TECHNICAL MANUAL

OPERATOR' S, UNIT, INTERMEDIATE (DS) AND INTERMEDIATE (GS) MAINTENANCE MANUAL

FOR

ENGINE, DIESEL, CATERPILLAR, MODEL 3508 NSN 2815-01-216-0938

HEADQUARTERS, DEPARTMENT OF THE ARMY

25 JULY 1986

⚠ WARNING

IMPORTANT SAFETY NOTICE

Proper repair-is important to the safe and reliable operation of this product. This Service Manual outlines basic recommended procedures, some of which require special tools, devices or work methods. Although not necessarily all inclusive, a list of additional skills, precautions and knowledge required to safely perform repairs is provided in the SAFETY section of this Manual.

Improper repair procedures can be dangerous and could result in injury or death.

READ AND UNDERSTAND ALL SAFETY PRECAUTIONS AND WARNINGS BEFORE PERFORMING REPAIRS

Basic safety precautions, skills and knowledge are listed in the SAFETY section of this Manual and in the descriptions of operations where hazards exist. Warning labels have also been put on to provide instructions and identify specific hazards which if not heeded could cause bodily injury or death to you or other persons. These labels identify hazards which may not be apparent to a trained mechanic. There are many potential hazards during repair for a untrained mechanic and there is no way to label the product against all such hazards. These warnings in the Service Manual and on the product are identified by this symbol:

⚠ WARNING

Operations that may result only in mechanical damage are identified by labels on the product and in the Service Manual by the word CAUTION or NOTICE.

Caterpillar can not anticipate every possible circumstance that might involve a potential hazard. The warnings in this Manual are therefore not all inclusive. If a procedure, tool device or work method not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and others. You should also ensure that the product will not be damaged or made unsafe by the procedures you choose.

IMPORTANT

The information, specifications and illustrations in this book are on the basis of information available at the time it was written. The specifications, torque, pressures of operation, measurements, adjustments, illustrations and other items can change at any time. These changes can affect the service given to the product. Get the complete and most current information before you start any job. Caterpillar Dealers have the most current information available. For a list of the most current modules and form numbers available for each Service Manual, see the SERVICE MANUAL CONTENTS MICROFICHE REG1139F.

SAFETY

⚠ WARNING

Improper performance of lubrication or maintenance procedures is dangerous and could result in injury or death. Read and understand the lubrication and maintenance procedures, recommended by Caterpillar, that are outlined in the OPERATION GUIDE and/or OWNER'S MANUAL for this product before performing any lubrication or maintenance.

Do not operate this product unless you have read and understood the instructions. Improper operation is dangerous and could result in injury or death.

The servicemen or mechanic may be unfamiliar with many of the components and systems of this product. This makes it important to use caution when performing service work. A knowledge of the system and/or components is important before the removal or disassembly of any component.

Because of the size of some components, the serviceman or mechanic should check the weights noted in this Manual. Use proper lifting procedures when removing any components.

Following is a list of basic precautions that should always be observed.

1. Read and understand all Warning plates and decals before operating, lubricating or repairing this product.

2. Make sure the work area around the product is made safe and be aware of hazardous conditions that may exist.

3. Always wear protective glasses and protective shoes when working. In particular, wear protective glasses when a hammer or sledge is used for pounding to make repairs. Use welders gloves, hood/goggles, apron and other protective clothing appropriate to the welding job being performed. Do not wear loose-fitting or torn clothing. Remove all rings from fingers when working on machinery.

4. If an engine must be started to make pressure or speed checks, be sure all guards and shields are installed. To help prevent an accident caused by parts in rotation, work carefully around machinery that has been put into operation.

5. If an engine has been running and the coolant is hot, loosen the filler cap slowly and let the pressure out of the cooling system, before any caps, plugs or lines are removed or disconnected.

6. Corrosion inhibitor contains alkali. Avoid contact with eyes. Avoid prolonged or repeated contact with skin. Do not take internally. In case of contact, immediately wash skin with soap and water. For eyes, flush with large amounts of water for at least 15 minutes. CALL PHYSICIAN. KEEP OUT OF REACH OF CHILDREN.

7. Do not smoke when an inspection of the battery electrolyte level is made. Never disconnect any charging unit circuit or battery circuit cable from the battery when the charging unit is operating. A spark can cause an explosion from the flammable vapor mixture of hydrogen and oxygen that is released from the electrolyte through the battery outlets. Do not let electrolyte solution make contact with skin or eyes. Electrolyte solution is an acid. In case of contact, immediately wash skin with soap and water. For eyes, flush with large amounts of water for at least 15 minutes. CALL PHYSICIAN. KEEP OUT OF REACH OF CHILDREN.

