Yanmar Gasoline Engines

John Deere Horicon Works
CTM12 (16MAY90)
LITHO IN U.S.A.
ENGLISH

This Component Technical Manual (CTM) contains necessary instructions to repair the engine and fuel and electrical systems. This manual also includes theory of operation, diagnostic, and testing procedures. For information on starting motors, alternators, power take-offs, and other miscellaneous accessories, order CTM-11 Engine Accessories.

Use this component technical manual in conjunction with the machine technical manual. An engine application listing in the Introduction (Group 00) identifies product-model/engine type-model relationship. See the machine technical manual for:

- Engine removal and installation.
- Gaining access to engine components.

This Safety-Alert symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

When you see this symbol on your machine or in your manual, be alert to the possibility of personal injury or death. Follow the instructions in the safety message.

INTRODUCTION

This manual is part of a total service support program.

FOS MANUALS—REFERENCE

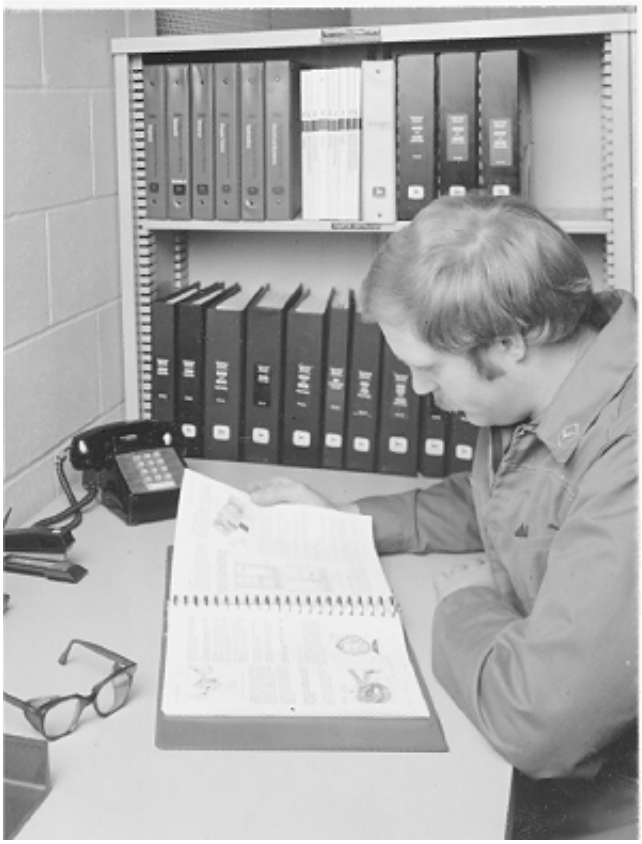
TECHNICAL MANUALS—MACHINE SERVICE

COMPONENT MANUALS—COMPONENT SERVICE

Fundamentals of Service (FOS) Manuals cover basic theory of operation, fundamentals of troubleshooting, general maintenance, and basic types of failures and their causes. FOS Manuals are for training new personnel and for reference by experienced technicians.

Technical Manuals are concise service guides for specific machines. Technical manuals are on-the-job guides containing only the vital information needed by an experienced service technician.

Component Technical Manuals are concise service guides for specific components. Component Technical Manuals are written as stand alone manuals covering multiple machine applications.



RW5559 -UN-23AUG88

O53,INTRO2 -19-03JUL85

Contents

Continued on next page

All information, illustrations and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

CTM12-19-16MAY90

FEATURES OF THIS TECHNICAL MANUAL

05
2

John Deere ILLUSTRUCTION format emphasizing illustrations and concise instructions in easy-to-use modules.

Emphasis on diagnosis, analysis, and testing so you can understand the problem and correct it.

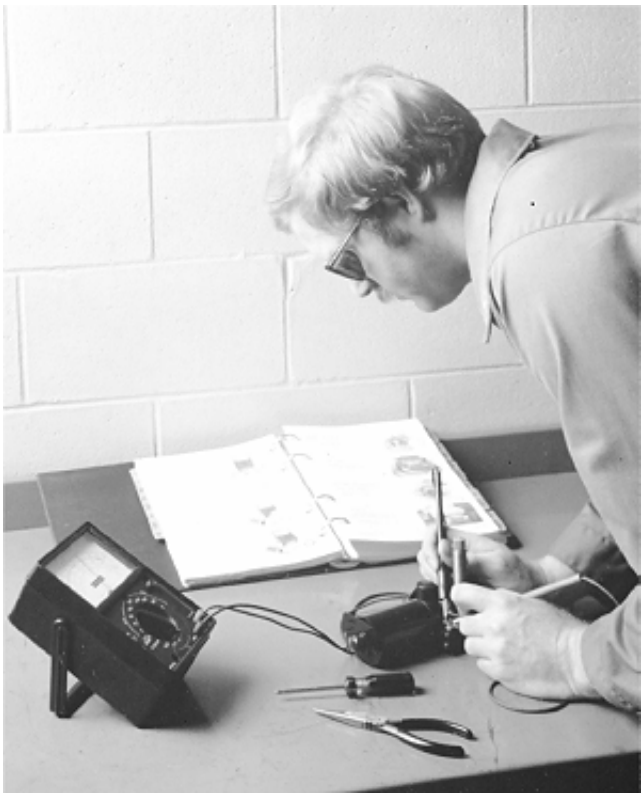
Diagnostic information presented with the most logical and easiest to isolate problems first to help you identify the majority of routine failures quickly.

Step-by-step instructions for teardown and assembly.

Summary listing at the beginning of each group of all applicable specifications, wear tolerances, torque values, essential tools, and materials needed to do the job.

An emphasis throughout on safety—so you do the job right without getting hurt.

This technical manual was planned and written for you—an experienced service technician. Keep it in a permanent binder in the shop where it is handy. Refer to it when you need to know correct service procedures or specifications.



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O53,INTRO3 -19-07OCT85

ABOUT THIS MANUAL

This Component Technical Manual (CTM-12) covers the recommended repair procedures for Yanmar Gasoline Engines removed from the machine.

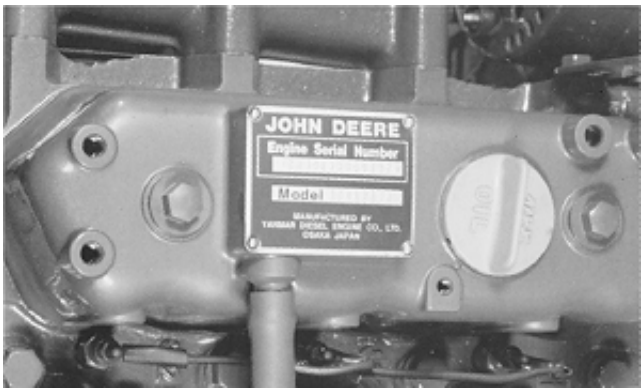
Some components may be serviced without removing the engine from the machine. You may want to determine the repair procedure before you remove the engine.

5M4,T1205,1 -19-25AUG87

ENGINE SERIAL NUMBER PLATE

The engine serial number plate is located on the rocker arm cover.

Refer to the engine model designation on your engine's serial number plate to identify repair information covered in the Component Technical Manual.



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M37502

M21,TM305,2 -19-21APR86

ENGINE APPLICATION CHART

Refer to the engine application chart to identify product-model/engine type-model relationship.

