1. General Description

A: SPECIFICATION

Engine	Model			2.0 L
	Cylinder arrangement			Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine
	Valve system mechanism			Chain driven, double overhead camshaft, 4-valve/cylinder
	Bore × Stroke mm (in)			84.0 × 90.0 (3.31 × 3.54)
	Displacement cm^3 (cu in)			1,995 (121.73)
	Compression ratio			10.5
	Compression pressure (at 200 — 300 rpm) kPa (kg/cm^2, psi)		Standard	1,050 — 1,400 (11 — 14, 152 — 203)
	Number of piston rings			Compression ring: 2 Oil ring: 1
	Intake valve timing	Open	Max. retard	ATDC 25°
			Min. advance	BTDC 43°
		Close	Max. retard	ABDC 85°
			Min. advance	ABDC 17°
	Exhaust valve timing	Open	Max. retard	ABDC 3°
			Min. advance	BBDC 52°
		Close	Max. retard	ATDC 47°
			Min. advance	BTDC 8°
	Cam clearance mm (in)	Intake	Standard	0.13±0.03 (0.0051±0.0012)
		Exhaust	Standard	0.24±0.03 (0.0094±0.0012)
	Idle speed (For CVT model, select lever in “P” or “N” range. For MT model, gear shift lever in neutral position.) rpm	No load	Standard	650±50
		A/C ON	Standard	800 — 900±50
	Ignition order			1 → 3 → 2 → 4
	Ignition timing BTDC/rpm		Standard	16°±10°/650

NOTE:
OS: Oversize US: Undersize

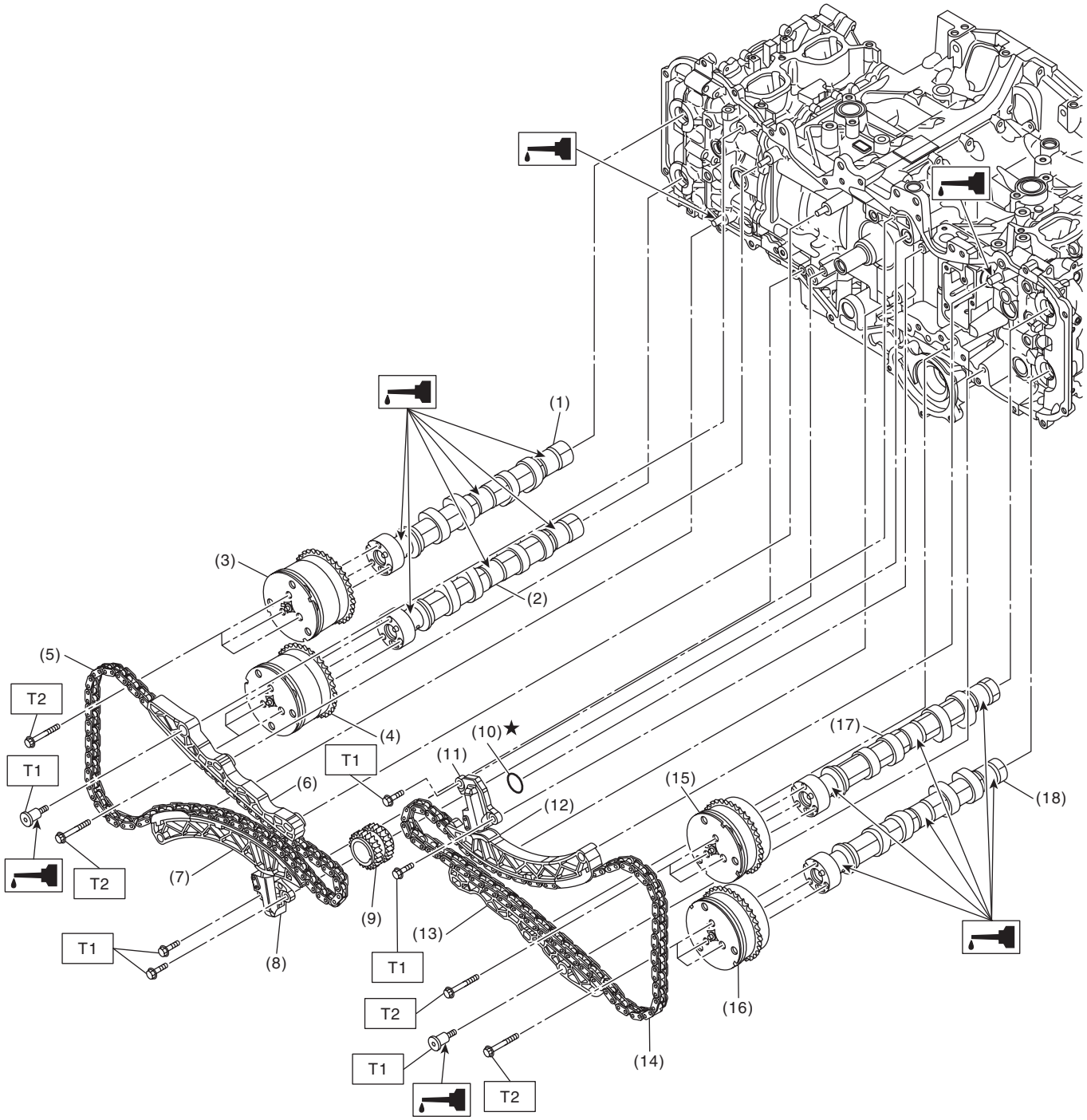
Camshaft	Bending			Limit	0.020 (0.00079)
	Cam lobe height mm (in)	Intake		Standard	40.77 — 40.87 (1.605 — 1.609)
		Exhaust		Standard	40.15 — 40.25 (1.581 — 1.585)
	Cam base circle diameter mm (in)			Standard	34.0 (1.339)
	Journal outer diameter mm (in)			Standard	25.946 — 25.963 (1.0215 — 1.0222)
	Thrust clearance mm (in)			Standard	0.068 — 0.116 (0.0027 — 0.0047)
	Oil clearance mm (in)			Standard	0.037 — 0.072 (0.0015 — 0.0028)
Cylinder head	Warpage (mating surface with cylinder block) mm (in)			Limit	0.035 (0.0014)
	Grinding limit mm (in)				To 98.4 (3.874)
	Height mm (in)			Standard	98.5 (3.878)
Valve & valve guide	Valve overall length mm (in)		Intake		103.3 (4.067)
			Exhaust		94.1 (3.705)
	Valve head edge thickness mm (in)	Intake		Standard	0.8 — 1.2 (0.031 — 0.047)
		Exhaust		Standard	1.0 — 1.4 (0.039 — 0.055)
	Valve stem outer diameter mm (in)	Intake		Standard	5.455 — 5.470 (0.2148 — 0.2154)
		Exhaust		Standard	5.445 — 5.460 (0.2144 — 0.2150)
	Valve guide inner diameter mm (in)			Standard	5.500 — 5.512 (0.2165 — 0.2170)
	Clearance between valve and valve guide mm (in)	Intake		Standard	0.030 — 0.057 (0.0012 — 0.0022)
		Exhaust		Standard	0.040 — 0.067 (0.0016 — 0.0026)
	Valve guide protrusion amount mm (in)			Standard	11.4 — 11.8 (0.449 — 0.465)
Valve & valve shim	Valve stem end outer diameter mm (in)	Intake		Standard	5.455 — 5.470 (0.2148 — 0.2154)
		Exhaust		Standard	5.445 — 5.460 (0.2144 — 0.2150)
	Valve shim inner diameter mm (in)			Standard	5.500 — 5.560 (0.2165 — 0.2189)
	Clearance between valve and valve shim mm (in)			Standard	0.030 — 0.115 (0.0012 — 0.0045)
Valve seat	Seating width between valve and valve seat mm (in)	Intake		Standard	0.8 — 1.6 (0.031 — 0.063)
		Exhaust		Standard	1.1 — 1.7 (0.043 — 0.067)
	Seating angle between valve and valve seat				45°
	Seating position between valve and valve seat				Valve face center
Valve spring	Free length mm (in)			Standard	41.06 (1.617)
	Tension/spring height N (kgf, lb)/mm (in)		Set	Standard	182 — 210 (18.56 — 21.41, 40.92 — 47.22)/ 33.0 (1.299)
			Lift	Standard	552 — 610 (56.29 — 62.20, 124.11 — 137.15)/ 22.0 (0.866)
	Squareness			Standard	2.5°, 1.8 mm (0.071 in) or less

