

Section 20 ENGINE REPAIR

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Group 00

SPECIFICATIONS AND SPECIAL TOOLS

Cylinder Head, Valves and Camshaft

Item	New Part Specification	Maximum Serviceable Dimension
Valve clearance		
4270D	0.018 in. (0.46 mm)	
6404; 6466		
Intake Valves	0.018 in. (0.46 mm)	
Exhaust Valves	0.028 in. (0.71 mm)	
Valve lift at specified clearance		
4270D		
Intake Valves	0.431 to 0.461 in. (10.95 to 11.71 mm)	
Exhaust Valves	0.427 to 0.457 in. (10.85 to 11.61 mm)	
6404D; 6466D	0.428 to 0.430 in. (10.87 to 10.92 mm)	
Intake Valves	0.424 to 0.454 in. (10.77 to 11.53 mm)	
Exhaust Valves	0.414 to 0.444 in. (10.52 to 11.28 mm)	
6404T, A; 6466T, A		
Intake Valves	0.412 to 0.442 in. (10.46 to 11.23 mm)	
Exhaust Valves	0.413 to 0.443 in. (10.49 to 11.25 mm)	
Valve springs - compressed		
Valve closed	1.81 in. at 54 to 62 lbs. (45.9 mm at 240.2 to 275.8 N)	
Valve open	1.36 in. at 133 to 153 lbs. (34.5 mm at 591.6 to 680.5 N)	
Valve face angle		
4270D; 6404D	44-1/2°	
6404T, A; 6466	29-1/2°	
Valve face O.D.	1.710 to 1.720 in. (43.4 to 43.7 mm)	
Valve stem O.D.	0.3715 to 0.3725 in. (9.43 to 9.46 mm)	
Valve guide I.D.	0.3745 to 0.3755 in. (9.512 to 9.537 mm)	
Valve stem-to-guide clearance	0.002 to 0.004 in. (0.051 to 0.102 mm)	0.006 in. (0.15 mm)
Valve seat width	0.083 to 0.093 in. (2.11 to 2.36 mm)	
Valve seat runout (concentricity with valve guide)		0.002 in. (0.05 mm)
Valve seat angle		
4270D; 6404D	45°	
6404T, A; 6466	30°	

Cylinder Head, Valves and Camshaft—Continued

Item	New Part Specification	Maximum Serviceable Dimension
Valve height in relation to cylinder head surface		
4270D; 6404D; 6466D	0.038 to 0.050 in. (0.96 to 1.27 mm) below	
Intake Valves	0.038 to 0.050 in. (0.96 to 1.27 mm) below	
Exhaust Valves	0.054 to 0.068 in. (1.37 to 1.72 mm) below	
6404T, A; 6466T, A	0.038 in. (0.096 mm) above to 0.006 in. (0.15 mm) below	
Camshaft end play	0.0025 to 0.0085 in. (0.06 to 0.22 mm)	0.015 in. (0.38 mm)
Camshaft thrust plate thickness	0.186 to 0.189 in. (4.72 to 4.80 mm)	0.182 in. (4.62 mm)
Camshaft bushing journal O.D.	2.3745 to 2.3755 in. (60.31 to 60.34 mm)	
Camshaft bushing I.D.	2.3775 to 2.3795 in. (60.39 to 60.44 mm)	
Bushing-to-journal clearance	0.002 to 0.005 in. (0.05 to 0.13 mm)	0.006 in. (0.15 mm)

Torques

Cylinder head-to-block - Initial

Initial		
4270D	115 ft-lbs (156 Nm) (15.6 kgm)	
6404D	105 ft-lbs (142 Nm) (14.2 kgm)	
6404T, A	80 ft-lbs (108 Nm) (10.8 kgm)	
6466	105 ft-lbs (142 Nm) (14.2 kgm)	
Second		
4270D	130 ft-lbs (180 Nm) (18.0 kgm)	
6404D	130 ft-lbs (180 Nm) (18.0 kgm)	
6404T, A	115 ft-lbs (156 Nm) (15.6 kgm)	
6466 (plain head)	115 ft-lbs (156 Nm) (15.6 kgm)	
6466 ("12.9" head)	130 ft-lbs (180 Nm) (18.0 kgm)	
Final		
4270D	130 ft-lbs (180 Nm) (18.0 kgm)	
6404D	150 ft-lbs (204 Nm) (20.4 kgm)	
6404T, A	130 ft-lbs (180 Nm) (18.0 kgm)	
6466 (plain head)	130 ft-lbs (180 Nm) (18.0 kgm)	
6466 ("12.9" head)	150 ft-lbs (204 Nm) (20.4 kgm)	
Rocker arm shaft clamps	55 ft-lbs (75 Nm) (7.5 kgm)	
Intake manifold-to-cylinder head	35 ft-lbs (47 Nm) (4.7 kgm)	
Intake cover-to-intake manifold	20 ft-lbs (27 Nm) (2.7 kgm)	
Camshaft thrust plate	20 ft-lbs (27 Nm) (2.7 kgm)	
Camshaft gear	85 ft-lbs (115 Nm) (11.5 kgm)	
Timing gear cover	30 ft-lbs (41 Nm) (4.1 kgm)	
Rocker arm cover	6 ft-lbs (8 Nm) (0.8 kgm)	

Cylinder Block, Liners, Pistons and Rods

Piston oil control ring clearance	0.0024 to 0.0040 in. (0.06 to 0.10 mm)	0.0065 in. (0.16 mm)
Piston pin O.D.		
4270D; 6404D	1.4997 to 1.5003 in. (38.09 to 38.11 mm)	
6404T, A; 6466D	1.6247 to 1.6253 in. (41.27 to 41.28 mm)	
6466T, A	1.8739 to 1.8745 in. (47.60 to 47.61 mm)	
Pin bore in piston I.D.		
4270D; 6404D	1.5003 to 1.5009 in. (38.11 to 38.12 mm)	
6404T, A; 6466D	1.6253 to 1.6259 in. (41.28 to 41.30 mm)	
6466T, A	1.8748 to 1.8752 in. (47.62 to 47.63 mm)	

Cylinder Block, Liners, Pistons and Rods—Continued

Item	New Part Specification	Maximum Serviceable Dimension
Rod pin bushing I.D.		
4270D; 6404D	1.5010 to 1.5020 in. (38.13 to 38.15 mm)	
6404T, A; 6466D	1.6260 to 1.6270 in. (41.30 to 41.33 mm)	
6466T, A	1.8725 to 1.8762 in. (47.63 to 47.66 mm)	
Pin-to-bushing oil clearance	0.0007 to 0.0023 in. (0.020 to 0.060 mm)	0.0030 in. (0.080 mm)
Connecting rod journal O.D.	2.9980 to 2.9990 in. (76.15 to 76.17 mm)	
Connecting rod bearing assembled I.D.		
4270D; 6404T, A	3.0015 to 3.0025 in. (78.24 to 78.26 mm)	
6404D; 6466	3.0005 to 3.0025 in. (76.21 to 76.26 mm)	
Bearing-to-journal oil clearance		
4270D; 6404T, A	0.0015 to 0.0045 in. (0.038 to 0.114 mm)	0.0060 in. (0.152 mm)
6404D; 6466	0.0010 to 0.0040 in. (0.020 to 0.100 mm)	0.0060 in. (0.152 mm)
Connecting rod journal bore out-of-round		0.001 in. (0.025 mm)
Connecting rod cap end gap (6-cyl. only)		0.010 in. (0.25 mm)
Piston O.D. -measured 0.09 in. (2.28) from bottom of piston		
Early 6404D	4.2455 to 4.2465 in. (107.836 to 107.861 mm)	
4270D	4.2450 to 4.2455 in. (107.823 to 107.836 mm)	"Low"
	4.2455 to 4.2460 in. (107.836 to 107.848 mm)	"High"
6404	4.2450 to 4.2460 in. (107.823 to 107.848 mm)	"Low"
	4.2466 to 4.2473 in. (107.864 to 107.881 mm)	"High"
6466	4.5575 to 4.5582 in. (115.760 to 115.778 mm)	"Low"
	4.5582 to 4.5589 in. (115.778 to 115.769 mm)	"High"
Cylinder liner I.D. -measured at four places		
4270D	4.2500 to 4.2507 in. (107.950 to 107.968 mm)	"Low"
	4.2507 to 4.2514 in. (107.968 to 107.986 mm)	"High"
6404	4.2493 to 4.2500 in. (107.932 to 107.950 mm)	"Low"
	4.2500 to 4.2507 in. (107.950 to 107.968 mm)	"High"
6466	4.5615 to 4.5625 in. (115.862 to 115.887 mm)	"Low"
	4.5625 to 4.5635 in. (115.887 to 115.913 mm)	"High"
Piston-to-liner clearance		
4270D	0.0047 to 0.0059 in. (0.119 to 0.150 mm)	
6404	0.0027 to 0.0041 in. (0.069 to 0.104 mm)	
6466	0.0036 to 0.0053 in. (0.091 to 0.135 mm)	0.0060 in. (0.150 mm)
Cylinder liner taper		0.0020 in. (0.050 mm)
Cylinder liner height above block		
4270D; 6404	0.001 to 0.004 in. (0.025 to 0.100 mm)	
6466		
In new block	0.002 to 0.005 in. (0.05 to 0.12 mm)	
In used block	0.000 to 0.004 in. (0.00 to 0.10 mm)	
Torques		
Connecting rod caps	55 ft-lbs (75 Nm) (7.5 kgm) plus 90° + 10° - 0°	
Piston cooling orifices	85 to 115 in-lbs (9.6 to 12.4 Nm) (0.9 to 1.2 kgm)	
Oil pan-to-cylinder block		
1/2 inch cap screws	85 ft-lbs (115 Nm) (11.5 kgm)	
3/8 inch cap screws	35 ft-lbs (47 Nm) (4.7 kgm)	

Crankshaft, Main Bearings, Flywheel, and 4270D Balancer

Item	New Part Specification	Maximum Serviceable Dimension
Crankshaft end play		
2-piece thrust bearing	0.0025 to 0.0085 in. (0.064 to 0.216 mm)	0.0085 in. (0.216 mm)
5-piece thrust bearing	0.0015 to 0.0150 in. (0.038 to 0.380 mm)	0.0150 in. (0.380 mm)
Damper radial runout		0.040 in. (1.0 mm)
Main bearing journal O.D.	3.3720 to 3.3730 in. (85.649 to 85.674 mm)	
Main bearing assembled I.D.	3.3742 to 3.3762 in. (85.705 to 85.755 mm)	
Bearing-to-journal oil clearance	0.0012 to 0.0042 in. (0.051 to 0.108 mm)	0.0077 in. (0.196 mm)
Undersize bearings available	0.002, 0.010, 0.020, 0.030 inch (0.05, 0.25, 0.50, 0.75 mm)	
Journal taper per inch of journal length		0.0001 in. (0.002 mm)
Journal out-of-roundness		0.0010 in. (0.025 mm)
Rear oil seal-to-housing run-out		0.006 in. (0.15 mm)
Balancer bushing pressed-in depth	3/64 inch (1.19 mm) from edge of bore	
Torques		
Damper pulley-to-crankshaft	150 ft-lbs (203 Nm) (20.3 kgm)	
Main bearing caps	150 ft-lbs (203 Nm) (20.3 kgm)	
Rear oil seal housing	20 ft-lbs (27 Nm) (2.7 kgm)	
Flywheel-to-crankshaft	85 ft-lbs (115 Nm) (11.5 kgm)	
Balancer-to-cylinder block	85 ft-lbs (115 Nm) (11.5 kgm)	
Lubrication System		
Oil filter body spring compression (4270D)	1.375 in. (35 mm) at 18 to 22 lbs. (80 to 90 N) (8.2 to 10.0 kg)	
Oil pressure regulator spring compression (6404; 6466)	1.71 in. (42.4 mm) at 30 to 33 lbs. (133 to 147 N) (13.6 to 15.0 kg)	
Oil filter relief valve spring compression (6404; 6466)	1.38 in. (35 mm) at 18 to 22 lbs. (80 to 90 N) (8.2 to 10.0 kg)	
Oil cooler bypass valve spring compression (4270D)	1.0 in. (25.4 mm) at 3.7 to 4.0 lbs. (16.5 to 17.8 N) (1.7 to 1.8 kg)	
(6404; 6466)	1.38 in. (35 mm) at 18 to 22 lbs. (80 to 90 N) (8.2 to 10.0 kg)	
Depth of gear bore in housing 4270D	1.503 to 1.507 in. (38.18 to 38.28 mm)	
6406; 6466	1.753 to 1.757 in. (44.52 to 44.63 mm)	
Gear thickness 4270D	1.500 to 1.507 in. (38.10 to 38.28 mm)	
6404; 6466	1.750 to 1.752 in. (44.45 to 44.50 mm)	
O.D. of gears 4270D	2.268 to 2.269 in. (57.61 to 57.63 mm)	
6404; 6466	3.380 to 3.381 in. (85.85 to 85.88 mm)	
Housing gear bore I.D. 4270D	2.272 to 2.274 in. (57.71 to 57.76 mm)	
6404; 6466	3.384 to 3.386 in. (85.95 to 86.00 mm)	
Driven gear I.D.	0.622 to 0.623 in. (15.80 to 15.82 mm)	
Idler gear I.D.	0.633 to 0.634 in. (16.08 to 16.10 mm)	
Idler gear bushing I.D. (6404; 6466)	0.630 to 0.631 in. (16.00 to 16.03 mm)	
Idler shaft O.D.	0.628 to 0.629 in. (15.96 to 15.98 mm)	
Driven shaft O.D. 4270D	0.6240 to 0.6250 in. (15.85 to 15.88 mm)	
6404; 6466	0.6235 to 0.6245 in. (15.84 to 15.86 mm)	
Oil filter relief valve spring compression (4270D)	1.00 in. (25.4 mm) at 3.7 to 4.0 lbs. (16.5 to 17.8 N) (1.7 to 1.8 kg)	
Torques		
Oil pump-to-block 4270D	35 ft-lbs (47 Nm) (4.7 kgm)	
6404; 6466	20 to 25 ft-lbs (27 to 34 Nm) (2.7 to 3.4 kgm)	
Oil pan-to-block 1/2 inch cap screws	85 ft-lbs (115 Nm) (11.5 kgm)	
3/8 inch cap screws	35 ft-lbs (47 Nm) (4.7 kgm)	

Cooling System

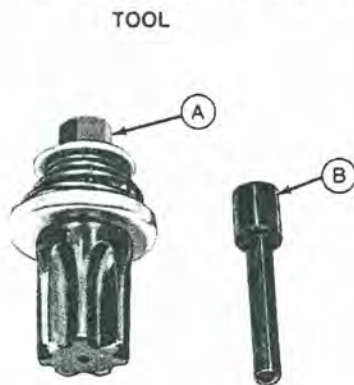
Item	New Part Specification	Maximum Serviceable Dimension
Radiator test pressure	18 psi (1.24 bar) (1.26 kg/cm ²)	
Radiator cap pressure	6.25 to 7.50 psi (0.3 to 0.4 bar) (0.4 to 0.5 kg/cm ²)	
Fan belt tension		
New belt - Single belt system	130 to 140 lbs. (578 to 622 N)	
- Dual belt system	95 to 104 lbs. (423 to 467 N)	
Run-in Belt - All	85 to 94 lbs. (378 to 423 N)	
Water pump impeller bore I.D.	0.6242 to 0.6252 in. (15.85 to 15.88 mm)	
Bearing shaft O.D.	0.6262 to 0.6267 in. (15.91 to 15.92 mm)	
Hub position on shaft		
4270D; 6404D (-357083)	0.140 in. (3.6 mm) above end of shaft	
6404T, A (-357083)	0.08 in. (2.0 mm) below end of shaft	
All 6404 (357084-)	0.063 in. (1.6 mm) above end of shaft	
Impeller-to-housing clearance		
6404T, A (-357083)	0.610 in. (15.49 mm)	
All other engines	0.025 in. (0.64 mm)	
Thermostat opening temperature	160° to 180°F (71° to 82°C)	

Torques

Water pump cover-to-housing	35 ft-lbs (47 Nm) (4.7 kgm)
Water pump-to-block	35 ft-lbs (47 Nm) (4.7 kgm)
Fan-to-pulley	35 ft-lbs (47 Nm) (4.7 kgm)
Thermostat cover-to-manifold	35 ft-lbs (47 Nm) (4.7 kgm)

SPECIAL TOOLS

Cylinder Head, Valves and Camshaft



NUMBER	USE
A—JDE-81-1 Flywheel Turning Tool	To rotate the engine flywheel when timing 6-cylinder engines
B—JDE-81-4 Timing Pin	

R 26134N

Fig. 1-Flywheel Turning Tool and Timing Pin

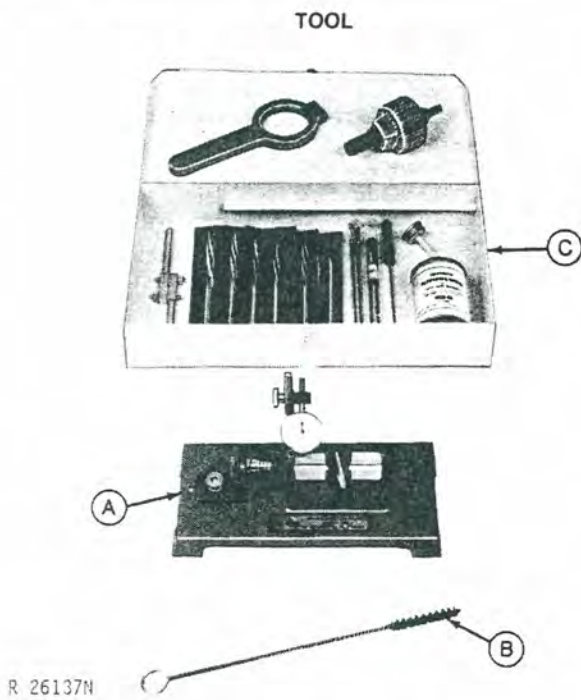


Fig. 2-Special Tools

TOOL	NUMBER	USE
	A—D-05058T Valve Inspection Center	To check valves for out-of-round.
	B—D-17011 BR Valve Guide Cleaning Brush	To clean valve guides.
	C—D-20002WI Knurling Tool Set	To knurl valve guides.

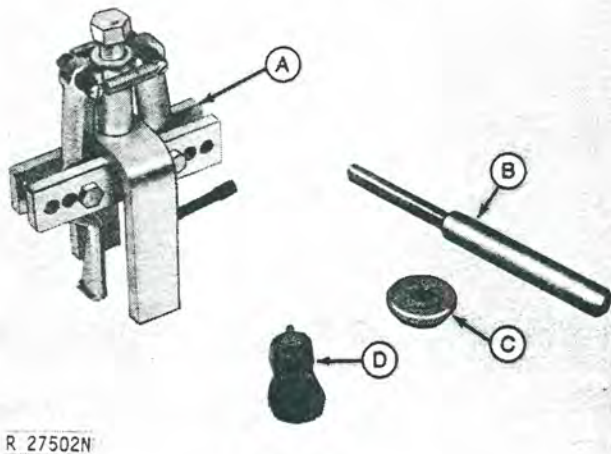


Fig. 3-Special Tools

A—JDE-41296 Seat Puller	To remove valve seats.
B—JDE-7 Driver	To install valve seats with Replacement Rings.
C—JDE-66 Replacement Ring	To install exhaust valve seats on 4270D, 6404D and T and 6466D Engines.
JDE-67 Replacement Ring	To install intake valve seats on 4270D, 6404D and T and 6466D Engines.
JDE-79 Replacement Ring	To install valve seats on 6404A and 6466T and A Engines.
D—D-17024 End Brush	To clean valve seat and bore.

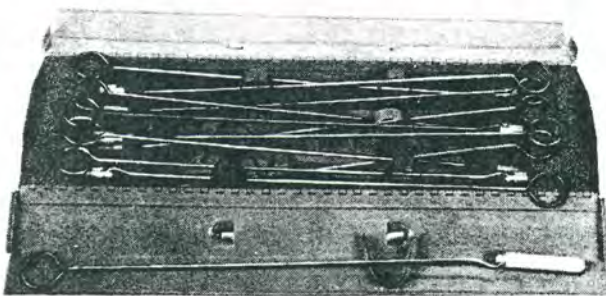


Fig. 4-D-15001NU Magnetic Holding Tool Set

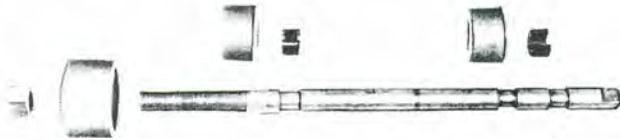
D—15001NU Magnetic Holding Tool Set	To hold cam followers away from camshaft.
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Cylinder Head, Valves and Camshaft Special Tools—Continued

TOOL

NUMBER
JDE-6 Camshaft
Bushing Replace-
ment Set.

USE
To remove and install camshaft bush-
ings.



R 26149N

Fig. 5-JDE-6 Camshaft Bushing Replacement Set

Cylinder Block, Liners, Pistons and Rods

Cylinder Liner Holding Fixture

See Making Special Tools, p. 20-00-10

JDE-47 Ring
Expander
JDE-93 Ring
Expander

To remove and install piston rings on
4270D and 6404 engines.
To remove and install piston rings on
6466 engines.



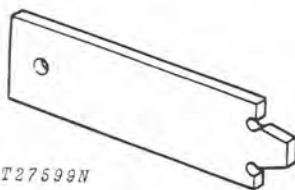
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Fig. 6-Piston Ring Expander

JDE-55 Ring
Groove Wear
Gauge
JDE-62 Ring
Groove Wear
Gauge

To check keystone ring groove wear
on 6404T and A and 6466 engines.

To check keystone ring groove wear
on 4270D and 6404D engines.



T27599N

Fig. 7-Piston Ring Groove Wear Gauge

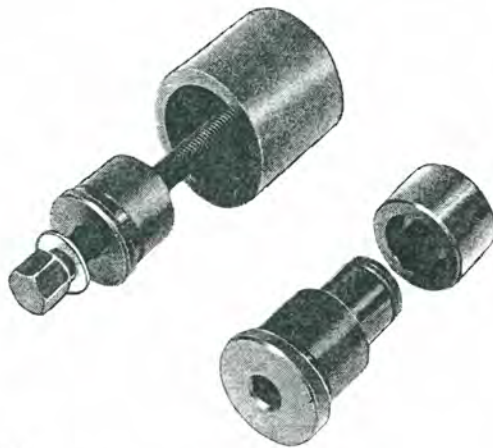
TOOL

NUMBER

USE

JDE-98-466
Connecting Rod
Bushing Service
Set

To remove and install connecting rod
bushings on 6466 engines.

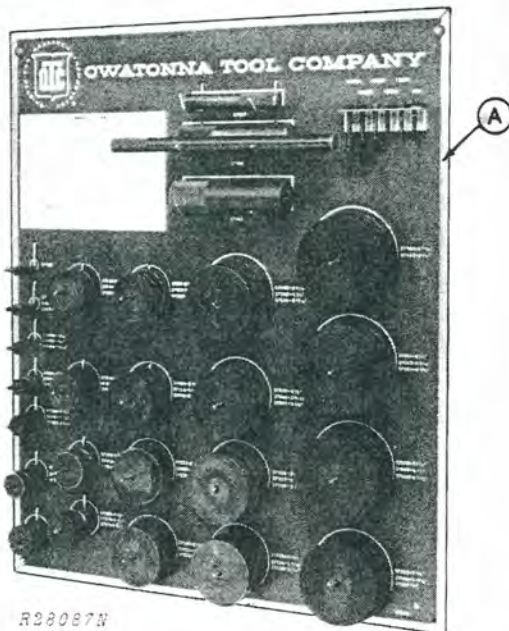


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Fig. 8-JDE-98-466 Connecting Rod Bushing Service Set

A—D-01045AA
Bushing and
Seal Driver
Set

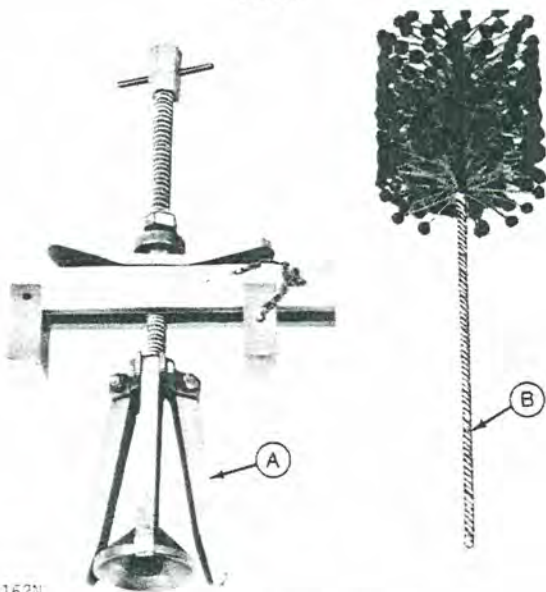
To remove and install connecting rod
bushings on 4270D and 6404 en-
gines.



R22087N

Fig. 9-D-01045AA Bushing and Seal Driver Set

TOOL

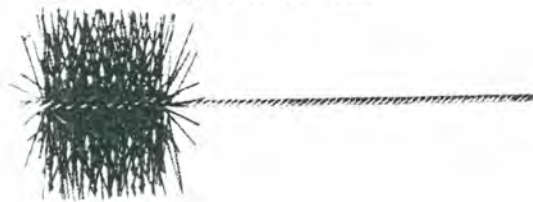


R 26162N

Fig. 10-Special Tools

- NUMBER**
 A—D-0162AA
 Liner Puller
 B—D-17004BR
 Flex-Hone

- USE**
 To remove cylinder liners.
 To hone cylinder liners.



