

# 680 CK LOADER BACKHOE

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**SECTION**

**C**

**SPECIFICATIONS FOR CASE**

**A267 DIESEL ENGINE**

**AND**

**A251 GASOLINE ENGINE**

# diesel engines

## C-2

### A267 ENGINE SPECIFICATIONS

Type ----- CASE Full Diesel, 4 Cylinder 4 Stroke Cycle Valve-in-Head Engine.

Cylinder Heads ----- Multiple Cylinder Heads can be removed individually for Servicing (2 cylinders per head).

Firing Order ----- 1-3-4-2

Bore ----- 4-1/8 Inches

Stroke ----- 5 Inches

Piston Displacement ----- 267 Cubic Inches

Compression Ratio ----- 15 to 1

Full Load Governed Engine Speed ----- 2000 RPM

No Load Governed Engine Speed ----- 2150 RPM

Engine Idle Speed ----- 750 RPM

Oil Filter, Crankcase ----- Replaceable Full Flow Element

Method of Starting Diesel Engine ----- Engine Starts on Diesel Fuel (Electric Starting Motor).

#### Maximum Compression Pressures (At Cranking Speed of 200 RPM -- Injectors Removed from Engine)

Altitude	Sea Level	1000 ft.	2000 ft.	3000 ft.	4000 ft.	5000 ft.
Compression	350 PSI	335 PSI	325 PSI	315 PSI	300 PSI	290 PSI
Allowable Variance Between Cylinders	----- 25 Pounds Pressure					

#### CYLINDER SLEEVES

Type ----- Replaceable Wet Type: Two Rubber O-ring Seals carried on each sleeve.

Inside Diameter of Sleeve Bore ----- 4.125 to 4.126 Inches. Replace Sleeve when inside Diameter below Top Ring Ridge Exceeds 4.133 Inches.

Piston Clearance in Sleeve (At Skirt) ----- .0045 to .0055 Inch

Cylinder Sleeve Out-of-Round ----- Max. .002 Inch

#### PISTON AND PISTON PINS

Piston Material ----- Aluminum

Piston Weight (Less Pin) ----- 4.742 to 4.758 Pounds

Diameter of Piston at Top of Skirt (Below Oil Ring) ----- 4.106 to 4.109 Inches

Diameter of Piston at Bottom of Skirt ----- 4.1205 to 4.1215 Inches

Piston Pins ----- Full Floating Type: Held in Position with Snap Rings in Piston. Replaceable Bronze Bushing in Connecting Rod.

Piston Pin Length ----- 3.395 to 3.405 Inches

Piston Pin Diameter ----- 1.3583 to 1.3586 Inches

Piston Pin Fit in Piston ----- .0003 to .0008 Inch. When Pin is lubricated with Light Engine Oil and held upright in Vise, Weight of Piston should allow it to slide slowly into position over Pin.

Piston Pin Fit in Connecting Rod Bushing ----- .0004 to .0011 Inch

#### PISTON RINGS

Rings Per Piston ----- 4-(3 Compression and 1 oil).

Compression Rings  
Width of Ring (All 3) ----- .0930 to .0935 Inch

Ring End Gap (All 3) when Compressed in 4.125 Inch Cylinder ----- .013 to .023 Inch

Side Clearance in Groove of 1st (Top) Ring ----- .003 to .0045 Inch

Side Clearance in Groove of 2nd and 3rd Ring --- .0025 to .004 Inch

Oil Ring ----- To install Replacement Ring, Follow Instructions Packed with Rings.

Width of Rings (Original Equipment) ----- .2455 to .2485 Inch  
Replacement Ring ----- .2441 to .2474 Inch  
Side Clearance in Groove (Original Equipment) -- .0025 to .0065 Inch  
Replacement Ring ----- .0015 to .003 Inch

#### CONNECTING RODS

Connecting Rod Bushing ----- Replaceable Bronze Bushing  
Replacement Bushing Must Be Reamed.

Piston Pin Hole Diameter in Rod (Without Bushing) -- 1.483 to 1.485 Inches

Inside Diameter of Piston Pin Bushing in Rod ----- 1.3590 to 1.3594 Inches: Install New Bushing if inside Diameter Exceeds 1.363 Inches.

Connecting Rod Bearing ----- Replaceable, Precision, Steel Backed Copper Lead Alloy Liners.

Connecting Rod Capscrews ----- Self Locking Type, No Lock Wires Required - May Be used More Than Once.

Connecting Rod Length (Center to Center Between Pin Hole and Bearing Journal Hole) --- 10.499 to 10.501 Inches

Bearing Liner Width ----- 1.625 Inches

Diameter of Crankshaft Journal Hole in Rod (Without Liner) ----- 2.9005 to 2.9010 Inches

Inside Diameter of Bearing Liner (Standard Liner in Place in Rod and Capscrews Tight) -- 2.7503 to 2.7518 Inches

Diameter of Crankshaft Rod Journal ----- 2.748 to 2.749 Inches

Clearance Between Rod Bearing and Crankshaft Journal ----- .0013 to .0038 Inch; Install New Bearing Liners When Clearance Exceeds .006 Inch

Undersize Bearing Liners Available for Service ----- .002, .010, .020, .030 Inch

Allowable Connecting Rod Bearing End Play ----- .005 to .012 Inch

#### CRANKSHAFT AND MAIN BEARINGS

Crankshaft ----- Balanced; Drilled to Provide Pressure Lubrication to Main and Connecting Rod Bearings.

Type Main Bearings ----- Replaceable, Precision Steel Backed Copper - Lead Alloy Liners.

Bearing Capscrews ----- Self Locking Type, No Lock Wires Required May Be Used More Than Once.

Bearing Taking End Thrust ----- Center (Two Replaceable Bronze Thrust Washers).

Crankshaft End Play (Measured at Center Main Bearing) ----- .004 to .012 Inch; Install New Thrust Washers if End Play Exceeds .020 Inch.

Oversize Thrust Washers for End Play Available for Service ----- .006 Inch

Connecting Rod Bearing Journal Diameter ----- 2.748 to 2.749 Inches

Main Bearing Journal Diameter ----- 2.998 to 2.999 Inches

Crankshaft Main and Connecting Rod Journal Bearings out of Round ----- Maximum .001 Inch

Maximum Allowable Taper on Crankshaft Rod Journal ----- .002 Inch

Inside Diameter of Main Bearing Liners (In Place and Capscrews Tight) ----- 3.0006 to 3.0026 Inches

Clearance Between Main Bearing Liner and Journal ----- .0016 to .0046 Inch; Install New Bearing Liner When Clearance Exceeds .0065 Inches.

Width of 1st, 3rd, 5th Main Bearing Liners ----- 2.218 Inches

Width of 2nd, 4th Bearing Liners ----- 1.156 Inches

Width Between Crankshaft Main Bearing Cheeks  
A. 5th ----- 2.620 to 2.630 Inches  
B. 2nd and 4th ----- 1.5575 to 1.5675 Inches  
C. 3rd (Center) ----- 2.624 to 2.626 Inches

**Thanks very much for your reading,  
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Width Between Crankshaft Rod Bearing Journal Cheeks ----- 1.9975 to 2.0025 Inches

Undersize Main Bearing Liners Available for Service ----- .002,.010,.020,.030 Inch

Crankshaft Main Bearing Journals Should Be Ground to -----2.988-2.989 Inches for .010 Inch Undersize Bearing  
2.978-2.979 Inches for .020 Inch Undersize Bearing  
2.968-2.969 Inches for .030 Inch Undersize Bearing

Undersize Connecting Rod Bearing Shells Available for Service ----- .002,.010,.020,.030 Inch

Connecting Rod Crankshaft Journals Should Be Ground to -----2.738-2.739 Inches for .010 Inch Undersize Bearing  
2.728-2.729 Inches for .020 Inch Undersize Bearing  
2.718-2.710 Inches for .030 Inch Undersize Bearing

**CAMSHAFT AND BUSHINGS**

Number of Bearing Surfaces on Camshaft ----- 4

Type Bushing ----- Replaceable, Precision, Steel Backed Babbitt

Bushing Lubrication ----- Pressure Lubricated from Oil Pump; Camshaft Drilled to Provide Pressure Lubrication to Valve Rocker Arm Assembly, and to Timing Gear Train.

