SUPPLEMENT FOR 6 CYLINDER ENGINE MODEL

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.

G2281GE

SUPPLEMENT FOR 6 CYLINDER ENGINE MODEL

MECHANICAL

ME(H6)

1. General Description S143001

A: SPECIFICATIONS S143001E49

Engine	Type			Horizontally opposed, liquid cooled, 6-cylinder, 4-stroke gasoline engine
	Valve arrangement			Chain driven, double over-head camshaft, 4-valve/cylinder
	Bore x Stroke		mm (in)	87.2 x 80 (3.433 x 3.150)
	Displacement		cm^3 (cu in)	2,999 (183)
	Compression ratio			10.7
	Compression pressure (350 rpm and fully open throttle)		kPa (kg/cm^2, psi)	1,275 — 1,471 (13.0 — 15.0, 185 — 213)
	Number of piston rings			Pressure ring: 2, Oil ring: 1
	Intake valve timing	Opening		5° BTDC
		Closing		55° ABDC
	Exhaust valve timing	Opening		52° BBDC
		Closing		0° ATDC
	Valve clearance	Intake	mm (in)	$0.20^{+0.04}_{-0.06}$ ($0.0079^{+0.0016}_{-0.0024}$)
		Exhaust	mm (in)	0.25±0.05 (0.0098±0.0020)
	Idle speed [At “P” or “N” position]		rpm	600±50 (No load) 700±50 (A/C switch ON)
	Firing order			1 → 6 → 3 → 2 → 5 → 4
	Ignition timing		BTDC/rpm	10°±3°/600

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

Belt tensioner	Spacer O.D.			17.955 — 17.975 mm (0.7069 — 0.7077 in)
	Tensioner bushing I.D.			18.00 — 18.08 mm (0.7087 — 0.7118 in)
	Clearance between spacer and bushing		STD	0.025 — 0.125 mm (0.0010 — 0.0049 in)
			Limit	0.175 mm (0.0069 in)
	Side clearance of spacer		STD	0.20 — 0.55 mm (0.0079 — 0.0217 in)
			Limit	0.81 mm (0.0319 in)
Camshaft	Bend limit			0.020 mm (0.0008 in)
	Thrust clearance	Intake	STD	0.075 — 0.135 mm (0.0030 — 0.0053 in)
			Limit	0.155 mm (0.0061 in)
		Exhaust	STD	0.048 — 0.108 mm (0.0019 — 0.0043 in)
			Limit	0.130 mm (0.0051 in)
	Cam lobe height	Intake	STD	46.05 — 46.15 mm (1.8130 — 1.8169 in)
			Limit	45.95 mm (1.8091 in)
		Exhaust	STD	45.55 — 45.65 mm (1.7933 — 1.7972 in)
			Limit	45.45 mm (1.7894 in)
	Camshaft journal O.D.	Front		37.963 — 37.946 mm (1.4946 — 1.4939 in)
		Center & Rear		27.963 — 27.946 mm (1.1009 — 1.1002 in)
	Camshaft journal hole I.D.	Front		38.000 — 38.018 mm (1.4961 — 1.4968 in)
		Center & Rear		28.000 — 28.018 mm (1.1024 — 1.1031 in)
	Oil clearance		STD	0.037 — 0.072 mm (0.0015 — 0.0028 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			124 mm (4.88 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			5.500 — 5.512 mm (0.2165 — 0.2170 in)
	Protrusion above head		Intake	12.3 — 12.7 mm (0.484 — 0.500 in)
Valve	Head edge thickness	Intake	STD	1.0 mm (0.039 in)
			Limit	0.8 mm (0.315 in)
		Exhaust	STD	1.2 mm (0.047 in)
			Limit	0.8 mm (0.315 in)
	Stem diameter		Intake	5.455 — 5.470 mm (0.2148 — 0.2154 in)
			Exhaust	5.455 — 5.460 mm (0.2148 — 0.2150 in)
	Stem oil clearance	STD	Intake	0.030 — 0.057 mm (0.0012 — 0.0022 in)
			Exhaust	0.040 — 0.067 mm (0.0016 — 0.0026 in)
		Limit	—	0.15 mm (0.0059 in)
	Overall length		Intake	103.5 mm (4.07 in)
			Exhaust	103.2 mm (4.06 in)
Valve spring	Free length			46.79 mm (1.8421 in)
	Squareness			2.5°, 2.0 mm (0.079 in)
	Tension/spring height		Set	186.2 — 205.8 N (18.99 — 20.99 kgf, 41.9 — 46.3 lb)/37.4 mm (1.472 in)
			Lift	446.5 — 493.5 N (45.54 — 50.34 kgf, 100.3 — 110.9 lb)/27.5 mm (1.083 in)
Cylinder block	Surface warpage limit (mating with cylinder head)			0.05 mm (0.0020 in)
	Surface grinding limit			0.1 mm (0.004 in)
	Cylinder bore	STD	A	89.205 — 89.215 mm (3.5120 — 3.5124 in)
			B	89.195 — 89.205 mm (3.5116 — 3.5120 in)
	Taper		Limit	0.050 mm (0.0020 in)
	Out-of-roundness		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	STD	A	89.185 — 89.195 mm (3.5112 — 3.5116 in)
			B	89.175 — 89.185 mm (3.5108 — 3.5112 in)
		0.25 mm (0.0098 in) OS		89.425 — 89.435 mm (3.5207 — 3.5211 in)
		0.50 mm (0.0197 in) OS		89.675 — 89.685 mm (3.5305 — 3.5309 in)
	Standard inner diameter of piston pin hole			22.000 — 22.006 mm (0.8661 — 0.8664 in)
Piston pin	Outer diameter			21.994 — 22.000 mm (0.8659 — 0.8661 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).

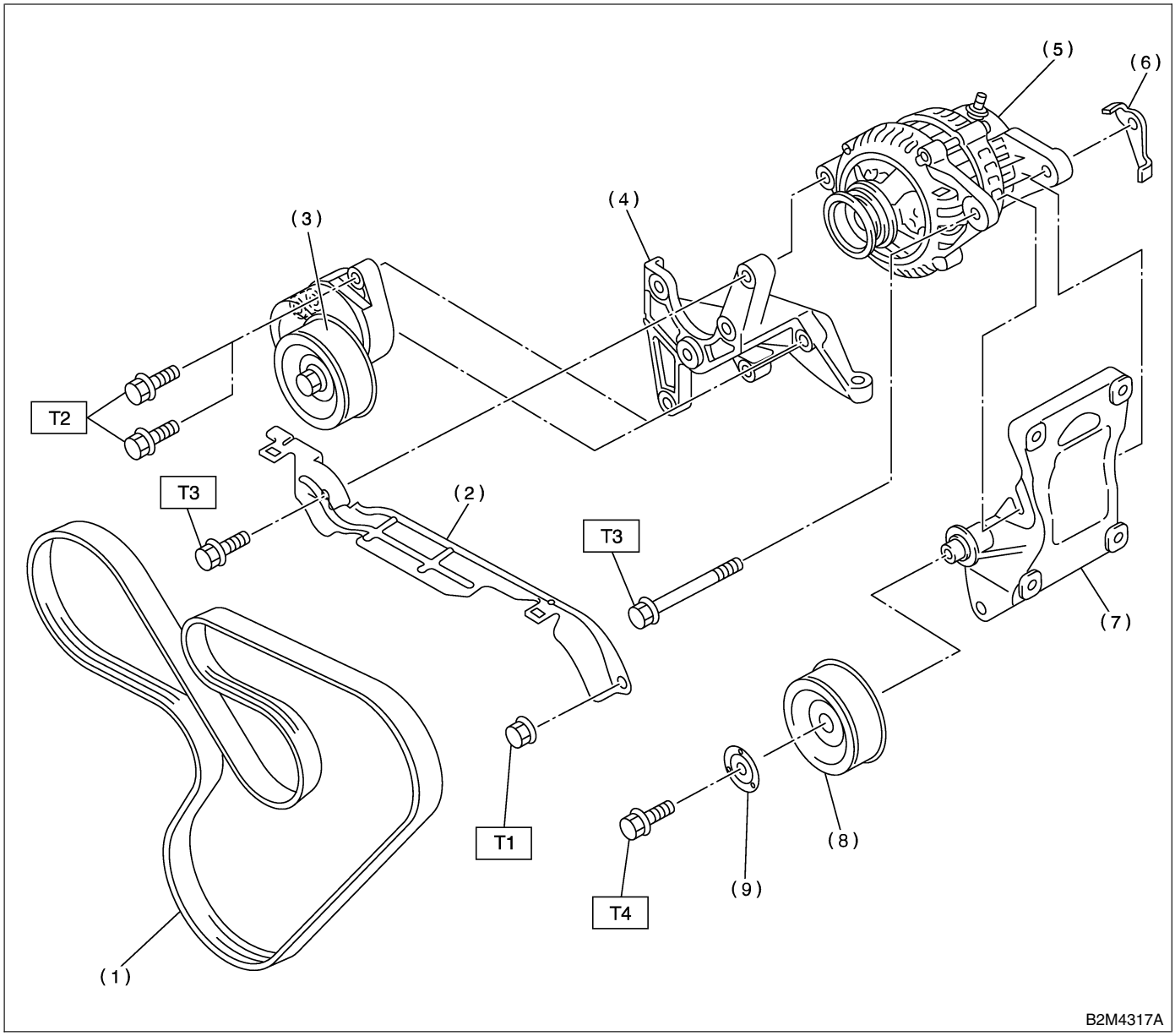
Piston ring	Piston ring gap	Top ring	STD	0.20 — 0.35 mm (0.0079 — 0.0138 in)
			Limit	1.0 mm (0.039 in)
		Second ring	STD	0.35 — 0.50 mm (0.0138 — 0.0197 in)
			Limit	1.0 mm (0.039 in)
		Oil ring	STD	0.20 — 0.60 mm (0.0079 — 0.0236 in)
			Limit	1.5 mm (0.059 in)
	Clearance between piston ring and piston ring groove	Top ring	STD	0.040 — 0.080 mm (0.0016 — 0.0031 in)
			Limit	0.15 mm (0.0059 in)
		Second ring	STD	0.030 — 0.070 mm (0.0012 — 0.0028 in)
			Limit	0.15 mm (0.0059 in)
Connecting rod	Bend 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		STD	0.022 — 0.052 mm (0.0009 — 0.0020 in)
			Limit	0.065 mm (0.0026 in)
	Thickness at center portion		STD	1.490 — 1.502 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)
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)
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		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, #5, #7	STD	63.992 — 64.008 mm (2.5194 — 2.5200 in)
			0.03 mm (0.0012 in) US	63.962 — 63.978 mm (2.5182 — 2.5188 in)
			0.05 mm (0.0020 in) US	63.942 — 63.958 mm (2.5174 — 2.5180 in)
			0.25 mm (0.0098 in) US	63.742 — 63.758 mm (2.5095 — 2.5102 in)
		#2, #4, #6	STD	63.992 — 64.008 mm (2.5194 — 2.5200 in)
			0.03 mm (0.0012 in) US	63.962 — 63.978 mm (2.5182 — 2.5188 in)
			0.05 mm (0.0020 in) US	63.942 — 63.958 mm (2.5174 — 2.5180 in)
			0.25 mm (0.0098 in) US	63.742 — 63.758 mm (2.5095 — 2.5102 in)
	Thrust clearance		STD	0.030 — 0.115 mm (0.0012 — 0.0045 in)
			Limit	0.25 mm (0.0098 in)
	Oil clearance		STD	0.015 — 0.030 mm (0.0006 — 0.0012 in)
			Limit	0.050 mm (0.0020 in)

Crankshaft bearing	Crankshaft bearing thickness	#1, #3, #5, #7	STD	1.992 — 2.005 mm (0.0784 — 0.0789 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	1.996 — 2.000 mm (0.0786 — 0.0787 in)
			0.03 mm (0.0012 in) US	2.019 — 2.020 mm (0.0795 — 0.0795 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)

MEMO:

B: COMPONENT S143001A05

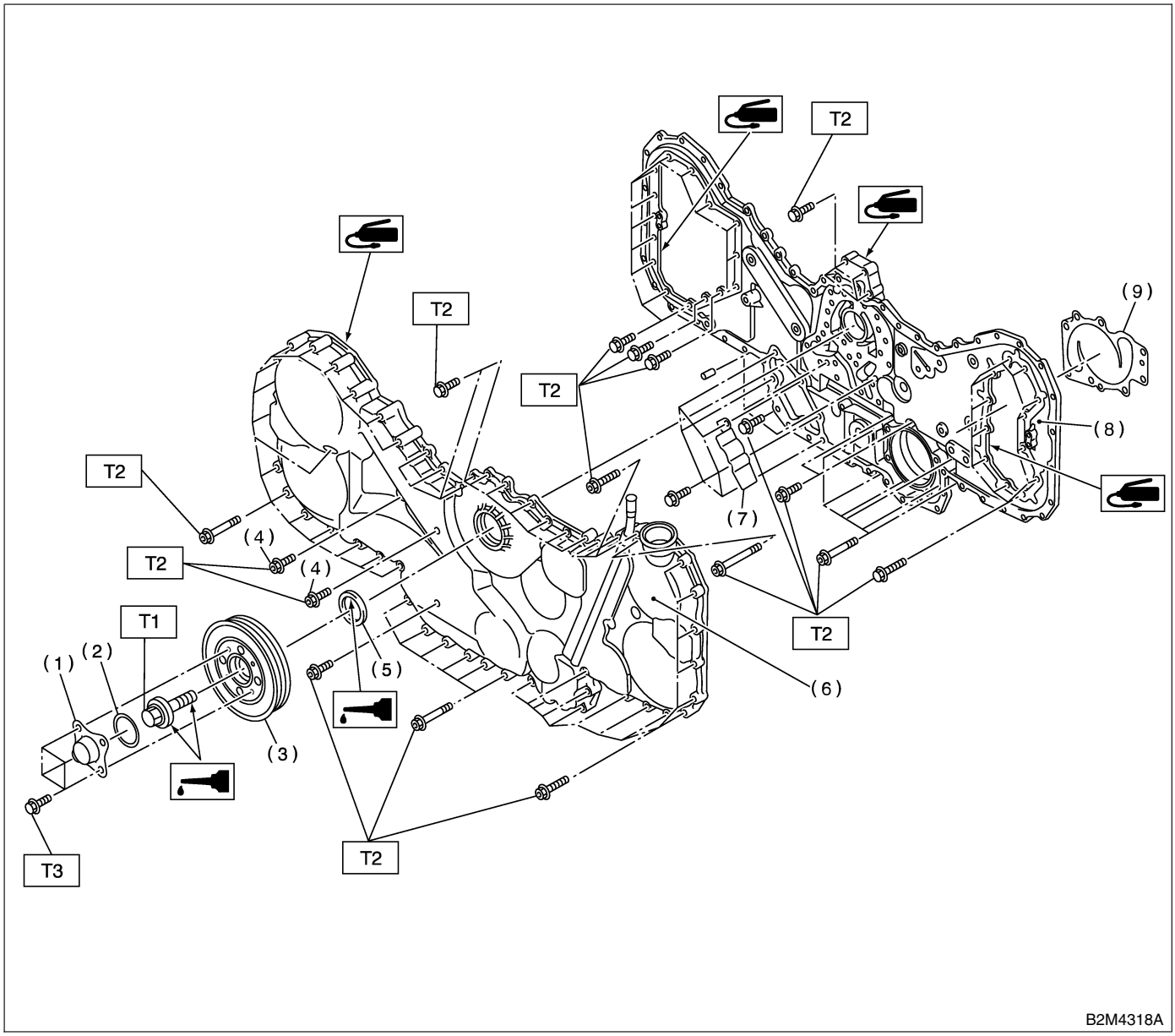
1. V-BELT S143001A0508



(1) V-belt
(2) Belt cover
(3) Belt tensioner
(4) Power steering pump bracket
(5) Generator
(6) Generator plate
(7) A/C compressor stay
(8) Idler pulley
(9) Idler pulley cover

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.65, 4.7)
T2: 20 (2.0, 14)
T3: 25 (2.5, 18)
T4: 33 (3.4, 25)

