

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 × Stroke			mm (in)			
	Displacement			cm ³ (cu in)			
	Compression ratio			8.4			
	Compression pressure (at 200 — 300 rpm)			kPa (kg/cm ² , psi)			
	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		Inspection value	Intake		0.20 ^{+0.04} _{-0.06} (0.0079 ^{+0.0016} _{-0.0024})	
				Exhaust		0.35±0.05 (0.0138±0.0020)	
			Adjustment value	Intake		0.20 ^{+0.01} _{-0.03} (0.0079 ^{+0.0004} _{-0.0012})	
				Exhaust		0.35±0.02 (0.0138±0.0008)	
	Idling speed (at “P” or “N” position on AT model, or neutral position on MT model)			rpm	No load	700±100	
					A/C ON	AT model: 825±100	
				MT model: 800±100			
Ignition order				1 → 3 → 2 → 4			
Ignition timing			BTDC/rpm		AT model: 17°±10°/700		
					MT model: 12°±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)	
	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)	
Cylinder head	Warping limit (Mating surface with cylinder block)			mm (in)	0.035 (0.0014)	
	Grinding limit			mm (in)	0.3 (0.012)	
	Standard height			mm (in)	127.5 (5.02)	
Valve seat	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)	
Valve guide	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 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	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 spring	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		
Valve lifter	Outer diameter		mm (in)	Standard	34.959 — 34.975 (1.3763 — 1.3770)	
	Valve lifter mating surface inner diameter		mm (in)	Standard	34.994 — 35.016 (1.3777 — 1.3786)	
	Valve lifter and valve lifter mating surface clearance		mm (in)	Standard	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)	

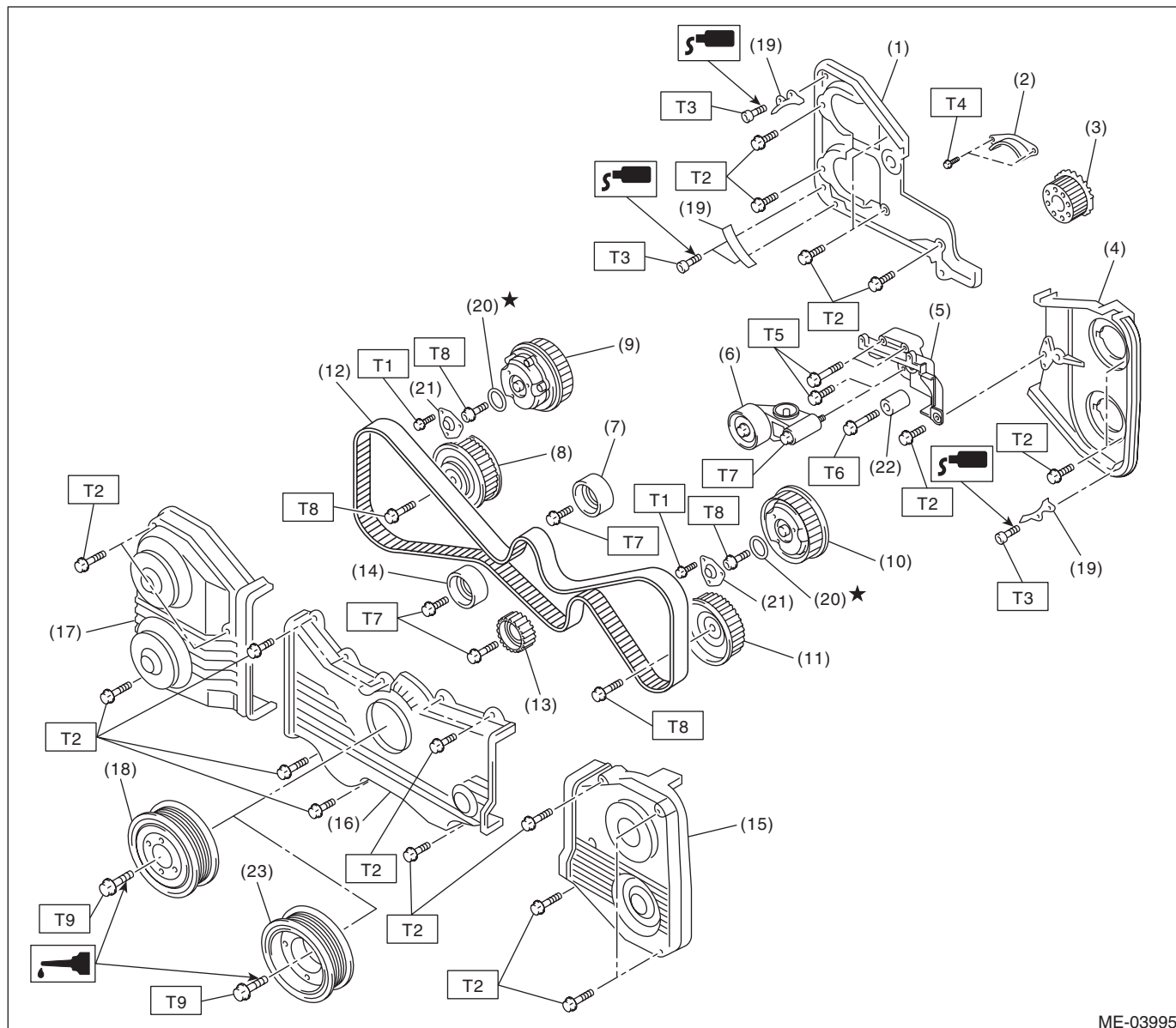
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Piston	Piston grade point		mm (in)		38.2 (1.50)	
	Outer diameter	mm (in)	Standard	A	99.505 — 99.515 (3.9175 — 3.9179)	
				B	99.495 — 99.505 (3.9171 — 3.9175)	
			0.25 (0.0098) OS		99.745 — 99.765 (3.9270 — 3.9278)	
			0.50 (0.0197) OS		99.995 — 100.015 (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	Out-of-roundness		mm (in)		0.003 (0.0001)
		Cylindricity		mm (in)		0.004 (0.0002)
		Grinding limit (dia.)		mm (in)		To 51.750 (2.0374)
		Crank journal	Out-of-roundness		mm (in)	
	Cylindricity		mm (in)		0.006 (0.0002)	
	Grinding limit (dia.)		mm (in)		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) mm (in)	#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



