SECTION 303-01C Engine — 6.0L Diesel

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SPECIFICATIONS

Material

Item	Specification	Fill Capacity
Gasket Maker TA-16	WSK-M2G348-A5	—
Motorcraft® Heavy Truck PAG Refrigerant Compressor Oil YN-24	WST-M1C231-B2	—
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A	—
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	—	—
Motorcraft® Premium Gold Engine Coolant VC-7-B (US); CVC-7-B (Canada); or equivalent	WSS-M97B51-A1	—
Motorcraft® SAE 15W-40 Super Duty Diesel Motor Oil XO-15W40-QSD (US); CXO-15W40-LSD12 (Canada); or equivalent	WSS-M2C171-E	14.1L (15 qt) with filter
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B	—
Penetrating and Lock Lubricant (US); Penetrating Fluid (Canada) XL-1 (US); CXC-51-A (Canada)	—	—
RTV Silicone Sealant TA-31	—	—
Motorcraft® R-134a Refrigerant YN-19 (US); CYN-16-R (Canada)	WSH-M17B19-A	—
Threadlock 262 TA-26	WSK-M2G351-A6	—
Thread Sealant with PTFE TA-24	WSK-M2G350-A2	—

General Specifications

Item	Specification
General Specifications — Engine	
Displacement	6.0 liter (365 cubic inch)
Number of cylinders	8
Bore	95 mm (3.74 in)
Stroke	105 mm (4.13 in)
Firing order	1-2-7-3-4-5-6-8
Oil pressure — minimum	82.7 kPa (12 psi) at 700 rpm, 165.5 kPa (24 psi) at 1,200 rpm and 310.3 kPa (45 psi) at 1,800 rpm with engine at operating temperature
Oil capacity	14.1 liters (15 quarts) with filter
Compression ratio	18.0:1
Cylinder head and valve train	
Cylinder head gasket surface flatness [a]	0.1 mm (0.004 in)
Cylinder head thickness — minimum	95 mm (3.74 in)
Combustion chamber volume	—
Valve arrangement (front to rear)	—
Valve guide bore diameter	7.003-7.029 mm (0.276-0.277 in)
Valve stem diameter	6.947-6.965 mm (0.2735-0.272 in)
Valve stem-to-guide clearance	0.140 mm (0.0055 in) maximum

SPECIFICATIONS (Continued)

General Specifications (Continued)

Item	Specification
Valve head diameter	—
Valve face runout (TIR max)	0.038 mm (0.015 in)
Valve face angle	Exhaust — 37.5 degrees
Valve face angle	Intake — 30 degrees
Valve seat width	Exhaust — 1.80-2.56 mm (0.071-0.101 in)
Valve seat width	Intake — 1.48-2.24 mm (0.058-0.088 in)
Valve seat runout	0.0035 mm (0.0014 in)
Valve seat angle	Exhaust — 37.5 degrees
Valve seat angle	Intake — 30 degrees
Valve spring free length	51.96 mm (2.045 in)
Valve spring solid height	36.1 mm (1.42 in)
Valve spring compression pressure	46.30 mm @ 340 ± 17 N (1.82 in 76.5 ± 3.8 lb-ft)
Valve spring compression pressure	383 mm (15.07 in) @ 858 ± 43 N (1.51 in @ 191 ± 9.7 lb)
Valve spring installed height	—
Valve spring installed pressure	—
Roller follower ratio	—
Hydraulic lash adjuster	
Diameter	—
Clearance to bore	—
Service limit	—
Hydraulic leakdown rate	—
Collapsed lash adjuster gap	—
Camshaft	
Gear backlash	0.179-0.315 mm (0.007-0.012 in)
Lobe lift	Intake — 5.744 mm (0.2261 in)
Lobe lift	Exhaust — 5.832 mm (0.2296 in)
Allowable lobe lift loss	0.51 mm (0.02 in)
Journal diameter	61.987-62.013 mm (2.440-2.441 in)
Camshaft journal bearing inside diameter	62.05-62.14 mm (2.443-2.446 in)
Camshaft journal-to-bearing clearance	0.037-0.153 mm (0.0015-0.0060 in)
Runout	—
End play	0.051-0.211 mm (0.002-0.008 in)
Cylinder block	
Cylinder bore diameter	94.999-95.001 mm (3.7401-3.7402 in)
Cylinder bore maximum taper	0.076 mm (0.003 in)
Cylinder bore maximum out-of-round	0.05 mm (0.002 in)
Main bearing bore inside diameter	85.99-86.01 mm (3.3854-3.3862 in)
Camshaft bearing bore inside diameter	65.98-66.02 mm (2.597-2.599 in)
Head gasket surface flatness	0.10 mm (0.004 in) across the total area 0.05 mm (0.002 in) across any 150 mm (5.9 in) x 150 mm (5.9 in) area 0.025 mm (0.001 in) across any 25 mm (0.98 in) x 25 mm (0.98 in) area
Crankshaft	
Main bearing journal diameter— Standard size	80.9873-81.0127 mm (3.188-3.150 in)
Main bearing journal diameter— 0.254 mm (0.010 in) undersize	80.7333-80.7587 mm (3.178-3.140 in)
Main bearing journal diameter— 0.508 mm (0.020 in) undersize	80.4793-80.5047 mm (3.168-3.130 in)

