Component Procedures: Engine Lubrication

Table of Contents

Component Procedures: Engine Lubrication

Parts and Labor (itype_189)

Parts

Qualifier	Part #	Name	Price	Note
Senders	9475037100	Oil Pressure Sending U?	36.23	
Filters	2630035504	Oil Filter	7.31	
Oil Pan > Oil Pan	215102E040	30 - Oil Pan	127.61	

Labor

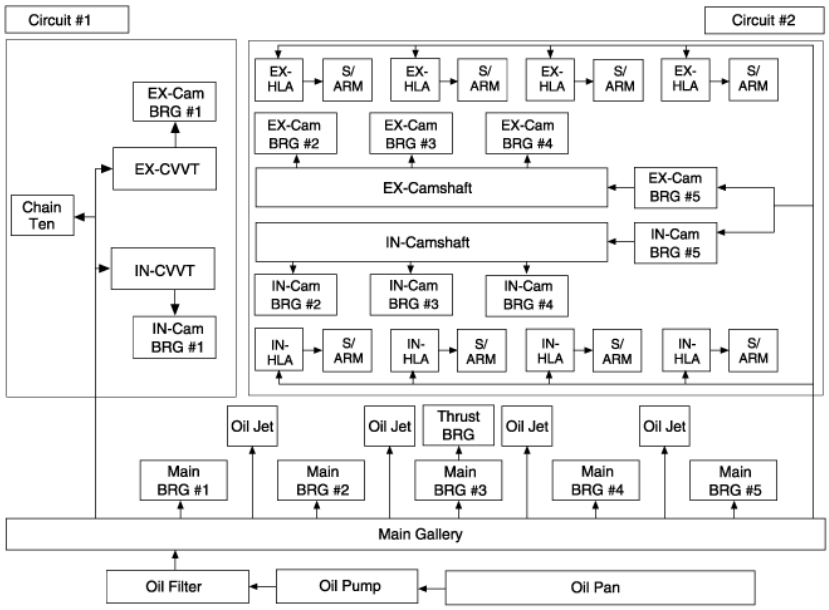
Operation	Qualifier Path	Skill	Std Hrs	Wty Hrs
Remove & Replace	Filters > Oil Filter, R&R	B	0.4	0.0
Remove & Replace	Filters > Oil Filter, R&R > NOTE > To Change ?		0.1	
Remove & Replace	Oil Pan > Oil Pan Gasket, R&R	B	1.5	0.0
Remove & Replace	Oil Pan > Oil Pan, R&R	B	1.5	0.0
Remove & Replace	Oil Pump > Oil Pump, R&R	B	6.6	0.0
Remove & Replace	Senders > Oil Pressure Sending Unit, R&R	B	0.9	0.0
Service	Periodical Maintenance > Lube & Filter, Servi?	B	0.8	0.0
Service	Periodical Maintenance > Lube & Filter, Servi?		0.1	

Specifications Quick Reference (itype_439)

Quick Specifications
- item

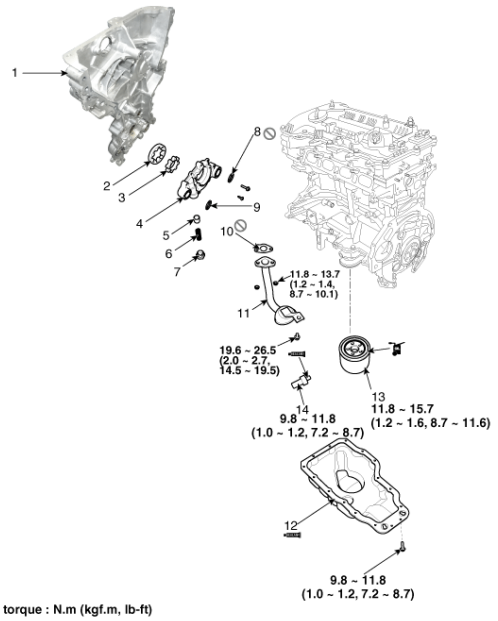
Lubrication System - Flow Diagram (Article 45382)

- Engine Oil Schemetics



Lubrication System - Components and Components Location (Article 45381)

- Components



1. Timing chain cover 2. Outer roter 3. Inner roter 4. Oil pump cover 5. Relief plunger 6. Relief spring 7. Relief plug 8. O-ring (suction side) 9. O-ring (discharge side) 10. Oil screen gasket 11. Oil screen 12. Oil pan 13. Oil filter 14. Oil pressure switch (OPS)

Engine Mechanical System - Specifications (Article 45309)

- 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 lmp.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 lmp.qt.)
Drain and refill 4.0 L (1.06 U.S.gal., 4.23 U.S.qt., 3.52 lmp.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.

- 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 lmp.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 mount ing 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 (M10×55) 39.2 - 49.0 4.0 - 5.0 28.9 - 36.2
Timing chain cover bolt (M10×85) 39.2 - 49.0 4.0 - 5.0 28.9 - 36.2
Timing chain cover bolt - Seal bolt (M6×38) 9.8 - 11.8 1.0 - 1.2 7.2 - 8.7
Timing chain cover bolt - Seal bolt (M8×50) 19.6 - 23.5 2.0 - 2.4 14.5 - 17.4

Timing chain cover bolt (M8×50) 18.6 - 23.5 1.9 - 2.4 13.7 - 17.4
Timing chain cover bolt (M8×28) 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 sw itch 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
- ENGINE OIL AND FILTER CHANGE SERVICE GUIDELINES (23-EM-005H, 2023/10/12)

OEM Policies and Procedures (itype_120)

Tsbs
- ENGINE OIL AND FILTER CHANGE SERVICE GUIDELINES (23-EM-005H, 2023/10/12)