

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)	
	Piston 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)	
Idle speed ["P" or "N" range]		No load	700±100		
		A/C ON	825±100		
Ignition order			1 → 3 → 2 → 4		
Ignition timing			BTDC/rpm		

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NOTE:

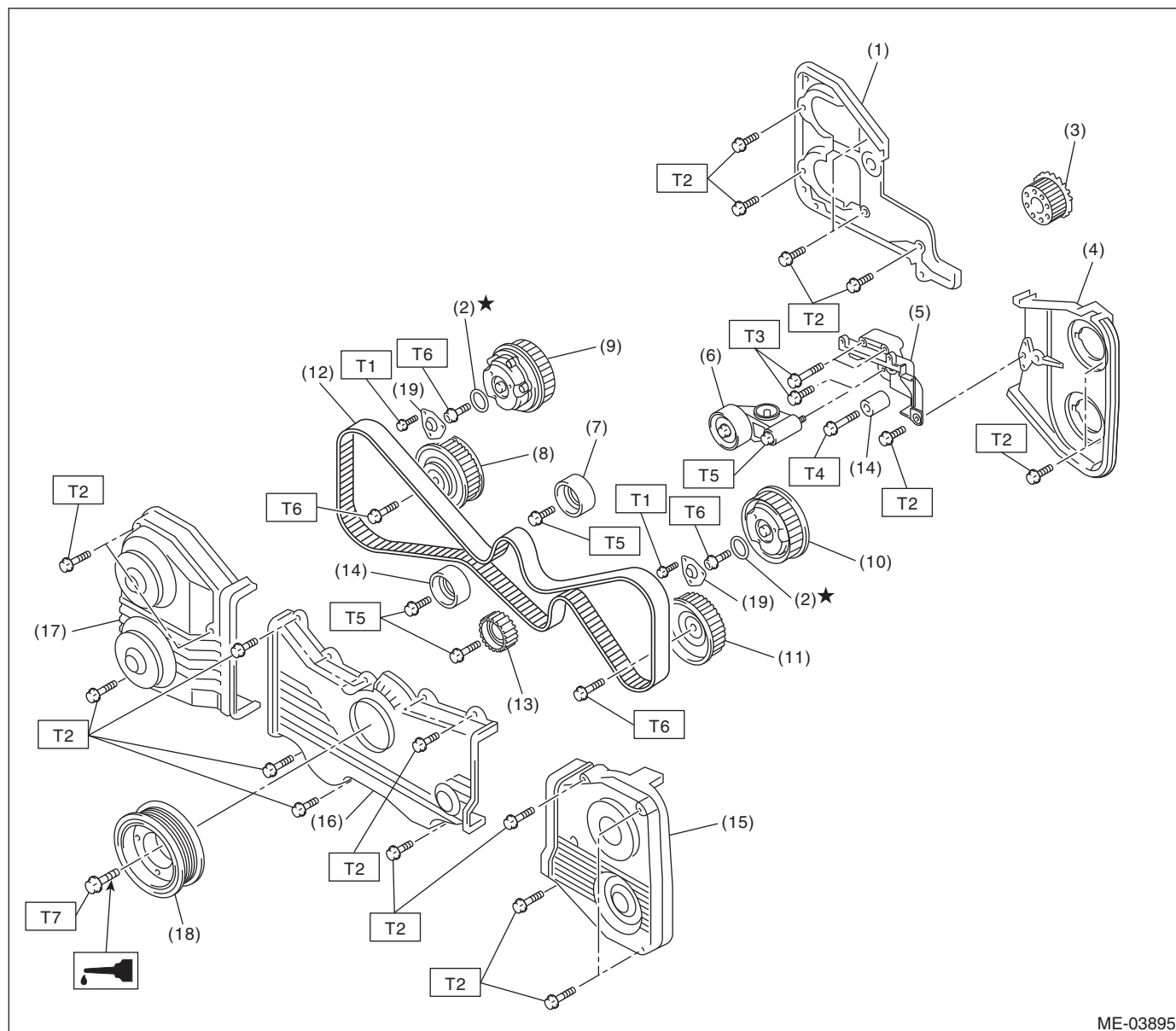
OS: Oversize US: Undersize

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)
	Thrust clearance		mm (in)	Standard	0.068 — 0.116 (0.0027 — 0.0047)
	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)
	Journal O.D.	mm (in)	Standard	Front	37.946 — 37.963 (1.4939 — 1.4946)
				Center rear	29.946 — 29.963 (1.1790 — 1.1796)
Journal clearance			mm (in)	Standard	0.037 — 0.072 (0.0015 — 0.0028)
Cylinder head	Surface warpage limit			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				90°
	Contacting width	mm (in)	Intake	Standard	0.6 — 1.4 (0.024 — 0.055)
			Exhaust	Standard	1.2 — 1.8 (0.047 — 0.071)
Valve guide	Inside diameter			mm (in)	6.000 — 6.012 (0.2362 — 0.2367)
	Protrusion above head			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)
	Stem outer diameter	mm (in)	Intake		5.955 — 5.970 (0.2344 — 0.2350)
			Exhaust		5.945 — 5.960 (0.2341 — 0.2346)
	Valve stem gap	mm (in)	Standard	Intake	0.030 — 0.057 (0.0012 — 0.0022)
				Exhaust	0.040 — 0.067 (0.0016 — 0.0026)
	Overall length	mm (in)	Intake		104.4 (4.110)
Exhaust			104.65 (4.1201)		
Valve spring	Free length			mm (in)	47.32 (1.863)
	Squareness				2.5°, 2.1 mm (0.083 in) or less
	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)/26.5 (1.043)
Valve lifter	Outer diameter		mm (in)	Standard	34.959 — 34.975 (1.3763 — 1.3770)
	Inner diameter (cylinder head)		mm (in)	Standard	34.994 — 35.016 (1.3777 — 1.3786)
	Valve lifter clearance		mm (in)	Standard	0.019 — 0.057 (0.0007 — 0.0022)
Cylinder block	Surface warpage 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)
	Cylinder inner diameter	mm (in)	Standard	A	99.505 — 99.515 (3.9175 — 3.9179)
				B	99.495 — 99.505 (3.9171 — 3.9175)
