

**MODEL 145 (LOWER) ENGINE SYSTEM
TEMPERATURES AND PRESSURES**

Lubrication Oil System

Pressure At Normal Operating Temperature

At Governor Connection (Nominal) 40 - 70 psi

Temperature

T1, To Engine (from cooler) 175° - 200° F

T2, From Engine (to cooler) 195° - 200° F

T, Temperature Differential 20° - 25° F

Alarm Settings

ELoS, Engine Lube Oil Switch

Rated Speed 17 - 21 psi

Idle Speed 5 - 9 psi

ELOT, Engine Lube Oil High Temperature

Switch (into engine) 220° F

Fresh Water System

Pressure Rise Across Fresh Water Pump At 900 RPM
(minimum 0 psi at pump inlet)

8 Cylinder 45 ± 3 psi

12 Cylinder 53 ± 3 psi

16 Cylinder 45 ± 3 psi

Temperature

T1, To Engine 165° - 180° F

T2, From Engine 175° - 190° F

T, Temperature Differential 8° - 15° F

T3, From Fresh Water Cooler

To Lube Oil Cooler 150° - 165° F

Alarm Setting

EWT, Engine Water Temperature
(from engine) 200° F

Raw Water System

Pressure Rise Across Raw Water Pump At 900 RPM
(maximum suction-2 psi at pump inlet)

With Gear Cooler

8 Cylinder 41 ± 2 psi

12 Cylinder 43 ± 2 psi

16 Cylinder 43 ± 2 psi

Without Gear Cooler

8 Cylinder 46.5 ± 2 psi

12 Cylinder 47 ± 2 psi

16 Cylinder 47 ± 2 psi

Design Temperature

T1, To Fresh Water Cooler (maximum) 85° F

T2-T1, Raw Water Temperature Rise Across
Fresh Water Cooler

8 Cylinder 11° - 17° F

12 Cylinder 7° - 13° F

16 Cylinder 9° - 15° F

Fuel System

Pressure

G1, At Filter Outlet (to engine) 12 - 25 psi

Card 3 of 3

Connecting rod basket 102 75

Piston cooling oil pipe bolts 27 20

Water jumper-to-liner 41 30

Water jumper saddle strap nuts 20 15

Damper/balancer-to-crankshaft 678 500

Bolt-on crankshaft stubshaft*
(where applicable) 678 500

Bolt-on cranshaft stubshaft
retention bolts 81 60

Accessory drive gear to crankshaft*

7/8" 678 500

3/4" 407 300

5/8" 217 160

Accessory drive gear oil slinger 33 24

Coupling disc-to-crankshaft

8, 12, & 16 cyl 2440 1800

20 cyl 1830 1350

Coupling disc rim bolts 400 295

Handhole cover bolts 27-41 20-30

Engine mounting bolts 617 455

Engine mounting bolts w/sleeves 881 650

*Lubricate with Texaco Threadex No. 2303

**Lubricate with Fel-Pro C5A or equivalent



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Exhaust manifold-to-crankcase*

Initial 68 50

Final 176 130

(recheck after 6 months)

Exhaust manifold connector bolts 108 80

(recheck after 6 months)

Exhaust manifold inspection cover
(when equipped) 108 80

ACCESSORY END

Accessory drive housing-to-crankcase & oil pan 88 65

Overspeed trip housing-to-crankcase 88 65

Water pump mounting bolts 88 65

Water pump elbows 88 65

Scavenging oil pump mounting bolts 88 65

Scavenging oil pump elbows 88 65

Lube oil pump mounting bolts 88 65

Lube oil pump elbows 88 65

Oil strainer housing mounting bolts 88 65

Governor drive housing mounting bolts 88 65

Governor-to-drive housing 88 65

Overspeed trip cover-to-overspeed
trip housing 41 30

Fuel manifolds-to-filter 47 35

Oil strainer elbows-to-strainer housing 54 40

Accessory drive oil seal cover 54 40

Accessory drive coupling

Single retaining bolt design

Initial 136 100

Final 678 500

Three retaining bolt design 393 290

Accessory drive flange locking spring bolt 88 65

Governor drive gear assembly

Stubshaft-to-crankcase 102 75

Stubshaft dowel bolts 23 17

Oil jumper-to-stubshaft 47 35

Retainer plate-to-stubshaft 47 35

Governor drive flange-to-drive gear 47 35

CAMSHAFT DRIVE END

Piston cooling manifold

flange-to-crankcase 37 27

Idler gear stubshaft bracket-to-crankcase

1/2" 122 90

3/8" 37 27

5/16" (dowel bolts) 23 17

No. 1 idler gear thrust plate

1/2" (to stubshaft) 102 75

5/8" (to crankcase) 251 185

Camshaft drive gear and counterweight-to-camshaft

1/2" 122 90

5/16" (dowel bolts) 23 17

**MODEL 645 (TURBO) ENGINE-SYSTEM
TEMPERATURES AND PRESSURES
Lubrication Oil System**

Pressure At Normal Operating Temperature	
At Governor Connection (nominal)	60 - 100 psi
Temperature	
T1, To Engine (from cooler)	175° - 195° F
T2, From Engine (to cooler)	195° - 220° F
T, Temperature Differential	20° - 25° F

