

GENERAL DESCRIPTION

MECHANICAL

1. General Description

A: SPECIFICATIONS

Engine	Type	Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine	
	Valve arrangement	Belt driven, single over-head camshaft, 4-valve/cylinder	
	Bore × Stroke	mm (in)	99.5 × 79.0 (3.917 × 3.110)
	Displacement	cm ³ (cu in)	2,457 (150)
	Compression ratio	10.0	
	Compression pressure (at 200 — 300 rpm)	kPa (kg/cm ² , psi)	1,079 — 1,275 (11.0 — 13.0, 156 — 185)
	Number of piston rings	Pressure ring: 2, Oil ring: 1	
	Intake valve timing	Opening	1° BTDC
		Closing	51° ABDC
	Exhaust valve timing	Opening	50° BBDC
		Closing	6° ATDC
	Valve clearance	Intake mm (in)	0.20±0.02 (0.0079±0.0008)
		Exhaust mm (in)	0.25±0.02 (0.0098±0.0008)
	Idling speed [At neutral position on MT, or "P" or "N" position on AT]		rpm
	No load		650±100 (MT vehicles) 700±100 (AT vehicles)
	A/C ON		850±100
	Firing order		
	1 → 3 → 2 → 4		
	Ignition timing	BTDC/rpm	
	MT: 10°±8°/650 AT: 15°±8°/700		

NOTE:

US: Undersize OS: Oversize

Belt tensioner adjuster	Protrusion of adjuster rod		5.2 — 6.2 mm (0.205 — 0.244 in)
Belt tensioner	Spacer O.D.		17.955 — 17.975 mm (0.7069 — 0.7077 in)
	Tensioner bushing I.D.		18.00 — 18.08 mm (0.7087 — 0.7118 in)
	Clearance between spacer and bushing	STD	0.025 — 0.125 mm (0.0010 — 0.0049 in)
		Limit	0.175 mm (0.0069 in)
	Side clearance of spacer	STD	0.20 — 0.55 mm (0.0079 — 0.0217 in)
		Limit	0.81 mm (0.0319 in)
Valve rocker arm	Clearance between shaft and arm	STD	0.020 — 0.054 mm (0.0008 — 0.0021 in)
		Limit	0.10 mm (0.0039 in)
Camshaft	Bend limit		0.025 mm (0.00098 in)
	Thrust clearance	STD	0.030 — 0.090 mm (0.0012 — 0.0035 in)
		Limit	0.10 mm (0.0039 in)
	Cam lobe height	Intake	39.485 — 39.585 mm (1.5545 — 1.5585 in)
			39.385 mm (1.5506 in)
		Exhaust	39.257 — 39.357 mm (1.5455 — 1.5495 in)
			39.157 mm (1.5416 in)
	Camshaft journal O.D.		31.928 — 31.945 mm (1.2570 — 1.2577 in)
Cylinder head	Camshaft journal hole I.D. (cylinder head)		32.000 — 32.018 mm (1.2598 — 1.2605 in)
	Oil clearance	STD	0.055 — 0.090 mm (0.0022 — 0.0035 in)
		Limit	0.10 mm (0.0039 in)
	Surface warpage limit (mating with cylinder block)		0.05 mm (0.0020 in)
	Surface grinding limit		0.1 mm (0.004 in)
	Standard height		97.5 mm (3.84 in)

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Valve seat	Refacing angle			90°		
	Contacting width	Intake	STD	1.1 mm (0.043 in)		
			Limit	1.8 mm (0.071 in)		
	Exhaust	STD	1.5 mm (0.059 in)			
			Limit	2.2 mm (0.087 in)		
Valve guide	Inner diameter			6.000 — 6.012 mm (0.2362 — 0.2367 in)		
	Protrusion above head	Intake	20.0 — 20.5 mm (0.787 — 0.807 in)			
			Exhaust	16.5 — 17.0 mm (0.650 — 0.669 in)		
Valve	Head edge thickness	Intake	STD	1.0 mm (0.039 in)		
			Limit	0.6 mm (0.024 in)		
		Exhaust	STD	1.2 mm (0.047 in)		
			Limit	0.6 mm (0.024 in)		
	Stem diameter	Intake		5.950 — 5.965 mm (0.2343 — 0.2348 in)		
		Exhaust		5.945 — 5.960 mm (0.2341 — 0.2346 in)		
	Stem oil clearance	STD	Intake	0.035 — 0.062 mm (0.0014 — 0.0024 in)		
			Exhaust	0.040 — 0.067 mm (0.0016 — 0.0026 in)		
		Limit	—	0.15 mm (0.0059 in)		
	Overall length	Intake		120.6 mm (4.75 in)		
		Exhaust		121.7 mm (4.79 in)		
Valve spring	Free length			54.30 mm (2.1378 in)		
	Squareness			2.5°, 2.4 mm (0.094 in)		
	Tension/spring height	Set	214 — 246 N (21.8 — 25.1 kgf, 48.1 — 55.3 lb)/ 45.0 mm (1.772 in)			
			526 — 582 N (53.6 — 59.3 kgf, 118 — 130.8 lb)/ 34.7 mm (1.366 in)			
Cylinder block	Surface warpage limit (mating with cylinder head)			0.05 mm (0.0020 in)		
	Surface grinding limit			0.1 mm (0.004 in)		
	Inner diameter	A	99.505 — 99.515 mm (3.9175 — 3.9179 in)			
		B	99.495 — 99.505 mm (3.9171 — 3.9175 in)			
	Taper	STD	0.015 mm (0.0006 in)			
		Limit	0.050 mm (0.0020 in)			
	Out-of-roundness	STD	0.010 mm (0.0004 in)			
		Limit	0.050 mm (0.0020 in)			
	Piston clearance	STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)			
		Limit	0.050 mm (0.0020 in)			
	Boring limit			0.5 mm (0.020 in)		
Piston	Outer diameter	STD	A	99.485 — 99.495 mm (3.9167 — 3.9171 in)		
			B	99.475 — 99.485 mm (3.9163 — 3.9167 in)		
		0.25 mm (0.0098 in)	99.725 — 99.735 mm (3.9262 — 3.9266 in)			
		OS				
	Standard inner diameter of piston pin hole	0.50 mm (0.0197 in)	99.975 — 99.985 mm (3.9360 — 3.9364 in)			
		OS				
	23.000 — 23.006 mm (0.9055 — 0.9057 in)					
Piston pin	Outer diameter			22.994 — 23.000 mm (0.9053 — 0.9055 in)		
	Standard clearance between piston pin and piston			0.004 — 0.008 mm (0.0002 — 0.0003 in)		
	Degree of fit			Piston pin must be fitted into position with thumb at 20°C (68°F).		