	Taper		mm (in)	Standard	0.015 (0.0006)
	Out-of-roundness		mm (in)	Standard	0.010 (0.0004)
	Piston clearance		mm (in)	Standard	−0.010 — 0.010 (−0.00039 — 0.00039)
Cylinder inner diameter boring limit (diameter)			mm (in)	To 100.005 (3.9372)	
Piston	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)

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Piston pin	Standard clearance between piston and piston pin		mm (in)	Standard	0.004 — 0.008 (0.0002 — 0.0003)	
	Degree of fit				Piston pin must be fitted into position with thumb at 20°C (68°F).	
Piston ring	Ring closed 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)	
	Ring groove gap	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	Bend or twist per 100 mm (3.94 in) in length		mm (in)	Limit	0.1 (0.0039)	
	Thrust clearance		mm (in)	Standard	0.070 — 0.330 (0.0028 — 0.0130)	
Bearing of large end	Oil clearance		mm (in)	Standard	0.017 — 0.045 (0.0007 — 0.0018)	
	Bearing size (Thickness at center)	mm (in)	Standard		1.490 — 1.502 (0.0587 — 0.0591)	
			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	Bending limit		mm (in)		0.035 (0.0014)	
	Crank pin	Out-of-roundness		mm (in)	0.003 (0.0001)	
		Cylindricality		mm (in)	0.004 (0.0002)	
		Grinding limit (dia.)		mm (in)	To 51.750 (2.0374)	
	Crank journal	Out-of-roundness		mm (in)	0.005 (0.0002)	
		Cylindricality		mm (in)	0.006 (0.0002)	
		Grinding limit (dia.)		mm (in)	To 59.758 (2.3527)	
	Crank pin outer diameter	mm (in)	Standard		51.984 — 52.000 (2.0466 — 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		59.992 — 60.008 (2.3619 — 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)		
Thrust clearance		mm (in)	Standard	0.030 — 0.115 (0.0012 — 0.0045)		
Oil clearance		mm (in)		0.010 — 0.030 (0.0004 — 0.0012)		
Main bearing	Bearing size (Thickness at center) mm (in)	#1, #3	Standard		1.998 — 2.011 (0.0787 — 0.0792)	
			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 — 2.013 (0.0787 — 0.0793)	
			0.03 (0.0012) US		2.019 — 2.022 (0.0795 — 0.0796)	
			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)	

