CATERPILLAR

GENERAL SPECIFICATIONS

Engine	Cycle	Displ. Cu. Ins.	Compr. Ratio	Bore	Stroke	Firing Order	Inj. Timing ①
1693	4	893″	16.0:1	5.40″	6.50″	1,5,3,6,2,4	11.0°
3208	4	636″	16.5:1	4.50″	5.00″	1,2,7,3,4,5,6,8	16.0°
3306	4	638″	17.5:1	4.75″	6.00″	1,5,3,6,2,4	13.5°
3406	4	893″	16.5:1	5.40″	6.50″	1,5,3,6,2,4	10.0°
3408	4	1099″	15.5:1	5.40″	6.00″	1,8,4,3,6,5,7,2	①11.00°

① — Unless noted otherwise, all Injection Timing is BTDC.
② — Direct Injection Turbocharged Model is 28°BTDC.

NORMAL OPERATING SPECIFICATIONS

Engine	Idle RPM	Max. RPM	Oil Temp.	Oil Press.	Coolant Temp.	Compression Pressure (PSI) @ RPM (Sea Level)
1693	550	2100	210°	45-65	210°	.....
3208	650	3070	210°	55-85	210°	.....
3306	600	2400	210°	45-60	210°	.....
3406	600	2300	210°	45-70	210°	.....
3408	700	2340	210°	55-69	210°	.....

VALVES & SEATS

Engine	Head Diameter	Face Angle	Seat Angle	Seat Width	Stem Diameter	Stem Clearance	Valve Seat Insert O.D.	Valve Clearance
1693								
Int.	1.771″	44¼°	45°	.060″	.3715-.3725″	.0007″	1.8115-1.8125″	.018″
Exh.	1.646″	44¼°	45°	.060″	.3715-.3725″	.0007″	1.6865-1.6875″	.030″
3208								
Int.	2.094″	30°	30°	.120″	.3720-.3730″	.0200″	2.0400-2.0500″	.015″
Exh.	1.804″	45°	45°	.105″	.3710-.3720″	.0200″	1.9115-1.9125″	.025″
3306								
Int.	2.094″	29°	30°	.076″	.3714-.3720″	.0170″	2.1280-2.1290″	.015″
Exh.	1.896″	29°	30°	.076″	.3714-.3720″	.0170″	2.0030-2.0040″	.025″
3406								
Int.	1.771″	30°	30°	.....	.3714-.3720″	.0180″	1.8115-1.8125″	.015″
Exh.	1.646″	45°	45°	.....	.3714-.3720″	.0180″	1.6865-1.6875″	.030″
3408								
Int.	1.771″	30°	30°	.....	.3714-.3720″	.0180″	1.8115-1.8125″	.015″
Exh.	1.646″	45°	45°	.....	.3714-.3720″	.0180″	1.6865-1.6875″	.030″

VALVE SPRINGS

Engine	Free Length	Compressed Length	Lbs. @ Comp. Length
1693	2.310″	1.950″	35
3208	1.855″	1.715″	35
3306	2.050″	1.766″	57.7
3406	2.470″	2.165″	77.5
3408	2.470″	2.165″	77.5

CAMSHAFT

Engine	Journal Diam.	Clearance	Lobe Lift
1693			
No.1,2,3	2.8750-2.8760″	.010″	.025″
No.4	1.8710-1.8720″	.010″	.025″
3208	2.4995-2.5000″	.007″	.004-.010″
3306	2.3105-2.3115″	.002-.006″	.004-.010″
3406	2.7495-2.7505″	.....	.004-.010″
3408	2.7495-2.7505″	.....	.004-.010″

CATERPILLAR (Cont.)

ROCKER ARMS & VALVE BRIDGES

Engine	Rocker Shaft O.D.	Rocker Arm I.D.	Rocker Arm Clearance	Bridge Guide O.D.	Bridge I.D.	Bridge Height Above Head
1693	.....	.....	.....	.....	.....	.....
3208	.8580-.8588"	.8595-.8611"	.005"	.....	.....	.....
3306	.7240-.7250"	.7258-.7268"	.008"	.....	.....	.....
3406	.9740-.9750"	.9760-.9770"	.010"	.4333-.4335"	.4338.4362"	2.080-2.120"
3408	.9740-.9750"	.9760-.9770"	.010"	.4333-.4335"	.4338-4362"	2.080-2.120"