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Piston ring	Piston ring gap	Top ring	STD	0.20 — 0.35 mm (0.0079 — 0.0138 in)
			Limit	1.0 mm (0.039 in)
	Second ring	STD	0.37 — 0.52 mm (0.0146 — 0.0205 in)	
		Limit	1.0 mm (0.039 in)	
	Oil ring	STD	0.20 — 0.50 mm (0.0079 — 0.0197 in)	
		Limit	1.5 mm (0.059 in)	
	Clearance between piston ring and piston ring groove	Top ring	STD	0.040 — 0.080 mm (0.0016 — 0.0031 in)
			Limit	0.15 mm (0.0059 in)
		Second ring	STD	0.030 — 0.070 mm (0.0012 — 0.0028 in)
		Limit	0.15 mm (0.0059 in)	
Connecting rod	Bend or twist per 100 mm (3.94 in) in length		Limit	0.10 mm (0.0039 in)
	Side clearance at large end		STD	0.070 — 0.330 mm (0.0028 — 0.0130 in)
			Limit	0.4 mm (0.016 in)
Connecting rod bearing	Oil clearance		STD	0.012 — 0.038 mm (0.0005 — 0.0014 in)
			Limit	0.05 mm (0.0020 in)
	Thickness at center portion		STD	1.490 — 1.502 mm (0.0587 — 0.0591 in)
			0.03 mm (0.0012 in)	1.504 — 1.512 mm (0.0592 — 0.0595 in)
			US	
			0.05 mm (0.0020 in)	1.514 — 1.522 mm (0.0596 — 0.0599 in)
			US	
			0.25 mm (0.0098 in)	1.614 — 1.622 mm (0.0635 — 0.0639 in)
	US			
Connecting rod bushing	Clearance between piston pin and bushing		STD	0 — 0.022 mm (0 — 0.0009 in)
			Limit	0.030 mm (0.0012 in)

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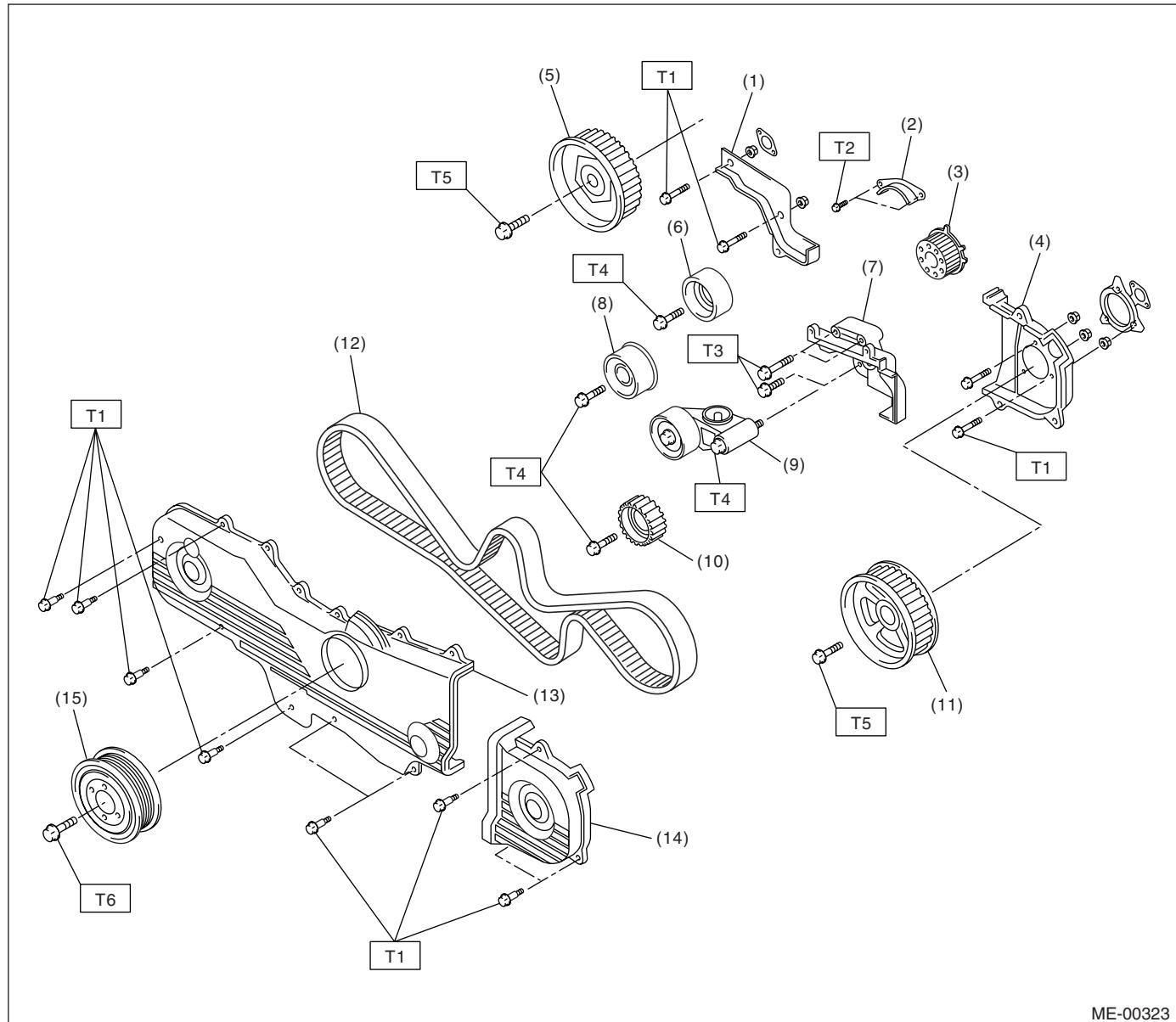
Crankshaft	Bend limit		0.035 mm (0.0014 in)
	Crank pin and crank journal	Out-of-roundness	Less than 0.020 mm (0.0008 in)
		Surface grinding limit	0.250 mm (0.0098 in)
	Crank pin outer diameter	STD	51.984 — 52.000 mm (2.0466 — 2.0472 in)
		0.03 mm (0.0012 in) US	51.954 — 51.970 mm (2.0454 — 2.0461 in)
		0.05 mm (0.0020 in) US	51.934 — 51.950 mm (2.0446 — 2.0453 in)
		0.25 mm (0.0098 in) US	51.734 — 51.750 mm (2.0368 — 2.0374 in)
	Crank journal outer diameter	STD	59.992 — 60.008 mm (2.3619 — 2.3625 in)
		#1, #3	0.03 mm (0.0012 in) US
			59.962 — 59.978 mm (2.3607 — 2.3613 in)
			0.05 mm (0.0020 in) US
			59.942 — 59.958 mm (2.3599 — 2.3605 in)
			0.25 mm (0.0098 in) US
		#2, #4, #5	STD
			59.992 — 60.008 mm (2.3619 — 2.3625 in)
	Thrust clearance	0.03 mm (0.0012 in) US	59.962 — 59.978 mm (2.3607 — 2.3613 in)
			0.05 mm (0.0020 in) US
	Oil clearance	STD	0.030 — 0.115 mm (0.0012 — 0.0045 in)
		#1	Limit
			0.25 mm (0.0098 in)
		#2	STD
			0.012 — 0.033 mm (0.0005 — 0.0013 in)
			Limit
		#3	0.045 mm (0.0018 in)
			STD
			0.040 mm (0.0016 in)
		#4	Limit
			0.012 — 0.033 mm (0.0005 — 0.0013 in)
			STD
		#5	0.045 mm (0.0018 in)
			Limit
			0.010 — 0.031 mm (0.0004 — 0.0012 in)
			STD
			0.040 mm (0.0016 in)
Crankshaft bearing	Crankshaft bearing	STD	1.998 — 2.011 mm (0.0787 — 0.0792 in)
		0.03 mm (0.0012 in) US	2.017 — 2.020 mm (0.0794 — 0.0795 in)
		#1, #3	0.05 mm (0.0020 in) US
			2.027 — 2.030 mm (0.0798 — 0.0799 in)
			0.25 mm (0.0098 in) US
			2.127 — 2.130 mm (0.0837 — 0.0839 in)
		#2, #4, #5	STD
			2.000 — 2.013 mm (0.0787 — 0.0793 in)
			0.03 mm (0.0012 in) US
			2.019 — 2.022 mm (0.0795 — 0.0796 in)
			0.05 mm (0.0020 in) US
			2.029 — 2.032 mm (0.0799 — 0.0800 in)
			0.25 mm (0.0098 in) US
			2.129 — 2.132 mm (0.0838 — 0.0839 in)

