Engine Top End

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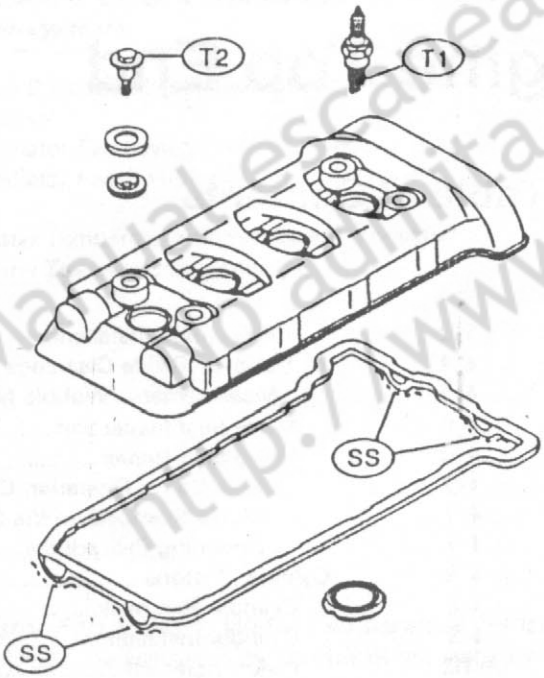
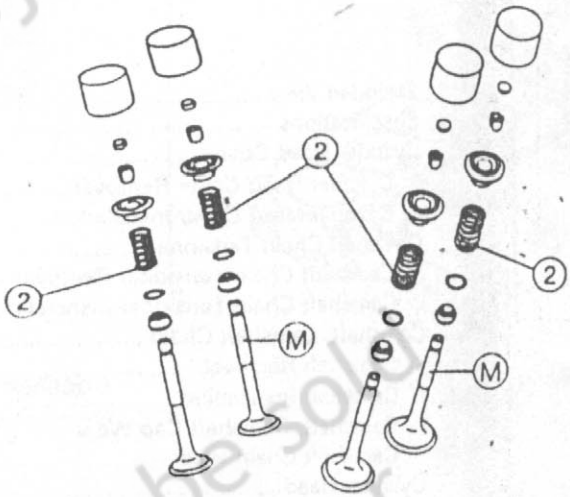
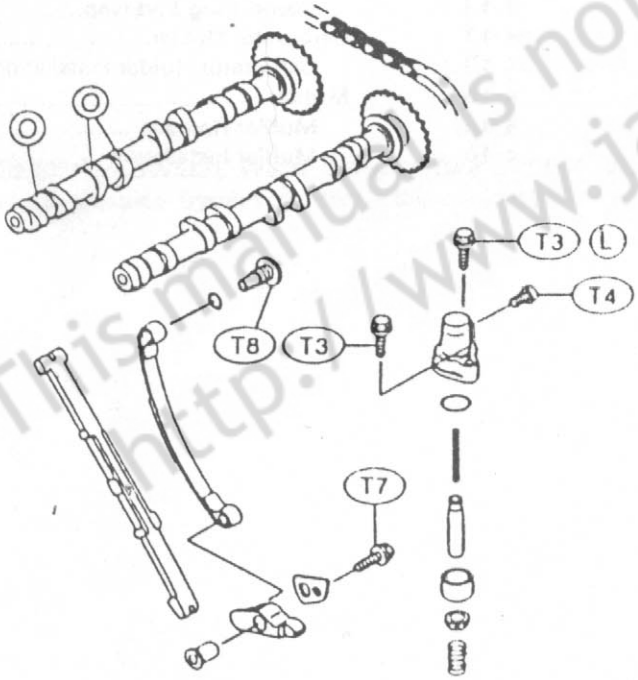
Exploded View







L: Apply a non-permanent locking agent.
M: Apply molybdenum disulfide grease
O: Apply engine oil.
R: Replacement Parts
SS: Apply silicone sealant (Kawasaki Bond: 56019-120).

T1: 13 N·m (1.3 kg-m)
T2: 9.8 N·m (1.0 kg-m)
T3: 11 N·m (1.1 kg-m)
T4: 2.9 N·m (0.30 kg-m)
T5: 5.9 N·m (0.60 kg-m)
T6: 7.8 N·m (0.80 kg-m)
T7: 20 N·m (2.0 kg-m)
T8: 25 N·m (2.5 kg-m)
T9: 18 N·m (1.8 kg-m) (Φ7 mm)
T10: 12 N·m (1.2 kg-m) (Φ6 mm)
T11: 8.3 N·m (0.85 kg-m)

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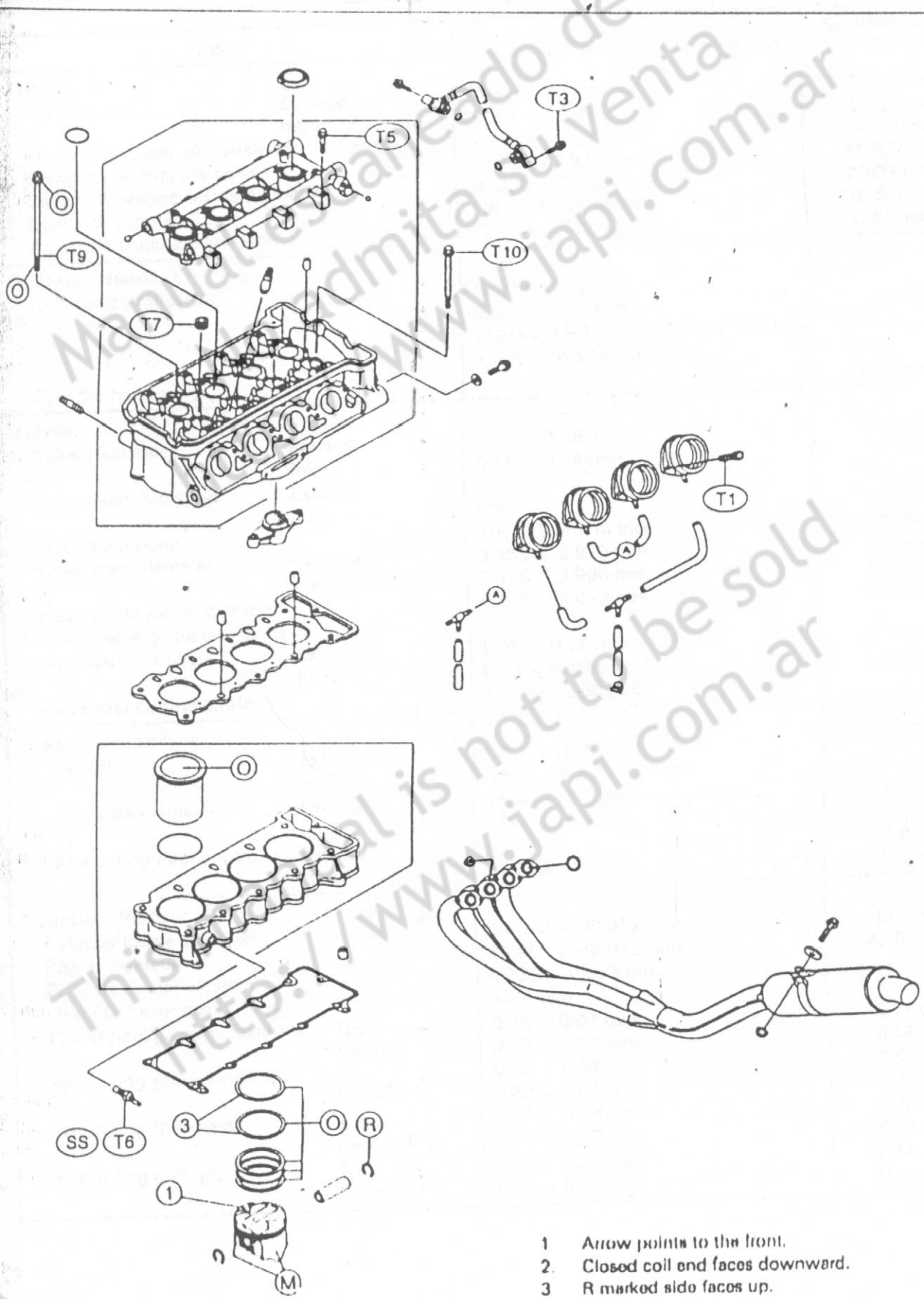