Consumer Products

Machine No.	Lawn and Garden Tractors Engine Model
322	3TG66UJ

Machine No.	Front Mowers Engine Model
F912	3TG66UJ
F932	3TG72UJ

5M4,T1205,3 -19-12OCT87

ENGLISH TORQUE SPECIFICATIONS

NOTE: Wrench torque tolerance is ± 20%.

Bolt Diameter	Plain Head*		Three Radial Dashes*		Six Radial Dashes*	
	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m
1/4 in.	6	8	9	12	12	16
5/16 in.	10	14	18	24	25	34
3/8 in.	20	27	30	41	45	61
7/16 in.	30	41	50	68	70	95
1/2 in.	45	61	75	101	110	149
9/16 in.	70	95	110	150	155	210
5/8 in.	95	128	155	210	215	290
3/4 in.	165	225	270	365	385	520
7/8 in.	170	230	435	590	620	840
1 in.	255	345	660	895	930	1260

Torque figures indicated above and in the Specification Sections of this manual are valid for non-greased or non-oiled threads and heads unless otherwise specified. Therefore, do not grease or oil bolts or cap screws unless otherwise specified in this manual.

** Torque value for bolts and cap screws are identified by their head markings.*

S11,2000,DD -19-11JUL85

METRIC TORQUE SPECIFICATIONS

NOTE: Wrench torque tolerance is ± 20%.

Bolt Diameter	Property Class 8.8*		Property Class 10.9*	
	lb-ft	N·m	lb-ft	N·m
M5	5	6	7	9
M6	8	10	11	15
M8	18	25	26	35
M10	37	50	52	70
M12	66	90	92	125
M16	166	225	229	310
M20	321	435	450	610
M24	554	750	775	1050

Torque figure indicated above and in the Specification Sections of this manual are valid for non-greased or non-oiled threads and heads unless otherwise specified. Therefore, do not grease or oil bolts or cap screws unless otherwise specified in this manual.

** Torque value for bolts and cap screws are identified by their head markings.*

S11,2000,DE -19-11JUL85

ENGINE: 3TG72

GROUP 10—Valve Train and Camshaft

Item	Specification
Valve Clearance	0.2 mm (0.008 in.)
Rocker Arm	
Minimum Shaft O.D.	11.9 mm (0.469 in.)
Maximum Shaft Support I.D.	12.1 mm (0.476 in.)
Maximum Arm I.D.	12.1 mm (0.476 in.)
Maximum Shaft Clearance	0.12 mm (0.005 in.)
Rocker Arm Assembly Cap Screw and Nut Torque	25 N·m (225 lb-in.)
Rocker Arm Cover Nut Torque	26 N·m 226 lb-in.)
Push Rod	
Maximum T.I.R.	0.3 mm (0.012 in.)
Minimum Length	141 mm (5.55 in.)
Cam Follower	
Minimum O.D.	20.85 mm (0.821 in.)
Maximum Bore I.D.	21.10 mm (0.831 in.)
Maximum Clearance	0.15 mm (0.006 in.)
Camshaft	
Maximum End Play	0.5 mm (0.02 in.)
Maximum Gear Backlash	0.2 mm (0.008 in.)
Minimum End Journals O.D.	39.84 mm (1.568 in.)
Minimum Intermediate Journals O.D.	39.81 mm (1.567 in.)
Minimum Lobe Height	33.6 mm (1.323 in.)
Maximum Bushing I.D.	41.115 mm (1.619 in.)
Maximum Intermediate and Flywheel End Bores I.D.	40.075 mm (1.578 in.)
Maximum Journal Clearance	0.18 mm (0.007 in.)
Attaching Cap Screw Torque	11 N·m (96 lb-in.)
Gear Housing Cover Cap Screw Torque	9 N·m (78 lb-in.)
Crankshaft Pulley Cap Screw Torque	113 N·m (84 lb-ft)

GROUP 15—Cylinder Head, Valves, and Manifolds

Item	Specification
Manifold	
Exhaust Manifold Cap Screw Torque	26 N·m (226 lb-in.)
Intake Manifold Cap Screw Torque	11 N·m (96 lb-in.)
Cylinder Head	
Maximum Valve Recession	0.60 mm (0.024 in.)
Valve Spring Free Length (Approx.)	36.9 mm (1.453 in.)
Valve Spring Test Length	22.5 mm (0.866 in.)
@ Test Force	299 N (67 lb)

5M4,T1206,1 -19-12OCT87

ENGINE: 3TG72

Item	Specification
Cylinder Head (continued)	
Minimum Valve Stem O.D.	6.90 mm (0.272 in.)
Exhaust Valve Angle	45°
Intake Valve Angle	30°
Maximum Valve Guide I.D.	7.08 mm (0.279 in.)
Valve Guide-to-Valve Stem Clearance:	
(Replace)	0.15 mm (0.006 in.)
Valve Seat Width	
Intake	1.43 mm (0.056 in.)
Exhaust	1.73 mm (0.068 in.)
Valve Seat Angle	
Intake	30°
Exhaust	45°
Cylinder Head Flatness	0.10 mm (0.004 in.)
Mill Cylinder Head No More Than	0.2 mm (0.008 in.)
Valve Guide Height	9 mm (0.354 in.)
Cylinder Head Cap Screw Torque	
In sequence (Lubricated)	61 N·m (45 lb-ft)

GROUP 20—Flywheel

Item	Specification
Stub Shaft	
Maximum T.I.R.	0.2 mm (0.008 in.)
Flatness	0.05 mm (0.002 in.)
Attaching Cap Screw Torque	59 N·m (44 lb-ft)
Flywheel	
Flatness	0.05 mm (0.002 in.)
Attaching Cap Screw Torque	83 N·m (61 lb-ft)
Flywheel Housing	
Mounting Plate or Housing	
Cap Screw Torque	49 N·m (36 lb-ft)
Starter-to-Mounting Plate	
Cap Screw Torque	49 N·m (36 lb-ft)
Flywheel Housing or Shield	
Cap Screw or Nut Torque	
M10	49 N·m (36 lb-ft)
M8	26 N·m (226 lb-in.)
M12 Nut	88 N·m (65 lb-ft)

5M4,T1206,2 -19-12OCT87

ENGINE:3TG72

GROUP 25—Connecting Rods and Pistons

Item	Specification
Connecting Rod	
Maximum Side Play	0.8 mm (0.031 in.)
End-Cap Screw Torque	23 N·m (200 lb-in.)
Maximum Bearing Clearance	0.12 mm (0.005 in.)
Minimum Journal O.D.	39.93 mm (1.572 in.)
Maximum Bearing I.D.	40.07 mm (1.577 in.)
Maximum Bearing Clearance	0.12 mm (0.005 in.)
Piston	
Maximum Ring Groove Clearance	
Top Ring	0.25 mm (0.010 in.)
Second Ring	0.25 mm (0.010 in.)
Oil Ring	0.25 mm (0.010 in.)
Maximum Ring End Gap	
Top Ring	1.25 mm (0.049 in.)
Second Ring	1.25 mm (0.049 in.)
Oil Ring	1.90 mm (0.075 in.)
Minimum Pin O.D.	20.9 mm (0.823 in.)
Maximum Pin Bushing I.D.	21.1 mm (0.831 in.)
Maximum Pin Bushing Clearance	0.15 mm (0.006 in.)
Maximum Pin Bore I.D.	21.08 mm (0.830 in.)
Maximum Pin Bore Clearance	0.10 mm (0.004 in.)
Minimum Piston O.D.	71.9 mm (2.831 in.)
Maximum Cylinder Bore I.D.	72.15 mm (2.841 in.)
Maximum Piston to Bore Clearance	0.15 mm (0.006 in.)

