

**SERVICE MANUAL**

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Engines

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6-590  
6T-590  
6TA-590

---

7-67681

1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4

**SERVICE MANUAL**

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TYPE 1-4

# 6-590, 6T-590 and 6TA-590 Engines

## Service Manual Don 7-67681

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Don 7-68021

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# Section 1001

## STANDARD TORQUE SPECIFICATIONS

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Rac 8-71601

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### TORQUE SPECIFICATIONS - DECIMAL HARDWARE

Use the torques in this chart when special torques are not given. These torques apply to fasteners with both UNC and UNF threads as received from suppliers dry, or when lubricated with engine oil. Not applicable if special graphities, Molydisulfide greases, or other extreme pressure lubricants are used.

<b>Grade 5 Bolts, Nuts, and Studs</b>		
		
Size	Pound-Inches	Newton metres
1/4 inch	108 to 132	12 to 15
5/16 inch	204 to 252	23 to 28
3/8 inch	420 to 504	48 to 57
Size	Pound-Feet	Newton metres
7/16 inch	54 to 64	73 to 87
1/2 inch	80 to 96	109 to 130
9/16 inch	110 to 132	149 to 179
5/8 inch	150 to 180	203 to 244
3/4 inch	270 to 324	366 to 439
7/8 inch	400 to 480	542 to 651
1.0 inch	580 to 696	787 to 944
1-1/8 inch	800 to 880	1085 to 1193
1-1/4 inch	1120 to 1240	1519 to 1681
1-3/8 inch	1460 to 1680	1980 to 2278
1-1/2 inch	1940 to 2200	2631 to 2983


<b>Grade 8 Bolts, Nuts, and Studs</b>		
		
Size	Pound-Inches	Newton metres
1/4 inch	144 to 180	16 to 20
5/16 inch	288 to 348	33 to 39
3/8 inch	540 to 648	61 to 73
Size	Pound-Feet	Newton metres
7/16 inch	70 to 84	95 to 114
1/2 inch	110 to 132	149 to 179
9/16 inch	160 to 192	217 to 260
5/8 inch	220 to 264	298 to 358
3/4 inch	380 to 456	515 to 618
7/8 inch	600 to 720	814 to 976
1.0 inch	900 to 1080	1220 to 1465
1-1/8 inch	1280 to 1440	1736 to 1953
1-1/4 inch	1820 to 2000	2468 to 2712
1-3/8 inch	2380 to 2720	3227 to 3688
1-1/2 inch	3160 to 3560	4285 to 4827


**NOTE:** Use thick nuts with Grade 8 bolts.

## TORQUE SPECIFICATIONS - METRIC HARDWARE

Use the following torques when specifications are not given.

These values apply to fasteners with coarse threads as received from supplier, plated or unplated, or when lubricated with engine oil. These values do not apply if graphite or Molydisulfide grease or oil is used.

<b>Grade 8.8 Bolts, Nuts, and Studs</b>		
		
Size	Pound-Inches	Newton metres
M4	24 to 36	3 to 4
M5	60 to 72	7 to 8
M6	96 to 108	11 to 12
M8	228 to 276	26 to 31
M10	456 to 540	52 to 61
Size	Pound-Feet	Newton metres
M12	66 to 79	90 to 107
M14	106 to 127	144 to 172
M16	160 to 200	217 to 271
M20	320 to 380	434 to 515
M24	500 to 600	675 to 815
M30	920 to 1100	1250 to 1500
M36	1600 to 1950	2175 to 2600

<b>Grade 10.9 Bolts, Nuts, and Studs</b>		
		
Size	Pound-Inches	Newton metres
M4	36 to 48	4 to 5
M5	84 to 96	9 to 11
M6	132 to 156	15 to 18
M8	324 to 384	37 to 43
Size	Pound-Feet	Newton metres
M10	54 to 64	73 to 87
M12	93 to 112	125 to 150
M14	149 to 179	200 to 245
M16	230 to 280	310 to 380
M20	450 to 540	610 to 730
M24	780 to 940	1050 to 1275
M30	1470 to 1770	2000 to 2400
M36	2580 to 3090	3500 to 4200

## Grade 12.9 Bolts, Nuts, and Studs



Usually the torque values specified for grade 10.9 fasteners can be used satisfactorily on grade 12.9 fasteners.

