

ENGINE SECTION 1

This service manual has been prepared to provide SUBARU service personnel with the necessary information and data for the correct maintenance and repair of SUBARU vehicles.

This manual includes the procedures for maintenance, disassembling, reassembling, inspection and adjustment of components and diagnostics for guidance of experienced mechanics.

Please peruse and utilize this manual fully to ensure complete repair work for satisfying our customers by keeping their vehicle in optimum condition. When replacement of parts during repair work is needed, be sure to use SUBARU genuine parts.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

FUEL INJECTION (FUEL SYSTEMS) FU(H4SO)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES) EC(H4SO)

INTAKE (INDUCTION) IN(H4SO)

MECHANICAL ME(H4SO)

EXHAUST EX(H4SO)

COOLING CO(H4SO)

LUBRICATION LU(H4SO)

SPEED CONTROL SYSTEMS SP(H4SO)

IGNITION IG(H4SO)

STARTING/CHARGING SYSTEMS SC(H4SO)

ENGINE (DIAGNOSTICS) EN(H4SO)(diag)

FUEL INJECTION (FUEL SYSTEMS) FU(H4SOw/oOBD)

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ENGINE SECTION 1

LUBRICATION

LU(H4SOw/oOBD)

SPEED CONTROL SYSTEMS

SP(H4SOw/oOBD)

IGNITION

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ENGINE (DIAGNOSTICS)

EN(H4SOw/oOBD)
(diag)

MECHANICAL

ME(H4SO)

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General Description

MECHANICAL

1. General Description

A: SPECIFICATIONS

Model		1.6 L	2.0 L	2.5 L
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)	87.9 × 65.8 (3.46 × 2.591)	92 × 75 (3.62 × 2.95)	99.5 × 79.0 (3.917 × 3.110)
Displacement	cm ³ (cu in)	1,597 (97.45)	1,994 (121.67)	2,457 (150)
Compression ratio		10.0		
Compression pressure (at 350 rpm)		kPa (kg/cm ² , psi) 1,020 — 1,275 (10.4 — 13.0, 148 — 185)		
Number of piston rings		Pressure ring: 2, Oil ring: 1		
Intake valve timing	Opening	10° BTDC	4° BTDC	1° BTDC
	Closing	46° ABDC	48° ABDC	51° ABDC
Exhaust valve timing	Opening	42° BBDC	48° BBDC	50° BBDC
	Closing	10° ATDC	4° ATDC	6° ATDC
Valve clearance	Intake mm (in)	0.20±0.04 (0.0079±0.0016)		
	Exhaust mm (in)	0.25±0.04 (0.0098±0.0016)		
Idling speed [At neutral position on MT, or “P” or “N” position on AT]		rpm With OBD: 650±100 (No load) 850±100 (A/C ON) Without OBD: 700±100 (No load) 850±100 (A/C ON)		650±100 (No load) 850±100 (A/C ON)
Firing order		1 → 3 → 2 → 4		
Ignition timing		BTDC/rpm With OBD: 5°±10°/650 Without OBD: 5°±10°/700	With OBD: 10°±10°/650 Without OBD: 10°±10°/700	MT: 10°±10°/650 AT: 15°±10°/650

NOTE:

STD: Standard I.D.: Inner Diameter O.D.: Outer Diameter 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 bush I.D.		18.00 — 18.08 mm (0.7087 — 0.7118 in)
	Clearance between spacer and bush	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)

General Description

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Camshaft	Bend limit				0.025 mm (0.0010 in)
	Thrust clearance			STD	0.030 — 0.090 mm (0.0012 — 0.0035 in)
				Limit	0.10 mm (0.0039 in)
	Cam lobe height	1.6 L	Intake	STD	39.378 — 39.478 mm (1.5503 — 1.5542 in)
				Limit	39.278 mm (1.5464 in)
			Exhaust	STD	39.565 — 39.665 mm (1.5577 — 1.5616 in)
				Limit	39.465 mm (1.5537 in)
		2.0 L	Intake	STD	38.732 — 38.832 mm (1.5249 — 1.5288 in)
				Limit	38.632 mm (1.5209 in)
			Exhaust	STD	39.257 — 39.357 mm (1.5455 — 1.5495 in)
				Limit	39.157 mm (1.5416 in)
		2.5 L	Intake	STD	39.485 — 39.585 mm (1.5545 — 1.5585 in)
				Limit	39.385 mm (1.5506 in)
			Exhaust	STD	39.257 — 39.357 mm (1.5455 — 1.5495 in)
				Limit	39.157 mm (1.5416 in)
Camshaft journal O.D.				31.928 — 31.945 mm (1.2570 — 1.2577 in)	
Camshaft journal hole I.D.				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)	
Cylinder head	Surface warpage limit			0.05 mm (0.0020 in)	
	Surface grinding limit			0.1 mm (0.004 in)	
	Standard height			97.5 mm (3.84 in)	
Valve seat	Refacing angle			90°	
	Contacting width		Intake	STD	1.0 mm (0.039 in)
				Limit	1.7 mm (0.067 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 (22 — 25 kgf, 48 — 55 lb)/ 45.0 mm (1.772 in)	
			Lift	526 — 582 N (54 — 59 kgf, 119 — 130 lb)/ 34.7 mm (1.366 in)	

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Cylinder block	Surface warpage limit (mating with cylinder head)			0.05 mm (0.0020 in)		
	Surface grinding limit			0.1 mm (0.004 in)		
	Standard height			201.0 mm (7.91 in)		
	Cylinder bore	1.6 L	STD	A	87.905 — 87.915 mm (3.4608 — 3.4612 in)	
				B	87.895 — 87.905 mm (3.4604 — 3.4608 in)	
		2.0 L	STD	A	92.005 — 92.015 mm (3.6222 — 3.6226 in)	
				B	91.995 — 92.005 mm (3.6218 — 3.6222 in)	
		2.5 L	STD	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)		
Enlarging (boring) limit			0.5 mm (0.020 in)			
Piston	Outer diameter	1.6 L	STD	A	87.885 — 87.895 mm (3.4600 — 3.4604 in)	
				B	87.875 — 87.885 mm (3.4596 — 3.4600 in)	
			0.25 mm (0.0098 in) OS		88.125 — 88.135 mm (3.4695 — 3.4699 in)	
			0.50 mm (0.0197 in) OS		88.375 — 88.385 mm (3.4793 — 3.4797 in)	
			2.0 L	STD	A	91.985 — 91.995 mm (3.6214 — 3.6218 in)
					B	91.975 — 91.985 mm (3.6211 — 3.6214 in)
		0.25 mm (0.0098 in) OS		92.225 — 92.235 mm (3.6309 — 3.6313 in)		
		0.50 mm (0.0197 in) OS		92.475 — 92.485 mm (3.6407 — 3.6411 in)		
		2.5 L	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) OS		99.725 — 99.735 mm (3.9262 — 3.9266 in)	
			0.50 mm (0.0197 in) OS		99.975 — 99.985 mm (3.9360 — 3.9364 in)	
		Standard inner diameter of piston pin hole			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 hole in 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).			
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	1.6 L, 2.5 L	0.35 — 0.50 mm (0.0138 — 0.0197 in)	
				2.0 L	0.40 — 0.50 mm (0.0157 — 0.0197 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)		

General Description

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Connecting rod	Bend twist per 100 mm (3.94 in) in length		Limit	0.10 mm (0.0039 in)
	Side clearance		STD	0.070 — 0.330 mm (0.0028 — 0.0130 in)
			Limit	0.4 mm (0.016 in)
Connecting rod bearing	Oil clearance	1.6 L 2.0 L	STD	0.010 — 0.038 mm (0.0004 — 0.0015 in)
			Limit	0.05 mm (0.0020 in)
		2.5 L	STD	0.020 — 0.046 mm (0.0008 — 0.0018 in)
			Limit	0.05 mm (0.0020 in)
	Thickness at center portion	1.6 L 2.0 L	STD	1.492 — 1.501 mm (0.0587 — 0.0591 in)
			0.03 mm (0.0012 in) US	1.510 — 1.513 mm (0.0594 — 0.0596 in)
			0.05 mm (0.0020 in) US	1.520 — 1.523 mm (0.0598 — 0.0600 in)
			0.25 mm (0.0098 in) US	1.620 — 1.623 mm (0.0638 — 0.0639 in)
		2.5 L	STD	1.490 — 1.502 mm (0.0587 — 0.0591 in)
			0.03 mm (0.0012 in) US	1.504 — 1.512 mm (0.0592 — 0.0595 in)
			0.05 mm (0.0020 in) US	1.514 — 1.522 mm (0.0596 — 0.0599 in)
			0.25 mm (0.0098 in) US	1.614 — 1.622 mm (0.0635 — 0.0639 in)
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)

General Description

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Crankshaft	Bend limit		0.035 mm (0.0014 in)		
	Crank pin and crank journal	Out-of-roundness	0.020 mm (0.0008 in) or less		
		Grinding limit		0.250 mm (0.0098 in)	
	Crank pin outer diameter	1.6 L	STD	47.984 — 48.000 mm (1.8891 — 1.8898 in)	
			0.03 mm (0.0012 in) US	47.954 — 47.970 mm (1.8879 — 1.8886 in)	
			0.05 mm (0.0020 in) US	47.934 — 47.950 mm (1.8872 — 1.8878 in)	
			0.25 mm (0.0098 in) US	47.734 — 47.750 mm (1.8793 — 1.8799 in)	
		2.0 L 2.5 L	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	#1, #3	STD	59.992 — 60.008 mm (2.3619 — 2.3625 in)	
			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	59.742 — 59.758 mm (2.3520 — 2.3527 in)	
		#2, #4, #5	STD	59.992 — 60.008 mm (2.3619 — 2.3625 in)	
			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	59.742 — 59.758 mm (2.3520 — 2.3527 in)	
	Thrust clearance		STD	0.030 — 0.115 mm (0.0012 — 0.0045 in)	
			Limit	0.25 mm (0.0098 in)	
	Oil clearance		#1	STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)
				Limit	0.040 mm (0.0016 in)
#2			STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)	
			Limit	0.045 mm (0.0018 in)	
#3			STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)	
			Limit	0.040 mm (0.0016 in)	
#4			STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)	
			Limit	0.045 mm (0.0018 in)	
#5			STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)	
			Limit	0.040 mm (0.0016 in)	

General Description

MECHANICAL

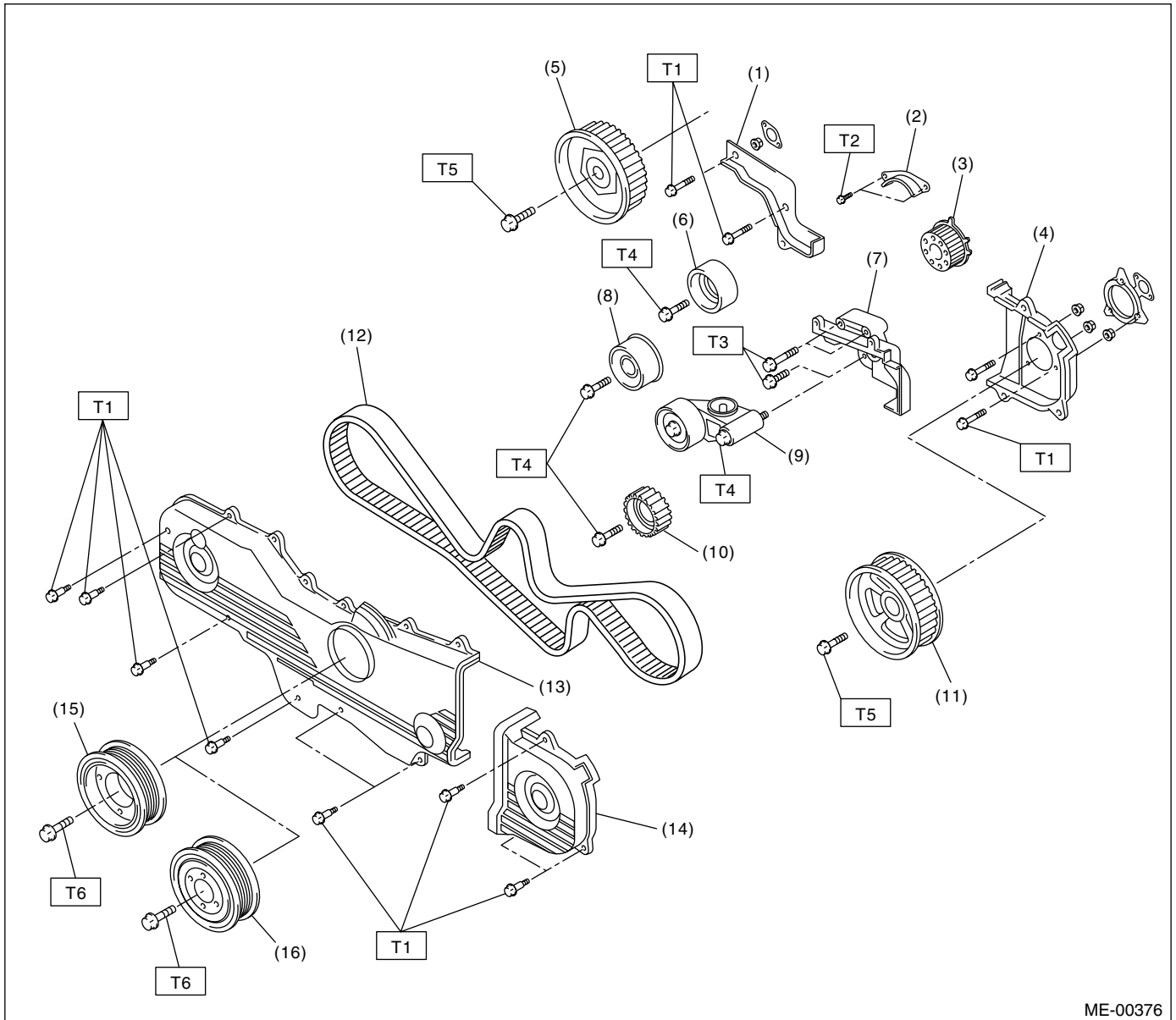
Crankshaft bearing	Crankshaft bearing thickness	#1, #3	STD	1.998 — 2.011 mm (0.0787 — 0.0792 in)
			0.03 mm (0.0012 in) US	2.017 — 2.020 mm (0.0794 — 0.0795 in)
			0.05 mm (0.0020 in) US	2.027 — 2.030 mm (0.0798 — 0.0799 in)
			0.25 mm (0.0098 in) US	2.127 — 2.130 mm (0.0837 — 0.0839 in)
		#2, #4, #5	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)