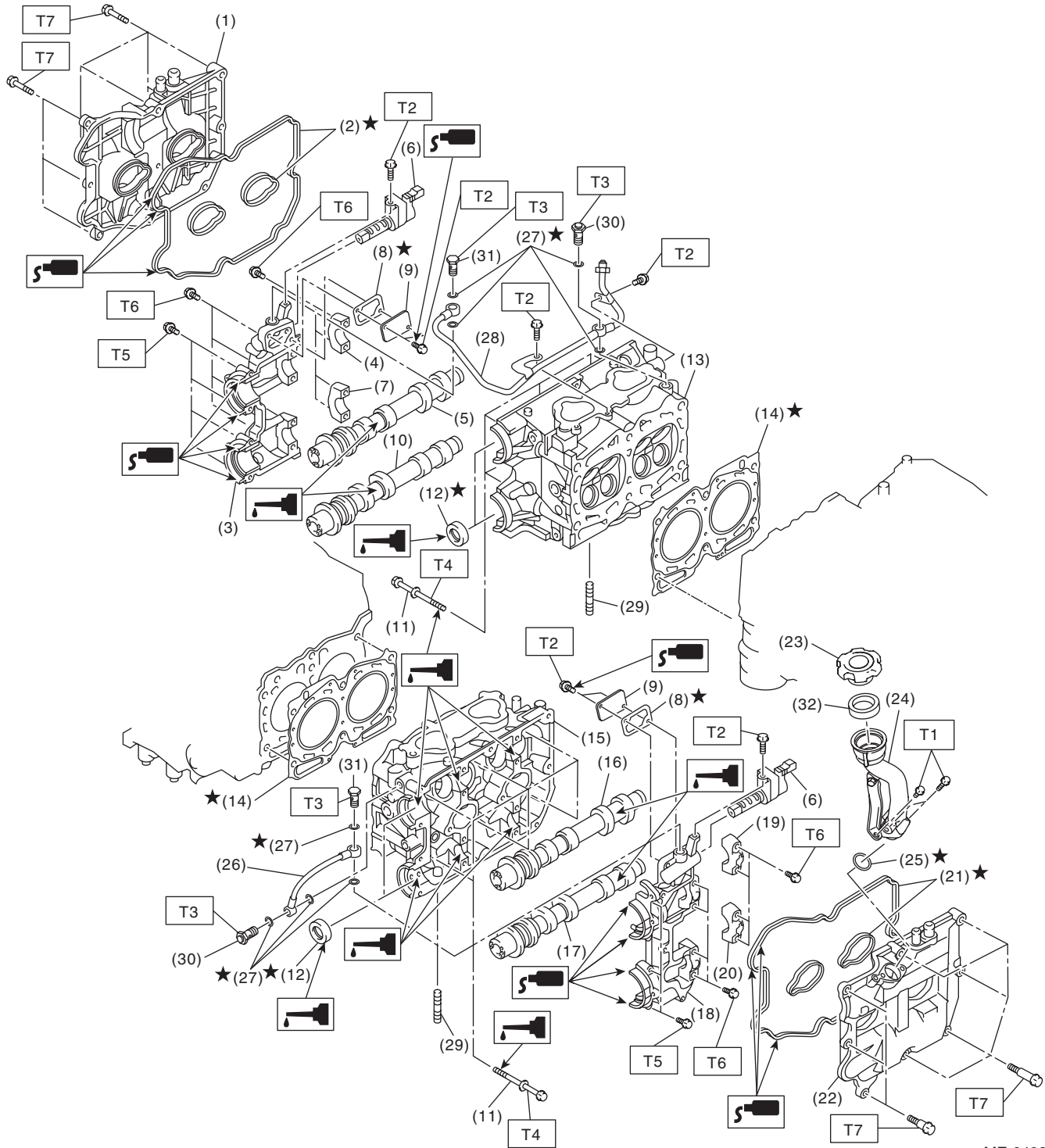
ME-03995

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

2. CYLINDER HEAD AND CAMSHAFT



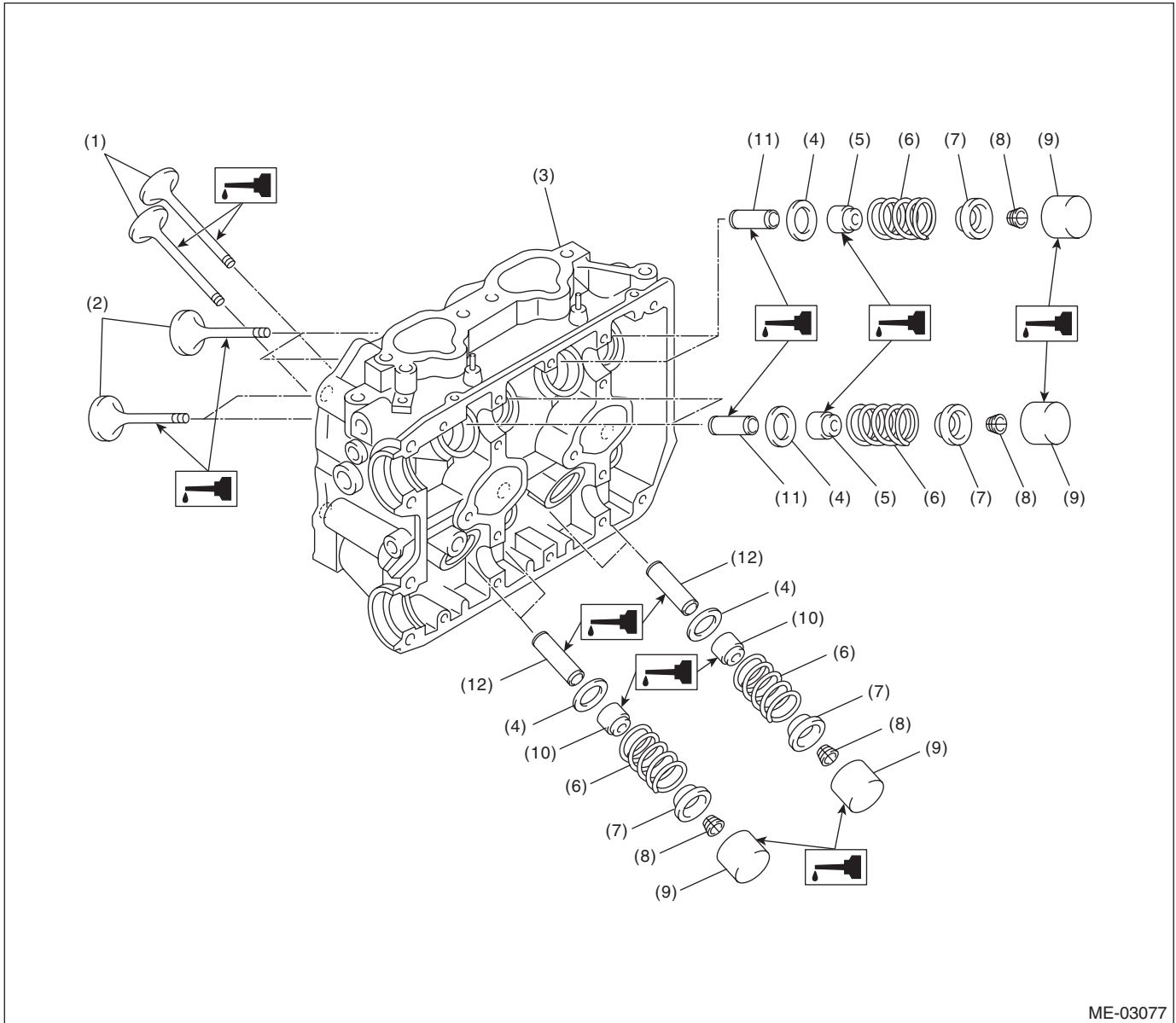
ME-04094

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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	<i>Tightening torque: N·m (kgf-m, ft-lb)</i>
(7) Exhaust camshaft cap RH	(21) Rocker cover gasket LH	<i>T1: 6.4 (0.7, 4.7)</i>
(8) Gasket	(22) Rocker cover LH	<i>T2: 8 (0.8, 5.9)</i>
(9) Oil return cover	(23) Oil filler cap	<i>T3: 29 (3.0, 21.4)</i>
(10) Exhaust camshaft RH	(24) Oil filler duct	<i>T4: <Ref. to ME(H4DOTC)-67, INSTALLATION, Cylinder Head.></i>
(11) Cylinder head bolt	(25) O-ring	<i>T5: <Ref. to ME(H4DOTC)-62, INSTALLATION, Camshaft.></i>
(12) Oil seal	(26) Oil pipe LH	<i>T6: <Ref. to ME(H4DOTC)-62, INSTALLATION, Camshaft.></i>
(13) Cylinder head RH	(27) Gasket	<i>T7: <Ref. to ME(H4DOTC)-62, INSTALLATION, Camshaft.></i>
(14) Cylinder head gasket	(28) Oil pipe RH	

