

2013 ENGINE**Engine Mechanical****ENGINE (FA20)****FUNCTION INSPECTION**

1. Coolant (SUBARU Super Coolant) check

(Refer to **COOLING SYSTEM (FA20)**)

2. Engine oil inspection

(Refer to **LUBRICATION SYSTEM (FA20)**)

3. Battery check

(Refer to **ON-VEHICLE INSPECTION**)

4. Check of air cleaner filter element SUB-ASSY

1. Inspect the air cleaner filter element SUB-ASSY for dirt or clogging.

5. V-ribbed belt tensioner ASSY check

1. Remove the fan & generator V belt from belt tensioner pulley.
2. Move the V-ribbed belt tensioner ASSY in the both rotational directions to check whether it is caught.

NOTE: **Replace the V-ribbed belt tensioner ASSY if faulty.**

3. Install the fan & generator V belt.

6. Ignition timing inspection

1. Warm up the engine and stop.
2. Connect the SSM3 to the DLC.
3. Start the engine.
4. According to the procedure shown on the display, display the [Data monitor]-->[Ignition timing adv. #1] screen to measure the ignition timing.

Standard value: -5 to 10°C A BTDC

CAUTION: Perform this measurement with all accessory switches OFF, A/C OFF, electric fan OFF and shift position N or P.

5. Check that the ignition timing advances promptly when the engine speed is increased.

7. Idle speed check

1. Warm up the engine and stop.
2. Inspection with SSM3
 - a. Connect the SSM3 to the DLC.
 - b. Start the engine.
 - c. According to the procedure shown on the display, display the [Data monitor] screen to measure the engine speed.

STANDARD VALUE

Transmission	Idle speed
A/T	600 to 800 r/min
M/T	550 to 750 r/min

CAUTION: Perform this measurement with all accessory switches OFF, A/C OFF, electric fan OFF and shift position N or P.

8. Compression inspection

1. Check the diagnosis code (Refer to **CHECKING/CLEARING DTC**).
2. Remove the relay block cover UPR.
3. Remove the fuel pump fuse from the engine compartment relay block.

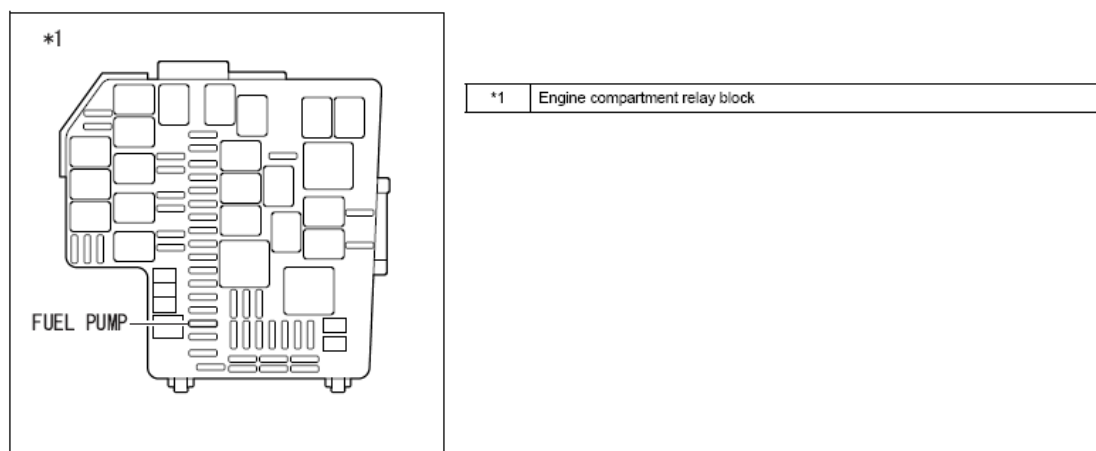
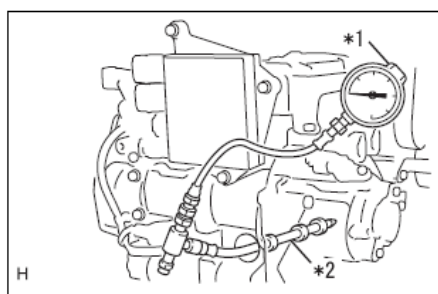


Fig. 1: Identifying Engine Compartment Relay Block Fuel Pump Fuse
Courtesy of SUBARU OF AMERICA, INC.

4. Start the engine.
5. Turn the ignition to OFF after the engine stalls by itself.
6. Crank the engine once and check that it does not start.
7. Remove the four spark plugs. (Refer to **REMOVAL**)
8. Set the compression gauge and compression gauge attachment.



*1	Compression gauge
*2	Compression gauge attachment

Fig. 2: Setting Compression Gauge And Compression Gauge Attachment
Courtesy of SUBARU OF AMERICA, INC.

9. Install the injector driver. (Refer to **INSTALLATION**)
10. Fully open the throttle.
11. With the brake pedal depressed, crank the engine and measure the compression of each cylinder.

Compression: 1150 to 1750 kPa {11.7 to 17.8 kgf/cm²} {167 to 254 psi}

Difference between cylinders: 200 kPa {2.0 kgf/cm²} {29 psi}

CAUTION:

- Perform compression inspection in a short period of time.
- Use a fully charged battery to keep the engine speed at 250 rpm or more.

NOTE:

When the compression pressure is low, pour a small amount of engine oil into cylinders and measure the compression again.

- When the compression increases, it is possible that the piston rings etc. are worn.
 - When the compression does not change, it is possible that the valve system is faulty.
12. Remove the injector driver. (Refer to **REMOVAL**)
 13. Install the four spark plugs. (Refer to **INSTALLATION**)
 14. Install the fuel pump fuse.
 15. Install the relay block cover UPR.
 16. Clear the diagnosis code (Refer to **CHECKING/CLEARING DTC**).

CAUTION: Be sure to clear the memory of diagnosis code once and then check that the normal code is output.

9. CO, HC concentration inspection

NOTE:

This check is for determining whether or not the idle CO/HC complies with regulations.

1. Start the engine.
2. Maintain the engine speed at 2500 rpm for approximately 180 seconds.
3. Insert a CO/HC meter testing probe at least 40 cm {15.7in} into the tailpipe during idling.
4. Immediately check the CO/HC concentration at idle and/or 2500 rpm.

NOTE:

- When performing the 2 mode (2500 rpm and idle) test, follow the measurement order prescribed by the applicable local regulations.
 - If the CO/HC concentration does not comply with regulations, troubleshoot in the order given below.
- a. Check the A/F sensor (Refer to UNIT INSPECTION) and heated oxygen sensor (Refer to UNIT INSPECTION) operation.
 - b. Refer to the table below for the possible cause, and then inspect and correct the applicable causes if necessary.

CO	HC	Trouble	Probable cause
Normal	High	Rough idling	1. Weak ignition ○ Defective timing ○ Faulty plug gap 2. Intake/exhaust leakage 3. Cylinder compression leakage
Low	High	Rough idling (HC unstable)	1. Vacuum leakage ○ PCV hose ○ Intake manifold ○ Throttle body 2. Misfire due to lean fuel mixture
High	High	Rough idling (black smoke)	1. Clogged air cleaner element 2. Clogged PCV valve 3. Faulty EFI system ○ Faulty pressure regulator ○ Faulty engine coolant sensor ○ Faulty air flow meter ○ Faulty ECM ○ Faulty injector ○ Faulty throttle position sensor

V-BELT (FA20)

COMPONENTS

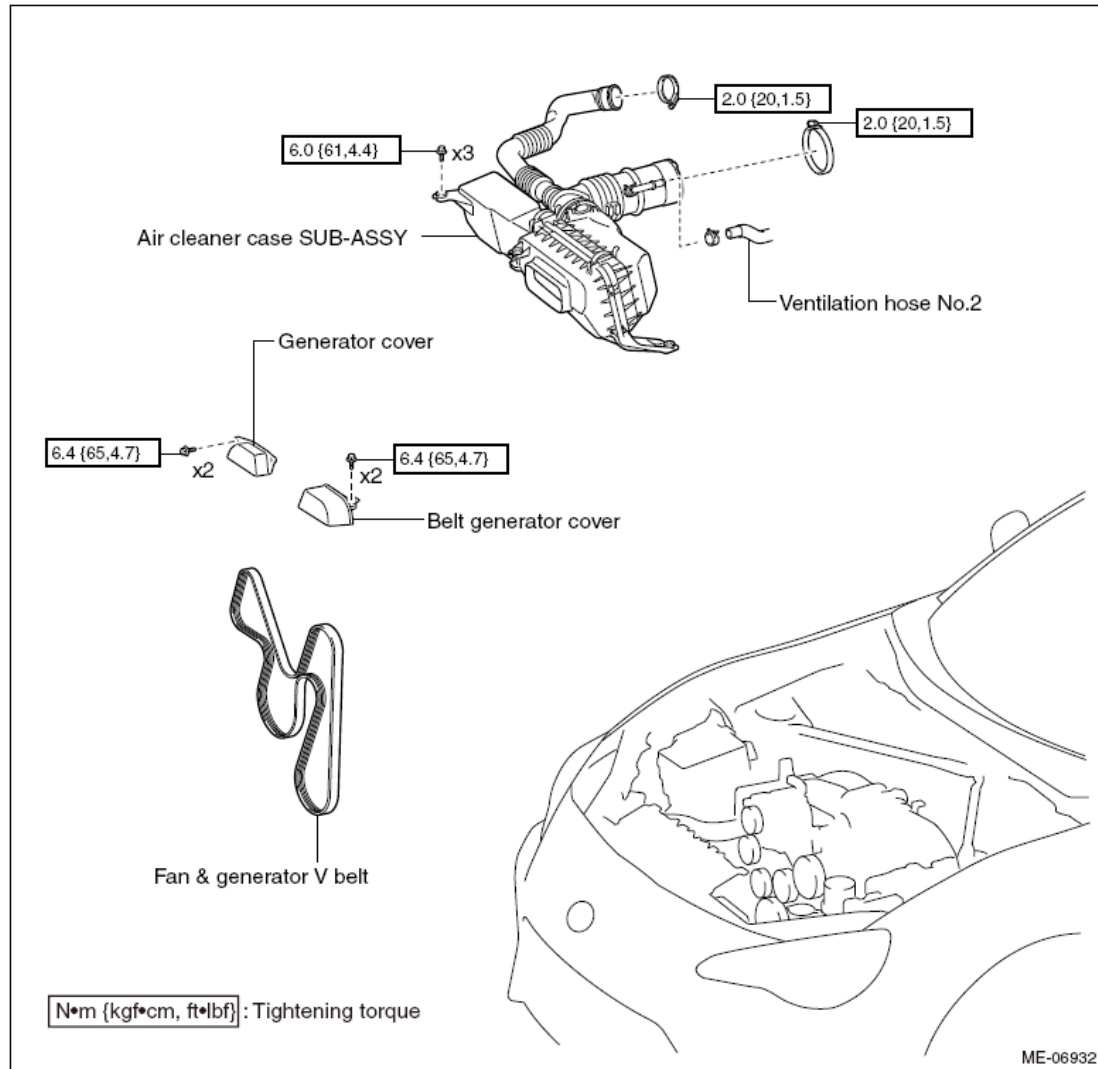


Fig. 3: Identifying V-Belt (FA20) Components With Torque Specifications
 Courtesy of SUBARU OF AMERICA, INC.

REMOVAL

1. Air cleaner case SUB-ASSY removal
 1. Move the hose clip and disconnect the ventilation hose NO. 2.

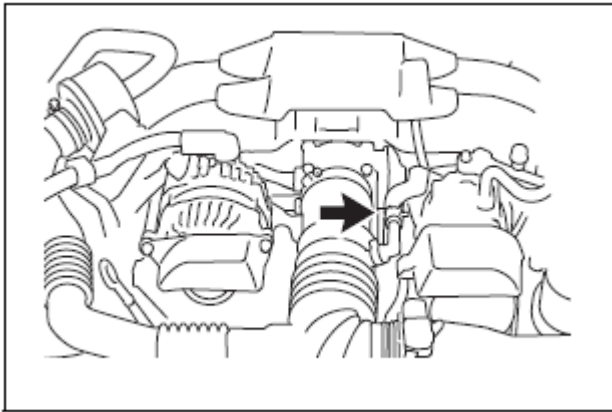


Fig. 4: Identifying Ventilation Hose No. 2 Hose Clip
Courtesy of SUBARU OF AMERICA, INC.

2. Disconnect the connector from the intake air flow meter SUB-ASSY.
3. Release the clamp and disconnect the wiring harness from the air cleaner cap.

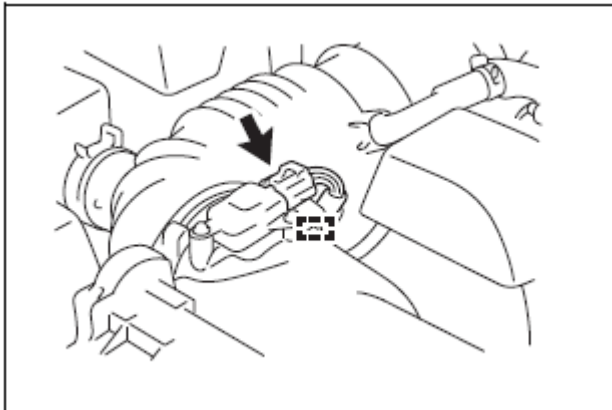


Fig. 5: Identifying Intake Air Flow Meter Sub-Assembly Connector
Courtesy of SUBARU OF AMERICA, INC.

4. Loosen the two hose clamps and remove the air cleaner duct and air intake boot.

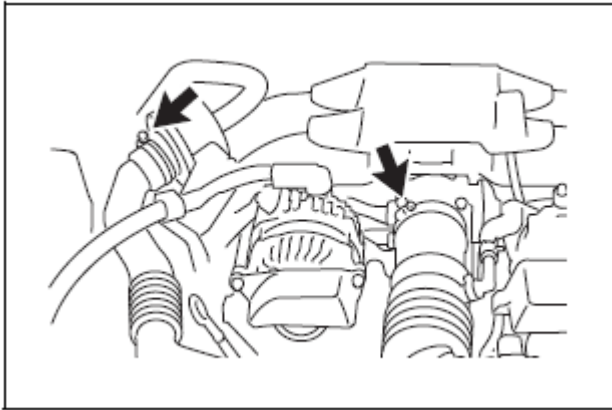


Fig. 6: Identifying Air Cleaner Duct And Air Intake Boot Hose Clamps
Courtesy of SUBARU OF AMERICA, INC.

5. Remove the three bolts and remove the air cleaner case SUB-ASSY.

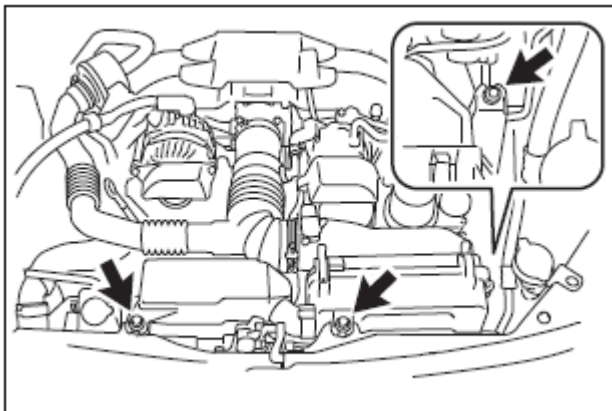


Fig. 7: Identifying Air Cleaner Case Sub-Assembly Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

2. Generator cover removal
 1. Remove the two bolts and remove the generator cover.

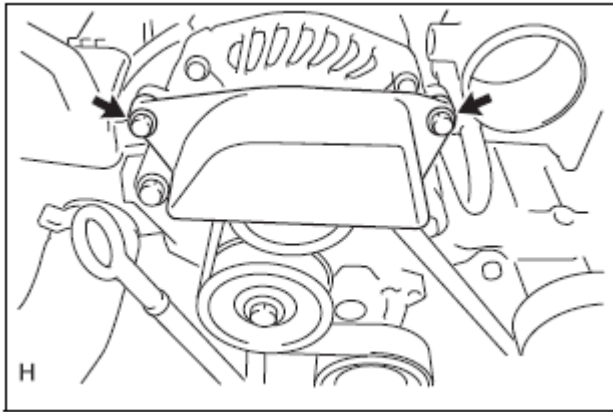


Fig. 8: Identifying Generator Cover Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

3. Belt generator cover removal

1. Release the two clamps and disconnect the wiring harness.
2. Remove the two bolts and remove the belt generator cover.

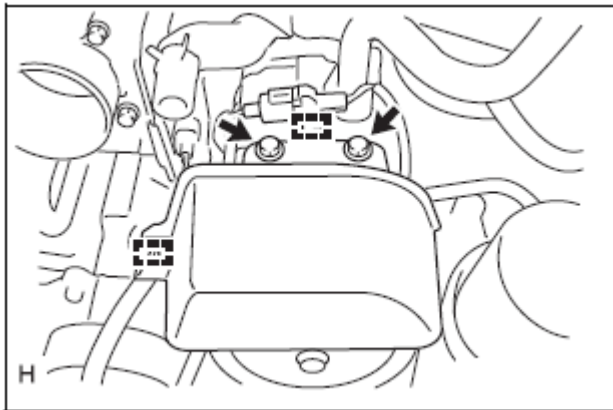


Fig. 9: Identifying Belt Generator Cover Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

4. Fan & generator V-belt removal

1. Attach the tool to the pulley set bolt of belt tensioner and loosen the tension by rotating the belt tensioner clockwise to remove the fan & generator V-belt.

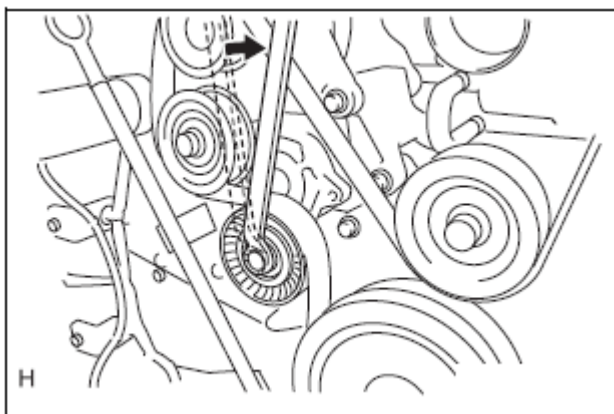


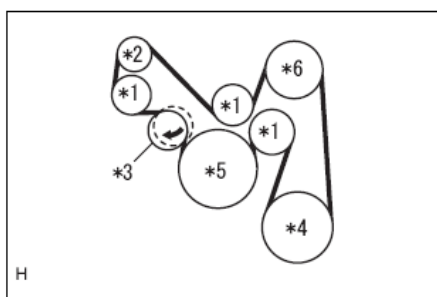
Fig. 10: Rotating Belt Tensioner To Clockwise
Courtesy of SUBARU OF AMERICA, INC.

INSTALLATION

1. Fan & generator V-belt installation

NOTE: When reusing the fan & generator V-belt, check the rib and back side of its entire perimeter for wear or crack and replace it if the wear or crack reaches to its core (at one or more locations) or the rib rubber is chipped (at one or more locations).

1. Hook the fan & generator V-belt on the pulleys as shown in the figure.



*1	Idler pulley
*2	Generator
*3	V-ribbed belt tensioner ASSY
*4	Water pump
*5	Crankshaft
*6	A/C compressor

Fig. 11: Identifying Fan And Generator V-Belt Pulley Routing
Courtesy of SUBARU OF AMERICA, INC.

CAUTION: For the belt tensioner and idler pulleys, hook the back side of fan & generator V-belt on them.

2. Attach the tool to the pulley set bolt of belt tensioner and turn the belt tensioner clockwise.
3. Make sure that the fan & generator V-belt is properly set on each pulley.

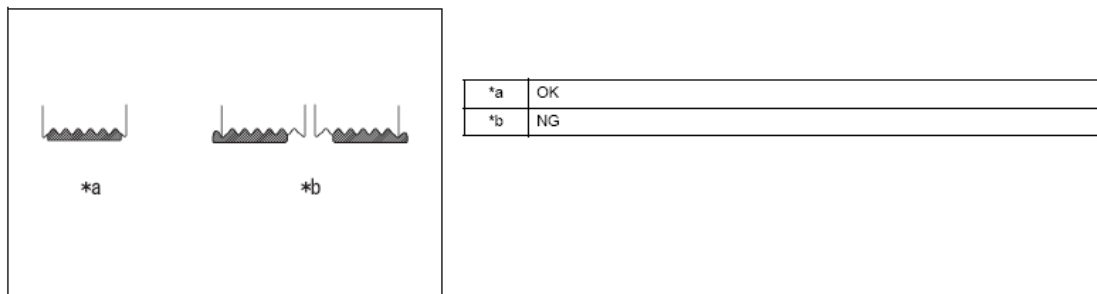


Fig. 12: Identifying Proper And Improper Setting Of Fan And Generator V-Belt Pulley
Courtesy of SUBARU OF AMERICA, INC.

2. Belt generator cover installation

1. Install the belt generator cover with the two bolts.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

2. Engage the two clamps and connect the wiring harness.

3. Generator cover installation

1. Install the generator cover with the two bolts.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

4. Air cleaner case SUB-ASSY installation

1. Install the air cleaner case SUB-ASSY with the three bolts.

Standard value: T=6.0N.m {61kgf.cm} {4.4 ft.lbf}

2. Install the air cleaner duct and air cleaner intake boot with the two hose clamps.

Standard value: T=2.0N.m {20kgf.cm} {1.5ft.lbf}

3. Engage the clamp and install the wiring harness to the air cleaner cap.

4. Connect the connector to the intake air flow meter SUB-ASSY.

5. Connect the ventilation hose NO. 2 with the hose clip.

5. Fan & generator V-belt check

1. Start the engine and check that the fan & generator V-belt is rotating smoothly without abnormal noise.

ON-VEHICLE INSPECTION

1. Fan & generator V-belt check

NOTE: Check the belt when reusing it.

1. Check the fan & generator V-belt for wear or cracks.

NOTE:

- Replace the belt if it is cracked.
- Replace the belt if it is worn until its core is exposed.
- Replace the belt if its rib rubber is chipped.

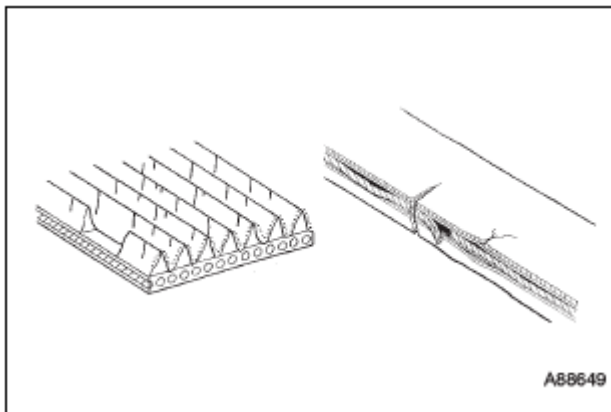


Fig. 13: Identifying Wear Or Cracks On Fan And Generator V-Belt
Courtesy of SUBARU OF AMERICA, INC.

2. Check that the fan & generator V-belt fits securely in the rib grooves.

NOTE:

- Visually and manually check that the fan & generator V-belt is properly located on the rib grooves at the lower side of the pulleys.
- If the fan & generator V-belt is not located properly, replace with a new part.

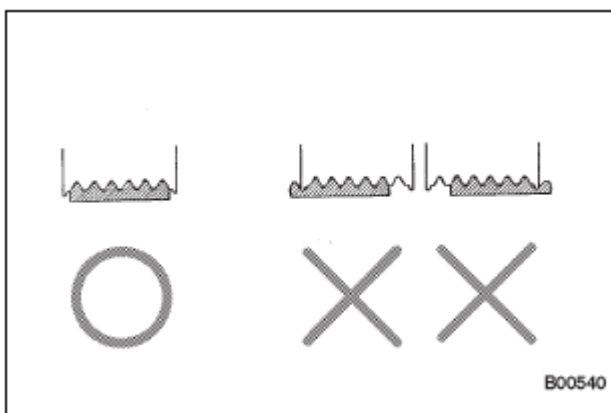


Fig. 14: Identifying Proper And Improper Setting Of Fan And Generator V-Belt On Rib Grooves
Courtesy of SUBARU OF AMERICA, INC.

2. V-ribbed belt tensioner ASSY check

1. Stop the engine from idling speed and check that the V-belt does not protrude from the width of belt tensioner pulley.
2. Move the belt tensioner in the both rotational directions to check whether it is caught.

NOTE: Replace the V-ribbed belt tensioner ASSY if faulty.

CAM CLEARANCE (FA20)

ADJUSTMENT

1. Ignition coil ASSY removal

(Refer to **REMOVAL**)

2. Removal of intake manifold protector (bank 1 side) (Refer to **REMOVAL**)3. Injector driver bracket removal (Refer to **REMOVAL**)4. Cylinder head cover SUB-ASSY removal (Refer to **REMOVAL**)5. Cylinder head cover SUB-ASSY LH removal (Refer to **REMOVAL**)

6. Inspection of cam clearance

1. Turn the crankshaft clockwise to set the NO. 1 cylinder to the top dead center of compression stroke and align the timing mark (cutout) to 0° position of the timing chain cover.

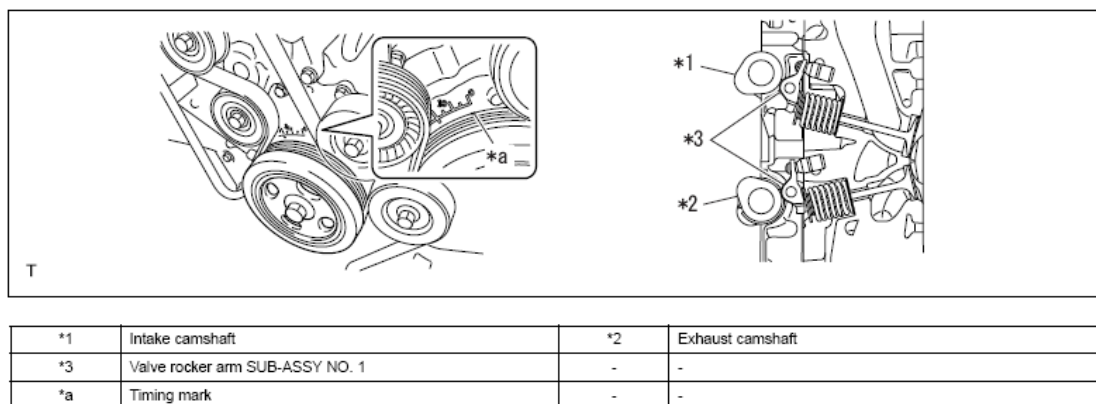


Fig. 15: Identifying Intake Camshaft, Valve Rocker Arm Sub-Assembly No. 1 And Timing Mark

Courtesy of SUBARU OF AMERICA, INC.

2. At this time, make sure that the intake camshaft and exhaust camshaft do not push down the intake side valve rocker arm SUB-ASSY NO. 1 (intake valve) and exhaust side valve rocker arm SUB-ASSY NO. 1 (exhaust valve) of NO. 1 cylinder.

NOTE: If the valve rocker arm SUB-ASSY NO. 1 (valve) is depressed, turning

the crankshaft by 360° makes the piston of NO. 1 cylinder at TDC of compression stroke.

3. Measure the cam clearance at the positions shown in the figure (#1 intake and exhaust, #3 exhaust).

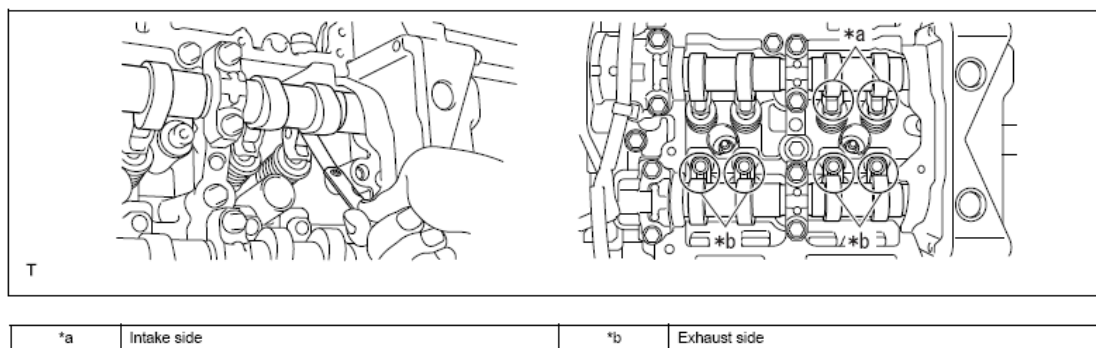


Fig. 16: Measuring Intake And Exhaust Side Cam Clearance Using Gauge
Courtesy of SUBARU OF AMERICA, INC.

4. Measure the roller surface of cam base circle and valve rocker arm SUB-ASSY NO. 1 using a thickness gauge.

Standard value (when engine is cold): 0.10 to 0.16 mm {0.0039 to 0.0063 in} (Intake side)

0.21 to 0.27 mm {0.0083 to 0.0106 in} (Exhaust side)

5. Turn the crankshaft pulley by 360° clockwise.

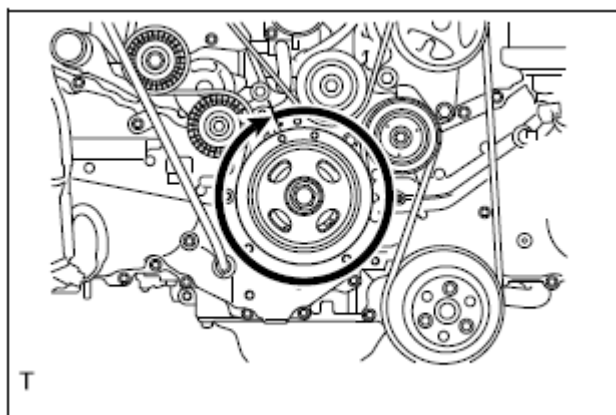


Fig. 17: Turning Crankshaft Pulley To Clockwise
Courtesy of SUBARU OF AMERICA, INC.

6. Measure the cam clearance at the position shown in the figure (#3 intake).

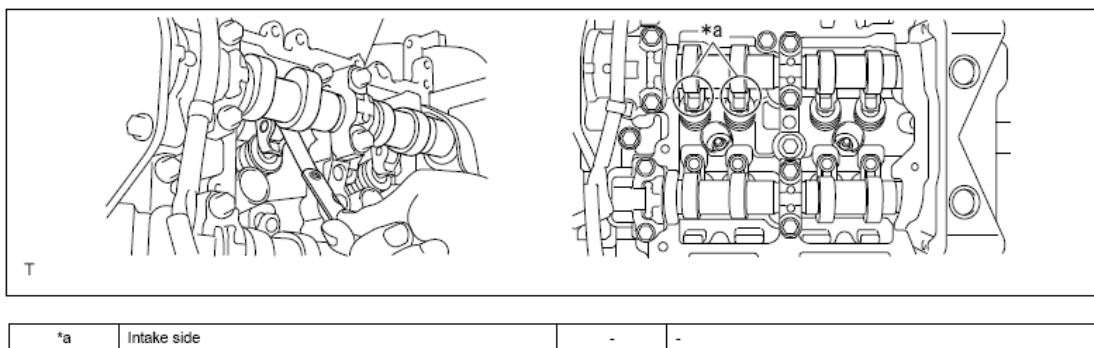


Fig. 18: Measuring Intake Side Cam Clearance
 Courtesy of SUBARU OF AMERICA, INC.

7. Measure the roller surface of cam base circle and valve rocker arm SUB-ASSY NO. 1 using a thickness gauge.

Standard value (when engine is cold): 0.10 to 0.16 mm {0.0039 to 0.0063 in} (Intake side)

8. Turn the crankshaft clockwise to set the NO. 2 cylinder to the top dead center of compression stroke and align the timing mark (cutout) to 0° position of the timing chain cover.

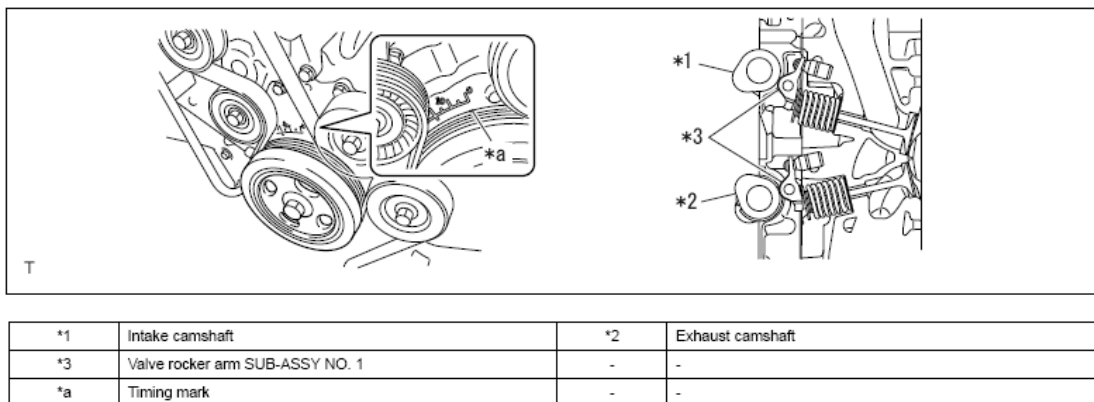


Fig. 19: Identifying Intake And Exhaust Camshaft, Valve Rocker Arm Sub-Assembly No. 1 And Timing Mark
 Courtesy of SUBARU OF AMERICA, INC.

9. At this time, make sure that the intake camshaft and exhaust camshaft do not push down the intake side valve rocker arm SUB-ASSY NO. 1 (intake valve) and exhaust side valve rocker arm SUB-ASSY NO. 1 (exhaust valve) of NO. 2 cylinder.

NOTE: If the valve rocker arm SUB-ASSY NO. 1 (valve) is depressed, turning the crankshaft by 360° makes the piston of NO. 2 cylinder at TDC of compression stroke.

10. Measure the cam clearance at the positions shown in the figure (#2 intake and exhaust, #4 exhaust).

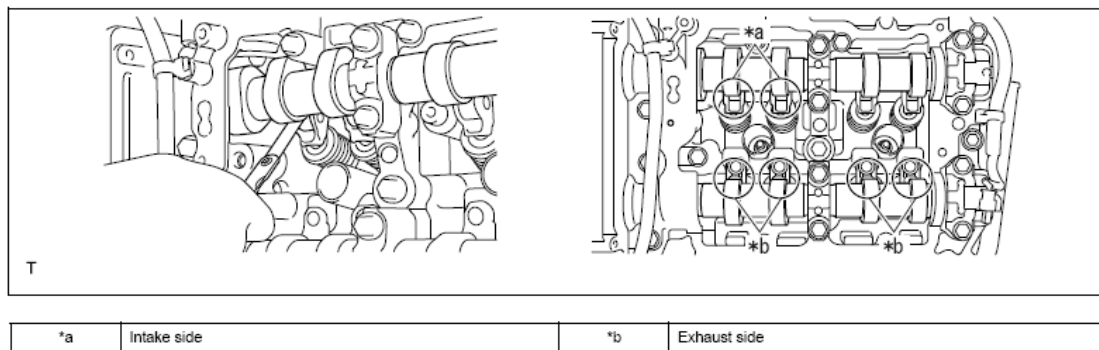


Fig. 20: Measuring Intake And Exhaust Side Cam Clearance
 Courtesy of SUBARU OF AMERICA, INC.

11. Measure the roller surface of cam base circle and valve rocker arm SUB-ASSY NO. 1 using a thickness gauge.

Standard value (when engine is cold): 0.10 to 0.16 mm {0.0039 to 0.0063 in} (Intake side)

0.21 to 0.27 mm {0.0083 to 0.0106 in} (Exhaust side)

12. Turn the crankshaft pulley by 360° clockwise.

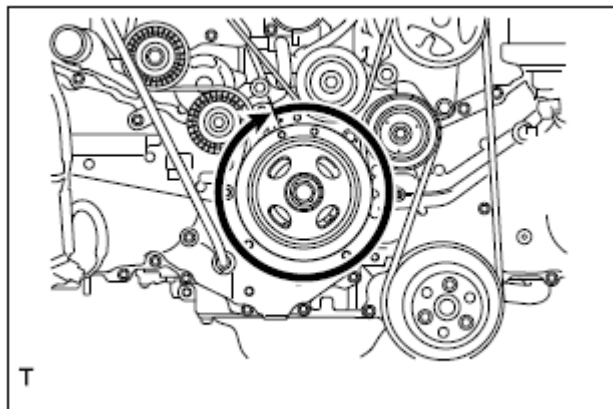


Fig. 21: Turning Crankshaft Pulley To Clockwise
 Courtesy of SUBARU OF AMERICA, INC.

13. Measure the cam clearance at the position shown in the figure (#4 intake).

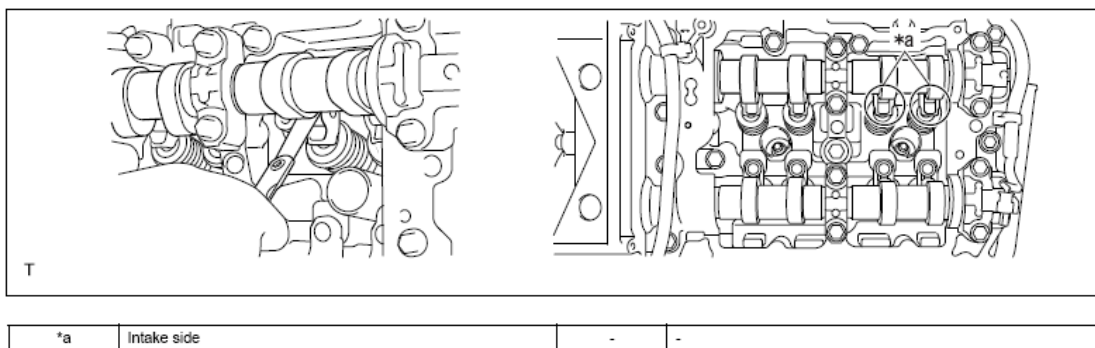


Fig. 22: Measuring Intake Side Cam Clearance
Courtesy of SUBARU OF AMERICA, INC.

14. Measure the roller surface of cam base circle and valve rocker arm SUB-ASSY NO. 1 using a thickness gauge.

Standard value (when engine is cold): 0.10 to 0.16 mm {0.0039 to 0.0063 in} (Intake side)

7. Cam clearance adjustment

1. Remove the camshaft housing SUB-ASSY.

(Refer to **REMOVAL**)

2. Remove the valve adjusting shim.
3. Measure the thickness of removed valve adjusting shim using a micrometer.

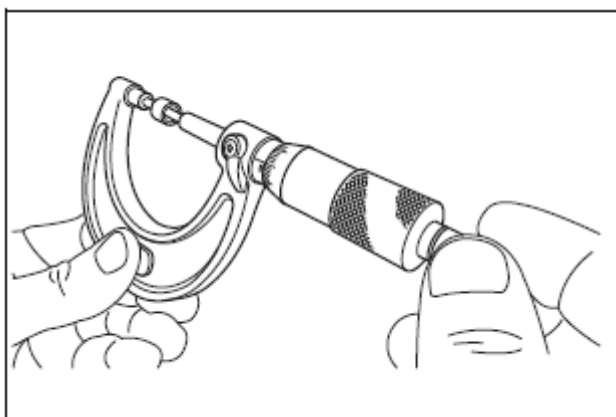


Fig. 23: Measuring Thickness Of Valve Adjusting Shim Using Micrometer
Courtesy of SUBARU OF AMERICA, INC.

4. Calculate the thickness of valve adjusting shim so that the cam clearance is within the standard value.

Standard value: Intake side: (Selected shim thickness) = (Removed shim thickness) + [(Measured clearance) - 0.13 mm {0.0051 in}] x 1.54

Exhaust side: (Selected shim thickness) = (Removed shim thickness) + [(Measured clearance) - 0.24 mm {0.0094 in}] x 1.69

5. Apply engine oil to the inner circumference of selected valve adjusting shim and install it to the valve.

CAUTION: After inserting the valve adjusting shim, make sure that it turns smoothly.

6. Install the camshaft housing SUB-ASSY.

(Refer to **INSTALLATION**)

8. Cylinder head cover SUB-ASSY LH installation (Refer to **INSTALLATION**)
9. Cylinder head cover SUB-ASSY installation (Refer to **INSTALLATION**)
10. Injector driver bracket installation (Refer to **INSTALLATION**)
11. Installation of intake manifold protector (bank 1 side) (Refer to **INSTALLATION**)
12. Installation of ignition coil ASSY

(Refer to **INSTALLATION**)

TIMING CHAIN (FA20)

COMPONENTS



1. Timing chain cover SUB-ASSY removal

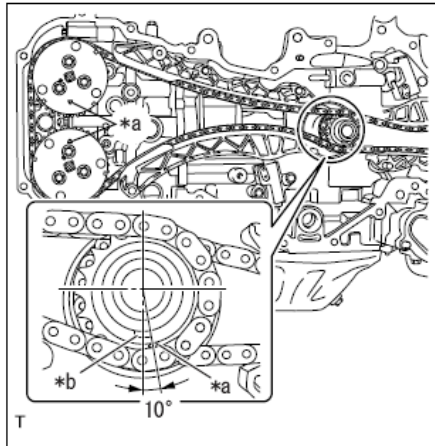
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2. Chain SUB-ASSY removal (bank 1 side)

1. Attach the SST to the crankshaft.

SST 18252AA000

2. Turn the crankshaft using the SST to align the alignment marks of crankshaft timing sprocket, camshaft timing intake gear ASSY RH and camshaft timing exhaust gear ASSY RH.



*a	Alignment marks
*b	Key

Fig. 25: Identifying Alignment Marks Of Crankshaft Timing Sprocket, Camshaft Timing Intake Gear Assembly RH And Camshaft Timing Exhaust Gear Assembly RH
Courtesy of SUBARU OF AMERICA, INC.

NOTE: At this time, the crankshaft timing sprocket key faces downward.

3. Push down the chain tensioner slipper as shown in the figure and secure the plunger by inserting a 2.5 mm {0.098 in} dia. hex wrench into the holes of chain tensioner ASSY NO. 1 and stopper plate.

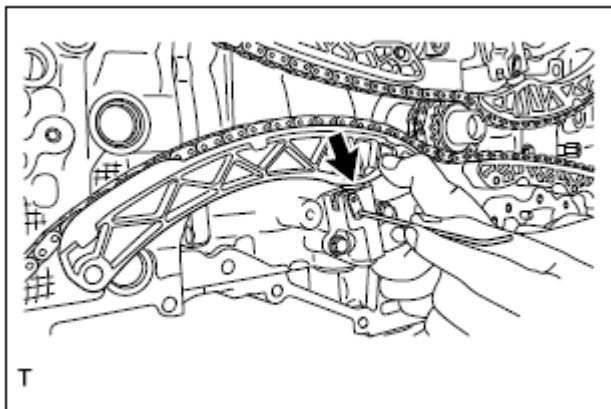


Fig. 26: Pushing Chain Tensioner Slipper
Courtesy of SUBARU OF AMERICA, INC.

4. Remove the two bolts and remove the chain tensioner ASSY NO. 1.

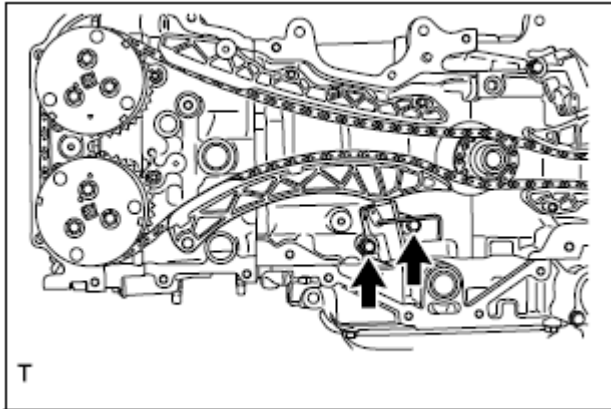


Fig. 27: Identifying Chain Tensioner Assembly No. 1 Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

5. Remove the chain tensioner slipper.
6. Remove the bolt and remove the chain vibration damper NO. 1.

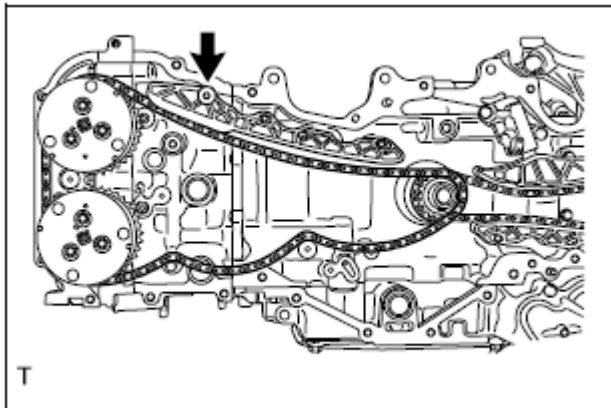


Fig. 28: Identifying Chain Vibration Damper No. 1 Mounting Bolt
Courtesy of SUBARU OF AMERICA, INC.

7. Remove the chain SUB-ASSY.

CAUTION: When the chain SUB-ASSY is removed, the valve heads contact each other and the valve stems may bend. Do not turn the intake camshaft RH and exhaust camshaft RH to the outside of the range of zero-lift (in range where they can be turned lightly by hand).

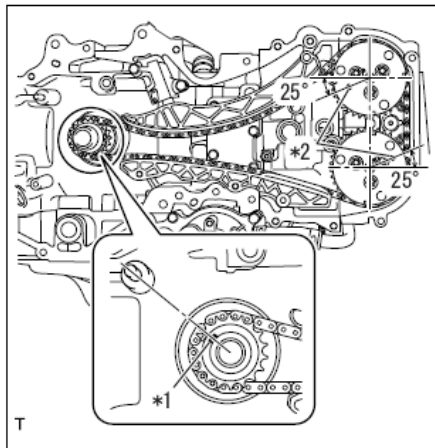
NOTE: The removed parts must be organized by installation location.

3. Chain SUB-ASSY removal (bank 2 side)

1. Attach the SST to the crankshaft.

SST 18252AA000

2. Turn the crankshaft using the SST to align the alignment marks of crankshaft timing sprocket, camshaft timing intake gear ASSY LH and camshaft timing exhaust gear ASSY LH.



*1	Key
*2	Alignment marks

Fig. 29: Identifying Alignment Marks Of Crankshaft Timing Sprocket, Camshaft Timing Intake Gear Assembly LH And Camshaft Timing Exhaust Gear Assembly LH
Courtesy of SUBARU OF AMERICA, INC.

3. Push up the chain tensioner slipper as shown in the figure and secure the plunger by inserting a wire (with a diameter of approx. 1 mm {0.039 in}) into the holes of chain tensioner ASSY NO. 2 and stopper plate.

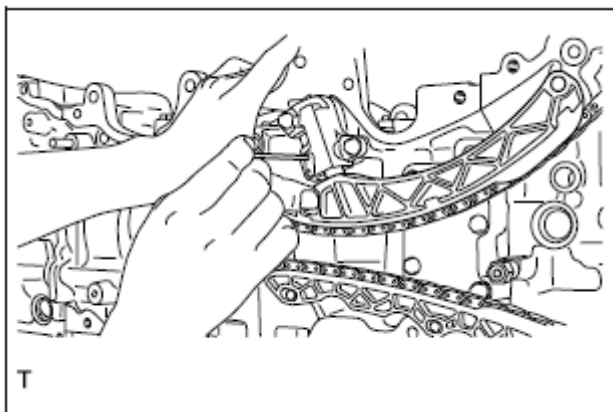


Fig. 30: Pushing Chain Tensioner Slipper
Courtesy of SUBARU OF AMERICA, INC.

4. Remove the two bolts and remove the chain tensioner ASSY NO. 2.
5. Remove the chain tensioner slipper.

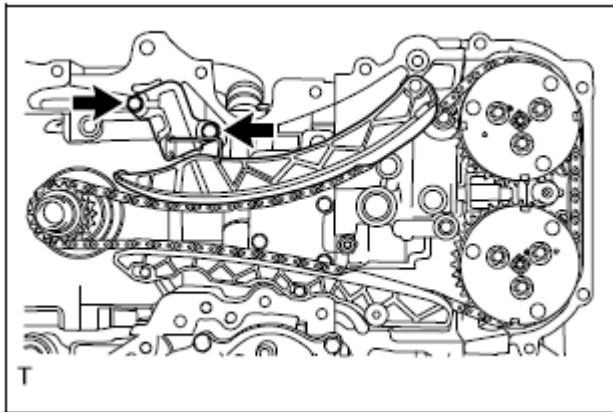


Fig. 31: Identifying Chain Tensioner Assembly No. 2 Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

6. Remove the O-ring from the cylinder block (bank 2 side).

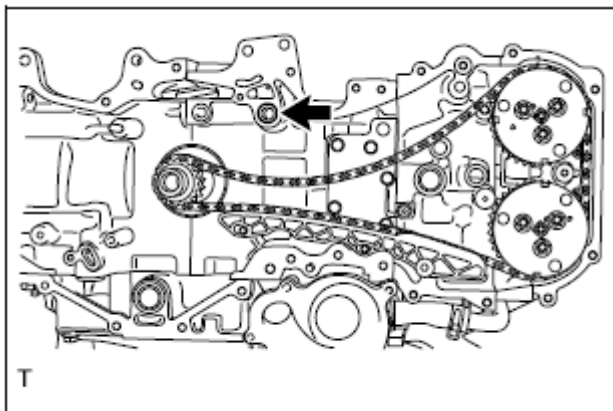


Fig. 32: Identifying Cylinder Block O-Ring (Bank 2 Side)
Courtesy of SUBARU OF AMERICA, INC.

7. Remove the bolt and remove the chain vibration damper NO. 1.
8. Remove the chain SUB-ASSY.

CAUTION:

- When the chain SUB-ASSY is removed, the valve heads contact each other and the valve stems may bend. Do not turn the exhaust camshaft LH to the outside of the range of zero-lift (in range where they can be turned lightly by hand).
- At this time, the No. 1 piston and No. 4 piston are located near the TDC of compression stroke. If the intake camshaft LH is turned, the valve and the piston may contact and valve stem may bend. Do not turn the intake camshaft LH.

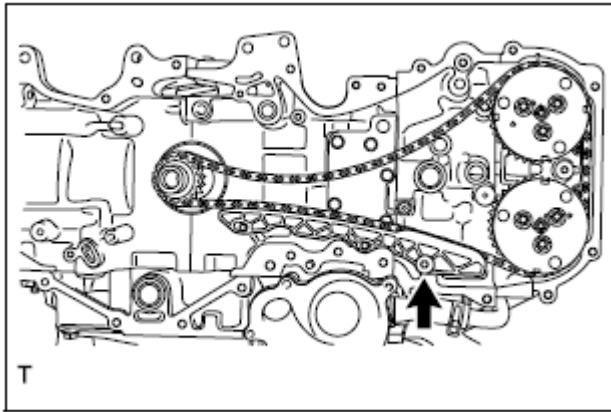


Fig. 33: Identifying Chain Vibration Damper No. 1 Mounting Bolt
Courtesy of SUBARU OF AMERICA, INC.

NOTE: The removed parts must be organized by installation location.

9. Remove the SST from the crankshaft.

INSTALLATION

1. Chain SUB-ASSY installation (bank 2 side)

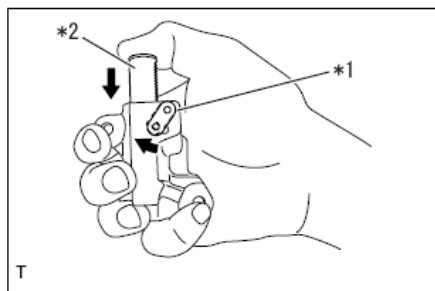
CAUTION: Be careful that the foreign matter is not into or onto the assembled component during installation.

NOTE: Apply engine oil to all component parts of the chain SUB-ASSY.

1. Attach the SST to the crankshaft.

SST 18252AA000

2. Move the link plate in the direction of the arrow and press in the plunger.

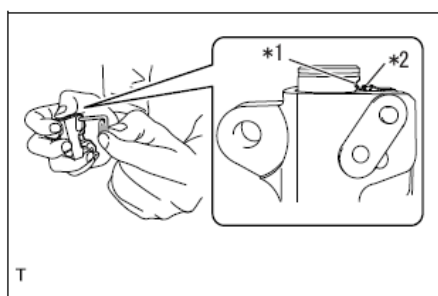


*1	Link plate
*2	Plunger

Fig. 34: Pressing Link Plate Plunger
Courtesy of SUBARU OF AMERICA, INC.

3. Insert a wire (with a diameter of approx. 1 mm {0.039 in}) into the stopper pin hole to secure the plunger.

NOTE: If the stopper pin hole on the link plate and the stopper pin hole on the chain tensioner ASSY are not aligned, check that the first notch of plunger rack is engaged with the stopper tooth. If not engaged, retract the plunger a little so that the first notch of plunger rack is engaged with the stopper tooth.



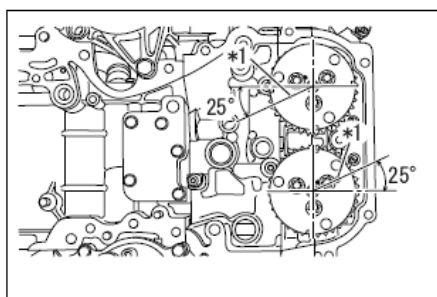
*1	First notch of rack
*2	Stopper tooth

Fig. 35: Inserting Wire Into Stopper Pin Hole
Courtesy of SUBARU OF AMERICA, INC.

4. Using the SST, align the alignment marks of camshaft timing intake gear ASSY LH and camshaft timing exhaust gear ASSY LH to the positions as shown in the figure.

SST 18355AA000, 18334AA030

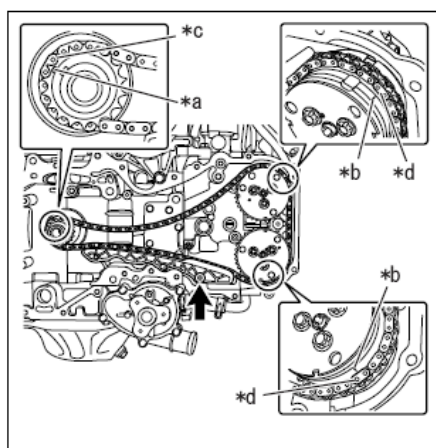
CAUTION: To prevent valve damage, turn the camshaft timing intake gear ASSY LH and camshaft timing exhaust gear ASSY LH only within the range of zero-lift (in range where they can be turned lightly by hand).



*1	Alignment marks
----	-----------------

Fig. 36: Identifying Alignment Marks Of Camshaft Timing Intake Gear Assembly LH And Camshaft Timing Exhaust Gear Assembly LH
Courtesy of SUBARU OF AMERICA, INC.

