

# **SPECIFICATIONS**

## **3208 DIESEL TRUCK ENGINE**

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**NOTE:** Refer to the complete Service Manual for information not found here.

A "C" in the left margin is an indication of a change from the former issue.

## Introduction

The specifications given in this book are on the basis of information available at the time the book was written. These specifications give the torques, operating pressures, measurements of new parts, adjustments and other items that will affect the service of the product.

When the words "use again" are in the description, the specification given can be used to determine if a part can be used again. If the part is equal to or within the specification given, use the part again.

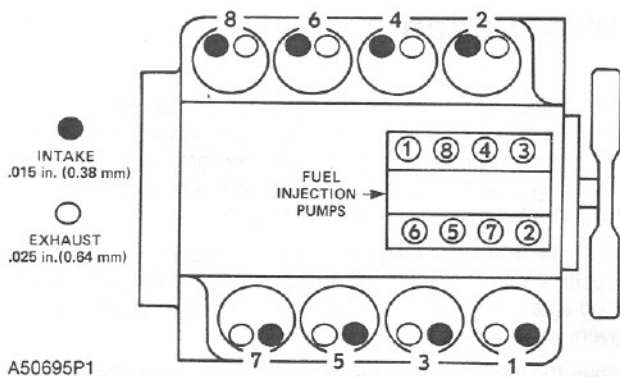
When the word "permissible" is in the description, the specification given is the "maximum or minimum" tolerance permitted before adjustment, repair and/or new parts are needed.

A comparison can be made between the measurements of a worn part and the specification of a new part to find the amount of wear. A part that is worn can be safe to use if an estimate of the remainder of its service life is good. If a short service life is expected, replace the part.

**NOTE:** The specification given for "use again" and "permissible" are intended for guidance only and Caterpillar Inc. hereby expressly denies and excludes any representation, warranty or implied warranty of the reuse of any component.

# Specifications

## Engine Design

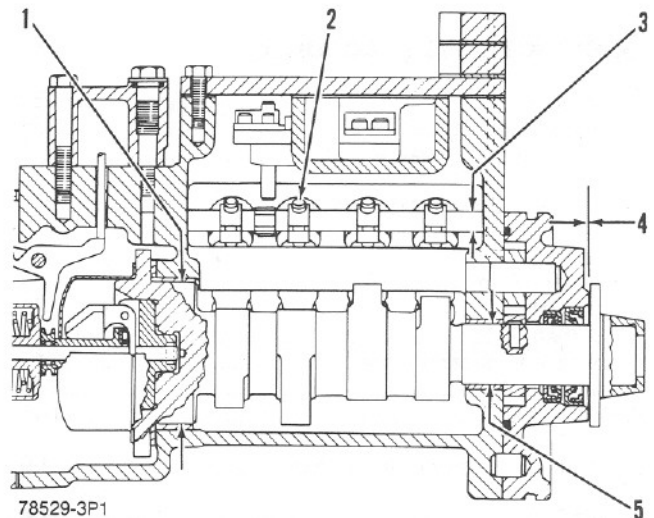


### Cylinder, Valve And Injection Pump Location

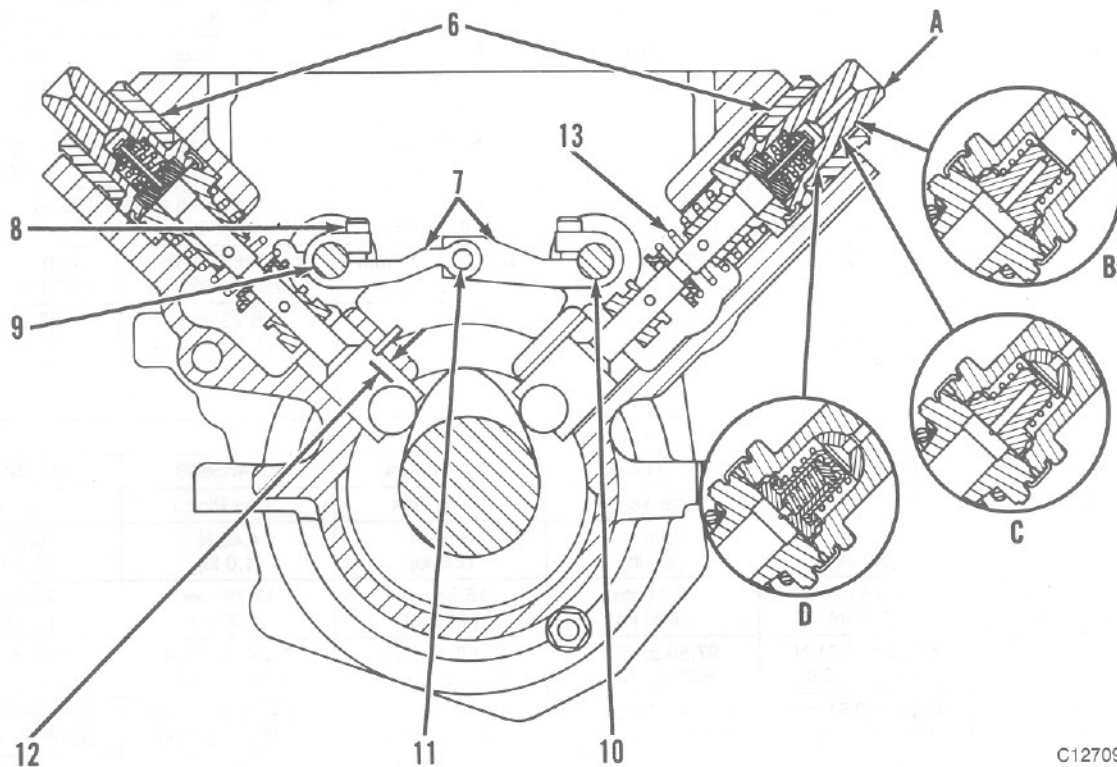
Bore .....	114.3 mm (4.5 in)
Stroke .....	127.0 mm (5.0 in)
Number Of Cylinders .....	8
Cylinder Arrangement .....	90°V
Firing Order (Injection Sequence) .....	1,2,7,3,4,5,6,8
Direction Of Rotation (As Seen From Flywheel End) .....	Counterclockwise

## Fuel Injection Pump

Firing order (injection sequence) .....	1,2,7,3,4,5,6,8
Injection timing BTC (before top center):	
Engines with 1W6742 Fuel Pump Group .....	8 ± 1°
Engines with 7C8966 and 7W5479 Fuel Pump Groups .....	10 ± 1°
Engines with 7E9890 Fuel Pump Groups .....	11.5 ± 1°
Engines with 7C8968, 7C8969, 7C8970, 7C8971 and 4P4260 Fuel Pump Groups .....	12.5 ± 1°
All other engines .....	15 ± 1°
Torque for the nuts that hold the fuel lines (Use 5P0144 Fuel Line Socket) .....	40 ± 7 N•m (30 ± 5 lb ft)



- (1) Bore in the rear bearing for the camshaft (new) ..... 60.325 ± 0.013 mm (2.3750 ± .0005 in)  
Diameter of rear bearing surface (journal) of the camshaft (new) ..... 60.249 ± 0.013 mm (2.3720 ± .0005 in)  
Maximum permissible clearance between the bearing and the camshaft bearing surface (journal) (worn) ..... 0.15 mm (.006 in)
  - (2) Torque for screws that hold sleeve control levers ..... 2.8 ± 0.2 N•m (24 ± 2 lb in)
  - (3) Bore in the housing for the fuel control shaft (new) ..... 8.999 ± 0.013 mm (.3543 ± .0005 in)  
Diameter of sleeve control shaft (new) ..... 8.966 ± 0.008 mm (.3530 ± .0003 in)  
Maximum permissible clearance between the bore in the housing and the sleeve control shaft (worn) ..... 0.08 mm (.003 in)
  - (4) End play for camshaft with sleeve installed (new) ..... 0.58 ± 0.46 mm (.023 ± .018 in)
- NOTE:** When installing sleeve on end of camshaft, support the camshaft to prevent damage to parts inside of injection pump and governor housing.
- (5) Bore in the front bearing for the camshaft (new) ..... 25.413 ± 0.013 mm (1.0005 ± .0005 in)  
Diameter of front bearing surface (journal) of the camshaft (new) .... 25.375 ± 0.013 mm (.9990 ± .0005 in)  
Maximum permissible clearance between the bearing and the camshaft bearing surface (journal) (worn) ..... 0.10 mm (.004 in)



C12709P1

(6) Torque for bushing .....  $82 \pm 7 \text{ N}\cdot\text{m}$  ( $60 \pm 5 \text{ lb ft}$ )

(7) Crossover levers.

**NOTE:** For adjustment of crossover levers, see the Testing And Adjusting Section.

(8) Torque for screws that hold crossover levers .....  $2.8 \pm 0.2 \text{ N}\cdot\text{m}$  ( $24 \pm 2 \text{ lb in}$ )

(9 and 10) Fuel control shafts.

(11) Dowel pin (linkage between crossover levers).

(12) Distance guide pin extends into bore .....  $1.20 \pm 0.10 \text{ mm}$  ( $.047 \pm .004 \text{ in}$ )

**NOTE:** Install guide pin with slot toward the top of the lifter bore.

(13) 9N5862 Spring for injection pump:

Length under test force .....  $35.13 \text{ mm}$  ( $1.383 \text{ in}$ )

Test force .....  $56.7 \pm 6.6 \text{ N}$  ( $12.4 \pm 1.4 \text{ lb}$ )

Free length after test .....  $40.80 \text{ mm}$  ( $1.606 \text{ in}$ )

Outside diameter .....  $18.49 \text{ mm}$  ( $.728 \text{ in}$ )

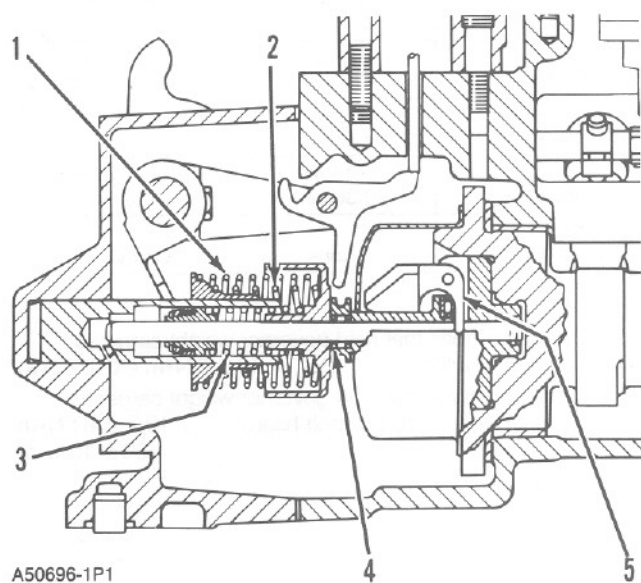
A. Reverse Flow Check Valve (RFC).

B. Orificed Delivery Valve (ODV).

C. Orificed Delivery Valve - Lo Volume (ODV).

D. Orificed Reverse Flow Check Valve (ORFC).

## Governor



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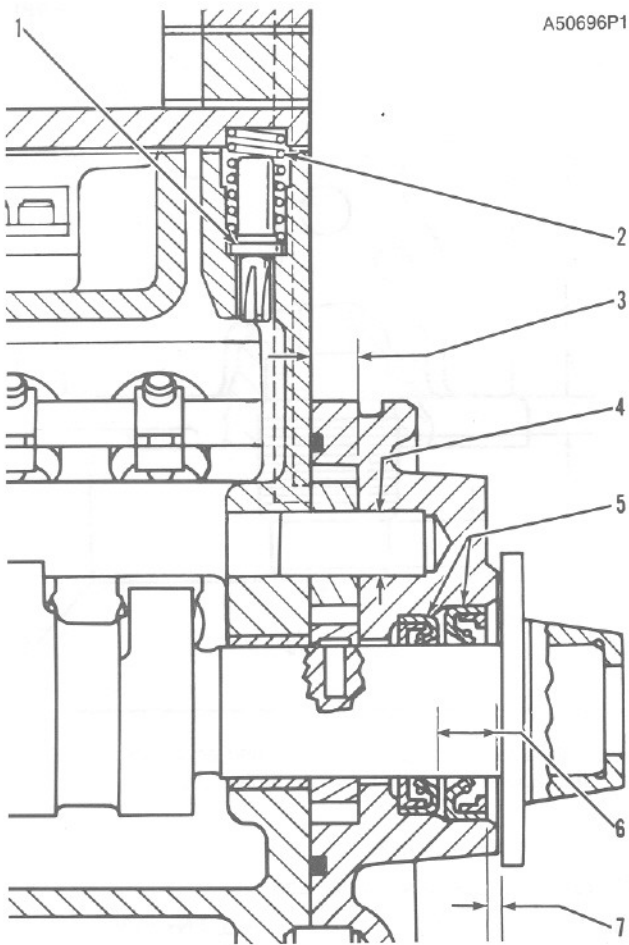
Governor Spring Chart					
Part No.	(1) 1W4925	(1) 6N2129	(1) 4N9226	(1) 4N6119	(1) 4N5661
Color code (Stripes)	One Purple	Two Pink	Two Green	Three Green	Two White
Put a force on spring of	17.79 N (4.0 lb)	8.90 N (2.0 lb)	17.79 N (4.0 lb)	13.34 N (3.0 lb)	13.34 N (3.0 lb)
Then add more force to make spring shorter by	15.00 mm (.590 in)	17.78 mm (.700 in)	17.78 mm (.700 in)	17.78 mm (.700 in)	17.78 mm (.700 in)
Total test force	59.82 ± 1.34 N (13.40 ± .30 lb)	36.92 ± 0.89 N (8.30 ± .20 lb)	67.61 ± 1.51 N (15.20 ± .34 lb)	50.71 ± 1.16 N (11.40 ± .26 lb)	56.94 ± 1.51 N (12.80 ± .34 lb)
Free length after test	38.97 ± 0.51 mm (1.534 ± .020 in)	44.20 ± 0.51 mm (1.740 ± .020 in)	44.20 ± 0.51 mm (1.740 ± .020 in)	42.14 ± 0.53 mm (1.659 ± .021 in)	44.20 ± 0.51 mm (1.740 ± .020 in)
Outside diameter	38.56 mm (1.518 in)	37.84 mm (1.490 in)	38.56 mm (1.518 in)	38.25 mm (1.506 in)	38.25 mm (1.506 in)

Governor Spring Chart					
Part No.	(1) 9L6508	(1) 7N3807	(1) 1W6804	(2) 4N5663	(3) 6N2517
Color code (Stripes)	One Yellow	Three Yellow	Three Pink	One Pink	None
Put a force on spring of	22.24 N (5.0 lb)	8.90 N (2.0 lb)	8.90 N (2.0 lb)	4.45 N (1.0 lb)	8.90 N (2.0 lb)
Then add more force to make spring shorter by	17.78 mm (.700 in)	15.24 mm (.600 in)	15.24 mm (.600 in)	17.78 mm (.700 in)	5.08 mm (.200 in)
Total test force	87.63 ± 2.31 N (19.70 ± .52 lb)	27.58 ± .53 N (6.20 ± .12 lb)	27.58 ± .53 N (6.20 ± .12 lb)	20.02 ± .53 N (4.50 ± .12 lb)	24.91 ± .80 N (5.60 ± .18 lb)
Free length after test	44.20 ± 0.51 mm (1.740 ± .020 in)	42.14 ± 0.53 mm (1.659 ± .021 in)	52.4 ± 1.0 mm (2.063 ± .039 in)	42.93 ± 0.51 mm (1.690 ± .020 in)	31.24 ± 0.51 mm (1.136 ± .020 in)
Outside diameter	38.56 mm (1.518 in)	37.84 mm (1.490 in)	37.84 mm (1.490 in)	29.06 mm (1.144 in)	14.83 mm (.584 in)

(4) Overfueling Springs		
Part No.	4N0527	6N6662
Length under test force	8.71 mm (.343 in)	19.00 mm (.748 in)
Test force	0.85 ± 0.08 N (.19 ± .02 lb)	0.84 ± 0.08 N (.189 ± .02 lb)
Free length after test	18.29 mm (.720 in)	28.60 mm (1.126 in)
Outside diameter	9.14 mm (.360 in)	9.14 mm (.360 in)
Color code (Stripes)	None	One White

- (5) Torque for bolts that hold governor weight carrier to camshaft (earlier) ..... 14 ± 3 N•m (10 ± 2 lb ft)  
 Torque for bolts that hold governor weight carrier to camshaft (later with thin bolt head) ..... 10.2 ± 1.1 N•m  
 (90 ± 10 lb in)

## Fuel Transfer Pump

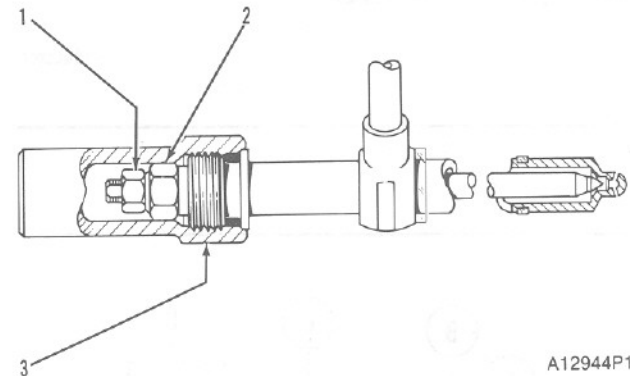


- (1) Bypass valve:  
Fuel pressure at FULL LOAD ..  $205 \pm 35$  kPa ( $30 \pm 5$  psi)
- (2) 4N605 Spring for bypass valve:  
Length under test force .....  $22.35$  mm (.880 in)  
Test force .....  $15.7 \pm 0.80$  N ( $3.53 \pm .18$  lb)  
Free length after test .....  $43.92$  mm (1.729 in)  
Outside diameter .....  $13.39$  mm (.527 in)
- (3) Thickness of gears (new) .....  $9.489 \pm 0.008$  mm  
(.3736  $\pm$  .0003 in)  
Depth of counterbore (new) .....  $9.525 \pm 0.013$  mm  
(.3750  $\pm$  .0005 in)
- (4) Diameter of shaft for idler gear .....  $12.482 \pm 0.008$  mm  
(.4914  $\pm$  .0003 in)  
Bore in idler gear .....  $12.512 \pm 0.008$  mm  
(.4926  $\pm$  .0003 in)
- (5) Put a thin layer of 5S1454 Sealing Compound on the outside diameter of the seals before installation. Remove the extra sealing compound after assembly.