3. CYLINDER HEAD AND VALVE ASSEMBLY

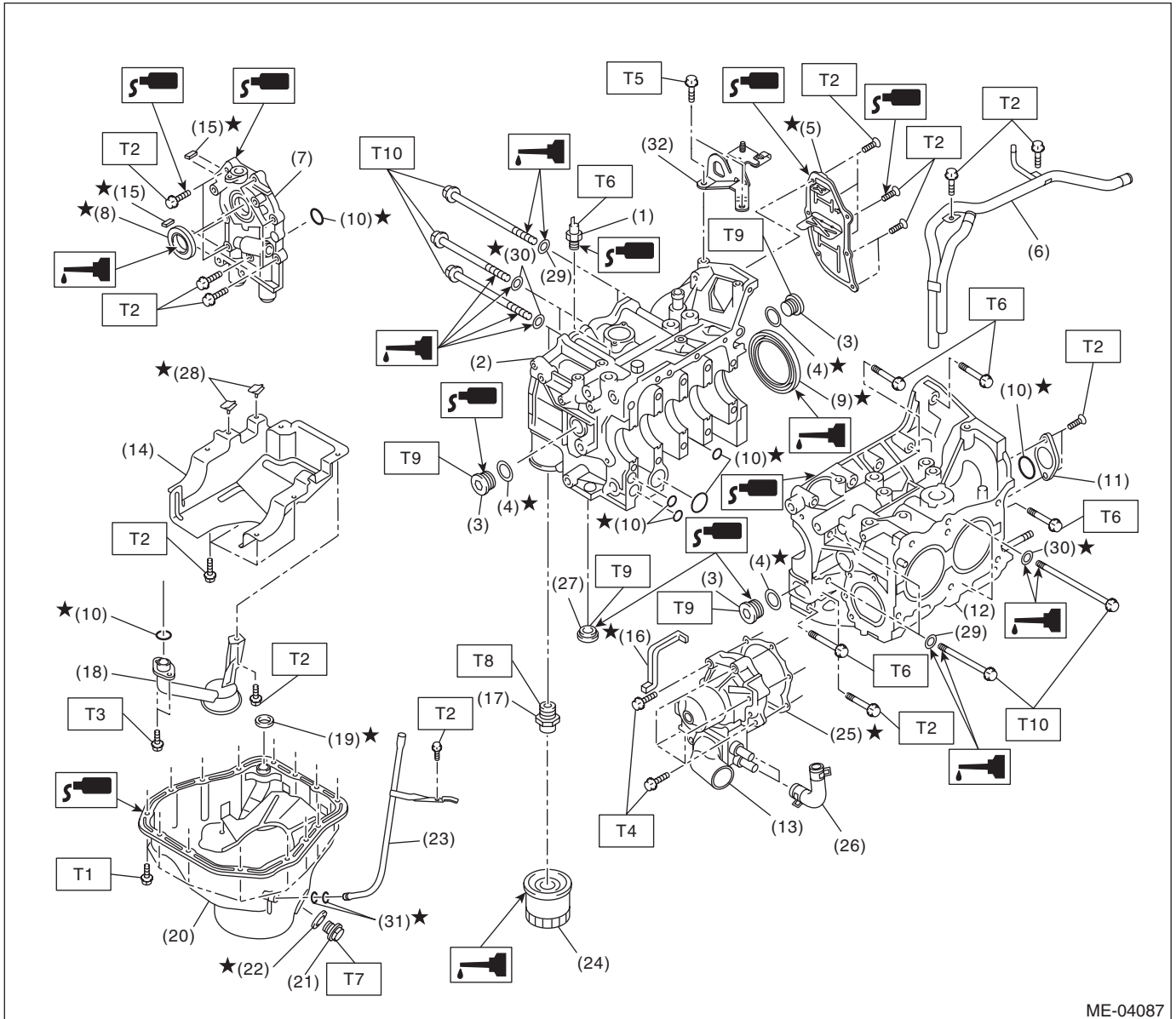


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|-----------------------|---------------------------|-----------------------------|
| (1) Exhaust valve | (5) Intake valve oil seal | (9) Valve lifter |
| (2) Intake valve | (6) Valve spring | (10) Exhaust valve oil seal |
| (3) Cylinder head | (7)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

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4. CYLINDER BLOCK



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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	
(5) Oil separator cover	(20) Oil pan	
(6) Water by-pass pipe	(21) Drain plug	
(7) Oil pump	(22) Drain plug gasket	
(8) Front oil seal	(23) Oil level gauge guide	
(9) Rear oil seal	(24) Oil filter	
(10) O-ring	(25) Gasket	
(11) Service hole cover	(26) Water pump hose	
(12) Cylinder block LH	(27) Plug	
(13) Water pump	(28) Seal	
(14) Baffle plate	(29) Washer	
(15) Oil pump seal	(30) Seal washer	

Tightening torque: N·m (kgf-m, ft-lb)

T1: 5 (0.5, 3.7)

T2: 6.4 (0.7, 4.7)

T3: 10 (1.0, 7.2)

***T4: First 12 (1.2, 8.9)
Second 12 (1.2, 8.9)***

T5: 16 (1.6, 11.8)

T6: 25 (2.5, 18.4)

T7: 44 (4.5, 32.5)

T8: 45 (4.6, 33.2)