## TORQUE SPECIFICATIONS - STEEL HYDRAULIC FITTINGS

Tube OD Hose ID	Thread Size	Pound- Inches	Newton metres
<b>37 Degree Flare Fitting</b>			
1/4 inch 6.4 mm	7/16-20	72 to 144	8 to 16
5/16 inch 7.9 mm	1/2-20	96 to 192	11 to 22
3/8 inch 9.5 mm	9/16-18	120 to 300	14 to 34
1/2 inch 12.7 mm	3/4-16	180 to 504	20 to 57
5/8 inch 15.9 mm	7/8-14	300 to 696	34 to 79
Tube OD Hose ID	Thread Size	Pound- Inches	Newton metres
3/4 inch 19.0 mm	1-1/16-12	40 to 80	54 to 108
7/8 inch 22.2 mm	1-3/16-12	60 to 100	81 to 135
1.0 inch 25.4 mm	1-5/16-12	75 to 117	102 to 158
1-1/4 inch 31.8 mm	1-5/8-12	125 to 165	169 to 223
1-1/2 inch 38.1 mm	1-7/8-12	210 to 250	285 to 338

Tube OD Hose ID	Thread Size	Pound- Inches	Newton metres
<b>Straight Threads with O-ring</b>			
1/4 inch 6.4 mm	7/16-20	144 to 228	16 to 26
5/16 inch 7.9 mm	1/2-20	192 to 300	22 to 34
3/8 inch 9.5 mm	9/16-18	300 to 480	34 to 54
1/2 inch 12.7 mm	3/4-16	540 to 804	57 to 91
Tube OD Hose ID	Thread Size	Pound- Inches	Newton metres
5/8 inch 15.9 mm	7/8-14	58 to 92	79 to 124
3/4 inch 19.0 mm	1-1/16-12	80 to 128	108 to 174
7/8 inch 22.2 mm	1-3/16-12	100 to 160	136 to 216
1.0 inch 25.4 mm	1-5/16-12	117 to 187	159 to 253
1-1/4 inch 31.8 mm	1-5/8-12	165 to 264	224 to 357
1-1/2 inch 38.1 mm	1-7/8-12	250 to 400	339 to 542

<b>Split Flange Mounting Bolts</b>		
Size	Pound- Inches	Newton metres
5/16-18	180 to 240	20 to 27
3/8-16	240 to 300	27 to 34
7/16-14	420 to 540	47 to 61
Size	Pound- Feet	Newton metres
1/2-13	55 to 65	74 to 88
5/8-11	140 to 150	190 to 203

## TORQUE SPECIFICATIONS - STEEL HYDRAULIC FITTINGS

Nom. SAE Dash Size	Tube OD	Thread Size	Pound-Inches	Newton metres	Thread Size	Pound-Inches	Newton metres
<b>O-ring Face Seal End</b>					<b>O-ring Boss End Fitting or Lock Nut</b>		
-4	1/4 inch 6.4 mm	9/16-18	120 to 144	14 to 16	7/16-20	204 to 240	23 to 27
-6	3/8 inch 9.5 mm	11/16-16	216 to 240	24 to 27	9/16-18	300 to 360	34 to 41
-8	1/2 inch 12.7 mm	13/16-16	384 to 480	43 to 54	3/4-16	540 to 600	61 to 68
					Thread Size	Pound-Inches	Newton metres
-10	5/8 inch 15.9 mm	1-14	552 to 672	62 to 76	7/8-14	60 to 65	81 to 88
Nom. SAE Dash Size	Tube OD	Thread Size	Pound-Inches	Newton metres	1-1/16-12	85 to 90	115 to 122
					1-3/16-12	95 to 100	129 to 136
-12	3/4 inch 19.0 mm	1-3/16-12	65 to 80	90 to 110	1-5/16-12	115 to 125	156 to 169
-14	7/8 inch 22.2 mm	1-3/16-12	65 to 80	90 to 110	1-5/8-12	150 to 160	203 to 217
-16	1.0 inch 25.4 mm	1-7/16-12	92 to 105	125 to 140	1-7/8-12	190 to 200	258 to 271
-20	1-1/4 inch 31.8 mm	1-11/16-12	125 to 140	170 to 190			
-24	1-1/2 inch 38.1 mm	2-12	150 to 180	200 to 254			

