

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

2002 ENGINE**2.0L (DOHC TURBO) - Impreza****GENERAL DESCRIPTION****SPECIFICATIONS****Engine General Specifications**

Engine	Type		Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine	
	Valve arrangement		Belt driven, double overhead camshaft, 4-valve/cylinder	
	Bore x Stroke mm (in)		92 x 75 (3.62 x 2.95)	
	Piston displacement cm ³ (cu in)		1,994 (121.67)	
	Compression ratio		8.0	
	Compression pressure (at 200 - 300 rpm) kPa (kgf/cm ² , psi)		981 - 1,177 (10 - 12, 142 - 171)	
	Number of piston rings		Pressure ring: 2, Oil ring: 1	
	Intake valve timing	Opening	10°BTDC	
		Closing	50° ABDC	
	Exhaust valve timing	Opening	53° BBDC	
		Closing	7° ATDC	
	Valve clearance	Intake mm (in)	0.20 ± 0.02 (0.0079 ± 0.0008)	
		Exhaust mm (in)	0.25 ± 0.02 (0.0098 ± 0.0008)	
	Idling speed [At neutral position] rpm		MT	750 ± 100 (No load) 800 ± 150 (A/C switch ON)
			AT	750 ± 100 (No load) 825 ± 150 (A/C switch ON)
Firing order		1 --> 3 --> 2 --> 4		
Ignition timing BTDC/rpm		12° ± 3°/750 rpm		

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

Engine Specifications

Belt tension adjuster	Protrusion of adjuster rod	5.2 - 6.2 mm (0.205 - 0.244 in)
	Spacer O.D.	17.955 - 17.975 mm (0.7069 - 0.7077 in)
	Tensioner bush I.D.	18.0 - 18.08 mm (0.7087 - 0.7118 in)
		STD 0.025 - 0.125 mm

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Belt tensioner	Clearance between spacer and bush			(0.0010 - 0.0049 in)
			Limit	0.175 mm (0.0069 in)
	Side clearance of spacer		STD	0.2 - 0.55 mm (0.0079 - 0.0217 in)
Limit			0.81 mm (0.0319 in)	
Camshaft	Bend limit			0.020 mm (0.0079 in)
	Thrust clearance		STD	0.015 - 0.070 mm (0.0006 - 0.0028 in)
			Limit	0.10 mm (0.0039 in)
	Cam lobe height	Intake	STD	46.25 - 46.35 mm (1.821 - 1.825 in)
			Limit	46.15 mm (1.817 in)
		Exhaust	STD	46.15 -46.25 mm (1.817 - 1.821 in)
			Limit	46.05 mm (1.813 in)
	Jounal O.D.	STD	Front	37.946 - 37.963 mm (1.4939 - 1.4946 in)
			Center rear	29.946 - 29.963 mm (1.1790 - 1.1796 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			0.3 mm (0.012 in)
	Standard height			127.5 mm (5.02 in)
Valve seat	Refacing angle			90°
	Contacting width	Intake	STD	1.0 mm (0.039 in)
			Limit	1.7 mm (0.067 in)
		Exhaust	STD	1.5 mm (0.059 in)
Limit			2.2 mm (0.087 in)	
Valve guide	Inner diameter			6.000 - 6.012 mm (0.2362 - 0.2367 in)
	Protrusion above head			12.0 - 12.4 mm (0.472 - 0.488 in)
	Head edge thickness	Intake	STD	1.2 mm (0.047 in)
			Limit	0.8 mm (0.031 in)
		Exhaust	STD	1.5 mm (0.059 in)
			Limit	0.8 mm (0.031 in)
	Stem diameter		Intake	5.950 - 5.965 mm (0.2343 - 0.2348 in)
			Exhaust	5.945 - 5.960 mm

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Valve				(0.2341 - 0.2346 in)
	Stem oil clearance	STD	Intake	0.035 - 0.062 mm (0.0014 - 0.0024 in)
			Exhaust	0.040 - 0.067 mm (0.0016 - 0.0026 in)
		Limit	-	0.15 mm (0.0059 in)
	Overall length		Intake	104.4 mm (4.110 in)
Exhaust			104.7 mm (4.122 in)	
Valve spring	Free length			44.67 mm (1.7587 in)
	Squareness			2.5°, 2.0 mm (0.079 in)
	Tension/spring height			220.7±15.7 N (22.5±1.6 kgf, 49.6±3.5 lb)/36.0mm (1.417 in) 510.9±25.5 N (52.1±2.6 kgf, 114.9±5.7 lb)/26.6 mm (1.047 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	92.005 - 92.015 mm (3.6222 - 3.6226 in)
			B	91.995 - 92.005 mm (3.6218 - 3.6222 in)
	Taper		STD	0.015 mm (0.0006 in)
			Limit	0.050 mm (0.0020 in)
	Out-of-roundness		STD	0.010 mm (0.0004 in)
			Limit	0.050 mm (0.0020 in)
	Piston clearance		STD	0.010 - 0.030 mm (0.0004 - 0.0012 in)
			Limit	0.050 mm (0.0020 in)
	Enlarging (boring) limit			0.5 mm (0.020 in)
	Piston	Outer diameter	STD	A
B				91.975 - 91.985 mm (3.6211-3.6214 in)
0.25 mm (0.0098 in) OS			92.225 - 92.235 mm	

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				(3.6309 - 3.6313 in)
		0.50 mm (0.0197 in) OS		92.475 - 92.485 mm (3.6407 - 3.6411 in)
Piston pin	Standard clearance between piston pin and hole in piston		STD	0.004 - 0.008 mm (0.0002 - 0.0003 in)
			Limit	0.020 mm (0.0008 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 - 0.70 mm (0.0079 - 0.0276 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	0.020 - 0.046 mm (0.0008 - 0.0018 in)
			Limit	0.05 mm (0.0020 in)
	Thickness at center portion		STD	1.492 - 1.501 mm (0.0587 - 0.0591 in)
			0.03 mm (0.0012 in) US	1.510 - 1.513 mm (0.0594 - 0.0596 in)
			0.05 mm (0.0020 in) US	1.520 - 1.523 mm (0.0598 - 0.0600 in)
			0.25 mm (0.0098 in) US	1.620 - 1.623 mm (0.0638 - 0.0639 in)
Connecting rod	Clearance between piston pin and		STD	0 - 0.022 mm (0 - 0.0009 in)

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bushing	bushing		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		0.25 mm (0.0098 in)
	Crank pin outer diameter		STD	47.984 - 48.000 mm (1.8891 - 1.8898)
			0.03 mm (0.0012 in) US	47.954 - 47.970 mm (1.8879 - 1.8886)
			0.05 mm (0.0020 in) US	47.934 - 47.950 mm (1.8872 - 1.8878)
			0.25 mm (0.0098 in) US	47.734 - 47.750 mm (1.8793 - 1.8799)
	Crank journal outer diameter	#1, #3, #5	STD	59.992 - 60.008 mm (2.3619 - 2.3625 in)
			0.03 mm (0.0012 in) US	59.962 - 59.978 mm (2.3607 - 2.3613 in)
			0.05 mm (0.0020 in) US	59.942 - 59.958 mm (2.3599 - 2.3605 in)
			0.25 mm (0.0098 in) US	59.742 - 59.758 mm (2.3520 - 2.3527 in)
		#2, #4	STD	59.992 - 60.008 mm (2.3619 - 2.3625 in)
			0.03 mm (0.0012 in) US	59.962 - 59.978 mm (2.3607 - 2.3613 in)
			0.05 mm (0.0020 in) US	59.942 - 59.958 mm (2.3599 - 2.3605 in)
			0.25 mm (0.0098 in) US	59.742 - 59.758 mm (2.3520 - 2.3527 in)
	Thrust clearance		STD	0.030 - 0.115 mm (0.0012 - 0.0045 in)
			Limit	0.25 mm (0.0098 in)
	Oil clearance		STD	0.010 - 0.030 mm (0.0004 - 0.0012 in)
			Limit	0.040 mm (0.0016 in)
		#1, #3	STD	1.998 - 2.011 mm (0.0787 - 0.0792 in)
			0.03 mm (0.0012 in) US	2.017 - 2.020 mm (0.0794 - 0.0795 in)
			0.05 mm (0.0020 in) US	2.027 - 2.030 mm (0.0798 - 0.0799 in)

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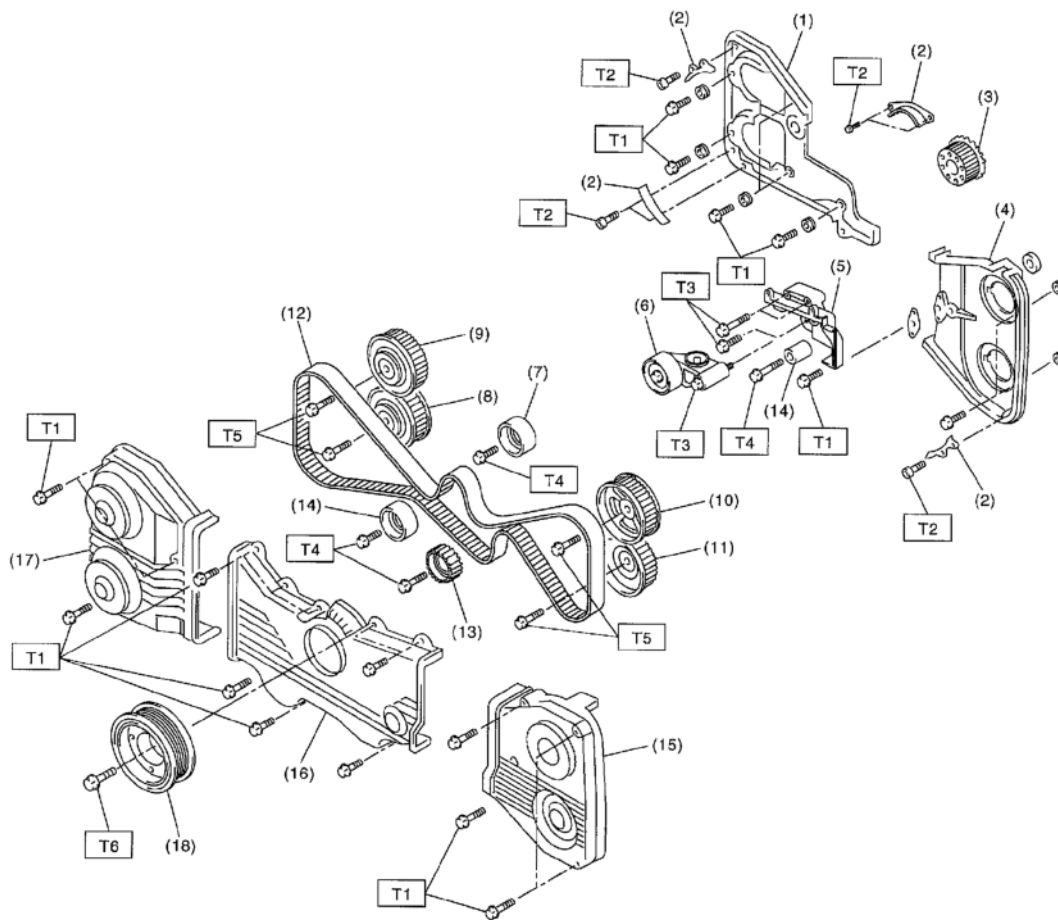
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Crankshaft bearing	Crankshaft bearing thickness	#2, #4, #5	0.25 mm (0.0098 in) US	2.127 - 2.130 mm (0.0837 - 0.0839 in)
			STD	2.000 - 2.013 mm (0.0787 - 0.0793 in)
			0.03 mm (0.0012 in) US	2.019 - 2.022 mm (0.0795 - 0.0796 in)
			0.05 mm (0.0020 in) US	2.029 - 2.032 mm (0.0799 - 0.0800 in)
			0.25 mm (0.0098 in) US	2.129 - 2.132 mm (0.0838 - 0.0839 in)

COMPONENT**TIMING BELT**

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- | | |
|--|--|
| (1) Right-hand belt cover No. 2 | (9) Right-hand intake camshaft sprocket |
| (2) Timing belt guide (MT vehicles only) | (10) Left-hand intake camshaft sprocket |
| (3) Crankshaft sprocket | (11) Left-hand exhaust camshaft sprocket |
| (4) Left-hand belt cover No. 2 | (12) Timing belt |
| (5) Tensioner bracket | (13) Belt idler No. 2 |
| (6) Automatic belt tension adjuster ASSY | (14) Belt idler |
| (7) Belt idler | (15) Left-hand belt cover |
| (8) Right-hand exhaust camshaft sprocket | (16) Front belt cover |

- | |
|----------------------------|
| (17) Right-hand belt cover |
| (18) Crankshaft pulley |

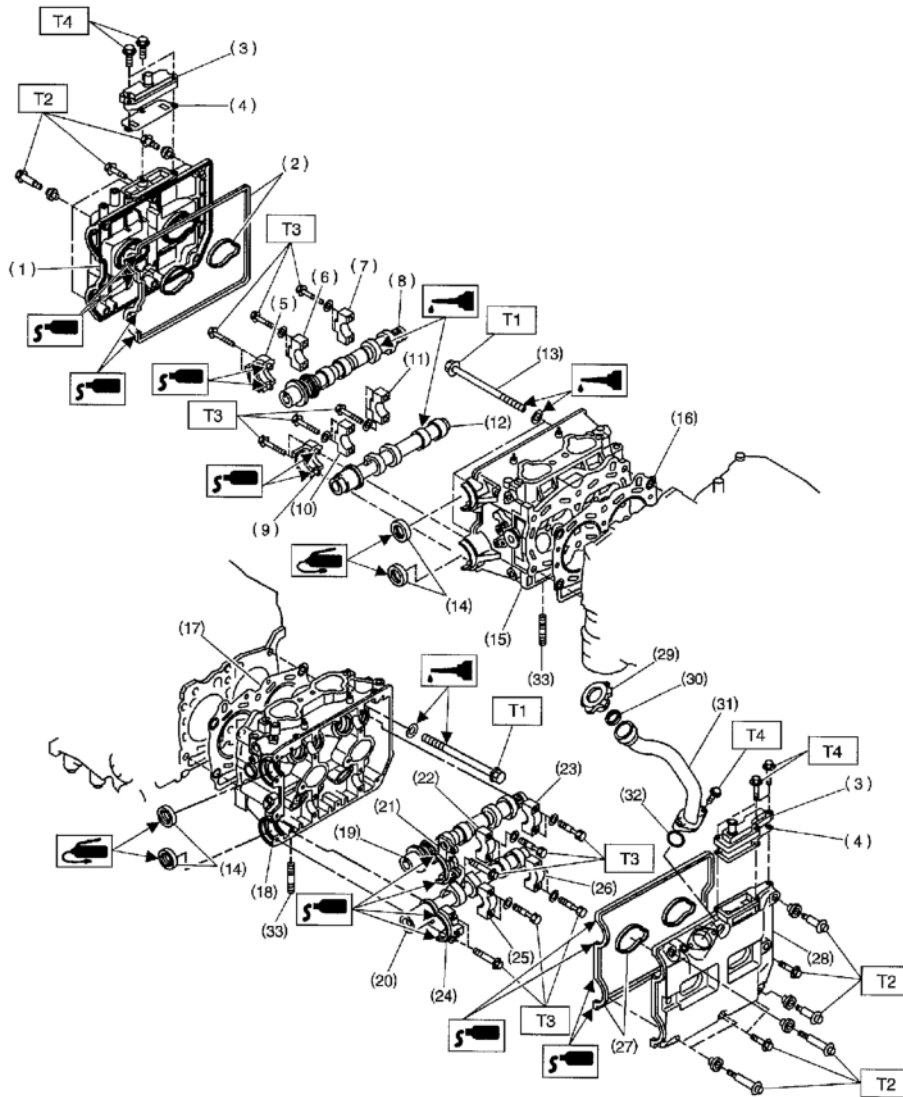
Tightening torque: N·m (kgf-m, ft-lb)

- | | |
|------------|---|
| T1: | 5 (0.5, 3.6) |
| T2: | 10 (1.0, 7) |
| T3: | 25 (2.5, 18.1) |
| T4: | 39 (4.0, 28.9) |
| T5: | 98 (10, 72.4) |
| T6: | <Ref. to INSTALLATION, Crankshaft Pulley.> |

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Fig. 1: Exploded View Of Timing Belt
Courtesy of SUBARU OF AMERICA, INC.

CYLINDER HEAD AND CAMSHAFT



- | | | |
|---------------------------------------|---------------------------------------|----------------------|
| (1) Rocker cover (RH) | (15) Cylinder head (RH) | (29) Oil filler cap |
| (2) Rocker cover gasket (RH) | (16) Cylinder head gasket (RH) | (30) Gasket |
| (3) Oil separator cover | (17) Cylinder head gasket (LH) | (31) Oil filler duct |
| (4) Gasket | (18) Cylinder head (LH) | (32) O-ring |
| (5) Intake camshaft cap (Front RH) | (19) Intake camshaft (LH) | (33) Stud bolt |
| (6) Intake camshaft cap (Center RH) | (20) Exhaust camshaft (LH) | |
| (7) Intake camshaft cap (Rear RH) | (21) Intake camshaft cap (Front LH) | |
| (8) Intake camshaft (RH) | (22) Intake camshaft cap (Center LH) | |
| (9) Exhaust camshaft cap (Front RH) | (23) Intake camshaft cap (Rear LH) | |
| (10) Exhaust camshaft cap (Center RH) | (24) Exhaust camshaft (Front LH) | |
| (11) Exhaust camshaft cap (Rear RH) | (25) Exhaust camshaft cap (Center LH) | |
| (12) Exhaust camshaft (RH) | (26) Exhaust camshaft cap (Rear LH) | |
| (13) Cylinder head bolt | (27) Rocker cover gasket (LH) | |
| (14) Oil seal | (28) Rocker cover (LH) | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: <Ref. to INSTALLATION, Cylinder Head Assembly.>

T2: 5 (0.5, 3.6)

T3: 10 (1.0, 7)

T4: 6.4 (0.65, 4.7)

Fig. 2: Exploded View Of Cylinder Head And Camshaft
Courtesy of SUBARU OF AMERICA, INC.

CYLINDER HEAD AND VALVE ASSEMBLY

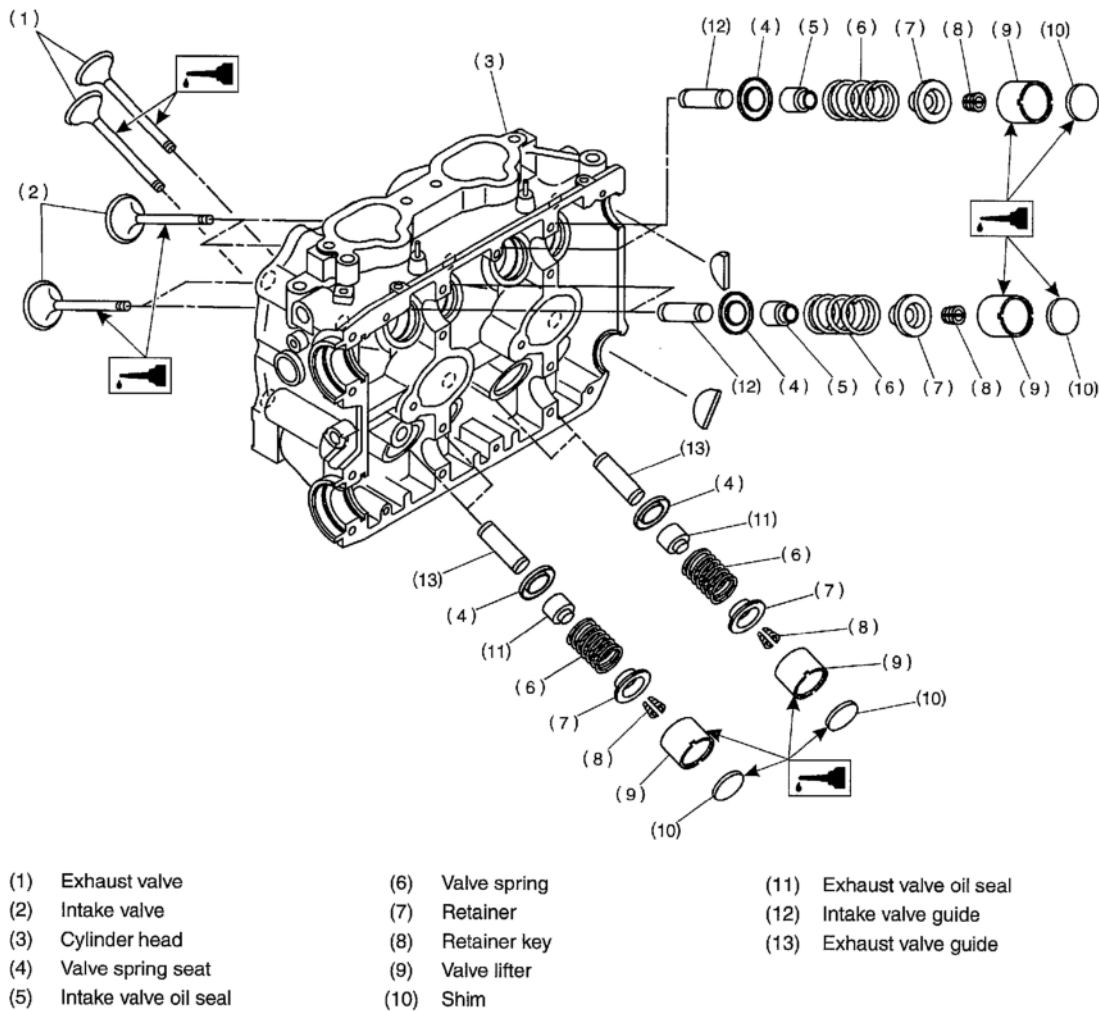
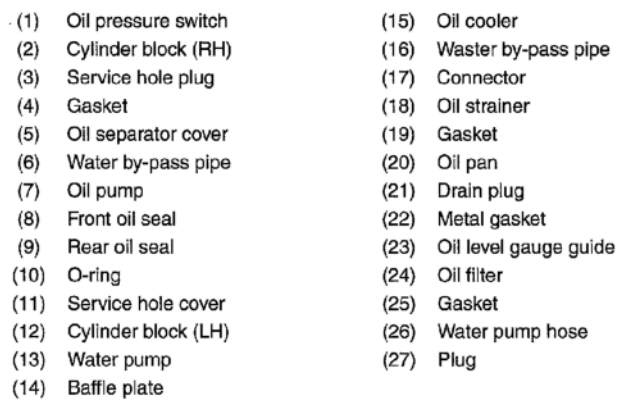


Fig. 3: Exploded View Of Cylinder Head And Valve Assembly
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CYLINDER BLOCK

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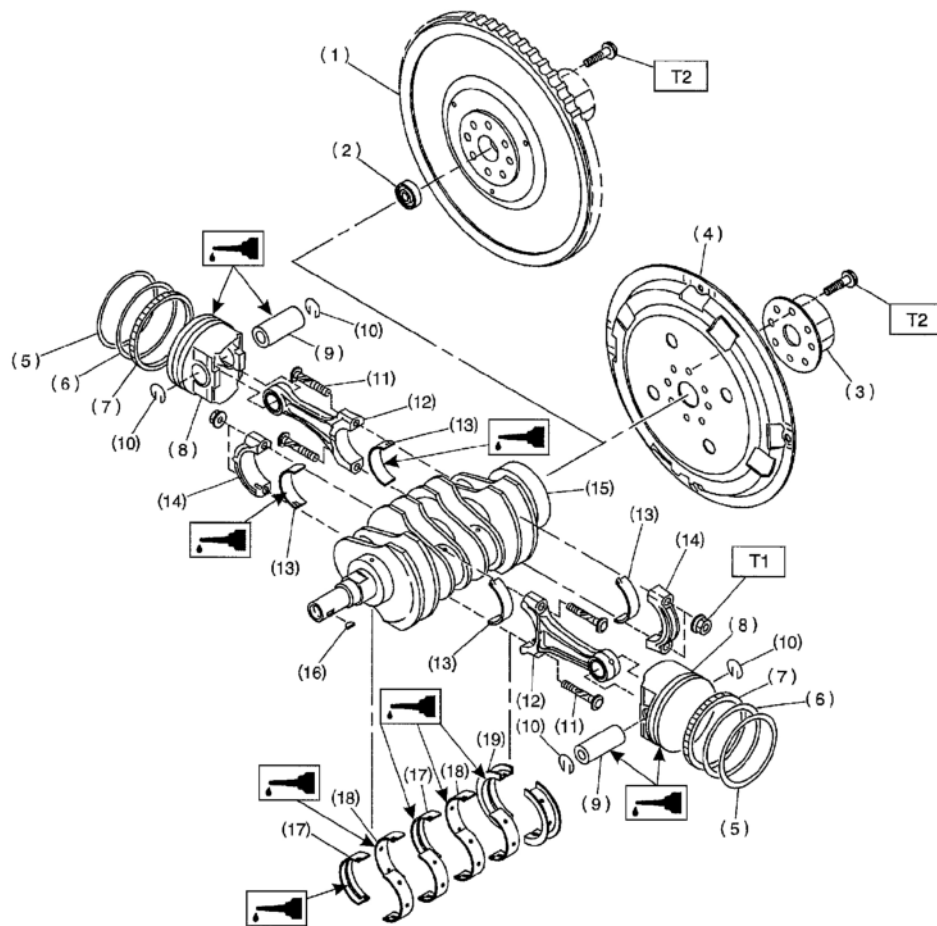


T1: 5 (0.5, 3.6)
T2: 6.4 (0.65, 4.7)
T3: 10 (1.0, 7)
T4: 25 (2.5, 18.1)
T5: 47 (4.8, 34.7)
T6: 69 (7.0, 50.6)
T7: First 12 (1.2, 8.7)
Second 12 (1.2, 8.7)
T8: 16 (1.6, 11.6)
T9: 44 (4.5, 33)
T10: 25 (2.5, 18.1)
T11: 55 (5.5, 40)

CRANKSHAFT AND PISTON

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- | | | |
|--------------------------------------|-----------------------------|--------------------------------|
| (1) Flywheel (MT vehicles only) | (9) Piston pin | (17) Crankshaft bearing #1, #3 |
| (2) Ball bearing (MT vehicles only) | (10) Circlip | (18) Crankshaft bearing #2, #4 |
| (3) Reinforcement (AT vehicles only) | (11) Connecting rod bolt | (19) Crankshaft bearing #5 |
| (4) Drive plate (AT vehicles only) | (12) Connecting rod | |
| (5) Top ring | (13) Connecting rod bearing | |
| (6) Second ring | (14) Connecting rod cap | |
| (7) Oil ring | (15) Crankshaft | |
| (8) Piston | (16) Woodruff key | |

Tightening torque: N·m (kgf-m, ft-lb)

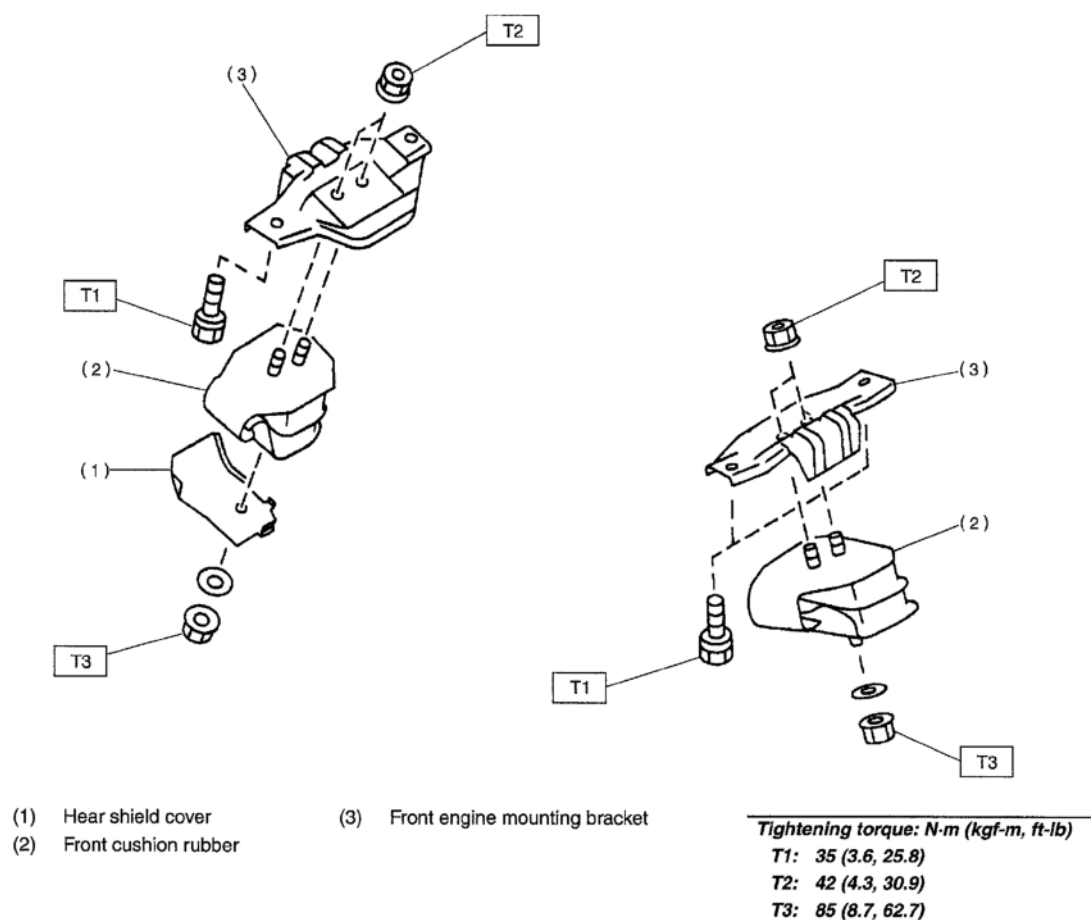
T1: 44.6 (4.55, 32.9)

T2: 72 (7.3, 52.8)

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Fig. 5: Exploded View Of Crankshaft And Piston
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ENGINE MOUNTING



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Fig. 6: Exploded View Of Engine Mounting
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CAUTION

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

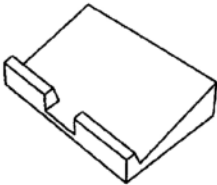
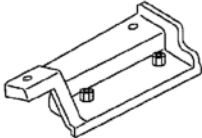
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- Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil prior to assembly.
- Be careful not to let oil, grease or coolant contact the timing belt, clutch disc and flywheel.
- All removed parts, if to be reused, 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 the engine in an area where chain hoists, lifting devices, etc. are available for ready use.
- Be sure not to damage coated surfaces of body panels with tools or 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.

PREPARATION TOOL

SPECIAL TOOLS

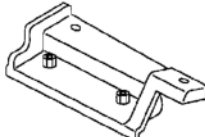
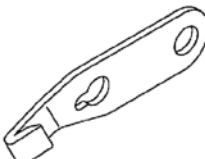
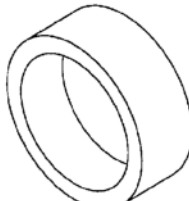
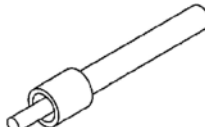
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
	498267600	CYLINDER HEAD TABLE	• Used for replacing valve guides. • Used for removing and installing valve springs.
	498457000	ENGINE STAND ADAPTER RH	Used with ENGINE STAND (499817000).

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Fig. 7: Identifying Special Tools (1 Of 8)
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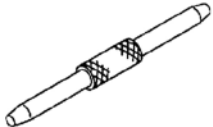
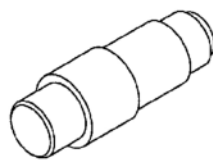
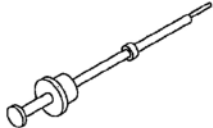
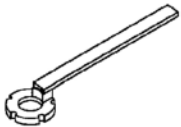
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
	498457100	ENGINE STAND ADAPTER LH	Used with ENGINE STAND (499817000).
	498497100	CRANKSHAFT STOPPER	Used for stopping rotation of flywheel when loosening and tightening crankshaft pulley bolt, etc.
	398744300 (Newly adopted tool)	PISTON GUIDE	Used for installing piston in cylinder for 2000 cc engine.
	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.

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Fig. 8: Identifying Special Tools (2 Of 8)
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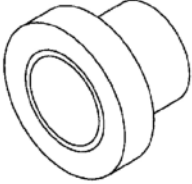
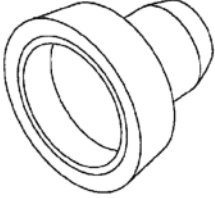
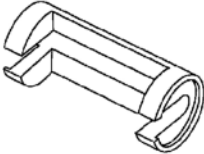
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
	499037100	CONNECTING ROD BUSHING REMOVER & INSTALLER	Used for removing and installing connecting rod bushing.
	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.
	499207400 (Newly adopted tool)	CAMSHAFT SPROCKET WRENCH	Used for removing and installing camshaft sprocket.

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Fig. 9: Identifying Special Tools (3 Of 8)
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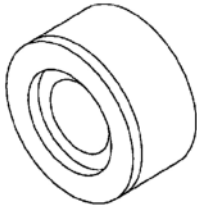
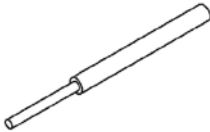
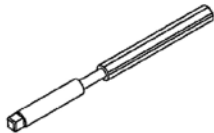
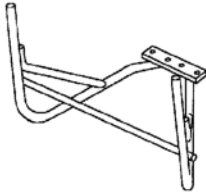
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
	499587700 (Newly adopted tool)	CAMSHAFT OIL SEAL INSTALLER	Used for installing cylinder head plug for DOHC engine.
	499587200	CRANKSHAFT OIL SEAL INSTALLER	• Used for installing crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL GUIDE (499597100).
	499597100	CRANKSHAFT OIL SEAL GUIDE	• Used for installing crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL INSTALLER (499587200).
	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.

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Fig. 10: Identifying Special Tools (4 Of 8)
Courtesy of SUBARU OF AMERICA, INC.

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

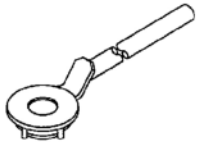
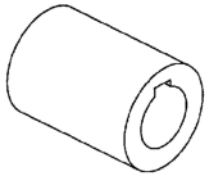
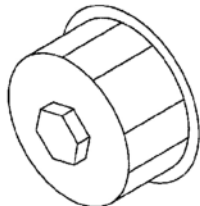
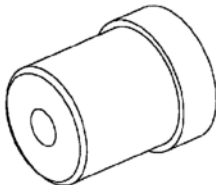
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
	498267700	VALVE GUIDE ADJUSTER	Used for installing intake and exhaust valve guides.
	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
	499817000	ENGINE STAND	• Stand used for engine disassembly and assembly. • Used with ENGINE STAND ADAPTER RH (498457000) & LH (498457100).

G02870926

Fig. 11: Identifying Special Tools (5 Of 8)
Courtesy of SUBARU OF AMERICA, INC.

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

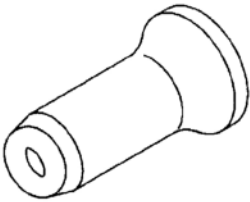
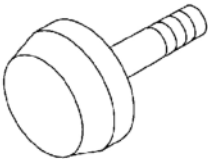
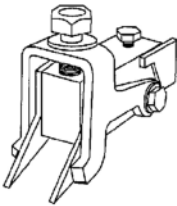
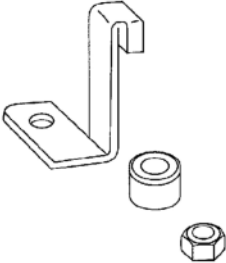
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
	499977300	CRANK PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolts.
	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.
	498547000	OIL FILTER WRENCH	Used for removing and installing oil filter.
	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.

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Fig. 12: Identifying Special Tools (6 Of 8)
Courtesy of SUBARU OF AMERICA, INC.

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

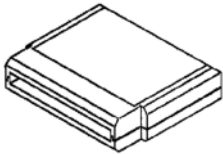
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
	499587600 (Newly adopted tool)	OIL SEAL GUIDE	Used for installing camshaft oil seal for DOHC engine.
	499597200 (Newly adopted tool)	OIL SEAL GUIDE	• Used for installing camshaft oil seal for DOHC engine. • Used with OIL SEAL GUIDE (499587600).
	498187200 (Newly adopted tool)	SHIM REPLACER	Used for correct valve clearance.
	498277200	STOPPER SET	Used for installing automatic transmission assembly to engine.

G02870928

Fig. 13: Identifying Special Tools (7 Of 8)
Courtesy of SUBARU OF AMERICA, INC.

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
	24082AA150	CARTRIDGE	Troubleshooting for electrical systems.
	22771AA030	SELECT MONITOR KIT	Troubleshooting for electrical systems. • English: 22771AA030 (Without printer) • German: 22771AA070 (Without printer) • French: 22771AA080 (Without printer) • Spanish: 22771AA090 (Without printer)

G02870929

Fig. 14: Identifying Special Tools (8 Of 8)

Courtesy of SUBARU OF AMERICA, INC.

GENERAL PURPOSE TOOLS

GENERAL PURPOSE TOOLS REMARKS

TOOL NAME	REMARKS
Compression Gauge	Used for measuring compression.
Timing Light	Used for measuring ignition timing.

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
- Camshaft
- Cylinder Head

COMPRESSION

INSPECTION

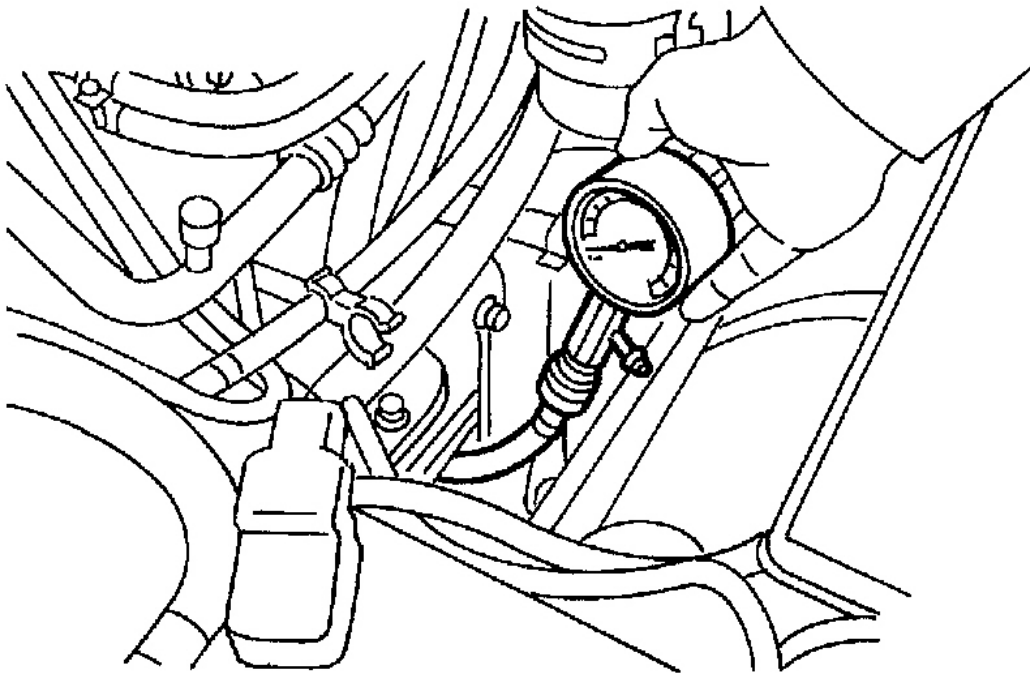
CAUTION: After warming-up, engine becomes very hot. Be careful not to burn

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 fuel pressure. < Ref. to **RELEASING OF FUEL PRESSURE** , Fuel. >
4. Remove all the spark plugs.
5. Fully open the 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.



G02870930

Fig. 15: Reading Maximum Value On Gauge When Pointer Is Steady
Courtesy of SUBARU OF AMERICA, INC.

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

Compression (350 rpm and fully open throttle):

Standard; 951 - 1,147 kPa (9.7 - 11 kgf/cm² , 138 - 166 psi)

Limit; 834 kPa (8.5 kgf/cm² , 121 psi)

Difference between cylinders; 49 kPa (0.5 kgf/cm² , 7 psi)

IDLE SPEED

INSPECTION

1. Before checking the 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 that hoses are connected properly.
 2. Ensure the malfunction indicator light (CHECK ENGINE light) does not illuminate.
2. Warm-up the engine.
3. Stop the engine, and turn the ignition switch to OFF.
4. Insert the cartridge to the SUBARU SELECT MONITOR.
5. Connect the SUBARU SELECT MONITOR to the data link connector.
6. Turn the ignition switch to ON, and SUBARU SELECT MONITOR switch to ON.
7. Select {2. Each System Check} in Main Menu.
8. Select {Engine Control System} in Selection Menu.
9. Select {1. Current Data Display & Save} in Engine Control System Diagnosis.
10. Select {1.12 Data Display} in Data Display Menu.
11. 1 11) Start the engine, and read engine idle speed.
12. Check the idle speed when unloaded. (With headlights, heater fan, rear defroster, radiator fan, air conditioning, etc. OFF)

idle speed (No load and gears in neutral: 750+/-100 rpm

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

Idle speed [A/C "ON", no load and gears in neutral]:

800+/-150 rpm (MT model)

825+/-150 rpm (AT model)

CAUTION: Never rotate the idle adjusting screw. If the idle speed is out of specifications, refer to **IDLE SPEED** .

IGNITION TIMING

INSPECTION

1. Before checking the ignition timing speed, check the following:
 1. Ensure the air cleaner element is free from clogging, spark plugs are in good condition, and that hoses are connected properly.
 2. Ensure the malfunction indicator light (CHECK ENGINE light) does not illuminate.
2. Warm-up the engine.
3. Stop the engine, and turn the ignition switch to OFF.
4. Insert the cartridge to the SUBARU SELECT MONITOR.
5. Connect the SUBARU SELECT MONITOR to the data link connector.
6. Turn the ignition switch to ON, and SUBARU SELECT MONITOR switch to ON.
7. Select {2. Each System Check} in Main Menu.
8. Select {Engine Control System} in Selection Menu.
9. Select {1. Current Data Display & Save} in Engine Control System Diagnosis.
10. Select {1.12 Data Display} in Data Display Menu.
11. Start the engine, at idle speed and check the ignition timing.

Ignition timing [BTDC/rpm]:

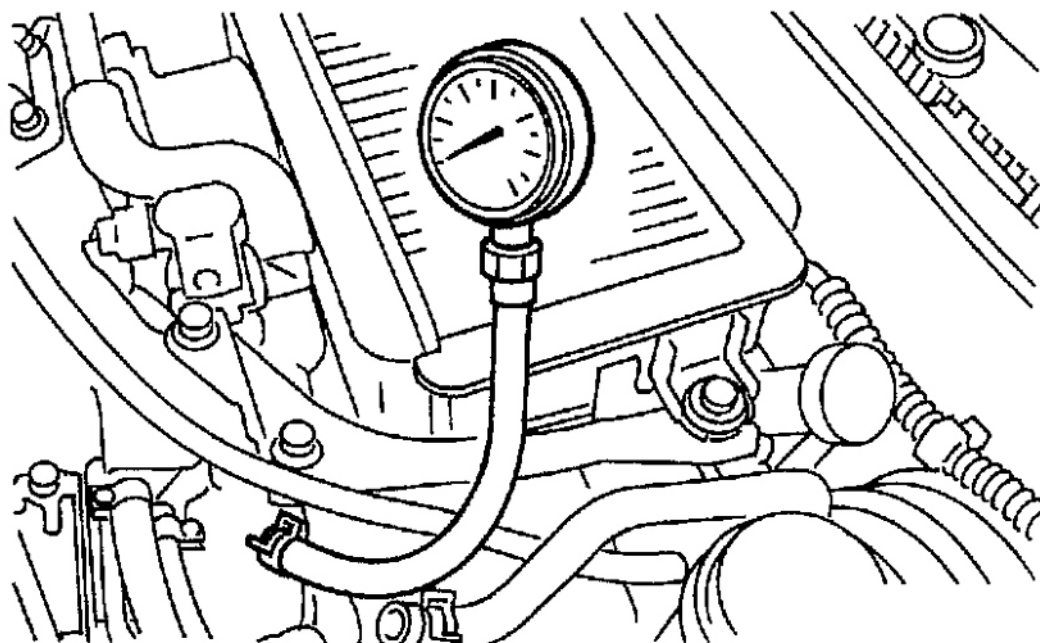
12°+/-3°/750

If the timing is not correct, check the ignition control system. Refer to **IGNITION TIMING** .

INTAKE MANIFOLD VACUUM

INSPECTION

1. Warm-up the engine.
2. Disconnect the brake vacuum hose and install the vacuum gauge to the hose fitting on the manifold.
3. Keep the engine at the idle speed and read the vacuum gauge indication. By observing the gauge needle movement, the internal condition of the engine can be diagnosed as described below.



G02870931

Fig. 16: Reading Vacuum Gauge Indication
 Courtesy of SUBARU OF AMERICA, INC.

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

DIAGNOSIS

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

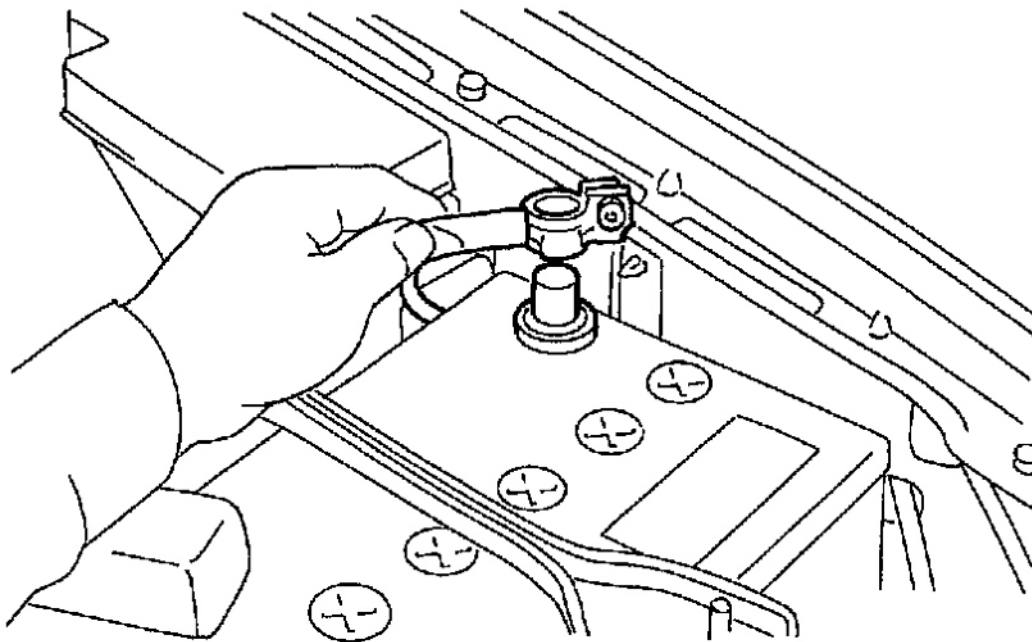
range.

chamber idle adjustment

ENGINE OIL PRESSURE

INSPECTION

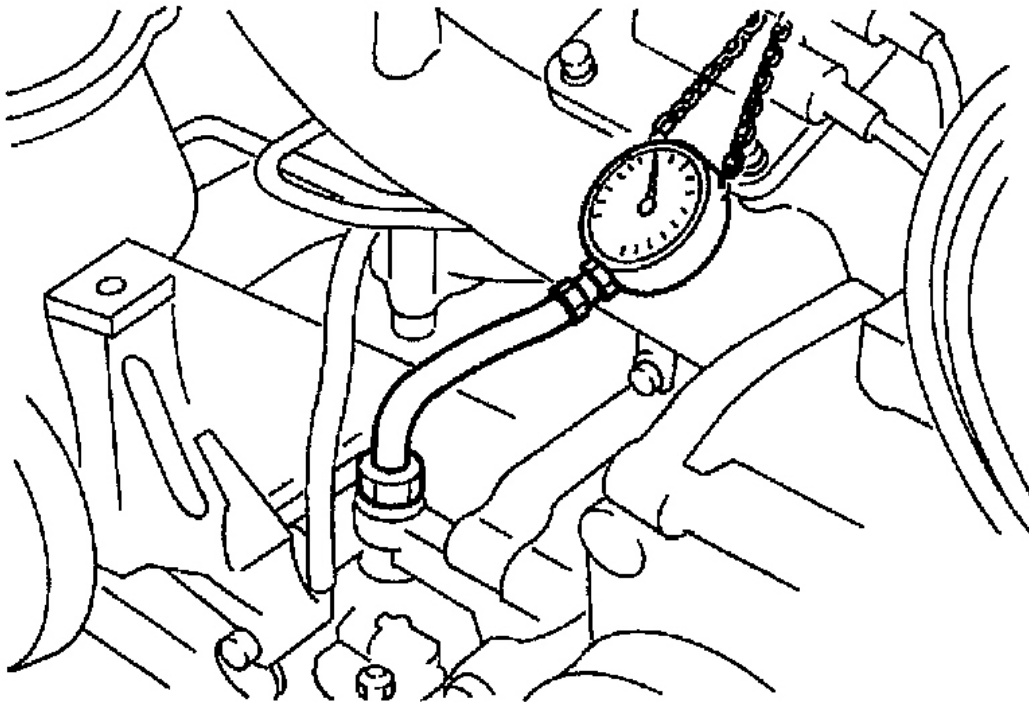
1. Remove the oil pressure switch from engine cylinder block. < Ref. to **REMOVAL** , Oil Pressure Switch. >
2. Connect the oil pressure gauge hose to cylinder block.
3. Connect the battery ground terminal to battery.



G02870932

Fig. 17: Connecting Battery Ground Terminal To Battery
Courtesy of SUBARU OF AMERICA, INC.

4. Start the engine, and measure oil pressure.



G02870933

Fig. 18: Measuring Oil Pressure

Courtesy of SUBARU OF AMERICA, INC.

Oil pressure:

98 kPa (1.0 kg/cm² ,14 psi) or more at 800 rpm 294 kPa (3.0 kg/cm² , 43 psi) or more at 5,000 rpm

CAUTION:

- If the oil pressure is out of specification, check oil pump, oil filter and lubrication line. < Ref. to 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 INSTALLATION . >

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

5. After measuring the oil pressure, install the oil pressure switch. < Ref. to INSTALLATION , INSTALLATION, Oil Pressure Switch . >

Tightening torque:

25 N.m (2.5 kgf-m, 18.1 ft-lb)

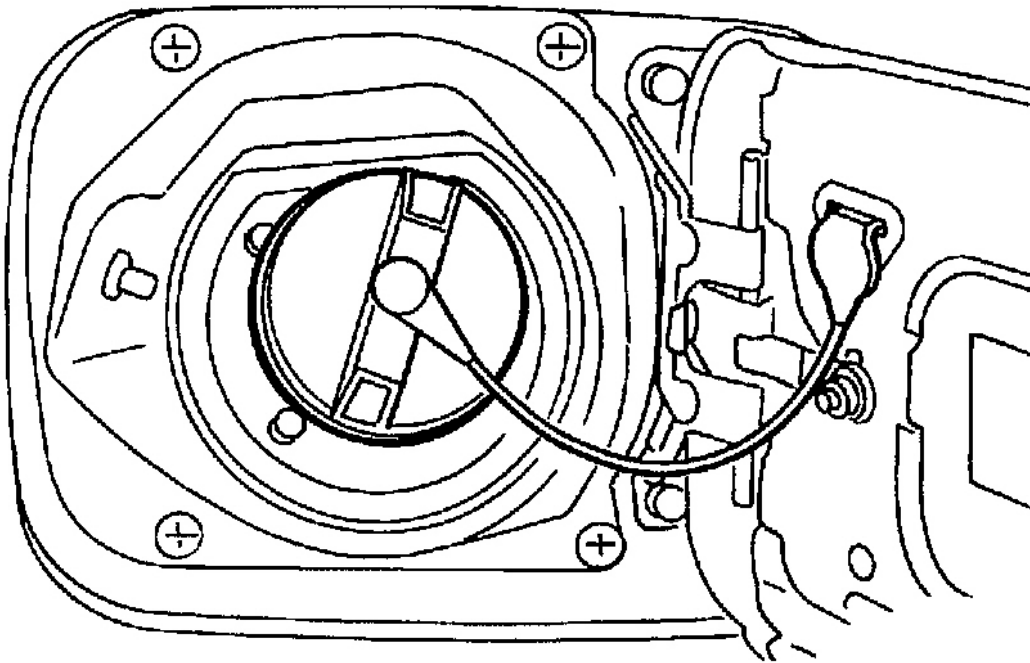
FUEL PRESSURE

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.

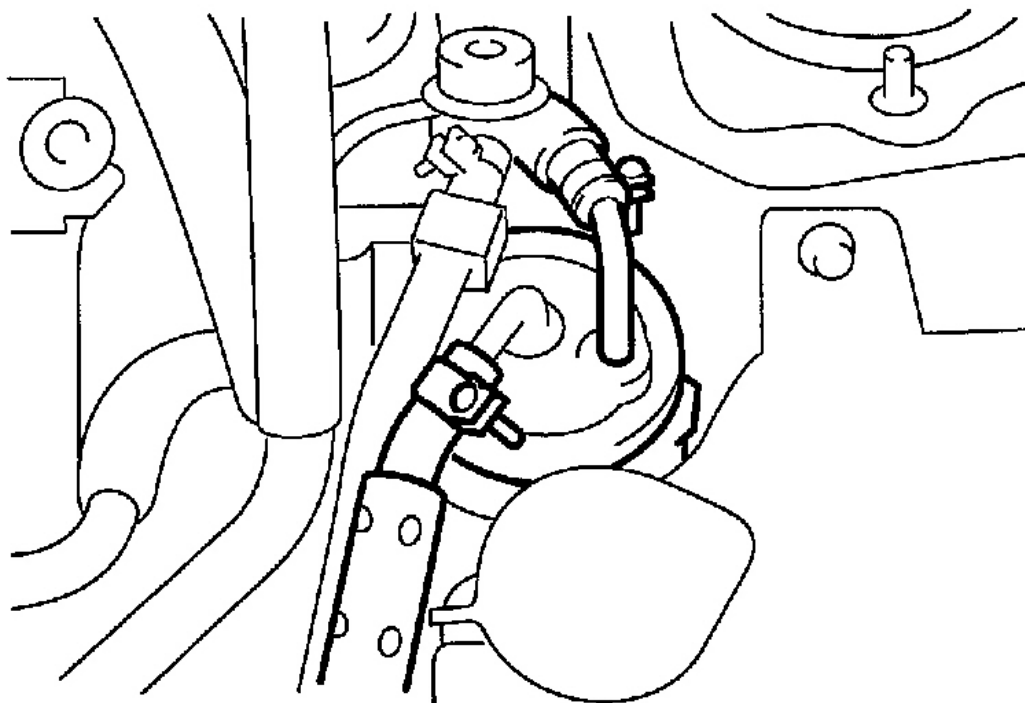
1. Release the fuel pressure. < Ref. to RELEASING OF FUEL PRESSURE , Fuel. >
2. Open the fuel flap lid, and remove the fuel filler cap.



G02870934

Fig. 19: Removing Fuel Filler Cap
Courtesy of SUBARU OF AMERICA, INC.

3. Disconnect the fuel delivery hoses from fuel filter, and connect the fuel pressure gauge.



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Fig. 20: Disconnecting Fuel Delivery Hoses From Fuel Filter
Courtesy of SUBARU OF AMERICA, INC.

4. Connect the connector of fuel pump relay.



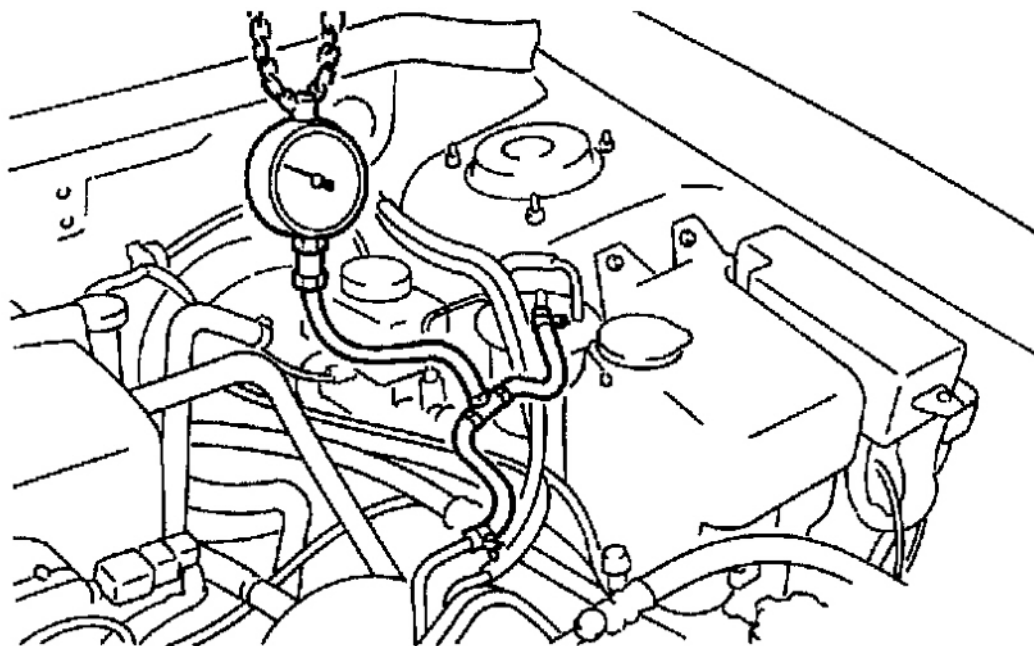
G02870936

Fig. 21: Connecting Connector Of Fuel Pump Relay
Courtesy of SUBARU OF AMERICA, INC.

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

Fuel pressure:

Standard; 284 - 314 kPa (2.9 - 3.2 kgf/cm² , 41 - 46 psi)



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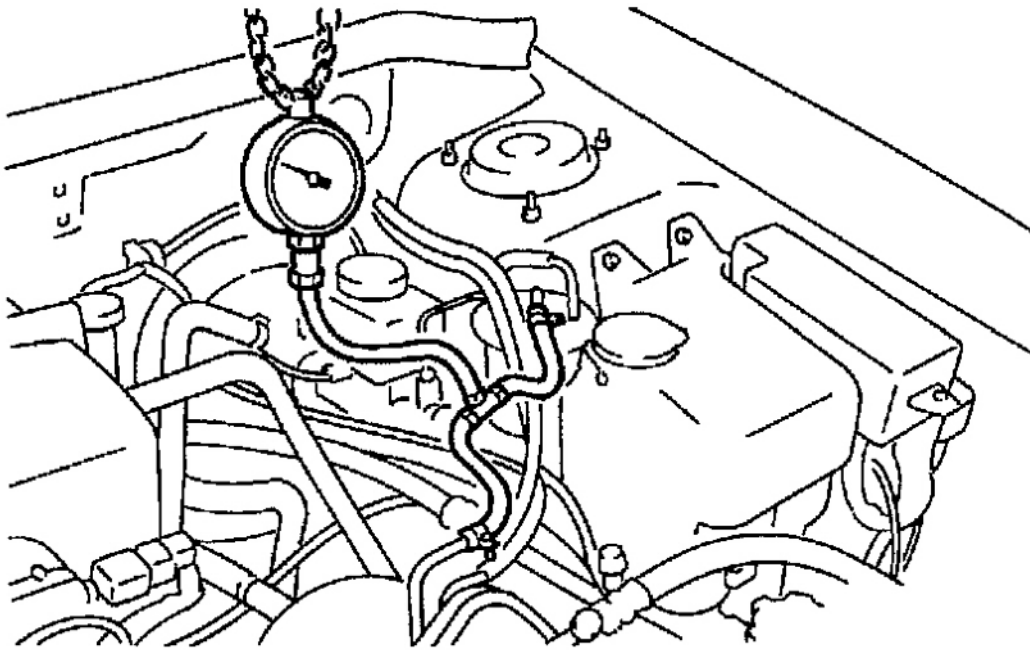
Fig. 22: Measuring Fuel Pressure

Courtesy of SUBARU OF AMERICA, INC.

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

Fuel pressure:

Standard; 230 - 260 kPa (2.35 - 2.65 kgf/cm² , 33 - 38 psi)



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Fig. 23: Measuring Fuel Pressure
Courtesy of SUBARU OF AMERICA, INC.

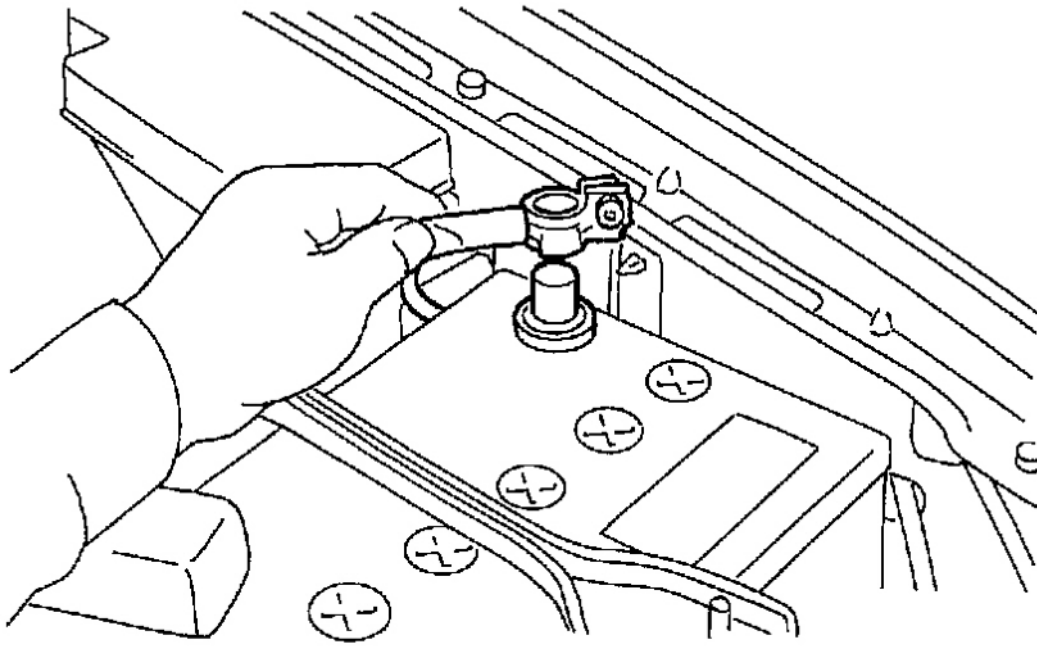
NOTE: The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kgf/cm², 1 to 3 psi) higher than standard values during high-altitude operations.

VALVE CLEARANCE

INSPECTION

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

1. Set the vehicle onto the lift.
2. Disconnect the ground terminal from battery.



G02870939

Fig. 24: Disconnecting Ground Terminal From Battery
 Courtesy of SUBARU OF AMERICA, INC.

3. Remove the air intake duct. < Ref. to **REMOVAL** , Air Intake Duct>.
4. Remove one bolt which secures the timing belt cover (RH).
5. Lift-up the vehicle.
6. Remove the under cover.
7. Loosen the remaining bolts which secure the timing belt cover (RH), then remove the belt cover.
8. Lower the vehicle.
9. When inspecting #1 and #3 cylinders:
 1. Pull out the engine harness connector with bracket from air cleaner upper cover.

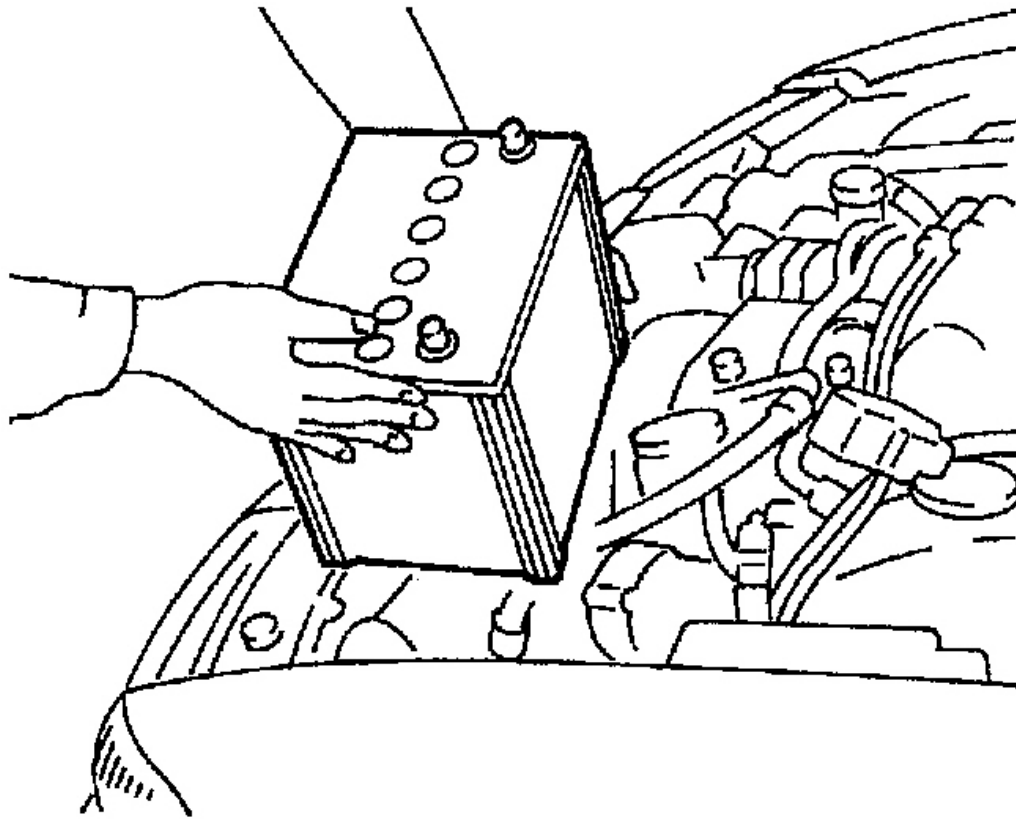


G02870940

Fig. 25: Pulling Out Engine Harness Connector With Bracket From Air Cleaner Upper Cover

Courtesy of SUBARU OF AMERICA, INC.

2. Remove the air cleaner case. < Ref. to **REMOVAL** , Air Cleaner. >
3. Disconnect the spark plug cords from spark plugs (#1 and #3 cylinders).
4. Place a suitable container under the vehicle.
5. Disconnect the PCV hose from rocker cover (RH).
6. Remove the bolts, then remove the rocker cover (RH).
10. When inspecting #2 and #4 cylinders:
 1. Disconnect the battery terminal, and then remove the battery and battery carrier.

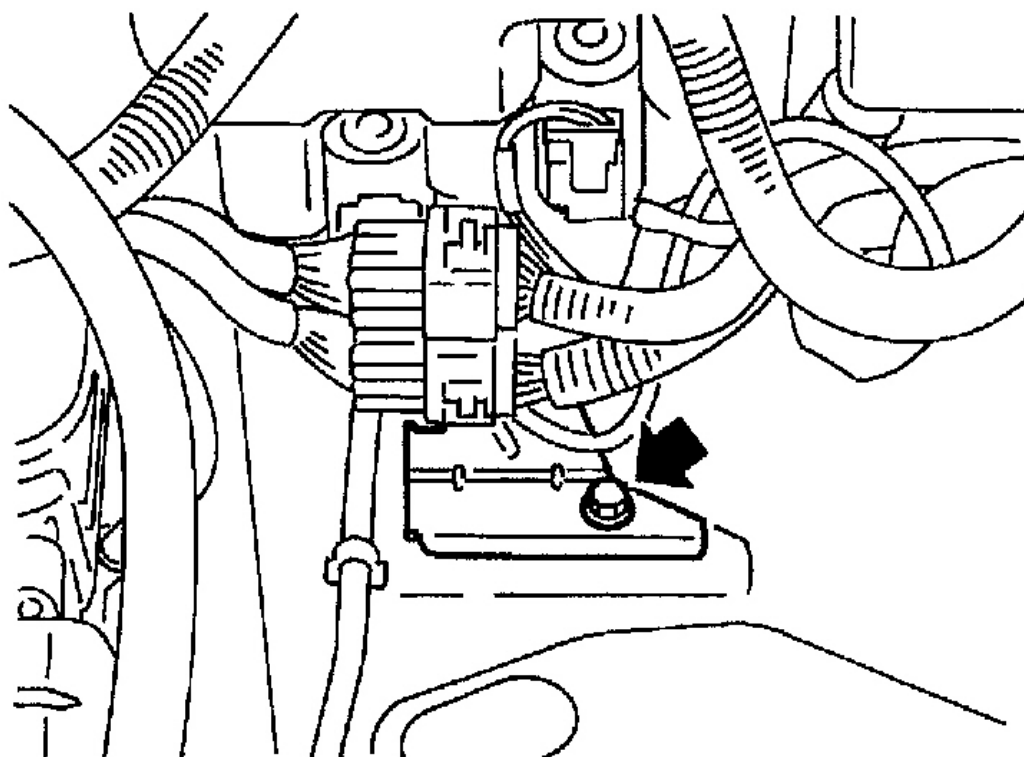


G02870941

Fig. 26: Removing Battery

Courtesy of SUBARU OF AMERICA, INC.

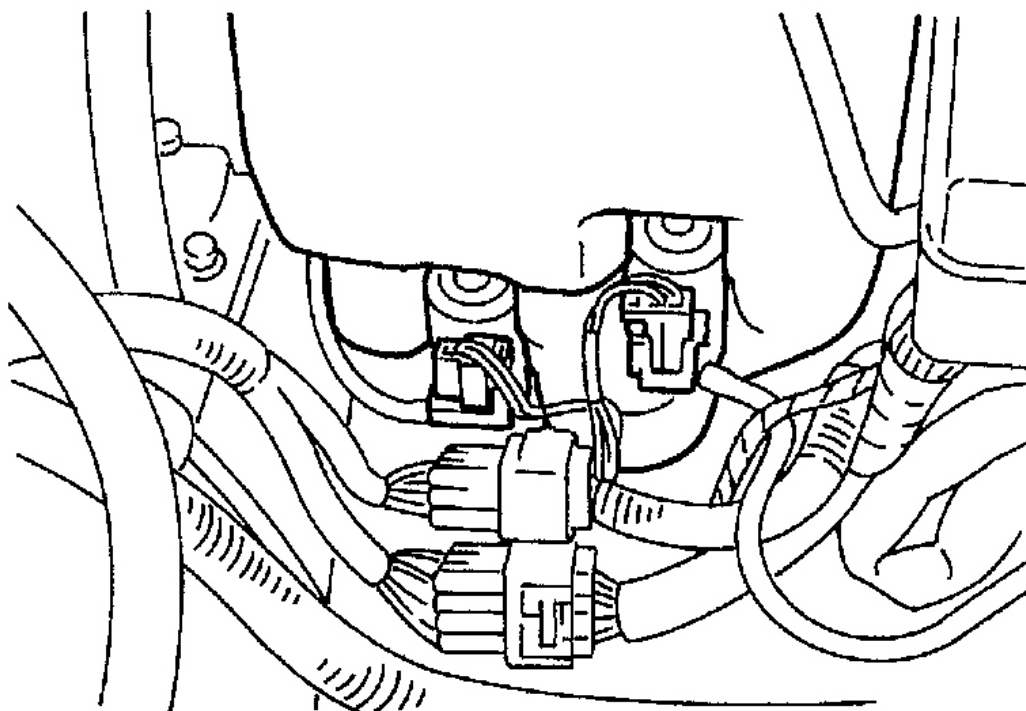
2. Remove the bolt which secures the engine harness bracket onto body.



G02870942

Fig. 27: Removing Bolt Which Secures Engine Harness Bracket Onto Body
Courtesy of SUBARU OF AMERICA, INC.

3. Disconnect the washer motor connectors.

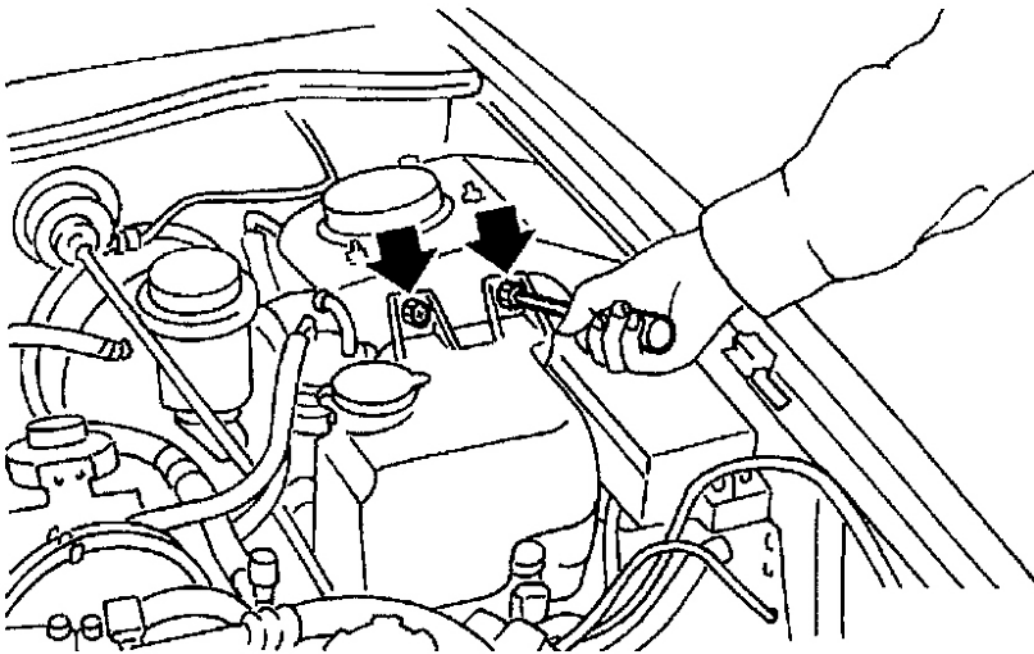


G02870943

Fig. 28: Disconnecting Washer Motor Connectors

Courtesy of SUBARU OF AMERICA, INC.

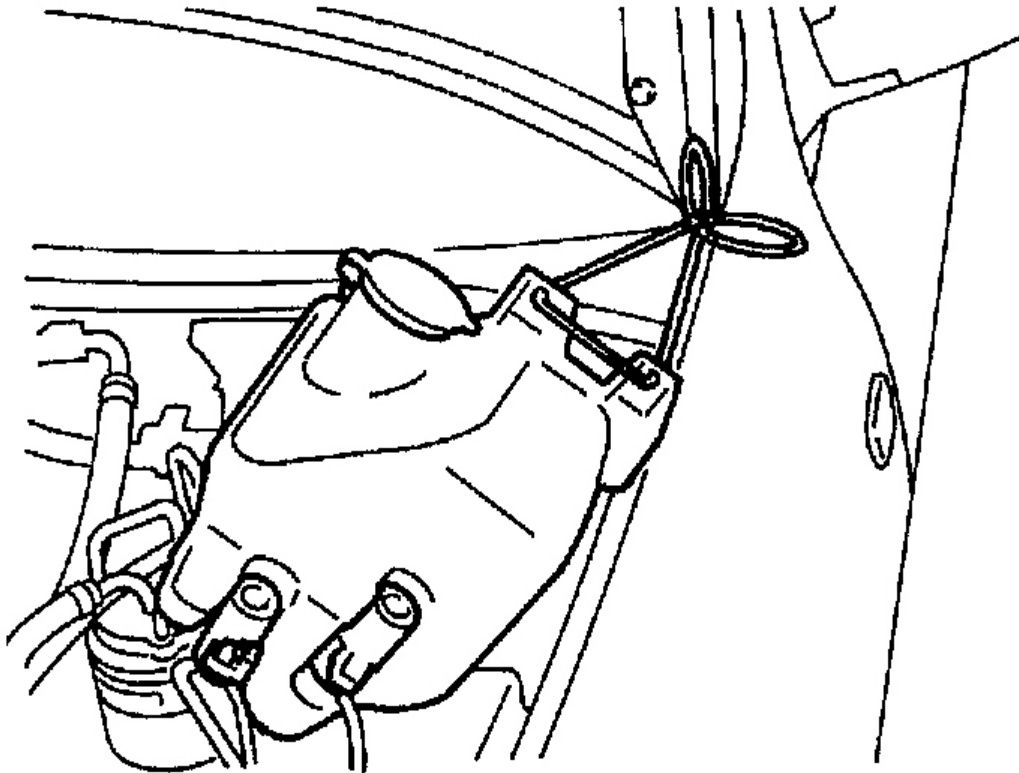
4. Remove the washer tank mounting bolts.



G02870944

Fig. 29: Removing Washer Tank Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

5. Move the washer tank upward.

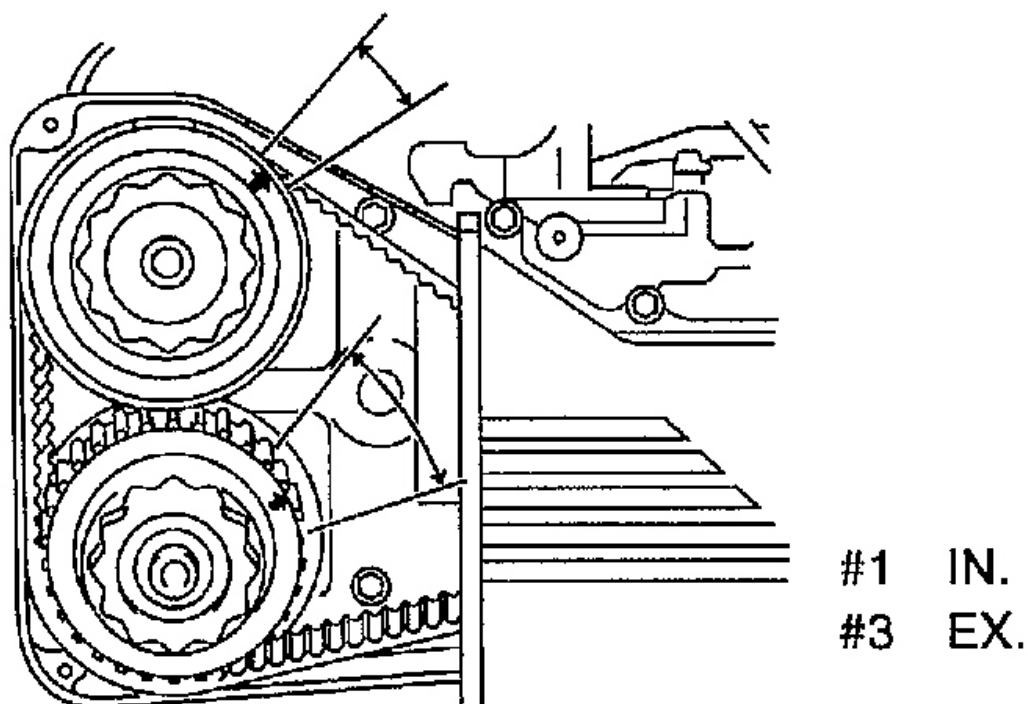


G02870945

Fig. 30: Moving Washer Tank Upward
Courtesy of SUBARU OF AMERICA, INC.

6. Disconnect the spark plug cords from spark plugs (#2 and #4 cylinders).
7. Place a suitable container under the vehicle.
8. Disconnect the PCV hose from rocker cover (LH).
9. Remove the bolts, then remove the rocker cover (LH).
11. Turn the crankshaft pulley clockwise until arrow mark on the camshaft sprocket is set to position shown in the figure.

NOTE: Turn the crankshaft using ST.
ST 499987500 CRANKSHAFT SOCKET



G02870946

Fig. 31: Turning Crankshaft Pulley Clockwise Until Arrow Mark On Camshaft Sprocket Is Set To Position

Courtesy of SUBARU OF AMERICA, INC.

12. Measure #1 cylinder intake valve and #3 cylinder exhaust valve clearance by using thickness gauge (A).

CAUTION:

- Insert the thickness gauge in as horizontal a direction as possible with respect to the shim.
- Measure the exhaust valve clearances while lifting-up the vehicle.

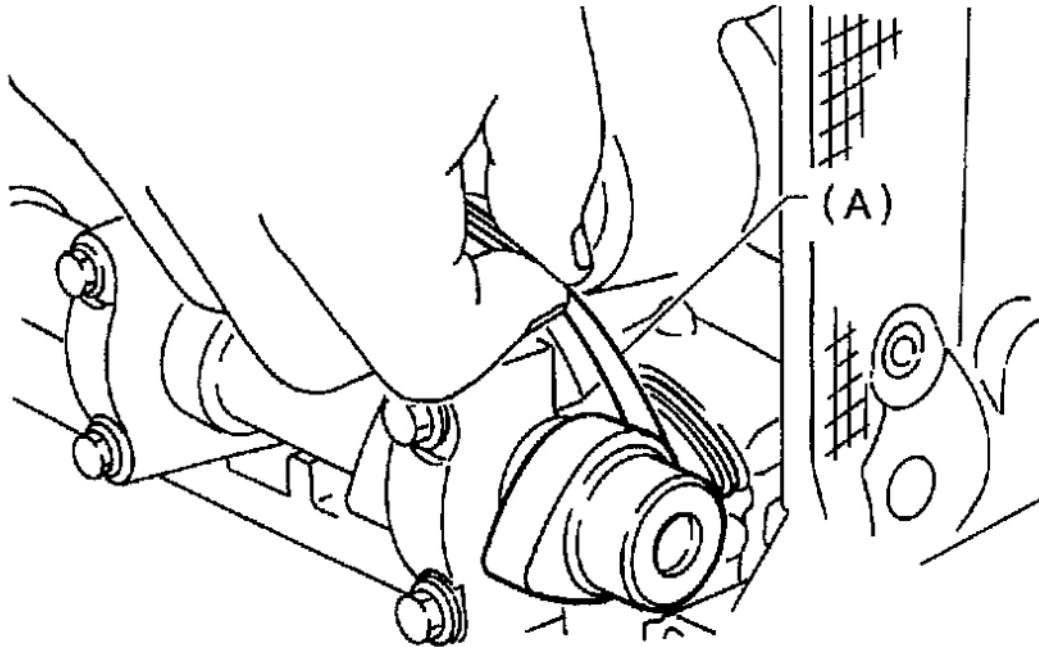
Valve clearance:

Intake: 0.20+/-0.02 mm (0.0079+/-0.0008 in)

Exhaust: 0.25+/-0.02 mm (0.0098+/-0.0008 in)

NOTE: If the measured value is not within specification, take notes of the value in

order to adjust the valve clearance later on.

