Workshop Manual

TE 125 2011
SMS4 2011

Part. N. 8000H4704 (07-2010)

Husqvarna

1st edition (07-2010)

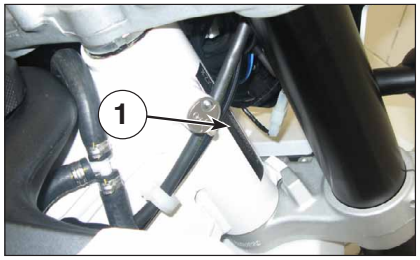
Workshop Manual

TE 125 2011
SMS4 2011

Technical Service
Via Nino Bixio, 8
21024
(Varese) - Italy
tel. ++39 0332 75.61.11
tel. ++39 0332 756 558
www.husqvarna-motorcycles.com

1st edition (07-2010)
Printed in Italy
Print no. 8000H4704

MODELS COVERED (from serial number onwards)



1. Chassis serial number

TE 125: ZKHA500AABV000001
SMS 4: ZKHA500ABBV000001

Foreword

This publication is designed for use by **HUSQVARNA** Service Centres to assist authorised personnel in the maintenance and repair of the models covered in this manual. The technical information provided in this manual is a critical complement to operator training and operators should become thoroughly familiar with it.
For ease of understanding, diagrams and photographs are provided next to the text.
Notes with special significance are identified as follows throughout the manual:

 Accident-prevention rules for operator and persons working nearby.

 Damage to vehicle and/or its components may result from incompliance with relevant instructions.

 Additional information concerning the operation covered in the text.

Useful tips

To prevent problems and ensure effective service work, observe the following **HUSQVARNA** recommendations:
– before repair, evaluate the customer's description of the problem and ask the appropriate questions to clearly identify problem symptoms;
– diagnose the problem and identify the causes clearly. This manual provides basic background information that must be supplemented with the operator's expertise and specific training available through **HUSQVARNA** held at regular periods;
– plan ahead before starting work: gather any spare parts and tools to avoid unnecessary delays;
– avoid unnecessary disassembly work to get to the part that needs repairing.
Always read the relevant instructions and follow the disassembly sequence outlined in this manual.

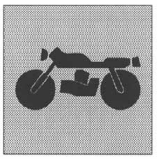
Recommended shop practices

1 Always replace gaskets, sealing rings and split pins with new ones.
2 When loosening or tightening nuts or bolts, always begin with the bigger ones or from the centre. Tighten to the specified torque and follow a cross pattern.
3 Always mark any parts or positions that might be confused upon assembly.
4 Use genuine **HUSQVARNA** parts and the recommended lubricant brands.
5 Use special tools where specified.
6 Technical Bulletins might contain more up-to-date setting data and procedures than this manual. Be sure to read them.

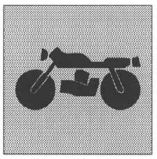
Table of Contents

NOTES

Unless otherwise specified, data and specifications apply to all models.



Section A



Engine
Single cylinder, 4 stroke
Bore ..... 2.05 In.
Stroke ..... 2.05 In.
Displacement ..... 7,591 cu.In.
Compression ratio 11,2:1

Timing system
Type ..... single overhead camshaft; chain operated 4 valve

Valve clearance (with engine cold)
INTAKE ..... 0.0039 ÷ 0.0055 Inches
EXHAUST ..... 0.0079 ÷ 0.0094 Inches

Fuel system
Type ..... "keihin" carburettor
Main jet 122
Low speed jet 35

Air cleaning: dry air filter

Lubrication
Type ..... wet sump with cartridge lobes and filters

Cooling
Liquid with double radiator and heater fan

Ignition
Electronic, inductive with adjustable advance (digital control)
Spark plug type ..... "NGK" CR8E
Spark plug gap ..... 0.027 ÷ 0.031 In.
Starting ..... electric

Transmission
Clutch: oil bath multiple disc clutch
Transmission: 6 gear ratios with constant-mesh gears
Motion is transmitted from engine to gearbox primary shaft through spur gears

Primary drive
Drive pinion gear ..... z 24

Clutch ring gear ..... z 73

Transmission ratio 3,042

Transmission ratio
1st gear ..... 2,833 (z 34/12)
2nd gear ..... 1,875 (z 30/16)
3rd gear ..... 1,364 (z 30/22)
4th gear ..... 1,143 (z 24/21)
5th gear ..... 0,957 (z 22/23)
6th gear ..... 0,840 (z 21/25)

Secondary drive
Motion is transmitted from gearbox to rear wheel by 4/8" x 1/4"

Transmission sprocket ..... z 14

Rear wheel sprocket ((TE) ..... z 59
Rear wheel sprocket (SMS) ..... z 54

Transmission ratio (TE) 4,214
Transmission ratio (SMS) 3,857

Final ratios (TE)
1st gear..... 36,32
2nd gear 24,03
3rd gear 17,48
4th gear 14,65
5Th gear 12,26
6Th gear 10,77

Final ratios (SMS)
1st gear..... 33,24
2nd gear 22,00
3rd gear 16,00
4th gear 13,41
5Th gear 11,22
6Th gear 9,86

Chassis
Single frame, in circular sectioned tubes, in steel; rear steel chassis.

Suspension
Front
”Upside-down” telescopic hydraulic front fork with advanced axle;tubes ø 40 mm;
Travel (mm) 260

Rear
Light alloy swingarm with progressive suspension and hydraulic monoshock.
Spring preload adjustment.
Wheel travel (TE) (in) 11.42
Wheel travel (SMS) (in) 11.10

Brakes
Front
Fixed disc ø 10.24 In. With floating calliper
Brake pad surface area ..... 16,2 cm^2
Separate hydraulic circuit and master cylinder with control on right handlebar.
Rear
Brake pad surface area ..... 16,2 cm^2
Separate hydraulic circuit, pedal and master cylinder on right side of vehicle.

Wheels
Rims
TE
Front..... in light alloy: 1,6x21”
Rear..... in light alloy: 2,15x18”

SMS
Front..... in light alloy: 2,50x17”
Rear..... in light alloy: 3,50x17”

Tyres
TE
Front..... 90/90x21"
Rear..... 120/90x18"

SMS
Front..... 110/70x17"
Rear..... 140/70x17"

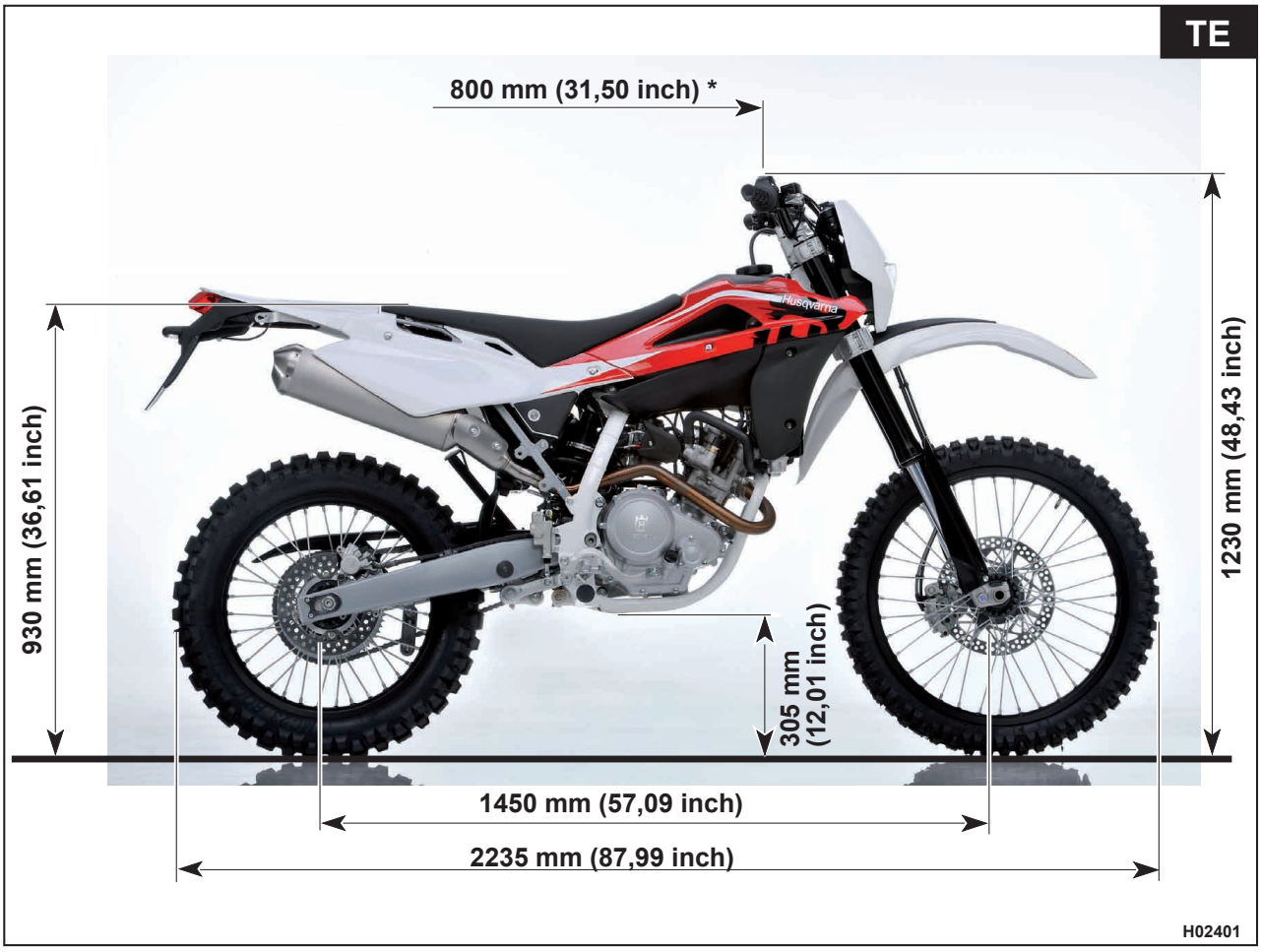
Cold tyre pressure (TE)
Front
Rider only ..... 17.07 Psi
Rider and passenger ..... 21.5 Psi
Rear
Rider only ..... 21.33 Psi
Rider and passenger ..... 25.5 Psi

Cold tyre pressure (SMS)
Front
Rider only ..... 21.33 Psi
Rider and passenger ..... 28.5 Psi
Rear
Rider only ..... 28.5 Psi
Rider and passenger ..... 31.5 Psi

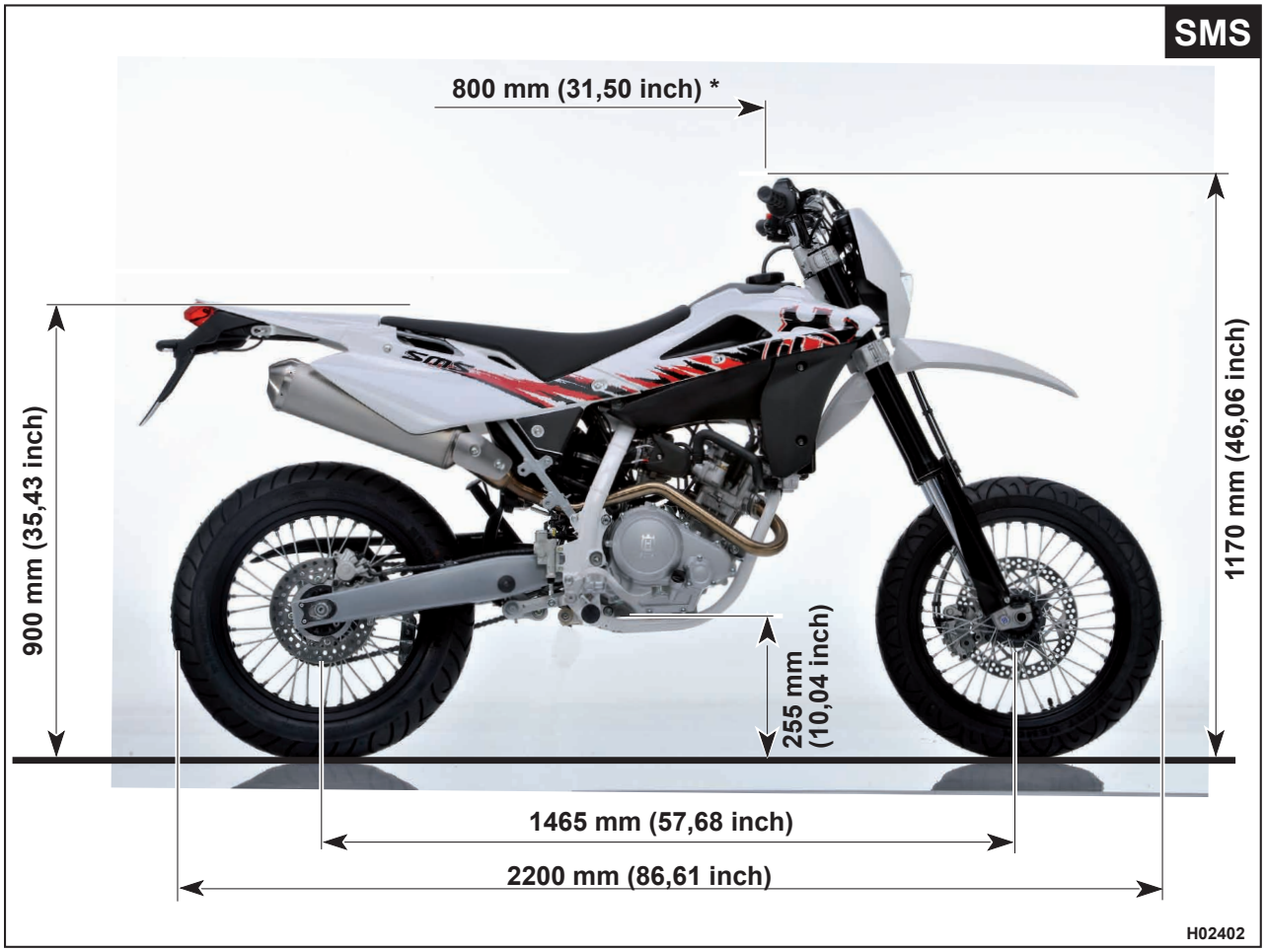
Electrical components location (TE)
The ignition system includes the following elements:
- Generator on the inner side of L.H. crankcase half cover;
- Electronic ignition coil under the fuel tank;
- Electronic control unit under the fuel tank;
- Voltage regulator under the fuel tank;
- Spark plug on cylinder head;
- 12V-450W starter motor behind the engine cylinder;
- Solenoid starter on the left of rear chassis;

The electrical system includes the following elements:
- 12V-6Ah battery under the saddle;
- Turning indicator flasher on left side of rear chassis;
- Relay for electric fan, fuel injection system and lights on right side of chassis;
- Electric fan;
- Fuse located on the left side of the rear subframe;
- Air temperature sensor located on air box;
- Coolant temperature sensor;
- Headlamp with 12V-60-55/W twin halogen bulb and 12V-5W parking light bulb;
- Tail light with 12V-21/W stop lamp and 12V-5W parking light lamp;
- 12V-10W turning indicator bulbs;
- Odometer.

Overall dimensions - Weight
Kerb weight, without fuel (TE-SMS): .....117 Kg (257.94 lb)



*: Max. Width



*: Max. Width

Capacities	Type	Quantity
Fuel tank, reserve included	98 octane unleaded fuel	9,5 litres (2,09 gal.)
Reserve fuel		2 litres (0,44 gal.)
Gearbox/engine oil	CASTROL POWER 1 RACING (SAE 10W50)	1,15 litres (0,3 gal.) (oil change and oil filter replacement) 0,95 litres (0,25 gal) (oil change)
Front fork oil	CASTROL SYNTHETIC FORK OIL (5W)	
Coolant	CASTROL MOTORCYCLE COOLANT	1,2 litres (0,32 gal.)
Front brake fluid	CASTROL RESPONSE SUPER (DOT 4)	
Rear brake fluid	CASTROL RESPONSE SUPER (DOT 4)	
Drive chain lubrication	CASTROL CHAIN LUBE RACING	
Grease lubrication	CASTROL LM GREASE 2	
Electric contact protection	CASTROL METAL PARTS CLEANER	
Fillers for radiator	AREXONS LIQUID FILLER	

IMPORTANT - Do not add any additives to fuel or lubricants.

Section b

TE and **SMS4** models are STREET LEGAL motorcycles; they are guaranteed exempt from functional defects and covered with legal guarantee, as far as the STANDARD CONFIGURATION IS MAINTAINED and the suggested maintenance table shown in Section "B" is observed.

IMPORTANT
VEHICLE CONFIGURATION as outlined below is a prerequisite for the warranty to remain valid:
A) STANDARD MOTORCYCLE, FOR ROAD USE.

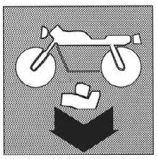
* In order to maintain the vehicle's "Guarantee of Functionality", the client must follow the maintenance programme indicated in Section B by having the required maintenance inspections carried out at authorised HUSQVARNA dealers. The cost for changing parts and for the labour necessary in order to comply with the maintenance plan is charged to the Client. The warranty becomes NULL AND VOID if the motorcycle is rented.

Notes
Left and right side is determined when seated on motorcycle.

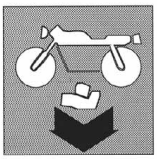
Z: number of teeth

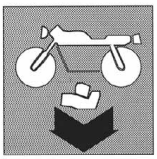
A: Austria
AUS: Australia
B: Belgium
BR: Brazil
CDN: Canada
CH: Switzerland
D: Germany
E: Spain
F: France
FIN: Finland
GB: Great Britain
I: Italy
J: Japan
USA: United States of America

Unless otherwise specified, data and instructions apply to all market variants.



Section F





ENGINE TECHNICAL DATA

Engine

- Engine type ..... 4-stroke, liquid cooled, SOHC
- Displacement ..... 124.7 cm3.
- Cylinders layout ..... Single-cylinder tilted forward
- Bore x stroke ..... 52.0 x 58.6 mm (2.05 x 2.31 in)
- Compression ratio 11.20:1
- Standard compression value (at sea level) ..... 550 kPa/600 rpm (78.2 psi/600 rpm) ..... (5.5 kgf/cm2/600 rpm)
- Minimum-maximum ..... 480-620 kPa (68.3-88.2 psi) (4.8-6.2 kgf/cm2)
- Starting system ..... Electric starting device

Fuel

- Recommended fuel ..... Only unleaded fuel

Engine oil

- Lubrication system ..... Wet sump
- Type ..... SAE 10W-30, SAE 10W-40, SAE 15W-40, SAE 20W-40 or SAE 20W-50
- Recommended engine oil grade ..... API service type SG or higher, JASO standard MA

Engine oil capacity

- Total quantity ..... 1.15 L (1.22 USqt) (1.01 Imp.qt)
- Without replacing the oil filter ..... 0.95 L (1.00 US qt) (0.84 Imp.qt)
- When replacing the oil filter ..... 1.00 L (1.06 US qt) (0.88 Imp.qt)

Oil filter

- Type of oil filter ..... Paper

Oil pump

- Type of oil pump ..... Trochoidal
- Internal rotor-external rotor end clearance ..... Below 0.15 mm (0.0059 in)
- Limit ..... 0.23 mm (0.0091 in.)
- External rotor-oil pump housing clearance ..... 0.13-0.18 mm (0.0051-0.0071 in)
- Limit ..... 0.25 mm (0.0098 in)
- Oil pump housing-internal and external rotor clearance ..... 0.06-0.11 mm (0.0024-0.0043 in)
- Limit ..... 0.18 mm (0.0071 in)
- Safety valve operating pressure ..... 39.2-78.4 kPa (5.7-11.4 psi) (0.39-0.78 kgf/cm2)
- Pressure pick-up point ..... Check bolt on cylinder head body

Thermostat

- Model/manufacturer ..... 5YP/NIPPON THERMOSTAT
- Valve opens at ..... 80.5-83.5 °C (176.9-182.3 °F)
- Valve completely opens at ..... 95.0 °C (203.0°F)
- Valve lift (fully open) ..... 3.0 mm (0.12 in)

Radiator

- Width ..... 198.0 mm (7.80 in)
- Height ..... 128.0 mm (5.04 in)
- Depth ..... 24.0 mm (0.94 in)

Water pump

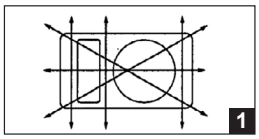
- Water pump type ..... Single suction centrifugal pump
- Reduction Transmission ratio 19/38 (0.500)

Spark plug(s)

- Manufacturer/model NGK/CR8E
- Electrode gap ..... 0.7-0.8 mm (0.028-0.031 in)

Cylinder head

- Volume ..... 9.90-10.50 cm3 (0.60-0.64 cu.in)
- Deformation limit ..... 0.03 mm (0.0012 in)

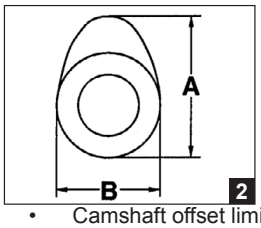


Camshaft

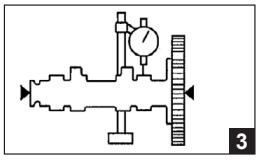
- Transmission system..... Chain-drive (left)

Camshaft lobe dimensions

- Intake A ..... 30.225-30.325 mm (1.1900-1.1939 in)
- Limit ..... 30.125 mm (1.1860 in)
- Intake B ..... 25.114 - 25.214
- Limit..... 25.014
- Exhaust A ..... 30.261 - 30.361
- Limit..... 30.161
- Exhaust B ..... 25.172 - 25.272
- Limit..... 25.072



- Camshaft offset limit..... 0.030 mm (0.0012 in)



Timing chain

- Model/number of links ..... DID SCR-0404SV/96
- Tensioning system..... Automatic

Rocker arm/rocker arm shaft

- Rocker arm inside diameter ..... 9.985-10.000 mm (0.3931-0.3937 in)
- Limit ..... 10.015 mm (0.3943 in)
- Rocker arm shaft outside diameter ..... 9.966-9.976 mm (0.3924-0.3928 in)
- Limit ..... 9.941 mm (0.3914 in)
- Rocker arm-rocker arm shaft clearance ..... 0.009-0.034 mm (0.0004-0.0013 in)
- Limit ..... 0.074 mm (0.0029 in)

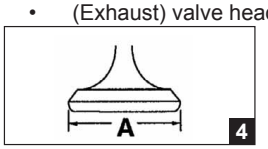
Valve, valve seat, valve guide

Valve clearance (with cold engine)

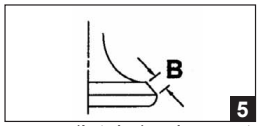
- Intake ..... 0.10-0.14 mm (0.0039-0.0055 in)
- Exhaust ..... 0.20-0.24 mm (0.0079-0.0094 in)