B: COMPONENT**1. TIMING BELT**

ME-03895

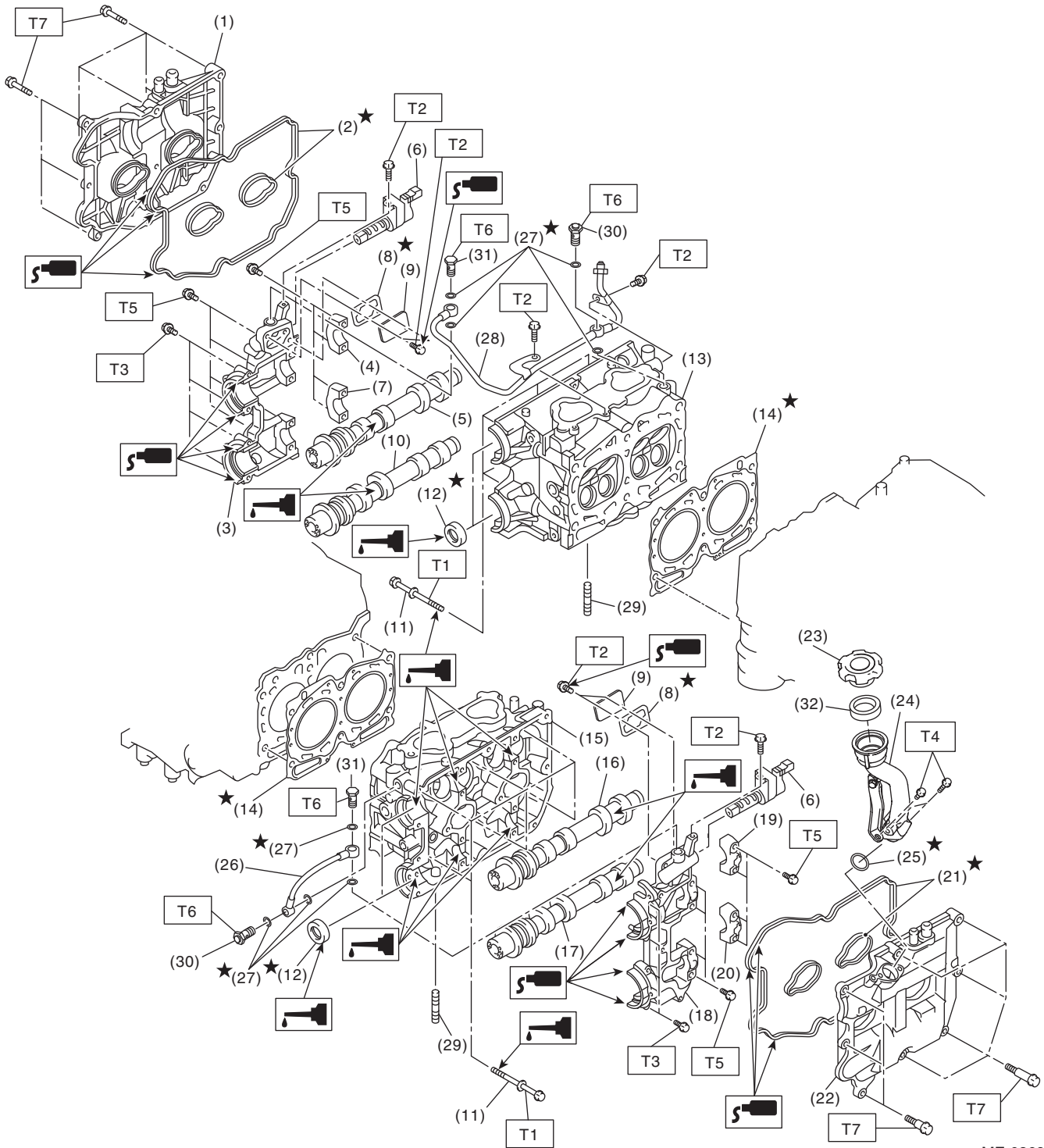
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| (1) Timing belt cover No. 2 RH | (10) Intake cam sprocket LH |
| (2) O-ring | (11) Exhaust cam sprocket LH |
| (3) Crank sprocket | (12) Timing belt |
| (4) Timing belt cover No. 2 LH | (13) Belt idler No. 2 |
| (5) Tensioner bracket | (14) Belt idler |
| (6) Automatic belt tension adjuster ASSY | (15) Timing belt cover LH |
| (7) Belt idler | (16) Front belt cover |
| (8) Exhaust cam sprocket RH | (17) Timing belt cover RH |
| (9) Intake cam sprocket RH | (18) Crank pulley |
| | (19) Actuator cover |

Tightening torque:N·m (kgf-m, ft-lb)**T1: 3.4 (0.3, 2.5)****T2: 5 (0.5, 3.7)****T3: 24.5 (2.5, 18.1)****T4: 25 (2.5, 18.4)****T5: 39 (4.0, 28.8)****T6: <Ref. to ME(H4DOTC)-57, INSTALLATION, Cam Sprocket.>****T7: <Ref. to ME(H4DOTC)-47, INSTALLATION, Crank Pulley.>**

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2. CYLINDER HEAD AND CAMSHAFT



ME-03696

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

- (32) Gasket

Tightening torque:N·m (kgf-m, ft-lb)

**T1: <Ref. to ME(H4DOTC)-67,
INSTALLATION, Cylinder Head.>**

T2: 8 (0.8, 5.9)

**T3: <Ref. to ME(H4DOTC)-61,
INSTALLATION, Camshaft.>**

T4: 6.4 (0.7, 4.7)