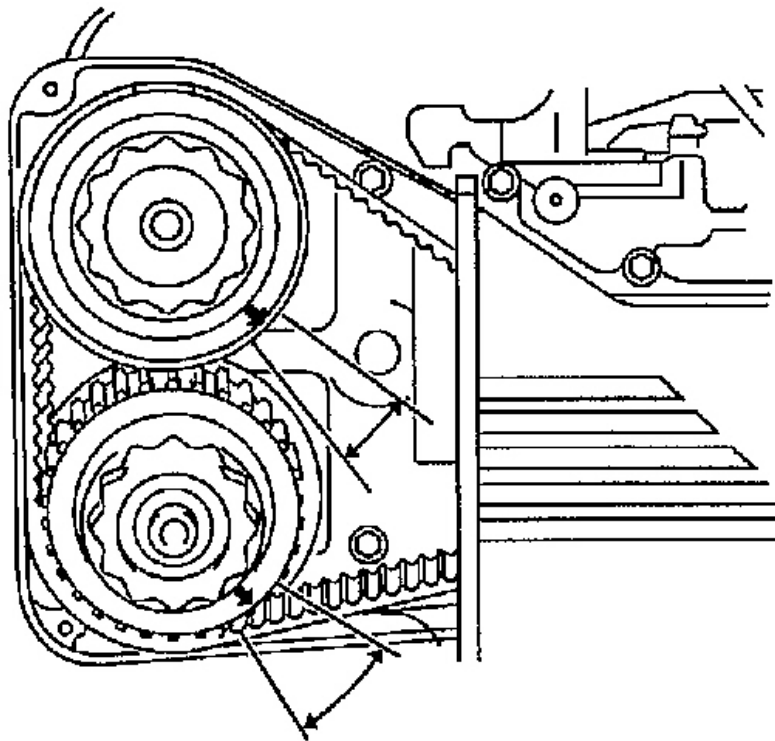


G02870947

Fig. 32: Measuring Exhaust Valve Clearances

Courtesy of SUBARU OF AMERICA, INC.

13. If necessary, adjust the valve clearance. < Ref. to **ADJUSTMENT**, Valve Clearances
14. Further turn the crankshaft pulley clockwise. Using the same procedures described previously, then measure valve clearances again.
 1. Set the arrow mark on camshaft sprocket to position shown in the figure, and measure #2 cylinder exhaust valve and #3 cylinder intake valve clearances.



#2 EX.
#3 IN.

G02870948

Fig. 33: Setting Arrow Mark On Camshaft Sprocket To Position
Courtesy of SUBARU OF AMERICA, INC.

2. Set the arrow mark on camshaft sprocket to position shown in the figure, and measure #2 cylinder intake valve and #4 cylinder exhaust valve clearances.

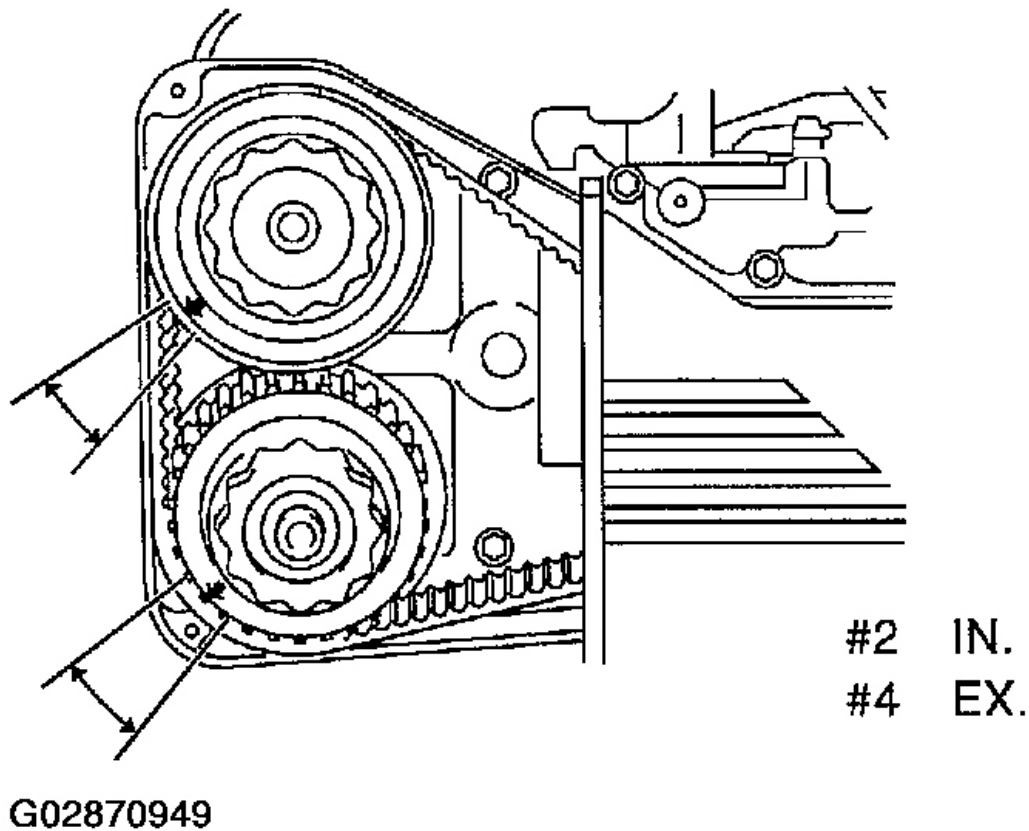
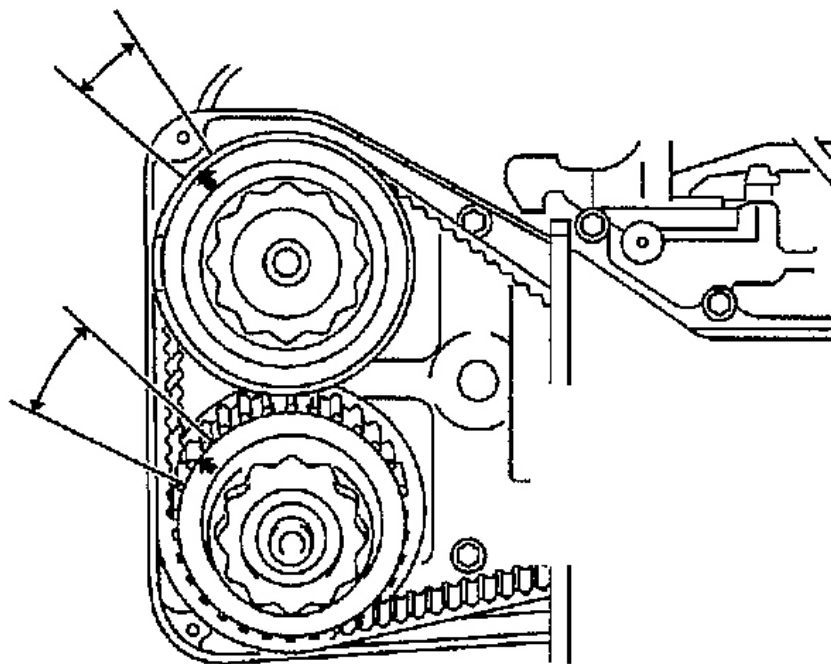


Fig. 34: Setting Arrow Mark On Camshaft Sprocket To Position
 Courtesy of SUBARU OF AMERICA, INC.

3. Set the arrow mark on camshaft sprocket to position shown in the figure, and measure #1 cylinder exhaust valve and #4 cylinder intake valve clearances.



#1 EX.

#4 IN.

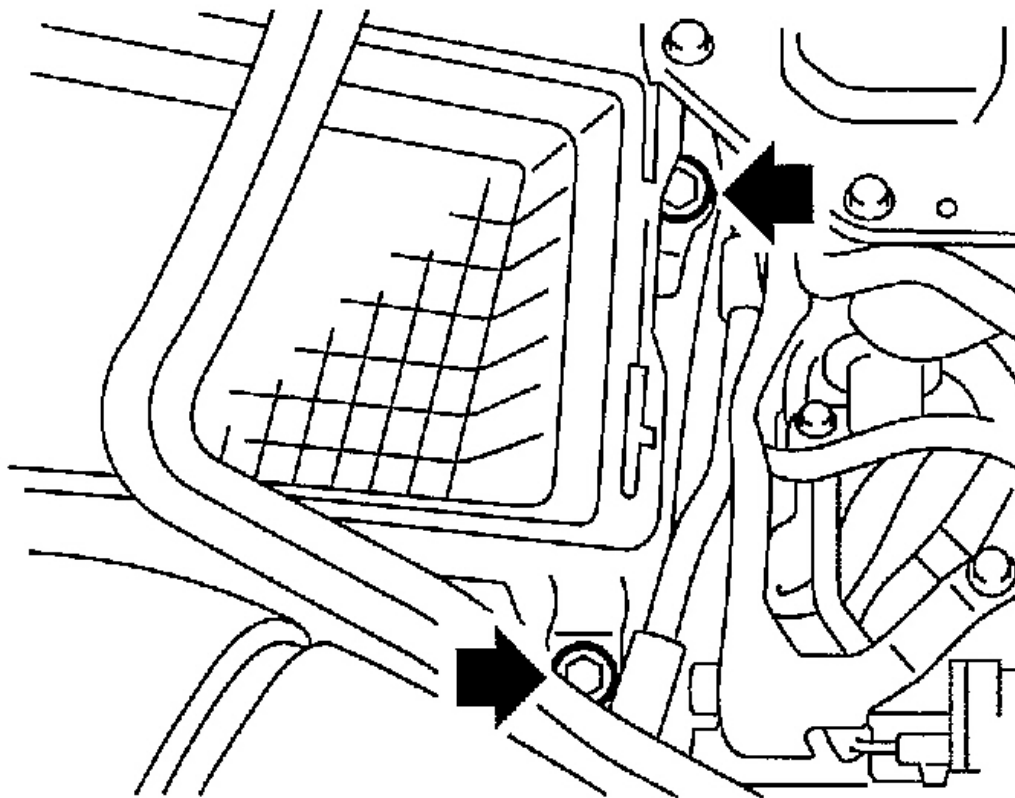
G02870950

Fig. 35: Setting Arrow Mark On Camshaft Sprocket To Position
Courtesy of SUBARU OF AMERICA, INC.

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

Tightening torque:

32 N.m (3.3 kgf-m, 24 ft-lb)



G02870951

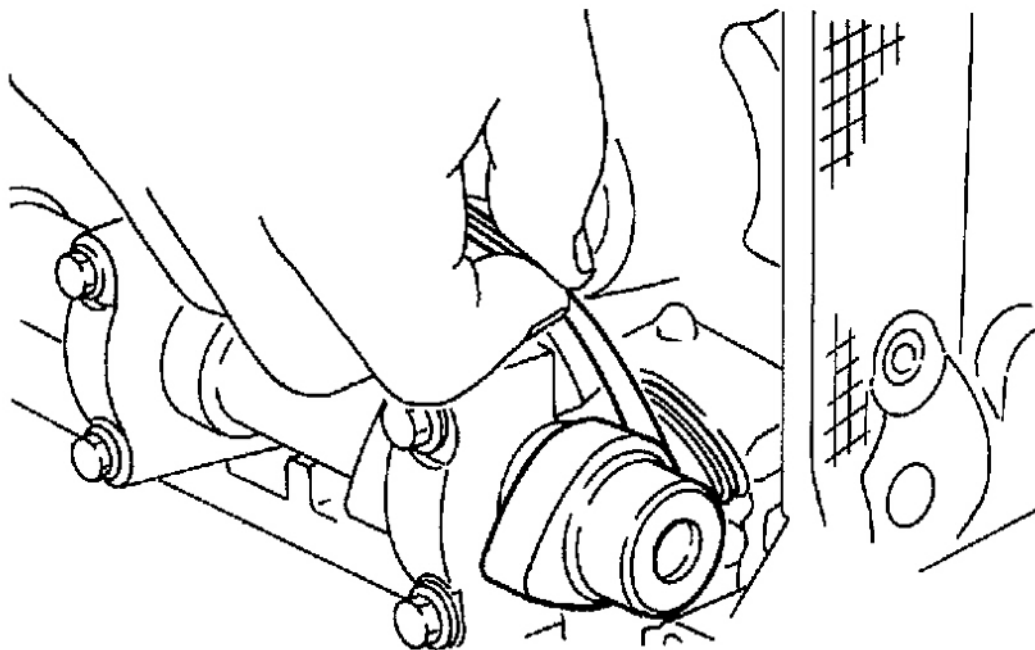
Fig. 36: Installing Related Bolts
Courtesy of SUBARU OF AMERICA, INC.

ADJUSTMENT

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

1. Measure all valve clearances. < Ref. to **INSPECTION** , Valve Clearance. >

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



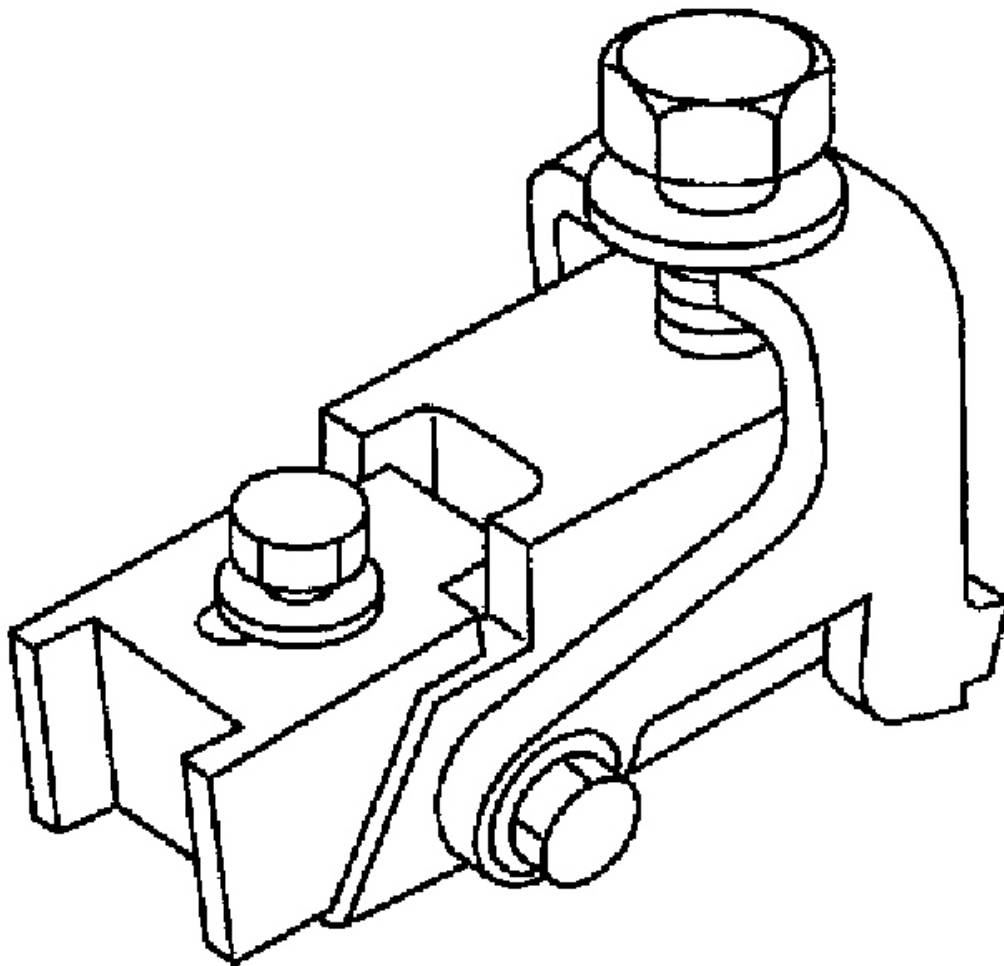
G02870952

Fig. 37: Measuring Valve Clearances

Courtesy of SUBARU OF AMERICA, INC.

2. Remove the shim from valve lifter.
 1. Prepare the ST.

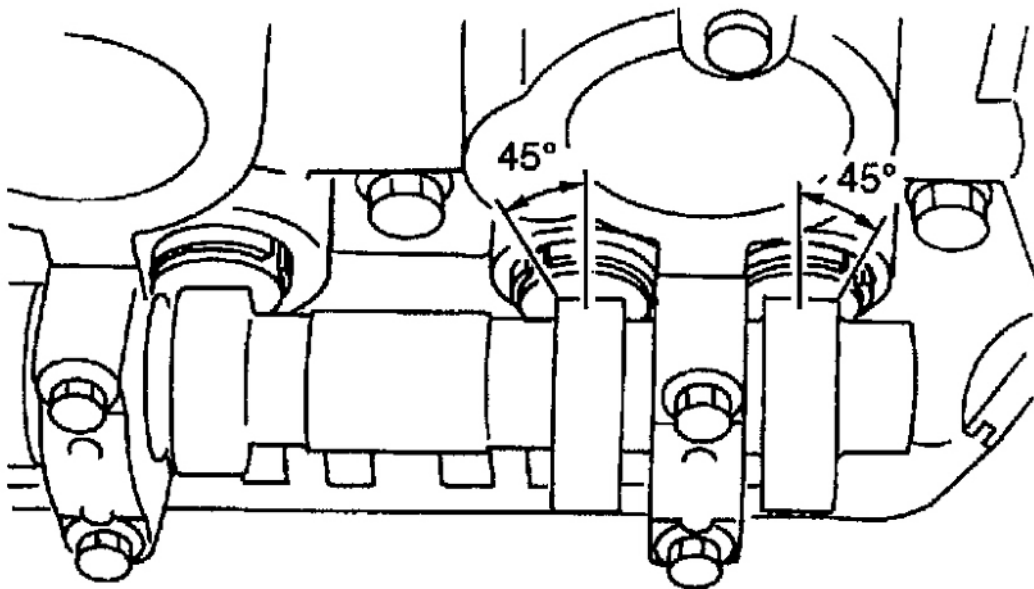
ST 498187200 SHIM REPLACER



G02870953

Fig. 38: Identifying Special Tools
Courtesy of SUBARU OF AMERICA, INC.

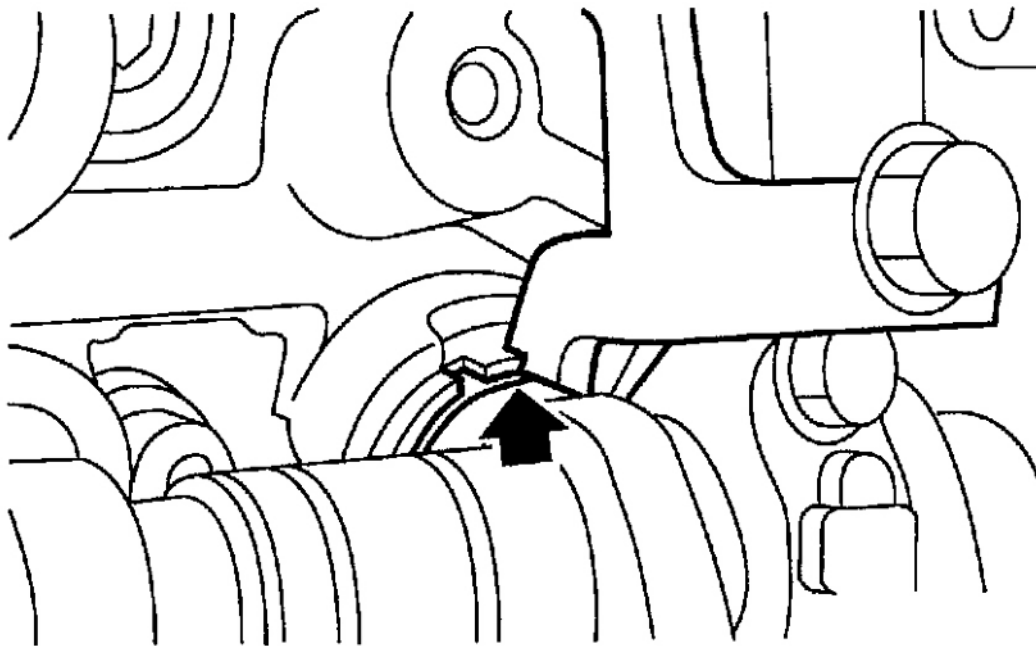
2. Rotate the notch of the valve lifter outward by 45°.



G02870954

Fig. 39: Rotating Notch Of Valve Lifter Outward By 45°
Courtesy of SUBARU OF AMERICA, INC.

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

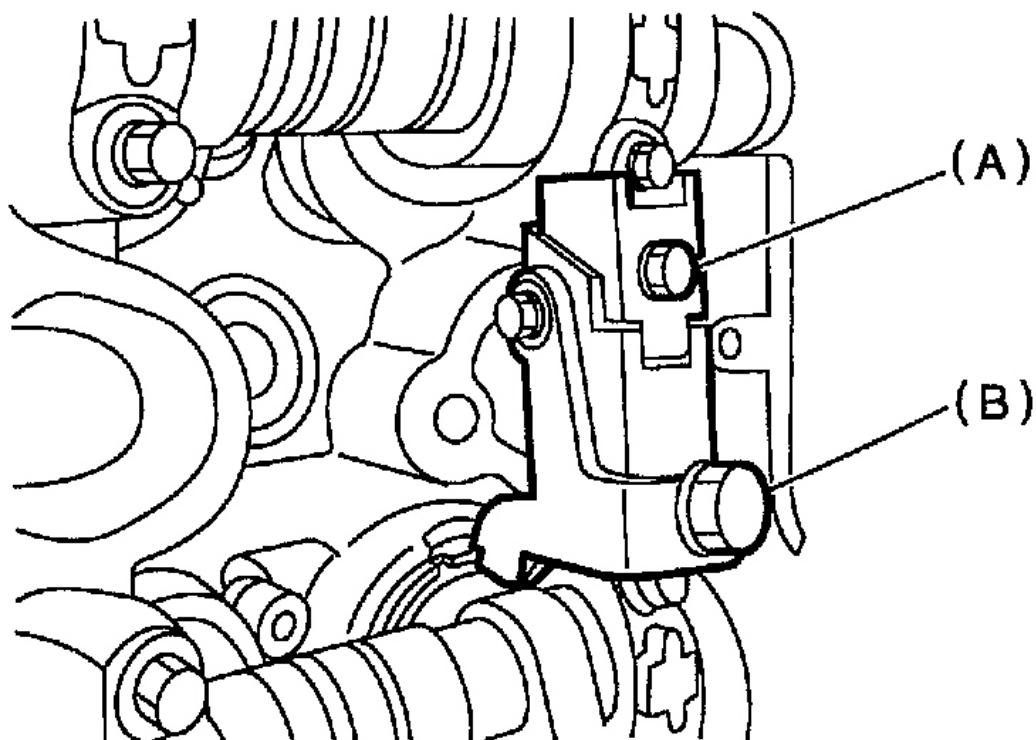


G02870955

Fig. 40: Adjusting Shim Replacer Notch To Valve Lifter
Courtesy of SUBARU OF AMERICA, INC.

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

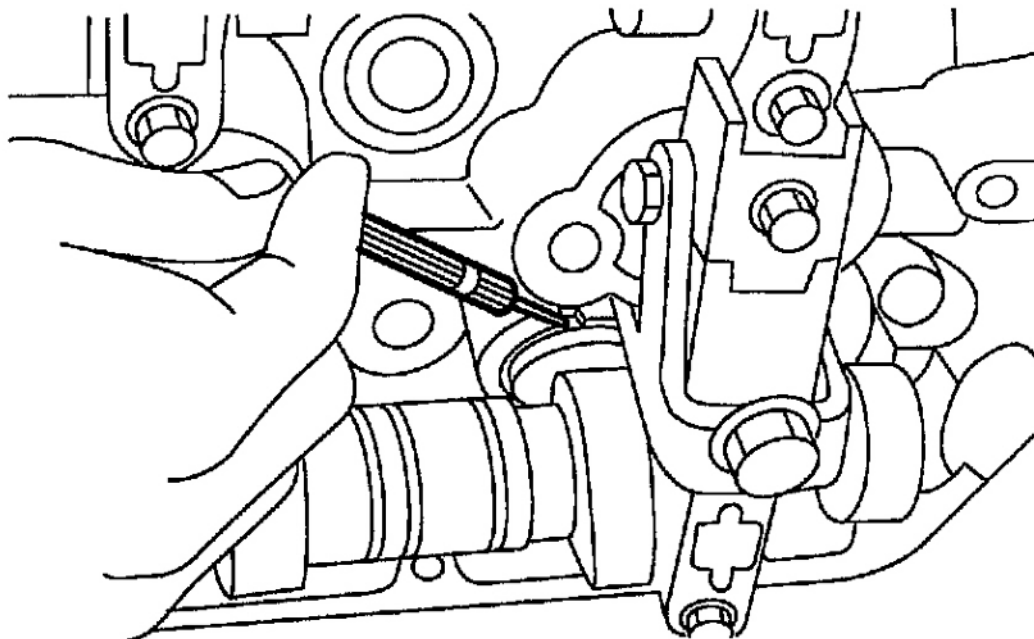
4. Tighten bolt (A) and install it to the cylinder head.
5. Tighten bolt (B) and insert the valve lifter.



G02870956

Fig. 41: Tightening Bolt (A) And Installing Shim Replacer To Cylinder Head
Courtesy of SUBARU OF AMERICA, INC.

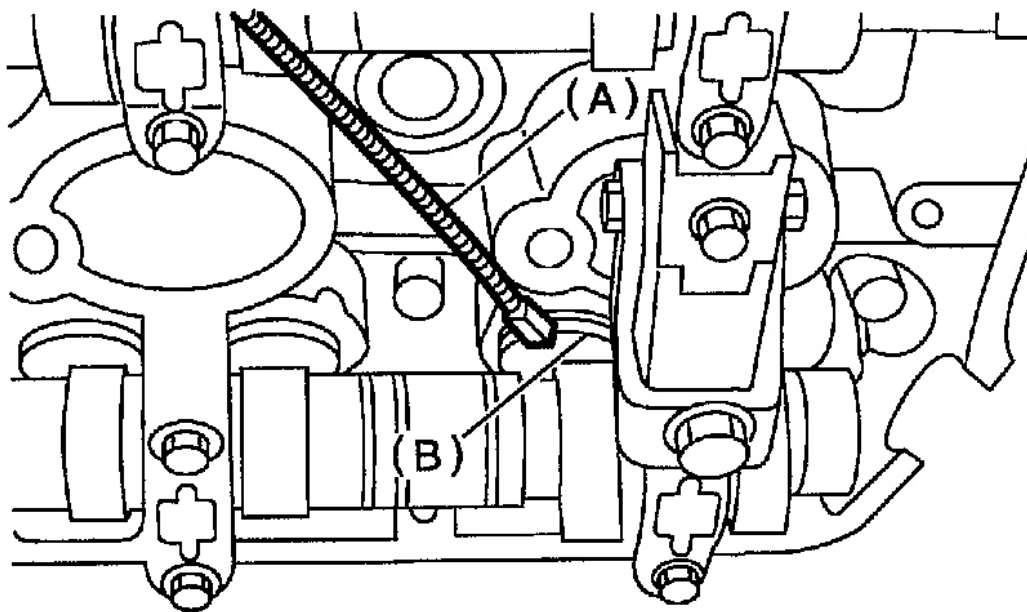
6. Insert tweezers into the notch of the valve lifter, and take the shim out.



G02870957

Fig. 42: Inserting Tweezers Into Notch Of Valve Lifter
Courtesy of SUBARU OF AMERICA, INC.

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

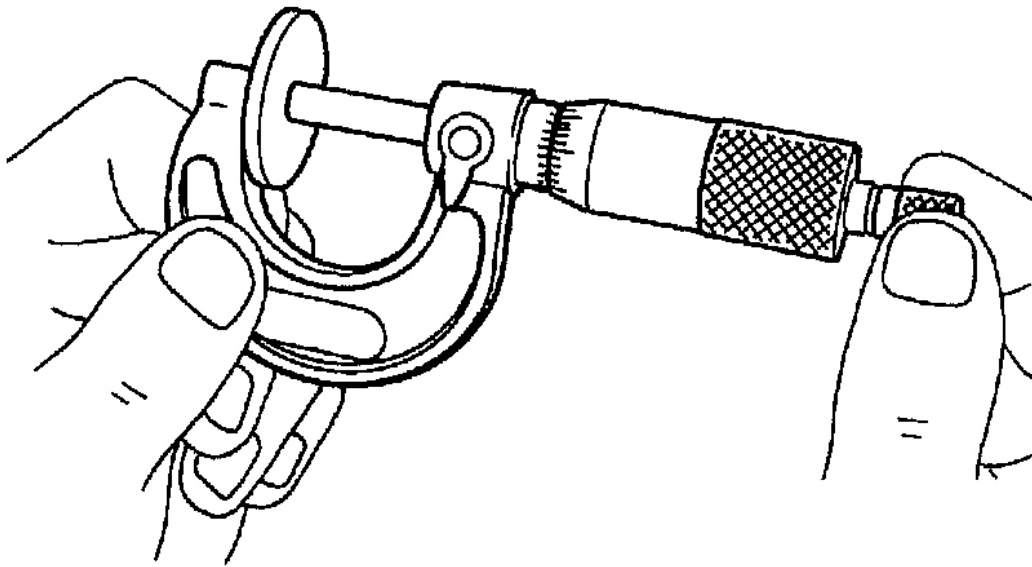


G02870958

Fig. 43: Removing Shim

Courtesy of SUBARU OF AMERICA, INC.

3. Measure the thickness of shim with a micrometer.



G02870959

Fig. 44: Measuring Thickness Of Shim With A Micrometer
 Courtesy of SUBARU OF AMERICA, INC.

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

SHIM THICKNESS SPECIFICATIONS

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	

SHIM THICKNESS SPECIFICATIONS

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)

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

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.

ENGINE ASSEMBLY

REMOVAL

1. Set the vehicle on lift arms.
2. Open the front hood fully and support with stay.
3. Raise the rear seat, and turn the floor mat up.
4. Release the fuel pressure.
 1. Disconnect the fuel pump relay connector.

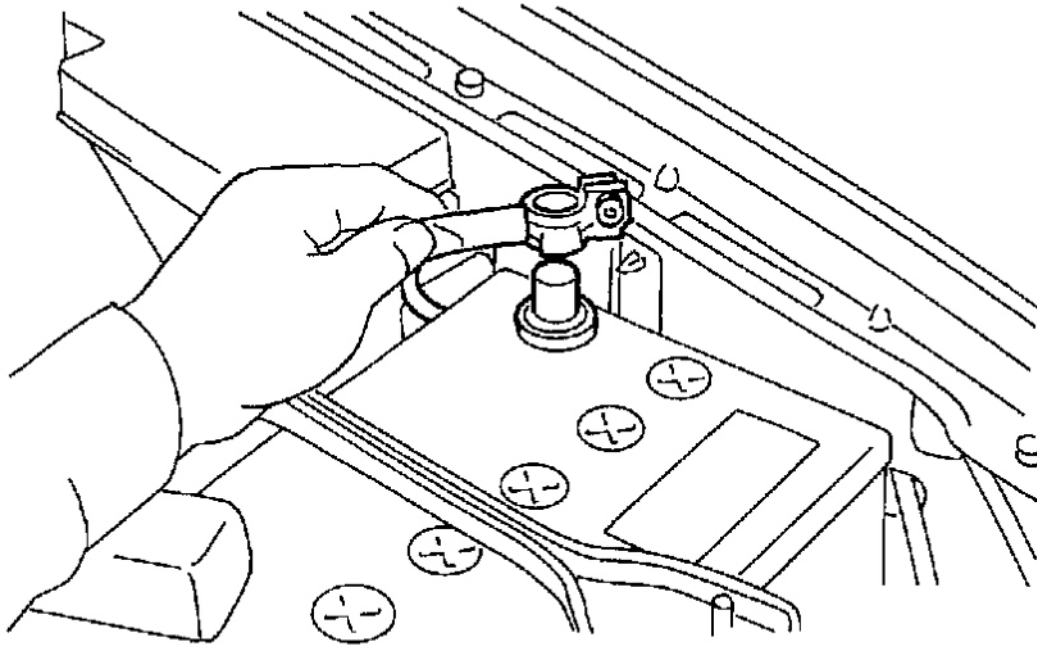


G02870960

Fig. 45: Disconnecting Fuel Pump Relay Connector
Courtesy of SUBARU OF AMERICA, INC.

2. Start the engine, and run until stalls.
3. After the engine stalls, crank it for five seconds more.

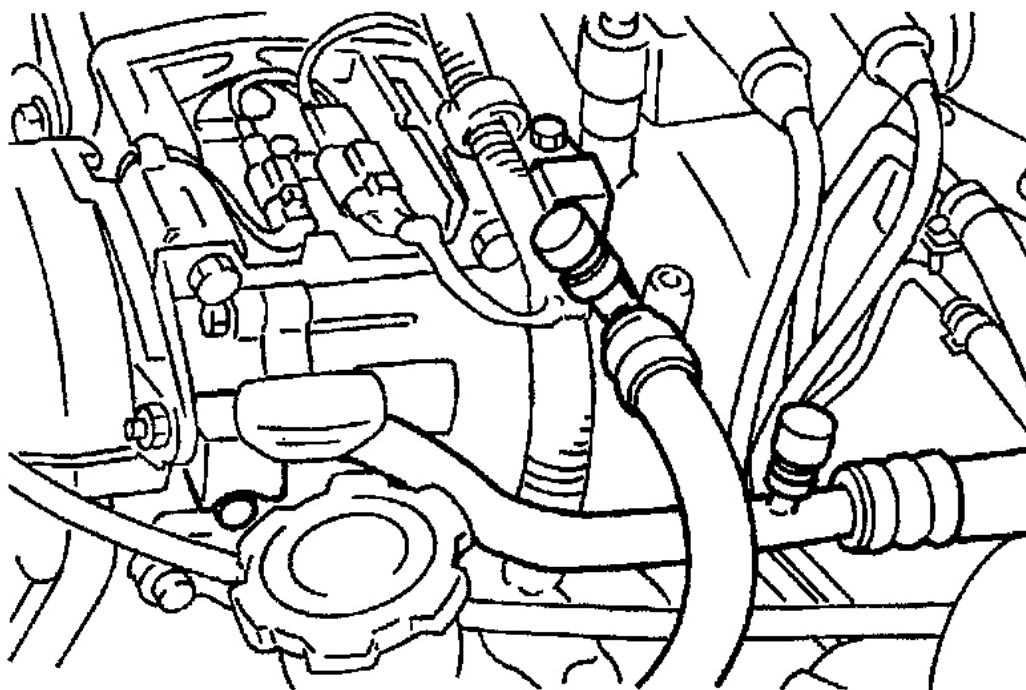
4. Turn the ignition switch to "OFF".
5. Remove the filler cap.
6. Disconnect the ground terminal from battery.



G02870961

Fig. 46: Disconnecting Ground Terminal From Battery
Courtesy of SUBARU OF AMERICA, INC.

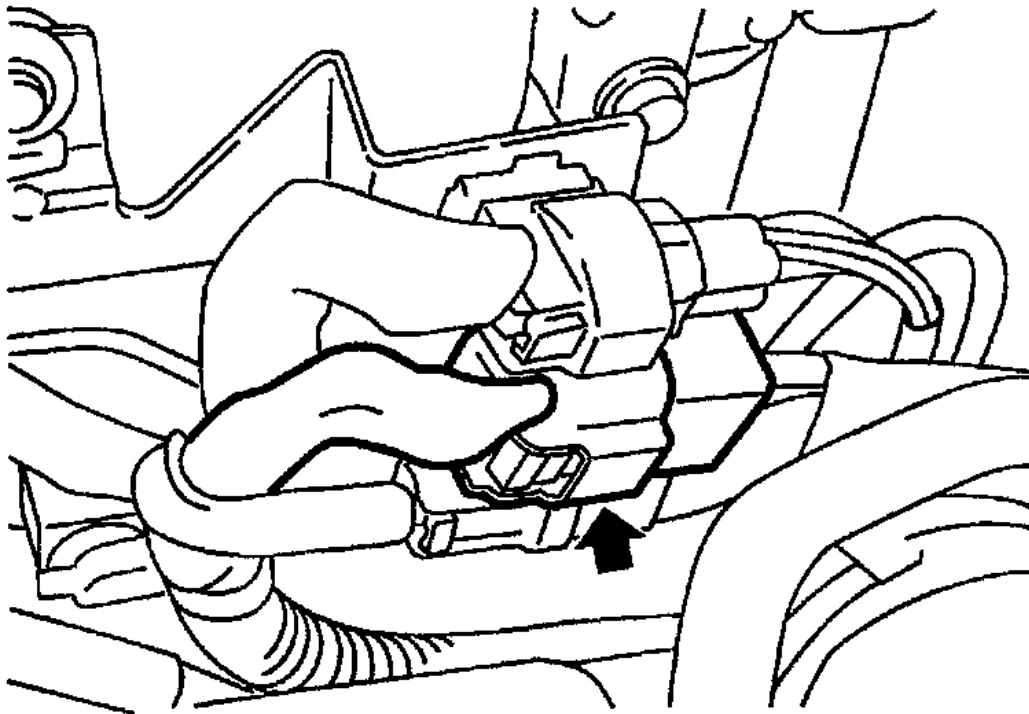
7. Remove the radiator from vehicle. < Ref. to **REMOVAL** , Radiator. >
8. Remove the coolant filler tank. < Ref. to **REMOVAL** , Coolant Filler Tank>.
9. Collect refrigerant, and remove the pressure hoses.
 1. Place and connect the attachment hose to the refrigerant recycle system.
 2. Collect the refrigerant from A/C system.
 3. Disconnect the A/C pressure hoses from A/C compressor.



G02870962

Fig. 47: Disconnecting A/C Pressure Hoses From A/C Compressor
Courtesy of SUBARU OF AMERICA, INC.

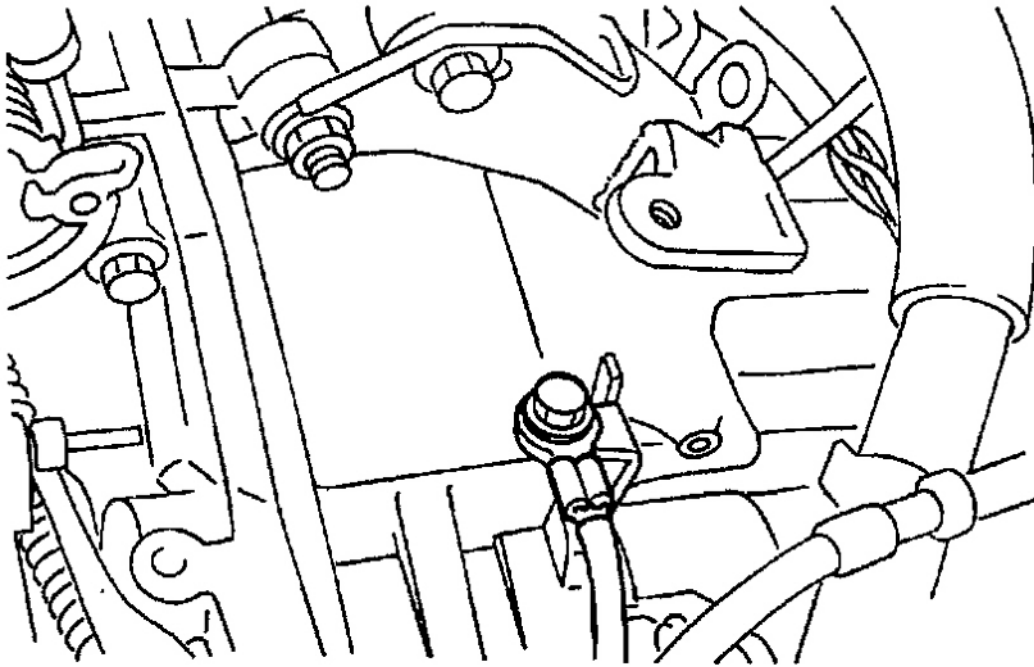
10. Remove the intercooler. < Ref. to **REMOVAL** , Intercooler. >
11. Disconnect the following connectors and cable.
 1. Engine harness connector



G02870963

Fig. 48: Disconnecting Engine Harness Connector
Courtesy of SUBARU OF AMERICA, INC.

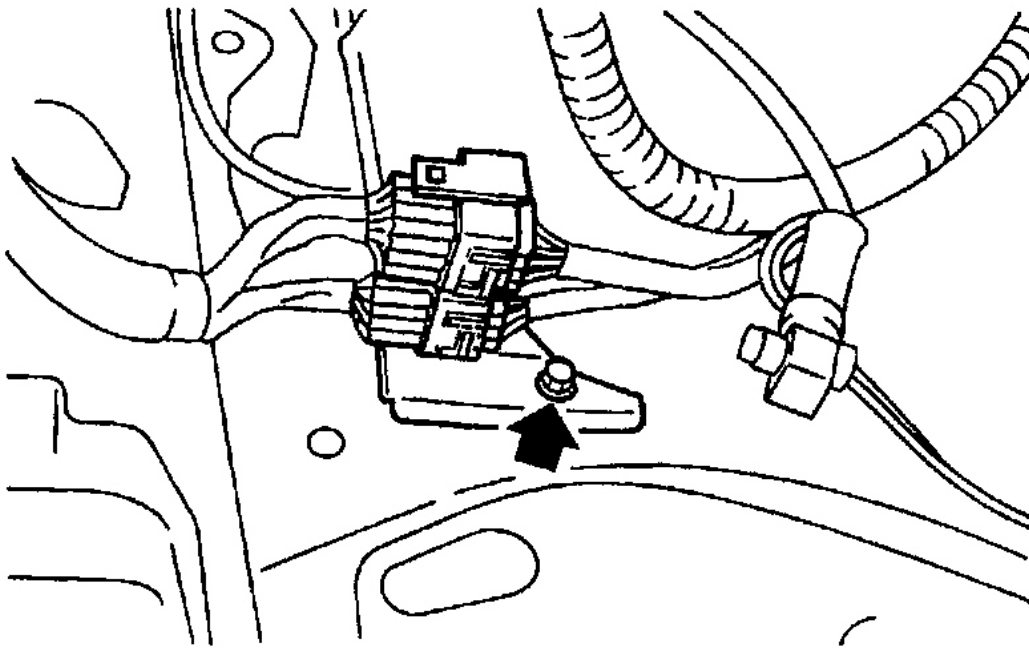
2. Engine ground terminal



G02870964

Fig. 49: Disconnecting Engine Ground Terminal
Courtesy of SUBARU OF AMERICA, INC.

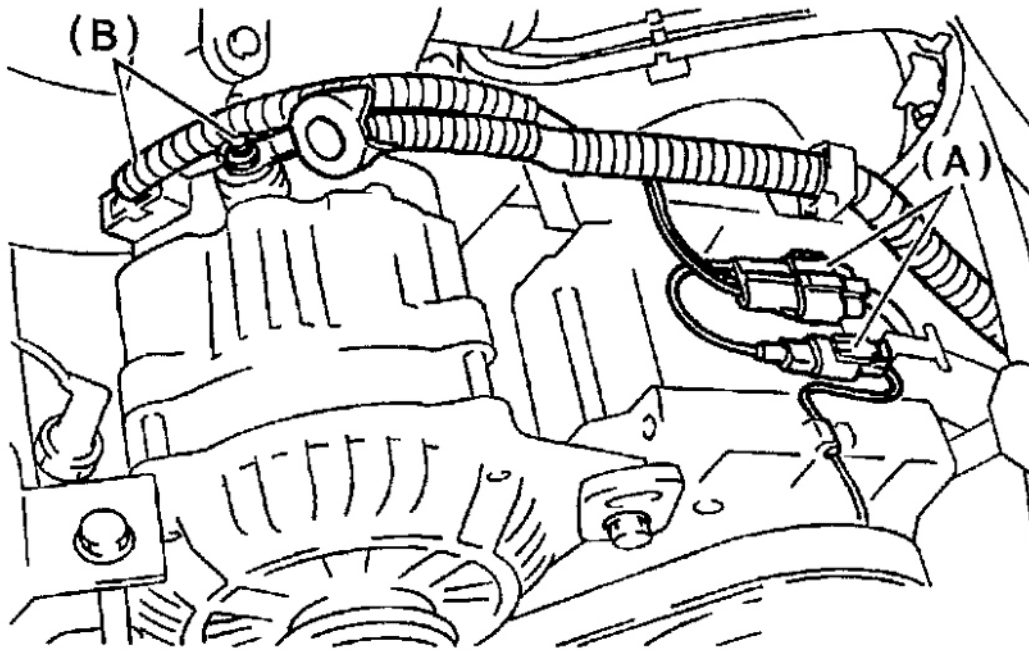
3. Engine harness connector



G02870965

Fig. 50: Disconnecting Engine Harness Connector
Courtesy of SUBARU OF AMERICA, INC.

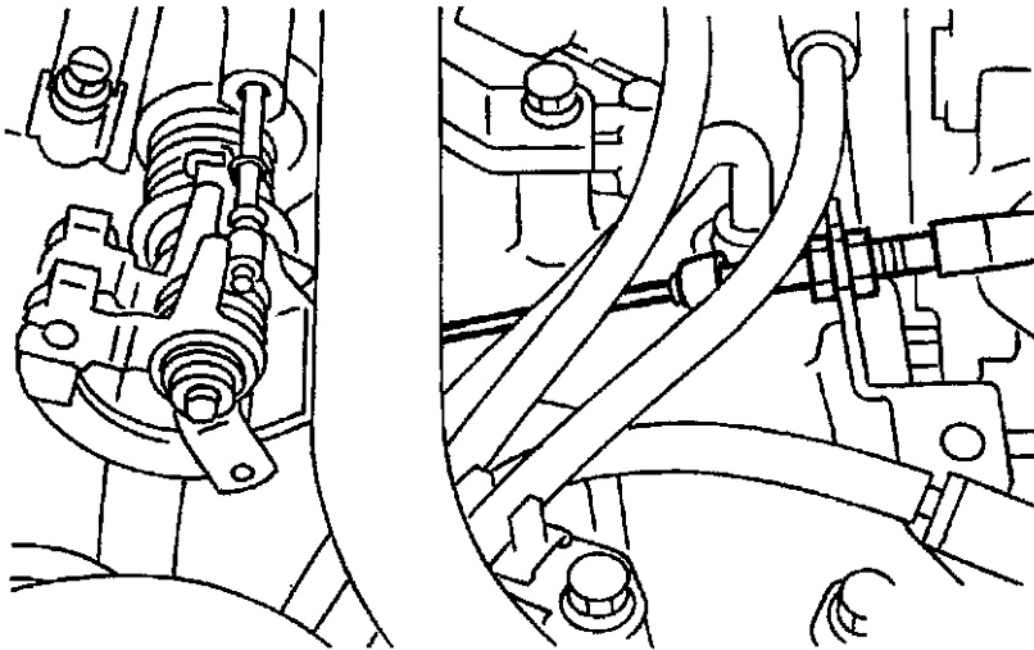
4. Generator connector, terminal and A/C compressor connectors



G02870966

Fig. 51: Disconnecting Generator Connector, Terminal And A/C Compressor Connector
Courtesy of SUBARU OF AMERICA, INC.

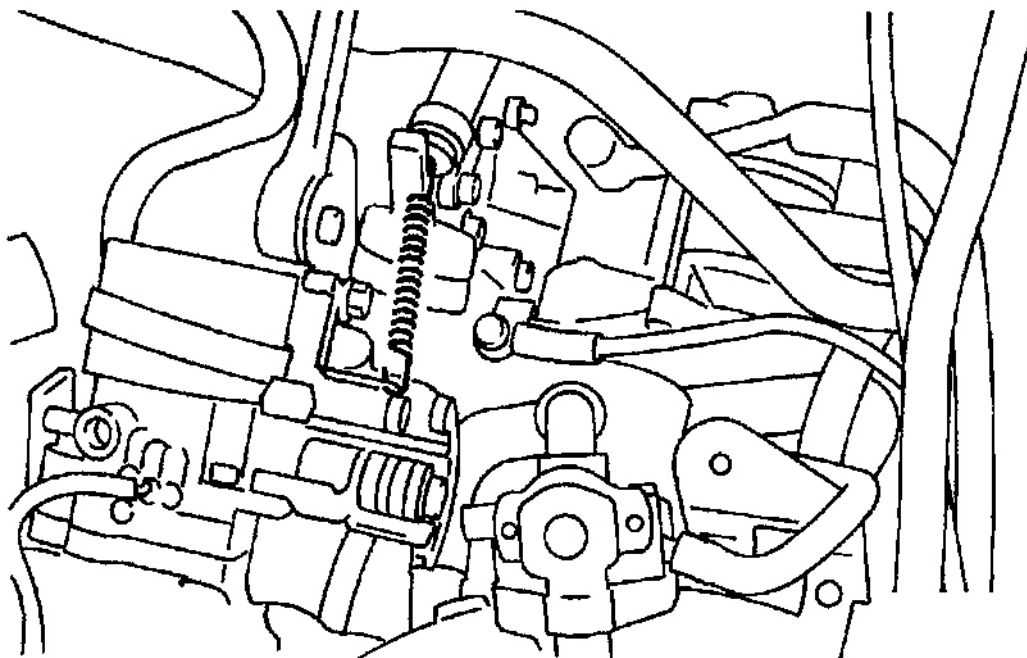
- A. A/C compressor connector
 - B. Generator connector and terminal
5. Accelerator cable



G02870967

Fig. 52: Disconnecting Accelerator Cable
Courtesy of SUBARU OF AMERICA, INC.

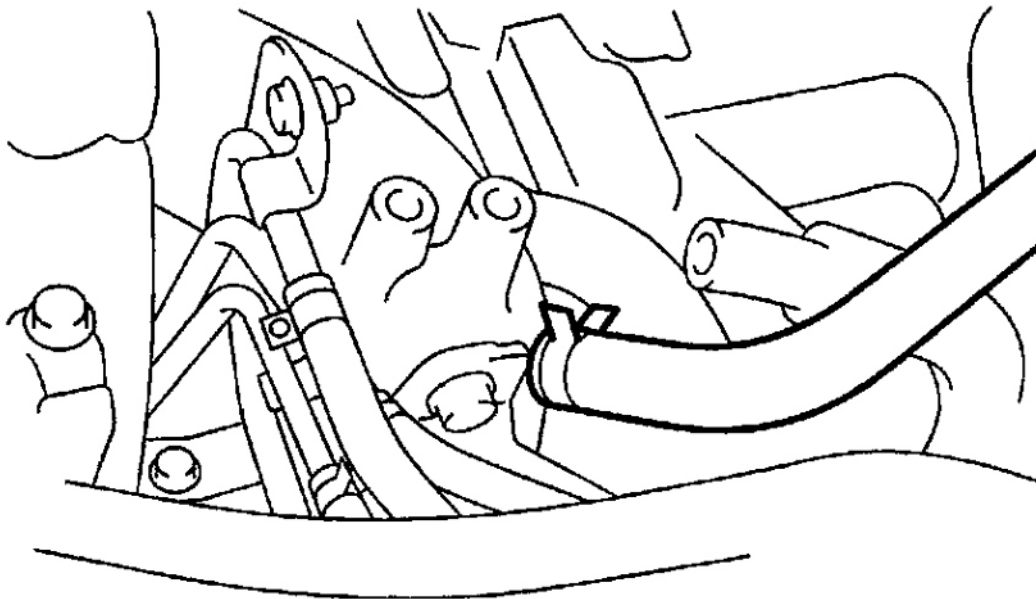
6. Clutch release spring



G02870968

Fig. 53: Disconnecting Clutch Release Spring
Courtesy of SUBARU OF AMERICA, INC.

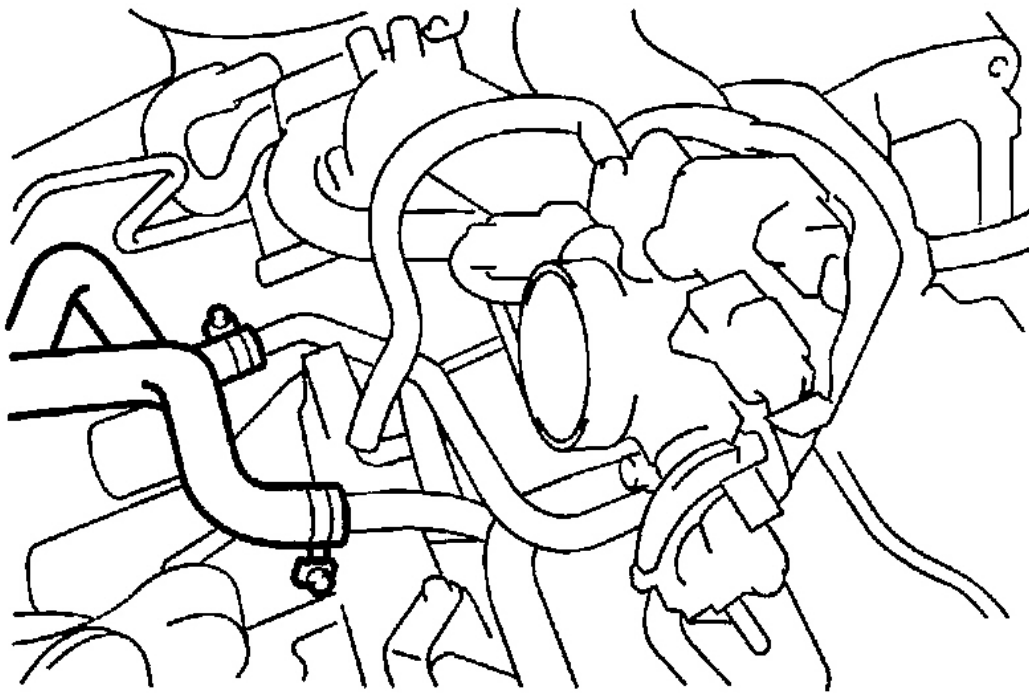
12. Disconnect the following hoses.
 1. Brake booster vacuum hose



G02870969

Fig. 54: Disconnecting Brake Booster Vacuum Hose
Courtesy of SUBARU OF AMERICA, INC.

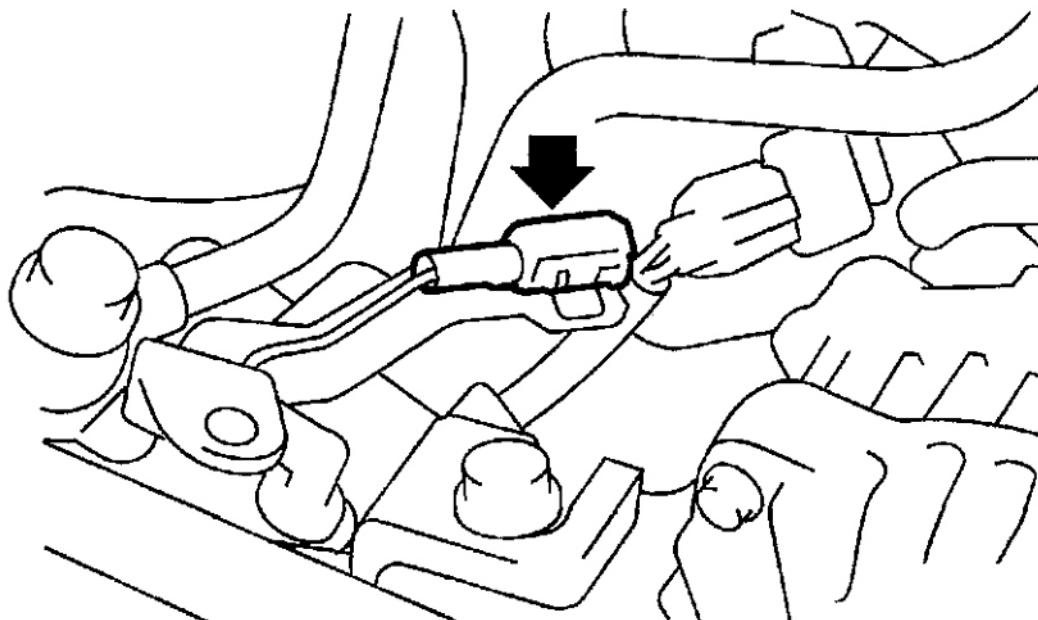
2. Heater inlet outlet hose



G02870970

Fig. 55: Disconnecting Heater Inlet Outlet Hose
Courtesy of SUBARU OF AMERICA, INC.

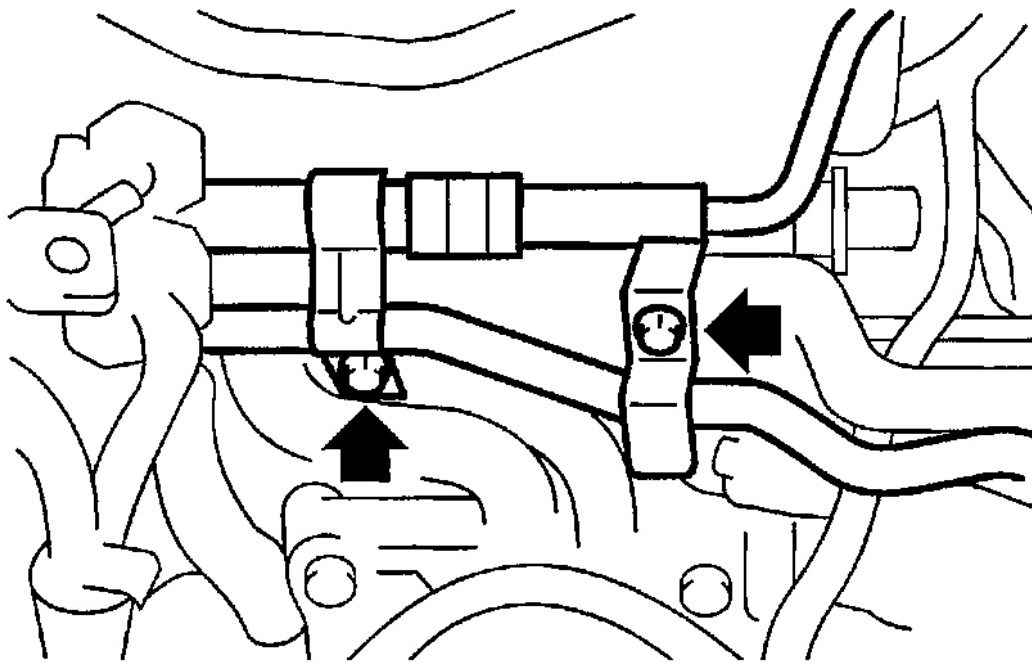
13. Remove the power steering pump from bracket.
 1. Loosen lock bolt and slider bolt, and remove the front side V-belt. < Ref. to **FRONT SIDE BELT** , V-belt. >
 2. Disconnect the power steering switch connector.



G02870971

Fig. 56: Disconnecting Power Steering Switch Connector
Courtesy of SUBARU OF AMERICA, INC.

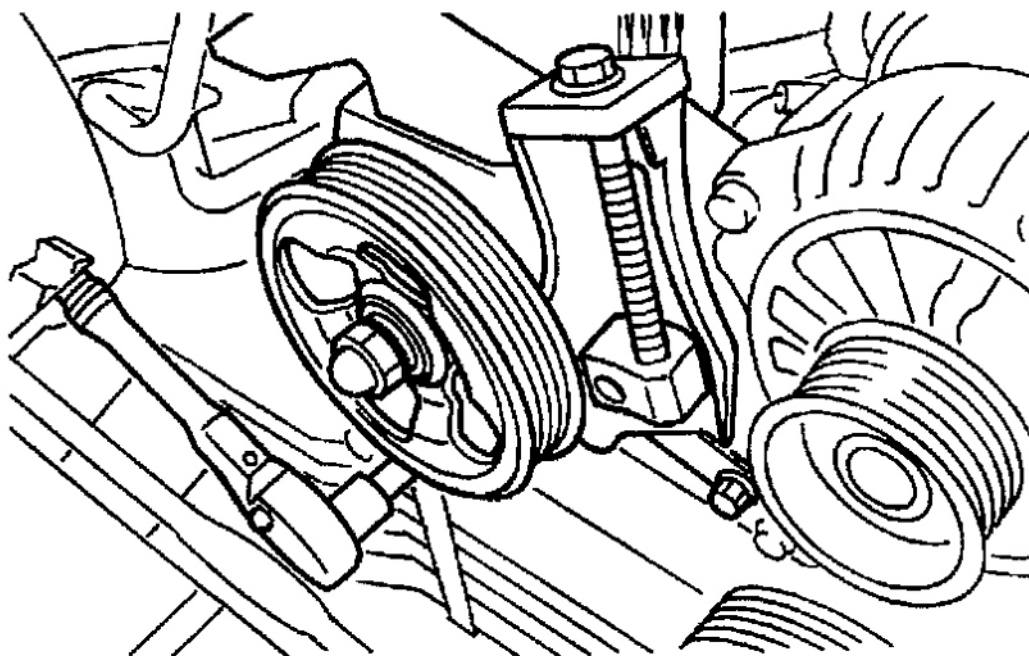
3. Remove the pipe with bracket from intake manifold.



G02870972

Fig. 57: Removing Pipe With Bracket From Intake Manifold
Courtesy of SUBARU OF AMERICA, INC.

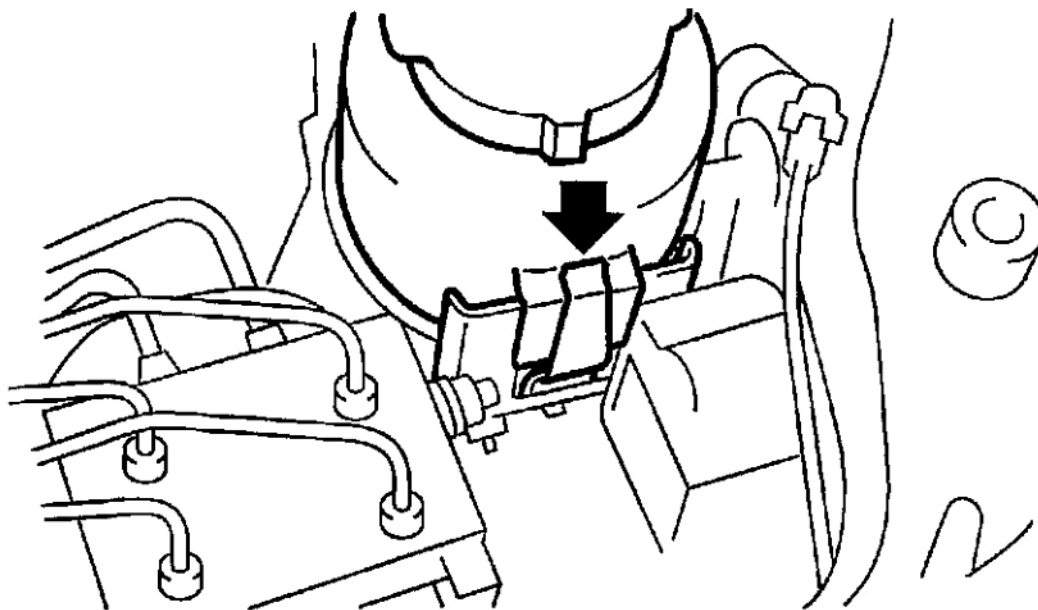
4. Remove the power steering pump from engine.



G02870973

Fig. 58: Removing Power Steering Pump From Engine
Courtesy of SUBARU OF AMERICA, INC.

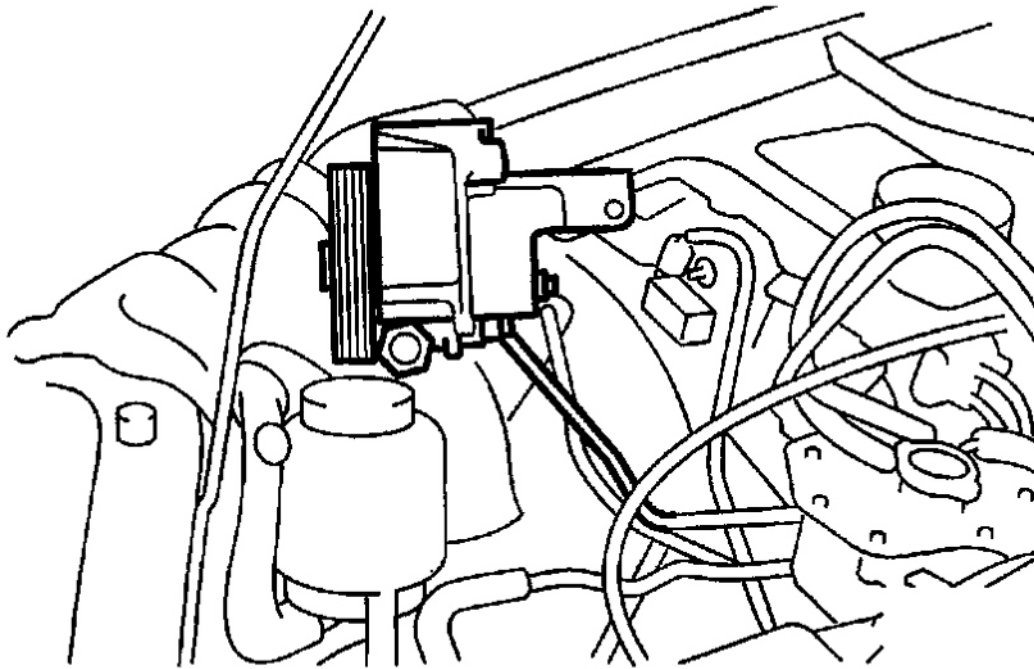
5. Remove the power steering tank from the bracket by pulling it upward.



G02870974

Fig. 59: Removing Power Steering Tank From Bracket
Courtesy of SUBARU OF AMERICA, INC.

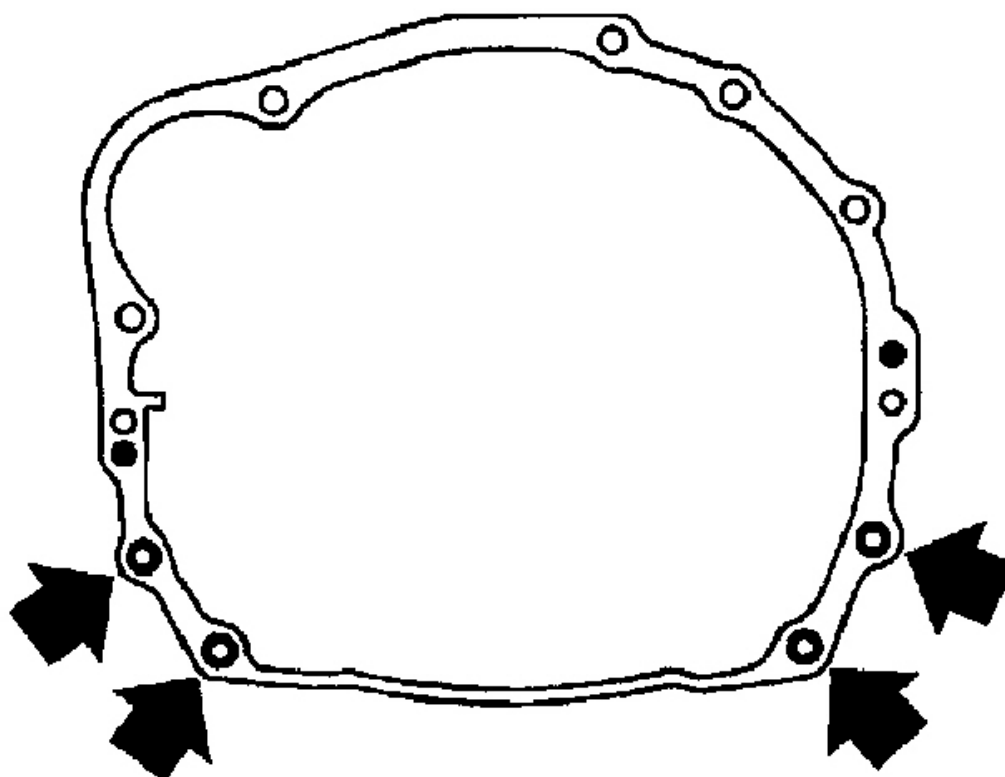
6. Place the power steering pump on the right side wheel apron.



G02870975

Fig. 60: Placing Power Steering Pump On Right Side Wheel Apron
Courtesy of SUBARU OF AMERICA, INC.

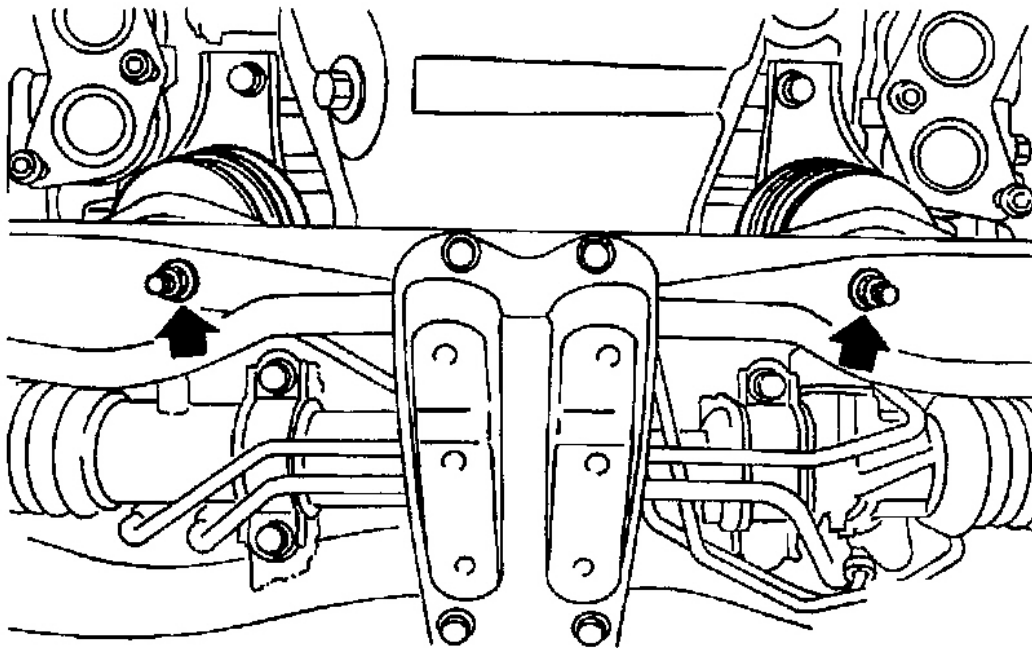
14. Remove the center exhaust pipe. < Ref. to **REMOVAL** , Center Exhaust Pipe. >
15. Remove the nuts which hold lower side of transmission to engine.



G02870976

Fig. 61: Removing Nuts Which Hold Lower Side Of Transmission To Engine
Courtesy of SUBARU OF AMERICA, INC.

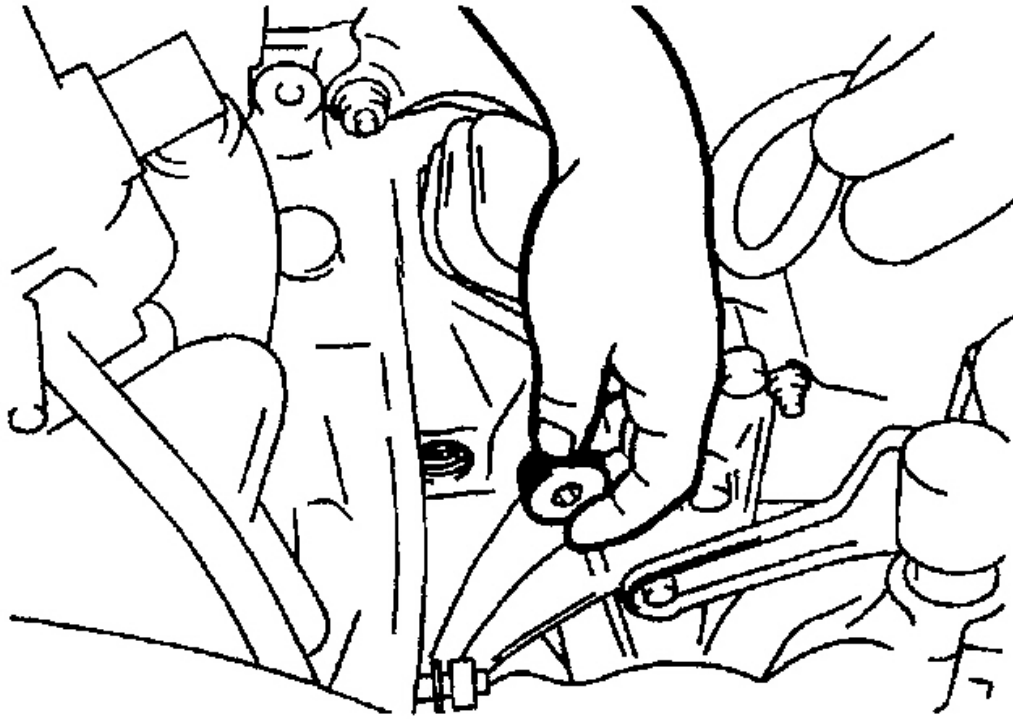
16. Remove the nuts which install the front cushion rubber onto front crossmember.



G02870977

Fig. 62: Removing Nuts Which Install Front Cushion Rubber Onto Front Crossmember
Courtesy of SUBARU OF AMERICA, INC.

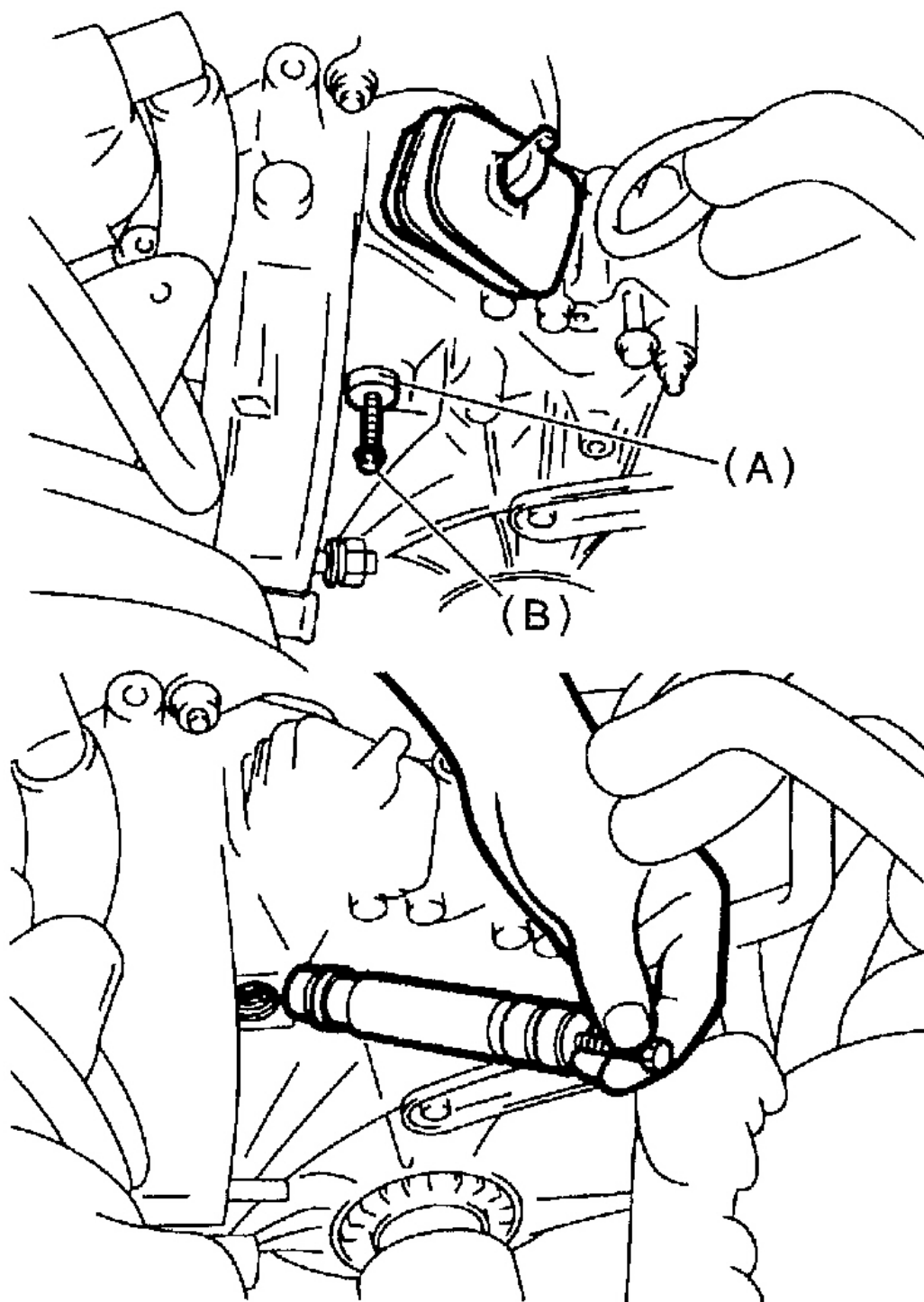
17. Separate the clutch release fork from release bearing. (MT vehicles)
 1. Remove the clutch operating cylinder from transmission.
 2. Remove the plug using a 10 mm hexagon wrench.



G02870978

Fig. 63: Removing Plug
Courtesy of SUBARU OF AMERICA, INC.

3. Screw the 6 mm dia. bolt into release fork shaft, and remove it.



G02870979

Fig. 64: Removing Release Fork Shaft

Courtesy of SUBARU OF AMERICA, INC.

- A. Shaft
- B. Bolt

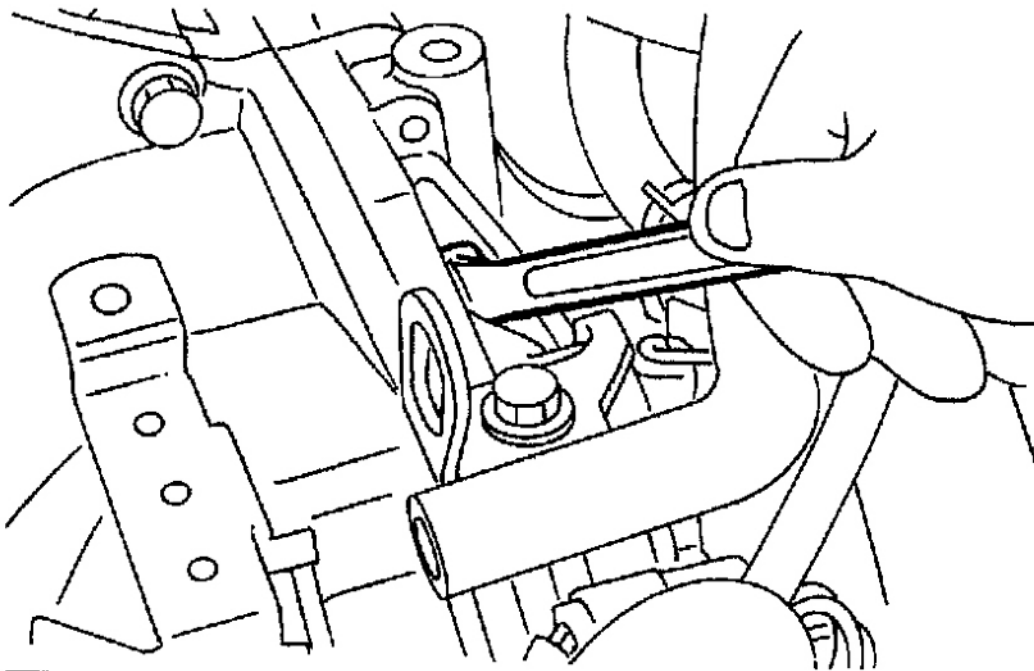
4. Raise the release fork and unfasten the release bearing tabs to free release fork.

CAUTION: Step (4) is required to prevent interference with engine when removing the engine from transmission.

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

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

ST 499977300 CRANK PULLEY WRENCH

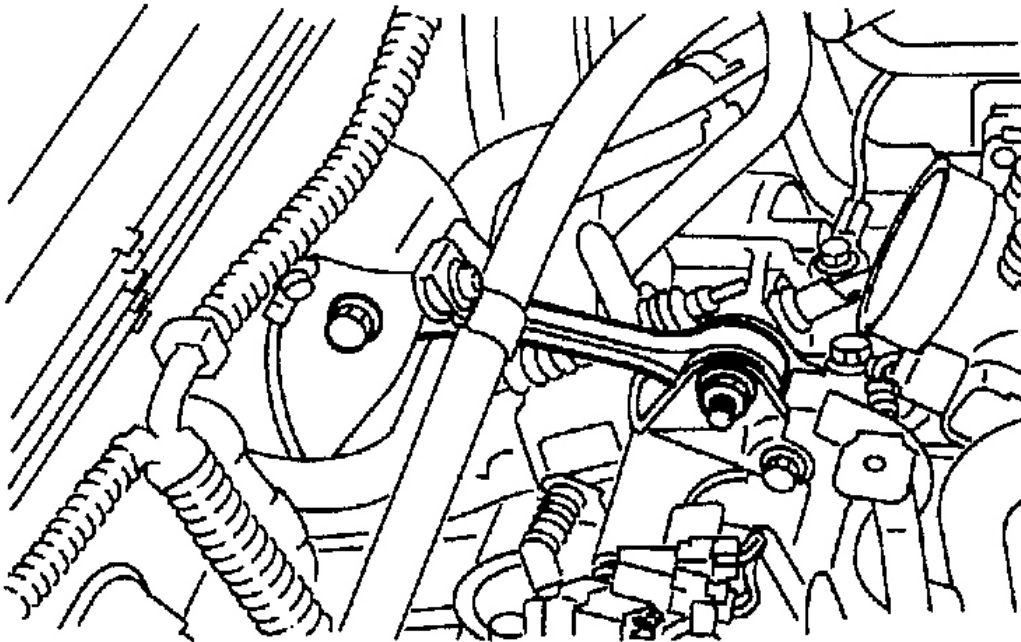


G02870980

Fig. 65: Removing Bolts Which Hold Torque Converter Clutch To Drive Plate

Courtesy of SUBARU OF AMERICA, INC.