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B: COMPONENT

1. TIMING BELT



ME-00323

(1) Timing belt cover No. 2 (RH)	(9) Automatic belt tension adjuster assembly
(2) Timing belt guide (MT)	(10) Belt idler No. 2
(3) Crankshaft sprocket	(11) Camshaft sprocket No. 2
(4) Timing belt cover No. 2 (LH)	(12) Timing belt
(5) Camshaft sprocket No. 1	(13) Front timing belt cover
(6) Belt idler (No. 1)	(14) Timing belt cover (LH)
(7) Tensioner bracket	(15) Crankshaft pulley
(8) Belt idler (No. 2)	

Tightening torque: N·m (kgf-m, ft-lb)

T1: 5 (0.5, 3.6)

T2: 10 (1.0, 7.2)

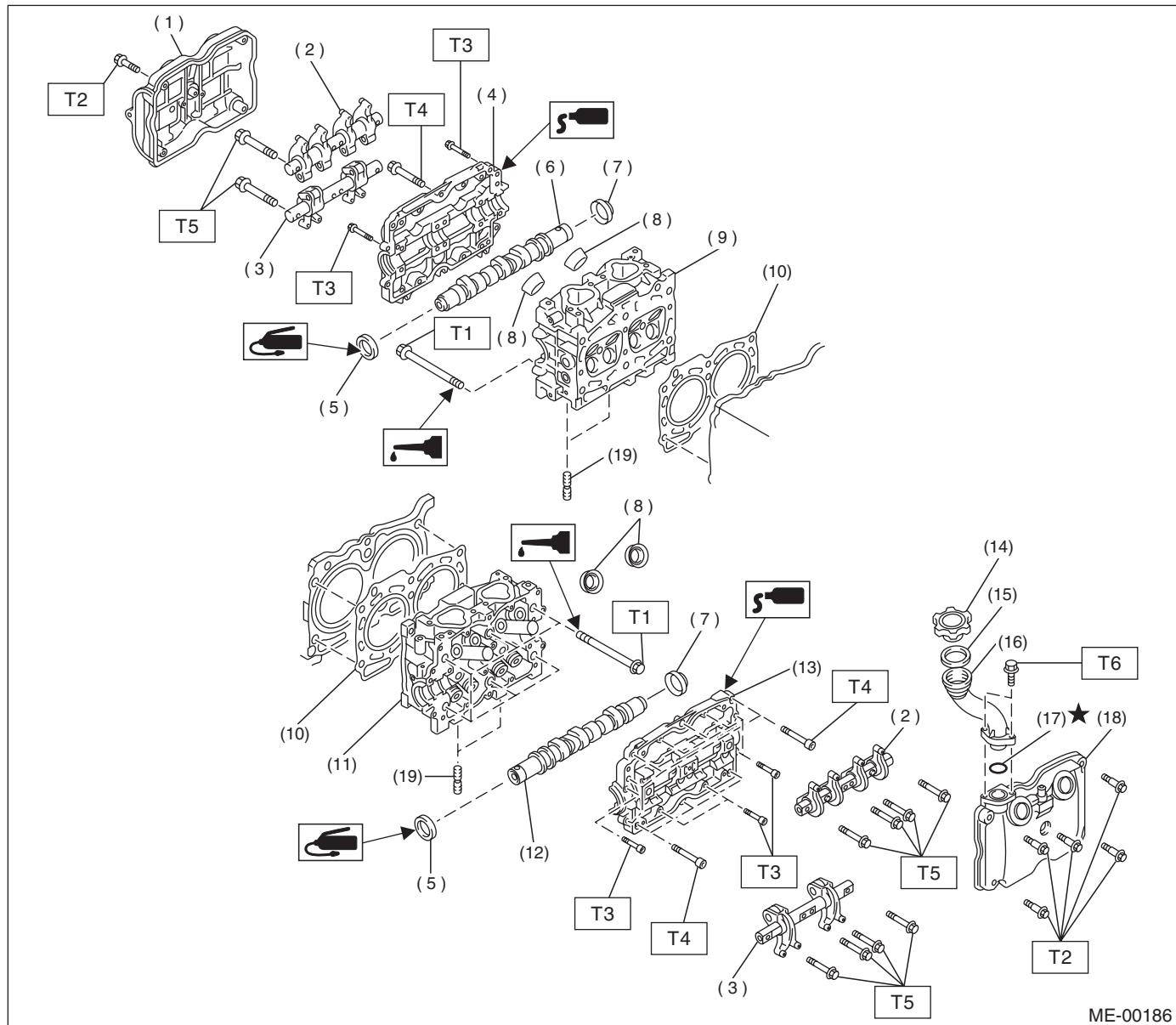
T3: 25 (2.5, 18.1)

T4: 39 (4.0, 28.9)

T5: 78 (8.0, 57.9)

