

Component Procedures: Exhaust System

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Component Procedures: Exhaust System

Parts and Labor (itype_189)

Parts

Qualifier	Part #	Name	Price	Note
Exhaust Manifold	285212E000	Manifold Gasket	10.53	
Exhaust Manifold > Exhaust M?	285102EHA0	Sulev Emission	3662.74	
Exhaust Manifold > Exhaust M?	285102EHB0	Ulev Emission	2543.35	
Exhaust Manifold > Exhaust M?	285102EFB0	Manual Trans	3112.79	
Exhaust Manifold > Exhaust M?	285102EFA0	Emission Sulev	2738.40	
Exhaust Manifold > Exhaust M?	285102EFB0	Emission Ulev	3112.79	
Exhaust System > Catalytic C?		Part Of Exhaust Manifo?	0.00	
Exhaust System > Muffler	28710F3400	Rear	718.61	Tailpipe Included With Rea?
Exhaust System > Muffler > C?	28600F3500	Emission Sulev	2068.66	Tailpipe Included With Rea?
Exhaust System > Muffler > C?	28600F3510	Emission Ulev	1838.87	Tailpipe Included With Rea?
Exhaust System > Muffler > C?	28600F2500	Korea Built	1669.90	Tailpipe Included With Rea?
Exhaust System > Muffler > C?	28600F3500	Us Built	2068.66	Tailpipe Included With Rea?
Exhaust System > Muffler > C?	28600F2510	Korea Built	1344.03	Tailpipe Included With Rea?
Exhaust System > Muffler > C?	28600F3510	Us Built	1838.87	Tailpipe Included With Rea?
Exhaust System > Muffler > F?	28610F2420	Korea Built	235.00	Tailpipe Included With Rea?
Exhaust System > Muffler > F?	28610F3450	Us Built	861.92	Tailpipe Included With Rea?
Exhaust System > Muffler > R?	28710F2400	Korea Built	516.71	Tailpipe Included With Rea?
Exhaust System > Muffler > R?	28710F3400	Us Built	718.61	Tailpipe Included With Rea?

Labor

Operation	Qualifier Path	Skill	Std Hrs	Wty Hrs
Remove & Replace	Exhaust Manifold > Exhaust Manifold, R&R	B	1.6	0.0
Remove & Replace	Exhaust Manifold > Manifold Gasket, R&R	B	1.6	0.0
Remove & Replace	Exhaust System > Catalytic Converter, R&R > S?			0.0
Remove & Replace	Exhaust System > Complete Exhaust System, R&R	C	1.3	0.0
Remove & Replace	Exhaust System > Front Pipe, R&R	C	0.9	0.0
Remove & Replace	Exhaust System > Intermediate Pipe, R&R	C	1.0	0.0
Remove & Replace	Exhaust System > Muffler & Pipe Assembly, R&R?	B	0.7	0.0
Remove & Replace	Exhaust System > Muffler, R&R > Front	B	1.0	0.0

Engine Mechanical System - Specifications (Article 45311)

- Specifications

Description Specifications Limit

General

Type In-line, DOHC

Number of cylinders 4

Bore 81.0 mm (3.1890 in.)

Stroke 97.0 mm (3.8189 in.)

Total displacement 1999 cc (121.99 cu.in.)

Compression ratio 12.5 ± 0.2 : 1

Firing order 1-3-4-2

Valve timing

Intake valve Open [BTDC 38° - ATDC 2°(initial position)] - [ATDC 42°]

Close [ABDC 43° - ABDC 83°(initial position)] - [ABDC 123°]

Exhaust valve Open BBDC 54° - ABDC 6°

Close ATDC 1° - ATDC 61°

Camshaft

Cam height Intake 39.0 mm (1.5354 in.)

Exhaust 38.66 mm (1.5220 in.)

Journal outer diameter Intake No.1 : 35.959 - 35.975 mm (1.41571 - 1.41634 in.)

No.2,3,4,5 : 22.959 - 22.975 mm (0.90390 - 0.90453 in.)

