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.

FUJI HEAVY INDUSTRIES LTD. G8080GE2

MECHANICAL

ME(H4SO)

1. General Description

A: SPECIFICATION

Engine	Model			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)			92×75 (3.62×2.95)	99.5×79.0 (3.917×3.110)
	Displacement cm^3 (cu in)			1,994 (121.67)	2,457 (150)
	Compression ratio			10.0	
	Compression pressure (at 200 — 300 rpm) kPa (kg/cm^2, psi)			1,079 — 1,275 (11.0 — 13.0, 156 — 185)	
	Number of piston rings			Pressure ring: 2, Oil ring: 1	
	Intake valve timing	Open		4° BTDC	1° BTDC
		Close		48° ABDC	51° ABDC
	Exhaust valve timing	Open		48° BBDC	50° BBDC
		Close		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" range on AT] rpm			650±100 (No load) 850±100 (A/C switch ON)	
	Firing order			1 → 3 → 2 → 4	
	Ignition timing BTDC/rpm			10°±10°/650	

NOTE:
STD: Standard I.D.: Inner Diameter O.D.: Outer Diameter US: Undersize OS: Oversize

Belt tensioner adjuster	Protrusion of adjuster rod mm (in)				5.7 — 6.7 (0.224 — 0.263)
Belt tensioner	Spacer O.D. mm (in)				17.955 — 17.975 (0.7069 — 0.7077)
	Tensioner bush I.D. mm (in)				18.00 — 18.08 (0.7087 — 0.7118)
	Clearance between spacer and bush mm (in)			STD	0.025 — 0.125 (0.0010 — 0.0049)
				Limit	0.175 (0.0069)
	Side clearance of spacer mm (in)			STD	0.20 — 0.55 (0.0079 — 0.0217)
				Limit	0.81 (0.0319)
Valve rocker arm	Clearance between shaft and arm mm (in)			STD	0.020 — 0.054 (0.0008 — 0.0021)
				Limit	0.10 (0.0039)
Camshaft	Bend limit mm (in)				0.025 (0.0010)
	Thrust clearance mm (in)			STD	0.030 — 0.090 (0.0012 — 0.0035)
				Limit	0.10 (0.0039)
	Cam lobe height mm (in)	2.0 L	Intake	STD	38.732 — 38.832 (1.5249 — 1.5288)
				Limit	38.632 (1.5209)
			Exhaust	STD	39.259 — 39.359 (1.5456 — 1.5496)
				Limit	39.157 (1.5417)
		2.5 L	Intake	STD	39.485 — 39.585 (1.5545 — 1.5585)
				Limit	39.385 (1.5506)
			Exhaust	STD	39.259 — 39.359 (1.5456 — 1.5496)
				Limit	39.159 (1.5417)
	Camshaft journal O.D. mm (in)				31.928 — 31.945 (1.2570 — 1.2577)
	Camshaft journal hole I.D. (Cylinder head) mm (in)				32.000 — 32.018 (1.2598 — 1.2605)
	Oil clearance mm (in)			STD	0.055 — 0.090 (0.0022 — 0.0035)
				Limit	0.10 (0.0039)

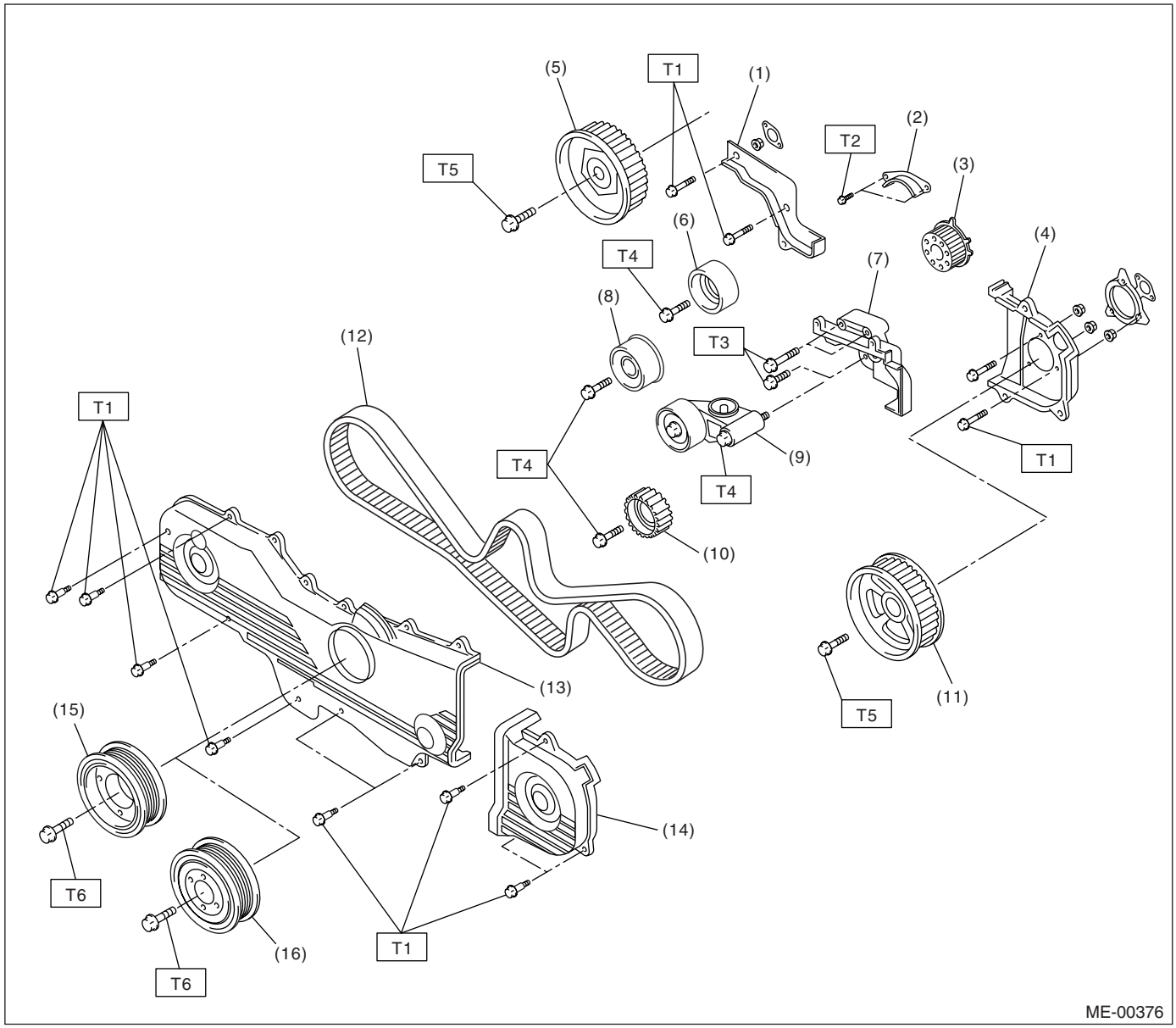
Cylinder head	Surface warpage limit (mating with cylinder block) mm (in)				0.05 (0.0020)
	Grinding limit mm (in)				0.1 (0.004)
	Standard height mm (in)				97.5 (3.84)
Valve seat	Refacing angle				90°
	Contacting width mm (in)		Intake	STD	1.1 (0.043)
				Limit	1.8 (0.070)
			Exhaust	STD	1.5 (0.059)
				Limit	2.2 (0.087)
Valve guide	Inner diameter mm (in)				6.000 — 6.012 (0.2362 — 0.2367)
	Protrusion above head mm (in)			Intake	20.0 — 20.5 (0.787 — 0.807)
				Exhaust	16.5 — 17.0 (0.650 — 0.669)
Valve	Head edge thickness mm (in)		Intake	STD	1.0 (0.039)
				Limit	0.6 (0.024)
			Exhaust	STD	1.2 (0.047)
				Limit	0.6 (0.024)
	Stem outer diameter mm (in)			Intake	5.950 — 5.965 (0.2343 — 0.2348)
				Exhaust	5.945 — 5.960(0.2341 — 0.2346)
	Stem oil clearance mm (in)		STD	Intake	0.035 — 0.062 (0.0014 — 0.0024)
				Exhaust	0.040 — 0.067 (0.0016 — 0.0026)
			Limit	—	0.15 (0.0059)
	Overall length mm (in)			Intake	120.6 (4.75)
				Exhaust	121.7 (4.79)
Valve spring	Free length mm (in)				54.30 (2.1378)
	Squareness mm (in)				2.5°, 2.4 (0.094)
	Tension/spring height N (kgf, lb)/mm (in)			Set	214 — 246 (22 — 25, 48 — 55)/ 45.0 (1.772)
				Lift	526 — 582 (54 — 59, 119 — 130)/ 34.7 (1.366)
Cylinder block	Surface warpage limit (mating with cylinder head) mm (in)				0.05 (0.0020)
	Grinding limit mm (in)				0.1 (0.004)
	Cylinder inner diameter mm (in)	2.0 L	STD	A	92.005 — 92.015 (3.6222 — 3.6226)
				B	91.995 — 92.005 (3.6218 — 3.6222)
		2.5 L	STD	A	99.505 — 99.515 (3.9175 — 3.9179)
				B	99.495 — 99.505 (3.9171 — 3.9175)
	Taper mm (in)			STD	0.015 (0.0006)
				Limit	0.050 (0.0020)
	Out-of-roundness mm (in)			STD	0.010 (0.0004)
				Limit	0.050 (0.0020)
	Piston clearance mm (in)			STD	0.010 — 0.030 (0.0004 — 0.0012)
				Limit	0.050 (0.0020)
	Boring mm (in)				0.5 (0.020)
Piston	Outer diameter mm (in)	2.0 L	STD	A	91.985 — 91.995 (3.6214 — 3.6218)
				B	91.975 — 91.985 (3.6211 — 3.6214)
			0.25 (0.0098) OS		92.225 — 92.235 (3.6309 — 3.6313)
			0.50 (0.0197) OS		92.475 — 92.485 (3.6407 — 3.6411)
		2.5 L	STD	A	99.485 — 99.495 (3.9167 — 3.9171)
				B	99.475 — 99.485 (3.9163 — 3.9167)
			0.25 (0.0098) OS		99.725 — 99.735 (3.9262 — 3.9266)
			0.50 (0.0197) OS		99.975 — 99.985 (3.9360 — 3.9364)
	Piston pin standard diameter mm (in)				23.000 — 23.006 (0.9055 — 0.9057)

Piston pin	Outer diameter mm (in)				22.994 — 23.000 (0.9053 — 0.9055)
	Standard clearance between piston and piston pin mm (in)				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	STD		0.20 — 0.35 (0.0079 — 0.0138)
			Limit		1.0 (0.039)
		Second ring	2.0 L	STD	0.35 — 0.50 (0.0138 — 0.0197)
				Limit	1.0 (0.039)
			2.5 L	STD	0.37 — 0.52 (0.0146 — 0.0204)
				Limit	1.0 (0.039)
		Oil ring	STD		0.20 — 0.50 (0.0079 — 0.0197)
			Limit		1.5 (0.059)
	Ring groove gap mm (in)	Top ring	STD		0.040 — 0.080 (0.0016 — 0.0031)
			Limit		0.15 (0.0059)
		Second ring	STD		0.030 — 0.070 (0.0012 — 0.0028)
			Limit		0.15 (0.0059)
Connecting rod	Bend or twist per 100 mm (3.94 in) in length mm (in)		Limit		0.10 (0.0039)
	Side clearance at large end mm (in)		STD		0.070 — 0.330 (0.0028 — 0.0130)
			Limit		0.4 (0.016)
Connecting rod bearing	Oil clearance mm (in)		STD		0.0158 — 0.0438 (0.0006 — 0.0017)
			Limit		0.05 (0.0020)
	Thickness at center portion mm (in)	2.0 L	STD		1.492 — 1.501 (0.0587 — 0.0591)
			0.03 (0.0012) US		1.510 — 1.513 (0.0594 — 0.0596)
			0.05 (0.0020) US		1.520 — 1.523 (0.0598 — 0.0600)
			0.25 (0.0098) US		1.620 — 1.623 (0.0638 — 0.0639)
		2.5 L	STD		1.492 — 1.503 (0.0587 — 0.0591)
			0.03 (0.0012) US		1.510 — 1.513 (0.0594 — 0.0596)
			0.05 (0.0020) US		1.520 — 1.523 (0.0598 — 0.0600)
			0.25 (0.0098) US		1.620 — 1.623 (0.0638 — 0.0639)
Connecting rod bushing	Clearance between piston pin and bushing mm (in)		STD		0 — 0.022 (0 — 0.0009)
			Limit		0.030 (0.0012)

Crankshaft	Bend limit			mm (in) 0.035 (0.0014)
	Crank pin and crank journal mm (in)	Out-of-roundness		0.020 (0.0008) or less
		Grinding limit		0.250 (0.0098)
	Crank pin outer diameter mm (in)		STD	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 (2.0446 — 2.0453)
			0.25 (0.0098) US	51.734 — 51.750 (2.0368 — 2.0374)
	Crank journal outer diameter mm (in)	#1, #3	STD	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)
		#2, #4, #5	STD	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)
	Side clearance mm (in)		STD	0.030 — 0.115 (0.0012 — 0.0045)
			Limit	0.25 (0.0098)
	Oil clearance mm (in)	#1	STD	0.010 — 0.030 (0.0004 — 0.0012)
			Limit	0.040 (0.0016)
		#2	STD	0.010 — 0.030 (0.0004 — 0.0012)
			Limit	0.045 (0.0018)
		#3	STD	0.010 — 0.030 (0.0004 — 0.0012)
			Limit	0.040 (0.0016)
		#4	STD	0.010 — 0.030 (0.0004 — 0.0012)
			Limit	0.045 (0.0018)
		#5	STD	0.010 — 0.030 (0.0004 — 0.0012)
			Limit	0.040 (0.0016)
Crankshaft bearing	Crankshaft bearing thickness mm (in)	#1, #3	STD	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	STD	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

