

GROUP 11B

ENGINE OVERHAUL

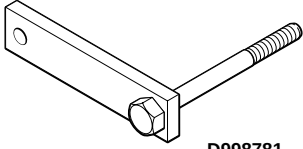
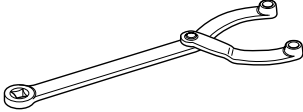
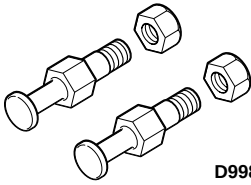
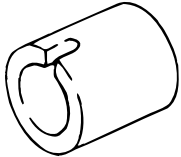
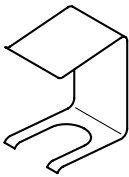
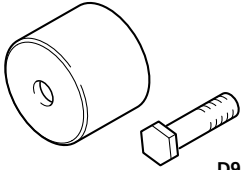
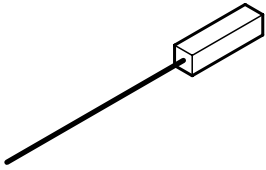
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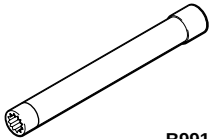
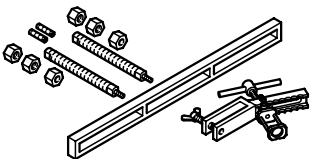
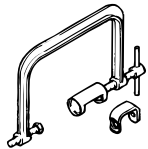
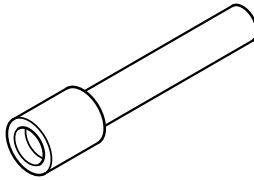
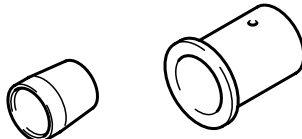
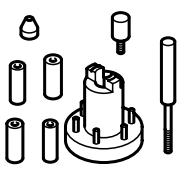
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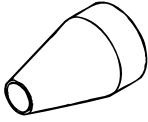
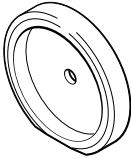
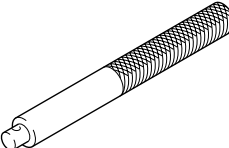
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SPECIAL TOOLS

M1113000600153

TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
 D998781	MD998781 Flywheel stopper	General service tool	Holding flywheel
 B990767	MB990767 End yoke holder Use with MD998719	MB990767-01 Use with MIT308239	Holding camshaft sprocket when loosening or torquing bolt
 D998719	MD998719 Pin (2)	MIT308239	
 MD998716	MD998716 Crankshaft wrench	MD998716-01	Turning crankshaft
 D998443	MD998443 Lash adjuster holder (8)	MD998443-01	Supporting lash adjuster to prevent it from falling when rocker arm shaft assembly is removed or installed.
 D998713	MD998713 Camshaft oil seal installer	MD998713-01	Installation of camshaft oil seal
 MD998442	MD998442 Air bleed wire	General service tool	Air bleeding of lash adjuster

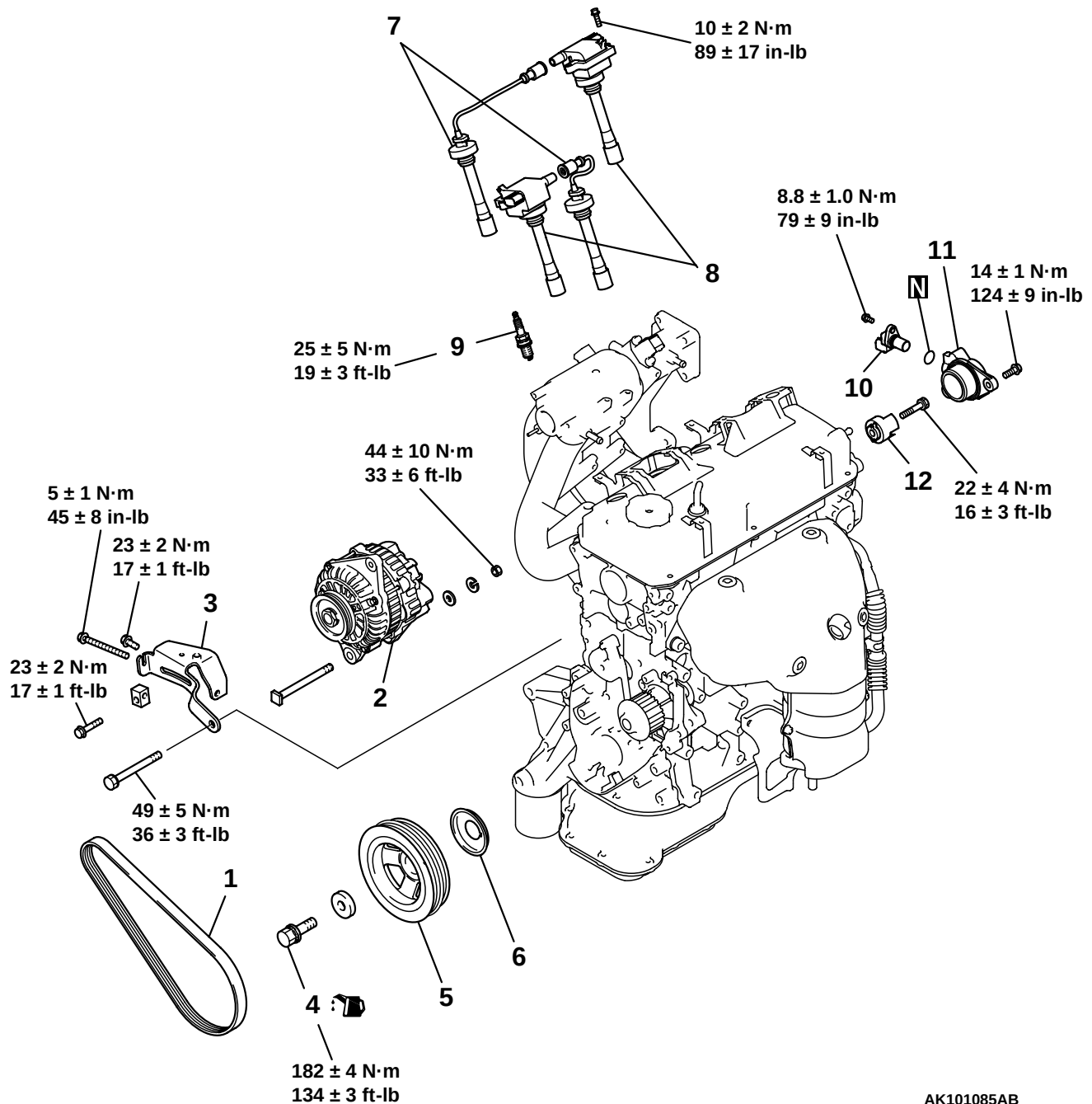
TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
 B991654	MB991653 Cylinder head bolt wrench	General service tool	Loosening and torquing of cylinder head bolt
	MD998772 Valve spring compressor	General service tool	Compressing valve spring
	MD998735 Valve spring compressor	MD998735-01	Compression of valve spring
	MD998774 Valve stem seal installer	MD998774-01	Installation of valve stem seal
	MD998717 Crankshaft front oil seal installer	MD998717-01	Installation of crankshaft front oil seal
	MD998780 Piston pin setting tool	MIT216941	Removal and installation of piston pin

TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
 D998776	MB991659 Guide D	—	Removal of piston pin (Use with MD998780)
 D998776	MD998776 Crankshaft rear oil seal installer Use with MB990938	MD998376-01 Use with MB990938-01	Installation of crankshaft rear oil seal
 B990938	MB990938 Handle	MB990938-01	Installation of crankshaft rear oil seal

GENERATOR AND IGNITION SYSTEM

REMOVAL AND INSTALLATION

M1113001000109



AK101085AB

REMOVAL STEPS

1. DRIVE BELT
2. GENERATOR
3. GENERATOR BRACE
4. CRANKSHAFT BOLT
5. CRANKSHAFT PULLEY
6. FRONT FLANGE
7. SPARK PLUG CABLE

REMOVAL STEPS (Continued)

8. IGNITION COIL
9. SPARK PLUG
10. CAM POSITION SENSOR
11. CAM POSITION SENSOR SUPPORT
12. CAM POSITION SENSING CYLINDER

<<A>> >>B<<

>>A<<

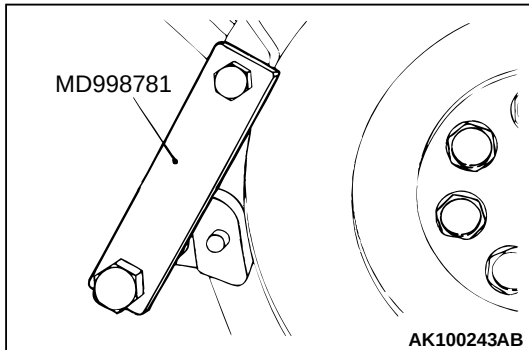
Required Special Tool:

- MD998781: Flywheel Stopper

REMOVAL SERVICE POINT

<<A>> CRANKSHAFT BOLT REMOVAL

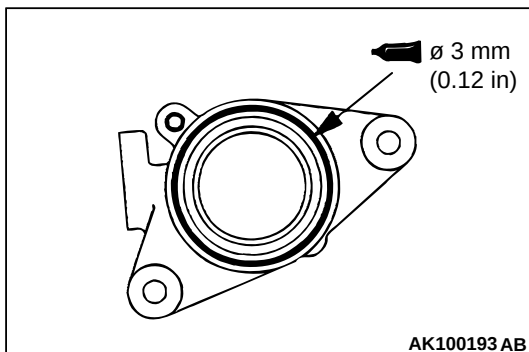
Lock the flywheel or drive plate in position using the special tool MD998781 shown in the illustration, then loosen the crankshaft bolt.



INSTALLATION SERVICE POINTS

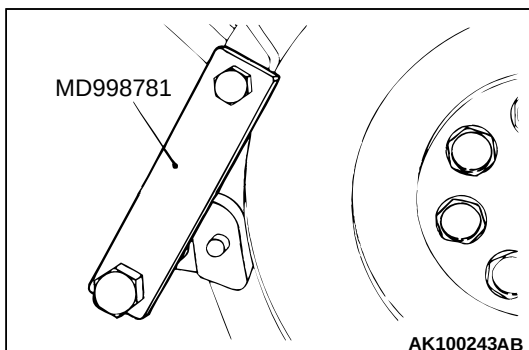
>>A<< CAMSHAFT POSITION SENSOR SUPPORT INSTALLATION

1. Clean the sealant application surfaces of cam position sensor support and cylinder head.
2. Apply a 3 mm (0.12 inch) diameter bead of sealant Mitsubishi Genuine Parts number MD970389, or equivalent to the cam position sensor support.
3. After installation, wait at least one hour. Never start the engine or let engine oil touch the adhesion surface during that time.



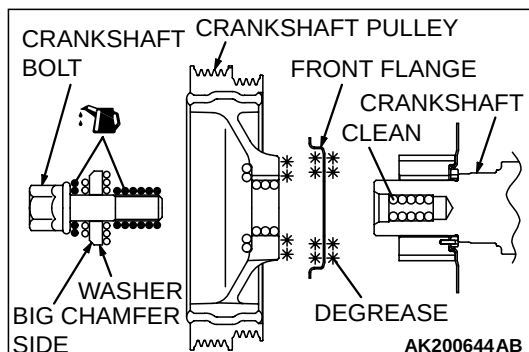
>>B<< CRANKSHAFT BOLT INSTALLATION

1. Lock the flywheel or drive plate in position using the special tool MD998781 shown in the illustration.



2. Clean the bolt hole in crankshaft bolt and crankshaft pulley's seating surface.
3. Degrease the cleaned seating surface of the crankshaft pulley.
4. Install the crankshaft pulley.
5. Apply oil to the threads of crankshaft bolt and the outer surface of washer.
6. Tighten the crankshaft bolt to the specified torque.

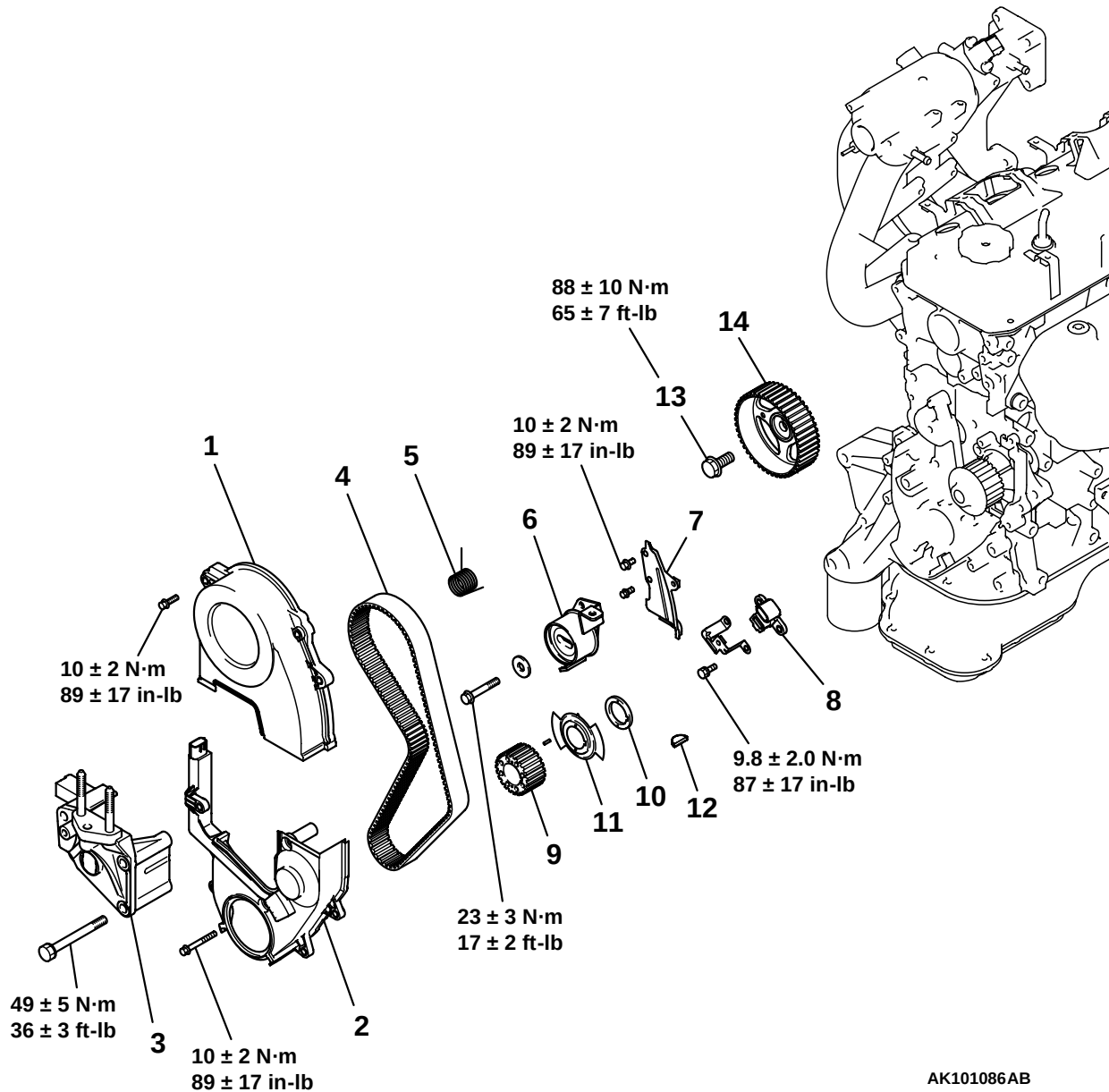
Tightening torque: 182 ± 4 N·m (134 ± 3 ft-lb)



TIMING BELT

REMOVAL AND INSTALLATION

M1113001900168



REMOVAL STEPS

1. TIMING BELT FRONT UPPER COVER
- >>F<< 2. TIMING BELT FRONT LOWER COVER
3. ENGINE SUPPORT BRACKET, RIGHT
- <<A>> >>E<< 4. TIMING BELT
- >>D<< 5. TENSIONER SPRING
- >>C<< 6. TIMING BELT TENSIONER

REMOVAL STEPS (Continued)

7. TIMING BELT REAR COVER
8. CRANKSHAFT ANGLE SENSOR
- >>B<< 9. CRANKSHAFT SPROCKET
- >>B<< 10. CRANKSHAFT SPACER
- >>B<< 11. CRANKSHAFT SENSING BLADE
12. CRANKSHAFT KEY
- <> >>A<< 13. CAMSHAFT SPROCKET BOLT
14. CAMSHAFT SPROCKET

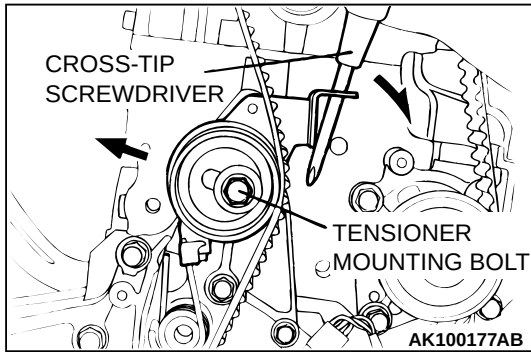
Required Special Tools:

- MB990767: End Yoke Holder
- MD998719: Pin (2)
- MD998716: Crankshaft Wrench

REMOVAL SERVICE POINTS

<<A>> TIMING BELT REMOVAL

1. Mark the belt running direction for reference in reinstallation.
2. Loosen the tensioner mounting bolt.
3. Insert a cross-tip screwdriver into the hole of the tensioner arm as shown illustration.
4. Move the screwdriver all the way in the direction of the arrow, and tighten the tensioner mounting bolt to hold this position.
5. Remove the timing belt.

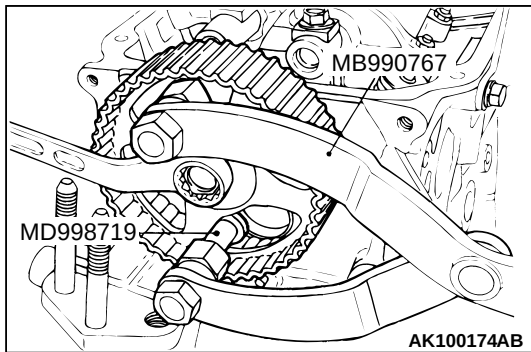


NOTE: Water oil on the belt shortens its life drastically, so the removed timing belt, sprocket, and tensioner must be kept free from oil and water. Do not immerse parts in cleaning solvent.

NOTE: If there is oil or water on any part, check the front case oil seal, camshaft oil seal and water pump for leaks.

<> CAMSHAFT SPROCKET BOLT LOOSENING

Use special tools MB990767 and MD998719 to prevent the camshaft sprocket from turning, and then loosen the camshaft sprocket bolt.

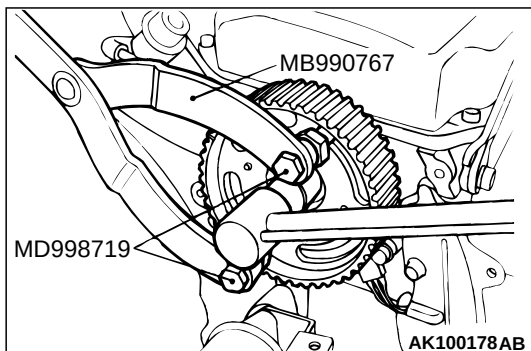


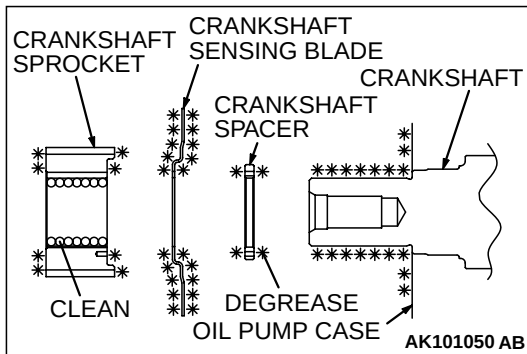
INSTALLATION SERVICE POINT

>>A<< CAMSHAFT SPROCKET BOLT TIGHTENING

Use special tools MB990767 and MD998719 to prevent the camshaft sprocket from turning, and then tighten the camshaft sprocket bolt.

Tightening torque: 88 ± 10 N·m (65 ± 7 ft-lb)

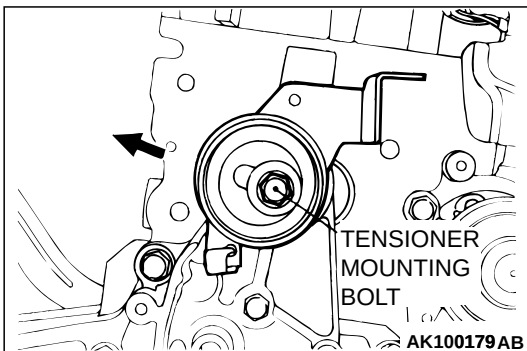




>>B<< CRANKSHAFT SENSING BLADE/CRANKSHAFT SPACER/CRANKSHAFT SPROCKET INSTALLATION

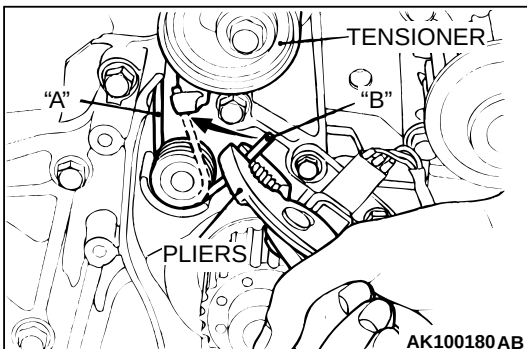
1. Clean the hole in the crankshaft sprocket.
2. Clean and degrease the mating surfaces of the crankshaft sprocket; sensing blade; and spacer

NOTE: Degreasing is necessary to prevent decrease in friction between the mating surface due to presence of oil.