19. Remove the pitching stopper.



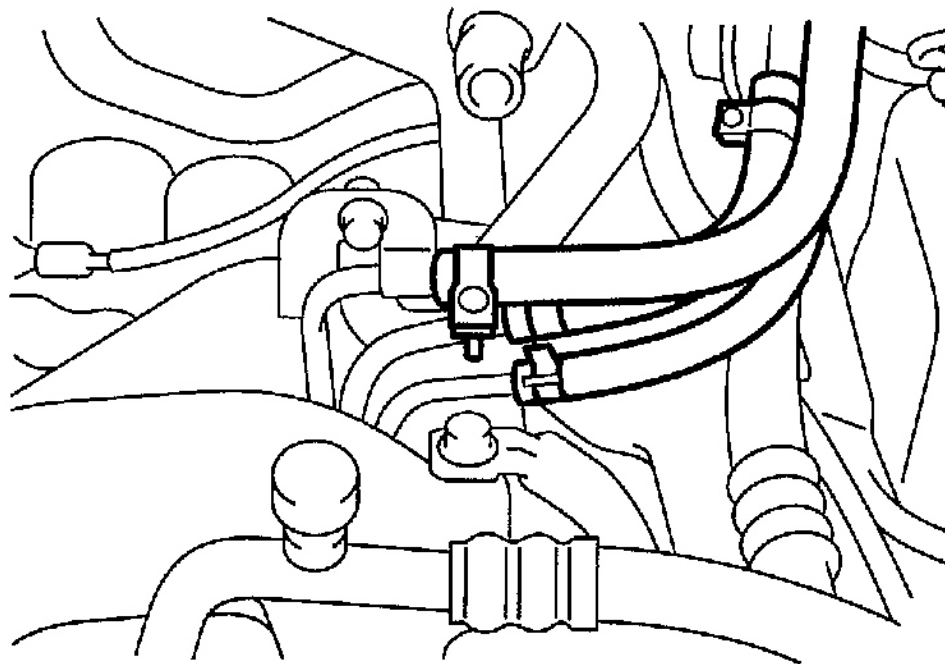
G02870981

Fig. 66: Removing Pitching Stopper
Courtesy of SUBARU OF AMERICA, INC.

20. Disconnect the fuel delivery hose, return hose and evaporation hose.

CAUTION:

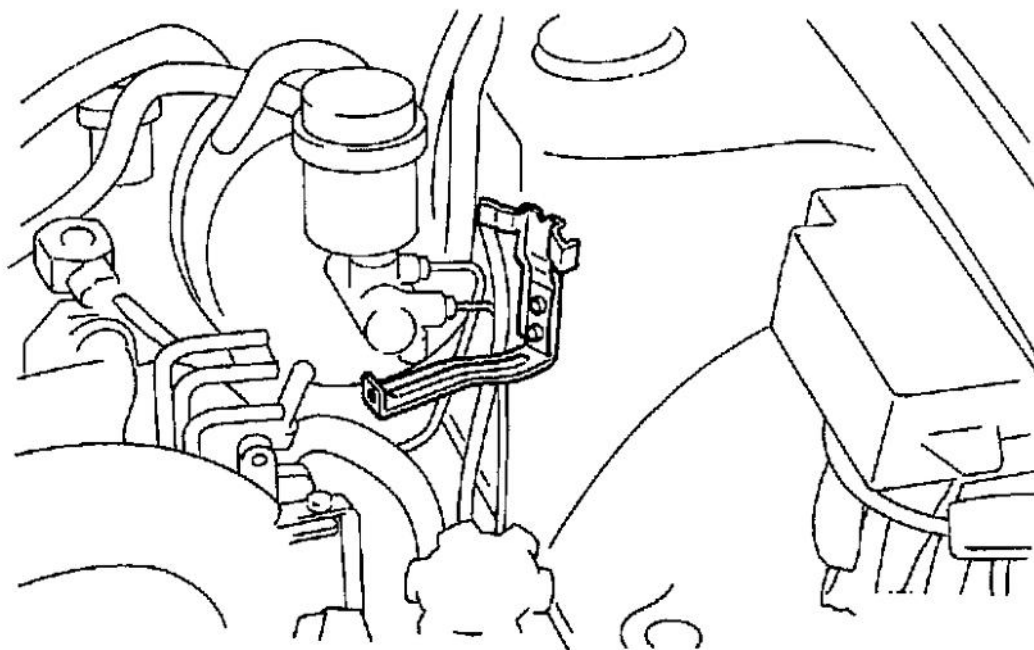
- Catch fuel from hose into container.
- Disconnect the hose with its end wrapped with cloth to prevent fuel splashing.



G02870982

Fig. 67: Disconnecting Hose With Its End Wrapped With Cloth To Fuel From Splashing
Courtesy of SUBARU OF AMERICA, INC.

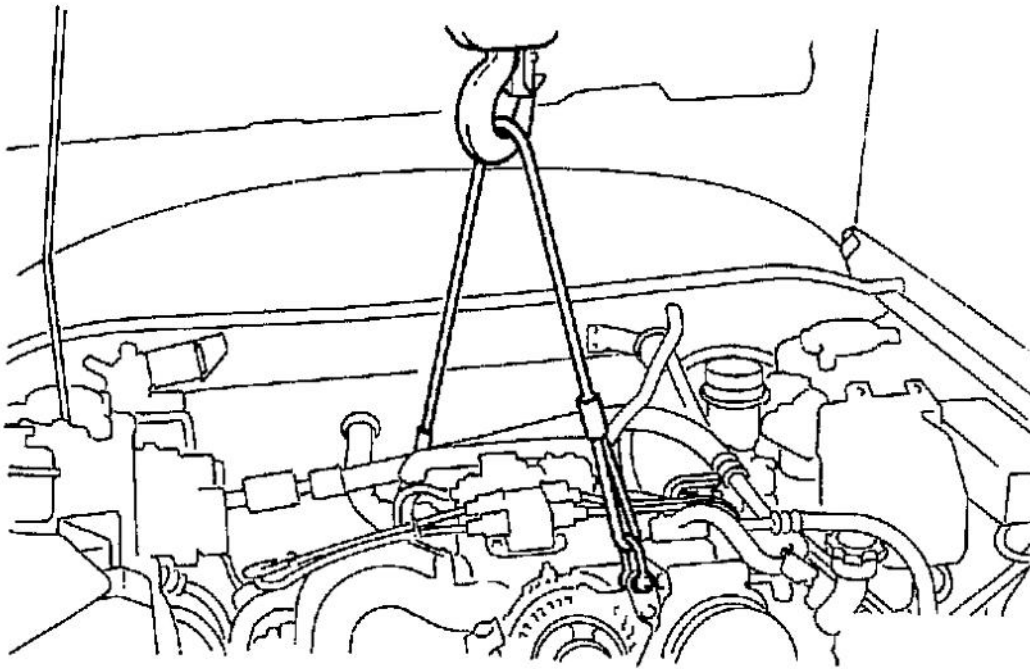
21. Remove the fuel filter and bracket.



G02870983

Fig. 68: Removing Fuel Filter And Bracket
Courtesy of SUBARU OF AMERICA, INC.

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

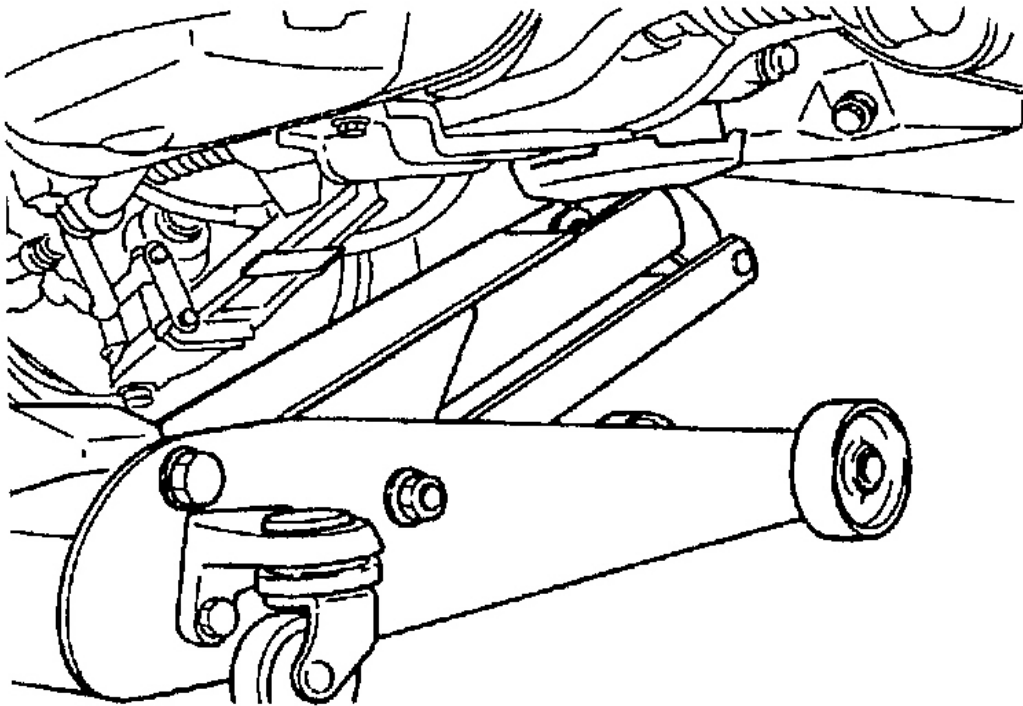


G02870984

Fig. 69: Supporting Engine With A Lifting Device And Wire Ropes
Courtesy of SUBARU OF AMERICA, INC.

23. 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 transmission lowers under its own weight.

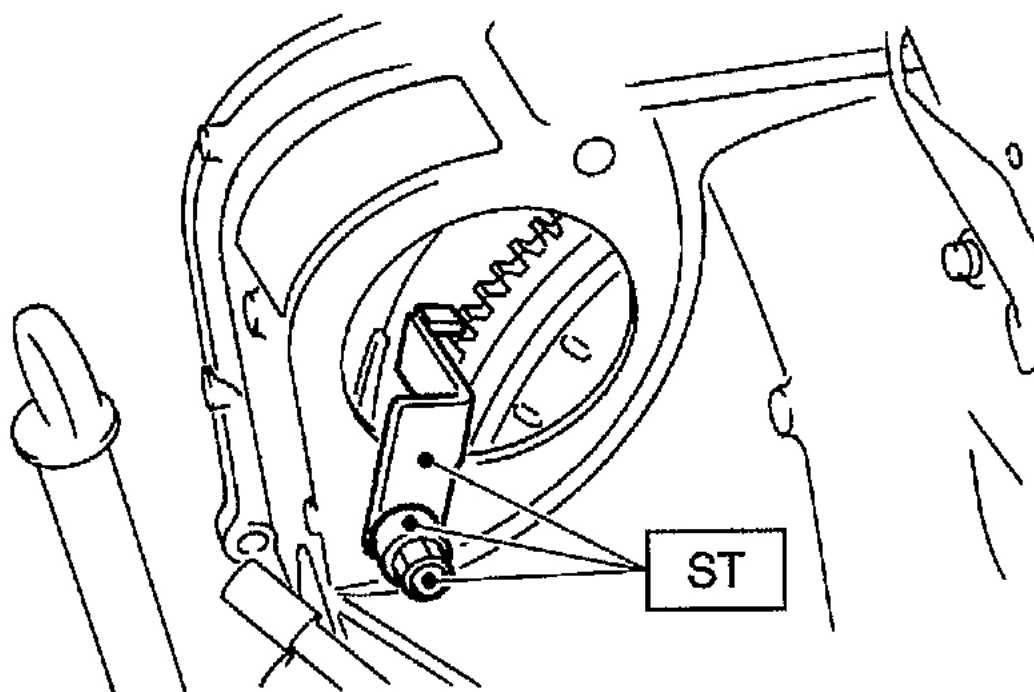


G02870985

Fig. 70: Supporting Transmission With A Garage Jack
Courtesy of SUBARU OF AMERICA, INC.

24. Separation of engine and transmission.
 1. Remove the starter. < Ref. to **REMOVAL** , Starter. >
 2. Install the ST to torque converter clutch case. (AT vehicles)

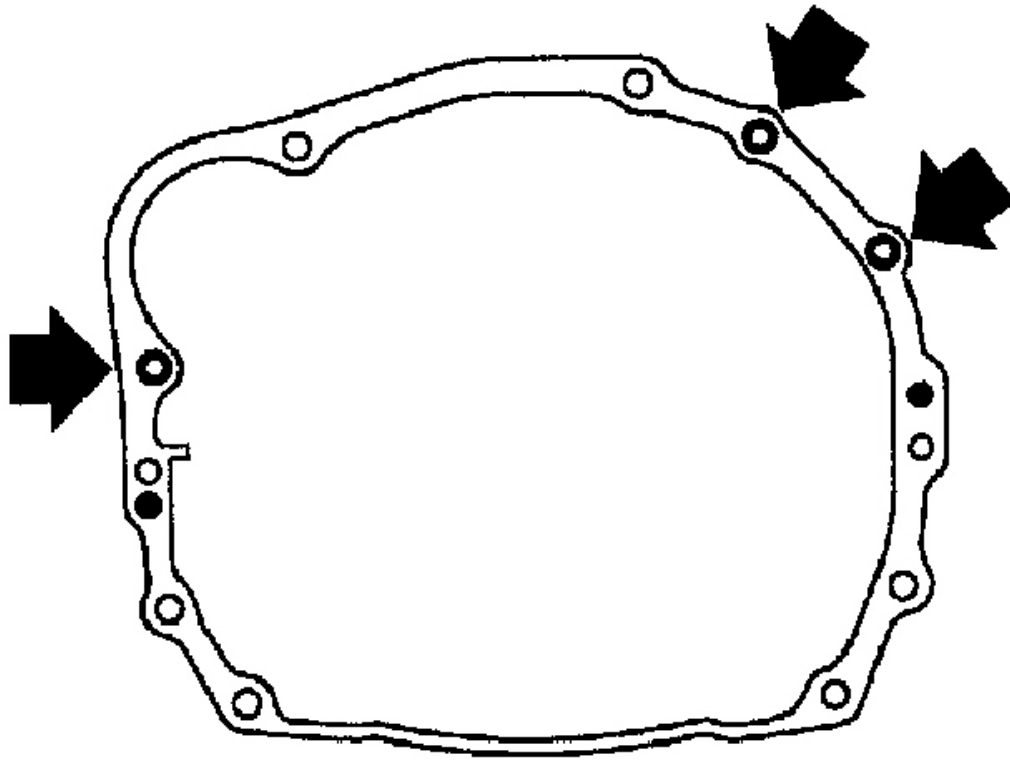
ST 498277200 STOPPER SET



G02870986

Fig. 71: Installing ST To Torque Converter Clutch Case
Courtesy of SUBARU OF AMERICA, INC.

3. Remove the bolts which hold right upper side of transmission to engine.



G02870987

Fig. 72: Removing Bolts Which Hold Right Upper Side Of Transmission To Engine
Courtesy of SUBARU OF AMERICA, INC.

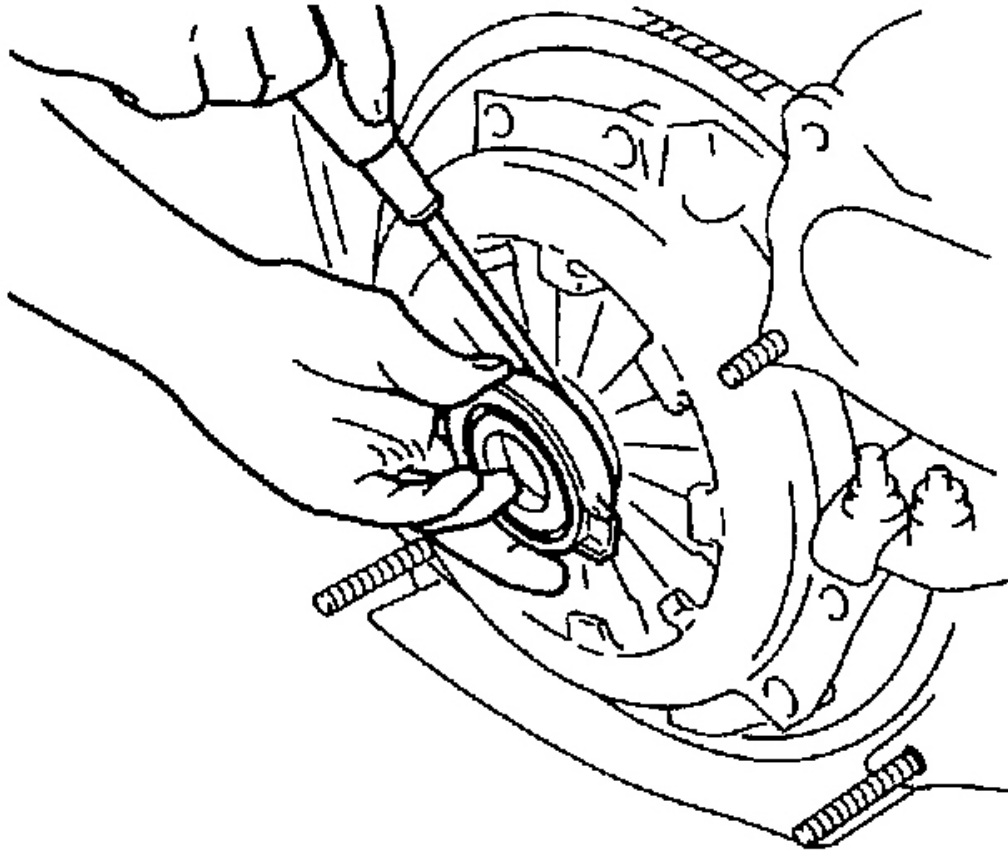
25. Remove the engine from vehicle.
 1. Slightly raise the engine.
 2. Raise the transmission with garage jack.
 3. Move the engine horizontally until the main-shaft is withdrawn from clutch cover.
 4. Slowly move the engine away from engine compartment.

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

26. Remove the front cushion rubbers.

INSTALLATION

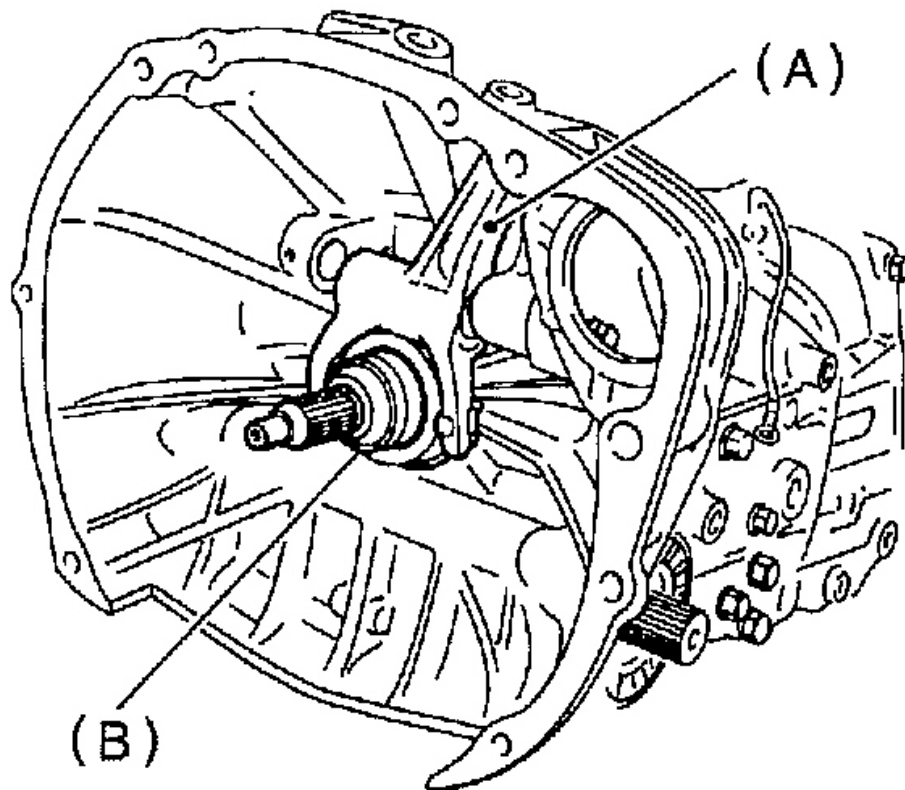
1. Install the clutch release fork and bearing onto transmission. (MT vehicles)
 1. Remove the release bearing from clutch cover with flat type screw driver.



G02870988

Fig. 73: Removing Release Bearing From Clutch Cover
Courtesy of SUBARU OF AMERICA, INC.

2. Install the release bearing on transmission.
3. Install the release fork into release bearing tab.

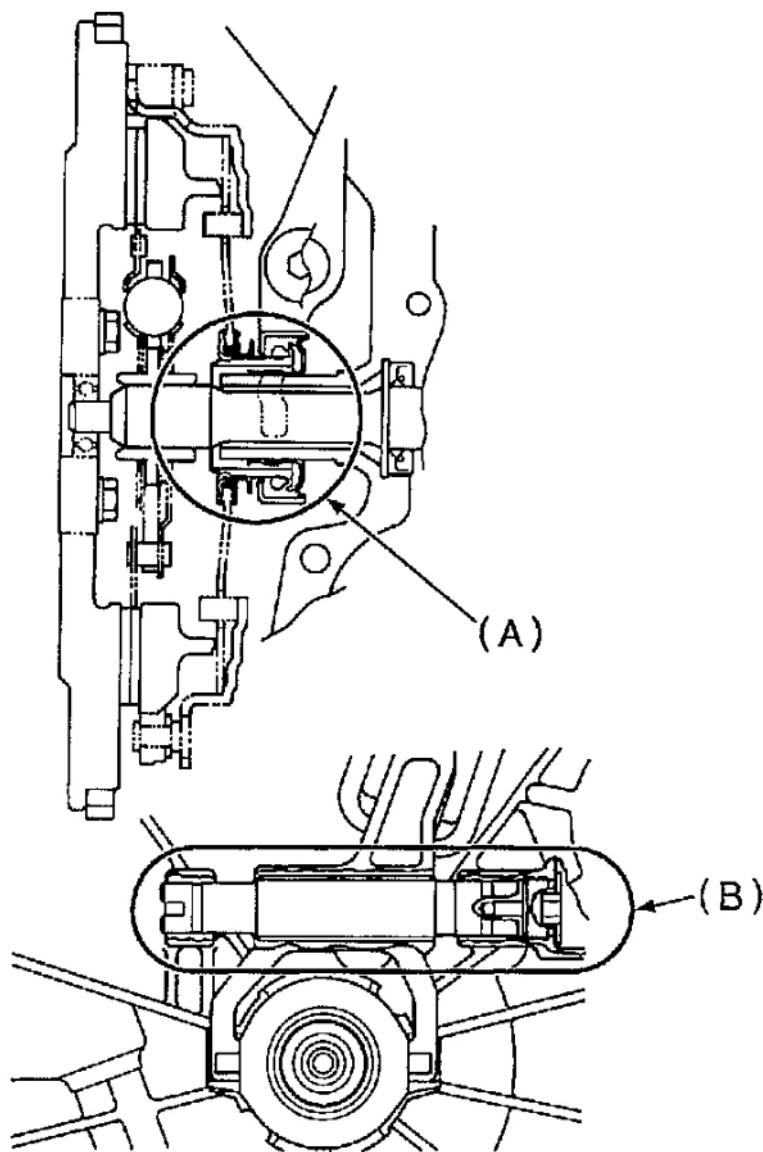


- (A) Release fork
(B) Release bearing

G02870989

Fig. 74: Installing Release Fork Into Release Bearing Tab
Courtesy of SUBARU OF AMERICA, INC.

4. Apply grease to the specified points.
 - Spline FX2200
 - Shaft SUNLIGHT 2



(A) Spline (FX2200)

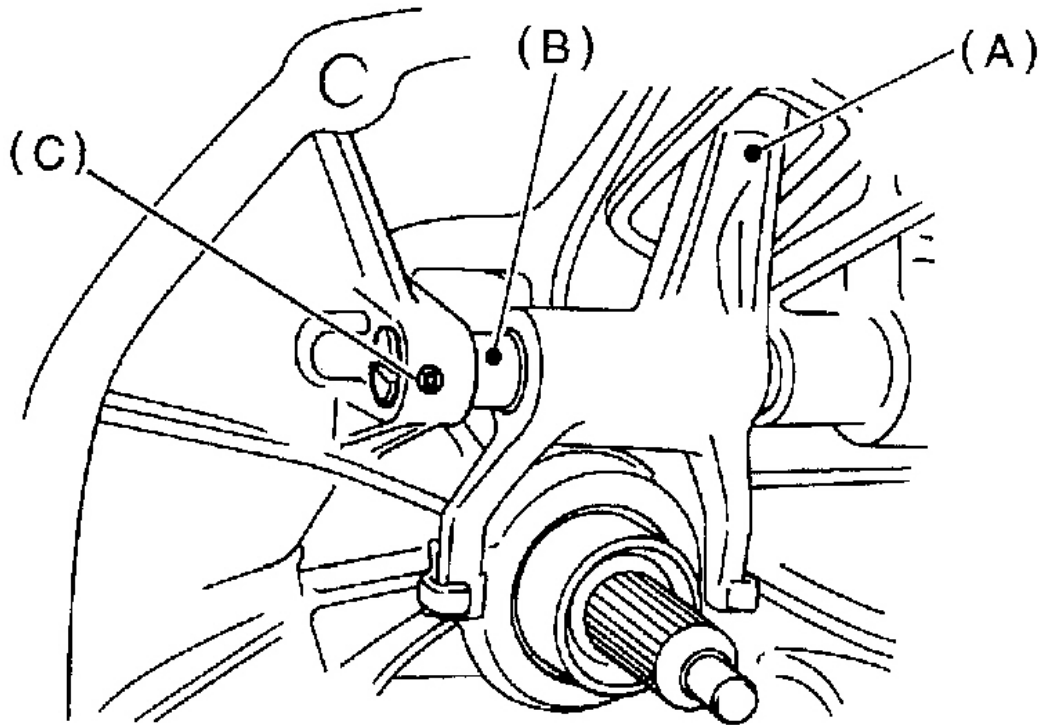
(B) Shaft (SUNLIGHT 2)

G02870990

Fig. 75: Identifying Grease Specified Points
Courtesy of SUBARU OF AMERICA, INC.

5. Insert the release fork shaft into release fork.

CAUTION: Make sure the cutout portion of release fork shaft contacts spring pin.



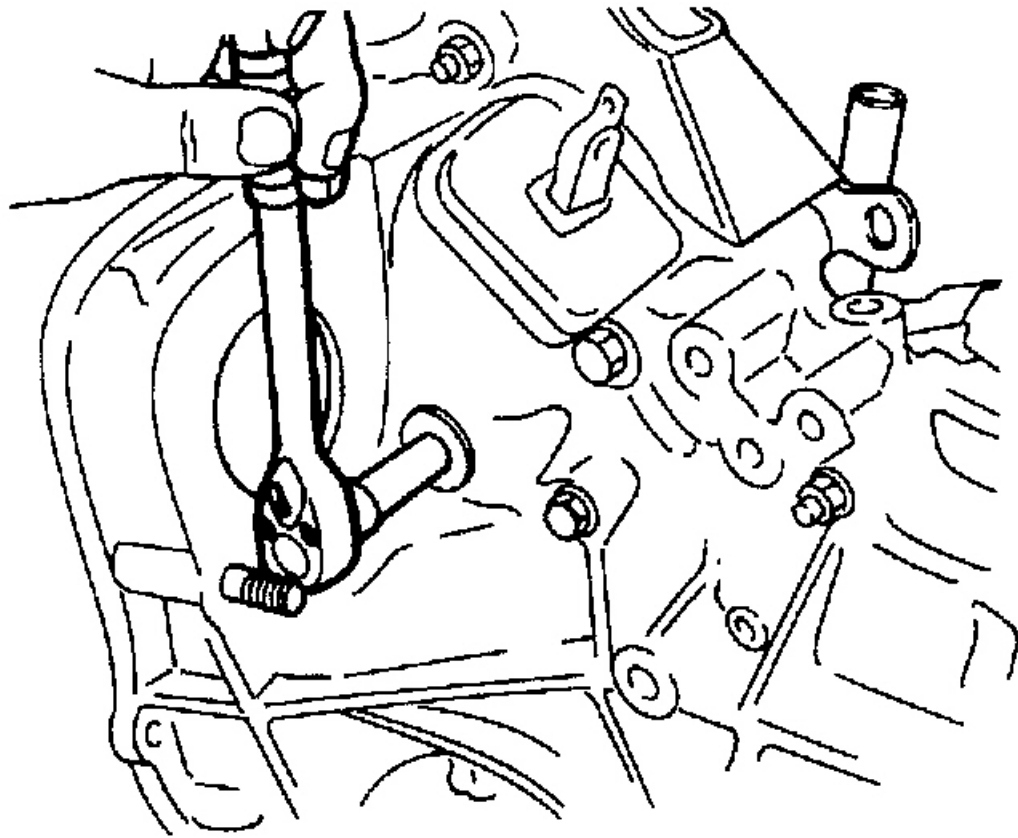
- (A) Release fork
- (B) Release shaft
- (C) Spring pin

G02870991

Fig. 76: Inserting Release Fork Shaft Into Release Fork
 Courtesy of SUBARU OF AMERICA, INC.

6. Tighten the plug.

Tightening torque: 44 N.m (4.5 kgf-m, 32.5 ft-lb)



G02870992

Fig. 77: Tightening Plug
Courtesy of SUBARU OF AMERICA, INC.

2. Install the front cushion rubbers to engine.

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

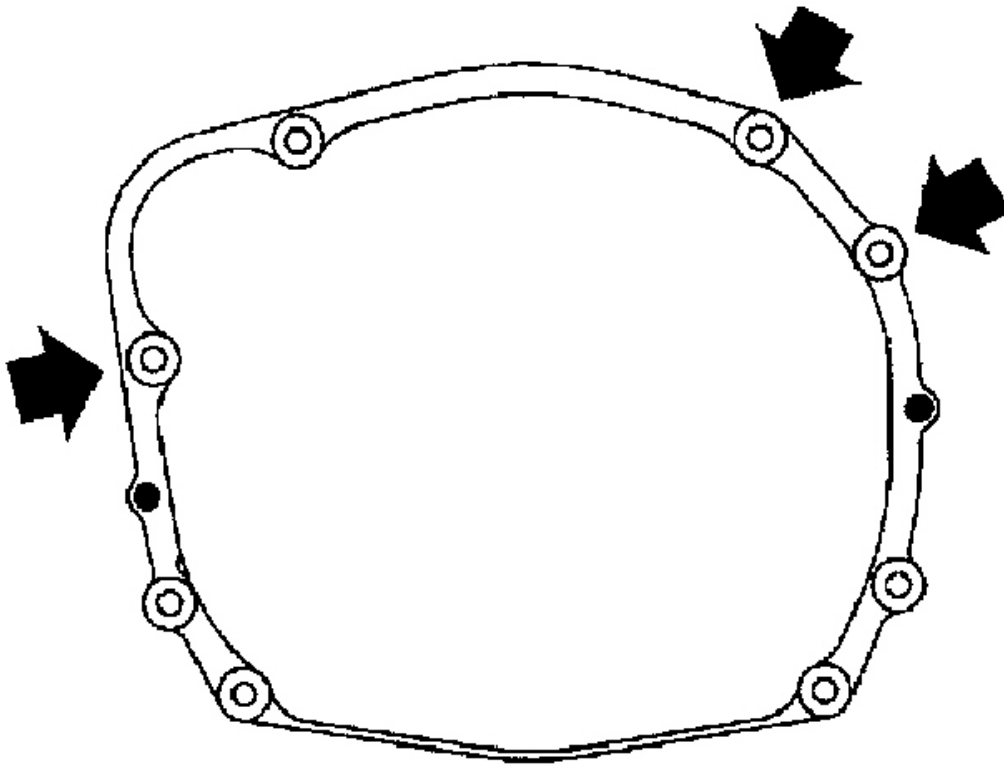
3. Install the engine onto transmission.
 1. Position the engine in engine compartment and align it with transmission.

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

2. Apply a small amount of grease to splines of mainshaft. (MT vehicles)

4. Tighten the bolts which hold right upper side of transmission to engine.

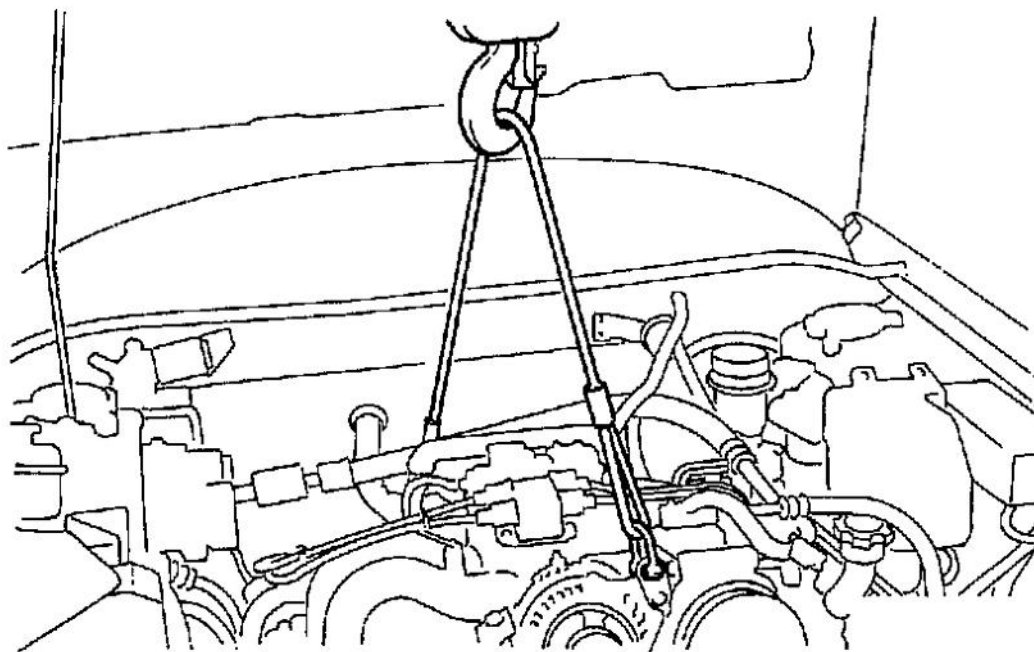
Tightening torque: 50 N.m (5.1 kgf-m, 36.9 ft-lb)



G02870993

Fig. 78: Tightening Bolts Which Hold Right Upper Side Of Transmission To Engine
Courtesy of SUBARU OF AMERICA, INC.

5. Remove the lifting device and wire ropes.
6. Remove the garage jack.



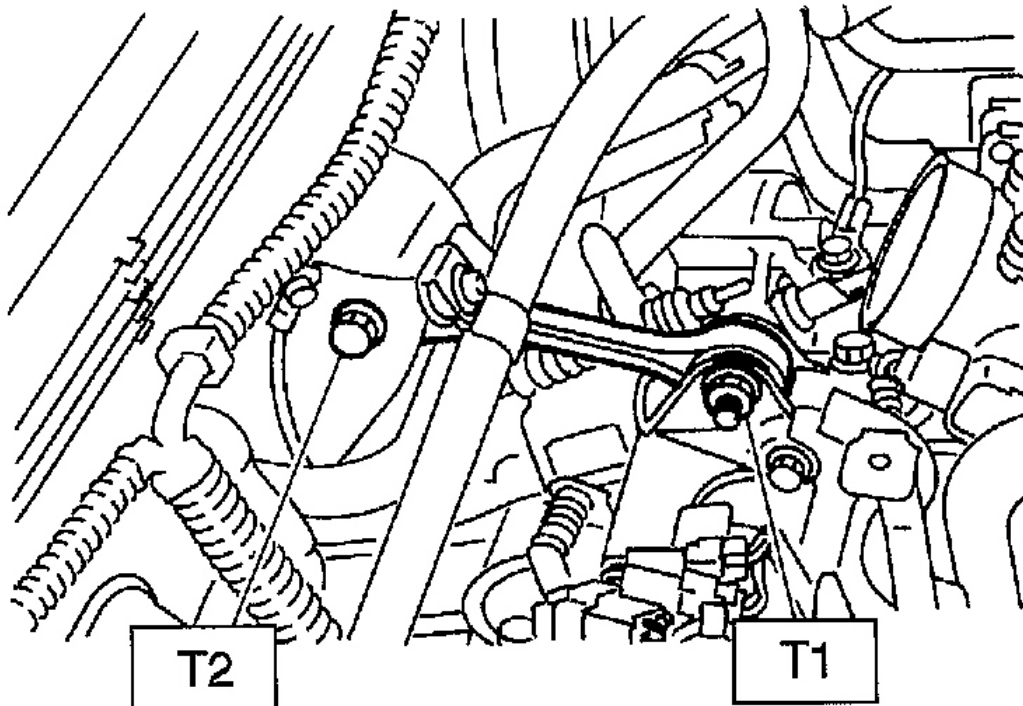
G02870994

Fig. 79: Removing Lifting Device And Wire Ropes
Courtesy of SUBARU OF AMERICA, INC.

7. Install the pitching stopper.

Tightening torque:

T2: 58 N.m (5.9 kgf-m, 43 ft-lb)



G02870995

Fig. 80: Installing Pitching Stopper
Courtesy of SUBARU OF AMERICA, INC.

8. Remove the ST from torque converter clutch case. (AT vehicles)

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

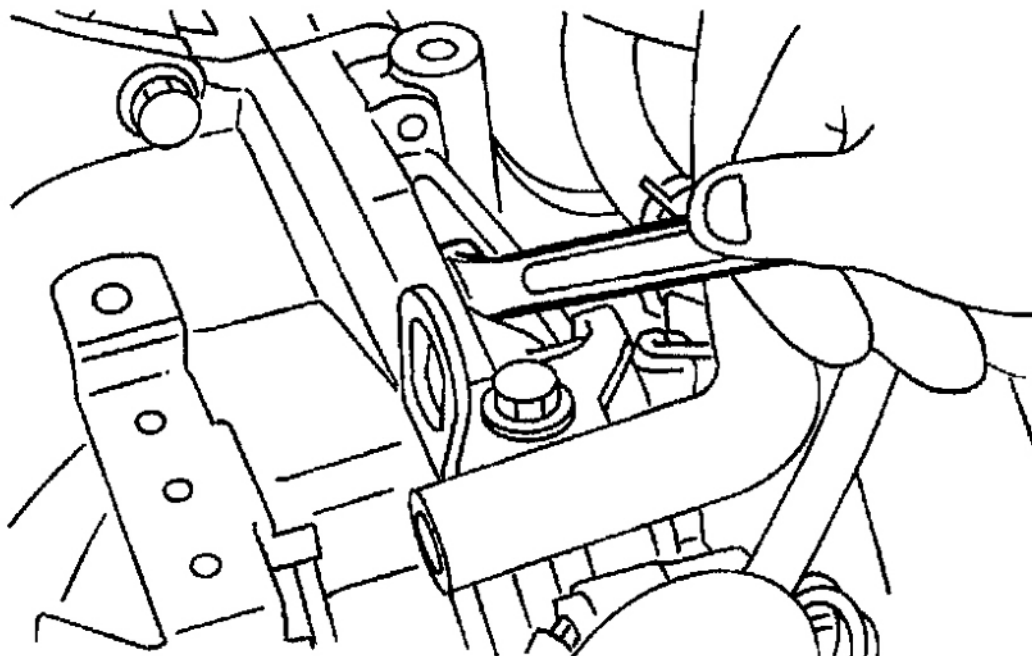
ST 498277200 STOPPER SET

9. Install the starter. < Ref. to **INSTALLATION** , Starter. >
10. Install the torque converter clutch onto drive plate. (AT vehicles)
 1. Tighten the 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 the torque converter clutch housing.

ST 499977300 CRANK PULLEY WRENCH

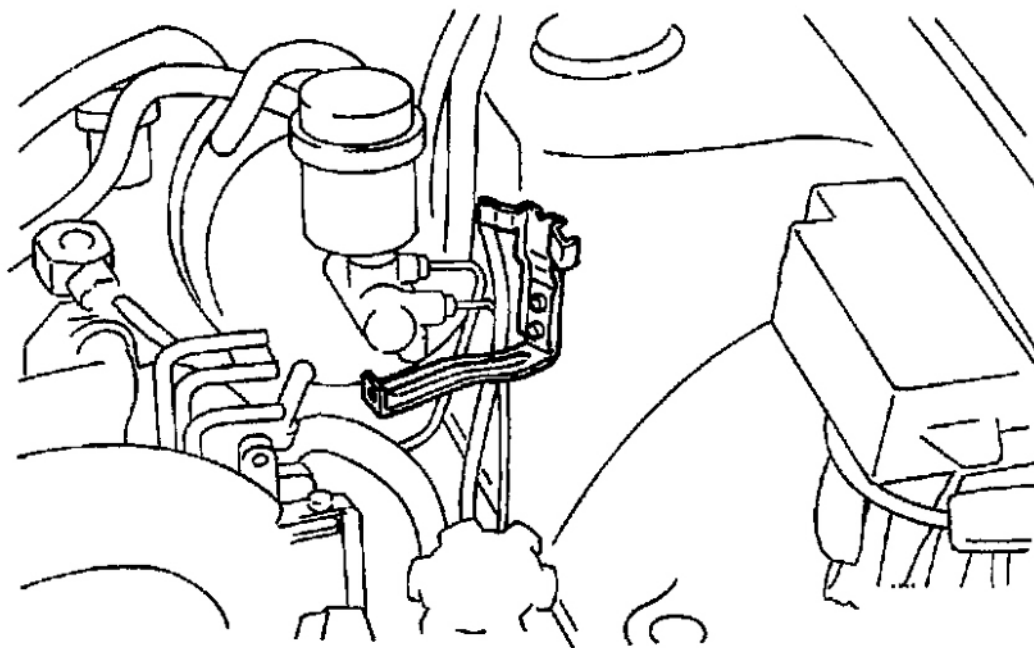
Tightening torque: 25 N.m (2.5 kgf-m, 18.1 ft-lb)



G02870996

Fig. 81: Tightening Bolts Which Hold Torque Converter Clutch To Drive Plate
Courtesy of SUBARU OF AMERICA, INC.

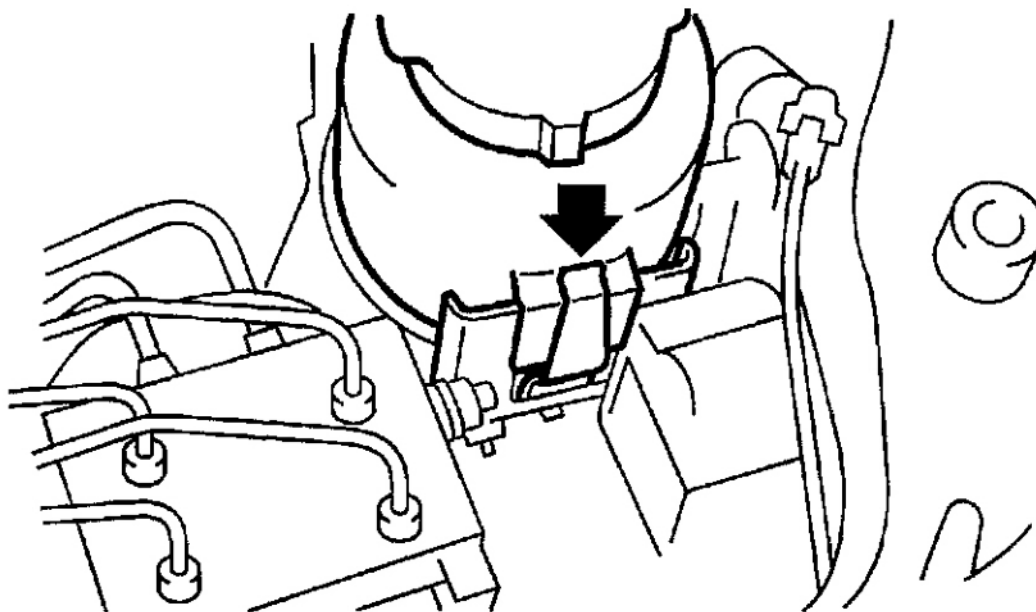
3. Clog the service hole with plug.
11. Install the fuel filter and bracket.



G02870997

Fig. 82: Installing Fuel Filter And Bracket
Courtesy of SUBARU OF AMERICA, INC.

12. Install the power steering pump on bracket.
 1. Install the power steering tank on bracket.

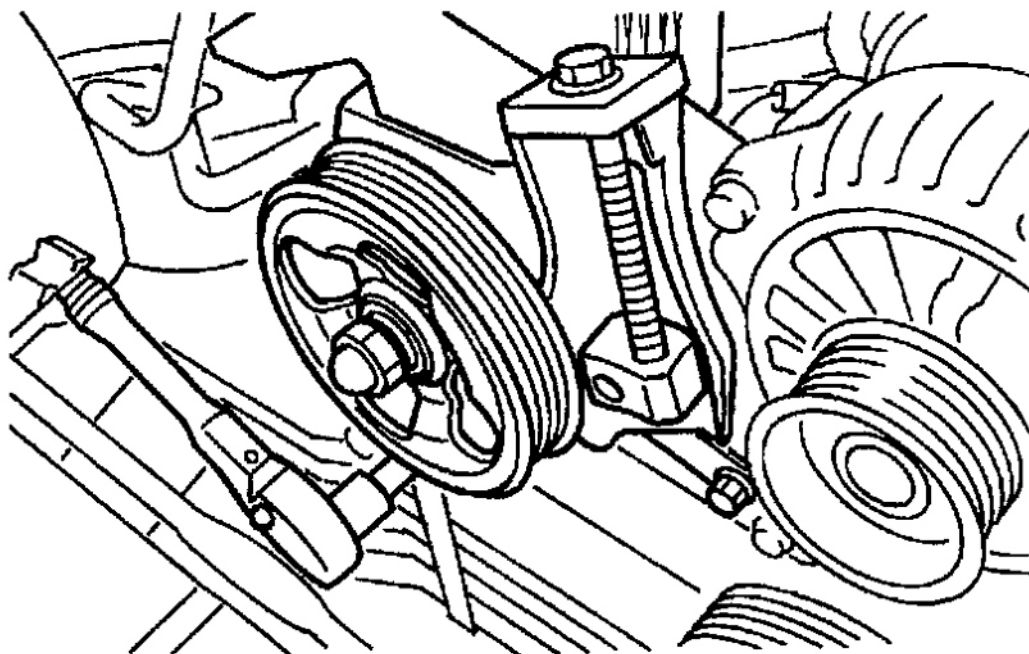


G02870998

Fig. 83: Installing Power Steering Tank On Bracket
Courtesy of SUBARU OF AMERICA, INC.

2. Install the power steering pump.

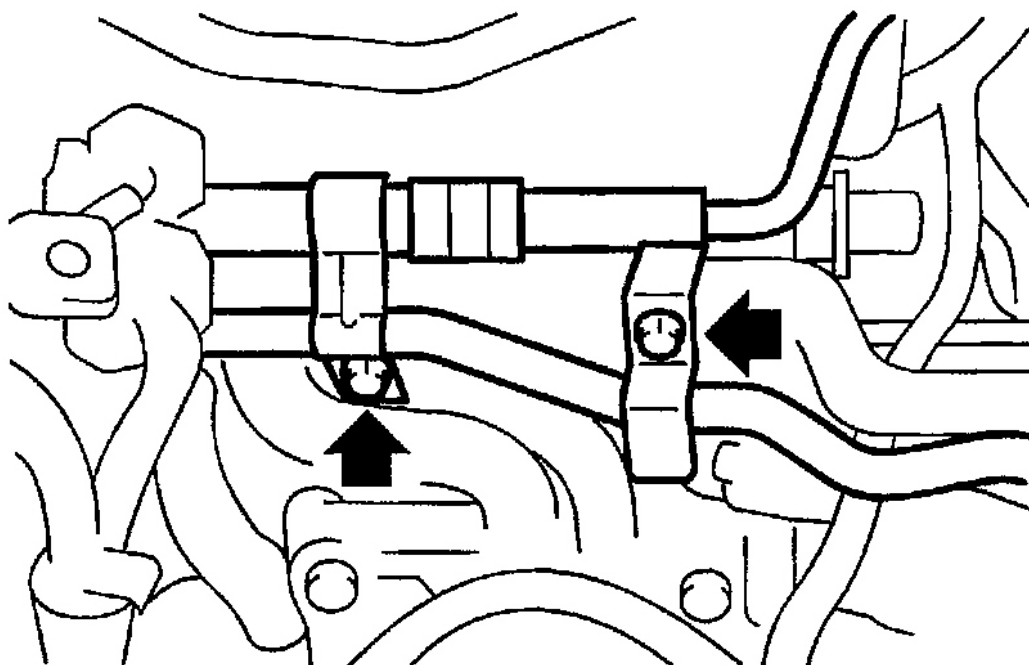
Tightening torque: 20.1 N.m (2.05kgf-m, 14.8 ft-lb)



G02870999

Fig. 84: Installing Power Steering Pump
Courtesy of SUBARU OF AMERICA, INC.

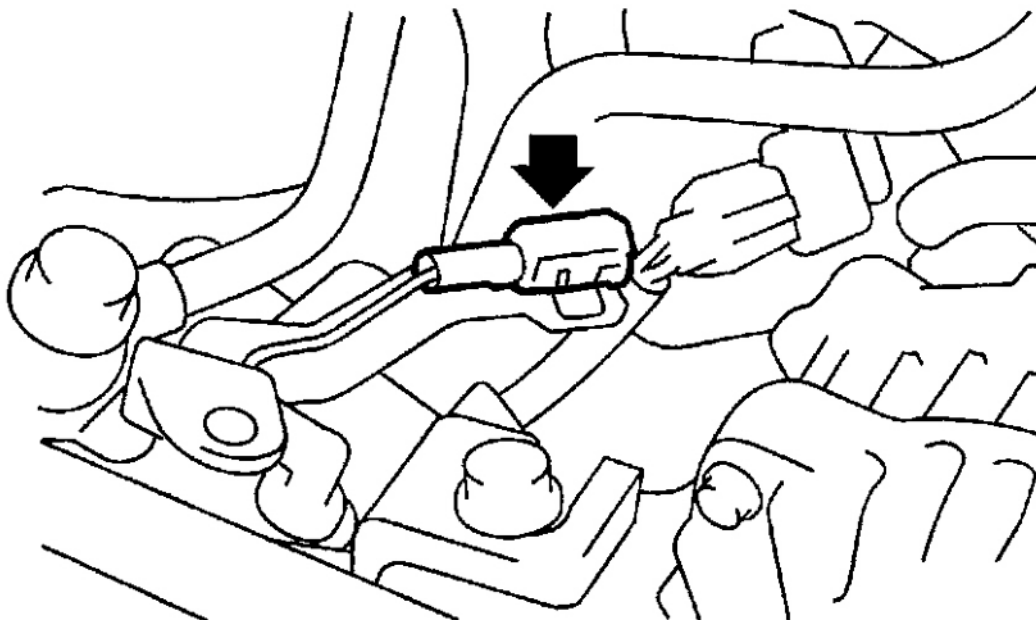
3. Install the power steering pipe bracket on right side intake manifold, and install the spark plug codes.



G02871000

Fig. 85: Installing Power Steering Pipe Bracket On Right Side Intake Manifold
Courtesy of SUBARU OF AMERICA, INC.

4. Connect the power steering switch connector.

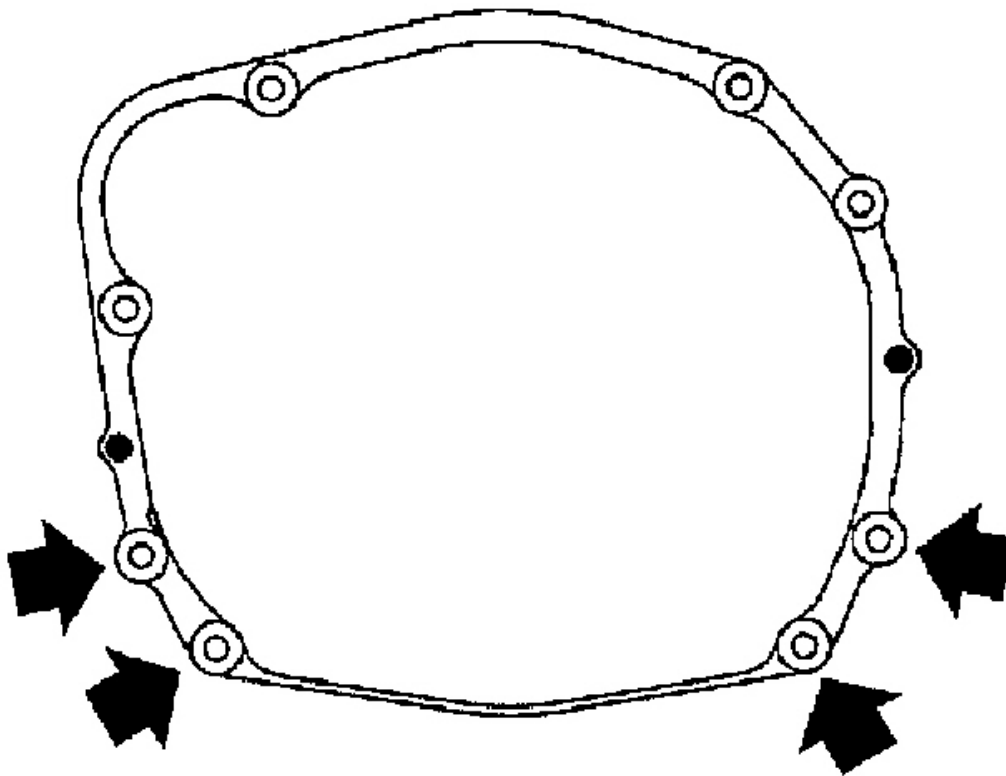


G02871001

Fig. 86: Connecting Power Steering Switch Connector
Courtesy of SUBARU OF AMERICA, INC.

5. Install the front side V-belt, and adjust it. < Ref. to **FRONT SIDE BELT**, V-belt . >
13. Tighten the nuts which hold lower side of transmission to engine.

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



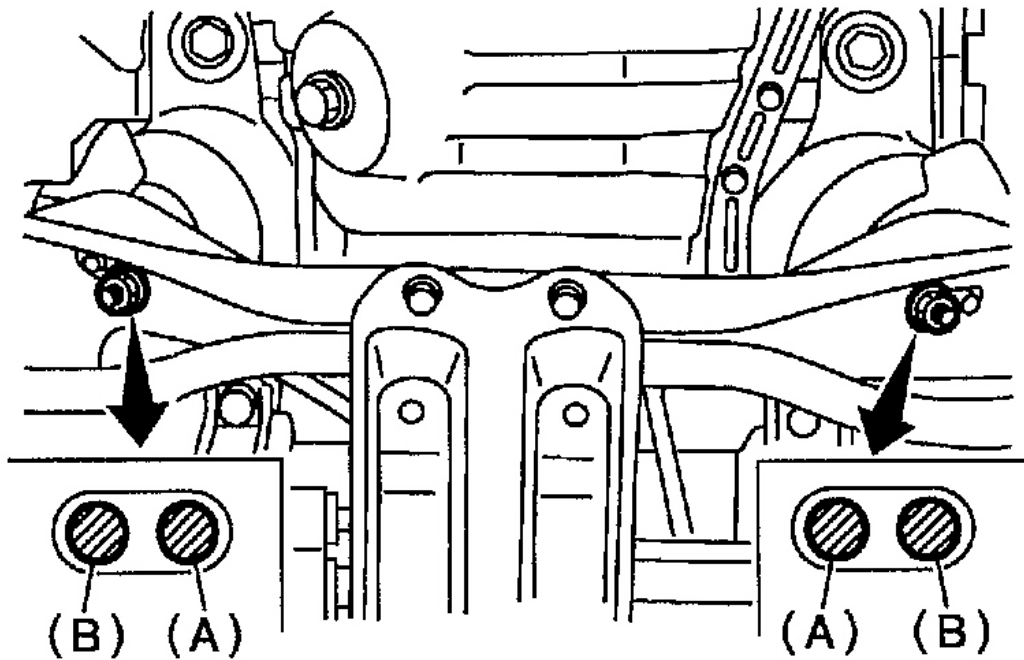
G02871002

Fig. 87: Tightening Nuts Which Hold Lower Side Of Transmission To Engine
Courtesy of SUBARU OF AMERICA, INC.

14. Tighten the nuts which install the front cushion rubber onto crossmember.

Tightening torque: 83 N.m (8.5kgf-m, 61 ft-lb)

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



G02871003

Fig. 88: Tightening Nuts Which Install Front Cushion Rubber Onto Crossmember
Courtesy of SUBARU OF AMERICA, INC.

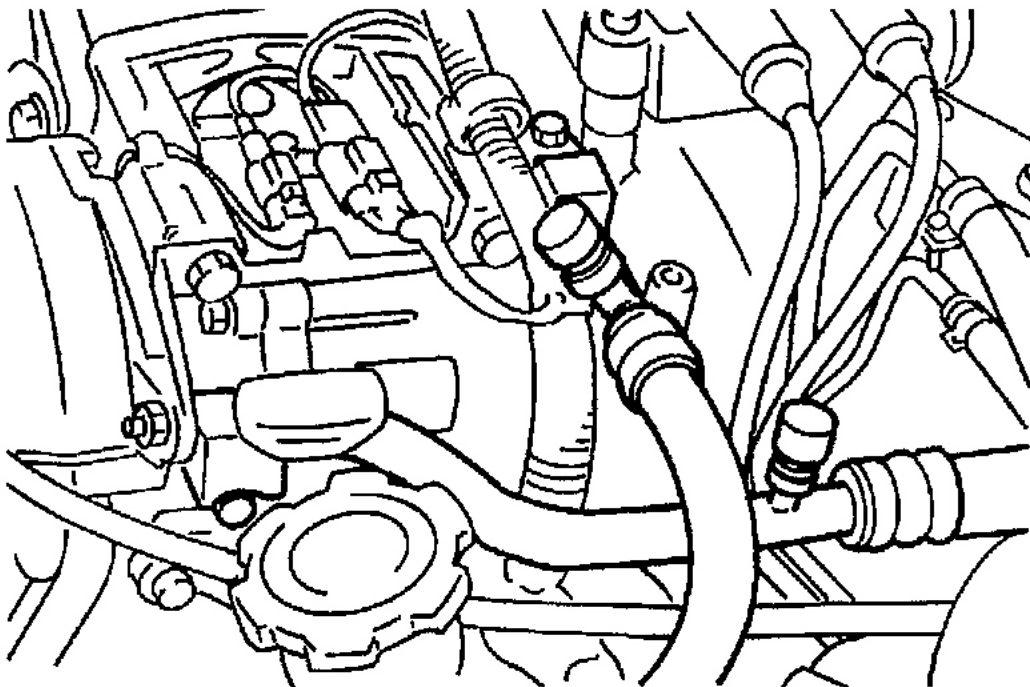
15. Install the center exhaust pipe. < Ref. to **INSTALLATION** , Center Exhaust Pipe. >
16. Connect the following hoses:
 1. Fuel delivery hose, return hose and evaporation hose
 2. Heater inlet and outlet hoses
 3. Brake booster vacuum hose
17. Connect the following connectors and terminals:
 1. Engine ground terminal
 2. Engine harness connectors
 3. Generator connector and terminal
 4. A/C compressor connectors
18. Connect the following cables:
 1. Accelerator cable
 2. Clutch release spring

CAUTION: After connecting each cable, adjust them.

19. Install the air intake system.
 1. Install the intercooler. < Ref. to **INSTALLATION** , Intercooler. >
 2. Install the air cleaner element and air cleaner upper cover.
 3. Install the engine harness connector bracket.
 4. Install the filler hose to air cleaner case.
20. Install the A/C pressure hoses.

CAUTION: Use new O-rings.

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



G02871004

Fig. 89: Installing A/C Pressure Hoses
Courtesy of SUBARU OF AMERICA, INC.

21. Install the radiator. < Ref. to **INSTALLATION** , Radiator. >
22. Install the coolant filler tank. < Ref. to **INSTALLATION** , Coolant Filler Tank. >

23. Install the window washer tank.
24. Install the battery in the vehicle, and connect cables.
25. Fill coolant.

< Ref. to **FILLING OF ENGINE COOLANT** , Engine Coolant. >

26. Charge the A/C system with refrigerant.

< Ref. to **OPERATION** , Refrigerant Charging Procedures

27. Remove the front hood stay, and close the front hood.
28. Take off the vehicle from lift arms.

ENGINE MOUNTING

REMOVAL

1. Remove the engine assembly. < Ref. to **REMOVAL** , Engine Assembly. >
2. Remove the engine mounting from engine assembly.

INSTALLATION

Install in the reverse order of removal.

Tightening torque:

35 N.m (3.6 kgf-m, 25.8 ft-lb)

INSPECTION

Make sure there are no cracks or other damage.

PREPARATION FOR OVERHAUL

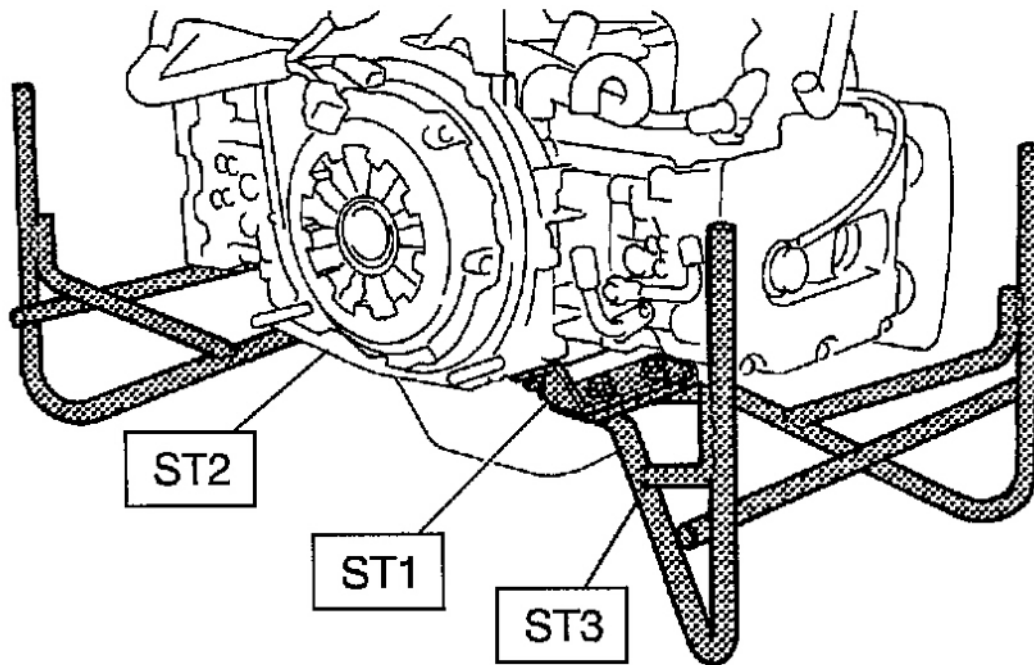
PROCEDURE

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

ST1 498457000 ENGINE STAND ADAPTER RH

ST2 498457100 ENGINE STAND ADAPTER LH

ST3 499817000 ENGINE STAND



G02871005

Fig. 90: Securing Engine In Special Tools
Courtesy of SUBARU OF AMERICA, INC.

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.

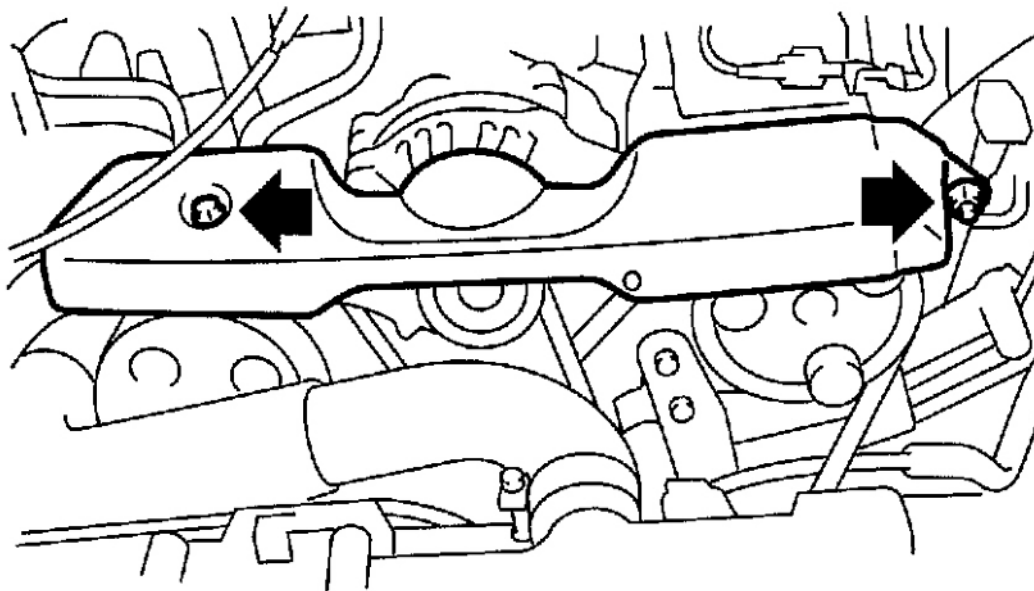
V-BELT

REMOVAL

FRONT SIDE BELT

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

1. Remove the V-belt cover.

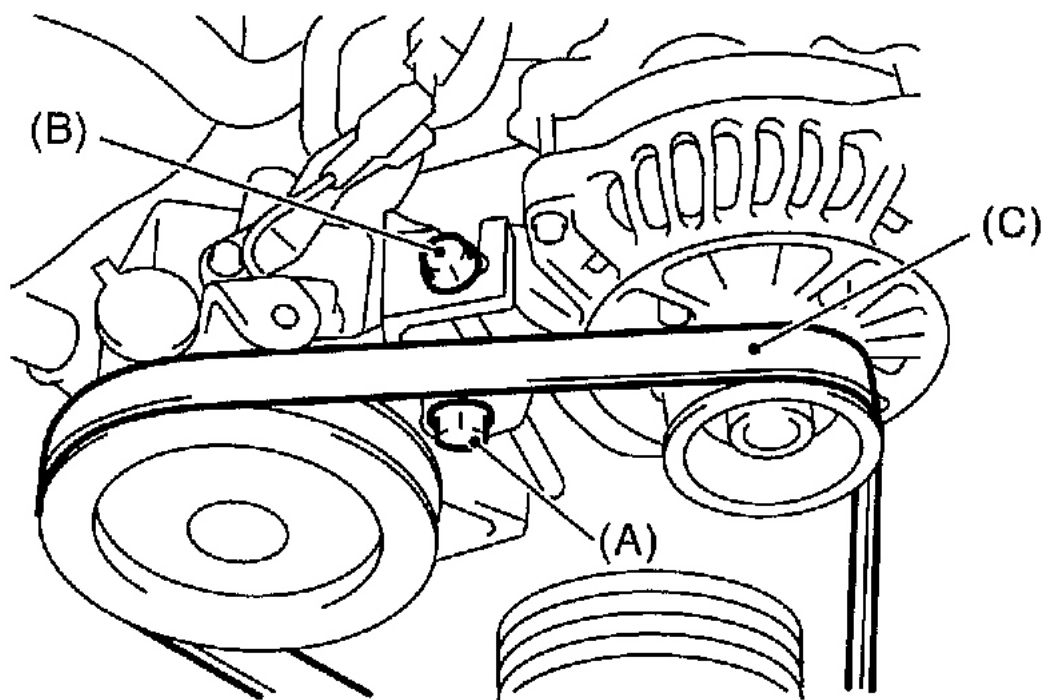


G02871006

Fig. 91: Removing V-Belt Cover

Courtesy of SUBARU OF AMERICA, INC.

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

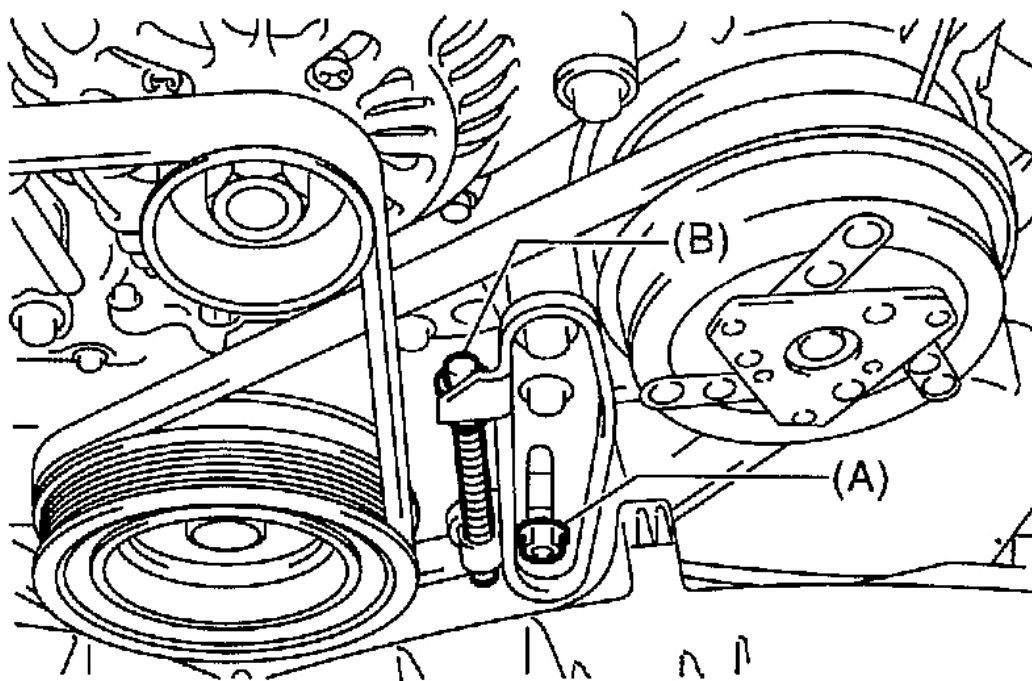


G02871007

Fig. 92: Removing Front Side Belt (C)
Courtesy of SUBARU OF AMERICA, INC.

REAR SIDE BELT

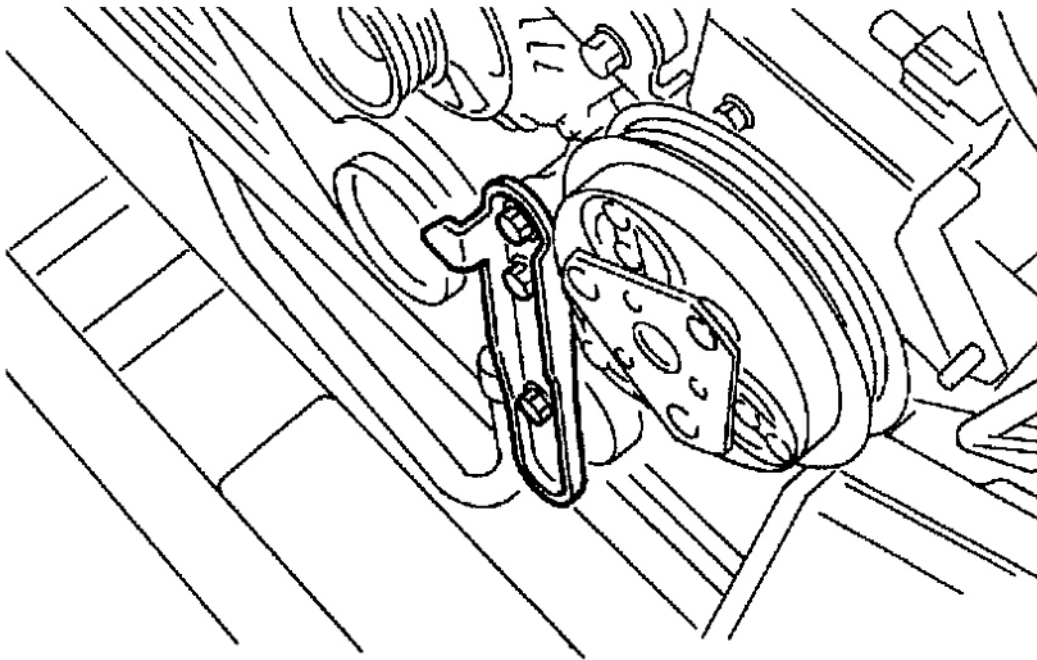
1. Loosen the lock nut (A).
2. Loosen the slider bolt (B).



G02871008

Fig. 93: Loosening Slider Bolt (B)
Courtesy of SUBARU OF AMERICA, INC.

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



G02871009

Fig. 94: Removing A/C Belt Tensioner
Courtesy of SUBARU OF AMERICA, INC.

INSTALLATION

FRONT SIDE BELT

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

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

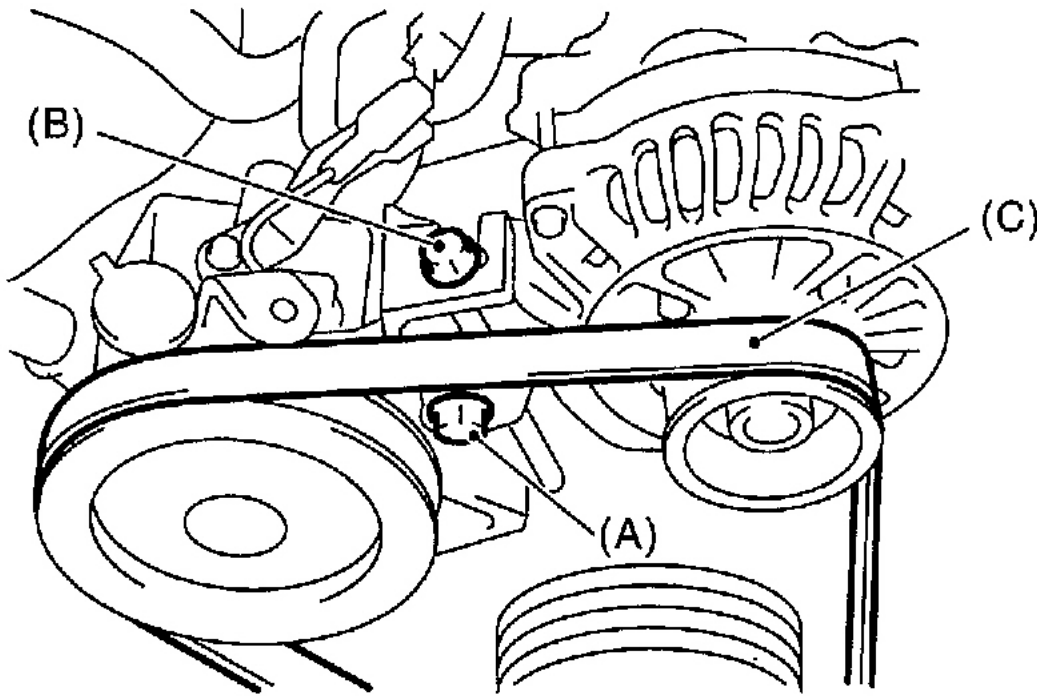
Tightening torque:

Lock bolt through bolt:

25 N.m (2.5 kgf-m, 18 ft-lb)

Slider bolt:

8 N.m (0.8 kgf-m, 5.5 ft-lb)



G02871010

Fig. 95: Installing Front Side Belt
Courtesy of SUBARU OF AMERICA, INC.

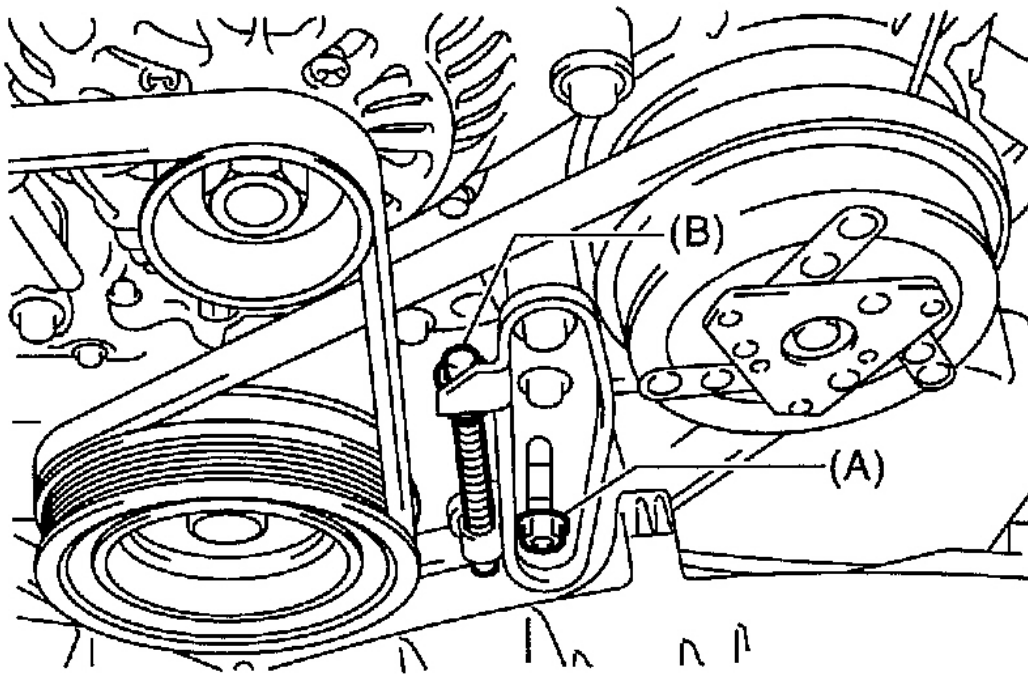
REAR SIDE BELT

1. Install a belt, and tighten the slider bolt (B) so as to obtain the specified belt tension. < Ref. to **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)



G02871011

Fig. 96: Installing Rear Side Belt
Courtesy of SUBARU OF AMERICA, INC.

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 generator installing position and/or idler pulley installing position.

Belt tension

(A)

replaced: 7 - 9 mm (0.276 - 0.354 in)

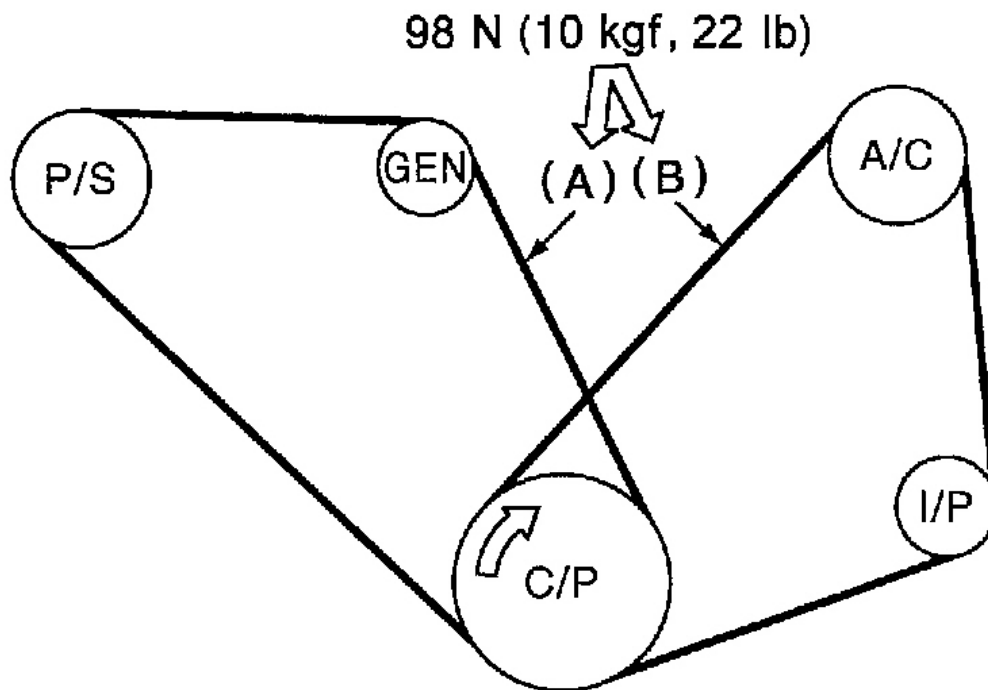
reused: 9 - 11 mm (0.354 - 0.433 in)

(B)*

replaced: 7.5 - 8.5 mm (0.295 - 0.335 in)

reused: 9.0 - 10.0 mm (0.354 - 0.394 in)

*: With Air conditioner



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

G02871012

Fig. 97: Identifying Belt Tension

Courtesy of SUBARU OF AMERICA, INC.

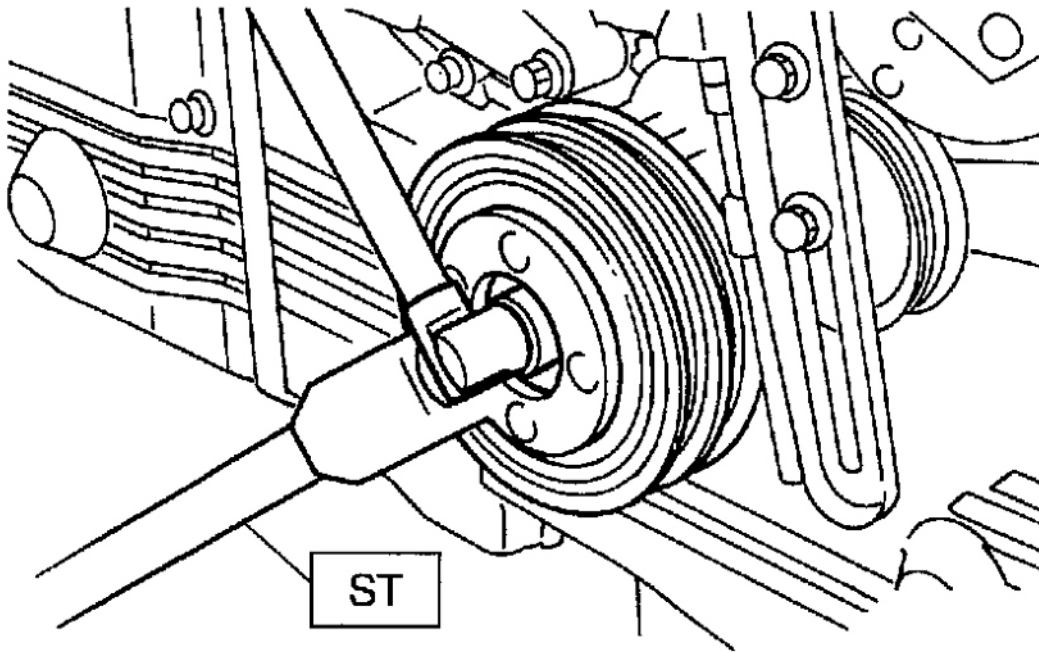
CRANKSHAFT PULLEY

REMOVAL

1. Remove the V-belt. < Ref. to **REMOVAL** , V-belt. >
2. Remove the crankshaft pulley bolt. To lock crankshaft, use ST.