General Description

MECHANICAL

B: COMPONENT

1. TIMING BELT



ME-00376

- | | |
|--|--|
| (1) Timing belt cover No. 2 (RH) | (10) Belt idler No. 2 |
| (2) Timing belt guide (MT model) | (11) Camshaft sprocket No. 2 |
| (3) Crankshaft sprocket | (12) Timing belt |
| (4) Timing belt cover No. 2 (LH) | (13) Front timing belt cover |
| (5) Camshaft sprocket No. 1 | (14) Timing belt cover (LH) |
| (6) Belt idler (No. 1) | (15) Crankshaft pulley (1.6 L and 2.0 L model) |
| (7) Tensioner bracket | (16) Crankshaft pulley (2.5 L model) |
| (8) Belt idler (No. 2) | |
| (9) Automatic belt tension adjuster ASSY | |

Tightening torque: N·m (kgf·m, ft·lb)

T1: 5 (0.5, 3.6)

T2: 10 (1.0, 7.2)

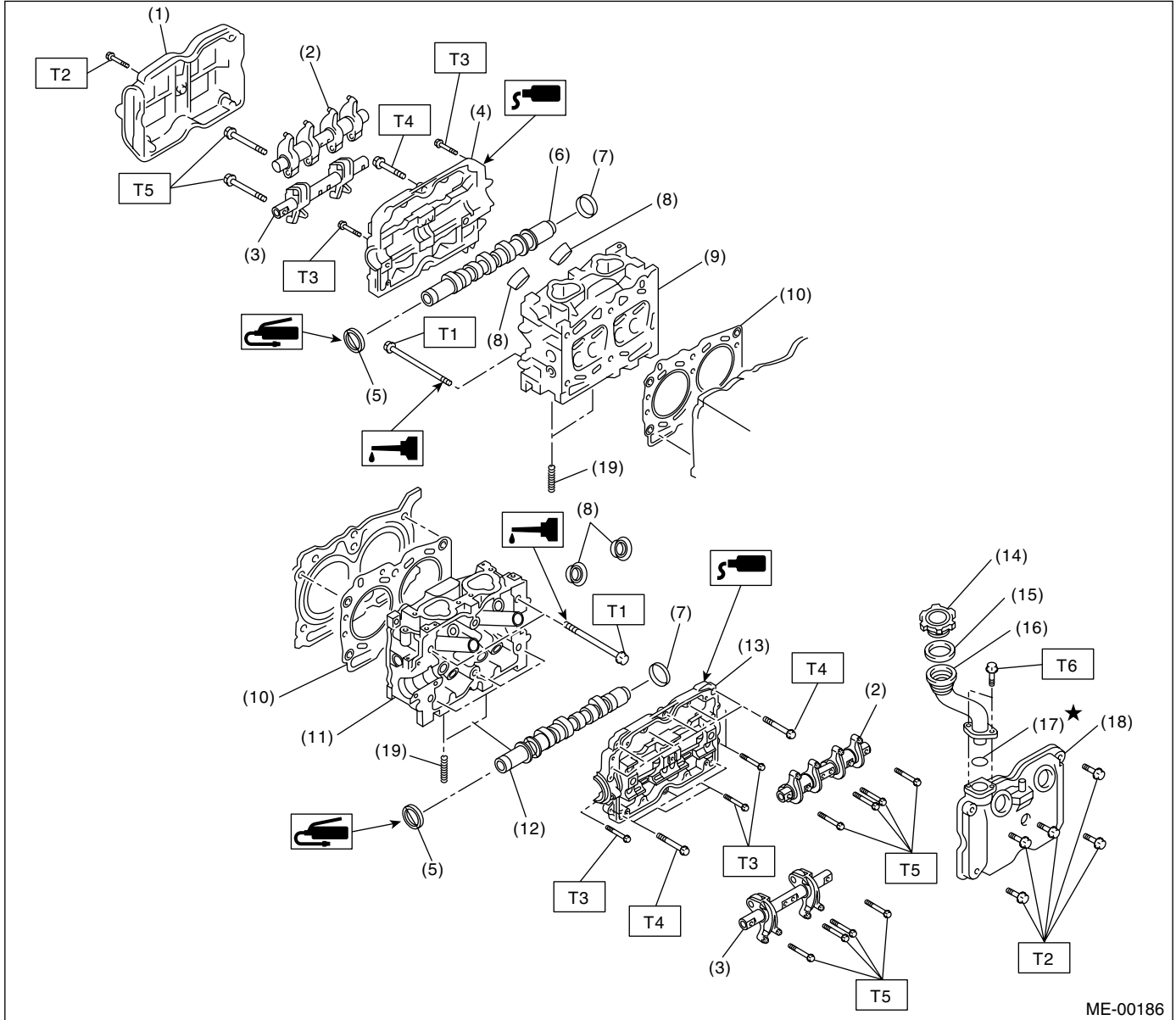
T3: 25 (2.5, 18.1)

T4: 39 (4.0, 28.9)

T5: 78 (8.0, 57.9)

T6: <Ref. to ME(H4SO)-45, INSTALLATION, Crankshaft Pulley.>

2. CYLINDER HEAD AND CAMSHAFT



ME-00186

- | | |
|-------------------------------|-------------------------|
| (1) Rocker cover (RH) | (11) Cylinder head (LH) |
| (2) Intake valve rocker ASSY | (12) Camshaft (LH) |
| (3) Exhaust valve rocker ASSY | (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)-62, INSTALLATION, Cylinder Head Assembly.>

T2: 5 (0.5, 3.6)

T3: 10 (1.0, 7.2)

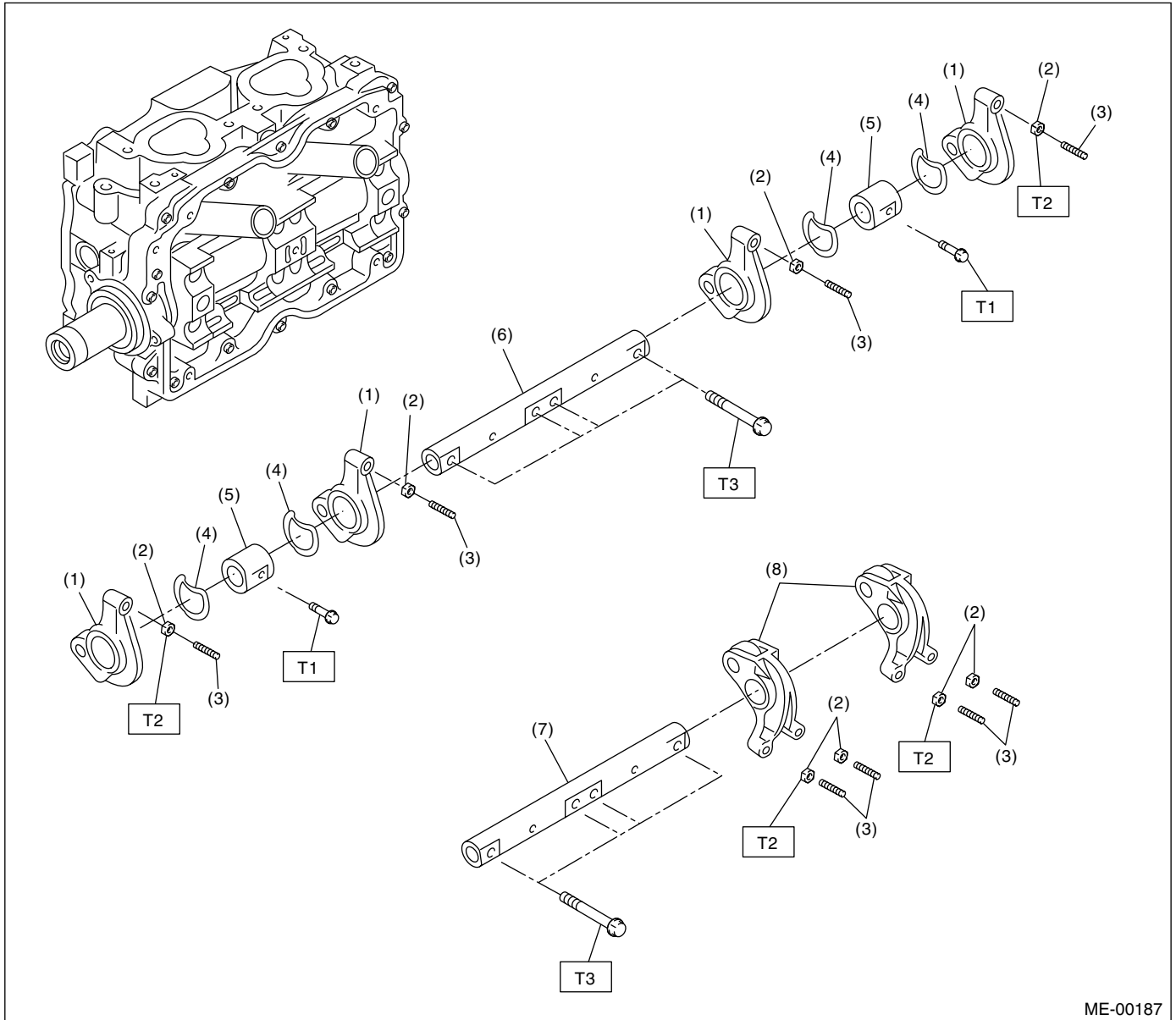
T4: 18 (1.8, 13.0)

T5: 25 (2.5, 18.1)

T6: 6.4 (0.65, 4.7)

General Description

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 |

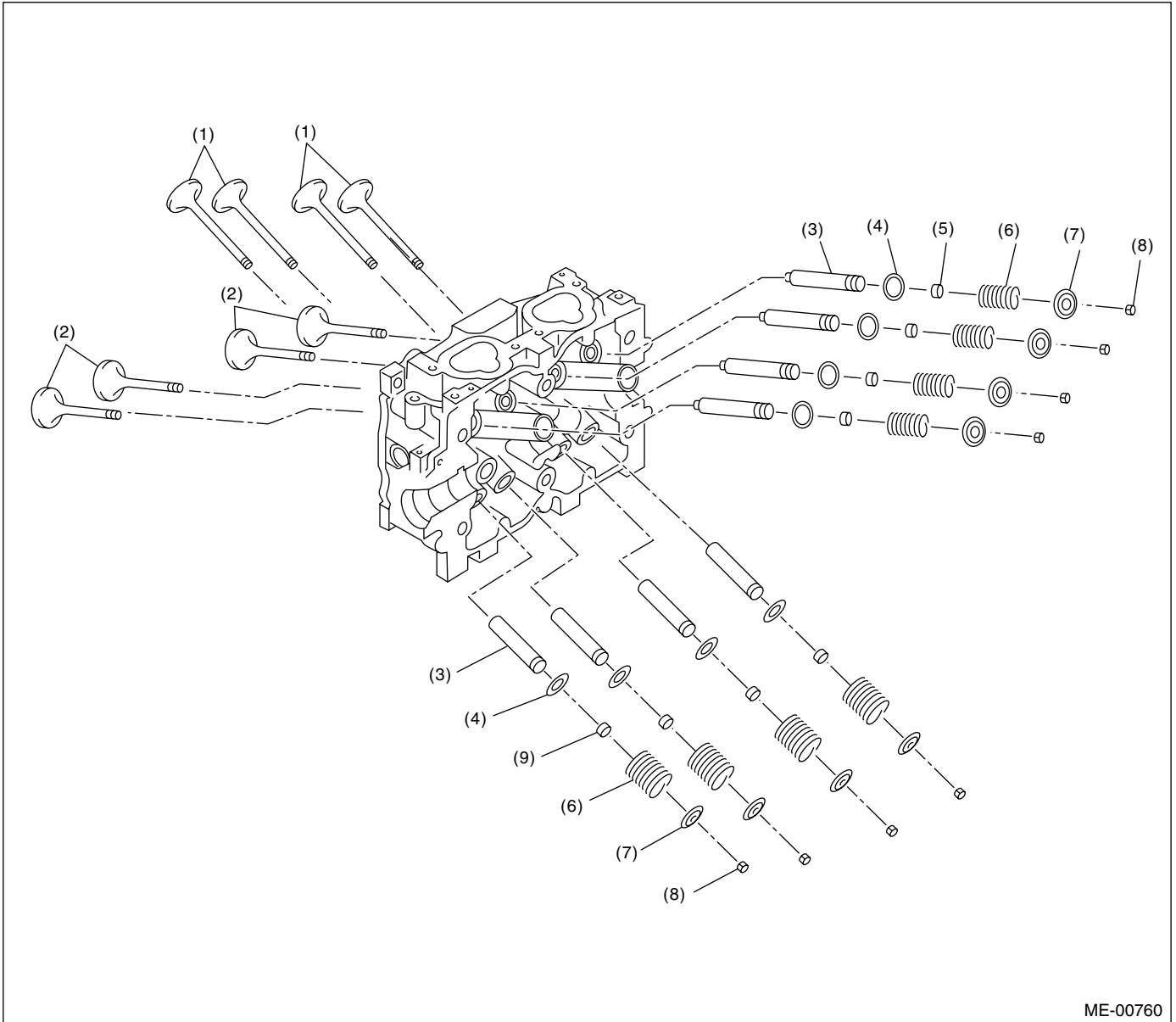
Tightening torque: N-m (kgf-m, ft-lb)

T1: 5 (0.5, 3.6)

T2: 10 (1.0, 7.2)

T3: 25 (2.5, 18.1)