R 27475N

Fig. 11-D-17015 O-Ring Bore Cleaning Brush

- D-17015 O-Ring
 Bore Cleaning
 Brush

To clean O-Ring bore in cylinder block.



R 27481N

Fig. 12-Piston Ring Compressor

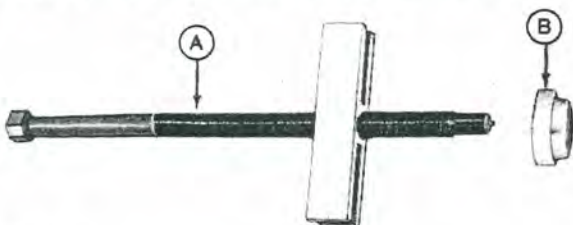
- JDE-57 Ring
 Compressor

To compress piston rings when installing pistons on 4270D and 6404 engines.

- JDE-96 Ring
 Compressor

To compress piston rings when installing pistons on 6466 engines

Crankshaft, Main Bearings and Flywheel



- A—D-1206AA Puller

Used with No. 630-6 Step. Plate adapter to remove damper pulley.

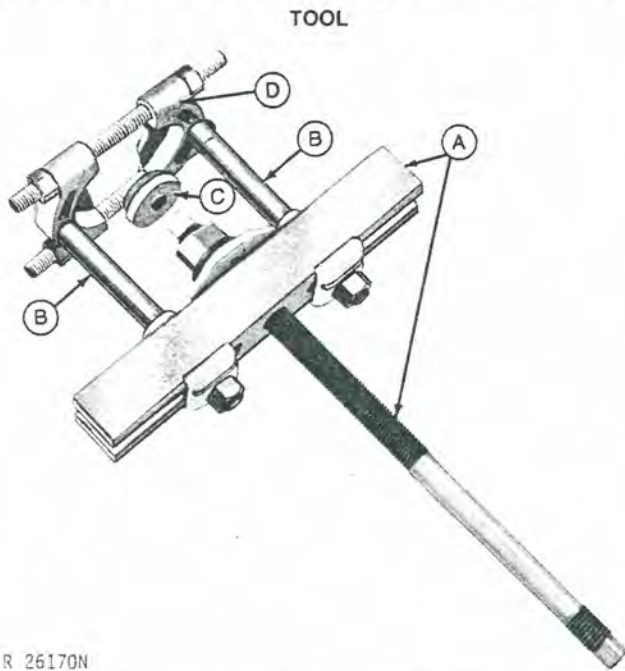
- B—No. 630-6
 Step Plate
 Adapter

Used with D-1206AA Puller to remove damper pulley.

R 27476N

Fig. 13-Special Tools

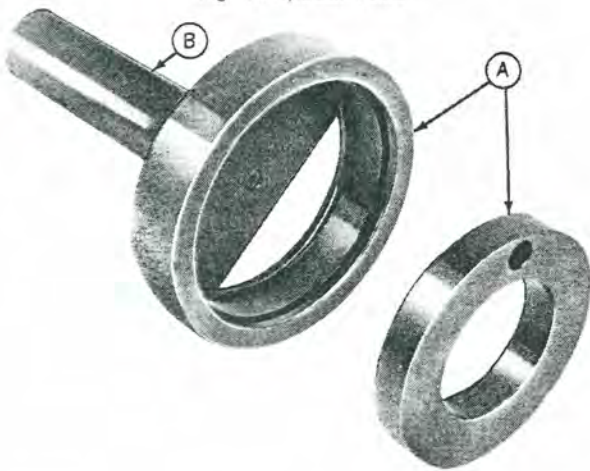
Crankshaft, Main Bearings and Flywheel—Continued



- | NUMBER | USE |
|----------------------------------|----------------------------|
| A—D-01219AA Puller | To remove crankshaft gear. |
| B—D-01222AA Pulling Legs | |
| C—No. 630-9 (From D-01212AA Set) | |
| D—D-01218 Pulling Attachment | |

R 26170N

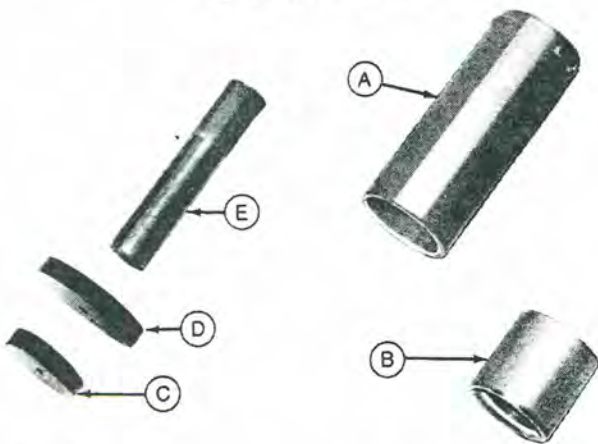
Fig. 14-Special Tools



- | | |
|----------------------|---|
| A—JDE-106-2 Tool Set | To install crankshaft rear wear sleeve and rear oil seal. |
| B—No. 27489 Driver | |

R 26388N

Fig. 15-Special Tools



- | | |
|---------------------------|--|
| A—JDH-7 Driver | To install crankshaft gear. |
| B—JDE-3 Driver | To install front wear sleeve. |
| C—No. 27522 Disk | To install front oil seal. |
| D—No. 27537 Disk | |
| E—No. 27488 Disk | To install bushings in engine balancer on 4270D engines. |
| JDE-16 Driver (not shown) | |

R 26391N

Fig. 16-Special Tools

Cooling System

TOOL

NUMBER

USE

D-05104ST
Pressure Pump

To test radiator and pressure cap.

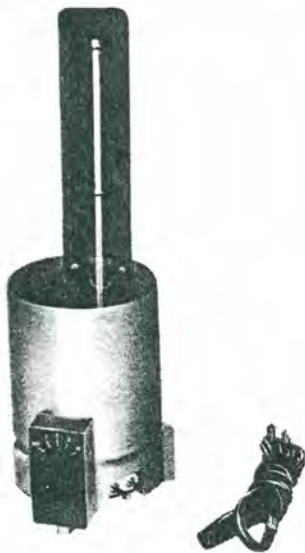


R 26133N

Fig. 17-Cooling System Testing Equipment

D-05103ST
Thermostat Tester

Used to check opening temperatures
of thermostats.



R 26408N

Fig. 18-D-05103ST Thermostat Tester

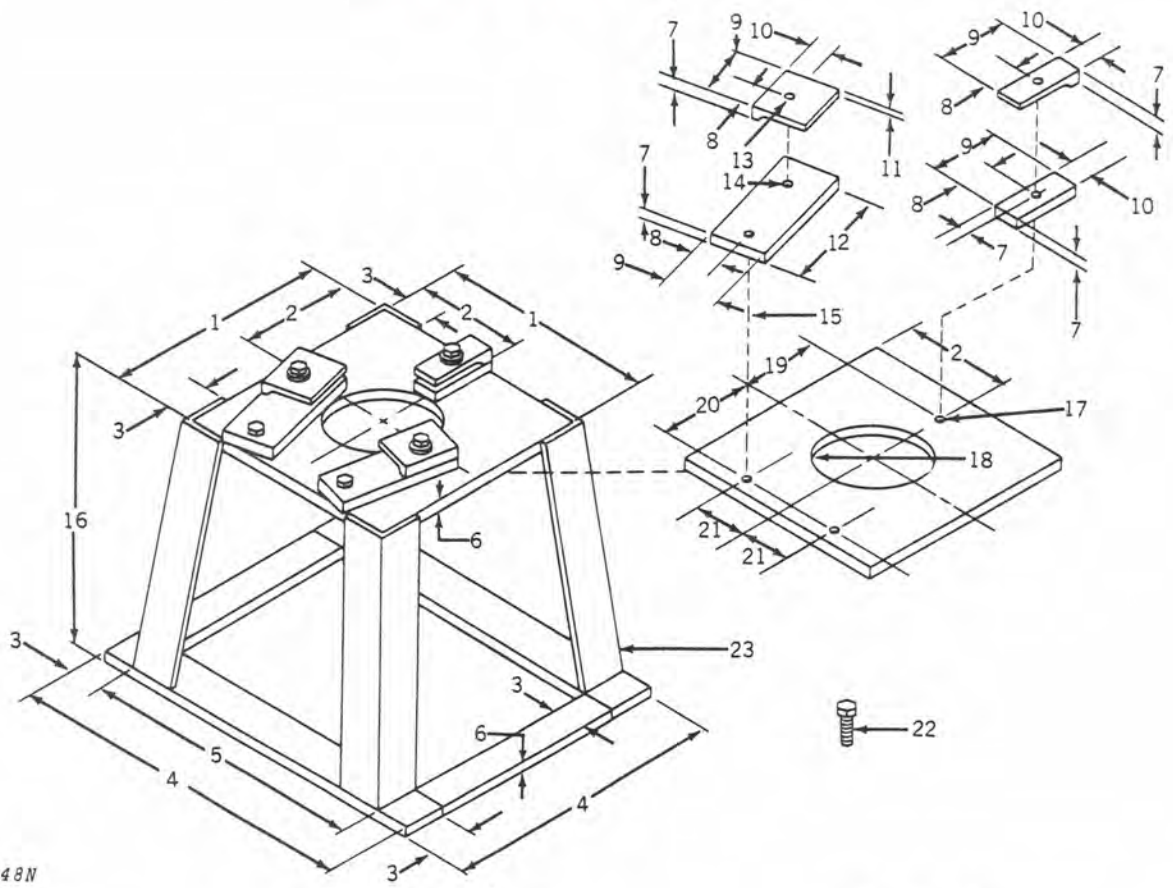
Cooling System—Continued

TOOL	NUMBER	USE
	JD-243 Installation Tool	To install bearing in water pump on 4270D and early 6404D engines.
	JD-262 Installation Tool	To install bearing in water pump on late 6404D and all other 400 Series engines.

R 26396N

Fig. 19-Bearing Installation Tool

MAKING SPECIAL TOOLS



T 36748N

- 1—10" (254.0 mm)
- 2—5" (127.0 mm)
- 3—1.5" (38.1 mm)
- 4—16" (405.4 mm)
- 5—13" (330.2 mm)
- 6—0.375" (9.52 mm)
- 7—0.5" (12.7 mm)
- 8—1.25" (31.8 mm)

- 9—2.5" (63.5 mm)
- 10—1" (25.4 mm)
- 11—0.25" (6.35 mm)
- 12—6" (152.4 mm)
- 13—0.328" Drill Through
- 14—5/16"—18 Tap
- 15—2 used
- 16—12" (304.8 mm)

- 17—5/16"—18 Tap
- 18—2.75" (69.85 mm) Radius
- 19—4" (101.6 mm)
- 20—4.38" (111.25 mm)
- 21—2.38" (60.45 mm)
- 22—5/16" x 1" Cap Screw
- 23—2.5" (63.5 mm) Angle Iron

Fig. 18-Cylinder Liner Holding Fixture (Make in dealers' service department)



Group 05

CYLINDER HEAD, VALVES, AND CAMSHAFT

PRELIMINARY VALVE CHECKS

During disassembly, inspect the valve train for the following malfunctions and causes.

Sticking Valves

- Carbon deposits on valve stem
- Worn valve guides
- Warped valve stems
- Cocked or broken valve springs
- Worn or distorted valve seats
- Insufficient lubrication

Warped, Worn, or Distorted Valve Guides

- Lack of lubrication
- Cylinder head distortion
- Excessive heat
- Unevenly tightened cylinder head cap screws

Distorted Cylinder Head and Cylinder Head Gasket Leakage

- Improperly tightened cylinder head cap screws
- Faulty gasket installation
- Incorrect gasket material
- Excessive oil pressure
- Improper cylinder liner height above cylinder block

Worn or Broken Valve Seats

- Misaligned valves
- Distorted cylinder head
- Carbon deposits on seats due to incomplete combustion
- Valve spring tension too weak
- Excessive heat
- Improper valve clearance
- Improper valve timing

Burned, Pitted, Worn, or Broken Valves

- Worn or distorted valve seats
- Worn valve guides
- Insufficient cooling
- Insufficient lubrication
- Cocked or broken valve springs
- Preignition
- Improper engine operation
- Improper valve train timing
- Faulty valve rotators
- Warped or distorted valve stems
- "Stretched" valves due to excessive spring tension
- Warped cylinder head
- Bent push rods
- Carbon build-up on valve seats
- Rocker arm failure

Camshaft Failures

- Scored camshaft lobes due to inadequate lubrication
- Excessive end play due to thrust plate wear
- Broken or warped camshaft due to improper timing

Checking Valve Clearance

Four-Cylinder Engine

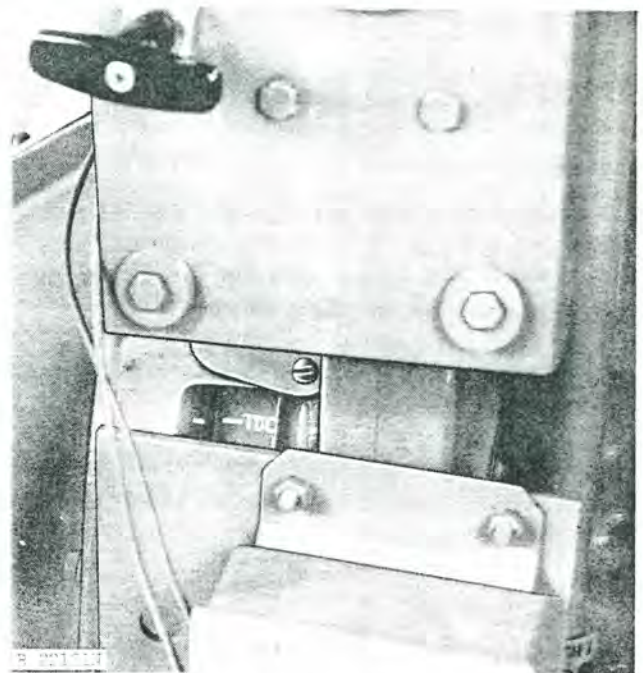
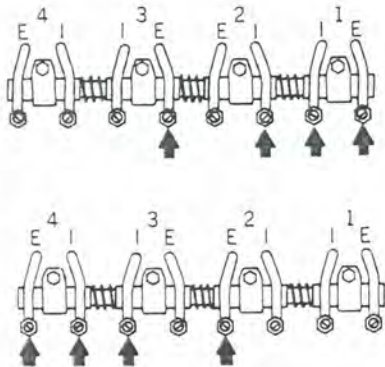


Fig. 1-Setting "TDC"

1. Rotate engine to position No. 1 piston at TDC of its compression stroke.
2. Turn flywheel until timing mark on flywheel lines up with mark on housing (Fig. 1).

Checking Valve Clearance—Continued

Four Cylinder Engine



T 22847W

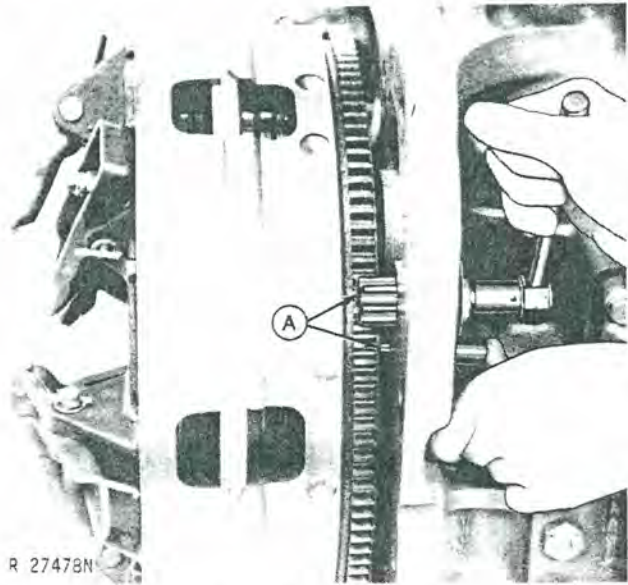
VALVE CLEARANCE SPECIFICATION

Intake and Exhaust Valves 0.018 in. (0.46 mm)

Fig. 2-Four-Cylinder Valve Clearance Adjustment

3. Adjust valve clearance on No. 1 and 3 exhaust valves and No. 1 and 2 intake valves.
4. Rotate flywheel 360 degrees until No. 4 piston is at TDC of its compression stroke.
5. Adjust valve clearance on No. 2 and 4 exhaust valves and No. 3 and 4 intake valves to the specification listed above.

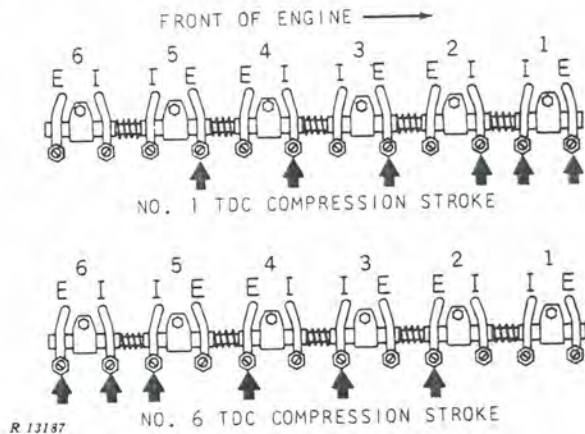
Six Cylinder Engine



R 27478N

Fig. 3-Setting "TDC"

1. Use JDE-81 Engine Rotation Tool Set (A, Fig. 3) to position No. 1 piston at TDC of its compression stroke.
2. Turn flywheel until timing pin engages timing hole in flywheel and both valves on No. 1 cylinder are in the up position (rocker arms loose).



R 13187

VALVE CLEARANCE SPECIFICATIONS

Intake Valves 0.018 in. (0.46 mm)
 Exhaust Valves 0.028 in. (0.71 mm)

Fig. 4-Six-Cylinder Valve Clearance Adjustment

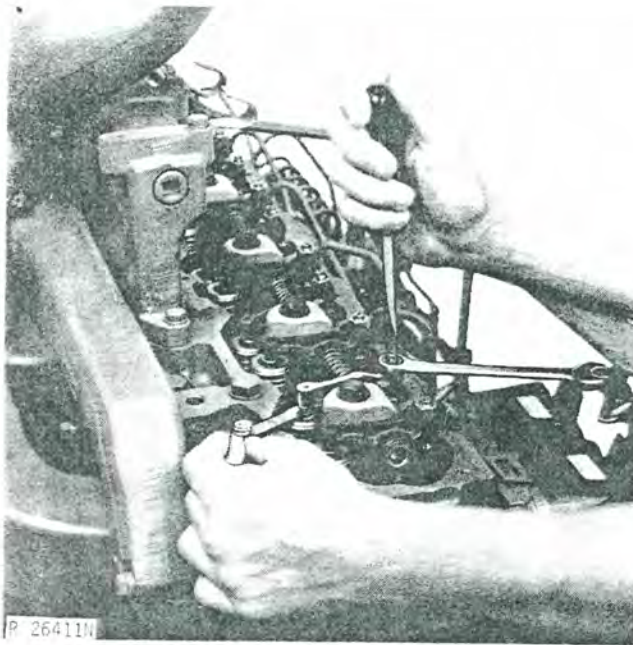


Fig. 5-Checking Valve Clearance

3. Adjust valve clearance on No. 1, 3, and 5 exhaust valves and No. 1, 2, and 4 intake valves (Fig. 5).

4. Rotate flywheel 360 degrees until No. 6 piston is at "TDC" of its compression stroke, and tool timing pin engages flywheel hole.

5. Adjust valve clearance on No. 2, 4, and 6 exhaust valves and No. 3, 5, and 6 intake valves to the specifications listed above.

Checking Valve Lift

Measuring valve lift can give an indication of wear to cam lobes, cam followers, and push rods.

1. Set valve clearance to specifications as previously indicated.

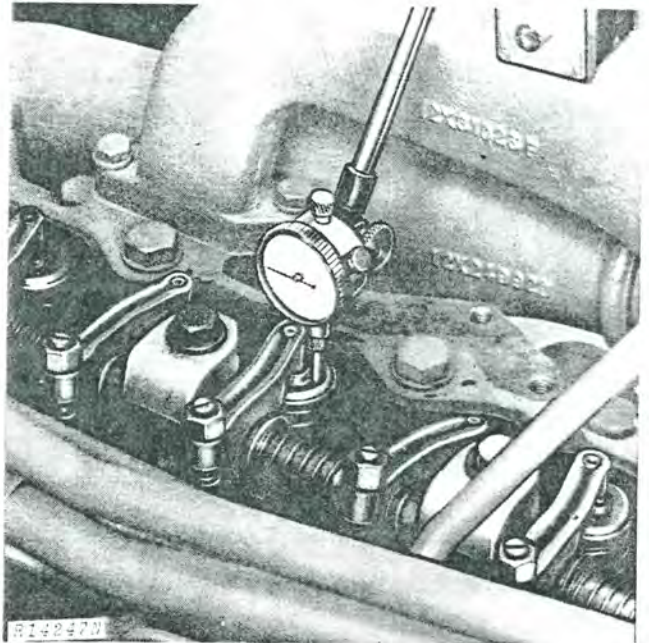


Fig. 6-Checking Valve Lift (6-Cylinder shown)

2. Place dial indicator on rotator (Fig. 6).

3. Manually turn engine in running direction (counterclockwise).

4. After rocker arm contacts valve stem, observe dial indicator reading as valve is moved to full open.

VALVE LIFT NEW PART SPECIFICATIONS

4270

Intake Valves 0.431 to 0.461 in.
(10.95 to 11.71 mm)

Exhaust Valves 0.427 to 0.457 in.
(10.85 to 11.61 mm)

6404D and 6466D

Intake Valves 0.424 to 0.454 in.
(10.77 to 11.53 mm)

Exhaust Valves 0.414 to 0.444 in.
(10.52 to 11.28 mm)

6404T and A; 6466T and A

Intake Valves 0.412 to 0.442 in.
(10.46 to 11.23 mm)

Exhaust Valves 0.413 to 0.443 in.
(10.49 to 11.25 mm)

CYLINDER HEAD AND VALVES

Access

1. Disconnect battery ground cables and drain cooling system (not shown).

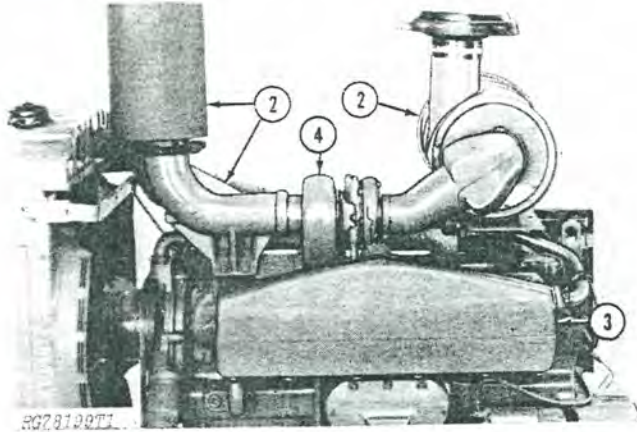


Fig. 7-Left Side Removal Steps
(6466A Engine Shown)

2. Remove air cleaner, muffler and exhaust elbow.
3. Remove intercooler ("A" engines) with intake manifold.
4. Remove turbocharger ("T" and "A" engines) with exhaust manifold.

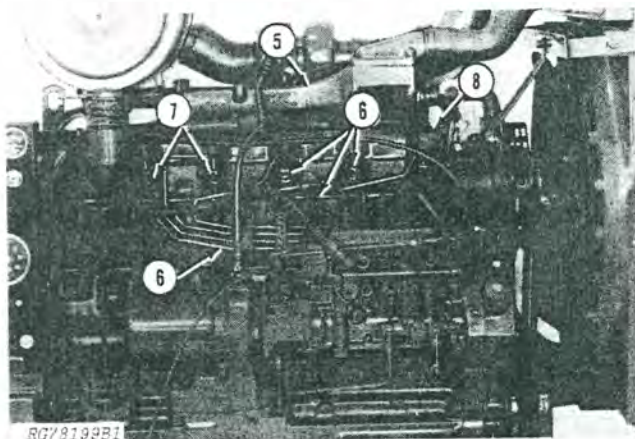


Fig. 8-Right Side Removal Steps
(6466A Engine Shown)

5. Remove water manifold.
6. Remove fuel lines and leak-off line. Plug openings to prevent contamination.
7. Remove fuel injection nozzles.
8. Remove rocker arm cover.

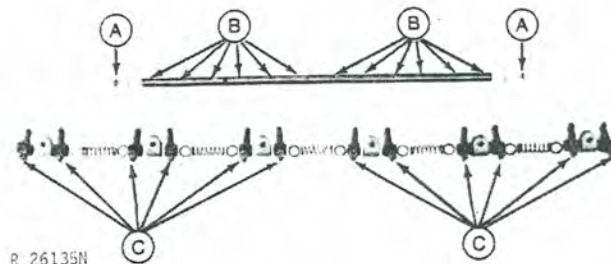
ROCKER ARM ASSEMBLY

Removal

NOTE: 6466T (072864-) and A (068223-) engines use a one-piece rocker arm shaft clamp in place of the Nos. 1 and 2 and 5 and 6 clamps.

1. Remove rocker arm shaft clamp cap screws.

NOTE: When removing rocker arm shaft components, identify for reassembly into original position.