Cylinder block & piston	Cylinder block warpage (Mating surface with cylinder head) mm (in)			Limit	0.025 (0.00098)
	Grinding limit of cylinder block mm (in)				To 204.9 (8.067)
	Height of cylinder block mm (in)			Standard	205.0 (8.071)
	Inner diameter of cylinder liner mm (in)	Cylinder bore size mark A		Standard	84.005 — 84.015 (3.3073 — 3.3077)
		Cylinder bore size mark B		Standard	83.995 — 84.005 (3.3069 — 3.3073)
	Cylindricality of cylinder liner mm (in)			Limit	0.015 (0.0006)
	Out-of-roundness of cylinder liner mm (in)			Limit	0.010 (0.0004)
	Piston grade point mm (in)				38.0 (1.50)
	Piston outer diameter mm (in)	Standard size	Grade A	Standard	83.975 — 83.985 (3.3061 — 3.3065)
			Grade B	Standard	83.965 — 83.975 (3.3057 — 3.3061)
		0.25 (0.0098) OS		Standard	84.215 — 84.235 (3.3155 — 3.3163)
		0.50 (0.0197) OS		Standard	84.465 — 84.485 (3.3254 — 3.3262)
	Clearance between cylinder liner and piston mm (in)			Standard	0.020 — 0.040 (0.00079 — 0.00158)
	Inner diameter of cylinder liner boring limit (diameter) mm (in)				To 84.505 (3.3270)
Piston and piston pin	Degree of fit				Piston pin must be fitted into position with thumb at 20°C (68°F).
	Clearance between piston and piston pin mm (in)			Standard	0.004 — 0.008 (0.0002 — 0.0003)
Piston ring	Closed gap mm (in)	Compression ring	Top ring	Standard	0.20 — 0.35 (0.0079 — 0.0138)
			Second ring	Standard	0.40 — 0.50 (0.0157 — 0.0197)
		Oil ring (upper rail and lower rail)		Standard	0.20 — 0.50 (0.0079 — 0.0197)
	Clearance between compression ring and piston mm (in)		Top ring	Standard	0.040 — 0.080 (0.0016 — 0.0031)
			Second ring	Standard	0.030 — 0.070 (0.0012 — 0.0028)
Connecting rod and connecting rod bearing	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)
	Connecting rod bearing thickness (at center) mm (in)	Standard size		Standard	1.492 — 1.508 (0.0587 — 0.0594)
		0.03 (0.0012) US		Standard	1.511 — 1.515 (0.0595 — 0.0596)
		0.05 (0.0020) US		Standard	1.521 — 1.525 (0.0599 — 0.0600)
		0.25 (0.0098) US		Standard	1.621 — 1.625 (0.0638 — 0.0640)
	Oil clearance mm (in)			Standard	0.017 — 0.047 (0.0007 — 0.0019)
Piston pin & connecting rod bushing	Clearance between piston pin and connecting rod bushing mm (in)			Standard	0.004 — 0.026 (0.0002 — 0.0010)

Crankshaft and crankshaft bearing	Bending		mm (in)	Limit	0.035 (0.0014)
	Crankshaft pin	Cylindricality	mm (in)	Limit	0.006 (0.0002)
		Out-of-roundness	mm (in)	Limit	0.005 (0.0002)
		Grinding limit (dia.)	mm (in)		To 47.726 (1.8790)
	Crankshaft journal	Cylindricality	mm (in)	Limit	0.006 (0.0002)
		Out-of-roundness	mm (in)	Limit	0.005 (0.0002)
		Grinding limit (dia.)	mm (in)		To 67.735 (2.6667)
	Crankshaft pin outer diameter	mm (in)	Standard size	Standard	47.976 — 48.000 (1.8888 — 1.8898)
			0.03 (0.0012) US	Standard	47.946 — 47.970 (1.8876 — 1.8886)
			0.05 (0.0020) US	Standard	47.926 — 47.950 (1.8868 — 1.8878)
			0.25 (0.0098) US	Standard	47.726 — 47.750 (1.8790 — 1.8799)
	Crankshaft journal outer diameter	mm (in)	Standard size	Standard	67.985 — 68.009 (2.6766 — 2.6775)
			0.03 (0.0012) US	Standard	67.955 — 67.979 (2.6754 — 2.6763)
			0.05 (0.0020) US	Standard	67.935 — 67.959 (2.6746 — 2.6755)
			0.25 (0.0098) US	Standard	67.735 — 67.759 (2.6667 — 2.6677)
	Crankshaft bearing thickness (at center)	mm (in)	#1, #2, #3, #4 Standard size	Standard	2.495 — 2.513 (0.0982 — 0.0989)
			0.03 (0.0012) US	Standard	2.519 — 2.522 (0.0992 — 0.0993)
			0.05 (0.0020) US	Standard	2.529 — 2.532 (0.0996 — 0.0997)
			0.25 (0.0098) US	Standard	2.629 — 2.632 (0.1035 — 0.1036)
			#5 Standard size	Standard	2.493 — 2.511 (0.0981 — 0.0989)
			0.03 (0.0012) US	Standard	2.517 — 2.520 (0.0991 — 0.0992)
			0.05 (0.0020) US	Standard	2.527 — 2.530 (0.0995 — 0.0996)
			0.25 (0.0098) US	Standard	2.627 — 2.630 (0.1034 — 0.1035)
	Thrust clearance		mm (in)	Standard	0.130 — 0.308 (0.00512 — 0.01213)
	Oil clearance		mm (in)	Standard	0.013 — 0.031 (0.00051 — 0.00122)