4. CYLINDER HEAD AND VALVE ASSEMBLY



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

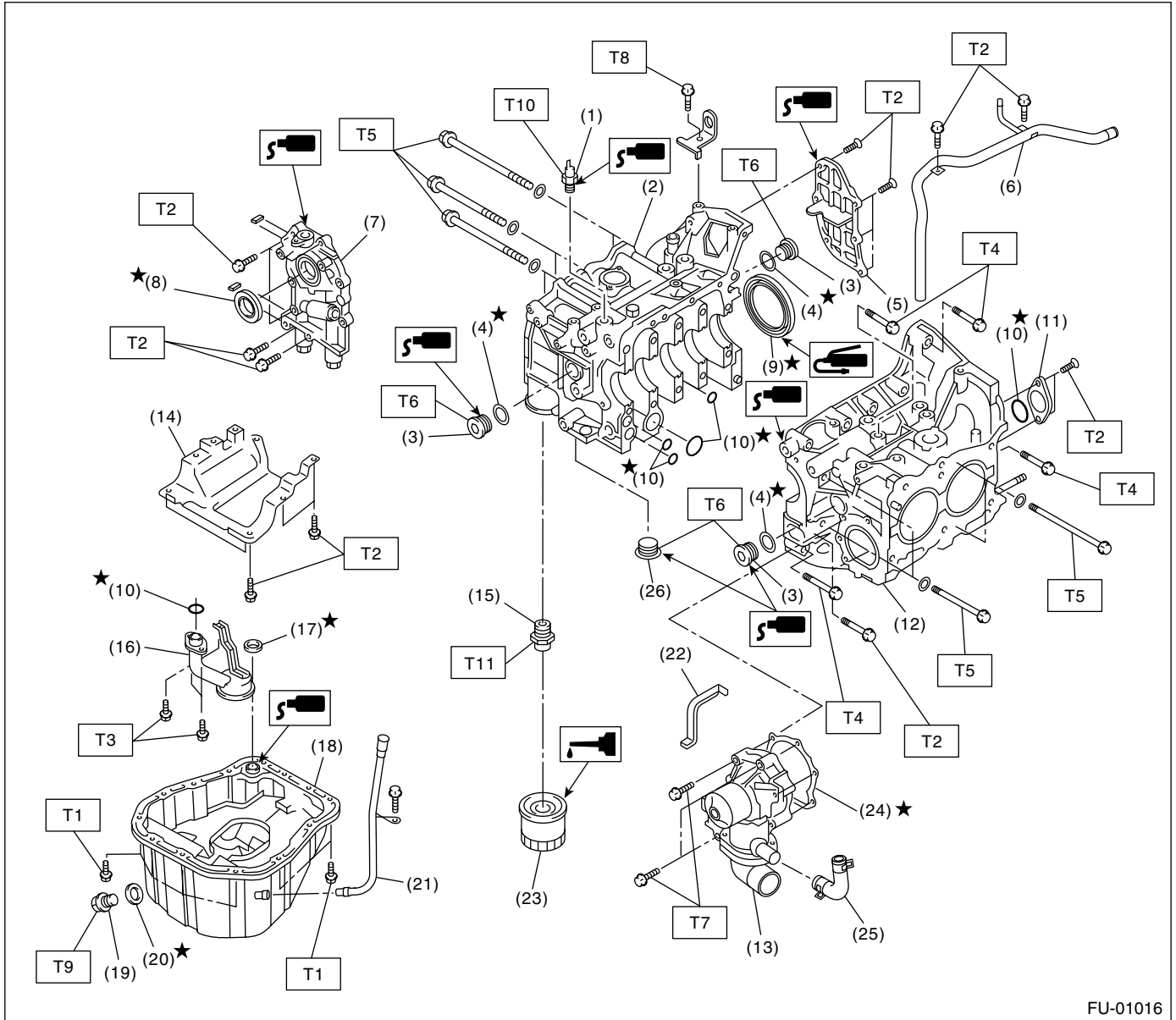
- (4) Valve spring seat
- (5) Intake valve oil seal
- (6) Valve spring

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

General Description

MECHANICAL

5. CYLINDER BLOCK



FU-01016

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

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)-73, INSTALLATION, Cylinder Block.>

T6: 70 (7.1, 50.6)

T7: First 12 (1.2, 8.7)

Second 12 (1.2, 8.7)

T8: 16 (1.6, 11.6)

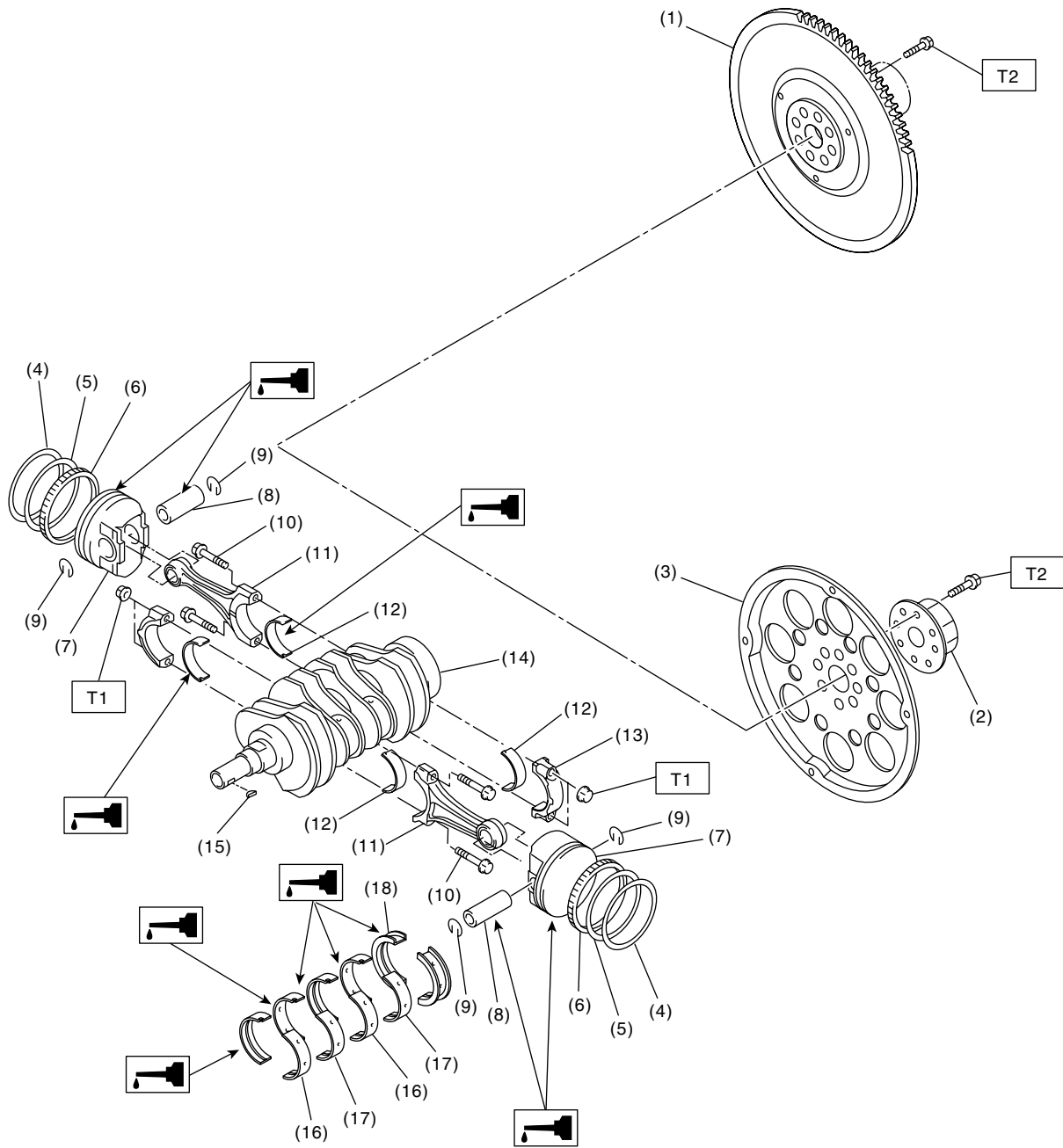
T9: 44 (4.5, 33)

T10: 25 (2.5, 18.1)

T11: 45 (4.6, 33.3)

ME(H4SO)-12

6. CRANKSHAFT AND PISTON



ME-00190

General Description

MECHANICAL

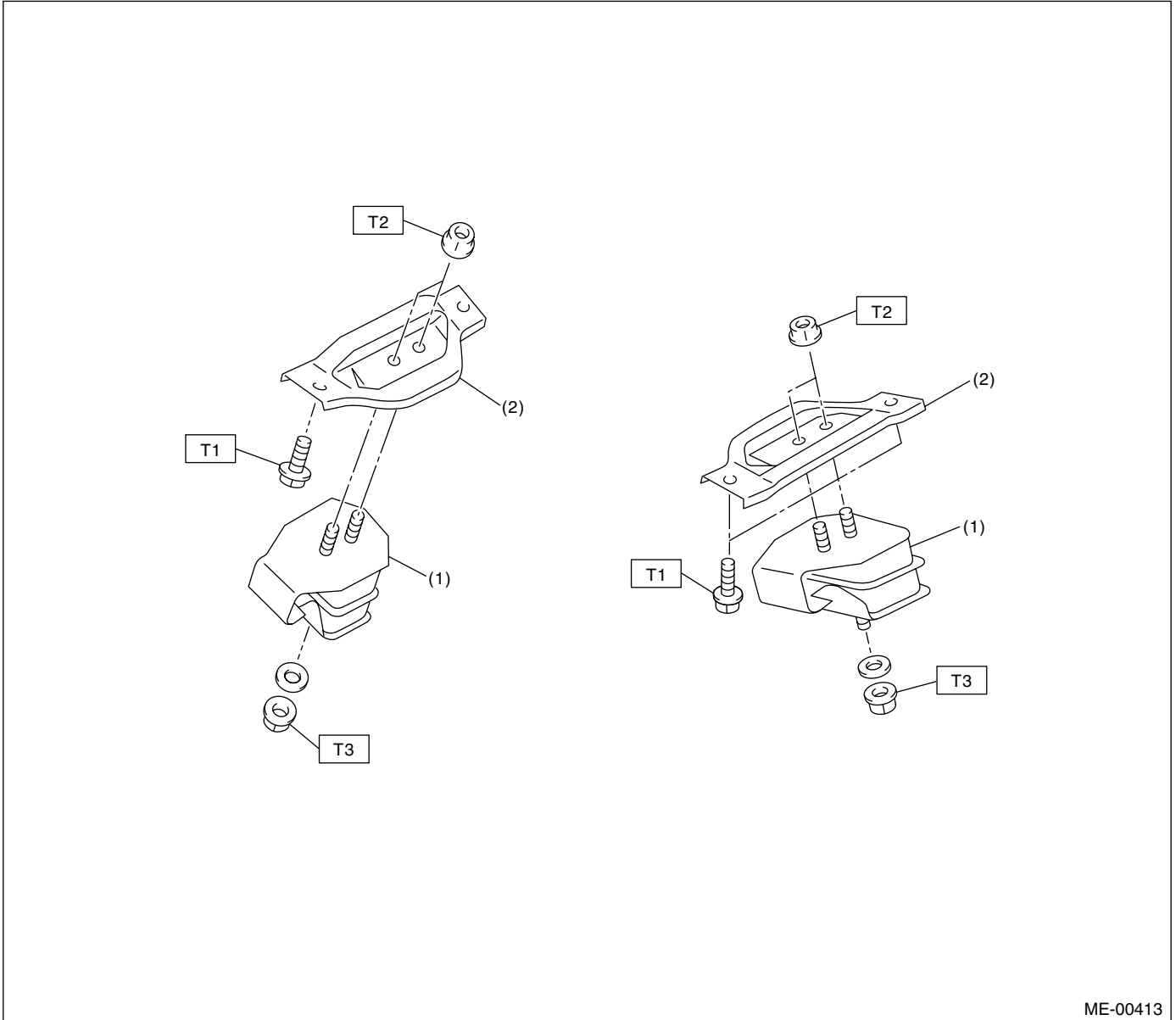
- | | | |
|------------------------------|--------------------------------|--------------------------------|
| (1) Flywheel (MT model) | (9) Circlip | (17) Crankshaft bearing #2, #4 |
| (2) Reinforcement (AT model) | (10) Connecting rod bolt | (18) Crankshaft bearing #5 |
| (3) Drive plate (AT model)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

Tightening torque: N·m (kgf·m, ft·lb)

T1: 45 (4.6, 33.3)

T2: 72 (7.3, 52.8)

7. ENGINE MOUNTING



ME-00413

(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)

General Description

MECHANICAL

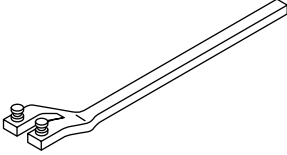
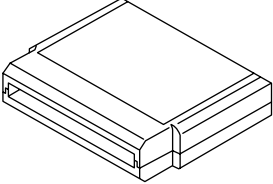
C: CAUTION

- 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 in the vehicle is hot after running.
- 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 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.
- 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 re-installed in the original positions and directions.
- Bolts, nuts and washers should be replaced with new ones as required.
- Even if necessary inspections have been made in advance, proceed with assembly work while making rechecks.
- Remove or install 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 stain seats and windows with coolant or oil. Place a cover over fenders, 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.


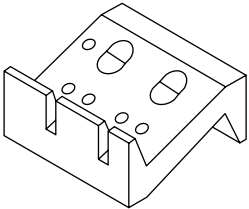
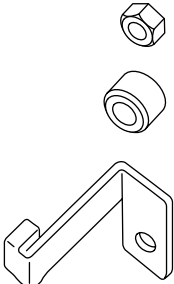
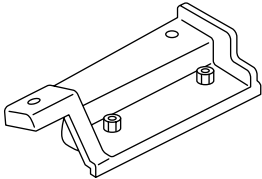
D: PREPARATION TOOL

1. SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST18231AA010</p>	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.
 <p>ST24082AA230</p>	24082AA230	CARTRIDGE	Troubleshooting for electrical systems.

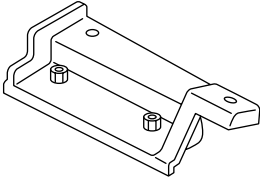
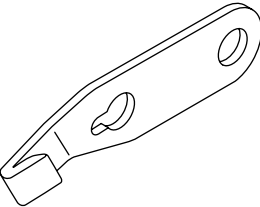
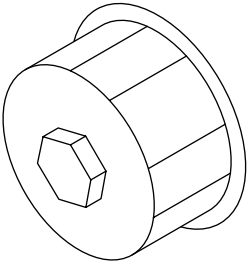
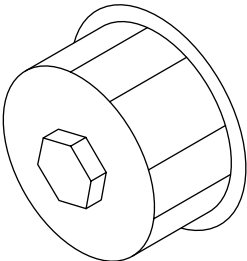
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST22771AA030</p>	22771AA030	SUBARU SELECT MONI- TOR KIT	Troubleshooting for electrical systems. <ul style="list-style-type: none"> • English: 22771AA030 (Without printer) • German: 22771AA070 (Without printer) • French: 22771AA080 (Without printer) • Spanish: 22771AA090 (Without printer)
 <p>ST-498267800</p>	498267800	CYLINDER HEAD TABLE	<ul style="list-style-type: none"> • Used for replacing valve guides. • Used for removing and installing valve springs.
 <p>ST-498277200</p>	498277200	STOPPER SET	Used for installing automatic transmission assembly to engine.
 <p>ST-498457000</p>	498457000	ENGINE STAND ADAPTER RH	Used with ENGINE STAND (499817000).