**NOTE:** 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.

# Section 2401

## SPECIFICATION DETAILS 6-590 Diesel Engine

**CASE CORPORATION**  
700 State Street  
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**CASE CANADA CORPORATION**  
3350 SOUTH SERVICE ROAD  
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**NOTE:** 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.

## RUN-IN INSTRUCTIONS

### Engine Lubrication

Fill the 6-590 engine crankcase with CC/SF, CD/SF, CE/SF or CF-4 service classification oil. Use the correct viscosity rating for the ambient air temperature. Install new oil filters after the engine is rebuilt.

Fill the 6T590 and the 6TA 590 engine crankcase with CE/SF or CF-4 service classification oil. Use the correct viscosity rating for the ambient air temperature. Install new oil filters after the engine is rebuilt.

### Run-In Procedure for Rebuilt Engine

Step 1 Disconnect the wire to the electric shut-off on the injection pump so that the engine will not start. Crank the engine for 30 seconds until there is oil pressure, then reconnect the wire.

Step 2 Remove the air from the cooling system at the temperature sending unit.

Step 3 Run the engine at 1000 RPM minimum load for 5 minutes and check for oil leaks.

Step 4 During the Run-In, continue to check the oil pressure, coolant level, and coolant temperature.

### Run-In Procedure for Rebuilt Engines (with a Dynamometer)

The following procedure must be followed when using a PTO dynamometer to Run-In the engine. The dynamometer will control the engine load at each speed and will remove stress on new parts during Run-In.

During the Run-In, continue to check the oil pressure, coolant level and coolant temperature.

STEP	TIME	ENGINE SPEED	DYNAMOMETER SCALE LOAD
1	5 Minutes	1000 RPM	50
2	5 Minutes	1100 RPM	1/2
3	5 Minutes	2200 RPM	Full

### Run-In Procedure for Rebuilt Engines (without a Dynamometer)

STEP	TIME	ENGINE SPEED	LOAD
1	5 Minutes	1000 RPM	No Load
2	5 Minutes	1100 RPM	Light Load
3	5 Minutes	2200 RPM	Light Load

### Run-In Procedure (Agriculture Equipment)

For the first 8 hours of field operation stay one gear lower than normal. For the next 12 hours DO NOT "lug" the engine. Prevent "lugging" by moving the lever to a lower gear. The engine must not be "lugged" below the rated engine RPM during early hours of life.

### Run-In Procedure (Construction Equipment)

For the first 8 hours, operate the engine at full throttle maintaining a normal load. Avoid converter or hydraulic stall. The engine must not be "lugged" below the Rated Engine RPM (Do not stall the engine more than 10 seconds).

## IDENTIFICATION MARKS

### Crankshaft

Letter N = Nitroc Hardened, crankshaft must be rehardened to a minimum hardness of 450 HV 0.2 rockwell any time the crankshaft has been reconditioned.

### Cylinder Block

Letter X = The cylinder block has been refaced and up to 0.25 mm has been removed. Use a thicker head gasket (two notches).

Letter XX = The cylinder block has been refaced and up to 0.50 mm has been removed. Use a thicker head gasket (three notches).

### Cylinder Head

Letter G = Thermostat passage in cylinder did not need to be machined.

Letter M = Thermostat passage in cylinder head was machined.

