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MECHANICAL

General Description

MECHANICAL

1. General Description

A: SPECIFICATION

1. EXCEPT FOR STI MODEL

Engine	Model		2.5 L	
	Cylinder arrangement		Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine	
	Valve system mechanism		Belt driven, double overhead camshaft, 4-valve/cylinder	
	Bore x Stroke		mm (in)	99.5 x 79.0 (3.92 x 3.11)
	Piston displacement		cm ³ (cu in)	2,457 (149.94)
	Compression ratio		8.4	
	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	Open	Max. retard	ATDC 5°
			Min. advance	BTDC 35°
		Close	Max. retard	ABDC 65°
			Min. advance	ABDC 25°
	Exhaust valve timing	Open	BBDC 55°	
		Close	ATDC 5°	
	Valve clearance	Intake	Standard	0.20±0.02 (0.0079±0.0008)
		Exhaust	Standard	0.35±0.02 (0.0138±0.0008)
	Idling speed [at neutral position on MT, or "P" or "N" position on AT]	rpm	No load	MT: 700±100 AT: 700±100
			A/C ON	A/C refrigerant pressure is low
A/C refrigerant pressure is high		MT: 800±100 AT: 825±100		
Ignition order		1 → 3 → 2 → 4		
Ignition timing	BTDC/rpm	MT model	17°±10°/700	
		AT model	17°±10°/700	

NOTE:

OS: Oversize US: Undersize

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Belt tension adjuster	Protrusion of adjuster rod		mm (in)	5.2 — 6.2 (0.205 — 0.244)	
Belt tensioner	Spacer O.D.		mm (in)	17.955 — 17.975 (0.7069 — 0.7077)	
	Tensioner bushing I.D.		mm (in)	18.0 — 18.08 (0.7087 — 0.7118)	
	Clearance between spacer and bushing	mm (in)	Standard	0.025 — 0.125 (0.0010 — 0.0049)	
			Limit	0.175 (0.069)	
	Side clearance of spacer	mm (in)	Standard	0.2 — 0.55 (0.0079 — 0.0217)	
Limit			0.81 (0.0319)		
Camshaft	Bending limit		mm (in)	0.020 (0.00079)	
	Thrust clearance	mm (in)	Standard	0.068 — 0.116 (0.0027 — 0.0046)	
			Limit	0.14 (0.0055)	
	Cam lobe height	mm (in)	Intake	Standard	46.55 — 46.65 (1.833 — 1.837)
				Limit	46.45(1.829)
			Exhaust	Standard	46.75 — 46.85 (1.841 — 1.844)
				Limit	46.65(1.837)
	Journal O.D.	mm (in)	Standard	Front	37.946 — 37.963 (1.4939 — 1.4946)
				Center rear	29.946 — 29.963 (1.1790 — 1.1796)
	Oil clearance	mm (in)	Standard	0.037 — 0.072 (0.0015 — 0.0028)	
Limit			0.10 (0.0039)		
Cylinder head	Surface warpage limit (Mating surface with cylinder block)		mm (in)	0.035 (0.0014)	
	Grinding limit		mm (in)	0.3 (0.012)	
	Standard height		mm (in)	127.5 (5.02)	
Valve seat	Seating angle			90°	
	Contacting width	mm (in)	Intake	Standard	0.6 — 1.4 (0.024 — 0.055)
				Limit	1.7 (0.067)
			Exhaust	Standard	1.2 — 1.8 (0.047 — 0.071)
				Limit	2.2 (0.087)
Valve guide	Inside diameter		mm (in)	6.000 — 6.012 (0.2362 — 0.2367)	
	Protrusion above head		mm (in)	15.8 — 16.2 (0.622 — 0.638)	
Valve	Head edge thickness	mm (in)	Intake	Standard	1.0 — 1.4 (0.039 — 0.055)
				Limit	0.8 (0.031)
			Exhaust	Standard	1.3 — 1.7 (0.051 — 0.067)
				Limit	0.8 (0.031)
	Stem outer diameter	mm (in)	Intake	5.955 — 5.970 (0.2344 — 0.2350)	
			Exhaust	5.945 — 5.960 (0.2341 — 0.2346)	
	Valve stem gap	mm (in)	Standard	Intake	0.030 — 0.057 (0.0012 — 0.0022)
				Exhaust	0.040 — 0.067 (0.0016 — 0.0026)
Limit			—	0.15 (0.0059)	
Overall length	mm (in)	Intake	104.4 (4.110)		
		Exhaust	104.65 (4.120)		
Valve spring	Free length		mm (in)	47.32 (1.863)	
	Squareness			2.5°, 2.1 mm (0.083 in) or less	
	Tension/spring height	N (kgf, lbf)/mm (in)	Set	205 — 235 (20.9 — 24.0, 46.1 — 52.8)/36.0 (1.417)	
Lift			426 — 490 (43.4 — 50.0, 95.8 — 110)/26.50 (1.043)		
Valve lifter	Outer diameter		mm (in)	34.959 — 34.975 (1.3763 — 1.3770)	
	Inner diameter (cylinder head)		mm (in)	34.994 — 35.016 (1.3777 — 1.3786)	
	Valve lifter clearance	mm (in)	Standard	0.019 — 0.057 (0.0007 — 0.0022)	
Limit			0.100 (0.0039)		

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Cylinder block	Surface warpage limit (Mating surface with cylinder head)		mm (in)	0.025 (0.00098)			
	Grinding limit		mm (in)	0.1 (0.004)			
	Standard height		mm (in)	201.0 (7.91)			
	Inside diameter	mm (in)	Standard	A	99.505 — 99.515 (3.9175 — 3.9179)		
				B	99.495 — 99.505 (3.9171 — 3.9175)		
	Taper	mm (in)	Standard	Limit	0.015 (0.0006)		
				Limit	0.050 (0.0020)		
	Out-of-roundness	mm (in)	Standard	Limit	0.010 (0.0004)		
				Limit	0.050 (0.0020)		
Piston clearance	mm (in)	Standard	Limit	-0.010 — 0.010 (-0.0004 — 0.0004)			
			Limit	0.030 (0.0012)			
Cylinder inner diameter boring limit (diameter)			mm (in)	To 100.005 (3.937)			
Piston	Outer diameter	mm (in)	Standard	A	99.505 — 99.515 (3.9175 — 3.9179)		
				B	99.495 — 99.505 (3.9171 — 3.9175)		
			0.25 (0.0098) OS				99.745 — 99.765 (3.9270 — 3.9278)
			0.50 (0.0197) OS				99.995 — 100.015 (3.9368 — 3.9376)
Piston pin	Standard clearance between piston and piston pin		mm (in)	Standard	0.004 — 0.008 (0.0002 — 0.0003)		
					Limit	0.020 (0.0008)	
	Degree of fit				Piston pin must be fitted into position with thumb at 20°C (68°F).		
Piston ring	Ring closed gap	mm (in)	Top ring	Standard	0.20 — 0.25 (0.0079 — 0.0098)		
				Limit	1.0 (0.039)		
			Second ring	Standard	0.37 — 0.52 (0.015 — 0.020)		
				Limit	1.0 (0.039)		
	Oil ring	mm (in)	Standard	0.20 — 0.50 (0.0079 — 0.0197)			
			Limit	1.5 (0.059)			
	Ring groove gap	mm (in)	Top ring	Standard	0.04 — 0.08 (0.0016 — 0.0031)		
				Limit	0.15 (0.0059)		
Second ring			Standard	0.030 — 0.070 (0.0012 — 0.0028)			
			Limit	0.15 (0.0059)			
Connecting rod	Bend or twist per 100 mm (3.94 in) in length		mm (in)	Limit	0.10 (0.0039)		
	Thrust clearance		mm (in)	Standard	0.070 — 0.330 (0.0028 — 0.0130)		
Bearing of large end	Oil clearance		mm (in)	Standard	0.017 — 0.045 (0.0007 — 0.0018)		
				Limit	0.05 (0.0020)		
	Thickness at center portion		mm (in)	Standard	1.490 — 1.502 (0.0587 — 0.0591)		
				0.03 (0.0012) US	1.504 — 1.512 (0.0592 — 0.0595)		
				0.05 (0.0020) US	1.514 — 1.522 (0.0596 — 0.0599)		
				0.25 (0.0098) US	1.614 — 1.622 (0.0635 — 0.0639)		
Bushing of small end	Clearance between piston pin and bushing		mm (in)	Standard	0 — 0.022 (0 — 0.0009)		
				Limit	0.030 (0.0012)		

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Crankshaft	Bending limit		mm (in)	0.035 (0.0014)		
	Crank pin	mm (in)	Out-of-roundness		0.003 (0.0001)	
			Cylindricity		0.004 (0.0002)	
			Grinding limit value (dia.)		To 51.750 (2.0374)	
	Crank journal	mm (in)	Out-of-roundness		0.005 (0.0002)	
			Cylindricity		0.006 (0.0002)	
			Grinding limit value (dia.)		To 59.758 (2.3527)	
	Crank pin outer diameter	mm (in)	Standard	51.984 — 52.000 (2.0466 — 2.0472)		
			0.03 (0.0012) US	51.954 — 51.970 (2.0454 — 2.0461)		
			0.05 (0.0020) US	51.934 — 51.950 (2.0447 — 2.0453)		
			0.25 (0.0098) US	51.734 — 51.750 (2.0368 — 2.0374)		
	Crank journal outer diameter	mm (in)	Standard	59.992 — 60.008 (2.3619 — 2.3625)		
			0.03 (0.0012) US	59.962 — 59.978 (2.3607 — 2.3613)		
			0.05 (0.0020) US	59.942 — 59.958 (2.3599 — 2.3605)		
			0.25 (0.0098) US	59.742 — 59.758 (2.3520 — 2.3527)		
	Thrust clearance	mm (in)	Standard	0.030 — 0.115 (0.0012 — 0.0045)		
Limit			0.25 (0.0098)			
Oil clearance	mm (in)	Standard	0.010 — 0.030 (0.0004 — 0.0012)			
		Limit	0.40 (0.0016)			
Main bearing	Thickness at center portion	#1, #3	mm (in)	Standard	1.998 — 2.011 (0.0787 — 0.0792)	
			0.03 (0.0012) US	2.017 — 2.020 (0.0794 — 0.0795)		
			0.05 (0.0020) US	2.027 — 2.030 (0.0798 — 0.0799)		
			0.25 (0.0098) US	2.127 — 2.130 (0.0837 — 0.0839)		
		#2, #4, #5	mm (in)	Standard	2.000 — 2.013 (0.0787 — 0.0793)	
			0.03 (0.0012) US	2.019 — 2.022 (0.0795 — 0.0796)		
			0.05 (0.0020) US	2.029 — 2.032 (0.0799 — 0.0800)		
			0.25 (0.0098) US	2.129 — 2.132 (0.0838 — 0.0839)		

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2. STI MODEL

Engine	Model		2.5 L	
	Cylinder arrangement		Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine	
	Valve system mechanism		Belt driven, double overhead camshaft, 4-valve/cylinder	
	Bore x Stroke		mm (in) 99.5 x 79.0 (3.917 x 3.110)	
	Piston displacement		cm ³ (cu in) 2,457 (150)	
	Compression ratio		8.2	
	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	Open	Max. retard	ATDC 5°
			Min. advance	BTDC 25°
		Close	Max. retard	ABDC 65°
			Min. advance	ABDC 35°
	Exhaust valve timing	Open		BBDC 55°
		Close		ATDC 5°
	Valve clearance	Intake	mm (in)	0.20±0.02 (0.0079±0.0008)
		Exhaust	mm (in)	0.35±0.02 (0.0138±0.0008)
Idle speed [at neutral position on MT]		rpm	700±100 (No load) 800±100 (A/C ON)	
Ignition order			1 → 3 → 2 → 4	
Ignition timing		BTDC/rpm	17°±10°/700	

NOTE:

OS: Oversize US: Undersize

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Belt tension adjuster	Protrusion of adjuster rod		mm (in)	5.2 — 6.2 (0.205 — 0.244)	
Belt tensioner	Spacer O.D.		mm (in)	17.955 — 17.975 (0.7069 — 0.7077)	
	Tensioner bushing I.D.		mm (in)	18.0 — 18.08 (0.7087 — 0.7118)	
	Clearance between spacer and bushing	mm (in)	Standard	0.025 — 0.125 (0.0010 — 0.0049)	
			Limit	0.175 (0.069)	
	Side clearance of spacer	mm (in)	Standard	0.2 — 0.55 (0.0079 — 0.0217)	
Limit			0.81 (0.0319)		
Camshaft	Bending limit		mm (in)	0.020 (0.00079)	
	Thrust clearance	mm (in)	Standard	0.068 — 0.116 (0.0027 — 0.0046)	
			Limit	0.14 (0.0055)	
	Cam lobe height	mm (in)	Intake	Standard	46.55 — 46.65 (1.833 — 1.837)
				Limit	46.45 (1.829)
			Exhaust	Standard	46.75 — 46.85 (1.841 — 1.844)
				Limit	46.65 (1.837)
	Journal O.D.	mm (in)	Standard	Front	37.946 — 37.963 (1.4939 — 1.4946)
				Center rear	29.946 — 29.963 (1.1790 — 1.1796)
	Journal oil clearance	mm (in)	Standard	0.037 — 0.072 (0.0015 — 0.0028)	
Limit			0.10 (0.0039)		
Cylinder head	Surface warpage limit		mm (in)	0.035 (0.0014)	
	Grinding limit		mm (in)	0.3 (0.012)	
	Standard height		mm (in)	127.5 (5.02)	
Valve seat	Seating angle			90°	
	Contacting width	mm (in)	Intake	Standard	0.6 — 1.4 (0.024 — 0.055)
				Limit	1.7 (0.067)
			Exhaust	Standard	1.2 — 1.8 (0.047 — 0.071)
				Limit	2.2 (0.087)
Valve guide	Inside diameter		mm (in)	6.000 — 6.012 (0.2362 — 0.2367)	
	Protrusion above head		mm (in)	15.8 — 16.2 (0.622 — 0.638)	
Valve	Head edge thickness	mm (in)	Intake	Standard	1.0 — 1.4 (0.039 — 0.055)
				Limit	0.8 (0.031)
			Exhaust	Standard	1.3 — 1.7 (0.051 — 0.067)
				Limit	0.8 (0.031)
	Stem outer diameter	mm (in)	Intake	5.955 — 5.970 (0.2344 — 0.2350)	
			Exhaust	5.945 — 5.960 (0.2341 — 0.2346)	
	Valve stem gap	mm (in)	Standard	Intake	0.030 — 0.057 (0.0012 — 0.0022)
				Exhaust	0.040 — 0.067 (0.0016 — 0.0026)
Overall length	mm (in)	Intake	104.4 (4.110)		
		Exhaust	104.65 (4.120)		
Valve spring	Free length		mm (in)	47.32 (1.863)	
	Squareness			2.5°, 2.1 mm (0.083 in) or less	
	Tension/spring height	N (kgf, lbf)/mm (in)	Set	205 — 235 (20.9 — 24.0, 46.1 — 52.8)/36.0 (1.417)	
Lift			426 — 490 (43.4 — 50.0, 95.8 — 110)/26.50 (1.043)		
Valve lifter	Outer diameter		mm (in)	34.959 — 34.975 (1.3763 — 1.3770)	
	Inner diameter (cylinder head)		mm (in)	34.994 — 35.016 (1.3777 — 1.3786)	
	Valve lifter clearance	mm (in)	Standard	0.019 — 0.057 (0.0007 — 0.0022)	
Limit			0.100 (0.0039)		

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Cylinder block	Surface warpage limit (Mating surface with cylinder head)		mm (in)	0.025 (0.00098)		
	Grinding limit		mm (in)	0.1 (0.004)		
	Standard height		mm (in)	201.0 (7.91)		
	Inside diameter	mm (in)	Standard	A	99.505 — 99.515 (3.9175 — 3.9179)	
				B	99.495 — 99.505 (3.9171 — 3.9175)	
	Taper	mm (in)	Standard	Limit	0.015 (0.0006)	
				Limit	0.050 (0.0020)	
	Out-of-roundness	mm (in)	Standard	Limit	0.010 (0.0004)	
				Limit	0.050 (0.0020)	
	Piston clearance	mm (in)	Standard	Limit	-0.010 — 0.010 (-0.0004 — 0.0004)	
Limit				0.030 (0.0012)		
Cylinder inner diameter boring limit (diameter)			mm (in)	100.005 (3.937) or less		
Piston	Outer diameter	mm (in)	Standard	A	99.505 — 99.515 (3.9175 — 3.9179)	
				B	99.495 — 99.505 (3.9171 — 3.9175)	
			0.25 (0.0098) OS			99.745 — 99.765 (3.9270 — 3.9278)
			0.50 (0.0197) OS			99.995 — 100.015 (3.9368 — 3.9376)
Piston pin	Standard clearance between piston and piston pin		mm (in)	Standard	0.004 — 0.008 (0.0002 — 0.0003)	
					Limit	0.020 (0.0008)
	Degree of fit				Piston pin must be fitted into position with thumb at 20°C (68°F).	
Piston ring	Ring closed gap	mm (in)	Top ring	Standard	0.20 — 0.25 (0.0079 — 0.0098)	
				Limit	1.0 (0.039)	
			Second ring	Standard	0.37 — 0.52 (0.015 — 0.020)	
				Limit	1.0 (0.039)	
	Oil ring	mm (in)	Standard	0.20 — 0.50 (0.0079 — 0.0197)		
			Limit	1.5 (0.059)		
	Ring groove gap	mm (in)	Top ring	Standard	0.040 — 0.080 (0.0016 — 0.0031)	
				Limit	0.15 (0.0059)	
Second ring			Standard	0.030 — 0.070 (0.0012 — 0.0028)		
			Limit	0.15 (0.0059)		
Connecting rod	Bend or twist per 100 mm (3.94 in) in length		mm (in)	Limit	0.10 (0.0039)	
	Thrust clearance		mm (in)	Standard	0.070 — 0.330 (0.0028 — 0.0130)	
Bearing of large end	Oil clearance		mm (in)	Standard	0.017 — 0.045 (0.0007 — 0.0018)	
				Limit	0.05 (0.0020)	
	Thickness at center portion		mm (in)	Standard	1.490 — 1.502 (0.0587 — 0.0591)	
				0.03 (0.0012) US	1.504 — 1.512 (0.0592 — 0.0595)	
				0.05 (0.0020) US	1.514 — 1.522 (0.0596 — 0.0599)	
				0.25 (0.0098) US	1.614 — 1.622 (0.0635 — 0.0639)	
Bushing of small end	Clearance between piston pin and bushing		mm (in)	Standard	0 — 0.022 (0 — 0.0009)	
				Limit	0.030 (0.0012)	

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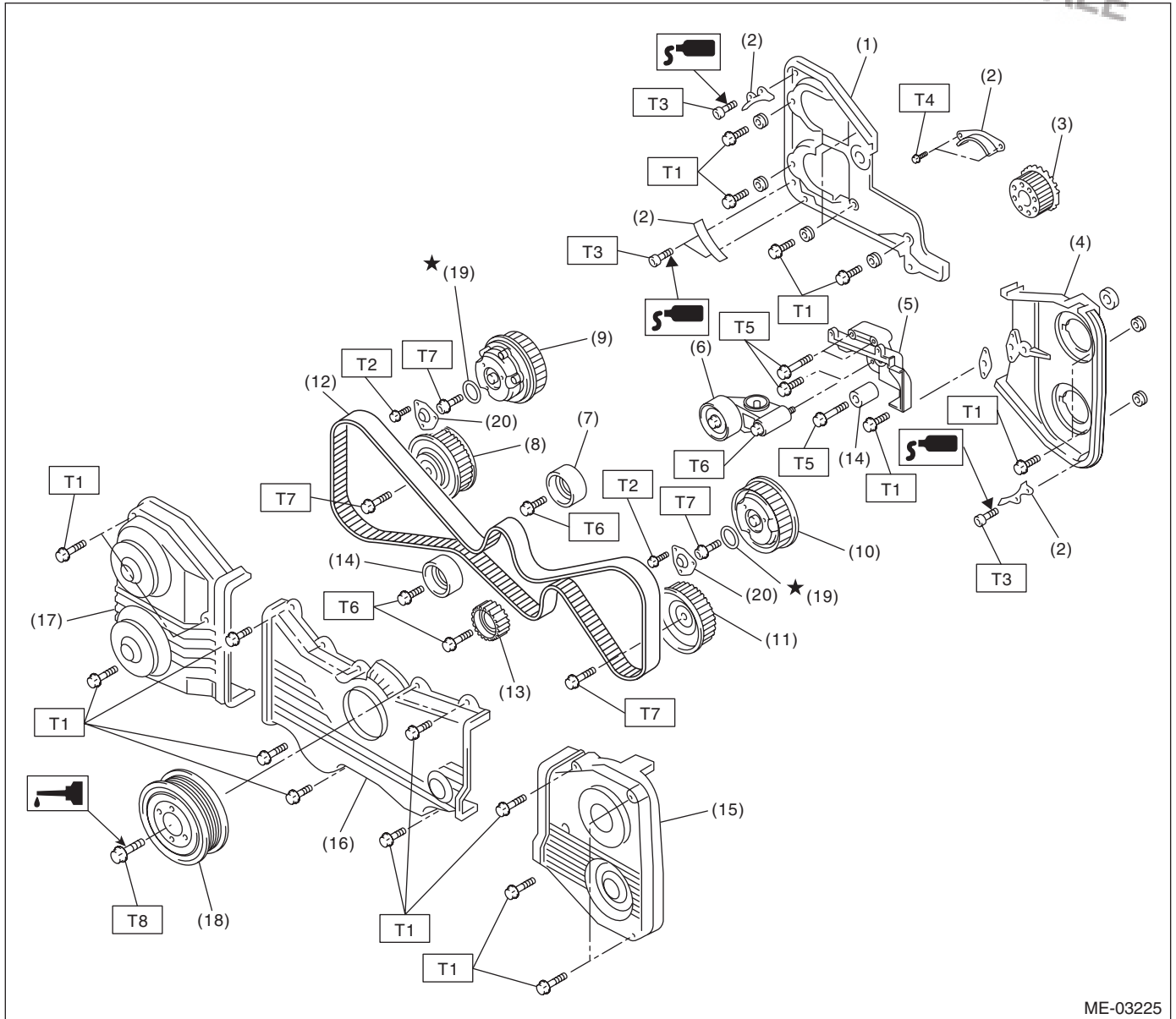
Crankshaft	Bending limit		mm (in)	0.035 (0.0014)	
	Crank pin	mm (in)	Out-of-roundness	0.003 (0.0001)	
			Cylindricality	0.004 (0.0002)	
			Grinding limit (dia.)	To 51.750 (2.0374)	
	Crank journal	mm (in)	Out-of-roundness	0.005 (0.0002)	
			Cylindricality	0.006 (0.0002)	
			Grinding limit	To 59.758 (2.3527)	
	Crank pin outer diameter	mm (in)	Standard	51.984 — 52.000 (2.0466 — 2.0472)	
			0.03 (0.0012) US	51.954 — 51.970 (2.0454 — 2.0461)	
			0.05 (0.0020) US	51.934 — 51.950 (2.0447 — 2.0453)	
			0.25 (0.0098) US	51.734 — 51.750 (2.0368 — 2.0374)	
	Crank journal outer diameter	mm (in)	Standard	59.992 — 60.008 (2.3619 — 2.3625)	
			0.03 (0.0012) US	59.962 — 59.978 (2.3607 — 2.3613)	
			0.05 (0.0020) US	59.942 — 59.958 (2.3599 — 2.3605)	
			0.25 (0.0098) US	59.742 — 59.758 (2.3520 — 2.3527)	
	Thrust clearance	mm (in)	Standard	0.030 — 0.115 (0.0012 — 0.0045)	
			Limit	0.25 (0.0098)	
	Oil clearance	mm (in)	Standard	0.010 — 0.030 (0.0004 — 0.0012)	
Limit			0.040 (0.0016)		
Main bearing	Main bearing thickness	#1, #3	mm (in)	Standard	1.998 — 2.011 (0.0787 — 0.0792)
			0.03 (0.0012) US	2.017 — 2.020 (0.0794 — 0.0795)	
			0.05 (0.0020) US	2.027 — 2.030 (0.0798 — 0.0799)	
			0.25 (0.0098) US	2.127 — 2.130 (0.0837 — 0.0839)	
		#2, #4, #5	Standard	2.000 — 2.013 (0.0787 — 0.0793)	
			0.03 (0.0012) US	2.019 — 2.022 (0.0795 — 0.0796)	
			0.05 (0.0020) US	2.029 — 2.032 (0.0799 — 0.0800)	
			0.25 (0.0098) US	2.129 — 2.132 (0.0838 — 0.0839)	

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B: COMPONENT

1. TIMING BELT



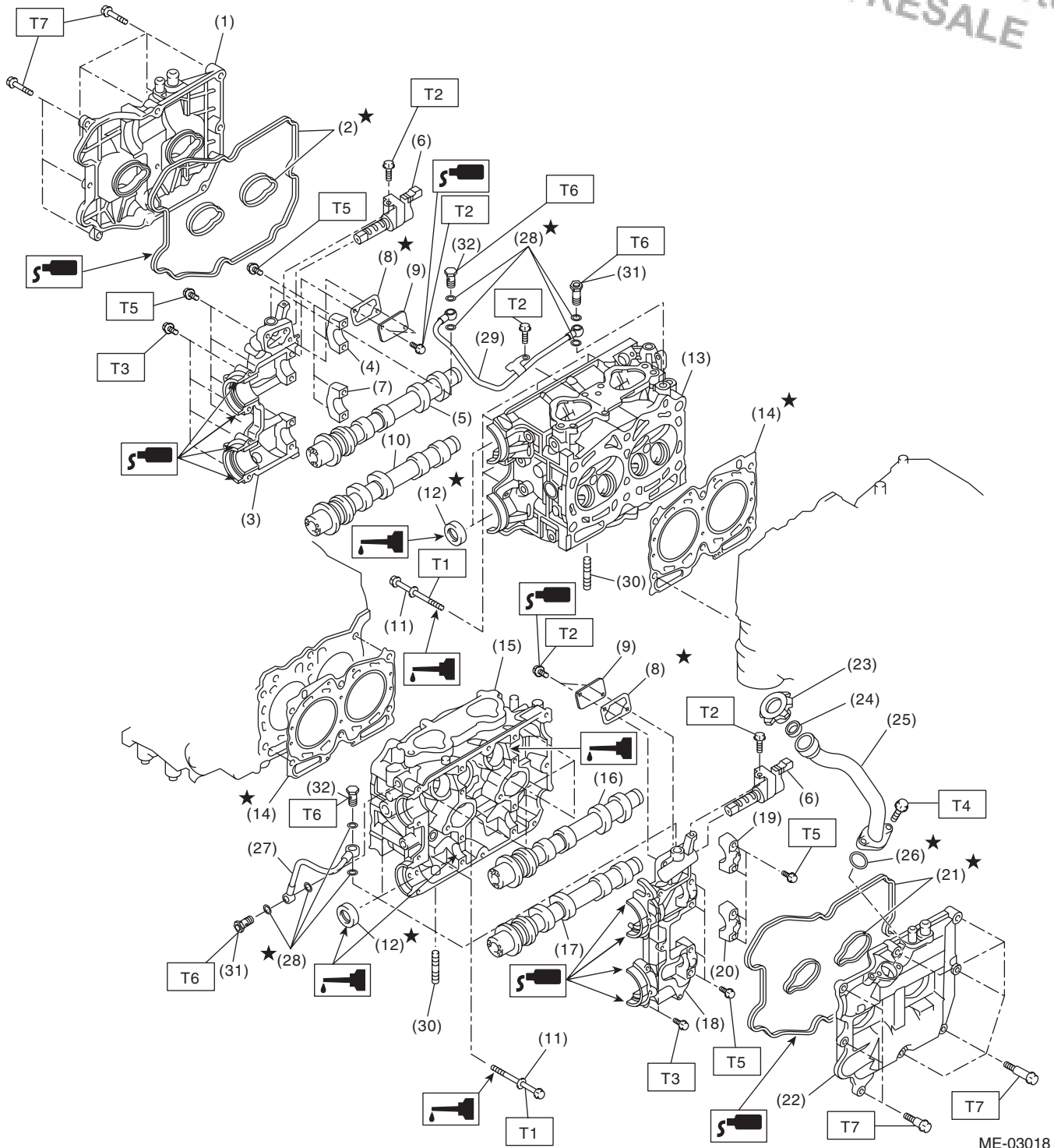
ME-03225

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|--|-----------------------------|
| (1) Timing belt cover No. 2 (RH) | (12) Timing belt |
| (2) Timing belt guide (MT model) | (13) Belt idler No. 2 |
| (3) Crank sprocket | (14) Belt idler |
| (4) Timing belt cover No. 2 (LH) | (15) Timing belt cover (LH) |
| (5) Tensioner bracket | (16) Front belt cover |
| (6) Automatic belt tension adjuster ASSY | (17) Timing belt cover (RH) |
| (7) Belt idler | (18) Crank pulley |
| (8) Exhaust cam sprocket (RH) | (19) O-ring |
| (9) Intake cam sprocket (RH) | (20) Actuator cover |
| (10) Intake cam sprocket (LH) | |
| (11) Exhaust cam sprocket (LH) | |

Tightening torque: N·m (kgf·m, ft·lb)

- T1: 5 (0.5, 3.6)**
T2: 3.4 (0.3, 2.5)
T3: 6.4 (0.65, 4.7)
T4: 9.75 (1.0, 7.2)
T5: 24.5 (2.5, 18.1)
T6: 39 (4.0, 28.9)
T7: <Ref. to ME(H4DOTC)-56, INSTALLATION, Cam Sprocket.>
T8: <Ref. to ME(H4DOTC)-46, INSTALLATION, Crank Pulley.>

2. CYLINDER HEAD AND CAMSHAFT



ME-03018

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- | | | |
|-------------------------------------|--|--|
| (1) Rocker cover (RH) | (17) Exhaust camshaft (LH) | (32) Union screw without filter (without protrusion) |
| (2) Rocker cover gasket (RH) | (18) Camshaft cap (Front LH) | |
| (3) Camshaft cap (Front RH) | (19) Intake camshaft cap (Rear LH) | |
| (4) Intake camshaft cap (Rear RH) | (20) Exhaust camshaft cap (Rear LH) | |
| (5) Intake camshaft (RH) | (21) Rocker cover gasket (LH) | |
| (6) Oil flow control solenoid valve | (22) Rocker cover (LH) | |
| (7) Exhaust camshaft cap (Rear RH) | (23) Oil filler cap | |
| (8) Gasket | (24) Gasket | |
| (9) Oil return cover | (25) Oil filler duct | |
| (10) Exhaust camshaft (RH) | (26) O-ring | |
| (11) Cylinder head bolt | (27) Oil pipe (LH) | |
| (12) Oil seal | (28) Gasket | |
| (13) Cylinder head (RH) | (29) Oil pipe (RH) | |
| (14) Cylinder head gasket | (30) Stud bolt | |
| (15) Cylinder head (LH) | (31) Union screw with filter (with protrusion) | |
| (16) Intake camshaft (LH) | | |

Tightening torque:N·m (kgf·m, ft·lb)

T1: <Ref. to ME(H4DOTC)-64, INSTALLATION, Cylinder Head.>

T2: 8 (0.8, 5.9)

T3: 9.75 (1.0, 7.2)

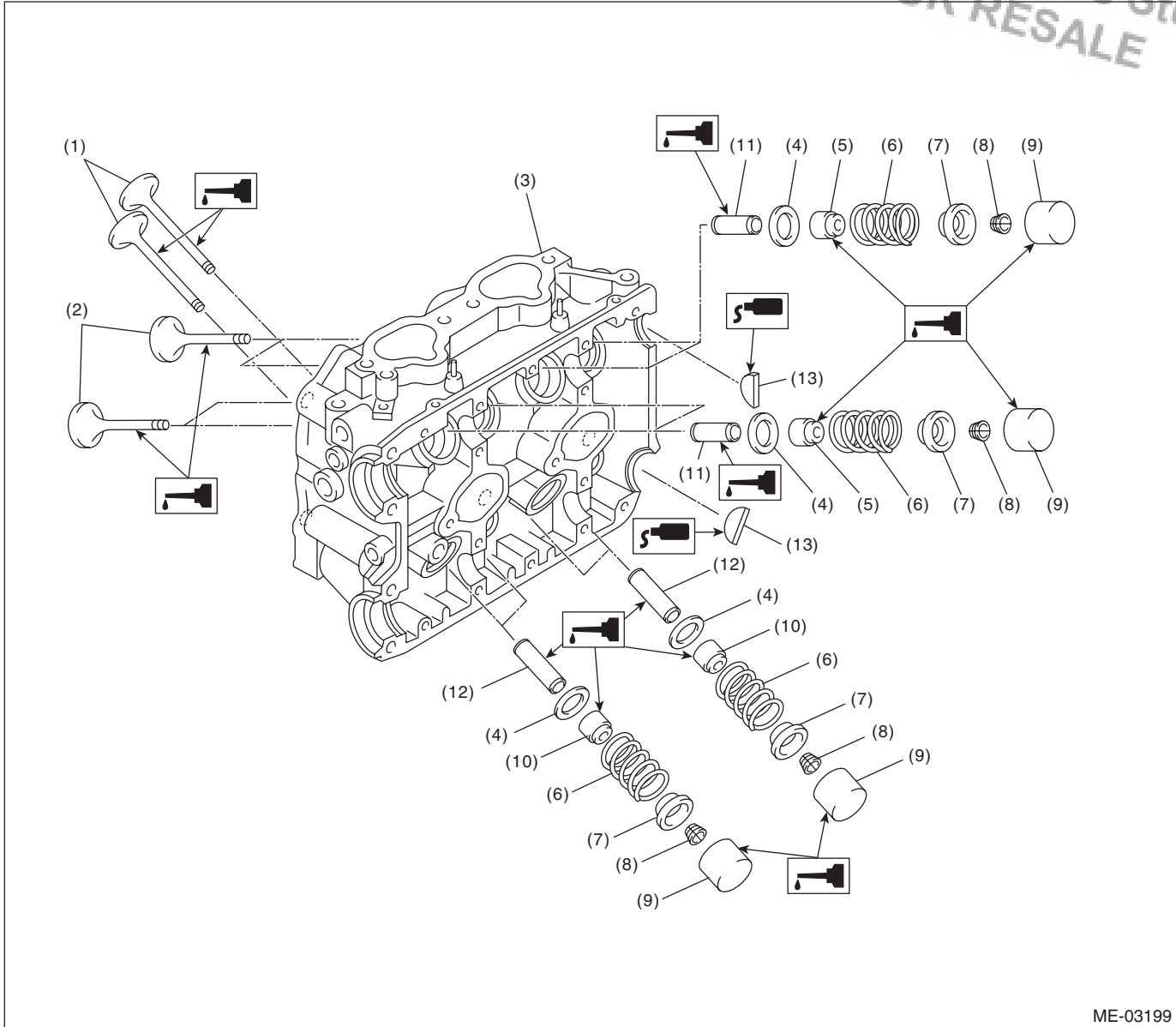
T4: 6.4 (0.65, 4.7)

T5: 20 (2.0, 14.5)

T6: 29 (3.0, 21.4)

T7: <Ref. to ME(H4DOTC)-59, INSTALLATION, Camshaft.>

3. CYLINDER HEAD AND VALVE ASSEMBLY



ME-03199

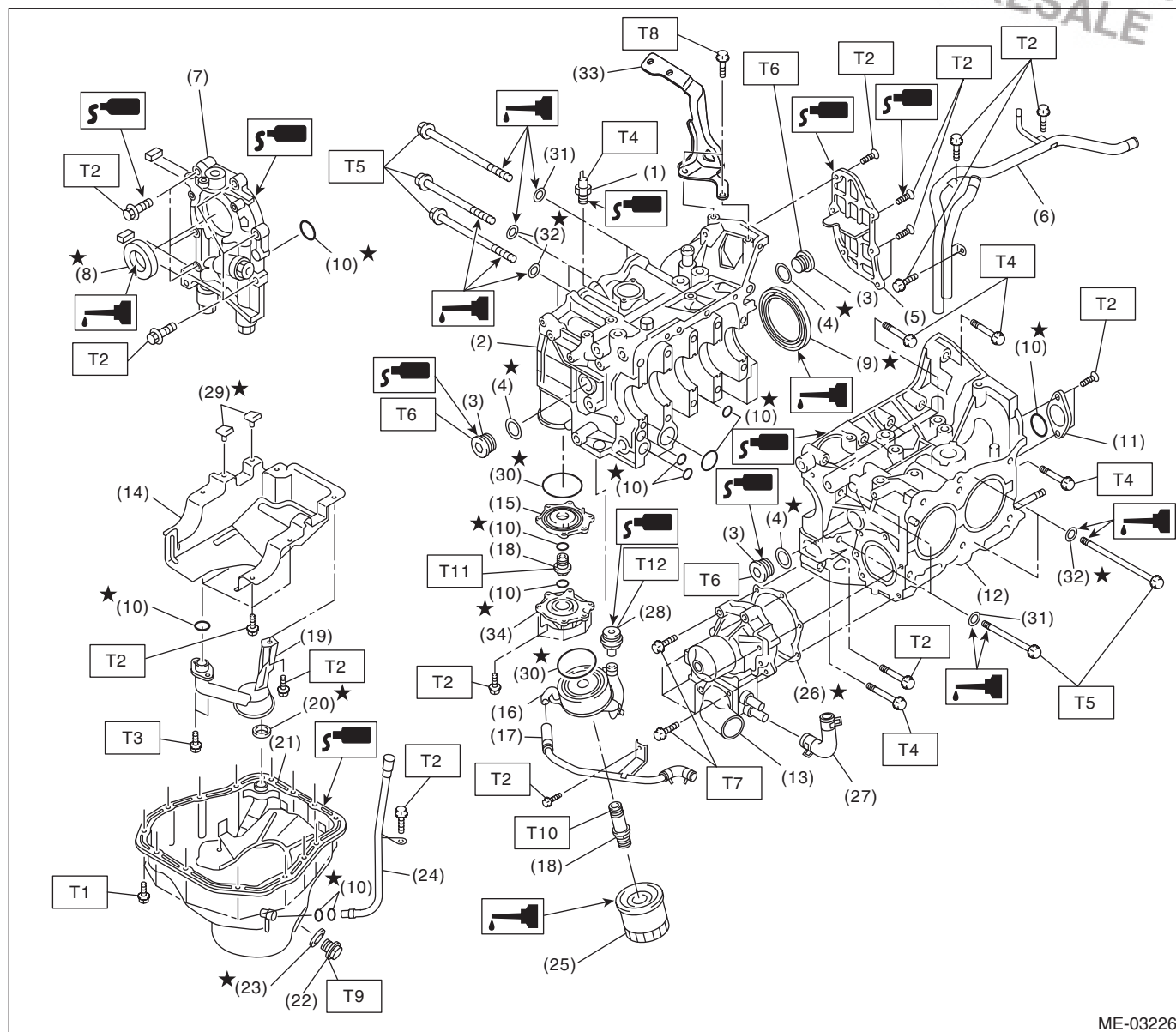
- | | | |
|---------------------------|-----------------------------|--------------------------|
| (1) Exhaust valve | (6) Valve spring | (11) Intake valve guide |
| (2) Intake valve | (7) Retainer | (12) Exhaust valve guide |
| (3) Cylinder head | (8) Retainer key | (13) Plug |
| (4) Valve spring seat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

