
**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT
MAINTENANCE MANUAL****FOR****SCRAPER, TRACTOR:
ELEVATING, SELF-PROPELLED,
11 CUBIC YARD,
SECTIONALIZED AND NONSECTIONALIZED
MODELS****613BSS
(NSN 3805-01-144-8837)****613BSS1
(NSN 3805-01-267-4177)****613BSNS
(NSN 3805-01-144-2992)****613BSNS1
(NSN 3805-01-267-4178)****SPECIFICATIONS
(TRACTOR) 1-1****SYSTEMS OPERATIONS,
TESTING, AND
ADJUSTING
(TRACTOR) 2-1****DISASSEMBLY
AND ASSEMBLY
(TRACTOR) 3-1****SCRAPER
MAINTENANCE 4-1****MODESL 613BSS
AND 613BSS1
(SECTIONALIZED)
UNIQUE
INFORMATION 5-1****SUPPLEMENTAL
MAINTENANCE
INSTRUCTIONS B-1**

Approved for public release: distribution is unlimited.

HEADQUARTER, DEPARTMENT OF THE ARMY**MARCH 1991**

TECHNICAL MANUAL
No.5-3805-260-24

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D.C., 15 March 1991

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT
MAINTENANCE MANUAL
FOR
SCRAPER, TRACTOR:
ELEVATING, SELF-PROPELLED,
11 CUBIC YARD,
SECTIONALIZED AND NONSECTIONALIZED
MODELS
613BSS
(NSN 3805-01-144-8837)
613BSS1
(NSN 3805-01-267-4177)
613BSNS
(NSN 3805-01-144-2992)
613BSNS1
(NSN 3805-01-267-4178)**

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (*Recommended Changes to Publications and Blank Forms*), or DA Form 2028-2, located in the back of this manual, direct to: Commander, U.S. Army Tank-Automotive Command, ATTN: AMSTA-MB, Warren, MI 48397-5000. A reply will be furnished to you.

This technical manual is an authentication of the manufacturer's commercial literature and does not conform with the format and content specified in AR 25-30, *Military Publications*. This technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment.

Approved for public release; distribution is unlimited.

Table of Contents

		Page
	How To Use The Technical Manual	iii
Chapter 1	Specifications (Tractor)	1-1
Chapter 2	Systems Operation, Testing, and Adjusting (Tractor)	2-1

Table of Contents (Con't)

	Page
Chapter 3 Disassembly and Assembly (Tractor)	3-1
Chapter 4 Scraper Maintenance	4-1
Chapter 5 Models 613BSS and 613BSS1 (Sectionalized) Unique Information	5-1
Appendix A References	A-1
Appendix B Supplemental Maintenance Instructions	B-1
Air System	FP-1
Electrical System	FP-3
Hydraulic System.....	FP-5
Blackout Lighting (Models 613BSS1 & 613BSNS1).....	FP-7
Air System and Brakes.....	FP-9

HOW TO USE THE TECHNICAL MANUAL

Introduction

The 613BS Series Tractor-Scraper is available in four configurations:

- 613BSNS and 613BSNS1 Type I - Nonsectionalized
- 613BSS and 613BSS1 Type II - Sectionalized

The Type I configurations are air transportable by three methods:

- Drive On/Drive Off*
- Low Altitude Parachute Extraction (LAPES)
- Low Velocity Air Drop (LVAD)
- Requires load transfer (weight distribution).

The Type II configurations, in addition to the three methods listed above, may be sectionalized (divided into two sections) and transported by helicopter.

Volume Identification

- Operation and Lubrication information, see TM 5-3805-260-10.
- Tractor Maintenance information, see Chapters 1-3 and Appendix B of this manual.
- Scraper Maintenance information, see Chapter 4 and Appendix B of this manual.
- Tractor-Scraper Parts information, see TM 5-3825-260-24P.
- Sectionalized Unique Information, see Chapter 5 of this manual.

There is a table of Contents located at the beginning of each Chapter/Appendix that provides the specific contents and location of what is covered in the Chapter/Appendix.