GROUP 30—Crankshaft and Main Bearings

Item	Specification
Crankshaft	
Maximum End Play	0.50 mm (0.020 in.)
Main Bearing Cap Screw Torque	79 N·m (58 lb-ft)
Maximum Main Bearing Clearance	0.12 mm (0.005 in.)
Oil Seal Case Cap Screw Torque	
Seal Case to Block	11 N·m (96 lb-in.)
Oil Pan to Seal Case	9 N·m (78 lb-in.)
Minimum Main Bearing Journal O.D.	43.93 (1.730 in.)
Maximum Main Bearing I.D.	40.07 mm (1.578 in.)

5M4,T1206,3 -19-12OCT87

ENGINE:3TG72

GROUP 35—Gear Housing

Item	Specification
Gear Housing Cap Screw Torque	9 N·m (78 lb-in.)
Crankshaft Pulley Cap Screw Torque	115 N·m (85 lb-ft)
Timing Gear Backlash	
Governor	0.38 mm (0.015 in.)
Idler	0.2 mm (0.008 in.)
Camshaft	0.2 mm (0.008 in.)
Crankshaft	0.2 mm (0.008 in.)
Oil Pump	0.3 mm (0.012 in.)
Timing Gear Wear Specifications	
Idler Gear Bushing Diameter	20.08 mm (0.791 in.)
Idler Shaft Diameter	19.9 mm (0.783 in.)
Idler Shaft Oil Clearance	0.1 mm (0.004 in.)

GROUP 40—Lubrication System

Item	Specification
Oil Pump	
Gear Backlash, Maximum	0.30 mm (0.012 in.)
Rotor Recess, Maximum	0.25 mm (0.010 in.)
Outer rotor-to-Pump Body Maximum Clearance	0.25 mm (0.010 in.)
Inner Rotor-to-outer Rotor Maximum Clearance	0.25 mm (0.010 in.)
Oil Pump Attaching Cap Screw Torque	11 N·m (96 lb-in.)
Oil Pressure Regulating Valve	
Valve Spring Free Length	43.5—48.5 mm (1.7—1.9 in.)
Valve Spring Test Length	27.5 mm (1.08 in.)
@ Test Force	20.5 ± 3.1 N (9.6 ± 0.7 lb)
Oil Pressure Change Per 1 mm (0.039 in.) of Shim Thickness	10.9 kPa (2 psi)
Oil Pan	
Strainer Tube Attaching Cap Screw Torque	11 N·m (96 lb-in.)
Oil Pan-to-Block Cap Screw Torque	11 N·m (96 lb-in.)
Oil Pan-to-Gear Housing Cover Torque	9 N·m (78 lb-in.)

5M4,T1206,4 -19-12OCT87

ENGINE: 3TG72

GROUP 45—Cooling system

Item	Specification
Thermostat	
Begin Opening Temperature	71° (160°F)
Fully Open Temperature	85°C (184°F)
Housing Cover Cap Screw Torque	20 N·m (180 lb-in.)
Water Pump	
Plate Screws Torque	9 N·m (78 lb-in.)
Pulley Cap Screws Torque	11 N·m (96 lb-in.)
Attaching Cap Screws	26 N·m (226 lb-in.)
Alternator Belt Deflection	13 mm (0.5 in.) at 107N (24 lb force) applied midway between pulleys.

GROUP 50—Carburetor

GROUP 55—Governor

Item	Specification
Governor Gear Backlash (New)	0.11—0.30 mm (0.004—0.012 in.)
Governor Gear Backlash (Maximum)	0.38 mm (0.015 in.)
Fuel Control Linkage Bore Maximum I.D.	8.15 mm (0.321 in.)
Governor Shaft Minimum Diameter	7.90 (0.311 in.)
Governor Shaft Clearance (Maximum) (Bore I.D. Minus Shaft O.D.)	0.18 mm (0.0071 in.)

GROUP 60—Starter
See Starter Specifications in this Group

GROUP 65—Alternator
See Alternator Specifications in this Group

GROUP 70—Ignition System
See Ignition System Specifications in this Group

5M4,T1206,5 -19-12OCT87

ENGINE: 3TG66

GROUP 10—Valve Train and Camshaft

Item	Specification
Valve Clearance	0.2 mm (0.008 in.)
Rocker Arm	
Minimum Shaft O.D.	9.9 mm (0.390 in.)
Maximum Shaft Support I.D.	10.1 mm (0.398 in.)
Maximum Arm I.D.	10.1 mm (0.398 in.)
Maximum Shaft Clearance	0.10 mm (0.004 in.)
Rocker Arm Assembly Cap Screw and Nut Torque	25 N·m (225 lb-in.)
Rocker Arm Cover Nut Torque	26 N·m (226 lb-in.)
Push Rod	
Maximum T.I.R.	0.3 mm (0.012 in.)
Minimum Length	114 mm (4.49 in.)
Cam Follower	
Minimum O.D.	17.85 mm (0.703 in.)
Maximum Bore I.D.	18.1 mm (0.713 in.)
Maximum Clearance	0.1 mm (0.004 in.)
Camshaft	
Maximum End Play	0.5 mm (0.02 in.)
Maximum Gear Backlash	0.2 mm (0.008 in.)
Minimum End Journals O.D.	35.84 mm (1.411 in.)
Minimum Intermediate Journals O.D.	35.81 mm (1.410 in.)
Minimum Lobe height	29.7 mm (1.169 in.)
Maximum Bushing I.D.	36.115 mm (1.422 in.)
Maximum Intermediate and Flywheel End Bores I.D.	36.075 mm (1.421 in.)
Maximum Journal Clearance	0.18 mm (0.007 in.)
Attaching Cap Screw Torque	11 N·m (96 lb-in.)
Gear Housing Cover Cap Screw Torque	9 N·m (78 lb-in.)
Crankshaft Pulley Cap Screw Torque	113 N·m (84 lb-ft)

GROUP 15—Cylinder Head, Valves, and Manifolds

Item	Specification
Manifold	
Exhaust Manifold Cap Screw Torque	11 N·m (96 lb-in.)
Intake Manifold Cap Screw Torque	11 N·m (96 lb-in.)
Cylinder Head	
Maximum Valve Recession	0.50 mm (0.020 in.)
Valve Spring Free Length (Approx.)	27.5 mm (1.083 in.)
Valve Spring Test Length @ Test Force	17 mm (0.591 in.) 125 N (28 lb)

5M4,T1206,6 -19-12OCT87

ENGINE: 3TG66

Item	Specification
Cylinder Head (continued)	
Minimum Valve Stem O.D.	5.40 mm (0.213 in.)
Exhaust Valve Angle	45°
Intake Valve Angle	30°
Maximum Valve Guide I.D.	5.57 mm (0.219 in.)
Valve Guide-to-Valve Stem Clearance:	
(Replace)	0.14 mm (0.006 in.)
Valve Seat Width	
Intake	1.14 mm (0.042 in.)
Exhaust	1.37 mm (0.054 in.)
Valve Seat Angle	
Intake	30°
Exhaust	45°
Cylinder Head Flatness	0.10 mm (0.004 in.)
Mill Cylinder Head No More Than	0.2 mm (0.008 in.)
Valve Guide Height	7 mm (0.276 in.)
Cylinder Head Cap Screw Torque	
In Sequence (Lubricated)	34 N·m (25 lb-ft)

