

FORM NO. REG01350-01

FOR USE IN SERVICE MANUALS:
VOLUME I SPECIFICATIONS,

REG01312
D4 TRACTOR, REG00632
D4 TRACTOR, SPECIAL APPLICATION,
REG00784
D5 TRACTOR, REG00633
D5 TRACTOR, SPECIAL APPLICATION,
REG00785
D6 TRACTOR, REG00530
D6 TRACTOR, SPECIAL APPLICATION,
REG00871
D7 TRACTOR, REG00691
D7G TRACTOR, SENR7112
12G MOTOR GRADER, REG01544
NO.12-NO.14 MOTOR
GRADER, REG00507
NO.14G MOTOR GRADER, REG01542
NO.112F MOTOR GRADER, REG00885
120G MOTOR GRADER, REG01654
NO.120-NO.140 MOTOR GRADERS,
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SPECIFICATIONS

FOR

3304 & 3306 VEHICLE ENGINES

SERIAL NUMBERS

3304: 78P

3306: 3N

NOTICE
This book also includes specifications for all 4.75" bore, four and
six cylinder vehicle engines with vehicle serial numbers. The speci-
fications in this book supersede the specifications in Forms
REG00502-05 and REG00511-03.

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 pressure, 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 specifications 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 specifications given for "use again" and "permissible" are intended for guidance only and Caterpillar Tractor Co. hereby expressly denies and excludes any representation, warranty or implied warranty of the reuse of any component.

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NOTE: For Systems Operation and Testing and Adjusting, make reference to 3304 & 3306 Vehicle Engines, Form No. REG01349.


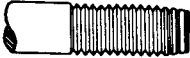
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GENERAL TIGHTENING TORQUE FOR BOLTS, NUTS AND TAPERLOCK STUDS

The following charts give the standard torque values for bolts, nuts and taperlock studs of SAE Grade 5 or better quality. Exceptions are given in the Specifications.



| THREAD DIAMETER | | STANDARD TORQUE | |
|--|-------------|---|--------------|
| inches | millimeters | lb. ft. | mkg |
| Standard thread  | | Use these torques for bolts and nuts with standard threads. | |
| 1/4 | 6.35 | 9 ± 3 | 1.24 ± 0.4 |
| 5/16 | 7.94 | 18 ± 5 | 2.5 ± 0.7 |
| 3/8 | 9.53 | 32 ± 5 | 4.4 ± 0.7 |
| 7/16 | 11.11 | 50 ± 10 | 6.9 ± 1.4 |
| 1/2 | 12.70 | 75 ± 10 | 10.4 ± 1.4 |
| 9/16 | 14.29 | 110 ± 15 | 15.2 ± 2.0 |
| 5/8 | 15.88 | 150 ± 20 | 20.7 ± 2.8 |
| 3/4 | 19.05 | 265 ± 35 | 36.6 ± 4.8 |
| 7/8 | 22.23 | 420 ± 60 | 58.1 ± 8.3 |
| 1 | 25.40 | 640 ± 80 | 88.5 ± 11.1 |
| 1 1/8 | 28.58 | 800 ± 100 | 110.6 ± 13.8 |
| 1 1/4 | 31.75 | 1000 ± 120 | 138 ± 16.6 |
| 1 3/8 | 34.93 | 1200 ± 150 | 166 ± 20.7 |
| 1 1/2 | 38.10 | 1500 ± 200 | 207 ± 27.7 |
| Use these torques for bolts and nuts on hydraulic valve bodies. | | | |
| 5/16 | 7.94 | 13 ± 2 | 1.8 ± 0.3 |
| 3/8 | 9.53 | 24 ± 2 | 3.3 ± 0.3 |
| 7/16 | 11.11 | 39 ± 2 | 5.4 ± 0.3 |
| 1/2 | 12.70 | 60 ± 3 | 8.3 ± 0.4 |
| 5/8 | 15.88 | 118 ± 4 | 16.3 ± 0.5 |
| Taperlock stud  | | Use these torques for studs with Taperlock threads. | |
| 1/4 | 6.35 | 5 ± 2 | 0.69 ± 0.3 |
| 5/16 | 7.94 | 10 ± 3 | 1.4 ± 0.4 |
| 3/8 | 9.53 | 20 ± 3 | 2.8 ± 0.4 |
| 7/16 | 11.11 | 30 ± 5 | 4.1 ± 0.7 |
| 1/2 | 12.70 | 40 ± 5 | 5.5 ± 0.7 |
| 9/16 | 14.29 | 60 ± 10 | 8.3 ± 1.4 |
| 5/8 | 15.88 | 75 ± 10 | 10.4 ± 1.4 |
| 3/4 | 19.05 | 110 ± 15 | 15.2 ± 2.0 |
| 7/8 | 22.23 | 170 ± 20 | 23.5 ± 2.8 |
| 1 | 25.40 | 260 ± 30 | 35.9 ± 4.1 |
| 1 1/8 | 28.58 | 320 ± 30 | 44.2 ± 4.1 |
| 1 1/4 | 31.75 | 400 ± 40 | 55 ± 5.5 |
| 1 3/8 | 34.93 | 480 ± 40 | 66 ± 5.5 |
| 1 1/2 | 38.10 | 550 ± 50 | 76 ± 7 |

T95416-5

| ENGINE DESIGN | | |
|--|----------------------|----------------------|
| | 3304 | 3306 |
| Bore | 4.75 in. (120.65 mm) | 4.75 in. (120.65 mm) |
| Stroke | 6.0 in. (152.40 mm) | 6.0 in. (152.40 mm) |
| Number of Cylinders | 4 | 6 |
| Cylinder Arrangement | *in-line | *in-line |
| Firing Order (Injection Sequence) | 1, 3, 4, 2 | 1, 5, 3, 6, 2, 4 |
| Direction of Rotation (when seen from flywheel end) | Counterclockwise | Counterclockwise |
| *No. 1 Cylinder Is Opposite Flywheel End. | | |

FUEL INJECTION EQUIPMENT

Firing order (injection sequence), 3306 Engine 1, 5, 3, 6, 2, 4

Firing order (injection sequence), 3304 Engine 1, 3, 4, 2

Injection timing before TC (top center), 3306 Engine 13° 30'

Injection timing before TC (top center), 3304 Engine 12° 30'

Torque for bolt in hole
for timing pin 108 ± 36 lb. in. (125 ± 42 cm.kg)

Torque for bolts that hold governor weight carrier
to camshaft 10 ± 2 lb.ft. (1.4 ± 0.3 mkg)

(1) Diameter of rear bearing surface (journal)
of the camshaft
(new) 2.3720 ± .0005 in. (60.249 ± 0.013 mm)

Bore in the rear bearing for the camshaft
(new) 2.3750 ± .0005 in. (60.325 ± 0.013 mm)

Maximum permissible clearance between the bearing
and the camshaft bearing surface (journal)
(worn)006 in. (0.15 mm)

(2) Diameter of sleeve control shaft
(new)3530 ± .0003 in. (8.966 ± 0.008 mm)

Bore in the housing for the fuel
control shaft (new)3543 ± .0005 in. (8.999 ± 0.013 mm)

Maximum permissible clearance between the
bore in the housing and the sleeve control
shaft (worn)003 in. (0.08 mm)

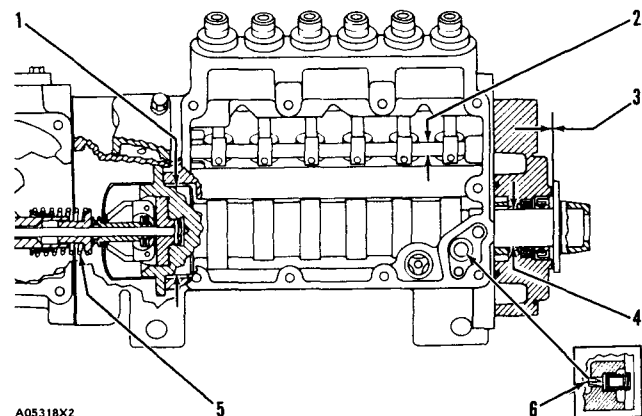
(3) End play for camshaft with sleeve installed
(new)023 ± .018 in. (0.58 ± 0.46 mm)

NOTE: When installing sleeve on end of camshaft, support the camshaft
to prevent damage to parts inside of injection pump and governor
housing.

(4) Diameter of front bearing surface (journal)
of the camshaft
(new)9990 ± .0005 in. (25.375 ± 0.013 mm)

Bore in the front bearing for the camshaft
(new) 1.0005 ± .0005 in. (25.413 ± 0.013 mm)

Maximum permissible clearance between the bearing
and the camshaft bearing surface (journal)
(worn)002 in. (0.05 mm)



Fuel Injection Equipment (Cont.)

Install spring washer with bent side towards the governor spring (5) as shown.

(5) 4N4223 Spring for governor:

Color code (stripes) 2 yellow
Put a load on spring of 3.0 lb. (1.4 kg)
Then make spring shorter by80 in. (20.3 mm)
Total test force $11.8 \pm .4$ lb. (5.4 ± 0.2 kg)
Free length after test $1.97 \pm .03$ in. (50.0 ± 0.7 mm)
Outside diameter 1.20 in. (30.5 mm)

(5) 4N4224 Spring for governor:

Color code (stripes) 2 yellow, 1 white
Put a load on spring of 4.0 lb. (1.8 kg)
Then make spring shorter by80 in. (20.3 mm)
Total test force $13.6 \pm .4$ lb. (6.2 ± 0.2 kg)
Free length after test $1.96 \pm .03$ in. (49.7 ± 0.7 mm)
Outside diameter 1.20 in. (30.5 mm)

(5) 4N4225 Spring for governor:

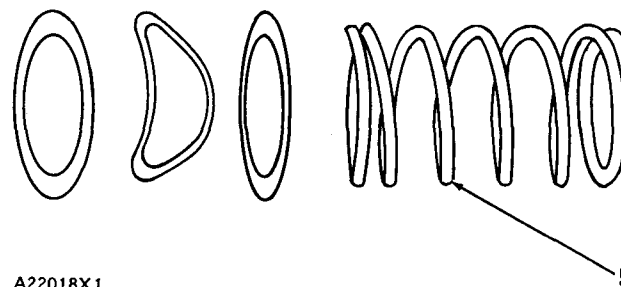
Color code (stripes) 1 pink, 2 yellow
Put a load on spring of 4.0 lb. (1.8 kg)
Then make spring shorter by80 in. (20.3 mm)
Total test force $14.4 \pm .4$ lb. (6.5 ± 0.2 kg)
Free length after test $1.95 \pm .03$ in. (49.4 ± 0.7 mm)
Outside diameter 1.20 in. (30.5 mm)

(5) 4N4227 Spring for governor:

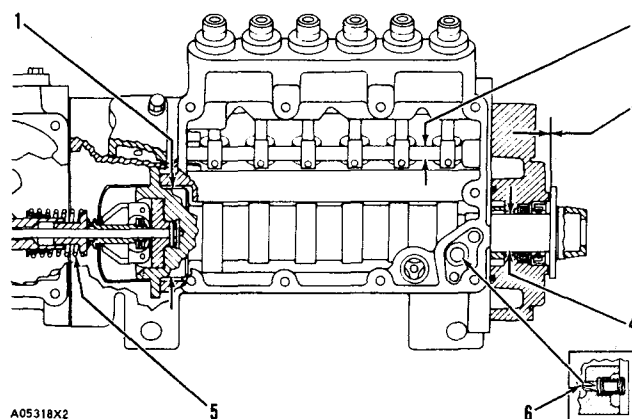
Color code (stripes) 2 yellow, 1 green
Put a load on spring of 4.0 lb. (1.8 kg)
Then make spring shorter by80 in. (20.3 mm)
Total test force $15.2 \pm .4$ lb. (6.9 ± 0.2 kg)
Free length after test $1.94 \pm .03$ in. (49.2 ± 0.7 mm)
Outside diameter 1.20 in. (30.5 mm)

(5) 4N4228 Spring for governor:

Color code (stripes) 2 yellow, 1 purple
Put a load on spring of 4.0 lb. (1.8 kg)
Then make spring shorter by80 in. (20.3 mm)
Total test force $16.0 \pm .4$ lb. (7.3 ± 0.2 kg)
Free length after test $1.93 \pm .03$ in. (49.0 ± 0.7 mm)
Outside diameter 1.21 in. (30.7 mm)



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Fuel Injection Equipment (Cont.)

Install spring washer with bent side towards governor spring (5) as shown.

(5) 4N4229 Spring for governor:

Color code (stripes) 1 pink, 2 green
Put a load on spring of 5.0 lb. (2.3 kg)
Then make spring shorter by70 in. (17.8 mm)
Total test force $17.6 \pm .4$ lb. (8.0 ± 0.2 kg)
Free length after test $1.91 \pm .03$ in. (48.5 ± 0.7 mm)
Outside diameter 1.21 in. (30.8 mm)

(5) 6N5169 Spring for governor:

Color code (stripes) 1 pink, 1 green
Put a force on spring of 5.0 lb. (2.3 kg)
Then make spring shorter by80 in. (20.3 mm)
Total test force $18.6 \pm .5$ lb. (8.4 ± 0.3 kg)
Free length after test $1.92 \pm .03$ in. (48.8 ± 0.7 mm)
Outside diameter 1.21 in. (30.7 mm)

(5) 6N5170 Spring for governor:

Color code (stripes) 1 yellow, 1 pink
Put a force on spring of 4.0 lb. (1.8 kg)
Then make spring shorter by80 in. (20.3 mm)
Total test force $16.8 \pm .4$ lb. (7.6 ± 0.2 kg)
Free length after test $1.92 \pm .03$ in. (48.8 ± 0.7 mm)
Outside diameter 1.21 in. (30.7 mm)

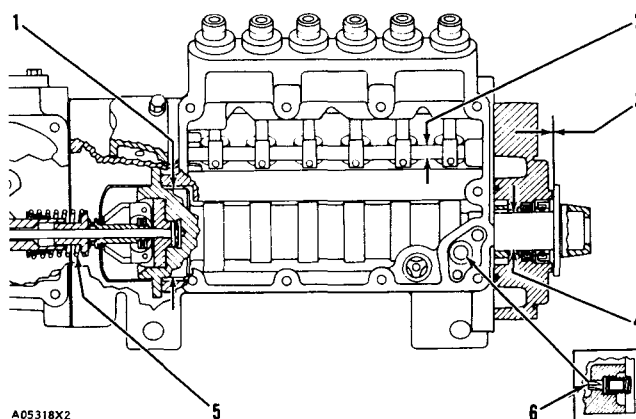
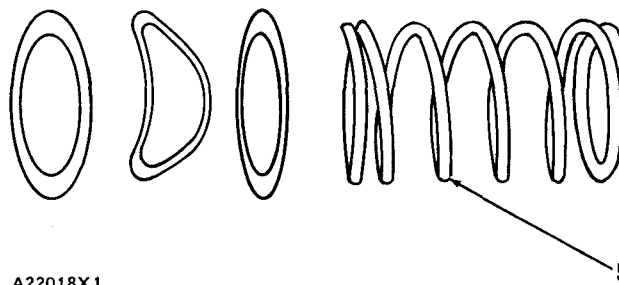
(5) 6N230 Spring for governor:

Color code (stripes) 1 yellow, 2 green
Put a force on spring of 4.0 lb. (1.8 kg)
Then make spring shorter by70 in. (17.8 mm)
Total test force $18.0 \pm .5$ lb. ($8.2 \pm .2$ kg)
Free length after test $1.89 \pm .03$ in. (48.0 ± 0.7 mm)
Outside diameter 1.24 in. (31.4 mm)

(6) Bypass valve:

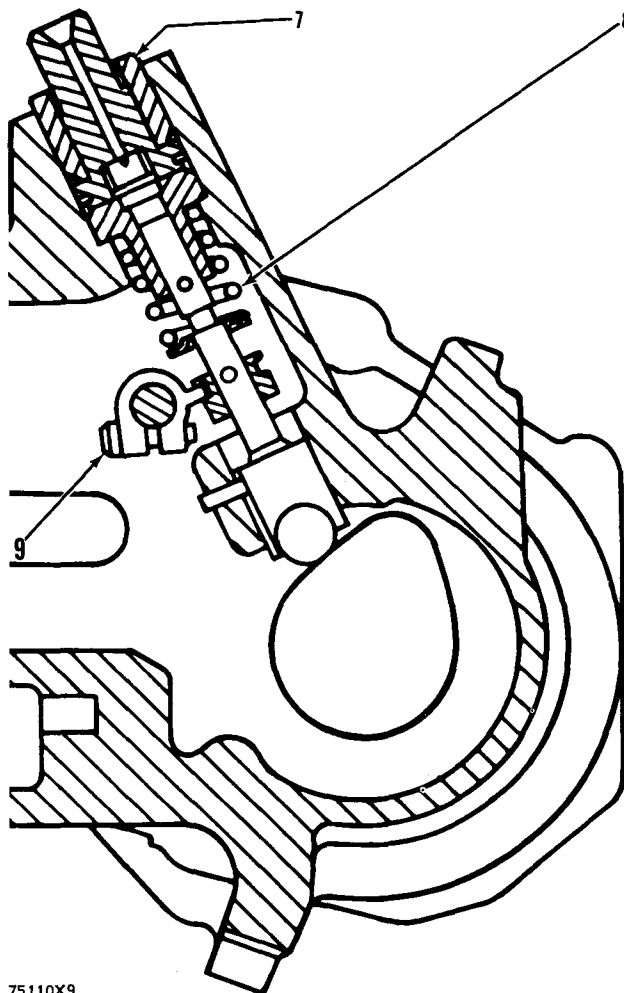
4N605 Spring for bypass valve:

Length under test force 1.23 in. (31.2 mm)
Test force 1.4 ± 0.1 lb. (0.64 ± 0.05 kg)
Free length after test 1.50 in. (38.1 mm)
Outside diameter53 in. (13.5 mm)



NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST
PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

Fuel Injection Equipment (Cont.)



75110X9

Pressure of fuel in housing
for fuel injection pumps,
(Full Load) 30 ± 5 psi (2.1 ± 0.4 kg/cm²)

(7) Torque for bushing 70 ± 5 lb. ft. (9.7 ± 0.7 mkg)

(8) 4N4318 Spring for injection pump:

Length under test force 1.35 in. (34.2 mm)

Test force 12.5 ± 1.3 lb. (5.7 ± 0.6 kg)

Free length after test 1.566 in. (39.78 mm)

Outside diameter728 in. (18.49 mm)

(9) Torque for bolt holding sleeve on
control shaft 24 ± 2 lb.in. (28 ± 3 cm.kg)

(10) Torque for the nuts that hold the fuel lines
(Use 5P144 Fuel line
Socket) 30 ± 5 lb.ft. (4.1 ± 0.7 mkg)

(11) Torque for the nuts that hold
the nozzles 105 ± 5 lb.ft. (14.5 ± 0.7 mkg)

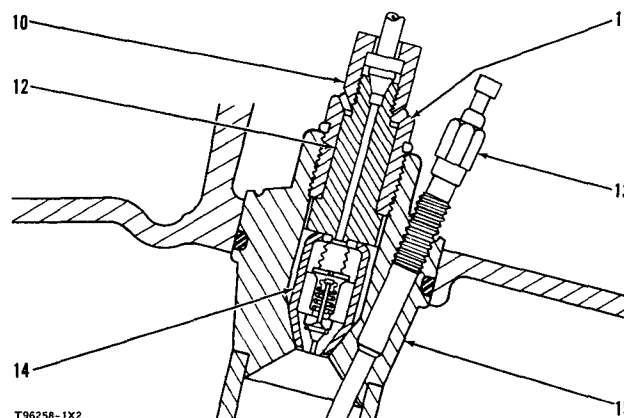
(12) Body.

(13) Put 9M3710 or 4S9416 Anti-Seize Compound
on threads of glow plug and
tighten to 120 ± 24 lb. in. (138.4 ± 27.7 cm.kg)

(14) Tighten nozzle finger tight on body.

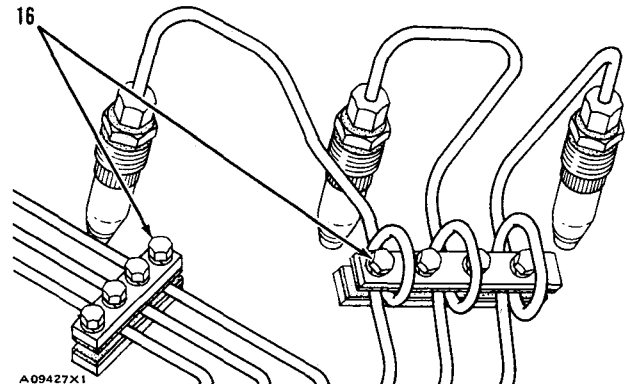
(15) Torque for precombustion chamber (put 9M3710 or
4S9416 Anti-Seize Compound
on threads) 150 ± 10 lb.ft. (20.7 ± 1.4 mkg)

NOTE: See Glow Plug Positioning.



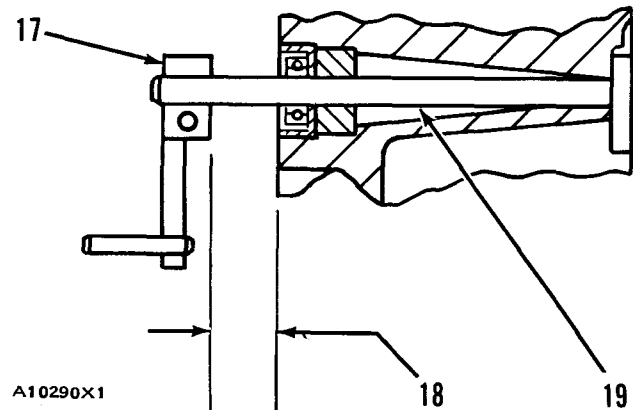
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Fuel Injection Equipment (Cont.)



TYPICAL ILLUSTRATION

- (16) Torque for bolts holding clamps on fuel injection lines 84 ± 24 lb. in. (97 ± 28 cm.kg)
- (17) Lever assembly.
- (18) Clearance between lever assembly (17) and governor housing when shaft assembly (19) is pulled against the governor housing437 in. (11.10 mm)
- (20) Spring for the terminal shaft. Install the spring (20) for the terminal shaft so that the end of the spring is in the 30° range as shown.



9S8597 Spring for terminal shaft:

Length under test force580 in. (14.732 mm)
 Test force 57.0 ± 4.6 lb. (25.9 ± 2.1 kg)
 Free length after test 1.21 in. (30.7 mm)
 Outside diameter 1.635 in. (41.529 mm)
 Diameter of wire135 in. (3.429 mm)

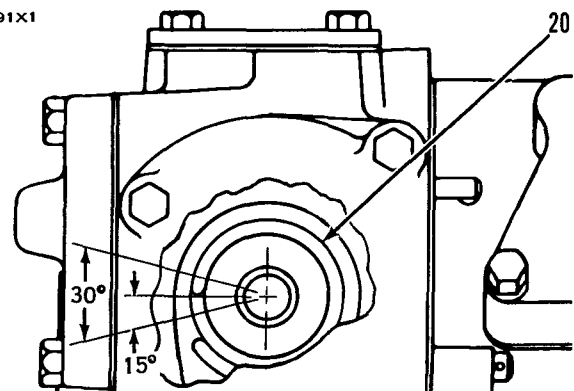
2P726 Spring for terminal shaft:

Length under test force580 in. (14.732 mm)
 Test force 110 ± 9.0 lb. (49.9 ± 4.1 kg)
 Free length after test 1.04 in. (26.416 mm)
 Outside diameter 1.635 in. (41.529 mm)
 Diameter of wire156 in. (3.962 mm)

4N4366 Spring for terminal shaft:

Length under test force600 in. (15.24 mm)
 Test force 150.1 ± 7.5 lb. (68.1 ± 3.4 kg)
 Free length after test 1.04 in. (26.37 mm)
 Outside diameter 1.638 in. (41.605 mm)
 Diameter of wire172 in. (4.37 mm)

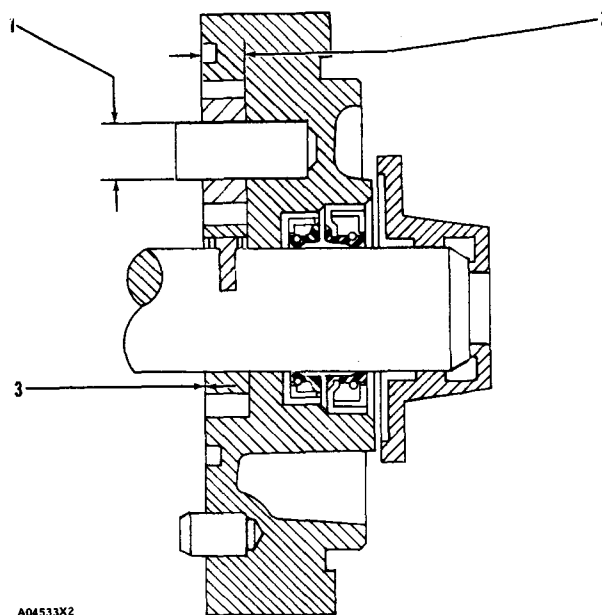
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NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

FUEL TRANSFER PUMP

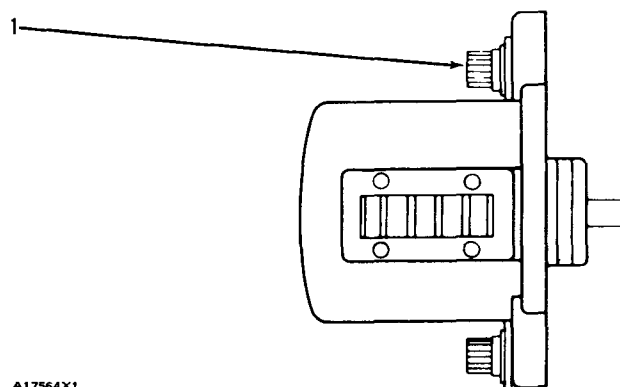
- (1) Diameter of shaft for idler gear (new) $.4914 \pm .0003$ in. (12.482 ± 0.008 mm)
Bore in idler gear (new) $.4926 \pm .0003$ in. (12.512 ± 0.008 mm)
- (2) Thickness of gears (new) $.3736 \pm .0003$ in. (9.489 ± 0.008 mm)
Depth of counterbore (new) $.3750 \pm .0005$ in. (9.525 ± 0.013 mm)
- (3) Clearance between end of gears and surface of pump body (new) $.0006$ to $.0022$ in. (0.015 to 0.056 mm)



A04533X2

SERVICE METER

- (1) Torque for bolts which hold service meter or adapter for service meter drive 96 ± 24 lb. in. (111 ± 28 cm.kg)
- NOTE: Torque for cable nut 50 lb. in. (58 cm.kg)

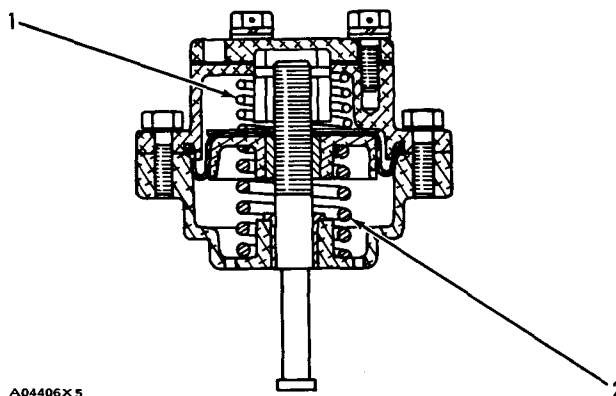


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TACHOMETER DRIVE

- Tighten bolts which hold adapter for tachometer drive to 96 ± 24 lb. in. (111 ± 28 cm.kg)
- NOTE: Torque for cable nut 100 ± 20 lb. in. (115 ± 23 cm.kg)

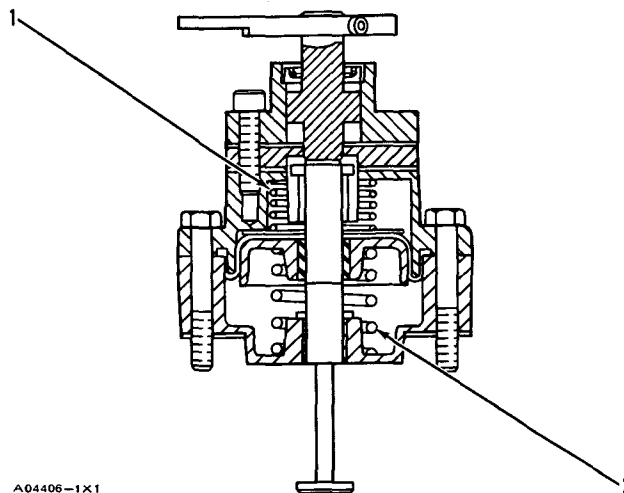
FUEL RATIO CONTROL



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6N4654 and 9N867 Illustrated

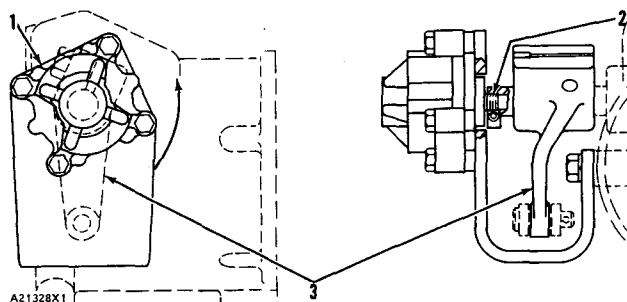
- (1) 6N1606 Spring:
- | | |
|-------------------------------|------------------------------|
| Length under test force | .96 in. (24.38 mm) |
| Test force | 7.7 ± .45 lb. (3.5 ± 0.2 kg) |
| Free length after test | 1.38 in. (35.05 mm) |
| Outside diameter | 1.268 in. (32.21 mm) |
| Diameter of wire | .086 in. (2.18 mm) |
- (2) 6N968 Spring:
- | | |
|-------------------------------|-----------------------------|
| Length under test force | 1.38 in. (35.05 mm) |
| Test force | 15 ± 1.0 lb. (6.8 ± 0.5 kg) |
| Free length after test | 1.500 in. (38.10 mm) |
| Outside diameter | 1.28 in. (32.51 mm) |
| Diameter of wire | .142 in. (3.61 mm) |



A04406-1X1

6N3047 Illustrated

GOVERNOR AND DECELERATOR CONTROL (FOR D7 TRACTORS, POWER SHIFT)



A21328X1

Install dashpot (1) with governor control lever (3) in high idle position as shown and with the dashpot shaft (2) turned to the farthest point in the direction of the arrow before putting the spline in engagement.

NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

TIMING GEARS (3304 ENGINES)

Tighten bolts which fasten into front plate to 17 ± 3 lb. ft. (2.4 ± 0.4 mkg)

Tighten nuts holding cover for fuel pump drive gear to 12 ± 2 lb. ft. (1.7 ± 0.3 mkg)

(1) With the timing pin and timing bolt correctly installed, put a clockwise force on the drive gear for the fuel pump and tighten bolt (1) to 110 ± 5 lb. ft. (15.2 ± 0.7 mkg)

(2) End play for the idler gear (new) $.004$ to $.016$ in. (0.10 to 0.41 mm)

Maximum permissible end play (worn) $.034$ in. (0.86 mm)

Bore in bearing for the idler gear (new) $1.3781 \pm .0019$ in. (35.004 ± 0.048 mm)

Diameter of shaft for idler gear (new) $1.3741 \pm .0005$ in. (34.902 ± 0.013 mm)

Clearance between shaft and bearing (new) $.0016$ to $.0064$ in. (0.041 to 0.163 mm)

Maximum permissible clearance between shaft and bearing (worn) $.009$ in. (0.23 mm)

(3) Camshaft gear.

(4) Crankshaft gear.

(5) End play for the balancer shafts (new) $.0035$ to $.0075$ in. (0.089 to 0.191 mm)

Maximum permissible end play (worn) $.017$ in. (0.43 mm)

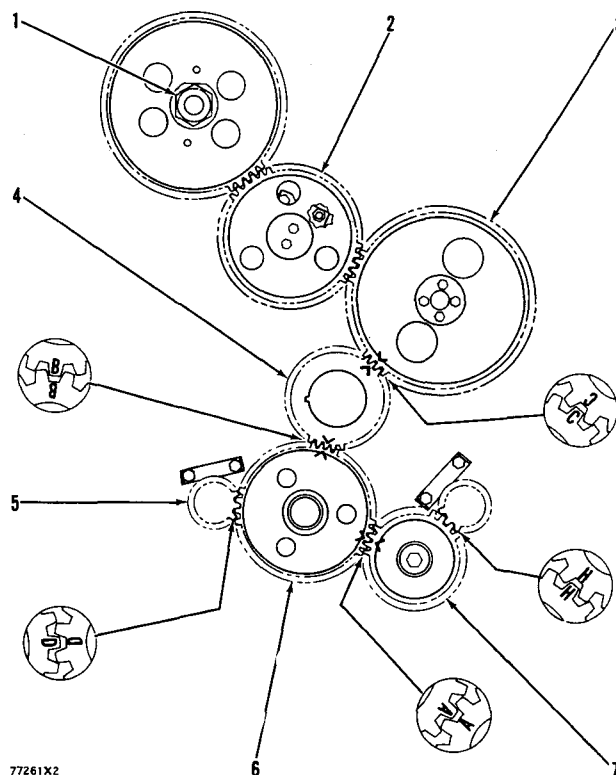
Diameter of balancer shaft bearing surface (journal) (new) $2.0825 \pm .0005$ in. (52.895 ± 0.013 mm)

Bore in bearing for balancer shaft (new) $2.0886 \pm .0024$ in. (53.050 ± 0.061 mm)

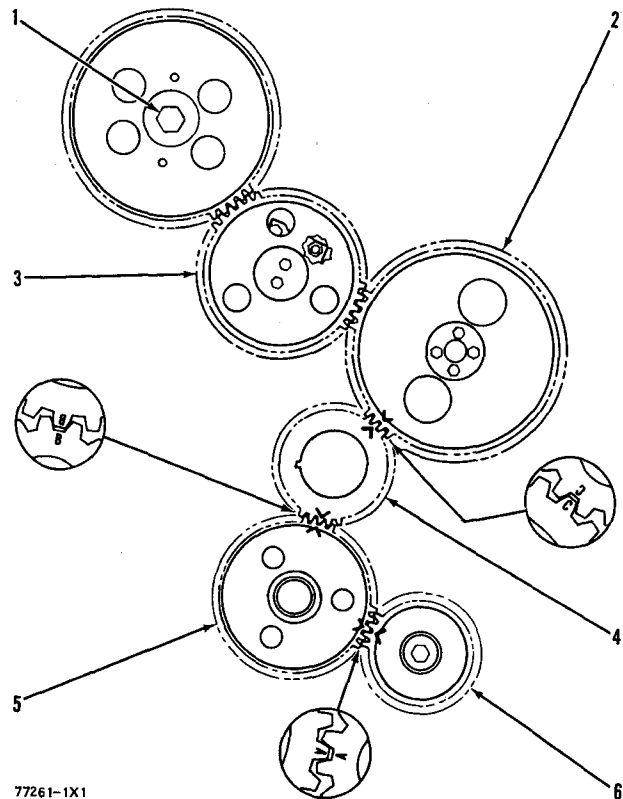
Maximum permissible clearance between balancer shaft and bearing (worn) .. $.010$ in. (0.25 mm)

(6) Idler gear for oil pump.

(7) Drive gear for oil pump.



**TIMING GEARS
(3306 ENGINES)**



77261-1X1

Tighten bolts which fasten into front plate to 17 ± 3 lb. ft. (2.4 ± 0.4 mkg)

Tighten nuts holding cover for fuel pump drive gear to 12 ± 2 lb. ft. (1.7 ± 0.3 mkg)

(1) With the timing pin and timing bolt correctly installed, put a clockwise force on the drive gear for the fuel pump and tighten bolt (1) to 110 ± 5 lb. ft. (15.2 ± 0.7 mkg)

(2) Camshaft gear.

(3) End play for the idler gear (new)004 to .016 in. (0.10 to 0.41 mm)

Maximum permissible end play (worn)034 in. (0.86 mm)

Bore in bearing for the idler gear (new) 1.3781 ± .0019 in. (35.004 ± 0.048 mm)

Diameter of shaft for idler gear (new) 1.3741 ± .0005 in. (34.902 ± 0.013 mm)

Clearance between shaft and bearing (new)0016 to .0064 in. (0.041 to 0.163 mm)

Maximum permissible clearance between shaft and bearing (worn)009 in. (0.23 mm)

(4) Crankshaft gear.

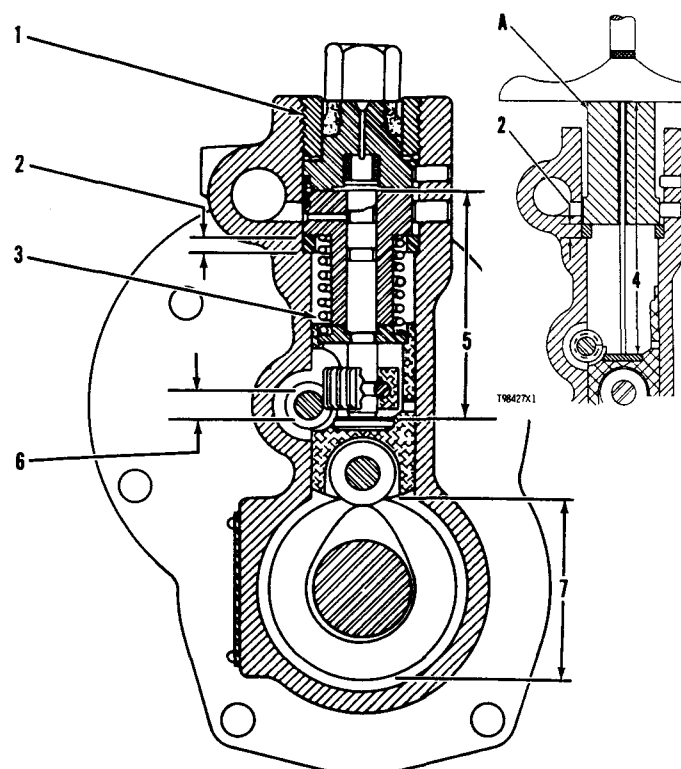
(5) Idler gear for oil pump.

(6) Drive gear for oil pump.

NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

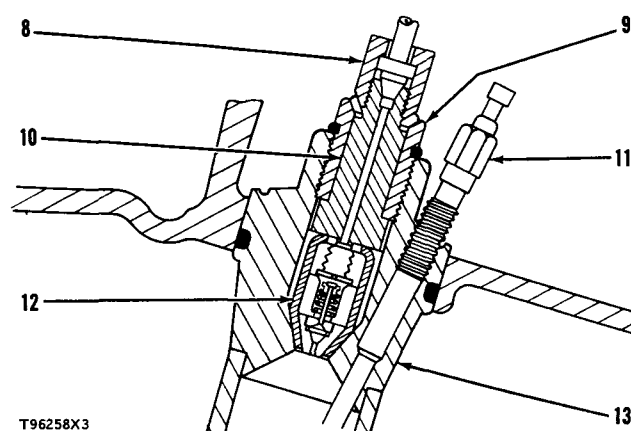
FUEL INJECTION EQUIPMENT

- Firing order (injection sequence) Six cylinder engine . . . 1, 5, 3, 6, 2, 4
 Firing order (injection sequence) Four cylinder engine 1, 3, 4, 2
 Injection timing before TC (top center) (six cylinder) 13° 30'
 Injection timing before TC (top center) (four cylinder) 12° 30'
- (1) Torque for bushing 150 ± 10 lb. ft. (20.7 ± 1.4 mkg)
- (2) Thickness of spacers:
- | | |
|-------------------------|--------------------|
| 5M2697 Spacer | .170 in. (4.32 mm) |
| 2M4208 Spacer | .174 in. (4.42 mm) |
| 2M4209 Spacer | .178 in. (4.52 mm) |
| 2M4210 Spacer | .182 in. (4.62 mm) |
| 2M4211 Spacer | .186 in. (4.72 mm) |
| 2M4212 Spacer | .190 in. (4.83 mm) |
| 5M2691 Spacer | .194 in. (4.93 mm) |
| 5S7189 Spacer | .198 in. (5.03 mm) |
- (3) 1S206 Spring:
- | | |
|-----------------------------------|------------------------------|
| Length under test force | 1.39 in. (35.3 mm) |
| Test force | 15.4 ± .8 lb. (7.0 ± 0.4 kg) |
| Free length after test | 1.59 in. (40.4 mm) |
| Outside diameter | .979 in. (24.87 mm) |
- (4) Timing dimension for the fuel injection pumps:
- OFF Engine with 8S7167 Gauge 4.2675 ± .0020 in. (108.395 ± 0.051 mm)
- ON Engine with 8S7167 Gauge:
- | | |
|--------------------------------|---|
| Six cylinder engine | 4.2179 ± .0020 in. (107.135 ± 0.051 mm) |
| Four cylinder engine | 4.2216 ± .0020 in. (107.229 ± 0.051 mm) |
- (5) Length of pump plunger (new) 2.5934 ± .0015 in. (65.872 ± 0.038 mm)
- Minimum permissible length (worn) . . . 2.5869 in. (65.707 mm)
- (6) Bore in the bearings for the rack:
- | | |
|--|---------------------------------------|
| Bearing at the rear | .5018 ± .0018 in. (12.746 ± 0.046 mm) |
| Bearing at the front | .5023 ± .0015 in. (12.758 ± 0.038 mm) |
| Diameter of fuel rack | .4985 ± .0002 in. (12.662 ± 0.005 mm) |
| Maximum permissible clearance between rack and bearings (worn) | .005 in. (0.13 mm) |
- (7) Bore in bearings for the camshaft 1.8755 ± .0005 in. (47.638 ± 0.013 mm)
- Diameter of bearing surfaces (journals) of the camshaft (new) 1.8730 ± .0005 in. (47.574 ± 0.013 mm)
- Maximum permissible clearance between the bearings and the camshaft bearing surfaces (journals) (worn)010 in. (0.25 mm)
- (8) Torque for the nuts that hold the fuel lines (use 5P144 Fuel Line Socket) 30 ± 5 lb. ft. (4.1 ± 0.7 mkg)
- (9) Torque for the nuts that hold the nozzles 105 ± 5 lb. ft. (14.5 ± 0.7 mkg)
- (10) Body
- (11) Put 9M3710 or 4S9416 Anti-Seize Compound on threads of glow plug and tighten to 120 ± 24 lb. in. (138.4 ± 27.7 cm.kg)
- (12) Tighten nozzle finger tight on body.



T96256X2

A-8S7167 GAUGE



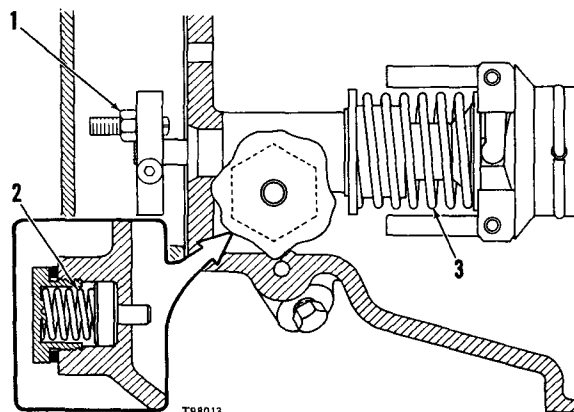
T96258X3

- (13) Put 9M3710 or 4S9416 Anti-Seize Compound on threads of precombustion chamber and tighten to 150 ± 10 lb. ft. (20.7 ± 1.4 mkg)

NOTE: See Glow Plug Positioning.

GOVERNOR

- (1) Torque for nut 11 ± 1 lb. ft. (1.52 ± 0.14 mkg)
- (2) 1S9312 Spring for speed limiter:
 Length under test force86 in. (21.8 mm)
 Test force $2.38 \pm .19$ lbs. (1.08 ± 0.09 kg)
 Free length after test 2.62 in. (66.5 mm)
 Outside diameter67 in. (17.0 mm)
- (3) 8S232 Spring for governor:
 Color code (stripes) 1 pink
 Put force on spring of 6.0 lb. (2.7 kg)
 Then add more force to make spring
 shorter by800 in. (20.32 mm)
 Total test force $23.6 \pm .8$ lb. (10.70 ± 0.36 kg)
 Free length after test $2.26 \pm .03$ in. (57.4 ± 0.8 mm)
 Outside diameter 1.41 in. (35.8 mm)
- (3) 9M3160 Spring for governor:
 Color code (stripes) 1 blue
 Put force on spring of 5.0 lb. (2.3 kg)
 Then add more force to make spring
 shorter by900 in. (22.86 mm)
 Total test force $19.4 \pm .5$ lb. (8.80 ± 0.23 kg)
 Free length after test $2.34 \pm .03$ in. (59.4 ± 0.8 mm)
 Outside diameter 1.39 in. (35.3 mm)
- (3) 9L3617 Spring for governor:
 Color code (stripes) 1 blue, 1 white
 Put force on spring of 6.0 lb. (2.7 kg)
 Then add more force to make spring
 shorter by900 in. (22.86 mm)
 Total test force $22.2 \pm .5$ lb. (10.08 ± 0.23 kg)
 Free length after test $2.34 \pm .03$ in. (59.4 ± 0.8 mm)
 Outside diameter 1.39 in. (35.3 mm)
- (3) 8M9140 Spring for governor:
 Color code (stripes) 1 green
 Put force on spring of 4.0 lb. (1.8 kg)
 Then add more force to make spring
 shorter by900 in. (22.86 mm)
 Total test force $16.6 \pm .3$ lb. (7.5 ± 0.1 kg)
 Free length after test $2.34 \pm .03$ in. (59.4 ± 0.8 mm)
 Outside diameter 1.38 in. (35.1 mm)
- (3) 8M9141 Spring for governor:
 Color code (stripes) 1 purple
 Put force on spring of 4.0 lb. (1.8 kg)
 Then add more force to make spring
 shorter by900 in. (22.86 mm)
 Total test force $14.8 \pm .5$ lb. (6.7 ± 0.2 kg)
 Free length after test $2.34 \pm .03$ in. (59.4 ± 0.8 mm)
 Outside diameter 1.37 in. (34.8 mm)



- (3) 8L9790 Spring for governor:
 Color code one end pink
 Put force on spring of 4.0 lb. (1.8 kg)
 Then add more force to make spring
 shorter by900 in. (22.86 mm)
 Total test force $13.5 \pm .3$ lb. (6.1 ± 0.1 kg)
 Free length after test $2.34 \pm .03$ in. (59.4 ± 0.8 mm)
 Outside diameter 1.38 in. (35.1 mm)

NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST
PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

FUEL TRANSFER PUMP

(4N4864, 4N4873, 4N4878, 7S4430 & 7S5445)

Pressure of fuel to injection

pump 25 to 32 psi (1.76 to 2.25 kg/cm²)

(1) Bore of bearing (new) .. .4953 ± .0003 in. (12.581 ± 0.008 mm)

(2) Depth of bore in body
(new)3750 ± .0003 in. (9.525 ± 0.008 mm)

Thickness of gear (new) .. .3730 ± .0003 in. (9.474 ± 0.008 mm)

(3) Torque for nut 22 ± 5 lb. ft. (3.0 ± 0.7 mkg)

(4) Clearance between gear and cover
(new)001 to .003 in. (0.03 to 0.08 mm)

Maximum permissible clearance between gear and
cover (worn)0035 in. (0.089 mm)

(5) Shaft diameter (new)4937 ± .0001 in. (12.540 ± 0.003 mm)

Bore in shaft bearing

(new)4953 ± .0003 in. (12.581 ± 0.008 mm)

Maximum permissible clearance between shaft and
bearing (worn)003 in. (0.08 mm)

7S4430 and 4N4864 Pumps only:

(6) 8M3210 Spring:

Length under test force 1.212 in. (30.79 mm)

Test force 5.36 ± .13 lbs. (2.43 ± 0.06 kg)

Free length after test 1.82 in. (46.23 mm)

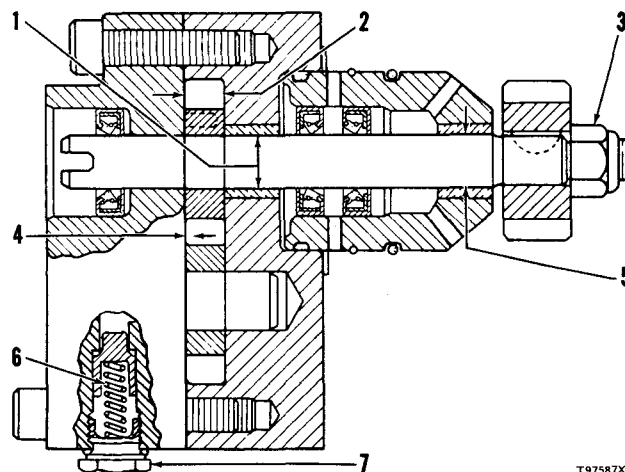
Outside diameter41 in. (10.4 mm)

(7) Torque for plug when used with gasket:

2A1913 Gasket (copper) 110 ± 15 lb. ft. (15.2 ± 2.1 mkg)

4N7465 Gasket (plastic) 40 ± 5 lb. ft. (5.5 ± 0.7 mkg)

NOTE: Put a thin layer of 8S6747 Sealer on face of pump body before installing pump cover. Do not let any of 8S6747 Sealer get into the pump.



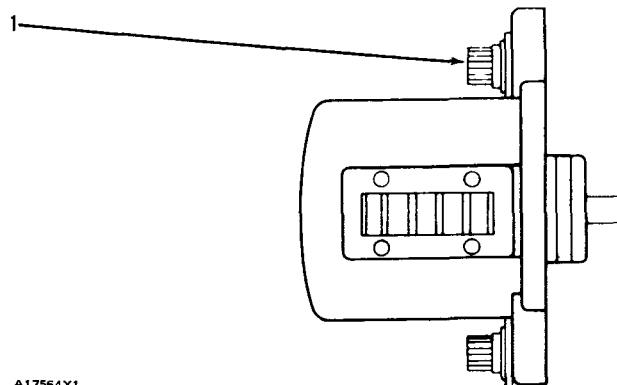
T97587X2

SERVICE METER

(1) Torque for bolts which hold the service meter or adapter for service

meter drive 96 ± 24 lb. in. (111 ± 28 cm.kg)

Torque for cable nut 100 ± 20 lb. in. (115 ± 23 cm.kg)



A17564X1

TACHOMETER DRIVE

Torque for bolts which hold adapter for

tachometer drive 96 ± 24 lb. in. (111 ± 28 cm.kg)

Torque for cable nut at governor end 100 lb. in. (115 cm.kg)

Torque for cable nut at tachometer end 50 lb. in. (58 cm.kg)

FUEL RATIO CONTROL (4N5063, 8S8951)

(1) 6N3017, 6L5768 Spring:

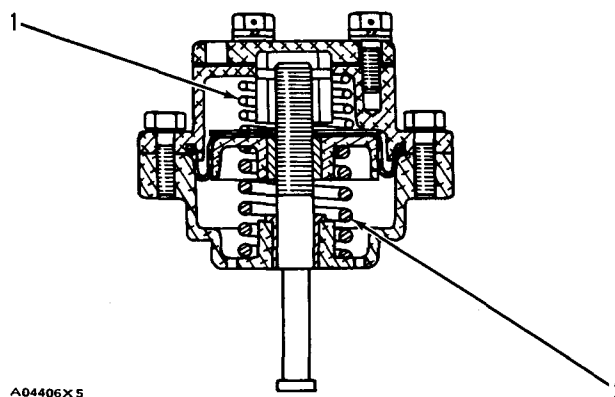
Length under test force660 in. (16.76 mm)
Test force 6.0 ± 1.0 lb. (2.7 ± 0.4 kg)
Free length after test 1.30 in. (33.0 mm)
Outside diameter 1.28 in. (32.5 mm)
Diameter of wire08 in. (2.0 mm)

(2) 4N5030 Spring for 4N5063 Fuel Ratio Control:

Length under test force 1.268 in. (32.21 mm)
Test force 17.0 lb. (7.7 kg)
Free length after test 1.76 in. (44.7 mm)
Outside diameter 1.24 in. (31.5 mm)
Diameter of wire11 in. (2.8 mm)

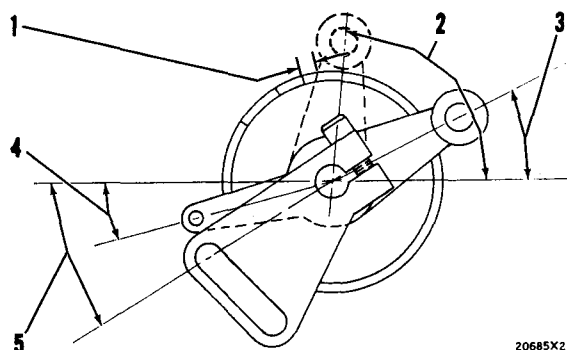
(2) 6N968, 6L5772 Spring for 8S8951 Fuel Ratio Control:

Length under test force 1.375 in. (34.93 mm)
Test force 15.0 ± 1.0 lb. (6.8 ± 0.4 kg)
Free length after test 1.50 in. (38.1 mm)
Outside diameter 1.28 in. (32.5 mm)
Diameter of wire14 in. (3.6 mm)



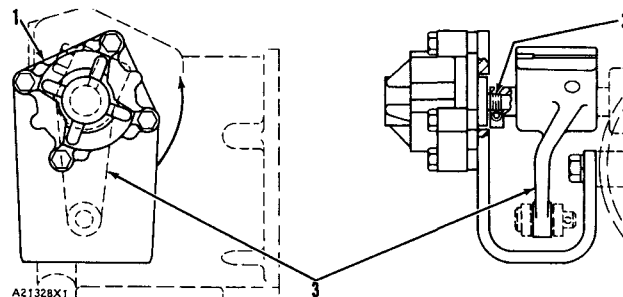
GOVERNOR AND DECELERATOR CONTROL (9S7053 For D7 Tractors; Power Shift; Scroll Fuel System)

- (1) Clearance from governor control lever to stop12 in. (3.0 mm)
- (2) Angle of governor lever from horizontal when lever is at the high idle position 87.5°
- (3) Angle of governor lever from horizontal when lever is at the shutoff position 26.5°
- (4) Angle of spring lever from horizontal when lever is at the shutoff position 15°
- (5) Angle of decelerator lever from horizontal when lever is at the shutoff position 30°



NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST
PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

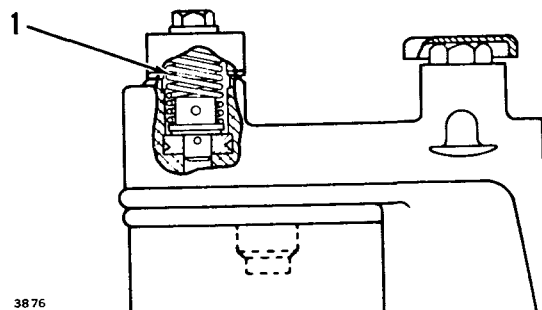
ENGINE DECELERATOR CONTROL (1P45 FOR 980 WHEEL LOADER)



TYPICAL ILLUSTRATION

Install dashpot (1) with governor control lever (3) in high idle position as shown and with the dashpot shaft (2) turned to the farthest position in the direction of the arrow before putting the spline in engagement.