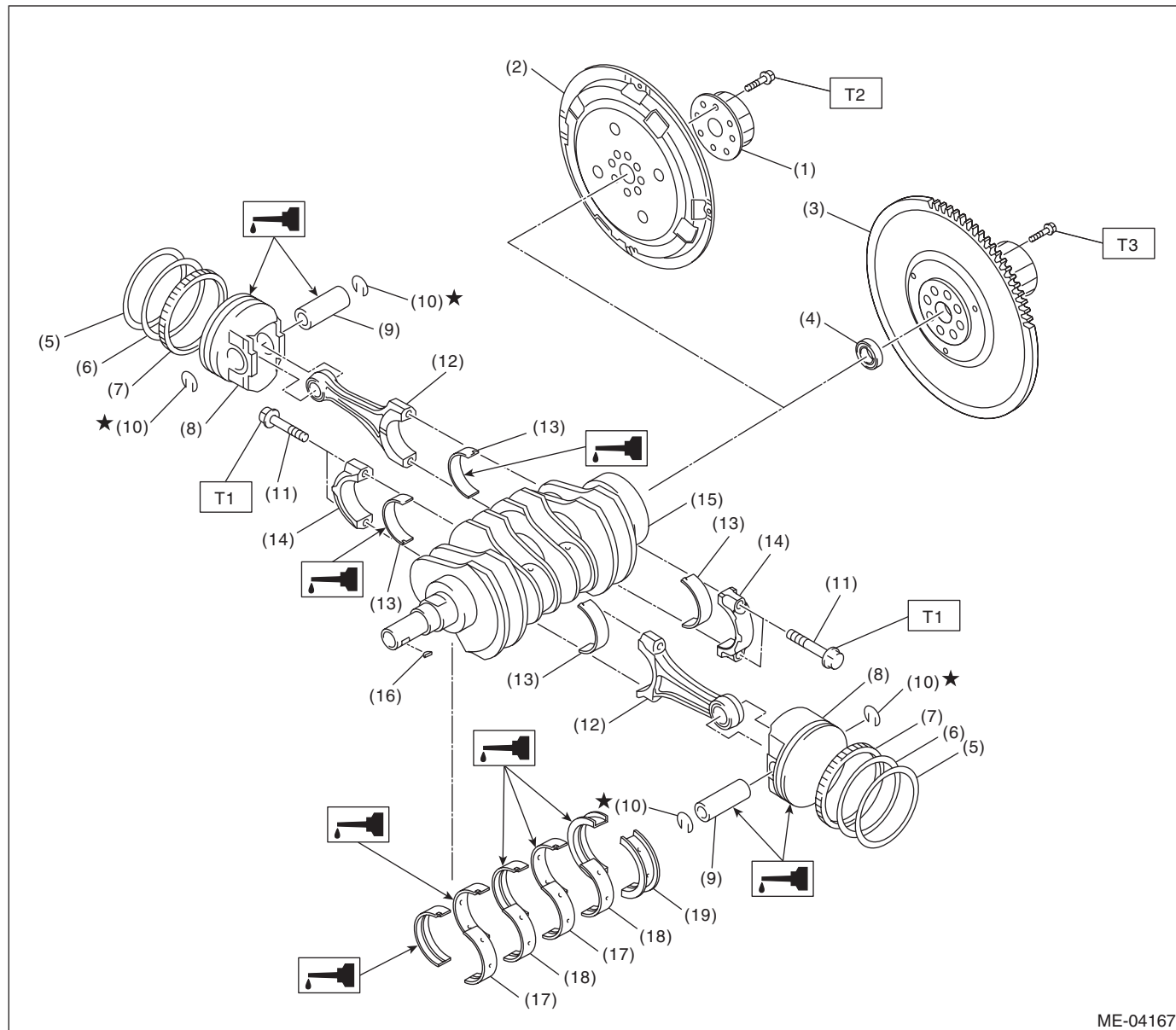
T9: 70 (7.1, 51.6)

***T10: <Ref. to ME(H4DOTC)-79,
INSTALLATION, Cylinder
Block.>***

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5. CRANKSHAFT AND PISTON



- (1) Reinforcement (AT model)
- (2) Drive plate (AT model)
- (3) Flywheel (MT model)
- (4) Ball bearing (MT model)
- (5) Top ring
- (6) Second ring
- (7) Oil ring
- (8) Piston

- (9) Piston pin
- (10) Snap ring
- (11) Connecting rod bolt
- (12) Connecting rod
- (13) Connecting rod bearing
- (14) Connecting rod cap
- (15) Crankshaft
- (16) Woodruff key

- (17) Crankshaft bearing #1, #3
- (18) Crankshaft bearing #2, #4
- (19) Crankshaft bearing #5