- (6) Install inner seal from outside edge of body assembly to a distance of .....  $11.51 \pm 0.25$  mm (.453  $\pm$  .010 in)
- (7) Install outside seal from outside edge of body assembly to a distance of .....  $0.76 \pm 0.25$  mm (.030  $\pm$  .010 in)

## Injection Nozzles

### 9N3979 and 1W5829



Bench test nozzles using clean SAE J967 Calibration Oil (Kent-Moore Corp J-26400 or Viscor Calibration Fluid 1487C-SAE J-967C) at a temperature of .....  $18$  to  $20^\circ\text{C}$  ( $65$  to  $70^\circ\text{F}$ )

Nozzle setting pressures (valve lift adjustment screw turned  $3/4 \pm 1/8$  turn from closed position):

Used nozzle .....  $10\ 300$  to  $17\ 690$  kPa (1500 to 2600 psi)  
Used, adjusted nozzle .....  $16\ 545$  to  $17\ 690$  kPa  
(2400 to 2600 psi)

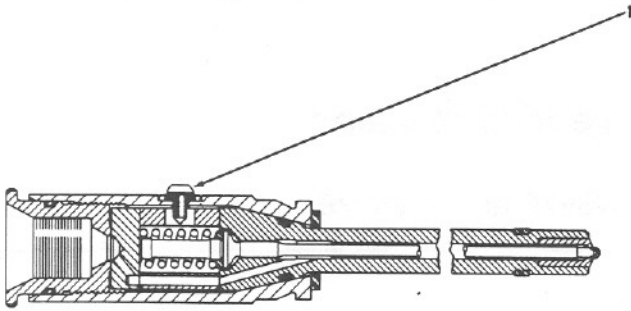
Return oil leakage test pressure .....  $9630$  to  $11\ 045$  kPa  
(1400 to 1600 psi)

Leakage in 15 seconds ..... NO minimum or maximum

Maximum tip leakage is 20 drops in 15 seconds with a pressure of  $1380$  kPa (200 psi) less than opening pressure.

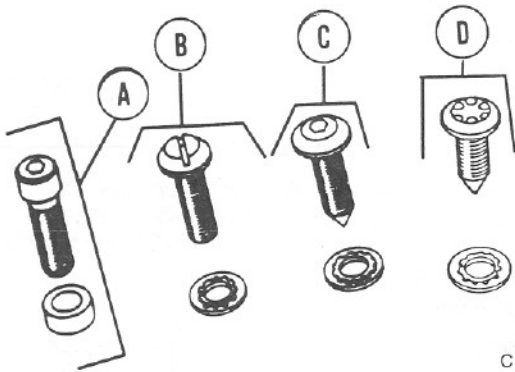
- (1) Torque for valve lift locknut .....  $4.0$  to  $5.1$  N•m  
(35 to 45 lb in)
- (2) Torque for pressure screw locknut .....  $8.0$  to  $9.1$  N•m  
(70 to 80 lb in)
- (3) Torque for cap .....  $12.4$  to  $13.6$  N•m (110 to 120 lb in)

## C 7000 Series Nozzle



B46400P1

(1) Bleed screw.



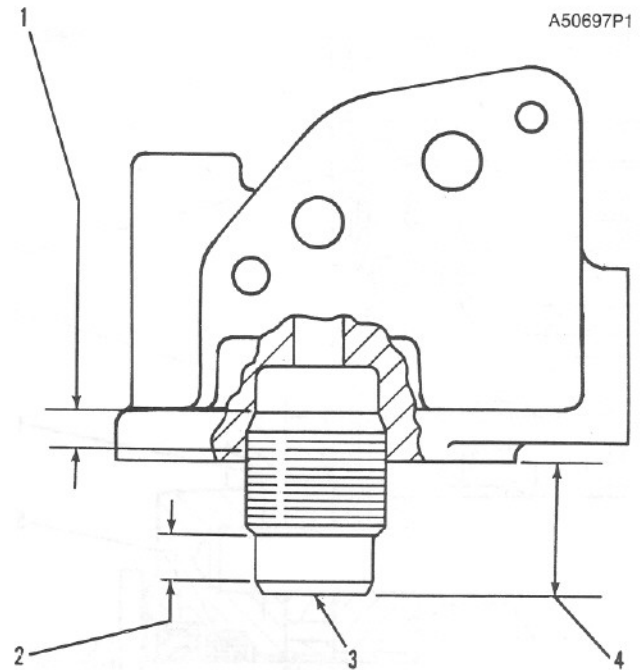
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Tighten bleed screws to the following torques:

Bleed screw A	0.9 ± 0.1 N•m (8 ± 1 lb ft)
Bleed screw B	1.8 ± 0.2 N•m (16 ± 2 lb ft)
Bleed screws C and D	2.2 ± 0.8 N•m (20 ± 7 lb ft)

NOTE: All fuel injection line nuts are tightened to a torque of 42 ± 7 N•m (31 ± 5 lb ft)

## Fuel Filter Base

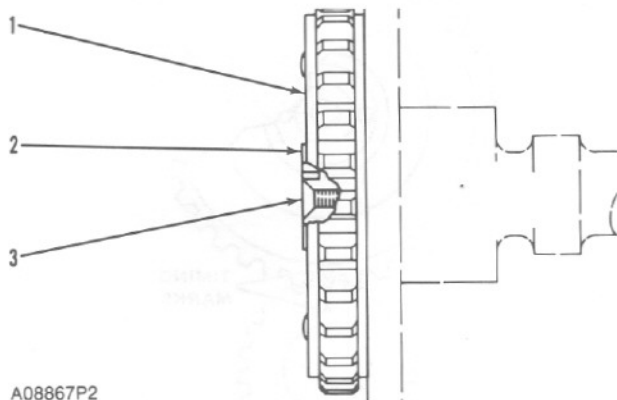


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- (1) Put 9S3263 Thread Lock Compound on the threads of the tapered end of the stud to a distance of ..... 7.6 mm (.30 in)
- (2) Sealing surface of stud.  
NOTE: Do not damage this surface.
- (3) Torque for stud ..... 70 ± 7 N•m (50 ± 5 lb ft)
- (4) Distance from sealing surface of base to end of stud ..... 24.6 ± 1.3 mm (.97 ± .05 in)

## Automatic Timing Advance Unit

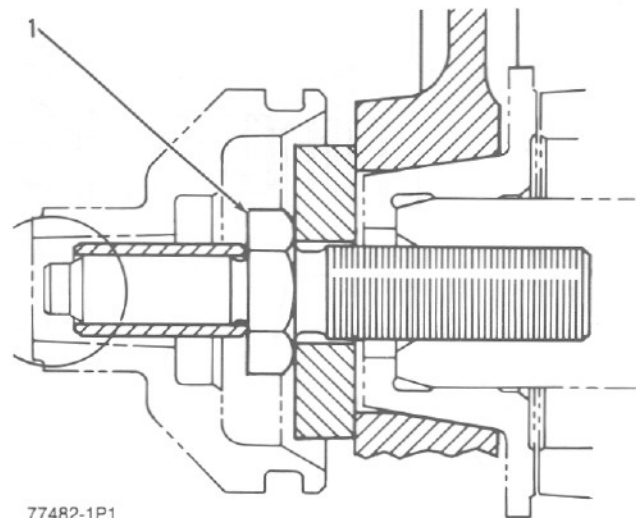
3.5° and 5° unit



A08867P2

End play between washer (2) and timing advance unit  
 (1) ..... 0.08 to 0.94 mm (.003 to .037 in)  
 (3) Torque for screw .....  $7.9 \pm 0.6 \text{ N}\cdot\text{m}$  ( $70 \pm 5 \text{ lb in}$ )  
 "Stake" (make a mark with a punch) screw (3) in two places.

## Drive Gear For The Injection Pump



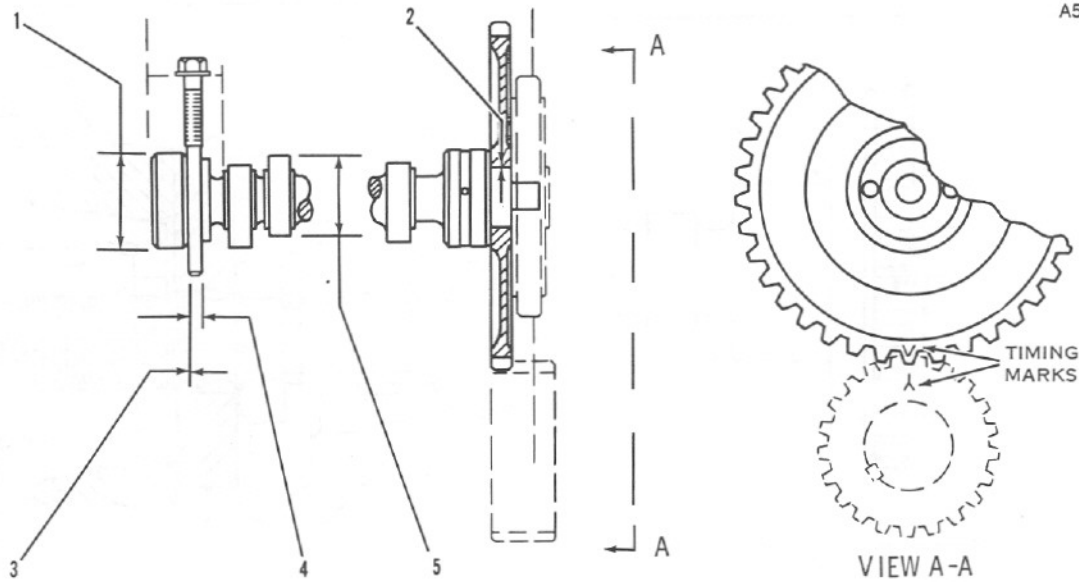
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(1) Torque for the bolt that holds the drive gear to the camshaft of the injection pump .....  $149 \pm 14 \text{ N}\cdot\text{m}$  ( $110 \pm 10 \text{ lb ft}$ )



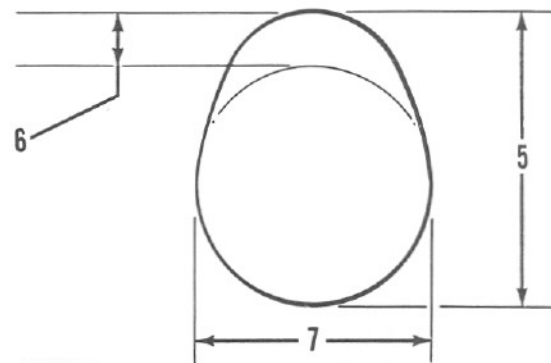
# C Camshaft

A50699P1

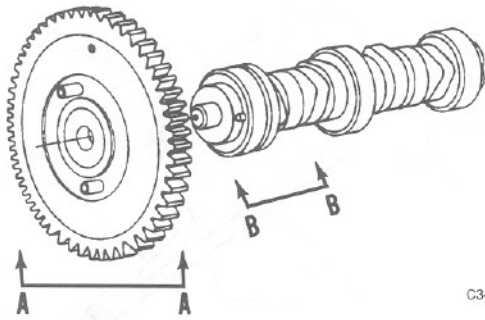


- (1) Diameter of the surfaces (journals) for the camshaft bearings (new) ..  $63.500 \pm 0.013$  mm ( $2.5000 \pm .0005$  in)  
 Bore in the five bearings for the camshaft (new) .....  $63.589 \pm 0.038$  mm ( $2.5035 \pm .0015$  in)  
 Maximum permissible clearance between bearing and bearing surface (journal) (worn) .....  $0.18$  mm (.007 in)
- (2) Tight fit between the gear and camshaft .....  $0.030$  to  $0.071$  mm (.0012 to .0028 in)  
 Maximum permissible temperature of the gear for installation on the camshaft (do not use a torch) ..  $315^\circ\text{C}$  ( $600^\circ\text{F}$ )
- (3) End play for the camshaft .....  $0.18 \pm 0.08$  mm ( $.007 \pm .003$  in)  
 Maximum permissible end play (worn) .....  $0.51$  mm (.020 in)
- (4) Width of thrust groove in camshaft (new) .....  $9.14 \pm 0.05$  mm (.360  $\pm$  .002 in)  
 Diameter of thrust pin (new) .....  $8.97 \pm 0.03$  mm (.353  $\pm$  .001 in)  
 Torque for thrust pin .....  $48 \pm 7$  N•m ( $35 \pm 5$  lb ft)
- (5) Height of camshaft lobes.  
 To find lobe lift, use the procedure that follows:  
 A. Measure camshaft lobe height (5).  
 B. Measure base circle (7).  
 C. Subtract base circle (Step B) from lobe height (Step A).  
 The difference is actual lobe lift (6).

- D. Specified camshaft lobe lift (6) is:  
 9N5230 Camshaft used with roller lifters:  
 a. Exhaust lobe .....  $9.40$  mm (.370 in)  
 b. Intake lobe .....  $9.33$  mm (.367 in)  
 2W4238 Camshaft used with flat face lifters:  
 c. Exhaust lobe .....  $9.40$  mm (.370 in)  
 d. Intake lobe .....  $9.06$  mm (.357 in)  
 Maximum permissible difference between actual lobe lift (Step C) and specified lobe lift (Step D) is  $0.25$  mm (.010 in).

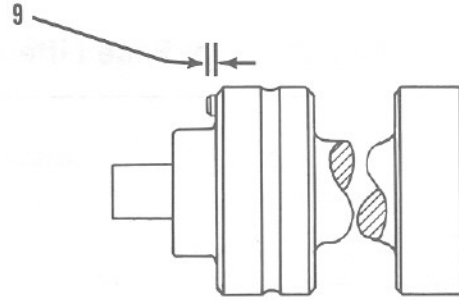


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C34657P1

Camshaft Gear Assembly



C34659P1

View B-B

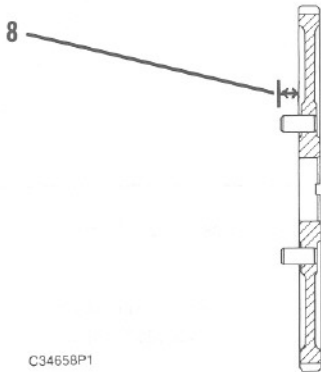
- (9) Distance from the end of 5P4283 Dowel to the face of camshaft .....  $2.00 \pm 0.25$  mm ( $.079 \pm .010$  in)

### Camshaft Installation

**NOTE:** For installation of camshaft, the timing mark on the camshaft gear tooth must be in alignment with the timing mark on the tooth space of the crankshaft gear.

### Intake Valve Timing

1. Check the No. 1 intake valve clearance with the engine stopped. The valve clearance must be 0.30 to 0.46 mm (.012 to .018 in). If the valve clearance is not in this range, adjust the clearance to 0.38 mm (.015 in).
2. Mark Top Center Position of the crankshaft on the vibration damper or pulley.
3. Use a dial indicator to measure the intake valve movement.
4. Rotate the crankshaft in the direction of normal engine rotation. Stop when the intake valve is 1.91 mm (.075 in) off its seat in the opening sequence. At this point the crankshaft must be  $10 \pm 2^\circ$  After Top Center.



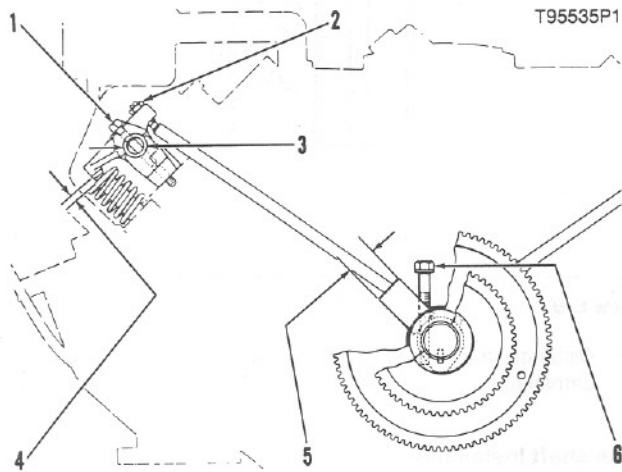
C34658P1

View A-A

- (8) Distance from the end of 9N5771 Dowel to the face of gear .....  $11.81 \pm 0.13$  mm ( $.465 \pm .005$  in)

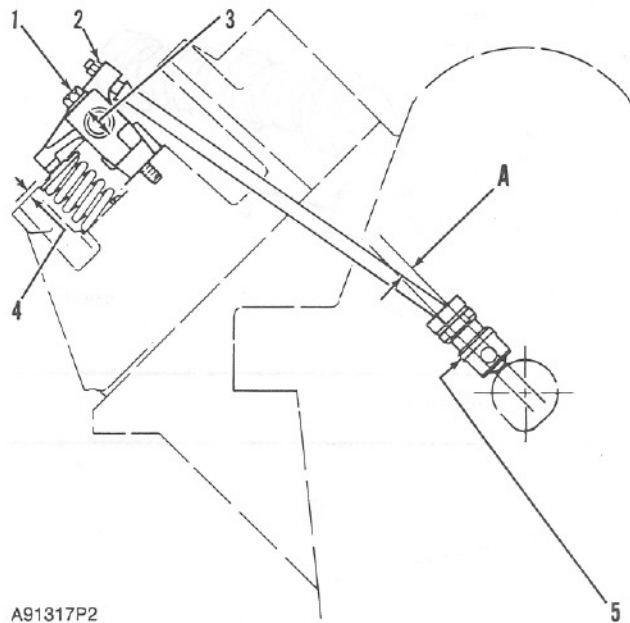
# Valve Rocker Arms And Lifters

## For Engines That Have Flat Face Lifters



- (1) Torque for bolts that hold rocker arms .....  $24 \pm 7 \text{ N}\cdot\text{m}$   
( $18 \pm 5 \text{ lb ft}$ )
- (2) Torque for locknut for valve adjustment  
screw .....  $30 \pm 7 \text{ N}\cdot\text{m}$  ( $24 \pm 5 \text{ lb ft}$ )
- (3) Diameter of the shaft for the rocker  
arms .....  $21.793 \text{ to } 21.814 \text{ mm}$  (.8580 to .8588 in)  
Minimum permissible diameter (worn) .....  $21.768 \text{ mm}$   
(.8570 in)  
  
Bore in bearings for the rocker arms  
(new) .....  $21.852 \pm 0.020 \text{ mm}$  (.8603  $\pm$  .0008 in)  
Maximum permissible bore (worn) .....  $21.920 \text{ mm}$   
(.8630 in)  
Maximum permissible clearance between bore in bearing  
and shaft (worn) .....  $0.13 \text{ mm}$  (.005 in)
- (4) Clearance for valves (intake valve) .....  $0.38 \text{ mm}$  (.015 in)  
Clearance for valves (exhaust valve) ...  $0.64 \text{ mm}$  (.025 in)
- (5) Diameter of cam follower .....  $29.436 \pm 0.010 \text{ mm}$   
( $1.1589 \pm .0004 \text{ in}$ ).  
Minimum permissible diameter (worn) .....  $29.401 \text{ mm}$   
( $1.1575 \text{ in}$ )  
Bore in block for cam follower .....  $29.525 \pm 0.025 \text{ mm}$   
( $1.1624 \pm .0010 \text{ in}$ )  
Maximum permissible bore (worn) .....  $29.591 \text{ mm}$   
( $1.1650 \text{ in}$ )
- (6) Torque for the thrust pin for the camshaft ....  $45 \pm 7 \text{ N}\cdot\text{m}$   
( $35 \pm 5 \text{ lb ft}$ )