FUEL BYPASS VALVE

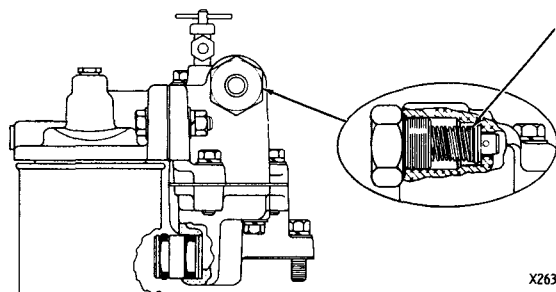


5S9665 Fuel Filter Illustrated

Pressure of fuel to
injection pump 25 to 32 psi (1.76 to 2.25 kg/cm²)

(1) 4S6526 Spring for bypass valve:

Length under test force 1.04 in. (26.4 mm)
Test force 3.16 ± .16 lb. (1.43 ± 0.07 kg)
Free length after test 1.88 in. (47.8 mm)
Outside diameter70 in. (17.8 mm)
Diameter of wire05 in. (1.27 mm)



7L261 Fuel Filter & Priming Pump Illustrated

TIMING GEARS

[3304 (78P) and 3306 (3N) Engines With Serial
Number Plate Located at Top, Left
Rear of Cylinder Block.]

Torque for two bolts that hold front cover
to plate 17 ± 3 lb. ft. (2.4 ± 0.4 mkg)

- (1) Torque for nut holding accessory
drive gear 100 ± 10 lb. ft. (13.8 ± 1.4 mkg)

Torque for nuts holding cover for accessory
drive gear 12 ± 2 lb. ft. (1.6 ± 0.3 mkg)

- (2) End play for the camshaft
(new)007 ± .003 in. (0.177 ± 0.076 mm)
Maximum permissible end play (worn)025 in. (0.635 mm)

Diameter of camshaft bearing surface
(journal) (new) 2.3110 ± .0005 in. (58.699 ± 0.013 mm)

Bore in bearing for camshaft
(new) 2.3150 ± .0024 in. (58.801 ± 0.061 mm)

Maximum permissible clearance between bearing and bearing
surface (journal) (worn)008 in. (0.20 mm)

- (3) End play for the idler
gear (new)004 to .016 in. (0.10 to 0.41 mm)
Maximum permissible end play (worn)034 in. (0.86 mm)

Bore in bearing for the idler gear
(new) 1.3781 ± .0019 in. (35.004 ± 0.048 mm)

Diameter of shaft for idler gear
(new) 1.3741 ± .0005 in. (34.902 ± 0.013 mm)

Maximum permissible clearance between shaft
and bearing (worn)009 in. (0.23 mm)

- (4) Four cylinder engines only:

End play for the balancer shafts
(new)0035 to .0075 in. (0.089 to 0.191 mm)
Maximum permissible end play (worn)017 in. (0.43 mm)

1P1723 and 1P1724 Balancer Shaft Assemblies:

Diameter of balancer shaft bearing surface (journal)
(new) 2.0825 ± .0005 in. (52.895 ± 0.013 mm)

Bore in bearing for balancer shaft
(new) 2.0886 ± .0024 in. (53.050 ± 0.061 mm)

Maximum permissible clearance between balancer shaft and
bearing (worn)010 in. (0.25 mm)

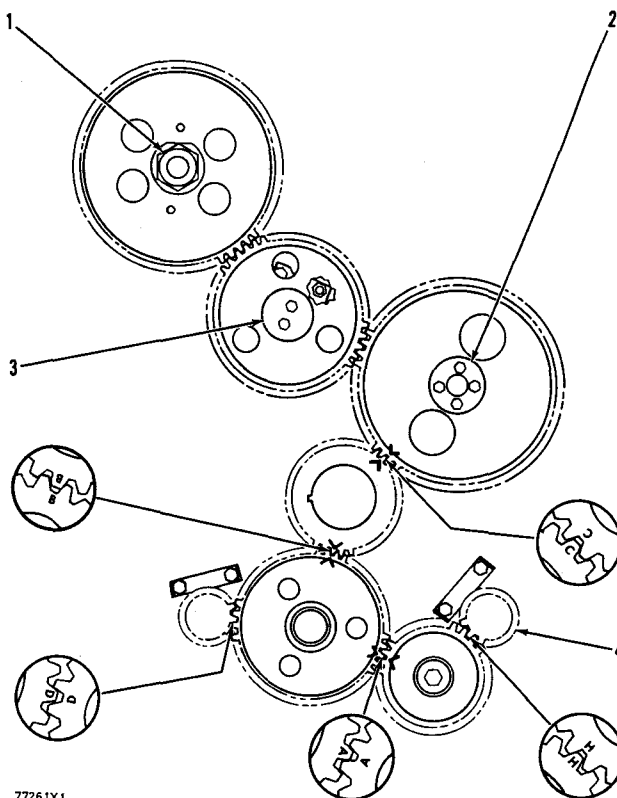
8S745 and 8S746 Balancer Shafts:

Diameter of balancer shaft bearing surface (journal)
(new) 2.0835 ± .0005 in. (52.921 ± 0.013 mm)

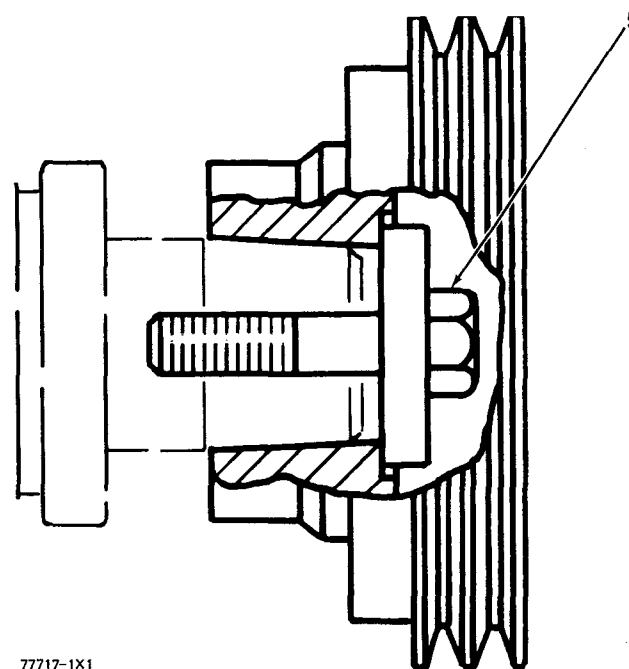
Bore in bearing for balancer shaft
(new) 2.0886 ± .0024 in. (53.050 ± 0.061 mm)

Maximum permissible clearance between balancer shaft and
bearing (worn)010 in. (0.25 mm)

- (5) Torque for bolt holding hub to
crankshaft 230 ± 20 lb. ft. (31.8 ± 2.8 mkg)
Hit bolt with hammer and again tighten
bolt to 230 ± 20 lb. ft. (31.8 ± 2.8 mkg)



Four Cylinder Engine Illustrated



NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST
PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

TIMING GEARS

(Earlier 4.75 Bore 4 and 6 Cylinder
Engines With Vehicle Serial Numbers)

Torque for two bolts that hold front
cover to plate 17 ± 3 lb. ft. (2.4 ± 0.4 mkg)

(1) Torque for nut holding accessory drive gear (scroll
fuel system) 100 ± 10 lb. ft. (13.8 ± 1.4 mkg)

Torque for nuts holding cover for accessory
drive gear 12 ± 2 lb. ft. (1.6 ± 0.3 mkg)

(2) End play for the camshaft
(new)007 ± .003 in. (0.177 ± 0.076 mm)

Maximum permissible end play (worn)025 in. (0.635 mm)

Diameter of camshaft bearing surface (journal)
(new) 2.3110 ± .0005 in. (58.699 ± 0.013 mm)

Bore in bearing for camshaft
(new) 2.3150 ± .0024 in. (58.801 ± .061 mm)

Maximum permissible clearance between bearing and bearing
surface (journal) (worn)008 in. (0.20 mm)

(3) End play for the idler gear
(new)004 to .016 in. (0.10 to 0.41 mm)

Maximum permissible end play (worn)034 in. (0.86 mm)

Bore in bearing for the idler gear
(new) 1.3781 ± .0019 in. (35.004 ± 0.048 mm)

Diameter of shaft for idler gear
(new) 1.3741 ± .0005 in. (34.902 ± 0.013 mm)

Maximum permissible clearance between shaft
and bearing (worn)009 in. (0.23 mm)

(4) Four cylinder engines only:

Diameter of balancer shaft bearing surface
(journal) (new) 2.0825 ± .0005 in. (52.895 ± 0.013 mm)

Bore in bearing for balancer shaft
(new) 2.0886 ± .0024 in. (53.050 ± 0.061 mm)

Maximum permissible clearance between balancer shaft
and bearing (worn)010 in. (0.25 mm)

End play for the balancer shaft
(new)0035 to .0075 in. (0.089 to 0.191 mm)

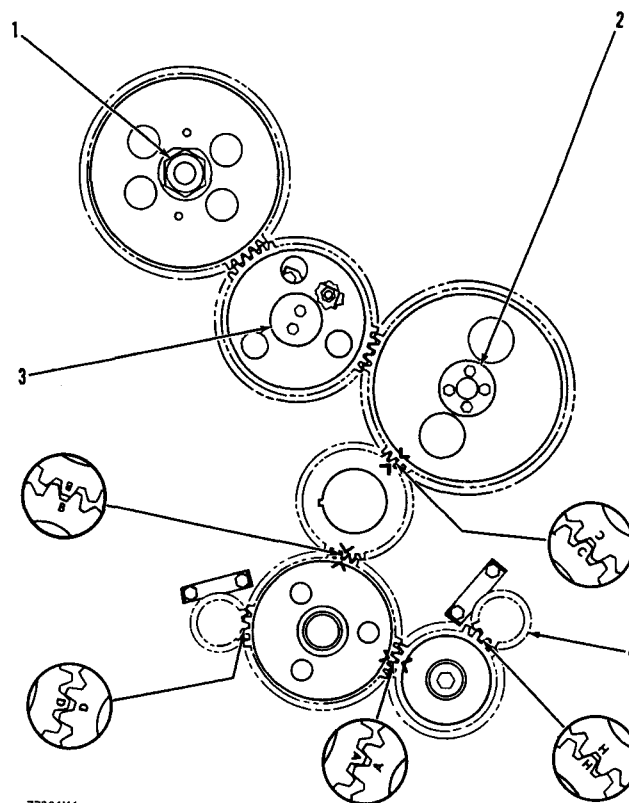
Maximum permissible end play (worn)017 in. (0.43 mm)

(5) Distance from front face of bushing to rear
face of cover 2.56 in. (65.02 mm)

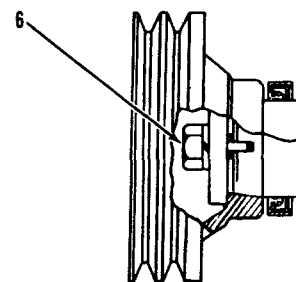
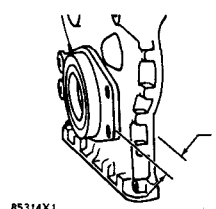
(6) Torque for bolt holding pulley to
crankshaft 230 ± 20 lb. ft. (31.8 ± 2.8 mkg)

Hit bolt with hammer and again tighten

bolt to 230 ± 20 lb. ft. (31.8 ± 2.8 mkg)



Four Cylinder Engine Illustrated



GLOW PLUG POSITIONING

- (1) Center line of engine.
- (2) Center line of cylinder.
- (A) Correct range for glow plug opening.

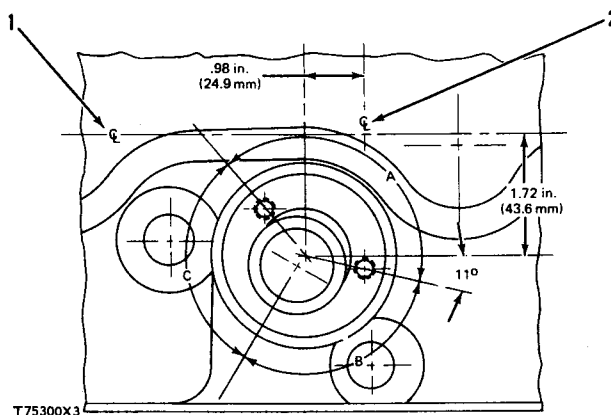
Put 9M3710 or 4S9416 Anti-Seize Compound on the threads of the precombustion chamber.

Put 5M2667 Gasket, with "2C" on it, on the precombustion chamber. Install the precombustion chamber in the cylinder head and tighten to 150 ± 10 lb.ft. (20.7 ± 1.4 mkg)

NOTE: If the hole for the glow plug is not in range (A), remove the precombustion chamber. Remove the gasket.

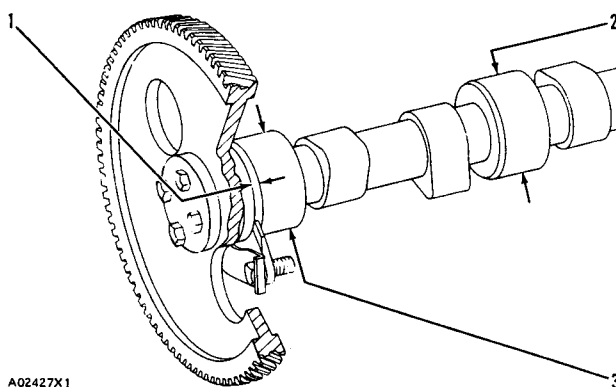
If the hole was in range (B) install 2S8959 Gasket, with "2S" on it, on the precombustion chamber. Install the precombustion chamber in the cylinder head and tighten to 150 ± 10 lb.ft. (20.7 ± 1.4 mkg)

If the hole was in range (C) install 2S8960 Gasket, with "2X" on it, on the precombustion chamber. Install the precombustion chamber in the cylinder head and tighten to 150 ± 10 lb.ft. (20.7 ± 1.4 mkg)



CAMSHAFT

- (1) Width of groove in camshaft for thrust washer
(new) $.190 \pm .002$ in. (4.83 ± 0.05 mm)
Thickness of thrust washer
(new) $.183 \pm .001$ in. (4.65 ± 0.03 mm)
End play of the camshaft
(new) $.007 \pm .003$ in. (0.18 ± 0.08 mm)
Maximum permissible end play (worn) $.025$ in. (0.635 mm)
- (2) Diameter of camshaft bearing surface (journal)
(new) $2.3110 \pm .0005$ in. (58.699 ± 0.013 mm)
- (3) Bore in bearing for camshaft
(new) $2.3150 \pm .0024$ in. ($58.801 \pm .061$ mm)
Clearance between bearing and bearing surface (journal)
(new) $.002$ to $.006$ in. (0.05 to 0.15 mm)
Maximum permissible clearance between bearing and bearing surface (journal) (worn) $.008$ in. (0.20 mm)



NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

VALVES

NOTE: GUIDELINE FOR REUSABLE PARTS; VALVES AND VALVE SPRINGS, Form SEBF8002, has the procedure necessary for checking used valves and valve springs.

(1) 7S7144 Spring for valves (new):

Length under test force 1.766 in. (44.86 mm)

Test force 57.7 ± 2.9 lb. (26.2 ± 1.3 kg)

Use again minimum load at length
under test force 52 lb. (23.6 kg)

Length of spring at valve open position 1.266 in. (32.2 mm)

Use again minimum load at valve
open position 152 lb. (68.9 kg)

Free length after test 2.05 in. (52.0 mm)

Outside diameter 1.38 in. (35.05 mm)

Spring must not be bent more than072 in. (1.8 mm)

(2) Height to top of valve guide875 in. (22.23 mm)

(3) Diameter of valve stem
(new)3717 ± .0003 in. (9.441 ± 0.008 mm)

Use again minimum diameter3704 in. (9.41 mm)

Bore in valve guide with guide
installed in the head
(new)3734 ± .0010 in. (9.484 ± 0.025 mm)

Maximum permissible bore (worn)3772 in. (9.581 mm)

(4) Valve lip thickness:

7S6767 Exhaust Valve

Use again minimum119 in. (3.02 mm)

5S7232 Exhaust Valve

Use again minimum106 in. (2.692 mm)

5S6449 Exhaust Valve

Use again minimum096 in. (2.438 mm)

7S8809 Intake Valve

Use again minimum106 in. (2.692 mm)

5S6452 Intake Valve

Use again minimum096 in. (2.438 mm)

(5) Diameter of valve head:

Exhaust valve 1.896 ± .005 in. (48.16 ± 0.13 mm)

Intake valve 2.020 ± .005 in. (51.31 ± 0.13 mm)

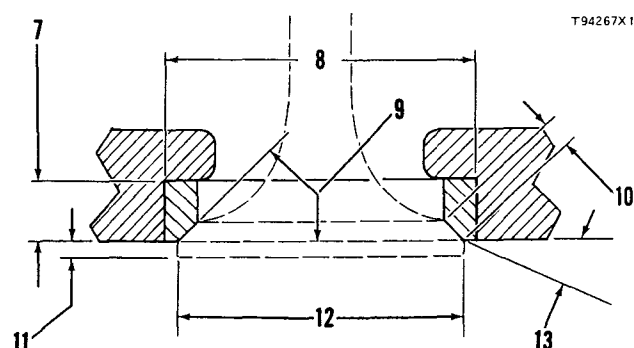
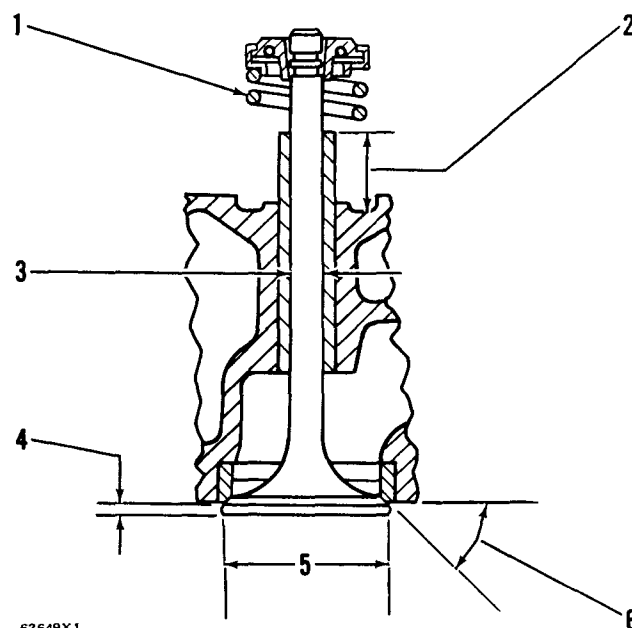
(6) Angle of valve face 29°

(7) Depth of bore in head for valve seat
insert449 ± .002 in. (11.40 ± 0.05 mm)(8) Diameter of valve seat insert for exhaust
valve 2.0035 ± .0005 in. (50.889 ± 0.013 mm)

Bore in head for valve seat insert for exhaust
valve 2.0005 ± .0005 in. (50.813 ± 0.013 mm)

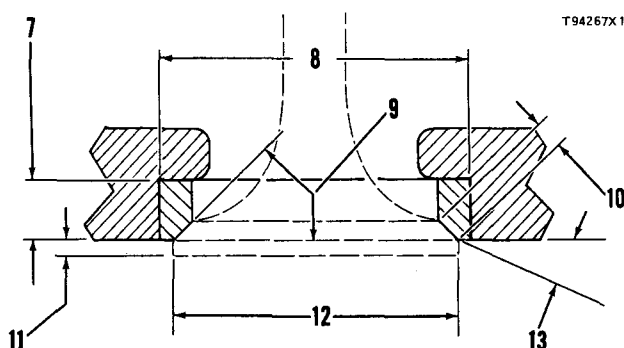
Diameter of valve seat insert for intake
valve 2.1285 ± .0005 in. (54.064 ± 0.013 mm)

Bore in head for valve seat insert for intake
valve 2.1255 ± .0005 in. (53.988 ± 0.013 mm)



Valves (Cont.)

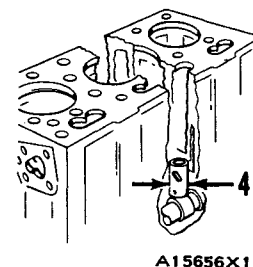
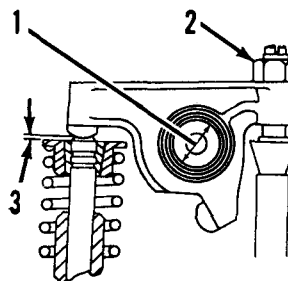
- (9) Angle of face of valve seat insert 30°
- (10) Maximum permissible width of valve seat
(intake and exhaust)076 in. (1.93 mm)
Minimum permissible width of valve seat
(intake and exhaust)045 in. (1.14 mm)
- (11) Dimension from top of closed valve to face of head:
- Maximum permissible dimension for 5S6449 or
5S7232 Exhaust Valves140 in. (3.56 mm)
- Minimum permissible dimension for 5S6449 or
5S7232 Exhaust Valves056 in. (1.42 mm)
- Maximum permissible dimension for 7S6767
Exhaust Valve163 in. (4.14 mm)
- Minimum permissible dimension for 7S6767
Exhaust valve079 in. (2.01 mm)
- Maximum permissible dimension for 5S6452 or
7S8809 Intake Valve140 in. (3.56 mm)
- Minimum permissible dimension for 5S6452 or
7S8809 Intake Valve066 in. (1.68 mm)
- (12) Outside diameter of the face of the valve seat or valve seat insert:
- Exhaust seat 1.810 in. (45.97 mm)
- Maximum permissible, exhaust seat 1.860 in. (47.24 mm)
- Intake seat 1.934 in. (49.12 mm)
- Maximum permissible, intake seat 1.984 in. (50.39 mm)
- (13) Angle to grind seat face of the insert to get
a reduction of maximum seat diameter 15°



T94267X1

VALVE ROCKER ARMS AND LIFTERS

- (1) Bore in bearing for shaft
(new)7263 ± .0005 in. (18.448 ± 0.013 mm)
Diameter of shaft
(new)7245 ± .0005 in. (18.402 ± 0.013 mm)
Maximum permissible clearance between
bearing and shaft (worn)008 in. (0.20 mm)
- (2) Torque for locknut on valve adjustment
screw 21 ± 5 lb.ft. (2.9 ± 0.7 mkg)
- (3) Clearance for valves:
- Intake valves015 in. (0.38 mm)
- Exhaust valves025 in. (0.64 mm)
- (4) Diameter of valve lifter
(new) 1.3105 ± .0005 in. (33.287 ± 0.013 mm)
Bore in block for valve lifter
(new) 1.3145 ± .0010 in. (33.388 ± 0.025 mm)
Maximum permissible clearance between lifter and bore
for valve lifter (worn)012 in. (0.30 mm)



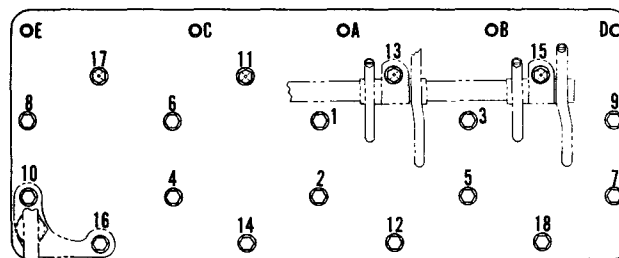
A15656X1

**NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST
PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES**

CYLINDER HEAD

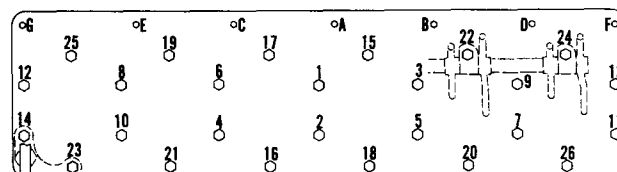
Put 9M3710 or 4S9416 Anti-Seize Compound on threads and tighten bolts in the following Step sequence:

- Step 1. Tighten all bolts in number sequence to 115 lb.ft. (15.9 mkg)
- Step 2. Again tighten all bolts in number sequence to 175 ± 5 lb.ft. (24.2 ± 0.7 mkg)
- Step 3. Again tighten all bolts in number sequence (hand torque only) to 175 ± 5 lb.ft. (24.2 ± 0.7 mkg)
- Step 4. Tighten all bolts in letter sequence to 22 lb. ft. (3.0 mkg)
- Step 5. Again tighten all bolts in letter sequence to 32 ± 5 lb.ft. (4.4 ± 0.7 mkg)
- Step 6. Again tighten all bolts in letter sequence (hand torque only) to 32 ± 5 lb.ft. (4.4 ± 0.7 mkg)



77078X1

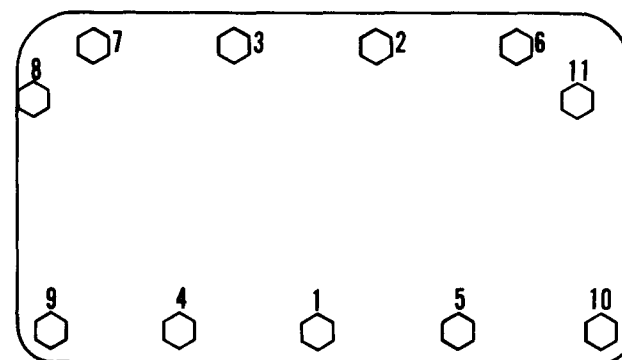
3304 ENGINE



77084X1

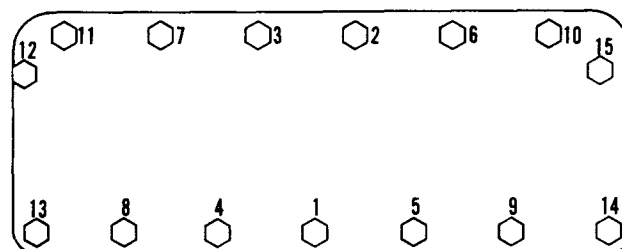
3306 ENGINE
VIEW FROM RIGHT SIDE
OF ENGINE

VALVE COVER



77077X1

3304 ENGINE



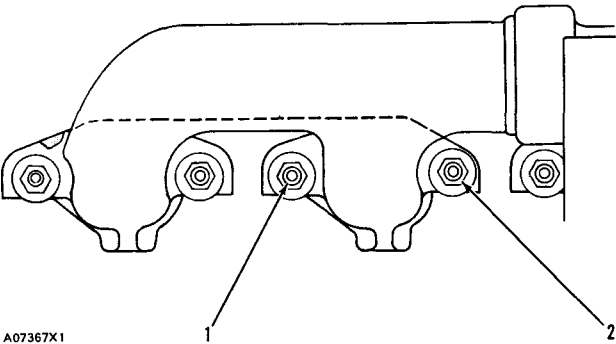
77083X1

3306 ENGINE
VIEW FROM RIGHT SIDE
OF ENGINE

Put 5H2471 Cement on the face of valve cover and top side of gasket.