T6: <Ref. to ME(H4SO)-44, INSTALLATION, Crankshaft Pulley.>

2. CYLINDER HEAD AND CAMSHAFT



(1) Rocker cover (RH)	(11) Cylinder head (LH)
(2) Intake valve rocker assembly	(12) Camshaft (LH)
(3) Exhaust valve rocker assembly	(13) Camshaft cap (LH)
(4) Camshaft cap (RH)	(14) Oil filler cap
(5) Oil seal	(15) Gasket
(6) Camshaft (RH)	(16) Oil filler duct
(7) Plug	(17) O-ring
(8) Spark plug pipe gasket	(18) Rocker cover (LH)
(9) Cylinder head (RH)	(19) Stud bolt
(10) Cylinder head gasket	

Tightening torque: N·m (kgf·m, ft·lb)

T1: <Ref. to ME(H4SO)-60, INSTALLATION, Cylinder Head.>

T2: 5 (0.5, 3.6)

T3: 10 (1.0, 7.2)

T4: 18 (1.8, 13.0)

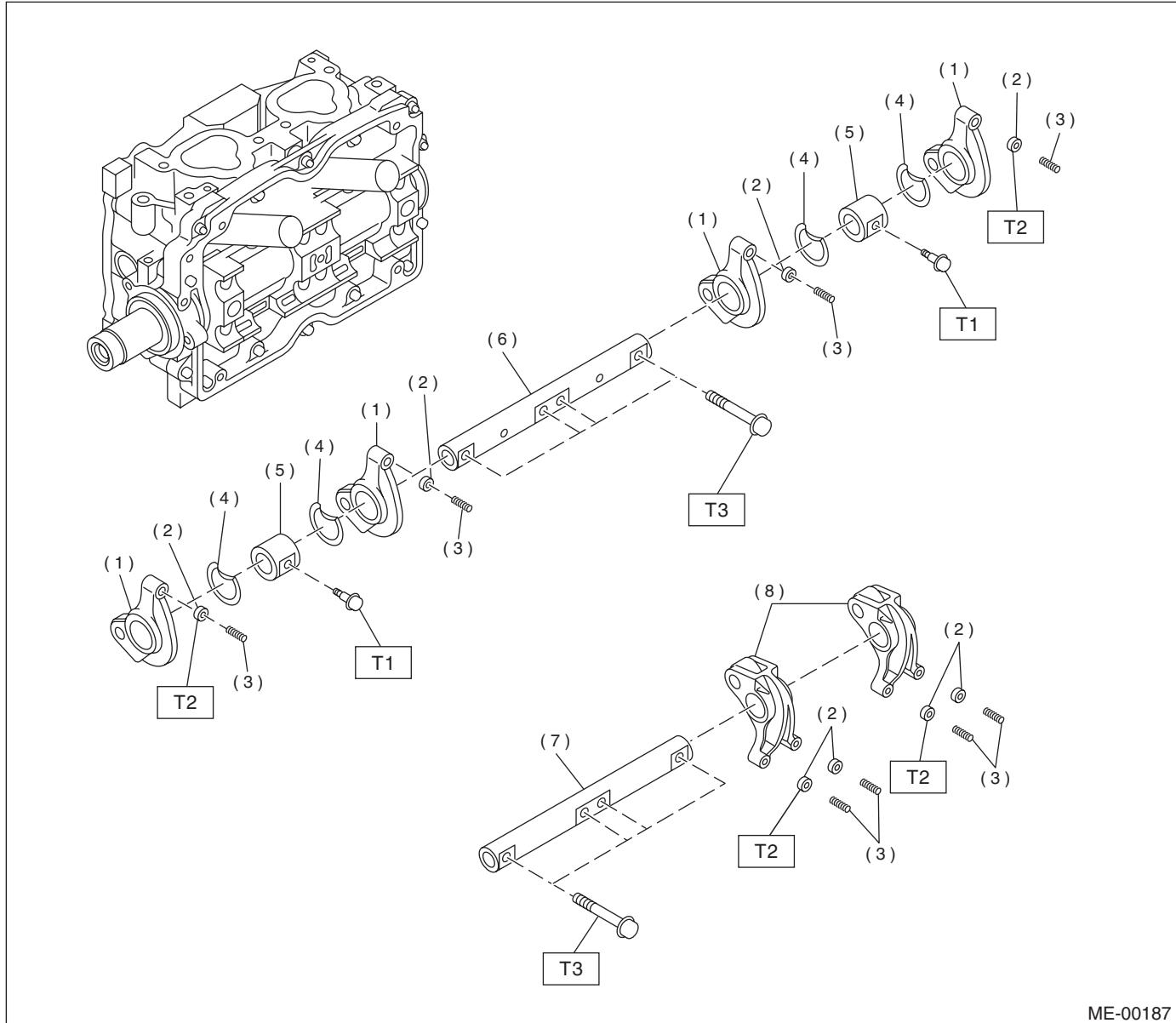
T5: 25 (2.5, 18.1)

T6: 6.4 (0.65, 4.7)

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3. VALVE ROCKER ASSEMBLY



ME-00187

(1) Intake valve rocker arm	(5) Rocker shaft support
(2) Valve rocker nut	(6) Intake rocker shaft
(3) Valve rocker adjust screw	(7) Exhaust rocker shaft
(4) Spring	(8) Exhaust valve rocker arm