ST 499977300

CRANKSHAFT PULLEY WRENCH



G02871013

Fig. 98: Removing Crankshaft Pulley Bolt
Courtesy of SUBARU OF AMERICA, INC.

3. Remove the crankshaft pulley.

INSTALLATION

1. Install the crankshaft pulley.
2. Install the pulley bolt.

To lock the crankshaft, use ST.

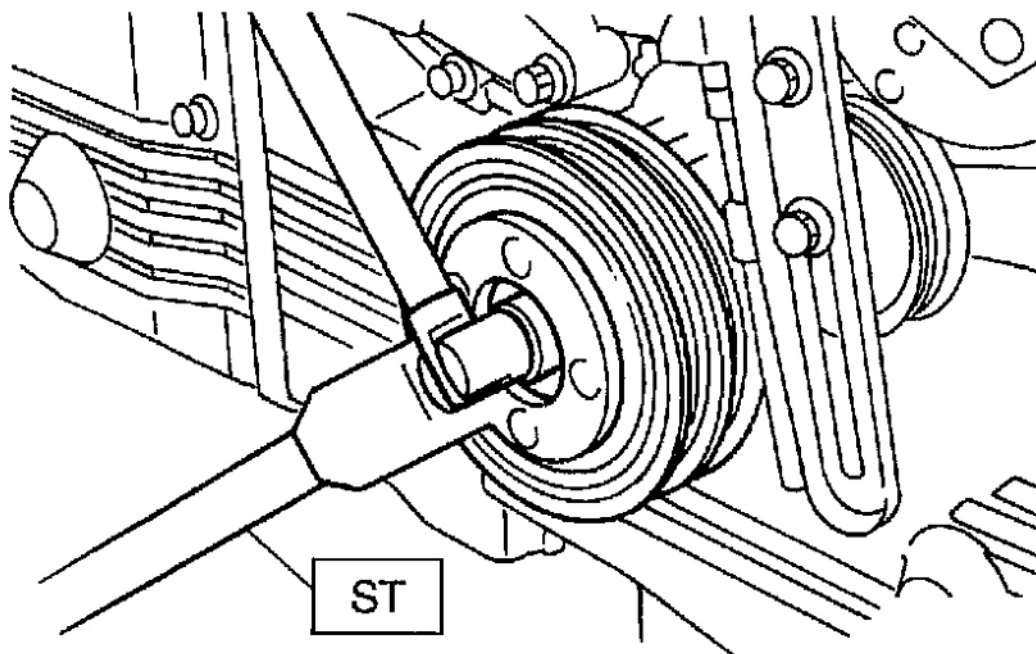
ST 499977300 CRANKSHAFT PULLEY WRENCH

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

Tightening torque:

127 N.m (13 kgf-m, 94.0 ft-lb)



G02871014

Fig. 99: Installing Crankshaft Pulley
Courtesy of SUBARU OF AMERICA, INC.

3. Confirm that the tightening angle of the crankshaft pulley bolt is 45 degrees or more. If not, conduct the following procedures (1) through (4).

CAUTION: If the tightening angle of crankshaft pulley bolt is less than 45 degrees, the bolt should be damaged. In this case, the bolt must be replaced.

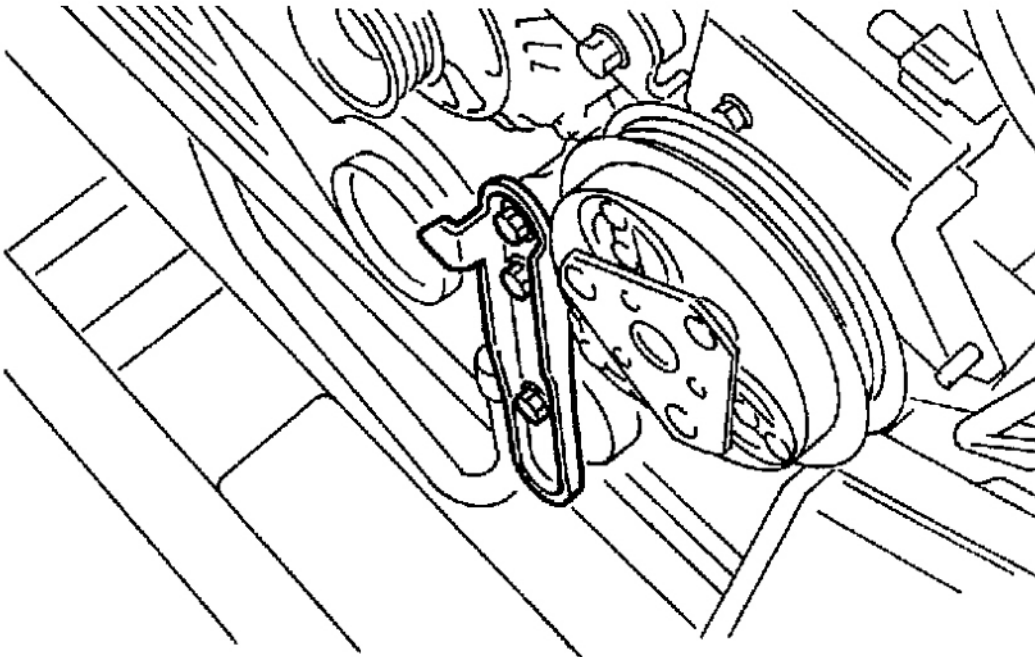
1. Replace the crankshaft pulley bolts and clean them.

Crankshaft pulley bolt: 12369AA011

2. Clean the crankshaft thread using an air gun.
3. Tighten the bolts temporarily with tightening torque of 44 N.m (4.5 kgf-m, 33 ft-lb).
4. Tighten the crankshaft pulley bolts keeping them in an angle between 65 degrees and 75 degrees.

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

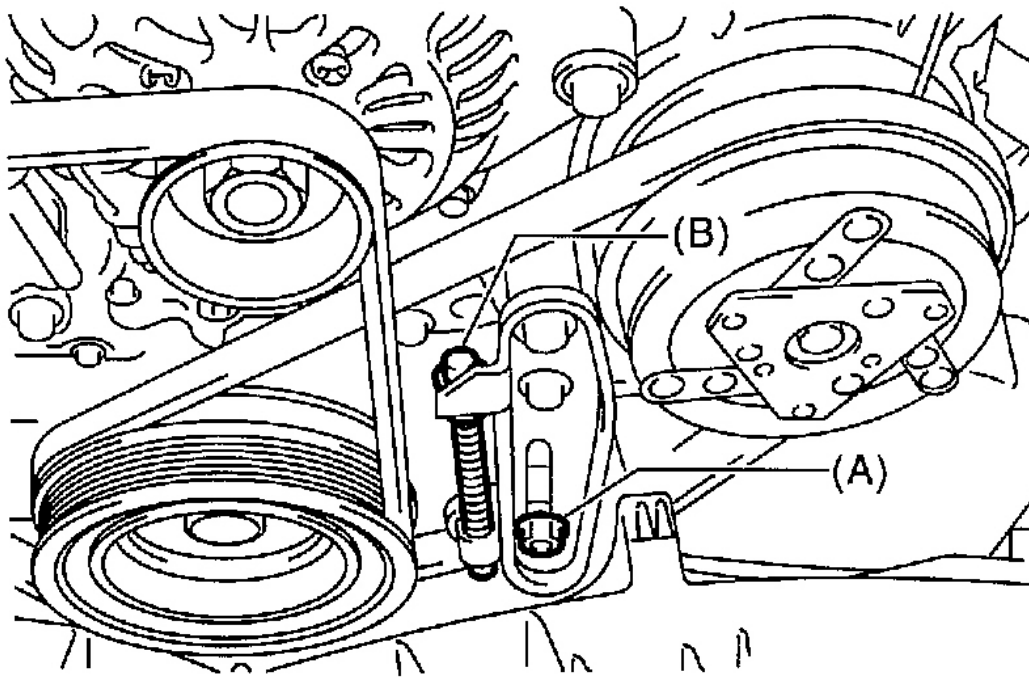
4. Install the A/C belt tensioner.



G02871015

Fig. 100: Installing A/C Belt Tensioner
Courtesy of SUBARU OF AMERICA, INC.

5. Install the A/C belt.



G02871016

Fig. 101: Installing A/C Belt
Courtesy of SUBARU OF AMERICA, INC.

INSPECTION

1. Make sure the V-belt is not worn or otherwise damaged.
2. Check the tension of the belt. < Ref. to **INSPECTION** , V-belt >

BELT COVER

REMOVAL

1. Remove the V-belt. < Ref. to **REMOVAL** , V-belt. >
2. Remove the crankshaft pulley. < Ref. to **INSTALLATION** , Crankshaft Pulley. >
3. Remove the left-hand belt cover (A).
4. Remove the right-hand belt cover (B).
5. Remove the front belt cover (C).

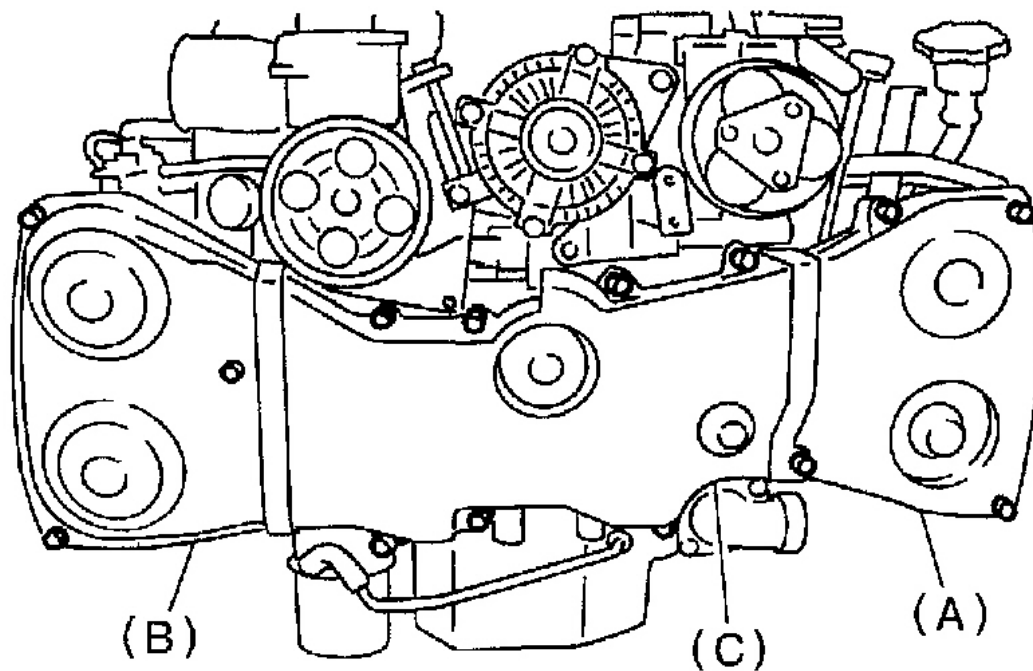


Fig. 102: Removing Front Belt Cover (C)
Courtesy of SUBARU OF AMERICA, INC.

INSTALLATION

1. Install the front belt cover (C).

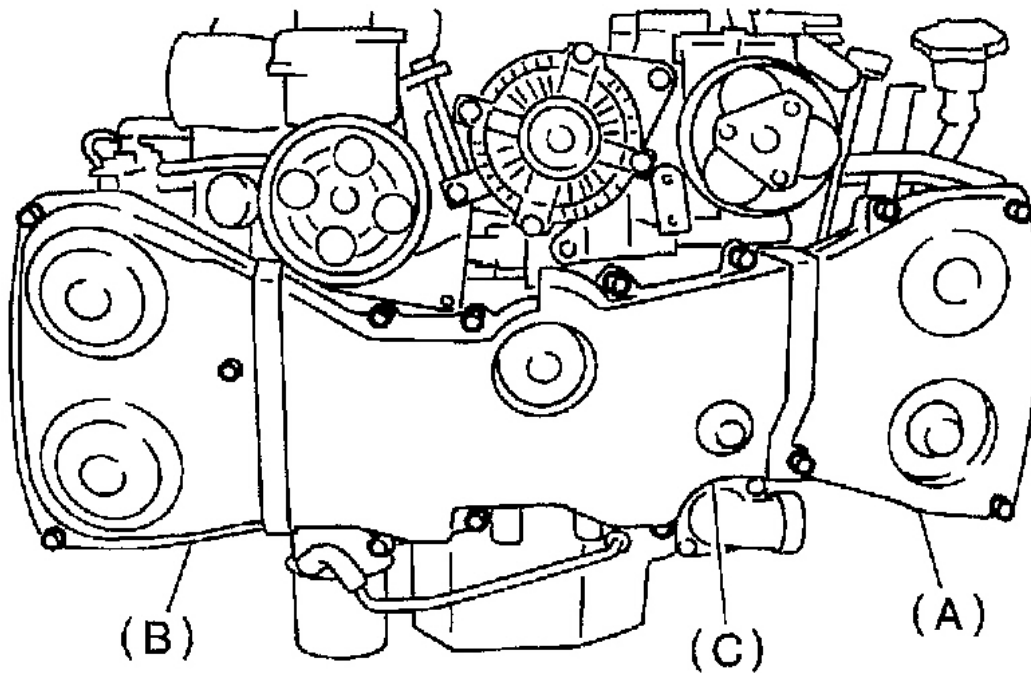
Tightening torque: 5 N.m (0.5 kgf-m, 3.6 ft-lb)

2. Install the right-hand belt cover (B).

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

3. Install the left-hand belt cover (A).

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



G02871018

Fig. 103: Installing Front Belt Cover (C)
Courtesy of SUBARU OF AMERICA, INC.

4. Install the crankshaft pulley. < Ref. to **INSTALLATION** , Crankshaft Pulley. >
5. Install the V-belt. < Ref. to **INSTALLATION** , V-belt. >

INSPECTION

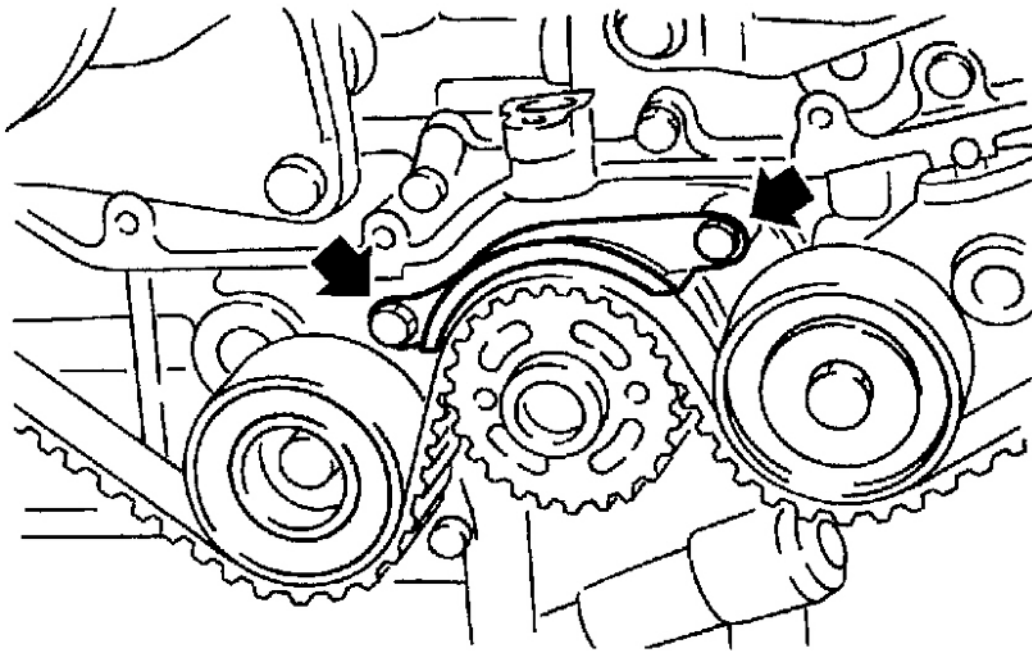
Make sure the cover is not damaged.

TIMING BELT ASSEMBLY

REMOVAL

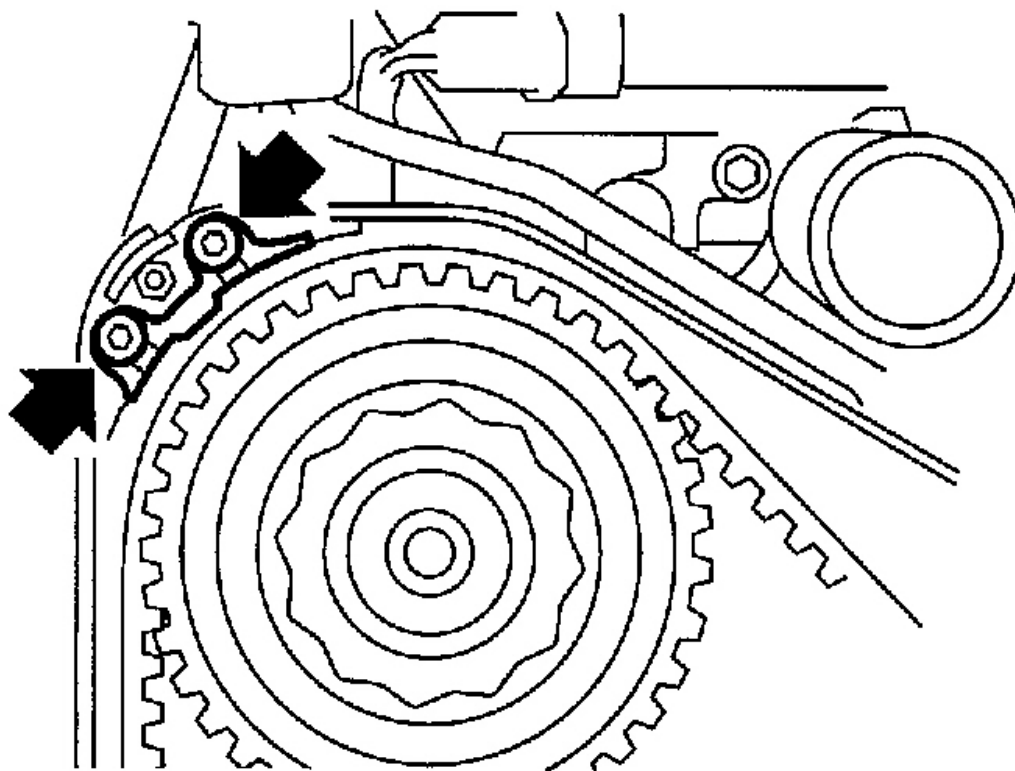
TIMING BELT

1. Remove the V-belt. < Ref. to **REMOVAL** , V-belt. >
2. Remove the crankshaft pulley. < Ref. to **INSTALLATION** , Crankshaft Pulley. >
3. Remove the belt cover. < Ref. to **REMOVAL** , Belt Cover. >
4. Remove the timing belt guides. (MT vehicle)



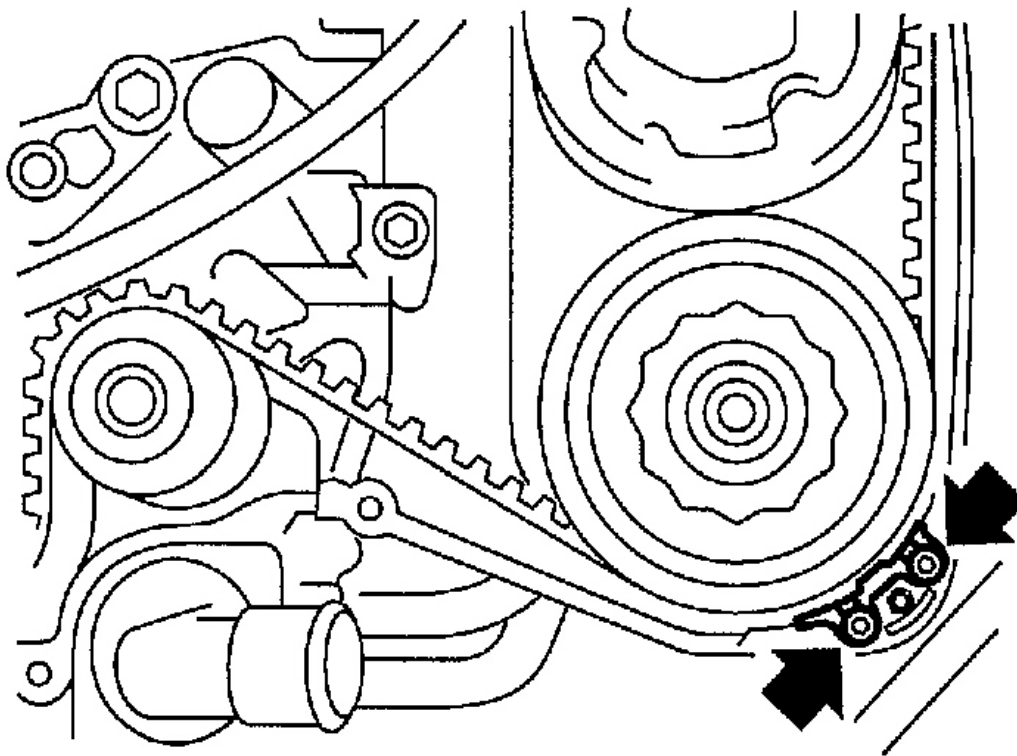
G02871019

Fig. 104: Removing Timing Belt Guides - MT Vehicle (1 Of 4)
Courtesy of SUBARU OF AMERICA, INC.



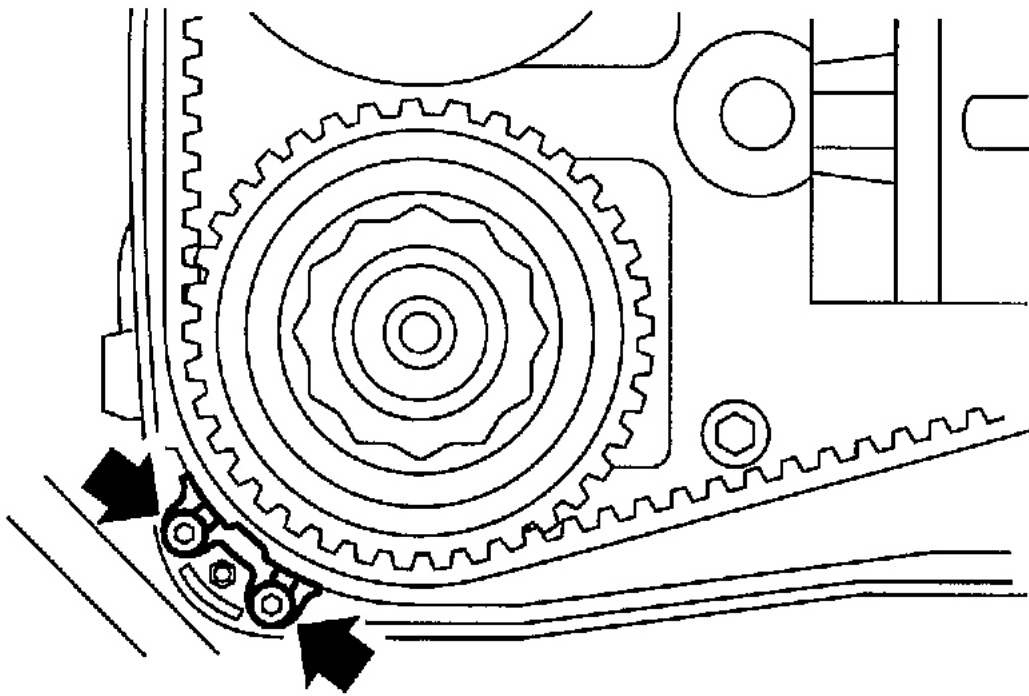
G02871020

Fig. 105: Removing Timing Belt Guides - MT Vehicle (2 Of 4)
Courtesy of SUBARU OF AMERICA, INC.



G02871021

Fig. 106: Removing Timing Belt Guides - MT Vehicle (3 Of 4)
Courtesy of SUBARU OF AMERICA, INC.

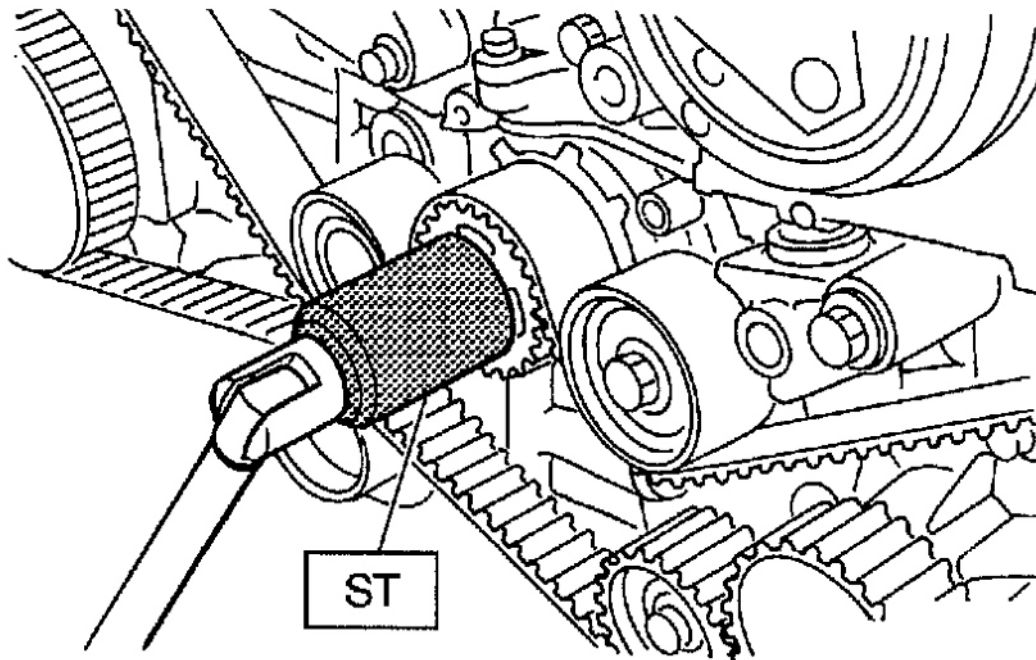


G02871022

Fig. 107: Removing Timing Belt Guides - MT Vehicle (4 Of 4)
 Courtesy of SUBARU OF AMERICA, INC.

5. If the alignment mark and/or arrow mark (which indicates rotation direction) on timing belt fade away, put new marks before removing the timing belt as follows:
 1. Turn the crankshaft using ST, and align alignment marks on crankshaft sprocket, left-hand intake camshaft sprocket, left-hand exhaust camshaft sprocket, right-hand intake camshaft sprocket and right hand exhaust camshaft sprocket with notches of belt cover and cylinder block.

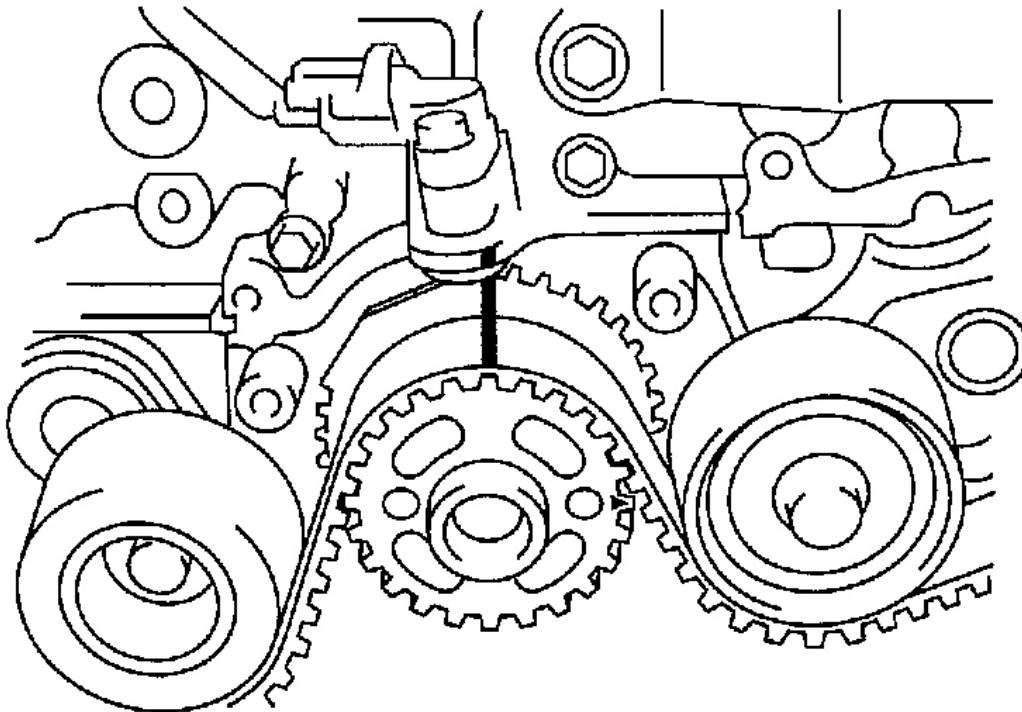
ST 499987500 CRANKSHAFT SOCKET



G02871023

Fig. 108: Aligning Alignment Marks On Crankshaft Sprocket
Courtesy of SUBARU OF AMERICA, INC.

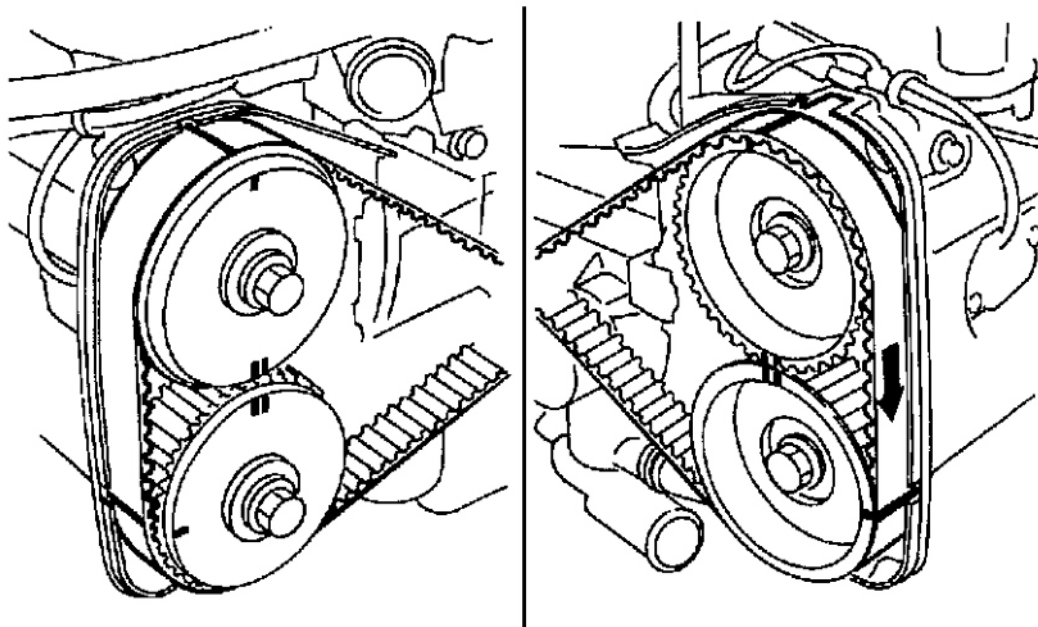
2. Using white paint, put alignment and/or arrow marks on the timing belts in relation to the sprockets.



G02871024

Fig. 109: Putting Alignment And/Or Arrow Marks On Timing Belts In Relation To Sprockets
(1 Of 3)

Courtesy of SUBARU OF AMERICA, INC.



G02871025

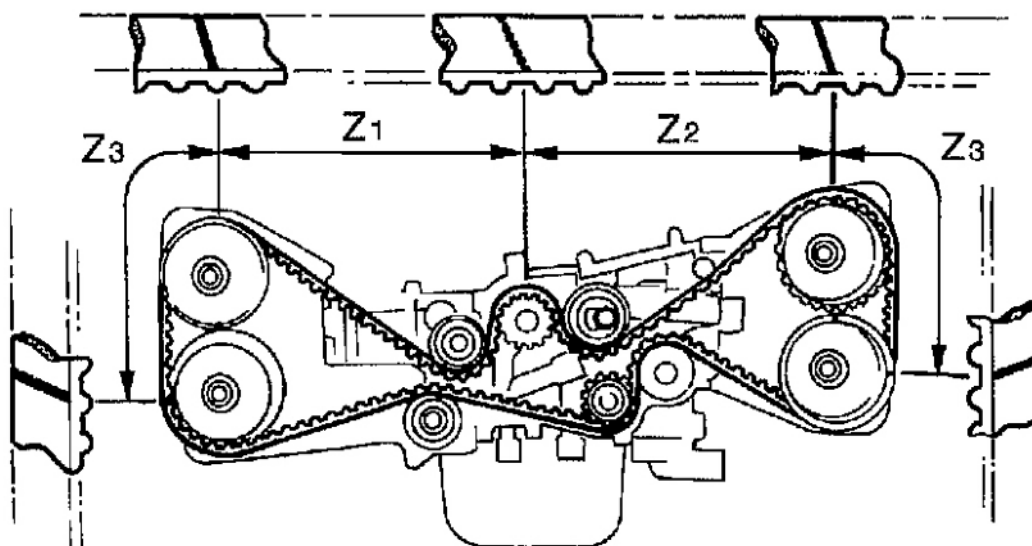
Fig. 110: Putting Alignment And/Or Arrow Marks On Timing Belts In Relation To Sprockets
(2 Of 3)

Courtesy of SUBARU OF AMERICA, INC.

Z^1 :54.5 tooth length

Z^2 :51 tooth length

Z^3 :28 tooth length

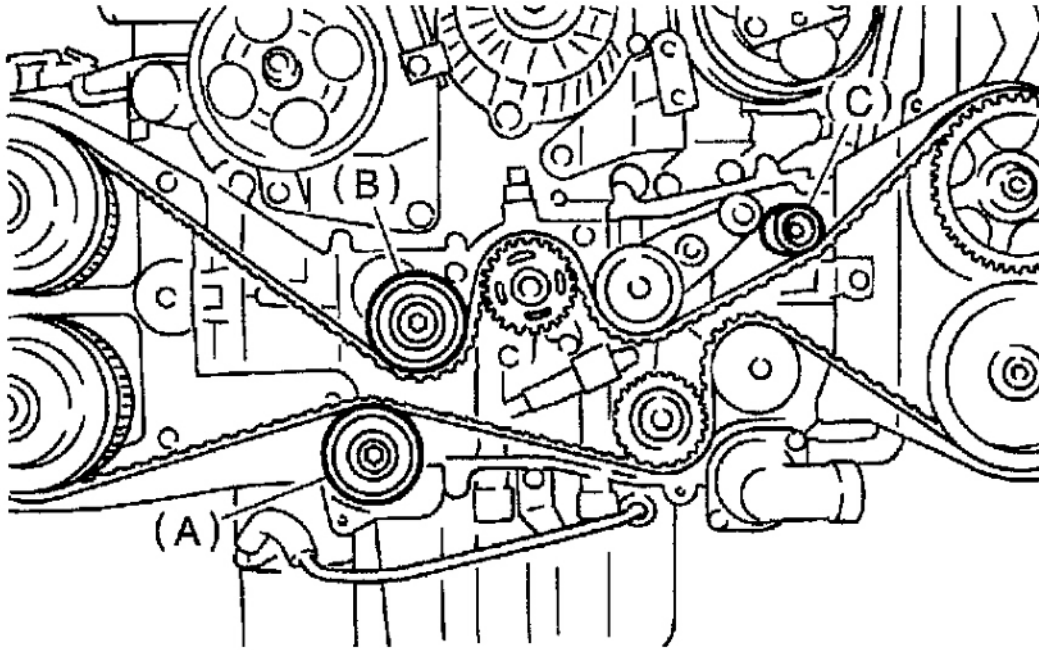


G02871026

Fig. 111: Putting Alignment And/Or Arrow Marks On Timing Belts In Relation To Sprockets
(3 Of 3)

Courtesy of SUBARU OF AMERICA, INC.

6. Remove the belt idler (A).



G02871027

Fig. 112: Removing Belt Idler (A)

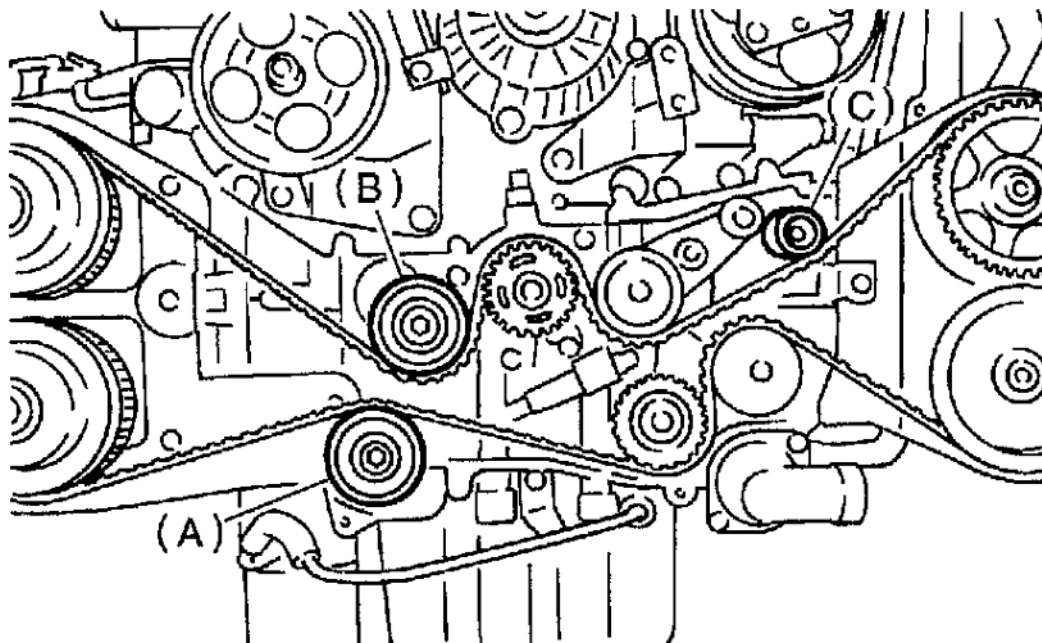
Courtesy of SUBARU OF AMERICA, INC.

7. Remove the timing belt.

CAUTION: After the timing belt has been removed, never rotate the intake and exhaust, camshaft sprocket. If the camshaft sprocket is rotated, the intake and exhaust valve heads strike together and valve stems are bent.

BELT IDLER AND AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY

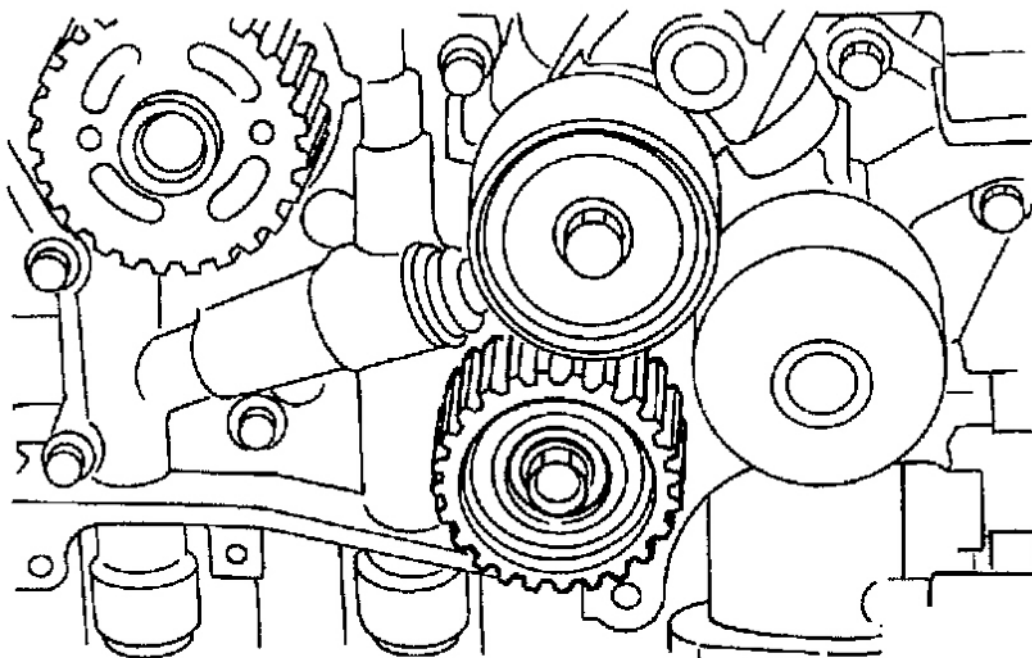
1. Remove the belt idler (B) and (C).



G02871028

Fig. 113: Removing Belt Idler (B) And (C)
Courtesy of SUBARU OF AMERICA, INC.

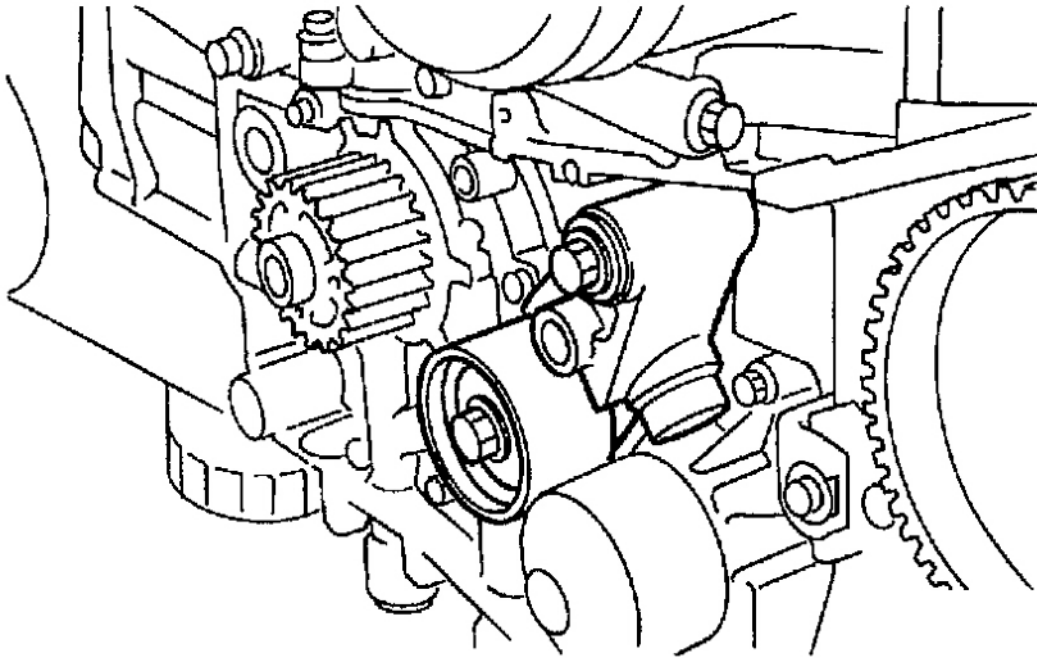
2. Remove the belt idler No. 2.



G02871029

Fig. 114: Removing Belt Idler No. 2
Courtesy of SUBARU OF AMERICA, INC.

3. Remove the automatic belt tension adjuster assembly.



G02871030

Fig. 115: Removing Automatic Belt Tension Adjuster Assembly
Courtesy of SUBARU OF AMERICA, INC.

INSTALLATION

AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

1. Preparation for installation of automatic belt tension adjuster assembly:

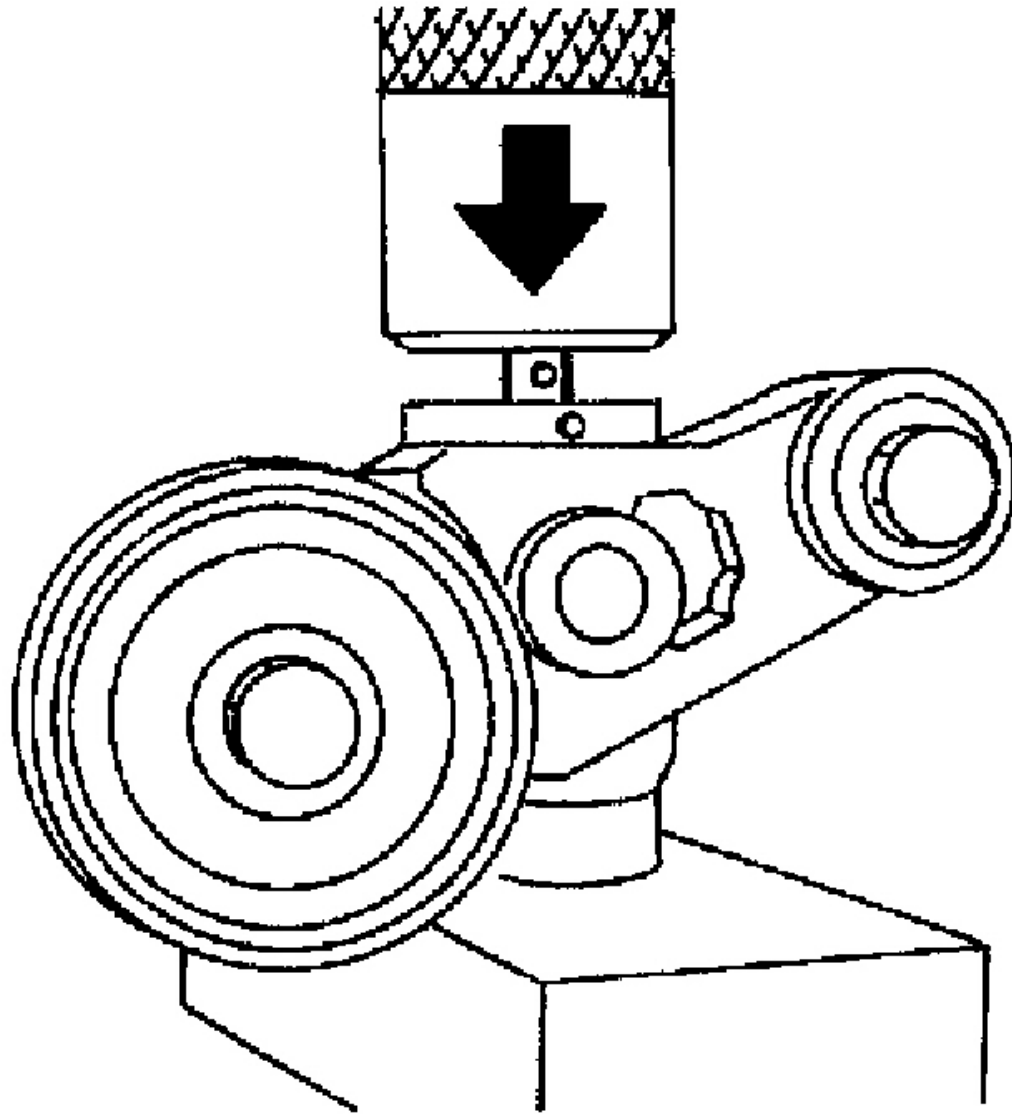
CAUTION:

- 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.
- Be sure to slowly move the adjuster rod down applying a pressure of 294 N (30 kgf, 66 lb).
- Press-in the push adjuster rod gradually taking more than three 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.

- **Do not release the press pressure until stopper pin is completely inserted.**

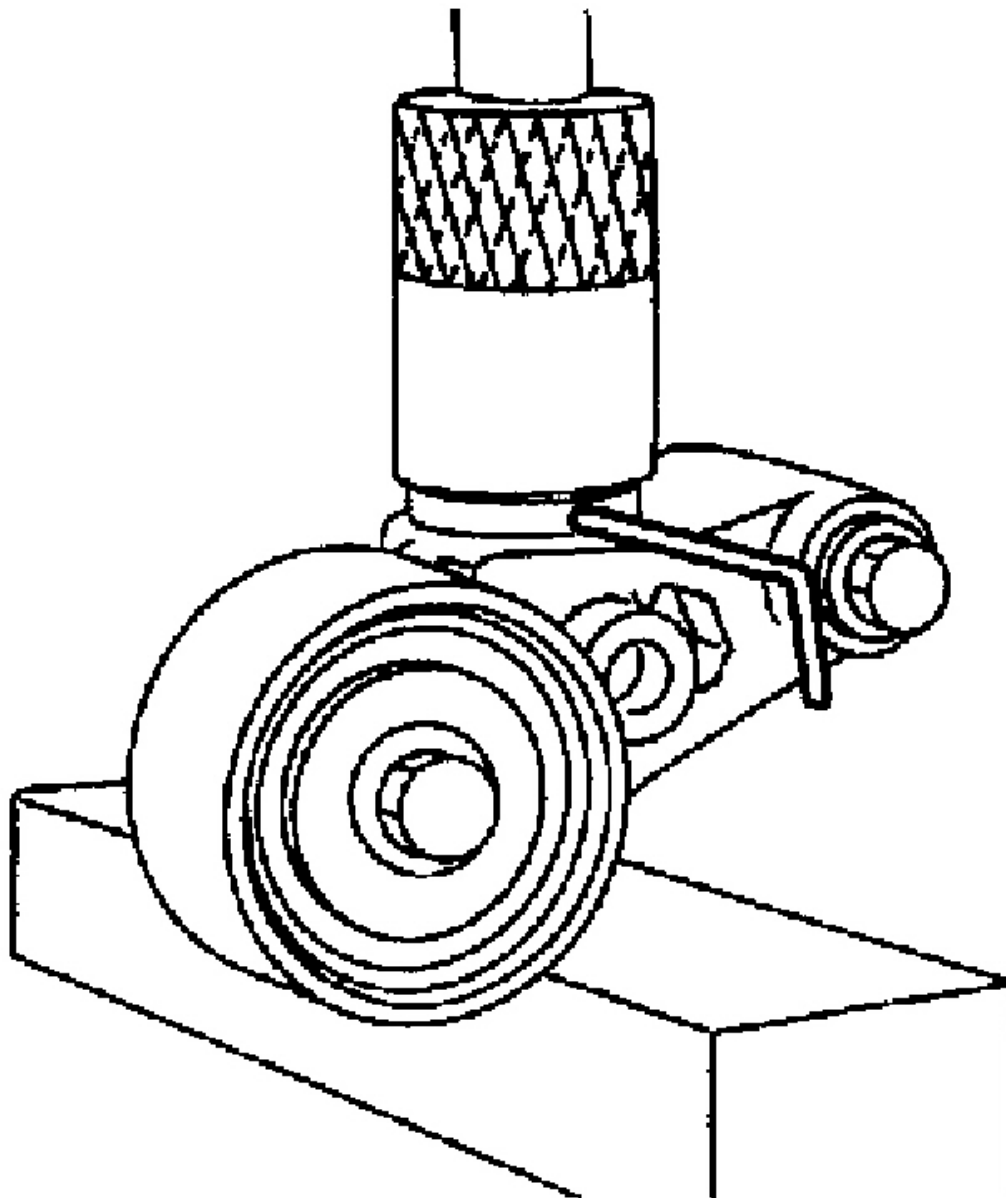
1. Attach the automatic belt tension adjuster assembly to the vertical pressing tool.
2. Slowly move the adjuster rod down with a pressure of 294 N (30 kgf, 66 lb) until the adjuster rod is aligned with the stopper pin hole in the cylinder.



G02871031

Fig. 116: Aligning Adjuster Rod With Stopper Pin Hole In Cylinder
Courtesy of SUBARU OF AMERICA, INC.

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

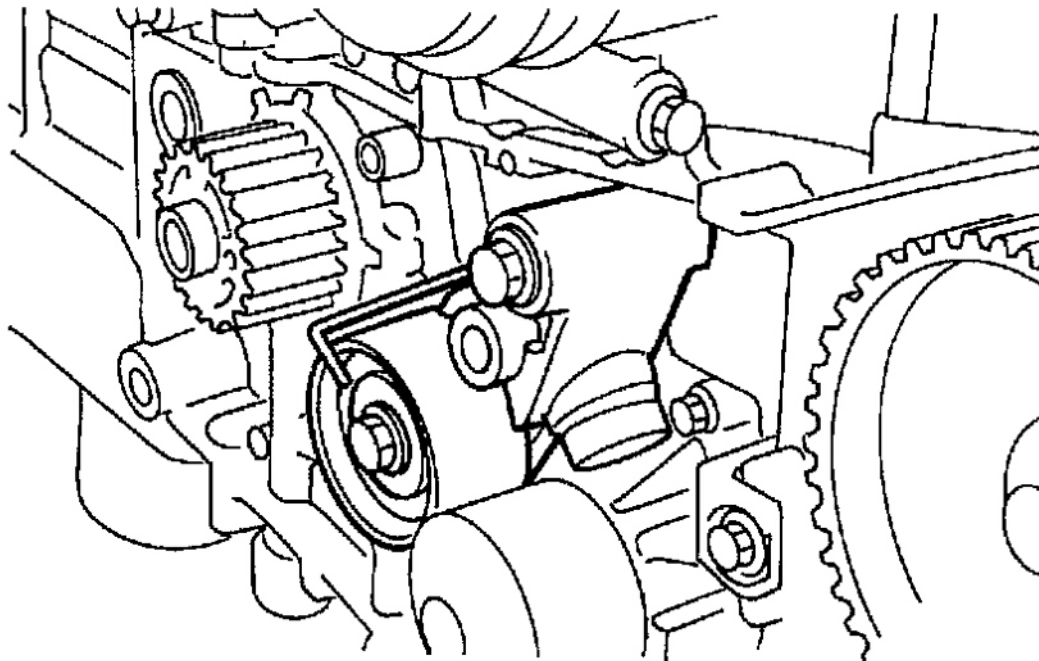


G02871032

Fig. 117: Securing Adjuster Rod
Courtesy of SUBARU OF AMERICA, INC.

2. Install the automatic belt tension adjuster assembly.

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

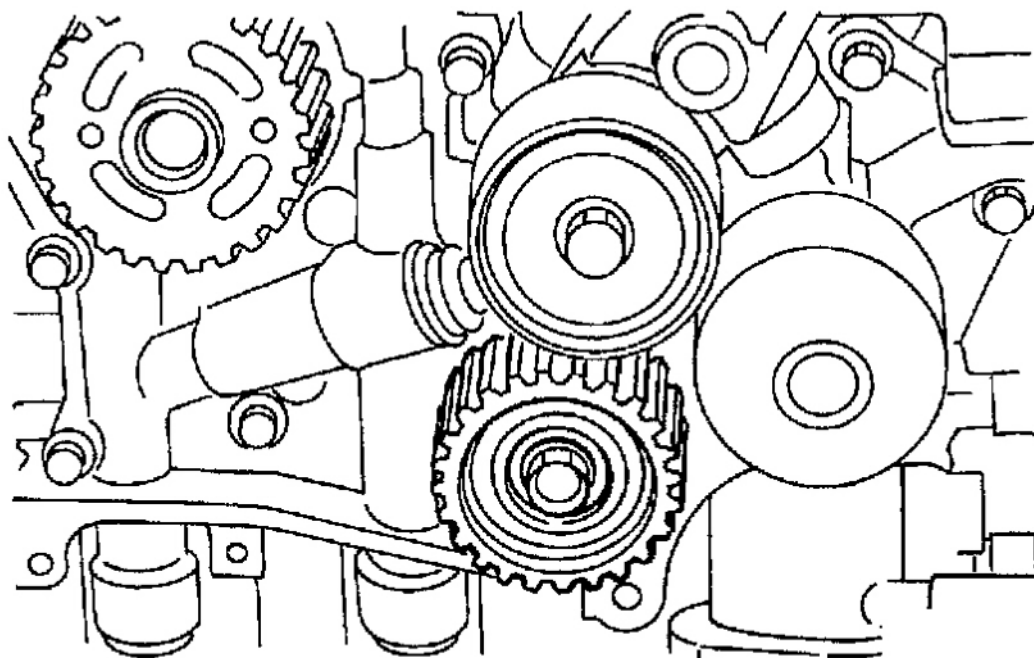


G02871033

Fig. 118: Installing Automatic Belt Tension Adjuster Assembly
Courtesy of SUBARU OF AMERICA, INC.

3. Install the belt idler No. 2.

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

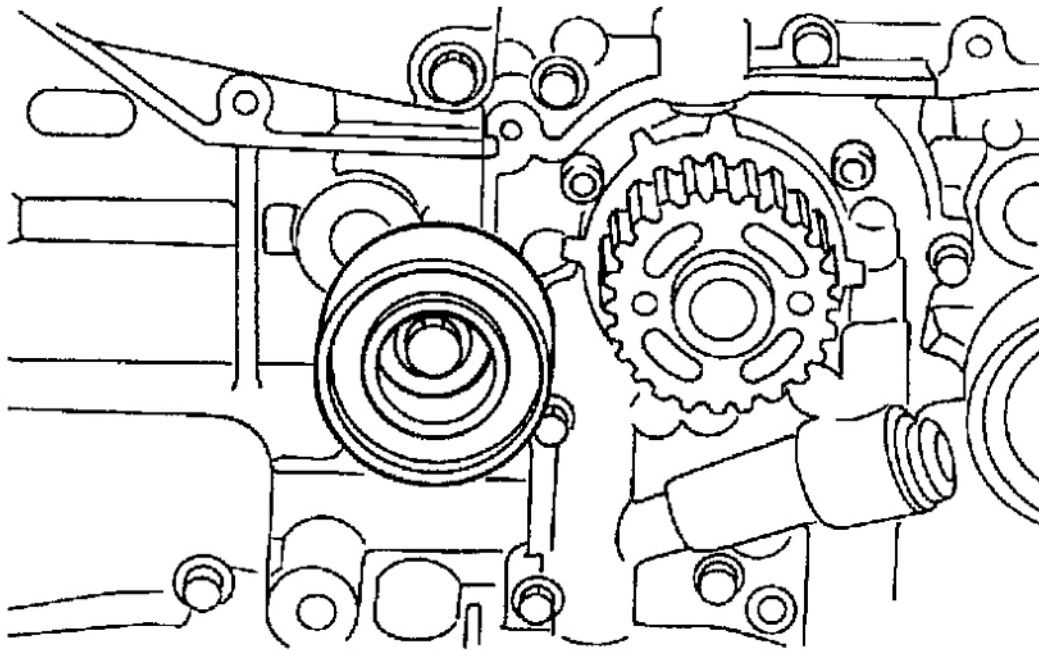


G02871034

Fig. 119: Installing Belt Idler No. 2
Courtesy of SUBARU OF AMERICA, INC.

4. Install the belt idler.

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



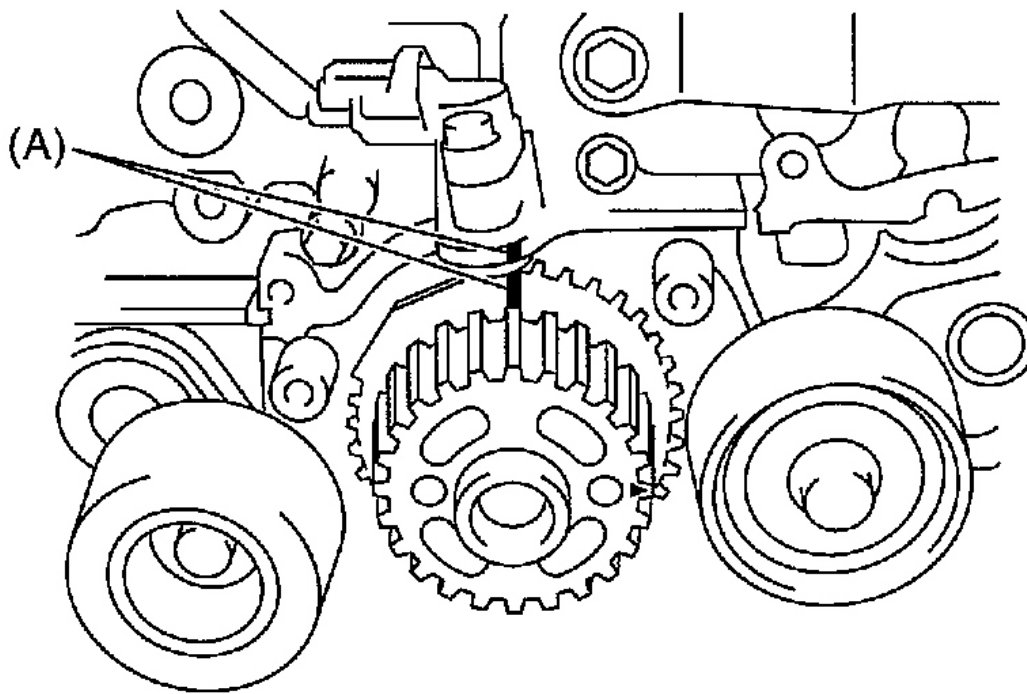
G02871035

Fig. 120: Installing Belt Idler

Courtesy of SUBARU OF AMERICA, INC.

TIMING BELT

1. Preparation for installation of automatic belt tension adjuster assembly. < Ref. to **AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER** , Timing Belt Assembly. >
2. Crankshaft and camshaft sprocket alignment.
 1. Align mark (A) on the crankshaft sprocket with mark on the oil pump cover at cylinder block.

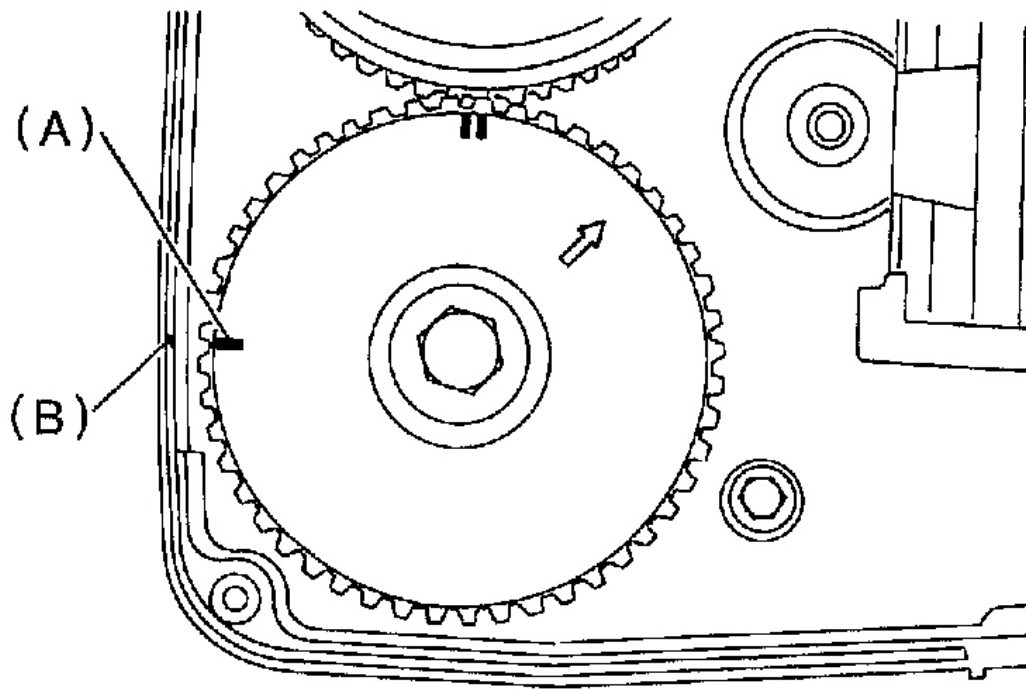


G02871036

Fig. 121: Aligning Mark (A) On Crankshaft Sprocket With Mark On Oil Pump Cover At Cylinder Block

Courtesy of SUBARU OF AMERICA, INC.

2. Align single line mark (A) on the right-hand exhaust camshaft sprocket with notch (B) on belt cover.

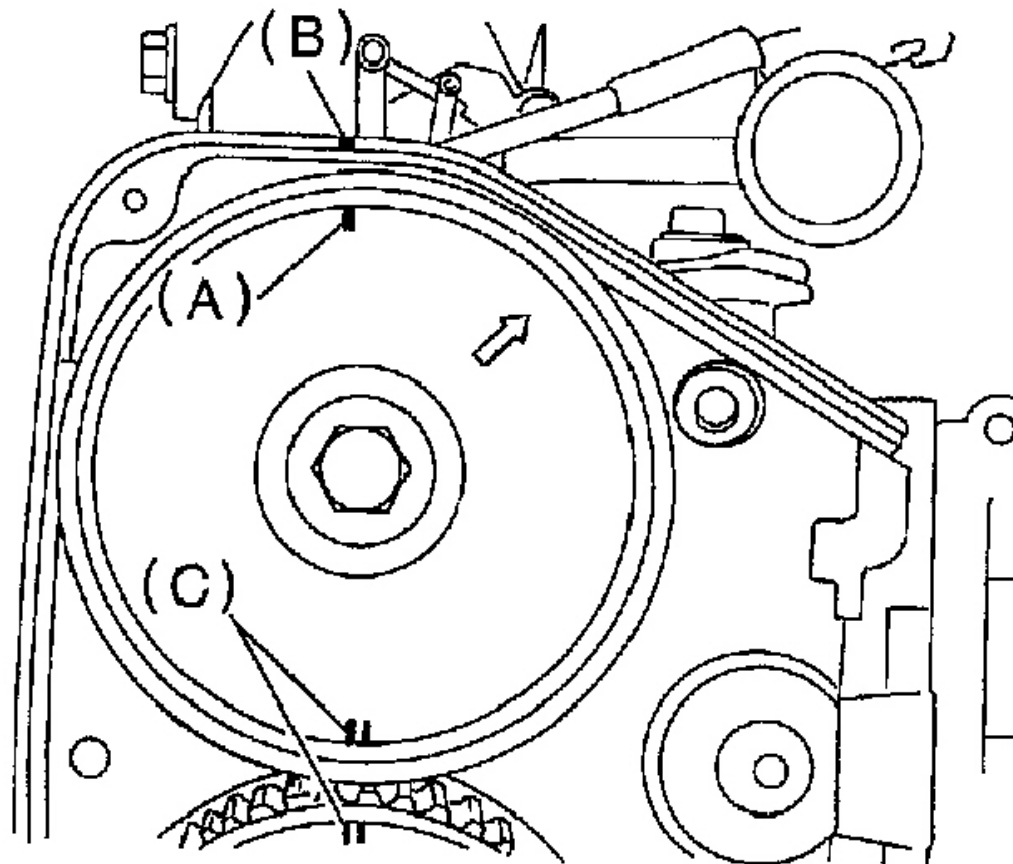


G02871037

Fig. 122: Aligning Single Line Mark (A) On Right-Hand Exhaust Camshaft Sprocket With Notch (B) On Belt Cover

Courtesy of SUBARU OF AMERICA, INC.

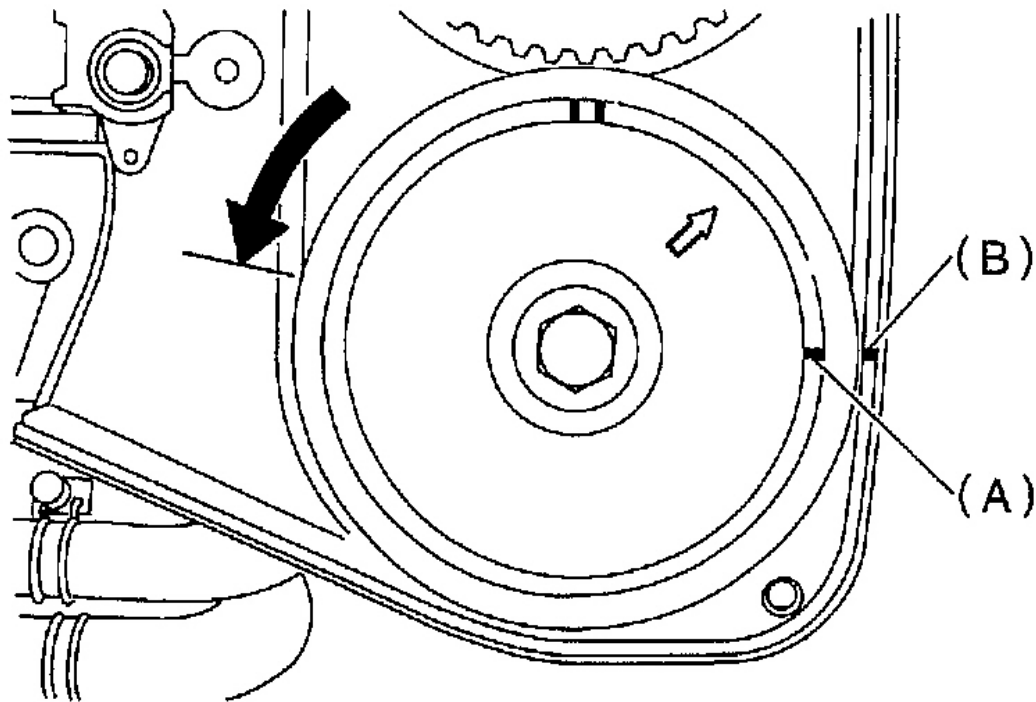
3. Align single line mark (A) on the right-hand intake camshaft sprocket with notch (B) on belt cover.
(Make sure double lines (C) on intake camshaft and exhaust camshaft sprockets are aligned.)



G02871038

Fig. 123: Aligning Single Line Mark (A) On Right-Hand Intake Camshaft Sprocket With Notch (B) On Belt Cover
Courtesy of SUBARU OF AMERICA, INC.

4. Align single line mark (A) on left-hand exhaust camshaft sprocket with notch (B) on belt cover by turning the sprocket counterclockwise (as viewed from front of engine).

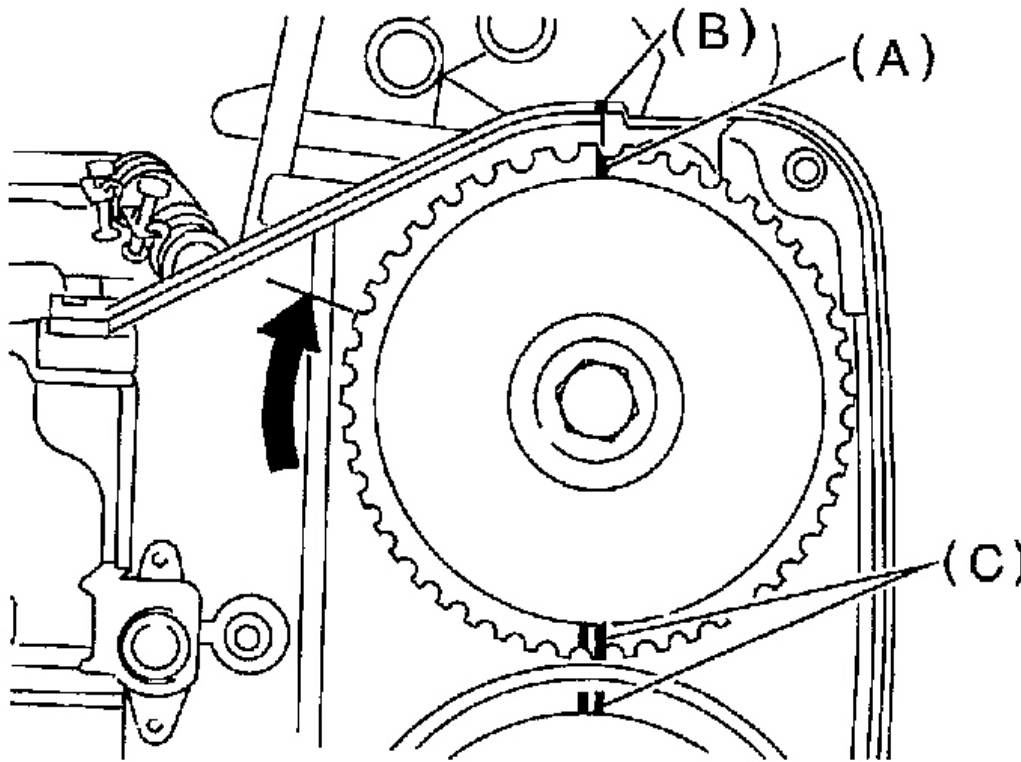


G02871039

Fig. 124: Aligning Single Line Mark (A) On Left-Hand Exhaust Camshaft Sprocket With Notch (B) On Belt Cover By Turning Sprocket Counterclockwise
Courtesy of SUBARU OF AMERICA, INC.

5. Align single line mark (A) on left-hand intake camshaft sprocket with notch (B) on belt cover by turning the sprocket clockwise (as viewed from front of engine).

Ensure double lines (C) on intake and exhaust camshaft sprockets are aligned.



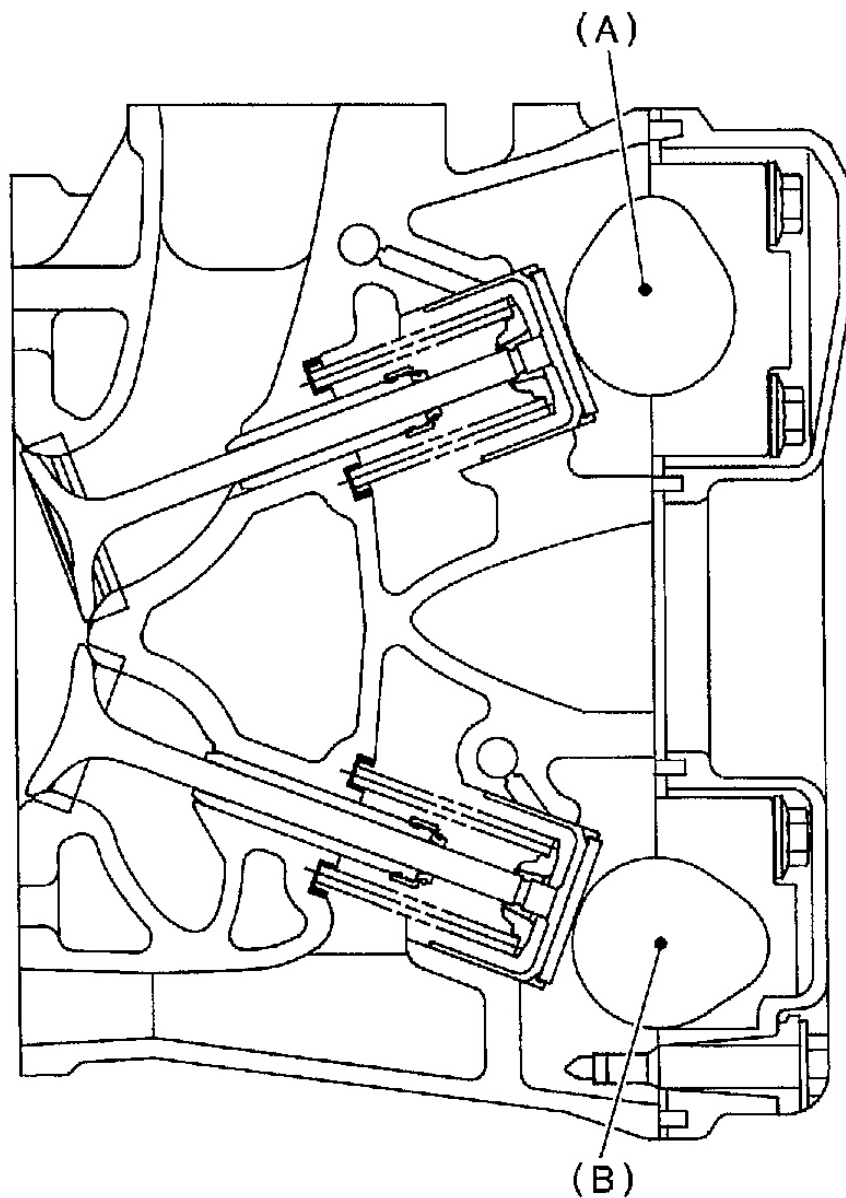
G02871040

Fig. 125: Aligning Double Lines (C) On Intake And Exhaust Camshaft Sprockets
Courtesy of SUBARU OF AMERICA, INC.

6. Ensure camshaft and crankshaft sprockets are positioned properly.

CAUTION:

- Intake and exhaust camshafts for this DOHC engine can be rotated with the timing belts removed. As can be seen from the intake and exhaust valves are lifted simultaneously, they interfere with each other, resulting in bent valves.



(A) Intake camshaft

(B) Exhaust camshaft

G02871041

Fig. 126: Identifying Camshaft Position
Courtesy of SUBARU OF AMERICA, INC.

- When the timing belts are not installed, four camshafts are I

"zero-lift" position, where all cams on camshafts do not push and exhaust valves down. (Under this condition, all valves remain unlifted.)

- **When the camshafts are rotated to install the timing belts, #4 exhaust cam of left-hand camshafts are held to push their corresponding valves down. (Under this condition, these valves are lifted.) Right-side camshafts are held so that their cams do not push valves down.**
- **Left-hand camshafts must be rotated from the "zero-lift" position where the timing belt is to be installed at as small an angle as possible, in order to prevent mutual interference of intake and exhaust valve heads.**
- **Do not allow the camshafts to rotate in the direction shown as this causes both intake and exhaust valves to lift simultaneously resulting in interference with their heads.**

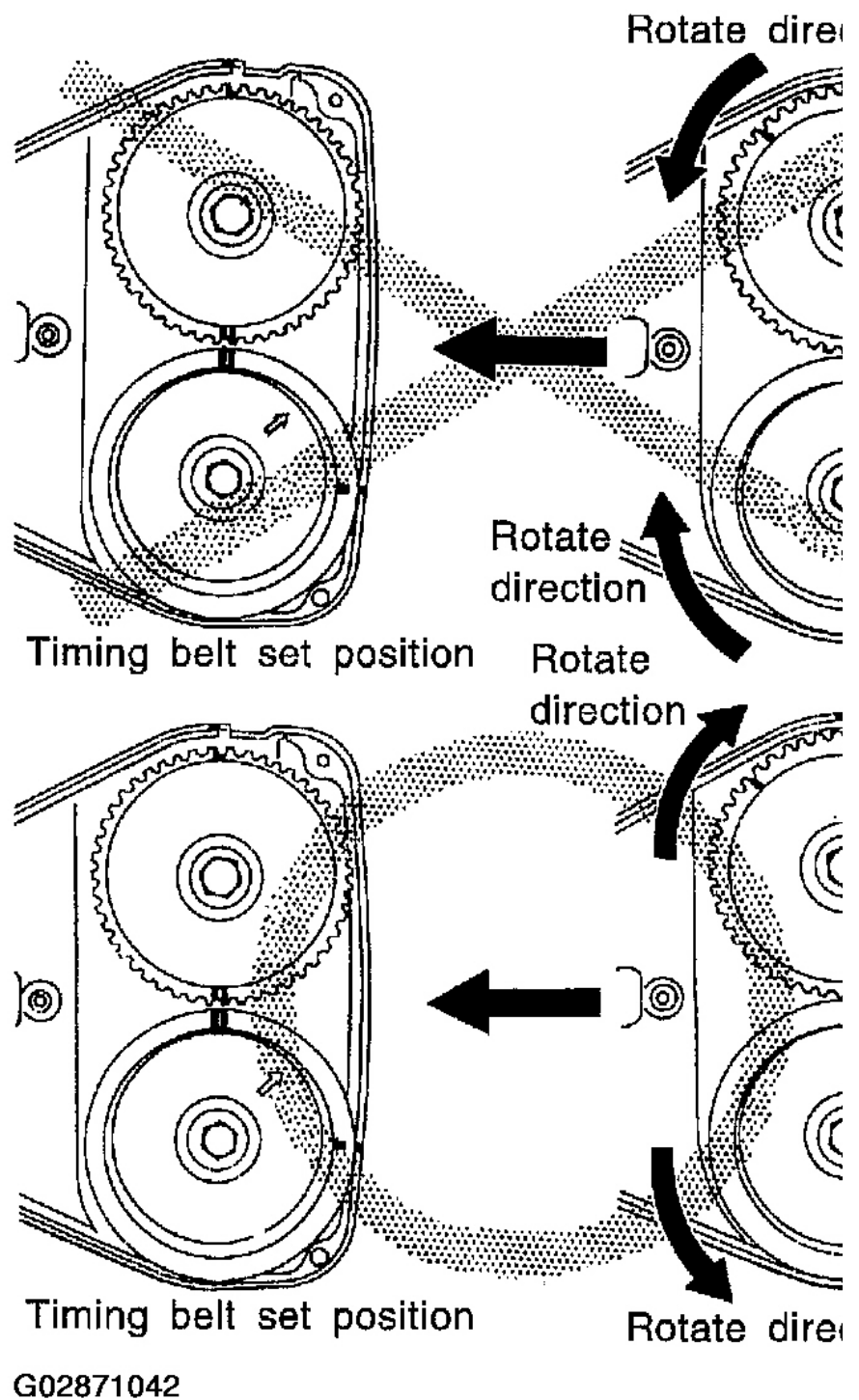
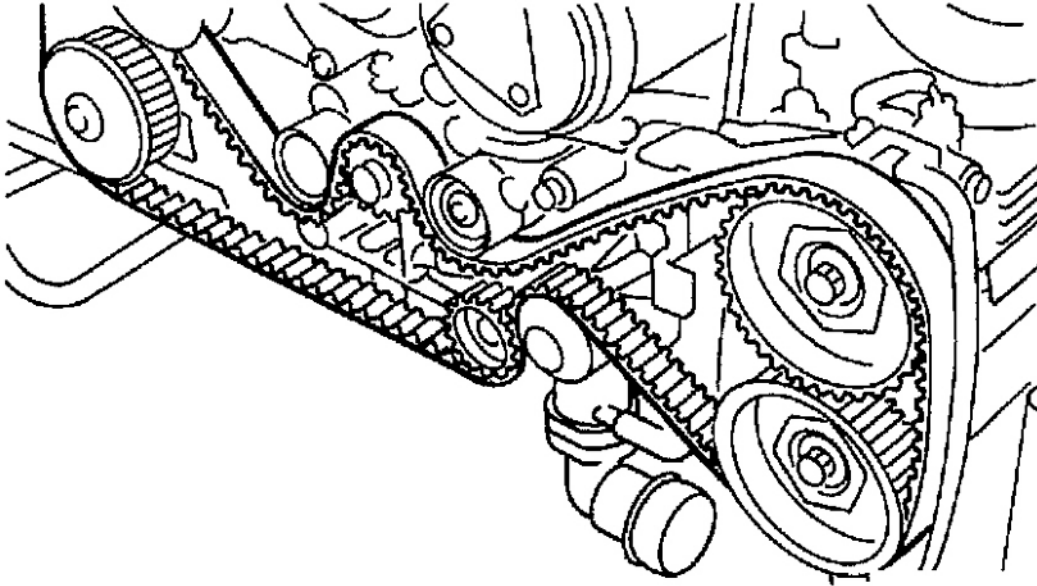


Fig. 127: Identifying Timing Belt Set Position
Courtesy of SUBARU OF AMERICA, INC.