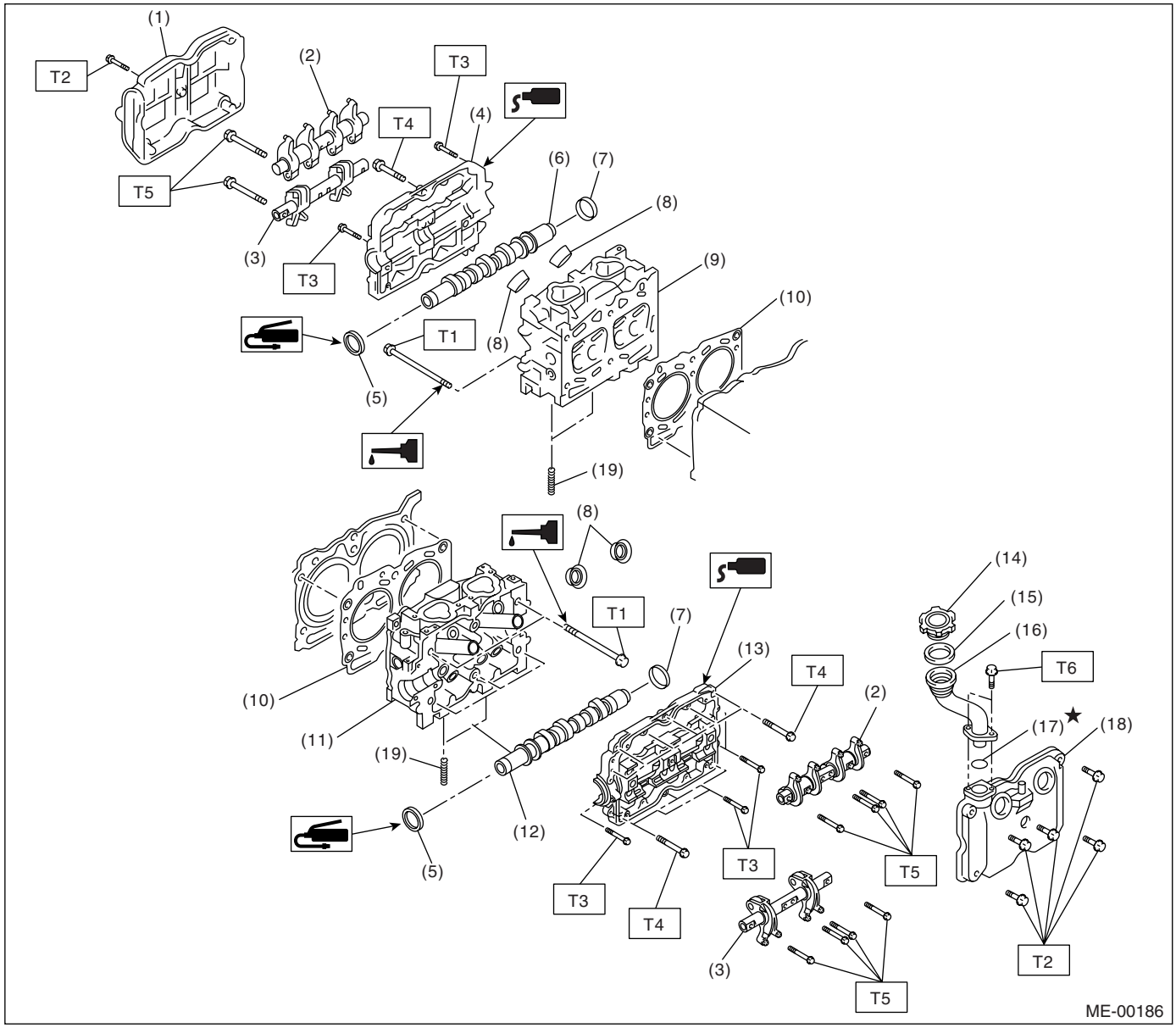
1. TIMING BELT



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

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, Crank Pulley.>

2. CYLINDER HEAD AND CAMSHAFT

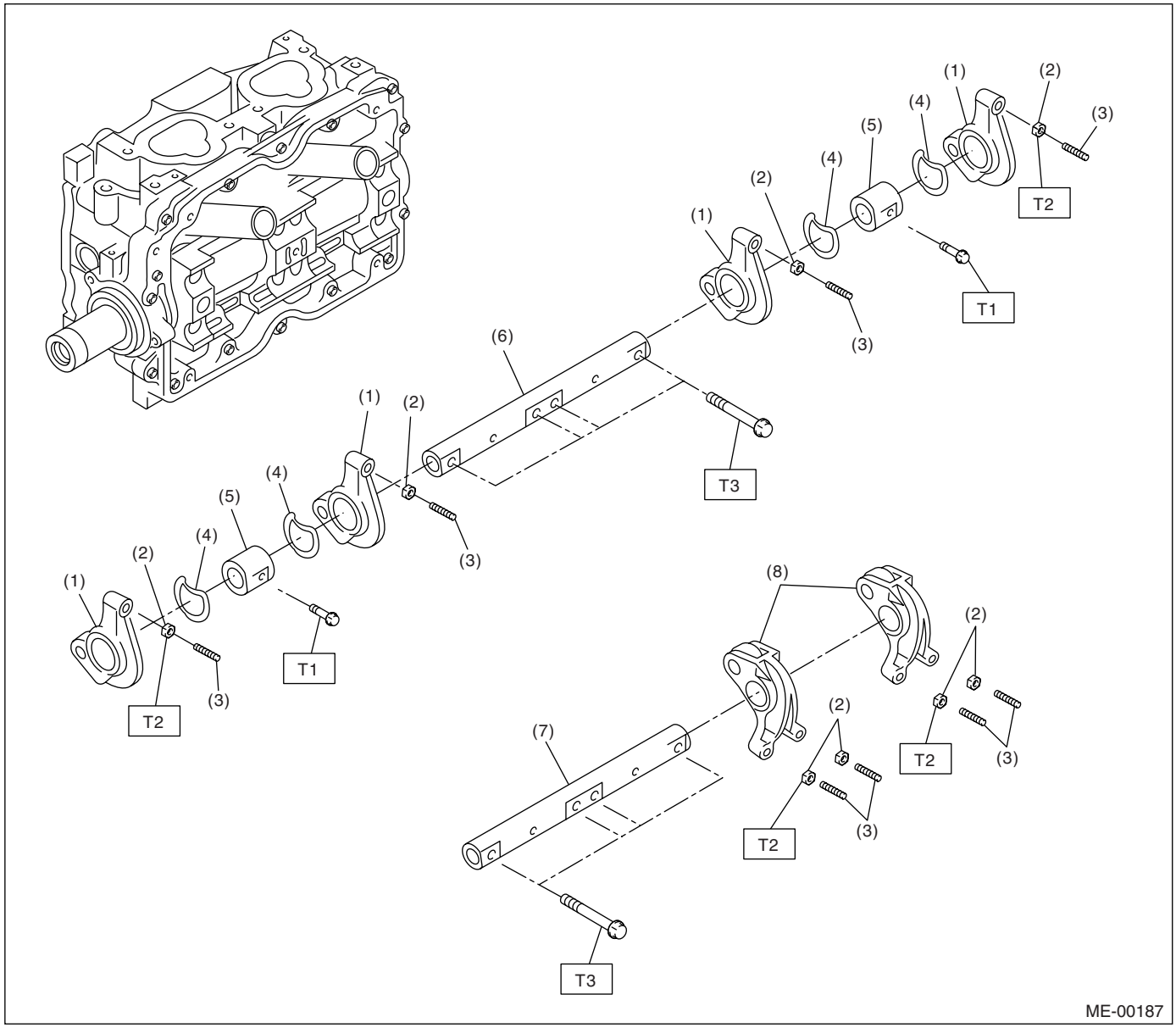


(1) Rocker cover (RH)
(2) Intake valve rocker ASSY
(3) Exhaust valve rocker ASSY
(4) Camshaft cap (RH)
(5) Oil seal
(6) Camshaft (RH)
(7) Plug
(8) Spark plug pipe gasket
(9) Cylinder head (RH)
(10) Cylinder head gasket
(11) Cylinder head (LH)
(12) Camshaft (LH)
(13) Camshaft cap (LH)
(14) Oil filler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

Tightening torque: N·m (kgf-m, ft-lb)

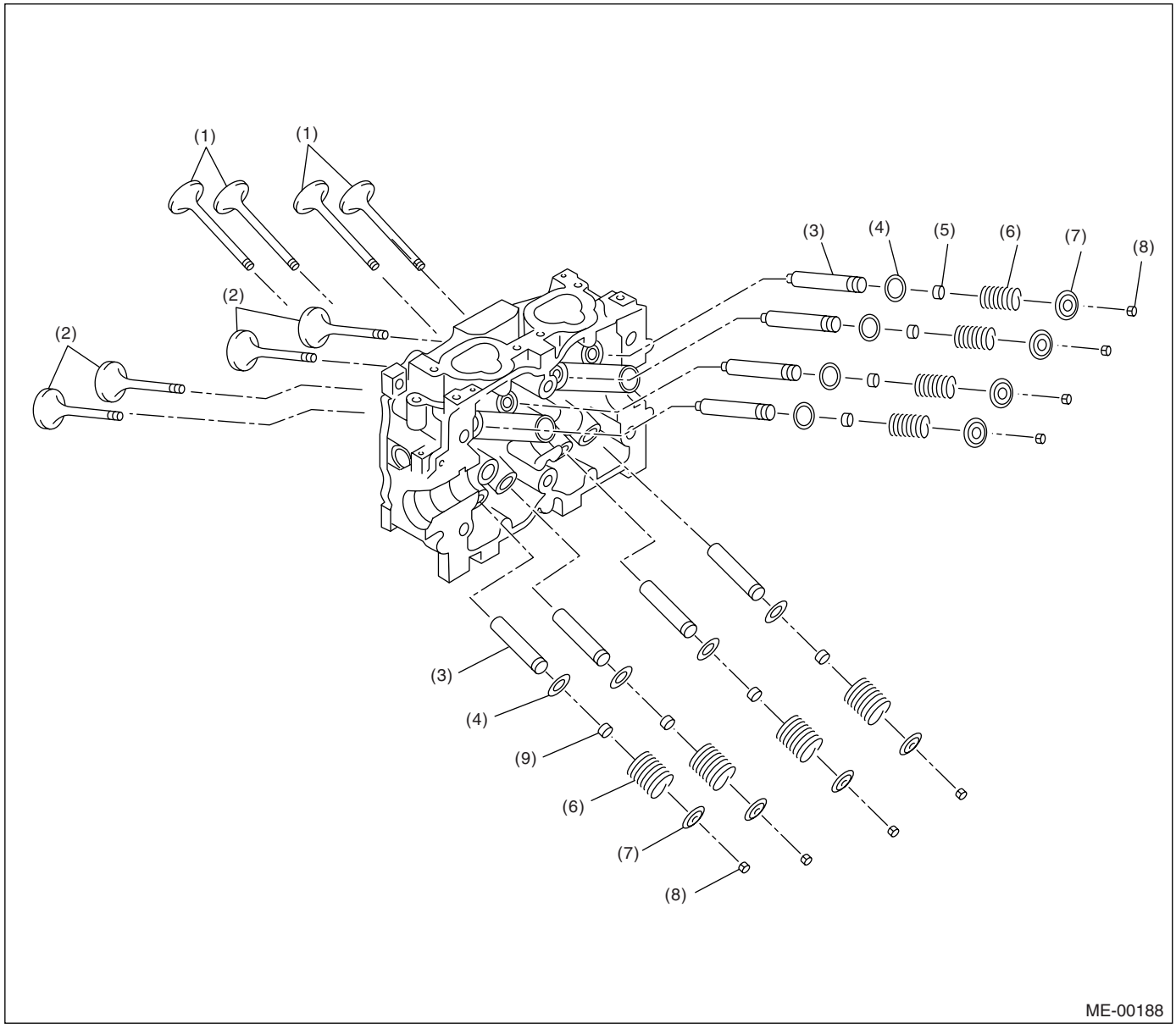
T1: ***<Ref. to ME(H4SO)-62, INSTALLATION, Cylinder Head.>***
T2: ***5 (0.5, 3.6)***
T3: ***10 (1.0, 7.2)***
T4: ***18 (1.8, 13.0)***
T5: ***25 (2.5, 18.1)***
T6: ***6.4 (0.65, 4.7)***

3. VALVE ROCKER ASSEMBLY



(1)	Intake valve rocker arm	(5)	Rocker shaft spacer	***Tightening torque: N·m (kgf-m, ft-lb)***
(2)	Valve rocker nut	(6)	Intake rocker shaft	***T1: 5 (0.5, 3.6)***
(3)	Valve rocker adjust screw	(7)	Exhaust rocker shaft	***T2: 10 (1.0, 7.2)***
(4)	Spring	(8)	Exhaust valve rocker arm	***T3: 25 (2.5, 18.1)***

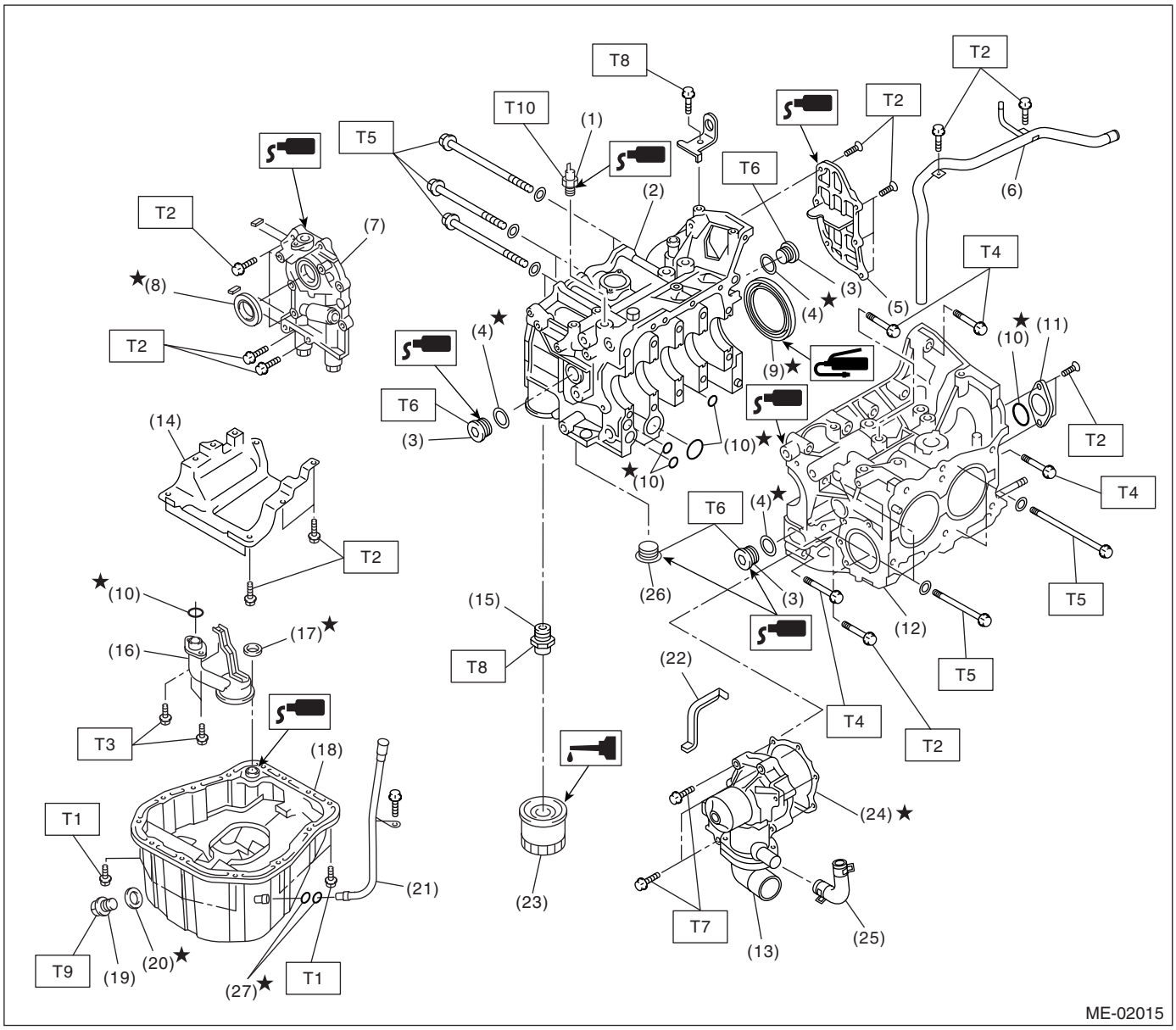
4. CYLINDER HEAD AND VALVE ASSEMBLY



(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

5. CYLINDER BLOCK

• MODEL WITHOUT ATF WARMER

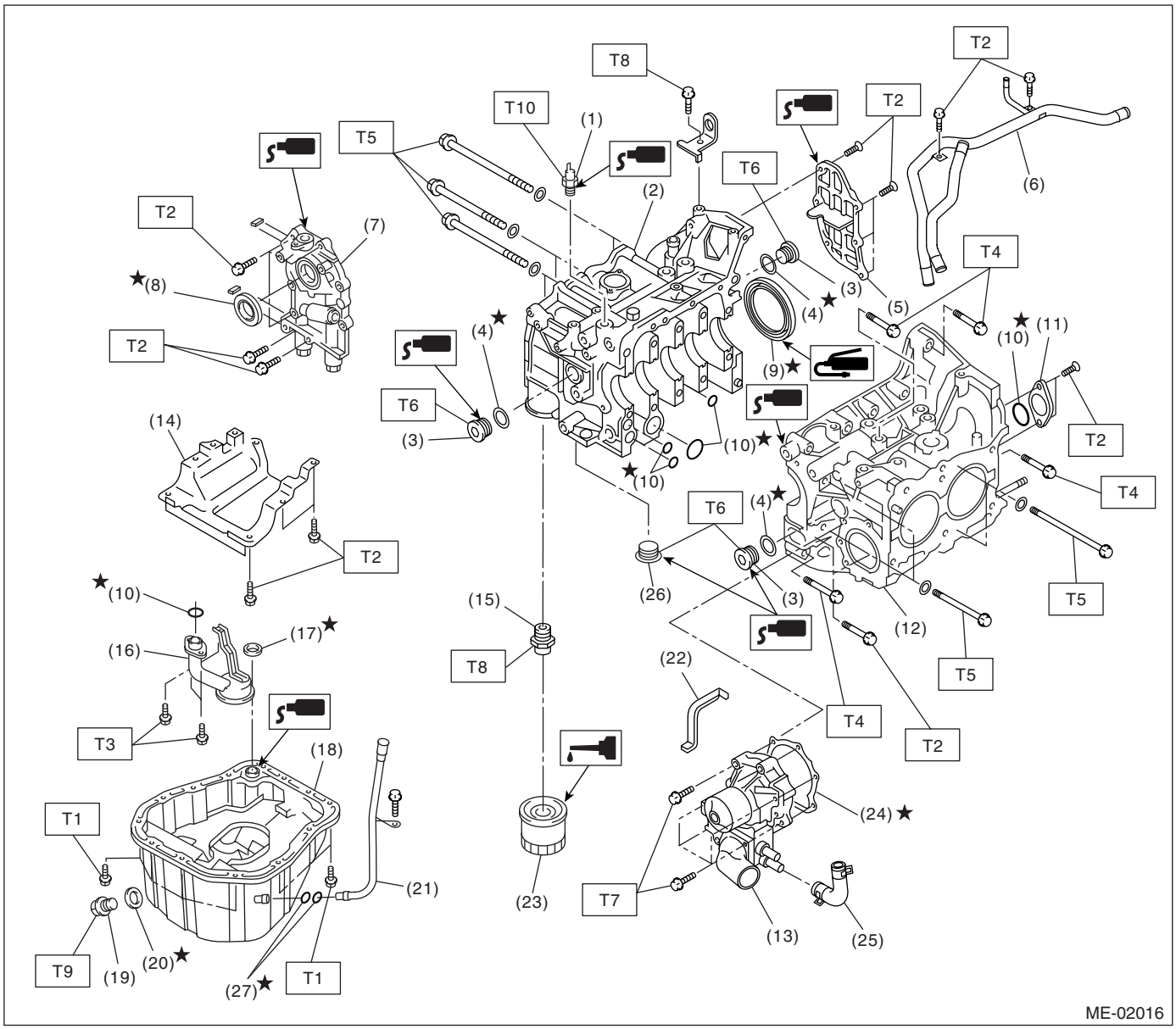


(1) Oil pressure switch
(2) Cylinder block (RH)
(3) Service hole plug
(4) Gasket
(5) Oil separator cover
(6) Water by-pass pipe
(7) Oil pump
(8) Front oil seal
(9) Rear oil seal
(10) O-ring
(11) Service hole cover
(12) Cylinder block (LH)
(13) Water pump
(14) Baffle plate
(15) Oil filter connector
(16)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

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: 45 (4.6, 33.3)
T9: 44 (4.5, 33)
T10: 25 (2.5, 18.1)