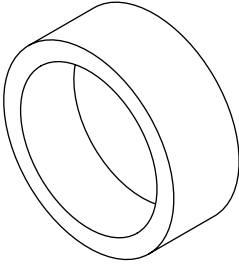
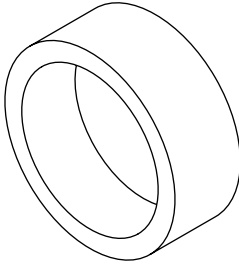
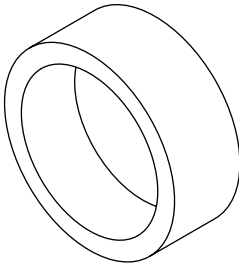
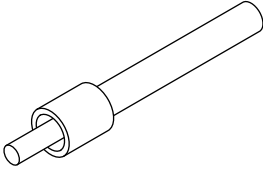
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498457100</p>	498457100	ENGINE STAND ADAPTER LH	Used with ENGINE STAND (499817000).
 <p style="text-align: center;">ST-498497100</p>	498497100	CRANKSHAFT STOPPER	Used for stopping rotation of flywheel when loosening and tightening crankshaft pulley bolt, etc.
 <p style="text-align: center;">ST-498547000</p>	498547000	OIL FILTER WRENCH	<ul style="list-style-type: none"> • Used for removing and installing oil filter. • For oil filter of outer diameter 80 mm (3.15 in).
 <p style="text-align: center;">ST18332AA000</p>	18332AA000	OIL FILTER WRENCH	<ul style="list-style-type: none"> • Used for removing and installing oil filter. • For oil filter of outer diameter 68 mm (2.68 in).

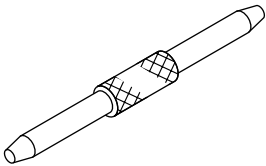
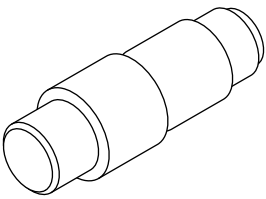
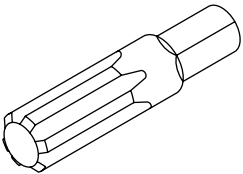
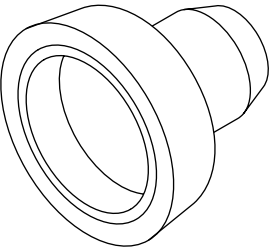
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-498747000</p>	498747000	PISTON GUIDE	Used for installing piston in cylinder. (1.6 L model)
 <p>ST-398744300</p>	398744300	PISTON GUIDE	Used for installing piston in cylinder. (2.0 L model)
 <p>ST-498747300</p>	498747300	PISTON GUIDE	Used for installing piston in cylinder. (2.5 L model)
 <p>ST-498857100</p>	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.

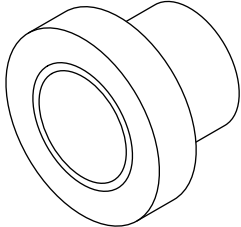
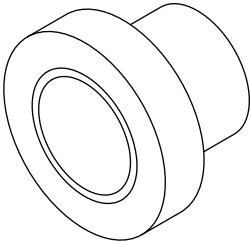
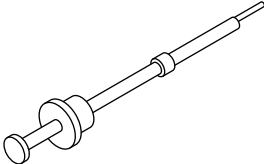
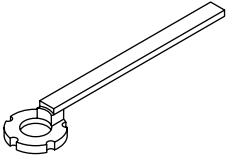
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-499017100</p>	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
 <p style="text-align: center;">ST-499037100</p>	499037100	CONNECTING ROD BUSHING REMOVER & INSTALLER	Used for removing and installing connecting rod bushing.
 <p style="text-align: center;">ST-499057000</p>	499057000	TORX® PLUS	Used for removing flywheel (Dual mass flywheel).
 <p style="text-align: center;">ST-499587200</p>	499587200	CRANKSHAFT OIL SEAL INSTALLER	<ul style="list-style-type: none"> • Used for installing crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL GUIDE (499597100).

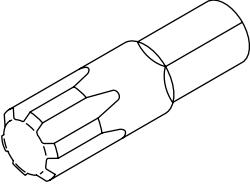
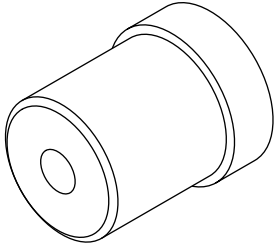
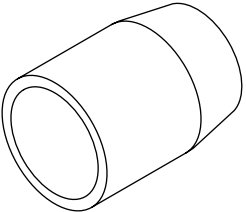
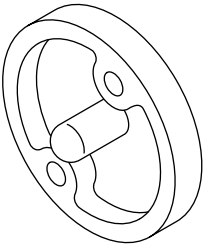
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-499587500</p>	499587500	OIL SEAL INSTALLER	<ul style="list-style-type: none"> • Used for installing camshaft oil seal. • Used with OIL SEAL GUIDE (499597000).
 <p style="text-align: center;">ST-499587700</p>	499587700	CAMSHAFT OIL SEAL INSTALLER	Used for installing cylinder head plug.
 <p style="text-align: center;">ST-499097700</p>	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.
 <p style="text-align: center;">ST-499207400</p>	499207400	CAMSHAFT SPROCKET WRENCH	Used for removing and installing camshaft sprocket. (RH side)

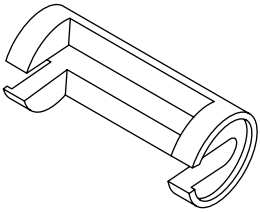
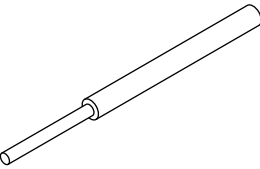
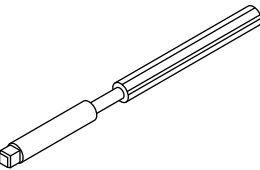
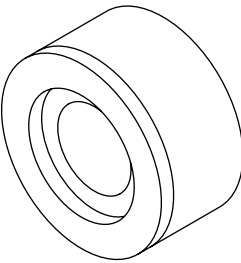
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-499497000</p>	499497000	TORX® PLUS	Used for removing and installing camshaft cap.
 <p style="text-align: center;">ST-499587100</p>	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.
 <p style="text-align: center;">ST-499597000</p>	499597000	OIL SEAL GUIDE	<ul style="list-style-type: none"> • Used for installing camshaft oil seal. • Used with CAMSHAFT OIL SEAL INSTALLER (499587500).
 <p style="text-align: center;">ST-499597100</p>	499597100	CRANKSHAFT OIL SEAL GUIDE	<ul style="list-style-type: none"> • Used for installing crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL INSTALLER (499587200).

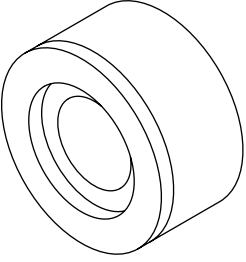
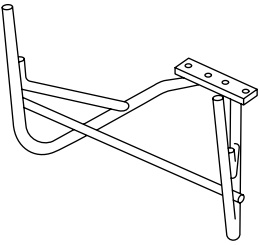
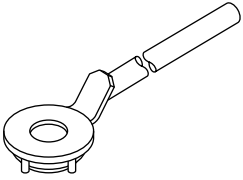
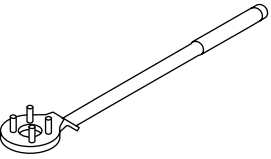
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-499718000</p>	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.
 <p style="text-align: center;">ST-499767200</p>	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
 <p style="text-align: center;">ST-499767400</p>	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
 <p style="text-align: center;">ST-499767700</p>	499767700	VALVE GUIDE ADJUSTER	Used for installing valve guide. (Intake side)

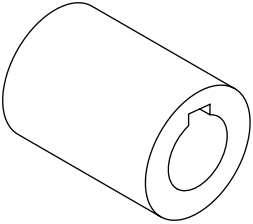
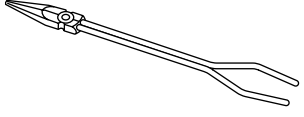
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-499767700</p>	499767800	VALVE GUIDE ADJUSTER	Used for installing valve guide. (Exhaust side)
 <p style="text-align: center;">ST-499817100</p>	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).
 <p style="text-align: center;">ST-499977400</p>	499977400	CRANKSHAFT PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolts. (1.6 L and 2.0 L model)
 <p style="text-align: center;">ST-499977100</p>	499977100	CRANKSHAFT PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolts. (2.5 L model)

General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 ST-499897200	499897200	PISTON CIR- CLIP PLIERS	Used for removing and installing piston pin circlip.

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

2. Compression

A: INSPECTION

CAUTION:

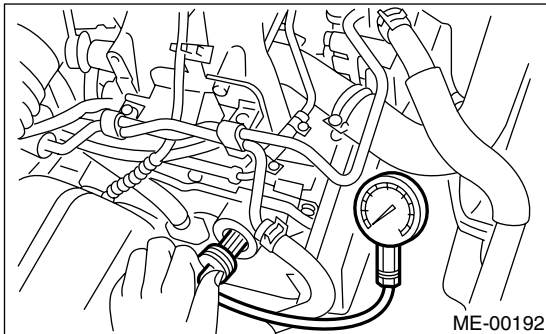
After warming up, engine becomes very hot. Be careful not to burn yourself during measurement.

- 1) After warming up the engine, turn the ignition switch to OFF.
- 2) Make sure that the battery is fully charged.
- 3) Lower the fuel pressure. <Ref. to FU(H4SO)-50, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.> or <Ref. to FU(H4SOw/oOBD)-46, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 4) Remove all the spark plugs. <Ref. to IG(H4SO)-5, REMOVAL, Spark Plug.>
- 5) Fully open the throttle valve.
- 6) Check the starter motor for satisfactory performance and operation.
- 7) Hold the compression gauge tight against spark plug hole.

NOTE:

When using a screw-in type compression gauge, the screw (put into cylinder head spark plug hole) should be less than 18 mm (0.71 in) long.

- 8) Crank the engine by means of starter motor, and then read the maximum value on the gauge when the pointer is steady.



- 9) Perform at least two measurements per cylinder, and make sure that the values are correct.

Compression (350 rpm and fully open throttle):

Standard;

1,275 kPa (13.0 kgf/cm², 185 psi)

Limit;

1,020 kPa (10.4 kgf/cm², 148 psi)

Difference between cylinders;

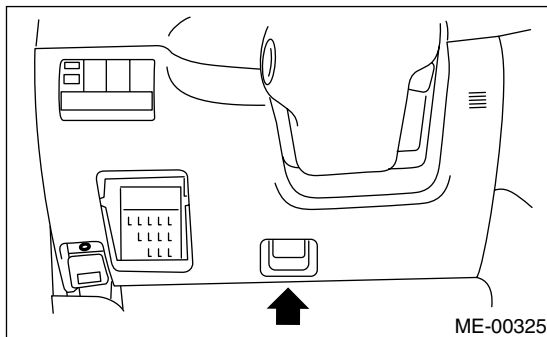
49 kPa (0.5 kgf/cm², 7 psi), or less

3. Idle Speed

A: INSPECTION

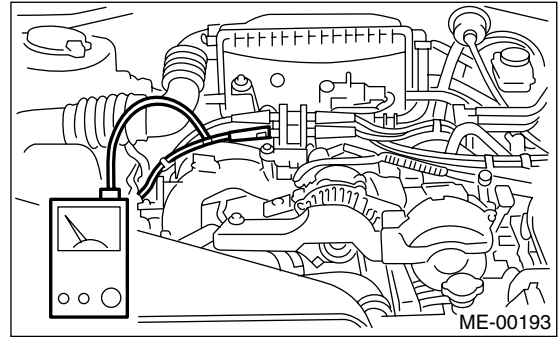
- 1) Before checking idle speed, check the following:
 - (1) Ensure the air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and the hoses are connected properly.
 - (2) Ensure the malfunction indicator light does not illuminate.
- 2) Warm up the engine.
- 3) Stop the engine, and then turn the ignition switch to OFF.
- 4) When using the Subaru Select Monitor, refer to the following. <Ref. to ME(H4SO)-16, SPECIAL TOOLS, PREPARATION TOOL, General Description.>

- (1) Insert the cartridge to Subaru Select Monitor.
- (2) Connect the Subaru Select Monitor to data link connector.



- (3) Turn the ignition switch to ON, and Subaru Select Monitor switch to ON.
 - (4) Select the {2. Each System Check} in Main Menu.
 - (5) Select the {Engine Control System} in Selection Menu.
 - (6) Select the {1. Current Data Display & Save} in Engine Control System Diagnosis.
 - (7) Select the {1.12 Data Display} in Data Display Menu.
 - (8) Start the engine, and then read the engine idle speed.
- 5) When using the tachometer (Secondary pick-up type).
 - (1) Attach the pick-up clip to No. 1 cylinder spark plug cord.

- (2) Start the engine, and then read the engine idle speed.



NOTE:

- When using the OBD-II general scan tool, carefully read its operation manual.
 - This ignition system provides simultaneous ignition for #1 and #2 plugs. It must be noted that some tachometers may register twice that of actual engine speed.
- 6) Check the idle speed when unloaded. (With headlights, heater fan, rear defroster, radiator fan, air conditioning, etc. OFF)

Idle speed [No load and gears in neutral (MT model), or N or P (AT model) range]:

1.6 L and 2.0 L model:

650±100 rpm (With OBD)

700±100 rpm (Without OBD)

2.5 L model:

650±100 rpm

- 7) Check the idle speed when loaded. (Turn the air conditioning switch to "ON" and operate the compressor for at least 1 minute before measurement.)

Idle speed [A/C "ON" and gears in neutral (MT model) or N or P (AT model) range]:

850±100 rpm

NOTE:

Idle speed can not be adjusted manually, because the idle speed is automatically adjusted. If the specified idle speed can not be maintained, refer to General On-board Diagnosis Table under "Engine Control System". <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>

4. Ignition Timing

A: INSPECTION

CAUTION:

After warming up, engine becomes very hot. Be careful not to burn yourself during measurement.

- 1) Warm up the engine.
- 2) To check the ignition timing, connect a timing light to #1 cylinder spark plug cord, and illuminate the timing mark with timing light.
- 3) Start the engine at idle speed and check the ignition timing.