3. Installation of timing belt:



G02871043

Fig. 128: Installing Of Timing Belt

Courtesy of SUBARU OF AMERICA, INC.

Align the alignment mark on the timing belt with marks on the sprockets in the alphabetical order shown in the figure. While aligning marks, position the timing belt properly.

CAUTION:

- Disengagement of more than three timing belt teeth may result in interference between the valve and piston.
- Ensure the belt's rotating direction is correct.

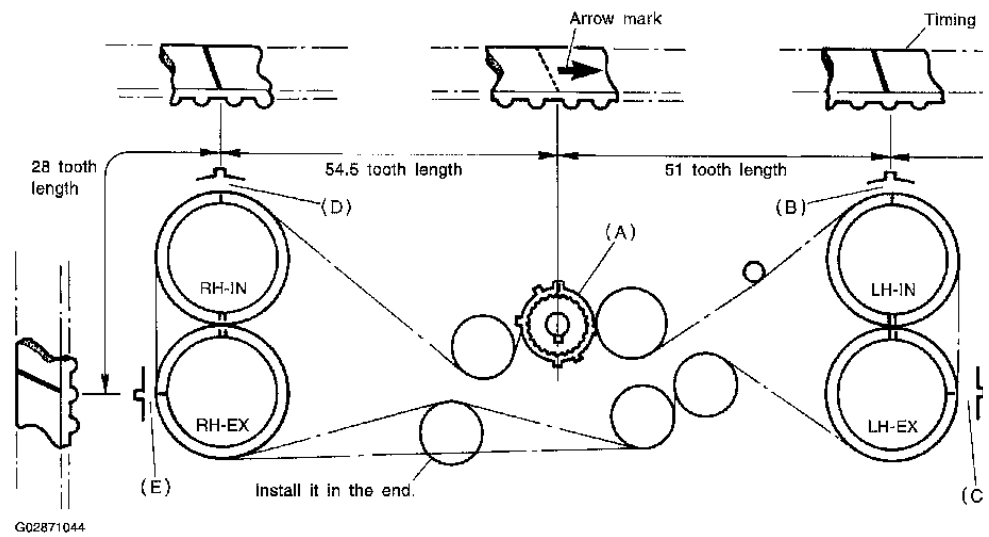
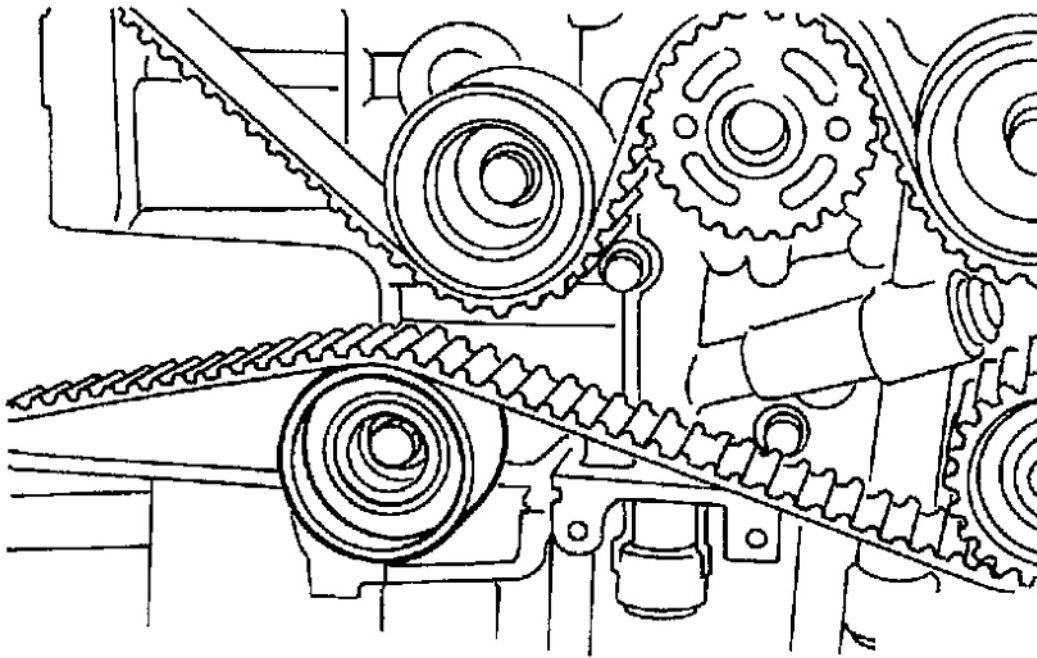


Fig. 129: Aligning Alignment Mark On Timing Belt With Marks On Sprockets In Alphabetical Order
 Courtesy of SUBARU OF AMERICA, INC.

4. Install the belt idlers.

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

CAUTION: Make sure that the marks on the timing belt and sprockets are aligned.

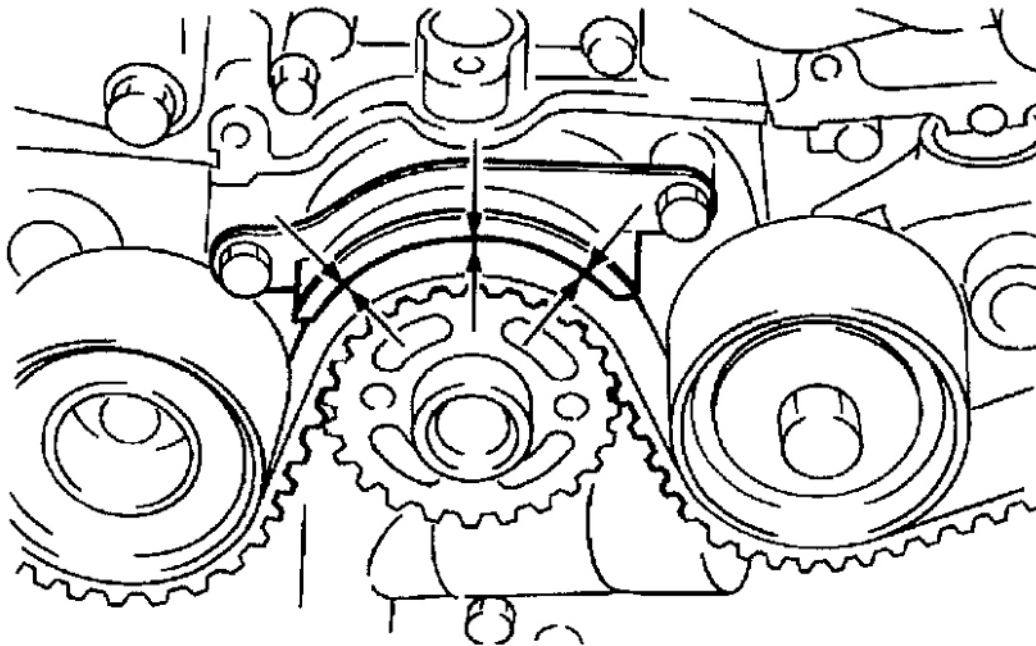


G02871045

Fig. 130: Installing Belt Idlers**Courtesy of SUBARU OF AMERICA, INC.**

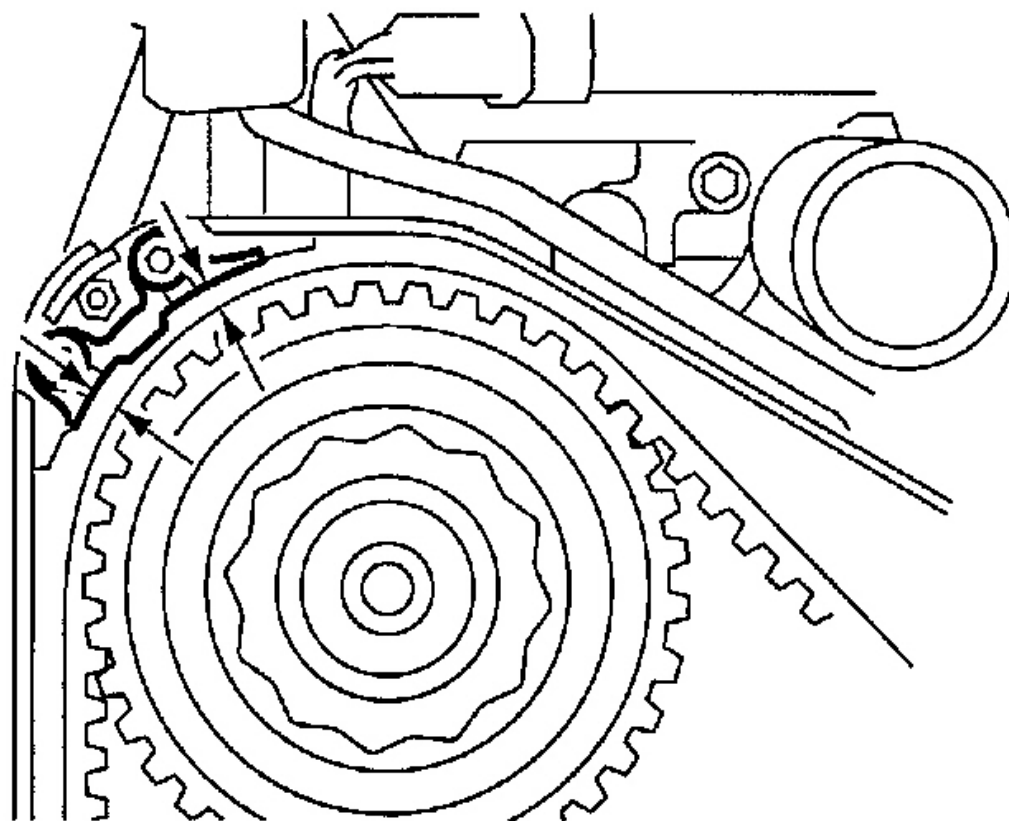
5. After ensuring that the marks on the timing belt and sprockets are aligned, remove the stopper pin from tensioner adjuster.
6. Install the timing belt guide. (MT vehicle)
 1. Temporarily tighten the remaining bolts.
 2. Check and adjust clearance between the timing belt and timing belt guide.

Clearance:***1.0+/-0.5 mm (0.039+/-0.020 in)***



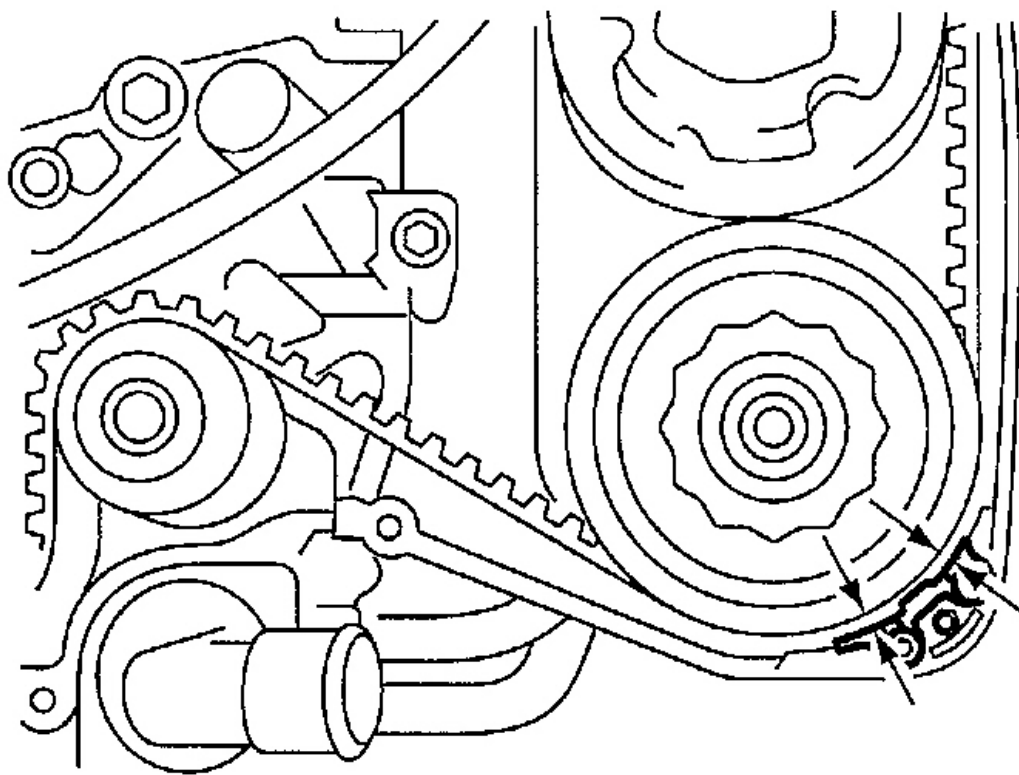
G02871046

Fig. 131: Identifying Adjust Clearance Between Timing Belt And Timing Belt Guide (1 Of 4)
Courtesy of SUBARU OF AMERICA, INC.



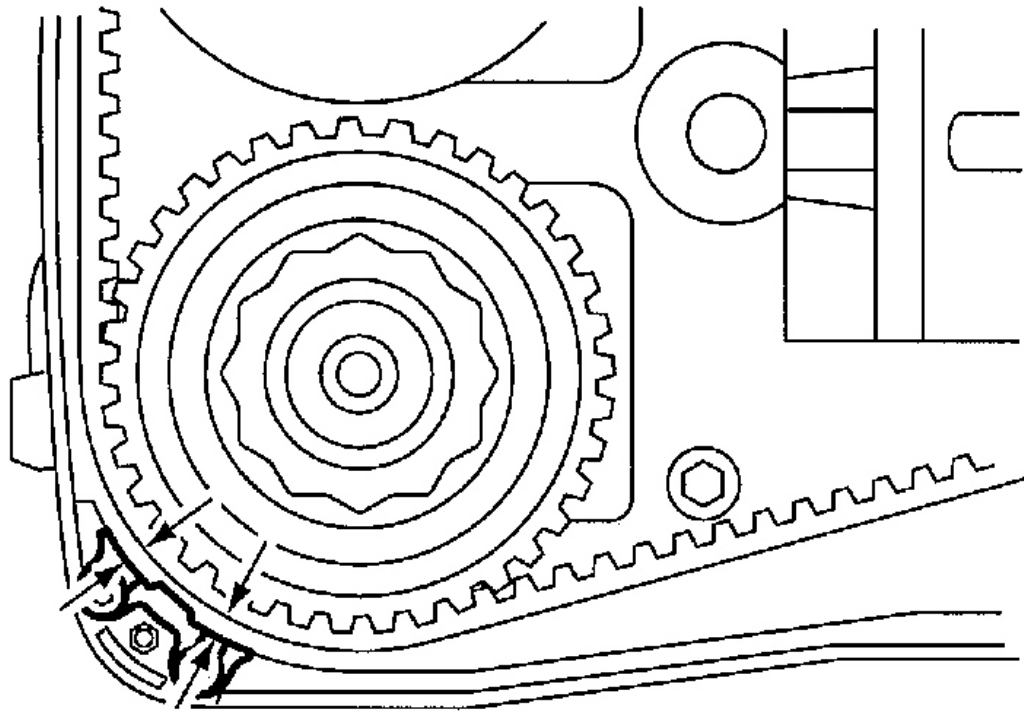
G02871047

Fig. 132: Identifying Adjust Clearance Between Timing Belt And Timing Belt Guide (2 Of 4)
Courtesy of SUBARU OF AMERICA, INC.



G02871048

Fig. 133: Identifying Adjust Clearance Between Timing Belt And Timing Belt Guide (3 Of 4)
Courtesy of SUBARU OF AMERICA, INC.

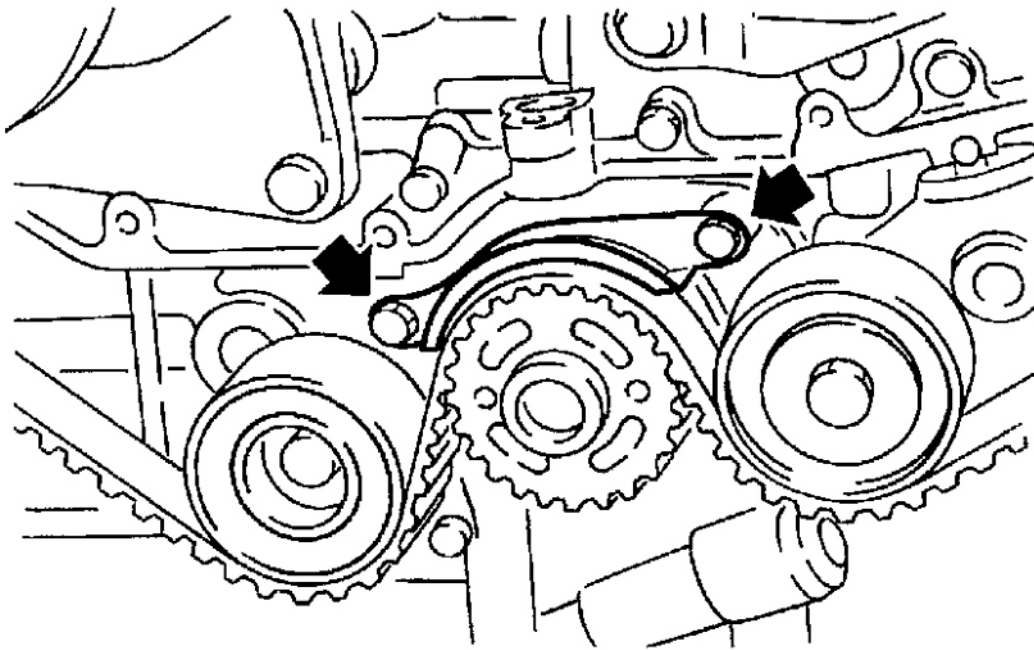


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Fig. 134: Identifying Adjust Clearance Between Timing Belt And Timing Belt Guide (4 Of 4)
Courtesy of SUBARU OF AMERICA, INC.

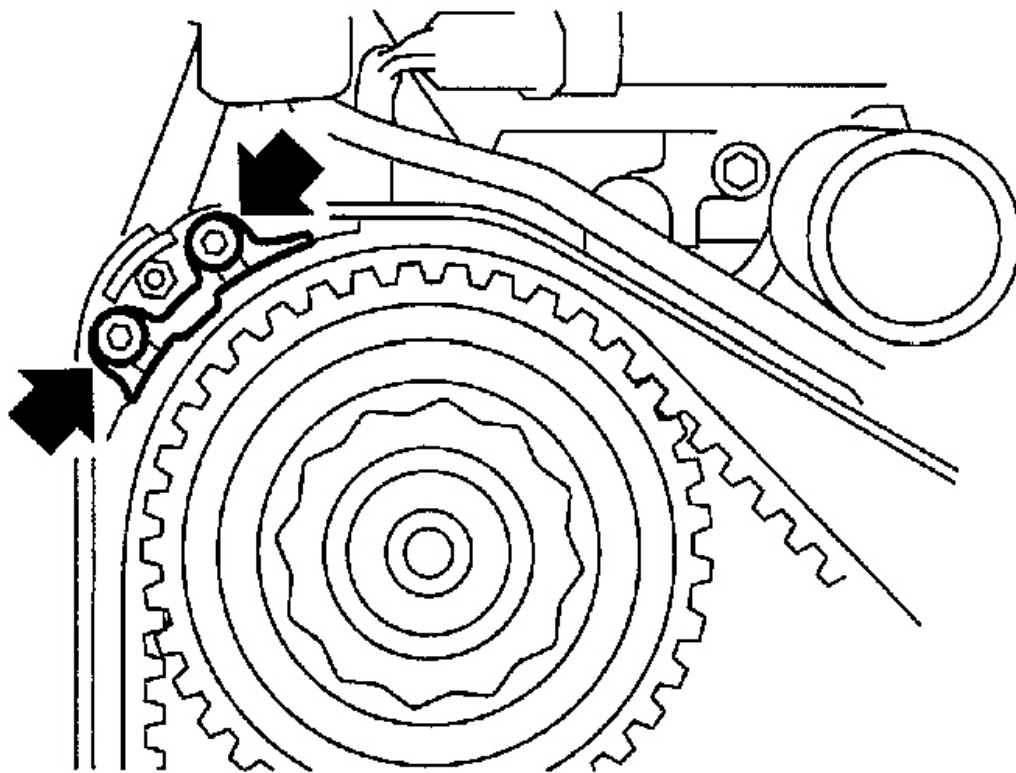
3. Tighten the remaining bolts.

Tightening torque: 9.8 N.m (1.0 kgf-m, 7.2 ft-lb)



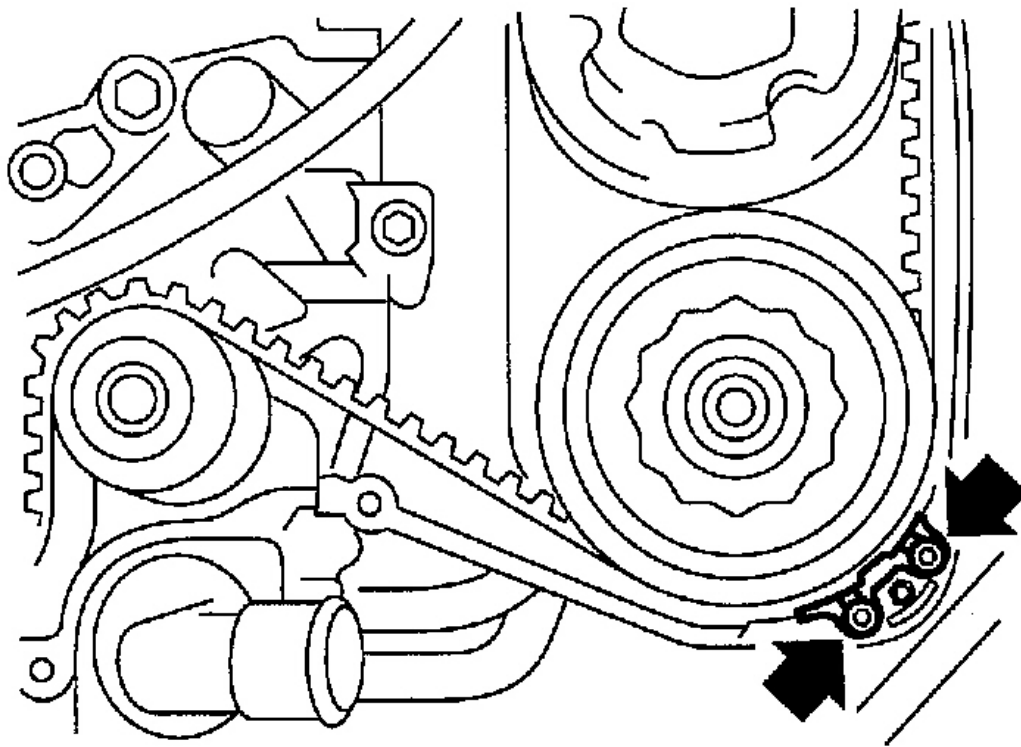
G02871050

Fig. 135: Tightening Timing Belt Guide Bolts (1 Of 4)
Courtesy of SUBARU OF AMERICA, INC.



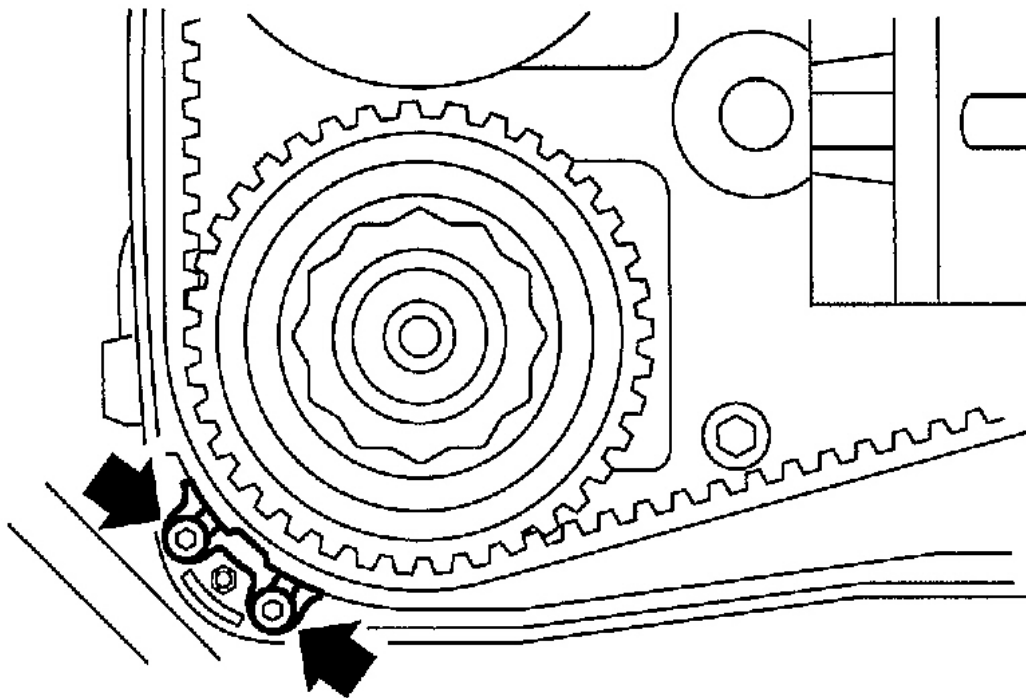
G02871051

Fig. 136: Tightening Timing Belt Guide Bolts (2 Of 4)
Courtesy of SUBARU OF AMERICA, INC.



G02871052

Fig. 137: Tightening Timing Belt Guide Bolts (3 Of 4)
Courtesy of SUBARU OF AMERICA, INC.



G02871053

Fig. 138: Tightening Timing Belt Guide Bolts (4 Of 4)
Courtesy of SUBARU OF AMERICA, INC.

7. Install the belt cover. < Ref. to **INSTALLATION** , Belt Cover. >
8. Install the crankshaft pulley. < Ref. to **REMOVAL** , Crankshaft Pulley. >
9. Install the V-belt. < Ref. to **INSTALLATION** , V-belt. >

INSPECTION

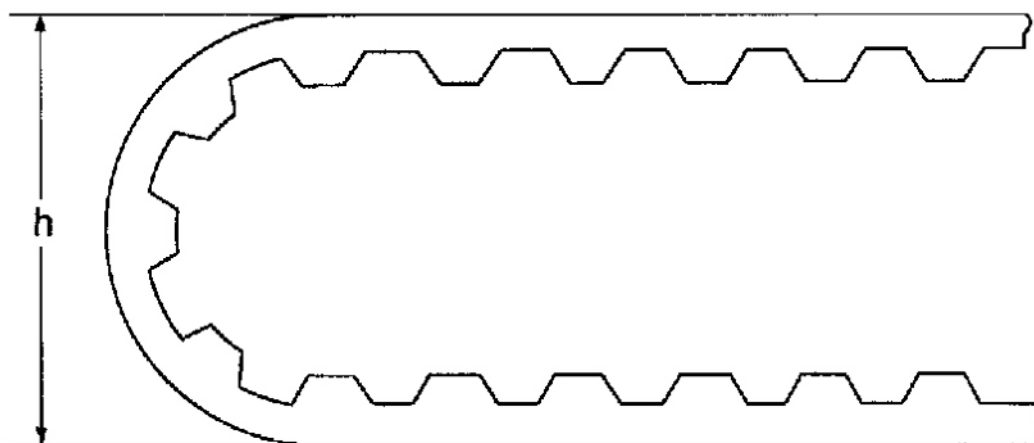
TIMING BELT

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 belt sharply.

Bending radius: h 60 mm (2.36 in) or more



G02871054

Fig. 139: Identifying Bending Radius

Courtesy of SUBARU OF AMERICA, INC.

AUTOMATIC BELT TENSION ADJUSTER

1. Visually check the oil seals for leaks, and rod ends for abnormal wear or scratches. If necessary, replace the automatic belt tension adjuster assembly.

CAUTION: Slight traces of oil at rod's oil seal does not indicate the a problem.

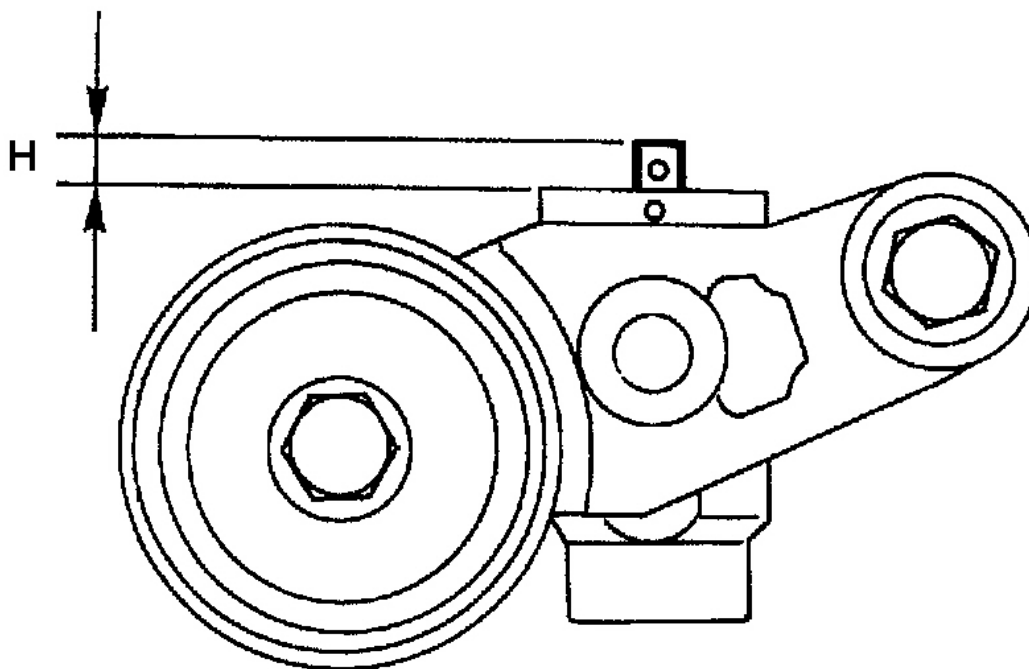
2. Check that the adjuster rod does not move when a pressure of 294 N (30 kgf, 66 lb) is applied to it. This is to check adjuster rod stiffness.
3. If the adjuster rod is not stiff and moves freely when applying 294 N (30 kgf, 66 lb), check it using the following procedures:
 1. Slowly press the adjuster 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 the 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 push adjuster rod gradually taking more than three 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)



G02871055

Fig. 140: Measuring Extension Of Rod Beyond Body
Courtesy of SUBARU OF AMERICA, INC.

BELT TENSION PULLEY

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

3. Check the belt tension pulley for grease leakage.

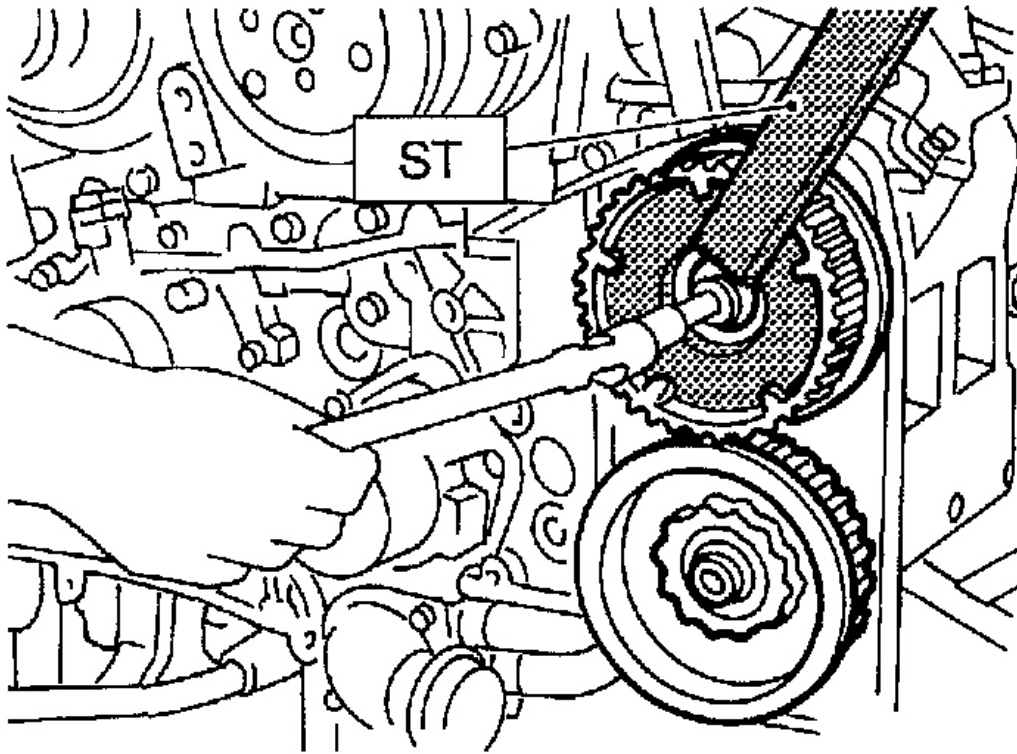
BELT IDLER

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

CAMSHAFT SPROCKET**REMOVAL**

1. Remove the V-belt. < Ref. to **REMOVAL** , V-belt >
2. Remove the crankshaft pulley. < Ref. to **REMOVAL** , Crankshaft Pulley. >
3. Remove the belt cover. < Ref. to **REMOVAL** , Belt Cover. >
4. Remove the timing belt assembly. < Ref. to **REMOVAL** , Timing Belt Assembly. >
5. Remove the camshaft position sensor. < Ref. to **REMOVAL** , Camshaft Position Sensor. >
6. Remove the camshaft sprockets. To lock the camshaft, use ST.

ST 499207400 CAMSHAFT SPROCKET WRENCH



G02871056

Fig. 141: Removing Camshaft Sprockets
Courtesy of SUBARU OF AMERICA, INC.

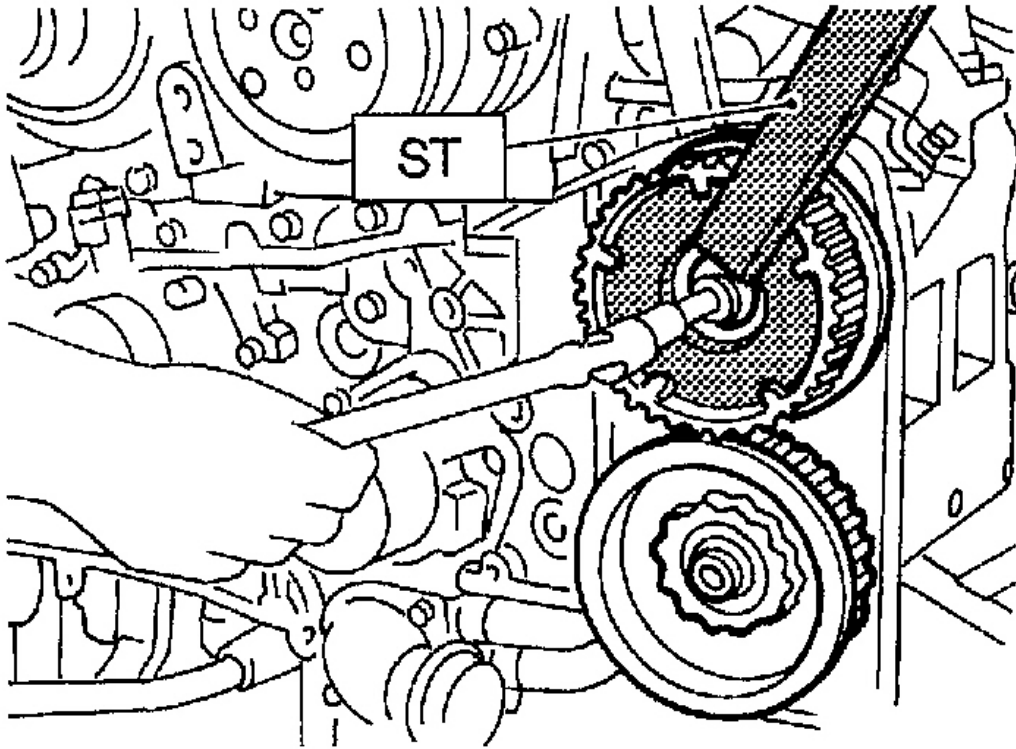
INSTALLATION

1. Install the camshaft sprocket No. 1. and No. 2. To lock camshaft, use ST.

ST 499207100 CAMSHAFT SPROCKET WRENCH

Tightening torque: 98 N.m (10 kgf-m, 72.4 ft-lb)

CAUTION: Do not confuse left and right side camshaft sprockets during installation. The camshaft sprocket No. 2 is identified by a projection used to monitor camshaft position sensor.



G02871057

Fig. 142: Installing Camshaft Sprockets
Courtesy of SUBARU OF AMERICA, INC.

2. Install the camshaft position sensor. < Ref. to **INSTALLATION** , Camshaft Position Sensor. >
3. Install the timing belt assembly. < Ref. to **INSTALLATION** , Timing Belt Assembly. >
4. Install the belt cover. < Ref. to **INSTALLATION** , Belt Cover. >
5. Install the crankshaft pulley. < Ref. to **INSTALLATION** , Crankshaft Pulley. >
6. Install the V-belt. < Ref. to **INSTALLATION** , V-belt. >

INSPECTION

1. Check the sprocket teeth for abnormal wear and scratches.
2. Make sure there is no free play between sprocket and key.
3. Check the crankshaft sprocket notch used for sensor for damage and contamination of foreign matter.

CRANKSHAFT SPROCKET

REMOVAL

1. Remove the V-belt. < Ref. to **REMOVAL** , V-belt >.
2. Remove the crankshaft pulley. < Ref. to **REMOVAL** , Crankshaft Pulley. >
3. Remove the belt cover. < Ref. to **REMOVAL** , Belt Cover. >
4. Remove the timing belt assembly. < Ref. to **REMOVAL** , Timing Belt Assembly. >
5. Remove the camshaft sprocket. < Ref. to **REMOVAL** , Camshaft Sprockets
6. Remove the crankshaft sprocket.

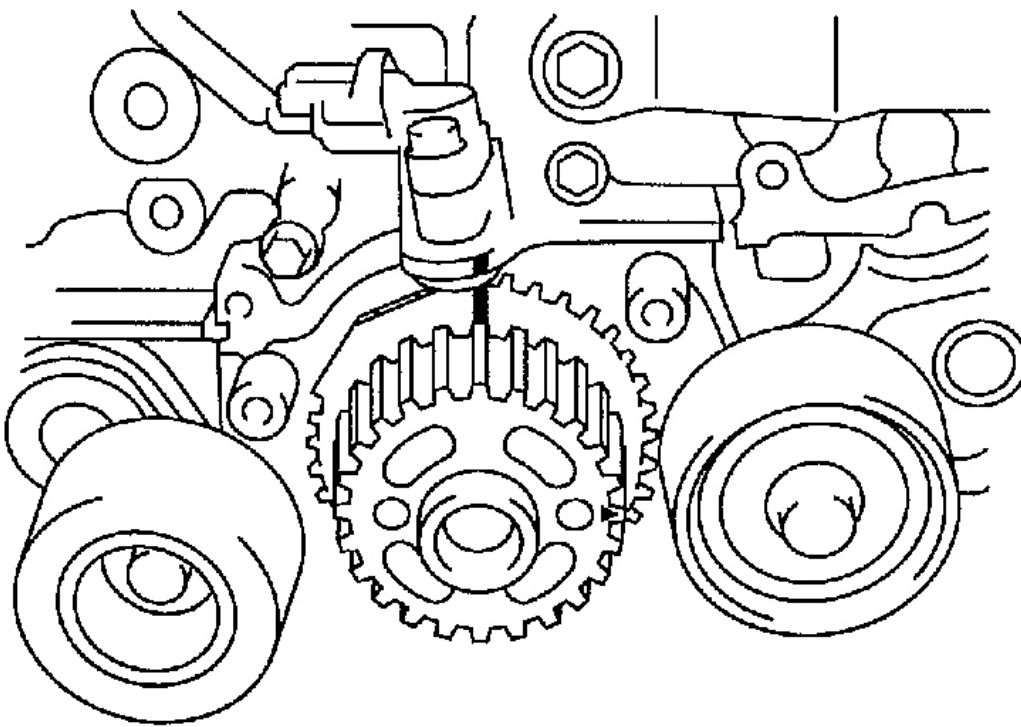
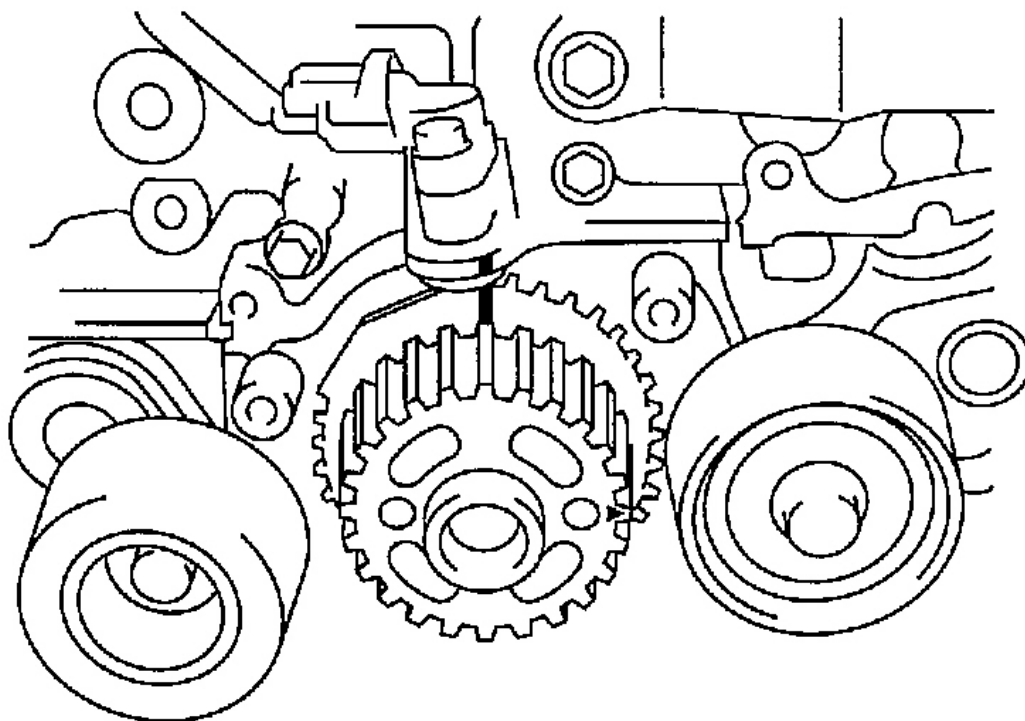
**G02871058**

Fig. 143: Removing Crankshaft Sprocket
Courtesy of SUBARU OF AMERICA, INC.

INSTALLATION

1. Install the crankshaft sprocket.



G02871059

Fig. 144: Installing Crankshaft Sprocket
Courtesy of SUBARU OF AMERICA, INC.

2. Install the camshaft sprocket. < Ref. to **REMOVAL** , Camshaft Sprockets. >
3. Install the timing belt assembly. < Ref. to **INSTALLATION** , Timing Belt Assembly. >
4. Install the belt cover. < Ref. to **INSTALLATION** , Belt Cover . >
5. Install the crankshaft pulley. < Ref. to **B: INSTALLATION** , Crankshaft Pulley. >
6. Install the V-belt. < Ref. to **INSTALLATION** , V-belt. >

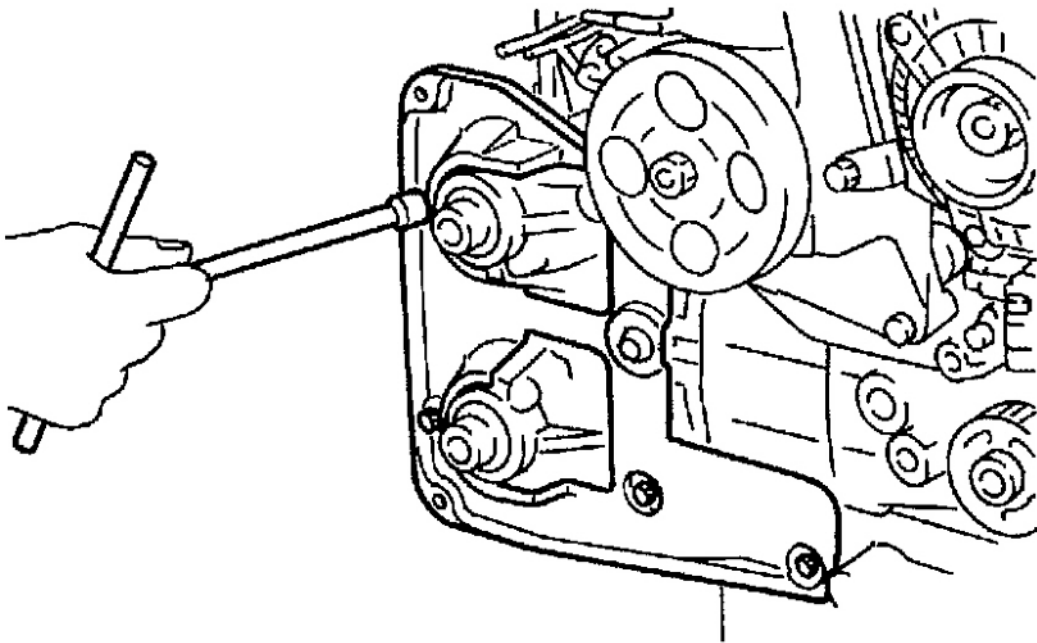
INSPECTION

1. Check the sprocket teeth for abnormal wear and scratches.
2. Make sure there is no free play between sprocket and key.
3. Check the crankshaft sprocket notch used for sensor for damage and contamination of foreign matter.

CAMSHAFT

REMOVAL

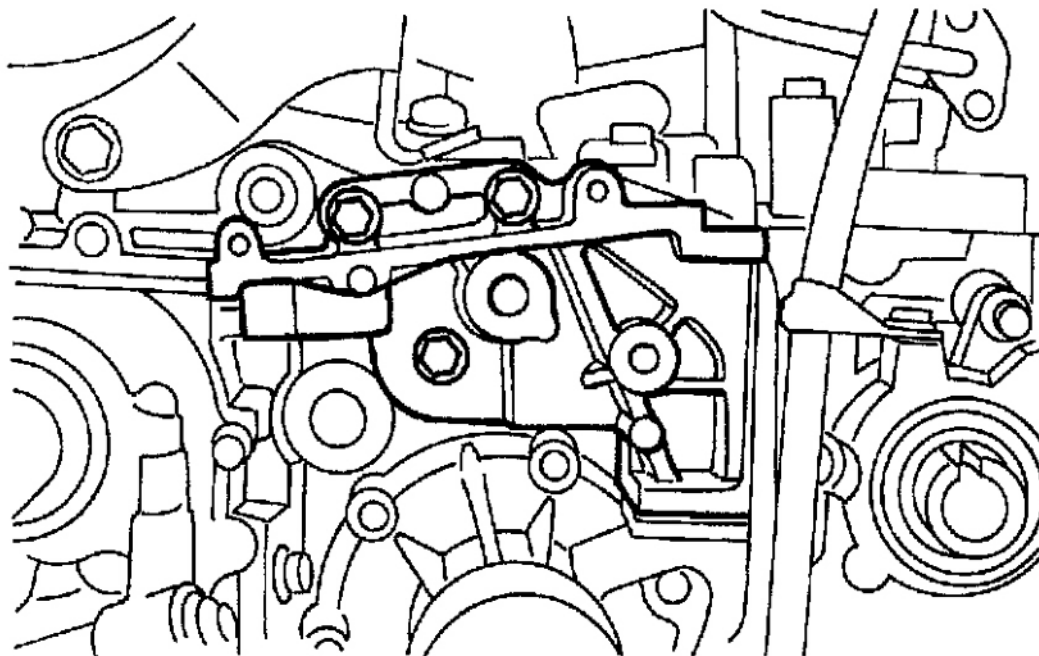
1. Remove the V-belt. < Ref. to **REMOVAL** , V-belt. >
2. Remove the crankshaft pulley. < Ref. to **A: REMOVAL** , Crankshaft Pulley. >
3. Remove the belt cover. < Ref. to **REMOVAL** , Belt Cover. >
4. Remove the timing belt assembly. < Ref. to **REMOVAL** , Timing Belt Assembly. >
5. Remove the camshaft sprocket. < Ref. to **REMOVAL** , Camshaft Sprockets
6. Remove the crankshaft sprocket. < Ref. to **REMOVAL** , Crankshaft Sprockets
7. Remove the right-hand belt cover No. 2.



G02871060

Fig. 145: Removing Right-Hand Belt Cover
Courtesy of SUBARU OF AMERICA, INC.

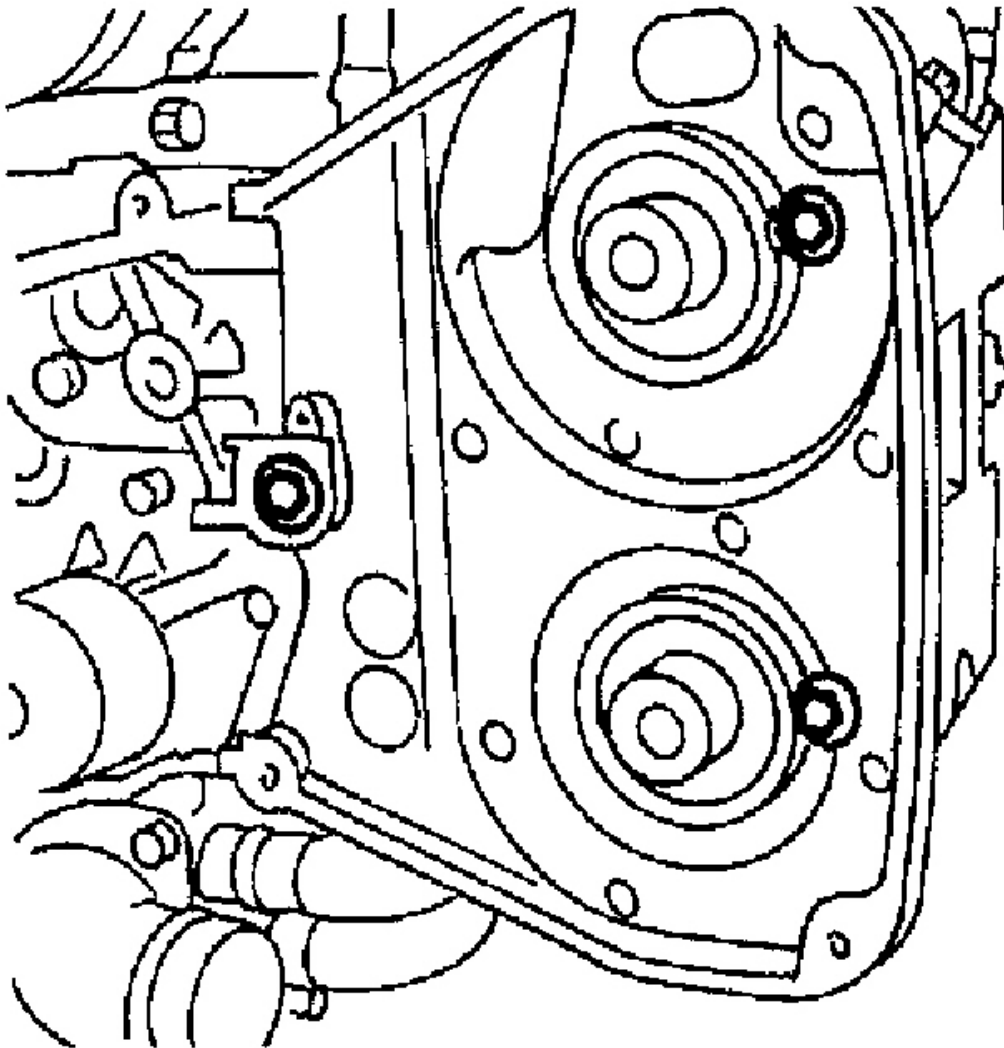
8. Remove the tensioner bracket.



G02871061

Fig. 146: Removing Tensioner bracket
Courtesy of SUBARU OF AMERICA, INC.

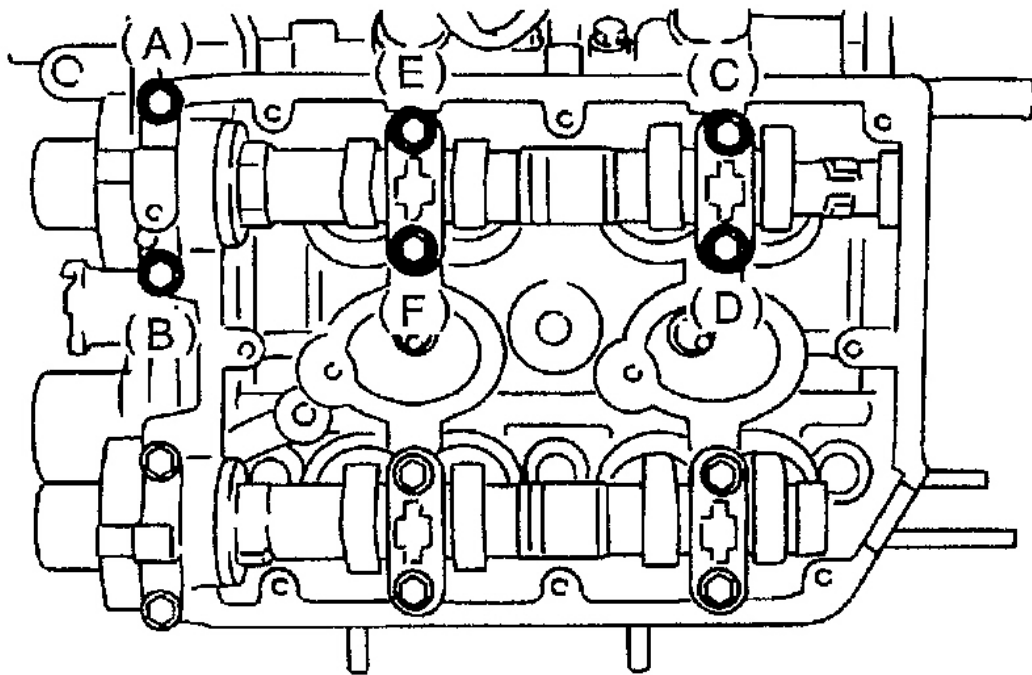
9. Remove the left-hand belt cover No. 2.



G02871062

Fig. 147: Removing Left-Hand Belt Cover No. 2
Courtesy of SUBARU OF AMERICA, INC.

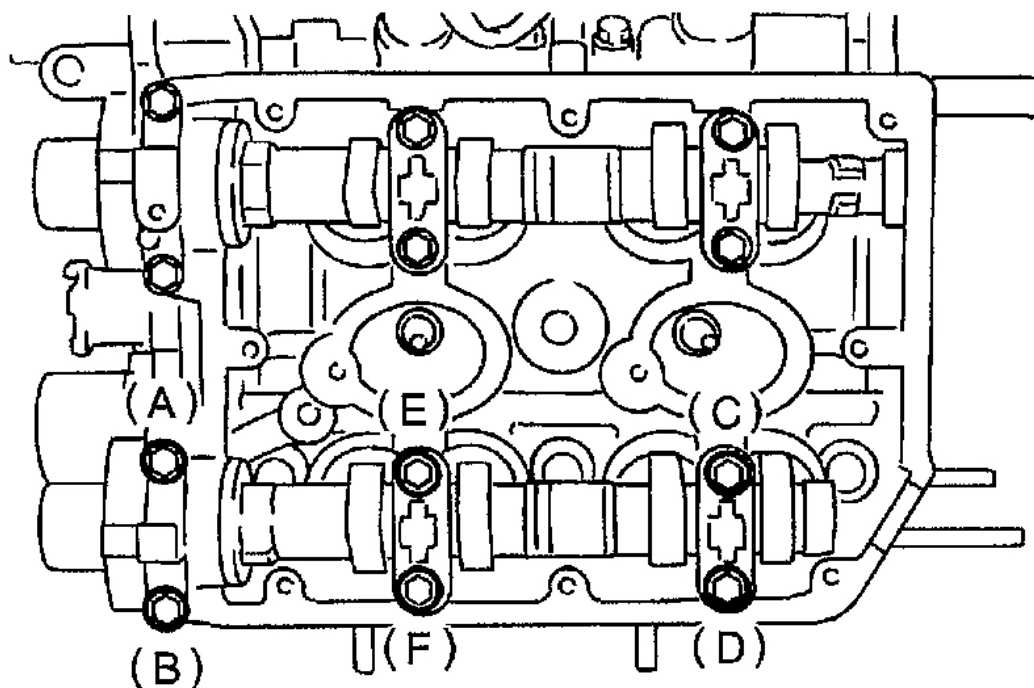
10. Remove the oil level gauge guide. (LH side only)
11. Remove the spark plug cord.
12. Remove the rocker cover and gasket.
13. Loosen the intake camshaft cap bolts equally, a little at a time in alphabetical sequence shown in the figure.



G02871063

Fig. 148: Loosening Intake Camshaft Cap Bolts In Alphabetical Sequence
Courtesy of SUBARU OF AMERICA, INC.

14. Remove the camshaft caps and intake camshaft.
15. Loosen the exhaust camshaft cap bolts equally, a little at a time in alphabetical sequence shown in the figure.



G02871064

Fig. 149: Loosening Exhaust Camshaft Cap Bolts In Alphabetical Sequence
Courtesy of SUBARU OF AMERICA, INC.

16. Remove the camshaft caps and exhaust camshaft.

CAUTION: Arrange camshaft caps in order so that they can be installed in their original positions.

17. Similarly, remove the right-hand camshafts and related parts.

INSTALLATION

1. Camshaft installation:

Apply engine oil to the cylinder head at camshaft bearing location before installing the camshaft. Install the camshaft so that each valves is close to or in contact with "base circle" of cam lobe.

CAUTION:

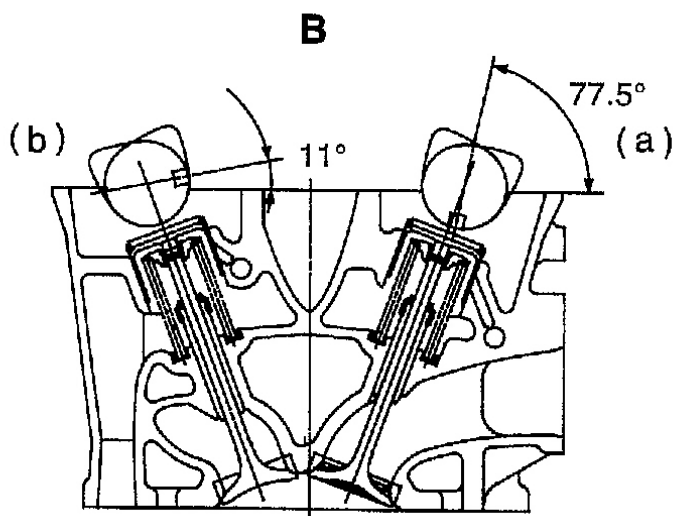
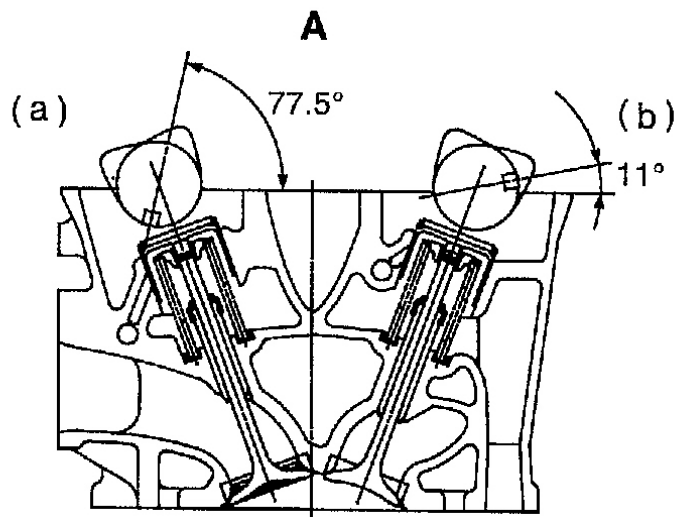
- When the camshafts are positioned as shown in the figure, camshafts need to be rotated at a minimum to align with the timing belt during installation.

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

- **Right-hand camshaft need not be rotated when set at the position shown in the figure. Left-hand intake camshaft: Rotate 80° clockwise.**

Left-hand exhaust camshaft: Rotate 45° counterclockwise.



A Left side cylinder head

B Right side cylinder head

(a) Intake camshaft

(b) Exhaust camshaft

G02871065

Fig. 150: Identifying Left-Hand Exhaust Camshaft Rotate Position

Courtesy of SUBARU OF AMERICA, INC.

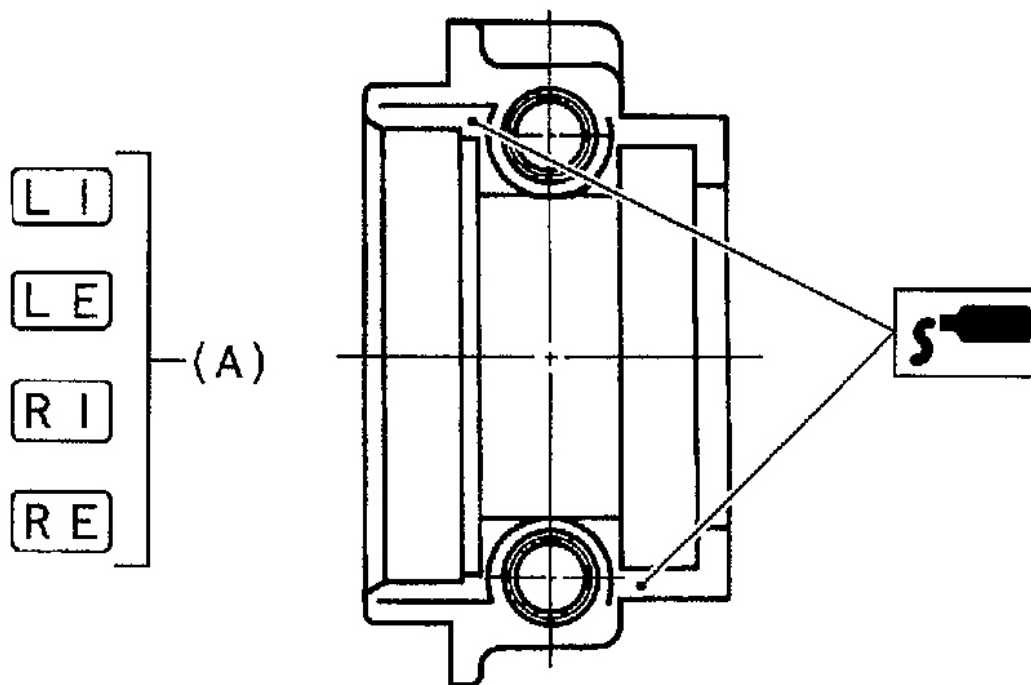
2. Camshaft cap installation:

1. Apply fluid packing sparingly to the cap mating surface.

CAUTION: Do not apply fluid packing excessively. Failure to do so may cause excess packing to come out and flow toward oil seal, resulting in oil leaks.

Fluid packing:

THREE BOND 1215 or equivalent

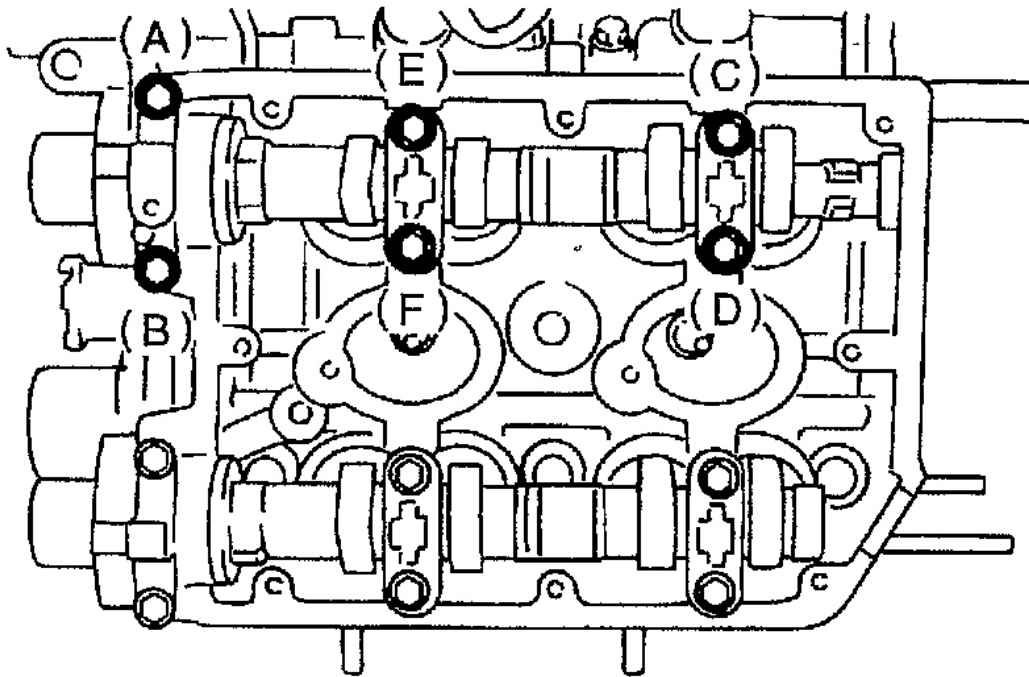


G02871066

Fig. 151: Identifying Fluid Packing On Cap Mating Surface
Courtesy of SUBARU OF AMERICA, INC.

2. Apply engine oil to cap bearing surface and install the cap on camshaft as shown by identification mark (A).
3. Gradually tighten the cap in at least two stages in alphabetical sequence shown in the figure, and then tighten to specified torque.

Tightening torque: 20 N.m (2.0 kgf-m, 14.5 ft-lb)



G02871067

Fig. 152: Identifying Tightening Alphabetical Sequence Of Bearing Cap Bolt
 Courtesy of SUBARU OF AMERICA, INC.

4. Similarly, tighten the cap on exhaust side. After tightening the cap, ensure the camshaft rotates only slightly while holding it at "base" circle.

Tightening torque: 20 N.m (2.0 kgf-m, 14.5 ft-lb)

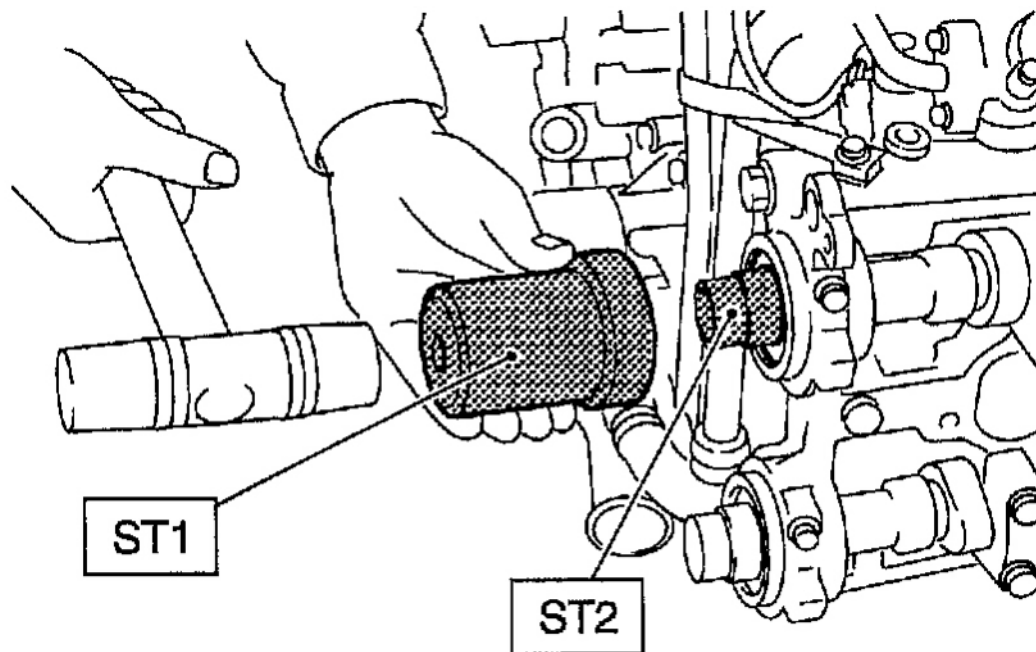
3. Camshaft oil seal installation:

Apply grease to the new oil seal lips and press onto the front end of camshaft by using ST1 and ST2.

CAUTION: Use a new oil seal.

ST1 499587600 OIL SEAL INSTALLER

ST2 499597200 OIL SEAL GUIDE



G02871068

Fig. 153: Installing Camshaft Oil Seal
Courtesy of SUBARU OF AMERICA, INC.

4. Rocker cover installation:
 1. Install the gasket on rocker cover.

Install the peripheral gasket and ignition coil gasket.
 2. Apply fluid packing to four front open edges of peripheral gasket.

Fluid packing:

THREE BOND 1215 or equivalent

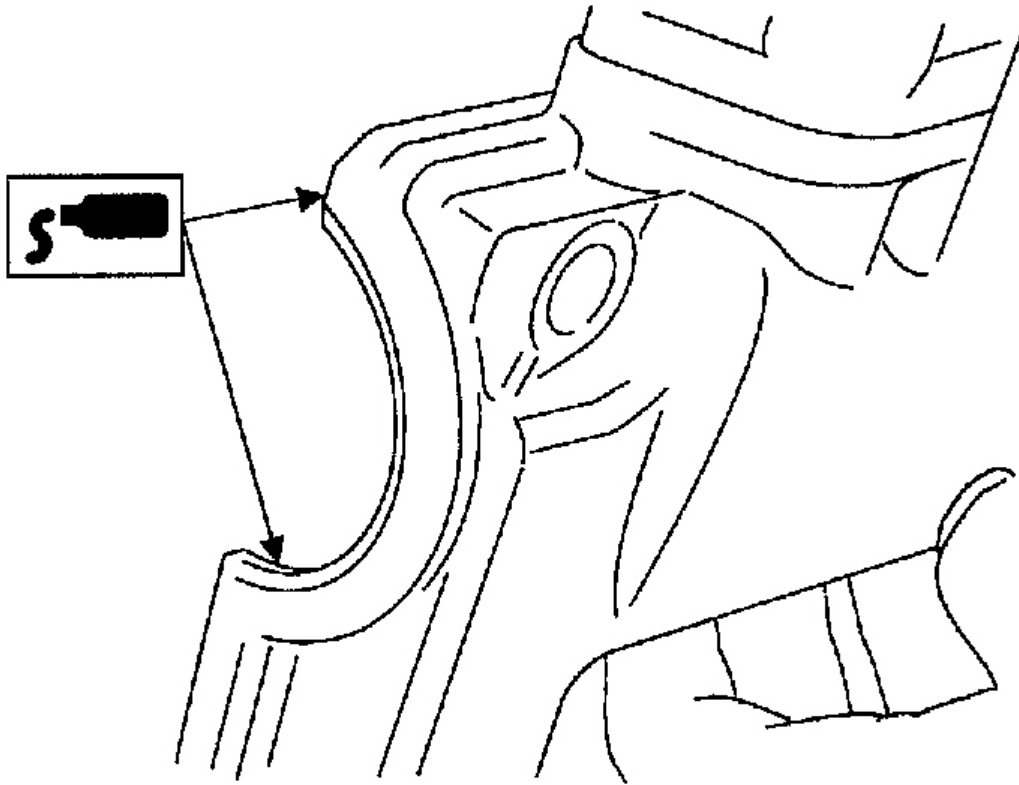
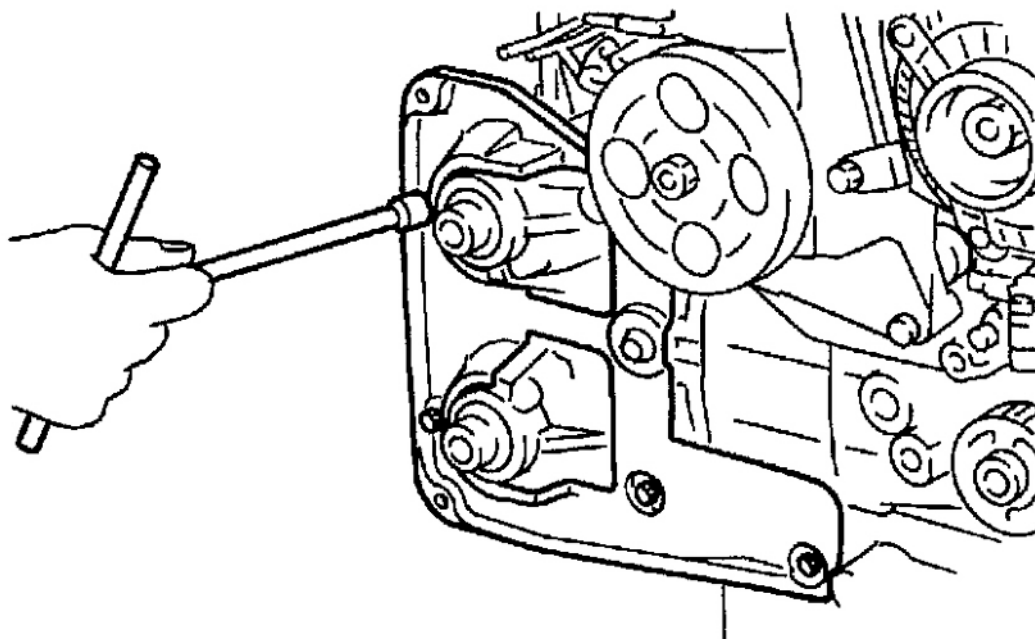
**G02871069**

Fig. 154: Applying Fluid Packing To Front Open Edges Of Peripheral Gasket
Courtesy of SUBARU OF AMERICA, INC.

3. Install the rocker cover on cylinder head. Ensure the gasket is properly positioned during installation.
5. Install the spark plug cord.
6. Similarly, install the parts on right-hand side.
7. Install the right-hand belt cover No. 2.

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

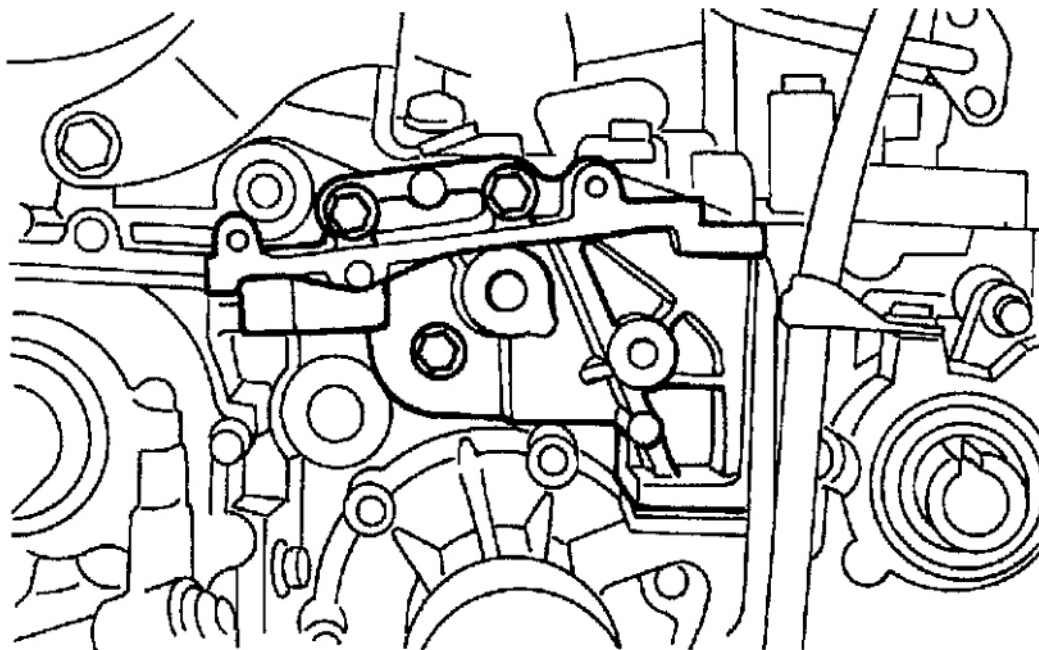


G02871070

Fig. 155: Installing Right-Hand Belt Cover No. 2
Courtesy of SUBARU OF AMERICA, INC.

8. Install the tensioner bracket.

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

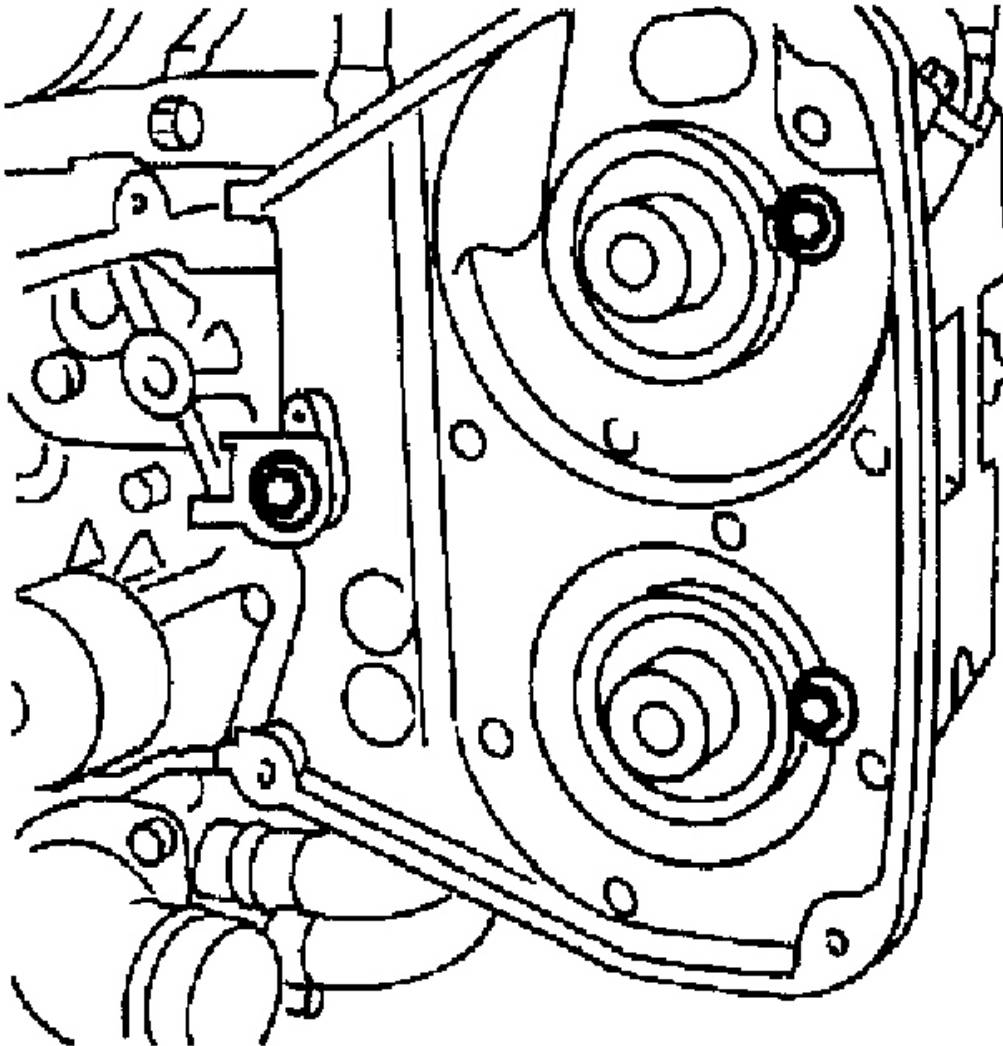


G02871071

Fig. 156: Installing Tensioner Bracket
Courtesy of SUBARU OF AMERICA, INC.

9. Install the left-hand belt cover No. 2.

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



G02871072

Fig. 157: Installing Left-Hand Belt Cover No. 2
Courtesy of SUBARU OF AMERICA, INC.

10. Install the crankshaft sprocket. < Ref. to **INSTALLATION** , Crankshaft Sprocket >
11. Install the camshaft sprockets. < Ref. to **INSTALLATION** , Camshaft Sprocket. >
12. Install the timing belt assembly. < Ref. to **INSTALLATION** , Timing Belt Assembly. >
13. Install the belt cover. < Ref. to **INSTALLATION** , Belt Cover. >
14. Install the crankshaft pulley. < Ref. to **INSTALLATION** , Crankshaft Pulley. >

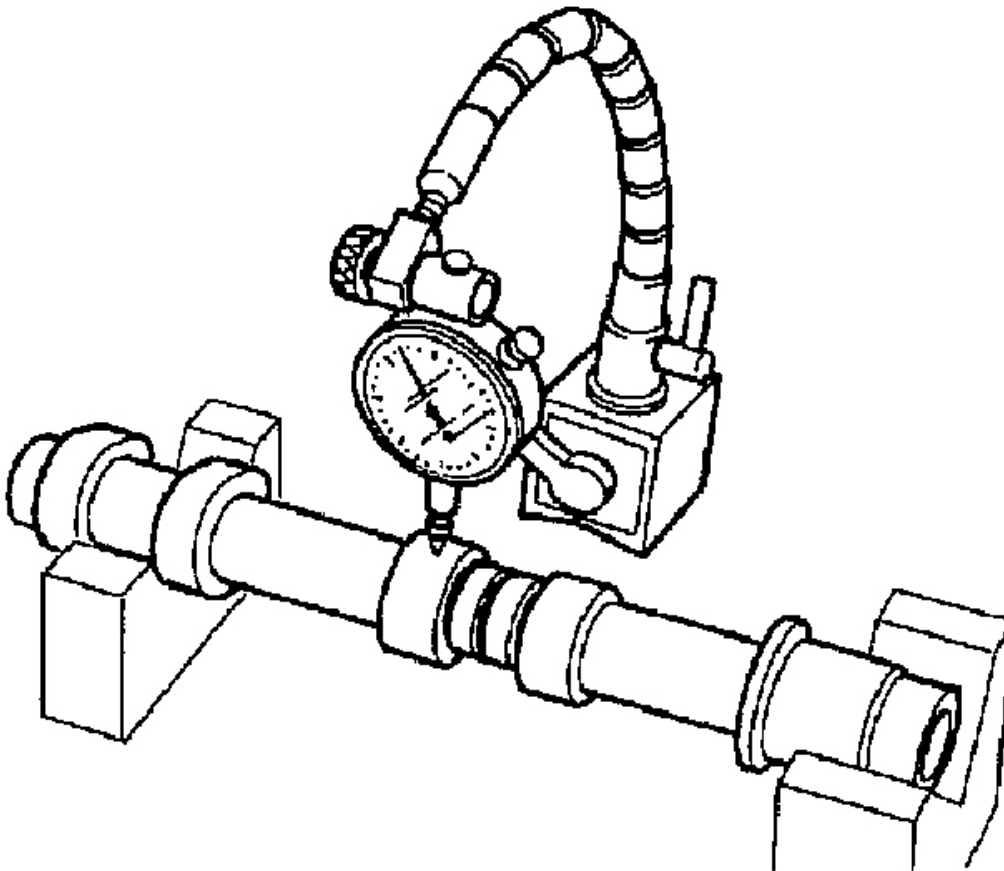
15. Install the V-belt. < Ref. to **INSTALLATION** , V-belt. >

INSPECTION

1. Measure the bend, and repair or replace if necessary.

Limit:

0.020 mm (0.0008 in)



G02871073

Fig. 158: Measuring Camshaft Bend
Courtesy of SUBARU OF AMERICA, INC.