5. Align the mark plate (blue) of chain SUB-ASSY to the alignment mark position of crankshaft timing sprocket.



*a	Alignment marks
*b	Timing mark
*c	Mark plate (blue)
*d	Mark plate (pink)

Fig. 37: Aligning Mark Plate (Blue) Of Chain Sub-Assembly To Alignment Mark Position Of Crankshaft Timing Sprocket

Courtesy of SUBARU OF AMERICA, INC.

6. Align the mark plate (pink) of chain SUB-ASSY to the timing mark position of camshaft timing intake gear ASSY LH.
7. Align the mark plate (pink) of chain SUB-ASSY to the timing mark position of camshaft timing exhaust gear ASSY LH.
8. Apply engine oil to the sliding surface of chain vibration damper NO. 1 bolt.
9. Install the chain vibration damper NO. 1 with the bolt.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

10. Attach a new O-ring on the cylinder block (bank 2 side).

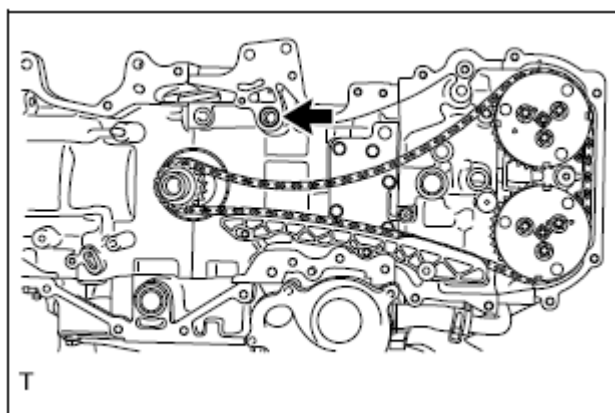


Fig. 38: Identifying Cylinder Block O-Ring (Bank 2 Side)

Courtesy of SUBARU OF AMERICA, INC.

11. Install the chain tensioner slipper.

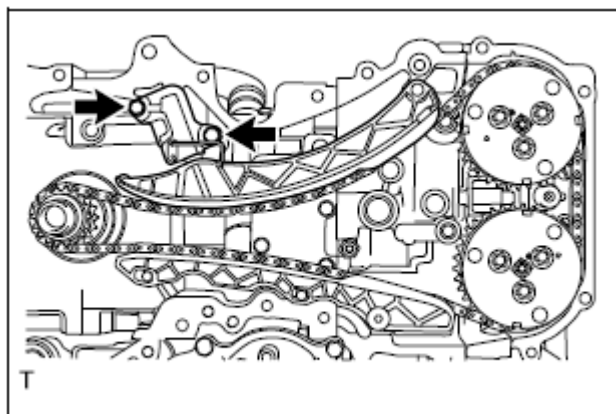
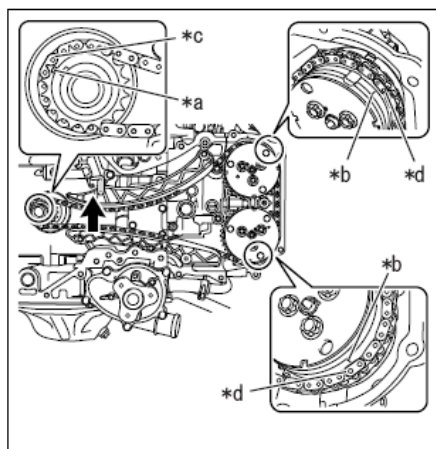


Fig. 39: Identifying Chain Tensioner Assembly No. 2 Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

12. Install the chain tensioner ASSY NO. 2 with the two bolts.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

13. Make sure that the chain SUB-ASSY is properly installed.



*a	Alignment marks
*b	Timing mark
*c	Mark plate (blue)
*d	Mark plate (pink)

Fig. 40: Identifying Alignment Mark Positions On Crankshaft Timing Sprocket, Intake And Exhaust Gear Assembly LH
Courtesy of SUBARU OF AMERICA, INC.

- a. The mark (blue) of chain SUB-ASSY is aligned to the alignment mark position of crankshaft timing sprocket.
 - b. The mark plate (pink) of chain SUB-ASSY is aligned to the timing mark position of camshaft timing intake gear ASSY LH.
 - c. The mark plate (pink) of chain SUB-ASSY is aligned to the timing mark position of camshaft timing exhaust gear ASSY LH.
14. Pull out the wire from the chain tensioner ASSY NO. 2.

NOTE: Push up the chain tensioner slipper and press in the plunger of chain tensioner ASSY NO. 2 to pull out the wire.

15. Attach the SST to the crankshaft.

SST 18252AA000

16. Turn the crankshaft clockwise and make sure that there are no abnormal conditions.

CAUTION: Always make sure to perform this confirmation.

17. Remove the SST from the crankshaft.

2. Chain SUB-ASSY installation (bank 1 side)

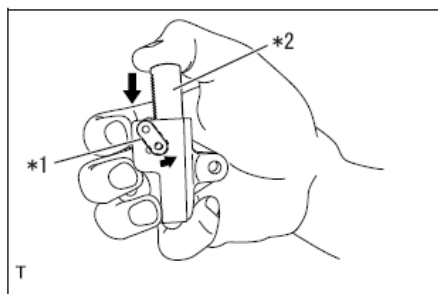
CAUTION: Be careful that foreign matter is not into or onto the assembled component during installation.

NOTE: Apply engine oil to all component parts of the chain SUB-ASSY.

1. Attach the SST to the crankshaft.

SST 18252AA000

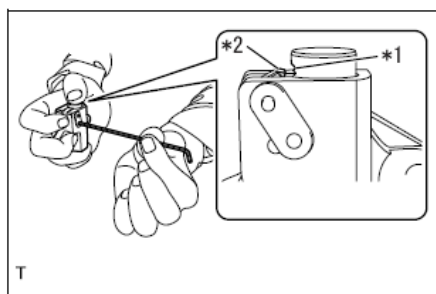
2. Move the link plate in the direction of the arrow and press in the plunger.



*1	Link plate
*2	Plunger

Fig. 41: Pressing Link Plate Plunger
Courtesy of SUBARU OF AMERICA, INC.

3. Insert a 2.5 mm {0.098 in} dia. hex wrench into the stopper pin hole to secure the plunger.

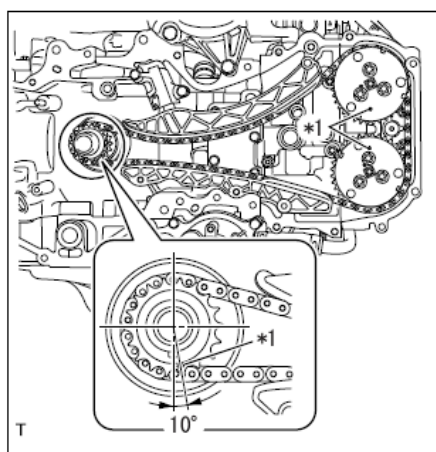


*1	First notch of rack
*2	Stopper tooth

Fig. 42: Inserting Wire Into Stopper Pin Hole
Courtesy of SUBARU OF AMERICA, INC.

NOTE: If the stopper pin hole on the link plate and the stopper pin hole on the chain tensioner ASSY are not aligned, check that the first notch of plunger rack is engaged with the stopper tooth. If not engaged, retract the plunger a little so that the first notch of plunger rack is engaged with the stopper tooth.

- Turn the crankshaft using the SST to align the alignment marks of crankshaft timing sprocket, camshaft timing intake gear ASSY LH and camshaft timing exhaust gear ASSY LH as shown in the figure.



*1	Alignment marks
----	-----------------

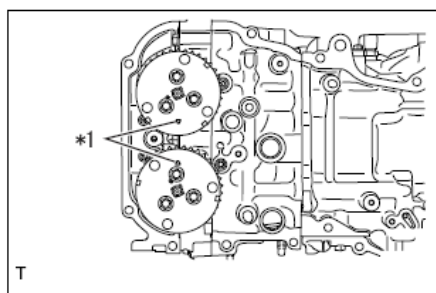
Fig. 43: Identifying Alignment Marks On Crankshaft Timing Sprocket, Camshaft Timing Intake And Exhaust Gear Assembly LH
Courtesy of SUBARU OF AMERICA, INC.

NOTE: If the marks are aligned to the positions as shown in the figure, the crankshaft key faces downward.

- Using the SST, align the alignment marks of camshaft timing intake gear ASSY RH and camshaft timing exhaust gear ASSY RH to the positions as shown in the figure.

SST 18355AA000, 18334AA030

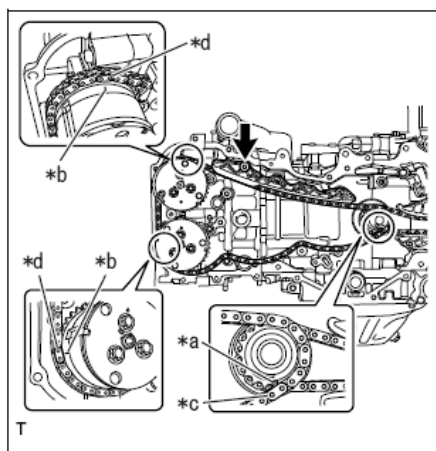
CAUTION: To prevent valve damage, turn the camshaft timing intake gear ASSY RH and camshaft timing exhaust gear ASSY RH only within the range of zero-lift (in range where they can be turned lightly by hand).



*1	Alignment marks
----	-----------------

Fig. 44: Identifying Alignment Marks On Crankshaft Timing Sprocket, Camshaft Timing Intake And Exhaust Gear Assembly RH
Courtesy of SUBARU OF AMERICA, INC.

- Align the mark plate (blue) of chain SUB-ASSY to the alignment mark position of crankshaft timing sprocket.



*a	Alignment marks
*b	Timing mark
*c	Mark plate (blue)
*d	Mark plate (pink)

Fig. 45: Identifying Alignment Mark Position Of Crankshaft Timing Sprocket And Mark Plate (Blue) Of Chain Sub-Assembly
Courtesy of SUBARU OF AMERICA, INC.

- Align the mark plate (pink) of chain SUB-ASSY to the timing mark position of camshaft timing intake gear ASSY RH.
- Align the mark plate (pink) of chain SUB-ASSY to the timing mark position of camshaft timing exhaust gear ASSY RH.
- Apply engine oil to the sliding surface of chain vibration damper NO. 1 bolt.
- Install the chain vibration damper NO. 1 with the bolt.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

11. Install the chain tensioner slipper.

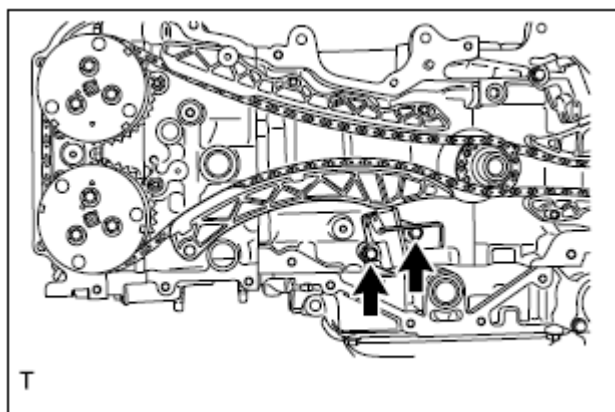
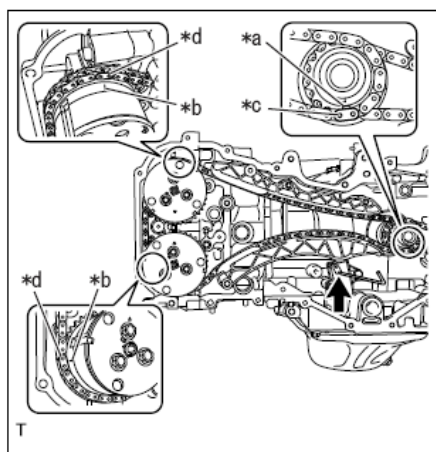


Fig. 46: Identifying Chain Tensioner Assembly No. 1 Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

12. Install the chain tensioner ASSY NO. 1 with the two bolts.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

13. Make sure that the chain SUB-ASSY is properly installed.



*a	Alignment marks
*b	Timing mark
*c	Mark plate (blue)
*d	Mark plate (pink)

Fig. 47: Identifying Alignment Mark Position On Crankshaft Timing Sprocket, Camshaft Timing Intake And Exhaust Gear Assembly RH
Courtesy of SUBARU OF AMERICA, INC.

- The mark plate (blue) of chain SUB-ASSY is aligned to the alignment mark position of crankshaft timing sprocket.
- The mark plate (pink) of chain SUB-ASSY is aligned to the timing mark position of camshaft timing intake gear ASSY RH.
- The mark plate (pink) of chain SUB-ASSY is aligned to the timing mark position of camshaft timing exhaust gear ASSY RH.

14. Pull out the hexagon wrench from the chain tensioner ASSY NO. 1.
15. Attach the SST to the crankshaft.

SST 18252AA000

16. Turn the crankshaft clockwise and make sure that there are no abnormal conditions.

CAUTION: Always make sure to perform this confirmation.

17. Remove the SST from the crankshaft.
3. Timing chain cover SUB-ASSY installation (Refer to INSTALLATION)

CAMSHAFT (FA20)

COMPONENTS

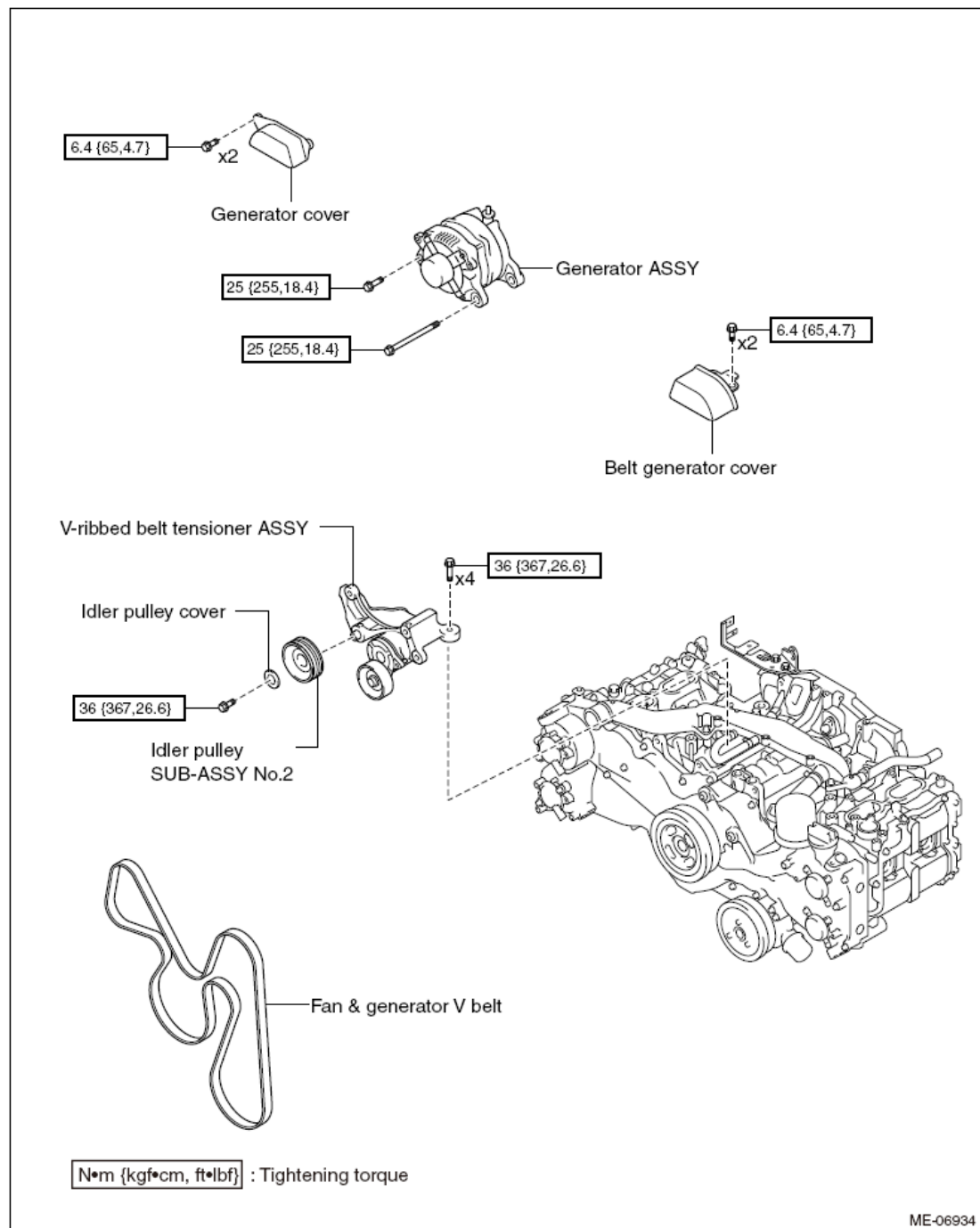


Fig. 48: Identifying Camshaft (FA20) Components With Torque Specifications (1 Of 8)
 Courtesy of SUBARU OF AMERICA, INC.

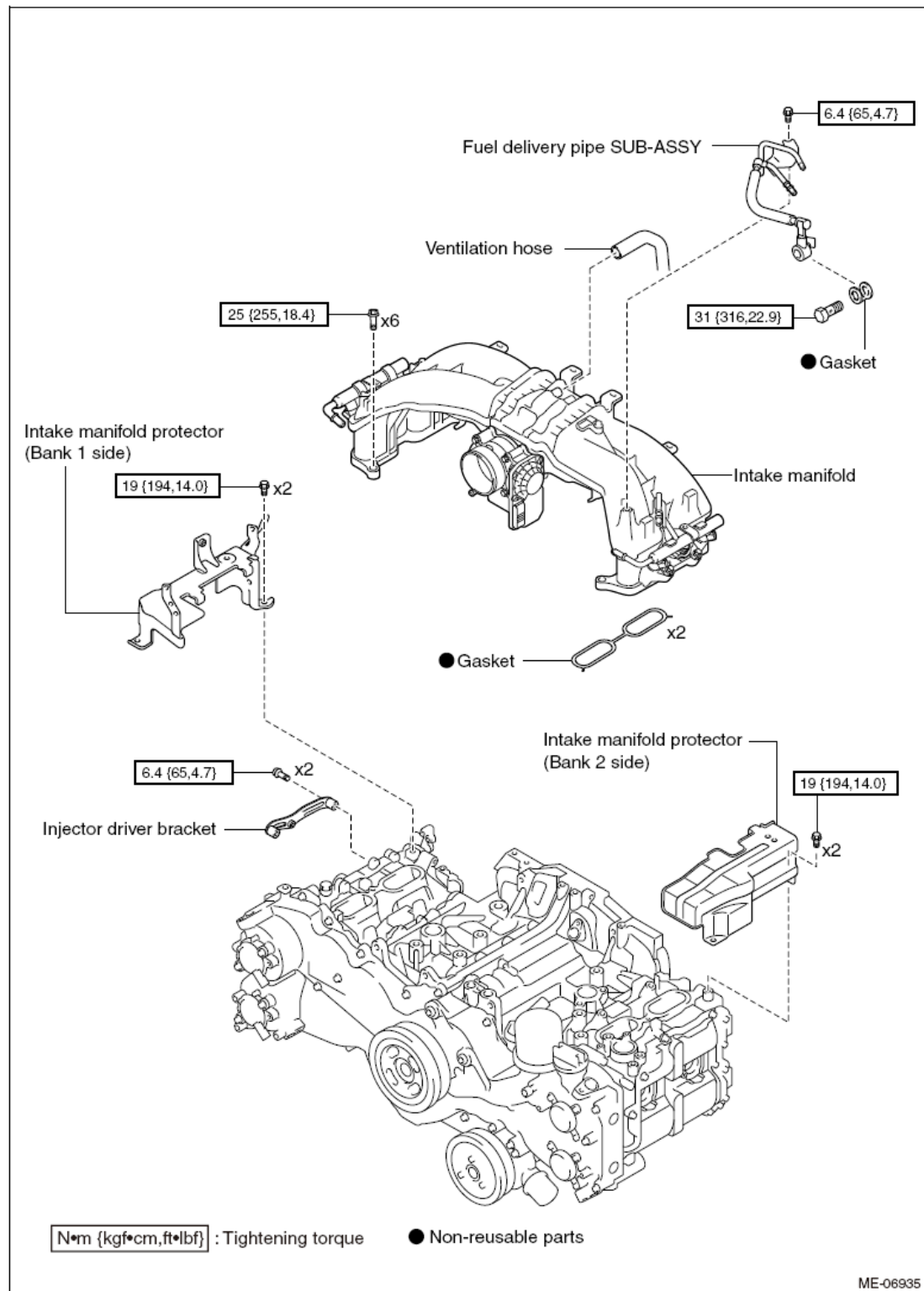


Fig. 49: Identifying Camshaft (FA20) Components With Torque Specifications (2 Of 8)
 Courtesy of SUBARU OF AMERICA, INC.

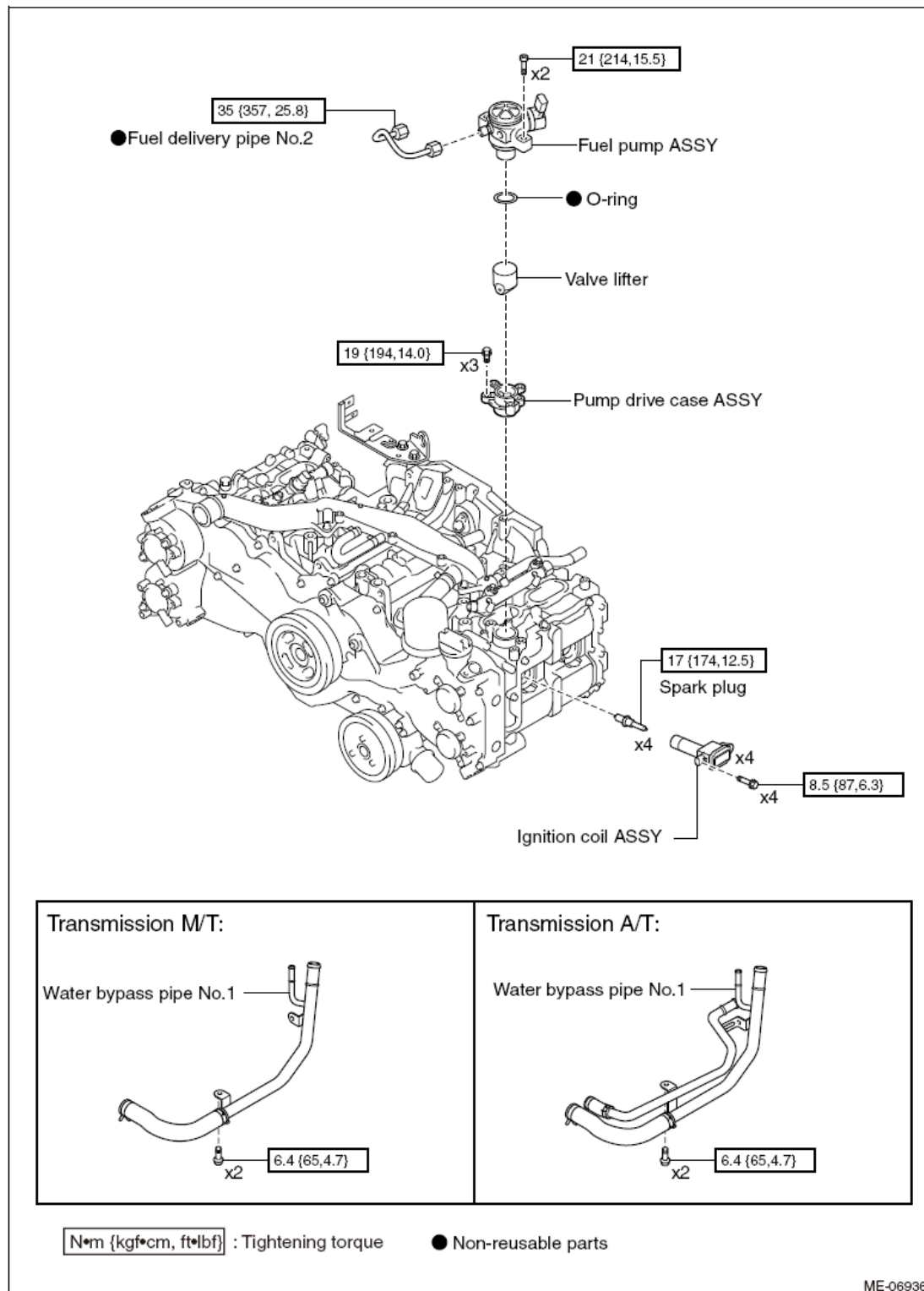


Fig. 50: Identifying Camshaft (FA20) Components With Torque Specifications (3 Of 8)
 Courtesy of SUBARU OF AMERICA, INC.

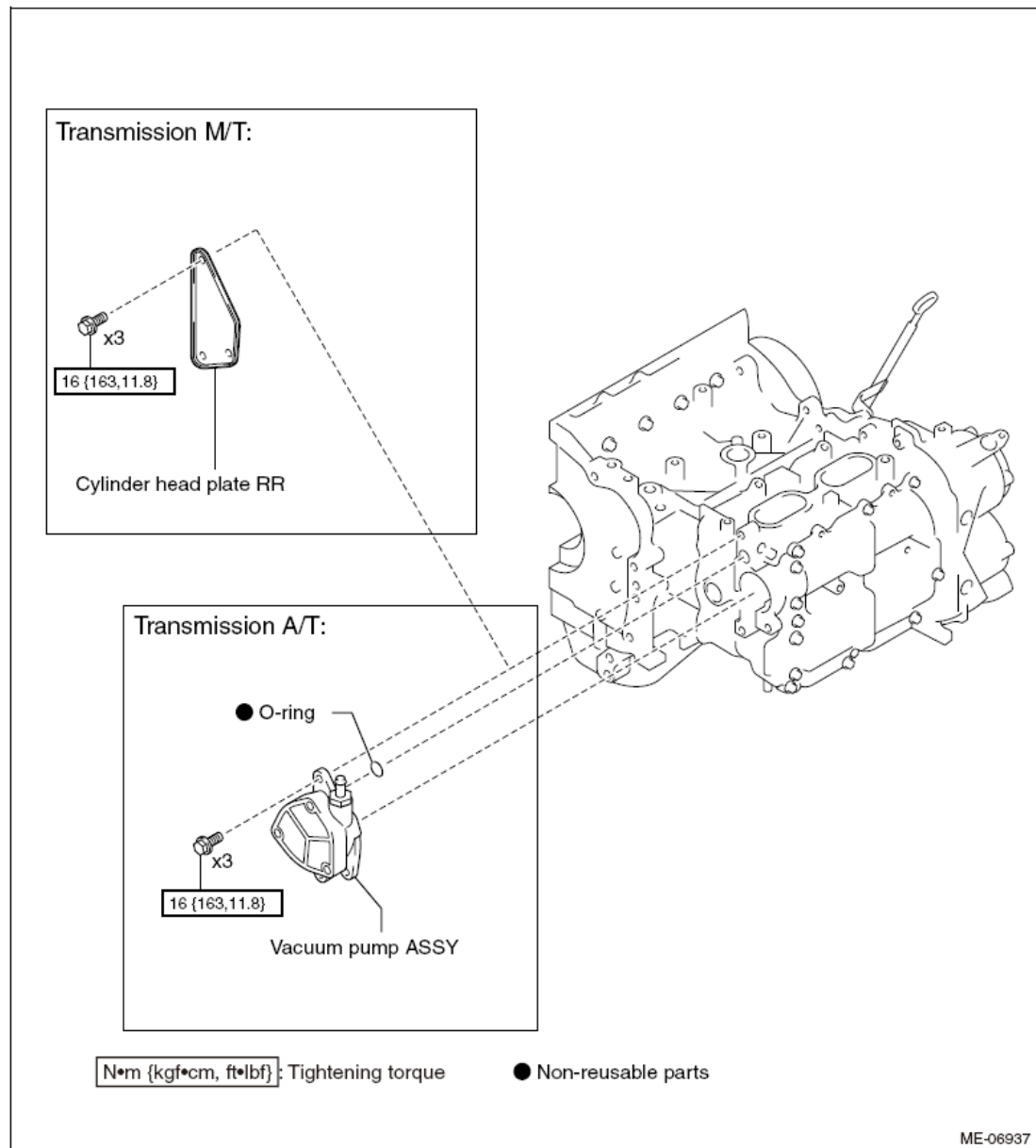


Fig. 51: Identifying Camshaft (FA20) Components With Torque Specifications (4 Of 8)
 Courtesy of SUBARU OF AMERICA, INC.

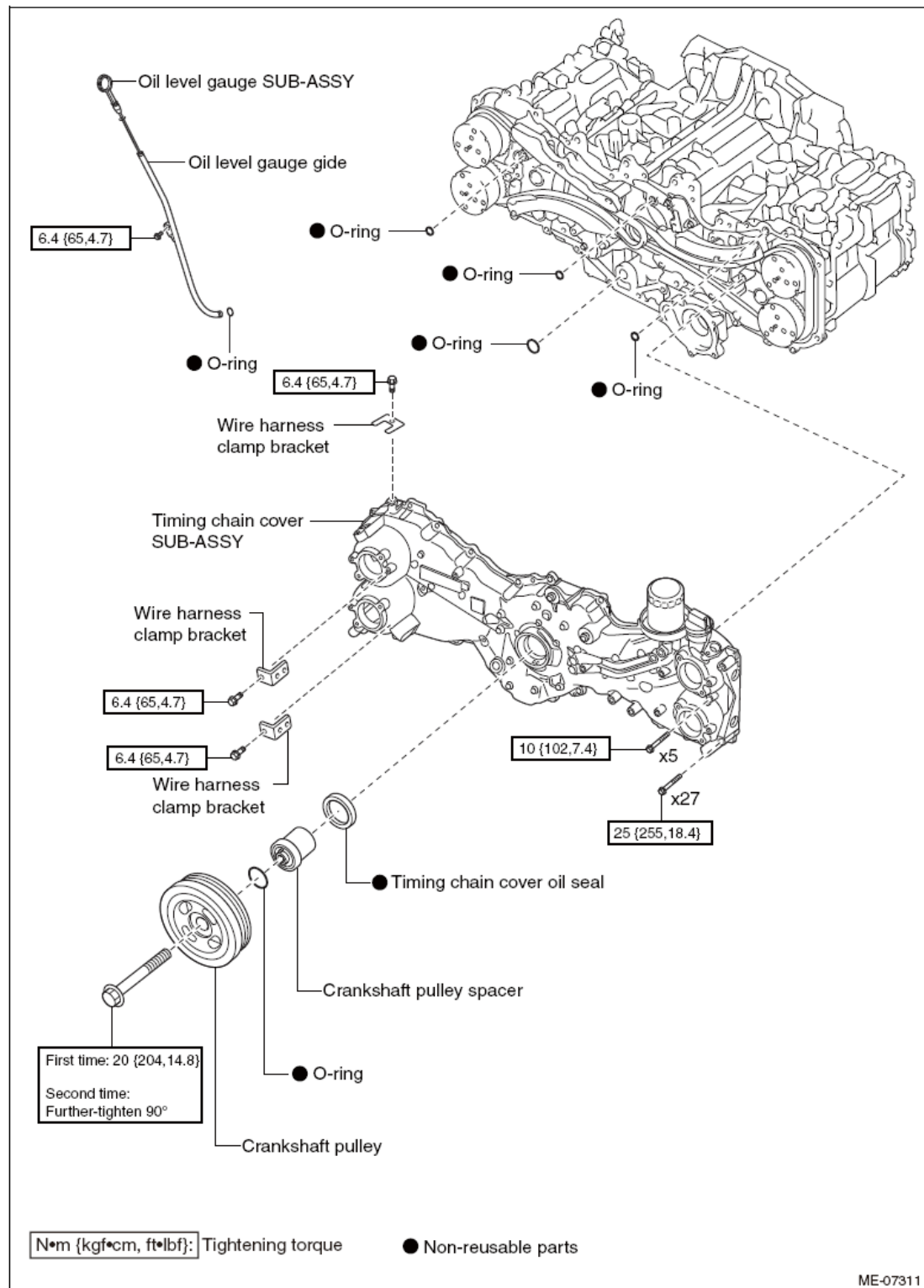


Fig. 52: Identifying Camshaft (FA20) Components With Torque Specifications (5 Of 8)
 Courtesy of SUBARU OF AMERICA, INC.

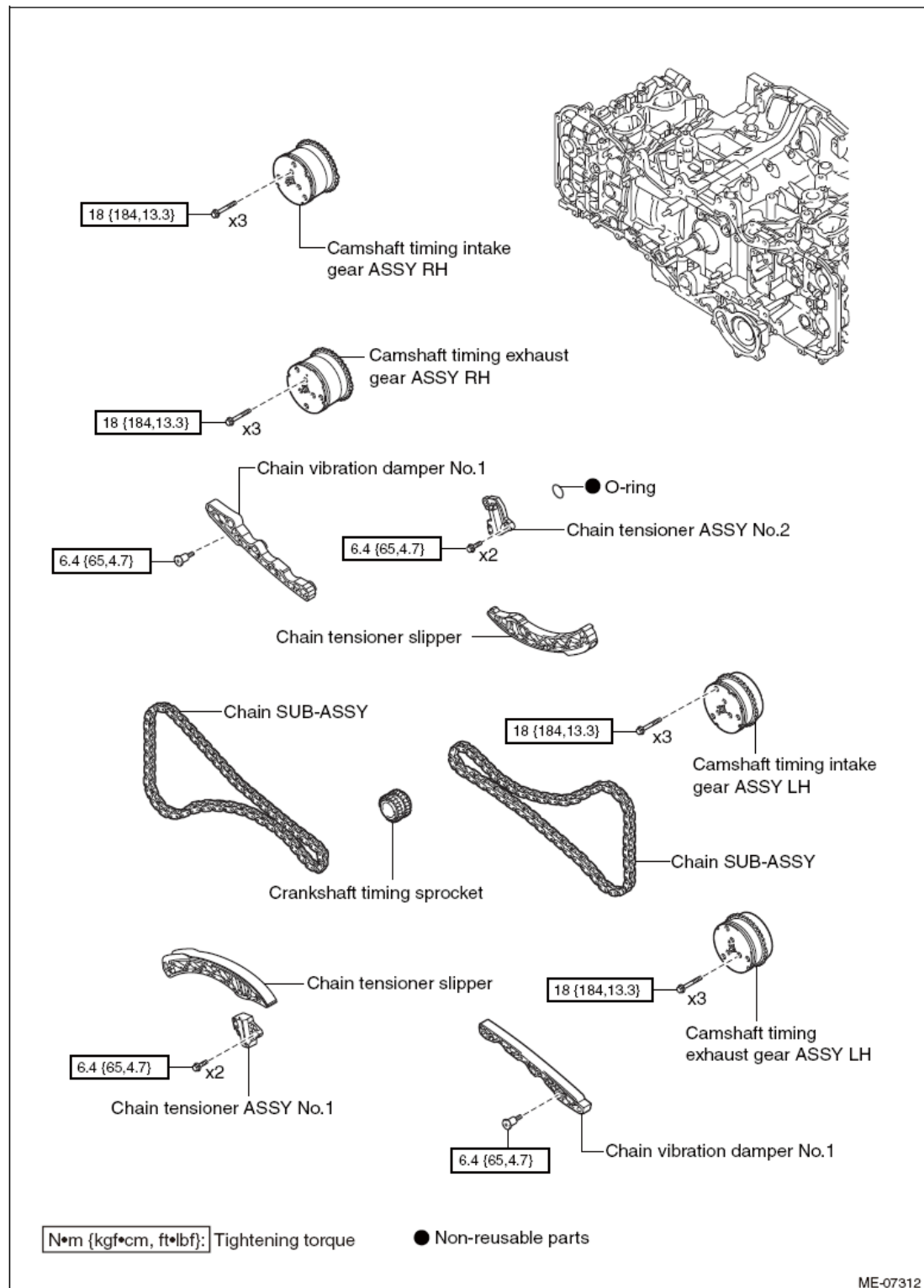


Fig. 53: Identifying Camshaft (FA20) Components With Torque Specifications (6 Of 8)
 Courtesy of SUBARU OF AMERICA, INC.

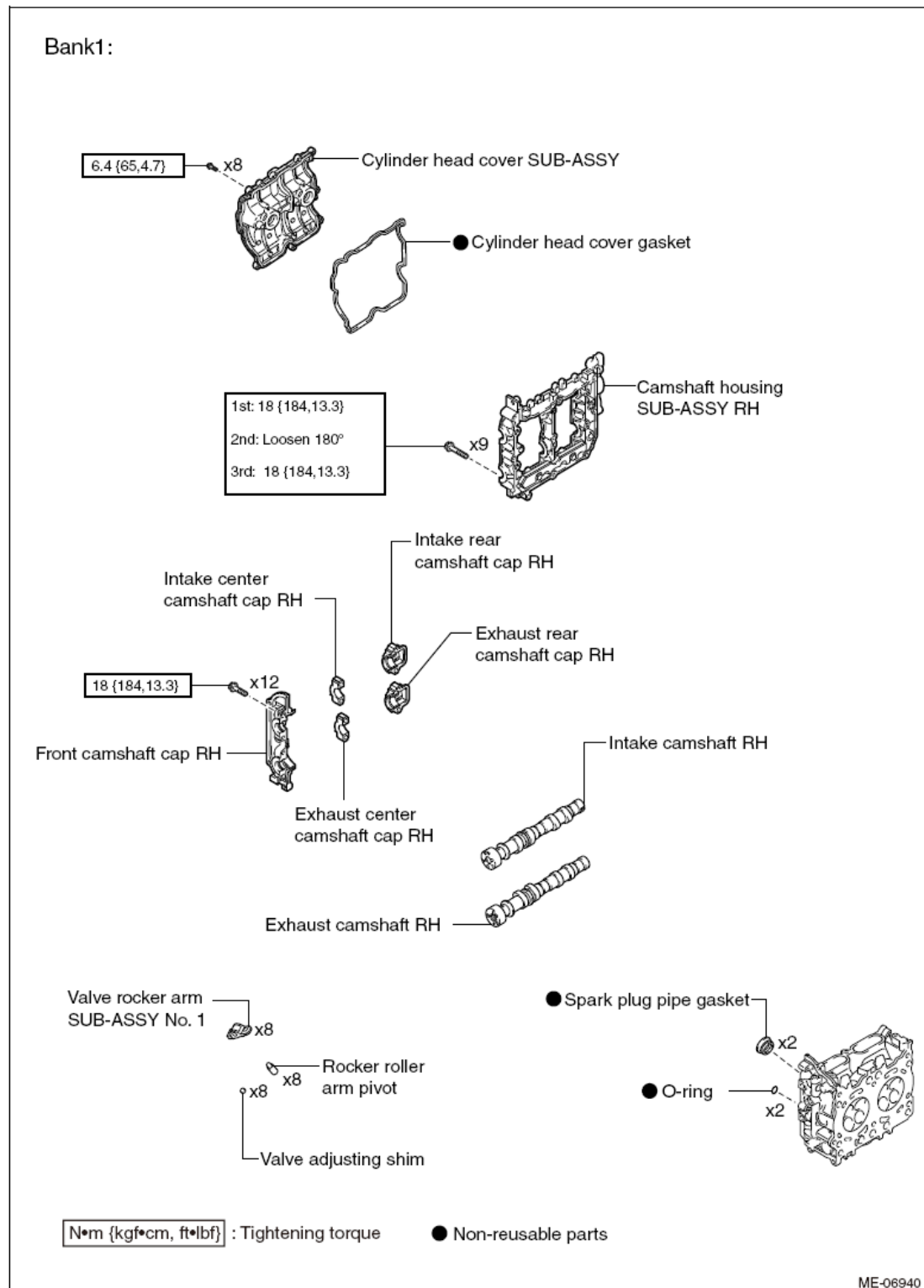


Fig. 54: Identifying Camshaft (FA20) Components With Torque Specifications (7 Of 8)
 Courtesy of SUBARU OF AMERICA, INC.

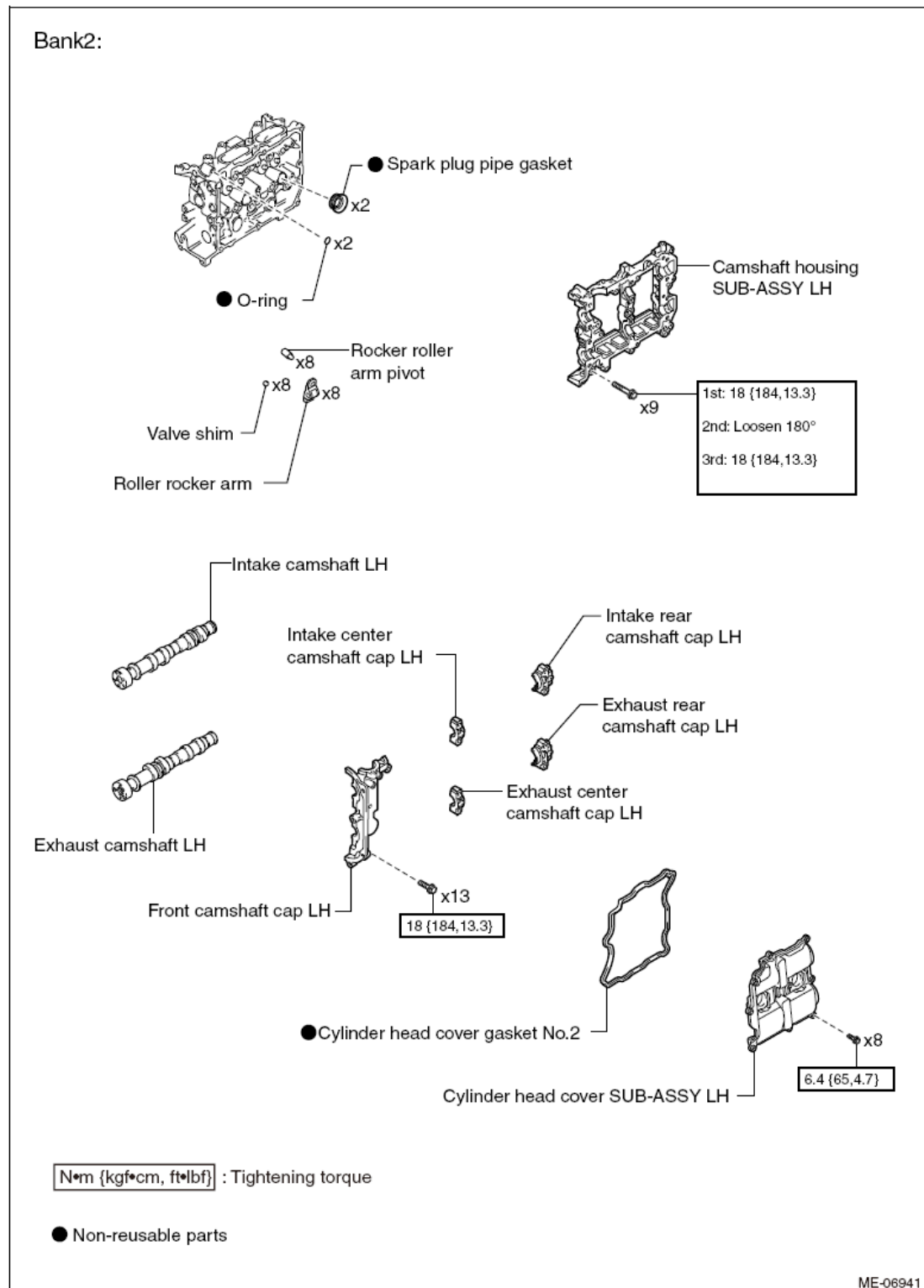


Fig. 55: Identifying Camshaft (FA20) Components With Torque Specifications (8 Of 8)
 Courtesy of SUBARU OF AMERICA, INC.

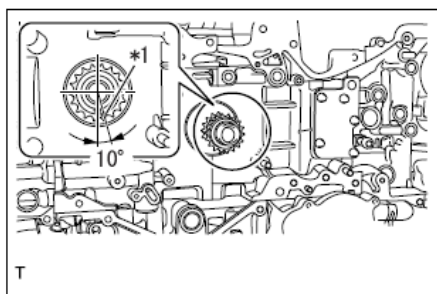
REMOVAL

1. Engine stand installation

(Refer to **REMOVAL**)

2. Engine hanger removal (Refer to **REMOVAL**)
3. Generator cover removal (Refer to **REMOVAL**)
4. Belt generator cover removal (Refer to **REMOVAL**)
5. Fan & generator V-belt removal (Refer to **REMOVAL**)
6. Generator ASSY removal (Refer to **REMOVAL**)
7. Oil level gauge guide removal (Refer to **REMOVAL**)
8. Idler pulley SUB-ASSY NO. 1 and NO. 2 removal (Refer to **REMOVAL**)
9. V-ribbed belt tensioner ASSY removal (Refer to **REMOVAL**)
10. Intake manifold protector (bank 1 side) removal (Refer to **REMOVAL**)
11. Intake manifold protector (bank 2 side) removal (Refer to **REMOVAL**)
12. Fuel delivery pipe SUB-ASSY removal (Refer to **REMOVAL**)
13. Ventilation hose disconnection (Refer to **REMOVAL**)
14. Intake manifold removal (Refer to **REMOVAL**)
15. Fuel delivery pipe (bank 2 side) removal (Refer to **REMOVAL**)
16. Fuel delivery pipe (bank 1 side) removal (Refer to **REMOVAL**)
17. Fuel pump ASSY removal (Refer to **REMOVAL**)
18. Valve lifter removal (Refer to **REMOVAL**)
19. Pump drive case ASSY removal (Refer to **REMOVAL**)
20. Vacuum pump ASSY removal (transmission A/T) (Refer to **REMOVAL**)
21. Cylinder head plate RR removal (transmission M/T) (Refer to **REMOVAL**)
22. Water by-pass pipe NO. 1 removal (transmission A/T) (Refer to **REMOVAL**)
23. Water by-pass pipe NO. 1 removal (transmission M/T) (Refer to **REMOVAL**)
24. Crankshaft pulley removal (Refer to **REMOVAL**)
25. Timing chain cover oil seal removal (Refer to **REMOVAL**)
26. Engine wiring disconnection (Refer to **REMOVAL**)
27. Timing chain cover SUB-ASSY removal (Refer to **REMOVAL**)
28. Chain SUB-ASSY removal (bank 1 side) (Refer to **REMOVAL**)
29. Chain SUB-ASSY removal (bank 2 side) (Refer to **REMOVAL**)
30. Piston and valve damage prevention procedure
 1. Use the SST to turn the crankshaft approximately 200° clockwise and align the alignment marks of crankshaft timing sprocket to the position as shown in the figure.

SST 18252AA000

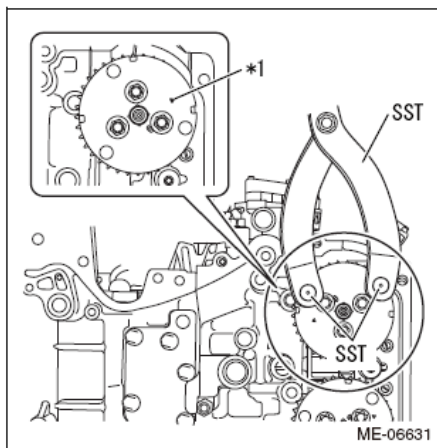


*1	Alignment marks
----	-----------------

Fig. 56: Identifying Alignment Marks On Crankshaft Timing Sprocket
 Courtesy of SUBARU OF AMERICA, INC.

CAUTION: Never turn the crankshaft counterclockwise other than when fine-adjusting the alignment mark position. Otherwise the valve and piston may contact.

- Using the SST, turn the camshaft timing intake gear ASSY LH approximately 180° clockwise and align the alignment mark of camshaft timing intake gear ASSY LH to the position (zero-lift position) as shown in the figure.



*1	Alignment marks
----	-----------------

Fig. 57: Turning Camshaft Timing Intake Gear Assembly LH To Clockwise Using SST
 Courtesy of SUBARU OF AMERICA, INC.

SST 18355AA000, 18334AA030

CAUTION: After this work, when the intake valve and exhaust valve lift at the same time, the valve heads contact each other and valve stems may bend. Do not turn the intake camshaft LH and exhaust camshaft LH to the outside of range of zero-lift (in range where it can be turned lightly by hand).

- Remove the SST from the crankshaft.
- Camshaft timing intake gear ASSY RH removal

1. Use the SST to secure the camshaft timing intake gear ASSY RH and remove the three bolts.

SST 18355AA000, 18334AA030, 18270KA010

2. Remove the camshaft timing intake gear ASSY RH.

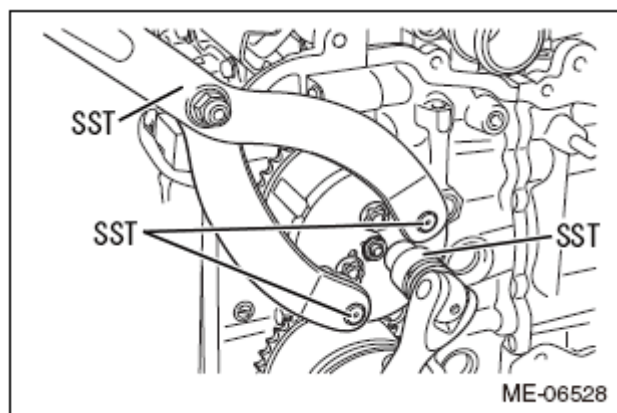


Fig. 58: Removing Camshaft Timing Intake Gear Assembly RH
Courtesy of SUBARU OF AMERICA, INC.

32. Camshaft timing exhaust gear ASSY RH removal

1. Use the SST to secure the camshaft timing exhaust gear ASSY RH, and remove the three bolts.

SST 18355AA000, 18334AA030, 18270KA010

2. Remove the camshaft timing exhaust gear ASSY RH.

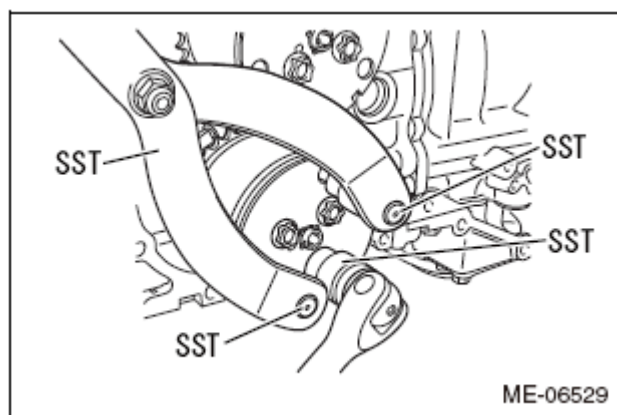


Fig. 59: Removing Camshaft Timing Exhaust Gear Assembly RH
Courtesy of SUBARU OF AMERICA, INC.

33. Camshaft timing intake gear ASSY LH removal

1. Use the SST to secure the camshaft timing intake gear ASSY LH and remove the three bolts.

SST 18355AA000, 18334AA030, 18270KA010

2. Remove the camshaft timing intake gear ASSY LH.

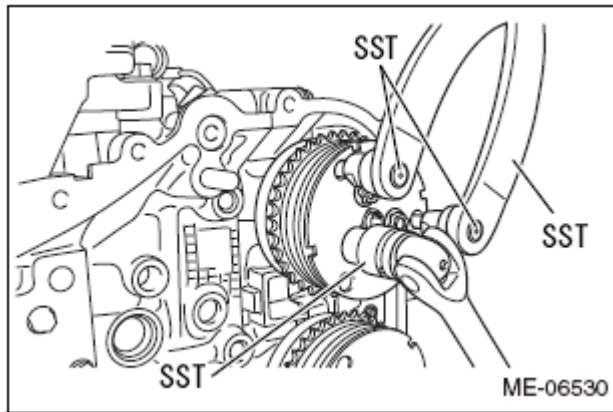


Fig. 60: Removing Camshaft Timing Intake Gear Assembly LH
Courtesy of SUBARU OF AMERICA, INC.

34. Camshaft timing exhaust gear ASSY LH removal

1. Use the SST to secure the camshaft timing exhaust gear ASSY LH, and remove the three bolts.

SST 18355AA000, 18334AA030, 18270KA010

2. Remove the camshaft timing exhaust gear ASSY LH.

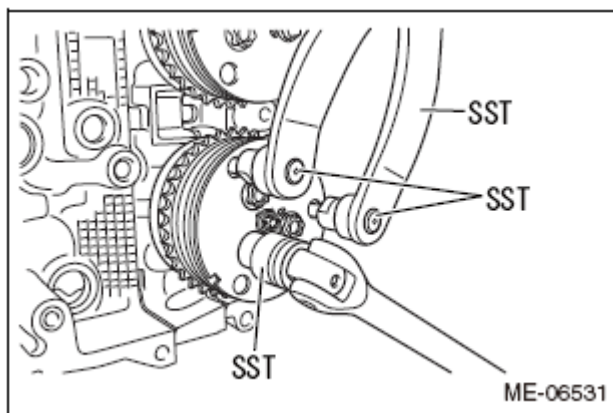


Fig. 61: Removing LH Camshaft Timing Exhaust Gear Assembly
Courtesy of SUBARU OF AMERICA, INC.

35. Ignition coil ASSY removal (bank 2 side) (Refer to **REMOVAL**)
36. Spark plug removal (bank 2 side) (Refer to **REMOVAL**)
37. Ignition coil ASSY removal (bank 1 side) (Refer to **REMOVAL**)
38. Spark plug removal (bank 1 side) (Refer to **REMOVAL**)

39. Cylinder head cover SUB-ASSY removal (Refer to **REMOVAL**)
40. Camshaft housing SUB-ASSY RH removal (Refer to **REMOVAL**)
41. Cylinder head cover SUB-ASSY LH removal (Refer to **REMOVAL**)
42. Camshaft housing SUB-ASSY LH removal (Refer to **REMOVAL**)
43. Camshaft cap removal (bank 1 side)
 1. Loosen the 12 bolts a little at a time equally in the order as shown in the figure and remove them to remove the front camshaft cap RH, intake center camshaft cap RH, intake rear camshaft cap RH, exhaust center camshaft cap RH and exhaust rear camshaft cap RH.

NOTE: The removed parts must be organized by installation location.

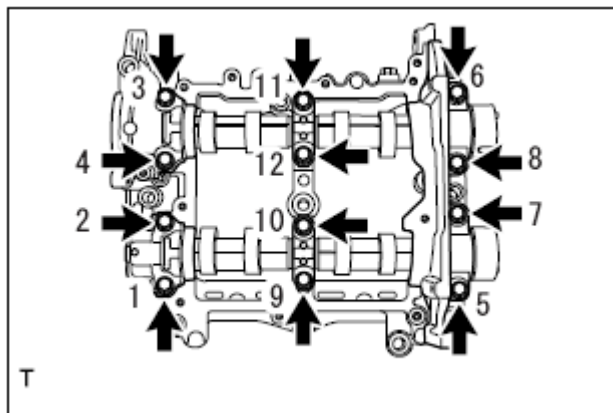


Fig. 62: Identifying Camshaft Cap Mounting Bolts With Loosening Sequence (Bank 1 Side)
 Courtesy of SUBARU OF AMERICA, INC.