1 Arrow points to the front.
2 Closed coil end faces downward.
3 R marked side faces up.

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Specifications

Item		Standard	Service Limit
Camshafts:			
Cam height:	Exhaust	27.73 ~ 27.87 mm	27.6 mm
	Inlet	28.43 ~ 28.57 mm	28.3 mm
Camshaft journal, camshaft cap clearance		0.028 ~ 0.071 mm	0.16 mm
Camshaft journal diameter		19.950 ~ 19.972 mm	19.92 mm
Camshaft bearing inside diameter		20.000 ~ 20.021 mm	20.08 mm
Camshaft runout		TIR 0.02 mm or less	TIR 0.1 mm
Camshaft chain 20-link length		127.00 ~ 127.36 mm	128.9 mm
Cylinder Head:			
Cylinder compression		(usable range) 980 ~ 1 500 kPa (10.0 ~ 15.3 kg/cm², 142 ~ 218 psi) @330 r/min (rpm)	- - -
Cylinder head warp		- - -	0.05 mm
Valves:			
Valve clearance:	Exhaust	0.20 ~ 0.29 mm	- - -
	Inlet	0.15 ~ 0.24 mm	- - -
Valve head thickness:	Exhaust	0.5 mm	0.3 mm
	Inlet	0.5 mm	0.3 mm
Valve stem bend		TIR 0.01 mm or less	TIR 0.05 mm
Valve stem diameter:	Exhaust	3.955 ~ 3.970 mm	3.94 mm
	Inlet	3.975 ~ 3.990 mm	3.96 mm
Valve guide inside diameter		4.000 ~ 4.012 mm	4.08 mm
Valve/valve guide clearance (wobble method):	Exhaust	0.08 ~ 0.15 mm	0.29 mm
	Inlet	0.03 ~ 0.10 mm	0.23 mm
Valve seat cutting angle		45°, 22.5°, 30°, 65°	- - -
Valve seat surface:			
Width:	Exhaust	0.5 ~ 1.0 mm	- - -
	Inlet	0.5 ~ 1.0 mm	- - -
Outside diameter:	Exhaust	15.9 ~ 16.1 mm	- - -
	Inlet	18.1 ~ 18.3 mm	- - -
Valve spring free length:	Inner	40.8 mm	39.8 mm
	Outer	41.2 mm	40.0 mm
Cylinder, Piston:			
Cylinder inside diameter		49.000 ~ 49.012 mm	49.1 mm
Piston diameter		48.960 ~ 48.975 mm	48.81 mm
Piston/cylinder clearance		0.025 ~ 0.052 mm	- - -
Oversize pistons and rings		+0.5 mm	- - -
Piston ring/groove clearance:	Top	0.03 ~ 0.07 mm	0.17 mm
	Second	0.03 ~ 0.07 mm	0.17 mm
Piston ring groove width:	Top	0.82 ~ 0.84 mm	0.92 mm
	Second	0.82 ~ 0.84 mm	0.92 mm
Piston ring thickness:	Top	0.77 ~ 0.79 mm	0.70 mm
	Second	0.77 ~ 0.79 mm	0.70 mm
Piston ring end gap:	Top	0.10 ~ 0.25 mm	0.55 mm
	Second	0.35 ~ 0.50 mm	0.80 mm

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Special Tools – Compression Gauge: 57001-221
Compression Gauge Adapter, M10 X 1.0: 57001-1317
Valve Spring Compressor Assembly: 57001-241
Valve Spring Compressor Adapter, Φ16: 57001-1305
Valve Guide Arbor, Φ4: 57001-1273
Valve Guide Reamer, Φ4: 57001-1274
Valve Seat Cutter, 45° – Φ18: 57001-1308
Valve Seat Cutter, 45° – Φ20.5: 57001-1307
Valve Seat Cutter, 30° – Φ18: 57001-1308
Valve Seat Cutter, 22.5° – Φ21: 57001-1309
Valve Seat Cutter, 65° – Φ19: 57001-1310
Valve Seat Cutter Holder, Φ4: 57001-1275
Valve Seat Cutter Holder Bar: 57001-1128
Piston Pin Puller Assembly: 57001-910
Thickness Gauge: 57001-1081
Valve Guide Driver, Φ4: 57001-1311
Flywheel Holder: 57001-1313

Sealant – Kawasaki Bond (Silicone Sealant): 56019-120

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Cylinder Head Cover

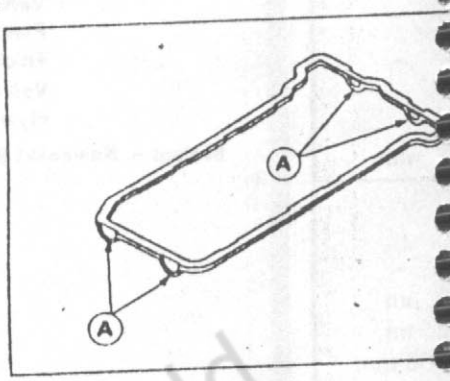
Cylinder Head Cover Removal

- Remove:
  - Lower Fairing (see Frame chapter)
  - Fuel Tank (see Fuel System chapter)
  - Air Cleaner Housing (see Fuel System chapter)
  - Carburetors (see Fuel System chapter)
  - Spark Plug Caps
- Remove the cylinder head cover bolts and take off the cover.

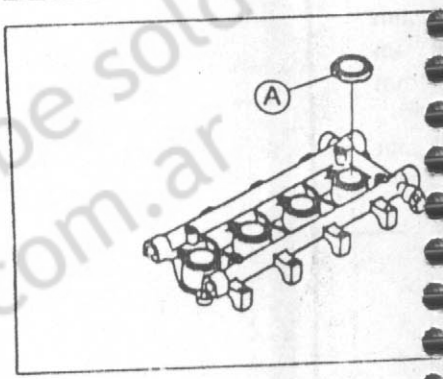
Cylinder Head Cover Installation

- Replace the head cover gasket with a new one if damaged.
- Apply silicone sealant [A] to the head cover gasket.

  Sealant – Kawasaki Bond (Silicone Sealant): 56019-120

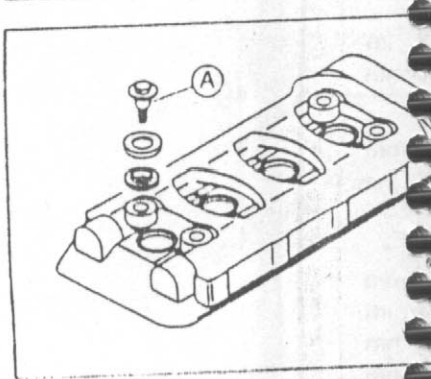


- Be sure install the rubber gaskets [A].



- Tighten the cylinder head cover bolts [A].

  Torque – Cylinder Head Cover Bolts: 9.8 N-m (1.0 kg-m)



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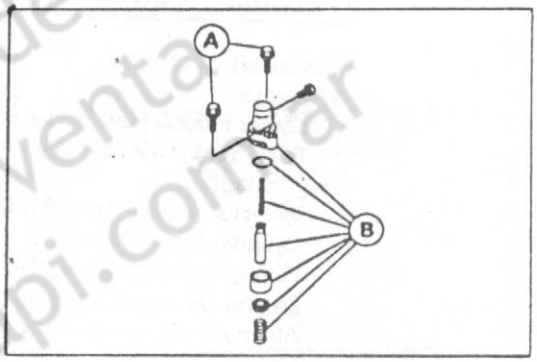
Camshaft Chain Tensioner

Camshaft Chain Tensioner Removal

CAUTION
Do not turn over the crankshaft while the tensioner is removed. This could upset the camshaft chain timing, and damage the valves.



- Remove:
  - Lower Fairing (see Frame chapter)
  - Mounting Bolts [A]
  - Camshaft Chain Tensioner [B]

Camshaft Chain Tensioner Installation

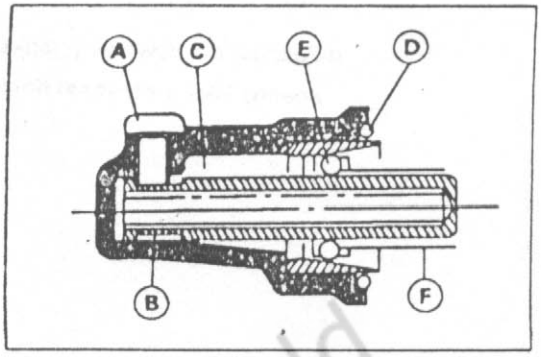
- Loosen the stopper screw [A] about 2 mm
- Insert the tensioner spring [B] and push rod [C] to the bottom, and tighten the stopper screw.
- Be sure the O-ring [D] is in place in the tensioner body
- Install:
  - Retainer [E]
  - Retainer Spring [F]
- Install the tensioner on the crankcase
- Apply a non-permanent locking agent to the right mounting bolt.
- Tighten the mounting bolts.

Torque – Chain Tensioner Mounting Bolts : 11 N-m (1.1 kg-m)

- Loosen the stopper screw about 2 mm, and then tighten it.

Torque – Chain Tensioner Stopper Screw : 2.9 N-m (0.30 kg-m)

○ With the bolt loose, the stiff spring inside takes up any slack automatically.