Tighten bolts by number in sequence shown to 96 ± 24 lb. in. (111 ± 28 cm.kg)

EXHAUST MANIFOLD



Put 9M3710 or 4S9416 Anti-Seize Compound on all threads.

- (1) Torque for studs 20 ± 3 lb. ft. (2.8 ± 0.4 mkg)
- (2) Torque for nuts holding exhaust manifold 32 ± 5 ft. (4.4 ± 0.7 mkg)

EXHAUST PIPES AND MUFFLERS

Put 9M3710 or 4S9416 Anti-Seize Compound on threads of bolts for clamps and tighten to 20 ± 5 lb. ft. (2.8 ± 0.7 mkg)

AIR CLEANERS

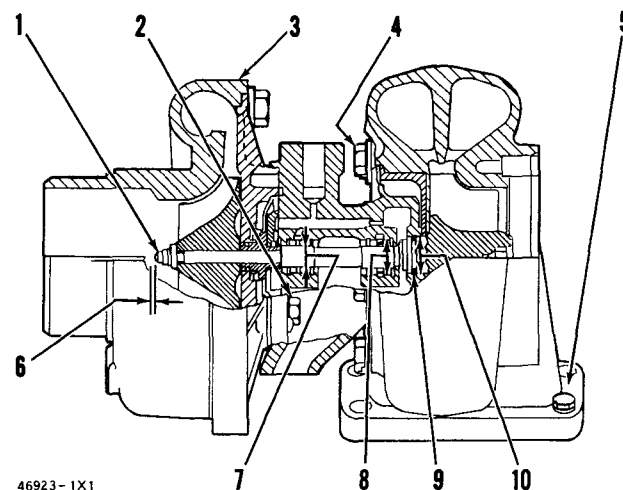
- Tighten bolts and nuts holding air filter to housing for air filter to 20 ± 5 lb. ft. (2.8 ± 0.7 mkg)
- Tighten wing bolts on air cleaner housing to 35 ± 5 lb. in. (40.4 ± 5.8 cm.kg)

NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

TURBOCHARGER

(AiResearch T04B91)

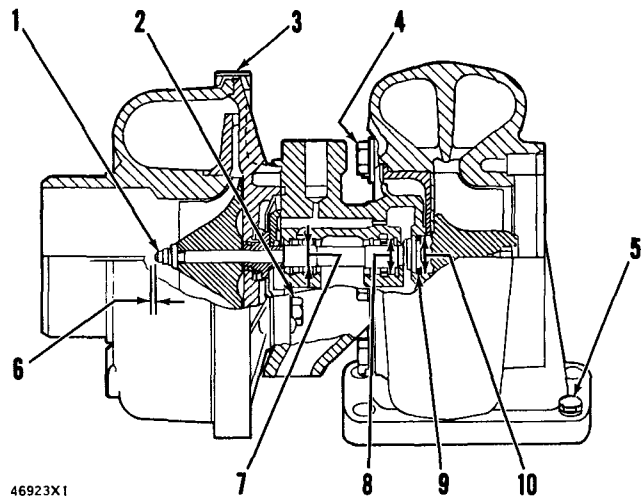
- (1) Torque for impeller nut 20 lb.in. (23.0 cm.kg)
Tighten nut an added 100°
- (2) Torque for bolts holding
back plate 75 to 90 lb. in. (86 to 104 cm.kg)
- (3) Put 9M3710 or 4S9416 Anti-Seize Compound on threads
and tighten bolts holding compressor housing to center
section to 115 ± 15 lb. in. (133 ± 17 cm.kg)
- (4) Put 9M3710 or 4S9416 Anti-Seize Compound on threads
and tighten bolts holding turbine housing to center
section to 115 ± 15 lb. in. (133 ± 17 cm.kg)
- (5) Put 9M3710 or 4S9416 Anti-Seize Compound on threads
and tighten bolts holding turbocharger to
manifold to 40 ± 4 lb.ft. (5.5 ± 0.6 mkg)
- (6) End play for shaft:
Mimumum permissible end play001 in. (0.025 mm)
Maximum permissible end play004 in. (0.102 mm)
- (7) Radial play for shaft:
Minimum permissible radial play003 in. (0.076 mm)
Maximum permissible radial play006 in. (0.152 mm)
- (8) Bore in the
bearing4010 to .4014 in. (10.185 to 10.196 mm)
Diameter of surface on shaft (journal) for
the bearing3997 to .4000 in. (10.152 to 10.160 mm)
- (9) Bore in housing6220 to .6223 in. (15.799 to 15.806 mm)
Outside diameter of the
bearing6182 to .6187 in. (15.702 to 15.715 mm)
- (10) Clearance between ends of oil
seal ring008 to .015 in. (0.20 to 0.38 mm)
Diameter of bore for oil
seal ring709 to .711 in. (18.01 to 18.06 mm)



46923-1X1

TURBOCHARGER (AiResearch T0490)

- (1) Torque for impeller nut 20 lb. in. (23.0 cm.kg)
Tighten nut an added 100°
- (2) Torque for bolts holding back
plate 50 ± 10 lb. in. (57.7 ± 11.5 cm.kg)
- (3) Put 9M3710 or 4S9416 Anti-Seize Compound on threads
and tighten bolt holding band
clamp to 60 ± 10 lb. in. (69.2 ± 11.5 cm.kg)
- (4) Put 9M3710 or 4S9416 Anti-Seize Compound on threads and
tighten bolts holding turbine
housing to 115 ± 15 lb. in. (132.6 ± 17.3 cm.kg)
- (5) Put 9M3710 or 4S9416 Anti-Seize Compound on threads
and tighten bolts holding turbocharger to
manifold to 40 ± 4 lb. ft. (5.5 ± 0.55 mkg)
- (6) End play for shaft001 to .004 in. (0.03 to 0.10 mm)
Radial play for shaft003 to .007 in. (0.08 to 0.18 mm)
- (7) Bore in the
bearing4010 to .4014 in. (10.185 to 10.196 mm)
Diameter of surface on shaft (journal) for
the bearing3997 to .4000 in. (10.152 to 10.160 mm)
- (8) Bore in housing6220 to .6223 in. (15.799 to 15.806 mm)
Outside diameter of the
bearing6182 to .6187 in. (15.702 to 15.715 mm)
- (9) Clearance between ends of oil
seal ring008 to .015 in. (0.20 to 0.38 mm)
- (10) Diameter of bore for oil
seal ring709 to .711 in. (18.01 to 18.06 mm)



46923X1

**NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST
PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES**

TURBOCHARGER

(AiResearch T1210 and T1224)

Put 9M3710 or 4S9416 Anti-Seize Compound on threads of plug for exhaust elbow.

Put 9M3710 or 4S9416 Anti-Seize Compound on threads of bolts holding support for exhaust and tighten to 45 ± 5 lb. ft. (6.22 ± 0.69 mkg)

(1) Install impeller as follows:

- a. Get temperature of impeller to 350°F (177°C)
(for ten minutes max.)
- b. Install impeller on shaft.
- c. Tighten nut to 120 lb. in. (138.4 cm.kg)
- d. Let impeller cool to below 150°F (66°C)
- e. Loosen nut and put lubricant on threads and washer.
- f. Tighten nut to 30 lb.in. (34.6 cm.kg)
- g. Tighten nut an added 120°

(2) Torque for bolts holding thrust plate 40 ± 5 lb.in. (46.1 ± 5.8 cm.kg)(3) Tighten bolt holding band clamp to 120 ± 10 lb.in. (138.4 ± 11.5 cm.kg)(4) Put 9M3710 or 4S9416 Anti-Seize Compound on threads of bolts holding turbine housing and tighten to 175 ± 15 lb.in. (201.8 ± 17.3 cm.kg)(5) Put 9M3710 or 4S9416 Anti-Seize Compound on threads of bolts holding turbocharger to manifold and tighten to 45 ± 5 lb.ft. ($6.22 \pm .69$ mkg)

(6) End play for shaft (new)006 to .011 in. (0.15 to 0.28 mm)

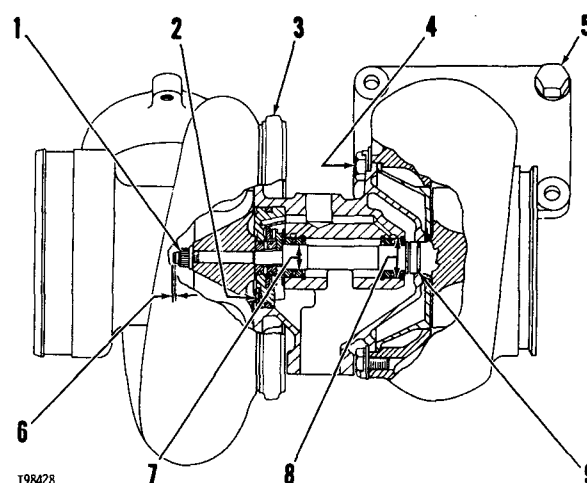
(7) Bore in the bearing . .6268 to .6272 in. (15.921 to 15.931 mm)

Diameter of surface on shaft (journal) for the bearing6250 to .6254 in. (15.875 to 15.885 mm)

(8) Bore in housing9827 to .9832 in. (24.961 to 24.973 mm)

Outside diameter of the bearing9780 to .9785 in. (24.841 to 24.854 mm)

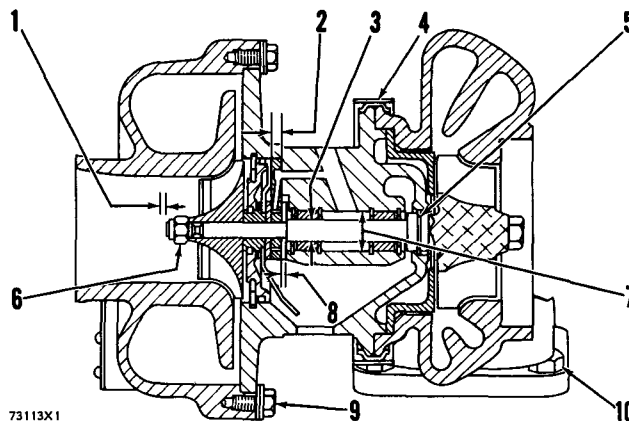
(9) Clearance between ends of oil seal ring008 to .015 in. (0.20 to 0.38 mm)



TURBOCHARGER

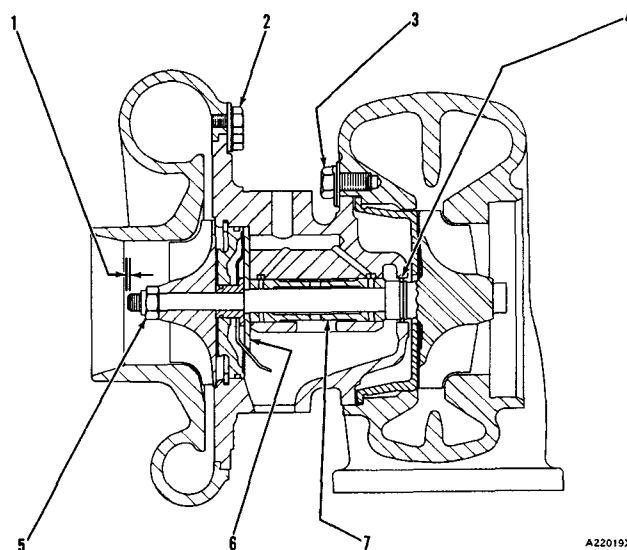
(Schwitzer 3LK)

- (1) End play for shaft
(new) $.0045 \pm .0015$ in. (0.114 ± 0.038 mm)
Maximum permissible end play (worn) $.008$ in. (0.20 mm)
- (2) Thickness of thrust bearing .. $.211 \pm .001$ in. (5.36 ± 0.03 mm)
- (3) Diameter of surface on shaft (journal) for
the bearing $.44015 \pm .00015$ in. (11.1798 ± 0.0038 mm)
Bore in the bearing $.44165 \pm .00015$ in. (11.2179 ± 0.0038 mm)
Maximum permissible clearance between bearing
and shaft $.0018$ in. (0.046 mm)
- (4) Put 9M3710 or 4S9416 Anti-Seize Compound on threads and
tighten bolt holding band
clamp to 120 lb. in. (138.4 cm.kg)
- (5) Maximum permissible gap of oil seal ring,
measured in bore of housing $.007$ in. (0.18 mm)
- (6) Torque for nut 156 ± 10 lb. in. (179.9 ± 11.5 cm.kg)
- (7) Bore in housing .. $.75025 \pm .00025$ in. (19.0564 ± 0.0064 mm)
Outside diameter of the
bearing $.74625 \pm .00025$ in. (18.9548 ± 0.0064 mm)
Maximum permissible clearance between bearing
and bore in housing $.0045$ in. (0.114 mm)
- (8) Thickness of each thrust
ring $.1005 \pm .0005$ in. (2.553 ± 0.013 mm)
- (9) Torque for bolts holding impeller
housing 60 lb. in. (69.2 cm.kg)
- (10) Put 9M3710 or 4S9416 Anti-Seize Compound on threads of
bolts holding turbocharger to
manifold and tighten to 40 ± 4 lb. ft. (5.5 ± 0.55 mkg)



**NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST
PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES**

TURBOCHARGER (Schwitzer 3LM)

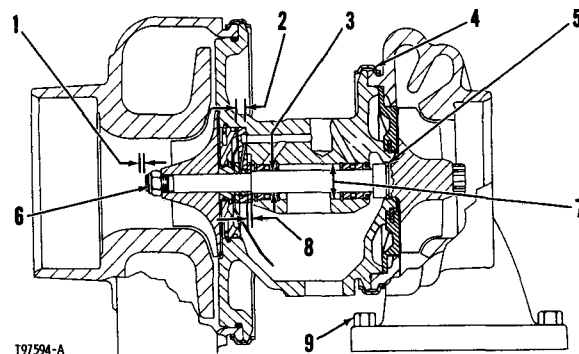


A22019X1

- (1) End play for shaft (new)002 to .005 in. (0.05 to 0.13 mm)
- (2) Put 9M3710 or 4S9416 Anti-Seize Compound on threads and tighten bolts holding impeller housing to 60 lb. in. (69 cm.kg)
- (3) Put 9M3710 or 4S9416 Anti-Seize Compound on threads and tighten bolts holding turbine housing to 11 to 12 lb. ft. (1.5 to 1.7 mkg)
- (4) Maximum permissible gap of oil seal ring, measured in bore of housing007 in. (0.18 mm)
- (5) Torque for nut holding impeller 156 ± 10 lb. in. (180 ± 12 cm.kg)
- (6) Thickness of thrust bearing . . .107 to .108 in. (2.72 to 2.74 mm)
- (7) Bearing:
 - Bore in housing for bearing7500 to .7505 in. (19.050 to 19.063 mm)
 - Diameter of surface of bearing for housing7460 to .7465 in. (18.948 to 18.961 mm)
 - Diameter of surface of bearing for shaft4415 to .4418 in. (11.214 to 11.222 mm)
 - Diameter of surface of shaft for bearing (journal)4400 to .4403 in. (11.176 to 11.184 mm)
 - Length of bearing 2.425 to 2.426 in. (61.60 to 61.62 mm)

TURBOCHARGER

(Schwitzer F444, 4LF504 and E Models)

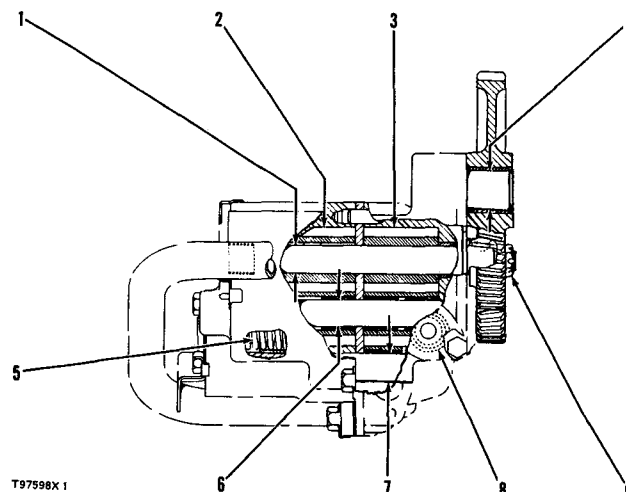


- (1) End play for shaft
 (new) $.0045 \pm .0015$ in. (0.114 ± 0.038 mm)
 Maximum permissible end play (worn) $.008$ in. (0.20 mm)
- (2) Thickness of thrust bearing ... $.211 \pm .001$ in. (5.36 ± 0.03 mm)
- (3) Diameter of surface on shaft (journal) for the bearing (new) $.5612$ to $.5615$ in. (14.254 to 14.262 mm)
 Bore in the bearing
 (new) $.5627$ to $.5630$ in. (14.293 to 14.300 mm)
 Maximum permissible clearance between bearing and shaft (worn) $.003$ in. (0.08 mm)
- (4) Put 9M3710 or 4S9416 Anti-Seize Compound on threads and tighten bolt holding band clamp to 120 lb. in. (138.4 cm.kg)
- (5) Maximum permissible gap of oil seal ring, measured in bore of housing $.009$ in. (0.23 mm)
- (6) Torque for nut 15 ± 1 lb. ft. (2.07 ± 0.14 mkg)
- (7) Bore in housing
 (new) $.8762$ to $.8767$ in. (22.255 to 22.268 mm)
 Outside diameter of the bearing
 (new) $.8718$ to $.8722$ in. (22.144 to 22.154 mm)
 Maximum permissible clearance between bearing and bore in housing (worn) $.006$ in. (0.15 mm)
- (8) Thickness of each thrust ring $.1005 \pm .0005$ in. (2.553 ± 0.013 mm)
- (9) Put 9M3710 or 4S9416 Anti-Seize Compound on threads and tighten bolts holding turbocharger to manifold to 40 ± 4 lb. ft. (5.5 ± 0.55 mkg)

NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

OIL PUMP (2P7830, 5S3876, & 7S9840)

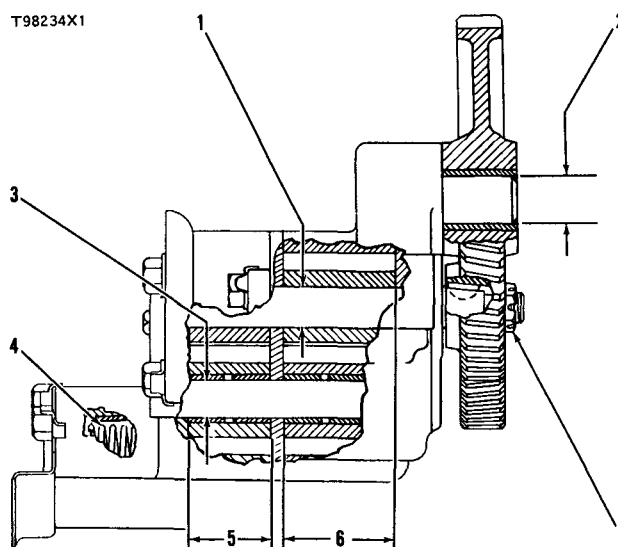
- (1) Diameter of the drive shaft (new) $.7407 \pm .0003$ in. (18.814 ± 0.008 mm)
 Bore in the bearings for the drive shaft $.7425 \pm .0005$ in. (18.860 ± 0.013 mm)
 Clearance between drive shaft and bearing (new) $.0018 \pm .0008$ in. (0.046 ± 0.020 mm)
 Maximum permissible clearance between shaft and bearing (worn) $.005$ in. (0.13 mm)
- (2) Length of gear $2.9955 \pm .0005$ in. (76.086 ± 0.013 mm)
 Depth of counterbore for gear $3.0008 \pm .0008$ in. (76.220 ± 0.020 mm)
 Clearance between end of gear and cover (new) $.0053 \pm .0013$ in. (0.135 ± 0.033 mm)
- (3) Length of gear $1.9975 \pm .0005$ in. (50.737 ± 0.013 mm)
 Depth of counterbore for gear $2.0008 \pm .0008$ in. (50.820 ± 0.020 mm)
 Clearance between end of gear and cover (new) $.0033 \pm .0013$ in. (0.084 ± 0.033 mm)
- (4) Diameter of the shaft for the drive idler gear (new) $1.1225 \pm .0005$ in. (28.512 ± 0.013 mm)
 Bore in bearing of gear (new) $1.1260 \pm .0019$ in. (28.600 ± 0.048 mm)
 Clearance between shaft and bearing (new) $.0035 \pm .0024$ in. (0.089 ± 0.061 mm)
 Maximum permissible clearance between shaft and bearing (worn) $.008$ in. (0.20 mm)
- (5) 1S3921 Spring for pressure relief valve (engine oil):
 Length under test force 3.25 in. (82.6 mm)
 Test force 39.8 ± 3.2 lbs. (18.1 ± 1.5 kg)
 Free length after test 3.57 in. (90.7 mm)
 Outside diameter $.77$ in. (19.6 mm)
- (6) Diameter of the shaft for the idler gear (clutch pump) (new) $.7407 \pm .0003$ in. (18.814 ± 0.008 mm)
 Bore in the bearing ... $.7425 \pm .0005$ in. (18.860 ± 0.013 mm)
 Clearance between shaft and bearing (new) $0.0018 \pm .0008$ in. (0.046 ± 0.020 mm)
 Maximum permissible clearance between shaft and bearing (worn) $.008$ in. (0.20 mm)
- (7) Diameter of the shaft for the idler gear (scavenge pump) (new) $.7407 \pm .0003$ in. (18.814 ± 0.008 mm)
 Bore in the bearing of the idler gear $.7425 \pm .0005$ in. (18.860 ± 0.013 mm)
 Clearance between shaft and bearing (new) $.0018 \pm .0008$ in. (0.046 ± 0.020 mm)
 Maximum permissible clearance between shaft and bearing (worn) $.008$ in. (0.20 mm)
 Length of gear $.9975 \pm .0005$ in. (25.337 ± 0.013 mm)
 Depth of counterbore for gear $1.0008 \pm .0008$ in. (25.420 ± 0.020 mm)



- (8) 4J4790 Spring for pressure relief valve (clutch oil):
 Length under test force 1.548 in. (39.32 mm)
 Test force 12.27 lbs. (5.6 kg)
 Free length after test 2.163 in. (54.94 mm)
 Outside diameter $.72$ in. (18.3 mm)
- (9) Torque for nut holding drive gear 60 lb. ft. (8.3 mkg)
 Tighten farther to get alignment for cotter pin.

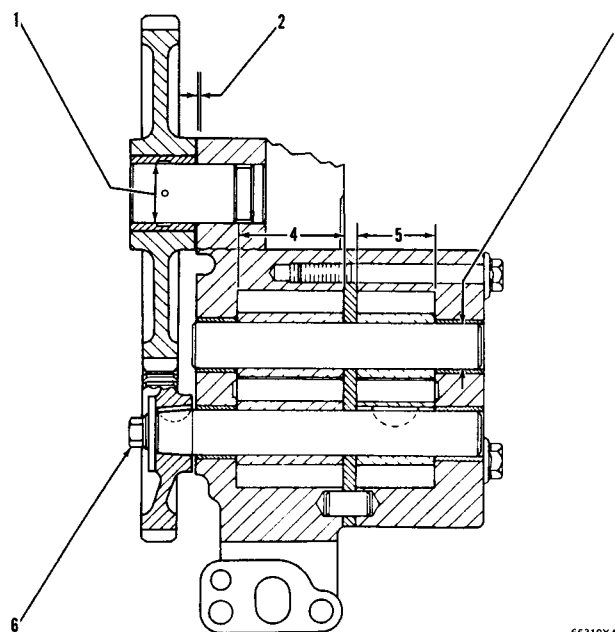
OIL PUMP (7S1849 & 7S9461)

- (1) Diameter of the drive shaft
(new) $.8747 \pm .0002$ in. (22.217 ± 0.005 mm)
Bore in the bearings for the
drive shaft $.8763 \pm .0003$ in. (22.258 ± 0.008 mm)
Clearance between drive shaft and
bearings (new) $.0016 \pm .0005$ in. (0.041 ± 0.013 mm)
Maximum permissible clearance between shaft
and bearing (worn) $.005$ in. (0.13 mm)
- (2) Diameter of the shaft for the drive idler
gear (new) $1.1225 \pm .0005$ in. (28.512 ± 0.013 mm)
Bore in the bearing ... $1.1260 \pm .0019$ in. (28.600 ± 0.048 mm)
Clearance between shaft and
bearing (new) $.0035 \pm .0024$ in. (0.089 ± 0.061 mm)
Maximum permissible clearance between shaft
and bearing (worn) $.008$ in. (0.20 mm)
- (3) Diameter of the shaft for the
idler gear (new) $.8747 \pm .0002$ in. (22.217 ± 0.005 mm)
Bore in the bearing ... $.8763 \pm .0003$ in. (22.258 ± 0.008 mm)
Clearance between shaft and
bearing (new) $.0016 \pm .0005$ in. (0.041 ± 0.013 mm)
Maximum permissible clearance between
shaft and bearing (worn) $.008$ in. (0.20 mm)
- (4) 1S3921 Spring for pressure relief valve:
Length under test force 3.25 in. (82.6 mm)
Test force 39.8 ± 3.2 lbs. (18.1 ± 1.5 kg)
Free length after test 3.57 in. (90.7 mm)
Outside diameter $.77$ in. (19.6 mm)
- (5) Length of gear $1.4988 \pm .0010$ in. (38.070 ± 0.025 mm)
Depth of counterbore
for gear $1.5038 \pm .0008$ in. (38.197 ± 0.020 mm)
Clearance between end of gear
and cover (new) $.0050 \pm .0018$ in. (0.127 ± 0.046 mm)
- (6) Length of gear $2.0003 \pm .0010$ in. (50.808 ± 0.025 mm)
Depth of counterbore
for gear $2.0053 \pm .0008$ in. (50.935 ± 0.020 mm)
Clearance between end of gear
and cover (new) $.0050 \pm .0018$ in. (0.127 ± 0.046 mm)
- (7) Torque for nut holding drive gear 60 lb. ft. (8.3 mkg)
Tighten farther to get alignment for cotter pin.



**NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST
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OIL PUMP (2P1785)

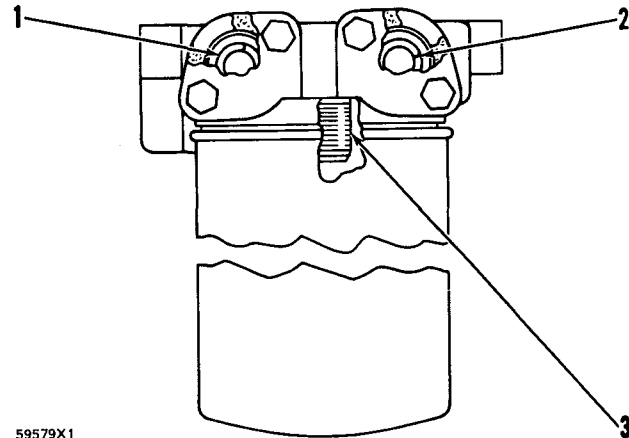


66310X4

- (1) Bore in bearing of idler gear $1.1260 \pm .0024$ in. (28.600 ± 0.061 mm)
 Diameter of shaft for the idler gear $1.1255 \pm .0005$ in. (28.588 ± 0.013 mm)
 Clearance between bearing and shaft $.0035 \pm .0029$ in. (0.089 ± 0.074 mm)
- (2) Clearance between gears and body of pump $.002$ to $.026$ in. (0.05 to 0.66 mm)
- (3) Diameter of shafts for pump $.8747 \pm .0002$ in. (22.217 ± 0.005 mm)
 Bore in bearings for shafts $.8763 \pm .0003$ in. (22.258 ± 0.008 mm)
 Clearance between shafts and bearings $.0016 \pm .0005$ in. (0.041 ± 0.013 mm)
- (4) Length of gears $2.0003 \pm .0010$ in. (50.808 ± 0.025 mm)
 Depth of bore in pump body for gears $2.0053 \pm .0008$ in. (50.935 ± 0.020 mm)
 Clearance between end of gears and pump body $.0050 \pm .0018$ in. (0.127 ± 0.046 mm)
- (5) Length of gears $1.4988 \pm .0010$ in. (38.070 ± 0.025 mm)
 Depth of bore in pump body for gears $1.5038 \pm .0008$ in. (38.197 ± 0.020 mm)
 Clearance between end of gears and pump body $.0050 \pm .0018$ in. (0.127 ± 0.046 mm)
- (6) Torque for bolt holding drive gear to drive shaft 32 ± 5 lb.ft. (4.4 ± 0.7 mkg)

OIL FILTER

(2P686, 2P916, 2P6475, 2P6525 & 4N6034)



59579X1

Oil cooler bypass valve and oil filter
bypass valve must open at a pressure
difference of 25 ± 3 psi (1.76 ± 0.21 kg/cm²)

(1) 8M3182 Spring for oil cooler bypass valve:

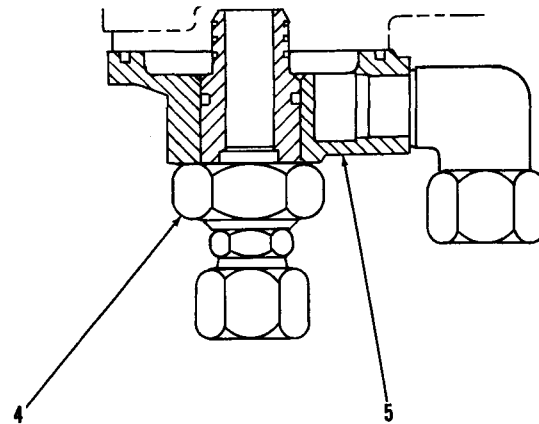
| | |
|-------------------------------|--------------------|
| Length under test force | 2.5 in. (63.5 mm) |
| Test force | 8.92 lb. (4.05 kg) |
| Free length after test | 3.61 in. (91.7 mm) |
| Outside diameter | .81 in. (20.6 mm) |

(2) 8M3182 Spring for oil filter bypass valve:

| | |
|-------------------------------|--------------------|
| Length under test force | 2.5 in. (63.5 mm) |
| Test force | 8.92 lb. (4.05 kg) |
| Free length after test | 3.61 in. (91.7 mm) |
| Outside diameter | .81 in. (20.6 mm) |

(3) Torque for stud:

Put 9S3263 Thread Lock Compound
on threads of the stud and tighten
the stud to 50 ± 10 lb.ft. (6.9 ± 1.4 mkg)



A22035X1

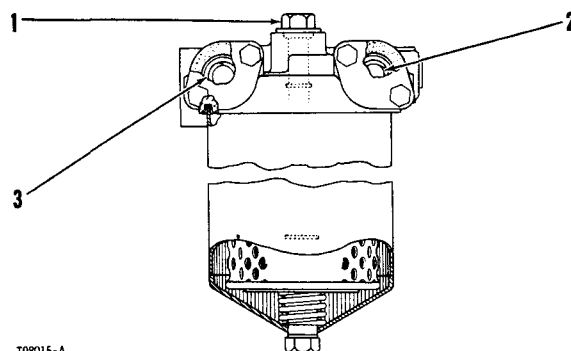
for 627 tractor engine only

(4) Torque for locknut (4) holding adapter (5) to
oil filter base 110 ± 15 lb. ft. (15 ± 2 mkg)

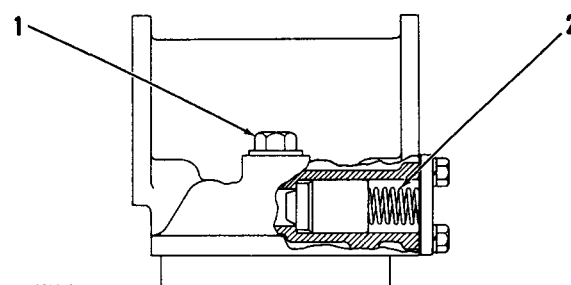
**NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST
PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES**

OIL FILTER (7S6638, 7S6639 & 9S1806)

- (1) Torque for the bolt 20 ± 5 lb. ft. (2.8 ± 0.7 mkg)
- (2) 6F8007 Spring for oil filter bypass valve:
- Length under test force 2.43 in. (61.7 mm)
- Test force 5.2 to 6.1 lbs. (2.4 to 2.8 kg)
- Free length after test 3.61 in. (91.7 mm)
- Outside diameter81 in. (20.6 mm)
- 7S6638 Filter only:
- (3) 6F8007 Spring for oil cooler bypass valve:
- Length under test force 2.43 in. (61.7 mm)
- Test force 5.2 to 6.1 lbs. (2.4 to 2.8 kg)
- Free length after test 3.61 in. (91.7 mm)
- Outside diameter81 in. (20.6 mm)



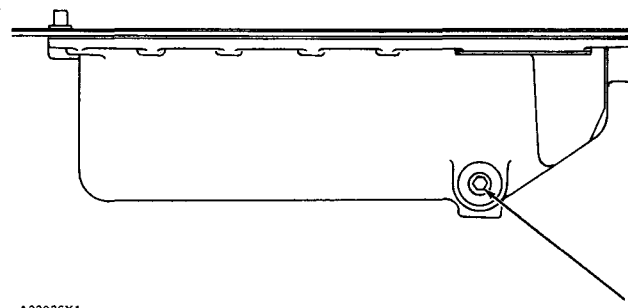
T98015-A



T98231-A

OIL PAN (2P9647 & 4N6057)

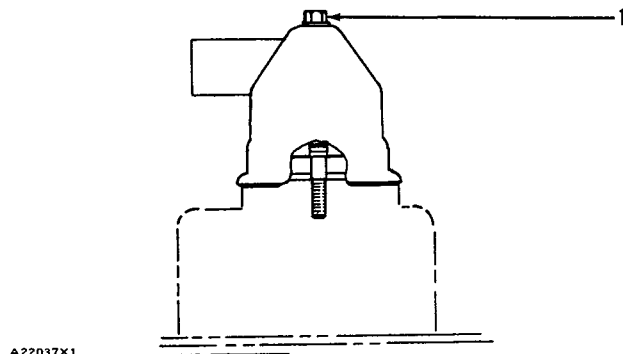
- (1) Tighten plug to 50 ± 7 lb. ft. (6.9 ± 0.97 mkg)



A22036X1

OIL BREATHER CAP

- (1) Torque for bolt holding breather cap 120 ± 24 lb. in. (138 ± 28 cm.kg)



A22037X1

| V-BELT TENSION CHART | | | | | | | |
|--|-------------------|-------|----------------------------------|-------|---------------------------|------------------------|-----------------------|
| BELT SIZE | WIDTH BELT TOP | | WIDTH TOP OF PULLEY GROOVE | | BELT TENSION "INITIAL" | BELT TENSION "USED" | BORROUGHS GAGE NO. |
| | in. | mm | in. | mm | GAGE READING | GAGE READING | |
| 3/8 | .422 | 25.82 | .380 | 9.65 | 100 ± 5 | 45 ± 5 | BT-33-73F |
| 1/2 | .547 | 13.89 | .500 | 12.70 | 120 ± 5 | 90 ± 10 | BT-33-96-4-16 |
| 5V | .625 | 15.88 | .600 | 15.24 | 120 ± 5 | 90 ± 10 | BT-33-72-4-15 |
| 11/16 | .688 | 17.48 | .625 | 15.88 | 120 ± 5 | 90 ± 10 | BT-33-72-4-15 |
| 3/4 | .750 | 19.05 | .690 | 41.34 | 120 ± 5 | 90 ± 10 | BT-33-72-4-15 |
| 15/16 | .938 | 23.83 | .878 | 22.30 | 120 ± 5 | 90 ± 10 | BT-33-72-4-15 |
| 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. | | | | | | | |
| A10232X1 | | | | | | | |

RADIATOR

Clean the threads of the studs with 8M8060 Quick Cure Primer. Then put 9S3265 Retaining Compound on the threads before installing them.

Tighten bolts holding baffles

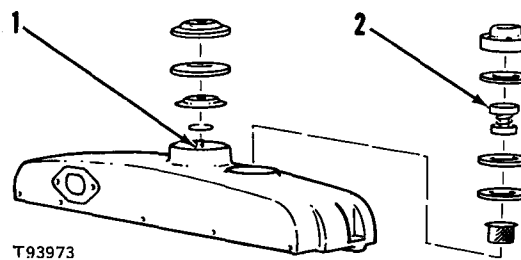
and shields to 15 ± 5 lb. ft. (2.1 ± 0.7 mkg)

- (1) Torque for stud for the
filler cap 40 ± 5 lb. ft. (5.5 ± 0.7 mkg)

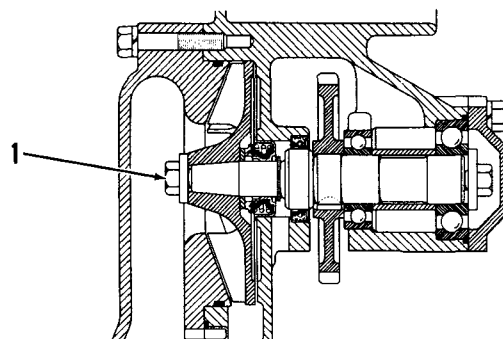
- (2) 5S1218 Pressure Relief Valve:

Pressure that makes the relief
valve open 13 to 16 psi (0.9 to 1.1 kg/cm²)

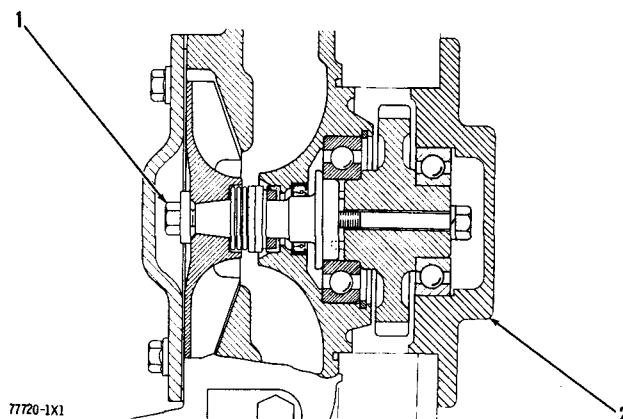
Maximum vacuum necessary to make relief
valve open 1 psi (0.1 kg/cm²)
or 27.7 in. H₂O (704. mm H₂O)
or 2.04 in. Hg (51.8 mm Hg)



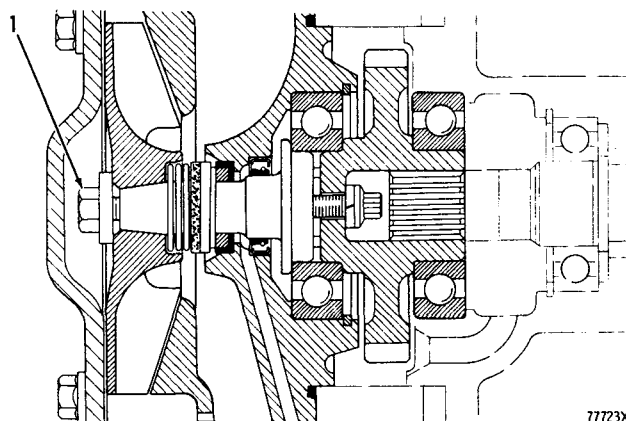
NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST
PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES



T98012-A

5S6684 Water Pump Illustrated**WATER PUMP**

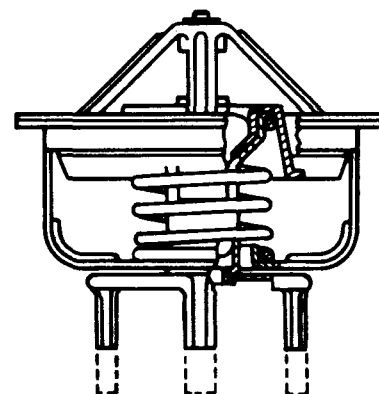
77720-1X1

2P662 Water Pump Illustrated

77723X1

2P661 Water Pump Illustrated

- (1) Torque for bolt holding
impeller 28 ± 1 lb. ft. (3.8 ± 0.14 mkg)
- (2) Torque for bolts holding
cover (2) 100 ± 10 lb. ft. (13.8 ± 1.4 mkg)

WATER TEMPERATURE REGULATOR**77719X1****6N1848 or 2P3768 Regulator:**

Approximate temperature when completely open 195° F (90° C)

Minimum completely open distance375 in. (9.53 mm)

6L5851 Regulator:

Approximate temperature when completely open 197° F (92° C)

Minimum completely open distance375 in. (9.53 mm)

4L7615 Regulator:

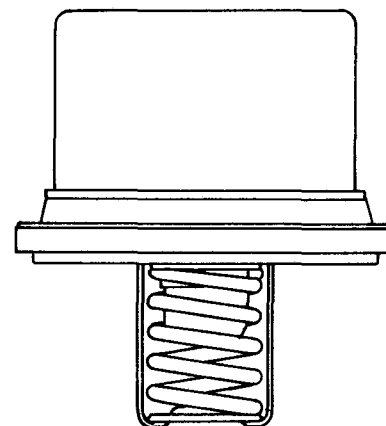
Approximate temperature when completely open 180° F (82° C)

Minimum completely open distance375 in. (9.53 mm)

9S9160 Regulator:

Approximate temperature when completely open 185° F (85° C)

Minimum completely open distance375 in. (9.53 mm)

**51865X1****4N3781 Regulator:**

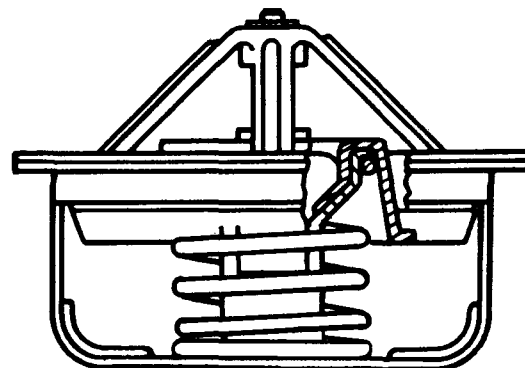
Approximate temperature when completely open 195° F (90° C)

Minimum completely open distance375 in. (9.53 mm)

2S4044 Regulator:

Approximate temperature when completely open 185° F (85° C)

Minimum completely open distance310 in. (7.87 mm)

**77719-1X1****4N3781 Illustrated**

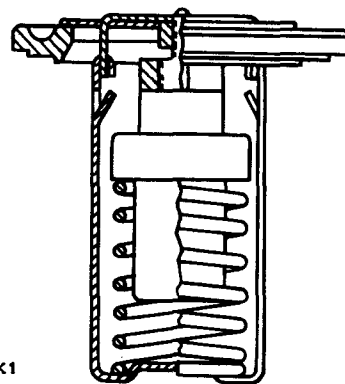
WATER TEMPERATURE REGULATOR

9S3808 and 4H1991 Regulator:

Approximate temperature when completely open 185° F (85° C)

Minimum completely open distance310 in. (7.87 mm)

85312X1



COOLING SYSTEM PRESSURE CAP

2S3080 Pressure Relief Cap:

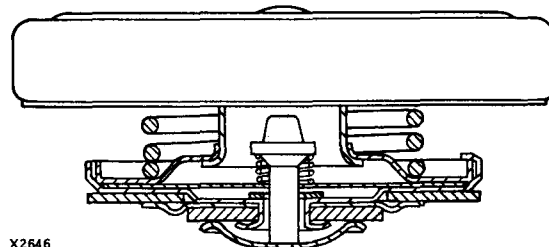
Minimum pressure that makes relief
valve open 12 psi (0.84 kg/cm²)

Maximum pressure that makes relief
valve open 15 psi (1.05 kg/cm²)

Maximum vacuum necessary to make relief
valve open 0.6 psi (0.042 kg/cm²)

321464 Pressure Relief Cap:

Pressure that makes the relief valve
open 6.5 to 8 psi (0.46 to 0.56 kg/cm²)



Typical Illustration

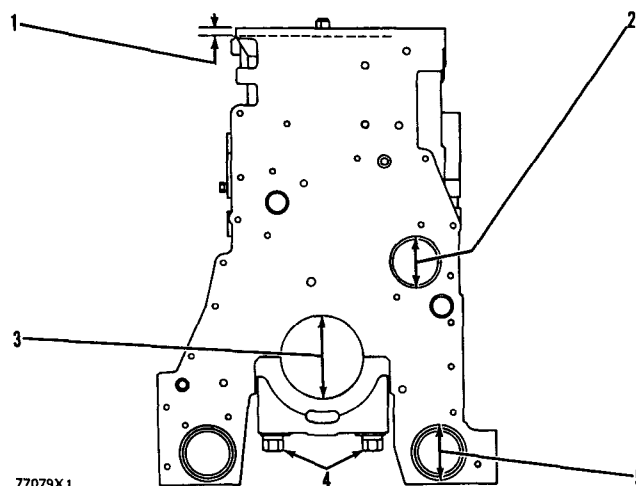
CYLINDER BLOCK

- (1) Depth of bore in block for liner $.401 \pm .001$ in. (10.19 ± 0.03 mm)
 Height of liner over block, under installation pressure $.0020$ to $.0056$ in. (0.051 to 0.142 mm)
- (2) Bore in block for camshaft bearing $2.5630 \pm .0010$ in. (65.100 ± 0.025 mm)
- (3) Bore in block for main bearing $3.8160 \pm .0005$ in. (96.926 ± 0.013 mm)
- (4) Torque for bolts holding bearing caps for main bearings:
- Put crankcase oil on threads and washer face.
 - Tighten all bolts to 30 ± 3 lb.ft. (4.1 ± 0.4 mkg)
 - Put a mark on each bolt and cap.
 - Tighten all bolts from mark 90°
- (5) Bore in block for balancer bearing (3304 Engines only) $2.2776 \pm .0010$ in. (57.851 ± 0.025 mm)

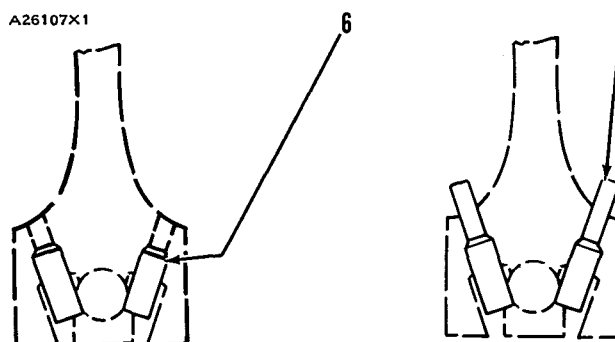
WARNING: There are holes in the bores for the main bearings, between cylinders 1 and 2, 3 and 4, and 5 and 6 (six cylinder engines), for piston cooling orifices. These holes must have either orifices (7) or plugs (6) installed. Find this information in OIL LINES in the parts book for your engine arrangement.

NOTE: If a turbocharger is installed on the engine, be sure to install orifices.

NOTE: If orifices are installed in the engine, be sure to install an engine oil cooler.

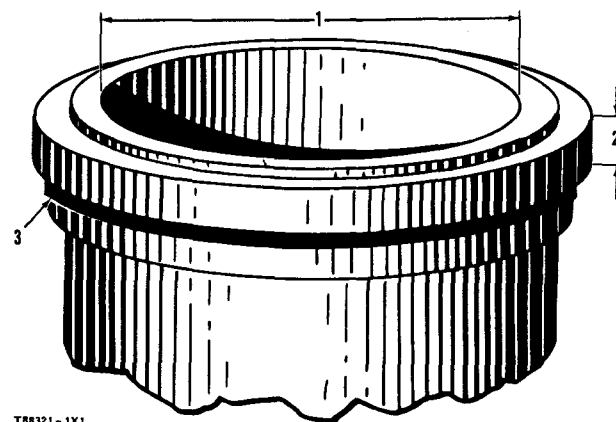


A26107X1



CYLINDER LINER

- (1) Bore in liner (new) $4.751 \pm .001$ in. (120.68 ± 0.025 mm)
 Use again maximum bore when measured near upper end of the wear surface of the cylinder liner 4.755 in. (120.78 mm)
- (2) Thickness of flange on liner $.4048 \pm .0008$ in. (10.282 ± 0.020 mm)
- (3) Put filler band in engine oil. Then immediately install the filler band on the liner. Then immediately install the liner in the cylinder block.



NOTE: Make a reference to GUIDELINE FOR REUSABLE PARTS; PISTONS AND CYLINDER LINERS, Form No. SEBF8001.

NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

PISTONS AND RINGS

NOTE: Use 5P3519 Piston Ring Groove Gauge to check top and center ring grooves with straight sides. For instructions on the use of the gauge, see the GUIDELINE FOR REUSABLE PARTS; PISTONS AND CYLINDER LINERS, Form No. SEBF8001.

Maximum permissible clearance between ring and groove (all rings) (worn)006 in. (0.15 mm)

(1) Top ring:

Width of groove for top ring1273 ± .0005 in. (3.233 ± 0.013 mm)

Width of top ring1240; +.0000 to −.0008 in. (3.150; +0.000 to −0.020 mm)

Clearance between top ring and groove .0033; +.0005 to −.0013 in. (0.084; +0.013 to 0.033 mm)

(2) Center ring:

Width of groove for center ring0963 ± .0005 in. (2.446 ± 0.013 mm)

Width of center ring0935; +.0000 to −.0008 in. (2.375; +0.000 to −0.020 mm)

Clearance between center ring and groove0028; +.0005 to −.0013 in. (0.071; +0.013 to −0.033 mm)

(3) Oil control ring:

Width of groove for oil control ring2195 ± .0005 in. (5.575 ± 0.013 mm)

Width of oil control ring2170 ± .0005 in. (5.512 ± 0.013 mm)

Clearance between oil control ring and groove0025 ± .0010 in. (0.064 ± 0.025 mm)

(4) Bore in piston for pin:

9S8913 Piston 1.5011 ± .0002 in. (38.128 ± 0.005 mm)

4N4029 Piston 1.5011 ± .0002 in. (38.128 ± 0.005 mm)

4N9258 Piston 1.7006 ± .0003 in. (43.195 ± 0.008 mm)

Maximum permissible clearance between piston pin and bore in piston (worn)002 in. (0.05 mm)

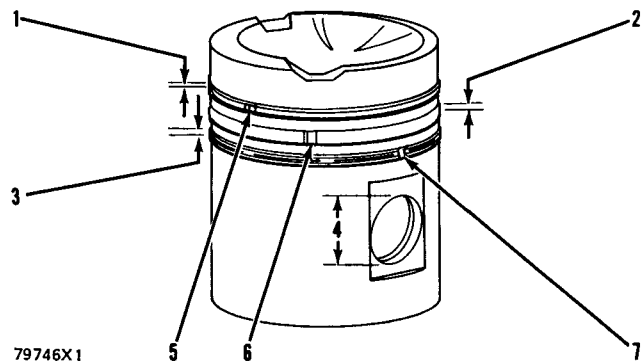
Clearance between ends of piston ring installed in cylinder liner with bore size of 4.750 in. (120.65 mm)*

(5) Top ring0245 ± .0075 in. (0.622 ± 0.191 mm)

(6) Center ring0245 ± .0075 in. (0.622 ± 0.191 mm)

(7) Oil control ring (bottom)0205 ± .0075 in. (0.521 ± 0.191 mm)

*Increase in clearance between ends of piston ring for each .001 in. (0.025 mm) increase in cylinder liner bore size003 in. (0.08 mm)



79746X1

CONNECTING ROD

- (1) Bore in bearing for piston pin (new):

| | |
|---|--|
| 5S6360 Rod | 1.5017 ± .0003 in. (38.143 ± 0.008 mm) |
| 5S2793 Rod | 1.7012 ± .0003 in. (43.210 ± 0.008 mm) |
| Maximum permissible clearance between bearing and piston pin (worn) | .003 in. (0.08 mm) |
- (2) Bore in connecting rod for bearing

| | |
|--|--|
| | 3.2500 ± .0005 in. (82.550 ± 0.013 mm) |
|--|--|
- (3) Distance between center of piston pin and center of crankshaft bearing (new)

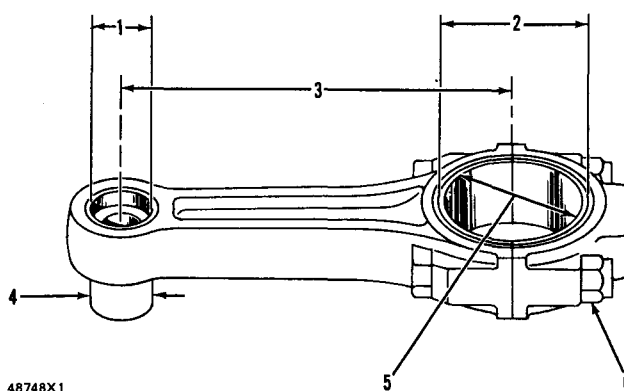
| | |
|--|-------------------------------------|
| | 9.595 ± .001 in. (243.71 ± 0.02 mm) |
|--|-------------------------------------|
- (4) Diameter of piston pin (new):

| | |
|------------|--|
| 9H4016 Pin | 1.5003 ± .0002 in. (38.108 ± 0.005 mm) |
| 8M6487 Pin | 1.6998 ± .0002 in. (43.175 ± 0.005 mm) |
- (5) Bore of crankshaft journal bearing

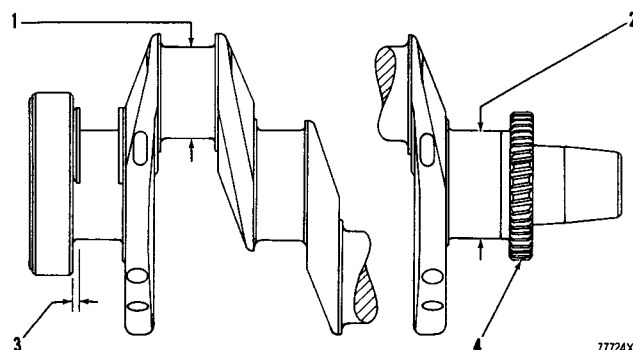
| | |
|---|--------------------------------------|
| | 3.004 ± .002 in. (76.30 ± 0.05 mm) |
| Clearance between connecting rod bearing and crankshaft bearing surface (journal) | .0020 to .0076 in. (0.05 to 0.19 mm) |
| Maximum permissible clearance between bearing and crankshaft (worn) | .010 in. (0.25 mm) |
- (6) Torque on nut for connecting rod:
 - a. Put crankcase oil on threads and nut seat.
 - b. Tighten both nuts to 30 ± 3 lb.ft. (4.1 ± 0.4 mkg)
 - c. Mark each nut and end of bolt.
 - d. Again tighten both nuts (from mark) 90°

Install the connecting rod in the piston with the slot for the bearing tab on the same side as the V mark on the piston.

Make a reference to Special Instructions GMG02394 and GMG02395 for information about checking and reconditioning connecting rods.