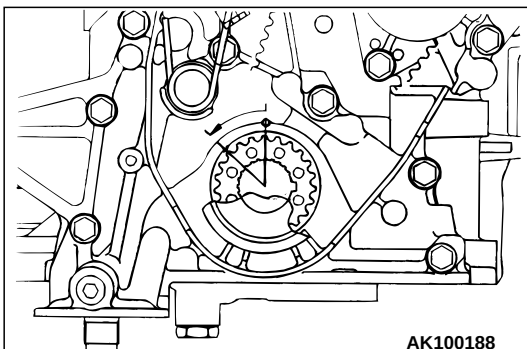
>>C<< TIMING BELT TENSIONER INSTALLATION

Install the timing belt tensioner in the illustrated position, and then tighten the tensioner mounting bolt.



>>D<< TENSIONER SPRING INSTALLATION

1. Install the tensioner spring onto the boss of the front case, and then hook the spring end "A" (shorter one) to the front case rib.
2. Grip the spring end "B" (longer one), and then hook it onto the tensioner arm.

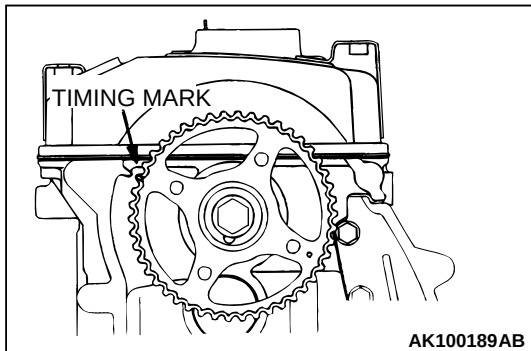


>>E<< TIMING BELT INSTALLATION

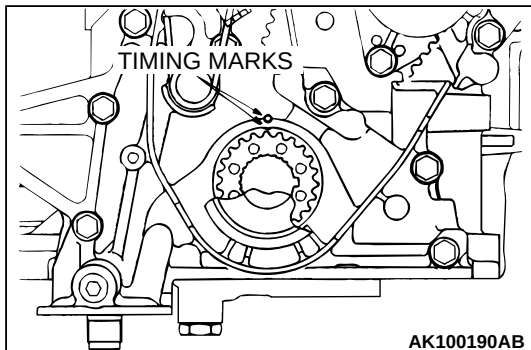
1. Align the crankshaft sprocket timing mark with the timing mark on the front case, and then rotate the crankshaft sprocket three teeth counterclockwise.

⚠ CAUTION

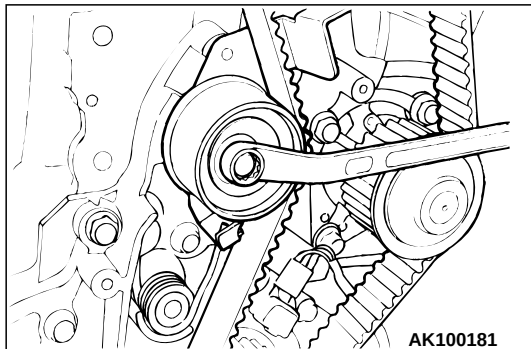
Aligning the timing marks positions the piston to the top dead center. Then, if the camshaft turns, the valves might interfere and damage the pistons.



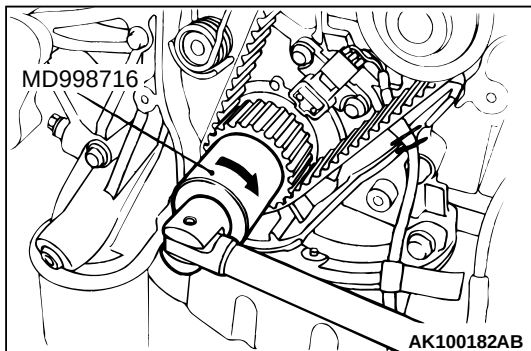
2. Align the camshaft sprocket timing mark with the timing mark on the cylinder head.



3. Rotate the crankshaft sprocket three teeth counterclockwise, and align the crankshaft sprocket timing mark with the timing mark on the front case.
4. Keeping the tension side of the timing belt tight, fit the timing belt onto the crankshaft sprocket, water pump sprocket, camshaft sprocket and tensioner puller in that order.



5. Slightly loosen the timing belt tensioner bolt to tension the belt by a force of the tensioner spring.



6. Using special tool MD998716 turn the crankshaft twice in the clockwise direction.

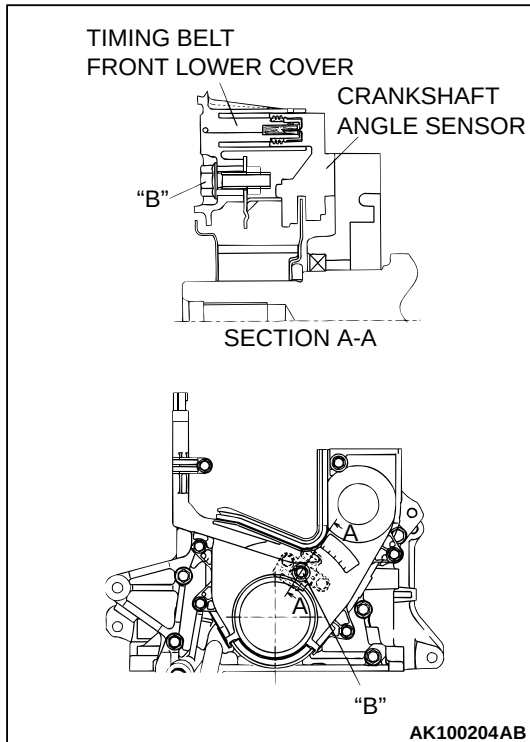
⚠ CAUTION

This procedure utilizes the camshaft's driving torque to apply tension evenly to the timing belt. Be sure to turn the crankshaft as described above. Do not turn the crankshaft counterclockwise.

7. Check that the timing marks are correctly aligned.
8. Tighten the timing belt tensioner locking bolt to the specified torque.

>>F<< TIMING BELT FRONT LOWER COVER
INSTALLATION

1. When installing the timing belt front lower cover, insert the terminal boss of the sensor securely into crankshaft angle sensor connector.
2. Tighten bolt "B" first and then tighten other bolts to specified torque.



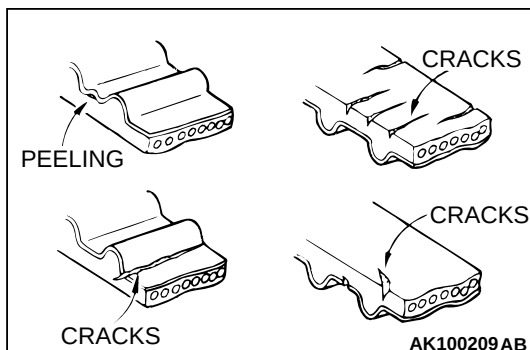
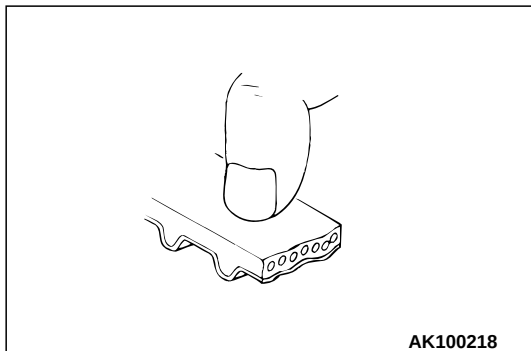
INSPECTION

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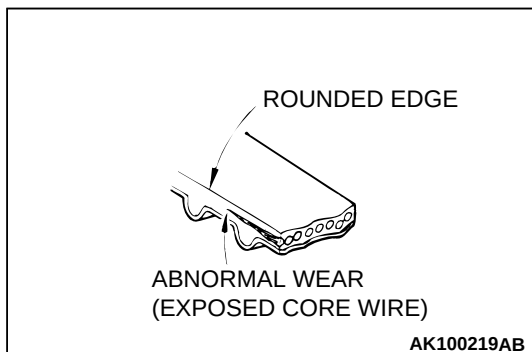
TIMING BELT

Check the timing belt closely. Replace the belt with a new one if any of the following defects are evident:

1. Hardening of rubber backing.
Back side is glossy without resilience and leaves no indent when pressed with fingernail.

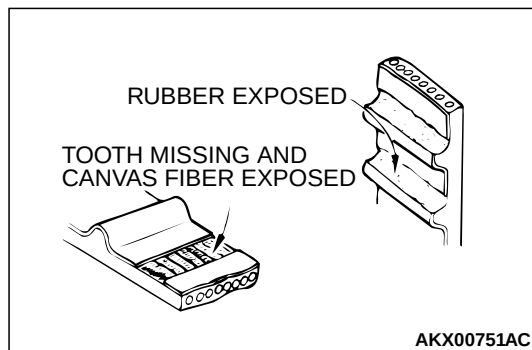


2. Surface cracks on the backing rubber.
3. Cracks or peeling of the canvas.
4. Cracks on the tooth bottom.
5. Cracks on the belt sides.



6. Abnormal wear on the belt sides.

NOTE: The sides of the belt are normal if they are sharp as if cut by a knife.



7. Abnormal wear on teeth.

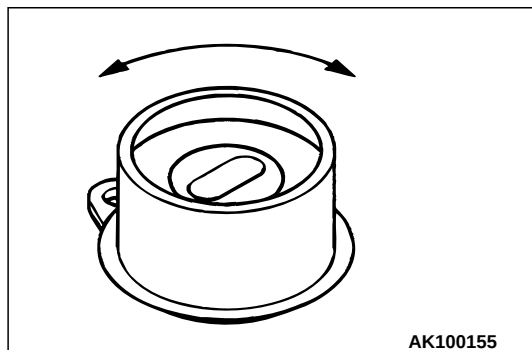
Initial stage:

Canvas worn (fluffy canvas fibers, rubbery texture gone, white discoloration, canvas texture indistinct)

Final stage:

Canvas worn, exposing rubber (tooth width reduced)

8. Missing teeth.



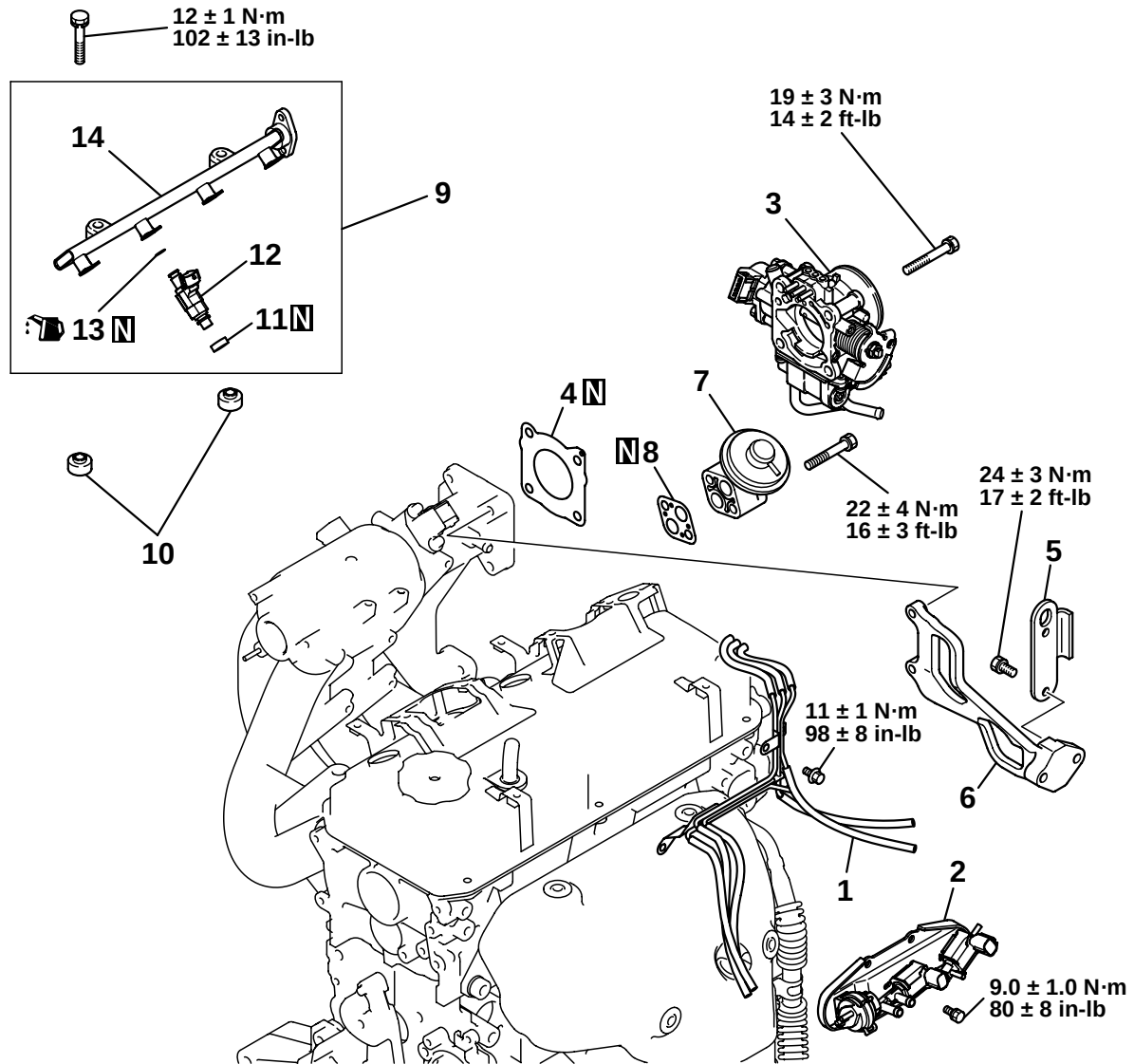
TENSIONER PULLEY

Check the pulley for smooth rotation, without play and are not noisy.

FUEL AND EMISSION PARTS

REMOVAL AND INSTALLATION

M1113002200429



AK301826AB

REMOVAL STEPS

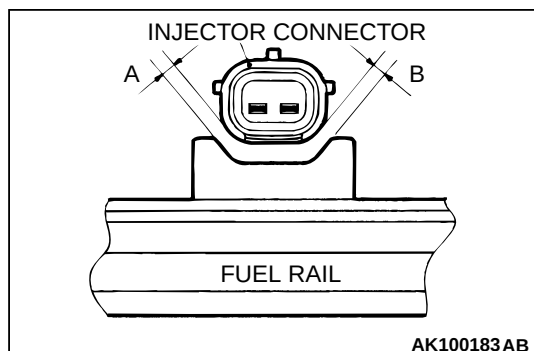
1. VACUUM HOSE AND PIPE ASSEMBLY
2. SOLENOID VALVE ASSEMBLY
3. THROTTLE BODY
- >>B<< 4. GASKET
5. ENGINE HANGER
6. THROTTLE BODY STAY
7. EGR VALVE

REMOVAL STEPS (Continued)

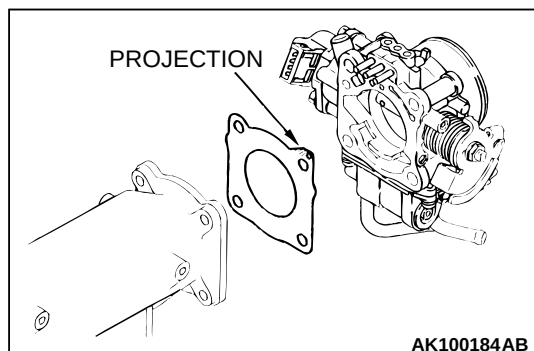
8. EGR VALVE GASKET
9. FUEL RAIL AND INJECTOR
10. INSULATOR
11. INSULATOR
- >>A<< 12. INJECTOR
13. O-RING
14. FUEL RAIL

INSTALLATION SERVICE POINT**>>A<< INJECTORS INSTALLATION**

1. Fit a new O-ring and grommet onto the injector.
2. Apply clean engine oil or gasoline to the injector O-ring.
3. Fit the injector onto the fuel rail, turning it to the left and right as it goes in.
4. Check that the injector rotates smoothly.
5. Check that the clearance between the injector connector and the fuel rail is uniform (A = B).

**>>B<< GASKET INSTALLATION**

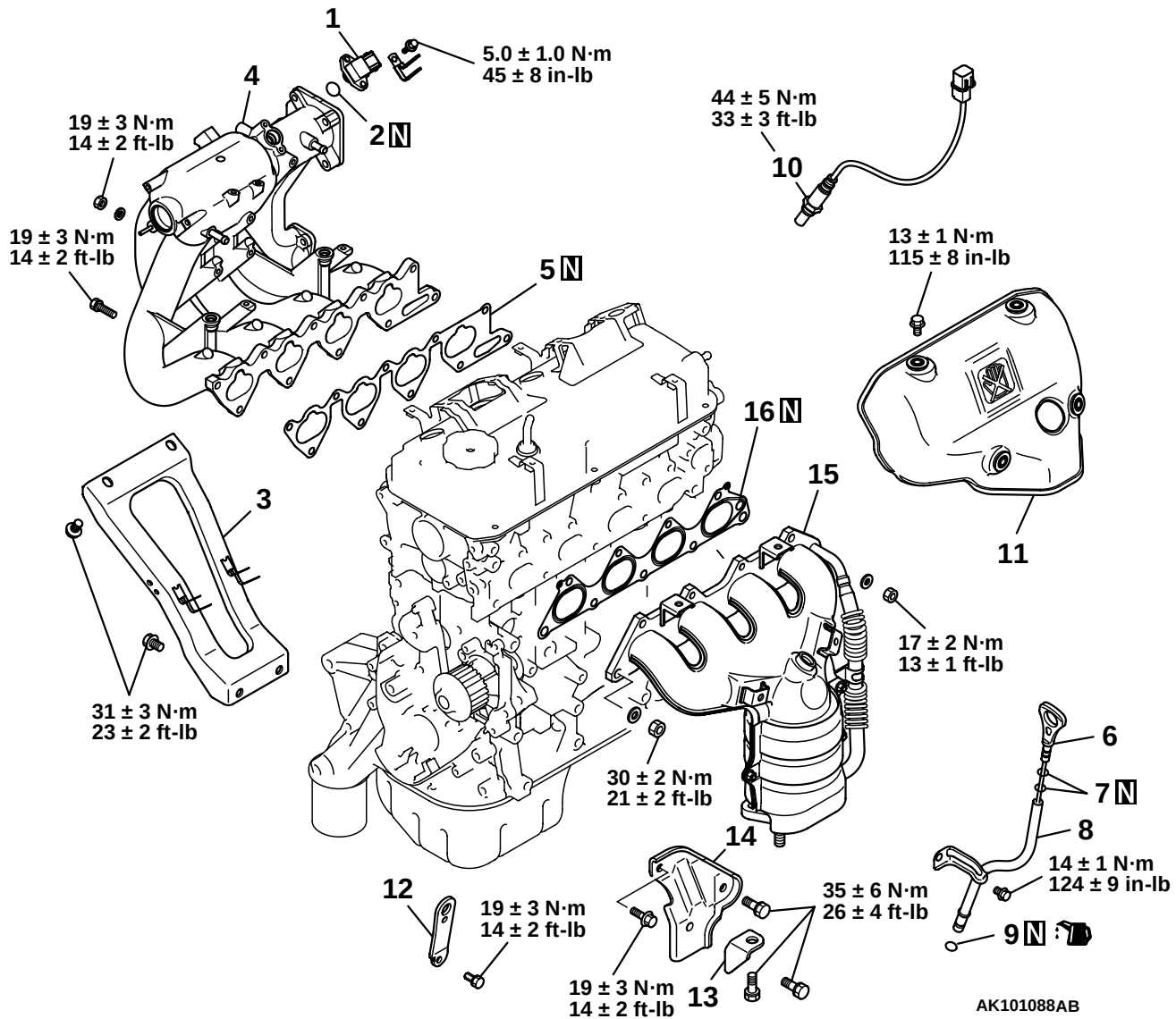
Position the projection as shown in the illustration.