SPECIFICATIONS (Continued)

General Specifications (Continued)

Item	Specification
Main bearing journal diameter— 0.762 mm (0.030 in) undersize	80.2253-80.2507 mm (3.158-3.120 in)
Main bearing journal maximum taper	—
Main bearing journal maximum out-of-round	—
Main bearing journal-to-cylinder block clearance	0.020-0.086 mm (0.0008-0.0034 in)
Connecting rod journal diameter	
Standard size	68.99 to 69.01 mm (2.716 to 2.717 in)
0.254 mm (0.010 in) undersize	68.73 to 68.75 mm (2.706 to 2.707 in)
0.508 mm (0.020 in) undersize	68.48 to 68.50 mm (2.696 to 2.697 in)
0.762 mm (0.030 in) undersize	68.23 to 68.25 mm (2.686 to 2.687 in)
Connecting rod journal maximum taper	—
Connecting rod journal maximum out-of-round	—
Crankshaft maximum end play	0.508 mm (0.020 in)
Piston and connecting rod	
Piston diameter— Standard size	94.9460-94.9186 mm (3.737-3.738 in)
Piston diameter— 0.254 mm (0.010 in) oversize	95.1738-95.1992 mm (3.747-3.748 in)
Piston diameter— 0.508 mm (0.020 in) oversize	95.4278-95.4532 mm (3.757-3.758 in)
Piston diameter — 0.762 mm (0.030 in) oversize	95.6818-95.7072 mm (3.767-3.768 in)
Piston-to-cylinder bore clearance	0.0441-0.0909 mm (0.0017-0.0036 in)
Piston ring end gap— top compression	0.29-0.55 mm (0.011-0.021 in)
Piston ring end gap— intermediate compression	1.40-1.66 mm (0.055-0.065 in)
Piston ring end gap— oil control	0.24-0.50 mm (0.009-0.019 in)
Piston ring groove width (measured over 2.08 mm (0.082 in) gauge pins)	Upper limit — 94.469 mm (3.7192 in)
Piston ring groove width (measured over 2.08 mm (0.082 in) gauge pins)	Replacement limit — 94.290 mm (3.7122 in)
Piston ring width	—
Piston ring-to-groove clearance	—
Piston pin bore diameter	—
Piston pin diameter	33.9975-34.0025 mm (1.3385-1.3387 in)
Piston pin length	65.073-65.327 mm (2.5619-2.5719 in)
Piston pin-to-piston fit	0.013-0.022 mm (0.0005-0.0009 in)
Connecting rod-to-pin clearance	—
Connecting rod pin bore diameter	—
Connecting rod length (center-to-center)	176 mm (6.929 in)
Connecting rod maximum allowed bend	—
Connecting rod maximum allowed twist	—
Connecting rod bearing bore diameter	72.987-73.013 mm (2.8735-2.8745 in)
Connecting rod bearing-to-crankshaft clearance	0.0203-0.0837 mm (0.0008-0.0033 in)
Connecting rod side clearance	0.3-0.6 mm (0.012-0.024 in)
Exhaust manifold warpage — maximum allowable clearance (cold)	0.0762 mm (0.003 in)
Intake manifold warpage — between ports	0.13 mm (0.005 in)
Intake manifold warpage — total	0.25 mm (0.0010 in)
Oil pump end clearance (inner and outer rotor to housing)	0.025-0.095 mm (0.001-0.004 in)
Oil pump radial clearance (between outer rotor and housing)	0.17-0.295 mm (0.007-0.012 in)
Vibration damper face runout (max)	0.635 mm (0.025 in)
Vibration damper rubber bulging (max)	1.5 mm (0.059 in)

SPECIFICATIONS (Continued)

General Specifications (Continued)

Item	Specification
Push rod runout (max)	0.25 mm (0.01 in)
Piston height above crankcase deck (protrusion)	0.9000 mm (0.0354 in)
Oil pump drive gear backlash	0.179-0.315 mm (0.007-0.012 in)
Lower crankcase groove depth and width	4.242 mm (0.167 in) maximum

a Refer to the Cylinder Head Distortion procedure in this section.