Part Number Identification

The part numbers identified in this manual may not always represent the most current RPSTL part numbers. ALWAYS verify given part numbers against the current RPSTL, TM 5-3805-260-24P.

REMEMBER!

This manual is a guide for the new mechanic and a reference for the experienced mechanic.

Illustrations will guide you through the procedures for maintaining the vehicle and attachments.

Your safety and the safety of others depend upon care and judgement in the maintenance of this vehicle. A careful mechanic is good insurance against an accident. Most accidents, no matter where they occur, are caused by someone's failure to observe and follow simple, fundamental rules or precautions. For this reason, most accidents can be avoided by recognizing hazards and taking steps to avoid them before an accident occurs.

CHAPTER 1

SPECIFICATIONS (TRACTOR)

1-1

INTRODUCTION

The specifications given in this chapter are on the basis of information available at the time the book was written. These specifications give the torques, operating pressure, measurements of new parts, adjustments and other items that will affect the service of the product.

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

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

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

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

Table of Contents

	Page		Page
SECTION 1. ENGINE		Cooling System	
Air Compressor	1-35	Pressure Cap	1-20
Air Induction and Exhaust System		Radiator	1-21
Air Cleaner	1-16	Water Pump	1-20
Air Inlet Manifold.....	1-16	Water Temperature	
Camshaft.....	1-11	Regulator (Thermostat)	1-20
Crankcase Ventilation Valve	1-16	Electrical System	
Cylinder Head.....	1-15	Alternator	1-32
Exhaust System	1-17	Electric Fuel Pump.....	1-35
Manifolds and Crankcase.....		Shutoff Solenoid	1-36
Ventilation Valve.....	1-16	Starter Motors	1-33
Valves.....	1-13	Starter Solenoids	1-34
Valve Covers.....	1-12	Engine Design	1-6
Valve Rocker Arms and Cam Followers	1-12	Fuel System	
Valve Seats and Inserts	1-14	Automatic Timing Advance Unit.....	1-10
Basic Engine Components		Drive Gear for the Injection Pump	1-10
Connecting Rod.....	1-23	Fuel Filter Base.....	1-10
Crankshaft.....	1-25	Fuel Injection Pump	1-7
Bearing Surface (Journal) -			
Connecting Rods.....	1-26	Fuel Transfer Pump	1-9
Bearing Surface (Journal) - Mains	1-26	Governor	1-8
Cylinder Block.....	1-22	Injection Nozzle	1-9
Flywheel.....	1-28	Lubrication System	
Flywheel Housing Bore.....	1-31	Engine Oil Cooler and Filter.....	1-17
Flywheel Housing Runout.....	1-30	Oil Level Gauge	1-18
Flywheel Runout.....	1-29	Oil Pan	1-18
Pistons and Rings.....	1-24	Oil Pump	1-19
Pulley and Damper	1-27	V-Belt Tension Chart.....	1-21

Table of Contents (Con't)

Page	Page
SECTION 2. POWER TRAIN	
Brake and Axle Group1-51	Oil Filter 1-56
Differential and Bevel Gear with Differential Lock 1-46, 1-48	Steering Control Valve 1-55
Differential Group1-46	Steering Cylinders 1-56
Differential Lock.....1-50	SECTION 4. AIR SYSTEM AND BRAKES
Drive Shafts1-44	Air Compressor Governor 1-60
Final Drive1-50	Control Valve for Emergency and Parking Brake 1-59
Lubrication Relief Valve.....1-43	Differential Lock Control Valve..... 1-58
Pressure Control Valve.....1-42	Emergency and Parking Brake 1-59
Selector Valve1-43	Emergency Control Valve 1-60
Torque Converter1-38	Relief Valve 1-59, 1-60
Transfer Gears (Input).....1-45	Wheel Brake Assembly 1-58
Transfer Gears (Output)1-45	
Transmission1-39	SECTION 5. MISCELLANEOUS
Transmission Hydraulic Controls1-41	General Tightening Torque for Bolts, Nuts and Taperlock Studs..... 1-62
Transmission and Scavenge Pump1-41	Lines, Plugs and Fittings 1-63
Transmission Oil Filter1-43	Assembly of Fittings with Straight Threads and O-Ring Seals..... 1-63
Wheel and Brake Group (Scraper)1-51	Hydraulic Line Installation 1-63
SECTION 3. STEERING SYSTEM	Torques for Flared and O-Ring Fittings 1-63
Hitch Group1-56	Torques for Other Fittings 1-64
Hydraulic Pump1-54	