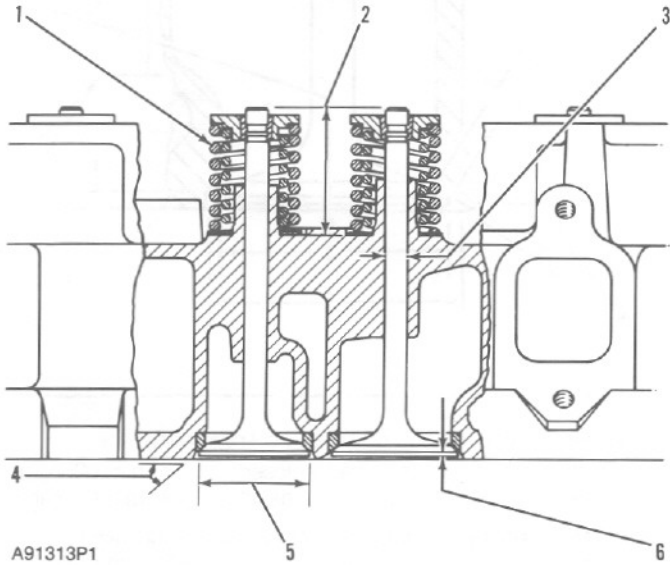
## For Engines That Have Roller Lifters



- 1. Turn camshaft so cam lobe is opposite lifter bore.
- 2. Install guide spring on lifter.
- 3. Put lifter assembly in engine oil and install into lifter bore so that the tab on the guide spring is located within area (A).
- 4. Push lifter into bore until contact is made with camshaft.
- (1) Torque for bolts that hold rocker arms .....  $24 \pm 7 \text{ N}\cdot\text{m}$   
( $18 \pm 5 \text{ lb ft}$ )
- (2) Torque for locknut for valve adjustment  
screw .....  $30 \pm 7 \text{ N}\cdot\text{m}$  ( $24 \pm 5 \text{ lb ft}$ )
- (3) Diameter of the shaft for the rocker  
arms .....  $21.793 \text{ to } 21.814 \text{ mm}$  (.8580 to .8588 in)  
Minimum permissible diameter (worn) .....  $21.768 \text{ mm}$   
(.8570 in)  
  
Bore in bearings for the rocker arms  
(new) .....  $21.852 \pm 0.020 \text{ mm}$  (.8603  $\pm$  .0008 in)  
Maximum permissible bore (worn) .....  $21.920 \text{ mm}$   
(.8630 in)  
Maximum permissible clearance between bore in bearing  
and shaft (worn) .....  $0.13 \text{ mm}$  (.005 in)
- (4) Clearance for valves (intake valve) .....  $0.38 \text{ mm}$  (.015 in)  
Clearance for valves (exhaust valve) ...  $0.64 \text{ mm}$  (.025 in)
- (5) Diameter of lifter .....  $29.464 \pm 0.015 \text{ mm}$   
( $1.1600 \pm .0006 \text{ in}$ )  
Bore in block for lifter .....  $29.525 \pm 0.025 \text{ mm}$   
( $1.1624 \pm .0010 \text{ in}$ )

# Valves

**NOTE:** GUIDELINE FOR REUSABLE PARTS; VALVES AND VALVE SPRINGS, Forms SEBF8002 and SEBF8034, have the procedure and specifications necessary for checking used valves and valve springs.



A91313P1

- (1) 9N5496 Spring for valves (outer):
  - Length under test force ..... 45.47 mm (1.790 in)
  - Test force ..... 185.0 ± 18.0 N (41.6 ± 4 lb)
  - Use again minimum load at length under test force ..... 166 N (37.3 lb)
  - Length of spring at valve open position ..... 30.23 mm (1.190 in)
  - Use again minimum load at valve open position .... 600 N (135 lb)
  - Free length after test ..... 51.77 mm (2.038 in)
  - Outside diameter ..... 39.62 mm (1.560 in)
  - Spring must not be bent more than ..... 1.80 mm (.071 in)
- (1) 9N5495 Spring for valves (inner):
  - Length under test force ..... 42.47 mm (1.672 in)
  - Test force ..... 91.2 ± 9.0 N (20.5 ± 2 lb)
  - Use again minimum load at length under test force ..... 81.9 N (18.4 lb)
  - Length of spring at valve open position ..... 27.23 mm (1.072 in)
  - Use again minimum load at valve open position .... 295 N (66.3 lb)
  - Free length after test ..... 48.77 mm (1.920 in)
  - Outside diameter ..... 26.67 mm (1.050 in)
  - Spring must not be bent more than ..... 1.70 mm (.067 in)
- (2) Distance from the end of the valve to the valve spring spacer seat ..... 52.40 ± 0.38 mm (2.063 ± .015 in)

- (3) Diameter of valve stem:
  - 7C362 and 9L7682 Intake Valve ..... 9.462 ± 0.013 mm (.3725 ± .0005 in)
  - Use again minimum diameter of the valve stem ..... 9.42 mm (.371 in)
  - 9L7683 and 9N5125 Exhaust Valve (tapered stem):
  - Head end of valve stem ..... 9.411 ± 0.013 mm (.3705 ± .0005 in)
  - Use again minimum diameter of the head end of valve stem ..... 9.37 mm (.369 in)
  - Lock end of valve stem ..... 9.436 ± 0.013 mm (.3715 ± .0005 in)
  - Use again minimum diameter of the lock end of valve stem ..... 9.408 mm (.3704 in)

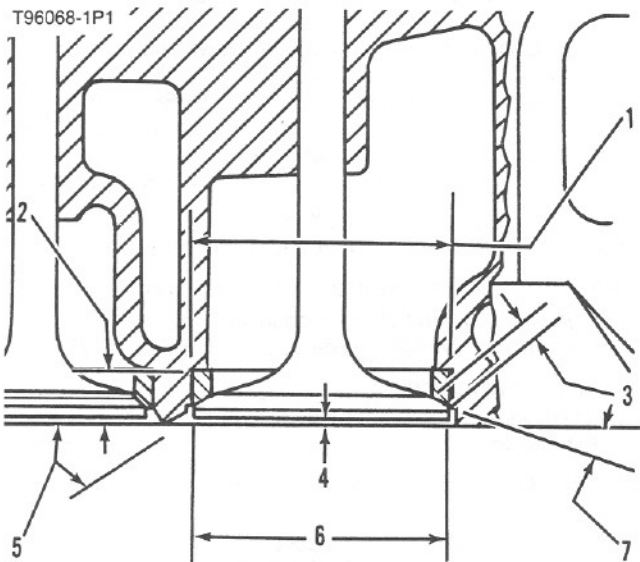
Bore in the valve guides (intake and exhaust) ..... 9.512 ± 0.013 mm (.3745 ± .0005 in)

Maximum permissible bore in the valve guides (worn):  
 Measure 19.0 mm (.75 in) deep in valve guide bore from both ends of the valve guide ..... 9.550 mm (.3760 in)

- (4) Angle of valve face:
  - Intake valve ..... 30° ± 15'
  - Exhaust valve ..... 45° ± 15'
- (5) Diameter of valve head (intake valve) ... 53.19 ± 0.13 mm (2.094 ± .005 in)
- Diameter of valve head (exhaust valve) ..... 45.82 ± 0.13 mm (1.804 ± .005 in)
- (6) Thickness of valve lip:
  - Intake valve ..... 2.31 mm (.091 in)
  - Use again minimum valve lip thickness ..... 1.78 mm (.070 in)
  - Exhaust valve ..... 1.60 mm (.063 in)
  - Use again minimum valve lip thickness ..... 1.27 mm (.050 in)

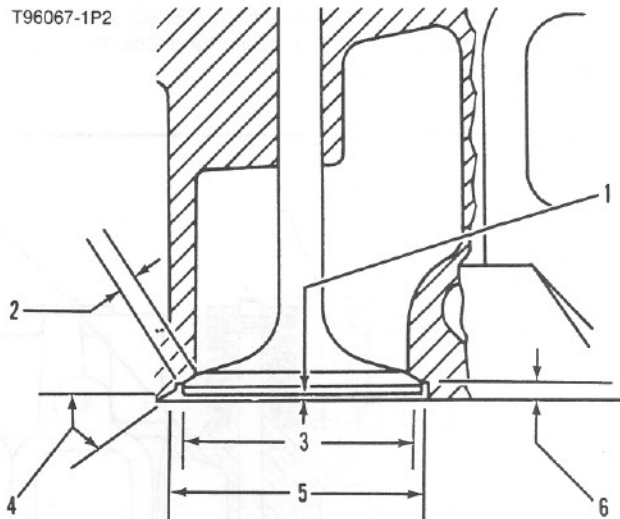
## c Valve Seats And Inserts

### Intake Valve (with valve seat insert)



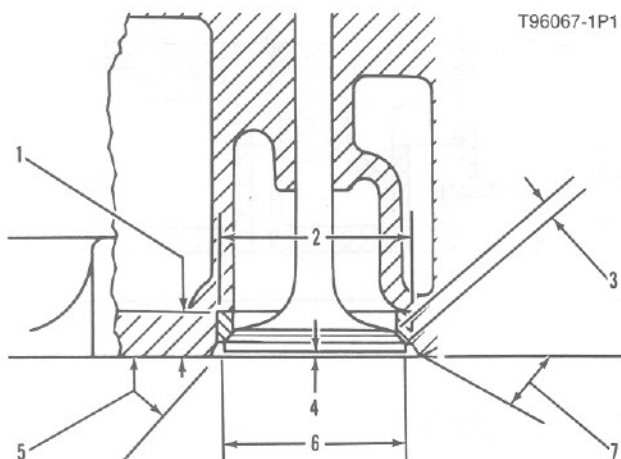
- (1) Diameter of the valve seat insert .....  $54.610 \pm 0.013$  mm  
( $2.1500 \pm .0005$  in)  
Bore in head for valve seat insert .....  $54.534 \pm 0.013$  mm  
( $2.1470 \pm .0005$  in)
- (2) Depth of bore in head for valve seat insert .....  $11.23 \pm 0.05$  mm ( $.442 \pm .002$  in)
- (3) Maximum permissible width of the face of the valve seat insert .....  $3.05$  mm (.120 in)
- (4) Distance from head of valve to cylinder head face:  
Maximum permissible (valve closed) ...  $1.73$  mm (.068 in)  
Minimum permissible (valve closed) ....  $0.91$  mm (.036 in)
- (5) Angle of the face of the valve seat insert .....  $30 \frac{1}{2} \pm \frac{1}{2}^\circ$
- (6) Outside diameter of the face of the valve seat insert .....  $52.23 \pm 0.13$  mm ( $2.045 \pm .005$  in)  
Maximum permissible .....  $52.45$  mm (2.065 in)
- (7) Angle to grind face of seat insert (to get a reduction of maximum seat diameter) .....  $15^\circ$

### Intake Valve (without valve seat insert)



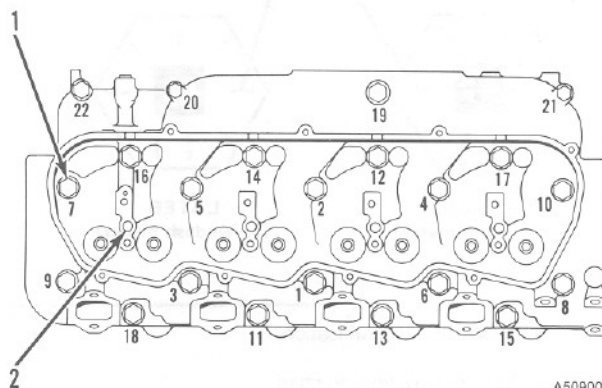
- (1) Distance from head of valve to cylinder head face:  
Maximum permissible (valve closed) ...  $1.73$  mm (.068 in)  
Minimum permissible (valve closed) ....  $0.91$  mm (.036 in)
- (2) Maximum permissible width of the face of the valve seat .....  $3.05$  mm (.120 in)
- (3) Outside diameter of the valve seat .....  $52.23 \pm 0.13$  mm  
( $2.045 \pm .005$  in)  
Maximum permissible .....  $52.45$  mm (2.065 in)
- (4) Angle of the face of the valve seat .....  $30 \frac{1}{2} \pm \frac{1}{2}^\circ$
- (5) Diameter of the bore .....  $54.61$  mm (2.150 in)
- (6) Maximum permissible depth of the bore to make the face of the valve seat smaller .....  $4.32$  mm (.170 in)

## Exhaust Valve



- (1) Depth of bore in head for valve seat insert .....  $11.23 \pm 0.13$  mm (.442  $\pm$  .005 in)
- (2) Diameter of valve seat insert .....  $48.565 \pm 0.013$  mm (1.9120  $\pm$  .0005 in)  
Bore in head for valve seat insert .....  $48.489 \pm 0.013$  mm (1.9090  $\pm$  .0005 in)
- (3) Maximum permissible width of the face of the valve seat insert ..... 2.67 mm (.105 in)
- (4) Distance from head of valve to cylinder head face:  
Maximum permissible (valve closed) ... 2.16 mm (.085 in)  
Minimum permissible (valve closed) .... 1.27 mm (.050 in)
- (5) Angle of the face of the valve seat insert .....  $45 \frac{1}{2} \pm \frac{1}{2}^\circ$
- (6) Outside diameter of the face of the valve seat insert .....  $44.07 \pm 0.13$  mm (1.735  $\pm$  .005 in)  
Maximum permissible ..... 44.70 mm (1.760 in)
- (7) Angle to grind face of seat insert (to get a reduction of maximum seat diameter) .....  $15^\circ$

## Cylinder Head



- (1) Put 6V4876 Molykote Lubricant on bolt threads and tighten bolts according to the Head Bolt Torque Chart that follows:

Head Bolt Torque Chart		
Tightening Procedure	Earlier Bolts (With Six Dash Marks) <sup>1</sup>	Later Bolts (With Seven Dash Marks) <sup>1</sup>
Step 1. Tighten bolts 1 through 18 in number sequence to:	$130 \pm 7$ N·m (95 $\pm$ 5 lb ft)	$150 \pm 7$ N·m (110 $\pm$ 5 lb ft)
Step 2. Loosen bolts 1 through 18 until the washers can be turned freely.		
Step 3. Tighten bolts 1 through 18 in number sequence to:	$80 \pm 14$ N·m (60 $\pm$ 10 lb ft)	$80 \pm 14$ N·m (60 $\pm$ 10 lb ft)
Step 4. Tighten bolts 1 through 18 in number sequence to:	$130 \pm 7$ N·m (95 $\pm$ 5 lb ft)	$150 \pm 7$ N·m (110 $\pm$ 5 lb ft)
Step 5. Again tighten bolts 1 through 10 in number sequence to:	$130 \pm 7$ N·m (95 $\pm$ 5 lb ft)	$165 \pm 7$ N·m (120 $\pm$ 5 lb ft)
Step 6. Tighten bolts 19 through 22 in number sequence to:	$43 \pm 7$ N·m (32 $\pm$ 5 lb ft)	$43 \pm 7$ N·m (32 $\pm$ 5 lb ft)

<sup>1</sup> See Illustration 1 for identification of EARLIER and LATER bolts.

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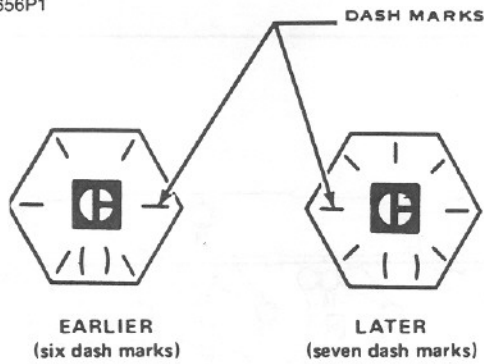


Illustration 1. Bolt head identification.

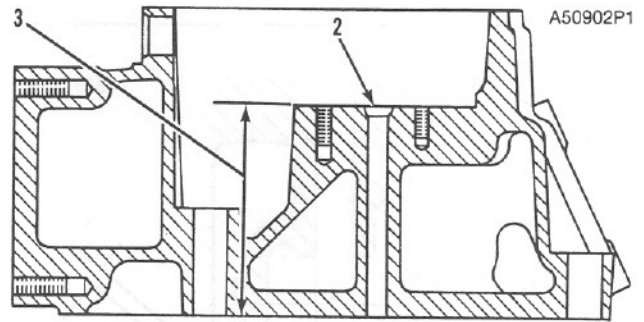
(2) Holes for fuel injection nozzles.

**NOTICE**

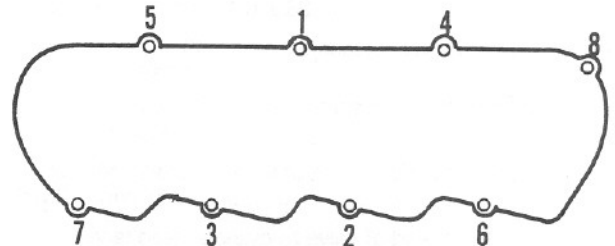
The higher cylinder head bolt torque may be used on earlier engines **ONLY** if the bolts are replaced with the later higher strength bolts (seven dash marks on the bolt head). If the earlier bolts are tightened to the later torque specification, they may yield (stretch) and lose their clamping force.

Head Bolt Location Chart			
Dia.	Part No.	Location (Bolt No.)	Bolt Length "L"
1/2"	6F5282	5,2,4,10	133.4 mm (5.25 in)
	2B2006	7,9,3,1,6,8	120.6 mm (4.75 in)
	L1329	16,14,12,17	76.2 mm (3.00 in)
	2B947	18,11,13,15	57.2 mm (2.25 in)
3/8"	5B9603	19,20,21	127.0 mm (5.00 in)
	S1571	22	44.5 mm (1.75 in)

(3) Thickness of cylinder head (measure through the fuel injection nozzle holes at each end of the cylinder head).  
 New ..... 96.14 ± 0.15 mm (3.785 ± .006 in)  
 Minimum permissible thickness ..... 95.86 mm (3.774 in)  
 Flatness of the cylinder head should be within 0.15 mm (.006 in) total, and a maximum of 0.08 mm (.003 in) for any 152.4 mm (6 in) span.



## Valve Covers

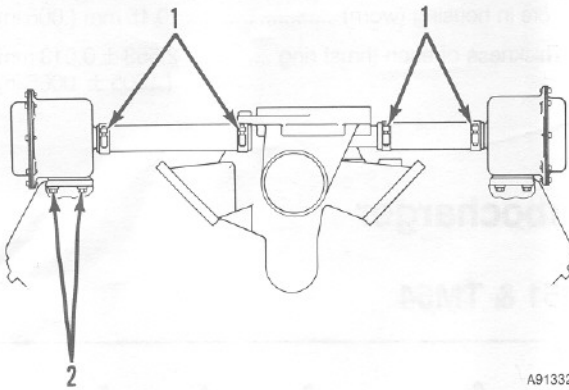


A50698P1

### Tightening Sequence

- (1) Tighten bolts in sequence shown to a torque of ..... 14 ± 3 N•m (10 ± 2 lb ft)

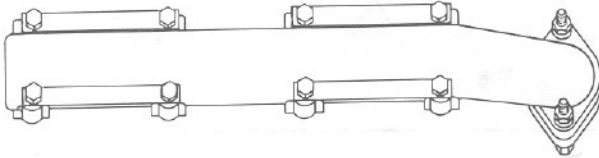
## Crankcase Ventilation Valve



A91332P2

- (1) Torque for hose clamps .....  $2.3 \pm 0.2 \text{ N}\cdot\text{m}$  ( $20 \pm 2 \text{ lb in}$ )  
 (2) Torque for bolts .....  $3.4 \pm 0.5 \text{ N}\cdot\text{m}$  ( $30 \pm 4 \text{ lb in}$ )

## Exhaust Manifold



A91316P2

Put 5P3931 Anti-Seize Compound on threads of bolts.