• MODEL WITH ATF WARMER

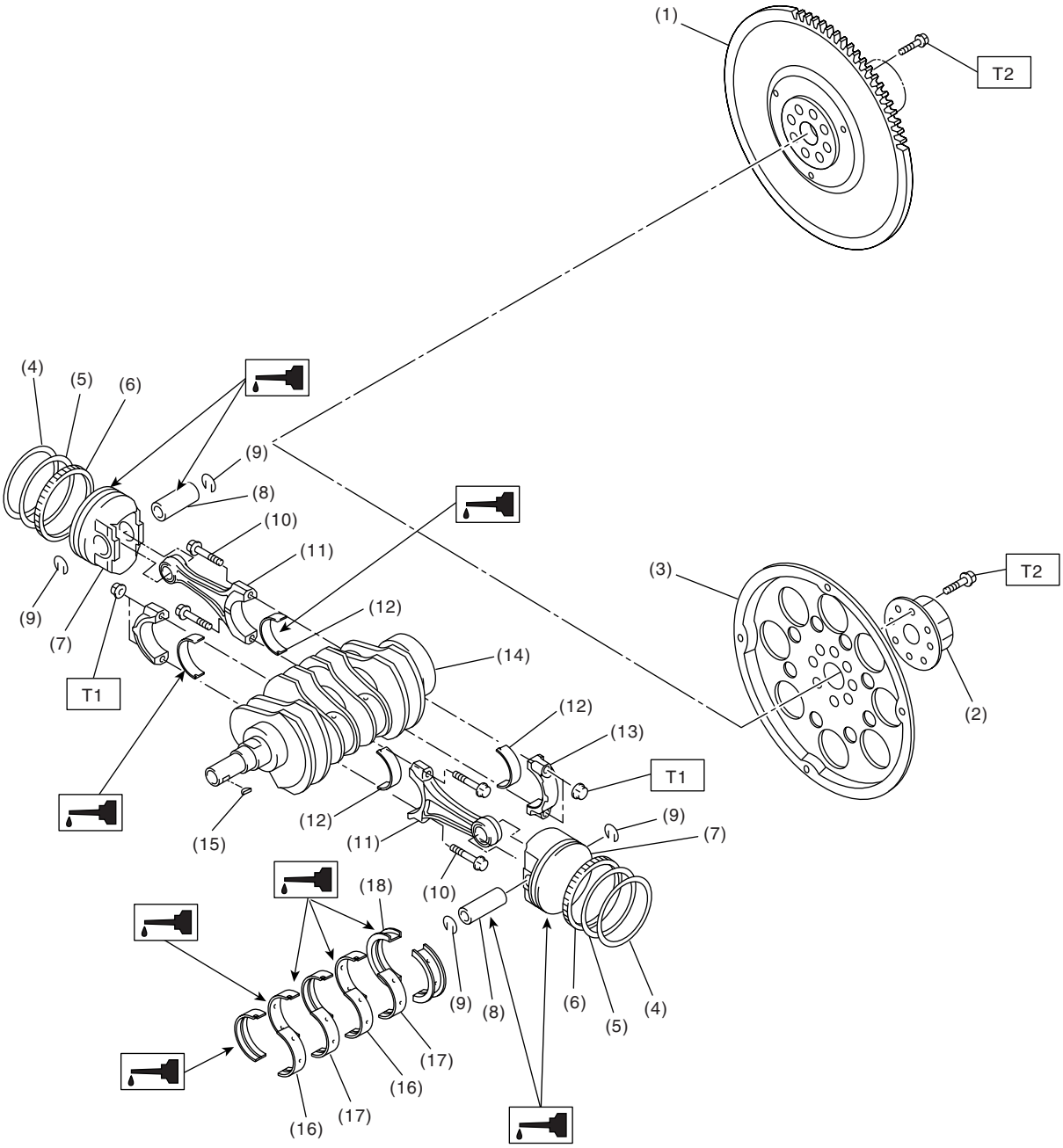


(1)	Oil pressure switch	(15)	Oil filter connector
(2)	Cylinder block (RH)	(16)	Oil strainer
(3)	Service hole plug	(17)	Gasket
(4)	Gasket	(18)	Oil pan
(5)	Oil separator cover	(19)	Drain plug
(6)	Water by-pass pipe	(20)	Metal gasket
(7)	Oil pump	(21)	Oil level gauge guide
(8)	Front oil seal	(22)	Water pump sealing
(9)	Rear oil seal	(23)	Oil filter
(10)	O-ring	(24)	Gasket
(11)	Service hole cover	(25)	Water pump hose
(12)	Cylinder block (LH)	(26)	Plug
(13)	Water pump	(27)	O-ring
(14)	Baffle plate		

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: 45 (4.6, 33.3)***
- ***T9: 44 (4.5, 33)***
- ***T10: 25 (2.5, 18.1)***

6. CRANKSHAFT AND PISTON

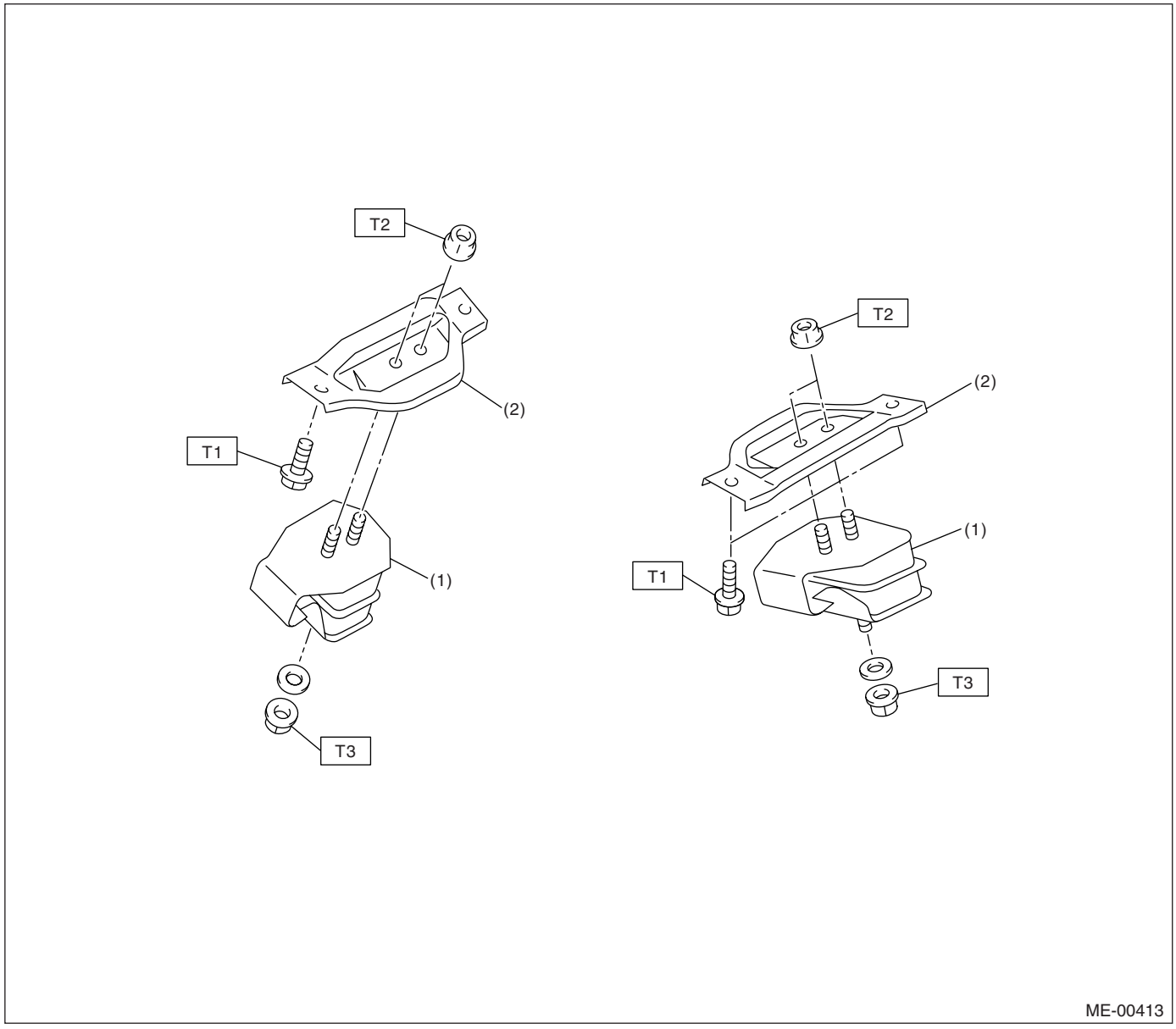


ME-00190

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

Tightening torque: N·m (kgf-m, ft-lb)
T1: 45 (4.6, 33.3)
T2: 72 (7.3, 52.8)

7. ENGINE MOUNTING



(1) Front cushion rubber
(2) Front engine mounting bracket

Tightening torque: N·m (kgf-m, ft-lb)
T1: 35 (3.6, 25.8)
T2: 42 (4.3, 31.0)
T3: 85 (8.7, 63)

C: CAUTION

• Wear working clothing, including a cap, protective goggles and protective shoes during operation.
• Remove contamination including dirt and corrosion before removal, installation or disassembly.
• Keep the disassembled parts in order and protect them from dust or dirt.
• Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
• Be careful not to burn yourself, because each part in the vehicle is hot after running.
• Be sure to tighten 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 reinstalled 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 not to 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 TOOL

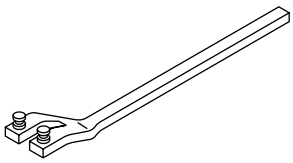
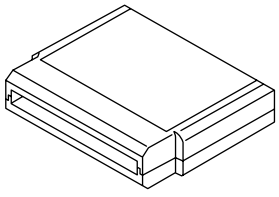
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18231AA010	18231AA010	CAM SPROCKET WRENCH	• Used for removing and installing cam sprocket. (LH side) • Also the CAM SPROCKET WRENCH (499207100) can be used.
 ST24082AA230	24082AA230 (Newly adopted tool)	CARTRIDGE	Troubleshooting for electrical systems.

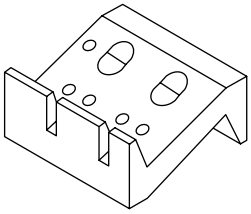
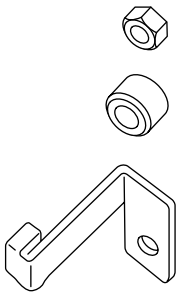
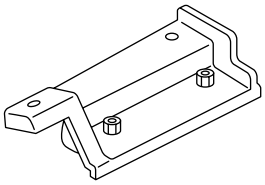
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST22771AA030	22771AA030	SUBARU SELECT MONITOR KIT	Troubleshooting for electrical systems. • English: 22771AA030 (Without printer) • German: 22771AA070 (Without printer) • French: 22771AA080 (Without printer) • Spanish: 22771AA090 (Without printer)
 ST-498267800	498267800	CYLINDER HEAD TABLE	• Used for replacing valve guides. • Used for removing and installing valve springs.
 ST-498277200	498277200	STOPPER SET	Used for installing automatic transmission assembly to engine.
 ST-498457000	498457000	ENGINE STAND ADAPTER RH	Used with ENGINE STAND (499817000).

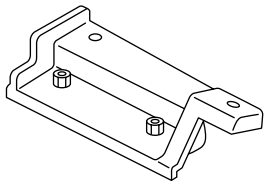
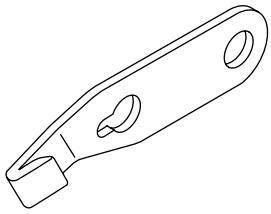
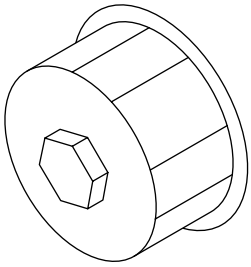
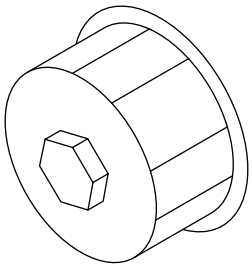
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498457100	498457100	ENGINE STAND ADAPTER LH	Used with ENGINE STAND (499817000).
 ST-498497100	498497100	CRANKSHAFT STOPPER	Used for stopping rotation of flywheel when loosening and tightening crank pulley bolt, etc.
 ST-498547000	498547000	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter : 80 mm (3.15 in))
 ST18332AA000	18332AA000	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter : 68 mm (2.68 in))

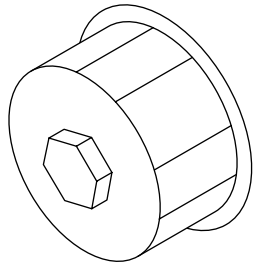
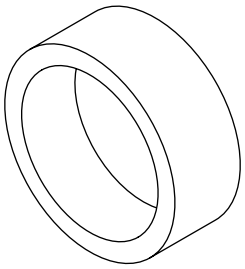
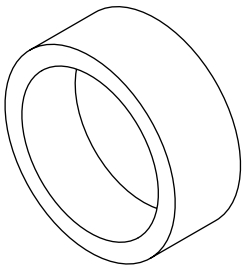
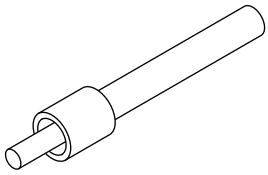
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18332AA010	18332AA010	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter : 65 mm (2.56 in))
 ST-398744300	398744300 (2.0 L model)	PISTON GUIDE	Used for installing piston in cylinder.
 ST-498747300	498747300 (2.5 L model)	PISTON GUIDE	Used for installing piston in cylinder.
 ST-498857100	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.

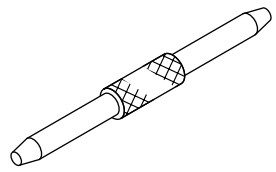
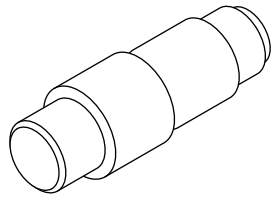
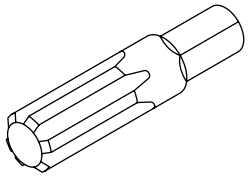
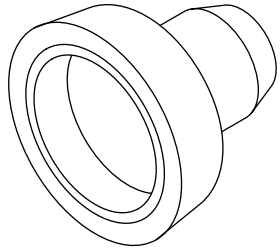
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499017100	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
 ST-499037100	499037100	CONNECTING ROD BUSHING REMOVER & INSTALLER	Used for removing and installing connecting rod bushing.
 ST-499057000	499057000	TORX PLUS	Used for removing flywheel (Dual mass flywheel).
 ST-499587200	499587200	CRANKSHAFT OIL SEAL INSTALLER	• Used for installing crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL GUIDE (499597100).

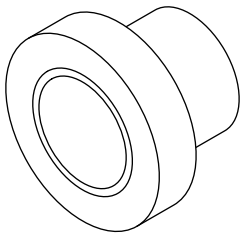
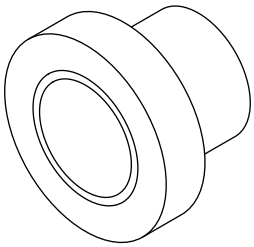
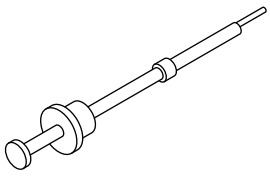
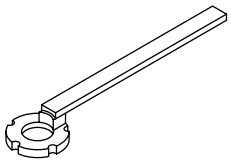
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499587500	499587500	OIL SEAL INSTALLER	Used for installing camshaft oil seal.
 ST-499587700	499587700	CAMSHAFT OIL SEAL INSTALLER	Used for installing cylinder head plug.
 ST-499097700	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.
 ST-499207400	499207400	CAM SPROCKET WRENCH	Used for removing and installing cam sprocket. (RH side)

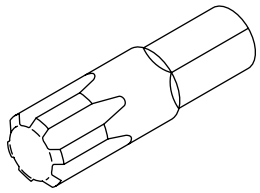
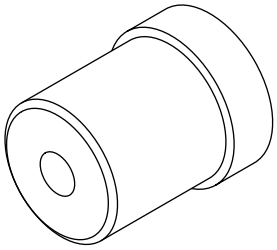
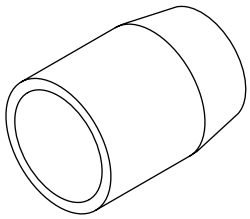
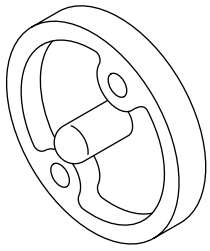
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499497000	499497000	TORX PLUS	Used for removing and installing camshaft cap.
 ST-499587100	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.
 ST-499597000	499597000	OIL SEAL GUIDE	• Used for installing camshaft oil seal. • Used with CAMSHAFT OIL SEAL INSTALLER (499587500).
 ST-499597100	499597100	CRANKSHAFT OIL SEAL GUIDE	• Used for installing crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL INSTALLER (499587200).