Alarm Settings

ELOS, Engine Lube Oil Switch	
Rated Speed	26 - 30 psi
Idle Speed	10 - 14 psi
LO2, Soak Back Pump Low Oil Pressure (rising pressure)	10 psi
ELOT, Engine Lube Oil High Temperature Switch (into engine)	220° F

Fresh Water System

Pressure Rise Across Fresh Water Pump At 900 RPM

(minimum 0 psi at pump inlet)

8 Cylinder	47 ± 3 psi
12 Cylinder	48 ± 3 psi
16 Cylinder	55 ± 3 psi
20 Cylinder	55 ± 3 psi

Temperature

T1, To Engine	165° - 180° F
T2, From Engine	175° - 190° F
T, Temperature Differential	8° - 15° F
T3, From Fresh Water Cooler To Lube Oil Cooler	150° - 165° F

Alarm Setting

EWT, Engine Water Temperature (from engine)	200° F
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Temperature

T, Oil to Water	25° F Max.
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Raw Water System

Pressure Rise Across Raw Water Pump At 900 RPM

(maximum suction-2 psi at pump inlet)

With Gear Cooler

8 Cylinder	43 ± 2 psi
12 Cylinder	43 ± 2 psi
16 Cylinder	32 ± 2 psi
20 Cylinder	32 ± 2 psi

Without Gear Cooler

8 Cylinder	47 ± 2 psi
12 Cylinder	47 ± 2 psi
16 Cylinder	41 ± 2 psi
20 Cylinder	32 ± 2 psi

Design Temperature

T1, To Fresh Water Cooler (max.)	85° F
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T2-T1, Raw Water Temperature Across

Fresh Water Cooler

8 Cylinder	7° - 13° F
12 Cylinder	11° - 17° F
16 Cylinder	13° - 19° F
20 Cylinder	17° - 23° F

Fuel System

G1, At Filter Outlet (to engine)	12 - 25 psi
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N • m Ft-Lbs

Camshaft drive housing-to-crankcase	88	65
Oil manifold-to-oil manifold	50	37
Oil manifold-to-crankcase	43	32
Oil slinger-to-crank shaft gear	23	17
Oil retainer-to-camshaft drive housing	41	30

TURBO ENGINES ONLY

Turbocharger mounting bolts-		
3/4"	238	175
1/2"	88	65
Air ducts-to-turbocharger	81	60
Air ducts-to-crankcase	88	65
Auxiliary drive-to-turbocharger		
3/8"	32	24
1/2"	88	65
Aftercooler-to-air duct	61	45
Aftercooler support pad bolts	176	130
Turbocharger-to-manifold*	122	90
Water piping-to-aftercooler	47	35
Water piping-to-engine	47	35
Oil separator bolts, attaching	122	90
Oil separator expansion joint	35	25
Camshaft drive housing-to-crankcase lockwire anchor bolts	88	65

BLOWER ENGINES ONLY

Blower rotor shaft nut	678	500
Blower timing gear cover nut	47	35
Blower end plate-to-housing nuts	88	65
Blower support-to-crankcase	88	65
Blower-to-support	88	65
Blower drain lines	88	65
Auxiliary drive housing-to-crankcase	238	175
Blower drive gear stubshaft bracket-to-crankcase	122	90
Camshaft drive gear cover-to-housing	88	65

CRANKCASE AND OIL PAN

Main bearing nuts*		
Initial	475-	350-
	542	400
Final	1017	750
Crankcase-to-oil pan		
Initial	136	100
Final	610	450
Connecting rod-to-piston pin*	610	450
Piston pin retainer bolts*		
1/4" Bolts	16.2	12
5/16" Bolts	38	28
Basket-to-connecting rod*		
Initial	13	10
Final	258	190



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ENGINE PARTS SPECIALISTS

**EMD®
DIESEL ENGINE BOLT TORQUES
(Metric & English)**

Note: When torque values are listed as "initial" and "final," torquing procedures in the engine manual MUST be followed.

TOP DECK

N • m Ft-Lbs

Camshaft stubshaft bearing bracket bolts-		
5/8" hex head	285	210
1/2" socket head	102	75
Cylinder head crab nuts (studs & nuts)*		
Initial	407	300
Final (except 645EC engines)	2440	1800
Final (645EC engines)	3254	2400
All engines w/ heavy crab plates	3254	2400
Injector crab nuts*	68	50
Cylinder head-to-liner nuts*		
Initial	95	70
Final	325	240
Top deck head frame bolts		
280m bolts with captive lockwasher & plain washer	41	30
300m bolts with hardened washers	54	40
Overspeed trip mechanism	32	24
Injector fuel lines	54	40
Camshaft bearing blocks	43	32
Rocker arm shaft nuts*		
Initial	203	150
Final	407	300
Fuel manifold blocks	54	40
Cylinder test valve packing nut	88	65
Water outlet elbow-to-head bolts	41	30