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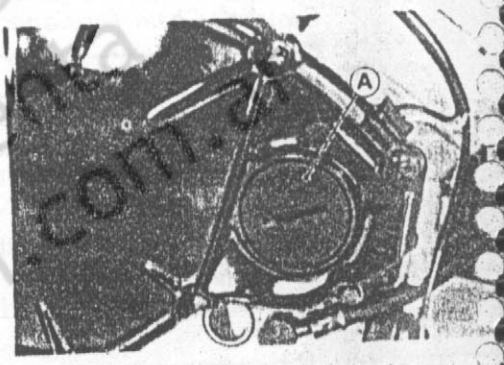
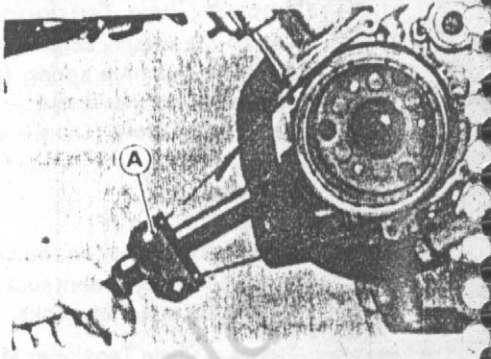
Camshaft, Camshaft Chain

Camshaft Removal

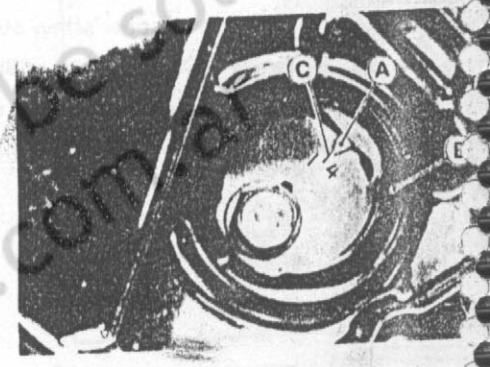
● Remove:
Lower Fairing (see Frame chapter)
Fuel Tank, Air Cleaner Housing, Carburetor (see Fuel System chapter)
Radiator (see Cooling System chapter)
Cylinder Head Cover
Timing Inspection Plug [A]
Engine Oil (drain, see Engine Lubrication System chapter)
Alternator Cover (see Electrical System chapter)



● Position the flywheel (crankshaft) at #1, 4 piston TDC.
Special Tool – Flywheel Holder: 57001-1313 [A]

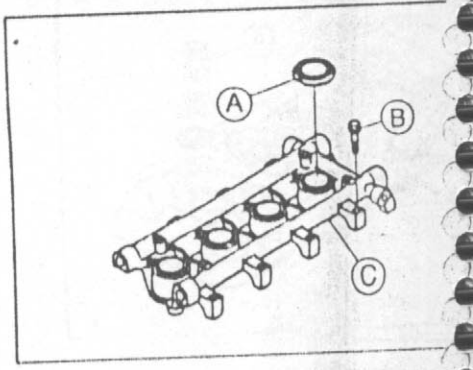


[A] Pointer
[B] Timing Inspection Opening
[C] Timing Mark (#1, #4)



● Remove:
Camshaft Chain Tensioner
Rubber Gaskets [A]
Camshaft Cap Bolts [B]
Camshaft Cap [C]

● Stuff a clean cloth into the chain tunnel to keep any parts from dropping into the crankcase.



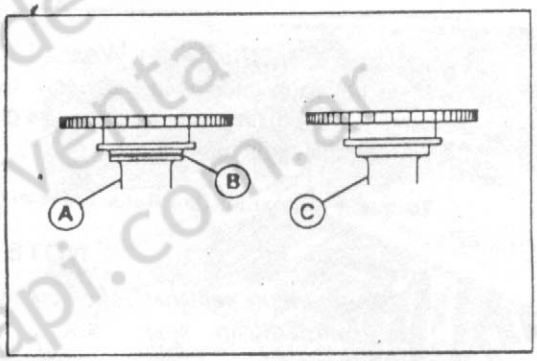
CAUTION
The crankshaft may be turned while the camshafts are removed. Always pull the chain taut while turning the crankshaft. This avoids kinking the chain on the lower (crankshaft) sprocket. A kinked chain could damage both the chain and the sprocket.

Camshaft Installation

- Apply engine oil to all cam parts and journals.
- If a new camshaft is to be used, apply a thin coat of molybdenum disulfide grease to the cam surfaces.

NOTE

○ *The exhaust camshaft [A] has a groove [B] at the right-hand and the inlet camshaft [C] has no groove. Be careful not to mix them up.*



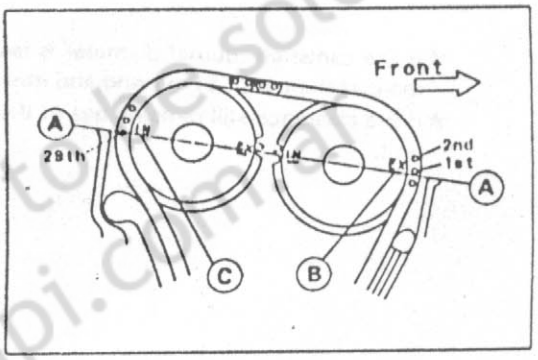
- Position the crankshaft at #1, 4 piston TDC (see Camshaft Removal).

CAUTION

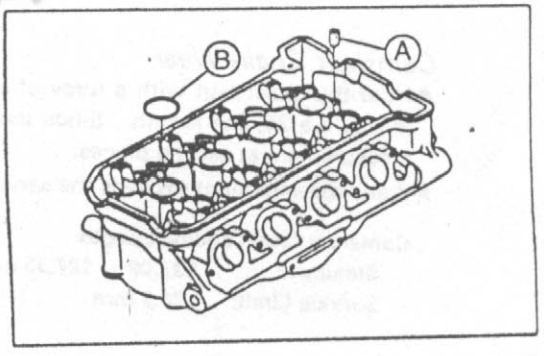
Always pull the chain taut while turning the crankshaft. This avoids kinking the chain on the lower (crankshaft) sprocket. A kinked chain could damage both the chain and the sprocket.

- Pull the tension side (exhaust side) of the chain taut to install the chain.
- Engage the camshaft chain with the camshaft sprockets so that the timing marks on the sprockets are positioned as shown.

○ The timing marks must be aligned with the cylinder head upper surface [A].
[B] EX Mark
[C] IN Mark

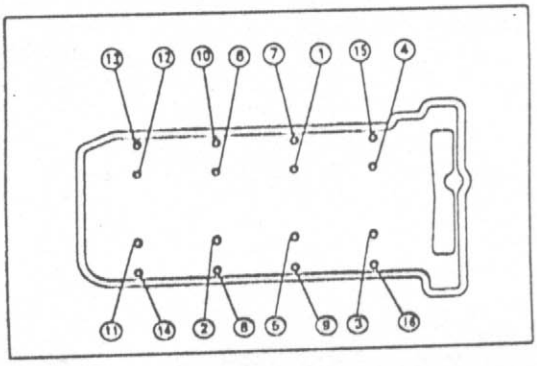


- Install:
Pins [A]
O-rings [B] (Apply engine oil.)



- Tighten the camshaft cap bolts following the tightening sequence [1 ~ 16].

Torque – Camshaft Cap Bolts: 5.9 N·m (0.60 kg·m)



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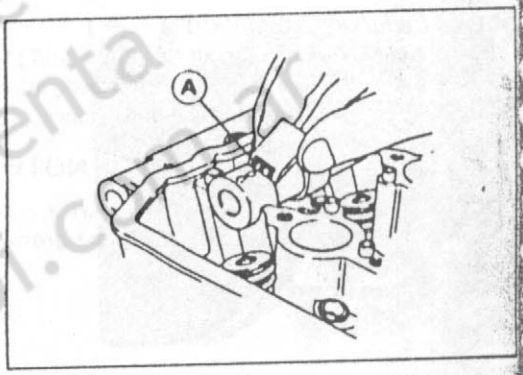
Camshaft, Camshaft Cap Wear



- Measure each clearance between the camshaft journal and the camshaft cap using plastigage (press gauge) (A).
- Tighten the camshaft cap bolts.

Torque – Camshaft Cap Bolts: 5.9 N-m (0.60 kg-m)

NOTE

○ *Do not turn the camshaft when the plastigage is between the journal and camshaft cap.*

★ If any clearance exceeds the service limit, measure the diameter of each camshaft journal with a micrometer.

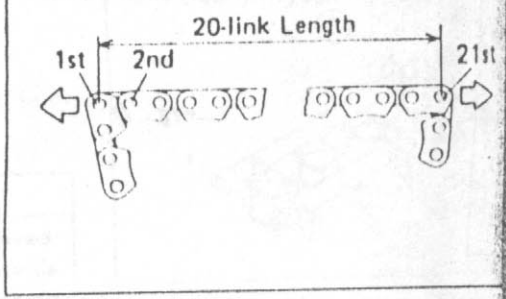
Camshaft Journal, Camshaft Cap Clearance

Standard:	**0.028 ~ 0.071 mm**
Service Limit:	**0.16 mm**

★ If the camshaft journal diameter is less than the service limit, replace the camshaft with a new one and measure the clearance again.

★ If the clearance still remains out of the limit, replace the cylinder head unit.

Camshaft Chain Wear



- Hold the chain taut with a force of about 5 kg in some manner, and measure a 20-link length. Since the chain may wear unevenly, take measurement at several places.

★ If any measurement exceeds the service limit, replace the chain.