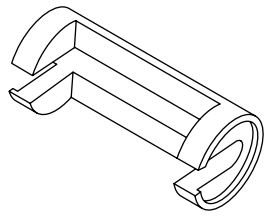
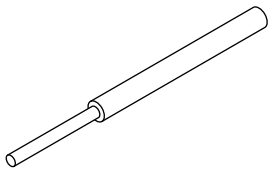
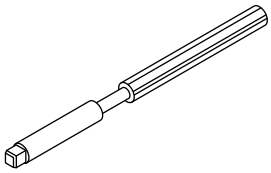
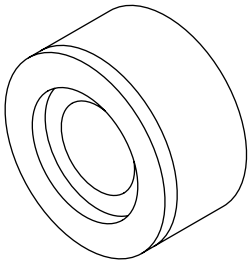
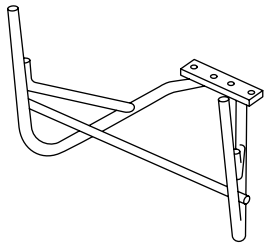
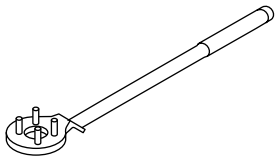
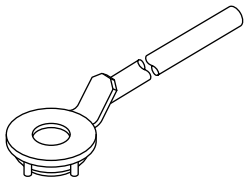
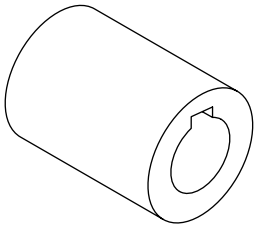
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499718000	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.
 ST-499767200	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
 ST-499767400	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
 ST-499767700	499767700 (Intake side) 499767800 (Exhaust side)	VALVE GUIDE ADJUSTER	Used for installing valve guides.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499817100	499817100	ENGINE STAND	• Stand used for engine disassembly and assembly. • Used with ENGINE STAND ADAPTER RH (498457000) & LH (498457100).
 ST-499977100	499977100	CRANK PULLEY WRENCH	Used for stopping rotation of crank pulley when loosening and tightening crank pulley bolts. (2.5 L model)
 ST-499977400	499977400	CRANK PULLEY WRENCH	Used for stopping rotation of crank pulley when loosening and tightening crank pulley bolts. (2.0 L model)
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.

2. GENERAL TOOL

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

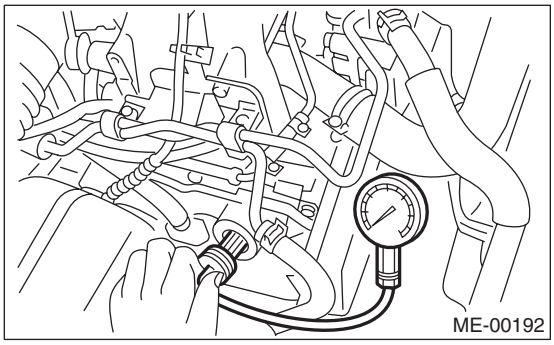
A: INSPECTION

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) Release the fuel pressure. <Ref. to FU(H4SO)-47, 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.



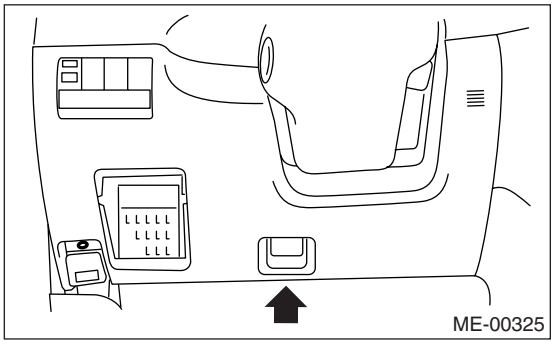
9) Perform at least two measurements per cylinder, and make sure that the values are correct.

Compression (350 rpm and fully open throttle):
Standard;
1,275 kPa (13.0 kgf/cm^2, 185 psi)
Limit;
1,020 kPa (10.4 kgf/cm^2, 148 psi)
Difference between cylinders;
49 kPa (0.5 kgf/cm^2, 7 psi), or less

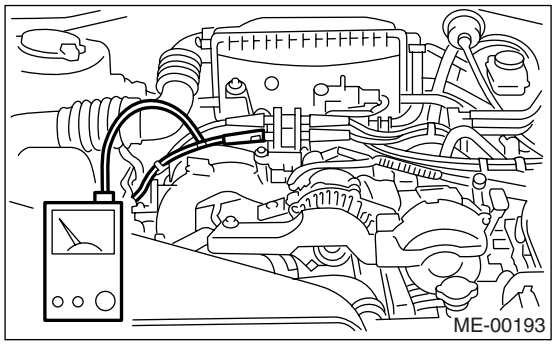
3. Idle Speed

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)-15, SPECIAL TOOL, 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 {Each System Check} in Main Menu.
   (5) Select the {Engine Control System} in Selection Menu.
   (6) Select the {Current Data Display & Save} in Engine Control System Diagnosis.
   (7) Select the {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 "N" or "P" range]:
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", no load and gears in "N" or "P" 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)-2, Basic Diagnostics Procedure.>

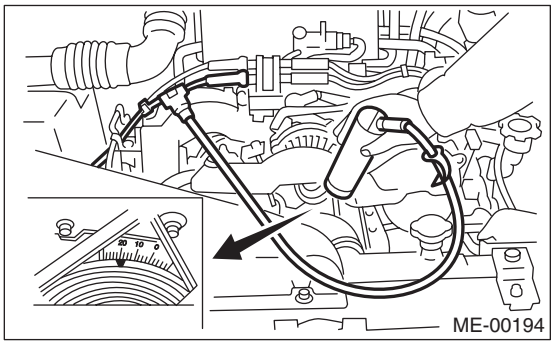
4. Ignition Timing

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]:
10°±10°/650



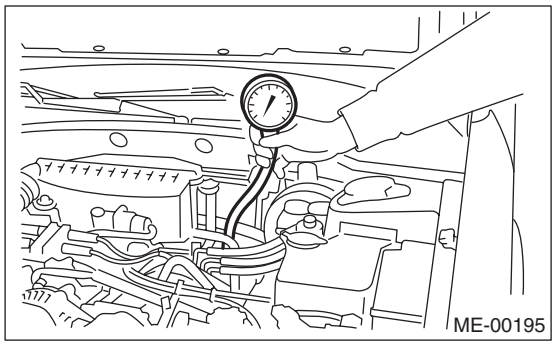
If the timing is not correct, check the ignition control system. <Ref. to EN(H4SO)-2, Basic Diagnostics Procedure.>

5. Intake Manifold Vacuum

A: INSPECTION

1) Warm-up the engine.
2) Disconnect the brake vacuum hose from intake manifold, and then install the vacuum gauge.
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.



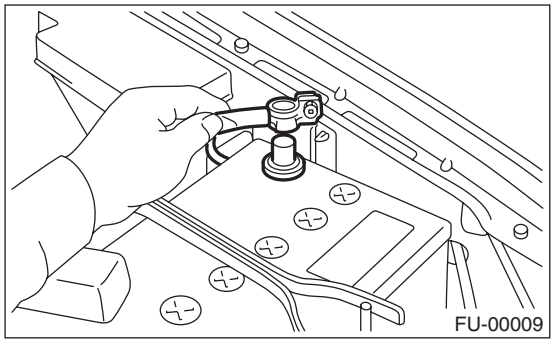
Vacuum pressure (at idling, A/C "OFF"): Less than –60.0 kPa (–450 mmHg, –17.72 in-Hg)

Diagnosis of engine condition by measurement of intake 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.	Air 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.	Exhaust 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

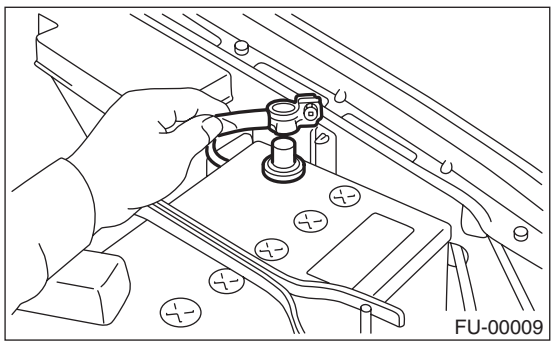
6. Engine Oil Pressure

A: INSPECTION

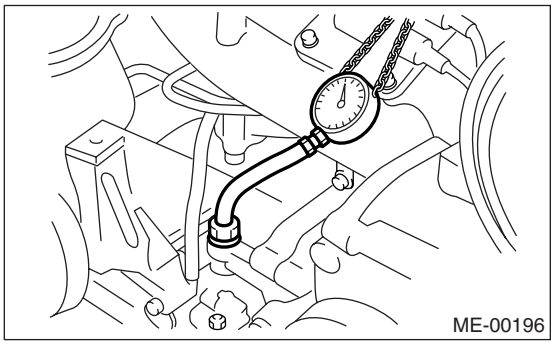
1) Disconnect the ground cable from battery.



2) Remove the generator from bracket. <Ref. to SC(H4SO)-15, REMOVAL, Generator.>
3) Disconnect the connector from oil pressure switch.
4) Remove the oil pressure switch from cylinder block. <Ref. to LU(H4SO)-20, 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:
Standard:
88 kPa (0.9 kg/cm^2, 13 psi) or more at 800 rpm
294 kPa (3.0 kg/cm^2, 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)-24, 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)-24, 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)-20, 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.>

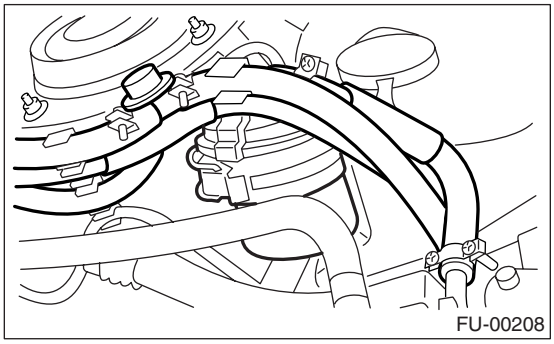
7. Fuel Pressure

A: INSPECTION

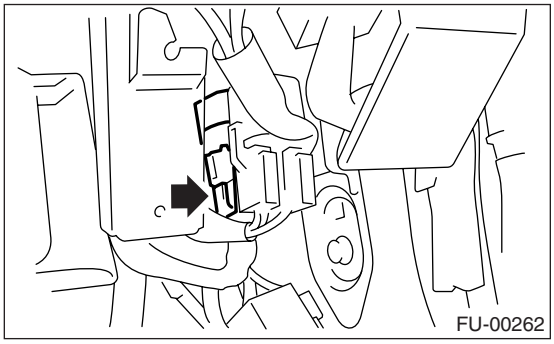
WARNING:
Before removing the fuel pressure gauge, release the fuel pressure.

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)-47, 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.

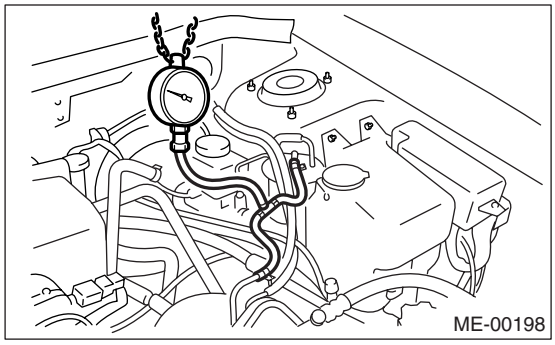


4) Connect the connector of fuel pump relay.



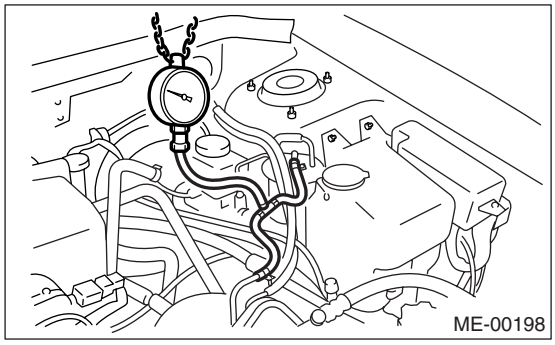
5) Start the engine.
6) Measure the fuel pressure while disconnecting the pressure regulator vacuum hose from intake manifold.

Fuel pressure:
Standard:
284 — 314 kPa (2.9 — 3.2 kg/cm^2, 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/cm^2, 30 — 34 psi)



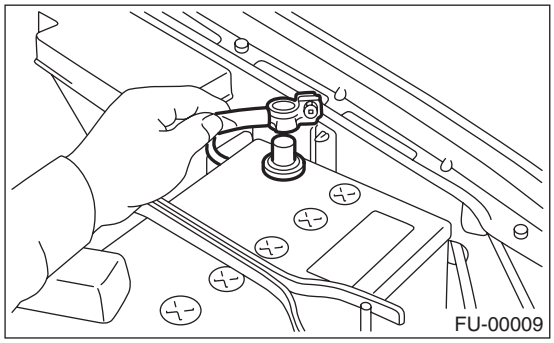
NOTE:
The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kg/cm^2, 1 to 3 psi) higher than standard values during high-altitude operations.

8. Valve Clearance

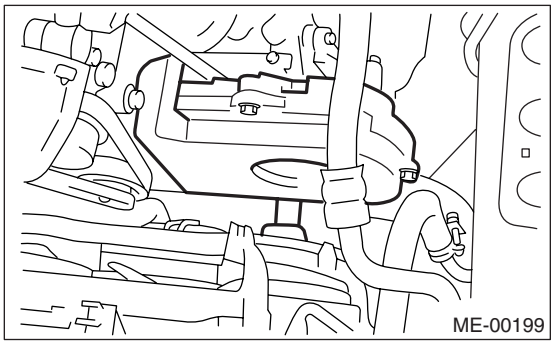
A: INSPECTION

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.

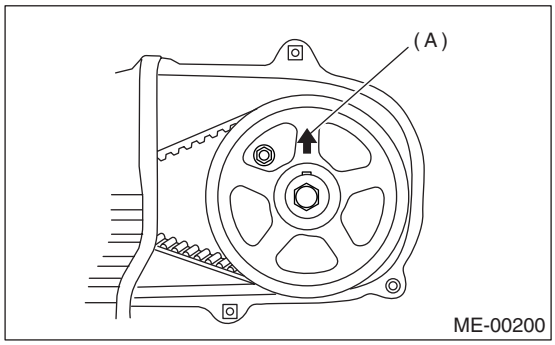


6) Remove the belt cover (LH).



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 crank pulley clockwise using a socket wrench.

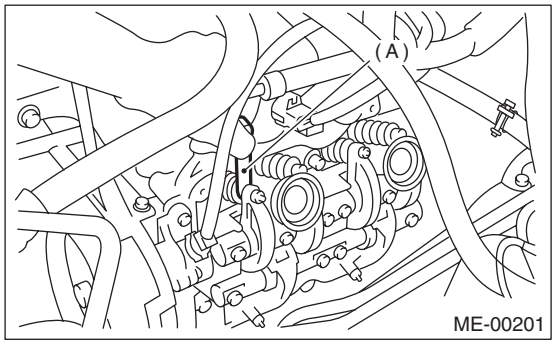
NOTE:
When arrow mark (A) on the cam sprocket (LH) comes exactly to the top, #1 cylinder piston is brought to the top dead center of compression stroke.



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.

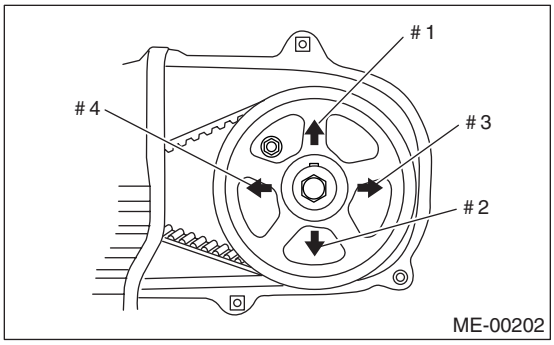
Valve clearance (Standard):
Intake;
0.20±0.04 mm (0.0079±0.0016 in)
Exhaust;
0.25±0.04 mm (0.0098±0.0016 in)



11) If necessary, adjust the valve clearance. <Ref. to ME(H4SO)-32, ADJUSTMENT, Valve Clearance.>
12) Similar to measurement procedures used for #1 cylinder, measure the #2, #3 and #4 cylinder valve clearances.

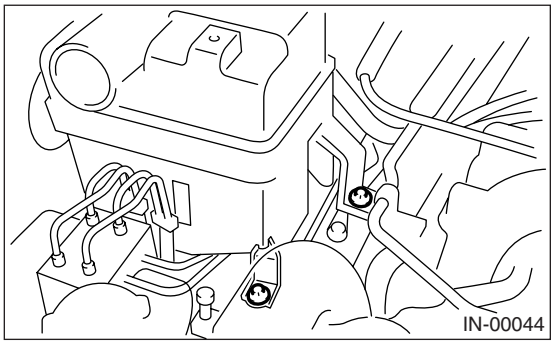
NOTE:
• Be sure to set the cylinder pistons to their respective top dead centers on compression stroke before measuring valve clearances.

• To set the #3, #2 and #4 cylinder pistons to their top dead centers on compression stroke, turn the crank pulley clockwise 90° at a time starting with arrow mark on cam sprocket (LH) facing up.



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

Tightening torque:
Resonator chamber;
33 N·m (3.4 kgf-m, 25 ft-lb)

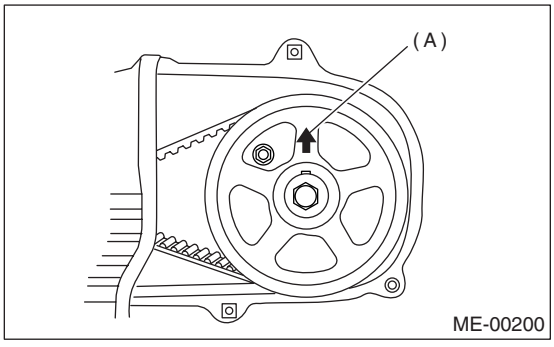


B: ADJUSTMENT

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 crank pulley clockwise using socket wrench.