Valve dimensions

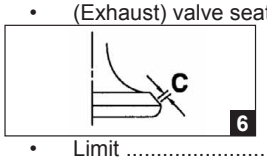
- (Intake) valve head A diameter ..... 19.40-19.60 mm (0.7638-0.7717 in)
- (Exhaust) valve head A diameter ..... 16.90-17.10 mm (0.6654-0.6732 in)



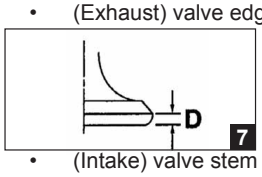
- (Intake) valve face B width .....1.538-2.138 mm (0.0606-0.0842 in)
- (Exhaust) valve face B width .....1.538-2.138 mm (0.0606-0.0842 in)



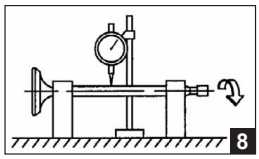
- (Intake) valve seat C width .....0.90-1.10 mm (0.0354-0.0433 in)
- Limit .....1.6 mm (0.06 in)
- (Exhaust) valve seat C width .....0.90-1.10 mm (0.0354-0.0433 in)



- Limit .....1.6 mm (0.06 in)
- (Intake) valve edge D thickness .....0.50-0.90 mm (0.0197-0.0354 in)
- (Exhaust) valve edge D thickness .....0.50-0.90 mm (0.0197-0.0354 in)



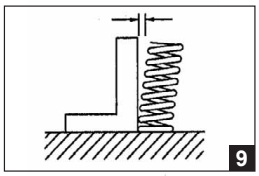
- (Intake) valve stem diameter .....4.475-4.490 mm (0.1762-0.1768 in)
- Limit .....4.445 mm (0.1750 in)
- (Exhaust) valve stem diameter .....4.460-4.475 mm (0.1756-0.1762 in)
- Limit .....4.430 mm (0.1744 in)
- (Intake) valve guide inside diameter .....4.500-4.512 mm (0.1772-0.1776 in)
- Limit .....4.550 mm (0.1791 in)
- (Exhaust) valve guide inside diameter .....4.500-4.512 mm (0.1772-0.1776 in)
- Limit .....4.550 mm (0.1791 in)
- (Intake) valve stem-valve guide clearance.....0.010-0.037 mm (0.0004-0.0015 in)
- Limit .....0.080 mm (0.0032 in)
- (Exhaust) valve stem-valve guide clearance.....0.025-0.052 mm (0.0010-0.0020 in)
- Limit .....0.100 mm (0.0039 in)
- Valve stem offset.....0.010 mm (0.0004 in)



- (Intake) cylinder head valve seat width .....0.90-1.10 mm (0.0354-0.0433 in)
- Limit .....1.6 mm (0.06 in)
- (Exhaust) cylinder head valve seat width .....0.90-1.10 mm (0.0354-0.0433 in)
- Limit .....1.6 mm (0.06 in)

Valve spring

- (Intake) free length.....41.71 mm (1.64 in)
- Limit .....39.62 mm (1.56 in)
- (Exhaust) free length.....41.71 mm (1.64 in)
- Limit .....39.62 mm (1.56 in)
- (Intake) length, when installed .....35.30 mm (1.39 in)
- (Exhaust) length, when installed .....35.30 mm (1.39 in)
- Flexibility K1 (intake).....23.54 N/mm (134.41 lb/in) (2.40 kgf/mm)
- Flexibility K2 (intake).....36.58 N/mm (208.87 lb/in) (3.73 kgf/mm)
- Flexibility K1 (exhaust).....23.54 N/mm (134.41 lb/in) (2.40 kgf/mm)
- Flexibility K2 (exhaust).....36.58 N/mm (208.87 lb/in) (3.73 kgf/mm)
- (Intake) compression spring pressure when installed.....140-162 N (31.47-36.42 lbf) (14.28-16.52 kgf)
- (Exhaust) compression spring pressure when installed.....140-162 N (31.47-36.42 lbf) (14.28-16.52 kgf)
- (Intake) spring tilt .....2.5° / 1.8 mm
- (Exhaust) spring tilt .....2.5° / 1.8 mm



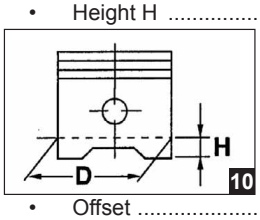
- Winding direction (intake)..... Clockwise
- Winding direction (exhaust)..... Clockwise

Cylinder

- Bore.....52.000-52.010 mm (2.0472-2.0476 in)
- Wear limit ..... 52.110 mm (2.0516 in)
- Taper limit ..... 0.050 mm (0.0020 in)
- Out-of-round limit ..... 0.005 mm (0.0002 in)

Piston

- Cylinder-piston clearance .....0.015-0.048 mm (0.0006-0.0019 in)
- Limit ..... 0.15 mm (0.0059 in)
- Diameter D .....51.962-51.985 mm (2.0457-2.0466 in)
- Height H ..... 5.0 mm (0.20 in)

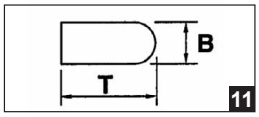


- Offset ..... 0.50 mm (0.0197 in)
- Offset direction ..... Intake side
- Piston pin bore inside diameter .....14.002-14.013 mm (0.5513-0.5517 in)
- Limit ..... 14.043 mm (0.5529 in)
- Piston pin outside diameter .....13.995-14.000 mm (0.5510-0.5512 in)
- Limit ..... 13.975 mm (0.5502 in)
- Piston pin-piston pin bore clearance .....0.002-0.018 mm (0.0001-0.0007 in)
- Limit ..... 0.068 mm (0.0027 in)

Piston ring

Upper piston ring

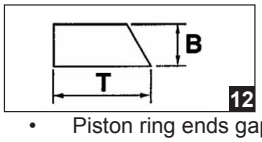
- Ring type ..... Cylinder
- Dimensions (B x T)..... 0.80 x 1.90 mm (0.03 x 0.07 in)



- Piston ring ends gap (when installed) .....0.10-0.25 mm (0.0039-0.0098 in)
- Limit ..... 0.50 mm (0.0197 in)
- Ring side play .....0.030-0.065 mm (0.0012-0.0026 in)
- Limit ..... 0.100 mm (0.0039 in)

Lower piston ring

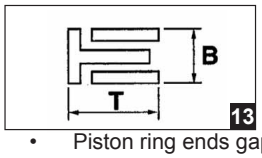
- Ring type ..... Taper
- Dimensions (B x T)..... 0.80 x 2.10 mm (0.03 x 0.08 in)



- Piston ring ends gap (when installed) .....0.10-0.25 mm (0.0039-0.0098 in)
- Limit ..... 0.60 mm (0.0236 in)
- Ring side play .....0.020-0.055 mm (0.0008-0.0022 in)
- Limit ..... 0.100 mm (0.0039 in)

Scraper ring

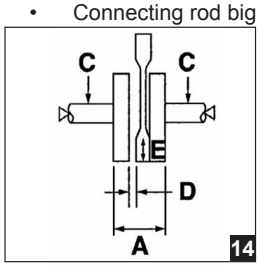
- Dimensions (B x T) ..... 1.50 x 1.95 mm (0.06 x 0.08 in)



- Piston ring ends gap (when installed) .....0.20-0.70 mm (0.0079-0.0276 in)
- Ring side play .....0.040-0.160 mm (0.0016-0.0063 in)

Crankshaft

- Width A .....47.95-48.00 mm (1.888-1.890 in)
- Offset limit C .....0.030 mm (0.0012 in)
- Connecting rod big end side play D .....0.110-0.410 mm (0.0043-0.0161 in)
- Connecting rod big end radial play E .....0.004-0.014 mm (0.0002-0.0006 in)



Balance shaft

- Balance shaft drive ..... Gear

Clutch

- Clutch type ..... Multiplate, wet
- Clutch release method ..... Internal control, cam control
- Clutch lever clearance .....10.0-15.0 mm (0.39-0.59 in)
  - Friction plate 1 thickness.....2.90 -3.10 mm (0.114-0.122 in)
  - Wear limit ..... 2.80 mm (0.1102 in)
  - Number of plates.....1 piece
  - Friction plate 3 thickness .....2.90 -3.10 mm (0.114-0.122 in)
  - Wear limit ..... 2.80 mm (0.1102 in)
  - Number of plates.....3 pieces
  - Friction plate 2 thickness .....2.90 -3.10 mm (0.114-0.122 in)
  - Wear limit ..... 2.80 mm (0.1102 in)
  - Number of plates.....1 piece
  - Clutch plate thickness .....1.45 -1.75 mm (0.057-0.069 in)
  - Number of plates.....4 pieces
  - Deformation limit .....0.20 mm (0.0079 in)
  - Clutch spring free length .....38.71 mm (1.52 in)
  - Minimum length .....36.77 mm (1.45 in)
  - Number of springs.....4 pieces
- Pushrod bending limit.....0.500 mm (0.0197 in)

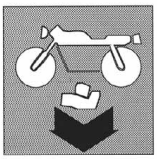
Transmission

- Transmission type .....With 6 constant mesh gears
- Primary reduction system..... Helical gear
- Primary drive ratio 73/24 (3.042)
- Final reduction system ..... Chain drive
- Final drive ratio 48/14 (3.429)
- Left foot operation
- Transmission ratio
- 1st 34/12 (2.833)
- 2nd 30/16 (1.875)
- 3rd 30/22 (1.364)

- 4th 24/21 (1.143)
- 5th 22/23 (0.957)
- 6th 21/25 (0.840)
- Input shaft offset limit ..... 0.08 mm (0.0032 in)
- Output shaft offset limit ..... 0.08 mm (0.0032 in)

Gear selector mechanism

- Type of gear selector mechanism ..... Gear selector drum and shaft
- Gear selector fork thickness..... 5.76-5.89 mm (0.227-0.232 in) x 1
- Gear selector fork thickness..... 4.76-4.89 mm (0.187-0.193 in) x 2



ELECTRICAL SYSTEM SPECIFICATIONS

Voltage

- System voltage ..... 12 V

Ignition system

- Ignition system ..... TCI (digital)
- Ignition advance (BTDC)

Ignition coil

- Model/manufacturer 2JN/YAMAHA
- Primary coil resistance ..... 1.92÷2.88 Ω at 20°
- Secondary coil resistance ..... 6.32÷9.48 Ω at 20°

AC magnet

- Model/manufacturer F39S/YAMAHA
- Standard power ..... 14.0 V, 20.8 A 5000 rpm
- Standard power ..... 14.0 V, 235 W 5000 rpm
- Stator coil resistance ..... 0.32÷0.48 Ω at 20°C (68 °F)

Rectifier/regulator

- Type of regulator ..... Semiconductor-short-circuit
- Model/manufacturer ..... SH640EA /SHINDENGEN
- Rectified voltage (CG) ..... 14.1÷14.9 V
- Rectifier capacity (DC) ..... 25.0 A
- Withstand voltage ..... 200.0 V

Electric starting system

- System type ..... Constant mesh

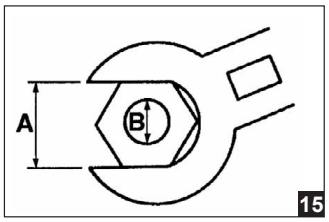
Starter motor

- Model/manufacturer 3C1/YAMAHA
- Output power ..... 0.20 kW
- Rotor winding resistance ..... 0.0315÷0.0385 Ω
- Brush overall length ..... 7.0 mm (0.28 in)
- Limit ..... 3.50 mm (0.14 in)
- Brush spring pressure ..... 3.92-5.88 N (14.11-21.17 oz) (400-600 gf)
- Switch diameter ..... 17.6 mm (0.69 in)
- Limit ..... 16.6 mm (0.65 in)
- Mica coating (depth) ..... 1.35 mm (0.05 in)

TIGHTENING TORQUE FIGURES

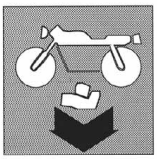
TIGHTENING TORQUE FIGURES GENERAL SPECIFICATIONS

The chart contains the tightening torque figures for the standard fasteners with standard ISO thread pitch. Tightening torque figures specifications for special assemblies or components can be found in the relevant chapters of this manual.
To avoid deformations, gradually tighten the fasteners in a cross pattern, until reaching the specified tightening torque. Unless otherwise indicated, specified tightening torque figures are intended with clean and dry threading. The components must be at ambient temperature.
A. Wrench opening



B. Thread outside diameter

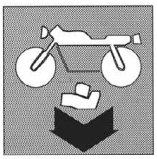
A (nut)	B (bolt)	General torque figures		
		Nm	m-kg	ft-lb
10 mm	6 mm	6	0.6	4.3
12 mm	8 mm	15	1.5	11
14 mm	10 mm	30	3.0	22
17 mm	12 mm	55	5.5	40
19 mm	14 mm	85	8.5	61
22 mm	16 mm	130	13.0	94



ENGINE TORQUE FIGURES

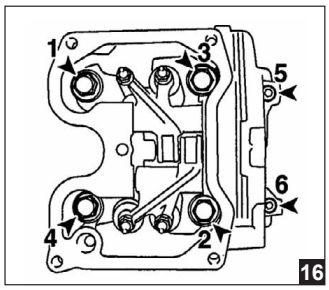
Cylinder head tightening sequence:

Element	Thread	Quantity	Tightening torque	Remarks
Cylinder head bolt	M8	4	22 Nm (2.2 m·kg, 16 ft-lb)	E
Cylinder head bolt	M6	2	10 Nm (1.0 m·kg, 7.2 ft-lb)	E
Spark plug	M10	1	13 Nm (1.3 m·kg, 9.4 ft-lb)	
Cylinder head cover bolt	M6	5	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Oil level inspection plug	M6	1	7 Nm (0.7 m·kg, 5.1 ft-lb)	
Balance shaft driven gear nut	M10	1	50 Nm (5.0 m·kg, 36 ft-lb)	
Valve adjuster screw check nut	M5	4	7 Nm (0.7 m·kg, 5.1 ft-lb)	
Camshaft sprocket bolt	M8	1	30 Nm (3.0 m·kg, 22 ft-lb)	
Camshaft retaining bolt	M6	2	7 Nm (0.7 m·kg, 5.1 ft-lb)	
Timing chain guide bolt (intake side)	M6	1	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Timing chain tensioner bolt	M6	2	10 Nm (1.0 m·kg, 7.2 ft-lb)	Sealant (Three Bond No.1215®)
Water pump assembly bolt	M6	2	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Water pump assembly bolt	M6	1	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Water pump housing cover bolt	M6	4	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Impeller shaft retainer bolt	M6	2	10 Nm (1.0 m·kg, 7.2 ft-lb)	LT
Thermostat cover bolt	M6	2	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Oil pump assembly screw	M5	2	4 Nm (0.4 m·kg, 2.9 ft-lb)	
Oil drain plug	M35	1	32 Nm (3.2 m·kg, 23 ft-lb)	
Oil filter element cover bolt	M6	2	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Oil filter element cover bolt	M6	1	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Oil baffle plate bolt	M6	2	10 Nm (1.0 m·kg, 7.2 ft-lb)	LT
Intake manifold bolt	M6	2	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Crankcase bolt	M6	2	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Crankcase bolt	M6	6	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Crankcase bolt	M6	4	10 Nm (1.0 m·kg, 7.2 ft-lb)	

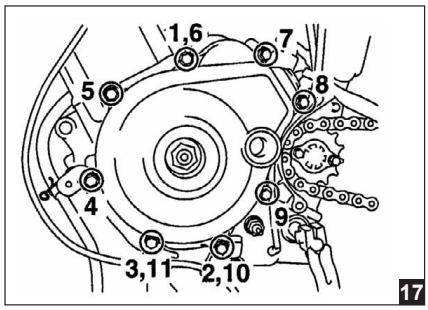


Element	Thread	Quantity	Tightening torque	Remarks
Generator cover bolt	M6	7	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Clutch casing bolt	M6	4	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Clutch casing bolt	M6	6	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Sprocket cover bolt	M6	2	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Unidirectional starter bolt	M6	3	14 Nm (1.4 m·kg, 10 ft-lb)	
Primary drive gear nut	M12	1	60 Nm (6.0 m·kg, 43 ft-lb)	
Clutch spring bolt	M6	4	12 Nm (1.2 m·kg, 8.7 ft-lb)	
Short clutch pushrod check nut	M6	1	8 Nm (0.8 m·kg, 5.8 ft-lb)	
Clutch hub nut	M14	1	70 Nm (7.0 m·kg, 50 ft-lb)	
Sprocket stop bolt	M6	2	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Crankcase bearing stop bolt	M6	2	7 Nm (0.7 m·kg, 5.1 ft-lb)	
Gear selector drum section screw	M6	1	12 Nm (1.2 m·kg, 8.7 ft-lb)	
Stop lever bolt	M6	1	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Stator coil bolt	M6	3	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Crankshaft position sensor bolt	M6	2	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Generator rotor nut	M12	1	70 Nm (7.0 m·kg, 50 ft-lb)	
Neutral switch	M10	1	20 Nm (2.0 m·kg, 14 ft-lb)	
Starter motor bolt	M6	1	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Starter motor bolt	M6	1	10 Nm (1.0 m·kg, 7.2 ft-lb)	
Coolant temperature sensor	M12	1	18 Nm (1.8 m·kg, 13 ft-lb)	

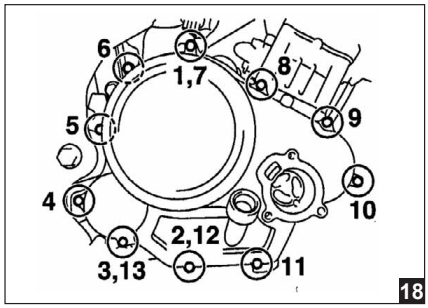
Generator cover tightening sequence:



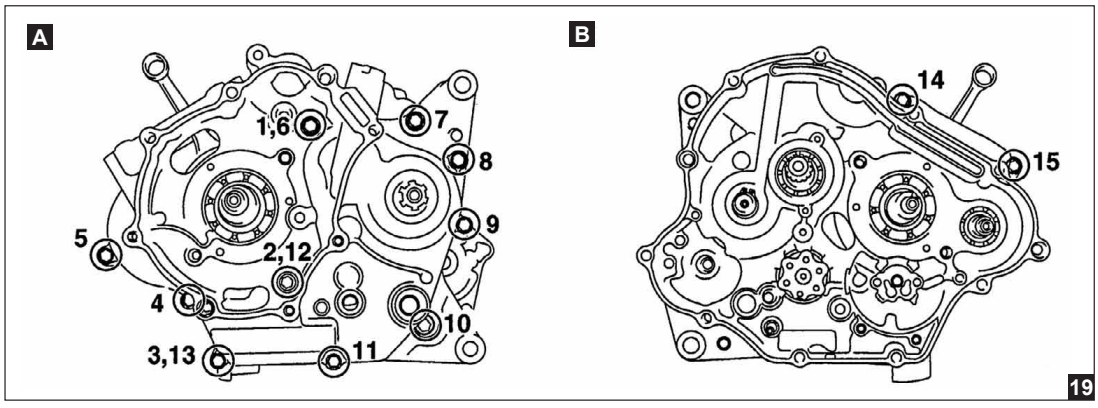
Clutch casing tightening sequence:



Crankcase tightening sequence:



A. Left crankcase



B. Right crankcase

LUBRICATION POINTS AND TYPES OF LUBRICANT

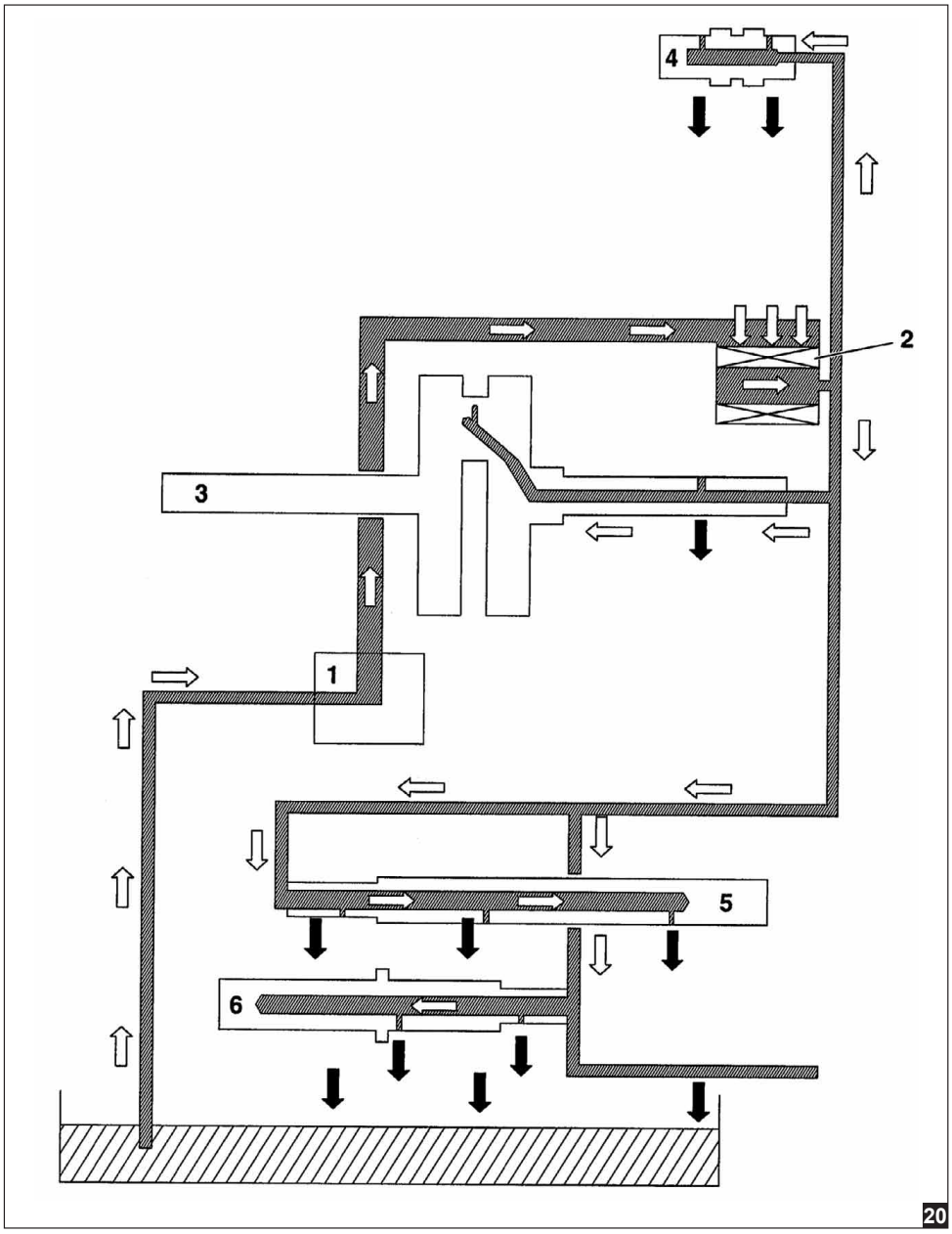
ENGINE

Lubrication point	Lubricant
Oil seal lips	LS
Bearings	E
Cylinder head bolts seat, thread and washers	E
Water pump assembly O-ring	LS
Cylinder head cover gasket	LS
Connecting rod big end	E
Piston pin	E
Cylinder inner surface, piston, piston rings grooves and piston rings	E
Balance shaft O-ring	LS
Camshaft lobes and rocker arm rollers	M
Decompression chamber cam	E
Valve stems and valve stem seals	M
Valve stem tip	M
Rocker arm shafts	E
Rocker arm inside surface	M
Decompression chamber arm joint	M
Engine oil drain plug O-ring	LS
Oil pump driven gear shaft	E
Oil filter cover O-ring	LS
Intake manifold O-ring	LS
Timing mark access screw O-ring	LS
Crankshaft end access screw O-ring	LS
Engine oil filler plug O-ring	LS
Unidirectional starter gear washer and thrust surfaces	E
Unidirectional starter rollers and unidirectional starter gear hub	E