Exhaust No.1 : 35.959 - 35.975 mm (1.41571 - 1.41634 in.)

Bearing oil clearance Intake No.1 : 0.032 - 0.062 mm (0.00126 - 0.00244 in.)

No.2,3,4,5 : 0.032 - 0.062 mm (0.00126 - 0.00244 in.)

Exhaust No.1 : 0.032 - 0.062 mm (0.00126 - 0.00244 in.)

End play 0.10 - 0.19 mm (0.0039 - 0.0075 in.)

Valve

Valve length Intake 102.22 mm (4.0244 in.) 101.97 mm (4.0146 in.)

Exhaust 104.04 mm (4.0961 in.) 103.79 mm (4.0862 in.)

Stem outer diameter Intake 5.465 - 5.480 mm (0.21516 - 0.21575 in.)

Exhaust 5.458 - 5.470 mm (0.21488 - 0.21535 in.)

Face angle 45.25° - 45.75°

Thickness of valve head (margin) Intake 1.41 - 1.71 mm (0.0555 - 0.0673 in.)

Exhaust 1.55 - 1.85 mm (0.0610 - 0.0728 in.)

Valve stem to valve guide clearance Intake 0.020 - 0.047 mm (0.00079 - 0.00185 in.)

Exhaust 0.030 - 0.054 mm (0.00118 - 0.00213 in.)

Valve guide

Length Intake 43.8 - 44.2 mm (1.7244 - 1.7402 in.)

Exhaust 43.8 - 44.2 mm (1.7244 - 1.7402 in.)

Inner diameter Intake 5.500 - 5.512 mm (0.21654 - 0.21701 in.)

Exhaust 5.500 - 5.512 mm (0.21654 - 0.21701 in.)

Valve seat

Width of seat contact Intake 1.05 - 1.35 mm (0.0413 - 0.0532 in.)

Exhaust 1.35 - 1.65 mm (0.0532 - 0.0650 in.)

Seat angle Intake 44° 45' - 45° 6'

Exhaust 44° 45' - 45° 6'

Valve spring

Free length 45.93 mm (1.8083 in.)

Load 19.6 ± 1.0 kg / 37.0 mm (43.21 ± 2.20 lb / 1.4567 in.)

45.7 ± 1.8 kg / 27.0 mm (100.75 ± 3.97 lb / 1.0630 in.)

Out of squareness Less than 1.5°

Cylinder head

Flatness of gasket surface Less than 0.05 mm (0.0020 in.) for total area

Less than 0.02 mm (0.0008 in.) for a section of 100 mm (3.9370 in.) x 100 mm (3.9370 in.)

Flatness of manifold mounting surface Intake Less than 0.10 mm (0.0039 in.)

Exhaust Less than 0.10 mm (0.0039 in.)

Piston

Piston outer diameter 80.97 - 81.00 mm (3.1878 - 3.1890 in.)

Piston to cylinder clearance 0.02 - 0.04 mm (0.0008 - 0.0016 in.)

Ring groove width No. 1 ring 1.030 - 1.050 mm (0.04055 - 0.04134 in.)

No. 2 ring 1.230 - 1.250 mm (0.04843 - 0.04921 in.)

Oil ring 2.010 - 2.025 mm (0.07913 - 0.07972 in.)

Piston ring

Side clearance No. 1 ring 0.040 - 0.080 mm (0.00157 - 0.00315 in.)

No. 2 ring 0.040 - 0.080 mm (0.00157 - 0.00315 in.)

Oil ring 0.020 - 0.055 mm (0.00079 - 0.00216 in.)

End gap No. 1 ring 0.15 - 0.30 mm (0.0059 - 0.0118 in.)

No. 2 ring 0.30 - 0.45 mm (0.0118 - 0.0177 in.)

Oil ring 0.20 - 0.40 mm (0.0079 - 0.0157 in.)

Piston pin

Piston pin outer diameter 19.997 - 20.000 mm (0.78728 - 0.78740 in.)