8. Disconnect battery and discharge any capacitors before starting any repair work. Hang "Do Not Operate" tag in the Operator's compartment or on the controls.

9. Do not work on anything that is supported only by lift jacks or a hoist. Always use blocks or proper stands to support the product before performing any service work.

10. Relieve all pressure in air, oil or water systems before any lines, fittings or related items are disconnected or removed. Be alert for possible pressure when disconnecting any device from a system that utilizes pressure. Do not check for pressure leaks with your hand. High pressure oil or fuel can pierce the skin.

⚠ WARNING

11. Never bend a fuel injection line, or install a line which has been bent. Keep the fuel injection lines and connections clean. Be sure to install caps and covers anytime a line is removed or disconnected.

12. During service work, do not hit the fuel injection lines with wrenches or other tools. When lines are installed, use the correct torque to tighten connections and be sure all clamps and dampers are correctly installed.

13. Make sure all fuel injection lines and pressure oil lines have enough clearance to prevent contact with any other component. Do not put any fuel or oil lines close to a hot component.

14. To avoid back injury use a hoist or get help when lifting components which weigh 50 lb. (23 kg) or more. Make sure all chains, hooks, slings, etc., are in good condition and are of the correct capacity. Be sure hooks are positioned correctly. Lifting eyes are not to be side loaded during a lifting operation.

15. To avoid burns, be alert for hot parts on products which have just been stopped and hot fluids in lines, tubes and compartments.

16. Be careful when removing cover plates. Gradually back off the last two bolts or nuts located at opposite ends of the cover or device and pry cover loose to relieve any spring or other pressure, before removing them completely.

17. Be careful when removing filler caps, breathers and plugs on the product. Hold a rag over the cap or plug to prevent being sprayed or splashed by liquids under pressure. The danger is even greater if the product has recently been stopped because fluids can be hot.

18. Always use tools that are in good condition and be sure you understand how to use them before performing any service work. Use only Caterpillar replacement parts.

19. Reinstall all fasteners with same part number. Do not use a lesser quality fastener if replacements are necessary.

20. Repairs which require welding should be performed only with the benefit of the appropriate reference information and by personnel adequately trained and knowledgeable in welding procedures. Make reference to “Techniques of Structural Repair Course” form number JEG03719. Determine type of metal being welded and select correct welding procedure and electrodes, rods or wire to provide a weld metal strength equivalent at least to that of parent metal.

21. Before doing electrical work, disconnect battery. Do not damage wiring during removal operations. Reinstall the wiring so it is not damaged nor will it be damaged in operation by contacting sharp corners, or by rubbing against some object or hot surface. Do not connect wiring to a line containing fluid.

22. Be sure all protective devices including guards and shields are properly installed and functioning correctly before starting a repair. If a guard or shield must be removed to perform the repair work, use extra caution. After the repair is completed, reinstall any guard or shield that was removed.

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⚠ WARNING

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⚠ WARNING

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Improper repair procedures can be dangerous and could result in injury or death.

READ AND UNDERSTAND ALL SAFETY PRECAUTIONS AND WARNINGS BEFORE PERFORMING REPAIRS ON THIS MACHINE

Basic safety precautions, skills and knowledge are listed in the SAFETY section of this Manual and in the descriptions of operations where hazards exist. Warning labels have also been put on the machine to provide instructions and identify specific hazards which if not heeded could cause bodily injury or death to you or other persons. These labels identify hazards which may not be apparent to a trained mechanic. There are many potential hazards during repair for an untrained mechanic and there is no way to label. the machine against all such hazards. These warnings in the Service Manual and on the machine are identified by this symbol:

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Operations that may result only in machine damage are identified by labels on the machine and in the Service Manual by the word **NOTICE**.

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Improper repair procedures can be dangerous and could result in injury or death.

READ AND UNDERSTAND ALL SAFETY PRECAUTIONS AND WARNINGS BEFORE PERFORMING REPAIRS ON THIS MACHINE

Basic safety precautions, skills and knowledge are listed in the SAFETY section of this Manual and in the descriptions of operations where hazards exist. Warning labels have also been put on the machine to provide instructions and identify specific hazards which if not heeded could cause bodily injury or death to you or other persons. These labels identify hazards which may not be apparent to a trained mechanic. There are many potential hazards during repair for an untrained mechanic and there is no way to label ,the machine against all such hazards. These warnings in the Service Manual and on the machine are identified by this symbol:

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67200-1 X1

⚠ WARNING

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⚠ WARNING

Improper performance of lubrication or maintenance procedures is dangerous and could result in injury or death. Read and understand the lubrication and maintenance procedures, recommended by Caterpillar, that are outlined in the OPERATION GUIDE and/or OWNER'S MANUAL for this product before performing any lubrication or maintenance.