**T5: <Ref. to ME(H4DOTC)-61,
INSTALLATION, Camshaft.>**

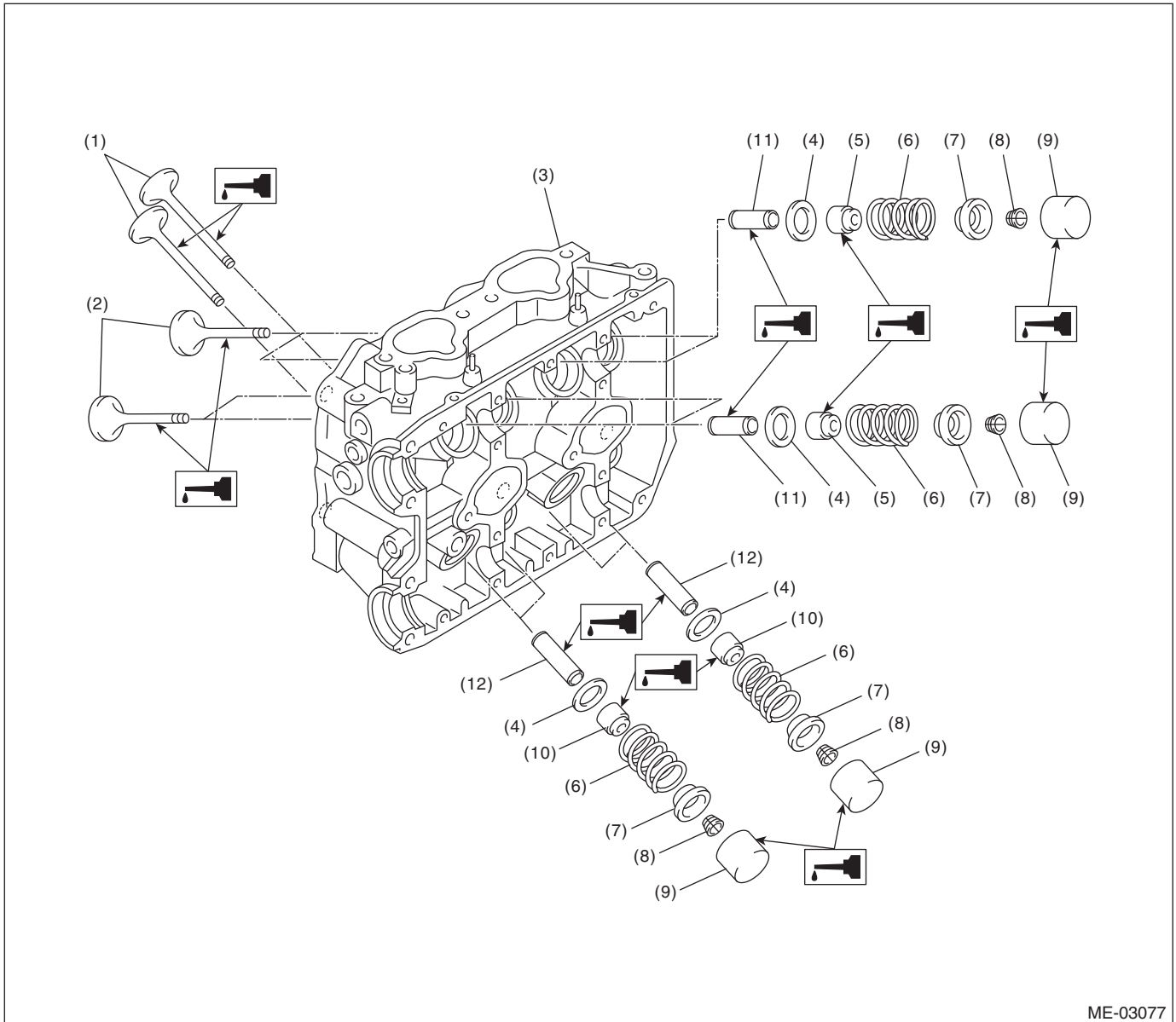
T6: 29 (3.0, 21.4)