Piston pin hole inner diameter 20.004 - 20.009 mm (0.78756 - 0.78775 in.)

Piston pin hole clearance 0.004 - 0.012 mm (0.00016 - 0.00047 in.)

Connecting rod small end hole inner diameter 20.007 - 20.015 mm (0.78768 - 0.78799 in.)

Piston pin-to-connecting rod bushing oil clearance 0.007 - 0.018 mm (0.00028 - 0.00071 in.)

Connecting rod

Connecting rod big end inner diameter 48.000 - 48.018 mm (1.88976 - 1.89047 in.)

Connecting rod bearing oil clearance 0.024 - 0.042 mm (0.00094 - 0.00165 in.)

Side clearance 0.10 - 0.25 mm (0.0039 - 0.0098 in.)

Crankshaft

Main journal outer diameter 54.942 - 54.960 mm (2.16307 - 2.16378 in.)

Pin journal outer diameter 44.954 - 44.972 mm (1.76984 - 1.77055 in.)

Main bearing oil clearance 0.016 - 0.034 mm (0.00063 - 0.00134 in.)

End play 0.07 - 0.25 mm (0.0028 - 0.0098 in.)

Cylinder block

Cylinder bore 81.00 - 81.03 mm (3.1890 - 3.1902 in.)

Engine oil

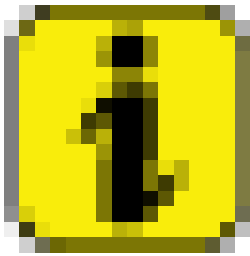
Oil quantity Total 4.5 L (1.19 U.S.gal., 4.76 U.S.qt., 3.96 Imp.qt.) When replacing a short engine or block assembly

Oil pan 3.7 L (0.98 U.S.gal., 3.91 U.S.qt., 3.26 Imp.qt.)

Drain and refill 4.0 L (1.06 U.S.gal., 4.23 U.S.qt., 3.52 Imp.qt.) Including oil filter

Oil grade Specifications 5W-20 / API SM& ILSAC GF-4 (or above) / ACEA A5 (or above) API SL, ILSAC GF-3, ACEA A3 Class engine oil can be used if the recommended engine oil is not available. Refer to the "Lubrication System" for recommended SAE viscosity number.

API SL, ILSAC GF-3, ACEA A3 Class engine oil can be used if the recommended engine oil is not available. Refer to the "Lubrication System" for recommended SAE viscosity number.



Information

- API SL, ILSAC GF-3, ACEA A3 Class engine oil can be used if the recommended engine oil is not available.

- Refer to the "Lubrication System" for recommended SAE viscosity number.

Oil pressure (at 1,000rpm) 90.22 kPa (0.92 kgf/cm², 13.09 psi) or above Oil temperature (oil pan): 110 ± 2°C (230 ± 35.6°F)

Oil Pump

Relief valve opening pressure 500.14 - 600.16 kPa (5.10 - 6.12 kgf/cm², 72.54 - 87.05 psi) (5-6bar)

Side clearance 0.040 - 0.090 mm (0.00157 - 0.00354 in.)

Body clearance 0.200 - 0.292 mm (0.00787 - 0.01149 in.)

Guide clearance 0.030 - 0.075 mm (0.00118 - 0.00295 in.)

Cooling system

Cooling method Forced circulation with cooling fan

Coolant quantity Approx. 6.6 L (1.66 U.S.gal., 6.97 U.S.qt., 5.81 Imp.qt.)