2. Check the journal for damage and wear. Replace if faulty.

3. Measure the outside diameter of camshaft journal. If the journal diameter is not as specified, check the oil clearance.

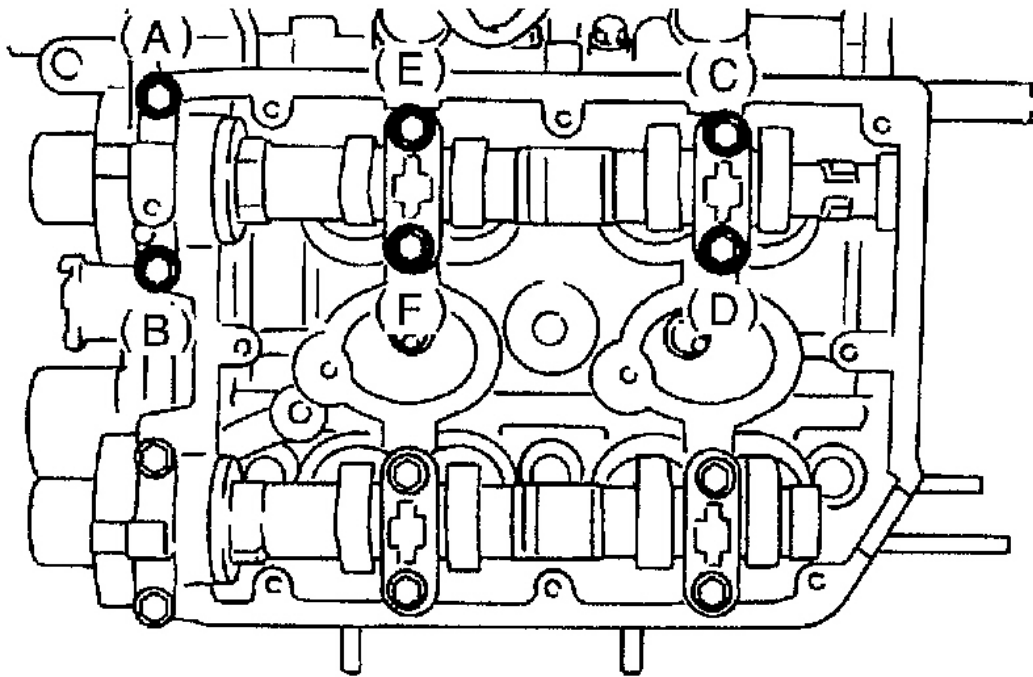
	Camshaft journal	
	Front	Center, rear
Standard	37.946 — 37.9635 mm (1.4939 — 1.4946 in)	29.946 — 29.963 mm (1.1790 — 1.1796 in)

G02871074

Fig. 159: Camshaft Journal Specifications
 Courtesy of SUBARU OF AMERICA, INC.

4. Measurement of the camshaft journal oil clearance:
 1. Clean the bearing caps and camshaft journals.
 2. Place the camshafts on the cylinder head. (Without installing the valve rocker.)
 3. Place a plastigauge across each of the camshaft journals.
 4. Gradually tighten the cap in at least two stages in alphabetical sequence shown in the figure, and then tighten to specified torque.

Tightening torque: 20 N.m (2.0 kgf-m, 14.5 ft-lb)



G02871075

Fig. 160: Identifying Tightening Alphabetical Sequence Of Bearing Cap Bolt
Courtesy of SUBARU OF AMERICA, INC.

CAUTION: Do not turn the camshaft.

5. Remove the bearing caps.
6. Measure the widest point of the plastigauge) on each journal.

If the oil clearance exceeds the limit, replace the camshaft. If necessary, replace the camshaft caps and cylinder head as a set.

Standard:

0.037 - 0.072 mm (0.0015 - 0.0028 in)

Limit:

0.10 mm (0.0039 in)

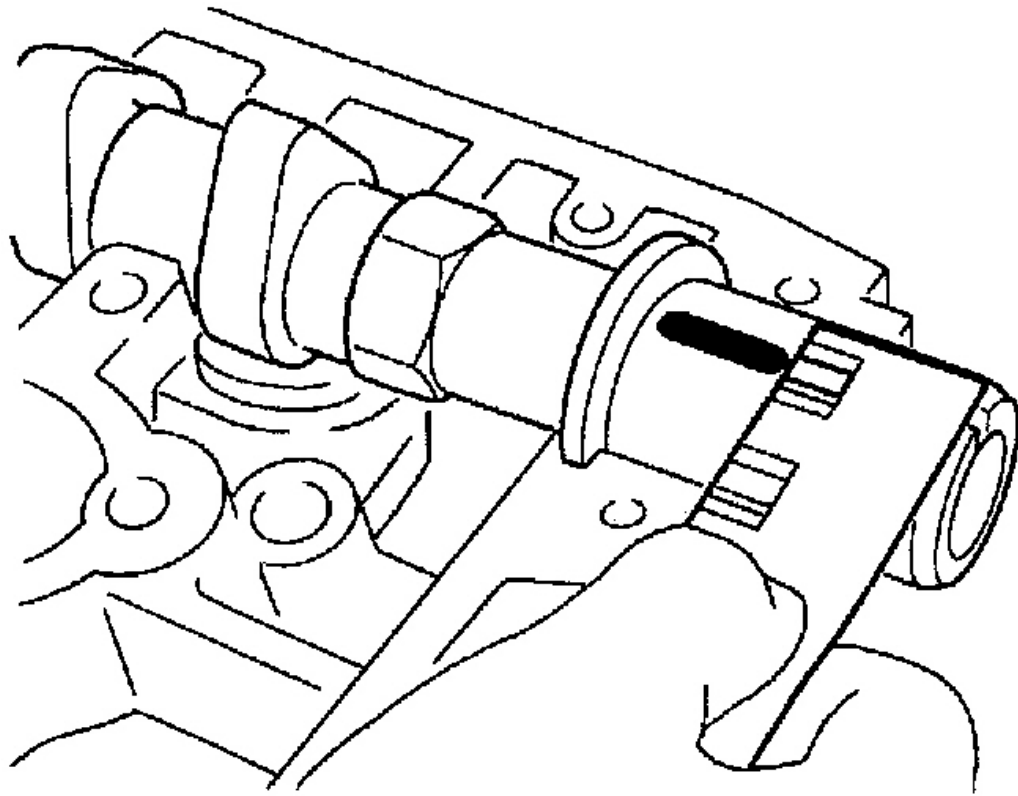
**G02871076**

Fig. 161: Measuring Widest Point Of Plastigauge On Each Journal
Courtesy of SUBARU OF AMERICA, INC.

7. Completely remove the plastigauge.
5. Check the cam face condition; remove the minor faults by grinding with oil stone. Measure the cam height H; replace if the limit has been exceeded.

Cam height: H

Standard:

intake:

46.25 - 46.35 mm (1.821 - 1.825 in) Exhaust:

46.15 - 46.25 mm (1.817- 1.821 in)

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

Limit:

Intake:

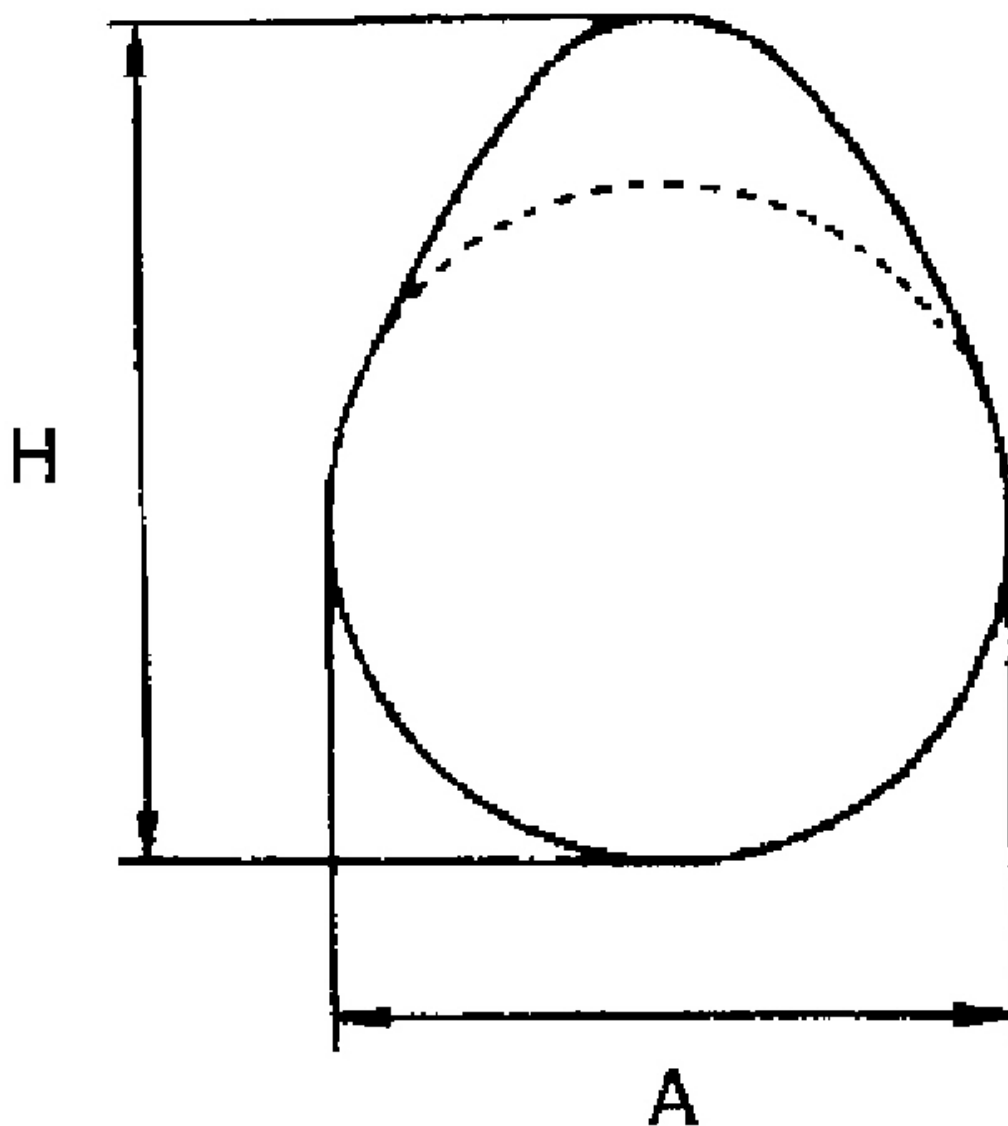
46.15 mm (1.817 in)

Exhaust:

46.05 mm (1.813 in)

Cam base circle diameter

A: 37.0 mm (1.457 in)



G02871077

Fig. 162: Measuring Cam Height H
Courtesy of SUBARU OF AMERICA, INC.

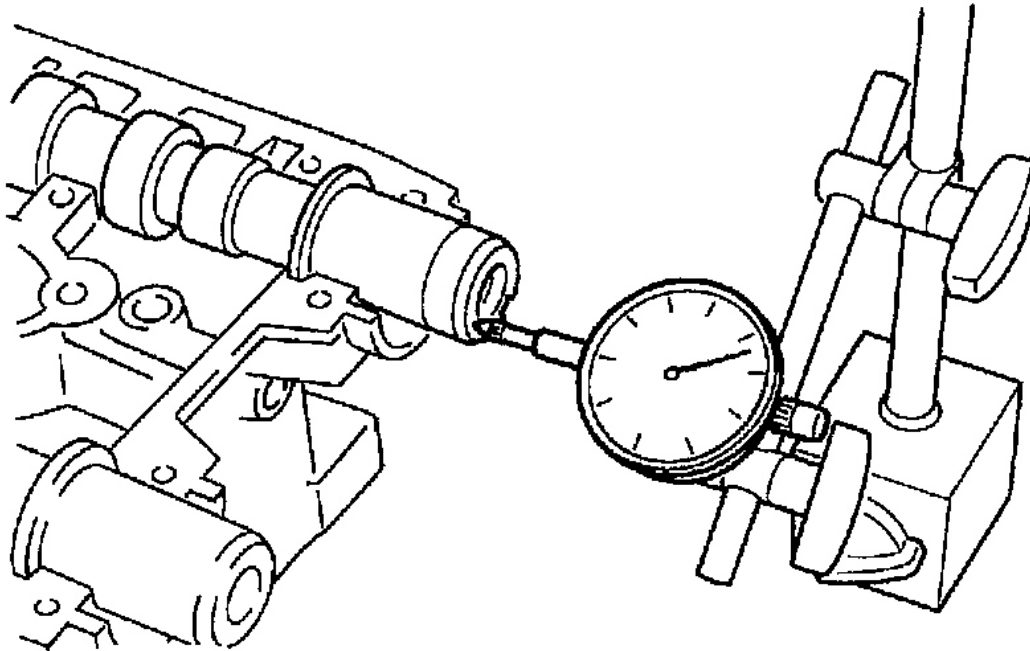
6. Measure the thrust clearance of camshaft with dial gauge. If the clearance exceeds the limit, replace the caps and cylinder head as a set. If necessary replace the camshaft.

Standard:

0.015 - 0.070 mm (0.0006 - 0.0028 in)

Limit:

0.1 mm (0.004 in)



G02871078

Fig. 163: Measuring Thrust Clearance Of Camshaft With Dial Gauge
Courtesy of SUBARU OF AMERICA, INC.

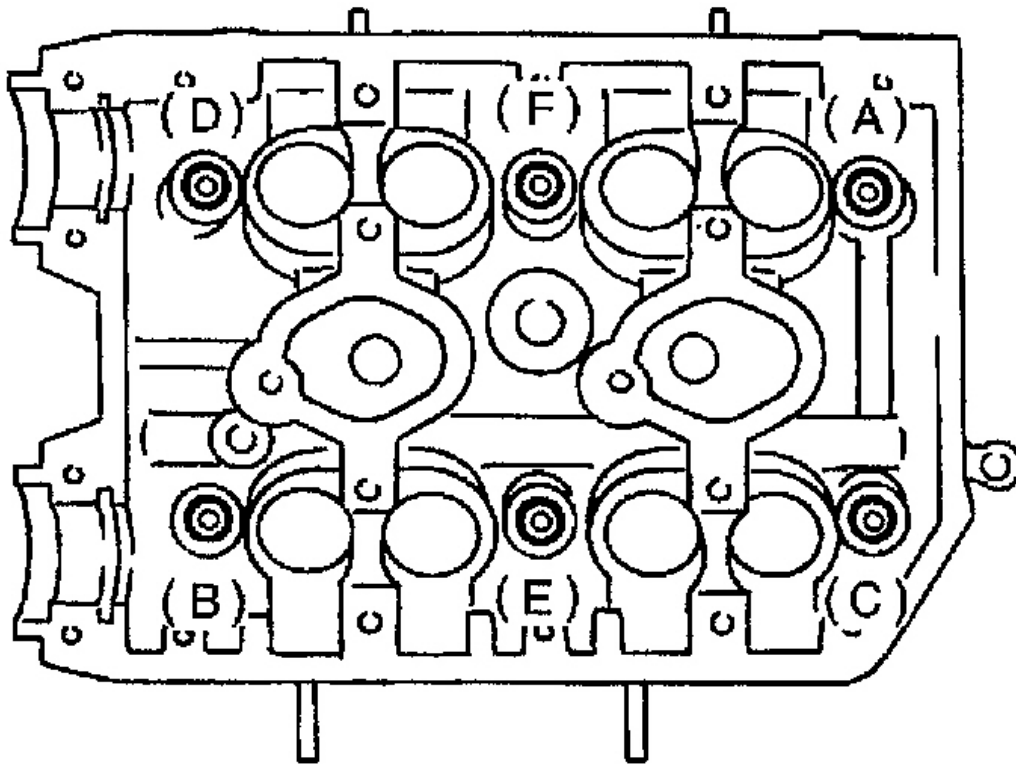
CYLINDER HEAD ASSEMBLY

REMOVAL

1. Remove the V-belt. < Ref. to **REMOVAL** , V-belt. >
2. Remove the crankshaft pulley. < Ref. to **REMOVAL** , Crankshaft Pulley. >
3. Remove the belt cover. < Ref. to **REMOVAL** , Belt Cover. >
4. Remove the timing belt assembly. < Ref. to **REMOVAL** , Timing Belt Assembly . >
5. Remove the camshaft sprocket. < Ref. to **REMOVAL** , Camshaft Sprockets
6. Remove the intake manifold. < Ref. to **REMOVAL** , Intake Manifold.>
7. Remove the bolt which installs the A/C compressor bracket on cylinder head.

8. Remove the camshaft. < Ref. to **REMOVAL**, Camshaft . >
9. Remove the cylinder head bolts in alphabetical sequence shown in the figure.

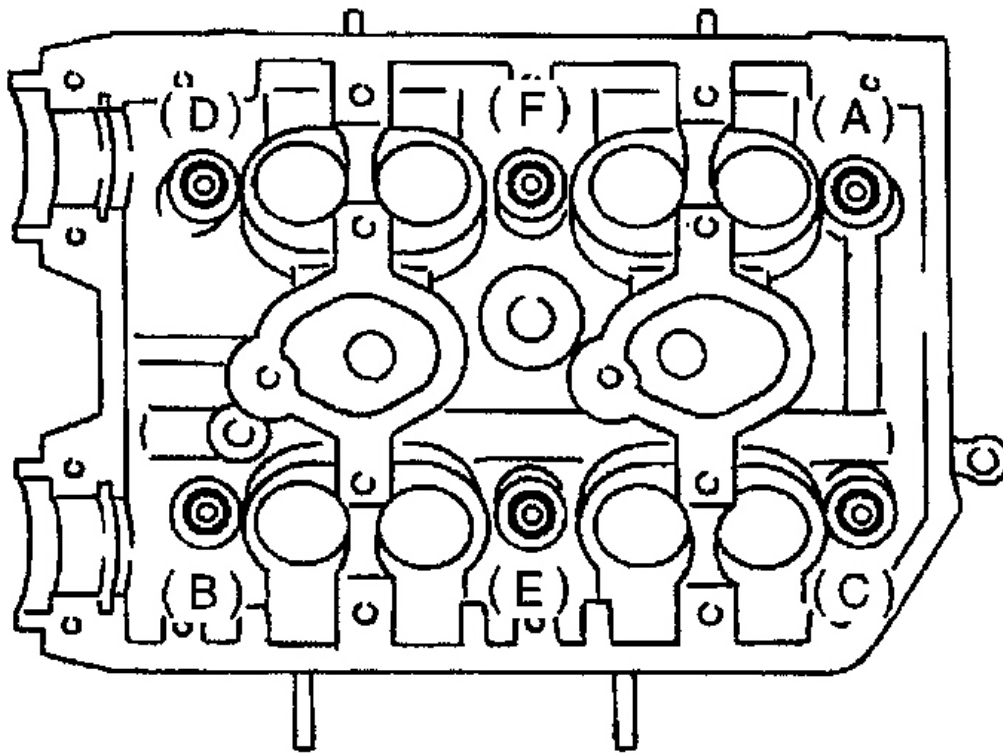
CAUTION: Leave bolts (A) and (D) engaged by three or four threads to prevent the cylinder head from falling.



G02871079

Fig. 164: Removing Cylinder Head Bolts In Alphabetical Sequence
Courtesy of SUBARU OF AMERICA, INC.

10. While tapping the cylinder head with a plastic hammer, separate it from cylinder block. Remove the bolts (A) and (D) to remove the cylinder head.



G02871080

Fig. 165: Removing Cylinder Head

Courtesy of SUBARU OF AMERICA, INC.

11. Remove the cylinder head gasket.

CAUTION: Do not scratch the mating surface of cylinder head and cylinder block.

12. Similarly, remove the right side cylinder head.

INSTALLATION

1. Install the cylinder head and gaskets on cylinder block.

CAUTION:

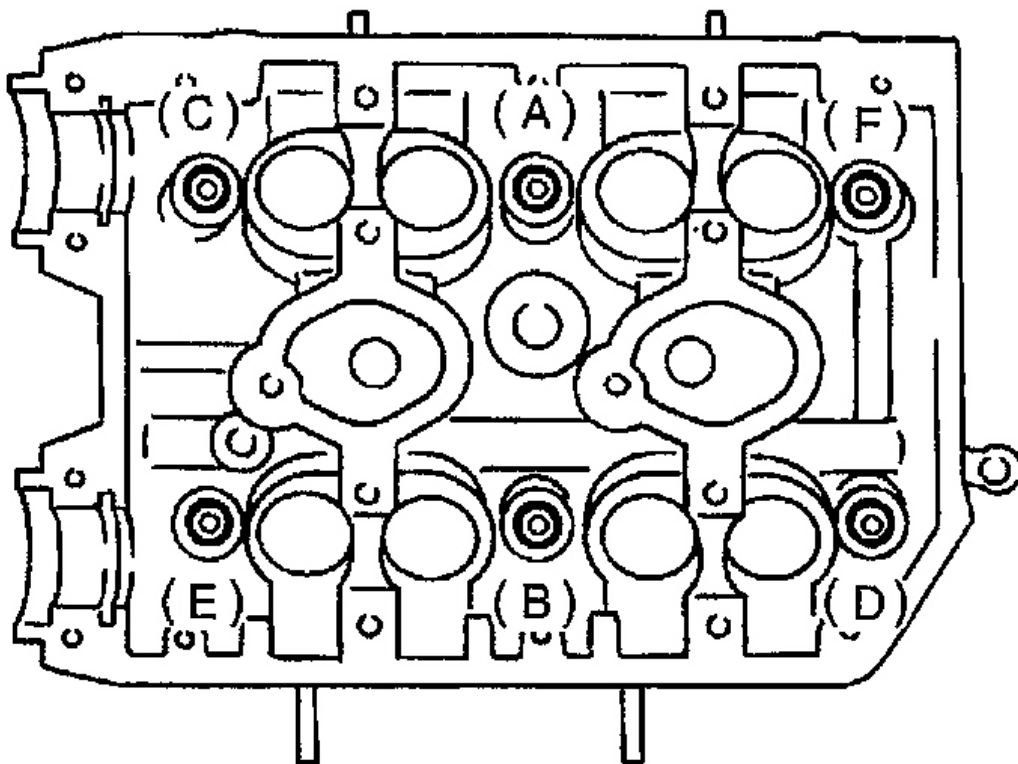
- Use new cylinder head gaskets.
- Be careful not to scratch the mating surface of cylinder head and cylinder block.

2. Tighten the cylinder head bolts.

1. Apply a coat of engine oil to washers and bolt threads.
2. Tighten all bolts to 29 N.m (3.0 kgf-m, 22 ft-lb) in alphabetical sequence.

Then tighten all bolts to 69 N.m (7.0 kgf-m, 51 ft-lb) in alphabetical sequence.

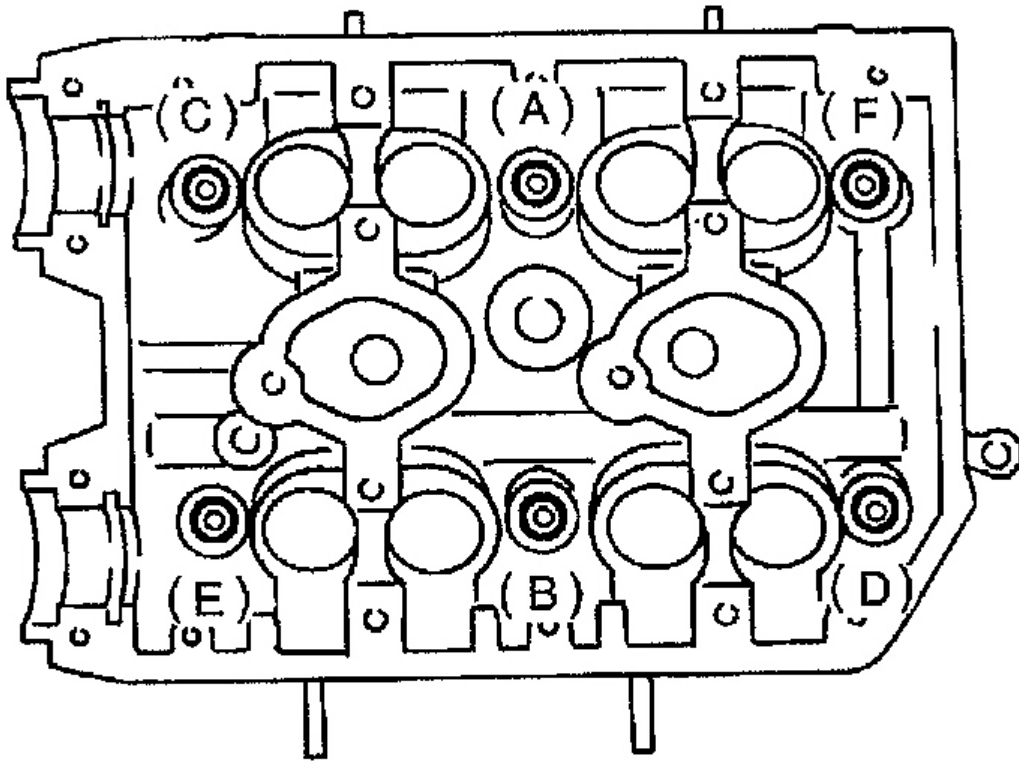
3. Back off all bolts by 180° first; back them off by 180° again.
4. Tighten the bolts (A) and (B) to 34 N.m (3.5 kgf-m, 25 ft-lb).



G02871081

Fig. 166: Tightening Cylinder Head Bolts In Alphabetical Sequence
Courtesy of SUBARU OF AMERICA, INC.

5. Tighten the bolts (C), (D), (E) and (F) to 15 N.m (1.5 kgf-m, 11 ft-lb).



G02871082

Fig. 167: Tightening Cylinder Head Bolts In Alphabetical Sequence
 Courtesy of SUBARU OF AMERICA, INC.

6. Tighten all bolts by 80 to 90° in alphabetical sequence.

CAUTION: Do not tighten the bolts more than 90°.

7. Further tighten all bolts by 80 to 90° in alphabetical sequence.

CAUTION: Ensure the total "re-tightening angle" [in the two previous steps] do not exceed 180°.

3. Install the camshaft. < Ref. to INSTALLATION, Camshaft . >
4. Install the A/C compressor bracket on cylinder head.
5. Install the intake manifold. < Ref. to INSTALLATION , Intake Manifold >

6. Install the camshaft sprocket. < Ref. to **INSTALLATION** , Camshaft Sprockets
7. Install the timing belt assembly. < Ref. to **INSTALLATION** , Timing Belt Assembly. >
8. Install the belt cover. < Ref. to **INSTALLATION** , Belt Cover. >
9. Install the crankshaft pulley. < Ref. to **INSTALLATION** , Crankshaft Pulley. >
10. Install the V-belt. < Ref. to **INSTALLATION** , V-belt. >

DISASSEMBLY

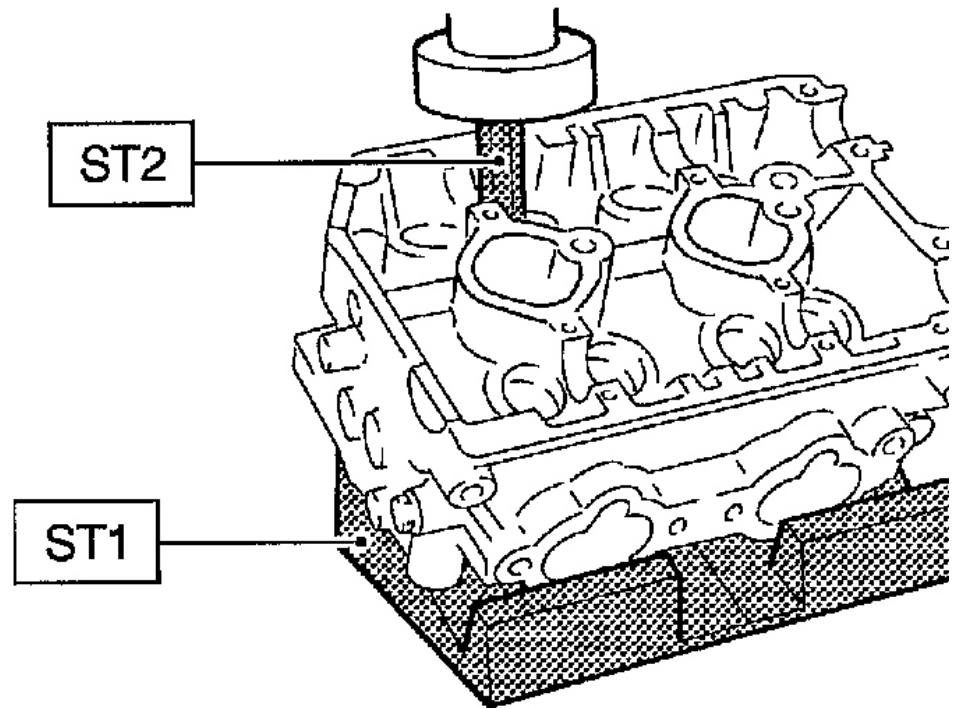
1. Remove the valve shims and valve lifters.
2. Compress the valve spring and remove the valve spring retainer key. Remove each valve and valve spring.

ST1 498267600 CYLINDER HEAD TABLE

ST2 499718000 VALVE SPRING REMOVER

CAUTION:

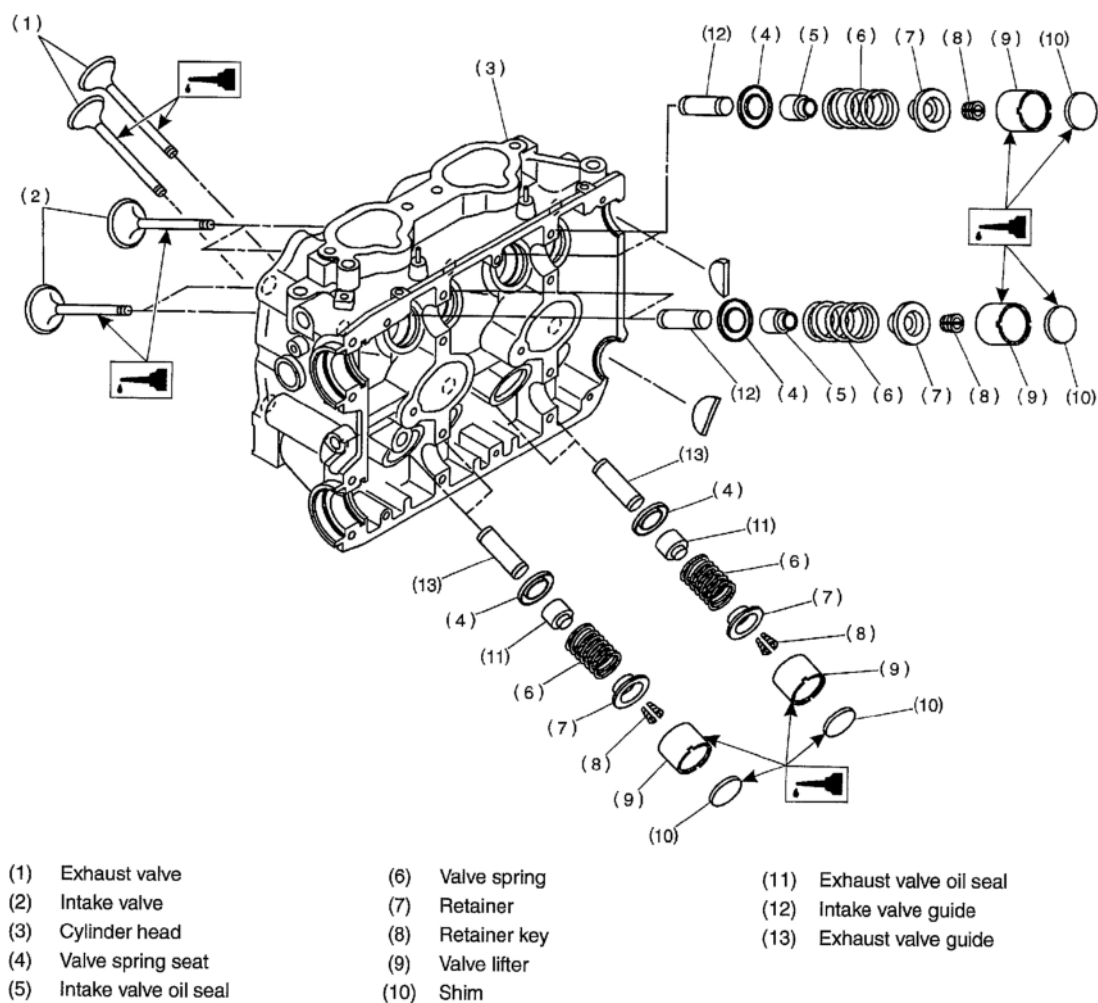
- **Keep the removed parts in order for re-installing in their original positions.**
- **Mark each valve to prevent confusion.**
- **Use extreme care not to damage the lips of the intake valve oil seal and exhaust valve oil seals.**



G02871083

Fig. 168: Removing Valve And Valve Spring
Courtesy of SUBARU OF AMERICA, INC.

ASSEMBLY



G02871084

Fig. 169: Exploded View Of Cylinder Head Assembly
Courtesy of SUBARU OF AMERICA, INC.

1. Installation of valve spring and valve:

1. Coat the stem of each valve with engine oil and insert the valve into valve guide.

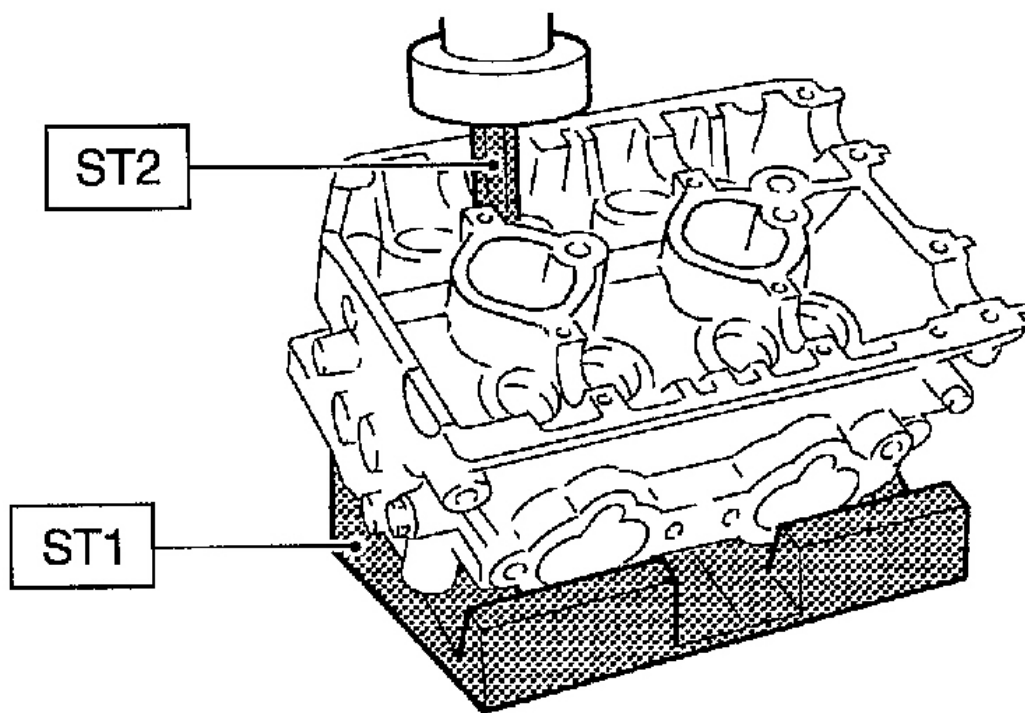
CAUTION: When inserting the valve into valve guide, use special care not to damage the oil seal lip.

2. Set the cylinder head on ST1.
3. Install the valve spring and retainer using ST2.

ST1 498267600 CYLINDER HEAD TABLE

ST2 499718000 VALVE SPRING REMOVER

CAUTION: Be sure to install the valve springs with their close-coiled end facing the seat on the cylinder head.



G02871085

Fig. 170: Installing Valve Spring And Retainer
Courtesy of SUBARU OF AMERICA, INC.

4. Compress the valve spring and fit the valve spring retainer key.
5. After installing, tap the valve spring retainers lightly with wooden hammer for better seating.
2. Apply oil to the surface of the valve lifter and valve shim.
3. Install the valve lifter and valve shim.

INSPECTION

CYLINDER HEAD

1. Make sure that no crack or other damage exists. In addition to visual inspection, inspect the important areas by means of red check.
2. Measure the warping of the cylinder head surface that mates with crankcase by using a straight edge (A) and thickness gauge (B).

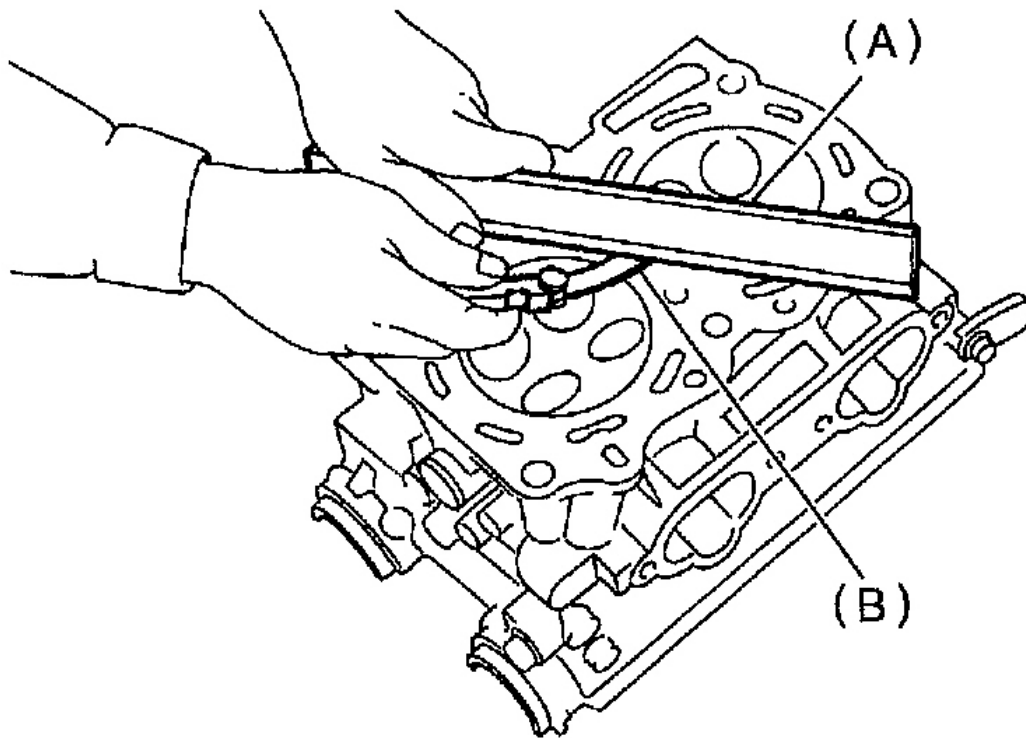
If the warping exceeds 0.05 mm (0.0020 in), re-grind the surface with a surface grinder.

Warping limit: 0.05 mm (0.0020 in)

Grinding limit: 0.3 mm (0.012 in)

Standard height of cylinder head: 127.5 mm (5.02 In)

CAUTION: Uneven torque for the cylinder head nuts can cause warping. When reassembling, pay special attention to the torque so as to tighten evenly.



G02871086

Fig. 171: Measuring Warping Of Cylinder Head Surface
Courtesy of SUBARU OF AMERICA, INC.

VALVE SEAT

Inspect the intake and exhaust valve seats, and correct the contact surfaces with valve seat cutter if they are defective or when valve guides are replaced.

Valve seat width: W

Intake

Standard

1.0 mm (0.039 in)

Limit

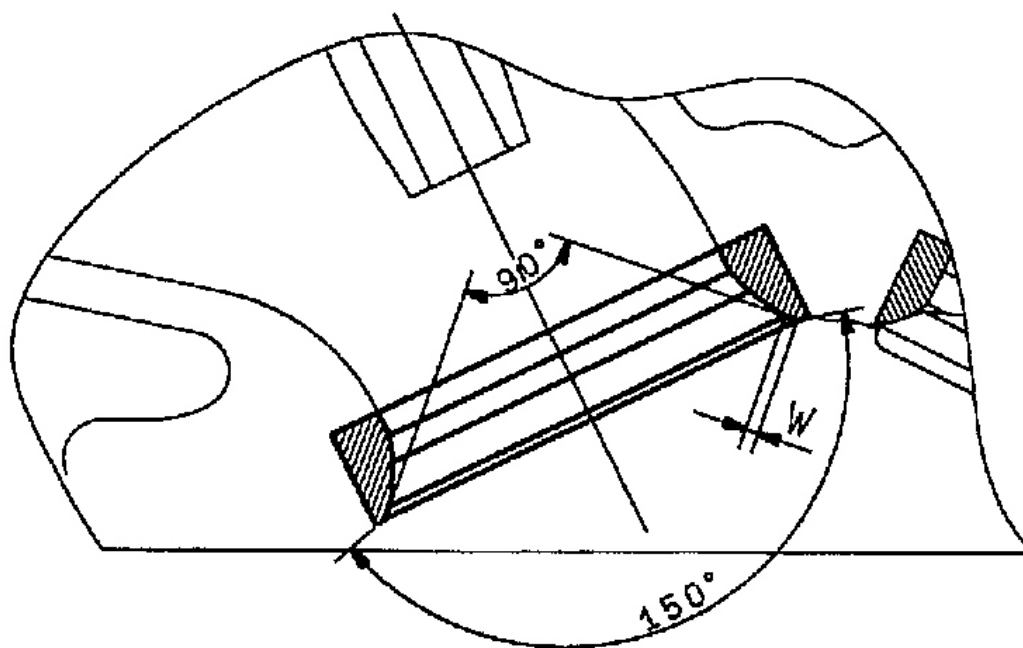
1.7 mm (0.067 in) Exhaust

Standard

1.5 mm (0.059 in)

Limit

2.2 mm (0.087 in)



G02871087

Fig. 172: Inspecting Intake And Exhaust Valve Seats
Courtesy of SUBARU OF AMERICA, INC.

VALVE GUIDE

1. Check the clearance between valve guide and stem. The clearance can be checked by measuring the outside diameter of valve stem and the inside diameter of valve guide with outside and inside micrometers respectively.

Clearance between the valve guide and valve stem:

Standard Intake

0.035 - 0.062 mm (0.0014 - 0.0024 in)

Exhaust

0.040 - 0.067 mm (0.0016 - 0.0026 in)

Limit

0.15 mm (0.0059 in)

2. If the clearance between valve guide and stem exceeds the limit, replace the valve guide or valve itself whichever shows greater amount of wear. See the following procedure for valve guide replacement.

Valve guide inner diameter:

6.000 - 6.012 mm (0.2362 - 0.2367 in)

Valve stem outer diameters:

Intake

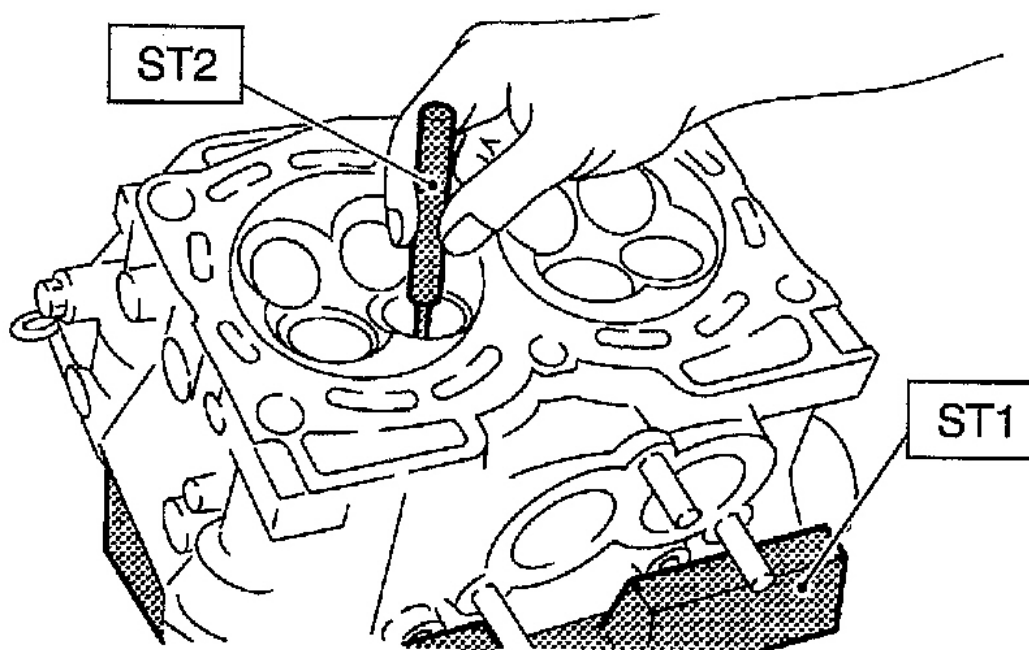
5.950 - 5.965 mm (0.2343 - 0.2348 in) Exhaust

5.945 - 5.960 mm (0.2341 - 0.2346 in)

1. Place the cylinder head on ST1 with the combustion chamber upward so that valve guides enter the holes in ST1.
2. Insert the ST2 into valve guide and press it down to remove the valve guide.

ST1 498267600 CYLINDER HEAD TABLE

ST2 499767200 VALVE GUIDE REMOVER

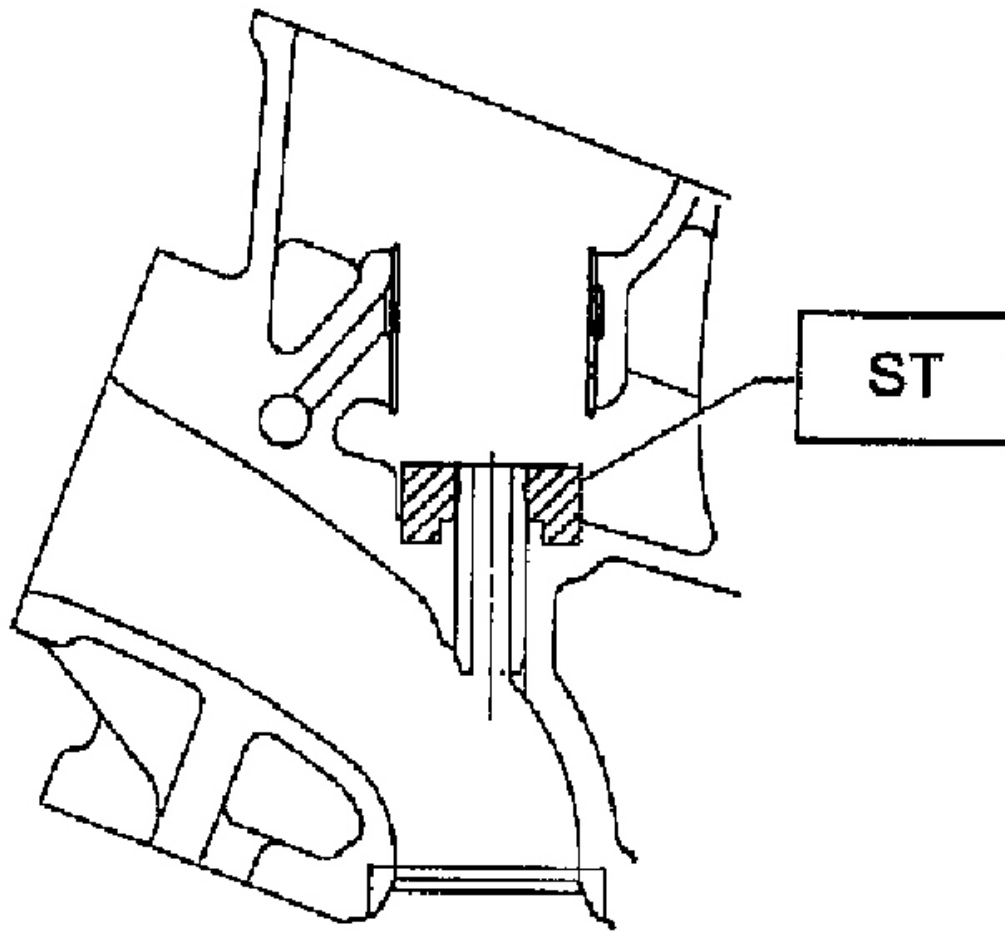


G02871088

Fig. 173: Removing Valve Guide
Courtesy of SUBARU OF AMERICA, INC.

3. Turn the cylinder head upside down and place ST as shown in the figure.

ST 498767700 VALVE GUIDE ADJUSTER



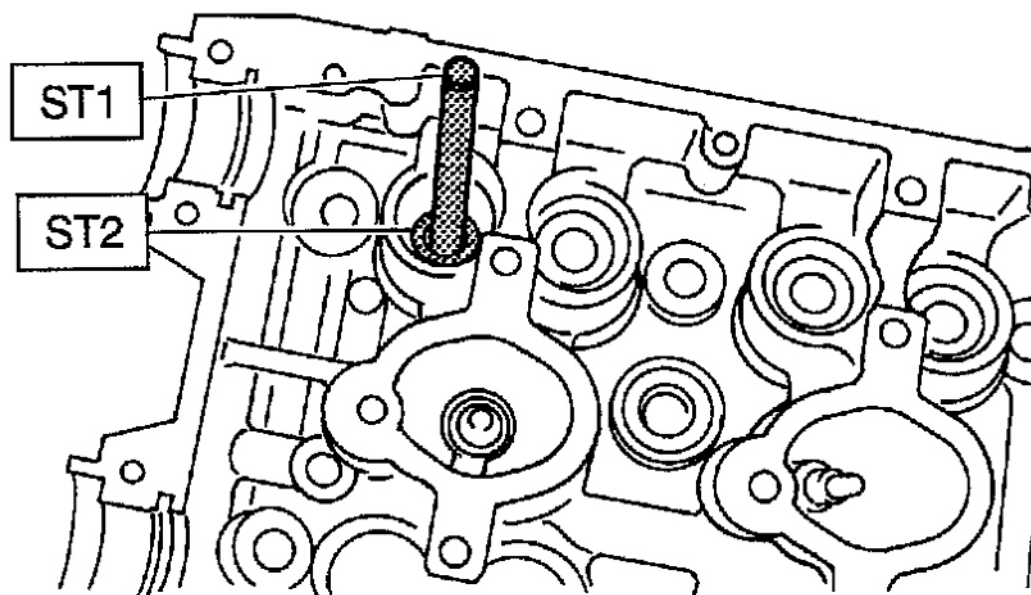
G02871089

Fig. 174: Placing Valve Guide Adjuster In Cylinder Head
Courtesy of SUBARU OF AMERICA, INC.

4. Before installing a new valve guide, make sure that neither scratches nor damages exist on the inside surface of the valve guide holes in cylinder head.
5. Put a new valve guide, coated with sufficient oil, in cylinder, and insert ST1 into valve guide. Press in until the valve guide upper end is flush with the upper surface of ST2.

ST1 499767200 VALVE GUIDE REMOVER

ST2 498267700 VALVE GUIDE ADJUSTER



G02871090

Fig. 175: Pressing Valve Guide Upper End Is Flush With Upper Surface Of ST2
Courtesy of SUBARU OF AMERICA, INC.

6. Check the valve guide protrusion.

Valve guide protrusion: L

12.0 - 12.4 mm (0.472 - 0.488 in)

7. Ream the inside of valve guide with ST. Gently rotate the reamer clockwise while pressing it lightly into the valve guide, and return it also rotating clockwise. After reaming, clean the valve guide to remove chips.

ST 499767400 VALVE GUIDE REAMER

CAUTION:

- Apply engine oil to the reamer when reaming.
- If the inner surface of the valve guide is torn, the edge of the reamer should be slightly ground with an oil stone.
- If the inner surface of the valve guide becomes lustrous and the reamer does not chips, use a new reamer or remedy the reamer.

8. Recheck the contact condition between valve and valve seat after replacing the valve guide.

INTAKE AND EXHAUST VALVE

1. Inspect the flange and stem of valve, and replace if damaged, worn, or deformed, or if "H" is less than the specified limit.

H:

Intake

Standard

1.2 mm (0.047 in)

Limit

0.8 mm (0.031 in)

Exhaust

Standard

1.5 mm (0.059 in)

Limit

0.8 mm (0.031 in)

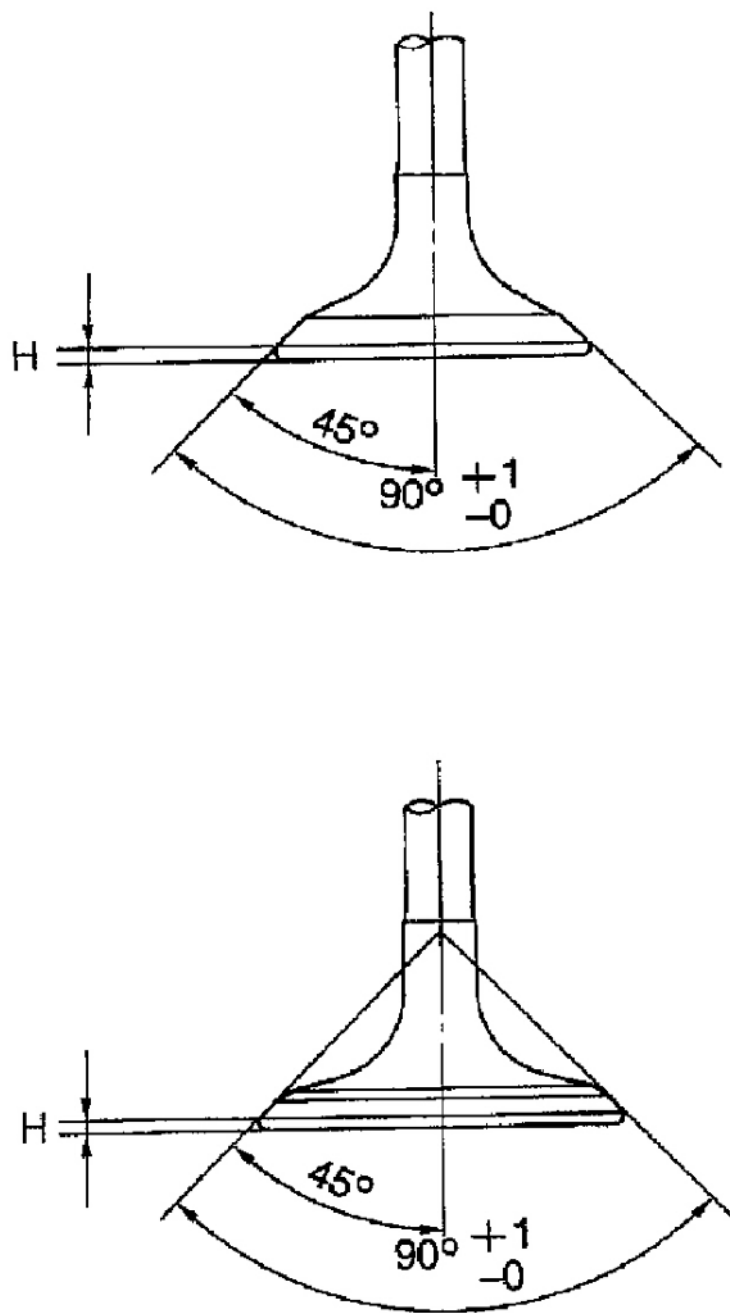
Valve overall length:

Intake

104.4 mm (4.110 in)

Exhaust

104.7 mm (4.122 in)



G02871091

Fig. 176: Inspecting Flange And Stem Of Valve
Courtesy of SUBARU OF AMERICA, INC.

2. Put a small amount of grinding compound on the seat surface and lap the valve and seat surface. Install a new intake valve oil seal after lapping.

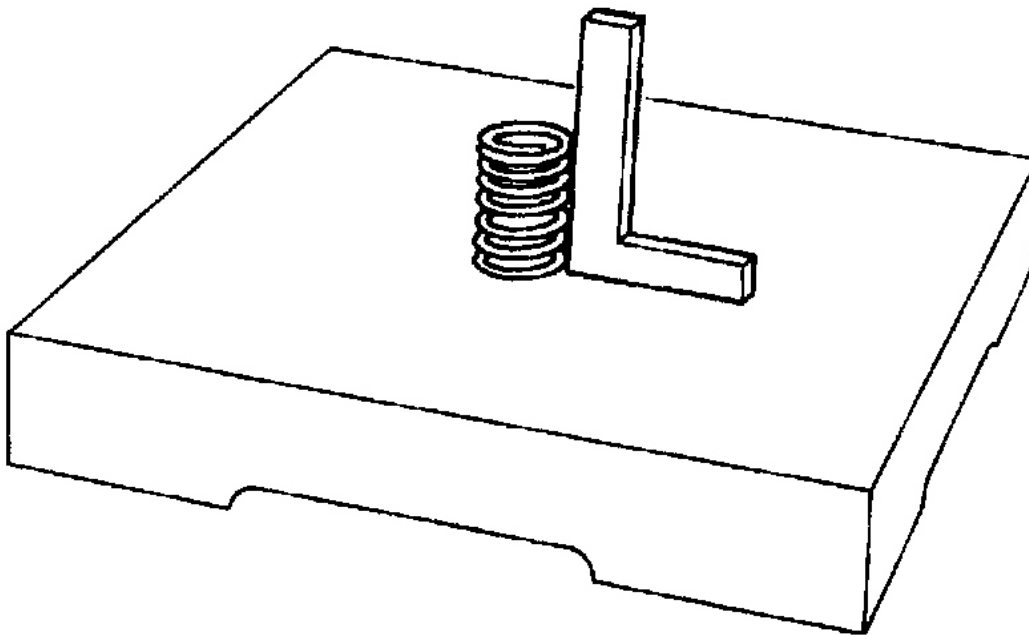
VALVE SPRINGS

1. Check the valve springs for damage, free length, and tension. Replace the valve spring if it is not within specifications presented in the table.
2. To measure the squareness of the valve spring, stand the spring on a surface plate and measure its deflection at the top using a try square.

	Valve spring
Free length	44.67 mm (1.7587 in)
Tension/spring height	220.7±15.7 N (22.5 ± 1.6 kgf, 49.6±3.5 lb)/36.0 mm (1.417 in)
	510.9±25.5 N (52.1±2.6 kgf, 114.9±5.7 lb)/26.6 mm (1.047 in)
Squareness	2.5°, 2.0 mm (0.079 in)

G02871092

Fig. 177: Identifying Valve Springs Specifications
 Courtesy of SUBARU OF AMERICA, INC.



G02871093

Fig. 178: Measuring Squareness Of Valve Spring
Courtesy of SUBARU OF AMERICA, INC.

INTAKE AND EXHAUST VALVE OIL SEAL

Replace the oil seal with a new one, if the lip is damaged or spring out of place, or when the surfaces of intake valve and valve seat are reconditioned or intake valve guide is replaced.

1. Place the cylinder head on ST1.
2. Press in the oil seal to the specified dimension indicated in the figure by using ST2.

ST1 498267600 CYLINDER HEAD TABLE

ST2 498857100 VALVE GUIDE REMOVER

CAUTION:

- Apply engine oil to oil seal before force-fitting.
- Differentiate between the intake valve oil seal and exhaust valve oil seal by noting their difference in color.

Color of rubber part:

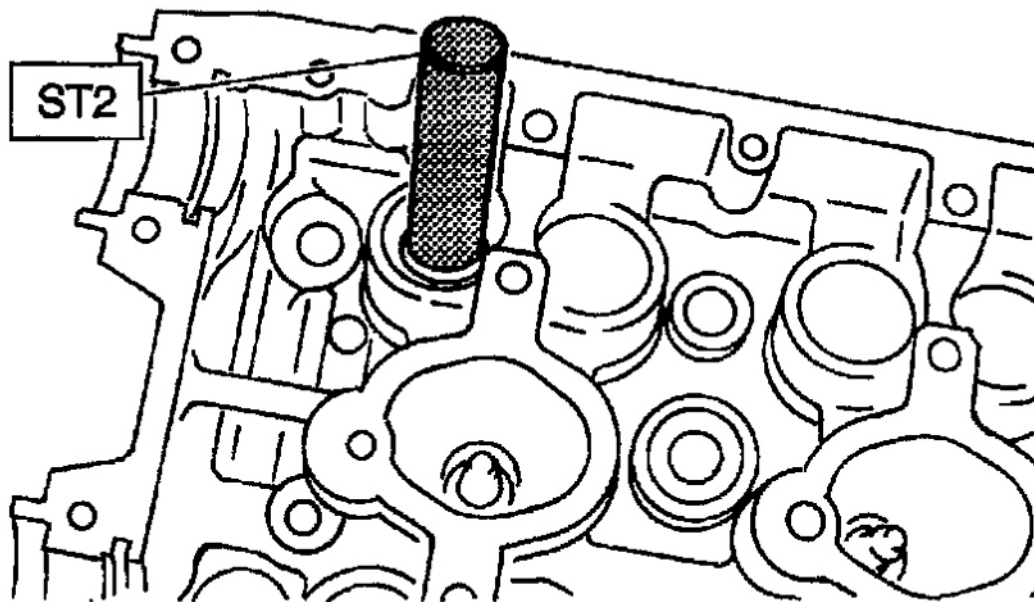
Intake [Black]

Exhaust [Brown]

Color of spring part:

Intake [Silver]

Exhaust [Silver]



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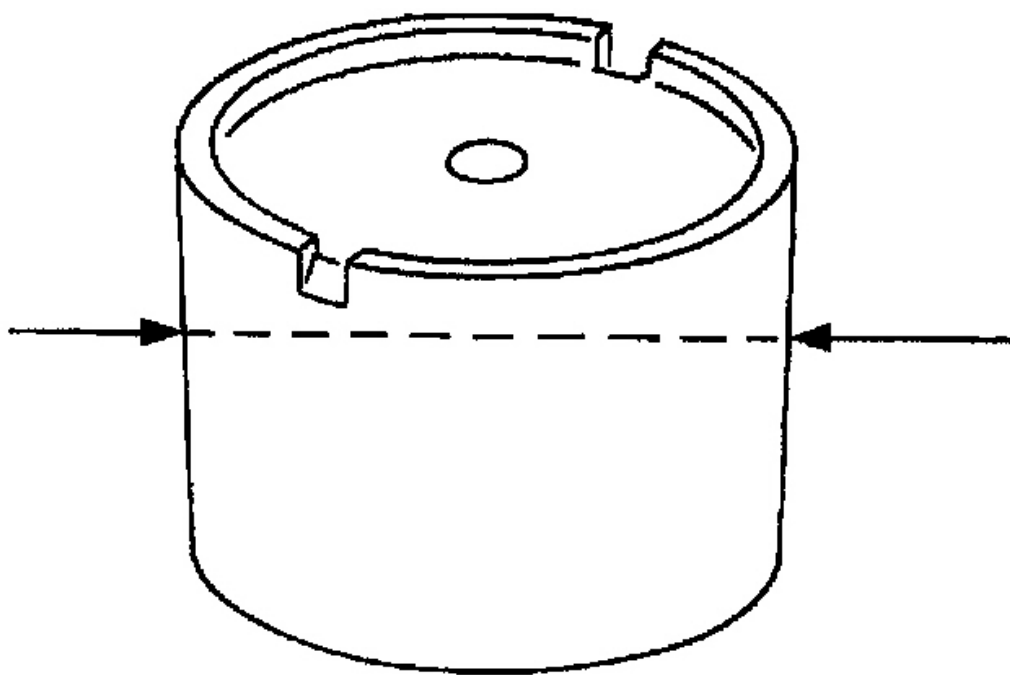
Fig. 179: Installing Valve Oil Seal
Courtesy of SUBARU OF AMERICA, INC.

VALVE LIFTER

1. Check the valve lifter visually.
2. Measure the outer diameter of valve lifter.

Outer diameter:

34.959 - 34.975 mm (1.3763 - 1.3770 in)



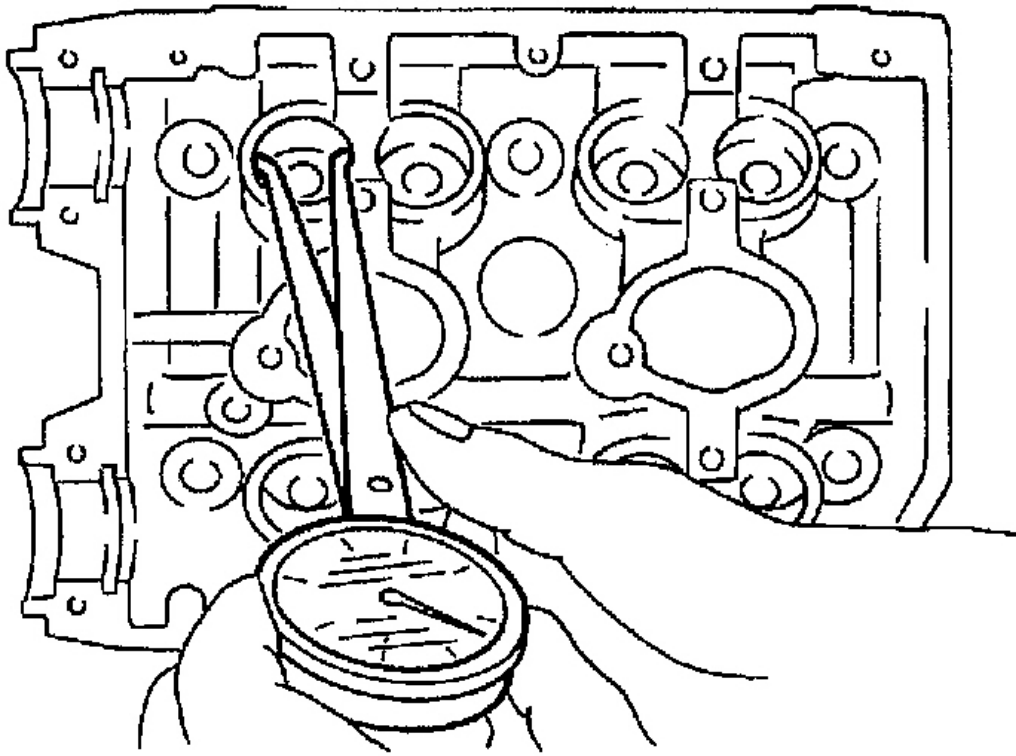
G02871095

Fig. 180: Measuring Outer Diameter Of Valve Lifter
Courtesy of SUBARU OF AMERICA, INC.

3. Measure the inner diameter of valve lifter mating part on cylinder head.

Inner diameter:

34.994 - 35.016 mm (1.3777 - 1.3786 in)



G02871096

Fig. 181: Measuring Inner Diameter Of Valve Lifter Mating Part On Cylinder Head
Courtesy of SUBARU OF AMERICA, INC.

CAUTION: If difference between outer diameter of valve lifter and inner diameter of valve lifter mating part is over the limit, replace the cylinder head.

Standard:

0.019 - 0.057 mm (0.0007 - 0.0022 in)

Limit:

0.100 mm (0.0039 in)

CYLINDER BLOCK

REMOVAL

NOTE: Before conducting this procedure, drain the engine oil completely if applicable.

1. Remove the intake manifold. < Ref. to **REMOVAL** , Intake Manifold. >
2. Remove the V-belt. < Ref. to **REMOVAL** , V-belt. >
3. Remove the crankshaft pulley. < Ref. to **REMOVAL** . >
4. Remove the belt cover. < Ref. to **REMOVAL** , Belt Cover. >
5. Remove the timing belt assembly. < Ref. to **REMOVAL** , Timing Belt Assembly. >
6. Remove the camshaft sprocket. < Ref. to **REMOVAL** , Camshaft Sprockets
7. Remove the crankshaft sprocket. < Ref. to **REMOVAL** , Crankshaft Sprockets
8. Remove the generator and A/C compressor with their brackets.
9. Remove the cylinder head assembly. < Ref. to **REMOVAL** , Cylinder Head Assembly.>
10. Remove the clutch disc and cover. (MT vehicles) < Ref. to **REMOVAL** , Clutch Disc and Cover. >
11. Remove the flywheel. (MT vehicles) < Ref. to **REMOVAL** , Flywheel . >
12. Remove the drive plate. (AT vehicles) Using the ST, lock crankshaft.

ST 498497100 CRANKSHAFT STOPPER

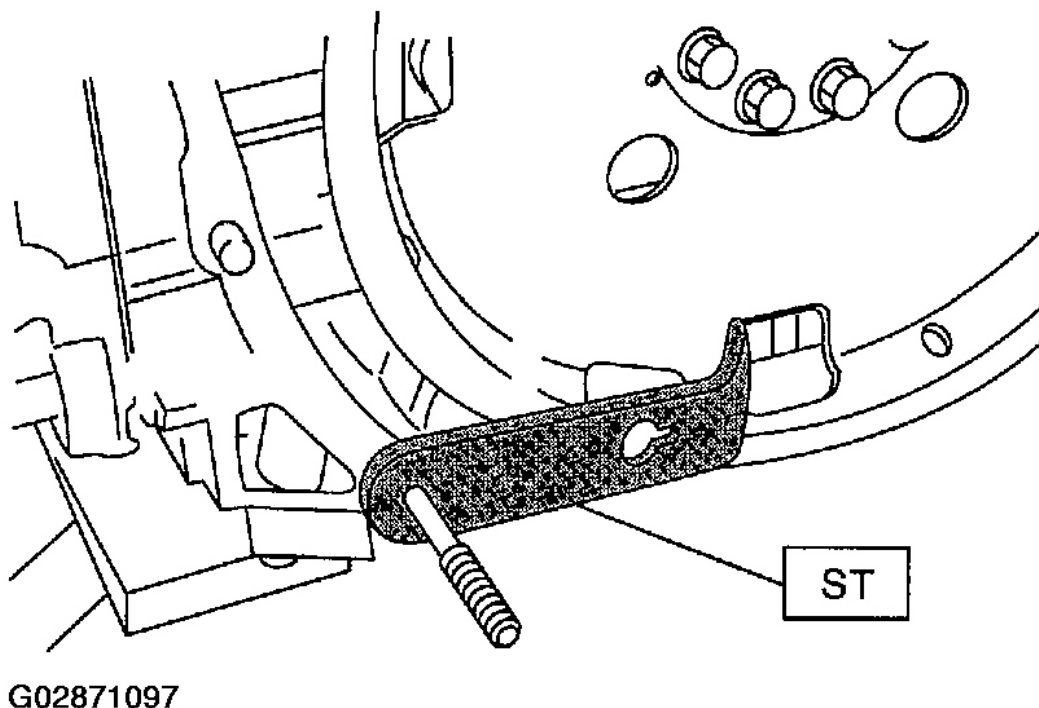
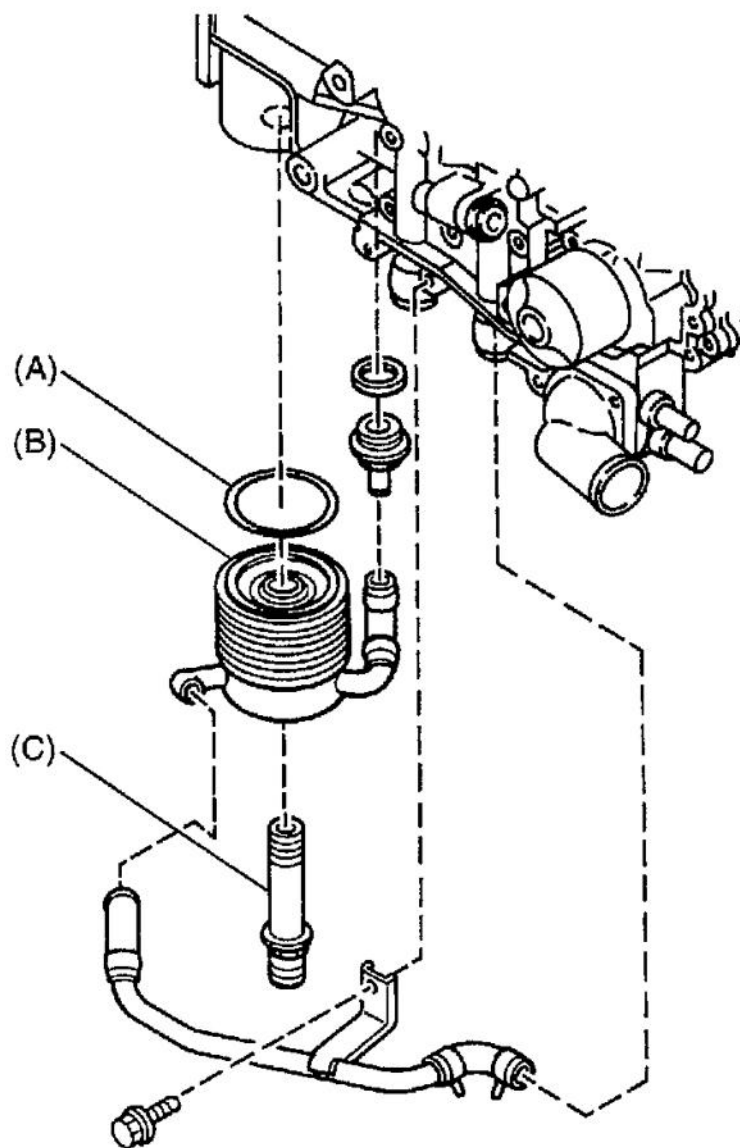


Fig. 182: Locking Crankshaft
Courtesy of SUBARU OF AMERICA, INC.

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

13. Remove the oil separator cover.
14. Remove the water by-pass pipe for heater.
15. Remove the oil filter.
16. Remove the oil cooler.



- (a) Gasket
- (b) Oil cooler
- (c) Connector

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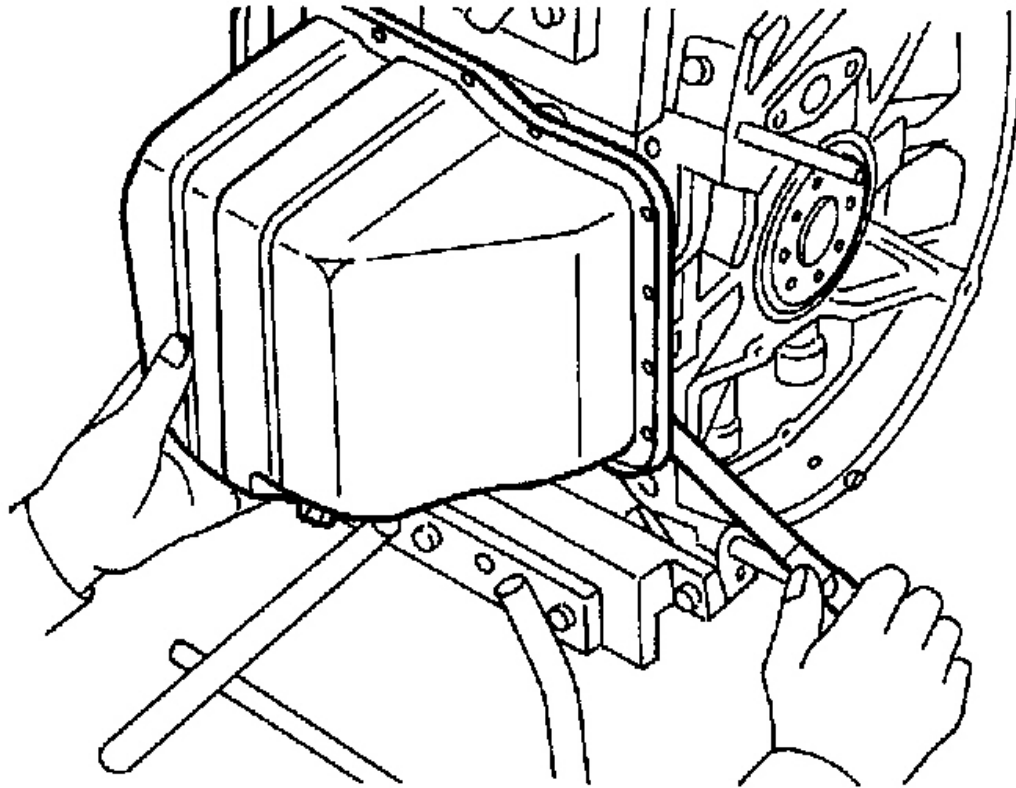
Fig. 183: Removing Oil Cooler
Courtesy of SUBARU OF AMERICA, INC.

17. Removal of oil pan:

1. Turn the cylinder block with #2 and #4 piston sides facing upward.

2. Remove the bolts which secure oil pan to cylinder block.
3. Insert a oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan.

CAUTION: Do not use a screwdriver or similar tool in place of oil pan cutter.



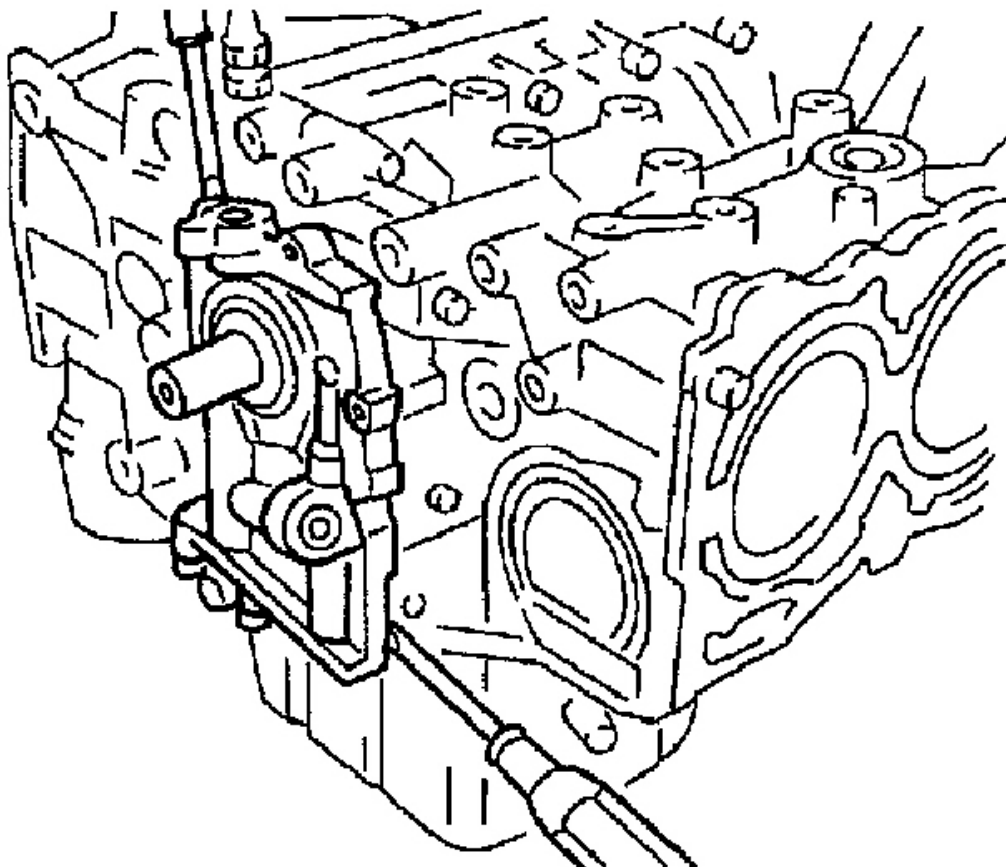
G02871099

Fig. 184: Removing Oil Pan
Courtesy of SUBARU OF AMERICA, INC.

18. Remove the oil strainer stay.
19. Remove the oil strainer.
20. Remove the baffle plate.
21. Remove the water pipes.
22. Remove the water pump.
23. Remove the oil pump from cylinder block. Use a flat-bladed screwdriver as shown in the figure when

removing the oil pump.

CAUTION: Be careful not to scratch the mating surface of cylinder block and oil pump.



G02871100

Fig. 185: Removing Oil Pump From Cylinder Block
Courtesy of SUBARU OF AMERICA, INC.

