

General Description

MECHANICAL

1. General Description

A: SPECIFICATION

Engine	Model	2.5 L			
	Cylinder arrangement	Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine			
	Valve system mechanism	Belt driven, double overhead camshaft, 4-valve/cylinder			
	Bore x Stroke	mm (in)		99.5 x 79.0 (3.92 x 3.11)	
	Displacement	cm ³ (cu in)		2,457 (149.94)	
	Compression ratio	8.4			
	Compression pressure (at 200 — 300 rpm)	kPa (kg/cm ² , psi)		981 — 1,177 (10 — 12, 142 — 171)	
	Number of piston rings	Pressure ring: 2, Oil ring: 1			
	Intake valve timing	Open	Max. retard	ATDC 5°	
			Min. advance	BTDC 35°	
		Close	Max. retard	ABDC 65°	
			Min. advance	ABDC 25°	
	Exhaust valve timing	Open		BBDC 55°	
		Close		ATDC 5°	
	Valve clearance mm (in)	Inspection value	Intake	0.20 ^{+0.04} _{-0.06} (0.0079 ^{+0.0016} _{-0.0024})	
			Exhaust	0.35 ^{+0.05} _{-0.04} (0.0138 ^{+0.0020} _{-0.0012})	
		Adjustment value	Intake	0.20 ^{+0.01} _{-0.03} (0.0079 ^{+0.0004} _{-0.0012})	
			Exhaust	0.35 ^{+0.02} _{-0.04} (0.0138 ^{+0.0008} _{-0.0012})	
	Idling speed (at "P" or "N" position on AT model, or neutral position on MT model)	rpm	No load	700 \pm 100	
			A/C ON	AT model: 825 \pm 100	
				MT model: 800 \pm 100	
	Ignition order	1 → 3 → 2 → 4			
	Ignition timing	BTDC/rpm		AT model: 17° \pm 10°/700	
				MT model: 12° \pm 10°/700	

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NOTE:

OS: Oversize US: Undersize

Belt tension adjuster	Protrusion of adjuster rod			mm (in)	5.2 — 6.2 (0.205 — 0.244)	
Camshaft	Bending limit			mm (in)	0.020 (0.00079)	
	Cam lobe height	mm (in)	Intake	Standard	46.55 — 46.65 (1.833 — 1.837)	
			Exhaust	Standard	46.75 — 46.85 (1.841 — 1.844)	
	Cam base circle diameter		mm (in)	Standard	37.0 (1.457)	
	Journal O.D.	mm (in)	Front	Standard	37.946 — 37.963 (1.4939 — 1.4946)	
			Center, rear		29.946 — 29.963 (1.1790 — 1.1796)	
Cylinder head	Oil clearance			mm (in)	Standard 0.037 — 0.072 (0.0015 — 0.0028)	
	Thrust clearance			mm (in)	Standard 0.068 — 0.116 (0.0027 — 0.0047)	
	Warping limit (Mating surface with cylinder block)			mm (in)	0.035 (0.0014)	
Valve seat	Grinding limit			mm (in)	0.3 (0.012)	
	Standard height			mm (in)	127.5 (5.02)	
Valve guide	Seating angle between valve and valve seat				90°	
	Contacting width between valve and valve seat	mm (in)	Intake	Standard	0.6 — 1.4 (0.024 — 0.055)	
			Exhaust	Standard	1.2 — 1.8 (0.047 — 0.071)	
	Clearance between the valve and valve stem	mm (in)	Intake	Standard	0.030 — 0.057 (0.0012 — 0.0022)	
			Exhaust		0.040 — 0.067 (0.0016 — 0.0026)	
	Inside diameter			mm (in)	6.000 — 6.012 (0.2362 — 0.2367)	
Valve	Valve stem outer diameters	mm (in)	Intake		5.955 — 5.970 (0.2344 — 0.2350)	
			Exhaust		5.945 — 5.960 (0.2341 — 0.2346)	
	Valve guide protrusion			mm (in)	15.8 — 16.2 (0.622 — 0.638)	
Valve spring	Head edge thickness	mm (in)	Intake	Standard	1.0 — 1.4 (0.039 — 0.055)	
			Exhaust	Standard	1.3 — 1.7 (0.051 — 0.067)	
	Overall length	mm (in)	Intake		104.4 (4.110)	
			Exhaust		104.65 (4.1201)	
Valve lifter	Free length			mm (in)	47.32 (1.863)	
	Tension/spring height	N (kgf, lb)/mm (in)	Set		205 — 235 (20.9 — 24.0, 46.1 — 52.8)/36.0 (1.417)	
			Lift		426 — 490 (43.4 — 50.0, 95.8 — 110)/26.50 (1.043)	
	Squareness				2.5°, 2.1 mm (0.083 in) or less	
Cylinder block	Outer diameter			mm (in)	34.959 — 34.975 (1.3763 — 1.3770)	
	Valve lifter mating surface inner diameter			mm (in)	34.994 — 35.016 (1.3777 — 1.3786)	
	Valve lifter and valve lifter mating surface clearance			mm (in)	0.019 — 0.057 (0.0007 — 0.0022)	
Cylinder block	Warping limit (Mating surface with cylinder head)			mm (in)	0.025 (0.0098)	
	Grinding limit			mm (in)	0.1 (0.004)	
	Standard height			mm (in)	201.0 (7.91)	
	Taper			mm (in)	Standard 0.015 (0.0006)	
	Out-of-roundness			mm (in)	Standard 0.010 (0.0004)	
	Cylinder to piston clearance at 20°C (68°F)			mm (in)	Standard -0.010 — 0.010 (-0.00039 — 0.00039)	
	Cylinder inner diameter boring limit (diameter)			mm (in)	To 100.005 (3.9372)	