Camshaft Chain 20-link Length

Standard:	**127.00 ~ 127.36 mm**
Service Limit:	**128.9 mm**

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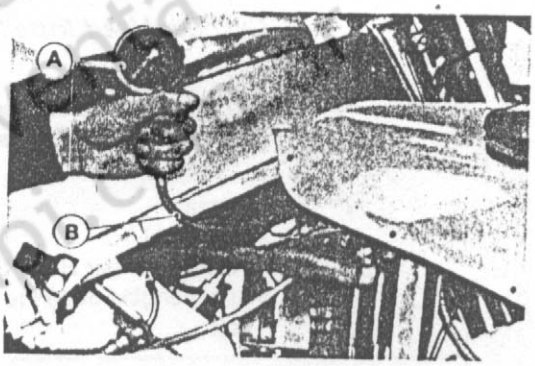
Cylinder Head

Cylinder Compression Measurement



- Warm up the engine thoroughly.
- Stop the engine, and remove the spark plugs

Owner's Tool – Spark Plug Wrench, 16mm: 92110-1154

- Measure the cylinder compression.

○ Using the starter motor, turn the engine over with the throttle fully open until the compression gauge stops rising; the compression is the highest reading obtainable.

Special Tools – Compression Gauge: 57001-221 [A]
Compression Gauge Adapter, M10 X 1.0: 57001-1317 [B]

NOTE

○ *Be sure the battery is fully charged.*
○ *Be sure no air leaks out of the cylinder head gasket.*

Cylinder Compression
Usable Range : 980 ~ 1500 kPa (10.0 ~ 15.3 kg/cm², 142 ~ 218 psi) @ 330 r/min (rpm)

○ Repeat the measurement for the other cylinder.

★ If cylinder compression is higher than the usable range, check the following:
(1) Carbon build-up on the cylinder head combustion chamber and the piston crown.
(2) Cylinder head gasket is not the original part.
(3) Valve stem oil seals and/or piston rings are damaged.

★ If cylinder compression is lower than the usable range, check the following:
(1) Condition of the valve seat is wrong.
(2) Valve clearance is too small.
(3) Piston/cylinder clearance is excessive.
(4) Cylinder head is warped and/or head gasket is damaged.
(5) Piston ring/piston ring groove clearance is excessive.

Cylinder Head Removal

- Remove:
  Lower Fairing (see Frame chapter)
  Fuel Tank, Air Cleaner Housing, Carburetor (see Fuel System chapter)
  Engine Oil (drain, see Engine Lubrication System chapter)
  Radiator (see Cooling System chapter)
  Cylinder Head Cover (see Cylinder Head Cover Removal)
  Camshaft Chain Tensioner (see Camshaft Chain Tensioner Removal)
  Camshafts (see Camshaft Removal)
  Oil Hose
  Camshaft Chain Guide (Exhaust side)
  Cylinder Head Bolts
  Cylinder Head

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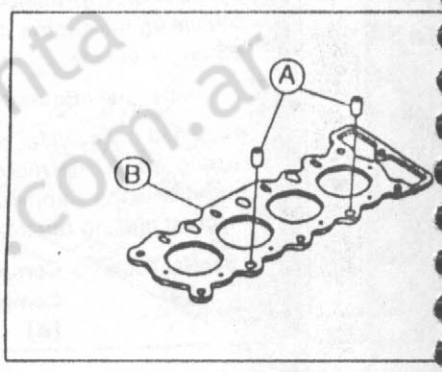
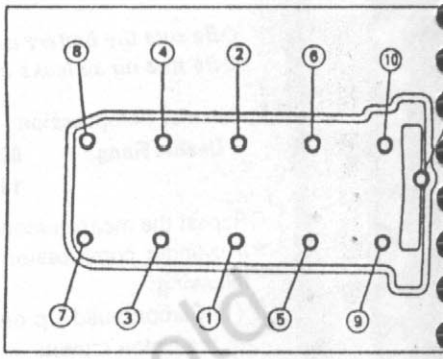
Cylinder Head Installation

NOTE

○ The camshaft caps are machined with the cylinder head so if a new cylinder head is installed, use the caps that are supplied with the new head.



- Install:
  Pins [A]
  New Cylinder Head Gasket [B]
- Apply engine oil to the threads and seating surface of the cylinder head bolt.



- Tighten the cylinder head bolts following the tightening sequence [1 ~ 11].
  [1 ~ 10] Bolts: Φ 7 mm
  [11] Bolt: Φ 6 mm

Torque – Cylinder Head Bolts :

Φ 7mm	**18 N-m (1.8 kg-m)**
Φ 6 mm	**12 N-m (1.2 kg-m)**

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Valves

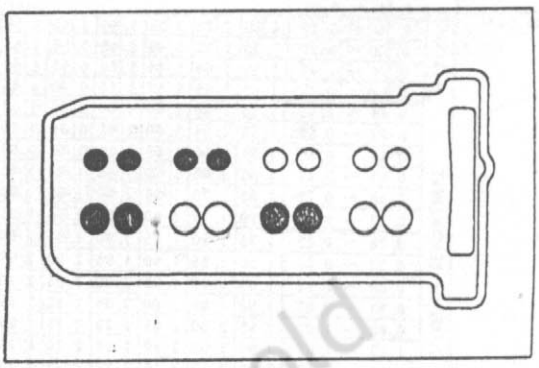
Valve Clearance Inspection

NOTE

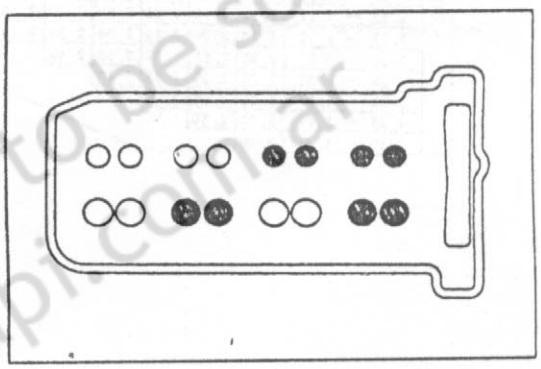
○*Valve clearance must be checked and adjusted when the engine is cold (at room temperature).*

●Remove:
Lower Fairing (see Frame chapter)
Cylinder Head Cover (see Cylinder Head Cover Removal)
Timing Inspection Plug
●Using a thickness gauge, measure the valve clearance between the cam and the valve lifter.

○**When positioning #1 piston TDC at the end of the compression stroke:**
Inlet valve clearance of #1 and #3 cylinders
Exhaust valve clearance of #1 and #2 cylinders



○**When positioning #4 piston TDC at the end of the compression stroke:**
Inlet valve clearance of #2 and #4 cylinders
Exhaust valve clearance of #3 and #4 cylinders

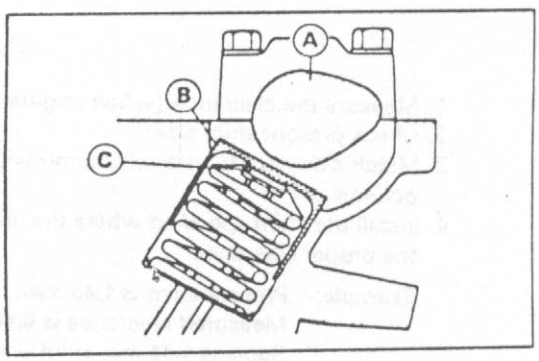


Valve Clearance
Standard: **EX: 0.20 ~ 0.29 mm**
IN: 0.15 ~ 0.24 mm

★If the valve clearance is not within the specified range, first record the clearance, and then adjust it.

Valve Clearance Adjustment

●Remove:
Camshafts [A] (see Camshaft Removal)
Valve Lifter [B]
Shim [C]
●Referring to the Valve Clearance Adjustment Chart, select a new shim which brings valve clearance within the specified range, and replace the original shim with the selected new one.



CAUTION

Do not put shim stock under the shim. This may cause the shim to pop out at high rpm, causing extensive engine damage.
Do not grind the shim. This may cause it to fracture, causing extensive engine damage.

●Apply engine oil to the valve lifter and install it
●Install the camshaft (see Camshaft Installation)

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VALVE CLEARANCE ADJUSTMENT CHART
EXHAUST VALVE

PART No. (92180-)	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156
THICKNESS (mm)	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40

Example

PRESENT SHIM

VALVE CLEARANCE MEASUREMENT	SPECIFIED CLEARANCE/NO CHANGE EQUIRED																								
0.00 ~ 0.02	—	—	—	—	—	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15
0.03 ~ 0.07	—	—	—	—	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20
0.08 ~ 0.12	—	—	—	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25
0.13 ~ 0.17	—	—	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30
0.18 ~ 0.19	—	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35
0.20 ~ 0.29	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	
0.30 ~ 0.32	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40		
0.33 ~ 0.37	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40			
0.38 ~ 0.42	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40				
0.43 ~ 0.47	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40					
0.48 ~ 0.52	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40						
0.53 ~ 0.57	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40							
0.58 ~ 0.62	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40								
0.63 ~ 0.67	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40									
0.68 ~ 0.72	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40										
0.73 ~ 0.77	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40											
0.78 ~ 0.82	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40												
0.83 ~ 0.87	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40													
0.88 ~ 0.92	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40														
0.93 ~ 0.97	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40															
0.98 ~ 1.02	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40																
1.03 ~ 1.07	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40																	
1.08 ~ 1.12	2.10	2.15	2.20	2.25	2.30	2.35	2.40																		
1.13 ~ 1.17	2.15	2.20	2.25	2.30	2.35	2.40																			
1.18 ~ 1.22	2.20	2.25	2.30	2.35	2.40																				
1.23 ~ 1.27	2.25	2.30	2.35	2.40																					
1.28 ~ 1.32	2.30	2.35	2.40																						
1.33 ~ 1.37	2.35	2.40																							
1.38 ~ 1.42	2.40																								
1.43 ~ 1.47																									

INSTALL THE SHIM OF THIS THICKNESS (mm)

1. Measure the clearance (when engine is cold).
2. Check present shim size.
3. Match clearance in vertical column with present shim size in horizontal column.
4. Install the shim specified where the lines intersect. This shim will give the proper clearance.