Do not operate this product unless you have read and understood the instructions. Improper operation is dangerous and could result in injury or death.

The servicemen or mechanic may be unfamiliar with many of the components and systems of this product. This makes it important to use caution when performing service work. A knowledge of the system and/or components is important before the removal or disassembly of any component.

Because of the size of some components, the serviceman or mechanic should check the weights noted in this Manual. Use proper lifting procedures when removing any components.

Following is a list of basic precautions that should always be observed.

1. Read and understand all Warning plates and decals before operating, lubricating or repairing this product.

2. Make sure the work area around the product is made safe and be aware of hazardous conditions that may exist.

3. Always wear protective glasses and protective shoes when working. In particular, wear protective glasses when a hammer or sledge is used for pounding to make repairs. Use welders gloves, hood/goggles, apron and other protective clothing appropriate to the welding job being performed. Do not wear loose-fitting or torn clothing. Remove all rings from fingers when working on machinery.

4.

4. If an engine must be started to make pressure or speed checks, be sure all guards and shields are installed. To help prevent an accident caused by parts in rotation, work carefully around machinery that has been put into operation.

5. If an engine has been running and the coolant is hot, loosen the filler cap slowly and let the pressure out of the cooling system, before any caps, plugs or lines are removed or disconnected.

6. Corrosion inhibitor contains alkali. Avoid contact with eyes. Avoid prolonged or repeated contact with skin. Do not take internally. In case of contact, immediately wash skin with soap and water. For eyes, flush with large amounts of water for at least 15 minutes. CALL PHYSICIAN. KEEP OUT OF REACH OF CHILDREN.

7. Do not smoke when an inspection of the battery electrolyte level is made. Never disconnect any charging unit circuit or battery circuit cable from the battery when the charging unit is operating. A spark can cause an explosion from the flammable vapor mixture of hydrogen and oxygen that is released from the electrolyte through the battery outlets. Do not let electrolyte solution make contact with skin or eyes. Electrolyte solution is an acid. In case of contact, immediately wash skin with soap and water. For eyes, flush with large amounts of water for at least 15 minutes. CALL PHYSICIAN. KEEP OUT OF REACH OF CHILDREN.

8. Disconnect battery and discharge any capacitors before starting any repair work. Hang "Do Not Operate" tag in the Operator's compartment or on the controls.

9. Do not work on anything that is supported only by lift jacks or a hoist. Always use blocks or proper stands to support the product before performing any service work.

10. Relieve all pressure in air, oil or water systems before any lines, fittings or related items are disconnected or removed. Be alert for possible pressure when disconnecting any device from a system that utilizes pressure. Do not check for pressure leaks with your hand. High pressure oil or fuel can pierce the skin.

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18. Always use tools that are in good condition and be sure you understand how to use them before performing any service work. Use only Caterpilla, replacement parts.

19. Reinstall all fasteners with same part number. Do not use a lesser quality fastener if replacements are necessary.

20. Repairs which require welding should be performed only with the benefit of the appropriate reference information and by personnel adequately trained and knowledgeable in welding procedures. Make reference to "Techniques of Structural Repair Course" form number JEG03719. Determine type of metal being welded and select correct welding procedure and electrodes, rods or wire to provide a weld metal strength equivalent at least to that of parent metal.

21. Before doing electrical work, disconnect battery. Do not damage wiring during removal operations. Reinstall the wiring so it is not damaged nor will it be damaged in operation by contacting sharp corners, or by rubbing against some object or hot surface. Do not connect wiring to a line containing, fluid.

22. Be sure all protective devices including guards and shields are properly installed and functioning correctly before starting a repair. If a guard or shield must be removed to perform the repair work, use extra caution. After the repair is completed, reinstall any guard or shield that was removed.

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IMPORTANT SAFETY INFORMATION

Most accidents involving engine operation and maintenance are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs.

Read and understand all safety precautions and warnings before operating or performing lubrication and maintenance on this engine.

Basic safety precautions are outlined in the "Safety" section of this guide and in the description of operations where hazards exist. WARNING labels have also been put on the engine to provide instructions and to identify specific hazards which if not heeded could cause bodily injury or death to you or other persons. These warnings in the guide and on the engine labels are identified by the symbol

Operations that may cause only engine damage are identified by NOTICE labels on the engine and in the guide.

Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this guide and on the engine are therefore not all inclusive. If a procedure, tool or work method or operating technique not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and others. You should also ensure that the engine will not be damaged or made unsafe by the method of operation or maintenance procedures you choose.

⚠ WARNING

Improper operation, lubrication or maintenance of this engine can be dangerous and could result in injury or death.

Do not operate this engine until you read and understand the instructions in the "Operation" section of the Operation and Maintenance Guide or the Owner's Manual.