Letter V = Valve seats have been machined.

Letter X = The cylinders in the cylinder block have been bored oversize. Use this gasket for standard replacement and oversize cylinder holes (one notch).

Letter XX = The cylinder block has been refaced and up to 0.25 mm has been removed use a thicker head gasket (two notches).

Letter XXX = The cylinder block has been refaced and up to 0.50 mm has been removed. Use a thicker head gasket (three notches).

Numbers = RH rear corner of cylinder head indicates the amount of material removed from the cylinder head.

## ENGINE SPECIFICATION DETAILS

### Cylinder Block

	Metric Value
Type .....	Parent Bore
Material .....	Cast Iron
ID of Cylinder .....	102.00 to 102.04 mm
Maximum Service Limit .....	102.116 mm
Cylinder Out of Round (Maximum) .....	0.038 mm
Cylinder Taper (Maximum) .....	0.076 mm
0.5 mm Oversize Piston	
Machine Cylinder Bore to .....	102.40 to 102.44 mm
Hone to (Finished Diameter) .....	102.50 to 102.54 mm
1.00 mm Oversize Piston	
Machine Cylinder Bore to .....	102.90 to 102.94 mm
Hone to (Finished Diameter) .....	103.00 to 103.04 mm
Warpage (Maximum) .....	0.075 mm
Maximum Material Removal .....	0.50 mm

## Service Cylinder Sleeve

Type .....	Dry, Can Be Replaced
Material .....	Cast Iron
Machine Cylinder Block Bore to .....	104.485 to 104.515 mm
Installation .....	Press Fit
Machine Sleeve Bore to:	
Standard Size Piston (Finished Diameter) .....	102.00 to 102.04 mm
0.5 mm Oversize Piston	
Machine Cylinder Bore to .....	102.40 to 102.44 mm
Hone to (Finished Diameter) .....	102.50 to 102.54 mm
1.0 mm Oversize Piston	
Machine Cylinder Bore to .....	102.90 to 102.94 mm
Hone to (Finished Diameter) .....	103.00 to 103.04 mm
Main Bearing Bolt Maximum Length .....	119.25 mm

## Piston

Type .....	Cam Ground
Material .....	Aluminum Alloy
OD at 12 mm From the Bottom, 90 Degrees Piston Pin	
Standard Size Piston .....	101.873 to 101.887 mm
Minimum Service Limit .....	101.823 mm
0.5 mm Oversize Piston .....	102.373 to 102.387 mm
Minimum Service Limit .....	101.323 mm
1.0 mm Oversize Piston .....	102.873 to 102.887 mm
Minimum Service Limit .....	102.823 mm
ID of Piston Pin Bore .....	40.006 to 40.012 mm Maximum Service Limit 40.025 mm
Width of 1st Ring Groove (Top) .....	2.465 to 2.485 mm
Width of 2nd Ring Groove (Intermediate) .....	2.425 to 2.445 mm
Width of 3rd Ring Groove (Oil Ring) .....	4.040 to 4.060 mm
Protrusion Above Cylinder Block Without Block Machining (Maximum) .....	0.660 mm

## Piston Pin

Type .....	Full Float
Pin Length	
Short Style .....	75.42 to 75.80 mm
Long Style .....	82.42 to 82.94 mm
OD of Pins .....	39.997 to 40.003 mm
Minimum Service Limit .....	39.990 mm

## Piston Rings

No. 1 Compression 6T-590 and 6TA-590 Engine .....	Key Stone Type (Barrel Face)
End Gap in 102.02 ID .....	0.4 to 0.70 mm
No. 1 Compression 6-590 Engine .....	Rectangular Type (Barrel Face)
End Gap in 102.02 ID .....	0.25 to 0.55 mm
Maximum Service Limit .....	0.806 mm
Side Clearance .....	0.075 to 0.120 mm
Maximum Service Limit .....	0.15 mm
No. 2 Compression .....	Rectangular Type (Tapper Face)
End Gap in 102.02 ID .....	0.25 to 0.55 mm
Maximum Service Limit .....	0.806 mm
Side Clearance .....	0.075 to 0.120 mm
Maximum Service Limit .....	0.15 mm
No. 3 Oil Control Rings .....	Two Piece
End Gap in 102.02 ID .....	0.25 to 0.55 mm
Maximum Service Limit .....	0.806 mm
Side Clearance .....	0.130 mm