GROUP 20—Flywheel

Item	Specification
Stub Shaft	
Maximum T.I.R.	0.2 mm (0.008 in.)
Flatness	0.05 mm (0.002 in.)
Attaching Cap Screw Torque	59 N·m (44 lb-ft)
Flywheel	
Flatness	0.05 mm (0.002 in.)
Attaching Cap Screw Torque	83 N·m (61 lb-ft)
Flywheel Housing	
Mounting Plate or Housing	
Cap Screw Torque	49 N·m (36 lb-ft)
Starter-to-Mounting Plate	
Cap Screw Torque	49 N·m (36 lb-ft)
Flywheel Housing or Shield	
Cap Screw or Nut Torque	
M10	49 N·m (36 lb-ft)
M8	26 N·m (226 lb-in.)
M12 Nut	88 N·m (65 lb-ft)

5M4,T1206,7 -19-12OCT87

ENGINE: 3TG66

GROUP 25—Connecting Rods and Pistons

Item	Specification
06 8	
Connecting Rod	
Maximum Side Play	0.8 mm (0.031 in.)
End-Cap Screw Torque	23 N·m (200 lb-in.)
Maximum Bearing Clearance	0.12 mm (0.0048 in.)
Minimum Journal O.D.	35.93 mm (1.415 in.)
Maximum Bearing I.D.	36.07 mm (1.420 in.)
Maximum Bearing Clearance	0.12 mm (0.005 in.)
Piston	
Maximum Ring Groove Clearance	
Top Ring	0.25 mm (0.010 in.)
Second Ring	0.25 mm (0.010 in.)
Oil Ring	0.25 mm (0.010 in.)
Maximum Ring End Cap	
Top Ring	1.30 mm (0.051 in.)
Second Ring	1.30 mm (0.051 in.)
Oil Ring	1.80 mm (0.071 in.)
Minimum Pin O.D.	19.9 mm (0.783 in.)
Maximum Pin Bushing I.D.	20.1 mm (0.791 in.)
Maximum Pin Bushing Clearance	0.15 mm (0.006 in.)
Maximum Pin Bore I.D.	20.08 mm (0.791 in.)
Maximum Pin Bore Clearance	0.10 mm (0.004 in.)
Minimum Piston O.D.	65.88 mm (2.593 in.)
Maximum Cylinder Bore I.D.	66.12 mm (2.603 in.)
Maximum Piston To Bore Clearance	0.15 mm (0.006 in.)

GROUP 30—Crankshaft and Main Bearings

Item	Specification
Crankshaft	
Maximum End Play	0.30 mm (0.012 in.)
Main Bearing Cap Screw Torque	54 N·m (40 lb-ft)
Maximum Main Bearing Clearance	0.12 mm (0.005 in.)
Oil Seal Case Cap Screw Torque	
Seal Case to Block	11 N·m (96 lb-in.)
Oil Pan to Seal Case	9 N·m (78 lb-in.)
Minimum Main Bearing Journal O.D.	40.93 (1.611 in.)
Maximum Main Bearing I.D.	40.07 mm (1.578 in.)

5M4,T1206,8 -19-11SEP87

ENGINE: 3TG66

GROUP 35—Gear Housing

Item	Specification
Gear Housing Cap Screw Torque	9 N·m (78 lb-in.)
Crankshaft Pulley Cap Screw Torque	115 N·m (85 lb-ft)
Timing Gear Backlash	
Governor	0.38 mm (0.015 in.)
Idler	0.2 mm (0.008 in.)
Camshaft	0.2 mm (0.008 in.)
Crankshaft	0.2 mm (0.008 in.)
Oil Pump	0.3 mm (0.012 in.)
Timing Gear Wear Specifications	
Idler Gear Bushing Diameter	20.08 mm (0.791 in.)
Idler Shaft Diameter	19.9 mm (0.783 in.)
Idler Shaft Oil Clearance	0.1 mm (0.004 in.)

GROUP 40—Lubrication System

Item	Specification
Oil Pump	
Gear Backlash, Maximum	0.30 mm (0.012 in.)
Rotor Recess, Maximum	0.25 mm (0.010 in.)
Outer rotor-to-Pump Body Maximum Clearance	0.25 mm (0.010 in.)
Inner Rotor-to-Outer Rotor Maximum Clearance	0.25 mm (0.010 in.)
Oil Pump Attaching Cap Screw Torque	11 N·m (96 lb-in.)
Oil Pressure Regulating Valve	
Valve Spring Free Length	21.9—24.5 mm (0.86—0.96 in.)
Valve Spring Test Length	14.7 mm (0.58 in.)
@ Test Force	12 ± 1.8 N (2.7 ± 0.4 lb)
Oil Pressure Change Per 1 mm (0.039 in.) of Shim Thickness	13.8 kPa (2 psi)
Oil Pan	
Strainer Tube Attaching Cap Screw Torque	11 N·m (96 lb-in.)
Oil Pan-to-Block Cap Screw Torque	11 N·m (96 lb-in.)
Oil Pan-to-Gear Housing Cover Torque	9 N·m (78 lb-in.)

5M4,T1206,9 -19-12OCT87

ENGINE: 3TG66

GROUP 45—Cooling system

Item	Specification
Thermostat	
Begin Opening Temperature	71˚C (160˚F)
Fully Open Temperature	85˚C (184˚F)
Housing Cover Cap Screw Torque	9 N·m (78 lb-in.)
Water Pump	
Plate Screws Torque	9 N·m (78 lb-in.)
Pulley Cap Screws Torque	11 N·m (96 lb-in.)
Attaching Cap Screws	26 N·m (226 lb-in.)
Alternator Belt Deflection	13 mm (0.5 in.) at 107N (24 lb force) applied midway between pulleys.

GROUP 50—Carburetor

GROUP 55—Governor

Item	Specification
Governor Gear Backlash (New)	0.11—0.30 mm (0.004—0.012 in.)
Governor Gear Backlash (Maximum)	0.38 mm (0.015 in.)
Fuel Control Linkage Bore Maximum I.D.	8.15 mm (0.321 in.)
Governor Shaft Minimum Diameter	7.90 (0.311 in.)
Governor Shaft Clearance (Maximum) (Bore I.D. Minus Shaft O.D.)	0.18 mm (0.0071 in.)

GROUP 60—Starter
See Starter Specifications in this Group

GROUP 65—Alternator
See Alternator Specifications in this Group

GROUP 70—Ignition System
See Ignition System Specifications in this Group

5M4,T1206,10 -19-12OCT87

SERVICE EQUIPMENT AND TOOLS

NOTE: Order tools from the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

Name	Use
Feeler Gauge	Measure valve clearance
Outside Micrometer	Measure engine components
Telescoping Gauge	Measure engine components
Valve Inspect Center	Measure pushrod TIR
Vernier Calipers	Measure pushrod length
Strap Wrench	Hold crankshaft pulley
13-Ton Puller Set	Remove crankshaft pulley
Magnetic Base with Adjustable Arm	To hold dial indicator
Dial Indicator	Measure gear and shaft end play
Magnetic Follower Holder Kit	To hold cam followers in place when removing camshaft
Bushing, Bearing, and Seal Driver Set	To service bushings, bearings, and oil seals
Press	To service camshaft gear

M21,TM310,1 -19-05FEB86

OTHER MATERIAL

Number	Name	Use
PT502	John Deere GASKET MAKER®	To seal camshaft plug
T43512	John Deere LOCTITE® Thread Lock and Sealer (Medium Strength)	Apply to threads of crankshaft pulley cap screw.
PT94	John Deere Form-In-Place Gasket (RTV rubber silicone sealant)	To seal gear case cover.