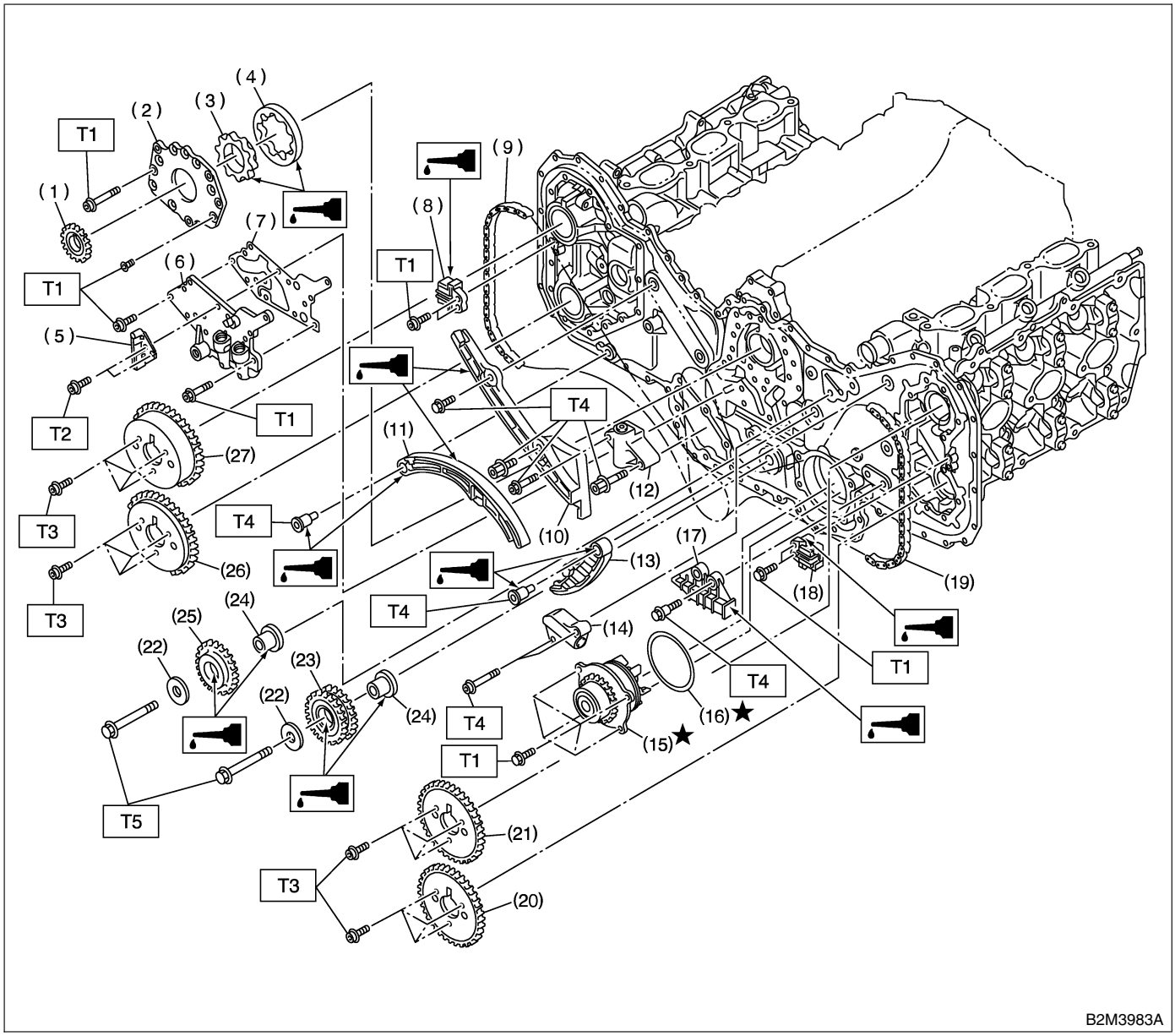
2. TIMING CHAIN COVER S143001A0509



(1) Crank pulley cover
(2) O-ring
(3) Crank pulley
(4) Sealing washer
(5) Oil seal
(6) Front chain cover
(7) Baffle
(8) Rear chain cover
(9) Water pump gasket

Tightening torque: N·m (kgf-m, ft-lb)
T1: Refer to ME(H6)-41, Crankshaft Pulley.
T2: Refer to ME(H6)-42, Front Chain Cover.
T3: 6.4 (0.65, 4.7)

3. TIMING BELT S143001A0501

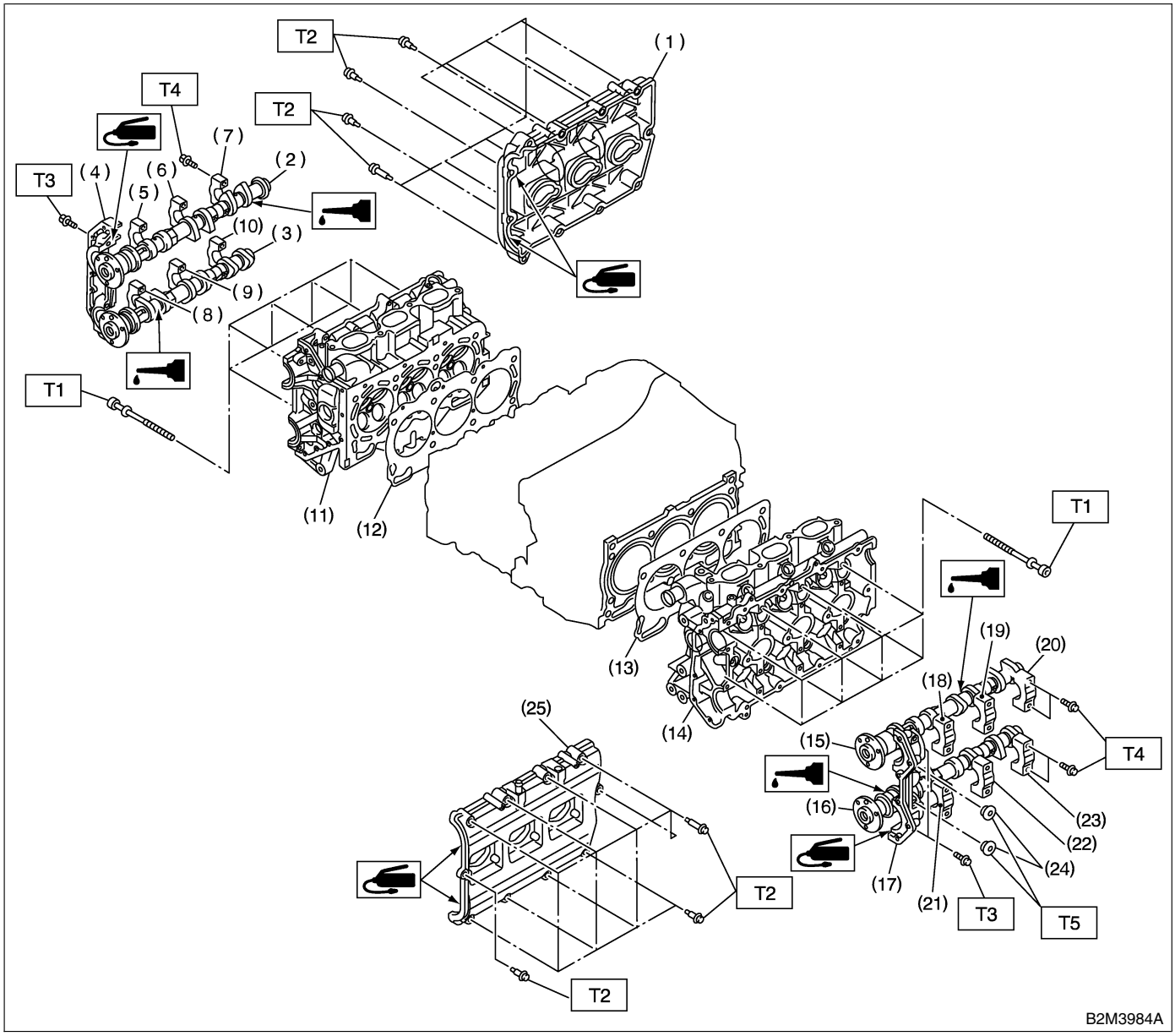


(1) Crank sprocket
(2) Oil pump cover
(3) Inner rotor
(4) Outer rotor
(5) Chain guide (Center)
(6) Relief valve case
(7) Relief valve case gasket
(8) Chain guide (Right-hand between cams)
(9) Timing chain (RH)
(10) Chain guide (RH)
(11) Chain tensioner lever (RH)
(12) Chain tensioner (RH)
(13) Chain tensioner lever (LH)
(14) Chain tensioner (LH)
(15) Water pump
(16) O-ring
(17) Chain guide (LH)
(18) Chain guide (Left-hand between cams)
(19) Timing chain (LH)
(20) Exhaust cam sprocket (RH)
(21) Intake cam sprocket (RH)
(22) Idler sprocket plate
(23) Idler sprocket (Lower)
(24) Idler sprocket color
(25) Idler sprocket (Upper)
(26) Exhaust cam sprocket (LH)
(27) Intake cam sprocket (LH)

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.64, 4.7)
T2: 7.8 (0.80, 5.8)
T3: 13 (1.3, 9.4)
T4: 16 (1.6, 11.6)
T5: 69 (7.0, 50.6)

4. CYLINDER HEAD AND CAMSHAFT

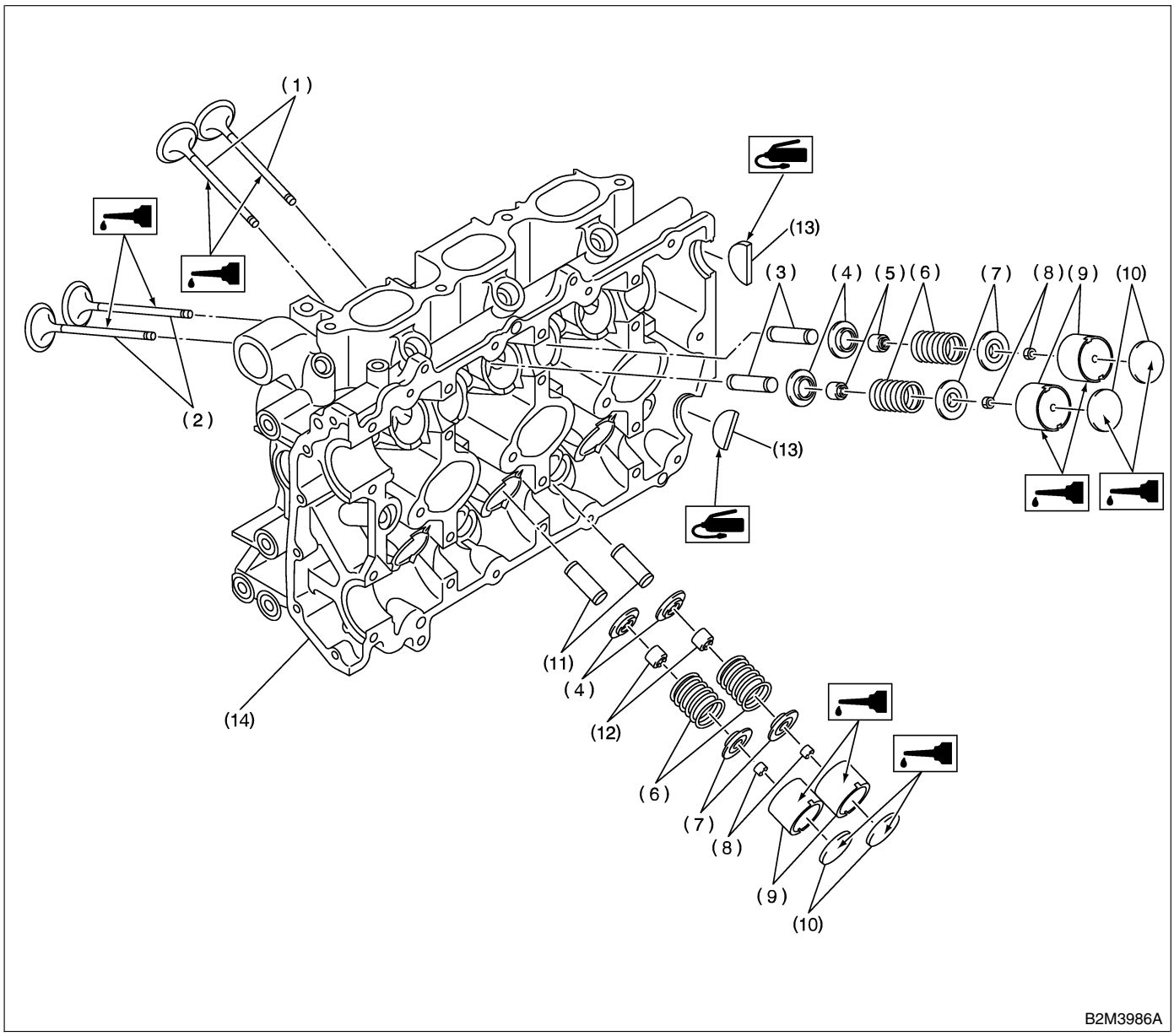
S143001A0502



(1) Rocker cover (RH)
(2) Intake camshaft (RH)
(3) Exhaust camshaft (RH)
(4) Front camshaft cap (RH)
(5) Intake camshaft cap (Front RH)
(6) Intake camshaft cap (Center RH)
(7) Intake camshaft cap (Rear RH)
(8) Exhaust camshaft cap (Front RH)
(9) Exhaust camshaft cap (Center RH)
(10) Exhaust camshaft cap (Rear RH)
(11) Cylinder head (RH)
(12) Cylinder head gasket (RH)
(13) Cylinder head gasket (LH)
(14) Cylinder head (LH)
(15) Intake camshaft (LH)
(16) Exhaust camshaft (LH)
(17) Front camshaft cap (LH)
(18) Intake camshaft cap (Front LH)
(19) Intake camshaft cap (Center LH)
(20) Intake camshaft cap (Rear LH)
(21) Exhaust camshaft cap (Front LH)
(22) Exhaust camshaft cap (Center LH)
(23) Exhaust camshaft cap (Rear LH)
(24) Plug
(25) Rocker cover (LH)

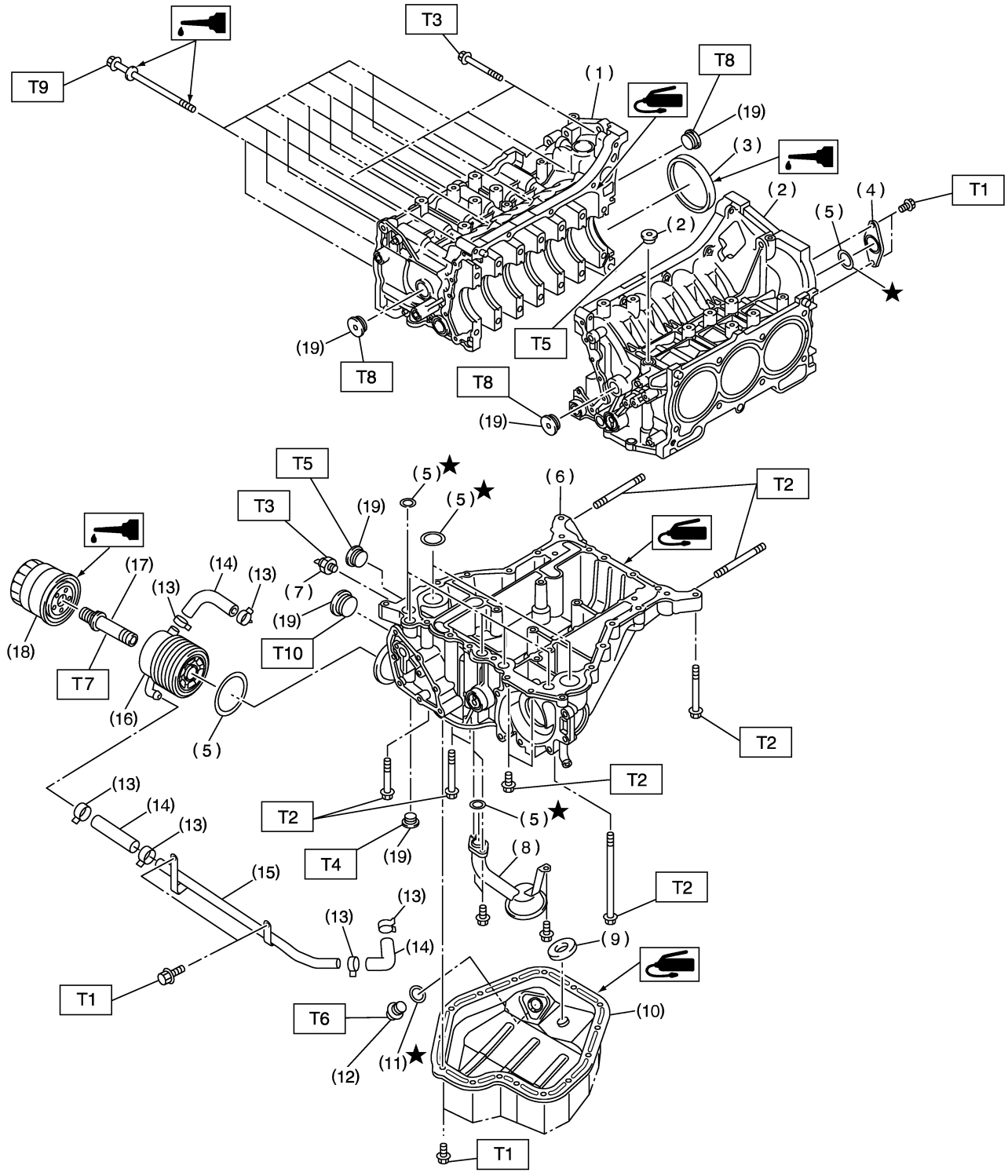
Tightening torque: N·m (kgf-m, ft-lb)
T1: Ref. to ME(H6)-58, Cylinder Head Assembly.
T2: Ref. to ME(H6)-54, Camshaft.
T3: 9.8 (1.0, 7.2)
T4: 16 (1.6, 12)
T5: 59 (6.0, 43)