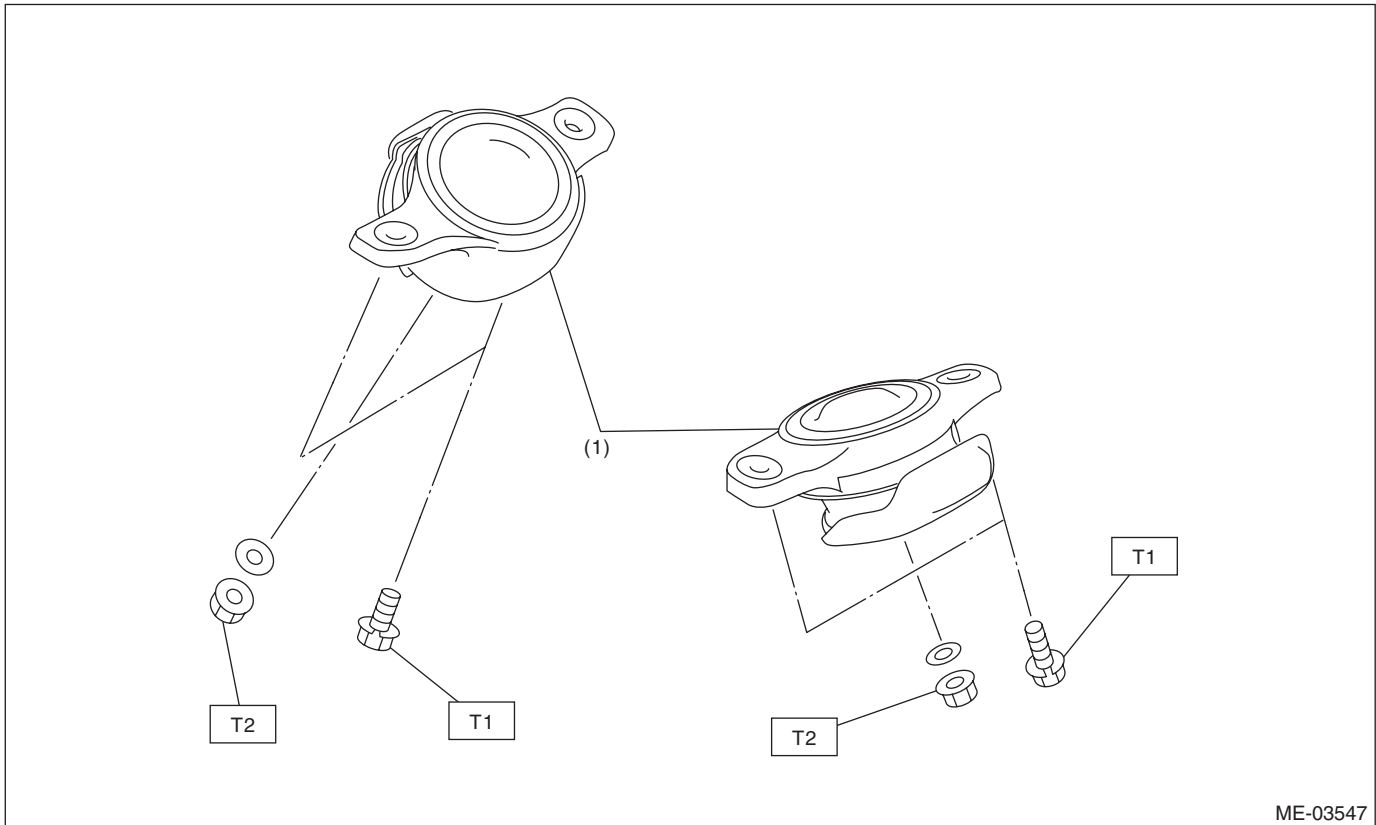
Tightening torque: N·m (kgf-m, ft-lb)

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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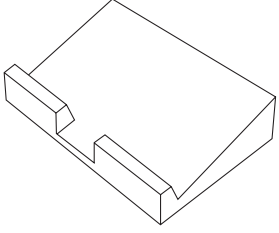
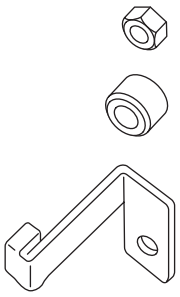
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C: CAUTION

- 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.

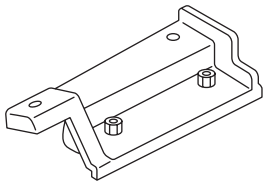
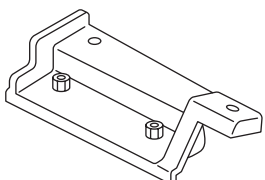
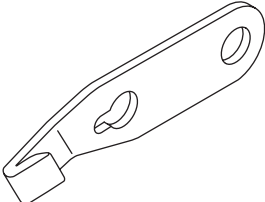
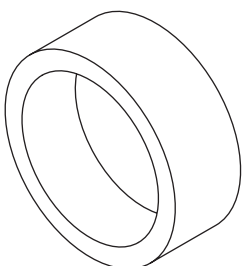
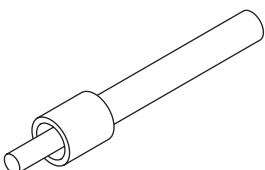
D: PREPARATION TOOL

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.

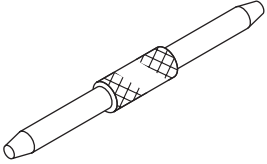
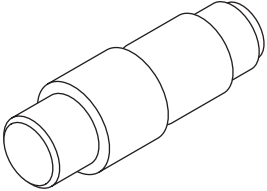
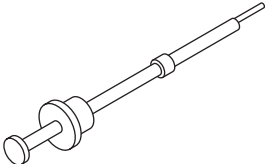
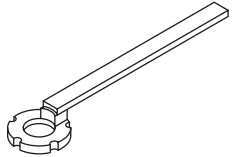
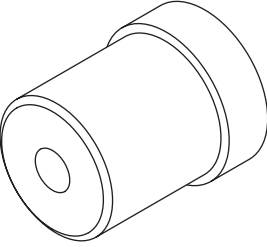
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ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-498457000</p>	498457000	ENGINE STAND ADAPTER RH	Used together with ENGINE STAND (499817100).
 <p>ST-498457100</p>	498457100	ENGINE STAND ADAPTER LH	Used together with ENGINE STAND (499817100).
 <p>ST-498497100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