B: COMPONENT

1. TIMING CHAIN

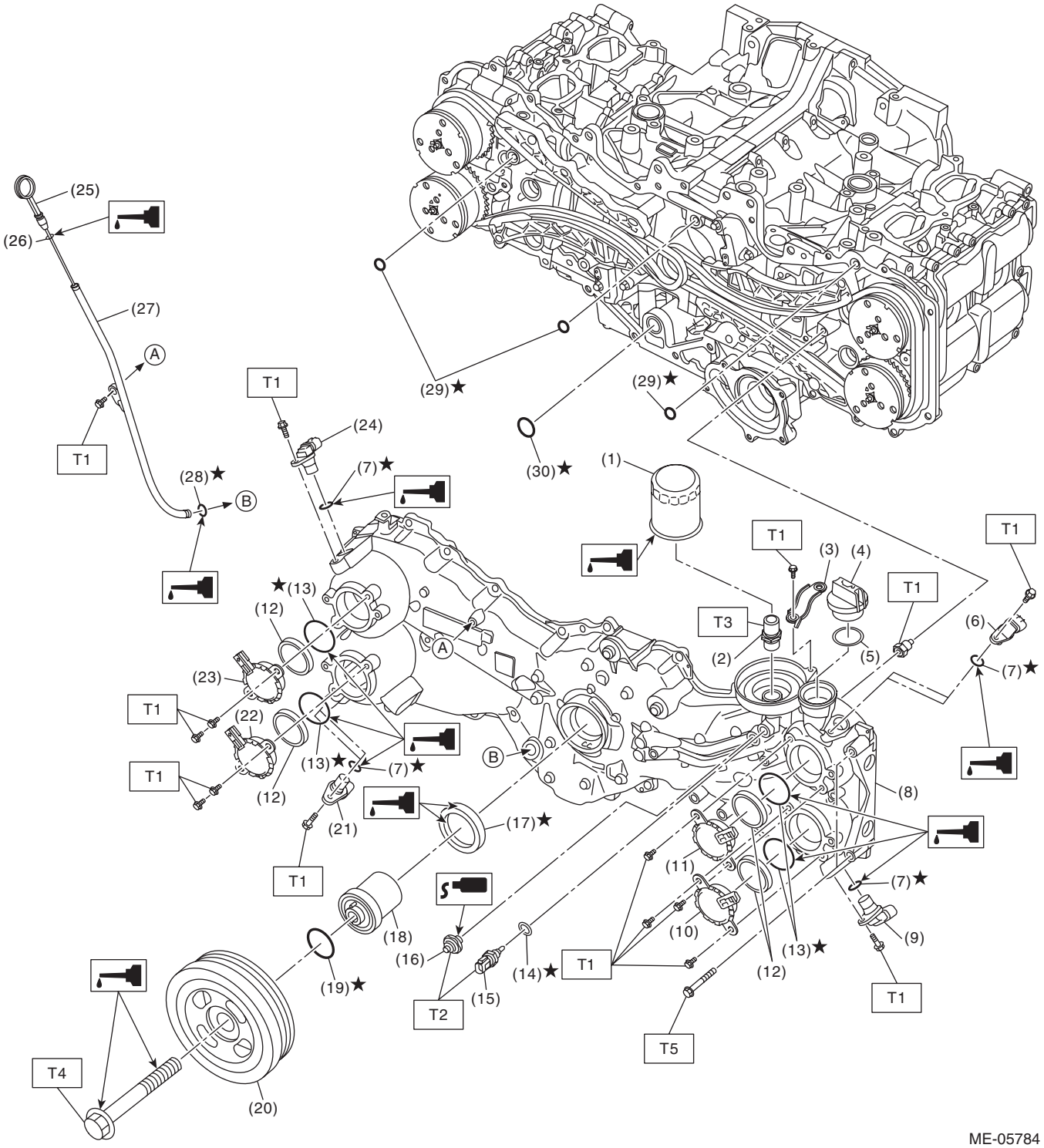


ME-05452

(1) Intake camshaft RH
(2) Exhaust camshaft RH
(3) Intake cam sprocket RH
(4) Exhaust cam sprocket RH
(5) Timing chain RH
(6) Chain guide
(7) Chain tensioner lever RH
(8) Chain tensioner RH
(9) Crank sprocket
(10) O-ring
(11) Chain tensioner LH
(12) Chain tensioner lever LH
(13) Chain guide
(14) Timing chain LH
(15) Intake cam sprocket LH
(16) Exhaust cam sprocket LH
(17) Intake camshaft LH
(18) Exhaust camshaft LH

Tightening torque:N·m (kgf-m, ft-lb)	
T1:	***6.4 (0.7, 4.7)***
T2:	***18 (1.8, 13.3)***

2. CHAIN COVER



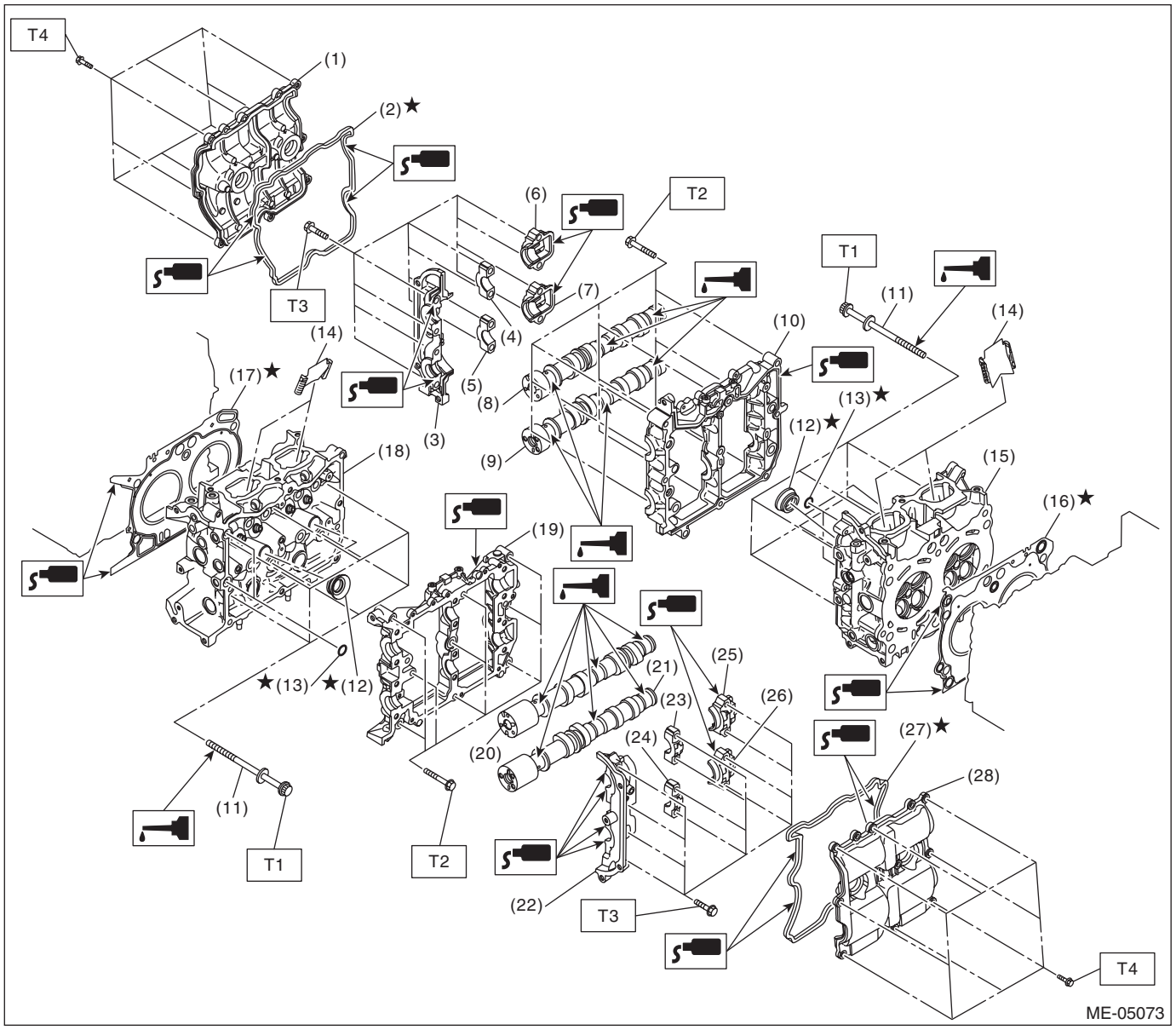
ME-05784

(1) Oil filter
(2) Oil pump union
(3) Generator cord stay
(4) Oil filler cap
(5) Gasket
(6) Intake camshaft position sensor LH
(7) O-ring
(8) Chain cover
(9) Exhaust camshaft position sensor LH
(10) Exhaust oil control solenoid LH
(11) Intake oil control solenoid LH
(12) Back-up ring
(13) O-ring
(14) Gasket
(15) Engine oil temperature sensor
(16) Oil pressure switch
(17) Front oil seal
(18) Crank pulley boss
(19) O-ring
(20) Crank pulley
(21) Exhaust camshaft position sensor RH
(22) Exhaust oil control solenoid RH
(23) Intake oil control solenoid RH
(24) Intake camshaft position sensor RH
(25) Oil level gauge
(26) O-ring
(27) Oil level gauge guide
(28) O-ring
(29) O-ring
(30) O-ring