Lubrication point	Lubricant
Starter motor O-ring	LS
Unidirectional starter idle gear shaft and unidirectional starter idle gear inner surface	E
Unidirectional starter idle gear washer and thrust surfaces	E
Clutch control lever	E
Primary driven gear inner surface	E
Long clutch pushrod	E
Ball and short clutch pushrod	E
Clutch pushrod ball	E
Clutch hub seat and thread	E
Input shaft and sprockets	E
Output shaft and gearwheels	M
Gear selector drum assembly	E
Gear selector forks and their shaft	E
Gearbox shaft	E
Crankshaft position sensor/stator assembly cable grommet	Sealant (Three Bond No. 1215®)
Crankcase mating surfaces	Sealant (Three Bond No. 1215®)
Timing chain tensioner bolt thread	Sealant (Three Bond No. 1215®)

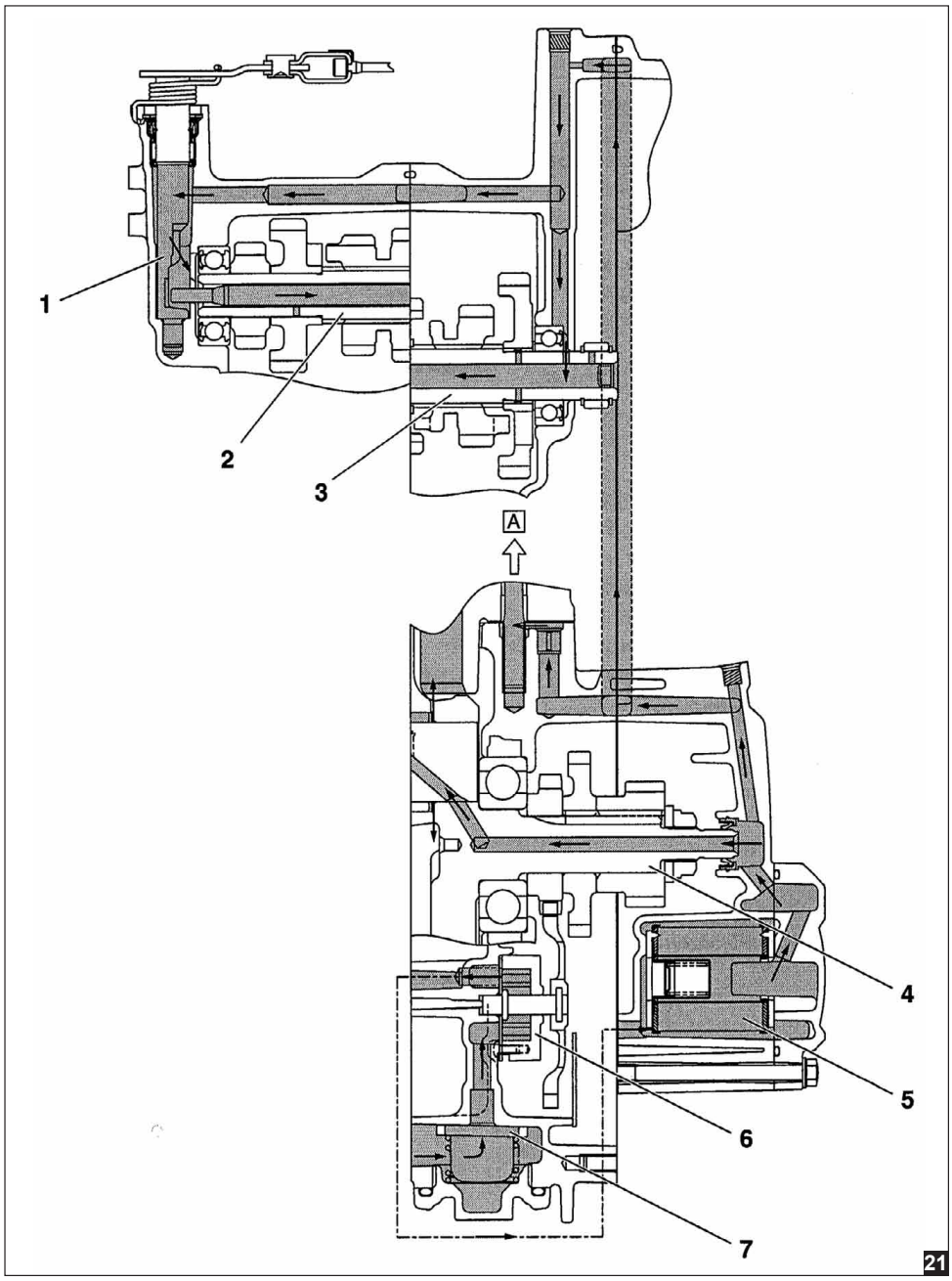
DIAGRAMS AND TABLES ABOUT THE LUBRICATION SYSTEM

ENGINE OIL LUBRICATION CHART



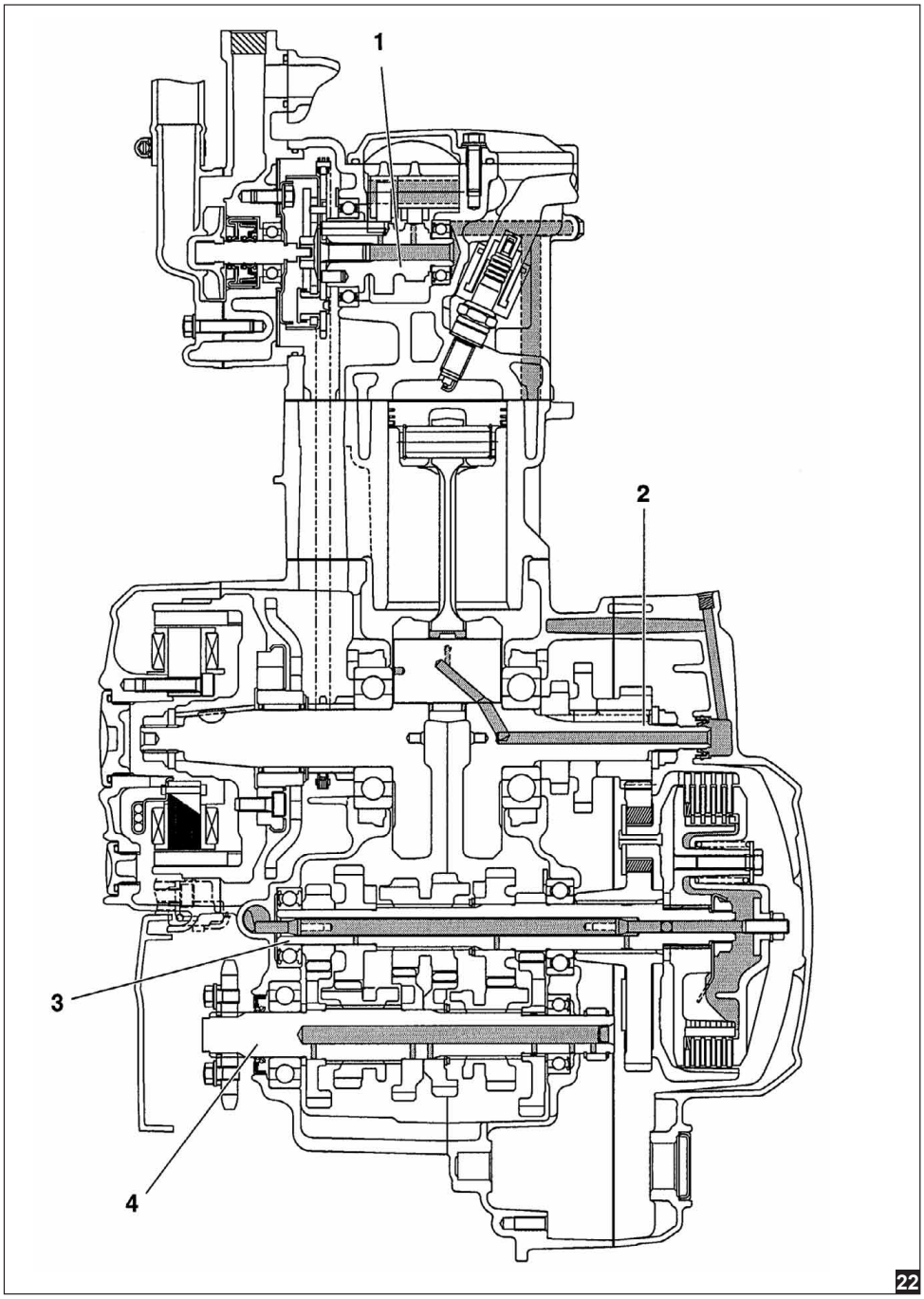
1. Oil pump
2. Oil filter element
3. Crankshaft
4. Camshaft
5. Input shaft
6. Output shaft

LUBRICATION DIAGRAMS



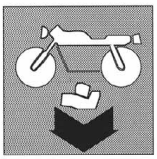
1. Clutch control lever
2. Input shaft
3. Output shaft
4. Crankshaft
5. Oil filter
6. Oil pump assembly
7. Oil filter

A. To cylinder head



1. Camshaft
2. Crankshaft
3. Input shaft
4. Output shaft

Section F1

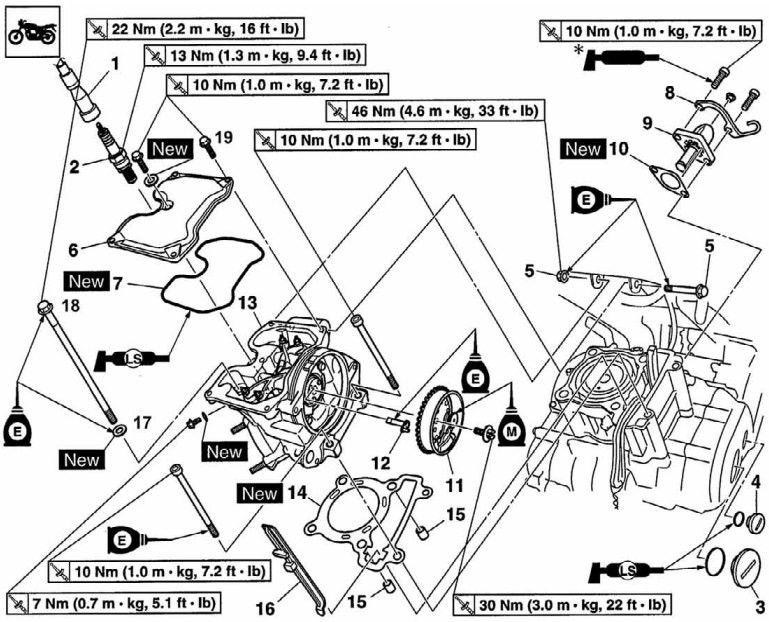


ENGINE OVERHAUL

CYLINDER HEAD REMOVAL

Cylinder head removal

New = part to be replaced upon reassembly

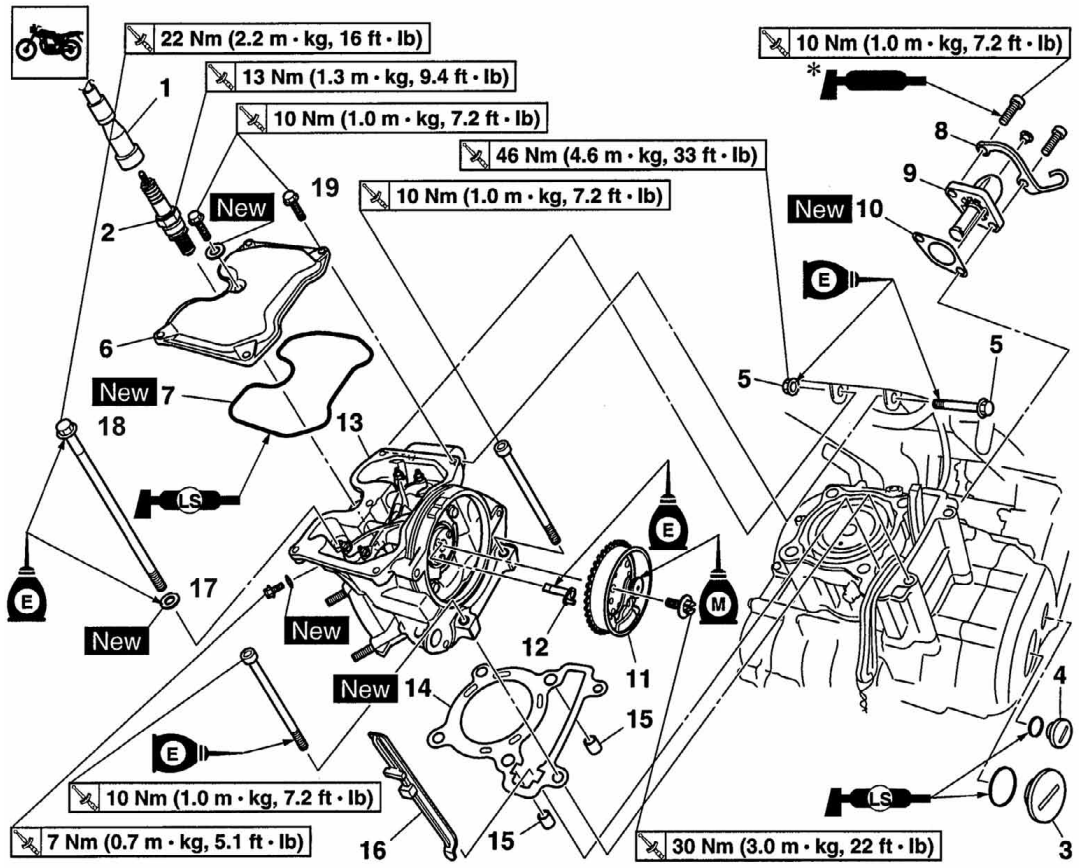


Sequence	Operation/Parts to remove	Quantity	Remarks
1	Spark plug cap	1	Disconnect
2	Spark plug	1	
3	Crankshaft end access screw	1	
4	Timing mark access screw	1	
5	Engine assembly nut/bolt (front side)	1/1	
6	Cylinder head cover	1	
7	Cylinder head cover gasket	1	
8	Clutch cable support	1	
9	Timing chain tensioner	1	
10	Timing chain tensioner gasket	1	
11	Camshaft sprocket	1	
12	Decompression chamber cam	1	
13	Cylinder head	1	
14	Cylinder head gasket	1	
15	Dowel pin	2	

CYLINDER HEAD REMOVAL

Cylinder head removal

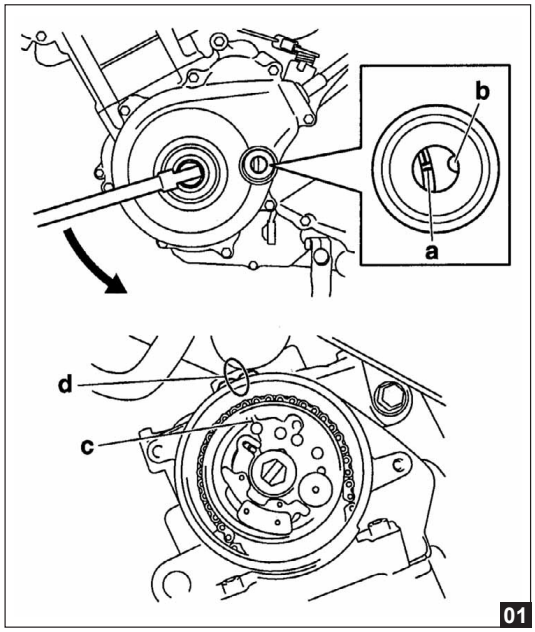
New = part to be replaced upon reassembly



Sequence	Operation/Parts to remove	Quantity	Remarks
16	Timing chain guide (exhaust side)	1	
17	Washer	4	
18	Head clamp screw	4	
19	Head cover clamp screw	4	
			Reverse removal procedure to install.

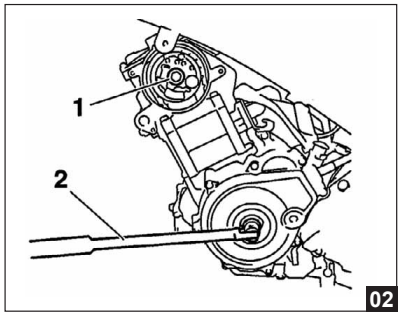
* Sealant Three Bond No.1215®

CYLINDER HEAD REMOVAL



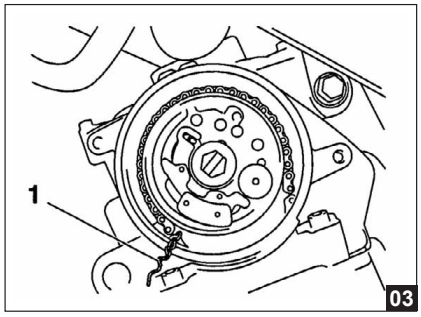
1. Align:
- Reference "I" "a" on generator rotor (with the stationary reference "b" on the generator cover). Keep the thermostat "1" suspended in a container "2" full of water. (see fig. 01)

a. Rotate the crankshaft anticlockwise.
b. With the piston at TDC in compression phase, align the reference " I " "c" on the camshaft sprocket to reference "d" on the cylinder head. (see fig. 01)



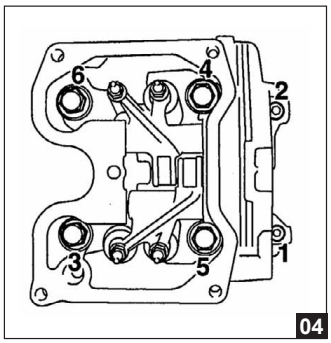
2. Slacken:
- Camshaft sprocket bolt "1" (see fig. 02)

- **NOTE:**
  Holding the generator rotor nut with a wrench "2", slacken the camshaft sprocket bolt.



3. Remove:
- Camshaft sprocket

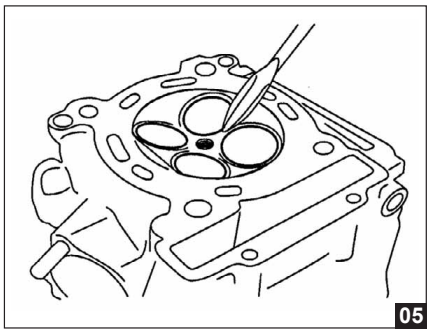
- **NOTE:**
  To prevent the timing chain from falling in the crankcase, fix it with an iron wire "1" . (see fig. 03)



4. **Remove:**
   - Cylinder head

- **NOTE:**
- **Slacken the bolts in the correct indicated sequence.**
- **Slacken each bolt of 1/2 turn at the time. Once all the bolts have been slackened, remove bolts 1, 2, 4 and 6, then remove the cylinder head with bolts 3 and 5 inserted in their holes.**

CYLINDER HEAD CHECK



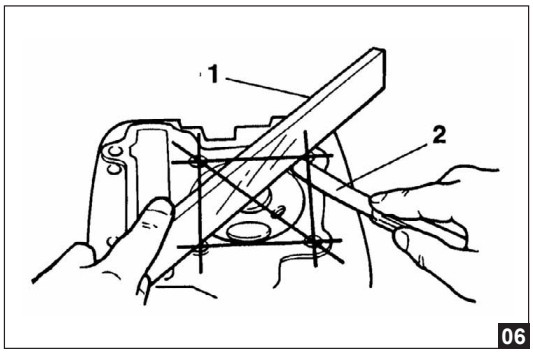
1. **To delete:**
   - Carbon deposits from the combustion chamber (with a rounded scraper)

- **NOTE:**
- **Do not use sharp objects to avoid damaging or scratching:**
- **Spark plug hole threading**
- **Valve seats**

2. **Check:**
   - Cylinder head
   - Damages/scratches → Replace.
   - Cylinder head water jacket mineral/rust deposit→ Eliminate.

3. **Measure:**
   - Cylinder head deformation
   - Not conforming to specifications → Surface cylinder head.

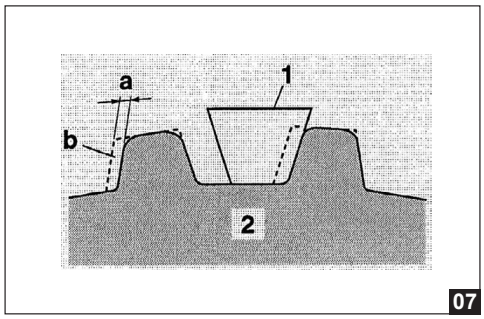
	• **Deformation limit 0.03 mm (0.0012 in)**



a. Place a checking ruler "1" and a feeler gauge "2" transversally on the cylinder head. (see fig. 06)
b. Measure the deformation.
c. Check if limits are exceeded, surface the cylinder head as follows.
d. Place damp sand paper of 400-600 grain on a surface plane and surface the cylinder head with a movement like an eight.

- **NOTE:**
- **To obtain a uniform surface, rotate the cylinder head several times.**

CAMSHAFT SPROCKET AND TIMING CHAIN GUIDE CHECK



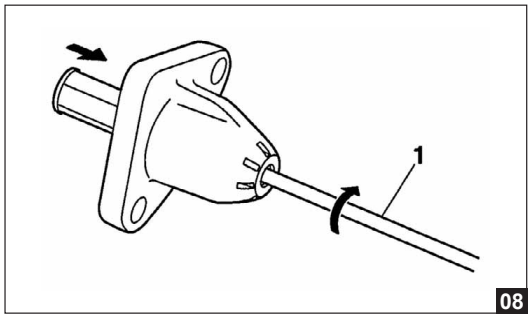
1. **Check:**
   - Camshaft sprocket.
   - Over 1/4 of "a" wear tooth → Replace as a block the camshaft sprocket, the timing chain and the crankshaft. (see fig. 07)

a. 1/4 of tooth
b. Correct

1. Timing chain roller
2. Camshaft sprocket

2. **Check:**
   - Timing chain guide (exhaust side) Damage/wear → Replace.