44. Camshaft removal (bank 1 side)
 1. Remove the intake camshaft RH and exhaust camshaft RH from the camshaft housing SUB-ASSY RH.

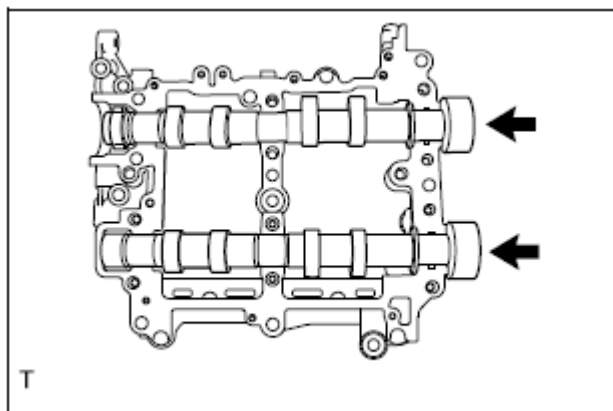


Fig. 63: Identifying Intake And Exhaust Camshaft RH (Bank 1 Side)
 Courtesy of SUBARU OF AMERICA, INC.

45. Camshaft cap removal (bank 2 side)

1. Loosen the 13 bolts a little at a time equally in the order as shown in the figure and remove them to remove the front camshaft cap LH, intake center camshaft cap LH, intake rear camshaft cap LH, exhaust center camshaft cap LH and exhaust rear camshaft cap LH.

NOTE: The removed parts must be organized by installation location.

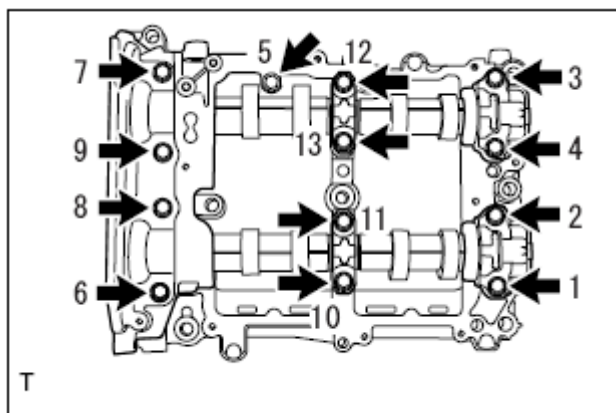


Fig. 64: Identifying Camshaft Cap Mounting Bolts With Loosening Sequence (Bank 2 Side)
Courtesy of SUBARU OF AMERICA, INC.

46. Camshaft removal (bank 2 side)

1. Remove the intake camshaft LH and exhaust camshaft LH from the camshaft housing SUB-ASSY LH.

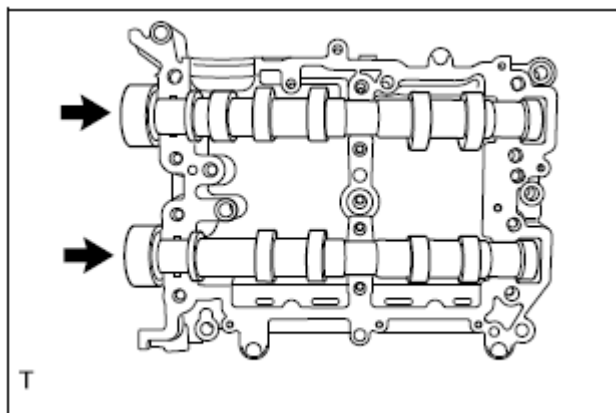


Fig. 65: Identifying Intake And Exhaust Camshaft LH (Bank 2 Side)
Courtesy of SUBARU OF AMERICA, INC.

INSTALLATION

1. Camshaft installation (bank 2 side)

1. Apply engine oil to the journal of camshaft housing SUB-ASSY LH.

2. Install the intake camshaft LH and exhaust camshaft LH to the camshaft housing SUB-ASSY LH.

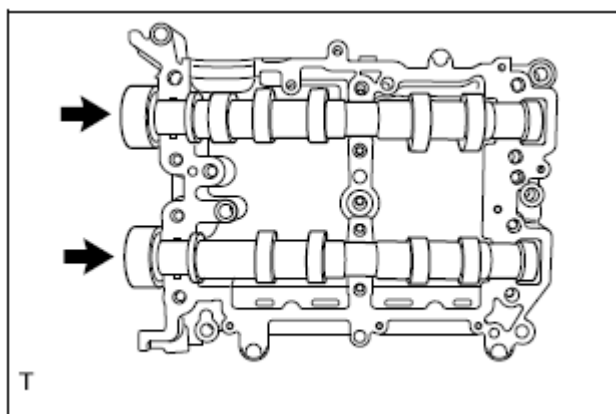
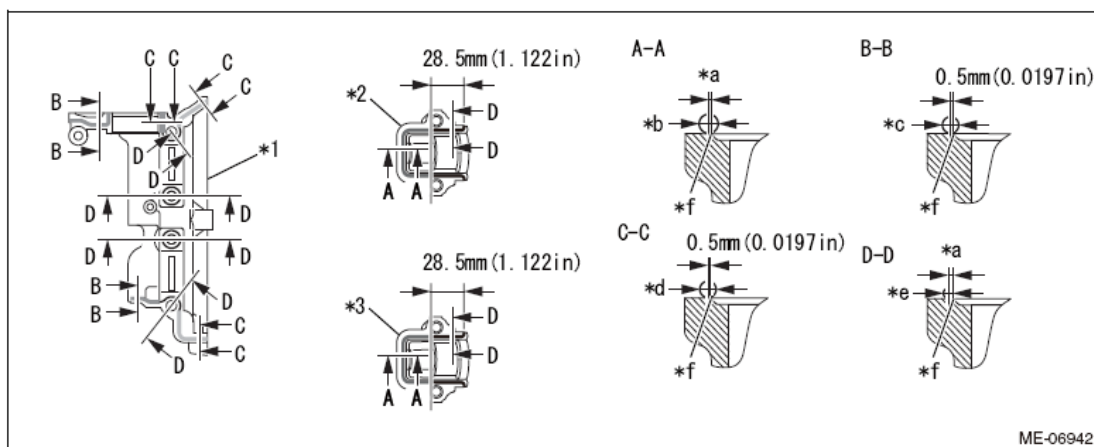


Fig. 66: Identifying Intake And Exhaust Camshaft LH (Bank 2 Side)
Courtesy of SUBARU OF AMERICA, INC.

2. Camshaft cap installation (bank 2 side)

1. Apply THREE BOND 1217G to the mating surface of front camshaft cap LH, intake rear camshaft cap LH and exhaust rear camshaft cap LH as shown in the figure.



*1	Front camshaft cap LH	*2	Intake rear camshaft cap LH
*3	Exhaust rear camshaft cap LH	-	-
*a	1.0 mm {0.0394 in} or less	*b	Diameter: 3.0 to 4.0 mm {0.1181 to 0.1575 in}
*c	Diameter: 2.5 to 3.5 mm {0.0984 to 0.1378 in}	*d	Diameter: 2.5 to 4.0 mm {0.0984 to 0.1575 in}
*e	Diameter: 1.5 to 2.5 mm {0.0591 to 0.0984 in}	*f	Groove end

Fig. 67: Identifying Three Bond 1217G Applying Areas On Mating Surface Of Camshaft Cap LH
Courtesy of SUBARU OF AMERICA, INC.

CAUTION:

- Clean and degrease the installation surface.
- Do not apply liquid gasket excessively, doing so cause

engine seizure.

- Do not apply liquid gasket to the intake center camshaft cap LH and exhaust center camshaft cap LH.
- Install within 5 min. after applying liquid gasket.

2. Apply engine oil to the journals of each camshaft cap and set it to the camshaft housing SUB-ASSY LH.
3. Tighten the 13 bolts in the order as shown in the figure and install the front camshaft cap LH, intake center camshaft cap LH, intake rear camshaft cap LH, exhaust center camshaft cap LH and exhaust rear camshaft cap LH.

Standard value: T=18N.m {184kgf.cm} {13.3ft.lbf}

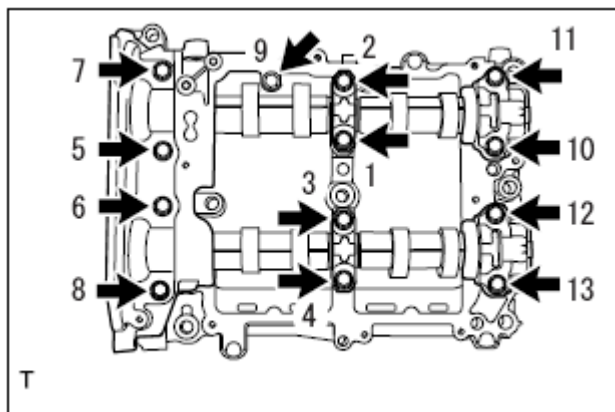


Fig. 68: Identifying Camshaft Cap Mounting Bolts With Tightening Sequence
Courtesy of SUBARU OF AMERICA, INC.

3. Camshaft installation (bank 1 side)
 1. Apply engine oil to the journal of camshaft housing SUB-ASSY RH.
 2. Install the intake camshaft RH and exhaust camshaft RH to the camshaft housing SUB-ASSY RH.

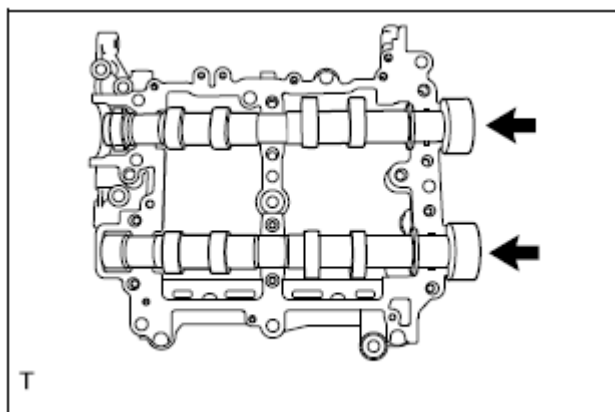
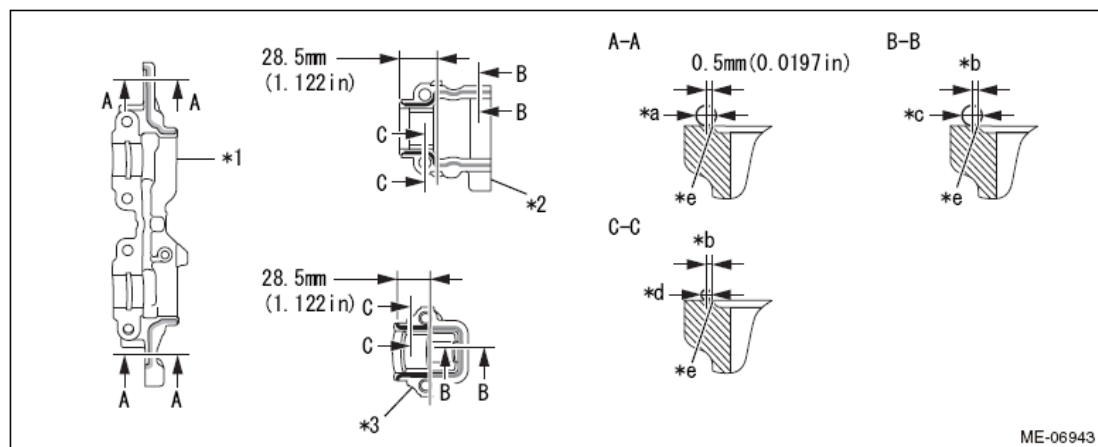


Fig. 69: Identifying Intake And Exhaust Camshaft (Bank 1 Side)

Courtesy of SUBARU OF AMERICA, INC.

4. Camshaft cap installation (bank 1 side)

1. Apply THREE BOND 1217G to the mating surface of front camshaft cap RH, intake rear camshaft cap RH and exhaust rear camshaft cap RH as shown in the figure.



*1	Front camshaft cap RH	*2	Intake rear camshaft cap RH
*3	Exhaust rear camshaft cap RH	-	-
a	Diameter: 2.5 to 4.0 mm {0.0984 to 0.1575 in}	b	1.0 mm {0.0394 in} or less
c	Diameter: 3.0 to 4.0 mm {0.1181 to 0.1575 in}	d	Diameter: 1.5 to 2.5 mm {0.0591 to 0.0984 in}
e	Groove end	-	-

Fig. 70: Identifying Three Bond 1217G Applying Areas On Mating Surface Of Camshaft Cap RH

Courtesy of SUBARU OF AMERICA, INC.

CAUTION:

- Clean and degrease the installation surface.
- Do not apply liquid gasket excessively, doing so cause engine seizure.
- Do not apply liquid gasket to the intake center camshaft cap RH and exhaust center camshaft cap RH.
- Install within 5 min. after applying liquid gasket.

2. Apply engine oil to the journals of each camshaft cap and set it to the camshaft housing SUB-ASSY RH.
3. Tighten the 12 bolts in the order as shown in the figure and install the front camshaft cap RH, intake center camshaft cap RH, intake rear camshaft cap RH, exhaust center camshaft cap RH and exhaust rear camshaft cap RH.

Standard value: T=18N.m {184kgf.cm} {13.3ft.lbf}

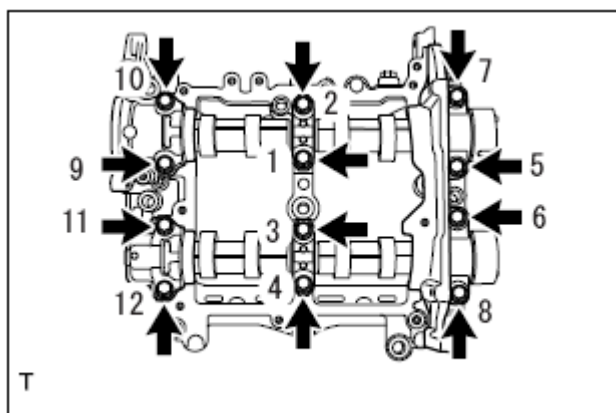
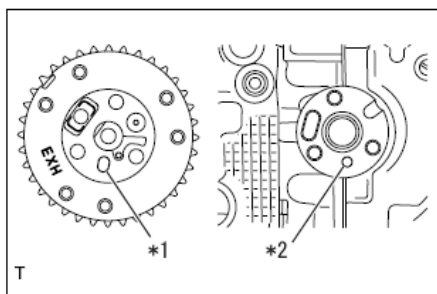


Fig. 71: Identifying Camshaft Cap Mounting Bolts With Tightening Sequence
 Courtesy of SUBARU OF AMERICA, INC.

5. Camshaft housing SUB-ASSY LH installation (Refer to INSTALLATION)
6. Cylinder head cover SUB-ASSY LH installation (Refer to INSTALLATION)
7. Camshaft housing SUB-ASSY RH installation (Refer to INSTALLATION)
8. Cylinder head cover SUB-ASSY installation (Refer to INSTALLATION)
9. Spark plug installation (bank 1 side) (Refer to INSTALLATION)
10. Ignition coil ASSY installation (bank 1 side) (Refer to INSTALLATION)
11. Spark plug installation (bank 2 side) (Refer to INSTALLATION)
12. Ignition coil ASSY installation (bank 2 side) (Refer to INSTALLATION)
13. Camshaft timing exhaust gear ASSY LH installation

CAUTION: Before installation, check that there is no foreign matter on the camshaft timing exhaust gear ASSY LH and exhaust camshaft LH.

1. Install the camshaft timing exhaust gear ASSY LH by aligning the knock hole of camshaft timing exhaust gear ASSY LH and the knock pin of exhaust camshaft LH.



*1	Knock hole
*2	Knock pin

Fig. 72: Identifying LH Camshaft Timing Exhaust Gear Assembly Knock Hole And Pin
 Courtesy of SUBARU OF AMERICA, INC.

2. Use the SST to secure the camshaft timing exhaust gear ASSY LH and tighten the three bolts.

SST 18355AA000, 18334AA030, 18270KA010

Standard value: T=18N.m {184kgf.cm} {13.3ft.lbf}

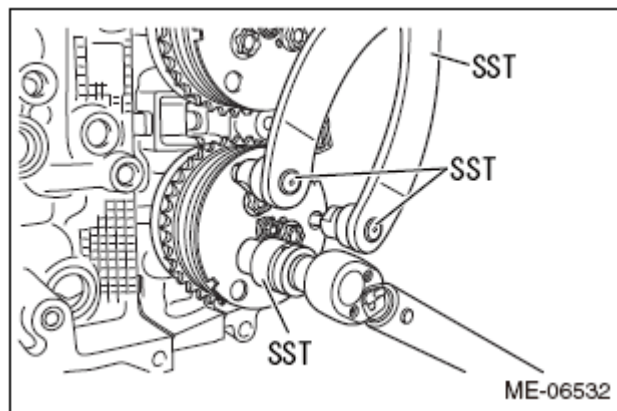
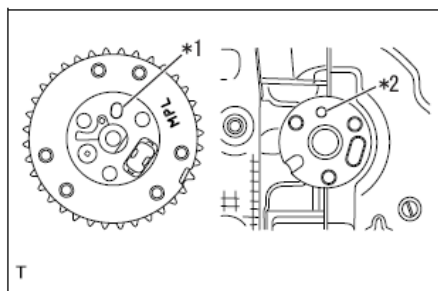


Fig. 73: Securing Camshaft Timing Exhaust Gear Assembly Using SST
Courtesy of SUBARU OF AMERICA, INC.

14. Camshaft timing intake gear ASSY LH installation

CAUTION: Before installation, check that there is no foreign matter on the camshaft timing intake gear ASSY LH and intake camshaft LH.

1. Install the camshaft timing intake gear ASSY LH by aligning the knock hole of camshaft timing intake gear ASSY LH and the knock pin of intake camshaft LH.



*1	Knock hole
*2	Knock pin

Fig. 74: Identifying Camshaft Timing Intake Gear Assembly Knock Hole And Pin
Courtesy of SUBARU OF AMERICA, INC.

2. Use the SST to secure the camshaft timing intake gear ASSY LH and tighten the three bolts.

SST 18355AA000, 18334AA030, 18270KA010

Standard value: T=18N.m {184kgf.cm} {13.3ft.lbf}

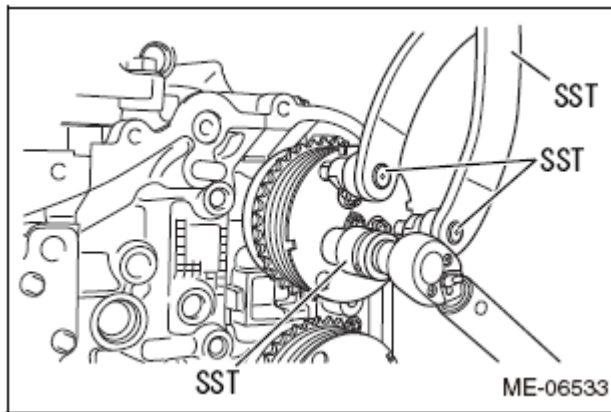
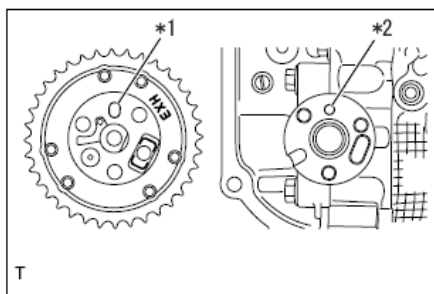


Fig. 75: Securing Camshaft Timing Intake Gear Assembly Using SST
 Courtesy of SUBARU OF AMERICA, INC.

15. Camshaft timing exhaust gear ASSY RH installation

CAUTION: Before installation, check that there is no foreign matter on the camshaft timing exhaust gear ASSY RH and exhaust camshaft RH.

1. Install the camshaft timing exhaust gear ASSY RH by aligning the knock hole of camshaft timing exhaust gear ASSY RH and the knock pin of exhaust camshaft RH.



*1	Knock hole
*2	Knock pin

Fig. 76: Identifying RH Camshaft Timing Exhaust Gear Assembly Knock Hole And Pin
 Courtesy of SUBARU OF AMERICA, INC.

2. Use the SST to secure the camshaft timing exhaust gear ASSY RH and tighten the three bolts.

SST 18355AA000, 18334AA030, 18270KA010

Standard value: T=18N.m {184kgf.cm} {13.3ft.lbf}

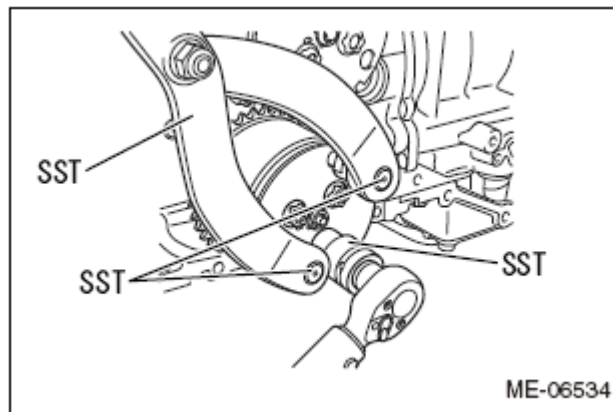
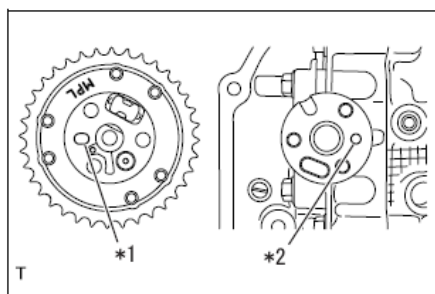


Fig. 77: Securing Camshaft Timing Exhaust Gear Assembly Using SST
Courtesy of SUBARU OF AMERICA, INC.

16. Camshaft timing intake gear ASSY RH installation

CAUTION: Before installation, check that there is no foreign matter on the camshaft timing intake gear ASSY RH and intake camshaft RH.

1. Install the camshaft timing intake gear ASSY RH by aligning the knock hole of camshaft timing intake gear ASSY RH and the knock pin of intake camshaft RH.



*1	Knock hole
*2	Knock pin

Fig. 78: Identifying RH Camshaft Timing Intake Gear Assembly Knock Hole And Pin
Courtesy of SUBARU OF AMERICA, INC.

2. Use the SST to secure the camshaft timing intake gear ASSY RH and tighten the three bolts.

SST 18355AA000, 18334AA030, 18270KA010

Standard value: T=18N.m {184kgf.cm} {13.3ft.lbf}

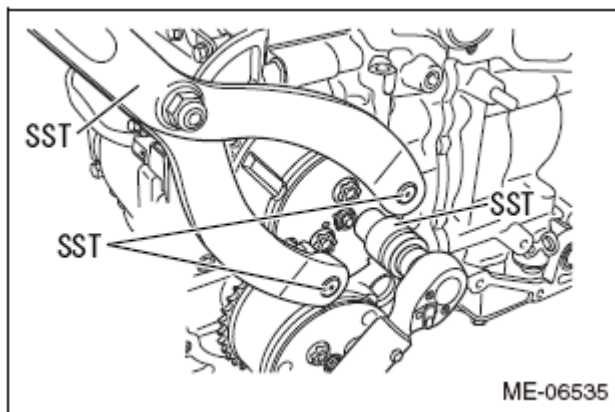


Fig. 79: Securing Camshaft Timing Intake Gear Assembly Using SST
 Courtesy of SUBARU OF AMERICA, INC.

17. Crankshaft timing sprocket installation

1. Install the crankshaft timing sprocket.

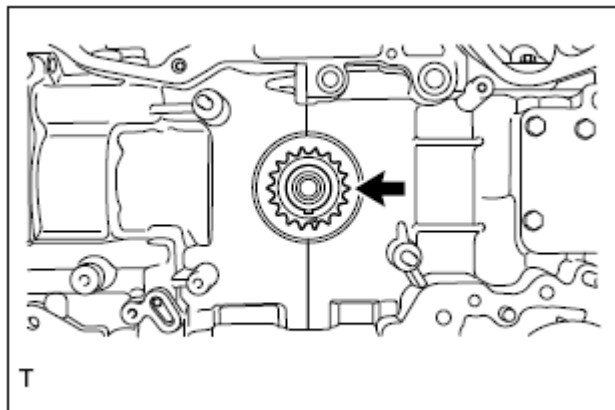


Fig. 80: Identifying Crankshaft Timing Sprocket
 Courtesy of SUBARU OF AMERICA, INC.

18. Chain SUB-ASSY installation (bank 2 side) (Refer to **INSTALLATION**)
19. Chain SUB-ASSY installation (bank 1 side) (Refer to **INSTALLATION**)
20. Timing chain cover SUB-ASSY installation (Refer to **INSTALLATION**)
21. Engine wiring connection (Refer to **INSTALLATION**)
22. Timing chain cover oil seal installation (Refer to **INSTALLATION**)
23. Crankshaft pulley installation (Refer to **INSTALLATION**)
24. Water by-pass pipe NO. 1 installation (transmission M/T) (Refer to **INSTALLATION**)
25. Water by-pass pipe NO. 1 installation (transmission A/T) (Refer to **INSTALLATION**)
26. Cylinder head plate RR installation (transmission M/T) (Refer to **INSTALLATION**)
27. Vacuum pump ASSY installation (transmission A/T) (Refer to **INSTALLATION**)

28. Pump drive case ASSY installation (Refer to **INSTALLATION**)
29. Valve lifter installation (Refer to **INSTALLATION**)
30. Fuel pump ASSY installation (Refer to **INSTALLATION**)
31. Fuel delivery pipe (bank 1 side) installation (Refer to **INSTALLATION**)
32. Fuel delivery pipe (bank 2 side) installation (Refer to **INSTALLATION**)
33. Intake manifold installation (Refer to **INSTALLATION**)
34. Ventilation hose connection (Refer to **INSTALLATION**)
35. Fuel delivery pipe SUB-ASSY installation (Refer to **INSTALLATION**)
36. Intake manifold protector (bank 2 side) installation (Refer to **INSTALLATION**)
37. Intake manifold protector (bank 1 side) installation (Refer to **INSTALLATION**)
38. V-ribbed belt tensioner ASSY installation (Refer to **INSTALLATION**)
39. Oil level gauge guide installation (Refer to **INSTALLATION**)
40. Idler pulley SUB-ASSY NO. 1 and NO. 2 installation (Refer to **INSTALLATION**)
41. Generator ASSY installation (Refer to **INSTALLATION**)
42. Fan & generator V-belt installation (Refer to **INSTALLATION**)
43. Belt generator cover installation (Refer to **INSTALLATION**)
44. Generator cover installation (Refer to **INSTALLATION**)
45. Engine hanger installation (Refer to **REMOVAL**)
46. Engine stand removal (Refer to **INSTALLATION**)

CYLINDER HEAD GASKET (FA20)

COMPONENTS

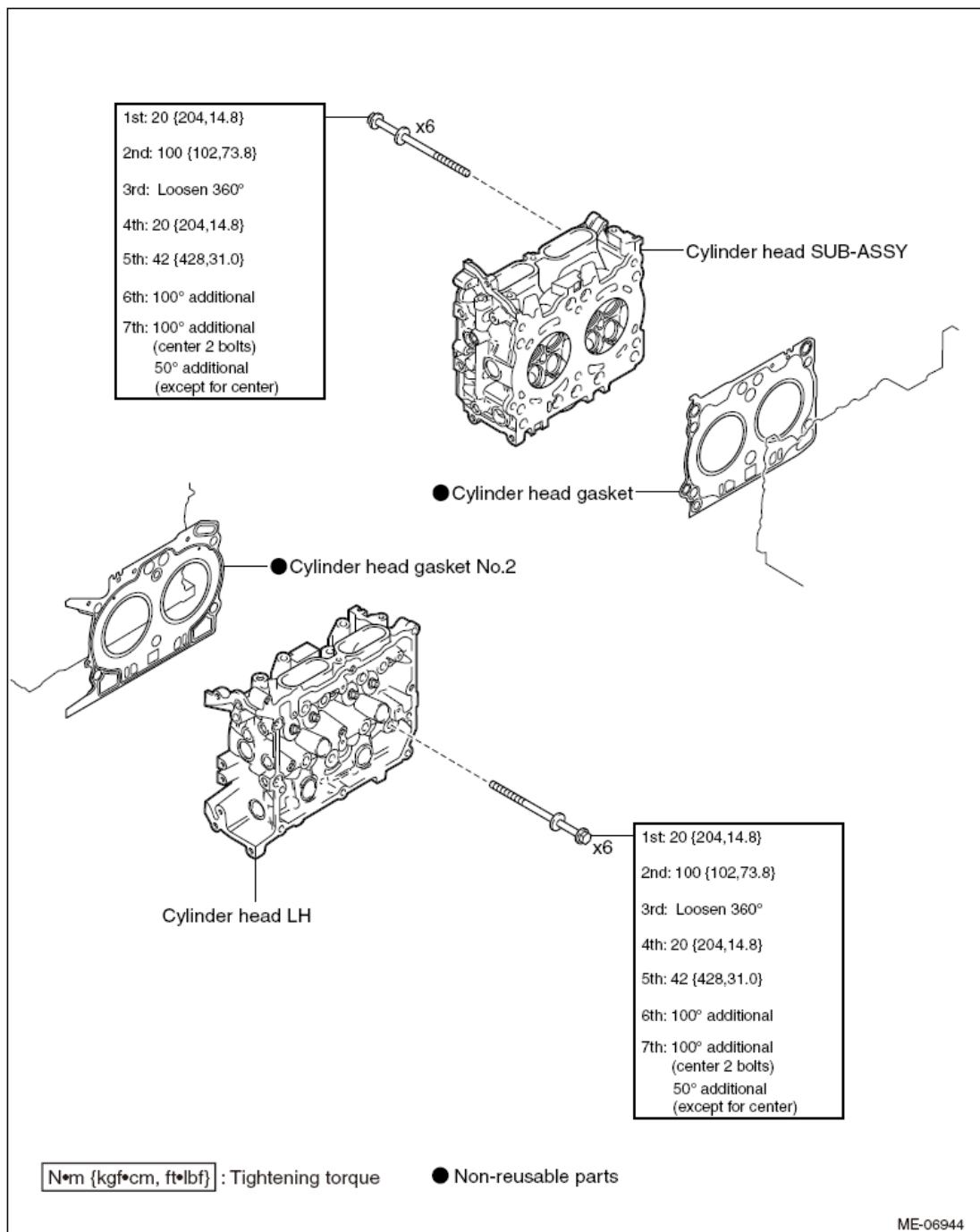


Fig. 81: Identifying Cylinder Head Gasket (FA20) Components With Torque Specifications
 Courtesy of SUBARU OF AMERICA, INC.

REMOVAL

1. Camshaft housing SUB-ASSY RH removal

(Refer to **REMOVAL**)

2. Cylinder head SUB-ASSY removal

1. Loosen the six cylinder head bolts equally in the order as shown in the figure.
2. Tap the cylinder head SUB-ASSY with a plastic hammer to separate it from cylinder block.
3. Remove the cylinder head SUB-ASSY.

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

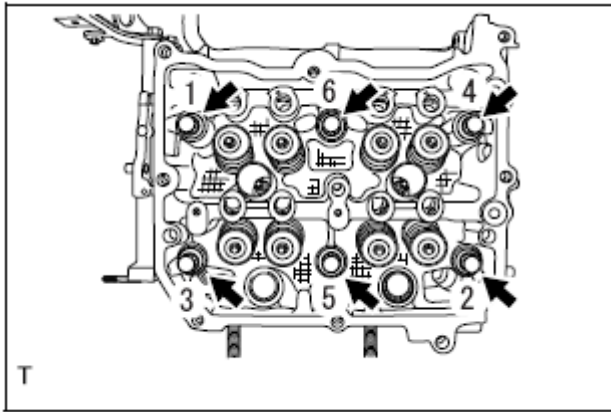


Fig. 82: Identifying Cylinder Head Sub-Assembly Mounting Bolts With Loosening Sequence
Courtesy of SUBARU OF AMERICA, INC.

3. Cylinder head gasket removal

1. Remove the cylinder head gasket.

4. Camshaft housing SUB-ASSY LH removal

(Refer to **REMOVAL**)

5. Cylinder head LH removal

1. Loosen the six cylinder head bolts equally in the order as shown in the figure.
2. Tap the cylinder head LH with a plastic hammer to separate it from cylinder block.
3. Remove the cylinder head LH.

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

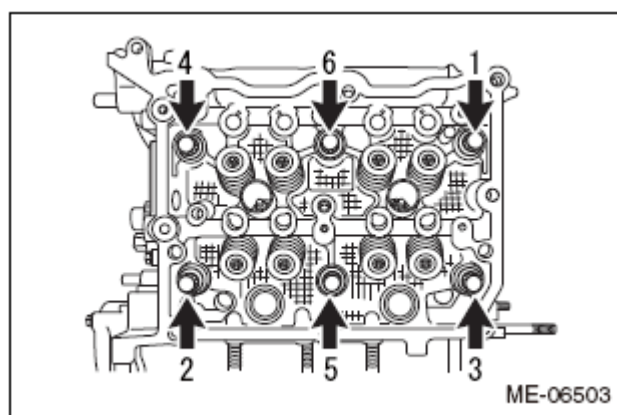


Fig. 83: Identifying Cylinder Head LH Mounting Bolts With Loosening Sequence
 Courtesy of SUBARU OF AMERICA, INC.

6. Cylinder head gasket NO. 2 removal
 1. Remove the cylinder head gasket NO. 2.

INSTALLATION

1. Cylinder head gasket NO. 2 installation
 1. Operate the engine stand, and make the bank 2 side face upward.
 2. Clean the bolt holes in the cylinder block (block 2 side).

CAUTION: To avoid erroneous tightening of the bolts, clean out the bolt holes sufficiently by blowing with compressed air to eliminate engine coolant etc.

3. Apply THREE BOND 1217G to both sides of a new cylinder head gasket NO. 2 as shown in the figure.

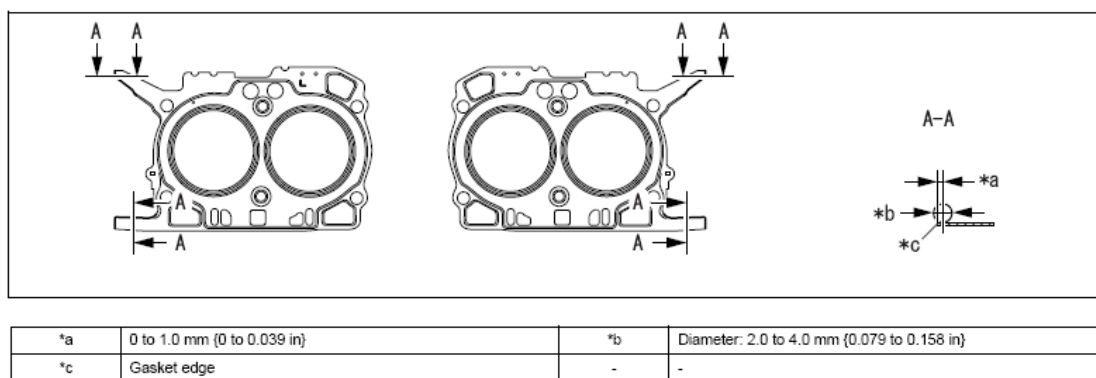


Fig. 84: Identifying Three Bond 1217G Applying Area On Cylinder Head Gasket
 Courtesy of SUBARU OF AMERICA, INC.

- CAUTION:**
- Clean and degrease the installation surface.
 - Install within 5 min. after applying liquid gasket.

4. Install the cylinder head gasket NO. 2.
2. Cylinder head LH installation
 1. Clean the cylinder head bolt threads and apply sufficient engine oil to the washer and cylinder head bolts threads.
 2. Set the cylinder block (bank 2 side) on the cylinder head LH.
 3. Tighten the six cylinder head bolts in the order as shown in the figure.

Standard value: T=20N.m {204kgf.cm} {14.8ft.lbf}

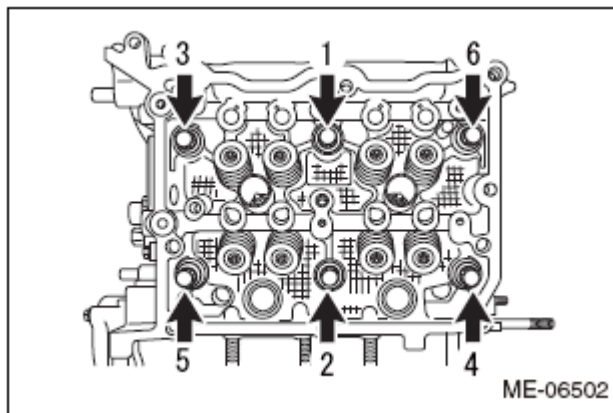


Fig. 85: Identifying Cylinder Head LH Mounting Bolts With Tightening Sequence
Courtesy of SUBARU OF AMERICA, INC.

4. Retighten the six cylinder head bolts in the same order.

Standard value: T=100N.m {102kgf.cm} {73.8ft.lbf}

CAUTION: If the bolt makes stick-slip sound during tightening, clean the bolt holes and installation surface, dry them completely, and then repeat the steps from the application of seal gasket.

NOTE: When repeating the steps, the cylinder head gasket can be reused.

5. Loosen the six cylinder head bolts by 360° in the order as shown in the figure.

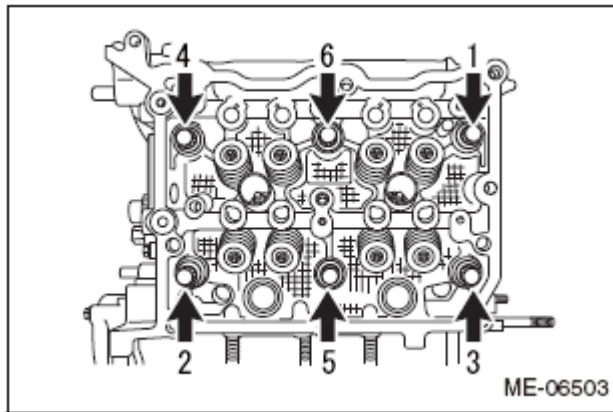


Fig. 86: Identifying Cylinder Head Mounting Bolts With Loosening Sequence
Courtesy of SUBARU OF AMERICA, INC.

6. Tighten the six cylinder head bolts in the order as shown in the figure.

Standard value: T=20N.m {204kgf.cm} {14.8ft.lbf}

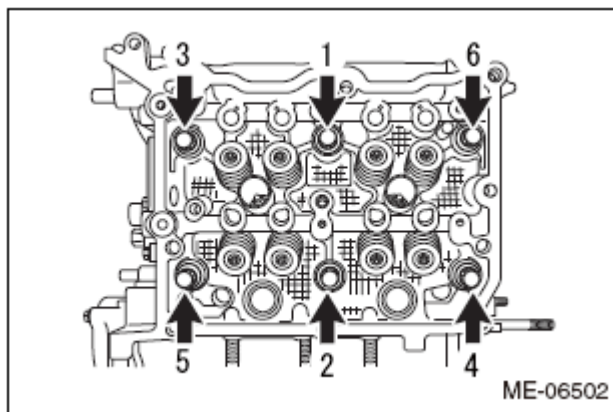


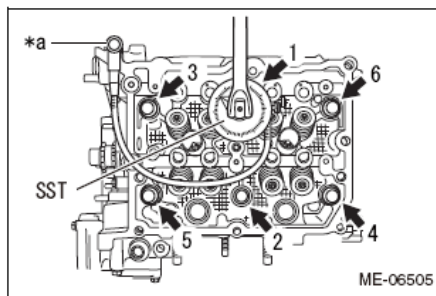
Fig. 87: Identifying Cylinder Head Mounting Bolts With Tightening Sequence
Courtesy of SUBARU OF AMERICA, INC.

7. Retighten the six cylinder head bolts in the same order.

Standard value: T=42N.m {428kgf.cm} {31.0ft.lbf}

8. Retighten the six cylinder head bolts by 100° using the SST in the order as shown in the figure.

SST 18854AA000



*a	Temporary bolt
----	----------------

Fig. 88: Tightening Cylinder Head Bolts Using SST
Courtesy of SUBARU OF AMERICA, INC.

NOTE: Install a temporary bolt to secure the SST as required.

9. Retighten the two cylinder head bolts by 100° using the SST in the order as shown in the figure.

SST 18854AA000

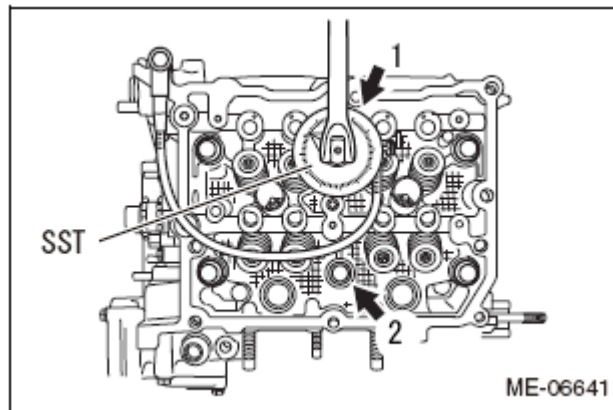


Fig. 89: Tightening Cylinder Head Bolts Using SST
Courtesy of SUBARU OF AMERICA, INC.

10. Retighten the four cylinder head bolts by 50° using the SST in the order as shown in the figure.

SST 18854AA000

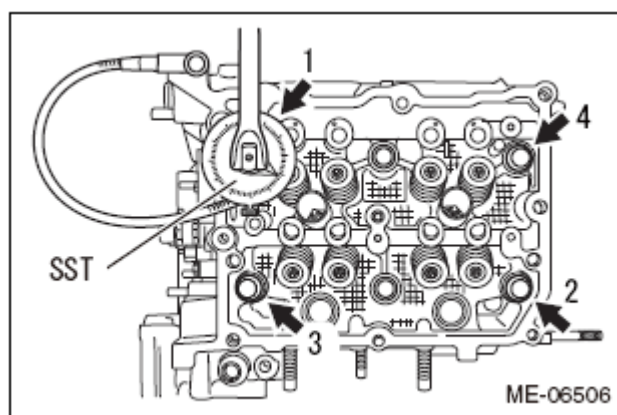


Fig. 90: Tightening Cylinder Head Bolts Using SST
Courtesy of SUBARU OF AMERICA, INC.

3. Camshaft housing SUB-ASSY LH installation

(Refer to **INSTALLATION**)

4. Cylinder head gasket installation

1. Operate the engine stand, and make the bank 1 side face upward.
2. Clean the bolt holes in the cylinder block (block 1 side).

CAUTION: To avoid erroneous tightening of the bolts, clean out the bolt holes sufficiently by blowing with compressed air to eliminate engine coolant etc.

3. Apply THREE BOND 1217G to both sides of a new cylinder head gasket as shown in the figure.

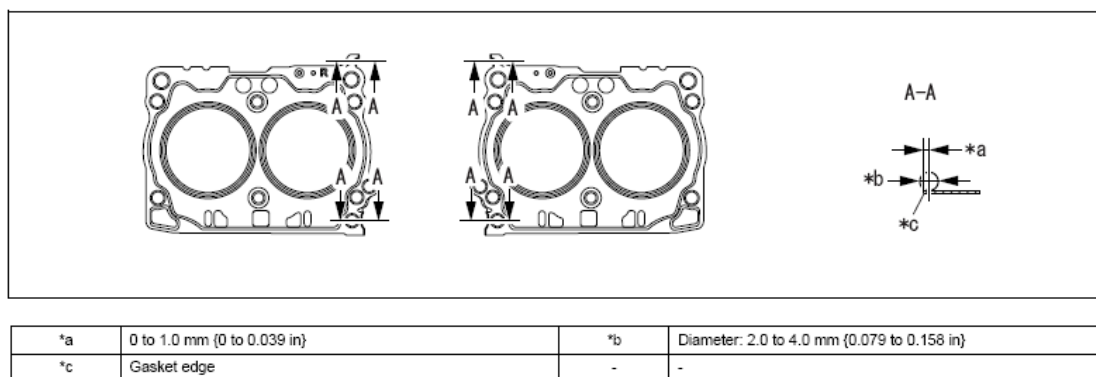


Fig. 91: Identifying Three Bond 1217G Applying Area On Cylinder Head Gasket
Courtesy of SUBARU OF AMERICA, INC.

CAUTION:

- Clean and degrease the installation surface.
- Install within 5 min. after applying liquid gasket.

4. Attach the cylinder head gasket.
5. Cylinder head SUB-ASSY installation
 1. Clean the cylinder head bolt threads and apply sufficient engine oil to the washer and cylinder head bolts threads.
 2. Set the cylinder block (bank 1 side) on the cylinder head SUB-ASSY.
 3. Tighten the six cylinder head bolts in the order as shown in the figure.

Standard value: $T=20\text{N.m}$ {204kgf.cm} {14.8ft.lbf}

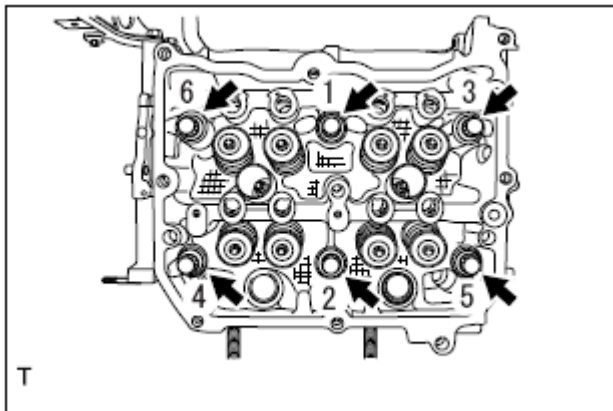


Fig. 92: Identifying Cylinder Head Bolt With Tightening Sequence
Courtesy of SUBARU OF AMERICA, INC.

4. Retighten the six cylinder head bolts in the same order.

Standard value: $T=100\text{N.m}$ {102kgf.cm} {73.8ft.lbf}

CAUTION: If the bolt makes stick-slip sound during tightening, clean the bolt holes and installation surface, dry them completely, and then repeat the steps from the application of seal gasket.

NOTE: When repeating the steps, the cylinder head gasket can be reused.

5. Loosen the six cylinder head bolts by 360° in the order as shown in the figure.

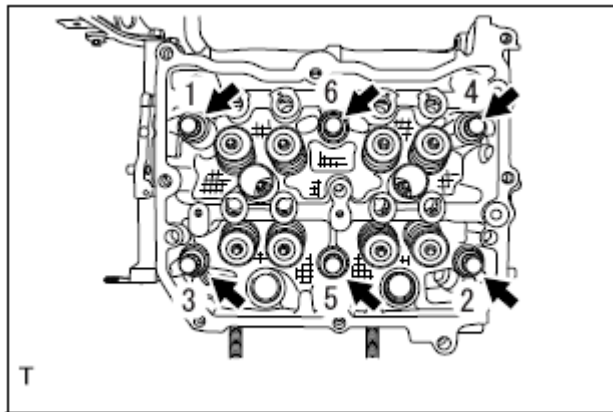


Fig. 93: Identifying Cylinder Head Bolt With Loosening Sequence
 Courtesy of SUBARU OF AMERICA, INC.

6. Tighten the six cylinder head bolts in the order as shown in the figure.

Standard value: T=20N.m {204kgf.cm} {14.8ft.lbf}

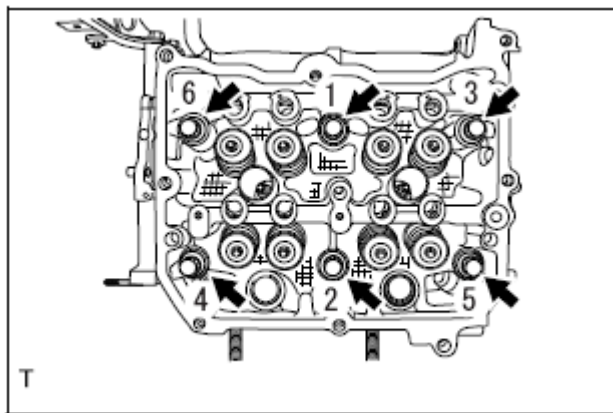


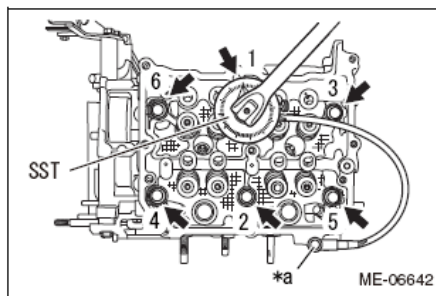
Fig. 94: Identifying Cylinder Head Bolt With Tightening Sequence
 Courtesy of SUBARU OF AMERICA, INC.

7. Retighten the six cylinder head bolts in the same order.

Standard value: T=42N.m {428kgf.cm} {31.0ft.lbf}

8. Retighten the six cylinder head bolts by 100° using the SST in the order as shown in the figure.

SST 18854AA000



*a	Temporary bolt
----	----------------

Fig. 95: Tightening Cylinder Head Bolts Using SST
Courtesy of SUBARU OF AMERICA, INC.

NOTE: Install a temporary bolt to secure the SST as required.

9. Retighten the two cylinder head bolts by 100° using the SST in the order as shown in the figure.

SST 18854AA000

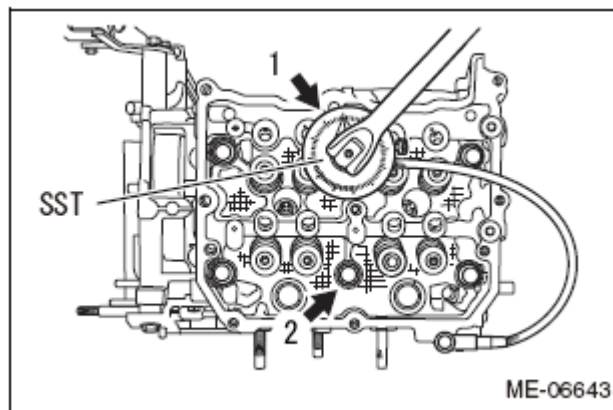


Fig. 96: Tightening Cylinder Head Bolts Using SST
Courtesy of SUBARU OF AMERICA, INC.

10. Retighten the four cylinder head bolts by 50° using the SST in the order as shown in the figure.

SST 18854AA000

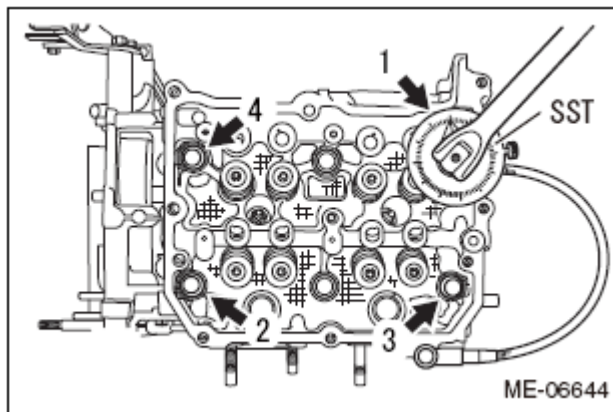


Fig. 97: Tightening Cylinder Head Bolts Using SST
 Courtesy of SUBARU OF AMERICA, INC.

6. Camshaft housing SUB-ASSY RH installation

(Refer to INSTALLATION)

TIMING CHAIN COVER OIL SEAL (FA20)

COMPONENTS

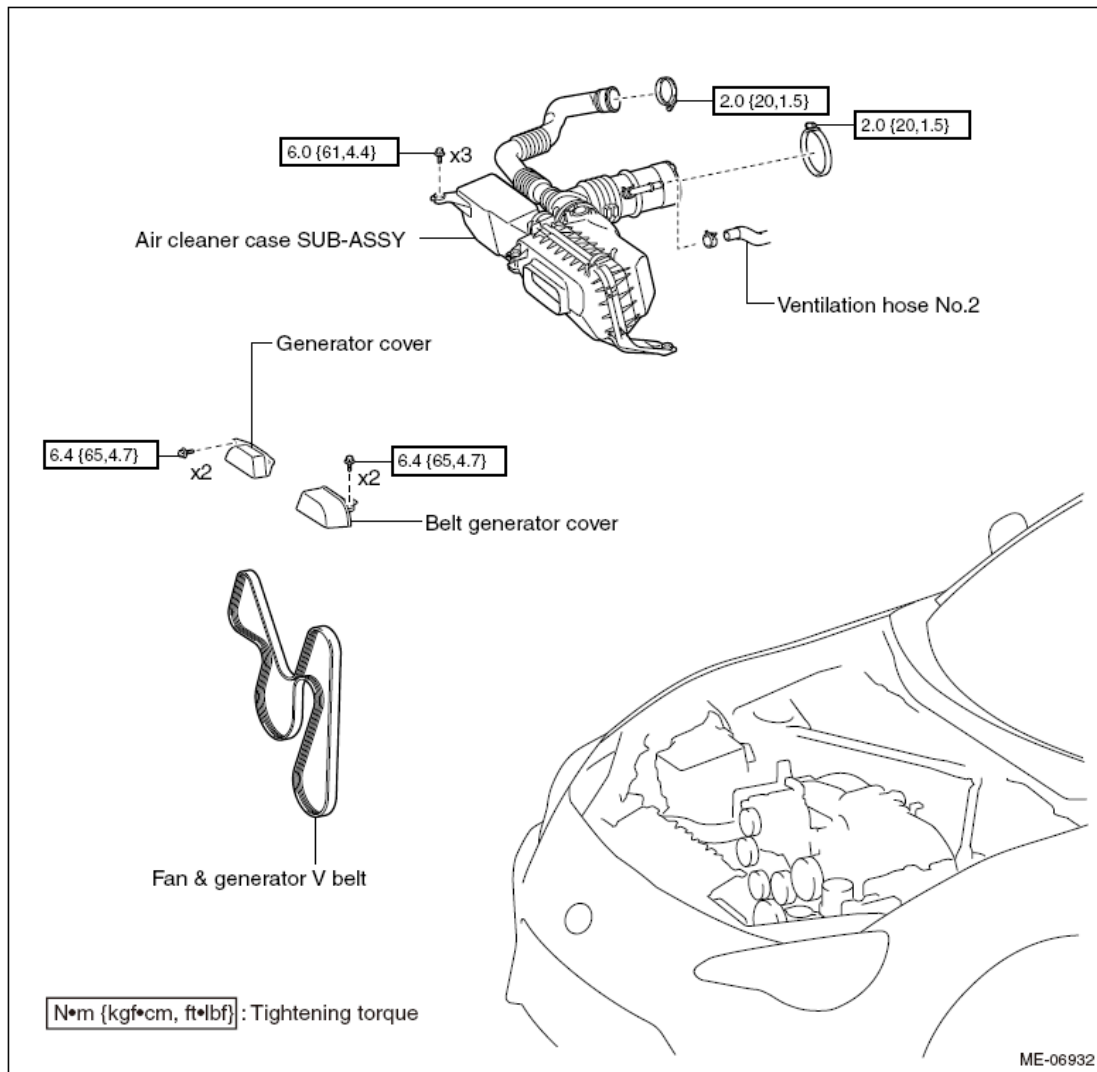


Fig. 98: Identifying Timing Chain Cover Oil Seal (FA20) Components With Torque Specifications (1 Of 2)

Courtesy of SUBARU OF AMERICA, INC.