INTAKE AND EXHAUST MANIFOLDS

REMOVAL AND INSTALLATION

M1113017500114



AK101088AB

REMOVAL STEPS

1. MANIFOLD DIFFERENTIAL PRESSURE SENSOR
2. O-RING
3. INTAKE MANIFOLD STAY
4. INTAKE MANIFOLD
5. INTAKE MANIFOLD GASKET
6. OIL DIPSTICK
7. O-RING
8. OIL DIPSTICK GUIDE

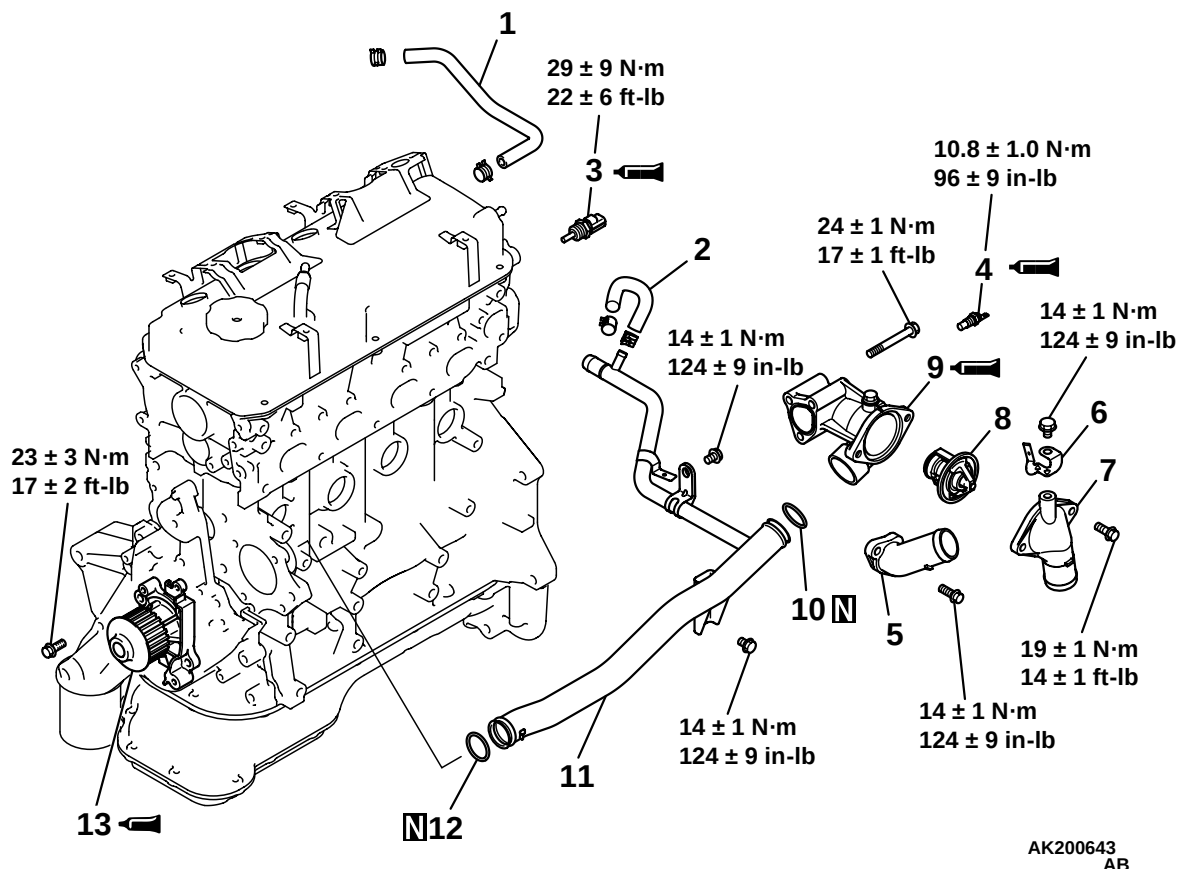
REMOVAL STEPS (Continued)

9. O-RING
10. OXYGEN SENSOR
11. EXHAUST MANIFOLD COVER
12. ENGINE HANGER
13. EXHAUST MANIFOLD BRACKET A
14. EXHAUST MANIFOLD BRACKET B
15. EXHAUST MANIFOLD
16. EXHAUST MANIFOLD GASKET

WATER PUMP & WATER HOSE

REMOVAL AND INSTALLATION

M1113017900060



REMOVAL STEPS

1. WATER HOSE A
2. WATER HOSE B
- >>G<< 3. ENGINE COOLANT TEMPERATURE SENSOR
- >>F<< 4. ENGINE COOLANT TEMPERATURE GAUGE UNIT
- >>E<< 5. WATER OUTLET FITTING
6. CONNECTOR BRACKET

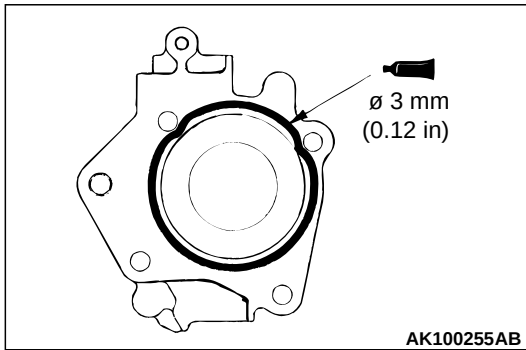
REMOVAL STEPS (Continued)

7. WATER INLET FITTING
- >>D<< 8. THERMOSTAT
- >>C<< 9. THERMOSTAT CASE
- >>B<< 10. O-RING
- >>B<< 11. WATER INLET PIPE
- >>B<< 12. O-RING
- >>A<< 13. WATER PUMP

INSTALLATION SERVICE POINTS

>>A<< WATER PUMP INSTALLATION

1. Clean the sealant application surfaces of the water pump case and cylinder block.
2. Apply a 3 mm (0.12 inch) diameter bead of sealant Mitsubishi Genuine Parts number MD970389, or equivalent to the water pump.
3. After installation, wait at least one hour. Never start the engine or let coolant touch the adhesion surface during that time.



>>B<< WATER INLET PIPE/O-RING INSTALLATION

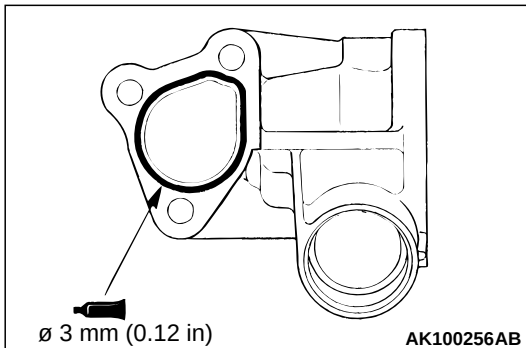
Replace the water inlet pipe O-ring with new ones, then apply water to the O-rings so that they can be inserted easily into the cylinder block and the thermostat case.

CAUTION

- Never apply any oil or grease to the O-ring.
- Secure the water pipe after the thermostat case has been installed.

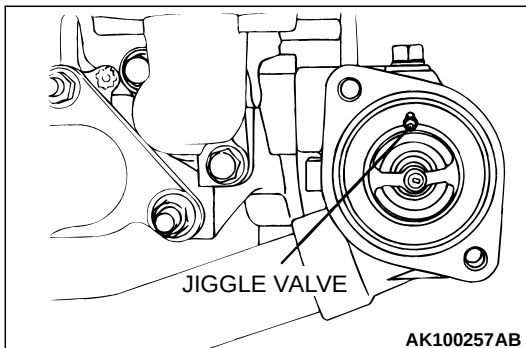
>>C<< THERMOSTAT CASE INSTALLATION

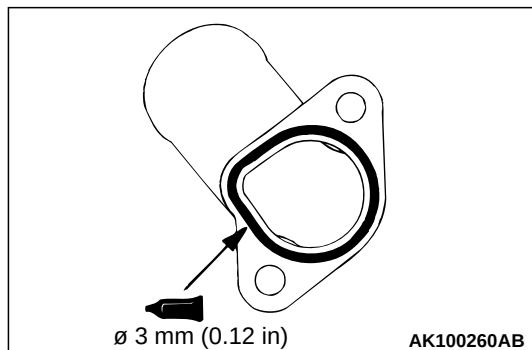
1. Clean the sealant application surfaces of the thermostat case and cylinder head.
2. Apply a 3 mm (0.12 inch) diameter bead of sealant Mitsubishi Genuine Parts number MD970389, or equivalent to the thermostat case.
3. After installation, wait at least one hour. Never start the engine or let coolant touch the adhesion surface during that time.



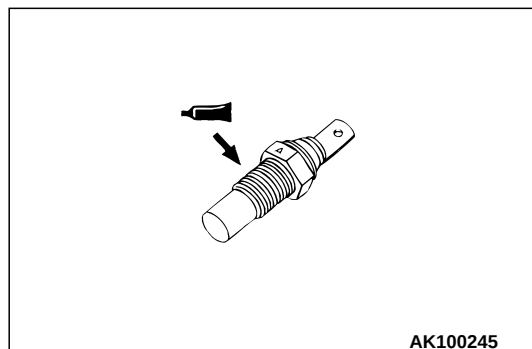
>>D<< THERMOSTAT INSTALLATION

Install the thermostat so that the jiggle valve is at the top.

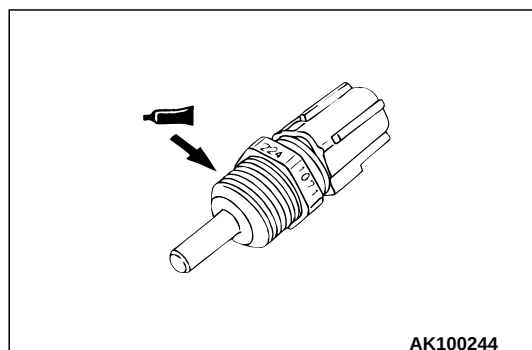


**>>E<< OUTLET FITTING INSTALLATION**

1. Clean the sealant application surfaces of the fittings and cylinder head.
2. Apply a 3 mm (0.12 inch) diameter bead of sealant Mitsubishi Genuine Parts number MD970389, or equivalent to the outlet fitting.
3. After installation, wait at least one hour. Never start the engine or let coolant touch the adhesion surface during that time.

**>>F<< ENGINE COOLANT TEMPERATURE GAUGE UNIT INSTALLATION**

1. When reusing the gauge unit, clean its thread.
2. Apply 3M™ AAD Part number 8672 or equivalent to the engine coolant temperature gauge unit.

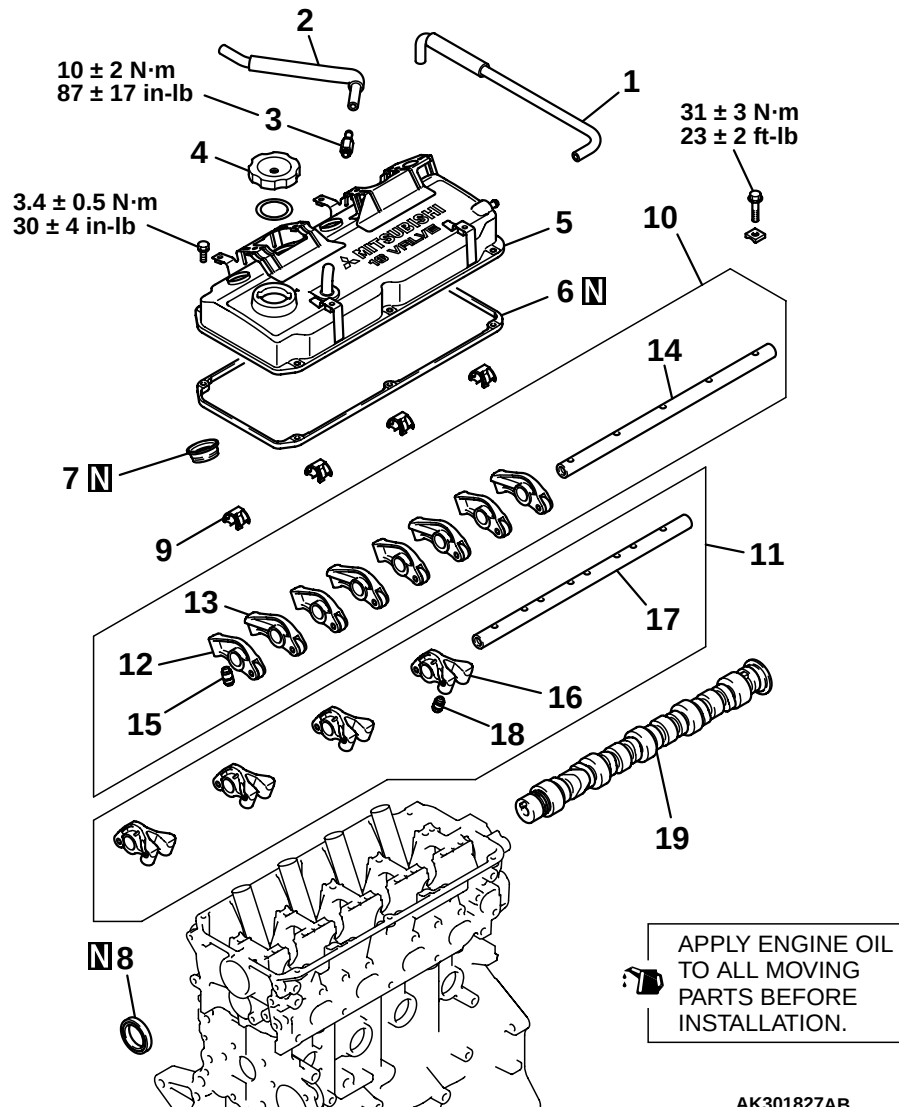
**>>G<< ENGINE COOLANT TEMPERATURE SENSOR INSTALLATION**

1. When reusing the sensor, clean its thread.
2. Apply 3M™ AAD Part number 8731 or equivalent to the engine coolant temperature sensor.

ROCKER ARMS AND CAMSHAFT

REMOVAL AND INSTALLATION

M1113005400563



AK301827AB

REMOVAL STEPS

1. BREATHER HOSE
2. POSITIVE CRANKCASE VENTILATION HOSE
3. POSITIVE CRANKCASE VENTILATION VALVE
4. OIL HILLER CAP
5. ROCKER COVER
6. ROCKER COVER GASKET
7. OIL SEAL
- >>E<< 8. OIL SEAL
- >>D<< 9. ROCKER ARM SPRING

REMOVAL STEPS (Continued)

- <<A>> >>C<< 10. ROCKER ARMS AND ROCKER ARM SHAFT (INTAKE)
- <<A>> 11. ROCKER ARMS AND ROCKER ARM SHAFT (EXHAUST)
12. ROCKER ARM B
13. ROCKER ARM A
- >>B<< 14. ROCKER ARM SHAFT
- >>A<< 15. LASH ADJUSTER
16. ROCKER ARM C
- >>B<< 17. ROCKER ARM SHAFT
- >>A<< 18. LASH ADJUSTER
19. CAMSHAFT

Required Special Tools:

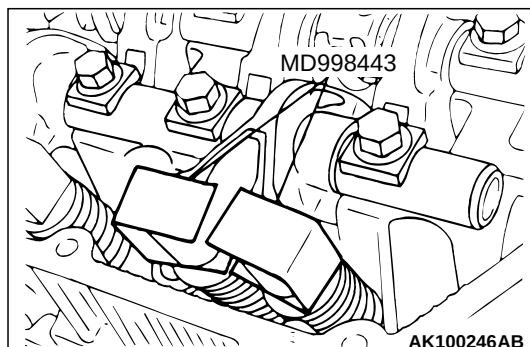
- MD998442: Air Bleed Wire
- MD998443: Lash Adjuster Holder (8)
- MD998713: Camshaft Oil Seal Installer

REMOVAL SERVICE POINT

<<A>> ROCKER ARM AND ROCKER ARM SHAFT
REMOVAL CAUTION

If the lash adjuster is re-used, clean the lash adjuster.
(Refer to [P.11B-21](#))

Set special tool MD998443 to prevent the lash adjuster coming free and falling to the floor.



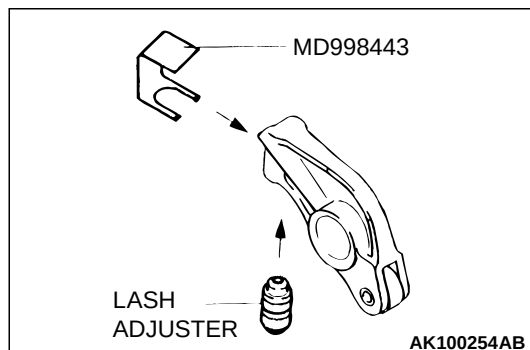
INSTALLATION SERVICE POINTS

>>A<< LASH ADJUSTER INSTALLATION

 CAUTION

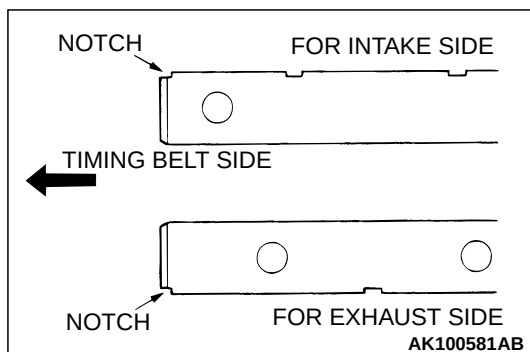
If the lash adjuster is re-used, clean the lash adjuster.
(Refer to [P.11B-21](#))

Fit the lash adjuster onto the rocker arm without allowing diesel fuel to spill out. Fit special tool MD998443 to prevent the lash adjuster coming free and falling to the floor.



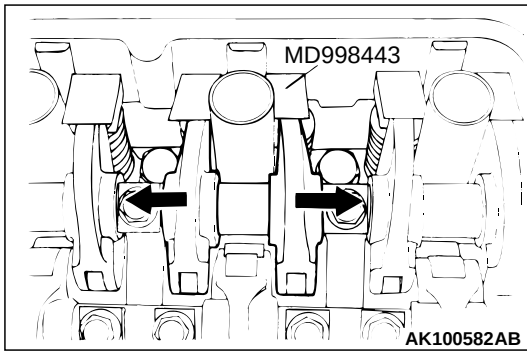
>>B<< ROCKER ARM SHAFT INSTALLATION

Install the rocker arm shafts, place the end with notched side toward the timing belt side as shown.



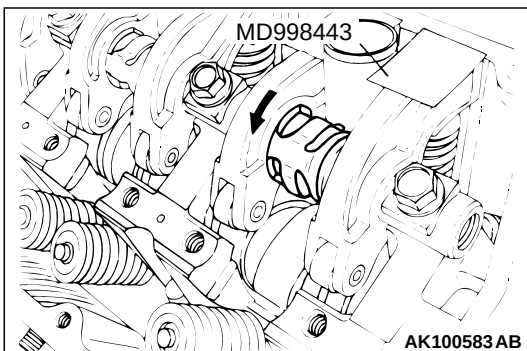
**>>C<< ROCKER ARMS AND ROCKER ARM SHAFT
INSTALLATION**

Move the rocker arms in the directions shown in the illustration before tightening the rocker arm shaft bolts.



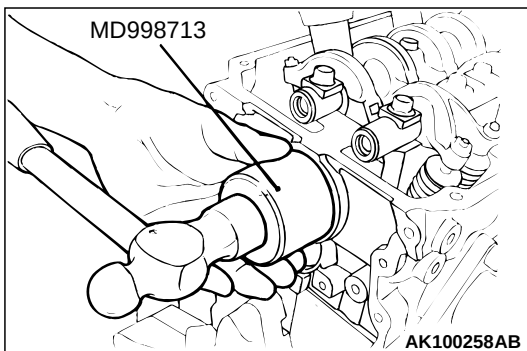
>>D<< ROCKER ARM SPRING INSTALLATION

1. Insert the rocker arm spring at an angle to the spark plug guide and then install it so that it is at a right angle to the guide.
2. Remove the special tool from rocker arms.



>>E<< OIL SEAL INSTALLATION

Use special tool MD998713 to install the camshaft oil seal.



INSPECTION

M1113005500098

CAMSHAFT

Measure the cam height and replace the camshaft if any height exceeds the specified limit.

Standard value:

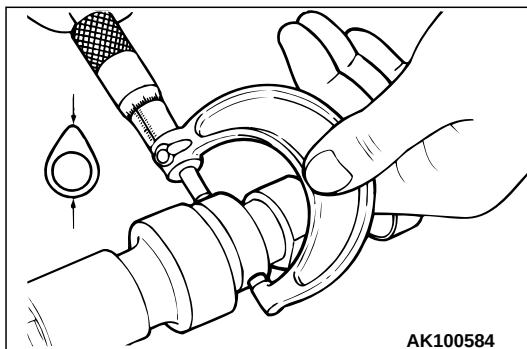
Intake: 37.86 mm (1.49 inches)

Exhaust: 37.67 mm (1.48 inches)

Limit:

Intake: 37.36 mm (1.47 inches)

Exhaust: 37.17 mm (1.46 inches)



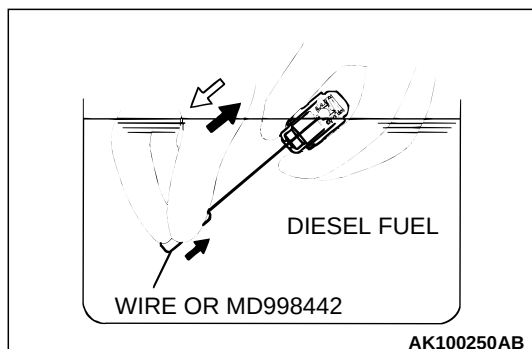
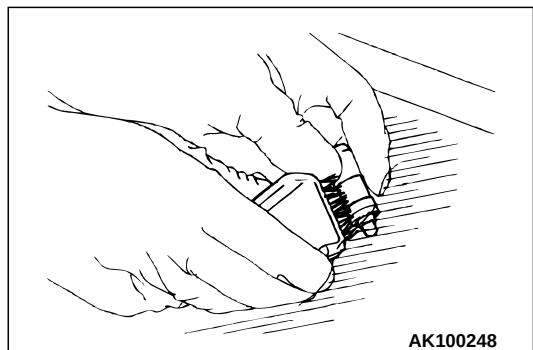
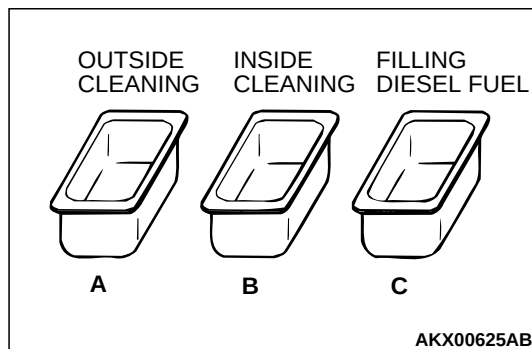
LASH ADJUSTERS

⚠ CAUTION

- The lash adjusters are precision-engineered mechanisms. Do not allow them to become contaminated by dirt or other foreign substances.
- Do not attempt to disassemble the lash adjusters.
- Use only fresh diesel fuel to clean the lash adjusters.

1. Prepare three containers and approximately 5 dm³ (30.5 quart) of diesel fuel. Into each container, pour enough diesel fuel to completely cover a lash adjuster when it is standing upright. Then, perform the following steps with each lash adjuster.
2. Place the lash adjuster in container A and clean its outside surface.

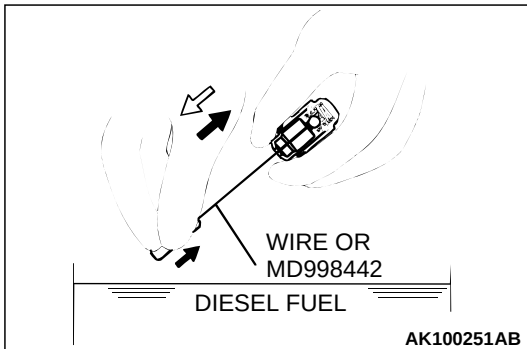
NOTE: Use a nylon brush if deposits are hard to remove.

**⚠ CAUTION**

The steel ball spring is extremely weak, so the lash adjuster's functionality may be lost if the air bleed wire is pushed in hard.