CRANKSHAFT

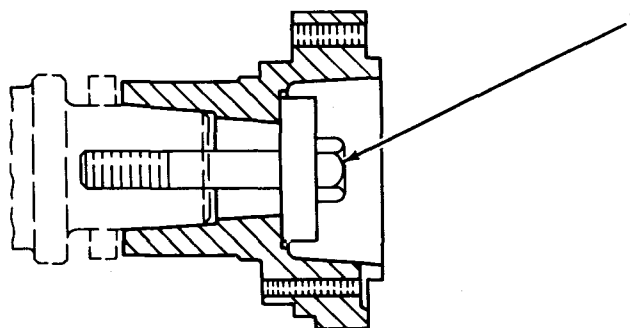


- (1) Diameter of bearing surface (journal) for connecting rod $2.9992 \pm .0008$ in. (76.180 ± 0.020 mm)
Minimum permissible diameter (worn) ... 2.992 in. (76.00 mm)
Maximum permissible difference from round bearing surface (journal) (worn) $.004$ in. (0.10 mm)
- (2) Diameter of bearing surface (journal) for the main bearing
(new) $3.4992 \pm .0008$ in. (88.880 ± 0.020 mm)
Minimum permissible diameter (worn) ... 3.491 in. (88.67 mm)
Clearance between main bearing and crankshaft bearing surface (journal)
(new) $.0030$ to $.0059$ in. (0.076 to 0.150 mm)
Maximum permissible bearing clearance between main bearing and crankshaft bearing surface (journal) (worn) $.010$ in. (0.25 mm)
- (3) End play for the crankshaft
(new) $.0025$ to $.0145$ in. (0.064 to 0.368 mm)
Maximum permissible end play for the crankshaft (worn) $.025$ in. (0.64 mm)

NOTE: If the width between the shoulders of the rear main bearing (journal) is $1.5935 \pm .0025$ in. (40.47 ± 0.06 mm) install 2P716 Thrust Plate. If the width is $1.6875 \pm .0025$ in. (42.86 ± 0.06 mm) install 9S3037 Thrust Plate.
- (4) Do not heat gear or wear sleeve to more than 600° F (316° C) before installation on the crankshaft.

Make a reference to Special Instruction SEHS6713 for specifications for crankshaft reconditioning.

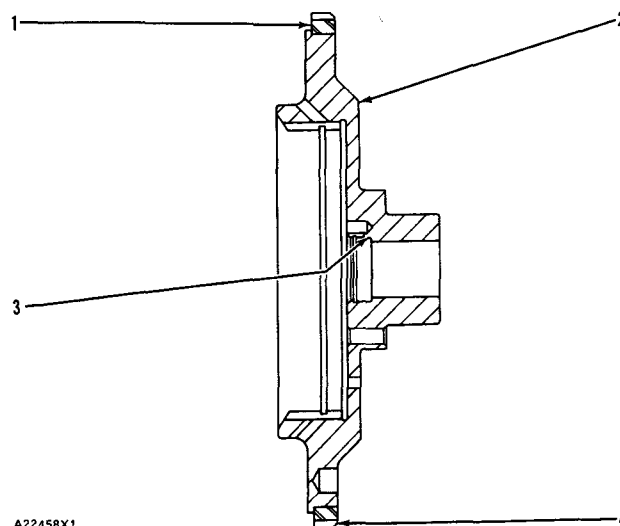
CRANKSHAFT HUB



A23401X1

- (1) Torque for bolt holding hub to crankshaft to 230 ± 20 lb. ft. (31.8 ± 2.8 mkg)
 Hit bolt with hammer and again tighten
 bolt to 230 ± 20 lb. ft. (31.8 ± 2.8 mkg)

FLYWHEEL



A22458X1

Typical Illustration

- (1) Maximum temperature to heat ring gear (1) before installing on flywheel (2) 600° F (316° C)
 (3) Maximum permissible bore run out (radial eccentricity) of the pilot bore005 in. (0.13 mm)

NOTE: On some flywheels the pilot bore has a much larger diameter.

- (4) Install ring gear with chamfer side of teeth as shown.

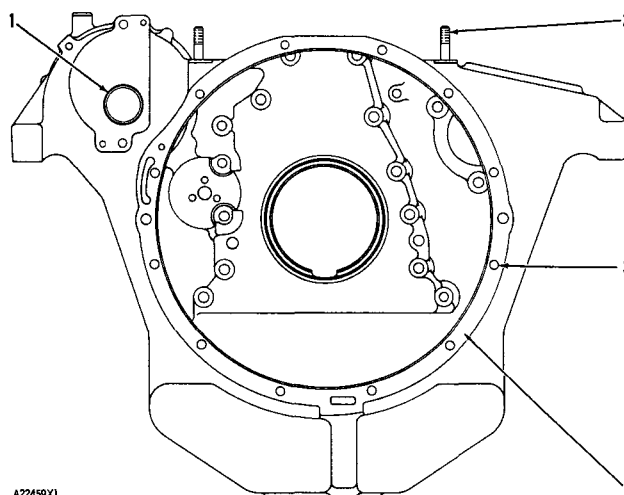
NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

FLYWHEEL HOUSING

2P8695 HOUSING ASSEMBLY

- (1) Bore in the bearing after installation in the flywheel housing $2.0015 \pm .0019$ in. (50.838 ± 0.048 mm)
- (2) Tighten studs to 40 ± 5 lb. ft. (5.5 ± 0.7 mkg)
- (3) Tighten studs to 40 ± 5 lb. ft. (5.5 ± 0.7 mkg)
- (4) With end play removed before each measurement, maximum permissible face run out (axial eccentricity)012 in. (0.30 mm)

NOTE: See Flywheel Housing Bore.

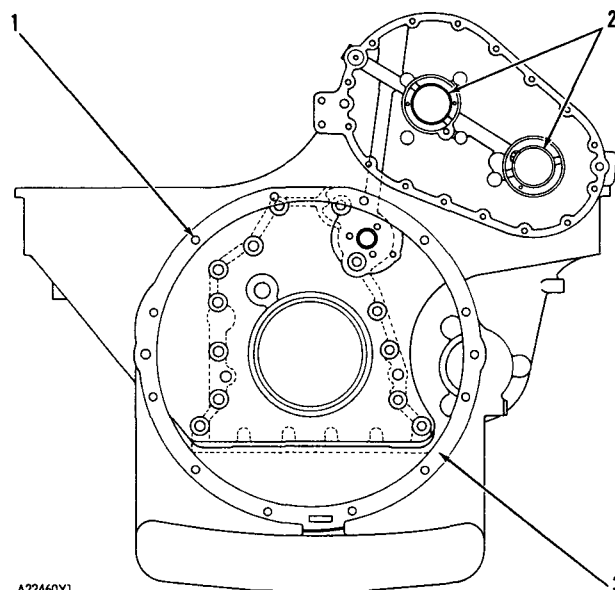


A22459X1

2P4691 HOUSING ASSEMBLY

- (1) Tighten studs to 40 ± 5 lb. ft. (5.5 ± 0.7 mkg)
- (2) Bore in bearings after installation in flywheel housing $2.2513 \pm .0019$ in. (57.183 ± 0.048 mm)
- (3) With end play removed before each measurement, maximum permissible face run out (axial eccentricity)012 in. (0.30 mm)

NOTE: See Flywheel Housing Bore.

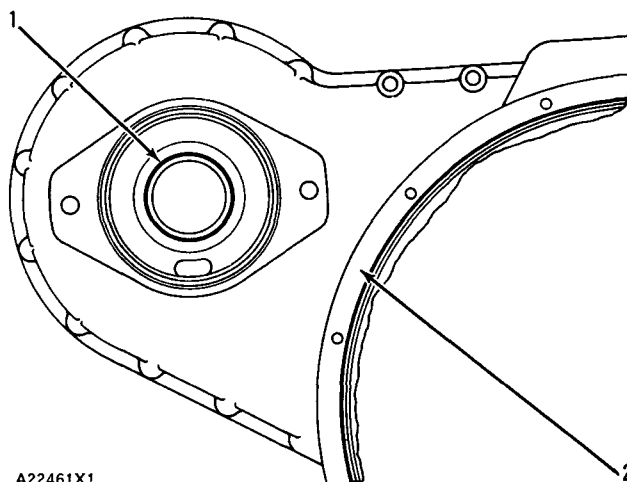


A22460X1

9S9763 HOUSING ASSEMBLY

- (1) Bore in bearing after installation in flywheel housing $2.251 \pm .001$ in. (57.18 ± 0.03 mm)
- (2) With end play removed before each measurement, maximum permissible face run out (axial eccentricity)012 in. (0.30 mm)

NOTE: See Flywheel Housing Bore.



A22461X1

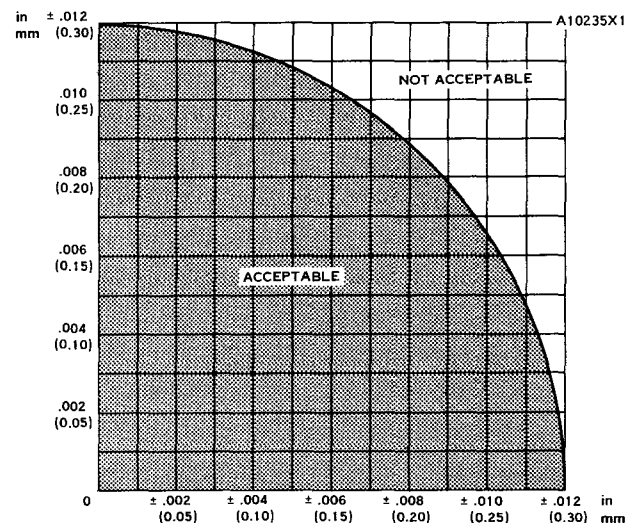
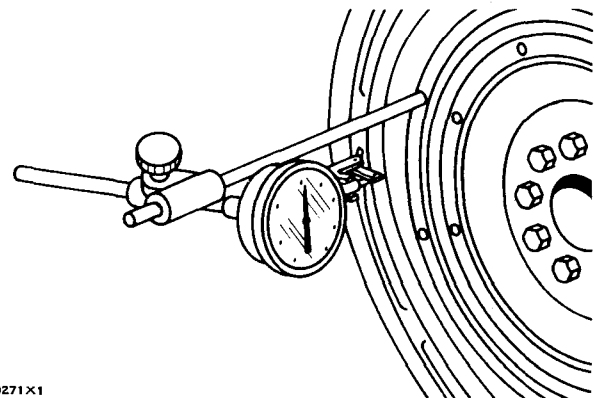
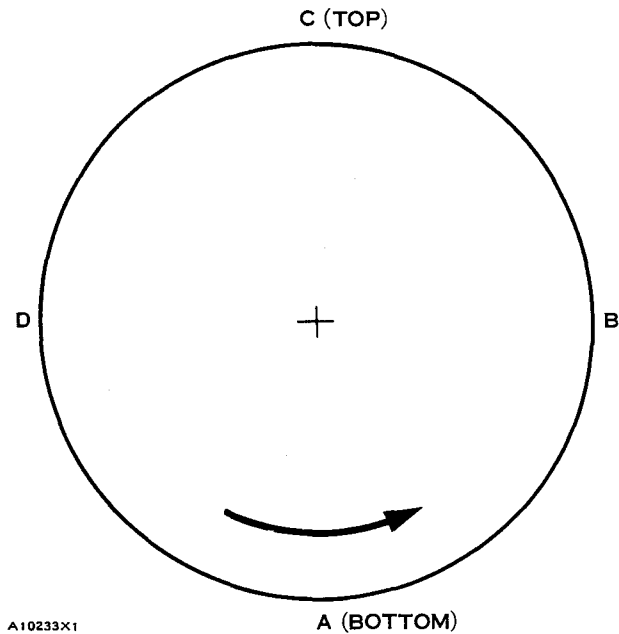
FLYWHEEL HOUSING BORE

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 & 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 | | | | | |
|---|----------------------------|---|----|---|----|
| | Position of dial indicator | | | | |
| | Line No. | 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. | | | | | |

A10234X1

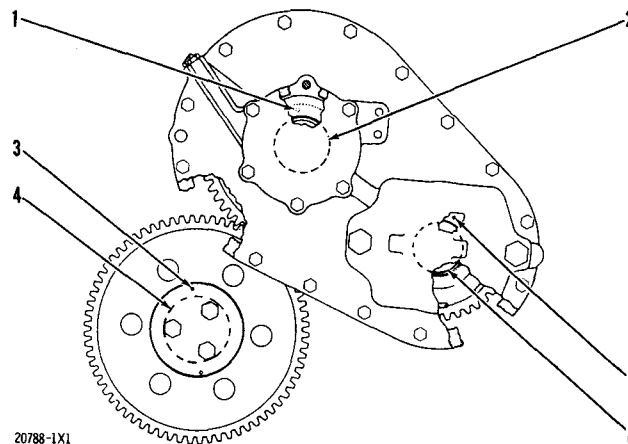
9. On the graph for total eccentricity find the point of intersection of the lines for vertical eccentricity and horizontal eccentricity.
10. If the point of intersection is in the range marked "Acceptable" the bore is in alignment. If the point of intersection is in the range marked "Not Acceptable" do Step 11.
11. Loosen the bolts holding the flywheel housing to the cylinder block. Hit the flywheel housing lightly with a hammer to put it in the correct position. Tighten the bolts holding the flywheel housing to the cylinder block and do Steps 1 through 10 again.



NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

REAR ACCESSORY DRIVE GEARS**(D7 Tractors, 571 & 572 Pipelayers)**

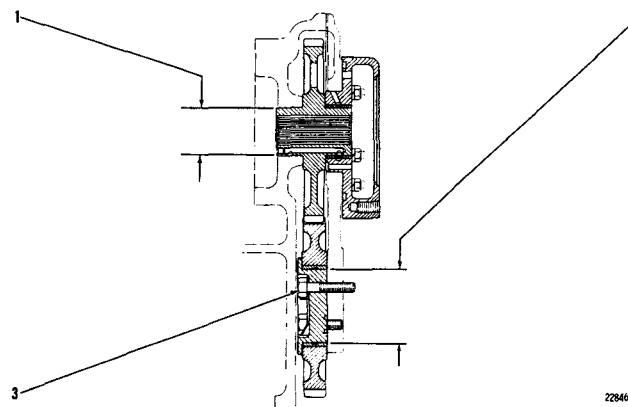
- (1) Distance the dowel holding the thrust washer is above face of the cover assembly141 in. (3.58 mm)
- (2) Diameter of surface on gear (journal) for the bearing (new) 2.2468 ± .0005 in. (57.069 ± 0.013 mm)
- Bore in the bearing (new) 2.2513 ± .0019 in. (57.183 ± 0.048 mm)
- Maximum permissible clearance between bearing and gear (worn)010 in. (0.25 mm)
- (3) Distance the dowel holding the thrust washer is above face of the shaft assembly141 in. (3.58 mm)
- (4) Diameter of surface on shaft (journal) for the bearing (new) 2.9970 ± .0005 in. (76.124 ± 0.013 mm)
- Bore in the bearing (new) 3.0014 ± .0019 in. (76.236 ± 0.048 mm)
- Maximum permissible clearance between bearing and shaft (worn)010 in. (0.25 mm)
- (5) Distance the dowel holding the thrust washer is above face of the cover assembly141 in. (3.58 mm)
- (6) Diameter of surface on gear (journal) for the bearing (new) 2.2468 ± .0005 in. (57.069 ± 0.013 mm)
- Bore in the bearing (new) 2.2513 ± .0019 in. (57.183 ± 0.048 mm)
- Maximum permissible clearance between bearing and gear (worn)010 in. (0.25 mm)

**Typical Illustration****REAR ACCESSORY DRIVE GEARS****(D6 Tractors, 966 & 980 Wheel Loaders,
814 Tractors, 815 Compactors & 816
Landfill Compactors)**

- (1) Diameter of surface on gear (journal) for the bearing (new) 2.2470 ± .0005 in. (57.074 ± 0.013 mm)
- Bore in the bearing (new) 2.2520 ± .0019 in. (57.201 ± 0.048 mm)
- Maximum permissible clearance between bearing and gear (worn)010 in. (0.25 mm)
- NOTE: Install the bearing below the surface of the cage06 in. (1.5 mm)
- (2) Diameter of surface on shaft (journal) for the bearing (new) 3.2460 ± .0005 in. (82.448 ± 0.013 mm)
- Bore in the bearing (new) 3.2510 ± .0019 in. (82.575 ± 0.048 mm)
- Maximum permissible clearance between bearing and shaft (worn)010 in. (0.25 mm)

NOTE: When installed in the gear, the grooves in the bearing must be in alignment with the grooves in the gear within 2°

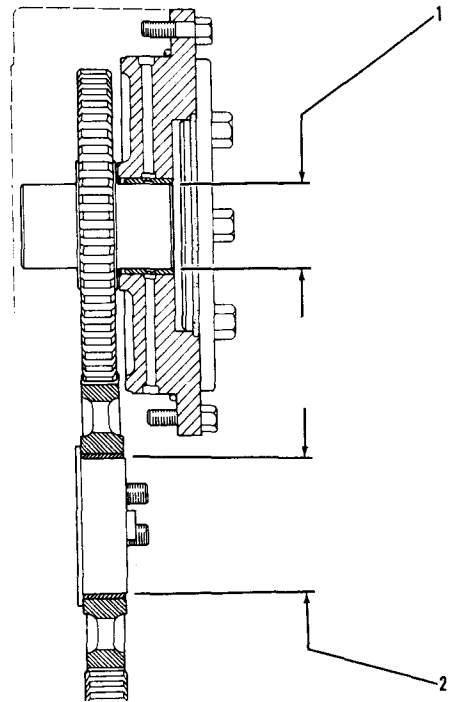
- (3) Put 8H5137 Sealing Compound on threads of bolts (3) before installing.

**Typical Illustration**

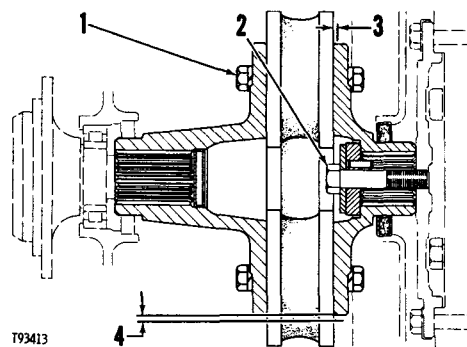
REAR ACCESSORY DRIVE GEARS (D6 Tractor)

- (1) Diameter of surface on gear (journal) for the bearing
(new) $1.9975 \pm .0005$ (50.737 ± 0.013 mm)
- Bore in the bearing
(new) $2.0015 \pm .0019$ (50.838 ± 0.048 mm)
- Maximum permissible clearance between bearing
and gear (worn)010 in. (0.25 mm)
- (2) Diameter of surface on retainer (journal) for the bearing
(new) $3.2470 \pm .0005$ in. (82.474 ± 0.013 mm)
- Bore in the bearing
(new) $3.2510 \pm .0019$ in. (82.575 ± 0.048 mm)
- Maximum permissible clearance between bearing and
retainer (worn)010 in. (0.25 mm)

85317X1

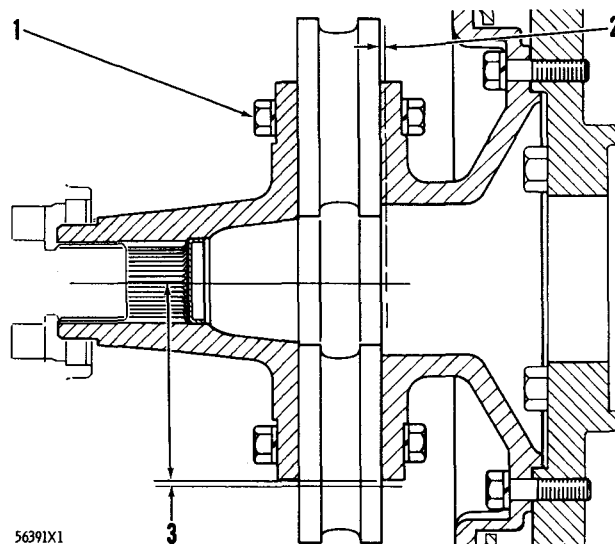


FLEXIBLE DRIVE COUPLING (Earlier; Two Piece Front Flange)



- (1) Torque for bolts 80 ± 5 lb. ft. (11.1 ± 0.7 mkg)
- (2) Torque for bolt holding flange
to drive 160 ± 10 lb. ft. (22.1 ± 1.4 mkg)
- (3) Maximum permissible "runout" axial alignment of face
(total indicator reading)026 in. (0.66 mm)
- (4) Maximum permissible "eccentricity" radial off
center of flywheel output flange rim to torque
converter shaft (total indicator reading)080 in. (2.03 mm)

FLEXIBLE DRIVE COUPLING (Earlier; One Piece Front Flange)

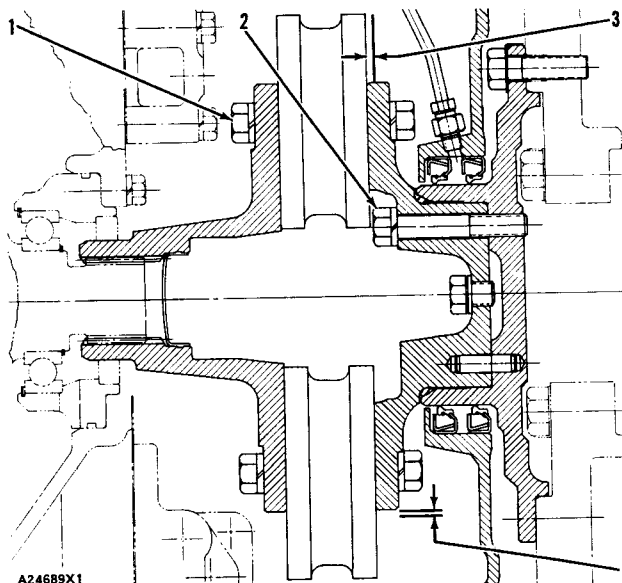


- (1) Torque for bolts 80 ± 5 lb. ft. (11.1 ± 0.7 mkg)
- (2) Maximum permissible "runout" axial alignment of face
(total indicator reading)026 in. (0.66 mm)
- (3) Maximum permissible "eccentricity" radial off
center of flywheel output flange rim to torque
converter shaft (total indicator reading)080 in. (2.03 mm)

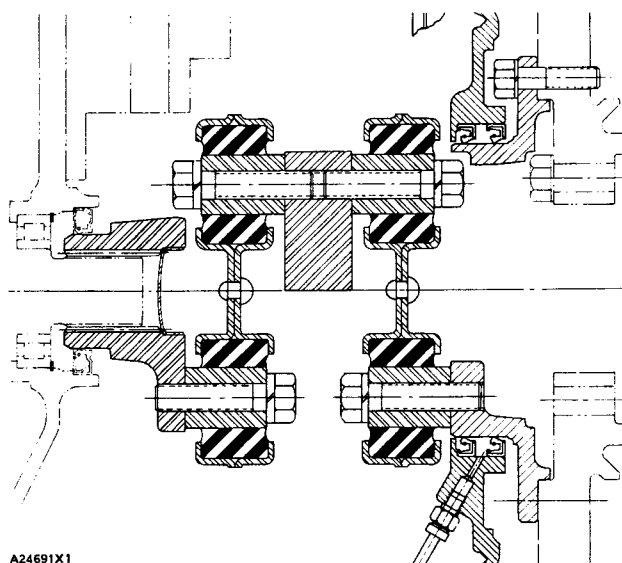
FLEXIBLE COUPLING DRIVE (6P3983, 6P3984, 6P5020)

- (1) Torque for bolts 80 ± 5 lb. ft. (11.1 ± 0.7 mkg)
- (2) Torque for bolts 95 ± 5 lb. ft. (13.1 ± 0.7 mkg)
- (3) Maximum permissible out of square of the face of flange in relation to the input shaft of the torque converter026 in. (0.66 mm)
- (4) Maximum permissible out of round of output flange in relation to the input shaft of the torque converter080 in. (2.03 mm)

NOTE: Fill the grease lines and the area between the seals with grease before installing in the vehicle.



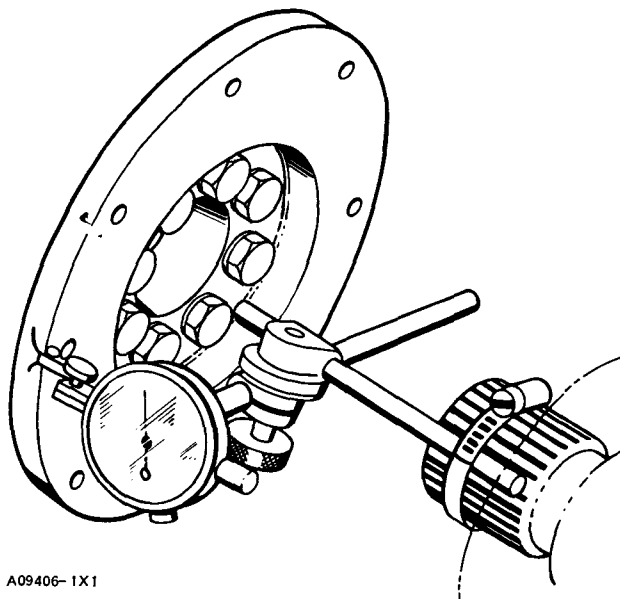
FLEXIBLE COUPLING DRIVE (6P3985)



NOTE: Fill the grease lines and the area between the seals with grease before installing in the vehicle.

NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

CHECKING AND ADJUSTING ALIGNMENT OF THE FLEXIBLE COUPLING DRIVE

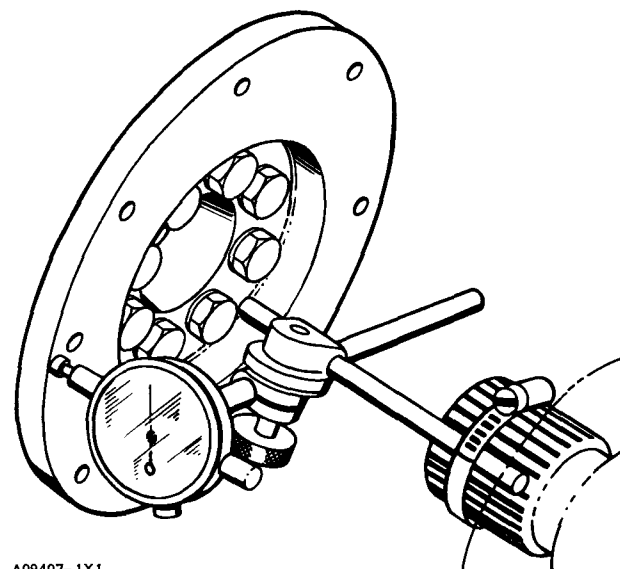


A09406-1X1

1. Remove the bolts, joints and torque converter flange.
2. Fasten a 3/8 in. (9.5 mm) diameter rod 3 in. (76.2 mm) long to the torque converter input shaft with a 1J9778 Hose Clamp. Install a 7H1948 Snug onto the rod. Assemble a 7H1942 Indicator (with a 7H1940 Universal Attachment), and 7H1945 Holding Rod into the 7H1948 Snug.
3. Put the universal attachment on the outside diameter of the engine output flange. Rotate the indicator until it stops on "0". Turn the torque converter input shaft 360°. Record the indicator measurement at each 90° of rotation.
4. The total indicator reading through 360° of rotation must not be more than .080 in. (2.03 mm). The alignment can be made correct by loosening the engine rear bolts and moving the engine from side to side. If the alignment up and down is not correct, install or remove shims under the engine rear supports.
5. If the holes for the support bolts have become larger because of wear, dowels should be installed after the engine has been fastened down. [See Step (8)].
6. Remove the universal attachment. Put the face of the 7H1942 Indicator rod against the engine flange between the bolt holes and outside diameter of the flange. Turn the indicator to "0".
7. Turn the torque converter input shaft 360°. Record the indicator measurement at each 90° of rotation. The total indicator reading through 360° of rotation must not be more than .026 in. (0.66 mm). The alignment can be made correct by loosening the engine front support bolts and moving the front of the engine side to side.
8. Check the vertical and horizontal alignment again. When the alignment is correct, tighten the engine mount bolts:

Make a reference to ENGINE MOUNTING BOLTS for the correct torque for the bolts that hold the engine to the frame.

