# ENGINE
## 4G99 SERIES

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## GENERAL INFORMATION

### 4G92

<table>
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<th>Descriptions</th>
<th>4G92 - SOHC</th>
<th>4G92 - DOHC-MIVEC</th>
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<td>In-line OHV, DOHC</td>
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<td>Number of cylinders</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Combustion chamber</td>
<td>Pentroof type</td>
<td>Pentroof type</td>
</tr>
<tr>
<td>Total displacement dm³</td>
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<td>1,597</td>
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<tr>
<td>Cylinder bore mm</td>
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<td>81.0</td>
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<tr>
<td>Piston stroke mm</td>
<td>77.5</td>
<td>77.5</td>
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<tr>
<td>Compression ratio</td>
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<td>11.0</td>
</tr>
<tr>
<td>Valve timing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opens (BTDC)</td>
<td>20°, 14°**</td>
<td>17° (Low-speed cam) 47.5° (High-speed cam)</td>
</tr>
<tr>
<td>Closes (ABDC)</td>
<td>42°, 58°**</td>
<td>31° (Low-speed cam) 72.5° (High-speed cam)</td>
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<td>Exhaust valve</td>
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<td></td>
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<tr>
<td>Opens (BBDC)</td>
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<td>41° (Low-speed cam) 70° (High-speed cam)</td>
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<tr>
<td>Closes (ATDC)</td>
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<td>11° (Low-speed cam) 35° (High-speed cam)</td>
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<td>Pressure feed, full-flow filtration</td>
<td>Pressure feed, full-flow filtration</td>
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<tr>
<td>Oil pump type</td>
<td>Trochoid type</td>
<td>Trochoid type</td>
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<tr>
<td>Cooling system</td>
<td>Water-cooled forced circulation</td>
<td>Water-cooled forced circulation</td>
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<tr>
<td>Water pump type</td>
<td>Centrifugal impeller type</td>
<td>Centrifugal impeller type</td>
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*: LANCER for general export and CARISMA for 6B model
### 4G93

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<tr>
<th>Descriptions</th>
<th>4G93-SOHC</th>
<th>4G93-DOHC</th>
<th>4G93-DOHC-GDI</th>
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<td>Pentroof type</td>
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<td>10.5</td>
<td>11.7<em>¹, 12.0</em>²</td>
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<td>Intake valve</td>
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<td>Pressure feed, full-flow filtration</td>
<td>Pressure feed, full-flow filtration</td>
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<tr>
<td>Oil pump type</td>
<td>Trochoid type</td>
<td>Trochoid type</td>
<td>Trochoid type</td>
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<tr>
<td>Cooling system</td>
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<td>Water-cooled forced circulation</td>
<td>Water-cooled forced circulation</td>
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<tr>
<td>Water pump type</td>
<td>Centrifugal impeller type</td>
<td>Centrifugal impeller type</td>
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*¹: Up to 1999 model
*²: From 2000 model
### 4G94

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<th>4G94–DOHC–GDI</th>
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<td>Pentroof type</td>
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</tr>
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<td></td>
<td>Closes (ABDC)</td>
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<td>Cooling system</td>
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<td>Water pump type</td>
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### 1. SPECIFICATIONS

#### SERVICE SPECIFICATIONS

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<tr>
<td>Timing belt</td>
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<tr>
<td>Auto-tensioner rod protrusion amount (When removed from engine) mm</td>
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<td>–</td>
</tr>
<tr>
<td>Auto-tensioner rod stroke mm</td>
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<td>–</td>
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<tr>
<td>Auto-tensioner rod protrusion amount (When checking with installed on engine) mm</td>
<td>3.8 – 4.5</td>
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#### Rocker arms and camshaft

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<thead>
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<th>Camshaft cam height mm</th>
<th>Intake</th>
<th>Exhaust</th>
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<td>4G92–SOHC*1</td>
<td>37.34</td>
<td>36.84</td>
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<td>4G92–SOHC*2</td>
<td>37.78</td>
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<td>4G92–SOHC*3</td>
<td>36.92</td>
<td>36.42</td>
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<td>4G93–SOHC*4</td>
<td>37.53</td>
<td>37.03</td>
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<td>4G93–SOHC*5</td>
<td>37.11</td>
<td>36.61</td>
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<td>4G94–SOHC</td>
<td>37.91</td>
<td>37.41</td>
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<td>4G93–DOHC</td>
<td>35.31</td>
<td>34.81</td>
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<td>4G93–DOHC–GDI</td>
<td>35.49</td>
<td>34.99</td>
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<td>4G94–DOHC–GDI</td>
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<td>34.99</td>
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<table>
<thead>
<tr>
<th>Valve clearance mm</th>
<th>Intake</th>
<th>Exhaust</th>
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<td>Intake</td>
<td>0.09</td>
<td>–</td>
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<th>Camshaft journal O.D. mm</th>
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#### Rocker cover and camshaft (MIVEC)

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<thead>
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<th>Camshaft height mm</th>
<th>Intake A</th>
<th>Intake B</th>
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<td>Intake A</td>
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<td>36.91</td>
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<tr>
<td>Intake B</td>
<td>33.58</td>
<td>33.08</td>
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<td>Exhaust A</td>
<td>35.83</td>
<td>35.33</td>
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<td>Exhaust B</td>
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<th>Valve clearance (cold engine) mm</th>
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<th>Exhaust</th>
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<td>Intake</td>
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<tr>
<td>Exhaust</td>
<td>0.2</td>
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*1: LANCER for Europe and CARISMA for Europe
*2: LANCER for general export and CARISMA for 6B model
*3: LANCER for Europe (from 2001 model) and CARISMA for Europe (from 2001 model)
*4: Except for Europe
*5: For Europe
### Cylinder head and valve

<table>
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<th>Items</th>
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<td>Grinding limit of cylinder head gasket surface mm</td>
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<tr>
<td>*Total resurfacing depth of both cylinder head and cylinder block</td>
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<td>Cylinder head overall height mm</td>
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</tr>
<tr>
<td>SOHC</td>
<td>119.9 – 120.1</td>
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</tr>
<tr>
<td>DOHC</td>
<td>131.9 – 132.1</td>
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</tr>
<tr>
<td>DOHC–MIVEC</td>
<td>119.8 – 120.0</td>
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<tr>
<td>DOHC–GDI</td>
<td>131.9 – 132.1</td>
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<td>Thickness of valve head (margin) mm</td>
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<td>Valve spring free length mm</td>
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<td>Valve stem to valve guide clearance mm</td>
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<td>Except DOHC–GDI for PAJERO io</td>
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<td>Valve seat valve contact width mm</td>
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<td>Valve guide projection from cylinder head upper surface mm</td>
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<td>Cylinder head bolt shank length mm</td>
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<td>Valve stem O.D. mm</td>
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<td>Valve face angle</td>
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<td>Valve spring load/installed height N/mm</td>
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<td>Valve guide I.D. mm</td>
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<td>Font case, oil pump and oil pan</td>
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<td>Oil pump tip clearance mm</td>
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<td>Oil pump side clearance mm</td>
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<td>Piston ring to piston ring groove clearance mm</td>
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<td>4G94</td>
<td>81.5</td>
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<td>Crankshaft, cylinder block, flywheel and drive plate</td>
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<td>Crankshaft journal oil clearance mm</td>
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<td>Cylinder block gasket surface flatness mm</td>
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<td>Grinding limit of cylinder block gasket surface mm</td>
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*Total resurfacing depth of both cylinder head and cylinder block*
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## REWORK DIMENSIONS

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<td>Oversize rework dimensions of valve guide hole (both intake and exhaust) mm</td>
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<td></td>
<td>0.05 O.S.</td>
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<td>0.25 O.S.</td>
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<td><strong>Crankshaft, flywheel and drive plate</strong></td>
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<tr>
<td>Crankshaft out of roundness and taper of journal and pin mm</td>
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**NOTE**

O.D.: Outer diameter
I.D.: Inner diameter
O.S.: Oversize diameter
## TORQUE SPECIFICATIONS

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<td>Oil level gauge</td>
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<td>Idler pulley bolt</td>
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<td>Breather tube</td>
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<tr>
<td>Water pipe</td>
<td>14</td>
</tr>
<tr>
<td>Water outlet fitting &lt;Except PAJERO io&gt;</td>
<td>19</td>
</tr>
<tr>
<td>Water outlet fitting &lt;PAJERO io&gt;</td>
<td>24</td>
</tr>
<tr>
<td>Engine coolant temperature gauge unit</td>
<td>10</td>
</tr>
<tr>
<td>Engine coolant temperature sensor</td>
<td>29</td>
</tr>
<tr>
<td>Water fitting</td>
<td>24</td>
</tr>
<tr>
<td><strong>Rocker arms and camshafts</strong></td>
<td></td>
</tr>
<tr>
<td>Lock nut</td>
<td>9</td>
</tr>
<tr>
<td>Rocker arm shaft</td>
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<td>Harness bracket</td>
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<tr>
<td>Rocker cover</td>
<td>3.5</td>
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<tr>
<td>Bearing cap bolt (M6)</td>
<td>11</td>
</tr>
<tr>
<td>Bearing cap bolt (M8)</td>
<td>24</td>
</tr>
<tr>
<td>Beam camshaft cap (M6)</td>
<td>11</td>
</tr>
<tr>
<td>Beam camshaft cap (M8)</td>
<td>21</td>
</tr>
<tr>
<td><strong>Rocker cover and camshafts (MIVEC)</strong></td>
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<td>Rocker cover</td>
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<tr>
<td>Oil pump</td>
<td>11</td>
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<tr>
<td>Arm spring holder</td>
<td>11</td>
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<tr>
<td>Camshaft bearing cap (M6)</td>
<td>11</td>
</tr>
<tr>
<td>Camshaft bearing cap (M8)</td>
<td>23</td>
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<tr>
<td>Oil control valve</td>
<td>9</td>
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<tr>
<td><strong>Rocker arms and rocker shaft caps (MIVEC)</strong></td>
<td></td>
</tr>
<tr>
<td>Rocker shaft cap</td>
<td>11</td>
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<tr>
<td><strong>Cylinder head and valves</strong></td>
<td></td>
</tr>
<tr>
<td>Cylinder head bolt</td>
<td>74 Nm and then completely loosen, finally tighten 20 Nm + 90° + 90°</td>
</tr>
<tr>
<td>Oil pressure switch</td>
<td>10</td>
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<tr>
<td><strong>Front case and oil pump</strong></td>
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<tr>
<td>Oil pump cover</td>
<td>10</td>
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<tr>
<td>Oil pump case</td>
<td>14</td>
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<tr>
<td>Relief plug</td>
<td>44</td>
</tr>
<tr>
<td>Oil screen</td>
<td>19</td>
</tr>
<tr>
<td>Oil pan</td>
<td>9</td>
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<tr>
<td>Upper oil pan (M6)</td>
<td>9</td>
</tr>
<tr>
<td>Items</td>
<td>Nm</td>
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<tr>
<td>-------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Upper oil pan (M8)</td>
<td>24</td>
</tr>
<tr>
<td>Lower oil pan</td>
<td>11</td>
</tr>
<tr>
<td>Cover</td>
<td>7</td>
</tr>
<tr>
<td>Baffle plate &lt;DOHC–MPI&gt;</td>
<td>7</td>
</tr>
<tr>
<td>Baffle plate &lt;Except DOHC–MPI&gt;</td>
<td>11</td>
</tr>
<tr>
<td>Drain plug</td>
<td>39</td>
</tr>
<tr>
<td>Oil pressure switch</td>
<td>10</td>
</tr>
<tr>
<td>Transmission stay</td>
<td>23</td>
</tr>
</tbody>
</table>

**Piston and connecting rod**

| Connecting rod cap nut                    | 20 + 90° to 100° |

**Crankshaft, cylinder block, flywheel and drive plate**

| Bearing cap bolt                          | 25 + 90° to 100° |
| Oil seal case                             | 11             |
| Bell housing cover (Flange bolt)          | 10             |
| Bell housing cover (Bolt and washer assembly) | 9             |
| Rear plate <SPACE STAR>                  | 10             |
| Rear plate <Except SPACE STAR>           | 11             |
| Drive plate bolt                          | 98             |
| Flywheel bolt                             | 98             |
| Baffle plate                              | 9              |
| Knock sensor                              | 23             |
NEW TIGHTENING METHOD - BY USE OF BOLTS TO BE TIGHTENED IN PLASTIC AREA

A new type of bolts, to be tightened in plastic area, is currently used for some parts of the engine. The tightening method for bolts of this type is different from the conventional one. Be sure to observe the method described in the text when tightening the bolts. Service limits are provided for the bolts. Make sure that the service limits described in the text are strictly observed.

- Areas where the bolts are in use:
  1. Cylinder head bolts
  2. Main bearing cap bolts
  3. Connecting rod cap bolts

- Tightening method
  After tightening the bolts to the specified torque, tighten them another $90^\circ$ or $180^\circ$ (twice $90^\circ$). The tightening method varies on different areas. Observe the tightening method described in the text.

SEALANT

<table>
<thead>
<tr>
<th>Items</th>
<th>Specified sealant</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water pump</td>
<td>Mitsubishi Genuine Part No.MD970389 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Thermostat case</td>
<td>Mitsubishi Genuine Part No.MD970389 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Water by-pass fitting</td>
<td>Mitsubishi Genuine Part No.MD970389 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Water fitting</td>
<td>Mitsubishi Genuine Part No.MD970389 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Engine coolant temperature sensor</td>
<td>3M Nut Locking Part No.4171 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Engine coolant temperature gauge unit</td>
<td>3M ATD Part No.8660 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Camshaft bearing cap</td>
<td>3M ATD Part No.8660 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Semi-circular packing</td>
<td>3M ATD Part No.8660 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Rocker cover</td>
<td>3M ATD Part No.8660 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Beam camshaft cap</td>
<td>Mitsubishi Genuine Part No.MD970389 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Cover</td>
<td>3M ATD Part No.8660 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Cylinder head</td>
<td>Mitsubishi Genuine Part No.MD970389 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Oil pressure switch</td>
<td>3M ATD Part No.8660 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Water outlet fitting</td>
<td>Mitsubishi Genuine Part No.MD970389 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Oil pump case</td>
<td>Mitsubishi Genuine Part No.MD970389 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Oil pan/Upper oil pan/Lower oil pan</td>
<td>Mitsubishi Genuine Part No.MD970389 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Oil seal case</td>
<td>Mitsubishi Genuine Part No.MD970389 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Drive plate bolt</td>
<td>3M Nut Locking Part No.4171 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Flywheel bolt</td>
<td>3M Nut Locking Part No.4171 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Cam position sensor support</td>
<td>Mitsubishi Genuine Part No.MD970389 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Oil control valve</td>
<td>3M ATD Part No.8660 or equivalent</td>
<td>As required</td>
</tr>
<tr>
<td>Camshaft holder</td>
<td>3M ATD Part No.8660 or equivalent</td>
<td>As required</td>
</tr>
</tbody>
</table>
FORM-IN-PLACE GASKET

The engine has several areas where the form-in-place gasket (FIPG) is in use. To ensure that the gasket fully serves its purpose, it is necessary to observe some precautions when applying the gasket. Bead size, continuity and location are of paramount importance. Too thin a bead could cause leaks. Too thick a bead, on the other hand, could be squeezed out of location, causing blocking or narrowing of the fluid feed line. To eliminate the possibility of leaks from a joint, therefore, it is absolutely necessary to apply the gasket evenly without a break, while observing the correct bead size.