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

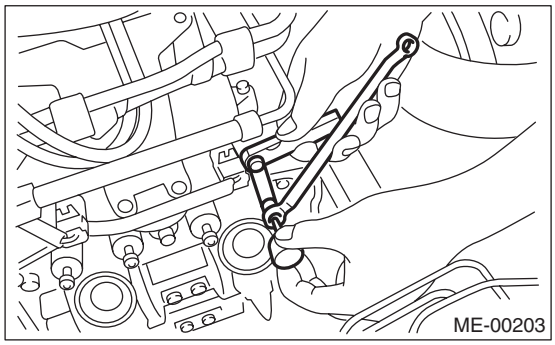


2) Adjust the #1 cylinder valve clearance.
(1) Loosen the valve rocker nut and screw.
(2) Place suitable thickness gauge.
(3) While noting the valve clearance, tighten the valve rocker adjusting screw.
(4) When specified valve clearance is obtained, tighten the valve rocker nut.

Tightening torque:
10 N·m (1.0 kgf-m, 7.2 ft-lb)

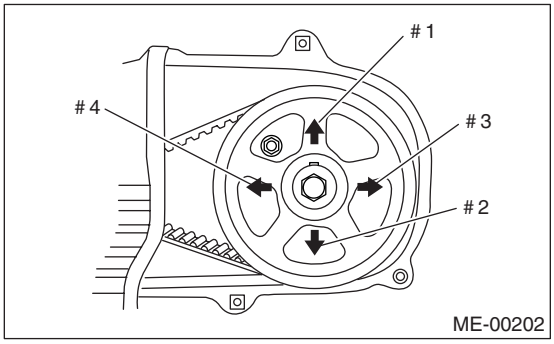
CAUTION:
• Insert the thickness gauge in as horizontally as possible with respect to the valve stem end face.
• Adjust the exhaust valve clearances while lifting up the vehicle.

Valve clearance:
Intake:
0.20±0.04 mm (0.0079±0.0016 in)
Exhaust:
0.25±0.04 mm (0.0098±0.0016 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 of 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.

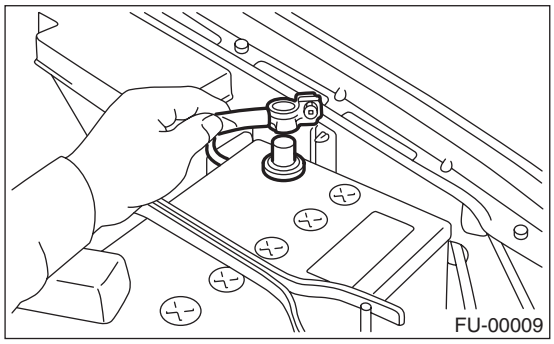
NOTE:
• Be sure to set the cylinder pistons to their respective top dead centers on compression stroke before adjusting valve clearances.
• To set the #3, #2 and #4 cylinder pistons to their top dead centers of compression stroke, turn the crank pulley clockwise 90° at a time starting with arrow mark on cam sprocket (LH) facing up.



9. Engine Assembly

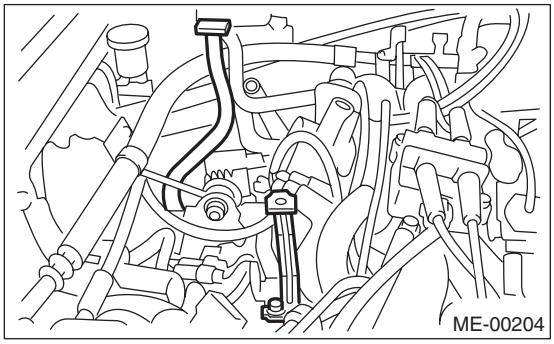
A: REMOVAL

1) Set the vehicle on lift arms.
2) Open the front hood fully, and then support with the front hood stay.
3) Release the fuel pressure. <Ref. to FU(H4SO)-47, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
4) Disconnect the A/C pressure hoses from A/C compressor.
5) Remove the fuel filler cap.
6) Disconnect the ground cable from battery.

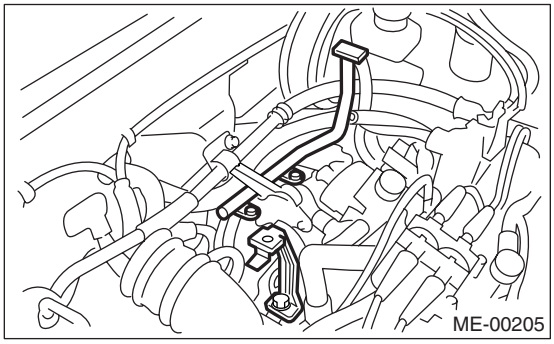


7) Remove the air intake duct and air cleaner case. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Duct.> <Ref. to IN(H4SO)-6, REMOVAL, Air Cleaner Case.>
8) Remove the under cover.
9) Remove the radiator from vehicle. <Ref. to CO(H4SO)-28, REMOVAL, Radiator.>
10) Remove the air cleaner case stay.

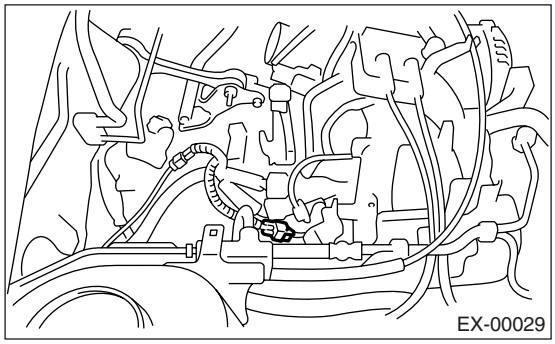
- MT model



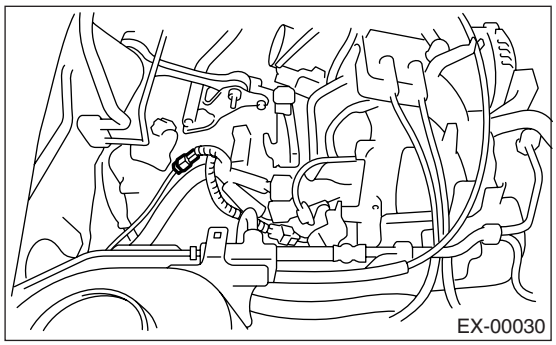
- AT model



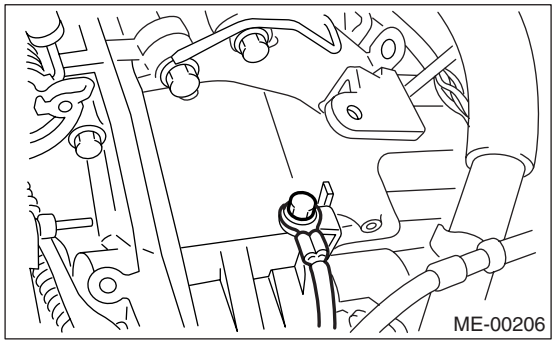
11) Disconnect the following connectors and cables.
(1) Front oxygen (A/F) sensor connector



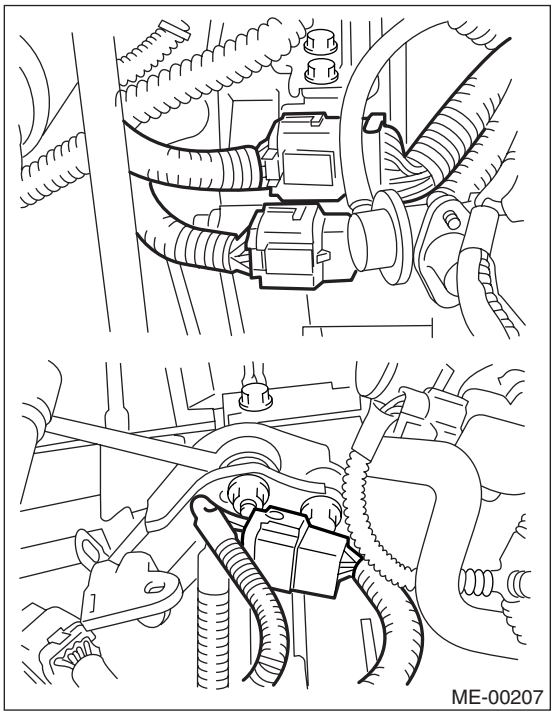
(2) Rear oxygen sensor connector



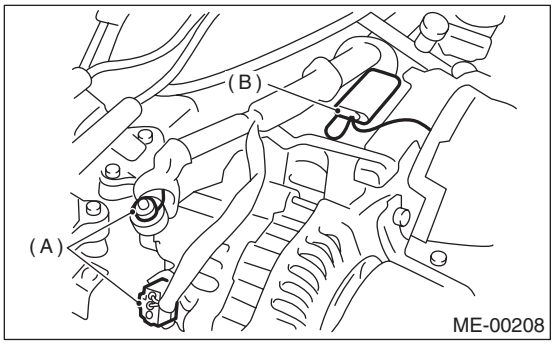
(3) Engine ground cable



(4) Engine harness connectors

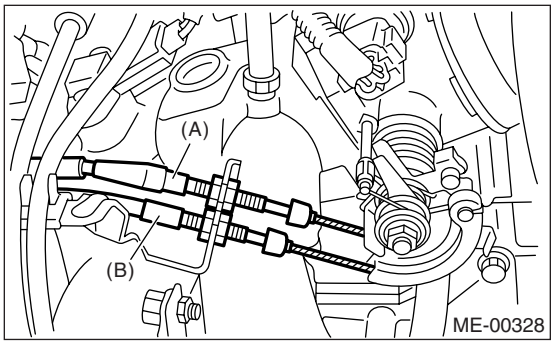


(5) Generator connector, terminal and A/C compressor connector

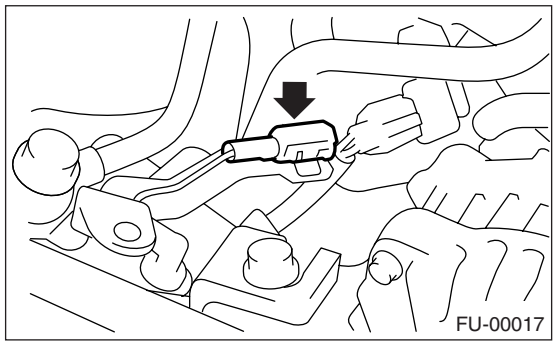


(A) Generator connector and terminal
(B) A/C compressor connector

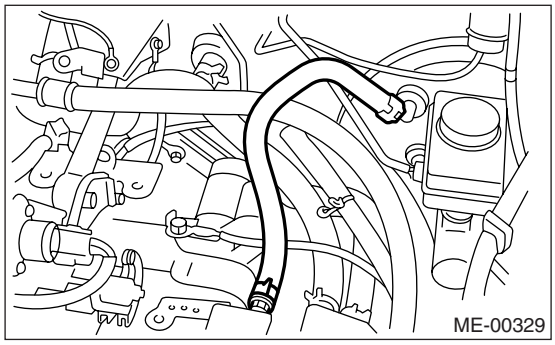
(6) Accelerator cable (A) and cruise control cable (B)



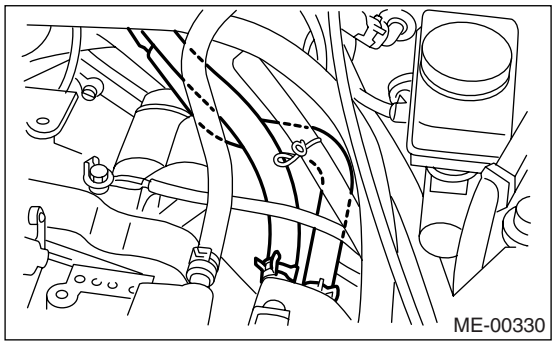
(7) Pressure switch



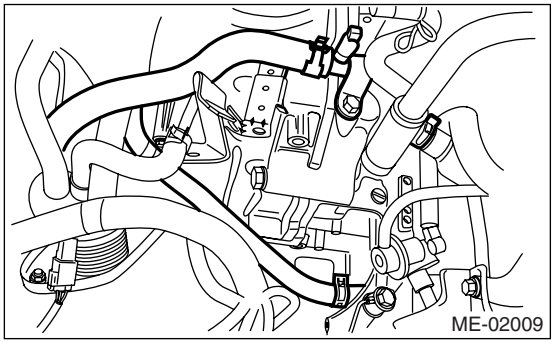
12) Disconnect the following hoses.
(1) Brake booster vacuum hose



(2) Heater inlet and outlet hose

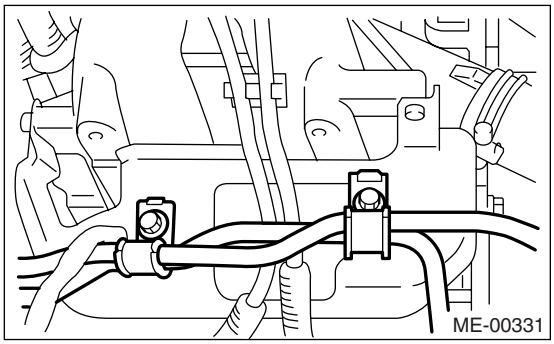


(3) Heater inlet and outlet hose (with ATF warmer model)

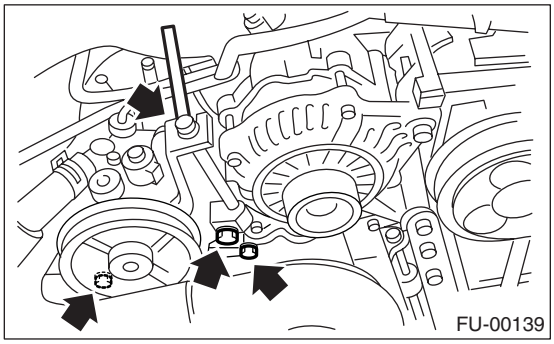


13) Remove the power steering pump from bracket.
(1) Remove the resonator chamber.

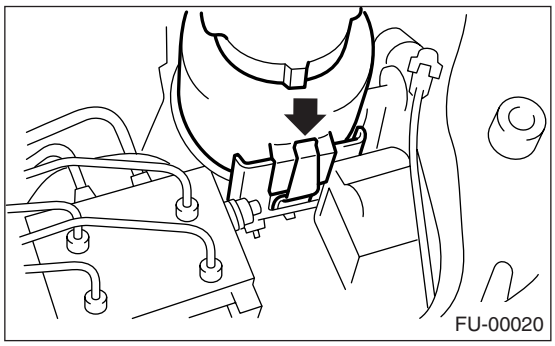
(2) Loosen the lock bolt and slider bolt, and then remove the front side V-belt. <Ref. to ME(H4SO)-43, FRONT SIDE BELT, REMOVAL, V-belt.>
(3) Remove the pipe with bracket.


ME-00331

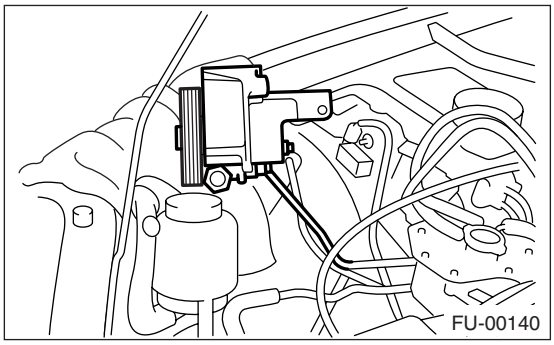
(4) Remove the bolts which install power steering pump bracket.


FU-00139

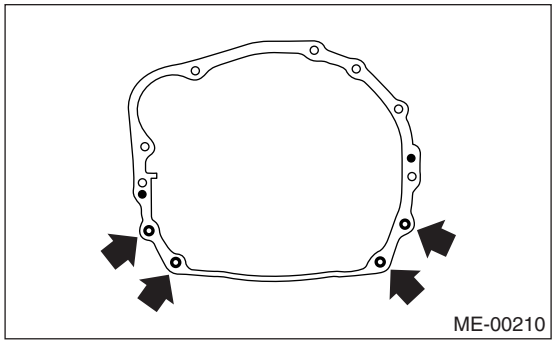
(5) Remove the reservoir tank from bracket by pulling it upward.


FU-00020

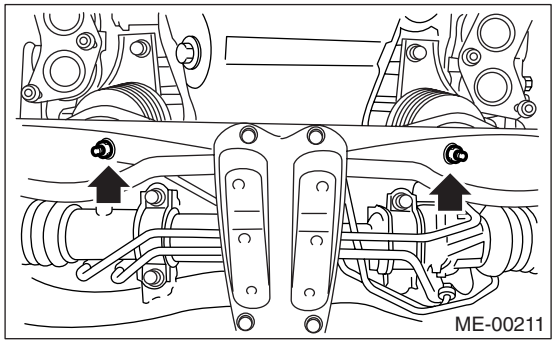
(6) Place the power steering pump on right side wheel apron.


FU-00140

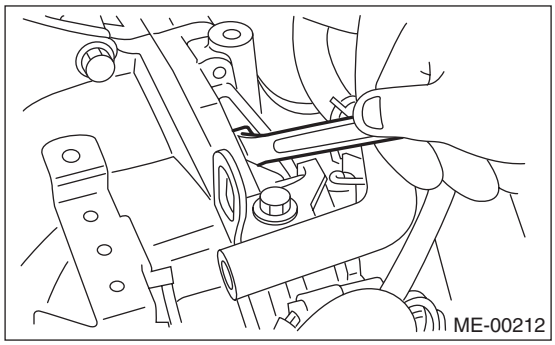
14) Remove the front and center exhaust pipe.
<Ref. to EX(H4SO)-7, REMOVAL, Front Exhaust Pipe.>
15) Remove the nuts which hold lower side of transmission to engine.