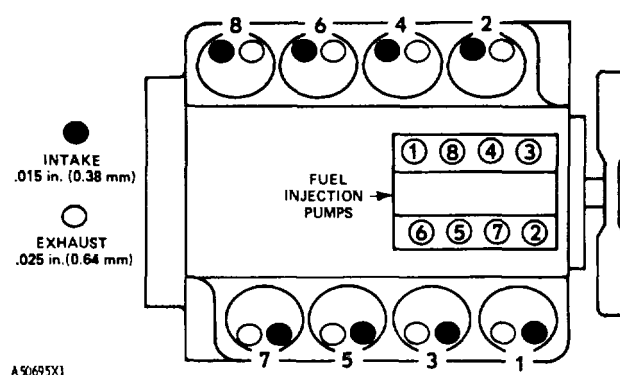
1-3/(1-4 Blank)

**SECTION 1
SPECIFICATIONS
ENGINE**

1-5

ENGINE DESIGN

Bore 4 5 in. (114 3 mm)
 Stroke 0 in. (127 0 mm)
 Number of Cylinders 8
 Cylinder Arrangement 90V
 Firing Order (Injection Sequence) 1, 2, 7, 3, 4, 5, 6, 8
 Direction of Rotation (As Seen From
 Flywheel End)..... Counterclockwise



**CYLINDER, VALVE AND INJECTION
PUMP LOCATION**

ENGINE SETTINGS

Model Description Serial Number	Altitude (In Feet)	Brake W/O Fan	Horsepower W/Fan	Full Load RPM	High Idle Engine Only	In Vehicle	Static Fuel Setting (In mm.)	Rated Fuel Rate (Lb/Min)	In Vehicle BSFC	Torque Spring and Spacer (Thickness in Inches)	Torque Conv. Stall Speed
613Tractor	0- 2, 500	164	150	2200	2385	2340	249 mm	1.027	.411	*5S2619(.010")	2110
Veh. S/N										**4N7777(.010")	
38W1-Up	2, 500- 5, 000		142	135	2200	2355	2310	2.14 mm			2035
	5, 000- 7, 500		131	125	2200	2335	2290	1.90 mm			1985
	7, 500-10, 000		121	115	2200	2315	2270	1.68mm			1940
	10, 000-12, 500		110	105	2200	2295	2250	1.44 mm			1880
	12, 500-15, 000		100	95	2200	2275	2230	1.22 mm-	1835		

*Torque spring **Spacer

GENERAL NOTES:

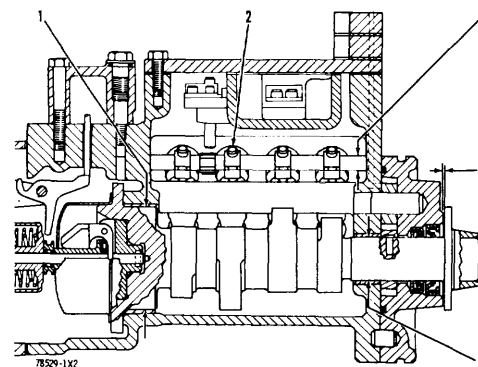
Low idle in vehicle is 700 ± 10 RPM.

Fuel injection timing (static) is 16° BTC, .127 inch
of piston travel.