The FIPG used in the engine is a room temperature vulcanization (RTV) type and is supplied in a 100-gram tube (Part No. MD970389 or MD997110). Since the RTV hardens as it reacts with the moisture in the atmospheric air, it is normally used in the metallic flange areas. The FIPG, Part No. MD970389, can be used for sealing both engine oil and coolant, while Part No. 997110 can only be used for engine oil sealing.

Disassembly

The parts assembled with the FIPG can be easily disassembled without use of a special method. In some cases, however, the sealant between the joined surfaces may have to be broken by lightly striking with a mallet or similar tool. A flat and thin gasket scraper may be lightly hammered in between the joined surfaces. In this case, however, care must be taken to prevent damage to the joined surfaces. For removal of the oil pan, the special tool “Oil Pan Remover” (MD998727) is available. Be sure to use the special tool to remove the oil pan. <Except aluminium die-cast oil pans>

Surface Preparation

Thoroughly remove all substances deposited on the gasket application surfaces, using a gasket scraper or wire brush. Check to ensure that the surfaces to which the FIPG is to be applied is flat. Make sure that there are no oils, greases and foreign substances deposited on the application surfaces. Do not forget to remove the old sealant remained in the bolt holes.

Form-In-Place Gasket Application

When assembling parts with the FIPG, you must observe some precautions, but the procedures is very simple as in the case of a conventional precut gasket. Applied FIPG bead should be of the specified size and without breaks. Also be sure to encircle the bolt hole circumference with a completely continuous bead. The FIPG can be wiped away unless it is hardened. While the FIPG is still moist (in less than 15 minutes), mount the parts in position. When the parts are mounted, make sure that the gasket is applied to the required area only. In addition, do not apply any oil or water to the sealing locations or start the engine until a sufficient amount of time (about one hour) has passed after installation is completed.

The FIPG application procedure may vary on different areas. Observe the procedure described in the text when applying the FIPG.
## 2. SPECIAL TOOLS

<table>
<thead>
<tr>
<th>Tool</th>
<th>Number</th>
<th>Name</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>MB990938</td>
<td>Handle</td>
<td>Use with MD998776</td>
<td></td>
</tr>
<tr>
<td>MB990767</td>
<td>Crankshaft pulley holder</td>
<td>Holding camshaft sprocket when loosening and tightening of bolt. Use with MD998719</td>
<td></td>
</tr>
<tr>
<td>MD998440</td>
<td>Leak-down tester</td>
<td>Leak-down test of lash adjuster</td>
<td></td>
</tr>
<tr>
<td>MD998442</td>
<td>Air bleed wire</td>
<td>Air bleeding of lash adjuster</td>
<td></td>
</tr>
<tr>
<td>MD998713</td>
<td>Camshaft oil seal installer</td>
<td>Installation of camshaft oil seal</td>
<td></td>
</tr>
<tr>
<td>MD998716</td>
<td>Crankshaft wrench</td>
<td>Rotation of crankshaft when installing piston and timing belt.</td>
<td></td>
</tr>
<tr>
<td>MD998717</td>
<td>Crankshaft front oil seal installer</td>
<td>Installation of crankshaft front oil seal</td>
<td></td>
</tr>
<tr>
<td>MB991653</td>
<td>Cylinder head bolt wrench</td>
<td>Tightening and loosening of cylinder head bolt</td>
<td></td>
</tr>
<tr>
<td>MB991659</td>
<td>Guide D</td>
<td>Removal of piston pin (Use with MD998780)</td>
<td></td>
</tr>
<tr>
<td>Tool</td>
<td>Number</td>
<td>Name</td>
<td>Use</td>
</tr>
<tr>
<td>------</td>
<td>----------</td>
<td>-----------------------------</td>
<td>----------------------------------------------</td>
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<tr>
<td></td>
<td>MD998719</td>
<td>Pulley holder pin (2)</td>
<td>Use with MB990767</td>
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<td></td>
<td>MD998727</td>
<td>Oil pan remover</td>
<td>Removal of the oil pan</td>
</tr>
<tr>
<td></td>
<td>MD998754</td>
<td>Pin</td>
<td>Use with MB990767</td>
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<tr>
<td></td>
<td>MD998767</td>
<td>Tensioner pulley socket wrench</td>
<td>Adjustment of timing belt tension</td>
</tr>
<tr>
<td></td>
<td>MD998772</td>
<td>Valve spring compressor</td>
<td>Removal and installation of valve and related parts</td>
</tr>
<tr>
<td></td>
<td>MD998774</td>
<td>Valve stem seal installer</td>
<td>Installation of valve stem seal</td>
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<tr>
<td></td>
<td>MD998775</td>
<td>Valve stem seal installer</td>
<td>Installation of valve stem seal</td>
</tr>
<tr>
<td></td>
<td>MD998776</td>
<td>Crankshaft rear oil seal installer</td>
<td>Installation of crankshaft rear oil seal Use with MB990938</td>
</tr>
<tr>
<td>Tool</td>
<td>Number</td>
<td>Name</td>
<td>Use</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
<td>-----------------------------------------</td>
<td>-------------------------------------------------------</td>
</tr>
</tbody>
</table>
| MD998780     | SETTING TOOL  
Piston pin | Removal and installation of piston pin |
| MD998735     | Valve spring compressor           | Compression of valve spring                      |
| MD998781     | Flywheel stopper             | Holding flywheel and drive plate                |
| MB991477     | Valve adjusting wrench         | Adjustment of valve clearance (MIVEC)           |
| MB991478     | Valve adjusting wrench feeler gauge set | Adjustment of valve clearance (MIVEC)           |
| MB991479     | Rocker arm piston checker       | Adjustment of valve clearance (MIVEC)           |
| MD998784     | Valve spring compressor adapter | Compression of valve spring (MIVEC)  
(Use with MD998772) |
3. ALTERNATOR AND IGNITION SYSTEM

REMOVAL AND INSTALLATION <SOHC> (Engines with distributor)

Removal steps:
1. Drive belt*
2. Alternator
3. Alternator brace
4. Crankshaft bolt
5. Crankshaft pulley
6. Front flange
7. Spark plug cable
8. Spark plug
9. O-ring
10. Distributor
11. Power steering pump pulley
12. Power steering pump bracket stay
13. Power steering pump bracket

NOTE:
*: For details of adjustment, refer to the relevant model’s chassis workshop manual.
REMOVAL AND INSTALLATION <SOHC for other than PAJERO io> (Engines without distributor)

Removal steps
1. Drive belt*
2. Alternator
3. Alternator brace
4. Crankshaft bolt
5. Crankshaft pulley
6. Front flange
7. Spark plug cable
8. Ignition coil
9. Spark plug
10. Ignition failure sensor (From 2001 model vehicles for Europe)
11. Cam position sensor
12. Cam position sensor support
13. Cam position sensing cylinder
14. Power steering pump pulley
15. Power steering pump bracket stay
16. Power steering pump bracket

NOTE:
*: For details of adjustment, refer to the relevant model’s chassis workshop manual.

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REMOVAL AND INSTALLATION <SOHC for PAJERO io>
(Engines without distributor)

Removal steps
1. Drive belt*
2. Alternator
3. Alternator brace
4. Crankshaft bolt
5. Crankshaft pulley
6. Front flange
7. Spark plug cable
8. Ignition coil
9. Spark plug
10. Ignition failure sensor (For Europe)
11. Ignition failure sensor bracket (For Europe)
12. Cam position sensor
13. Cam position sensor support
14. Cam position sensing cylinder
15. Power steering pump pulley
16. Power steering pump bracket stay
17. Power steering pump bracket

NOTE
*: For details of adjustment, refer to the relevant model's chassis workshop manual.
4G9 ENGINE (E–W) – Alternator and Ignition System

REMOVAL AND INSTALLATION <DOHC>

Removal steps
1. Drive belt*
2. Alternator
3. Alternator brace
4. Crankshaft bolt
5. Crankshaft pulley
6. Front flange
7. Center cover
8. Ignition coil

9. Spark plug cable
10. Spark plug
11. Ignition failure sensor
12. Power steering pump pulley
13. Power steering pump bracket stay
14. Power steering pump bracket

NOTE:
*: For details of adjustment, refer to the relevant model's chassis workshop manual.
Removal steps
1. Drive belt*
2. Alternator
3. Alternator brace
4. Crankshaft bolt
5. Crankshaft pulley
6. Front flange
7. Center cover
8. Spark plug cable
9. Ignition coil
10. Spark plug
11. Cam position sensor
12. Cam position sensor support
13. Cam position sensing cylinder
14. Power steering pump pulley
15. Power steering pump bracket stay
16. Power steering pump bracket

NOTE:
*: For details of adjustment, refer to the relevant model’s chassis workshop manual.
REMOVAL AND INSTALLATION
<DOHC–GDI for CARISMA, SPACE STAR, SPACE RUNNER, GALANT>

Removal steps
1. Drive belt*
2. Alternator
3. Alternator brace
4. Crankshaft bolt
5. Crankshaft pulley
6. Front flange
7. Engine cover
8. Earth strap (From 2001 model for CARISMA, From 2001 model for SPACE STAR)
9. Ignition coil
10. Spark plug
11. Cam position sensor
12. Cam position sensor support
13. Cam position sensing cylinder
14. Ignition failure sensor (From 2001 model for CARISMA, From 2001 model for SPACE STAR)
15. Power steering pump pulley
16. Power steering pump bracket stay
17. Power steering pump bracket

NOTE:
*: For details of adjustment, refer to the relevant model’s chassis workshop manual.
Removal steps
1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Drive belt*
5. Alternator
6. Alternator brace
7. Crankshaft bolt
8. Crankshaft pulley
9. Front flange
10. Power steering pump pulley
11. Power steering pump bracket stay
12. Power steering pump bracket
13. Ignition coil
14. Spark plug
15. Cam position sensor
16. Cam position sensor support
17. Cam position sensing cylinder

NOTE:
*: For details of adjustment, refer to the relevant model's chassis workshop manual.
REMOVAL SERVICE POINT

A CRANKSHAFT BOLT REMOVAL

(1) Use the special tool to hold the flywheel or the drive plate, and then loosen the crankshaft mounting bolts.

INSTALLATION SERVICE POINTS

A CAM POSITION SENSOR SUPPORT INSTALLATION

(1) Apply a 3 mm bead of form-in-place gasket (FIPG) to the area shown.

Specified sealant:
Mitsubishi Genuine Part No. MD970389 or equivalent.

B FRONT FLANGE / CRANKSHAFT PULLEY / CRANKSHAFT BOLT INSTALLATION

(1) Use the special tool to hold the flywheel or the drive plate.

(2) Clean and then degrease the front flange contacting surface of the crankshaft pulley.

NOTE
Degreasing is necessary to prevent decrease in the friction between contacting surfaces.

(3) Clean the bolt hole in the crankshaft, the crankshaft contacting surface and washer contacting surface of the crankshaft pulley, and the washer.

(4) Apply an appropriately small amount of oil to the threads and seating surface of the crankshaft bolt.

(5) Tighten the crankshaft bolt to the specified torque of 182 ± 4 Nm.
4. TIMING BELT

REMOVAL AND INSTALLATION <SOHC for CARISMA (Up to 1999 model), LANCER (Except from 2001 model for Europe), GALANT>

Removal steps
1. Timing belt front upper cover
2. Timing belt front lower cover
3. Engine support bracket, right
4. Timing belt
5. Tensioner spring
6. Timing belt tensioner
7. Timing belt rear cover
8. Crankshaft angle sensor
   (Engines without distributor)
9. Crankshaft sprocket
10. Crankshaft spacer
    (Engines without distributor)
11. Crankshaft sensing blade
    (Engines without distributor)
12. Crankshaft key
13. Camshaft sprocket bolt
14. Camshaft sprocket
REMOVAL AND INSTALLATION
<SOHC for CARISMA (From 2000 model), LANCER (From 2001 model for Europe), SPACE STAR>

Removal steps
1. Timing belt front upper cover
2. Timing belt front lower cover
3. Engine support bracket, right
4. Timing belt
5. Tensioner spring
6. Timing belt tensioner
7. Timing belt rear cover
8. Crankshaft angle sensor (Engines without distributor)
9. Crankshaft sprocket
10. Crankshaft spacer (Engines without distributor)
11. Crankshaft sensing blade (Engines without distributor)
12. Crankshaft key
13. Camshaft sprocket bolt
14. Camshaft sprocket
Intentionally blank
Removal steps

1. Timing belt front upper cover
2. Timing belt front lower cover
3. Accessory mount
4. Timing belt
5. Tensioner spring
6. Timing belt tensioner
7. Timing belt rear cover
8. Crankshaft angle sensor
9. Crankshaft sprocket
10. Crankshaft spacer
11. Crankshaft sensing blade
12. Crankshaft key
13. Camshaft sprocket bolt
14. Camshaft sprocket
REMOVAL AND INSTALLATION <DOHC>

Removal steps
1. Timing belt upper cover
2. Timing belt lower cover
3. Engine support bracket
4. Timing belt
5. Tensioner pulley
6. Tensioner arm
7. Shaft
8. Auto-tensioner
9. Timing belt rear cover
10. Idler pulley
11. Cam position sensor
12. Crankshaft angle sensor
13. Crankshaft sprocket
14. Crankshaft spacer
15. Crankshaft sensing blade
16. Crankshaft sprocket key
17. Camshaft sprocket bolt
18. Camshaft sprocket
19. Timing belt rear cover
20. Timing belt rear cover
REMOVAL AND INSTALLATION <DOHC–MIVEC>