ME-00210

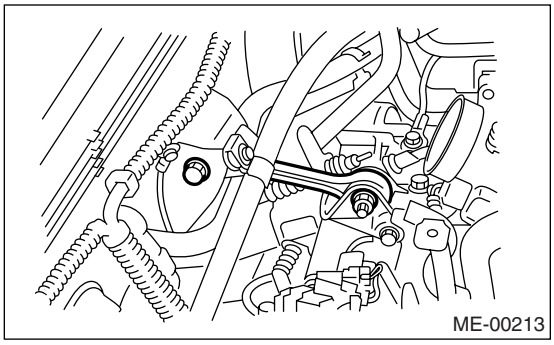
16) Remove the nuts which install front cushion rubber onto front crossmember.


ME-00211

17) 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 torque converter clutch to drive plate.
(4) Remove other bolts while rotating the engine using socket wrench.

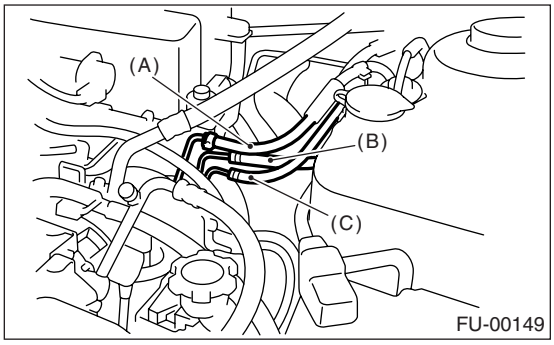

ME-00212

18) Remove the pitching stopper.

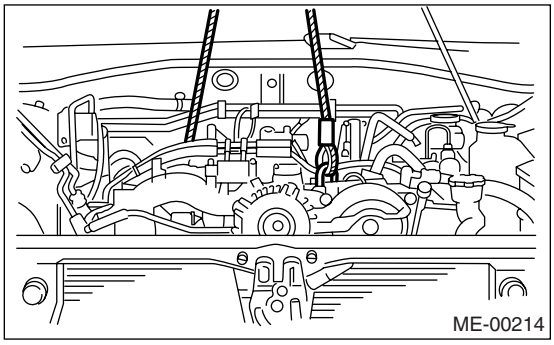


19) Disconnect the fuel delivery hose (A), return hose (B) and evaporation hose (C).

CAUTION:
• Disconnect the hose with its end wrapped with cloth to prevent fuel from splashing.
• Catch fuel from the hose into container.

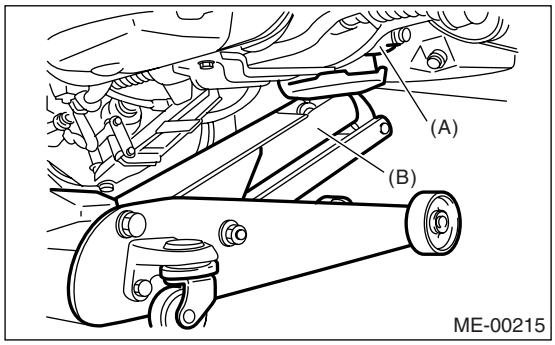


20) Support the engine with a lifting device and wire ropes.



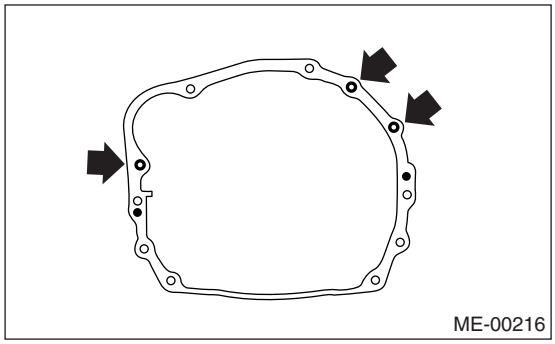
21) Support the transmission with a garage jack.

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.

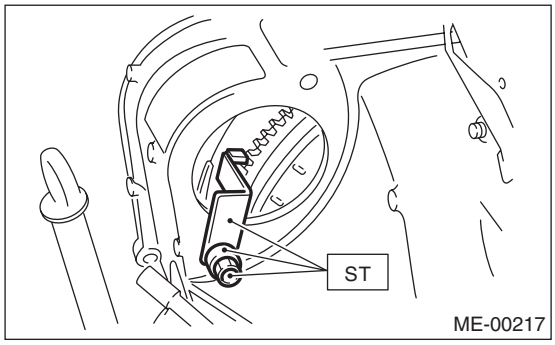


(A) Transmission
(B) Garage jack

22) Separation of the engine and transmission.
(1) Remove the starter. <Ref. to SC(H4SO)-6, REMOVAL, Starter.>
(2) Remove the bolts which hold upper side of transmission to engine.



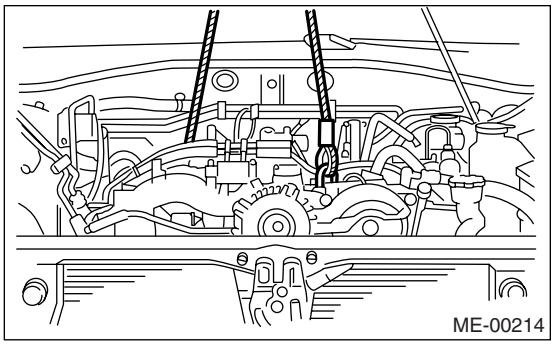
23) Install the ST to torque converter clutch case. (AT model)
ST 498277200 STOPPER SET



24) 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.



25) Remove the front cushion rubbers.

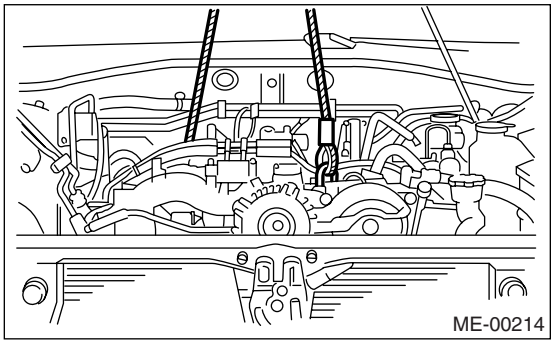
B: INSTALLATION

1) Install the front cushion rubbers.

Tightening torque:
34 N·m (3.5 kgf-m, 25.3 ft-lb)

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

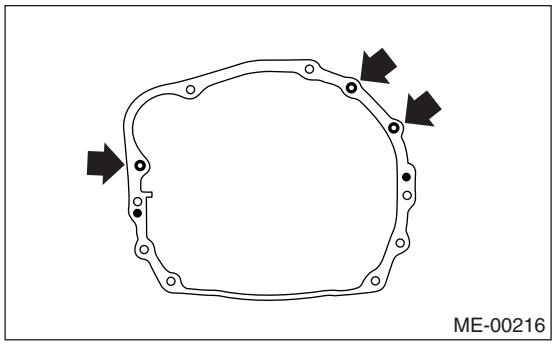
NOTE:
Be careful not to damage the adjacent parts or body panels with crank pulley, oil level gauge, etc.



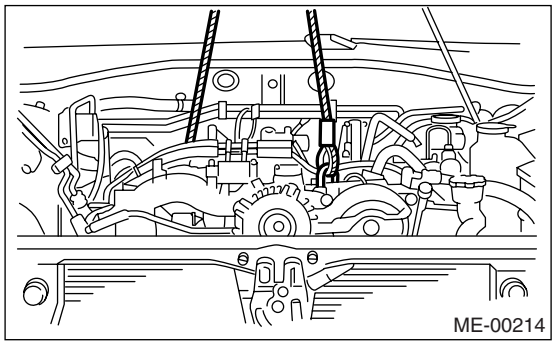
(2) Apply a small amount of grease to the spline of main shaft. (MT model)

3) Tighten the bolts which hold upper side of transmission to engine.

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

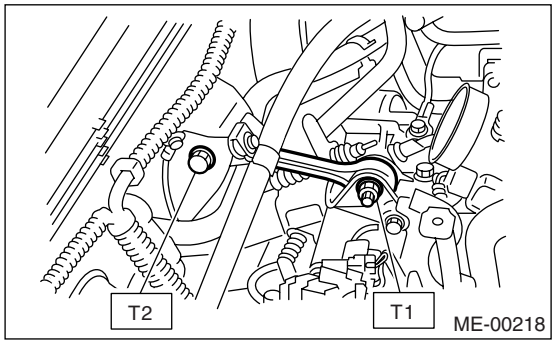


4) Remove the lifting device and wire ropes.



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.

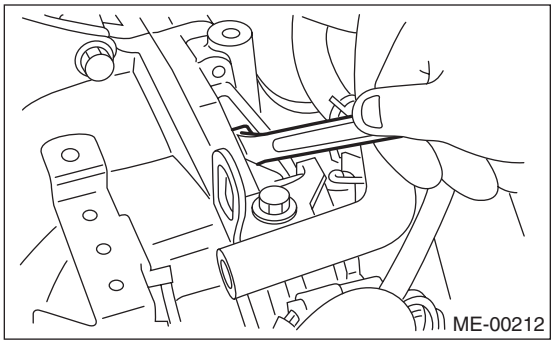
ST 498277200 STOPPER SET

8) Install the starter. <Ref. to SC(H4SO)-6, INSTALLATION, Starter.>
9) Install the torque converter clutch onto drive plate. (AT model)

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

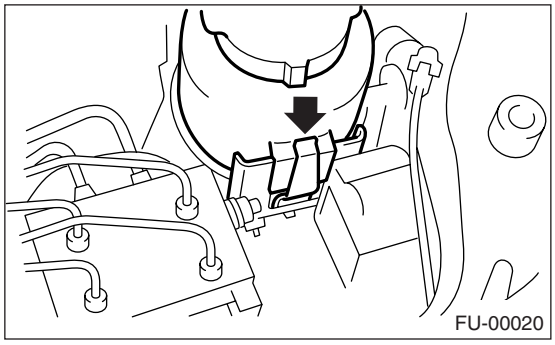
NOTE:
Be careful not to drop the bolts into torque converter clutch housing.

Tightening torque:
25 N·m (2.5 kgf-m, 18.1 ft-lb)



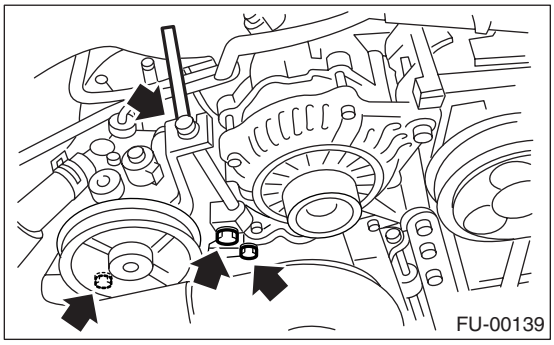
(3) Plug up the service hole and prevent foreign matters from getting in.

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

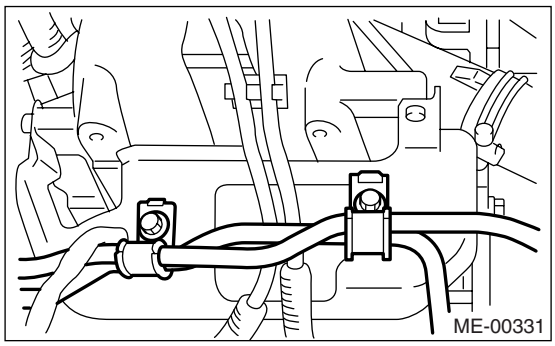


(2) Install the power steering pump on bracket, and then tighten the bolts.

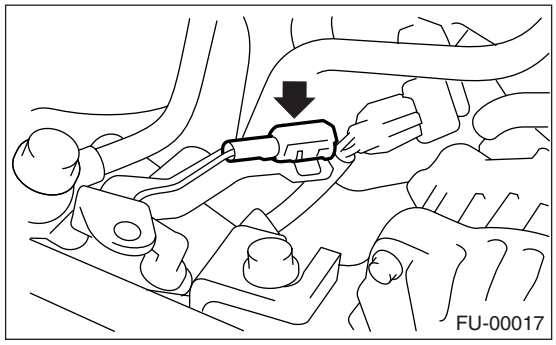
Tightening torque:
20.1 N·m (2.05 kgf-m, 14.8 ft-lb)



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

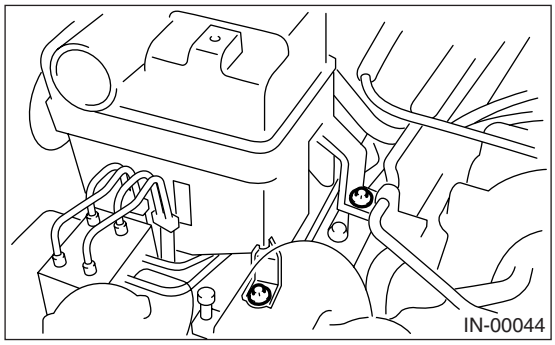


(4) Connect the power steering switch connector.



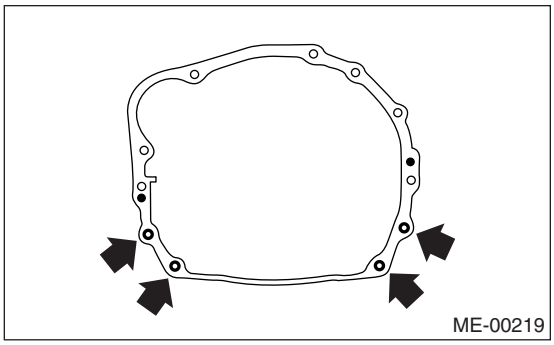
(5) Install the front side V-belt, and adjust it. <Ref. to ME(H4SO)-43, FRONT SIDE BELT, INSTALLATION, V-belt.>
(6) Install the resonator chamber.

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



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

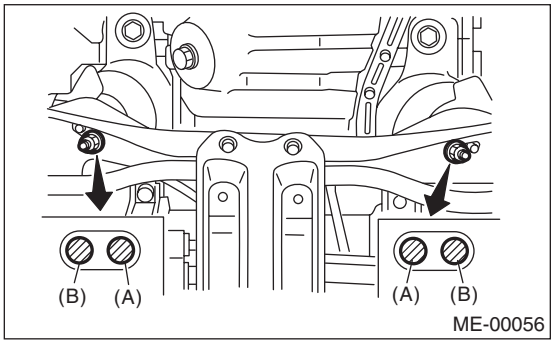
Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



12) Tighten the nuts which install 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)-8, INSTALLATION, Front Exhaust Pipe.>
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
(5) Power steering pressure switch
16) Connect the following cables.
(1) Accelerator cable
(2) Cruise control cable (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-41, INSTALLATION, Hose and Tube.>
20) Install the radiator to vehicle. <Ref. to CO(H4SO)-30, INSTALLATION, Radiator.>
21) Install the air intake duct and air cleaner case. <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Duct.> <Ref. to IN(H4SO)-6, 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)-19, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
25) Check the ATF level and correct if necessary. (AT model)
<Ref. to 4AT-30, INSPECTION, Automatic Transmission Fluid.>
26) Charge the A/C system with refrigerant. <Ref. to AC-27, 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:
34 N·m (3.5 kgf-m, 25.3 ft-lb)

C: INSPECTION

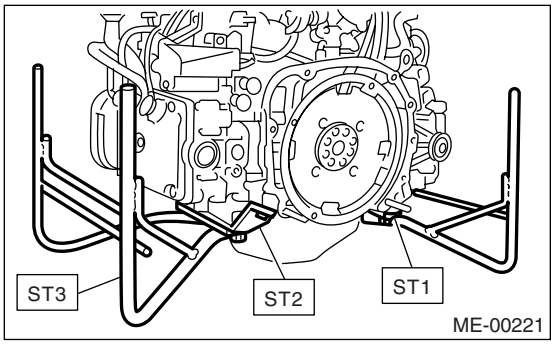
Make sure there are no cracks or other damage.

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.

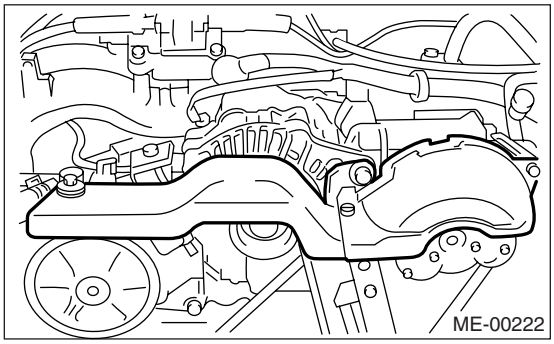
12.V-belt

A: REMOVAL

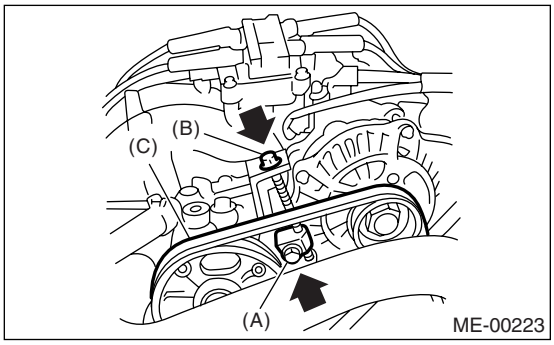
1. FRONT SIDE BELT

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

1) Remove the V-belt cover.