3. While gently pushing down the internal steel ball using wire [0.5 mm (0.020 inch) in diameter] or special tool MD998442, move the plunger through 5 to 10 strokes until it slides smoothly. In addition to eliminating stiffness in the plunger, this operation will removed dirty oil.

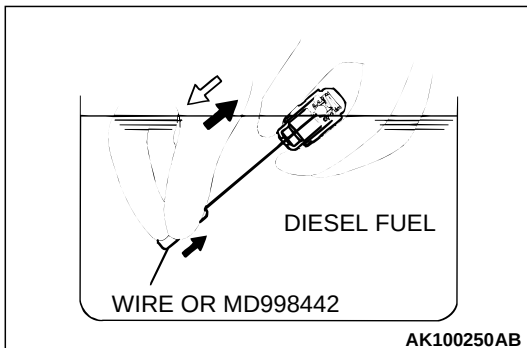
NOTE: If the plunger remains stiff or the mechanism appears otherwise abnormal, replace the lash adjuster.



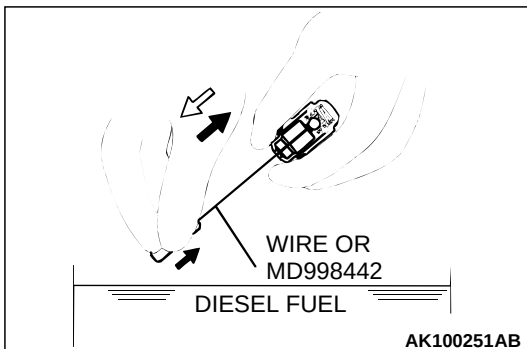
4. Remove the lash adjuster from the container. Then, push down the steel ball gently and push the plunger to eliminate diesel fuel from the pressure chamber.

CAUTION

The steel ball spring is extremely weak, so the lash adjuster's functionality may be lost if the air bleed wire is pushed in hard.



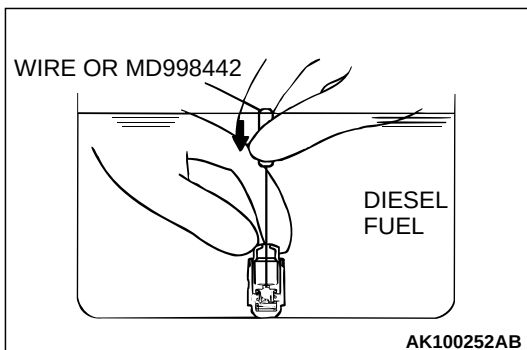
5. Place the lash adjuster in container B. Then, gently push down the internal steel ball using wire [0.5 mm (0.020 inch) in diameter] or special tool MD998442 and move the plunger through 5 to 10 strokes until it slides smoothly. This operation will clean the lash adjuster's pressure chamber.



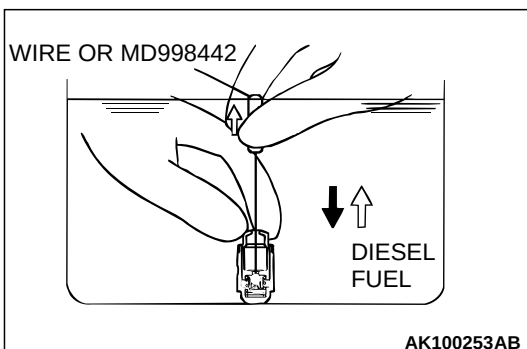
6. Remove the lash adjuster from the container. Then, push down the steel ball gently and push the plunger to eliminate diesel fuel from the pressure chamber.

CAUTION

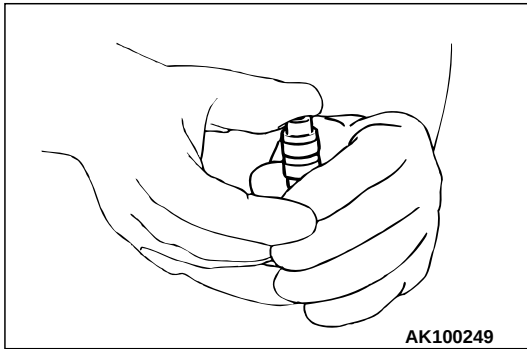
Do not use container C for cleaning. If cleaning is performed in container C, foreign matter could enter the pressure chamber when the chamber is filled with diesel fuel.



7. Place the lash adjuster in container C. Then, gently push down the internal steel ball using wire [0.5 mm (0.020 inch) in diameter] or special tool MD998442.



8. Stand the lash adjuster with its plunger at the top, then push the plunger downward firmly until it moves through its greatest possible stroke. Return the plunger slowly, then release the steel ball and allow the pressure chamber to fill with diesel fuel.



9. Remove the lash adjuster from the container, then stand the lash adjuster with its plunger at the top. Push the plunger firmly and check that it does not move. Also, check that the lash adjuster's height matches that of a new lash adjuster.

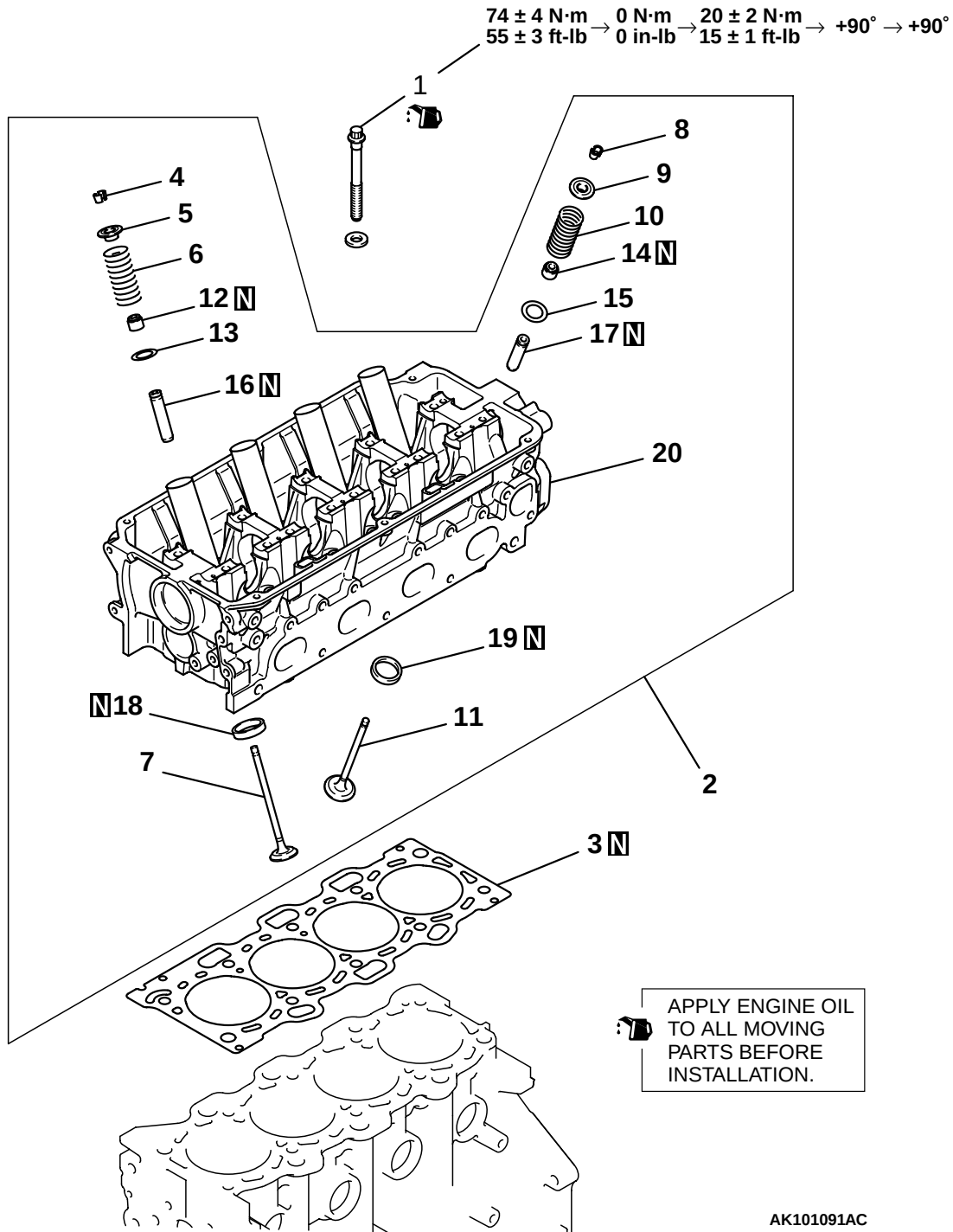
NOTE: If lash adjuster contracts, perform the operations 7 through 9 again to fill it with diesel fuel completely. Replace the lash adjuster if it still contracts after performing these steps.

10. Stand the lash adjuster upright to prevent diesel fuel spilling out. Do not allow the lash adjuster to become contaminated by dirt or other foreign matter. Fit the lash adjuster onto the engine as soon as possible.

CYLINDER HEAD AND VALVES

REMOVAL AND INSTALLATION

M1113006900505



AK101091AC

- REMOVAL STEPS**
- <<A>> >>D<< 1. CYLINDER HEAD BOLT
2. CYLINDER HEAD ASSEMBLY
3. CYLINDER HEAD GASKET
- <> >>C<< 4. RETAINER LOCK
5. VALVE SPRING RETAINER
>>B<< 6. VALVE SPRING
7. INTAKE VALVE

- REMOVAL STEPS (Continued)**
- <> >>C<< 8. RETAINER LOCK
9. VALVE SPRING RETAINER
>>B<< 10. VALVE SPRING
11. EXHAUST VALVE
<<C>> >>A<< 12. VALVE STEM SEAL
13. VALVE SPRING SEAT
<<C>> >>A<< 14. VALVE STEM SEAL

REMOVAL STEPS (Continued)

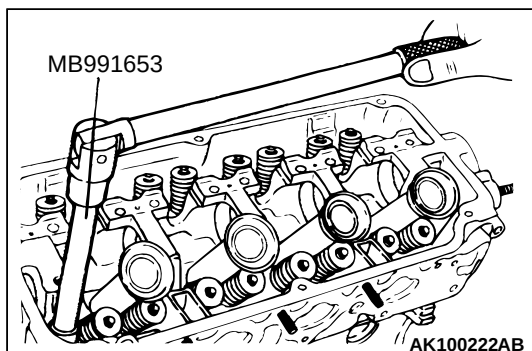
15. VALVE SPRING SEAT
16. INTAKE VALVE GUIDE
17. EXHAUST VALVE GUIDE
18. INTAKE VALVE SEAT
19. EXHAUST VALVE SEAT
20. CYLINDER HEAD

Required Special Tools:

- MB991653: Cylinder Head Bolt Wrench
- MD998772: Valve Spring Compressor
- MD998735: Valve Spring Compressor
- MD998774: Valve Stem Seal Installer

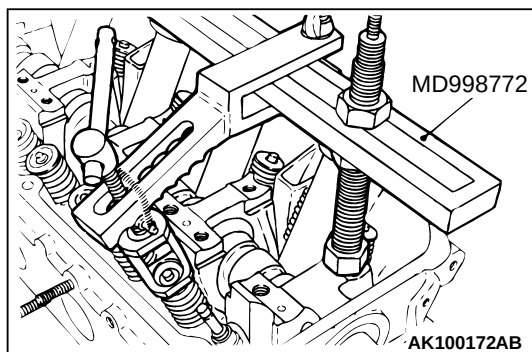
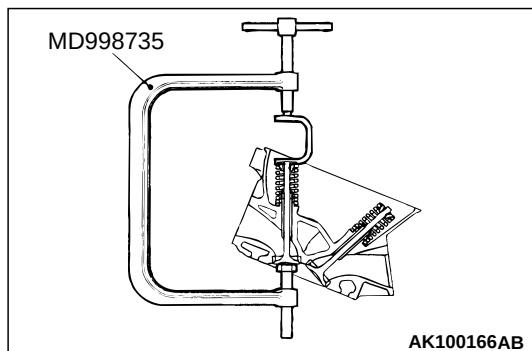
REMOVAL SERVICE POINTS**<<A>> CYLINDER HEAD BOLT REMOVAL**

Using the special tool MB991653 to loosen the cylinder head bolts.

**<> RETAINER LOCK REMOVAL**

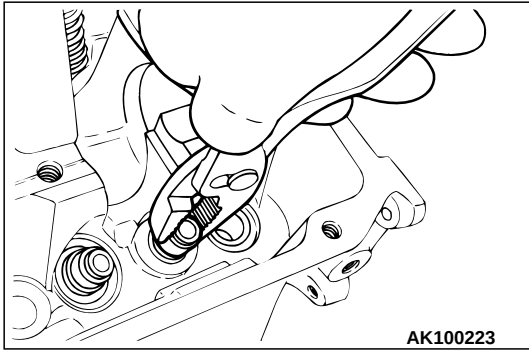
1. Using special tool MD998735 or MD998772, compress the retainer locks.
2. Remove the retainer locks.

NOTE: Tag removed valves, springs and other components, noting their cylinder numbers and locations to facilitate reassembly. Store these components safely.



<<C>> VALVE STEM SEAL REMOVAL

Do not reuse removed valve stem seal.



INSTALLATION SERVICE POINTS

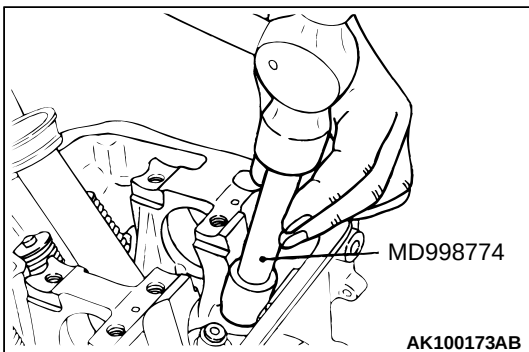
>>A<< VALVE STEM SEAL INSTALLATION

1. Install the valve spring seat.

⚠ CAUTION

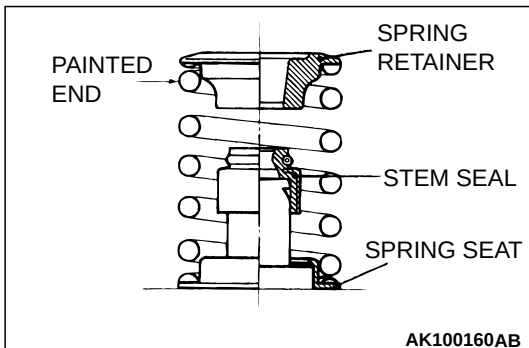
- Do not reuse removed valve stem seals.
- The valve stem seal must be installed using the correct special tool. Incorrect installation could result in oil leaking past the valve guide.

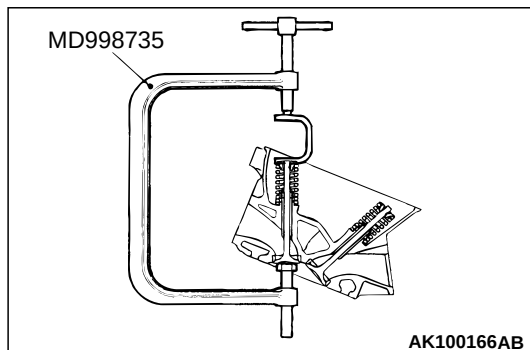
2. Using special tool MD998774, install a new stem seal to the valve guide.



>>B<< VALVE SPRING INSTALLATION

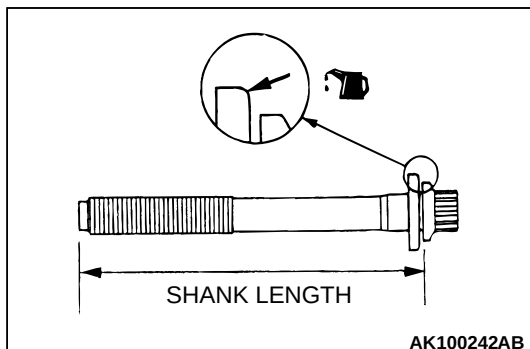
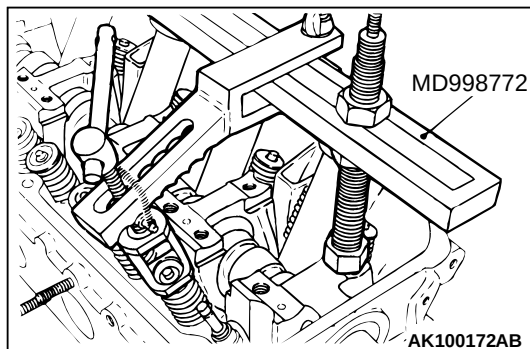
Install the valve spring so that the painted end is on the rocker arm side.



**>>C<< RETAINER LOCK INSTALLATION**

Using special tool MD998735 or MD998772, compress the valve spring and insert the retainer lock into position.

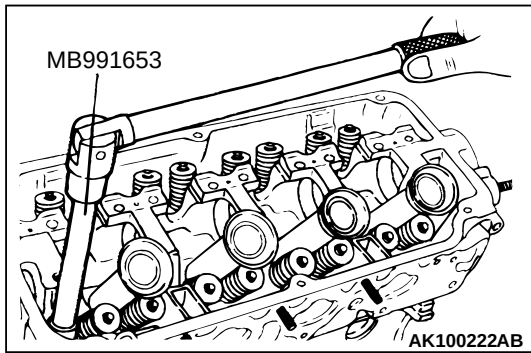
NOTE: The valve spring, if excessively compressed, causes the bottom end of retainer to be in contact with the stem seal, and damage it.

**>>D<< CYLINDER HEAD BOLT INSTALLATION**

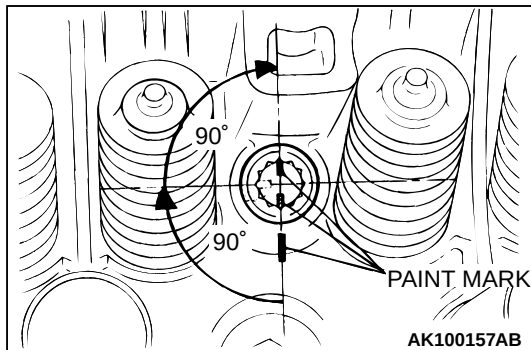
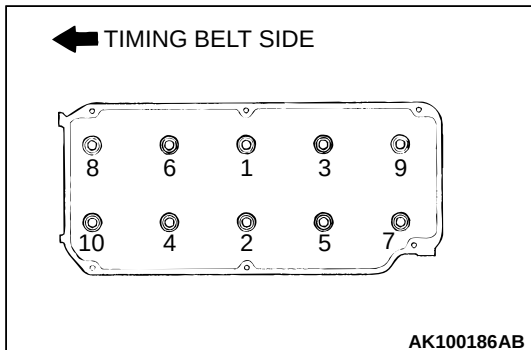
1. Before reusing the cylinder head bolt, measure that its shank length does not exceed the specified limit. Replace the bolt if this measurement exceeds the limit.

Limit: Max. 96.4 mm (3.795 inches)

2. Fit the washer as shown.
3. Apply engine oil to the bolt thread and washer.



4. Tighten the bolts in the sequence shown until each is torqued to 74 ± 1 N·m (55 ± 1 ft-lb) using the cylinder head bolt wrench special tool MB991653.
5. Loosen all bolts fully.
6. Retighten the bolts in the sequence shown until each is torqued to 20 ± 1 N·m (15 ± 1 ft-lb).
7. Make paint marks on the cylinder head bolt heads and cylinder head as shown.



⚠ CAUTION

If the bolts are tightened by an angle of less than 90 degrees, they may not hold the cylinder head with sufficient strength. If the bolts are tightened by an angle exceeding 90 degrees, completely remove them and repeat the installation procedure.

8. In accordance with the tightening sequence, tighten each bolt by 90 degrees.
9. Tighten each bolt by further 90 degrees and check that the paint marks on the bolt head and cylinder head are aligned.

INSPECTION

M1113007000099

CYLINDER HEAD

1. Before cleaning the cylinder head, check it for water leaks, gas leaks, cracks, and other damage.
2. Remove all oil, water scale, sealant, and carbon. After cleaning the oil passages, blow air through them to verify that they are not blocked.
3. Check the cylinder head gasket surface for flatness by using a straight edge and feeler gauge.

Standard value: 0.03 mm (0.0012 inch)

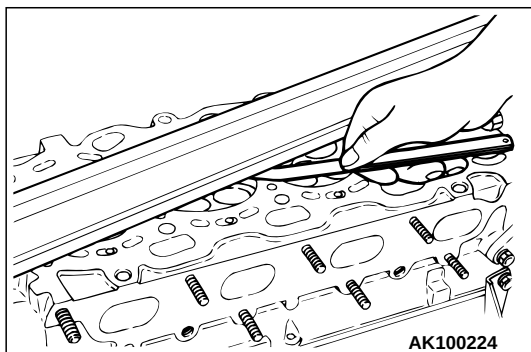
Limit: 0.2 mm (0.008 inch)

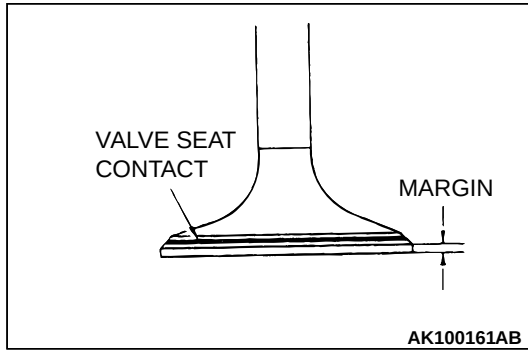
4. If flatness exceeds the specified limit, grind the gasket surface to specification.