GASKET MAKER is a trademark of the Permatex Corp.

LOCTITE is a trademark of the Loctite Corp.

M21,TM310,2 -19-23JUL87

SERVICE PARTS KITS

The following kits are available through your parts catalog:

Cylinder Block Gasket Kit.

Cylinder Head Gasket Kit.

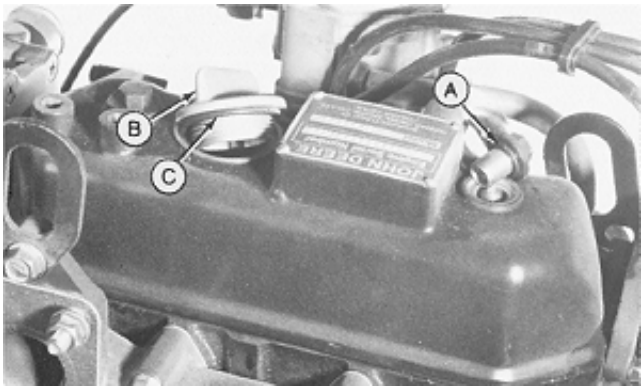
M21,TM310,3 -19-17MAR86

REMOVE AND DISASSEMBLE ROCKER ARM COVER

1. Remove rocker arm cover.

2. Remove O-ring (A) from special nuts.

3. Remove oil fill cap (B) and O-ring (C).



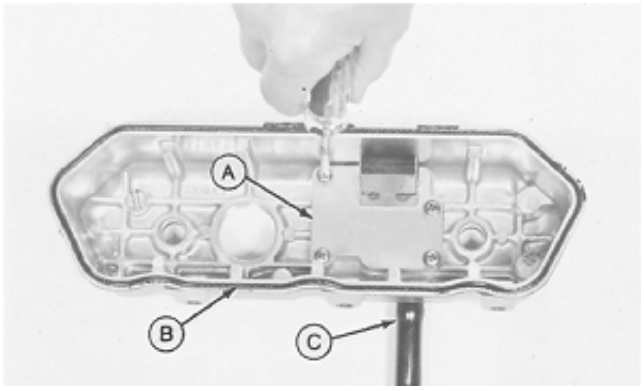
M46065 -UN-08JAN90

5M4,T1210,1 -19-11SEP87

4. Remove O-ring (B) and crankcase breather tube (C).

5. Remove four screws and lock washers to remove baffle (A).

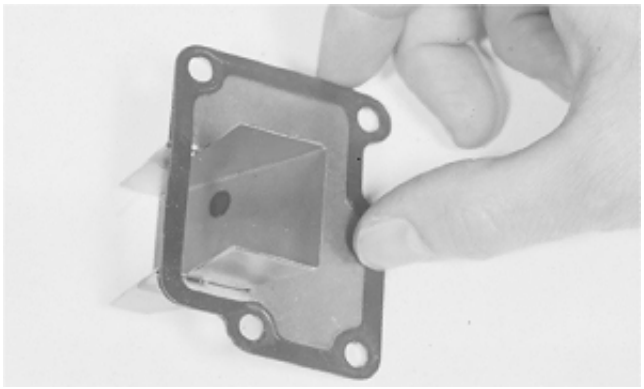
A—Baffle
B—O-Ring
C—Crankcase Breather Tube



M35328 -UN-29AUG88

5M4,T1210,2 -19-11SEP87

6. Remove gasket from baffle.

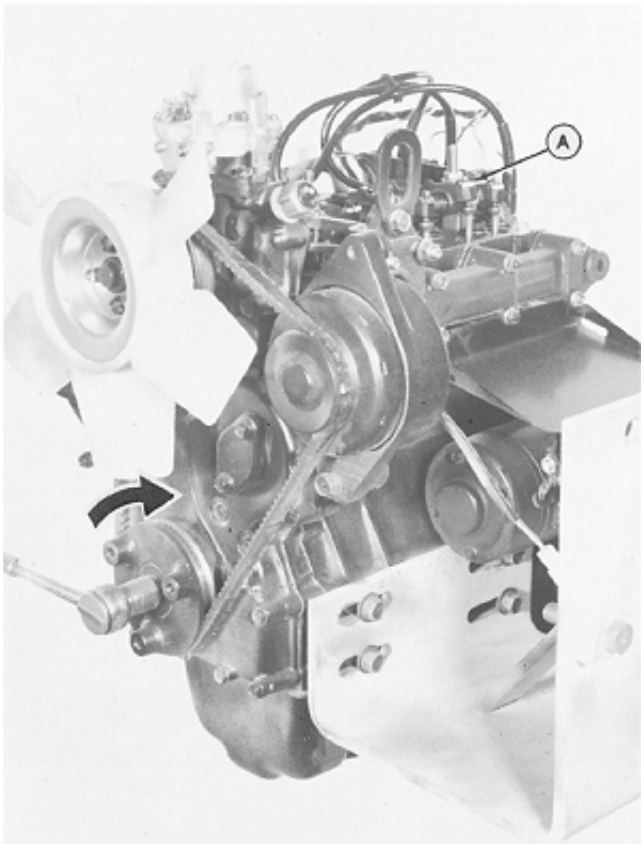


M35329 -UN-29AUG88

5M4,T1210,3 -19-12OCT87

MEASURE AND ADJUST VALVE CLEARANCE

1. Turn crankshaft clockwise until No. 1 cylinder intake valve (A) opens.



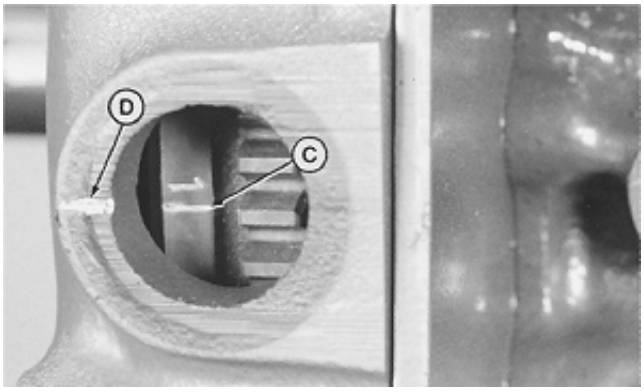
M46066 -UN-08JAN90

5M4,T1210,4 -19-12OCT87

NOTE: TDC—Top Dead Center (the piston at its highest point).

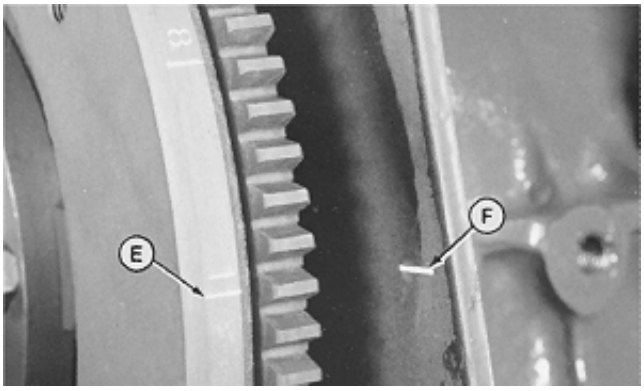
2. Remove flywheel housing plug. Continue turning crankshaft until No. 1 timing mark (C) on flywheel lines up with mark (D) on flywheel housing. (TDC on compression stroke.)