Diameter of Camshaft at Each Bearing Surface--- 2.246 to 2.247 Inches

Inside Diameter of Each Bushing (Measured when in Place in Block) ----- 2.2484 to 2.2514 Inches

No. 1 (Front) Bushing Length ----- 1.656 Inches

No. 2 and 3 Bushing Lengths ----- 1.438 Inches

No. 4 Bushing Length----- 1.156 Inches

Camshaft End Play ----- Automatically Taken Up by Spring Loaded Thrust Button in Front end of Camshaft. Washer Provided Between Drive Gear and Front Bearing.

Camshaft Washer

Outside Diameter ----- 3.240 to 3.260 Inches

Inside Diameter ----- 2.250 to 2.260 Inches

Thickness ----- .1225 to .1275 Inch

**VALVE PUSH ROD LIFTERS**

Type ----- Mushroom

Outside Diameter of End that Projects into Block--- .8097 to .8102 Inches

Diameter of Bore in Block for Lifter ----- .8115 to .8130 Inch

Oversize Lifter Available for Service ----- .010 In. Oversize Lifter

Bore in Block Must Be Reamed to ---- .8215 to .8225 Inch for .010 Inch Oversize Lifter.

**VALVES**

**Valve Tappet Clearance**

Intake and Exhaust ----- .025 Inch, Engine Cold

Intake and Exhaust ----- .025 Inch, Engine Hot  
Hot Settings Are Made At Low Idle After The Engine Has Operated At Thermostat Control Temperature For At Least Fifteen Minutes

**Exhaust Valves**

Angle of Valve Face ----- 44 Degrees

Valve Length ----- 6.238 Inches

Maximum Valve Face Runout ----- .002 Inch as Determined with a Dial Indicator.

Diameter of Valve Stem --- .4000 to .401 Inch Install New Valve if there is More than .002 Inch Difference in Diameter at any Point on Stem.

Diameter of Valve Head -----1.484 Inches

Inside Diameter of Valve Guide -- .4045 to .4055 Inch(After Assembly) .

Valve Stem Clearance in Guide ----- .0035 to .0055 Inch

**Exhaust Valve Seat Insert**

Seat Angle ----- 45 Degrees

Seat Contact Width ----- .073 to .084 Inch

Outside Diameter of Insert ----- 1.640 to 1.641 Inches

Inside Diameter of Insert ----- 1.323 to 1.333 Inches

Maximum Allowable Seat Runout ----- .002 Inch as Determined with a Dial Indicator.

**Intake Valves**

Angle of Valve Face ----- 44 Degrees

Valve Length ----- 7.243 Inches

Maximum Valve Face Runout ----- .002 Inch as Determined with a Dial Indicator.

Diameter of Valve Stem ----- .402 to .403 Inch Install New Valve if there is More than .002 Inch Difference in Diameter at any Point on Stem.

Diameter of Valve Head ----- 1.731 Inches

Inside Diameter of Valve Guide -- .4045 to .4055 Inch (After Assembly).

Stem Clearance in Guide ----- .0015 to .0035 Inch

**Intake Valve Seat**

Seat Angle ----- 45 Degrees

Seat Contact Width ----- .086 to .096 Inch

Maximum Allowable Seat Runout ----- .002 Inch as Determined with a Dial Indicator.

**Exhaust Valve Guides**

Length ----- 3.218 Inches

Outside Diameter ----- .7510 to .7515 Inch

Inside Diameter ----- .4045 to .4055 Inch (After Assembly)

Valve Stem Clearance in Guide ----- .0035 to .0055 Inch

Distance Above Head Guide Must Protrude---- 1.062 Inches, Press Fit

**Intake Valve Guides**

Length ----- 4.375 Inches

Outside Diameter ----- .7510 to .7515 Inch

Inside Diameter ----- .4045 to .4055 Inch (After Assembly)

Valve Stem Clearance in Guide ----- .0015 to .0035 Inch

Distance Above Head Guide Must Protrude ----- 1.062 Inches, Press Fit

**VALVE SPRINGS**

Free Length ----- Approximately 2.438 Inches

Spring Pressure at Compressed Height of 1.484 Inches (Valve Open) -----102 Pounds; Install New Spring if Pressure is Less than 92 Pounds.

Spring Pressure at Compressed Height of 1.937 Inches (Valve Closed)----- 45 Pounds; Install New Spring if Pressure is Less than 41 Pounds.

**ROCKER ARM ASSEMBLY**

Rocker Arm Bushing ----- Replaceable Precision Bronze Bushing

Number of Bushings ----- 8

Lubrication -----Pressure Lubricated; Crankcase Oil to Rocker Arms Metered by Camshaft.

Oil Holes in Rocker Arm Shaft ----- Oil Holes must Face Push Rod Side of Engine Only. Shaft Cannot Be Rotated.

Positioning of Exhaust Valve Rocker Arms ----- Spacer Washers Position Exhaust Valve Rocker Arm and Eliminate End Play without Binding.

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Outside Diameter of  
Rocker Arm Shaft ----- .872 to .873 Inch

Inside Diameter of Rocker  
Arm Bushing (Installed) ----- .8745 to .8760 Inch

Rocker Arm Shaft Spring

Spring Pressure at Compressed Height of  
1.562 Inches -----10 Pounds; Install  
New Spring If Pressure is Less than 8.5 Pounds

**OIL PUMP**

Type ----- Positive Displacement, Gear Type Pump

Pressure Relief Valve ----- Maintains 40 to 45 Pounds Full Pressure  
(Oil Warm, Engine Operating at Full Governed Speed)  
Relief Valve is Adjustable.

**WATER PUMP AND THERMOSTAT**

Type of System ----- Pressurized Thermostat - Continuous  
By-Pass Type; Forced Circulation (Pump).

Type Pump ----- Impeller Vane Type

Radiator ----- Heavy Duty Fin and Tube Type

Temperature Control ----- By Pass Type Thermostat

**FUEL SYSTEM**

Injection Pump ----- Robert Bosch, Type PES Multiple Plunger Pump

Direction of Pump Rotation -----Counter-Clockwise

Pump Mounting----- Right Hand Side of Engine

Pump Drive ----- Gear Driven from Camshaft Gear at Camshaft Speed

Injection Pump Drive Lubrication ----- Pressure Lubricated From  
Front Camshaft Bearing.

Injection Pump Drive Shaft Diameter ----- 1.3700 to 1.3705 Inches

Normal Clearance Between  
Drive Shaft and Bushings ----- .001 to .002 Inch

Number of Drive  
Shaft Bushings ----- (2) These Bushings are Not Replaceable.  
A Replacement Drive Housing with Bushings  
in Place Aligned and Fine Bored is Provided.

Injection Pump Drive  
Shaft End Play ----- Automatically Taken Up By a Spring  
Loaded Thrust Button on Front End Of Drive Shaft.  
Thrust Washers Provided Between Front Drive Gear  
and Drive Shaft Housing.

Thrust Washer

Outside Diameter ----- 2.085 to 2.105 Inches

Inside Diameter ----- 1.3725 to 1.3825 Inches

Thickness ----- .1225 to .1275 Inch

Timing Marks on Engine ----- Timing Marks Located on Crankshaft  
Pulley Flange. Pointer Located on  
Timing Gear Cover.

Fuel Injectors ----- Robert Bosch Pintle Type; Opening  
Pressure 2000 Pounds Per Square Inch.

Governor ----- Mechanical Variable Speed Fly-Weight  
Centrifugal Type; Integral Part of Injection Pump.

Fuel Filters

Fuel Tank Breather ----- Fuel Tank Cap

Fuel Tank Water Trap ----- Located in Base of Fuel Tank

1st Stage Fuel Filter ----- Replaceable Element Type

2nd Stage Fuel Filter ----- Replaceable Element Type

Final Fuel Filter ----- Replaceable Sealed "Can" Type Filter.