Torque for bolts... $43 \pm 7 \text{ N}\cdot\text{m}$  ( $32 \pm 5 \text{ lb ft}$ )

Locks must be bent on a flat side of the bolt head. Bolts must be turned no more than  $30^\circ$  (in the direction of increased torque only) for the alignment of locks with a flat side of the bolt head.

## Turbocharger Impeller Installation

### (Schwitzer Only)

#### Installation Procedure

- A. Put 6V1541 Quick Cure Primer on the nut and the shaft threads to clean them, if necessary.
- B. Put a small amount of 9S3265 Retaining Compound on the nut and shaft threads.

#### NOTICE

Do not let the retaining compound get into the compressor wheel bore or on the shaft, because it can make removal of the compressor wheel difficult during future turbocharger disassembly.

- C. Put a small amount of lubricant, such as Lubriplate, on the nut seat area on the compressor. Do not put lubrication on the threads.
- D. Tighten the compressor wheel retainer nut to .....  $28 \pm 3 \text{ N}\cdot\text{m}$  ( $22 \pm 2 \text{ lb ft}$ )

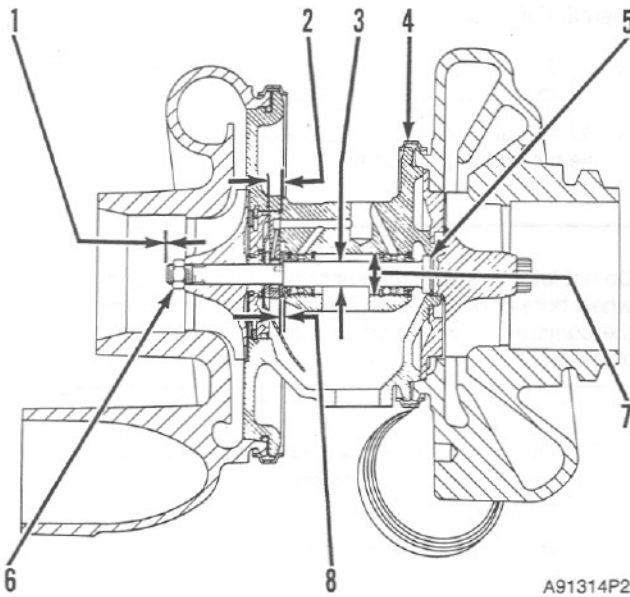
#### NOTICE

Do not bend or add stress to the shaft when nut is loosened or tightened.



## Turbocharger

### 4TF555 & 4TF606



- (1) End play for shaft (new) .....  $0.114 \pm 0.038$  mm  
(.0045 ± .0015 in)  
Maximum permissible end play (worn) ..... 0.20 mm  
(.008 in)
- (2) Thickness of thrust bearing .....  $5.36 \pm 0.03$  mm  
(.211 ± .001 in)
- (3) Diameter of surface on shaft (journal) for the bearing  
(new) ..... 14.254 to 14.262 mm (.5612 to .5615 in)  
Bore in the bearing (new) ..... 14.293 to 14.300 mm  
(.5627 to .5630 in)  
Maximum permissible clearance between bearing and  
shaft (worn) ..... 0.08 mm (.003 in)
- (4) Put 5P3931 Anti-Seize Compound on threads and tighten  
bolt holding band clamp to ..... 13.6 N•m (120 lb in)
- (5) Maximum permissible gap of oil seal ring, measured in  
bore of housing ..... 0.23 mm (.009 in)
- (6) Nut for impeller (See Turbocharger Impeller Installation).

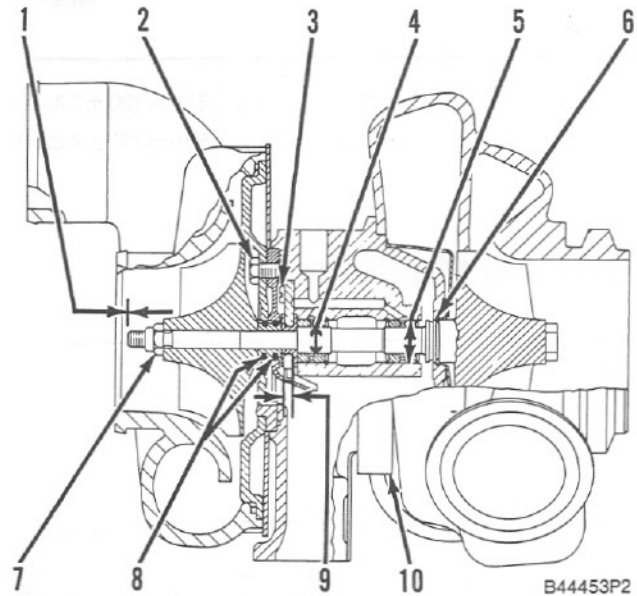
#### NOTICE

Do not bend or add stress to the shaft when nut is loosened or tightened.

- (7) Bore in housing (new) ..... 22.255 to 22.268 mm  
(.8762 to .8767 in)  
Outside diameter of the bearing  
(new) ..... 22.144 to 22.154 mm (.8718 to .8722 in)  
Maximum permissible clearance between bearing and  
bore in housing (worn) ..... 0.15 mm (.006 in)
- (8) Thickness of each thrust ring .....  $2.553 \pm 0.013$  mm  
(.1005 ± .0005 in)

## Turbocharger

### TM51 & TM54



- (1) End play for shaft (new) ..... 0.051 to 0.081 mm  
(.0020 to .0032 in)
- (2) Tighten bolts that hold back plate to bearing housing  
to .....  $9.5 \pm 1$  N•m (84 ± 9 lb in)
- (3) Tighten screws that hold thrust bearing  
to .....  $2.5 \pm 0.2$  N•m (22 ± 2 lb in)
- (4) Diameter of surface on shaft (journal) for the bearing  
(new) ..... 12.992 to 13.000 mm (.5115 to .5118 in)  
Bore in the bearing (new) ..... 13.028 to 13.038 mm  
(.5129 to .5133 in)
- (5) Bore in housing (new) ..... 20.175 to 20.188 mm  
(.7943 to .7948 in)  
Outside diameter of the bearing  
(new) ..... 20.069 to 20.081 mm (.7901 to .7906 in)
- (6) Turbine end oil seal ring, end gap when installed in a  
bore of 20.90 mm (.823 in) ..... 0.10 to 0.38 mm  
(.004 to .015 in)

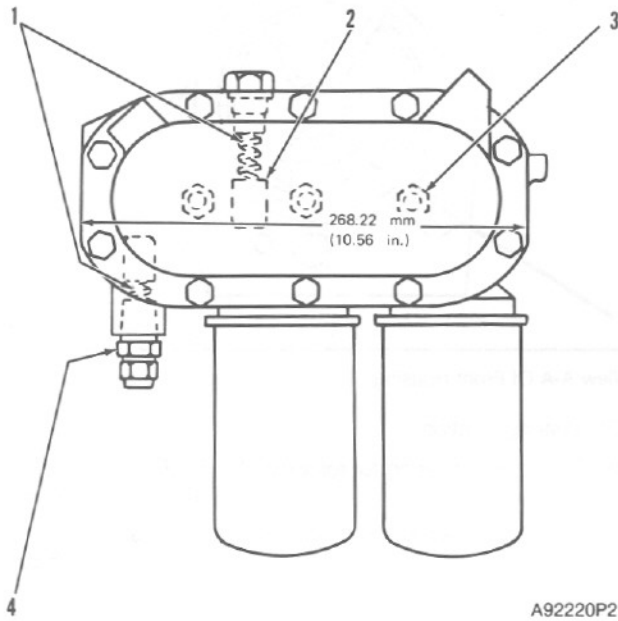
- (7) Put 2P2506 Thread Lubricant on the shaft threads and on the nut face and tighten nut to ..... 4 N•m (35 lb in)  
Tighten nut more ..... 120°

**NOTICE**

Do not bend or add stress to the shaft when nut is loosened or tightened.

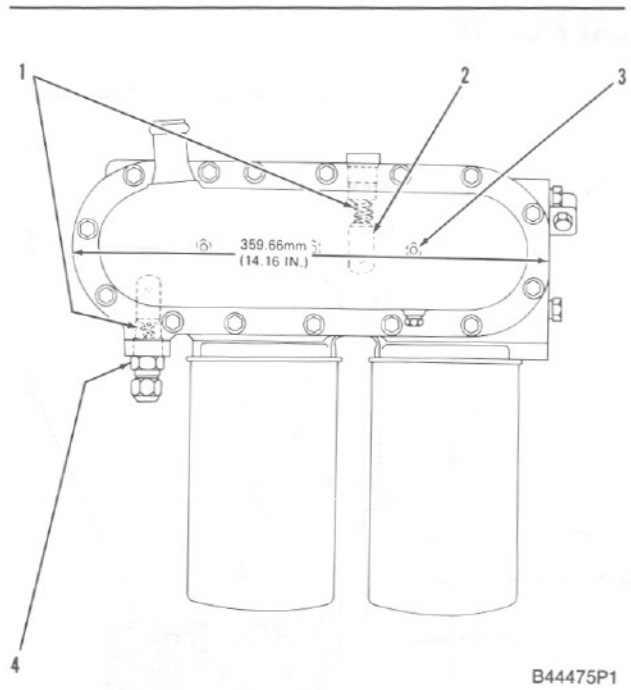
- (8) Impeller end oil seal ring, end gap when installed in a bore of 17.463 mm (.6875 in) ..... 0.08 to 0.38 mm (.003 to .015 in)
- (9) Thickness of thrust bearing ..... 4.359 to 4.369 mm (.1716 to .1720 in)
- (10) Put 5P3931 Anti-Seize Compound on threads and tighten bolt holding band clamp to ..... 14 ± 1 N•m (120 ± 12 lb in)

**Engine Oil Cooler And Filter**



A92220P2

Earlier



B44475P1

Later

Oil pressure difference that makes the oil filter bypass valve open ..... 140 ± 25 kPa (20 ± 4 psi)

Oil pressure difference that makes the oil cooler bypass valve open ..... 125 ± 25 kPa (18 ± 4 psi)

- (1) 9L9188 Spring (oil cooler and oil filter bypass valve):  
Length under test force ..... 43.2 mm (1.70 in)  
Test force ..... 15.6 N (3.5 lb)  
Free length after test ..... 57.9 mm (2.28 in)  
Outside diameter ..... 11.18 mm (.440 in)

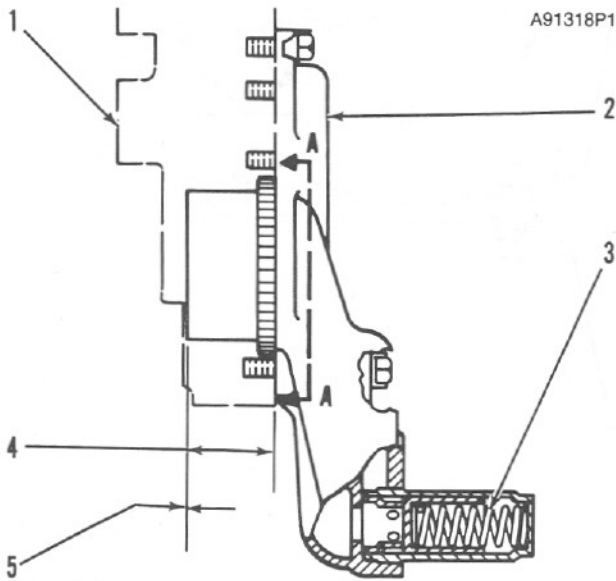
(2) Oil filter bypass valve.

(3) Torque for nuts that hold oil cooler core to oil cooler base (hand torque only) ..... 22 ± 3 N•m (16 ± 2 lb ft)

**NOTE:** If applicable, assemble gasket to oil cooler base with indexing point toward the front of the engine and in the up position.

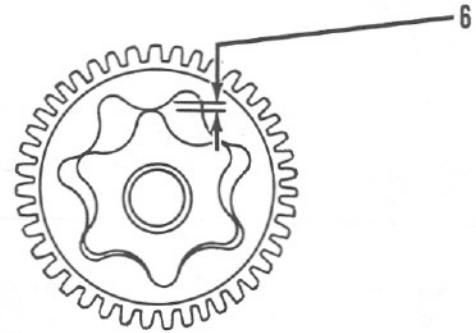
(4) Oil cooler bypass valve.

# Oil Pump



NOTE: Tighten relief valve guide to .....  $40 \pm 7 \text{ N}\cdot\text{m}$   
 (30 ± 5 lb ft)

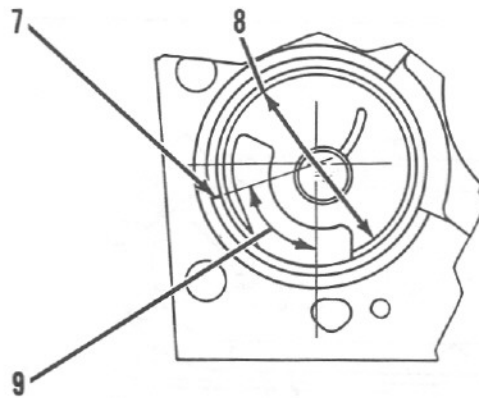
- (1) Front housing assembly.
- (2) Oil pump cover assembly.
- (3) 1W1788 Spring (pump pressure relief valve):
  - Length under test force ..... 59.94 mm (2.360 in)
  - Test force .....  $314 \pm 14 \text{ N}$  (71 ± 3 lb)
  - Free length after test ..... 78.23 mm (3.080 in)
  - Outside diameter ..... 22.23 mm (.875 in)
- (3) 1W2208 Spring (pump pressure relief valve):
  - Length under test force ..... 59.94 mm (2.360 in)
  - Test force .....  $290 \pm 14 \text{ N}$  (65 ± 3 lb)
  - Free length after test ..... 85.85 mm (3.380 in)
  - Outside diameter ..... 22.23 mm (.875 in)
- (4) Width of oil pump rotors (new) .....  $36.474 \pm 0.008 \text{ mm}$   
 (1.4360 ± .0003 in)
- Depth of counterbore in front housing  
 (new) .....  $36.576 \pm 0.025 \text{ mm}$  (1.4400 ± .0010 in)
- (5) Maximum permissible end clearance of oil pump rotors  
 when measured with oil pump installed to front  
 cover ..... 0.15 mm (.006 in)



C5327P5

View A-A Of Rotor Oil Pump

- (6) Clearance of oil pump rotor tip when measured with oil  
 pump installed to front cover ..... 0.05 to 0.20 mm  
 (.002 to .008 in)
- Maximum permissible clearance of oil pump rotor  
 tip ..... 0.28 mm (.011 in)

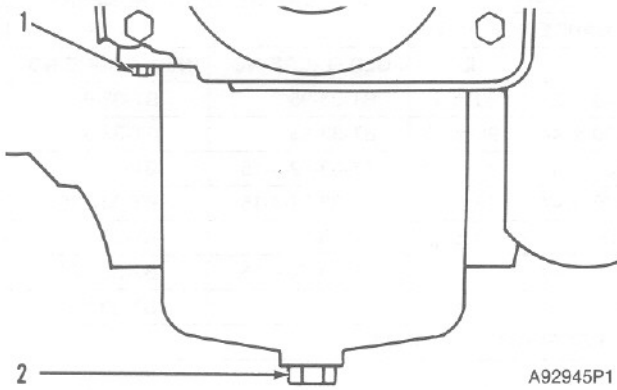


A51104P4

View A-A Of Front Housing

- (7) Bearing junction.
- (8) Diameter of bearing for rotor (new) ...  $71.224 \pm 0.056 \text{ mm}$   
 (2.8041 ± .0022 in)
- (9) Position of main bearing junction from vertical  
 centerline .....  $75 \pm 30^\circ$

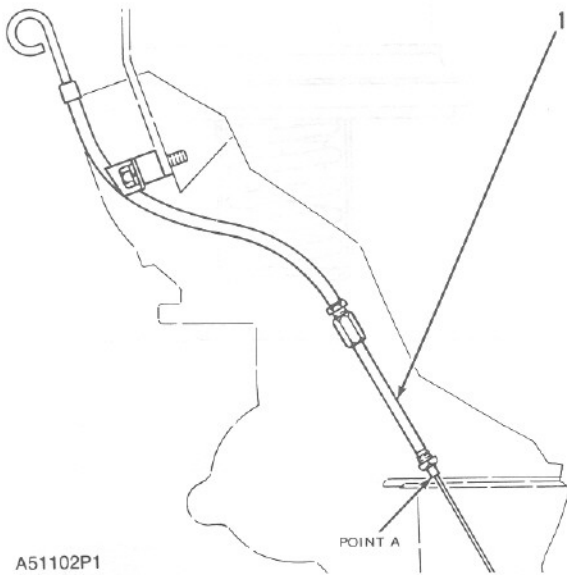
## Oil Pan



A92945P1

- (1) Torque for bolts that hold oil pan .....  $23 \pm 4 \text{ N}\cdot\text{m}$   
( $17 \pm 3 \text{ lb ft}$ )
- (2) Torque for oil pan drain plug .....  $70 \pm 14 \text{ N}\cdot\text{m}$   
( $50 \pm 10 \text{ lb ft}$ )

## Oil Level Gauge

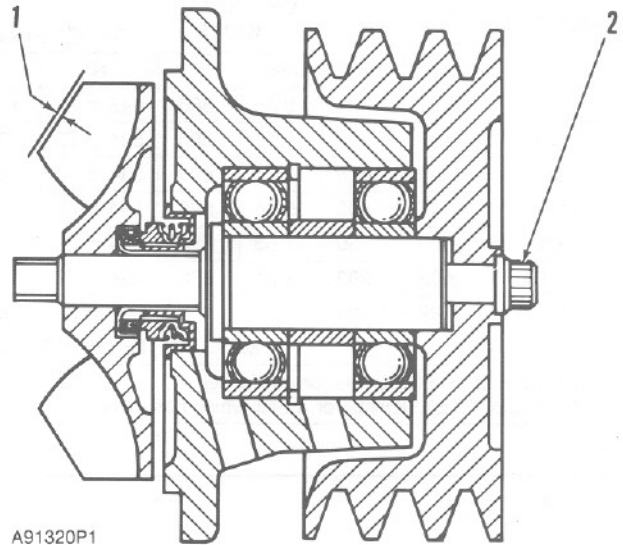


A51102P1

- (1) Guide assembly.

