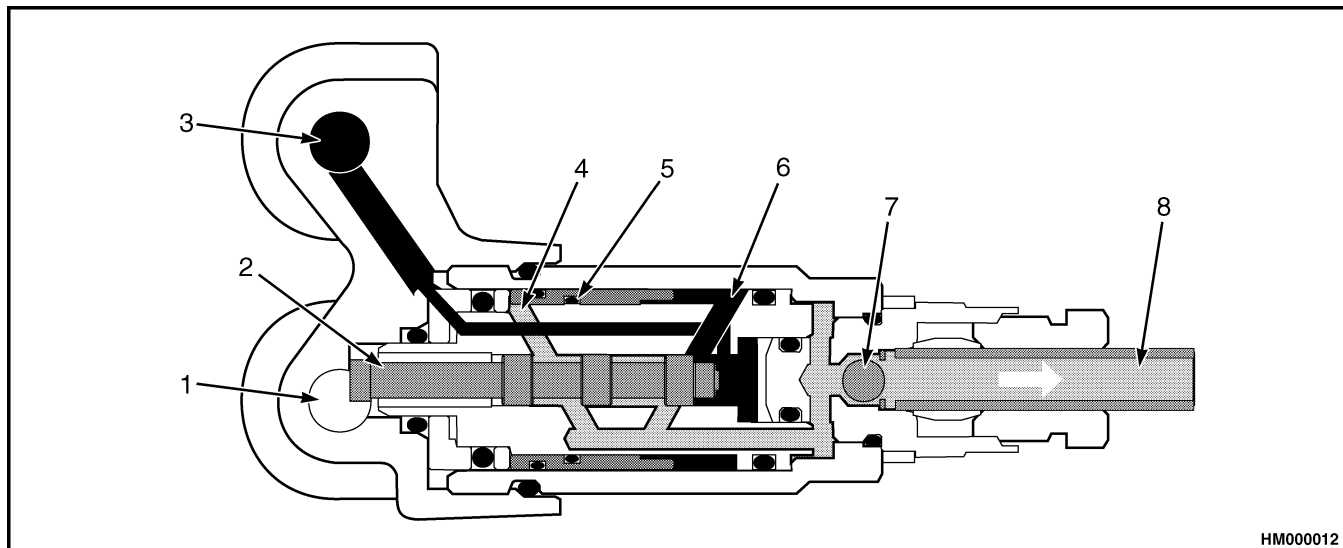
The emergency lowering valve is located at the left hand side of the main control valve. See Figure 115. Initial turning of the hand wheel **CLOCKWISE** will remove play between spindle and shock valve. Continued turning clockwise opens the shock valve against spring force and allows oil from the lift cylinders to drain to tank. See Figure 116.



1. EMERGENCY LOWERING CONTROL VALVE

Figure 115. Emergency Lowering Control Valve - Location

When supply line B is pressurized (pump phase B), the admission spool is moved towards supply line A. Grease will flow through piston channel B and push the piston towards piston channel A. Movement of the piston pushes all grease at the A-side out of the cavity, through piston channel A and further past the ball valve into the grease line. See Figure 127.



- | | |
|---------------------|---------------------|
| 1. SUPPLY LINE A | 5. PISTON |
| 2. ADMISSION SPOOL | 6. PISTON CHANNEL B |
| 3. SUPPLY LINE B | 7. BALL VALVE |
| 4. PISTON CHANNEL A | 8. GREASE LINE |

Figure 127. Pump Phase B

The amount of grease delivered depends on the size of the piston. A smaller piston can make a larger stroke and will pump more grease. A larger piston has a shorter stroke and will pump less grease. The supply of the metering units used on this truck varies between 0.05 cc per stroke (nr 1) and 2 cc per stroke (nr 10). The metering number is stamped on the fastening hexagon.

The speed of grease delivery depends on fluidity of the grease and the resulting resistance in the grease lines. Grease fluidity is determined by the NLGI Grade and the grease temperature. See the Repair Manual, Grease Recommendations.

Components of the metering units are not serviced separately. Replace the entire metering unit when malfunctioning.

Pressure Switch

The function of the pressure switch is to provide a signal to the controller when all divider blocks are pressurized. The pressure switch for the frame greasing system connects at 150 bar (2176 psi), and is located at the most distant divider block, which is at the end of the outer boom.