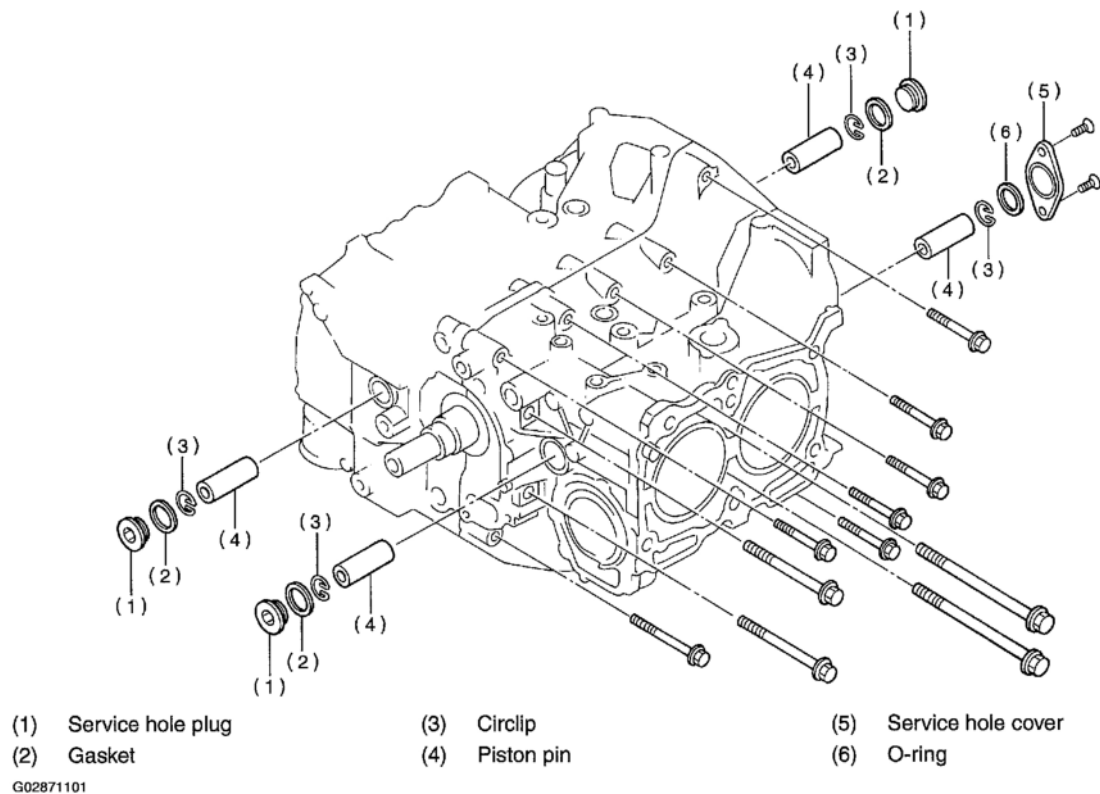
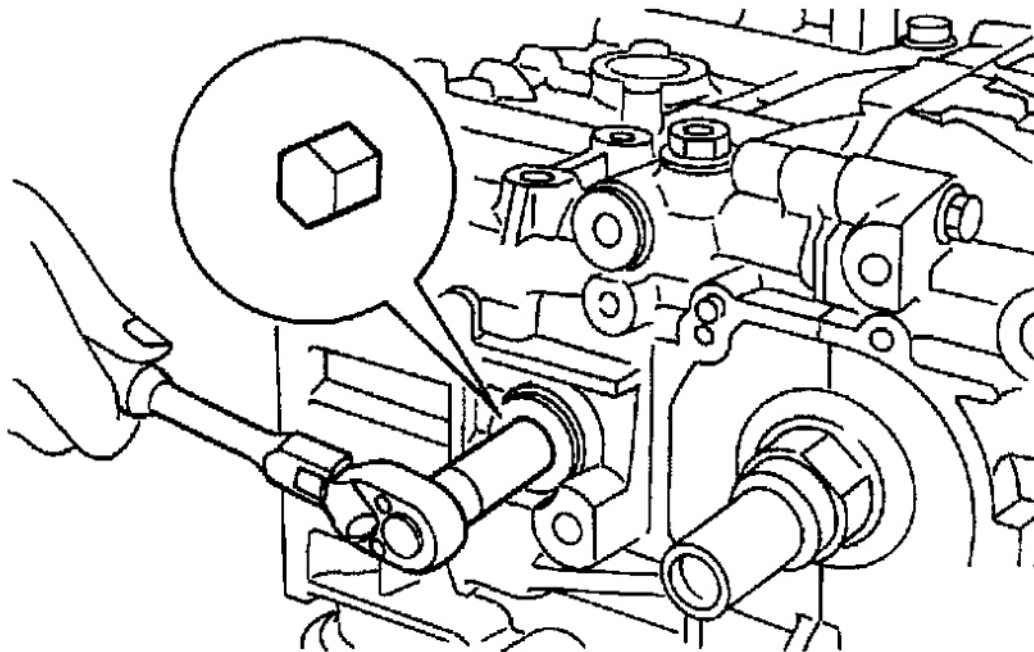


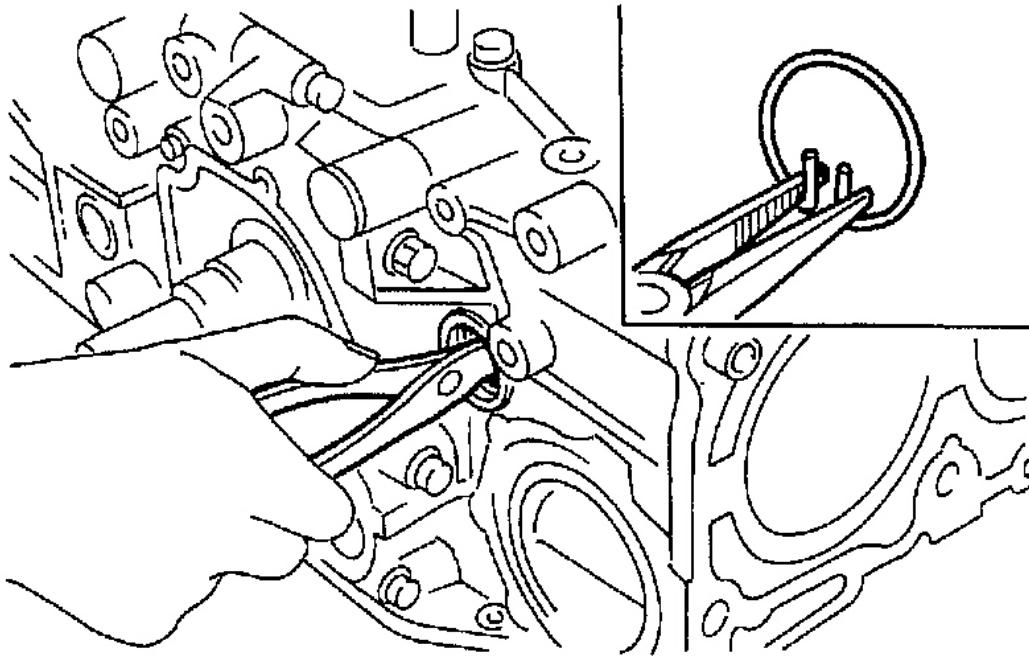
Fig. 186: Removing Cylinder Block
Courtesy of SUBARU OF AMERICA, INC.

24. Remove the service hole cover and service hole plugs using the hexagon wrench [14 mm (0.55 in)].
25. Rotate the crankshaft to bring #1 and #2 pistons to bottom dead center position, then remove the piston circlip through service hole of #1 and #2 cylinders.



G02871102

Fig. 187: Removing Service Hole Cover And Service Hole Plugs
Courtesy of SUBARU OF AMERICA, INC.



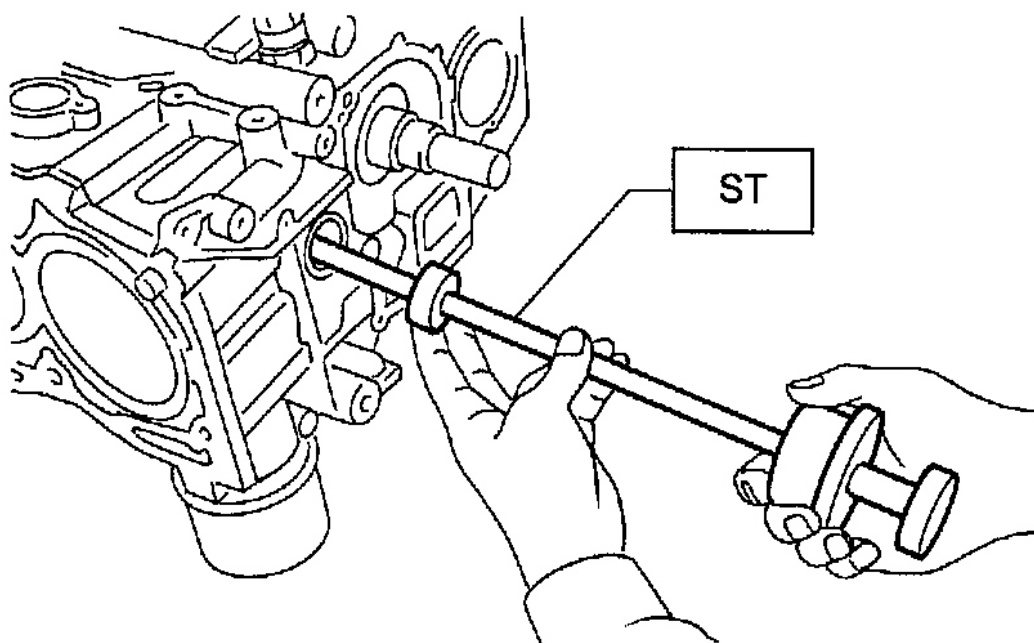
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Fig. 188: Removing Piston Circlip Through Service Hole Of #1 And #2 Cylinders
Courtesy of SUBARU OF AMERICA, INC.

26. Draw out the piston pin from #1 and #2 pistons using ST.

ST 499097700 PISTON PIN REMOVER

CAUTION: Be careful not to confuse the original combination of piston, piston pin and cylinder.

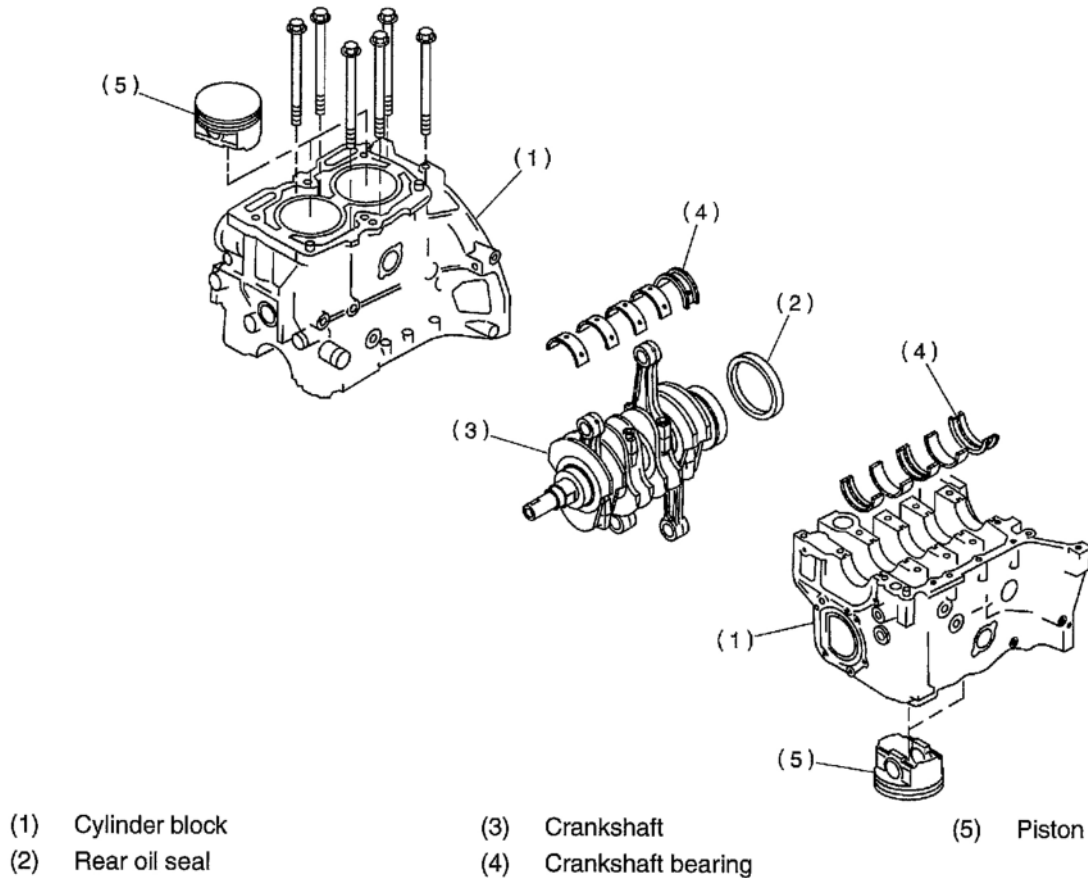


G02871104

Fig. 189: Removing Piston Pin From #1 And #2 Pistons
Courtesy of SUBARU OF AMERICA, INC.

27. Similarly remove the piston pins from #3 and #4 pistons.
28. Remove the bolts which connect cylinder block on the side of #2 and #4 cylinders.
29. Back off the bolts which connect cylinder block on the side of #1 and #3 cylinders two or three turns.
30. Set up the cylinder block so that #1 and #3 cylinders are on the upper side, then remove the cylinder block connecting bolts.
31. Separate the left-hand and right-hand cylinder blocks.

CAUTION: When separating the cylinder block, do not allow the connecting rod to fall and damage the cylinder block.



G02871105

Fig. 190: Separating Left-Hand And Right-Hand Cylinder Blocks
 Courtesy of SUBARU OF AMERICA, INC.

32. Remove the rear oil seal.
33. Remove the crankshaft together with connecting rod.
34. Remove the crankshaft bearings from cylinder block using a hammer handle.

CAUTION: Do not confuse the combination of crankshaft bearings.
Press the bearing at the end opposite to locking lip.

35. Draw out each piston from cylinder block using a wooden bar or hammer handle.

CAUTION: Do not confuse the combination of piston and cylinder.

INSTALLATION

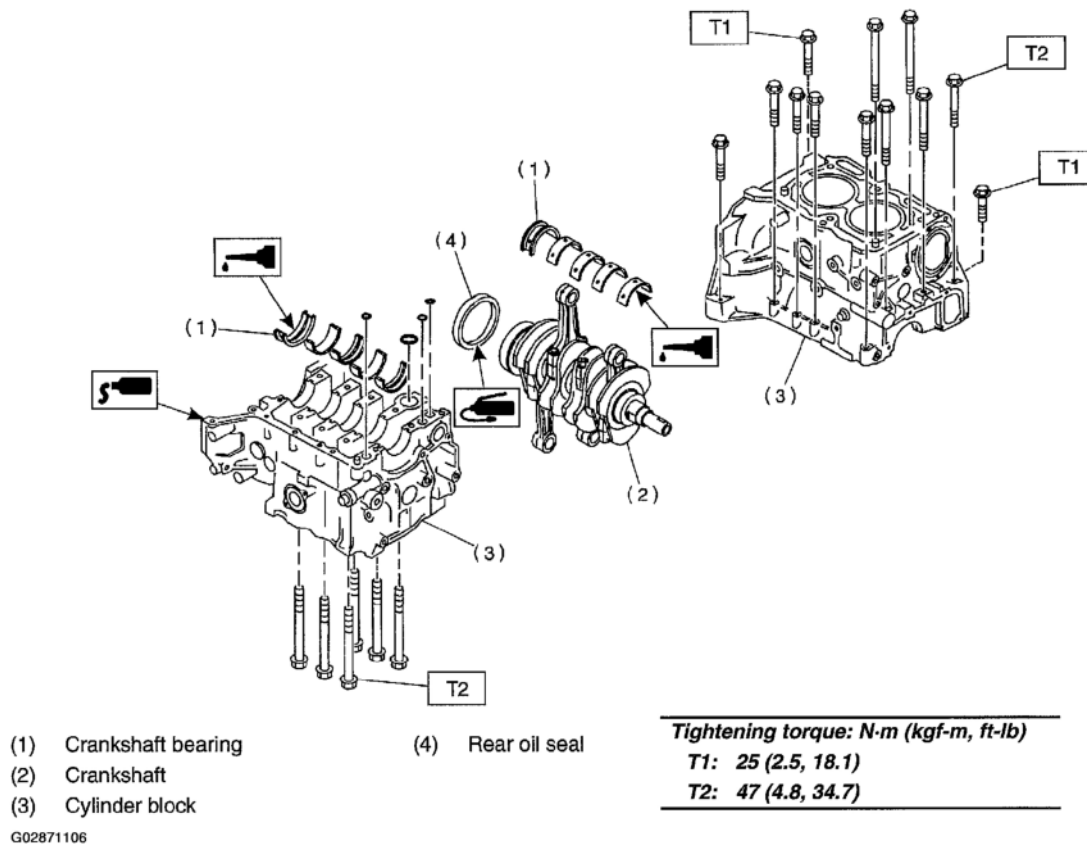


Fig. 191: Installing Left-Hand And Right-Hand Cylinder Blocks
 Courtesy of SUBARU OF AMERICA, INC.

CAUTION: Remove oil in the mating surface of bearing and cylinder block before installation. Also apply a coat of engine oil to crankshaft pins.

1. Position the crankshaft on the #2 and #4 cylinder block.
2. Apply fluid packing to the mating surface of #1 and #3 cylinder block, and position it on #2 and #4 cylinder block.

Fluid packing:

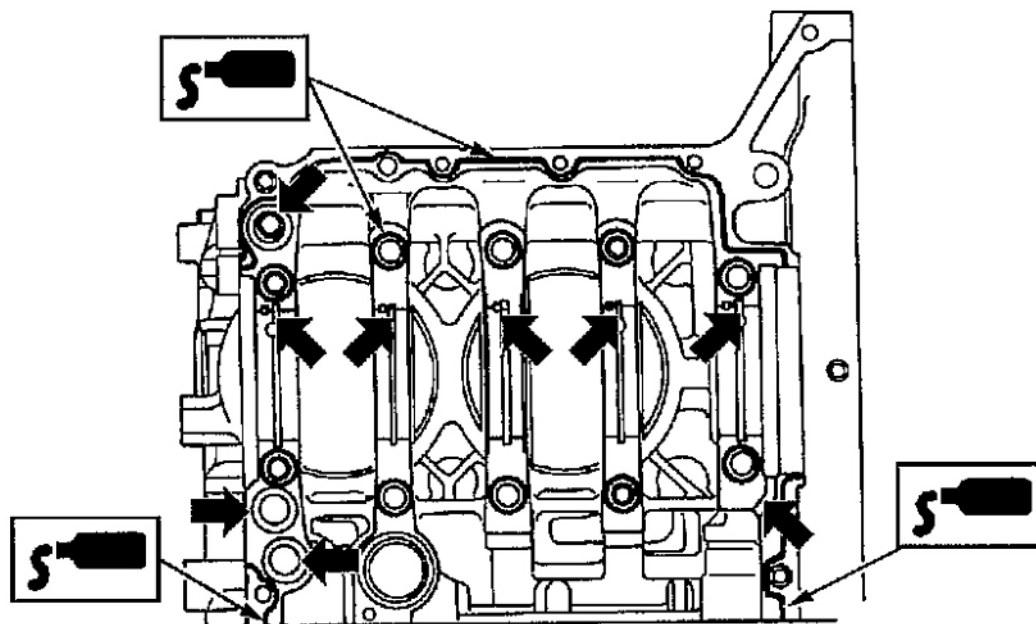
THREE BOND 1215 or equivalent

CAUTION: Do not allow fluid packing to jut into O-ring grooves, oil passages, bearing grooves, etc.

Tightening torque: N·m (kgf-m, ft-lb)

T1: 25 (2.5, 18.1)

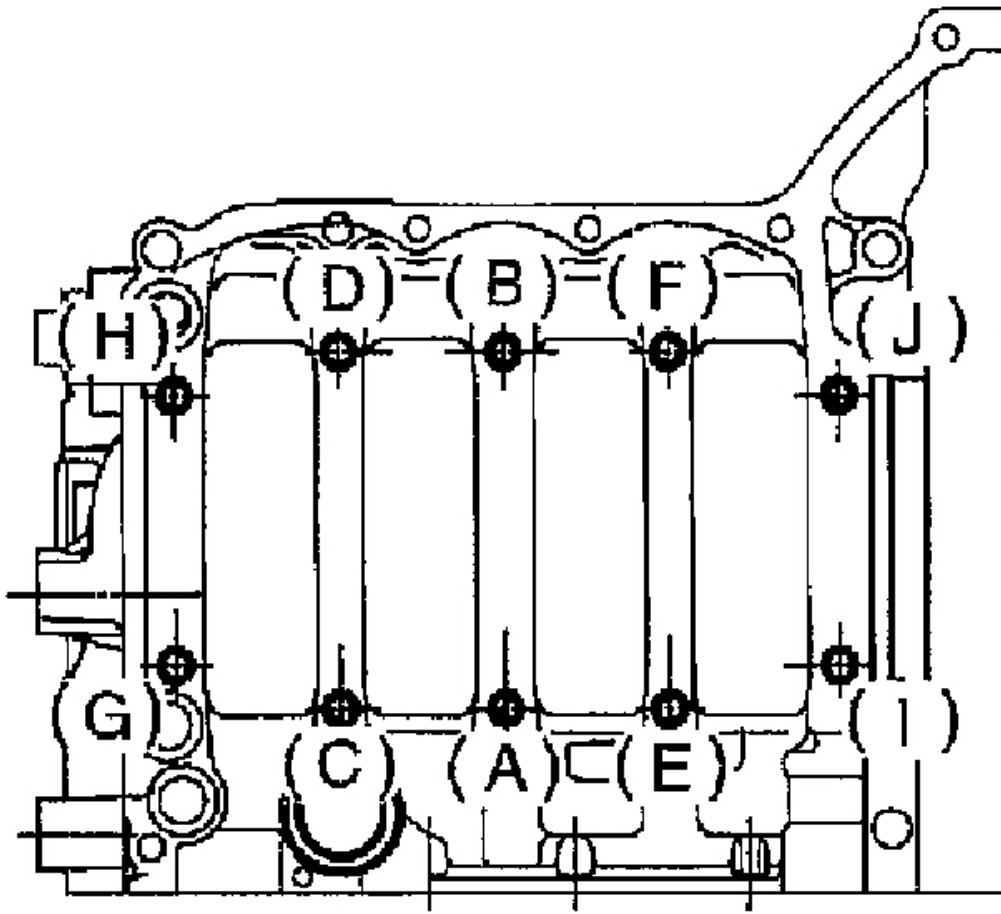
T2: 47 (4.8,34.7)



G02871107

Fig. 192: Applying Fluid Packing To Mating Surface Of Cylinder Block
Courtesy of SUBARU OF AMERICA, INC.

3. Temporarily tighten the 10 mm cylinder block connecting bolts in alphabetical sequence shown in the figure.

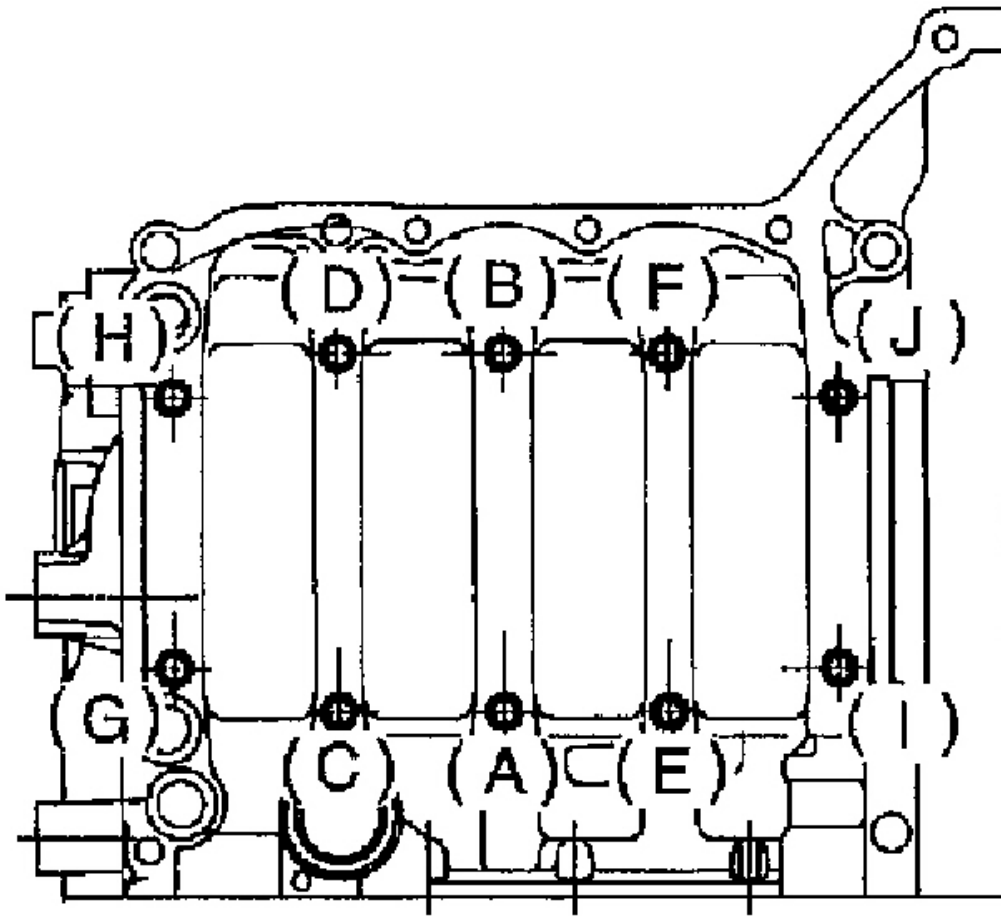


G02871108

Fig. 193: Tightening Cylinder Block Connecting Bolts In Alphabetical Sequence
Courtesy of SUBARU OF AMERICA, INC.

4. Tighten the 10 mm cylinder block connecting bolts in alphabetical sequence.

Tightening torque: 47 N.m (4.8 kgf-m, 34.7 ft-lb)



G02871109

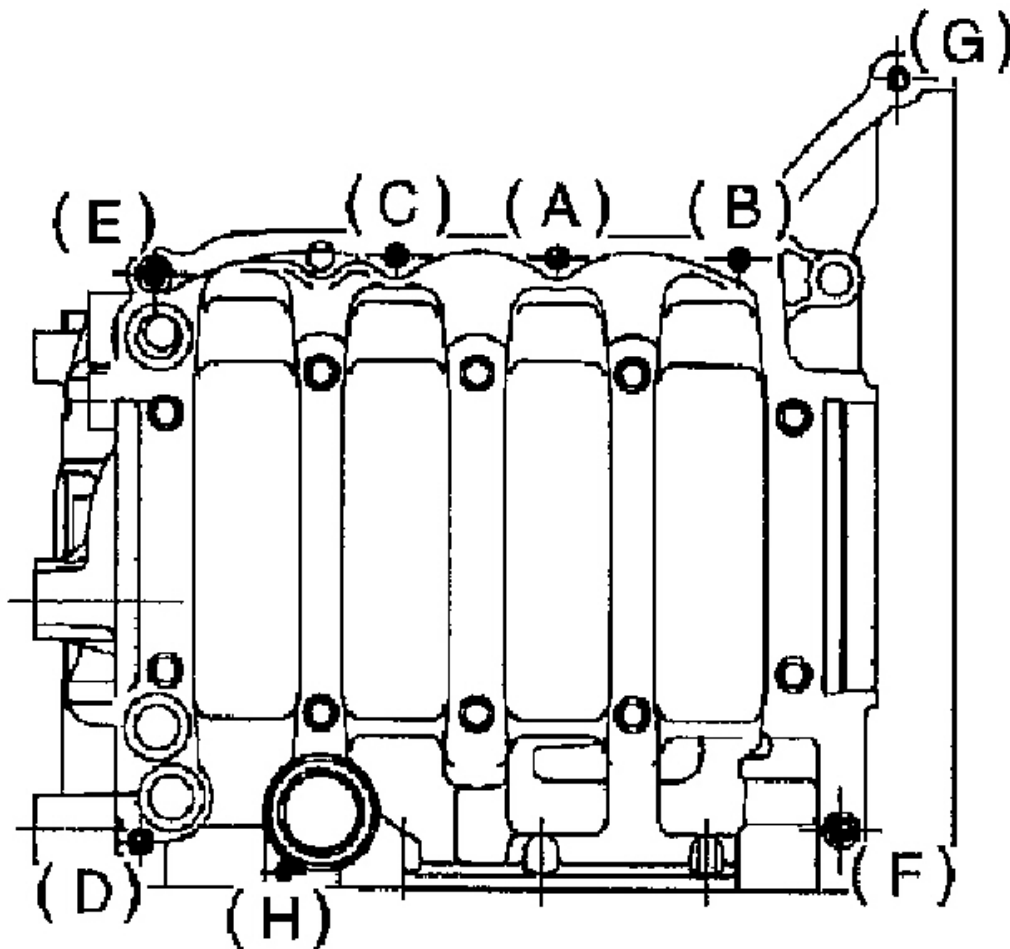
Fig. 194: Tightening Cylinder Block Connecting Bolts In Alphabetical Sequence
Courtesy of SUBARU OF AMERICA, INC.

5. Tighten the 8 mm and 6 mm cylinder block connecting bolts in alphabetical sequence shown in the figure.

Tightening torque:

(A) - (G): 25 N.m (2.5 kgf-m, 18.1 ft-lb)

(H): 6.4 N.m (0.65 kgf-m, 4.7 ft-lb)



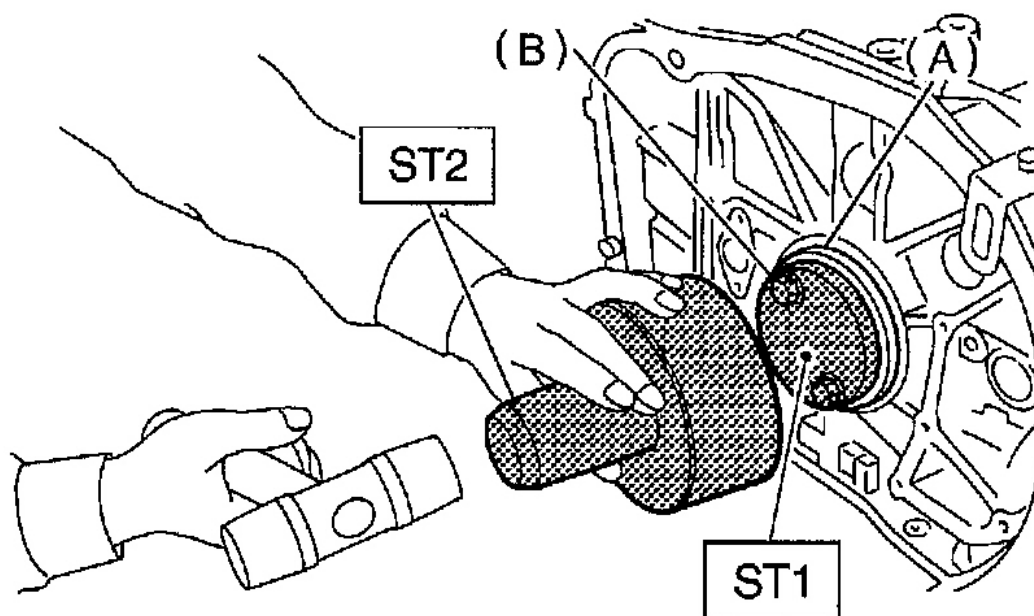
G02871110

Fig. 195: Tightening Cylinder Block Connecting Bolts In Alphabetical Sequence
Courtesy of SUBARU OF AMERICA, INC.

6. Install the rear oil seal using ST1 and ST2.

ST1 499597100 OIL SEAL GUIDE

ST2 499587200 OIL SEAL INSTALLER



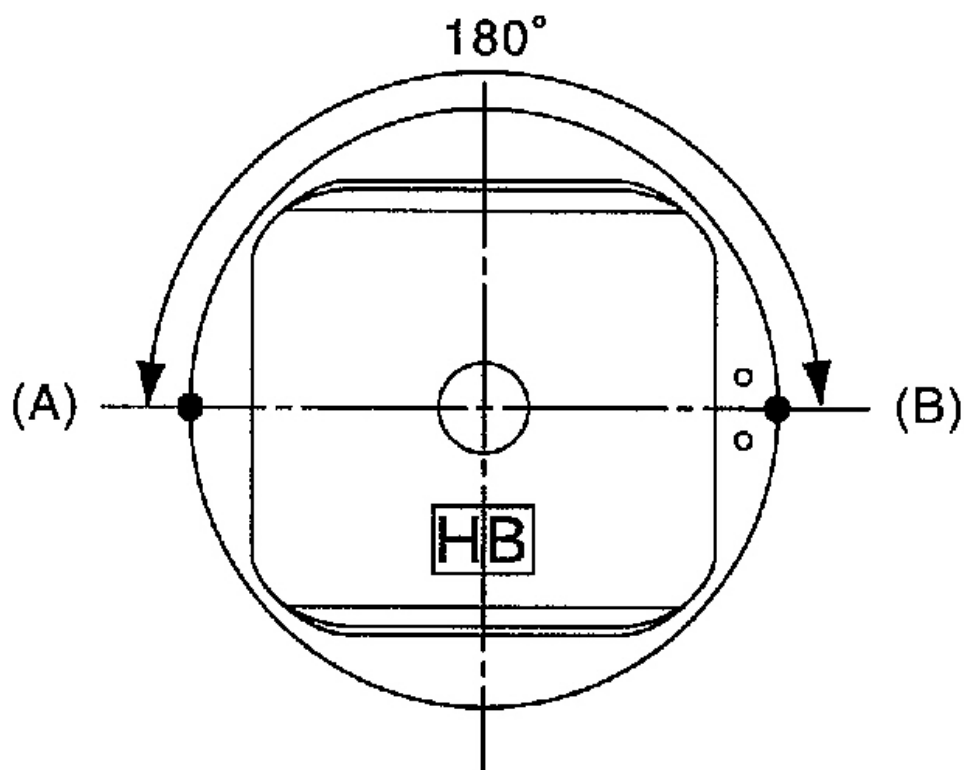
(A) Rear oil seal

(B) Flywheel attaching bolt

G02871111

Fig. 196: Installing Rear Oil Seal
Courtesy of SUBARU OF AMERICA, INC.

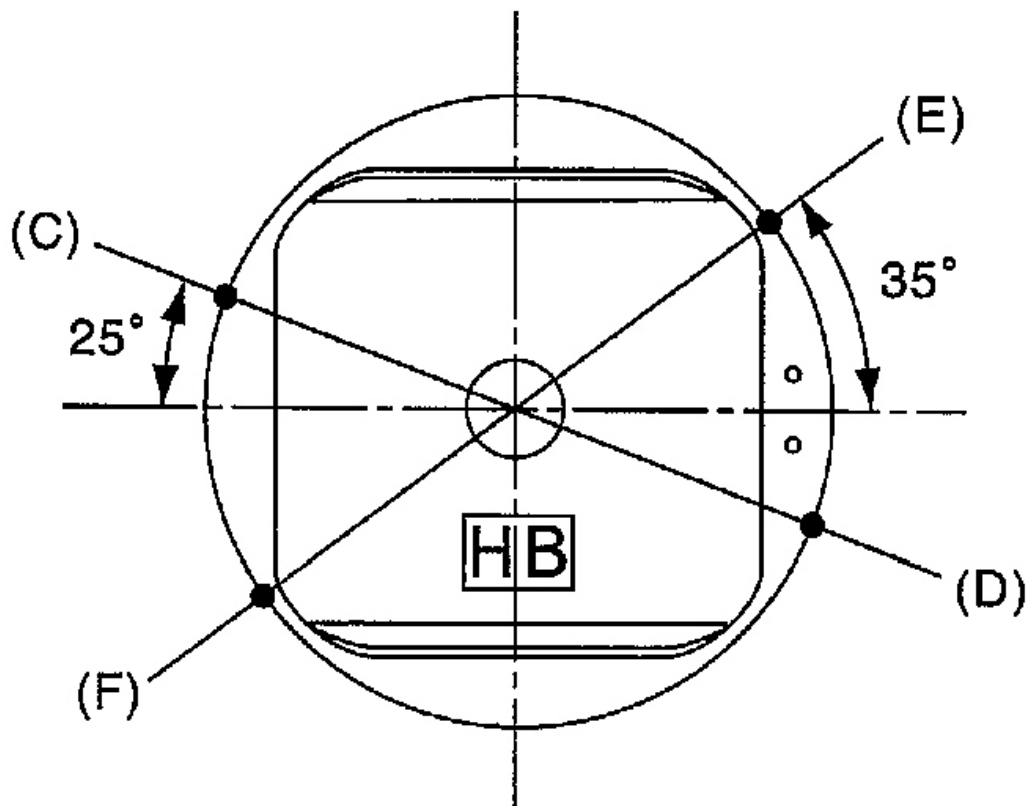
7. Position the top ring gap at (A) or (B) in the figure.



G02871112

Fig. 197: Positioning Top Ring Gap At (A) Or (B)
Courtesy of SUBARU OF AMERICA, INC.

8. Position the second ring gap at 180° on the reverse side for the top ring gap.
9. Position the upper rail gap at (C) or (D) in the figure.



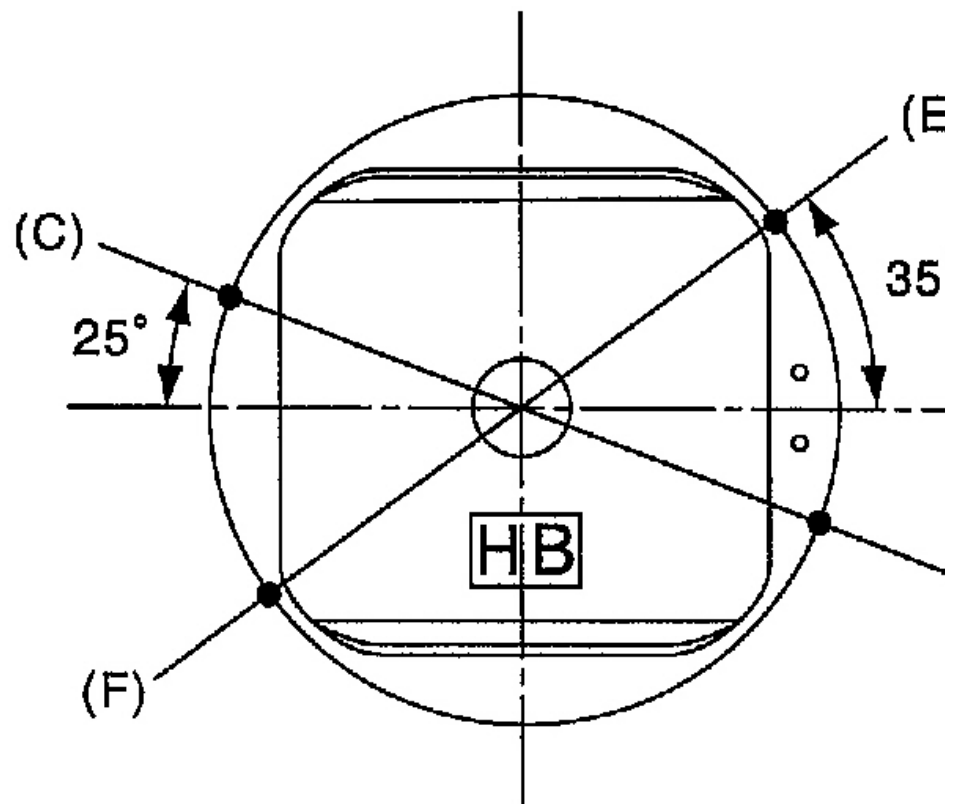
G02871113

Fig. 198: Positioning Upper Rail Gap At (C) Or (D)
Courtesy of SUBARU OF AMERICA, INC.

10. Position the expander gap at 180° of the reverse side for the upper rail gap.
11. Position the lower rail gap at (E) or (F) in the figure.

CAUTION:

- Ensure ring gaps do not face the same direction.
- Ensure ring gaps are not within the piston skirt area.



G02871114

Fig. 199: Positioning Lower Rail Gap At (E) Or (F)
Courtesy of SUBARU OF AMERICA, INC.

12. Installing the circlip:

Install the circlips in piston holes located opposite of the service holes in cylinder block, when positioning all pistons in the corresponding cylinders.

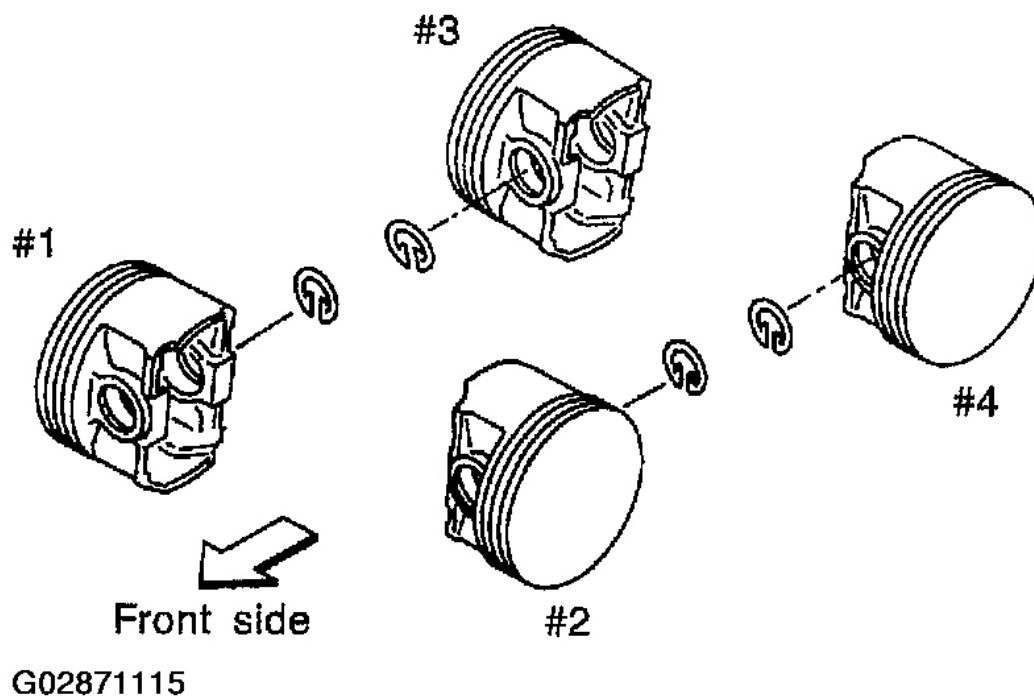
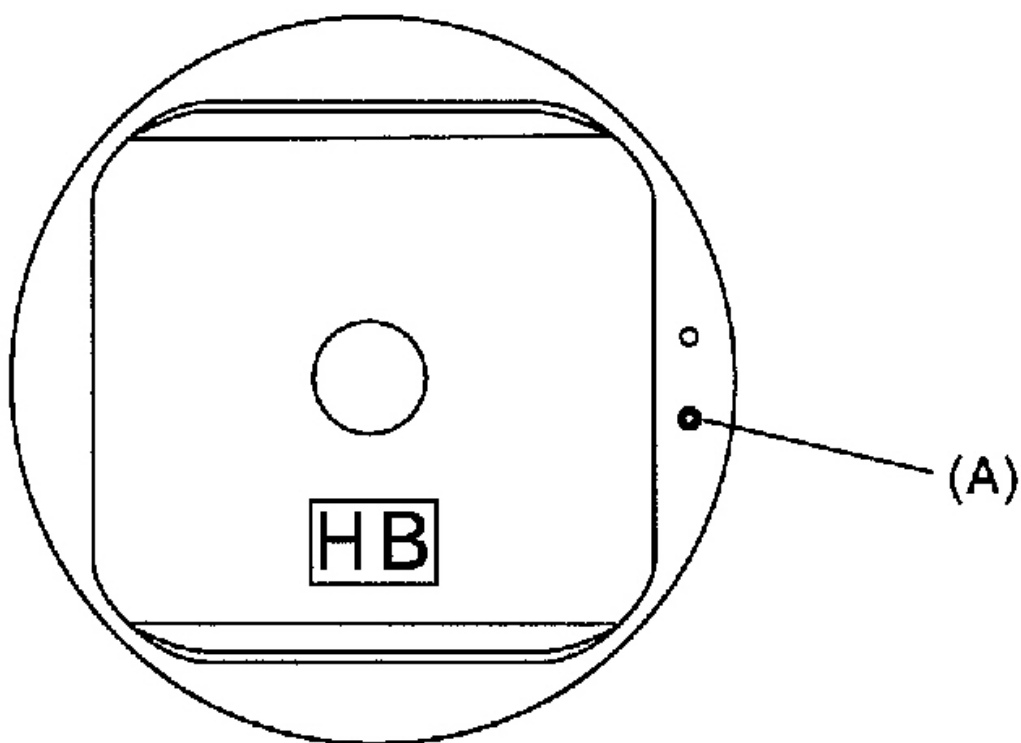


Fig. 200: Identifying Lubricating Points Of Piston And Piston Pin
Courtesy of SUBARU OF AMERICA, INC.

CAUTION: Use new circlips.



G02871116

Fig. 201: Identifying Piston Circlips Position
Courtesy of SUBARU OF AMERICA, INC.

CAUTION: Piston front mark faces towards the front of the engine.

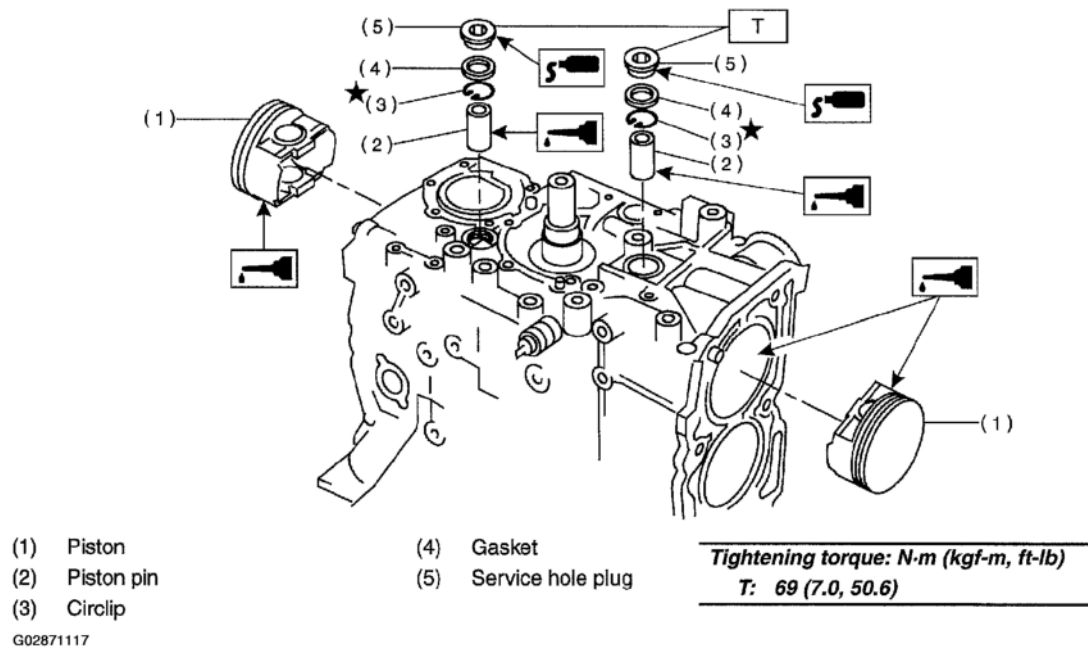


Fig. 202: Identifying Piston Front Mark Faces Towards Front Of Engine
Courtesy of SUBARU OF AMERICA, INC.

Tightening torque: N·m (kgf-m, ft-lb)

T: 69 (7.0, 50.6)

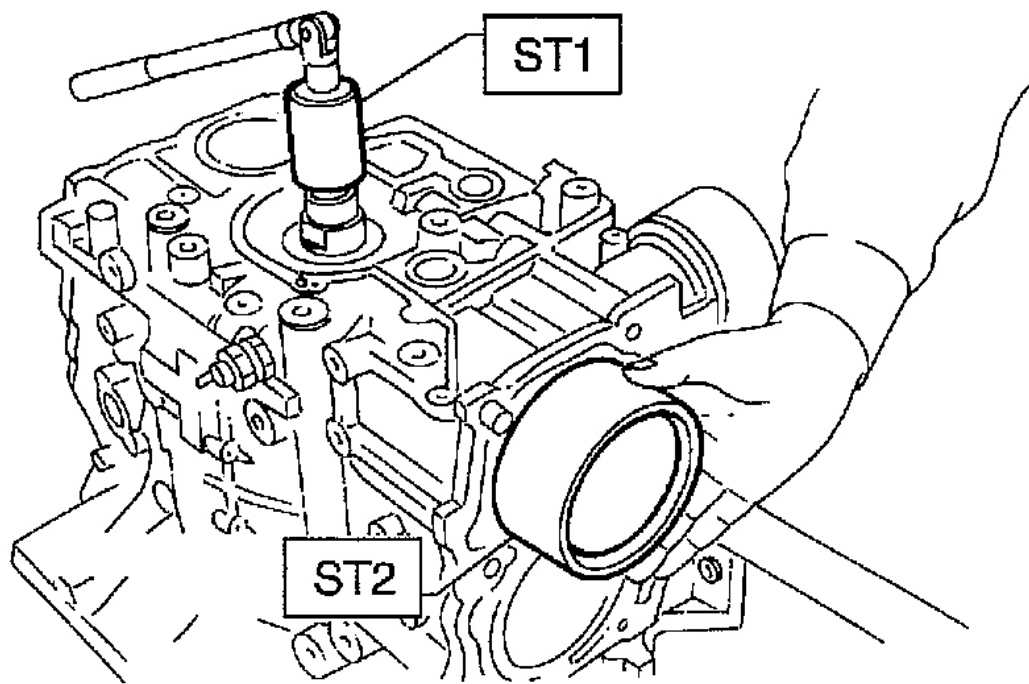
13. Installing the piston:

1. Turn the cylinder block so that #1 and #2 cylinders face upward.
2. Using ST1, turn the crankshaft so that #1 and #2 connecting rods are set at bottom dead center.

ST1 499987500 CRANKSHAFT SOCKET

3. Apply a coat of engine oil to the pistons and cylinders and insert pistons in their cylinders using ST2.

ST2 498744300 PISTON GUIDE



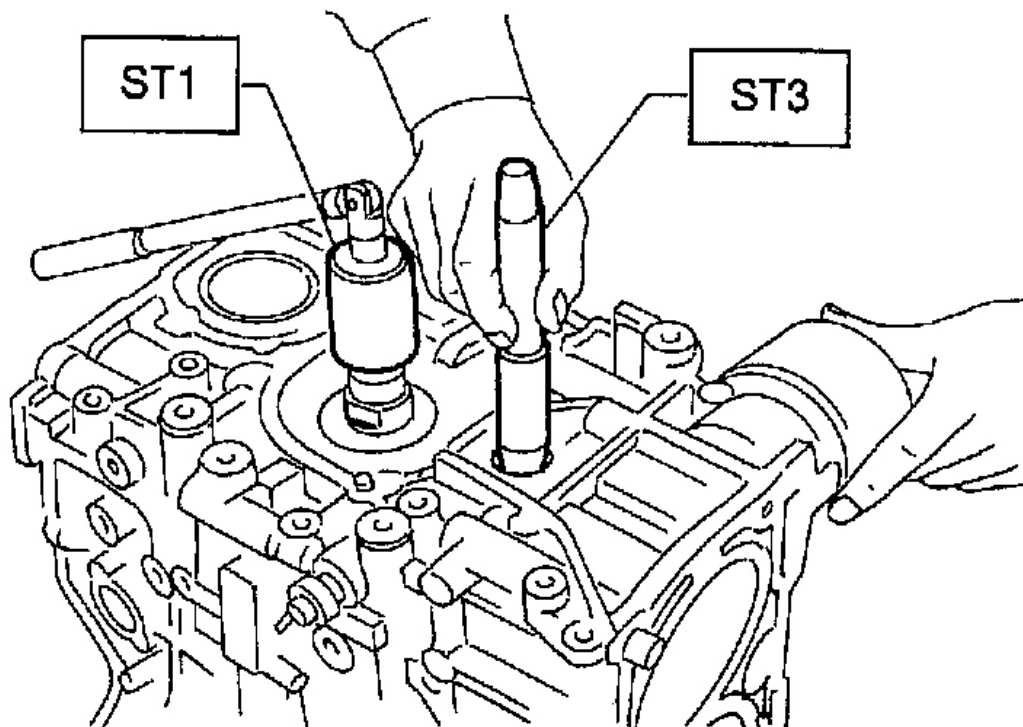
G02871118

Fig. 203: Installing Pistons In Cylinders
Courtesy of SUBARU OF AMERICA, INC.

14. Installing piston pin:
 1. Insert ST3 into service hole to align piston pin hole with connecting rod small end.

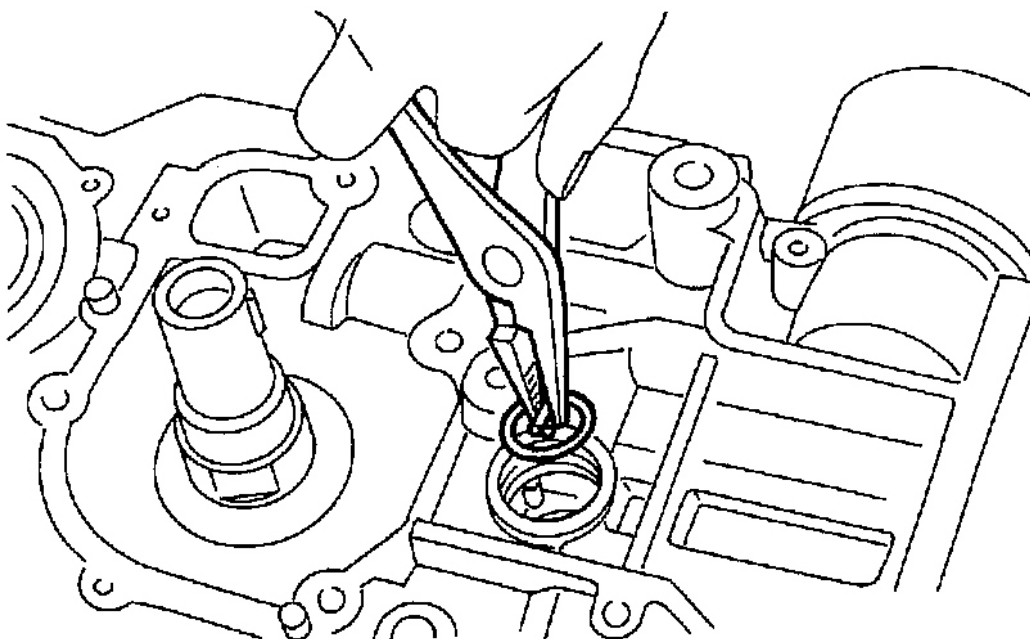
CAUTION: Apply a coat of engine oil to ST3 before insertion.

ST3 499017100 PISTON PIN GUIDE

**G02871119****Fig. 204: Installing Piston Pin****Courtesy of SUBARU OF AMERICA, INC.**

2. Apply a coat of engine oil to the piston pin and insert piston pin into piston and connecting rod through service hole.
3. Install the circlip.

CAUTION: Use new circlips.



G02871120

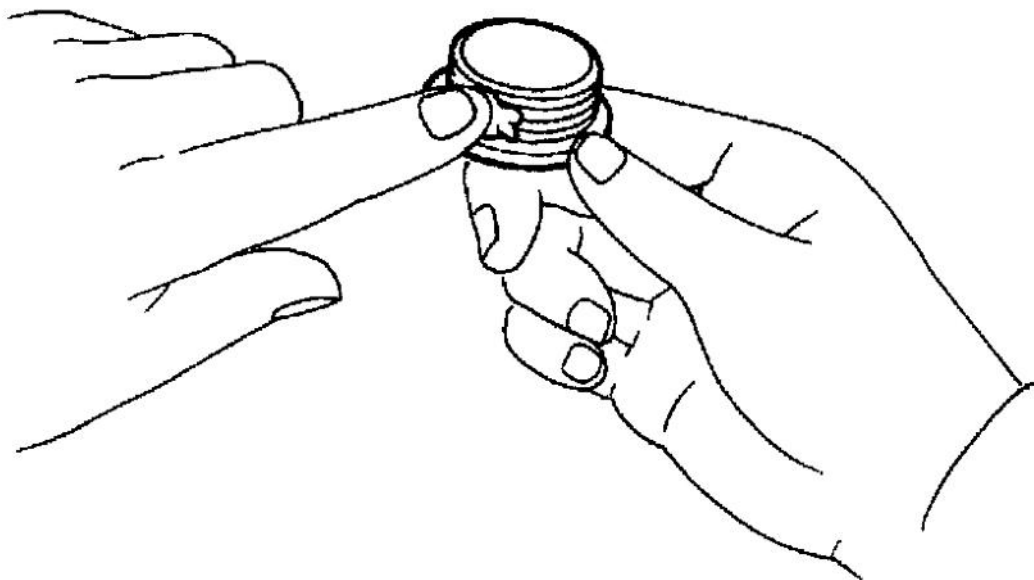
Fig. 205: Installing Circlip

Courtesy of SUBARU OF AMERICA, INC.

4. Apply fluid packing around the service hole plug.

Fluid packing:

THREE BOND 1215 or equivalent

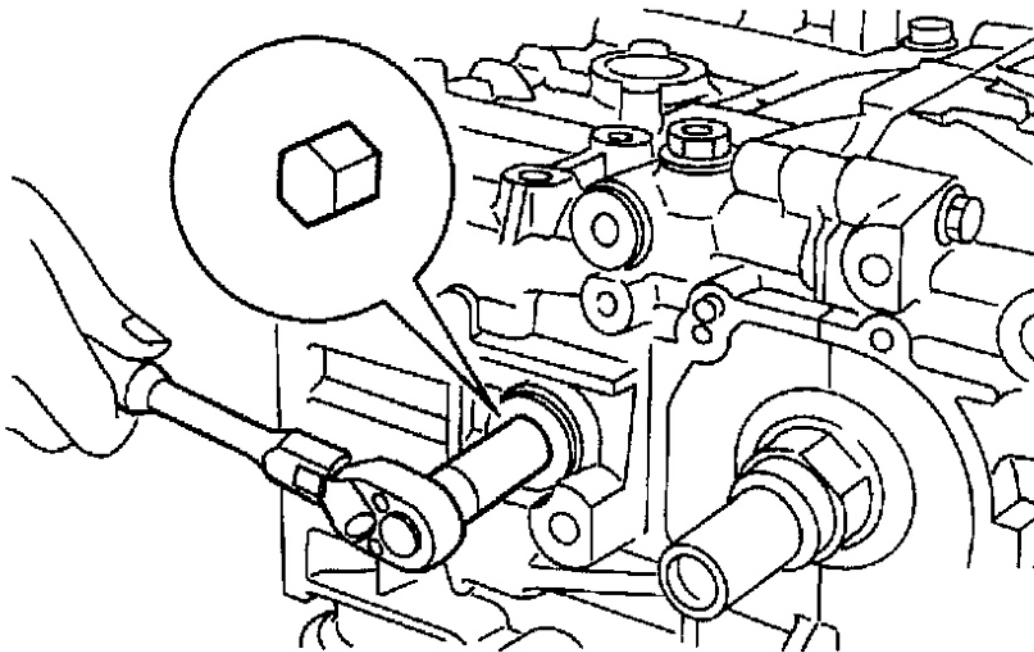


G02871121

Fig. 206: Applying Fluid Packing Around Service Hole Plug
Courtesy of SUBARU OF AMERICA, INC.

5. Install the service hole plug and gasket.

CAUTION: Use a new gasket.



G02871122

Fig. 207: Installing Service Hole Plug And Gasket
Courtesy of SUBARU OF AMERICA, INC.

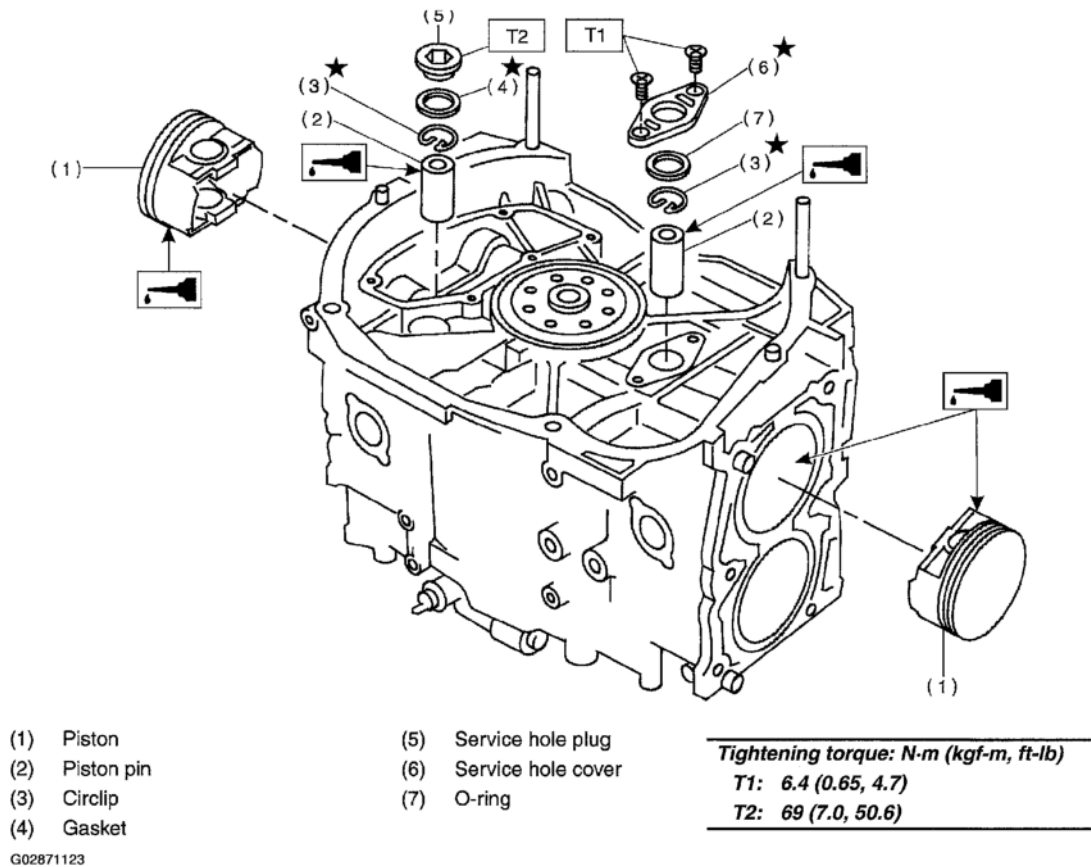


Fig. 208: Identifying Lubricating Points Of Pistons And Piston Pins
 Courtesy of SUBARU OF AMERICA, INC.

6. Turn the cylinder block so that #3 and #4 cylinders face upward. Using the same procedures as used for #1 and #2 cylinders, install the pistons and piston pins.
15. Install the water pipe.
16. Install the baffle plate.

Tightening torque:

6.4 N.m (0.65 kgf-m, 4.7 ft-lb)

17. Install the oil strainer and O-ring

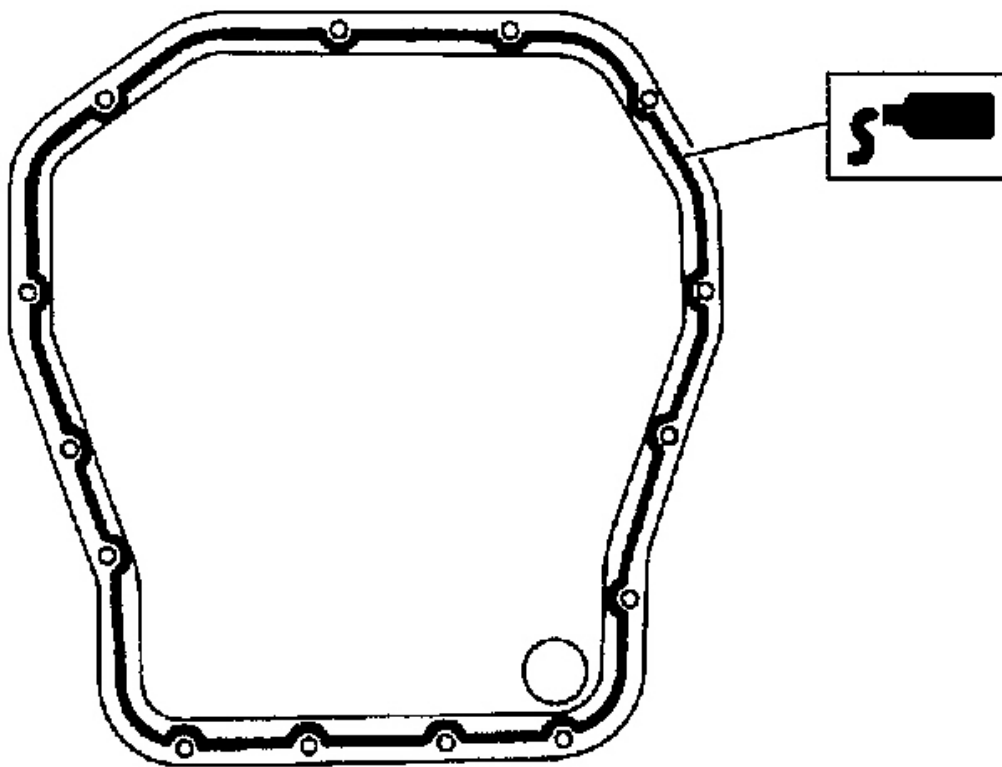
Tightening torque:

10 N.m (1.0 kgf-m, 7 ft-lb)

18. Install the oil strainer stay.
19. Apply fluid packing to matching surfaces and install the oil pan.

Fluid packing:

THREE BOND 1215 or equivalent



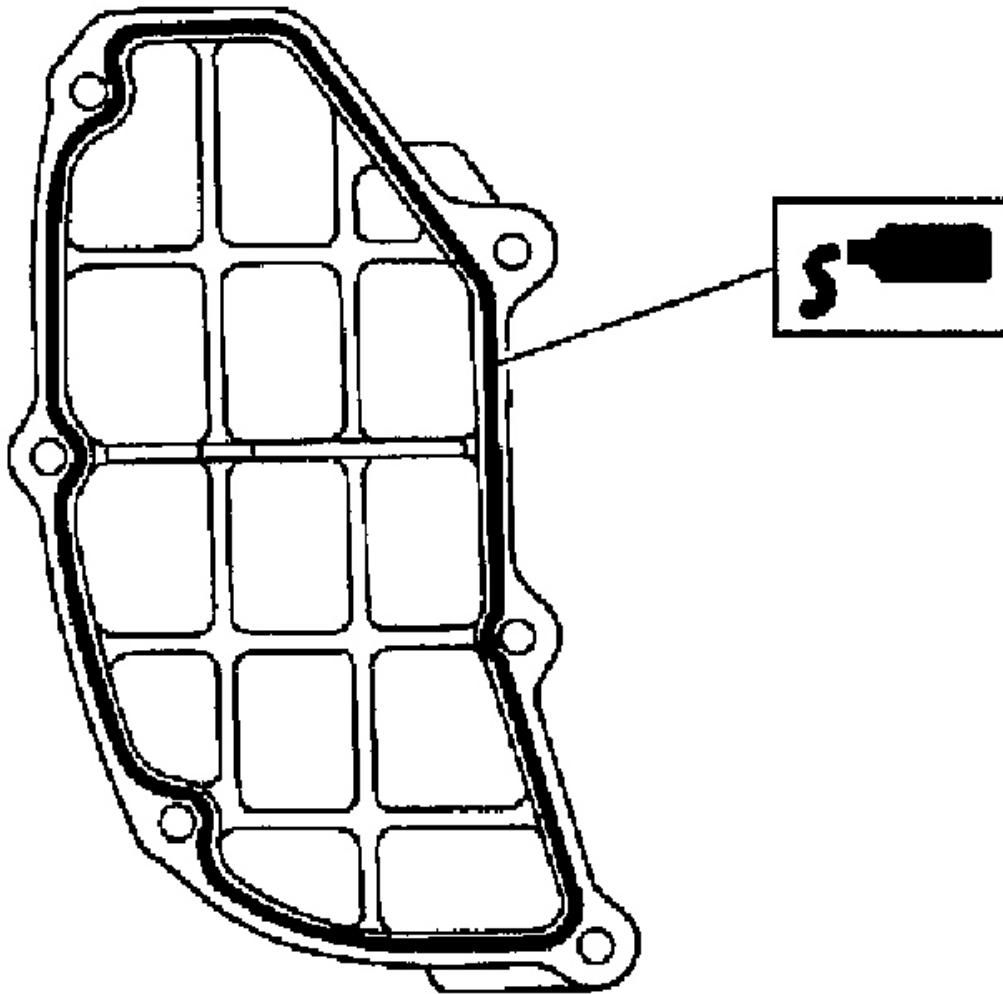
G02871124

Fig. 209: Applying Fluid Packing To Matching Surfaces Of Oil Pan
Courtesy of SUBARU OF AMERICA, INC.

20. Apply fluid packing to matching surfaces and install the oil separator cover.

Fluid packing:

THREE BOND 1215 or equivalent



G02871125

Fig. 210: Applying Fluid Packing To Matching Surfaces Of Oil Separator Cover
Courtesy of SUBARU OF AMERICA, INC.

21. Install the drive plate. (AT vehicles)

To lock the crankshaft, use ST.

ST 498497100 CRANKSHAFT STOPPER

Tightening torque: 72 N.m (7.3 kgf-m, 52.8 ft-lb)

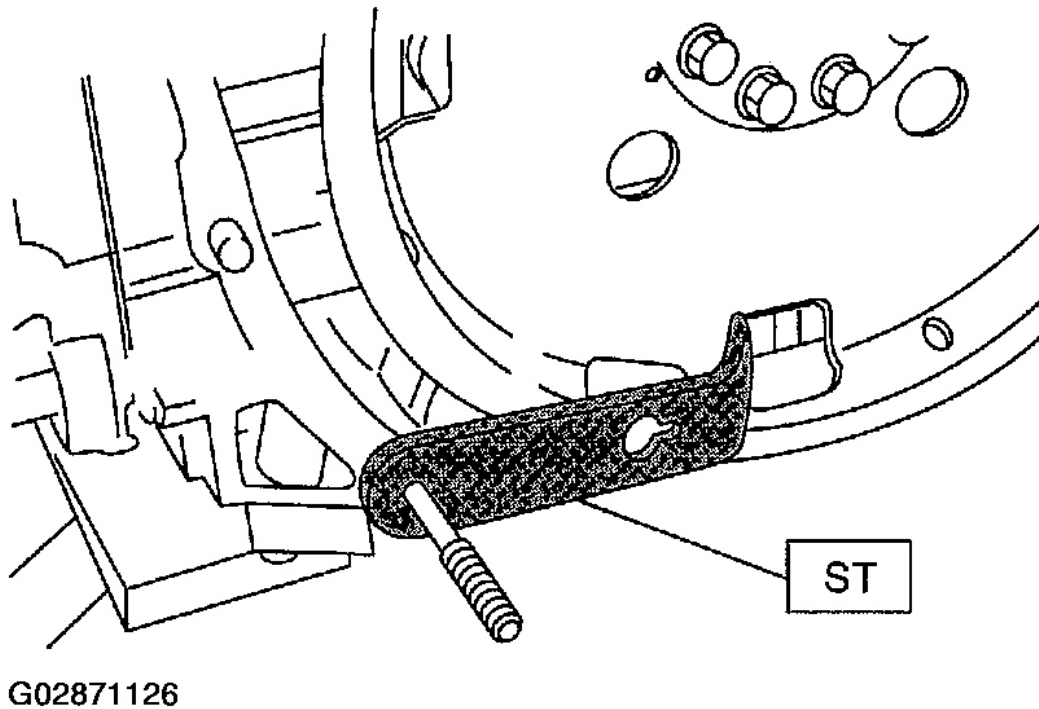
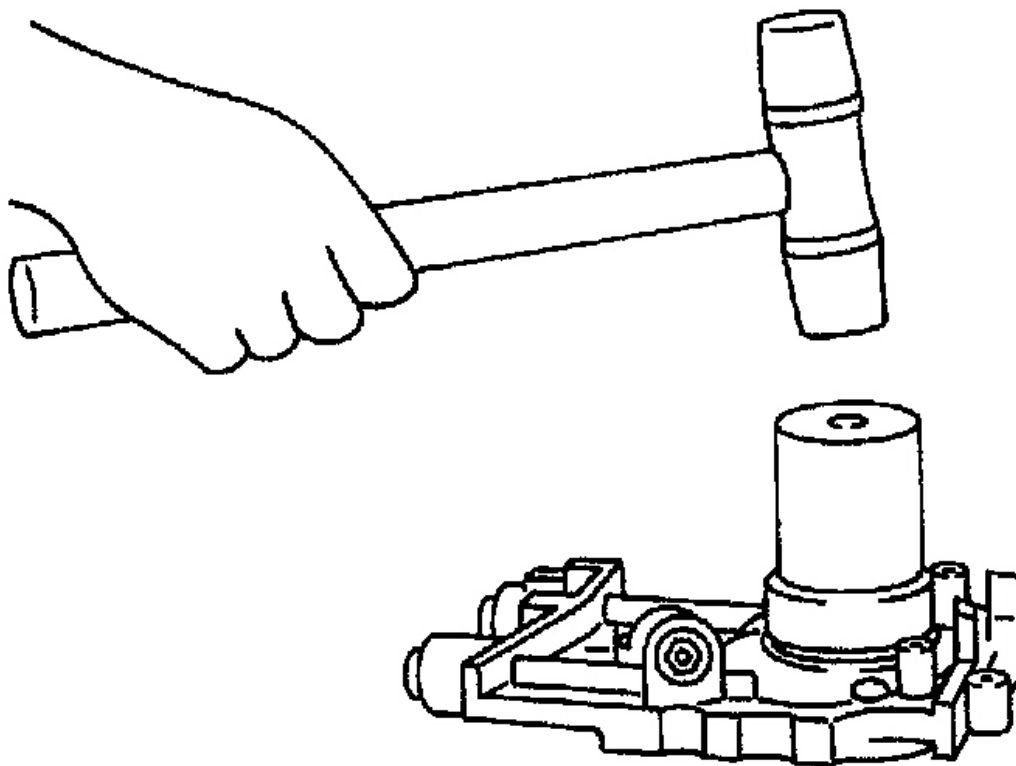


Fig. 211: Locking Crankshaft
Courtesy of SUBARU OF AMERICA, INC.

22. Install the flywheel. (MT vehicles) < Ref. to **INSTALLATION** , Flywheel. >
23. Install the clutch disc and cover. (MT vehicles) < Ref. to **INSTALLATION** , Clutch Disc and Cover . >
24. Installation of oil pump:
 1. Discard the front oil seal after removal. Replace with a new one using ST.

ST 499587100 OIL SEAL INSTALLER



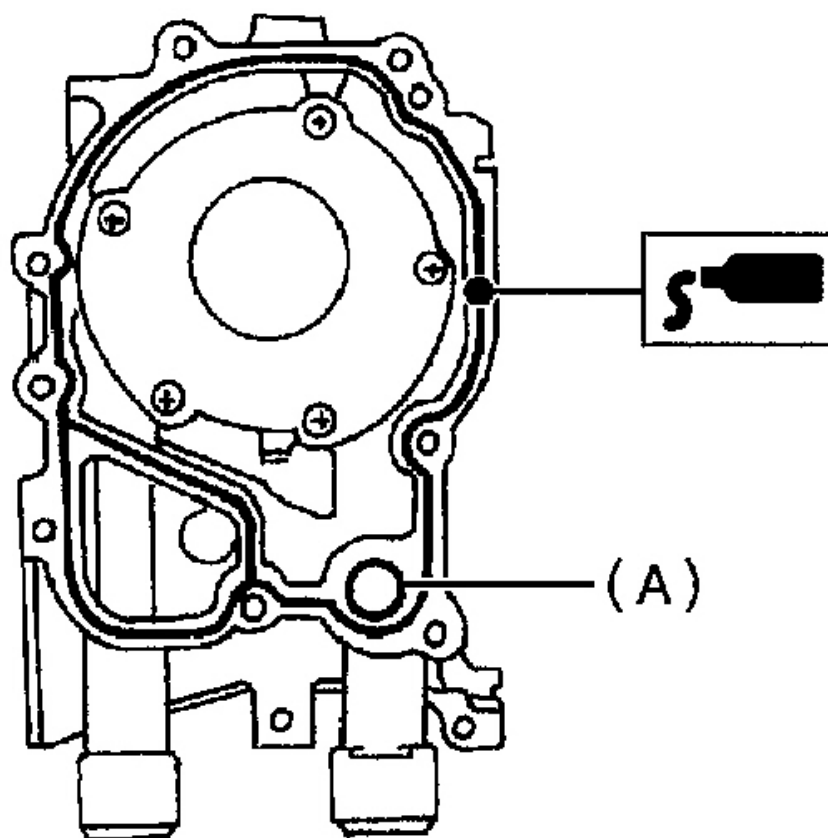
G02871127

Fig. 212: Installing Pump Front Oil Seal
Courtesy of SUBARU OF AMERICA, INC.

2. Apply fluid packing to the matching surface of oil pump.

Fluid packing:

THREE BOND 1215 or equivalent



(A) O-ring

G02871128

Fig. 213: Applying Fluid Packing To Matching Surface Of Oil Pump
Courtesy of SUBARU OF AMERICA, INC.

3. Apply a coat of engine oil to the inside of the oil seal.

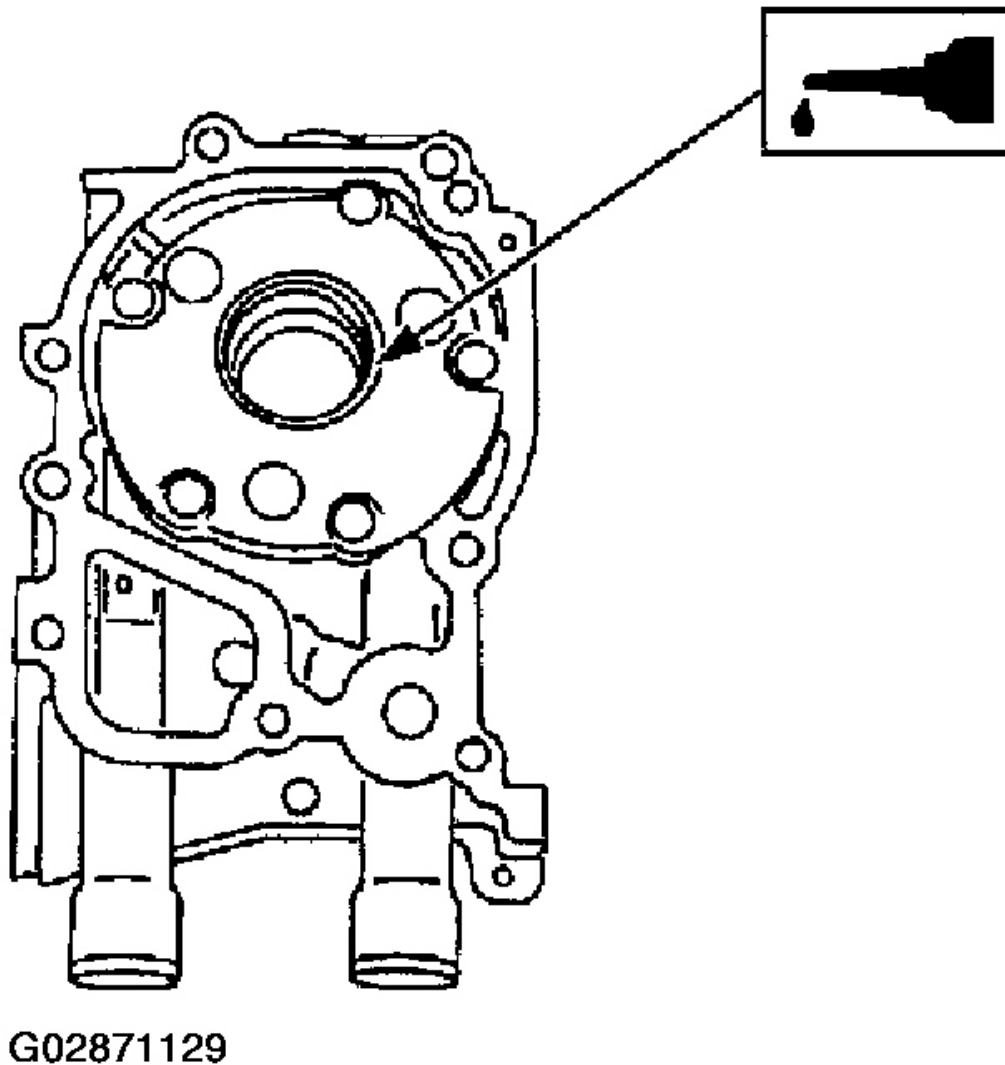


Fig. 214: Applying A Coat Of Engine Oil To Inside Of Oil Seal
Courtesy of SUBARU OF AMERICA, INC.

4. Install the oil pump on cylinder block. Be careful not to damage the oil seal during installation.

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

CAUTION:

- Do not forget to install the O-ring and seal when installing the oil pump.
- Align the flat surface of oil pump's inner rotor with

crankshaft before installation.