## Cylinder Head

Cylinder Head Height (New) .....	94.75 to 95.25 mm
Warpage (Maximum) .....	0.20 mm
Maximum Material Removal .....	1.00 mm
Minimum Head Height .....	93.75 mm

### Engines Manufactured in U.S.A.:

Prior to Engine Serial Number 45511034 .....	Injector Nozzle 9 mm
Engine Serial Number 45511034 and After .....	Injector Nozzle 7 mm

### Engines Manufactured in Darlington England:

Prior to Engine Serial Number 21092870 .....	Injector Nozzle 9 mm
Engine Serial Number 21092870 and After .....	Injector Nozzle 7 mm

### Engines Manufactured in Neuss Germany:

Prior to Engine Serial Number 52107489 .....	Injector Nozzle 9 mm
Engine Serial Number 52107489 and After .....	Injector Nozzle 7 mm

## Lifters

Material .....	Hardened Iron
OD of Lifter .....	15.961 to 15.977 mm
Minimum Service Limit .....	15.960 mm
Bore Diameter in Block .....	16.000 to 16.030 mm
Maximum Service Limit .....	16.055 mm

## Cylinder Block

Maximum (Warpage) .....	0.075 mm
Maximum Material Removal .....	0.50 mm

## Connecting Rod

Bushing .....	Steel Backed Leaded Bronze
Bushing ID Installed (Ream to Size) .....	40.053 to 40.067 mm
Maximum Service Limit .....	40.092 mm
Bearing Liners .....	Replaceable
Journal ID Without Bearing Liners .....	72.987 to 73.013 mm
Bearing Oil Clearance .....	0.038 to 0.116 mm
Maximum Service Limit .....	0.129 mm
Side Clearance .....	0.100 to 0.300 mm
Maximum Service Limit .....	0.330 mm
Connecting Rod Bend (Maximum)	
Without Bushing .....	0.200 mm
With Bushing .....	0.150 mm
Connecting Rod Twist (Maximum)	
Without Bushing .....	0.500 mm
With Bushing .....	0.300 mm
Connecting Rod Bolt Maximum Length .....	59.25 mm

## Crankshaft

Type .....	Hardened Steel, Balanced
Main Bearing Liners .....	Replaceable
End Clearance, Center Main Bearing Cap .....	0.13 to 0.25 mm
Center Main Bearing Thrust Surface Thickness	
Standard .....	2.50 mm
0.50 Over Width .....	2.72 to 2.78 mm
1.00 Over Width .....	2.97 to 3.03 mm
Connecting Rod Journal	
OD, Standard .....	68.987 to 69.013 mm
Maximum Service Limit .....	68.962 mm
0.25 mm OD Undersize, Grind to .....	68.737 to 68.763 mm
Maximum Service Limit .....	68.712 mm
0.50 mm OD Undersize, Grind to .....	68.487 to 68.513 mm
Maximum Service Limit .....	68.462 mm
0.75 mm OD Undersize, Grind to .....	68.237 to 68.263 mm
Maximum Service Limit .....	68.212 mm
1.00 mm OD Undersize, Grind to .....	67.987 to 68.013 mm
Maximum Service Limit .....	67.962 mm
Connecting Rod Journal Maximum Taper .....	0.013 mm
Journals Out of Round Maximum .....	0.050 mm
Undersize Main Bearing Liners For Service .....	0.25, 0.50, 0.75 and 1.00 mm
Main Bearing Oil Clearance .....	0.041 to 0.119 mm
Maximum Service Limit .....	0.140 mm
Main Bearing Journal	
OD, Standard .....	82.987 to 83.013 mm
Maximum Service Limit .....	82.962 mm
0.25 mm OD Undersize, Grind to .....	82.737 to 82.763 mm
Maximum Service Limit .....	82.712 mm
0.50 mm OD Undersize, Grind to .....	82.487 to 82.513 mm
Maximum Service Limit .....	82.462 mm
0.75 mm OD Undersize, Grind to .....	82.237 to 82.263 mm
Maximum Service Limit .....	82.212 mm
1.00 mm OD Undersize, Grind to .....	81.987 to 82.013 mm
Maximum Service Limit .....	81.962 mm
Main Bearing Journal Bore ID No Liners .....	87.982 to 88.018 mm
Maximum Service Limit .....	88.031 mm
Main Bearing Thrust Surfaces	
Standard .....	37.475 to 37.576 mm
0.25 mm Oversize .....	37.725 to 37.826 mm
0.50 mm Oversize .....	37.975 to 38.076 mm
Main Journal Width:	
1st, 2nd, 3rd, 5th .....	37.424 to 37.576 mm
4th .....	37.475 to 37.525 mm
Main Bearing Shell Thickness (Standard) .....	2.438 to 2.464 mm
Connect Rod Journals Width .....	38.950 to 39.050 mm