Assemble lower part of gauge assembly (1) so that Point A is even with bottom surface of block within  $\pm 0.8 \text{ mm}$  ( $\pm .03 \text{ in}$ )

## Water Pump



A91320P1

**NOTE:** The outer bearing O.D. and housing bore must be free of oil before assembling bearing into housing. After assembly, apply 4C9508 Sealant-Wicking to the chamfer area only. Remove excess sealant.

Alternate sealant: Put 9S3263 Thread Lock on outer bearing O.D. and housing bore before assembly.

- (1) Clearance between the water pump impeller face and front cover .....  $0.28 \text{ to } 0.84 \text{ mm}$  ( $.011 \text{ to } .033 \text{ in}$ )
- (2) Torque for pulley .....  $75 \pm 7 \text{ N}\cdot\text{m}$  ( $55 \pm 5 \text{ lb ft}$ )

BELT TENSION CHART										
BELT SIZE	WIDTH BELT TOP		WIDTH TOP OF PULLEY GROOVE		BELT TENSION "INITIAL"		BELT TENSION "USED"		BORROUGHS GAUGE NUMBERS	
	mm	in.	mm	in.	GAUGE READING		GAUGE READING		OLD GAUGE NO.	NEW GAUGE NO.
					N	lb	N	lb		
3/8	10.72	.422	9.65	.380	445 ± 22	100 ± 5	400 ± 22	90 ± 5	BT-33-95	BT-33-97
1/2	13.89	.547	12.70	.500	534 ± 22	120 ± 5	400 ± 44	90 ± 10	BT-33-95	BT-33-97
5V	15.88	.625	15.24	.600	534 ± 22	120 ± 5	400 ± 44	90 ± 10	BT-33-72-4-15	BT-33-72C
11/16	17.48	.688	15.88	.625	534 ± 22	120 ± 5	400 ± 44	90 ± 10	BT-33-72-4-15	BT-33-72C
3/4	19.05	.750	17.53	.690	534 ± 22	120 ± 5	400 ± 44	90 ± 10	BT-33-72-4-15	BT-33-72C
15/16	23.83	.983	22.30	.878	534 ± 22	120 ± 5	400 ± 44	90 ± 10	BT-33-72-4-15	BT-33-72C
8K	27.92	1.099			800 ± 22	180 ± 5	489 ± 44	110 ± 10		BT-33-109

MEASURE TENSION OF BELT FARTHEST FROM THE ENGINE

\*\*"INITIAL" BELT TENSION is for a new belt.  
 \*\*\*"USED" BELT TENSION is for a belt which has more than 30 minutes of operation at rated speed of engine.

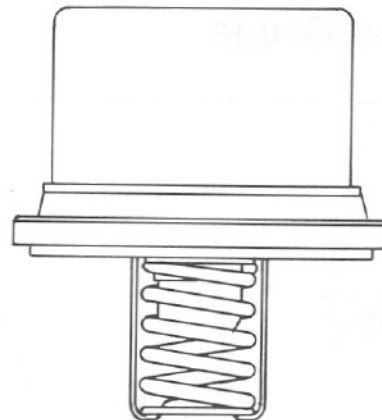
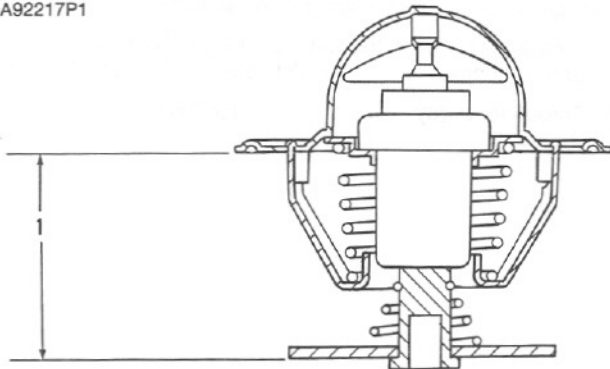
A10232-4P1

## C Water Temperature Regulators

### 9N3711 Temperature Regulator

#### 9N5121 And 7C3472 Temperature Regulators

A92217P1

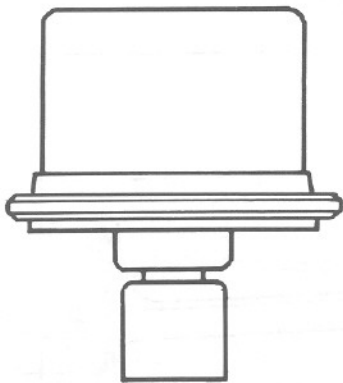


51865P1

Temperature when completely open:

9N5121 Water Temperature Regulator ..... 92°C (197°F)  
 7C3472 Water Temperature Regulator ..... 98°C (208°F)

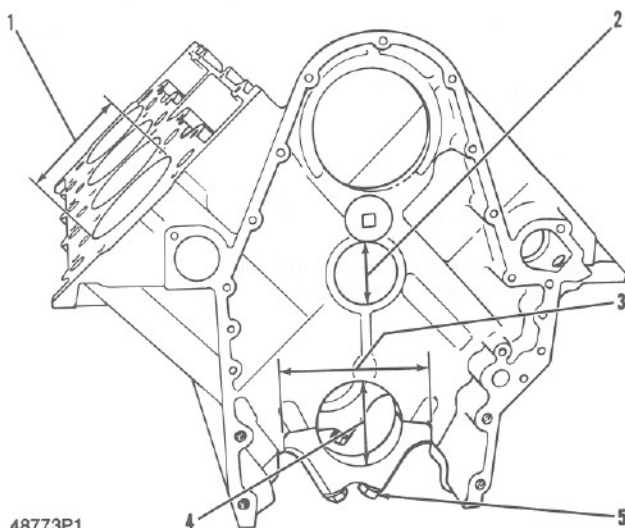
- (1) Distance at completely open temperature must not be more than ..... 37.85 mm (1.490 in)



B75390P1

Temperature when completely open:  
 9N3711 Water Temperature Regulator ..... 92°C (197°F)  
 Minimum completely open distance ..... 9.53 mm (.375 in)

## Cylinder Block



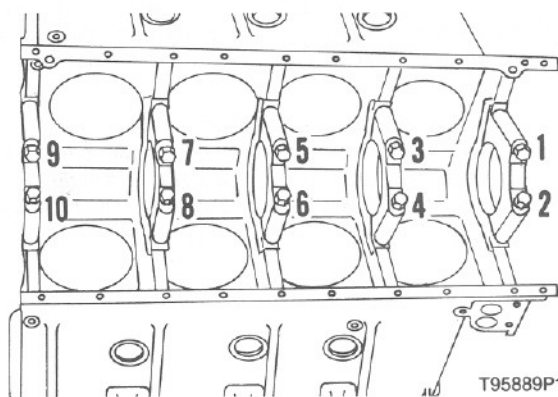
48773P1

Measure wear of the cylinder bore at the top and bottom of piston ring travel.

- (1) Cylinder bore [standard, original size] ..... 114.300 to 114.338 mm (4.5000 to 4.5015 in)  
 The recommendation is made to make the cylinder bore the next size larger when the size of the bore is ..... 114.452 mm (4.5060 in)  
 Cylinder bore must be made the next size larger when the size of the bore is ..... 114.529 mm (4.5090 in)  
 Cylinder bore [0.51 mm (.020 in) larger than the original size] ..... 114.821 ± 0.013 mm (4.5205 ± .0005 in)  
 The recommendation is made to make the cylinder bore the next size larger when the size of the bore is ..... 114.960 mm (4.5260 in)  
 Cylinder bore must be made the next size larger when the size of the bore is ..... 115.037 mm (4.5290 in)  
 Cylinder bore [1.02 mm (.040 in) larger than the original size] ..... 115.329 ± 0.013 mm (4.5405 ± .0005 in)  
 Maximum permissible wear of cylinder bores (replacement of the cylinder block is necessary) ..... 115.545 mm (4.5490 in)
- (2) Bore in block for camshaft bearing .. 67.374 ± 0.013 mm (2.6525 ± .0005 in)

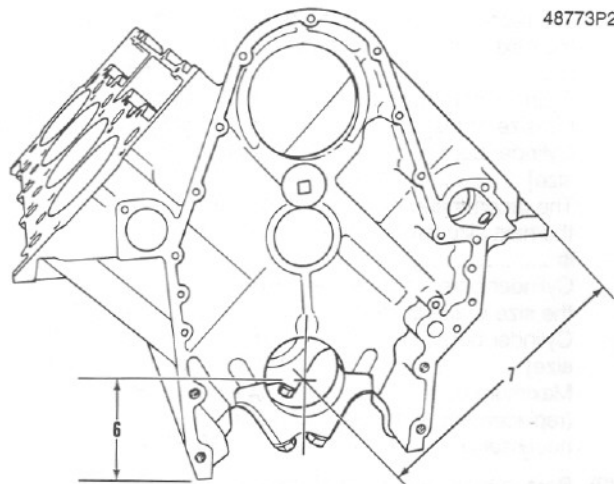
**NOTE:** Install camshaft bearings with the oil hole toward the top of the cylinder block.

- (3) Width of main bearing cap ..... 166.624 ± 0.018 mm (6.5600 ± .0007 in)  
 Minimum permissible width of main bearing cap ..... 166.573 mm (6.5580 in)  
 Width of main bearing cap guide (in cylinder block) ..... 166.599 ± 0.013 mm (6.5590 ± .0005 in)
- (4) Bore in block for main bearing ..... 94.171 ± 0.013 mm (3.7075 ± .0005 in)  
 Permissible amount of distortion in bore ..... 94.13 to 94.21 mm (3.706 to 3.709 in)



T95889P1

- (5) Torque for bolts holding caps for main bearings:
- Put 2P2506 Thread Lubricant on bolt threads and washer face.
  - Tighten all bolts in number sequence to ..... 40 ± 4 N•m (30 ± 3 lb ft)
  - Put a mark on each bolt and cap.
  - Tighten all bolts in number sequence from mark ..... 120 ± 5°



48773P2

- (6) Dimension (new) from centerline of crankshaft bearing bore to bottom of block (pan rails) ...  $95.250 \pm 0.038$  mm ( $3.7500 \pm .0015$  in)
- (7) Dimension (new) from centerline of crankshaft bearing bore to top of block (top deck) .....  $322.66 \pm 0.13$  mm ( $12.703 \pm .005$  in)

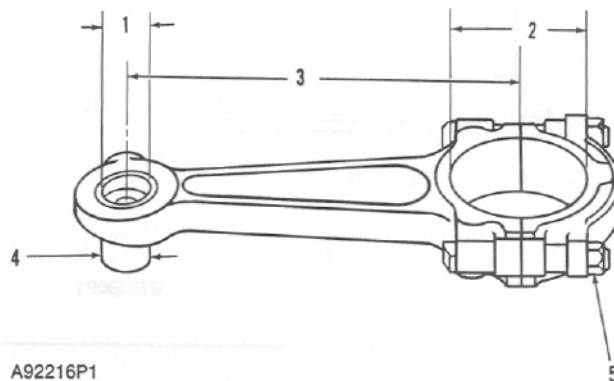
**NOTICE**

There are holes in the bores for the main bearings, between the cylinders for piston cooling orifices. These holes must have orifices or plugs installed or low oil pressure will be the result.

If the base for the oil cooler is 357.2 mm (14.06 in) long the engine has piston cooling orifices installed. If the base for the oil cooler is 268.2 mm (10.56 in) long the engine has plugs installed.

Piston cooling orifices were eliminated from 3208 truck engines effective with truck engine 2Z30692 with a rating of 150 KW (200 hp) @ 2000 rpm or 160 KW (215 hp) @ 2200 rpm. On earlier engines with these ratings the piston cooling orifices may continue to be used or replaced with 7N4953 Plugs.

## C Connecting Rod

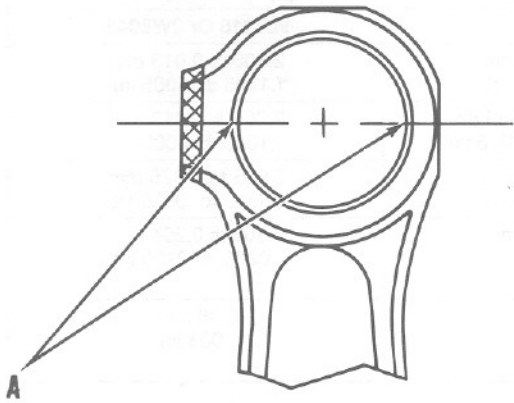


A92216P1

- (1) Bore in bearing for piston pin .....  $38.135 \pm 0.008$  mm ( $1.5014 \pm .0003$  in)
- (2) Bore in connecting rod for bearing [when tightened according to procedure shown in (5)] .....  $74.721 \pm 0.013$  mm ( $2.9418 \pm .0005$  in)
- (3) Distance between center of bearing for piston pin and center of bearing for crankshaft journal .....  $200.66 \pm 0.03$  mm ( $7.900 \pm .001$  in)
- (4) Diameter of piston pin .....  $38.097 \pm 0.005$  mm ( $1.4999 \pm .0002$  in)
- Maximum permissible clearance between bearing and piston pin .....  $0.08$  mm (.003 in)
- (5) Torque for nuts:
- Put 2P2506 Thread Lubricant on bolt threads and seating faces of cap and nut.
  - Tighten both nuts to .....  $40 \pm 4$  N•m ( $30 \pm 3$  lb ft)
  - Put a mark on each nut and cap.
  - Tighten each nut from mark .....  $60 \pm 5^\circ$

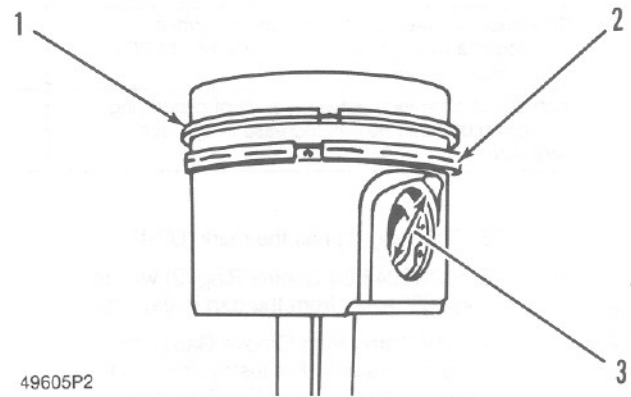
## C Pistons And Rings (two ring piston)

Make reference to Guideline For Reusable Parts: Pistons, Form No. SEBF8049.



A50904P3

NOTE: Piston pin bearing junction and locating notch must be assembled in the top half of rod eye. Location of bearing junction to be within  $\pm 5^\circ$  of center line "A".



49605P2



Pistons And Piston Rings		
	(1) Top Ring	(2) Oil Control Ring*
	9L6233	9L9316 Or 2W8045
Width of groove in piston for piston ring (new).	3.276 ± 0.013 mm (.1290 ± .0005 in)	2.806 ± 0.013 mm (.1105 ± .0005 in)
Thickness of piston ring (new).	3.150 + 0.000 - 0.038 mm (.1240 + .0000 - .0015 in)	2.756 ± 0.013 mm (.1085 ± .0005 in)
Clearance between groove and piston ring (new).	0.076 to 0.140 mm (.0030 to .0055 in)	0.025 to 0.076 mm (.0010 to .0030 in)
Clearance between ends of piston ring when installed in a cylinder with a bore size of 114.300 mm (4.5000 in) (new).	0.572 ± 0.190 mm (.0225 ± .0075 in)	0.508 ± 0.254 mm (.0200 ± .0100 in)
Increase in clearance between ends of piston ring for each 0.03 mm (.001 in) increase in cylinder bore size.	0.08 mm (.003 in)	0.08 mm (.003 in)

NOTE: 9L6233 Top Ring (1) has the mark "UP-1".

\*Install 9L9316 or 2W8045 Oil Control Ring (2) with the gap in the spring 180° away from the gap in the ring.

NOTE: Use 5P3519 Piston Ring Groove Gauge to check the top ring groove only. For instructions on the use of the gauge, see the Guideline For Reusable Parts; Pistons, Form No. SEBF8049.

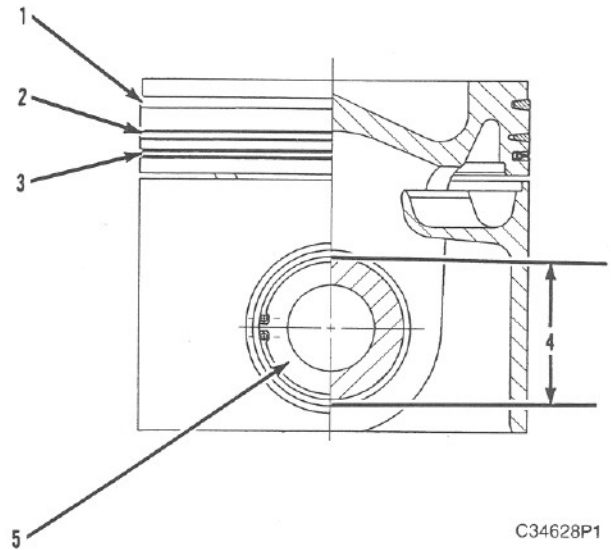
NOTE: Two different pistons are used in 3208 Truck engines. One piston has a crater volume of 53.7 ± 1.2 cm<sup>3</sup> (3.28 ± .07 in<sup>3</sup>), and the other piston has a crater volume of 58.8 ± 1.2 cm<sup>3</sup> (3.59 ± .07 in<sup>3</sup>). Check the part number stamped on the top of the piston, and refer to the parts book to be sure the correct replacement piston is used.

### Piston Pin Bore

(3) Bore in piston for pin ..... 38.123 to 38.133 mm  
(1.5009 to 1.5013 in)

Clearance between pin and bore in piston  
(new) ..... 0.020 to 0.040 mm (.0008 to .0016 in)  
Maximum permissible clearance between piston  
pin and bore in piston (worn) ..... 0.08 mm (.003 in)

### C Pistons And Rings (three ring piston)



Make reference to Guideline For Reusable Parts, Pistons, Form No. SEBF8049, and Guideline For Reusable Parts, Piston Pins And Retaining Rings, Form No. SEBF8051.

## Top And Intermediate Ring

The 1U6431 Keystone Piston Ring Groove Gauge is necessary for measuring ring grooves in keystone style pistons. For correct use of the gauge group, refer to SEES5678 Instruction Card that is with the gauge group.

Install piston rings with "UP" side toward top of piston.

- (1) Top ring has the mark "UP-1".
- (2) Intermediate ring has the mark "UP-2".

Clearance between ends of piston ring when installed in a cylinder liner with a bore size of 114.30 mm (4.500 in)

Top and intermediate rings .....  $0.572 \pm 0.190$  mm  
(.0225  $\pm$  .0075 in)

Increase in clearance between ends of piston rings for each 0.03 mm (.001 in) increase in cylinder liner bore size ..... 0.08 mm (.003 in)

## Oil Control Ring

- (3) Install oil control ring with the gap in the spring  $180 \pm 45^\circ$  away from the gap in the ring.