5. CYLINDER HEAD AND VALVE ASSEMBLY S143001A0504



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

6. CYLINDER BLOCK S143001A0505

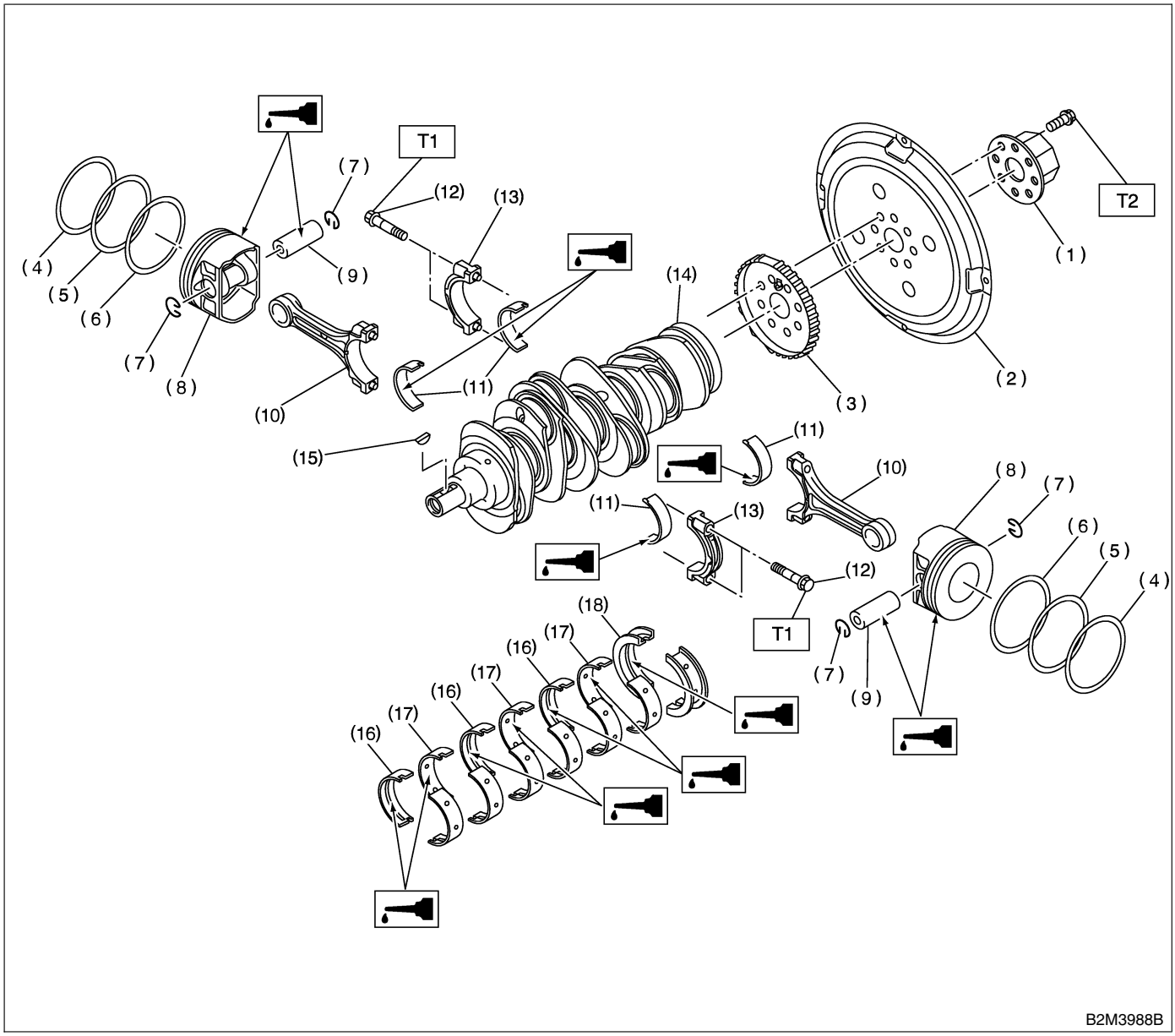


B2M3987A

(1) Cylinder block (RH)
(2) Cylinder block (LH)
(3) Rear oil seal
(4) Service hole cover
(5) O-ring
(6) Oil pan upper
(7) Oil pressure switch
(8) Oil strainer
(9) Magnet
(10) Oil pan
(11) Metal gasket
(12) Drain plug
(13) Clamp
(14) Hose
(15) Oil cooler pipe
(16) Oil cooler
(17) Connector
(18) Oil filter
(19) Plug

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.65, 4.7)
T2: 18 (1.8, 13.0)
T3: 25 (2.5, 18)
T4: 34 (3.5, 25)
T5: 37 (3.8, 27)
T6: 44 (4.5, 33)
T7: 54 (5.5, 40)
T8: 69 (7.0, 51)
T9: Ref. to ME(H6)-64, Cylinder Block.
T10: 90 (9.2, 67)

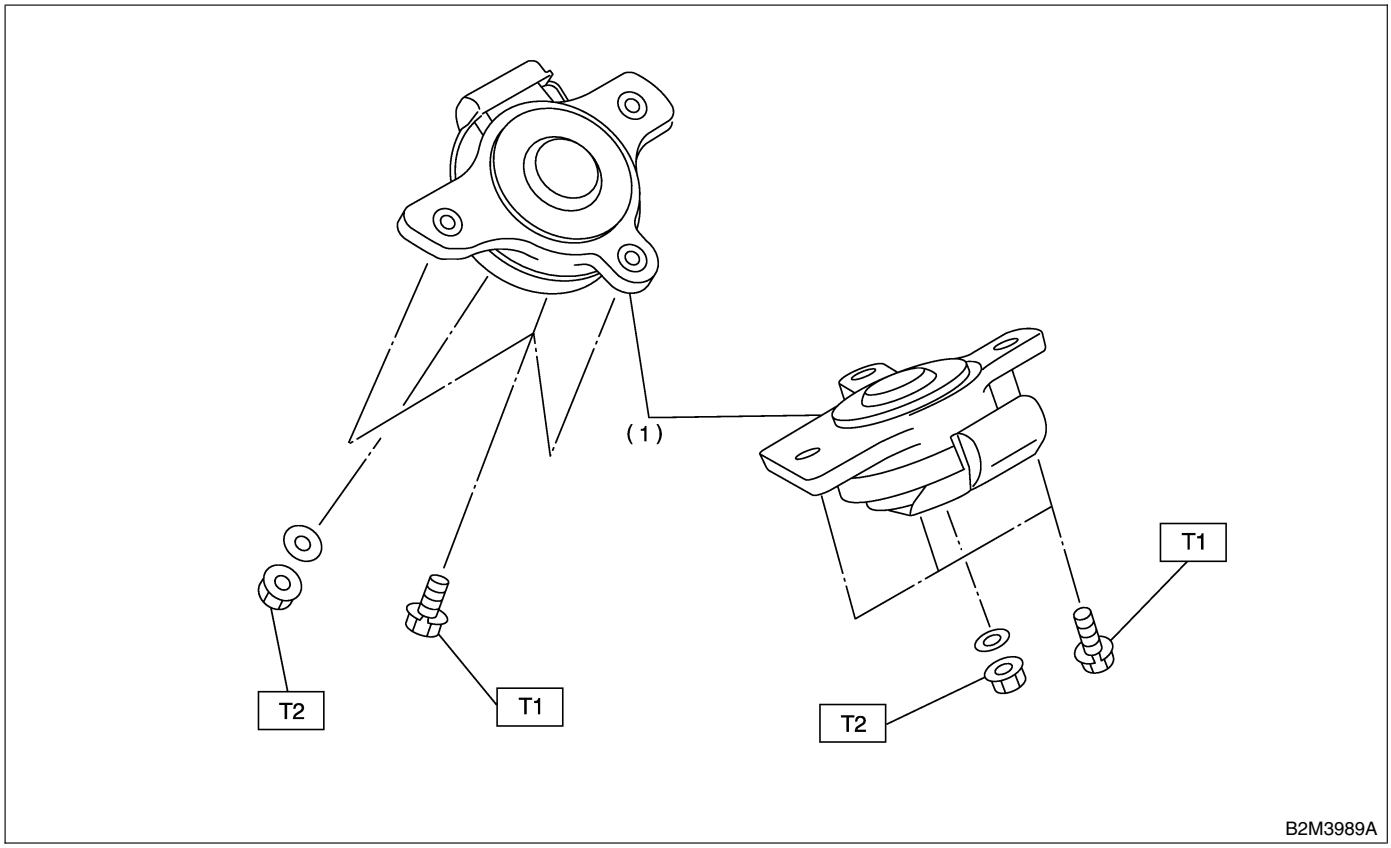
7. CRANKSHAFT AND PISTON S143001A0506



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

Tightening torque: N·m (kgf-m, ft-lb)
T1: 53 (5.4, 39)
T2: 81 (8.3, 60)

8. ENGINE MOUNTING S143001A0507



(1) Front cushion rubber

Tightening torque: N·m (kgf-m, ft-lb)
T1: 34 (3.5, 25.3)
T2: 74 (7.5, 54)

C: CAUTION S143001A03

- 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 safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect negative terminal 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 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 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 S143001A17

1. SPECIAL TOOLS S143001A1701

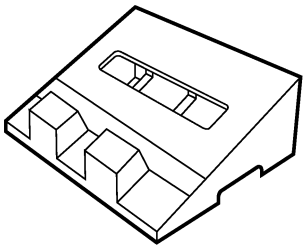
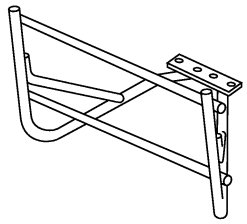
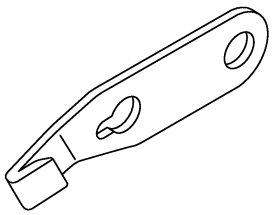
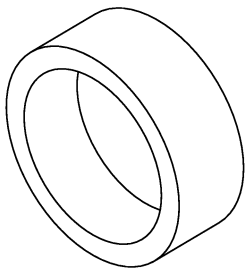
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3990	18250AA000 (Newly adopted tool)	CYLINDER HEAD TABLE	• Used for replacing valve guides. • Used for removing and installing valve springs.
 B2M3991	18232AA000 (Newly adopted tool)	ENGINE STAND	Used for engine disassembly and assembly.
 B2M3853	498497100	CRANKSHAFT STOPPER	Used for stopping rotation of flywheel when loosening and tightening crankshaft pulley bolt, etc.
 B2M3854	18254AA000 (Newly adopted tool)	PISTON GUIDE	Used for installing piston in cylinder.

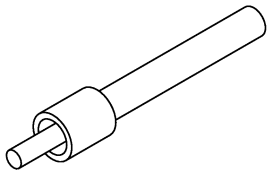
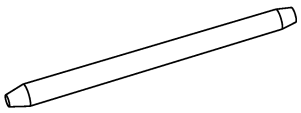
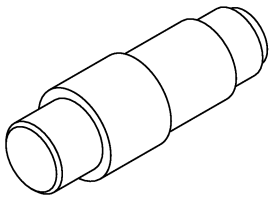
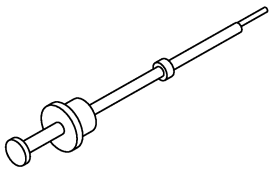
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3855	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.
 B2M3993	18253AA000 (Newly adopted tool)	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
 B2M3857	18350AA000 (Newly adopted tool)	CONNECTING ROD BUSHING REMOVER & INSTALLER	Used for removing and installing connecting rod bushing.
 B2M3858	499097500	PISTON PIN REMOVER ASSY	Used for removing piston pin.

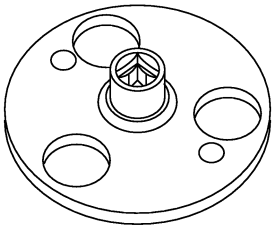
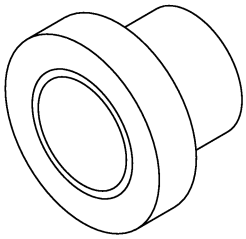
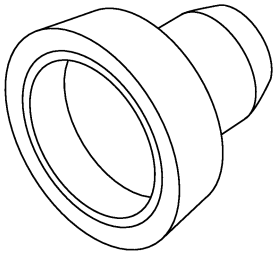
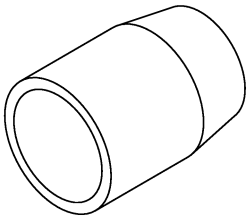
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3995	18231AA000 (Newly adopted tool)	CAMSHAFT SPROCKET WRENCH	Used for removing and installing camshaft sprocket.
 B2M3860	499587700	CAMSHAFT OIL SEAL INSTALLER	Used for installing cylinder head plug.
 B2M3861	499587200	CRANKSHAFT OIL SEAL INSTALLER	• Used for installing crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL GUIDE (499597100).
 B2M3862	499597000	OIL SEAL GUIDE	• Used for installing camshaft oil seal. • Used with CAMSHAFT OIL SEAL INSTALLER (499587100).

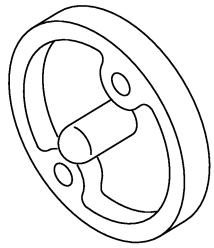
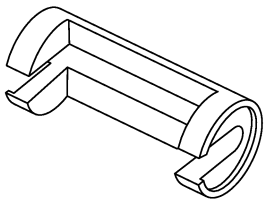
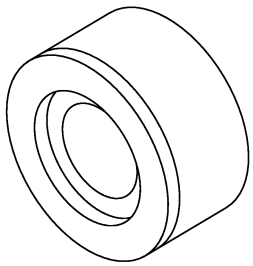
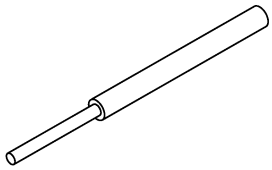
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3863	499597100	CRANKSHAFT OIL SEAL GUIDE	• Used for installing crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL INSTALLER (499587200).
 B2M3864	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.
 B2M3865	18251AA000 (Newly adopted tool)	VALVE GUIDE ADJUSTER	Used for installing valve guides.
 B2M3867	499765700	VALVE GUIDE REMOVER	Used for removing valve guides.