Ignition timing [BTDC/rpm]:

1.6 L model:

With OBD: $5^{\circ} \pm 10^{\circ} / 650$

Without OBD: $5^{\circ} \pm 10^{\circ} / 700$

2.0 L model:

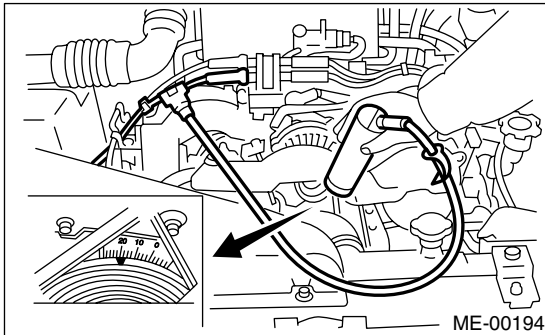
With OBD: $10^{\circ} \pm 10^{\circ} / 650$

Without OBD: $10^{\circ} \pm 10^{\circ} / 700$

2.5 L model:

MT: $10^{\circ} \pm 10^{\circ} / 650$

AT: $15^{\circ} \pm 10^{\circ} / 650$



If the timing is not correct, check the ignition control system.

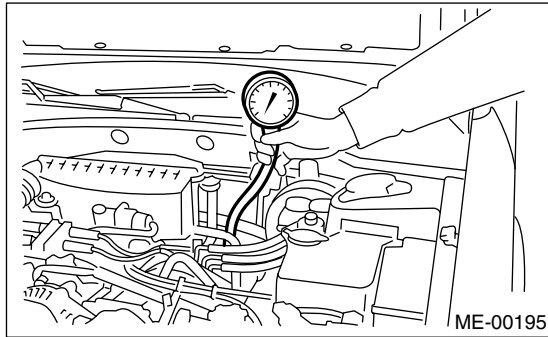
Refer to Engine Control System. <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>

5. Intake Manifold Vacuum

A: INSPECTION

- 1) Warm up the engine.
- 2) Disconnect the brake vacuum hose, and then install the vacuum gauge to hose fitting on manifold.
- 3) Keep the engine at idle speed, and then read the vacuum gauge indication.

By observing the gauge needle movement, the internal condition of engine can be diagnosed as described below.



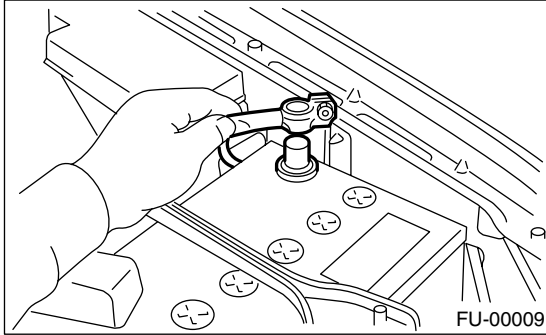
Vacuum pressure (at idling, A/C “OFF”):
Less than -60.0 kPa (-450 mmHg, -17.72 inHg)

Diagnosis of engine condition by measurement of manifold vacuum	
Vacuum gauge indication	Possible engine condition
1. Needle is steady but lower than normal position. This tendency becomes more evident as engine temperature rises.	Leakage around intake manifold gasket or disconnection or damaged vacuum hose
2. When engine speed is reduced slowly from higher speed, needle stops temporarily when it is lowering or becomes steady above normal position.	Back pressure too high, or exhaust system clogged
3. Needle intermittently drops to position lower than normal position.	Leakage around cylinder
4. Needle drops suddenly and intermittently from normal position.	Sticky valves
5. When engine speed is gradually increased, needle begins to vibrate rapidly at certain speed, and then vibration increases as engine speed increases.	Weak or broken valve springs
6. Needle vibrates above and below normal position in narrow range.	Defective ignition system

6. Engine Oil Pressure

A: INSPECTION

1) Disconnect the ground cable from battery.



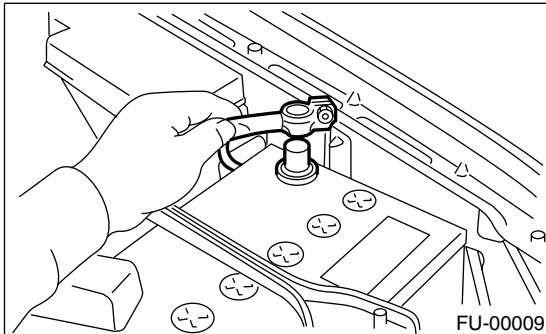
2) Remove the generator from bracket. <Ref. to SC(H4SO)-13, REMOVAL, Generator.>

3) Disconnect the connector from oil pressure switch.

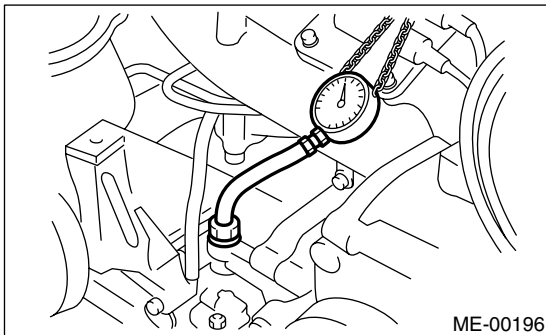
4) Remove the oil pressure switch from engine cylinder block. <Ref. to LU(H4SO)-19, REMOVAL, Oil Pressure Switch.>

5) Connect the oil pressure gauge hose to cylinder block.

6) Connect the battery ground cable to battery.



7) Start the engine, and then measure the oil pressure.



Oil pressure:

88 kPa (0.9 kg/cm², 13 psi) or more at 800 rpm
294 kPa (3.0 kg/cm², 43 psi) or more at 5,000 rpm

CAUTION:

- If the oil pressure is out of specification, check the oil pump, oil filter and lubrication line. <Ref. to LU(H4SO)-21, INSPECTION, Engine Lubrication System Trouble in General.>
- If the oil pressure warning light is turned ON and oil pressure is in specification, replace the oil pressure switch. <Ref. to LU(H4SO)-21, INSPECTION, Engine Lubrication System Trouble in General.>

NOTE:

The specified data is based on an engine oil temperature of 80°C (176°F).

8) After measuring the oil pressure, install the oil pressure switch. <Ref. to LU(H4SO)-19, INSTALLATION, Oil Pressure Switch.>

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

9) Install the generator and V-belt in the reverse order of removal, and then adjust the V-belt deflection. <Ref. to ME(H4SO)-43, INSTALLATION, V-belt.>

7. Fuel Pressure

A: INSPECTION

WARNING:

Before removing the fuel pressure gauge, lower the fuel pressure.

NOTE:

If out of specification, check or replace the pressure regulator and pressure regulator vacuum hose.

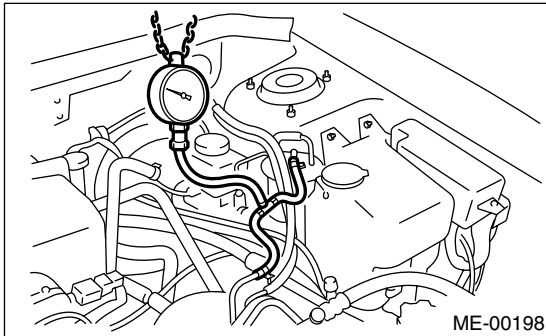
1) Release the fuel pressure. <Ref. to FU(H4SO)-50, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>

2) Open the fuel flap lid, and then remove the fuel filler cap.

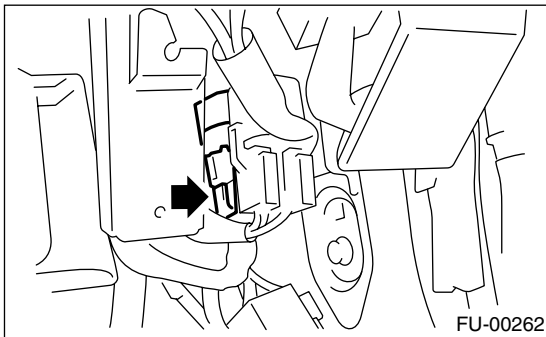
3) Disconnect the fuel delivery hoses from fuel damper, and then connect the fuel pressure gauge.

NOTE:

The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kg/cm², 1 to 3 psi) higher than standard values during high-altitude operations.



4) Connect the connector of fuel pump relay.



5) Start the engine.

6) Measure the fuel pressure while disconnecting the pressure regulator vacuum hose from intake manifold.

Fuel pressure:

Standard; 284 — 314 kPa (2.9 — 3.2 kg/cm², 41 — 46 psi)

7) After connecting the pressure regulator vacuum hose, measure the fuel pressure.

Fuel pressure:

Standard; 206 — 235 kPa (2.1 — 2.4 kg/cm², 30 — 34 psi)

Valve Clearance

MECHANICAL

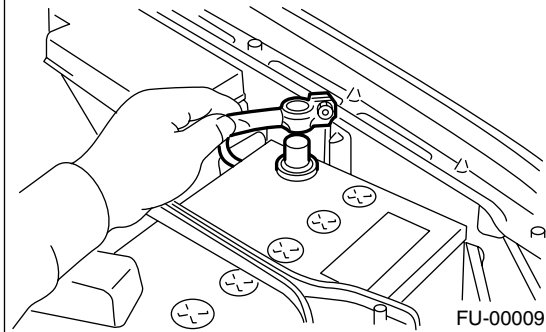
8. Valve Clearance

A: INSPECTION

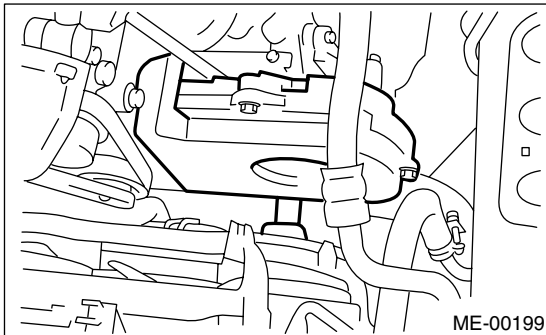
NOTE:

Inspection and adjustment of the valve clearance should be performed while engine is cold.

- 1) Set the vehicle on a lift.
- 2) Lift-up the vehicle.
- 3) Remove the under cover.
- 4) Lower the vehicle.
- 5) Disconnect the ground cable from battery.



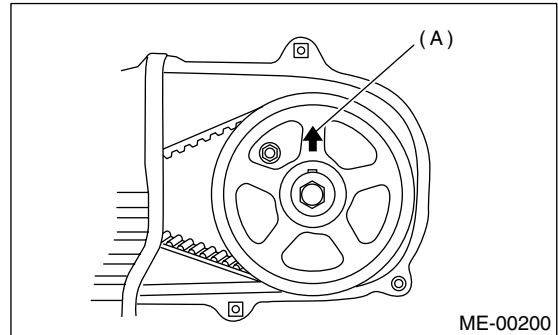
- 6) Remove the timing belt cover (LH).



- 7) When inspecting the #1 and #3 cylinders;
 - (1) Disconnect the spark plug cords from spark plugs RH side. <Ref. to IG(H4SO)-5, RH SIDE, REMOVAL, Spark Plug.>
 - (2) Disconnect the PCV hose from rocker cover (RH).
 - (3) Remove the bolts, and then remove the rocker cover (RH).
- 8) When inspecting the #2 and #4 cylinders;
 - (1) Disconnect the spark plug cords from spark plugs (LH Side). <Ref. to IG(H4SO)-5, LH SIDE, REMOVAL, Spark Plug.>
 - (2) Disconnect the PCV hose from rocker cover (LH).
 - (3) Remove the bolts, and then remove the rocker cover (LH).
- 9) Set the #1 cylinder piston to top dead center of compression stroke by rotating crankshaft pulley clockwise using a socket wrench.

NOTE:

When arrow mark (A) on the camshaft sprocket (LH) comes exactly to the top, #1 cylinder piston is brought to the top dead center of compression stroke.



- 10) Measure the #1 cylinder valve clearance by using thickness gauge.

CAUTION:

- Insert the thickness gauge (A) in as horizontal a direction as possible with respect to the valve stem end face.
- Measure the exhaust valve clearances while lifting up the vehicle.

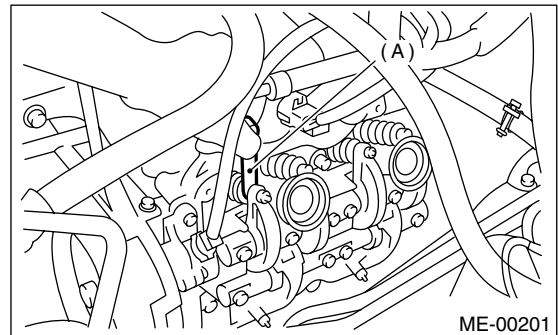
Valve clearance:

Intake;

0.20 ± 0.04 mm (0.0079 ± 0.0016 in)

Exhaust;

0.25 ± 0.04 mm (0.0098 ± 0.0016 in)



- 11) If necessary, adjust the valve clearance. <Ref. to ME(H4SO)-33, ADJUSTMENT, Valve Clearance.>

- 12) Similar to measurement procedures used for #1 cylinder, measure the cylinder valve clearances in the following sequence: #3, #2 and #4 cylinder.

NOTE:

- Be sure to set the cylinder pistons to their respective top dead centers on compression stroke before measuring valve clearances.

- To set each cylinder piston to its top dead center on compression stroke in the following sequence: #3, #2 and #4 cylinder, turn the crankshaft pulley clockwise by every 180° at starting with #1 cylinder piston being on top dead center on compression stroke.

13) After inspection, install the related parts in the reverse order of removal.

B: ADJUSTMENT

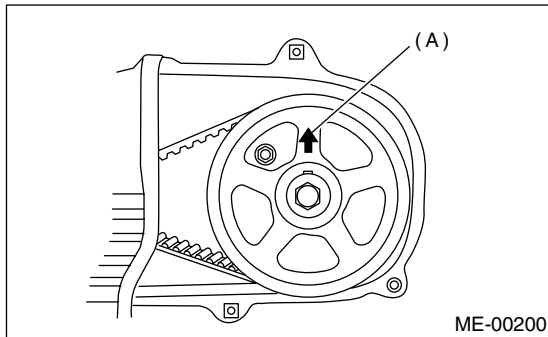
NOTE:

Adjustment of the valve clearance should be performed while engine is cold.

1) Set the #1 cylinder piston to top dead center of compression stroke by rotating crankshaft pulley clockwise using socket wrench.

