YANMAR

SERVICE MANUAL

INDUSTRIAL ENGINES

2TNV70
3TNV70
3TNV76

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PRINCIPAL ENGINE SPECIFICATIONS

2TNV70

Engine Model	2TNV70										
Version	VM						CH		VH		
Type	Vertical In-line Diesel Engine										
Combustion System	Ball-Type Swirl Chamber										
Aspiration	Natural										
No. of Cylinders	2										
Bore × Stroke	2.756 x 2.913 in. (70 × 74 mm)										
Displacement	34.777 cu in. (0.570 L)										
Continuous Rated Output	RPM (min^{-1})							3000	3600		
	hp SAE							10.9	13.1		
	kW							8.16	9.76		
	PS							11.1	13.3		
Max. Rated Output (Net)	RPM (min^{-1})	2000	2200	2400	2600	2800	3000	3000	3600	3200	3400	3600
	hp SAE	7.99	8.88	9.76	10.55	11.44	12.23	12.03	14.40	12.53	13.12	13.81
	kW	5.96	6.62	7.28	7.87	8.53	9.12	8.97	10.7	9.34	9.78	10.3
	PS	8.10	9.00	9.90	10.7	11.6	12.4	12.2	14.6	12.7	13.3	14.0
High Idling	RPM (min^{-1})	2160 ± 25	2375 ± 25	2570 ± 25	2780 ± 25	2995 ± 25	3210 ± 25	3165 ± 25	3800 ± 25	3400 ± 25	3600 ± 25	3815 ± 25
Engine Weight (Dry) with Flywheel Housing	182.2 lb (84 kg)											
PTO Position	Flywheel End											
Direction of Rotation	Counterclockwise Viewed From Flywheel End											
Cooling System	Liquid-Cooled with Radiator											
Lubricating System	Forced Lubrication with Trochoid Pump											
Normal Oil Pressure at Rated Engine Speed	42 - 64 psi (0.29 -0.44 MPa, 2.96 - 4.49 kgf/cm^2)											
Normal Oil Pressure at Low Idle Speed	8.5 psi (0.06 MPa, 0.6 kgf/cm^2) or greater											
Starting System	Electric Starting - Starter Motor: DC12V, 1.3 hp (1.0 kW)**											
	Dynamo: DC12V, 20A**											
	Recommended Battery Capacity: 12V, 36 Amp-Hour (5h rating)**											
Dimensions (L × W × H)*	16.38 x 16.81 x 19.06 in. (419 × 427 × 484 mm)							16.38 x 16.81 x 20.24 in. (416 x 427 x 514 mm)		16.38 x 16.81 x 19.06 in. (416 x 427 x 484 mm)		
Engine Oil Pan Capacity	1.7 / 0.9 qt (1.65 / 0.8 L) (Dipstick Upper Limit / Lower Limit)							2.4 / 1.4 qt (2.3 / 1.3 L) (Dipstick Upper Limit / Lower Limit)		1.7 / 0.8 qt (1.6 / 0.8 L) (Dipstick Upper Limit / Lower Limit)		
Engine Coolant Capacity	0.16 gal (0.6 L) Engine Only											
Standard Cooling Fan	10.23 in. (260 mm) O.D., 5 Blade Pusher-Type**											
Top Clearance	0.768 ± 0.072mm											

* *Engine specifications without radiator.*

** *May vary depending on application.*

*** *Engine oil capacity for a "Deep Standard" oil pan. Refer to the operation manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.*

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○:Check ◇:Replace ●: Contact your authorized Yanmar industrial engine dealer or distributor