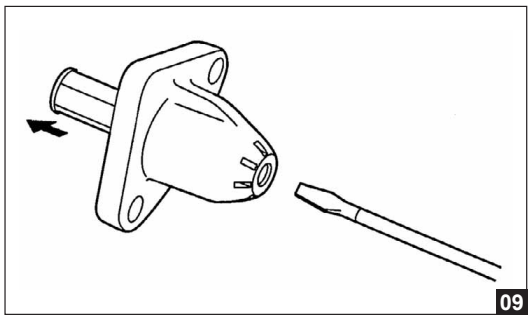
TIMING CHAIN TENSIONER CHECK



1. **Check:**
   - Timing chain tensioner
   - Clefts/damage/irregular movement → Replace.

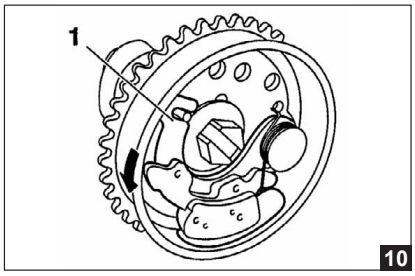
a. Slightly press with your hands the timing chain tensioner rod in the tensioner slot.

- **NOTE:**
- **Pressing the timing chain tensioner rod, turn it clockwise with a blade screwdriver.**



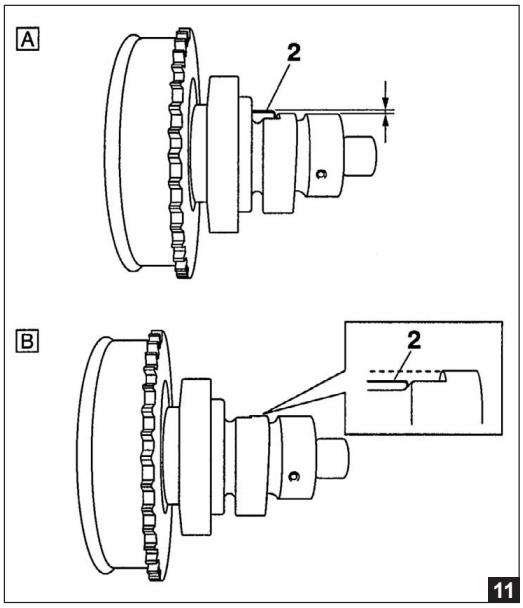
b. Remove the screwdriver and slowly release the timing chain tensioner rod "1" until stop. (see fig. 08)
c. Make sure the timing chain tensioner rod is easily removed from the timing chain tensioner slot.
If the movement is irregular, replace the chain tensioner.

DECOMPRESSION SYSTEM CHECK



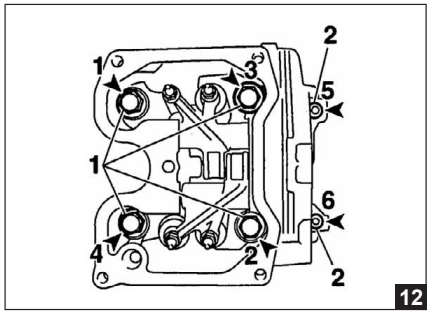
1. **Check:**
   • Decompression system

a. Check the decompression system with the camshaft sprocket and the decompression chamber cam installed in the camshaft.
b. Check that the decompression chamber lever "1" moves easily. (see fig. 10)



c. Without acting on the decompression chamber lever, verify that the decompression chamber cam "2" protrudes from the camshaft (exhaust cam) as shown in figure 11 "A".
d. Move the decompression chamber lever "1" in the direction of the arrow and verify that the decompression chamber cam does not protrude from the camshaft (exhaust cam) as shown in figure 11 "B".

CYLINDER HEAD INSTALLATION



1. **Install:**
   - Cylinder head

- **Make the timing chain go through the timing chain notch.**

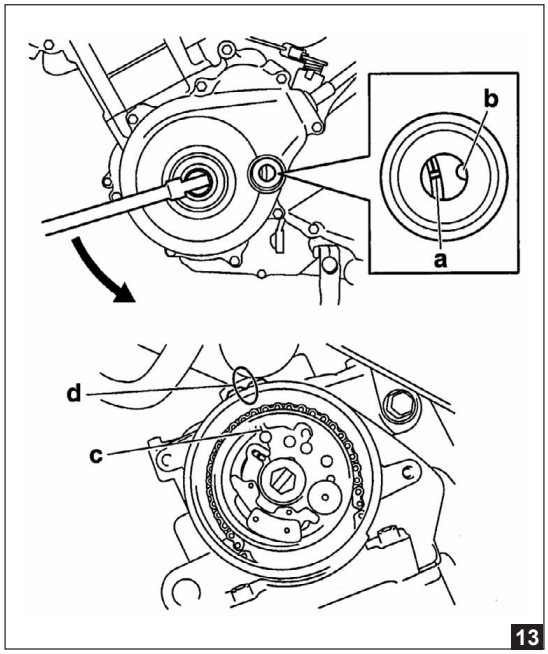
2. **Tighten:**
   - Cylinder head bolts "1" (see fig. 12)
   - Cylinder head bolts "2" (see fig. 12)

Nm	• **Cylinder head bolt 22 Nm - 2.2 Kgm - 16 ft-lb**

- **Lubricate cylinder head bolts and washers with engine oil.**

Nm	• **Cylinder head bolt 10 Nm - 1.0 Kgm - 7.2 ft-lb**

- **Tighten cylinder head bolts in two stages, respecting the correct tightening sequence indicated in the figure.**



3. **Install:**
   - Camshaft sprocket

a. Rotate the crankshaft anticlockwise.
b. Align the reference " I " "a" on the generator rotor to the stationary reference "b" on the generator cover. (see fig. 13)
c. Align the reference " I " "c" on the camshaft sprocket to the stationary reference "d" on the cylinder head. (see fig. 13)
d. Install the timing chain on the camshaft sprocket, hence install the camshaft sprocket on the camshaft.

- **When installing the camshaft sprocket, make sure the timing chain is as tight as possible on the exhaust side.**

⚠	**WARNING!** • **Do not rotate the crankshaft during installation of the crankshaft(s) to avoid damage or an incorrect valve adjustment.**

e. Blocking the camshaft, temporarily tighten the camshaft sprocket bolt.
f. Remove the iron wire from the timing chain.

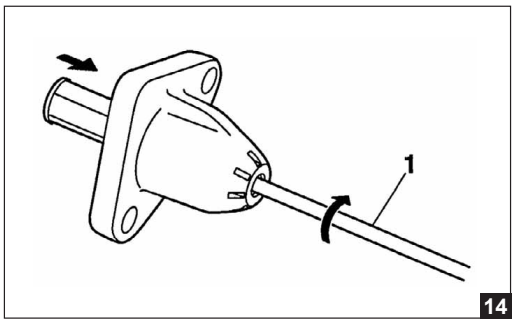
CYLINDER HEAD INSTALLATION

1. Install:
- timing chain tensioner gasket

- Timing chain tensioner

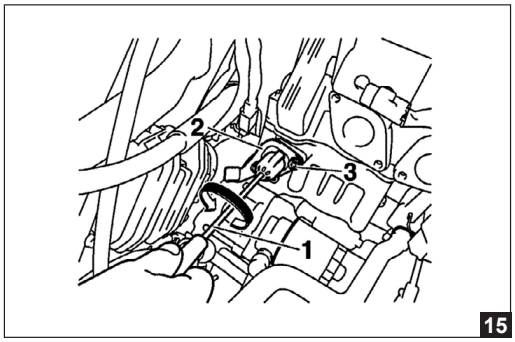
a. Apply sealant to the timing chain tensioner bolt threading.

Nm	• **Sealant Three Bond No.1215®**

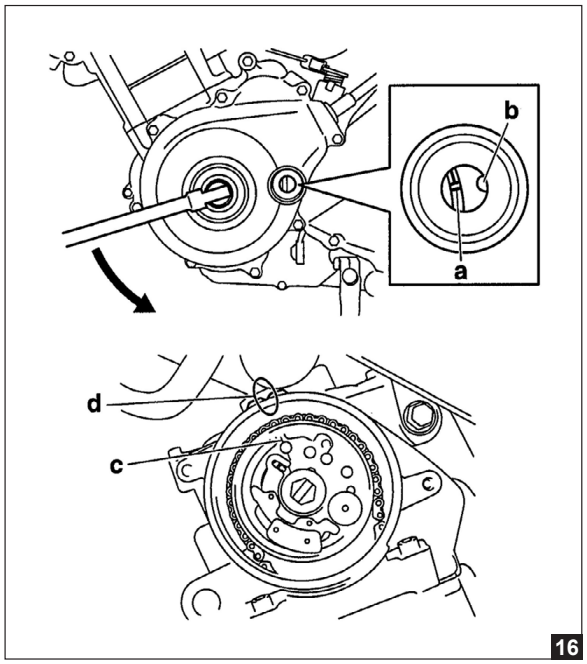


b. Slightly press with your hands the timing chain tensioner rod and at the same time rotate it completely clockwise with a thin blade screwdriver "1" . (see fig. 14)
c. With the timing chain tensioner rod completely rotated in the timing chain tensioner slot, (with the screwdriver inserted), install the timing chain tensioner gasket "2" on the crankcase.
d. Tighten timing chain tensioner bolts "3" to the recommended torque.

Nm	• **Timing chain tensioner bolt 10 Nm (1.0 mkg, 7.2 ft-lb)**



e. Remove the screwdriver and make sure of slowly releasing the timing chain tensioner rod.



5. **Rotate:**
   - Crankshaft (various revolutions clockwise)
6. **Check:**
   - **Reference " I " "a"**
   - Align the reference " I " on the generator rotor to the stationary reference "b" on the generator cover.
   - **Reference " I " "c"**
   - Align the reference " I " on the camshaft sprocket to the stationary reference "d" on the cylinder head.
   - Misalignment → Correct.
   - Make reference to installation operations mentioned above.

7. **Tighten:**
   - Camshaft sprocket bolt

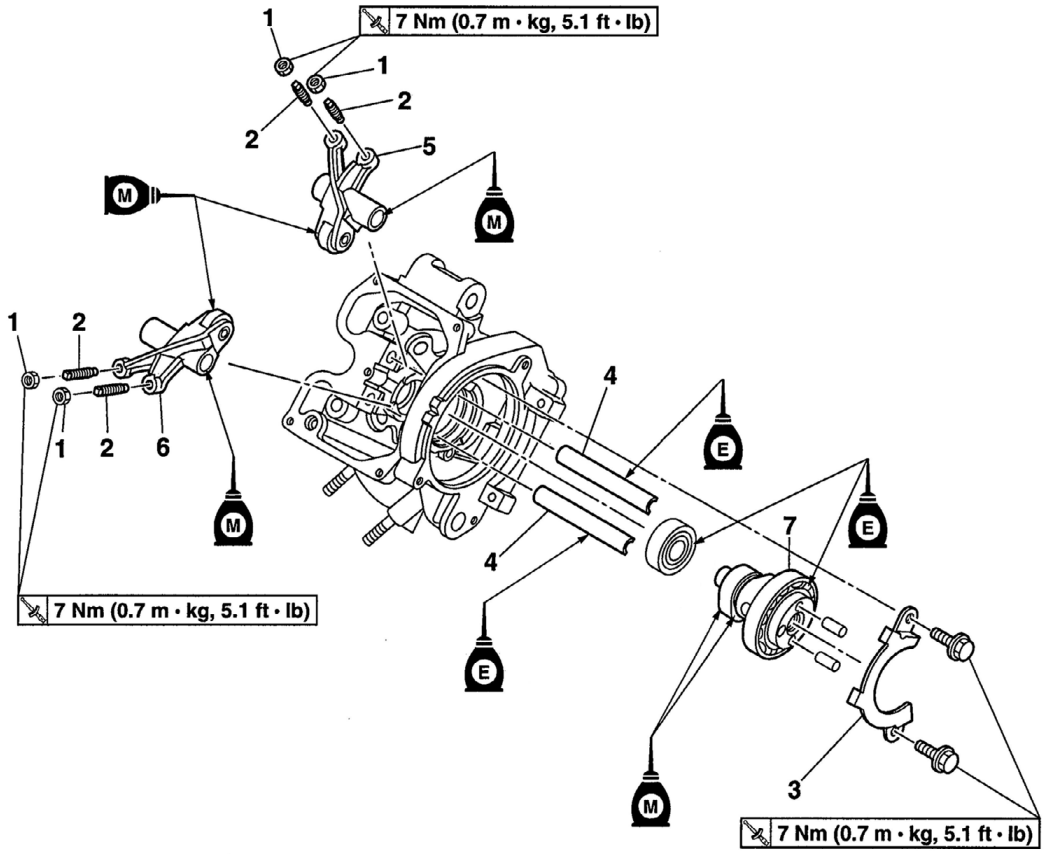
Nm	• **Camshaft sprocket bolt 30 Nm (3.0 mkg, 22 ft-lb)**

	WARNING! • **Make sure the camshaft sprocket bolt is tightened to the specified torque to avoid the bolt from loosening and damaging the engine.**

8. **Measure:**
   - Valve clearance
   - Not conforming to specifications → Adjust.

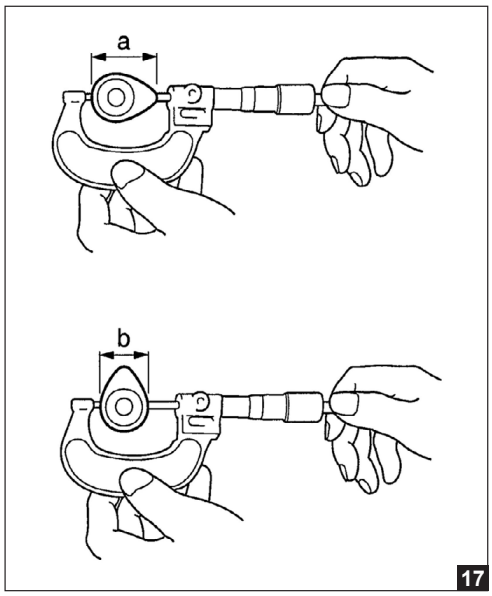
ROCKER ARMS AND CAMSHAFT REMOVAL

Rocker arms and camshaft removal



Sequence	Operation/Parts to remove	Quantity	Remarks
	Cylinder head		
1	Check nut	4	
2	Adjuster screw	4	
3	Camshaft stop	1	
4	Rocker arm shaft	2	
5	Intake rocker arm	1	
6	Exhaust rocker arm	1	
7	Camshaft	1	
			Reverse removal procedure to install.

CAMSHAFT CHECK

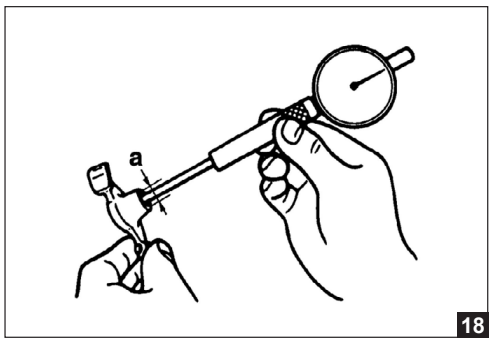


1. **Check:**
- Camshaft lobes
  Discoloured blue/pittings/scratches → Replace the camshaft.
2. **Measure:**
- Dimensions of camshaft lobes "a" and "b"
  Not conforming to specifications → Replace the camshaft. (see fig. 17)

	• Camshaft lobe dimensions **• Intake A** 30.225-30.325mm (1.1900-1.1939 in) **• Limit** 30.125 mm (1.1860 in) **• Intake B** 25.114-25.214mm (0.9887-0.9927in) **• Limit** 25.014mm (0.9848in) **Exhaust A** 30.261-30.361mm (1.1914-1.1953in) **• Limit** 30.161mm (1.1874in) **• Exhaust B** 25.172-25.272mm (0.9910-0.9950in) **• Limit** 25.072mm (0.9871in)

3. **Check:**
- Camshaft oil gallery
  Obstruction → Clean with a compressed air jet.

ROCKER ARM AND ROCKER ARM SHAFTS CHECK



- The following procedure can be applied to all rocker arms and rocker arm shafts.

1. **Check:**
   - Rocker arm
     Damage/wear → Replace.
2. **Check:**
   - Rocker arm shaft
     Discoloured blue/excessive wear/pittings/scratches → Replace or check lubrication system.
3. **Measure:**
   - Rocker arm "a" inside diameter
     Not conforming to specifications → Replace. (see fig. 18)

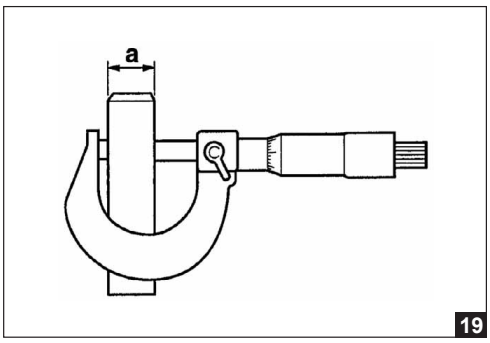
	• Rocker arm inside diameter 9.985-10.000 mm (0.3931-0.3937 in) **• Limit 10.015 mm (0.3943 in)**

4. **Measure:**
   - Rocker arm shaft "a" outside diameter
     Not conforming to specifications → Replace. (see fig. 18)

	• Rocker arm outside diameter 9.966-9.976 mm (0.3924-0.3928 in) **• Limit 9.941 mm (0.3914 in)**

HAS23880

ROCKER ARM AND ROCKER ARM SHAFTS CHECK



5. **Calculate:**
   - Rocker arm - rocker arm shaft clearance

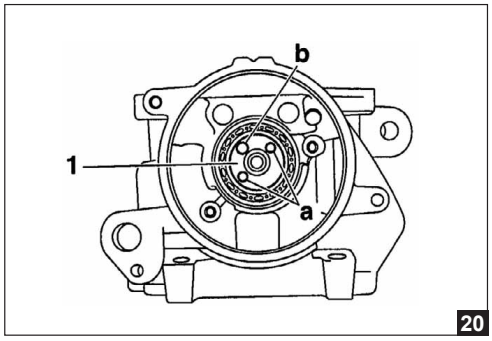
- **Calculate the clearance subtracting the outside diameter of the rocker arm shaft from the inside diameter of the rocker arm.**

  - Not conforming to specifications → Replace faulty part(s).

	• Rocker arm - rocker arm shaft clearance **0.009-0.034 mm (0.0004-0.0013 in)** **• Limit** **0.074 mm (0.0029 in)**

CAMSHAFT AND ROCKER ARMS INSTALLATION

1. **Lubricate:**
   - Rocker arms
   - Rocker arm shafts

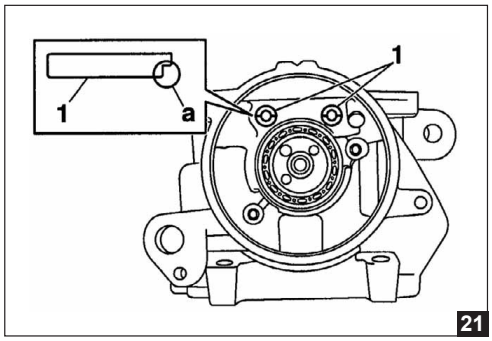


	• Recommended lubricant **• Rocker arm inside surface** **• Molybdenum disulphide oil** **• Rocker arm shaft** **• Engine oil**

2. **Lubricate:**
   - Camshaft

	• Recommended lubricant **• Camshaft** **• Molybdenum disulphide oil** **• Camshaft bearing** **• Engine oil**

3. **Install:**
   - Camshaft "1"



- **Make sure the protrusions of the camshaft "a" and hole "b" are placed as shown in the figure.**

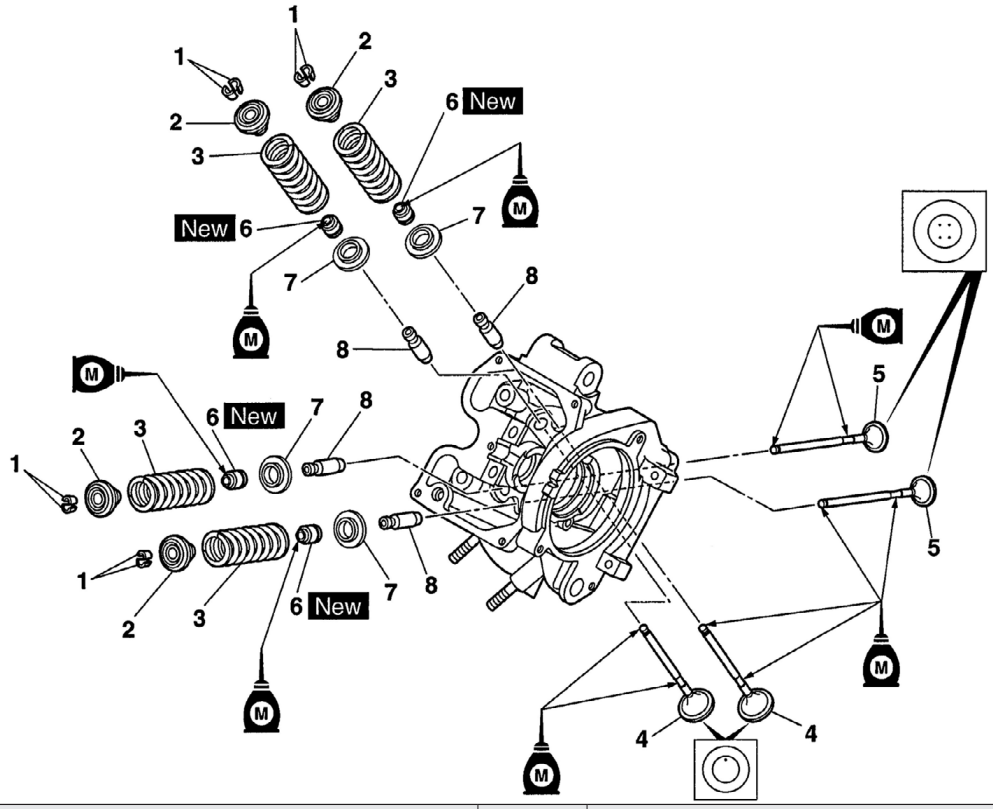
4. **Install:**
   - Rocker arms
   - Rocker arm shafts "1"

- **Make sure the crop-end "a" of each rocker arm shaft is facing downwards as shown in the figure.**
- **Make sure the rocker arm shafts (intake and exhaust) are completely inserted in the cylinder head.**

VALVE AND VALVE SPRING REMOVAL

Valve and valve spring removal

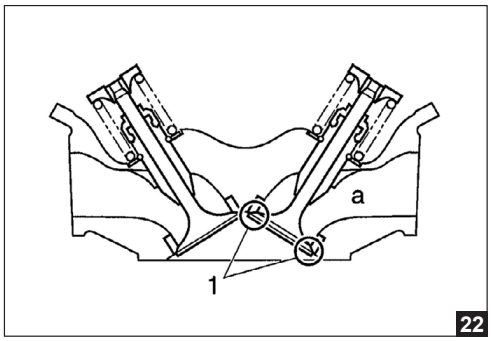
New = part to be replaced upon reassembly



Sequence	Operation/Parts to remove	Quantity	Remarks
	Cylinder head		
	Rocker arms/camshaft		
1	Valve collet	8	
2	Upper spring seat	4	
3	Valve spring	4	
4	Intake valve	2	
5	Exhaust valve	2	
6	Valve stem seal	4	
7	Lower spring seat	4	
8	Valve guide	4	
			Reverse removal procedure to install.