The 5P3519 Piston Ring Groove Gauge is available for checking ring grooves with straight sides. For instructions on the use of the gauge, refer to Guideline For Reusable Parts, Pistons, Form No. SEBF8049.

Width of groove in piston for piston ring (new) .....  $2.806 \pm 0.013$  mm (.1105  $\pm$  .0005 in)

Thickness of piston ring (new) .....  $2.756 \pm 0.013$  mm  
(.1085  $\pm$  .0005 in)

Clearance between groove and piston ring (new) ..... 0.025 to 0.076 mm (.0010  $\pm$  .0030 in)

Clearance between ends of piston ring when installed in a cylinder liner with a bore size of 114.30 mm (4.500 in) .....  $0.505 \pm 0.255$  mm (.0199  $\pm$  .0100 in)

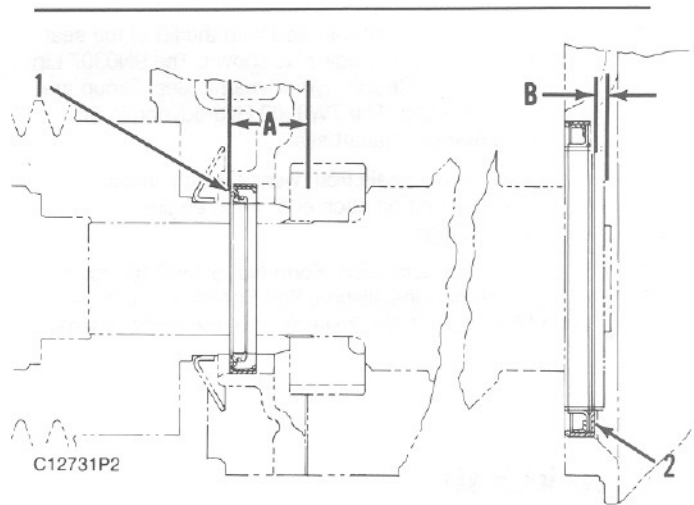
Increase in clearance between ends of piston ring for each 0.03 mm (.001 in) increase in cylinder liner bore size ..... 0.08 mm (.003 in)

## Piston Pin Bore

(4) Bore in piston for pin ..... 38.123 to 38.133 mm  
(1.5009 to 1.5013 in)

(5) Pin diameter .....  $38.097 \pm 0.005$  mm (1.4998  $\pm$  .0002 in)  
Clearance between pin and bore in piston (new) ..... 0.020 to 0.040 mm (.0008 to .0016 in)  
Maximum permissible clearance between piston pin and bore in piston (worn) ..... 0.08 mm (.003 in)

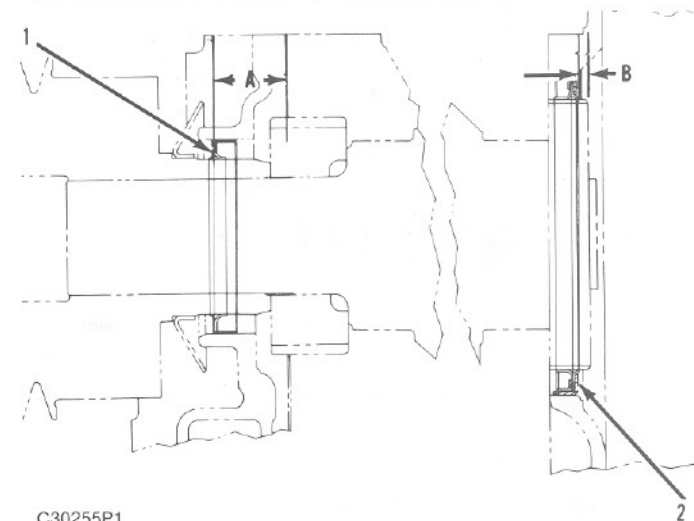
## C Crankshaft Seals



C12731P2

### 9N0542 Crankshaft Seal Group

(1) 9N0307 Lip Type Seal. (2) 7W3200 Hydrodynamic Seal Group.



C30255P1

### 9N0542 Crankshaft Seal Group

(1) 7C6660 Hydrodynamic Type Seal. (2) 7W3200 Hydrodynamic Seal Group.

(A) The distance from the edge of seal (1) to the gasket surface of the front housing is .....  $38.10 \pm 0.50$  mm  
(1.500  $\pm$  .020 in)

(B) The distance from the edge of the hydrodynamic seal (3) to the edge of the wear sleeve is .....  $4.30 \pm 0.25$  mm  
(.169  $\pm$  .010 in)

Remove front and rear seal groups as follows:

- a. Use the 1P3075 Puller Group to remove the seals.
- b. Use the 5P7318 Distorter Group to remove the wear sleeves.

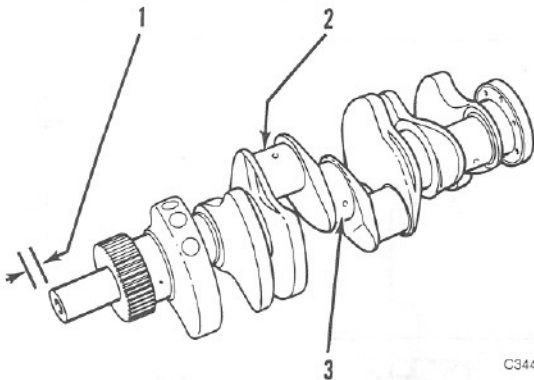
**NOTE:** Seals and wear sleeves can not be used again after the seals and wear sleeves are separated.

Install front and rear seal groups as follows:

- Clean the outer surface of the crankshaft with 6V1541 Quick Cure Primer.
- Crankshaft seals must be installed with the lip of the seal toward the inside of the engine as shown. The 9N0307 Lip Type Seal and the 7C6660 Hydrodynamic Seal Group are front crankshaft seals. The 7W3200 Hydrodynamic Seal Group is the rear crankshaft seal.
- Do not separate the seals from wear sleeves. Install the seal groups as a unit on each end of the engine as shown with correct tooling.

NOTE: See Special Instruction, Form No. SMHS7100 for the lip type seal assembly installation. See Special Instruction, Form No. SMHS8508 for the installation of the hydrodynamic seals.

### c Crankshaft



C34404P4

Heat gear to install. Do not heat to a temperature of more than 260°C (500°F).

- End play for the crankshaft ..... 0.08 to 0.25 mm (.003 to .010 in)  
Maximum permissible end play for the crankshaft (worn) ..... 0.36 mm (.014 in)
- Make reference to Bearings For Connecting Rods And Mains.
- Make reference to Bearings For Connecting Rods And Mains.

NOTE: See Reconditioning Procedures for the correct method to check for bent crankshafts.

### c Bearings For Connecting Rods And Mains

Make reference to Guidelines For Reusable Parts: Main Bearings And Connecting Rod Bearings, Form No. SEBF8009.

CONNECTING ROD BEARINGS	
Original Size Journal	69.840 ± 0.015 mm (2.7496 ± .0006 in)
Undersize Journal 0.25 mm (.010 in)	69.586 ± 0.015 mm (2.7396 ± .0006 in)
Undersize Journal 0.51 mm (.020 in)	69.332 ± 0.015 mm (2.7296 ± .0006 in)
Undersize Journal 1.27 mm (.050 in)	68.570 ± 0.015 mm (2.6996 ± .0006 in)

Clearance between bearing and journal (new) ..... 0.053 to 0.140 mm (.0021 to .0055 in)

Maximum permissible clearance between bearing and journal ..... 0.15 mm (.006 in)

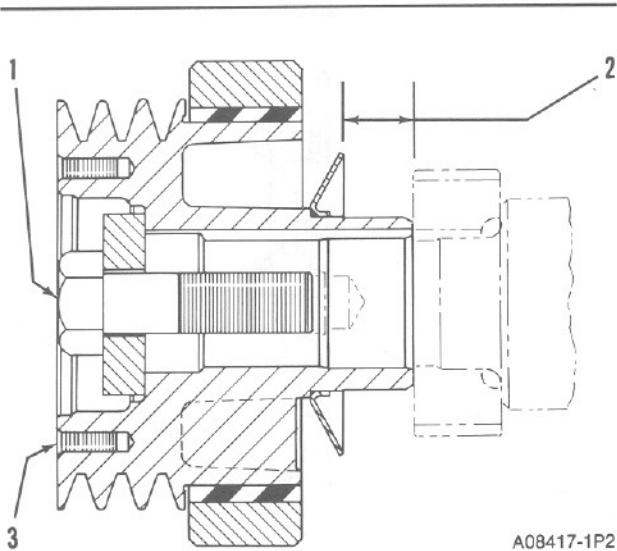
MAIN BEARINGS	
Original Size Journal	88.887 ± 0.015 mm (3.4995 ± .0006 in)
Undersize Journal 0.25 mm (.010 in)	88.633 ± 0.015 mm (3.4895 ± .0006 in)
Undersize Journal 0.51 mm (.020 in)	88.379 ± 0.015 mm (3.4795 ± .0006 in)
Undersize Journal 1.27 mm (.050 in)	87.617 ± 0.015 mm (3.4495 ± .0006 in)

Clearance between bearing and journal (new) ..... 0.076 to 0.168 mm (.0030 to .0066 in)

Maximum permissible clearance between bearing and journal ..... 0.18 mm (.007 in)

## Pulley And Damper

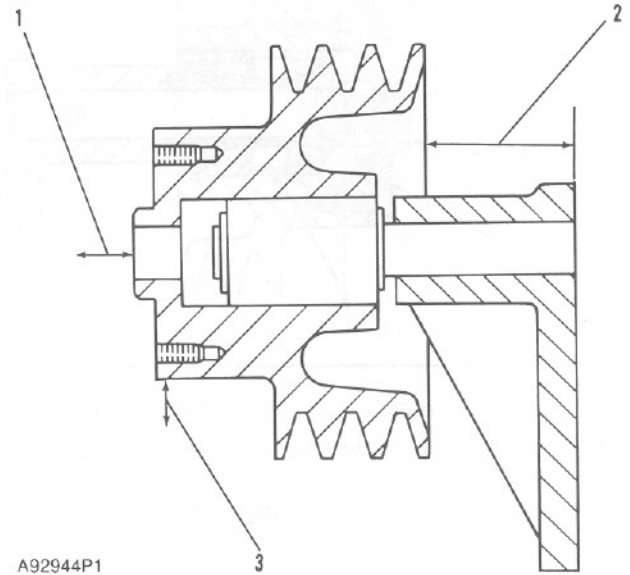
Install the damper assembly on the crankshaft until the hub of the damper assembly comes in contact with the gear on the crankshaft. DO NOT use the bolt and washer that holds the damper assembly on the crankshaft to install the damper assembly.



- (1) Torque for bolt that holds the pulley .....  $624 \pm 80 \text{ N}\cdot\text{m}$   
( $460 \pm 60 \text{ lb ft}$ )  
When a front power take off is used, increase torque for bolt to .....  $950 \pm 50 \text{ N}\cdot\text{m}$  ( $700 \pm 37 \text{ lb ft}$ )
- (2) Distance from end of damper assembly to edge of dust shield .....  $31.8 \pm 1.5 \text{ mm}$  ( $1.25 \pm .06 \text{ in}$ )
- (3) When front power take off is used, tighten bolts to .....  $55 \pm 7 \text{ N}\cdot\text{m}$  ( $40 \pm 5 \text{ lb ft}$ )

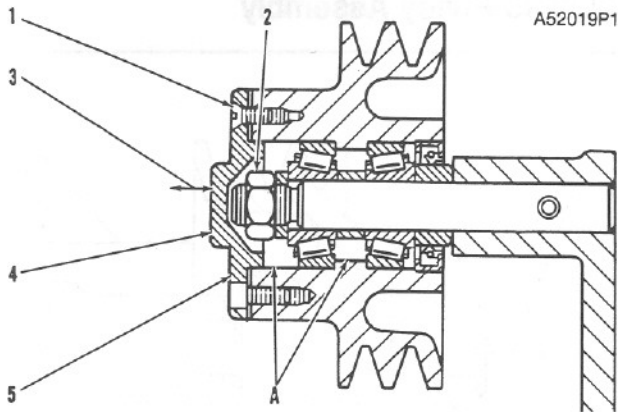
## Fan Mounting Pulley Assemblies

### 9L7243 Pulley Assembly



- (1) End play of pulley .....  $0.03 \text{ to } 0.23 \text{ mm}$  ( $.001 \text{ to } .009 \text{ in}$ )
- (2) Dimension from mounting face of bracket to the rear face of pulley .....  $53.1 \text{ mm}$  ( $2.09 \text{ in}$ )
- (3) Maximum radial play of pulley .....  $0.13 \text{ mm}$  ( $.005 \text{ in}$ )

## 6N7691 Pulley Assembly (with hexagon nut and pinned shaft).



(1) Torque for screws .....  $4.5 \pm 0.8 \text{ N}\cdot\text{m}$  ( $40 \pm 7 \text{ lb in}$ )

**NOTE:** The head of screws (1) must be below outer surface (5) of cover (4).

(2) Torque for nut .....  $149 \pm 20 \text{ N}\cdot\text{m}$  ( $110 \pm 15 \text{ lb ft}$ )

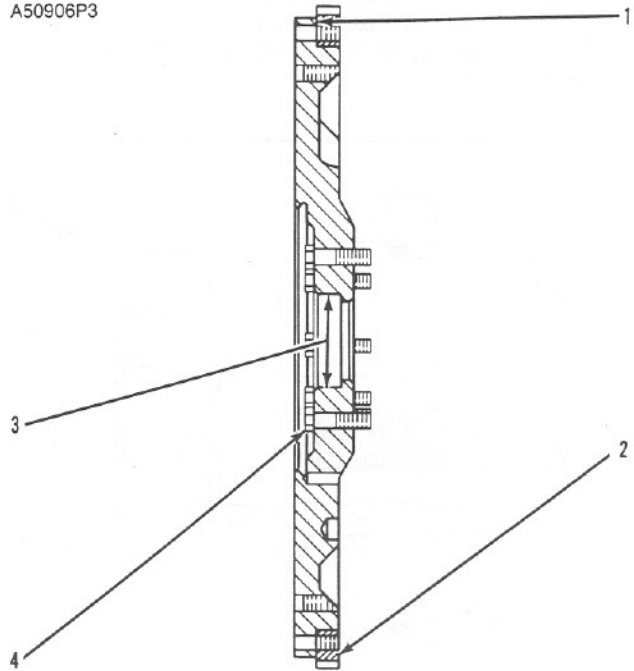
(3) \*End play for the pulley .....  $0.03 \text{ to } 0.25 \text{ mm}$   
(.001 to .010 in)

**NOTE:** Put 2S3230 Bearing Lubricant in areas (A) until they are one-third to one-half full of lubricant.

\*See 3208 Diesel Truck Engine Testing & Adjusting for end play adjustment procedure.

## Flywheel

A50906P3



(1) Flywheel shoulder.

(2) Install ring gear so that Part No. is on this side. Ring gear must be assembled against shoulder of flywheel.

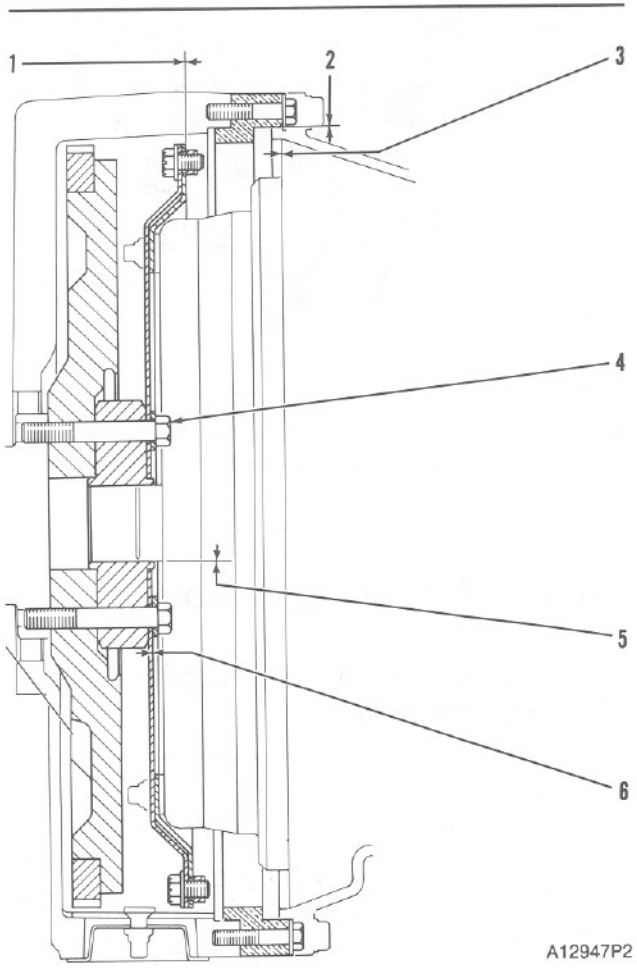
**NOTE:** Do not heat ring gear to more than  $204^\circ\text{C}$  ( $400^\circ\text{F}$ ) before installing on flywheel.

(3) Pilot bore.

(4) Torque for bolts that hold flywheel to crankshaft .....  $90 \pm 7 \text{ N}\cdot\text{m}$  ( $66 \pm 5 \text{ lb ft}$ )  
Put 5P3413 Sealant on bolt threads.