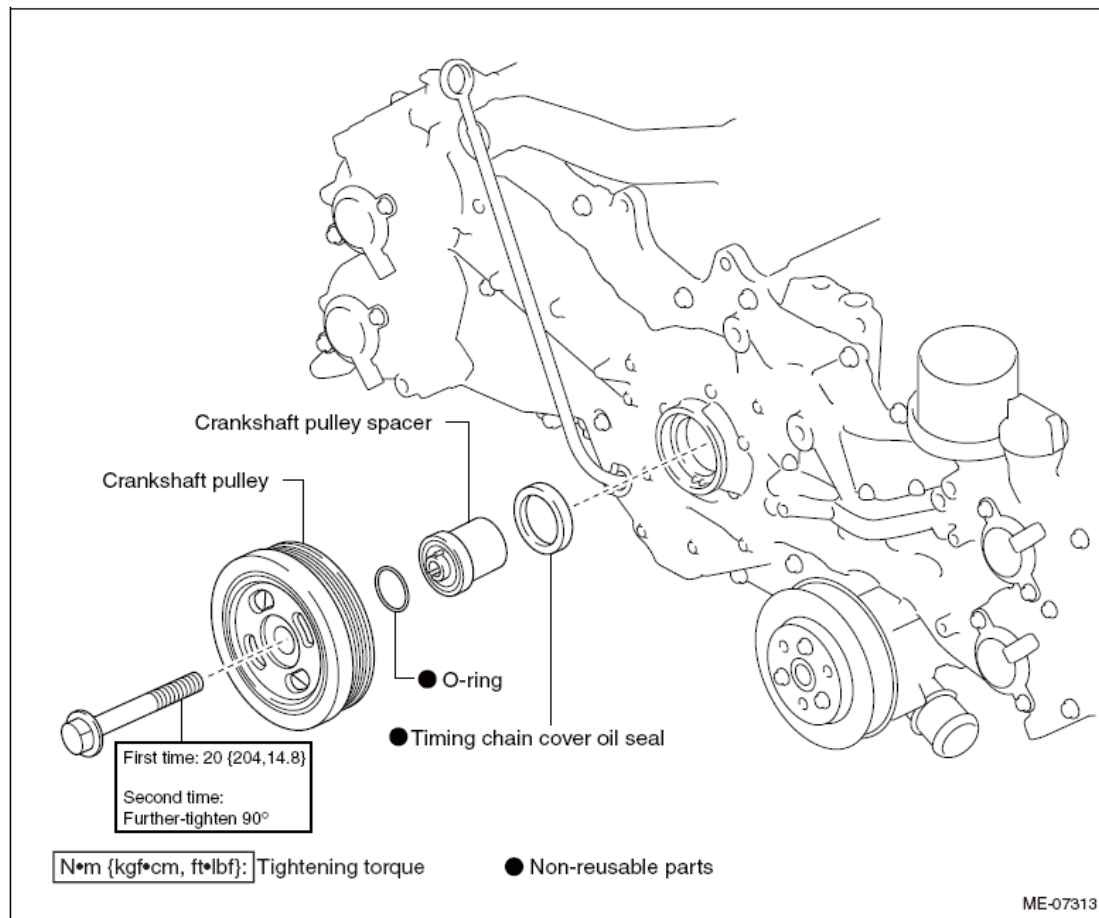


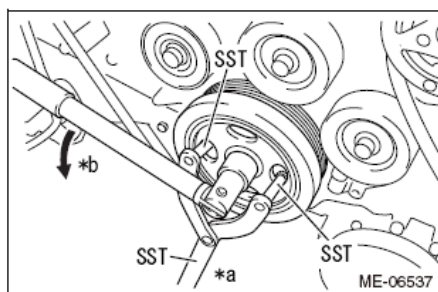
Fig. 99: Identifying Timing Chain Cover Oil Seal (FA20) Components With Torque Specifications (2 Of 2)

Courtesy of SUBARU OF AMERICA, INC.

REMOVAL

1. Air cleaner case SUB-ASSY removal (Refer to **REMOVAL**)
2. Generator cover removal (Refer to **REMOVAL**)
3. Belt generator cover removal (Refer to **REMOVAL**)
4. Fan & generator V-belt removal (Refer to **REMOVAL**)
5. Crankshaft pulley removal
 1. Use the SST to secure the crankshaft pulley.

SST 18355AA000, 18334AA000



*a	Hold
*b	Drive

Fig. 100: Removing Crankshaft Pulley Using Special Tool
Courtesy of SUBARU OF AMERICA, INC.

2. Remove the crankshaft pulley set bolt to remove the crankshaft pulley.
3. Remove the O-ring from the crankshaft pulley spacer.
4. Remove the crankshaft pulley spacer.

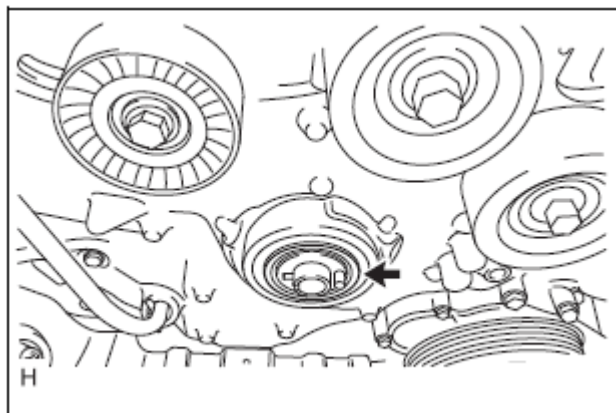
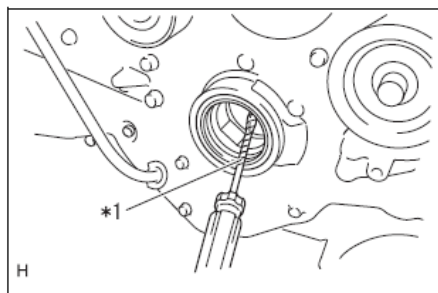


Fig. 101: Identifying Crankshaft Pulley Spacer
Courtesy of SUBARU OF AMERICA, INC.

6. Timing chain cover oil seal removal
 1. Using a flat tip screwdriver wrapped with protective tape, remove the timing chain cover oil seal.



*1	Protective tape
----	-----------------

Fig. 102: Removing Timing Chain Cover Oil Seal Using Flat Tip Screwdriver
Courtesy of SUBARU OF AMERICA, INC.

CAUTION: Make sure that there are no scratches in the fitting area of crankshaft and timing chain cover oil seal.

NOTE: If the crankshaft is scratched, repair it with sandpaper (# 400).

INSTALLATION

1. Timing chain cover SUB-ASSY installation

1. Apply a thin coat of engine oil to the inner and outer peripheries of a new oil seal.

CAUTION:

- Do not let foreign matter get on the lip.
- Do not let engine get on the dust seal.

2. Use the SST to drive in the timing chain cover oil seal equally until it is flush with the end surface of timing chain cover SUB-ASSY.

SST 398437700

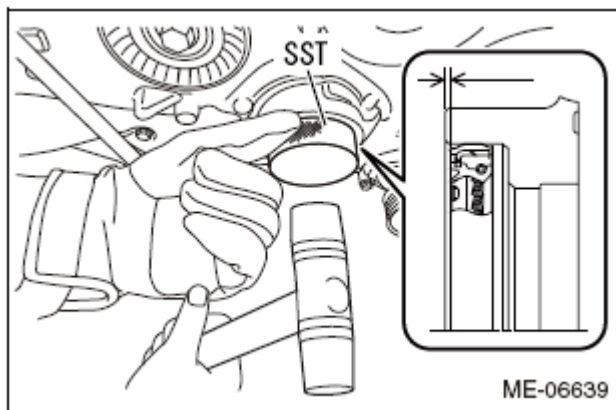


Fig. 103: Installing Timing Chain Cover Sub-Assembly
Courtesy of SUBARU OF AMERICA, INC.

CAUTION:

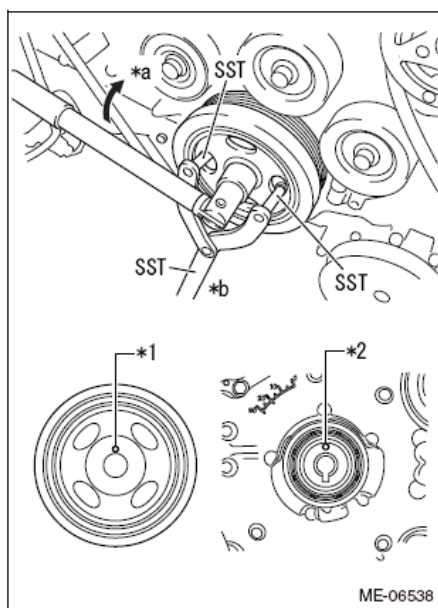
- Do not drive in the oil seal at an angle.
- Do not deform the oil seal.

NOTE: The driving distance of timing chain cover oil seal may be in a range of 0 to 1.0 mm {0 to 0.039 in} from the end surface of timing chain cover SUB-ASSY.

2. Crankshaft pulley installation

1. Install the crankshaft pulley spacer.
2. Install a new O-ring to the crankshaft pulley spacer.

3. Install the crankshaft pulley while aligning its knock hole to the knock pin of crankshaft pulley spacer.



*1	Knock hole
*2	Knock pin
*a	Drive
*b	Hold

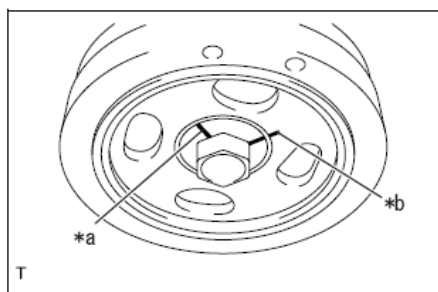
Fig. 104: Installing Crankshaft Pulley Using SST
Courtesy of SUBARU OF AMERICA, INC.

4. Apply engine oil to the thread and washer of crankshaft pulley set bolt.
5. Use the SST to secure the crankshaft pulley and tighten the crankshaft pulley set bolt.

SST 18355AA000, 18334AA000

Standard value: T=20N.m {204kgf.cm} {14.8ft.lbf}

6. Draw a reference line (A) on the crankshaft pulley set bolt and end line (B) on the crankshaft pulley according to the engraved lines on the bolt using a marker as shown in the figure.



*a	Reference line (A)
*b	End line (B)

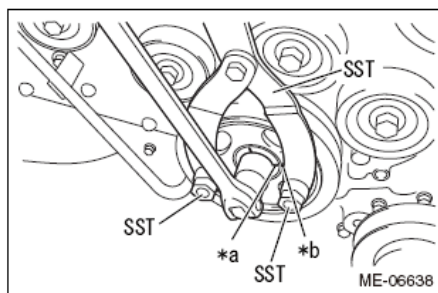
Fig. 105: Identifying Crankshaft Pulley Reference Line And End Line
Courtesy of SUBARU OF AMERICA, INC.

NOTE: There are engraved lines on the head of crankshaft pulley set bolt

every 90°.

7. Use the SST to secure the crankshaft pulley and retighten the crankshaft pulley bolt by 90° until the reference line (A) and end line (B) are aligned.

SST 18355AA000, 18334AA000



*a	Reference line (A)
*b	End line (B)

Fig. 106: Tightening Crankshaft Pulley Bolt Using SST
Courtesy of SUBARU OF AMERICA, INC.

3. Fan & generator V-belt installation (Refer to **INSTALLATION**)
4. Belt generator cover installation (Refer to **INSTALLATION**)
5. Generator cover installation (Refer to **INSTALLATION**)
6. Air cleaner case SUB-ASSY installation (Refer to **INSTALLATION**)

ENGINE REAR OIL SEAL (FA20)

COMPONENTS

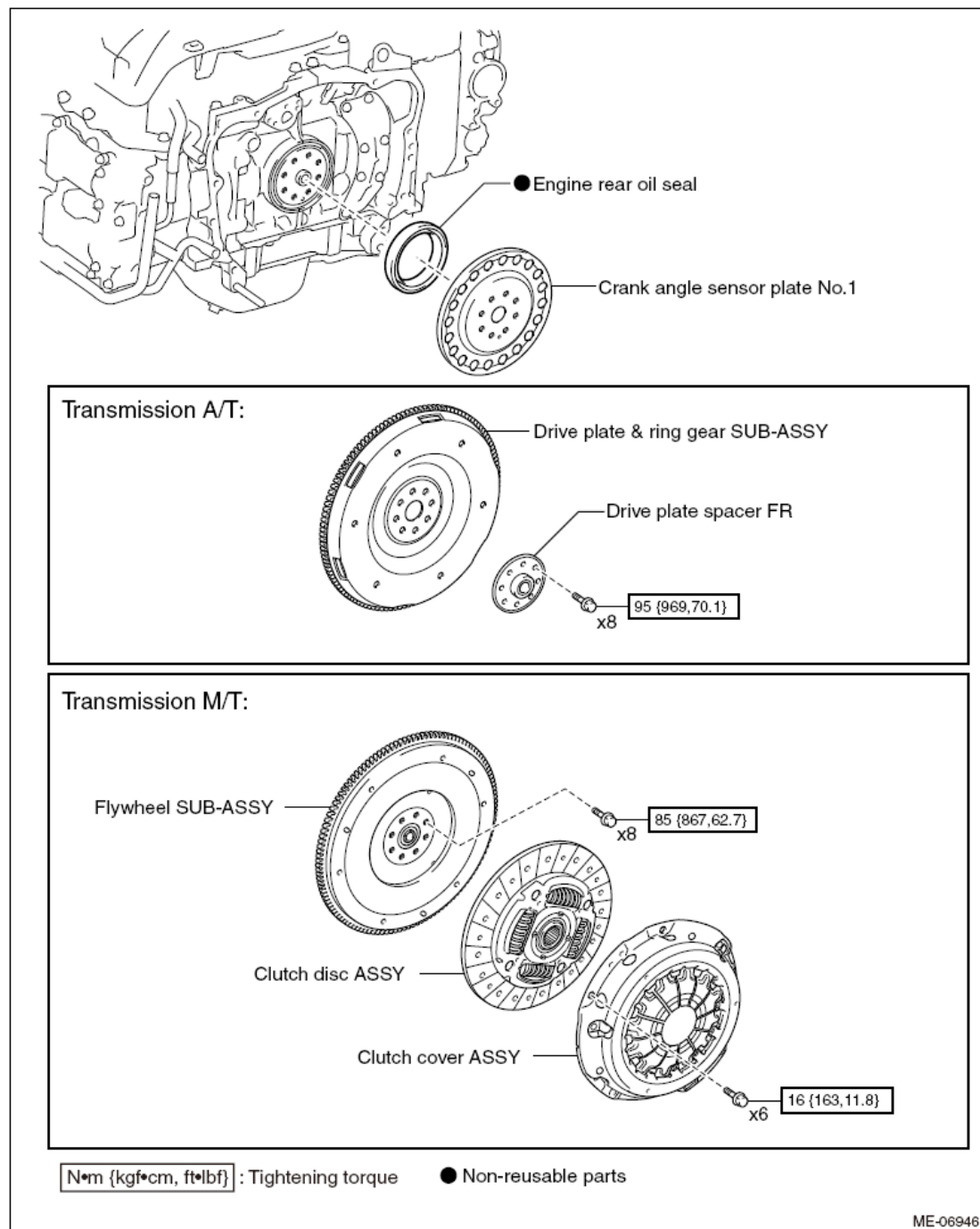


Fig. 107: Identifying Engine Rear Oil Seal (FA20) Components With Torque Specifications
 Courtesy of SUBARU OF AMERICA, INC.

REMOVAL

1. Automatic transmission ASSY removal (transmission A/T)

(Refer to **REMOVAL**)

2. Manual transmission ASSY removal (transmission M/T)

(Refer to **REMOVAL**)

3. Drive plate & ring gear SUB-ASSY removal (transmission A/T)

1. Use the SST to secure the crankshaft pulley.

SST 18355AA000, 18334AA000

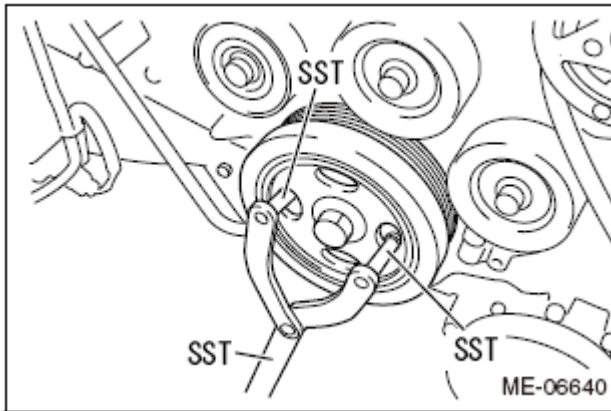


Fig. 108: Securing Crankshaft Pulley Using SST
Courtesy of SUBARU OF AMERICA, INC.

2. Remove the eight bolts to remove the drive plate spacer FR and drive plate & ring gear SUB-ASSY.

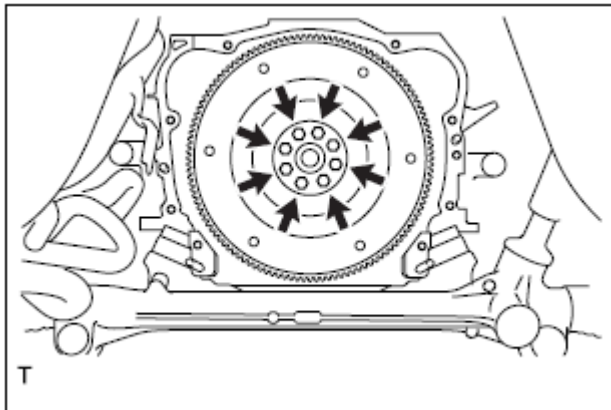


Fig. 109: Identifying Drive Plate Spacer FR And Drive Plate And Ring Gear Sub-Assembly Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

4. Clutch cover ASSY removal (transmission M/T) (Refer to **REMOVAL**)
5. Clutch disc ASSY removal (transmission M/T) (Refer to **REMOVAL**)

6. Flywheel SUB-ASSY removal (transmission M/T)

1. Use the SST to secure the crankshaft pulley.

SST 18355AA000, 18334AA000

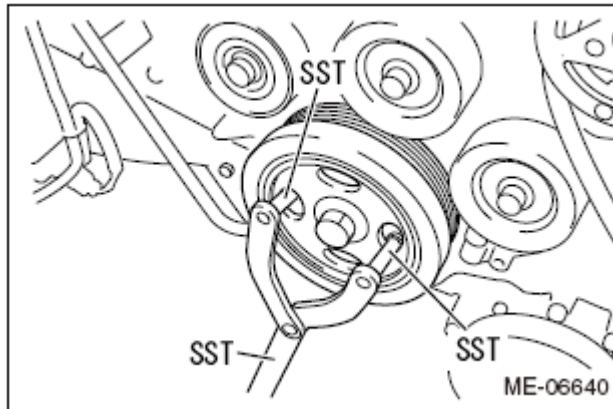


Fig. 110: Securing Crankshaft Pulley Using SST
Courtesy of SUBARU OF AMERICA, INC.

2. Remove the eight bolts and remove the flywheel SUB-ASSY.

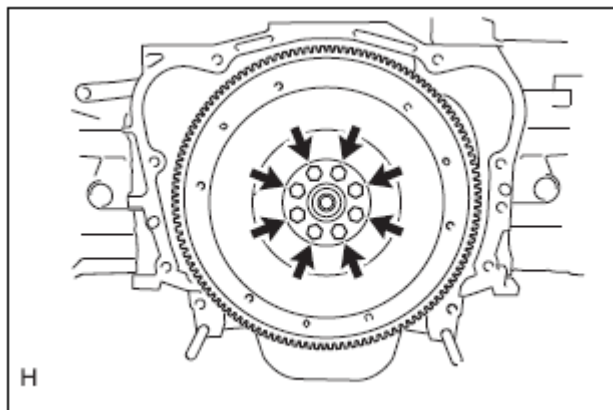


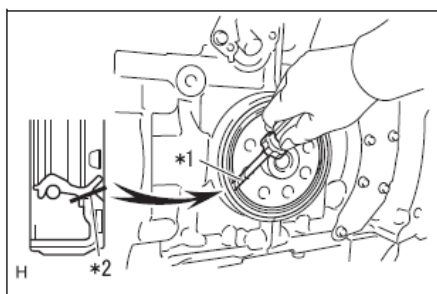
Fig. 111: Identifying Flywheel Sub-Assembly Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

7. Crank angle sensor plate NO. 1 removal

1. Remove the crank angle sensor plate NO. 1.

8. Engine rear oil seal removal

1. Make a slit to the oil seal lip using a cutter knife.



*1	Protective tape
*2	Cut line

Fig. 112: Removing Engine Rear Oil Seal Using Cutter Knife
Courtesy of SUBARU OF AMERICA, INC.

2. Remove the oil seal using a flat tip screwdriver wrapped with protective tape.

CAUTION: Make sure that there are no scratches in the fitting area of crankshaft and rear oil seal retainer.

NOTE: If the crankshaft is scratched, repair it with sandpaper (# 400).

INSTALLATION

1. Engine rear oil seal installation
 1. Apply a thin coat of engine oil to the inner and outer peripheries of a new engine rear oil seal.
 2. Use the SST to drive in the engine rear oil seal equally until it is aligned to the end surface of cylinder block.

SST 18671AA020, 18657AA030

- CAUTION:**
- Do not drive in the engine rear oil seal at an angle.
 - Do not deform the engine rear oil seal.
 - Do not drive in the engine rear oil seal excessively.

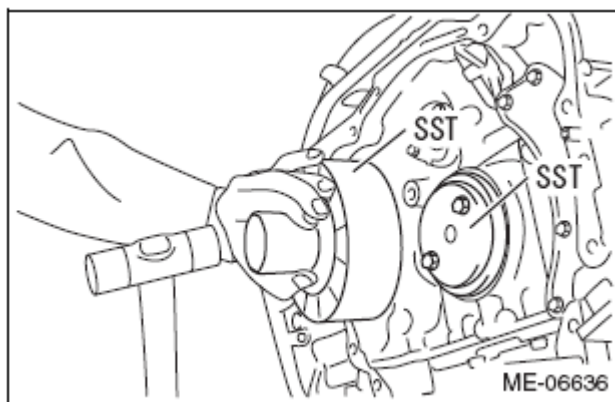
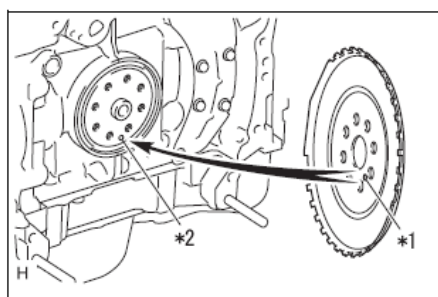


Fig. 113: Installing Engine Rear Oil Seal
Courtesy of SUBARU OF AMERICA, INC.

NOTE: The driving distance of engine rear oil seal may be in a range of 0 to 1.0 mm {0 to 0.039 in} from the end surface of cylinder block.

2. Crank angle sensor plate NO. 1 installation

1. Install the crankshaft angle sensor plate NO. 1 by aligning the pin hole of the crankshaft and the pin of crankshaft angle sensor plate NO. 1.



*1	Pin hole
*2	Pin

Fig. 114: Identifying Crank Angle Sensor Plate No. 1 Pin Hole And Pin
Courtesy of SUBARU OF AMERICA, INC.

3. Flywheel SUB-ASSY installation (transmission M/T)

1. Temporarily tighten the eight bolts to secure the flywheel SUB-ASSY.
2. Use the SST to secure the crankshaft.

SST 18355AA000, 18334AA000

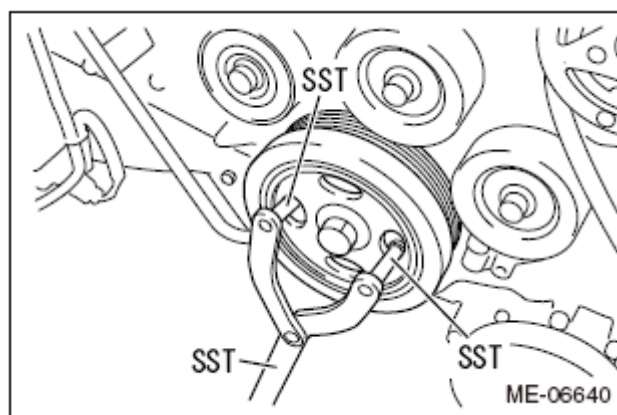


Fig. 115: Securing Crankshaft Pulley Using SST
Courtesy of SUBARU OF AMERICA, INC.

3. Tighten the eight bolts in the order as shown in the figure.

Standard value: T=85N.m {867kgf.cm} {62.7ft.lbf}

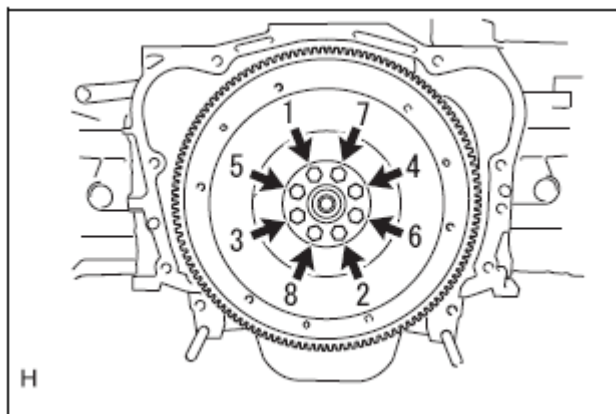


Fig. 116: Identifying Flywheel Sub-Assembly Mounting Bolts With Tightening Sequence
 Courtesy of SUBARU OF AMERICA, INC.

4. Clutch disc ASSY installation (transmission M/T) (Refer to **INSTALLATION**)
5. Clutch cover ASSY installation (transmission M/T) (Refer to **INSTALLATION**)
6. Drive plate & ring gear SUB-ASSY installation (transmission A/T)
 1. Temporarily tighten the eight bolts through the drive plate spacer FR to secure the drive plate & ring gear SUB-ASSY.
 2. Use the SST to secure the crankshaft.

SST 18355AA000, 18334AA000

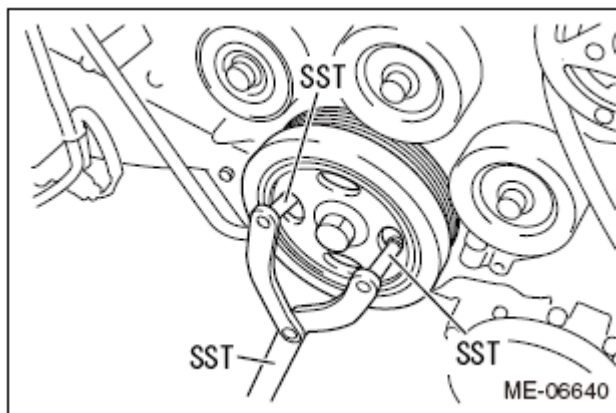


Fig. 117: Securing Crankshaft Pulley Using SST
 Courtesy of SUBARU OF AMERICA, INC.

3. Tighten the eight bolts in the order as shown in the figure.

Standard value: T=95N.m {969kgf.cm} {70.1ft.lbf}

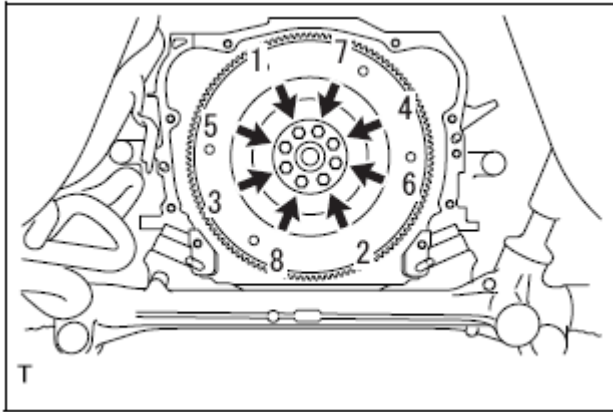


Fig. 118: Identifying Drive Plate Assembly Mounting Bolts With Tightening Sequence
Courtesy of SUBARU OF AMERICA, INC.

7. Manual transmission ASSY installation (transmission M/T)
(Refer to **INSTALLATION**)
8. Automatic transmission ASSY installation (transmission A/T)
(Refer to **INSTALLATION**)
9. Engine oil leakage check

PARTIAL ENGINE ASSEMBLY (FA20)

COMPONENTS

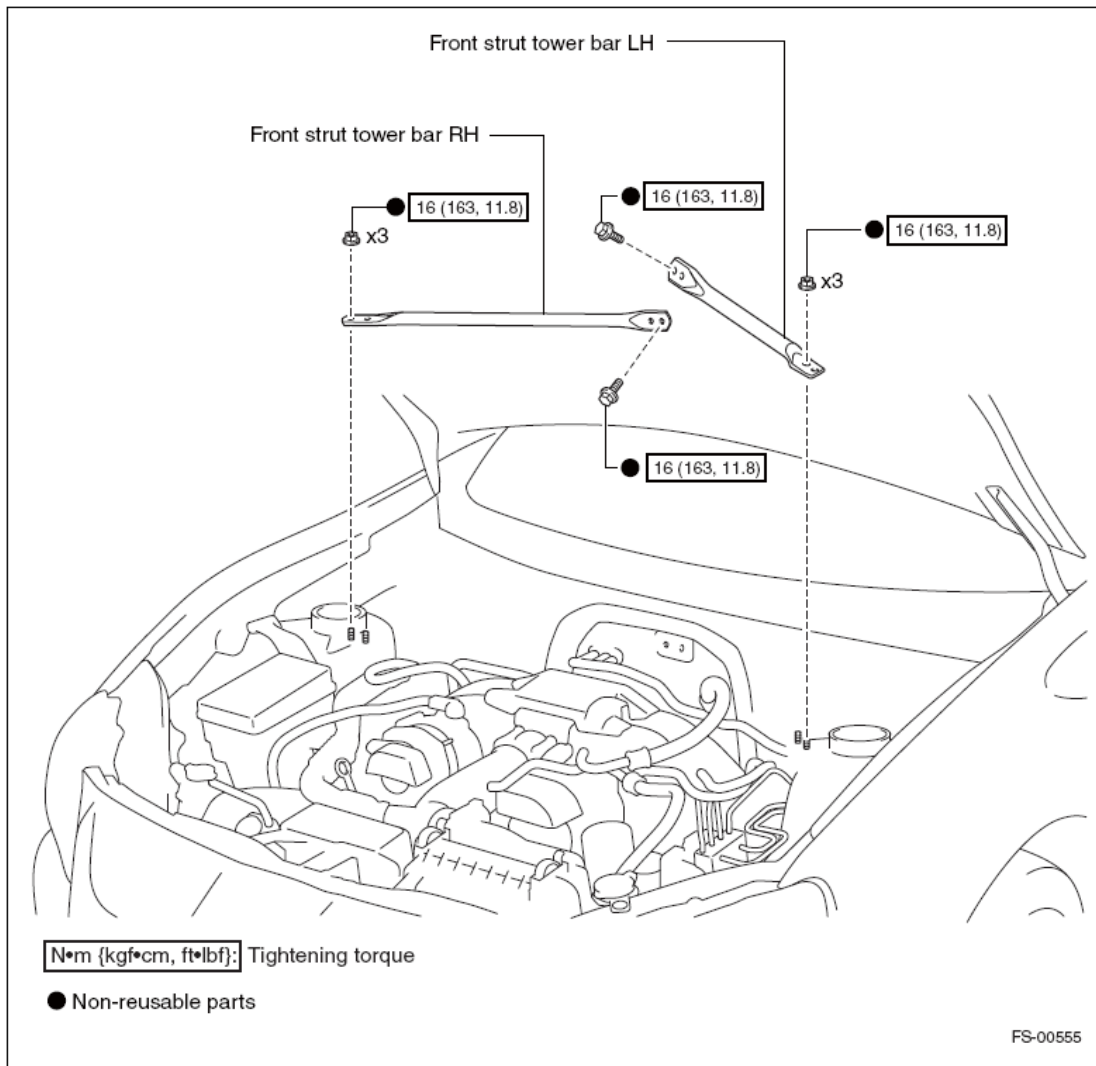


Fig. 119: Identifying Partial Engine Assembly Components With Torque Specifications (FA20) (1 Of 17)
 Courtesy of SUBARU OF AMERICA, INC.

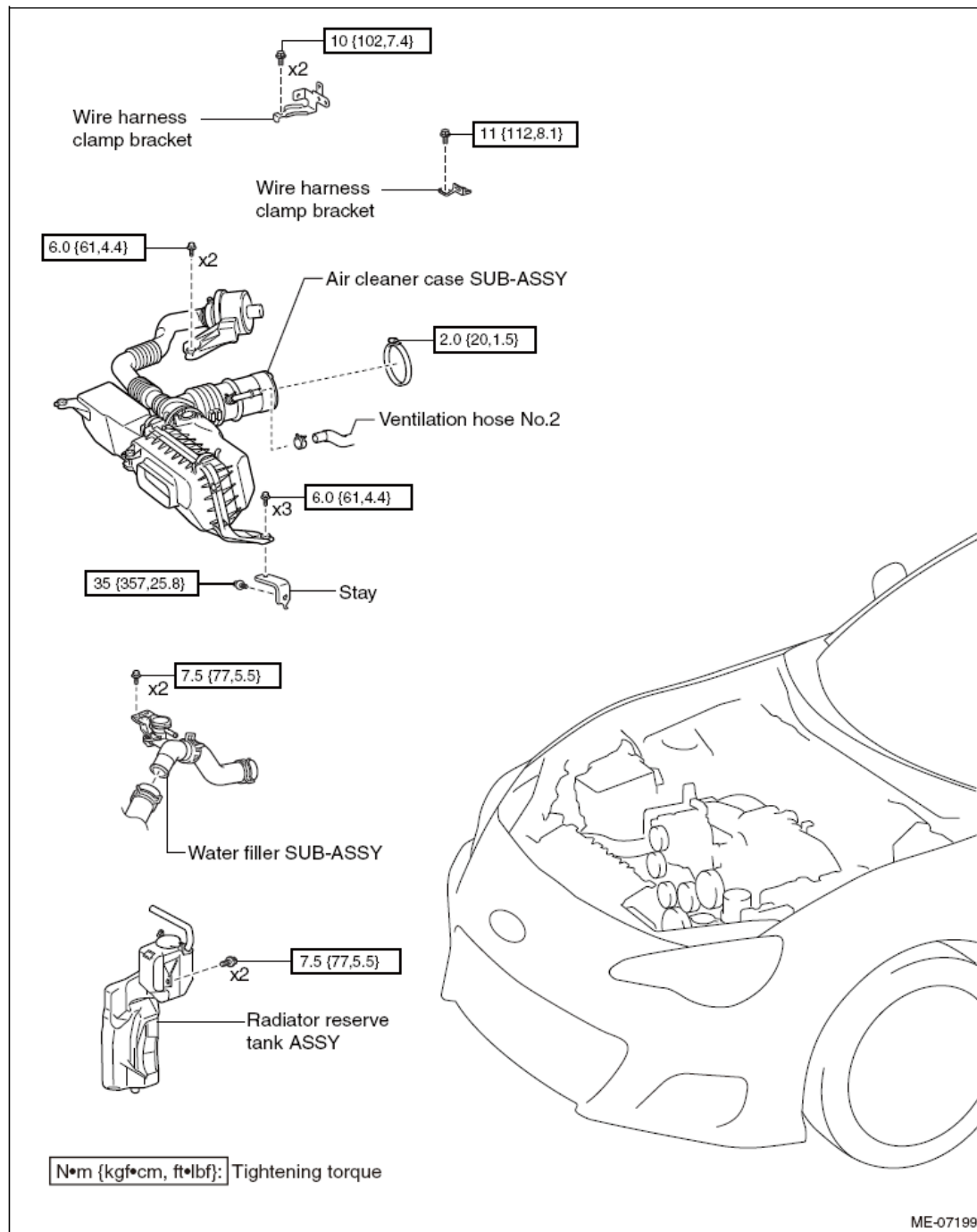


Fig. 120: Identifying Partial Engine Assembly Components With Torque Specifications (FA20) (2 Of 17)
 Courtesy of SUBARU OF AMERICA, INC.

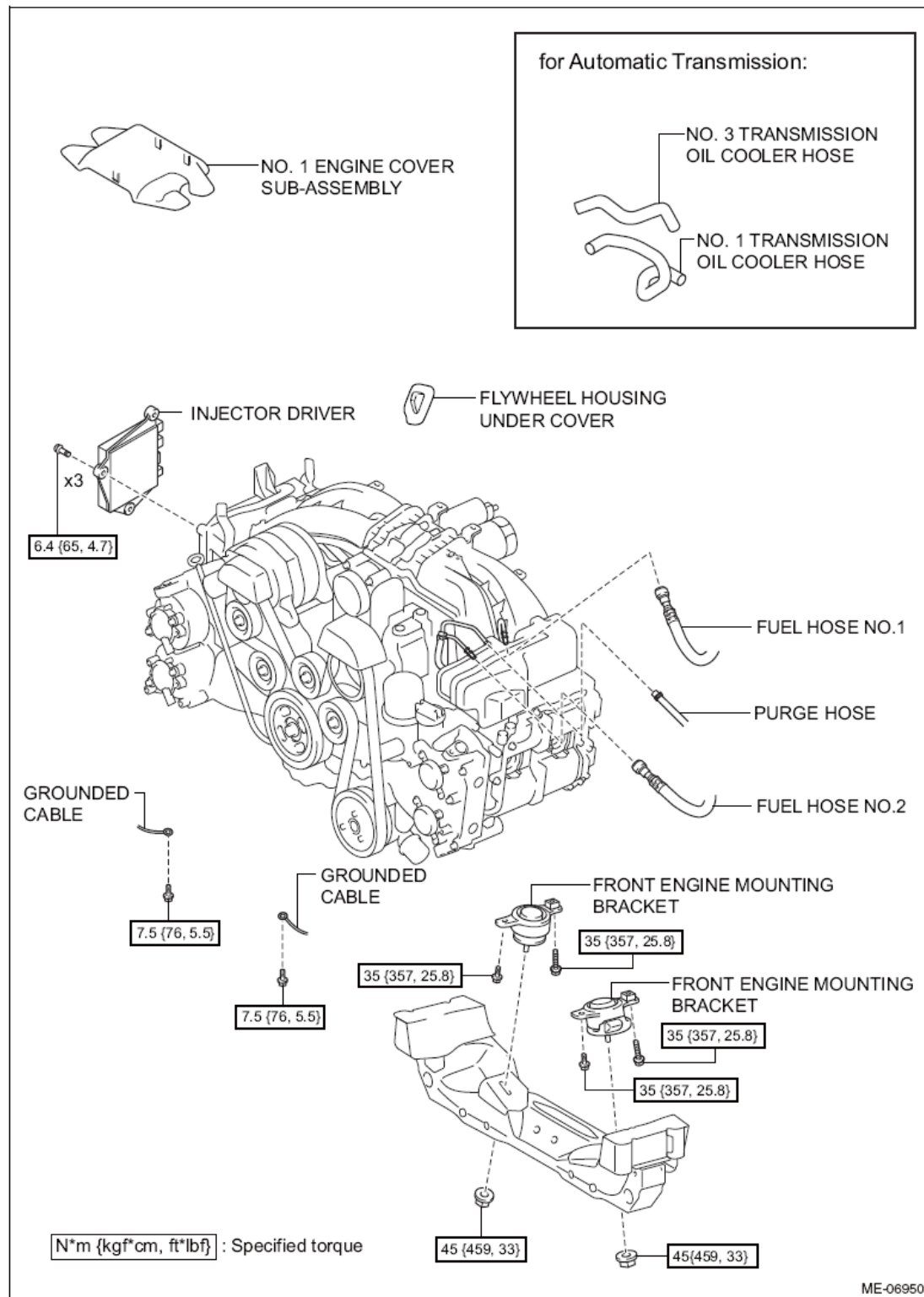


Fig. 121: Identifying Partial Engine Assembly Components With Torque Specifications (FA20) (3 Of 17)
 Courtesy of SUBARU OF AMERICA, INC.

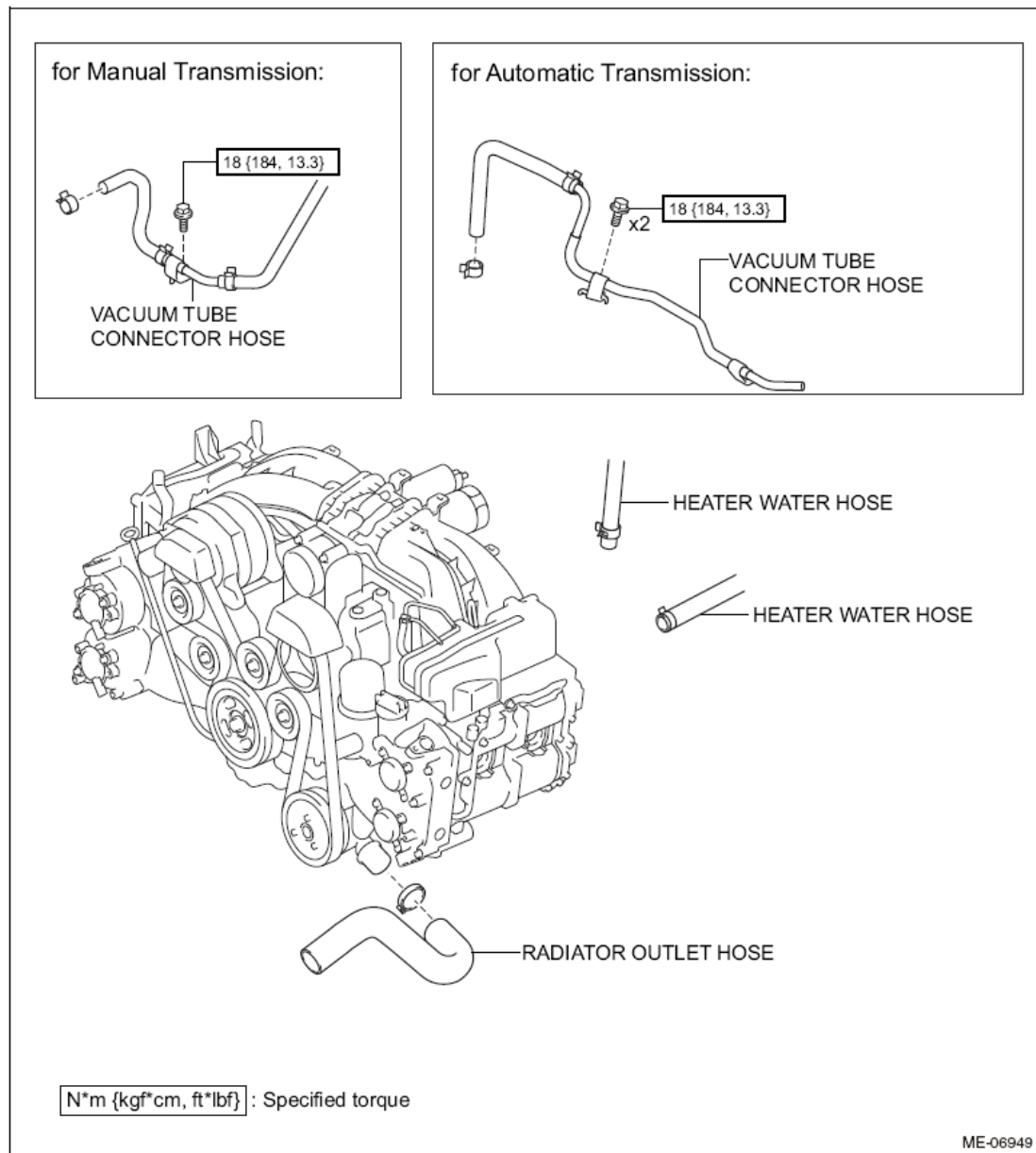


Fig. 122: Identifying Partial Engine Assembly Components With Torque Specifications (FA20) (4 Of 17)
 Courtesy of SUBARU OF AMERICA, INC.

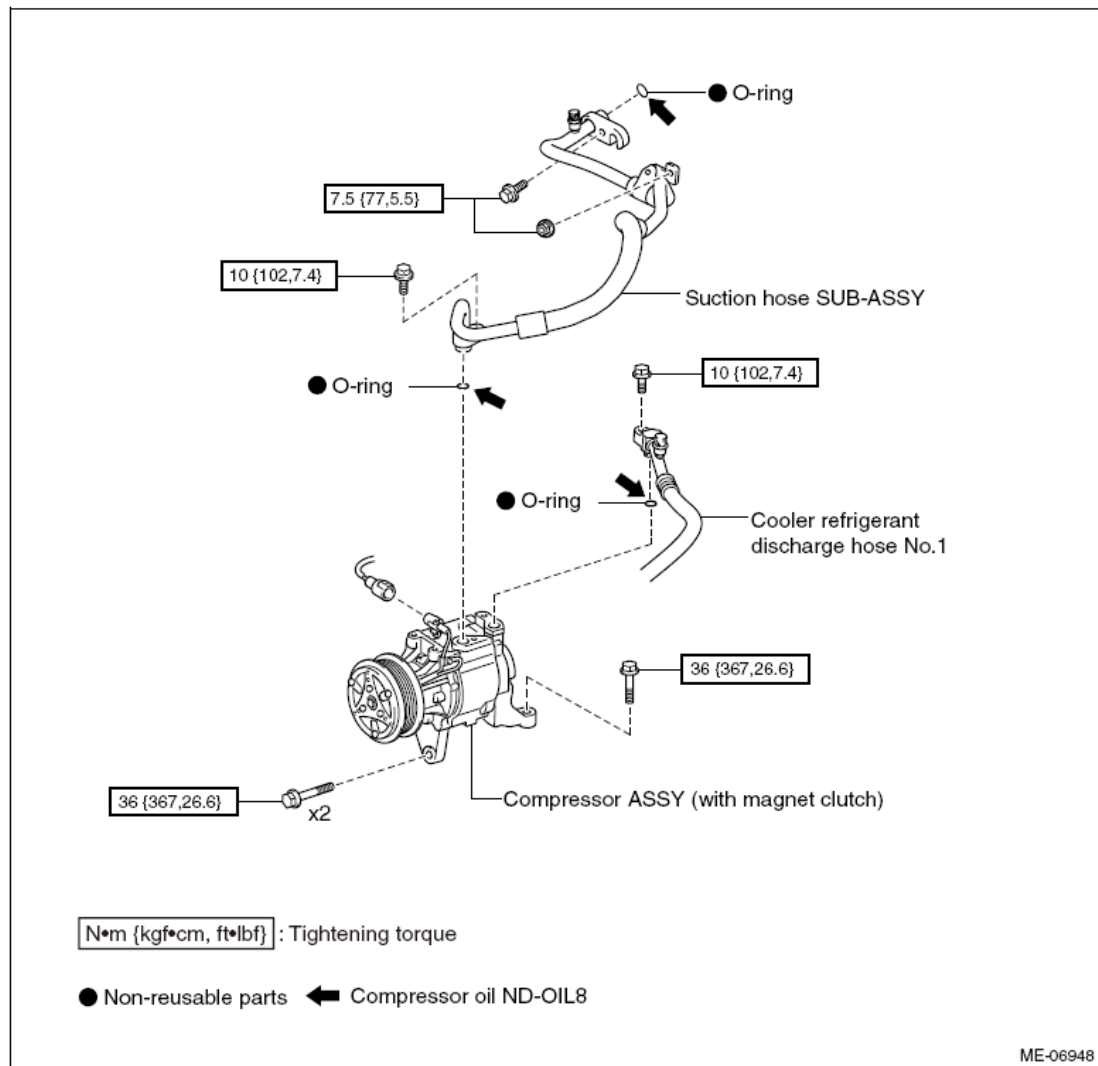


Fig. 123: Identifying Partial Engine Assembly Components With Torque Specifications (FA20) (5 Of 17)
 Courtesy of SUBARU OF AMERICA, INC.

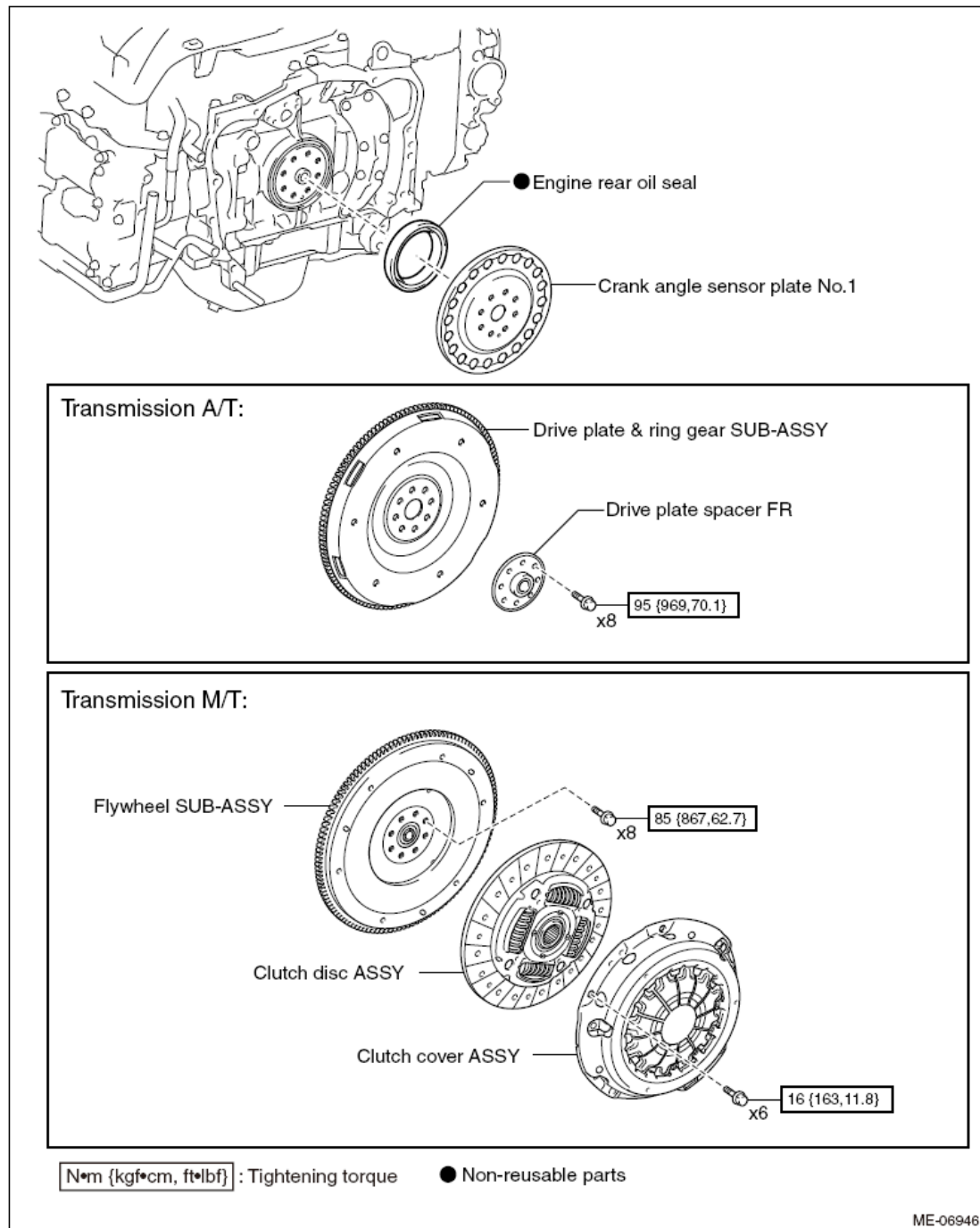
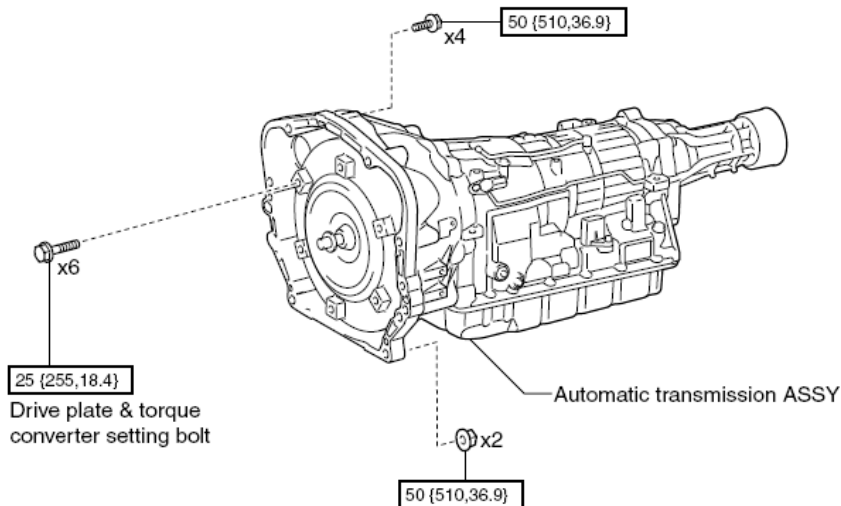
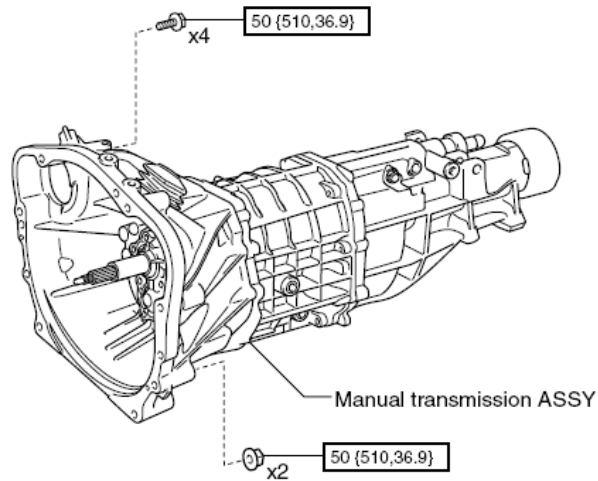


Fig. 124: Identifying Partial Engine Assembly Components With Torque Specifications (FA20) (6 Of 17)
 Courtesy of SUBARU OF AMERICA, INC.

Transmission A/T:



Transmission M/T:



N•m {kgf•cm, ft•lbf} : Tightening torque

ME-06951

Fig. 125: Identifying Partial Engine Assembly Components With Torque Specifications (FA20) (7 Of 17)
 Courtesy of SUBARU OF AMERICA, INC.