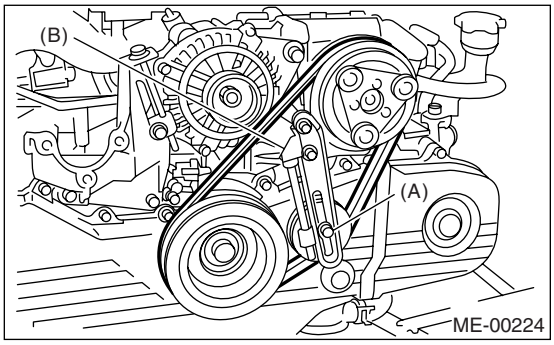


2) Loosen the lock bolt (A).
3) Loosen the slider bolt (B).
4) Remove the front side belt (C).

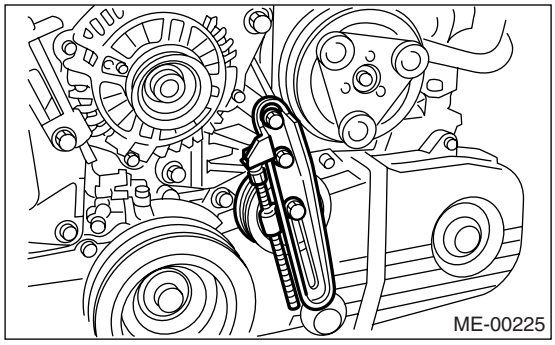


2. REAR SIDE BELT

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



3) Remove the A/C belt.
4) Remove the A/C belt tensioner.

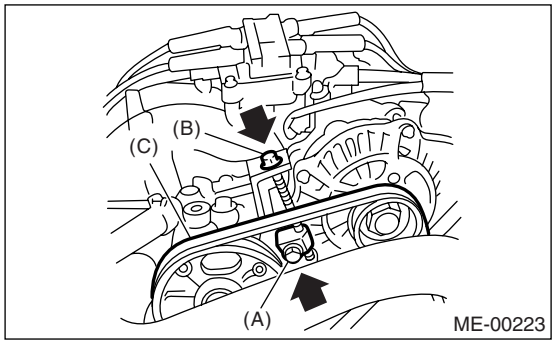


B: INSTALLATION

1. FRONT SIDE BELT

1) Wipe off any oil or water on the belt and pulley.
2) Install the V-belt (C), and tighten the slider bolt so as to obtain the specified belt tension <Ref. to ME(H4SO)-44, INSPECTION, V-belt.>
3) Tighten the lock bolt (A).
4) Tighten the slider bolt (B).

Tightening torque:
Lock bolt through bolt:
25 N·m (2.5 kgf-m, 18.1 ft-lb)
Slider bolt:
8 N·m (0.8 kgf-m, 5.5 ft-lb)

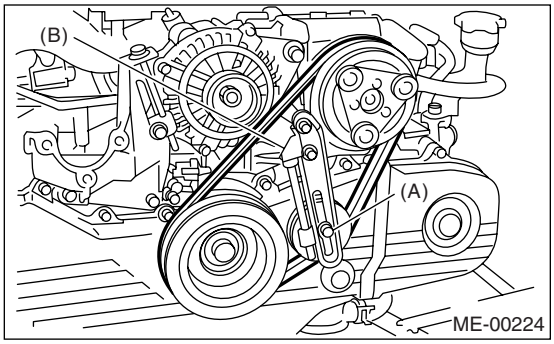


2. REAR SIDE BELT

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

2) Tighten the lock nut (A).

Tightening torque:
Lock nut (A)
22.6 N·m (2.3 kgf-m, 16.6 ft-lb)



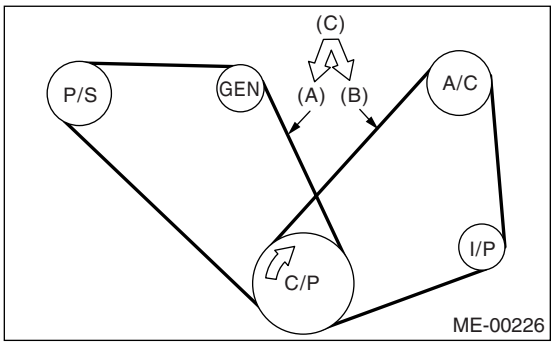
C: INSPECTION

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

Belt tension

(A)
replaced: 7 — 9 mm (0.276 — 0.354 in)
reused: 9 — 11 mm (0.354 — 0.433 in)

(B)
replaced: 7.5 — 8.5 mm (0.295 — 0.335 in)
reused: 9.0 — 10.0 mm (0.354 — 0.394 in)



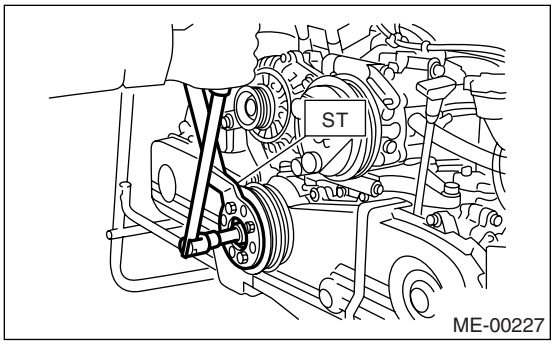
C/P	Crank pulley
GEN	Generator
P/S	Power steering oil pump pulley
A/C	Air conditioning compressor pulley
I/P	Idler pulley

13.Crank Pulley

A: REMOVAL

1) Remove the V-belt. <Ref. to ME(H4SO)-43, REMOVAL, V-belt.>
2) Remove the crank pulley bolt. Use ST to lock the crankshaft.

ST 499977400 CRANK PULLEY WRENCH (2.0 L model)
ST 499977100 CRANK PULLEY WRENCH (2.5 L model)



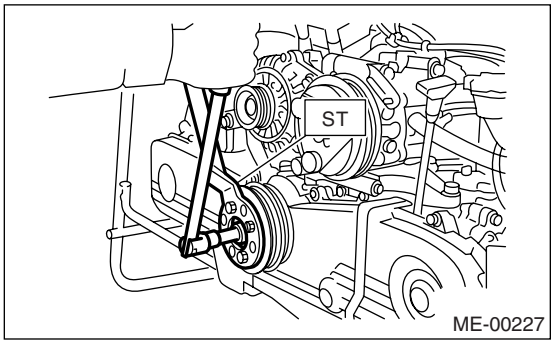
3) Remove the crank pulley.

B: INSTALLATION

1. 2.0 L MODEL

1) Install the crank pulley.
2) Install the pulley bolt.
Use ST to lock the crankshaft.
ST 499977400 CRANK PULLEY WRENCH
(1) Clean the crank pulley thread using an air gun.
(2) Apply engine oil to the crank pulley bolt seat and thread.
(3) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).
(4) Tighten the crank pulley bolts.

Tightening torque:
127 N·m (13.0 kgf-m, 94.0 ft-lb)



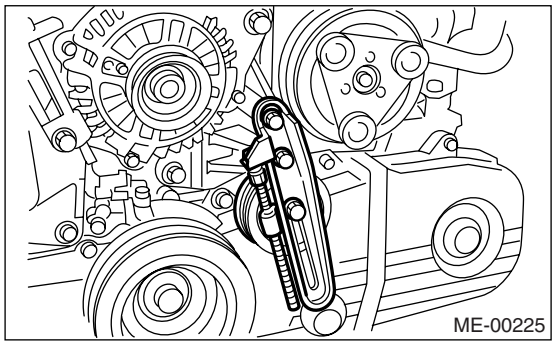
3) Confirm that the tightening angle of crank pulley bolt is 45° or more. If the tightening angle of crank pulley bolt is less than 45°, conduct the following procedures.
(1) Replace the crank pulley bolts and clean them.

Crank pulley bolt:
12369AA011

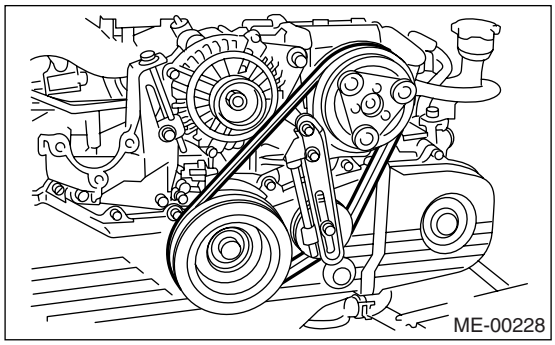
(2) Clean the crankshaft thread using an air gun.
(3) Apply engine oil to the crank pulley bolt seat and thread.
(4) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).
(5) Tighten the crank pulley bolts keeping them in an angle between 45° and 60°.

NOTE:
Conduct the tightening procedures by confirming the turning angle of crank pulley bolt referring to the gauge indicated on belt cover.

4) Install the A/C belt tensioner.



5) Install the A/C belt.

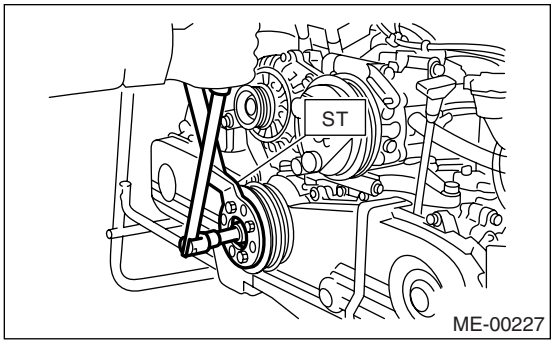


2. 2.5 L MODEL

1) Install the crank pulley.
2) Install the pulley bolt.
Use ST to lock the crankshaft.
ST 499977100 CRANK PULLEY WRENCH
(1) Clean the crank pulley thread using an air gun.
(2) Apply engine oil to the crank pulley bolt seat and thread.
(3) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).

(4) Tighten the crank pulley bolts.

Tightening torque:
177 N·m (18.0 kgf-m, 130.2 ft-lb)



3) Confirm that the tightening angle of crank pulley bolt is 65° or more. If the tightening angle of crank pulley bolt is less than 65°, conduct the following procedures.

(1) Replace the crank pulley bolts and clean them.

Crank pulley bolt:
12369AA011

(2) Clean the crankshaft thread using an air gun.

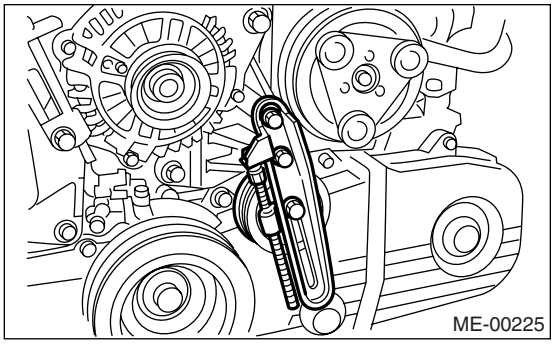
(3) Apply engine oil to the crank pulley bolt seat and thread.

(4) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).

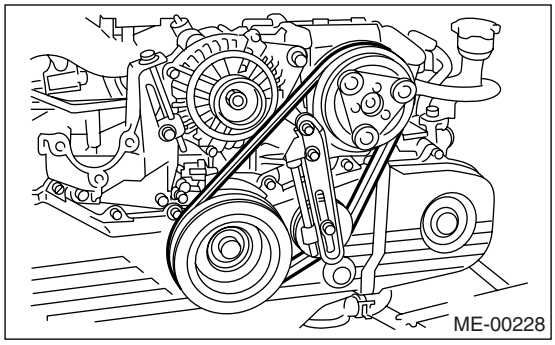
(5) Tighten the crank pulley bolts keeping them in an angle between 65° and 75°.

NOTE:
Conduct the tightening procedures by confirming the turning angle of crank pulley bolt referring to the gauge indicated on belt cover.

4) Install the A/C belt tensioner.



5) Install the A/C belt.



C: INSPECTION

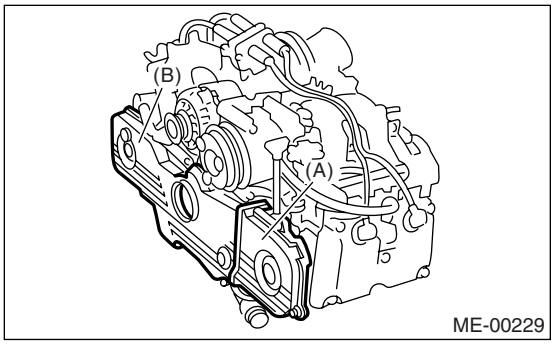
1) Make sure the V-belt is not worn or otherwise damaged.

2) Check the tension of the belt. <Ref. to ME(H4SO)-44, INSPECTION, V-belt.>

14.Timing Belt Cover

A: REMOVAL

1) Remove the V-belt. <Ref. to ME(H4SO)-43, REMOVAL, V-belt.>
2) Remove the crank pulley. <Ref. to ME(H4SO)-45, REMOVAL, Crank Pulley.>
3) Remove the belt cover (LH).
4) Remove the front belt cover.



(A) Timing belt cover (LH)
(B) Front timing belt cover

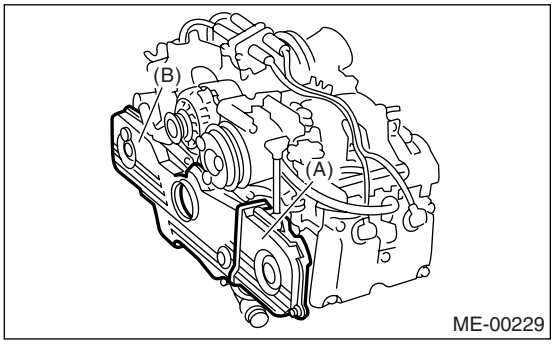
B: INSTALLATION

1) Install the front belt cover.

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)

2) Install the belt cover (LH).

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)



(A) Timing belt cover (LH)
(B) Front timing belt cover

3) Install the crank pulley. <Ref. to ME(H4SO)-45, INSTALLATION, Crank Pulley.>
4) Install the V-belt. <Ref. to ME(H4SO)-43, INSTALLATION, V-belt.>

C: INSPECTION

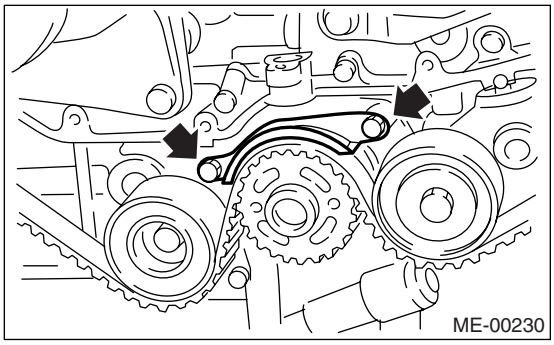
Make sure the cover is not damaged.

15.Timing Belt

A: REMOVAL

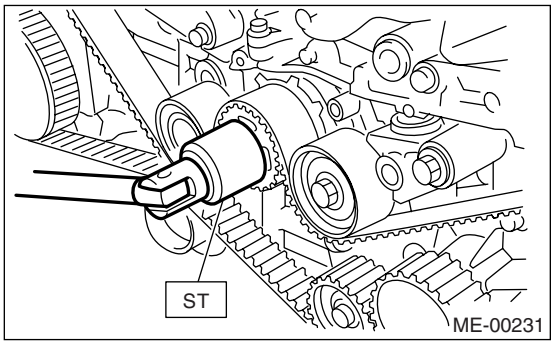
1. TIMING BELT

1) Remove the V-belt. <Ref. to ME(H4SO)-43, REMOVAL, V-belt.>
2) Remove the crank pulley. <Ref. to ME(H4SO)-45, REMOVAL, Crank Pulley.>
3) Remove the belt cover. <Ref. to ME(H4SO)-47, REMOVAL, Timing Belt Cover.>
4) Remove the timing belt guide. (MT model)

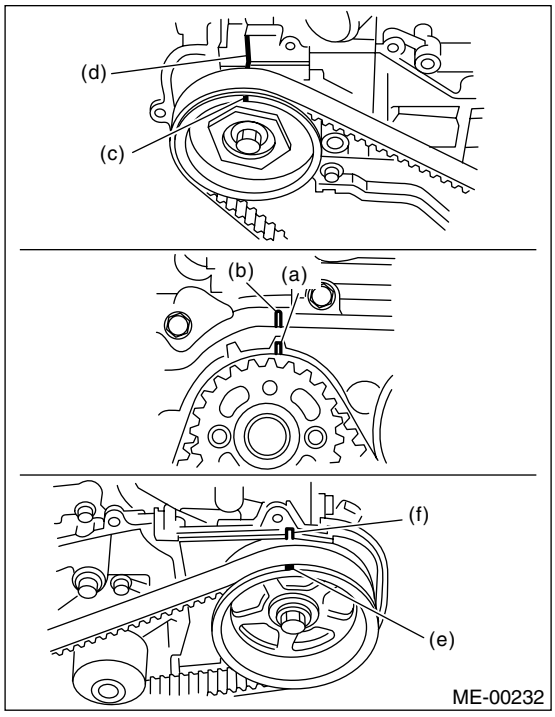

ME-00230

5) If the alignment mark (a) or arrow mark (which indicates rotation direction) on timing belt fade away, put new marks before removing the timing belt as shown in procedures below.
   (1) Turn the crankshaft using ST. Align the mark (a) of sprocket to cylinder block notch (b) and ensure the right side cam sprocket mark (c), cam cap and cylinder head matching surface (d) or left side cam sprocket mark (e) and belt cover notch (f) are properly adjusted.