Tightening torque:N·m (kgf-m, ft-lb)

T1: 6.4 (0.7, 4.7)
T2: 18 (1.8, 13.3)
T3: 45 (4.6, 33.2)
T4: <Ref. to ME(H4DO)-87, INSTALLATION, Crank Pulley.>
T5: <Ref. to ME(H4DO)-102, INSTALLATION, Chain Cover.>

3. CYLINDER HEAD AND CAMSHAFT

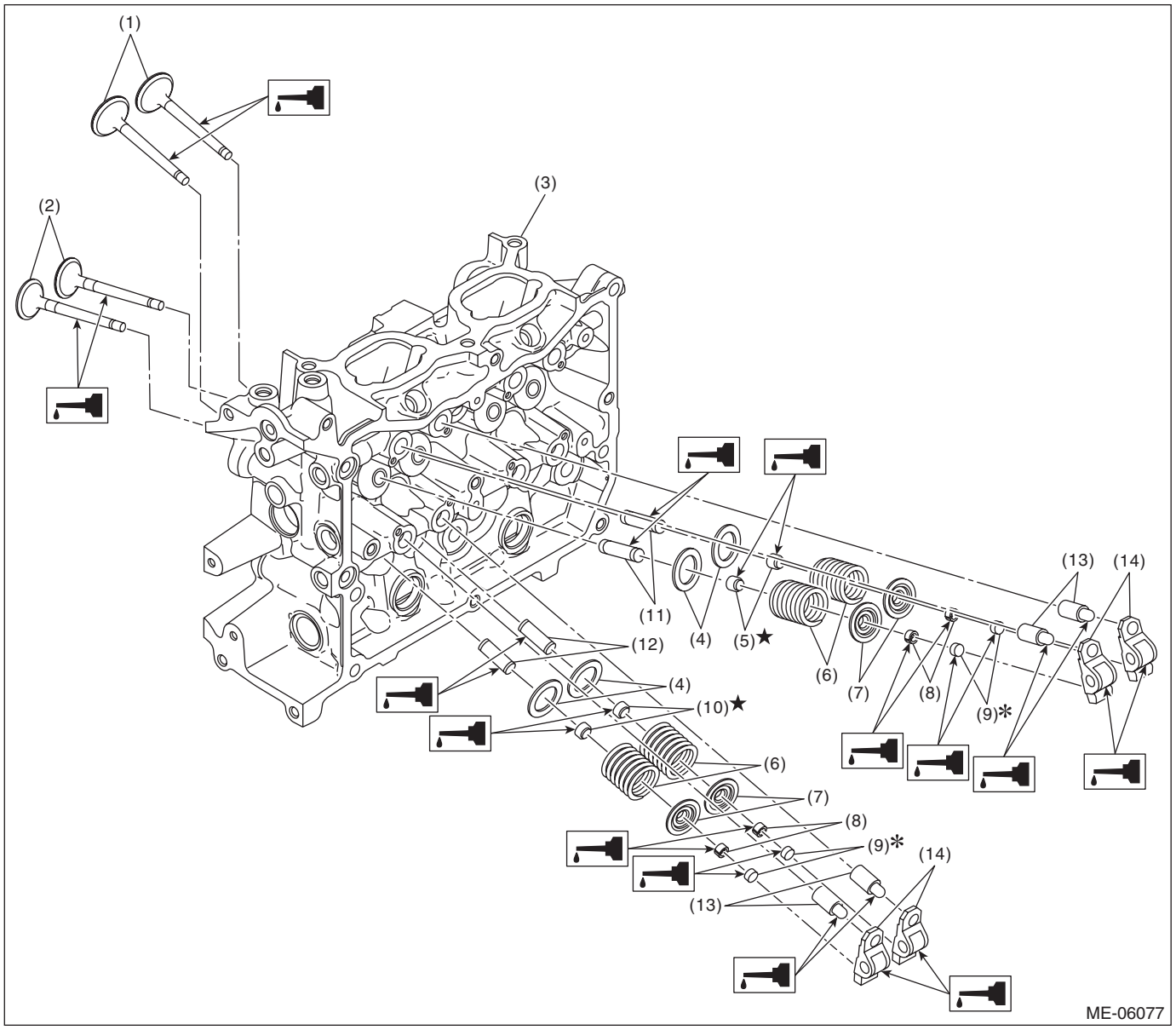


(1) Rocker cover RH
(2) Rocker cover gasket RH
(3) Front camshaft cap RH
(4) Intake center camshaft cap RH
(5) Exhaust center camshaft cap RH
(6) Intake rear camshaft cap RH
(7) Exhaust rear camshaft cap RH
(8) Intake camshaft RH
(9) Exhaust camshaft RH
(10) Cam carrier RH
(11) Cylinder head bolt
(12) Spark plug pipe gasket
(13) O-ring
(14) Cylinder head plate
(15) Cylinder head RH
(16) Cylinder head gasket RH
(17) Cylinder head gasket LH
(18) Cylinder head LH
(19) Cam carrier LH
(20) Intake camshaft LH
(21) Exhaust camshaft LH
(22) Front camshaft cap LH
(23) Intake center camshaft cap LH
(24) Exhaust center camshaft cap LH
(25) Intake rear camshaft cap LH
(26) Exhaust rear camshaft cap LH
(27) Rocker cover gasket LH
(28) Rocker cover LH

Tightening torque:N·m (kgf-m, ft-lb)