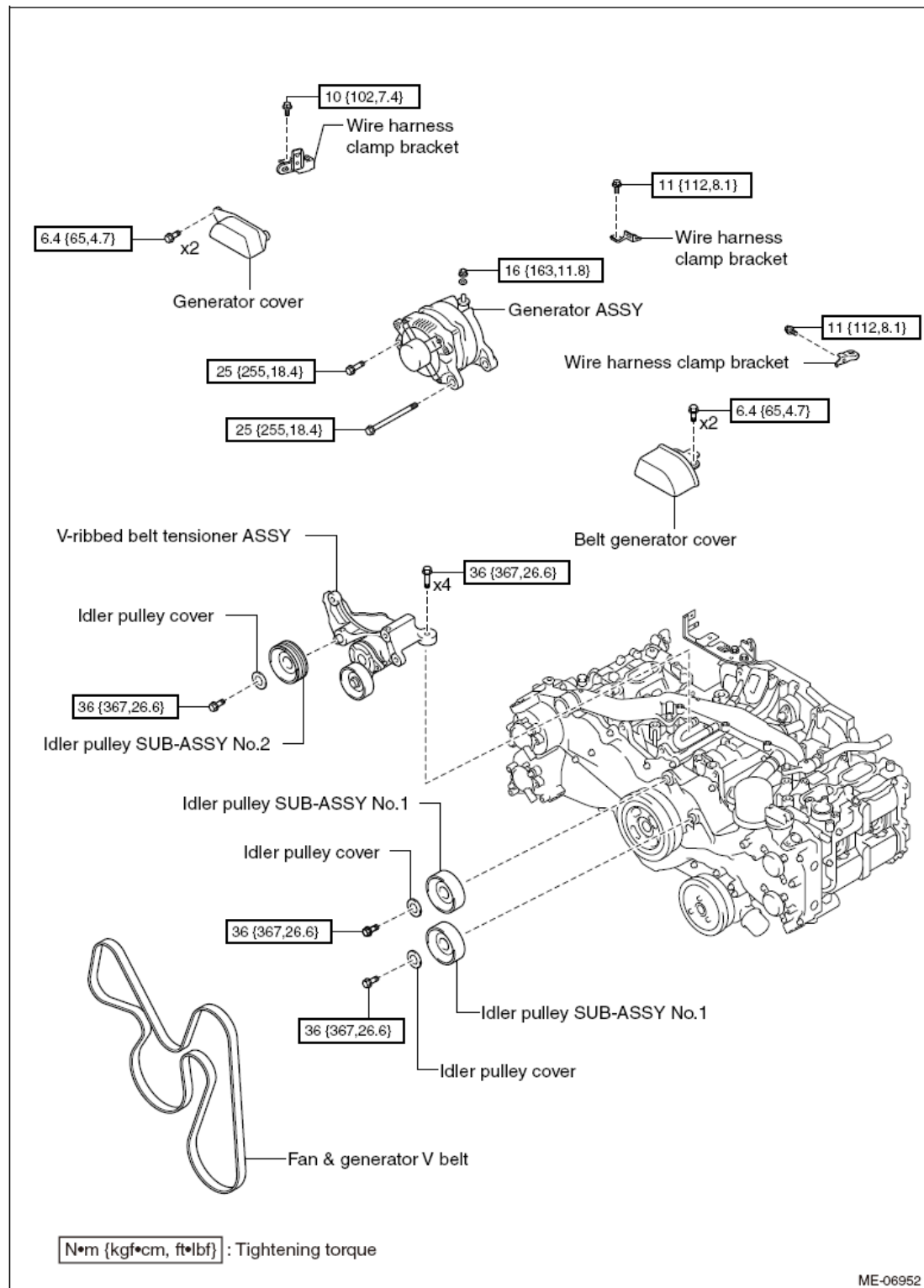


Fig. 126: Identifying Partial Engine Assembly Components With Torque Specifications (FA20) (8 Of 17)
 Courtesy of SUBARU OF AMERICA, INC.

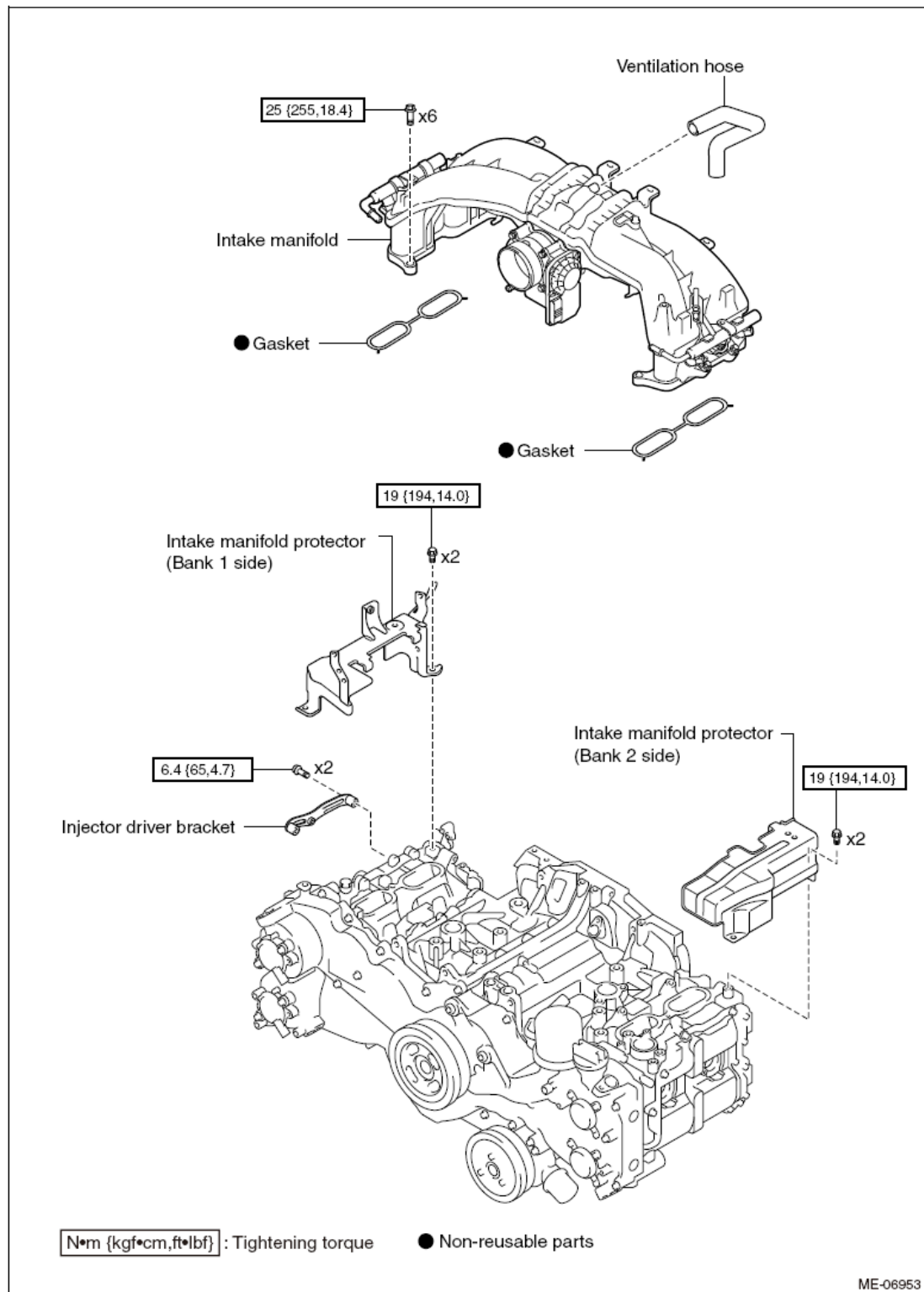


Fig. 127: Identifying Partial Engine Assembly Components With Torque Specifications (FA20) (9 Of 17)
 Courtesy of SUBARU OF AMERICA, INC.

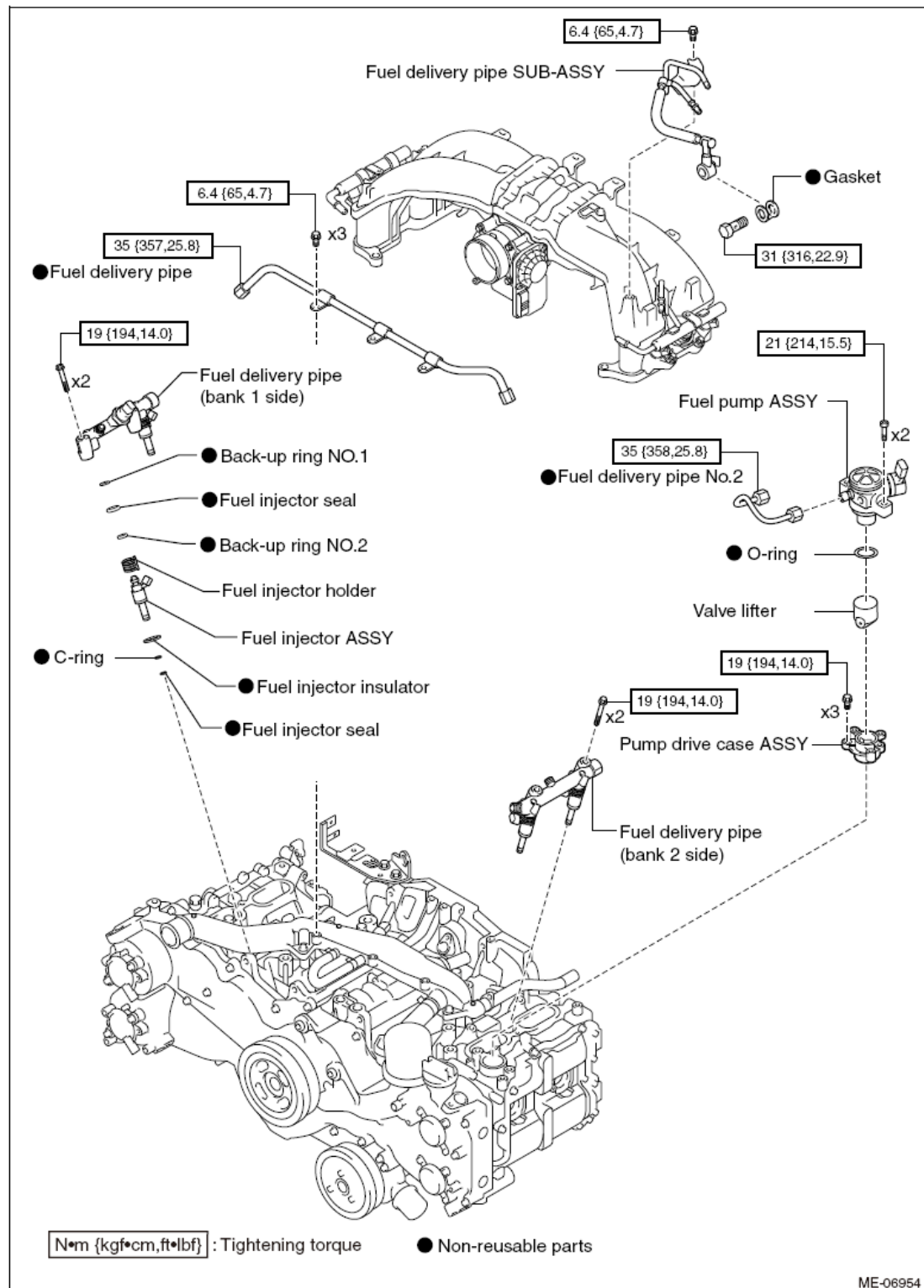


Fig. 128: Identifying Partial Engine Assembly Components With Torque Specifications (FA20) (10 Of 17)
 Courtesy of SUBARU OF AMERICA, INC.

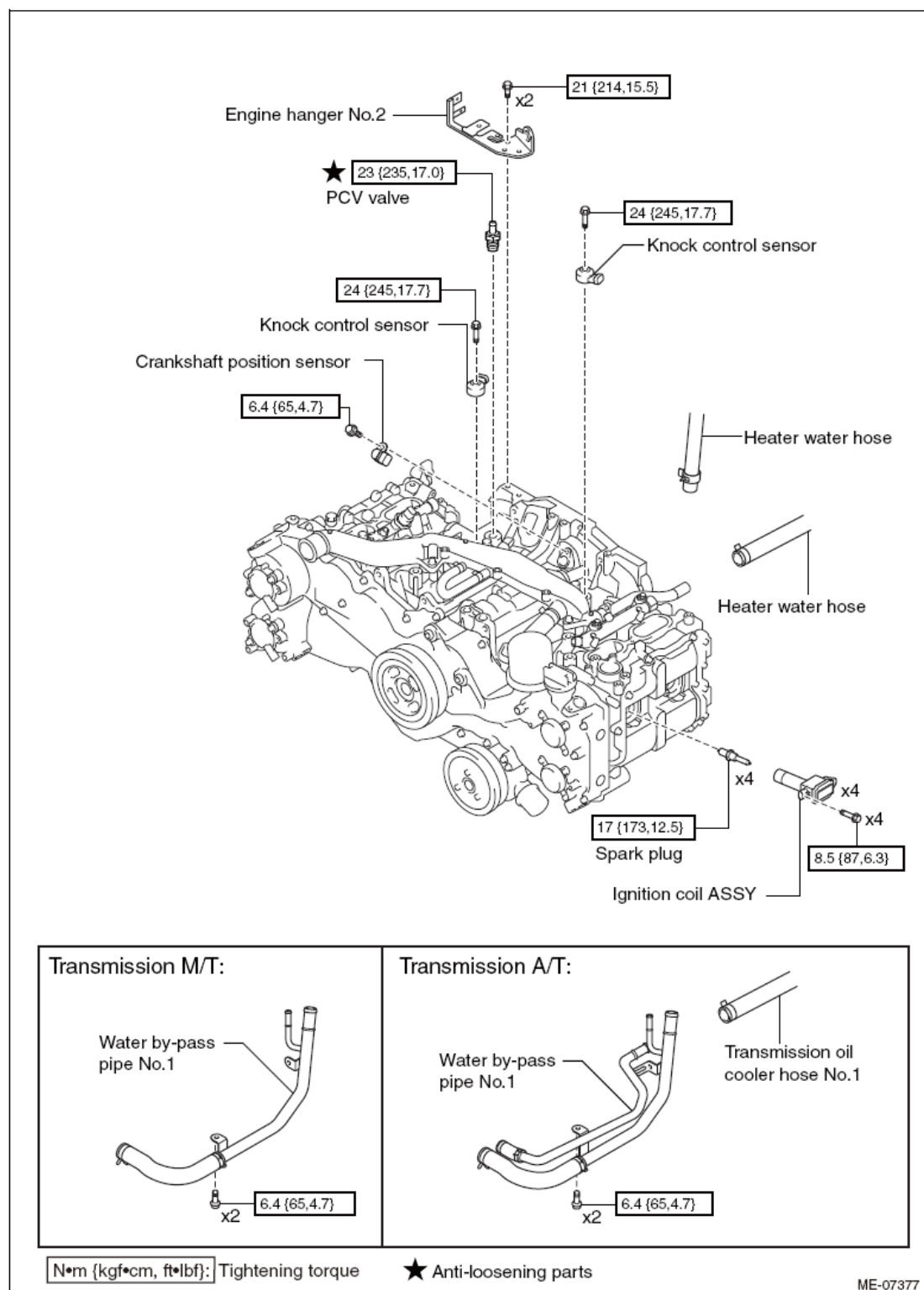


Fig. 129: Identifying Partial Engine Assembly Components With Torque Specifications (FA20) (11 Of 17)
 Courtesy of SUBARU OF AMERICA, INC.

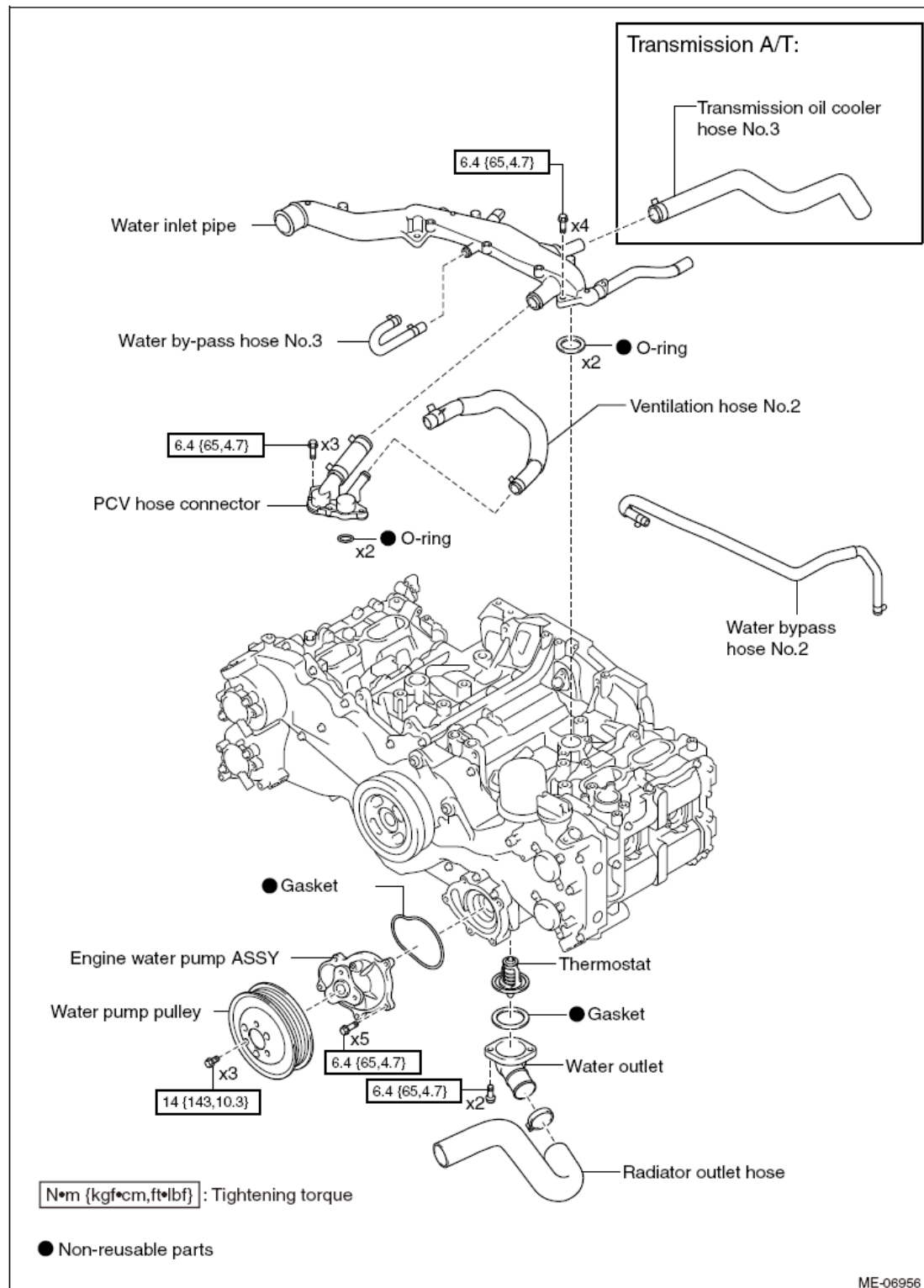


Fig. 130: Identifying Partial Engine Assembly Components With Torque Specifications (FA20) (12 Of 17)
 Courtesy of SUBARU OF AMERICA, INC.

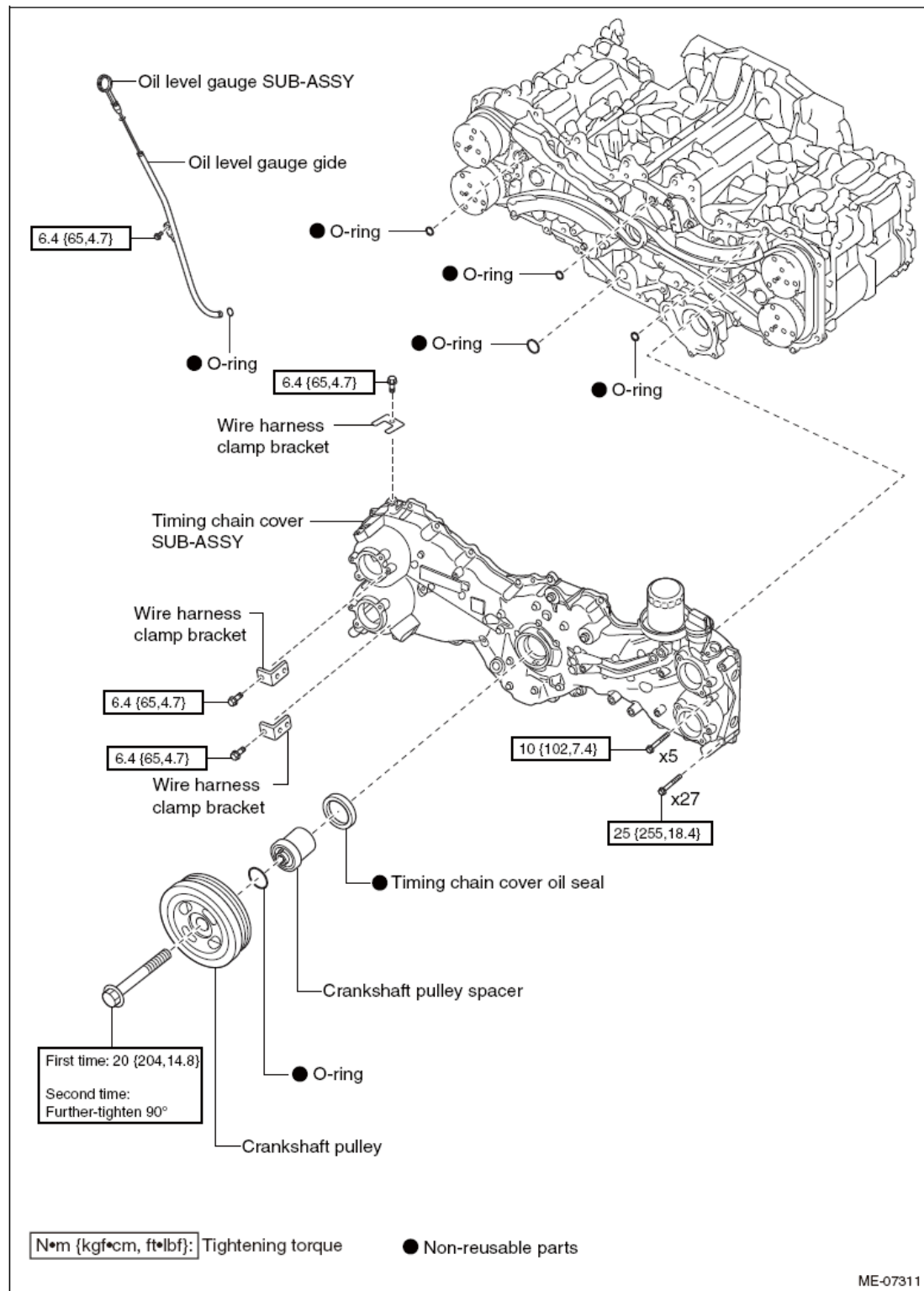


Fig. 131: Identifying Partial Engine Assembly Components With Torque Specifications (FA20) (13 Of 17)
 Courtesy of SUBARU OF AMERICA, INC.

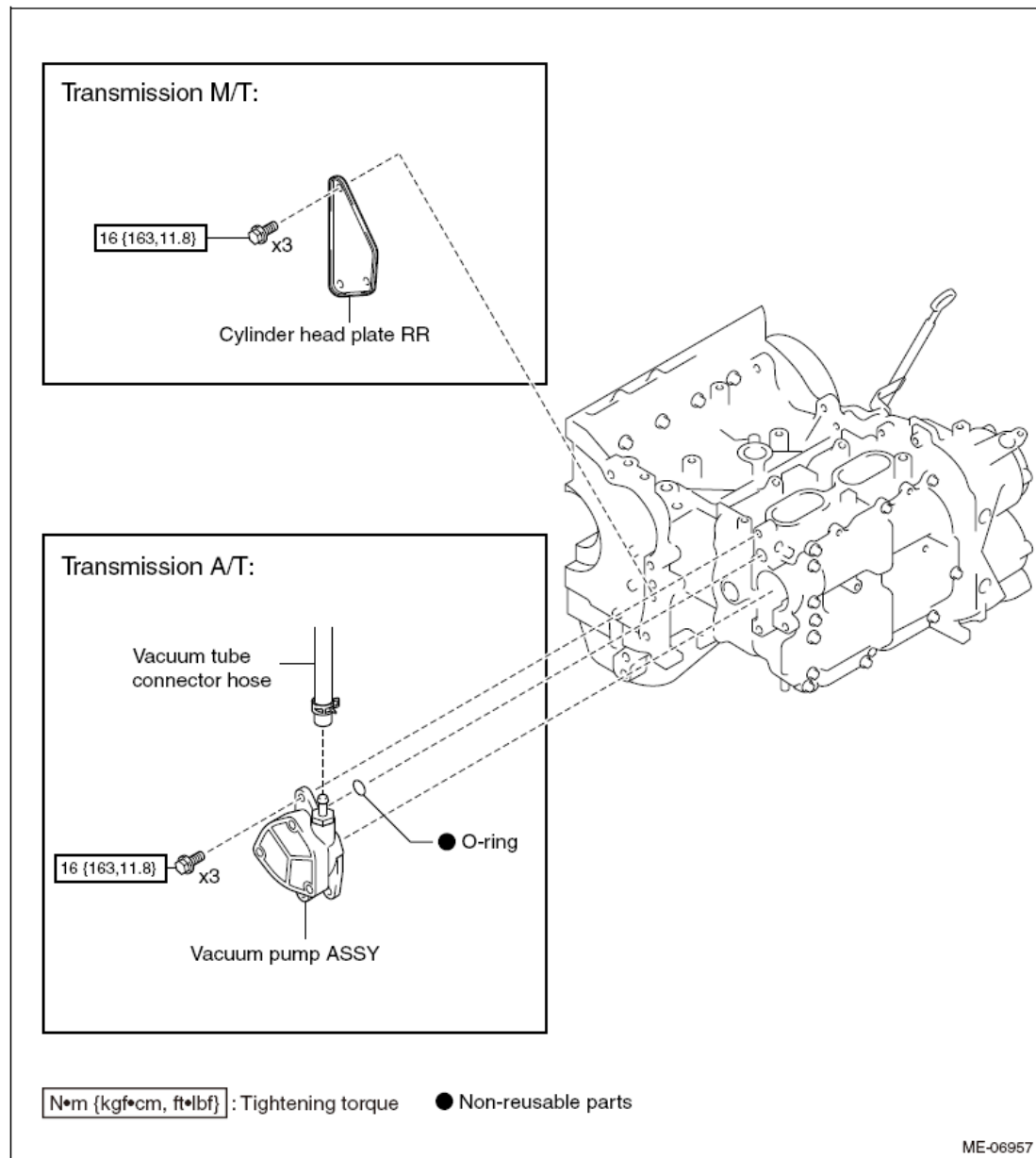
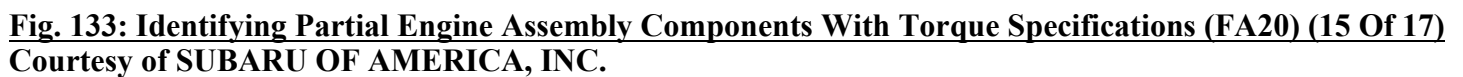


Fig. 132: Identifying Partial Engine Assembly Components With Torque Specifications (FA20) (14 Of 17)
 Courtesy of SUBARU OF AMERICA, INC.



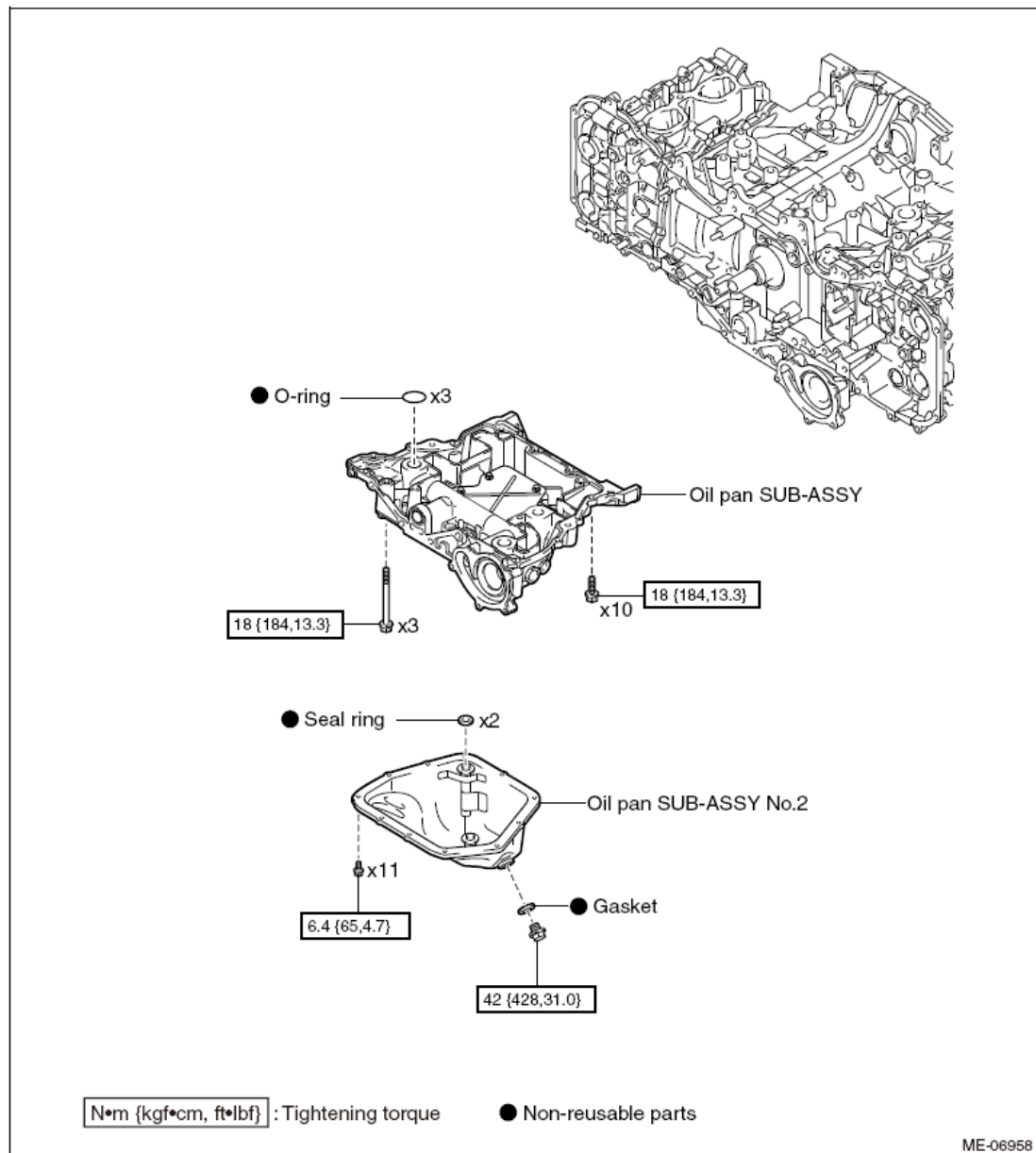


Fig. 134: Identifying Partial Engine Assembly Components With Torque Specifications (FA20) (16 Of 17)
 Courtesy of SUBARU OF AMERICA, INC.

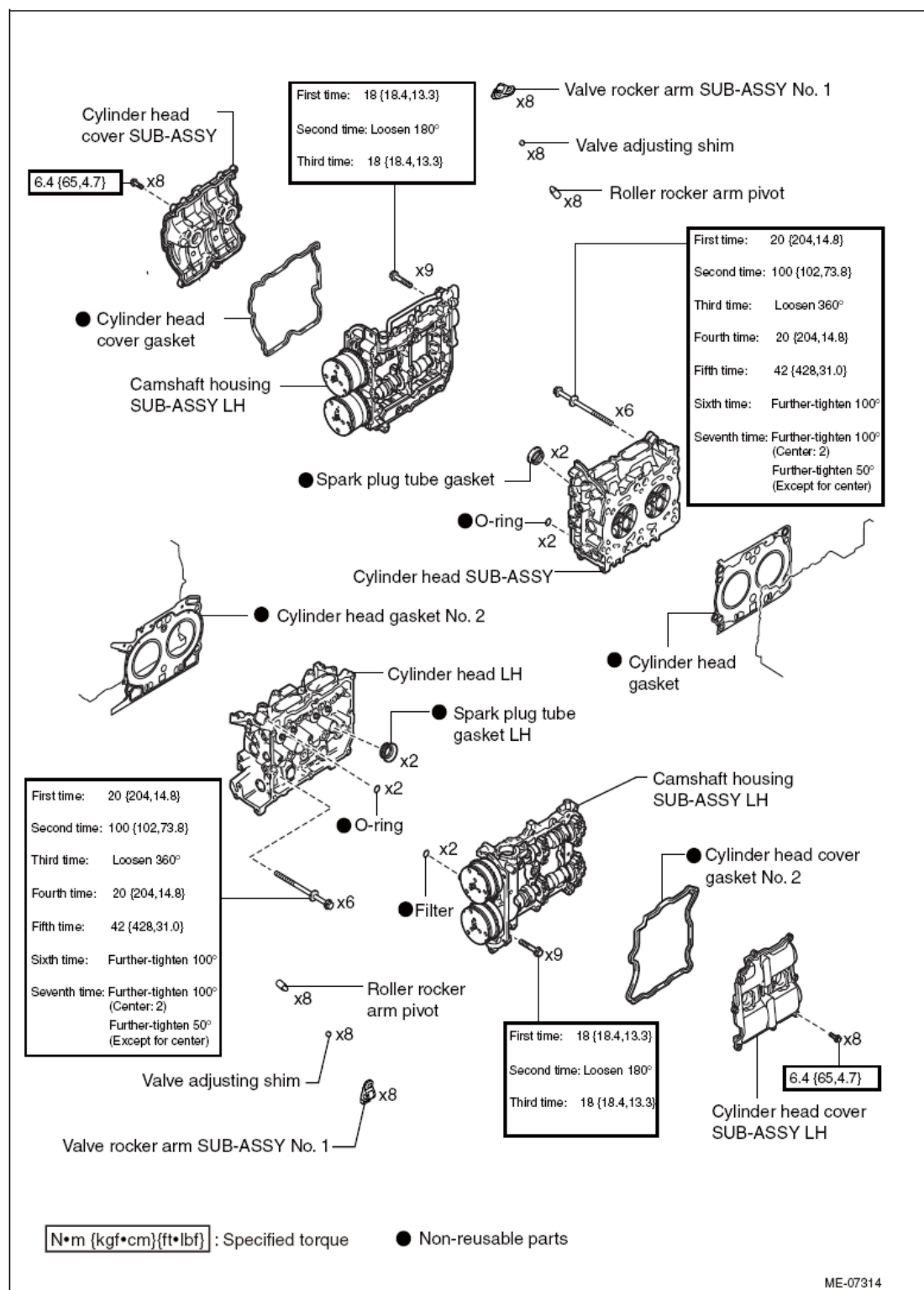


Fig. 135: Identifying Partial Engine Assembly Components With Torque Specifications (FA20) (17 Of 17)
 Courtesy of SUBARU OF AMERICA, INC.

REMOVAL

1. Hood SUB-ASSY set

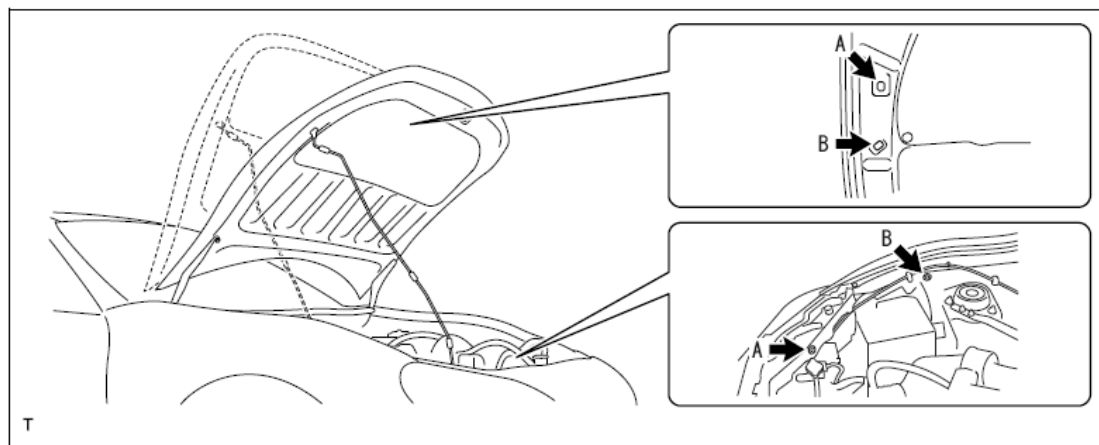


Fig. 136: Identifying Hood Sub-Assembly Mounting Bolts
 Courtesy of SUBARU OF AMERICA, INC.

1. Change the hood stay position from A to B in order to support the hood SUB-ASSY at the position B.
2. Refrigerant HFC-134a (R134a) draining (Refer to **ADJUSTMENT**)
3. Fuel spill prevention procedure (Refer to **FUEL SYSTEM (FA20)**)
4. Disconnection of the battery ground terminal (Refer to **WORKING PRECAUTIONS AND NOTES**)
5. Front strut tower bar RH removal (Refer to **REMOVAL**)
6. Front strut tower bar LH removal (Refer to **REMOVAL**)
7. Air cleaner case SUB-ASSY removal
 1. Disconnect the hose from the chamber ASSY.

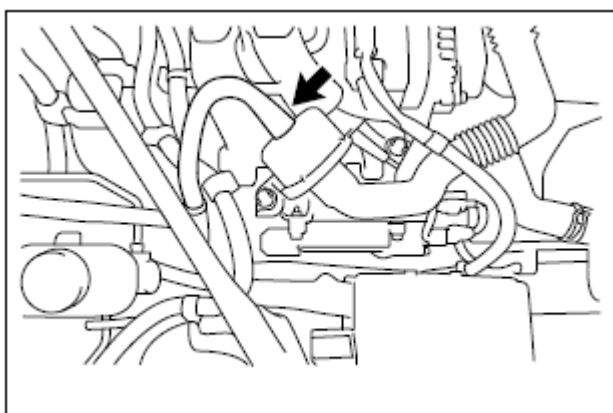


Fig. 137: Identifying Chamber Assembly Hose
 Courtesy of SUBARU OF AMERICA, INC.

2. Remove the two bolts and remove the chamber ASSY.

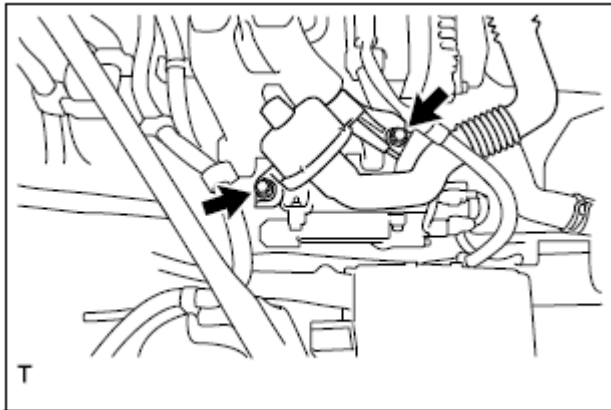


Fig. 138: Identifying Chamber Assembly Mounting Bolts
 Courtesy of SUBARU OF AMERICA, INC.

3. Move the hose clip and disconnect the ventilation hose NO. 2.

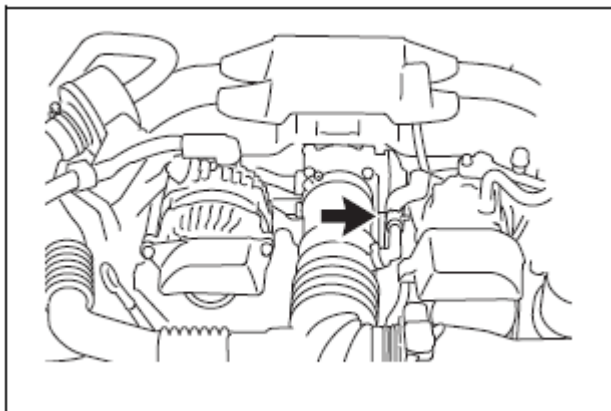


Fig. 139: Identifying Ventilation Hose No. 2 Hose Clip
 Courtesy of SUBARU OF AMERICA, INC.

4. Release the clamp and disconnect the wiring harness from the air cleaner cap.
5. Disconnect the connector from the intake air flow meter SUB-ASSY.

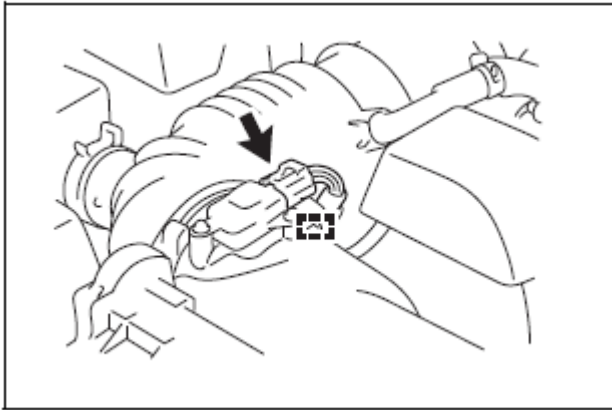


Fig. 140: Identifying Intake Air Flow Meter Sub-Assembly Connector
 Courtesy of SUBARU OF AMERICA, INC.

6. Loosen the hose clamp.

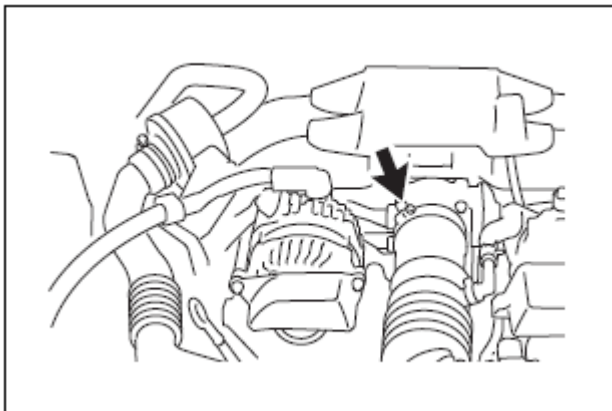


Fig. 141: Identifying Hose Clamp
 Courtesy of SUBARU OF AMERICA, INC.

7. Remove the three bolts and remove the air cleaner case SUB-ASSY.

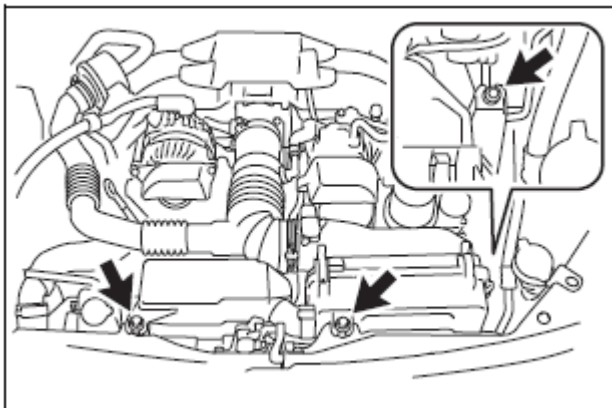


Fig. 142: Identifying Air Cleaner Case Sub-Assembly Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

8. Remove the bolt and remove the stay.

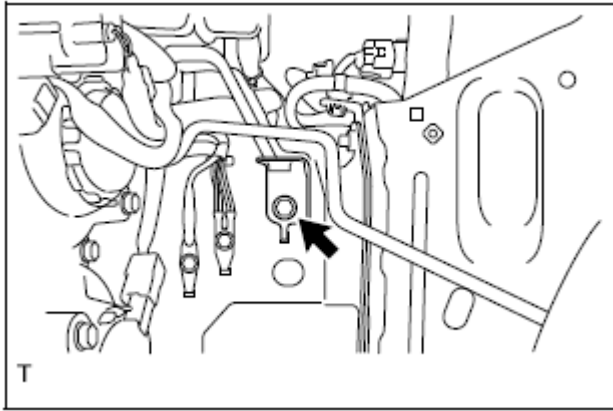


Fig. 143: Identifying Stay Mounting Bolt
Courtesy of SUBARU OF AMERICA, INC.

8. Engine oil draining
 1. Remove the oil filler cap SUB-ASSY.
 2. Remove the oil pan drain plug and gasket.
 3. After draining the oil, install the oil pan drain plug with a new gasket.

Standard value: T=42N.m {428kgf.cm} {31.0ft.lbf}

9. Draining of coolant (SUBARU Super Coolant) (Refer to **REPLACEMENT**)
10. Radiator reservoir tank ASSY removal (Refer to **REMOVAL**)
11. Water filler SUB-ASSY removal
 1. Remove the two bolts and remove the water filler SUB-ASSY.
 2. Move the two hose clamps and remove the radiator hose NO. 1 and water filler SUB-ASSY as a unit.

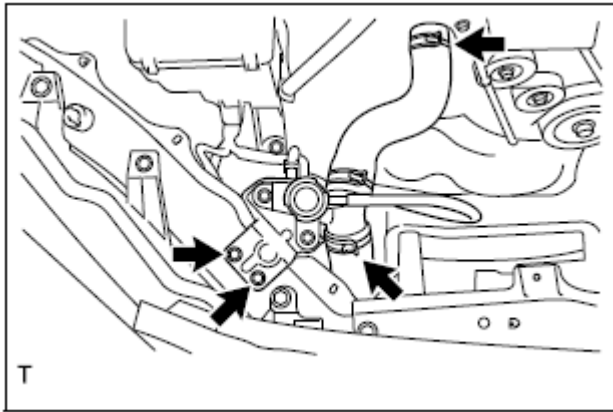


Fig. 144: Identifying Water Filler Sub-Assembly Mounting Bolts And Hose Clamp
Courtesy of SUBARU OF AMERICA, INC.

12. Removal of injector driver (Refer to **REMOVAL**)
13. Engine wiring harness disconnection

NOTE: **Secure the disconnected harness etc. with tape.**

1. Transmission A/T:
 - a. Release the lock of connector A to disconnect the connector.
 - b. Disconnect the connector B.
 - c. Release the two clamps and disconnect the wiring harness.

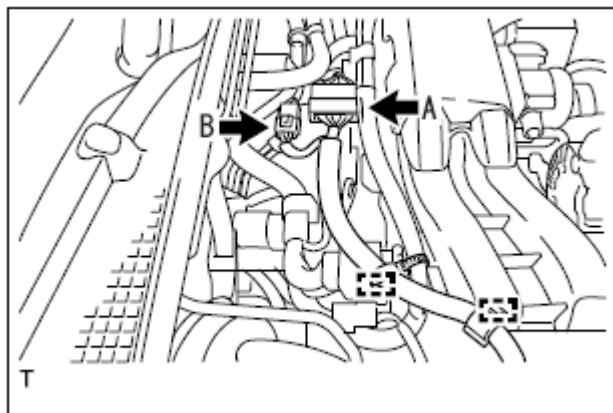


Fig. 145: Identifying Automatic Transmission Connectors (A And B)
Courtesy of SUBARU OF AMERICA, INC.

- d. Slide the connector in the direction as shown in the figure and disconnect the wiring harness.

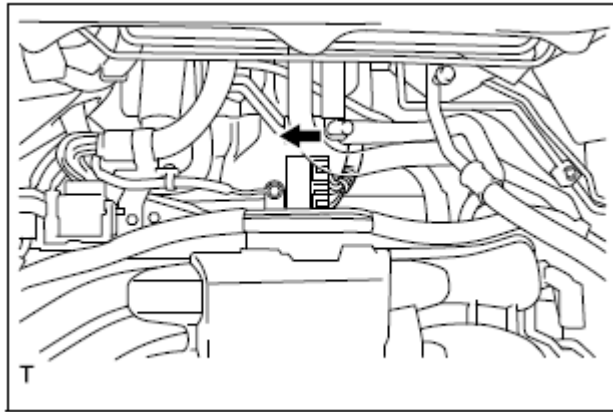


Fig. 146: Sliding Connector
 Courtesy of SUBARU OF AMERICA, INC.

2. Remove the bolt and disconnect the wiring harness clamp bracket.

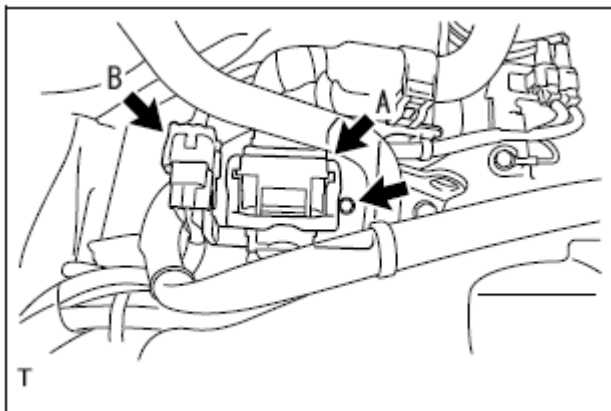


Fig. 147: Identifying Wiring Harness Clamp Bracket Mounting Bolts
 Courtesy of SUBARU OF AMERICA, INC.

3. Release the lock of connector A to disconnect the connector.
4. Disconnect the connector B.
5. Release the two clamps and remove the two bolts to remove the two wiring harness clamp brackets.

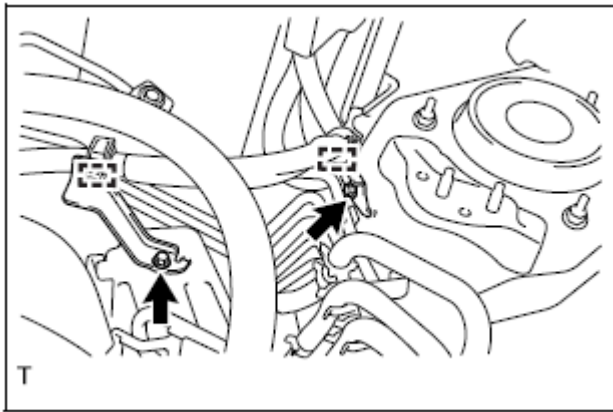


Fig. 148: Identifying Wiring Harness Clamp Bracket Mounting Bolts And Clamps
Courtesy of SUBARU OF AMERICA, INC.

6. Release the five clamps and disconnect the wiring harness.

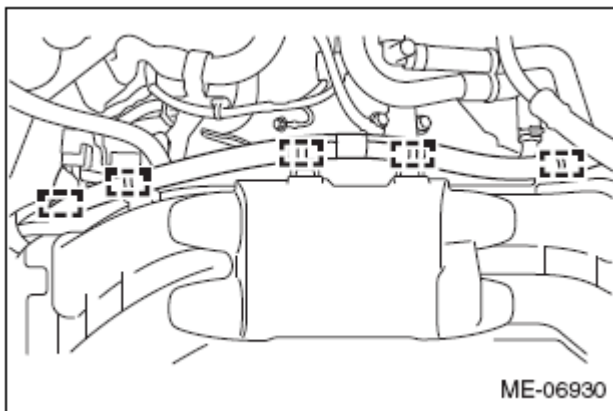


Fig. 149: Identifying Wiring Harness Mounting Clamps
Courtesy of SUBARU OF AMERICA, INC.

7. Release the clamp and disconnect the wiring harness.

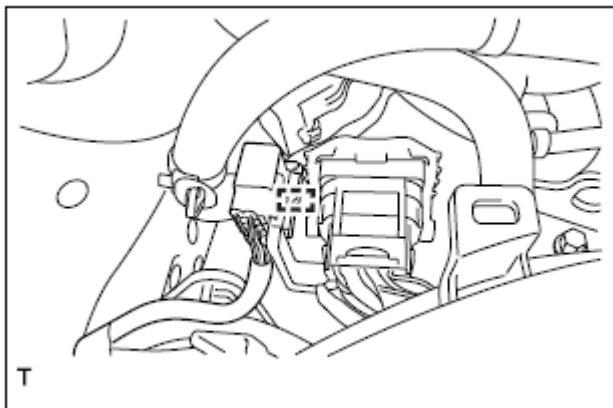


Fig. 150: Identifying Wiring Harness Mounting Clamp
Courtesy of SUBARU OF AMERICA, INC.

8. Turn over the terminal cap.

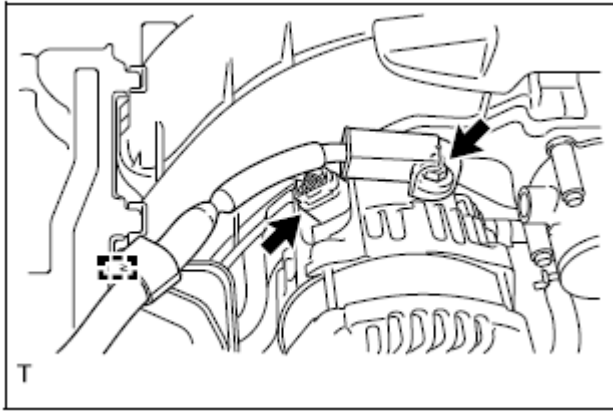


Fig. 151: Identifying Terminal Cap
Courtesy of SUBARU OF AMERICA, INC.

9. Remove the nut and disconnect the wiring harness from the terminal B.
10. Remove the connector and clamp to disconnect the wiring harness.
14. Generator cover removal (Refer to **REMOVAL**)
15. Belt generator cover removal (Refer to **REMOVAL**)
16. Fan & generator V-belt removal (Refer to **REMOVAL**)
17. Engine cover SUB-ASSY NO. 1 removal (Refer to **REMOVAL**)
18. Removal of flywheel housing under cover (transmission A/T)
 1. Remove the flywheel housing under cover.

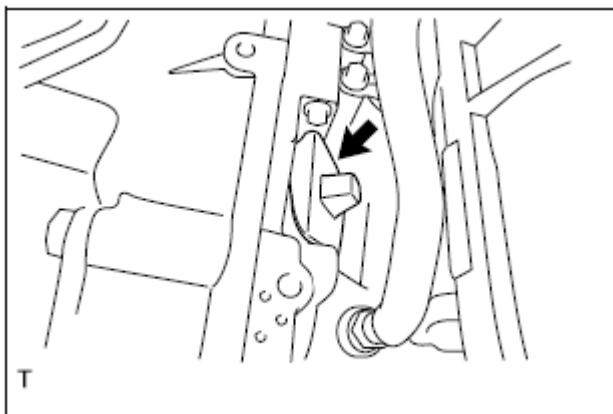


Fig. 152: Identifying Flywheel Housing Under Cover (Transmission A/T)
Courtesy of SUBARU OF AMERICA, INC.