Do not perform any lubrication and maintenance on this engine until you read and understand the instructions in the "Maintenance" section of the Operation and Maintenance Guide or the Owner's Manual.

Table of Contents

WHERE TITLE SHOWS DELETED TEXT DOES NOT PERTAIN TO THE 3508 ENGINE.

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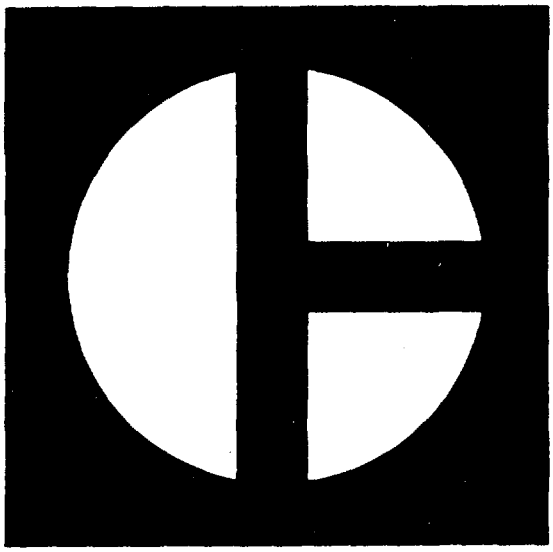
FOR USE IN SERVICE MANUALS:
3500 INDUSTRIAL ENGINES,
SENR2573
VOLUME I SPECIFICATIONS,
REGO1312



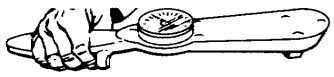
SPECIFICATIONS

FOR

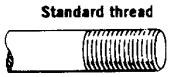
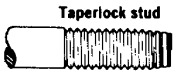
3500 INDUSTRIAL
ENGINE ATTACHMENTS

49Y1-UP	65Z1-UP
95Y1-UP	68Z1-UP
27Z1-UP	71Z1-UP

GENERAL TIGHTENING TORQUE FOR BOLTS, NUTS AND TAPERLOCK STUDS



The following charts give the standard torque values for bolts, nuts and taperlock studs of SAE Grade 5 or better quality. Exceptions are given in other sections of the Service Manual where needed.

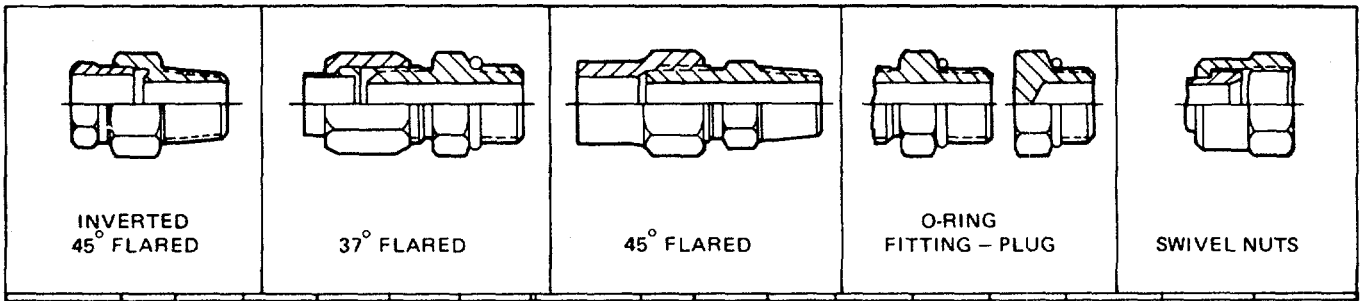
THREAD DIAMETER		STANDARD TORQUE	
inches	millimeters	lb. ft.	N·m*
 Standard thread		Use these torques for bolts and nuts with standard threads (conversions are approximate).	
1/4	6.35	9 ± 3	12 ± 4
5/16	7.94	18 ± 5	25 ± 7
3/8	9.53	32 ± 5	45 ± 7
7/16	11.11	50 ± 10	70 ± 15
1/2	12.70	75 ± 10	100 ± 15
9/16	14.29	110 ± 15	150 ± 20
5/8	15.88	150 ± 20	200 ± 25
3/4	19.05	265 ± 35	360 ± 50
7/8	22.23	420 ± 60	570 ± 80
1	25.40	640 ± 80	875 ± 100
1 1/8	28.58	800 ± 100	1100 ± 150
1 1/4	31.75	1000 ± 120	1350 ± 175
1 3/8	34.93	1200 ± 150	1600 ± 200
1 1/2	38.10	1500 ± 200	2000 ± 275
		Use these torques for bolts and nuts on hydraulic valve bodies.	
5/16	7.94	13 ± 2	20 ± 3
3/8	9.53	24 ± 2	35 ± 3
7/16	11.11	39 ± 2	50 ± 3
1/2	12.70	60 ± 3	80 ± 4
5/8	15.88	118 ± 4	160 ± 6
 Taperlock stud		Use these torques for studs with Taperlock threads.	
1/4	6.35	5 ± 2	7 ± 3
5/16	7.94	10 ± 3	15 ± 5
3/8	9.53	20 ± 3	30 ± 5
7/16	11.11	30 ± 5	40 ± 10
1/2	12.70	40 ± 5	55 ± 10
9/16	14.29	60 ± 10	80 ± 15
5/8	15.88	75 ± 10	100 ± 15
3/4	19.05	110 ± 15	150 ± 20
7/8	22.23	170 ± 20	230 ± 30
1	25.40	260 ± 30	350 ± 40
1 1/8	28.58	320 ± 30	400 ± 40
1 1/4	31.75	400 ± 40	550 ± 50
1 3/8	34.93	480 ± 40	650 ± 50
1 1/2	38.10	550 ± 50	750 ± 70