# spark ignition engines

## A251 ENGINE SPECIFICATIONS

Type -----	Case 4 Cylinder, 4 Stroke Cycle Valve-In-Head Engine.
Cylinder Heads -----	Multiple Cylinder Heads can be removed individually for Servicing (2 cylinders per head).
Firing Order -----	1-3-4-2
Bore -----	4 Inches
Stroke -----	5 Inches
Piston Displacement -----	251 Cubic Inches
Compression Ratio . . . . .	.6,9 to 1
Full Load Governed Engine Speed -----	2000 RPM
No Load Governed Engine Speed -----	2160 RPM
Engine Idle Speed -----	750 RPM
Maximum Compression at Cranking Speed (150 RPM) Engine Warmed up to Operating Temperature ----	140 PSI at Sea Level
Allowable Variance Between Cylinders -----	15 Pounds Pressure
Oil Filter, Crankcase -----	Replaceable Full Flow Element Type
Ignition -----	Distributor

### CYLINDER SLEEVES

Type -----	Replaceable Wet Type; Two Rubber "O" Ring Seals Carried on Each Sleeve.
Inside Diameter of Sleeve Bore -----	4.00 to 4.001 Inches. Replace Sleeve When Inside Diameter Below Top Ring Ridge Exceeds 4.008 Inches.
Piston Clearance in Sleeve (At Skirt) -----	.0035 to .0045 Inches

### PISTON AND PISTON PINS

Piston Material -----	Aluminum
Piston Weight (Less Pin) -----	2.205 to 2.214 Pounds
Diameter of Piston at Top -----	3.964 to 3.968 Inches
Diameter of Piston at Top of Skirt (Measured Immediately Below Oil Ring, Across Thrust Faces) -----	3.996 to 3.997 Inches
Piston Pins -----	Full Floating Type; Held in Position with Snap Rings in Piston; Replaceable Bronze Bushing in Connecting Rod.
Piston Pin Length -----	3.395 to 3.405 Inches
Piston Pin Diameter -----	1.3583 to 1.3586 Inches
Piston Pin Fit in Piston -----	.0001 to .0003 Inch
Piston Pin Fit in Connecting Rod Bushing -----	.0004 to .0011 Inch

### PISTON RINGS

Rings Per Piston -----	4-(3 Compression and 1 Oil)
Compression Rings (Top 3)	
Width of Rings (All 3) -----	.0930 to .0935 Inch
Ring End Gap (All 3) When Compressed in 4.000 Inch Cylinder -----	.013 to .023 Inch
Side Clearance in Groove of 1st (Top) Ring -----	.0025 to .0040 Inch
Side Clearance in Groove of 2nd and 3rd Ring -----	.0020 to .0040 Inch
Oil Ring -----	To install Replacement Ring, Follow Instructions Packed with Rings.
Width of Ring (Both Original and Replacement) ----	.2485 to .2490 Inch
Ring End Gap When Compressed in 4.00 Inch Cylinder -----	.002 to .0035 Inch
Side Clearance in Groove (Original Equipment) ----	.0015 to .0085 Inch
(Replacement Ring) -----	.0031 to .0074 Inch

### CONNECTING RODS

Piston Pin Bushing -----	Replaceable Bronze Bushing Ream in Place. Use 1.3590 to 1.3594 Reamer.
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Piston Pin Hole Diameter in Rod (Without Bushing) -----	1.483 to 1.485 Inches
Inside Diameter of Piston Pin Bushing in Rod -----	1.3590 to 1.3594 Inches; Install New Bushing if Inside Diameter Exceeds 1.363.
Connecting Rod Bearing -----	Replaceable, Precision Steel Backed, Copper Lead Alloy Liners.
Connecting Rod Capscrews -----	Self Locking Type, No Lock Wire Required - May Be Used More Than Once
Connecting Rod Length (Center to Center Between Pin Hole and Bearing Journal Hole) -----	10.499 to 10.501 Inches
Bearing Liner Width -----	1.625 Inch
Diameter of Crankshaft Journal Hole in Rod (Without Liner) -----	2.9005 to 2.9010 Inches
Inside Diameter of Bearing Liner (Standard Liner in Place in Rod and Capscrews Tight) ----	2.7503 to 2.7518 Inches
Diameter of Crankshaft Rod Journal -----	2.748 to 2.749 Inches
Clearance Between Rod Bearing and Crankshaft Journal -----	.0015 to .0036 Inch; Install New Bearing Liners When Clearance Exceeds .006 Inch.
Undersize Bearing Liners Available for Service -----	.002, .010, .020, .030 Inch
Allowable Connecting Rod Bearing End Play -----	.005 to .012 Inch

### CRANKSHAFT AND MAIN BEARINGS

Crankshaft -----	Balanced; Drilled to Provide Pressure Lubrication to Main and Connecting Rod Bearings
Type Main Bearings -----	Replaceable, Precision, Steel Backed, Copper Lead Alloy Liners
Bearing Capscrews -----	Self Locking Type, No Lock Wires Required - May Be Used More Than Once
Bearing Taking End Thrust ----	Center (Two Replaceable Bronze Thrust Washers).
Crankshaft End Play (Measured At Center Main Bearing) -----	.004 to .012 Inch; Install New Thrust Washers if End Play Exceeds .020 Inch
Oversize Thrust Washers for End Play Available for Service -----	.006 Inch
Connecting Rod Bearing Journal Diameter -----	2.748 to 2.749 Inches
Main Bearing Journal Diameter -----	2.998 to 2.999 Inches
Crankshaft Main and Connecting Rod Journal Bearing Out of Round -----	Maximum .001 Inch
Inside Diameter of Main Bearing Liners (In Place and Capscrews Tight) -----	3.0006 to 3.0026 Inches
Clearance Between Main Bearing Liner and Journal -----	.0020 to .0046 Inch; Install New Bearing Liners When Clearance Exceeds .0065 Inches
Width of 1st, 3rd and 5th Main Bearing Liners -----	2.218 Inches
Width of 2nd and 4th Main Bearing Liners -----	1.156 Inches
Width Between Crankshaft Main Bearing Cheeks:	
A. 5th -----	2.620 to 2.630 Inches
B. 2nd and 4th -----	1.5575 to 1.5675 Inches
C. 3rd (Center) -----	2.624 to 2.628 Inches
Width Between Crankshaft Rod Bearing Journal Cheeks -----	1.9975 to .20025 Inches
Undersize Main Bearing Liners Available for Service -----	.002, .010, .020, .030 Inch
Crankshaft Main Bearing Journals should be ground to -----	2.988-2.989 Inches for .010 Inch Undersize Bearing 2.978-2.979 Inches for .020 Inch Undersize Bearing 2.968-2.969 Inches for .030 Inch Undersize Bearing



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Undersize Connecting Rod Bearing  
Shells Available for Service ----- .002, .010, .020, .030 Inch

Connecting Rod Crankshaft  
Journals Should be  
ground to ----- 2.738-2.739 Inches for .010 Inch Undersize Bearing  
2.728-2.729 Inches for .020 Inch Undersize Bearing  
2.718-2.719 Inches for .030 Inch Undersize Bearing

**CAMSHAFT AND BUSHINGS**

Number of Bearing Surfaces on Camshaft ----- 4

Type Bushing ----- Replaceable, Precision, Steel Backed Babbitt

Bushing Lubrication ---- Pressure Lubricated from Oil Pump; Camshaft  
Drilled to Provide Pressure Lubrication to Valve  
Rocker Arm Assembly, and to Timing Gear Train.

Diameter of Camshaft at Each  
Bearing Surface ----- 2.246 to 2.247 Inches

Inside Diameter of Each Bushing  
(Measured when in Place in Block) ----- 2.2484 to 2.2514 Inches

No. 1 (Front) Bushing Length ----- 1.656 Inches

No. 2 and 3 Bushing Lengths ----- 1.438 Inches

No. 4 Bushing Length ----- 1.156 Inches

Camshaft End Play ----- Automatically Taken up by Spring Loaded  
Thrust Button in Front End of Camshaft. Bronze  
Washer Provided Between Drive Gear and Front  
Bearing.

Camshaft Washer

Outside Diameter ----- 3.240 to 3.260 Inches

Inside Diameter ----- 2.250 to 2.260 Inches

Thickness ----- .1225 to .1275 Inch

**VALVE PUSH ROD LIFTERS**

Type ----- Mushroom Type

Outside Diameter of End That Projects  
into Block ----- .8097 to .8102 Inches

Diameter of Bore in Block for Lifter ----- .8115 to .8130 Inches

Oversize Lifter Available for Service ----- .010 Inch Oversize Lifter

Bore in Block Must Be Reamed to ----- .8215 to .8225 Inch for  
.010 Inch Oversize Lifter.

**VALVES****Valve Tappet Clearance**

Intake ----- .015 Inch, Engine Cold  
Exhaust ----- .025 Inch, Engine Cold

Intake and Exhaust ----- .025 Inch, Engine Hot  
Hot Settings Are Made At Low Idle After The Engine Has Operated At  
Thermostat Control Temperature For At Least Fifteen Minutes.

**Exhaust Valves**

Angle of Valve Face ----- 44 Degrees

Valve Length ----- 6.537 Inches

Maximum Valve Face Runout ----- .002 Inch as Determined  
with a Dial Indicator.