**T7: <Ref. to ME(H4DOTC)-61,
INSTALLATION, Camshaft.>**

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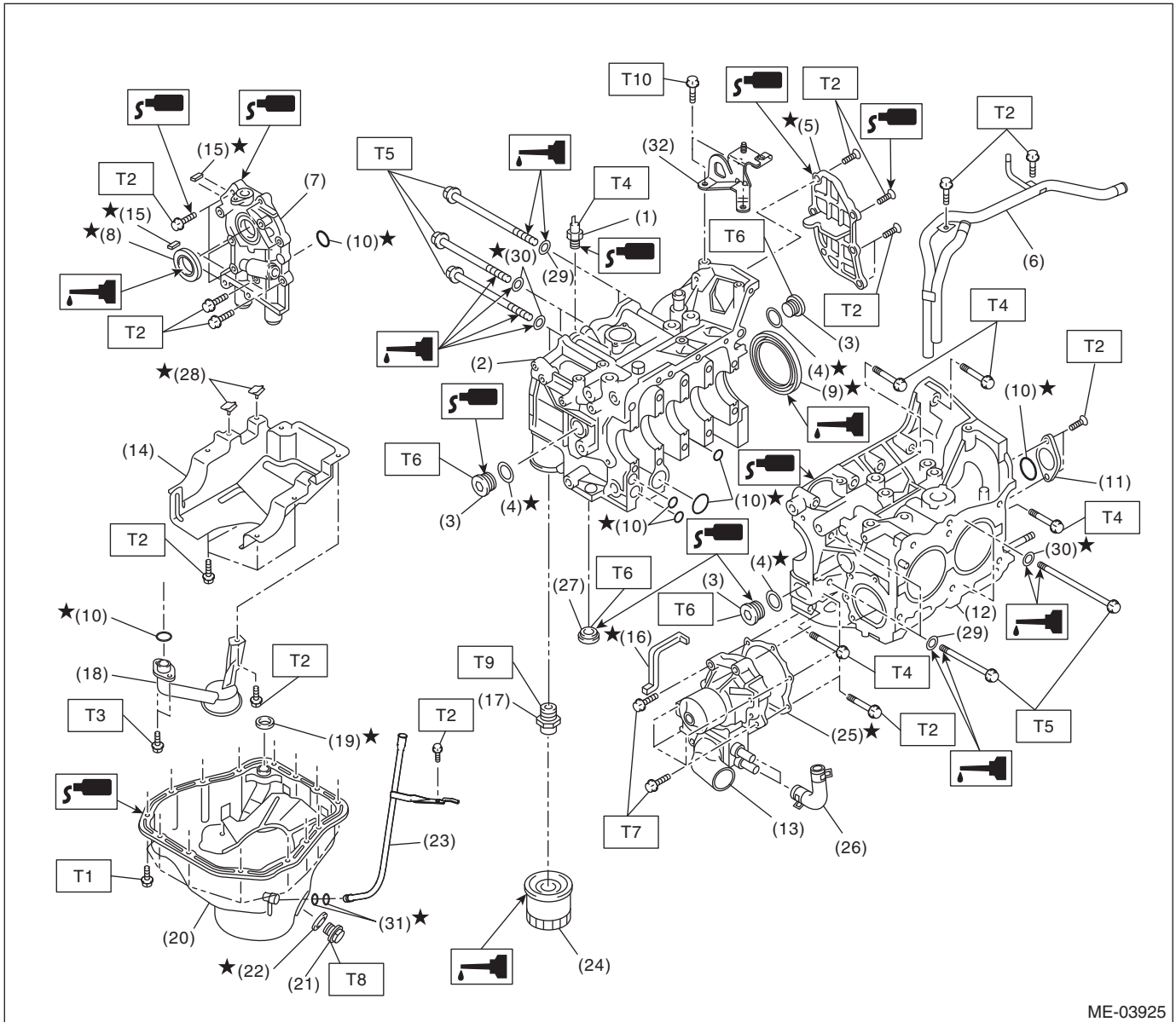
3. CYLINDER HEAD AND VALVE ASSEMBLY



ME-03077

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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 |