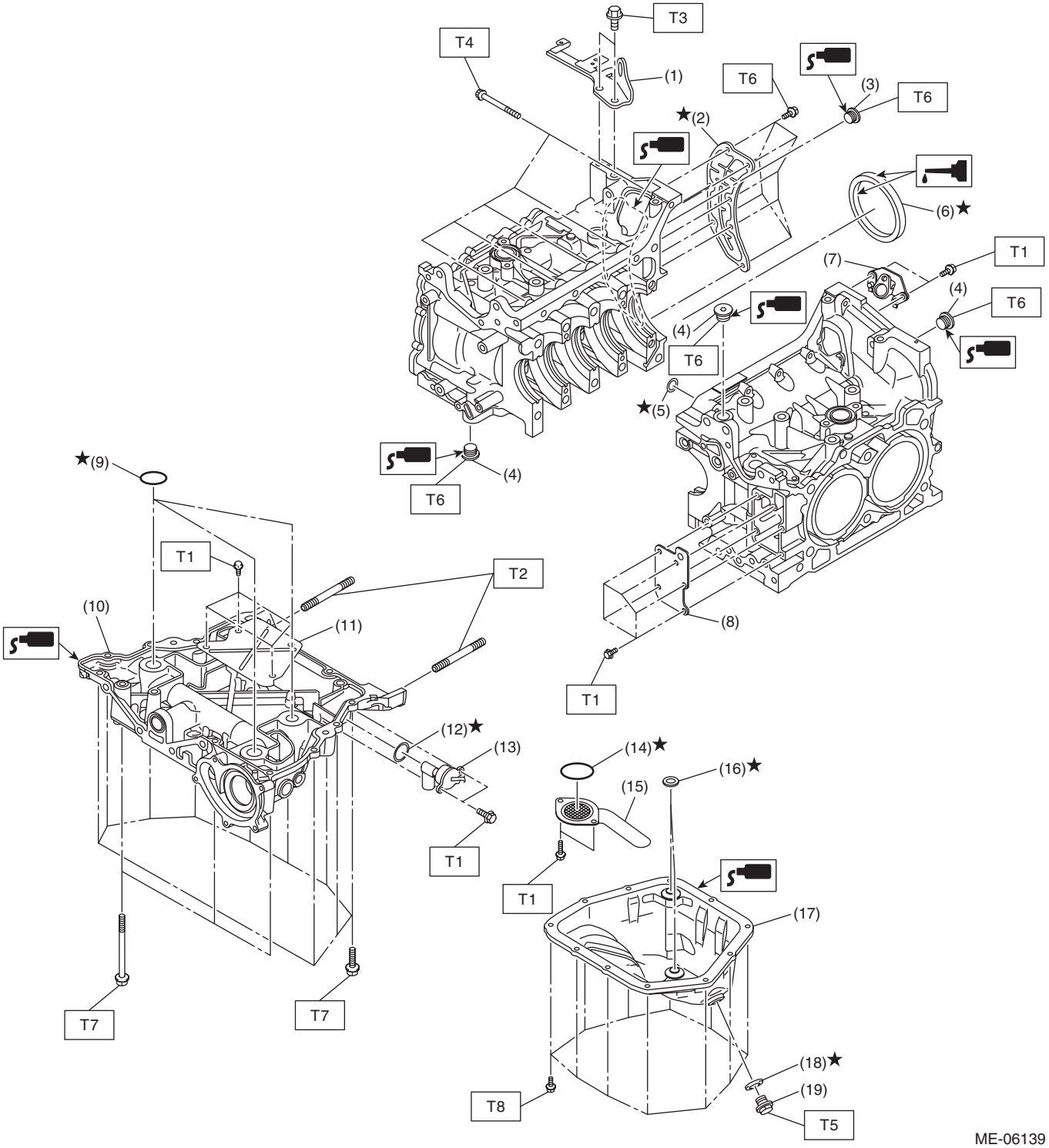
T1: ***<Ref. to ME(H4DO)-208, INSTALLATION, Cylinder Head.>***
T2: ***<Ref. to ME(H4DO)-170, INSTALLATION, Cam Carrier.>***
T3: ***<Ref. to ME(H4DO)-195, ASSEMBLY, Cam Carrier.>***
T4: ***<Ref. to ME(H4DO)-151, INSTALLATION, Rocker Cover.>***

4. CYLINDER HEAD AND VALVE ASSEMBLY



(1) Exhaust valve
(2) Intake valve
(3) Cylinder head
(4) Valve spring seat
(5) Intake valve oil seal
(6) Valve spring
(7) Valve spring retainer
(8) Valve collet
(9) Valve shim
(10) Exhaust valve oil seal
(11) Intake valve guide
(12) Exhaust valve guide
(13) Roller rocker arm pivot
(14) Roller rocker arm

5. CYLINDER BLOCK 1

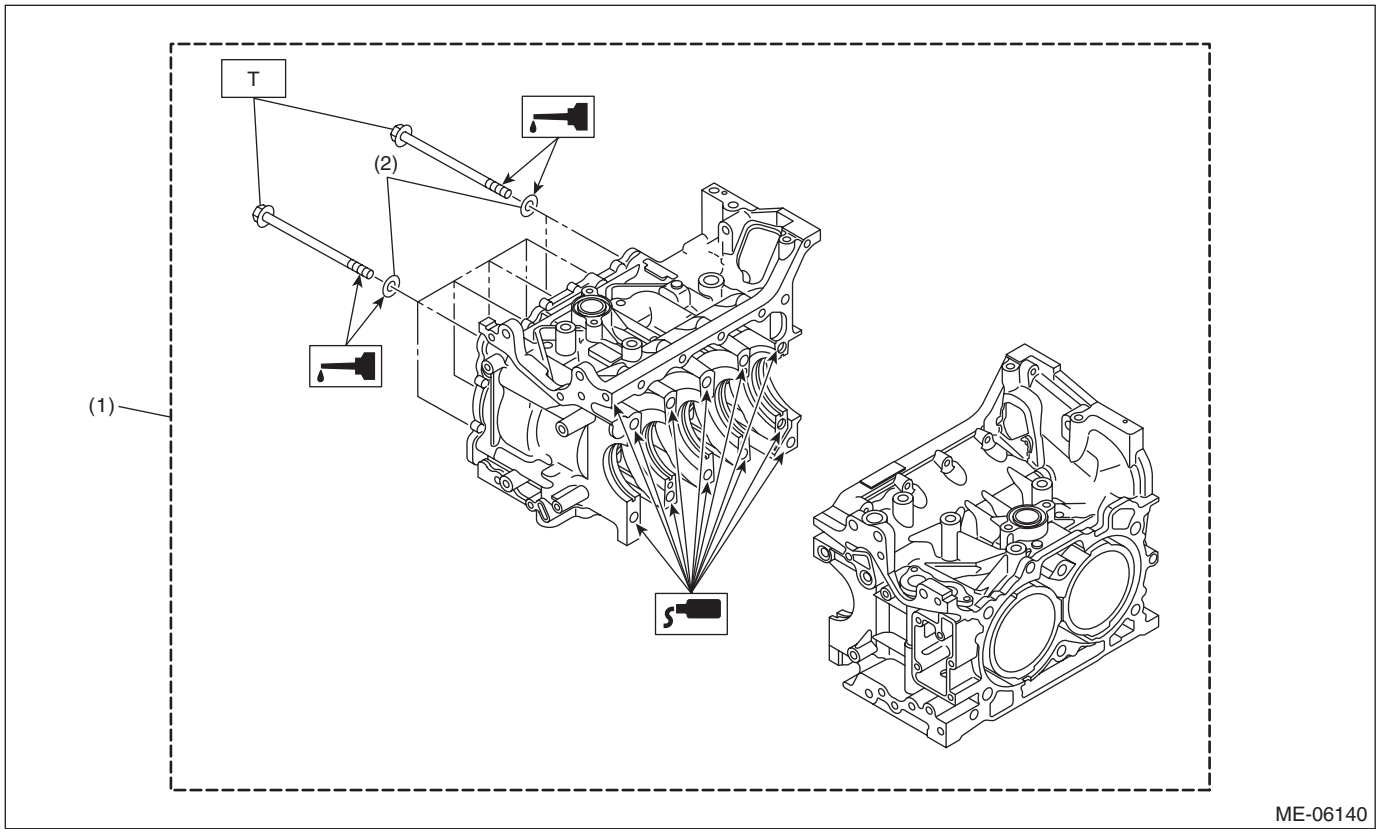


ME-06139

(1) Engine rear hanger
(2) Oil separator cover
(3) Cylinder block plug
(4) Main gallery plug
(5) O-ring
(6) Rear oil seal
(7) Crankshaft position sensor holder
(8) Cylinder block plate
(9) O-ring
(10) Oil pan upper
(11) Baffle plate
(12) O-ring
(13) Oil level switch
(14) O-ring
(15) Oil strainer
(16) Oil pan seal ring
(17) Oil pan
(18) Drain plug gasket
(19) Drain plug