Diameter of Valve Stem ----- .400 to .401 Inch; Install New Valve  
if there is More Than .002 Inch Difference  
in Diameter at any Point on Stem.

Diameter of Valve Head ----- 1.545 Inches

Inside Diameter of Valve Guide ----- .4045 to .4055 Inch

Valve Stem Clearance in Guide ----- .0035 to .0055 Inch

Valve Rotators ----- Positive Type

**Exhaust Valve Seat Insert**

Seat Angle ----- 45 Degrees

Seat Width ----- .073 to .084 Inch

Insert Height ----- .250 to .255 Inch

Outside Diameter of Insert ----- 1.630 to 1.631 Inches

Inside Diameter of Insert ----- 1.370 to 1.380 Inches

Maximum Allowable Seat Runout ----- .002 Inch as Determined  
with a Dial Indicator.

**Intake Valves**

Angle of Valve Face ----- 44 Degrees

Valve Length ----- 6.695 Inches

Maximum Valve Face Runout ----- .002 Inch as Determined  
with a Dial Indicator.

Diameter of Valve Stem ----- .402 to .403 Inch; Install New Valve  
if there is More Than .002 Inch Difference  
in Diameter at any Point on Stem.

Diameter of Valve Head ----- 1.720 Inches

Inside Diameter of Valve Guide --- .4045 to .4055 Inch (After Assembly)

Stem Clearance in Guide ----- .0015 to .0035 Inch

**Intake Valve Seat**

Seat Angle ----- 45 Degrees

Seat Width ----- .070 to .086 Inch

**Exhaust Valve Guides**

Length ----- 3.625 Inches

Outside Diameter ----- .7510 to .7515 Inch

Inside Diameter ----- .4045 to .4055 Inch

Valve Stem Clearance in Guide ----- .0035 to .0055 Inch

Distance Above Head Guide Must Protrude ----- 1.062 Inch Press Fit

**Intake Valve Guides**

Length ----- 3.625 Inches

Outside Diameter ----- .7510 to .7515 Inch

Inside Diameter ----- .4045 to .4055 Inch

Valve Stem Clearance in Guide ----- .0015 to .0035 Inch

Distance Above Head Guide Must Protrude ----- 1.062 Inch Press Fit

**VALVE SPRINGS**

Free Length ----- Approx. 2.438 Inches

Spring Pressure at Compressed Height of  
1.531 Inches (Valve Open) ----- 95.5 Pounds; Install New Spring if  
Pressure is Less Than 86 Pounds.

Spring Pressure at Compressed Height of  
1.938 Inches (Valve Closed) ----- 45 Pounds; Install New Spring if  
Pressure is Less Than 41 Pounds.

**ROCKER ARM ASSEMBLY**

Rocker Arm Bushings ----- Replaceable Precision Bronze Bushing

Number of Bushings ----- 8

Lubrication ----- Pressure Lubricated; Crankcase Oil to Rocker  
Arms Metered by Camshaft.

Oil Holes in Rocker Arm Shaft --- Oil Holes Must Face Push Rod Side of  
of Engine Only. Shaft Cannot Be Rotated.

Positioning of Exhaust Valve  
Rocker Arms ----- Spacer Washers Position Exhaust  
Valve Rocker Arm and Eliminates End Play  
Without Binding.

Outside Diameter of Rocker Arm Shaft ----- .872 to .873 Inch  
 Inside Diameter of Rocker Arm Bushing ----- .8745 to .8755 Inch  
 Rocker Arm Shaft Spring  
 Pressure at Compressed Height of  
 1.562 ----- 10 Pounds; Install New Spring if  
 Pressure is Less than 8.500 Pounds

**OIL PUMP**

Type ----- Positive Displacement, Gear Type Pump  
 Pressure Relief Valve ----- Maintains 40 to 45 Pounds Full Pressure  
 (Oil Warm, Engine Operating at Full Governed  
 Speed) Relief Valve is Adjustable.

**WATER PUMP AND THERMOSTAT**

Type of System ----- Pressurized Thermostat Continuous  
 By-Pass Type; Forced Circulation (Pump)  
 Type Pump ----- Impeller Vane Type  
 Temperature Control ----- By-Pass Type Thermostat

**FUEL SYSTEM**

Type of System ----- Electric Fuel Pump  
 Carburetor ----- Marvel Schebler Model TSX 785  
 Flange ----- SAE 1.250 Inch  
 Load Jet ----- Adjustable

**TIGHTENING TORQUE SPECIFICATIONS**

Engine	Torque in Ft. Lbs.	Size	Threads per In.	Type
Camshaft Nut -----	125	1-1/8	12	NF*
Connecting Rod Bearing Capscrews -----	95 to 105	1/2	20	NF
Crankshaft Pulley Bolt -----	100	5/8	18	NF
Cylinder Head Cover (Valve Cover) Stud Nuts ----	5 Max	7/16	20	NF
Cylinder Head Bolts (Grade 8) -----	145 to 150	9/16	18	NF
Flywheel to Crankshaft Capscrews -----	100	5/8 9/16	18 18	NF NF
Crankshaft Rear Oil Seal Retainer Capscrews -----	25	3/8	16	NC**
Injectors, Diesel Fuel Clamp Stud Nuts, Injector to Cylinder Head (Diesel) -----	14 to 17	3/8	24	NF
Injector Nozzle Cap Nut (Diesel) -----	50 to 55			
Powrcel Clamp Screws (Diesel) -----	100	1-1/8	16	NC
Mainbearing Capscrews ----	145 to 155	5/8	11	NC
Manifold Clamp Stud Nuts -----	25	7/16	20	NF
Water Manifold Hold Down Capscrews -----	15	5/16	18	NC
Oil Filter Mounting Capscrews -----	25	3/8	16	NC
Oil Pan Capscrews -----	40	3/8	16	NC
Oil Pump Cover Capscrews -----	25	1/4	20	NC
Rocker Arm Bracket Studs and Capscrews -----	40	7/16	14	NC

**C-7**



Water Pump and Fan Shaft  
 Nut ----- 60 5/8 18 NF  
 Water Pump Mounting  
 Capscrews ----- 25 3/8 16 NC  
 Maximum Backlash at  
 Tightest Point (All Timing Gears) ----- .002 to .005 Inch  
 Maximum Backlash at  
 Looset Point (All Timing Gears) ----- .006 Inch

National Fine\*  
 National Coarse\*\*

## GENERAL TORQUE SPECIFICATION TABLE (Revised 5-64)

**USE THE FOLLOWING TORQUES WHEN SPECIAL TORQUES ARE NOT GIVEN**

**NOTE:** These values apply to fasteners as received from supplier, dry, or when lubricated with normal engine oil. They do not apply if special graphited or moly-disulphide greases or other extreme pressure lubricants are used. This applies to both UNF and UNC threads.

SAE Grade No.	5		8 *	
Bolt head identification marks as per grade Note: Manufacturing Marks Will Vary				
	Torque Foot Pounds		Torque Foot Pounds	
Bolt Size	Min.	Max.	Min.	Max.
1/4"	9	11	12	15
5/16	15	18	24	28
3/8	35	40	45	50
7/16	54	60	70	80
1/2	80	90	110	125
9/16	110	120	160	180
5/8	150	165	220	240
3/4	260	280	380	420
7/8	360	400	600	660
1"	540	600	900	1000
1-1/8	720	800	1280	1440
1-1/4	1000	1100	1800	2000
1-3/8	1460	1680	2380	2720
1-1/2	1940	2200	3160	3560

\* Thick nuts must be used with Grade 8 bolts

### TIMING CHART

ENGINE	FULL LOAD GOVERNED ENGINE SPEED	NUMBER OF DEGREES
A267D	2000	33°
A251G	2000	5°ATDC (Static) 29°BTDC (Running at 2000 RPM)

### VALVE TIMING

With valve clearances set correctly, dial indicator mounted above valve stem, reading taken with valve .040" off its seat.