The pressure switch for the attachment greasing system switches at 175 bar (2538 psi), and is located on the rotator, where the hoses connect with the hoses coming from the inner boom of the truck.

The construction and operation of the pressure switch is similar to the construction of the metering unit, except that the pressure switch does NOT have a piston and that a switch has been fitted instead of the ball valve. See Figure 128.



Torque Specifications, Cummins Diesel

LUBRICATION SYSTEM

Plug, Oil Sump, Steel Oil Pan
80 N•m (59 lbf ft)

All other Torque Specifications are found in Cummins Engine Manual. Contact Cummins Engine for any torque specifications not listed for this engine.

- *The OPS needs repair when hydraulic functions can only be operated with the hydraulic service switch in the ON position.*
- *To repair the OPS, check functionality of OPS fuse, seat switch, seat belt switch, and operator presence relay. Replace any failed OPS component.*

Fault Code

Look up the fault code and determine the location of the indicated component on the truck. See **Diagrams** 8000YRM2159 and **Electric, Software and Controls** 2200YRM2153.

- *Check functionality of the component and repair as required.*

If a fault code suggests checking a Directional Control Valve or an Actuation Valve, verify if partial or complete replacement is required.

Move the spool by rotating the actuator axle about 15 degrees with a spanner.

- *When the spool moves smoothly, replace the failed Electrical Actuation Module only.*
- *When the spool sticks, disassemble and clean the spool section.*
- *If components of the spool section are damaged after disassembly, replace the spool section.*

No Lowering Possible with Engine OFF

Make sure the lift cylinders are extended and the lift chains carry at least the weight of the carriage.

- *If the carriage is not installed, use the emergency lowering control valve to lower the mast.*

Turn the key switch to the **ON** position.

Move the hoist lever into the lowering position.

- *If fault code H2664 is displayed, resolve the open circuit or short circuit situation for the (emergency) Lowering Selector Valve [B].*

Attach a pressure gauge to port MPLT.

Read the pressure gauge at port MPLT with the key switch in the **ON** position and the hoist lever in the lowering position.

- *If pressure is lower than 1 MPa, investigate proper functioning of the Pilot Supply Valve [F] and the Lowering Selector Valve [B]. Repair or replace as necessary.*

Incorrect Movement

Irregular (shaking) Movement or Slight Carriage Movement When Starting Engine

De-aerate system by operating the affected function(s) several times.

- *Activate for one second and reverse cycle. Repeat a few times.*
- *When the problem re-occurs, search for entry of air in pump suction line.*

Unequal Movement of Left And Right Tilt Cylinder

Verify and correct tilt cylinder adjustment and condition of pivot points.

Establish and repair internal leaks in the tilt cylinders.

Verify and correct relief pressure setting of the individual tilt relief valves.

Table 5. Fault Code Descriptions (Continued)