FUEL INJECTION PUMP

Firing order (injection sequence)1, 2, 7, 3, 4, 5, 6, 8

Injection timing before TC (top center): $16 \pm 1^\circ$



Torque for the nuts that hold the fuel lines

(Use 5P144 Fuel Line Socket) ... 30 ± 5 lb ft (40 ± 7 N-m)

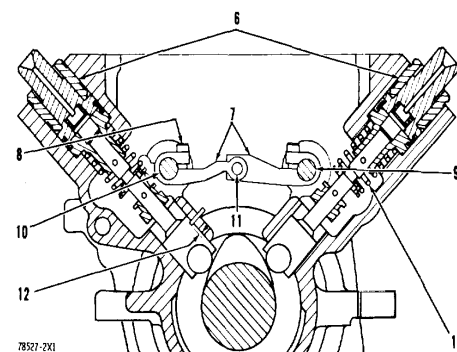
- (1) Bore in the rear bearing for the camshaft (new) 2.3750 ± 0.0005 in (60.325 ± 0.013 mm)
Diameter of rear bearing surface (journal) of the camshaft (new) 2.3720 ± 0.0005 in (60.249 ± 0.013 mm)
Maximum permissible clearance between the bearing and the camshaft bearing surface (journal) (worn) 0.006 in (0.15 mm)
- (2) Torque for screws that hold sleeve control levers 24 ± 2 lb in (2.8 ± 0.2 N-m)
- (3) Bore in the housing for the fuel control shaft (new) 3.543 ± 0.0005 in (8.999 ± 0.013 mm)
Diameter of sleeve control shaft (new) 3.530 ± 0.0003 in (8.966 ± 0.008 mm)
Maximum permissible clearance between the bore in the housing and the sleeve control shaft (worn) 0.003 in (0.08 mm)
- (4) End play for camshaft with sleeve installed (new) 0.023 ± 0.018 in (0.58 ± 0.46 mm)

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

- (5) Bore in the front bearing for the camshaft (new) 1.0005 ± 0.0005 in (25.413 ± 0.013 mm)
Diameter of front bearing surface (journal) of the camshaft (new) 0.9990 ± 0.0005 in (25.375 ± 0.013 mm)
Maximum permissible clearance between the bearing and the camshaft bearing surface (journal) (worn) 0.004 in (0.10 mm)
- (6) Torque for bushing 60 ± 5 lb ft (80 ± 7 N-m)
- (7) Crossover levers

NOTE: For adjustment of crossover levers, see the TESTING AND ADJUSTING SECTION

- (8) Torque for screws that hold crossover levers 24 ± 2 lb in (2.8 ± 0.2 N-m)



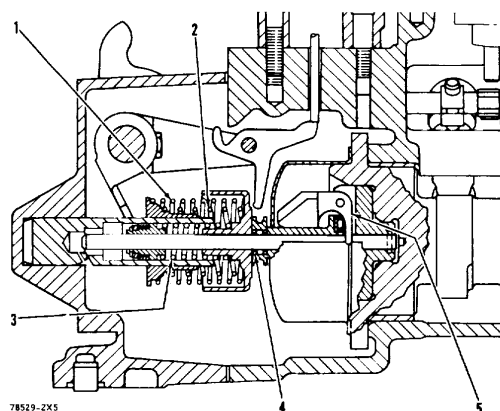
- (9 and 10) Fuel control shafts
- (11) Dowel pin (linkage between crossover levers)
- (12) Distance guide pin extends into bore 0.047 ± 0.004 in (1.20 ± 0.10 mm)
NOTE Install guide pin with slot towards the top of the lifter bore
- (13) 9N5862 Spring for injection pump:
Length under test force 1.348 in (34.24 mm)
Test force 12.5 ± 1.3 lb (55.5 ± 5.8 N)
Free length after test 1.566 in (39.78 mm)
Outside diameter 0.728 ± 0.010 in (18.49 ± 0.25 mm)