*1 newton meter (N·m) is approximately the same as 0.1 mkg.

T95416-7

TORQUE FOR FLARED AND O-RING FITTINGS

The torques shown in the chart that follows are to be used on the part of 37° Flared, 45° Flared and Inverted Flared fittings (when used with steel tubing), O-ring plugs and O-ring fittings.



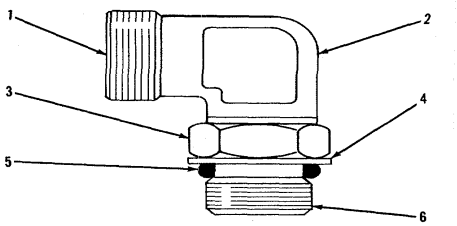
TUBE SIZE (O.D.)	mm	3.18	4.78	6.35	7.92	9.52	TUBE SIZE (O.D.)	mm	12.70	15.88	19.05	22.22	25.40	31.75	38.10	50.80
	in.	.125	.188	.250	.312	.375		in.	.500	.625	.750	.875	1.000	1.250	1.500	2.000
THREAD SIZE (in.)		5/16	3/8	7/16	1/2	9/16 5/8	THREAD SIZE (in.)		3/4	7/8	1 1/16	1 3/16 1 1/4	1 5/16	1 5/8	1 7/8	2 1/2
TORQUE N·m		5 ±1	11 ±1	16 ±2	20 ±2	25 ±3	TORQUE N·m		50 ±5	75 ±5	100 ±5	120 ±5	135 ±10	180 ±10	225 ±10	320 ±15
TORQUE lb.in.		45 ±10	100 ±10	145 ±20	175 ±20	225 ±25	TORQUE lb.ft.		35 ± 4	55 ± 4	75 ± 4	90 ± 4	100 ± 7	135 ± 7	165 ± 7	235 ± 10

ASSEMBLY OF FITTINGS WITH STRAIGHT THREADS AND O-RING SEALS

1. Put locknut (3), backup washer (4) and O-ring seal (5) as far back on fitting body (2) as possible. Hold these components in this position. Turn the fitting into the part it is used on, until backup washer (4) just makes contact with the face of the part it is used on.

NOTE: If the fitting is a connector (straight fitting) or plug, the hex on the body takes the place of the locknut. To install this type fitting tighten the hex against the face of the part it goes into.

2. To put the fitting assembly in its correct position turn the fitting body (2) out (counterclockwise) a maximum of 359°. Tighten locknut (3) to the torque shown in the chart.y



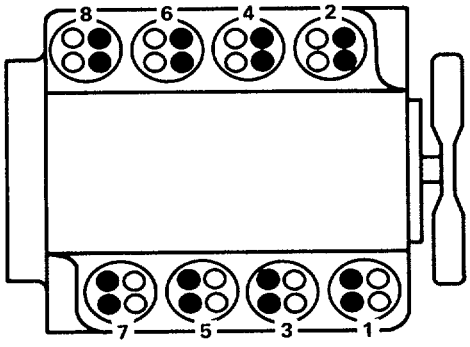
ELBOW BODY ASSEMBLY

1. End of fitting body (connects to tube). 2. Fitting body. 3. Locknut. 4. Backup washer. 5. O-ring seal. 6. End of fitting that goes into other part.