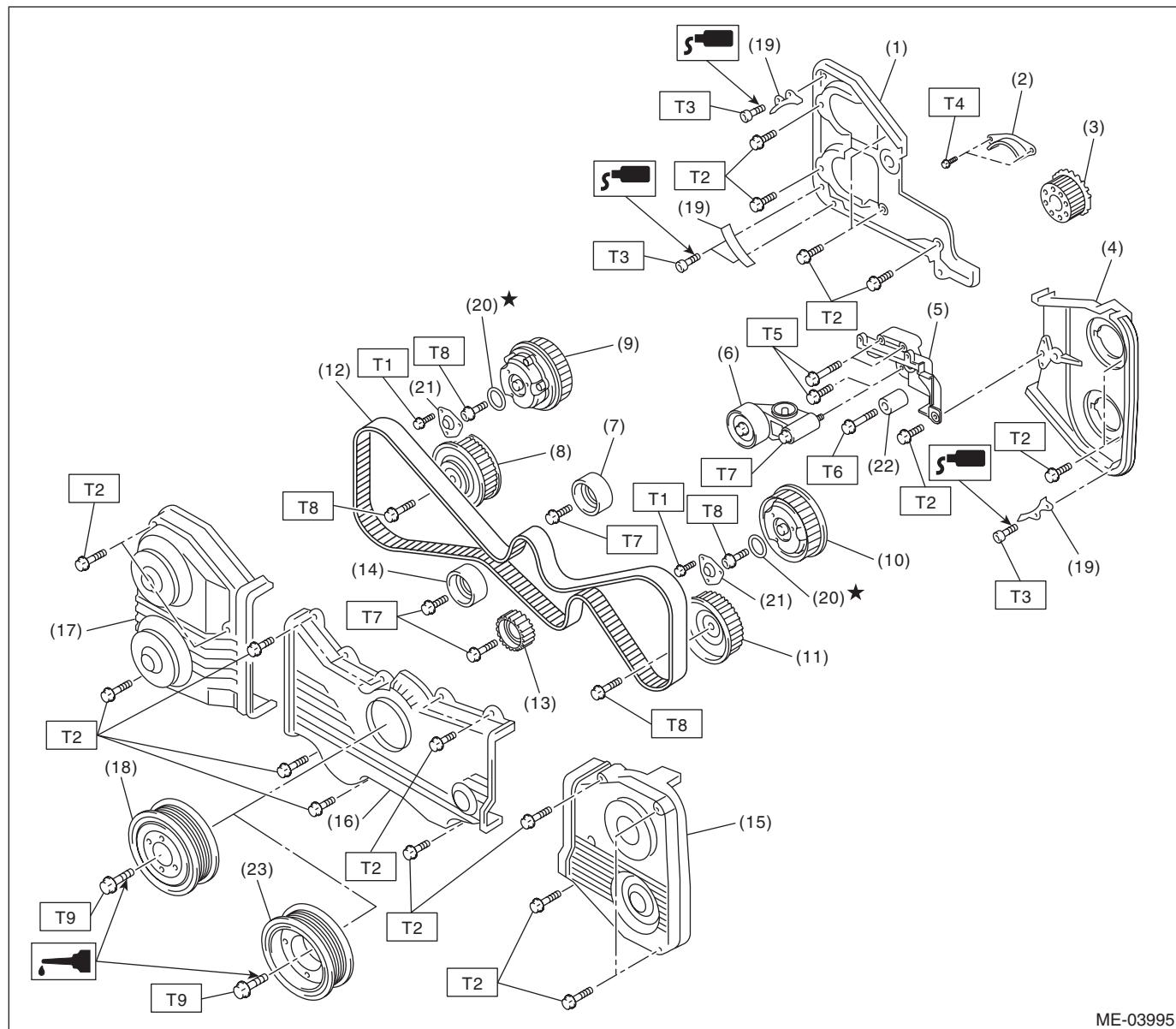
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Piston	Piston grade point			mm (in)	38.2 (1.50)		
	Outer diameter	mm (in)	Standard	A	99.505 — 99.515 (3.9175 — 3.9179)		
			B		99.495 — 99.505 (3.9171 — 3.9175)		
		0.25 (0.0098) OS			99.745 — 99.765 (3.9270 — 3.9278)		
		0.50 (0.0197) OS			99.995 — 100.015 (3.9368 — 3.9376)		
Piston pin	Degree of fit			Piston pin must be fitted into position with thumb at 20°C (68°F).			
	Clearance between piston hole and piston pin			mm (in)	Standard 0.004 — 0.008 (0.0002 — 0.0003)		
Piston ring	Piston ring gap	mm (in)	Top ring	Standard	0.20 — 0.25 (0.0079 — 0.0098)		
			Second ring	Standard	0.37 — 0.52 (0.015 — 0.0203)		
			Oil ring	Standard	0.20 — 0.50 (0.0079 — 0.0197)		
	Clearance between piston ring and piston ring groove	mm (in)	Top ring	Standard	0.040 — 0.080 (0.0016 — 0.0031)		
			Second ring	Standard	0.030 — 0.070 (0.0012 — 0.0028)		
Connecting rod and connecting rod bearing	Bend or twist per 100 mm (3.94 in) in length			mm (in)	Service limit 0.10 (0.0039)		
	Thrust clearance			mm (in)	Standard 0.070 — 0.330 (0.0028 — 0.0130)		
	Oil clearance			mm (in)	Standard 0.017 — 0.045 (0.0007 — 0.0018)		
	Bearing size (Thickness at center)	mm (in)	Standard		1.490 — 1.506 (0.0587 — 0.0593)		
			0.03 (0.0012) US		1.504 — 1.512 (0.0592 — 0.0595)		
			0.05 (0.0020) US		1.514 — 1.522 (0.0596 — 0.0599)		
			0.25 (0.0098) US		1.614 — 1.622 (0.0635 — 0.0639)		
Bushing of small end	Clearance between piston pin and bushing			mm (in)	Standard 0 — 0.022 (0 — 0.0009)		
Crankshaft and crankshaft bearing	Bending limit			mm (in)	0.035 (0.0014)		
	Crank pin	mm (in)	Out-of-roundness		0.003 (0.0001)		
			Cylindricality		0.004 (0.0002)		
			Grinding limit (dia.)		To 51.750 (2.0374)		
	Crank journal	mm (in)	Out-of-roundness		0.005 (0.0002)		
			Cylindricality		0.006 (0.0002)		
			Grinding limit (dia.)		To 59.758 (2.3527)		
	Crank pin outer diameter	mm (in)	Standard		51.976 — 52.000 (2.0463 — 2.0472)		
			0.03 (0.0012) US		51.954 — 51.970 (2.0454 — 2.0461)		
			0.05 (0.0020) US		51.934 — 51.950 (2.0447 — 2.0453)		
			0.25 (0.0098) US		51.734 — 51.750 (2.0368 — 2.0374)		
	Crank journal outer diameter	mm (in)	Standard		59.984 — 60.008 (2.3616 — 2.3625)		
			0.03 (0.0012) US		59.962 — 59.978 (2.3607 — 2.3613)		
			0.05 (0.0020) US		59.942 — 59.958 (2.3599 — 2.3605)		
			0.25 (0.0098) US		59.742 — 59.758 (2.3520 — 2.3527)		
	Bearing size (Thickness at center)	#1, #3	Standard		1.998 — 2.015 (0.0787 — 0.0793)		
			0.03 (0.0012) US		2.017 — 2.020 (0.0794 — 0.0795)		
			0.05 (0.0020) US		2.027 — 2.030 (0.0798 — 0.0799)		
			0.25 (0.0098) US		2.127 — 2.130 (0.0837 — 0.0839)		
		#2, #4, #5	Standard		2.000 — 2.017 (0.0787 — 0.0793)		
			0.03 (0.0012) US		2.019 — 2.022 (0.0795 — 0.0794)		
			0.05 (0.0020) US		2.029 — 2.032 (0.0799 — 0.0800)		
			0.25 (0.0098) US		2.129 — 2.132 (0.0838 — 0.0839)		
Thrust clearance			mm (in)	Standard	0.030 — 0.115 (0.0012 — 0.0045)		
Oil clearance			mm (in)	Standard	0.010 — 0.030 (0.0004 — 0.0012)		