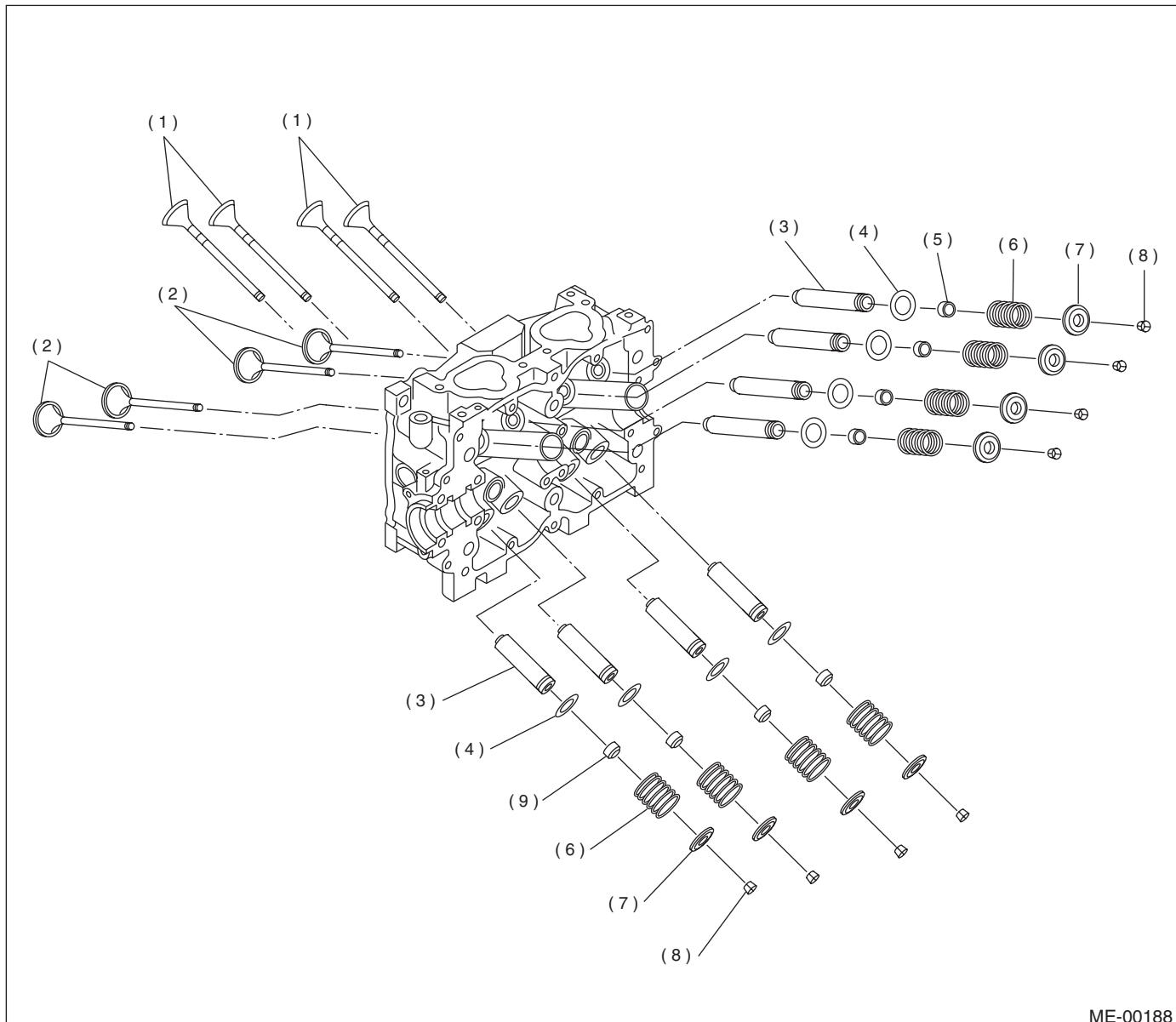
Tightening torque: N·m (kgf·m, ft·lb)

T1: 5 (0.5, 3.6)

T2: 10 (1.0, 7.2)

T3: 25 (2.5, 18.1)

4. CYLINDER HEAD AND VALVE ASSEMBLY



ME-00188

- (1) Exhaust valve
- (2) Intake valve
- (3) Valve guide

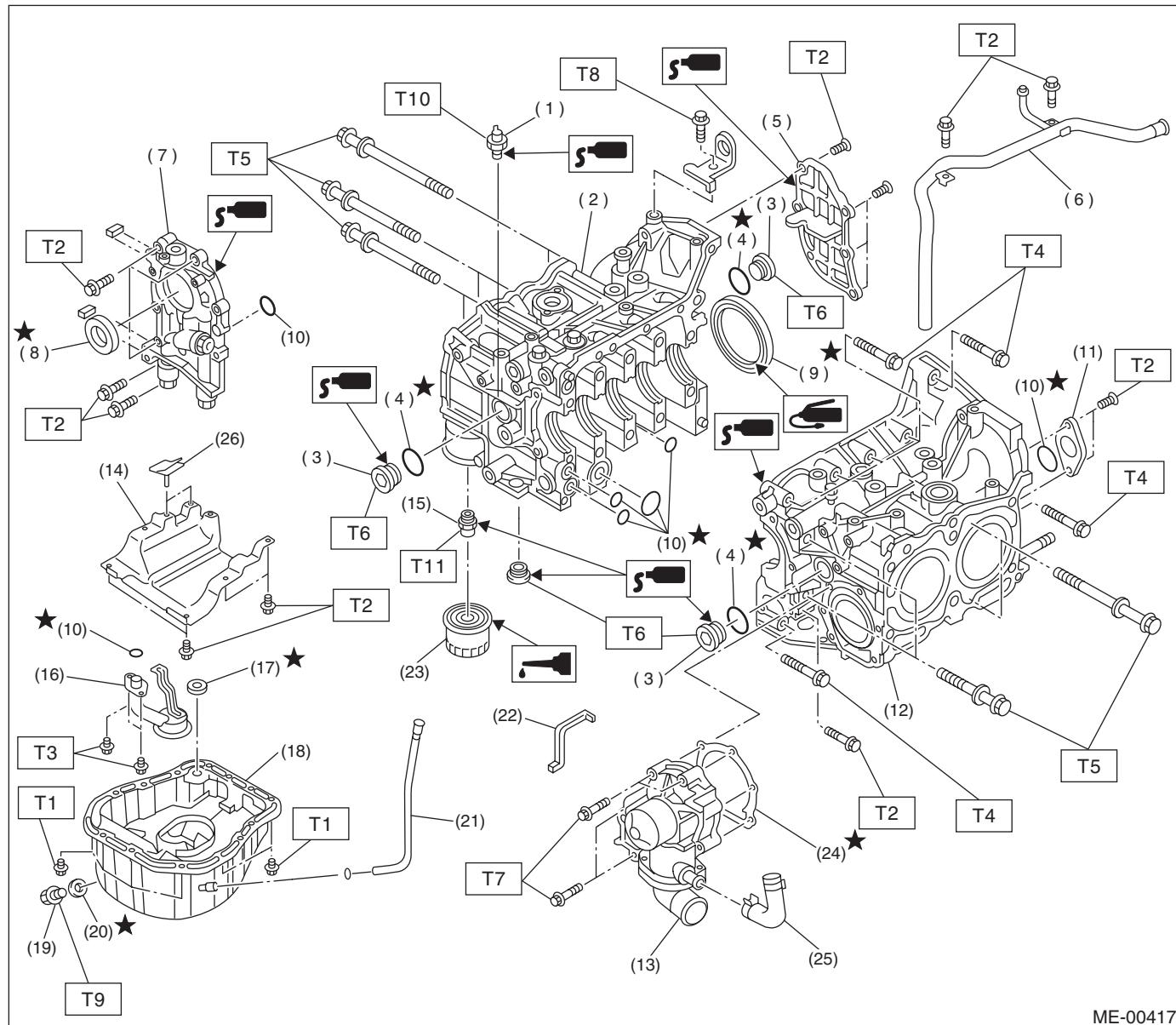
- (4) Valve spring seat
- (5) Intake valve oil seal
- (6) Valve spring