NOTE:

When arrow mark (A) on the camshaft sprocket (LH) comes exactly to the top, #1 cylinder piston is brought to the top dead center of compression stroke.



2) Adjust the #1 cylinder valve clearance.

- Loosen the valve rocker nut and screw.
- Place suitable thickness gauge.
- While noting the valve clearance, tighten the valve rocker adjust screw.
- When specified valve clearance is obtained, tighten the valve rocker nut.

Tightening torque:

10 N·m (1.0 kgf-m, 7.2 ft-lb)

CAUTION:

- Insert the thickness gauge in as horizontal a direction as possible with respect to the valve stem end face.
- Adjust the exhaust valve clearances while lifting up the vehicle.

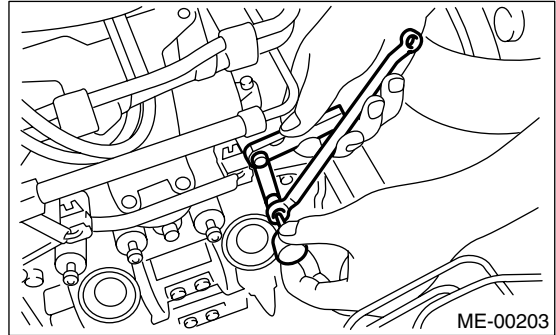
Valve clearance:

Intake;

0.20±0.02 mm (0.0079±0.0008 in)

Exhaust;

0.25±0.02 mm (0.0098±0.0008 in)



3) Ensure the valve clearances are within specifications.

4) Turn the crankshaft two complete rotations until #1 cylinder piston is again set to the top dead center on compression stroke.

5) Ensure the valve clearances are within specifications. If necessary, readjust the valve clearances.

6) Similar to adjustment procedures used for #1 cylinder, adjust the #2, #3 and #4 cylinder valve clearances.

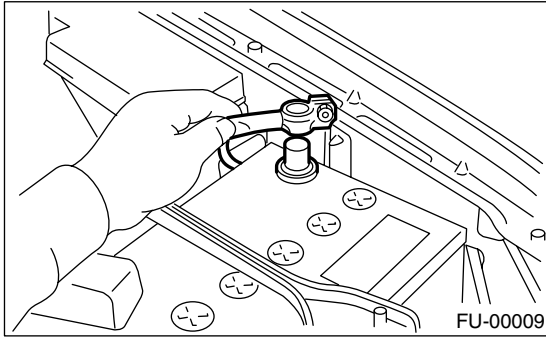
NOTE:

- Be sure to set the cylinder pistons to their respective top dead centers on compression stroke before adjusting valve clearances.
- To set each cylinder piston to its top dead center on compression stroke in the following sequence: #3, #2 and #4 cylinder, turn the crankshaft pulley clockwise by every 180° at starting with #1 cylinder piston being on top dead center on compression stroke.

9. Engine Assembly

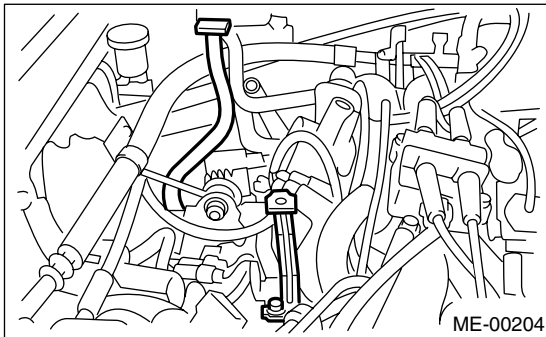
A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Open the front hood fully, and then support with the hood stay.
- 3) Using the refrigerant recovery system, discharge refrigerant. <Ref. to AC-21, OPERATION, Refrigerant Recovery Procedure.>
- 4) Release the fuel pressure. <Ref. to FU(H4SO)-50, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 5) Remove the fuel filler cap.
- 6) Disconnect the ground cable from battery.

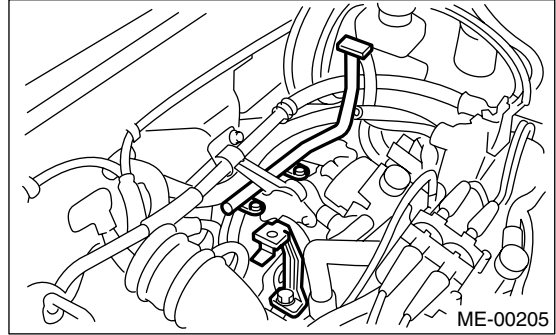


- 7) Remove the air intake duct and air cleaner case. <Ref. to IN(H4SO)-6, REMOVAL, Air Intake Duct.> and <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>
- 8) Remove the under cover.
- 9) Remove the radiator from vehicle. <Ref. to CO(H4SO)-19, REMOVAL, Radiator.>
- 10) Disconnect the A/C pressure hoses from A/C compressor.
- 11) Remove the air intake chamber stay.

• MT MODEL

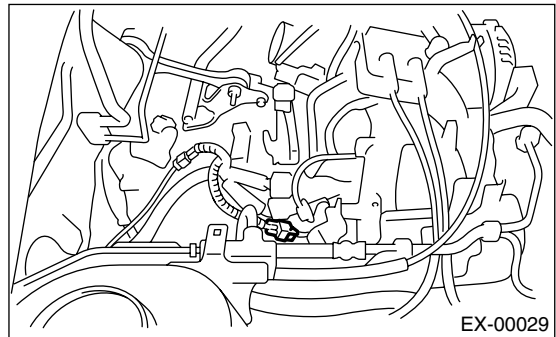


• AT MODEL

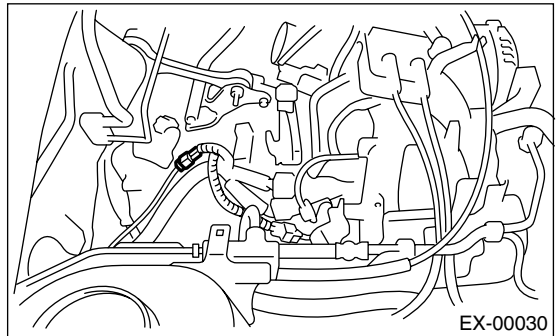


- 12) Disconnect the following connectors and cables.

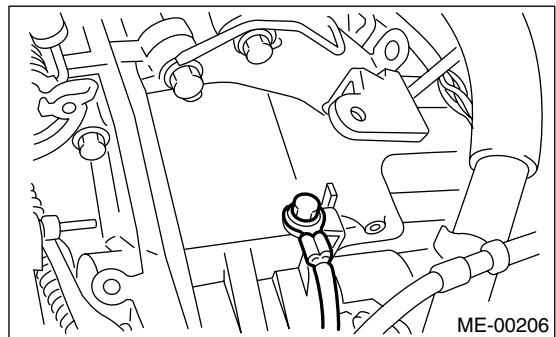
(1) Front oxygen (A/F) sensor connector



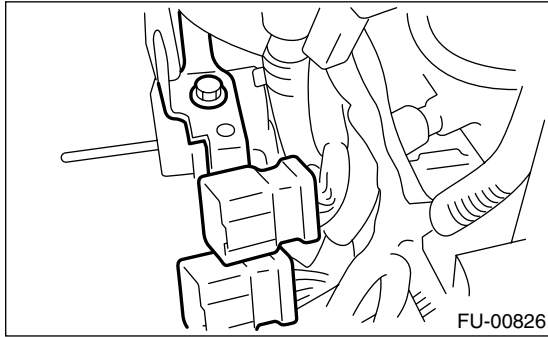
(2) Rear oxygen sensor connector



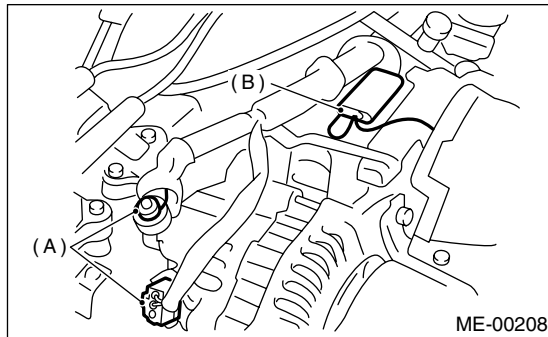
(3) Engine ground cable



(4) Engine harness connectors

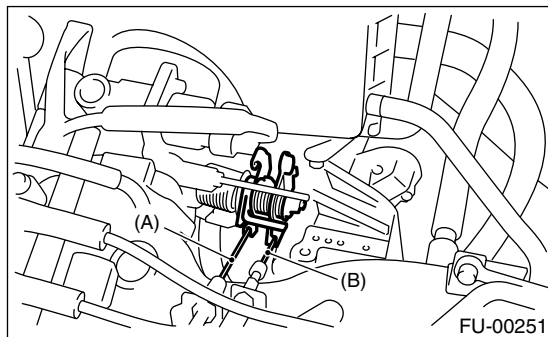


(5) Generator connector, terminal and A/C compressor connector

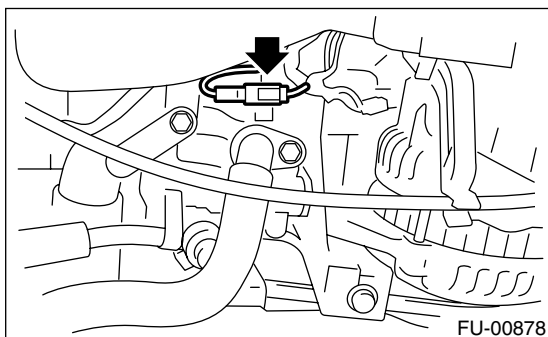


- (A) Generator connector and terminal
- (B) A/C compressor connector

(6) Accelerator cable (A) and cruise control cable (B) (Model with cruise control)

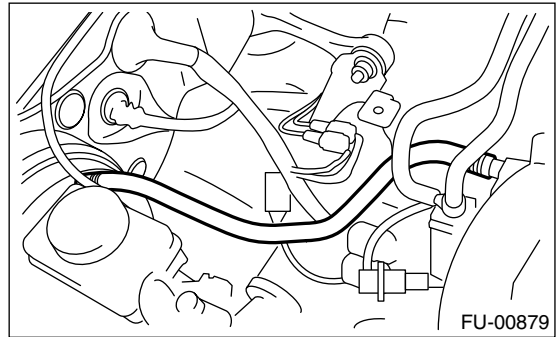


(7) Power steering switch connector

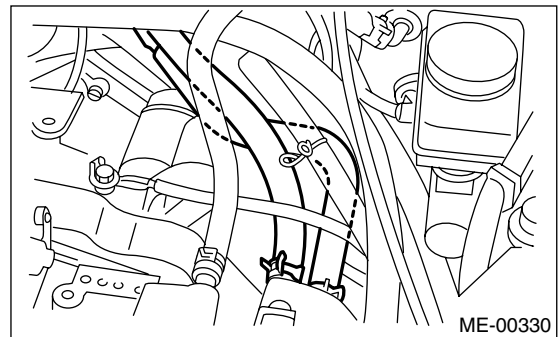


13) Disconnect the following hoses.

(1) Brake booster vacuum hose

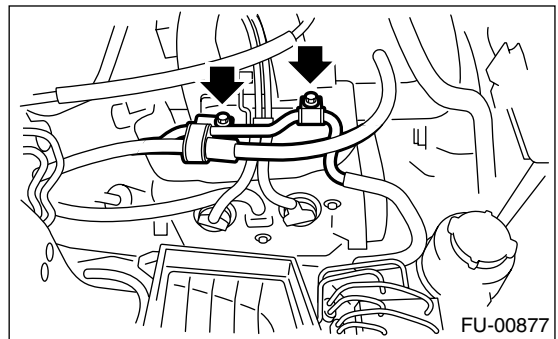


(2) Heater inlet outlet hose



14) Remove the power steering pump from bracket.

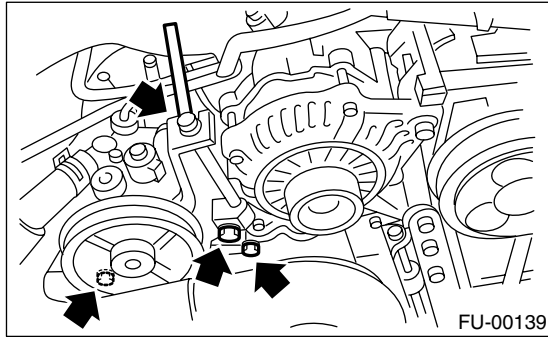
- (1) Remove the resonator chamber.
- (2) Loosen the lock bolt and slider bolt, and then remove the front side V-belt. <Ref. to ME(H4SO)-43, FRONT SIDE BELT, REMOVAL, V-belt.>
- (3) Remove the pipe with bracket.



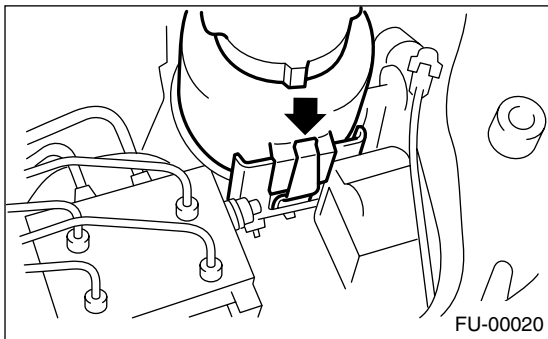
Engine Assembly

MECHANICAL

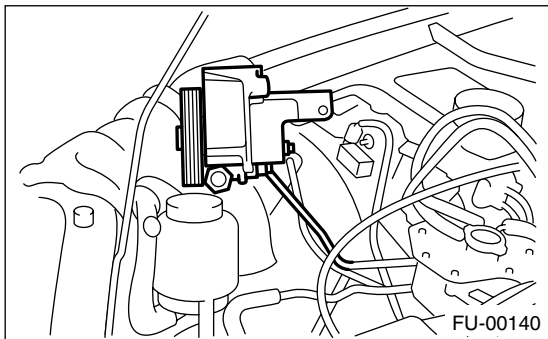
(4) Remove the bolts which install the power steering pump bracket.



(5) Remove the power steering tank from bracket by pulling it upward.