If equipped, remove flywheel shield. Continue turning crankshaft until No. 1 timing mark (E) on flywheel lines up with mark (F) on mounting plate. (TDC on compression stroke).



M37500 -UN-29AUG88

3TG66 (Lawn Tractor)



M37501 -UN-29AUG88

3TG66, 3TG72 (Front Mower)

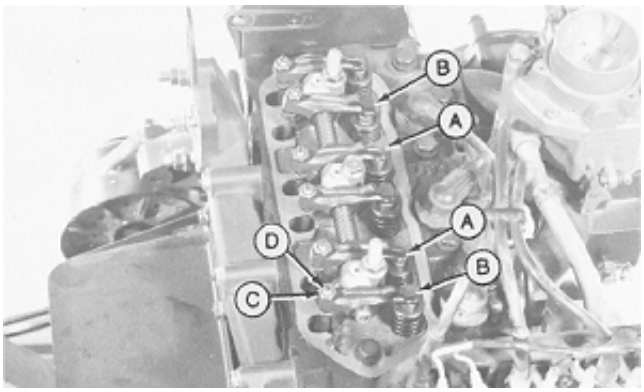
5M4,T1210,5 -19-12OCT87

3. Measure valve clearance.

VALVE CLEARANCE SPECIFICATIONS

Intake Valves (A) . . . . . 0.2 mm (0.008 in.)
Exhaust Valves (B) . . . . . 0.2 mm (0.008 in.)

4. To adjust valves (A and B), loosen nut (C) and turn adjusting screw (D) to proper clearance. Hold screw while tightening nut.



-UN-08JAN90
M46067

View From Flywheel End

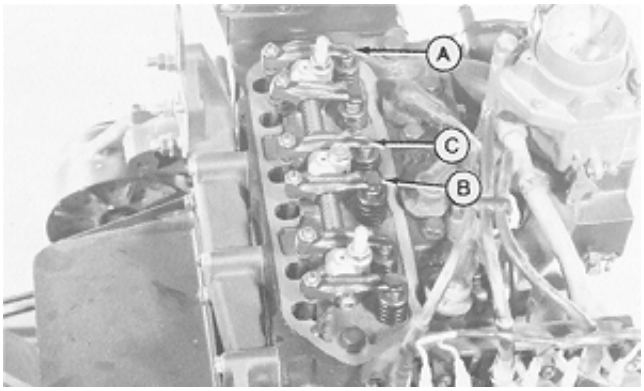
5M4,T1210,6 -19-12OCT87

5. To adjust remaining valves (A and B):

a. Turn crankshaft until No. 2 cylinder intake valve (C) opens.

Continue turning crankshaft to align the No. 2 timing mark on flywheel with mark on flywheel housing or mounting plate.

b. See Step 4 to adjust intake and exhaust valve. Adjust valves to 0.2 mm (0.008 in.).



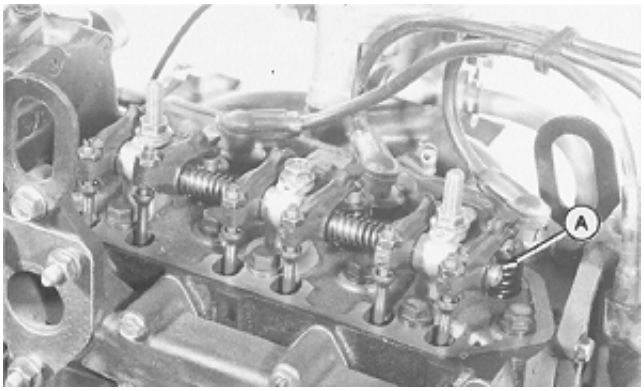
-UN-12JAN90
M46068

View From Flywheel End

5M4,T1210,7 -19-12OCT87

REMOVE AND DISASSEMBLE ROCKER ARM ASSEMBLY

1. Remove rocker arm assembly (A).

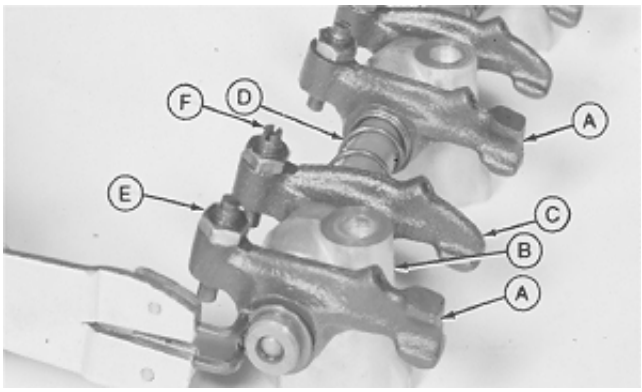


-UN-08JAN90
M46069

5M4,T1210,8 -19-11SEP87

2. Remove snap ring and parts (A—F).

A—Exhaust Rocker Arm (2 used)
B—Support
C—Intake Rocker Arm
D—Spring
E—Nut (3 used)
F—Adjusting Screw (3 used)

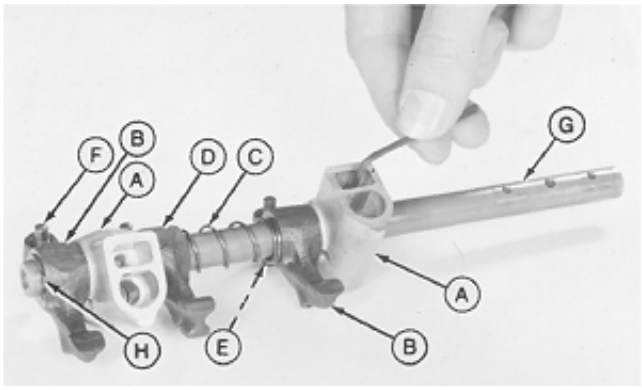


M35260 -UN-29AUG88

5M4,T1210,9 -19-12OCT87

3. Remove set screw and parts (A—H).

A—Support
B—Intake Rocker Arm
C—Spring
D—Exhaust Rocker Arm
E—Nut
F—Adjusting Screw
G—Rocker Arm Shaft
H—Snap Ring

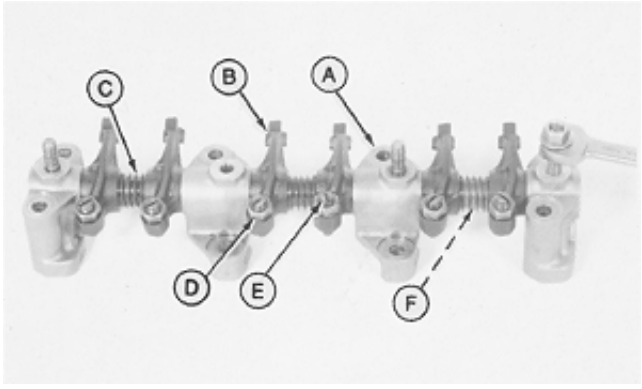


M35261 -UN-29AUG88

M21,TM310,16 -19-17FEB86

4. Remove three studs using two M8 nuts. Remove parts (A—F).

A—Support (4 used)
B—Rocker Arm (6 used)
C—Spring (3 used)
D—Nut (6 used)
E—Adjusting Screw (6 used)
F—Rocker Arm Shaft



M37504 -UN-29AUG88

5M4,T1210,10 -19-14SEP87

5. Measure rocker arm shaft outside diameter at each rocker arm location.

ROCKER ARM SHAFT O.D. SPECIFICATION

Engine	Wear Tolerance
3TG66	9.9 mm (0.390 in.)
3TG72	11.9 mm (0.469 in.)