- (7) Retainer
- (8) Retainer key
- (9) Exhaust valve oil seal

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5. CYLINDER BLOCK



ME-00417

(1) Oil pressure switch	(16) Oil strainer
(2) Cylinder block (RH)	(17) Gasket
(3) Service hole plug	(18) Oil pan
(4) Gasket	(19) Drain plug
(5) Oil separator cover	(20) Metal gasket
(6) Water by-pass pipe	(21) Oil level gauge guide
(7) Oil pump	(22) Water pump sealing
(8) Front oil seal	(23) Oil filter
(9) Rear oil seal	(24) Gasket
(10) O-ring	(25) Water pump hose
(11) Service hole cover	(26) Seal
(12) Cylinder block (LH)	
(13) Water pump	
(14) Baffle plate	
(15) Oil filter connector	

Tightening torque: N·m (kgf·m, ft·lb)

T1: 5 (0.5, 3.6)
T2: 6.4 (0.65, 4.7)
T3: 10 (1.0, 7.2)
T4: 25 (2.5, 18.1)
T5: <Ref. to ME(H4SO)-72, INSTALLATION, Cylinder Block. >
T6: 70 (7.1, 51.6)
T7: First 12 (1.2, 8.7) Second 12 (1.2, 8.7)
T8: 45 (4.6, 33.2)
T9: 44 (4.5, 33)
T10: 25 (2.5, 18.1)
T11: 54 (5.6, 41)

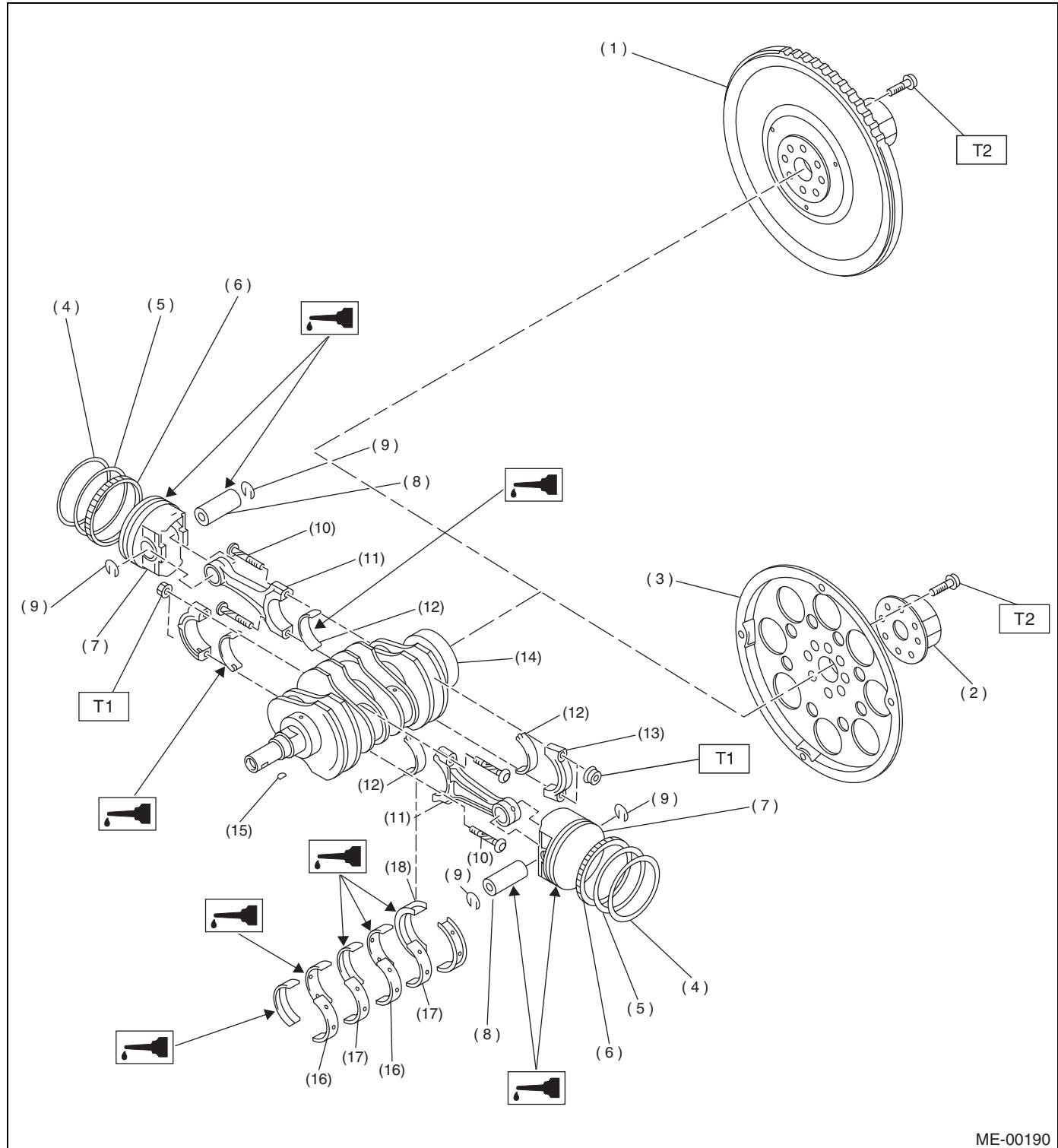
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6. CRANKSHAFT AND PISTON