19. Removal of drive plate and torque converter setting bolt

1. Use the SST to secure the crankshaft pulley.

SST 18355AA000, 18334AA000

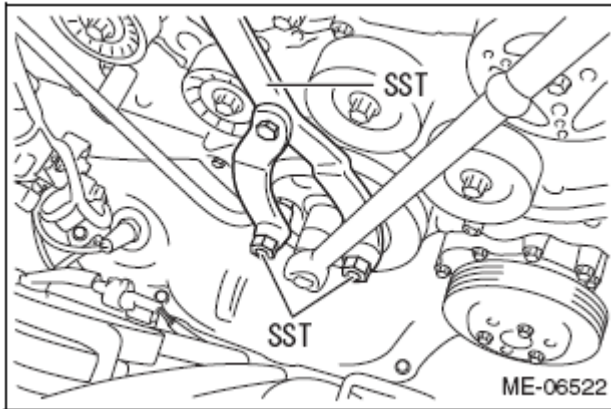
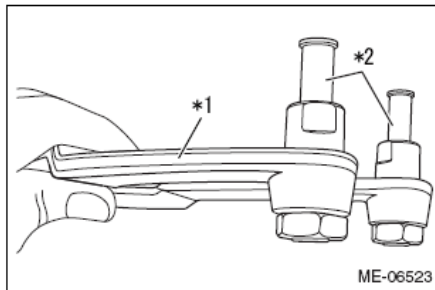


Fig. 153: Using SST To Secure Crankshaft Pulley
Courtesy of SUBARU OF AMERICA, INC.



*1	18355AA000
*2	18334AA000

Fig. 154: Identifying SST Components
Courtesy of SUBARU OF AMERICA, INC.

2. Remove the six drive plate & torque converter setting bolts through the service hole.

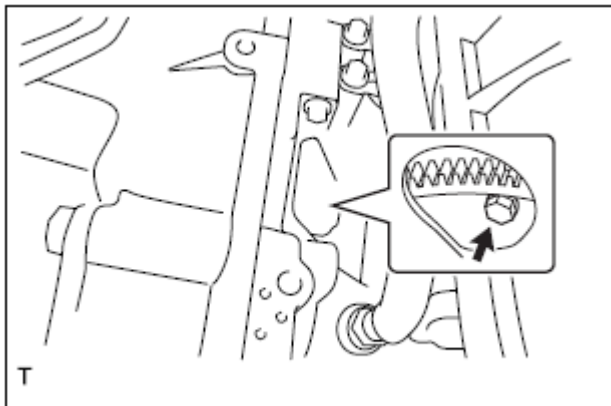


Fig. 155: Identifying Drive Plate And Torque Converter Setting Bolts
Courtesy of SUBARU OF AMERICA, INC.

20. Vacuum tube connector hose disconnection (transmission A/T)
 1. Move the clamp and disconnect the vacuum tube connector hose from the vacuum pump ASSY.

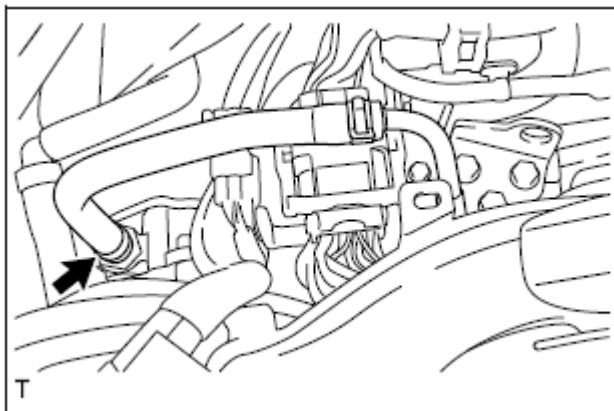


Fig. 156: Identifying Vacuum Tube Connector Hose Clamp
Courtesy of SUBARU OF AMERICA, INC.

2. Remove the 2 bolts and disconnect the vacuum tube connector hose.
3. Loosen the hose clamp and remove the vacuum tube connector hose.

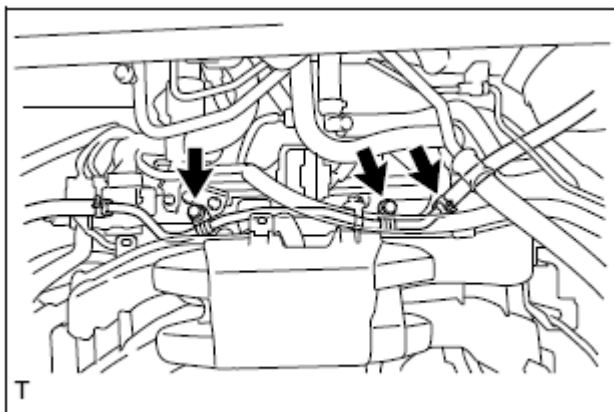


Fig. 157: Identifying Vacuum Tube Connector Hose Clamp And Bolts
Courtesy of SUBARU OF AMERICA, INC.

21. Vacuum tube connector hose disconnection (transmission M/T)
 1. Move the hose clamp and disconnect the vacuum tube connector hose from the intake manifold ASSY.
 2. Remove the bolt and disconnect the vacuum tube connector hose.

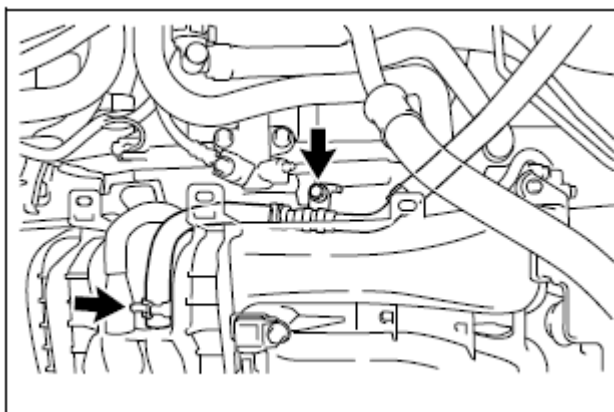


Fig. 158: Identifying Vacuum Tube Connector Hose Clamp And Bolt
Courtesy of SUBARU OF AMERICA, INC.

22. Removal of exhaust manifold

(Refer to **REMOVAL**)

23. Exhaust pipe SUB-ASSY FR fixation (transmission M/T)

1. Tie the exhaust pipe SUB-ASSY FR to the front suspension crossmember SUB-ASSY with the rope.

NOTE: This operation is required to avoid dropping the exhaust pipe SUB-ASSY FR.

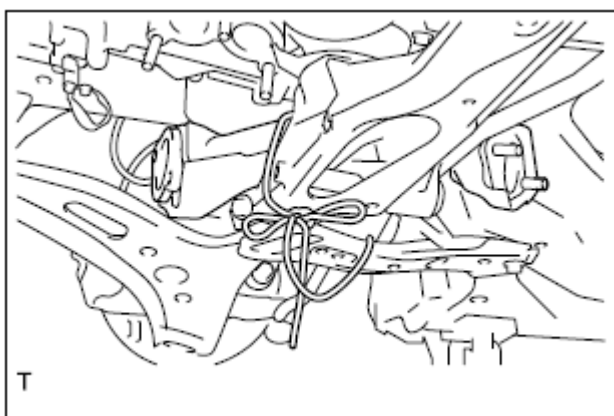


Fig. 159: Tying Exhaust Pipe Sub-Assembly FR To Front Suspension Crossmember Sub-Assembly Using Rope
Courtesy of SUBARU OF AMERICA, INC.

24. Heater water hose disconnection

1. Move the two hose clamps and disconnect the two heater water hoses.

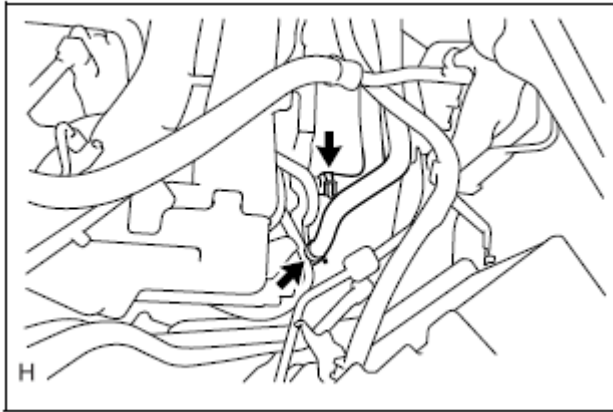


Fig. 160: Identifying Heater Water Hose Clamps
Courtesy of SUBARU OF AMERICA, INC.

25. Transmission oil cooler hose NO. 1 disconnection (transmission A/T)
1. Move the hose clamp, and disconnect the transmission oil cooler hose NO. 1.

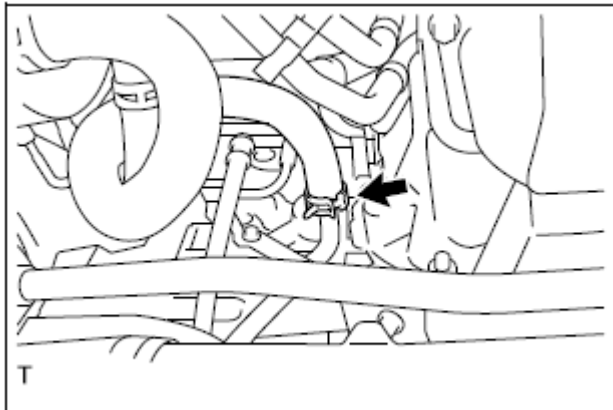


Fig. 161: Identifying Transmission Oil Cooler Hose No. 1 Hose Clamp
Courtesy of SUBARU OF AMERICA, INC.

26. Suction hose SUB-ASSY removal
1. Remove the bolt and disconnect the suction hose SUB-ASSY.
 2. Remove the O-ring from the suction hose SUB-ASSY.

CAUTION: Wrap vinyl tape around the fitting areas of disconnected suction hose SUB-ASSY and compressor ASSY (with magnet clutch) to prevent dust, moisture, etc. from entering into them.

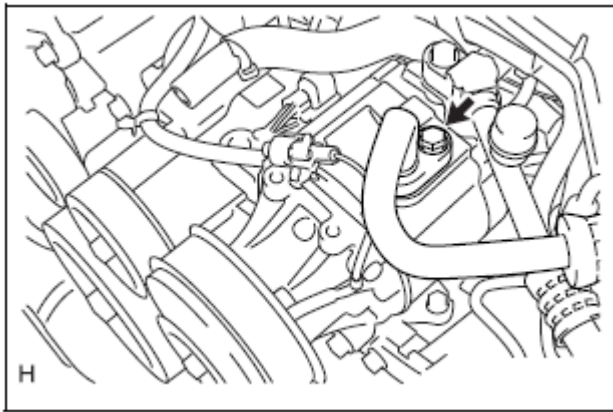


Fig. 162: Identifying Suction Hose Sub-Assembly Mounting Bolts
 Courtesy of SUBARU OF AMERICA, INC.

3. Remove bolts and turn the hook type connector in the direction of the arrow in the figure.
4. Remove the nut and disconnect the suction hose SUB-ASSY.
5. Remove the O-ring from the suction hose SUB-ASSY.

CAUTION: Wrap vinyl tape around the fitting areas of the disconnected suction hose SUB-ASSY and the unit to prevent entry of dirt or moisture.

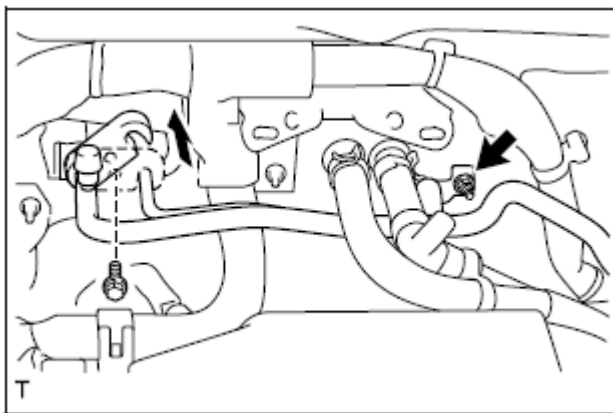


Fig. 163: Removing Suction Hose Sub-Assembly Mounting Bolts
 Courtesy of SUBARU OF AMERICA, INC.

27. Cooler refrigerant discharge hose NO. 1 disconnection (Refer to **REMOVAL**)
28. Removal of starter ASSY

(Refer to **REMOVAL**)

29. SST installation (transmission A/T)
 1. Attach the SST to the starter hole of torque converter clutch case.

SST 18750AA010

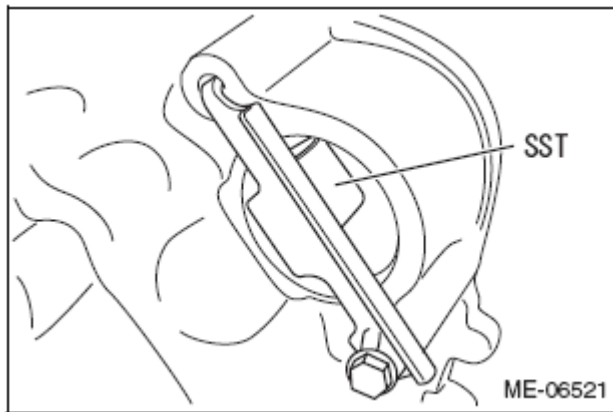


Fig. 164: Connecting SST To Starter Hole Of Torque Converter Clutch Case
Courtesy of SUBARU OF AMERICA, INC.

30. Transmission oil cooler hose NO. 3 disconnection (transmission A/T)
1. Move the hose clamp, and disconnect the transmission oil cooler hose NO. 3.

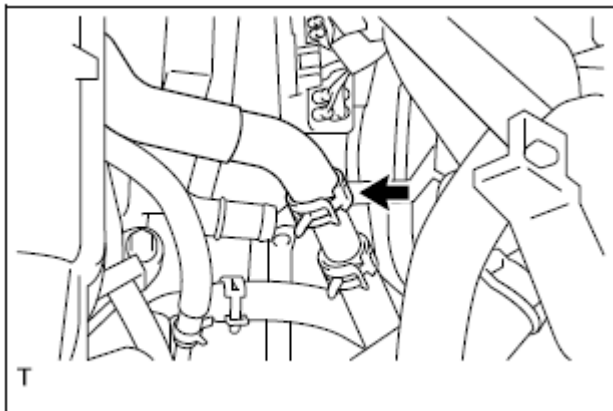


Fig. 165: Identifying Transmission Oil Cooler Hose No. 3 Hose Clamp
Courtesy of SUBARU OF AMERICA, INC.

31. Radiator outlet hose disconnection
1. Move the hose clamp and disconnect the radiator outlet hose.

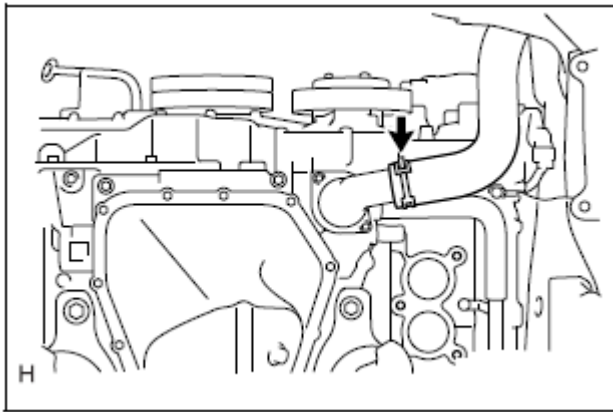


Fig. 166: Identifying Radiator Outlet Hose Clamp
Courtesy of SUBARU OF AMERICA, INC.

32. Ground cable disconnection

1. Remove the two bolts and remove the two ground cables.

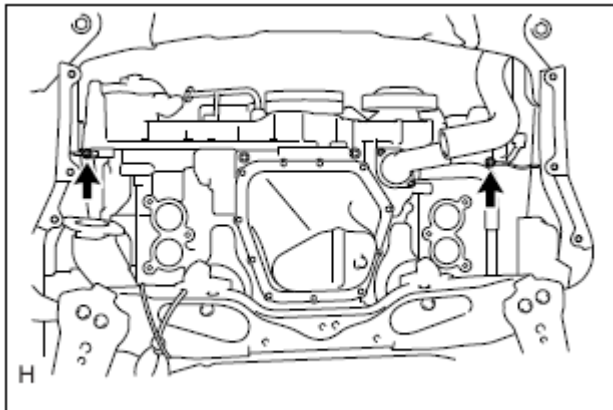


Fig. 167: Identifying Ground Cable Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

33. Exhaust pipe SUB-ASSY FR fixation (transmission A/T)

1. Tie the exhaust pipe SUB-ASSY FR to the front suspension crossmember SUB-ASSY with the rope.

NOTE: This operation is required to avoid dropping the exhaust pipe SUB-ASSY FR.

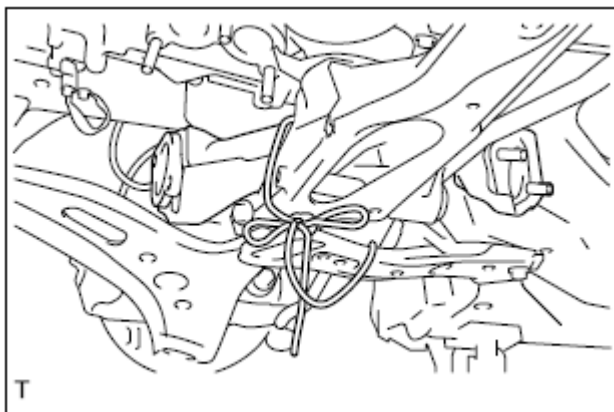


Fig. 168: Tying Exhaust Pipe Sub-Assembly FR To Front Suspension Crossmember Sub-Assembly Using Rope

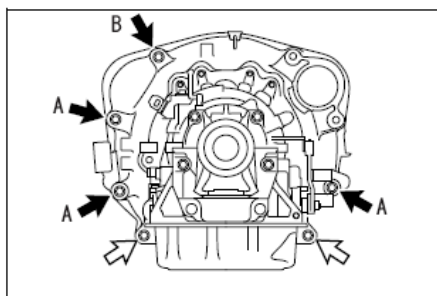
Courtesy of SUBARU OF AMERICA, INC.

34. Stabilizer bar FR removal (transmission A/T)

(Refer to **REMOVAL**)

35. Automatic transmission ASSY disconnection (transmission A/T)

1. Remove the three bolts A and two nuts.



	Bolt
	Nut

Fig. 169: Identifying Automatic Transmission Assembly Mounting Bolts And Nuts

Courtesy of SUBARU OF AMERICA, INC.

CAUTION: Do not remove the bolt B to prevent the ASSY from falling off.

36. Manual transmission ASSY removal (transmission M/T)

1. Remove the three bolts A and two nuts.

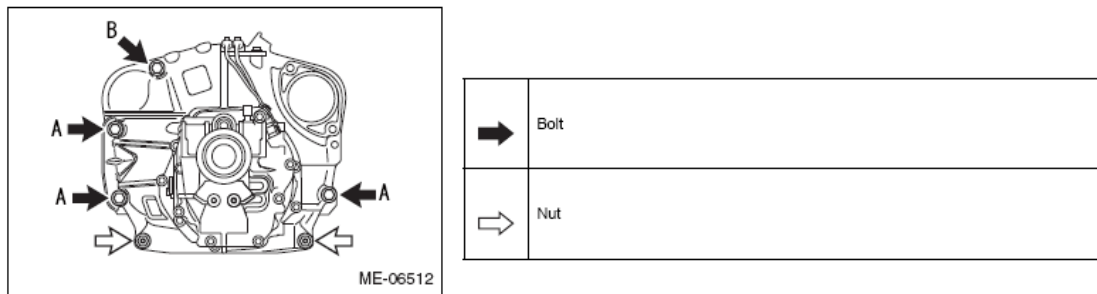


Fig. 170: Identifying Manual Transmission Assembly Mounting Bolts And Nuts
 Courtesy of SUBARU OF AMERICA, INC.

CAUTION: Do not remove the bolt B to prevent the ASSY from falling off.

37. Disconnection of front crossmember SUB-ASSY
 1. Remove the two nuts of front crossmember SUB-ASSY.

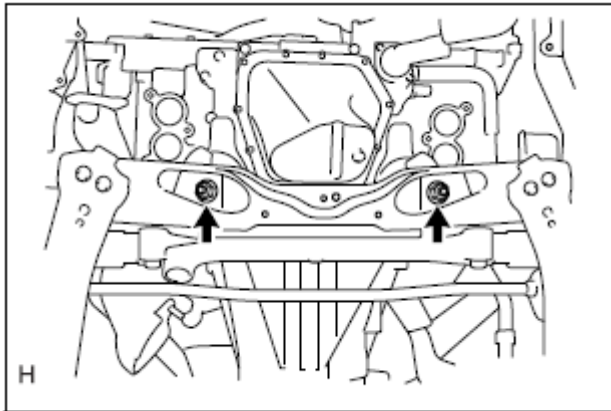
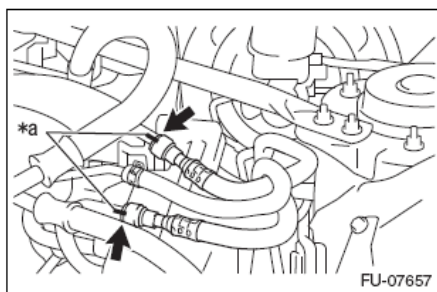


Fig. 171: Identifying Front Crossmember Sub-Assembly Mounting Bolts
 Courtesy of SUBARU OF AMERICA, INC.

38. Flywheel housing under cover removal (transmission A/T) (Refer to **REMOVAL**)
39. Drive plate & torque converter setting bolt removal (transmission A/T) (Refer to **REMOVAL**)
40. SEPARATE FUEL HOSE
 1. Put alignment marks on the fuel hoses No. 1 and No. 2.



*a	Alignment marks
----	-----------------

Fig. 172: Identifying Alignment Marks On Fuel Hoses No. 1 And No. 2
Courtesy of SUBARU OF AMERICA, INC.

2. Using SST, disconnect the fuel hose NO. 1 and fuel hose NO. 2 from the fuel pipe (Refer to **FUEL SYSTEM (FA20)**).

SST 42099AE000

3. Remove the clamp and disconnect the purge hose from the fuel pipe.

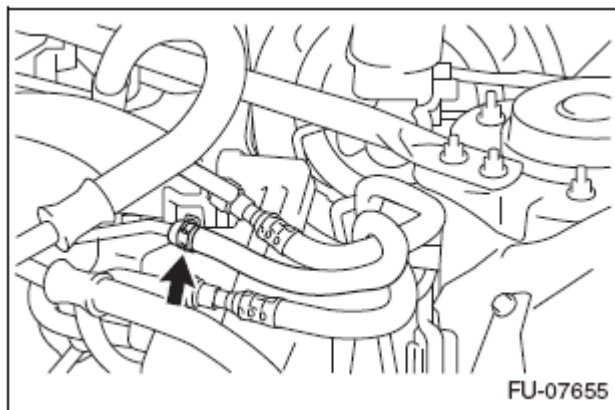
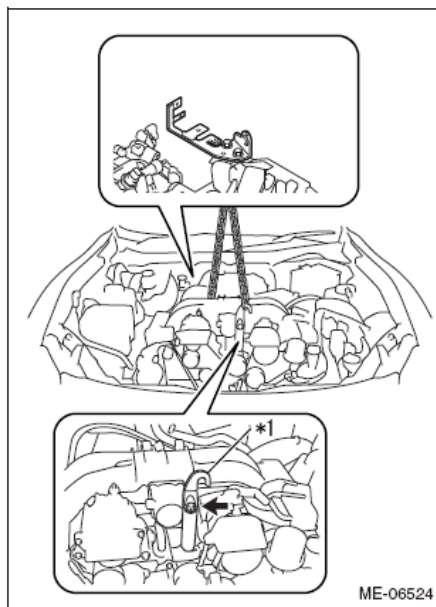


Fig. 173: Identifying Fuel Pipe Purge Hose Clamp
Courtesy of SUBARU OF AMERICA, INC.

41. Engine hanger installation

1. Install the engine hanger NO. 1 to the position as shown in the figure.

SST 12281-38150, 90119-14120



*1	Engine hanger NO. 1
----	---------------------

Fig. 174: Identifying Engine Hanger No. 1 Installation Position
 Courtesy of SUBARU OF AMERICA, INC.

Standard value: T=43N.m {439kgf.cm} {31.7ft.lbf}

2. Support the engine with an engine sling device and lifter.
42. Transmission ASSY support (transmission A/T)
 1. Tie the SST to the transmission ASSY with rope.

SST 18632AA010

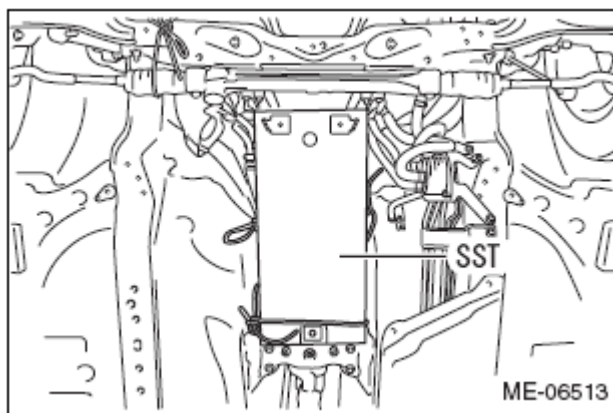


Fig. 175: Tying SST To Transmission Assembly Using Rope
 Courtesy of SUBARU OF AMERICA, INC.

2. Support the SST with a jack.

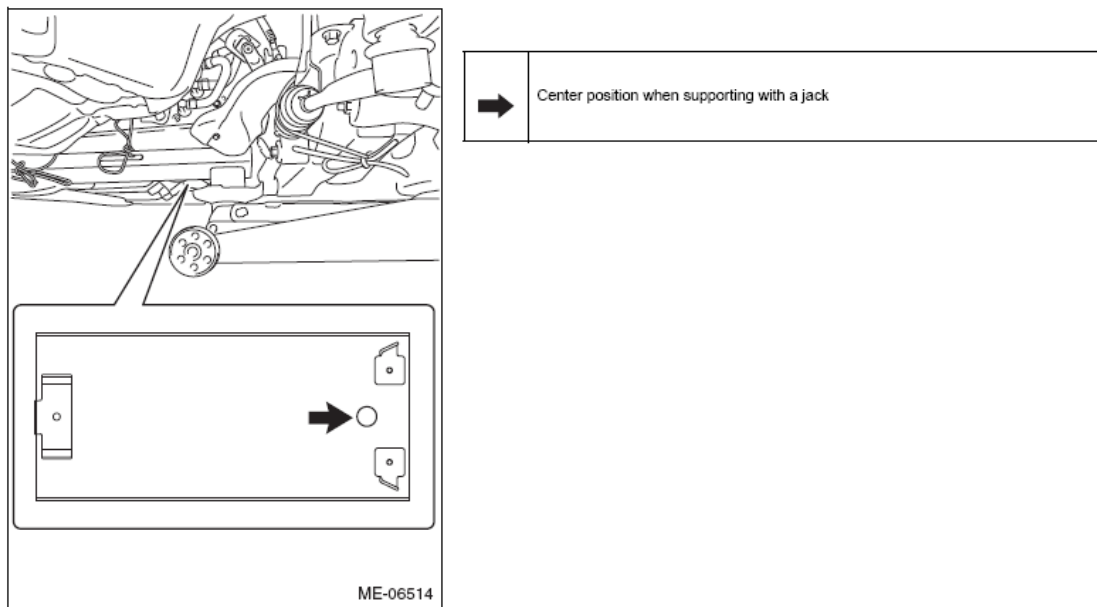


Fig. 176: Supporting SST Using Jack
Courtesy of SUBARU OF AMERICA, INC.

CAUTION: Support the transmission ASSY until the installation of partial engine ASSY is completed.

43. Transmission ASSY support (transmission M/T)
1. Support the clutch housing portion of transmission ASSY.

CAUTION: Support the transmission ASSY until the removal of partial engine ASSY is completed.

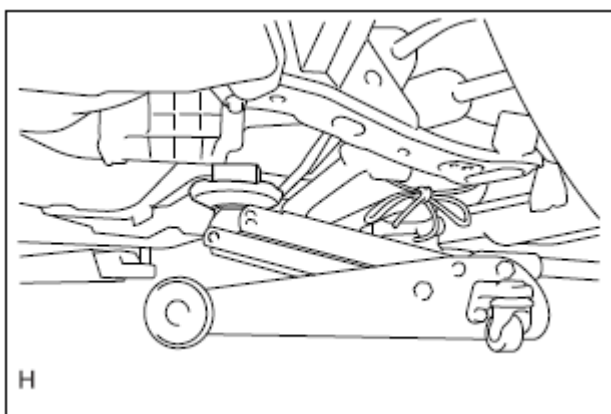
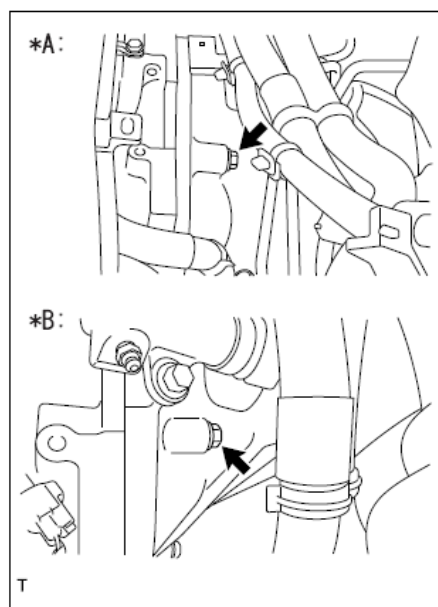


Fig. 177: Supporting Transmission Assembly Clutch Housing Portion
Courtesy of SUBARU OF AMERICA, INC.

44. Engine ASSY removal

1. Remove the connecting bolt of transmission ASSY.



*A	Transmission A/T
*B	Transmission M/T

Fig. 178: Identifying Transmission Assembly Connecting Bolt
 Courtesy of SUBARU OF AMERICA, INC.

2. Suspend the partial engine ASSY with an engine sling device and mini-crane.

45. Drive plate & ring gear SUB-ASSY removal (transmission A/T) (Refer to **REMOVAL**)
46. Clutch cover ASSY removal (transmission M/T) (Refer to **REMOVAL**)
47. Clutch disc ASSY removal (transmission M/T) (Refer to **REMOVAL**)
48. Flywheel SUB-ASSY removal (transmission M/T) (Refer to **REMOVAL**)
49. Crank angle sensor plate NO. 1 removal (Refer to **REMOVAL**)
50. Engine stand installation
 1. Install the engine ASSY to the engine stand.

CAUTION: Since the operation with the engine ASSY suspended are danger, never perform it other than when installing the ASSY to the engine stand or removing it from the stand.

51. Engine mounting insulator FR removal

1. Remove the four bolts and remove the two engine mounting insulators FR.

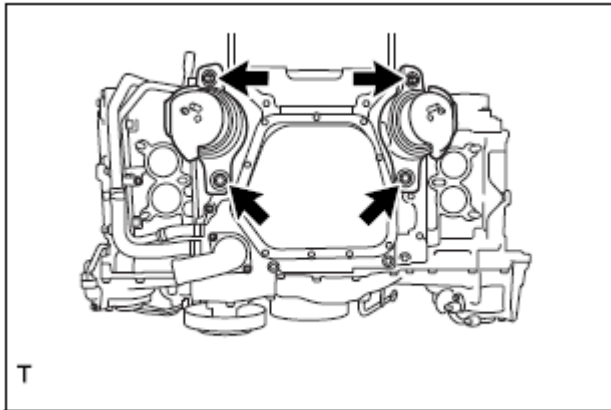


Fig. 179: Identifying Engine Mounting Insulators FR Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

- 52. Engine hanger removal
 - 1. Remove the bolt and remove the engine hanger.
- 53. Generator ASSY removal
 - 1. Remove the two bolts and remove the generator ASSY.

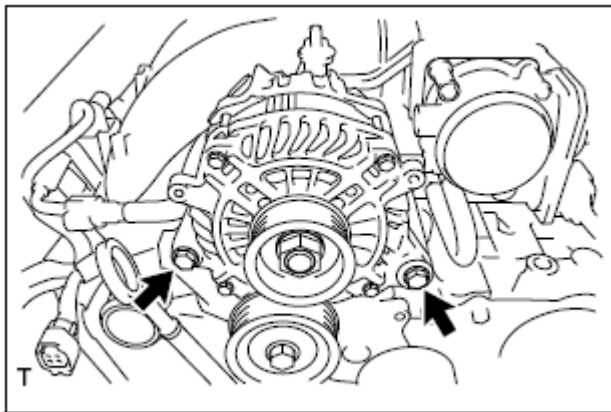


Fig. 180: Identifying Generator Assembly Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

- 54. Idler pulley SUB-ASSY NO. 2 removal (Refer to **REMOVAL**)
- 55. Oil level gauge guide removal (Refer to **REMOVAL**)
- 56. V-ribbed belt tensioner ASSY removal (Refer to **REMOVAL**)
- 57. Removal of compressor ASSY (with magnet clutch)
 - 1. Remove the 3 bolts and remove the compressor ASSY (with magnet clutch).

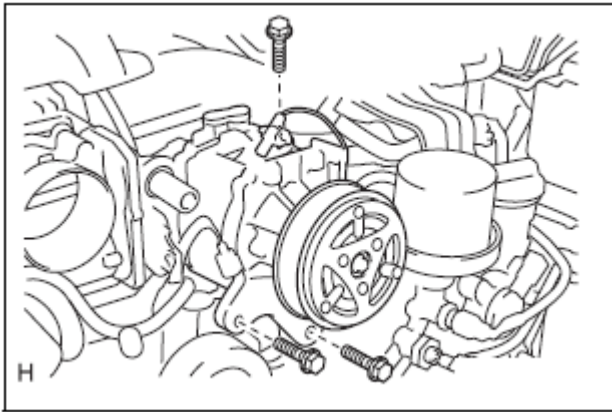


Fig. 181: Identifying Compressor Assembly Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

58. Intake manifold protector (bank 2 side) removal
1. Remove the 2 bolts and remove the intake manifold protector (bank 2 side).

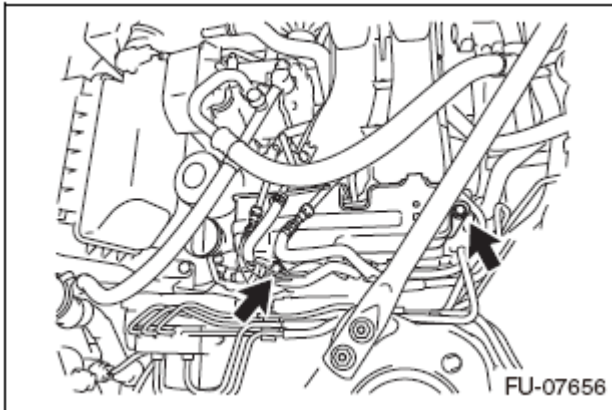


Fig. 182: Identifying Intake Manifold Protector Mounting Bolts (Bank 2 Side)
Courtesy of SUBARU OF AMERICA, INC.

59. Intake manifold protector (bank 1 side) removal
1. Remove the 2 bolts and remove the intake manifold protector (bank 1 side).

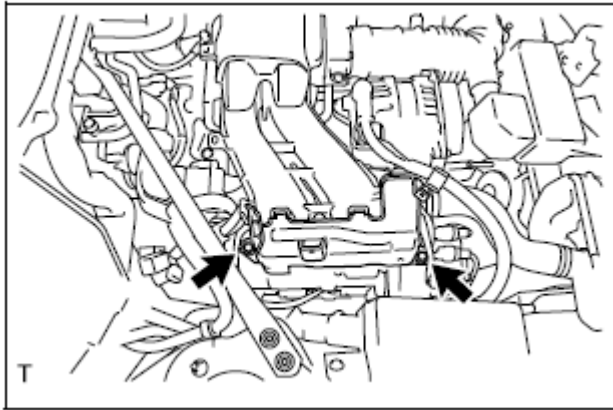


Fig. 183: Identifying Intake Manifold Protector Mounting Bolts (Bank 1 Side)
Courtesy of SUBARU OF AMERICA, INC.

60. Fuel delivery pipe SUB-ASSY removal

1. Remove the bolt and disconnect the fuel delivery pipe SUB-ASSY.
2. Disconnect the vacuum hose SUB-ASSY.

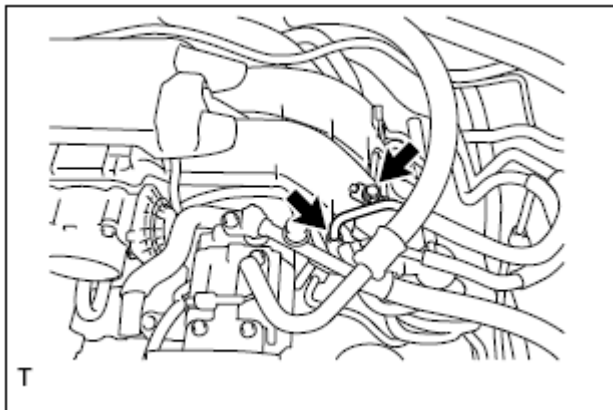


Fig. 184: Identifying Fuel Delivery Pipe Sub-Assembly Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

3. Remove the union bolt and gasket to disconnect the fuel delivery pipe SUB-ASSY.

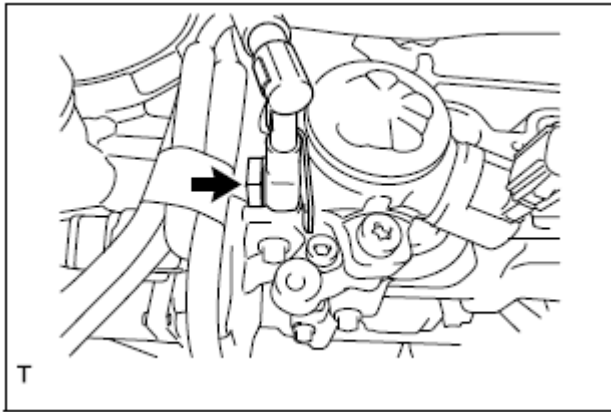


Fig. 185: Identifying Fuel Delivery Pipe Sub-Assembly Union Bolts
Courtesy of SUBARU OF AMERICA, INC.

61. Ventilation hose disconnection (Refer to **REMOVAL**)
62. Intake manifold removal
 1. Move the two hose clamps and disconnect the water by-pass hoses NO. 2 and NO. 3 from the throttle body ASSY.

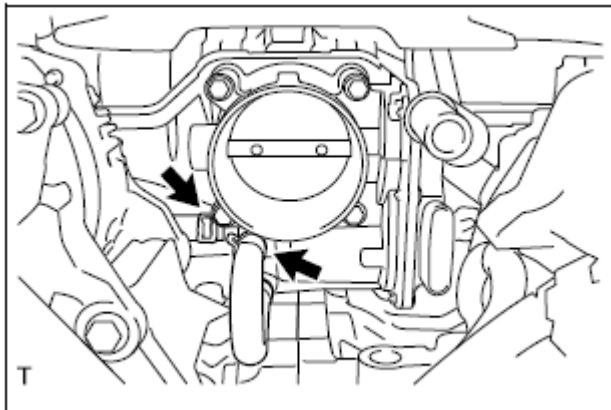


Fig. 186: Identifying Water By-Pass Hoses No. 2 And No. 3 Hose Clamps
Courtesy of SUBARU OF AMERICA, INC.

2. Disconnect the connector for air pressure sensor ASSY.

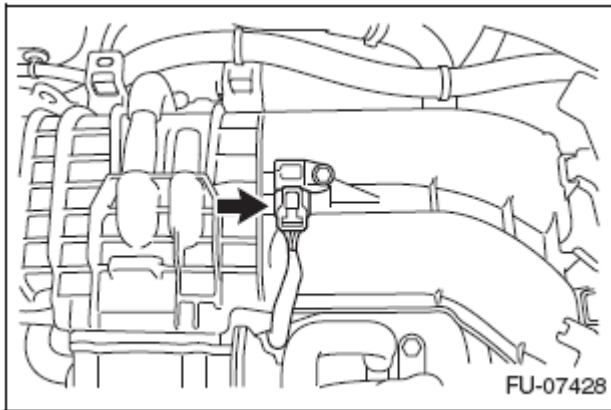


Fig. 187: Identifying Air Pressure Sensor Assembly Connector
Courtesy of SUBARU OF AMERICA, INC.

3. Disconnect the connector for the purge control solenoid valve.

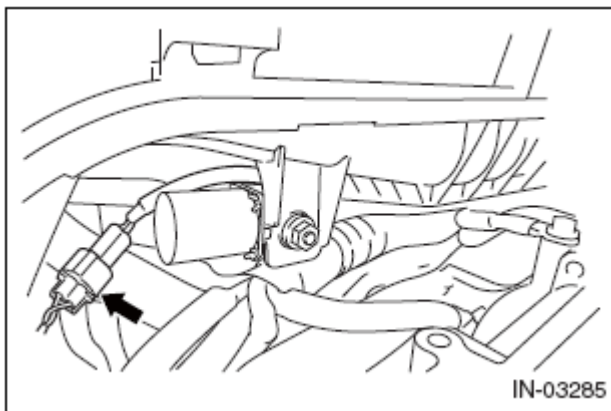
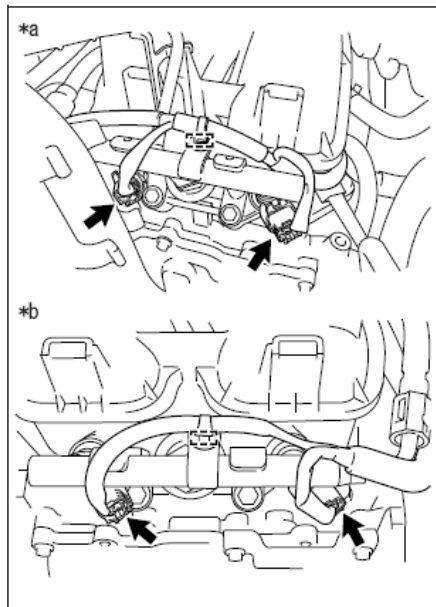


Fig. 188: Identifying Purge Control Solenoid Valve Connector
Courtesy of SUBARU OF AMERICA, INC.

4. Release the two clamps and disconnect the four connectors to disconnect the wiring harness.



*a	Bank 2 side
*b	Bank 1 side

Fig. 189: Identifying Wiring Harness Connector Clamps
Courtesy of SUBARU OF AMERICA, INC.

5. Disconnect the connectors of fuel pump ASSY.

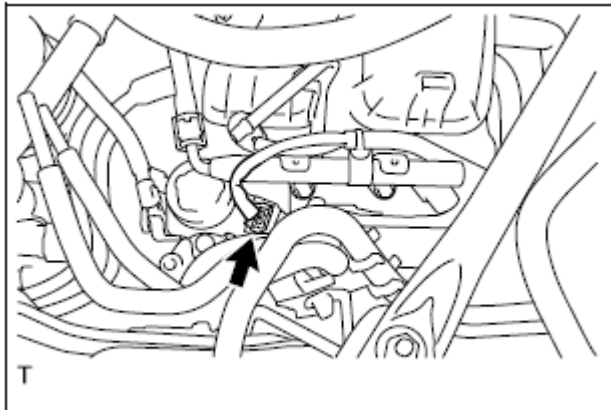
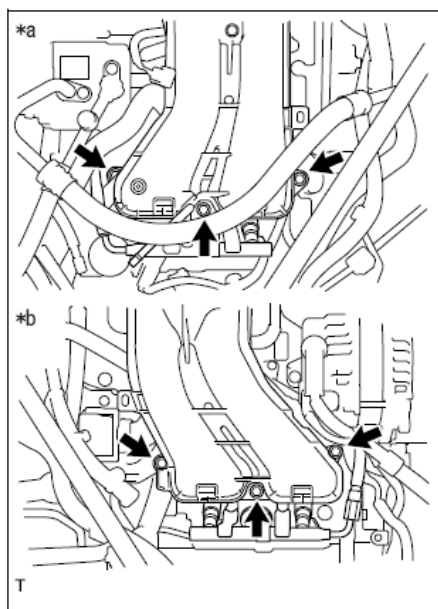


Fig. 190: Identifying Fuel Pump Assembly Connector
Courtesy of SUBARU OF AMERICA, INC.

6. Remove the six bolts and remove the intake manifold and two gaskets.



*a	Bank 2 side
*b	Bank 1 side

Fig. 191: Identifying Intake Manifold Mounting Bolts
 Courtesy of SUBARU OF AMERICA, INC.

63. Fuel delivery pipe NO. 2 removal (Refer to **REMOVAL**)
64. Fuel delivery pipe removal (Refer to **REMOVAL**)
65. Fuel delivery pipe (bank 2 side) removal (Refer to **REMOVAL**)
66. Fuel delivery pipe (bank 1 side) removal (Refer to **REMOVAL**)
67. Fuel injector ASSY removal (Refer to **REMOVAL**)
68. Fuel injector seal removal (Refer to **REMOVAL**)
69. Fuel pump ASSY removal
 1. Remove the two bolts with a TORX PLUS socket wrench 40IP to remove the fuel pump ASSY.

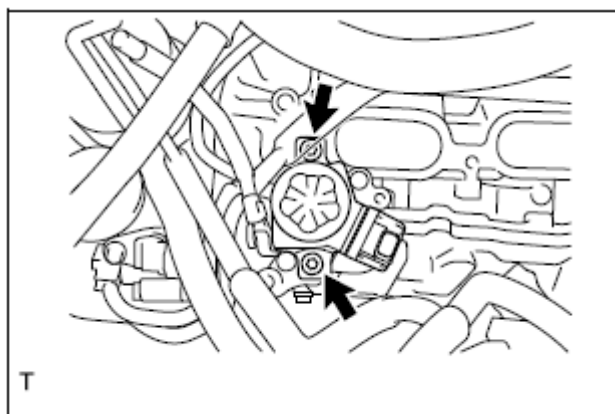


Fig. 192: Identifying Fuel Pump Assembly Mounting Bolts
 Courtesy of SUBARU OF AMERICA, INC.

70. Valve lifter removal (Refer to **REMOVAL**)
71. Pump drive case ASSY removal (Refer to **REMOVAL**)
72. Engine wiring removal
 1. Remove the two bolts and disconnect the engine wiring.
 2. Disconnect each connector and clamp to remove the engine wiring.

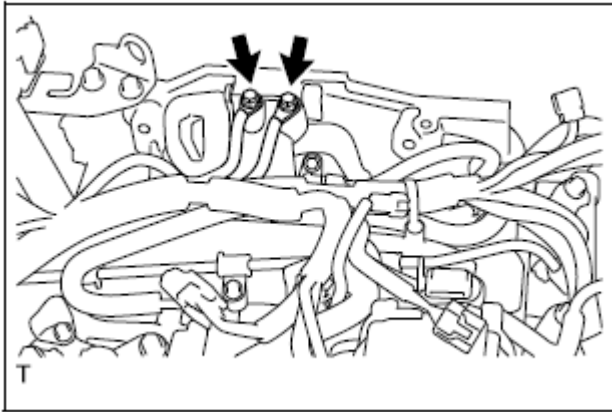


Fig. 193: Identifying Engine Wiring Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

73. Ventilation hose NO. 2 removal
 1. Move the hose clamp and remove the ventilation hose NO. 2.

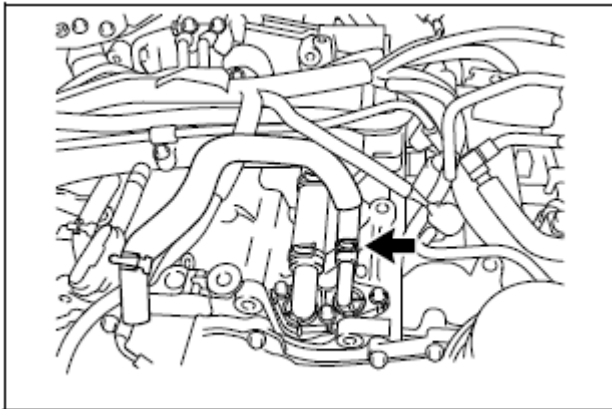


Fig. 194: Identifying Ventilation Hose No. 2 Hose Clamp
Courtesy of SUBARU OF AMERICA, INC.

74. PCV hose connector removal
 1. Remove the three bolts and remove the PCV hose connector.
 2. Move the hose clamp and disconnect the water by-pass hose NO. 1 from the water inlet pipe.
 3. Move the hose clamp and remove the water by-pass hose NO. 1 from the PCV hose connector.

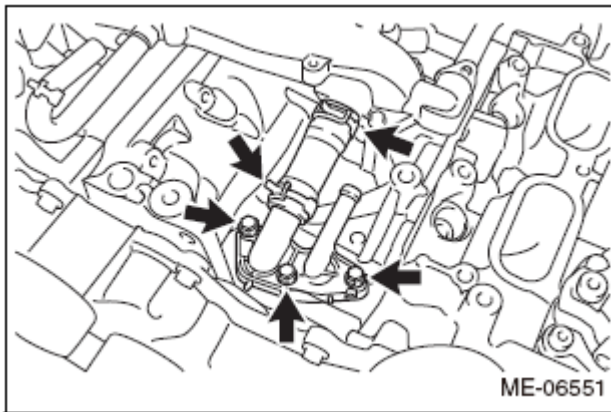


Fig. 195: identifying PCV Hose Connector Mounting Bolts
 Courtesy of SUBARU OF AMERICA, INC.

4. Remove the two O-rings from the PCV hose connector.

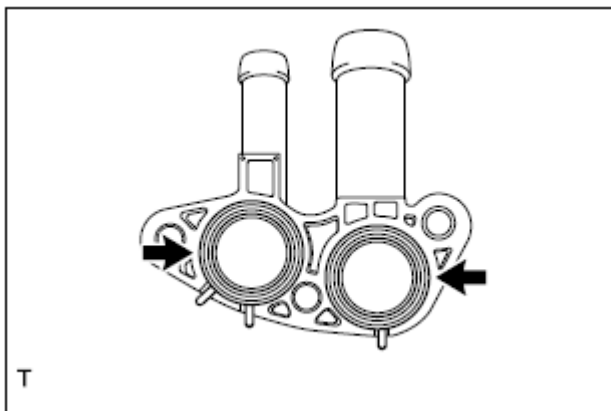


Fig. 196: Identifying PCV Hose Connector O-Rings
 Courtesy of SUBARU OF AMERICA, INC.

75. Water by-pass hose NO. 2 removal
 1. Move the hose clamp and remove the water by-pass hose NO. 2.

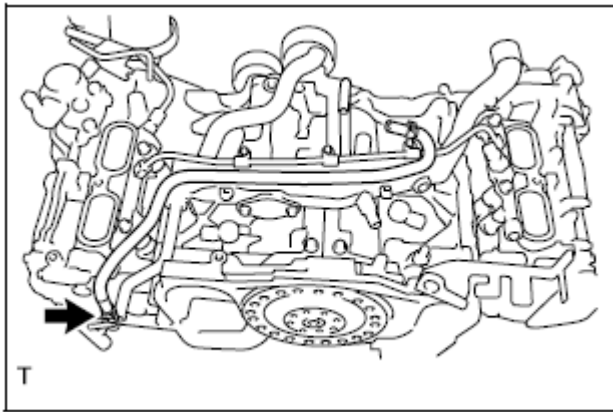


Fig. 197: Identifying Water By-Pass Hose No. 2 Hose Clamp
Courtesy of SUBARU OF AMERICA, INC.

76. Transmission oil cooler hose NO. 3 removal (transmission A/T)
 1. Move the hose clamp and remove the transmission oil cooler hose NO. 3.
77. Water inlet pipe removal
 1. Move the hose clamp and remove the water by-pass hose NO. 3.
 2. Remove the four bolts and remove the water inlet pipe.

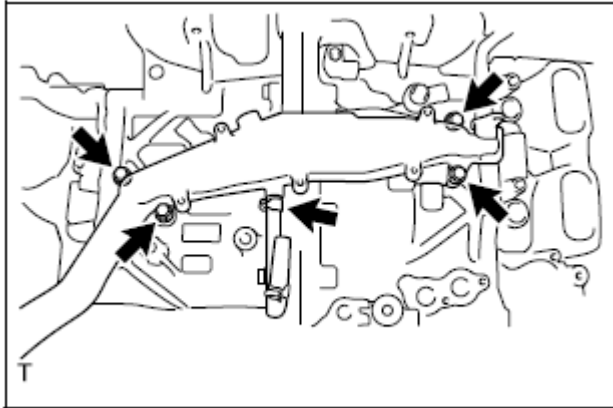


Fig. 198: Identifying Water Inlet Pipe Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

3. Remove the two O-rings from the cylinder block (bank 1 side and bank 2 side).

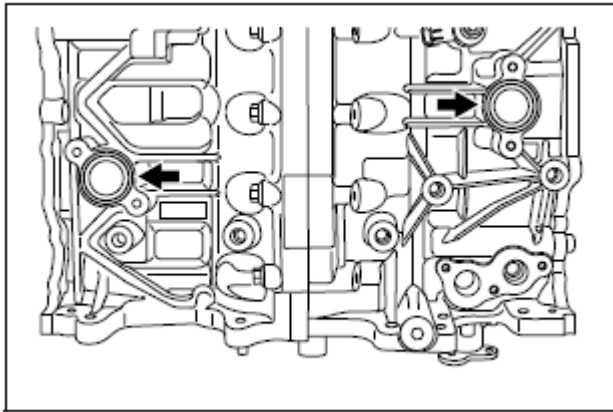


Fig. 199: Identifying Cylinder Block O-Rings (Bank 1 Side And Bank 2 Side)
Courtesy of SUBARU OF AMERICA, INC.

78. Water by-pass pipe NO. 1 removal (transmission M/T)
1. Move the hose clamp and disconnect the water by-pass hose NO. 4.
 2. Remove the two bolts and remove the water by-pass pipe NO. 1.

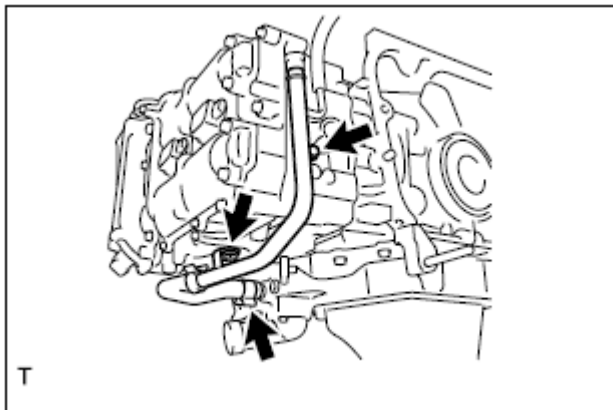


Fig. 200: Identifying Water By-Pass Hose No. 4 Hose Clamps And Bolts
Courtesy of SUBARU OF AMERICA, INC.

79. Water by-pass pipe NO. 1 removal (transmission A/T)
1. Move the two hose clamps and disconnect the two water by-pass hoses.
 2. Remove the two bolts and remove the water by-pass pipe NO. 1.