A—End Plugs
B—Oil Holes

C—Adjusting Screws

Fig. 9-Rocker Arm Shaft Components
(6-Cylinder Shown)

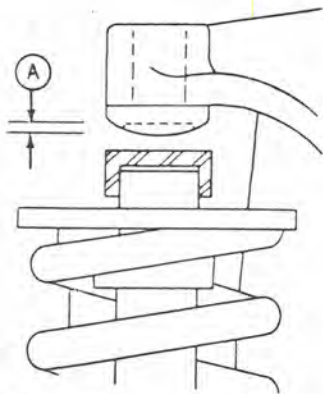
2. Remove rocker arm shaft end plugs and slide components from shaft (Fig. 9).

Inspection and Repair

1. Inspect rocker arm shaft for scratches, scores, or excessive wear at points of rocker arm contact.

NOTE: Wear could indicate weak valve springs, bent push rods, or loose rocker arm shaft clamps.

2. Be sure that all oil holes are open and clean (B, Fig. 9).
3. Check rocker arm adjusting nut and screw for damage (C, Fig. 9).
4. Check for cups or concave wear on ends of rocker arms where they contact valve tips (A, Fig. 10).



R 26131N

A—Worn Area

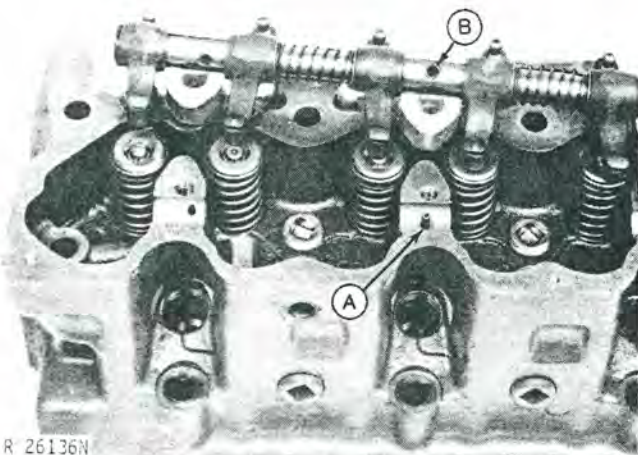
Fig. 10-Rocker Arm Wear

5. Examine spacer springs on shaft between rocker arms, and be sure they are strong enough to exert a positive pressure on arms.

NOTE: If the rocker arm has been damaged by a valve failure, replace it and the push rod when replacing valves.

Assembly and Installation

1. Assemble parts on rocker arm shaft in reverse of sequence removed.
2. Make sure rocker arm shaft end plugs are firmly seated in end of shaft.



R 26136N

A—Spring Pin

B—Locating Hole

Fig. 11-Rocker Arm Shaft Locating Holes

3. Position rocker arm shaft on head, insuring that spring pin (A, Fig. 11) and locating hole (B) in rocker arm shaft line up.

4. Tighten rocker arm shaft clamp cap screws to 55 ft-lbs (75 Nm) (7.5 kgm).

VALVES, VALVE SPRINGS, VALVE ROTATORS, AND WEAR CAPS

Removal

1. Remove rocker arm assembly as previously described.
2. Remove head.

NOTE: When removing valves, valve springs, and valve rotators, identify for reassembly into original positions.

3. Use a valve spring compressor to remove valves from head.

Inspection And Repair

Valve Springs

1. Inspect valve springs for alignment, wear, and damage.
2. Place springs on a flat surface to see that they are square and parallel.
3. Check valve spring tension on a spring tester.

VALVE SPRING NEW PART SPECIFICATIONS

Compression	Height
54 to 62 lbs. (240.2 to 275.8 N)	1.81 in. (45.9 mm)
133 to 153 lbs. (591.6 to 680.5 N)	1.36 in. (34.5 mm)

Valves, Rotators and Wear Caps

1. Insure that valve rotators will turn freely in one direction. If defective, replace with new.
2. Replace valve wear caps if pitted or worn.
3. Visually check valve face and stem for wear or damage.
4. Perform the following cleaning procedure before measuring or repairing valves.

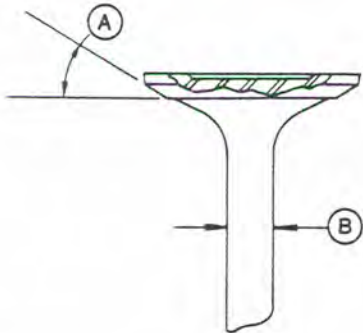
Cleaning Valves

1. Hold each valve firmly against a wire wheel on a bench grinder.
2. Make sure all carbon is removed from the valve head, face and stem.

IMPORTANT: Any carbon left on the stem will affect alignment in valve refacer if valves need to be refaced.

3. Polish the valve stems with steel wool or fine emery cloth to remove any scratch marks left by the wire brush.

Inspection and Repair—Continued



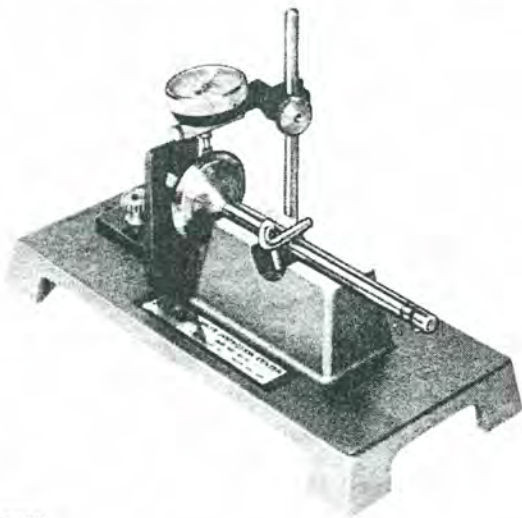
RG1177

A—44-1/2° (4270D, 6404D)
29-1/2° (6404T, A and 6466)

B—0.3715 to 0.3725 in.
(9.43 to 9.46 mm)

Fig. 12-Valve Specifications

4. Compare valve stem O.D. (B, Fig. 12) with valve guide I.D. to determine stem-to-guide clearance.



R 26139N

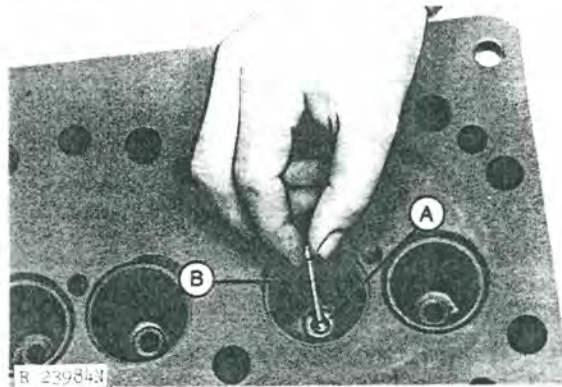
Fig. 13-Inspecting Valves

5. Use D-05058ST Valve Inspection Center (Fig. 13) to determine if valves are out of round, bent or warped.

Valve Guides

1. Use a valve guide cleaning brush to clean valve guides before inspection or repair.

NOTE: A few drops of light oil or kerosene will help to fully clean the guide.



A—Valve Guide

B—Telescope Gauge

Fig. 14-Checking Valve Guide

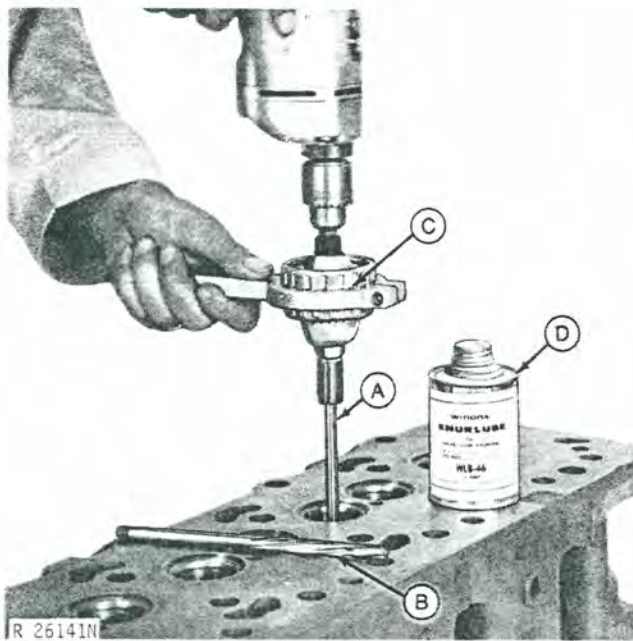
2. Measure valve guides for wear (Fig. 14).

VALVE GUIDE NEW PART SPECIFICATIONS

I.D. of guide in a new head ... 0.3745 to 0.3755 in.
(9.512 to 9.537 mm)

New guide-to-valve stem
clearance 0.0020 to 0.0040 in.
(0.051 to 0.102 mm)

NOTE: Worn guides can allow a clearance of 0.006 in. (0.15 mm) and still be acceptable. Worn guides may be knurled to return them to specified clearance if valve-to-guide clearance is 0.010 in. (0.25 mm) or less. If clearance exceeds 0.010 in. (0.25 mm), install over-size valves.



A—Knurler
B—Reamer
C—Speed Reducer
D—Lubricant

Fig. 15—Knurling Valve Guides

3. Use No. D-20002WI Knurling Tool Set to knurl valve guides (Fig. 15).

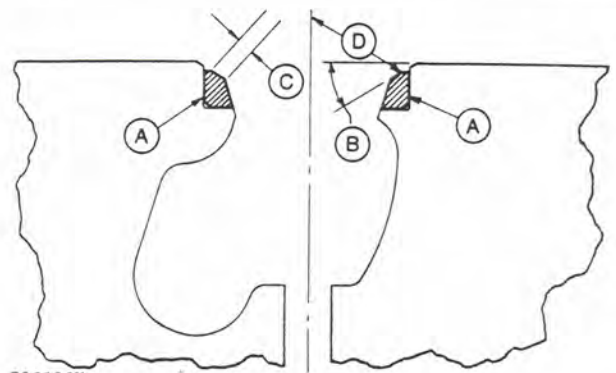
NOTE: Use tool set exactly as directed by the manufacturer.

Valve Seats



Fig. 16—Cleaning Valve Seats

1. Use an electric hand drill with wire cleaning brush (Fig. 16) and remove all carbon.
2. Check seats for cracks, pits, or excessive wear.
3. Recondition valve seat by grinding.

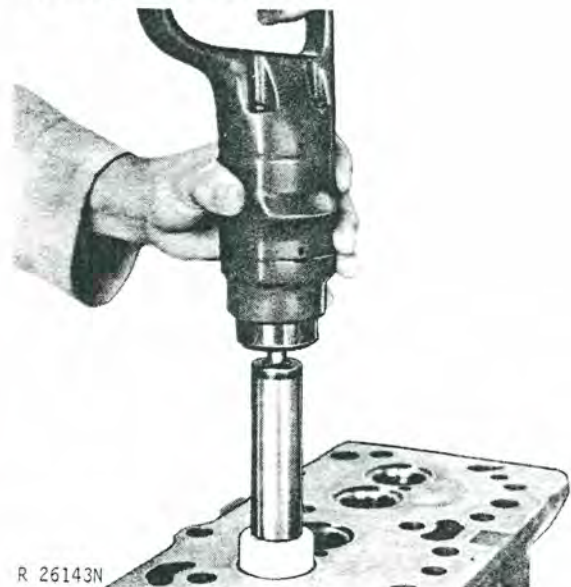


R26126N

A—Valve Seat Insert	
B—Valve Seat Angle (4270D, 6404D)	45°
(6404T, A and 6466)	30°
C—Valve Seat Width	0.083 to 0.093 in.
	(2.11 to 2.36 mm)
D—Valve Seat Runout (Maximum)	0.002 in.
	(0.05 mm)

Fig. 17—Valve Seat Specifications

Grinding Valve Seats



R 26143N

Fig. 18—Grinding Valve Seats

1. Do not grind too long. Only a few seconds are required to recondition the average valve seat. Avoid the natural tendency to grind off too much.
2. Do not use too much pressure. While grinding, support the weight of the driver to avoid excess pressure on the stone.
3. Keep the work area clean.
4. Check the seat width and contact pattern between the seat and valve with blueing.

Installing Oversize Inserts

In some cases, the outside diameter of the valve seat bore may become damaged and require machining. In this case, oversize inserts are available in 0.010 in. (0.25 mm) oversize only.

1. Remove valve seats with JDE-41296 Valve Seat Puller.
2. Machine seat diameter to 1.7585 to 1.7595 in. (44.67 to 44.69 mm).
3. Replace inserts as previously indicated.

Cylinder Head

1. Thoroughly clean the cylinder head.

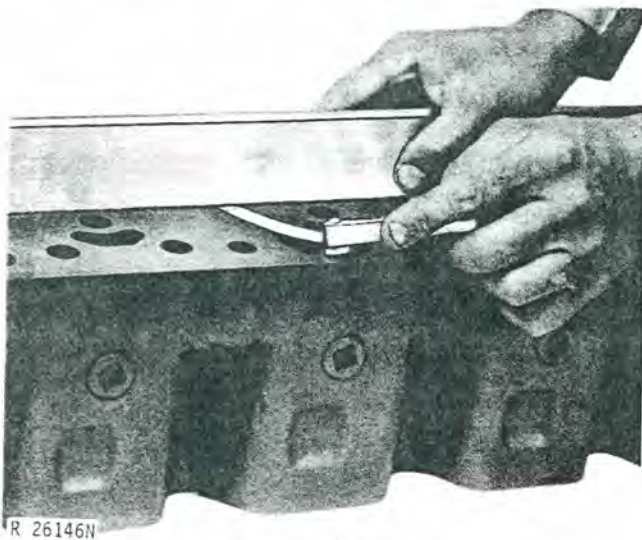


Fig. 22-Checking Cylinder Head

2. Use a straight edge to check the head for level (Fig. 22).
3. Warpage should not exceed 0.001 in. (0.02 mm) for every 5 in. (127 mm) of head length.

Assembly

1. Apply AR44402 Lubricant to valve stems and guides.

NOTE: New exhaust and intake valves are color coded green and yellow respectively on 6404T and A. Valves are coded black and red respectively on 6404D and 4270D.

2. Install valves in guides from which they were removed.

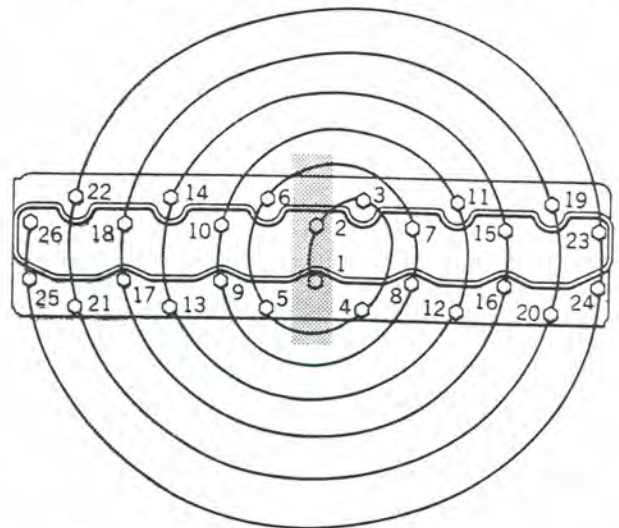
NOTE: Valves must move freely and seat properly.

3. Install valve springs making certain that cylinder head end of spring is located correctly in machined counter bore of the head.
4. Install rotators.
5. Compress valve springs with valve spring compressor.
6. Install retainer locks on valves.
7. Strike the end of each valve three or four times with a soft mallet to insure proper positioning of the retainer locks.

Installation

NOTE: See page 20-10-10 before installing cylinder head gasket on 6404D and 6466D engines.

1. Install cylinder head gasket dry.
2. Place cylinder head in correct position on block.
3. Dip cap screws and washers in clean engine oil.



R 26147N

Fig. 23-Cylinder Head Cap Screw Tightening Sequence (Start at No. 1)

Installation—Continued

4. Install cap screws and tighten to the following specifications using the sequence shown in Fig. 23.

CYLINDER HEAD CAP SCREW TORQUES

	ft-lbs	Nm	kgm
Initial			
4270D	115	156	15.6
6404D	105	142	14.2
6404T and A	80	108	10.8
6466D, T and A	105	142	14.2
Second			
4270D	130	180	18.0
6404D	130	180	18.0
6404T and A	115	156	15.6
6466D, T and A (plain head)	115	156	15.6
6466D, T, and A ("12.9" head)	130	180	18.0

NOTE: Early model 6466 engines may have a plain headed cap screw. Late models may have screws marked "12.9" on the head.

5. Install push rods in holes from which they were removed.

6. Install wear caps on valves making certain caps rotate freely.

8. Tighten rocker arm shaft clamp cap screws to 55 ft-lbs (75 Nm) (7.5 kgm).

9. Reverse access steps.

10. Run engine at 2100 RPM for 1/2 hour.

11. Retighten cylinder head cap screws to the following specifications using the sequence shown in Fig. 23.

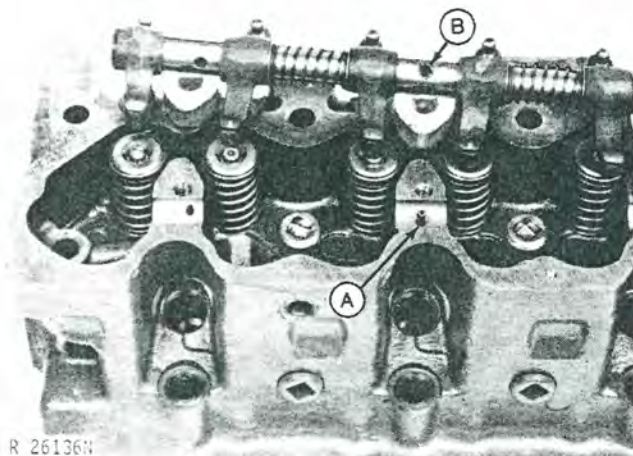
CYLINDER HEAD CAP SCREW TORQUES

	ft-lbs	Nm	kgm
Final			
4270D and 6404D	150	204	20.4
6404T and A	130	180	18.0
6466D, T and A (plain head)	130	180	18.0
6466D, T and A ("12.9" head)	150	204	20.4

CAMSHAFT

Checking Camshaft End Play

1. Remove rocker arm cover.
2. Remove rocker arm assembly.
3. Remove push rods. Identify for reassembly.
4. Remove damper and pulley (6 cylinder engines).
5. Remove timing gear cover.



A—Spring Pin B—Locating Hole

Fig. 24-Rocker Arm Shaft Locating Hole

7. Position rocker arm shaft on head, insuring that spring pin (A, Fig. 24) and locating hole (B) in rocker arm shaft line up.

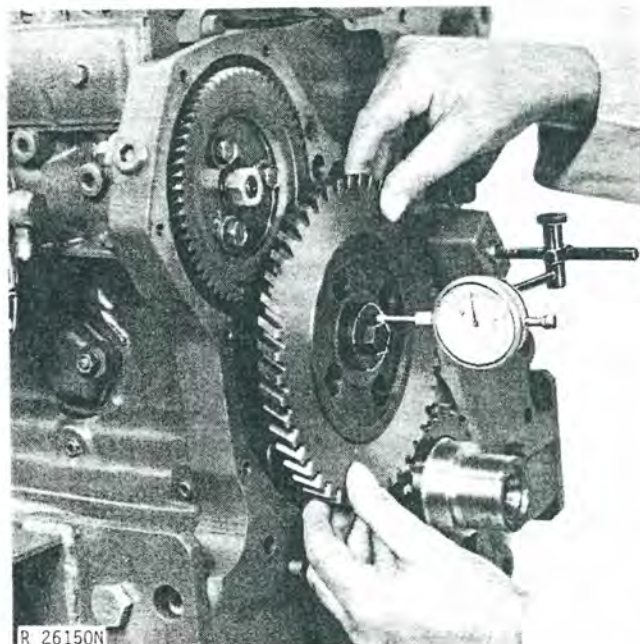


Fig. 25-Checking Camshaft End Play

1. Place a dial indicator on camshaft (Fig. 25).
2. Check camshaft end play.

CAMSHAFT END PLAY SPECIFICATIONS

New engine end play	0.0025 to 0.0085 in. (0.06 to 0.22 mm)
Allowable end play	0.0150 in. (0.38 mm)

NOTE: If end play exceeds wear specification check thrust washer thickness during disassembly.

Removal

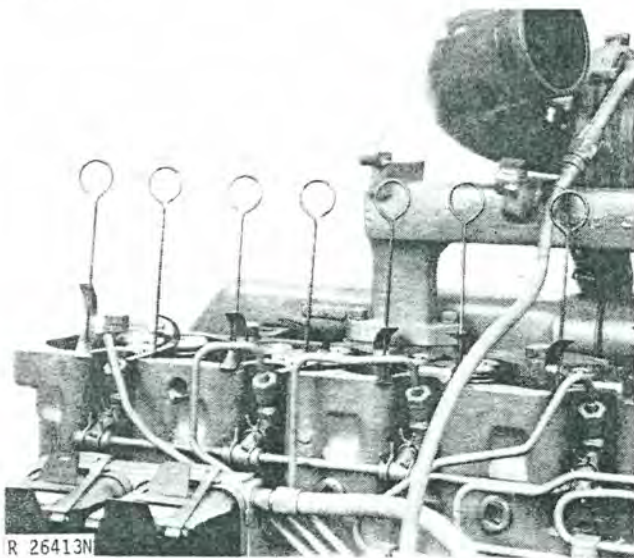


Fig. 26-Installing Magnetic Holding Tool Set

1. Remove oil pan and oil pump.
2. Use D-15001NU Magnetic Holding Tool Set to hold cam followers away from camshaft (Fig. 26).
3. Remove four cap screws from thrust plate.
4. Carefully remove camshaft from cylinder block so that camshaft lobes do not drag in bores.

Inspection and Repair

Camshaft Gear

1. Inspect camshaft drive gear for worn or broken teeth and replace as necessary.

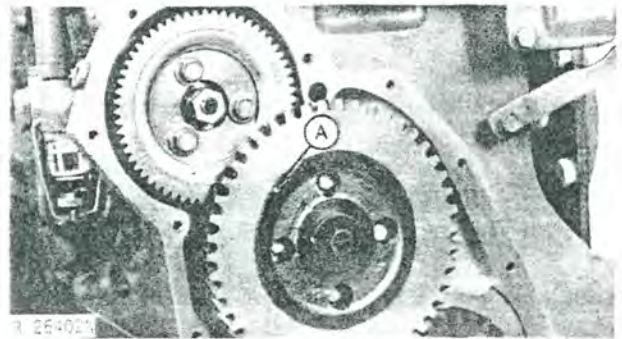


Fig. 27-6-Cylinder Camshaft Drive Gear

2. On 6-cylinder engines, inspect camshaft drive gear for slippage between the two parts of the gear.

NOTE: An indexing mark has been placed across the parting line of the two parts of the gear (A, Fig. 27). If the mark has separated, the gear should be replaced.
3. Examine crankshaft gear and injection pump drive gear for worn or broken teeth or damage.

NOTE: If either gear has failed, both gears must be replaced as a matched set.

Removing Camshaft Gear

1. Remove cap screw and special washer.

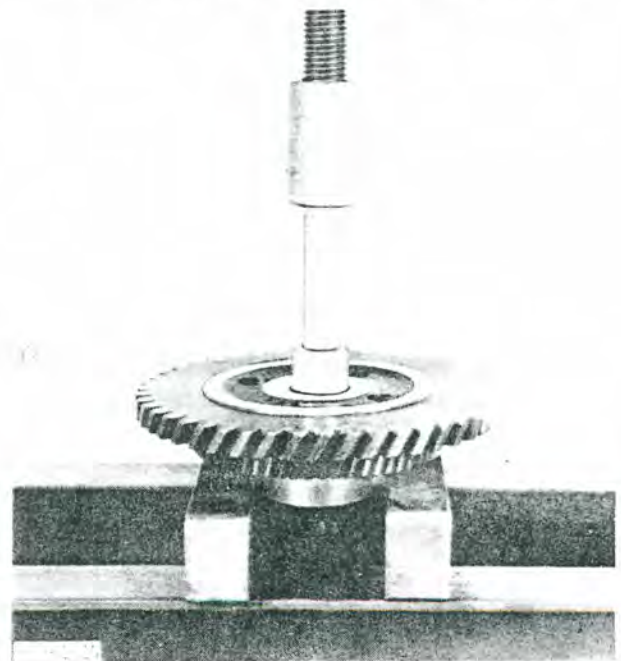


Fig. 28-Removing Camshaft Gear

Inspection and Repair—Continued

2. Support camshaft gear in a press (Fig. 28).

IMPORTANT: Prevent camshaft from striking floor when pressing camshaft from gear.

3. Press camshaft from gear.

Thrust Plate

After removal of camshaft gear, check thrust plate for proper thickness.

THRUST PLATE SPECIFICATIONS

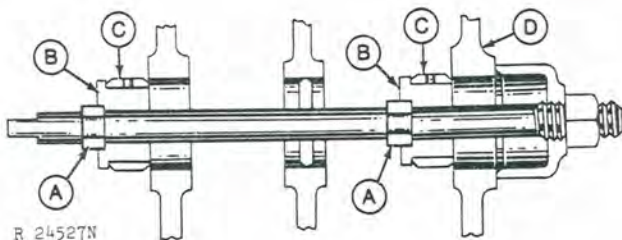
New Part Thickness	0.1860 to 0.1890 in. (4.72 to 4.80 mm)
Acceptable wear thickness	0.1820 in. (4.62 mm)

Bushings and Journals

Check camshaft bushings and journals for wear or damage.