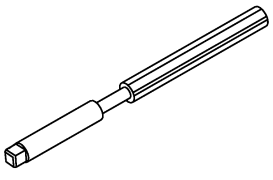
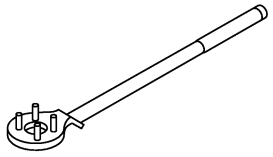
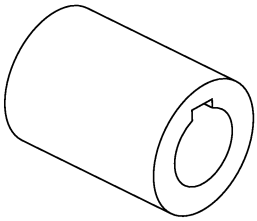
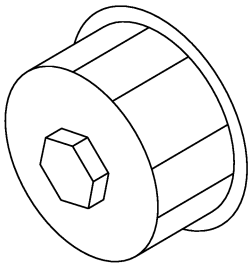
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3868	499765900	VALVE GUIDE REAMER	Used for reaming valve guides.
 B2M3870	499977100	CRANK PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolts.
 B2M3871	18252AA000 (Newly adopted tool)	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 B2M3872	498547000	OIL FILTER WRENCH	Used for removing and installing oil filter.

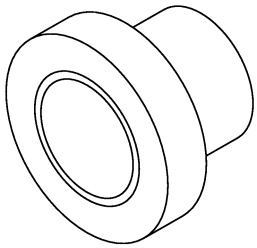
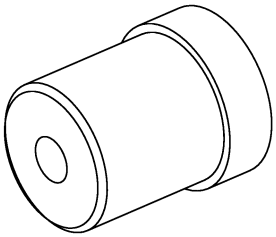
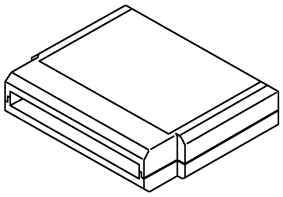
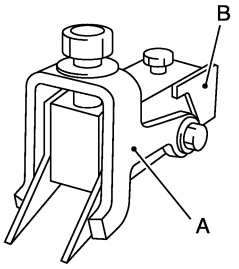
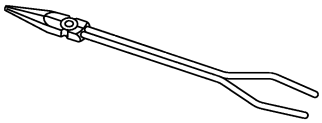
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3874	499587500	OIL SEAL INSTALLER	Used for installing front camshaft oil seal.
 B2M3875	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.
 B2M3876	24082AA130 (Newly adopted tool)	CARTRIDGE	Troubleshooting for electrical systems.
 B2M3877	22771AA0202	SELECT MONITOR KIT	Troubleshooting for electrical systems. • English: 22771AA020 (With printer) 22771AA030 (Without printer) • German: (Without printer) • French: (Without printer) • Spanish: (Without printer)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3992A	18329AA000 (Newly adopted tool)	SHIM REPLACER ASSY	Used for correct valve clearance.
	A: 18330AA010 (Newly adopted tool)	LIFTER	If 498187200 SHIM REPLACER ASSY (H4) tool is available, it is commonly used for H6 by partially replacing the following parts: • LIFTER (H4) → LIFTER (H6) A: 18330AA010 • SLIDER (H4) → SLIDER (H6) B: 18351AA000
	B: 18351AA000 (Newly adopted tool)	SLIDER	
 B2M3994	18233AA000 (Newly adopted tool)	PISTON PIN CIRCLIP PLIERS	Used for removing piston pin circlip.

2. GENERAL PURPOSE TOOLS S143001A1702

TOOL NAME	REMARKS
Compression gauge	Used for measuring compression.

E: PROCEDURE S143001E45

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.

- Camshaft
- Cylinder Head

2. Compression S143081

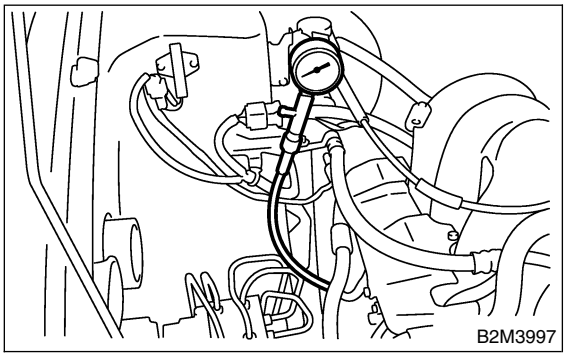
A: INSPECTION S143081A10

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

1) After warming-up the engine, turn ignition switch to OFF.
2) Make sure that the battery is fully charged.
3) Release fuel pressure. <Ref. to FU(H6)-49, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
4) Remove all the spark plugs. <Ref. to IG(H6)-4, REMOVAL, Spark Plug.>
5) Fully open throttle valve.
6) Check the starter motor for satisfactory performance and operation.
7) Hold the compression gauge tight against the spark plug hole.

CAUTION:
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 the starter motor, and read the maximum value on the gauge when the pointer is steady.



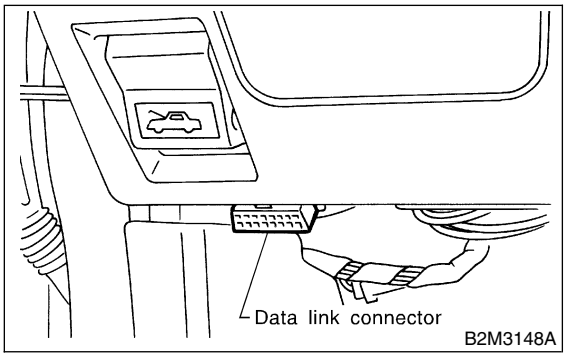
9) Perform at least two measurements per cylinder, and make sure that the values are correct.

Compression (350 rpm and fully open throttle):
Standard;
1,275 — 1,471 kPa (13.0 — 15.0 kg/cm^2, 185 — 213 psi)
Limit;
1,128 kPa (11.5 kg/cm^2, 164 psi)

3. Idle Speed S143082

A: INSPECTION S143082A10

1) Before checking idle speed, check the following:
(1) Ensure that air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and that hoses are connected properly.
(2) Ensure that malfunction indicator light (CHECK ENGINE light) does not illuminate.
2) Warm-up the engine.
3) Stop the engine, and turn ignition switch to OFF.
4) When using SUBARU SELECT MONITOR <Ref. to ME(H6)-16, SPECIAL TOOLS, PREPARATION TOOL, General Description.>
(1) Insert the cartridge to SUBARU SELECT MONITOR.
(2) Connect SUBARU SELECT MONITOR to the data link connector.



(3) Turn ignition switch to ON, and SUBARU SELECT MONITOR switch to ON.
(4) Select {2. Each System Check} in Main Menu.
(5) Select {Engine Control System} in Selection Menu.
(6) Select {1. Current Data Display & Save} in Engine Control System Diagnosis.
(7) Select {1.12 Data Display} in Data Display Menu.
(8) Start the engine, and read 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.

5) Check 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 position):
600±50 rpm

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

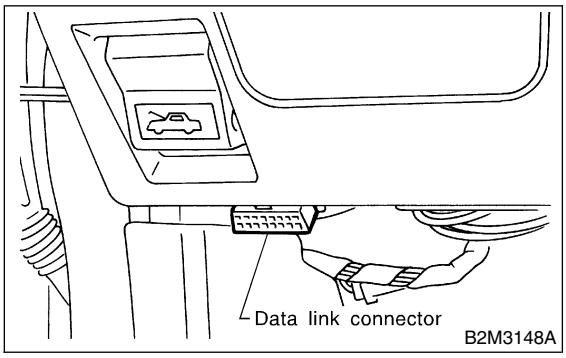
Idle speed [A/C "ON", no load and gears in N or P position]:
700±50 rpm

CAUTION:
Never rotate idle adjusting screw. If idle speed is out of specifications, refer to General On-board Diagnosis Table under "Engine Control System". <Ref. to EN(H6)-2, Basic Diagnostic Procedure.>

4. Ignition Timing S143086

A: INSPECTION S143086A10

1) Before checking ignition timing, check the following:
   (1) Ensure that air cleaner element is free from clogging, spark plugs are in good condition, and that hoses are connected properly.
   (2) Ensure that malfunction indicator light (CHECK ENGINE light) does not illuminate.
2) Warm-up the engine.
3) Stop the engine, and turn ignition switch to OFF.
4) When using SUBARU SELECT MONITOR <Ref. to ME(H6)-16, SPECIAL TOOLS, PREPARATION TOOL, General Description.>
   (1) Insert the cartridge to SUBARU SELECT MONITOR.
   (2) Connect SUBARU SELECT MONITOR to the data link connector.



   (3) Turn ignition switch to ON, and SUBARU SELECT MONITOR switch to ON.
   (4) Select {2. Each System Check} in Main Menu.
   (5) Select {Engine Control System} in Selection Menu.
   (6) Select {1. Current Data Display & Save} in Engine Control System Diagnosis.
   (7) Select {1.12 Data Display} in Data Display Menu.
   (8) Start engine at idle speed and check the ignition timing.

Ignition timing [BTDC/rpm]:
10°±3°/600

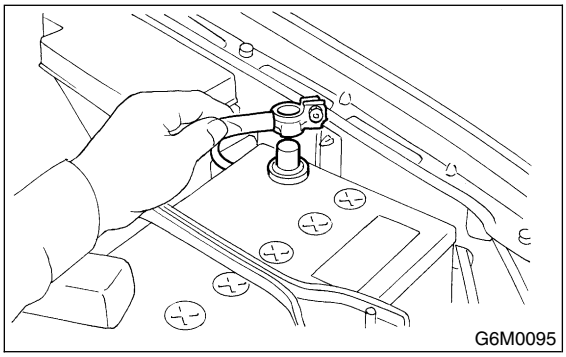
If the timing is not correct, check the ignition control system.
Refer to EN(H6) Engine Control System. <Ref. to EN(H6)-2, Basic Diagnostic Procedure.>

5. Valve Clearance S143083

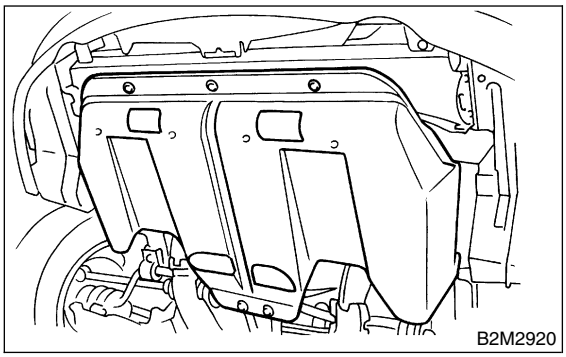
A: INSPECTION S143083A10

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

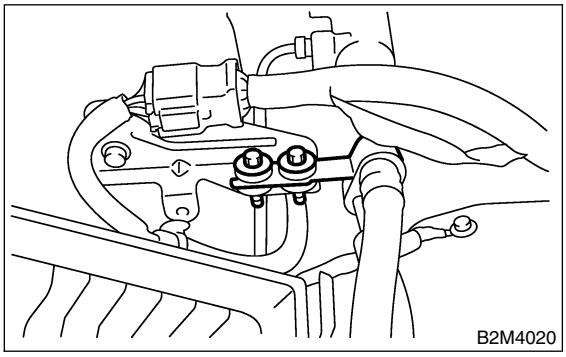
1) Set the vehicle on the lift.
2) Disconnect battery ground cable.


G6M0095

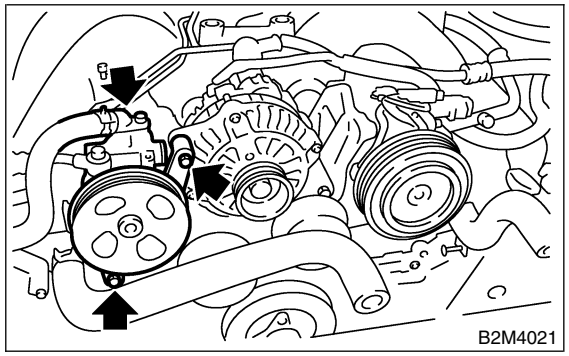
3) Lift up the vehicle.
4) Remove under cover.


B2M2920

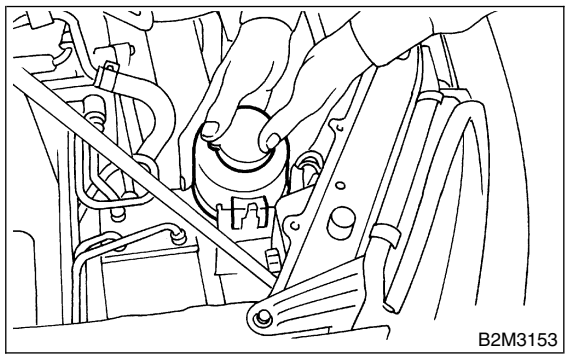
5) Lower the vehicle.
6) Place suitable container under the vehicle.
7) When inspecting RH side cylinder.
   (1) Remove air intake duct and air cleaner case. <Ref. to IN(H6)-7, REMOVAL, Air Intake Duct.> and <Ref. to IN(H6)-5, REMOVAL, Air Cleaner.>
   (2) Remove V-belt. <Ref. to ME(H6)-31, REMOVAL, V-belt.>
   (3) Remove power steering hose from bracket.


B2M4020

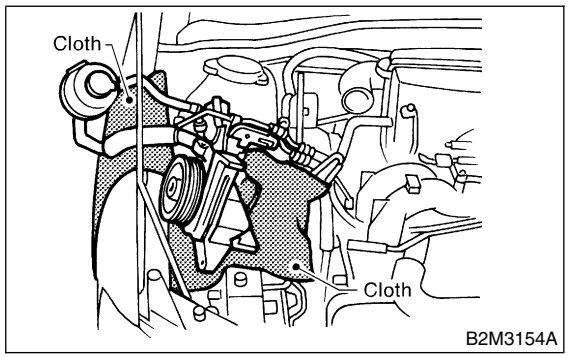
(4) Remove bolts which install power steering pump bracket.


B2M4021

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

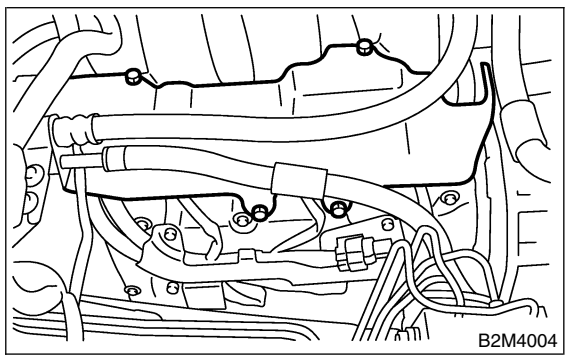

B2M3153

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

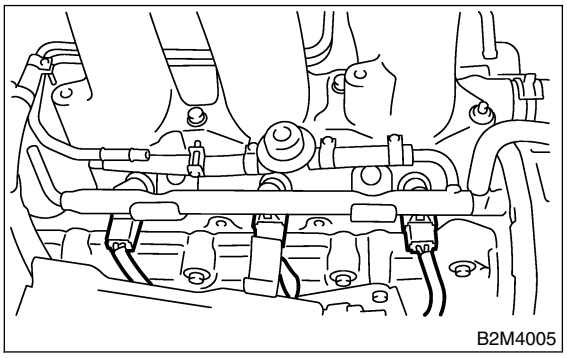


B2M3154A

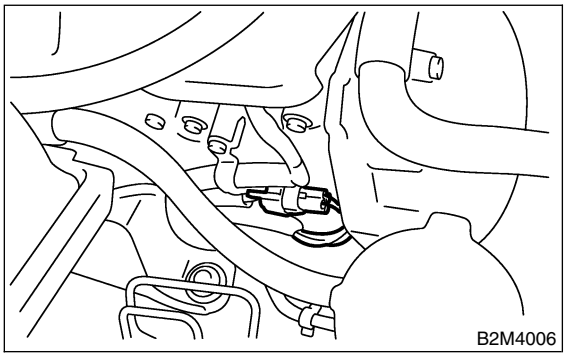
(7) Remove fuel pipe protector RH.