Grinding limit: *0.2 mm (0.008 inch)

***Includes/combined with cylinder block grinding**

**Cylinder head height (Specification when new):
119.9 – 120.1 mm (4.720 – 4.728 inches)**

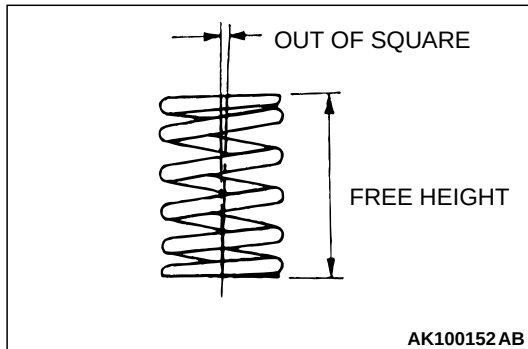


**VALVE**

1. Check the valve face for correct contact. If contact is uneven or incomplete, reface the valve seat.
2. If the margin is less than specified, replace the valve.

Standard value:**Intake: 1.0 mm (0.039 inch)****Exhaust: 1.3 mm (0.051 inch)****Limit:****Intake: 0.5 mm (0.020 inch)****Exhaust: 0.8 mm (0.031 inch)**

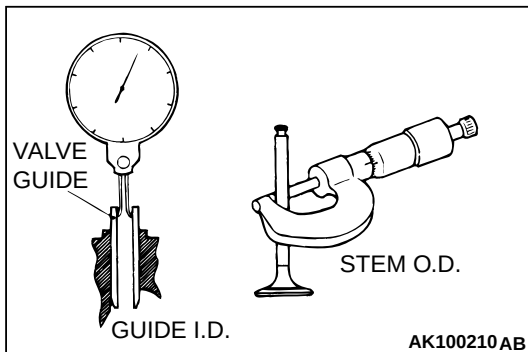
3. Measure the valve length. If the measurement is less than specified, replace the valve.

Standard value:**Intake: 110.15 mm (4.337 inches)****Exhaust: 113.70 mm (4.476 inches)****Limit:****Intake: 109.65 mm (4.317 inches)****Exhaust: 113.20 mm (4.457 inches)****VALVE SPRING**

1. Measure the valve spring free height. If the measurement is less than specified, replace spring.

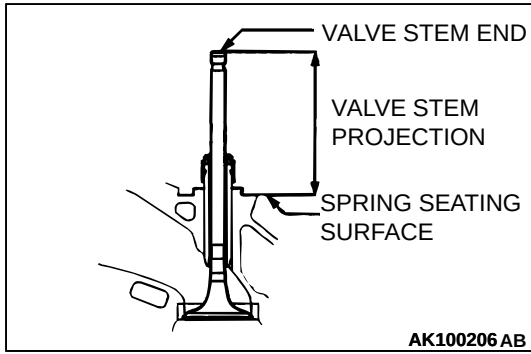
Standard value: 49.5 mm (1.95 inches)**Limit: 48.5 mm (1.91 inches)**

2. Measure the squareness of the spring. If the measurement is less than specified, replace the spring.

Standard value: 2° or less**Limit: 4°****VALVE GUIDE**

Measure the clearance between the valve guide and valve stem. If the clearance exceeds the specified limit, replace the valve guide or valve, or both.

Standard value:**Intake: 0.02 – 0.05 mm (0.0008 – 0.0020 inch)****Exhaust: 0.04 – 0.06 mm (0.0016 – 0.0024 inch)****Limit:****Intake: 0.10 mm (0.0039 inch)****Exhaust: 0.15 mm (0.0059 inch)**



VALVE SEAT

Assemble the valve, then measure the valve stem projection between the end of the valve stem and the spring seating surface. If the measurement exceeds the specified limit, replace the valve seat.

Standard value:

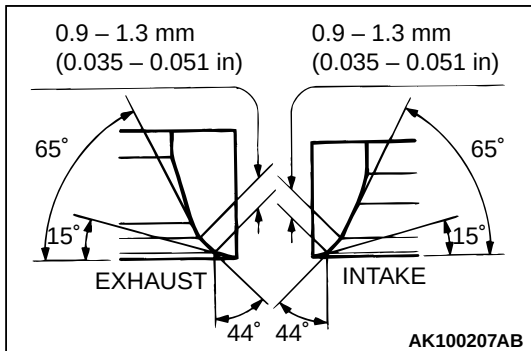
Intake: 49.30 mm (1.9409 inches)

Exhaust: 49.35 mm (1.9429 inches)

Limit

Intake: 49.80 mm (1.9606 inches)

Exhaust: 49.85 mm (1.9626 inches)

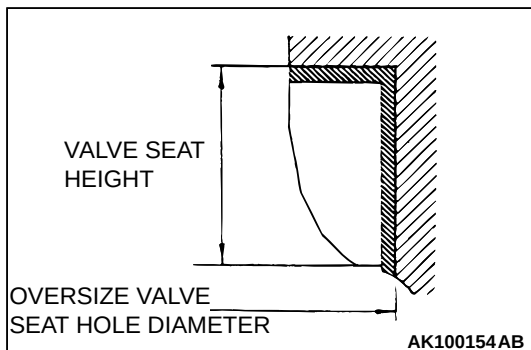
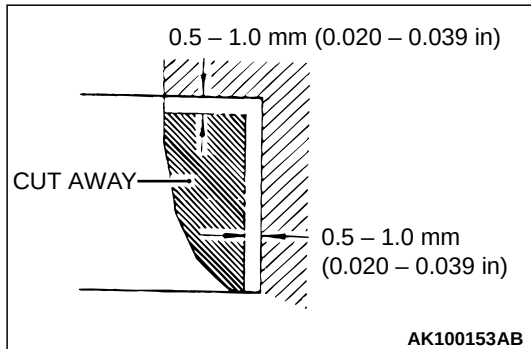


VALVE SEAT RECONDITIONING PROCEDURE

1. Before correcting the valve seat, check the clearance between the valve guide and valve. If necessary, replace the valve guide.
2. Using the appropriate special tool or seat grinder, correct the valve seat to achieve the specified seat width and angle.
3. After correcting the valve seat, lap the valve and valve seat using lapping compound. Then, check the valve stem projection. (refer to VALVE SEAT in INSPECTION)

VALVE SEAT REPLACEMENT PROCEDURE

1. Cut the valve seat to be replaced from the inside to reduce the wall thickness. Then, remove the valve seat.



2. Rebore the valve seat hole in the cylinder head to match the selected oversize valve seat diameter.

Intake valve seat hole diameter

0.3 oversize:

31.80 – 31.83 mm (1.2520 – 1.2531 inches)

0.6 oversize:

32.10 – 32.13 mm (1.2638 – 1.2650 inches)

Exhaust valve seat hole diameter

0.3 oversize:

29.30 – 29.32 mm (1.1535 – 1.1543 inches)

0.6 oversize:

29.60 – 29.62 mm (1.1654 – 1.1661 inches)

3. Prevent galling of the cylinder head bore by cooling the valve seat with liquid nitrogen before press-fitting it.

4. Correct the valve seat to achieve the specified width and angle. (refer to VALVE SEAT RECONDITIONING PROCEDURE)

VALVE GUIDE REPLACEMENT PROCEDURE

1. Using a press, push the valve guide out toward the cylinder block side.

CAUTION

Do not install a valve guide of the same size again.

2. Rebore the valve guide hole in the cylinder head to match the oversize valve guide that is to be fitted.

Valve guide hole diameters in cylinder head

0.05 oversize:

11.05 – 11.07 mm (0.4350 – 0.4358 inch)

0.25 oversize:

11.25 – 11.27 mm (0.4429 – 0.4337 inch)

0.50 oversize:

CAUTION

- The valve guide must be installed from the upper side of the cylinder head.
- The valve guides differ in length on the intake and exhaust sides.

Valve guide length

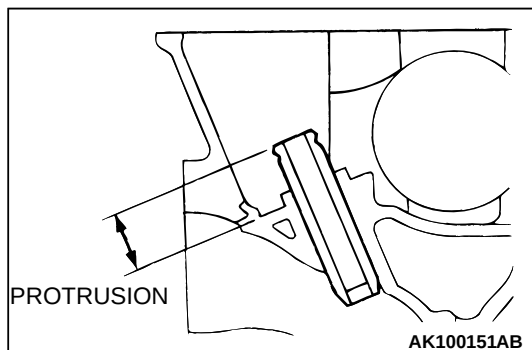
Intake: 45.5 mm (1.791 inches)

Exhaust: 50.5 mm (1.988 inches)

3. Press-fit the valve guide until it projects by the specified amount.

Standard value: 14.0 mm (0.551 inch)

4. After press-fitting the valve guide, insert a new valve and check that it slides smoothly.

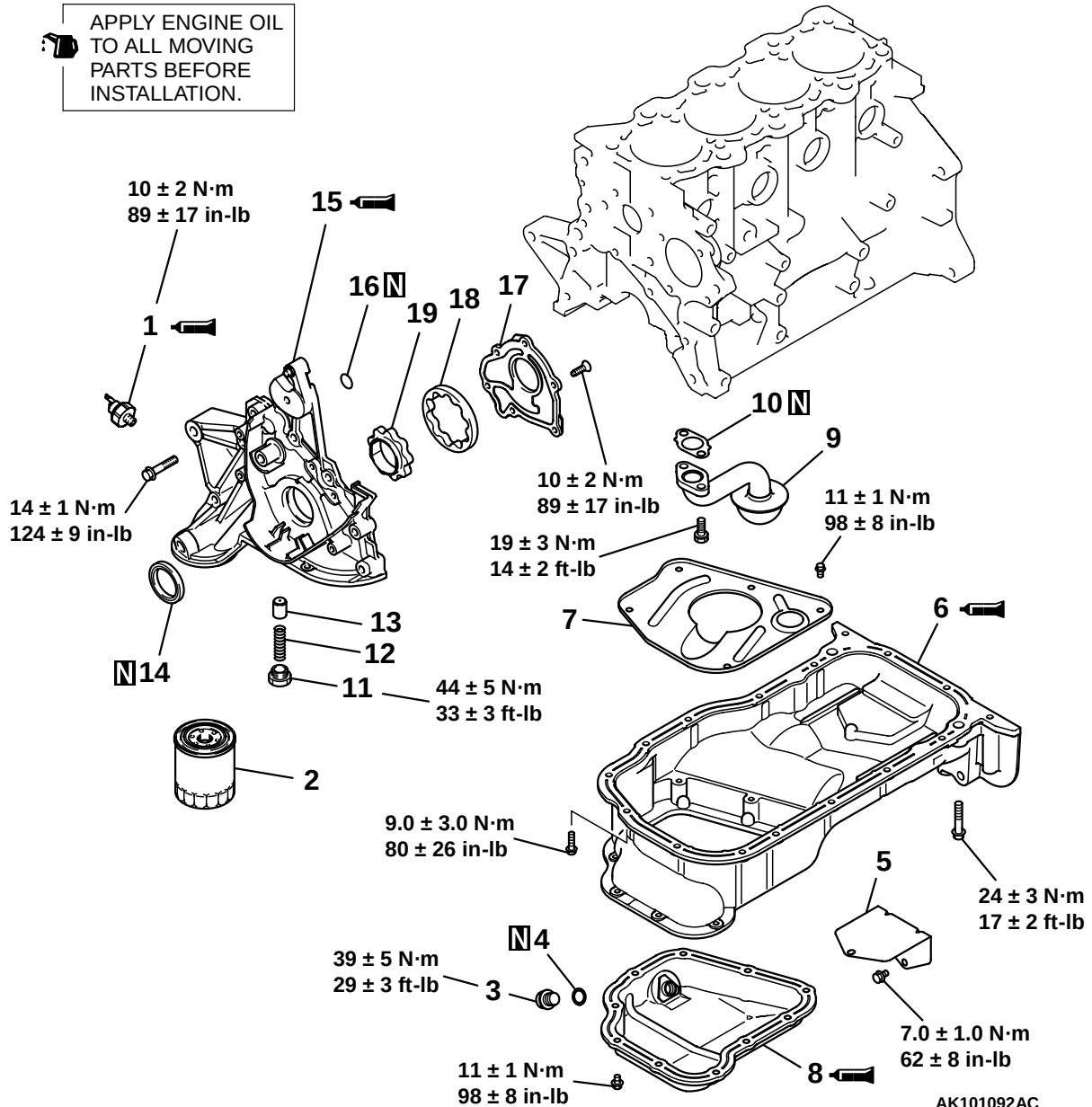


OIL PAN AND OIL PUMP

REMOVAL AND INSTALLATION

M1113008100408

APPLY ENGINE OIL
TO ALL MOVING
PARTS BEFORE
INSTALLATION.



AK101092AC

REMOVAL STEPS

- >>G<< 1. OIL PRESSURE SWITCH
- >>F<< 2. OIL FILTER
- 3. DRAIN PLUG
- >>E<< 4. GASKET
- 5. COVER
- <<A>> >>D<< 6. UPPER OIL PAN
- 7. BAFFLE PLATER
- <<A>> >>D<< 8. LOWER OIL PAN
- 9. OIL SCREEN
- 10. OIL SCREEN GASKET

REMOVAL STEPS (Continued)

- 11. RELIEF PLUG
- 12. RELIEF SPRING
- 13. RELIEF PLUNGER
- >>C<< 14. OIL SEAL
- >>B<< 15. OIL PUMP CASE
- 16. O-RING
- 17. OIL PUMP CASE COVER
- <> >>A<< 18. OUTER ROTOR
- <> >>A<< 19. INNER ROTOR

Required Special Tool:

- MD998717: Crankshaft Front Oil Seal Installer

REMOVAL SERVICE POINTS

<<A>> UPPER OIL PAN/LOWER OIL PAN REMOVAL

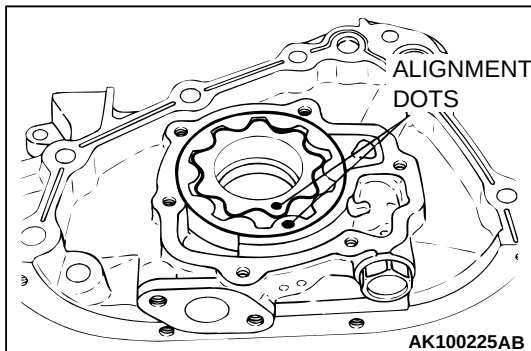
⚠ CAUTION

Never use the special tool (oil pan remover), etc.

At first remove the bolt [length 127: mm (5 inches)] Which is nearest to flywheel or drive plate, and the remove the other bolts.

<> OUTER ROTOR/INNER ROTOR REMOVAL

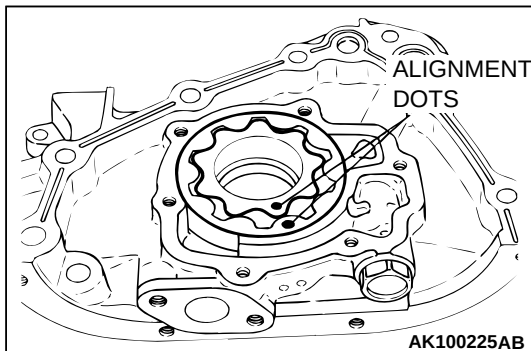
Make alignment dots on the outer and inner rotors for reference in reassembly.



INSTALLATION SERVICE POINTS

>>A<< INNER ROTOR/OUTER ROTOR INSTALLATION

Apply engine oil to the rotors. Then, install the rotors ensuring that the alignment dots made at disassembly are properly aligned.

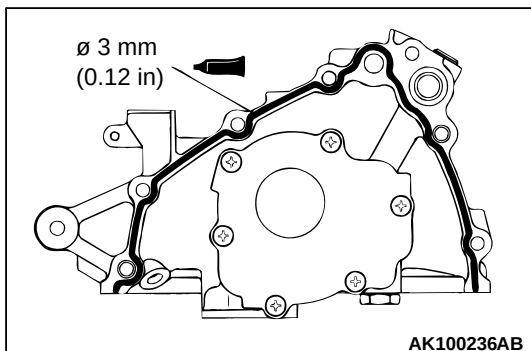


>>B<< OIL PUMP CASE INSTALLATION

1. Clean the sealant application surfaces on the cylinder block and oil pump case.
2. Apply a 3 mm (0.12 inch) diameter bead of sealant Mitsubishi Genuine Parts number MD970389, or equivalent to the oil pump case.
3. Tighten the oil pan bolts to the specified torque.

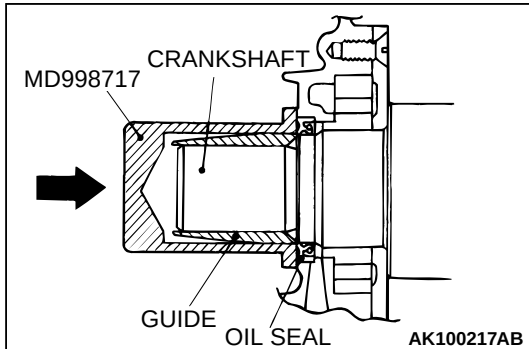
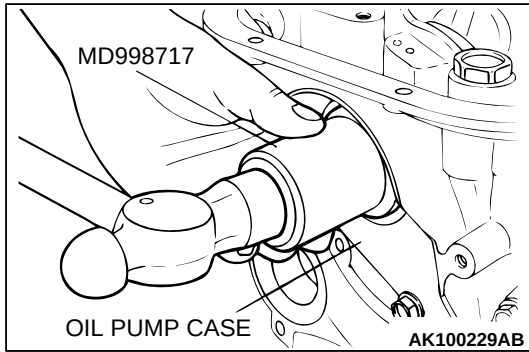
Tightening torque: 14 ± 1 N·m (124 ± 9 in-lb)

4. After installation, wait at least one hour. Never start the engine or let engine oil touch the adhesion surface during that time.



>>C<< OIL SEAL INSTALLATION

1. Place the special tool MD998717 on the crankshaft front end and apply engine oil to the its outer diameter.
2. Apply engine oil to the oil seal lip, then push the oil seal along the guide by hand until it touches the oil pump case. Tap the oil seal into place using the special tool.

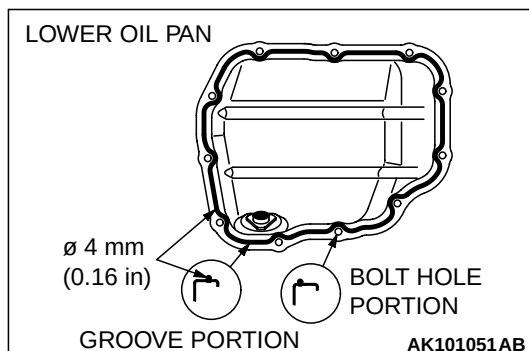
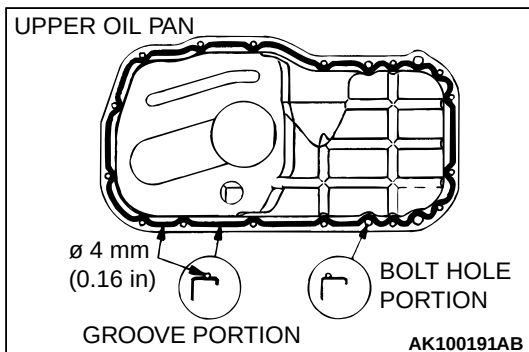


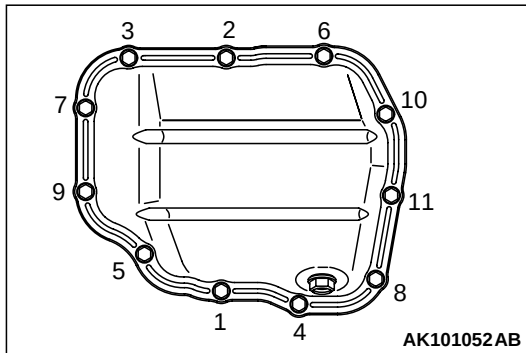
>>D<< UPPER OIL PAN/LOWER OIL PAN INSTALLATION

1. Clean the mating surfaces of the upper oil pan and lower oil pan and cylinder block.
2. Apply a 4 mm (0.16 inch) diameter bead of sealant Mitsubishi Genuine Parts number MD970389, or equivalent to the upper oil pan and lower oil pan.

NOTE: Install the oil pan within 15 minutes after applying liquid gasket.

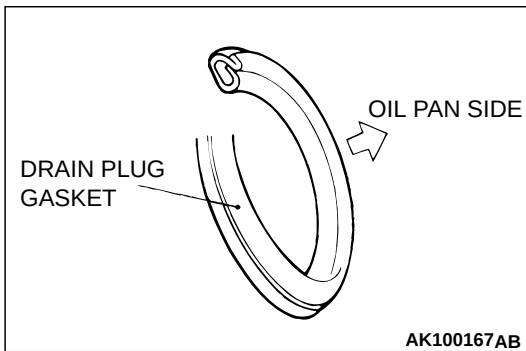
NOTE: Then wait at least one hour. Never start the engine or let engine oil or coolant touch the adhesion surface during that time.





3. Tighten the lower oil pan mounting bolts in the sequence shown in the illustration.

Tightening torque: 11 ± 1 N·m (98 ± 8 in-lb)



>>E<< DRAIN PLUG GASKET INSTALLATION

⚠ CAUTION

If the gasket is installed in the wrong direction, oil leaks will be occurred.

Replace the drain plug gasket with a new one. Fit the new gasket as shown.

>>F<< OIL FILTER INSTALLATION

1. Clean the filter mounting surfaces on the front case.
2. Apply clean engine oil to the O-ring of the oil filter.

⚠ CAUTION

The oil filter must be tightened using a commercially available filter wrench. If the filter is tightened by hand only, it will be insufficiently torqued, resulting in oil leaks.

3. Screw on the oil filter until its O-ring is seated on the mounting surface. Then, give the oil filter one further turn.

⚠ CAUTION

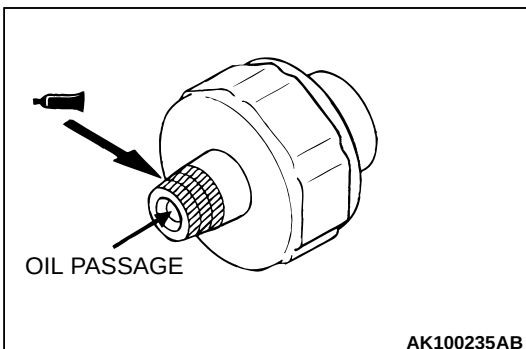
Use care not to allow the sealant to plug the oil passage.