Electric thermostat (ECT) Type Wax pellet type

Opening temperature 100 ± 2°C (212 ± 3.6°F)

Full opening valve lift / temperature More than 8 mm (0.3 in.) / 115°C (239°F)

Radiator cap Main valve opening pressure 93.16 - 122.58 kPa (0.95 - 1.25 kgf/cm², 13.51 - 17.78 psi)

Vacuum valve opening pressure 0 - 6.86 kPa (0 - 0.07 kgf/cm², 0 - 1.00 psi)

- Liquid Gasket

Location Product

Mating surface of timing chain cover Threebond 1217H or equivalent

Front area of mating surface between cam carrier and cylinder head

Front area of mating surface between cylinder block and head

Upper area of mating surface between timing chain cover and cam carrier

Front upper area of cylinder block

Front upper area of cylinder head gasket

Lower area of cam carrier

Lower area of cylinder block

Mating surface of oil pan

Mating surface of oil pressure switch THREEBOND 2403

- Tightening Torques

Item N.m kgf.m lb-ft

Engine mounting

Engine mounting bracket to body fixing bolt 49.0 - 63.7 5.0 - 6.5 36.2 - 47.0

Engine mounting support bracket to engine mounting insulator fixing nut 88.3 - 107.9 9.0 - 11.0 65.1 - 79.6

Engine mounting support bracket to engine support bracket fixing bolt 58.8 - 73.5 6.0 - 7.5 43.4 - 54.2