Removal steps
1. Timing belt front upper cover
2. Timing belt front lower cover
3. Engine support bracket, right
4. Timing belt
5. Tensioner pulley
6. Tensioner arm
7. Shaft
8. Auto tensioner
9. Timing belt rear cover
10. Idler pulley
11. Crankshaft angle sensor
12. Crankshaft sprocket
13. Crankshaft spacer
14. Crankshaft sensing blade
15. Crankshaft key
16. Camshaft sprocket bolt
17. Camshaft sprocket
18. Timing belt rear cover
19. Timing belt rear cover
REMOVAL AND INSTALLATION
<DOHC–GDI for CARISMA, SPACE STAR, SPACE RUNNER>

Removal steps
1. Timing belt front upper cover
2. Timing belt front lower cover
3. Engine support bracket, right
4. Timing belt
5. Tensioner pulley
6. Tensioner arm
7. Shaft
8. Auto tensioner
9. Timing belt rear cover
10. Idler pulley
11. Crankshaft angle sensor
   (Up to 1999 model)
12. Crankshaft angle sensor
    (From 2000 model)
13. Crankshaft sprocket
14. Crankshaft spacer
15. Crankshaft sensing blade
16. Crankshaft key
17. Camshaft sprocket bolt
18. Camshaft sprocket
19. Timing belt rear cover
   (Up to 2000 model)
20. Timing belt rear cover
    (Up to 2000 model)
21. Timing belt rear upper cover
    (From 2001 model)
Removal and Installation <DOHC–GDI for GALANT>

Removal steps
1. Timing belt front upper cover
2. Timing belt front lower cover
3. Engine support bracket, right
4. Timing belt
5. Tensioner pulley
6. Tensioner arm
7. Shaft
8. Auto tensioner
9. Timing belt rear cover
10. Idler pulley
11. Crankshaft angle sensor
12. Crankshaft sprocket
13. Crankshaft spacer
14. Crankshaft sensing blade
15. Crankshaft key
16. Camshaft sprocket bolt
17. Camshaft sprocket
18. Timing belt rear upper cover
Removal steps
1. Timing belt front upper cover
2. Timing belt front lower cover
3. Accessory mount
4. Timing belt
5. Tensioner pulley
6. Tensioner arm
7. Shaft
8. Auto tensioner
9. Timing belt rear cover
10. Idler pulley
11. Bracket
12. Crankshaft angle sensor
13. Crankshaft sprocket
14. Crankshaft spacer
15. Crankshaft sensing blade
16. Crankshaft key
17. Camshaft sprocket bolt
18. Camshaft sprocket
19. Timing belt rear cover <4G93>
20. Timing belt rear cover <4G93>
21. Timing belt rear upper cover <4G94>
Intentionally blank
REMOVAL SERVICE POINTS

A. TIMING BELT REMOVAL

(1) Mark belt running direction for reinstallation.

B. CAMSHAFT SPROCKET BOLT REMOVAL

<With rocker cover removed> (Except SOHC)

(1) Use a wrench to hold the hexagonal part of the camshaft, and then remove the camshaft sprocket mounting bolt.

INSTALLATION SERVICE POINTS

A. CAMSHAFT SPROCKET BOLT INSTALLATION

MD998719 or MD998754
TIMING BELT TENSIONER INSTALLATION

(1) Let the pulley of the timing belt tensioner come closest to the exhaust side. Temporarily tighten the tensioner pulley fixing bolt.

TENSIONER SPRING INSTALLATION

(1) Insert the tip A (shorter one) of the tensioner spring into the oil pump case.

(2) Use pliers or similar tool to pinch the tip B (longer one), and then hook it to the tensioner bracket arm.

TIMING BELT INSTALLATION

(1) Turn the crankshaft sprocket by three teeth from the timing mark.

Caution
Aligning the timing marks positions the piston to the top dead centre. Then, if the camshaft turns, the valves may hit and damage the pistons.

(2) Check that the timing belt tensioner and tensioner spring are installed correctly. (Refer to the service points B and C.)

(3) Align the timing marks on the camshaft sprocket to that on the cylinder head.

(4) Align the timing mark on the crankshaft sprocket to that on the oil pump case.

(5) Place the timing belt over the sprocket according in the following order.
1. Crankshaft sprocket
2. Water pump sprocket
3. Camshaft sprocket
4. Tension pulley
(6) Slightly loosen the tensioner pulley fixing bolt which is tightened temporarily to tighten the belt by a force of the tensioner spring.

(7) Turn the crankshaft clockwise by two turns.
(8) Check that the timing marks are aligned.
(9) Tighten the fixing bolt of the tensioner pulley.

► AUTO-TENSIONER INSTALLATION

(1) If the auto-tensioner rod is fully extended, set it in the retracted position with the following procedure.
1) Hold the auto-tensioner in a vice, being careful not to tilt it.
2) Slowly close the vice to force the rod in to align hole (A) of the rod with the set hole (B).
3) Insert a 2.0-mm-Allen key in diameter or similar into the set holes.
4) Remove the auto-tensioner from the vice.

(2) Install the auto-tensioner
Leave the align key until installation of the timing belt is completed.
TIMING BELT INSTALLATION

(1) Make sure that the auto-tensioner is installed properly. (Refer to service point F.)
(2) Align the timing mark on each sprocket with the corresponding mark on the timing belt.
(3) Turn the crankshaft sprocket one half the tooth width counterclockwise.

(4) Fit the timing belt to the intake camshaft sprocket and secure with a paper clip at the illustrated position.

(5) Use two wrenches to fit the timing belt to the exhaust sprocket while aligning the timing marks.
(6) Secure the timing belt with a paper clip at the illustrated position.

(7) Fit the belt to the idler pulley water pump sprocket, crankshaft sprocket and tensioner pulley in that order.

(8) Raise the tensioner pulley in the direction of an arrow and tighten the tensioner pulley bolt.

(9) Remove the two paper clips.

(10) Make sure that all timing marks are in alignment.

(11) Give a 1/4 counterclockwise turn to the crankshaft. Then turn the crankshaft clockwise to align the timing marks again.
(12) Install the special tool and a torque wrench to the tensioner pulley.
(13) Using torque wrench, torque to 2.6 Nm.
(14) While holding the tensioner pulley to prevent it from turning, tighten the center bolt to the specified torque.
(15) Give two clockwise turns to the crankshaft and leave as it is for approx. 15 minutes.
(16) Check if the Allen wrench inserted during installation of the auto-tensioner can be pulled out lightly. If it can be pulled out lightly, the belt is properly tensioned. Therefore, pull out the wrench. The belt is also properly tensioned if the auto-tensioner projection is of standard value.

**Standard value: 3.8 – 4.5 mm**

(17) If the wrench cannot be pulled out lightly, repeat the steps (12) through (15) to obtain appropriate belt tension.

**NOTE**
Check the tightening torque of the crankshaft bolt always after rotating the crankshaft counterclockwise using the crankshaft bolt. Retighten the bolt if the tightening torque is not up to specification.

**G CRANKSHAFT SENSING BLADE / CRANKSHAFT SPACER / CRANKSHAFT SPROCKET INSTALLATION**

(1) Clean and then degrease the following surfaces and parts:
- Front surface of oil pump case
- Sprocket mounting surface of crankshaft
- Crankshaft spacer
- Crankshaft sensing blade
- Crankshaft sprocket

**NOTE**
Degreasing is necessary to prevent decrease in the friction between contacting surfaces.

(2) Clean the crankshaft contacting surface of the crankshaft sprocket.

**INSPECTION**

**TIMING BELT**
Replace belt if any of the following conditions exist.
(1) Hardening of back rubber.
   Back side is glossy without resilience and leaves no indent when pressed with fingernail.

(2) Cracks on rubber back.
(3) Cracks or peeling of canvas.
(4) Cracks on tooth bottom.
(5) Cracks on belt sides.
(6) Abnormal wear of belt sides. The sides are normal if they are sharp as if cut by a knife.

(7) Abnormal wear on teeth.

(8) Missing tooth.

TENSIONER PULLER, IDLER PULLEY

(1) Check the pulley for smooth rotation, excessive play, abnormal noise. Replace it if necessary.

AUTO-TENSIONER

(1) Check the tensioner for oil leaks. Replace it if necessary.
(2) Check the rod end for wear or damage. Replace the tensioner if necessary.
(3) Measure the rod projection length. If not within the standard value, replace the tensioner.

   Standard value: 11 mm

(4) Press the rod by a force of 98 to 196 N and measure the rod stroke. If not within the standard value, replace the tensioner.

   Standard value: 1 mm or less
5. FUEL AND EMISSION CONTROL SYSTEM

REMOVAL AND INSTALLATION <SOHC-CARBURETOR>

Removal steps
1. Breather tube
2. Fuel hose
3. Fuel hose
4. Fuel pump
5. Gasket
6. Insulator
7. Gasket
8. Carburetor
9. Gasket
10. EGR valve
11. Gasket
Removal steps
1. Vacuum hose and pipe assembly
2. Throttle body
3. Gasket
4. Engine hanger (4G94)
5. Throttle body stay (4G94)
6. Vacuum hose
7. Fuel hose
8. Fuel pressure regulator
9. O-ring
10. Delivery pipe and injector
11. Insulator
12. Insulator
13. Injector
14. O-ring
15. Grommet
16. Delivery pipe
17. Fuel return pipe
18. Solenoid valve assembly
   (Engine with solenoid valve)
19. EGR valve
   (Engine with EGR valve)
20. Cover
   (Engine without EGR valve)
21. Gasket
REMOVAL AND INSTALLATION <SOHC–MPI for PAJERO io>
Removal steps
1. Vacuum pipe assembly
2. Throttle body assembly
3. Gasket
4. Throttle body stay (MIVEC)
5. Vacuum hose
6. Fuel hose
7. Fuel pressure regulator
8. O-ring
9. Delivery pipe and injector
10. Insulator
11. Insulator
12. Injector
13. O-ring
14. Grommet
15. Delivery pipe
16. Fuel return pipe
17. Solenoid valve
INSTALLATION SERVICE POINTS

► A INJECTORS INSTALLATION
(1) Apply a small amount of new engine oil to the O-ring.
Caution
Be sure not to let engine oil get into the delivery pipe.
(2) While turning the injector to the left and right, install it to the delivery pipe.
(3) Check that the injector turns smoothly. If it does not turn smoothly, the O-ring may be trapped. Remove the injector and check the O-ring for damage, and then re-insert it into the delivery pipe and check once again.
(4) Check that the clearance between the injector connector and the delivery pipe is uniform (A = B).

► B FUEL PRESSURE REGULATOR INSTALLATION
(1) Apply a small amount of new engine oil to the O-ring. Insert the fuel pressure regulator into the delivery pipe being careful not to damage the O-ring.
Caution
Be sure not to let engine oil get into the delivery pipe.
(2) Check that the fuel pressure regulator turns smoothly. If it does not turn smoothly, the O-ring may be trapped. Remove the fuel pressure regulator and check the O-ring for damage, and then re-insert it into the delivery pipe and check once again.

► C GASKET INSTALLATION
(1) Position the projection as shown in the illustration.
<SOHC-MPI for PAJERO io>
5a. THROTTLE BODY AND EGR SYSTEM (GDI)

REMOVAL AND INSTALLATION <Up to 2000 model for CARISMA, 1999 model for SPACE STAR, SPACE RUNNER>

Removal steps

1. Air intake plenum resonator
2. O-ring
3. Intake manifold stay
4. Water hose
5. Water hose (Up to 1998 model for CARISMA, SPACE RUNNER)
6. Throttle body
7. Throttle body gasket
8. Ignition harness
9. Water hose
10. EGR valve
11. EGR valve gasket
12. Engine hanger
13. EGR valve support
14. Gasket
15. Water hose (Up to 1998 model for CARISMA, SPACE RUNNER)
16. Air by-pass valve (Up to 1998 model for CARISMA, SPACE RUNNER)
17. Air by-pass valve gasket (Up to 1998 model for CARISMA, SPACE RUNNER)
REMOVAL AND INSTALLATION
<From 2001 model for CARISMA, SPACE STAR and GALANT>

Removal steps

1. Intake manifold stay (For GALANT)
2. Water hose
3. Water hose
4. Water hose
5. Throttle body stay
6. Throttle body
7. Throttle body gasket
8. Ignition harness
9. Water hose
10. EGR valve
11. EGR valve support
12. Gasket
Removal steps
1. Water hose
2. Water hose
3. Water hose
4. Water hose
5. Water hose
6. Water hose clamp
7. Water pipe
8. Water pipe
9. Throttle body
10. Throttle body gasket
11. EGR valve
12. EGR valve gasket
13. EGR valve support
14. Gasket
15. Engine hanger
REMOVAL AND INSTALLATION <For PAJERO io - 4G94>

Removal steps
1. Water hose
2. Water hose
3. Water hose
4. Water hose
5. Water hose
6. Water hose clamp
7. Water pipe
8. Water pipe
9. Throttle body stay
10. Throttle body
11. Throttle body gasket
12. EGR valve
13. EGR valve gasket
14. EGR valve support
15. Gasket
16. Engine hanger
INSTALLATION SERVICE POINTS

A THROTTLE BODY GASKET

B INTAKE MANIFOLD STAY INSTALLATION

1. Tighten the four bolts at the top and bottom of the stay handtight.
2. Check that the stay seating surface is in close contact with the bosses on the intake manifold and the cylinder block.
3. Tighten the four bolts to the specified torque.
6. INTAKE AND EXHAUST MANIFOLD

REMOVAL AND INSTALLATION <SOHC-CARBURETOR>

Removal steps
1. Engine hanger
2. Intake manifold stay
3. Intake manifold
4. Intake manifold gasket
5. Oil level gauge
6. Oil level gauge guide
7. O-ring
8. Exhaust manifold cover
9. Engine hanger
10. Exhaust manifold bracket A
11. Exhaust manifold bracket B
12. Exhaust manifold
13. Exhaust manifold gasket
REMOVAL AND INSTALLATION <SOHC–MPI–FRONT WHEEL DRIVE (4G92 and 4G93–Except from 2001 model for Europe)>

Removal steps
1. Engine hanger
2. Intake manifold stay
3. Intake manifold
4. Intake manifold gasket
5. Oil level gauge
6. Oil level gauge guide
7. O-ring
8. Exhaust manifold cover
9. Engine hanger
10. Exhaust manifold bracket A
11. Exhaust manifold bracket B
12. Exhaust manifold
13. Exhaust manifold gasket
REMOVAL AND INSTALLATION <SOHC–MPI–FRONT WHEEL DRIVE (4G92 and 4G93–From 2001 model for Europe)>