| Warning Lights | | Fault Code Readout | |
|----------------------|-------------------|--------------------|---|
| Engine Warning Light | Engine Stop Light | Engine Fault Code | Description |
| ON | | E0418 | Water in Fuel Indicator - Data Valid But Above Normal Operating Range - Least Severe Level |
| ON | | E0421 | Engine oil temperature high, over temperature warning. |
| ON | | E0422 | Engine coolant level sensor circuit - Data Erratic, Intermittent, or Incorrect |
| ON | | E0425 | Engine Oil Temperature - Data erratic, intermittent, or incorrect. |
| | | E0426 | SAE J1939 datalink, - Data erratic, intermittent or incorrect |
| ON | | E0428 | Water in Fuel Indicator Sensor Circuit - Voltage Above Normal or Shorted to High Source |
| ON | | E0429 | Water in Fuel Indicator Sensor Circuit - Voltage Below Normal or Shorted to Low Source |
| ON | | E0431 | Accelerator Pedal or Lever Idle Validation Switch - Data Erratic, Intermittent, or Incorrect |
| ON | ON | E0432 | Accelerator Pedal or Lever Idle Validation Switch Circuit - Out of Calibration |
| ON | | E0433 | Intake Manifold Pressure Sensor Circuit - Data erratic, intermittent, or incorrect. |
| ON | | E0434 | Power Lost without Ignition Off - Data erratic, intermittent, or incorrect. |
| ON | | E0435 | Engine Oil Rifle Pressure - Data Erratic, Intermittent, or Incorrect |
| ON | | E0441 | Battery 1 Voltage - Data Valid But Below Normal Operating Range - Moderately Severe Level |
| ON | | E0442 | Battery 1 Voltage - Data Valid But Above Normal Operating Range - Moderately Severe Level |
| ON | | E0443 | Accelerator pedal position sensor supply voltage circuit, shorted low. |
| ON | | E0444 | OEM sensor supply voltage low - warning. |
| ON | ON | E0449 | Injector Metering Rail 1 Pressure - Data Valid But Above Normal Operating Range - Most Severe Level |
| ON | | E0451 | Injector Metering Rail 1 Pressure Sensor Circuit - Voltage Above Normal or Shorted to High Source |
| ON | | E0452 | Injector Metering Rail 1 Pressure Sensor Circuit - Voltage Below Normal or Shorted to Low Source |
| ON | | E0453 | Gas mass flow sensor circuit, shorted high. |
| ON | | E0454 | Gas mass flow sensor circuit, shorted low. |
| | ON | E0455 | Fuel control valve circuit, shorted high. |
| | ON | E0458 | Ignition timing signal circuit, shorted high. |
| | ON | E0459 | Ignition timing signal circuit, shorted low. |
| | ON | E0461 | Ignition reference signal circuit, shorted high. |
| | ON | E0462 | Ignition reference signal circuit, shorted low. |
| ON | | E0464 | Heated Oxygen Sensor Circuit, shorted low. |
| ON | | E0465 | Wastegate actuator #1 circuit, high voltage. |
| ON | | E0466 | Wastegate actuator #1 circuit, low voltage or faulty ECM output circuit. |
| ON | | E0482 | Secondary fuel pressure sensor circuit, low pressure. |

Table 5. Fault Code Descriptions (Continued)

| Warning Lights | | Fault Code Readout | |
|----------------------|-------------------|--------------------|--|
| Engine Warning Light | Engine Stop Light | Engine Fault Code | Description |
| | ON | E3255 | Aftertreatment Diesel Particulate Filter Outlet Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level. |
| ON | | E3256 | Aftertreatment Diesel Particulate Filter Outlet Temperature - Data Valid But Above Normal Operating Range - Least Severe Level. |
| ON | | E3258 | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Circuit - Current Below Normal or Open Circuit |
| ON | | E3261 | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 Circuit - Current Below Normal or Open Circuit |
| ON | | E3295 | Engine Exhaust Gas Recirculation (EGR) Mixer Inlet Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source |
| ON | | E3296 | Engine Exhaust Gas Recirculation (EGR) Mixer Inlet Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source |
| ON | | E3298 | Anti-theft Encryption Seed - Out of Calibration |
| ON | | E3311 | Aftertreatment Diesel Particulate Filter Intake Gas Temperature – Data valid but above normal operational range – Most Severe Level |
| ON | | E3312 | Aftertreatment Diesel Particulate Filter Outlet Gas Temperature – Data valid but above normal operational range – Most Severe Level |
| ON | | E3313 | Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature Sensor Circuit - Voltage Below Normal or Shorted to Low Source |
| ON | | E3314 | Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source |
| ON | | E3315 | Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature - Data Erratic, Intermittent, or Incorrect |
| ON | | E3316 | Aftertreatment 1 Diesel Particulate Filter Intake Temperature Sensor Circuit - Voltage below normal, or shorted to low source |
| ON | | E3317 | Aftertreatment 1 Diesel Particulate Filter Intake Temperature Sensor Circuit - Voltage above normal, or shorted to high source |
| ON | | E3318 | Aftertreatment 1 Diesel Particulate Filter Intake Temperature - Data |
| ON | | E3319 | Aftertreatment 1 Diesel Particulate Filter Outlet Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source |
| ON | | E3321 | Aftertreatment Diesel Particulate Filter Outlet Temperature Sensor Circuit - Voltage below normal, or shorted to low source. |
| ON | | E3322 | Aftertreatment Diesel Particulate Filter Outlet Temperature - Data erratic, intermittent or incorrect. |
| ON | | E3325 | Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature Swapped - Out of Calibration erratic, intermittent or incorrect |
| ON | ON | E3326 | SAE J1939 Multiplexed Accelerator Pedal or Lever Sensor System - Abnormal Update Rate |
| ON | | E3328 | Transmission Output Shaft Speed - Abnormal Update Rate |
| ON | | E3329 | J1939 Network #2 - Data Erratic, Intermittent or Incorrect |
| ON | | E3331 | J1939 Network #3 - Data Erratic, Intermittent or Incorrect |
| ON | | E3341 | Engine Air Filter Differential Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level |