VALVE REMOVAL

- The following procedure is applied to all the valves and their components.

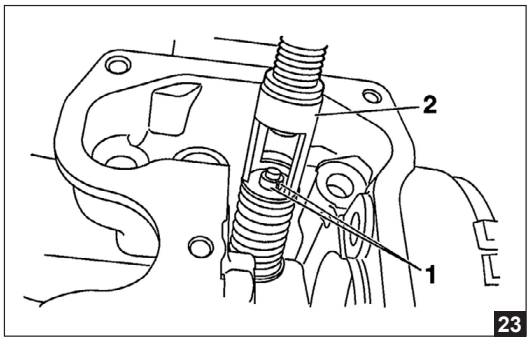


- **Before removing the inside components of the cylinder head (e.g. valves, valve springs and valve seats), check for correct valve sealing.**

1. Check:
- Valve sealing
  Loss of valve seal → Check valve face, valve seat and width of the valve seat.

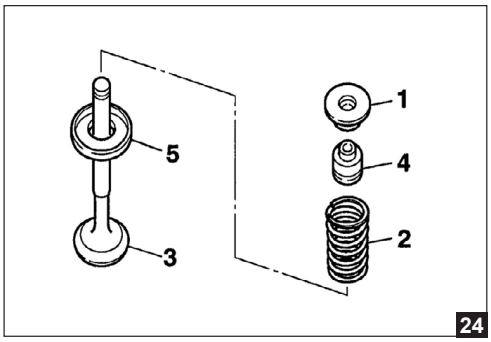
a. Pour a clean solvent "a" in the intake and exhaust ports.
b. Check the correct sealing of the valves.

- **There should not be any leaks from valve seat "1" .**



2. Remove:
- Valve collets "1" .

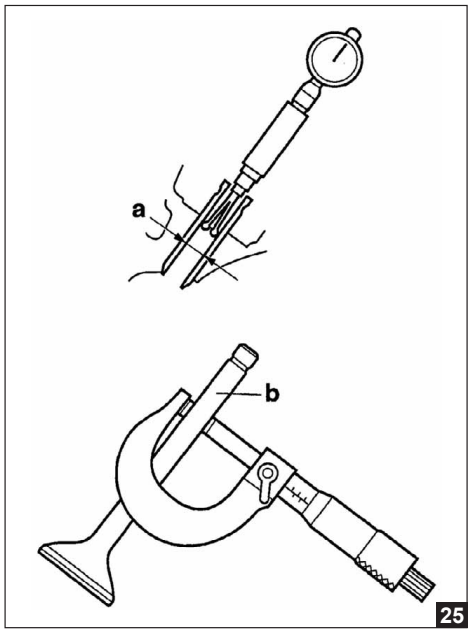
- **Remove the valve collets compressing the valve spring with the suitable tool.**



3. Remove:
- Upper spring seat "1"
- Valve spring "2"
- Valve "3"
- Valve stem seal "4"
- Lower spring seat "5".

- **Carefully locate the position of each component, so that it can be installed in the original position again.**

VALVES AND VALVE GUIDES CHECK

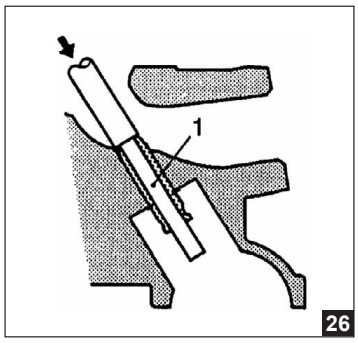


- The following procedure is applied to all the valves and valve guides.

1. Measure:
- Valve stem - valve guides clearance
  Not conforming to specifications→ Replace valve guide.
  Valve stem - valve guides clearance = Inside diameter of valve guide "a" - Valve stem diameter "b" (see fig. 25)

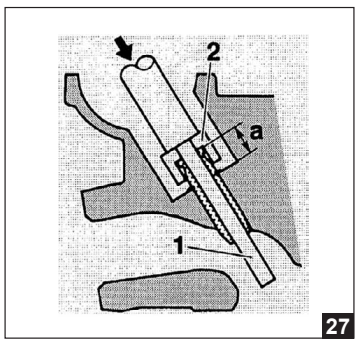
	• (Intake) valve stem-valve guide clearance **0.010-0.037 mm (0.0004-0.0015 in)** **• Limit** **0.080 mm (0.0032 in)** **• (Exhaust) valve stem-valve guide clearance** **0.025-0.052 mm (0.0010-0.0020 in)** **• Limit** **0.100 mm (0.0039 in)**

2. Replace:
- Valve guides



• To facilitate removal and installation of the valve guide and to maintain the correct coupling, heat the cylinder head in an oven at 100°C (212 °F).

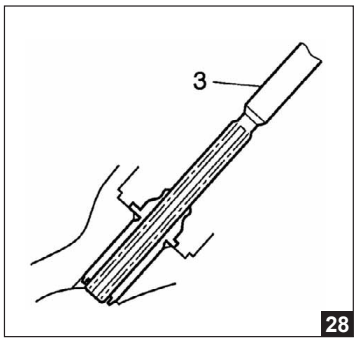
a. Remove the valve guide with a suitable puller "1". (see fig 26)



b. Install the new valve guide with a valve guide installation tool "2" and a valve guide puller "1". (see fig. 27)

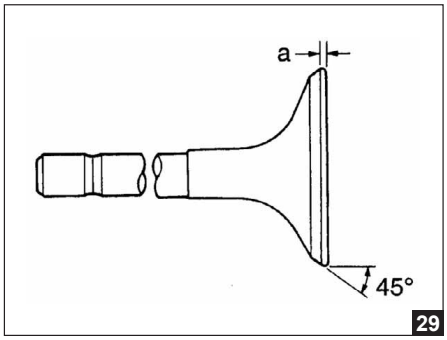
	• (Intake) valve guide position **17.0-17.4 mm (0.669-0.685 in)** **• (Exhaust) valve guide position** **14.0-14.4 mm (0.551-0.567 in)**

• Valve guide position



c. After installation, ream the valve guide with its reamer "3" to get the correct valve stem - valve guide clearance.(see fig. 28)

- **After replacing the valve guide, grind the valve seat.**

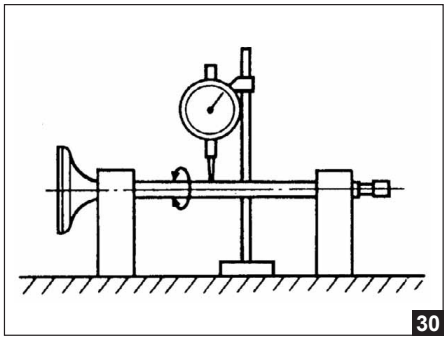


3. To delete:
- Scale deposits (from valve face and seat)

4. Check:
- Valve face
  Pittings/wear → Ream valve face.
- Valve stem end
- Mushroom shape or diameter greater than the valve stem → Replace the valve.

5. Measure:
- D valve edge thickness "a" (see fig. 29)
  Not conforming to specifications → Replace the valve.

	• (Intake) valve edge thickness D 0.50-0.90 mm (0.0197-0.0354 in) **• (Exhaust) valve edge thickness D 0.50-0.90 mm (0.0197-0.0354 in)**

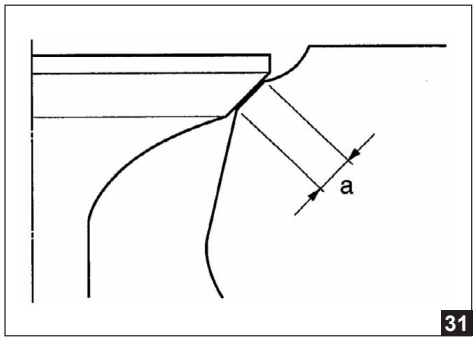


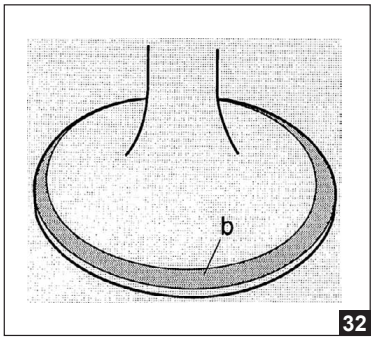
6. Measure:
- Valve stem misalignment
  Not conforming to specifications → Replace the valve.

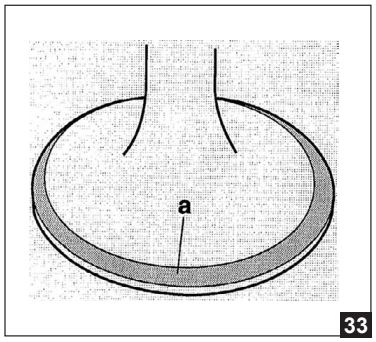
- **When a new valve is installed, always replace the valve guide.**
- **If a valve is removed or replaced, always replace the valve stem seal.**

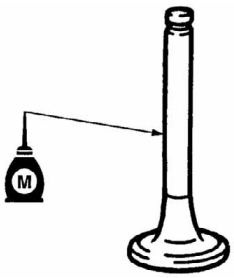
	• Valve stem misalignment 0.010 mm (0.0004 in)

VALVE SEATS CHECK









- The following procedure is applied to all the valves and valve seat.

1. **To delete:**
   - Scale deposits (from valve face and seat)
2. **Check:**
   - Valve seat
     Pittings/wear → Replace cylinder head.
3. **Measure:**
   - C width seat of valve "a" (see fig. 31)
     Not conforming to specifications → Replace cylinder head.

	• (Intake) valve seat width C 0.90-1.10 mm (0.0354-0.0433 in) **• (Exhaust) valve seat width C 0.90-1.10 mm (0.0354-0.0433 in)**

a. Apply Prussian blue (Dykem) "b" on valve face. (see fig. 32)
b. Install the valve in the cylinder head.
c. Press the valve through the valve guide and on the valve seat so as to leave a clear impression.
d. Measure valve seat width.

• Where the valve seat and valve face have touched, Prussian blue is removed.

4. **Lap:**
   - Valve face
   - Valve seat

• After replacing the cylinder head or the valve and valve guide, valve seat and valve face must be lapped.

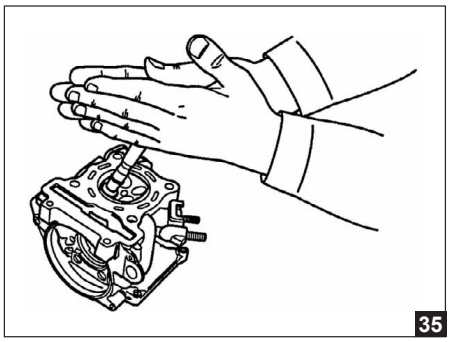
a. Apply a coarse grain lapping abrasive agent "a" to the face of the valve. (see fig. 33)

	WARNING! **• Do not allow the lapping abrasive agent to penetrate in the gap between valve stem and valve guide.**

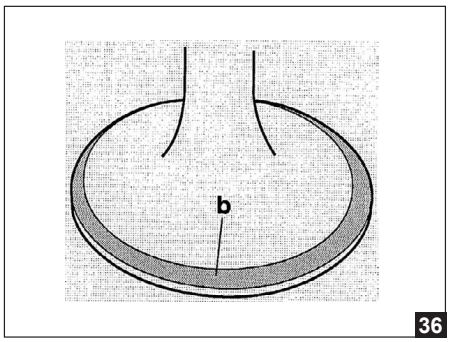
b. Apply molybdenum disulphide oil to the valve stem.
c. Install the valve in the cylinder head.
d. Rotate the valve until the valve face and the valve seat are evenly lapped, then remove every trace of lapping abrasive agent.

HAS24300

VALVE SEATS CHECK

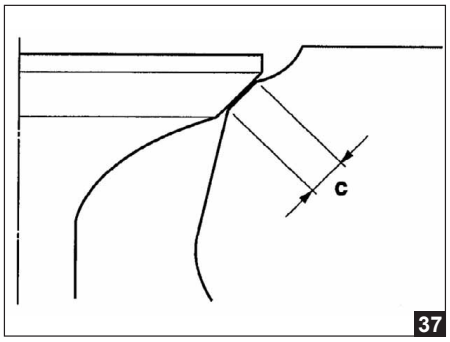


- **To obtain the best results when lapping, slightly patter on the valve seat while rotating it back and forth with the hands.**



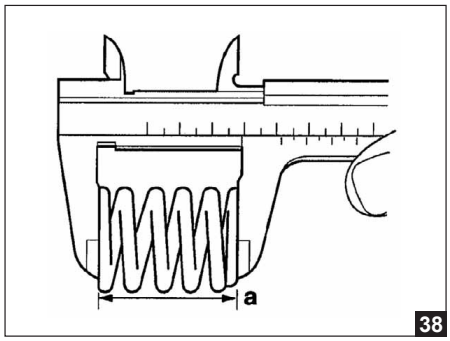
e. Apply a fine grain lapping abrasive agent to the valve face and repeat the previous procedures.
f. After each lapping operation, remove every trace of lapping abrasive agent from the valve face and valve seat.
g. Apply Prussian blue (Dykem) "b" on valve face.(see fig. 36)

h. Install the valve in the cylinder head.
i. Press the valve through the valve guide and on the valve seat so as to leave a clear impression.



j. Measure width of "c" valve seat again If the width is not conforming to the specifications, grind and lap the valve seat. (see fig. 37)

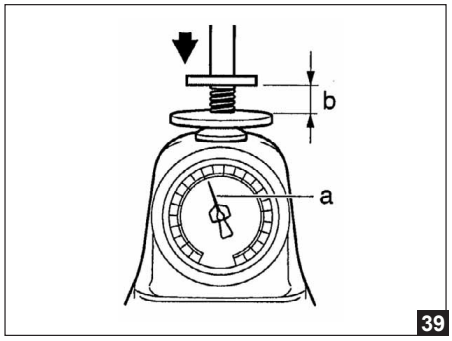
VALVE SPRINGS CHECK



- The following procedure is applied to all valve springs.

1. **Measure:**
   - Valve spring "a" free length
     Not conforming to specifications → Replace valve spring. (see fig. 38)

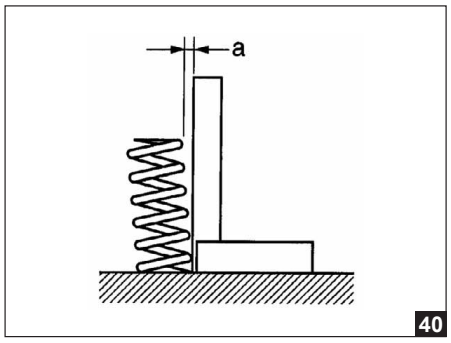
	• (Intake) free length **41.71 mm (1.64 in)** **• Limit** **39.62 mm (1.56 in)** **• (Exhaust) free length** **41.71 mm (1.64 in)** **• Limit** **39.62 mm (1.56 in)**



- **b. Installed length**

2. **Measure:**
   - Compressed valve spring "a" strength
     Not conforming to specifications → Replace valve spring. (see fig. 39)

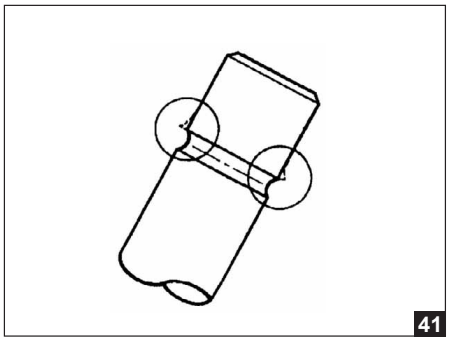
	• (Intake) compression spring pressure, when installed **140-162 N (31.47-36.42 lbf)** **(14.28-16.52 kgf)** **• (Exhaust) compression spring pressure, when installed** **140-162 N (31.47-36.42 lbf)** **(14.28-16.52 kgf)** **• (Intake) length, when installed** **35.30 mm (1.39 in)** **• (Exhaust) length, when installed** **35.30 mm (1.39 in)**



3. **Measure:**
   - Valve spring "a" inclination (see fig. 40)
   - Not conforming to specifications → Replace valve spring.

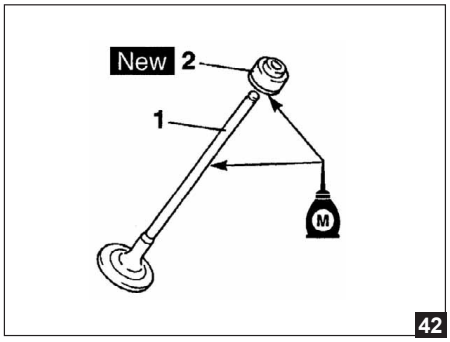
	• (Intake) spring inclination 2.5° / 1.8 mm **• (Exhaust) spring inclination** 2.5° / 1.8 mm

VALVES INSTALLATION



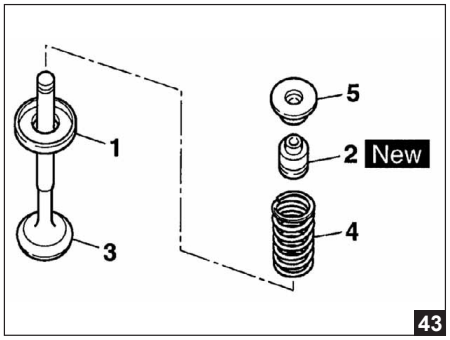
• The following procedure is applied to all the valves and their components.

1. **Trim:**
   • End of the valve stem (with the whetstone)



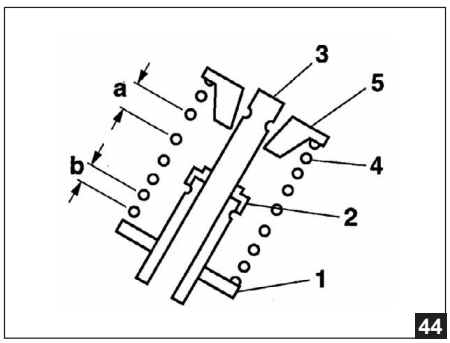
2. **Lubricate:**
   • Valve stem "1"
   • Valve stem seal "2"
   (with recommended lubricant) (see fig. 42)

	• **Recommended lubricant** • **Molybdenum disulphide oil**



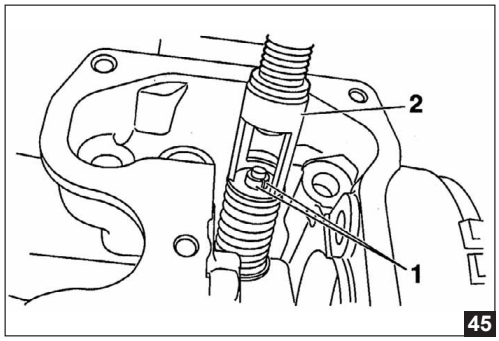
3. **Install:**
   • Lower spring seat "1".
   • Valve stem seal "2"
   • Valve "3"
   • Valve spring "4"
   • Upper spring seat " 5 "
   (in cylinder head) (see fig. 43)

New = part to be replaced upon reassembly



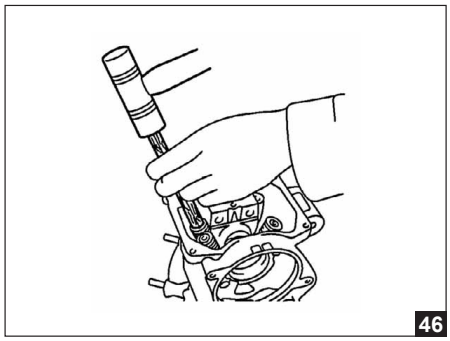
• **Make sure each valve is installed in its original position.**
• **Install the valve springs with the bigger pitch "a" facing upwards. (see fig. 44)**

• **b. Smaller pitch**



4. **Install:**
   • Valve collets "1"

• Install the valve collets compressing the valve spring with the suitable tool.



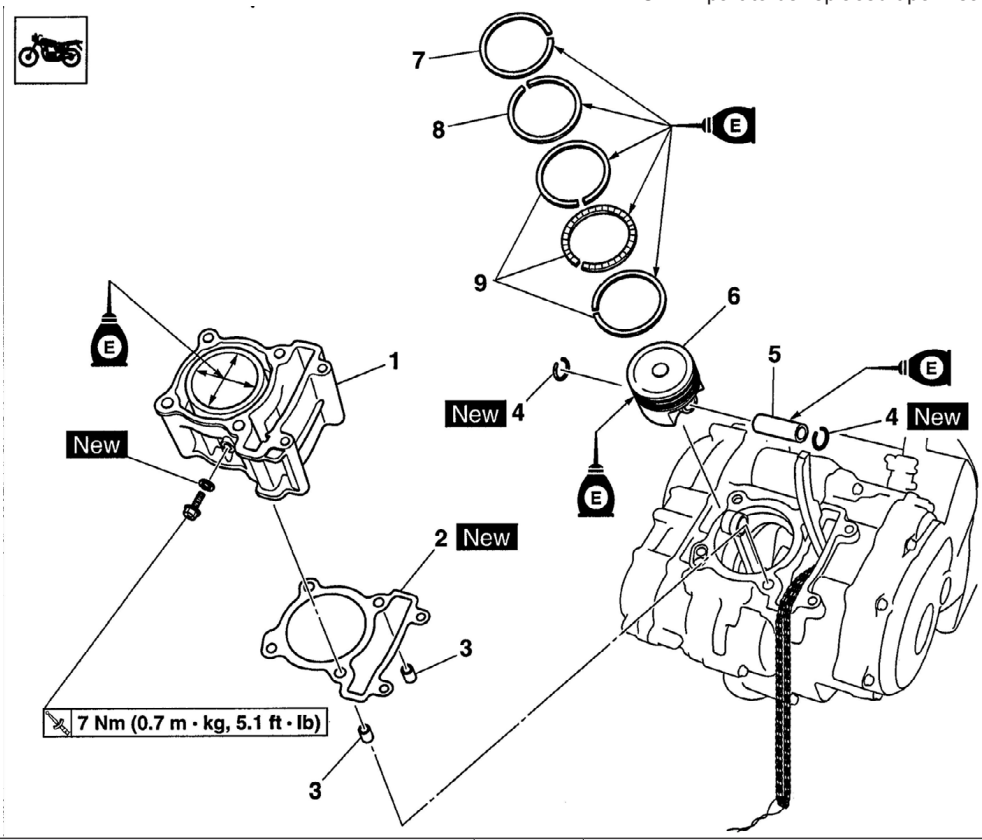
5. To fix the valve collets to the valve stem, slightly patter with a soft mallet on the end of the valve.