GOVERNOR**GOVERNOR SPRING CHART**

Part No.	(1) 4N6119	(2) 4N5663	(3) 6N2517
Color code (Stripes)	Three Green	One Pink	None
Put a force on spring of	3 0 lb (13 34 N)	1 0 lb (4 45 N)	20 lb (8 90 N)
Then add more force to make spring shorter by	700 in (17 78 mm)	700 in (17.78 mm)	200 in. (5 08 mm)
Total test force	11 40 ± 26 lb (50.71±1.16 N)	4.50 ± 12 lb (20 02± 53 N)	5.60±18 lb 124 91±80 N)
Free length after test	1 659± 021 in (42 14 ± 0 53 mm)	1.690±020 in (42 93±0 51 mm)	1.136±020 in (31.24 ± 0 51 mm)
Outside diameter	1.506 in (38 25 mm)	1 144 in. (29.06 mm)	.584 in. (14.83 mm)

(4) OVERFUELING SPRINGS

Part No	6N6662
Length under test force	748 in. (19 00 mm)
Test force (0 84 * 008 N)	189 ± .02 lb
Free length after Test	1.126 in 128.60 mm)
Outside diameter	360 in. (9.14 mm)
Color code (Stripes)	One White

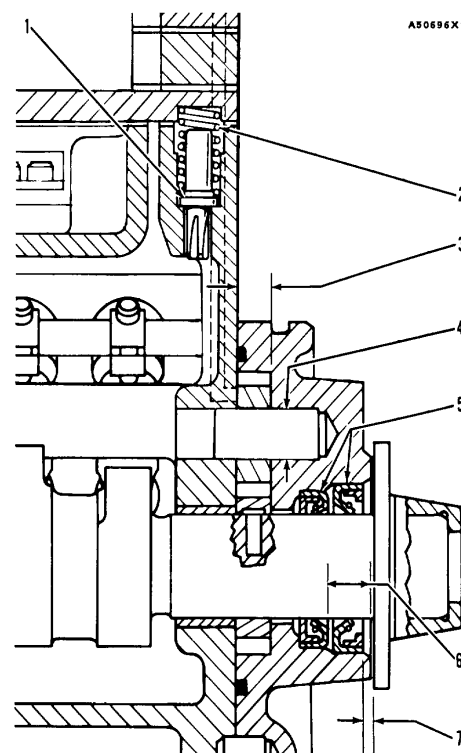


Torque for bolts that hold governor weight carrier to camshaft

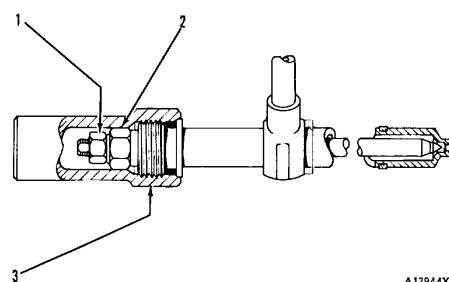
90 ± 10 lb in (10 2 ± 1 1 N-m)

FUEL TRANSFER PUMP

- (1) Bypass valve.
Fuel pressure at FULL LOAD305 psi 1205 $\pm$ 35 kPa)
- (2) 4N605 Spring for bypass valve-
Length under test force880 in (22.35 mm)
Test force3 5318 lb (15 3 $\pm$ 0 80 N)
Free length after test1 729 in (43 92 mm)
Outside diameter.....527 in(13 39 mm)
- (3) Thickness of gears
(new)3736 $\pm$ 0003 in (9 489 $\pm$ 0 008 mm)
Depth of counterbore
(new)3750 $\pm$ 0005 in (9 525 $\pm$ 0 013 mm)
- (4) Diameter of shaft for
Idler gear4914 $\pm$ 0003 in (12482 $\pm$ 0 008 mm)
Bore in idler gear4926 $\pm$ 0003 in (12 512 $\pm$ 008 mm)
- (5) Put a thin layer of 5S1454 Sealing Compound on the outside diameter of the seals before installation Remove the extra sealing compound after assembly.
- (6) Install inner seal from outside edge of body assembly a distance of453 $\pm$.010 in (11 51 $\pm$ 0.25 mm)
- (7) Install outside seal from outside edge of body assembly to a distance of030 $\pm$.010 in (0.76 $\pm$ 0 25 mm)