B2M4004

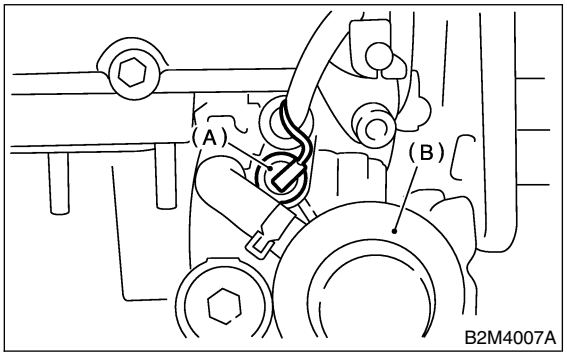
(8) Disconnect fuel injector connectors.



(9) Disconnect front oxygen (A/F) sensor connector.



(10) Disconnect oil pressure switch connector.

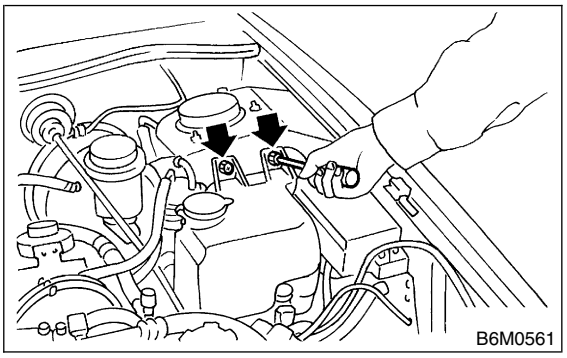


(A) Oil pressure switch
(B) Oil filter

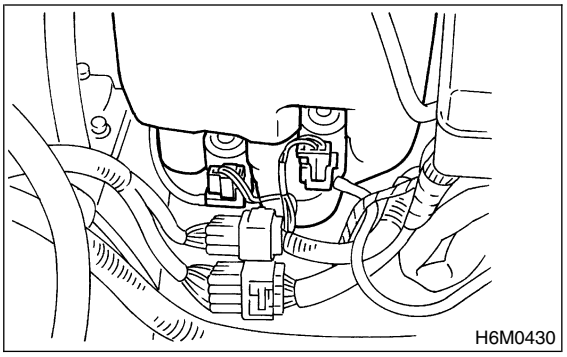
(11) Remove ignition coils. <Ref. to IG(H6)-7, REMOVAL, Ignition Coil and Ignitor Assembly.>
(12) Remove rocker cover RH. <Ref. to ME(H6)-54, REMOVAL, Camshaft.>

8) When inspecting LH side cylinder.
(1) Set the vehicle on the lift.
(2) Remove battery.

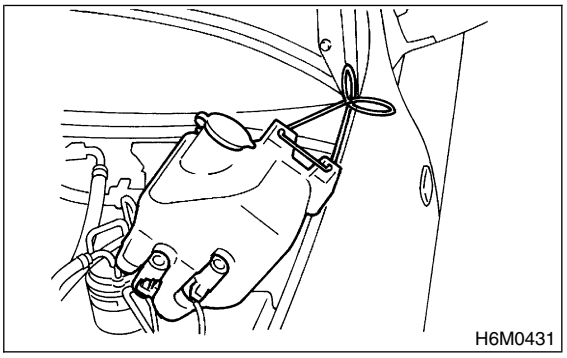
(3) Remove washer tank mounting bolts.



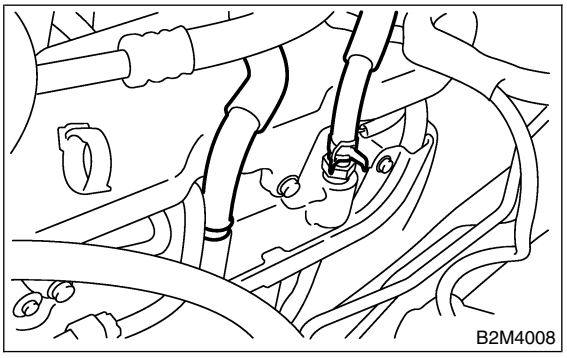
(4) Disconnect washer motor connectors.



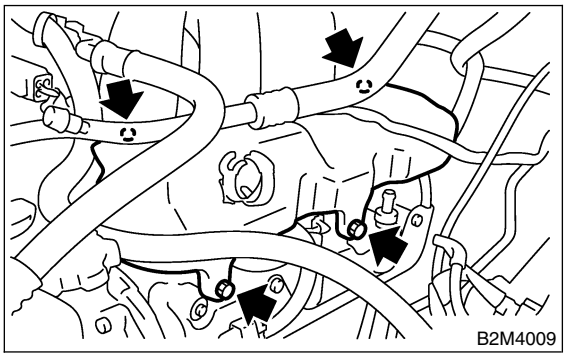
(5) Move washer tank upward.



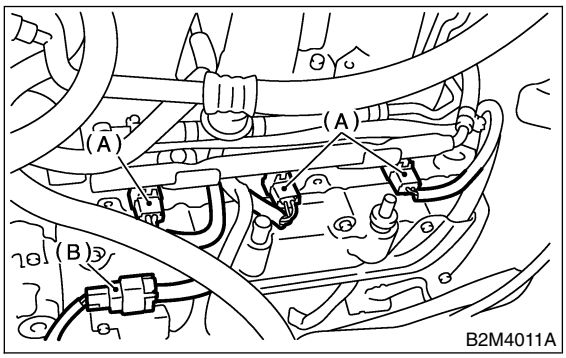
(6) Disconnect PCV and blow-by hose from rocker cover LH.



(7) Remove fuel pipe protector LH.



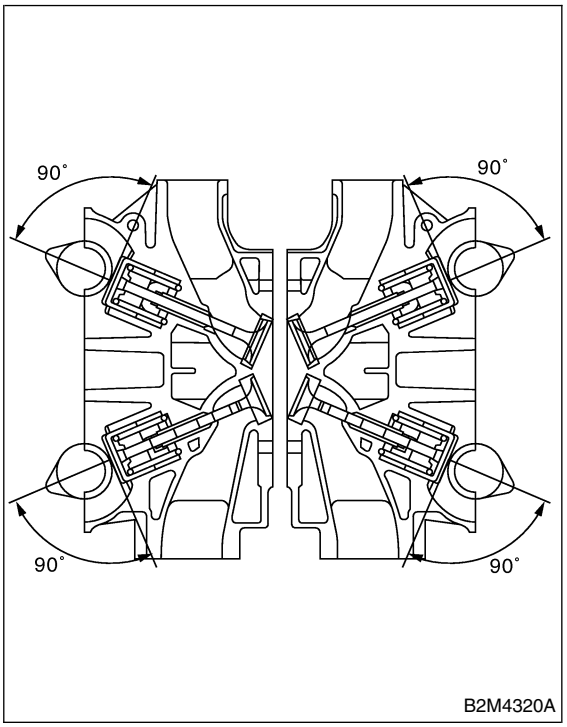
(8) Disconnect fuel injector connectors. (A)
(9) Disconnect front oxygen (A/F) sensor connector. (B)



(10) Remove ignition coils. <Ref. to IG(H6)-7, REMOVAL, Ignition Coil and Ignitor Assembly.>
(11) Remove rocker cover LH. <Ref. to ME(H6)-54, REMOVAL, Camshaft.>

9) Using the ST, turn the crankshaft clockwise. Adjust the camshaft position so that the cam lobe is perpendicular to the shim as shown in the figure.

ST 18252AA000 CRANKSHAFT SOCKET

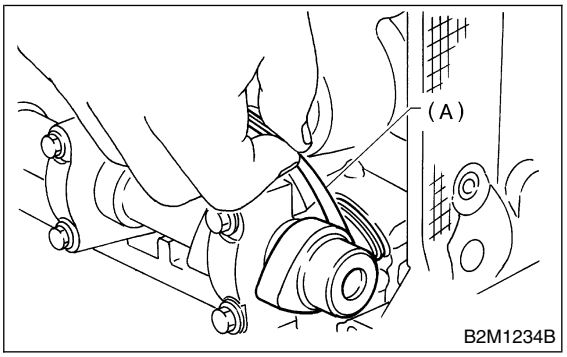


10) Measure intake valve and exhaust valve clearances by using thickness gauge (A).

CAUTION:
Insert the thickness gauge in as horizontal a direction as possible with respect to the shim.

Valve clearance:
Intake: $0.20^{+0.04}_{-0.06}$ mm ($0.0079^{+0.0016}_{-0.0024}$ in)
Exhaust: 0.25±0.05 mm (0.0098±0.0020 in)

NOTE:
If the measured value is not within specification, take notes of the value in order to adjust the valve clearance later on.



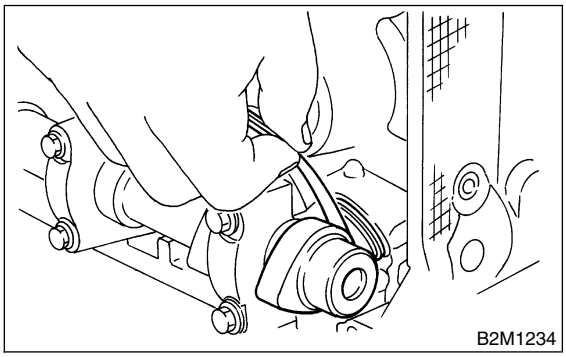
11) If necessary, adjust the valve clearance. <Ref. to ME(H6)-29, ADJUSTMENT, Valve Clearance.>
12) Further turn crankshaft pulley clockwise. Using the same procedure described previously, then measure valve clearances again.
13) After inspection, install the related parts in the reverse order of removal.

B: ADJUSTMENT S143083A01

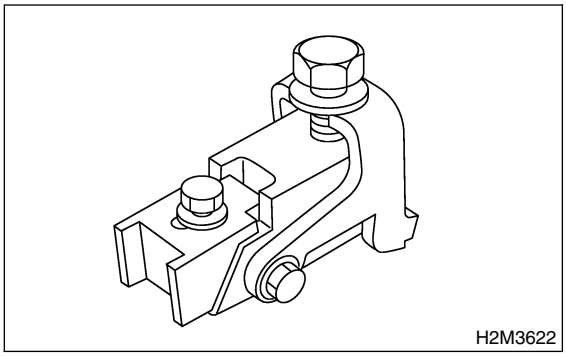
CAUTION:
Adjustment of valve clearance should be performed while engine is cold.

1) Measure all valve clearances. <Ref. to ME(H6)-26, INSPECTION, Valve Clearance.>

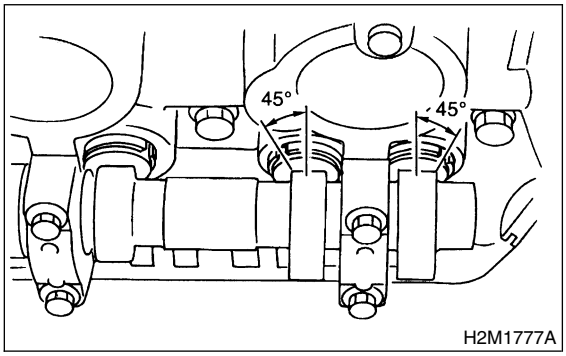
NOTE:
Record each valve clearance after it has been measured.


B2M1234

2) Remove shim from valve lifter.
(1) Prepare the ST.
ST 18329AA000 SHIM REPLACER
<Ref. to ME(H6)-16, PREPARATION TOOL, General Description.>

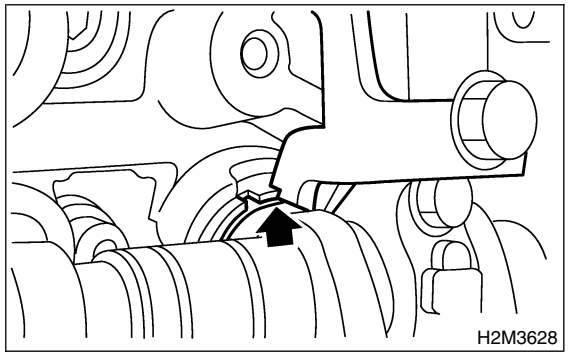

H2M3622

(2) Rotate the notch of the valve lifter outward by 45°.



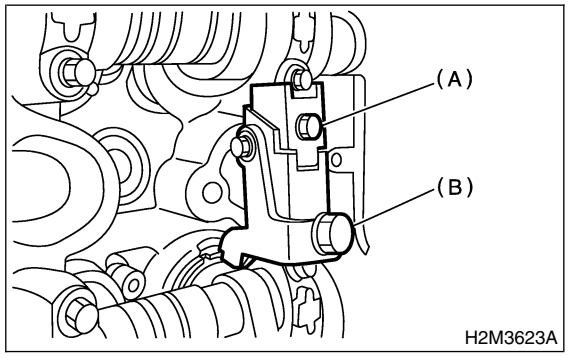
H2M1777A

(3) Adjust SHIM REPLACER notch to valve lifter and set it.


H2M3628

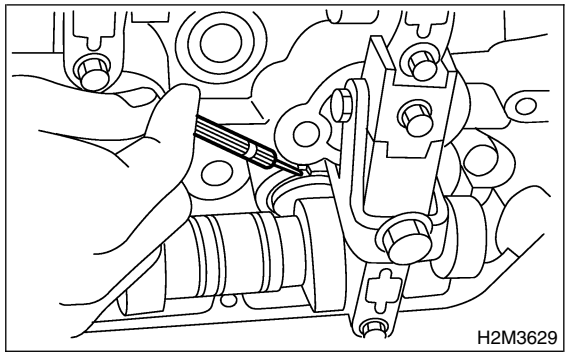
NOTE:
When setting, be careful SHIM REPLACER edge does not touch shim.

(4) Tighten bolt (A) and install it to the cylinder head.
(5) Tighten bolt (B) and insert the valve lifter.

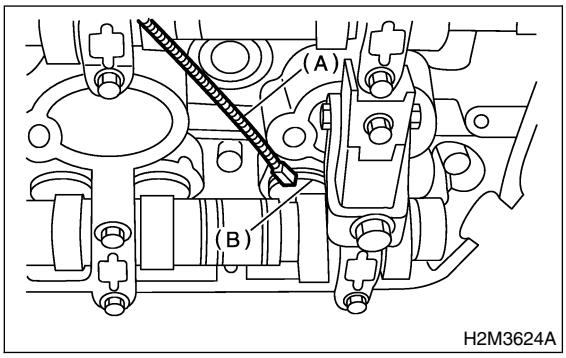


H2M3623A

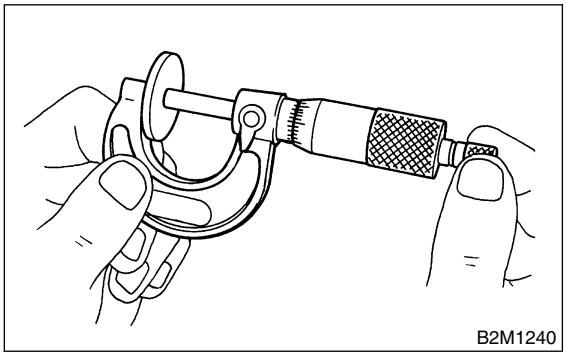
(6) Insert tweezers into the notch of the valve lifter, and take the shim out.


H2M3629

NOTE:
By using a magnet (A), the shim (B) can be taken out without dropping it.



3) Measure thickness of shim with micrometer.



4) Select a shim of suitable thickness using measured valve clearance and shim thickness, by referring to the following table.
5) Set suitable shim selected in step 4) to valve lifter.