   Example: Present shim is 1.65 mm.
   Measured clearance is 0.45 mm.
   Replace 1.65 mm shim with 1.85 mm shim.

5. Remeasure the valve clearance and readjust if necessary.

CAUTION

Be sure to remeasure the clearance after selecting a shim according to the table. The clearance can be out of the specified range because of the shim tolerance.

NOTE

○If there is no clearance, select a shim which is several sizes smaller and then measure the clearance.

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VALVE CLEARANCE ADJUSTMENT CHART
INLET VALVE

	PRESENT SHIM																										
PART No. (92180-)	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156
THICKNESS (mm)	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40
0.00 ~ 0.02	—	—	—	—	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20
0.03 ~ 0.07	—	—	—	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25
0.08 ~ 0.12	—	—	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30
0.13 ~ 0.14	—	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35
0.15 ~ 0.24	SPECIFIED CLEARANCE/NO CHANGE REQUIRED																								
0.25 ~ 0.27	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	
0.28 ~ 0.32	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40		
0.33 ~ 0.37	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40			
0.38 ~ 0.42	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40				
0.43 ~ 0.47	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40					
0.48 ~ 0.52	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40						
0.53 ~ 0.57	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40							
0.58 ~ 0.62	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40								
0.63 ~ 0.67	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40									
0.68 ~ 0.72	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40										
0.73 ~ 0.77	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40											
0.78 ~ 0.82	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40												
0.83 ~ 0.87	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40													
0.88 ~ 0.92	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40														
0.93 ~ 0.97	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40															
0.98 ~ 1.02	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40																
1.03 ~ 1.07	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40																	
1.08 ~ 1.12	2.10	2.15	2.20	2.25	2.30	2.35	2.40																		
1.13 ~ 1.17	2.15	2.20	2.25	2.30	2.35	2.40																			
1.18 ~ 1.22	2.20	2.25	2.30	2.35	2.40																				
1.23 ~ 1.27	2.25	2.30	2.35	2.40																					
1.28 ~ 1.32	2.30	2.35	2.40																						
1.33 ~ 1.37	2.35	2.40																							
1.38 ~ 1.42	2.40																								

Example

VALVE CLEARANCE MEASUREMENT

Example

INSTALL THE SHIM OF THIS THICKNES (mm)

1. Measure the clearance (when engine is cold).
2. Check present shim size.
3. Match clearance in vertical column with present shim size in horizontal column.
4. Install the shim specified where the lines intersect. This shim will give the proper clearance.

   Example: Present shim is **1.65 mm**
   Measured clearance is **0.45 mm**
   Replace **1.65 mm** shim with **1.90 mm** shim.

5. Remeasure the valve clearance and readjust if necessary.

CAUTION

Be sure to remeasure the clearance after selecting a shim according to the table. The clearance can be out of the specified range because of the shim tolerance.

NOTE

If there is no clearance, select a shim which is several sizes smaller and then measure the clearance.

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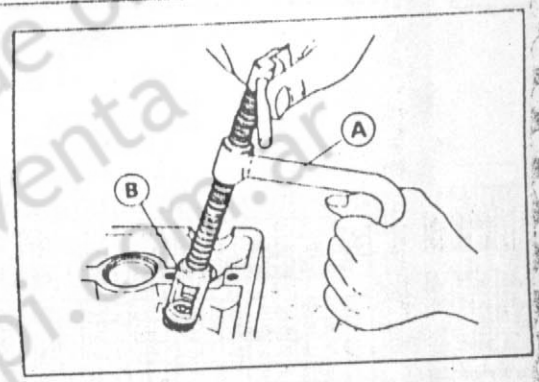
Valve Removal

- Remove the cylinder head (see Cylinder Head Removal).
- Remove the valve lifter and shim.
- Mark and record the shim locations so that the shims can be installed in their original positions.
- Using the valve spring compressor assembly, remove the valve.

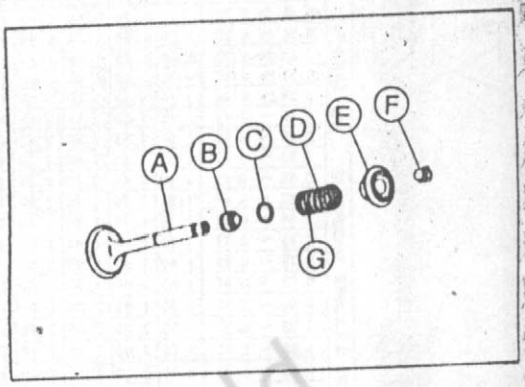
Special Tools – Valve Spring Compressor Assembly: 57001-241 [A]
Valve Spring Compressor Adapter, Φ16: 57001-1305 [B]



Valve Installation

- Replace the oil seal with a new one.
- Apply a thin coat of molybdenum disulfide grease to the valve stem before valve installation.
- Install the springs so that the closed coil end faces downwards

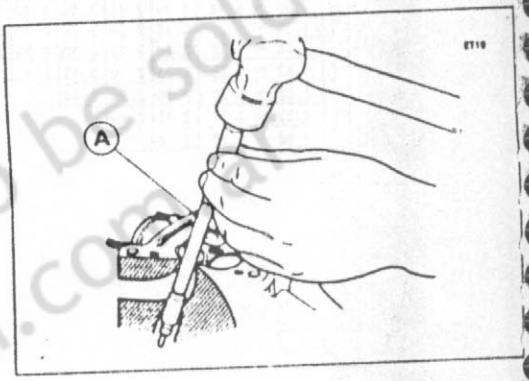
[A] Valve Stem
[B] Oil Seal
[C] Spring Seat
[D] Spring
[E] Retainer
[F] Split Keepers
[G] Closed Coil End



Valve Guide Removal

- Remove:
  Valve (see Valve Removal)
  Oil Seal
  Spring Seat
- Heat the area around the valve guide to 120 ~ 150°C (248 ~ 302 °F), and hammer lightly on the valve guide arbor [A] to remove the guide from the top of the head.

Special Tool – Valve Guide Arbor, Φ4: 57001-1273

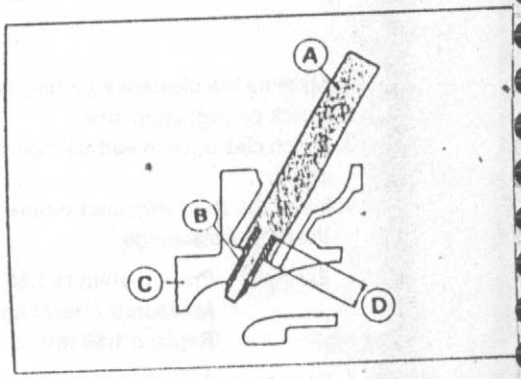


Valve Guide Installation

- Apply oil to the valve guide outer surface before installation.
- Heat the area around the valve guide hole to about 120 ~ 150 °C (248 ~ 302 °F).
- Drive the valve guide in from the top of the head using the valve guide driver [A].

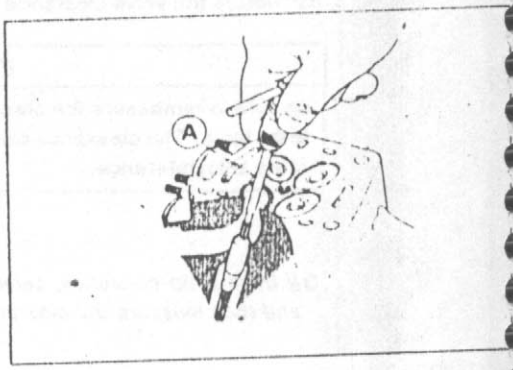
Special Tool – Valve Guide Driver, Φ4: 57001-1311

[B] Valve Guide
[C] Cylinder Head
[D] Valve Guide Installed Height (19.5 ~ 19.7 mm)



- Ream the valve guide with valve guide reamer [A] even if the old guide is reused.

Special Tool – Valve Guide Reamer, Φ4: 57001-1274



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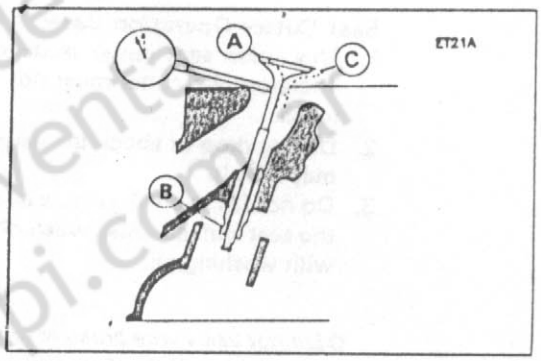
Valve-to-Guide Clearance Measurement (Wobble Method)

If a small bore gauge is not available, inspect the valve guide wear by measuring the valve to valve guide clearance with the wobble method as indicated below.