System	Check Item	Daily	Periodic Maintenance Interval					
			Every 50 hours	Every 250 hours	Every 500 hours	Every 1000 hours	Every 1500 hours	Every 2000 hours
Cooling System	Check and Refill Engine Coolant	○						
	Check and Clean Radiator Fins			○				
	Check and Adjust Cooling Fan V-Belt		○1st time	○ 2nd and after				
	Drain, Flush and Refill Cooling System with New Coolant					◇ or every 1 yr. which-ever comes first		
Cylinder Head	Adjust Intake / Exhaust Valve Clearance					●		
	Lap Intake / Exhaust Valve Seats (if required)							●
Electrical Equipment	Check Indicators	○						
	Check Battery		○					
Engine Oil	Check Engine Oil Level	○						
	Drain and Fill Engine Oil		◇1st time	◇2nd and after				
	Replace Engine Oil Filter							
Engine Speed Control	Check and Adjust Governor Lever and Engine Speed Control	○		○				
Emission Control Warranty	Inspect, Clean and Test Fuel Injectors, if necessary						●	
	Inspect Crankcase Breather System						●	
Fuel	Check and Refill Fuel Tank Level	○						
	Drain Fuel Tank			○				
	Drain Fuel Filter / Water Separator		○					
	Check Fuel Filter / Water Separator	○						
	Clean Fuel Filter / Water Separator				○			
	Replace Fuel Filter				◇			
Hoses	Replace Fuel System and Cooling System Hoses							● or every 2 yrs.
Intake and Exhaust	Clean or Replace Air Cleaner Element			○	◇			
Complete Engine	Overall Visual Check Daily	○						

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Note: These procedures are considered normal maintenance and are performed at the owner's expense.

SPECIAL TORQUE CHART

Torque for Bolts and Nuts

Component		Thread Diameter and Pitch	Tightening Torque	Lubricating Oil Application (Thread Portion and Seat Surface)	Reference Page
Cylinder Head Bolts		M9 x 1.25 mm	40 - 43 ft·lb (53.9 - 57.9 N·m; 5.5 - 5.9 kgf·m)	Applied	*See Reassembly of Cylinder Head on page 6-29*
Connecting Rod Bolts		M7 x 1.0 mm	17 - 20 ft·lb (22.6 - 27.5 N·m; 2.3 - 2.8 kgf·m)	Applied	*See Installation of Pistons on page 6-56*
Flywheel Bolts		M10 x 1.25 mm	59 - 64 ft·lb (80.4 - 86.4 N·m; 8.2 - 8.8 kgf·m)	Applied	*See Installation of Crankshaft on page 6-55*
Main Bearing Cap Bolts		M10 x 1.25 mm	56 - 60 ft·lb (75.5 - 81.5 N·m; 7.7 - 8.3 kgf·m)	Applied	*See Installation of Crankshaft on page 6-55*
Crankshaft Pulley Bolts	Cast FC250	M12 x 1.25 mm	61 - 69 ft·lb (83.4 - 93.1 N·m; 8.5 - 9.5 kgf·m)	Applied	*See Installation of Crankshaft on page 6-55*
	Forged PS48C		83 - 90 ft·lb (113 - 123 N·m; 11.5 - 12.5 kgf·m)		
Glow Plug		M10 x 1.25	11 - 15 ft·lb (14.7 - 19.6 N·m; 1.5 - 2.0 kgf·m)	Not Applied	*See Reassembly of Intake Manifold / Valve Cover on page 6-31*

See Tightening Torques for Standard Bolts and Nuts on page 4-26 for standard hardware torque values.