Removal steps
1. Engine hanger
2. Intake manifold stay
3. Intake manifold
4. Intake manifold gasket
5. Oil level gauge
6. Oil level gauge guide
7. O-ring
8. Oxygen sensor
9. Engine hanger
10. Exhaust manifold cover
11. Exhaust manifold bracket B
12. Exhaust manifold
13. Exhaust manifold gasket
14. Exhaust manifold bracket A
Removal steps
1. Intake manifold stay
2. Intake manifold
3. Intake manifold gasket
4. Oil level gauge
5. Oil level gauge guide
6. O-ring
7. Exhaust manifold cover
8. Engine hanger
9. Exhaust manifold bracket A
10. Exhaust manifold bracket B
11. Exhaust manifold
12. Exhaust manifold gasket
REMOVAL AND INSTALLATION
<SOHC–MPI – REAR WHEEL DRIVE (4G93 – Except from 2002 model for Europe)>

Removal steps
1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Engine hanger
5. Intake manifold stay
6. Intake manifold
7. Intake manifold gasket
8. Exhaust manifold cover
9. Engine hanger
10. Exhaust manifold bracket
11. Exhaust manifold
12. Exhaust manifold gasket
REMOVAL AND INSTALLATION
<SOHC–MPI – REAR WHEEL DRIVE (4G93 – from 2002 model for Europe)>

Removal steps
1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Engine hanger
5. Intake manifold stay
6. Intake manifold
7. Intake manifold gasket
8. Exhaust manifold cover
9. Engine hanger
10. Exhaust manifold bracket
11. Exhaust manifold
12. Exhaust manifold gasket
Removal steps
1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Engine hanger
5. Intake manifold stay
6. Intake manifold
7. Intake manifold gasket
8. Exhaust manifold cover
9. Engine hanger
10. Exhaust manifold bracket
11. Exhaust manifold
12. Exhaust manifold gasket
Intentionally blank
Removal steps
1. Engine hanger
2. Intake manifold stay
3. Intake manifold
4. Intake manifold gasket
5. Oil level gauge
6. Oil level gauge guide
7. O-ring
8. Engine hanger
9. Exhaust manifold bracket A
10. Exhaust manifold bracket B
11. Exhaust manifold
12. Exhaust manifold gasket
INSTALLATION SERVICE POINT

▶ A ◀ EXHAUST MANIFOLD BRACKET INSTALLATION

<FRONT WHEEL DRIVE>
(1) Install temporarily the exhaust manifold brackets A and B as shown in the illustration.
(2) Check that both brackets are in close contact with the bosses, and then tighten fully the bracket mounting bolts.

<REAR WHEEL DRIVE>
(1) Temporarily install the exhaust manifold bracket as shown in the illustration.
(2) Verify that the bracket is brought into close contact with the boss on the exhaust manifold, then tighten the bolts to the specified torque.

▶ B ◀ INTAKE MANIFOLD STAY INSTALLATION

<FRONT WHEEL DRIVE>
(1) Check to ensure that the intake manifold stay is in close contact with the intake manifold and the cylinder block before tightening the respective mounting bolts to the specified torque.

<REAR WHEEL DRIVE>
(1) Install the intake manifold stay with its “UP” mark directed toward the intake manifold.
6a. INTAKE MANIFOLD (GDI)

REMOVAL AND INSTALLATION <Up to 2000 model for CARISMA, 1999 model for SPACE STAR, SPACE RUNNER>

Removal steps
1. Air by-pass hose
   (Up to 1998 model for CARISMA, SPACE RUNNER)
2. Vacuum pipe and hose
3. Bracket
4. Solenoid valve
5. Connector bracket
6. Accelerator cable bracket
7. Vacuum hose
8. Vacuum pipe
9. Intake manifold
10. Intake manifold gasket
REMOVAL AND INSTALLATION
<From 2001 model for CARISMA, SPACE STAR and GALANT>

Removal steps
1. Vacuum pipe and hose
2. Purge hose
3. Solenoid valve
4. Vacuum pipe
5. Intake manifold
Intentionally blank
Removal steps
1. Air by-pass hose
2. Vacuum pipe and hose
3. Bracket
4. Solenoid valve
5. Connector bracket
6. Accelerator cable bracket
7. Vacuum hose
8. Vacuum pipe
9. Intake manifold
10. Intake manifold gasket
REMOVAL AND INSTALLATION <For PAJERO io>

Removal steps

1. P.C.V. hose
2. Vacuum pipe and hose
3. Solenoid valve
4. Fuel pump protector
5. Connector bracket
6. Branch tube
7. Gasket
8. Intake manifold stay
9. Intake manifold
10. Intake manifold gasket
INSTALLATION SERVICE POINT

\(\text{A} \rightarrow \text{INTAKE MANIFOLD STAY INSTALLATION}\)

(1) Check to ensure that the intake manifold stay is in close contact with the intake manifold and the cylinder block before tightening the respective mounting bolts to the specified torque.
Removal steps
1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Exhaust manifold cover
5. Engine hanger
6. Exhaust manifold bracket A
7. Exhaust manifold bracket B
8. Exhaust manifold
9. Exhaust manifold gasket
Removal steps
1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Oxygen sensor
5. Engine hanger
6. Exhaust manifold cover
7. Exhaust manifold bracket B
8. Heat protector
9. Exhaust manifold
10. Exhaust manifold gasket
11. Exhaust manifold bracket A
Removal steps
1. Exhaust manifold cover
2. Engine hanger
3. Exhaust manifold bracket
4. Exhaust manifold
5. Exhaust manifold gasket
INSTALLATION SERVICE POINTS

**A** EXHAUST MANIFOLD BRACKET INSTALLATION

1. Slide the washers over the bolts with the chamfered side toward the bolt.

2. Install temporarily the exhaust manifold brackets A and B as shown in the illustration.

3. Check that both brackets are in close contact with the bosses, and then tighten fully the bracket mounting bolts.

**B** EXHAUST MANIFOLD BRACKET INSTALLATION

1. The washers must be installed with the shear-drooped side toward the bolts.

2. Temporarily install the exhaust manifold bracket as shown in the illustration.

3. Verify that the bracket is brought into close contact with the boss on the exhaust manifold, then tighten the bolts to the specified torque.
6c. INJECTOR AND FUEL PUMP ASSEMBLY (GDI)

REMOVAL AND INSTALLATION <Up to 2000 model for CARISMA, 1999 model for SPACE STAR, SPACE RUNNER>

Removal steps
1. Fuel hose
2. Fuel low pressure pipe
3. O-ring
4. Fuel nipple
5. O-ring
6. Clamp
7. Fuel feed pipe
8. Backup ring
9. O-ring
10. Backup ring
11. Fuel pump
12. O-ring
13. Harness bracket
14. Fuel return pipe
15. Backup ring
16. O-ring
17. Backup ring
18. Fuel high pressure regulator
19. Flange
20. Fuel pressure sensor
21. O-ring
22. Backup ring
23. Pump camshaft case
24. O-ring
25. O-ring
26. Harness bracket
27. Injector harness
28. Washer
29. Injector holder
30. Delivery pipe and injector
31. Insulator
32. Injector gasket
33. Injector
34. Corrugated washer
35. Backup ring
36. O-ring
37. Backup ring
38. Delivery pipe
REMOVAL AND INSTALLATION
<From 2001 model for CARISMA, SPACE STAR and GALANT>

Removal steps
1. Injector harness
2. Flange
3. Fuel pressure sensor
4. Backup ring
5. O-ring
6. Fuel pipe
7. Backup ring
8. O-ring
9. Backup ring
10. Fuel pump
11. O-ring
12. Washer
13. Injector holder
14. Delivery pipe and injector
15. Insulator
16. Injector gasket
17. Corrugated washer
18. Backup ring
19. O-ring
20. Backup ring
21. Injector
22. Delivery pipe
REMOVAL AND INSTALLATION <For PAJERO io - 4G94>

Removal steps
1. Fuel hose
2. Fuel hose
3. Injector harness
4. Flange
5. Fuel pressure sensor
6. Backup ring
7. O-ring
8. Fuel pipe
9. Backup ring
10. O-ring
11. Backup ring
12. Fuel pump
13. O-ring
14. Washer
15. Injector holder
16. Delivery pipe and injector
17. Insulator
18. Injector gasket
19. Corrugated washer
20. Backup ring
21. O-ring
22. Backup ring
23. Injector
24. Delivery pipe
Removal steps

1. Injector harness
2. Fuel hose
3. Fuel hose
4. Fuel hose
5. Fuel pipe
6. Fuel nipple
7. O-ring
8. Fuel nipple
9. O-ring
10. Fuel feed pipe
11. Backup ring
12. O-ring
13. Backup ring
14. Fuel pump
15. O-ring
16. Fuel return pipe
17. Backup ring
18. O-ring
19. Backup ring

20. Fuel high pressure regulator
21. Fuel pressure sensor
22. Backup ring
23. O-ring
24. Spacer
25. Washer
26. Injector holder
27. Delivery pipe and injector
28. Insulator
29. Injector gasket
30. Corrugated washer
31. Backup ring
32. O-ring
33. Backup ring
34. Injector
35. Delivery pipe
INSTALLATION SERVICE POINTS

A BACKUP RING / O-RING / CORRUGATED WASHER INSTALLATION

(1) Attach the backup rings and O-ring to the injector. The thicker backup ring must be so installed that the inside cut surface is directed as shown in the illustration.

(2) Coat the corrugated washer with white vaseline and install it to the injector as shown.

Caution
Always replace the corrugated washer with new one. Reused corrugated washer can cause fuel or gas leaks.

B DELIVERY PIPE AND INJECTOR ASSEMBLY INSTALLATION

(1) Lubricate O-ring in the injector with spindle oil or gasoline.
(2) Insert the injector straight into the injector mounting hole in the delivery pipe.
(3) Turn the injector clockwise and counterclockwise. If it does not rotate smoothly, remove it to check for damaged O-ring. Damaged O-ring must be replaced with a new one. Reinstall the injector and check for smooth rotation again.
(4) Align the mating mark on the injector with that on the delivery pipe.
(5) Install the injector gaskets and insulators on the cylinder head. The insulator can drop off easily. Apply vaseline to it before installation so that it may be held in position.
(6) Install the delivery pipe and injector assembly onto the cylinder head, then tighten the fasteners temporarily.
(7) Install the injector holders and the washers to the assembly and tighten the fasteners to the specified torque.

Caution
Strictly observe the specified torque.
(8) Tighten the fasteners of the delivery pipe and injector assembly to the specified torque in the order given in the illustration.

C. PUMP CAMSHAFT CASE INSTALLATION
(1) Apply small amount of engine oil to the O-ring (larger one) on the case.
(2) Install the pump camshaft case onto the cylinder head while aligning the coupling keys of the case with the grooves in the rear end face of the camshaft.

**NOTE**
The coupling keys and the grooves at the camshaft rear end are offset with respect to the camshaft center.
(3) Tighten the case mounting bolts to the specified torque.

D. FUEL PRESSURE SENSOR INSTALLATION
(1) Install the backup ring to the fuel pressure sensor with its inside cut surface in the illustrated direction.
(2) Install the fuel pressure sensor straight into the fuel pressure regulator with labeled surface upward.
(3) Tighten the fuel pressure sensor mounting bolt to the specified torque.

E. FUEL HIGH PRESSURE REGULATOR INSTALLATION
(1) Install the fuel high pressure regulator on the pump camshaft case <for CARISMA> or onto the spacer <for PAJERO io> and tighten the 3 bolts lightly (with somewhat larger torque than fingertight). Tightening to the specification is to be carried out in the step described in F. 
(2) Fit the backup rings and the O-ring on both ends of the fuel return pipe. Note that the larger backup ring must be installed with the inside cut surface in the direction shown in the illustration.

(3) Lubricate the O-rings on both ends of the pipe with spindle oil or gasoline.

(4) Insert the fuel return pipe ends straight in the respective mounting holes of the pressure regulator and the delivery pipe. Be sure to insert the pipe fully to the stop using care not to twist it.

(5) Tighten the bolts at both ends of the pipe to the specified torque.

**FUEL PUMP / FUEL FEED PIPE INSTALLATION**

(1) Insert the fuel pump into the mounting hole in the pump camshaft case <for CARISMA> or in the cylinder head <for PAJERO io>, and secure it temporarily with 4 bolts (tighten somewhat with a larger torque than fingertight).

(2) Fit the backup rings and the O-ring on both ends of the feed pipe. Note that the larger backup ring must be installed with the inside cut surface in the direction shown in the illustration.

(3) Lubricate the O-rings on both ends of the pipe with spindle oil or gasoline.

(4) Insert the fuel feed pipe ends straight in the respective mounting holes of the fuel and the delivery pipe. Be sure to insert the pipe fully to the stop using care not to twist it.

(5) Tighten the bolts at ends of the pipe to the specified torque.

(6) Tighten the mounting bolts of the fuel pressure regulator to the specified torque.

(7) Using a torque wrench having the minimum scale of 0.5 Nm, tighten the fuel pump mounting bolts in the following order.

1) Tighten the bolts to 5 Nm in the order given in the illustration.

2) Tighten the bolts to 17 Nm in the order given in the illustration. The torque variation among 4 bolts must be within 2 Nm.

**Caution**

Strictly observe the specified tightening torque. Deviation from the specification can cause problems such as leakage or the like.
**O-RING / FUEL PUMP INSTALLATION**

1. Apply engine oil to the roller of the fuel pump and O-ring.

2. Insert the fuel pump into the mounting hole in the cylinder head and lightly tighten the four bolts.

3. Using a torque wrench (minimum graduations of 0.5 Nm), follow these steps to tighten the fuel pump mounting bolts.
   1. Tighten the bolts to 4.9 Nm in the order shown.
   2. Tighten the bolts to $17 \pm 2$ Nm in the order shown.

   Variations in torque among the four bolts should be within 2 Nm.

   **Caution**
   Strictly observe the tightening order. A leak and other problem could result if the torque specifications and torquing order are not met.

**O-RING / BACKUP RING / FUEL PIPE INSTALLATION**

1. Fit the backup rings and O-ring to both ends of the fuel pipe. Mount the backup ring (thicker one) so that its inner cut surface faces in the direction shown.

2. Coat the O-rings on both ends of the pipe with spindle oil or gasoline.

3. Insert the fuel pipe straight into the mounting hole in the delivery pipe. Insert it all the way into the hole, ensuring that it does not twist.

4. Tighten the bolts on both ends of the fuel pipe to the specified torque.
**O-RING / BACKUP RING / FUEL PRESSURE SENSOR INSTALLATION**

1. Fit the backup ring to the fuel pressure sensor so that its inner cut surface faces in the direction shown.

2. Being attentive to the shape of the connector and label surface of the fuel pressure sensor, install the fuel pressure sensor in the direction shown.