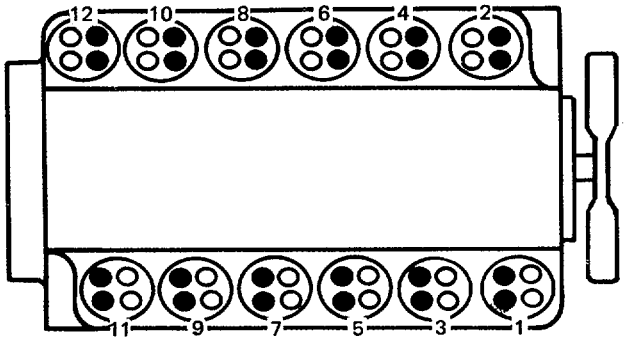
A71009X3

ENGINE DESIGN

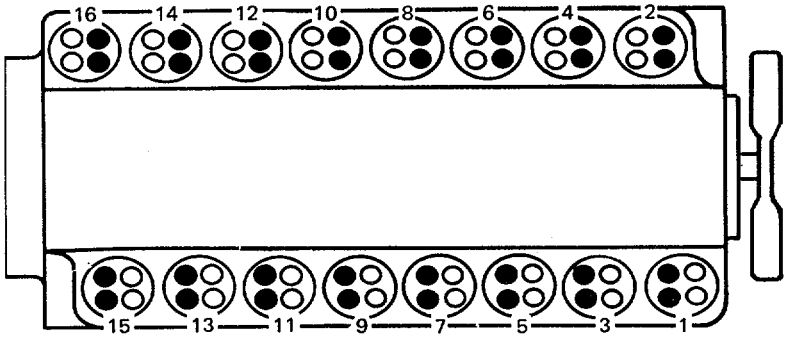
CYLINDER AND VALVE LOCATION



3508



3512



3516

○ INTAKE	● EXHAUST
0.38mm (.015 in.)	0.76mm (.030 in.)

B62374X1

ENGINE DESIGN

SPECIFICATIONS		ENGINE		
		3508	3512	3516
NUMBER AND ARRANGEMENT		60° V-8	60° V-12	60° V-16
OF CYLINDERS				
VALVES PER CYLINDER		4	4	4
DISPLACEMENT		34.5 LITER	51.8 LITER	69.1 LITER
		(2105 cu. in.)	(3158 cu. in.)	(4210 cu. in.)
BORE			170mm (6.7 in.)	
STROKE		190mm (7.5 in.)		
COMPRESSION RATIO		13:1		
TYPE OF COMBUSTION		Direct Injection		
VALVE	Intake	0.38mm (.015 in.)		
SETTING	Exhaust	0.76mm (.030 in.)		

FIRING ORDER (INJECTION SEQUENCE)		
ENGINE	SAE STANDARD ROTATION*	SAE OPPOSITE ROTATION*
3508	1-2-7-3-4-5-6-8	1-8-7-2-6-5-4-3
3512	1-12-9-4-5-8-11-2-3-10-7-6	14-9-8-5-2-11 -10-3-6-7-12
3516	1-2-5-6-3-4-9-10-15-16-11-12-13-14-7-8	1-6-5-4-3-10-9-16-15-12-11-14-13-8-7-2

* Direction of Rotation (as viewed from flywheel end):
SAE Standard Rotation ----------Counterclockwise
SAE Opposite Rotation ----------Clockwise

NOTE: Front end of engine is opposite the flywheel end.
Left side and right side of engine are as seen from flywheel end.
No. 1 cylinder is the front cylinder on the right side.
No. 2 cylinder is the front cylinder on the left side. B62375X1

INTRODUCTION

The specifications given in this book are on the basis of information available at the time it was written. The specifications torques, pressures of operation, measurements, adjustments and other items can change at any time. These changes can effect the service given to the product. Get the complete and most current information before you start any job. Caterpillar Dealers have the most current information which is available. For a list of the most current modules and form numbers available for each Service Manual, see the SERVICE MANUAL CONTENTS MICROFICHE REG 1139F.

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

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

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

77200X2

NOTE: For Systems Operation and Testing and Adjusting, make reference to 3500 INDUSTRIAL ENGINES, Form No. SENR2352.

FUEL INJECTION

(1) Torque for locknut for rocker arm adjustment screw .... 70 + 15 N•m (50 ± 11 lb. ft.)

(2) Diameter of rocker arm shaft..... 37.084 ± 0.013 mm (1.4600 + .0005 in.)
Bore in bearing for rocker arm shaft ..... 37.140 ± 0.015 mm (1.4622 ± .0006 in.)

(3) Injector installation:

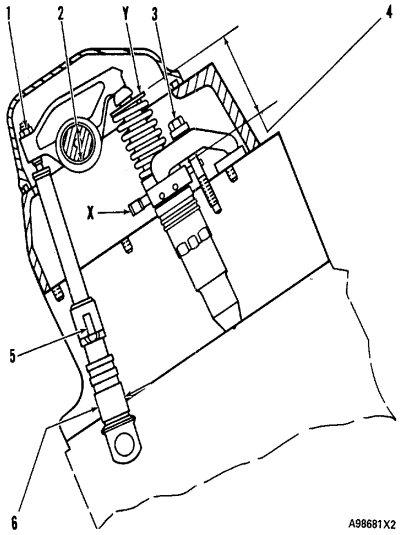
a. Put multipurpose type grease in bore of cylinder head for lubrication of the O-ring seals.

b. Put injector in bore. Use bolt and clamp to push injector into the correct position.