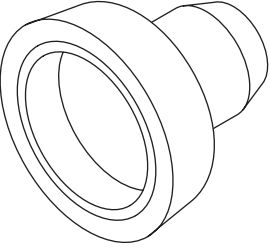
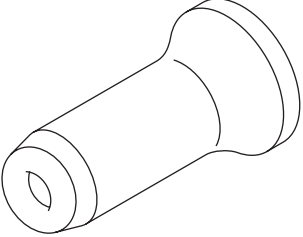
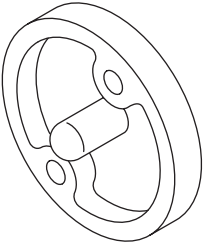
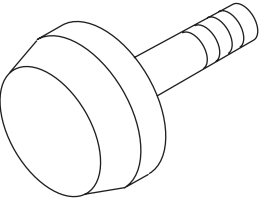
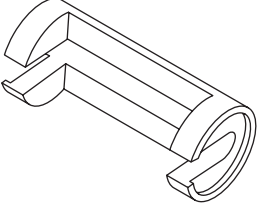
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ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499017100</p>	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
 <p>ST-499037100</p>	499037100	CONNECTING ROD BUSHING REMOVER AND INSTALLER	Used for removing and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

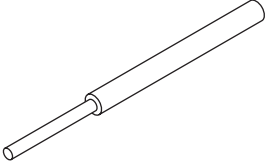
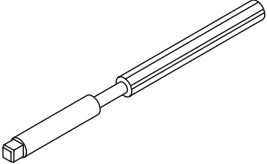
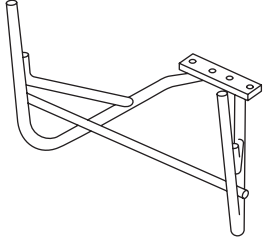
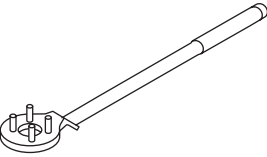
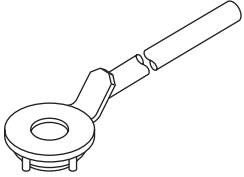
General Description

MECHANICAL

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

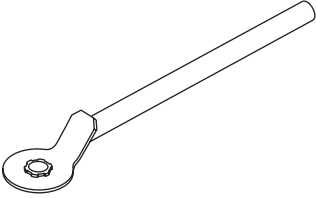
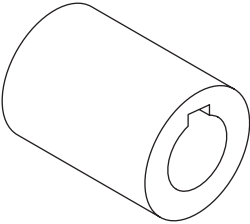
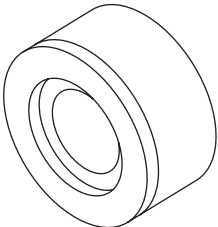
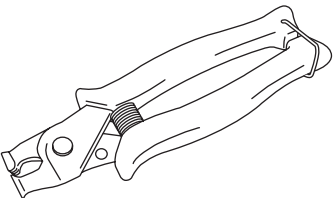
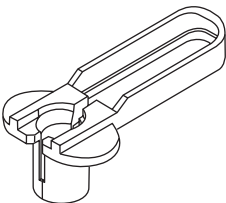
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499767200</p>	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
 <p>ST-499767400</p>	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
 <p>ST-499817100</p>	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).
 <p>ST-499977100</p>	499977100	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts. (MT model)
 <p>ST-499977400</p>	499977400	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts. (AT model)

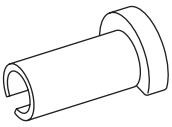
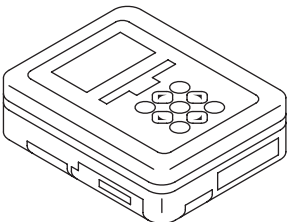
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499977500</p>	499977500	CAM SPROCKET WRENCH	Used for removing and installing intake cam sprocket.
 <p>ST-499987500</p>	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 <p>ST18251AA020</p>	18251AA020	VALVE GUIDE ADJUSTER	Used for installing intake and exhaust valve guides.
 <p>ST18353AA000</p>	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>
 <p>ST18371AA000</p>	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
 ST42099AE000	42099AE000	QUICK CONNECTOR RELEASE	Used for disconnecting quick connector of the engine compartment.
 ST1B022XU0	1B022XU0	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.