B: COMPONENT

1. TIMING BELT

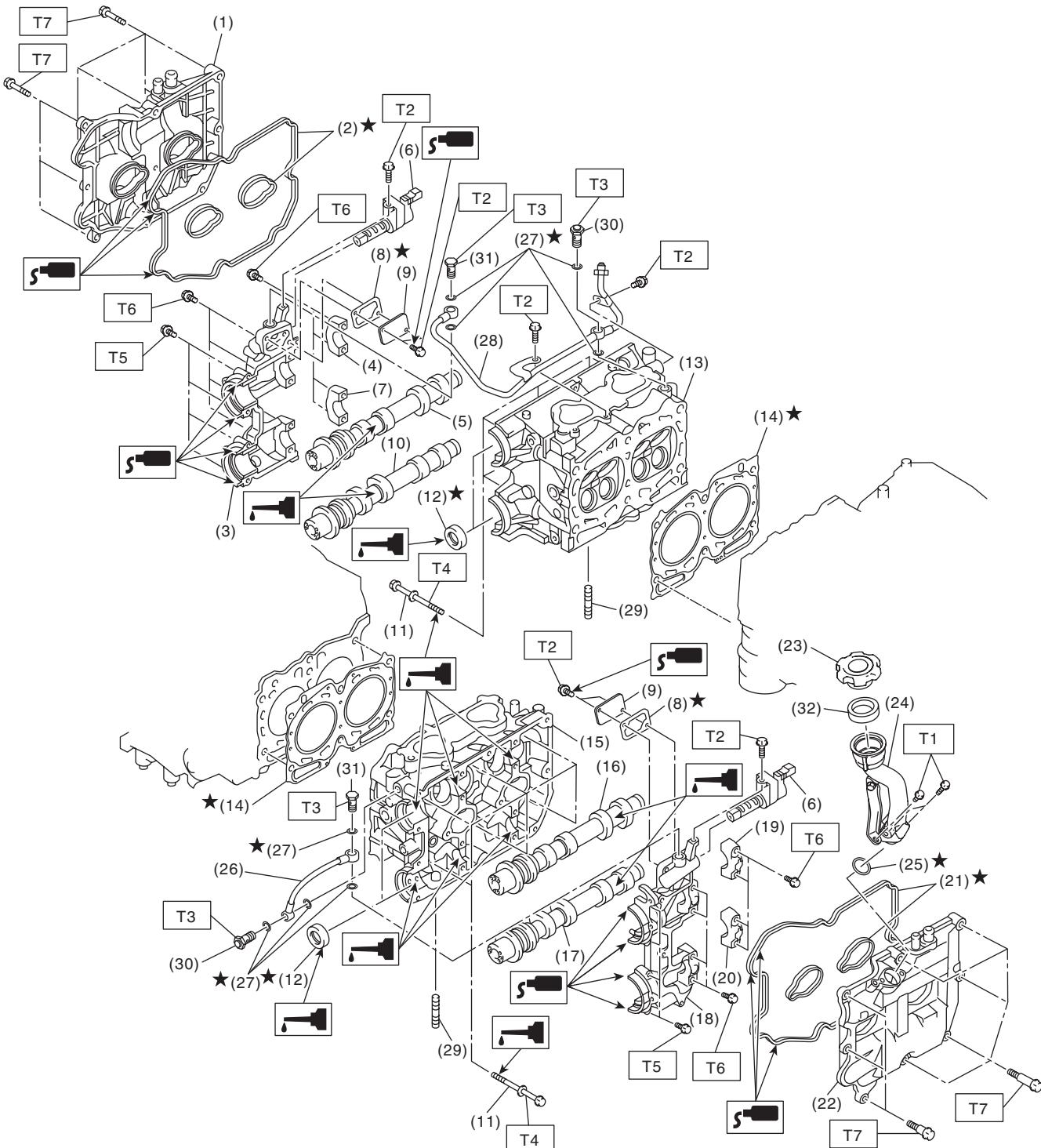


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(1) Timing belt cover No. 2 RH	(13) Belt idler No. 2	Tightening torque: N·m (kgf·m, ft·lb)
(2) Timing belt guide (MT model)	(14) Belt idler	T1: 3.4 (0.3, 2.5)
(3) Crank sprocket	(15) Timing belt cover LH	T2: 5 (0.5, 3.7)
(4) Timing belt cover No. 2 LH	(16) Front belt cover	T3: 6.4 (0.7, 4.7)
(5) Tensioner bracket	(17) Timing belt cover RH	T4: 9.75 (1.0, 7.2)
(6) Automatic belt tension adjuster ASSY	(18) Crank pulley (MT model)	T5: 24.5 (2.5, 18.1)
(7) Belt idler	(19) Timing belt guide (MT model)	T6: 25 (2.5, 18.4)
(8) Exhaust cam sprocket RH	(20) O-ring	T7: 39 (4.0, 28.8)
(9) Intake cam sprocket RH	(21) Actuator cover	T8: <Ref. to ME(H4DOTC)-59, INSTALLATION, Cam Sprocket.>
(10) Intake cam sprocket LH	(22) Belt idler	T9: <Ref. to ME(H4DOTC)-47, INSTALLATION, Crank Pulley.>
(11) Exhaust cam sprocket LH	(23) Crank pulley (AT model)	
(12) Timing belt		