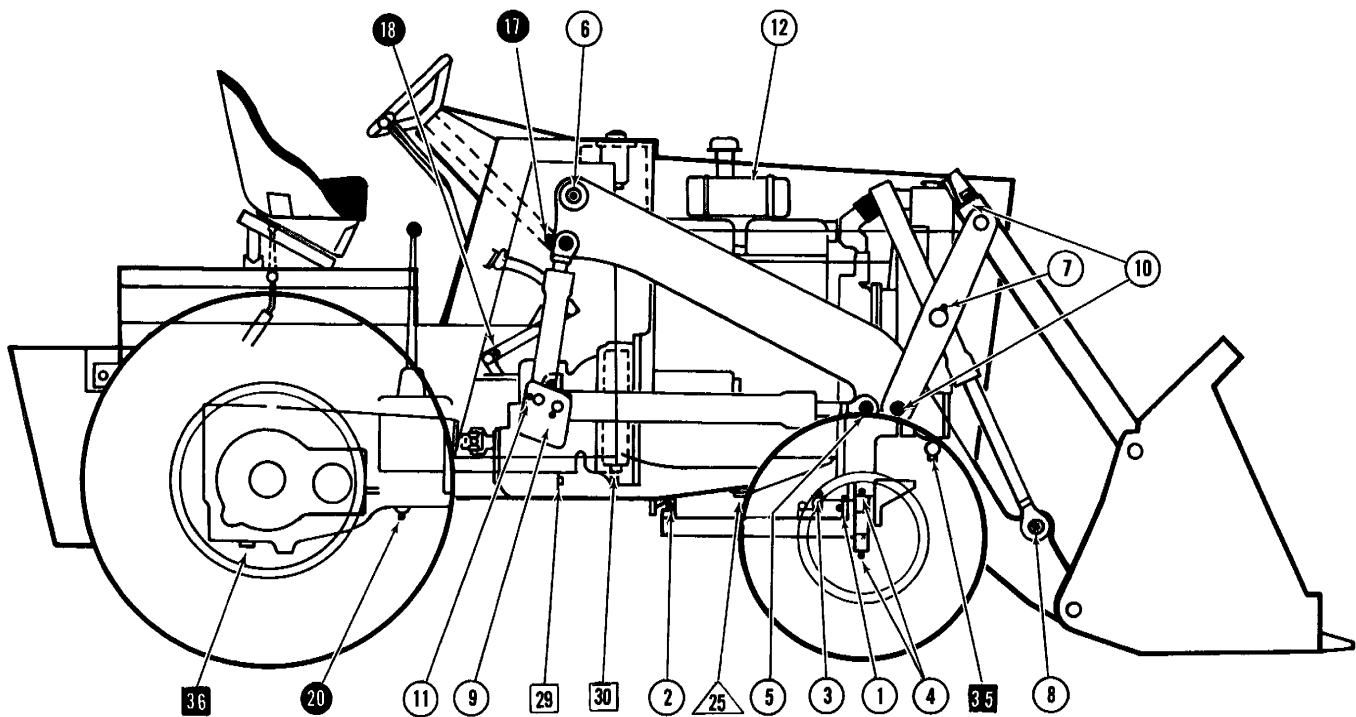
A267D Inlet Opening (No. 1 Cyl.) ----- 3° BTDC

A251G Inlet Opening (No. 1 Cyl.) ----- 6° ATC

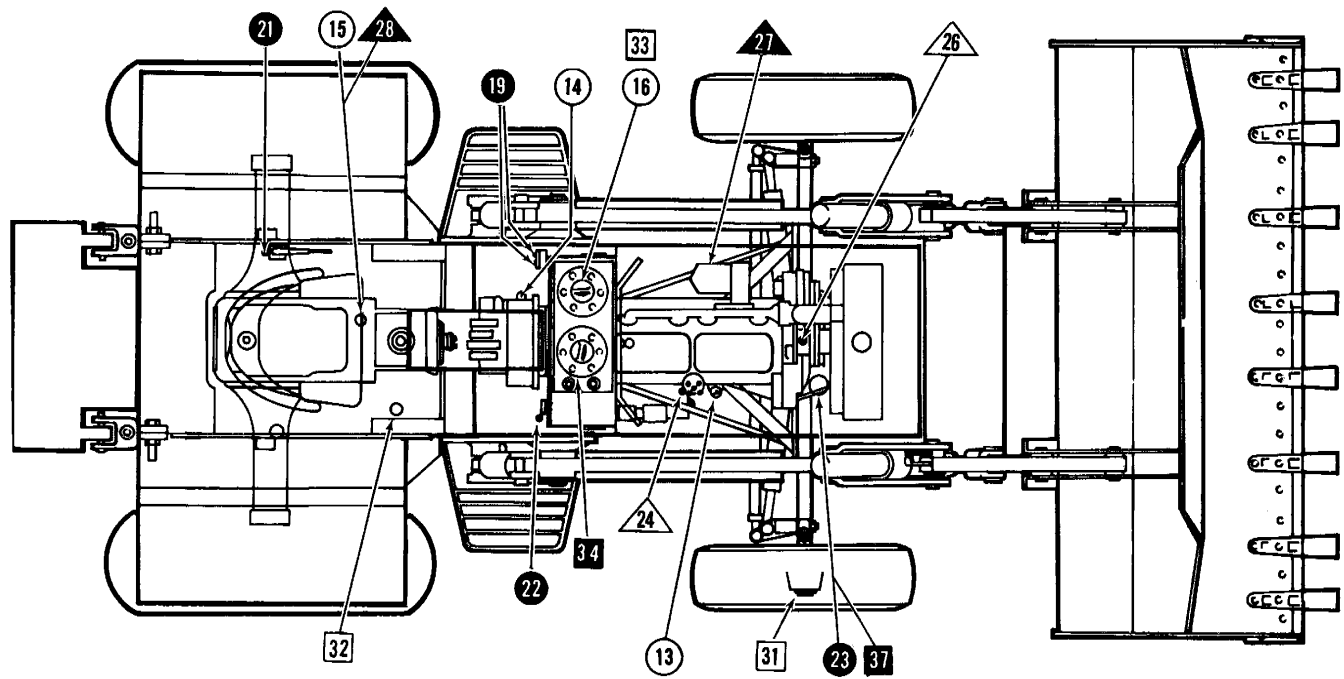
**NOTE** "Inlet Opening" is the only position on these engines that can be checked by the crankshaft pulley marks. Since the crankshaft pulley is only marked to 5° ATC, the 6° ATC mark will have to be measured and scribed on the pulley. Use the degree marks already on the pulley for measurement. If this position is correct, it can be assumed that the timing gears are correctly marked and properly assembled.

NOTE: The CASE CORPORATION reserves the right to make improvements in design or changes in specifications at any time without incurring any obligation to install them on units previously sold.

# **LUBRICATION AND MAINTENANCE SCHEDULE**



B672516



B672515

REF. NO.	LUBRICATION POINT	No. of POINTS	GREASE	DRAIN & REFILL	CHECK	CLEAN	(FEW DROPS) OIL CHANGE	FREQUENCY
1	Front Axle Pivot	1	●					10 Hours or Daily
2	Radius Rod Pivot	1	●					
3	Steering Cylinders	2	●					
4	King Pins	4	●					
5	Lift Cyl. Front Pivot	2	●					
6	Lift Arm Pivot Pins	2	●					
7	Tilt Cyl. Trunnion	2	●					
8	Tilt Cyl. Front Pivot	2	●					
9	Lift Cyl. Rear Pivot	2	●					
10	Tilt Linkage	4	●					
11	Hydra-Leveling Cyl. Lower Pivot Backhoe Pressure Fittings See Page 5 of Backhoe Section	2	●					
12	Air Cleaner * ■	1				●		
13	Engine Oil Level **	1				●		
14	Forward-Reverse Trans. Level	1				●		
15	Trans. & Final Drive Level-Breather	1				●		
16	Hydraulic Reservoir Level	1				●		
17	Forward - Reverse Transmission Shift Lever	1					●	60 Hours or Weekly
18	Brake Pedals	2	●					
19	Brake Bell Crank	2	●					
20	Brake Cross Shaft	3	●					
21	Parking Brake Bellcrank	1	●					
22	Throttle Linkage Shaft Pivot	1	●					
23	Power Steering Reservoir Level	1				●		
24	Tachometer Drive (Sp. Ign. Only)	1	●		●			120 Hours
25	Engine Oil	1						
26	Water Pump***	1	●					
27	Engine Oil Filter ■ ■	1					●	240 Hours
28	Trans. & Final Drive Breather	1				●		
29	Forward-Reverse Transmission	1			●			500 Hours
30	Torque Converter	1			●			
31	Front Wheel Bearings ■ ■ ■	2	●					
32	Fuel Pump Filter	1					●	
33	Hydraulic System Oil	1			●			
34	Hydraulic System Filter (Suction)	1					●	1000 Hours
35	Hydraulic System Filter (Return)	1					●	
36	Trans. & Final Drive Oil	1			●			
37	Power Steering Reservoir Filter	1					●	