**O-RING / FUEL PUMP INSTALLATION**

1. Apply engine oil to the O-ring.

2. Insert the fuel pump into the mounting hole in the cylinder head and lightly tighten the four bolts.

3. Using a torque wrench (minimum graduations of 0.5 Nm), follow these steps to tighten the fuel pump mounting bolts.
   1. Tighten the bolts to 4.9 Nm in the order shown.
   2. Tighten the bolts to 17 ± 2 Nm in the order shown.

   Variations in torque among the four bolts should be within 2 Nm.

**Caution**

Strictly observe the tightening order. A leak and other problem could result if the torque specifications and torquing order are not met.
6d. INTAKE AND EXHAUST MANIFOLD
<4G94-GDI for PAJERO io>

REMOVAL AND INSTALLATION

Removal steps
1. P.C.V. hose
2. Purge hose
3. Vacuum pipe and hose
4. Solenoid valve
5. Fuel pump protector
6. Connector bracket
7. Intake manifold stay
8. Low pressure fuel pipe
9. Intake manifold
g. Intake manifold gasket
11. Exhaust manifold cover
12. Engine hanger
13. Exhaust manifold bracket
14. Exhaust manifold
g. Exhaust manifold gasket
INSTALLATION SERVICE POINTS

A. EXHAUST MANIFOLD BRACKET INSTALLATION

(1) The washers must be installed with the shear-drooped side toward the bolts.

(2) Temporarily install the exhaust manifold bracket as shown in the illustration.

(3) Verify that the bracket is brought into close contact with the boss on the exhaust manifold, then tighten the bolts to the specified torque.

B. INTAKE MANIFOLD STAY INSTALLATION

(1) Check to ensure that the intake manifold stay is in close contact with the intake manifold and the cylinder block before tightening the respective mounting bolts to the specified torque.
7. WATER PUMP AND WATER HOSE

REMOVAL AND INSTALLATION <SOHC – FRONT WHEEL DRIVE>

Removal steps
1. Water hose
   (Except carburetor engines)
2. Water hose
3. Engine coolant temperature sensor
4. Engine coolant temperature gauge unit
5. Water outlet fitting
6. Water inlet fitting
7. Thermostat
8. Thermostat case
9. O-ring
10. Water inlet pipe
11. O-ring
12. Water pump

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Mitsubishi Motors Corporation Revised
Removal steps

1. Water hose
2. Water hose
3. Water hose
4. Water pipe
5. Engine coolant temperature sensor
6. Engine coolant temperature gauge unit
7. Water fitting
8. Water outlet fitting
9. Water inlet fitting
10. Thermostat
11. Water by-pass fitting
12. Water pipe
13. O-ring
14. Thermostat case
15. Water pipe
16. O-ring
17. Water pump
Removal steps
1. Water hose A (Except GDI engine)
2. Water hose B (Except GDI engine)
3. Engine coolant temperature sensor
4. Engine coolant temperature gauge unit
5. Water outlet fitting
6. Water inlet fitting
7. Thermostat
8. Thermostat case
9. O-ring
10. Water inlet pipe
11. O-ring
12. Water pump
Removal steps

1. Engine coolant temperature sensor
2. Engine coolant temperature gauge unit
3. Water fitting
4. Water outlet fitting
5. Water inlet fitting
6. Thermostat
7. Water by-pass fitting
8. Water pipe
9. O-ring
10. Thermostat case
11. Water pipe
12. O-ring
13. Water pump
INSTALLATION SERVICE POINTS

► A WATER PUMP INSTALLATION
(1) Apply 3 mm diameter of Form-In-Place Gasket (FIPG) to the location shown in the illustration.

Specified sealant:
Mitsubishi Genuine Part No. MD970389 or equivalent

► B WATER INLET PIPE <FRONT WHEEL DRIVE>/WATER PIPE <REAR WHEEL DRIVE>/O-RING INSTALLATION
(1) Replace the O-ring of the water inlet pipe <FRONT WHEEL DRIVE> or water pipe <REAR WHEEL DRIVE>, and then apply water to the O-ring to make installation easy.

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

► C THERMOSTAT CASE INSTALLATION
(1) Apply 3 mm diameter of Form-In-Place Gasket (FIPG) to the location shown in the illustration.

Specified sealant:
Mitsubishi Genuine Part No. MD970389 or equivalent

► D THERMOSTAT INSTALLATION
(1) Install the thermostat so that the jiggle valve is facing straight up.

► E WATER OUTLET FITTING INSTALLATION
(1) Apply 3 mm diameter of Form-In-Place Gasket (FIPG) to the location shown in the illustration.

Specified sealant:
Mitsubishi Genuine Part No. MD970389 or equivalent
ENGINE COOLANT TEMPERATURE GAUGE UNIT INSTALLATION
(1) Apply the specified sealant to the threads.

Specified sealant:
3M ATD Part No.8660 or equivalent

ENGINE COOLANT TEMPERATURE SENSOR INSTALLATION
(1) When reusing the sensor, apply the specified sealant to the threads.

Specified sealant:
3M Nut Locking Part No.4171 or equivalent

WATER BY-PASS FITTING INSTALLATION
(1) Apply 3 mm diameter of Form-In-Place Gasket (FIPG) to the location shown in the illustration.

Specified sealant:
Mitsubishi Genuine Part No.MD970389 or equivalent.

WATER FITTING INSTALLATION
(1) Apply 3 mm diameter of Form-In-Place Gasket (FIPG) to the location shown in the illustration.

Specified sealant:
Mitsubishi Genuine Part No.MD970389 or equivalent.
8. ROCKER ARMS AND CAMSHAFTS

REMOVAL AND INSTALLATION <SOHC (with Adjusting screw)>

Removal steps
1. Breather hose
2. P.C.V. hose
3. Oil filler cap
4. Rocker cover
5. Rocker cover gasket
6. Oil seal
7. Oil seal
8. Rocker arm spring
9. Rocker arms and rocker arm shaft IN
10. Rocker arms and rocker arm shaft EX
11. Rocker arm B
12. Rocker arm A
13. Rocker arm shaft B
14. Adjusting screw A
15. Nut
16. Rocker arm C
17. Rocker arm shaft B
18. Adjusting screw A
19. Nut
20. Camshaft

Apply engine oil to all moving parts before installation.
Apply engine oil to all moving parts before installation.

Removal steps:
1. Breather hose
2. P.C.V. hose
3. Oil filler cap
4. Rocker cover
5. Rocker cover gasket
6. Oil seal
7. Oil seal
8. Rocker arm spring
9. Rocker arms and rocker arm shaft IN
10. Rocker arms and rocker arm shaft EX
11. Rocker arm B
12. Rocker arm A
13. Rocker arm shaft
14. Lash adjuster
15. Rocker arm C
16. Rocker arm shaft
17. Lash adjuster
18. Camshaft
Intentionally blank
**Removal and Installation <DOHC>**

**Removal steps**

1. Breather hose
2. P.C.V. hose
3. P.C.V. valve
4. P.C.V. valve gasket
5. Oil filler cap
6. Rocker cover
7. Rocker cover gasket A
8. Rocker cover gasket B
9. Semi-circular packing
10. Oil seal
11. Bearing cap
12. Intake camshaft
13. Exhaust camshaft
14. Rocker arm
15. Lash adjuster

*Apply engine oil to all moving parts before installation.*
**Removal and Installation <DOHC-GDI>**

Apply engine oil to all moving parts before installation.

**Removal steps**

1. Breather hose
2. P.C.V hose
3. P.C.V valve
4. P.C.V valve gasket
5. Oil filler cap
6. Rocker cover
7. Rocker cover gasket
8. Oil seal
9. Beam camshaft cap
10. Gasket
11. Intake camshaft
12. Exhaust camshaft
13. Rocker arm
14. Lash adjuster
Intentionally blank
Apply engine oil to all moving parts before installation.

Removal steps
1. Breather hose
2. P.C.V. hose
3. P.C.V. valve
4. P.C.V. valve gasket
5. Oil filler cap
6. Rocker cover
7. Rocker cover gasket
8. Oil seal
9. Beam camshaft cap
10. Gasket
11. Intake camshaft
12. Exhaust camshaft
13. Rocker arm
14. Lash adjuster
Removal steps

1. P.C.V. hose
2. P.C.V. valve
3. P.C.V. valve gasket
4. Breather hose
5. Oil filler cap
6. Rocker cover, intake
7. Rocker cover gasket, intake
8. Rocker cover, exhaust
9. Rocker cover gasket, exhaust
10. Oil seal
11. Circular packing
12. Beam camshaft cap
13. Beam camshaft cap gasket
14. Intake camshaft
15. Exhaust camshaft
16. Rocker arm
17. Lash adjuster
Apply engine oil to all moving parts before installation.

Removal steps
1. P.C.V. valve
2. P.C.V. valve gasket
3. Breather hose
4. Oil filler cap
5. Rocker cover, inlet
6. Rocker cover gasket, inlet
7. Rocker cover, exhaust
8. Rocker cover gasket, exhaust
9. Cover
10. O-ring
11. Oil seal
12. Beam camshaft cap
13. Beam camshaft cap gasket
14. Intake camshaft
15. Exhaust camshaft
16. Rocker arm
17. Lash adjuster
Apply engine oil to all moving parts before installation.

Removal steps
1. Breather hose
2. P.C.V. valve
3. P.C.V. valve gasket
4. Oil filler cap
5. Rocker cover
6. Rocker cover gasket
7. Oil seal
8. Thrust case
9. O-ring
10. Beam camshaft cap
11. Gasket
12. Intake camshaft
13. Exhaust camshaft
14. Rocker arm
15. Lash adjuster
REMOVAL SERVICE POINT

★A★ LASH ADJUSTER REMOVAL

Caution
- If the lash adjuster is re-used, clean the lash adjuster. (Refer to 11A-8-10.)

INSTALLATION SERVICE POINTS

★A★ ADJUSTING SCREW INSTALLATION

(1) Install provisionally the screw to the rocker arm. Insert it so that the end of the screw is flush with the edge of the rocker arm or projects slightly (1 mm or less).

★B★ ROCKER ARM SHAFT INSTALLATION

(1) Place the end with the larger chamfered side toward the timing belt side.

**NOTE**
The rocker arm shaft for intake valves has eight oil holes.

(2) Install the shaft with the oil holes toward the cylinder head.

★C★ ROCKER ARMS AND ROCKER ARM SHAFT INSTALLATION

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

**NOTE**
Move the rocker arms until they touch the rocker arm shaft mounting bosses on the cylinder head.

★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.
**E** OIL SEAL INSTALLATION

**F** LASH ADJUSTER INSTALLATION

**Caution**
- If the lash adjuster is re-used, clean the lash adjuster. (Refer to 11A-8-10.)

(1) Fit the lash adjuster onto the cylinder head using care not to allow diesel fuel to spill out.

**G** CAMSHAFT INSTALLATION

(1) Apply engine oil to the camshaft journals and cam before installing the camshaft. Use care not to confuse the intake camshaft with the exhaust camshaft.

**NOTE**
The rear end of the intake camshaft is provided with a 4 mm-wide slit.

**H** BEARING CAP INSTALLATION

(1) Locate the camshaft dowel pins as illustrated.

(2) Apply sealant to the locations shown in the illustration.

**Specified sealant:**
- 3M ATD Part No. 8660 or equivalent
(3) The bearing caps No. 2 through No. 5 are of the same shape. Before they are installed, check the cap number and the intake and exhaust identification marks.

Identification mark (stamped on front and No. 2 through No. 5 bearing caps)
L: Intake side
R: Exhaust side

(4) Make sure that the rocker arms are installed in the specified locations.

BEAM CAMSHAFT CAP INSTALLATION

(1) Locate the camshaft dowel pin as illustrated.

(2) Turn the crankshaft anticlockwise a quarter turn (90°).

(3) Apply a 3 mm thick continuous bead of sealant to the bottom surface of the beam camshaft cap along the groove.

Specified sealant:
Mitsubishi Genuine Part No. MD970389 or equivalent
(4) Apply sealant to the illustrated position of the cylinder head upper surface.

**Specified sealant:**
Mitsubishi Genuine Part No. MD970389 or equivalent

(5) Install the beam camshaft cap before the sealant applied becomes dry and hard.

(6) Tighten the bolts to the specified torque in the order shown in the illustration.
- M6 bolt 11Nm
- M8 bolt 21Nm

**Caution**
The M8 bolts plated green cannot be reused. Always replace such bolts with M8 bolts finished by glossy plating which are available separately.
The M8 bolt finished by glossy plating is reusable; if the caps have already been assembled with such bolts, then reassemble the caps using them.

(7) Install the camshaft oil seal (use the special tool) and the thrust case <DOHC-GDI for PAJERO io - 4G93> before the sealant applied becomes dry and hard.

(8) Wipe off squeezed out excess sealant from the circumference of the beam camshaft cap.
J SEALANT APPLICATION ON SEMI-CIRCULAR PACKING
Specified sealant: 3M ATD Part No.8660 or equivalent

K SEALANT APPLICATION ON ROCKER COVER
(1) Apply sealant to the areas indicated in the illustration.
Specified sealant: 3M ATD Part No.8660 or equivalent

L O-RING / COVER INSTALLATION
(1) Apply liquid gasket on the illustrated position of the cover.
Specified sealant: 3M ATD Part No.8660 or equivalent
(2) Lubricate the O-ring in the cover with engine oil. Install the cover in place on the cylinder head and the beam camshaft cap.

VALVE CLEARANCE ADJUSTMENT
Adjust the valve clearance by the following procedure.

Adjustment values (when engine is cold):
Intake valve: 0.09 mm
Exhaust valve: 0.20 mm

(1) Turn the crankshaft in the clockwise direction to align the camshaft sprocket timing marks and to set the No.1 cylinder to the compression top dead centre position.
(2) The valve clearances at the places indicated by arrows in the illustration can be adjusted.
(3) Use a thickness gauge to adjust the clearance between the ends of the valve stems and the adjusting screws.
(4) Hold the adjusting screws with a screwdriver so that they do not turn, and then tighten the lock nuts.
(5) Turn the crankshaft once in the clockwise direction to set the No.4 cylinder to the compression top dead centre position.
(6) Adjust the valve clearances indicated by arrows in the illustration by the same procedure as in steps (3) and (4) above.
### INSPECTION

#### CAMSHAFT

(1) Measure the cam height.