Unit: mm
Intake valve: S = (V + T) – 0.20 Exhaust valve: S = (V + T) – 0.25
S: Shim thickness to be used V: Measured valve clearance T: Shim thickness required

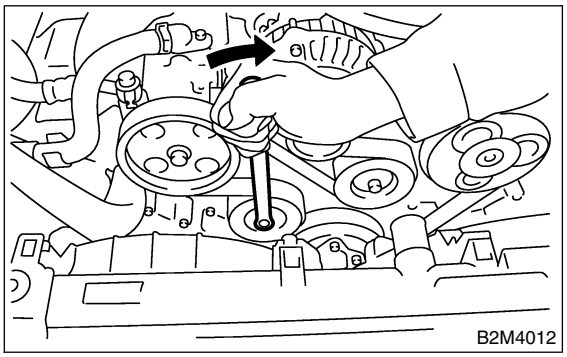
Part No.	Thickness mm (in)
13218 AK010	2.00 (0.0787)
13218 AK020	2.02 (0.0795)
13218 AK030	2.04 (0.0803)
13218 AK040	2.06 (0.0811)
13218 AK050	2.08 (0.0819)
13218 AK060	2.10 (0.0827)
13218 AK070	2.12 (0.0835)
13218 AK080	2.14 (0.0843)
13218 AK090	2.16 (0.0850)
13218 AK100	2.18 (0.0858)
13218 AK110	2.20 (0.0866)
13218 AE710	2.22 (0.0874)
13218 AE730	2.24 (0.0882)
13218 AE750	2.26 (0.0890)
13218 AE770	2.28 (0.0898)
13218 AE790	2.30 (0.0906)
13218 AE810	2.32 (0.0913)
13218 AE830	2.34 (0.0921)
13218 AE850	2.36 (0.0929)
13218 AE870	2.38 (0.0937)
13218 AE890	2.40 (0.0945)
13218 AE910	2.42 (0.0953)
13218 AE920	2.43 (0.0957)
13218 AE930	2.44 (0.0961)
13218 AE940	2.45 (0.0965)
13218 AE950	2.46 (0.0969)
13218 AE960	2.47 (0.0972)
13218 AE970	2.48 (0.0976)
13218 AE980	2.49 (0.0980)
13218 AE990	2.50 (0.0984)
13218 AF000	2.51 (0.0988)
13218 AF010	2.52 (0.0992)
13218 AF020	2.53 (0.0996)
13218 AF030	2.54 (0.1000)
13218 AF040	2.55 (0.1004)
13218 AF050	2.56 (0.1008)
13218 AF060	2.57 (0.1012)
13218 AF070	2.58 (0.1016)
13218 AF090	2.60 (0.1024)
13218 AF110	2.62 (0.1031)
13218 AF130	2.64 (0.1039)
13218 AF150	2.66 (0.1047)
13218 AF170	2.68 (0.1055)
13218 AF190	2.70 (0.1063)

6) Inspect all valves for clearance again at this stage. If the valve clearance is not correct, repeat the procedure over again from the first step.
7) After inspection, install the related parts in the reverse order of removal.

6. V-belt S143080

A: REMOVAL S143080A18

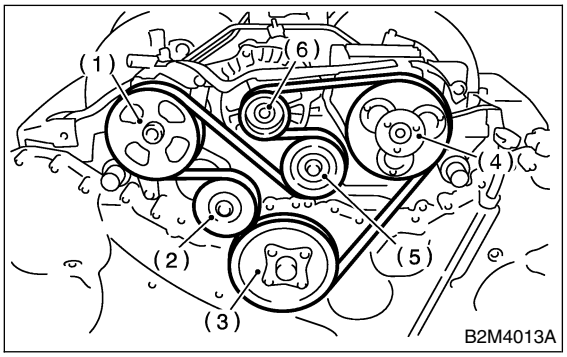
1) Fit the tool to the belt tensioner mounting bolt.
2) Turn the tool clockwise, and loosen the V-belt to remove.



3) Remove the V-belt cover.

B: INSTALLATION S143080A11

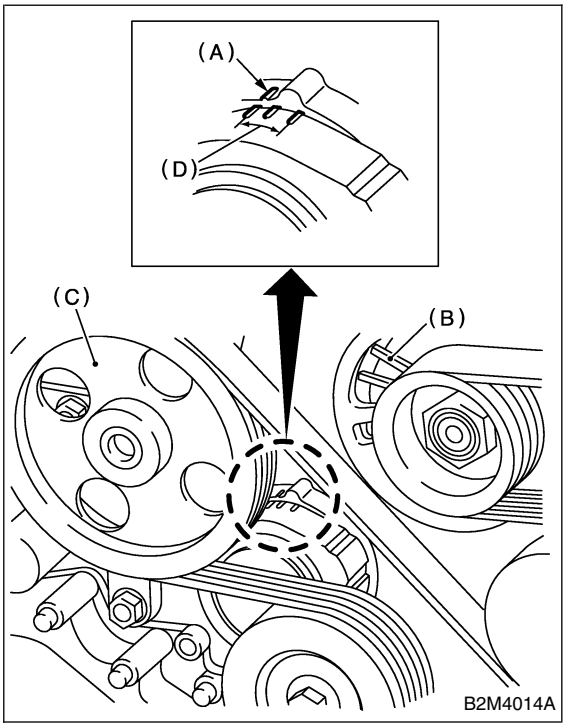
1) Install in the reverse order of removal.



(1) Power steering oil pump
(2) Belt tension adjuster
(3) Crankshaft pulley
(4) A/C compressor
(5) Belt idler
(6) Generator

C: INSPECTION S143080A10

1) Replace belts, if cracks, fraying or wear is found.
2) Check that the V-belt automatic tensioner indicator is within the range (D).

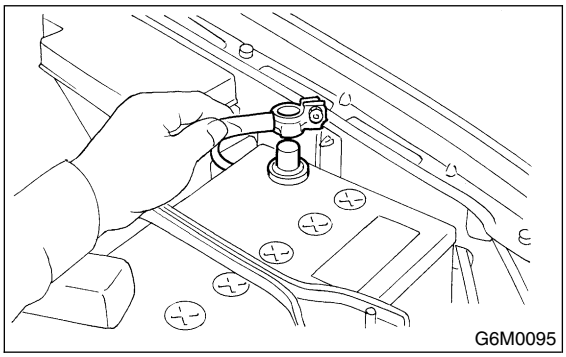


(A) Indicator
(B) Generator
(C) Power steering oil pump
(D) Service limit

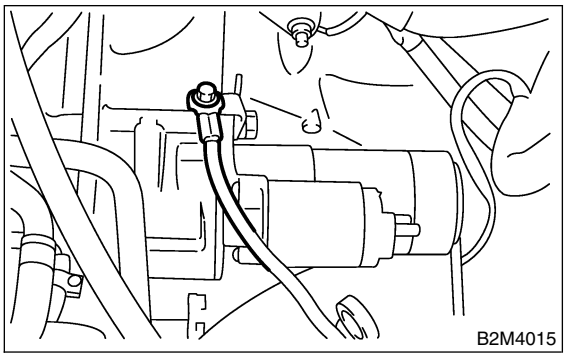
7. Engine Assembly S143079

A: REMOVAL S143079A18

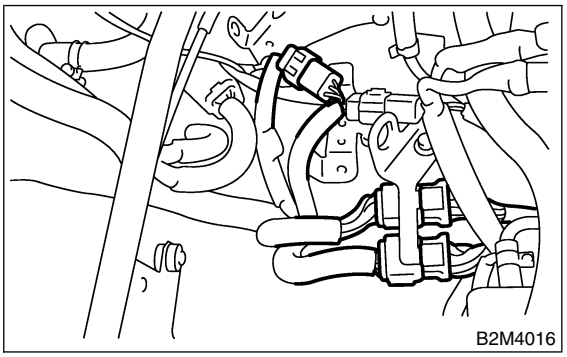
1) Set the vehicle on lift arms.
2) Open front hood fully and support with stay.
3) Raise rear seat, and turn floor mat up.
4) Release fuel pressure. <Ref. to FU(H6)-49, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
5) Remove filler cap.
6) Disconnect battery ground terminal.


G6M0095

7) Remove air intake duct, air cleaner case and air intake chamber.
<Ref. to IN(H6)-7, REMOVAL, Air Intake Duct.>, <Ref. to IN(H6)-6, REMOVAL, Air Intake Chamber.> and <Ref. to IN(H6)-5, REMOVAL, Air Cleaner.>
8) Lift up the vehicle.
9) Remove under cover.
10) Remove radiator from vehicle. <Ref. to CO(H6)-23, REMOVAL, Radiator.>
11) Remove V-belt. <Ref. to ME(H6)-31, REMOVAL, V-belt.>
12) Disconnect A/C pressure hoses from A/C compressor. <Ref. to AC-42, REMOVAL, Flexible Hose.>
13) Disconnect the following connectors and cables.
(1) Engine ground terminal


B2M4015

(2) Engine harness connectors

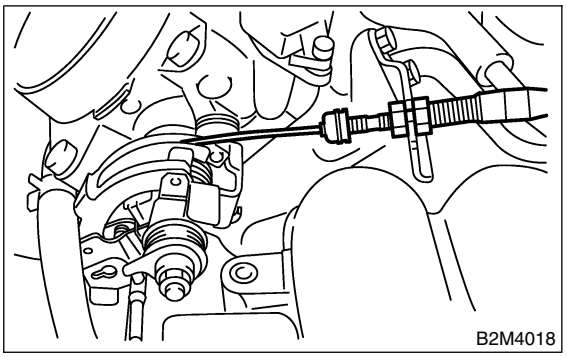

B2M4016

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

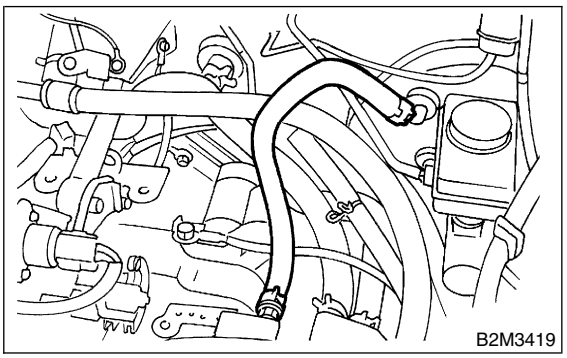
B2M4017A

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

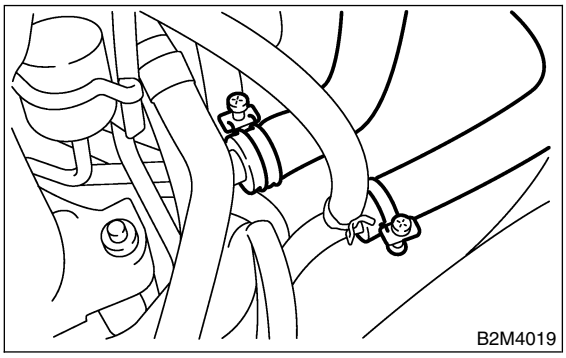
(4) Accelerator cable


B2M4018

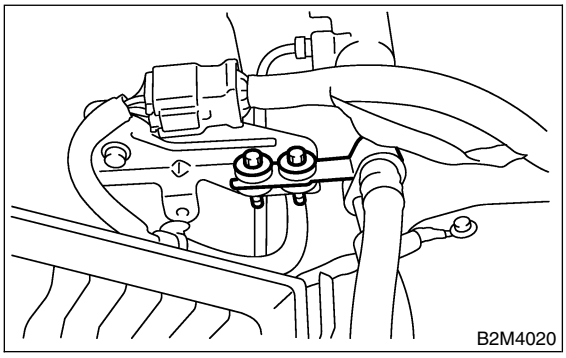
14) Disconnect the following hoses.
(1) Brake booster vacuum hose


B2M3419

(2) Heater inlet outlet hose

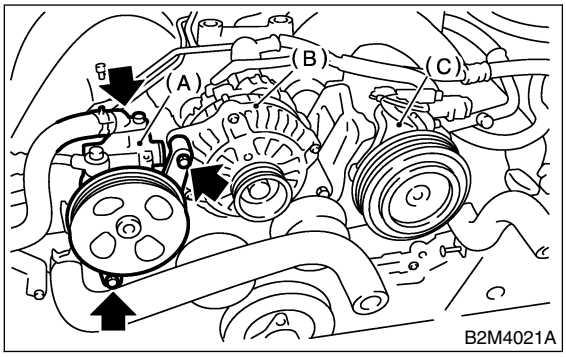


15) Remove power steering pump from bracket.
(1) Remove pipe with bracket.



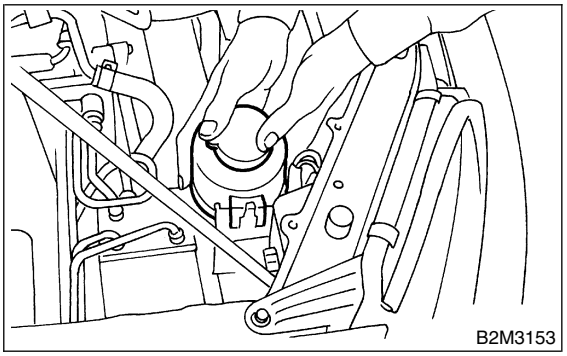
(2) Remove bolts which install power steering pump bracket.

CAUTION:
Do not separate the hose and the pipe from the pump body.

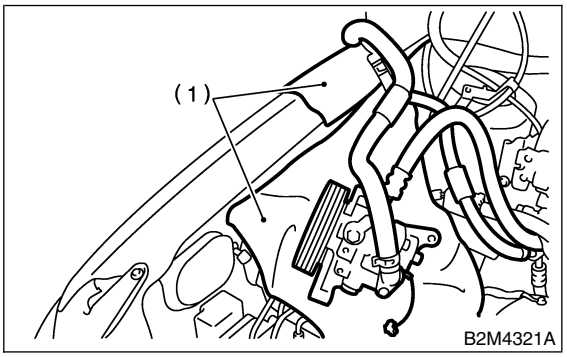


(A) Power steering pump
(B) Generator
(C) A/C compressor

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

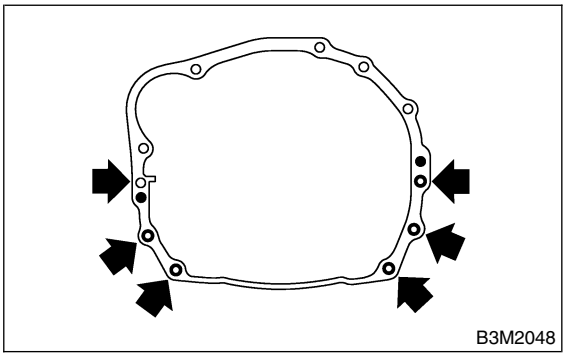


(4) Place power steering pump on the right side wheel apron.

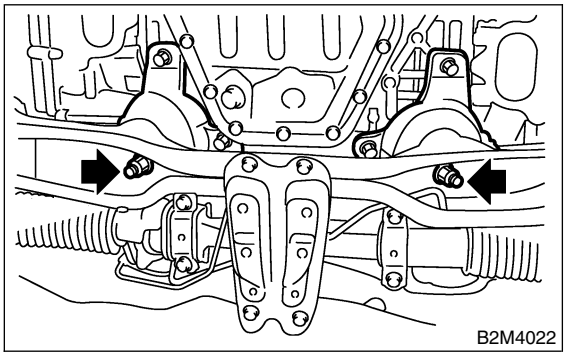


(1) Cloth

16) Remove front exhaust pipe.
<Ref. to EX(H6)-5, REMOVAL, Front Exhaust Pipe.>
17) Remove nuts which hold lower side of transmission to engine.



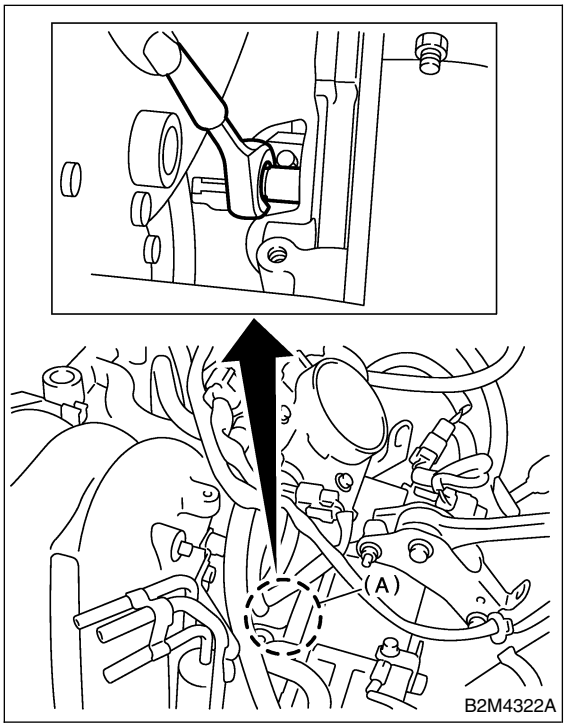
18) Remove nuts which install front cushion rubber onto front crossmember.