1. Apply 3M™ AAD part number 8672 or equivalent to the oil pressure switch.

⚠ CAUTION

If the switch is tightened with a spanner or offset wrench, an over-torque may be applied and the switch to be damaged.

2. Install and tighten the switch to the specified torque by using a socket wrench and torque wrench.

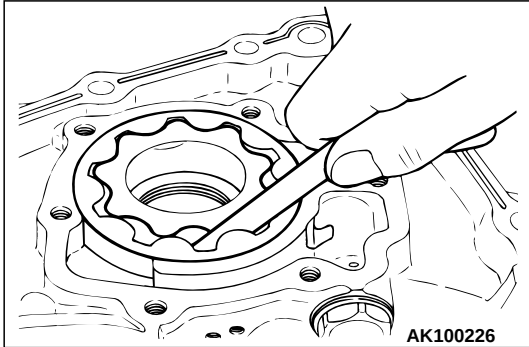


INSPECTION

OIL PUMP

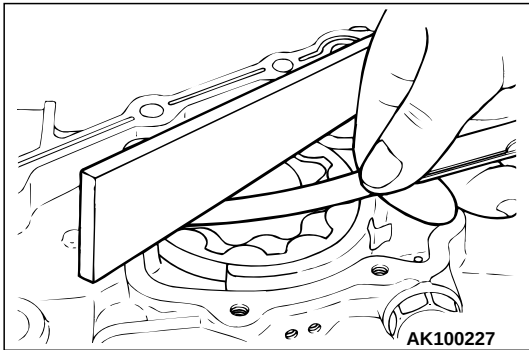
1. Fit the rotors into the oil pump case.
2. Check the tip clearance, using a feeler gauge.

Standard value: 0.03 – 0.08 mm (0.0012 – 0.0032 inch)



3. Check the side clearance, using a straight edge and feeler gauge.

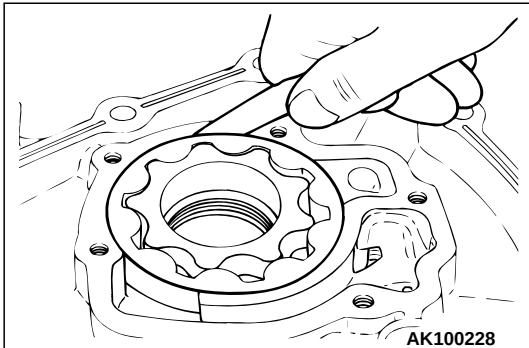
Standard value: 0.04 – 0.10 mm (0.0016 – 0.0039 inch)



4. Check the body clearance, using a feeler gauge.

Standard value: 0.10 – 0.18 mm (0.0039 – 0.0071 inch)

Limit: 0.35 mm (0.0138 inch)



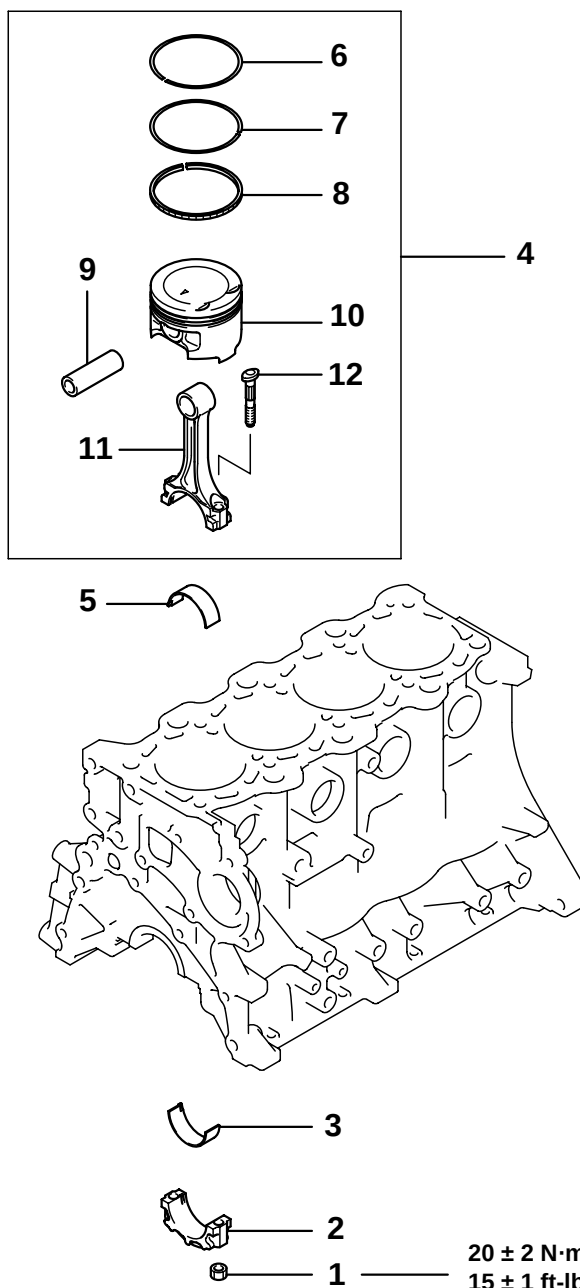
PISTON AND CONNECTING ROD

REMOVAL AND INSTALLATION

M1113008400614



APPLY ENGINE OIL
TO ALL MOVING
PARTS BEFORE
INSTALLATION.



20 ± 2 N·m
15 ± 1 ft-lb
+

AK101093AC

REMOVAL STEPS (Continued)

- REMOVAL STEPS**
- >>G<< 1. NUT
<<A>> >>F<< 2. CONNECTING ROD CAP
>>E<< 3. CONNECTING ROD BEARING
>>D<< 4. PISTON AND CONNECTING ROD
>>E<< 5. CONNECTING ROD BEARING
>>C<< 6. PISTON RING NO.1

- >>C<< 7. PISTON RING NO.2
>>B<< 8. OIL RING
<> >>A<< 9. PISTON PIN
10. PISTON
11. CONNECTING ROD
12. BOLT

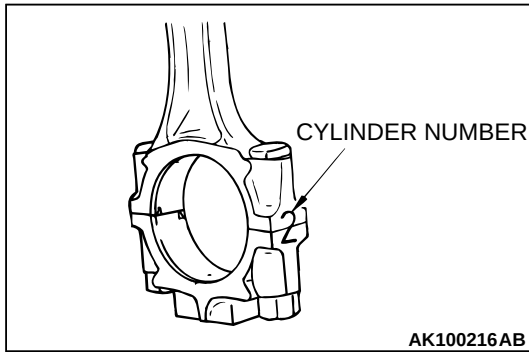
Required special tool:

- MIT216941: Piston Pin Setting Tool

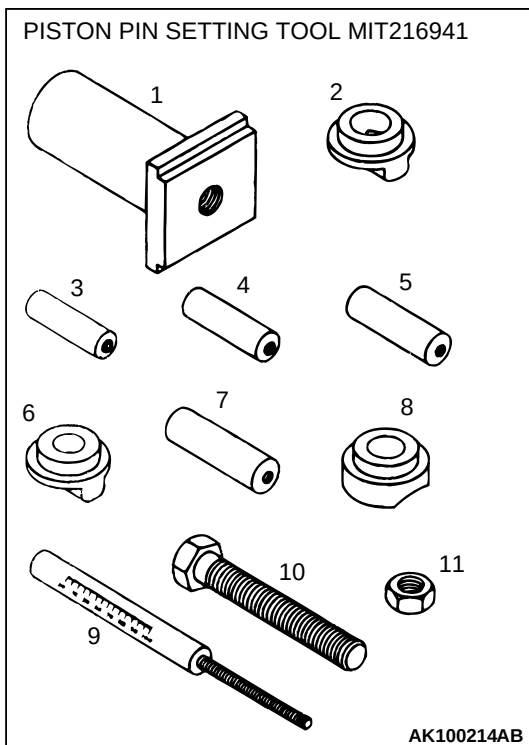
REMOVAL SERVICE POINTS

<<A>> CONNECTING ROD CAP REMOVAL

1. Mark the cylinder number on the side of the connecting rod big end for correct reassembly.
2. Keep the removed connecting rods, caps, and bearings in order according to the cylinder number.

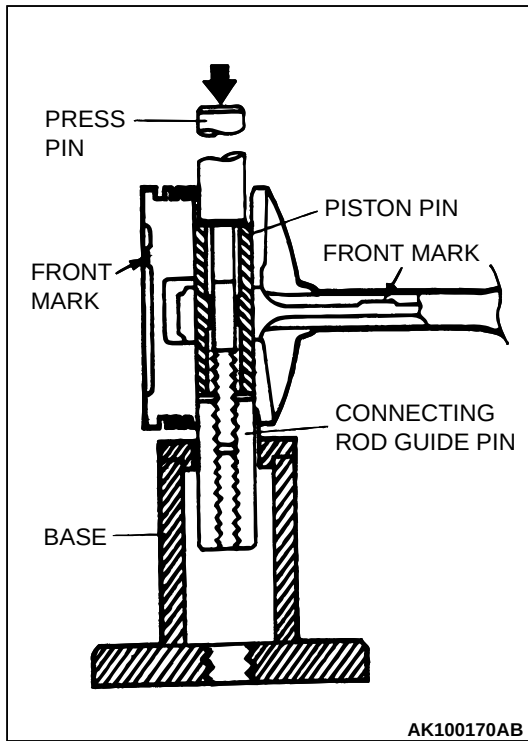


<> PISTON PIN REMOVAL



ITEM NO.	PART NO.	DESCRIPTION
1	MIT310134	Base
2	MIT310136	Piston Support
3	MIT310137	Connecting Rod Guide Pin
4	MIT310138	Connecting Rod Guide Pin
5	MIT310139	Connecting Rod Guide Pin
6	MIT310140	Piston Support
7	MIT310141	Connecting Rod Guide Pin
8	MIT310142	Piston Support
9	MIT48143	Press Pin
10	216943	Stop Screw
11	10396	Nut

1. Remove the stop screw from the base.
2. Select the correct piston support for your application (See above). Fit the piston support onto the base. Place the base on press support blocks.



3. Insert the press pin through the piston pin hole. Select the correct connecting rod guide pin (See above). Thread the guide pin onto the threaded portion of the press pin.
4. Position the piston assembly on the piston support in the press. With the press pin up as shown in Figure 4, insert the guide pin through the hole in the piston and through the hole in the piston support.

⚠ CAUTION

The piston support must seat squarely against the piston. Verify that the piston pin will slide through the hole in the piston support.

5. Press the piston pin out of the assembly.
6. Remove the piston pin from the press pin.

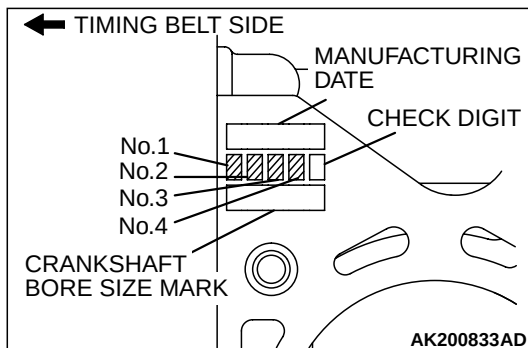
INSTALLATION SERVICE POINTS

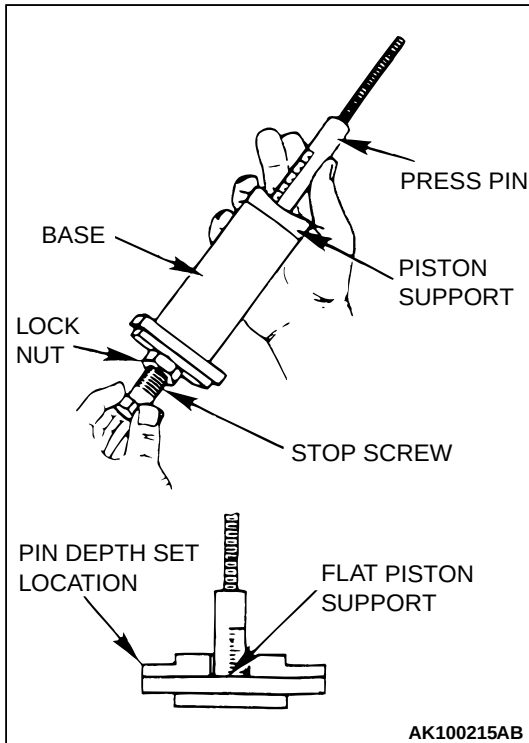
>>A<< PISTON PIN INSTALLATION

1. When replacing the piston, read off the cylinder bore size mark on the cylinder block as illustrated, and select a piston according to the following table.

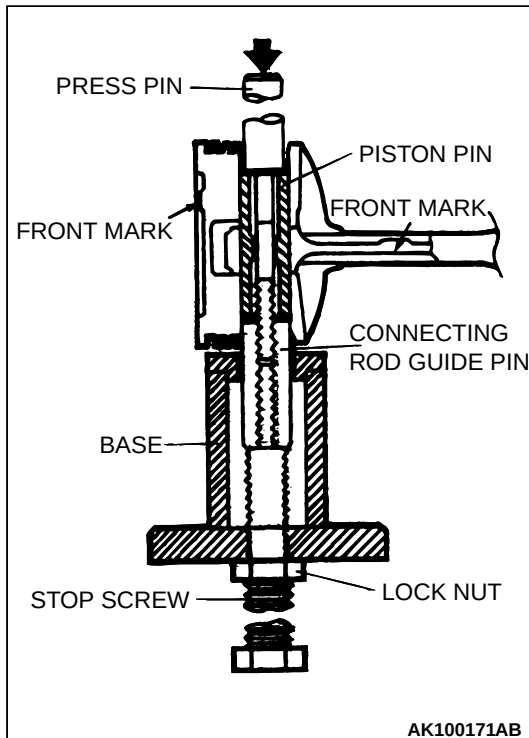
CYLINDER BORE SIZE MARK	PISTON SIZE MARK
A	A
B	None
C	C

NOTE: The piston size mark shows on the top of the piston.





2. Thread the stop screw and lock nut assembly into the base. Fit the correct piston support on top of the base. Insert the press pin, threaded end up, into the hole in the piston support until the press pin touches the stop screw.
3. Using the markings on the press pin, adjust the stop screw to the depth as shown on the instruction for special tool MIT216941.

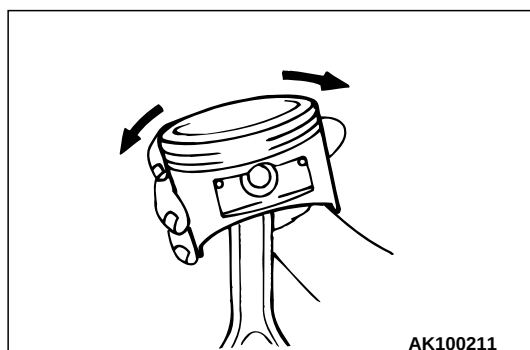


4. Place the base on press support blocks.
5. Slide the piston pin over the threaded end of the press pin, and thread the correct guide pin up against it.
6. Coat the piston pin with oil, and with the connecting rod held in position, slide the guide pin through the piston and connecting rod.
7. Press the piston pin through the connecting rod until the guide pin contacts the stop screw.

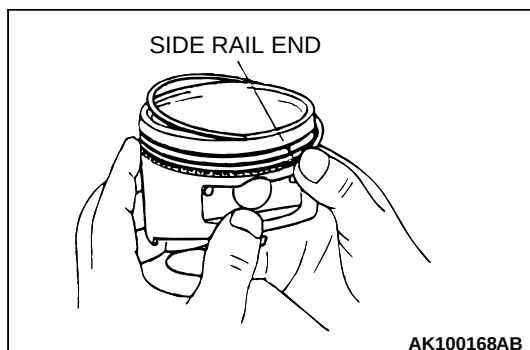
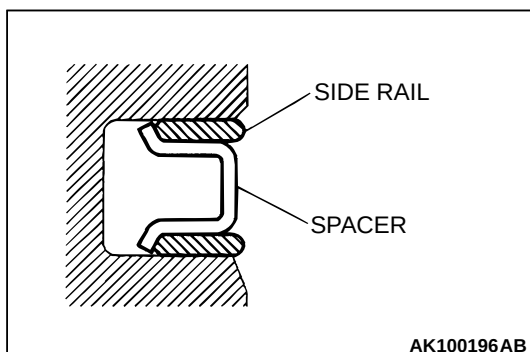
CAUTION

Due to production tolerance variations, it is necessary to visually inspect the piston pin depth after installation to verify that the piston pin is centered. Adjust if necessary.

8. Remove the piston assembly from the base. Remove the guide pin and press pin from the assembly.



9. Check that the piston moves smoothly.



⚠ CAUTION

Do not fit side rails using a piston ring expander since they may break.

1. Fit the oil ring spacer into the piston ring groove. Then fit the upper and lower side rails.

NOTE: The spacer and side rails may be fitted in either direction. No distinction is made between top and bottom.

NOTE: Spacer and side rail sizes are color-coded as follows:

SIZE	IDENTIFICATION COLOR
Standard size	None
0.50 mm (0.020 in) oversize diameter	Blue
1.00 mm (0.040 in) oversize diameter	Yellow

To install a side rail, fit one end of the rail into the groove, then press the rest of the rail into position by hand as shown.

2. After installing the side rails, check that they move smoothly in both directions.

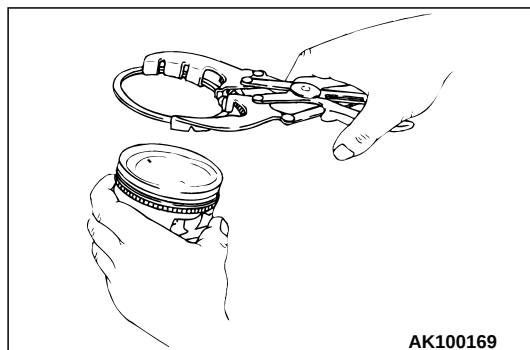
>>C<< PISTON RING NO.2/PISTON RING NO.1 INSTALLATION

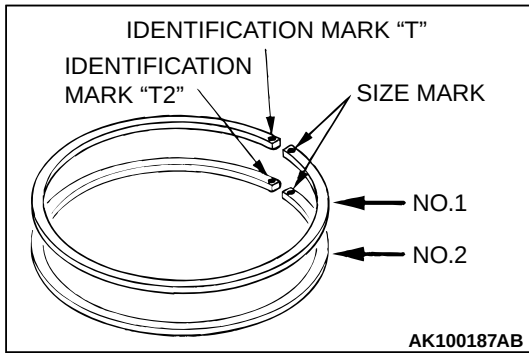
Using a ring expander, fit ring No.2 and ring No.1 with their identification marks facing upward (on the piston crown side).

Identification mark:

No.1 ring: T

No.2 ring: T2



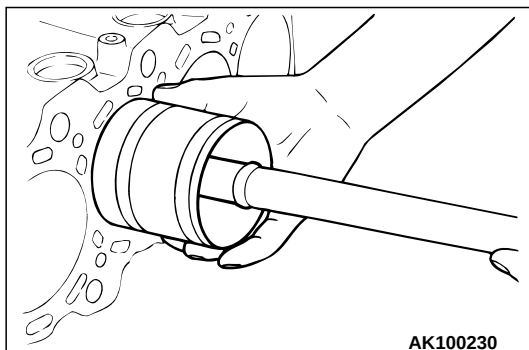
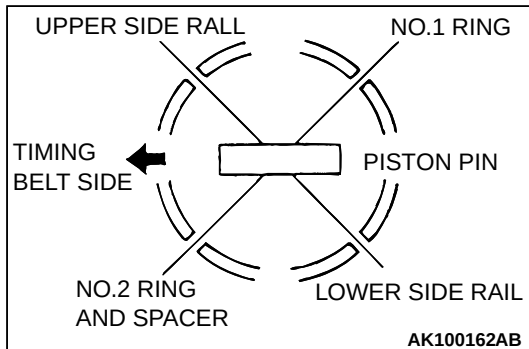


NOTE: The piston ring is stamped with the following size mark.

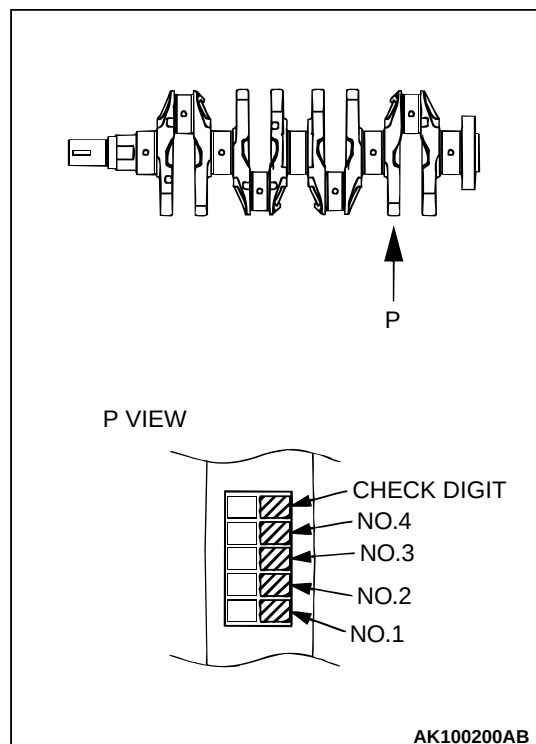
SIZE	IDENTIFICATION MARK
Standard size	None
0.50 mm (0.020 in) oversize diameter	50
1.00 mm (0.040 in) oversize diameter	100

>>D<< PISTON AND CONNECTING ROD ASSEMBLY INSTALLATION

1. Apply oil to the piston, piston ring, and oil ring.
2. Align the gaps of the piston rings and oil rings (side rails and spacer) as shown.
3. With the piston crown's front arrow mark pointing toward the timing belt side, press the piston and connecting rod assembly into the cylinder from the top of the cylinder.