2. CYLINDER HEAD AND CAMSHAFT



ME-04094

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(1) Rocker cover RH	(15) Cylinder head LH	(29) Stud bolt
(2) Rocker cover gasket RH	(16) Intake camshaft LH	(30) Union screw with filter (with protrusion)
(3) Front camshaft cap RH	(17) Exhaust camshaft LH	(31) Union screw without filter (without protrusion)
(4) Intake camshaft cap RH	(18) Front camshaft cap LH	(32) Gasket
(5) Intake camshaft RH	(19) Intake camshaft cap LH	
(6) Oil flow control solenoid valve	(20) Exhaust camshaft cap LH	
(7) Exhaust camshaft cap RH	(21) Rocker cover gasket LH	
(8) Gasket	(22) Rocker cover LH	
(9) Oil return cover	(23) Oil filler cap	
(10) Exhaust camshaft RH	(24) Oil filler duct	
(11) Cylinder head bolt	(25) O-ring	
(12) Oil seal	(26) Oil pipe LH	
(13) Cylinder head RH	(27) Gasket	
(14) Cylinder head gasket	(28) Oil pipe RH	

Tightening torque: N·m (kgf·m, ft-lb)

T1: 6.4 (0.7, 4.7)

T2: 8 (0.8, 5.9)

T3: 29 (3.0, 21.4)

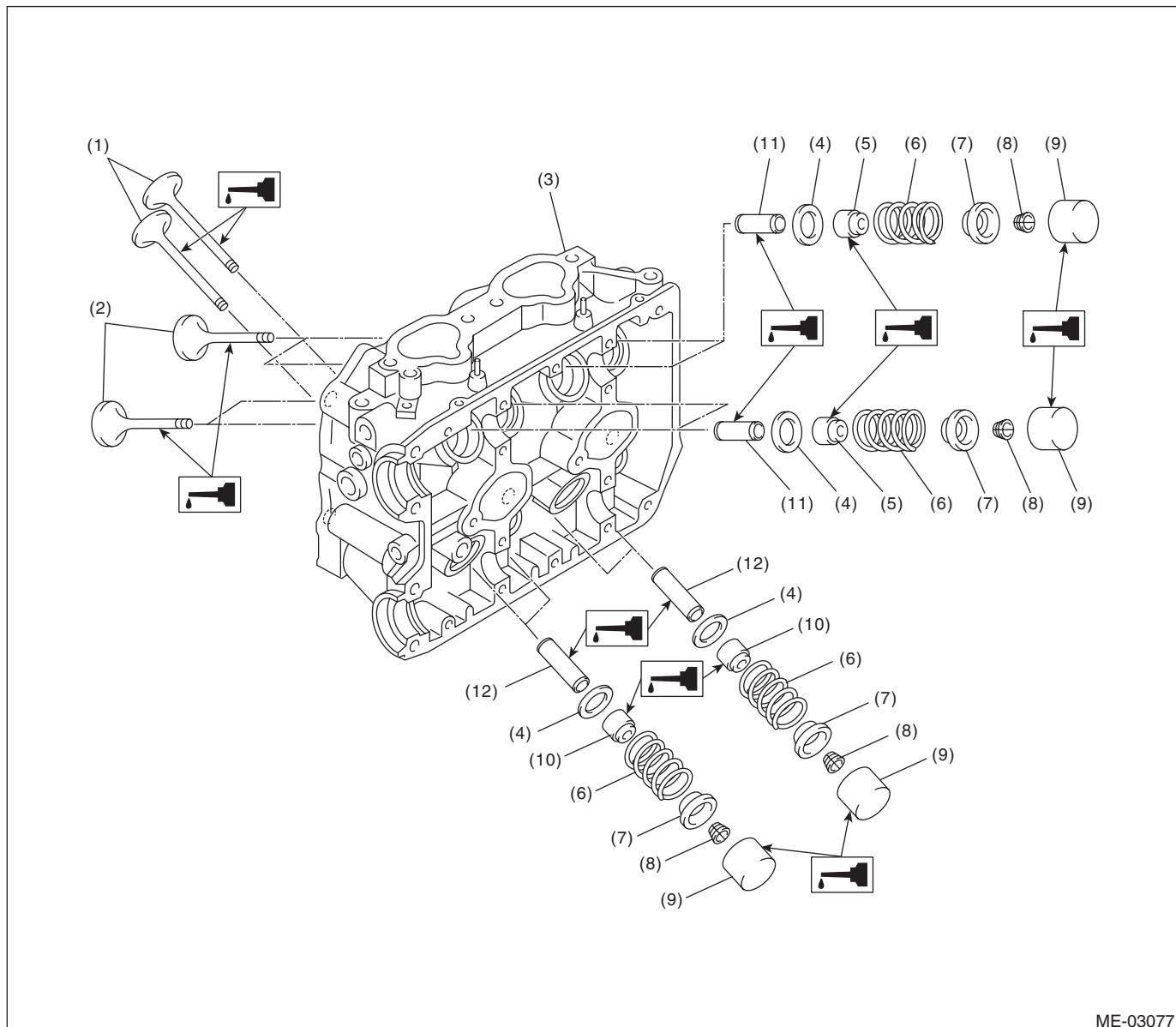
***T4: <Ref. to ME(H4DOTC)-67,
INSTALLATION, Cylinder
Head.>***