- \* See Section I, Page 6
- \*\* Drain and refill after first 20 hours
- \*\*\* 2 Strokes - Do Not Overlubricate
- More often in dusty conditions
- ■ Change after first 20 hours
- ■ ■ Clean, Repack and Adjust

# LUBRICATION RECOMMENDATIONS

ALL CAPACITIES GIVEN IN U.S. MEASURE

LUBRICATION POINTS	APPROXIMATE CAPACITIES	AIR TEMPERATURE RANGES			
		Above 80° F.	80° F. to 32° F.	32° F. to -20° F.	-20° F. or Lower
Engine Crankcase	8 Quarts	SAE 30	SAE 20W	SAE 10W	SAE 5W or SAE 5W - 20
Engine Crankcase (Including Oil Filter)	9 Quarts				
Forward-Reverse Transmission Shift Lever Bearing	Few Drops				
Transmission and Final Drive	28 Quarts (Refill)	SAE 90 Multi-Purpose Gear Lubricant			
Forward-Reverse Transmission and Torque Converter	5 Quarts (Refill)	Case Hi-Lo TCH Oil			
Hydraulic System Reservoir	27 Quarts (Refill)				
Hydraulic Power Steering Reservoir	1 Quart				
Water Pump	2 Strokes	*Lithium Soap-Base Grease			
Wheel Bearings	Use As Required				
All Pressure Fittings	As Many Strokes As Required				

## Procedure

## Grade Recommendations

1. Before applying a grease gun to the pressure fittings, wipe all accumulated dirt from each tip. Lubricate until clean grease runs out.
2. Lubricate all fittings illustrated every 10 hours of operation or daily.
3. If the loader is operated in mud or water, lubricate the immersed fittings more often.

Below 32° F. . . . .	No. 1
32° F. to 90° F. . . . .	No. 2
Above 90° F. . . . .	No. 3

**SECTION**

**K**

**SERVICING THE**



**CYLINDER HEADS**



**VALVE SYSTEMS**



**ROCKER ARMS**



**DECOMPRESSOR**

**ON**

**CASE POWRCEL DIESEL ENGINES**



## TABLE OF CONTENTS

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DECOMPRESSOR (If So Equipped) - Disassembly and Assembly . . . . .	K-6
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VALVES, GUIDES AND SPRINGS - Inspection . . . . .	K-12
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INTAKE AND EXHAUST VALVE SEATS - Grinding . . . . .	K-15
LOCATING TOP DEAD CENTER AND TAPPET ADJUSTMENT . . . . .	K-16

## CYLINDER HEAD AND COMPONENTS

(Refer to Figure K-1)

### Removal

Steam clean the engine completely before doing any disassembly or service work.

Drain cooling system. Remove the intake, exhaust and water manifolds. Remove the rocker arm covers. Disconnect and remove the decompressor if so equipped, Page K-6.

Remove the rocker arm assemblies and tag them for proper installation. (Refer to Page K-8.

Disconnect the high pressure fuel lines to

the injectors and cap them. Disconnect the fuel leak-off tubes between each cylinder head and cap them.

Remove the push rods and tag or store them in a holder or rack so they can be installed in their same locations.

Remove the cylinder head bolts or nuts and lift the heads off the engine. Remove the head gaskets and discard them.

### Inspection and Installation

Remove all carbon and clean all parts before installation.

#### STANDARD HEAD GASKETS

If you are installing the standard gasket, install the new gasket with new rubber seals. The gasket must be installed with either the copper side up or the side with the case part number up. Continued on Page K-5.

#### FIRE RING HEAD GASKETS

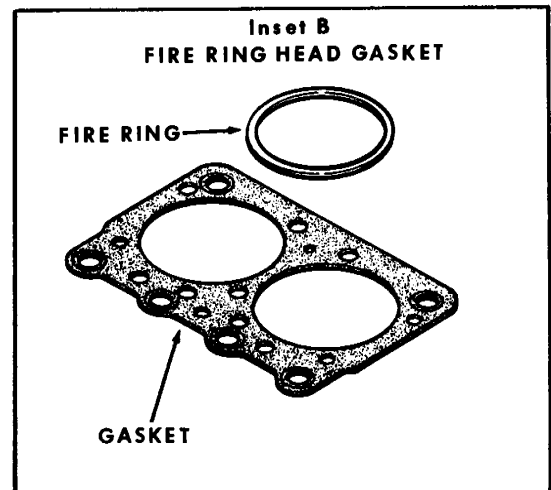
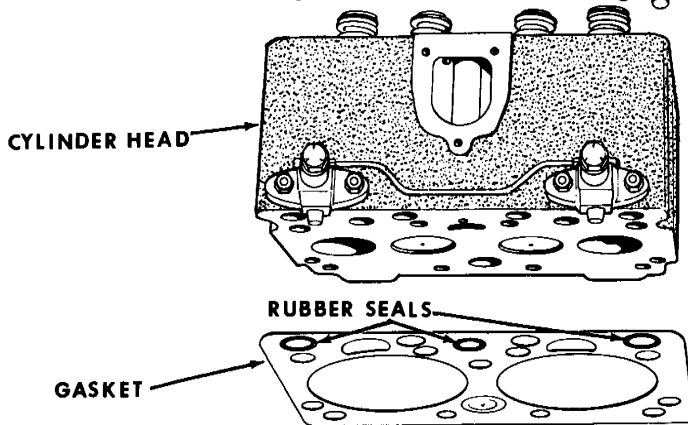
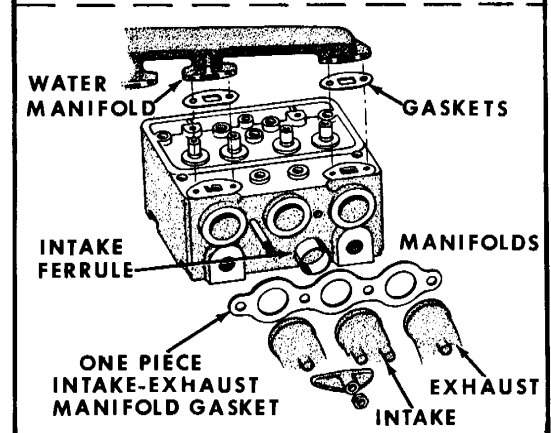
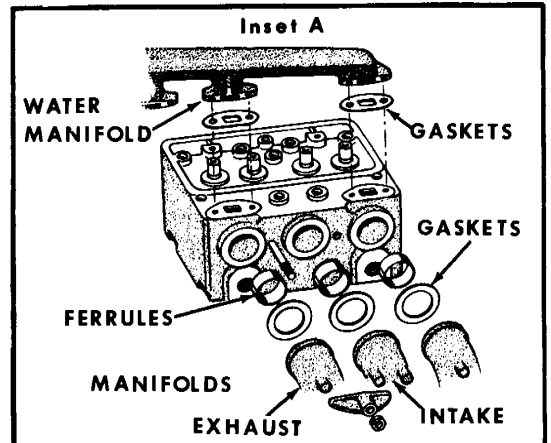
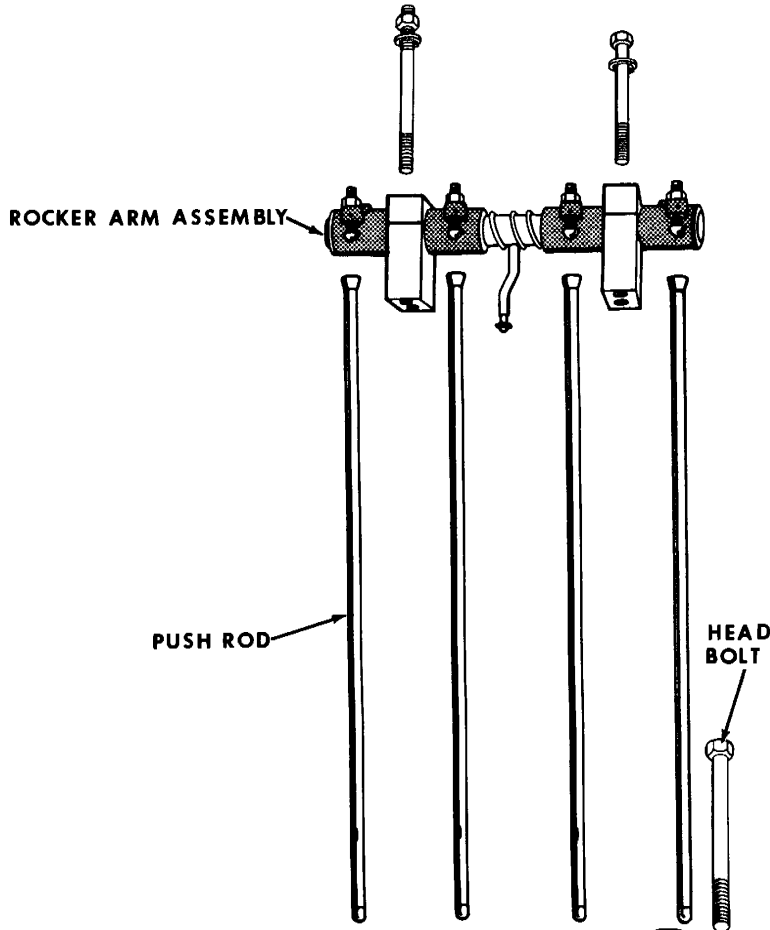
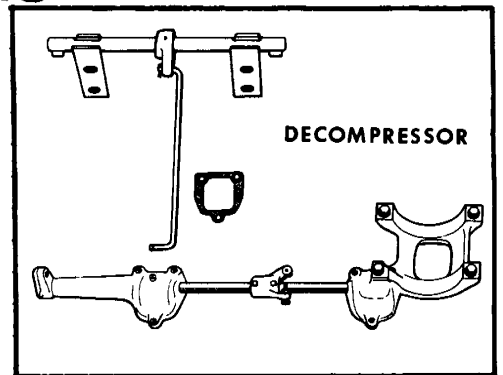
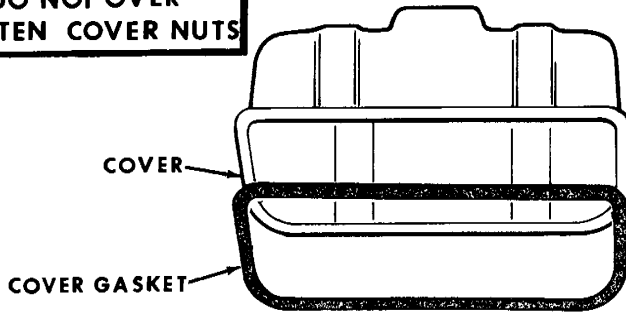
If you are installing the fire ring head gasket, inset B, cylinder sleeve protrusion