General Description

MECHANICAL

4. CYLINDER BLOCK

- Except for STI model



ME-03226

General Description

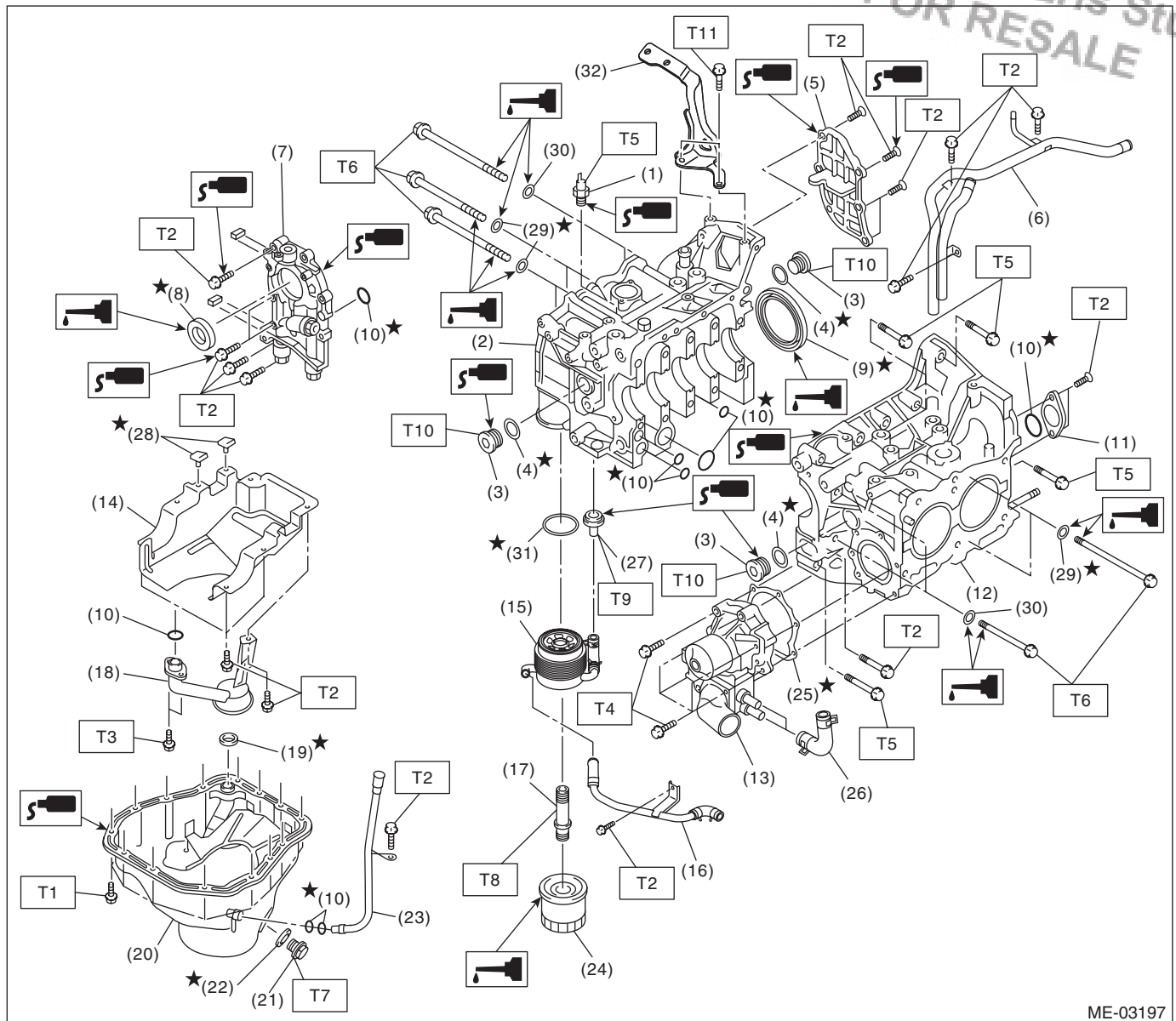
MECHANICAL

(1) Oil pressure switch	(18) Connector	Tightening torque:N·m (kgf·m, ft·lb)
(2) Cylinder block (RH)	(19) Oil strainer	T1: 5 (0.5, 3.6)
(3) Service hole plug	(20) Gasket	T2: 6.4 (0.65, 4.7)
(4) Gasket	(21) Oil pan	T3: 10 (1.0, 7.2)
(5) Oil separator cover	(22) Drain plug	T4: 25 (2.5, 18.1)
(6) Water by-pass pipe	(23) Metal gasket	T5: <Ref. to ME(H4DOTC)-74, INSTALLATION, Cylinder Block.>
(7) Oil pump	(24) Oil level gauge guide	
(8) Front oil seal	(25) Oil filter	T6: 70 (7.1, 50.6)
(9) Rear oil seal	(26) Gasket	T7: First 12 (1.2, 8.7) Second 12 (1.2, 8.7)
(10) O-ring	(27) Water pump hose	T8: 16 (1.6, 11.6)
(11) Service hole cover	(28) Nipple	T9: 44 (4.5, 33)
(12) Cylinder block (LH)	(29) Seal	T10: 54 (5.3, 39)
(13) Water pump	(30) Gasket	T11: 45 (4.6, 33)
(14) Baffle plate	(31) Washer	T12: 69 (7.0, 50.9)
(15) Adapter A	(32) Seal washer	
(16) Oil cooler	(33) Intercooler stay	
(17) Water by-pass pipe	(34) Adapter B	

General Description

MECHANICAL

- STI model



ME-03197

- | | |
|--------------------------|----------------------------|
| (1) Oil pressure switch | (17) Connector |
| (2) Cylinder block (RH) | (18) Oil strainer |
| (3) Service hole plug | (19) Gasket |
| (4) Gasket | (20) Oil pan |
| (5) Oil separator cover | (21) Drain plug |
| (6) Water by-pass pipe | (22) Metal gasket |
| (7) Oil pump | (23) Oil level gauge guide |
| (8) Front oil seal | (24) Oil filter |
| (9) Rear oil seal | (25) Gasket |
| (10) O-ring | (26) Water pump hose |
| (11) Service hole cover | (27) Nipple |
| (12) Cylinder block (LH) | (28) Seal |
| (13) Water pump | (29) Seal washer |
| (14) Baffle plate | (30) Washer |
| (15) Oil cooler | (31) Gasket |
| (16) Water by-pass pipe | (32) Intercooler stay |

Tightening torque: N·m (kgf·m, ft·lb)

T1: 5 (0.5, 3.7)

T2: 6.4 (0.65, 4.7)

T3: 10 (1.0, 7.4)

T4: First 12 (1.2, 8.9)

Second 12 (1.2, 8.9)

T5: 25 (2.5, 18.4)

**T6: <Ref. to ME(H4DOTC)-74,
INSTALLATION, Cylinder
Block.>**

T7: 44 (4.5, 32.5)

T8: 54 (5.3, 39.8)

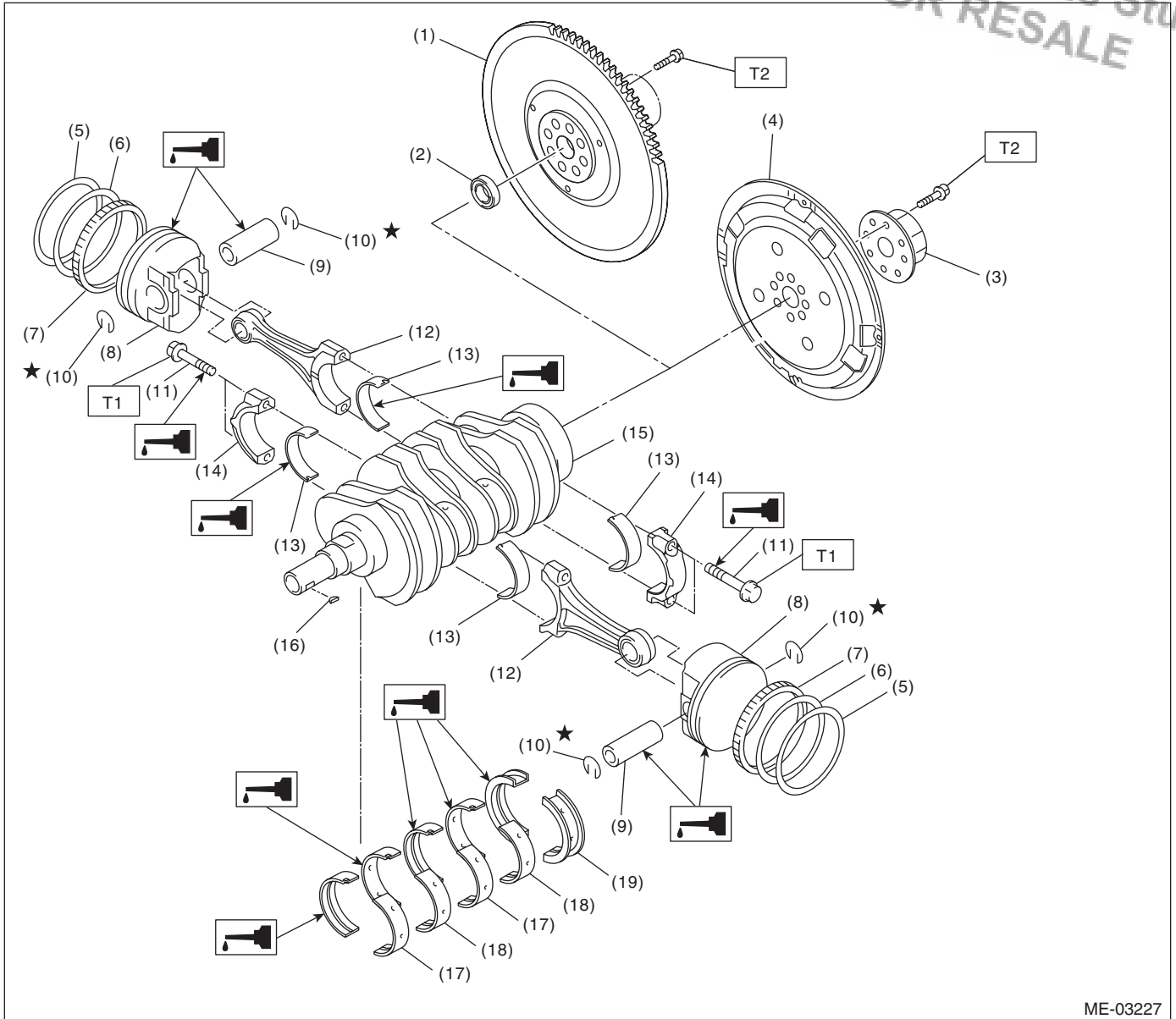
T9: 69 (7.0, 50.9)

T10: 70 (7.1, 51.6)

T11: 16 (1.6, 11.6)

ME(H4DOTC)-16

5. CRANKSHAFT AND PISTON



ME-03227

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

Tightening torque: N·m (kgf-m, ft-lb)

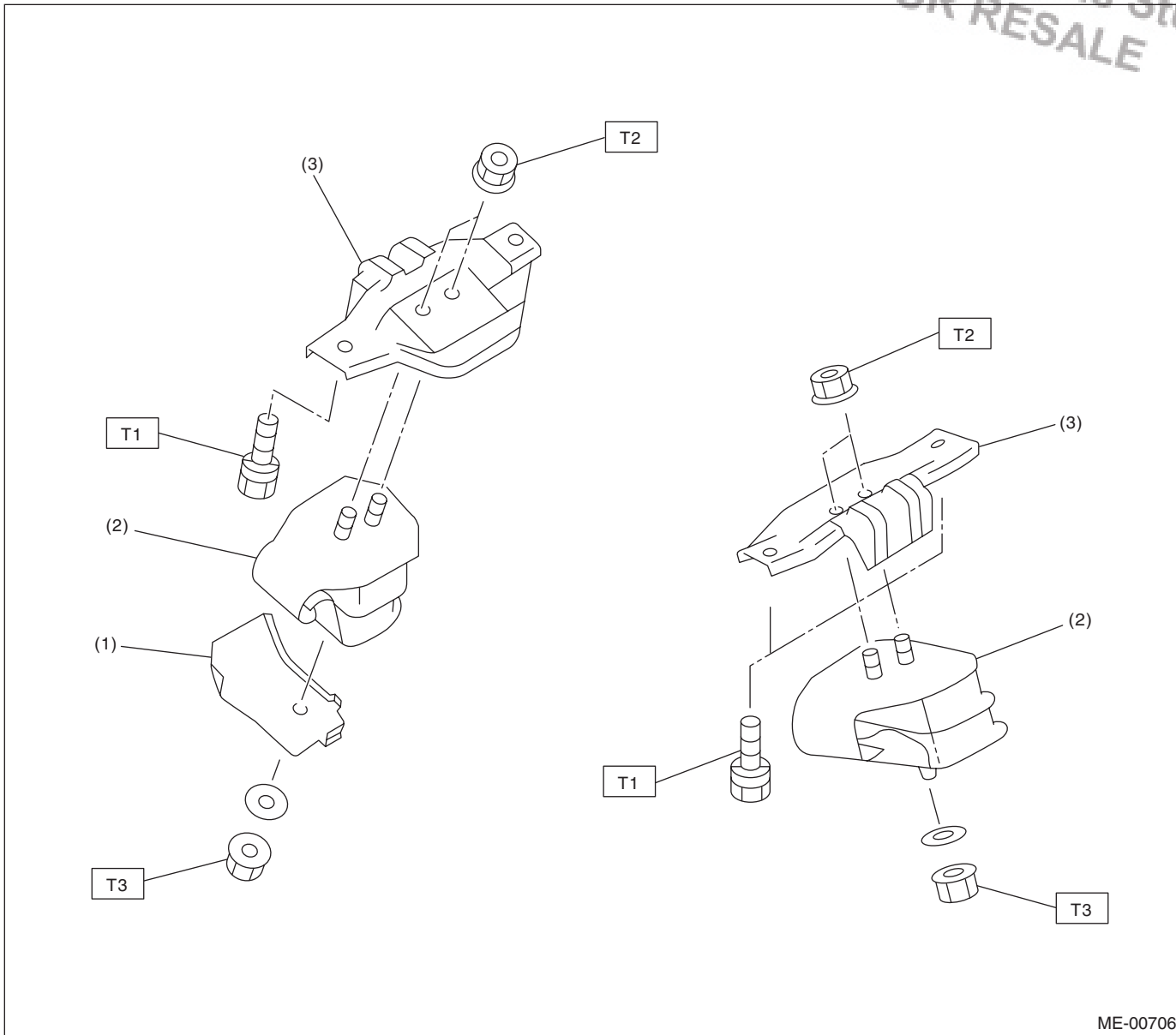
T1: 52 (5.3, 38.4)

T2: 72 (7.3, 52.8) (Except for STI model)

75 (7.6, 55.3) (STI model)

6. ENGINE MOUNTING

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ME-00706

- (1) Heat shield cover
- (2) Front cushion rubber
- (3) Front engine mounting bracket

Tightening torque: N·m (kgf·m, ft·lb)
T1: 35 (3.6, 25.8)
T2: 42 (4.3, 30.9)
T3: 85 (8.7, 62.7)

C: CAUTION

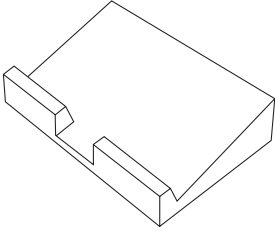
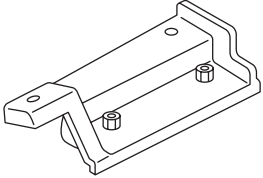
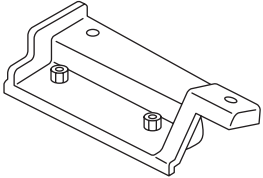
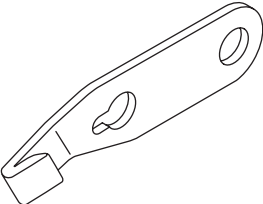
- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.
- All parts should be thoroughly cleaned, paying special attention to engine oil passages, pistons and bearings.
- Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil prior to assembly.
- Be careful not to let oil, grease or coolant contact the timing belt, clutch disc and flywheel.
- All removed parts, if to be reused, should be reinstalled in the original positions and directions.
- Bolts, nuts and washers should be replaced with new parts 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 fender, as required, for protection.
- Prior to starting work, prepare the following:
Service tools, clean cloth, containers to catch coolant and oil, wire ropes, chain hoist, transmission jacks, etc.
- Lift-up or lower the vehicle when necessary. Make sure to support the correct positions.

General Description

MECHANICAL

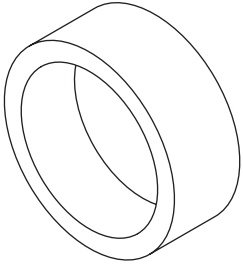
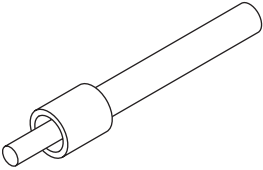
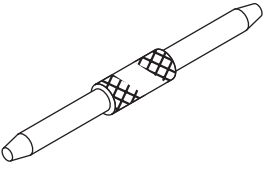
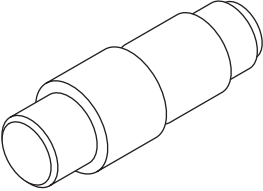
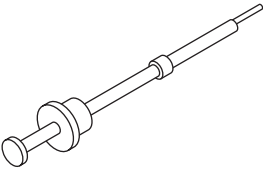
D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498267600</p>	498267600	CYLINDER HEAD TABLE	<ul style="list-style-type: none"> • Used for replacing valve guides. • Used for removing and installing valve spring.
 <p style="text-align: center;">ST-498457000</p>	498457000	ENGINE STAND ADAPTER RH	Used together with the ENGINE STAND (499817100).
 <p style="text-align: center;">ST-498457100</p>	498457100	ENGINE STAND ADAPTER LH	Used together with the ENGINE STAND (499817100).
 <p style="text-align: center;">ST-498497100</p>	498497100	CRANKSHAFT STOPPER	Used for removing and installing the flywheel and drive plate.

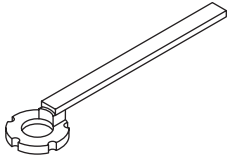
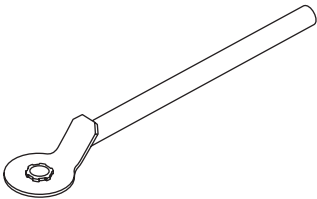
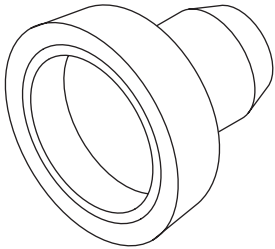
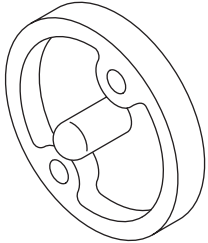
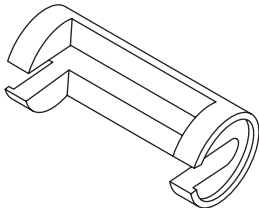
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-498747300</p>	498747300	PISTON GUIDE	Used for installing the piston to the cylinder.
 <p>ST-498857100</p>	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.
 <p>ST-499017100</p>	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
 <p>ST-499037100</p>	499037100	CONNECTING ROD BUSHING REMOVER AND INSTALLER	Used for removing and installing connecting rod bushing.
 <p>ST-499097700</p>	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.

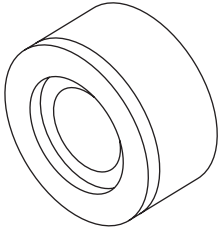
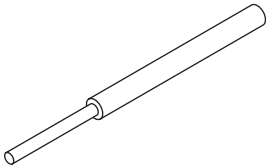
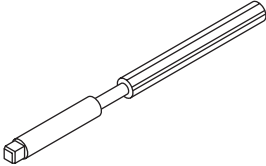
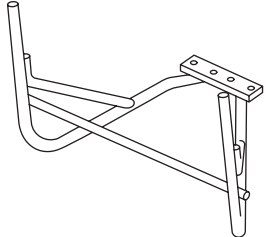
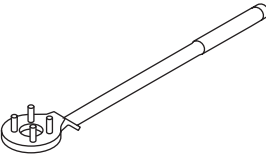
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-499207400</p>	499207400	CAM SPROCKET WRENCH	Used for removing and installing cam sprocket. (Exhaust side)
 <p style="text-align: center;">ST-499977500</p>	499977500	CAM SPROCKET WRENCH	Used for removing and installing cam sprocket. (Intake side)
 <p style="text-align: center;">ST-499587200</p>	499587200	CRANKSHAFT OIL SEAL INSTALLER	<ul style="list-style-type: none"> • Used for installing crankshaft oil seal. • Used together with the CRANKSHAFT OIL SEAL GUIDE (499597100).
 <p style="text-align: center;">ST-499597100</p>	499597100	CRANKSHAFT OIL SEAL GUIDE	<ul style="list-style-type: none"> • Used for installing crankshaft oil seal. • Used together with the CRANKSHAFT OIL SEAL INSTALLER (499587200).
 <p style="text-align: center;">ST-499718000</p>	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.

General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST18251AA020</p>	18251AA020	VALVE GUIDE ADJUSTER	Used for installing intake and exhaust valve guides.
 <p>ST-499767200</p>	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
 <p>ST-499767400</p>	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
 <p>ST-499817100</p>	499817100	ENGINE STAND	<ul style="list-style-type: none"> • Stand used for engine disassembly and assembly. • Used together with the ENGINE STAND ADAPTER RH (498457000) & LH (498457100).
 <p>ST-499977100</p>	499977100	CRANK PULLEY WRENCH	Used for stopping rotation of crank pulley when loosening/tightening crank pulley bolt.

General Description

MECHANICAL

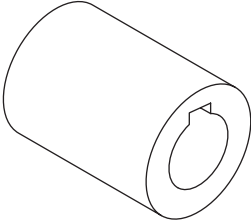
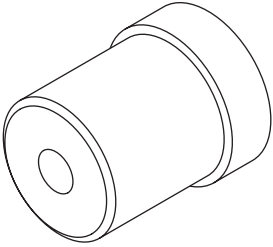
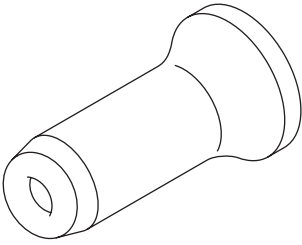
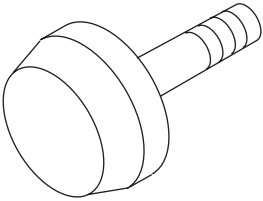
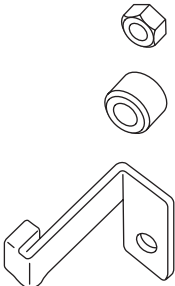
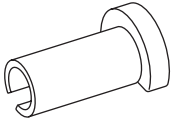
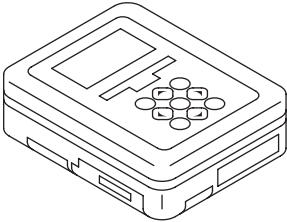
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-499987500</p>	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 <p style="text-align: center;">ST-499587100</p>	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.
 <p style="text-align: center;">ST-499587600</p>	499587600	OIL SEAL GUIDE	Used for installing camshaft oil seal for DOHC engine.
 <p style="text-align: center;">ST-499597200</p>	499597200	OIL SEAL GUIDE	<ul style="list-style-type: none"> • Used for installing camshaft oil seal for DOHC engine. • Used together with the OIL SEAL GUIDE (499587600).
 <p style="text-align: center;">ST-498277200</p>	498277200	STOPPER SET	Used for installing automatic transmission assembly to engine.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST42099AE000	42099AE000	CONNECTOR REMOVER	Used for disconnecting quick connector of the engine compartment.
 ST1B020XU0	1B020XU0	SUBARU SELECT MONITOR KIT	Used for troubleshooting the electrical system.

2. GENERAL TOOL

TOOL NAME	REMARKS
Compression gauge	Used for measuring compression.
Timing light	Used for measuring ignition timing.
Vacuum gauge	Used for measuring intake manifold vacuum.
Oil pressure gauge	Used for measuring engine oil pressure.
Fuel pressure gauge	Used for measuring fuel pressure.

E: PROCEDURE

It is possible to conduct the following service procedures with engine on 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

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2. Compression

A: INSPECTION

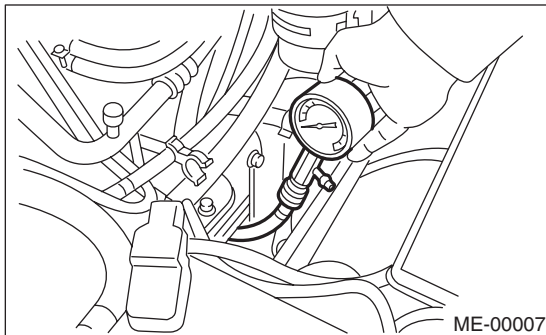
CAUTION:

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

- 1) After warming-up the engine, turn the ignition switch to OFF.
- 2) Make sure that the battery is fully charged.
- 3) Release the fuel pressure. <Ref. to FU(H4DOTC)-55, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 4) Remove all spark plugs. <Ref. to IG(H4DOTC)-4, REMOVAL, Spark Plug.>
- 5) Fully open the throttle valve.
- 6) Check the starter motor for satisfactory performance and operation.
- 7) Hold the compression gauge tightly against the spark plug hole.

NOTE:

When using a screw-in type compression gauge, the screw should be less than 18 mm (0.71 in) long.
8) Crank the engine by the starter motor, and read the maximum value on the gauge when the needle of gauge is steady.



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

Compression pressure (at 200 — 300 rpm):

Standard

**981 — 1,177 kPa
(10 — 12 kgf/cm², 142 — 171 psi)**

Limit

882 kPa (9.0 kgf/cm², 128 psi)

Difference between cylinders

49 kPa (0.5 kgf/cm², 7 psi), or less

3. Idle Speed

A: INSPECTION

1) Before checking the idle speed, check the following item:

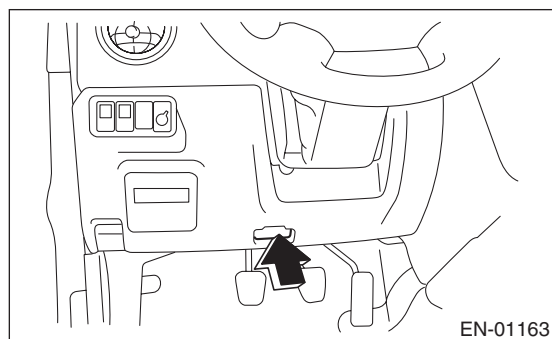
(1) Check the air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and hoses are connected properly.

(2) Check the malfunction indicator light does not illuminate.

2) Warm-up the engine.

3) Stop the engine, and turn the ignition switch to OFF.

4) Connect the Subaru Select Monitor to the data link connector.



5) Turn the ignition switch to ON and run the Subaru Select Monitor.

6) Select {Each System Check} in Main Menu.

7) Select {Engine Control System} in Selection Menu.

8) Select {Current Data Display & Save} in Engine Control System Diagnosis.

9) Select {Data Display} in Data Display Menu.

10) Start the engine, and read the engine idle speed.

11) Check the idle speed when no-loaded. (Headlight, heater fan, rear defroster, radiator fan, A/C, etc. are OFF.)

Idle speed (No load and gears in neutral, "P" or "N" range):

700±100 rpm

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

IDLE SPEED (A/C ON AND GEARS IN NEUTRAL, "P" OR "N" RANGE):

Except for STI model:

When A/C refrigerant pressure is low.

725±100 rpm (MT model)

750±100 rpm (AT model)

When A/C refrigerant pressure is high.

800±100 rpm (MT model)

825±100 rpm (AT model)

STI model:

800±100 rpm

NOTE:

Idle speed cannot be adjusted manually, because the idle speed is automatically adjusted. If the prescribed idle speed cannot be maintained, refer to the engine control system. <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(STI)(diag)-2, Basic Diagnostic Procedure.>

4. Ignition Timing

A: INSPECTION

CAUTION:

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

1. METHOD WITH SUBARU SELECT MONITOR

1) Before checking the ignition timing, check the following item:

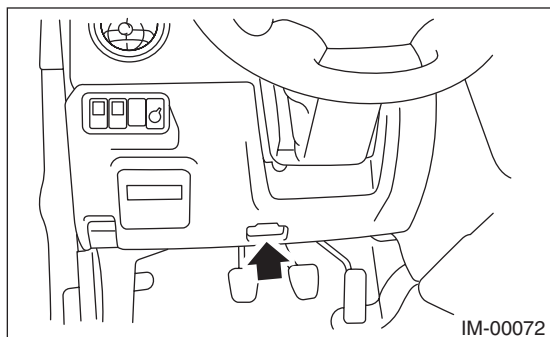
(1) Check the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.

(2) Check the malfunction indicator light does not illuminate.

2) Warm-up the engine.

3) Stop the engine, and turn the ignition switch to OFF.

4) Connect the Subaru Select Monitor to the data link connector.



5) Turn the ignition switch to ON and run the Subaru Select Monitor.

6) Select {Each System Check} in Main Menu.

7) Select {Engine Control System} in Selection Menu.

8) Select {Current Data Display & Save} in Engine Control System Diagnosis.

9) Select {Data Display} in Data Display Menu.

10) Start the engine and check the ignition timing at idle speed.

Ignition timing [BTDC/rpm]:

$17^{\circ} \pm 10^{\circ} / 700$

If the timing is not correct, check the ignition control system. Refer to "Engine Control System". <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(STI)(diag)-2, Basic Diagnostic Procedure.>

2. METHOD WITH TIMING LIGHT

1) Before checking the ignition timing, check the following item:

(1) Check the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.

(2) Check the malfunction indicator light does not illuminate.

2) Warm-up the engine.

3) Stop the engine, and turn the ignition switch to OFF.

4) Remove the air intake duct.

5) Disconnect the connector from the mass air flow and intake air temperature sensor.

6) Remove the air cleaner cover and element.

7) Connect the timing light to the power wire of #1 ignition coil.

8) Attach the air cleaner cover, element and connector of mass air flow and intake air temperature sensor.

9) Start the engine, turn the timing light to the crank pulley, and check the ignition timing by means of crank pulley indicator.

Ignition timing [BTDC/rpm]:

$17^{\circ} \pm 10^{\circ} / 700$

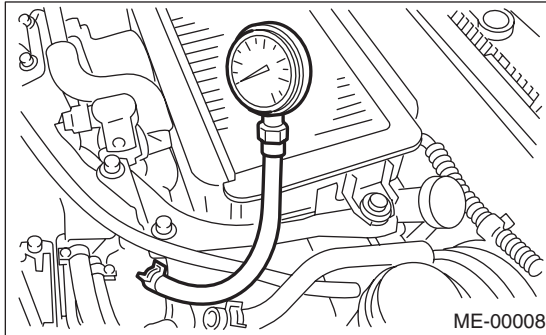
If the timing is not correct, check the ignition control system. Refer to "Engine Control System". <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(STI)(diag)-2, Basic Diagnostic Procedure.>

5. Intake Manifold Vacuum

A: INSPECTION

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

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



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

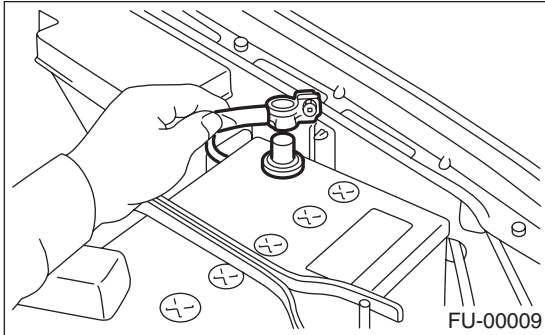
Diagnosis of engine condition by measurement of intake manifold vacuum	
Vacuum gauge indication	Possible engine condition
1. Needle is steady but lower than normal position. This tendency becomes more evident as engine temperature rises.	Leakage around intake manifold gasket, or disconnected or damaged vacuum hose
2. Needle intermittently drops to position lower than normal position.	Leakage around cylinder
3. Needle drops suddenly and intermittently from normal position.	Sticky valve
4. 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
5. Needle vibrates above and below normal position in narrow range.	Defective ignition system or throttle chamber idle adjustment

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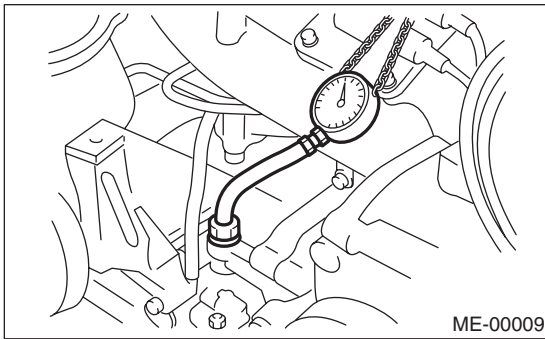
6. Engine Oil Pressure

A: INSPECTION

- 1) Remove the oil pressure switch. <Ref. to LU(H4DOTC)-21, REMOVAL, Oil Pressure Switch.>
- 2) Connect the oil pressure gauge hose to cylinder block.
- 3) Connect the ground cable to the battery.



- 4) Start the engine, and measure the oil pressure.



Oil pressure:

98 kPa (1.0 kgf/cm², 14 psi) or more (600 rpm)
294 kPa (3.0 kgf/cm², 43 psi) or more (5,000 rpm)

- If the oil pressure is out of specification, check oil pump, oil filter and lubrication line. <Ref. to LU(H4DOTC)-26, INSPECTION, Engine Lubrication System Trouble in General.>
- If the oil pressure warning light is turned on and oil pressure is within specification, check the oil pressure switch. <Ref. to LU(H4DOTC)-26, INSPECTION, Engine Lubrication System Trouble in General.>

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 LU(H4DOTC)-21, INSTALLATION, Oil Pressure Switch.>

Tightening torque:

25 N·m (2.5 kgf·m, 18.4 ft·lb)

7. Fuel Pressure

A: INSPECTION

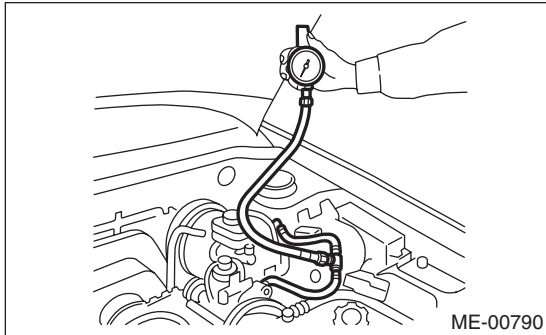
CAUTION:

- Before removing the fuel pressure gauge, release the fuel pressure.
- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.

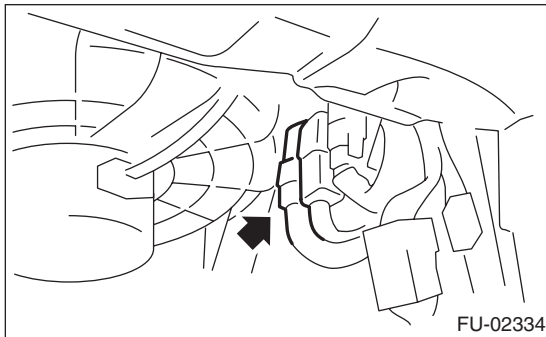
NOTE:

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

- 1) Release the fuel pressure. <Ref. to FU(H4DOTC)-55, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Disconnect the fuel delivery hose from the fuel damper, and connect the fuel pressure gauge.



- 3) Connect the connector of fuel pump relay.



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

Fuel pressure:

Standard

284 — 314 kPa (2.9 — 3.2 kgf/cm², 41 — 46 psi)

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

Fuel pressure:

Standard

230 — 260 kPa

(2.35 — 2.65 kgf/cm², 33 — 38 psi)

NOTE:

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

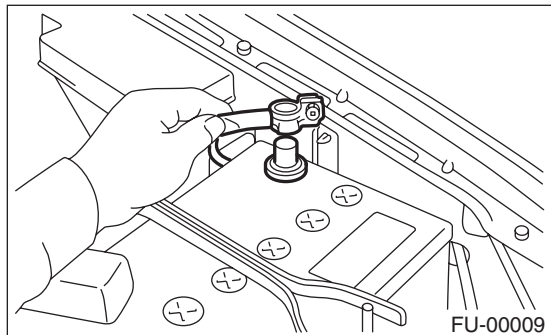
8. Valve Clearance

A: INSPECTION

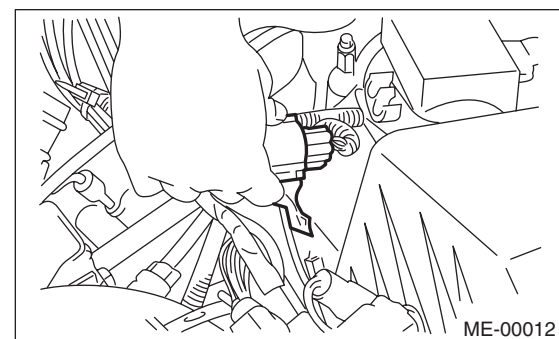
NOTE:

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

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

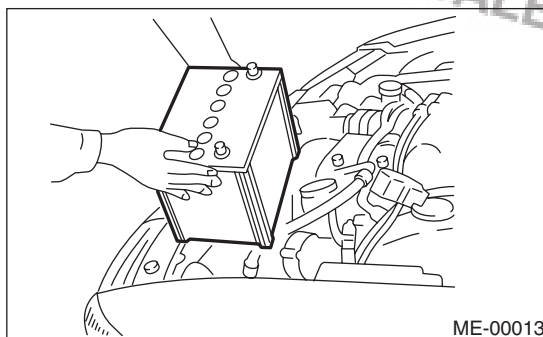


- 3) Remove the air intake duct. <Ref. to IN(H4DOTC)-11, REMOVAL, Air Intake Duct.>
- 4) Remove a bolt which secures timing belt cover (RH).
- 5) Lift up the vehicle.
- 6) Remove the under cover.
- 7) Loosen the remaining bolts which secure timing belt cover (RH), then remove the timing belt cover.
- 8) Lower the vehicle.
- 9) When inspecting #1 and #3 cylinders



- (1) Pull out the engine harness connector together with bracket from air cleaner upper cover.
- (2) Remove the air cleaner case. <Ref. to IN(H4DOTC)-10, REMOVAL, Air Cleaner Case.>
- (3) Disconnect the connector of ignition coil.
- (4) Remove the ignition coil. <Ref. to IG(H4DOTC)-6, REMOVAL, Ignition Coil.>
- (5) Place a suitable container under the vehicle.
- (6) Disconnect the PCV hose from the rocker cover (RH).
- (7) Remove the bolts, then remove the rocker cover (RH).