***T5: <Ref. to ME(H4DOTC)-62,
INSTALLATION, Camshaft.>***

***T6: <Ref. to ME(H4DOTC)-62,
INSTALLATION, Camshaft.>***

***T7: <Ref. to ME(H4DOTC)-62,
INSTALLATION, Camshaft.>***

3. CYLINDER HEAD AND VALVE ASSEMBLY



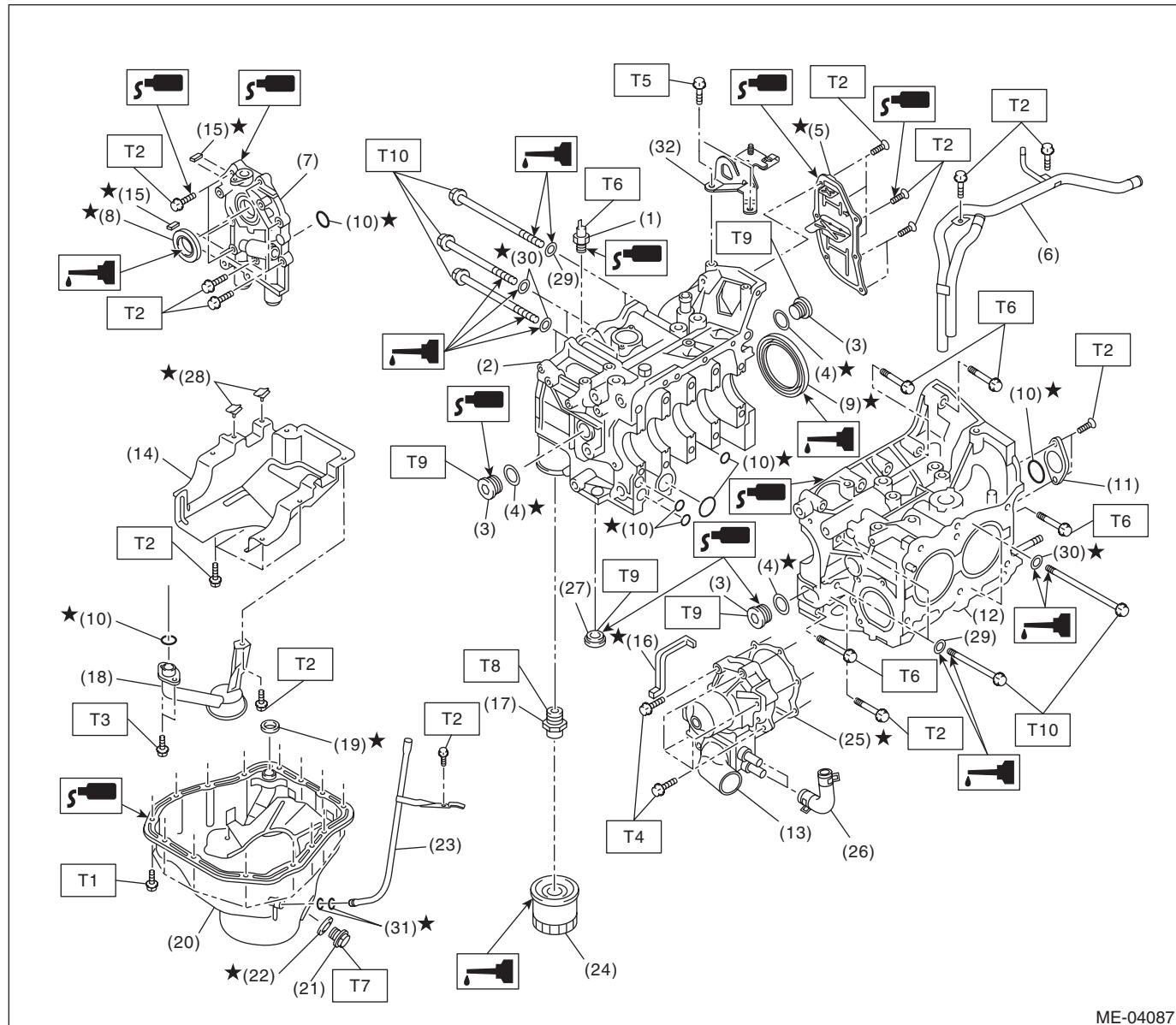
ME-03077

(1) Exhaust valve	(5) Intake valve oil seal	(9) Valve lifter
(2) Intake valve	(6) Valve spring	(10) Exhaust valve oil seal
(3) Cylinder head	(7) Retainer	(11) Intake valve guide
(4) Valve spring seat	(8) Retainer key	(12) Exhaust valve guide