WARNING!
• If you hit valve tip too hard you could damage the valve.

PISTON AND CYLINDER REMOVAL

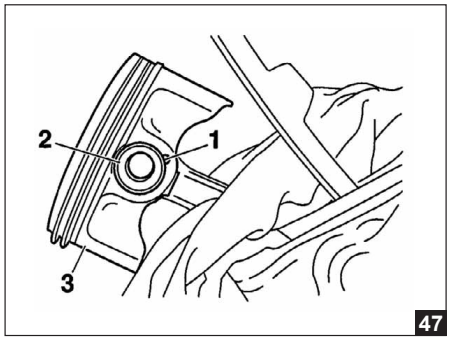
Piston and cylinder removal

New = part to be replaced upon reassembly



Sequence	Operation/Parts to remove	Quantity	Remarks
	Cylinder head		
1	Cylinder	1	
2	Cylinder gasket	1	
3	Dowel pin	2	
4	Piston pin clip	2	
5	Piston pin	1	
6	Piston	1	
7	Upper piston ring	1	
8	Lower piston ring	1	
9	Scraper ring	1	
			Reverse removal procedure to install.

PISTON REMOVAL

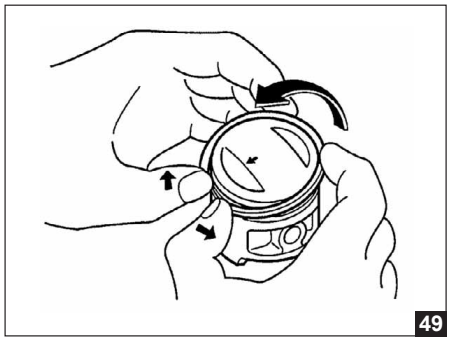


47

1. **Remove:**
   - Piston pin clips "1"
   - Piston pin "2"
   - Piston "3"
   (see fig. 47)

WARNING!
- **Do not use a hammer to remove the piston pin.**

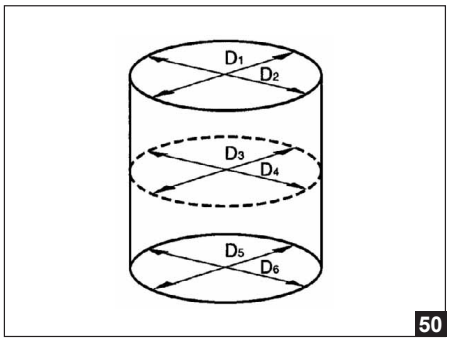
- **Before removing the piston pin clip, cover the opening of the crankcase with a clean cloth to avoid the piston pin clip from falling into the crankcase.**


49

2. **Remove:**
   - Upper piston ring
   - Lower piston ring
   - Scraper ring

- **To remove a piston ring, widen with your fingers the space between the ends and lift the other side of the piston ring above the piston crown.**

PISTON AND CYLINDER CHECK



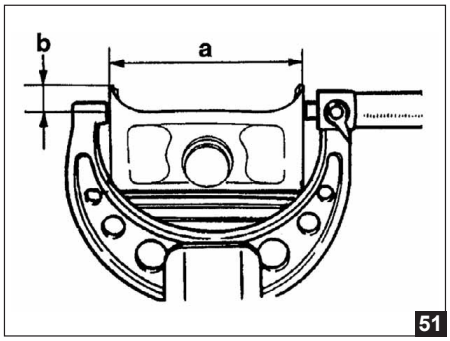
1. **Check:**
   - Piston wall
   - Cylinder wall
     Vertical scratches → Replace the cylinder and replace as a block piston and piston rings.
2. **Measure:**
   - Cylinder - piston clearance

a. Measure cylinder "C" bore with a bore meter.

- **Measure cylinder bore "C" at (three) different heights; at every height take two measurements at right angle. Hence, calculate the average.**

C	**• Bore** **52.000-52.010 mm (2.0472-2.0476 in)**
T	**• Taper limit** **0.050 mm (0.0020 in)**
R	**• Out-of-round limit** **0.005 mm (0.0002 in)**

- **"C" = maximum of D_1-D_2**
- **"T" = maximum of D_1 or D_2 - maximum of D_5 or D_6**
- **"R" = maximum of D_1, D_3 or D_5 - minimum of D_2, D_4 or D_6**



- **b. 5.0 mm (0.20 in) from lower rim of the piston**

b. If not conforming to specifications, replace the cylinder and replace the piston and piston rings together.

c. Measure D piston skirt "a" diameter with the micrometer.

	• Piston **• Diameter D** 51.962-51.985 mm (2.0457-2.0466 in)

d. If not conforming to specifications, replace the piston and piston rings together.

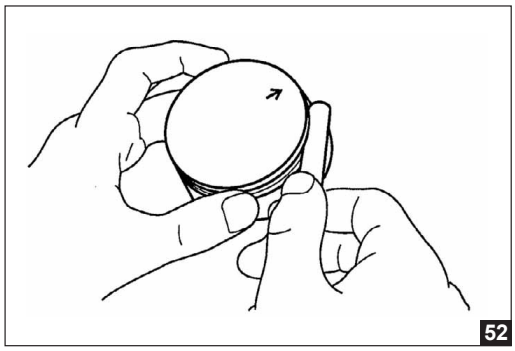
e. Calculate piston - cylinder clearance with the following formula.

- **Piston-cylinder clearance = Cylinder "C" bore - Piston skirt "D" diameter**

	• Cylinder-piston clearance **0.015-0.048 mm (0.0006-0.0019 in)** **• Limit** **0.15 mm (0.0059 in)**

f. If not conforming to specifications, replace the cylinder as well as the piston and piston rings together.

PISTON RINGS CHECK



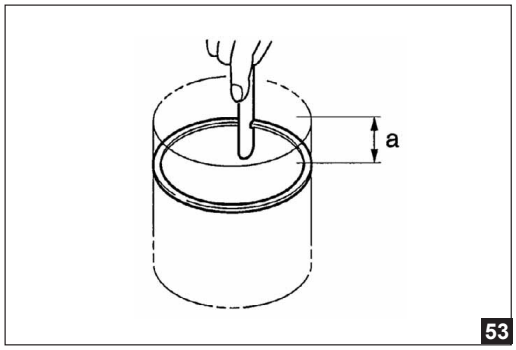
1. **Measure:**
   • Piston rings side clearance
   Not conforming to specifications → Replace the piston and piston rings together.

• Before measuring piston rings side clearance, eliminate carbon deposits from piston rings and their grooves.

	• Piston ring **• Upper piston ring** **• Ring side clearance** **0.030-0.065 mm (0.0012-0.0026 in)** **• Limit** **0.100 mm (0.0039 in)** **• Lower piston ring** **• Ring side clearance** **0.020-0.055 mm (0.0008-0.0022 in)** **• Limit** **0.100 mm (0.0039 in)**

2. **Install:**
   • Piston ring (in the cylinder)

• Level the piston ring in the cylinder with the piston crown.



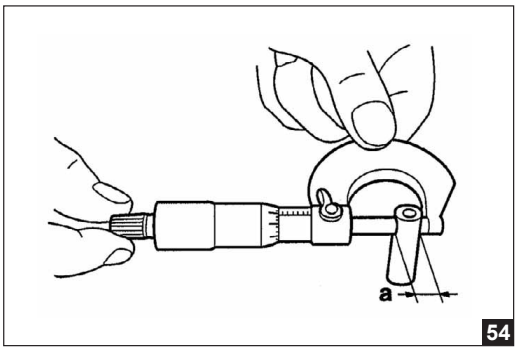
• a. 40 mm (1.57 in)

3. **Measure:**
   • Piston ring ends gap
   Not conforming to specifications→ Replace piston ring.

• It is not possible to measure the gap between the scraper ring expander spacer ends. If the scraper ring gap is excessive, replace all three piston rings.

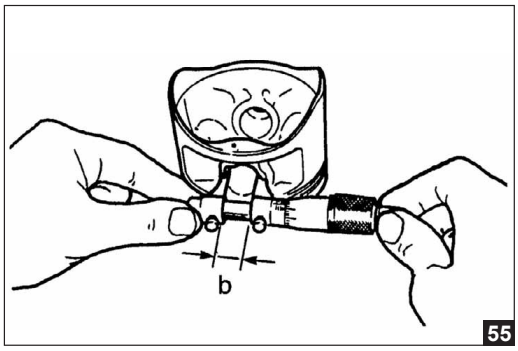
	• Piston ring **• Upper piston ring** **• Piston ring ends gap (when installed)** **0.10-0.25 mm (0.0039-0.0098 in)** **• Limit** **0.50 mm (0.0197 in)** **• Lower piston ring** **• Piston ring ends gap (when installed)** **0.10-0.25 mm (0.0039-0.0098 in)** **• Limit** **0.60 mm (0.0236 in)** **• Scraper ring** **• Piston ring ends gap (when installed)** **0.20-0.70 mm (0.0079-0.0276 in)**

PISTON PIN CHECK



1. **Check:**
   - Piston pin
     Discoloured blue/grooves→ Replace the piston pin, then check lubrication system.
2. **Measure:**
   - Piston pin "a" outside diameter
     Not conforming to specifications→ Replace piston pin. (see fig. 54)

	• Piston pin outside diameter **13.995-14.000 mm (0.5510-0.5512 in)** **• Limit** **13.975 mm (0.5502 in)**



3. **Measure:**
   - Piston pin "b" hole diameter
   - Not conforming to specifications→ Replace piston. (see fig. 55)

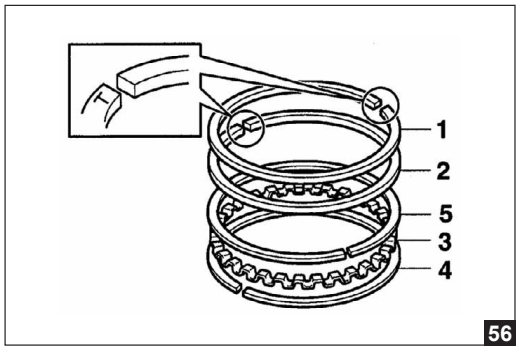
	• Piston pin hole inside diameter **14.002-14.013 mm (0.5513-0.5517 in)** **• Limit** **14.043 mm (0.5529 in)**

4. **Calculate:**
   - Piston pin - piston pin hole clearance
     Not conforming to specifications → Replace the piston and piston pin together.

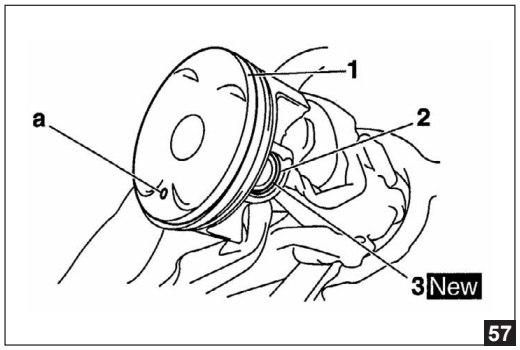
• Piston pin - piston pin hole clearance = Piston pin hole "b" diameter - Piston pin "a"outside diameter.

	• Piston pin-piston pin hole clearance **0.002-0.018 mm (0.0001-0.0007 in)** **• Limit** **0.068 mm (0.0027 in)**

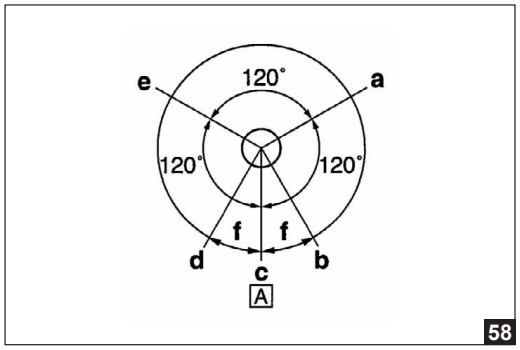
PISTON AND CYLINDER INSTALLATION



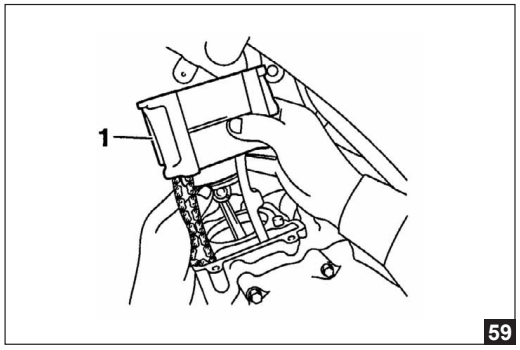
56



57



58



59

1. **Install:**
   - Upper piston ring "1"
   - Lower piston ring "2"
   - Scraper ring expander "3"
   - Lower scraper ring "4"
   - Upper scraper ring "5"
     (see fig. 56)

- **Make sure the piston rings are installed with manufacturer references or numbers facing upwards.**

2. **Install:**
   - Piston "1"
   - Piston pin "2"
   - Piston pin clips "3" B.
     (see fig. 57)

- **Smear some engine oil on the piston pin.**
- **Make sure the reference arrow "a" on the piston is facing towards the exhaust side of the cylinder.**
- **Before installing the piston pin clips, cover the opening of the crankcase with a clean cloth to prevent the clips from falling into the crankcase.**

3. **Lubricate:**
   - Piston
   - Piston rings
   - Cylinder
     (with recommended lubricant)

	• **Recommended lubricant** • **Engine oil**

4. **Arrangement of piston ring gaps:**
   - Piston ring ends gap.

a. Upper piston ring
b. Upper scraper ring
c. Scraper ring expander
d. Lower scraper ring
e. Lower piston ring
f. 20 mm (0.79 in)
A. Intake side
(see fig. 58)

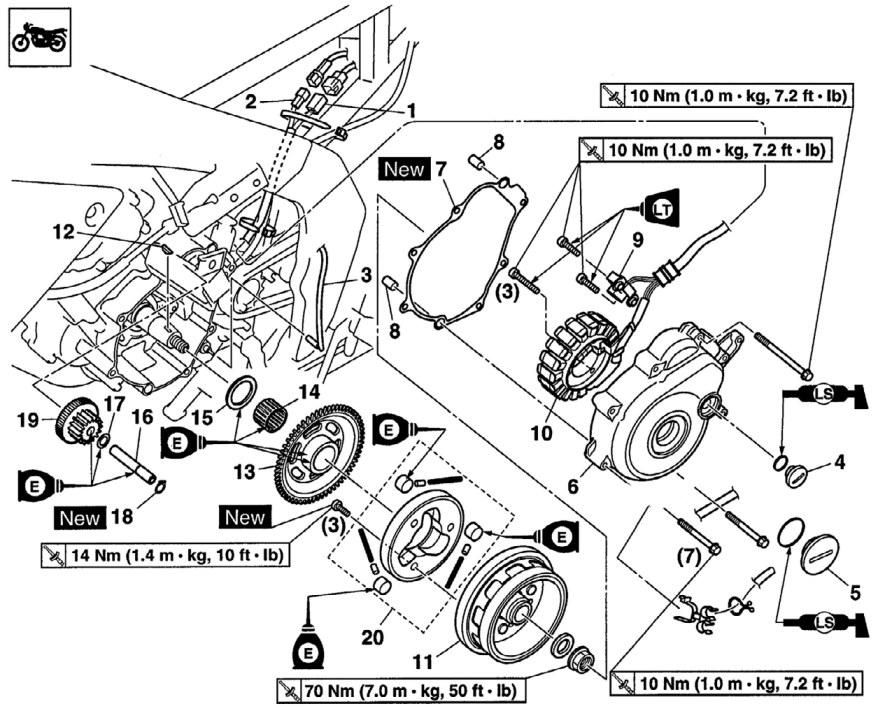
5. **Install:**
   - Dowel pin
   - Cylinder head gasket
   - Cylinder "1" (see fig. 59)

- **Compress the piston rings with one hand and install the cylinder with the other one.**
- **Make the timing chain and the timing chain guide (intake side) through the timing chain notch.**

GENERATOR AND UNIDIRECTIONAL STARTER

Generator and unidirectional starter removal

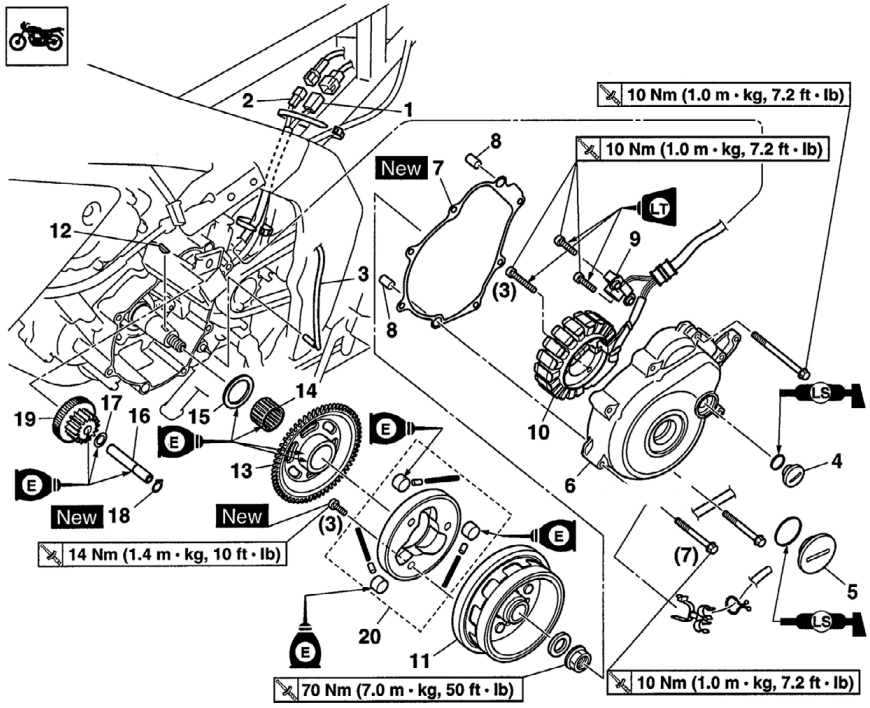
New = part to be replaced upon reassembly



Sequence	Operation/Parts to remove	Quantity	Remarks
	Engine oil		
	Sprocket cover		
1	Stator coil connector	1	Disconnect.
2	2 Crankshaft position sensor connector	1	Disconnect.
3	3 Neutral switch cable connector	1	Disconnect.
4	Timing mark access screw	1	
5	Crankshaft end access screw	1	
6	Generator cover	1	
7	Generator cover gasket	1	
8	Dowel pin	2	
9	Crankshaft position sensor	1	

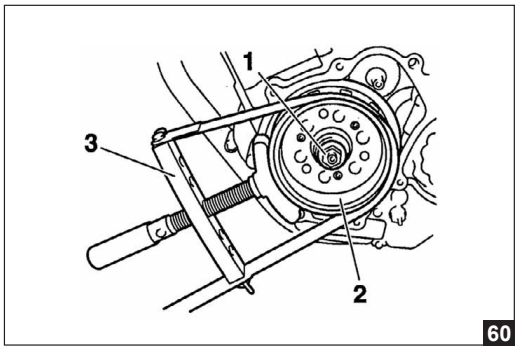
Generator and unidirectional starter removal

New = part to be replaced upon reassembly



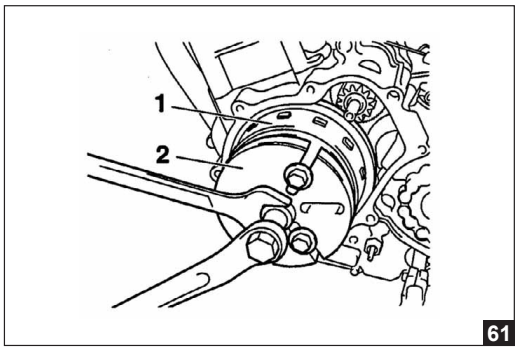
Sequence	Operation/Parts to remove	Quantity	Remarks
10	Stator coil	1	
11	Generator rotor	1	
12	Woodruff key	1	
13	Unidirectional starter gear	1	
14	Bearing	1	
15	Washer	1	
16	Unidirectional starter idle gear shaft	1	
17	Washer	1	
18	Snap ring	1	
19	Unidirectional starter idle gear	1	
20	Unidirectional starter unit	1	
			Reverse removal procedure to install.

GENERATOR REMOVAL



1. **Remove:**
   - Generator rotor nut "1" (see fig. 60)
   - Washer

- **Holding the generator rotor "2" with suitable tool "3", slacken the generator rotor nut.**
- **Do not allow the pulley support to touch the protrusion on the generator rotor.**

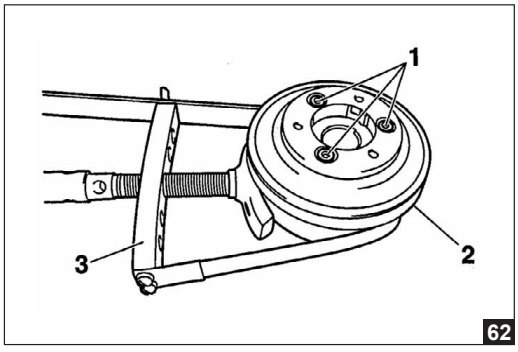


2. **Remove:**
   - Generator rotor "1" (with flywheel puller "2")
   - Woodruff key

WARNING!
- **Protect crankshaft end by setting a suitably sized socket wrench between flywheel puller kit centring bolt and the crankshaft.**

- **Make sure the flywheel puller is centred on the generator rotor.**

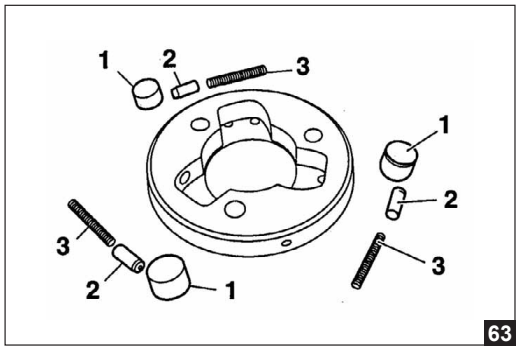
UNIDIRECTIONAL STARTER REMOVAL



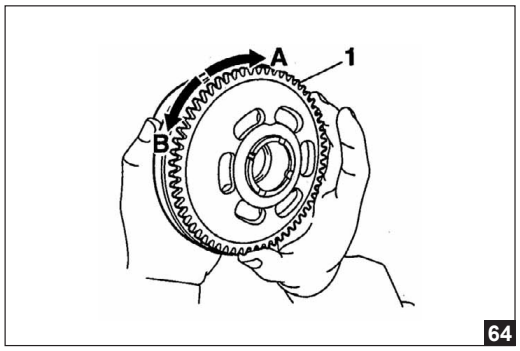
1. **Remove:**
   - Unidirectional starter bolts "1" (see fig. 62)

- **Locking out the generator rotor "2" with suitable tool "3", remove unidirectional starter bolts.**
- **Do not allow the pulley support to touch the protrusion on the generator rotor.**

UNIDIRECTIONAL STARTER CHECK



63

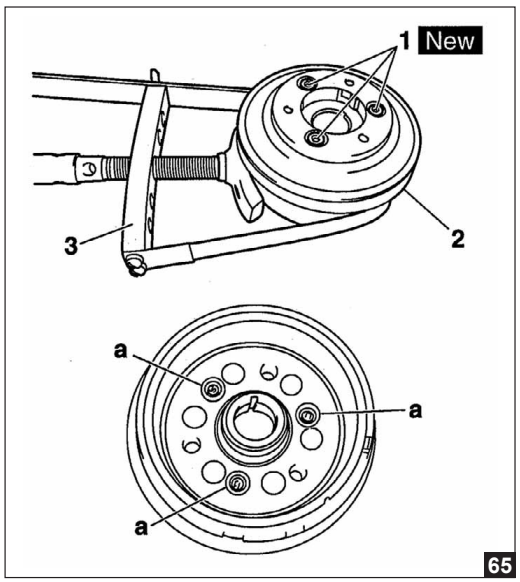


64

1. **Check: (see fig. 63)**
   - Unidirectional starter rollers "1"
   - Unidirectional starter spring caps "2"
   - Unidirectional starter springs "3"
   - Damage/wear → Replace the unidirectional starter unit.
2. **Check:**
   - Unidirectional starter idle gear
   - Unidirectional starter gear
     Unevenness/splinters/roughness/wear→ Replace the faulty parts.
3. **Check:**
   - Unidirectional starter gear contact
   - surface
   - Damage/pittings/wear → Replace unidirectional starter gear.
4. **Check:**
   - Unidirectional starter operation

a. Install the unidirectional starter gear "1" on the unidirectional starter and block the generator rotor.
b. When the unidirectional starter gear "A" is rotated in a clockwise direction, it should mesh with the unidirectional starter, otherwise the unidirectional starter would be faulty hence to be replaced.
c. When the unidirectional starter gear "B" is rotated in a counter-clockwise direction, it should rotate freely, otherwise the unidirectional starter would be faulty hence to be replaced.