**NOTE:** Dash mark on flywheel must be in alignment with dash mark on crankshaft.

# Mounting Group For AT540, MT643, and MT653 Allison Transmission



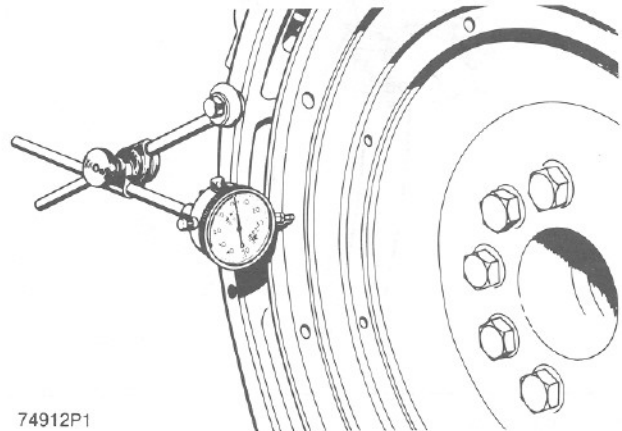
A12947P2

- (1) Maximum face runout of flexplate measured at bolt circle diameter ..... 0.76 mm (.030 in)
- (2) Bore runout of spacer T.I.R.  
(Total indicator reading)  
AT540 ..... 0.51 mm (.020 in)  
MT643, MT653 ..... 0.20 mm (.008 in)
- (3) Face runout of spacer T.I.R.  
(Total indicator reading)  
AT540 ..... 0.51 mm (.020 in)  
MT643, MT653 ..... 0.20 mm (.008 in)
- (4) Torque for bolts that hold flywheel and adapter to crankshaft .....  $75 \pm 7 \text{ N}\cdot\text{m}$  ( $55 \pm 5 \text{ lb ft}$ )
- (5) Bore runout of adapter T.I.R.  
(Total indicator reading)  
AT540 ..... 0.25 mm (.010 in)  
MT643, MT653 ..... 0.13 mm (.005 in)

- (6) Face runout of adapter with flexplate installed [measured 76.2 mm (3.00 in) from center of bore] (Total indicator reading) ..... 0.08 mm (.003 in)

## Flywheel Runout

### Face Runout (Axial Eccentricity) Of The Flywheel:

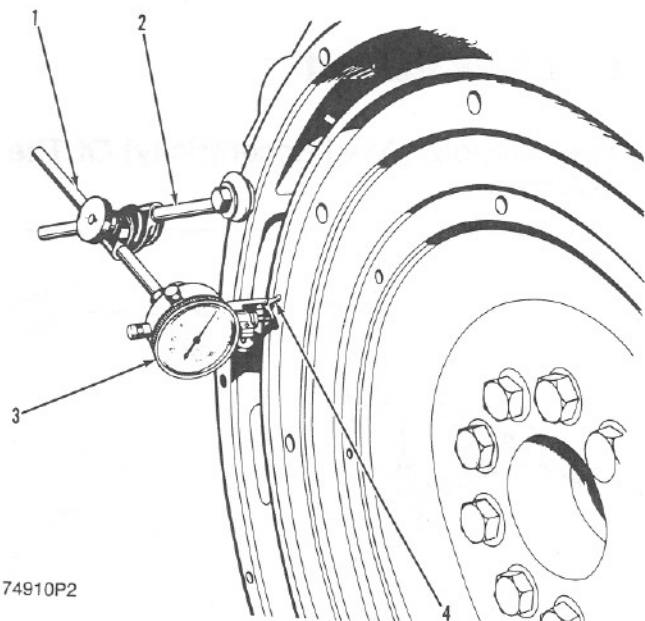


74912P1

#### Checking Face Runout Of The Flywheel

1. Install the dial indicator as shown. Put a force on the flywheel toward the rear.
2. Set the dial indicator to read 0.00 mm (.000 in).
3. Turn the flywheel and read the indicator every 90°. Put a force on the flywheel to the rear before each reading.
4. The difference between the lower and higher measurements taken at all four points must not be more than 0.15 mm (.006 in), which is the maximum permissible face runout (axial eccentricity) of the flywheel.

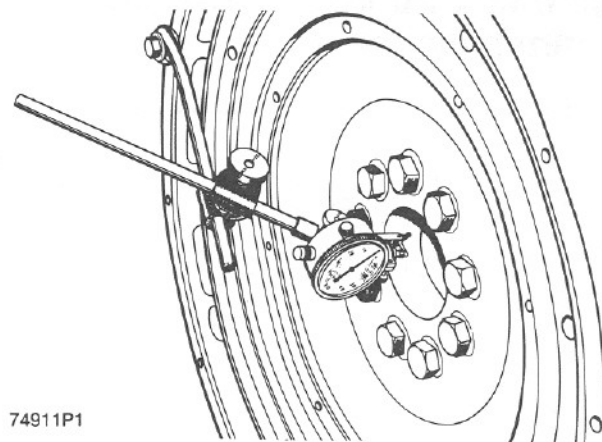
## Bore Runout (Radial Eccentricity) Of The Flywheel:



74910P2

### Checking Flywheel Bore

1. Install the dial indicator (3) and make an adjustment of the universal attachment (4) so it makes contact as shown.
2. Set the dial indicator to read 0.00 mm (.000 in).
3. Turn the flywheel and read the indicator every 90°.
4. The difference between the lower and higher measurements taken at all four points must not be more than 0.15 mm (.006 in), which is the maximum permissible bore runout (radial eccentricity) of the flywheel.

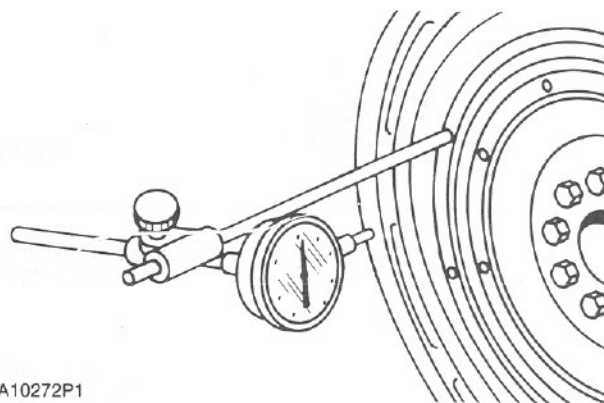


74911P1

5. Runout (eccentricity) of the bore for the pilot bearing for the flywheel clutch, must not exceed 0.13 mm (.005 in).

## Flywheel Housing Runout

### Face Runout (Axial Eccentricity) Of The Flywheel Housing:

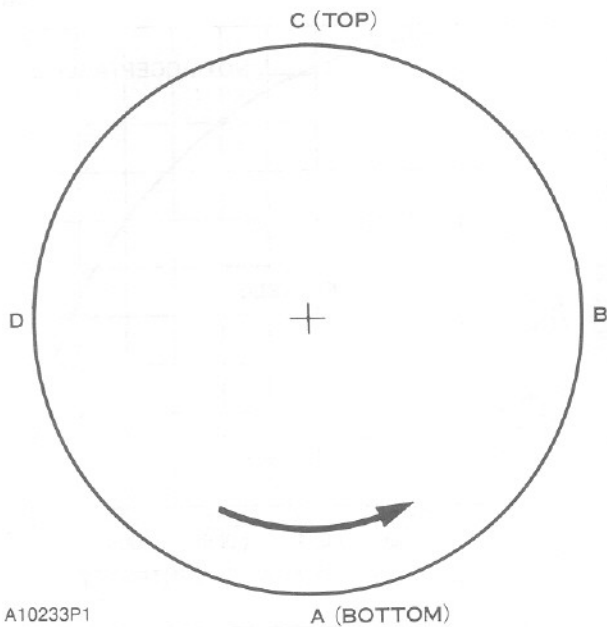


A10272P1

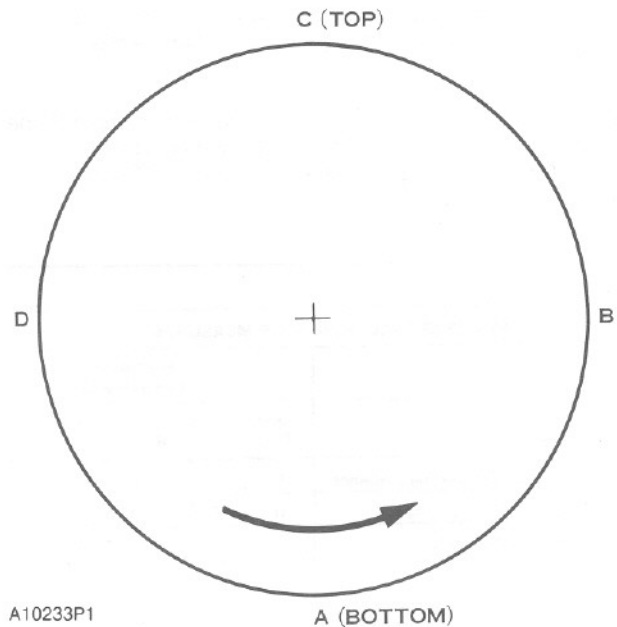
### 8T5096 Dial Indicator Group Installed

1. Fasten a dial indicator to the crankshaft flange so the anvil of the indicator will touch the face of the flywheel housing.
2. Put a force on the crankshaft toward the rear before reading the indicator at each point.

## Flywheel Housing Bore



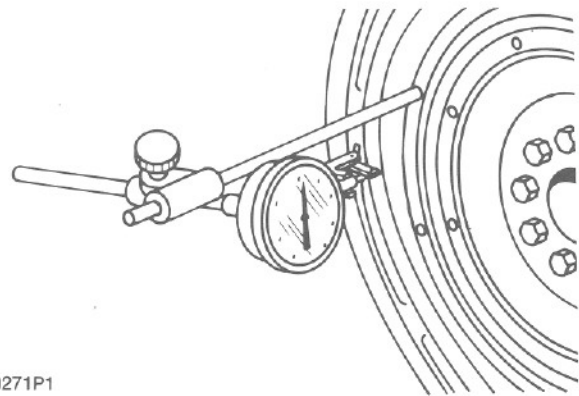
A10233P1



A10233P1

3. With dial indicator set at 0.00 mm (.000 in) at location (A), turn the crankshaft and read the indicator at locations (B), (C) and (D).
4. The difference between lower and higher measurements taken at all four points must not be more than 0.25 mm (.010 in), which is the maximum permissible face run out (axial eccentricity) of the flywheel housing.

**NOTE:** Write the dial indicator measurements with their positive (+) and negative (-) notation (signs). This notation is necessary for making the calculations in the chart correctly.



A10271P1

1. With the dial indicator in position at (C), adjust the dial indicator to "0" (zero). Push the crankshaft up against the top bearing. Write the measurement for bearing clearance on line 1 in column (C).
2. Divide the measurement from Step 1 by 2. Write this number on line 1 in columns (B) & (D).
3. Turn the crankshaft to put the dial indicator at (A). Adjust the dial indicator to "0" (zero).

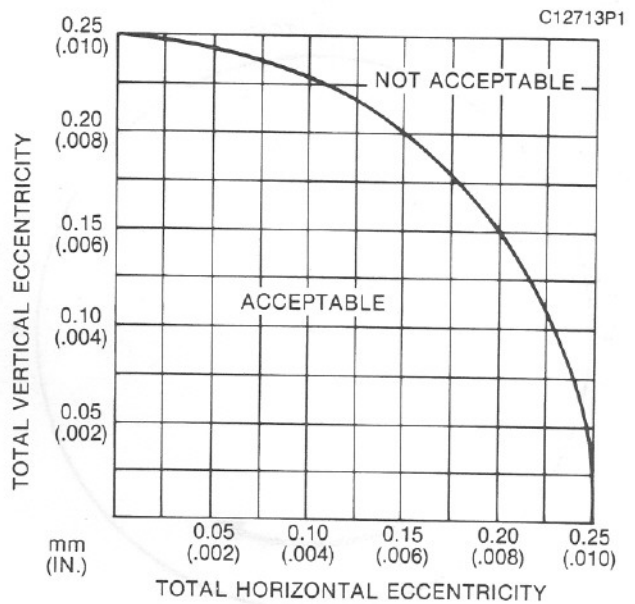


4. Turn the crankshaft counterclockwise to put the dial indicator at (B). Write the measurement in the chart.
5. Turn the crankshaft counterclockwise to put the dial indicator at (C). Write the measurement in the chart.
6. Turn the crankshaft counterclockwise to put the dial indicator at (D). Write the measurement in the chart.
7. Add lines I and II by columns.
8. Subtract the smaller number from the larger number in line III in columns (B) & (D). The result is the horizontal "eccentricity" (out of round). Line III, column (C) is the vertical eccentricity.

CHART FOR DIAL INDICATOR MEASUREMENTS					
	Line No.	Position of dial indicator			
		A	B	C	D
Correction for bearing clearance	I	0			
Dial Indicator Reading	II	0			
Total of Line 1 & 2	III	0	**	*	**

\*Total Vertical eccentricity (out of round).  
 \*\*Subtract the smaller No. from the larger No. The difference is the total horizontal eccentricity.

A10234P1

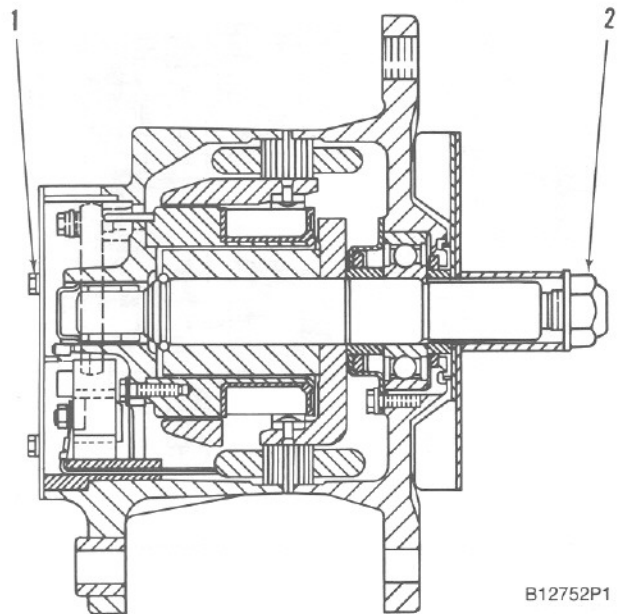


Total Horizontal Eccentricity

9. On the graph for total eccentricity find the point of intersection of the lines for vertical eccentricity and horizontal eccentricity.
10. If the point of intersection is in the range marked "Acceptable" the bore is in alignment. If the point of intersection is in the range marked "Not Acceptable", the flywheel housing must be changed.

# Alternators And Regulators

## Delco Remy Alternators



B12752P1

### 7G7889 Alternator

Voltage rating ..... 12V  
 Polarity ..... Neg Grnd  
 Rotation ..... Either Direction  
 Speed for testing (rpm) ..... 2600 to 6500  
 Output (cold) ..... 28 A @ 14V  
 Output (cold) ..... 62A @ 14V  
 Rated output (hot) at max speed ..... 60 A  
 Field current at rated voltage and 27° C (80°F) ..... 7 to 8A  
 Positive output terminal torque ..... 6.2 to 8.0 N•m  
 (55 to 71 lb in)

- (1) Ground terminal torque ..... 1.7 to 2.9 N•m (15 to 26 lb in)
- (2) Shaft nut torque ..... 95 to 109 N•m (70 to 80 lb ft)

### Regulator (9G5235-Inside Alternator)

Voltage setting ..... No Adjustment  
 Permissible voltage range ..... 13 to 15V

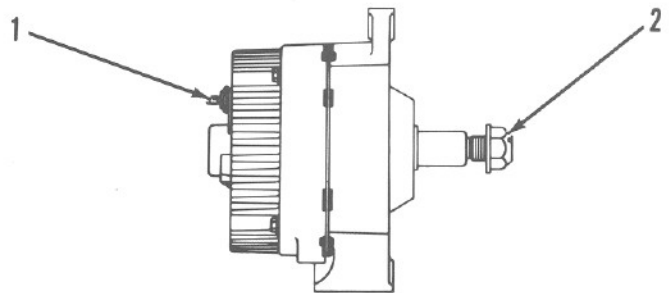
### 3T6352 Alternator

Voltage rating ..... 24V  
 Polarity ..... Neg Grnd  
 Rotation ..... Either Direction  
 Speed for testing (rpm) ..... 2600 to 6500  
 Output (cold) ..... 15A @ 28V  
 Output (cold) ..... 35A @ 28V  
 Rated output (hot) at max speed ..... 35A  
 Field current at rated voltage and 27°C (80°F) ..... 2.5 to 3.2A  
 Positive output terminal torque ..... 6.2 to 8.0 N•m  
 (55 to 71 lb in)

- (1) Ground terminal torque ..... 1.7 to 2.9 N•m (15 to 26 lb in)
- (2) Shaft nut torque ..... 95 to 109 N•m (70 to 80 lb ft)

### Regulator (3T6354 - Inside alternator)

Voltage setting ..... No Adjustment  
 Permissible voltage range ..... 26 to 30 V



A08440P3

### 9G6079 & 6T1194 Alternators

Voltage rating .....	12V
Polarity .....	Neg Grnd
Rotation .....	Either Direction
Output at 2000 rpm (cold) .....	30A
Output at 5000 rpm (cold) .....	57A
Rated output (hot) .....	61A

(1) Torque for stud nut for battery connection ..... 2.8 to 4.5 N•m (25 to 40 lb in)

(2) Torque for pulley nut ..... 100 ± 7 N•m (75 ± 5 lb ft)

Voltage Regulator (3S8828) is internally mounted and is not adjustable.

### 9G6081 & 6T1196 Alternators

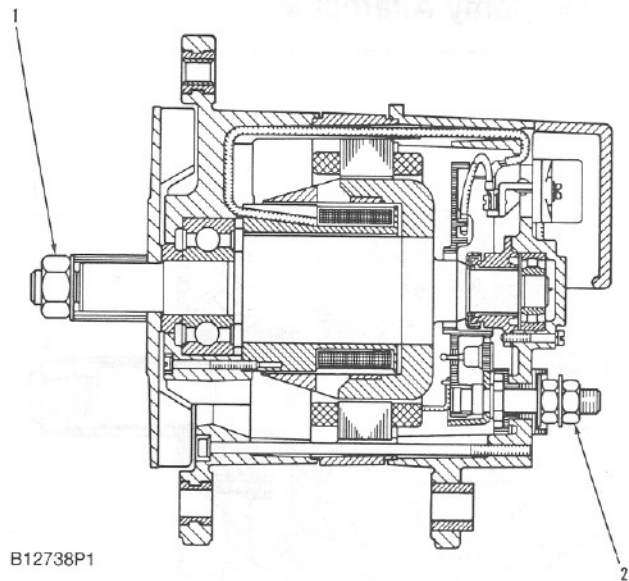
Polarity .....	Neg Grnd
Rotation .....	Either Direction
Output at 2600 rpm (cold) .....	25A
Output at 7000 rpm (cold) .....	41A
Rated output (hot) .....	40A

(1) Torque for stud nut for battery connection ..... 2.8 to 4.5 N•m (25 to 40 lb in)

(2) Torque for pulley nut ..... 100 ± 7 N•m (75 ± 5 lb ft)

Voltage Regulator (3T6354) is internally mounted and not adjustable.