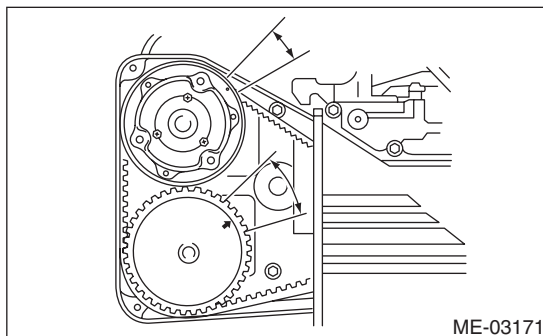
- 10) When inspecting #2 and #4 cylinders
 - (1) Disconnect the battery cable, and then remove the battery and battery carrier.



- (2) Remove the secondary air pump. <Ref. to EC(H4DOTC)-9, REMOVAL, Secondary Air Pump.>
- (3) Disconnect the connector of ignition coil.
- (4) Remove the ignition coil. <Ref. to IG(H4DOTC)-6, REMOVAL, Ignition Coil.>
- (5) Place a suitable container under the vehicle.
- (6) Disconnect the PCV hose from the rocker cover (LH).
- (7) Remove the bolts, then remove the rocker cover (LH).
- 11) Turn the crank pulley clockwise until the round mark and arrow mark on the camshaft sprocket are set to position shown in the figure.

NOTE:

Turn the crankshaft using socket wrench.



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

NOTE:

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

Valve clearance:

Standard:

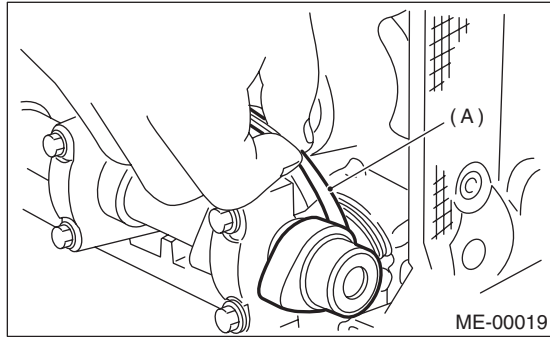
Intake

0.20±0.02 mm (0.0079±0.0008 in)

Exhaust

0.35±0.02 mm (0.0138±0.0008 in)

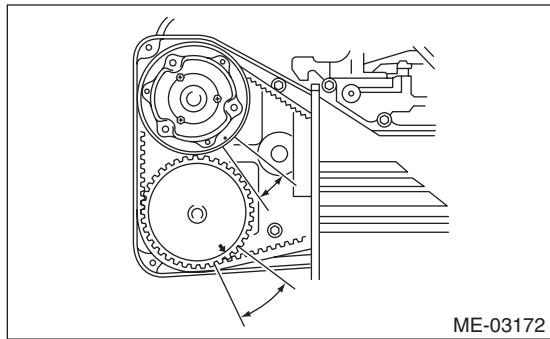
- If the measured value is not within specification, take notes of the value in order to adjust the valve clearance later on.



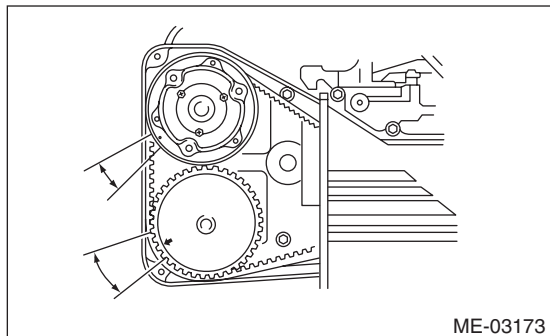
13) If necessary, adjust the valve clearance. <Ref. to ME(H4DOTC)-33, ADJUSTMENT, Valve Clearance.>

14) Further turn the crank pulley clockwise. Using the same procedures described previously, then measure valve clearances again.

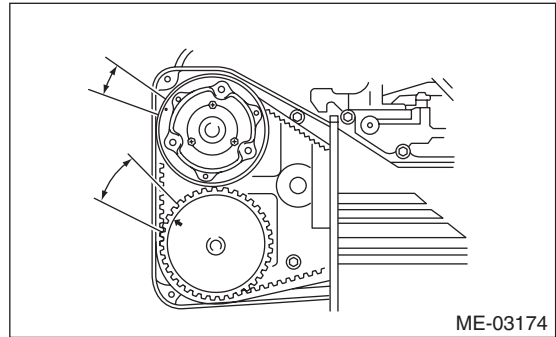
(1) Set the round mark and arrow mark on cam sprocket to the position shown in the figure, and measure the #2 cylinder exhaust valve and #3 cylinder intake valve clearances.



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



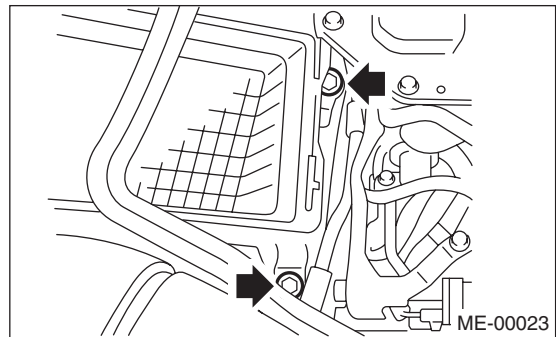
(3) Set the round mark and arrow mark on cam sprocket to the position shown in the figure, and measure the #1 cylinder exhaust valve and #4 cylinder intake valve clearances.



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

Tightening torque:

33 N·m (3.4 kgf·m, 25 ft·lb)



B: ADJUSTMENT

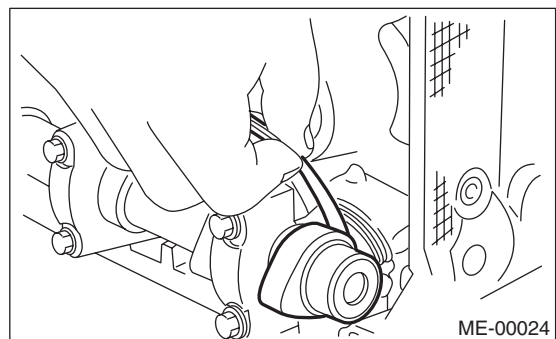
NOTE:

Perform adjustment of valve clearance while the engine is cold.

1) Measure all the valve clearances. <Ref. to ME(H4DOTC)-32, INSPECTION, Valve Clearance.>

NOTE:

Record each valve clearance after measurement.



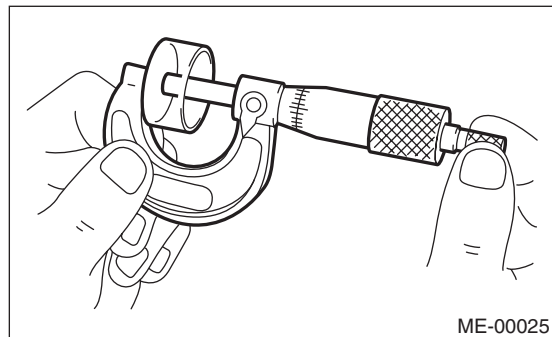
2) Remove the camshaft. <Ref. to ME(H4DOTC)-58, REMOVAL, Camshaft.>

3) Remove the valve lifter.

Valve Clearance

MECHANICAL

4) Measure the thickness of valve lifter using micrometer.



5) Select a shim of suitable thickness from the following table using the measured valve clearance and valve lifter thickness.

Unit: (mm)
Intake valve: $S = (V + T) - 0.20$
Exhaust valve: $S = (V + T) - 0.35$
S: Valve lifter thickness required
V: Measured valve clearance
T: Valve lifter thickness to be used

Part No.	Thickness mm (in)
13228AB102	4.68 (0.1843)
13228AB112	4.69 (0.1846)
13228AB122	4.70 (0.1850)
13228AB132	4.71 (0.1854)
13228AB142	4.72 (0.1858)
13228AB152	4.73 (0.1862)
13228AB162	4.74 (0.1866)
13228AB172	4.75 (0.1870)
13228AB182	4.76 (0.1874)
13228AB192	4.77 (0.1878)
13228AB202	4.78 (0.1882)
13228AB212	4.79 (0.1886)
13228AB222	4.80 (0.1890)
13228AB232	4.81 (0.1894)
13228AB242	4.82 (0.1898)
13228AB252	4.83 (0.1902)
13228AB262	4.84 (0.1906)
13228AB272	4.85 (0.1909)
13228AB282	4.86 (0.1913)
13228AB292	4.87 (0.1917)
13228AB302	4.88 (0.1921)
13228AB312	4.89 (0.1925)
13228AB322	4.90 (0.1929)
13228AB332	4.91 (0.1933)
13228AB342	4.92 (0.1937)
13228AB352	4.93 (0.1941)
13228AB362	4.94 (0.1945)
13228AB372	4.95 (0.1949)
13228AB382	4.96 (0.1953)

Part No.	Thickness mm (in)
13228AB392	4.97 (0.1957)
13228AB402	4.98 (0.1961)
13228AB412	4.99 (0.1965)
13228AB422	5.00 (0.1969)
13228AB432	5.01 (0.1972)
13228AB442	5.02 (0.1976)
13228AB452	5.03 (0.1980)
13228AB462	5.04 (0.1984)
13228AB472	5.05 (0.1988)
13228AB482	5.06 (0.1992)
13228AB492	5.07 (0.1996)
13228AB502	5.08 (0.2000)
13228AB512	5.09 (0.2004)
13228AB522	5.10 (0.2008)
13228AB532	5.11 (0.2012)
13228AB542	5.12 (0.2016)
13228AB552	5.13 (0.2020)
13228AB562	5.14 (0.2024)
13228AB572	5.15 (0.2028)
13228AB582	5.16 (0.2031)
13228AB592	5.17 (0.2035)
13228AB602	5.18 (0.2039)
13228AB612	5.19 (0.2043)
13228AB622	5.20 (0.2047)
13228AB632	5.21 (0.2051)
13228AB642	5.22 (0.2055)
13228AB652	5.23 (0.2059)
13228AB662	5.24 (0.2063)
13228AB672	5.25 (0.2067)
13228AB682	5.26 (0.2071)
13228AB692	5.27 (0.2075)
13228AB702	4.38 (0.1724)
13228AB712	4.40 (0.1732)
13228AB722	4.42 (0.1740)
13228AB732	4.44 (0.1748)
13228AB742	4.46 (0.1756)
13228AB752	4.48 (0.1764)
13228AB762	4.50 (0.1771)
13228AB772	4.52 (0.1780)
13228AB782	4.54 (0.1787)
13228AB792	4.56 (0.1795)
13228AB802	4.58 (0.1803)
13228AB812	4.60 (0.1811)
13228AB822	4.62 (0.1819)
13228AB832	4.64 (0.1827)
13228AB842	4.66 (0.1835)
13228AB852	5.29 (0.2083)
13228AB862	5.31 (0.2091)
13228AB872	5.33 (0.2098)
13228AB882	5.35 (0.2106)

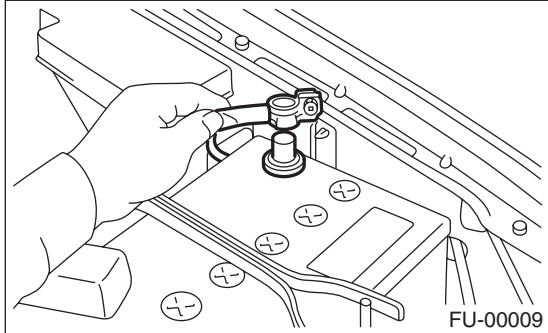
Part No.	Thickness mm (in)
13228AB892	5.37 (0.2114)
13228AB902	5.39 (0.2122)
13228AB912	5.41 (0.2126)
13228AB922	5.43 (0.2138)
13228AB932	5.45 (0.2146)
13228AB942	5.47 (0.2154)
13228AB952	5.49 (0.2161)
13228AB962	5.51 (0.2169)
13228AB972	5.53 (0.2177)
13228AB982	5.55 (0.2185)
13228AB992	5.57 (0.2193)
13228AC002	5.59 (0.2201)
13228AC012	5.61 (0.2209)
13228AC022	5.63 (0.2217)
13228AC032	5.65 (0.2224)

- 6) Inspect all valves for valve clearance again at this time. 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.

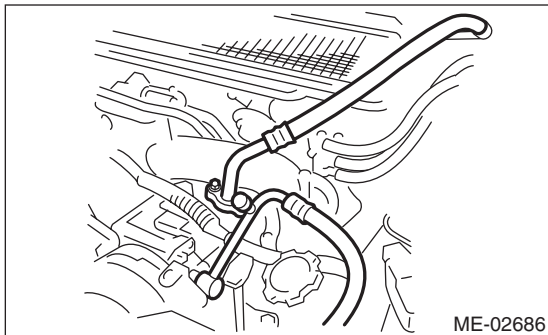
9. Engine Assembly

A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Open the front hood fully and support with the front food stay.
- 3) Collect the refrigerant from A/C system. <Ref. to AC-19, Refrigerant Recovery Procedure.>
- 4) Release the fuel pressure. <Ref. to FU(H4DOTC)-55, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 5) Disconnect the ground cable from the battery.



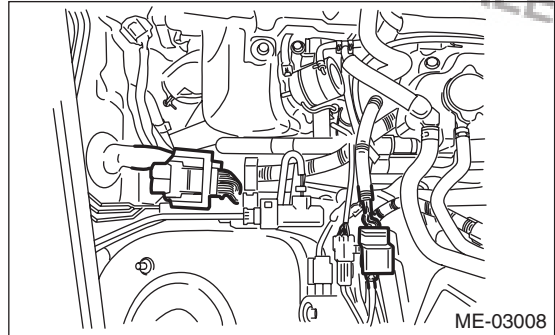
- 6) Open the fuel flap lid, and remove the fuel filler cap.
- 7) Remove the air cleaner case and air intake boot. <Ref. to IN(H4DOTC)-10, REMOVAL, Air Cleaner Case.>
- 8) Remove the radiator from vehicle. <Ref. to CO(H4DOTC)-25, REMOVAL, Radiator.>
- 9) Remove the coolant filler tank. <Ref. to CO(H4DOTC)-35, REMOVAL, Coolant Filler Tank.>
- 10) Remove the secondary air pump. <Ref. to EC(H4DOTC)-9, REMOVAL, Secondary Air Pump.>
- 11) Disconnect the A/C pressure hoses from A/C compressor.



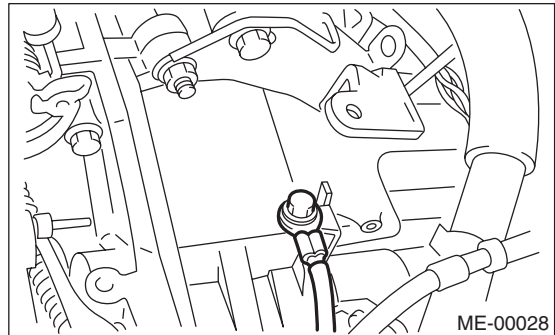
- 12) Remove the intercooler. <Ref. to IN(H4DOTC)-13, REMOVAL, Intercooler.>

- 13) Disconnect the following connectors and cables.

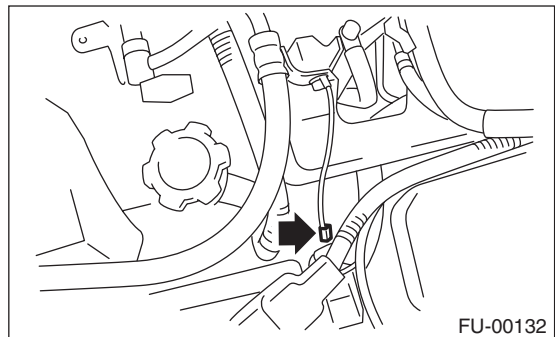
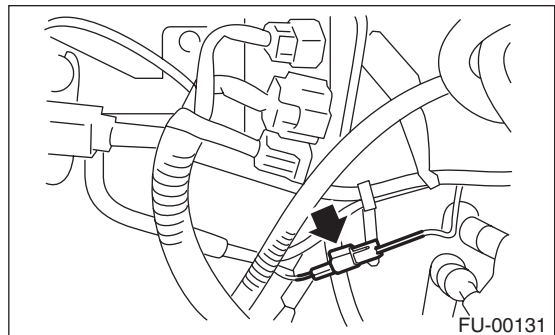
- (1) Engine harness connectors



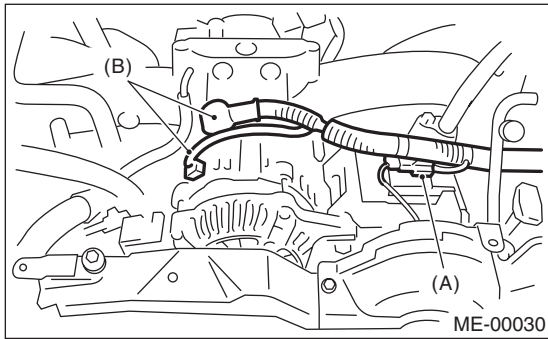
- (2) Engine ground terminal



- (3) Left and right engine ground cables

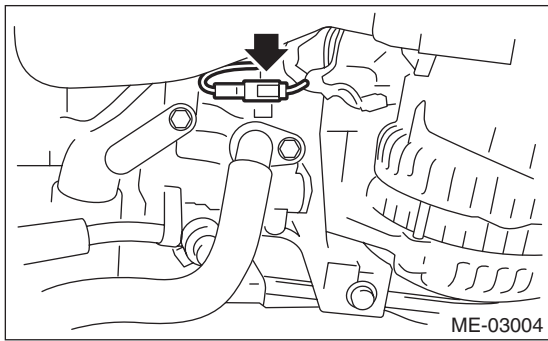


(4) Generator connector, terminal and A/C compressor connector

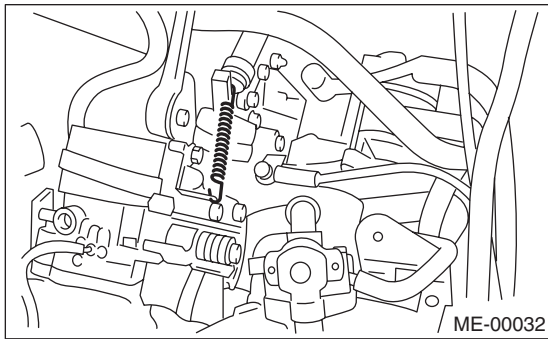


- (A) A/C compressor connector
- (B) Generator connector and terminal

(5) Power steering switch connector

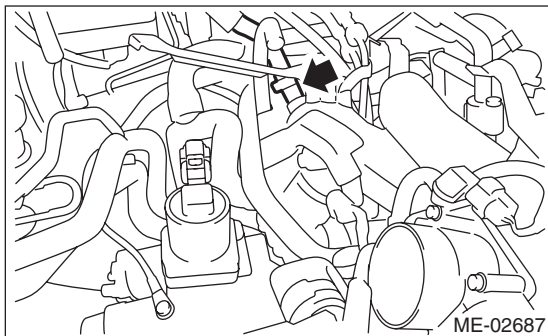


(6) Clutch release spring



14) Disconnect the following hoses.

(1) Brake booster vacuum hose

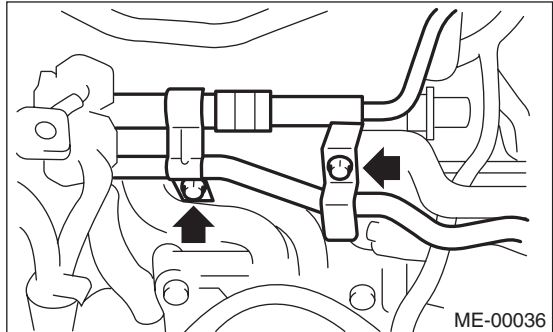


(2) Heater inlet and outlet hoses

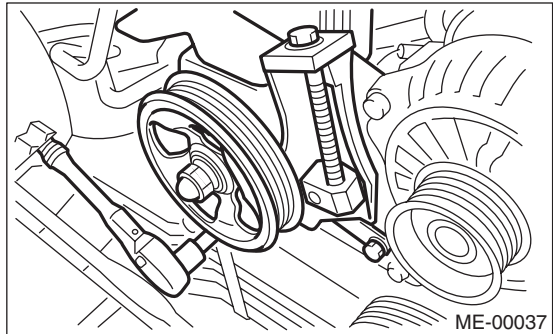
15) Remove the power steering pump.

(1) Remove the front V-belt. <Ref. to ME(H4DOTC)-44, FRONT SIDE BELT, REMOVAL, V-belt.>

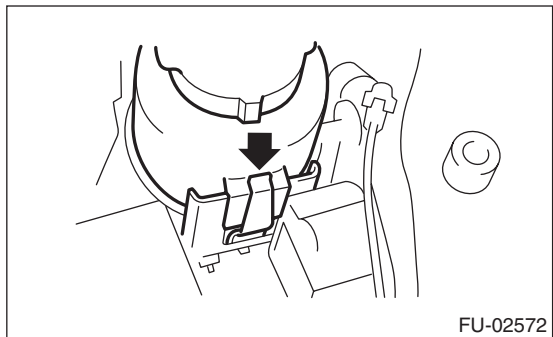
(2) Remove the power steering pipe from the fuel pipe protector RH along with the bracket.



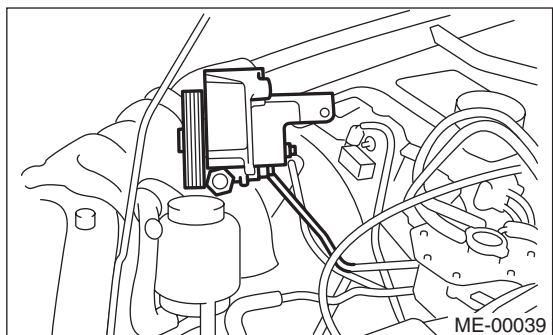
(3) Remove the power steering pump.



(4) Remove the reservoir tank from the bracket by pulling it upwards.



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



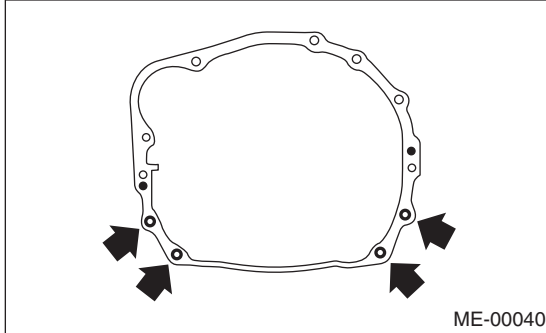
16) Lift up the vehicle.

MECHANICAL

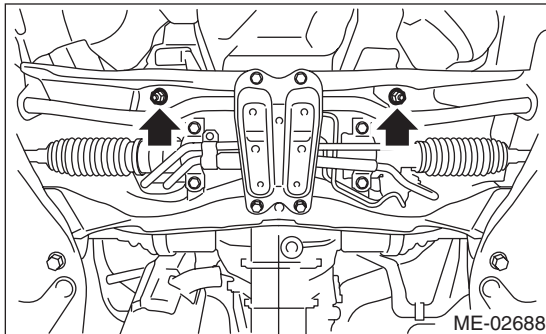
17) Remove the ATF cooler pipe from frame. (AT model)

18) Remove the center exhaust pipe. <Ref. to EX(H4DOTC)-10, REMOVAL, Center Exhaust Pipe.>

19) Remove the bolts and nuts which hold lower side of transmission to engine.



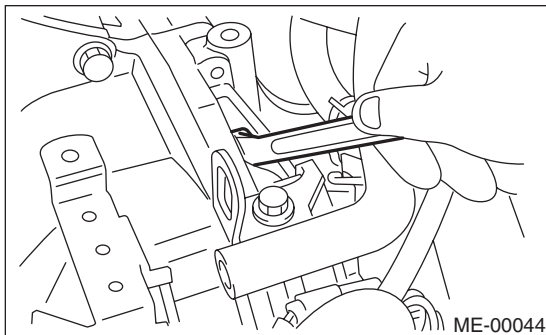
20) Remove the nuts which install front cushion rubber onto front crossmember.



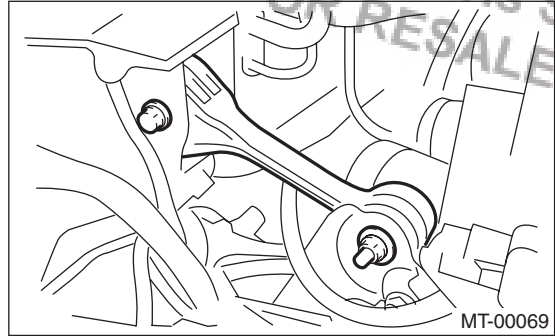
21) Separate the clutch release fork from the release bearing. (MT model) <Ref. to CL-18, REMOVAL, Release Bearing and Lever.>

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

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



23) Remove the pitching stopper.

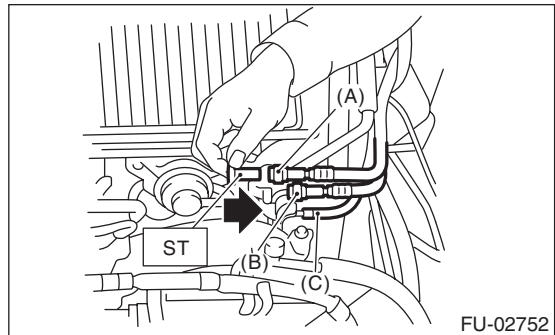


24) Remove the fuel hoses from the fuel pipes using the ST. <Ref. to FU(H4DOTC)-70, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>

CAUTION:

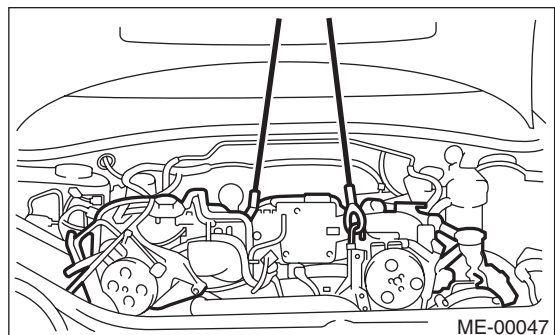
- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.

ST 42099AE000 CONNECTOR REMOVER



- (A) Fuel delivery hose
- (B) Return hose
- (C) Evaporation hose

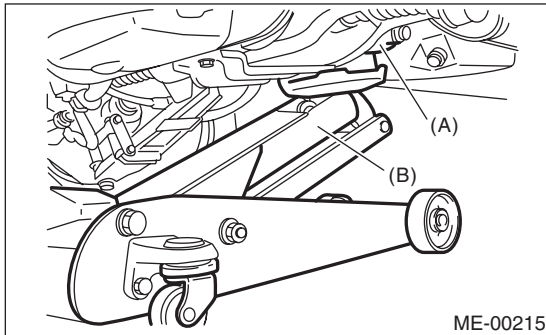
25) Support the engine with a lifting device and wire ropes.



26) Support the transmission with a garage jack.

CAUTION:

Doing this is very important to prevent the transmission from lowering due to its own weight.



(A) Transmission
(B) Garage jack

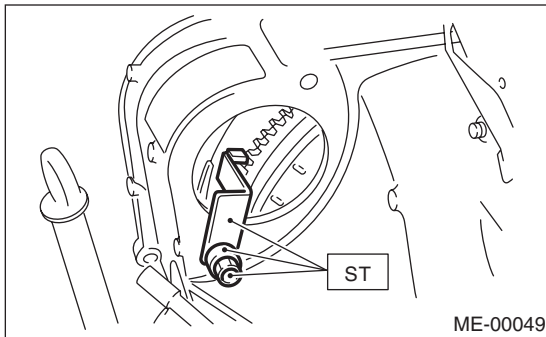
CAUTION:

Before removing the engine away from transmission, check to be sure no work has been overlooked.

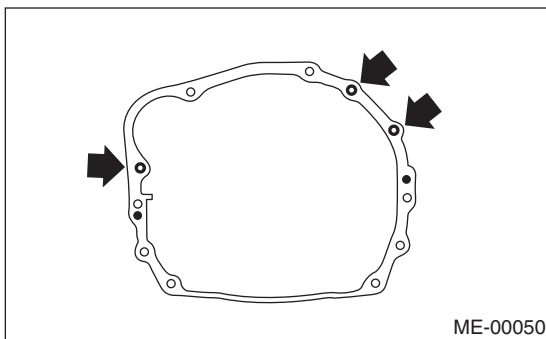
27) Separate the engine and transmission.

- (1) Remove the starter. <Ref. to SC(H4SO)-8, REMOVAL, Starter.>
- (2) Set the ST to torque converter clutch case. (AT model)

ST 498277200 STOPPER SET



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



28) Remove the engine from vehicle.

- (1) Slightly raise the engine.
- (2) Raise the transmission with garage jack.

(3) Move the engine horizontally until main shaft is withdrawn from clutch cover.

(4) Slowly move the engine away from engine compartment.

NOTE:

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

29) Remove the front cushion rubbers.

B: INSTALLATION

1) Attach the clutch release fork and bearing to the transmission. (MT model) <Ref. to CL-18, INSTALLATION, Release Bearing and Lever.>

2) Install the front cushion rubbers.

Tightening torque:

35 N·m (3.6 kgf-m, 25.8 ft-lb)

3) Position the engine in engine compartment and align it with transmission.

NOTE:

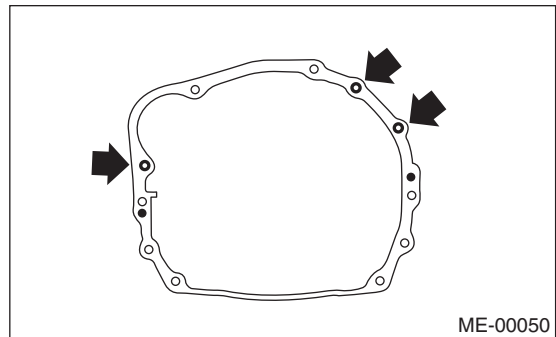
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

4) Apply a small amount of grease to the splines of the main shaft. (MT model)

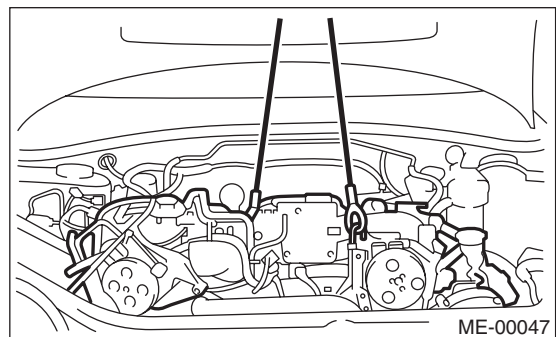
5) Tighten the bolts which hold upper side of transmission to engine.

Tightening torque:

50 N·m (5.1 kgf-m, 37 ft-lb)



6) Remove the lifting device and wire ropes.



7) Remove the garage jack.

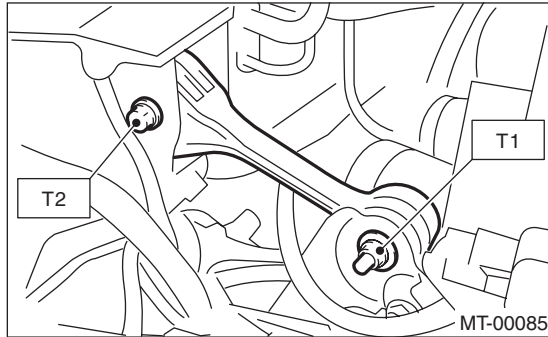
MECHANICAL

8) Install the pitching stopper.

Tightening torque:

T1: 50 N·m (5.1 kgf·m, 37 ft·lb)

T2: 58 N·m (5.9 kgf·m, 43 ft·lb)



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

NOTE:

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

ST 498277200 STOPPER SET

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

11) Install the torque converter clutch to drive plate. (AT model)

(1) Tighten the bolts which hold torque converter clutch to drive plate.

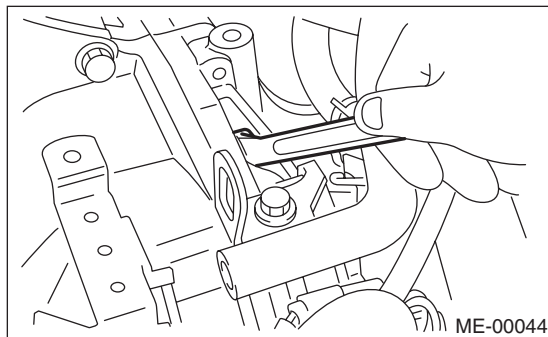
(2) Tighten other bolts while rotating the crankshaft using socket wrench.

NOTE:

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

Tightening torque:

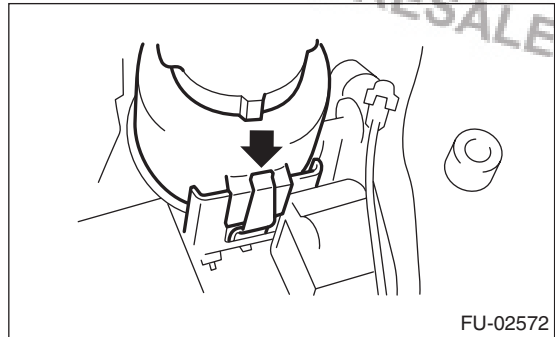
25 N·m (2.5 kgf·m, 18.4 ft·lb)



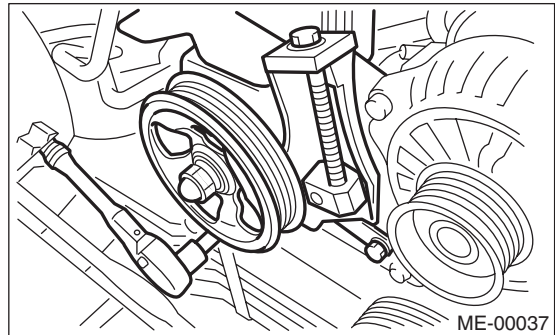
(3) Install the service hole plug.

12) Install the power steering pump.

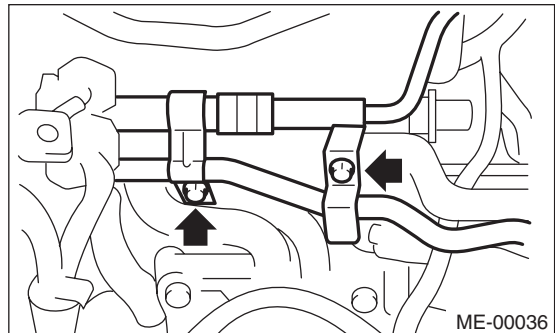
(1) Install the reservoir tank to the bracket.



(2) Install the power steering pump. <Ref. to PS-60, INSTALLATION, Oil Pump.>



(3) Install the power steering pipes onto the fuel pipe protector RH.



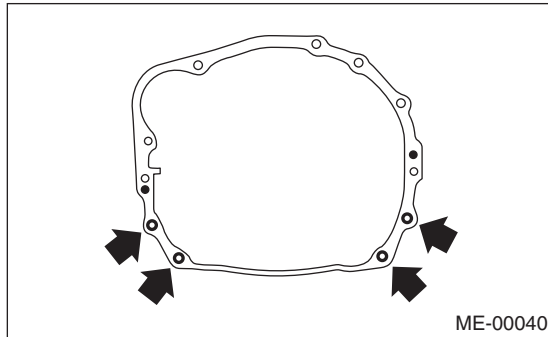
(4) Install the front V-belt and adjust it. <Ref. to ME(H4DOTC)-44, FRONT SIDE BELT, INSTALLATION, V-belt.>

13) Lift up the vehicle.

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

Tightening torque:

50 N·m (5.1 kgf-m, 37 ft-lb)



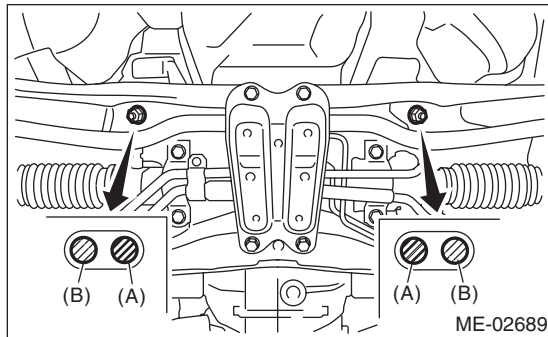
15) Tighten the nuts which install the front cushion rubber onto crossmember.

Tightening torque:

85 N·m (8.7 kgf-m, 62.7 ft-lb)

NOTE:

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



16) Install the ATF cooler pipe to frame. (AT model)

17) Install the center exhaust pipe. <Ref. to EX(H4DOTC)-11, INSTALLATION, Center Exhaust Pipe.>

18) Lower the vehicle.

19) Connect the following hoses.

- (1) Fuel delivery hose, return hose and evaporation hose
- (2) Heater inlet and outlet hoses
- (3) Brake booster vacuum hose

20) Connect the following connectors and terminals.

- (1) Engine ground terminal
- (2) Engine harness connectors
- (3) Generator connector and terminal
- (4) A/C compressor connector
- (5) Power steering switch connector

21) Adjust after connecting the cables.