ST 499987500 CRANKSHAFT SOCKET

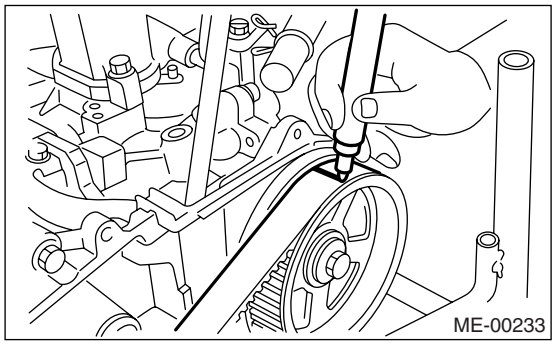


ME-00231

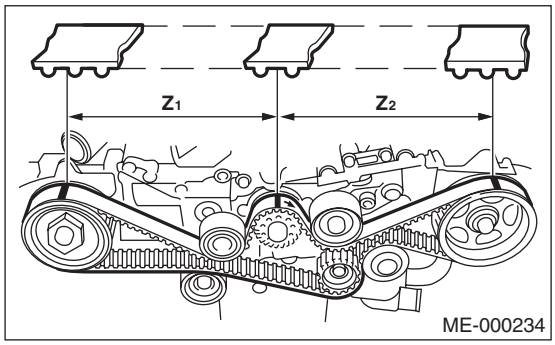


ME-00232

(2) Using white paint, put alignment or arrow marks on the timing belts in relation to crank sprocket and cam sprockets.


ME-00233

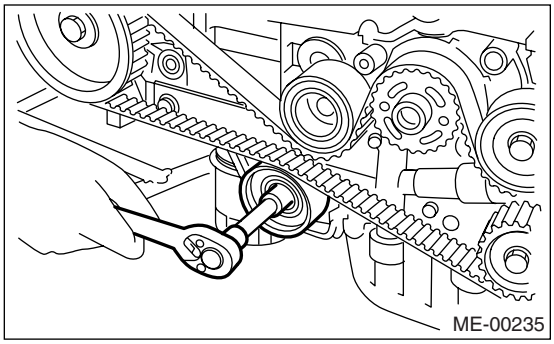
Specified data:
Z_1: 46.8 tooth length
Z_2: 43.7 tooth length



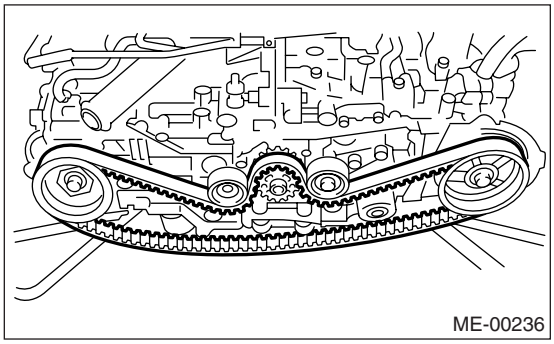
ME-000234

6) Remove the belt idler (No. 2).

7) Remove the belt idler No. 2.

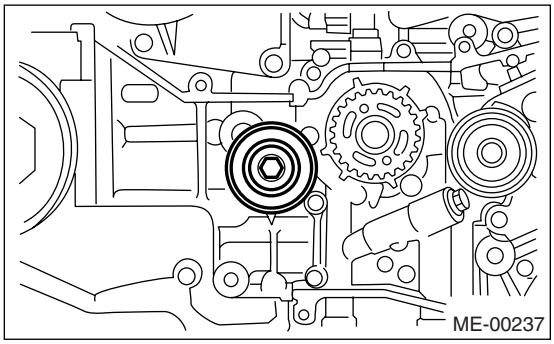


8) Remove the timing belt.

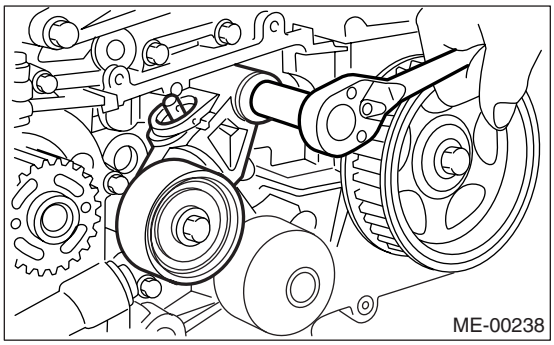


2. BELT IDLER AND AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY

1) Remove the belt idler (No. 1).



2) Remove the automatic belt tension adjuster assembly.



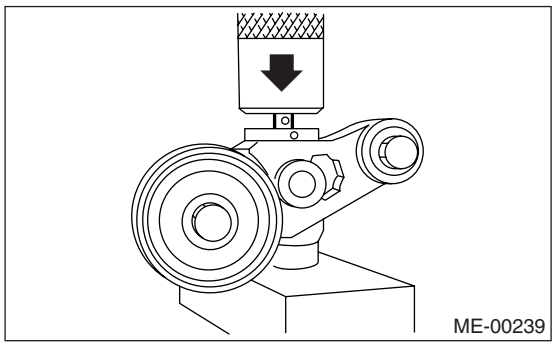
B: INSTALLATION

1. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

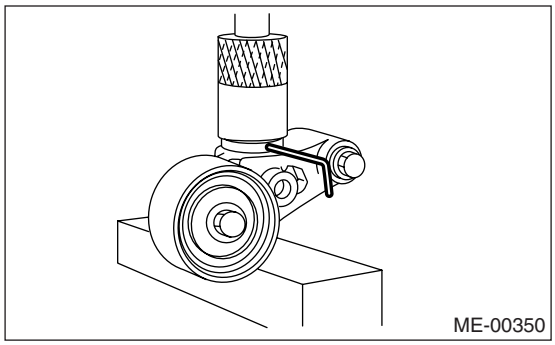
1) Preparation for installation of automatic belt tension adjuster assembly

CAUTION:
• Always use a vertical type pressing tool to move the adjuster rod down.
• Do not use a lateral type vise.
• Push the adjuster rod vertically.
• Press-in the push adjuster rod gradually taking more than 3 minutes.
• Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lb).
• Press the adjuster rod as far as the end surface of cylinder. Do not press the adjuster rod into the cylinder. Doing so may damage the cylinder.
• Do not release the press pressure until stopper pin is completely inserted.

(1) Attach the automatic belt tension adjuster assembly to the vertical pressing tool.
(2) Slowly move the adjuster rod down with a pressure of 294 N (30 kgf, 66 lb) until the adjuster rod is aligned with the stopper pin hole in the cylinder.

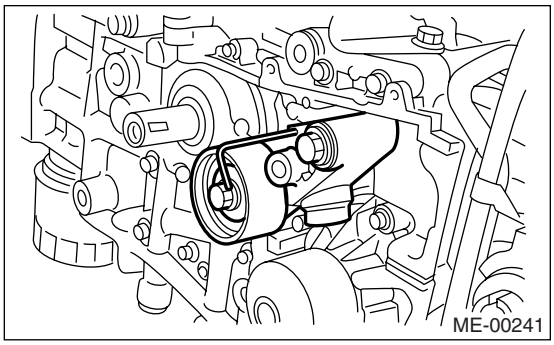


(3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (0.08 in) (nominal) dia. hex wrench inserted into the stopper pin hole in the cylinder, secure the adjuster rod.



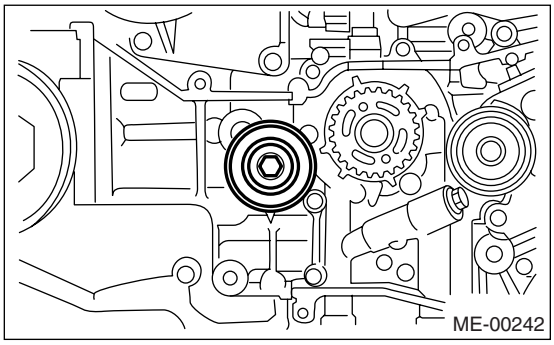
2) Install the automatic belt tension adjuster assembly.

Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)



3) Install the belt idler (No. 1).

Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)



2. TIMING BELT

1) Preparation for the installation of automatic belt tension adjuster assembly <Ref. to ME(H4SO)-49, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>

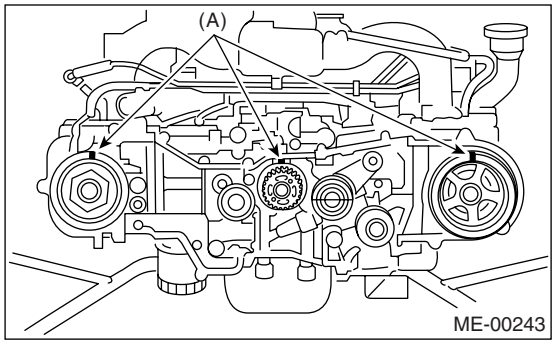
2) Installation of timing belt

(1) Turn the cam sprocket No. 2 using ST1, and then turn the cam sprocket No. 1 using ST2 so that their alignment marks (A) come to top positions.

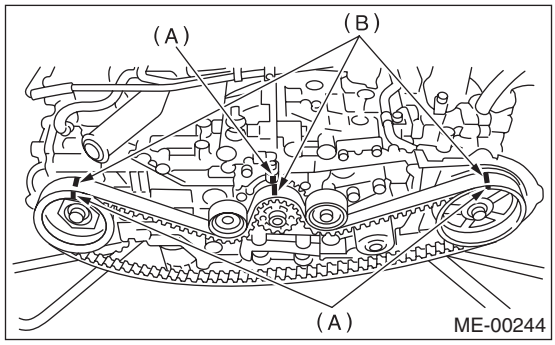
ST1 18231AA010 CAM SPROCKET WRENCH

NOTE:
Also the CAM SPROCKET WRENCH (499207100) can be used.

ST2 499207400 CAM SPROCKET WRENCH



(2) While aligning alignment marks (B) on the timing belt with marks (A) on sprockets, position the timing belt properly.

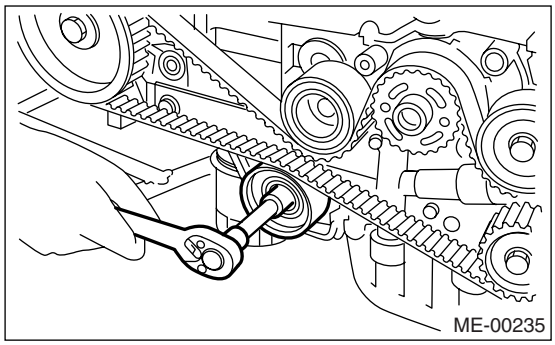


3) Install the belt idler No. 2.

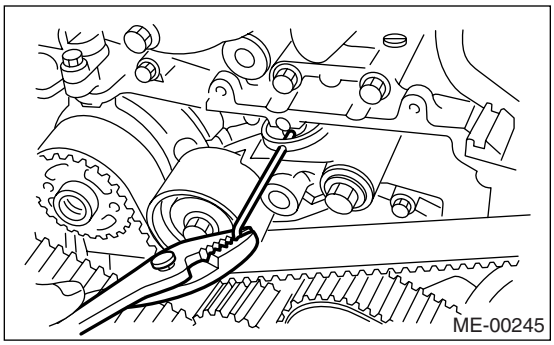
Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)

4) Install the belt idler (No. 2).

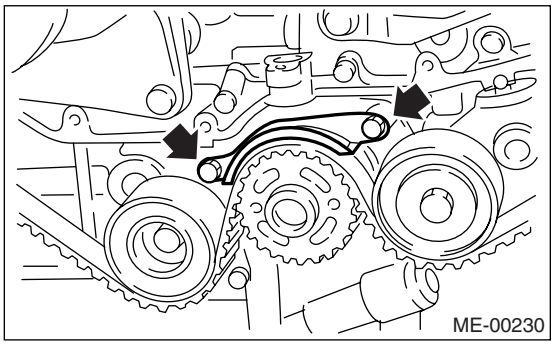
Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)



5) After ensuring that the marks on timing belt and cam sprockets are aligned, remove the stopper pin from belt tension adjuster.

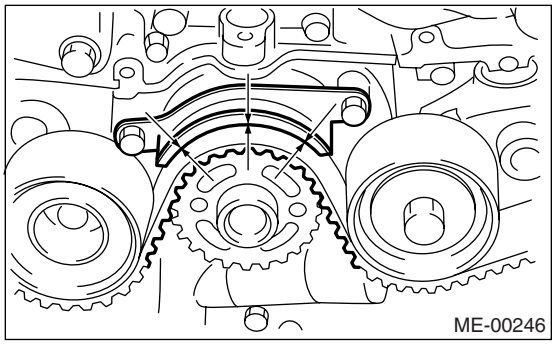


6) Install the timing belt guide. (MT model)
(1) Temporarily tighten the remaining bolts.



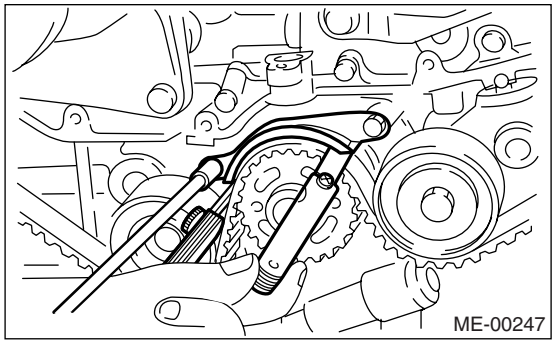
(2) Check and adjust the clearance between timing belt and timing belt guide by using thickness gauge.

Clearance:
1.0±0.5 mm (0.039±0.020 in)



(3) Tighten the remaining bolts.

Tightening torque:
10 N·m (1.0 kgf-m, 7.2 ft-lb)



7) Install the belt cover. <Ref. to ME(H4SO)-47, INSTALLATION, Timing Belt Cover.>
8) Install the crank pulley. <Ref. to ME(H4SO)-45, INSTALLATION, Crank Pulley.>
9) Install the V-belt. <Ref. to ME(H4SO)-43, INSTALLATION, V-belt.>

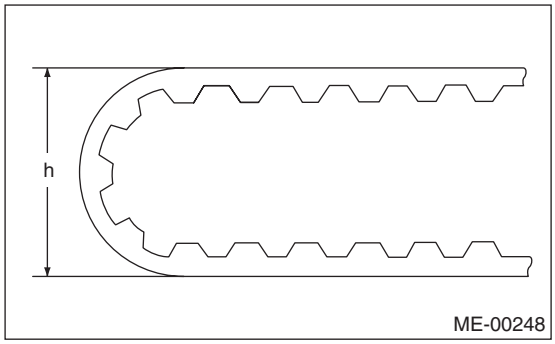
C: INSPECTION

1. TIMING BELT

1) Check the timing belt teeth for breaks, cracks, and wear. If any fault is found, replace the belt.
2) Check the condition of back side of belt; if any crack is found, replace the belt.

CAUTION:
• Be careful not to let oil, grease or coolant contact the belt. Remove quickly and thoroughly if this happens.
• Do not bend the timing belt sharply.

In radial diameter: h
60 mm (2.36 in) or more



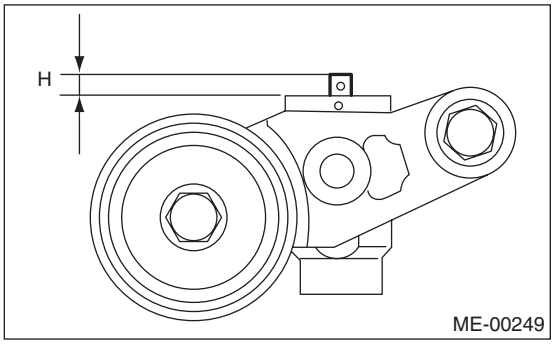
2. AUTOMATIC BELT TENSION ADJUSTER

1) Visually check oil seals for leaks, and rod ends for abnormal wear or scratches. If necessary, replace faulty parts.
2) Check that the adjuster rod does not move when a pressure of 294 N (30 kgf, 66 lb) is applied to it. This is to check adjuster rod stiffness.
3) If the adjuster rod is not stiff and moves freely when applying 294 N (30 kgf, 66 lb), check it using the following procedures:
   (1) Slowly press the adjuster rod down to the end surface of the cylinder. Repeat this motion 2 or 3 times.
   (2) With the adjuster rod moved all the way up, apply a pressure of 294 N (30 kgf, 66 lb) to it. Check adjuster rod stiffness.
   (3) If the adjuster rod is not stiff and moves down, replace the automatic belt tension adjuster assembly with a new one.

CAUTION:
• Always use a vertical type pressing tool to move the adjuster rod down.
• Do not use a lateral type vise.
• Push the adjuster rod vertically.
• Press-in the adjuster rod gradually taking more than 3 minutes.
• Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lb).
• Press the adjuster rod as far as the end surface of the cylinder. Do not press the adjuster rod into the cylinder. Doing so may damage the cylinder.

4) Measure the extension of rod beyond the body. If it is not within specifications, replace with a new one.

Rod extension: H
5.7±0.5 mm (0.224±0.020 in)



3. BELT TENSION PULLEY

1) Check the mating surfaces of timing belt and contact point of adjuster rod for abnormal wear or scratches. Replace the automatic belt tension adjuster assembly if faulty.
2) Check the tension pulley for smooth rotation. Replace if noise or excessive play is noted.
3) Check the tension pulley for grease leakage.

4. BELT IDLER

1) Check the belt idler for smooth rotation. Replace if noise or excessive play is noted.
2) Check the belt outer contacting surfaces of idler pulley for abnormal wear and scratches.
3) Check the belt idler for grease leakage.