If rocker arm shaft diameter is less than wear tolerance, replace shaft.

M35262 -UN-29AUG88

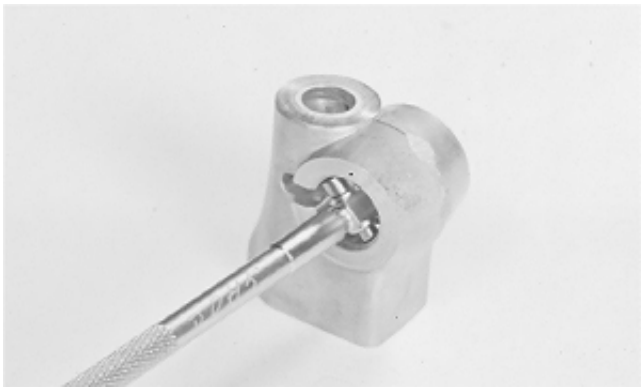
5M4,T1210,11 -19-05OCT87

6. Measure each rocker arm shaft support inside diameter.

ROCKER ARM SHAFT SUPPORT I.D. SPECIFICATION

Engine	Wear Tolerance
3TG66	10.1 mm (0.398 in.)
3TG72	12.1 mm (0.476 in.)

If rocker arm shaft support diameter exceeds wear tolerance, replace support.



M35263 -UN-29AUG88

5M4,T1210,12 -19-14SEP87

7. Measure each rocker arm inside diameter and determine rocker arm shaft clearance (rocker arm I.D. minus rocker arm shaft O.D.).

Inspect rocker arm to valve surface and adjusting screw for metal flakes or wear.

ROCKER ARM SPECIFICATIONS

Engine	Measurement	Wear Tolerance
3TG66	Arm I.D.	10.1 mm (0.398 in.)
3TG66	Shaft Clearance	0.10 mm (0.004 in.)
3TG72	Arm I.D.	12.1 mm (0.476 in.)
3TG72	Shaft Clearance	0.12 mm (0.005 in.)

If rocker arm bore diameter exceeds wear tolerance, replace rocker arm.

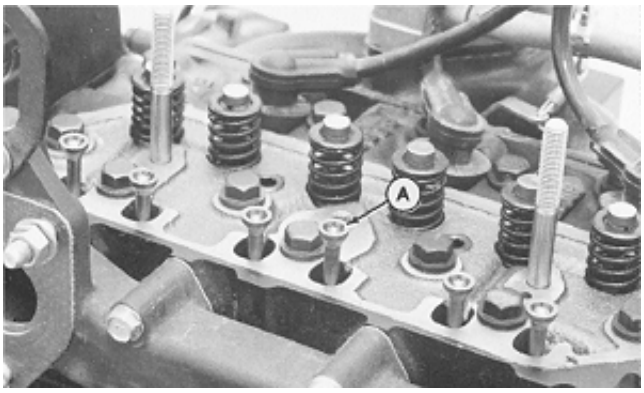
If shaft clearance exceeds wear tolerance, replace rocker arm shaft, rocker arm, or both.

M35264 -UN-29AUG88

5M4,T1210,13 -19-14SEP87

REMOVE AND INSPECT PUSHRODS AND CAM FOLLOWERS

1. Remove pushrods (A).



M46070 -UN-08JAN90

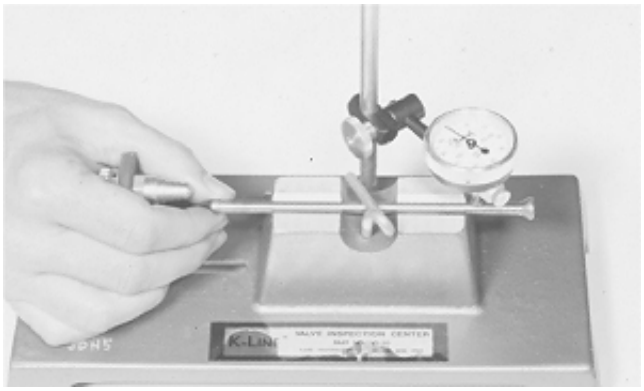
5M4,T1210,14 -19-12OCT87

2. Measure pushrod TIR (Total Indicator Runout) using Valve Inspection Center.

SPECIFICATION

Pushrod TIR (Max)	0.30 mm (0.012 in.)

If pushrod TIR exceeds 0.30 mm (0.012 in.), replace it.



M35400 -UN-06SEP88

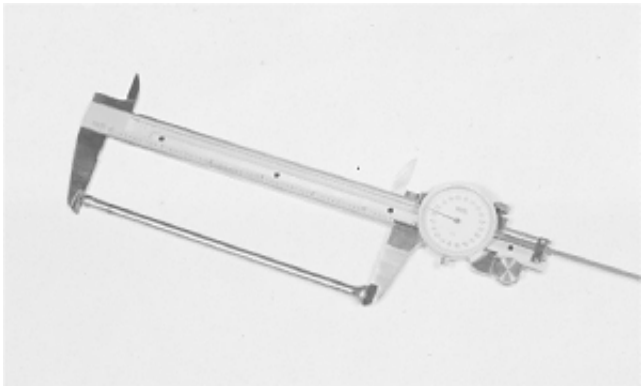
M21,TM310,22 -19-22APR86

3. Measure pushrod length.

PUSHROD LENGTH SPECIFICATION

Engine	Wear Tolerance
3TG66	114 mm (4.49 in.)
3TG72	141 mm (5.55 in.)

If pushrod length is less than wear tolerance, replace it.



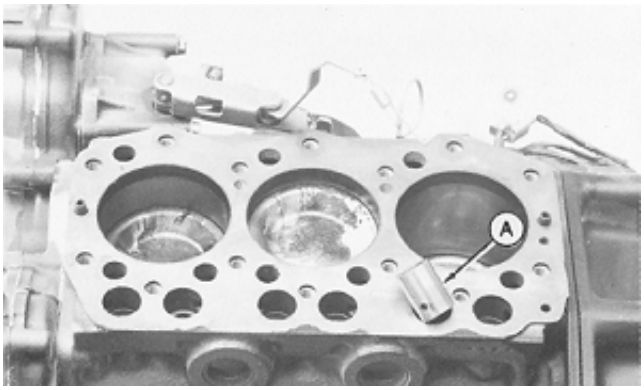
5M4,T1210,15 -19-14SEP87

4. Remove cylinder head. (See Group 15 in this manual).

IMPORTANT: Cam followers must be installed in the same bores they were removed from.

5. Put a mark on each cam follower and cylinder block bore to aid in assembly.

6. Remove cam followers (A).



5M4,T1210,16 -19-14SEP87

7. Measure cam followers outside diameter.

CAM FOLLOWER O.D. SPECIFICATIONS

Engine	Wear Tolerance
3TG66	17.85 mm (0.703 in.)
3TG72	20.85 mm (0.821 in.)

If cam follower diameter is less than wear tolerance, replace it.