must be checked to determine which fire ring to install. Only the standard fire ring is included in the valve grind gasket kit, however a thicker fire ring (.004") is available if the protrusion checks indicate a need for it. The thicker fire ring can be identified by a blue marking stripe.

Refer to Pages K-4 and K-5 for the procedure to follow when installing the fire ring cylinder head gasket.

# REMOVAL AND INSTALLATION OF CYLINDER HEAD AND COMPONENTS

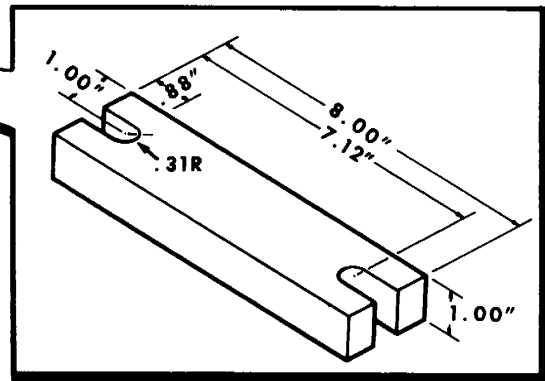
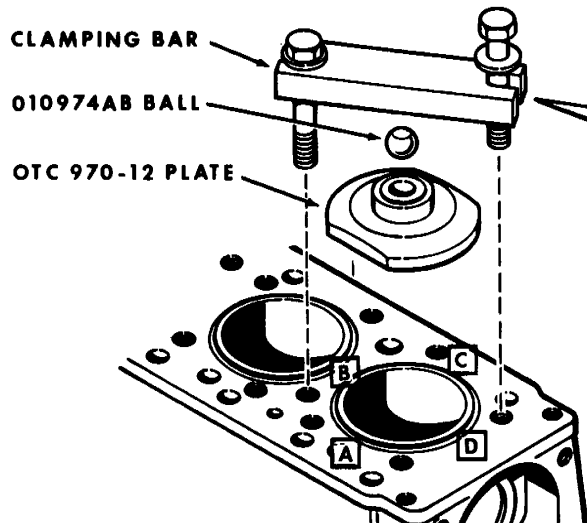
**CAUTION**  
DO NOT OVER  
TIGHTEN COVER NUTS



## Inspection and Installation Fire Ring Gaskets (Continued)

The following procedure must be followed when installing the fire ring head gasket:

1. Clean the top surface of the block and sleeve flange carefully. All traces of carbon and other deposits must be removed. During the final cleaning operation, the use of a rag dampened in solvent is recommended.
2. Using a small stone, remove any small burrs in the areas to be measured so that accurate readings can be obtained.



MEASURE SLEEVE PROTRUSION AT POINTS A, B, C, AND D.

Figure K-2

4. Either a magnetic base dial indicator or a depth micrometer can now be used to determine the cylinder sleeve protrusion as indicated in Figure K-3. Refer to chart, Figure K-5, to make sure the correct fire ring is used.

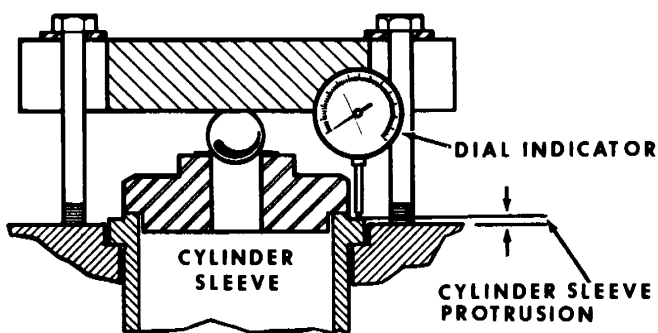


Figure K-3

5. Install cylinder head gaskets. **IMPORTANT** Two of the capscrew holes in the gasket are slightly smaller and act as guides to position the gasket as well as the fire ring,

3. Using plate OTC970-12\* from cylinder sleeve puller OTC970\*, 010974AB ball and clamping bar, clamp the cylinder sleeve in place, Figure K-2. Torque the hold down capscrews evenly to 50 foot pounds. **NOTE** Refer to Figure K-2 for clamping bar dimensions.

\*These tools are available through local Owatonna Tool Dealers or the Owatonna Tool Co., Owatonna, Minnesota.

4. Regular line-up studs could be used for most engines. In some instances it is very difficult to install the

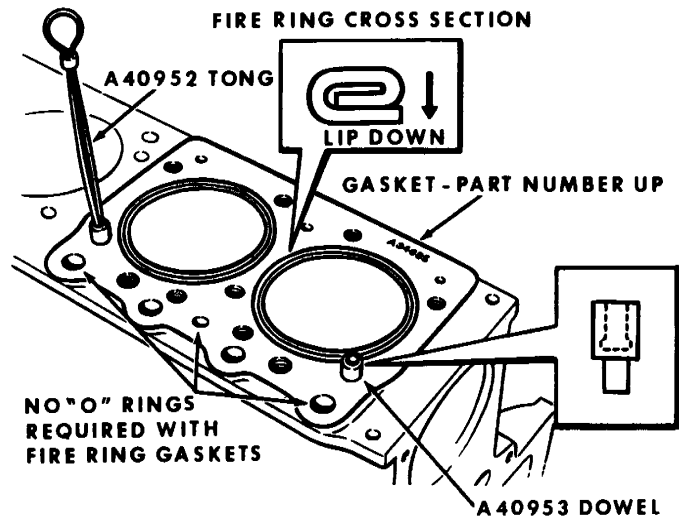


Figure K-4

rear cylinder head due to the limited space in which to place the head when lowering it down over the long guide studs.

## Inspection and Installation(Continued)

CYLINDER SLEEVE PROTRUSION	USE STANDARD FIRE RING	USE OVERSIZE (THICKNESS) FIRE RING
BOTH SLEEVES UNDER ONE HEAD FLUSH TO .002"		X
BOTH SLEEVES UNDER ONE HEAD .002" OR OVER BUT LESS THAN .0025" BETWEEN SLEEVES	X	
BOTH SLEEVES UNDER ONE HEAD OVER .0025" DIFFERENCE BETWEEN SLEEVES	ON THE HIGH SLEEVE	ON THE LOW SLEEVE

Figure K-5

6. For difficult installations, the use of dowel pins and a tong are recommended and can be purchased through a local Snap-On Tool Dealer or J.I. Case Central Parts Dept. under the following part numbers.