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CYLINDER HEAD

Cylinder Head Components

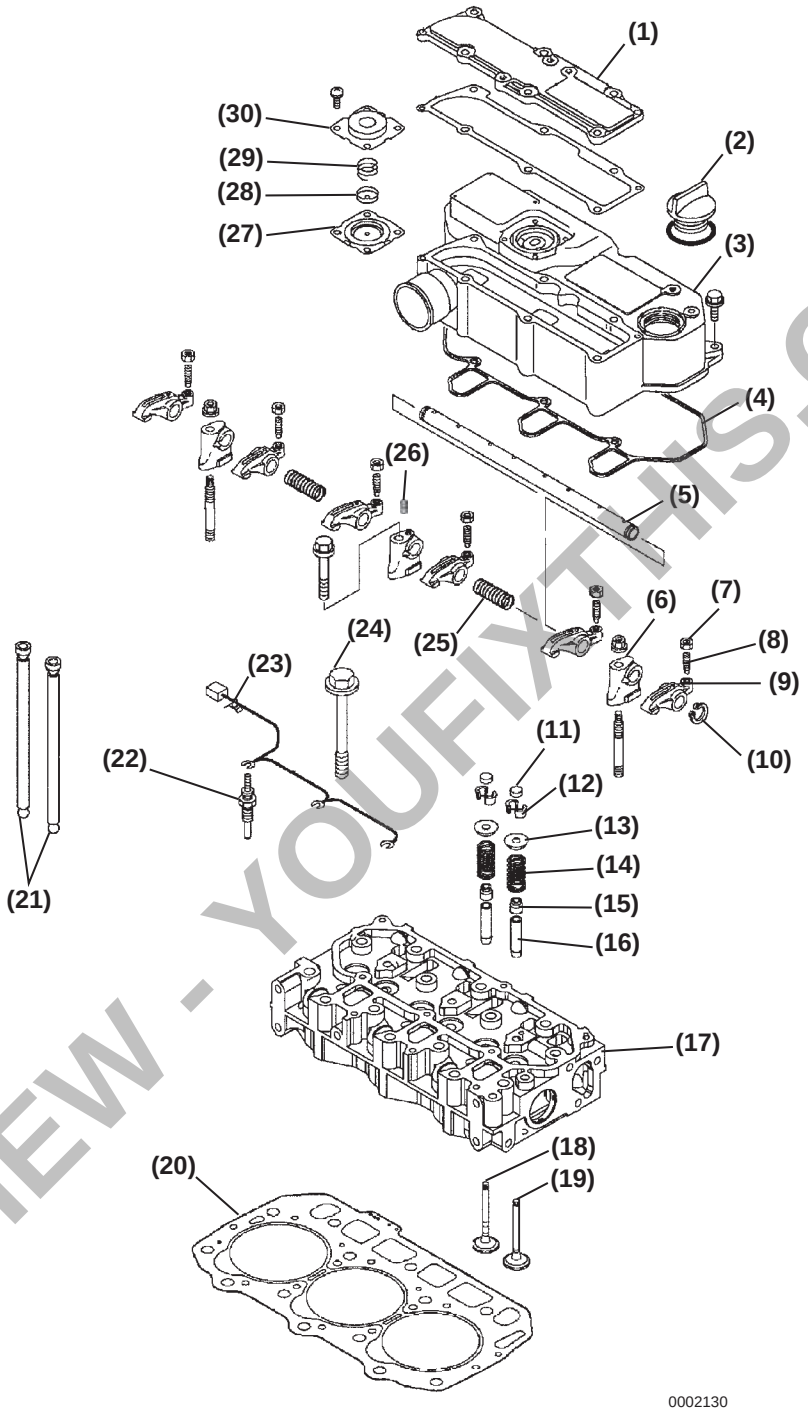


Figure 6-1

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1 – Baffle Plate
2 – Oil Fill Cap
3 – Valve Cover / Intake Manifold
4 – Gasket
5 – Rocker Arm Shaft
6 – Rocker Arm Shaft Support
7 – Adjuster Lock Nut
8 – Valve Adjuster Screw
9 – Rocker Arm
10 – Circlip
11 – Valve Cap
12 – Keeper
13 – Valve Spring Retainer
14 – Valve Spring
15 – Valve Stem Seal
16 – Valve Guide
17 – Cylinder Head
18 – Exhaust Valve
19 – Intake Valve
20 – Cylinder Head Gasket
21 – Push Rod (2 per cylinder)
22 – Glow Plug
23 – Glow Plug Wiring Harness
24 – Cylinder Head Bolt

Disassembly of Cylinder Head

Prepare a clean, flat working surface on a workbench large enough to accommodate the cylinder head assembly. Discard all gaskets, O-rings and seals. Use new gaskets, O-rings and seals on reassembly of cylinder head.

IMPORTANT

Mark all valve train components so they can be installed in their original locations.

Note: Record all measurements taken during disassembly.

1. Drain coolant from engine into a suitable container. *See Drain, Flush and Refill Cooling System with New Coolant on page 5-21.*

NOTICE

Identify all parts and their location using an appropriate method. It is important that all parts are returned to the same position during the reassembly process.