<table>
<thead>
<tr>
<th></th>
<th>Standard value mm</th>
<th>Limit mm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intake side</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4G92–SOHC*1</td>
<td>37.34</td>
<td>36.84</td>
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<tr>
<td>4G92–SOHC*2</td>
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<td>4G93–SOHC*5</td>
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<td>4G94–SOHC</td>
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<td>34.99</td>
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<tr>
<td>4G93–DOHC–GDI</td>
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<td>34.99</td>
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<tr>
<td>4G94–DOHC–GDI</td>
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<td>34.99</td>
</tr>
<tr>
<td><strong>Exhaust side</strong></td>
<td></td>
<td></td>
</tr>
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<td>4G92–SOHC*1</td>
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<td>37.33</td>
</tr>
<tr>
<td>4G92–SOHC*2</td>
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<tr>
<td>4G94–DOHC–GDI</td>
<td>34.91</td>
<td>34.41</td>
</tr>
</tbody>
</table>

*1: LANCER for Europe and CARISMA for Europe
*2: LANCER for general export and CARISMA for 6B model
*3: LANCER for Europe (from 2001 model) and CARISMA for Europe (from 2001 model)
*4: Except for Europe
*5: For Europe

#### LASH ADJUSTER

**SOHC**

**Caution**

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

(1) Prepare three containers and approximately five liters 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.

(3) While gently pushing down the internal steel ball using 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 remove dirty oil.

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.

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.

(5) Place the lash adjuster in container B. Then, gently push down the internal steel ball using 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.

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.
(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.

(7) Place the lash adjuster in container C. Then, gently push down the internal steel ball using special tool MD998442.

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

(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 from 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.
(DOHC)

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

(1) Prepare three containers and approximately five liters 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.

(3) While gently pushing down the internal steel ball using 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 remove dirty oil.

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.

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**
- Make sure the oil hole in the side of the body is pointing toward container A. Do not point the oil hole at yourself or other people.

(5) Place the lash adjuster in container B. Then, gently push down the internal steel ball using 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.

**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.

(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**
- Make sure the oil hole in the side of the body is pointing toward container B. Do not point the oil hole at yourself or other people.

(7) Place the lash adjuster in container C. Then, gently push down the internal steel ball using special tool MD998442.

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

(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 from 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.
8a. ROCKERS COVER AND CAMSHAFTS (MIVEC)

REMOVAL AND INSTALLATION

Apply engine oil to all moving parts before installation.

Removal steps:
1. Breather hose
2. PCV hose
3. Oil filler cap
4. Rocker cover
5. Rocker cover gasket
6. Oil seal
7. Oil seal
8. Oil control valve
9. Arm spring holder
10. Cam shaft bearing cap
11. Arm spring
12. Cam shaft
13. Cam shaft holder
14. Semi-circular packing
INSPECTION

1. OIL CONTROL VALVE

(1) Connect a 12VDC power supply between terminals (1) and (2) of the oil control valve and check if the valve operates smoothly.

2. CAMSHAFT

(1) Measure the cam heights. If the specified limit is exceeded, replace the camshaft.

<table>
<thead>
<tr>
<th></th>
<th>Standard value</th>
<th>Limit</th>
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</thead>
<tbody>
<tr>
<td>4G92 DOHC-MIVEC</td>
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<td></td>
</tr>
<tr>
<td>Intake A</td>
<td>36.41</td>
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<tr>
<td>Intake B</td>
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<tr>
<td>Exhaust A</td>
<td>35.83</td>
<td>35.33</td>
</tr>
<tr>
<td>Exhaust B</td>
<td>34.24</td>
<td>33.74</td>
</tr>
</tbody>
</table>
INSTALLATION SERVICE POINTS

A) SEMI-CIRCULAR PACKING INSTALLATION

(1) Apply the specified sealant to the area shown.

Specified sealant:
3M ATD Part No. 8660 or equivalent.

B) CAMSHAFT HOLDER ASSEMBLY INSTALLATION

(1) Apply the specified sealant to the area shown.

Specified sealant:
3M ATD Part No. 8660 or equivalent

C) CAMSHAFT INSTALLATION

(1) Ensure that the intake-side and exhaust-side camshafts are not reversed. The exhaust-side camshaft is longer and has a slot in its rear end.

(2) Set the No. 1 piston at the top dead center and install the camshafts with their cams for No. 1 cylinder directed upward so that the No. 1 cylinder becomes the top dead center on the compression stroke.

D) CAMSHAFT BEARING CAP / CAMSHAFT HOLDER INSTALLATION

(1) Confirm the identification mark on each bearing cap to install the cap in the correct position.

Identification mark
L1: Front bearing for exhaust camshaft
R1: Front bearing for intake camshaft
(2) Apply the specified sealant to the front and rear camshaft bearing caps at the positions shown. Position the camshaft bearing caps and tighten their mounting bolts not numbered in the illustration. Then tighten the remaining (numbered) bolts in the order shown in the illustration to install the bearing caps and camshaft holder to the cylinder head.

**Specified sealant:**

3M ATD part No. 8660 or equivalent

---

**E** OIL CONTROL VALVE INSTALLATION

(1) Apply the specified sealant to the area shown.

**Specified sealant:**

3M ATD Part No. 8660 or equivalent

---

**F** OIL SEAL INSTALLATION
ROCKER COVER INSTALLATION

Apply the specified sealant to the area shown.

Specified sealant:
3M ATD part No. 8660 or equivalent

VALVE CLEARANCE ADJUSTMENT

Adjustment must be performed with the cylinder at the top dead center on the compression stroke.

(1) Inserting the special tool between one of two adjusting screws and the valve and adjust the clearance.

(2) Then adjust the other adjusting screw in the same way.

ROCKER ARM PISTON INSPECTION

(1) Screw in the special tool to the rocker arm piston for high speed side rocker arm and check that the piston can be lifted up lightly by hand.
8b. ROCKER ARMS AND ROCKER SHAFT CAPS (MIVEC)

REMOVAL AND INSTALLATION

Removal steps
1. Rocker shaft cap
2. Seal cap “A”
3. Seal cap “B”
4. Spring guide
5. Wave washer
6. Intake rocker arm assembly “A”
7. Spring guide
8. Wave washer
9. Exhaust rocker arm assembly “A”
10. Camshaft holder

Apply engine oil to all moving parts before installation.

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PWE9502-A
INSTALLATION SERVICE POINT

■ A ■ ROCKER ARM ASSEMBLY INSTALLATION

(1) Install the rocker arm assemblies while checking the identification marks at the positions shown to ensure that the intake and exhaust sides are not reversed.

Identification marks:
- E: Intake
- I: Exhaust
9. CYLINDER HEAD AND VALVES

REMOVAL AND INSTALLATION <SOHC>

Removal steps

1. Cylinder head bolt
2. Cylinder head assembly
3. Cylinder head gasket
4. Retainer lock
5. Valve spring retainer
6. Valve spring
7. Exhaust valve
8. Retainer lock
9. Valve spring retainer
10. Valve spring
11. Intake valve
12. Valve stem seal
13. Valve spring seat
14. Valve stem seal
15. Valve spring seat
16. Exhaust valve guide
17. Intake valve guide
18. Exhaust valve seat
19. Intake valve seat
20. Cylinder head

Lubricate all internal parts with engine oil during reassembly.
Removal steps

1. Oil pressure switch
2. Cylinder head bolt
3. Cylinder head assembly
4. Cylinder head gasket
5. Retainer lock
6. Valve spring retainer
7. Valve spring
8. Exhaust valve
9. Retainer lock
10. Valve spring retainer
11. Valve spring
12. Intake valve
13. Valve stem seal
14. Valve spring seat
15. Valve stem seal
16. Valve spring seat
17. Exhaust valve guide
18. Intake valve guide
19. Exhaust valve seat
20. Intake valve seat
21. Cylinder head

Lubricate all internal parts with engine oil during assembly.
Apply engine oil to all moving parts before installation.

Removal steps:

1. Oil pressure switch
2. Cylinder head bolt
3. Cylinder head assembly
4. Cylinder head gasket
5. Retainer lock
6. Valve spring retainer
7. Valve spring
8. Intake valve
9. Retainer lock
10. Valve spring retainer
11. Valve spring
12. Exhaust valve
13. Valve stem seal
14. Valve spring seat
15. Valve stem seal
16. Valve spring seat
17. Intake valve guide
18. Exhaust valve guide
19. Intake valve seat
20. Exhaust valve seat
21. Cylinder head
REMVAL AND INSTALLATION <DOHC-GDI>

Apply engine oil to all moving parts before installation.

Removal steps

1. Cylinder head bolt
2. Cylinder head assembly
3. Cylinder head gasket
4. Retainer lock
5. Valve spring retainer
6. Valve spring
7. Intake valve
8. Retainer lock
9. Valve spring retainer
10. Valve spring
11. Exhaust valve
12. Valve stem seal
13. Valve spring seat
14. Valve stem seal
15. Valve spring seat
16. Intake valve guide
17. Exhaust valve guide
18. Intake valve seat
19. Exhaust valve seat
20. Cylinder head
REMOVAL SERVICE POINTS

(A) CYLINDER HEAD BOLT REMOVAL
(1) Loosen the cylinder head bolts using the special tool.

(B) RETAINER LOCK REMOVAL
(1) Store the removed valves, springs and other parts, tagged to indicate their cylinder No. and location to aid reassembly.
**D** VALVE HANDLING PRECAUTIONS

(1) Sodium reacts violently with water or moisture generation heat and liberating hydrogen. It must be handled with utmost care because otherwise the following dangerous conditions may result:
- Loss of eyesight if sodium gets in eyes.
- Burns if sodium contact skin.
- Fire hazard.

(2) Handling of Sodium-filled Exhaust Valves
Sodium-filled exhaust valves are not dangerous and may be handled in the same way as ordinary valves unless they are broken.
Never try to break the valves and expose sodium to the air. When worn exhaust valves are to be discarded, have them disposed of by a salvage company equipped with special disposal system, notifying them that the valves contain sodium.
Should the exhaust valves be broken, neutralize sodium using the method described below, and discard the valves in the same way as ordinary valves.

(3) How to Neutralize Sodium
Place a container filled with more than 10 liters of water in a well ventilated large space.
Wear rubber gloves and goggles, and carefully take out broken valves from the cylinder head.
Put a broken valve in the water-filled container and quickly get away from the container at least 2 or 3 m (6.6 or 10 ft.)
Caution
- Valves must be neutralized one at a time.
- Put a valve in the container only after sodium in the preceding one has completely reacted with water.

Keep fire away from the container during the neutralization. The resulting hydrogen gas is highly explosive.

When the reaction has finished (there is no more generation of hydrogen gas), take the valves out of the container with large tweezers or the like.

NOTE
The reaction occurs when water enters the cavity in the valve. Hydrogen gas may be trapped inside the valve, temporarily blocking the water passage. In such a case, wait until hydrogen gas in released and remaining sodium reacts with water.

After the neutralization of sodium, water in the container contains sodium hydroxide and is highly alkaline. The water solution should be disposed of according to local regulations.

Caution
- Do not let the solution contact the eyes or the skin.
- Should it get in the eyes, immediately flush them with clean water thoroughly, and receive medical attention. When it contacts the skin, wash with ample amounts of clean water.

INSTALLATION SERVICE POINTS

VALVE STEM SEAL INSTALLATION
(1) Install the valve spring seat.
(2) Use the special tool to install the valve stem seal. Improper installation could result oil leaking past the valve guide.

Caution
Do not reuse removed valve stem seals.
**B. VALVE SPRING INSTALLATION**

1. Install the valve spring with the painted end on the rocker arm side.

**C. RETAINER LOCK INSTALLATION**

1. 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. When installing the cylinder head bolts, check that the shank length of each bolt meets the limit. If the limit is exceeded, replace the bolts.

   **Limit:** Max. 96.4 mm

2. Install the washers as illustrated.
3. Apply engine oil to the bolt threads and washers.
(4) According to the tightening sequence, tighten the bolts to the specified torque 74 Nm.
(5) Loosen all bolts fully.
(6) Retighten the loosened bolts to a torque of 20 Nm in the specified tightening sequence.
(7) Make paint marks on the cylinder head bolt heads and cylinder head.
(8) Give a 90° turn to the cylinder head bolts in the specified tightening sequence.
(9) Give another 90° turn to the cylinder head bolts and make sure that the paint mark on the head of each cylinder head bolt and that on the cylinder head are on the same straight line.

Caution
1. If the bolt is turned less than 90°, proper fastening performance may not be expected. When tightening the bolt, therefore, be careful to give a sufficient turn to it.
2. If the bolt is overtightened, loosen the bolt completely and then retighten it by repeating the tightening procedure from step (1).

▶ SEALANT APPLICATION TO OIL PRESSURE SWITCH
(1) Apply sealant to the threads of the switch.
   Specified sealant:
   3M ATD Part No. 8660 or equivalent
   Caution
   Use care not to allow the sealant to plug the oil passage.
INSPECTION

CYLINDER HEAD

(1) Check the cylinder head gasket surface for flatness by using a straightedge and thickness gauge.

   Standard value: 0.03 mm
   Limit: 0.2 mm

(2) If the service limit is exceeded, correct to meet the specification.

   Grinding limit: *0.2 mm
   *Includes/combined with cylinder block grinding

Cylinder head height (Specification when new):

- **SOHC**
  - Intake: 119.9 - 120.1 mm
  - Exhaust: 113.70 mm

- **DOHC**
  - Intake: 131.9 - 132.1 mm
  - Exhaust: 103.87 mm

- **DOHC-MIVEC**
  - Intake: 115.63 mm
  - Exhaust: 115.63 mm

- **DOHC-GDI**
  - Intake: 104.19 mm
  - Exhaust: 103.87 mm

VALVE

(1) Check the valve face for correct contact. If incorrect, reface using a valve refacer. Valve should make a uniform contact with the seat at the centre of valve face.

(2) If the margin is smaller than the service limit, replace the valve.

<table>
<thead>
<tr>
<th></th>
<th>Standard value mm</th>
<th>Limit mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake</td>
<td>1.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Exhaust</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOHC</td>
<td>1.3</td>
<td>0.8</td>
</tr>
<tr>
<td>DOHC</td>
<td>1.2</td>
<td>0.7</td>
</tr>
</tbody>
</table>

(3) Measure the overall height of the valve. If the specified limit is exceeded, replace the valve.