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4. CYLINDER BLOCK



ME-04087

General Description

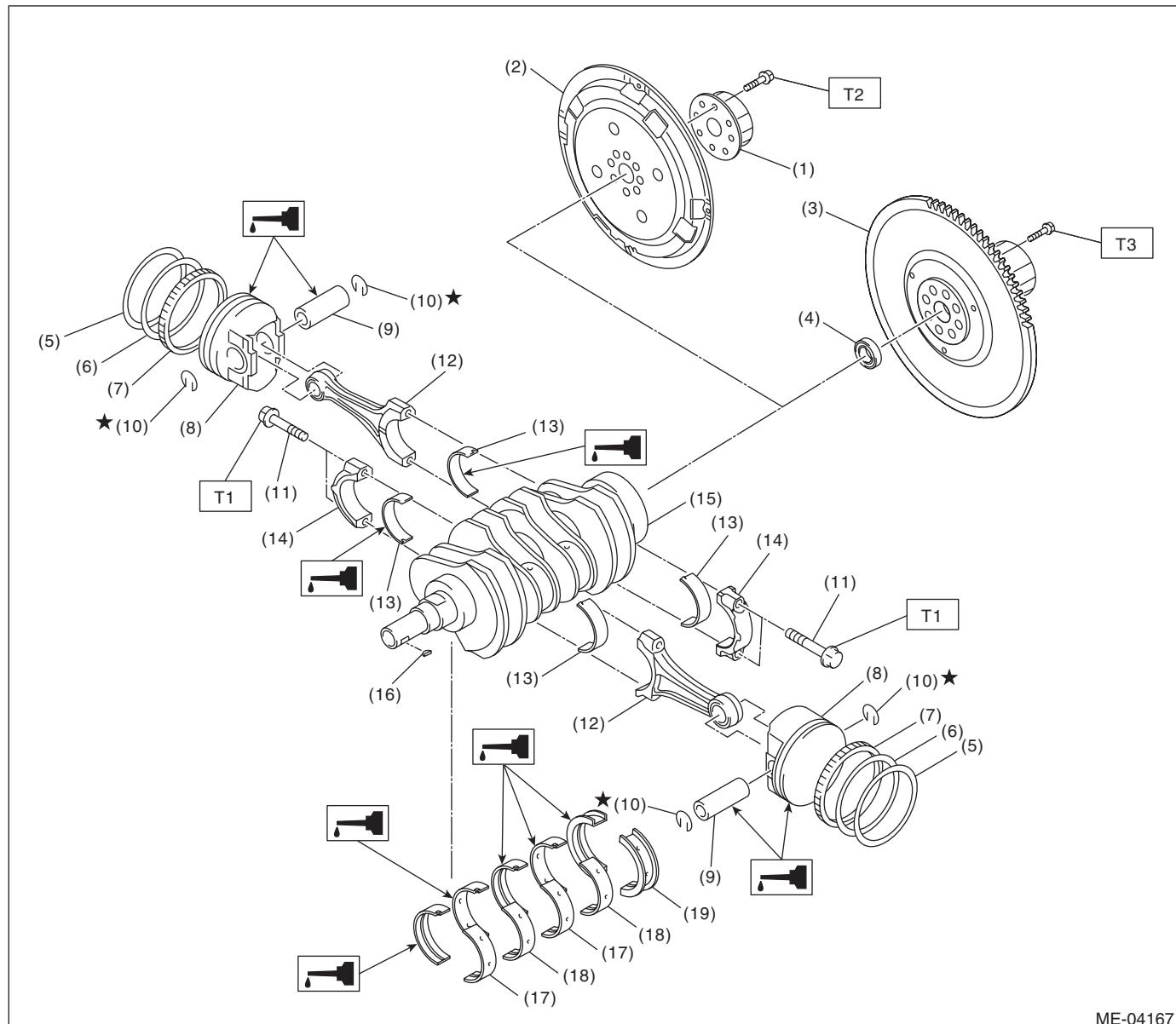
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(1) Oil pressure switch	(16) Water pump sealing	(31) O-ring
(2) Cylinder block RH	(17) Oil filter connector	(32) Engine rear hanger
(3) Service hole plug	(18) Oil strainer	
(4) Gasket	(19) Gasket	Tightening torque: N·m (kgf·m, ft·lb)
(5) Oil separator cover	(20) Oil pan	T1: 5 (0.5, 3.7)
(6) Water by-pass pipe	(21) Drain plug	T2: 6.4 (0.7, 4.7)
(7) Oil pump	(22) Drain plug gasket	T3: 10 (1.0, 7.2)
(8) Front oil seal	(23) Oil level gauge guide	T4: First 12 (1.2, 8.9) Second 12 (1.2, 8.9)
(9) Rear oil seal	(24) Oil filter	T5: 16 (1.6, 11.8)
(10) O-ring	(25) Gasket	T6: 25 (2.5, 18.4)
(11) Service hole cover	(26) Water pump hose	T7: 44 (4.5, 32.5)
(12) Cylinder block LH	(27) Plug	T8: 45 (4.6, 33.2)
(13) Water pump	(28) Seal	T9: 70 (7.1, 51.6)
(14) Baffle plate	(29) Washer	T10: <Ref. to ME(H4DOTC)-79, INSTALLATION, Cylinder Block.>
(15) Oil pump seal	(30) Seal washer	

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5. CRANKSHAFT AND PISTON



ME-04167

(1) Reinforcement (AT model)	(9) Piston pin	(17) Crankshaft bearing #1, #3
(2) Drive plate (AT model)	(10) Snap ring	(18) Crankshaft bearing #2, #4
(3) Flywheel (MT model)	(11) Connecting rod bolt	(19) Crankshaft bearing #5
(4) Ball bearing (MT model)	(12) Connecting rod	
(5) Top ring	(13) Connecting rod bearing	
(6) Second ring	(14) Connecting rod cap	
(7) Oil ring	(15) Crankshaft	
(8) Piston	(16) Woodruff key	