NOTE: If the alignment is off by a large amount, inspect for the cause. If the frame is bent, it can be straightened. If the engine front support is badly worn, a replacement is needed.



A09407-1X1

ENGINE MOUNTING BOLTS

NOTE: Use a torque wrench to get the correct torque for all the engine mounting bolts.

The chart has the correct tightening torque for all the bolts except those in the list that follows.

| THREAD DIAMETER | | TORQUE | |
|-----------------|-------------|----------|-------------|
| inches | millimeters | lb. ft. | mkg |
| 1/2 | 12.70 | 75 ± 10 | 10.4 ± 1.4 |
| 9/16 | 14.29 | 110 ± 15 | 15.2 ± 2.0 |
| 5/8 | 15.88 | 150 ± 20 | 20.7 ± 2.8 |
| 3/4 | 19.05 | 265 ± 35 | 36.6 ± 4.8 |
| 7/8 | 22.23 | 420 ± 60 | 58.1 ± 8.3 |
| 1 | 25.40 | 640 ± 80 | 88.5 ± 11.1 |

D4 Tractor

Tighten the bolts which hold the front support to the frame to 400 ± 40 lb. ft. (55.3 ± 5.5 mkg)

Solid rear brackets only:

Tighten the bolts which hold the rear brackets together to 400 ± 40 lb. ft. (55.3 ± 5.5 mkg)

Tighten the bolts which hold the rear brackets to the frame to 225 ± 25 lb. ft. (31.1 ± 3.5 mkg)

D5, D6 Tractors

Tighten the bolts which hold the front support to the frame to 350 ± 35 lb. ft. (48.4 ± 4.8 mkg)

Solid rear brackets only:

Tighten the bolts which hold the rear brackets to the frame to 200 ± 20 lb. ft. (27.7 ± 2.8 mkg)

D7 Tractor

Tighten the bolts which hold the front support to the frame to 350 ± 35 lb. ft. (48.4 ± 4.8 mkg)

Tighten the bolts which hold the rear support to the frame to 350 ± 35 lb. ft. (48.4 ± 4.8 mkg)

941-951 Traxcavators

Tighten the bolts which hold the front support to the frame to 460 ± 50 lb. ft. (63.6 ± 6.9 mkg)

Tighten the bolts which hold the block on the flywheel housing to the frame to 460 ± 50 lb. ft. (63.6 ± 6.9 mkg)

955 Traxcavator

Tighten the bolts which hold the front support to the frame to 460 ± 50 lb. ft. (63.6 ± 6.9 mkg)

225 Excavator

Tighten the bolts which hold the support for the hydraulic pump drive housing to the frame to 350 ± 35 lb. ft. (48.4 ± 4.8 mkg)

235 Excavator

Tighten the 1 in. (25.40 mm) diameter bolts which hold the front support to the frame to 880 ± 80 lb. ft. (121.7 ± 11.1 mkg)

Tighten the 3/4 in. (19.05 mm) diameter bolts which hold the bracket to the frame to 400 ± 50 lb. ft. (55.3 ± 6.9 mkg)

Tighten the bolts which hold the top cap to the support for the hydraulic pump drive housing to 400 ± 50 lb. ft. (55.3 ± 6.9 mkg)

Tighten the bolts which hold the top and bottom caps of the support together to 400 ± 50 lb. ft. (55.3 ± 6.9 mkg)

Tighten the bolts which hold the pin for the support to the frame to 400 ± 50 lb. ft. (55.3 ± 6.9 mkg)

627 Tractor-Scraper (Tractor ENGINE only)

Tighten the bolts which hold the rear support to the frame to 350 ± 35 lb. ft. (48.4 ± 4.8 mkg)

NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

ALTERNATORS

7S5897 24V 19A (Prestolite Number ANB6001)

9S4070 24V 19A (Prestolite Number ANB7001)*

Polarity is negative ground

Rated output at 28V 19 A

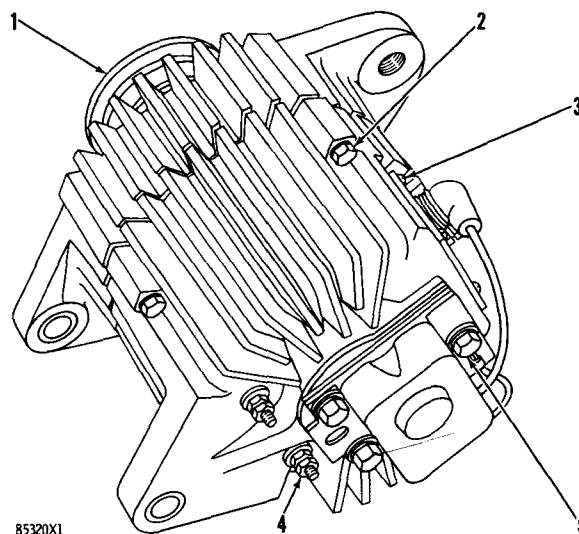
Output at 1500 rpm and 28V 10 A

Resistance of the rotor at 77° F (25° C) 18 to 20 ohm

Current consumption (draw) at 77° F (25° C)
and 24V 1.20 to 1.3A

- (1) Torque for nut holding pulley 87.5 ± 2.5 lb. ft. (12.1 ± 0.3 mkg)
- (2) Torque for bolts 27.5 ± 2.5 lb. in. (31.7 ± 2.9 cm.kg)
- (3) Torque for screws 12.5 ± 2.5 lb. in. (14.4 ± 2.9 cm.kg)
- (4) Torque for terminal nuts ... 32.5 ± 2.5 lb. in. (37.5 ± 2.9 cm.kg)
- (5) Torque for bolts holding the regulator 47.5 ± 2.5 lb. in. (54.8 ± 2.9 cm.kg)

*Including the 9S2329 Regulator (Prestolite Number VSH6401)



2P1698 24V 19A (Prestolite Number ANB6002 or ANB6004)

2P1204 24V 19A (Prestolite Number ANB7002 or ANB7004)*

Polarity is negative ground.

Rated output at 28V 19 A

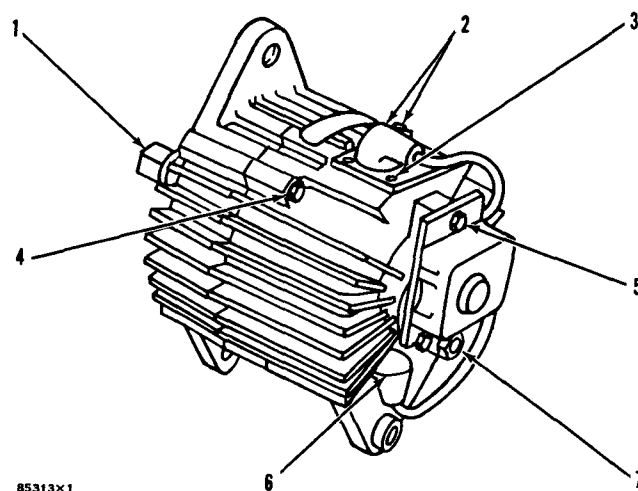
Output at 1500 rpm and 28V 10 A

Resistance of the rotor at 77° F (25° C) 18 to 20 ohm

Current consumption (draw) at 77° F (25° C) and
24V 1.20 to 1.33 A

- (1) Torque for nuts holding pulley 75 ± 5 lb. ft. (10.4 ± 0.7 mkg)
- (2) Torque for nuts for terminals for field and ground 25 to 30 in. lb. (28.8 to 34.6 cm.kg)
- (3) Torque for screws holding terminal plate 12.5 ± 2.5 lb. in. (14.4 ± 2.9 cm.kg)
- (4) Torque for bolts 27.5 ± 2.5 lb. in. (31.7 ± 2.9 cm.kg)
- (5) Torque for bolts holding regulator 47.5 ± 2.5 lb. in. (54.8 ± 2.9 cm.kg)
- (6) Torque for nut for terminal 47.5 ± 2.5 lb. in. (54.8 ± 2.9 cm.kg)
- (7) Torque for nut for positive terminal 225 to 250 lb. in. (259 to 288 cm.kg)

*Including 2P1699 or 4N5938 Regulator (Prestolite Number VSH-6401A or VSH-6401B)



Alternators (Cont.)

4N3986 24V (Delco-Remy Number 1117734)

Rotation can be either direction.

Polarity is negative ground.

Circuit B

Speed for testing 5000 rpm

Output when cold:

Fasten carbon pile to battery to get
maximum output 58 A

Rated output, hot 60 A

Field current at 24V and 80°F (27°C) 2.5 to 2.9 A

Voltage regulator:

Voltage setting range 26 to 30 V

Adjust voltage setting to 28 V

then increase speed to get

maximum output 60 A

(1) Torque for nut holding
pulley 75 ± 5 lb.ft. (10.4 ± 0.7 mkg)

(2) Torque for output
terminal 55 to 75 lb.in. (63 to 87 cm.kg)

4N3987 30 or 32V (Delco-Remy Number 1117733)

Polarity is negative ground.

Circuit B

Speed for testing 5000 rpm

Rotation can be either direction.

Output when cold:

Fasten carbon pile to battery
to get maximum output 56 A

Rated output, hot 60 A

Field current at 32V and 80°F (27°C) 1.5 to 1.6 A

Voltage regulator:

Voltage setting range 33.7 to 37.7 V

Adjust voltage setting to:

for 32V operation 36.7 V

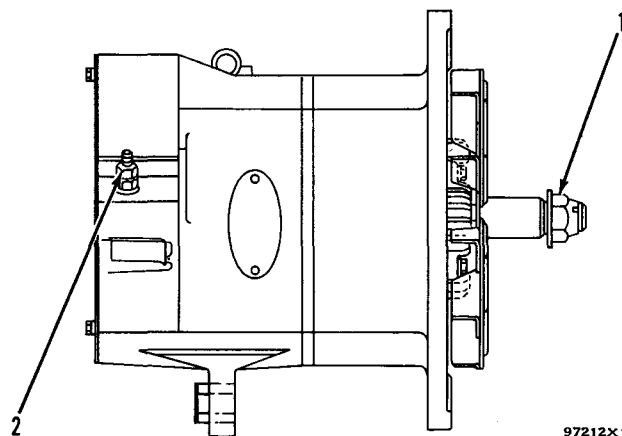
for 30V operation 34.7 V

then increase speed to get

maximum output 60 A

(1) Torque for nut holding
pulley 75 ± 5 lb.ft. (10.4 ± 0.7 mkg)

(2) Torque for output
terminal 55 to 75 lb.in. (63 to 87 cm.kg)



97212X1

NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST
PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

Alternators (Cont.)

5S9088 24V 50A (Delco-Remy Number 1117226)

Rotation can be either direction.

Polarity is negative ground

Circuit B

Speed for testing 5000 rpm

Output when cold:

Fasten carbon pile to battery to get
maximum output 54 A

Rated output, hot 50 A

Field current at 24V and 80° F (27° C) 2.5 to 2.9 A

Voltage regulator:

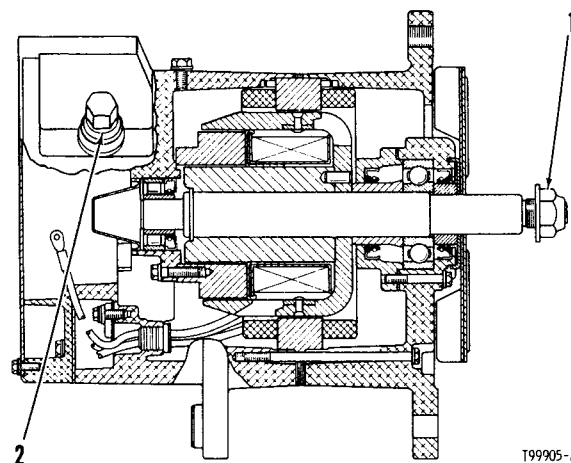
Voltage setting range 26 to 30 V

Adjust voltage setting to 28 V

then increase speed to get

maximum output 50 A

- (1) Torque for nut holding
pulley 75 ± 5 lb. ft. (10.4 ± 0.7 mkg)
- (2) Torque for output terminal 10 ± 1 lb. ft. (1.4 ± 0.14 mkg)



T99905-A

3P77 24V (Delco-Remy Number 1102398)

Polarity is negative ground.

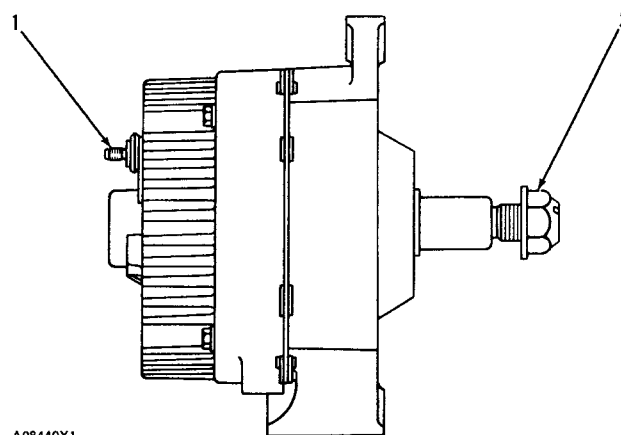
Rotation can be either direction.

Output at 26V and 2600 rpm (cold) 25 A

Output at 26V and 7000 rpm (cold) 41 A

Rated output (hot) 40 A

- (1) Torque for stud nut for battery
connection 25 to 40 lb. in. (29 to 46 cm.kg)
- (2) Torque for pulley nut 60 ± 5 lb. ft. (8.3 ± 0.7 mkg)



A08440X1

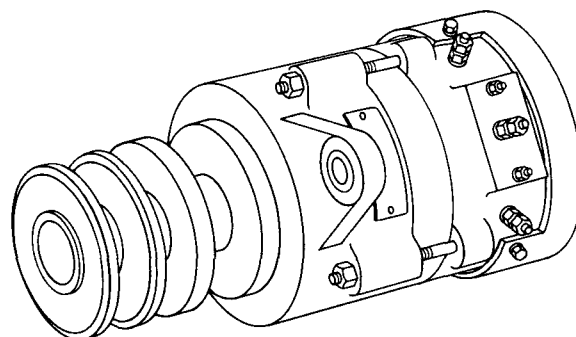
Alternators (Cont.)

5A8908 24V 20A (Mitsubishi Number AR4020A)

Rotation is clockwise when seen from drive end.

Polarity is negative ground.

| | |
|--|-------------------------------------|
| Rated output at 24V | 20 A |
| No load output at speed below 1150 rpm | 28 V |
| Loaded output at speed below 2500 rpm and 28 V | 20 A |
| Resistance of field coil at 68° F (20° C) | 29.5 ohms |
| Tension of brush spring | 11 to 14 oz. (0.33 to 0.42 kg) |
| Minimum permissible tension of spring | 7.4 oz. (0.21 kg) |
| Brush length | .75 in. (19.0 mm) |
| Minimum permissible brush length | .25 in. (6.4 mm) |
| Torque for nut holding pulley | 75 to 90 lb. ft. (10.4 to 12.4 mkg) |
| Torque for nut holding slip rings | 35 lb. ft. (4.8 mkg) |



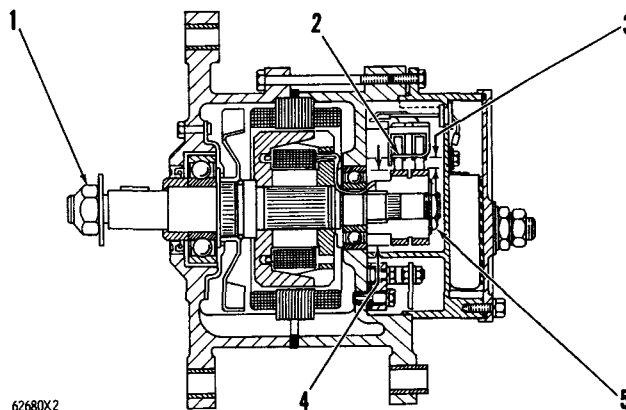
85318X1

3A1997 24V 19A (Paris-Rhone Number A13R-113T)

Polarity is negative ground.

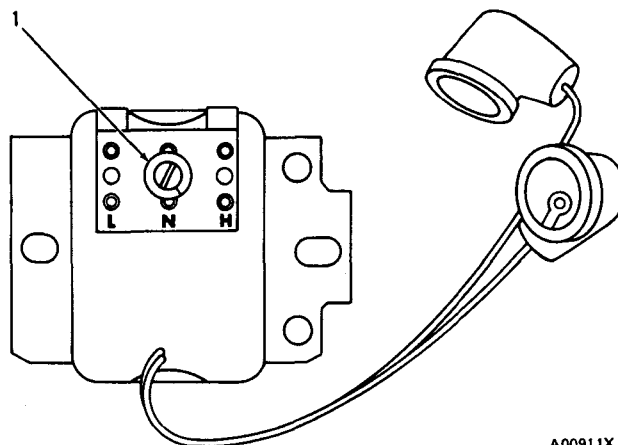
Rotation is clockwise when seen from drive end.

| | |
|--|-------------------------------------|
| Output at 4,000 rpm (hot) | 19 A |
| Output at 1,180 rpm (hot) | 28 V |
| (1) Torque for pulley nut | 75 to 90 lb. ft. (10.4 to 12.4 mkg) |
| (2) Tension of brush spring | 2.25 to 2.75 lb. (1.02 to 1.25 kg) |
| (3) Minimum brush length | 0.44 in. (11.2 mm) |
| (4) Diameter of slip ring (new) | 1.65 in. (42.0 mm) |
| Minimum permissible slip ring diameter | 1.57 in. (40.0 mm) |
| (5) Torque for slip ring nut | 18 to 22 lb. ft. (2.5 to 3.0 mkg) |



62680X2

NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

ALTERNATOR REGULATOR

A00911X1

4N5938 24V (Prestolite Number VSH-6401B)

2P1699 24V (Prestolite Number VSH-6401A)

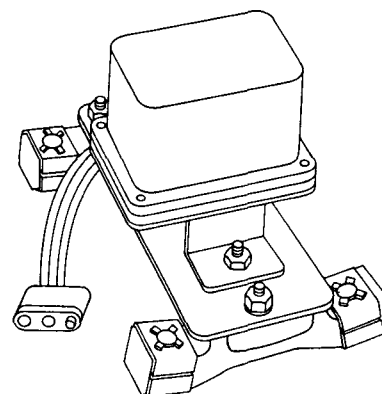
9S2329 24V (Prestolite Number VSH-6401)

Polarity is negative ground.

Voltage setting range at 70°F (21°C) 27.3 to 28.7 V*

(1) Adjustment screw and washer.

*With voltage adjustment screw (1) in position
 "N" (center). When screw (1) is in position
 "L", voltage will be 0.5V less. When screw (1)
 is in position "H", voltage will be 0.5V higher.



85319X1

5A9131 24V (Mitsubishi Number RM4140G)

Voltage range at 3000 rpm 28 to 31 V

GENERATORS

4M9102 24V 20A (Delco-Remy Number 1106971)

Rotation is clockwise when seen from the drive end.

| | |
|--|---------------------------------|
| Circuit | A |
| Speed for testing | 1720 rpm |
| Field current at 24V and 80° F (27° C) | .83 to .89 A |
| Output at 1720 rpm and 26V when cold | 20 A |
| Output when cold | 26 V |
| (1) Tension of brush spring | 20 oz. (0.56 kg) |
| (2) Torque for nut holding pulley | 83 ± 8 lb. ft. (11.5 ± 1.1 mkg) |

1S151 24V 15A (Delco-Remy Number 1105241)

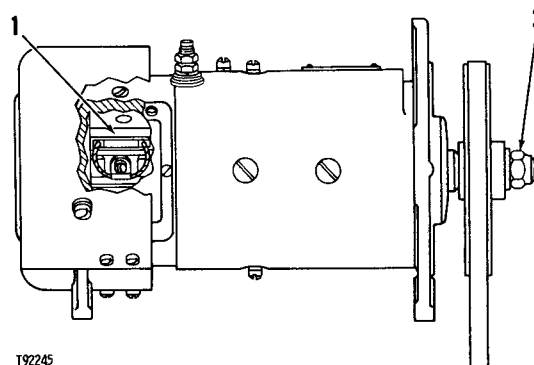
Rotation is clockwise when seen from the drive end.

| | |
|--|---------------------------------|
| Circuit | A |
| Speed for testing | 1800 rpm |
| Field current at 24V and 80° F (27° C) | .94 to 1.02 A |
| Output at 1800 rpm and 28.5V when cold | 15 A |
| Output when cold | 28.5 V |
| (1) Tension of brush spring | 16 oz. (0.45 kg) |
| (2) Torque for nut holding pulley | 83 ± 8 lb. ft. (11.5 ± 1.1 mkg) |

1S5134 24V and 25A (Delco-Remy Number 1106867)

Rotation is clockwise when seen from the drive end.

| | |
|--|---------------------------------|
| Circuit | A |
| Speed for testing | 1700 rpm |
| Field current at 24V 80° F (27° C) | .83 to .89 A |
| Output at 1700 rpm and 26V when cold | 20 A |
| Output when cold | 26 V |
| (1) Tension of brush spring | 20 oz. (0.56 kg) |
| (2) Torque for nut holding pulley | 60 ± 10 lb. ft. (8.3 ± 1.4 mkg) |

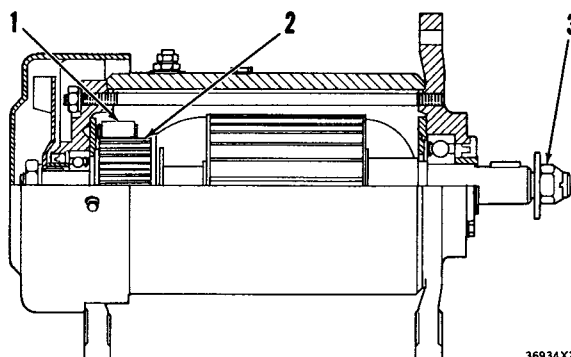


T92245

3A1873 24V (Paris-Rhone Number G 13 R81)

Rotation is clockwise when seen from the drive end.

| | |
|---|---------------------------------|
| Circuit | B |
| Speed for testing | 2400 rpm |
| Output at 2400 rpm and 28.5V | 15 A |
| Output when cold | 28.5 V |
| Field current at 24V 80° F (27° C) | 0.7 to 0.8 A |
| (1) Tension of brush spring | 2.75 lb. (1.25 kg) |
| Minimum permissible length of the brush (worn) | 0.31 in. (8.0 mm) |
| (2) Minimum permissible diameter of the commutator (worn) | 2.05 in. (52.1 mm) |
| (3) Torque for nut holding pulley | 83 ± 8 lb. ft. (11.1 ± 1.1 mkg) |



36934X2

NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

Generators (Cont.)

5A3033 & 5A6539 (Mitsubishi Number DR 350/24MR)

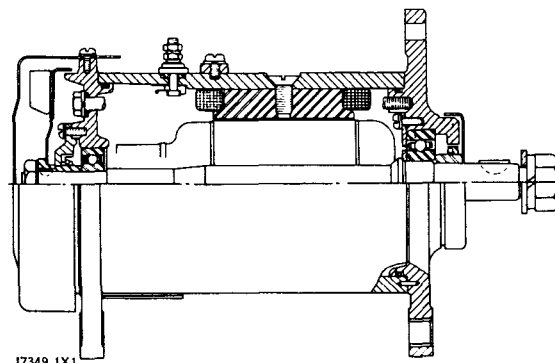
Rotation is clockwise when seen from the drive end.

| | |
|--|-------------------|
| Speed for testing with a load (less than) | 2000 rpm |
| Output with a load | 28.5 V |
| Output at below 2000 rpm and 28.5V | 15 A |
| Speed for testing with no load (less than) | 1550 rpm |
| Output with no load (zero Amps) | 28.5 V |
| Tension of brush spring | .77 lb. (0.35 kg) |

5A7375 (Mitsubishi Number DT 600/24 ZR)

Rotation is clockwise when seen from the drive end.

| | |
|--|-------------------|
| Speed for testing with a load (less than) | 1600 rpm |
| Output with a load | 28 V |
| Output at below 1600 rpm and 28V | 25 A |
| Speed for testing with no load (less than) | 1450 rpm |
| Output with no load (zero Amps) | 28 V |
| Tension of brush spring | .93 lb. (0.42 kg) |



GENERATOR REGULATORS

2M6497 24V 15A (Delco-Remy Number 1119626)

Polarity is negative ground or insulated.

Circuit A

(1) Cutout relay:

| | |
|-----------------------------------|--------------------|
| Air gap between armature and core | .017 in. (0.43 mm) |
| Point gap | .032 in. (0.81 mm) |
| Voltage closing range | 22.8 to 25.2 V |

(2) Current regulator:

| | |
|-----------------------------------|------------------------------------|
| Air gap between armature and core | .068 to .082 in. (1.71 to 2.09 mm) |
| Current setting range | 14 to 16 A |

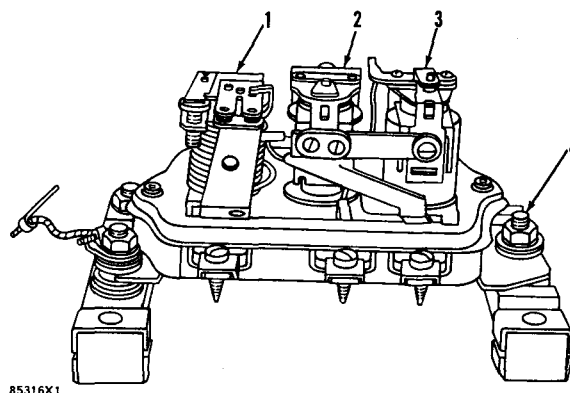
(3) Voltage regulator:

| | |
|---|--------------------|
| Air gap between armature and core | .067 in. (1.7 mm) |
| Point gap | .016 in. (0.41 mm) |
| Voltage setting range at 85° F (29° C): | |

Upper contacts 27.4 to 29.4 V

Lower contacts2 to .6V less than upper contacts

(4) Torque for bolt 36 ± 6 lb. in. (41 ± 7.0 cm.kg)



Generator Regulators (Cont.)

4M9349 24V 20A (Delco-Remy Number 1119653)

Polarity is negative ground or insulated.

Circuit A

(1) Cutout relay:

- Air gap between armature and core015 to .019 in. (0.38 to 0.48 mm)
- Point gap032 in. (0.81 mm)
- Voltage closing range 22.8 to 25.2 V

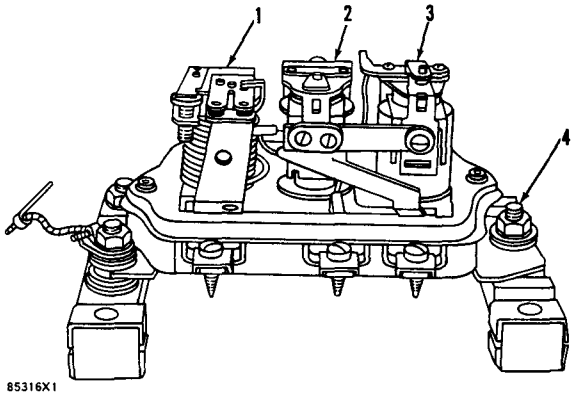
(2) Current regulator:

- Air gap between armature and core068 to .082 in. (1.71 to 2.09 mm)
- Current setting range 19 to 21 A

(3) Voltage regulator:

- Air gap between armature and core067 in. (1.7 mm)
- Point gap016 in. (0.41 mm)
- Voltage setting range at 85° F (29° C):
 - Upper contacts 27.4 to 29.4 V
 - Lower contacts2 to .6V less than upper contacts.