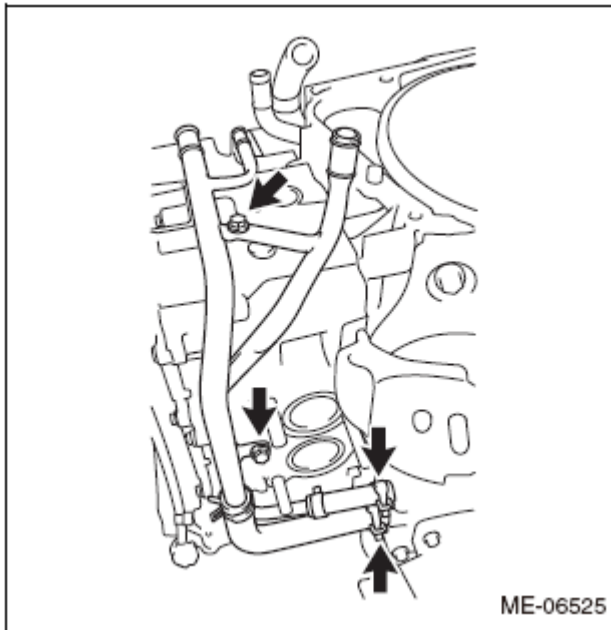


Fig. 201: Identifying Water By-Pass Hose No. 1 Hose Clamps And Bolts
Courtesy of SUBARU OF AMERICA, INC.

80. Vacuum pump ASSY removal (transmission A/T) (Refer to **REMOVAL**)
81. Cylinder head plate RR removal (transmission M/T)
 1. Remove the three bolts and remove the cylinder head plate RR from the camshaft housing SUB-ASSY RH.

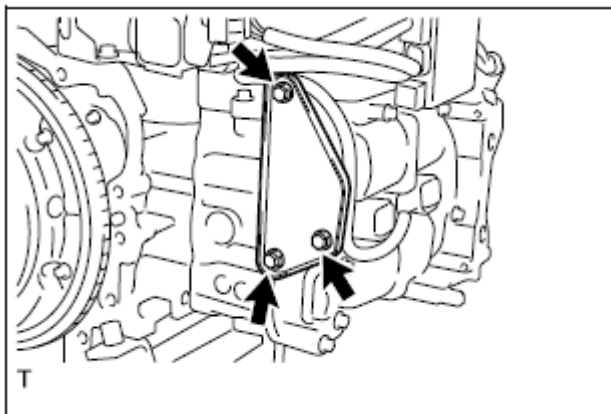


Fig. 202: Identifying Cylinder Head Plate RR Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

82. Removal of knock control sensor
 1. Remove the two bolts and remove the two knock control sensors.

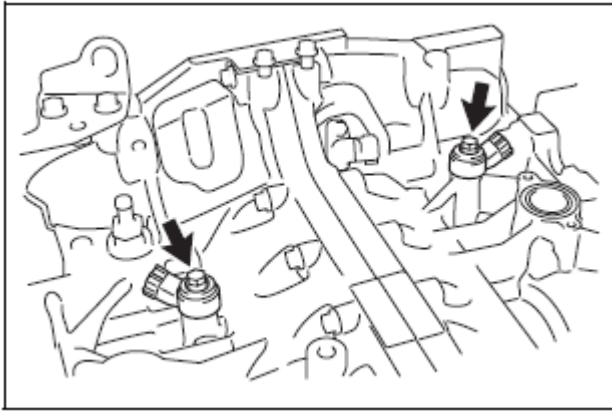


Fig. 203: Identifying Knock Control Sensors Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

83. Removal of crankshaft position sensor

1. Remove the bolt and remove the crank position sensor.

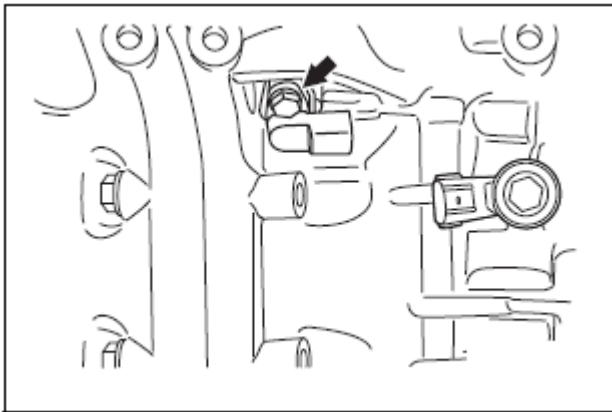


Fig. 204: Identifying Crank Position Sensor Mounting Bolt
Courtesy of SUBARU OF AMERICA, INC.

84. PCV valve removal (Refer to **REMOVAL**)
85. Idler pulley SUB-ASSY NO. 1 removal (Refer to **REMOVAL**)
86. Water pump pulley removal (Refer to **REMOVAL**)
87. Engine water pump ASSY removal (Refer to **REMOVAL**)
88. Water outlet removal (Refer to **REMOVAL**)
89. Thermostat removal (Refer to **REMOVAL**)
90. Crankshaft pulley removal (Refer to **REMOVAL**)
91. Timing chain cover oil seal removal (Refer to **REMOVAL**)
92. Timing chain cover SUB-ASSY removal (Refer to **REMOVAL**)
93. Chain SUB-ASSY removal (bank 1 side) (Refer to **REMOVAL**)

94. Chain SUB-ASSY removal (bank 2 side) (Refer to **REMOVAL**)
95. Piston and valve damage prevention procedure (Refer to **REMOVAL**)
96. Crankshaft timing sprocket removal
 1. Remove the crankshaft timing sprocket.

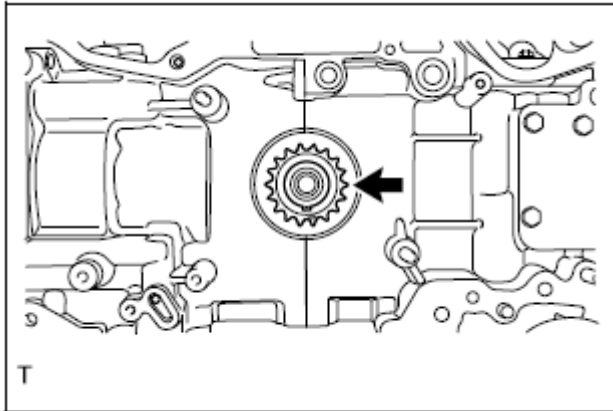


Fig. 205: Identifying Crankshaft Timing Sprocket
Courtesy of SUBARU OF AMERICA, INC.

97. Removal of ignition coil ASSY (bank 2 side)
 1. Remove 2 bolts, and remove 2 ignition coil ASSYs.

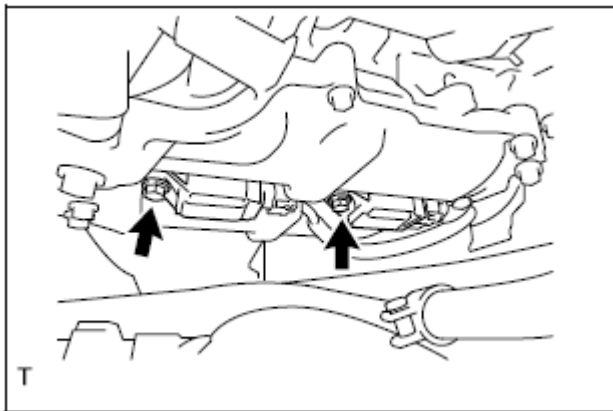


Fig. 206: Identifying Ignition Coil Assembly Mounting Bolts (Bank 2 Side)
Courtesy of SUBARU OF AMERICA, INC.

98. Removal of ignition coil ASSY (bank 1 side)
 1. Remove 2 bolts, and remove 2 ignition coil ASSYs.

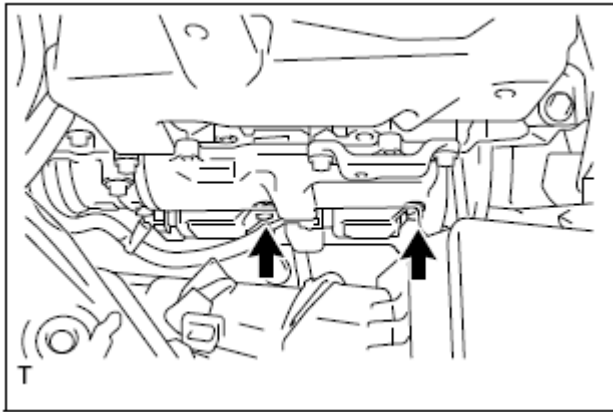


Fig. 207: Identifying Ignition Coil Assembly Mounting Bolts (Bank 1 Side)
Courtesy of SUBARU OF AMERICA, INC.

99. Injector driver bracket removal

1. Remove the two bolts and remove the injector driver bracket.

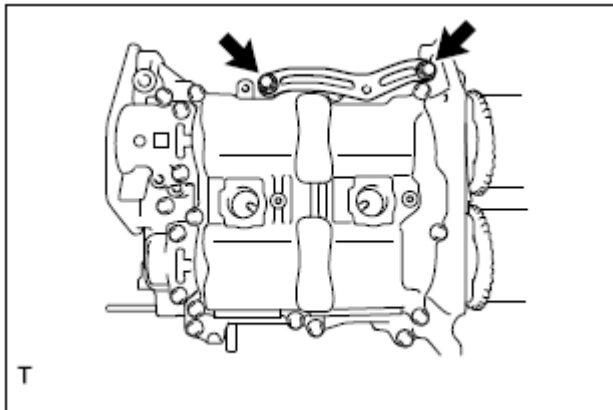


Fig. 208: Identifying Injector Driver Bracket Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

100. Cylinder head cover SUB-ASSY removal

1. Operate the engine stand, and make the bank 1 side face upward.
2. Remove the 8 bolts.

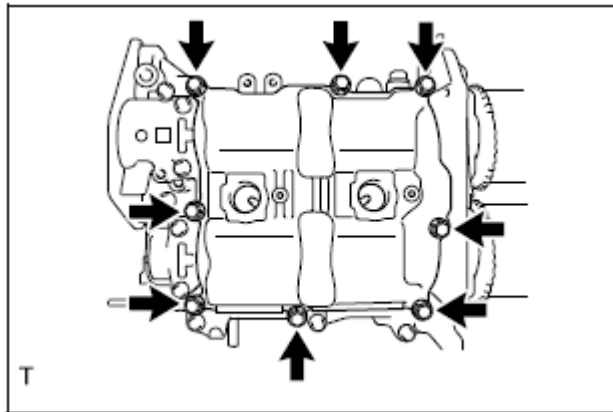


Fig. 209: Identifying Cylinder Head Cover Sub-Assembly Mounting Bolts
 Courtesy of SUBARU OF AMERICA, INC.

3. Remove the cylinder head cover SUB-ASSY using a flat tip screwdriver wrapped with protective tape.

CAUTION: Do not damage the camshaft housing SUB-ASSY, cam cap and cylinder head cover SUB-ASSY.

4. Remove the cylinder head cover gasket.
5. Remove the two spark plug tube gaskets.

CAUTION: When removing the seal gasket using scraper etc., be careful not to damage the cam lobe of camshaft.

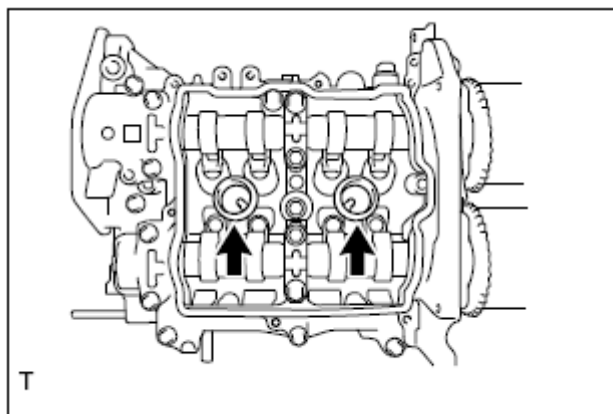


Fig. 210: Identifying Spark Plug Tube Gaskets
 Courtesy of SUBARU OF AMERICA, INC.

101. Camshaft housing SUB-ASSY RH removal

CAUTION: Do not remove the intake and exhaust camshafts before removing the camshaft housing SUB-ASSY. Doing so will result in distortion of camshaft housing SUB-ASSY.

1. Loosen the nine bolts equally in the order as shown in the figure and remove them.

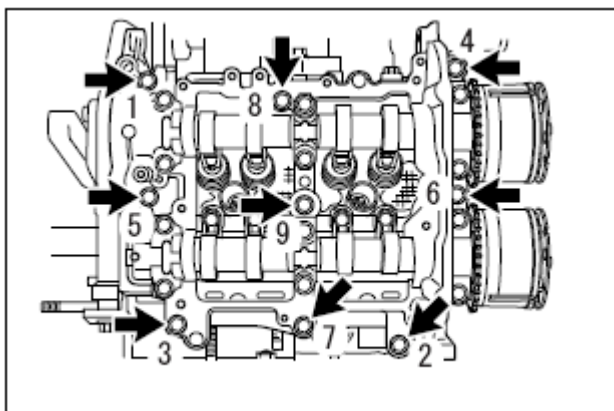


Fig. 211: Identifying RH Camshaft Housing Sub-Assembly Mounting Bolts With Tightening Sequence

Courtesy of SUBARU OF AMERICA, INC.

2. Remove the camshaft housing SUB-ASSY RH using a flat tip screwdriver wrapped with protective tape.

CAUTION: Do not damage the cylinder head and camshaft housing SUB-ASSY.

3. Remove the two O-rings and eight valve rocker arm SUB-ASSYs NO. 1 from the cylinder head SUB-ASSY.

NOTE: The removed parts must be organized by installation location.

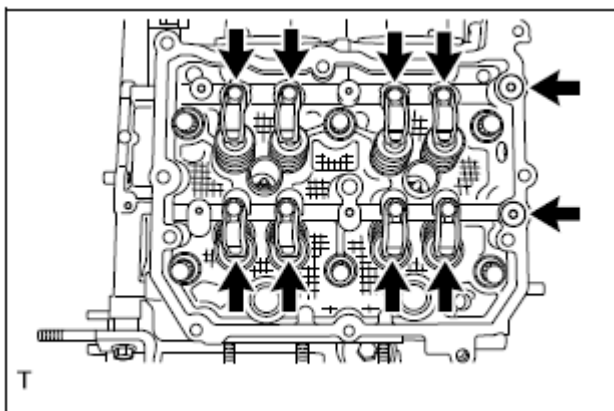


Fig. 212: Identifying Cylinder Head Sub-Assembly Valve Rocker Arm Sub-Assembly No. 1 And O-Ring
Courtesy of SUBARU OF AMERICA, INC.

4. Remove the eight valve adjusting shims and eight roller rocker arm pivot from the cylinder head SUB-ASSY.

NOTE: The removed parts must be organized by installation location.

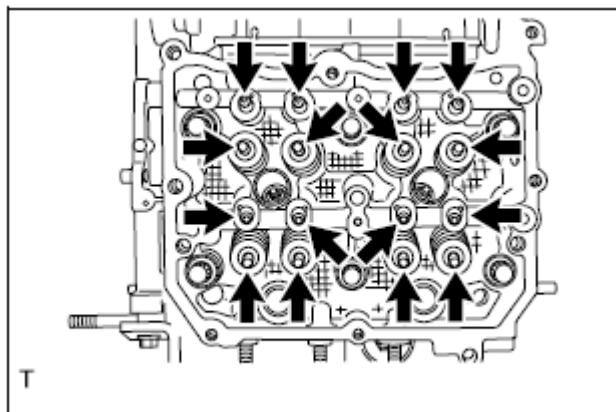


Fig. 213: Identifying Cylinder Head Sub-Assembly Valve Adjusting Shims And Roller Rocker Arm Pivot
Courtesy of SUBARU OF AMERICA, INC.

102. Cylinder head SUB-ASSY removal (Refer to **REMOVAL**)
103. Cylinder head gasket removal (Refer to **REMOVAL**)
104. Cylinder head cover SUB-ASSY LH removal
 1. Operate the engine stand, and make the bank 2 side face upward.
 2. Remove the 8 bolts.

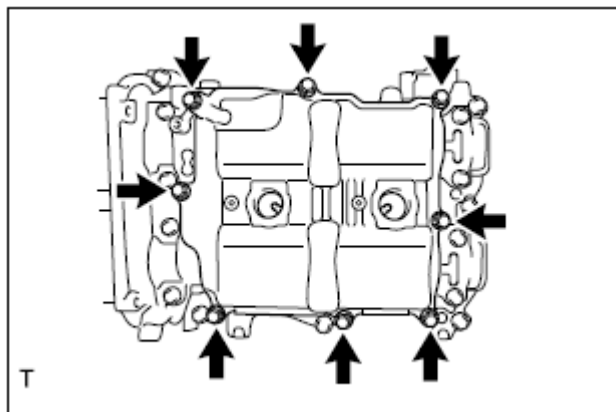


Fig. 214: Identifying LH Cylinder Head Cover Sub-Assembly Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

3. Remove the cylinder head cover SUB-ASSY LH using a flat tip screwdriver wrapped with protective tape.

CAUTION: Do not damage the camshaft housing SUB-ASSY, cam cap and cylinder head cover SUB-ASSY.

4. Remove the cylinder head cover gasket NO. 2.
5. Remove the two spark plug tube gaskets.

CAUTION: When removing the seal gasket using scraper etc., be careful not to damage the cam lobe of camshaft.

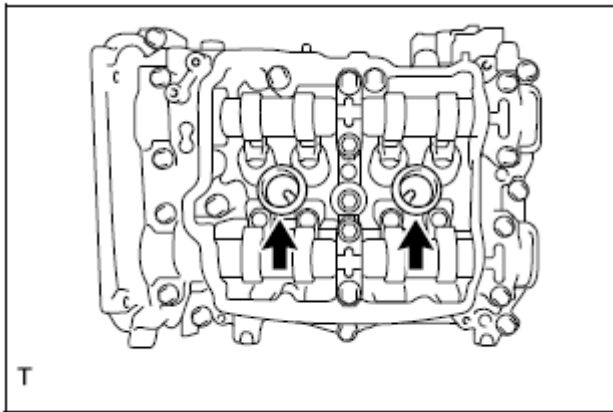


Fig. 215: Identifying Spark Plug Tube Gaskets
Courtesy of SUBARU OF AMERICA, INC.

105. Camshaft housing SUB-ASSY LH removal

CAUTION: Do not remove the intake and exhaust camshafts before removing the camshaft housing SUB-ASSY. Doing so will result in distortion of camshaft housing SUB-ASSY.

1. Loosen the nine bolts equally in the order as shown in the figure and remove them.

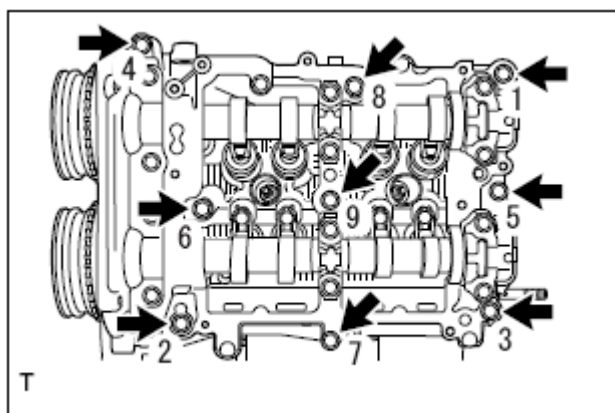


Fig. 216: Identifying LH Camshaft Housing Sub-Assembly Mounting Bolts With Loosening Sequence

Courtesy of SUBARU OF AMERICA, INC.

2. Remove the camshaft housing SUB-ASSY using a flat tip screwdriver wrapped with protective tape.

CAUTION: Do not damage the cylinder head and camshaft housing SUB-ASSY.

3. Remove the two O-rings and eight valve rocker arm SUB-ASSYs NO. 1 from the cylinder head LH.

NOTE: The removed parts must be organized by installation location.

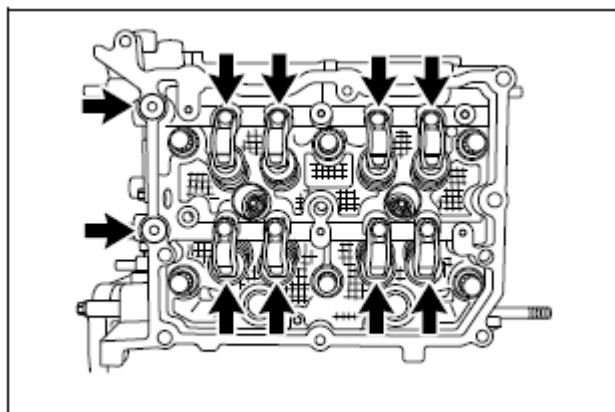


Fig. 217: Identifying LH Cylinder Head Valve Rocker Arm Sub-Assembly No. 1 And O-Ring
Courtesy of SUBARU OF AMERICA, INC.

4. Remove the eight valve adjusting shims and eight roller rocker arm pivot from the cylinder head LH.

NOTE: The removed parts must be organized by installation location.

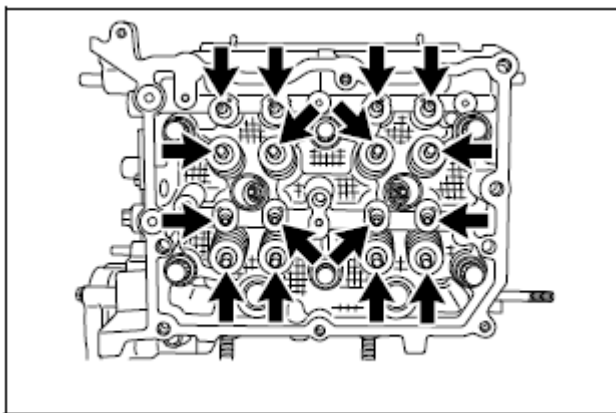


Fig. 218: Identifying LH Cylinder Head Valve Adjusting Shims And Roller Rocker Arm Pivot
 Courtesy of SUBARU OF AMERICA, INC.

106. Cylinder head LH removal (Refer to **REMOVAL**)
107. Cylinder head gasket NO. 2 removal (Refer to **REMOVAL**)
108. Engine hanger NO. 2 removal
 1. Remove the two bolts and remove the engine hanger NO. 2 from the cylinder block (bank 1 side).

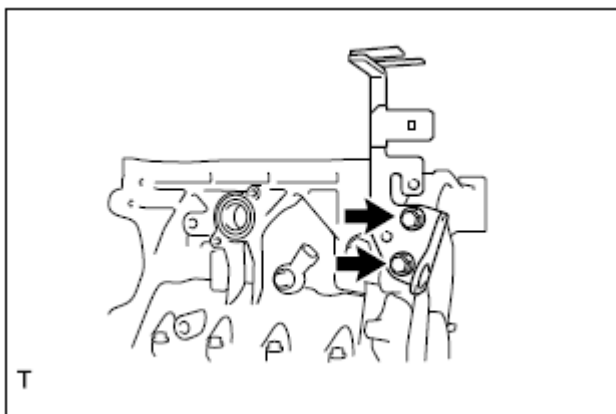


Fig. 219: Identifying Cylinder Block Engine Hanger No. 2 Mounting Bolts (Bank 1 Side)
 Courtesy of SUBARU OF AMERICA, INC.

109. Oil pan SUB-ASSY NO. 2 removal
 1. Remove the 11 bolts.

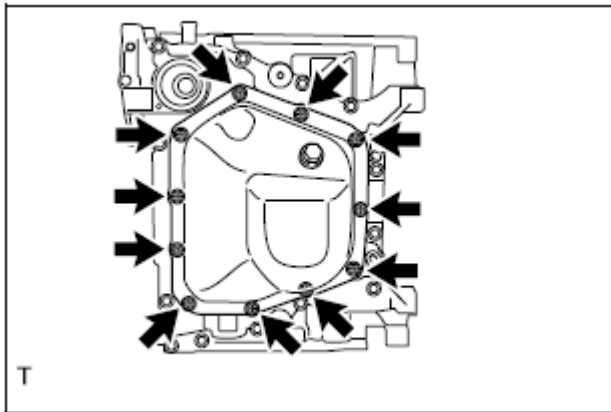


Fig. 220: Identifying Oil Pan Sub-Assembly No. 2 Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

2. Remove the oil pan SUB-ASSY NO. 2 with a oil pan seal cutter.

CAUTION: Do not damage the installation surface of oil pan SUB-ASSY and the flange portion of oil pan SUB-ASSY NO. 2.

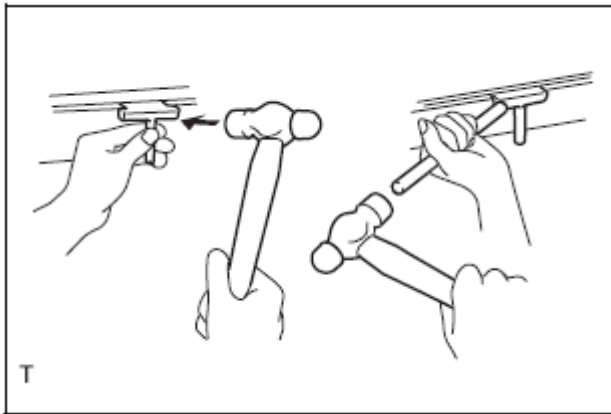


Fig. 221: Removing Oil Pan Sub-Assembly No. 2 Using Oil Pan Seal Cutter
Courtesy of SUBARU OF AMERICA, INC.

3. Remove the two seal rings from the oil pan SUB-ASSY NO. 2.

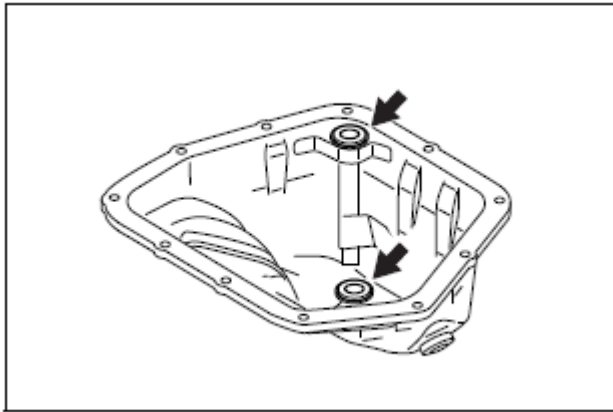


Fig. 222: Identifying Oil Pan Sub-Assembly No. 2 Seal Rings
Courtesy of SUBARU OF AMERICA, INC.

110. Oil strainer SUB-ASSY removal

1. Remove the two bolts and remove the oil strainer SUB-ASSY.
2. Remove the O-ring.

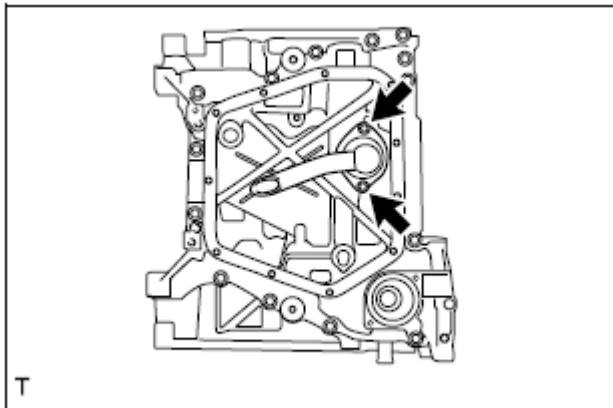


Fig. 223: Identifying Oil Strainer Sub-Assembly Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

111. Oil pan SUB-ASSY removal

1. Remove the 13 bolts.
2. Remove the oil pan SUB-ASSY using a flat tip screwdriver wrapped with protective tape.

CAUTION: Do not damage the installation surfaces of cylinder block and oil pan SUB-ASSY.

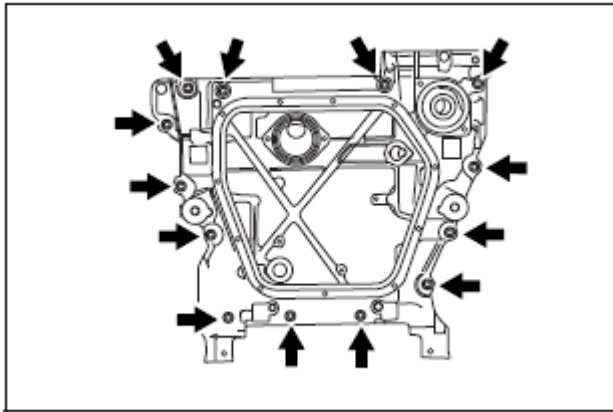


Fig. 224: Identifying Oil Pan Sub-Assembly Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

3. Remove the three O-rings from the cylinder block.

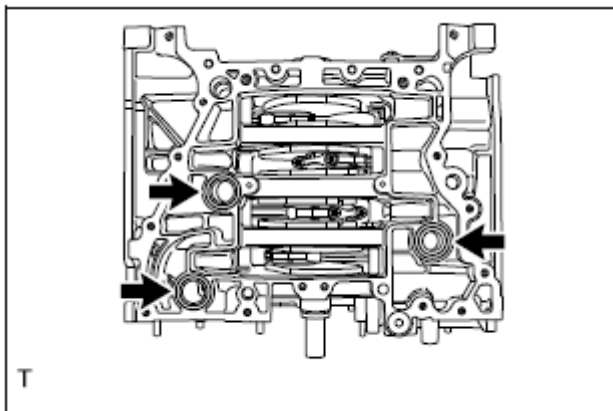
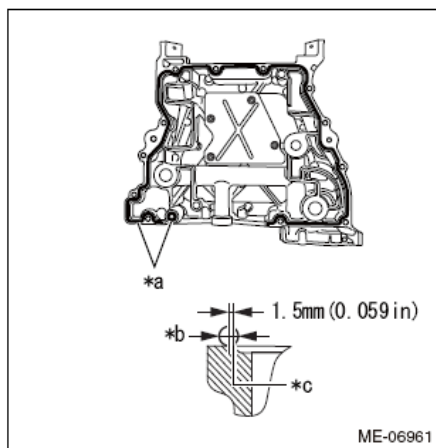


Fig. 225: Identifying Cylinder Block O-Rings
Courtesy of SUBARU OF AMERICA, INC.

INSTALLATION

1. Oil pan SUB-ASSY installation
 1. Apply THREE BOND 1217G to the mating surface of oil pan SUB-ASSY as shown in the figure.



*a	THREE BOND 1217G
*b	Diameter: 4.0 to 6.0 mm {0.156 to 0.236 in}
*c	Groove end

Fig. 226: Identifying Three Bond 1217G Applying Area On Oil Pan Sub-Assembly
Courtesy of SUBARU OF AMERICA, INC.

CAUTION:

- Clean and degrease the installation surface.
- Install within 5 min. after applying liquid gasket.
- Apply liquid gasket 1.5 mm {0.0591 in} outside from the groove on the oil pan SUB-ASSY. However, application of liquid gasket on the groove around the bolt hole is allowed.

2. Install three new O-rings to the cylinder block.

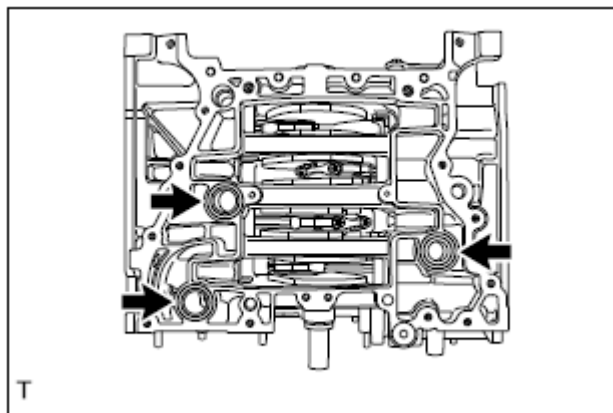


Fig. 227: Identifying Cylinder Block O-Rings
Courtesy of SUBARU OF AMERICA, INC.

3. Tighten the 13 bolts (A and B) in the order as shown in the figure to install the oil pan SUB-ASSY to the cylinder block.

Standard value: T=18N.m {184kgf.cm}

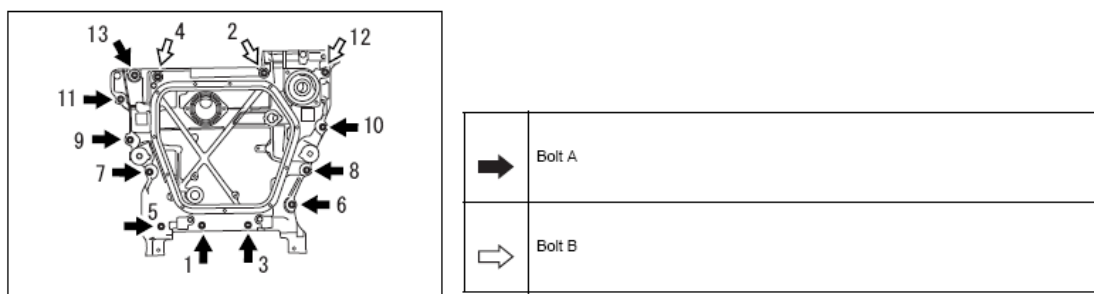


Fig. 228: Identifying Oil Pan Sub-Assembly To Cylinder Block With Tightening Sequence
 Courtesy of SUBARU OF AMERICA, INC.

Bolt	type Bolt length (except for head)
Bolt A	25 mm {0.984 in}
Bolt B	75 mm {2.953 in}

NOTE: After tightening, if the liquid gasket is squeezed out onto the seal surface of timing chain cover SUB-ASSY, completely remove any squeezed-out liquid gasket.

2. Oil strainer SUB-ASSY installation

1. Install a new O-ring.
2. Install the oil strainer SUB-ASSY to the oil pan SUB-ASSY with the two bolts.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

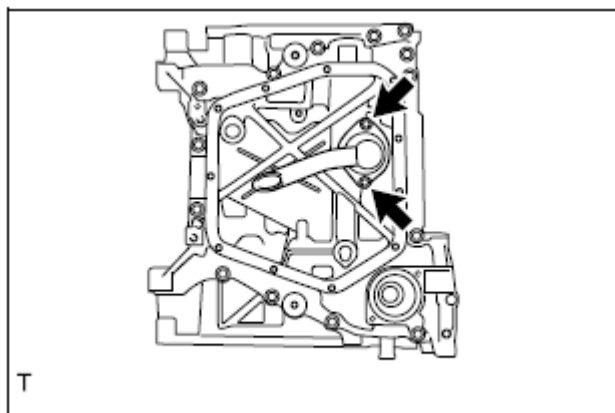


Fig. 229: Identifying Oil Strainer Sub-Assembly Mounting Bolts
 Courtesy of SUBARU OF AMERICA, INC.

3. Oil pan SUB-ASSY NO. 2 installation

1. Install two new oil pan seal rings to the oil pan SUB-ASSY NO. 2.

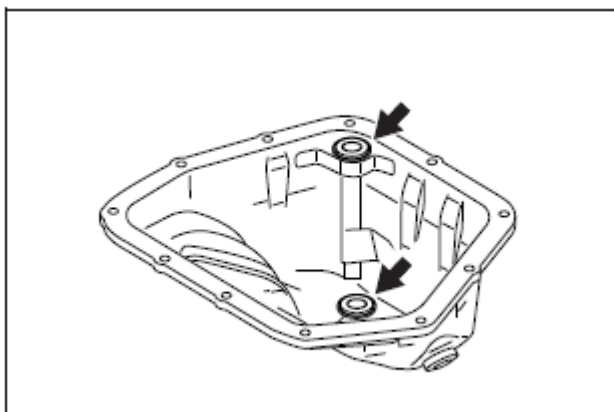
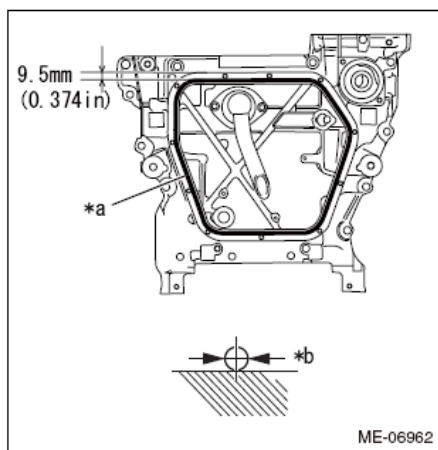


Fig. 230: Identifying Oil Pan Sub-Assembly No. 2 Seal Rings
 Courtesy of SUBARU OF AMERICA, INC.

2. Apply THREE BOND 1217G to the mating surface of oil pan SUB-ASSY for the oil pan SUB-ASSY NO. 2 as shown in the figure.



*a	THREE BOND 1217G
*b	Diameter: 4.0 to 6.0 mm {0.158 to 0.236 in}

Fig. 231: Identifying Three Bond 1217G Applying Area On Oil Pan Sub-Assembly
 Courtesy of SUBARU OF AMERICA, INC.

CAUTION:

- Clean and degrease the installation surface.
- Install within 5 min. after applying liquid gasket.

3. Tighten the 11 bolts in the order as shown in the figure to install the oil pan SUB-ASSY NO. 2.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

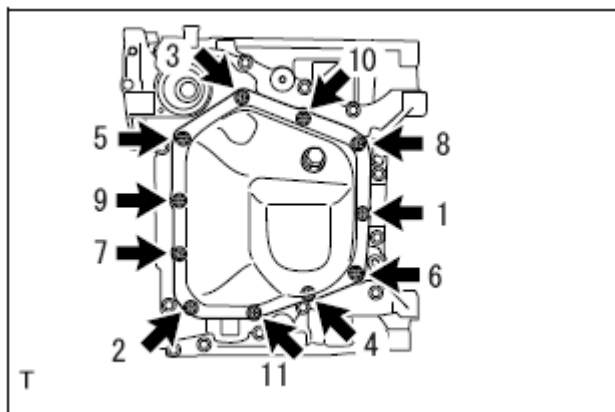


Fig. 232: Identifying Oil Pan Sub-Assembly No. 2 Mounting Bolts With Tightening Sequence
Courtesy of SUBARU OF AMERICA, INC.

4. Engine hanger NO. 2 installation

1. Install the engine hanger NO. 2 to the cylinder block (bank 1 side) with the two bolts.

Standard value: T=21N.m {214kgf.cm} {15.5ft.lbf}

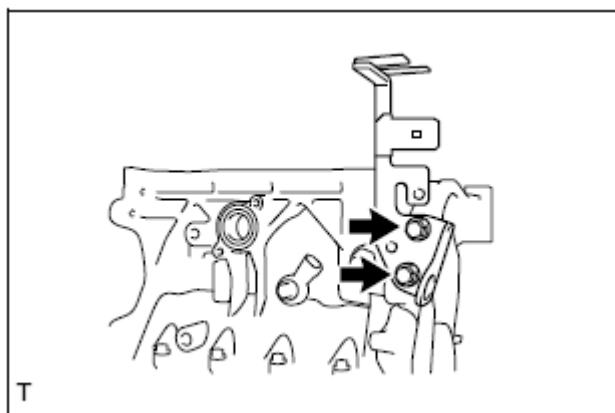


Fig. 233: Identifying Engine Hanger No. 2 To Cylinder Block Mounting Bolts (Bank 1 Side)
Courtesy of SUBARU OF AMERICA, INC.

5. Cylinder head gasket NO. 2 installation (Refer to **INSTALLATION**)

6. Cylinder head LH installation (Refer to **INSTALLATION**)

7. Camshaft housing SUB-ASSY LH installation

1. Apply engine oil to the valve adjusting shim and roller rocker arm pivot, and install them to the cylinder head LH.

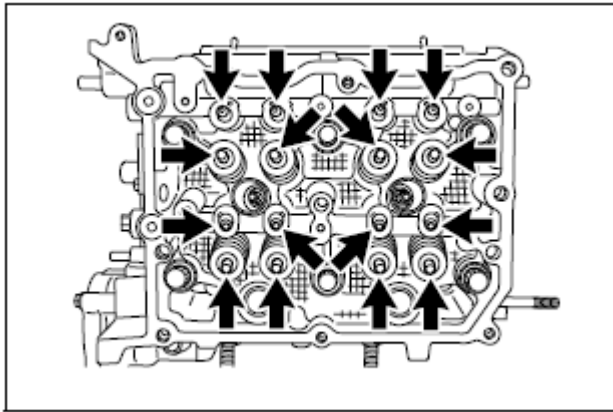


Fig. 234: Identifying Valve Adjusting Shim And Roller Rocker Arm Pivot
Courtesy of SUBARU OF AMERICA, INC.

2. Apply engine oil to the eight valve rocker arm SUB-ASSYs NO. 1 and two new O-rings, and install them to the cylinder head LH.

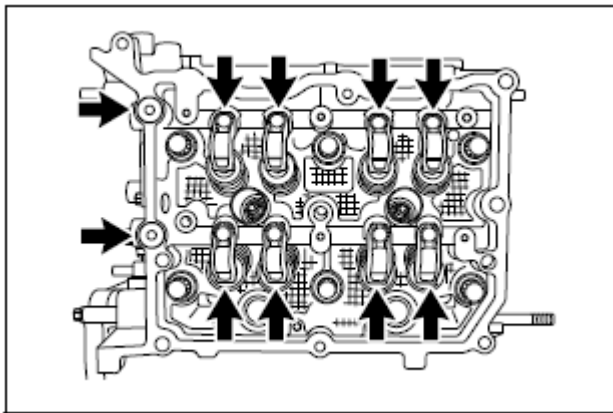
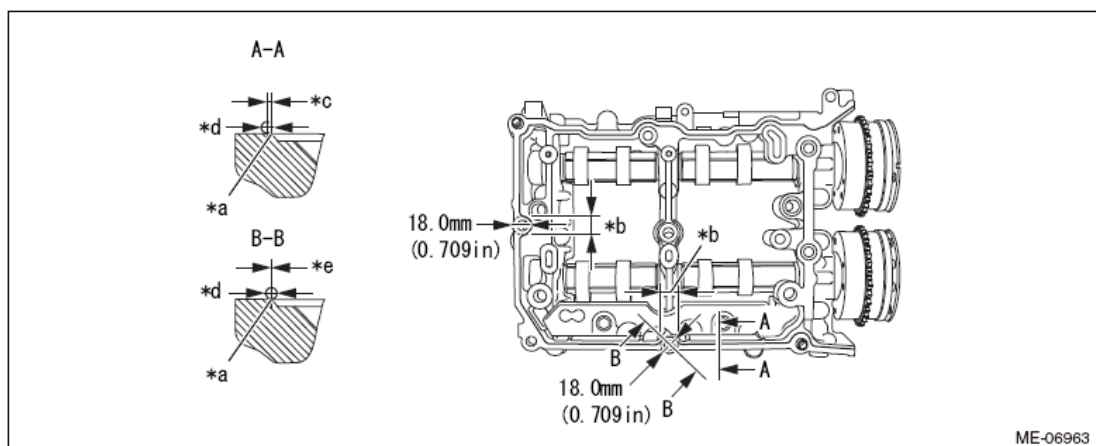


Fig. 235: Identifying Valve Rocker Arm Sub-Assembly No. 1 And O-Rings
Courtesy of SUBARU OF AMERICA, INC.

3. Apply THREE BOND 1217G to the mating surface of camshaft housing SUB-ASSY LH as shown in the figure.



*a	Groove end	*b	Area of B-B
*c	1.0 mm {0.0394 in} or less	*d	Diameter: 2.5 to 3.5 mm {0.098 to 0.138 in}
*e	-0.5 to 0.5 mm {-0.0197 to 0.0197 in}	-	-

Fig. 236: Identifying Three Bond 1217G Applying Area On Camshaft Housing Sub-Assembly
Courtesy of SUBARU OF AMERICA, INC.

CAUTION:

- Clean and degrease the installation surface.
- Do not apply liquid gasket excessively.
- Install within 5 min. after applying liquid gasket.
- Completely remove any liquid gasket that is squeezed out on the installation surface of timing chain cover SUB-ASSY.

4. Tighten the 9 bolts in the order as shown in the figure to install the camshaft housing SUB-ASSY LH.

Standard value: T=18N.m {184kgf.cm} {13.3ft.lbf}

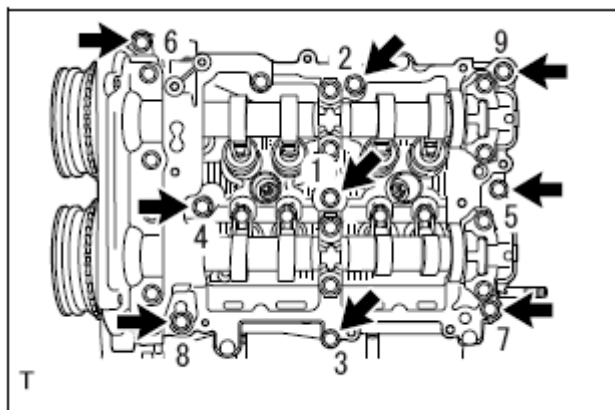


Fig. 237: Identifying LH Camshaft Housing Sub-Assembly Mounting Bolts With Tightening Sequence

Courtesy of SUBARU OF AMERICA, INC.

NOTE: Set the intake camshaft LH and exhaust camshaft LH to the zero-lift position.

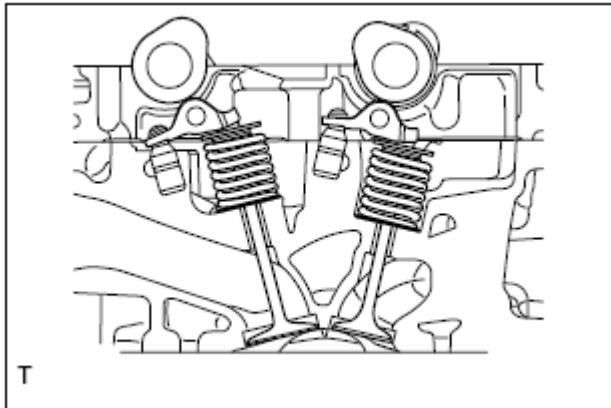


Fig. 238: Identifying LH Intake And Exhaust Camshaft
Courtesy of SUBARU OF AMERICA, INC.

5. Loosen the three bolts by 180° in the order as shown in the figure.

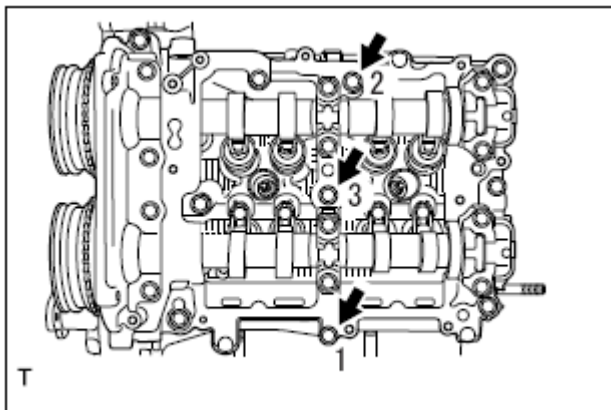


Fig. 239: Identifying Camshaft Housing Sub-Assembly Mounting Bolts With Loosening Sequence
Courtesy of SUBARU OF AMERICA, INC.

6. Tighten the three bolts in the order as shown in the figure.

Standard value: T=18N.m {184kgf.cm} {13.3ft.lbf}

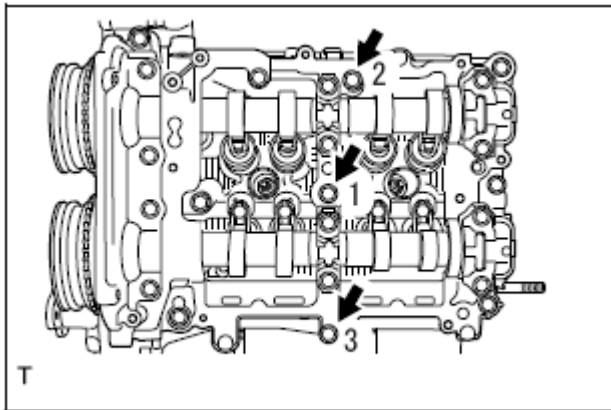


Fig. 240: Identifying Camshaft Housing Sub-Assembly Mounting Bolts With Tightening Sequence

Courtesy of SUBARU OF AMERICA, INC.

7. Loosen the three bolts by 180° in the order as shown in the figure.

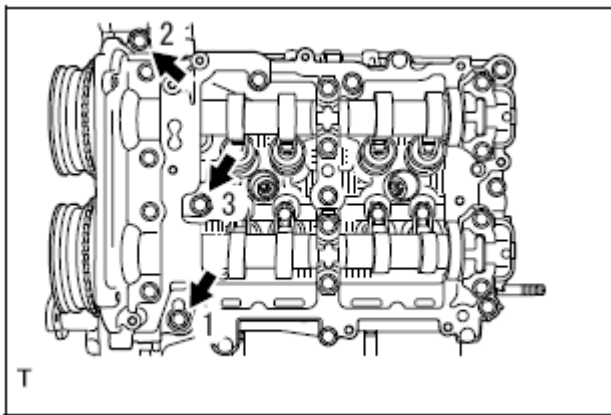


Fig. 241: Identifying Camshaft Housing Sub-Assembly Mounting Bolts With Loosening Sequence

Courtesy of SUBARU OF AMERICA, INC.

8. Tighten the three bolts in the order as shown in the figure.

Standard value: T=18N.m {184kgf.cm} {13.3ft.lbf}

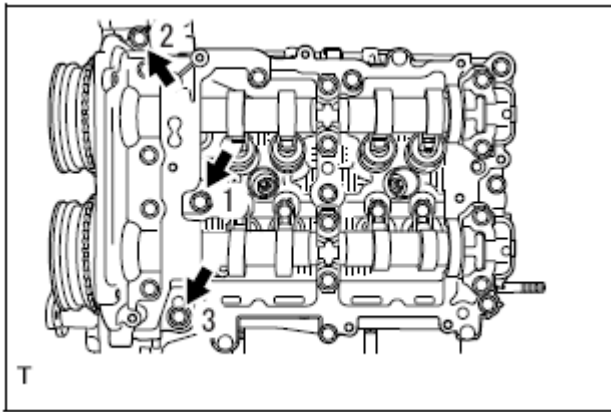


Fig. 242: Identifying Camshaft Housing Sub-Assembly Mounting Bolts With Tightening Sequence

Courtesy of SUBARU OF AMERICA, INC.

9. Loosen the three bolts by 180° in the order as shown in the figure.

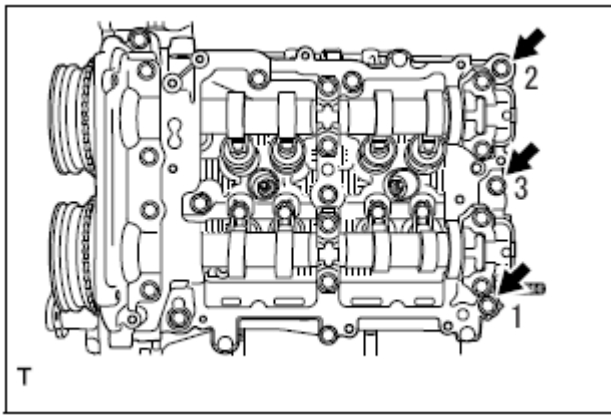


Fig. 243: Identifying Camshaft Housing Sub-Assembly Mounting Bolts With Loosening Sequence

Courtesy of SUBARU OF AMERICA, INC.

10. Tighten the three bolts in the order as shown in the figure.

Standard value: T=18N.m {184kgf.cm} {13.3ft.lbf}

NOTE: After tightening, if the liquid gasket is squeezed out of the seal surface of timing chain cover SUB-ASSY, completely remove any squeezed-out liquid gasket.

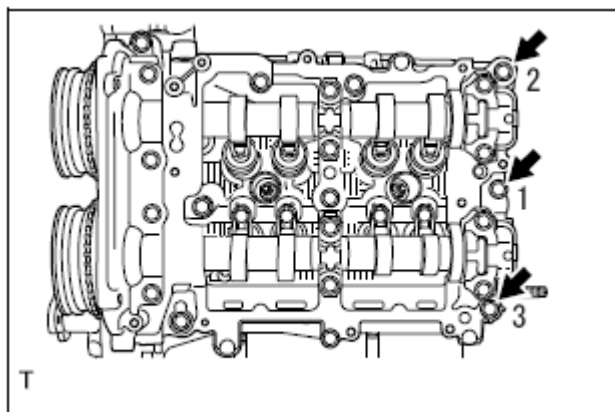


Fig. 244: Identifying Camshaft Housing Sub-Assembly Mounting Bolts With Tightening Sequence

Courtesy of SUBARU OF AMERICA, INC.

8. Cylinder head cover SUB-ASSY LH installation

1. Apply a coat of engine oil to two new spark plug tube gaskets and insert them onto the spark plug tube edge.

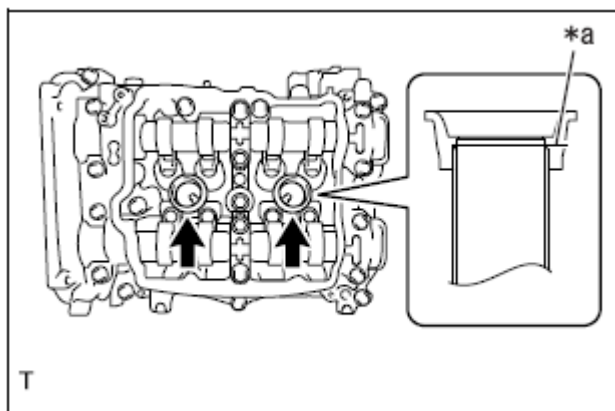
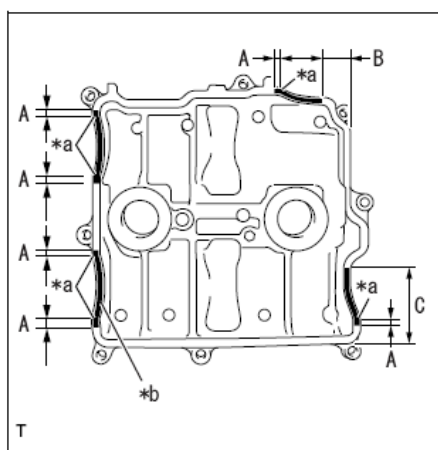


Fig. 245: Identifying Spark Plug Tube Edge

Courtesy of SUBARU OF AMERICA, INC.

2. Install a new cylinder head cover gasket NO. 2 to the cylinder head cover SUB-ASSY LH.
3. Apply THREE BOND 1217G to the mating surface of cylinder head cover SUB-ASSY LH as shown in the figure.

Application area	Application length
A	10.0 mm {0.394 in} or more
B	18.8 mm {0.740 in} or more
C	63.0 mm {2.480 in} or more



*a	Arch starting point
*b	Diameter: 2.0 to 4.0 mm (0.079 to 0.158 in)

Fig. 246: Identifying Three Bond 1217G Applying Area On Cylinder Head Cover Sub-Assembly

Courtesy of SUBARU OF AMERICA, INC.