22) Install the intercooler. <Ref. to IN(H4DOTC)-14, INSTALLATION, Intercooler.>

23) Install the air cleaner case and air intake boot. <Ref. to IN(H4DOTC)-10, INSTALLATION, Air Cleaner Case.>

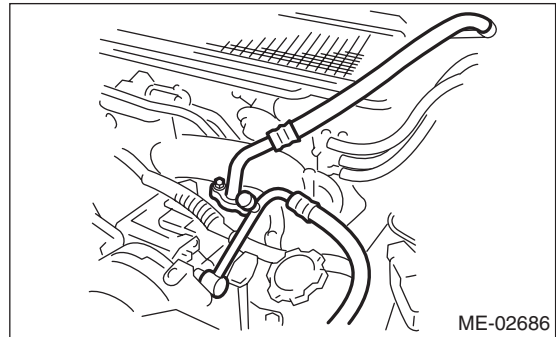
24) Install the A/C pressure hoses.

NOTE:

Use new O-rings.

Tightening torque:

15 N·m (1.5 kgf-m, 10.8 ft-lb)



25) Install the radiator. <Ref. to CO(H4DOTC)-26, INSTALLATION, Radiator.>

26) Install the coolant filler tank. <Ref. to CO(H4DOTC)-35, INSTALLATION, Coolant Filler Tank.>

27) Install the secondary air pump. <Ref. to EC(H4DOTC)-9, INSTALLATION, Secondary Air Pump.>

28) Install the battery in the vehicle, and connect cables.

29) Fill engine coolant. <Ref. to CO(H4DOTC)-19, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

30) Check the ATF level and replenish it if necessary. (AT model) <Ref. to 4AT-28, INSPECTION, Automatic Transmission Fluid.>

31) Charge the A/C system with refrigerant. <Ref. to AC-20, PROCEDURE, Refrigerant Charging Procedure.>

32) Remove the front hood stay, and close the front hood.

33) Lower the vehicle from the lift.

10.Engine Mounting

A: REMOVAL

- 1) Remove the engine unit. <Ref. to ME(H4DOTC)-36, REMOVAL, Engine Assembly.>
- 2) Remove the engine mounting from engine assembly.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

Engine mounting

35 N·m (3.6 kgf·m, 25.8 ft·lb)

C: INSPECTION

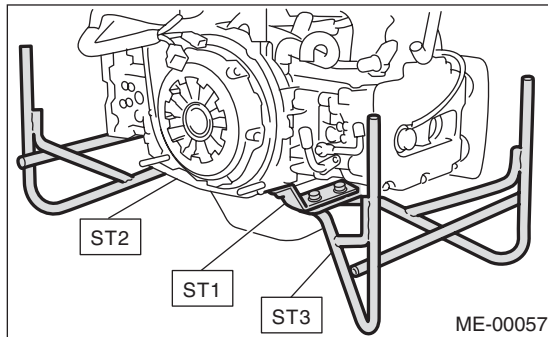
Make sure that no crack or other damages do not exist.

11. Preparation for Overhaul

A: PROCEDURE

1) After removing the engine from body, secure it to ST in the following procedure.

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



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

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

12.V-belt

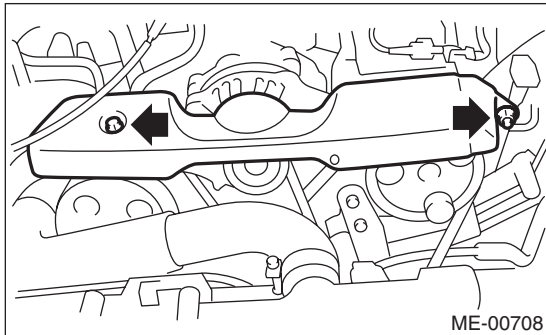
A: REMOVAL

NOTE:

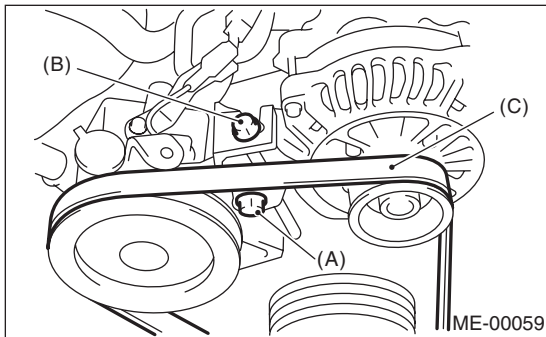
Perform the work with the engine installed to body when replacing a single part.

1. FRONT SIDE BELT

- 1) Remove the V-belt covers.

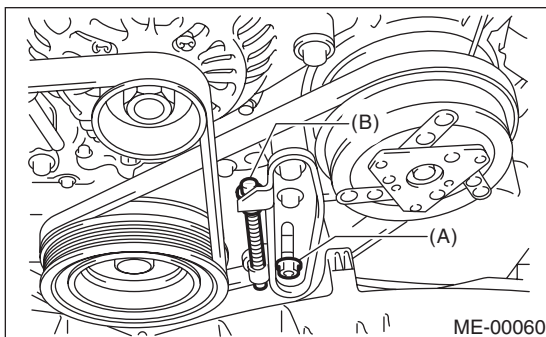


- 2) Loosen the lock bolt (A).
- 3) Loosen the slider bolt (B).
- 4) Remove the front side belt (C).



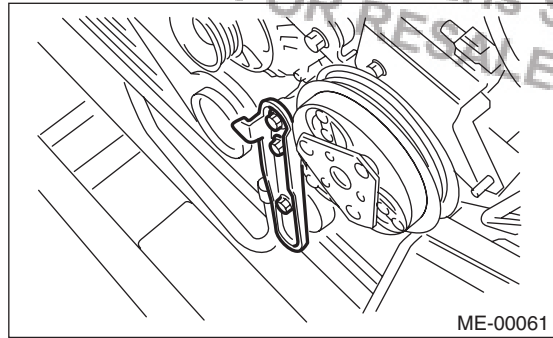
2. REAR SIDE BELT

- 1) Remove the front side belts. <Ref. to ME(H4DOTC)-44, FRONT SIDE BELT, REMOVAL, V-belt.>
- 2) Loosen the lock nut (A).
- 3) Loosen the slider bolt (B).



- 4) Remove the rear side belt.

- 5) Remove the belt tensioner.



B: INSTALLATION

1. FRONT SIDE BELT

CAUTION:

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

- 1) Install the front side belt (C), and tighten the slider bolt so as to obtain the specified belt tension. <Ref. to ME(H4DOTC)-45, INSPECTION, V-belt.>
- 2) Tighten the lock bolt (A).
- 3) Tighten the slider bolt (B).

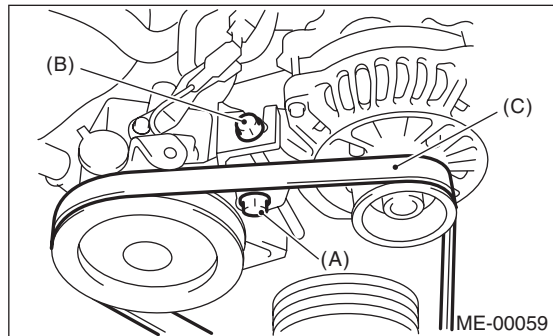
Tightening torque:

Lock bolt (A)

25 N·m (2.5 kgf-m, 18.4 ft-lb)

Slider bolt (B)

8 N·m (0.8 kgf-m, 5.9 ft-lb)



- 4) Install the V-belt cover.

Tightening torque:

Bolt

13.7 N·m (1.4 kgf-m, 10.1 ft-lb)

Nut

4 N·m (0.4 kgf-m, 2.95 ft-lb)

2. REAR SIDE BELT

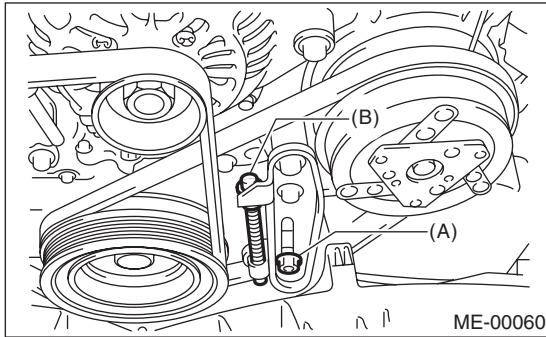
- 1) Install the belt tensioner.
- 2) Install the rear side belt, and tighten the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME(H4DOTC)-45, INSPECTION, V-belt.>

3) Tighten the lock nut (A).

Tightening torque:

Lock nut (A)

22.6 N·m (2.3 kgf·m, 16.6 ft·lb)



4) Install the front side belt. <Ref. to ME(H4DOTC)-44, FRONT SIDE BELT, INSTALLATION, V-belt.>
<Ref. to ME(H4DOTC)-45, INSPECTION, V-belt.>

C: INSPECTION

1) Replace the belts, if crack, fraying or wear is found.

2) Check the V-belt tension and adjust it if necessary by changing the generator installing position or idler pulley installing position.

Belt tension (with belt tension gauge):

(A)

When installing new parts:

640 — 780 N (65 — 80 kgf, 144 — 175 lbf)

At inspection:

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

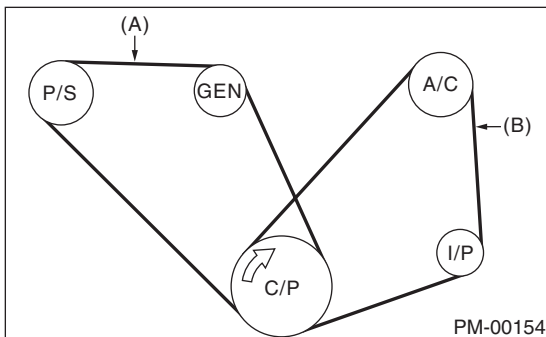
(B)

When installing new parts:

650 — 750 N (66 — 76 kgf, 146 — 169 lbf)

At inspection:

350 — 450 N (36 — 46 kgf, 79 — 101 lbf)



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

Belt tension (without belt tension gauge)

(A)

When installing new parts:

7 — 9 mm (0.276 — 0.354 in)

At inspection:

9 — 11 mm (0.354 — 0.433 in)

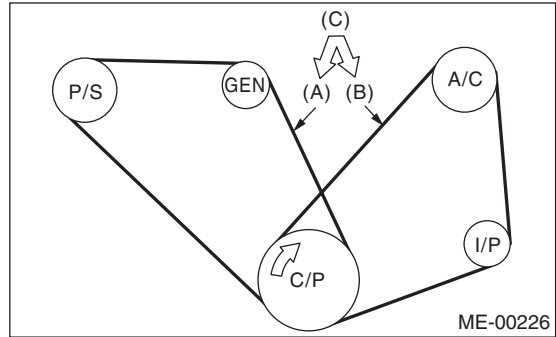
(B)

When installing new parts:

7.5 — 8.5 mm (0.295 — 0.335 in)

At inspection:

9.0 — 10.0 mm (0.354 — 0.394 in)



- (A) Front side belt
- (B) Rear side belt
- (C) 98 N (10 kgf, 22 lbf)
- C/P Crank pulley
- GEN Generator
- P/S Power steering oil pump pulley
- A/C Air conditioning compressor pulley
- I/P Idler pulley

13. Crank Pulley

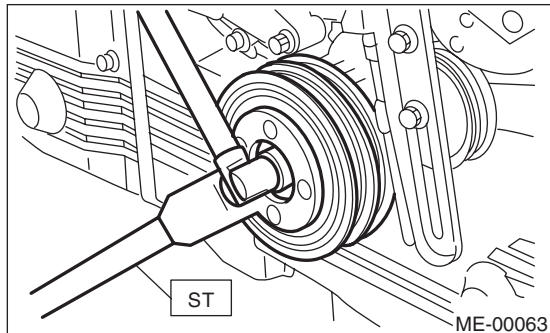
A: REMOVAL

NOTE:

Perform the work with the engine installed to body when replacing a single part.

- 1) Remove the V-belts. <Ref. to ME(H4DOTC)-44, REMOVAL, V-belt.>
- 2) Remove the crank pulley bolt. To lock the crankshaft, use ST.

ST 499977100 CRANK PULLEY WRENCH



- 3) Remove the crank pulley.

B: INSTALLATION

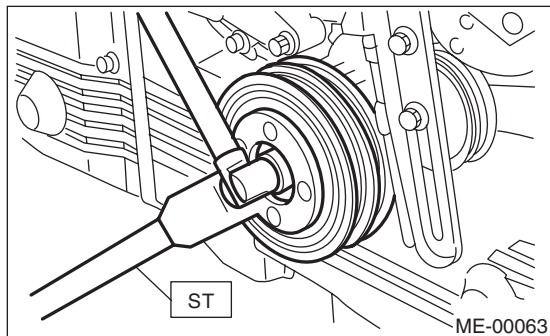
- 1) Install the crank pulley.
- 2) Install the pulley bolt. To lock the crankshaft, use ST.

ST 499977100 CRANK PULLEY WRENCH

- (1) Clean the crank pulley threads using compressed air.
- (2) Apply engine oil to the crank pulley bolt seat and thread.
- (3) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).
- (4) Tighten the crank pulley bolts.

Tightening torque:

180 N·m (18.4 kgf-m, 132.8 ft-lb)



- 3) Check that the tightening angle of the crank pulley bolt is 65° or more. Perform the following procedure when less than 65°.

CAUTION:

If the tightening angle of the crank pulley bolt is less than 65°, the bolt is damaged. In this case, the bolt must be replaced with a new part.

- (1) Replace the crank pulley bolts with new parts and clean.

Crank pulley bolt:

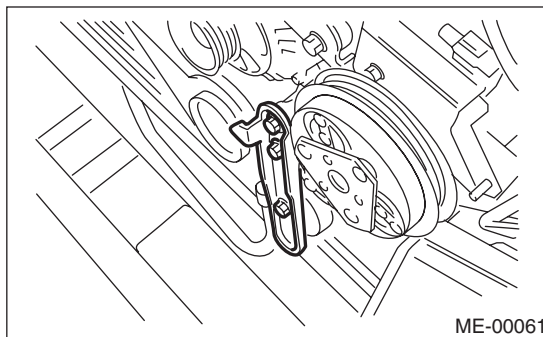
12369AA011

- (2) Clean the crankshaft thread using compressed air.
- (3) Apply engine oil to the crank pulley bolt seat and thread.
- (4) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).
- (5) Tighten the crank pulley bolts 65° to 75°.

NOTE:

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

- 4) Install the belt tensioner.



- 5) Install the V-belts. <Ref. to ME(H4DOTC)-44, INSTALLATION, V-belt.>

C: INSPECTION

- 1) Make sure the V-belt is not worn or otherwise damaged.
- 2) Check the tension of the belt. <Ref. to ME(H4DOTC)-45, INSPECTION, V-belt.>

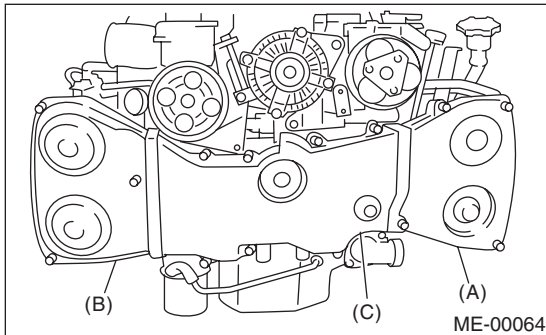
14. Timing Belt Cover

A: REMOVAL

NOTE:

Perform the work with the engine installed to body when replacing a single part.

- 1) Remove the V-belts. <Ref. to ME(H4DOTC)-44, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4DOTC)-46, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover (LH) (A).
- 4) Remove the timing belt cover (RH) (B).
- 5) Remove the front timing belt cover (C).



B: INSTALLATION

- 1) Install the front timing belt cover (C).

Tightening torque:

5 N·m (0.5 kgf·m, 3.6 ft·lb)

- 2) Install the timing belt cover (RH) (B).

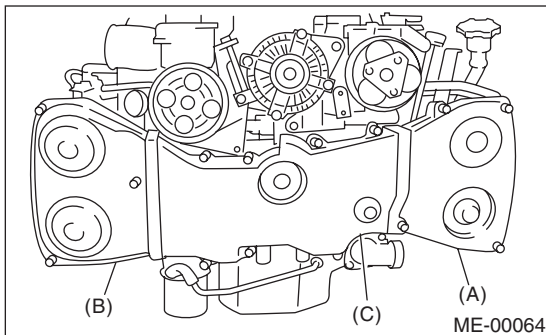
Tightening torque:

5 N·m (0.5 kgf·m, 3.6 ft·lb)

- 3) Install the timing belt cover (LH) (A).

Tightening torque:

5 N·m (0.5 kgf·m, 3.6 ft·lb)



- 4) Install the crank pulley. <Ref. to ME(H4DOTC)-46, INSTALLATION, Crank Pulley.>
- 5) Install the V-belts. <Ref. to ME(H4DOTC)-44, INSTALLATION, V-belt.>

C: INSPECTION

Check the cover for damage.

15. Timing Belt

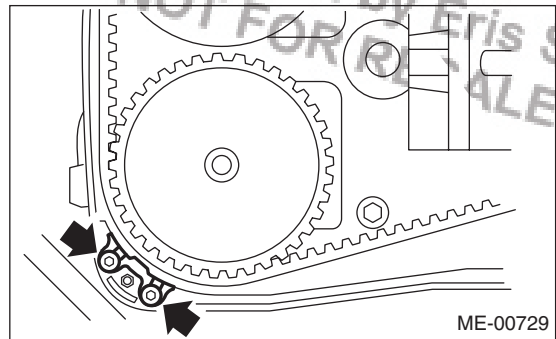
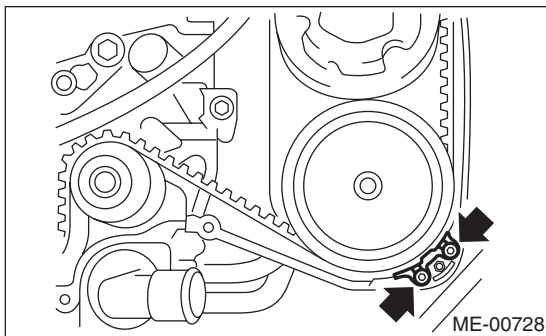
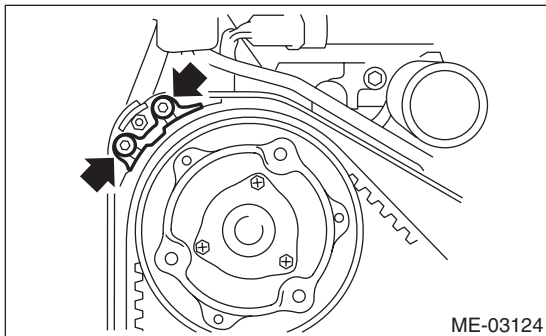
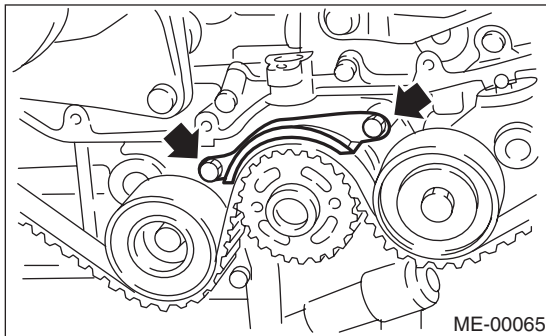
A: REMOVAL

1. TIMING BELT

NOTE:

Perform the work with the engine installed to body when replacing a single part. For operation procedures, refer to "Timing Belt" in the PM section. <Ref. to PM-12, Timing Belt.>

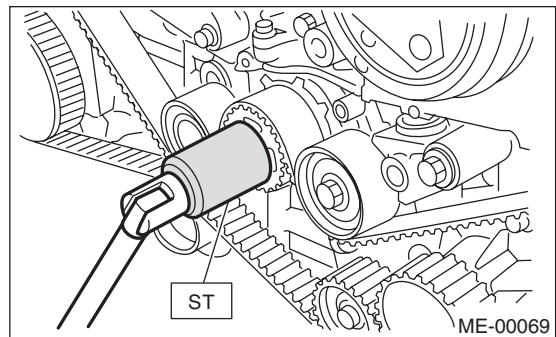
- 1) Remove the V-belts. <Ref. to ME(H4DOTC)-44, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4DOTC)-46, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4DOTC)-47, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt guide. (MT model)



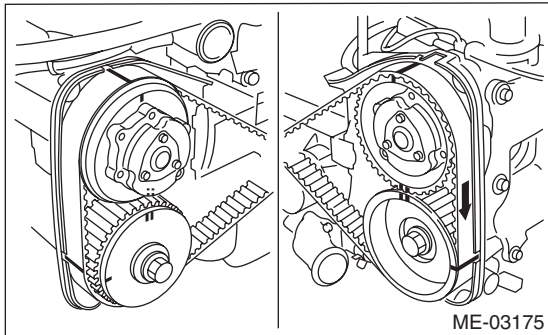
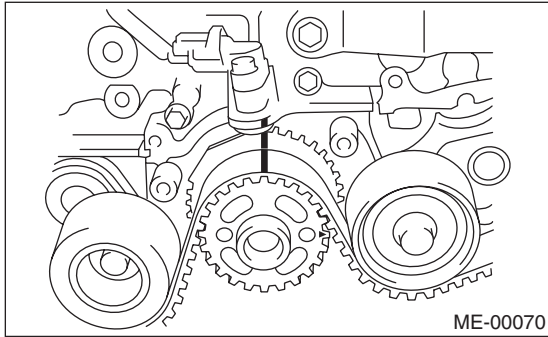
5) If the alignment mark or arrow mark (which indicates the direction of rotation) on timing belt fade away, put new marks before removing the timing belt as shown in procedures below.

(1) Turn the crankshaft using ST, and align the alignment marks on crank sprocket, intake cam sprocket (LH), exhaust cam sprocket (LH), intake cam sprocket (RH) and exhaust cam sprocket (RH) with notches of timing belt cover and cylinder block.

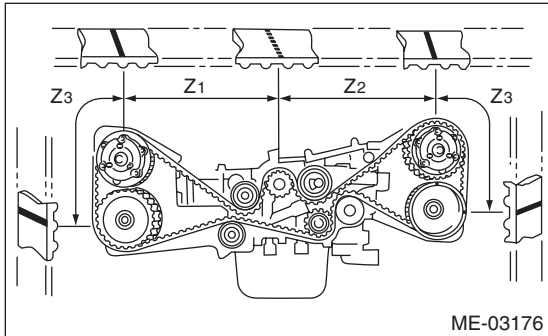
ST 499987500 CRANKSHAFT SOCKET



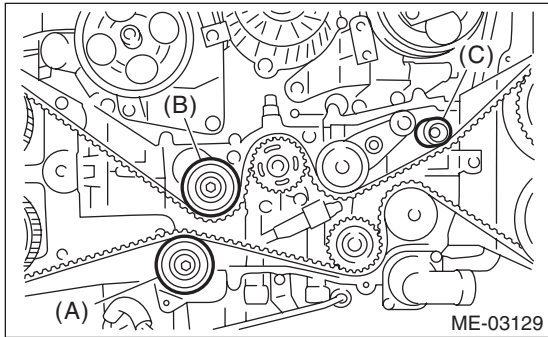
(2) Using white paint, put alignment and/or arrow marks on timing belts in relation to the cam sprockets.



Z₁: 54.5 teeth
Z₂: 51 teeth
Z₃: 28 teeth



6) Remove the belt idler (A).



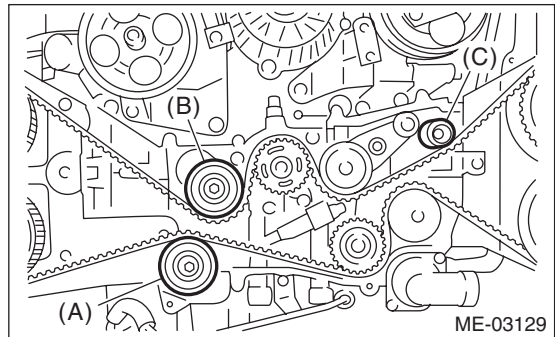
7) Remove the timing belt.

CAUTION:

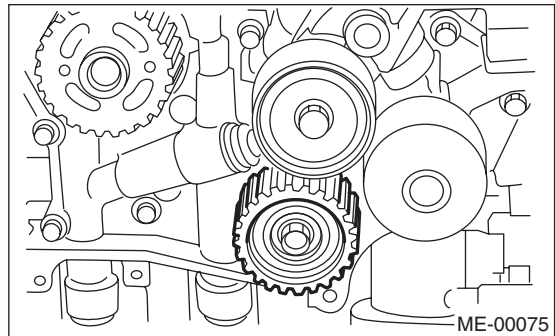
After the timing belt has been removed, never rotate the intake and exhaust sprocket. If the cam sprocket is rotated, the intake and exhaust valve heads strike together and valve stems are bent.

2. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

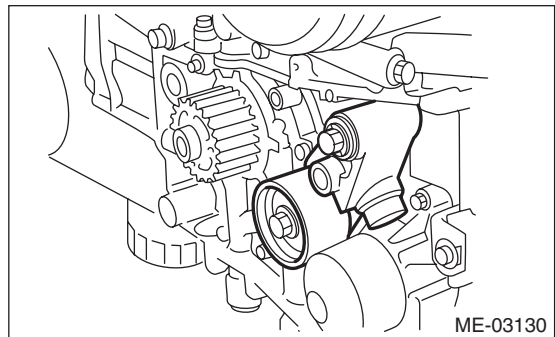
1) Remove the belt idler (B) and (C).



2) Remove the belt idler No. 2.



3) Remove the automatic belt tension adjuster assembly.



B: INSTALLATION

1. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

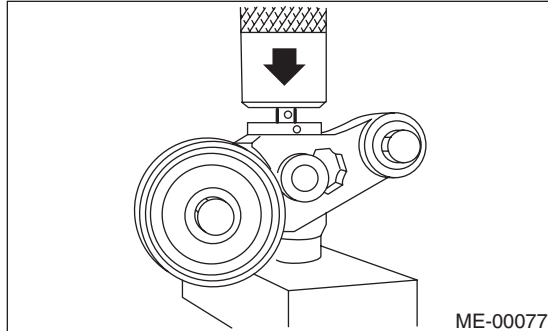
1) Preparation for installation of automatic belt tension adjuster assembly.

CAUTION:

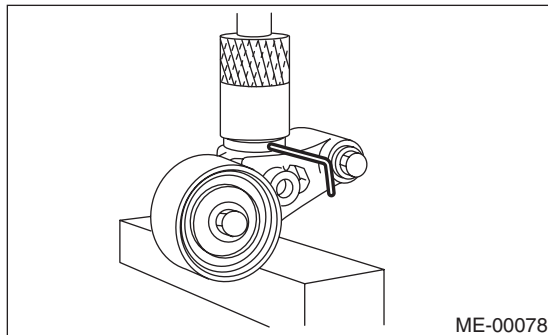
- Always use a vertical type pressing tool to move the adjuster rod down.
- Do not use a lateral type vise.
- Push the adjuster rod vertically.
- Press-in the push adjuster rod gradually taking three minutes or more.
- Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lbf).
- Push in the adjuster rod to the end face of the cylinder. Do not push in the adjuster rod farther than the end face of 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 vertical pressing tool.

(2) Slowly move the adjuster rod down with a pressure of 294 N (30 kgf, 66 lbf) or more until the adjuster rod is aligned with the stopper pin hole in the cylinder.

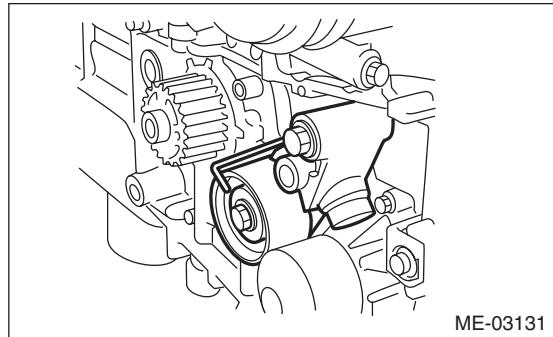


(3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (nominal) dia. hex bar wrench inserted into the stopper pin hole in the cylinder, secure the adjuster rod.



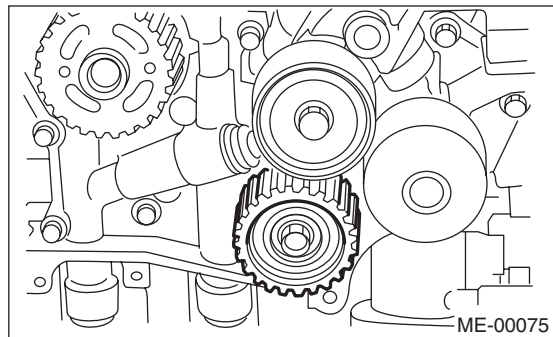
2) Install the automatic belt tension adjuster assembly.

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



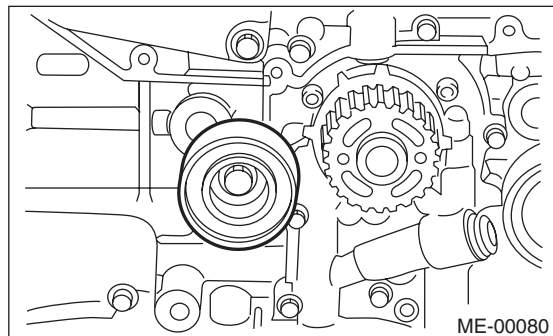
3) Install the belt idler No. 2.

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



4) Install the belt idlers.

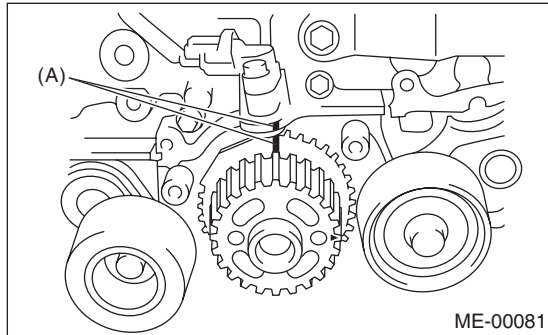
Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)



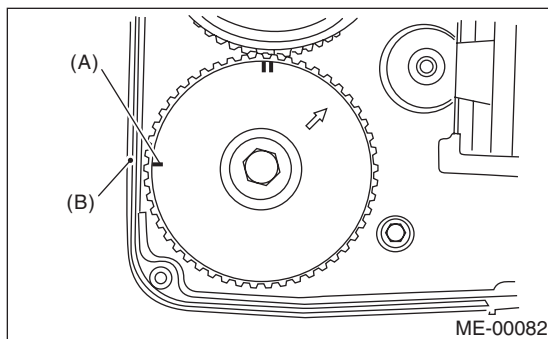
2. TIMING BELT

1) Preparation for installation of automatic belt tension adjuster assembly. <Ref. to ME(H4DOTC)-50, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>

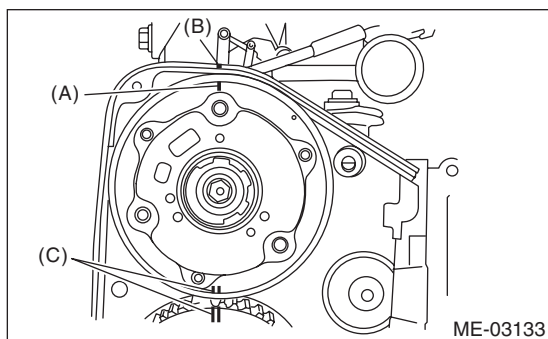
2) Align the mark (A) on crank sprocket with the mark on oil pump cover at cylinder block.



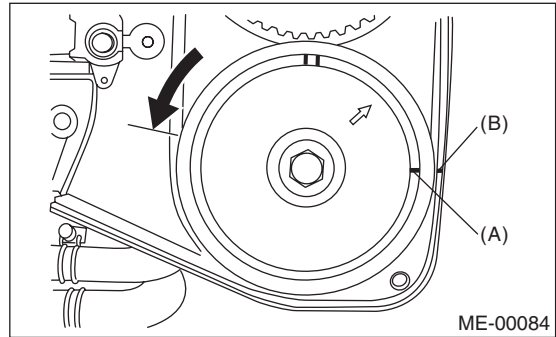
3) Align single line mark (A) on the exhaust cam sprocket (RH) with notch (B) on timing belt cover.



4) Align single line mark (A) on the intake cam sprocket (RH) with notch (B) on timing belt cover. (Make sure that the double lines (C) on intake and exhaust camshaft sprockets are aligned.)

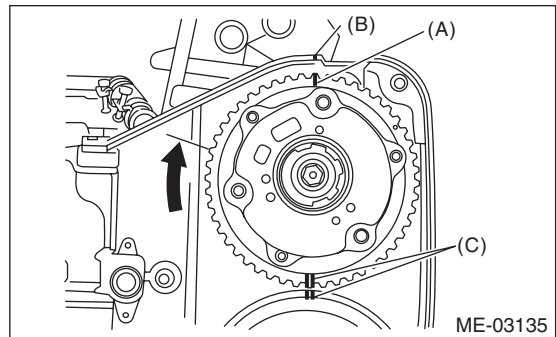


5) Align the single line mark (A) on exhaust cam sprocket (LH) with notch (B) on timing belt cover by turning the sprocket counterclockwise (as viewed from front of engine).



6) Align the single line mark (A) on intake cam sprocket (LH) with notch (B) on timing belt cover by turning the sprocket clockwise (as viewed from front of engine).

(Make sure that the double line marks (C) on intake and exhaust cam sprockets are aligned.)



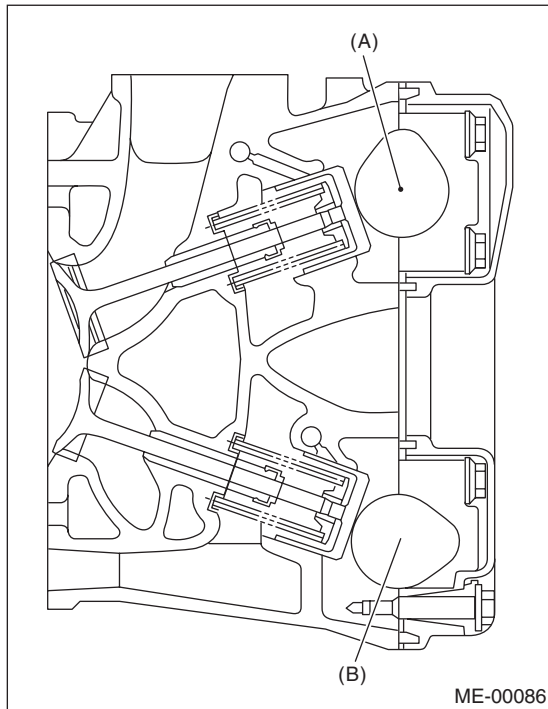
Timing Belt

MECHANICAL

7) Make sure that the cam and crank sprockets are positioned properly.

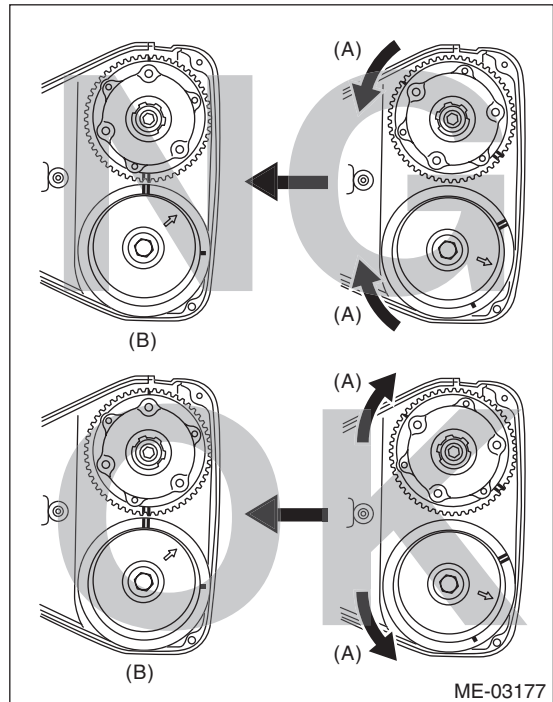
CAUTION:

• Intake and exhaust camshafts for this DOHC engine can be independently rotated with the timing belts removed. As can be seen from the figure, if the intake and exhaust valves are lifted simultaneously, the valve heads will interfere with each other, resulting in bent valves.



- (A) Intake camshaft
- (B) Exhaust camshaft

• Do not allow the camshafts to rotate in the direction shown in the upper figure. Doing this may cause both the intake and exhaust valves to lift simultaneously, resulting in mutual interference of heads.



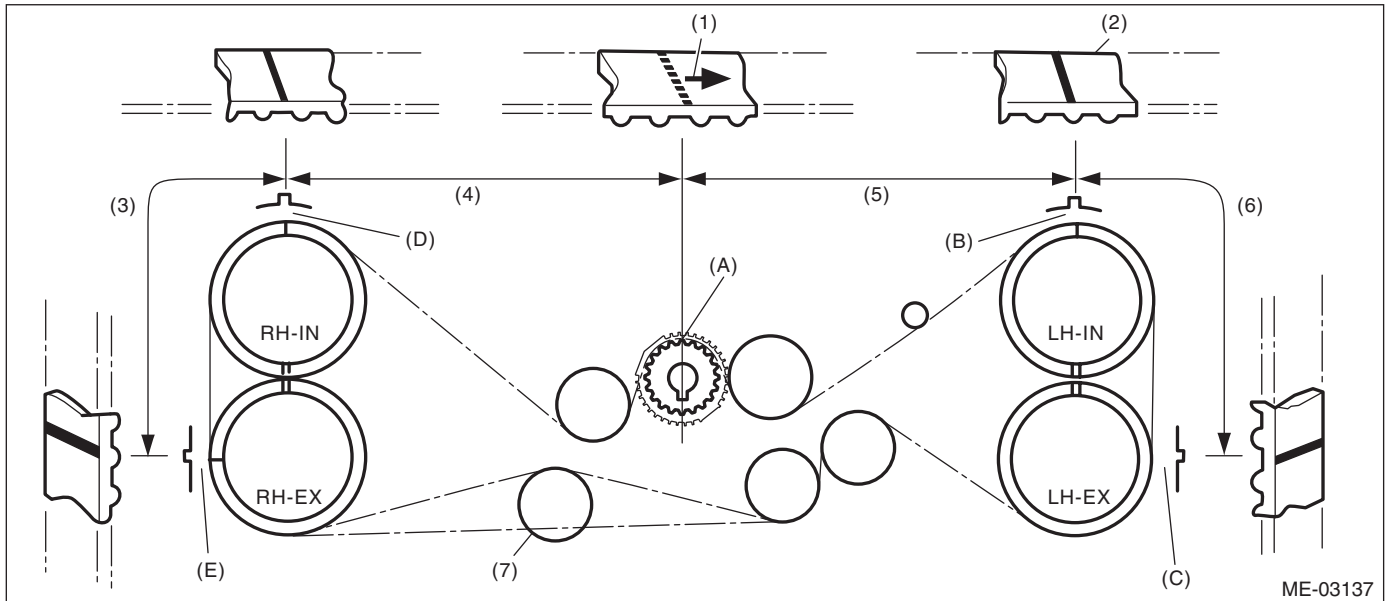
- (A) Direction of rotation
- (B) Timing belt installation position

- When the timing belts are not installed, four camshafts are held at the “zero-lift” position, where all cams on camshafts do not push the intake and exhaust valves down. (Under this condition, all valves remain unlifted.)
- When the camshafts are rotated to install the timing belts, #2 intake and #4 exhaust cam of camshafts (LH) are held to push their corresponding valves down. (Under this condition, these valves are held lifted.) Right-side camshafts are held so that their cams do not push valves down.
- Camshafts (LH) must be rotated from the zero-lift position to the position where the timing belt is to be installed with the smallest possible angle, in order to prevent mutual interference of intake and exhaust valve heads.