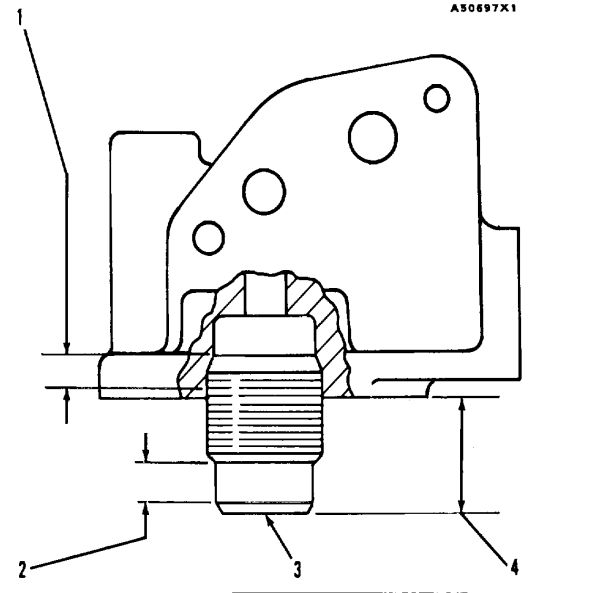

**INJECTION NOZZLE
(9N3979)**

- Bench test nozzles using clean SAE J967 Calibration Oil (Kent-Moore Corp J-26400 or Viscor Calibration Fluid 1487C-SAE J-967C) at a temperature of65 to 70° F (18 to 20° C)
- Nozzle setting pressures (valve lift adjustment screw turned 3/4 + 1/8 turn from closed position)
- Used nozzle1500 to 2600 psi (10300 to 17690 kPa)
- Used, adjusted nozzle2400 to 2600 psi (16545 to 17690 kPa)
- Return oil leakage test pressure1400 to 1600 psi (9630 to 11 045 kPa)
- Leakage in 15 secondsNO minimum or maximum
- Maximum tip leakage Is 20 drops in 15 seconds with a pressure of 200 psi (1380 kPa) less than opening pressure
- (1) Torque for valve lift locknut35 to 45 lb in (4.0 to 5.1 N-m)
 - (2) Torque for pressure screw locknut70 to 80 lb in (8.0 to 9.1 N-m)
 - (3) Torque for cap110 to 120 lb in (12.4 to 13.6 Nm)

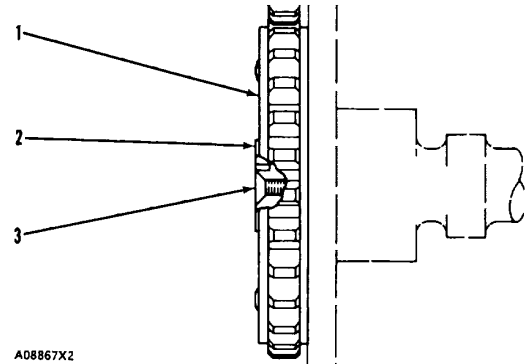


FUEL FILTER BASE

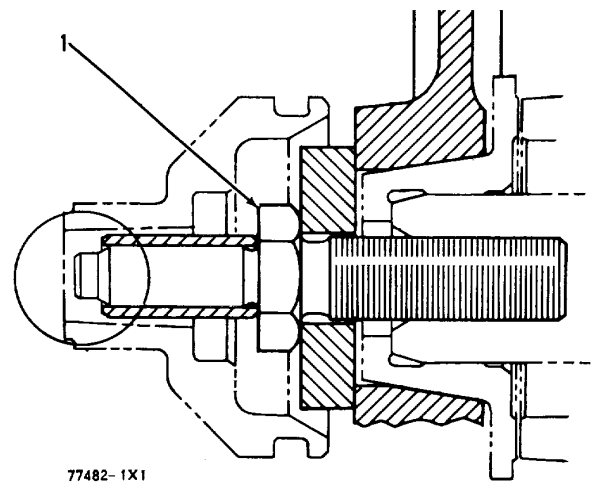
- (1) Put 9S3263 Thread Lock Compound on the threads of the tapered end of the stud to a distance of30 in (7 6 mm)
- (2) Sealing surface of stud.
NOTE Do not damage this surface
- (3) Torque for stud 50 ± 10 lb ft (70 ± 14 N-m)
- (4) Distance from sealing surface of base to end of stud..... 97 ± 05 in ($24\ 61 \pm 3$ mm)