4. CYLINDER BLOCK

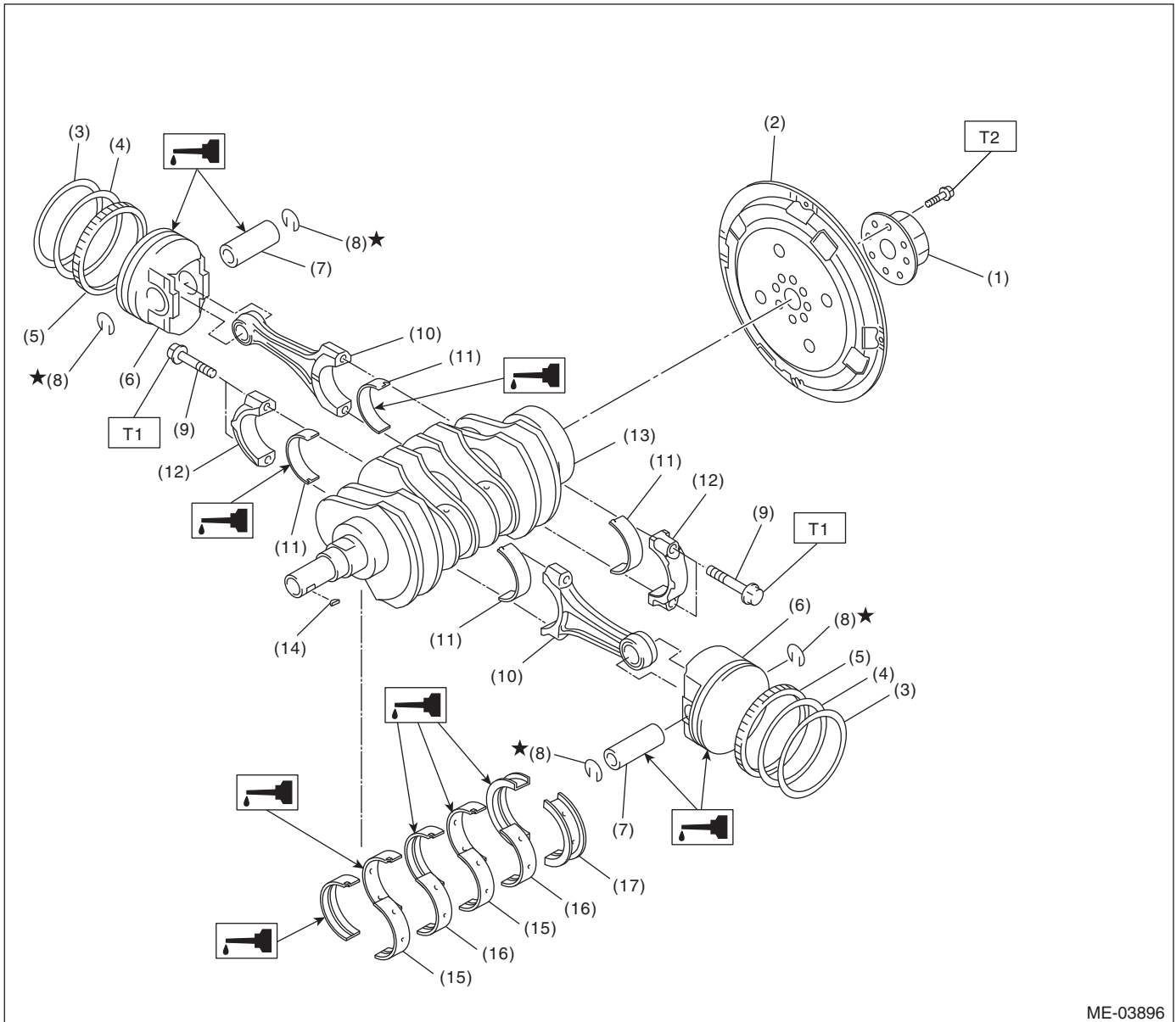


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(1) Oil pressure switch	(17) Oil filter connector	(32) Engine rear hanger
(2) Cylinder block RH	(18) Oil strainer	
(3) Service hole plug	(19) Gasket	<i>Tightening torque:N·m (kgf-m, ft-lb)</i>
(4) Gasket	(20) Oil pan	<i>T1: 5 (0.5, 3.7)</i>
(5) Oil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

5. CRANKSHAFT AND PISTON



ME-03896

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

Tightening torque: N·m (kgf-m, ft-lb)

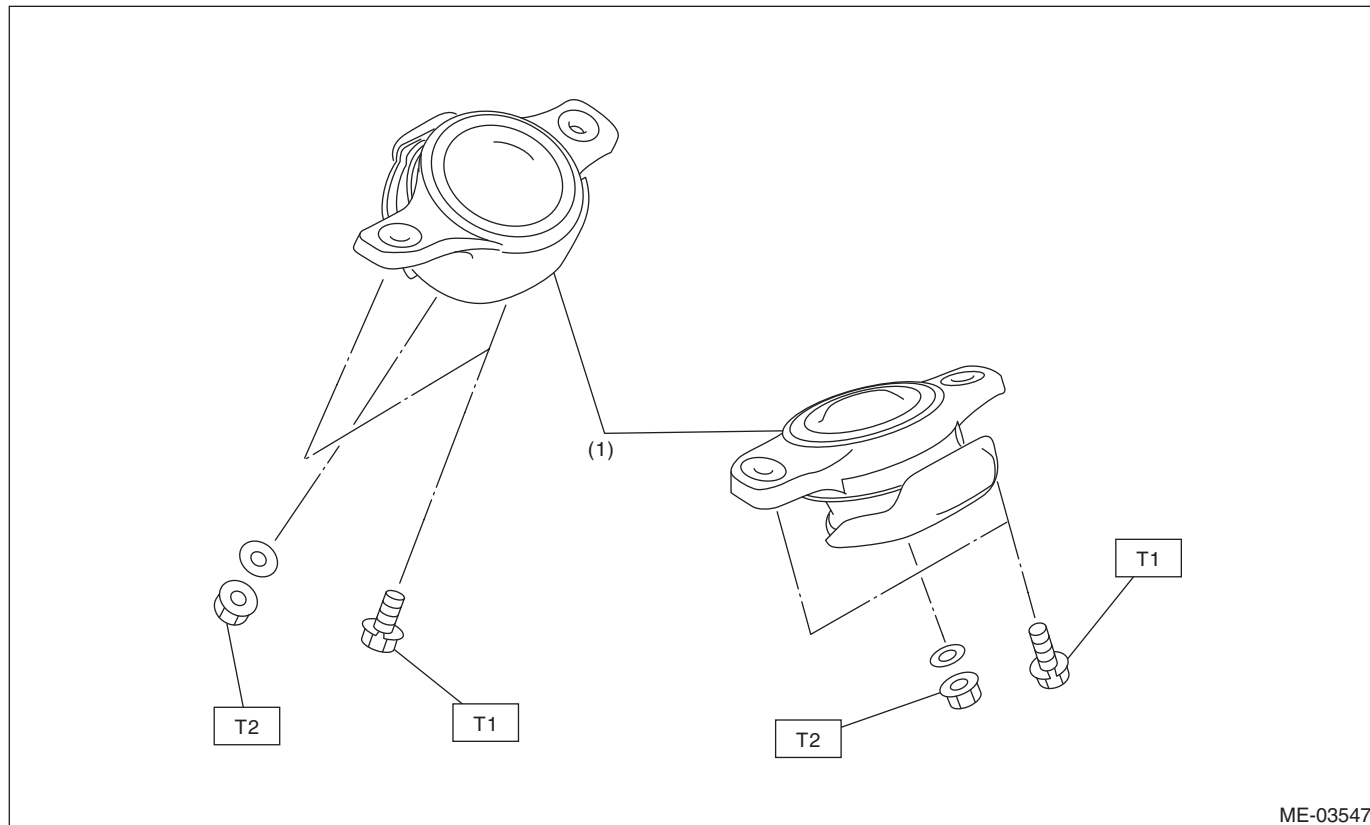
T1: 52 (5.3, 38.4)