PISTONS, PINS, RINGS

Engine	PISTONS	PINS		RINGS		
	Clearance	Piston Fit	Rod Fit	Rings	End Gap	Side Clearance
1693	.....	.003-.011"	.0009-.0019"	1	.021-.036"	.0057-.0071"
				2	.035-.050"	.0030-.0048"
				3	.015-.030"	.0015-.0030"
3208	.....	.003"	.003"	1	.015-.030"	.0030-.0055"
				2	.010-.025"	.0015-.0035"
3306	.....	.003-.013"	.003"	1	.0175-.0325"	.0028-.0046"
				2	.0175-.0325"	.0023-.0041"
				3	.0130-.0280"	.0015-.0035"
3406	.....	.003-.013"	.003"	1	.021-.036"	①
				2	.035-.050"	①
				3	.015-.030"	.010-.030"
3408	.....	.003-.011"	.003"	1	.021-.036"	①
				2	.035-.050"	①
				3	.015-.030"	.010-.030"

① — Ring should be a snug fit in groove, with no visible side play.

CRANKSHAFT & MAIN BEARINGS

Engine	Journal Diameter	Bearing Clearance	Crankshaft End Play	Thrust Location	Thrust Washer Thickness	Number of Main Bearings
1693	4.4995-4.5005"	.0035-.0066"	.0060-.0180"	.....	.....	7
3208	3.4990-3.5000"	.0060"	.0030-.0090"	.....	.....	5
3306	3.4984-3.5000"	.0030-.0065"	.0025-.0145"	Front	.1835-.1865"	7
3406	4.7495-4.7508"	.0037-.0068"	.0060-.0200"	Center	.....	7
3408	4.7492-4.7508"	.0036-.0073"	.0060-.0200"	Center	.....	5

CYLINDER LINER & BORE

Engine	Type	Liner Bore	Liner Protrusion
1693	Wet	5.400-5.402"	.002-.007"
3208	.....	①4.500-4.510"	.....
3306	Wet	4.750-4.752"	.001"
3406	Wet	5.400-5.402"	.002-.008"
3408	Wet	5.400-5.402"	.002-.008"

① — Liners not used on Model 3208

CONNECTING RODS & BEARINGS

Engine	Journal Diameter	Bearing Clearance	Sideplay
1693	3.5395-3.5405"	.003-.006"	.....
3208	2.7496-2.7504"	.007"	.. ..
3306	2.9984-2.3000"	.0030-.0066"	.....
3406	3.8195-3.8205"	.003-.006"	.....
3408	3.8192-3.8208"	.0028-.0066"	

CATERPILLAR (Cont.)

OIL PUMP SPECIFICATIONS

1693

Type	Gear
Shaft Diameter	1.2275-1.2281"
Bore in Bushings	1.2300-1.2310"
Clearance Between Gear and Cover	.001-.004"
Relief Valve Spring	
Compressed Length	4.02"@34 lbs.
Free Length	4.38"

3208

Type	Rotary
Clearance Pump Gear Rotor Tip	.002-.006"
Relief Valve Spring	
Compressed Length	2.579"@37.3 lbs.
Free Length	3.500"

3306

Type	Gear
Bore in Idler Gear Bearing	1.1236-1.1284"
Idler Shaft Diameter	1.1250-1.1260"
Clearance Bearing-to-Shaft	.0006-.0064"
Drive Shafts Diameter	.8745-.8749"
Drive Shaft Bearings I.D.	.8760-.8766"
Clearance Drive Shafts-to-Bearings	.0011-.0022"
Clearance all Gears and Housing	.0032-.0068"

3406

Type	Gear
Drive Shaft Diameter	.8745-.8749"
Drive Shaft Bearing Bore	.8760-.8766"
Idler Shaft Bearing Bore	.8760-.8766"
Gear Length	3.1245-3.1255"
Gear Bore Depth	3.1292-3.1308"
Pressure Relief Valve Spring	
Length Compressed @110 lbs.	4.640"
Free Length	6.020"

3408

Type	Gear
Drive Shaft Diameter	.8745-.8749"
Drive Shaft Bearing Bore	.8760-.8766"
Idler Shaft Diameter	.8745-.8749"
Idler Shaft Bearing Bore	.8760-.8766"
Gear Length	3.1240-3.1260"
Gear Bore Depth	3.1292-3.1308"
Pressure Relief Valve Spring	
Length Compressed @110lbs.	4.640"
Free Length	6.020"

TIGHTENING SPECIFICATIONS

1693

Application	Ft. Lbs.
Cylinder Head Bolts①	
Step One	200
Step Two	330
Step Three	330
Main Bearing Cap Bolts②	75
Connecting Rod Cap Bolts③	50
Vibration Damper-to-Crankshaft	138-159
Flywheel Bolts④	375

① — See cylinder head tightening sequence.
② — Mark each bolt and cap, tighten bolt 120°.
③ — Mark each bolt and nut, tighten nut 180°.
④ — Engine with brakesaver, without brakesaver 265 Ft.Lbs.