- ●Insert a new valve [A] into the guide [B] and set a dial gauge against the stem perpendicular to it as close as possible to the cylinder head mating surface.
- ●Move the stem back and forth [C] to measure valve/valve guide clearance.
- ○Repeat the measurement in a direction at a right angle to the first.
- ★If the reading exceeds the service limit, replace the guide.



NOTE

○*The reading is not actual valve/valve guide clearance because the measuring point is above the guide.*

Valve/Valve Guide Clearance (Wobble Method)

	Standard	Service Limit
Exhaust	0.08 ~ 0.15 mm	0.29 mm
Inlet	0.03 ~ 0.10 mm	0.23 mm

Valve Seat Inspection

- ●Remove the valve (see Valve Removal).
- ●Check the valve seating surface [A] between the valve [B] and valve seat [C].
- ○Measure the outside diameter [D] of the seating pattern on the valve seat.
- ★If the outside diameter is too large or too small, repair the seat (see Seat Repair).

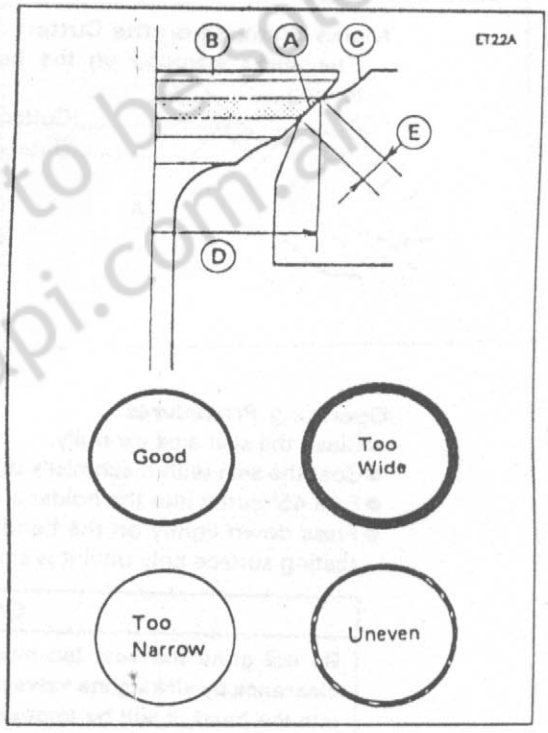
Valve Seating Surface Outside Diameter

Standard:	Exhaust	15.9 ~ 16.1 mm
	Inlet	18.1 ~ 18.3 mm

- ○Measure the seat width [E] of the portion where there is no build up carbon (white portion) of the valve seat with a vernier caliper.
- ★If the width is too wide, too narrow or uneven, repair the seat (see Valve Seat Repair).

Valve Seating Surface Width

Standard: Exhaust, Inlet 0.5 ~ 1.0 mm



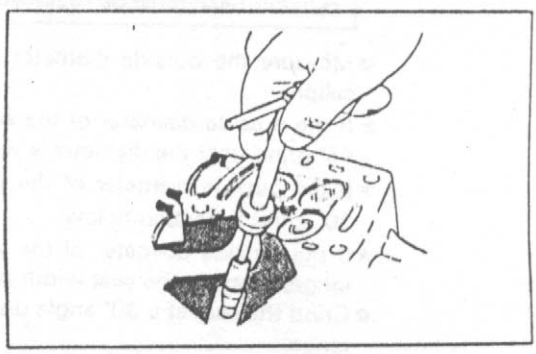
Valve Seat Repair

- ●Repair the valve seat with the valve seat cutters.

Special Tools – Valve Seat Cutter Holder, Φ4: 57001-1275
Valve Seat Cutter Holder Bar: 57001-1128

[For Inlet Valve Seat]
Valve Seat Cutter, 45° – Φ20.5: 57001-1307
Valve Seat Cutter, 22.5° – Φ21: 57001-1309
Valve Seat Cutter, 65° – Φ19: 57001-1310

[For Exhaust Valve Seat]
Valve Seat Cutter, 45° Φ18: 57001-1306
Valve Seat Cutter, 30° Φ18: 57001-1308
Valve Seat Cutter, 65° – Φ19: 57001-1310



★If the manufacturer's instructions are not available, use the following procedure.

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Seat Cutter Operation Care:

1. This valve seat cutter is developed to grind the valve for repair. Therefore the cutter must not be used for other purposes than seat repair.
2. Do not drop or shock the valve seat cutter, or the diamond particles may fall off.
3. Do not fail to apply engine oil to the valve seat cutter before grinding the seat surface. Also wash off ground particles sticking to the cutter with washing oil.

NOTE

○ *Do not use a wire brush to remove the metal particles from the cutter. It will take off the diamond particles.*

4. Setting the valve seat cutter holder in position, operate the cutter in one hand. Do not apply too much force to the diamond portion.

NOTE

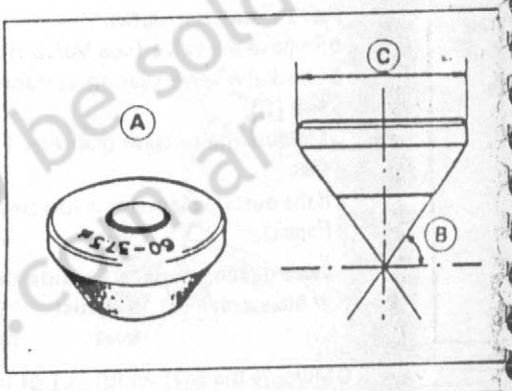
○ *Prior to grinding, apply engine oil to the cutter and during the operation, wash off any ground particles sticking to the cutter with washing oil.*

5. After use, wash it with washing oil and apply thin layer of engine oil before storing.

Marks Stamped on the Cutter:

The marks stamped on the back of the cutter (A) represent the following.

60°.....Cutter angle (B)
37.5Φ.....Outer diameter of cutter (C)



Operating Procedures:

- Clean the seat area carefully.
- Coat the seat with machinist's dye.
- Fit a 45° cutter into the holder and slide it into the valve guide.
- Press down lightly on the handle and turn it right or left. Grind the seating surface only until it is smooth.

CAUTION
Do not grind the seat too much. Overgrinding will reduce valve clearance by sinking the valve into the head. If the valve sinks too far into the head, it will be impossible to adjust the clearance, and the cylinder head must be replaced.

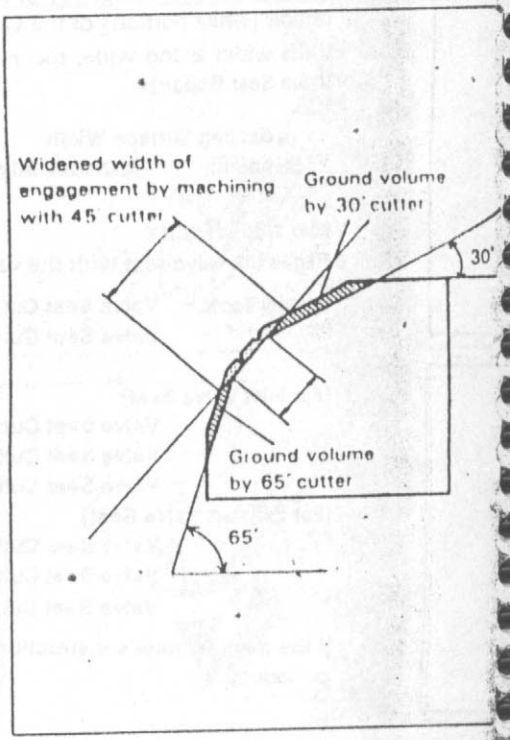
- Measure the outside diameter of the seating surface with a vernier caliper.

★ If the outside diameter of the seating surface is too small, repeat the 45° grind until the diameter is within the specified range.

★ If the outside diameter of the seating surface is too large, make the 30° grind described below.

★ If the outside diameter of the seating surface is within the specified range, measure the seat width as described below.

- Grind the seat at a 30° angle until the seat O.D. is within the specified range.



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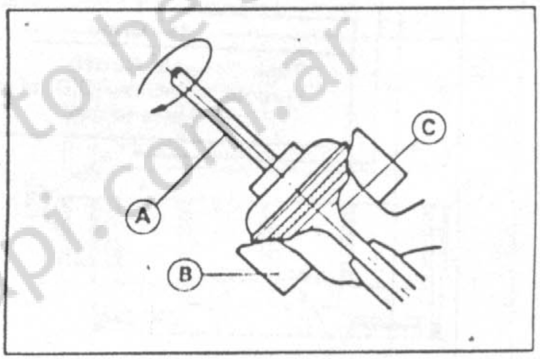
○To make the 30° grind, fit a 30° cutter into the holder, and slide it into the valve guide.
○Turn the holder one turn at a time while pressing down very lightly. Check the seat after each turn.

CAUTION

The 30° cutter removes material very quickly. Check the seat outside diameter frequently to prevent overgrinding.