NOTE:Do not tap (hit) surface "Y" to install injector.

c. Tighten bolt that holds fuel injector clamp to..... 65 ± 7 N-m (48 ± 5 lb. ft.)

d. After clamp is tightened, injector rack "X" must move freely.



(4) Fuel timing dimension set by gauge. See FUEL SETTING AND RELATED INFORMATION FICHE for the correct dimension to use.

(5) Guide springs must not be used again. Always install new guide springs.

(6) Diameter of valve lifter (new)..... 29.937 ± 0.010 mm (1.1786 ± .0004 in.)

Bore in head for valve lifter..... 30.000 ± 0.025 mm (1.1811 ± .0010 in.)

FUEL PRESSURE REGULATOR (Earlier)

(1) Fuel manifold adapter on right hand front fuel manifold

(2) 9N4053 Spring for fuel pressure regulator valve plunger

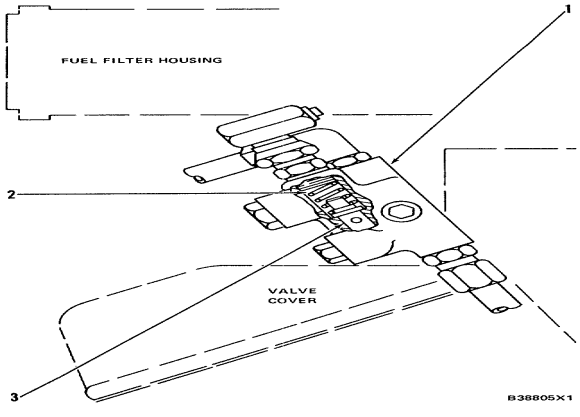
Length under test force ..... 28 5 mm (1.12 in.)

Test force .....40 8 ± 2 1 N (9 17 ± 46 lb)

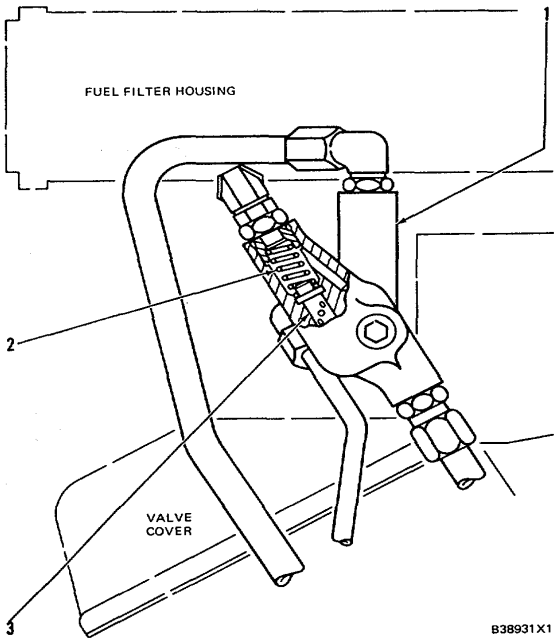
Free length after test ..... 57 2 mm (2 25 In)

Outside diameter ..... 15 24 mm (600 in)

(3) Regulator valve plunger. Regulator valve to hold fuel manifold pressure at ..... 415 to 620 kPa (60 to 90 psi)



FUEL PRESSURE REGULATOR (Later)



(1) Fuel manifold adapter on right hand front fuel manifold.

(2) 9N4053 Spring for fuel pressure regulator valve plunger

Length under test force ..... 28.5 mm (1.12 in.)

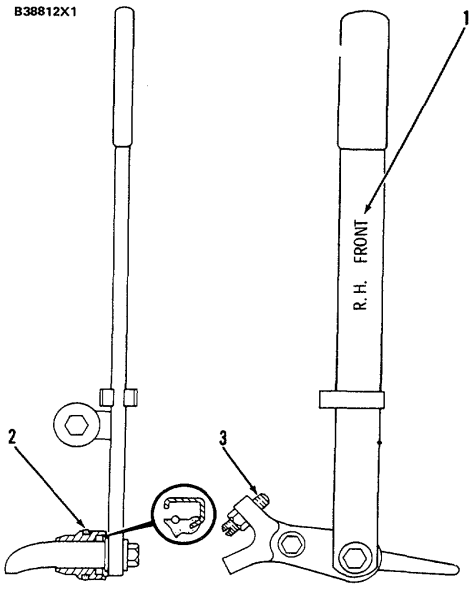
Test force .....40.8 ± 2 1 N (9.17 ± .46 lb.)