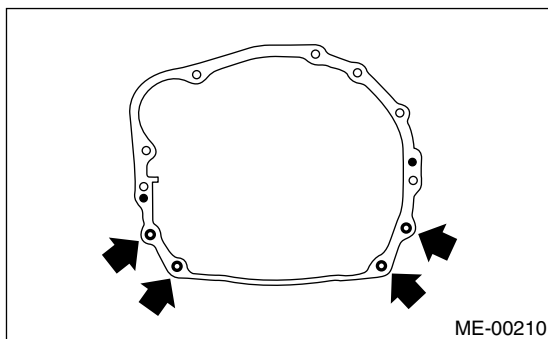


(6) Place the power steering pump on right side wheel apron.

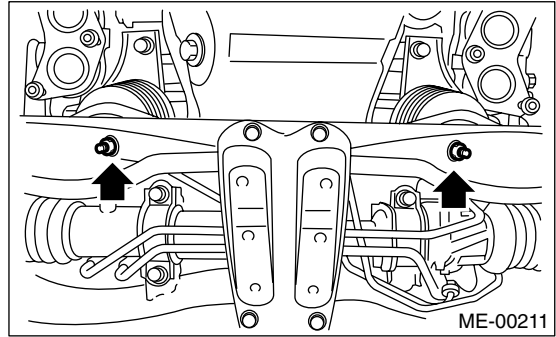


15) Remove the front and center exhaust pipe.
<Ref. to EX(H4SO)-6, REMOVAL, Front Exhaust Pipe.>

16) Remove the nuts which hold the lower side of transmission to engine.

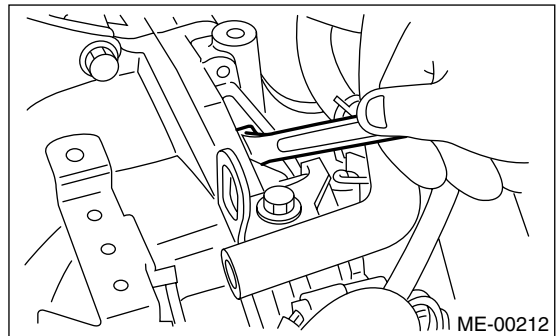


17) Remove the nuts which install the front cushion rubber onto front crossmember.

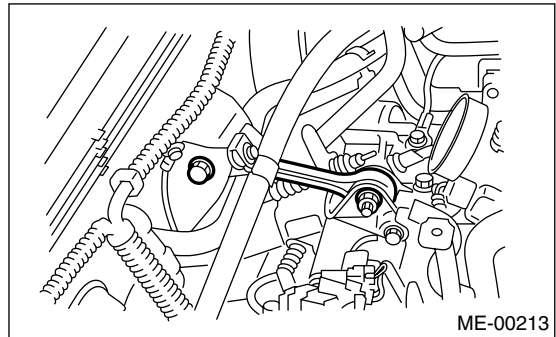


18) Separate the torque converter clutch from drive plate. (AT model)

- (1) Lower the vehicle.
- (2) Remove the service hole plug.
- (3) Remove the bolts which hold the torque converter clutch to drive plate.
- (4) Remove other bolts while rotating the engine using socket wrench.



19) Remove the pitching stopper.

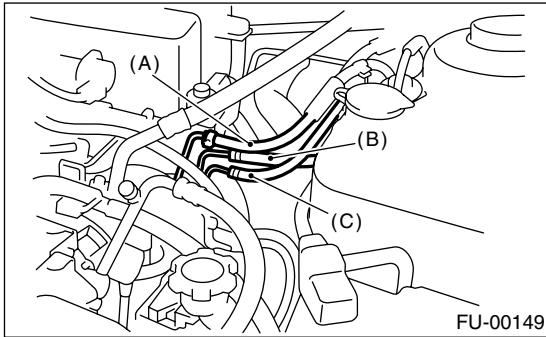


20) Disconnect the fuel delivery hose (A), return hose (B) and evaporation hose (C).

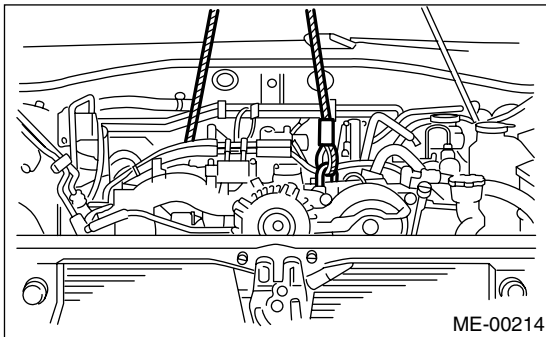
CAUTION:

- Disconnect the hose with its end wrapped with cloth to prevent fuel from splashing.

- Catch fuel from the hose into container.



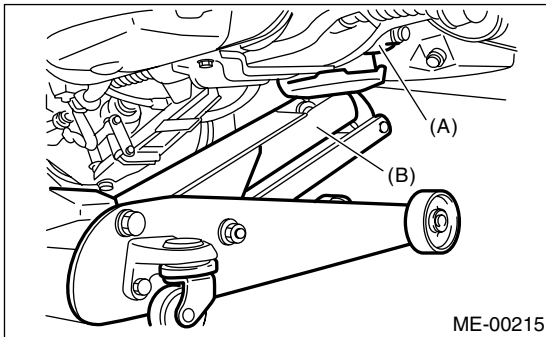
21) Support the engine with a lifting device and wire ropes.



22) Support the transmission with a garage jack.

CAUTION:

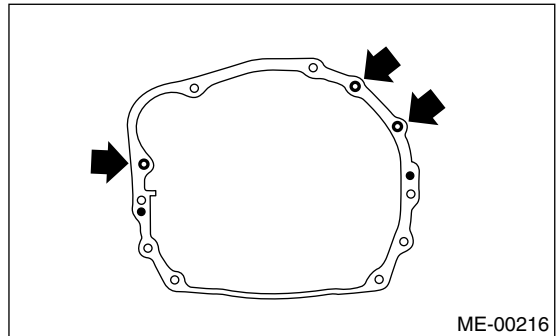
Before moving the engine away from transmission, check to be sure no work has been overlooked. Doing this is very important in order to facilitate re-installation and because the transmission lowers under its own weight.



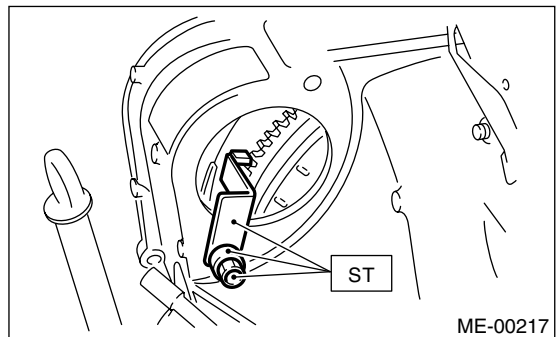
- (A) Transmission
- (B) Garage jack

23) Separation of the engine and transmission.
 (1) Remove the starter. <Ref. to SC(H4SO)-7, REMOVAL, Starter.>

(2) Remove the bolts which hold the upper side of transmission to engine.



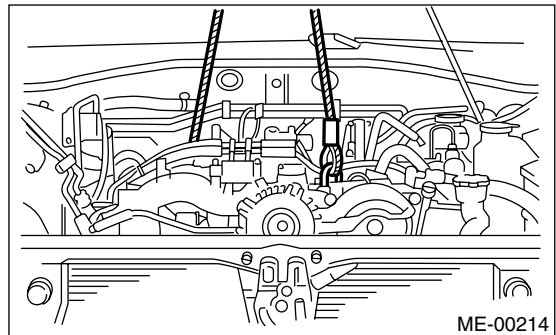
24) Install the ST to torque converter clutch case.
 (AT model)
 ST 498277200 STOPPER SET



25) Remove the engine from vehicle.
 (1) Slightly raise the engine.
 (2) Raise the transmission with garage jack.
 (3) Move the engine horizontally until main shaft is withdrawn from clutch cover.
 (4) Slowly move the engine away from engine compartment.

NOTE:

Be careful not to damage the adjacent parts or body panels with crank pulley, oil level gauge, etc.



26) Remove the front cushion rubbers.

B: INSTALLATION

1) Install the front cushion rubbers.

Tightening torque:

34 N·m (3.5 kgf-m, 25.3 ft-lb)

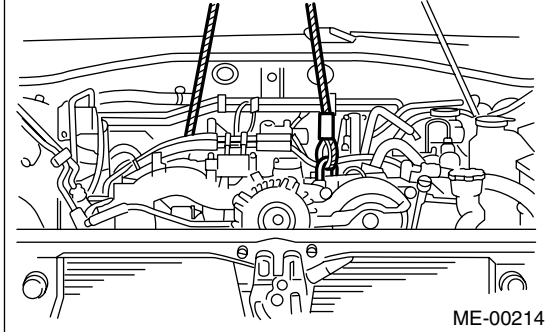
Engine Assembly

MECHANICAL

- 2) Install the engine onto transmission.
 - (1) Position the engine in engine compartment and align it with transmission.

NOTE:

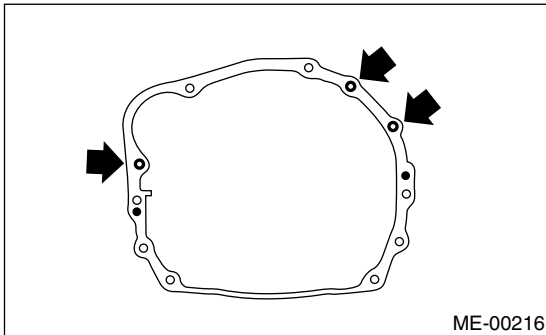
Be careful not to damage the adjacent parts or body panels with crank pulley, oil level gauge, etc.



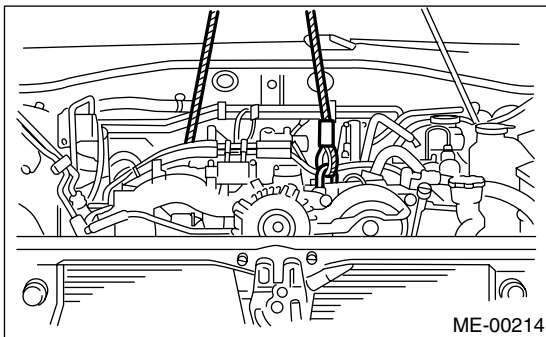
- (2) Apply a small amount of grease to the spline of main shaft. (MT model)
- 3) Tighten the bolts which hold the upper side of transmission to engine.

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)



- 4) Remove the lifting device and wire ropes.

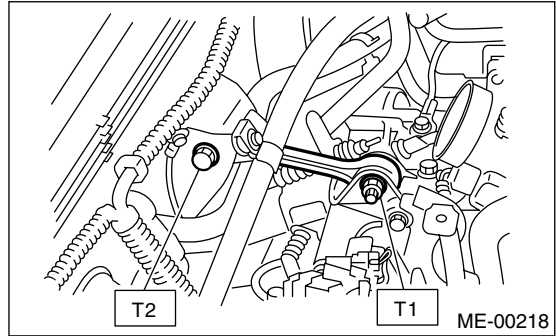


- 5) Remove the garage jack.
- 6) Install the pitching stopper.

Tightening torque:

T1: 50 N·m (5.1 kgf-m, 37 ft-lb)

T2: 58 N·m (5.9 kgf-m, 43 ft-lb)



- 7) Remove the ST from torque converter clutch case. (AT model)

NOTE:

Be careful not to drop the ST into torque converter clutch case when removing ST.

ST 498277200 STOPPER SET

- 8) Install the starter. <Ref. to SC(H4SO)-7, INSTALLATION, Starter.>

- 9) Install the torque converter clutch onto drive plate. (AT model)

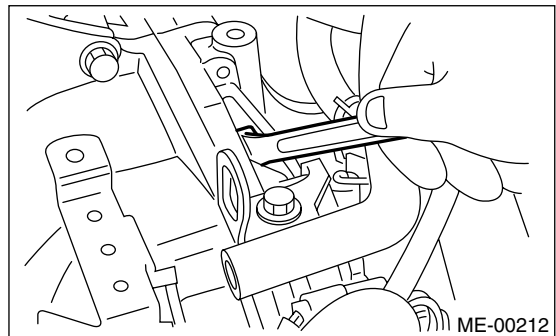
- (1) Tighten the bolts which hold the torque converter clutch to drive plate.
- (2) Tighten other bolts while rotating the engine by using a socket wrench.

NOTE:

Be careful not to drop the bolts into torque converter clutch housing.

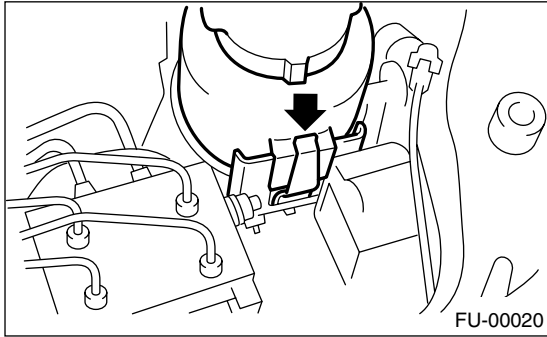
Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



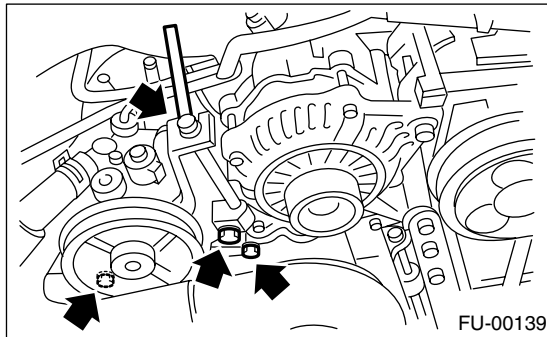
- (3) Clog the plug onto service hole.

- 10) Install the power steering pump on bracket.
 (1) Install the power steering tank on bracket.

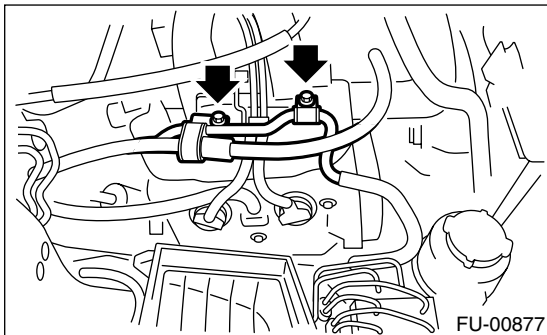


- (2) Install the power steering pump on bracket, and then tighten the bolts.