T2: <Ref. to 4AT-67, INSTALLATION, Drive Plate.>

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6. ENGINE MOUNTING



ME-03547

(1) Front cushion rubber

Tightening torque:N·m (kgf-m, ft-lb)

T1: 35 (3.6, 25.8)

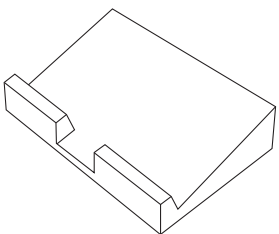
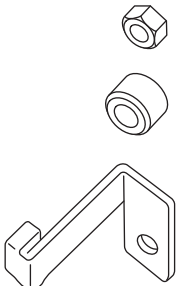
T2: 85 (8.7, 62.7)

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 the 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 engine 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.

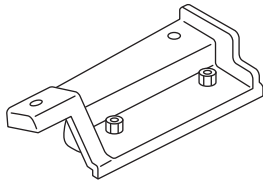
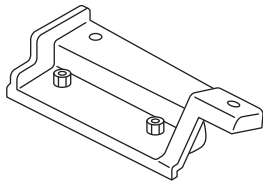
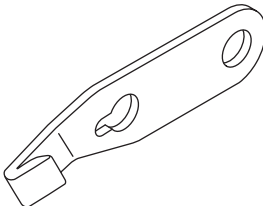
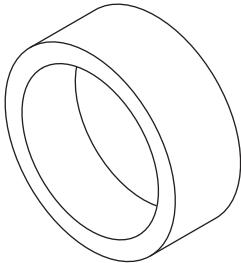
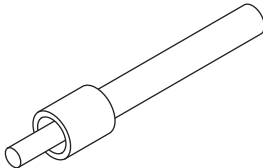
D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498267600	498267600	CYLINDER HEAD TABLE	• 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.

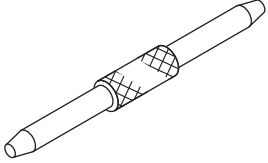
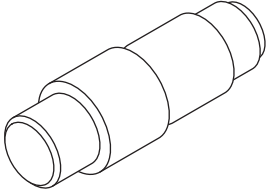
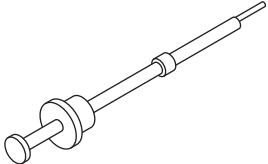
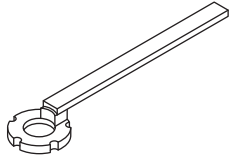
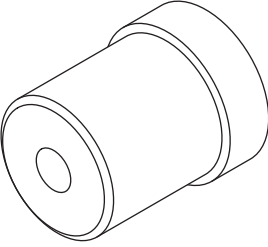
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 ST-498457000	498457000	ENGINE STAND ADAPTER RH	Used together with the ENGINE STAND (499817100).
 ST-498457100	498457100	ENGINE STAND ADAPTER LH	Used together with the ENGINE STAND (499817100).
 ST-498497100	498497100	CRANKSHAFT STOPPER	Used for removing and installing the drive plate.
 ST-498747300	498747300	PISTON GUIDE	Used for installing the cup to the wheel cylinder piston. (2.5 L model)
 ST-498857100	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.

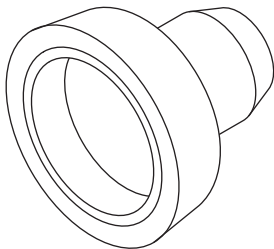
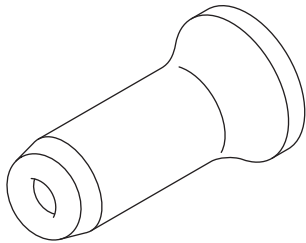
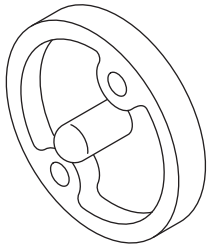
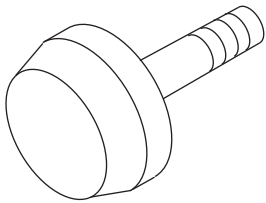
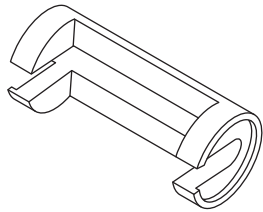
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 ST-499017100	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
 ST-499037100	499037100	CONNECTING ROD BUSHING REMOVER AND INSTALLER	Used for removing and installing connecting rod bushing.
 ST-499097700	499097700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