Torque Specifications

Description	Nm	lb-ft	lb-in
Air inlet duct clamp	5	—	44
Turbocharger exhaust adapter V-clamp	12	9	—
Exhaust tube-to-exhaust manifold flange bolts (left side) [a]	27	20	—
Exhaust tube-to-exhaust manifold flange bolts (right side) [a]	27	20	—
Turbocharger flange-to-exhaust/EGR tube bolts (right side) [a]	27	20	—
Turbocharger mounting bolts	31	23	—
Turbocharger pedestal bolts	31	23	—
Turbocharger oil supply tube bolts (at turbocharger)	23	17	—
Turbocharger oil supply tube bolt (at oil cooler)	10	—	89
Exhaust manifold flange bolts [a]	38	28	—
Intake manifold flange bolts	11	8	—
Intake manifold heat shield	11	8	—
EGR valve mounting bolts	13	10	—
EGR clamp, V-band	6	—	53
EGR cooler bolts, (M6 x 16)	13	10	—
EGR cooler stud bolts (M6 x 55 x 20)	13	10	—
Crankcase breather screws	7	—	62
Cylinder head bolt sequence and torque [b]	—	—	—
Fuel injector hold-down bolt	33	24	—
Rocker arm fulcrum plate	31	23	—
Oil rail assembly [b]	—	—	—
Valve cover bolts and studs	9	—	80
Oil drain pan plug	44	32	—
Front cover module bolts	24	18	—
Thermostat housing retaining bolts	23	17	—
Coolant pump mounting bolts	23	17	—
Vibration damper mounting bolts [b]	—	—	—
Oil pump housing retaining bolts	8	—	71
Connecting rod bearing bolts [b]	—	—	—
Lower crankcase main bearing cap bolts [b]	—	—	—
Lower crankcase outer bolts (M8 x 30)	31	23	—
Oil pickup tube flange bolts	13	10	—
Piston cooling jet mounting bolt [c]	13	10	—
Cam follower mounting bolt	13	10	—
Camshaft thrust plate-mounting bolts	31	23	—

SPECIFICATIONS (Continued)

Torque Specifications (Continued)

Description	Nm	lb-ft	lb-in
Coolant heater	41	30	—
Oil cooler mounting bolts (6 mm)	10	—	89
Oil cooler mounting bolts (8 mm)	22	16	—
Oil cooler-to-oil cooler cover bolts	22	16	—
Oil cooler-to-oil cooler cover nuts	22	16	—
EGR cooler coolant supply port cover (M6)	10	—	89
Oil filter housing bolts (Torx)	15	11	—
Oil filter return tube bolt, new base	5	—	44
Oil filter return tube bolt, reinstallation	3	—	27
Crankshaft position (CKP) sensor	13	10	—
Camshaft position (CMP) sensor	13	10	—
Injection control pressure (ICP) sensor	12	9	—
Injection pressure regulator (IPR) valve	50	37	—
Intake air temperature 2 (IAT2) sensor	18	13	—
Exhaust pressure tube assembly	30	22	—
Exhaust pressure (EP) sensor (early build)	12	9	—
EP sensor (late build)	20	15	—
EP sensor bracket	12	9	—
Lower oil pan bolt	13	10	—
Upper oil pan bolts	13	10	—
Engine coolant temperature (ECT) sensor (early build)	12	9	—
ECT sensor (late build)	18	13	—
Engine oil pressure (EOP) switch	12	9	—
Engine oil temperature (EOT) sensor (early build)	12	9	—
EOT sensor (late build)	18	13	—
Glow plug	19	14	—
Glow plug module	8	—	71
High-pressure oil pump cover bolts	11	8	—
High-pressure oil pump bolts	31	23	—
High-pressure oil branch tube adapter bolts	14	—	124
High-pressure oil branch tube bolts	14	—	124
Rear heat shield (M6 x 1.0 x 1.2)	11	8	—
Rear heat shield (M10 x 1.5 x 16)	49	36	—
Banjo bolt with copper sealing washers	38	28	—
Banjo bolt with Viton® sealing washers	25	18	—
Fuel filter plug assembly (back of head)	27	20	—
Flywheel/flexplate mounting bolts	94	69	—
Fuel supply tube at secondary fuel filter	43	32	—
Banjo bolt at secondary fuel filter with copper sealing washers	35	26	—
Banjo bolt at secondary fuel filter with Viton® sealing washers	28	21	—
Right and left head supply tubes at filter	26	19	—
Front, lifting eye (M10 x 30)	41	30	—
Crankcase-to-Head Tube (Late Build)	82	60	—
Rear, lifting eye (M10 x 35)	41	30	—