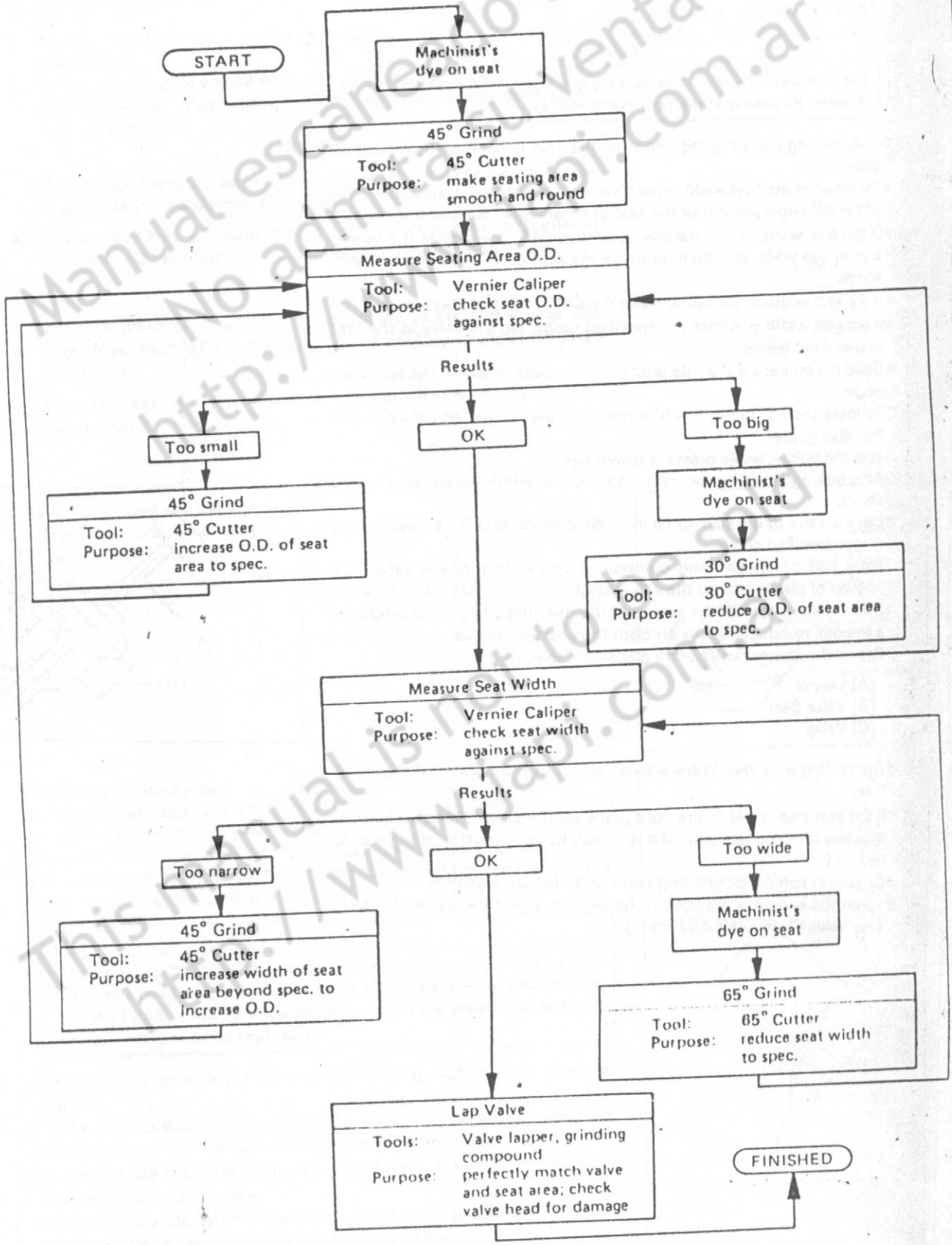
○After making the 30° grind, return to the seat O.D. measurement step above.
●To measure the seat width, use a vernier caliper to measure the width of the 45° angle portion of the seat at several places around the seat.
★If the seat width is too narrow, repeat the 45° grind until the seat is slightly too wide, and then return to the seat O.D. measurement step above.
★If the seat width is too wide, make the 65° grind described below.
★If the seat width is within the specified range, lap the valve to the seat as described below.
●Grind the seat at a 65° angle until the seat width is within the specified range.
○To make the 65° grind, fit 65° cutter into the holder, and slide it into the valve guide.
○Turn the holder, while pressing down lightly.
○After making the 65° grind, return to the seat width measurement step above.
●Lap the valve to the seat, once the seat width and O.D. are within the ranges specified above.
○Put a little coarse grinding compound on the face of the valve in a number of places around the valve head.
○Spin the valve against the seat until the grinding compound produces a smooth, matched surface on both the seat and the valve.
○Repeat the process with a fine grinding compound.



[A] Lapper
[B] Valve Seat
[C] Valve

●The seating area should be marked about in the middle of the valve face.
★If the seat area is not in the right place on the valve, check to be sure the valve is the correct part. If it is, it may have been refaced too much; replace it.
●Be sure to remove all grinding compound before assembly.
●When the engine is assembled, be sure to adjust the valve clearance (see Valve Clearance Adjustment).

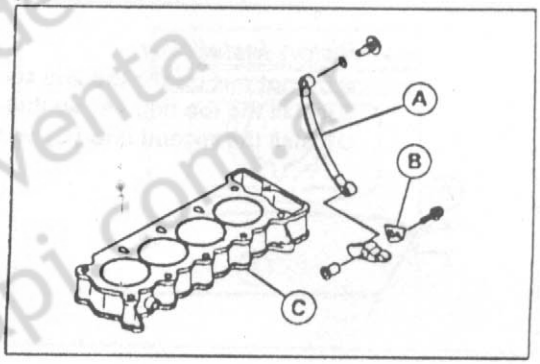
Valve Seat Repair



Cylinder, Pistons

Cylinder Removal

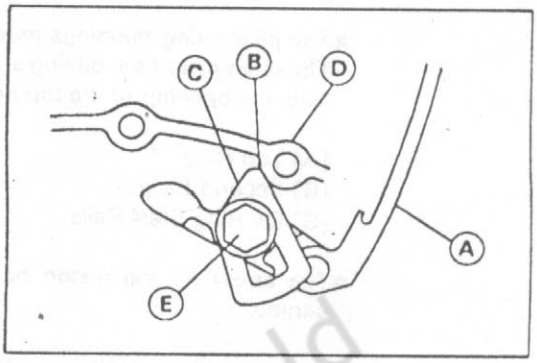
- Remove:
  - Cylinder Head (see Cylinder Head Removal)
  - Water Hose
  - Rear Camshaft Chain Guide [A]
  - Stopper Plate [B]
  - Cylinder [C]



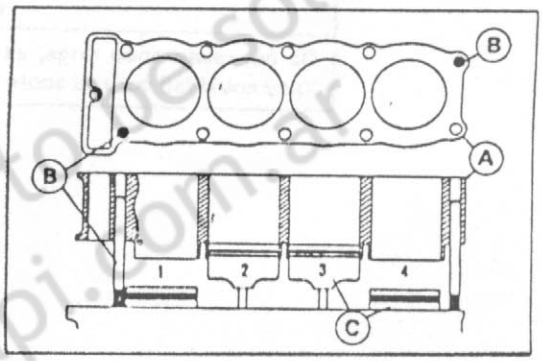
Cylinder Installation

- Install:
  - New Cylinder Gasket
  - Pins
- When the rear camshaft chain guide [A] install, attach [B] the stopper plate [C] to the crankcase [D].
- Tighten the camshaft chain guide lower mounting bolt [E].

Torque – Camshaft Chain Guide Lower Mounting Bolt : 20 N-m (2.0 kg-m)



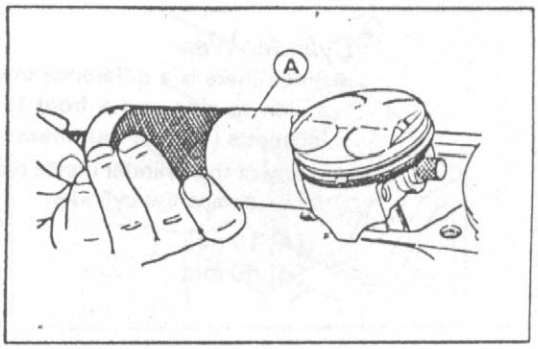
- Apply engine oil to the cylinder bore.
- Prepare two auxiliary head bolts with their head cut.
- Install the two bolts [C] diagonally in the crankcase.
- Position the crankshaft at #2, #3 piston TDC.
- Install the cylinder block [A].
  - [B] Auxiliary Head Bolts
  - [C] Pistons



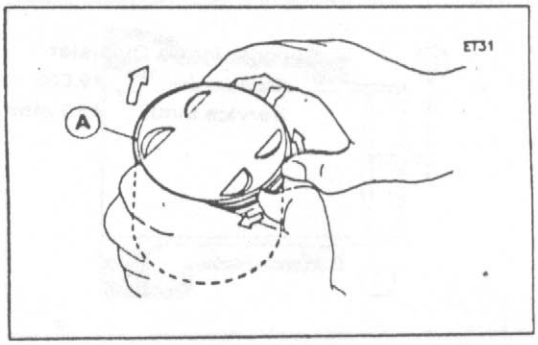
Piston Removal

- Remove the cylinder (see Cylinder Removal).
- Place a clean cloth under the pistons and remove the piston pin snap ring from the outside of each piston.
- Remove the piston pins.