BUSHING AND JOURNAL SPECIFICATIONS

New Journal O.D.	2.3745 to 2.3755 in. (60.31 to 60.34 mm)
New Bushing I.D.	2.3775 to 2.3795 (60.39 to 60.44 mm)
Clearance Allowable	0.0060 in. (0.15 mm)



A—Tool Locking Key
B—Tool Mandrel
C—Camshaft Bushing
D—Engine Block

Fig. 29—Installing Camshaft Bushings

1. Use JDE-6 Camshaft Bushing Replacement Set to remove and install camshaft bushings.

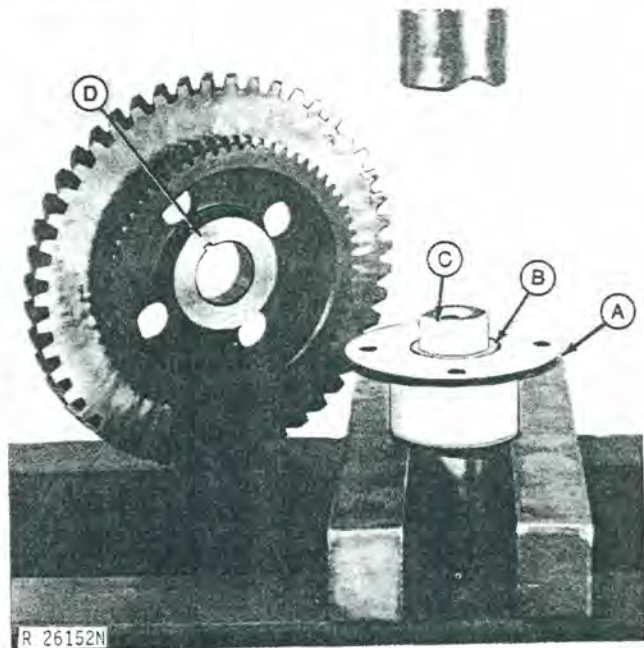
NOTE: The first two bushings can be reached from the front of the engine. The PTO assembly and fly-wheel must be removed to service the rear bushings. When new bushings are installed, be sure that the elongated oil holes are to the top and are aligned with the oil holes in the cylinder block.

Lobes

1. Check camshaft lobes for wear or damage.
2. Check camshaft oil pump drive gear for wear or damage.

NOTE: If camshaft is replaced due to a damaged oil pump drive gear, check gear and shaft on oil pump for damage and replace if necessary. If camshaft is replaced, cam followers must also be replaced.

Assembly



A—Thrust Plate
B—Spacer
C—Woodruff Key
D—Keyway

Fig. 30—Supporting Camshaft in Press

1. Support camshaft under first journal in a hydraulic press. (Fig. 30).
2. Install thrust plate (A) and spacer (B).
3. Install Woodruff key (C).
4. Align Woodruff key (C) and keyway (D) and place gear on camshaft with timing mark facing away from camshaft.
5. Press gear on until tight against camshaft shoulder.

Installation

If cam followers have been removed, reinstall using the D-15001NU (ND425) Magnetic Holding Tool Set to hold cam followers away from camshaft bore until camshaft is installed.

1. Coat camshaft with JDT405 High Temperature Grease, or equivalent.

2. Carefully install camshaft in cylinder block so that camshaft lobes do not drag in bores.



A—Location Mark
B—Thrust Plate Cap Screw

C—Timing Mark

Fig. 31-Gear Timing

3. With No. 1 piston on TDC of its compression stroke, align timing marks (C, Fig. 31) on camshaft and crankshaft gears.

4. Turn camshaft gear to align thrust plate holes with cylinder block holes.

5. Tighten thrust plate-to-block cap screws to 20 ft-lbs (27 Nm) (2.7 kgm).

6. Install special washer on camshaft.

7. Tighten camshaft gear-to-camshaft cap screw to 85 ft-lbs (115 Nm) (11.5 kgm).

8. Check camshaft for 0.0025 to 0.0085 in. (0.06 to 0.22 mm) end play.

Group 10

CYLINDER BLOCK, LINERS, PISTONS AND RODS**DIAGNOSING MALFUNCTIONS****Scuffed or Scored Pistons**

- Insufficient lubrication
- Insufficient cooling
- Improper piston-liner clearance
- Preignition or postignition
- Coolant leakage in crankcase
- Misaligned or bent connecting rod
- Improperly installed piston
- Low oil level
- Improper operation
- Incorrect connecting rod bearing clearance
- Carbon buildup in ring groove
- Improper break-in
- Worn piston
- Contaminated oil
- Distorted cylinder liner

Worn or Broken Compression Rings

- Preignition or postignition
- Insufficient lubrication
- Insufficient cooling
- Improper ring installation
- Improper combustion
- Improper timing
- Abrasives in combustion chamber

Clogged Oil Control Ring

- Improper oil
- Excessive blow-by
- Contaminated Oil
- Improper periodic service
- Low operating temperature

Stuck Rings

- Preignition or postignition
- Improper oil classification
- Improper periodic service
- Poor operating conditions
- Coolant leakage in crankcase
- Excessive cylinder liner taper

Cylinder Liner Wear and Distortion

- Incorrectly installed compression rings
- Insufficient lubrication
- Uneven cooling around liner
- Improper piston-liner clearance
- Liner bore damage

Warped Cylinder Block

- Insufficient cooling

Broken Connecting Rod

- Inadequate piston-liner clearance
- Worn connecting rod bushing
- Distorted cylinder liner
- Piston pin failure

Piston Pin and Snap Ring Failure

- Misaligned connecting rod
- Excessive crankshaft end play
- Incorrect snaprings

Mottled, Grayish or Pitted Compression Rings

- Internal coolant leaks

Dull Satin Finish and Fine Vertical Scratches on Rings

- Dirt and abrasive in air intake system

PISTONS**Access**

Under normal conditions the engine need not be removed from the tractor to service pistons, rods and liners. If engine removal is desirable, see Section 10, Group 25.

1. Remove cylinder head as described in Group 05.
2. Remove oil pan.

Removal

1. Use a short cap screw and washer to bolt down cylinder liner.

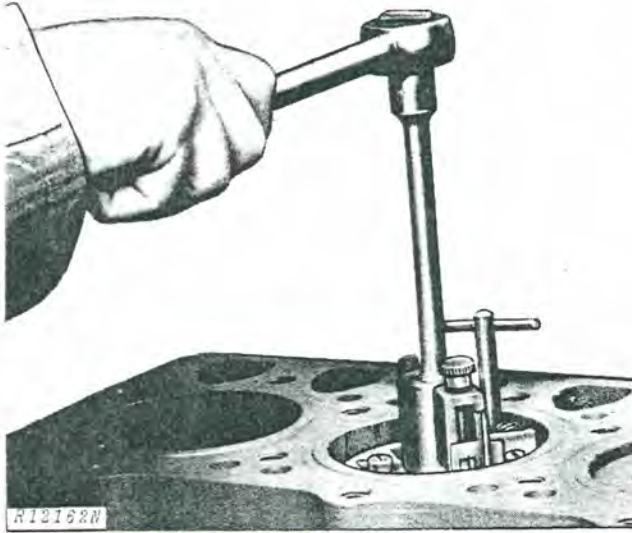


Fig. 1-Removing Ridge From Cylinder Liner

2. Remove carbon or ridge from liner bore with a ridge reamer (Fig. 1).

IMPORTANT: Keep bearing inserts with their respective rods and caps, and mark rods, pistons, and caps to insure correct reassembly.

3. Remove rod cap screws and rod caps.
4. Gently tap piston through top of cylinder.

Inspection and Repair

Cleaning the Pistons

Clean the pistons by using Immersion-Solvent "D-Part" and Hydra-Jet Rinse Gun or Glass Bead Blasting machine.

CAUTION: Follow manufacturer's instructions exactly. **AVOID CONTACT OF CHEMICAL WITH YOUR SKIN OR EYES;** chemical contains creosols which can be very harmful.

Using "D-Part" Cleaner

1. Follow manufacturer's directions for handling, mixing and use of cleaner.
2. Use a solvent to remove oil and grease from piston before soaking in cleaner.
3. One or two soakings may be required to loosen carbon and residue from piston.
4. IF NECESSARY, LIGHTLY scrape piston to remove some carbon. DO NOT scrape on piston skirt. Be VERY CAREFUL when scraping other parts of piston.

5. Thoroughly rinse piston with water and air after soaking.

Using Glass Bead Blasting Machine

1. Only an experienced operator should use a glass bead blasting machine to clean pistons. Follow manufacturer's directions.

2. Remove rings and wash piston in solvent to remove oil and grease. Use a stiff - BUT NOT A WIRE - brush to help loosen some carbon residue. Dry with compressed air.

3. Use the proper sized bead and correct pressure. Do not hold the bead blast in one area too long; keep the blast moving. The distance the blast nozzle is held away from the area will depend on the recommended pressure.

4. Avoid scratching the ring land area. Be sure ring grooves are thoroughly cleaned. Excessive deposits can force rings out, causing scuffing and scoring.

Piston Rings and Ring Grooves

1. Examine piston rings for damage, wear, and scratched or scored conditions.



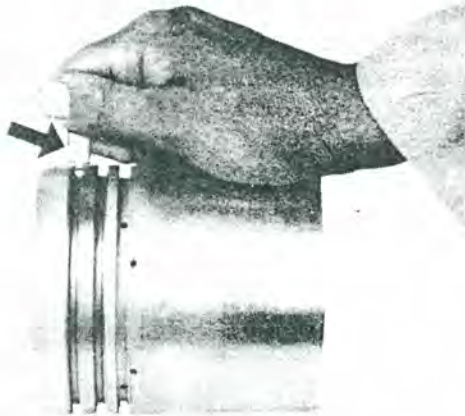
9 26155N

A—Piston Ring

B—Ring Expander

Fig. 2-Removing Piston Rings

2. Use JDE-47 Ring Expander to remove piston rings on 4270D and 6404 Engines. Use JDE-93 Ring Expander to remove rings on 6466 Engines.

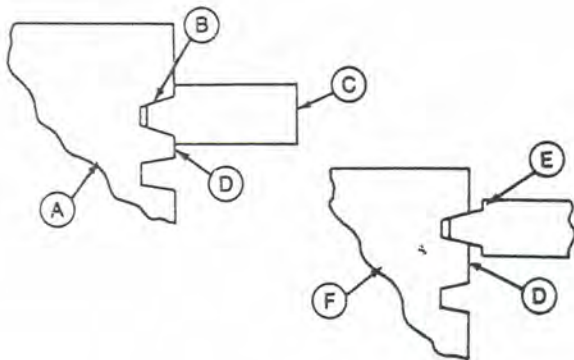


R 26157N

Fig. 3-Checking Ring Groove Wear

3. Use JDE-55 Ring Groove Wear Gauge (Fig. 3) to check wear of compression ring grooves.

NOTE: On 4270D and 6404D engines, check only the top ring groove for wear, using the JDE-62 Ring Groove Wear Gauge.



R 24201N

- A—Piston with Worn Ring Groove
- B—Keystone Ring Groove
- C—Ring Groove Wear Gauge
- D—Ring Land
- E—Gauge Shoulder
- F—Piston with Good Ring Groove

Fig. 4-Using Ring Groove Wear Gauge

NOTE: Gauge shoulders should not contact ring land (Fig. 4).

4. Check oil control ring groove clearance by installing a new ring in groove and measuring clearance with a feeler gauge at several points (Fig. 5).



R 26157N

Fig. 5-Checking Oil Control Ring Groove Clearance

OIL CONTROL RING GROOVE SPECIFICATIONS

New part clearance	0.0024 to 0.0040 (0.06 to 0.10 mm)
Allowable clearance	0.0065 in. (0.16 mm)

5. Measure pistons as directed on page 20-10-

Piston Pins

1. Inspect and measure piston pin, pin bore in piston and connecting rod pin bushing. Excessive wear can cause scored pistons or broken connecting rods.

PISTON PIN SPECIFICATIONS

O.D. of piston pin	
4270D, 6404D	1.4997 to 1.5003 in. (38.09 to 38.11 mm)
6404T and A, 6466D	1.6247 to 1.6253 in. (41.27 to 41.28 mm)
6466T and A	1.8739 to 1.8745 in. (47.60 to 47.61 mm)
I.D. of Pin Bore in Piston	
4270D, 6404D	1.5003 to 1.5009 in. (38.11 to 38.12 mm)
6404T and A, 6466D	1.6253 to 1.6259 in. (41.28 to 41.30 mm)
6466T and A	1.8748 to 1.8752 in. (47.62 to 47.63 mm)
I.D. of Rod Pin Bushing	
4270D, 6404D	1.5010 to 1.5020 in. (38.13 to 38.15 mm)
6404T and A, 6466D	1.6260 to 1.6270 in. (41.30 to 41.33 mm)
6466T and A	1.8725 to 1.8762 in. (47.63 to 47.66 mm)
Pin-to-Bushing Oil Clearance	
Clearance	0.0007 to 0.0023 in. (0.02 to 0.06 mm)
Maximum Serviceable Clearance	0.0030 in. (0.08 mm)

CONNECTING RODS

Removal

1. Remove cylinder head as described in Group 5.
2. Remove pistons.
3. Using a snap ring pliers, remove snap rings from piston pin bore.

Inspection and Repair

1. Check the piston pin bushing in the rod for damage or excessive wear.



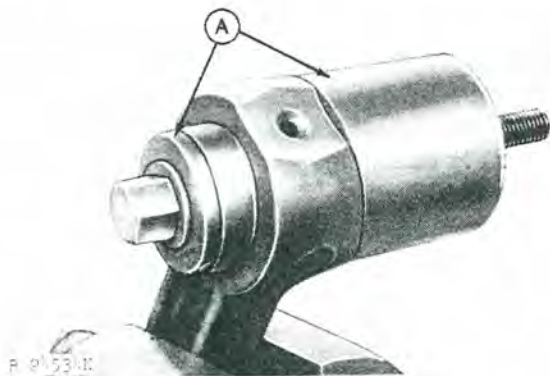
B 214533W

A—Pin Bushing Lubrication Hole
B—Pin Bushing Measurement
C—Bearing Insert Measurement

Fig. 6-Connecting Rod Pin Bushing and Bearing

Measurement

2. Compare bushing I.D. (B, Fig. 6) with piston pin for specified clearance.

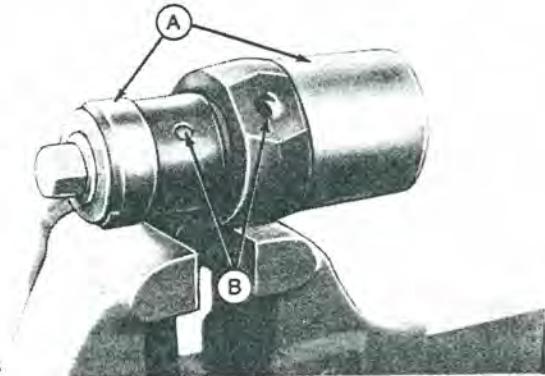


B 214533W

A—JDE-98-466 Piston Pin Bushing Tool

Fig. 7-Removing Piston Pin Bushing (6466 Engines)

3. Remove bushing if it has failed. On 4270D and 6404 engines, use disks and drivers from the D-01045AA Driver Set. On 6466 engines, use JDE-98-466 Piston Pin Bushing Tool (A, Fig. 7).



B 214533W

A—JDE-98-466 Piston Pin Bushing Tool

B—Lubrication Hole

Fig. 8-Installing Piston Pin Bushing (6466 Engines)

4. Install new bushing in connecting rod. Be sure that bushing lubrication hole is aligned with hole in connecting rod (B, Fig. 8). Install bushings in 4270D and 6404 engines with disks and drivers from D-01045AA Driver Set, Use JDE-98-466 Piston Pin Bushing Tool for 6466 engines.

5. After installation, hone new bushing to a "thumb press" fit with piston pin.

Connecting Rod Bearings

Rod bearings can be checked with "Plastigage" if rod is connected to crankshaft, or by measuring assembled I.D. of connecting rod bearings if rod is out of the engine.

NOTE: Use "Plastigage" as directed by the manufacturer. Remember, the use of "Plastigage" will determine bearing-journal clearance, but will not indicate which surface is worn, or the condition of either surface.

Measuring Assembled I.D. of bearings and O.D. of journals

1. Remove connecting rod from engine.
2. Measure connecting rod journal O.D. on crankshaft at several points around journal.
3. Install connecting rod cap on rod with bearing in correct position.
4. Tighten rod cap-to-rod using torque-turn method on p. 20-10-14.
5. Using an inside micrometer, measure inside diameter of bearing.

6. Subtract I.D. of rod bearings from O.D. of crankshaft journal to obtain oil clearance.

7. Compare the measurements with the following specifications.

ROD BEARING AND JOURNAL SPECIFICATIONS

O.D. of Bearing Journal	2.9980 to 2.9990 in. (76.15 to 76.17 mm)
I.D. of Assembled Rod Bearing	
4270D, 6404T, A	3.0015 to 3.0025 in. (78.24 to 78.26 mm)
6404D, 6466D, T and A	3.0005 to 3.0025 in. (76.21 to 76.26 mm)
Bearing-to-Journal Oil Clearance	
4270D, 6404T, A	0.0015 to 0.0045 in. (0.038 to 0.114 mm)
6404D, 6466D, T and A	0.0010 to 0.0040 in. (0.02 to 0.10 mm)
Maximum Serviceable Clearance	0.0060 in. (0.152 mm)

Connecting Rod and Cap

Inspect rod and cap for wear or damage, such as chips or cracks, in the area of the tongue-and-groove joint. Also inspect in and around cap screw holes in cap. If any defects are found, replace rod and cap.

Carefully clamp rod in a vise and install cap *without* bearing inserts. Tighten cap screws using the torque-turn method (see p. 20-10-14).

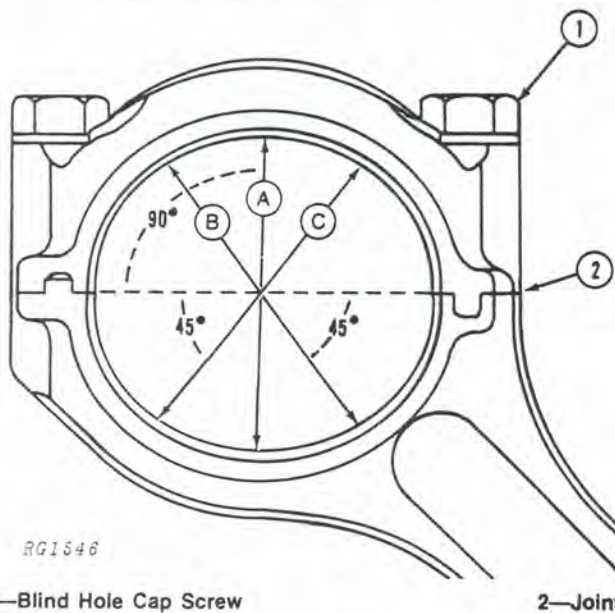


Fig. 9-Connecting Rod Inspection

Using an inside micrometer, measure rod bore at center of bore (Fig. 9) and record measurements:

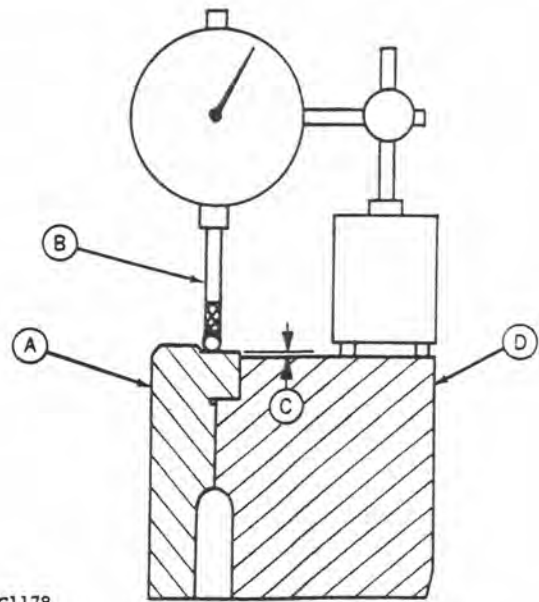
- A. At right angle to rod/cap joint
- B. At 45° left of measurement "A"
- C. At 45° right of measurement "A"

Compare the measurements. If the difference between measurements is greater than 0.001 in. (0.025 mm), the rod and cap are out-of-round and must be replaced.

Remove blind hole cap screw (1, Fig. 9). Using a feeler gauge, measure gap at rod/cap joint (2). If gap is greater than 0.010 in. (0.25 mm), the rod and cap are worn and must be replaced.

CYLINDER LINERS

Removal



- A—Cylinder Liner
- B—Dial Indicator
- C—Liner Height
- D—Cylinder Block

Fig. 10-Checking Cylinder Liner Height

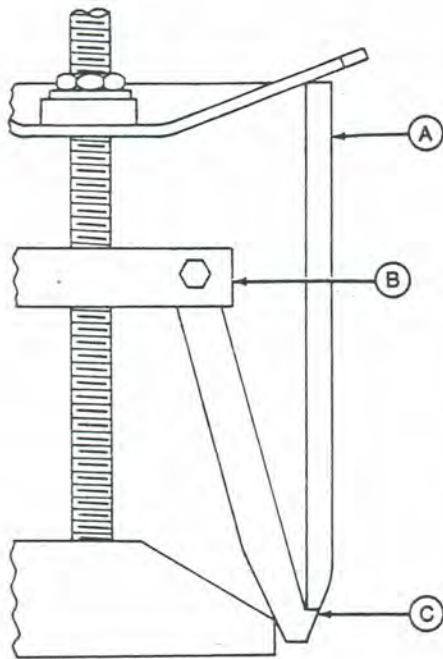
1. Use a dial indicator to measure height of bolted-down liners before removal from block (Fig. 10).

NOTE: Variations in height can give an indication of liner distortion, or liner-piston problems.

LINER HEIGHT SPECIFICATIONS

Height Above Block	
4270D; 6404	0.001 to 0.004 in. (0.025 to 0.10 mm)
6466	0.000 to 0.004 in. (0.00 to 0.10 mm)

Removal—Continued

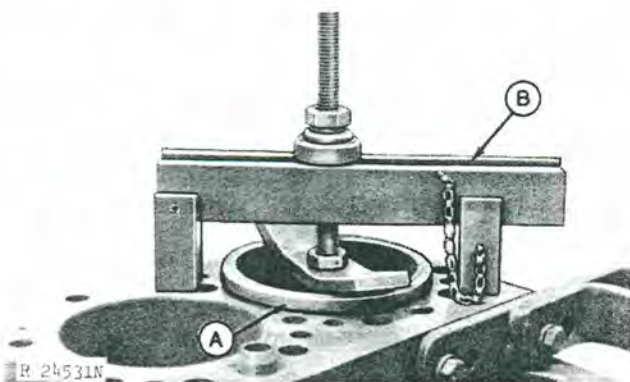


RG1179

A—Cylinder Liner
 B—D-01062AA (No. 974) Liner Puller
 C—Proper Jaw Position

Fig. 11—Installing Cylinder Liner Puller

IMPORTANT: When using Cylinder Liner Puller (B, Fig. 11) to remove liners, insure that jaw of puller is correctly positioned before attempting to remove liner.



R 24531N

A—Cylinder Liner Flange
 B—Liner Puller

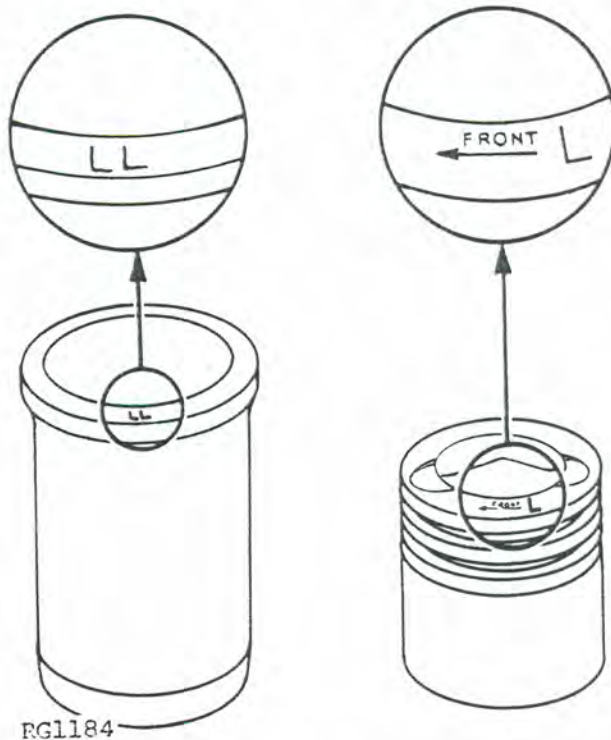
Fig. 12—Removing Cylinder Liner

2. Use D-01062AA (No. 974) Puller to remove liners (Fig. 12).

Inspection

Except on some early model 6404D engines, pistons and liners are selectively fitted to maintain piston-to-liner clearance. Pistons color-coded green and stamped with an "L" are low size and are matched with low size liners marked "LL" (Fig. 13).