ME-00190

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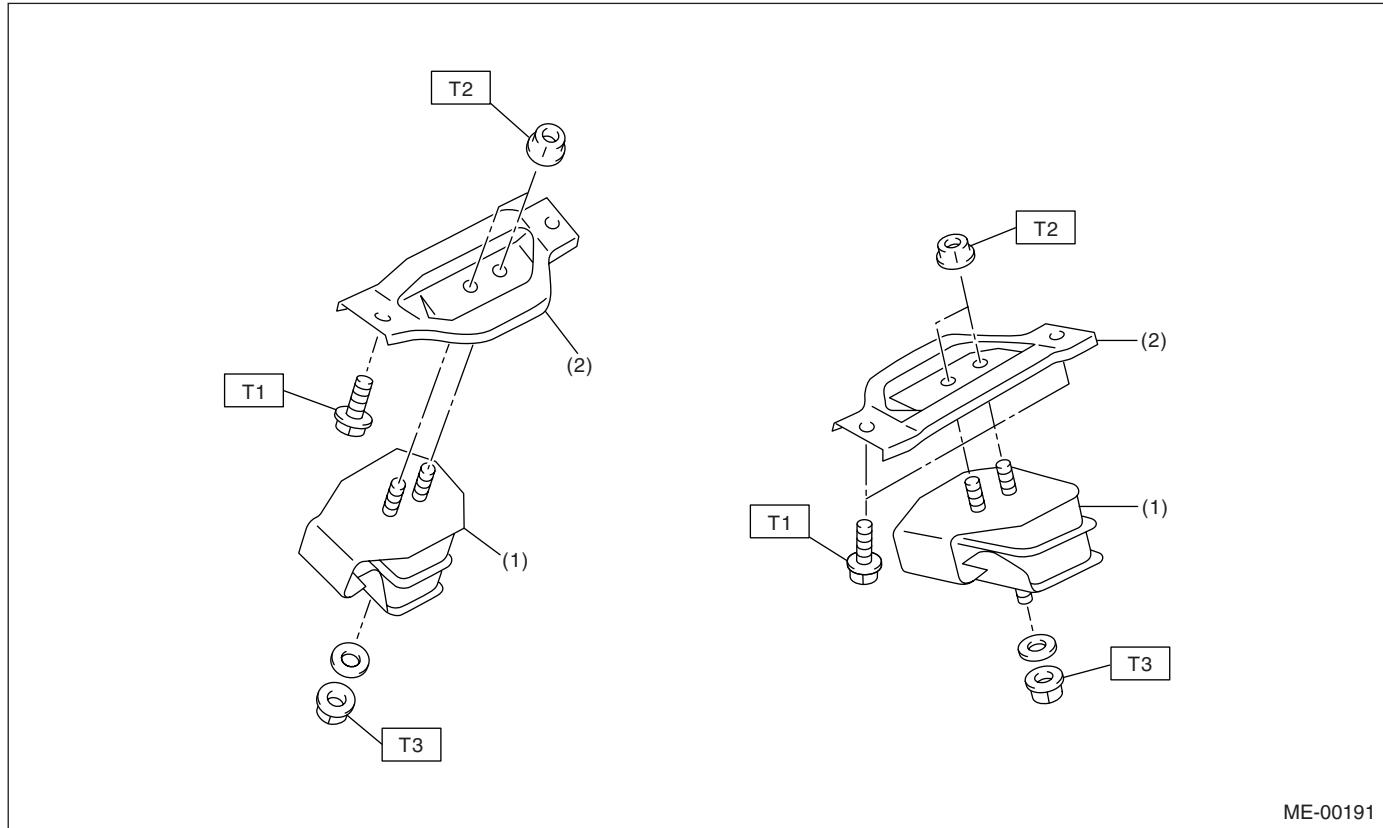
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(1) Flywheel (MT)	(9) Snap ring	(17) Crankshaft bearing #2, #4
(2) Reinforcement (AT)	(10) Connecting rod bolt	(18) Crankshaft bearing #5
(3) Drive plate (AT)	(11) Connecting rod	
(4) Top ring	(12) Connecting rod bearing	<i>Tightening torque: N·m (kgf·m, ft-lb)</i>
(5) Second ring	(13) Connecting rod cap	<i>T1: 45 (4.6, 33.2)</i>
(6) Oil ring	(14) Crankshaft	<i>T2: 72 (7.3, 52.8)</i>
(7) Piston	(15) Woodruff key	
(8) Piston pin	(16) Crankshaft bearing #1, #3	

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7. ENGINE MOUNTING



(1) Front cushion rubber

(2) Front engine mounting bracket

Tightening torque: N·m (kgf·m, ft·lb)

T1: 35 (3.6, 25.8)

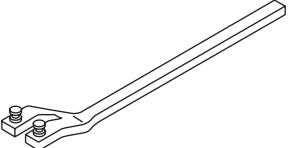
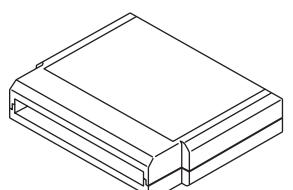
T2: 42 (4.3, 31.0)

T3: 85 (8.7, 63)

C: CAUTION

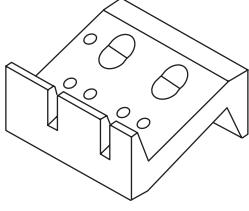
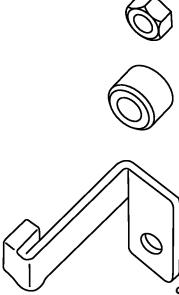
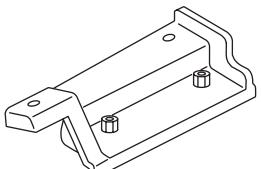
- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.
- All parts should be thoroughly cleaned, paying special attention to the engine oil passages, pistons and bearings.

D: PREPARATION TOOL**1. SPECIAL TOOLS**

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
	18231AA010	CAMSHAFT SPROCKET WRENCH	<ul style="list-style-type: none"> • Used for removing and installing camshaft sprocket. (LH side) • Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.
	24082AA210 (newly adopted tool)	CARTRIDGE	Troubleshooting for electrical systems.

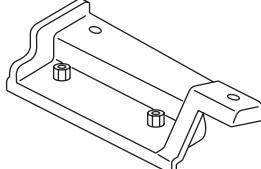
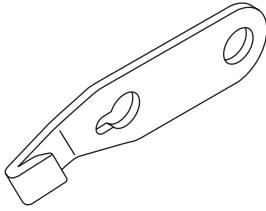
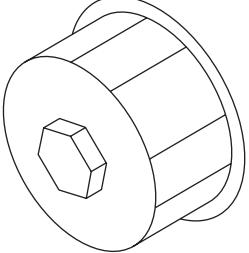
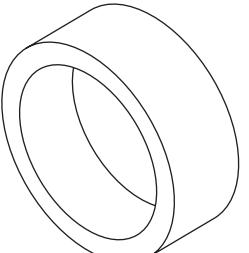
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 ST22771AA30	22771AA030	SELECT MONITOR KIT	Troubleshooting for electrical systems.
 ST-498267800	498267800	CYLINDER HEAD TABLE	<ul style="list-style-type: none"> • Used for replacing valve guides. • Used for removing and installing valve springs.
 ST-498277200	498277200	STOPPER SET	Used for installing automatic transmission assembly to engine.
 ST-498457000	498457000	ENGINE STAND ADAPTER RH	Used with ENGINE STAND (499817000).