4. Set the cylinder head cover SUB-ASSY LH and tighten the eight bolts in the order as shown in the figure.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

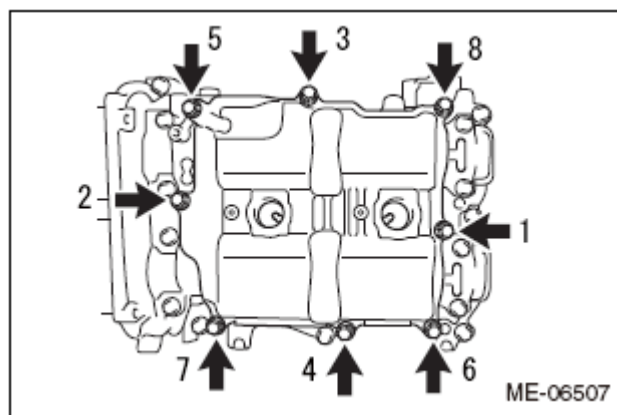


Fig. 247: Identifying Cylinder Head Cover Sub-Assembly Mounting Bolts With Tightening Sequence

Courtesy of SUBARU OF AMERICA, INC.

9. Cylinder head gasket installation (Refer to **INSTALLATION**)
10. Cylinder head SUB-ASSY installation (Refer to **INSTALLATION**)
11. Camshaft housing SUB-ASSY RH installation
 1. Apply engine oil to the valve adjusting shim and roller rocker arm pivot, and install them to the cylinder head SUB-ASSY.

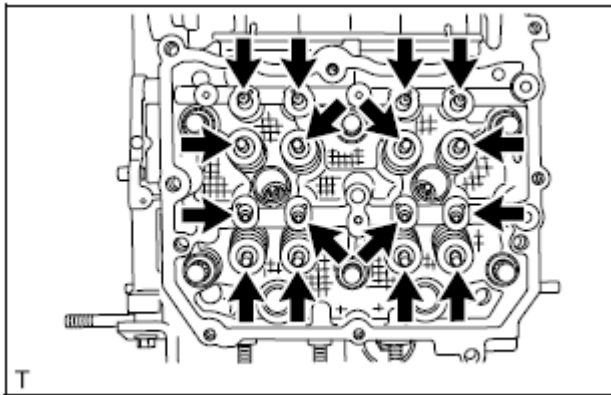


Fig. 248: Identifying Cylinder Head Cover Sub-Assembly Valve Adjusting Shim And Roller Rocker Arm Pivot

Courtesy of SUBARU OF AMERICA, INC.

2. Apply engine oil to the eight valve rocker arm SUB-ASSYs NO. 1 and two new O-rings, and install them to the cylinder head SUB-ASSY.

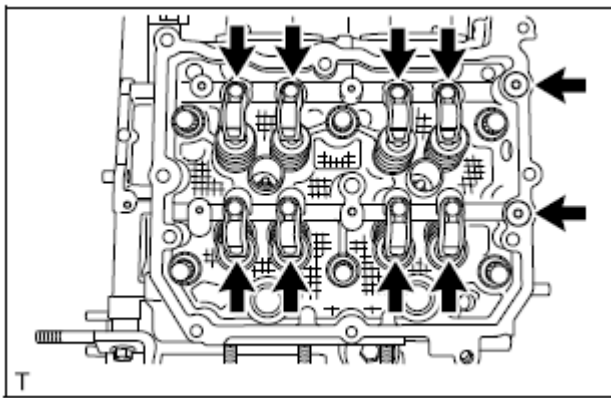
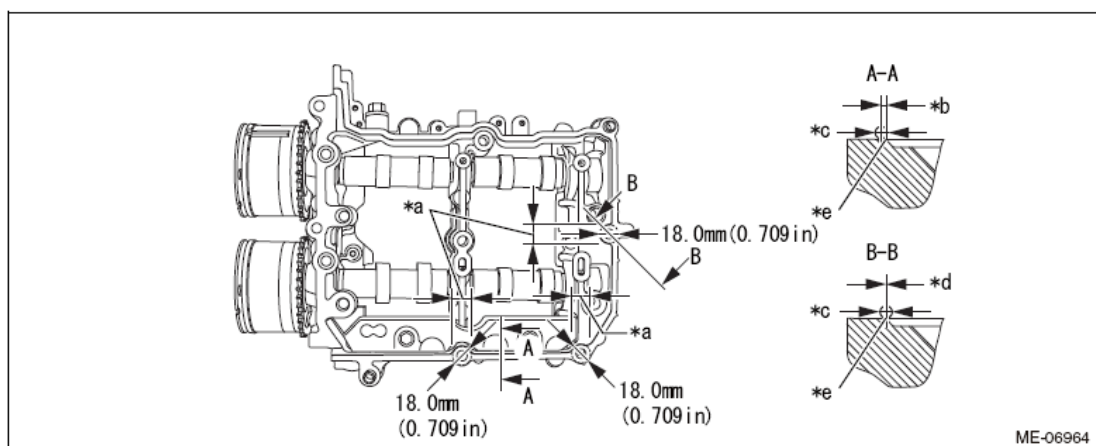


Fig. 249: Identifying Valve Rocker Arm Sub-Assembly No. 1 And O-Rings

Courtesy of SUBARU OF AMERICA, INC.

3. Apply THREE BOND 1217G to the mating surface of camshaft housing SUB-ASSY RH as shown in the figure.



*a	Area of B-B	*b	0 to 1.0 mm (0 to 0.0394 in)
*c	Diameter: 2.5 to 3.5 mm (0.098 to 0.138 in)	*d	-0.5 to 0.5 mm (-0.0197 to 0.0197 in)
*e	Groove edge	-	-

Fig. 250: Identifying Three Bond 1217G Applying Area On Camshaft Housing Sub-Assembly
Courtesy of SUBARU OF AMERICA, INC.

CAUTION:

- Clean and degrease the installation surface.
- Do not apply liquid gasket excessively.
- Install within 5 min. after applying liquid gasket.
- Completely remove any liquid gasket that is squeezed out on the installation surface of timing chain cover SUB-ASSY.

4. Tighten the 9 bolts in the order as shown in the figure to install the camshaft housing SUB-ASSY RH.

Standard value: T=18N.m {184kgf.cm} {13.3ft.lbf}

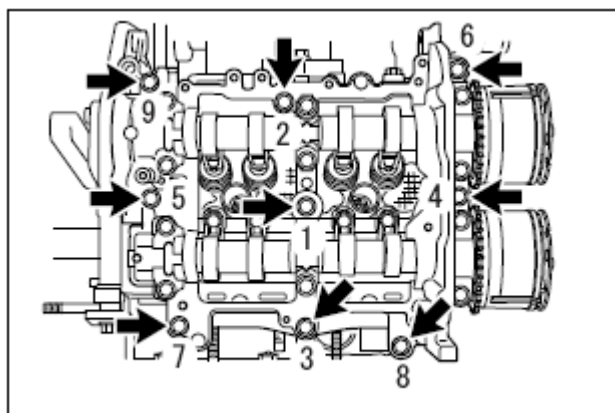


Fig. 251: Identifying RH Camshaft Housing Sub-Assembly Mounting Bolts With Tightening Sequence

Courtesy of SUBARU OF AMERICA, INC.

NOTE: Set the intake camshaft RH and exhaust camshaft RH to the zero-lift position.

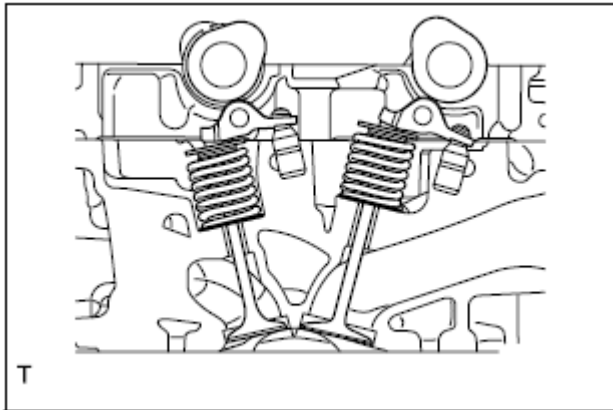


Fig. 252: Identifying Intake And Exhaust Camshaft
Courtesy of SUBARU OF AMERICA, INC.

5. Loosen the three bolts by 180° in the order as shown in the figure.

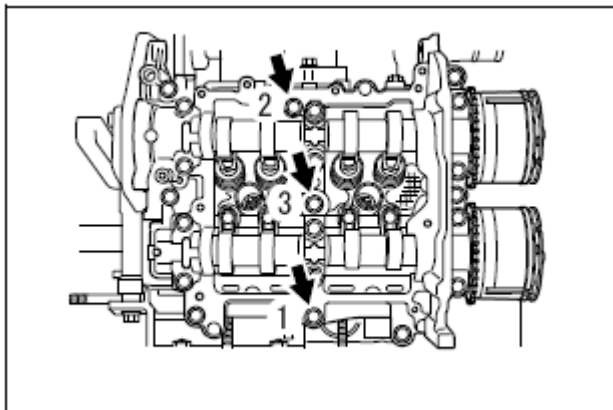


Fig. 253: Identifying RH Camshaft Housing Sub-Assembly Mounting Bolts And Loosening Sequence
Courtesy of SUBARU OF AMERICA, INC.

6. Tighten the three bolts in the order as shown in the figure.

Standard value: T=18N.m {184kgf.cm} {13.3ft.lbf}

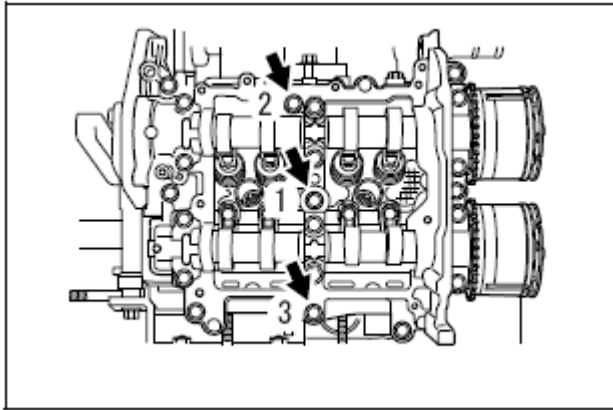


Fig. 254: Identifying RH Camshaft Housing Sub-Assembly Mounting Bolts And Tightening Sequence

Courtesy of SUBARU OF AMERICA, INC.

7. Loosen the three bolts by 180° in the order as shown in the figure.

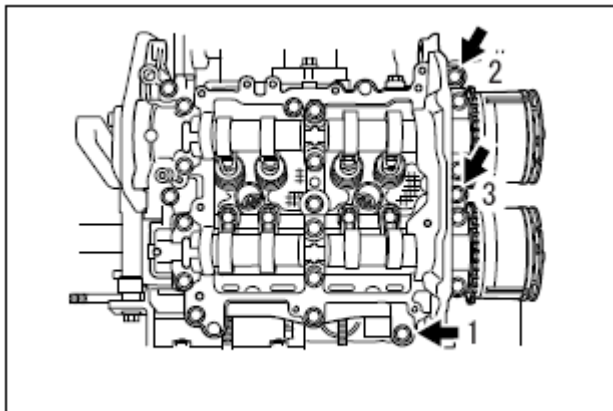


Fig. 255: Identifying RH Camshaft Housing Sub-Assembly Mounting Bolts And Loosening Sequence

Courtesy of SUBARU OF AMERICA, INC.

8. Tighten the three bolts in the order as shown in the figure.

Standard value: T=18N.m {184kgf.cm} {13.3ft.lbf}

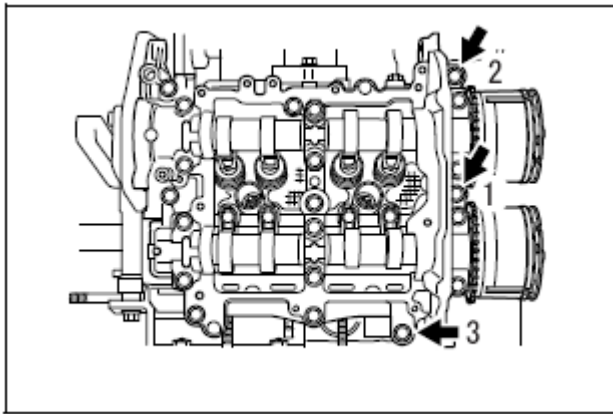


Fig. 256: Identifying RH Camshaft Housing Sub-Assembly Mounting Bolts And Tightening Sequence

Courtesy of SUBARU OF AMERICA, INC.

9. Loosen the three bolts by 180° in the order as shown in the figure.

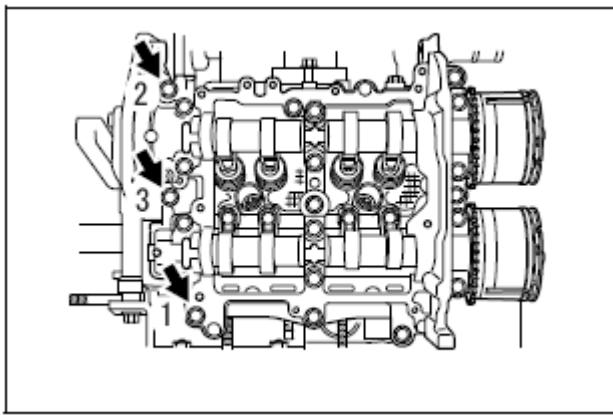


Fig. 257: Identifying RH Camshaft Housing Sub-Assembly Mounting Bolts And Loosening Sequence

Courtesy of SUBARU OF AMERICA, INC.

10. Tighten the three bolts in the order as shown in the figure.

Standard value: T=18N.m {184kgf.cm} {13.3ft.lbf}

NOTE: After tightening, if the liquid gasket is squeezed out of the seal surface of timing chain cover SUB-ASSY, completely remove any squeezed-out liquid gasket.

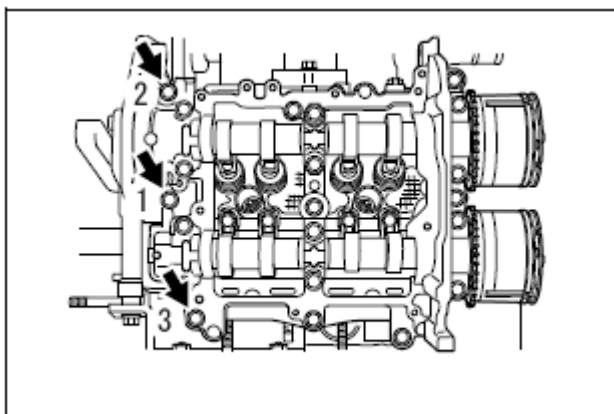
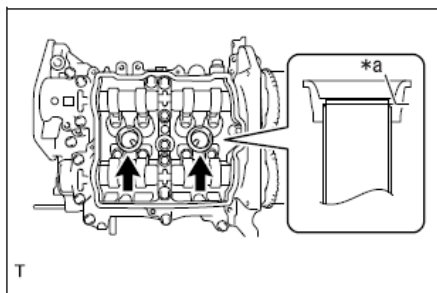


Fig. 258: Identifying RH Camshaft Housing Sub-Assembly Mounting Bolts And Tightening Sequence

Courtesy of SUBARU OF AMERICA, INC.

12. Cylinder head cover SUB-ASSY installation

1. Apply a coat of engine oil to two new spark plug tube gaskets and insert them onto the spark plug tube edge.



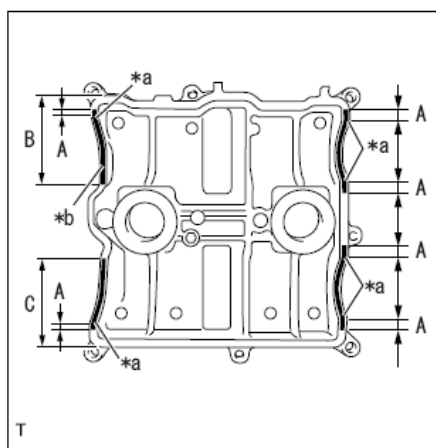
*a Spark plug tube edge

Fig. 259: Identifying Spark Plug Tube Edge

Courtesy of SUBARU OF AMERICA, INC.

2. Install a new cylinder head cover gasket to the cylinder head cover SUB-ASSY.
3. Apply THREE BOND 1217G to the mating surface of cylinder head cover SUB-ASSY as shown in the figure.

Application area	Application length
A	10.0 mm {0.394 in} or more
B	68.0 mm {2.677 in} or more
C	70.7 mm {2.784 in} or more



*a	Arch starting point
*b	Diameter: 2.0 to 4.0 mm {0.079 to 0.158 in}

Fig. 260: Identifying Three Bond 1217G Application Area On Mating Surface Of Cylinder Head Cover Sub-Assembly

Courtesy of SUBARU OF AMERICA, INC.

4. Set the cylinder head cover SUB-ASSY and tighten the eight bolts in the order as shown in the figure.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

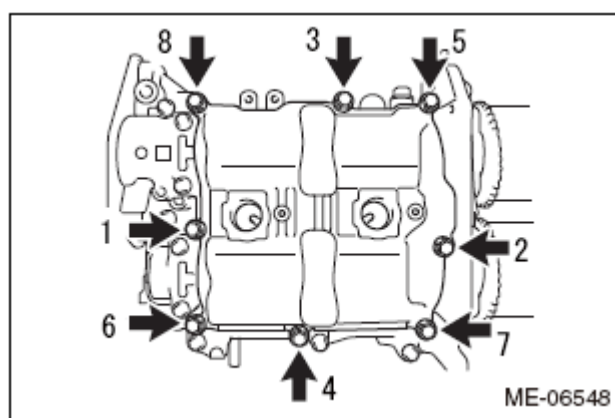


Fig. 261: Identifying Cylinder Head Cover Sub-Assembly With Tightening Sequence

Courtesy of SUBARU OF AMERICA, INC.

13. Injector driver bracket installation

1. Install the injector driver bracket with the two bolts.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

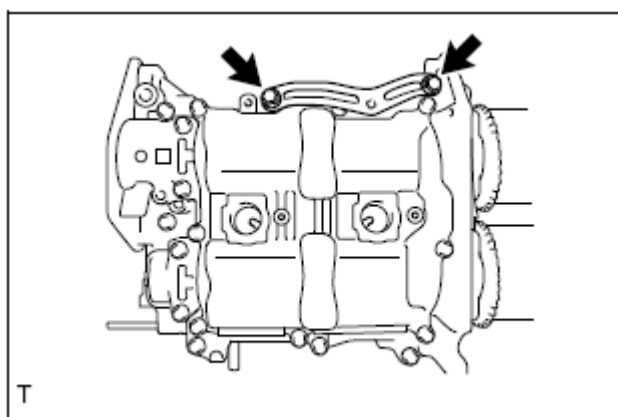


Fig. 262: Identifying Injector Driver Bracket Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

14. Installation of ignition coil ASSY (bank 1 side)

1. Using 2 bolts, install the ignition coil ASSY.

Standard value: T=8.5N.m {87kgf.cm} {6.3ft.lbf}

15. Installation of ignition coil ASSY (bank 2 side)

1. Using 2 bolts, install the ignition coil ASSY.

Standard value: T=8.5N.m {87kgf.cm} {6.3ft.lbf}

16. Crankshaft timing sprocket installation

1. Install the crankshaft timing sprocket.

17. Chain SUB-ASSY installation (bank 2 side) (Refer to **INSTALLATION**)

18. Chain SUB-ASSY installation (bank 1 side) (Refer to **INSTALLATION**)

19. Timing chain cover SUB-ASSY installation (Refer to **INSTALLATION**)

20. Timing chain cover oil seal installation (Refer to **INSTALLATION**)

21. Crankshaft pulley installation (Refer to **INSTALLATION**)

22. Thermostat installation (Refer to **INSTALLATION**)

23. Water outlet installation (Refer to **INSTALLATION**)

24. Engine water pump ASSY installation (Refer to **INSTALLATION**)

25. Water pump pulley installation (Refer to **INSTALLATION**)

26. Idler pulley SUB-ASSY NO. 1 installation (Refer to **INSTALLATION**)

27. PCV valve installation (Refer to **INSTALLATION**)

28. Installation of crankshaft position sensor

1. Using bolt, install the crankshaft position sensor.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

29. Installation of knock control sensor

1. Install the two knock control sensors in the direction shown in the figure with the two bolts.

Standard value: T=24N.m {245kgf.cm} {17.7ft.lbf}

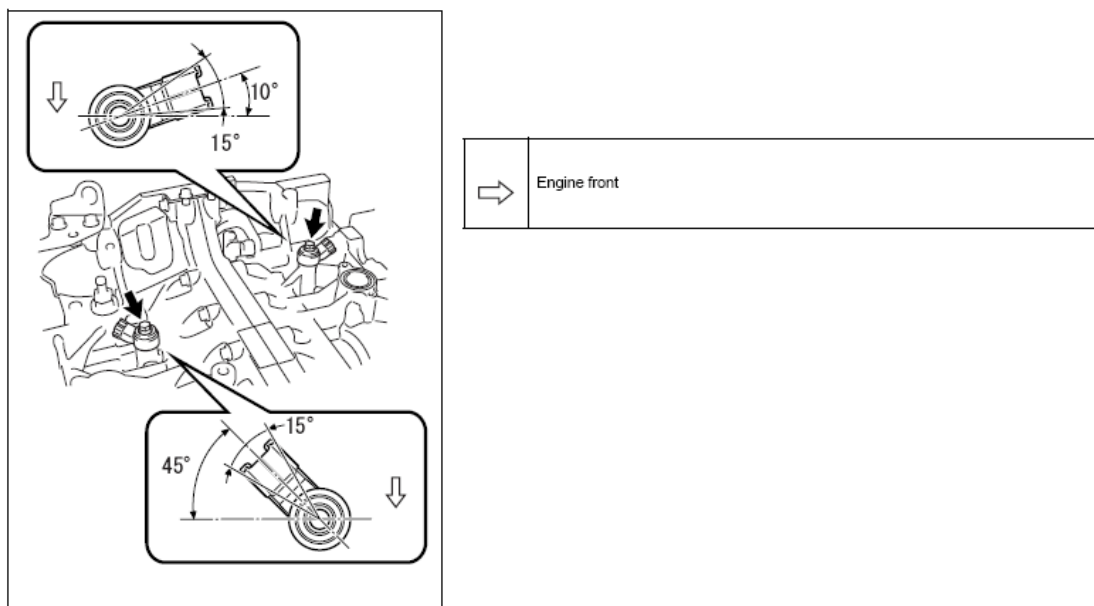


Fig. 263: Positioning Of Knock Control Sensors
Courtesy of SUBARU OF AMERICA, INC.

30. Cylinder head plate RR installation (transmission M/T)

1. Apply THREE BOND 1217G to the camshaft housing SUB-ASSY RH as shown in the figure.

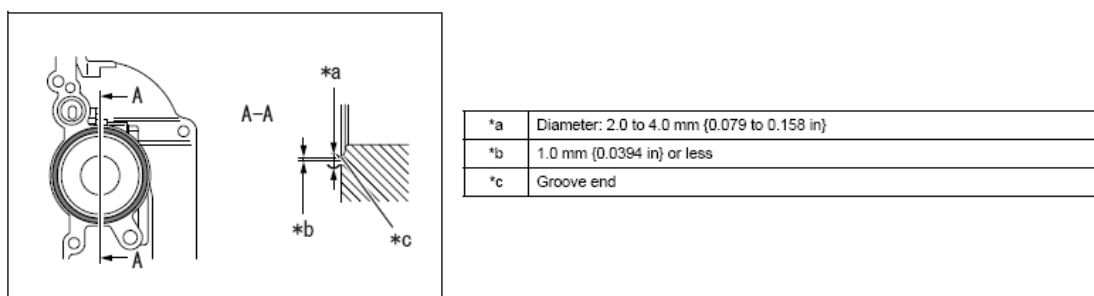


Fig. 264: Identifying Three Bond 1217G Application Area On RH Camshaft Housing Sub-Assembly
Courtesy of SUBARU OF AMERICA, INC.

CAUTION:

- Clean and degrease the installation surface.
- Install within 5 min. after applying liquid gasket.

2. Install the cylinder head plate with the three bolts.

Standard value: T=16N.m {163kgf.cm} {11.8ft.lbf}

31. Vacuum pump ASSY installation (transmission A/T) (Refer to **INSTALLATION**)

32. Water by-pass pipe NO. 1 installation (transmission M/T)

1. Install the water by-pass pipe NO. 1 with the two bolts.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

2. Install the water by-pass hose with the hose clamp.

33. Water by-pass pipe NO. 1 installation (transmission A/T)

1. Install the water by-pass pipe NO. 1 with the two bolts.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

2. Install the two water by-pass hoses with the two hose clamps.

34. Water inlet pipe installation

1. Install two new O-rings to the cylinder block.
2. Install the water inlet pipe with the four bolts.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

3. Install the water by-pass hose NO. 3 with the hose clamp.

35. Transmission oil cooler hose NO. 3 installation

1. Connect the transmission oil cooler hose NO. 3.

36. Water by-pass hose NO. 2 installation

1. Install the water by-pass hose NO. 2 with the hose clamp.

37. PCV hose connector installation

1. Install two new O-rings to the PCV hose connector.
2. Connect the water by-pass hose NO. 1 to the PCV hose connector and water inlet pipe with the hose clamps.
3. Install the PCV hose connector with the three bolts.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

38. Ventilation hose NO. 2 installation

1. Connect the ventilation hose NO. 2 with the hose clamp.

39. Engine wiring installation

1. Confirm the connection of each connector and clamp as shown in the figure.

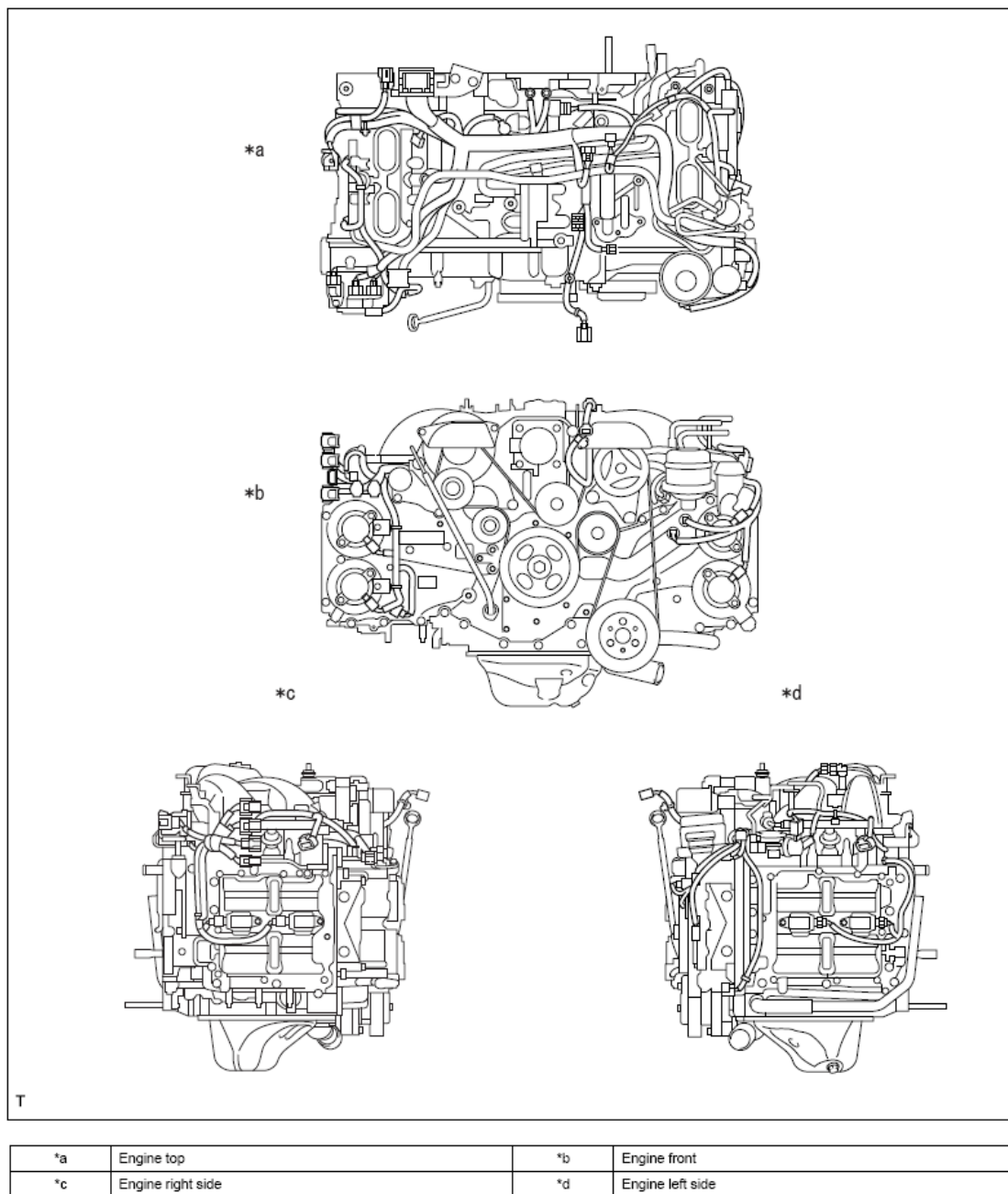


Fig. 265: Identifying Engine Top And Front Of Engine Right And Left Side
 Courtesy of SUBARU OF AMERICA, INC.

40. Pump drive case ASSY installation (Refer to **INSTALLATION**)
41. Valve lifter installation (Refer to **INSTALLATION**)
42. Fuel pump ASSY installation
 1. Install the fuel pump ASSY with a TORX PLUS socket wrench 40IP and the two bolts.

Standard value: T=21N.m {214kgf.cm} {15.5ft.lbf}

43. Fuel injector seal installation (Refer to **INSTALLATION**)
44. Fuel injector ASSY installation (Refer to **INSTALLATION**)
45. Fuel delivery pipe (bank 1 side) installation (Refer to **INSTALLATION**)
46. Fuel delivery pipe (bank 2 side) installation (Refer to **INSTALLATION**)
47. Fuel delivery pipe installation (Refer to **INSTALLATION**)
48. Fuel delivery pipe NO. 2 installation (Refer to **INSTALLATION**)
49. Intake manifold installation

1. Install two new gaskets to the intake manifold.
2. Install the intake manifold with the six bolts.

Standard value: T=25N.m {255kgf.cm} {18.4ft.lbf}

3. Engage the four clamps and connect the engine wiring.
 4. Connect the connector of fuel pump ASSY.
 5. Connect the connector for the purge control solenoid valve.
 6. Connect the connector for air pressure sensor ASSY.
 7. Install the water by-pass hoses NO. 2 and water by-pass hoses NO. 3 to the throttle body ASSY with the two clamps.
 8. Connect the connector of throttle body ASSY.
50. Ventilation hose connection (Refer to **INSTALLATION**)
 51. Fuel delivery pipe SUB-ASSY installation
 1. Connect the vacuum hose SUB-ASSY.
 2. Install the fuel delivery pipe SUB-ASSY with the bolt.

Standard value: T=6.4N.m {65kgf.cm} {4.7ft.lbf}

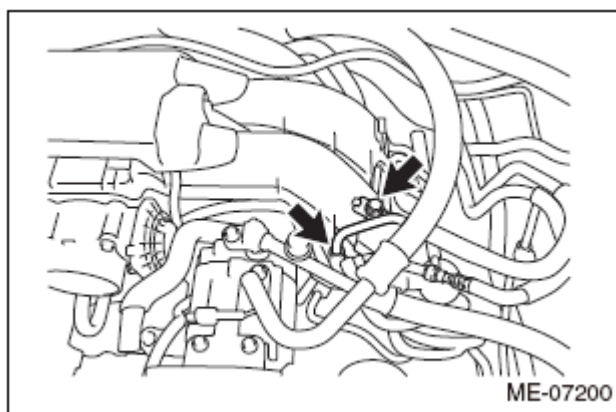


Fig. 266: Identifying Fuel Delivery Pipe Sub-Assembly Hose And Bolt
Courtesy of SUBARU OF AMERICA, INC.

3. Connect the fuel delivery pipe SUB-ASSY with a new gasket and the union bolt.

Standard value: T=31N.m {316kgf.cm} {22.9ft.lbf}

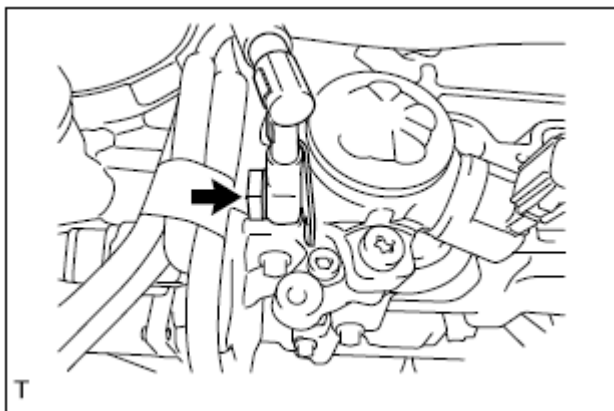


Fig. 267: Identifying Fuel Delivery Pipe Sub-Assembly Union Bolt
Courtesy of SUBARU OF AMERICA, INC.

52. Intake manifold protector (bank 2 side) installation

1. Install the intake manifold protector (bank 2 side) with 2 bolts.

Standard value: T=19N.m {194kgf.cm} {14.0ft.lbf}

53. Intake manifold protector (bank 1 side) installation

1. Install the intake manifold protector (bank 1 side) with 2 bolts.

Standard value: T=19N.m {194kgf.cm} {14.0ft.lbf}

54. Installation of compressor ASSY (with magnet clutch)

1. Temporarily install the compressor ASSY (with pulley) with the three bolts.
2. Tighten the three bolts in the order as shown in the figure.

Standard value: T=36N.m {367kgf.cm} {26.6ft.lbf}

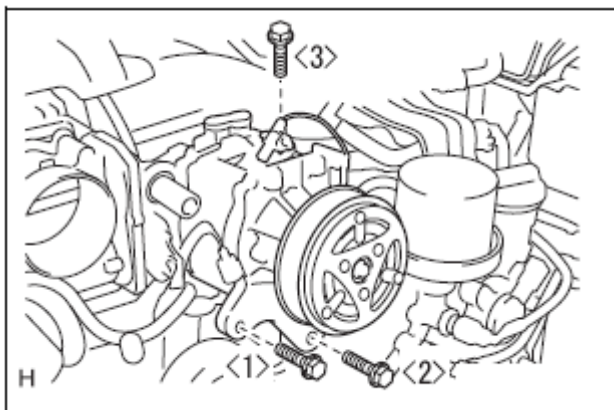


Fig. 268: Identifying Compressor Assembly Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

- 55. V-ribbed belt tensioner ASSY installation (Refer to INSTALLATION)
- 56. Oil level gauge guide installation (Refer to INSTALLATION)
- 57. Idler pulley SUB-ASSY NO. 2 installation (Refer to INSTALLATION)
- 58. Install the alternator ASSY

- 1. Install the generator ASSY with the two bolts.

Standard value: T=25N.m {255kgf.cm} {18.4ft.lbf}

- 59. Engine mounting insulator FR installation

- 1. Install the two engine mounting insulators FR with the four bolts.

Standard value: T=35N.m {357kgf.cm} {25.8ft.lbf}

- 60. Engine hanger installation (Refer to INSTALLATIONREMOVAL)

- 61. Engine stand removal

- 1. Support the engine ASSY with an engine sling device and mini-crane.

CAUTION: Since the operation with the engine ASSY suspended are danger, never perform it other than when installing the ASSY to the engine stand or removing it from the stand.

- 2. Remove the engine ASSY from the engine stand.

- 62. Crank angle sensor plate NO. 1 installation (Refer to INSTALLATION)
- 63. Flywheel SUB-ASSY installation (transmission M/T) (Refer to INSTALLATION)
- 64. Clutch disc ASSY installation (transmission M/T) (Refer to INSTALLATION)
- 65. Clutch cover ASSY installation (transmission M/T) (Refer to INSTALLATION)
- 66. Drive plate & ring gear SUB-ASSY installation (transmission A/T) (Refer to INSTALLATION)
- 67. Engine ASSY installation

- 1. Make sure that the knock pins are attached to 2 locations on the engine side.
 - 2. Align the knock pins to the knock holes by leveling the engine and transmission ASSY using an engine sling device and mini-crane.

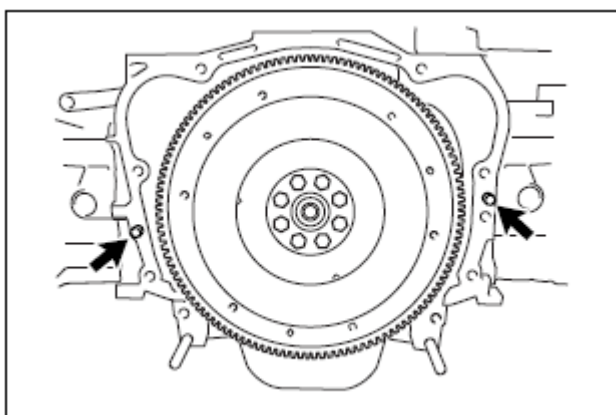
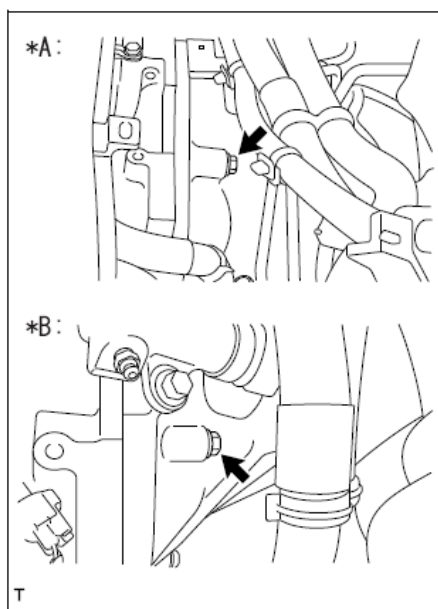


Fig. 269: Identifying Knock Pins
Courtesy of SUBARU OF AMERICA, INC.

68. Transmission ASSY installation

1. Install the connecting bolt of transmission ASSY.



*A	Transmission A/T
*B	Transmission M/T

Fig. 270: Identifying Transmission Assembly Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

Standard value: T=50N.m {510kgf.cm} {36.9ft.lbf}

2. Remove the SST. (Transmission A/T)

69. Engine hanger removal (Refer to **REMOVAL**)

70. Fuel hose and purge hose connection

1. Align the alignment marks on purge hose and pipe, and secure them with the hose clump.
2. Connect the fuel hose NO. 1 and fuel hose NO. 2.

71. Drive plate & torque converter setting bolt installation (transmission A/T) (Refer to **INSTALLATION**)
72. Flywheel housing under cover installation (Refer to **INSTALLATION**)
73. Installation of front crossmember SUB-ASSY
 1. Install the two nuts of front crossmember SUB-ASSY.

Standard value: T=45N.m {459kgf.cm} {33.2ft.lbf}

74. Manual transmission ASSY installation (transmission M/T)
 1. Install the manual transmission ASSY with the three bolts A and two nuts.

Standard value: T=50N.m {510kgf.cm} {36.9ft.lbf}

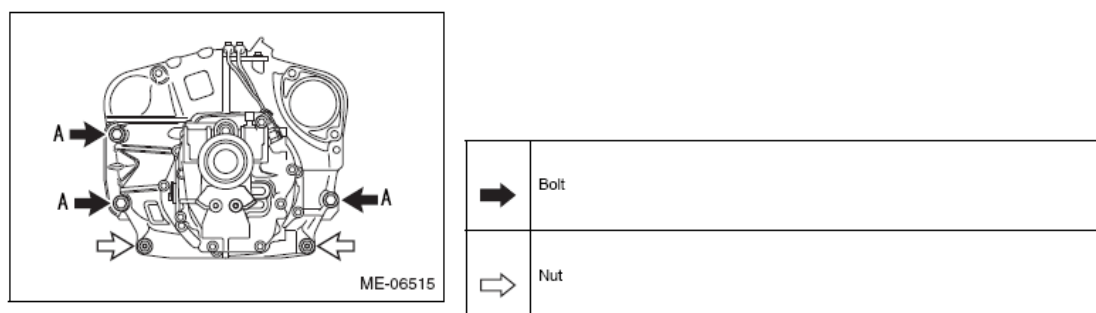


Fig. 271: Identifying Manual Transmission Assembly Mounting Bolts And Nuts
Courtesy of SUBARU OF AMERICA, INC.

75. Automatic transmission ASSY installation (transmission A/T)
 1. Install the automatic transmission ASSY with the three bolts A and two nuts.

Standard value: T=50N.m {510kgf.cm} {36.9ft.lbf}

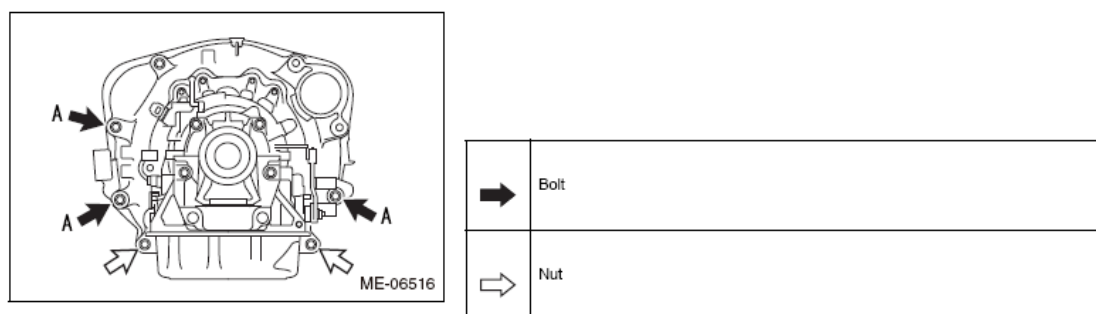


Fig. 272: Identifying Automatic Transmission Assembly Mounting Bolts And Nuts
Courtesy of SUBARU OF AMERICA, INC.

76. Stabilizer bar FR installation (transmission A/T)

(Refer to **INSTALLATION**)

77. Ground cable installation

1. Install the ground cable with the two bolts.

Standard value: T=7.5N.m {77kgf.cm} {5.5ft.lbf}

78. Radiator outlet hose connection

1. Connect the radiator outlet hose with the hose clamp.

79. Transmission oil cooler hose NO. 3 connection (transmission A/T)

1. Connect the transmission oil cooler hose NO. 3 with the hose clamp.

80. SST removal (transmission A/T)

1. Remove the SST from the starter hole of torque converter clutch case.

81. Installation of starter ASSY

(Refer to **INSTALLATION**)

82. Cooler refrigerant discharge hose NO. 1 connection (Refer to **INSTALLATION**)

83. Suction hose SUB-ASSY installation

1. Remove the vinyl tape wrapped around the joint of the suction hose SUB-ASSY.
2. Apply sufficient compressor oil to a new O-ring and the fitting area of compressor ASSY (with pulley).
3. Install the O-ring to the suction hose SUB-ASSY.

CAUTION: Do not allow dust etc. to adhere to the O-ring and O-ring sealing portion.

4. Connect the suction hose SUB-ASSY to the compressor ASSY (with pulley) with the bolt.

Standard value: T=10N.m {102kgf.cm} {7.4ft.lbf}

5. Remove the vinyl tape wrapped on the connection of suction hose SUB-ASSY and unit.
6. Apply sufficient compressor oil to a new O-ring and the connection of suction hose SUB-ASSY.
7. Install the O-ring to the suction hose SUB-ASSY.

CAUTION: Do not allow dust etc. to adhere to the O-ring and O-ring sealing portion.

8. Push the shaft of the pipe joint into the seal hole until it is completely engaged.
9. Turn the hook type connector to the tightening position and tighten it with bolts.

Standard value: T=7.5N.m {77kgf.cm} {5.5ft.lbf}

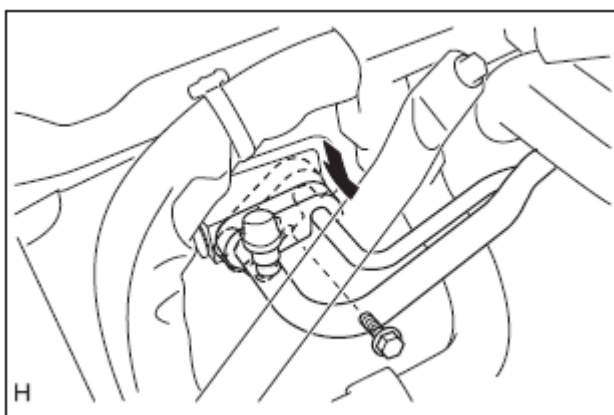


Fig. 273: Turning Hook Type Connector
Courtesy of SUBARU OF AMERICA, INC.

10. Install the suction hose SUB-ASSY with the nut.

Standard value: T=10N.m {102kgf.cm} {7.4ft.lbf}

84. Transmission oil cooler hose NO. 1 connection (transmission A/T)
 1. Connect the transmission oil cooler hose NO. 1 with the hose clamp.
85. Heater water hose connection
 1. Install the heater water hoses with the two hose clamps.
86. Exhaust manifold installation

(Refer to **INSTALLATION**)

87. Vacuum tube connector hose connection (transmission M/T)
 1. Install the vacuum tube connector hose with the bolt.

Standard value: T=18N.m {184kgf.cm} {13.3ft.lbf}

2. Connect the vacuum tube connector hose with the hose clamp.
88. Vacuum tube connector hose connection (transmission A/T)
 1. Connect the vacuum tube connector hose with the hose clamp.
89. Drive plate & torque converter setting bolt installation (transmission A/T)
 1. Use the SST to secure the crank pulley.

SST 18355AA000, 18334AA000

2. Install the six drive plate & torque converter setting bolts through the service hole.

Standard value: T=25N.m {255kgf.cm} {18.4ft.lbf}

90. Flywheel housing under cover installation (transmission A/T)
 1. Install the flywheel housing under cover.
91. Installation of engine cover SUB-ASSY No. 1 (Refer to **INSTALLATION**)
92. Fan & generator V-belt installation (Refer to **INSTALLATION**)
93. Belt generator cover installation (Refer to **INSTALLATION**)
94. Generator cover installation (Refer to **INSTALLATION**)
95. Engine wiring harness connection
 1. Connect the connector and clamp to connect the wiring harness.
 2. Connect the wiring harness to the terminal B with the nut.

Standard value: T=16N.m {163kgf.cm} {11.8ft.lbf}

3. Install the terminal cap.
4. Engage the clamp to connect the wiring harness.
5. Engage the five clamps and connect the wiring harness.
6. Install the two wiring harness clamp brackets with the two clamps and two bolts.

Standard value: T=11N.m {112kgf.cm} {8.1ft.lbf}

7. Connect the connector B.

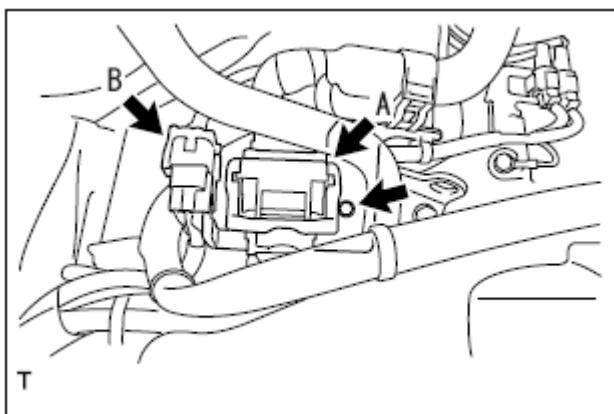


Fig. 274: Identifying Wiring Harness Connectors (A And B)
Courtesy of SUBARU OF AMERICA, INC.

8. Turn down the lock of connector A to securely lock the connector.
9. Install the wiring harness clamp bracket with the bolt.

Standard value: T=10N.m {102kgf.cm} {7.4ft.lbf}

10. Transmission A/T:
 - a. Slide the connector in the direction as shown in the figure and connect the wiring harness.

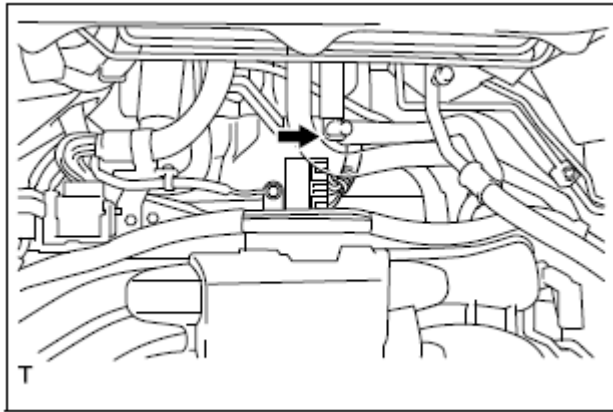


Fig. 275: Sliding Wiring Harness Connector
Courtesy of SUBARU OF AMERICA, INC.

- b. Engage the two clamps and connect the wiring harness.
- c. Connect the connector B.
- d. Turn down the lock of connector A to securely lock the connector.

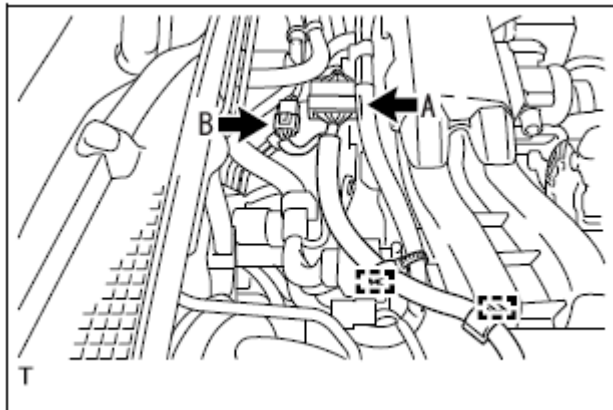


Fig. 276: Identifying Connectors (A And B)
Courtesy of SUBARU OF AMERICA, INC.

96. Installation of injector driver (Refer to **INSTALLATION**)
97. Water filler SUB-ASSY installation
 1. Install the water filler SUB-ASSY with the two hose clamps.
 2. Install the water filler SUB-ASSY with the two bolts.

Standard value: T=7.5N.m {77kgf.cm} {5.5ft.lbf}

98. Radiator reservoir tank ASSY installation (Refer to **INSTALLATION**)
99. Air cleaner case SUB-ASSY installation
 1. Install the stay with the bolt.

Standard value: T=35N.m {357kgf.cm} {25.8ft.lbf}

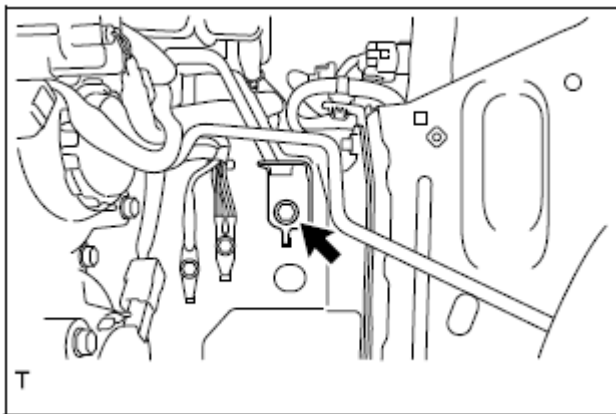


Fig. 277: Identifying Stay Mounting Bolts
Courtesy of SUBARU OF AMERICA, INC.

2. Install the air cleaner case SUB-ASSY with the three bolts.

Standard value: T=6.0N.m {61kgf.cm} {4.4ft.lbf}

3. Tighten the hose clamp.

Standard value: T=2.0N.m {20kgf.cm} {1.5ft.lbf}

4. Engage the clamp and install the wiring harness to the air cleaner cap.
5. Connect the connector to the intake air flow meter SUB-ASSY.
6. Connect the ventilation hose NO. 2 with the hose clamp.
7. Install the chamber with the two bolts.

Standard value: T=6.0N.m {61kgf.cm} {4.4ft.lbf}

8. Connect the hose to the chamber ASSY.

100. Installation of front strut tower bar LH (Refer to **INSTALLATION**)

101. Installation of front strut tower bar RH (Refer to **INSTALLATION**)

102. Engine oil refill (Refer to **REPLACEMENT**)

103. Connection of the battery ground terminal

Standard value: T=6.0N.m {61kgf.cm} {4.4ft.lbf}

104. Replenishing of coolant (SUBARU Super Coolant) (Refer to **COOLANT (FA20)**)

105. Shift lever position check (transmission A/T) (Refer to **ON-VEHICLE INSPECTION**)

106. Refrigerant HFC-134a (R134a) refill (Refer to **ADJUSTMENT**)

107. Leak check of coolant (SUBARU Super Coolant) (Refer to **COOLING SYSTEM (FA20)**)

108. Engine oil leakage check (Refer to **REPLACEMENT**)
109. Fuel leakage check (Refer to **FUNCTION INSPECTION**)
110. Leak check of exhaust gas (Refer to **INSTALLATION**)
111. Refrigerant gas leakage check (Refer to **ADJUSTMENT**)
112. Throttle body function check (Refer to **INSTALLATION**)
113. Ignition timing check (Refer to **FUNCTION INSPECTION**)
114. Idle speed check (Refer to **FUNCTION INSPECTION**)
115. CO, HC concentration check (Refer to **FUNCTION INSPECTION**)
116. Coolant (SUBARU Super Coolant) level check (Refer to **COOLING SYSTEM (FA20)**)
117. Engine oil level check (Refer to **LUBRICATION SYSTEM (FA20)**)
118. Hood SUB-ASSY set
 1. Change the front hood stay position from B to A and store it in the position A.

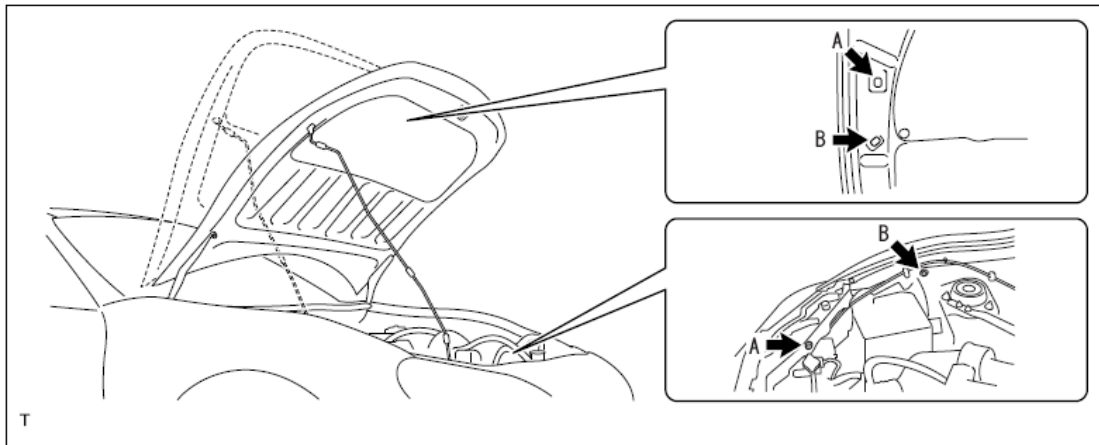


Fig. 278: Identifying Front Hood Stay Position
Courtesy of SUBARU OF AMERICA, INC.