25. Install the water pump and gasket.

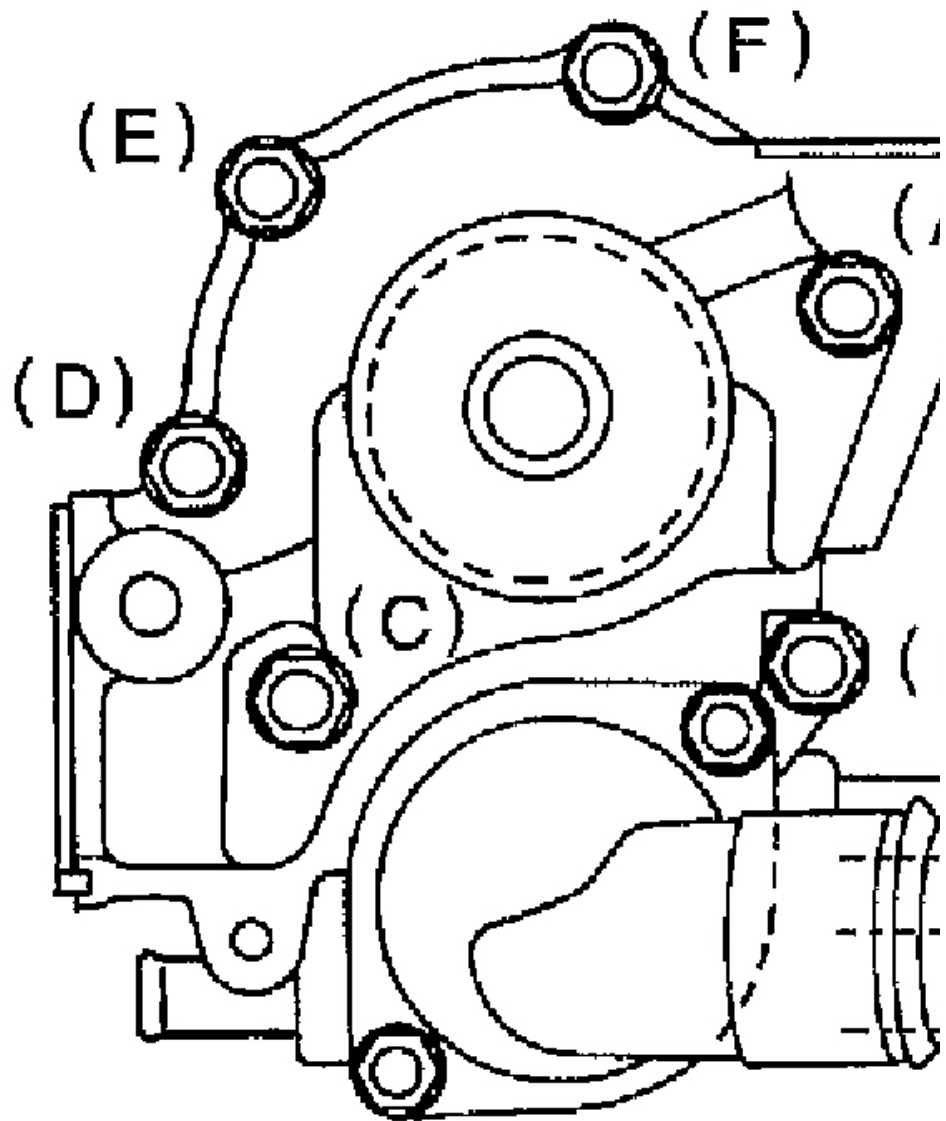
Tightening torque:

First; 12 N.m (1.2 kgf-m, 8.7 ft-lb)

Second; 12 N.m (1.2 kgf-m, 8.7 ft-lb)

CAUTION:

- **Be sure to use a new gasket.**
- **When installing the water pump, tighten bolts in two stages in alphabetical sequence as shown in the figure.**



G02871130

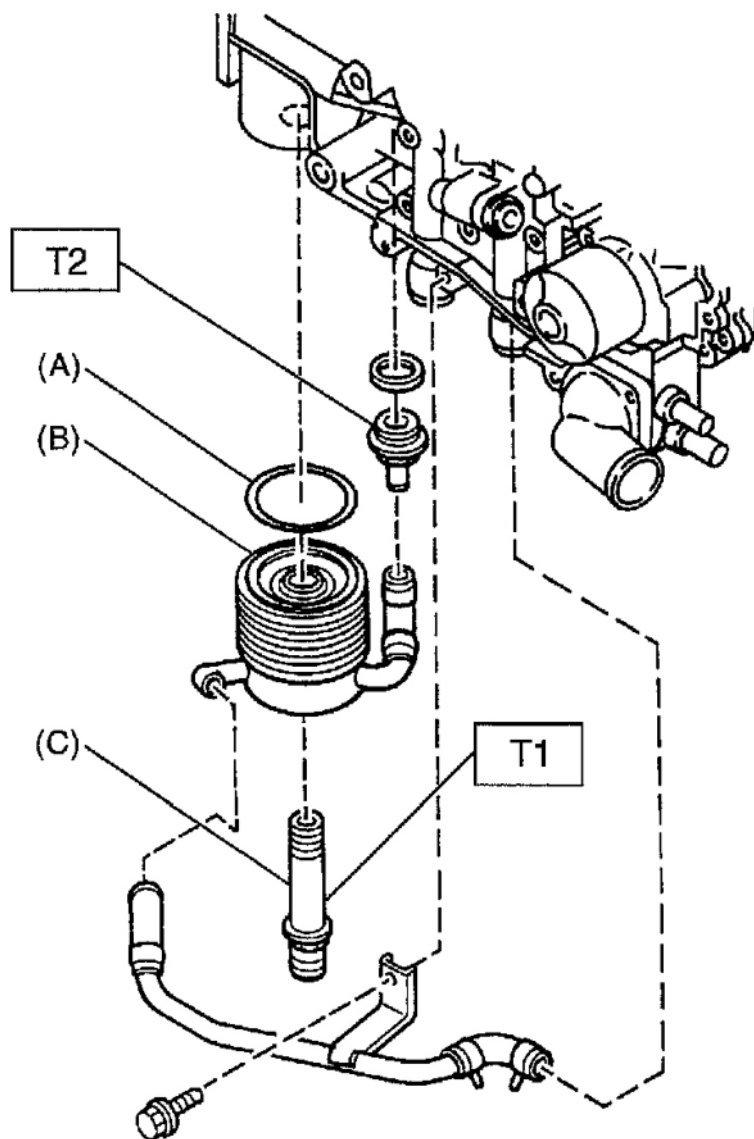
Fig. 215: Tightening Water Pump Bolts In Alphabetical Sequence
 Courtesy of SUBARU OF AMERICA, INC.

26. Install the water by-pass pipe for heater.
27. Install the oil cooler.

Tightening torque:

T1: 55 N.m (5.5 kgf-m, 40 ft-lb)

T2: 69 N.m (7.0 kgf-m, 50.6 ft-lb)



- (A) O-ring
- (B) Oil cooler
- (C) Connector

G02871131

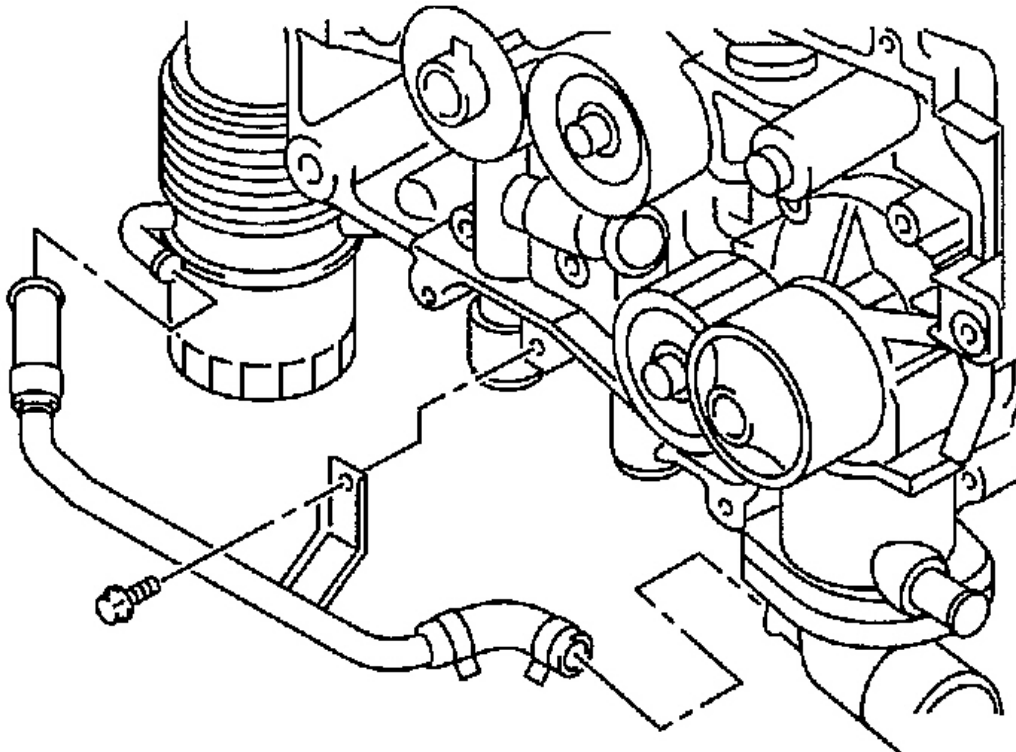
Fig. 216: Installing Oil Cooler

Courtesy of SUBARU OF AMERICA, INC.

28. Install the oil filter using ST.

ST 498547000 OIL FILTER WRENCH

29. Install the water by-pass pipe between oil cooler and water pump.



G02871132

Fig. 217: Installing Water By-Pass Pipe Between Oil Cooler And Water Pump
Courtesy of SUBARU OF AMERICA, INC.

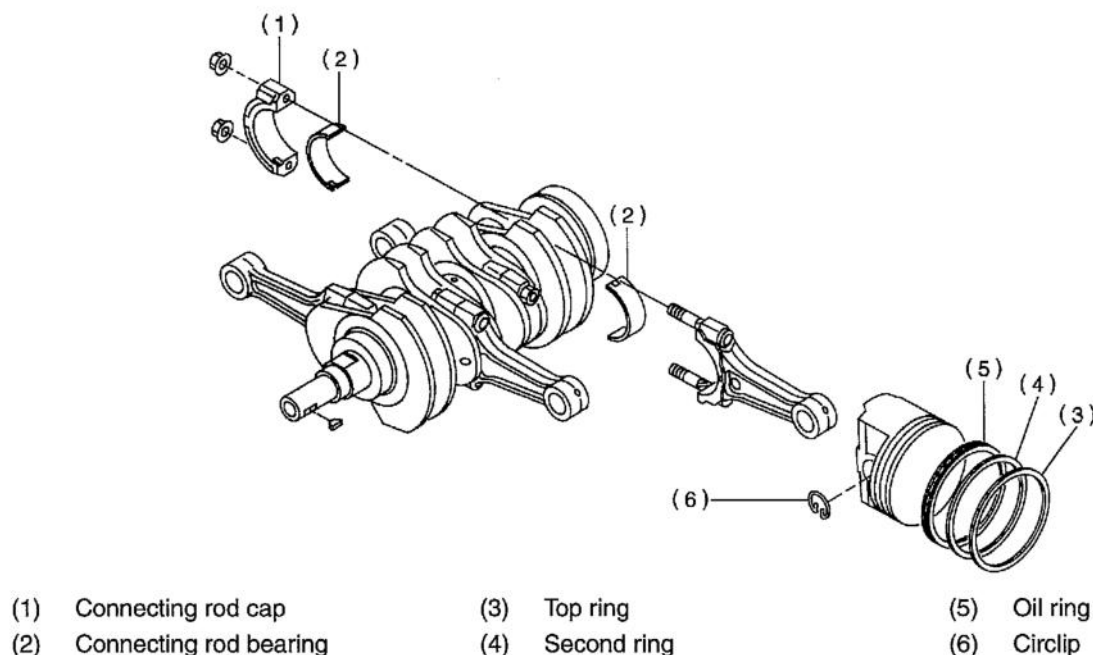
30. Install the water pipe.

NOTE: Always use a new O-ring.

31. Install the cylinder head assembly. < Ref. to **INSTALLATION**, Cylinder Head Assembly . >
32. Install the oil level gauge guide and tighten the attaching bolt (left side only).
33. Install the rocker cover.

34. Install the crankshaft sprocket. < Ref. to **INSTALLATION**, Crankshaft Sprockets
35. Install the camshaft sprocket. < Ref. to **INSTALLATION**, Camshaft Sprockets
36. Install the timing belt assembly. < Ref. to **INSTALLATION**, Timing Belt Assembly . >
37. Install the belt cover. < Ref. to **INSTALLATION**, Belt Cover . >
38. Install the crankshaft pulley. < Ref. to **INSTALLATION** , Crankshaft Pulley. >
39. Install the generator and A/C compressor brackets on cylinder head.
40. Install the V-belt. < Ref. to **INSTALLATION** , V-belt. >
41. Install the intake manifold. < Ref. to **INSTALLATION** , Intake Manifold. >

DISASSEMBLY



G02871133

Fig. 218: Disassembling Piston

Courtesy of SUBARU OF AMERICA, INC.

1. Remove the connecting rod cap.
2. Remove the connecting rod bearing.

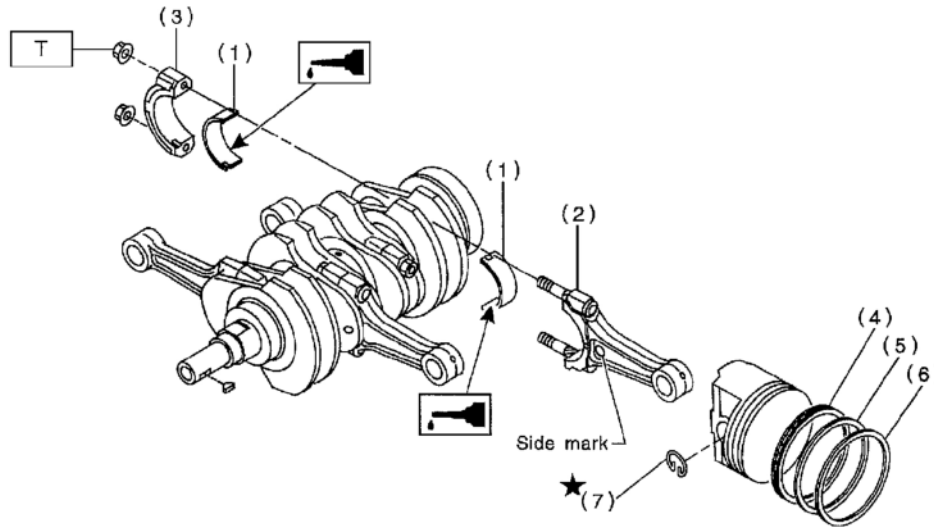
CAUTION: Arrange the removed connecting rod, connecting rod cap and bearing in order to prevent confusion.

3. Remove the piston rings using the piston ring expander.
4. Remove the oil ring by hand.

CAUTION: Arrange the removed piston rings in proper order to prevent confusion.

5. Remove the circlip.

ASSEMBLY



- (1) Connecting rod bearing
- (2) Connecting rod
- (3) Connecting rod cap
- (4) Oil ring

- (5) Second ring
- (6) Top ring
- (7) Circlip

Tightening torque: N·m (kgf-m, ft-lb)
T: 44.6 (4.55, 32.9)

G02871134

Fig. 219: Assembling Piston

Courtesy of SUBARU OF AMERICA, INC.

1. Install the connecting rod bearings on connecting rods and connecting rod caps.

CAUTION: Apply oil to the surfaces of the connecting rod bearings.

2. Install the connecting rod on crankshaft.

CAUTION: Position each connecting rod with the side marked facing forward.

3. Install the connecting rod cap with connecting rod nut.

Ensure the arrow on connecting rod cap faces the front during installation.

CAUTION:

- Each the connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching number.
- When tightening the connecting rod nuts, apply oil on the threads.

4. Install the oil ring spacer, upper rail and lower rail in this order by hand. Then install the second ring and top ring with a piston ring expander.

INSPECTION**CYLINDER BLOCK**

1. Visually check for cracks and damage. Especially, inspect the important parts by means of red lead check.
2. Check the oil passages for clogging.
3. Inspect the crankcase surface that mates with cylinder head for warping by using a straight edge, and correct by grinding if necessary.

Warping limit: 0.05 mm (0.0020 in)

Grinding limit: 0.1 mm (0.004 in)

Standard height of cylinder block: 201.0 mm (7.91 in)

CYLINDER AND PISTON

1. The cylinder bore size is stamped on the cylinder block's front upper surface.

CAUTION: Measurement should be performed at a temperature of 20°C (68°F).

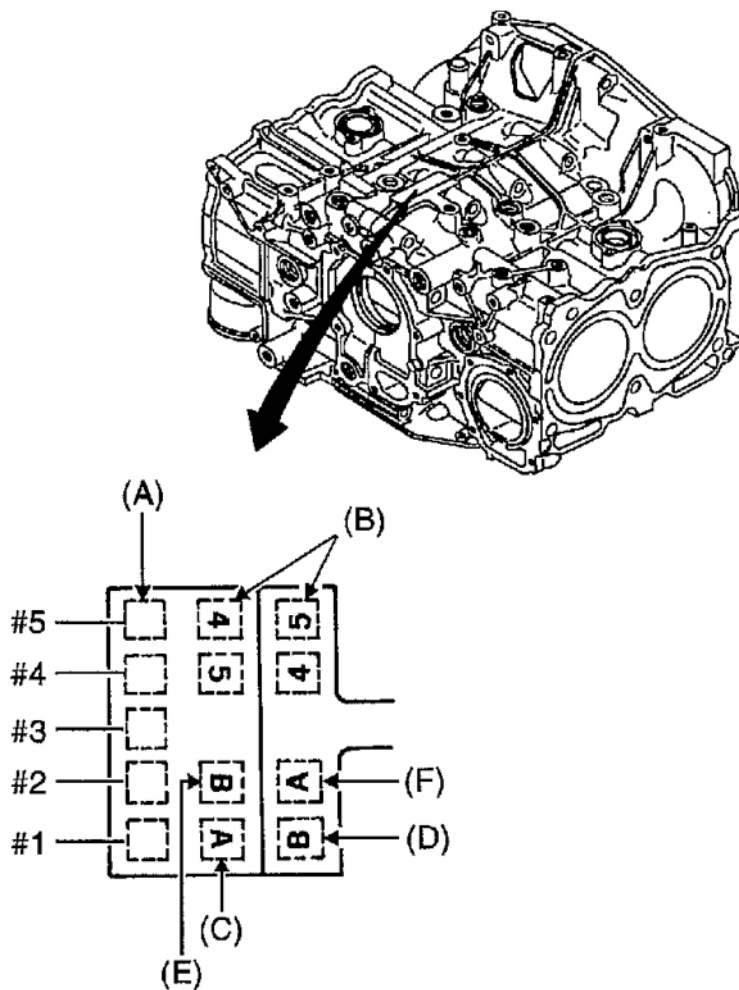
NOTE:

Standard sized pistons are classified into two grades, "A" and "B". These grades should be used as a guide line in selecting a standard piston.

Standard diameter:

A: 92.005 - 92.015 mm (3.6222 - 3.6226 in)

B: 91.995 - 92.005 mm (3.6218 - 3.6222 in)



- (A) Main journal size mark
- (B) Cylinder block RH-LH combination mark
- (C) #1 cylinder bore size mark
- (D) #2 cylinder bore size mark
- (E) #3 cylinder bore size mark
- (F) #4 cylinder bore size mark

G02871135

Fig. 220: Identifying Cylinder Bore Size Is Stamped On Cylinder Block'S Front Upper Surface
 Courtesy of SUBARU OF AMERICA, INC.

2. How to measure the inner diameter of each cylinder:

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

Measure the inner diameter of each cylinder in both the thrust and piston pin directions at the heights shown in the figure, using a cylinder bore gauge.

CAUTION: Measurement should be performed at a temperature of 20°C (68°F).

Taper:

Standard

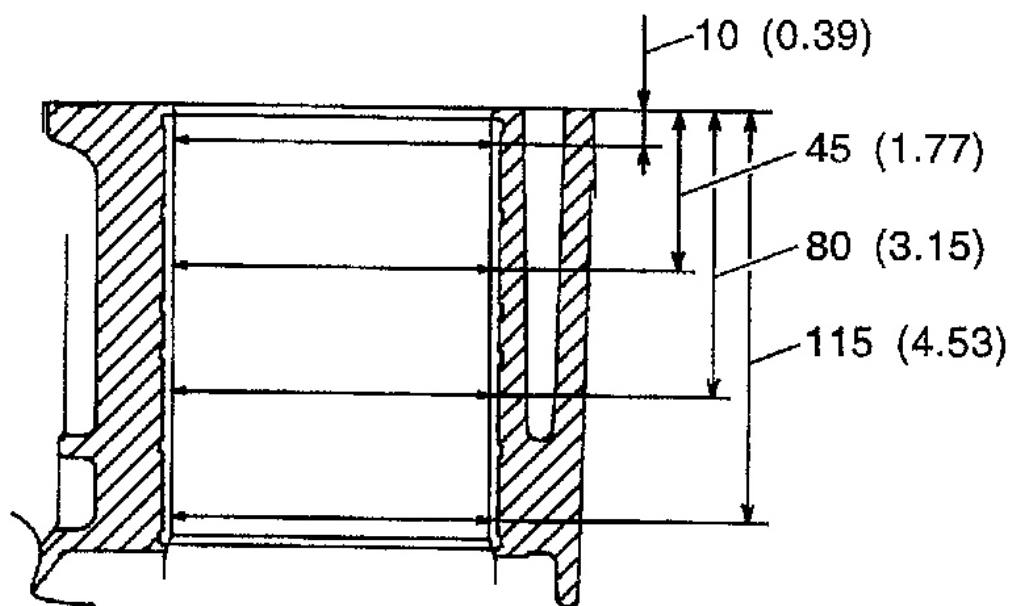
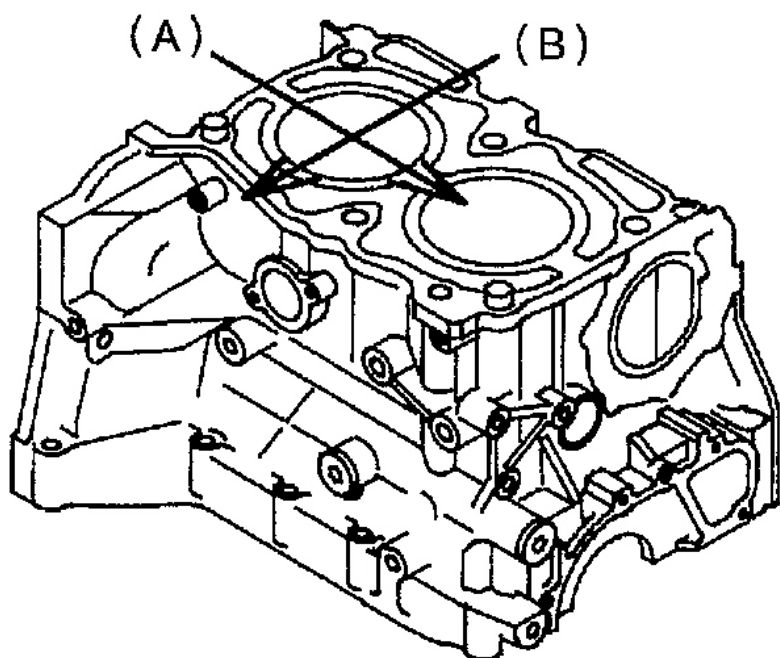
0.015 mm (0.0006 in) Limit

0.050 mm (0.0020 in)

Out-of-roundness: Standard

0.010 mm (0.0004 in) Limit

0.050 mm (0.0020 in)



Unit: mm (in)

(A) Piston pin direction

(B) Thrust direction

G02871136

Fig. 221: Measuring Inner Diameter Of Cylinder In Both Thrust And Piston Pin Directions At Heights**Courtesy of SUBARU OF AMERICA, INC.**

3. When the piston is to be replaced due to general or cylinder wear, determine a suitable sized piston by measuring the piston clearance.
4. How to measure the outer diameter of each piston:

Measure the outer diameter of each piston at the height shown in the figure. (Thrust direction)

CAUTION: Measurement should be performed at a temperature of 20°C (68°F).

Piston grade point H:

37.0 mm (1.457 in)

Piston outer diameter:

Standard

A: 91.985 - 91.995 mm

(3.6214 - 3.6218 in)

B: 91.975 - 91.985 mm

(3.6211- 3.6214 in)

0.25 mm (0.0098 in) oversize

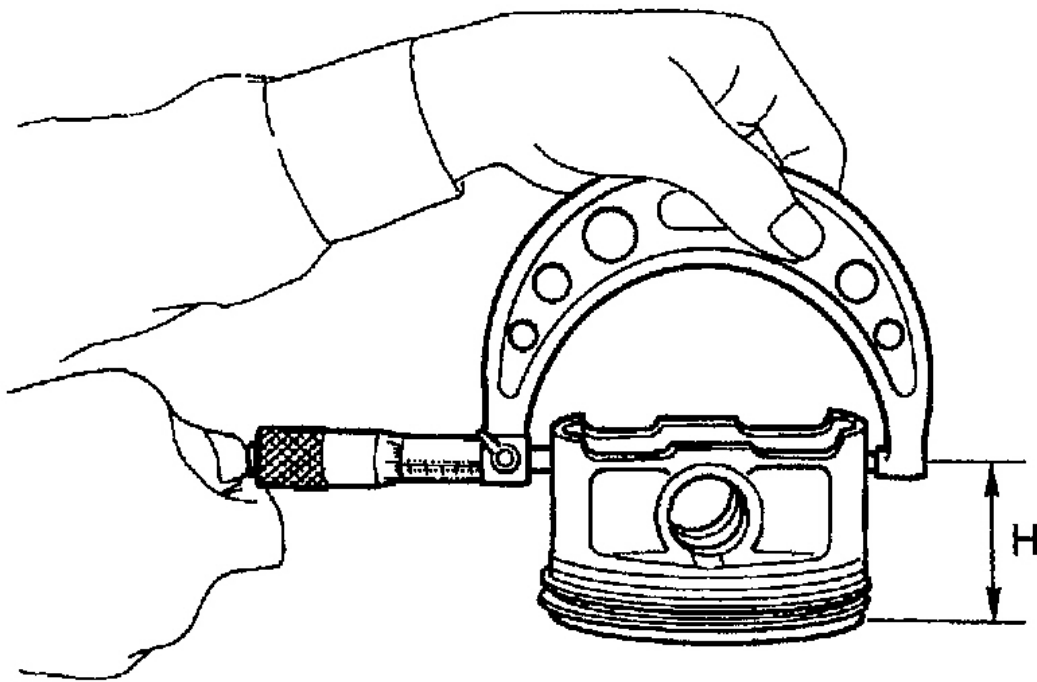
92.225 - 92.235 mm

(3.6309 -3.6313 in)

0.50 mm (0.0197 in) oversize

92.475 - 92.485 mm

(3.6407- 3.6411 in)



G02871137

Fig. 222: Measuring Outer Diameter Of Piston At Height (Thrust Direction)
Courtesy of SUBARU OF AMERICA, INC.

5. Calculate the clearance between cylinder and piston.

CAUTION: Measurement should be performed at a temperature of 20°C (68°F).

Cylinder to piston clearance at 20°C (68°F):

Standard

0.010 - 0.030 mm (0.0004 - 0.0012 in)

Limit

0.050 mm (0.0020 in)

6. Boring and honing:
 1. If the value of taper, out-of-roundness, or cylinder-to-piston clearance measured exceeds the

specified limit or if there is any damage on the cylinder wall, rebore it to use an oversize piston.

CAUTION: When any of the cylinders needs reboring, all other cylinders must be bored at the same time, and use oversize pistons. Do not perform boring on one cylinder only, nor use an oversize piston for one cylinder only.

2. If the cylinder inner diameter exceeds the limit after boring and honing, replace the crank-case.

CAUTION: Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, pay attention to this when measuring the cylinder diameter.

Limit of cylinder enlarging (boring):

0.5 mm (0.020 in)

PISTON AND PISTON PIN

1. Check the pistons and piston pins for damage, cracks, and wear and the piston ring grooves for wear and damage. Replace if defective.
2. Measure the piston-to-cylinder clearance at each cylinder. < Ref. to , INSPECTION CYLINDER AND PISTON . > If any of the clearances is not within specification, replace the piston or bore the cylinder to use an oversize piston.
3. Make sure that the piston pin can be inserted into the piston pin hole with a thumb at 20°C (68°F). Replace if defective.

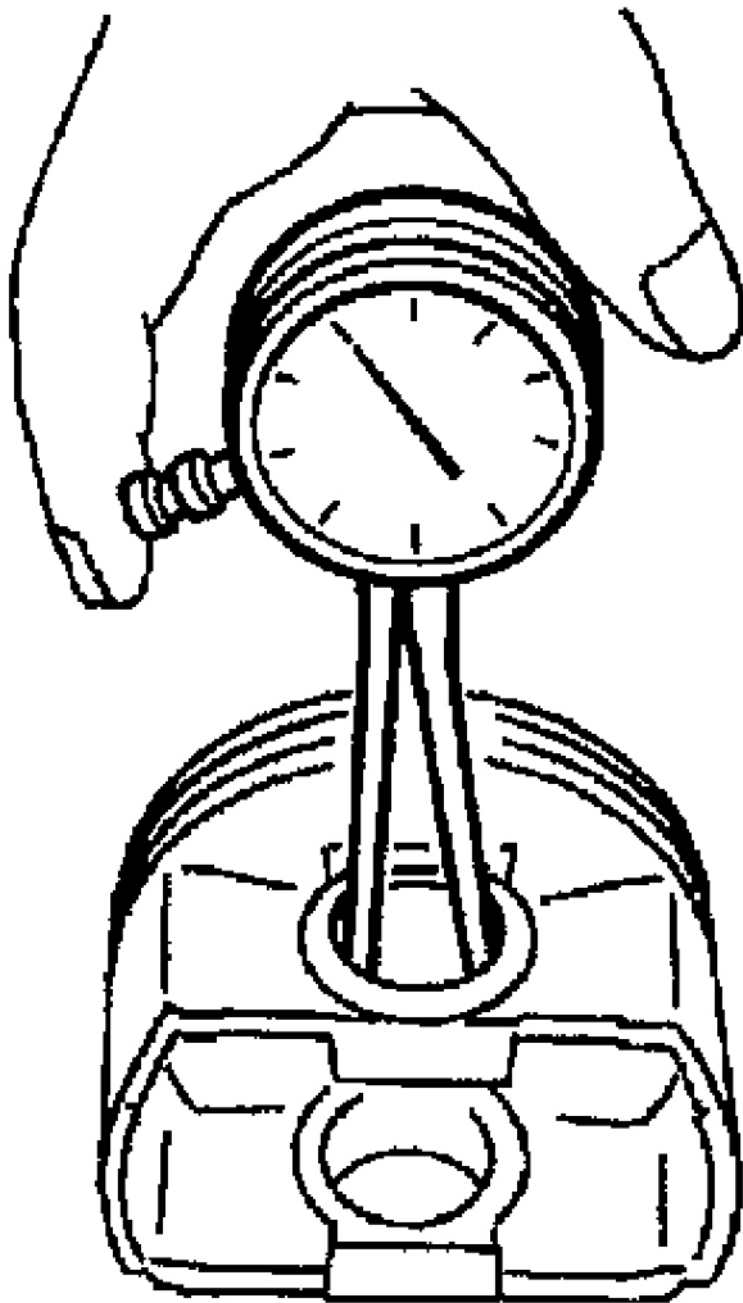
Standard clearance between piston pin and hole in piston:

Standard

0.004 - 0.008 mm (0.0002 - 0.0003 in)

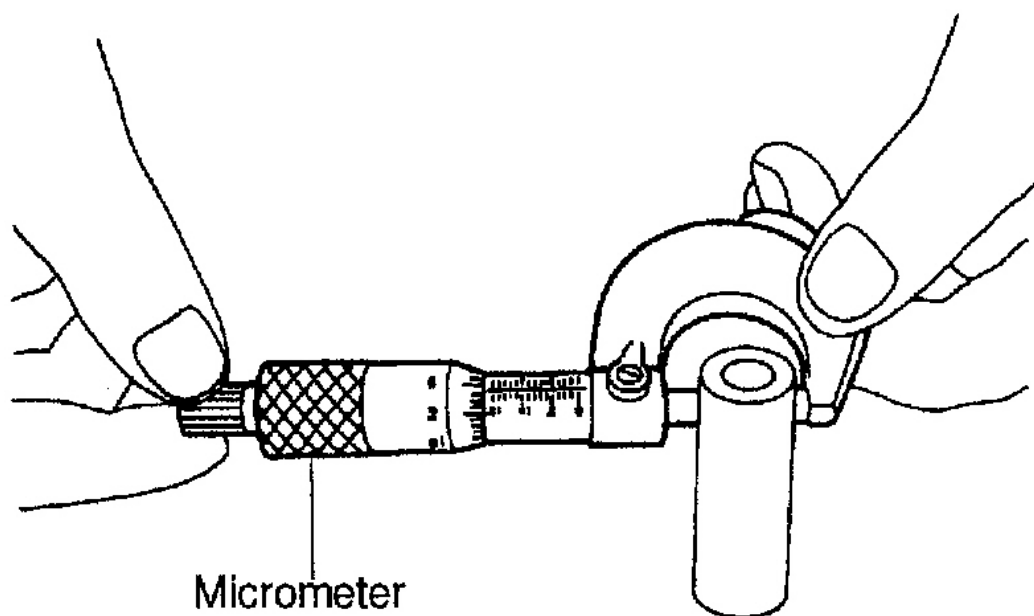
Limit

0.020 mm (0.0008 in)



G02871138

Fig. 223: Measuring Piston Pin Hole In Piston
Courtesy of SUBARU OF AMERICA, INC.

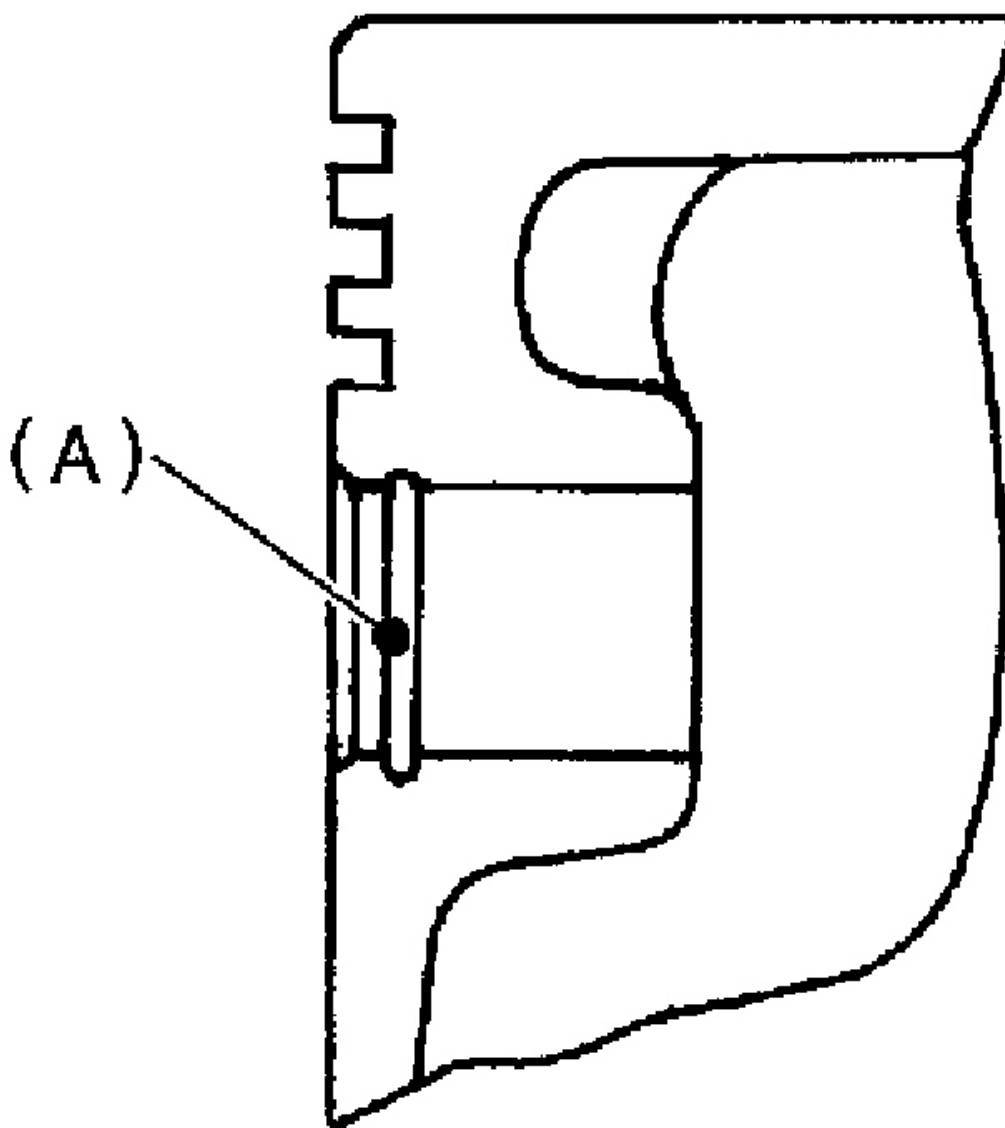


G02871139

Fig. 224: Measuring Piston Pin

Courtesy of SUBARU OF AMERICA, INC.

4. Check the circlip installation groove on the piston for burr (A). If necessary, remove burr from the groove so that the piston pin can lightly move.



G02871140

Fig. 225: Checking Circlip Installation Groove On Piston For Burr (A)
Courtesy of SUBARU OF AMERICA, INC.

5. Check the piston pin circlip for distortion, cracks and wear.

PISTON RING

1. If the piston ring is broken, damaged, or worn, or ; if its tension is insufficient, or when the piston is replaced, replace the piston ring with a new one of the same size as the piston.

CAUTION:

- "N" is marked on the end of the top and second rings. When installing rings to the piston, face this mark upward.

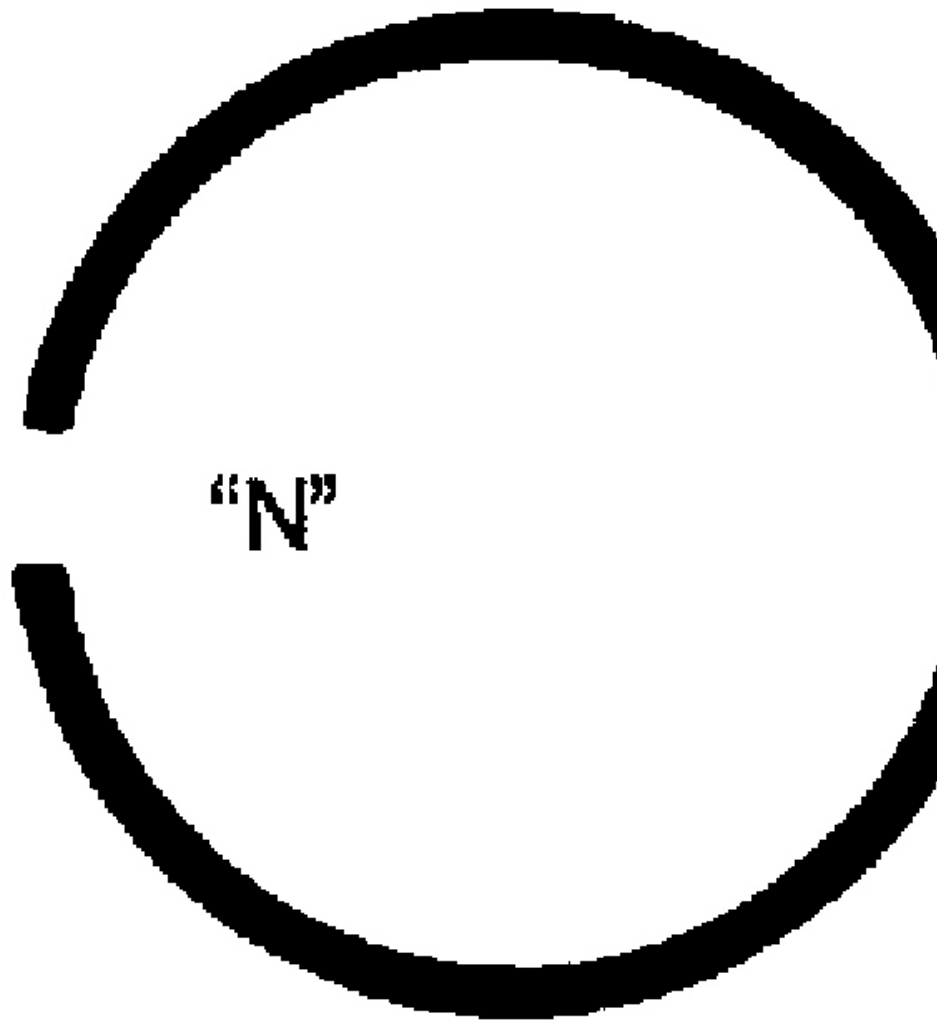
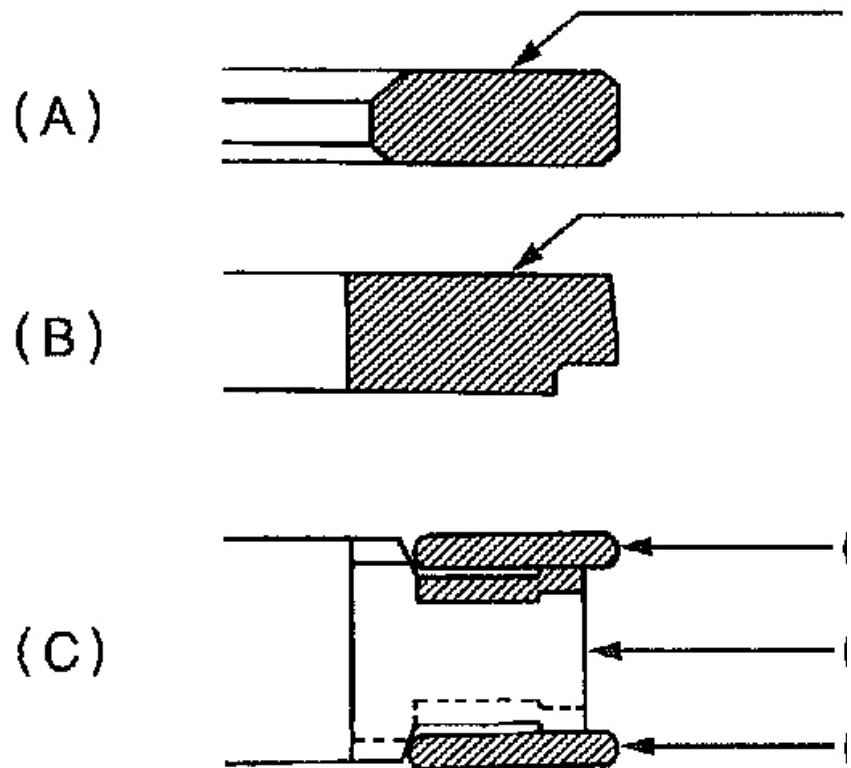
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Fig. 226: Identifying Piston Ring
Courtesy of SUBARU OF AMERICA, INC.

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

- The oil ring is a combined ring consisting of two rails and a space between. When installing, be careful to assemble correctly.



- (A) Top ring
- (B) Second ring
- (C) Oil ring
- (a) Upper rail
- (b) Spacer
- (c) Lower rail

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Fig. 227: Identifying Piston Oil Ring

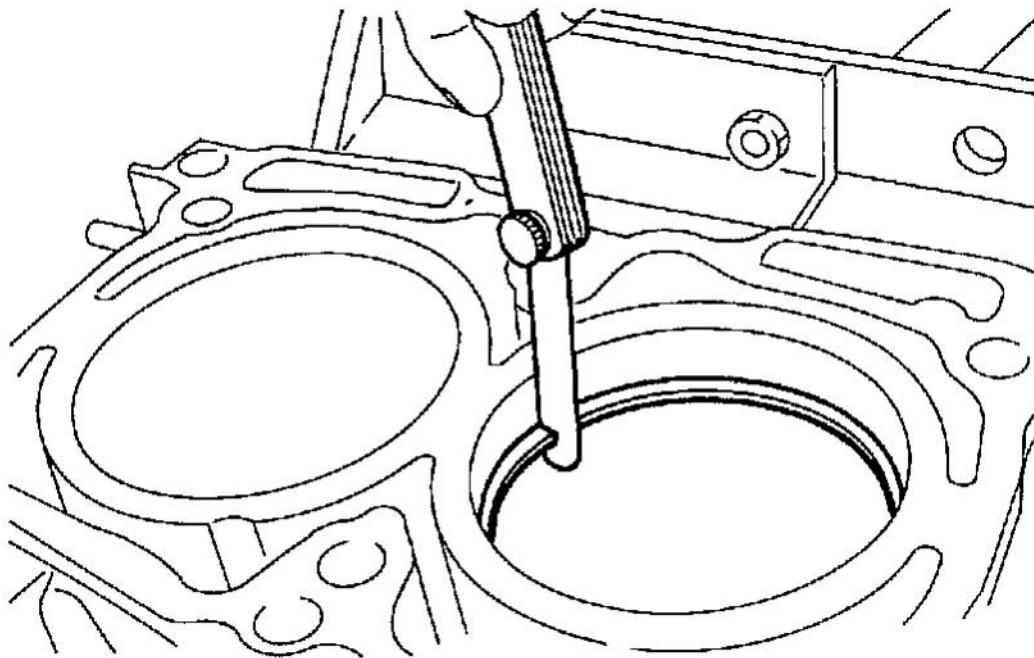
Courtesy of SUBARU OF AMERICA, INC.

2. Squarely place the piston ring and oil ring in cylinder, and measure the piston ring gap with a thickness gauge.

			Unit: mm (in)
		Standard	Limit
Piston ring gap	Top ring	0.20 — 0.35 (0.0079 — 0.0138)	1.0 (0.039)
	Second ring	0.35 — 0.50 (0.0138 — 0.0197)	1.0 (0.039)
	Oil ring rail	0.20 — 0.70 (0.0079 — 0.0276)	1.5 (0.059)

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Fig. 228: Piston Ring Gap Specifications Table
Courtesy of SUBARU OF AMERICA, INC.



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Fig. 229: Measuring Piston Ring Gap

Courtesy of SUBARU OF AMERICA, INC.

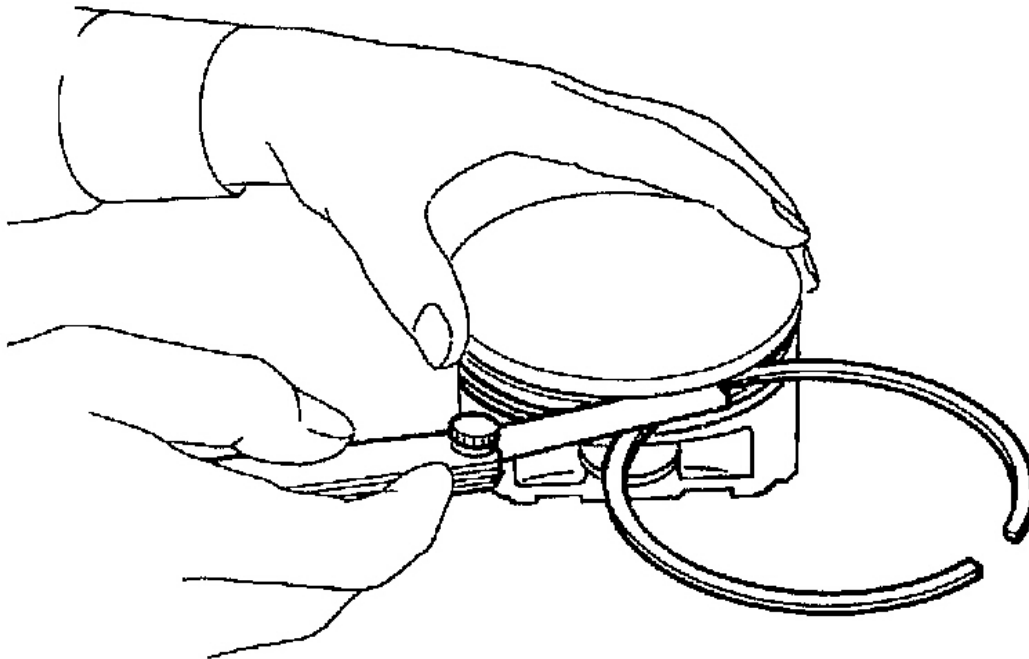
3. Measure the clearance between piston ring and piston ring groove with a thickness gauge.

CAUTION: Before measuring the clearance, clean the piston ring groove and piston ring.

			Unit: mm (in)
		Standard	Limit
Clearance between piston ring and piston ring groove	Top ring	0.040 — 0.080 (0.0016 — 0.0031)	0.15 (0.0059)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)	0.15 (0.0059)

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Fig. 230: Piston Ring And Piston Ring Groove Clearance Specifications Table
 Courtesy of SUBARU OF AMERICA, INC.



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Fig. 231: Measuring Clearance Between Piston Ring And Piston Ring Groove

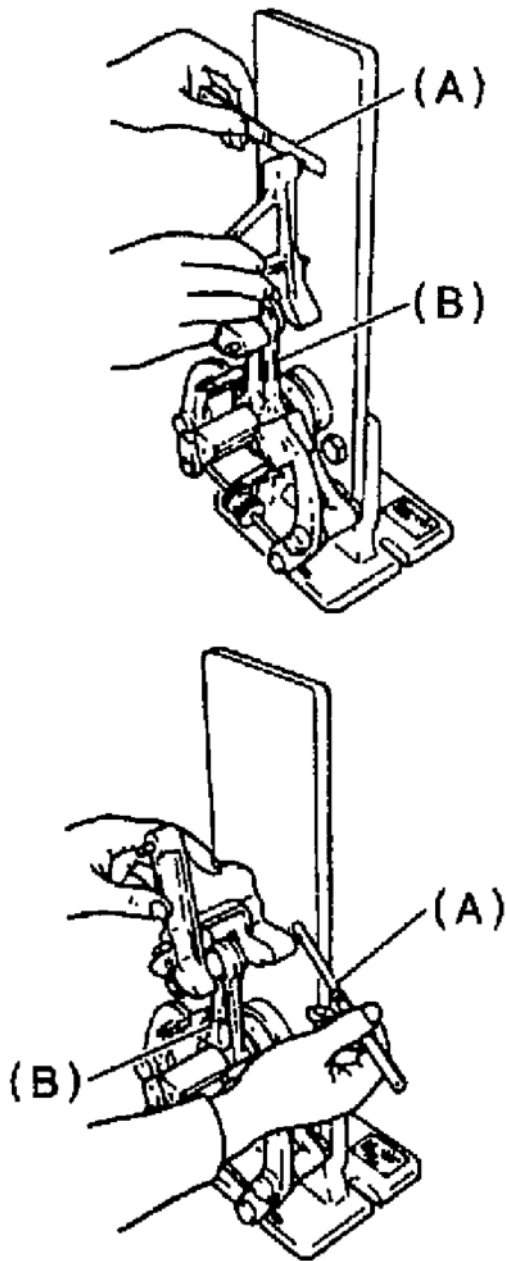
Courtesy of SUBARU OF AMERICA, INC.

CONNECTING ROD

1. Replace the connecting rod, if the large or small end thrust surface is damaged.
2. Check for bend or twist using a connecting rod aligner. Replace the connecting rod if the bend or twist exceeds the limit.

Limit of bend or twist per 100 mm (3.94 in) in length:

0.10 mm (0.0039 in)



(A) Thickness gauge

(B) Connecting rod

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Fig. 232: Checking Connecting Rod Bend Or Twist
Courtesy of SUBARU OF AMERICA, INC.

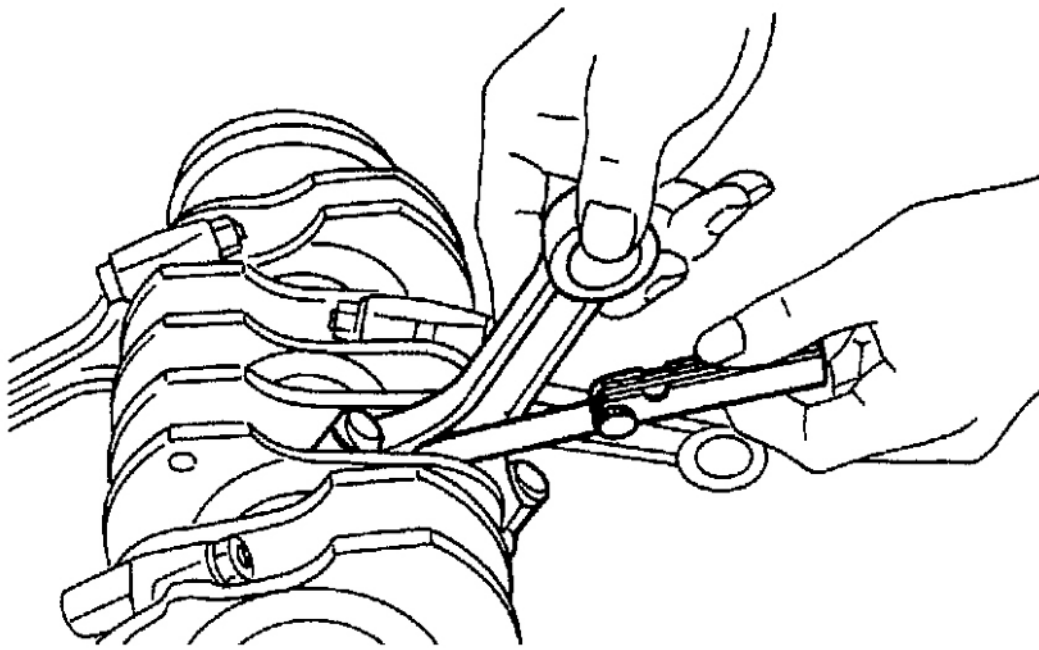
3. Install the connecting rod fitted with bearing to crankshaft and measure the side clearance (thrust clearance). Replace the connecting rod if the side clearance exceeds the specified limit.

Connecting rod side clearance:***Standard***

0.070 - 0.330 mm (0.0028 - 0.0130 in)

Limit

0.4 mm (0.016 in)



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Fig. 233: Measuring Side Clearance (Thrust Clearance)

Courtesy of SUBARU OF AMERICA, INC.

4. Inspect the connecting rod bearing for scar, peeling, seizure, melting, wear, etc.
5. Measure the oil clearance on individual connecting rod bearings by means of plastigauge. If any oil clearance is not within specification, replace the defective bearing with a new one of standard size or undersize as necessary. (See the table below.)

Connecting rod oil clearance:***Standard***

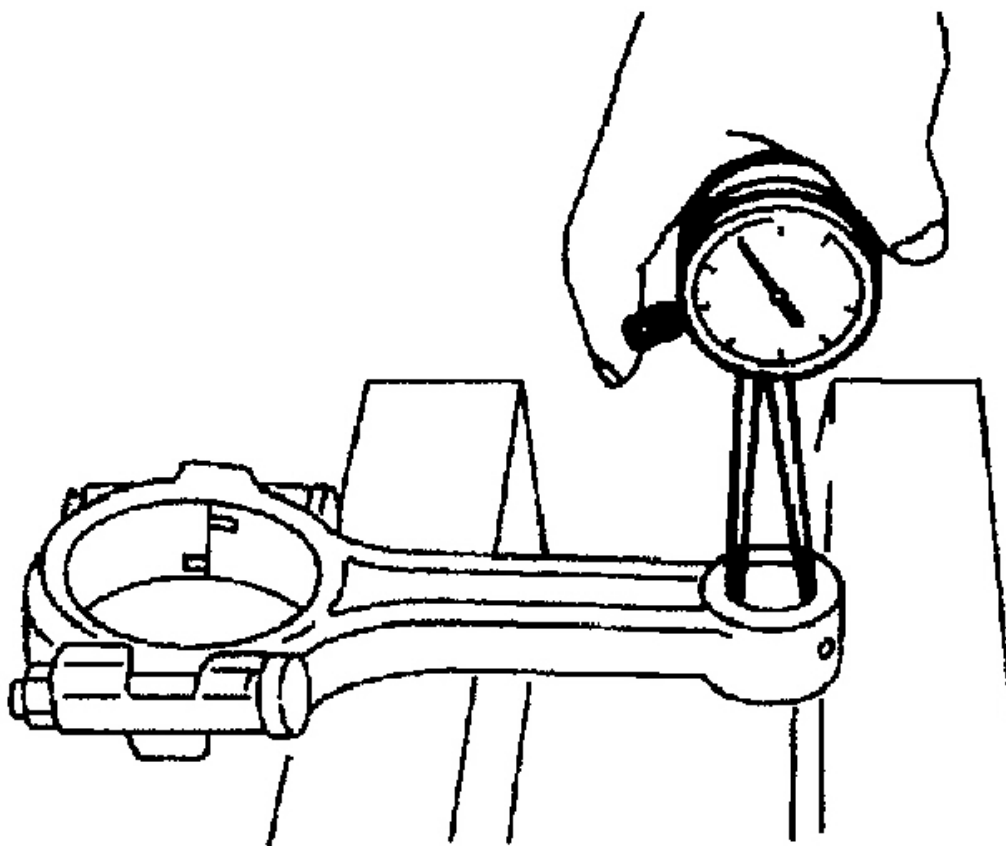
0.020 - 0.046 mm (0.0008 - 0.0018 in)

Limit***0.05 mm (0.0020 in)*****CONNECTING ROD BEARING SPECIFICATIONS**

Unit: mm (in)		
Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.492-1.501 (0.0587 - 0.0591)	47.984 - 48.000 (4.8891-1.8898)
0.03 (0.0012) undersize	1.510 - 1.513 (0.0594 - 0.0596)	47.954 - 47.970 (1.8879 - 1.8886)
0.05 (0.0020) undersize	1.520 - 1.523 (0.0598 - 0.0600)	47.934 - 47.950 (1.8872 - 1.8878)
0.25 (0.0098) undersize	1.620 - 1.623 (0.0638 - 0.0639)	47.734 - 47.750 (1.8793 - 1.8799)

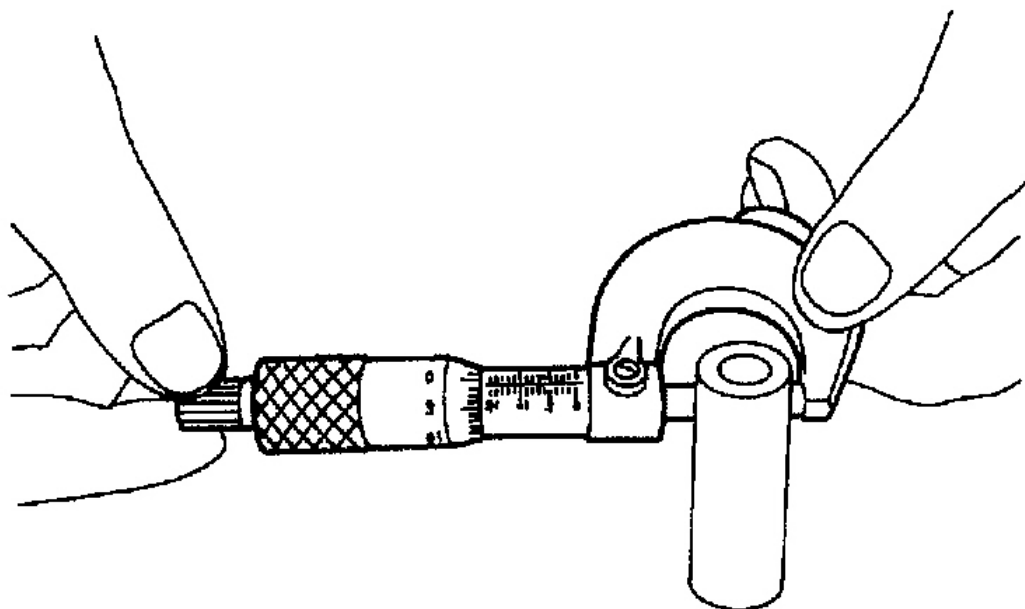
6. Inspect the bushing at connecting rod small end, and replace if worn or damaged. Also measure the piston pin clearance at the connecting rod small end.

Clearance between piston pin and bushing:***Standard******0 - 0.022 mm (0 - 0.0009 in)******Limit******0.030 mm (0.0012 in)***



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Fig. 234: Measuring Connecting Rod Small End
Courtesy of SUBARU OF AMERICA, INC.



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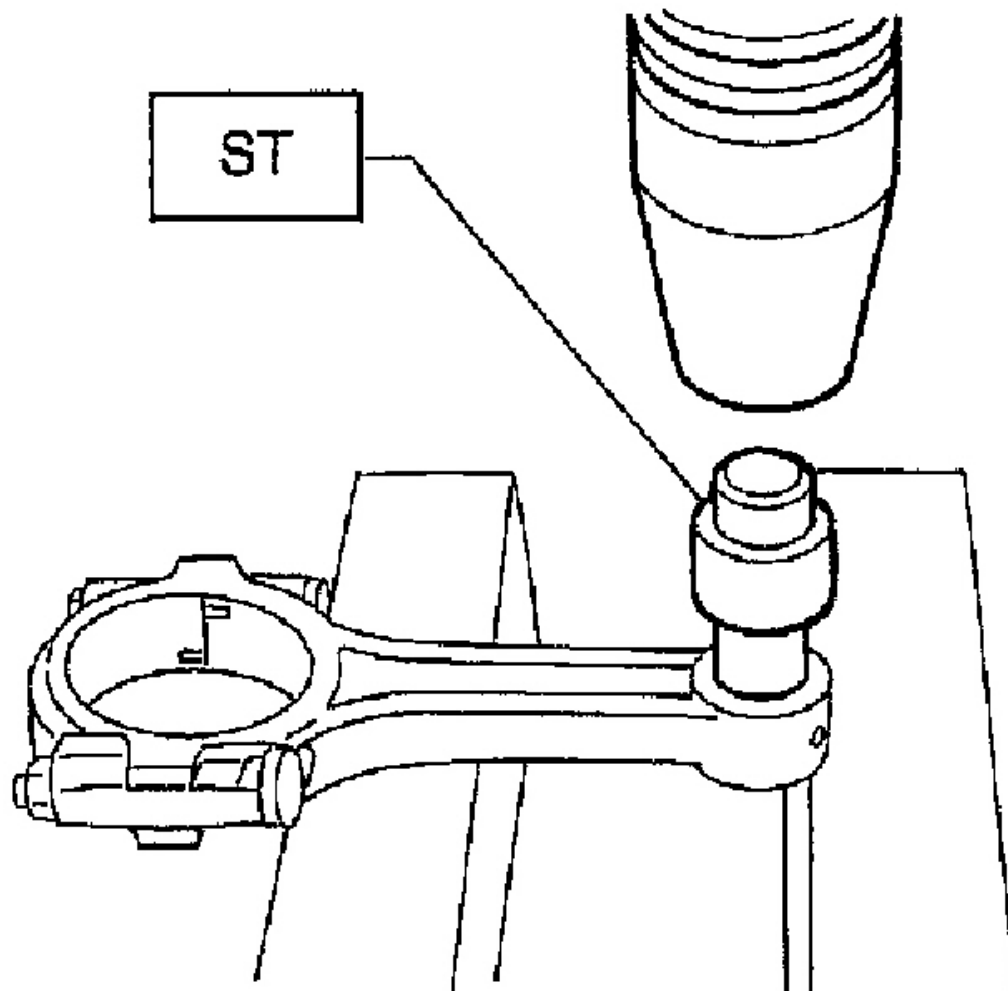
Fig. 235: Measuring Piston Pin

Courtesy of SUBARU OF AMERICA, INC.

7. Replacement procedure is as follows:

1. Remove the bushing from connecting rod with ST and press.
2. Press the bushing with ST after applying oil on the periphery of bushing.

ST 499037100 CONNECTING ROD BUSHING REMOVER AND INSTALLER



G02871151

Fig. 236: Removing Bushing From Connecting Rod
Courtesy of SUBARU OF AMERICA, INC.

3. Make two 3 mm (0.12 in) holes in bushing. Ream the inside of bushing.
4. After completion of reaming, clean the bushing to remove chips.

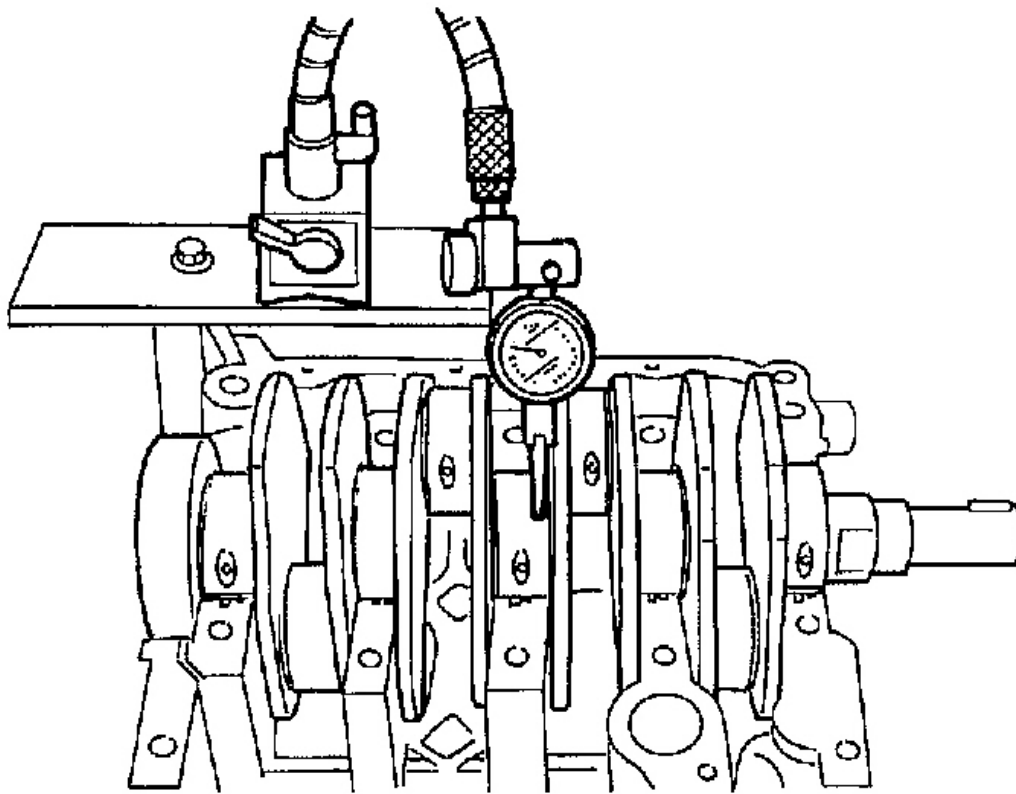
CRANKSHAFT AND CRANKSHAFT BEARING

1. Clean the crankshaft completely and check for cracks by means of red lead check etc., and replace if defective.
2. Measure the crankshaft bend, and correct or replace if it exceeds the limit.

CAUTION: If a suitable V-block is not available, install #1 and #5 crankshaft bearing on cylinder block, position crankshaft on these bearings and measure the crankshaft bend using a dial gauge.

Crankshaft bend limit:

0.035 mm (0.0014 in)



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Fig. 237: Measuring Crankshaft Bend
Courtesy of SUBARU OF AMERICA, INC.

3. Inspect the crank journal and crank pin for wear. If they are not within the specifications, replace the bearing with a suitable (undersize) one, and replace or recondition crankshaft as necessary. When grinding the crank journal or crank pin, finish them to the specified dimensions according to the undersize bearing to be used.

Crank pin and crank journal:

Out-of-roundness

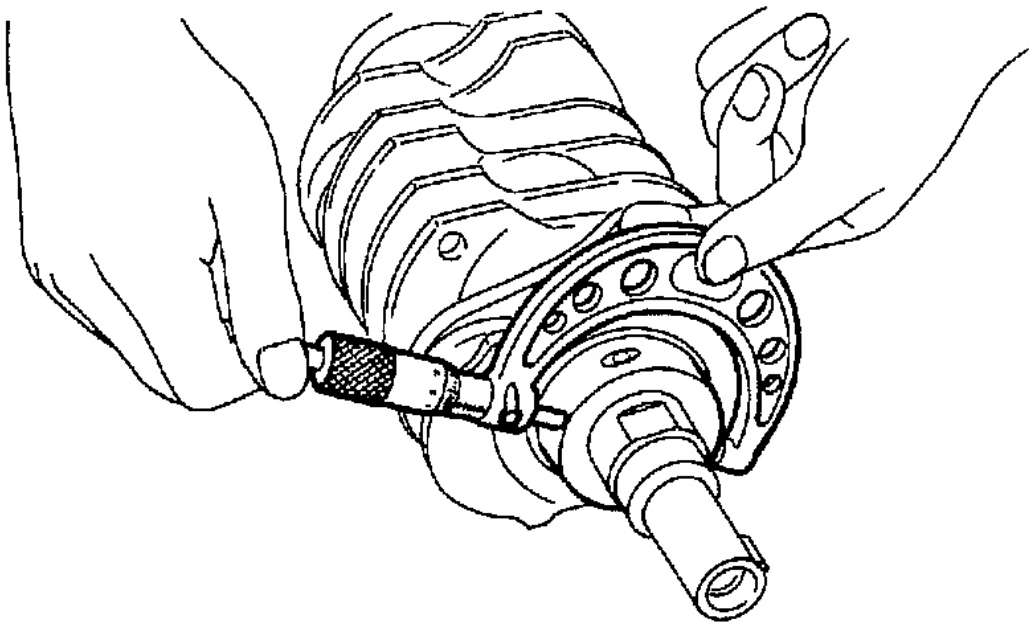
0.020 mm (0.0008 in) or less

Taper limit

0.07 mm (0.0028 in)

Grinding limit

0.250 mm (0.0098 in)



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Fig. 238: Measuring Crank Journal
Courtesy of SUBARU OF AMERICA, INC.

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

		Unit: mm (in)		
		Crank journal diameter		Crank pin diameter
		#1, #3, #5	#2, #4	
Standard	Journal O.D.	59.992 — 60.008 (2.3619 — 2.3625)	59.992 — 60.008 (2.3619 — 2.3625)	47.984 — 48.000 (1.8891 — 1.8898)
	Bearing size (Thickness at center)	1.998 — 2.011 (0.0787 — 0.0792)	2.000 — 2.013 (0.0787 — 0.0793)	1.492 — 1.510 (0.0587 — 0.0591)
0.03 (0.0012) undersize	Journal O.D.	59.962 — 59.978 (2.3607 — 2.3613)	59.962 — 59.978 (2.3607 — 2.3613)	47.954 — 47.970 (1.8879 — 1.8886)
	Bearing size (Thickness at center)	2.017 — 2.020 (0.0794 — 0.0795)	2.019 — 2.022 (0.0795 — 0.0796)	1.510 — 1.513 (0.0594 — 0.0596)
0.05 (0.0020) undersize	Journal O.D.	59.942 — 59.958 (2.3599 — 2.3605)	59.942 — 59.958 (2.3599 — 2.3605)	47.934 — 47.950 (1.8872 — 1.8878)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.520 — 1.523 (0.0598 — 0.0600)
0.25 (0.0098) undersize	Journal O.D.	59.742 — 59.758 (2.3520 — 2.3527)	59.742 — 59.758 (2.3520 — 2.3527)	47.734 — 47.750 (1.8793 — 1.8799)
	Bearing size (Thickness at center)	2.127 — 2.130 (0.0837 — 0.0839)	2.129 — 2.132 (0.0838 — 0.0839)	1.620 — 1.623 (0.0638 — 0.0639)

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Fig. 239: Crank Journal Specifications Table
Courtesy of SUBARU OF AMERICA, INC.

O.D.: Outer Diameter

4. Measure the thrust clearance of crankshaft at center bearing. If the clearance exceeds the limit, replace the bearing.

Crankshaft thrust clearance:

Standard

0.030 - 0.115 mm (0.0012 - 0.0045 in)

Limit

0.25 mm (0.0098 in)

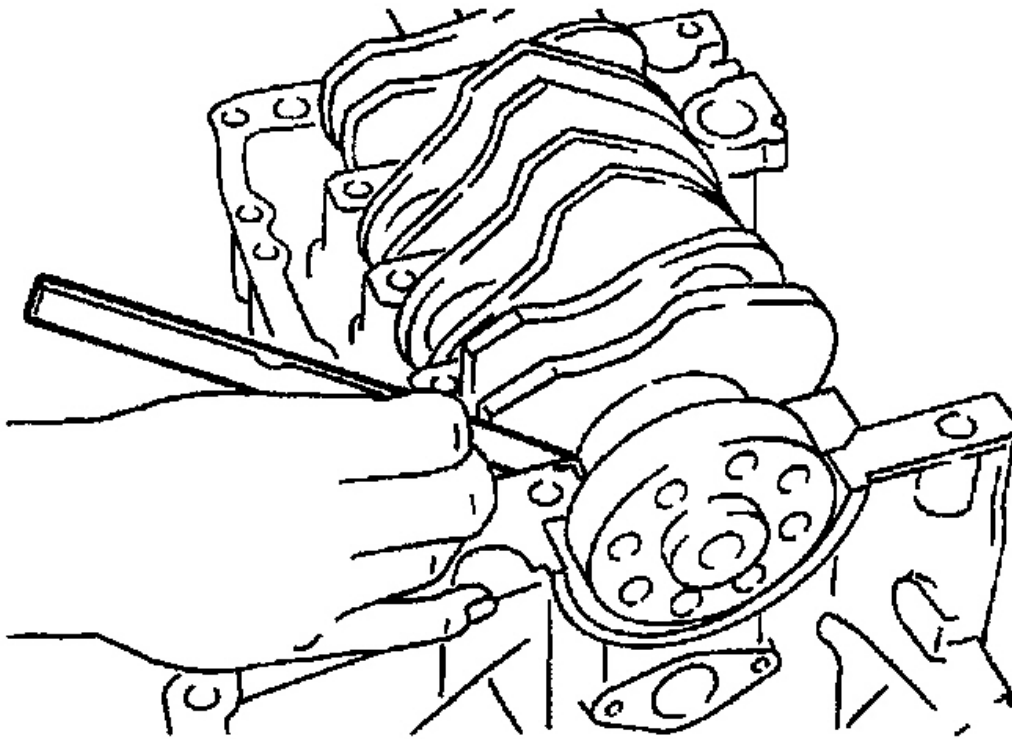
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Fig. 240: Measuring Thrust Clearance Of Crankshaft At Center Bearing
Courtesy of SUBARU OF AMERICA, INC.

5. Inspect individual crankshaft bearings for signs of flaking, seizure, melting, and wear.
6. Measure the oil clearance on each crankshaft bearing by means of plastigauge. If the measurement is not within the specification, replace the defective bearing with an undersize one, and replace or recondition the crankshaft as necessary.

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

Unit: mm (in)	
Crankshaft oil clearance	
Standard	0.010 — 0.030 (0.0004 — 0.0012)
Limit	0.040 (0.0016)

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Fig. 241: Crankshaft Oil Clearance Specifications Table
Courtesy of SUBARU OF AMERICA, INC.

ENGINE TROUBLE IN GENERAL

INSPECTION

NOTE: "RANK" shown in the chart refers to the possibility of reason for the trouble in order ("Very often" to "Rarely")

A - Very often

B - Sometimes

C - Rarely

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
1. Engine will not start.			
1) Starter does not turn.	• Starter	• Defective battery-to-starter harness	B
		• Defective starter switch	C
		• Defective inhibitor switch or neutral switch	C
		• Defective starter	B
	• Battery	• Poor terminal connection	A
		• Run-down battery	A
		• Defective charging system	B
	• Friction	• Seizure of crankshaft and connecting rod bearing	C
		• Seized camshaft	C
		• Seized or stuck piston and cylinder	C
2) Initial combustion does not occur.	• Starter	• Defective starter	C
	• Engine control system <Ref. to EN(DOHC TURBO)-2, Basic Diagnostic Procedure.>		A
	• Fuel line	• Defective fuel pump and relay	A
		• Lack of or insufficient fuel	B
	• Belt	• Defective	B
		• Defective timing	B
	• Compression	• Incorrect valve clearance	C
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	C
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	B
		• Improper engine oil (low viscosity)	B
	• Engine control system <Ref. to EN(DOHC TURBO)-2, Basic Diagnostic Procedure.>		A
3) Initial combustion occur.	• Intake system	• Defective intake manifold gasket	B
		• Defective throttle body gasket	B
	• Fuel line	• Defective fuel pump and relay	C
		• Clogged fuel line	C
		• Lack of or insufficient fuel	B
	• Belt	• Defective	B
		• Defective timing	B
	• Compression	• Incorrect valve clearance	C
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	C
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	B
		• Improper engine oil (low viscosity)	B

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Fig. 242: Engine Troubleshooting Table (1 Of 5)
 Courtesy of SUBARU OF AMERICA, INC.

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
4) Engine stalls after initial combustion.	• Engine control system <Ref. to EN(DOHC TURBO)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Loosened or cracked intake duct	B
		• Loosened or cracked PCV hose	C
		• Loosened or cracked vacuum hose	C
		• Defective intake manifold gasket	B
		• Defective throttle body gasket	B
		• Dirty air cleaner element	C
	• Fuel line	• Clogged fuel line	C
		• Lack of or insufficient fuel	B
	• Belt	• Defective	B
		• Defective timing	B
	• Compression	• Incorrect valve clearance	C
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	C
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	B
		• Improper engine oil (low viscosity)	B
2. Rough idle and engine stall	• Engine control system <Ref. to EN(DOHC TURBO)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Loosened or cracked intake duct	A
		• Loosened or cracked PCV hose	A
		• Loosened or cracked vacuum hose	A
		• Defective intake manifold gasket	B
		• Defective throttle body gasket	B
		• Defective PCV valve	C
		• Loosened oil filler cap	B
		• Dirty air cleaner element	C
	• Fuel line	• Defective fuel pump and relay	C
		• Clogged fuel line	C
		• Lack of or insufficient fuel	B
	• Belt	• Defective timing	C
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	B
		• Loosened cylinder head bolts or defective gasket	B
		• Improper valve seating	B
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	B
		• Incorrect valve timing	A
		• Improper engine oil (low viscosity)	B
	• Lubrication system	• Incorrect oil pressure	B
		• Defective rocker cover gasket	C
	• Cooling system	• Overheating	C
	• Others	• Malfunction of evaporative emission control system	A
		• Stuck or damaged throttle valve	B
		• Accelerator cable out of adjustment	C

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Fig. 243: Engine Troubleshooting Table (2 Of 5)

Courtesy of SUBARU OF AMERICA, INC.

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
3. Low output, hesitation and poor acceleration	• Engine control system <Ref. to EN(DOHC TURBO)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Loosened or cracked intake duct	A
		• Loosened or cracked PCV hose	A
		• Loosened or cracked vacuum hose	B
		• Defective intake manifold gasket	B
		• Defective throttle body gasket	B
		• Defective PCV valve	B
		• Loosened oil filler cap	B
		• Dirty air cleaner element	A
	• Fuel line	• Defective fuel pump and relay	B
		• Clogged fuel line	B
		• Lack of or insufficient fuel	C
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	B
		• Loosened cylinder head bolts or defective gasket	B
		• Improper valve seating	B
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	A
		• Improper engine oil (low viscosity)	B
	• Lubrication system	• Incorrect oil pressure	B
	• Cooling system	• Overheating	C
		• Over cooling	C
	• Others	• Malfunction of evaporative emission control system	A
4. Surging	• Engine control system <Ref. to EN(DOHC TURBO)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Loosened or cracked intake duct	A
		• Loosened or cracked PCV hose	A
		• Loosened or cracked vacuum hose	A
		• Defective intake manifold gasket	B
		• Defective throttle body gasket	B
		• Defective PCV valve	B
		• Loosened oil filler cap	B
		• Dirty air cleaner element	B
	• Fuel line	• Defective fuel pump and relay	B
		• Clogged fuel line	B
		• Lack of or insufficient fuel	C
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	C
		• Defective valve stem	C
		• Worn or broken valve spring	C
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	A
		• Improper engine oil (low viscosity)	B
	• Cooling system	• Overheating	B
	• Others	• Malfunction of evaporative emission control system	C

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Fig. 244: Engine Troubleshooting Table (3 Of 5)

Courtesy of SUBARU OF AMERICA, INC.

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
5. Engine does not return to idle.	• Engine control system <Ref. to EN(DOHC TURBO)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Loosened or cracked vacuum hose	A
	• Others	• Stuck or damaged throttle valve	A
		• Accelerator cable out of adjustment	B
6. Dieseling (Run-on)	• Engine control system <Ref. to EN(DOHC TURBO)-2, Basic Diagnostic Procedure.>		A
	• Cooling system	• Overheating	B
	• Others	• Malfunction of evaporative emission control system	B
7. After burning in exhaust system	• Engine control system <Ref. to EN(DOHC TURBO)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Loosened or cracked intake duct	C
		• Loosened or cracked PCV hose	C
		• Loosened or cracked vacuum hose	B
		• Defective PCV valve	B
		• Loosened oil filler cap	C
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	B
		• Defective valve stem	C
		• Worn or broken valve spring	C
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	A
	• Lubrication system	• Incorrect oil pressure	C
	• Cooling system	• Over cooling	C
	• Others	• Malfunction of evaporative emission control system	C
8. Knocking	• Engine control system <Ref. to EN(DOHC TURBO)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Loosened oil filler cap	B
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	C
		• Incorrect valve timing	B
	• Cooling system	• Overheating	A
9. Excessive engine oil consumption	• Intake system	• Loosened or cracked PCV hose	A
		• Defective PCV valve	B
		• Loosened oil filler cap	C
	• Compression	• Defective valve stem	A
		• Worn or stuck piston rings, cylinder and piston	A
	• Lubrication system	• Loosened oil pump attaching bolts and defective gasket	B
		• Defective oil filter o-ring	B
		• Defective crankshaft oil seal	B
		• Defective rocker cover gasket	B
		• Loosened oil drain plug or defective gasket	B
		• Loosened oil pan fitting bolts or defective oil pan	B

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Fig. 245: Engine Troubleshooting Table (4 Of 5)
Courtesy of SUBARU OF AMERICA, INC.

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
10. Excessive fuel consumption	• Engine control system <Ref. to EN(DOHC TURBO)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Dirty air cleaner element	A
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	B
		• Defective valve stem	C
		• Worn or broken valve spring	C
		• Worn or stuck piston rings, cylinder and piston	B
		• Incorrect valve timing	B
	• Lubrication system	• Incorrect oil pressure	C
	• Cooling system	• Over cooling	C
	• Others	• Accelerator cable out of adjustment	B

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Fig. 246: Engine Troubleshooting Table (5 Of 5)
Courtesy of SUBARU OF AMERICA, INC.

ENGINE NOISE

INSPECTION

2002 Subaru Impreza TS

2002 ENGINE 2.0L (DOHC TURBO) - Impreza

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	- Valve mechanism is defective. - Incorrect valve clearance - Worn valve rocker - Worn camshaft - Broken valve spring
Heavy and dull clank	Oil pressure is low.	- Worn crankshaft main bearing - Worn connecting rod bearing (big end)
	Oil pressure is normal.	- Loose flywheel mounting bolts - Damaged engine mounting
High-pitched clank (Spark knock)	Sound is noticeable when accelerating with an overload.	- Ignition timing advanced - Accumulation of carbon inside combustion chamber - Wrong spark plug - Improper gasoline
Clank when engine speed is medium (1,000 to 2,000 rpm).	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	- Worn crankshaft main bearing - Worn bearing at crankshaft end of connecting rod
Knocking sound when engine is operating under idling speed and engine is warm	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	- Worn cylinder liner and piston ring - Broken or stuck piston ring - Worn piston pin and hole at piston end of connecting rod
	Sound is not reduced if each fuel injector connector is disconnected in turn. (NOTE*)	- Unusually worn valve lifter - Worn cam gear - Worn camshaft journal bore in crankcase
Squeaky sound	—	Insufficient generator lubrication
Rubbing sound	—	Defective generator brush and rotor contact
Gear scream when starting engine	—	- Defective ignition starter switch - Worn gear and starter pinion
Sound like polishing glass with a dry cloth	—	- Loose drive belt - Defective water pump shaft
Hissing sound	—	- Loss of compression - Air leakage in air intake system, hoses, connections or manifolds
Timing belt noise	—	- Loose timing belt - Belt contacting case/adjacent part
Valve tappet noise	—	Incorrect valve clearance

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Fig. 247: Engine Noise Troubleshooting Table
Courtesy of SUBARU OF AMERICA, INC.

NOTE: *:When disconnecting the fuel injector connector, Malfunction Indicator Light (CHECK ENGINE light) illuminates and trouble code is stored in ECM memory. Therefore, carry out the **CLEAR MEMORY MODE** < Ref. to **CLEARING DIAGNOSTIC TROUBLE CODES** . >