UNIDIRECTIONAL STARTER INSTALLATION



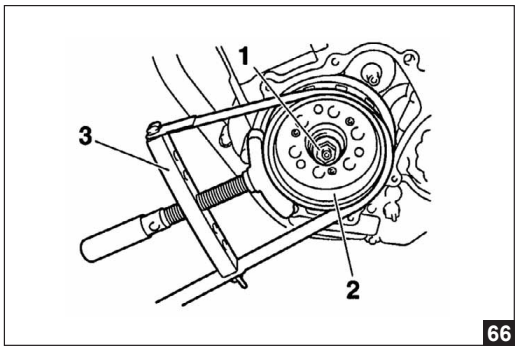
65

1. **Install:**
   - Unidirectional starter unit
   - Unidirectional starter bolts "1"

Nm	• **Unidirectional starter bolt** **14 Nm (1.4 mkg, 10 ft-lb)**

- **Holding the generator rotor "2" still with suitable tool "3", tighten the unidirectional starter bolts.**
- **Do not allow the pulley support to touch the protrusion on the generator rotor.**

GENERATOR INSTALLATION

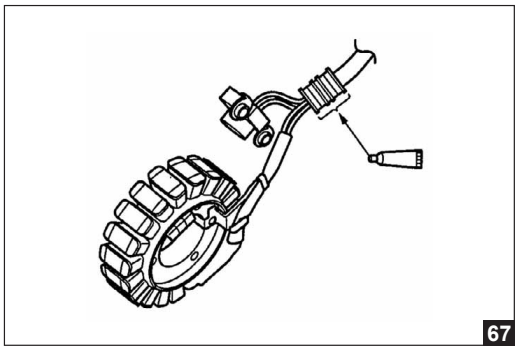


1. **Install:**
   - Woodruff key
   - Generator rotor
   - Washer
   - Generator rotor nut

- **Clean the tapered part of the crankshaft and the generator rotor hub.**
- **When installing the generator rotor, make sure the Woodruff key is correctly fixed in the crankshaft keyway.**

2. **Tighten:**
   - Generator rotor nut "1" (see fig. 66)

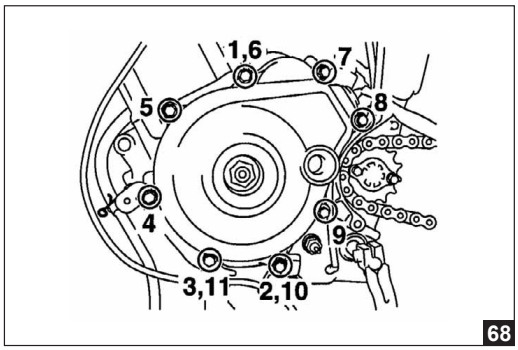
Nm	**• Generator rotor nut 70 Nm (7.0 mkg, 50 ft-lb)**



- **Blocking the generator rotor "2" with suitable tool "3", tighten the generator rotor bolt.**
- **Do not allow the pulley support to touch the protrusion on the generator rotor.**

3. **Apply:**
   - Sealant
   - (on the rubber block of the crankshaft position sensor/stator unit cable)

	Sealant Three Bond No.1215®



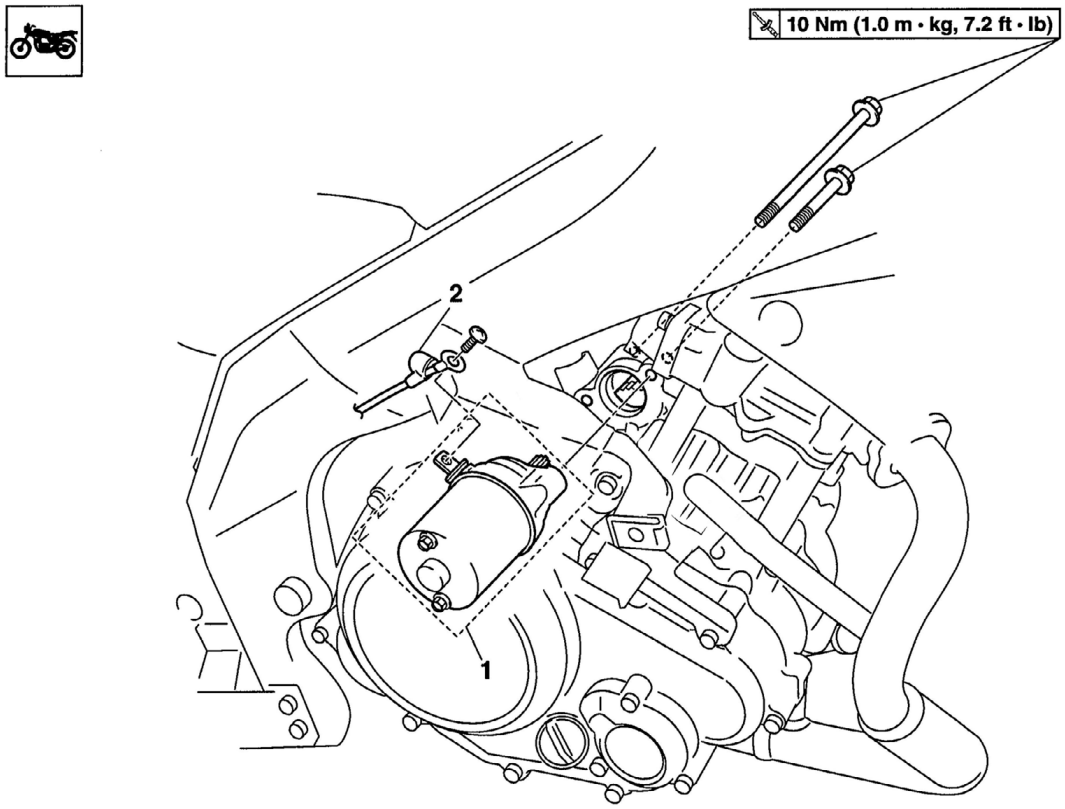
4. **Install:**
   - Generator cover

Nm	**• Generator cover bolt 10 Nm (1.0 mkg, 7.2 ft-lb)**

- **Tighten the generator cover bolts in the correct sequence as shown in the figure.**

ELECTRIC STARTING DEVICE

Starter motor removal

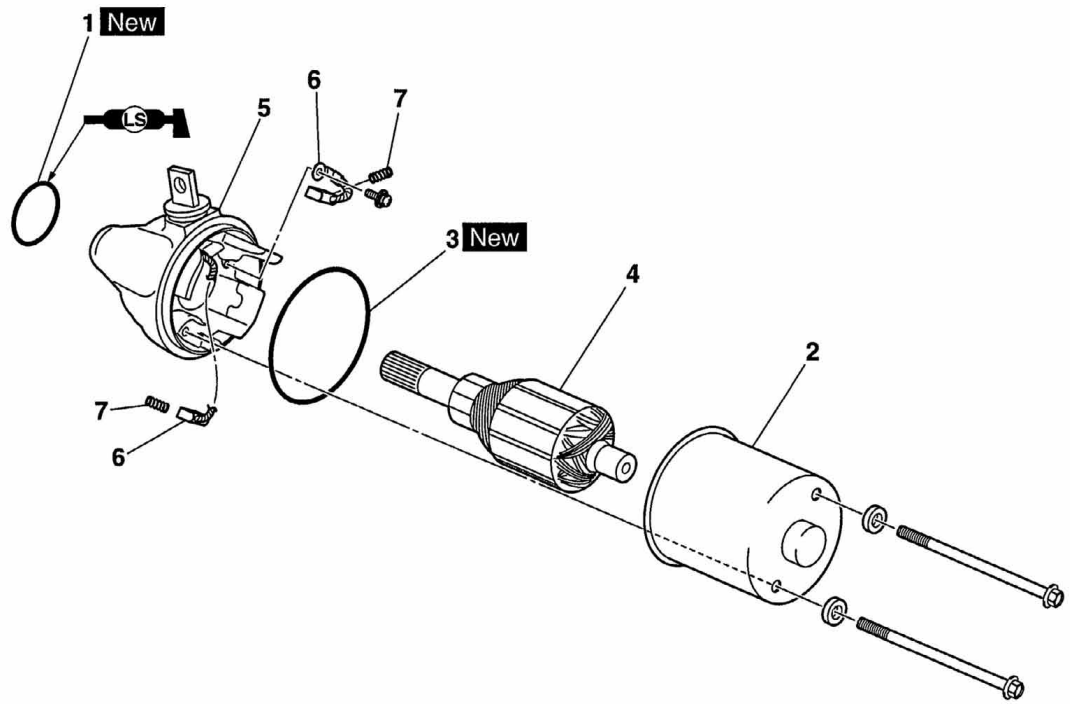


Sequence	Operation/Parts to remove	Quantity	Remarks
1	Starter motor	1	
2	Starter motor cable	1	Disconnect.
			Reverse removal procedure to install.

STARTER MOTOR DISASSEMBLY

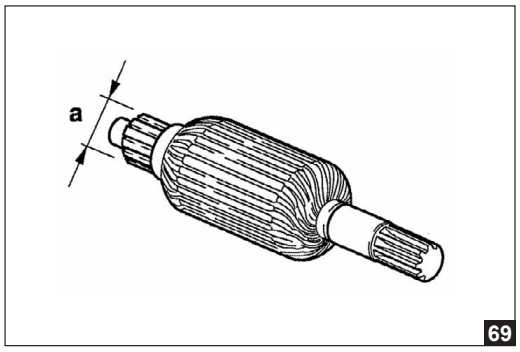
Starter motor removal

New = part to be replaced upon reassembly



Se-quen-ce	Operation/Parts to remove	Quantity	Remarks
1	O-ring	1	
2	Starter motor rear cover	1	
3	O-ring	1	
4	Switch	1	
5	Starter motor front cover/brush support set	1	
6	Brush	2	
7	Brush spring	2	
			Reverse removal procedure to install.

STARTER MOTOR CHECK

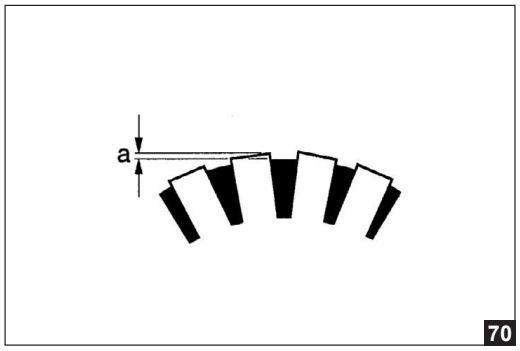


69

1. **Check:**
   • Switch
   Impurity → Clean with sand paper of 600 grain.
2. **Measure:**
   • switch "a" diameter
   Not conforming to specifications → Replace the starter motor. (see fig. 69)

	• Limit **16.6 mm (0.65 in)**

3. **Measure:**
   • Mica "a" coating
   Not conforming to specifications → Scrape off the mica coating until the correct value with a saw blade appropriately grounded, to adapt it to the switch.



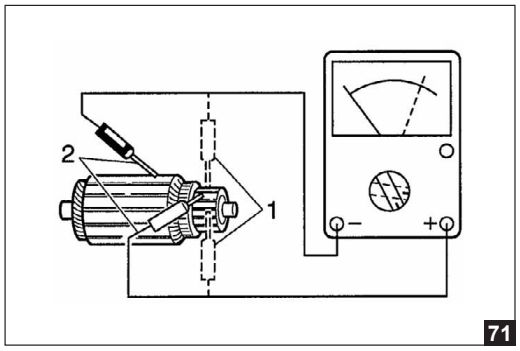
70

	• Mica coating (depth) **1.35 mm (0.05 in)**

• The switch mica coating must be made thin to assure the switch correct operation.

4. **Measure:**
   • Resistance of the rotor unit (switch and insulation)
   Not conforming to specifications → Replace the starter motor.

a. Measure the resistance of the of the rotor unit with a tester.

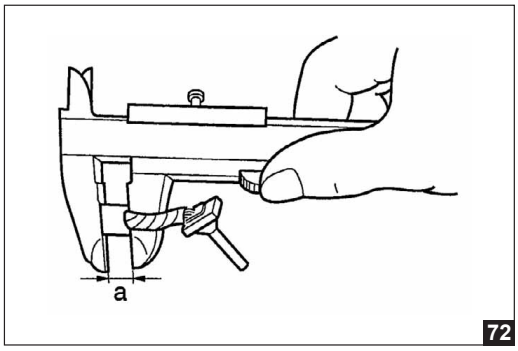


71

	• Rotor winding **• Switch "1" resistance** **0.0315-0.0385 Ω** **• Insulation"2" resistance** **• Over 1 MΩ**

b. If any resistance value is not conforming to specifications replace the starter motor.

STARTER MOTOR CHECK



5. **Measure:**
   - Brush "a" length (see fig. 72)
     Not conforming to specifications → Replace the starter motor front cover/brush support set.

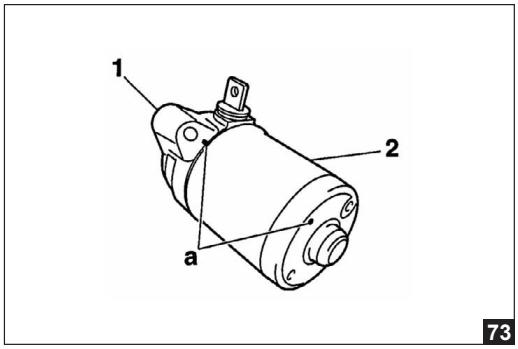
	• **Limit** **3.50 mm (0.14 in)**

6. **Measure:**
   - Brush spring pressure
     Not conforming to specifications → Replace the brush springs together.

	• **Brush spring pressure** **3.92-5.88 N (14.11-21.17 oz)** **(400-600 gf)**

7. **Check:**
   - Gear teeth
     Damage/wear → Replace the gear.
8. **Check:**
   - Bearing
   - Oil seal
     Damage/wear → Replace the starter motor front cover/brush support set.

STARTER MOTOR ASSEMBLY



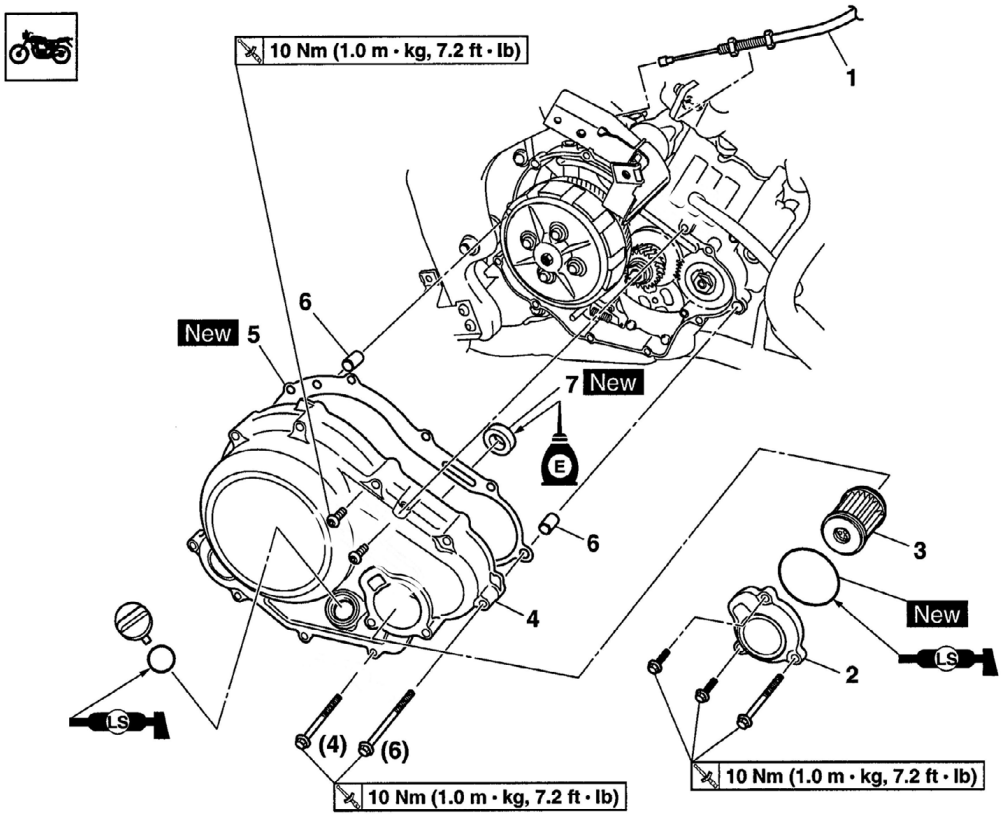
1. **Install:**
   - Starter motor front cover/brush support set "1"
   - Starter motor rear cover "2"
     (see fig. 73)

- **Align the references "a" on the starter motor rear and front cover/brush support set.**

CLUTCH

Clutch casing removal

New = part to be replaced upon reassembly

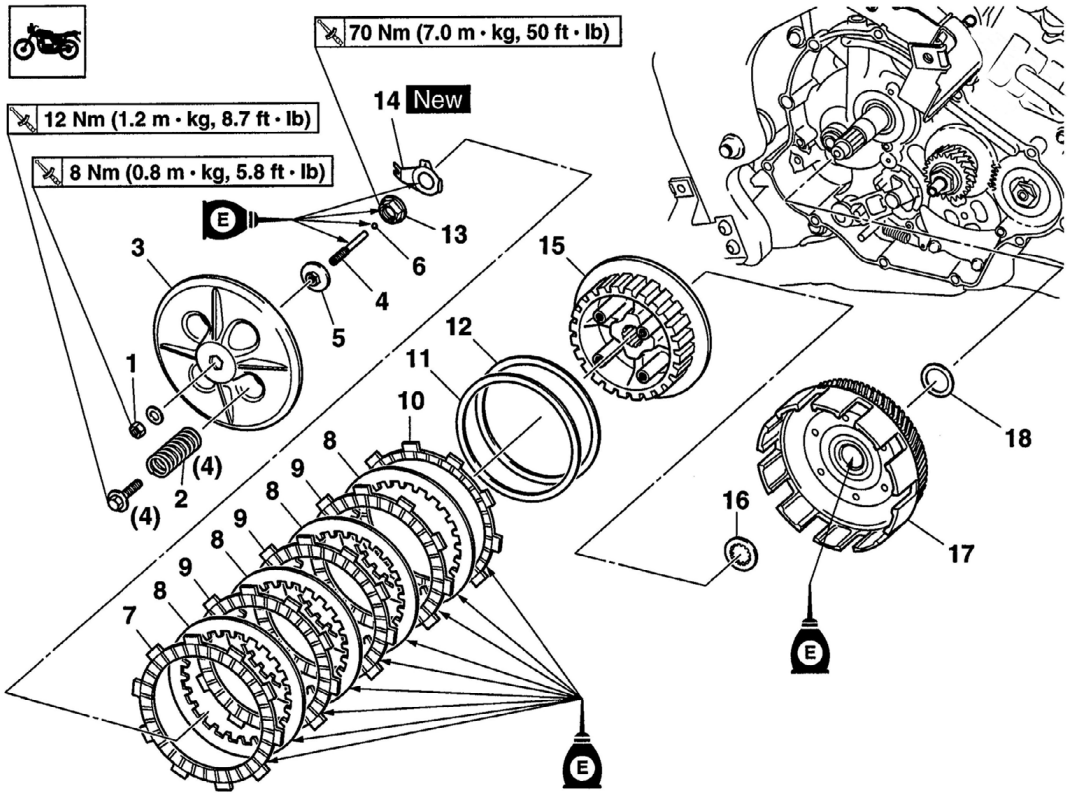


Sequence	Operation/Parts to remove	Quantity	Remarks
	Engine oil		Disconnect
1	Clutch cable	1	Disconnect
2	Oil filter element cover	1	
3	Oil filter element	1	
4	Clutch casing	1	
5	Clutch casing gasket	1	
6	Dowel pin	2	
7	Oil seal	1	
			Reverse removal procedure to install.