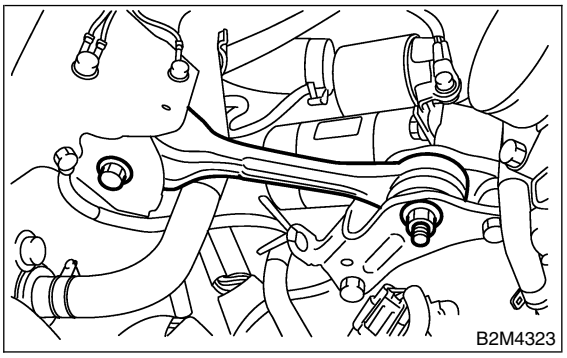
19) Separate torque converter clutch from drive plate.

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

ST 499977100 CRANK PULLEY WRENCH

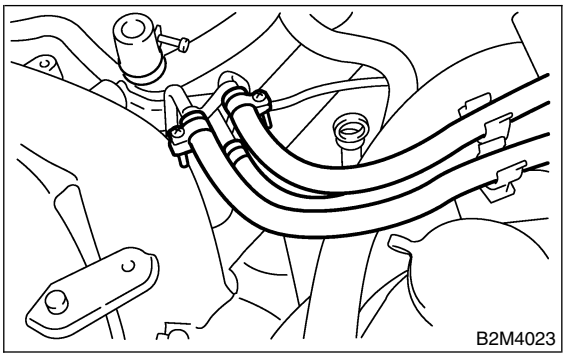


20) Remove pitching stopper.

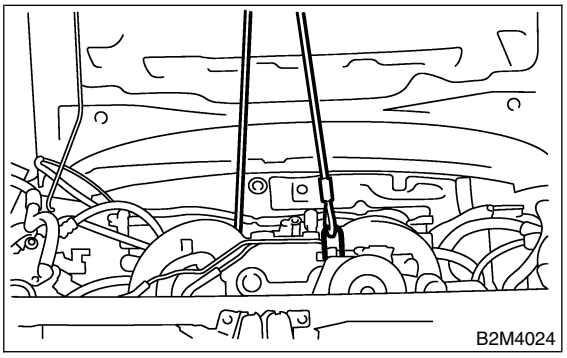


21) Disconnect fuel delivery hose, return hose and evaporation hose.

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

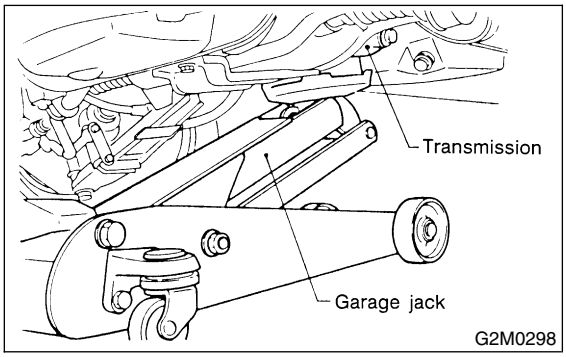


22) Support engine with a lifting device and wire ropes.

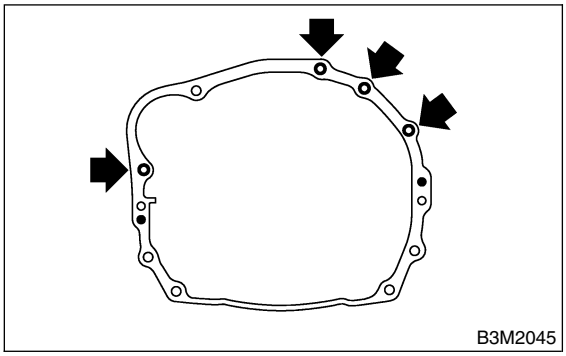


23) Support transmission with a garage jack.

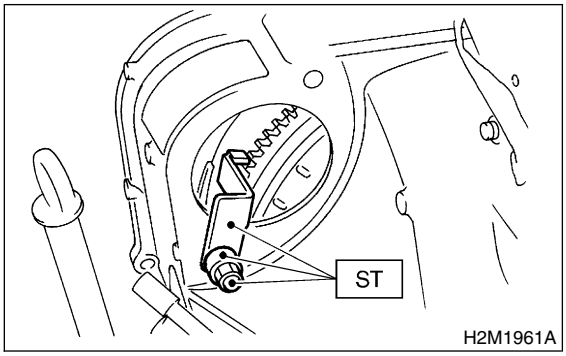
CAUTION:
Before moving engine away from transmission, check to be sure no work has been overlooked. Doing this is very important in order to facilitate re-installation and because transmission lowers under its own weight.



24) Separation of engine and transmission.
(1) Remove starter. <Ref. to SC(H6)-6, REMOVAL, Starter.>
(2) Remove bolts which hold upper side of transmission to engine.

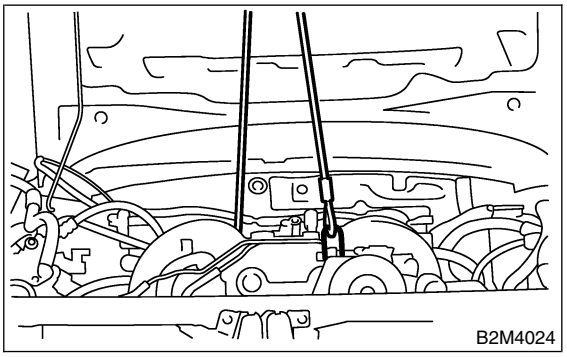


25) Install ST to torque converter clutch case.
ST 498277200 STOPPER SET



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

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



27) Remove front cushion rubbers.

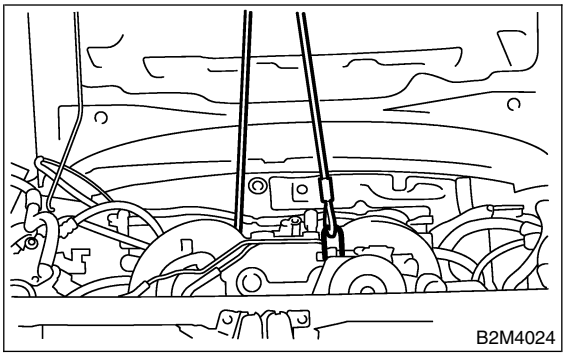
B: INSTALLATION S143079A11

1) Install front cushion rubbers.

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

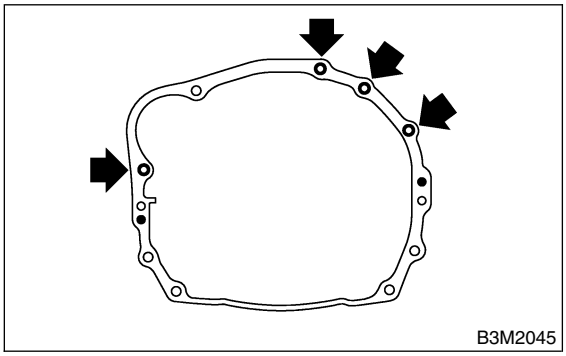
2) Position engine in engine compartment and align it with transmission.

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

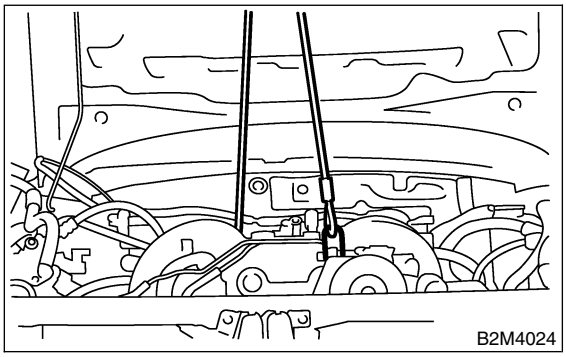


3) Tighten bolts which hold upper side of transmission to engine.

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

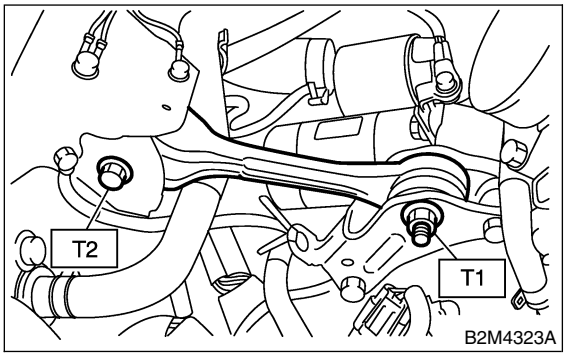


4) Remove lifting device and wire ropes.



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

Tightening torque:
T1: 49 N·m (5.0 kgf-m, 36.2 ft-lb)
T2: 57 N·m (5.8 kgf-m, 42 ft-lb)



7) Remove ST from torque converter clutch case.

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

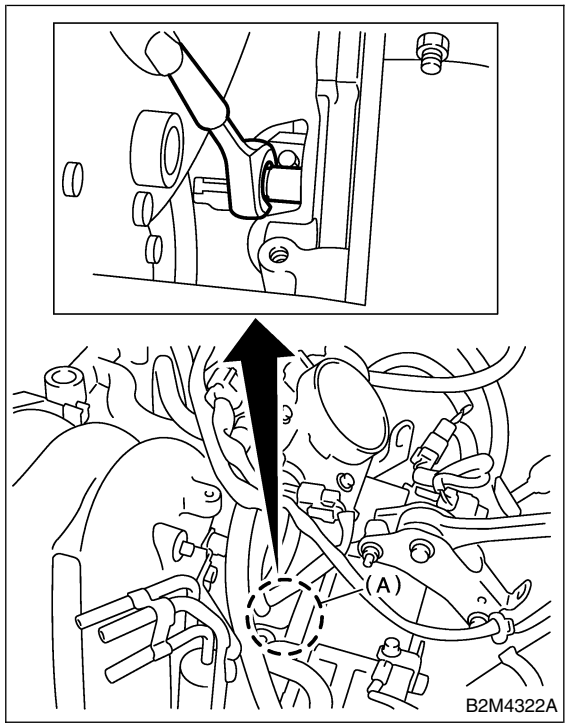
ST 498277200 STOPPER SET

8) Install starter. <Ref. to SC(H6)-6, INSTALLATION, Starter.>
9) Install torque converter clutch onto drive plate.
   (1) Tighten bolts which hold torque converter clutch to drive plate.
   (2) Tighten other bolts while rotating the engine by using ST.

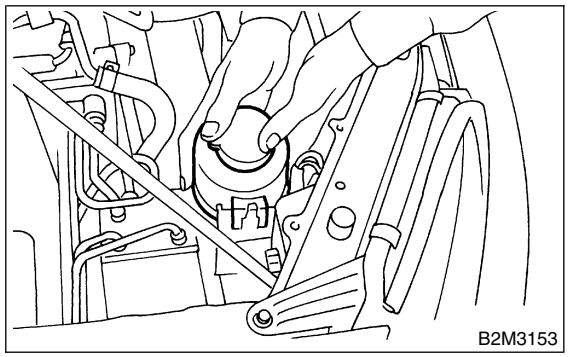
CAUTION:
Be careful not to drop bolts into torque converter clutch housing.

ST 499977100 CRANK PULLEY WRENCH

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

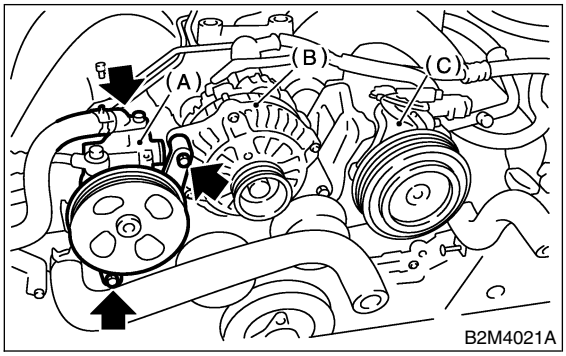


   (3) Clog plug (A) onto service hole.
10) Install power steering pump on bracket.
   (1) Install power steering tank on bracket.

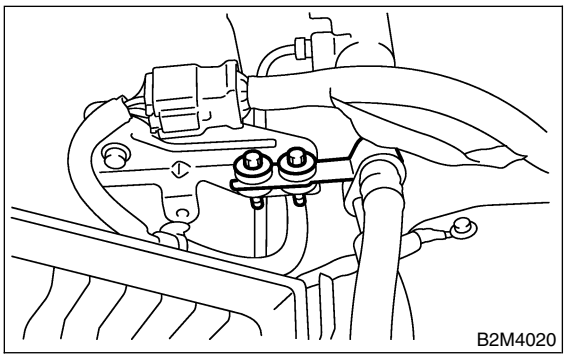


(2) Install power steering pump on bracket, and tighten bolts.

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

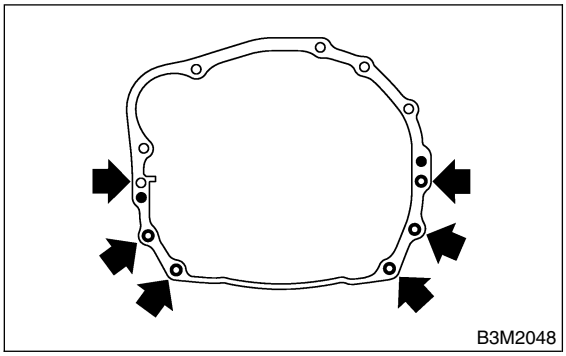


(3) Tighten bolt which installs power steering pipe bracket.



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

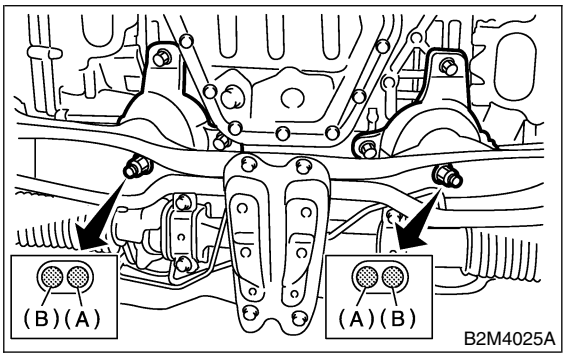
Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



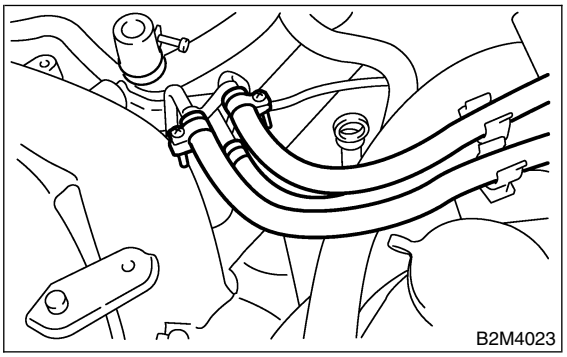
12) Tighten nuts which install front cushion rubber onto crossmember.

Tightening torque:
74 N·m (7.5 kgf-m, 54 ft-lb)

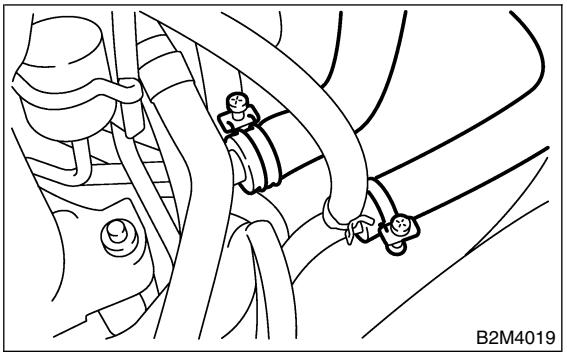
CAUTION:
Make sure the front cushion rubber mounting bolts (A) and locator (B) are securely installed.