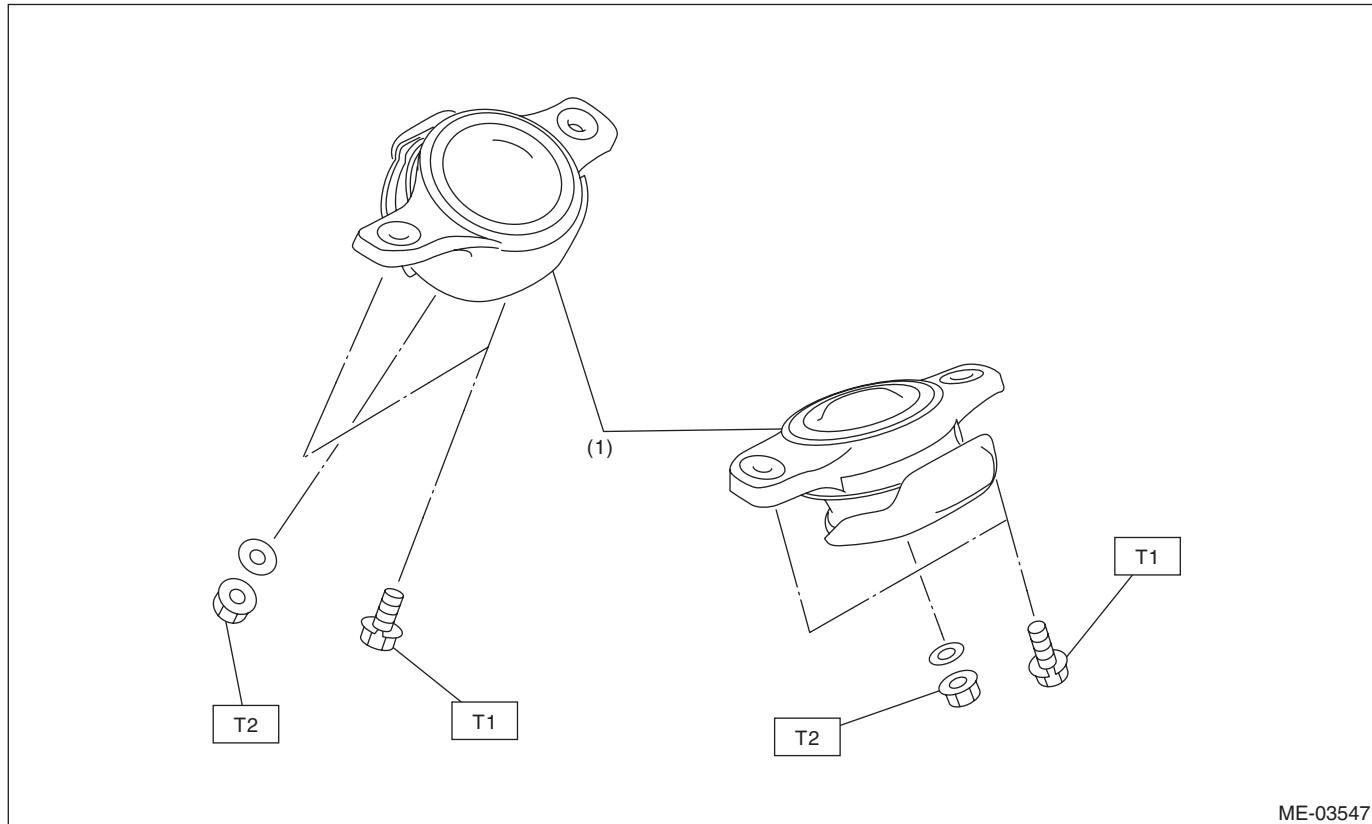
Tightening torque: N·m (kgf·m, ft-lb)

T1: 52 (5.3, 38.4)

T2: <Ref. to 4AT-68, INSTALLATION, Drive Plate. >

T3: <Ref. to CL-12, INSTALLATION, Flywheel. >

6. ENGINE MOUNTING



(1) Front cushion rubber

Tightening torque: N·m (kgf·m, ft-lb)

T1: 35 (3.6, 25.8)

T2: 85 (8.7, 62.7)

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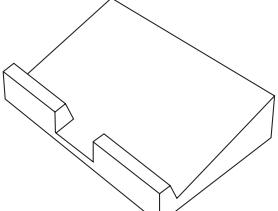
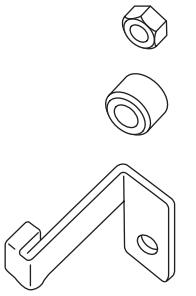
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C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- All parts should be thoroughly cleaned, paying special attention to engine oil passages, pistons and bearings.
- Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil prior to assembly.
- Be careful not to let oil, grease or coolant contact the timing belt, clutch disc and flywheel.
- All removed parts, if to be reused, should be reinstalled in the original positions and directions.
- Bolts, nuts and washers should be replaced with new parts as required.
- Even if necessary inspections have been made in advance, proceed with assembly work while making re-checks.
- Remove or install the engine in an area where chain hoists, lifting devices, etc. are available for ready use.
- Be sure not to damage coated surfaces of body panels with tools, or not to stain seats and windows with coolant or oil. Place a cover over fender, as required, for protection.
- Prior to starting work, prepare the following:
Service tools, clean cloth, containers to catch coolant and oil, wire ropes, chain hoist, transmission jacks, etc.
- Lift up or lower the vehicle when necessary. Make sure to support the correct positions.

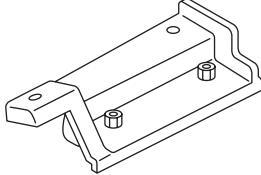
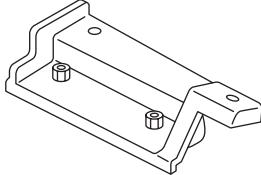
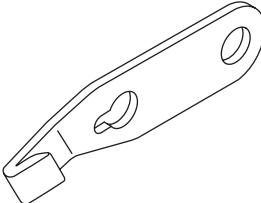
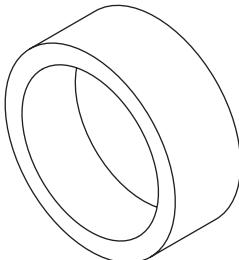
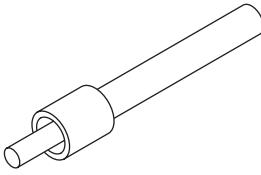
D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498267600	498267600	CYLINDER HEAD TABLE	<ul style="list-style-type: none">• Used for replacing valve guides.• Used for removing and installing valve spring.
 ST-498277200	498277200	STOPPER SET	Used for installing automatic transmission assembly to engine.

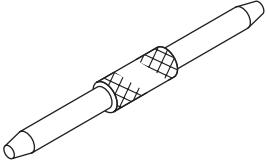
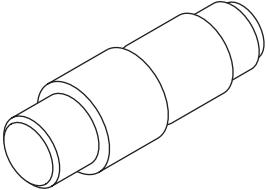
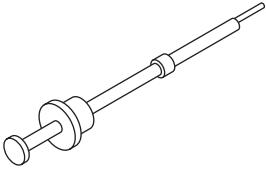
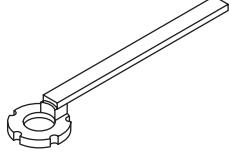
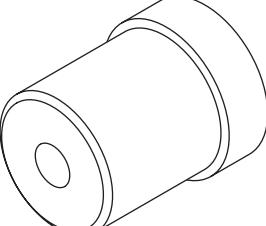
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ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498457000	498457000	ENGINE STAND ADAPTER RH	Used together with ENGINE STAND (499817100).
 ST-498457100	498457100	ENGINE STAND ADAPTER LH	Used together with ENGINE STAND (499817100).
 ST-498497100	498497100	CRANKSHAFT STOPPER	Used for removing and installing the flywheel and drive plate.
 ST-498747300	498747300	PISTON GUIDE	Used for installing the piston into the cylinder.
 ST-498857100	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.