2. Remove the coolant pump. *See Disassembly of Engine Coolant Pump on page 8-6.*
3. Remove the high-pressure fuel lines and fuel injectors from the cylinder head. *See Removal of Fuel Injectors on page 7-22.*

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LUBRICATION SYSTEM DIAGRAM

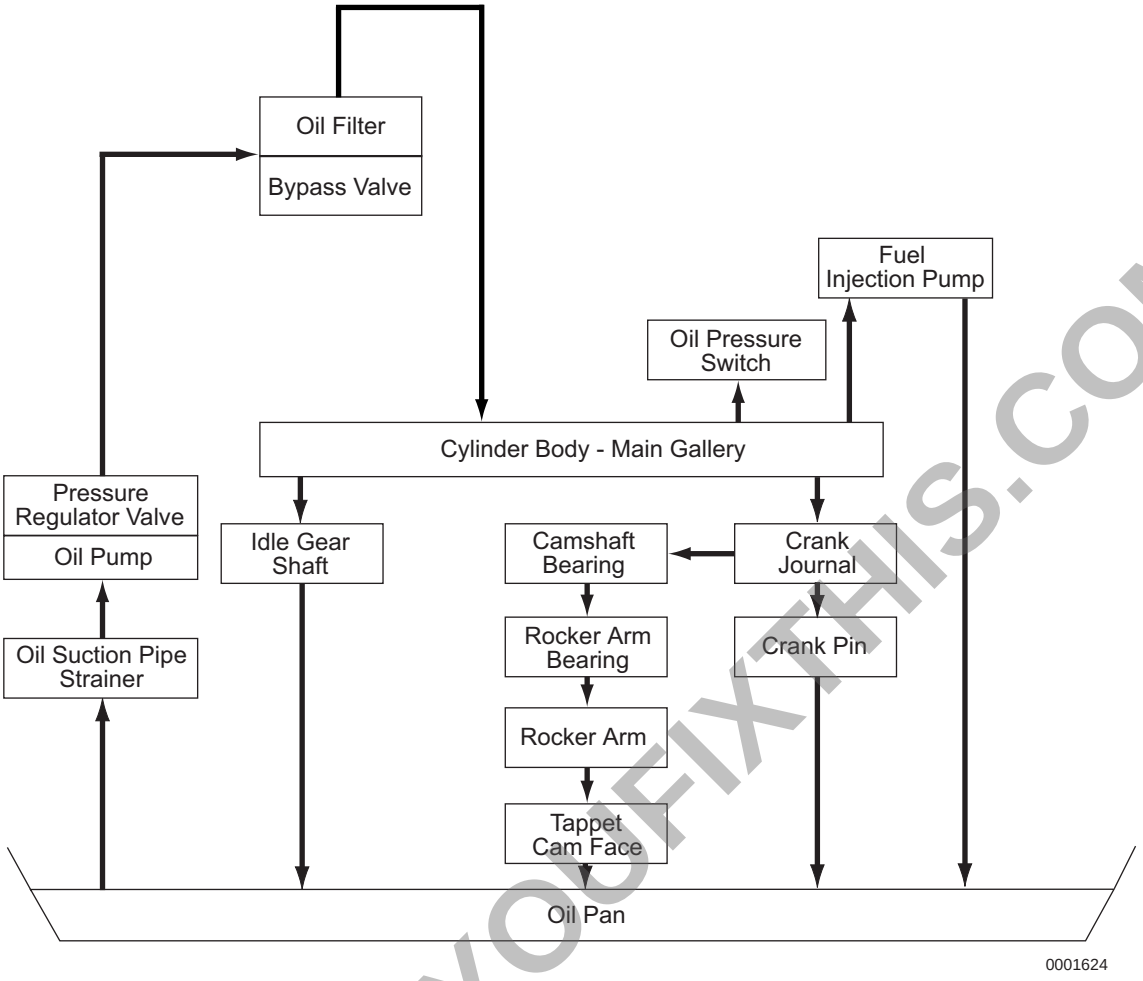


Figure 9-1

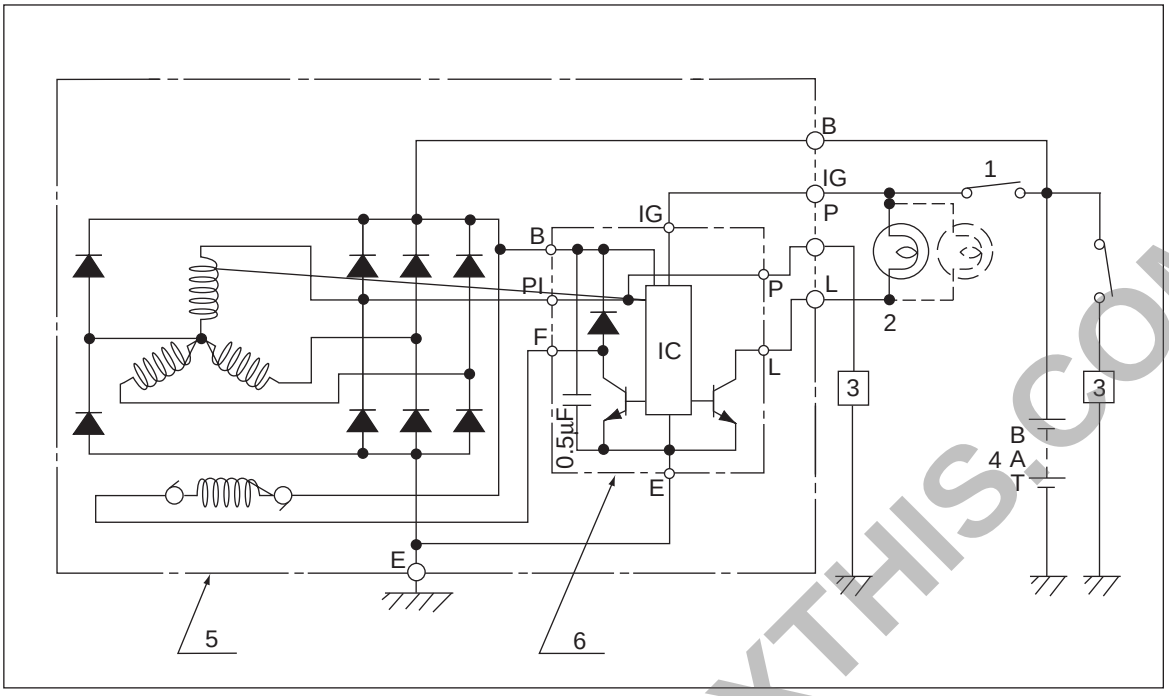
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Troubleshooting Charts

	Trouble Symptom / Cause	Starting Problem: Engine Does Not Start	Starting Problem: Engine Starts But Stops Soon. – Exhaust Smoke: None	Starting Problem: Engine Starts But Stops Soon. – Exhaust Smoke: Little	Starting Problem: Engine Starts But Stops Soon. – Exhaust Smoke: Much	Insufficient Engine Output – Exhaust Color: Ordinary	Insufficient Engine Output – Exhaust Color: White	Insufficient Engine Output – Exhaust Color: Black	Poor Exhaust Color – During Work: White	Poor Exhaust Color – During Work: Black	High Knocking Sound During Combustion	Abnormal Engine Sound	Uneven Combustion Sound	Engine Surging: During Idling	Engine Surging: During Work Operation	Excessive Engine Vibration	Difficulty in Returning to Low Speed	Excessive Fuel Consumption	Engine Oil: Excessive Oil Consumption	Engine Oil: Dilution by Diesel Fuel	Engine Oil: Oil with Water	Engine Oil: Low Oil Pressure	Excessive Blow-by Gas	Engine Coolant: Overheat	Engine Coolant: Low Water Temperature	Air Intake: Pressure Drop	Air Intake: Pressure Rise	Exhaust Temperature Rise	Corrective Action	Reference Page