<table>
<thead>
<tr>
<th></th>
<th>Standard value mm</th>
<th>Limit mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake SOHC</td>
<td>110.15</td>
<td>109.65</td>
</tr>
<tr>
<td>DOHC</td>
<td>104.19</td>
<td>103.69</td>
</tr>
<tr>
<td>DOHC-MIVEC</td>
<td>115.63</td>
<td>115.13</td>
</tr>
<tr>
<td>DOHC-GDI</td>
<td>104.19</td>
<td>103.69</td>
</tr>
<tr>
<td>Exhaust SOHC</td>
<td>113.70</td>
<td>113.20</td>
</tr>
<tr>
<td>DOHC</td>
<td>103.87</td>
<td>103.37</td>
</tr>
<tr>
<td>DOHC-MIVEC</td>
<td>115.63</td>
<td>115.13</td>
</tr>
<tr>
<td>DOHC-GDI</td>
<td>103.87</td>
<td>103.37</td>
</tr>
</tbody>
</table>
VALVE SPRING
(1) Measure the valve spring’s free height. If the measurement is less than specified, replace the spring.

<table>
<thead>
<tr>
<th></th>
<th>Standard value mm</th>
<th>Limit mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOHC (with adjusting screw)</td>
<td>50.9</td>
<td>49.9</td>
</tr>
<tr>
<td>SOHC (with lash adjuster)</td>
<td>49.5</td>
<td>48.5</td>
</tr>
<tr>
<td>DOHC</td>
<td>45.0</td>
<td>44.0</td>
</tr>
<tr>
<td>DOHC–MIVEC</td>
<td>51.5</td>
<td>50.5</td>
</tr>
<tr>
<td>DOHC–GDI</td>
<td>44.8</td>
<td>43.8</td>
</tr>
</tbody>
</table>

(2) Measure the squareness of the spring. If the measurement exceeds the specified limit, replace the spring.

Standard value: $2^\circ$ or less
Limit: $4^\circ$

VALVE SEAT
(1) 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.

<table>
<thead>
<tr>
<th></th>
<th>Standard value mm</th>
<th>Limit mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOHC</td>
<td>49.30</td>
<td>49.80</td>
</tr>
<tr>
<td>DOHC</td>
<td>46.70</td>
<td>47.20</td>
</tr>
<tr>
<td>DOHC–MIVEC</td>
<td>57.85</td>
<td>58.35</td>
</tr>
<tr>
<td>DOHC–GDI</td>
<td>46.65</td>
<td>47.15</td>
</tr>
<tr>
<td>Exhaust</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOHC</td>
<td>49.35</td>
<td>49.85</td>
</tr>
<tr>
<td>DOHC</td>
<td>46.65</td>
<td>47.15</td>
</tr>
<tr>
<td>DOHC–MIVEC</td>
<td>58.13</td>
<td>58.63</td>
</tr>
<tr>
<td>DOHC–GDI</td>
<td>46.70</td>
<td>47.20</td>
</tr>
</tbody>
</table>

VALVE GUIDE
(1) Measure the clearance between the valve guide and valve stem. If the limit is exceeded, replace the valve guide or valve, or both.

Standard value:
Intake: 0.02 – 0.05 mm
Exhaust: 0.05 – 0.09 mm

<SOHC, DOHC, DOHC–MIVEC, DOHC–GDI for CARISMA, SPACE STAR, SPACE RUNNER, GALANT>
0.04 – 0.06 mm <DOHC–GDI for PAJERO io>

Limit:
Intake: 0.10 mm
Exhaust: 0.15 mm
VALVE SEAT RECONDITIONING PROCEDURE
(1) Before correcting the valve seat, check the clearance between the valve guide and valve. If necessary, replace the valve and/or 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 thin the wall thickness. Then, remove the valve seat.
(2) Rebore the valve seat hole in the cylinder head to a selected oversize valve seat diameter.

<table>
<thead>
<tr>
<th>Valve Type</th>
<th>Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake</td>
<td>31.80 - 31.83 mm</td>
</tr>
<tr>
<td></td>
<td>34.30 - 34.33 mm</td>
</tr>
<tr>
<td>Exhaust</td>
<td>29.30 - 29.32 mm</td>
</tr>
<tr>
<td></td>
<td>30.80 - 30.83 mm</td>
</tr>
</tbody>
</table>

(3) Before fitting the valve seat, either heat the cylinder head up to approximately 250°C or cool the valve seat in liquid nitrogen, to prevent the cylinder head bore from galling.
(4) Correct the valve seat to the specified width and angle.

VALVE GUIDE REPLACEMENT
(1) Force the valve guide out toward the cylinder block using a press.
(2) Machine the valve guide hole in the cylinder head to the size of the oversize valve guide to be installed.

Caution
Do not use the valve guide of the same size as the removed one.

<table>
<thead>
<tr>
<th>Valve Guide Hole Diameter</th>
<th>Oversize</th>
<th>0.05 O.S.</th>
<th>11.05 - 11.07 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.25 O.S.</td>
<td>11.25 - 11.27 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.50 O.S.</td>
<td>11.50 - 11.52 mm</td>
<td></td>
</tr>
</tbody>
</table>
(3) Press-fit the valve guide until it protrude specified value (SOHC: 14 mm, DOHC: 19 mm) as shown in the illustration.

**Caution**

1. Press the valve guide from the cylinder head top surface.
2. Valve guide for intake valve and that for exhaust valve are different in length. (45.5 mm for intake valve; 50.5 mm for exhaust valve)

(4) After the valve guide has been installed, insert a new valve to check for smooth sliding motion.
10. FRONT CASE AND OIL PUMP

REMOVAL AND INSTALLATION <SOHC (4G92, 4G93)>

Apply engine oil to all moving parts before installation.

Removal steps

1. Oil pressure switch
2. Oil filter
3. Drain plug
4. Drain plug gasket
5. Transmission stay
6. Oil pan
7. Oil screen
8. Oil screen gasket
9. Relief plug
10. Relief spring
11. Relief plunger
12. Oil seal
13. Oil pump case
14. O-ring
15. Oil pump case cover
16. Outer rotor
17. Inner rotor
Apply engine oil to all moving parts before installation.

**Removal steps**

- 1. Oil pressure switch
- 2. Oil filter
- 3. Drain plug
- 4. Drain plug gasket
- 5. Cover
- 6. Baffle plate
- 7. Upper oil pan
- 8. Lower oil pan
- 9. Oil screen
- 10. Oil screen gasket
- 11. Relief plug
- 12. Relief spring
- 13. Relief plunger
- 14. Oil seal
- 15. Oil pump case
- 16. O-ring
- 17. Oil pump case cover
- 18. Outer rotor
- 19. Inner rotor
Apply engine oil to all moving parts before installation.

Removal steps

1. Oil pressure switch
2. Oil filter
3. Drain plug
4. Drain plug gasket
5. Cover
6. Upper oil pan
7. Lower oil pan
8. Oil screen
9. Oil screen gasket

10. Relief plug
11. Relief spring
12. Relief plunger
13. Oil seal
14. Oil pump case
15. O-ring
16. Oil pump case cover
17. Outer rotor
18. Inner rotor
Removal steps

1. Oil pressure switch
2. Oil filter
3. Drain plug
4. Drain plug gasket
5. Cover (GDI, MIVEC)
6. Baffle plate

<Except SPACE RUNNER>

7. Upper oil pan
8. Lower oil pan
9. Oil screen
10. Oil screen gasket
11. Relief plug
12. Relief spring
13. Relief plunger
14. Oil seal
15. Oil pump case
16. O-ring
17. Oil pump case cover
18. Outer rotor
19. Inner rotor

Apply engine oil to all moving parts before installation.
Apply engine oil to all moving parts before installation.

Removal steps:
1. Oil pressure switch
2. Oil filter
3. Drain plug
4. Drain plug gasket
5. Cover
6. Upper oil pan
7. Lower oil pan
8. Oil screen
9. Oil screen gasket
10. Relief plug
11. Relief spring
12. Relief plunger
13. Oil seal
14. Oil pump case
15. O-ring
16. Oil pump case cover
17. Outer rotor
18. Inner rotor
REMOVAL SERVICE POINTS

A. OIL PAN REMOVAL
(1) Knock in the special tool deeply between the oil pan and the cylinder block.
(2) Hitting the side of the special tool, slide the special tool along the oil pan to remove the oil pan.

B. REMOVAL OF UPPER OIL PAN
(1) At first remove the bolt (Length: 121 mm <DOHC, DOHC-GDI for CARISMA>, 116 mm <DOHC-GDI for PAJERO io>) which is nearest to flywheel, and the remove the other bolts.
Caution
Never use the special tool (oil pan remover), etc.

C. OUTER ROTOR/INNER ROTOR REMOVAL
(1) Make alignment dots on the outer and inner rotors for reference in reassembly.

INSTALLATION SERVICE POINTS

A. INNER ROTOR/OUTER ROTOR INSTALLATION
(1) Apply engine oil to the rotors. Then, install the rotors ensuring that the alignment dots made at disassembly are properly aligned.

B. SEALANT APPLICATION TO OIL PUMP CASE
Specified sealant:
Mitsubishi Genuine Part No. MD970389 or equivalent
**C** CRANKSHAFT FRONT OIL SEAL INSTALLATION

Using the special tool, knock the oil seal into the oil pump case.

**D** OIL PAN/UPPER OIL PAN/LOWER OIL PAN INSTALLATION

1. Remove all the remaining gasket from the mating surfaces using a scraper or a wire brush.
2. Apply a 4 mm diameter bead of sealant to the oil pan flange. See “Form-In-Place Gasket” in “SPECIFICATIONS”.

   **Specified sealant:**
   - Mitsubishi Genuine Part No. MD970389 or equivalent

3. Install the oil pan within 15 minutes after applying the sealant.
(4) Tighten the lower oil pan mounting bolts in the sequence shown in the illustration.

**E** OIL FILTER INSTALLATION

1. Clean the filter installation surface of the cylinder block.
2. Apply engine oil to the O-ring of the oil filter.
3. Screw in the oil filter until its O-ring comes in contact with the base. Then tighten one more turn.

**F** SEALANT APPLICATION TO OIL PRESSURE SWITCH

1. Apply sealant to the threads of the switch.
   - Specified sealant: 3M ATD Part No. 8660 or equivalent
   - Caution: Use care not to allow the sealant to plug the oil passage.

**INSPECTION**

**OIL PUMP**

1. Check the tip clearance.
   - Standard value: 0.06 – 0.18 mm
(2) Check the side clearance.
   Standard value: 0.04 - 0.10 mm

(3) Check the body clearance.
   Standard value: 0.10 - 0.18 mm
   Limit: 0.35 mm
11. PISTON AND CONNECTING ROD
REMOVAL AND INSTALLATION

Lubricate all internal parts with engine oil during re-assembly.

Removal steps
1. Nut
2. Connecting rod cap
3. Connecting rod bearing
4. Piston and connecting rod
5. Connecting rod bearing
6. Piston ring No. 1
7. Piston ring No. 2
8. Oil ring
9. Piston pin
10. Piston
11. Connecting rod
12. Bolt
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.

☞B☜ PISTON PIN REMOVAL

Piston pin setting tool (MD998780) consists of the parts shown in the illustration at left. To remove the piston pin, Guide D (MB991659) is also used in combination with the Piston pin setting tool.

(1) Insert the Push Rod (special tool) into the piston from the side on which the front mark is stamped in the piston head, and attach the guide D to the push rod end.

(2) Place the piston and connecting rod assembly on the Piston Pin Setting Base (special tool) with the front mark facing upward.

(3) Using a press, remove the piston pin.

NOTE
Keep the disassembled pistons, piston pins and connecting rods in order according to the cylinder number.
A. PISTON PIN INSTALLATION

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

<table>
<thead>
<tr>
<th>Cylinder bore size mark</th>
<th>Piston class</th>
<th>Piston size mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>B</td>
<td>B</td>
<td>None</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
</tbody>
</table>

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

2. Measure the following dimensions of the piston, piston pin and connecting rod.
   A: Piston pin insertion hole length
   B: Distance between piston bosses
   C: Piston pin length
   D: Connecting rod small end width

3. Calculate the following formula by substituting the measured value.
   \[ L = \frac{(A - C) - (B - D)}{2} \]

4. Insert the Push Rod (special tool) into the piston pin and attach the guide A to the push rod end.

5. Assemble the connecting rod in the piston with their front marks facing the same direction.

6. Apply engine oil to the entire periphery of the piston pin.

7. Insert the piston pin, push rod and guide A assembly having assembled in step (3) from the guide A side into the piston pin hole on the front marked side.

8. Screw the guide B into the guide A until the gap between both guides amounts to the value L obtained in step (3) plus 3 mm.
(9) Place the piston and connecting rod assembly onto the piston setting base with the front marks directed upward.
(10) Press-fit the piston pin using a press. If the press-fitting force required is less than the standard value, replace the piston and piston pin set or/and the connecting rod.

**Standard value:** 4,500 – 14,700 N

---

**OIL RING INSTALLATION**

(1) Fit the oil ring spacer into the piston ring groove. Install the upper side rail, and then install the lower side rail.

**NOTE**

1. The side rails and spacer may be installed in either direction.
2. New spacer and side rail are painted with the following identification colour according to the size.

<table>
<thead>
<tr>
<th>Size</th>
<th>Identification colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard size</td>
<td>None *1 or red *2</td>
</tr>
<tr>
<td>0.50 mm O.S.</td>
<td>Blue</td>
</tr>
<tr>
<td>1.00 mm O.S.</td>
<td>Yellow</td>
</tr>
</tbody>
</table>

*1: Except PAJERO io 4G94–16-valve for General Export, South Africa, Egypt
*2: PAJERO io 4G94–16-valve for General Export, South Africa, Egypt

3. To install the side rail, first fit one end of the rail into the piston groove, then press the remaining portion into position by finger as shown in the illustration.

**Caution**

Do not use piston ring expander when installing side rail. Use of piston ring expander to expand the side rail end gap can break the side rail, unlike other piston rings.

(2) Make sure that the side rails move smoothly in either direction.
**C** PISTON RING NO.2/PISTON RING NO.1 INSTALLATION

(1) Using piston ring expander, install the piston rings with their side having identification marks facing up.

**Identification mark:**
No.1 ring: T
No.2 ring: 2T or T2

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

<table>
<thead>
<tr>
<th>Size</th>
<th>Size mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard size</td>
<td>None</td>
</tr>
<tr>
<td>0.50 mm O.S.</td>
<td>50</td>
</tr>
<tr>
<td>1.00 mm O.S.</td>
<td>100</td>
</tr>
</tbody>
</table>

**D** PISTON AND CONNECTING ROD INSTALLATION

(1) Liberally coat engine oil on the circumference of the piston, piston ring and oil ring.

(2) Arrange the piston ring and oil ring gaps (side rail and spacer) as shown in the illustration.