## Camshaft

Type .....	Hardened Iron
Bushing (Front Only) .....	1, Replaceable
Bushing Lubrication:	
Front Bushing .....	Pressure Lubricated
Intermediate .....	Pressure Lubricated
Rear .....	Pressure Lubricated
Oil Clearance .....	0.076 to 0.152 mm
ID of No. 1 Bushing, Installed .....	54.107 to 54.133 mm
Maximum Service Limit .....	54.146 mm
ID of No. 1 Oversize (57.24 mm OD) Service Bushing .....	54.089 to 54.139 mm
Maximum Service Limit .....	54.146 mm
ID of No. 2, 3, 4 and 5 Service Bushing .....	54.089 to 54.139 mm
Maximum Service Limit .....	54.146 mm
Width of No. 1 Bushing .....	25.15 to 25.65 mm
Width of No. 2, 3, 4 and 5 Service Bushing .....	17.75 to 18.25 mm
Camshaft Bushing Journal OD .....	53.987 to 54.013 mm
Camshaft Bore Diameter in Block	
No. 1 Bushing .....	57.222 to 57.258 mm
No. 1 Oversize Bushing, Machine to .....	57.722 to 57.758 mm
No. 2, 3, 4 and 5, Less Bushings .....	54.089 to 54.139 mm
No. 2, 3, 4 and 5 Oversize for Bushings, Machine to .....	57.222 to 57.258 mm
Camshaft Thrust Plate Thickness .....	9.4 to 9.6 mm
Minimum Service Limit .....	9.34 mm
Camshaft Thrust Clearance .....	0.130 to 0.340 mm
Maximum Service Limit .....	0.470 mm
Camshaft Lobes:	
Minimum Diameter at Peak Intake .....	47.040mm
Minimum Diameter at Peak Exhaust .....	46.770 mm

## Turbocharger

Axial Clearance	
Before SN 840638 .....	0.10 to 0.16 mm
SN 840638 and After .....	0.03 to 0.08 mm
Radial Clearance .....	0.30 to 0.46 mm
Wastegate Rod Travel at 191 kPa (27.7 psi) Applied Pressure .....	0.33 to 1.3 mm

## Gear Train

### Backlash:

Crankshaft Gear to Camshaft Gear .....	0.08 to 0.33 mm
Crankshaft Gear to Idler Gear .....	0.08 to 0.33 mm
Camshaft to Fuel Pump Gear .....	0.08 to 0.33 mm
Idler Gear to Oil Pump .....	0.08 to 0.33 mm
Camshaft to Auxiliary .....	0.08 to 0.33 mm
Maximum Service Limit (All Gears) .....	0.45 mm



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