(4) Torque for bolt 36 ± 6 lb. in. (41 ± 7.0 cm.kg)



3S5028 24V 25A (Delco-Remy Number 1119306 and 1119306-E)

Polarity is negative ground.

Circuit A

(1) Cutout relay:

- Air gap between armature and core015 to .019 in. (0.38 to 0.48 mm)
- Point gap032 in. (0.81 mm)
- Voltage closing range 24 to 27 V

(2) Current regulator:

- Air gap between armature and core068 to .082 in. (1.71 to 2.09 mm)
- Current setting range 23 to 27 A

(3) Voltage regulator:

- Air gap between armature and core060 in. (1.52 mm)
- Voltage setting range at 85° F (29° C) 27.5 to 29.5 V

(4) Torque for bolts 36 ± 6 lb. in. (41 ± 7.0 cm.kg)

NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

Generator Regulators (Cont.)**3A1874 24 V (Paris-Rhone Number 2T216)****(1) Cutout relay:**

Air gap between armature and core027 in. (0.68 mm)

Point gap031 in. (0.80 mm)

Closing range when cold 24.0 to 26.0 V

(2) Current regulator:

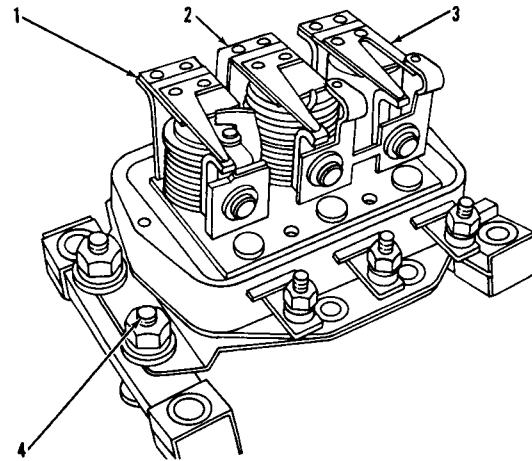
Air gap between armature and core039 in. (1.0 mm)

Current setting range 14 to 15 A

(3) Voltage regulator:

Air gap between armature and core043 in. (1.1 mm)

Voltage setting range at 85° F (29° C) 26.8 to 28.2 V

(4) Torque for bolts 36 ± 6 lb. in. (41 ± 7.0 cm.kg)

85315X1

5A3061 (Mitsubishi Number RW-3B)**Cutout relay:**

Air gap between armature and core043 to .055 in. (1.1 to 1.4 mm)

Back gap030 to .047 in. (0.76 to 1.2 mm)

Point gap020 to .032 in. (0.5 to 0.8 mm)

Switch in 24.5 ± 1 V

Reverse current (less than) 7 A

Voltage regulator:

Air gap between armature and core039 to .047 in. (1.0 to 1.2 mm)

Back gap029 to 0.43 in. (0.74 to 1.1 mm)

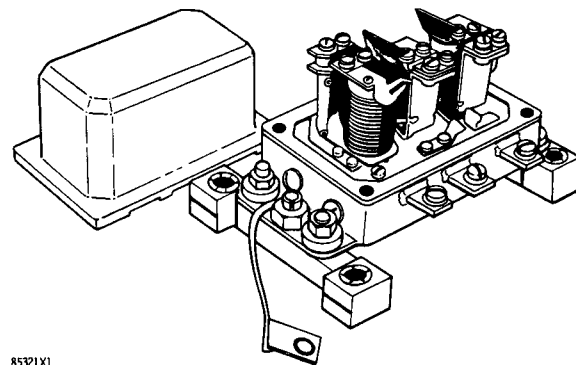
Regulator setting (no load) at 3000 rpm 27.5 to 29.5 V

Current regulator:

Air gap between armature and core047 to .055 in. (1.2 to 1.4 mm)

Back gap029 to .043 in. (0.74 to 1.1 mm)

Current limiter setting range at 3000 rpm 14 to 16 A



85321X1

5A7385 (Mitsubishi Number RT4342E)**Cutout relay:**

Air gap between armature and core051 in. (1.3 mm)

Point gap016 to .024 in. (0.4 to 0.6 mm)

Switch in 26 to 27 V

Reverse current (less than) 10 A

Voltage regulator:

Air gap between armature and core079 to .087 in. (2.0 to 2.2 mm)

Regulator setting (no load) at 3000 rpm 28 to 29 V

Current regulator:

Air gap between armature and core051 to .069 in. (1.3 to 1.8 mm)

Current limiter setting range at 4000 rpm 24 to 26 A

STARTING MOTORS

1P7838 24V (Delco-Remy Number 1113992)

9M1662 24V (Delco-Remy Number 1113967)

4N3182 24V (Delco-Remy Number 1114711)

Rotation is clockwise when seen from drive end.

Minimum speed with no load 5500 rpm

Maximum speed with no load 7500 rpm

Current consumption (draw) at no load:

Minimum with solenoid at 20V 75 A

Maximum with solenoid at 20V 95 A

Clearance between pinion and housing

(pinion clearance)36 in. (9.1 mm)

(1) Tension of brush spring 80 oz. (2.26 kg)

(2) Torque for screws holding nose housing to
lever housing 13 to 17 lb. ft. (1.8 to 2.4 mkg)

(3) Torque for terminal nuts 20 to 25 lb. ft. (2.8 to 3.5 mkg)

8S3961 24V (Delco-Remy Number 1109624)

8S9207 24V (Delco-Remy Number 1109628)

3S8473 24V (Delco-Remy Number 1109998)

3S4458 and 8S9542 24V (Delco-Remy Number 1109757)

Rotation is clockwise when seen from drive end.

Minimum speed with no load 5500 rpm

Maximum speed with no load 7500 rpm

Current consumption (draw) at no load:

Minimum with solenoid at 20V 95 A

Maximum with solenoid at 20V 120 A

Clearance between pinion and housing

(pinion clearance)36 in. (9.1 mm)

(1) Tension of brush spring 80 oz. (2.26 kg)

(2) Torque for screws holding nose housing
to lever housing 13 to 17 lb. ft. (1.8 to 2.4 mkg)

(3) Torque for terminal nuts 20 to 25 lb. ft. (2.8 to 3.5 mkg)

4N3313 24V (Delco-Remy Number 1109645)

1P9182 24V (Delco-Remy Number 1109632)

4N3180 24V (Delco-Remy Number 1109640)

Rotation is clockwise when seen from drive end.

Minimum speed with no load 5500 rpm

Maximum speed with no load 7500 rpm

Current consumption (draw) at no load:

Minimum with solenoid at 20V 127.5 A

Maximum with solenoid at 20V 160.1 A

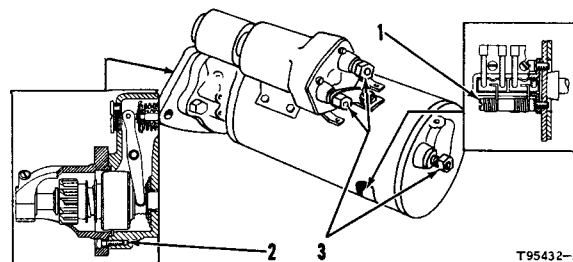
Clearance between pinion and housing

(pinion clearance)36 in. (9.1 mm)

(1) Tension of brush spring 80 oz. (2.26 kg)

(2) Torque for screws holding nose housing to
lever housing 13 to 17 lb. ft. (1.8 to 2.4 mkg)

(3) Torque for terminal nuts 20 to 25 lb. ft. (2.8 to 3.5 mkg)



T95432-A

**NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST
PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES**

Starting Motors (Cont.)

2P2502 24V (Delco-Remy Number 1113393)**4N7902 24V (Delco-Remy Number 1113415)**

Rotation is clockwise when seen from drive end.

Minimum speed with no load 5500 rpm

Maximum speed with no load 7500 rpm

Current consumption (draw) at no load:

Minimum with solenoid at 20 V 60 A

Maximum with solenoid at 20 V 80 A

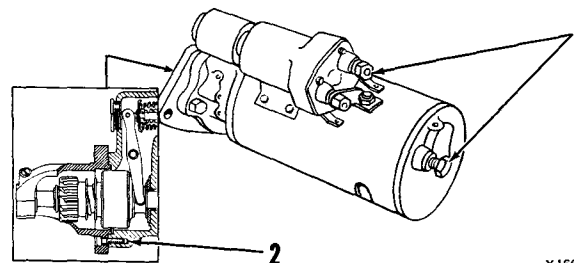
Clearance between pinion and housing

(pinion clearance)36 in. (9.1 mm)

(1) Tension of brush spring* 36 to 40 oz. (1.01 to 1.14 kg)

(2) Torque for terminal nuts 20 to 25 lb. ft. (2.8 to 3.5 mkg)

*Minimum for leaf springs 80 oz. (2.27 kg)



X 1661

7S5900 and 2P2501 24V (Prestolite Number MYF-6201K)**3P6 24V (Prestolite Number MFY 6401K)****4N7901 24V (Prestolite Number MFY 6401 L)**

Rotation is clockwise when seen from drive end.

Minimum speed with no load 6500 rpm

Current consumption (draw) at no load:

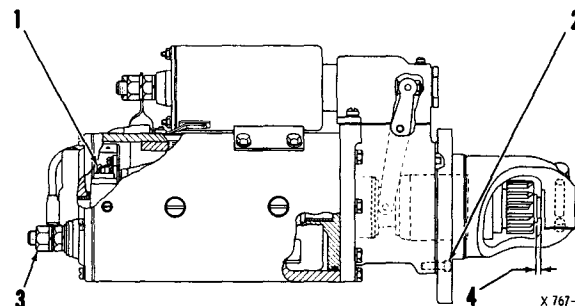
Maximum at 20V 77 A

(1) Tension of brush spring 52 to 65 oz. (1.49 to 1.86 kg)

(2) Torque for screws holding nose housing to lever housing 8 lb. ft. (1.1 mkg)

(3) Torque for terminal nuts 20 to 25 lb. ft. (2.8 to 3.5 mkg)

(4) Clearance between pinion and housing (pinion clearance)020 to .050 in. (0.51 to 1.27 mm)



X 767-A

7S2234 and 1P839 24V (Prestolite Number MES6101K)**4N7752 24V (Prestolite Number MES 6404 K)****2P6162 24V (Prestolite Number MES 6301 K)**

Rotation is clockwise when seen from drive end.

Minimum speed with no load 5000 rpm

Current consumption (draw) with no load:

Maximum at 20 V 77 A

(1) Tension of brush spring 80 to 90 oz. (2.27 to 2.55 kg)

(2) Torque for housing bolts 8 lb. ft. (1.1 mkg)

(3) Torque for terminal nuts 20 to 25 lb. ft. (2.8 to 3.5 mkg)

(4) Clearance between pinion and housing (pinion clearance)020 to .050 in. (0.51 to 1.27 mm)

Starting Motors (Cont.)

3A2035 24V (Paris-Rhone Number D13 E76)**3A1872 24V (Paris-Rhone Number D13 E77)**

Rotation is clockwise when seen from drive end.

Maximum speed with no load at 20 V 6000 rpm

Current consumption (draw) at no load:

Maximum with solenoid at 20 V and 6000 rpm 75 A

Minimum permissible diameter of the commutator 2.05 in. (52.1 mm)

Clearance between pinion and support (pinion clearance)039 ± .020 in. (1.00 ± 0.5 mm)

(1) Tension of brush spring 53.3 ± 5.3 oz. (1500 ± 150 gr.)

(2) Torque for screws holding support to lever housing 15 ± 2 lb. ft. (2.1 ± 0.3 mkg)

(3) Torque for terminal nuts 22.5 ± 2.5 lb. ft. (3.1 ± 0.3 mkg)

3A1529 24V (Paris-Rhone Number D13 E68)**3A1531 24V (Paris-Rhone Number D13 E75)**

Rotation is clockwise when seen from drive end.

Maximum speed with no load at 20 V 6000 rpm

Current consumption (draw) with no load:

Maximum with solenoid at 20 V and 6000 rpm 75 A

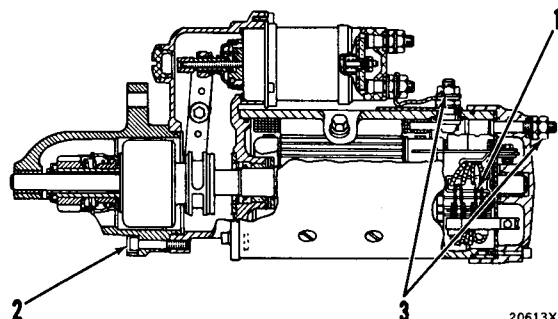
Minimum permissible diameter of the commutator 2.05 in. (52.1 mm)

Clearance between pinion and thrust washer (pinion clearance)039 ± .020 in. (1.00 ± 0.51 mm)

(1) Tension of brush spring 53.3 ± 5.3 oz. (1500 ± 150 gr.)

(2) Torque for screws holding support to lever housing 15 ± 2 lb. ft. (2.1 ± 0.3 mkg)

(3) Torque for terminal nuts 22.5 ± 2.5 lb. ft. (3.1 ± 0.3 mkg)

**5A6492 and 5A3031 (Mitsubishi Number MT 10/24 ZR)****5A6494 and 5A3196 (Mitsubishi Number MT 10/24 YR)**

Rotation is clockwise when seen from drive end.

Minimum speed with no load 6000 rpm

Current consumption (draw) at no load:

Maximum at 23V 110 A

Stall torque test:

Maximum current consumption (draw) at 9V (maximum) 1500 A

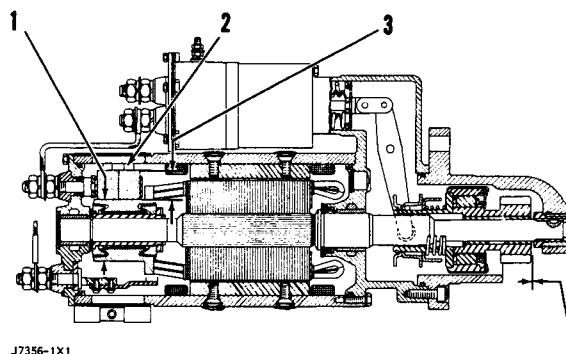
Stall torque at 9V (minimum) 79.6 lb. ft. (11 mkg)

(1) Minimum permissible diameter of the commutator 2.01 in. (51.1 mm)

(2) Tension of brush spring 2.29 ± .34 lb. (1.04 ± 0.16 kg)

(3) Minimum permissible length of brushes55 in. (14.0 mm)

(4) Clearance between pinion and housing (pinion clearance)118 to .138 in. (2.99 to 3.51 mm)



NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

Starting Motors (Cont.)

5A6522 (Mitsubishi Number MRA 7 5/24 ER or MOO7T03774)

5A6495 (Mitsubishi Number MRE 7 5/24 ER)

5A5744 (Mitsubishi Number MTR 7 5/24 YR)

Rotation is clockwise when seen from drive end.

Minimum speed with no load 6000 rpm

Current consumption (draw) at no load:

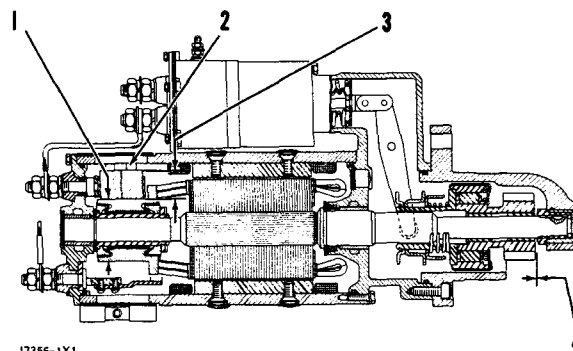
Maximum at 23V 110 A

Stall torque test:

Maximum current consumption (draw) at 9V
(maximum) 1500 A

Stall torque at 9V (minimum) 80 lb. ft. (11 mkg)

- (1) Minimum permissible diameter of the commutator 2.01 in. (51.1 mm)
- (2) Tension of brush spring $4.6 \pm .7$ lb. (2.1 ± 0.3 kg)
- (3) Minimum permissible length of brushes55 in. (14.0 mm)
- (4) Clearance between pinion and housing (pinion clearance)118 to .138 in. (3 to 3.5 mm)



STARTER SOLENOIDS

4M1812 24V (Delco-Remy Number 1119832 or 1119848)

Current consumption (draw):

Current pull in windings at 5V 10 to 11.5 A

Current pull in windings at 20 to 24V 40 to 55.2 A

Current hold in winding at 20 to 24V Maximum of 8.2 A

- (1) 4M1815 Spring for contact release:

Length under test force42 in. (10.7 mm)

Test force 8.5 to 9.5 lb. (3.9 to 4.3 kg)

Free length after test $.83 \pm .015$ in. (21.1 ± 0.38 mm)Outside diameter $.875 \pm .010$ in. (22.23 ± 0.25 mm)

- (2) 9M7609 or 8M1856 Spring to return the clutch lever:

Length under test force 1.56 in. (39.6 mm)

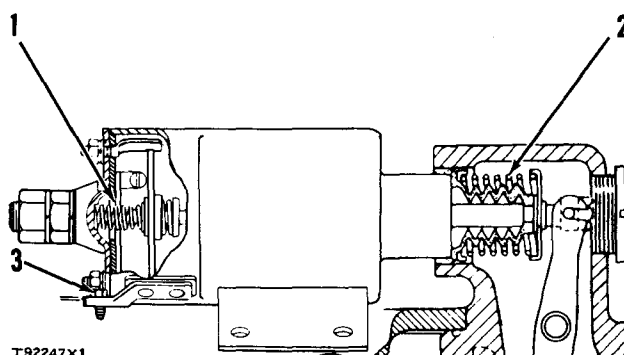
Test force $14 \pm .5$ lb. (6.35 ± 0.2 kg)

Free length after test 2.79 in. (70.9 mm)

Outside diameter $1.393 \pm .015$ in. (35.38 ± 0.38 mm)

- (3) Torque for terminal

screws 16 to 30 lb. in. (18.4 to 35.0 cm.kg)



Starter Solenoids (Cont.)

1P9181 24V (Delco-Remy Number 1115526)

Current consumption (draw):

| | |
|----------------------------|--------------|
| Current at 20V | 40 to 45.5 A |
| Current at 20 to 24V | 40 to 54.6 A |

(1) 4M1815 Spring for contact release:

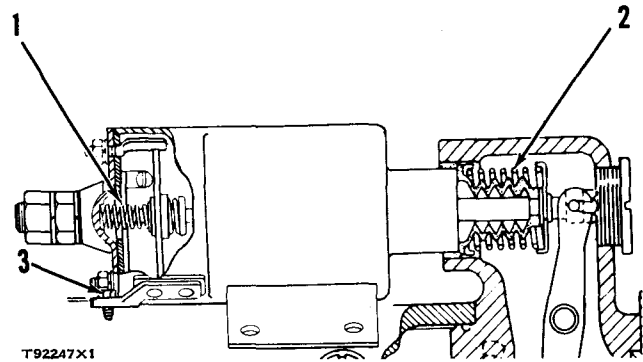
| | |
|-------------------------------|-----------------------------------|
| Length under test force | .42 in. (10.7 mm) |
| Test force | 8.5 to 9.5 lb. (3.9 to 4.3 kg) |
| Free length after test | .83 ± .015 in. (21.1 ± 0.38 mm) |
| Outside diameter | .875 ± .010 in. (22.23 ± 0.25 mm) |

(2) 9M7609 Spring to return the clutch lever:

| | |
|-------------------------------|------------------------------------|
| Length under test force | 1.56 in. (39.6 mm) |
| Test force | 14 ± .5 lb. (6.35 ± 0.2 kg) |
| Free length after test | 2.79 in. (70.9 mm) |
| Outside diameter | 1.393 ± .015 in. (35.38 ± 0.38 mm) |

(3) Torque for terminal

| | |
|--------------|---------------------------------------|
| screws | 16 to 30 lb. in. (18.4 to 35.0 cm.kg) |
|--------------|---------------------------------------|



9S7976 24V (Prestolite Number SAT-4103)

8S1529 24V (Prestolite Number SAT-4101)

Current consumption (draw):

| | |
|--|----------------|
| Current pull in windings at 12 V | 23.2 to 26.6 A |
| Current pull in windings at 20 to 24 V | 38.6 to 52.4 A |
| Current hold in windings at 12 V | 4.1 to 4.8 A |
| Current hold in windings at 20 to 24 V | 6.8 to 9.6 A |

3A1555 24V (Paris-Rhone Number CED65)

Current Consumption (draw):

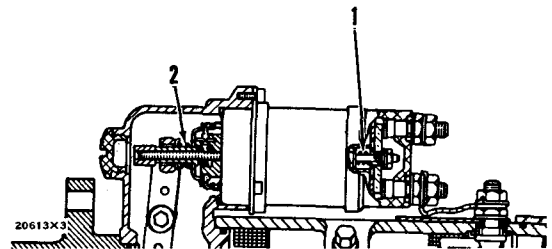
| | |
|---------------------------------------|--------------|
| Current both windings at 20V | 70 ± 7 A |
| Current hold in windings at 20V | 11.2 ± 1.2 A |

(1) Spring for contact release:

| | |
|-------------------------------|---------------------------------|
| Length under test force | .295 in. (7.49 mm) |
| Test force | 18.7 ± 1.9 lb. (8.48 ± 0.86 kg) |
| Free length after test | .433 ± .010 (10.99 ± 0.25 mm) |
| Outside diameter | .37 in. (9.5 mm) |

(2) Spring to return the clutch lever:

| | |
|-------------------------------|-------------------------------|
| Length under test force | 2.4 in. (61.0 mm) |
| Test force | 13.2 ± 1.3 lb. (6.0 ± 0.6 kg) |
| Outside diameter | .45 in. (11.5 mm) |



NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

STARTER MAGNETIC SWITCHES

7M4291 24V (Delco-Remy Number 1119866)

Current consumption (draw) at 20 V 3.5 to 3.9 A

(1) 7M7553 Spring:

Length under test force278 in. (7.06 mm)

Test force 7.6 to 8.4 lb. (3.4 to 3.8 kg)

Free length after test657 in. (16.69 mm)

Outside diameter514 in. (13.06 mm)

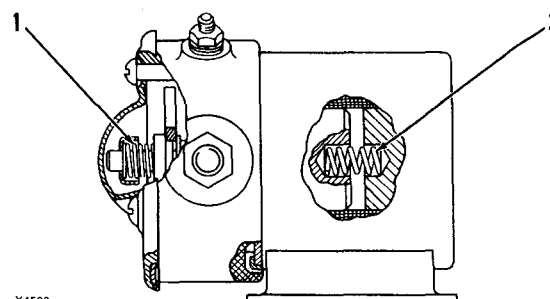
(2) 7M7622 Spring:

Length under test force56 in. (14.2 mm)

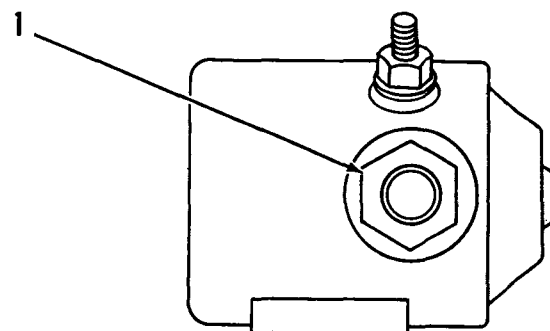
Test force 2.65 to 3.25 lb. (1.2 to 1.5 kg)

Free length after test874 in. (22.20 mm)

Outside diameter434 in. (11.02 mm)



X4500



30707X2

9F3099 24V (Delco-Remy Number 0001481)

Current consumption (draw) both
windings at 24 V83 to .89 A

(1) Torque for large terminal

nuts 30 to 40 lb. in. (35 to 46 cm.kg)

5L5886 12V (Delco-Remy Number 0001486)

302266 or 9N964 12V (Delco-Remy Number 1119828)

Rating 12 V

Current consumption (draw) hold-in
windings at 8 V 2.1 to 2.4 A

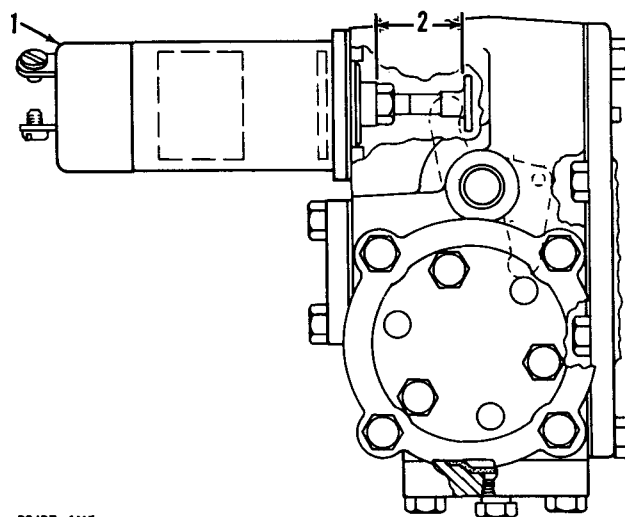
(1) Torque for large terminal

nuts 30 to 40 lb. in. (35 to 46 cm.kg)

SHUTOFF SOLENOID

- (1) 4N3889 12V (Synchro Start Number Series 1500)
 Current consumption (draw):
 Current pull in windings at 12 V 21 A
 Current hold in windings at 14.3 V less than 1 A
- (1) 4N3890 24V or 32V (Synchro Start Number Series 1500)
 Current consumption (draw):
 Current pull in windings at 24 V 10 A
 Current hold in windings at 28 V less than 1 A
- (2) Distance from face to shaft shoulder* 1.02 in. (25.88 mm)

*A test on the engine can show need for more adjustment. The hold in test on engine must take less than 1A.

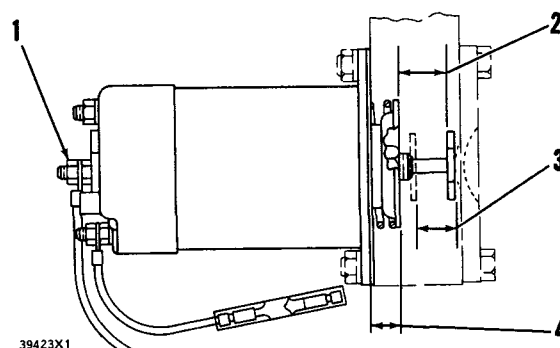


5L5645 24V (Delco-Remy Number 1119891)

2N2385 24V or 32V (Delco-Remy Number 1115524)

Current consumption (draw):

- Current pull in windings at 9V 5.5 to 6.3 A
 Current pull in windings at 20 to 24V 12.2 to 16.8 A
 Current hold in windings at 20 to 24V Maximum of 45 A
- (1) Torque for terminal nuts 14 ± 3 lb. in. (16 ± 3.5 cm.kg)
- (2) Distance from 5L8982 or 3N548 shaft to plate70 in. (17.8 mm)
 Distance from 7L5189 shaft to plate 1.25 in. (31.8 mm)
- (3) Distance plunger will travel [start with dimension of .44 in. (11.2 mm) at (4)]62 in. (15.7 mm)



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