Engine System	Improper Intake/Exhaust Valve Clearance	O	O			O						O													O		O	Adjust the Valve Clearance.	*See “Measuring and Adjusting Valve Clearance” on page 6-32.*
	Compression Leakage from Valve Seat					O		O		O		O					O					O			O		O	Lap the Valve Seat.	*See “Valve Face and Valve Seat” on page 6-26.*
	Intake/Exhaust Valve Seizure	O			O	O		O		O		O		O	O				O			O			O			Correct or Replace Intake/ Exhaust Valve.	*See “Inspection of Intake and Exhaust Valves” on page 6-25.*
	Cylinder Head Gasket Blowout					O														O			O					Replace the Gasket.	*See “Disassembly of Cylinder Head” on page 6-19.*
	Seized or Broken Piston Ring	O			O		O		O			O		O		O		O	O			O	O				O	Replace the Piston Ring.	*See “Reassembly of Cylinder Head” on page 6-29.*
	Worn Piston Ring, Piston or Cylinder	O			O		O		O									O	O			O						Perform Honing and Use Oversize Parts.	*See “Honing and Boring” on page 6-51.*
	Seized Crankpin Metal or Bearing	O	O									O		O	O	O						O						Repair or Replace.	*See “Inspection of Crankshaft and Camshaft Components” on page 6-44.*
	Improper Arrangement of Piston Ring Gaps		O				O												O			O						Correct the Ring Joint Positions.	*See “Reassembly of Pistons” on page 6-53.*

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ALTERNATOR WIRING DIAGRAM



1 – Key Switch
2 – Charge Lamp (3.4 Watts Max.)
3 – Load
4 – Battery
5 – Alternator Assembly
6 – IC Regulator Assembly

Figure 11-2

NOTICE

Do not short-circuit the charging system between alternator terminals IG and L. Damage to the alternator will result.