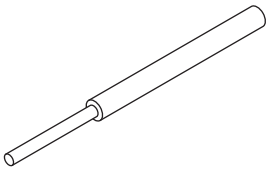
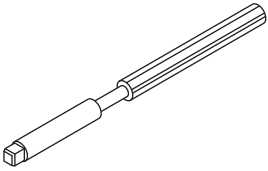
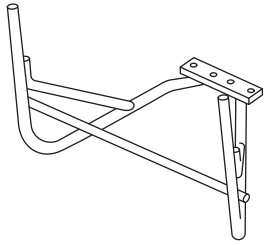
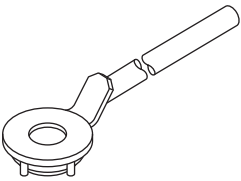
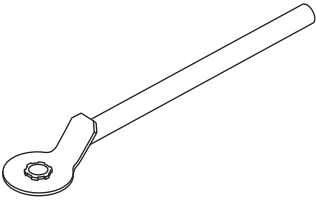
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499587200	499587200	CRANKSHAFT OIL SEAL INSTALLER	- Used for installing crankshaft oil seal. - Used together with the CRANKSHAFT OIL SEAL GUIDE (499597100).
 ST-499587600	499587600	OIL SEAL INSTALLER	Used for installing camshaft oil seal for DOHC engine.
 ST-499597100	499597100	CRANKSHAFT OIL SEAL GUIDE	- Used for installing crankshaft oil seal. - Used together with the CRANKSHAFT OIL SEAL INSTALLER (499587200).
 ST-499597200	499597200	OIL SEAL GUIDE	- Used for installing camshaft oil seal for DOHC engine. - Used together with the OIL SEAL INSTALLER (499587600).
 ST-499718000	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.

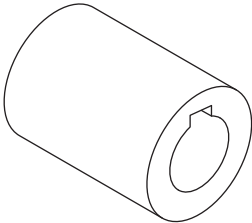
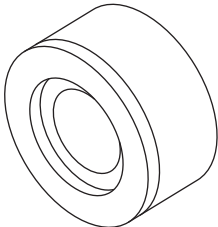
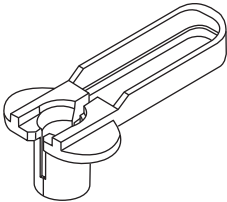
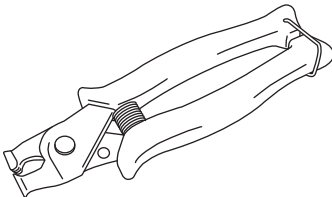
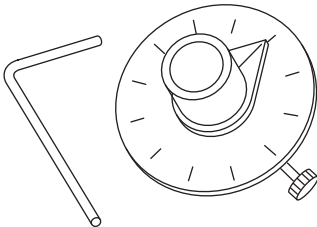
General Description

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	• Stand used for engine disassembly and assembly. • Used together with the ENGINE STAND ADAPTER RH (498457000) & LH (498457100).
 ST-499977400	499977400	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts.
 ST-499977500	499977500	CAM SPROCKET WRENCH	Used for removing and installing intake cam sprocket.

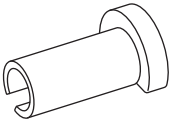
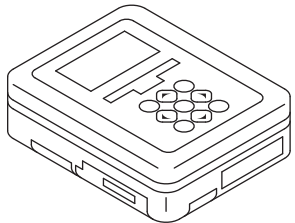
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 ST18251AA020	18251AA020	VALVE GUIDE ADJUSTER	Used for installing intake and exhaust valve guides.
 ST18371AA000	18371AA000	CONNECTOR REMOVER	Used for disconnecting the quick connector on the fuel return hose of the engine compartment.
 ST18353AA000	18353AA000	CLAMP PLIERS	- Used for removing and installing the PCV hose. - This is a general tool made by the French company CAILLAU. (code) 54.0.000.205 To make this easier to obtain in the same way as genuine Subaru parts, it has been provided with a tool number as an ST.
 ST18854AA000	18854AA000	ANGLE GAUGE	Used for installing the crank pulley.

General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST42099AE000	42099AE000	QUICK CONNECTOR RELEASE	Used for disconnecting quick connector of the engine compartment.
 ST1B022XU0	1B022XU0 (Newly adopted tool)	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

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.

E: PROCEDURE

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

- V-belt
- Timing belt
- Camshaft
- Cylinder head