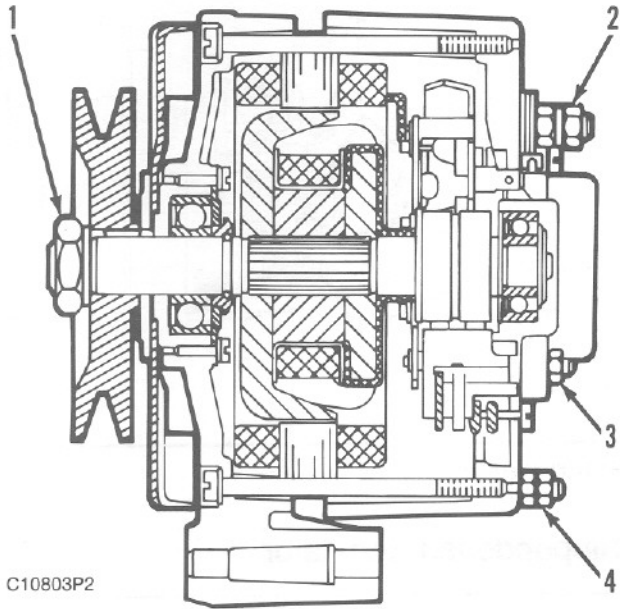
## Bosch Alternators



### 7N9720 Alternator

Voltage rating .....	24V
Polarity .....	Neg Grnd
Rotation .....	Either Direction
Speed for testing (rpm) .....	4000
Output (cold) .....	47A
Output (hot) .....	37A
Field Current at 28V and 25° C (77°F) .....	1.8A
(1) Torque for pulley nut .....	95 to 110 N•m (70 to 80 lb ft)
(2) Torque for output terminal B+ .....	7.5 to 10 N•m (5.5 to 7.0 lb ft)
Torque for ground terminal .....	2.1 to 2.8 N•m (19 to 25 in lb)
Regulator Number .....	9G7567

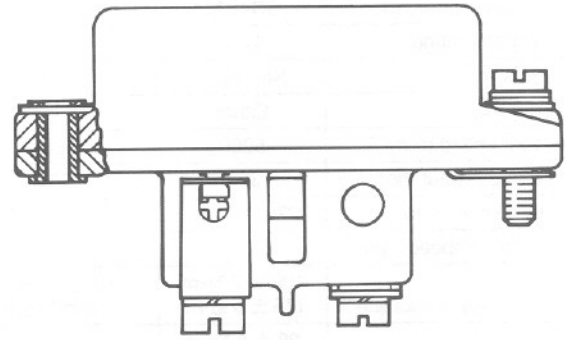
## Bosch Regulators



C10803P2

### 9W3043 Alternator

Voltage rating .....	24V
Polarity .....	Neg Grnd
Rotation .....	Clockwise
Speed for testing (rpm) .....	5000
Output (cold) .....	40A
Output (hot) .....	52A
Field current at 28V and 25°C (77°F) .....	2.9A
(1) Torque for pulley nut .....	50 ± 5 N•m (37 ± 4 lb ft)
(2) Torque for output terminal B+ .....	7.8 ± 0.8 N•m (70 ± 7 lb in)
(3) Torque for field D+ terminal nut .....	1.70 ± 0.25 N•m (15 ± 2 lb in)
(4) Torque for ground (B-) terminal nut .....	3.60 ± 0.8 N•m (32 ± 7 lb in)
Torque for W terminal (not shown) .....	2.25 ± 0.25 N•m (20 ± 2 lb in)
Regulator Number .....	8C6145



B12749P1

### 9G7567 Regulator

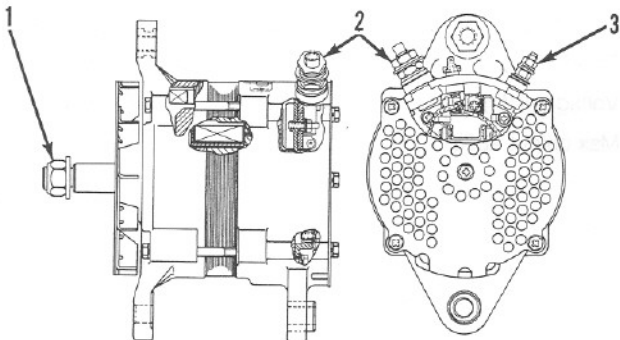
Voltage rating .....	28V
Polarity .....	Neg Grnd
Voltage setting range .....	26.7 to 28.3 V
Max output at 28V .....	40A

### 8C6145 Regulator

Voltage rating .....	28V
Polarity .....	Neg Grnd
Voltage setting range .....	27.5 to 28.5V
Max output at 28V .....	52A

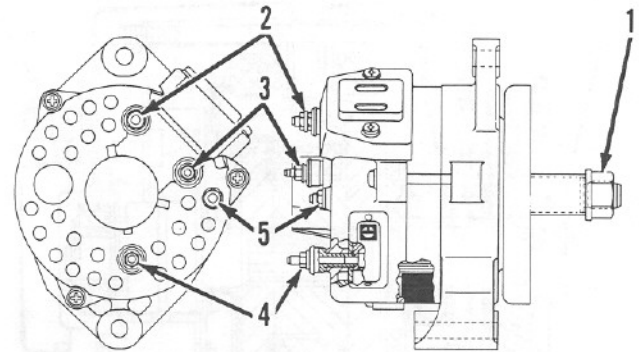
## Nippondenso Alternator

Alternator Specifications		
Caterpillar No.	9G4574	8T9700
Voltage rating	24V	12V
Polarity	Neg Grnd	Neg Grnd
Rotation	Either	Clockwise
Test speed (rpm)	5000	5000
Rated output (hot)	35A	55A
Output voltage	27.5 ± 1.0V	14.25 ± .35V
Turn on speed (rpm)	2000	2000
(1) Pulley nut torque	100 ± 7 N·m (75 ± 5 lb ft)	100 ± 7 N·m (75 ± 5 lb ft)
(2) B+ nut torque	29 ± 8 N·m (21 ± 6 lb ft)	
(3) B- nut torque	4 ± 1 N·m (35 ± 9 lb in)	
(2) Battery terminal (B) torque		4.25 ± 0.85 N·m (38 ± 6 lb in)
(3) Ignition terminal (IG) torque		4.1 ± 1.0 N·m (36 ± 9 lb in)
(4) (R) terminal		4.1 ± 1.0 N·m (36 ± 9 lb in)
(5) Ground terminal (E)		4.25 ± 0.85 N·m (38 ± 6 lb in)



C10825P2

9G4574 Alternator

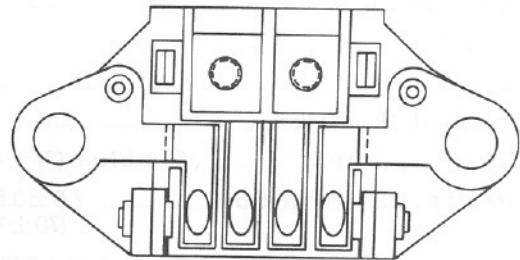


C12708P1

8T9700 Alternator

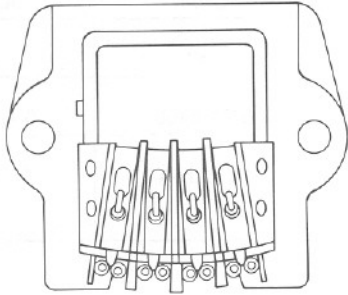
## Nippondenso Regulator

Regulator Specifications		
Caterpillar No	7T2798	8T9693
Voltage rating	24V	12V
Polarity	Neg Grnd	Neg Grnd
Voltage range	27.5 ± 1V	14.25 ± .35V



C10874P1

7T2798 Regulator

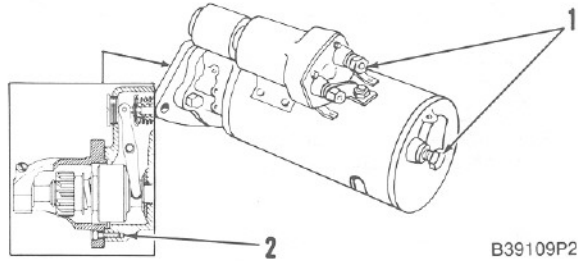


C12707P1

8T9693 Regulator

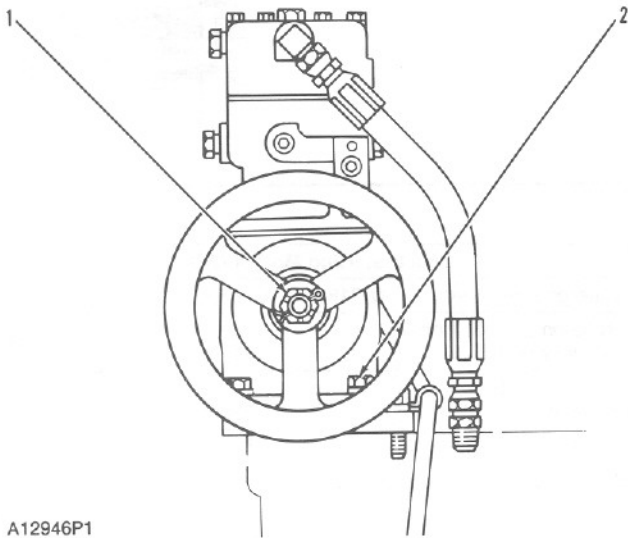
## Starter Motors

### Delco Remy



B39109P2

## Air Compressor



A12946P1

- (1) Torque for nut that holds the drive pulley ..... 70 N•m  
(50 lb ft)

**NOTE:** Tighten nut more to get alignment of hole for cotter pin.

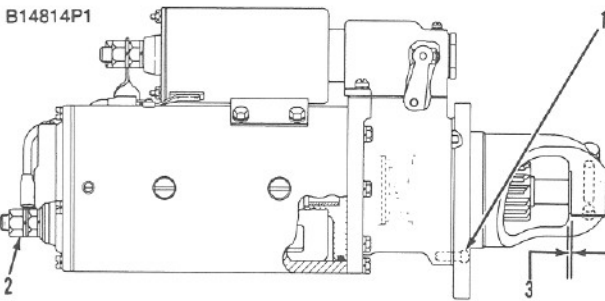
- (2) Torque for studs that hold the air compressor .....  $70 \pm 7$  N•m ( $70 \pm 5$  lb ft)

Delco-Remy Starter Motors					
Voltage	12V	12V	24V	24V	24V
Caterpillar No.	4N8253	8C3643	2S0900	8C3647	8C3651
Rotation as seen from the drive end	CW	CW	CW	CW	CW
No Load Speed Min-Max rpm	4000-7000	5500-7800	5500-9000	6300-8400	6300-8400
Current Consumption (Draw) with solenoid at V*	140 to 215A	100 to 170A	70 to 110A	60 to 75A	60 to 75A

\* 12V Starter Motors Solenoid at 10V  
24V Starter Motors Solenoid at 20V

- (1) Terminal nut torque ..... 27.0 to 33.8 N•m (20 to 25 lb ft)
- (2) Screw torque ..... 17.6 to 23.0 N•m (13 to 17 lb ft)
- Clearance between pinion and housing ..... 8.3 to 9.9 mm (.33 to .39 in)

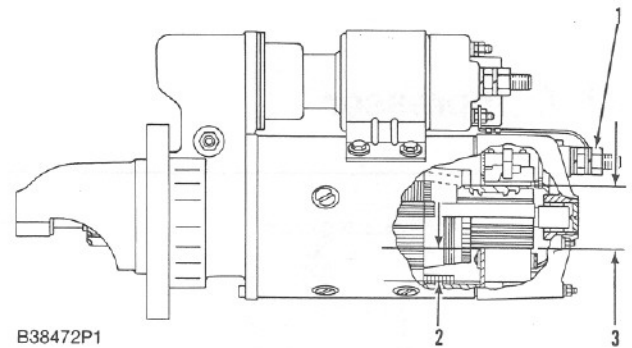
### Prestolite



Prestolite Starting Motor (24V)	
Caterpillar Number	9G4337
Rotation as seen from the drive end	CW
No Load Speed Minimum rpm	5000
Current Consumption (Draw) at 20V	65A

- (1) Housing bolt torque ..... 11 N•m (8 lb ft)
- (2) Terminal nut torque ..... 27.0 to 33.8 N•m (20 to 25 lb ft)
- (3) Clearance between pinion and housing ..... 0.51 to 1.27 mm (.020 to .050 in)

### Bosch

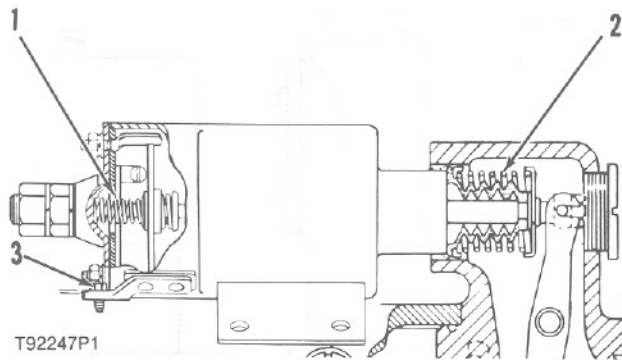


Bosch Starting Motors (24)			
Caterpillar Number	4N3181	3T6305	7T0798
Rotation as seen from the drive end	CW		
No Load Speed Minimum rpm	5500		
Minimum Current Draw	140A		

- (1) Terminal nut torque ..... 27 to 33 N•m (1.1 to 1.3 lb ft)
- (2) Service limit of brushes ..... 17.5 mm (.69 in)
- (3) Service limit of commutator diameter ..... 48 mm (1.9 in)  
Pinion to ring gear clearance ..... 1.5 to 5.5 mm (.06 to .22 in)  
Solenoid terminal torque ..... 4 to 5 mm (.16 to .20 in)

# Starter Motor Solenoids

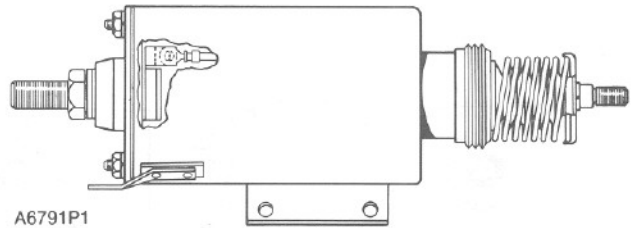
## Delco-Remy



T92247P1

- Voltage ..... 24V
- Caterpillar Part Number ..... 7T8854
- Current Consumption (Draw):
  - Pull-in windings ..... 9 to 11.5A @ 5V
  - Hold-in windings ..... 6.8 A max. @ 20V
- Voltage ..... 12V
- Caterpillar Part Number ..... 7T0258
- Caterpillar Part Number ..... 8T8822
- Current Consumption (Draw):
  - Pull-in windings ..... 28 to 35.7A @ 5V
  - Hold-in windings ..... 13 to 15.4A @ 10V
- (1) 4M1815 Spring (contact release):
  - Length under test force ..... 10.7 mm (.42 in)
  - Test force .....  $40 \pm 2$  N (9.0  $\pm$  .5 lb)
  - Free length after test .....  $21.1 \pm 0.5$  mm (.83  $\pm$  .02 in)
  - Outside diameter .....  $9.53 \pm 0.25$  mm (.375  $\pm$  .010 in)
- (2) 9M7609 Spring (to return the clutch lever):
  - Length under test force ..... 39.6 mm (1.56 in)
  - Test force .....  $62 \pm 2$  N (14.0  $\pm$  .5 lb)
  - Free length after test .....  $70.9 \pm 0.5$  mm (2.79  $\pm$  .02 in)
  - Outside diameter .....  $35.38 \pm 0.35$  mm (1.393  $\pm$  .015 in)
- (3) Torque for small terminal nuts ..... 1.8 to 3.4 N•m  
(16 to 30 lb in)
- Torque for large terminal nuts ..... 27.1 to 33.7 N•m  
(20 to 25 lb ft)

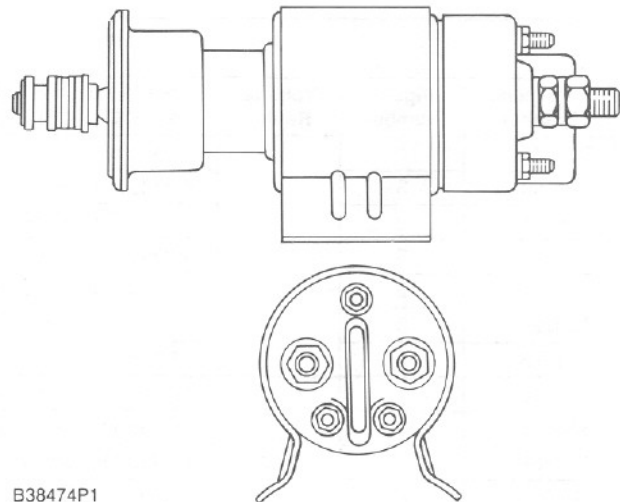
## Prestolite



A6791P1

- Voltage ..... 24V
- Caterpillar Part Number ..... 3T8635
- Current Consumption (Draw):
  - Pull-in windings ..... 23.2 to 26.6A @ 12V
  - Hold-in windings ..... 4.1 to 4.8A @ 12V
- Torque for small terminals ..... 1.7 to 2.2 N (15 to 20 lb in)

## Bosch

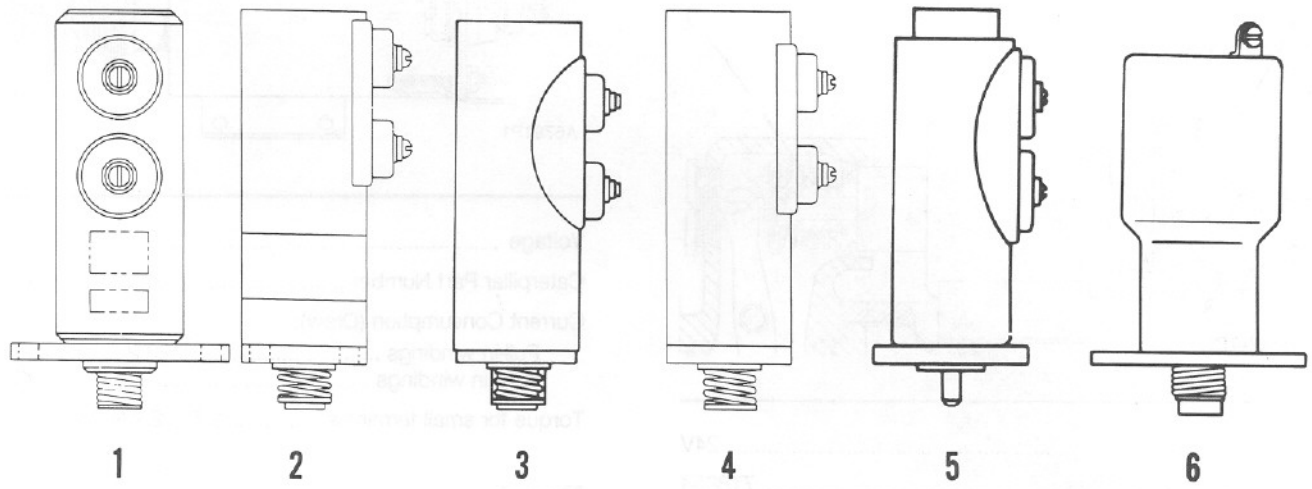


B38474P1

- Voltage ..... 24V
- Caterpillar Part Number ..... 3T0868
- Current Consumption (Draw):
  - Pull-in windings ..... 8.3 to 12.5A at 5V
  - Hold-in windings ..... 5.4 to 6.5A at 20V
  - Resistance of pull-in windings ..... .4 to .6 ohm
  - Resistance of hold-in windings ..... 3.1 to 3.7 ohm



# Shutoff Solenoids



C12710P1

Caterpillar Number	Figure Number	Voltage Rating	Coil Resistance at 25°C (77°F)
6N3749	1	12V	4.23 to 5.17 ohms
6T4750	3		4.23 to 5.17 ohms
6T6121	2		4.23 to 5.17 ohms
7N8883	3		4.23 to 5.17 ohms
8C5523	5		1.26 to 1.40 ohms
9G3227	5		1.26 to 1.40 ohms
9N1068	6		4.3 to 5.3 ohms
6T4126	4	24V	17.7 to 21.7 ohms
6T6122	2		17.7 to 21.7 ohms
7N8884	1		15.3 to 18.7 ohms
7N8886	3		17.7 to 21.7 ohms
8C5524	5		4.86 to 5.38 ohms
9G3228	5		4.86 to 5.38 ohms