NOTICE

Do not connect a load between alternator terminals L and E. Damage to the alternator will result.

NOTICE

Do not remove the positive (+) battery cable from alternator terminal B while the engine is operating. Damage to the alternator will result.

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Inspection of Pistons, Piston Rings and Wrist Pin

Notes:

- On an engine with low hours, the pistons, piston rings may be reused if they are found to be within specifications. The pistons and piston rings must be reinstalled in the same cylinders from which they were originally removed.
- On an engine with high hours, the pistons rings should be replaced and the cylinder honed *(See Honing and Boring on page 6-51)* or replaced. The piston should be replaced as necessary.

1. Clean piston ring grooves using a piston ring groove cleaning tool. Follow manufacturer's instructions for correct operation.
2. Wash the pistons in an appropriate solvent using a soft brush.
3. Visually inspect each piston for cracks. Pay particular attention to the ring lands between the piston ring grooves.
4. Measure the diameter of the piston skirt at 90° to the wrist pin bore as shown **(Figure 6-64)**. Measurements must be taken at a specified distance **(Figure 6-64, (1))** from the bottom of the piston, based on engine model. Record the measurements. *See Piston on page 6-9 for specifications.*

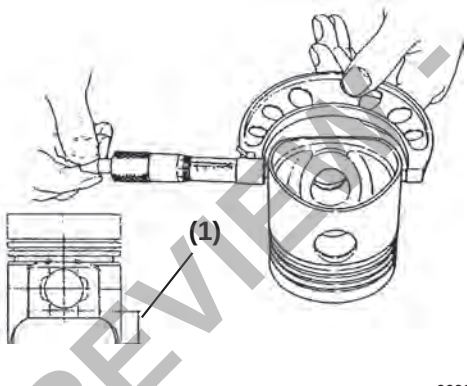


Figure 6-64

5. Subtract the piston measurement from the greatest measurement acquired during cylinder inspection *(see Inspection of Cylinder Block on page 6-45)* to obtain piston-to-cylinder clearance. Record the measurements. *See Piston on page 6-9 for specifications.*
6. Measure the diameter of the wrist pin bore on both sides of the piston **(Figure 6-65)**. *See Piston on page 6-9 for specifications.* Record the measurements.

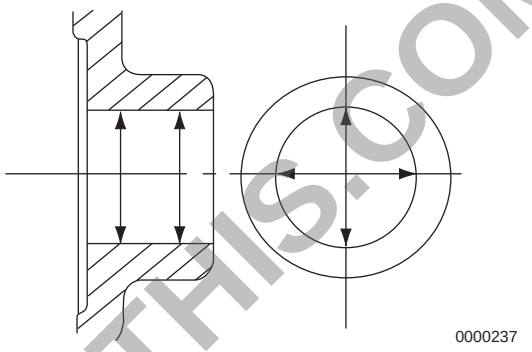


Figure 6-65

7. Measure the outside diameter of the wrist pin in three places and at 90° **(Figure 6-66)**. *See Piston on page 6-9 for specifications.* Record the measurements.

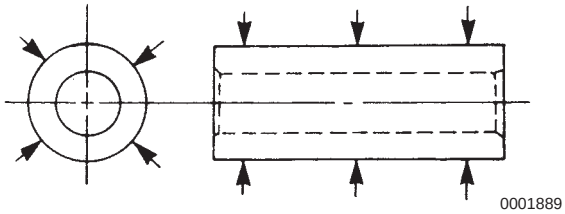


Figure 6-66

8. Using a micrometer, measure the thickness of each piston ring. *See Piston Ring on page 6-10 for specifications.* Record the measurements.

   Notes:

   - On an engine with low hours, the pistons, piston rings and cylinders may be reused if they are found to be within specifications.

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