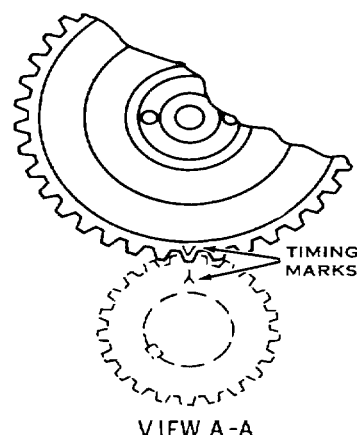
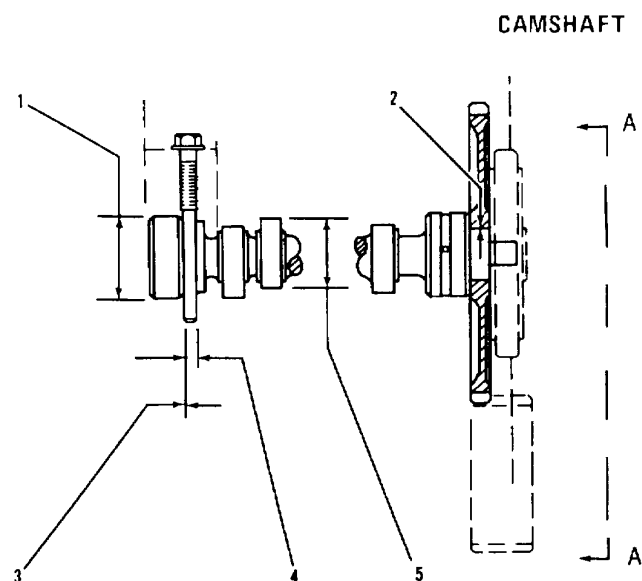
**AUTOMATIC TIMING ADVANCE UNIT**

- End play between washer (2) and timing advance unit (1)003 to 037 in (O 08 to O 94 mm)
- (3) Torque for screw..... 72 ± 5 lb In ($8\ 2 \pm 0.6$ N m)
- "Stake" (make a mark with a punch) screw (3) in two places

**DRIVE GEAR FOR THE INJECTION PUMP**

- (1) Torque for the bolt that holds the drive gear to the camshaft of the injection pump 110 ± 10 lb ft. (149 ± 14 N.m)



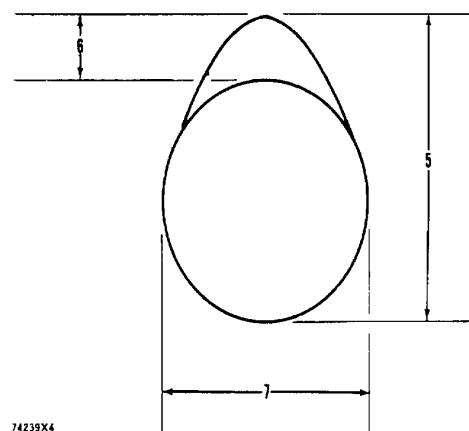


- (1) Diameter of the surfaces (journals) for the camshaft bearings
 (new).....2 500 ± 0005 in (63 500 ± 0 013 mm)
 Bore In the live bearings for the camshaft (new)2.5035 ± 0015 in (63 589 ± 0 038 mm)
 Maximum permissible clearance between bearing and bearing surface journal) (, worn).007 in (0 18 mm)
- (2) Tight fit between the gear and camshaft0012 to 0028 in (0 030 to 0 071 mm)
 Maximum permissible temperature of the gear for Installation on the camshaft (do not use a torch) 600° F (315° C)
- (3) End play for the camshaft..007 ± 003 in (18 ± 08 mm)
 Maximum permissible end play (worn) 020 In (0 51 mm)
- (4) Width of thrust groove in camshaft (new)360 ± 002 in (9 14 ± 0 05 mm)
 Diameter of thrust pin (new) I.....353 ± 001 in (8.97 ± 0 03 mm)
 Torque for thrust pin-35 ± 5 lb ft (45 ± 7 N m)