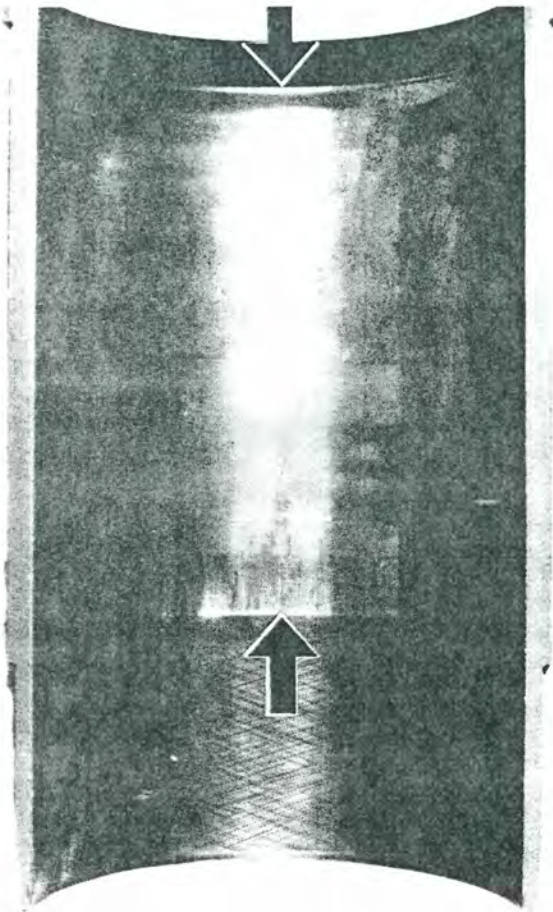
High size pistons are color-coded black and are stamped with an "H". High size liners are marked with an "HH".



RG1184

Fig. 13—Piston and Liner Size Marking

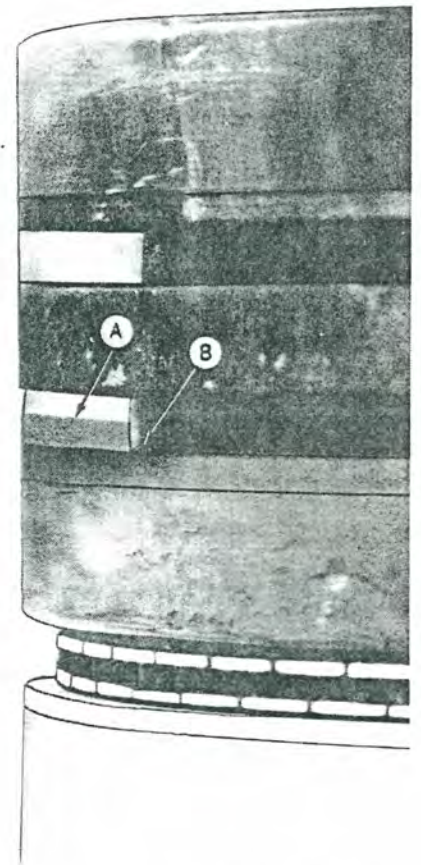
1. Carefully inspect pistons and liners and replace as a unit if:



RG1199

Fig. 14-Cylinder Liner Wear

A. Cross hatch pattern inside the liner has been worn away in the area of piston ring travel around the entire liner (Fig. 14).



RG1200

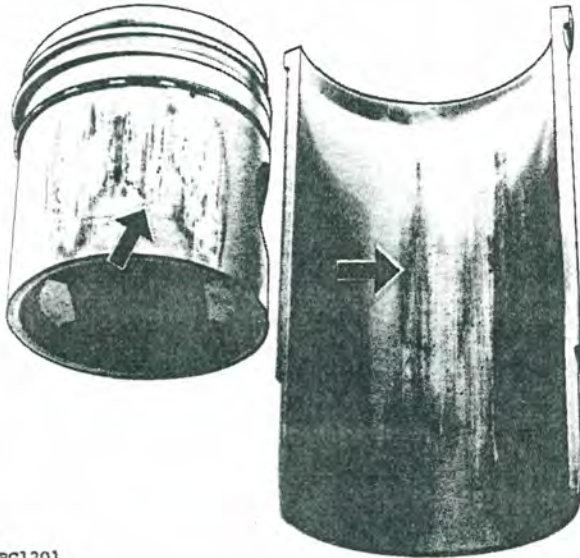
A—Piston Ring Face Wear

B—Ring Land Wear

Fig. 15-Cylinder Contamination

B. Wear on piston ring face (A, Fig. 15) and ring land (B) is excessive. Wear in these areas indicates that foreign material has entered the cylinder, possibly through the air intake system.

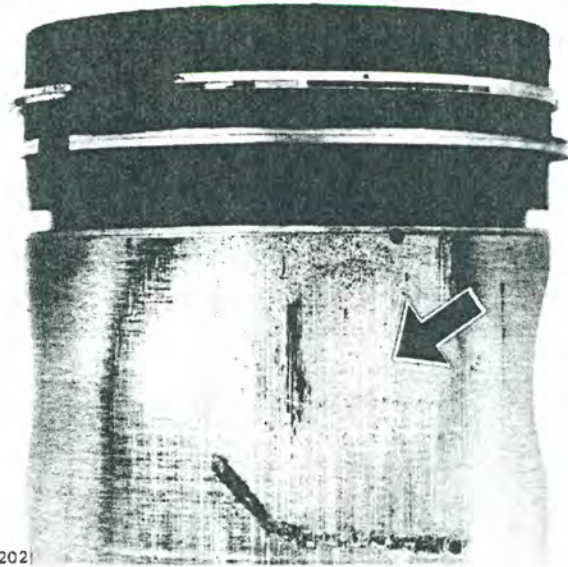
Inspection—Continued



RG1201

Fig. 16-Piston and Liner Scoring

C. Scoring is present on both piston and liner. Wear of this type could possibly be caused by the engine overheating or a mismatched piston and liner set (Fig. 16).



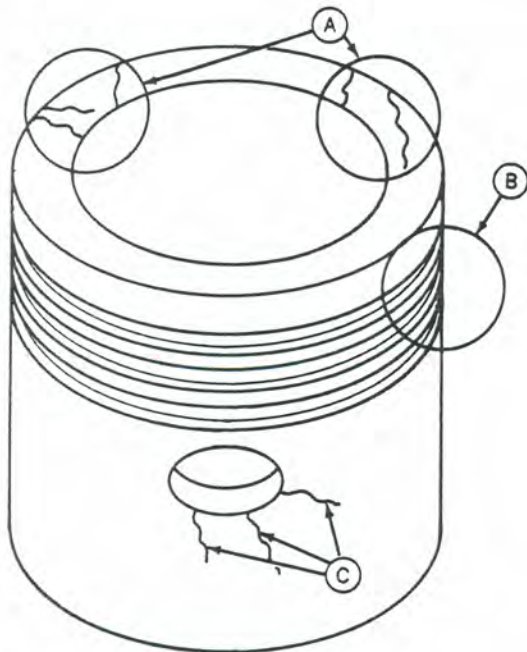
RG1202

Fig. 17-Cylinder Contamination

D. Wear on thrust side of piston (Fig. 17) and in piston ring turn-around area is excessive. Wear in these areas indicates that foreign material has entered the cylinder, possibly through the engine oiling system.

E. Any transfer of material has occurred between piston and liner.

F. Piston or liner shows any breakage or other obvious failure.

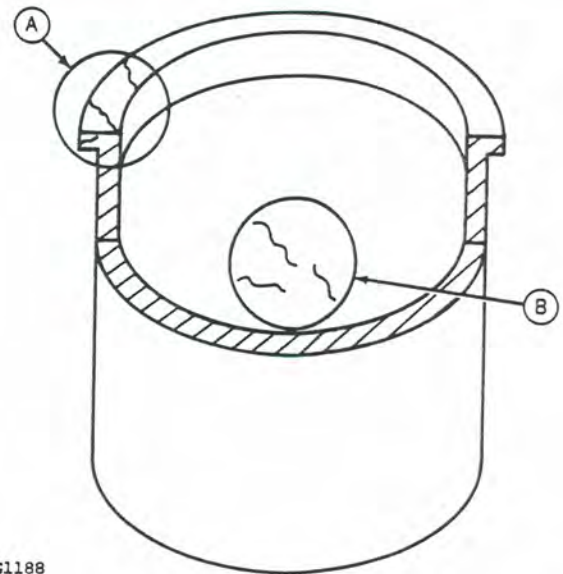


RG1187

A—Cracks in Piston Head C—Cracks at Piston Pin Bore
 B—Damaged Ring Lands

Fig. 18-Piston Inspection (Defects exaggerated)

2. Carefully inspect the piston under magnification for signs of fatigue. Look for fine cracks in the piston head (A, Fig. 18), bent or broken ring lands (B) and cracks around the piston pin bore in the skirt (C). If any defects are found, replace the piston and liner as a unit.



RG1188

A—Cracks in Flange Area B—Cracks in Ring Travel Area

Fig. 19-Cylinder Liner Inspection (Defects exaggerated)

3. Carefully examine the cylinder liners for signs of fatigue such as cracks in the flange area (A, Fig. 19) and cracks in the ring travel area (B).

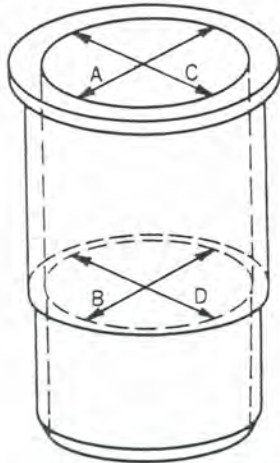


RG1203

Fig. 20-Cylinder Liner Erosion

4. Inspect the exterior surface of the liner for pitting and erosion. If liner has eroded to one half its original thickness, replace (Fig. 20).

Inspection—Continued



R25922N

Fig. 21-Cylinder Liner Measurements

NOTE: Measure parts at room temperature.

5. Measure cylinder liner as follows and record measurements:

A. Measure the liner bore parallel to the piston pin at the top end of ring travel (Fig. 21).

B. Measure bore in same position at bottom end of ring travel.

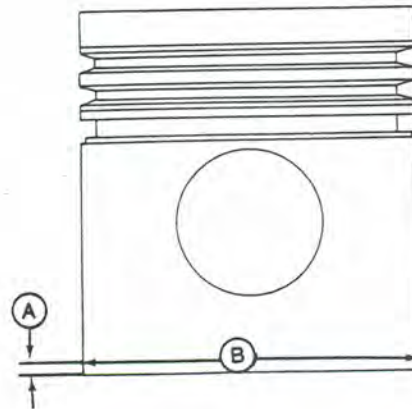
C. Measure the liner bore at right angles to the piston pin at the top of ring travel.

D. Measure bore in same position at bottom end of ring travel.

6. Compare the results of measurements A, B, C and D to determine if liner has worn tapered.

LINER TAPER SPECIFICATION

Maximum in ring travel area . . . 0.0020 in. (0.05 mm)



RG1204N

Fig. 22-Piston Measurements

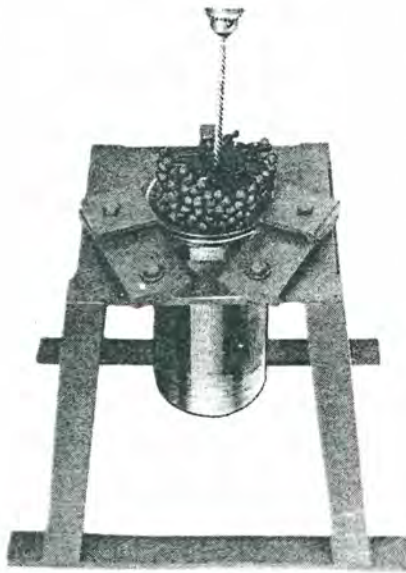
7. Measure piston O.D. at right angles to the piston pin bore (B, Fig. 22) at 0.09 inch (2.28 mm) from bottom of piston skirt (A) and record measurement.

8. Compare piston O.D. measurement (Step 7) with liner I.D. measurement (Step 6).

PISTON-TO-LINER SPECIFICATION

4270D	New Parts	0.0047 to 0.0059 in. (0.119 to 0.150 mm)
6404	New Parts	0.0027 to 0.0041 in. (0.069 to 0.104 mm)
6466	New Parts	0.0036 to 0.0053 in. (0.091 to 0.135 mm)
	Maximum serviceable	0.0060 in. (0.150 mm)

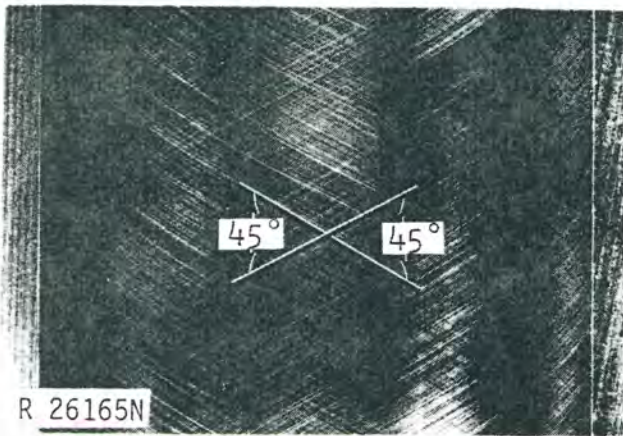
Deglazing Cylinder Liners



R 26164N

Fig. 23-Deglazing Cylinder Liners

1. Secure cylinder liner in a holding fixture (Fig. 23). (See Making Special Tools p. 20-00-10, for assembly of holding fixture.)
2. Use D-17004BR Flex-Hone to deglaze cylinder liner.



R 26165N

Fig. 24-Proper Honing Pattern

3. Use D-17004BR Flex-Hone according to instructions supplied with tool to obtain a 45-degree crosshatch pattern (Fig. 24).

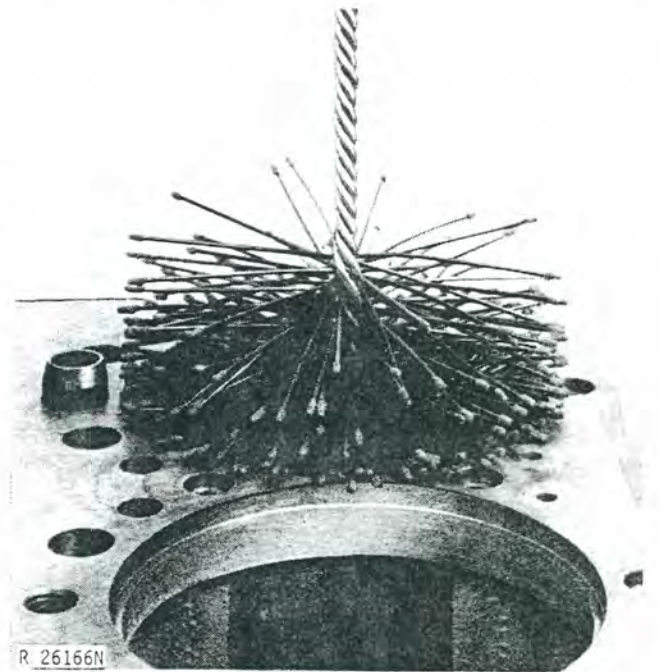
NOTE: After honing, thoroughly clean liners. First, wipe abrasive residue from liner walls with a dry rag. Swab out liner as many times as necessary with SAE-10W oil. Continue to clean liner until white rag shows no discoloration.

IMPORTANT: Do not use gasoline, kerosene or commercial solvents to clean liners. Solvents will not remove all the abrasive from liner walls.

BLOCK

Inspection and Repair

1. Clean block thoroughly with cleaning solvent or pressure steam cleaning.
2. Make sure all passages and crevices are cleared of sludge, rust, and grease.
3. Make sure all coolant passages are cleaned of lime deposits and scale.
4. Clean liner flange counter bore. Remove any burrs from bore I.D. (B, Fig. 27) with a file.
5. Inspect block carefully for cracks or damage. If a cracked block is suspected, pressure test the block. A procedure for pressure testing is outlined in FOS-30 Engines manual.



R 26166N

Fig. 25-Cleaning O-Ring Bore

6. Use D-17015BR O-ring Bore Cleaning Brush (Fig. 25) to clean O-ring bore.

Inspection and Repair—Continued

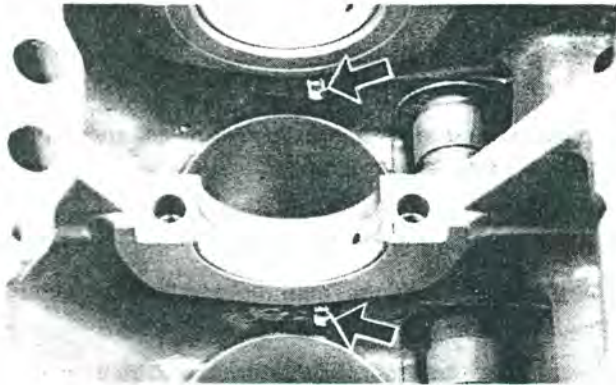


Fig. 26-Piston Cooling Orifice

6. Check each piston cooling orifice (Fig. 18) for a plugged or damaged condition.

NOTE: A cooling orifice failure could cause damage to pistons, piston pins, rod pin bushings and liners.

7. Reinstall orifices and tighten to 85 to 115 in-lbs (9.6 to 12.4 Nm) (.9 to 1.2 kgm).

Installation

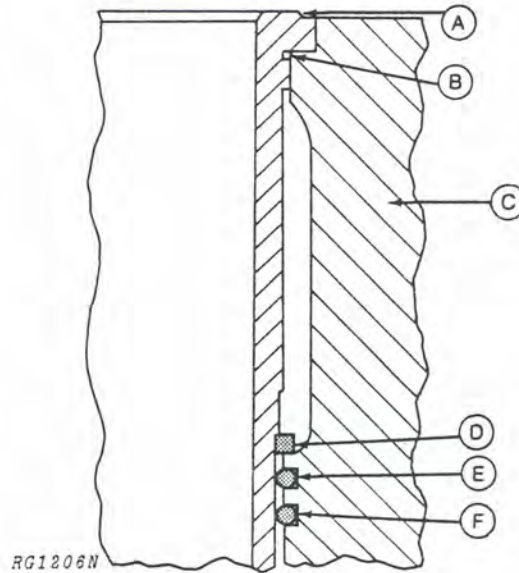
Liners

1. Be sure liner bore is clean.
2. Install liner without O-rings and secure with cap screws and washers.
3. Check liner height in several places and compare measurement obtained with the following specifications.

LINER HEIGHT

4270D, 6404		0.001 to 0.004 in. (0.025 to 0.10 mm)
6466	In new block	0.002 to 0.005 in. (0.05 to 0.12 mm)
	In used block	0.000 to 0.004 in. (0.00 to 0.10 mm)

4. Remove liner.



- A—Cylinder Liner
- B—Liner Flange Bore I.D.
- C—Cylinder Block
- D—Square Packing
- E—Red O-Ring
- F—Black O-Ring

Fig. 27-Liner Sealing Ring Installation

5. Install square packing on cylinder liner (D, Fig. 27).

NOTE: The packing is smaller than the liner and must be stretched when installing. Make certain O-rings are not twisted when installed.

6. Install red O-ring in top groove in block (E, Fig. 27).

7. Install black O-ring in bottom groove in block (F, Fig. 27).

8. Lubricate O-rings and bottom of liner with AR54749 Lubricant Soap.

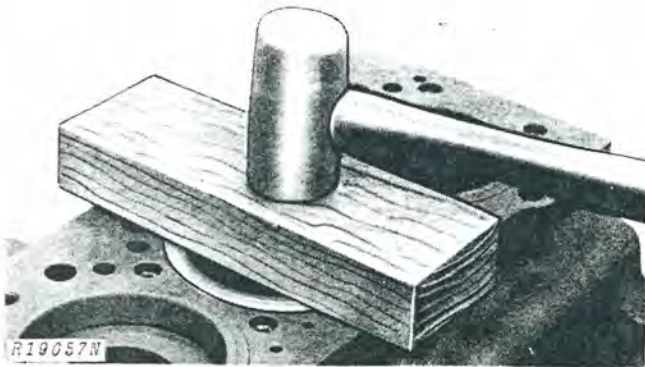


Fig. 28-Installing Cylinder Liner

NOTE: "LL" or "HH" mark on liner flange must face to front of engine.

9. Work liner in place by hand and seat with a wood block and hammer.

Pistons and Connecting Rods

1. Lubricate piston pin and bushing with SAE 10W oil.

IMPORTANT: If a new piston and liner assembly is to be installed, **DO NOT** remove piston from liner. Push piston out of liner bottom only far enough to install piston pin.

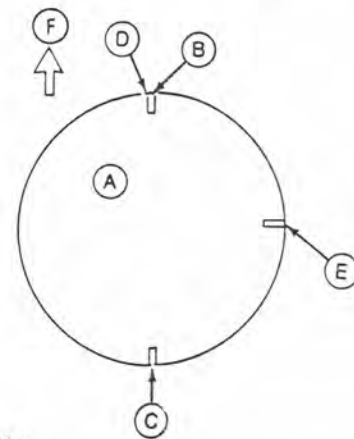
- 2. Install piston pin in piston and connecting rod.
- 3. Insert piston pin snap rings in grooves, making certain snap rings are expanded in the grooves in the piston.
- 4. Install expander ring in bottom ring bore.

NOTE: "Pip" marks on No. 1 and No. 2 rings face toward head of piston.

5. Install piston rings. Use JDE-47 Ring Expander on 4270D and 6404 engines. For 6466 engines, use JDE-93 Ring Expander.

NOTE: New rings are furnished with the correct end gap, therefore, fitting to the liner is not necessary.

6. Use JDE-57 Ring Compressor to install pistons in 4270D and 6404 engines. For 6466 engines, use JDE-96 Ring Compressor. Coat pistons, liners and inside of ring compressor with SAE 10W oil.

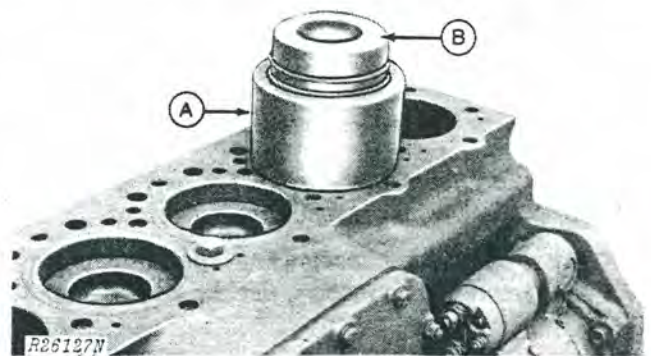


R 31127

- A—Piston Head
- B—Top Compression Ring Gap
- C—Oil Control Ring Gap
- D—Expander Ring Gap
- E—Bottom Compression Ring Gap
- F—Front of Engine

Fig. 29-Staggering Piston Rings

- 7. Stagger piston rings according to Fig. 29.
- 8. Carefully place Ring Compressor over piston.



- A—Ring Compressor
- B—Piston

Fig. 30-Installing Piston

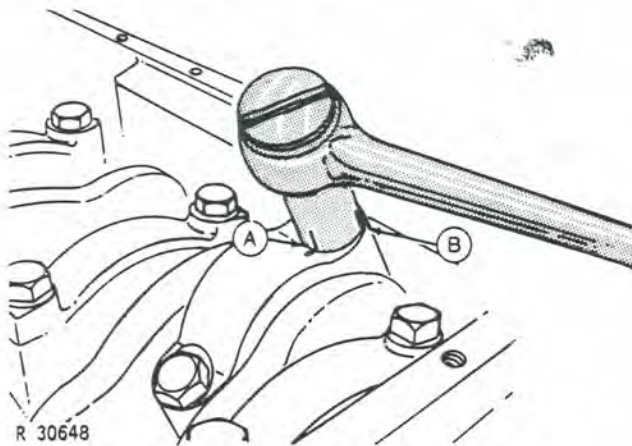
9. Carefully place ring compressor with piston and rod over liner.

IMPORTANT: Be sure crankshaft journals are not damaged when pushing piston into cylinder.

NOTE: Be sure the word "front" on piston and rod faces toward front of engine.

10. With piston centered in installing tool and rings staggered correctly, push piston into liner.

11. Apply engine oil to bearing inserts and crankshaft rod journals.
12. Install connecting rod caps.
13. Dip entire capscrew in clean, heavyweight oil (SAE 30).
14. Install and tighten capscrews evenly to 55 ft-lbs (75 Nm) (7.5 kgm).
15. Turn each cap screw an additional 1/4 turn (90 + 10 degrees -0 degrees).



R 30648

A—Reference Mark B—90 Degree Mark

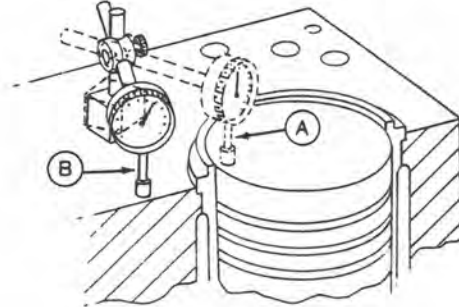
Fig. 31-Torque-Turn Method of Tightening

NOTE: To ensure that the full 1/4 turn is accomplished, the following procedure can be used.

- a) After tightening capscrews to 55 ft-lbs (75 Nm) (7.5 kgm), mark the connecting rod cap and socket (A, Fig. 31).
- b) Make a second mark on the socket (B) 90 degrees counterclockwise from the first mark.
- c) Turn 1/4 turn (90 degrees) clockwise until mark (B) is in line with reference mark on cap. This ensures 90 degree rotation of the socket instead of the wrench handle.
16. Rotate crankshaft several revolutions to be sure there is no binding of parts.

Head Gasket Installation (6404D and 6466D engines only)

Use the following procedure to measure height of each piston above cylinder block to determine the size of cylinder head gasket that should be used.