Table 6. Transmission Fault Codes (Continued)

| Fault Code | Description and TCU Reaction | Repair Information |
|-----------------------|---|---|
| t0302 0x32 | Short circuit (s.c.) to ground at engine speed input The measured voltage at the control unit input is < 0.45 Volt. <ul style="list-style-type: none"> • Cable or connector contacts vehicle ground. • Engine speed sensor has internal defect • Transmission Control Unit (TCU) has internal defect (A1 on ZF schematic). OP-Mode: substitute clutch control | <ul style="list-style-type: none"> • Check wiring from sensor to control unit, in particular for defective plug connection like corroded or damaged plug contact. • Check sensor and change component if necessary. • In case of further active failure change control unit. |
| t0303 0x33 | Logical error at engine speed input The control measures a high engine speed which is zero the next moment. <ul style="list-style-type: none"> • Cable or connector defective. • Cable or connector has bad contact. • Gap engine speed sensor – tone wheel too large. • Engine speed sensor has internal defect. OP-Mode: substitute clutch control | The failure is reset, if ignition is turned on. <ul style="list-style-type: none"> • Check wiring from sensor to control unit, in particular for defective plug connection like corroded or damaged plug contact. • Check gap between sensor and tone wheel, the gap must not be too large. Verify assembly tolerances of sensor and adjust mounting if necessary. • Check sensor and change component if necessary. |
| t0304 0x34 | Short circuit (s.c.) to battery voltage or open circuit (o.c.) at turbine speed input The measured voltage at the control unit input is > 7 Volt. <ul style="list-style-type: none"> • Cable or connector without contact to transmission control unit. • Cable or connector contacts battery voltage. • Turbine speed sensor has internal defect. • Transmission Control Unit (TCU) has internal defect (A1 on ZF schematic). OP-Mode: substitute clutch control if a failure is existing at output speed, TCU shifts to neutral OP-Mode: limp home | <ul style="list-style-type: none"> • Check wiring from sensor to control unit, in particular for defective plug connection like corroded or damaged plug contact. • Check sensor and change component if necessary. • In case of further active failure change control unit |

Table 6. Transmission Fault Codes (Continued)

| Fault Code | Description and TCU Reaction | Repair Information |
|-----------------------------|---|---|
| t1101 0xB1 | <p>Slippage at clutch K1The control calculates a speed difference though clutch K1 is closed. If speed difference exceeds released range, slippage is assumed. Transmission is shifted to neutral.</p> <ul style="list-style-type: none"> • Low main pressure. • Low pressure at clutch K* • Internal speed sensor signal faulty. • Output speed sensor signal faulty. • Gap sensor – tone wheel too large. • Clutch is defective. <p>TCU shifts to neutral OP-Mode: limp home if failure at another clutch is pending TCU shifts to neutral OP-Mode: TCU shutdown</p> | <p>Reason for differential speed must be localize.</p> <ul style="list-style-type: none"> • Check main pressure in system. • Check pressure at clutch. • Check gap between sensors and tone wheels, the gap must not be too large. Verify assembly tolerances of sensor and adjust mounting if necessary. • Check signal of sensors and change component if necessary. • In case of further active failure replace clutch. |
| t1102 0xB2 | <p>Slippage at clutch K2The control calculates a speed difference though clutch K2 is closed. If speed difference exceeds released range, slippage is assumed. Transmission is shifted to neutral.</p> <ul style="list-style-type: none"> • Low main pressure. • Low pressure at clutch K* • Internal speed sensor signal faulty. • Output speed sensor signal faulty. • Gap sensor – tone wheel too large. • Clutch is defective. <p>TCU shifts to neutral OP-Mode: limp home if failure at another clutch is pending TCU shifts to neutral OP-Mode: TCU shutdown</p> | <p>Reason for differential speed must be localize.</p> <ul style="list-style-type: none"> • Check main pressure in system. • Check pressure at clutch. • Check gap between sensors and tone wheels, the gap must not be too large. Verify assembly tolerances of sensor and adjust mounting if necessary. • Check signal of sensors and change component if necessary. • In case of further active failure replace clutch. |

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