8) Install the timing belt.
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:

- If the timing belt slips by 3 or more teeth, the valve and piston may hit each other.
- Make sure that the direction of belt rotation is correct.



- | | | |
|-----------------|----------------|---------------------------|
| (1) Arrow mark | (4) 54.5 teeth | (6) 28 teeth |
| (2) Timing belt | (5) 51 teeth | (7) Install it in the end |
| (3) 28 teeth | | |

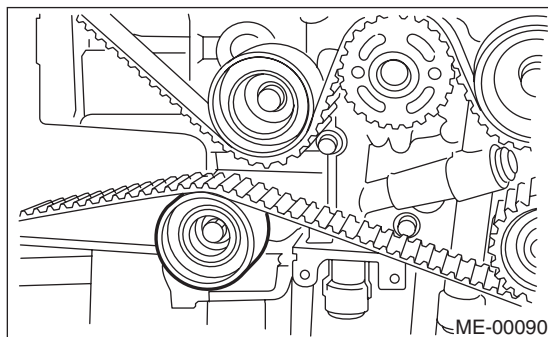
9) Install the belt idlers.

Tightening torque:

39 N·m (4.0 kgf·m, 28.9 ft·lb)

NOTE:

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



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

11) Install the timing belt guide. (MT model)

NOTE:

- Before installing bolts, clean the screw part of timing belt cover.
- Apply liquid gasket to the threaded portion of cam sprocket side. (When reusing the bolts)

Liquid gasket:

THREE BOND 1324 (Part No. 004403042) or equivalent

- (1) Temporarily tighten the bolts mounting the timing belt guide.

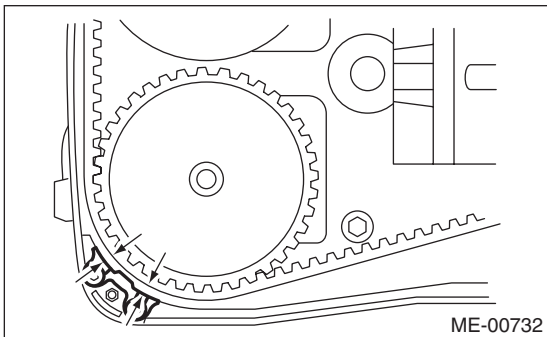
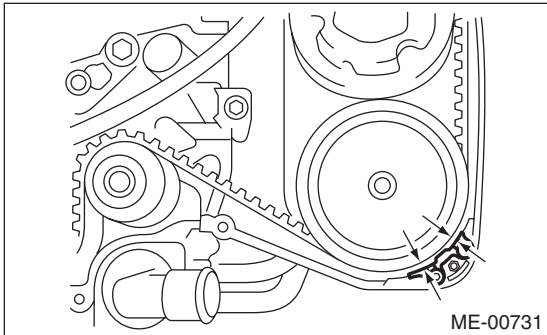
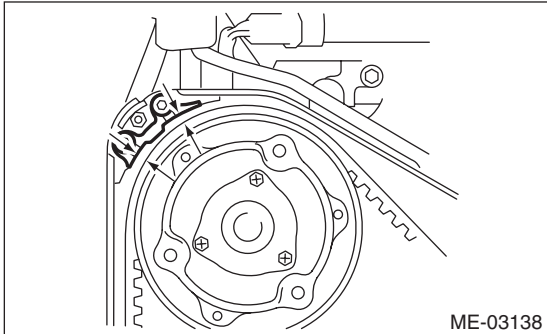
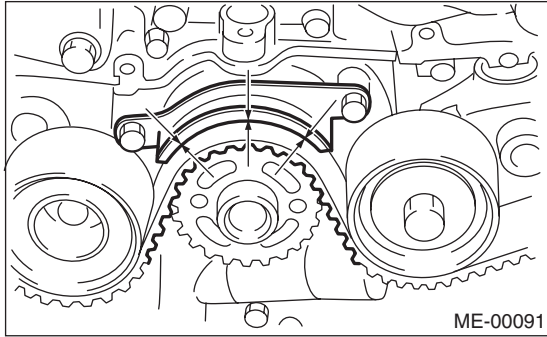
Timing Belt

MECHANICAL

(2) Check and adjust the clearance between timing belt and timing belt guide.

Clearance:

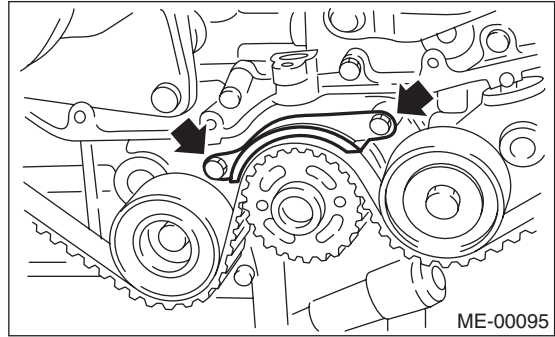
$1.0 \pm 0.5 \text{ mm}$ ($0.039 \pm 0.020 \text{ in}$)



(3) Tighten the bolts mounting the timing belt guide.

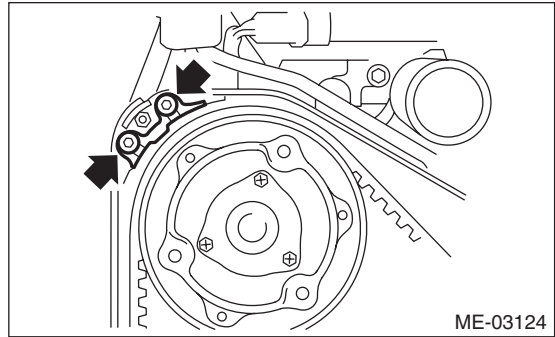
Tightening torque:

$9.75 \text{ N}\cdot\text{m}$ ($1.0 \text{ kgf}\cdot\text{m}$, $7.2 \text{ ft}\cdot\text{lb}$)



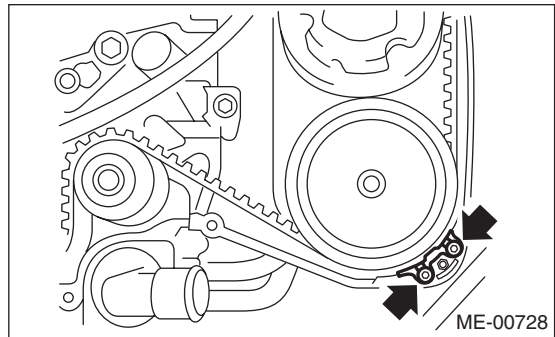
Tightening torque:

$6.4 \text{ N}\cdot\text{m}$ ($0.65 \text{ kgf}\cdot\text{m}$, $4.7 \text{ ft}\cdot\text{lb}$)



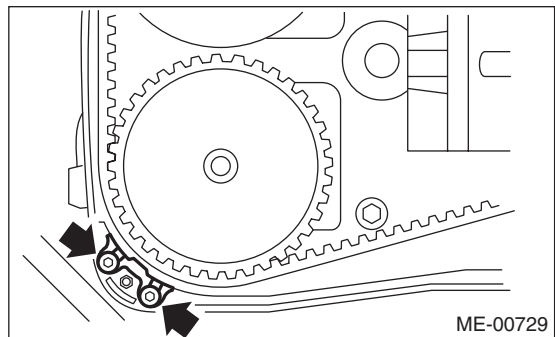
Tightening torque:

$6.4 \text{ N}\cdot\text{m}$ ($0.65 \text{ kgf}\cdot\text{m}$, $4.7 \text{ ft}\cdot\text{lb}$)



Tightening torque:

$6.4 \text{ N}\cdot\text{m}$ ($0.65 \text{ kgf}\cdot\text{m}$, $4.7 \text{ ft}\cdot\text{lb}$)



12) Install the timing belt cover. <Ref. to ME(H4DOTC)-47, INSTALLATION, Timing Belt Cover.>

13) Install the crank pulley. <Ref. to ME(H4DOTC)-46, INSTALLATION, Crank Pulley.>

14) Install the V-belts. <Ref. to ME(H4DOTC)-44, INSTALLATION, V-belt.>

C: INSPECTION

1. TIMING BELT

1) Check the timing belt teeth for breaks, cracks or wear. If any fault is found, replace the timing belt.

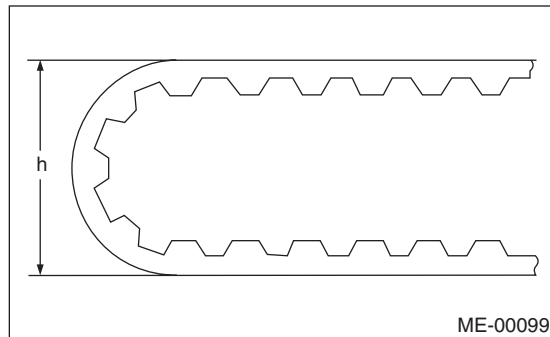
2) Check the condition on the back surface of the timing belt. If cracks are found, replace the timing belt.

CAUTION:

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

In radial diameter h:

60 mm (2.36 in) or more



2. AUTOMATIC BELT TENSION ADJUSTER

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

NOTE:

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

2) Check that the adjuster rod does not move when a pressure of 294 N (30 kgf, 66 lbf) is applied to it. This is to check the adjuster rod stiffness.

3) If the adjuster rod is not stiff and moves freely when applying 294 N (30 kgf, 66 lbf), check it using the following procedures:

(1) Slowly press the adjuster rod down to the end surface of cylinder. Repeat this operation two to three times.

(2) With the adjuster rod extended all the way up, apply a pressure of 294 N (30 kgf, 66 lbf) to it to inspect the stiffness of the adjuster rod.

(3) If the adjuster rod is not stiff and compresses downward, replace the automatic belt tension adjuster assembly.

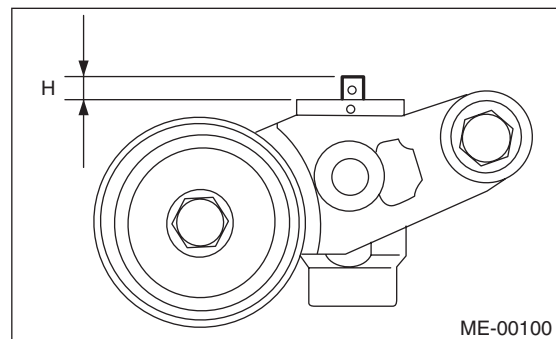
CAUTION:

- Always use a vertical type pressing tool to move the adjuster rod down.
- Do not use a lateral type vise.
- Push the adjuster rod vertically.
- Press-in the push adjuster rod gradually taking three minutes or more.
- Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lbf).
- Push in the adjuster rod to the end face of the cylinder. Do not push in the adjuster rod farther than the end face of the cylinder. Doing so may damage the cylinder.

4) Measure the amount of rod protrusion "H" beyond the body. If it is not within specifications, replace with a new part.

Amount of rod protrusion H:

5.2 — 6.2 mm (0.205 — 0.244 in)



5) Check the mating surfaces of timing belt and contact point of adjuster rod for uneven wear or scratches. Replace the automatic belt tension adjuster assembly if faulty.

6) Check the belt tension pulley for smooth rotation. Replace if noise or excessive play occurs.

7) Check the belt tension pulley for grease leakage.

3. BELT IDLER

1) Check the belt idler for smooth rotation. Replace if noise or excessive play occurs.

2) Check the outer contacting surface of idler pulley for uneven wear and scratches.

3) Check the belt idler for grease leakage.

16. Cam Sprocket

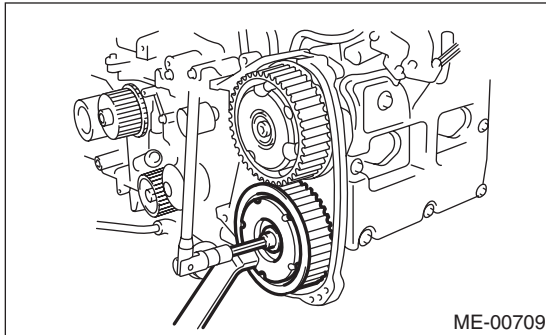
A: REMOVAL

NOTE:

Perform the work with the engine installed to body when replacing a single part.

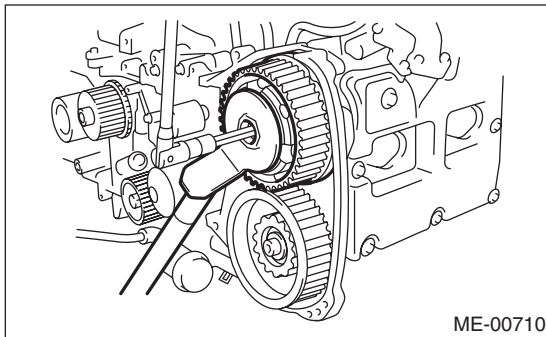
- 1) Remove the V-belts. <Ref. to ME(H4DOTC)-44, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4DOTC)-46, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4DOTC)-47, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt. <Ref. to ME(H4DOTC)-48, REMOVAL, Timing Belt.>
- 5) Remove the actuator cover of the intake cam sprocket.
- 6) Fasten the cam sprocket and remove from the cam shaft using ST.

ST 499207400 CAM SPROCKET WRENCH



ME-00709

ST 499977500 CAM SPROCKET WRENCH



ME-00710

B: INSTALLATION

- 1) Fasten the cam sprocket and install to the cam shaft using ST.

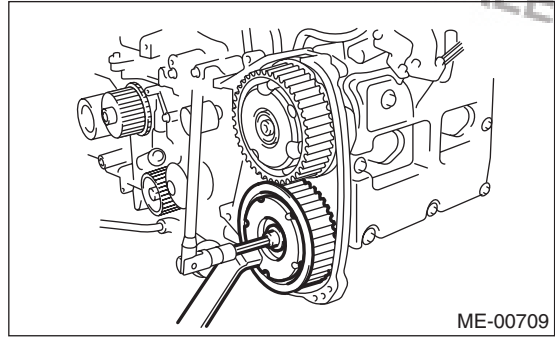
NOTE:

Do not confuse the cam sprockets (LH) and (RH) during installation.

ST 499207400 CAM SPROCKET WRENCH

Tightening torque:

Tighten to 30 N·m (3.1 kgf·m, 22.1 ft·lb) of torque, and then tighten further by 45°.

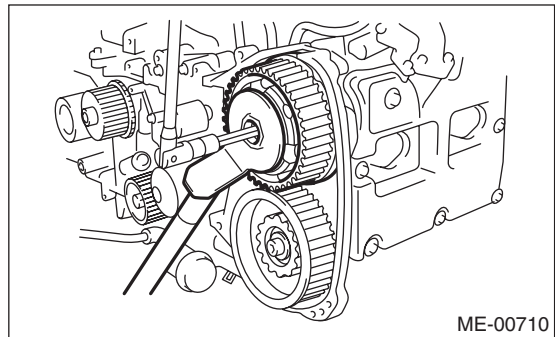


ME-00709

ST 499977500 CAM SPROCKET WRENCH

Tightening torque:

Tighten to 30 N·m (3.1 kgf·m, 22.1 ft·lb) of torque, and then tighten further by 45°.



ME-00710

- 2) Attach the actuator cover of the intake cam sprocket.

NOTE:

Use new O-rings.

Tightening torque:

3.4 N·m (0.3 kgf·m, 2.5 ft·lb)

- 3) Install the timing belt. <Ref. to ME(H4DOTC)-50, INSTALLATION, Timing Belt.>
- 4) Install the timing belt cover. <Ref. to ME(H4DOTC)-47, INSTALLATION, Timing Belt Cover.>
- 5) Install the crank pulley. <Ref. to ME(H4DOTC)-46, INSTALLATION, Crank Pulley.>
- 6) Install the V-belts. <Ref. to ME(H4DOTC)-44, INSTALLATION, V-belt.>

C: INSPECTION

- 1) Check the cam sprocket teeth for uneven wear and scratches.
- 2) Make sure there is no free play between cam sprocket and key.

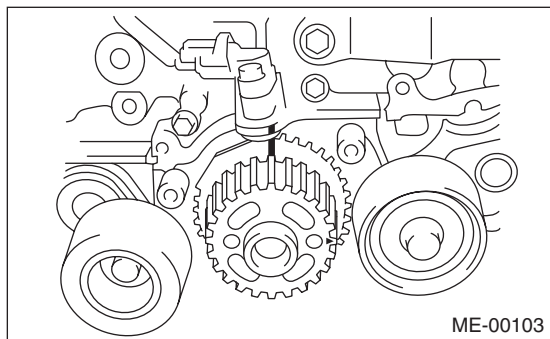
17. Crank Sprocket

A: REMOVAL

NOTE:

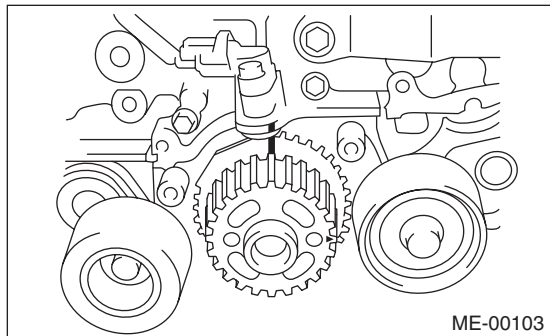
Perform the work with the engine installed to body when replacing a single part.

- 1) Remove the V-belts. <Ref. to ME(H4DOTC)-44, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4DOTC)-46, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4DOTC)-47, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt. <Ref. to ME(H4DOTC)-48, REMOVAL, Timing Belt.>
- 5) Remove the crank sprocket.



B: INSTALLATION

- 1) Install the crank sprocket.



- 2) Install the timing belt. <Ref. to ME(H4DOTC)-50, INSTALLATION, Timing Belt.>
- 3) Install the timing belt cover. <Ref. to ME(H4DOTC)-47, INSTALLATION, Timing Belt Cover.>
- 4) Install the crank pulley. <Ref. to ME(H4DOTC)-46, INSTALLATION, Crank Pulley.>
- 5) Install the V-belts. <Ref. to ME(H4DOTC)-44, INSTALLATION, V-belt.>

C: INSPECTION

- 1) Check the crank sprocket teeth for uneven wear and scratches.
- 2) Make sure there is no free play between crank sprocket and key.
- 3) Check the crank sprocket protrusion used for sensor for damage and contamination of foreign matter.

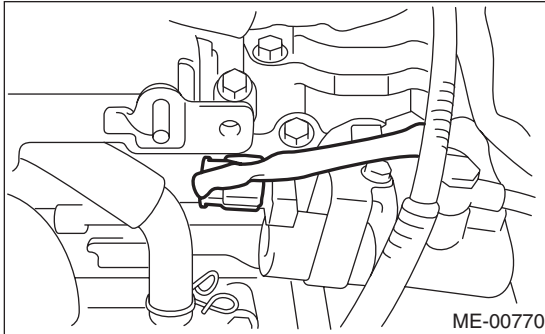
18. Camshaft

A: REMOVAL

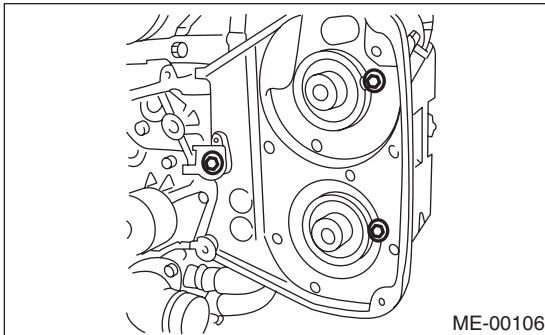
NOTE:

Perform the work with the engine installed to body when replacing a single part. Refer to "Valve Clearance" for preparation. <Ref. to ME(H4DOTC)-32, Valve Clearance.>

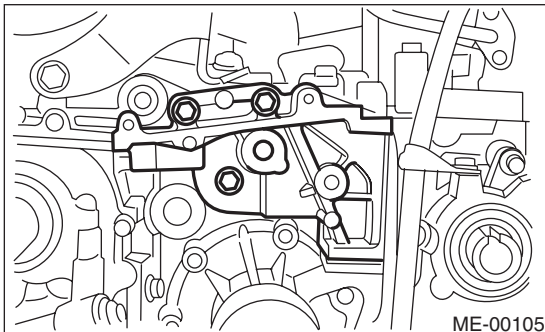
- 1) Remove the V-belts. <Ref. to ME(H4DOTC)-44, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4DOTC)-46, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4DOTC)-47, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt. <Ref. to ME(H4DOTC)-48, REMOVAL, Timing Belt.>
- 5) Remove the cam sprocket. <Ref. to ME(H4DOTC)-56, REMOVAL, Cam Sprocket.>
- 6) Disconnect the oil flow control solenoid valve assembly connector.



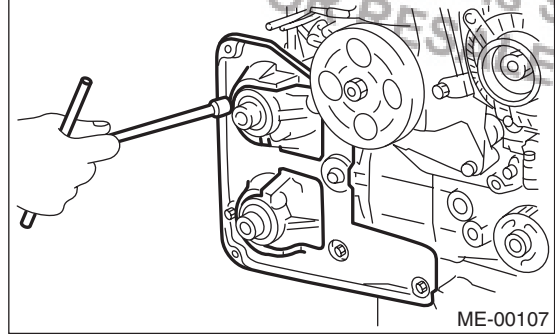
- 7) Remove the timing belt cover No. 2 (LH).



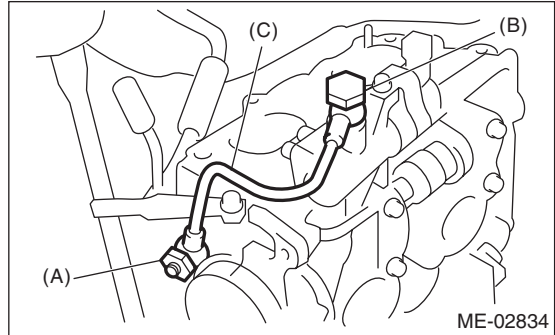
- 8) Remove the tensioner bracket.



- 9) Remove the timing belt cover No. 2 (RH).

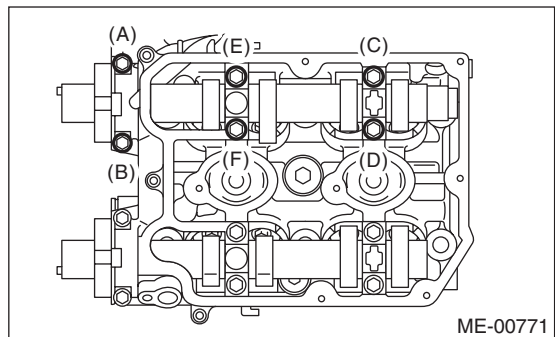


- 10) Remove the ignition coil.
- 11) Disconnect the PCV hose from the rocker cover.
- 12) Remove the oil level gauge guide. (LH side)
- 13) Remove the rocker cover and gasket.
- 14) Remove the oil pipe.

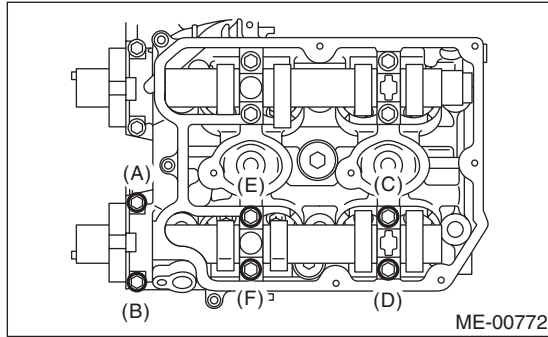


- (A) Union screw with filter (with protrusion)
- (B) Union screw without filter (without protrusion)
- (C) Oil pipe

- 15) Loosen the oil flow control solenoid valve assembly and intake camshaft cap bolts equally, a little at a time in alphabetical order shown in the figure.



16) Loosen the exhaust camshaft cap bolts equally, a little at a time in alphabetical order shown in the figure.



17) Remove the oil flow control solenoid valve assembly, intake camshaft cap and camshaft.

18) Remove the exhaust camshaft caps and camshaft.

NOTE:

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

19) Similarly, remove the camshafts (RH) and related parts.

B: INSTALLATION

1) Install the camshaft.

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

NOTE:

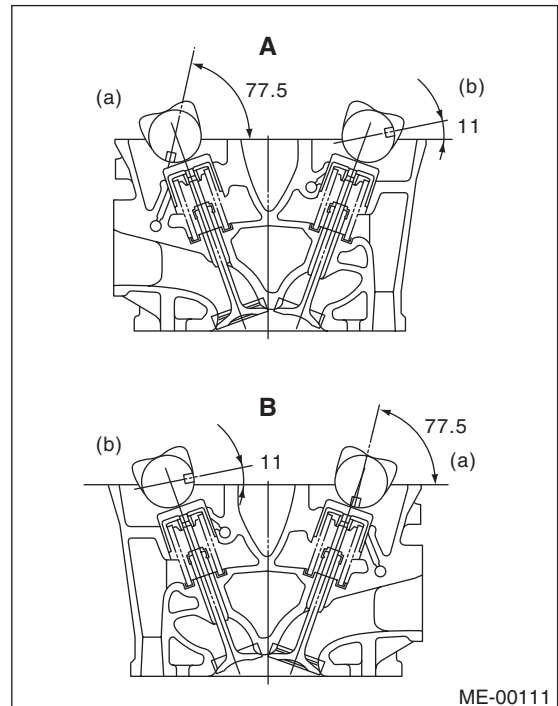
- Set the camshaft to the position shown in the figure. It is necessary to rotate the camshaft (LH) slightly when installing the timing belt.
- Camshaft (RH) need not be rotated when set at the position shown in the figure.

Intake camshaft (LH):

Rotate 80° clockwise.

Exhaust camshaft (LH):

Rotate 45° counterclockwise.



- A Cylinder head (LH)
- B Cylinder head (RH)
- (a) Intake camshaft
- (b) Exhaust camshaft

Camshaft

MECHANICAL

2) Install the camshaft cap and oil flow control solenoid valve assembly.

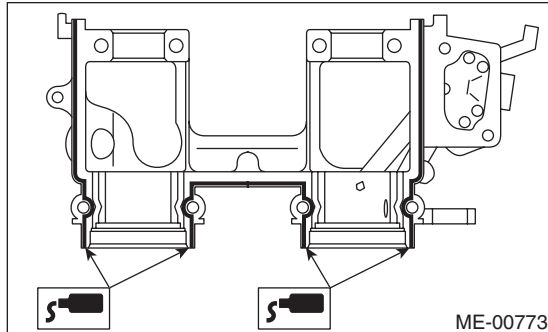
(1) Apply small amount of liquid gasket to the mating surface of cap.

NOTE:

Do not apply liquid gasket excessively. Applying excessively may cause excess gasket to come out and flow toward oil seal, resulting in oil leak.

Liquid gasket:

THREE BOND 1215 (Part No. 004403007) or equivalent



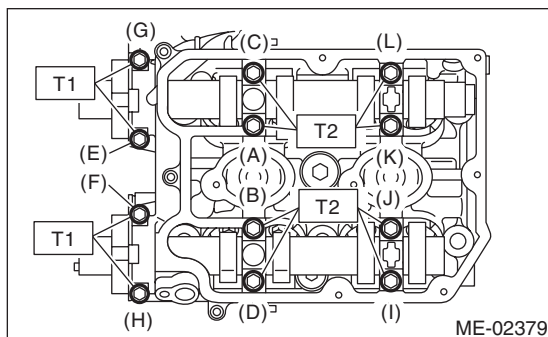
(2) Apply a thin coat of engine oil to cap bearing surface, and install the cap to the camshaft.

(3) Gradually tighten the camshaft cap and oil control valve assembly in at least two stages in alphabetical order shown in the figure, and then tighten to specified torque.

Tightening torque:

T1: 9.75 N·m (1.0 kgf·m, 7.2 ft·lb)

T2: 20 N·m (2.0 kgf·m, 14.8 ft·lb)



(4) After tightening the camshaft cap, ensure the camshaft rotates only slightly while holding it at base circle.

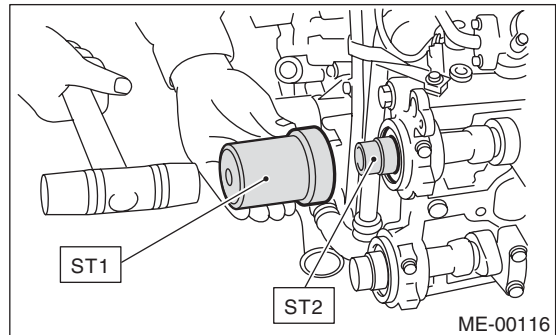
3) Apply a coat of engine oil to oil seal periphery and oil seal lips and install the oil seal on camshaft using ST1 and ST2.

NOTE:

Use a new oil seal.

ST1 499587600 OIL SEAL INSTALLER

ST2 499597200 OIL SEAL GUIDE



4) Install the rocker cover.

(1) Install the gasket on rocker cover. Install the peripheral gasket and ignition coil unit gasket.

NOTE:

Use a new gasket.

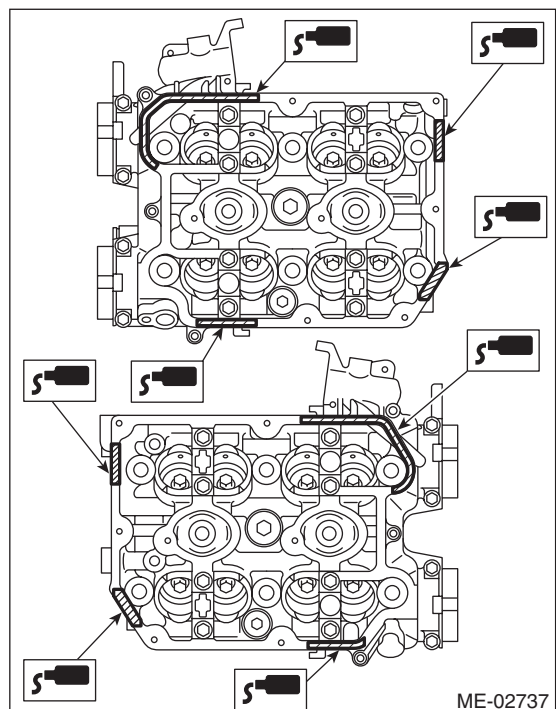
(2) Apply liquid gasket to the specified point of the cylinder head.

NOTE:

Apply extra liquid gasket around semicircular plugs 5 mm (0.2 in) or more.

Liquid gasket:

THREE BOND 1215 (Part No. 004403007) or equivalent

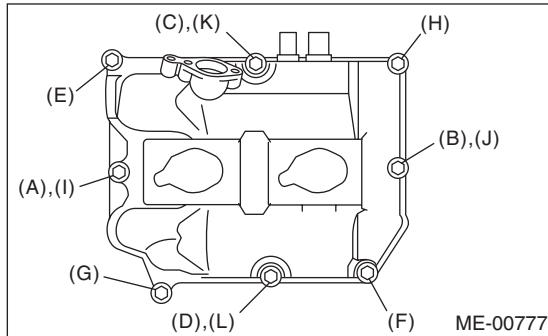


(3) Install the rocker cover on cylinder head. Ensure the gasket is properly positioned during installation.

(4) Temporarily tighten the rocker cover tightening bolt in alphabetical sequence shown in the figure, and then tighten to specified torque in alphabetical order.

Tightening torque:

6.4 N·m (0.65 kgf·m, 4.7 ft·lb)



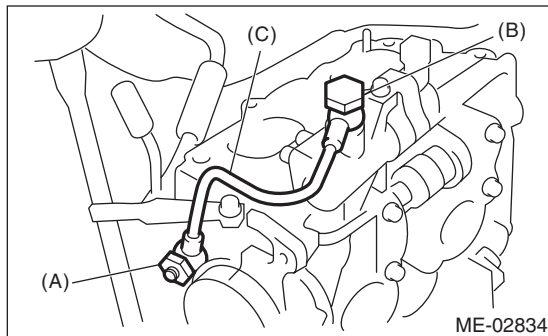
5) Install the oil pipe.

NOTE:

Be careful of the installing location of the union screw; the location will differ depending on whether or not there is a filter.

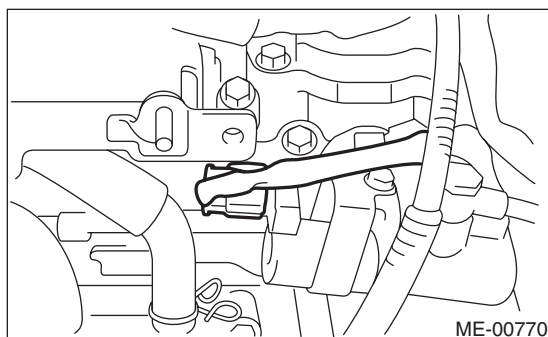
Tightening torque:

29 N·m (3.0 kgf·m, 21.4 ft·lb)



- (A) Union screw with filter (with protrusion)
- (B) Union screw without filter (without protrusion)
- (C) Oil pipe

6) Connect the oil flow control solenoid valve connector.

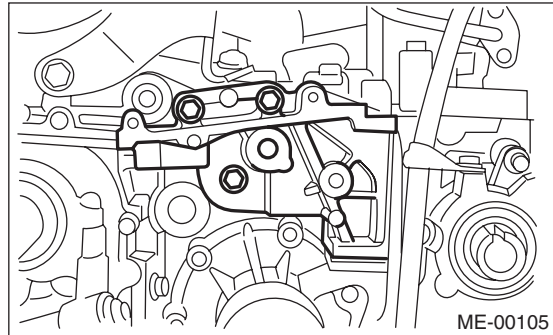


7) Similarly, install the parts on right-hand side.

8) Install the tensioner bracket.

Tightening torque:

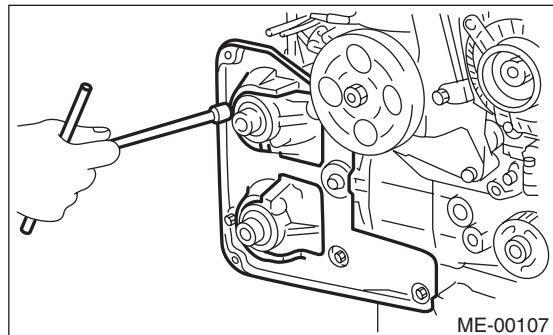
24.5 N·m (2.5 kgf·m, 18.1 ft·lb)



9) Install the timing belt cover No. 2 (RH).

Tightening torque:

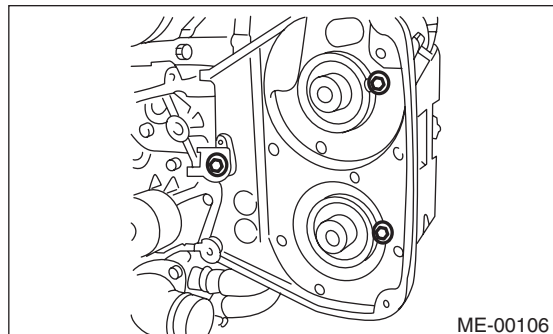
5 N·m (0.5 kgf·m, 3.6 ft·lb)



10) Install the timing belt cover No. 2 (LH).

Tightening torque:

5 N·m (0.5 kgf·m, 3.6 ft·lb)



11) Install the cam sprocket. <Ref. to ME(H4DOTC)-56, INSTALLATION, Cam Sprocket.>

12) Install the timing belt. <Ref. to ME(H4DOTC)-50, INSTALLATION, Timing Belt.>

13) Install the timing belt cover. <Ref. to ME(H4DOTC)-47, INSTALLATION, Timing Belt Cover.>

14) Install the crank pulley. <Ref. to ME(H4DOTC)-46, INSTALLATION, Crank Pulley.>

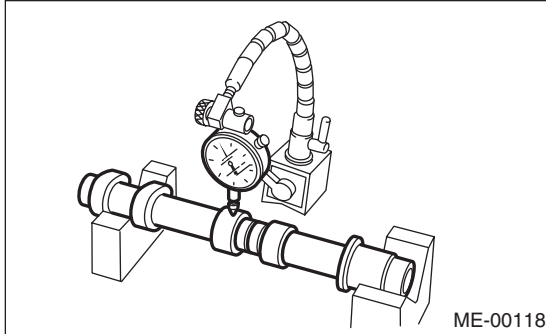
15) Install the V-belts. <Ref. to ME(H4DOTC)-44, INSTALLATION, V-belt.>

C: INSPECTION

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

Service limit:

0.020 mm (0.0008 in)



- 2) Check the journal for damage and wear. Replace if faulty.
- 3) Check the cutout portion used for camshaft sensor for damage. Replace if faulty.
- 4) Measure the outside diameter of camshaft journal. If the journal diameter is not within the standard value, check the oil clearance.