R 31106

Fig. 32-Measuring Piston Height

- a) Make sure area on block where indicator base is to be placed (Fig. 32) is clean and smooth.
- b) Position indicator and base as shown in (A, Fig. 32). Indicator point should be near rear edge of piston.
- c) Rotate crankshaft while watching indicator dial. When piston has reached its highest point (TDC), "zero" indicator.
- d) Carefully lift indicator point, and rotate indicator and base to the position shown in B, Fig. 32.
- e) Release indicator point and record reading on dial.

6404D Engines

If height of any piston is more than 0.009 in. (0.23 mm) above block, use R53483 (Grey and Red) head gasket. If height of all pistons is less than 0.009 in. (0.23 mm), use R48291 (Red) head gasket.

6466D Engines

If height of any piston is more than 0.029 in. (0.74 mm) above block, use R66065 (Black with Blue Stripes) head gasket. If height of all pistons is less than 0.029 in. (0.74 mm), use R55182 (Black) head gasket.

NOTE: If height of any piston exceeds 0.017 in. (0.43 mm) on 6404D engines or 0.037 in. (0.94 mm) on 6466D engines, interchange or install new piston and connecting rod assemblies.

Group 15

CRANKSHAFT, MAIN BEARINGS, FLYWHEEL, AND 4270D BALANCER

DIAGNOSING MALFUNCTIONS

Scored Main Bearings (Diagnosis applies to Connecting Rod Bearings, also—See Group 10, this Section)

- Oil starvation
- Contaminated oil
- Engine parts failure
- Excessive heat
- Poor periodic service

Galled or "Wiped" Bearings

- Fuel in lubricating oil (incomplete combustion)
- Coolant in lubrication system (cracked block or liner seal failure)
- Insufficient bearing oil clearance
- Parts not lubricated prior to engine operation
- Wrong bearing size

Inconsistent Wear Pattern

- Misaligned or bent connecting rod
- Warped or bowed crankshaft
- Distorted cylinder block

Broken Main Bearing Caps

- Improper installation
- Dirt between bearing and crankshaft journal
- Low oil pressure
- Oil pump failure

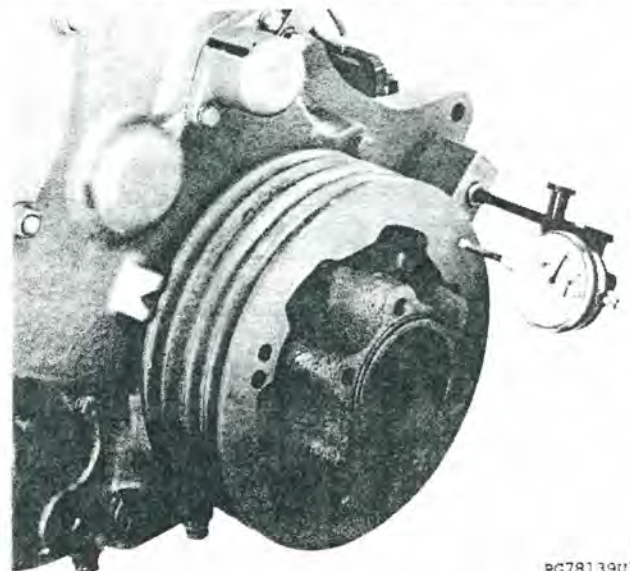
Cracked, Chipped or Broken Bearings

- Overspeeding
- Excessive idling
- Lugging
- Excessive oil clearance
- Improper installation.

INSPECTION AND REPAIR

Checking Crankshaft End Play

Before beginning disassembly, check crankshaft end play. Excessive end play can give an indication of worn thrust bearings. Insufficient end play can be the result of misaligned thrust bearings or contaminants between bearing flanges and crankshaft throws.



RG78139U1

Fig. 1-Checking Crankshaft End Play
(Six-cylinder damper removed to show detail)

1. Place a dial indicator on pulley (Fig. 1).

IMPORTANT: Use care not to distort timing gear cover or damage bearing inserts when prying.

2. Pry between pulley and timing gear cover.

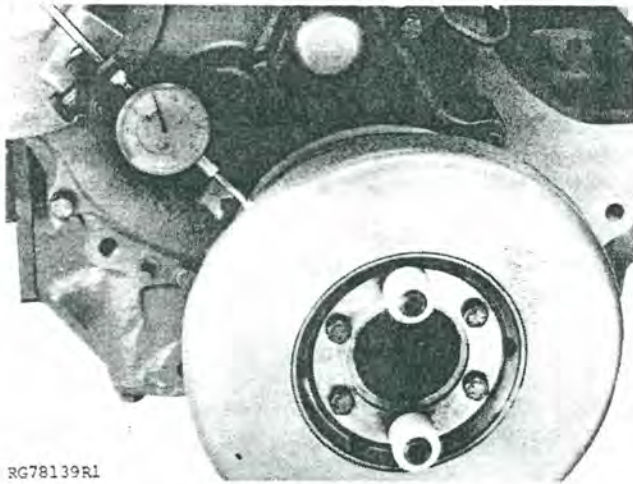
CRANKSHAFT END PLAY SPECIFICATIONS

4270D; 6404 (444688-)); 6466
New Parts	0.0015 to 0.0150 in. (0.038 to 0.380 mm)
Maximum Serviceable	0.0150 in. (0.380 mm)
6404 (-444687)	
New Parts	0.0025 to 0.0085 in. (0.064 to 0.216 mm)
Maximum Serviceable	0.0085 in. (0.216 mm)

Inspection and Repair—Continued

Damper and Damper Pulley — 6404 and 6466

NOTE: The damper assembly is not repairable and should be replaced, every 5 years or 4500 hours, whichever occurs first.



RG78139R1

Fig. 2—Checking Damper Run-out

1. Attach a dial indicator to damper (Fig. 2) and check radial run-out. Use JDE-81 Engine Rotation Tool to rotate crankshaft. If run-out exceeds 0.040 in. (1.0 mm), replace damper.

2. Grasp damper and try to turn in both clockwise and counter-clockwise direction. If rotation is felt, replace damper.

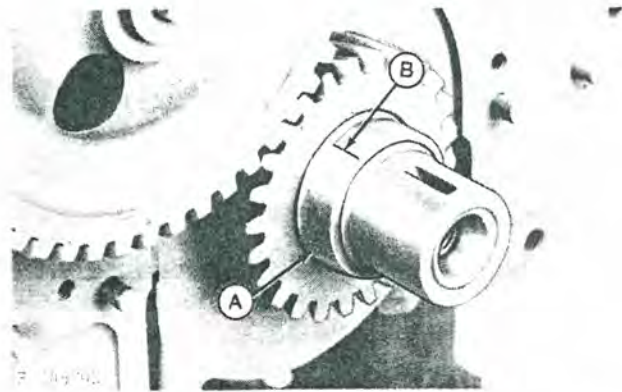
3. Remove damper from pulley by removing six screws.

4. Remove pulley-to-crankshaft cap screw and remove pulley with a puller.

Front Wear Sleeve

1. Remove timing gear cover.
2. Check front wear sleeve for wear or damage.

IMPORTANT: Do not penetrate wear sleeve with chisel.



A—Front Wear Sleeve

B—Score Lightly

Fig. 3—Scoring Wear Sleeve Before Removal

3. To remove wear sleeve, score lightly with a DULL CHISEL. DO NOT score too deeply (Fig. 3).
4. Gently pry wear sleeve from crankshaft.
5. Inspect crankshaft flange for burrs or nicks.
6. Clean up flange with a light file and fine emery cloth, if necessary.

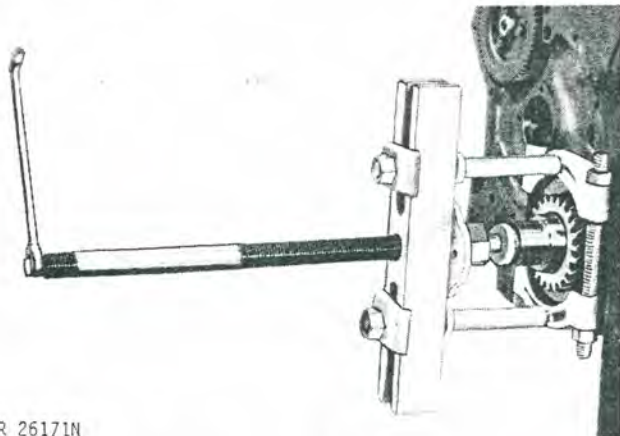
Front Oil Seal

1. Check front oil seal for wear or deterioration.
2. Use a small punch and tap around metal edge of seal to remove.

Crankshaft Gear

1. Check crankshaft gear and camshaft gear for wear or damage.

NOTE: To remove crankshaft gear, camshaft must first be removed.

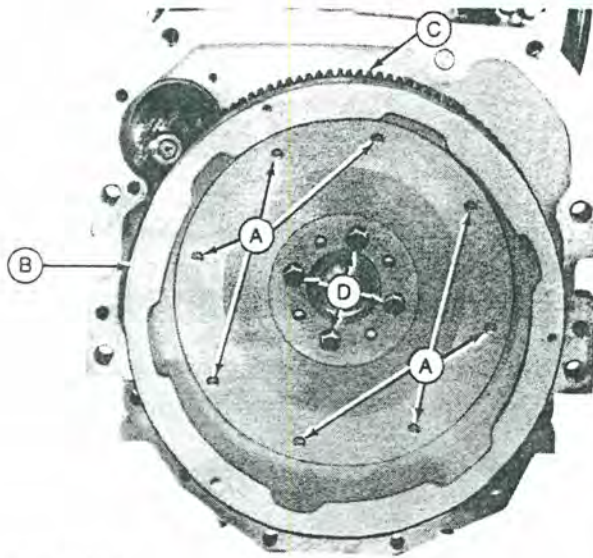


R 26171N

Fig. 4—Removing Crankshaft Gear

2. Remove crankshaft gear using gear pulling attachment and adapter (Fig. 4).

Flywheel



RG73139E1

- A—Clutch Mounting Holes
- B—Flywheel
- C—Ring Gear
- D—Flywheel Mounting Holes

Fig. 5-Flywheel Assembly

1. Check flywheel for cracks or damage, particularly around clutch mounting (A, Fig. 5) and flywheel mounting holes (D).
2. Examine flywheel ring gear (C) for chipped or broken teeth.
3. Remove ring gear by placing the flywheel on a solid flat surface, and driving ring gear off with a brass drift and hammer.

CAUTION: Oil fumes or oil can ignite above 380°F (193°C). Use a thermometer and do not exceed 360°F (182°C). Do not allow a flame or heating element to be in direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.

4. Install new ring gear by heating gear to 300°F (148°C) using either heated oil, oven heat, or flame heat.

IMPORTANT: If flame heat is used, be sure gear is heated uniformly around circumference. DO NOT OVERHEAT. SEE CAUTION. Overheating may also destroy original heat treatment of gear.

NOTE: Be sure gear circumference is against shoulder.

5. Tap heated gear into place against flywheel shoulder.
6. Always replace flywheel cap screws once they are removed or torque disturbed.

Rear Crankshaft Oil Seal, Housing, and Wear Sleeve

1. Remove rear oil seal housing.
2. Check oil seal for damage or leakage.

IMPORTANT: Do not cut through wear sleeve with chisel.

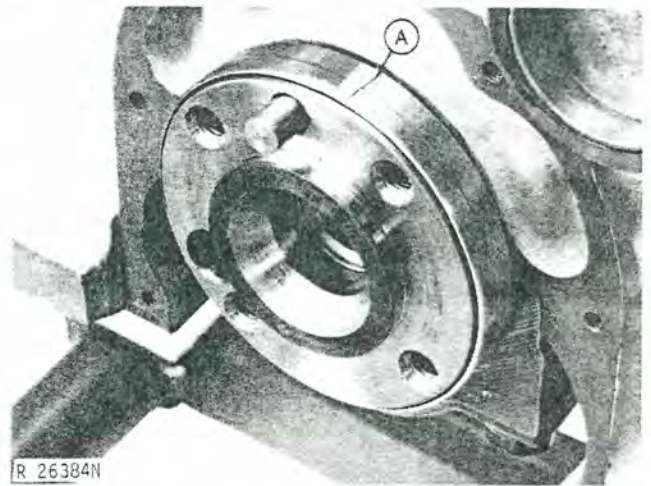


Fig. 6-Scored Wear Sleeve Before Removal

3. To remove wear sleeve, score lightly (A, Fig. 6) with a **dull chisel**. DO NOT score too deeply.
4. Gently pry wear sleeve from crankshaft.
5. Inspect crankshaft for burrs or nicks.
6. Clean flange with a light file and fine emery cloth if necessary.

INSPECTION AND REPAIR—Continued

Main Bearings

A drop in oil pressure, excessive oil consumption, engine knock, or excessive crankshaft end play are indications of main bearing and main thrust bearing washer failures.

1. Remove main bearing caps and examine main bearing inserts for excessive wear, scoring, and damage.

NOTE: Main bearing caps are numbered for reassembly on the same numbered main bearing bosses. Identify bearing inserts for comparison with crankshaft journals.

NOTE: Main bearing oil clearance can be determined by measuring the assembled I.D. of bearings and O.D. of crankshaft journals, or with the use of "Plastigage".

Measuring Assembled I.D. of Bearings and O.D. of Crankshaft Journals

1. With crankshaft out of engine, install main bearing inserts and caps (be sure inserts are installed correctly.)
2. Tighten main bearing cap screws to 150 ft-lbs (203 Nm) (20.3 kgm).

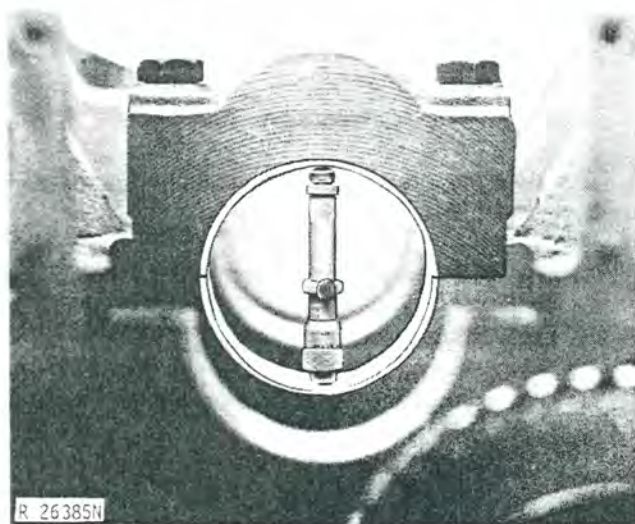


Fig. 7-Measuring Bearing I.D.

3. Measure bearing I.D.

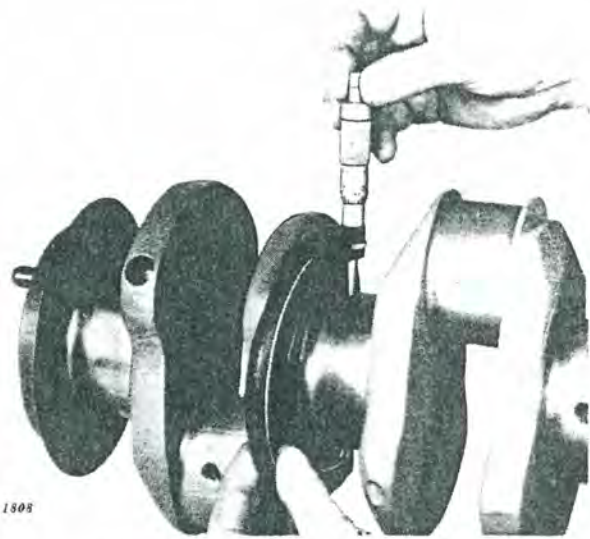


Fig. 8-Measuring Crankshaft Journal

4. Measure crankshaft journal O.D. at several points around journal (Fig. 8).

MAIN BEARING AND JOURNAL SPECIFICATIONS

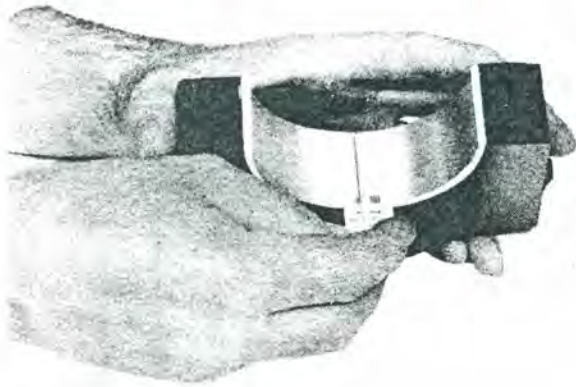
Measurement	Specifications
O.D. of main bearing journal	3.3720 to 3.3730 in. (85.649 to 85.674 mm)
I.D. of main bearing (assembled)	3.3742 to 3.3762 in. (85.705 to 85.755 mm)
Oil Clearance	0.0012 to 0.0042 in. (0.051 to 0.108 mm)
Maximum Serviceable Clearance	0.0077 in. (0.196 mm)

NOTE: If engine had previous major overhaul and undersized bearing inserts were used, above listed I.D. and O.D. dimensions may not be the same as those recorded. However, oil clearance should be within specifications.

If wear is even but out of specifications, dress journals and select proper undersize bearing inserts. Bearing inserts are available in 0.002, 0.010, 0.020 and 0.030 inch (0.05, 0.25, 0.50, and 0.75 mm) undersizes.

NOTE: If undersized main bearings are used, check bearing clearance with bearing caps tightened to specified torque. If undersize bearings are too tight and clearance is not within specifications, the journal and bearing will be wiped clean of oil resulting in premature wear on parts.

Measuring Clearance with "Plastigage"

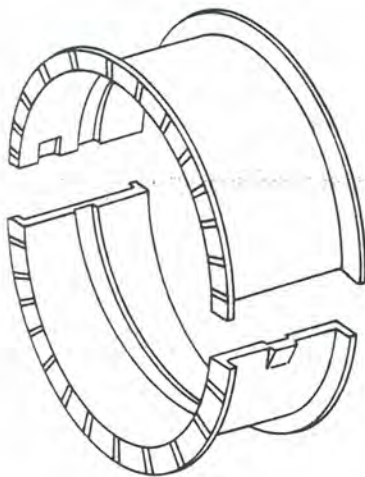


R 22978N

Fig. 9-Determining Main Bearing Clearance

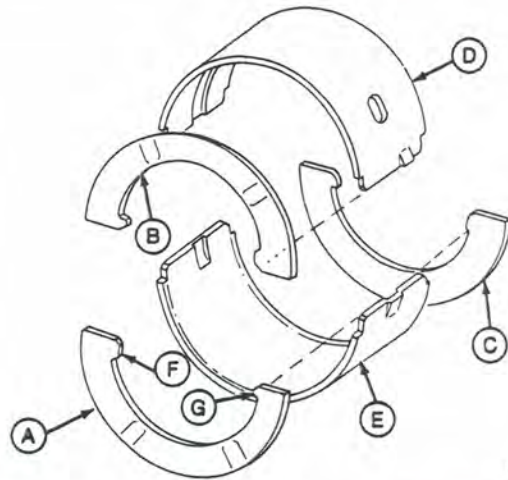
1. Remove main bearing caps with inserts.
2. Place a strip of "Plastigage" in the center of the cap.
3. Tighten main bearing cap screws to 150 ft-lbs (203 Nm) (20.3 kgm).
4. Remove the cap and compare the width of "Plastigage" with scale provided on side of package to determine clearance (Fig. 9).

Thrust Bearings



R 26128N

*Fig. 10-Early Style Thrust Bearings
4270D; 6404 (-444687)*



R 24545N

- | | |
|--|---|
| A—Lower Rear Thrust Bearing Washer | D—Main Bearing Fillet Thrust Bearing |
| B—Upper Rear Thrust Bearing Washer | E—Main Bearing Cap Thrust Bearing |
| C—Lower Front Thrust Bearing Washer | F—Large Tang |
| | G—Small Tang |

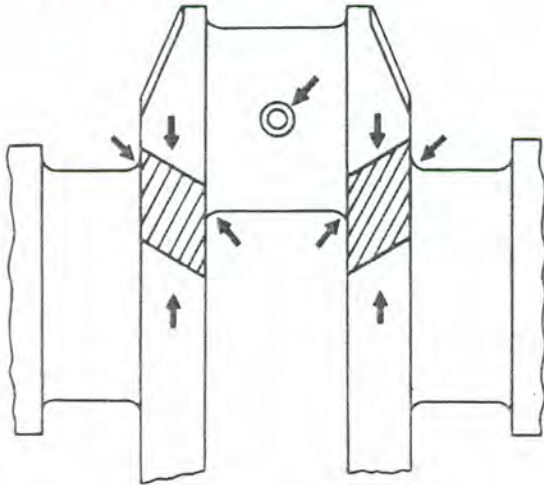
*Fig. 11-Late Style Thrust Bearing
6404 (444688-); 6466*

1. Examine crankshaft thrust surfaces and thrust bearing washers for excessive wear or damage.
2. If crankshaft end play was excessive, dress thrust surfaces of crankshaft, and install new regular size or oversize thrust bearing washers.

Early style thrust bearings are available with a standard flange in 0.002, 0.010, 0.020 and 0.030 inch (0.05, 0.25, 0.50 and 0.75 mm) undersize. Additionally, a 0.007 in. (0.18 mm) oversize flange is available on 0.010 in. (0.25 mm) undersize bearing.

Later style thrust bearings are available in 0.002, 0.010, 0.020 and 0.030 inch (0.05, 0.25, 0.50 and 0.75 mm) undersizes. Oversize thrust washer sets contain one regular size washer and two 0.007 in. (0.18 mm) oversize washers. The regular size washer is installed on the front side of main thrust bearing cap.

Crankshaft Journals



R 26386N

Fig. 12-Load Stress Areas on 6-Cylinder Crankshaft

1. Check crankshaft for cracks or signs of load stress. If there is any question as to the condition of the crankshaft, it should be inspected by Magnaflux or a similar crack detection process (Fig. 12).

NOTE: On 6 cylinder engines, stress cracks are more likely to occur at the No. 5 and No. 6 journal oil holes than at other oil holes.

2. Use crankshaft journal O.D. measurements to determine if journal is out-of-round or has worn tapered.

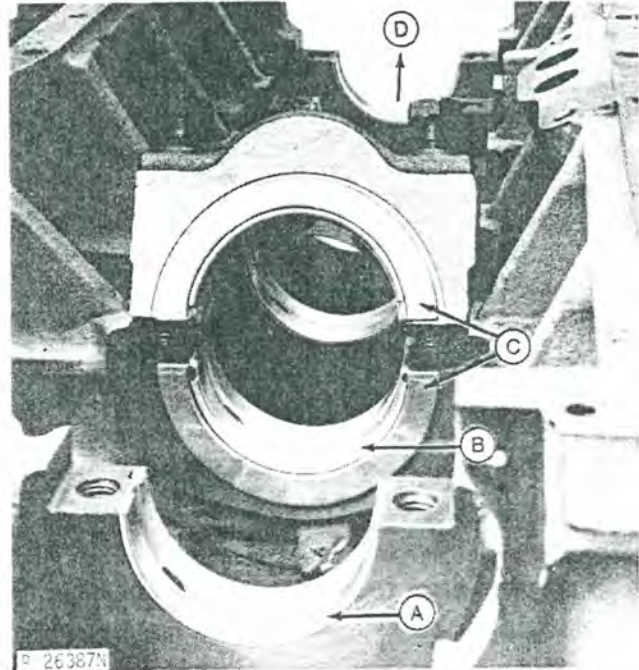
Journal taper per inch of	
journal length	0.0001 in. (0.002 mm)
Journal out-of-roundness	0.0010 in. (0.025 mm)

3. If journals have worn tapered or out-of-round or are scored or damaged, the crankshaft should be ground and proper undersize bearing inserts should be installed.

IMPORTANT: Crankshaft grinding should be done ONLY by experienced personnel on equipment capable of maintaining crankshaft size and finish specifications.

INSTALLATION

Main Bearings and Crankshaft



R 26387N

A—Main Bearing Insert C—Thrust Bearing Washers
B—Main Thrust Bearing D—Front of Engine

Fig. 13—Main Bearing Installation
(Late 6404; 6466 Shown)

1. Install main bearing inserts.
2. Be sure thrust bearing insert is installed in fifth bore from front of engine.

3. Make sure the tangs on all bearings fit in recesses in bore and that oil slots line up with oil passages in block.

NOTE: If new thrust bearing inserts or thrust bearing washers are installed, they must be installed as a set.

4. Apply a film of oil to bearing surfaces and to crankshaft journals.

5. Install crankshaft.

6. Install each bearing cap with the recesses and tabs facing the same side of the engine as those on the respective upper bearings in the block.

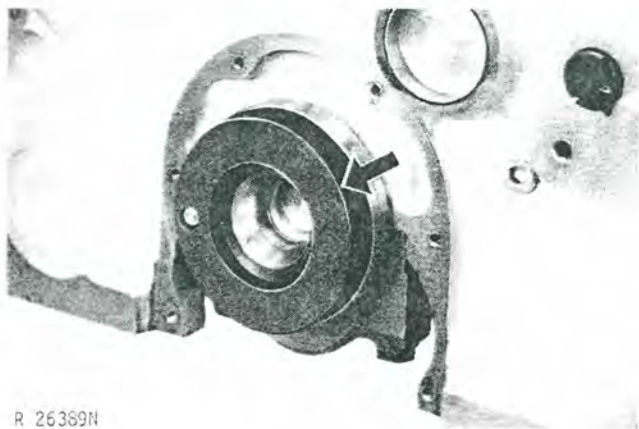
7. Make sure bearing caps are installed on the bearing bosses from which they were removed.