3208

Application	Ft. Lbs.
Cylinder Head Bolts①	
Step One — Bolts 1-18	60
Step Two — Bolts 1-18	95
Step Three — Bolts 1-18	95
Bolts 19-22	32
Main Bearing Caps②	30
Connecting Rod Caps③	30
Pulley and Damper	460
Flywheel Bolts	55
Fuel Injection Pump	70

① — See cylinder head tightening sequence.
② — Mark each bolt and cap, tighten bolts 120°.
③ — Mark each bolt and nut, tighten nuts 60°.

3306

Application	Ft. Lbs.
Cylinder Head Bolts①	
Step One — All Numbered Bolts	115
Step Two — All Numbered Bolts	175
Step Three — All Numbered Bolts	175
Step Four — All Bolts in Letter Sequence	22
Step Five — All Bolts in Letter Sequence	32
Step Six — All Bolts in Letter Sequence	32
Main Bearing Caps②	30
Connecting Rod Caps③	30
Crankshaft Hub and Damper	230

① — See cylinder head tightening sequence.
② — Mark each bolt and cap, tighten bolts 90°.
③ — Mark each bolt and nut, tighten nuts 90°.

CATERPILLAR (Cont.)

TIGHTENING SPECIFICATIONS (Cont.)

3406

Application	Ft. Lbs.
Cylinder Head Bolts①	
Step One — Bolts 1-20	200
Step Two — Bolts 1-20	330
Step Three — Bolts 1-20	330
Step Four — Install Rocker Arm Groups	
Step Five — Bolts 21-26	200
Step Six — Bolts 21-26	330
Step Seven — Bolts 21-26	330
Step Eight — Tighten Remaining 12 Bolts	32
Main Bearing Caps②	190
Connecting Rod Caps③	60
Flywheel-to-Crankshaft Bolts	210

① — See cylinder head tightening sequence.
② — Mark each bolt and cap, tighten bolts 120°.
③ — Mark each bolt and nut, tighten nuts 120°.

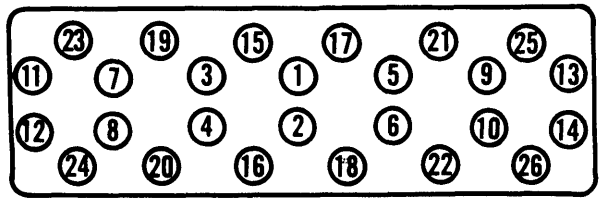
3408

Application	Ft. Lbs.
Cylinder Head Bolts①	
Step One — Bolts 1-14	200
Step Two — Bolts 1-14	330
Step Three — Bolts 1-14	330
Step Four — Install Rocker Arms	
Step Five — Bolts 15-18	200
Step Six — Bolts 15-18	330
Step Seven — Bolts 15-18	330
Step Eight — Nine Small Bolts	32
Main Bearing Caps②	190
Connecting Rod Caps③	60
Flywheel Bolts	200
Vibration Damper	100

① — See cylinder head tightening sequence.
② — Mark each bolt and cap, tighten bolts 120°.
③ — Mark each bolt and nut, tighten nuts 120°.

CYLINDER HEAD TIGHTENING SEQUENCE

1693



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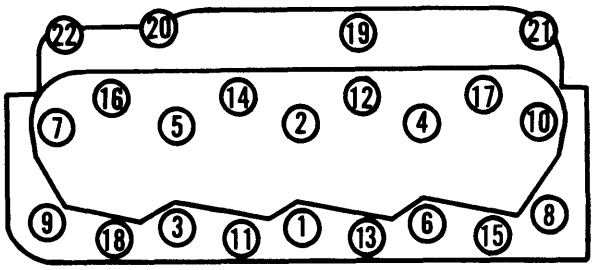

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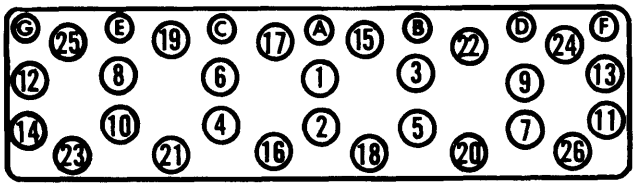
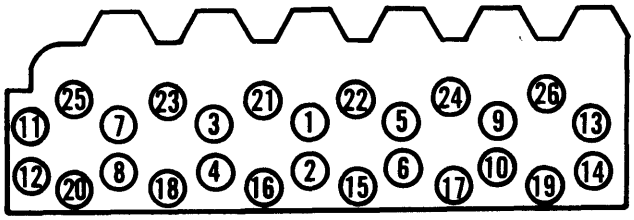


3406



3408