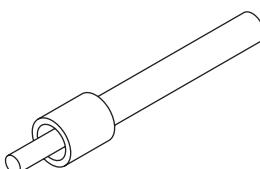
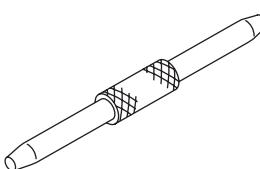
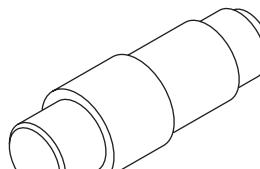
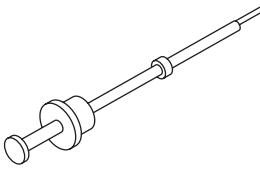
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 ST-498457100	498457100	ENGINE STAND ADAPTER LH	Used with ENGINE STAND (499817000).
 ST-498497100	498497100	CRANKSHAFT STOPPER	Used for stopping rotation of flywheel when loosening and tightening crankshaft pulley bolt, etc.
 ST-498547000	498547000	OIL FILTER WRENCH	Used for removing and installing oil filter.
 ST-498747300	498747300	PISTON GUIDE	Used for installing piston in cylinder of a 2500 cc engine.

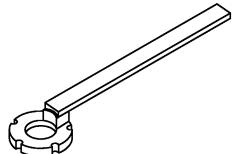
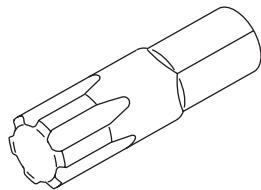
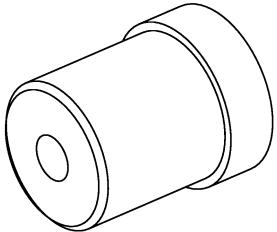
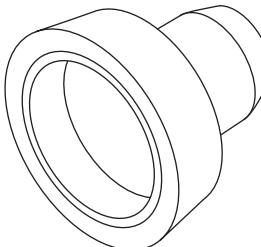
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ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498857100	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.
 ST-499017100	499017100	PISTON GUIDE	Used for installing piston pin, piston and connecting rod.
 ST-499037100	499037100	CONNECTING ROD BUSHING REMOVER & INSTALLER	Used for removing and installing connecting rod bushing.
 ST-499097700	499097700	PISTON PIN REMOVER ASSEMBLY	Used for removing piston pin.

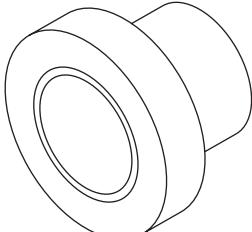
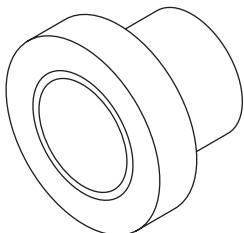
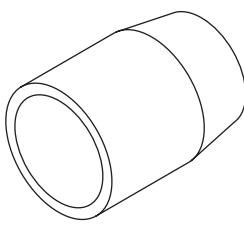
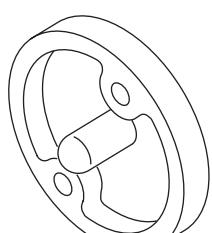
GENERAL DESCRIPTION

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499207400	499207400	CAMSHAFT SPROCKET WRENCH	Used for removing and installing camshaft sprocket. (RH side)
 ST-499497000	499497000	TORX PLUS	Used for removing and installing camshaft cap.
 ST-499587100	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.
 ST-499587200	499587200	CRANKSHAFT OIL SEAL INSTALLER	<ul style="list-style-type: none">Used for installing crankshaft oil seal.Used with CRANKSHAFT OIL SEAL GUIDE (499597100).

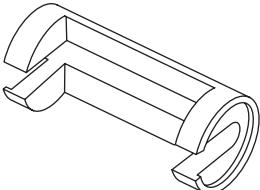
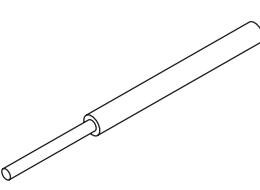
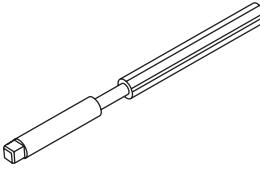
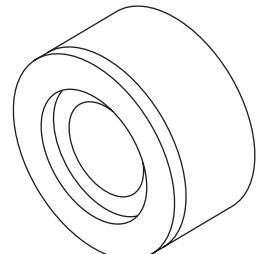
GENERAL DESCRIPTION

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499587500	499587500	OIL SEAL INSTALLER	Used for installing camshaft oil seal.
 ST-499587700	499587700	CAMSHAFT OIL SEAL INSTALLER	Used for installing cylinder head plug.
 ST-499597000	499597000	OIL SEAL GUIDE	<ul style="list-style-type: none">Used for installing camshaft oil seal.Used with CAMSHAFT OIL SEAL INSTALLER (499587500).
 ST-499597100	499597100	CRANKSHAFT OIL SEAL GUIDE	<ul style="list-style-type: none">Used for installing crankshaft oil seal.Used with CRANKSHAFT OIL SEAL INSTALLER (499587200).

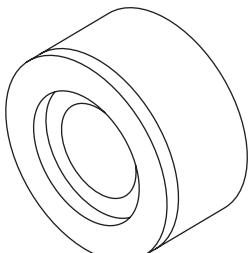
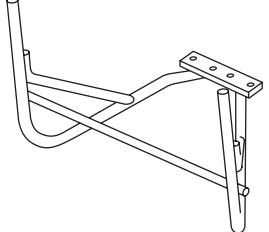
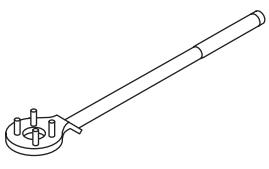
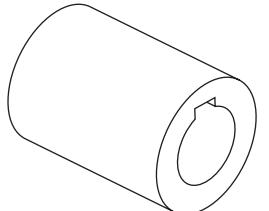
GENERAL DESCRIPTION

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499718000	499718000	VALVE SPRING REMOVER	Used for removing and installing valve springs.
 ST-499767200	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
 ST-499767400	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
 ST-499767700	499767700 (Intake side)	VALVE GUIDE ADJUSTER	Used for installing valve guides.

GENERAL DESCRIPTION

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499767800	499767800 (Exhaust side)	VALVE GUIDE ADJUSTER	Used for installing valve guides.
 ST-499817100	499817100	ENGINE STAND	<ul style="list-style-type: none"> Stand used for engine disassembly and assembly. Used with ENGINE STAND ADAPTER RH (498457000) & LH (498457100).
 ST-499977100	499977100	CRANKSHAFT PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolts.
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.

2. GENERAL PURPOSE TOOLS

TOOL NAME	REMARKS
Compression gauge	Used for measuring compression.
Tachometer (secondary pick-up type)	Used for measuring idle speed.
Timing light	Used for measuring ignition timing.

E: PROCEDURE

It is possible to conduct the following service procedures with engine on the vehicle, however, the procedures described in this section are based on the condition that the engine is removed from the vehicle.

- V-belt
- Timing belt
- Valve rocker assembly
- Camshaft
- Cylinder head