	Camshaft journal	
	Front	Center, rear
Standard mm (in)	37.946 — 37.963 (1.4939 — 1.4946)	29.946 — 29.963 (1.1790 — 1.1796)

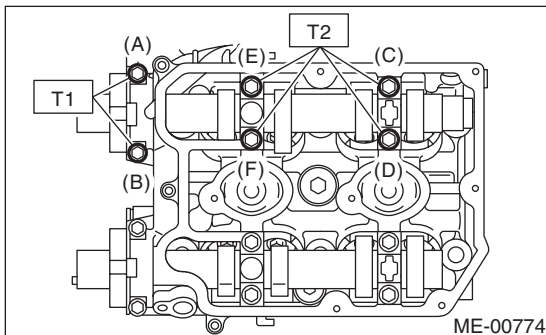
5) Measurement of the camshaft journal oil clearance

- (1) Clean the bearing caps and camshaft journals.
- (2) Place the camshafts on cylinder head. (Without installing the valve lifter)
- (3) Place a plastigauge across each camshaft journals.
- (4) Gradually tighten the cap in at least two stages in alphabetical order shown in the figure, and then tighten to specified torque. Do not turn the camshaft.

Tightening torque:

T1: 9.75 N·m (1.0 kgf-m, 7.2 ft-lb)

T2: 20 N·m (2.0 kgf-m, 14.8 ft-lb)



(5) Remove the bearing caps.

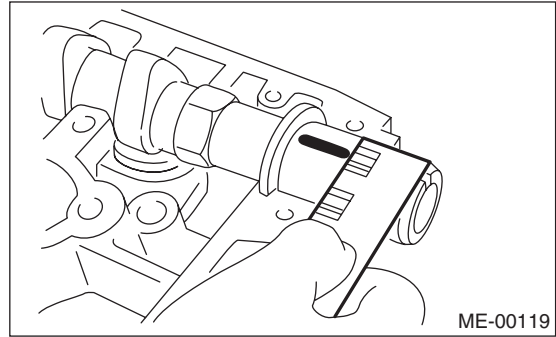
(6) Measure the widest point of the plastigauge on each journal. If the oil clearance exceeds the limit, replace the camshaft. If necessary, replace the camshaft caps and cylinder head as a set.

Standard:

0.037 — 0.072 mm (0.0015 — 0.0028 in)

Service limit:

0.10 mm (0.0039 in)



- (7) Completely remove the plastigauge.
- 6) Check the cam face condition; remove the minor faults by grinding with oil stone. Measure the cam height H. Replace if it exceeds the limit or there is uneven wear.

Cam height H:

Standard

Intake

46.55 — 46.65 mm (1.833 — 1.837 in)

Exhaust

46.75 — 46.85 mm (1.841 — 1.844 in)

Limit

Intake

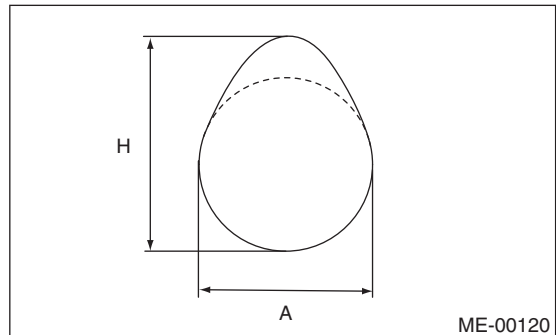
46.45 mm (1.829 in)

Exhaust

46.65 mm (1.837 in)

Cam base circle diameter A:

37.0 mm (1.457 in)



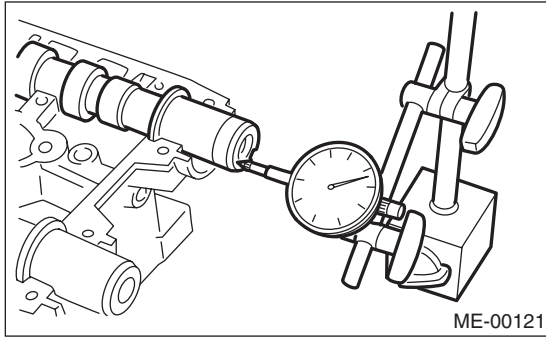
7) Measure the thrust clearance of camshaft with setting the dial gauge at end of camshaft. If the thrust clearance exceeds the limit or there is uneven wear, replace the caps and cylinder head as a set. If necessary replace the camshaft.

Standard:

0.068 — 0.116 mm (0.0027 — 0.0046 in)

Service limit:

0.14 mm (0.0055 in)



19. Cylinder Head

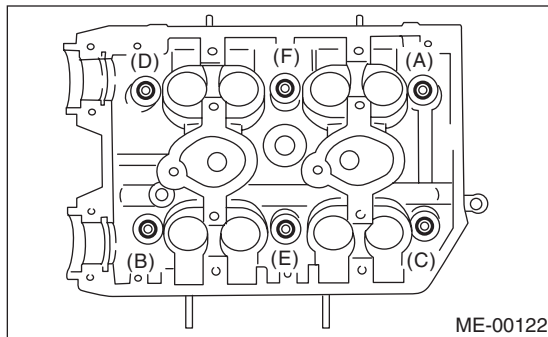
A: REMOVAL

NOTE:

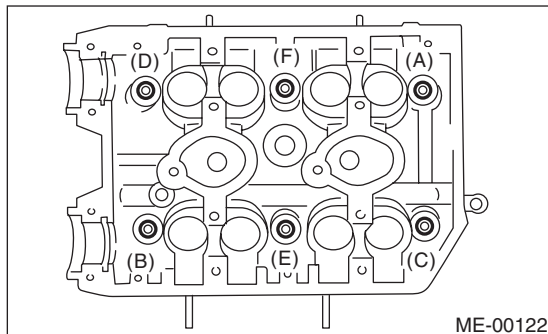
Perform the work with the engine installed to body when replacing a single part. Refer to "Valve Clearance" for preparation. <Ref. to ME(H4DOTC)-32, Valve Clearance.>

- 1) Remove the V-belts. <Ref. to ME(H4DOTC)-44, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4DOTC)-46, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4DOTC)-47, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt. <Ref. to ME(H4DOTC)-48, REMOVAL, Timing Belt.>
- 5) Remove the cam sprocket. <Ref. to ME(H4DOTC)-56, REMOVAL, Cam Sprocket.>
- 6) Remove the intake manifold. <Ref. to FU(H4DOTC)-17, REMOVAL, Intake Manifold.>
- 7) Remove the bolt which installs the A/C compressor bracket on cylinder head.
- 8) Remove the camshaft. <Ref. to ME(H4DOTC)-58, REMOVAL, Camshaft.>
- 9) Remove the cylinder head bolts in alphabetical order shown in the figure.

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



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



- 11) Remove the cylinder head gasket.

CAUTION:

Be careful not to scratch the mating surface of the cylinder head and cylinder block.

- 12) Similarly, remove the cylinder head (RH).

B: INSTALLATION

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

CAUTION:

Be careful not to scratch the mating surface of the cylinder head and cylinder block.

NOTE:

Use a new cylinder head gasket.

- 2) Tighten the cylinder head bolts.
 - (1) Apply a thin coat of engine oil to washer and bolt thread.
 - (2) Tighten all bolts to 29 N·m (3.0 kgf·m, 22 ft·lb) in alphabetical order.
 - (3) Further tighten all bolts to 69 N·m (7.0 kgf·m, 51 ft·lb) in alphabetical order.
 - (4) Loosen all the bolts by 180° in reverse order of installation, and loosen again by 180°.
 - (5) Tighten all bolts to 49 N·m (5.0 kgf·m, 36 ft·lb) in alphabetical order.
 - (6) Tighten all bolts by 80 to 90° in alphabetical order.
 - (7) Tighten all bolts by 40 to 45° in alphabetical order.

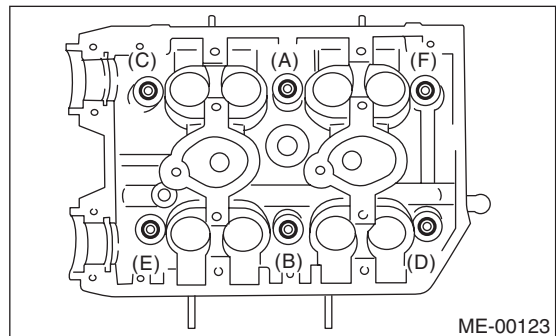
CAUTION:

Do not tighten the bolts 45° or more.

- (8) Further tighten the bolts (A) and (B) by 40 to 45°.

CAUTION:

Make sure that the total "re-tightening angle" of the previous steps (7) and (8) does not exceed 90°.



- 3) Install the camshaft. <Ref. to ME(H4DOTC)-59, INSTALLATION, Camshaft.>
- 4) Install the A/C compressor bracket on cylinder head.
- 5) Install the intake manifold. <Ref. to FU(H4DOTC)-20, INSTALLATION, Intake Manifold.>

- 6) Install the cam sprocket. <Ref. to ME(H4DOTC)-56, INSTALLATION, Cam Sprocket.>
- 7) Install the timing belt. <Ref. to ME(H4DOTC)-50, INSTALLATION, Timing Belt.>
- 8) Install the timing belt cover. <Ref. to ME(H4DOTC)-47, INSTALLATION, Timing Belt Cover.>
- 9) Install the crank pulley. <Ref. to ME(H4DOTC)-46, INSTALLATION, Crank Pulley.>
- 10) Install the V-belts. <Ref. to ME(H4DOTC)-44, INSTALLATION, V-belt.>

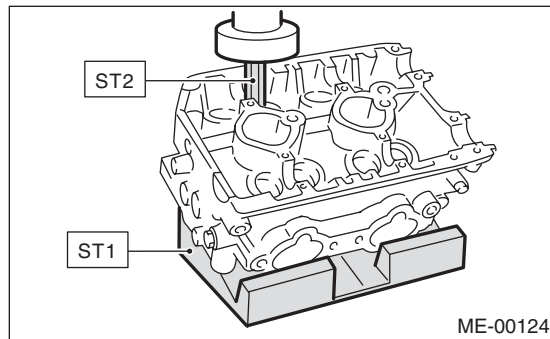
C: DISASSEMBLY

- 1) Remove the valve lifter.
- 2) Compress the valve spring and remove the valve spring retainer key. Remove each valve and valve spring.

NOTE:

- Mark each valve to prevent confusion.
- Pay careful attention not to damage the lips of intake valve oil seals and exhaust valve oil seals.
- Keep all the removed parts in order for re-installing in their original positions.

ST1 498267600 CYLINDER HEAD TABLE
ST2 499718000 VALVE SPRING REMOVER

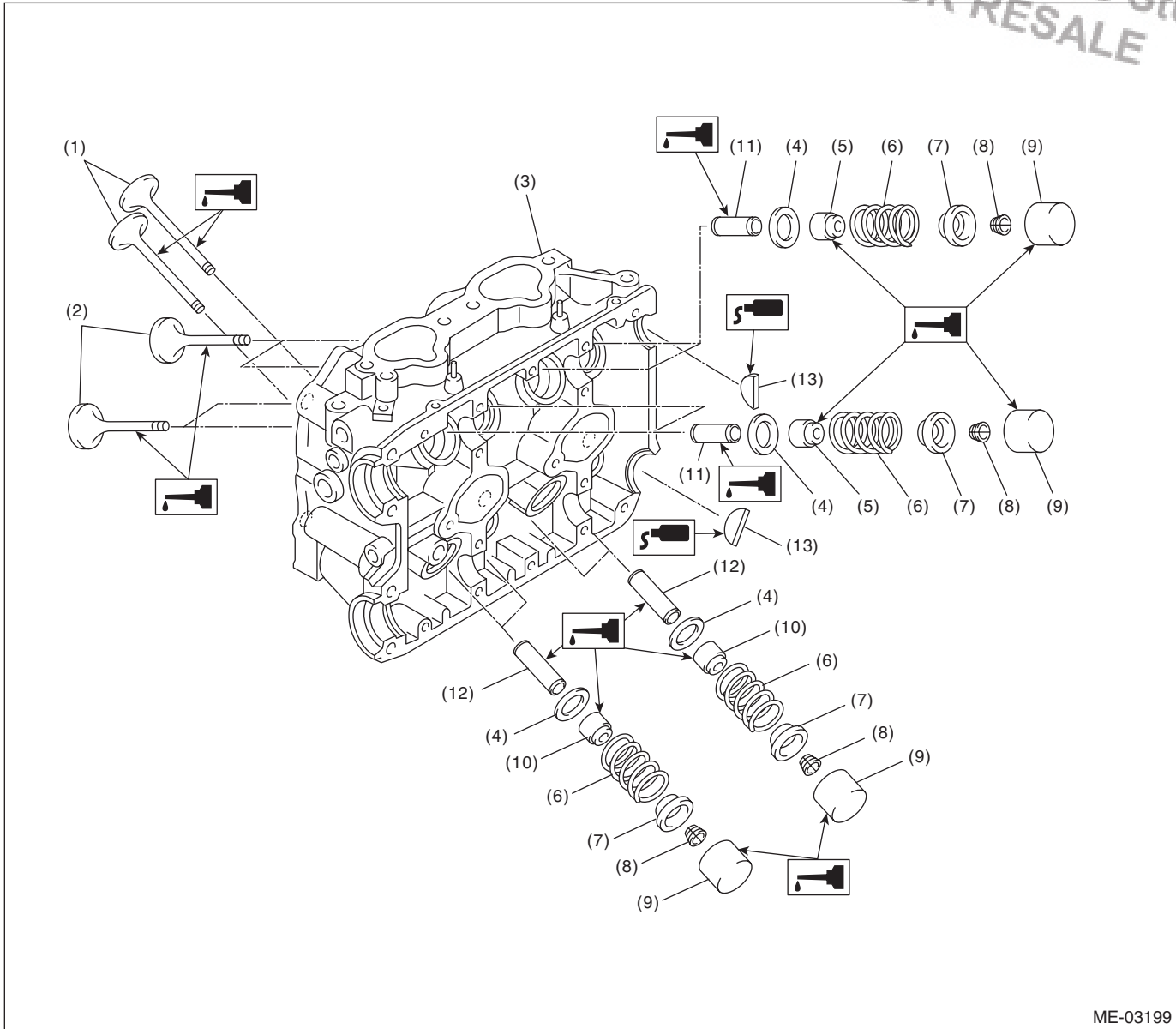


Cylinder Head

MECHANICAL

D: ASSEMBLY

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

- 1) Install the valve spring and valve.
 - (1) Coat the stem of each valve with engine oil and insert the valve into the valve guide.

NOTE:

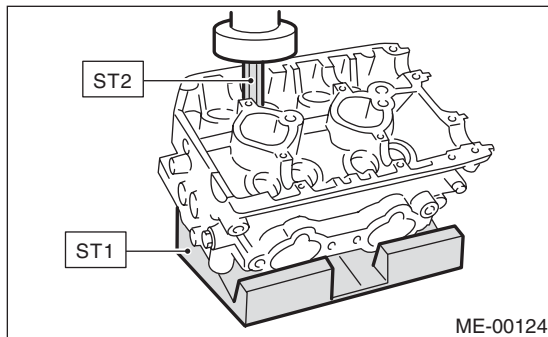
When inserting the valve into valve guide, use special care not to damage the oil seal lip.

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

NOTE:

Be sure to install the valve spring with its close-coiled end facing the seat on cylinder head.

- ST1 498267600 CYLINDER HEAD TABLE
 ST2 499718000 VALVE SPRING REMOVER



- (4) Compress the valve spring and install the retainer key.
 - (5) After installing, tap the valve spring retainers lightly with a wooden hammer for better seating.
- 2) Apply oil to the surfaces of the valve lifter.
 - 3) Install the valve lifter.

E: INSPECTION

1. CYLINDER HEAD

- 1) Check for cracks or damage. Use liquid penetrant tester on the important sections to check for fissures. Check that there are no marks of gas leaking or water leaking on gasket installing surface.
- 2) Measure the warping of the cylinder head surface that mates with cylinder block using a straight edge (A) and thickness gauge (B). If the warping exceeds the limit, correct the surface by grinding it with a surface grinder.

Service limit:

0.035 mm (0.0014 in)

Grinding limit:

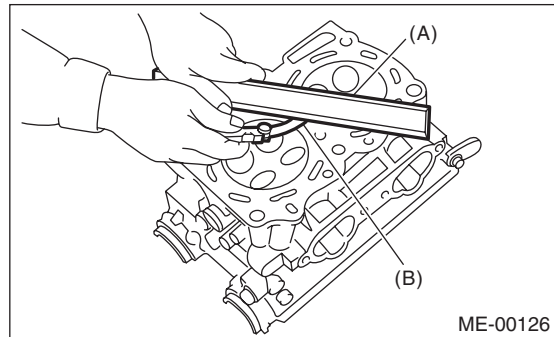
0.3 mm (0.012 in)

Standard height of cylinder head:

127.5 mm (5.02 in)

NOTE:

Uneven torque for the cylinder head bolts can cause warping. When reinstalling, pay special attention to the torque so as to tighten evenly.



2. VALVE SEAT

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

Valve seat width W:

Standard:

Intake

0.6 — 1.4 mm (0.024 — 0.055 in)

Exhaust

1.2 — 1.8 mm (0.047 — 0.071 in)

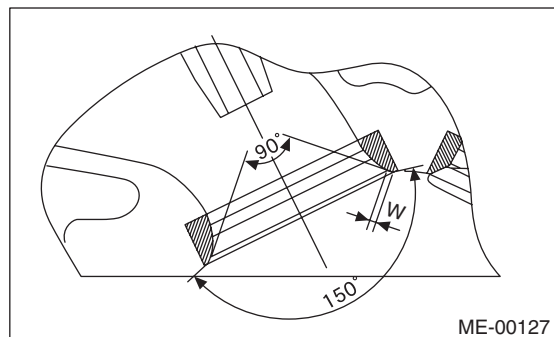
Service limit:

Intake

1.7 mm (0.067 in)

Exhaust

2.2 mm (0.087 in)



3. VALVE GUIDE

1) Check the clearance between valve guide and stem. The clearance can be checked by measuring respectively the outer diameter of valve stem with a micrometer and the inner diameter of valve guide with a caliper gauge.

Clearance between the valve guide and valve stem:

Standard:

Intake

0.030 — 0.057 mm (0.0012 — 0.0022 in)

Exhaust

0.040 — 0.067 mm (0.0016 — 0.0026 in)

Service limit:

0.15 mm (0.0059 in)

2) If the clearance between the valve guide and stem exceeds the limit, replace the valve guide or the 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

5.955 — 5.970 mm (0.2344 — 0.2350 in)

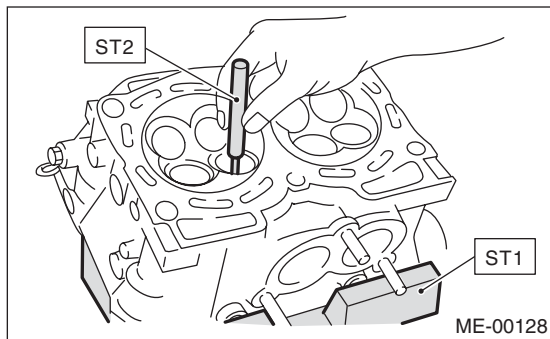
Exhaust

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 fit the holes in ST1.

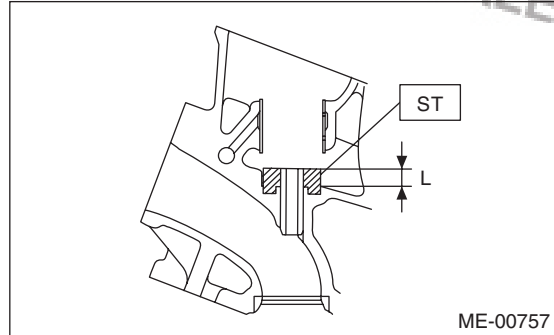
(2) Insert the ST2 into valve guide and press it down to remove the valve guide.

ST1 498267600 CYLINDER HEAD TABLE
ST2 499767200 VALVE GUIDE REMOVER



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

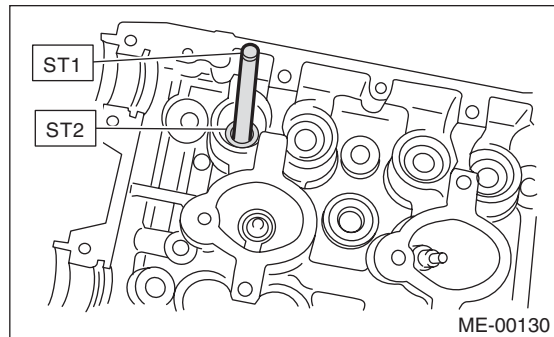
ST 18251AA020 VALVE GUIDE ADJUSTER



(4) Before installing a new valve guide, make sure that neither scratches nor damages exist on the inner surface of valve guide holes in cylinder head.

(5) Put a new valve guide, coated with sufficient oil, in the cylinder head, and insert the 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 18251AA020 VALVE GUIDE ADJUSTER



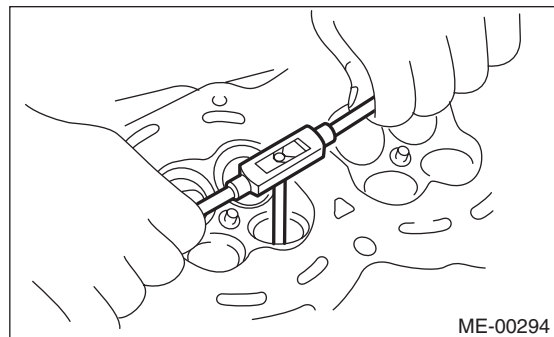
(6) Check the valve guide protrusion.

Valve guide protrusion L:

15.8 — 16.2 mm (0.622 — 0.638 in)

(7) Insert the ST in valve guide, and rotate the ST slowly clockwise while pushing it lightly. Bring the ST back while rotating it clockwise.

ST 499767400 VALVE GUIDE REAMER



NOTE:

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

(8) After reaming, clean the valve guide to remove chips.

(9) Recheck the contact condition between valve and valve seat after replacing the valve guide.

4. INTAKE AND EXHAUST VALVE

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

Head edge thickness H:

Standard:

Intake (A)

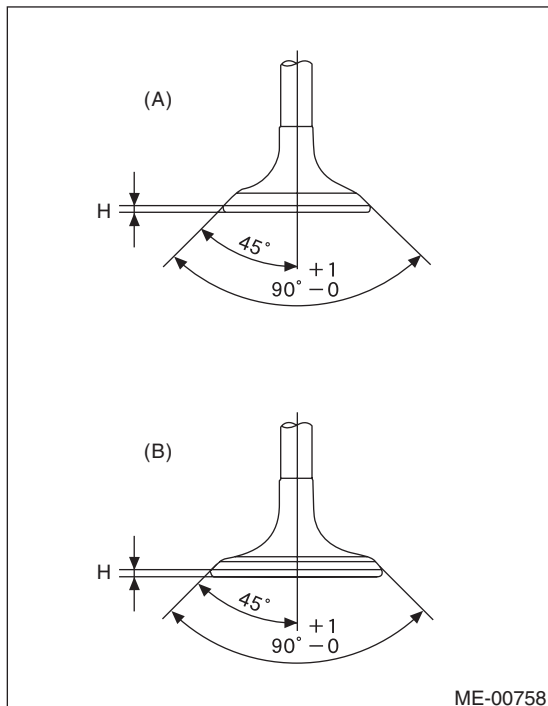
1.0 — 1.4 mm (0.039 — 0.055 in)

Exhaust (B)

1.3 — 1.7 mm (0.051 — 0.067 in)

Service limit:

0.8 mm (0.031 in)



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

NOTE:

It is possible to differentiate between the intake valve and the exhaust valve by their overall length.

Valve overall length:

Intake

104.4 mm (4.110 in)

Exhaust

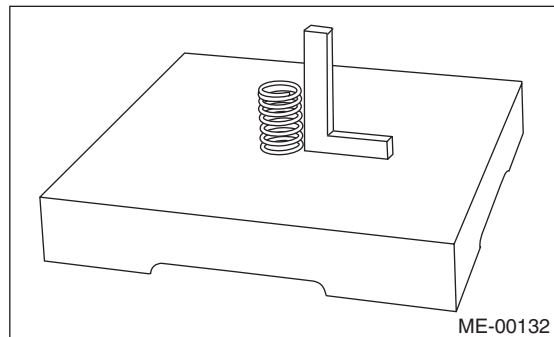
104.65 mm (4.120 in)

5. VALVE SPRING

1) Check the valve springs for damage, free length, and spring constant. Replace the valve spring if it is not within standard values presented in the table.

Free length		47.32 mm (1.863 in)
Tension/spring height	Set	205 — 235 N (20.9 — 24.0 kgf, 46.1 — 52.8 lbf) /36.0 mm (1.417 in)
	Lift	426 — 490 N (43.4 — 50.0 kgf, 95.8 — 110 lbf) /26.50 mm (1.043 in)
Squareness		2.5°, 2.1 mm (0.083 in) or less

2) To measure the squareness of the valve spring, stand the spring on a surface plate and measure its deflection at the top of spring using a try square.



Cylinder Head

MECHANICAL

6. INTAKE AND EXHAUST VALVE OIL SEAL

Replace the oil seal in the following cases:

- When the lip is damaged.
- When the spring is out of the specified position.
- When readjusting the surfaces of valve and valve seat.
- When replacing the intake valve guide.

- 1) Set the cylinder head on ST1.
- 2) Using the ST2, press-fit the oil seal.

NOTE:

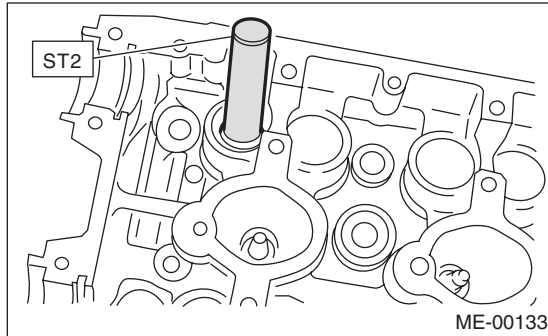
- Apply engine oil to oil seal before press-fitting.
- When press-fitting the oil seal, do not use a hammer or strike in.
- The intake valve oil seal and exhaust valve oil seal can be distinguished by colors.

Color of rubber part:

Intake [Gray]

Exhaust [Green]

- | | | |
|-----|-----------|----------------------|
| ST1 | 498267600 | CYLINDER HEAD TABLE |
| ST2 | 498857100 | VALVE OIL SEAL GUIDE |

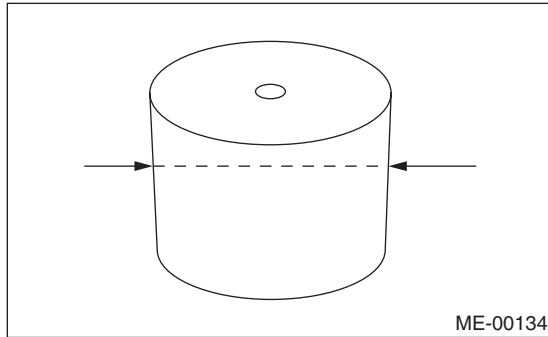


7. VALVE LIFTER

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

Outer diameter:

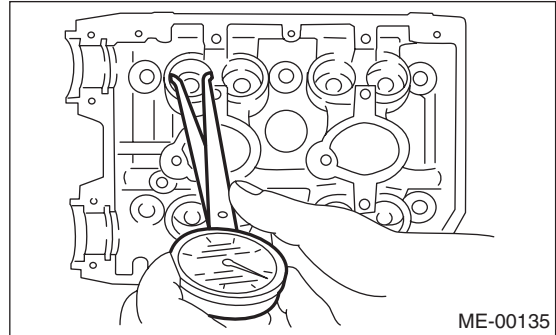
34.959 — 34.975 mm (1.3763 — 1.3770 in)



- 3) Measure the inner diameter of valve lifter mating surface on cylinder head.

Inner diameter:

34.994 — 35.016 mm (1.3777 — 1.3786 in)



NOTE:

If difference between outer diameter of valve lifter and inner diameter of its mating surface exceeds the standard or there is uneven wear on the inner surface, replace the cylinder head.

Standard:

0.019 — 0.057 mm (0.0007 — 0.0022 in)

Service limit:

0.100 mm (0.0039 in)

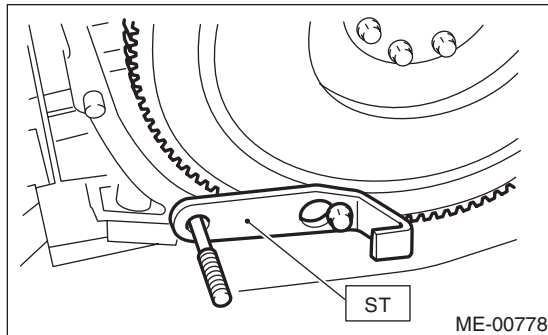
20. Cylinder Block

A: REMOVAL

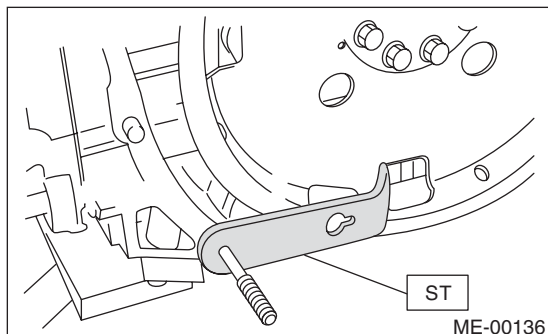
NOTE:

Before conducting this procedure, drain the engine oil completely.

- 1) Remove the intake manifold. <Ref. to FU(H4DOTC)-17, REMOVAL, Intake Manifold.>
 - 2) Remove the V-belts. <Ref. to ME(H4DOTC)-44, REMOVAL, V-belt.>
 - 3) Remove the crank pulley. <Ref. to ME(H4DOTC)-46, REMOVAL, Crank Pulley.>
 - 4) Remove the timing belt cover. <Ref. to ME(H4DOTC)-47, REMOVAL, Timing Belt Cover.>
 - 5) Remove the timing belt. <Ref. to ME(H4DOTC)-48, REMOVAL, Timing Belt.>
 - 6) Remove the cam sprocket. <Ref. to ME(H4DOTC)-56, REMOVAL, Cam Sprocket.>
 - 7) Remove the crank sprocket. <Ref. to ME(H4DOTC)-57, REMOVAL, Crank Sprocket.>
 - 8) Remove the generator and A/C compressor with their brackets.
 - 9) Remove the cylinder head. <Ref. to ME(H4DOTC)-64, REMOVAL, Cylinder Head.>
 - 10) Remove the clutch disc and cover. (MT model) <Ref. to CL-14, REMOVAL, Clutch Disc and Cover.>
 - 11) Remove the flywheel. (MT model) <Ref. to CL-17, REMOVAL, Flywheel.>
- ST 498497100 CRANKSHAFT STOPPER

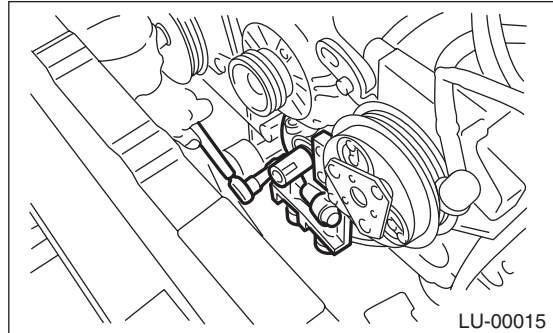


- 12) Remove the drive plate. (AT model)
Using the ST, lock the crankshaft.
ST 498497100 CRANKSHAFT STOPPER



- 13) Remove the oil separator cover.

- 14) Remove the water by-pass pipe for heater.
- 15) Remove the oil filter. <Ref. to LU(H4DOTC)-25, REMOVAL, Engine Oil Filter.>
- 16) Remove the oil cooler. <Ref. to LU(H4DOTC)-22, REMOVAL, Engine Oil Cooler.>
- 17) Remove the water pump. <Ref. to CO(H4DOTC)-21, REMOVAL, Water Pump.>
- 18) Remove the bolts which install oil pump onto cylinder block.



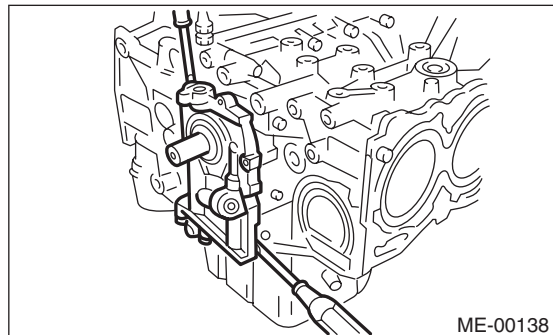
- 19) Remove the oil pump from cylinder block.

NOTE:

- When disassembling and checking the oil pump, loosen the relief valve plug before removing the oil pump.
- Remove the oil pump from cylinder block using a flat tip screwdriver.

CAUTION:

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



- 20) Remove the oil pan.
 - (1) Set the part so that the cylinder block (LH) is on the upper side.
 - (2) Remove the bolts which secure oil pan to cylinder block.
 - (3) Insert an oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan.

CAUTION:

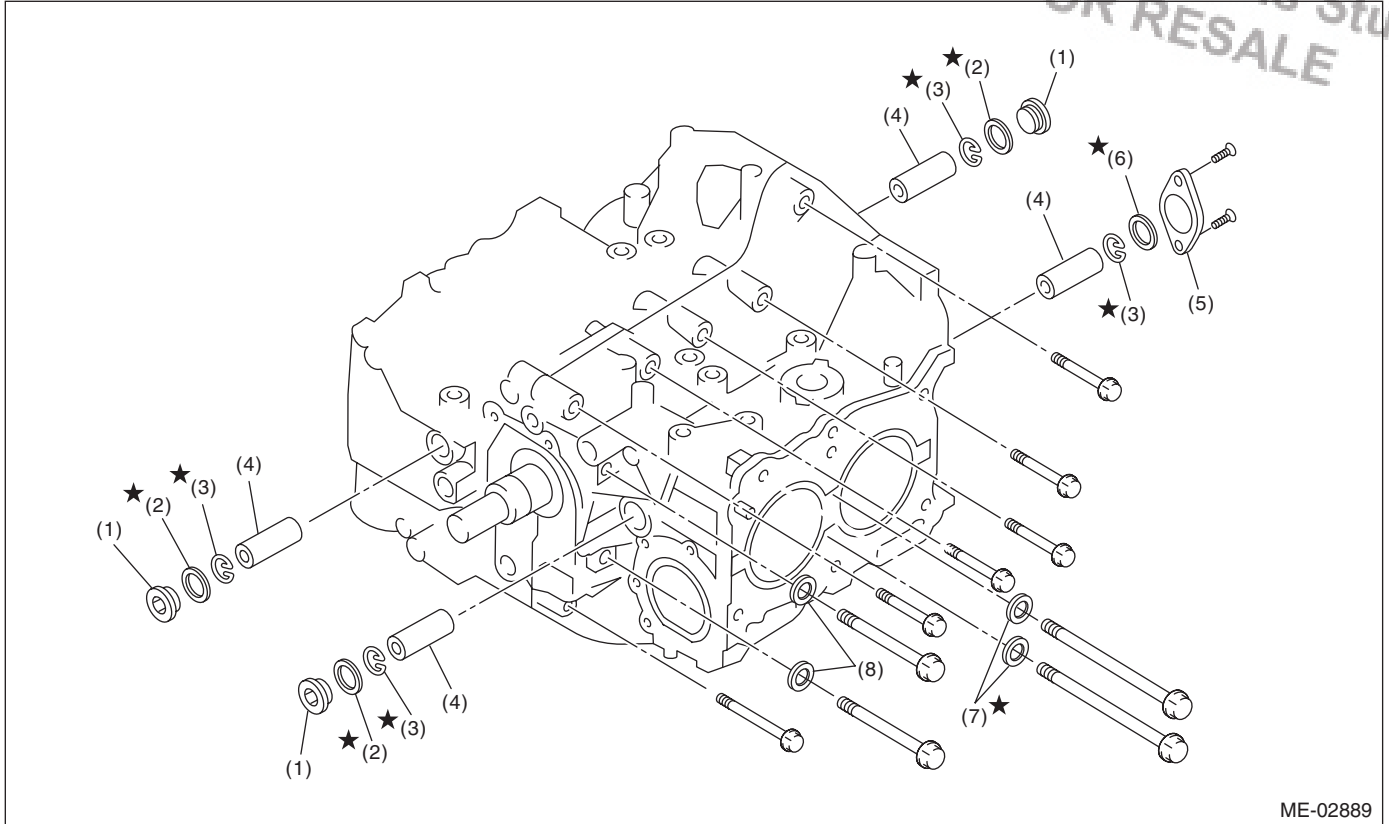
Do not use a screwdriver or similar tools in place of oil pan cutter.

- 21) Remove the oil strainer stay.
- 22) Remove the oil strainer.
- 23) Remove the baffle plate.

Cylinder Block

MECHANICAL

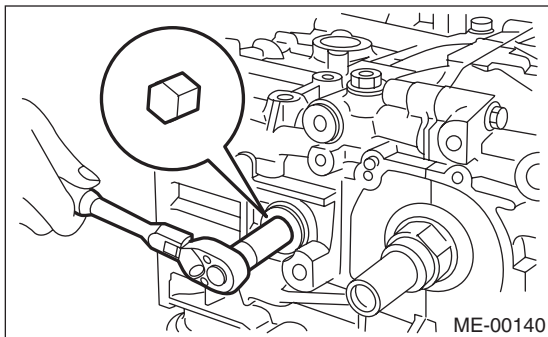
24) Remove the water pipe.



ME-02889

- | | | |
|-----------------------|------------------------|-----------------|
| (1) Service hole plug | (4) Piston pin | (7) Seal washer |
| (2) Gasket | (5) Service hole cover | (8) Washer |
| (3) Snap ring | (6) O-ring | |

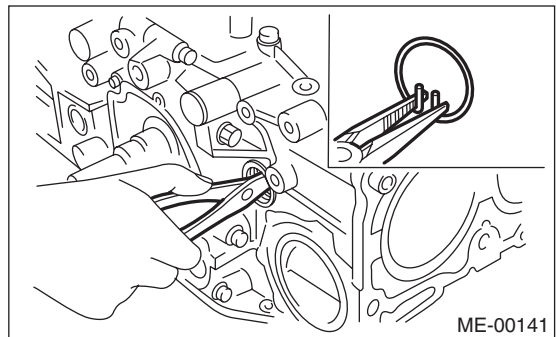
25) Remove the service hole plugs using a hexagon wrench [14 mm].



ME-00140

26) Remove the service hole cover.

27) Rotate the crankshaft to bring #1 and #2 pistons to bottom dead center position, then remove the piston snap ring through service hole of #1 and #2 cylinders.