Tightening torque:N·m (kgf-m, ft-lb)
T1: 6.4 (0.7, 4.7)
T2: 18 (1.8, 13.3)
T3: 21 (2.1, 15.5)
T4: 25 (2.5, 18.4)
T5: 41.7 (4.3, 30.8)
T6: <Ref. to ME(H4DO)-312, CYLINDER BLOCK, ASSEMBLY, Cylinder Block.>
T7: <Ref. to ME(H4DO)-265, INSTALLATION, Cylinder Block.>
T8: <Ref. to LU(H4DO)-17, OIL PAN, INSTALLATION, Oil Pan and Strainer.>

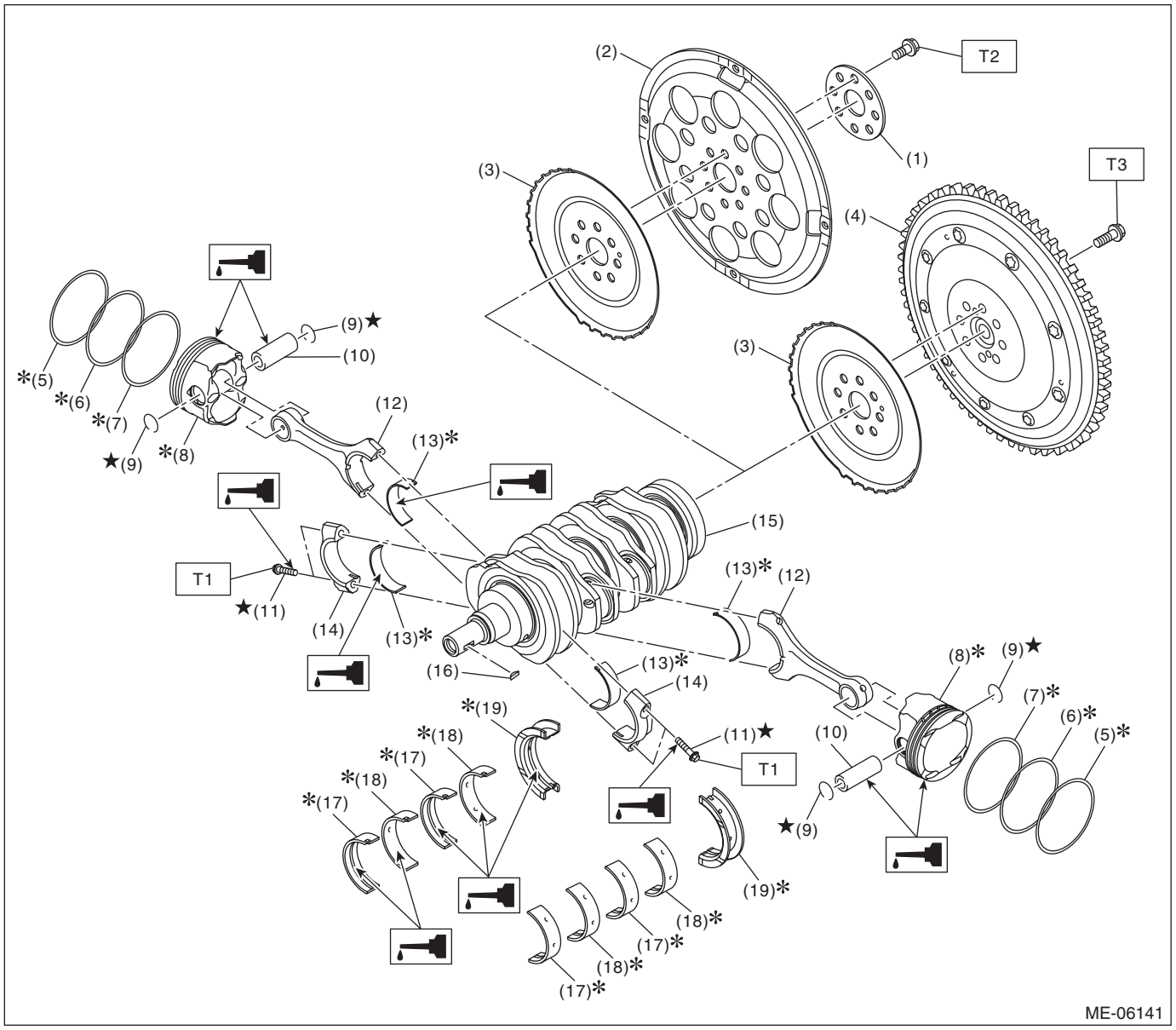
6. CYLINDER BLOCK 2



(1) Cylinder block ASSY
(2) Washer

Tightening torque:N·m (kgf-m, ft-lb)
T: <Ref. to ME(H4DO)-265, INSTALLATION, Cylinder Block.>

7. CRANKSHAFT AND PISTON



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

Tightening torque:N·m (kgf-m, ft-lb)

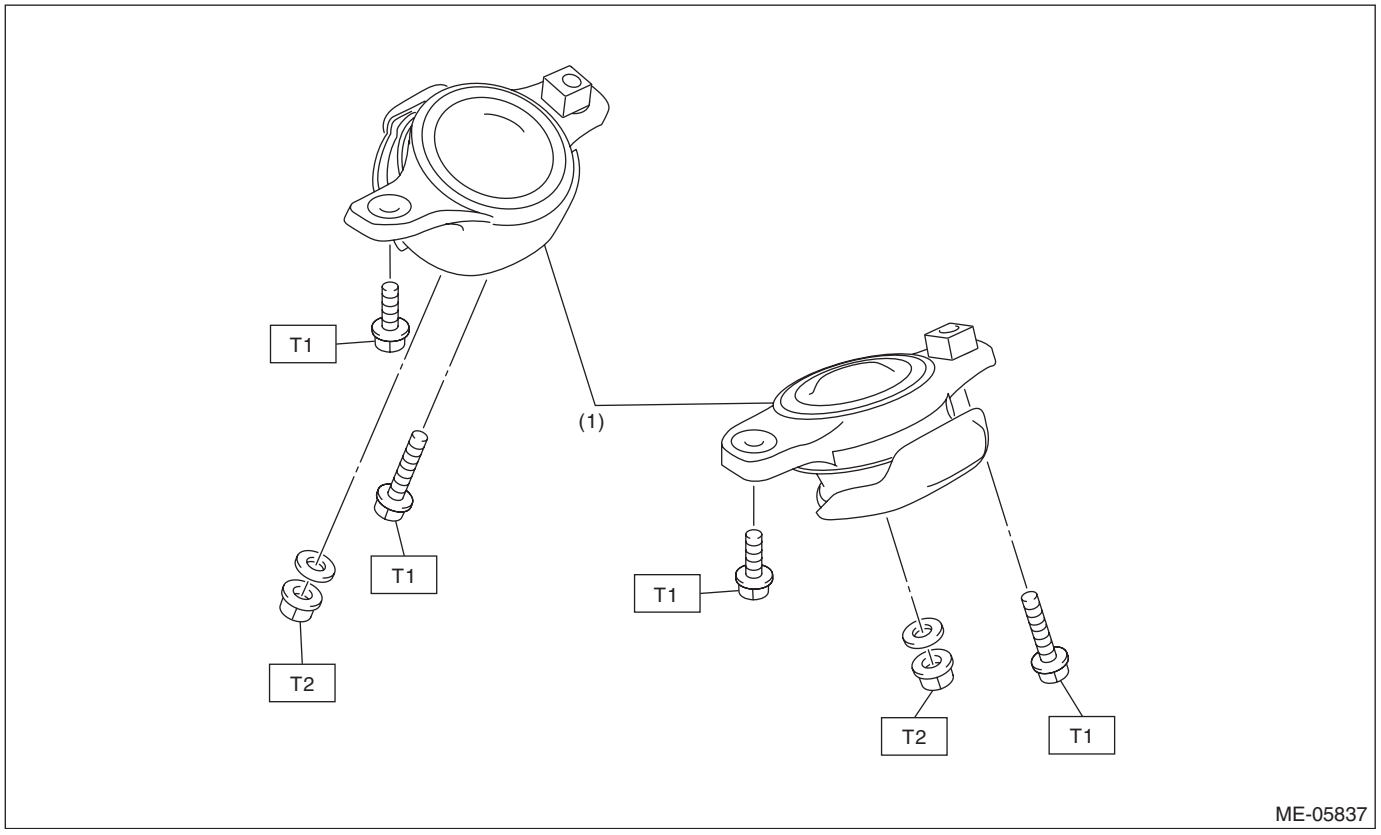
T1: ***<Ref. to ME(H4DO)-265, INSTALLATION, Cylinder Block.>***