NOTE: The numbers stamped on the caps should be on the same side as the numbers on the block.

8. Tighten main bearing cap screws (except thrust bearing cap screws) to 50 ft-lbs (68 Nm) (6.8 kgm).
9. Align upper and lower thrust flanges on main thrust bearings.
10. Gently tap crankshaft to the rear then to the front of engine to line up flanges.
11. Tighten all main bearing cap screws to 150 ft-lbs (203 Nm) (20.3 kgm).

Rear Wear Sleeve

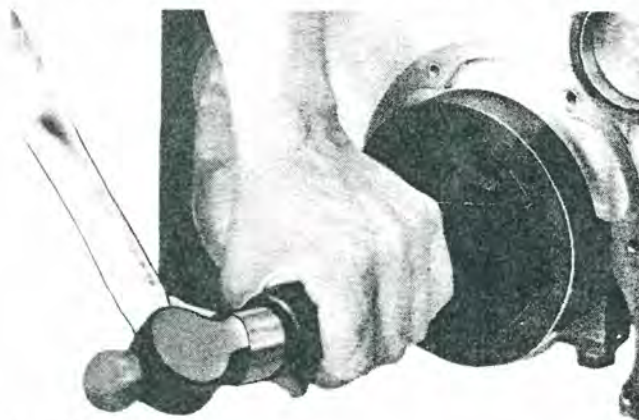
1. Apply a light coat of Permatex No. 3 to the crankshaft flange before installing wear sleeve.
2. Carefully center new wear sleeve in crankshaft flange with the O.D. chamfer of the sleeve toward the rear of the engine.
3. To install wear sleeve, first start wear sleeve onto crankshaft flange.



R 26389N

Fig. 14-Installing JDE-106 Guide

4. Install guide from JDE-106 Tool Set (Fig. 14).

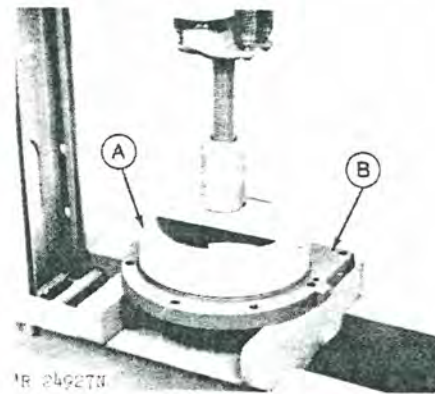


R 26390N

Fig. 15-Installing Wear Sleeve

5. Use JDE-106 Driver to drive sleeve onto flange until driver bottoms on the guide.

Rear Oil Seal and Housing



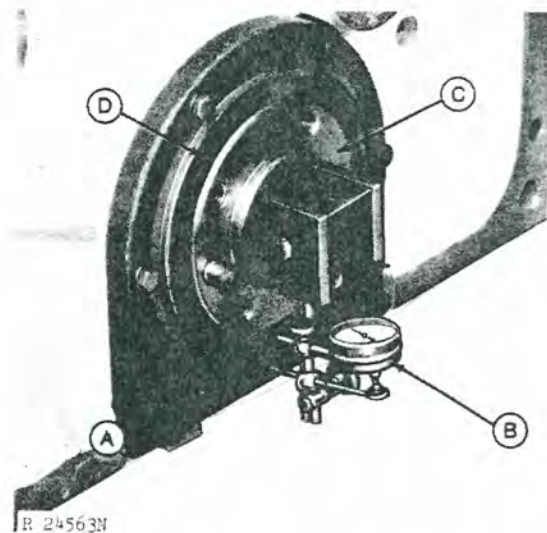
R 24927N

A—Driver

B—Oil Seal Housing

Fig. 16-Installing Oil Seal

1. Support the oil seal housing as close to the seal bore as possible (Fig. 16).
2. Start seal by hand with spring side of seal away from flange side of housing.
3. Press in seal with JDE-106-2 Driver until driver bottoms on the housing flange.
4. Lubricate seal lip with engine oil.
5. Carefully work seal and housing over wear sleeve.
6. Snug, but do not tighten housing cap screws.



R 24563N

A—O.D. of Oil Seal Housing Flange
B—Dial Indicator

C—Crankshaft Flange
D—Oil Seal

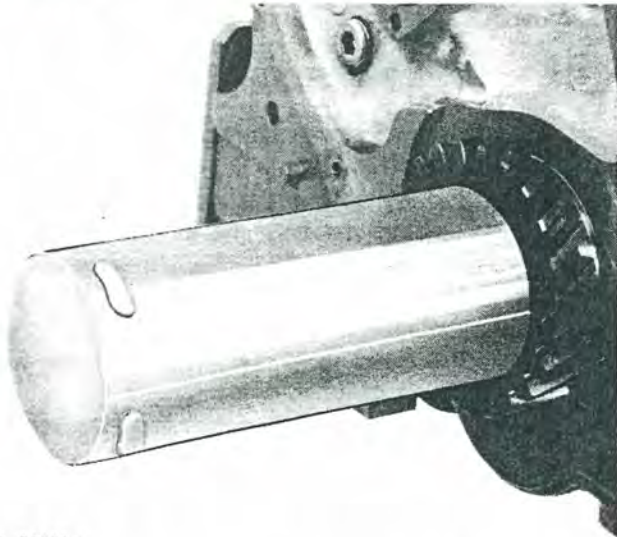
Fig. 17-Checking Oil Seal Run-Out

7. Attach a dial indicator base to the crankshaft flange (Fig. 17).

Rear Oil Seal and Housing—Continued

8. Locate the dial indicator on the O.D. of the oil seal housing flange (A, Fig. 17).
9. Turn the crankshaft and check housing bore run-out.
10. Lightly tap the housing to bring into .0060 in. (0.15 mm) maximum run-out.
11. Tighten cap screws to 20 ft-lbs (27 Nm) (2.7 kgm).
12. Trim off gasket material extending below bottom of oil seal housing.

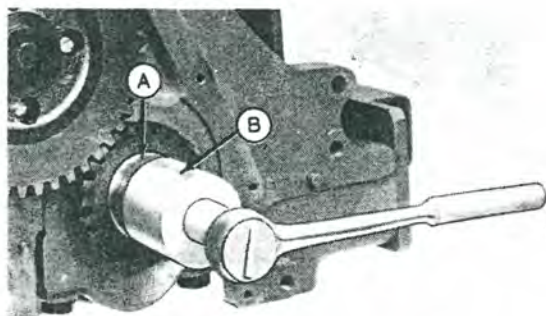
Crankshaft Gear, Front Wear Sleeve and Oil Seal



R 26392N

Fig. 18-Installing Crankshaft Gear

1. Install crankshaft gear using JDH-7 Driver (Fig. 18).
2. Coat I.D. of new wear sleeve with Permatex No. 3.

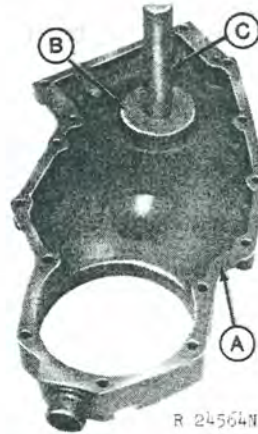


R 26393N

A—Wear Sleeve B—JDE-3 Driver

Fig. 19-Installing Front Wear Sleeve

3. Use JDE-3 Driver to press on wear sleeve.
4. Install front oil seal in housing, with spring side of seal facing engine.



R 24564N

A—Time Gear Cover B—Oil Seal C—Driver

Fig. 20-Installing Front Oil Seal

5. Support timing gear cover around seal bore.
 6. Press seal in with No. 27522 and No. 27537 Disks from No. 27797 Bushing Driver Set.
- NOTE: Closed side of seal should be 0.33 in. (8.4 mm) below front of cover.*
7. Lubricate seal before installing cover on engine.
 8. Position timing gear cover on engine and install cap screws, tightening to 30 ft-lbs (41 Nm) (4.1 kgm).

ENGINE BALANCER-4270D

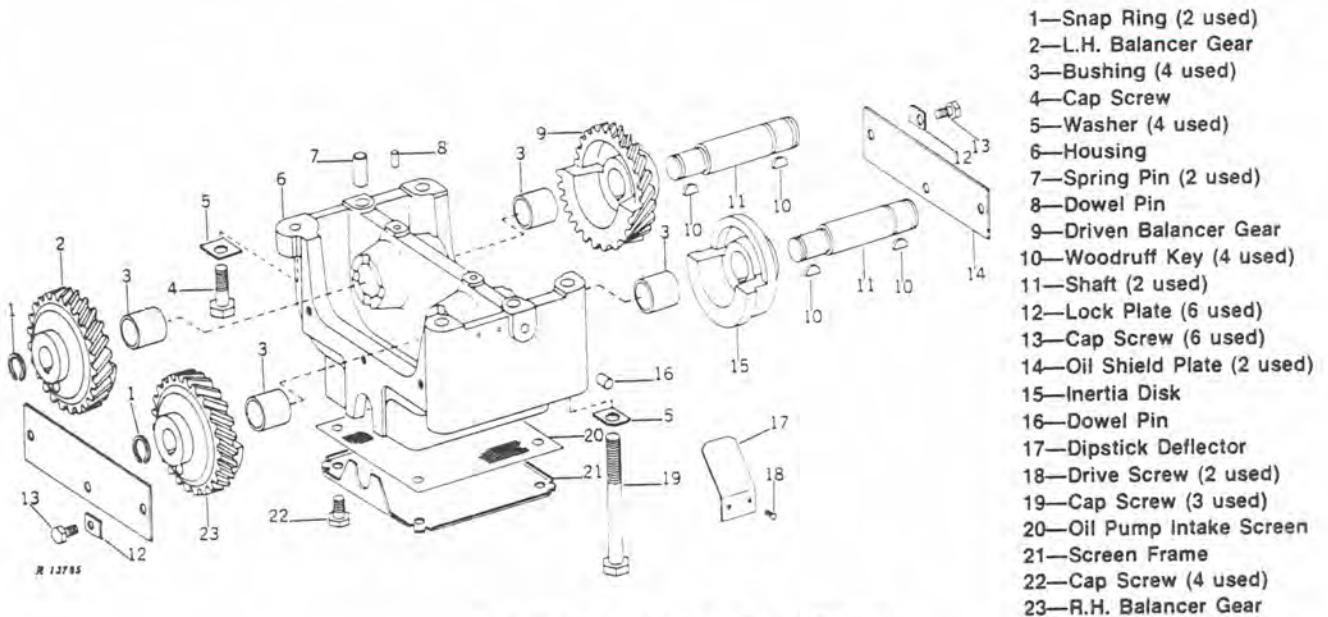


Fig. 21-Exploded View of Engine Balancer

DISASSEMBLY

1. Remove oil shield plates (14, Fig. 21).
2. Remove snap rings (1) from ends of balancer shafts (11).
3. Remove gears (2, 9 and 23) and inertia disk (15) by pressing on small end of balancer shafts. Support the gears while pressing.

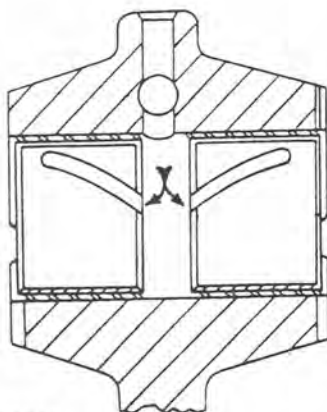
Repair

1. Inspect bushings (3) for wear and damage.
 Balancer Housing Bushing Specification
 Bushing I.D. 1.127 to 1.128 inch
 (28.63 to 28.65 mm)
2. Install new bushing with oil grooves toward inside of housing (Fig. 22).
3. Use JDE-16 Driver to drive bushing to 0.047 in. (1.19 mm) below edge of bore.
4. Line up keyways and press both gears, or gear and inertia disk, on shaft together.
5. Install oil shield plates.

Crankshaft Balancer Drive Gear

The crankshaft balancer drive gear can be replaced if worn or damaged.

1. Remove crankshaft from engine.
2. Cut drive gear-to-crankshaft welds using a small grinder.
3. Dress the welded surfaces to conform with the surrounding flange surface.
4. Install new gear over front of crankshaft with chamfered side of gear to front.
5. Align groove in gear with dowel pin in crankshaft.



T 22255

Fig. 22-Bushing Oil Groove Alignment

Balancer Drive Gear—Continued

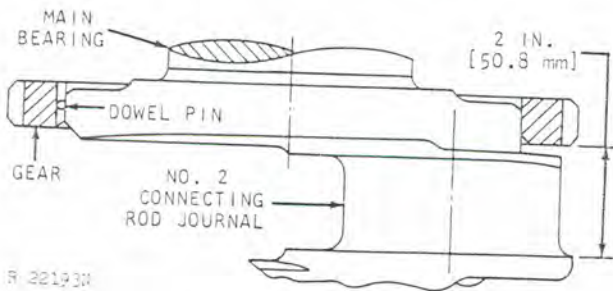


Fig. 23-Drive Gear Position

6. Position gear on crankshaft to obtain 2.00 in. (50.8 mm) clearance as shown in Fig. 23.

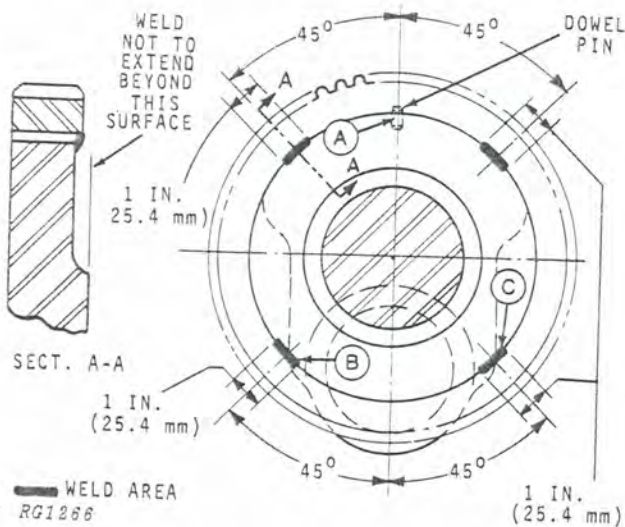


Fig. 24-Crankshaft Drive Gear Welding Diagram

IMPORTANT: Tack welds are not to exceed a maximum length of 0.375 in. (9.55 mm).

7. Tack weld gear to crankshaft at points A, B and C, Fig. 24.

8. Use E7018 welding rod, 1/8-inch (3.18 mm) in diameter and arc weld gear in place. Apply approximately 100 amperes of current. Make beads approximately one inch in length, as unequal length welds may upset crankshaft balance. Clean slag from beads.

IMPORTANT: Do NOT apply more heat than is necessary to make weld. Protect gear teeth from weld splatter. A nick or burr on teeth will cause an objectionable noise.

INSTALLATION

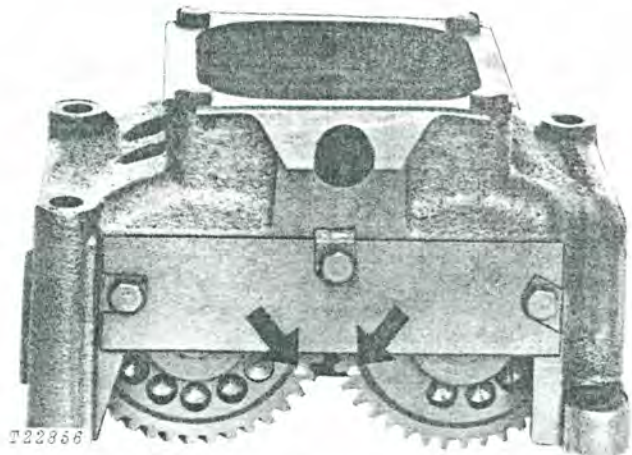


Fig. 25-Balancer Timing Marks Aligned

1. Align gear timing marks as shown in Fig. 25. The counterweights on driven gear and inertia disk should be down.

2. Install balancer assembly on engine. Tighten cap screws to 85 lbs-ft (11.8 kg-m) torque.

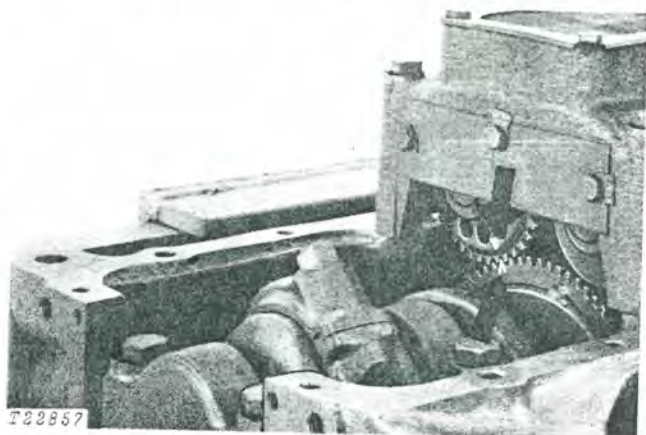


Fig. 26-Balancer Timed with Crankshaft Drive Gear

Turn crankshaft so Nos. 1 and 4 pistons are approximately bottom dead center (BDC). Crankshaft drive gear timing mark should be in position to be timed with balancer drive gear timing mark. See Fig. 26.

Group 20 LUBRICATION SYSTEM

DIAGNOSING MALFUNCTIONS

Low Oil Pressure

- Low oil level
- Clogged cooler or filter
- Excessive oil temperature
- Incorrect oil
- Oil pressure regulating valve failure
- Worn main bearings
- Clogged oil pump screen
- Worn oil pump gears

High Oil Pressure

- Improper oil classification
- Clogged oil lines
- Oil pressure regulating valve failure

Oil Sludge and Dilution

- Improper operation and servicing
- Coolant in oil
- Incomplete combustion
- Excessive oil temperature

REMOVAL, INSPECTION AND REPAIR

Oil Filter Housing

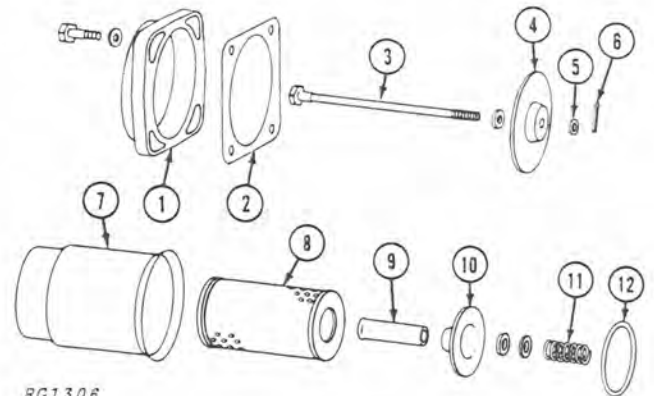
4270D

1. Remove cover (1, Fig. 1).
2. Remove filter body (7) from oil pan by removing cap screw (3).
3. Check filter body for cracks or damage.
4. Check filter spring (11) tension.

OIL FILTER BODY SPRING COMPRESSION

1.375 in.....	18 to 22 lbs.
(35 mm)	(80 to 90 N)
	(8.2 to 10 kg)

5. Install filter assembly using new O-ring (12).

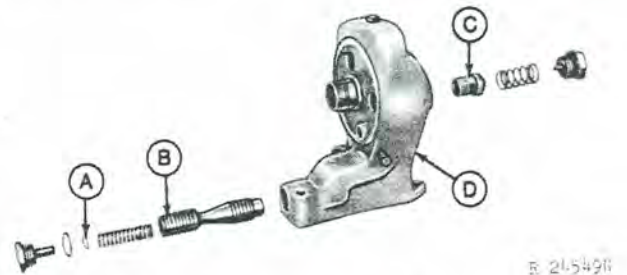


RG1306

- | | |
|--------------|------------------|
| 1—Cover | 7—Filter Body |
| 2—Gasket | 8—Filter Element |
| 3—Cap Screw | 9—Outlet Tube |
| 4—Plate | 10—Sealing Plate |
| 5—Packing | 11—Body Spring |
| 6—Cotter Pin | 12—O-Ring |

Fig. 1-4270D Oil Filter Assembly

6404 and 6466



R 2154911

- | | |
|---------------------------------|-----------------------|
| A—Adjusting Washer | C—Filter Relief Valve |
| B—Oil Pressure Regulating Valve | D—Oil Filter Housing |

Fig. 2-Oil Filter Housing

1. Remove oil pressure regulator plug, spring and valve from base of filter housing.
2. Check valve and valve bore for damage.
3. Check oil pressure regulator spring tension.

REMOVAL, INSPECTION AND REPAIR—Continued

6404, 6466 Oil Filter Housing—Continued

OIL PRESSURE REGULATOR SPRING COMPRESSION

1.71 in. (42.4 mm) at 30 to 33 lbs. (133 to 147 N) (13.6 to 15.0 kg)

4. Remove filter relief valve plug, spring and valve.
5. Check filter relief valve spring tension.

OIL FILTER RELIEF VALVE SPRING TENSION

1.38 in. (35 mm) at 18 to 22 lbs. (80 to 90 N) (8.2 to 10 kg)

6. Make sure oil filter housing passages are clean.

Oil Cooler

4270D

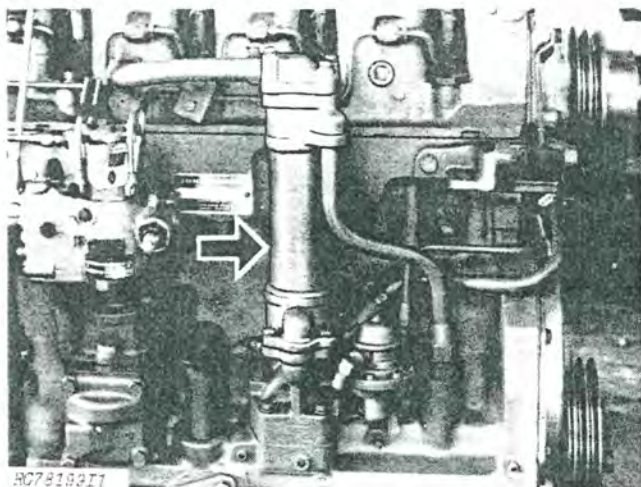
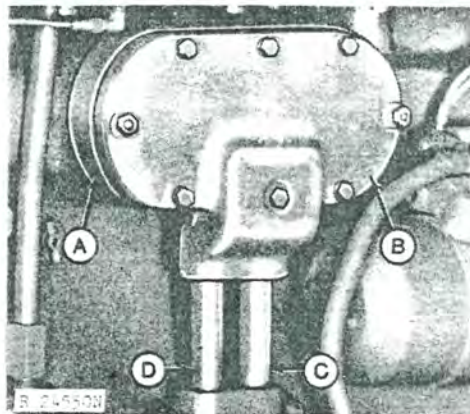


Fig. 3-4270D Engine Oil Cooler

1. Remove oil cooler and disassemble.
2. Check for scale build-up and clogged passages.
3. Clean with a suitable brush, solvent and compressed air.
4. Assemble oil cooler and install on engine.

6404 and 6466

1. Remove oil cooler.
2. Check for clogged passages and scale build-up. Clean with a suitable brush, solvent and compressed air.



A—Oil Cooler Spacer
B—Oil Cooler Cover
C—To Cooler
D—From Cooler

Fig. 4-6404 and 6466 Engine Oil Cooler

NOTE: Oil cooler spacer (A, Fig. 4) is not used on 6404D and T engines.

3. Install oil cooler spacer with large side toward cylinder block.
4. Install oil cooler, gasket with center web and oil cooler cover with pipes.

Oil Cooler Bypass Valve

4270D

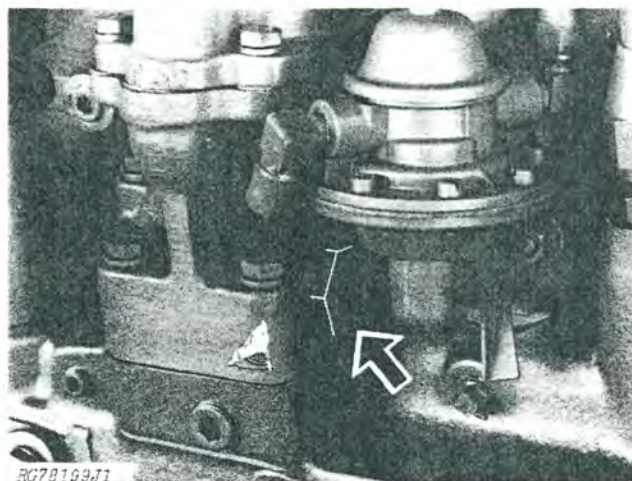


Fig. 5-4270D Oil Cooler Bypass Valve Location

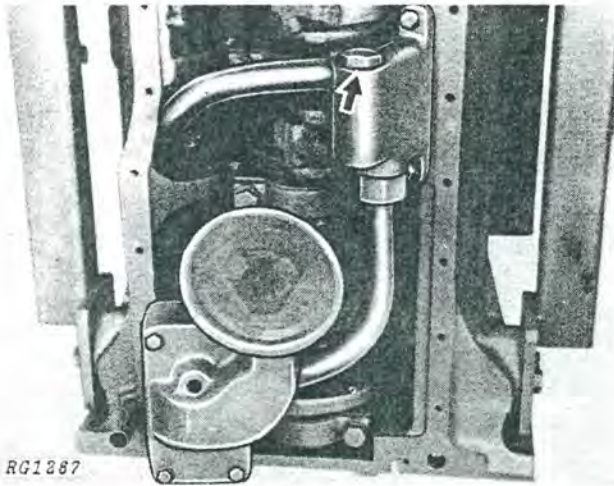
1. Remove bypass valve plug, shims, spring and valve.
2. Check valve bore and valve for damage.
3. Check bypass valve spring tension.