Special Tool – Piston Pin Puller Assembly: 57001-910 [A]



- Carefully spread the ring opening with your thumbs and then push up on the opposite side of the ring [A] to remove it.
- Remove the 3-piece oil ring with your thumbs in the same manner.



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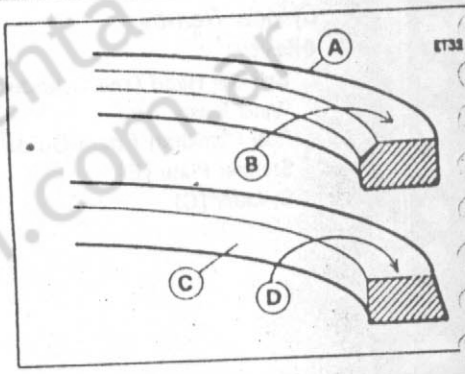
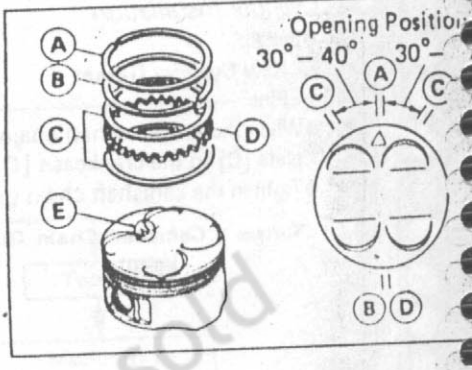
Piston Installation

● Do not mix up the top and second ring.
○ Install the top ring [A] so that the "R" mark [B] faces up.
○ Install the second ring [C] so that the "R" mark [D] faces up.



● The piston ring openings must be positioned as shown in the figure. The openings of the oil ring steel rails must be about 30 – 40° of angle from the opening of the top ring.

[A] Top Ring
[B] Second Ring
[C] Oil Ring Steel Rails
[D] Oil Ring Expander
[E] Arrow



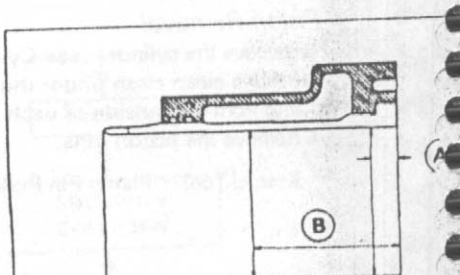
● The arrow on the piston head must point toward the front of the engine.

CAUTION
Do not reuse snap rings, as removal weakens and deforms them. They could fall out and score the cylinder wall.

Cylinder Wear

● Since there is a difference in cylinder wear in different directions, take a side-to-side and a front-to-back measurement at each of the two locations (total of four measurements) shown in the figure.
★ If any of the cylinder inside diameter measurements exceeds the service limit, replace the cylinder.

[A] 10 mm
[B] 60 mm



Cylinder Inside Diameter
Standard: 49.000 ~ 49.012 mm
Service Limit: 49.1 mm

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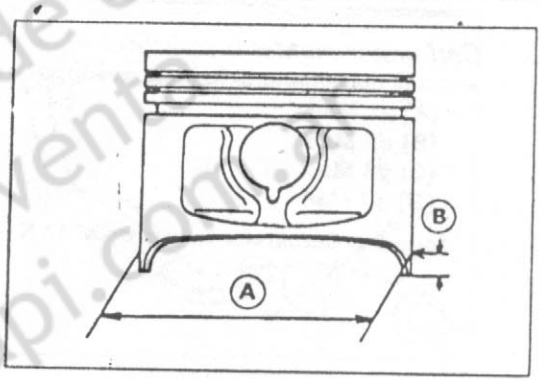
Piston Wear



● Measure the outside diameter [A] of each piston 5 mm [B] up from the bottom of the piston at a right angle to the direction of the piston pin.

★ If the measurement is under service limit, replace the piston.

Piston Diameter

Standard: 48.960 ~ 48.975 mm
Service Limit: 48.81 mm

Boring, Honing

When boring and honing a cylinder, note the following:

○ There is one size of oversize piston available. Oversize piston require oversize ring.

Oversize Piston and Ring
0.5 mm Oversize

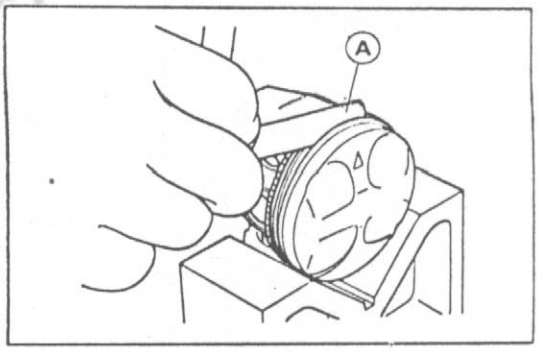
○ Before boring a cylinder, first measure the exact diameter of the oversize piston, and then, according to the standard clearance in the Specifications, determine the rebore diameter. However, if the amount of boring necessary would make the inside diameter greater than 0.5 mm, the cylinder block must be replaced.

○ Cylinder inside diameter must not vary more than 0.01 mm at any point.

○ Be wary of measurements taken immediately after boring since the heat affects cylinder diameter.

○ In the case of a rebored cylinder and oversize piston, the service limit for the cylinder is the diameter that the cylinder was bored to plus 0.1 mm and the service limit for the piston is the oversize piston original diameter minus 0.15 mm. If the exact figure for the rebored diameter is unknown, it can be roughly determined by measuring the diameter at the base of the cylinder.

Piston Ring, Piston Ring Groove Wear



● Check for uneven groove wear by inspecting the ring seating.

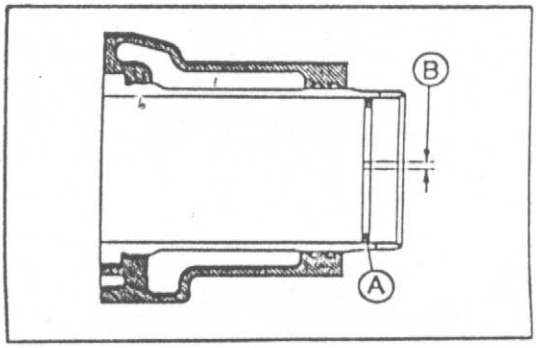
★ The rings should fit perfectly parallel to groove surfaces. If not, the piston must be replaced.

● With the piston rings in their grooves, make several measurements with a thickness gauge [A] to determine piston ring/groove clearance.

Piston Ring/Groove Clearance

	Standard	Service Limit
Top	0.03 ~ 0.07 mm	0.17 mm
Second	0.03 ~ 0.07 mm	0.17 mm

Piston Ring End Gap



● Place the piston ring [A] inside the cylinder, using the piston to locate the ring squarely in place. Set it close to the bottom of the cylinder, where cylinder wear is low.

● Measure the gap [B] between the ends of the ring with a thickness gauge.

Piston Ring End Gap

	Standard	Service Limit
Top	0.10 ~ 0.25 mm	0.55 mm
Second	0.35 ~ 0.50 mm	0.80 mm

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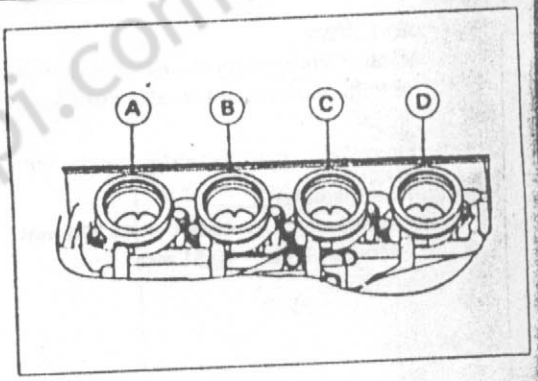
Carburetor Holder

Carburetor Holder Installation

● Install the carburetor holders as shown, and tighten the bolts.

[A] #1 Mark
[B] #2 Mark
[C] #3 Mark
[D] #4 Mark

Torque – Carburetor Holder Bolts: 13 N-m (1.3 kg-m)



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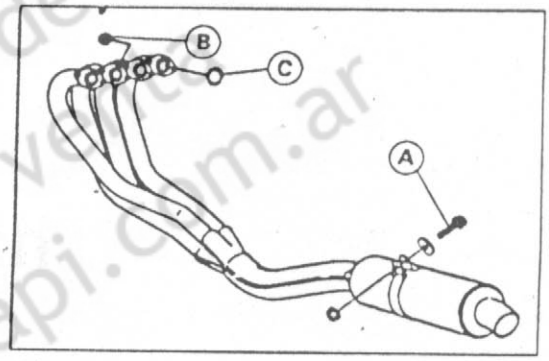
Muffler

Muffler Removal

- Remove:

Lower Faring (see Frame chapter)
Muffler Mounting Bolt [A]
Exhaust Pipe Mounting Nuts [B]
Gasket [C]



Muffler Installation

- Replace the exhaust pipe gaskets with new ones.
- After installation, thoroughly warm up the engine, wait until the engine cools down, and tighten all the exhaust pipe mounting nuts.

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