Engine mounting support bracket to engine support bracket fixing nut 58.8 - 73.5 6.0 - 7.5 43.4 - 54.2
Transaxle mounting bracket to body fixing bolt 49.0 - 63.7 5.0 - 6.5 36.2 - 47.0
Transaxle mounting bracket to transaxle mounting support bracket fixing bolt 88.3 - 107.9 9.0 - 11.0 65.1 - 79.6
Roll rod bracket to sub frame fixing bolt 49.0 - 63.7 5.0 - 6.5 36.2 - 47.0
Roll rod bracket to roll rod support bracket fixing bolt & nut 107.9 - 127.5 11.0 - 13.0 79.6 - 94.0
Timing system
Crankshaft pulley bolt 196.1 - 205.9 20.0 - 21.0 144.7 - 151.9
Timing chain cover service plug bolt 29.4 - 39.2 3.0 - 4.0 21.7 - 28.9
Timing chain cover bolt (M10x55) 39.2 - 49.0 4.0 - 5.0 28.9 - 36.2
Timing chain cover bolt (M10x85) 39.2 - 49.0 4.0 - 5.0 28.9 - 36.2
Timing chain cover bolt - Seal bolt (M6x38) 9.8 - 11.8 1.0 - 1.2 7.2 - 8.7
Timing chain cover bolt - Seal bolt (M8x50) 19.6 - 23.5 2.0 - 2.4 14.5 - 17.4
Timing chain cover bolt (M8x50) 18.6 - 23.5 1.9 - 2.4 13.7 - 17.4
Timing chain cover bolt (M8x28) 18.6 - 23.5 1.9 - 2.4 13.7 - 17.4
Timing chain tensioner bolt 9.8 - 11.8 1.0 - 1.2 7.2 - 8.7
Timing chain tensioner arm bolt 18.6 - 22.6 1.9 - 2.3 13.7 - 16.6
Timing chain guide bolt 18.6 - 22.6 1.9 - 2.3 13.7 - 16.6
Engine cover mounting bolt 7.8 - 9.8 0.8 - 1.0 5.8 - 7.2
Ignition coil bolt 9.8 - 11.8 1.0 - 1.2 7.2 - 8.7
Cylinder head cover bolt [3.9 - 5.9] + [7.8 - 9.8] [0.4 - 0.6] + [0.8 - 1.0] [2.9 - 4.3] + [5.8 - 7.2]
Injector & rail assembly bolt 18.6 - 23.5 1.9 - 2.4 13.7 - 17.4
CVVT bolt (LH/RH) 64.7 - 76.5 6.6 - 7.8 47.7 - 56.4
Camshaft bearing cap bolt (M6) 11.8 - 13.7 1.2 - 1.4 8.7 - 10.1
Camshaft bearing cap bolt (M8) 18.6 - 22.6 1.9 - 2.3 13.7 - 16.6
Cam carrier bolt 18.6 - 22.6 1.9 - 2.3 13.7 - 16.6
Cylinder head bolt [32.4 - 36.3] + [90 - 95°] + [90 - 95°] [3.3 - 3.7] + [90 - 95°] + [90 - 95°] [23.9 - 26.8] + [90 - 95°] + [90 - 95°]
Engine hanger bolt (Front/Rear) 34.3 - 39.2 3.5 - 4.0 25.3 - 28.9
Camshaft position sensor (LH/RH) 9.8 - 11.8 1.0 - 1.2 7.2 - 8.7
Oil control valve (OCV) bolt (LH/RH) 9.8 - 11.8 1.0 - 1.2 7.2 - 8.7
Drive plate bolt 117.7 - 127.5 12.0 - 13.0 86.8 - 93.9
Connecting rod bearing cap bolt [17.7 - 21.6] + [103 - 107°] [1.8 - 2.2] + [103 - 107°] [13.0 - 15.9] + [103 - 107°]
Lower crankcase bolt 18.6 - 23.5 1.9 - 2.4 13.7 - 17.4
Main bearing cap bolt [27.5 - 31.4] + [120 - 125°] [2.8 - 3.2] + [120 - 125°] [20.3 - 23.1] + [120 - 125°]
Crankshaft position sensor bolt 10.8 - 11.8 1.1 - 1.2 8.0 - 8.7
Knock sensor 18.6 - 23.5 1.9 - 2.4 13.7 - 17.4
Lubrication system
Oil drain plug 34.3 - 44.1 3.5 - 4.5 25.3 - 32.5
Oil filter 11.8 - 15.7 1.2 - 1.6 8.7 - 11.6
Oil pan bolt 11.8 - 13.7 1.2 - 1.4 8.7 - 10.1
Oil screen bolt 19.6 - 26.5 2.0 - 2.7 14.5 - 19.5
Oil screen nut 11.8 - 13.7 1.2 - 1.4 8.7 - 10.1
Oil pressure switch 9.8 - 11.8 1.0 - 1.2 7.2 - 8.7
Water pump pulley bolt 9.8 - 11.8 1.0 - 1.2 7.2 - 8.7
Water pump bolt 9.8 - 11.8 1.0 - 1.2 7.2 - 8.7
Water inlet fitting nut 18.6 - 23.5 1.9 - 2.4 13.7 - 17.4
Water temperature control assembly bolt 9.8 - 11.8 1.0 - 1.2 7.2 - 8.7
Heater pipe bolt 19.6 - 23.5 2.0 - 2.4 14.5 - 17.4
Intake and exhaust system
Air intake hose clamp bolt 2.9 - 4.9 0.3 - 0.5 2.2 - 3.6
Air cleaner assembly bolt 7.8 - 9.8 0.8 - 1.0 5.8 - 7.2
Electronic throttle control (ETC) module bolt 9.8 - 11.8 1.0 - 1.2 7.2 - 8.7
Intake manifold stay bolt 18.6 - 23.5 1.9 - 2.4 13.7 - 17.4
Intake manifold bolt 18.6 - 23.5 1.9 - 2.4 13.7 - 17.4
Intake manifold nut 18.6 - 23.5 1.9 - 2.4 13.7 - 17.4
Exhaust manifold heat protector bolt 9.8 - 11.8 1.0 - 1.2 7.2 - 8.7
Exhaust manifold stay bolt 39.2 - 49.0 4.0 - 5.0 28.9 - 36.2
Exhaust manifold nut 34.3 - 39.2 3.5 - 4.0 25.3 - 28.9

Muffler nut 39.2 - 58.8 4.0 - 6.0 28.9 - 43.4

All Technical Service Bulletins (itype_100)

Tsbs

- CENTER MUFFLER ASSEMBLY REPLACEMENT (20-EM-001H, 2020/02/04)

Leaks (itype_149)

Tsbs

- CENTER MUFFLER ASSEMBLY REPLACEMENT (20-EM-001H, 2020/02/04)

Noise (itype_156)

Tsbs

- CENTER MUFFLER ASSEMBLY REPLACEMENT (20-EM-001H, 2020/02/04)