OIL COOLER BYPASS VALVE SPRING COMPRESSION
 1.0 in. (25.4 mm) at 3.7 to 4.0 lbs. (16.5 to 17.8 N) (1.7 to 1.8 kg).

4. Install oil cooler bypass valve.

6404 and 6466

1. Remove oil pan.



RG1287

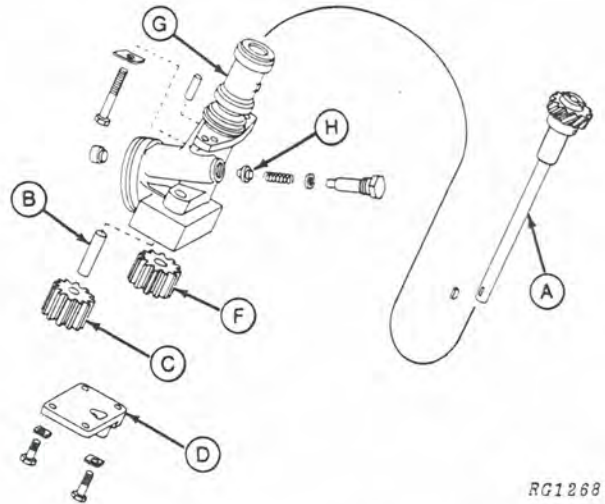
Fig. 6-Oil Cooler Bypass Valve Location (6 cylinder)

2. Remove oil cooler bypass valve plug, shims, spring and valve.
3. Check valve and valve bore for damage.
4. Check cooler bypass valve spring tension.

OIL COOLER BYPASS VALVE SPRING COMPRESSION
 1.38 in. (35 mm) at 18 to 22 lbs. (80 to 90 N) (8.2 to 10 kg).

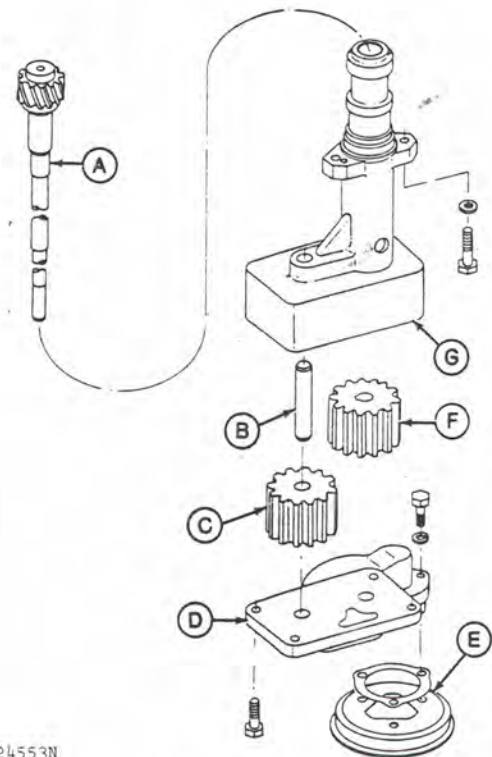
5. Install cooler bypass valve.

Oil Pump



RG1288

Fig. 7-4270D Engine Oil Pump



R 24553N

Fig. 8-6404 and 6466 Engine Oil Pump

Legend for Figs. 7 and 8

- | | |
|---------------|--------------------------------|
| A—Drive Shaft | E—Intake Screen (6 cyl. only) |
| B—Idler Shaft | F—Driven Gear |
| C—Idler Gear | G—Housing |
| D—Gear Cover | I —Filter Relief Valve (4270D) |

Oil Pump—Continued

1. Remove oil pan.
2. On 4270D engines, remove timing gear cover and set engine to No. 1 TDC. Do not rotate engine after removing pump.
3. Remove oil pump.
4. On 6404 and 6466 engines, remove intake screen.
5. Remove gear cover.
6. Examine gears and housing for wear or damage.
7. Check sealing edge of housing for signs of damage that could cause leakage.

NOTE: Worn gears, shafts of housing can reduce pump output and could indicate oil contamination, sludge or bent or warped shafts.

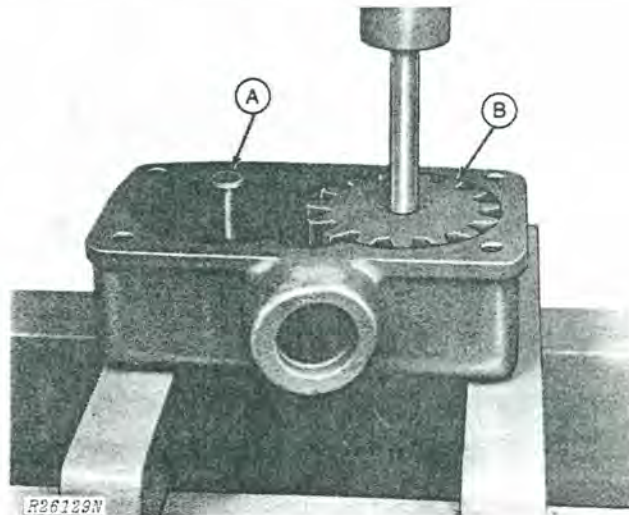
OIL PUMP SPECIFICATIONS

Depth of gear bore in housing	
4270D	1.503 to 1.507 in. (38.18 to 38.28 mm)
6404, 6466	1.753 to 1.757 in. (44.52 to 44.63 mm)
Gear thickness	
4270D	1.500 to 1.507 in. (38.10 to 38.28 mm)
6404, 6466	1.750 to 1.752 in. (44.45 to 44.50 mm)
O.D. of gears	
4270D	2.268 to 2.269 in. (57.61 to 57.63 mm)
6404, 6466	3.380 to 3.381 in. (85.85 to 85.88 mm)
I.D. of housing gear bore	
4270D	2.272 to 2.274 in. (57.71 to 57.76 mm)
6404, 6466	3.384 to 3.386 in. (85.95 to 86.00 mm)
I.D. of driven gear	
.....	0.622 to 0.623 in. (15.80 to 15.82 mm)
I.D. of idler gear	
.....	0.633 to 0.634 in. (16.08 to 16.10 mm)
I.D. of idler gear bushing	
6404, 6466	0.630 to 0.631 in. (16.00 to 16.03 mm)
O.D. of idler shaft	
.....	0.628 to 0.629 in. (15.96 to 15.98 mm)
O.D. of driven shaft	
4270D	0.6240 to 0.2650 in. (15.85 to 15.88 mm)
6404, 6466	0.6235 to 0.6245 in. (15.84 to 15.86 mm)

If the drive gear on top of the shaft is excessively worn or damaged, check the integral oil pump drive gear on the camshaft for wear or damage. Replace pump drive gear and camshaft as necessary.

If either the idler gear or driven gear must be replaced, replace both gears.

Oil Pump Gears



A—Idler Shaft

B—Driven Gear

Fig. 9-Driven Gear Removal

1. Remove idler gear by sliding from idler shaft (A).
2. To remove driven gear (B), press shaft from gear (Fig. 9).

ASSEMBLY AND INSTALLATION

Oil Pump

4270D

1. Apply AT30408 High Temperature Grease to oil pump drive gear.
2. Install idler gear and gear cover.
3. Spin drive gear to check if both gears turn freely.
4. Install oil pump as follows:
 - a) If crankshaft has been rotated while pump was removed, set engine to No. 1 TDC.
 - b) Remove speed-hour meter drive housing and drive gear.

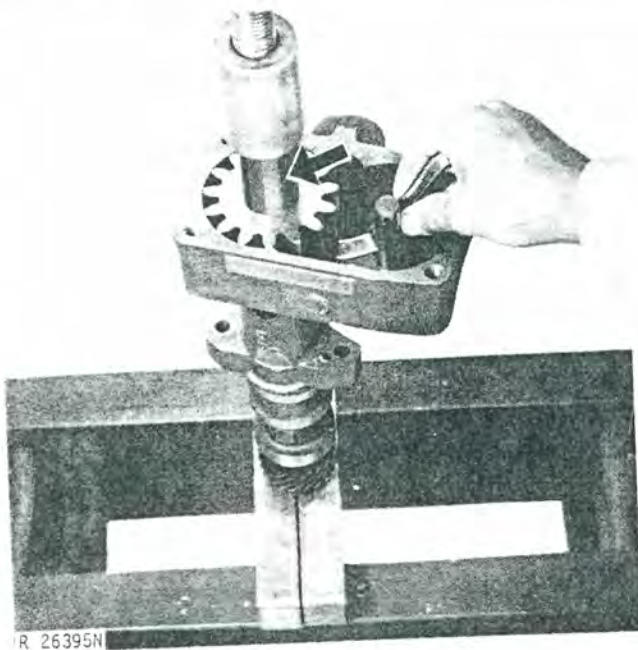


Fig. 10-Installing Driven Gear

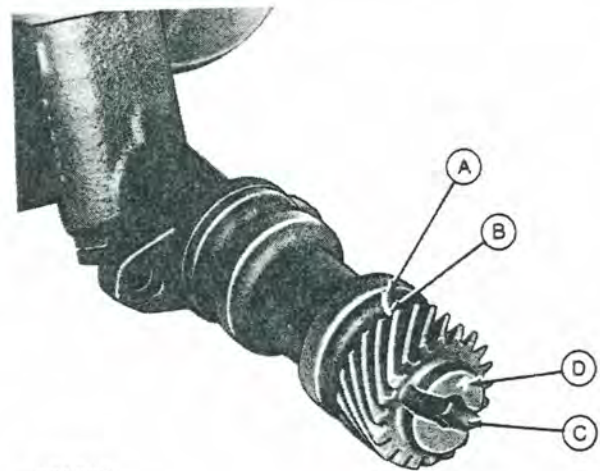
3. Support pump housing as shown in Fig. 10.
 4. Use a press adapter that has a bore with an I.D. larger than the pump shaft O.D. (Fig. 10) to install gear.
- NOTE: Adapter bore must be deeper than 1.02 in. (25.9 mm).*
5. Carefully start gear onto shaft.
 6. Use a feeler gauge when pressing on gear to obtain a clearance of 0.001 to 0.007 in. (0.03 to 0.18 mm) between gear and bottom of housing.

NOTE: Steps 7 through 10 apply only to 4270D engines.

7. Remove filter relief valve plug, shims, spring and valve (see Fig. 7).
8. Check valve and valve bore for damage.
9. Check filter relief valve spring tension.
10. Install filter relief valve.

OIL FILTER RELIEF VALVE SPRING COMPRESSION

1.0 in. (25.4 mm) at 3.7 to 4.0 lbs. (16.5 to 17.8 N) (1.7 to 1.8 kg).



RG1269

A—Oil Hole
B—Cast Mark

C—Drive Slot
D—Timing Mark

Fig. 11-Timing Oil Pump (4270D)

Assembly and Installation—Continued

NOTE: The bottom of gear tooth that is directly in line with drive slot (C, Fig. 11) must line up with cast mark (B) next to oil hole (A).

- c) Set "V" timing mark (D, Fig. 11).
- d) Install pump with drive slot approximately 15 degrees from parallel with crankshaft and "V" mark toward crankshaft. Make sure gears on oil pump and camshaft mesh.
- 5. Tighten oil pump-to-cylinder block cap screws to 35 ft-lbs (47 Nm) (4.7 kgm).

6404 and 6466

- 1. Apply AT30408 High Temperature Grease to drive gear.
- 2. Install pump cover and intake screen.
- 3. Spin drive gear to check if both gears turn freely.
- 4. Install engine oil pump, making sure that pump drive gear and camshaft oil pump drive gear mesh.
- 5. Use new oil pump-to-block cap screws and tighten to 20 to 25 ft-lbs (27 to 34 Nm) (2.7 to 3.4 kgm).

Oil Cooler By-Pass Valve (6-Cylinder)

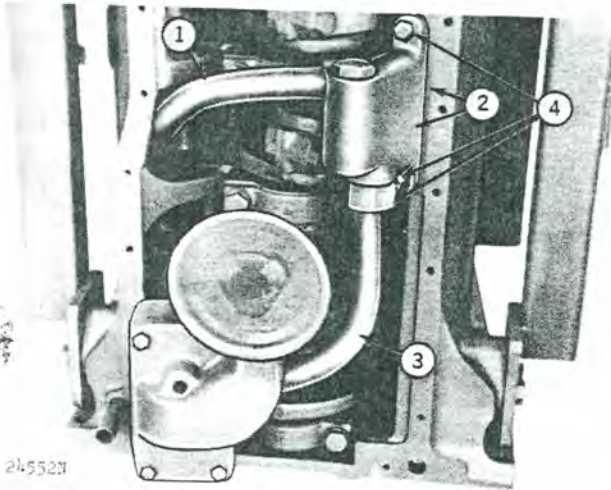


Fig. 12-Oil Cooler Bypass Valve Housing Installation

- 1. Install the long end of the cooler bypass housing-to-block tube into the housing and insert opposite end into block.

2. Adjust tube and housing so housing is flat against the block mounting pad. Attach housing to block, but do not tighten cap screws.

3. Install oil pump-to-bypass housing tube in pump. Place gland nut with O-ring on tube.

4. Align tube and gland nut with bypass housing and tighten gland nut.

NOTE: Check bypass housing-to-block tube installation by pulling it out of bypass housing while pushing it as far as possible into the block. This will ensure that the bypass tube is engaged with the O-ring in block and prevent the possibility of having low oil pressure.

Tighten cap screws.

Oil Pan

Install oil pan, using a new gasket. Tighten cap screws as follows:

Location	(Ft-lbs)	(Nm)	(kgm)
Oil pan-to-block			
1/2-inch cap screws	85	115	11.5
3/8-inch cap screws	35	47	4.7

Group 25 COOLING SYSTEM

DIAGNOSING MALFUNCTIONS

Engine Overheats

- Loose fan belt
- Dirty radiator or grille screen
- Low coolant level
- Low oil level
- Improper operation
- Defective head gasket
- Incorrect timing
- Faulty thermostat
- Faulty radiator cap
- Faulty water pump
- Corroded coolant passages

Low Coolant Level

- Improper maintenance
- Improper operation
- Damaged radiator
- Water pump seal leakage
- Leakage
- Faulty radiator cap

RADIATOR

Inspection and Repair

1. Visually check radiator for leaks or damage.

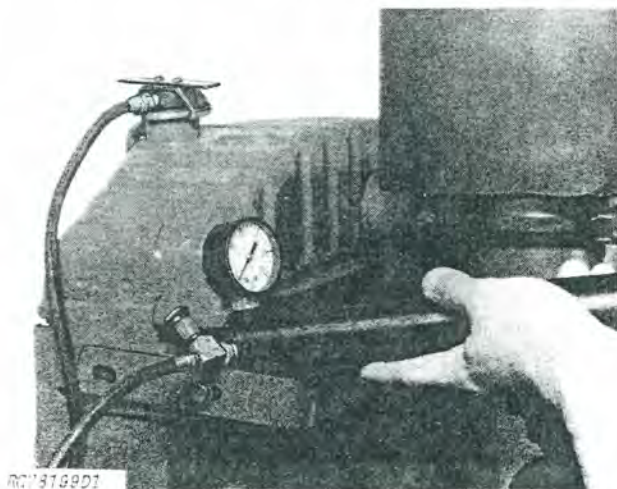


Fig. 1-Checking Radiator

2. Remove radiator cap and attach D-05104ST Pressure Pump to filler neck.

3. Use pump to apply 18 psi (1.24 bar) (1.26 kg/cm²) pressure to system.

4. Check engine, radiator and hoses for coolant leaks.

NOTE: Repairs should be performed only by experienced radiator service personnel.

Radiator Cap

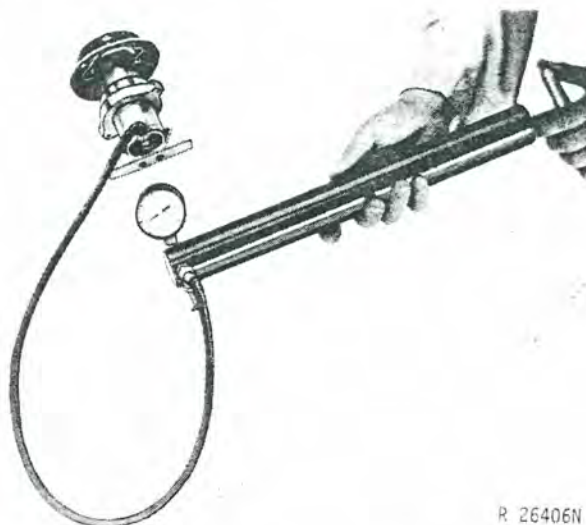


Fig. 2-Checking Radiator Cap Pressure

1. Remove cap and attach to D-05104ST Pressure Pump.

2. Cap should maintain 6.25 to 7.50 psi (0.3 to 0.4 bar) (0.4 to 0.5 kg/cm²) pressure.

3. Check rubber seal on cap for brittleness and cuts.

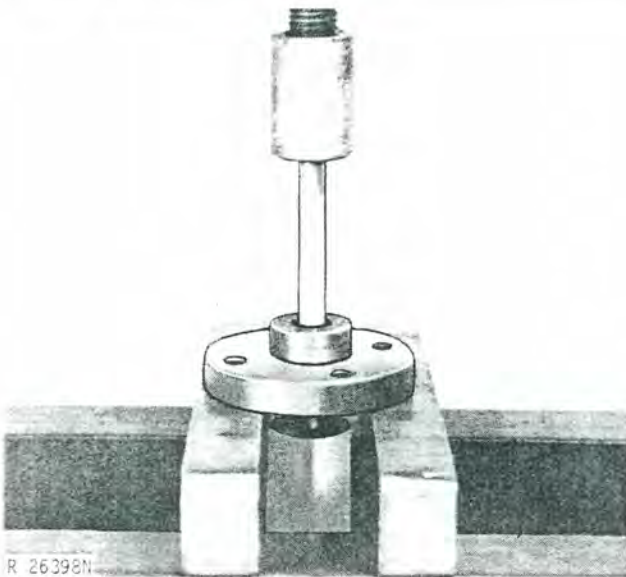


Fig. 5-Pushing Bearing from Hub

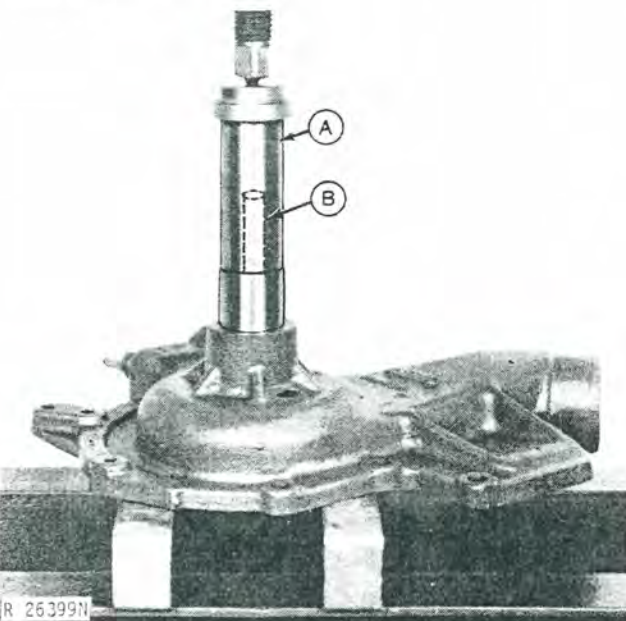
3. If bearing or hub is to be replaced, press bearing from hub.

WATER PUMP SPECIFICATIONS

Impeller bore	0.6242 to 0.6252 in. (15.85 to 15.88 mm)
Bearing shaft O.D.	0.6262 to 0.6267 in. (15.91 to 15.92 mm)

Assembly

1. Coat bearing shaft with a light coat of clean SAE 10W engine oil.



A—Installation Tool B—Bearing Shaft

Fig. 6-Pressing in Bearing (6404 Shown)

2. Place installation tool (A, Fig. 6) over bearing shaft (B) and press bearing into housing flush with housing edge. On 4270D and early 6404D water pumps, use JD-243 Installation Tool. On all other water pumps, use JD-262 Installation Tool.

3. Be sure that seal is clean and dry. Install into seal bore.

NOTE: The insert is placed in the cup with polished side out. Do not handle insert with bare hand.

4. Install the rubber cup and ceramic insert into the impeller.

IMPORTANT: The seal lip and insert face must be perfectly clean, as both surfaces are lapped to a fine finish.

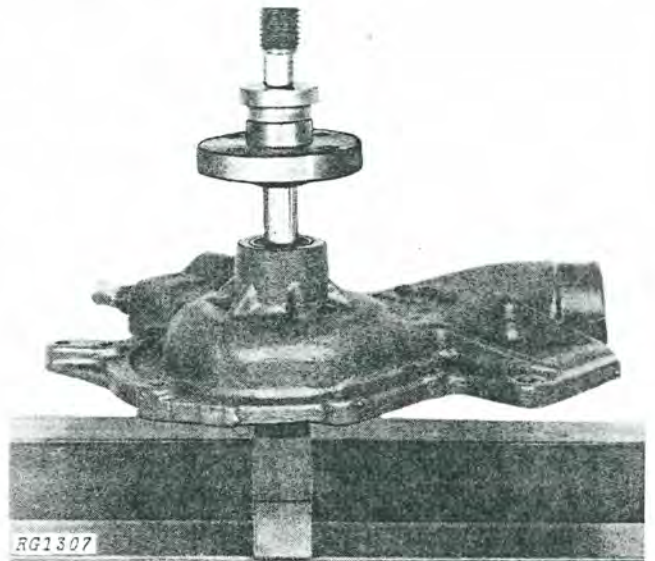


Fig. 7-Pressing on Hub.

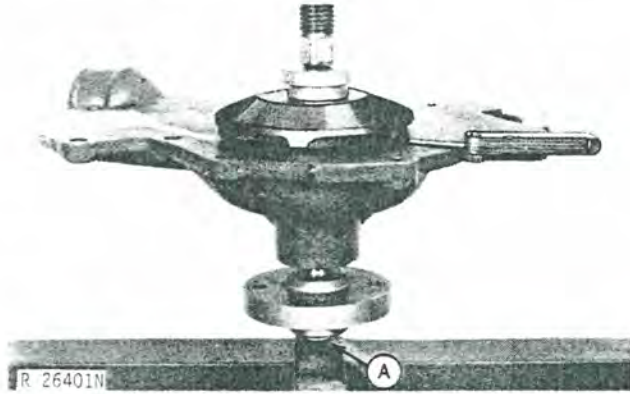
5. Support bearing shaft and press on hub. Position hub on shaft according to the following specifications. See inset, Fig. 7.

HUB POSITION ON SHAFT SPECIFICATION	
4270D; Early 6404D	0.140 in. (3.6 mm) above
Early 6404T,A	0.08 in. (2.0 mm) below
Late 6404 (all); 6466	0.063 in. (1.6 mm) above

6. Apply a light coat of bearing shaft bore in the impeller. Application should be from the side opposite the insert to prevent getting Permatex on the insert.

Assembly—Continued

7. Apply a light coat of SAE 10W engine oil to insert face (do not grease).



A—Bearing Shaft

Fig. 8—Pressing on Impeller

8. Support shaft at hub end and press impeller on. Press to specified clearance between impeller and housing.

IMPELLER TO HOUSING CLEARANCE SPECIFICATION

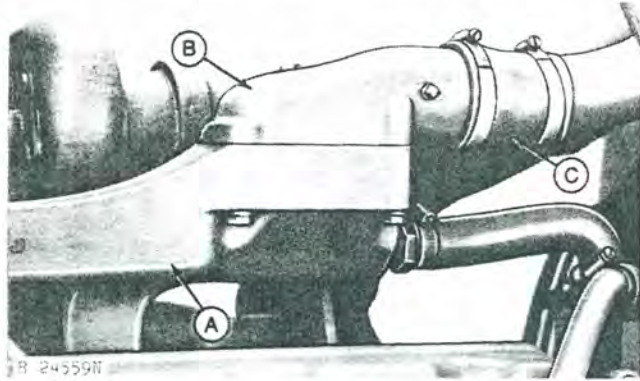
NOTE: On early 6404T and A engines, clearance is measured from impeller hub face to rear cover mounting face.

Early 6404T and A	0.610 in. (15.49 mm)
All Other Engines	0.025 in. (0.64 mm)

9. Remove from press, and turn shaft and impeller to be sure that impeller does not drag on housing.

10. Install rear housing on impeller housing.

11. Tighten cap screws to 35 ft-lbs (47 Nm) (4.7 kgm).

WATER MANIFOLD AND THERMOSTATS**Inspection and Repair**A—Water Manifold
B—Thermostat Cover

C—Upper Radiator Hose

Fig. 12—Water Manifold and Thermostats

1. Visually inspect area around water manifold for leaks.
2. Remove upper radiator hose.
3. Remove thermostat cover.
4. Remove thermostats.
5. Check each thermostat in D-05103ST Tester. Thermostat should open at 160° to 180° (71 to 82°C).

Installation

1. Apply Permatex Form-a-Gasket No. 2 to water manifold-to-thermostat cover parting surface.
2. Install thermostats.
3. Install gasket.
4. Install thermostat cover.
5. Install upper radiator hose.