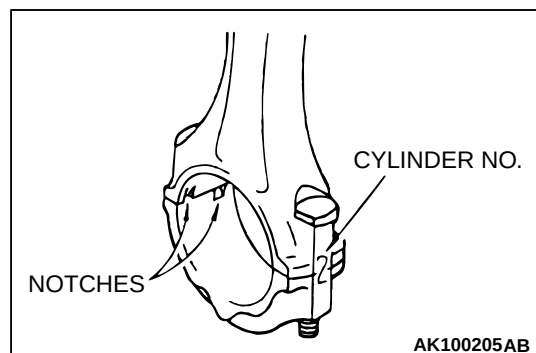
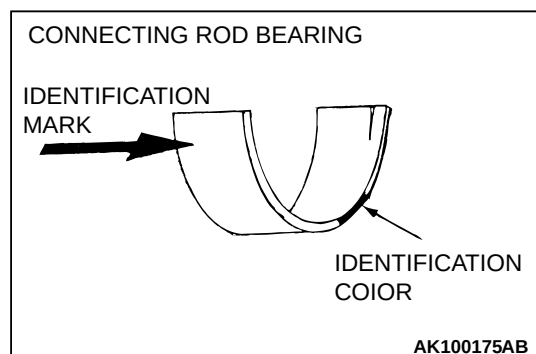


4. Compress the piston rings tightly with a suitable ring compression tool, then press the piston and connecting rod fully into the cylinder. Do not strike the piston hard since the piston rings may break and the crank pin may be nicked.

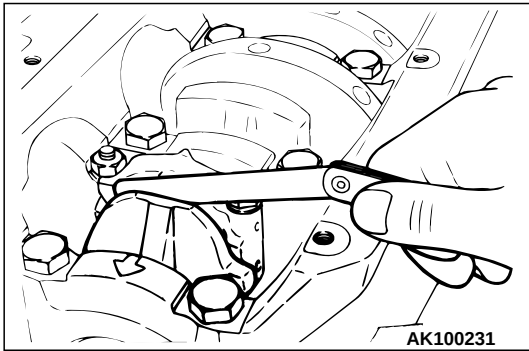
**>>E<< CONNECTING ROD BEARING INSTALLATION**

When replacing the bearings and/or crankshaft, read off the identification mark on the crankshaft (as illustrated), and select a bearing according to the following table.

CRANKSHAFT PIN OUTSIDE DIAMETER	CONNECTING ROD BEARING	
IDENTIFICATION MARK	IDENTIFICATION MARK	IDENTIFICATION COLOR
1	S1	Brown
2	S2	Black
3	S3	Green

**>>F<< CONNECTING ROD CAP INSTALLATION**

1. Aligning the marks made during disassembly, fit the bearing cap onto the connecting rod. If the connecting rod is new and has no index mark, ensure that the bearing locking notches are both on the same side.

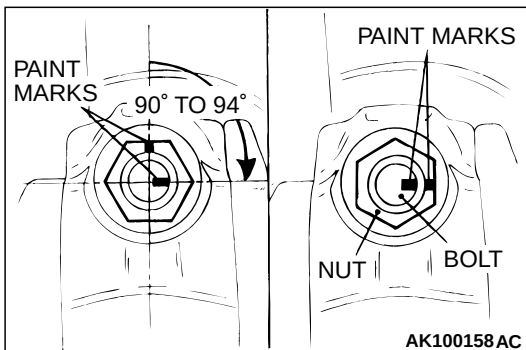


2. Check that the connecting rod big end side clearance confirms with specification.

Standard value: 0.10 – 0.25 mm (0.0039 – 0.0098 inch)
Limit: 0.4 mm (0.016 inch)

>>G<< CONNECTING ROD CAP NUT TIGHTENING

1. Since the connecting rod cap bolts and nuts are torqued using the plastic area tightening method, the bolts should be examined before reuse. If the bolt threads are "necked down", the bolt should be replaced.
Necking can be checked by running a nut with your fingers the full length of the bolt threads. If the nut does not run down smoothly, the bolt should be replaced.
2. Before installation of each nut, apply engine oil to the nut.
3. Install each nut to the bolt and finger-tighten it. Then tighten the nuts alternately to install the cap properly.
4. Tighten the nuts to a torque of 20 ± 1 N·m (15 ± 1 ft·lb).
5. Make a paint mark on the head of each nut.



⚠ CAUTION

- If the nut is turned less than 90 degrees, proper fastening performance may not be expected. When tightening the nut, therefore, be careful to give a sufficient turn to it.
 - If the nut is overtightened (exceeding 94 degrees), loosen the nut completely and then retighten it by repeating the tightening procedure from step 1.
6. Make a paint mark on the bolt end at the position 90 degrees to 94 degrees from the paint mark made on the nut in the direction of tightening the nut.
 7. Give a 90 degrees to 94 degrees turn to the nut and make sure that the paint mark on the nut and that on the bolt are in alignment.

INSPECTION

M1113008500075

PISTON RING

1. Check for side clearance.

If the limit is exceeded, replace the ring or piston, or both.

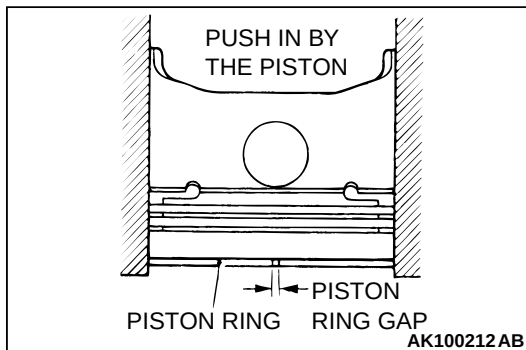
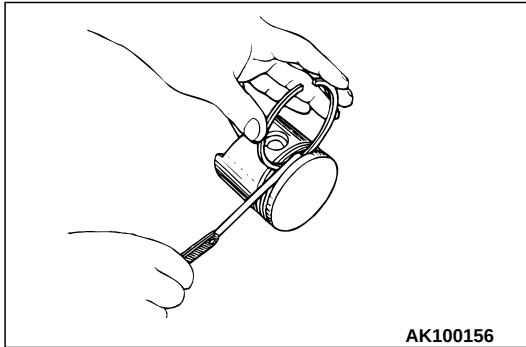
Standard value:

No.1: 0.03 – 0.07 mm (0.0012 – 0.0028 inch)

No.2: 0.02 – 0.06 mm (0.0008 – 0.0024 inch)

Limit:

No.1, No.2: 0.1 mm (0.004 inch)



2. Install the piston ring into the cylinder bore. Force the ring down with a piston, the piston crown being in contact with the ring, to correctly position it at right angles to the cylinder wall. Then, measure the end gap with a feeler gauge. If the end gap is excessive, replace the piston ring.

Standard value:

No.1 ring: 0.15 – 0.30 mm (0.0059 – 0.0118 inch)

No.2 ring: 0.40 – 0.55 mm (0.0157 – 0.0217 inch)

Oil ring: 0.10 – 0.35 mm (0.0039 – 0.0138 inch)

Limit:

No.1, No.2 ring: 0.8 mm (0.031 inch)

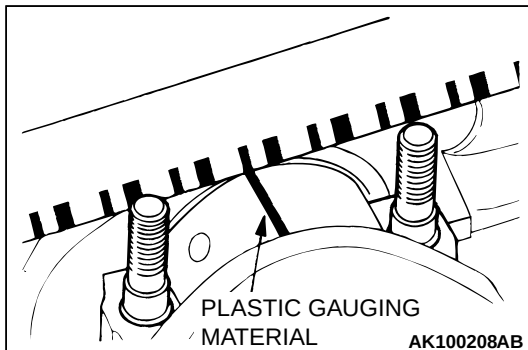
Oil ring: 1.0 mm (0.039 inch)

**CRANKSHAFT PIN OIL CLEARANCE
(PLASTIC GAUGING MATERIAL METHOD)**

1. Remove oil from the crankshaft pin and connecting rod bearing.
2. Cut the plastic gauging material to the same length as the width of bearing and place it on crankshaft pin in parallel with its axis.
3. Install the connecting rod cap carefully and tighten the nuts to the specified torque. (See "Connecting rod cap nut tightening" procedure.)
4. Carefully remove the connecting rod cap.
5. Measure the width of the plastic gauging material at its widest part by using a scale printed on its package.

Standard value: 0.02 – 0.05 mm (0.0008 – 0.0020 inch)

Limit: 0.1 mm (0.004 inch)



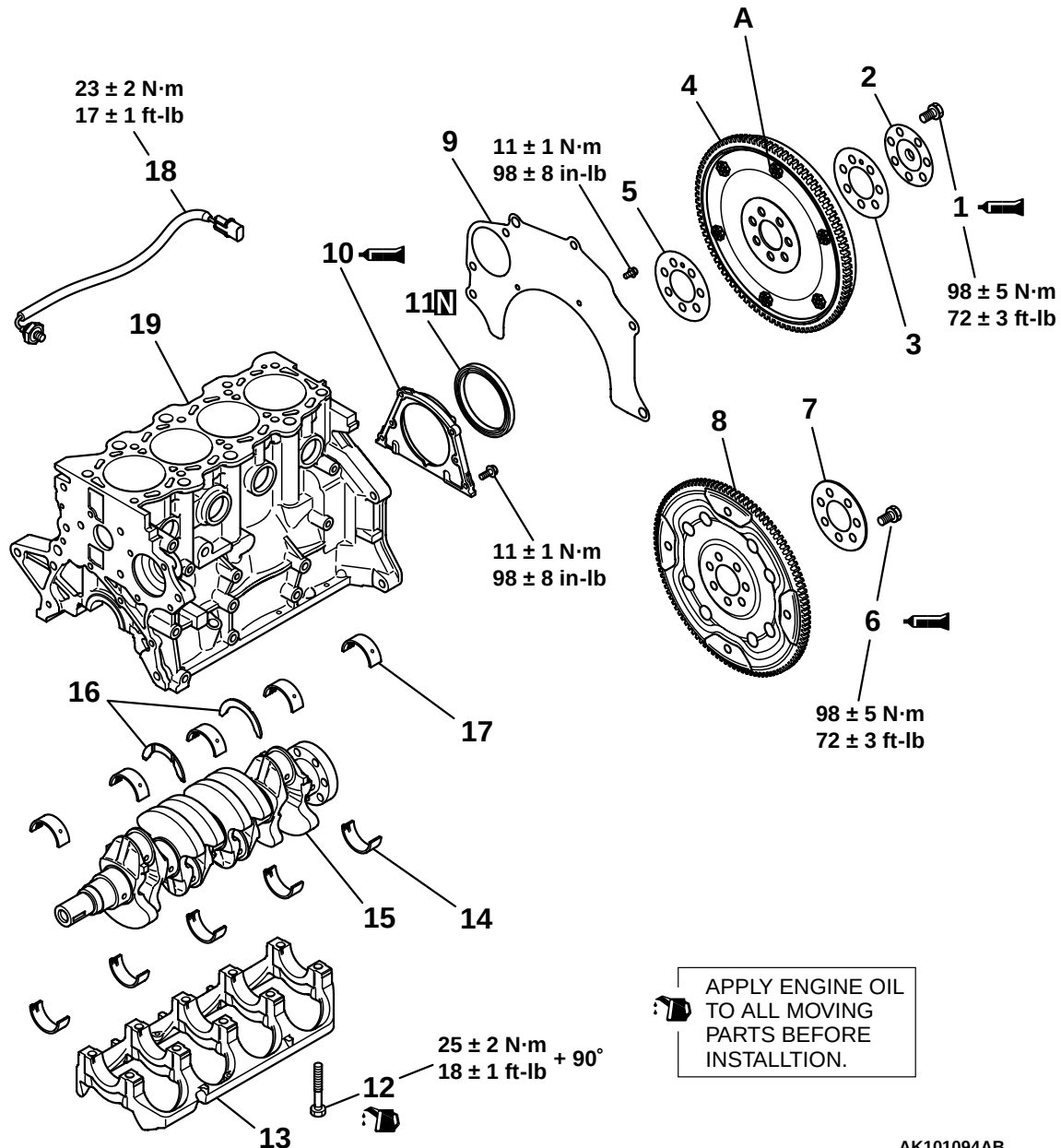
CRANKSHAFT AND CYLINDER BLOCK

REMOVAL AND INSTALLATION

M1113008700176

CAUTION

Do not remove any of the bolts "A" of the flywheel shown in the illustration. The balance of the flexible type flywheel is adjusted in an assembled condition. Removing the bolt, therefore, can cause the flexible flywheel to be out of balance, giving damage to the flywheel.



REMOVAL STEPS

- >>E<< 1. FLYWHEEL BOLT <M/T>
- 2. PLATE <M/T>
- 3. ADAPTER PLATE <M/T>
- 4. FLYWHEEL (NON-DISASSEMBLED PART) <M/T>
- 5. ADAPTER PLATE <M/T>
- >>E<< 6. DRIVE PLATE BOLT <A/T>
- 7. ADAPTER PLATE <A/T>
- 8. DRIVE PLATE BOLT <A/T>

REMOVAL STEPS (Continued)

- 9. REAR PLATE
- >>D<< 10. REAR OIL SEAL CASE
- >>C<< 11. REAR OIL SEAL
- >>B<< 12. BEARING CAP BOLT
- >>B<< 13. BEARING CAP
- >>A<< 14. CRANKSHAFT BEARING, LOWER
- 15. CRANKSHAFT
- >>A<< 16. THRUST PLATE
- >>A<< 17. CRANKSHAFT BEARING, UPPER

REMOVAL STEPS (Continued)

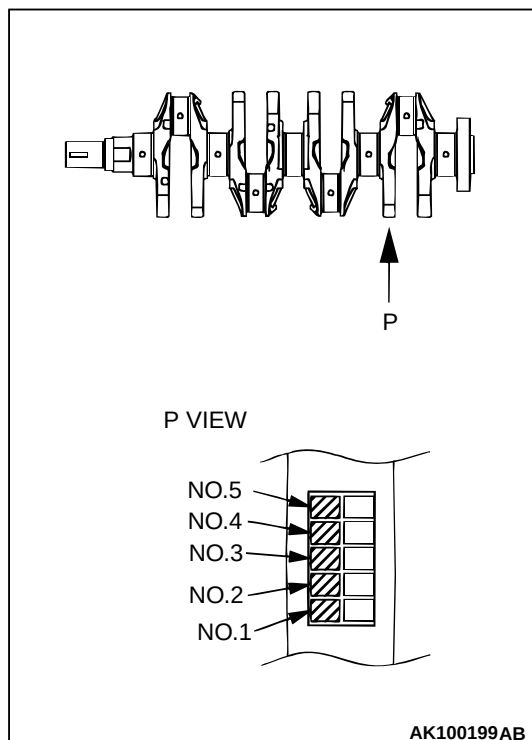
18. KNOCK SENSOR
19. CYLINDER BLOCK

Required Special Tools:

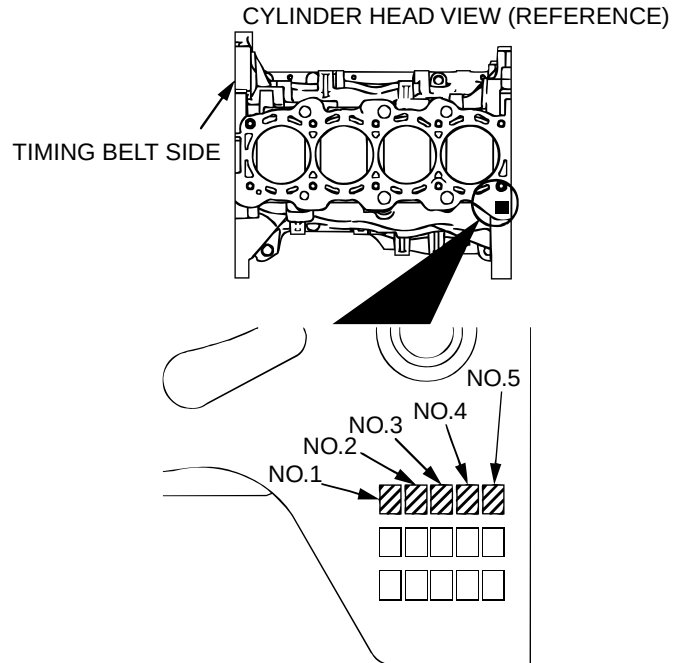
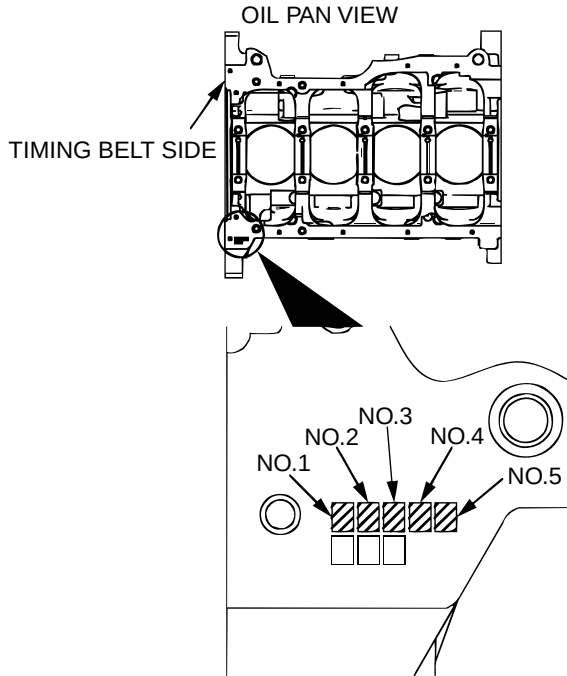
- MD998776: Crankshaft Rear Oil Seal Installer
- MB990938: Handle

INSTALLATION SERVICE POINTS**>>A<< CRANKSHAFT BEARING INSTALLATION**

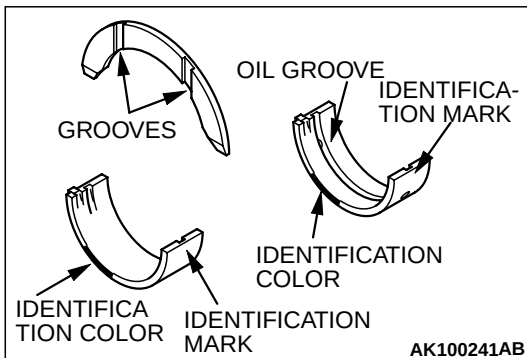
1. When replacing the bearings, crankshaft and/or cylinder block, read off the identification mark on the crankshaft and cylinder block (as illustrated), and select a bearing according to the following table.



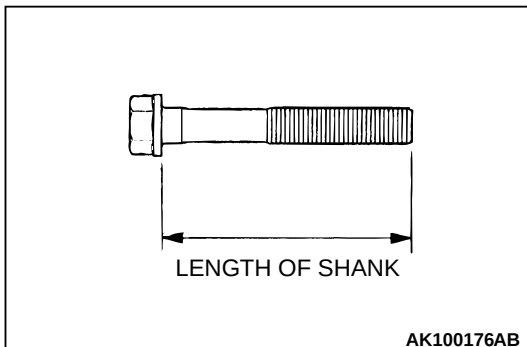
CRANKSHAFT JOURNAL OUTSIDE DIAMETER	CYLINDER BLOCK BEARING BORE INSIDE DIAMETER	CRANKSHAFT BEARING
IDENTIFICATION MARK	IDENTIFICATION MARK	IDENTIFICATION MARK OR COLOR
1	0	S1 or Brown
	1	S2 or Black
	2	S3 or Green
2	0	S2 or Black
	1	S3 or Green
	2	S4 or Yellow
3	0	S3 or Green
	1	S4 or Yellow
	2	S5 or Red



AK100202AB



2. Install bearings having an oil groove to the cylinder block.
3. Install bearings having no oil groove onto the bearing caps.
4. Install the thrust bearings at the No.3 upper bearing with the grooved side toward the crankshaft web.

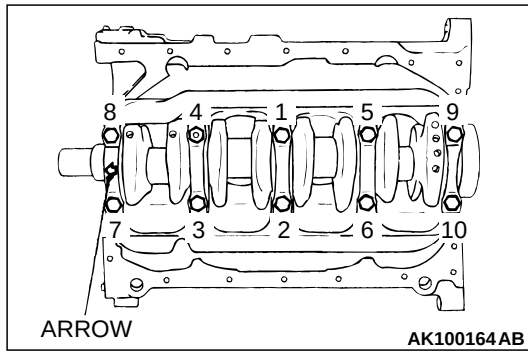


>>B<< BEARING CAP/BEARING CAP BOLT INSTALLATION

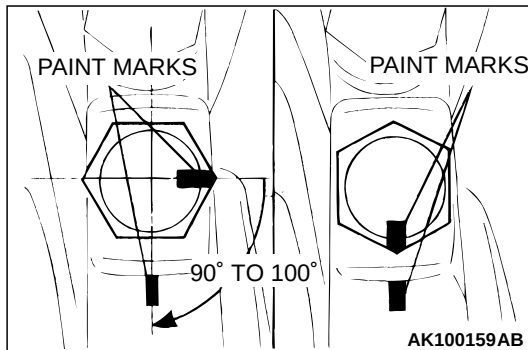
1. Install the bearing cap so their arrow is positioned on the timing belt side.
2. When reusing the bearing cap bolt, measure that its shank length dose not exceed the specified limit. Replace the bolt if this measurement exceeds the limit.