8. Inspect cam follower-to-camshaft surface for uneven wear or damage; replace as necessary.

5M4,T1210,17 -19-12OCT87

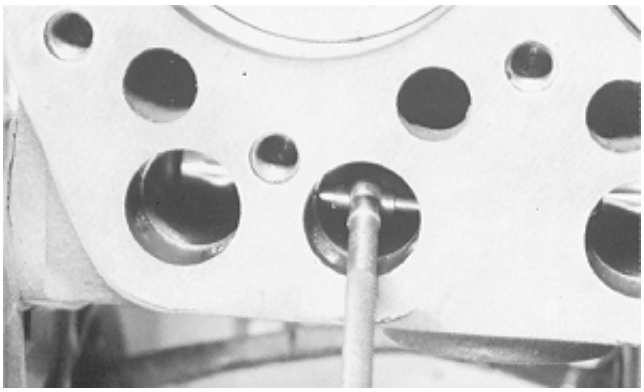
9. Measure cam follower bore inside diameter and determine cam follower clearance (cam follower bore I.D. minus cam follower O.D.).

CAM FOLLOWER BORE SPECIFICATIONS

Engine	Measurement	Wear Tolerance
3TG66	Bore I.D.	18.1 mm (0.713 in.)
3TG66	Clearance	0.1 mm (0.004 in.)
3TG72	Bore I.D.	21.00 mm (.823 in.)
3TG72	Clearance	0.15 mm (0.006 in.)

If cam follower bore diameter exceeds wear tolerance, replace cylinder block.

If cam follower clearance exceeds wear tolerance; replace cam follower, cylinder block or both.



M46072 -UN-08JAN90

5M4,T1210,18 -19-14SEP87

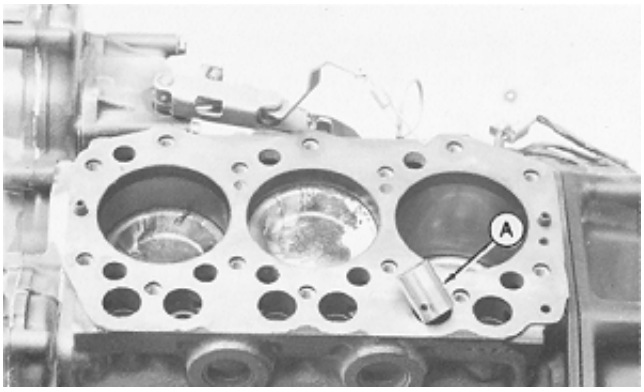
INSTALL PUSHRODS AND CAM FOLLOWERS

1. Put clean engine oil on cam followers.

IMPORTANT: Cam followers must be installed in the same bores they were removed from.

2. Install cam followers (A).

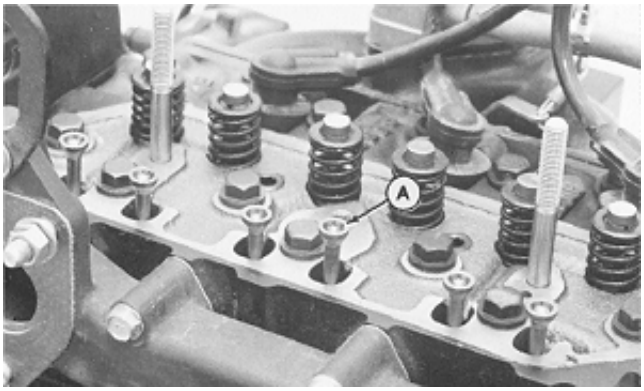
3. Install cylinder head. (See Group 15 in this manual.)



M46071 -UN-08JAN90

5M4,T1210,19 -19-14SEP87

4. Install the pushrods.



M46070 -UN-08JAN90

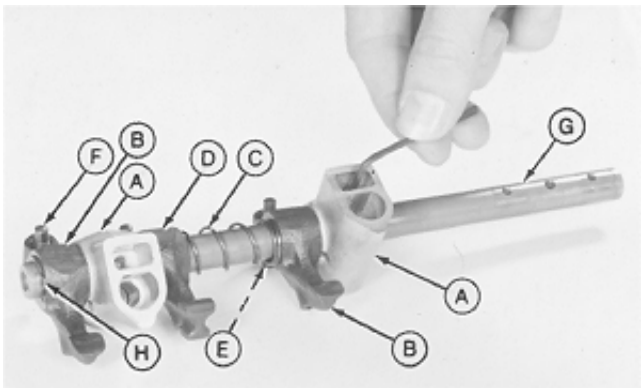
5M4,T1210,20 -19-14SEP87

ASSEMBLE AND INSTALL ROCKER ARM ASSEMBLY

1. Install parts (A—H) on rocker arm shaft.

2. Align set screw hole in support with center hole in rocker arm shaft. Install and tighten set screw.

A—Support (2 used)
B—Intake Rocker Arm (2 used)
C—Spring
D—Exhaust Rocker Arm
E—Nut (3 used)
F—Adjusting Screw (3 used)
G—Rocker Arm Shaft
H—Snap Ring



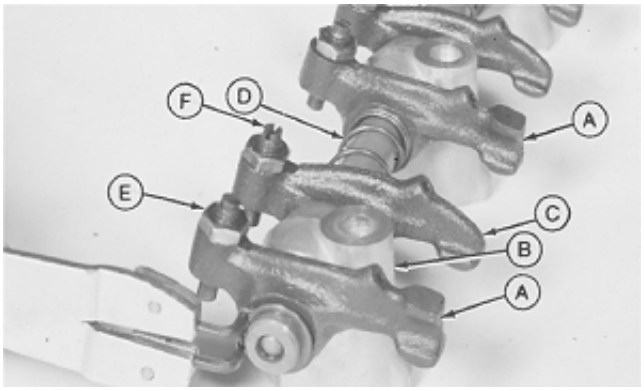
-UN-29AUG88
M35261

5M4,T1210,21 -19-14SEP87

3. Install parts (A—F) on rocker arm shaft.

4. Install snap ring.

A—Exhaust Rocker Arm
B—Support
C—Intake Rocker Arm
D—Spring
E—Nut
F—Adjusting Screw



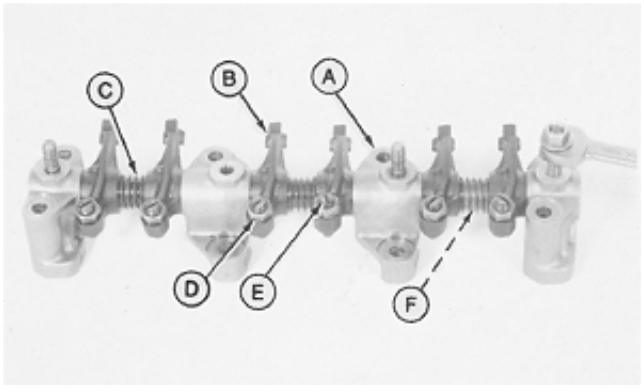
-UN-29AUG88
M35260

M21,TM310,30 -19-17FEB86

5. Install parts (A—F) on rocker arm shaft.

6. Align hole in each support with hole in rocker arm shaft. Install and tighten three studs using two M8 nuts.

A—Support (4 used)
B—Rocker Arm (6 used)
C—Spring (3 used)
D—Nut (6 used)
E—Adjusting Screw (6 used)
F—Rocker Arm Shaft



-UN-29AUG88
M37504

5M4,T1210,22 -19-14SEP87