(3) Face the front mark (arrow) on the top of the piston toward the camshaft sprocket.

(4) Using a suitable piston ring compressor tool, insert the piston and connecting rod assembly into the cylinder block.

**Caution**
Do not strike the piston into the cylinder block because the piston ring or crank pin will be damaged.
CONNECTING ROD BEARING INSTALLATION

1. When the bearings are to be replaced, select correct ones according to the identification marks stamped in the crankshaft.

<table>
<thead>
<tr>
<th>Crankshaft</th>
<th>Connecting rod bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin O.D. identification mark</td>
<td>Identification mark (service part)</td>
</tr>
<tr>
<td>1</td>
<td>S1 or 1</td>
</tr>
<tr>
<td>2</td>
<td>S2 or 2</td>
</tr>
<tr>
<td>3</td>
<td>S3 or 3</td>
</tr>
</tbody>
</table>
CONNECTING ROD CAP INSTALLATION

(1) Mate the correct bearing cap with the correct connecting rod by checking with the alignment marks marked during disassembly. If a new connecting rod has no alignment mark, position the notches for locking the bearing on the same side.

(2) Check if the thrust clearance in the connecting rod big end is correct.

Standard value: 0.10 – 0.25 mm
Limit: 0.4 mm

CONNECTING ROD CAP NUT INSTALLATION

Caution
If the cylinder head has been installed before installing the connecting rod cap nut, be sure to remove the spark plugs.

(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 fingers to 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 thread portion and bearing surface of the nut.

(3) Install each nut to the bolt and tighten it with fingers. Then tighten the nuts alternately to install the cap properly.

(4) Tighten the nuts to a torque of 20 Nm.

(5) Make a paint mark on the head of each nut.

(6) Make a paint mark on the bolt end at the position 90° to 100° from the paint mark made on the nut in the direction of tightening the nut.

(7) Give a 90° to 100° turn to the nut and make sure that the paint mark on the nut and that on the bolt are in alignment.

Caution
1. If the nut is turned less than 90°, proper fastening performance may not be expected. When tightening the nut, therefore, be careful to give a sufficient turn to it.

2. If the nut is overtightened (exceeding 100°), loosen the nut completely and then retighten it by repeating the tightening procedure from step (1).
INSPECTION

PISTON RING

(1) Check the clearance between the piston ring and ring groove. If the limit is exceeded, replace the ring or piston, or both.

Standard value:
   No.1: 0.03 – 0.07 mm
   No.2: 0.02 – 0.06 mm

Limit:
   No.1: 0.1 mm
   No.2: 0.1 mm

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 thickness gauge. If the ring gap is excessive, replace the piston ring.

Standard value:
   No.1: 0.25 – 0.40 mm (4G92, 4G93)
   0.15 – 0.30 mm (4G94)
   No.2: 0.40 – 0.55 mm

Oil:
   SOHC (4G92, 4G93): 0.20 – 0.60 mm
   SOHC (4G94), DOHC: 0.10 – 0.35 mm

Limit:
   No.1, No.2: 0.8 mm
   Oil: 1.0 mm

CRANKSHAFT PIN OIL CLEARANCE (PLASTIGAUGE METHOD)

(1) Remove oil from crankshaft pin and connecting rod bearing.
(2) Cut the Plastigauge 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 bolts to specified torque.
(4) Carefully remove the connecting rod cap.
(5) Measure the width of the Plastigauge at its widest part by using a scale printed on the Plastigauge package.

Standard value: 0.02 – 0.05 mm

Limit: 0.1 mm
12. CRANKSHAFT, CYLINDER BLOCK, FLYWHEEL AND DRIVE PLATE REMOVAL AND INSTALLATION (MANUAL TRANSMISSION)

Removal steps

1. Flywheel bolt
2. Flywheel
3. Flywheel bolt
4. Plate
5. Adapter plate
6. Flywheel
7. Adapter plate
8. Rear plate
9. Bell housing cover
10. Rear oil seal case
11. Oil seal
12. Baffle plate
13. Bearing cap bolt
14. Bearing cap
15. Crankshaft bearing, lower
16. Crankshaft
17. Thrust plate
18. Crankshaft bearing, upper
19. Knock sensor
20. Oil jet
21. Cylinder block

Caution
On the flexible wheel equipped engines, do not remove any of the bolts “A” of the flywheel shown in the illustration.
The balance of the flexible 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 AND INSTALLATION (AUTOMATIC TRANSMISSION)

**Removal steps**

1. Flywheel bolt
2. Adapter plate
3. Drive plate
4. Drive plate bolt
5. Adapter plate
6. Drive plate
7. Rear plate
8. Bell housing cover
   <4G92–SOHC, 4G93–SOHC>
9. Rear oil seal case
10. Oil seal
11. Baffle plate
   <MIVEC engine manufactured from Nov. 1995 to Dec. 1995>
12. Bearing cap bolt
13. Bearing cap
14. Crankshaft bearing, lower
15. Crankshaft
16. Thrust plate
17. Crankshaft bearing, upper
18. Knock sensor
   <Except GALANT–CARBURETOR, LANCER for Australia>
19. Oil jet <DOHC–MIVEC>
20. Cylinder block

**Apply engine oil to all moving parts before installation.**
**REMOVAL AND INSTALLATION <PAJERO io>**

Apply engine oil to all moving parts before installation.

Removal steps

1. Flywheel bolt <M/T>
2. Flywheel <M/T>
3. Flywheel bolt <M/T>
4. Plate <M/T>
5. Adapter plate <M/T>
6. Flywheel <M/T>
7. Adapter plate <M/T>
8. Drive plate bolt <A/T>
9. Adapter plate <A/T>
10. Drive plate <A/T>
11. Crankshaft adaptor <A/T>
12. Rear plate
13. Bell housing cover <with transmission stay>
14. Rear oil seal case
15. Oil seal
16. Bearing cap bolt
17. Bearing cap
18. Crankshaft bearing, lower
19. Crankshaft
20. Thrust plate
21. Crankshaft bearing, upper
22. Knock sensor
23. Cylinder block

**Caution**

On the flexible wheel equipped engines, do not remove any of the bolts “A” of the flywheel shown in the illustration. The balance of the flexible 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 SERVICE POINT

**A** OIL JET REMOVAL

(1) Knock out the oil jets using an appropriate metal rod.

**Caution**
1. Be careful not to scratch the cylinder wall.
2. Do not reuse the removed oil jets.

INSTALLATION SERVICE POINTS

**A** OIL JET INSTALLATION

(1) Using a 4.5 mm diameter pin punch, drive in the oil jet to the crankshaft journal until it seats to the bottom.

**B** CRANKSHAFT BEARING INSTALLATION

(1) When the bearings are to be replaced, select correct ones and install them in the correct positions according to the identification marks stamped on the crankshaft and the top surface of the cylinder block.

<table>
<thead>
<tr>
<th>Crankshaft journal</th>
<th>Cylinder block bearing bore</th>
<th>Crankshaft bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification mark</td>
<td>Identification mark (service parts)</td>
<td>Identification colour (Line production parts)</td>
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<tr>
<td>1</td>
<td>0</td>
<td>S1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>S2</td>
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<tr>
<td></td>
<td>2</td>
<td>S3</td>
</tr>
<tr>
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<td>0</td>
<td>S2</td>
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<td>1</td>
<td>S3</td>
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<tr>
<td></td>
<td>2</td>
<td>S4</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>S3</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>S4</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>S5</td>
</tr>
</tbody>
</table>

*: Older bearings may be marked in red.
(2) Install the bearings having an oil groove to the cylinder block.
(3) Install the bearings having no oil groove on the bearing caps.
(4) Install the thrust bearings at the No. 3 upper bearing with the grooved side towards the crank web.
BEARING CAP/BEARING CAP BOLT INSTALLATION

1. Install the bearing caps so that their arrows are positioned on the time belt side.

2. When installing the bearing cap bolts, check that the shank length of each bolt meets the limit. If the limit is exceeded, replace the bolt.
   
   **Limit:** max. 71.1 mm

3. Apply engine oil to the threaded portion and bearing surface of the bolt.

4. Tighten the bearing cap bolts to 25 Nm torque in the tightening sequence.

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

6. Make a paint mark on the area around the bolt bearing surface at location 90° to 100° in the direction of tightening the bolt, as referenced from the paint mark on the bolt head.

7. Give a 90° to 100° turn to the bolts in the tightening sequence. Make sure that the paint mark on the bolt and that on the area around the bolt bearing surface are in alignment.

**Caution**

1. If the bolt is turned less than 90°, proper fastening performance may not be expected. When tightening the bolt, therefore, be careful to give a sufficient turn to it.

2. If the bolt is overtightened (exceeding 100°), loosen the bolt completely and then retighten it by repeating the tightening procedure from step (1).

8. After installing the bearing caps, make sure that the crankshaft turns smoothly and the end play is correct. If the end play exceeds the limit, replace crankshaft bearings.

**Standard value:** 0.05 – 0.25 mm

**Limit:** 0.4 mm
OIL SEAL INSTALLATION

SEALANT APPLICATION TO OIL SEAL CASE

Specified sealant:
Mitsubishi Genuine Part No. MD970389 or equivalent

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 specified sealant to the thread of bolts.

Specified sealant:
3M Nut Locking Part No. 4171 or equivalent

(5) Tighten the bolts to specified torque.

INSPECTION
CRANKSHAFT JOURNAL OIL CLEARANCE (PLASTIGAUGE METHOD)

(1) Remove oil from the crankshaft journal and he crankshaft bearing.
(2) Install the crankshaft.
(3) Cut the Plastigauge 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 Plastigauge at its widest part by using a scale printed on the Plastigauge package.

Standard value: 0.02 – 0.04 mm
Limit: 0.1 mm
CYLINDER BLOCK

(1) Using a straightedge and thickness gauge, check the block top surface for warpage. Make sure that the surface is free from gasket chips and other foreign matter.

**Standard value:** 0.05 mm or less

**Limit:** 0.1 mm

(2) If the distortion is excessive, correct within the allowable limit or replace.

**Grinding limit:** 0.2 mm

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

**Cylinder block height (when new):**
- 243.5 mm <4G92>
- 263.5 mm <4G93>
- 286.7 mm <4G94>

(3) Check the cylinder walls for scratches and seizure. If defects are evident, correct (bored to oversize) or replace.

(4) Using a cylinder gauge, measure the cylinder bore and cylindricity. If worn badly, correct the cylinder to an oversize and replace the piston and piston rings. Measure at the points shown in illustration.

**Standard value:**

- **Cylinder inner diameter:**
  - 4G92, 4G93: 81.00 – 81.03 mm
  - 4G94: 81.50 – 81.53 mm

- **Out-of-roundness and taper of cylinder bore:** 0.01 mm or less

BORING CYLINDER

(1) Oversize pistons to be used should be determined on the basis of the largest bore cylinder.

**Piston size identification**

<table>
<thead>
<tr>
<th>Size</th>
<th>Identification mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50 mm O.S.</td>
<td>0.50</td>
</tr>
<tr>
<td>1.00 mm O.S.</td>
<td>1.00</td>
</tr>
</tbody>
</table>

**NOTE**

Size mark is stamped on the piston top.

(2) Measure outside diameter of piston to be used. Measure it in thrust direction as shown.

(3) Based on the measured piston O.D., calculate the boring finish dimension.

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

(4) Bore all cylinders to the calculated boring finish dimension.
Caution
To prevent distortion that may result from temperature rise during honing, bore cylinders, in the order of No. 2, No. 4, No.1 and No. 3.

(5) Hone to the final finish dimension (Piston O.D. + clearance between piston O.D. and cylinder.)

(6) Check the clearance between piston and cylinder.

Clearance between piston and cylinder:
\[ 0.02 - 0.04 \, \text{mm} \]

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

HYDRO-FLYWHEEL <DOHC–GDI for PAJERO io>

(1) Check the rear side of the flywheel for color of the hatched area A in the illustration, and determine whether it is serviceable or not in accordance with the criteria given in the following table.

If judged unendurable for reuse, replace the flywheel assembly.

<table>
<thead>
<tr>
<th>Color</th>
<th>Purple</th>
<th>Dark blue</th>
<th>Light blue</th>
<th>Gray</th>
</tr>
</thead>
<tbody>
<tr>
<td>Judgment</td>
<td>Reusable</td>
<td>Not reusable</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(2) Measure the play in the circumferential direction using the following procedure.

(3) Turn the flywheel clockwise and anticlockwise to measure the distance over which the dowel pin moves freely.

Limit: 9 mm

(4) Check the friction surface for runout in the following manner.

(5) Apply a thrust force of approx. 98 N by hand on the flywheel to move it in the axial direction, and measure the runout at the dowel pin position. If the limit is exceeded, replace the flywheel assembly.

Limit: 0.75 mm
Service Bulletins

Click on the applicable bookmark to select the Service Bulletin.
## SERVICE BULLETIN

**No.:** MSB-99E11-001  
**Date:** 1999-12-15  

<table>
<thead>
<tr>
<th>Subject:</th>
<th>CHANGE IN POSITIONS OF CRANKSHAFT IDENTIFICATION MARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group:</td>
<td>ENGINE</td>
</tr>
<tr>
<td>Draft No.:</td>
<td>99EN531509</td>
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### INFORMATION

INTERNATIONAL CAR ADMINISTRATION OFFICE  
T. NITTA - PROJECT LEADER  
AFTER SALES SERVICE & CS PROMOTION

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1. **Description:**

This Service Bulletin informs you that the journal O.D. identification marks and the pin O.D. identification marks have been changed in their positions.

2. **Applicable Manuals:**

<table>
<thead>
<tr>
<th>Manual</th>
<th>Pub. No.</th>
<th>Language</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>'98 4G9 Series</td>
<td>PWEE9502-E</td>
<td>(English)</td>
<td>11A-12-2</td>
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<td>(E-W) Engine Supplement</td>
<td>PWES9503-E</td>
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</table>

3. **Effective Date:**

From September 1997  
Effective model: 4G93-G-10Z3K (HP9123)
• Crankshaft weight
1. **Description:**
   This service bulletin informs you of disuse of one of the backup rings that has been used in each fuel injector on GDI engines.

2. **Applicable Manuals:**
   See attachment.

3. **Effective date:**
   From the engines produced in the middle of July 2002. This modification is also applicable to the engines produced before that date, as modified injectors will be supplied as service parts for these engines.

4. **Details:**
   The backup ring indicated by the arrow in the drawing below has been disused.
## Attachment

### Applicable Manuals:

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>ENGINE 4G6 (E–W) Workshop Manual</td>
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