SPECIFICATIONS (Continued)

Torque Specifications (Continued)

Description	Nm	lb-ft	lb-in
Automatic transmission tube nut	8	—	71
Engine ground strap bolt	10	—	89
Starter positive cable nut	12	9	—
Starter control wire nut	6	—	53
Torque converter nut	35	26	—
Motor mount nuts	103	76	—
Turbocharger down pipe bolts	40	30	—
Transmission-to-engine bolts	47	35	—
Transmission tubes mounting bracket bolts	10	—	89
Transmission cooler bolts	8	—	71
Power steering cooler bolts	11	8	—
Battery crossover cable nut	12	9	—
Port plug	82	60	—
Power steering pump bolt	25	18	—
Battery ground cable-to-engine block bolts	47	35	—
Air conditioning compressor bolts	25	18	—
A/C manifold bolt	21	15	—
Coolant pump mounting bolt	23	17	—
Coolant pump pulley bolts	31	23	—
Cooling fan stator bolts	40	30	—
Fan clutch hub-to-coolant pump	133	98	—
Belt idler pulley bolts	47	35	—
Belt tensioner bolts	25	18	—
Crankshaft pulley bolts (dual alternators)	47	35	—
Alternator mounting bracket bolts (dual alternators)	47	35	—
Starter mounting bolts	25	18	—
Solenoid wire nut	6	—	53
Battery cable nut	12	9	—
Cylinder block drain plug [d]	20	15	—
Charge-air-cooler duct clamps (metal duct)	12	9	—
Charge-air-cooler duct clamps (blow molded duct)	12	9	—

a Apply High Temperature Nickel Anti-Seize Lubricant (XL-2) to the threads prior to assembly.

b Refer to the procedure in this section.

c Apply High Strength Threadlocker to bolt threads prior to assembly.

d Apply clean engine oil to the O-ring seal before installing.

Standard Torque — Pipe Thread

Thread Size	Torque [a]
1/8 in NPT	10.2 Nm (7 lb-ft)
1/4 in NPT	13.6 Nm (10 lb-ft)
3/8 in NPT	20.4 Nm (15 lb-ft)
1/2 in NPT	34 Nm (25 lb-ft)
3/4 in NPT	40.8 Nm (30 lb-ft)

a Tolerances are ± 10% of nominal value.

SPECIFICATIONS (Continued)

Standard Torques — Class 10.9 Metric Bolts and Studs

Thread Diameter	Thread Pitch (mm/thread)	Torque [a]
6 mm	1	13 Nm (10 lb-ft)
8 mm	1.25	31 Nm (23 lb-ft)
10 mm	1.5	62 Nm (45 lb-ft)
12 mm	1.75	107 Nm (79 lb-ft)
14 mm	2	172 Nm (127 lb-ft)
15 mm	2	216 Nm (159 lb-ft)
16 mm	2	266 Nm (196 lb-ft)
18 mm	2.5	368 Nm (272 lb-ft)
20 mm	2.5	520 Nm (384 lb-ft)

a Tolerances are ± 10% of nominal value.

Standard Torques — Class 12.9 Metric Bolts and Studs

Thread Diameter	Thread Pitch (mm/thread)	Torque [a]
6 mm	1	15 Nm (11 lb-ft)
8 mm	1.25	36 Nm (27 lb-ft)
10 mm	1.5	72 Nm (53 lb-ft)
12 mm	1.75	126 Nm (93 lb-ft)
14 mm	2	201 Nm (148 lb-ft)
15 mm	2	252 Nm (186 lb-ft)
16 mm	2	311 Nm (230 lb-ft)
18 mm	2.5	430 Nm (317 lb-ft)
20 mm	2.5	608 Nm (448 lb-ft)

a Tolerances are ± 10% of nominal value.