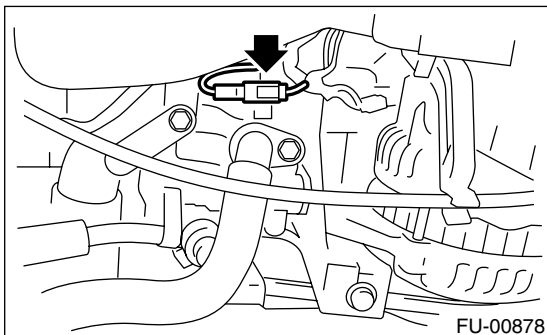
Tightening torque:
20.1 N·m (2.05 kgf-m, 14.8 ft-lb)



- (3) Tighten the bolts which install the power steering pipe bracket, and then install the spark plug cords.

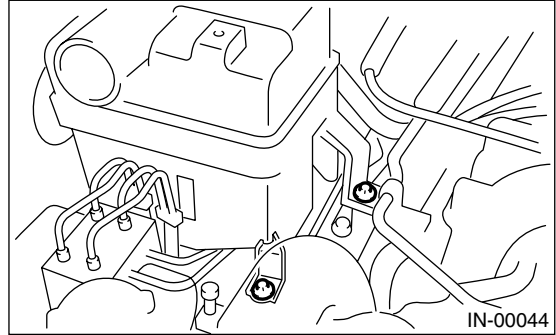


- (4) Connect the power steering switch connector.



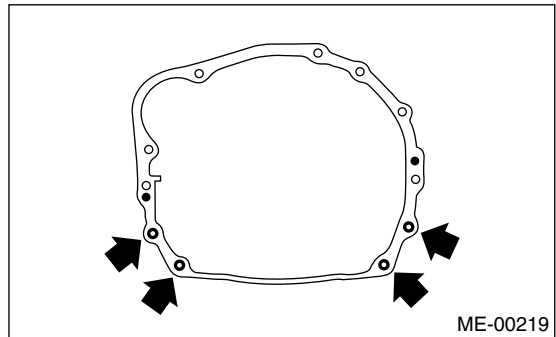
- (5) Install the front side V-belt, and adjust it. <Ref. to ME(H4SO)-43, FRONT SIDE BELT, INSTALLATION, V-belt.>
 (6) Install the resonator chamber.

Tightening torque:
33 N·m (3.4 kgf-m, 24.6 ft-lb)



- 11) Tighten the nuts which hold the lower side of transmission to engine.

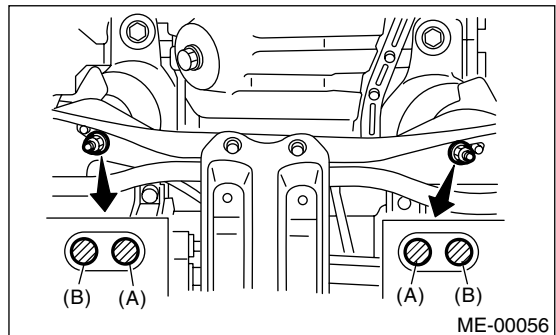
Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



- 12) Tighten the nuts which install the front cushion rubber onto crossmember.

Tightening torque:
85 N·m (8.7 kgf-m, 63 ft-lb)

NOTE:
 Make sure the front cushion rubber mounting bolts (A) and locator (B) are securely installed.



- 13) Install the front and center exhaust pipe. <Ref. to EX(H4SO)-7, INSTALLATION, Front Exhaust Pipe.>

Engine Assembly

MECHANICAL

- 14) Connect the following hoses.
 - (1) Fuel delivery hose, return hose and evaporation hose
 - (2) Heater inlet and outlet hoses
 - (3) Brake booster vacuum hose
- 15) Connect the following connectors.
 - (1) Engine ground cables

Tightening torque:

14 N·m (1.4 kgf-m, 10.1 ft-lb)

- (2) Engine harness connectors
 - (3) Generator connector and terminal
 - (4) A/C compressor connectors
- 16) Connect the following cables.
 - (1) Accelerator cable
 - (2) Cruise control cable (Model with cruise control)
 - 17) Adjust each connected cable.
 - 18) Install the air cleaner case stay.

Tightening torque:

16 N·m (1.6 kgf-m, 11.6 ft-lb)

- 19) Install the A/C pressure hoses.
<Ref. to AC-36, INSTALLATION, Hose and Tube.>
- 20) Install the radiator to vehicle. <Ref. to CO(H4SO)-20, INSTALLATION, Radiator.>
- 21) Install the air intake duct and air cleaner case. <Ref. to IN(H4SO)-6, INSTALLATION, Air Intake Duct.> and <Ref. to IN(H4SO)-5, INSTALLATION, Air Cleaner Case.>
- 22) Install the under cover.
- 23) Install battery in the vehicle, and then connect the cables.
- 24) Fill engine coolant.
<Ref. to CO(H4SO)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 25) Check the ATF level and correct if necessary. (AT model)
<Ref. to 4AT-31, INSPECTION, Automatic Transmission Fluid.>
- 26) Charge the A/C system with refrigerant.
<Ref. to AC-22, OPERATION, Refrigerant Charging Procedure.>
- 27) Remove the front hood stay, and then close the front hood.
- 28) Take off the vehicle from lift arms.

C: INSPECTION

- 1) Make sure the pipes and hoses are installed correctly.
- 2) Make sure the engine coolant and ATF are at specified levels.

10.Engine Mounting

A: REMOVAL

- 1) Remove the engine assembly. <Ref. to ME(H4SO)-34, REMOVAL, Engine Assembly.>
- 2) Remove the engine mounting from engine assembly.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

Engine mounting;

35 N·m (3.6 kgf-m, 25.8 ft-lb)

C: INSPECTION

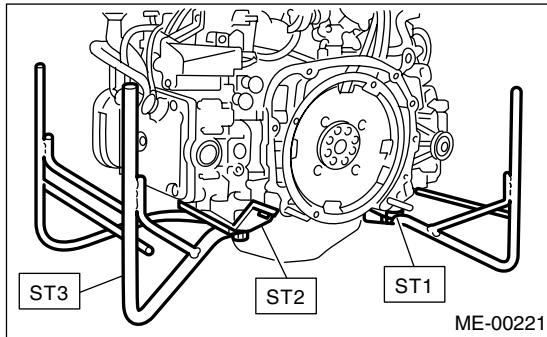
Make sure there are no cracks or other damage.

11. Preparation for Overhaul

A: PROCEDURE

1) After removing the engine from body, secure it in the ST shown below.

ST1	498457000	ENGINE STAND ADAPTER RH
ST2	498457100	ENGINE STAND ADAPTER LH
ST3	499817100	ENGINE STAND



2) In this section the procedures described under each index are all connected and stated in order. It will be the complete procedure for overhauling of the engine itself when you go through all steps in the process.

Therefore, in this section, to conduct the particular procedure within the flow of a section, you need to go back and conduct the procedure described previously in order to do that particular procedure.

12.V-belt

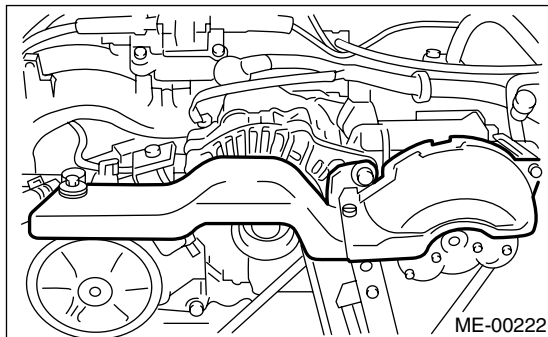
A: REMOVAL

1. FRONT SIDE BELT

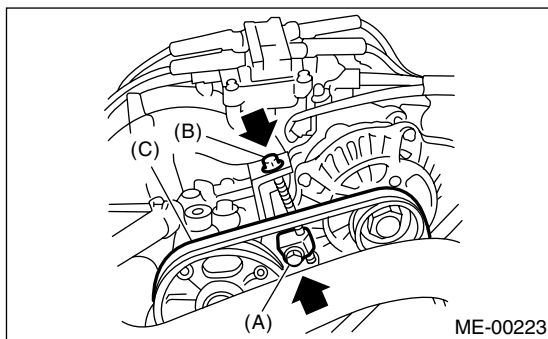
NOTE:

Perform the following procedures 1) to 4) with the engine installed to body.

- 1) Remove the V-belt cover.

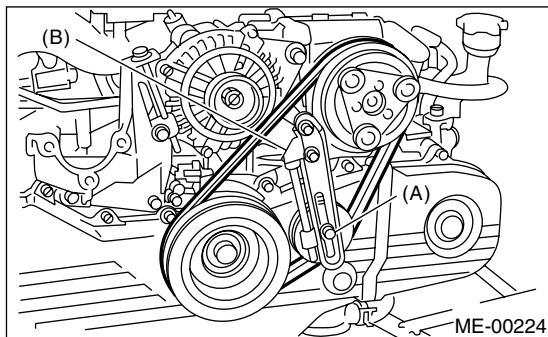


- 2) Loosen the lock bolt (A).
- 3) Loosen the slider bolt (B).
- 4) Remove the front side belt (C).



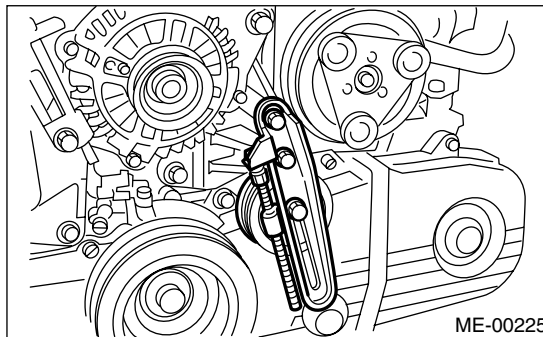
2. REAR SIDE BELT

- 1) Loosen the lock nut (A).
- 2) Loosen the slider bolt (B).



- 3) Remove the rear side belt.

- 4) Remove the belt tensioner.



B: INSTALLATION

NOTE:

Wipe off any oil or water on the belt and pulley.

1. FRONT SIDE BELT

- 1) Install a V-belt (C), and tighten the slider bolt so as to obtain the specified belt tension. <Ref. to ME(H4SO)-44, INSPECTION, V-belt.>
- 2) Tighten the lock bolt (A).
- 3) Tighten the slider bolt (B).

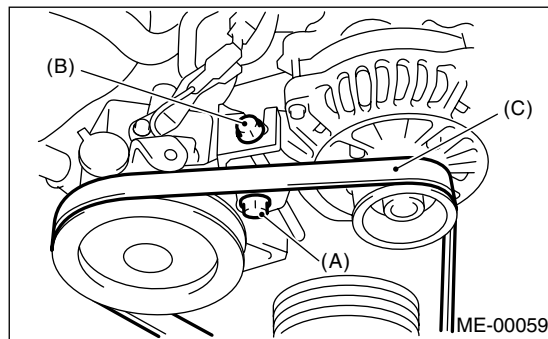
Tightening torque:

Lock bolt (A):

25 N·m (2.5 kgf·m, 18.1 ft·lb)

Slider bolt (B):

8 N·m (0.8 kgf·m, 5.9 ft·lb)



2. REAR SIDE BELT

- 1) Remove the A/C belt tensioner.
- 2) Install a V-belt, and tighten the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME(H4SO)-44, INSPECTION, V-belt.>

V-belt

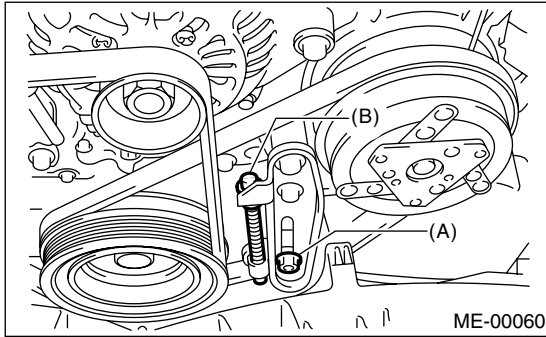
MECHANICAL

3) Tighten the lock nut (A).

Tightening torque:

Lock nut (A):

22.6 N·m (2.3 kgf·m, 16.6 ft·lb)



C: INSPECTION

- 1) Replace the belts, if cracks, fraying or wear is found.
- 2) Check the V-belt tension and adjust it if necessary by changing the generator installing position and idler pulley installing position.

Belt tension (with belt tension gauge)

(A)

When installing new parts:

618 — 755 N (63 — 77 kgf, 139 — 170 lb)

At inspection:

490 — 640 N (50 — 65 kgf, 110 — 144 lb)

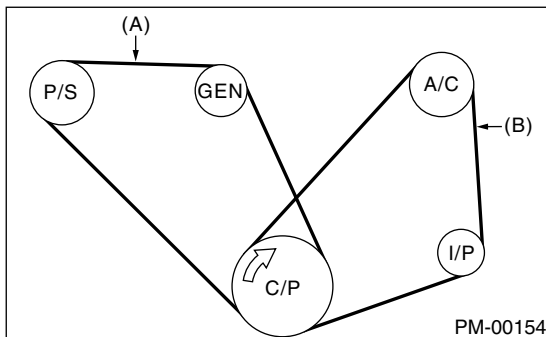
(B)

When installing new parts:

740 — 880 N (75 — 90 kgf, 166 — 198 lb)

At inspection:

350 — 450 N (36 — 46 kgf, 78 — 101 lb)



- (A) Front side belt
- (B) Rear side belt
- C/P Crank pulley
- GEN Generator
- P/S Power steering oil pump pulley
- A/C A/C compressor pulley
- I/P Idler pulley

Belt tension (without belt tension gauge)

(A)

When installing new parts:

7 — 9 mm (0.276 — 0.354 in)

At inspection:

9 — 11 mm (0.354 — 0.433 in)

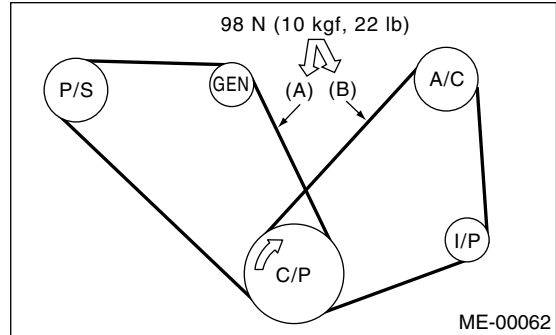
(B)

When installing new parts:

7.5 — 8.5 mm (0.295 — 0.335 in)

At inspection:

9.0 — 10.0 mm (0.354 — 0.394 in)



- C/P Crank pulley
- GEN Generator
- P/S Power steering oil pump pulley
- A/C A/C compressor pulley
- I/P Idler pulley