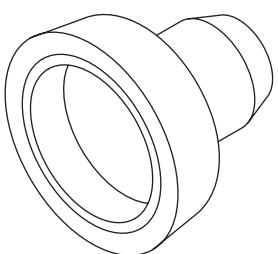
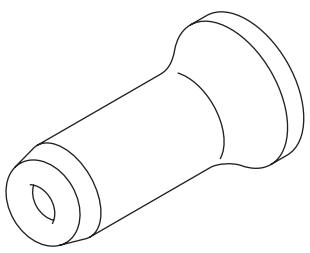
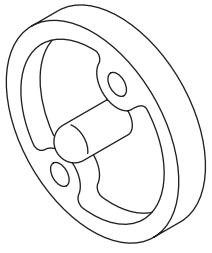
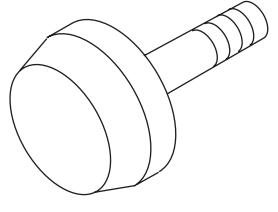
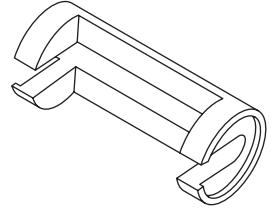
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ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
	499037100	CONNECTING ROD BUSHING REMOVER AND INSTALLER	Used for removing and installing connecting rod bushing.
	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.
	499207400	CAM SPROCKET WRENCH	Used for removing and installing exhaust cam sprocket.
	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.

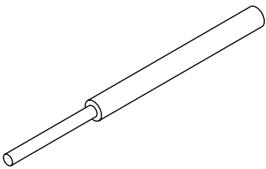
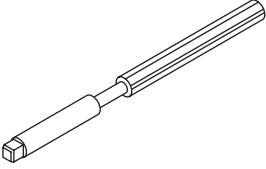
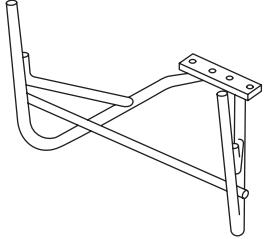
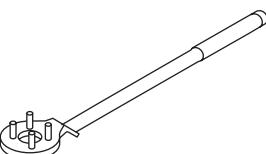
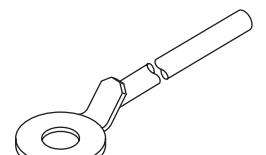
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499587200	499587200	CRANKSHAFT OIL SEAL INSTALLER	<ul style="list-style-type: none"> Used for installing crankshaft oil seal. Used together with CRANKSHAFT OIL SEAL GUIDE (499597100).
 ST-499587600	499587600	OIL SEAL INSTALLER	Used for installing the camshaft oil seal.
 ST-499597100	499597100	CRANKSHAFT OIL SEAL GUIDE	<ul style="list-style-type: none"> Used for installing crankshaft oil seal. Used together with CRANKSHAFT OIL SEAL INSTALLER (499587200).
 ST-499597200	499597200	OIL SEAL GUIDE	<ul style="list-style-type: none"> Used for installing the camshaft oil seal. Used together with OIL SEAL INSTALLER (499587600).
 ST-499718000	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.

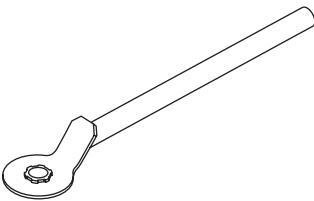
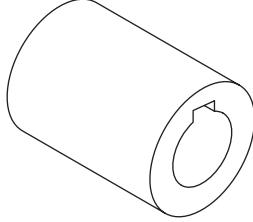
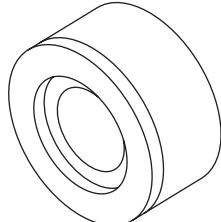
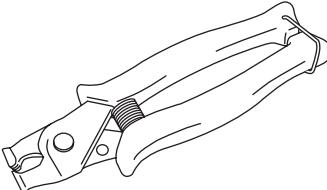
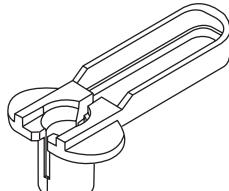
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499767200	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
 ST-499767400	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
 ST-499817100	499817100	ENGINE STAND	<ul style="list-style-type: none"> Used for disassembling and assembling engine. Used together with ENGINE STAND ADAPTER RH (498457000) & LH (498457100).
 ST-499977100	499977100	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts. (MT model)
 ST-499977400	499977400	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts. (AT model)

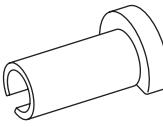
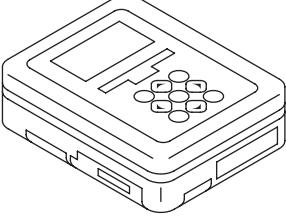
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977500	499977500	CAM SPROCKET WRENCH	Used for removing and installing intake cam sprocket.
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 ST18251AA020	18251AA020	VALVE GUIDE ADJUSTER	Used for installing intake and exhaust valve guides.
 ST18353AA000	18353AA000	CLAMP PLIERS	<ul style="list-style-type: none"> Used for removing and installing the PCV hose. This tool is made by the French company CAILLAU. (code) 54.0.000.205 <p>To make it easier to obtain, it has been provided with a tool number.</p>
 ST18371AA000	18371AA000	CONNECTOR REMOVER	Used for disconnecting the quick connector on the fuel return hose of the engine compartment.

General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
	42099AE000 ST42099AE000	QUICK CONNECTOR RELEASE	Used for disconnecting quick connector of the engine compartment.
	1B022XU0 ST1B022XU0	SUBARU SELECT MONITOR III KIT	Used for various inspections.

2. GENERAL TOOL

TOOL NAME	REMARKS
Compression gauge	Used for measuring compression.
Timing light	Used for measuring ignition timing.
Vacuum gauge	Used for measuring intake manifold vacuum.
Oil pressure gauge	Used for measuring engine oil pressure.
Fuel pressure gauge	Used for measuring fuel pressure.