Free length after test ..... 57.2 mm (2.25 in)

Outside diameter ..... 15.24 mm (600 in.)

(3) Regulator valve plunger. Regulator valve to hold fuel manifold pressure at
..... 415 to 450 kPa (60 to 65 psi)

MANUAL SHUTOFF GROUP



NOTE: The shutoff group must be installed on the same side of the engine that the governor is installed.

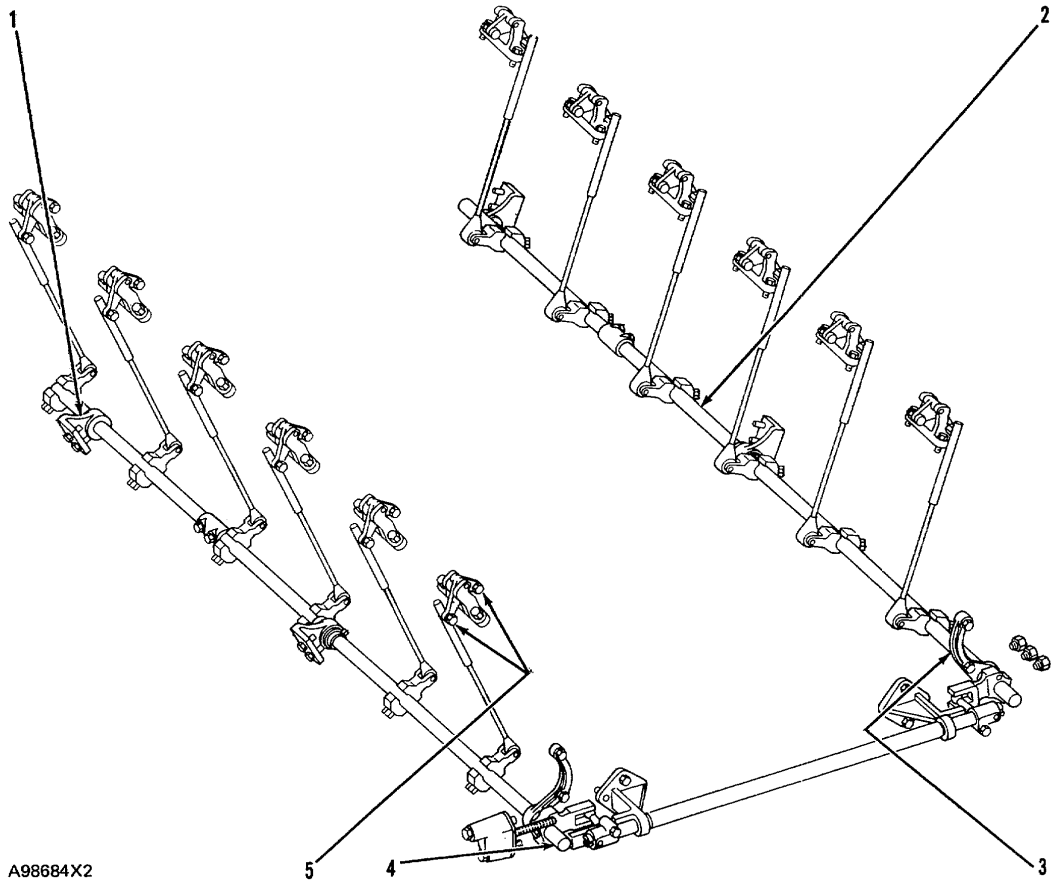
(1) When right hand mounted, "RH FRONT" should be visible from front of engine. When left hand mounted, "LH FRONT" should be visible from front of engine.

(2) Put clean engine oil on the O-ring seal and lip-type seal at assembly.

(3) Pull shutoff lever until governor linkage stops against internal stop. Turn adjustment screw until it makes contact with lever. Turn adjustment screw one complete turn more and tighten locknut.

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

FUEL INJECTION CONTROL GROUP



(1) Bore of the bearings in the bracket assemblies (after assembly)
..... 21.925 ± 0.015 mm (.8632 ± .0006 in.)

(2) Diameter of the surfaces for the bearings and rod assemblies on the shafts
..... 21.850 ± 0.015 mm (.8602 ± .0006 In)

(3) Bore of the bearings in the two support assemblies (after
assembly}21.925 ± 0.015 mm (.8632 ± .0006 in.)

(4) Clearance between the lever assemblies on the front cross shaft and the side shafts
.....0 80 ± 0.10 mm (.031 ± .004 in.)

(5) Tighten locknuts at each end of bellcrank to a torque of.....8 ± 2 N-m (6 ± 1 lb. ft.)