Snap-On Tool No.	Case Part No.
CF83-1 Tong	A40952
CF83-4 Dowel	A40953

7. Install the fire rings with the lip downwards, Figure K-4. **NOTE** Fire ring gaskets must be installed dry.

8. Carefully clean the cylinder heads as described in No. 1. If evidence of fretting or erosion exist in the area of the fire ring contact or if the head is warped more than .005", the head must be resurfaced.

9. Install cylinder heads and several bolts, then remove the A40953 dowels using A40952 tong and install all the bolts.

### STANDARD AND FIRE RING HEAD GASKETS

10. Install intake and exhaust manifold ferrules and new gaskets. **NOTE** When the manifolds are designed for the one piece manifold gasket, the ferrules are used only in the intake ports. Refer to Page K-3, inset A. Install the intake and exhaust manifolds and torque to proper torque. Refer to Specification Section.

11. Torque cylinder head bolts or nuts to the proper sequence illustrated in Figure K-6. The three torquing steps recommended are 50 foot pounds, 100 foot pounds and finally 150 foot pounds.

12. Install the push rods in their original location. Connect the high pressure fuel lines and leak-off tubes. Install the de-

compressor (if so equipped.) Refer to Page K-16 for proper firing order.

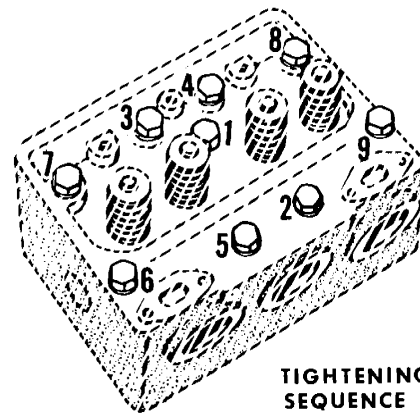


Figure K-6

13. Install the rocker arm assemblies in their original location.

14. Adjust the valve tappet clearance, refer to Page K-16.

15. Fill cooling system and start engine. Check that the rocker arms are receiving lubrication.

16. Run engine for approximately one (1) hour, under load if possible, to thoroughly warm up the engine and seat the head gaskets.

17. Stop the engine and retorque the cylinder head bolts or nuts to 150 foot pounds while the engine is still hot. Check and readjust the tappets.

18. Clean the rocker arm covers and remove the old gasket. Install new gaskets and seals; then install covers. Refer to Specification Section for proper torque. Do not over torque the valve cover nuts.

## **INSPECTION OF DECOMPRESSOR**

**(If So Equipped)**

**(Refer to Figure K-7)**

When the decompressor is engaged all the exhaust valves must be held in an open position. Inspect the trip pins for excessive wear. Inspect for bent or worn control linkage if the valves are not held open.

When the decompressor is disengaged and the tappet clearance is correct be sure the trip pins release the rocker arms completely. Inspect for loose coupling set screws, bent or worn control linkage, control link cotter pin missing or a pin in one of the control levers sheared off.

## **DISASSEMBLY OF DECOMPRESSOR**

**(Refer to Figure K-7)**

Remove the control link cotter pins (1) and link (2). Remove the decompressor control housings (3) and the housing gaskets (4). Loosen the coupling set screws (5) and remove the coupling (6).

Remove the roll pins (7) from the control

levers (8). Remove the control shafts (9) from the housings. Remove the control levers (8). Remove the trip pins (10) from the decompressor shaft (11). Remove and discard the "O" rings (12) from the shafts.

## **ASSEMBLY**

**(Refer to Figure K-7)**

Install the trip pins (10) and lever (8) with roll pin (7) to the decompressor mounting brackets (13). Install the new "O" rings (12) on the shafts - Install the shafts (9) into the housings (3) and install the control levers (8) with roll pins (7). Install the shaft coupl-

ing (6) and tighten square head set screws (5).

Install the housing and shaft assembly to the cylinder heads with new gaskets (4). Install the control link (2) with cotter pins (1).

## **DECOMPRESSOR ADJUSTMENTS**

**(Refer to Figure K-7)**

The stop bolts (14) in the coupling stop (6) should be adjusted so the decompressor can open the valves when engaged and lift the trip pins so they are clear of the rocker arms when disengaged (Refer to Inset A). Tighten the lock nuts (15) on the stop bolts (14) after adjustment is made.

# DISASSEMBLY AND ASSEMBLY OF DECOMPRESSOR

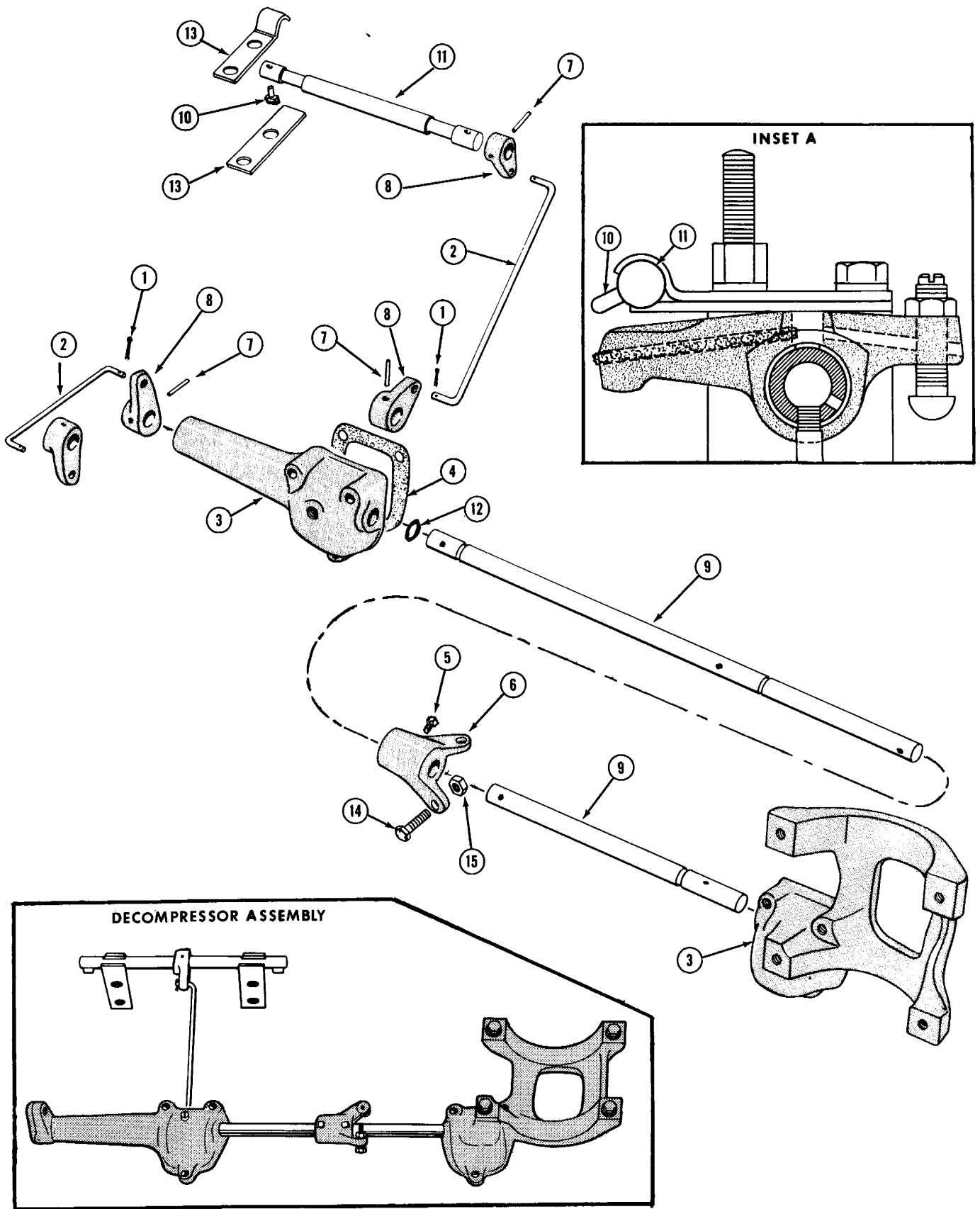


Figure K-7