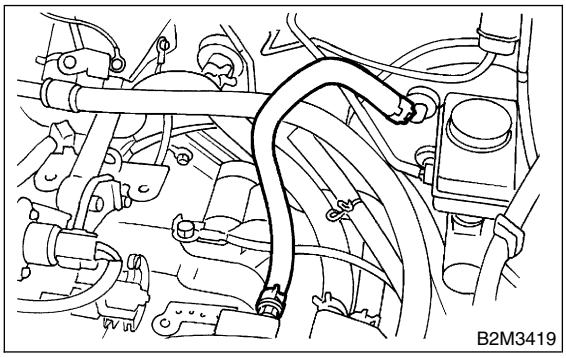
13) Install front exhaust pipe.
<Ref. to EX(H6)-6, INSTALLATION, Front Exhaust Pipe.>
14) Connect the following hoses.
(1) Fuel delivery hose, return hose and evaporation hose



(2) Heater inlet and outlet hoses

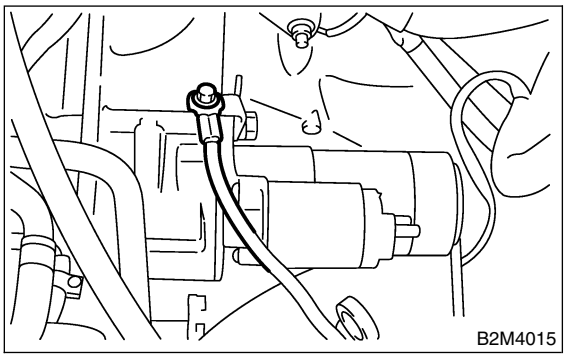


(3) Brake booster vacuum hose

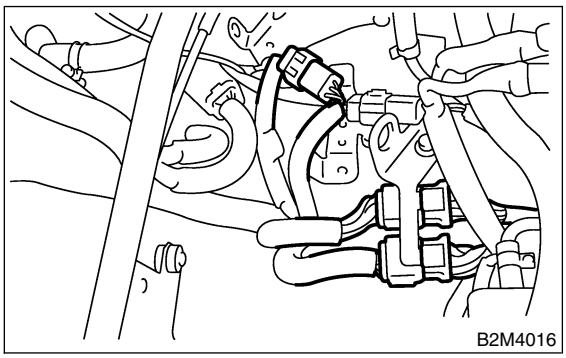


15) Connect the following connectors.
(1) Engine ground terminals

Tightening torque:
14 N·m (1.4 kgf-m, 10.1 ft-lb)

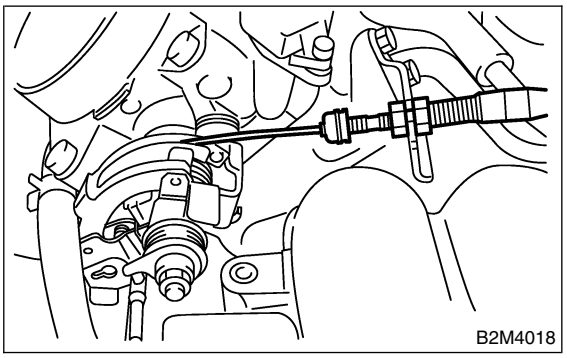


(2) Engine harness connectors



(3) Alternator connector and terminal (A)
(4) A/C compressor connectors (B)

16) Connect the following cables.
(1) Accelerator cable



CAUTION:
After connecting each cable, adjust them.

17) Install A/C pressure hoses.
<Ref. to AC-42, INSTALLATION, Flexible Hose.>
18) Install V-belt. <Ref. to ME(H6)-31, INSTALLATION, V-belt.>
19) Install radiator to vehicle. <Ref. to CO(H6)-24, INSTALLATION, Radiator.>
20) Install air intake duct, cleaner case and air intake chamber.
<Ref. to IN(H6)-2, General Description.>
21) Install under cover.
22) Install battery in the vehicle, and connect cables.
23) Fill coolant.
<Ref. to CO(H6)-18, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
24) Check ATF level and correct if necessary.
<Ref. to AT-9, Automatic Transmission Fluid.>
25) Charge A/C system with refrigerant.
<Ref. to AC-23, OPERATION, Refrigerant Charging Procedure.>
26) Remove front hood stay, and close front hood.
27) Take off the vehicle from lift arms.

C: INSPECTION *S143079A10*

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

8. Engine Mounting S143085

A: REMOVAL S143085A18

1) Remove engine assembly. <Ref. to ME(H6)-32, REMOVAL, Engine Assembly.>
2) Remove engine mounting from engine assembly.

B: INSTALLATION S143085A11

Install in the reverse order of removal.

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

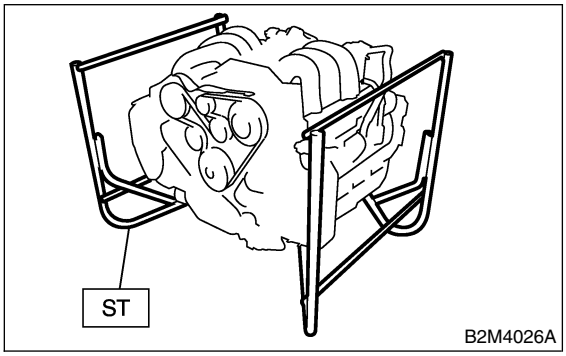
C: INSPECTION S143085A10

Make sure there are no cracks or other damage.

9. Preparation for Overhaul S143091

A: REMOVAL S143091A18

1) Remove engine from body. <Ref. to ME(H6)-32, REMOVAL, Engine Assembly.>
2) After removing engine from body, install ST onto engine.
ST 18232AA000 ENGINE STAND

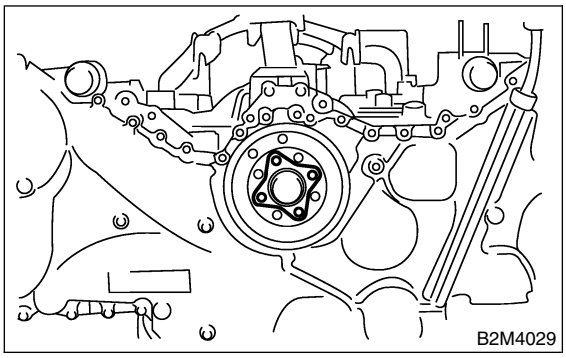


3) Remove sensors, pipes, and hoses installed on engine before starting overhaul.
(1) Remove intake manifold. <Ref. to FU(H6)-17, REMOVAL, Intake Manifold.>
(2) Remove generator. <Ref. to SC(H6)-11, REMOVAL, Generator.>
(3) Remove A/C compressor. <Ref. to AC-35, REMOVAL, Compressor.>
(4) Remove EGR pipe. <Ref. to EC(H6)-10, REMOVAL, EGR Valve.>
(5) Remove water pipe and hoses.
(6) Remove engine harness.
(7) Remove spark plugs. <Ref. to IG(H6)-4, REMOVAL, Spark Plug.>
(8) Remove camshaft position sensor. <Ref. to FU(H6)-31, REMOVAL, Camshaft Position Sensor.>
(9) Remove crankshaft position sensor. <Ref. to FU(H6)-30, REMOVAL, Crankshaft Position Sensor.>
(10) Remove knock sensor. <Ref. to FU(H6)-32, REMOVAL, Knock Sensor.>
(11) Remove engine temperature sensor. <Ref. to FU(H6)-29, REMOVAL, Engine Coolant Temperature Sensor.>
(12) Remove oil pressure switch. <Ref. to LU(H6)-17, REMOVAL, Oil Pressure Switch.>
(13) Remove oil filter. <Ref. to LU(H6)-18, REMOVAL, Engine Oil Filter.>
(14) Remove oil cooler. <Ref. to LU(H6)-19, REMOVAL, Oil Cooler.>

10. Crankshaft Pulley S143098

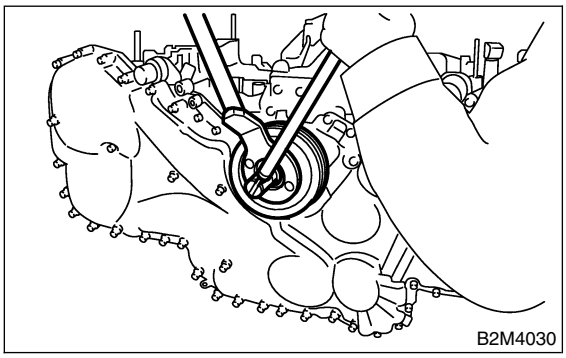
A: REMOVAL S143098A18

1) Remove crankshaft pulley cover.



2) Remove crankshaft pulley bolt. To lock crankshaft, use ST.

ST 49997100 CRANKSHAFT PULLEY WRENCH



3) Remove crankshaft pulley.

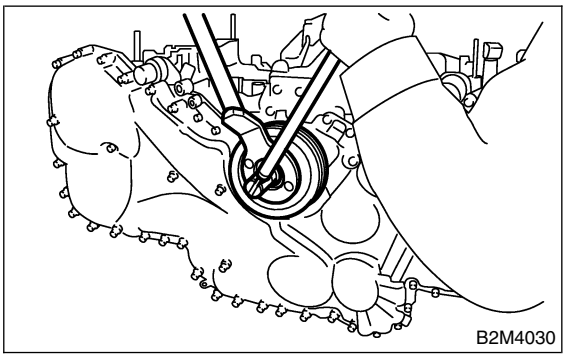
B: INSTALLATION S143098A11

1) Install crankshaft pulley.
2) Install crankshaft pulley bolt. To lock crankshaft, use ST.

ST 49997100 CRANKSHAFT PULLEY WRENCH

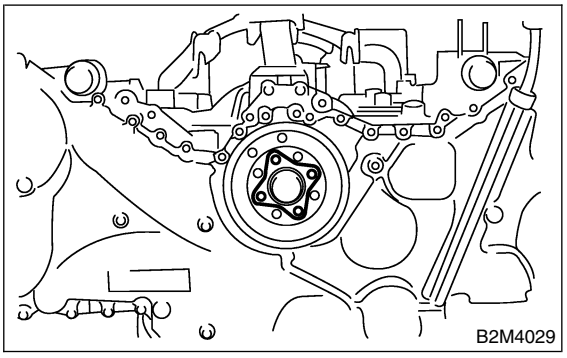
(1) Clean the crankshaft pulley thread using an air gun.
(2) Apply engine oil to the crankshaft pulley bolt seat and thread.
(3) Tighten the crankshaft pulley bolts.

Tightening torque:
178 N·m (18.1 kgf-m, 131 ft-lb)



3) Install the crankshaft pulley cover.

Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



C: INSPECTION S143098A10

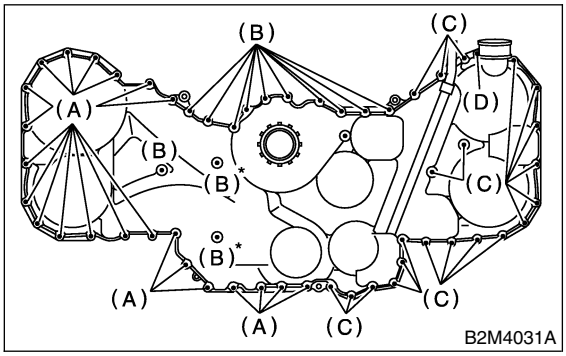
1) Check crankshaft pulley cover for oil leaks and bleeding.
2) Check crankshaft pulley for looseness.

11. Front Chain Cover S143739

A: REMOVAL S143739A18

1) Remove crankshaft pulley. <Ref. to ME(H6)-41, REMOVAL, Crankshaft Pulley.>
2) Remove front chain cover.

NOTE:
There are four different types of chain cover mounting bolts. Sort them into separate containers to avoid confusion at installation.



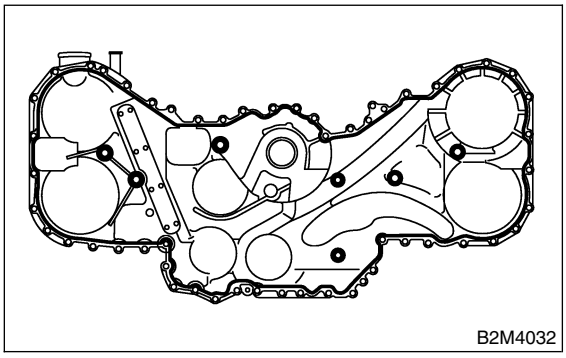
Bolt dimension:
(A) 6 × 45
(B) 6 × 16
(C) 6 × 30
(D) 6 × 50

*: Sealing washer

B: INSTALLATION S143739A11

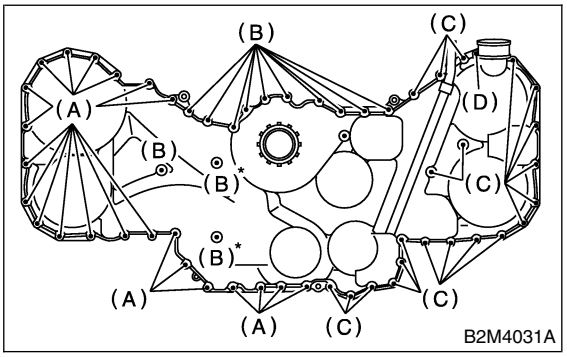
1) Remove old fluid packing on the matching surface, and degrease it.
2) Apply fluid packing to the mating surface of front chain cover.

Fluid packing:
THREE BOND 1280B



3) Install front chain cover. Temporarily tighten the bolts.

CAUTION:
Do not confuse the mounting positions of the bolts.

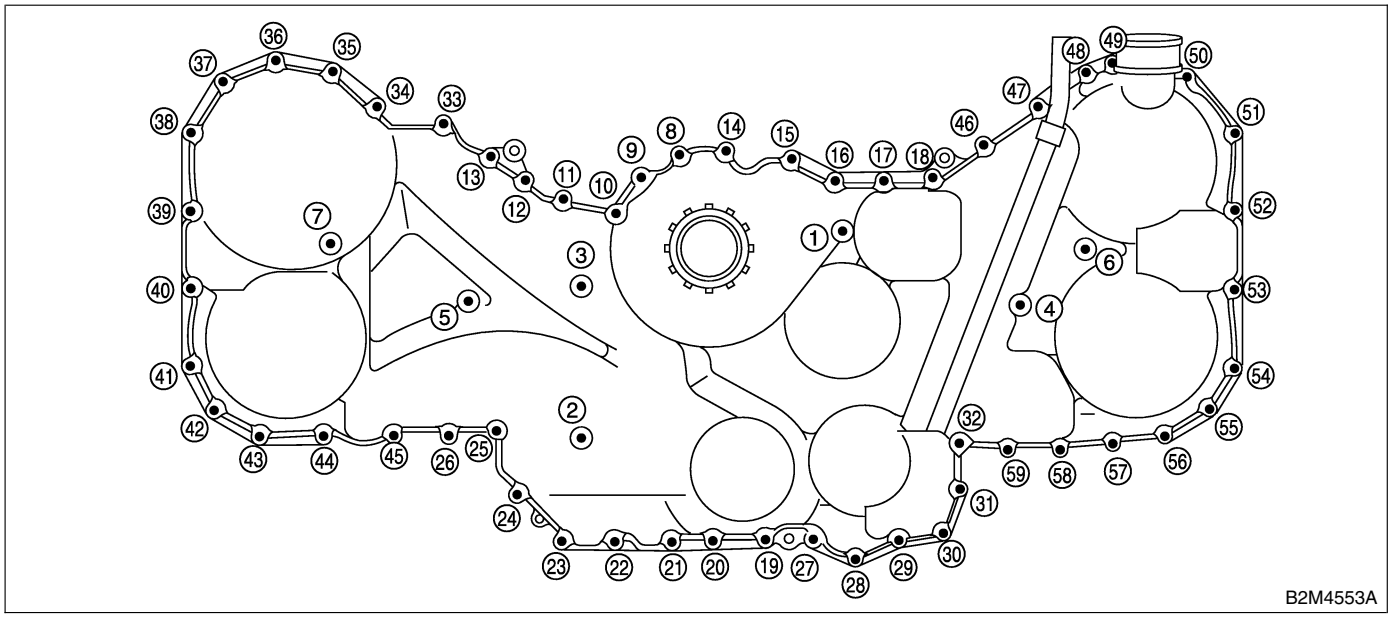


Bolt dimension:
(A) 6 × 45
(B) 6 × 16
(C) 6 × 30
(D) 6 × 50

*: Sealing washer

4) Tighten the bolts in the numerical sequence shown in figure.

Tightening torque:
6.6 N·m (0.67 kgf-m, 4.8 ft-lb)



5) Install crankshaft pulley. <Ref. to ME(H6)-41, INSTALLATION, Crankshaft Pulley.>

C: INSPECTION *S143739A10*

Check the cover surface for flaws and dents.
Check the cover mating surface and the mounting point of crankshaft pulley for oil leaks.