T2: ***<Ref. to CVT-150, INSTALLATION, Drive Plate.>***

T3: ***<Ref. to CL-13, INSTALLATION, Flywheel.>***

8. ENGINE MOUNTING

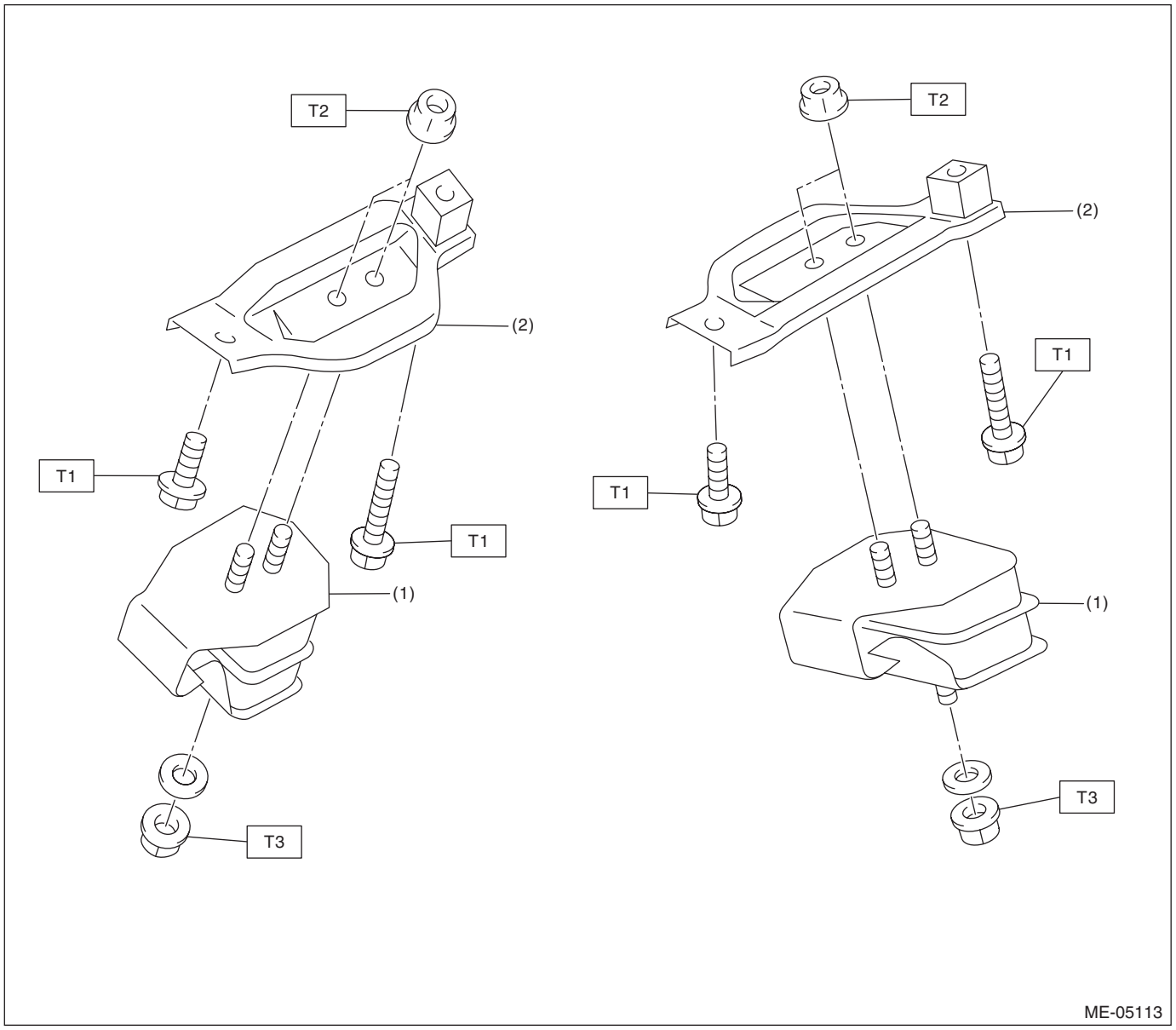
- CVT model



(1) Front cushion rubber

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

- MT model



(1) Front cushion rubber

(2) Front engine mounting bracket

Tightening torque:N·m (kgf-m, ft-lb)
T1: 35 (3.6, 25.8)
T2: 42 (4.3, 31.0)
T3: 85 (8.7, 62.7)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove or install the engine in an area where chain hoists, lifting devices, etc. are available for ready use. When lifting up the vehicle, make sure to support the vehicle at the jack-up points.
- Be careful not to let any oil or grease contact the clutch disc or flywheel.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil when being assembled.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

D: PREPARATION TOOL

1. SPECIAL TOOL

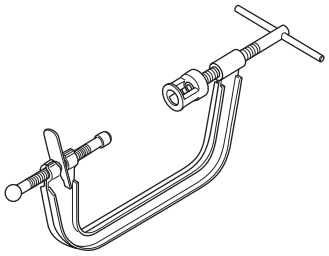
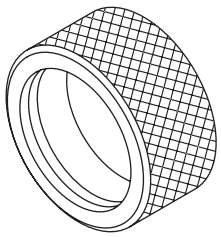
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST0920287002000	0920287002000	REMOVER AND REPLACER	Used for removing and installing valve spring.
 ST-398437700	398437700	OIL SEAL INSTALLER	Used for installing the front oil seal of engine.

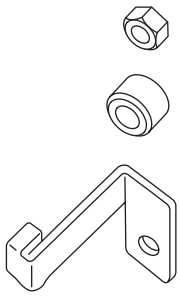
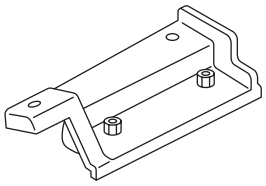
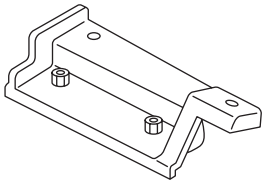
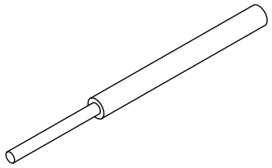
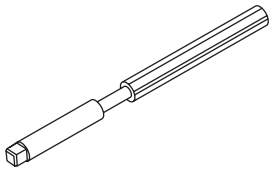
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498277200	498277200	STOPPER SET	Used for preventing the torque converter from falling when removing and installing the engine.
 ST-498457000	498457000	ENGINE STAND ADAPTER RH	• Used for disassembling and assembling engine. • Used together with ENGINE STAND (499817100) and ADAPTER (18362AA020).
 ST-498457100	498457100	ENGINE STAND ADAPTER LH	• Used for disassembling and assembling engine. • Used together with ENGINE STAND (499817100) and ADAPTER (18362AA020).
 ST-499765700	499765700	VALVE GUIDE REMOVER AND INSTALLER	Used for removing and installing valve guide.
 ST-499765900	499765900	VALVE GUIDE REAMER	Used for reaming valve guides.