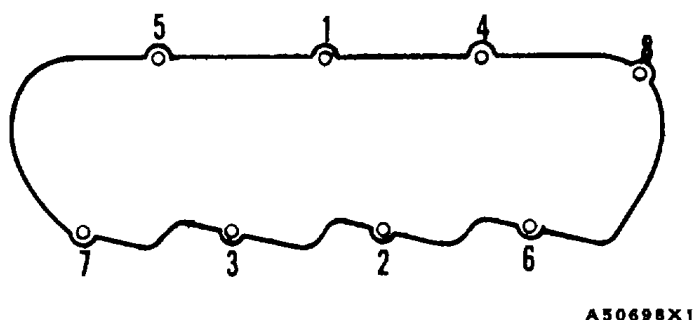
NOTE For installation of camshaft. The timing mark or the camshaft gear tooth must be in alignment with the timing mark on the tooth space of the crankshaft gear

- (5) Height of camshaft lobes
 To find lobe lift, use the following procedure
 - A. Measure camshaft lobe height (5)
 - B. Measure base circle (7)
 - C. Subtract base circle (STEP 8) from lobe height (STEP A) The difference Is actual lobe lift (6)
 - D. Specified camshaft lobe lift (6) is
 - a. Exhaust lobe.....3071 in (7 800 mm)
 - b. Intake lobe3077 in (7.816 mm)

Maximum permissible difference between actual lobe lift (STEP C) and specified lobe lift (STEP D) is 010 in (0 25 mm)



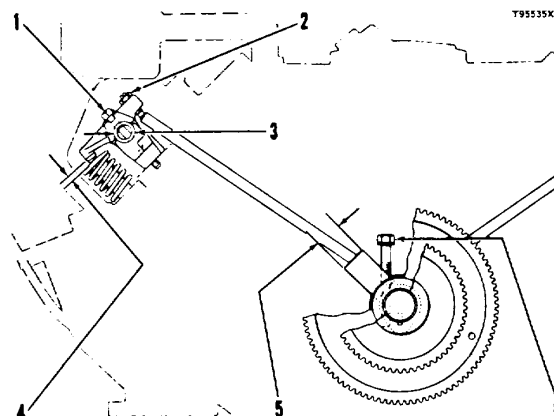
VALVE COVERS



A50698X1

- (1) Tighten bolts in sequence shown
to a torque of 10 ± 2 lb ft (14 ± 3 N m)

VALVE ROCKER ARMS AND CAM FOLLOWERS



- (1) Torque for bolts holding
rocker arms 18 ± 5 lb ft (24 ± 7 N m)
- (2) Torque for lock nut for valve
adjustment screw 24 ± 5 lb ft (30 ± 7 N m)
- (3) Diameter of the shaft for
the rocker arms 8580 to 8588 in (21 793 to 21 814 mm)
Minimum permissible diameter (worn) 8570 in (21 768 mm)
Bore In bearings for the
rocker arms (new) 8603 ± 0008 in ($21\ 8520 \pm 020$ mm)
Maximum permissible bore (worn) 8630 in (21 920 mm)
Maximum permissible clearance between bore
in bearing and shaft (worn) 005 in (0.13 mm)
- (4) Clearance for valves I intake valve) 015 in (0.38 mm)
Clearance for valves (exhaust valve) 025 in (0.64 mm)
- 15) Diameter of cam
follower 1.1589 ± 0004 in ($29\ 436 \pm 0.010$ mm)
Minimum permissible diameter (worn) 1.1575 in (29.401 mm)
Bore In block for cam
follower 1.1624 ± 0010 in ($29\ 525 \pm 0\ 025$ mm)
Maximum permissible bore (worn) 1.1650 in (29.591 mm)
- (6) Torque for the thrust pin for the
camshaft 35 ± 5 lb ft (45 ± 7 N m)