ME-00141

Cylinder Block

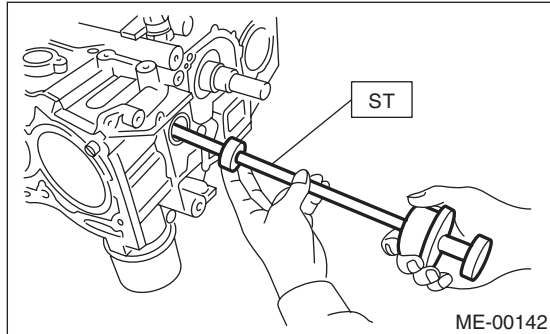
MECHANICAL

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

NOTE:

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

ST 499097700 PISTON PIN REMOVER



29) Similarly remove the piston pins from #3 and #4 pistons.

30) Remove the cylinder block connecting bolt on the RH side.

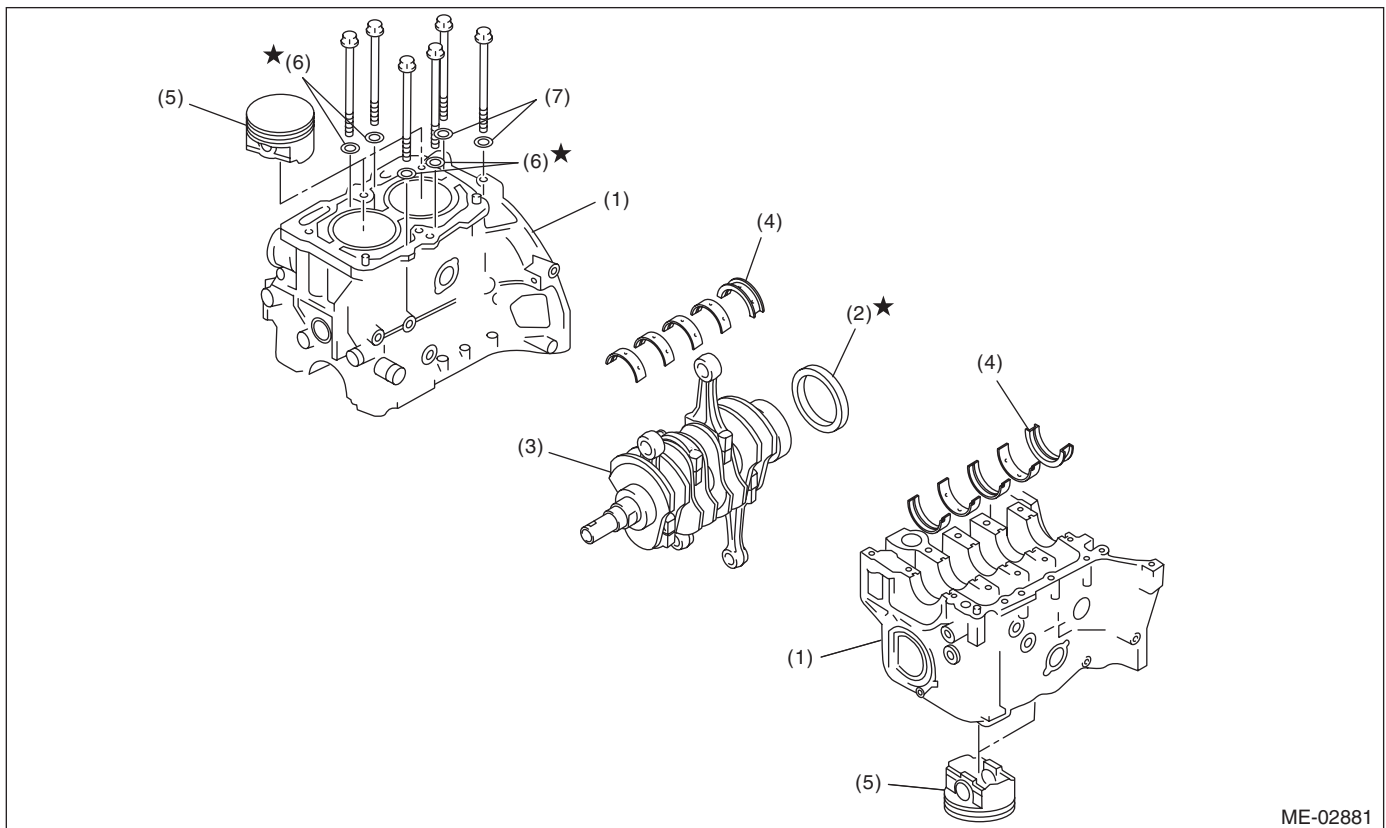
31) Loosen the cylinder block connecting bolt on the LH side by 2-3 turns.

32) Set the part so that the cylinder block (LH) is on the upper side, and remove the cylinder block connecting bolt.

33) Separate the cylinder block (LH) and (RH).

NOTE:

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



- | | | |
|--------------------|------------------------|-----------------|
| (1) Cylinder block | (4) Crankshaft bearing | (6) Seal washer |
| (2) Rear oil seal | (5) Piston | (7) Washer |
| (3) Crankshaft | | |

34) Remove the rear oil seal.

35) Remove the crankshaft together with connecting rod.

36) Remove the crankshaft bearings from cylinder block using a hammer handle.

NOTE:

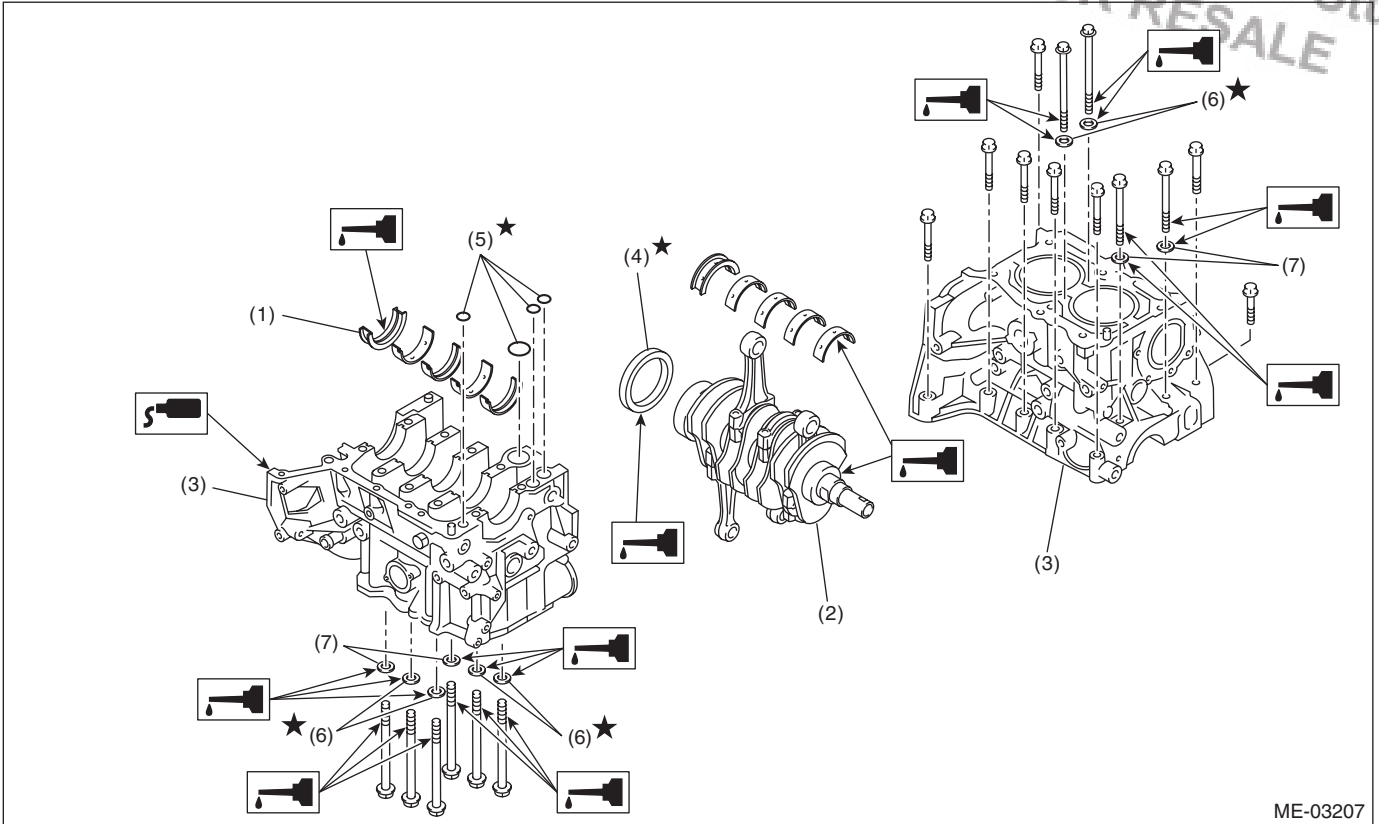
Be careful not to confuse the crankshaft bearing combination. Press the bearing at the end opposite to locking lip.

37) Draw out each piston from cylinder block using wooden bar or hammer handle.

NOTE:

Be careful not to confuse the original combination of piston and cylinder.

B: INSTALLATION



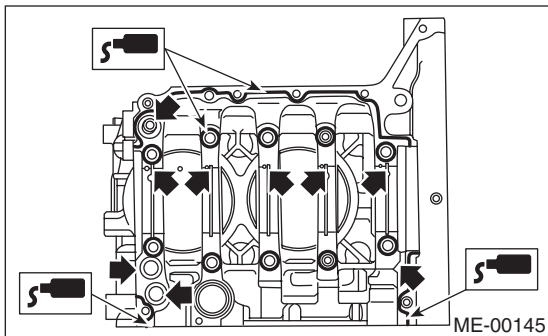
ME-03207

- | | | |
|------------------------|-------------------|-----------------|
| (1) Crankshaft bearing | (4) Rear oil seal | (6) Seal washer |
| (2) Crankshaft | (5) O-ring | (7) Washer |
| (3) Cylinder block | | |

- 1) Remove oil on the mating surface of cylinder block before installation. Apply a coat of engine oil to the bearing and crankshaft journal.
- 2) Position the crankshaft and O-ring on the cylinder block (RH).
- 3) Apply liquid gasket to the mating surfaces of cylinder block (RH), and position the cylinder block (LH).

Liquid gasket:
THREE BOND 1215 (Part No. 004403007) or equivalent

NOTE:
 Do not allow liquid gasket to run over into O-ring grooves, oil passages, bearing grooves, etc.

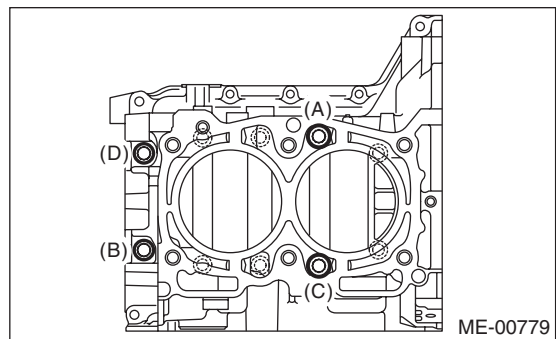


ME-00145

- 4) Apply a coat of engine oil to the washer and bolt thread.

NOTE:
 Use a new seal washer.
 5) Tighten the 10 mm cylinder block connecting bolts on LH side (A — D) in alphabetical sequence.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)

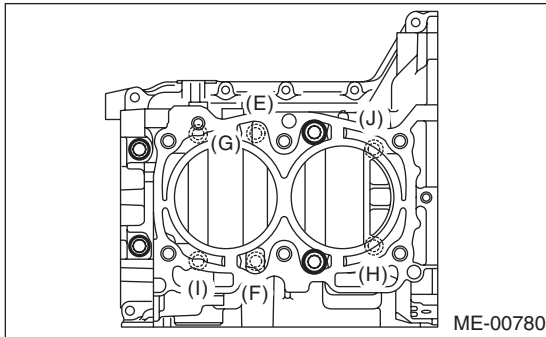


ME-00779

6) Tighten the 10 mm cylinder block connecting bolts on RH side (E — J) in alphabetical sequence.

Tightening torque:

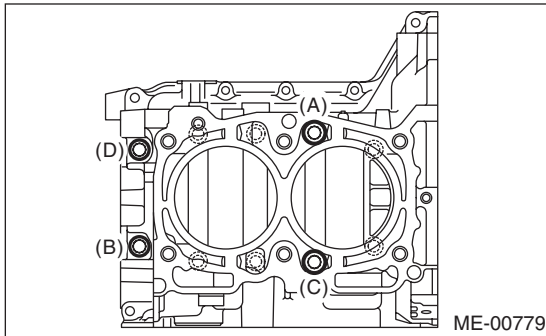
10 N·m (1.0 kgf-m, 7.4 ft-lb)



7) Tighten the cylinder block connecting bolts on LH side (A — D) further in alphabetical sequence.

Tightening torque:

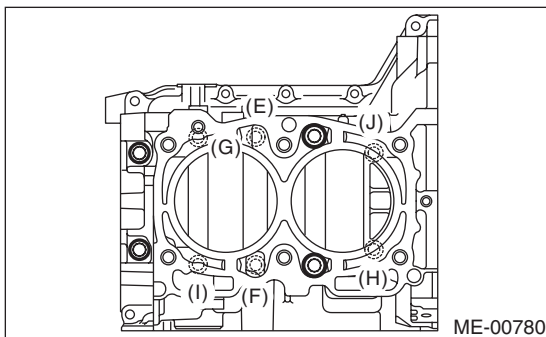
18 N·m (1.8 kgf-m, 13.3 ft-lb)



8) Tighten the cylinder block connecting bolts on RH side (E — J) further in alphabetical sequence.

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)



9) Tighten the cylinder block connecting bolts on LH side (A — D) further in alphabetical sequence.

- (A), (C): Angle tightening

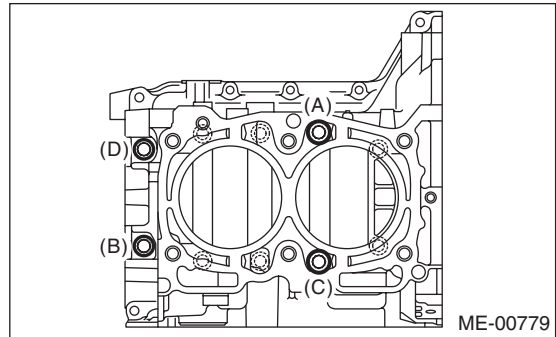
Tightening angle:

90°

- (B), (D): Torque tightening

Tightening torque:

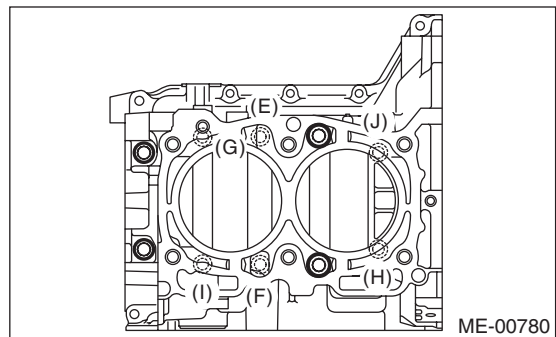
40 N·m (4.1 kgf-m, 29.6 ft-lb)



10) Tighten the cylinder block connecting bolts on RH side (E — J) further in alphabetical sequence.

Tightening angle:

90°

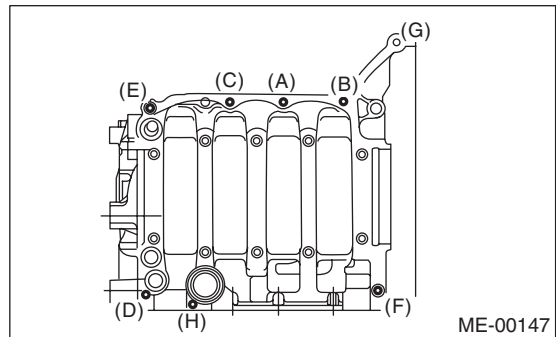


11) Tighten the 8 mm and 6 mm cylinder block connecting bolts on the LH side (A — H) in alphabetical order.

Tightening torque:

(A) — (G): 25 N·m (2.5 kgf-m, 18.4 ft-lb)

(H): 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



Cylinder Block

MECHANICAL

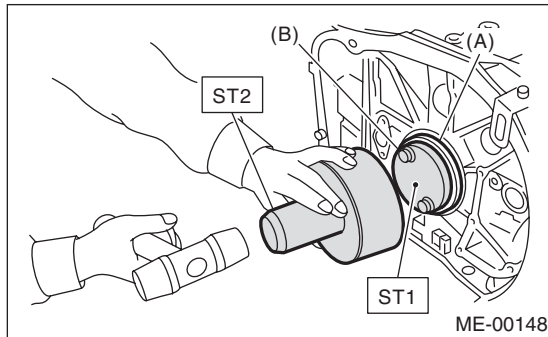
12) Apply a coat of engine oil to the oil seal periphery, then install the rear oil seal using ST1 and ST2.

NOTE:

Use a new oil seal.

ST1 499597100 CRANKSHAFT OIL SEAL GUIDE

ST2 499587200 CRANKSHAFT OIL SEAL INSTALLER



(A) Rear oil seal

(B) Flywheel attaching bolt

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

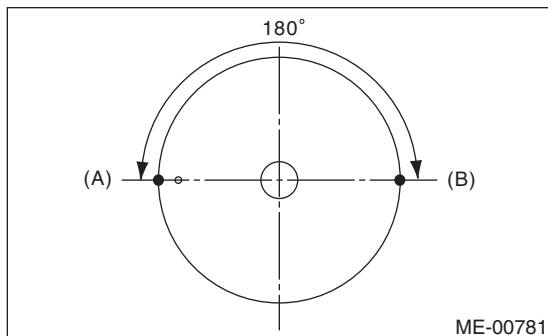
NOTE:

Assemble so that the piston ring mark "R" faces the top side of the piston.

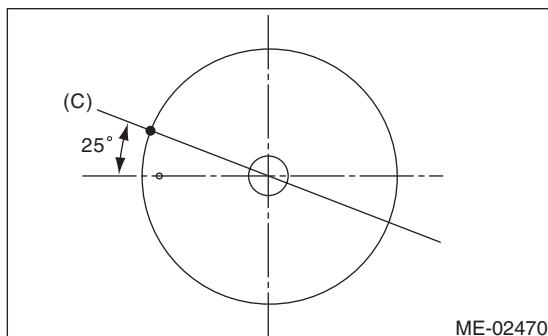
14) Position the second ring gap at 180° on the reverse side the top ring gap.

NOTE:

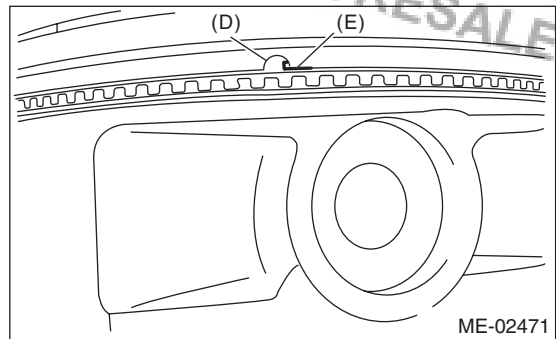
Assemble so that the piston ring mark "R" faces the top side of the piston.



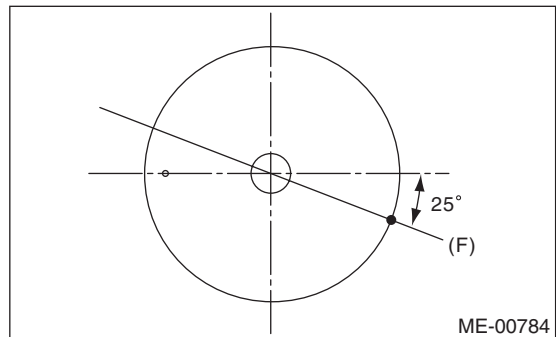
15) Position the upper rail gap at (C) in the figure.



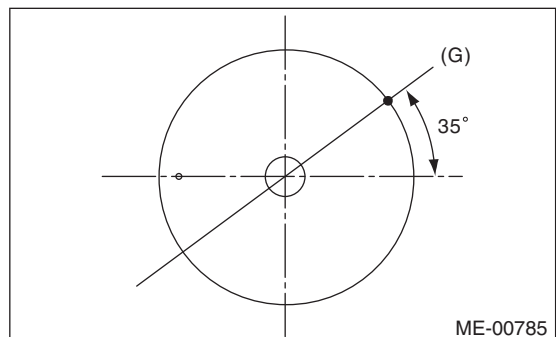
16) Align the upper rail spin stopper (E) to the side hole (D) on the piston.



17) Position the expander gap at (F) in the figure.



18) Position the lower rail gap at (G) in the figure.

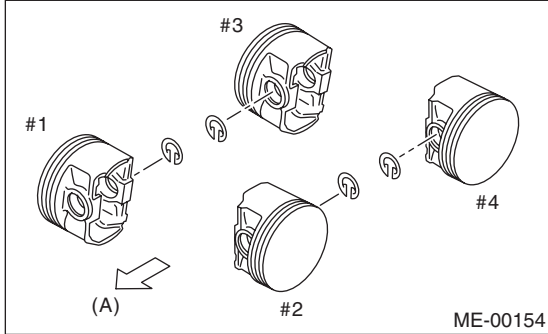


NOTE:

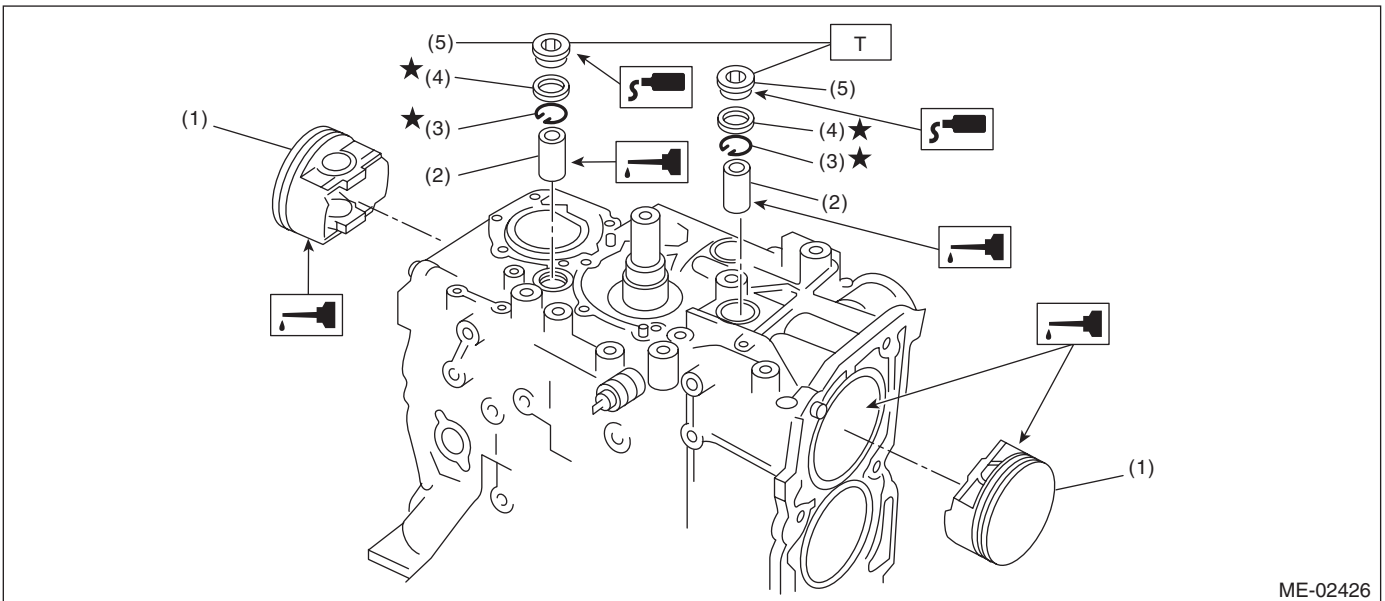
- Make sure ring gaps do not face the same direction.
- Make sure ring gaps are not within the piston skirt area.

19) Install the snap ring.
Install the snap rings in the piston holes located opposite to the service holes in cylinder block before positioning pistons in cylinders.

NOTE:
Use new snap rings.



(A) Front



- | | |
|----------------|-----------------------|
| (1) Piston | (4) Gasket |
| (2) Piston pin | (5) Service hole plug |
| (3) Snap ring | |

Tightening torque: N·m (kgf·m, ft·lb)
T: 70 (7.1, 51.6)

Cylinder Block

MECHANICAL

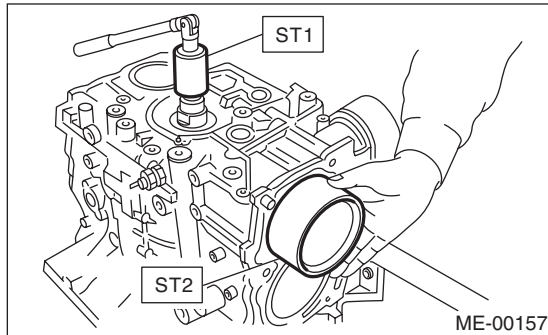
20) Install piston.

- (1) Set the parts so that the #1 and #2 cylinders are on the upper side.
- (2) Using the ST1, turn the crankshaft so that #1 and #2 connecting rods are set at bottom dead center.

ST1 499987500 CRANKSHAFT SOCKET

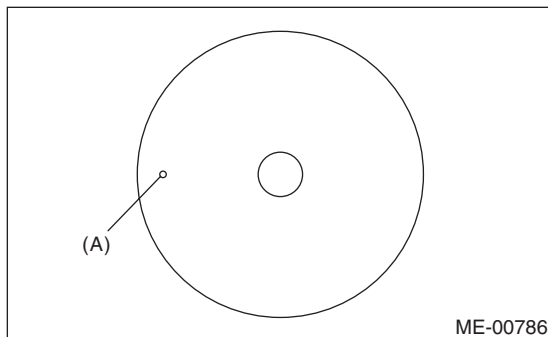
- (3) Apply a coat of engine oil to the pistons and cylinders and insert pistons in their cylinders using ST2.

ST2 498747300 PISTON GUIDE



NOTE:

Face the piston front mark towards the front of the engine.

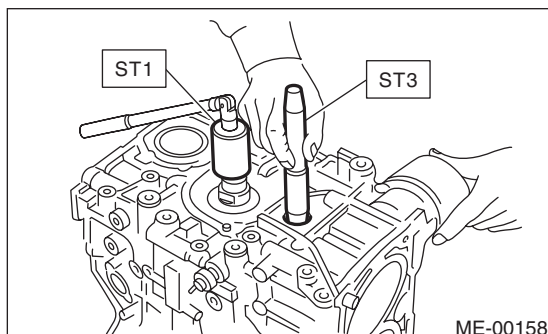


(A) Front mark

21) Install piston pin.

- (1) Apply a coat of engine oil to ST3.
- (2) Insert ST3 into the service hole to align the piston pin hole and the connecting rod small end.

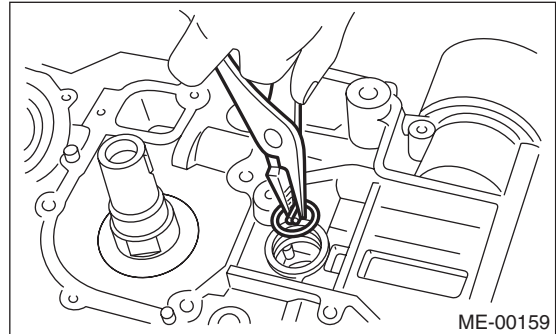
ST3 499017100 PISTON PIN GUIDE



- (3) Apply a coat of engine oil to piston pin, and insert the piston pin into piston and connecting rod through service hole.
- (4) Install the snap ring.

NOTE:

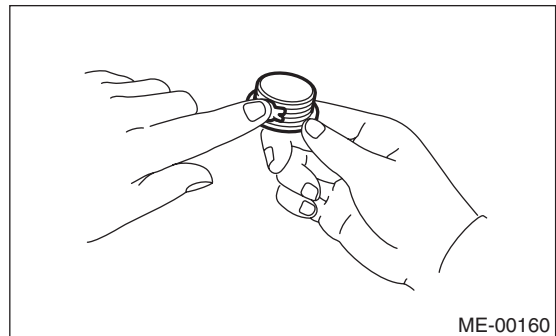
Use new snap rings.



- (5) Apply liquid gasket to the threaded portion of the service hole plug.

Liquid gasket:

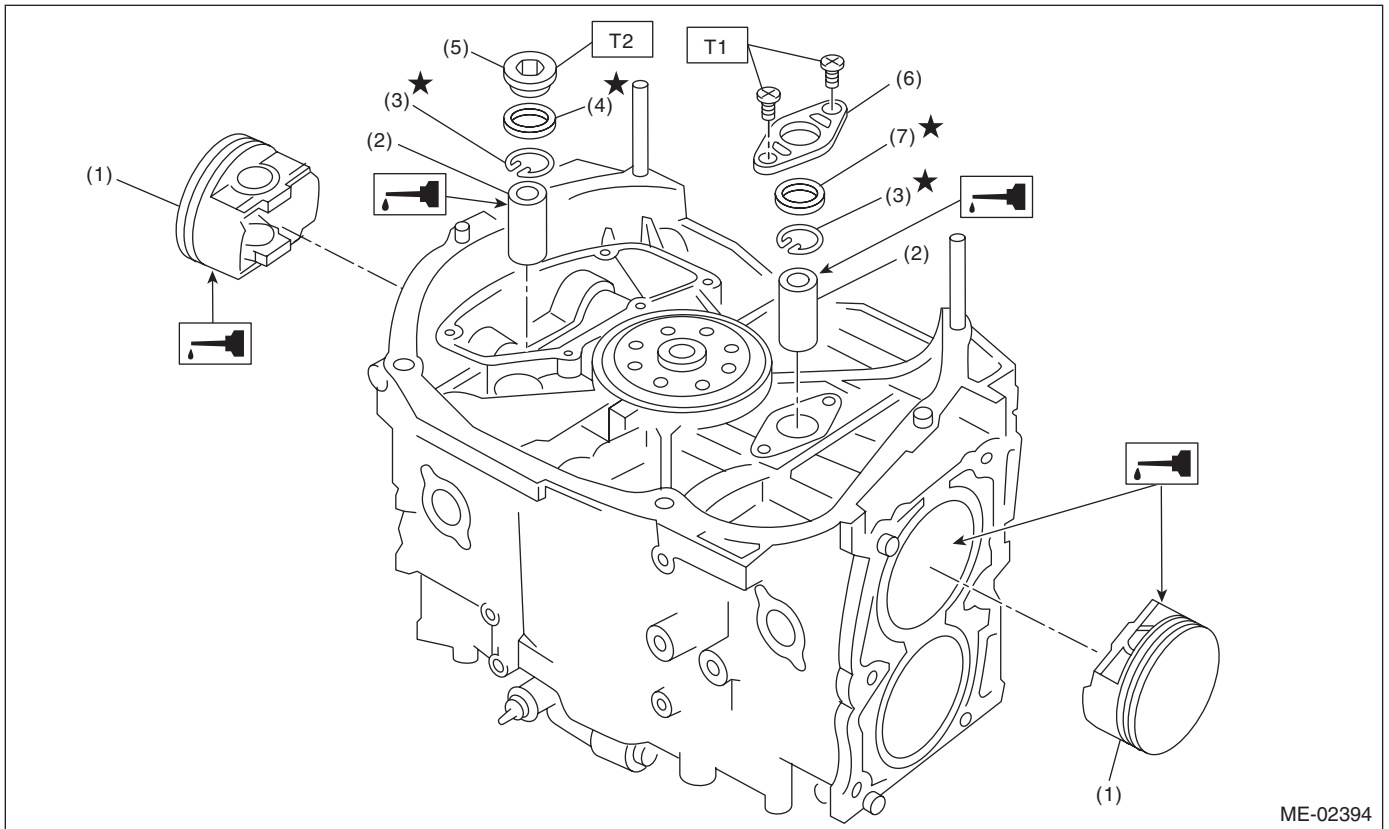
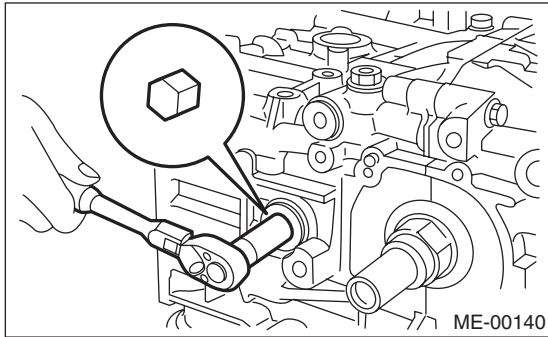
THREE BOND 1105 (Part No. 004403010) or equivalent



(6) Install the service hole plug and gasket.

NOTE:

Use a new gasket.



- (1) Piston
- (2) Piston pin
- (3) Snap ring
- (4) Gasket
- (5) Service hole plug
- (6) Service hole cover
- (7) O-ring

Tightening torque: N·m (kgf-m, ft-lb)

T1: 6.4 (0.65, 4.7)

T2: 70 (7.1, 51.6)

(7) Set the parts so that the #3 and #4 cylinders are on the upper side. Following the same procedures as used for #1 and #2 cylinders, install the pistons and piston pins.

22) Install the water pipe.

23) Install the baffle plate.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

24) Install the oil strainer to the cylinder block.

NOTE:

Use new O-rings.

Tightening torque:

10 N·m (1.0 kgf-m, 7.4 ft-lb)

Cylinder Block

MECHANICAL

25) Install the oil strainer stay.

NOTE:

Tighten the oil strainer along with the baffle plate.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

26) Apply liquid gasket to the mating surfaces, and install the oil pan.

NOTE:

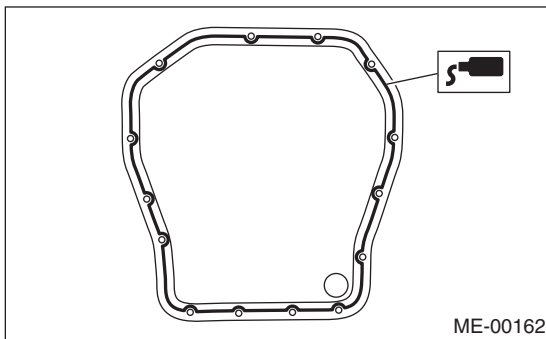
Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1207C (Part No. 004403012) or equivalent

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)



27) Apply liquid gasket to the mating surfaces and the threaded portion of bolt (A) shown in the figure (when reusing the bolt), and then install the oil separator cover.

Liquid gasket:

Mating surface

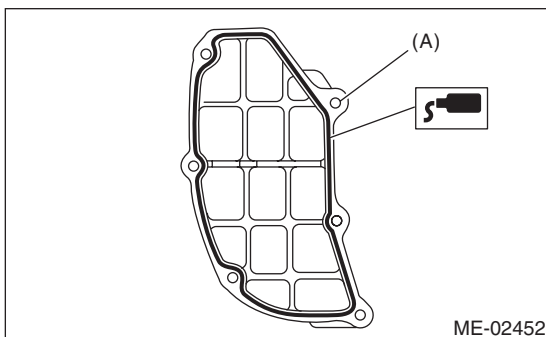
THREE BOND 1217G (Part No. K0877Y0100) or equivalent

Bolt thread (A)

THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



28) Install the flywheel. <Ref. to CL-17, INSTALLATION, Flywheel.>

29) Install the clutch disc and cover. <Ref. to CL-14, INSTALLATION, Clutch Disc and Cover.>

30) Install the drive plate. (AT model)

To lock the crankshaft, use ST.

ST 498497100 CRANKSHAFT STOPPER

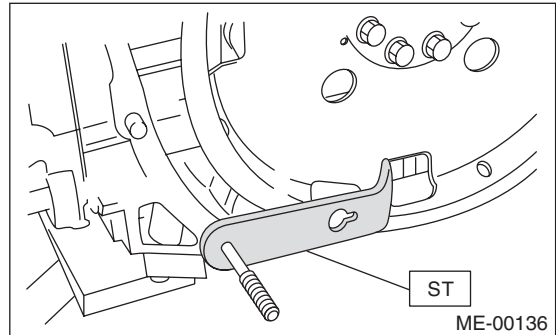
Tightening torque:

Except for STI model

72 N·m (7.3 kgf-m, 52.8 ft-lb)

STI model

75 N·m (7.6 kgf-m, 55.3 ft-lb)



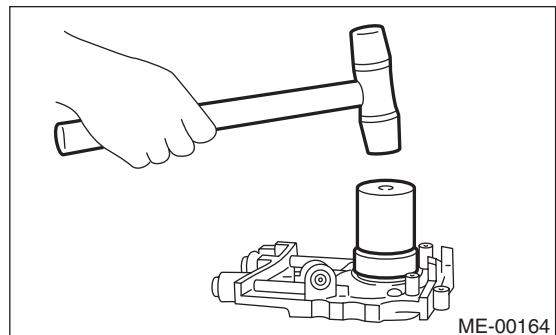
31) Install the oil pump.

(1) Using the ST, install the front oil seal.

NOTE:

Use a new front oil seal.

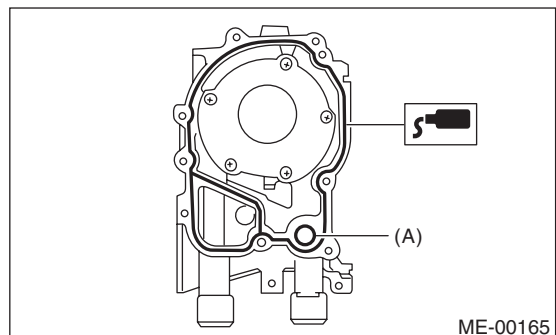
ST 499587100 OIL SEAL INSTALLER



(2) Apply liquid gasket to the matching surface of oil pump.

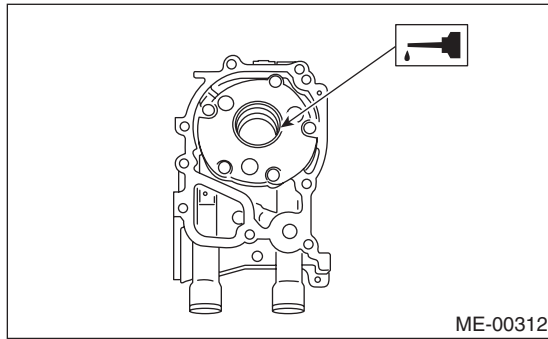
Liquid gasket:

THREE BOND 1215 (Part No. 004403007) or equivalent



(A) O-ring

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



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

NOTE:

- Make sure the oil seal lip is not folded.
- Align the flat surface of oil pump's inner rotor with crankshaft before installation.
- Use a new O-ring and oil seal.
- When disassembly and check of the oil pump was performed, tighten the relief valve plug after attaching the oil pump.