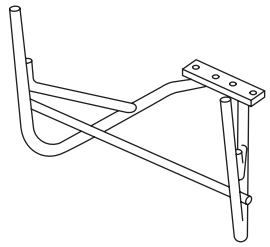
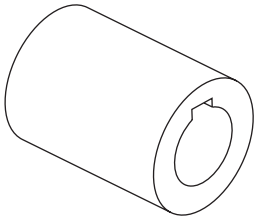
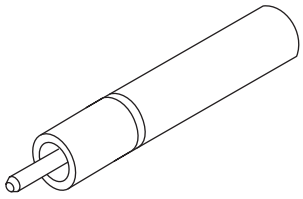
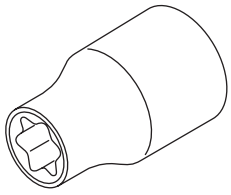
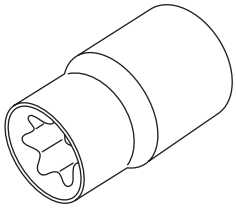
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499817100	499817100	ENGINE STAND	• Used for disassembling and assembling engine. • Used together with ADAPTER (18362AA020), ENGINE STAND ADAPTER RH (498457000) and LH (498457100).
 ST18252AA000	18252AA000	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 ST18261AA010	18261AA010	VALVE OIL SEAL GUIDE	Used for press-fitting of intake valve guide stem seals and exhaust valve guide stem seals.
 ST18270AA010	18270AA010	SOCKET	Used for removing and installing connecting rod cap bolt TORX® E12.
 ST18270AA020	18270AA020	SOCKET	Used for removing and installing connecting rod cap bolt TORX® E14.

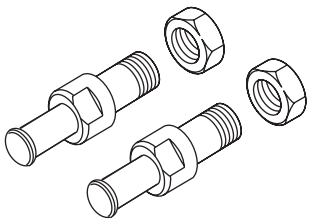
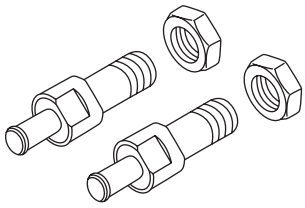
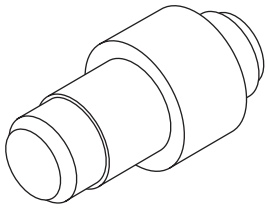
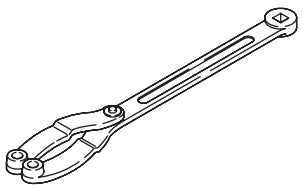
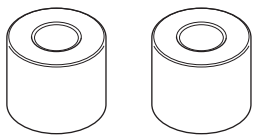
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18334AA000	18334AA000	PULLEY WRENCH PIN SET	• Used for removing and installing the crank pulley. • Used together with PULLEY WRENCH (18355AA000).
 ST18334AA030	18334AA030	PULLEY WRENCH PIN SET	• Used for removing and installing water pump pulley, intake cam sprocket and exhaust cam sprocket. • Used together with PULLEY WRENCH (18355AA000).
 ST18350AA000	18350AA000	CONNECTING ROD BUSHING REMOVER AND INSTALLER	Used for removing and installing connecting rod bushing at connecting rod small end.
 ST18355AA000	18355AA000	PULLEY WRENCH	• Used for installing and removing the water pump pulley. • Used for removing and installing the crank pulley. • Used for removing and installing intake cam sprocket and exhaust cam sprocket. • Used together with PULLEY WRENCH PIN SET (18334AA030) or PULLEY WRENCH PIN SET (18334AA000).
 ST18362AA020	18362AA020	ADAPTER	• Used for disassembling and assembling engine. • Used together with STAND (499817100), ENGINE STAND ADAPTER RH (498457000) and LH (498457100). • Bolt of M10 × 50 (SUBARU genuine Part No.: 010410500) is used.

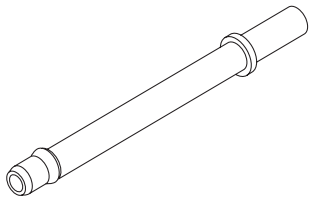
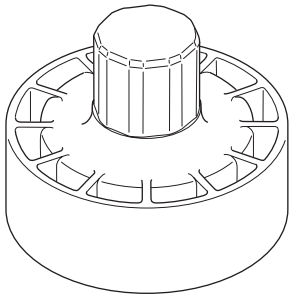
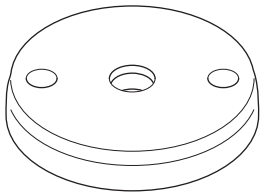
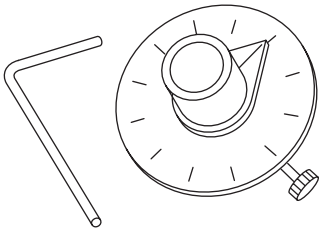
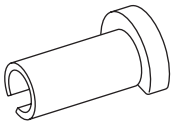
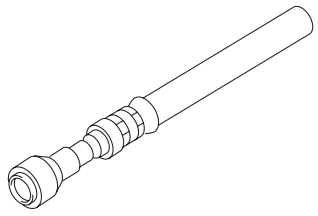
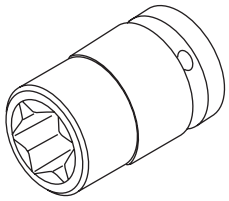
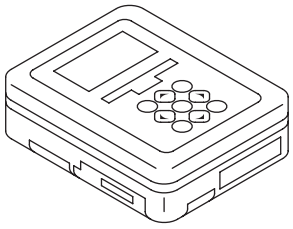
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18471AA000	18471AA000	FUEL PIPE ADAPTER	Used for inspecting the fuel pressure.
 ST18657AA030	18657AA030	OIL SEAL INSTALLER	• Used for installing the rear oil seal of engine. • Used together with OIL SEAL GUIDE (18671AA020).
 ST18671AA020	18671AA020	OIL SEAL GUIDE	• Used for installing the rear oil seal of engine. • Used together with OIL SEAL INSTALLER (18657AA030).
 ST18854AA000	18854AA000	ANGLE GAUGE	Used for angle tightening.
 ST42099AE000	42099AE000	QUICK CONNECTOR RELEASE	Used for removing the quick connector.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST42075AG690	42075AG690	FUEL HOSE	Used for inspecting the fuel pressure. NOTE: This is the SUBARU genuine part.
 ST18270KA010	18270KA010	SOCKET	Used for installing and removing intake cam sprocket and exhaust cam sprocket.
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for various inspections.

2. GENERAL TOOL

TOOL NAME	REMARKS
Compression gauge	Used for measuring compression.
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.
Piston ring compressor	Used for installing the piston into the cylinder block.
Thickness gauge	Used for various inspections.