Limit: max. 71.1 mm (2.799 inches)

3. Apply engine oil to the bolt thread and flange of the bolt.



4. Tighten the bearing cap bolts to 25 ± 2 N·m (18 ± 1 ft-lb) torque in the sequence shown.

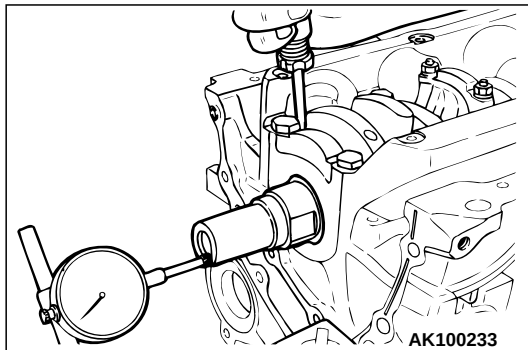


5. Make a paint mark on the head of each bolt.

⚠ CAUTION

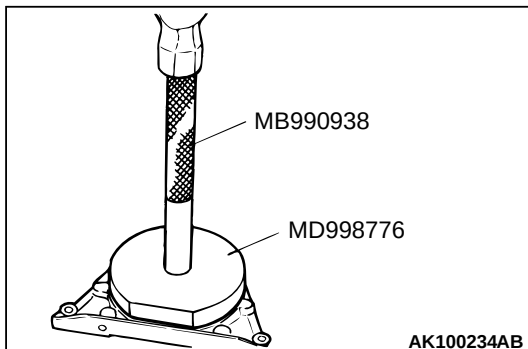
- If the bolt is turned less than 90 degrees, proper fastening performance may not be expected. When tightening the bolt, therefore, be careful to give a sufficient turn to it.
 - If the bolt is overtightened (exceeding 100 degrees), loosen the bolt completely and then retighten it by repeating the tightening procedure from step 1.
6. Make a paint mark on the bearing cap at the position 90 degrees to 100 degrees from the paint mark on the bolt head in the direction of tightening the bolt.
7. Give a 90 degrees to 100 degrees turn to the bolt in the tightening sequence. Make sure that the paint mark on the bolt and that on the bearing cap are in alignment.
8. Check that the crankshaft rotates smoothly.
9. Measure the end play in the crankshaft. If the measurement exceeds the specified limit, replace the crankshaft bearings.

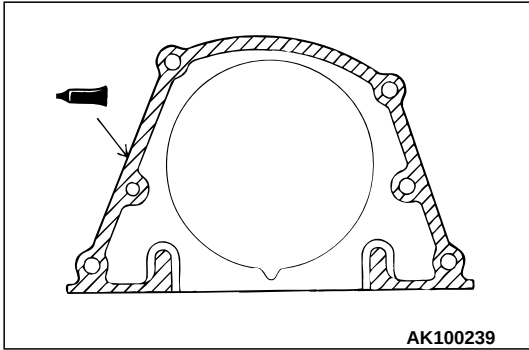
Standard value: 0.05 – 0.25 mm (0.0020 – 0.0098 inch)
Limit: 0.4 mm (0.016 inch)



>>C<< REAR OIL SEAL INSTALLATION

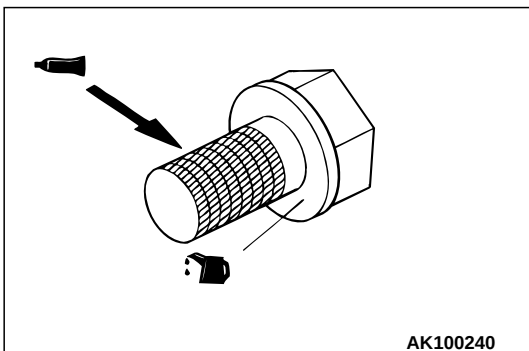
Using special tools MD998776 and MB990938, press-fit the oil seal in the case.





>>D<< SEALANT APPLICATION TO OIL SEAL CASE

1. Apply the sealant Mitsubishi Genuine Part number MD970389 or equivalent to the oil seal case.
2. Apply a small amount of engine oil to the entire circumference of the oil seal lip section, and place the oil seal case on the cylinder block.



>>E<< DRIVE PLATE BOLT/FLYWHEEL BOLT INSTALLATION

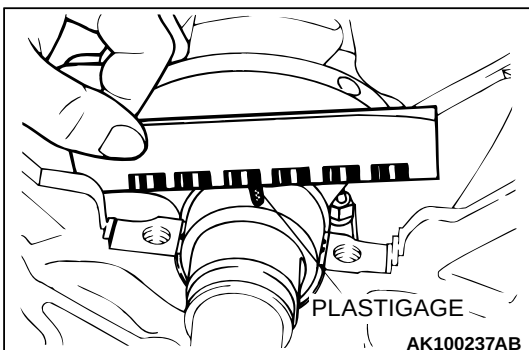
1. Remove all the remaining sealant from bolts and thread holes of crankshaft.
2. Apply engine oil to the flange of bolt.
3. Apply engine oil into the thread holes of crankshaft.
4. Apply 3M™ AAD part number 8672 or equivalent to the drive plate bolt or flywheel bolt.
5. Tighten the bolts to specified torque.

Tightening torque: 98 ± 5 N·m (72 ± 3 ft-lb)

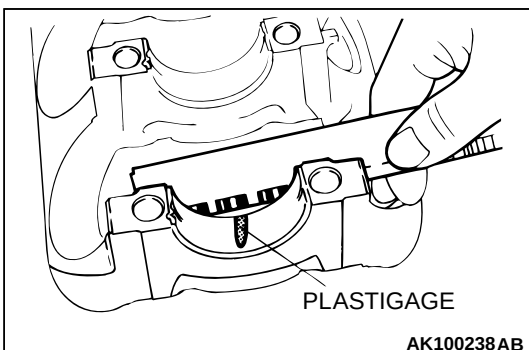
INSPECTION

M1113008800098

CRANKSHAFT JOURNAL OIL CLEARANCE (PLASTIGAGE METHOD)



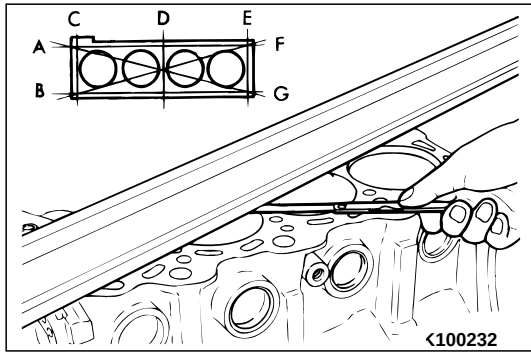
1. Remove oil from the crankshaft journal and the crankshaft bearing.
2. Install the crankshaft.
3. Cut the Plastigage to the same length as the width of bearing and place it on the journal in parallel with its axis.



4. Install the crankshaft bearing cap carefully and tighten the bolts to the specified torque.
5. Carefully remove the crankshaft bearing cap.
6. Measure the width of the Plastigage at its widest part by using a scale printed on the Plastigage package.

Standard value: 0.02 – 0.04 mm (0.0008 – 0.0016 inch)

Limit: 0.1 mm (0.004 inch)

**CYLINDER BLOCK**

1. Visually check for cracks, rust, and corrosion, and inspect the cylinder block using a flaw detecting agent. Rectify defects where possible or replace the cylinder block.
2. Ensure that the top surface is free of gasket chips and other foreign material. Check the cylinder block top surface for distortion using a straight edge and feeler gauge.

Standard value: 0.05 mm (0.0020 inch) or less

Limit: 0.1 mm (0.004 inch)

3. If the distortion is excessive, correct within the allowable limit or replace.

Grinding limit: 0.2 mm (0.008 inch)

The total thickness of the stock allowed to be removed from cylinder block and mating cylinder head 0.2 mm (0.008 inch) at maximum.

Cylinder block height (when new):

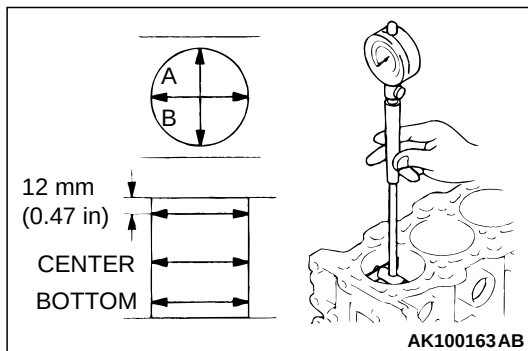
286.7 mm (11.287 inches)

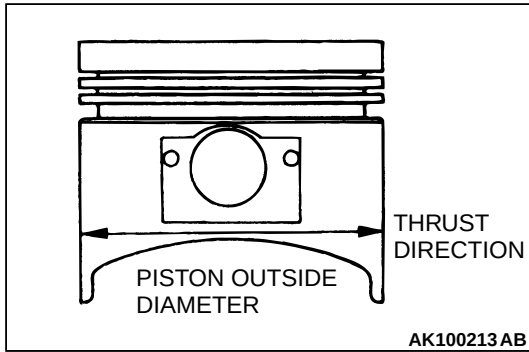
4. Check the cylinder walls for cracks and seizure marks. If defects are evident, bore all the cylinders to oversize or replace the cylinder block.
5. Using a cylinder gauge, measure each cylinder bore and cylindricity. If any cylinder is severely worn, bore all the cylinders to oversize and replace the piston and piston rings accordingly. Take measurements at the points shown.

Standard value:

Cylinder bore inside diameter: 81.5 mm (3.21 inches)

Cylindricity: 0.01 mm (0.0004 inch) or less





BORING CYLINDER

1. Oversize pistons should be based on the largest bore cylinder.

Piston size identification

SIZE	IDENTIFICATION MARK
0.50 mm (0.20 in) oversize diameter	0.50
1.00 mm (0.40 in) oversize diameter	1.00

NOTE: The size mark is stamped on the piston top.

2. Measure the outside diameter of piston to be used. Measure it in thrust direction as shown.
3. Based on the measured piston outside diameter (O.D.), calculate the boring finish dimension.

Boring finish dimension = Piston O.D. + (Clearance between piston O.D. and cylinder) – 0.02 mm (0.0008 inch) (honing margin)

⚠ CAUTION

To prevent distortion caused by heat increased during boring, bore the cylinders in the following order: No.2, No.4, No.1, No.3.

4. Bore each cylinders to the calculated boring finish dimension.
5. Hone the cylinders to the final finish dimension (Piston O.D. + Piston-to-cylinder clearance).
6. Check the clearance between piston and cylinder.

Standard value: 0.02 – 0.04 mm (0.0008 – 0.0016 inch)

NOTE: When boring cylinders, finish all of four cylinders to the same oversize. Do not bore only one cylinder to an oversize.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

M1113023400633

Items	Specifications
Generator and ignition system	
Ignition coil	10 ± 2 N·m (89 ± 17 in-lb)
Spark plug	25 ± 2 N·m (19 ± 3 ft-lb)
Crankshaft bolt	182 ± 4 N·m (134 ± 3 ft-lb)
Generator brace (M10)	49 ± 5 N·m (36 ± 3 ft-lb)
Generator brace (M8)	23 ± 2 N·m (17 ± 1 ft-lb)
Lock bolt	23 ± 2 N·m (17 ± 1 ft-lb)
Adjusting bolt	5.0 ± 1.0 N·m (45 ± 8 in-lb)
Generator pivot nut	44 ± 10 N·m (33 ± 6 ft-lb)
Cam position sensor	8.8 ± 10 N·m (79 ± 9 in-lb)
Cam position sensor support	14 ± 1 N·m (124 ± 9 in-lb)
Cam position sensing cylinder	22 ± 4 N·m (16 ± 3 ft-lb)
Timing belt	
Camshaft sprocket bolt	88 ± 10 N·m (65 ± 7 ft-lb)
Crank angle sensor	9.8 ± 2.0 N·m (87 ± 17 in-lb)
Timing belt rear cover	10 ± 2 N·m (89 ± 17 in-lb)
Timing belt tensioner	23 ± 3 N·m (17 ± 2 ft-lb)
Engine support bracket, right	49 ± 5 N·m (36 ± 3 ft-lb)
Timing belt cover	10 ± 2 N·m (89 ± 17 in-lb)
Fuel system and emission system	
Fuel rail	12 ± 1 N·m (102 ± 13 in-lb)
EGR Valve	22 ± 4 N·m (16 ± 3 ft-lb)
Throttle body	19 ± 3 N·m (14 ± 2 ft-lb)
Vacuum hose and pipe assembly	11 ± 1 N·m (98 ± 8 in-lb)
Solenoid valve assembly	9.0 ± 2.0 N·m (88 ± 17 in-lb)
Throttle body stay	24 ± 3 N·m (17 ± 2 ft-lb)
Intake and exhaust manifold	
Manifold differential pressure sensor	5.0 ± 1.0 N·m (45 ± 8 in-lb)
Exhaust manifold (M10)	30 ± 2 N·m (21 ± 2 ft-lb)
Exhaust manifold (M8)	17 ± 2 N·m (13 ± 1 ft-lb)
Oxygen sensor	44 ± 5 N·m (33 ± 3 ft-lb)
Exhaust manifold bracket (M10)	35 ± 6 N·m (26 ± 4 ft-lb)
Exhaust manifold bracket (M8)	19 ± 3 N·m (14 ± 2 ft-lb)
Engine hanger	19 ± 3 N·m (14 ± 2 ft-lb)
Oil dipstick guide	14 ± 1 N·m (124 ± 9 in-lb)
Exhaust manifold cover	13 ± 1 N·m (115 ± 8 in-lb)
Intake manifold	19 ± 3 N·m (14 ± 2 ft-lb)

Items	Specifications
Intake manifold stay	31 ± 3 N·m (23 ± 2 ft-lb)
Water pump and water hose	
Water pump	23 ± 3 N·m (17 ± 2 ft-lb)
Water inlet pipe	14 ± 1 N·m (124 ± 9 in-lb)
Thermostat case	24 ± 1 N·m (17 ± 1 ft-lb)
Water inlet fitting	19 ± 1 N·m (14 ± 1 ft-lb)
Water outlet fitting	14 ± 1 N·m (124 ± 9 in-lb)
Engine coolant temperature gauge unit	10.8 ± 1.0 N·m (96 ± 9 in-lb)
Engine coolant temperature sensor	29 ± 9 N·m (22 ± 6 ft-lb)
Connector bracket	14 ± 1 N·m (124 ± 9 in-lb)
Rocker arms and camshaft	
Rocker arm shaft	31 ± 3 N·m (23 ± 2 ft-lb)
Rocker cover	3.4 ± 0.5 N·m (30 ± 4 in-lb)
Cylinder head and valves	
Cylinder head bolt	74 ± 4 N·m (55 ± 3 ft-lb) → 20 ± 1 N·m (15 ± 1 ft-lb) → +90° → +90°
Oil pump and oil pan	
Oil pump cover	10 ± 2 N·m (89 ± 17 in-lb)
Front case	14 ± 1 N·m (124 ± 9 in-lb)
Relief plug	44 ± 5 N·m (33 ± 3 ft-lb)
Oil screen	19 ± 3 N·m (14 ± 2 ft-lb)
Upper oil pan (M8)	24 ± 3 N·m (17 ± 2 ft-lb)
Upper oil pan (M6)	9.0 ± 3.0 N·m (80 ± 26 in-lb)
Lower oil pan	11 ± 1 N·m (98 ± 8 in-lb)
Baffle plate	11 ± 1 N·m (98 ± 8 in-lb)
Cover	7.0 ± 1.0 N·m (62 ± 8 in-lb)
Drain plug	39 ± 5 N·m (29 ± 3 ft-lb)
Oil pressure switch	10 ± 2 N·m (89 ± 17 in-lb)
Piston and connecting rod	
Connecting rod cap nut	20 ± 2 N·m (15 ± 1 ft-lb) + 90° to 94°
Crankshaft and cylinder block	
Bearing cap bolt	25 ± 2 N·m (18 ± 1 ft-lb) + 90° to 100°
Oil seal case	11 ± 1 N·m (98 ± 8 in-lb)
Rear plate	11 ± 1 N·m (98 ± 8 in-lb)
Drive plate bolt	98 ± 5 N·m (72 ± 3 ft-lb)
Flywheel bolt	98 ± 5 N·m (72 ± 3 ft-lb)
Knock sensor	23 ± 2 N·m (17 ± 1 ft-lb)

GENERAL SPECIFICATIONS

M1113000200144

Descriptions			Specifications
Type			In-line OHV, SOHC
Number of cylinders			4
Combustion chamber			Pentroof type
Total displacement dm ³ (cu. in)			1,999 (122)
Cylinder bore mm (in)			81.5 (3.21)
Piston stroke mm (in)			95.8 (3.77)
Compression ratio			9.5
Number of valve		Intake	8
		Exhaust	8
Valve timing	Intake valve	Opens (BTDC)	2°
		Closes (ABDC)	58°
	Exhaust valve	Opens (BBDC)	58°
		Closes (ATDC)	10°
Lubrication system			Pressure feed, full-flow filtration
Oil pump type			Trochoid type
Cooling system			Water-cooled forced circulation
Water pump type			Centrifugal impeller type

SERVICE SPECIFICATIONS

M1113000300141

Items		Standard value	Limit
Rocker arms and camshaft			
Camshaft cam height mm (in)	Intake	37.86 (1.49)	37.36 (1.47)
	Exhaust	37.67 (1.48)	36.17 (1.46)
Cylinder head and valve			
Cylinder head flatness of gasket surface mm (in)		Less than 0.03 (0.0012)	0.2 (0.008)
Cylinder head grinding limit of gasket surface mm (in) *Total resurfacing depth of both cylinder head and cylinder block		—	0.2* (0.008)
Cylinder head overall height mm (in)		119.9 – 120.1 (4.720 – 4.728)	—
Cylinder head bolt shank length mm (in)		—	96.4 (3.795)
Valve stem outside diameter mm (in)		6.0 (0.236)	—
Valve stem-to-guide clearance mm (in)	Intake	0.02 – 0.05 (0.0008 – 0.0020)	0.10 (0.0039)
	Exhaust	0.04 – 0.06 (0.0016 – 0.0024)	0.15 (0.0059)
Valve face angle		45° – 45.5°	—
Valve margin mm (in)	Intake	1.0 (0.039)	0.5 (0.020)
	Exhaust	1.3 (0.051)	0.8 (0.031)

Items		Standard value	Limit
Valve stem projection mm (in)	Intake	49.30 (1.9409)	49.80 (1.9606)
	Exhaust	49.35 (1.9429)	49.85 (1.9626)
Overall valve length mm (in)	Intake	110.15 (4.337)	109.65 (4.317)
	Exhaust	113.70 (4.476)	113.20 (4.457)
Valve spring free height mm (in)		49.5 (1.95)	48.5 (1.91)
Valve spring load/installed height N (in) /mm (in)		216/44.2 (49/1.74)	—
Valve spring squareness		Max. 2°	4°
Valve seat contact width mm (in)		0.9 – 1.3 (0.035 – 0.051)	—
Valve guide inside diameter mm (in)		6.0 (.236)	—
Valve guide projection mm (in)		14.0 (0.551)	—
Oversize valve guide hole diameter mm (in)	0.05 oversize diamete	11.05 – 11.07 (0.4350 – 0.4358)	—
	0.25 oversize diamete	11.25 – 11.27 (0.4429 – 0.4337)	—
	0.50 oversize diamete	11.50 – 11.52 (0.4528 – 0.4535)	—
Oversize intake valve seat hole diameter mm (in)	0.30 oversize diamete	31.80 – 31.83 (1.2520 – 1.2531)	—
	0.60 oversize diamete	32.10 – 32.13 (1.2638 – 1.2650)	—
Oversize exhaust valve seat hole diameter mm (in)	0.30 oversize diamete	29.30 – 29.32 (1.1535 – 1.1543)	—
	0.60 oversize diamete	29.60 – 29.62 (1.1654 – 1.1661)	—
Oil pump and oil pan			
Oil pump tip clearance mm (in)		0.03 – 0.08 (0.0012 – 0.0032)	—
Oil pump side clearance mm (in)		0.10 – 0.18 (0.0016 – 0.0039)	—
Oil pump body clearance mm (in)		0.10 – 0.18 (0.0039 – 0.0071)	0.35 (0.0138)
Piston and connecting rod			
Piston outside diameter mm (in)		81.5 (3.21)	—
Piston ring side clearance mm (in)	No.1	0.03 – 0.08 (0.0012 – 0.0028)	0.1 (0.0039)
	No.2	0.02 – 0.06 (0.0008 – 0.0024)	0.1 (0.0039)
Piston ring end gap mm (in)	No.1	0.15 – 0.30 (0.0059 – 0.0118)	0.8 (0.031)
	No.2	0.40 – 0.55 (0.0157 – 0.0217)	0.8 (0.031)
	Oil ring	0.10 – 0.35 (0.0039 – 0.0138)	1.0 (0.039)

Items	Standard value	Limit
Piston pin outside diameter mm (in)	19.0 (0.75)	—
Piston pin press-in load [at room temperature] N (lb)	4900 – 14700 (1.1020 – 3.3070)	—
Crankshaft pin oil clearance mm (in)	0.02 – 0.04 (0.0008 – 0.0016)	0.1 (0.004)
Connecting rod big end side clearance mm (in)	0.10 – 0.25 (0.0039 – 0.0098)	0.4 (0.016)
Crankshaft and cylinder block		
Crankshaft end play mm (in)	0.05 – 0.25 (0.0020 – 0.0098)	0.4 (0.016)
Crankshaft journal outside diameter mm (in)	50 (1.97)	—
Crankshaft pin outside diameter mm (in)	47 (1.85)	—
Crankshaft journal oil clearance mm (in)	0.02 – 0.03 (0.0008 – 0.0012)	0.1 (0.004)
Cylinder block gasket surface flatness mm (in)	0.05 (0.0020)	0.1 (0.004)
Cylinder block gasket surface grinding limit mm (in)	—	0.2 (0.008)
Cylinder block overall height mm (in)	286.7(11.29)	—
Cylinder bore inside diameter mm (in)	81.5 (3.21)	—
Cylinder bore cylindricity mm (in)	0.01 (0.0004) or less	—
Piston-to-cylinder clearance mm (in)	0.02 – 0.04 (0.0008 – 0.0016)	—
Bearing cap bolt shank length mm (in)	—	71.1 (2.799)

SEALANTS AND ADHESIVES

M1113000500123

Items	Specified sealant	Quantity
Camshaft position sensor support	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Water pump	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Thermostat case	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Engine coolant temperature sensor	3M™ AAD Part No.8731 or equivalent	As required
Engine coolant temperature gauge unit	3M™ AAD Part No.8672 or equivalent	As required
Oil pressure switch	3M™ AAD Part No.8672 or equivalent	As required
Water outlet fitting	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Front case	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Oil pan	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Oil seal case	Mitsubishi Genuine Part No.MD970389 or equivalent	As required
Drive plate bolt	3M™ AAD Part No.8731 or equivalent	As required
Flywheel bolt	3M™ AAD Part No.8731 or equivalent	As required