Tightening torque:

44 N·m (4.5 kgf-m, 32.5 ft-lb)

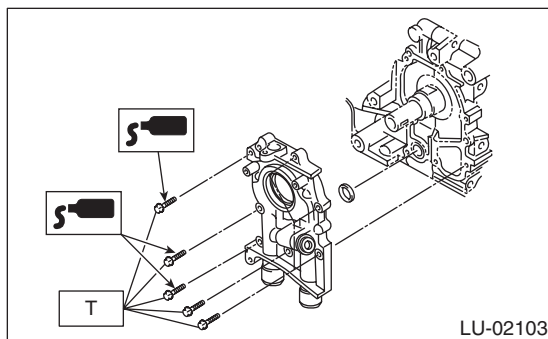
(5) Apply liquid gasket to the three bolts thread shown in figure. (When reusing the bolts)

Liquid gasket:

THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



32) Install the water pump and gasket.

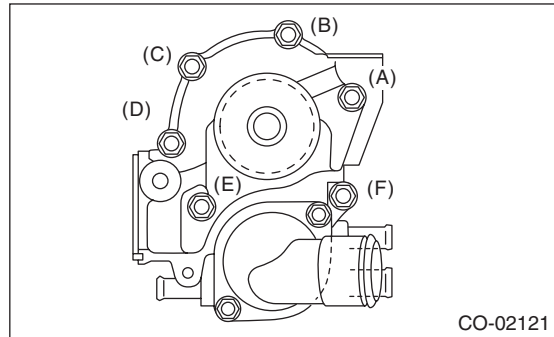
Tightening torque:

First: 12 N·m (1.2 kgf-m, 8.7 ft-lb)

Second: 12 N·m (1.2 kgf-m, 8.7 ft-lb)

NOTE:

- When installing the water pump, tighten bolts in two stages in alphabetical sequence as shown in the figure.
- Use a new gasket.



33) Install the water by-pass pipe for heater.

34) Install the oil cooler. <Ref. to LU(H4DOTC)-23, INSTALLATION, Engine Oil Cooler.>

35) Install the oil filter. <Ref. to LU(H4DOTC)-25, INSTALLATION, Engine Oil Filter.>

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

37) Install the water pipe.

NOTE:

Use new O-rings.

38) Install the cylinder head. <Ref. to ME(H4DOTC)-64, INSTALLATION, Cylinder Head.>

39) Install the oil level gauge guide and tighten the attaching bolt (left side).

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

40) Install the rocker cover and rocker cover gasket.

NOTE:

Use a new rocker cover gasket.

41) Install the crank sprocket. <Ref. to ME(H4DOTC)-57, INSTALLATION, Crank Sprocket.>

42) Install the cam sprocket. <Ref. to ME(H4DOTC)-56, INSTALLATION, Cam Sprocket.>

43) Install the timing belt. <Ref. to ME(H4DOTC)-50, INSTALLATION, Timing Belt.>

44) Install the timing belt cover. <Ref. to ME(H4DOTC)-47, INSTALLATION, Timing Belt Cover.>

45) Install the crank pulley. <Ref. to ME(H4DOTC)-46, INSTALLATION, Crank Pulley.>

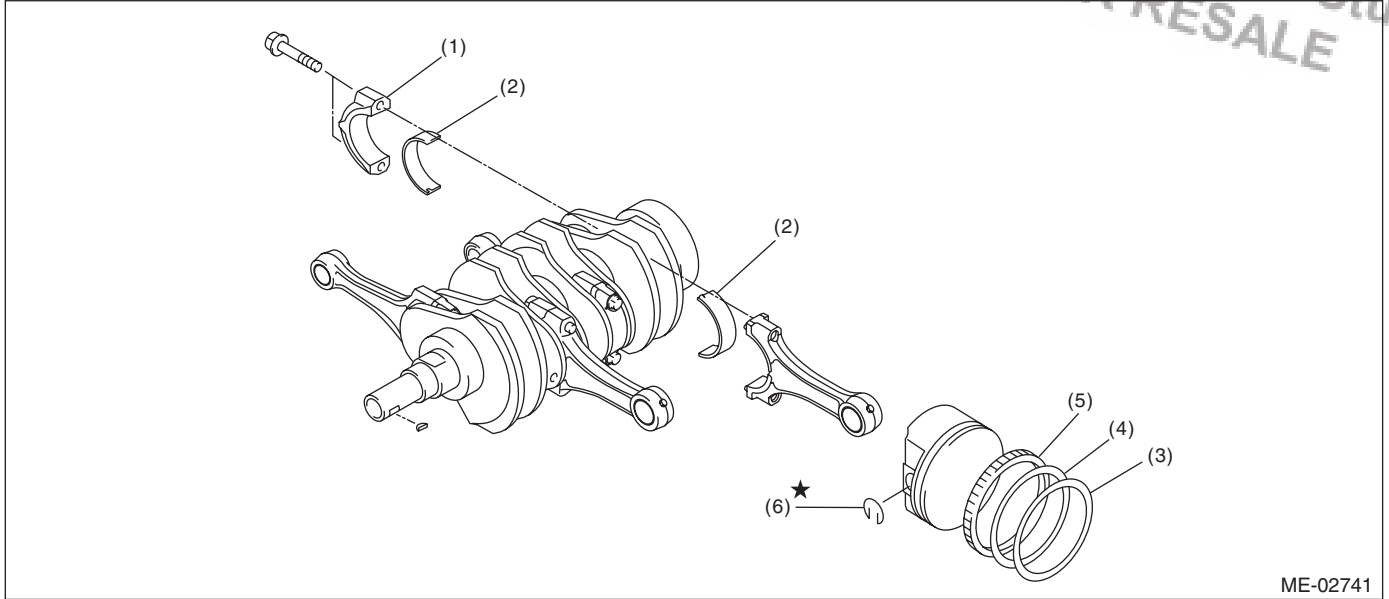
46) Install the generator and A/C compressor brackets on cylinder head.

47) Install the V-belts. <Ref. to ME(H4DOTC)-44, INSTALLATION, V-belt.>

48) Install the intake manifold. <Ref. to FU(H4DOTC)-17, REMOVAL, Intake Manifold.>

C: DISASSEMBLY

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ME-02741

- | | | |
|----------------------------|-----------------|---------------|
| (1) Connecting rod cap | (3) Top ring | (5) Oil ring |
| (2) Connecting rod bearing | (4) Second ring | (6) Snap ring |

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

NOTE:

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

3) Remove the piston rings using piston ring expander.

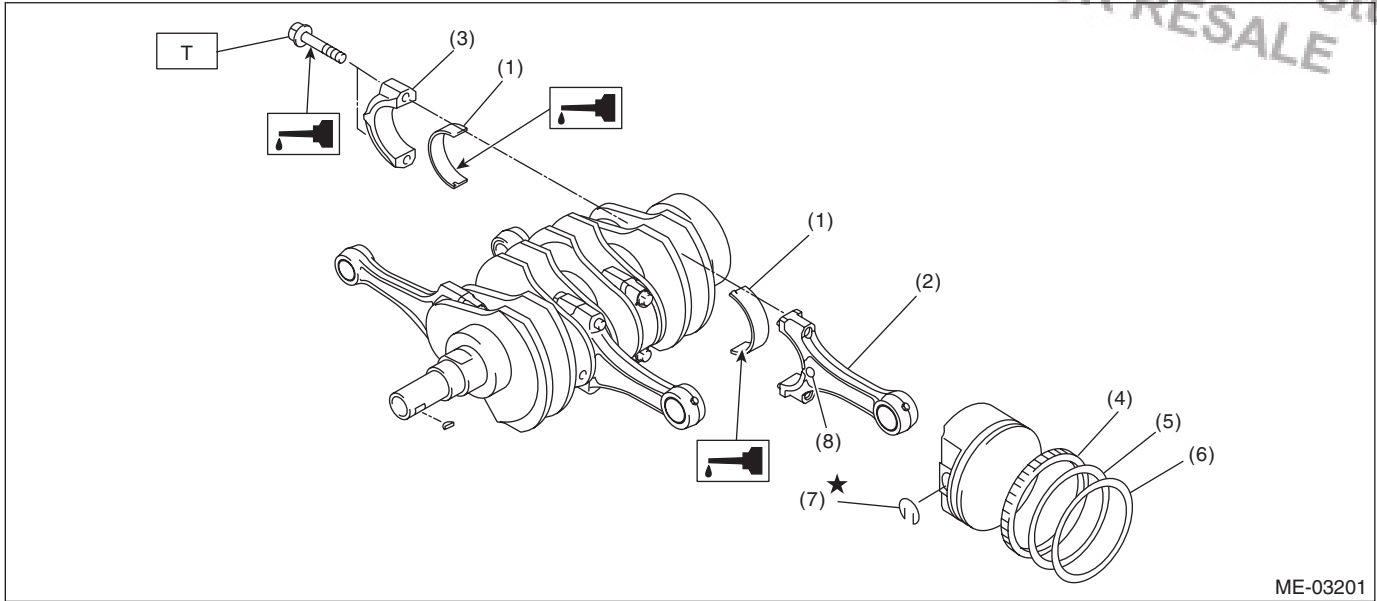
4) Remove the oil ring by hand.

NOTE:

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

5) Remove the snap ring.

D: ASSEMBLY



ME-03201

- | | |
|----------------------------|-----------------|
| (1) Connecting rod bearing | (5) Second ring |
| (2) Connecting rod | (6) Top ring |
| (3) Connecting rod cap | (7) Snap ring |
| (4) Oil ring | (8) Side mark |

Tightening torque: N·m (kgf-m, ft-lb)

T: 52 (5.3, 38.4)

1) Apply oil to the surface of the connecting rod bearings, and install the connecting rod bearings on connecting rods and connecting rod caps.

2) Position each connecting rod with the marking side facing forward.

3) Tighten the connecting rod cap with connecting rod bolt.

Make sure the arrow on connecting rod cap faces the front during installation.

NOTE:

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

Tightening torque:

52 N·m (5.3 kgf-m, 38.4 ft-lb)

4) Install the oil ring upper rail, expander and lower rail by hand.

5) Install the second ring and top ring using piston ring expander.

E: INSPECTION

1. CYLINDER BLOCK

1) Check for cracks and damage. Use liquid penetrant tester on the important sections to check for fissures. Check that there are no marks of gas leaking or water leaking on gasket installing surface.

2) Check the oil passages for clogging.

3) Inspect the cylinder block surface that mates with cylinder head for warping by using a straight edge, and correct by grinding if necessary.

Warping limit:

0.025 mm (0.00098 in)

Grinding limit:

0.1 mm (0.004 in)

Standard height of cylinder block:

201.0 mm (7.91 in)

Cylinder Block

MECHANICAL

2. CYLINDER AND PISTON

1) The cylinder bore size is stamped on the front upper face of the cylinder block.

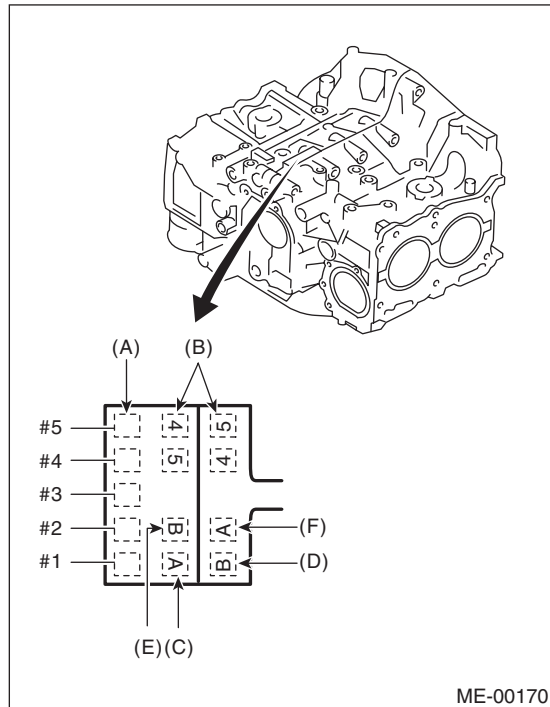
NOTE:

- Measurement should be performed at a temperature of 20°C (68°F).
- Standard sized pistons are classified into two grades, "A" and "B". These grades should be used as guide lines in selecting a standard piston.

Standard diameter:

A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)

B: 99.495 — 99.505 mm (3.9171 — 3.9175 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

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

NOTE:

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)

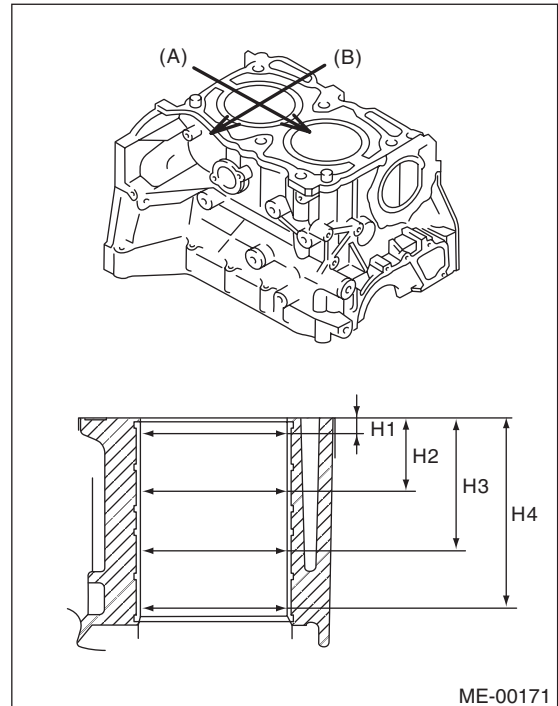
Out-of-roundness:

Standard

0.010 mm (0.0004 in)

Limit

0.050 mm (0.0020 in)



- (A) Piston pin direction
- (B) Thrust direction
- H1: 10 mm (0.39 in)
- H2: 45 mm (1.77 in)
- H3: 80 mm (3.15 in)
- H4: 115 mm (4.53 in)

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

NOTE:

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

Piston grade point H:

38.2 mm (1.50 in)

Piston outer diameter:

Standard

A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)

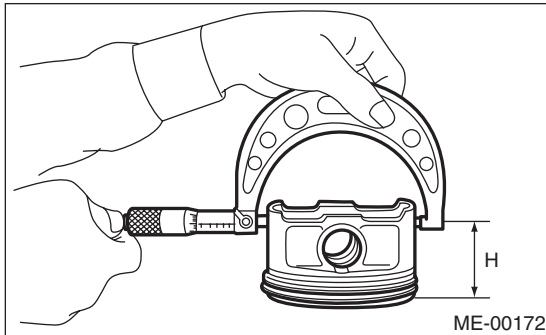
B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)

0.25 mm (0.0098 in) oversize

99.745 — 99.765 mm (3.9270 — 3.9278 in)

0.50 mm (0.0197 in) oversize

99.995 — 100.015 mm (3.9368 — 3.9376 in)



5) Calculate the clearance between cylinder and piston.

NOTE:

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

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

Standard

-0.010 — 0.010 mm (-0.0004 — 0.0004 in)

Limit

0.030 mm (0.0012 in)

6) Boring and honing

(1) If any of the value of taper, out-of-roundness, or cylinder-to-piston clearance exceeds the specified limit or if there is any damage on the cylinder wall, rebores it for replacement with an oversize piston.

CAUTION:

- When any of the cylinders needs reboring, other cylinders must be bored at the same time, and replaced with oversize pistons.
- Do not perform boring on one cylinder only. Do not replace only a single cylinder for an oversize piston.

(2) If the cylinder inner diameter exceeds the limit after boring and honing, replace the cylinder block.

NOTE:

Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, when measuring the cylinder diameter, wait until it has cooled to room temperature.

Cylinder inner diameter boring limit (diameter):

To 100.005 mm (3.937 in)

3. PISTON AND PISTON PIN

- 1) Check the piston and piston pin for breaks, cracks or wear. Replace if faulty.
- 2) Check the piston ring groove for wear or damage. Replace if faulty.
- 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 faulty.

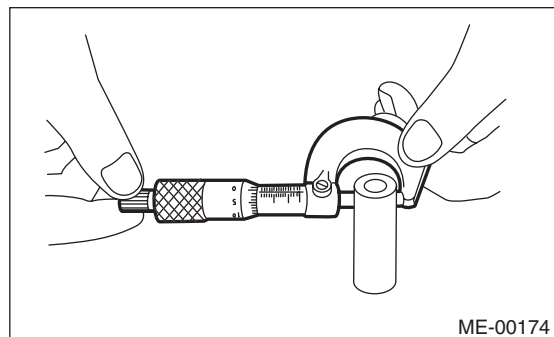
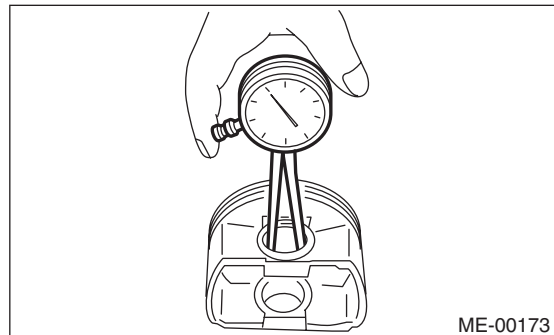
Standard clearance between piston pin and hole in piston:

Standard

0.004 — 0.008 mm (0.0002 — 0.0003 in)

Limit

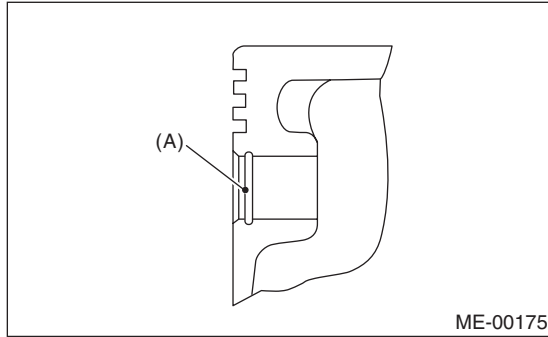
0.020 mm (0.0008 in)



Cylinder Block

MECHANICAL

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



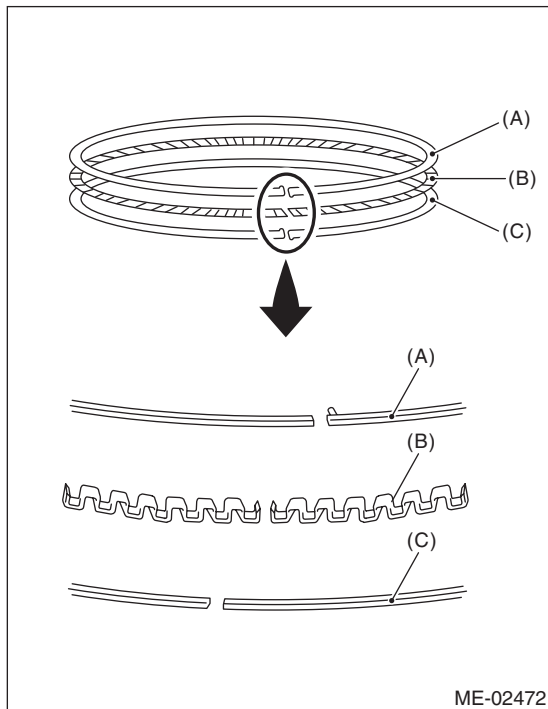
5) Check the piston pin snap ring for distortion, cracks and wear.

4. 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 part of the same size as the piston.

NOTE:

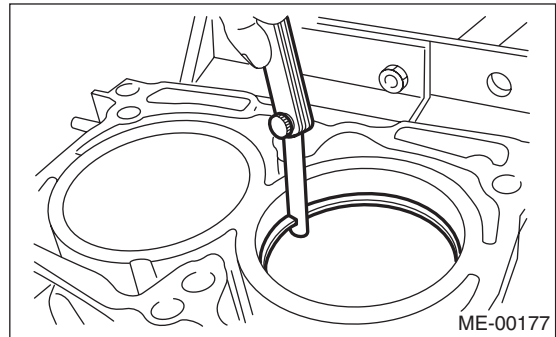
- The top ring and second ring have the mark to determine the direction to install on them. When installing them to piston, face this mark to the top side.
- Oil ring consists of the upper rail, expander and lower rail. When installing oil ring on piston, be careful of the direction of each rail.



- (A) Upper rail
- (B) Expander
- (C) Lower rail

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

		Unit: mm (in)	
		Standard	Limit
Piston ring closed gap	Top ring	0.20 — 0.25 (0.0079 — 0.0098)	1.0 (0.039)
	Second ring	0.37 — 0.52 (0.015 — 0.020)	1.0 (0.039)
	Oil ring rail	0.20 — 0.50 (0.0079 — 0.0197)	1.5 (0.059)

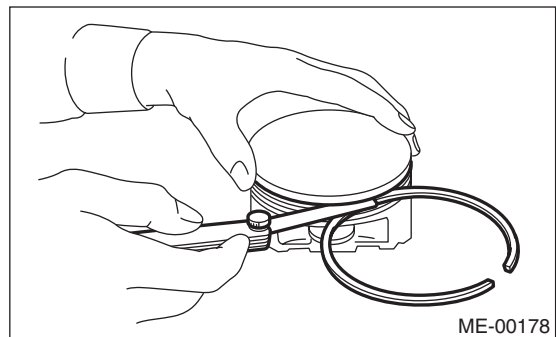


3) Fit the piston ring straight into the piston ring groove, then measure the clearance between piston ring and piston ring groove with a thickness gauge.

NOTE:

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

		Unit: mm (in)	
		Standard	Limit
Ring groove gap	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)

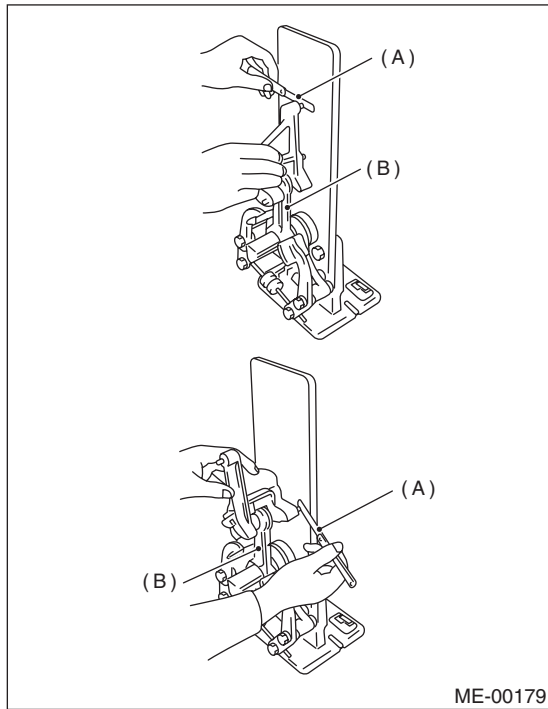


5. CONNECTING ROD

- 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

- 3) Install the connecting rod fitted with bearing to the crankshaft, and measure the thrust clearance using a thickness gauge. Replace the connecting rod if the thrust clearance exceeds the limit.

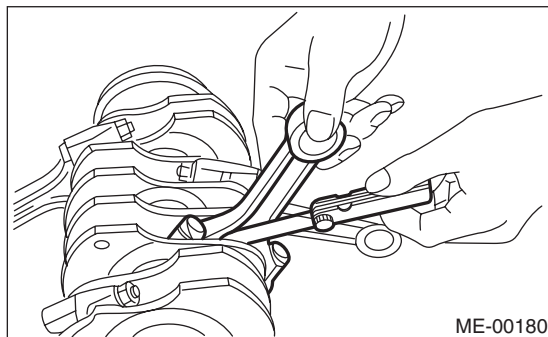
Connecting rod thrust clearance:

Standard

0.070 — 0.330 mm (0.0028 — 0.0130 in)

Limit

0.4 mm (0.016 in)



ME-00180

- 4) Inspect the connecting rod bearing for scar, peeling, seizure, melting, wear, etc.
- 5) Measure the oil clearance on each connecting rod bearing using plastigauge. If any oil clearance is not within specification, replace the defective bearing with a standard size or undersize part as necessary.

Connecting rod oil clearance:

Standard

0.017 — 0.045 mm (0.0007 — 0.0018 in)

Limit

0.05 mm (0.0020 in)

Unit: mm (in)		
Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.490 — 1.502 (0.0587 — 0.0591)	51.984 — 52.000 (2.0466 — 2.0472)
0.03 (0.0012) undersize	1.504 — 1.512 (0.0592 — 0.0595)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) undersize	1.514 — 1.522 (0.0596 — 0.0599)	51.934 — 51.950 (2.0447 — 2.0453)
0.25 (0.0098) undersize	1.614 — 1.622 (0.0635 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

- 6) Inspect the bushing at connecting rod small end, and replace if worn or damaged.
- 7) Measure the piston pin clearance at connecting rod small end. Replace it if the limit has been exceeded.

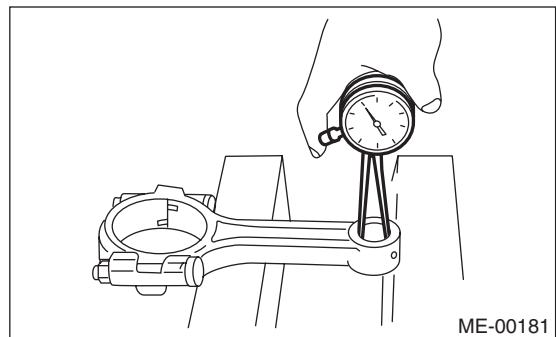
Clearance between piston pin and bushing:

Standard:

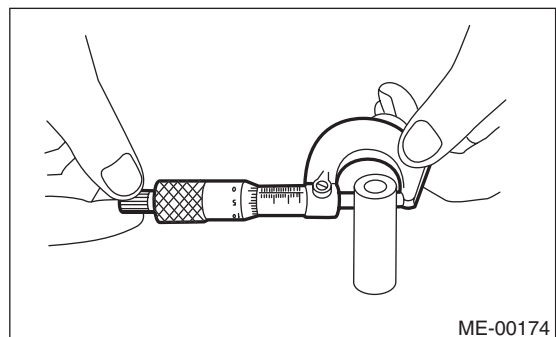
0 — 0.022 mm (0 — 0.0009 in)

Service limit:

0.030 mm (0.0012 in)



ME-00181



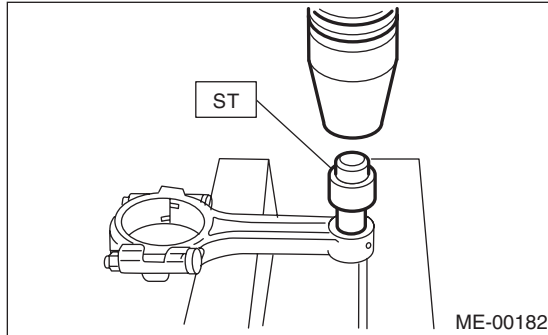
ME-00174

MECHANICAL

8) The replacement procedure for the connecting rod small end bushing 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



(3) Make two 3 mm (0.12 in) holes in the pressed bushing by aligning with the pre-manufactured holes on the connecting rod, and ream the inside of the bushing.

(4) After completion of reaming, clean the bushing to remove chips.

6. CRANKSHAFT AND CRANKSHAFT BEARING

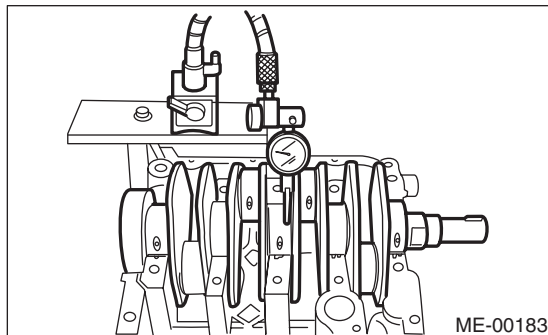
1) Clean the crankshaft completely, and check it for cracks using liquid penetrant tester. Replace if faulty.

2) Measure the bend of crankshaft. If it exceeds the limit, correct it or replace the part.

NOTE:

If a suitable V-block is not available, using just the #1 and #5 crankshaft bearings on cylinder block, position the crankshaft on cylinder block. Then, measure the crankshaft bend using a dial gauge.

Crankshaft bend limit:
0.035 mm (0.0014 in)



3) Inspect the crank journal and crank pin for wear. If they are not within the specification, replace the bearing with a suitable (undersize) one, and replace or grind to correct the 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:

Out-of-roundness

0.003 mm (0.0001 in)

Cylindricality

0.004 mm (0.0002 in)

Grinding limit

To 51.750 mm (2.0374 in) dia.

Crank journal:

Out-of-roundness

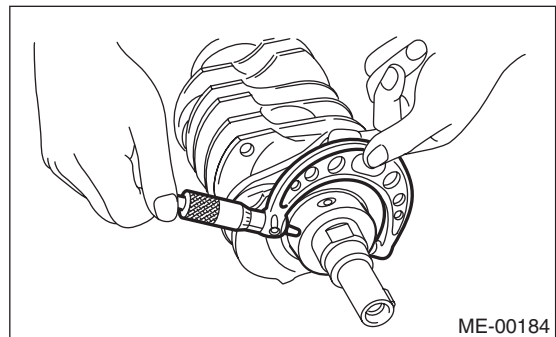
0.005 mm (0.0002 in)

Cylindricality

0.006 mm (0.0002 in)

Grinding limit

To 59.758 mm (2.3527 in) dia.



		Crank journal diameter		Unit: mm (in)
		#1, #3	#2, #4, #5	Crank pin diameter
Standard	Journal O.D.	59.992 — 60.008 (2.3619 — 2.3625)	59.992 — 60.008 (2.3619 — 2.3625)	51.984 — 52.000 (2.0466 — 2.0472)
	Bearing size (Thickness at center)	1.998 — 2.011 (0.0787 — 0.0792)	2.000 — 2.013 (0.0787 — 0.0793)	1.490 — 1.502 (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)	51.954 — 51.970 (2.0454 — 2.0461)
	Bearing size (Thickness at center)	2.017 — 2.020 (0.0794 — 0.0795)	2.019 — 2.022 (0.0795 — 0.0796)	1.504 — 1.512 (0.0592 — 0.0595)
0.05 (0.0020) undersize	Journal O.D.	59.942 — 59.958 (2.3599 — 2.3605)	59.942 — 59.958 (2.3599 — 2.3605)	51.934 — 51.950 (2.0447 — 2.0453)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.514 — 1.522 (0.0596 — 0.0599)
0.25 (0.0098) undersize	Journal O.D.	59.742 — 59.758 (2.3520 — 2.3527)	59.742 — 59.758 (2.3520 — 2.3527)	51.734 — 51.750 (2.0368 — 2.0374)
	Bearing size (Thickness at center)	2.127 — 2.130 (0.0837 — 0.0839)	2.129 — 2.132 (0.0838 — 0.0839)	1.614 — 1.622 (0.0635 — 0.0639)

4) Use a thickness gauge to measure the thrust clearance of crankshaft at center bearing. If the clearance exceeds the limit, replace the bearing.

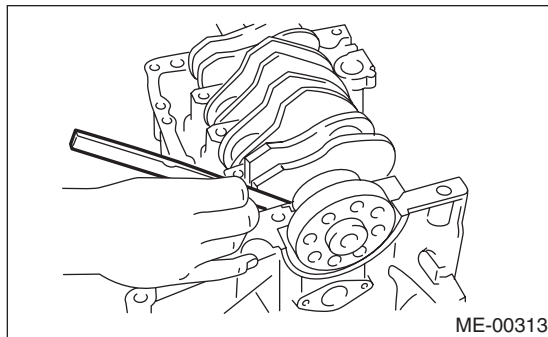
Crankshaft thrust clearance:

Standard

0.030 — 0.115 mm (0.0012 — 0.0045 in)

Limit

0.25 mm (0.0098 in)



5) Inspect individual crankshaft bearings for signs of flaking, seizure, melting and wear.

6) Measure the oil clearance on each crankshaft bearing using plastigauge. If the measurement is over the limit, replace the faulty bearing with an undersized bearing, and replace or grind to correct the crankshaft as necessary.

Crankshaft oil clearance:

Standard

0.010 — 0.030 mm (0.0004 — 0.0012 in)

Limit

0.040 mm (0.0016 in)

21. Intake and Exhaust Valve

A: SPECIFICATION

Refer to "Cylinder Head" for removal and installation procedures of intake and exhaust valves. <Ref. to ME(H4DOTC)-64, REMOVAL, Cylinder Head.>
<Ref. to ME(H4DOTC)-64, INSTALLATION, Cylinder Head.>

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22.Piston

A: SPECIFICATION

Refer to "Cylinder Block" for removal and installation procedures of pistons. <Ref. to ME(H4DOTC)-71, REMOVAL, Cylinder Block.> <Ref. to ME(H4DOTC)-74, INSTALLATION, Cylinder Block.>

23. Connecting Rod

A: SPECIFICATION

Refer to "Cylinder Block" for removal and installation procedures for connecting rods. <Ref. to ME(H4DOTC)-71, REMOVAL, Cylinder Block.>
<Ref. to ME(H4DOTC)-74, INSTALLATION, Cylinder Block.>

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24.Crankshaft

A: SPECIFICATION

Refer to "Cylinder Block" for removal and installation procedures of crankshaft. <Ref. to ME(H4DOTC)-71, REMOVAL, Cylinder Block.>
<Ref. to ME(H4DOTC)-74, INSTALLATION, Cylinder Block.>

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Engine Trouble in General

MECHANICAL

25.Engine Trouble in General

A: INSPECTION

NOTE:

The "RANK" shown in the chart shows the possibilities of the cause of trouble in order from "Very often" to "Rarely".

A — Very often

B — Sometimes

C — Rarely

Symptoms	Problem parts etc.	Possible cause	RANK
1. Engine does 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	Improper connection of terminal	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(H4DOTC)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(STI)(diag)-2, Basic Diagnostic Procedure.>		A
	Fuel line	Defective fuel pump and relay	A
		Clogged fuel line	C
		Lack of or insufficient fuel	B
	Timing belt	Degradation, etc.	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective head gasket	C
		Improper valve sealing	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 Trouble in General

MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK
3) Initial combustion occurs.	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(STI)(diag)-2, Basic Diagnostic Procedure.>		A
	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
	Timing belt	Degradation, etc.	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective head gasket	C
		Improper valve sealing	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		
4) Engine stalls after initial combustion.	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(STI)(diag)-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
	Timing belt	Degradation, etc.	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective head gasket	C
Improper valve sealing		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 Trouble in General

MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK
2. Rough idle and engine stall	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(STI)(diag)-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
	Timing belt	Defective timing	C
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	B
		Loosened cylinder head bolt or defective head gasket	B
		Improper valve sealing	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	Evaporative emission control system malfunction	A	
	Stuck or damaged throttle valve	B	

Engine Trouble in General

MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK
3. Low output, hesitation and poor acceleration	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(STI)(diag)-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
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	B
		Loosened cylinder head bolt or defective head gasket	B
		Improper valve sealing	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	Evaporative emission control system malfunction	A	

Engine Trouble in General

MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK
4. Surging	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(STI)(diag)-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
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective head gasket	C
		Improper valve sealing	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	Evaporative emission control system malfunction	C	
5. Engine does not return to idle.	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(STI)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked vacuum hose	A
	Others	Stuck or damaged throttle valve	A
6. Dieseling (Run-on)	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(STI)(diag)-2, Basic Diagnostic Procedure.>		A
	Cooling system	Overheating	B
	Others	Evaporative emission control system malfunction	B

Engine Trouble in General

MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK
7. After burning in exhaust system	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(STI)(diag)-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
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective head gasket	C
		Improper valve sealing	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	Evaporative emission control system malfunction	C	
8. Knocking	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(STI)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened oil filler cap	B
	Timing 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	

Engine Trouble in General

MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK	
10. Excessive fuel consumption	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(STI)(diag)-2, Basic Diagnostic Procedure.>		A	
	Intake system	Dirty air cleaner element	A	
	Timing belt	Defective timing	B	
	Compression	Incorrect valve clearance		B
		Loosened spark plug or defective gasket		C
		Loosened cylinder head bolt or defective head gasket		C
		Improper valve sealing		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	

26.Engine Noise

A: INSPECTION

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	<ul style="list-style-type: none"> Valve mechanism is defective. Incorrect valve clearance Worn camshaft Broken valve spring
Heavy and dull clank	Oil pressure is low.	<ul style="list-style-type: none"> Worn crankshaft main bearing Worn connecting rod bearing (large end)
	Oil pressure is normal.	<ul style="list-style-type: none"> Loosened flywheel mounting bolt Damaged engine mounting
High-pitched clank	Sound is noticeable when accelerating with an overload condition.	<ul style="list-style-type: none"> Ignition timing advanced Accumulation of carbon inside combustion chamber Wrong heat-durability spark plug Improper octane value gasoline
Clank when engine speed is 1,000 to 2,000 rpm	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	<ul style="list-style-type: none"> Worn crankshaft main bearing Worn connecting rod bearing (large end)
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*)	<ul style="list-style-type: none"> 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*)	<ul style="list-style-type: none"> Unusually worn valve lifter Worn cam sprocket Worn camshaft journal in cylinder head assembly
Squeaky sound	—	<ul style="list-style-type: none"> Insufficient generator lubrication
Rubbing sound	—	<ul style="list-style-type: none"> Poor contact of generator brush and rotor
Gear scream when starting engine	—	<ul style="list-style-type: none"> Defective ignition starter switch Worn gear and starter pinion
Sound like polishing glass with a dry cloth	—	<ul style="list-style-type: none"> Loose drive belt Defective water pump shaft
Hissing sound	—	<ul style="list-style-type: none"> Insufficient compression Air leakage in air intake system, hose, connection or manifold
Timing belt noise	—	<ul style="list-style-type: none"> Loose timing belt Belt contacting with case/adjacent part
Valve noise	—	<ul style="list-style-type: none"> Incorrect valve clearance

NOTE*)

When disconnecting the fuel injector connector, the malfunction indicator light illuminates and DTC is stored in ECM memory. Therefore, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-53, OPERATION, Clear Memory Mode.> <Ref. to EN(STI)(diag)-48, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-43, PROCEDURE, Inspection Mode.> <Ref. to EN(STI)(diag)-39, PROCEDURE, Inspection Mode.> after connecting the fuel injector connector.

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