CLUTCH REMOVAL

Clutch removal

New = part to be replaced upon reassembly

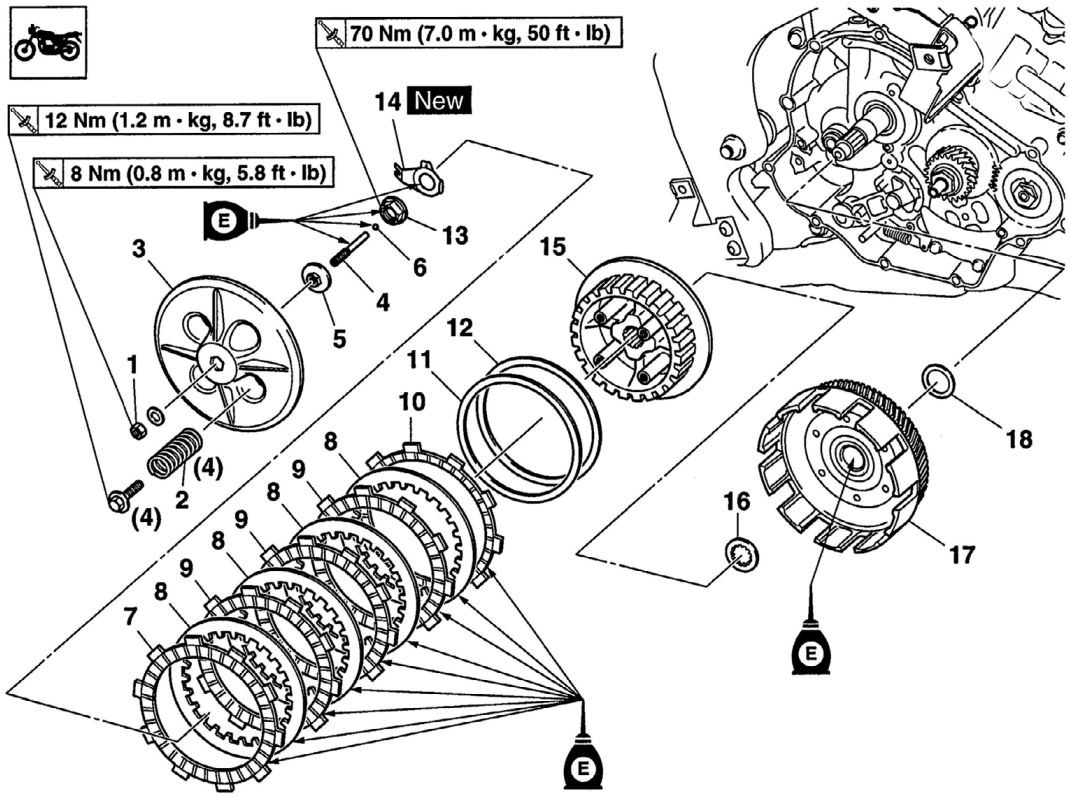


Sequence	Operation/Parts to remove	Quantity	Remarks
1	Check nut	1	
2	Clutch spring	4	
3	Pressure plate	1	
4	Short clutch pushrod	1	
5	Clutch pushrod support	1	
6	Ball	1	
7	Friction plate 1	1	
8	Clutch plate	4	
9	Friction plate 3 (green)	3	
10	Friction plate 2	1	

CLUTCH REMOVAL

Clutch removal

New = part to be replaced upon reassembly

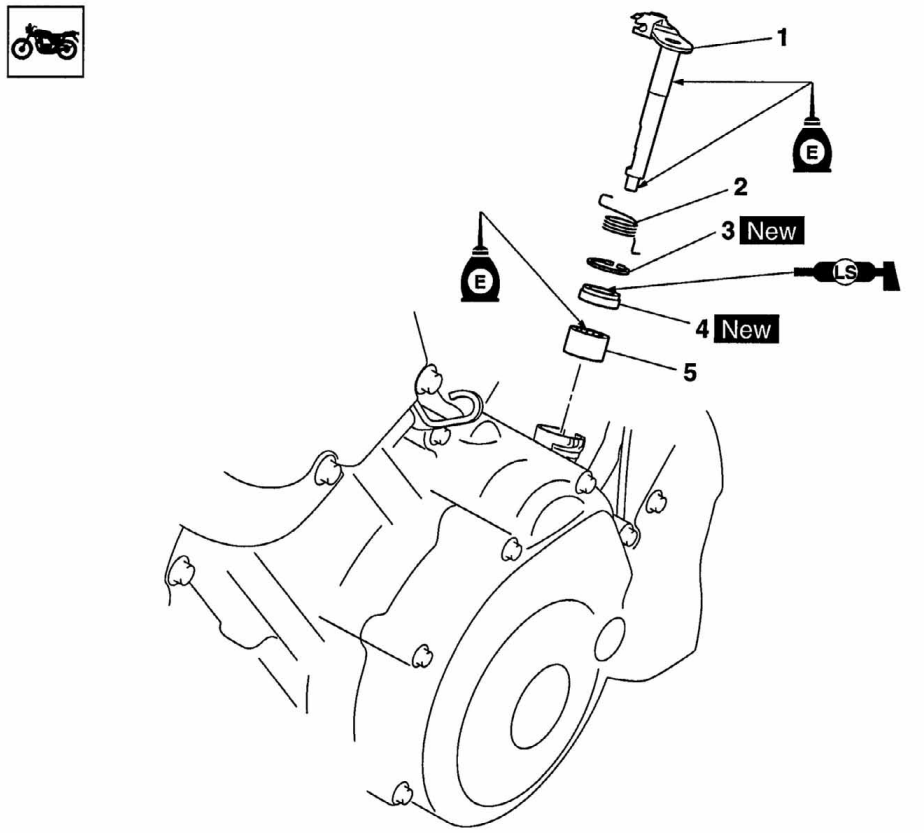


Sequence	Operation/Parts to remove	Quantity	Remarks
11	Clutch dished plate spring	1	
12	Clutch dished plate seat	1	
13	Clutch hub nut	1	
14	Lock washer	1	
15	Clutch hub	1	
16	Thrust washer	1	
17	Clutch housing	1	
18	Spring washer	1	
			Reverse removal procedure to install.

CONTROL LEVER REMOVAL

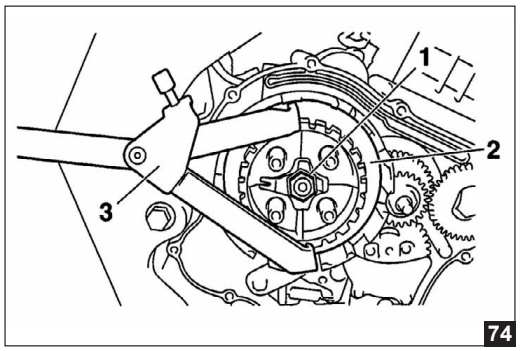
Control lever removal

New = part to be replaced upon reassembly



Sequence	Operation/Parts to remove	Quantity	Remarks
1	Clutch control lever	1	
2	Clutch control lever spring	1	
3	Snap ring	1	
4	Oil seal	1	
5	Bearing	1	
			Reverse removal procedure to install.

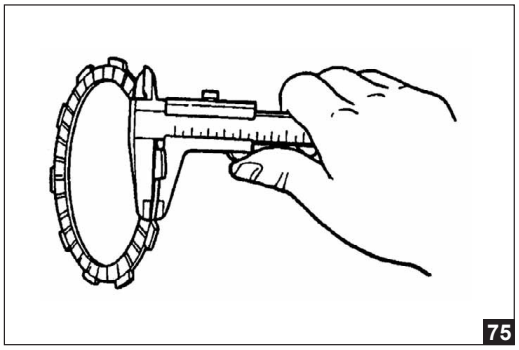
CLUTCH REMOVAL



1. **Unbend the lock washer tab.**
2. **Slacken:**
   - Clutch hub nut "1" (see fig. 74)

- **Blocking the clutch hub "2" with suitable tool "3", slacken the clutch hub nut.**

FRICTION PLATE CHECK

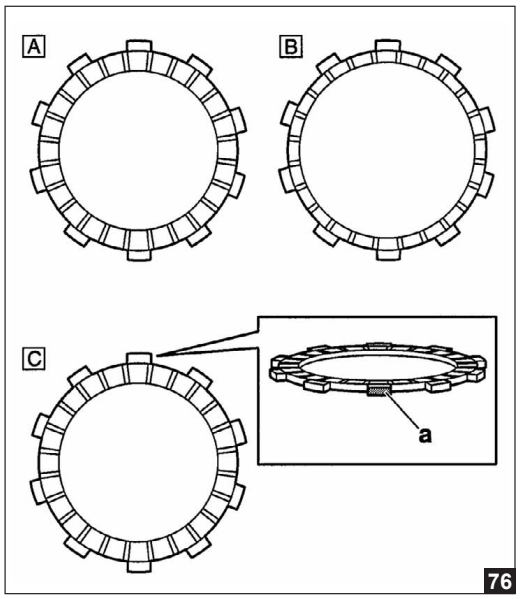


- The following procedure applies to all friction plates.

1. **Check:**
   - Friction plate
     Damage/wear → Replace friction plates together.
2. **Measure:**
   - Friction plate thickness
     Not conforming to specifications → Replace friction plates together.

- **Measure the friction plate in four different positions.**

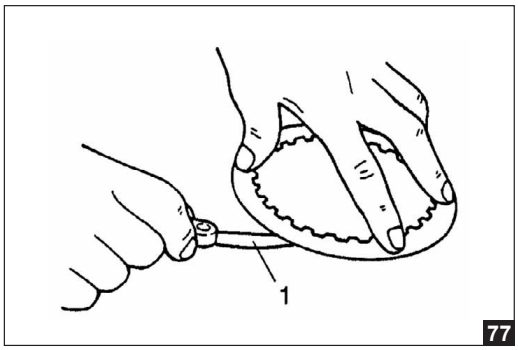
A. Friction plate 1



	• Friction plate 1 thickness **2.90-3.10 mm (0.114-0.122 in)** **• Wear limit** **2.80 mm (0.110 in)** **• Friction plate 2 thickness** **2.90-3.10 mm (0.114-0.122 in)** **• Wear limit** **2.80 mm (0.1102 in)** **• Friction plate 3 thickness** **2.90-3.10 mm (0.114-0.122 in)** **• Wear limit** **2.80 mm (0.1102 in)**

B. Friction plate 2
C. Friction plate 3 (green)
a. Green varnish

CLUTCH PLATE CHECK



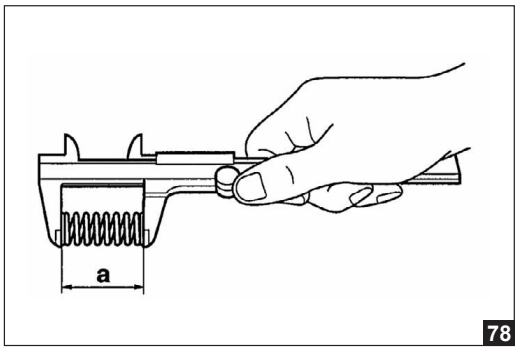
- The following procedure applies to all clutch plates.

1. **Check:**
   - Clutch plate
     Damage → Replace the clutch plates together.
2. **Measure:**
   - Clutch plate deformation
     (with a surface plane and a feeler gauge "1")
     Not conforming to specifications → Replace clutch plates together. (see fig. 77)

	• Clutch plate thickness **1.45-1.75 mm (0.057-0.069 in)** **• Deformation limit** **0.20 mm (0.0079 in)**

HAS25140

CLUTCH SPRING CHECK

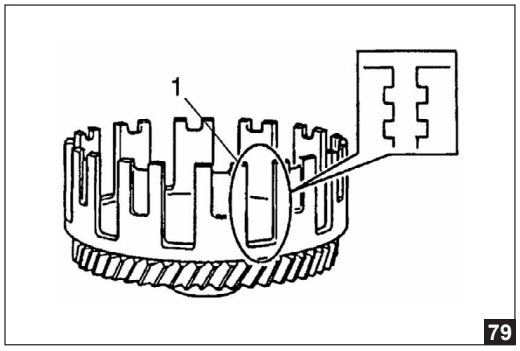


- The following procedure is applied to all clutch springs.

1. **Check:**
   - Clutch spring
     Damage → Replace the clutch springs together.
2. **Measure:**
   - Spring "a" free length
     Not conforming to specifications → Replace the clutch springs together. (see fig. 78)

	• Clutch spring free length **38.71 mm (1.52 in)** **• Minimum length** **36.77 mm (1.45 in)**

CLUTCH HOUSING CHECK

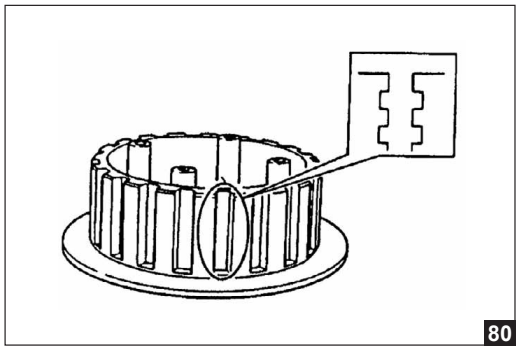


1. **Check:**
   - Clutch housing teeth "1"
   - Damage/pittings/wear → Trim the clutch housing teeth or replace the clutch housing. (see fig. 79)

- **The presence of pittings on clutch housing teeth will cause erratic clutch operation.**

2. **Check:**
   - Bearing
   - Damage/wear → Replace bearing seat and clutch housing.

CLUTCH HUB CHECK



1. **Check:**
   - Spline clutch hub
     Damage/pittings/wear → Replace the clutch hub. (see fig. 80)

- **The presence of pittings on clutch hub spline will cause erratic clutch operation.**

PRESSURE PLATE CHECK

1. **Check:**
   - Pressure plate
     Cracks/Damage → Replace.

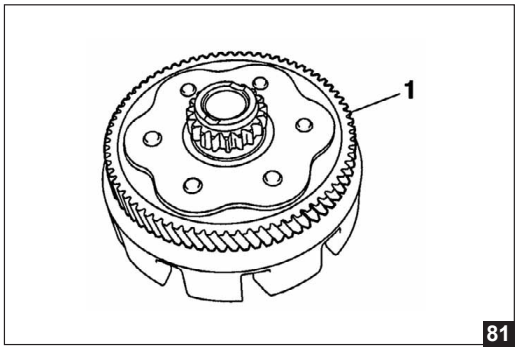
CLUTCH CONTROL LEVER AND SHORT CLUTCH PUSHROD CHECK

1. **Check:**
   - Clutch control lever
   - Short clutch pushrod
     Damage/wear → Replace faulty part(s).

PRIMARY DRIVE GEAR CHECK

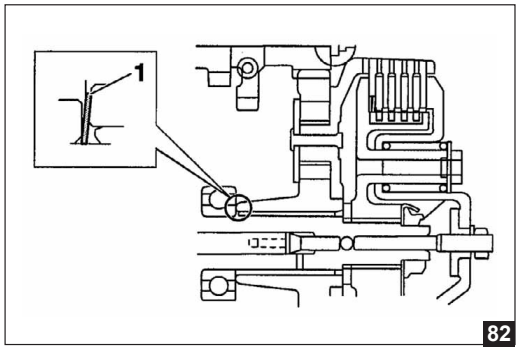
1. **Remove:**
   - Primary drive gear
   - Refer to "BALANCE SHAFT GEAR".
2. **Check:**
   - Primary drive gear
     Damage/wear → Replace primary drive gear and clutch housing together.
   - Excessive noise during operation → Replace primary drive gear and clutch housing together.
3. **Install:**
   - Primary drive gear
   - Refer to "BALANCE SHAFT GEAR".

PRIMARY DRIVEN GEAR CHECK



1. **Check:**
   - Primary driven gear "1"
     Damage/wear → Replace primary drive gear and clutch housing together.
   - Excessive noise during operation → Replace primary drive gear and clutch housing together. (see fig. 81)

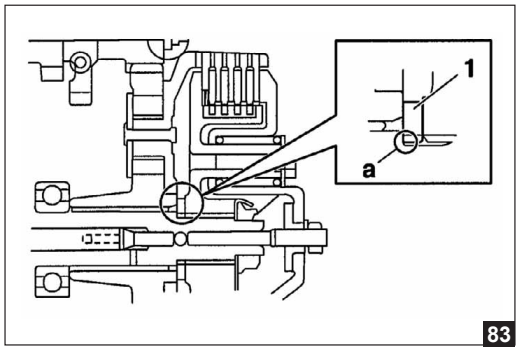
CLUTCH INSTALLATION



82

1. **Install:**
   - Spring washer "1" (see fig. 82)

- **Install the spring washer as shown in the figure.**



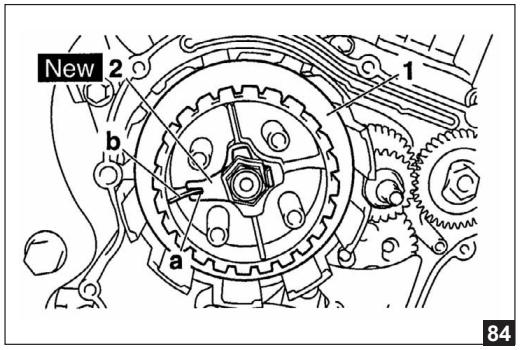
83

2. **Install:**
   - Clutch housing
   - Thrust washer "1"

- **Make sure the thrust washer is installed with sharp side "a" opposite to the clutch hub.**

3. **Install:**
   - Clutch hub "1"
   - Lock washer "2"
   - Clutch hub nut

- **Lubricate clutch hub nut threading and lock washer surface with engine oil.**
- **Align notch "a" in lock washer with a thread "b" on the clutch hub.**

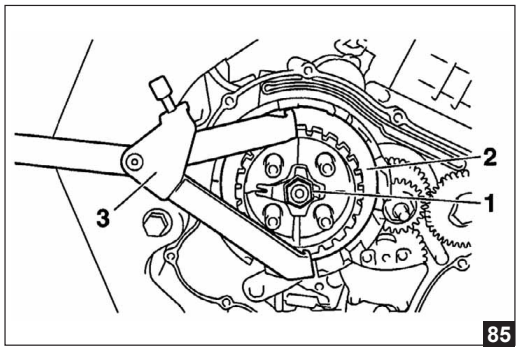


84

4. **Tighten:**
   - Clutch hub nut "1"

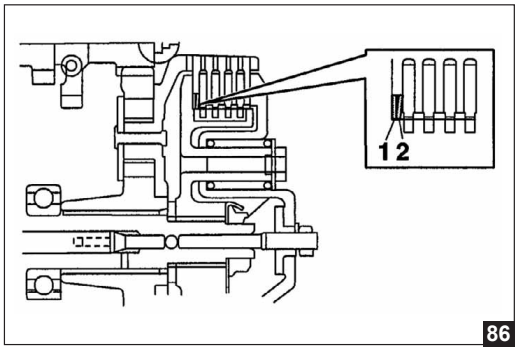
Nm	**• Clutch hub nut** **70 Nm (7.0 mkg, 50 ft-lb)**

- **Locking the clutch hub "2" with suitable tool "3", tighten the clutch hub nut.**



85

5. **Bend the lock washer tab on one of the flat sides of the nut.**
6. **Lubricate:**
   - Friction plates
   - Clutch plates
     (with recommended lubricant)
   - Recommended lubricant
   - Engine oil

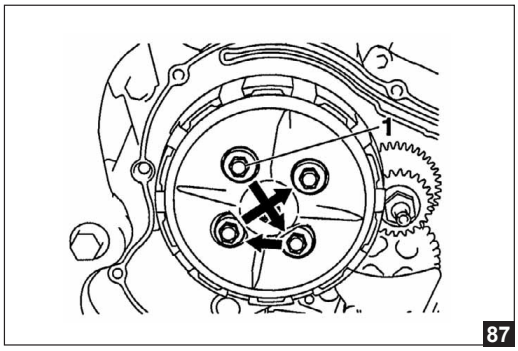


86

7. **Install:**
   - Clutch dished plate seat "1"
   - Clutch dished plate "2"
   - Friction plate 2
   - Clutch plates
   - Friction plates 3
   - Friction plate 1
     (see fig. 86)

	• **Recommended lubricant** • **Engine oil**

- **Install the clutch dished plate seat and the clutch dished plate as shown in the figure.**
- **First of all install a friction plate, then alternate a plate and a friction plate.**

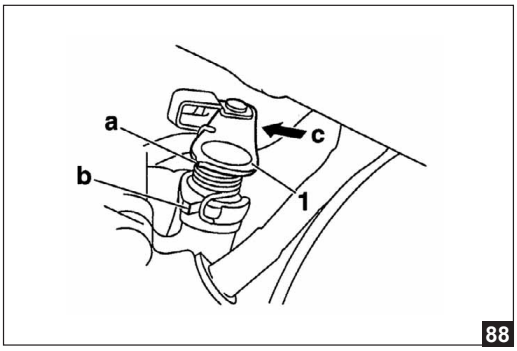


87

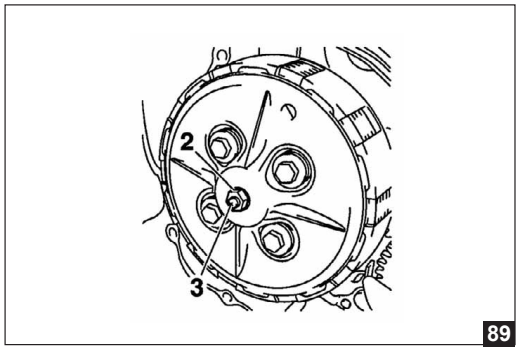
8. **Install:**
   - Pressure plate
   - Clutch springs
   - Clutch spring bolts "1" (see fig. 87)

Nm	• **Clutch spring bolt** **12 Nm (1.2 mkg, 8.7 ft-lb)**

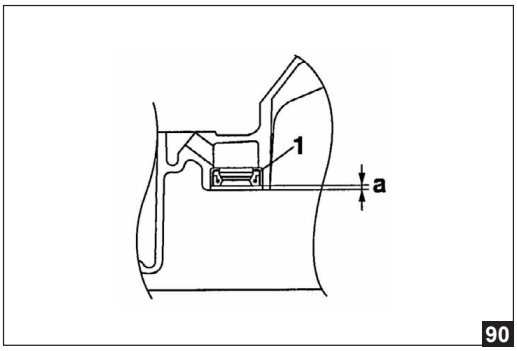
- **Gradually tighten the clutch spring bolts in a crossed manner.**



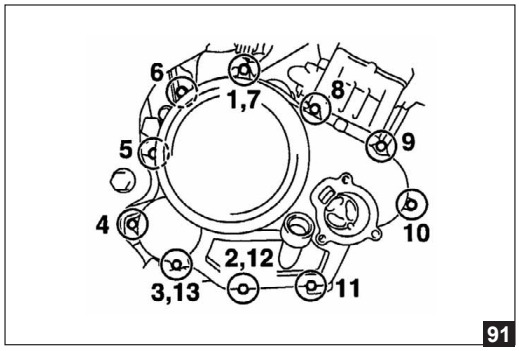
88



89



90



91

9. Adjust:
- Clutch mechanism clearance

a. Check that protrusion "a" on clutch control lever "1 " is aligned to reference "b" on the crankcase as shown in the figure, by manually pushing the clutch control lever in "c" direction until it stops.

b. If protrusion "a" is not aligned to reference "b", align it as follows:
- Slacken the check nut "2".
- With clutch control lever completely pressed in "c" direction, turn short clutch pushrod "3" towards the inside or the outside until reference "a" is aligned to reference "b".
- Stop the short clutch pushrod to avoid its movement then tighten the check nut as specified. (see fig. 88)

Nm	**• Short clutch pushrod check nut 8 Nm (0.8 mkg, 5.8 ft-lb)**

10. Install:
- Oil seal "1"

	• Oil seal mounting depth "a" 1.4-1.9 mm (0.055-0.075 in)

11. Install:
- Clutch casing

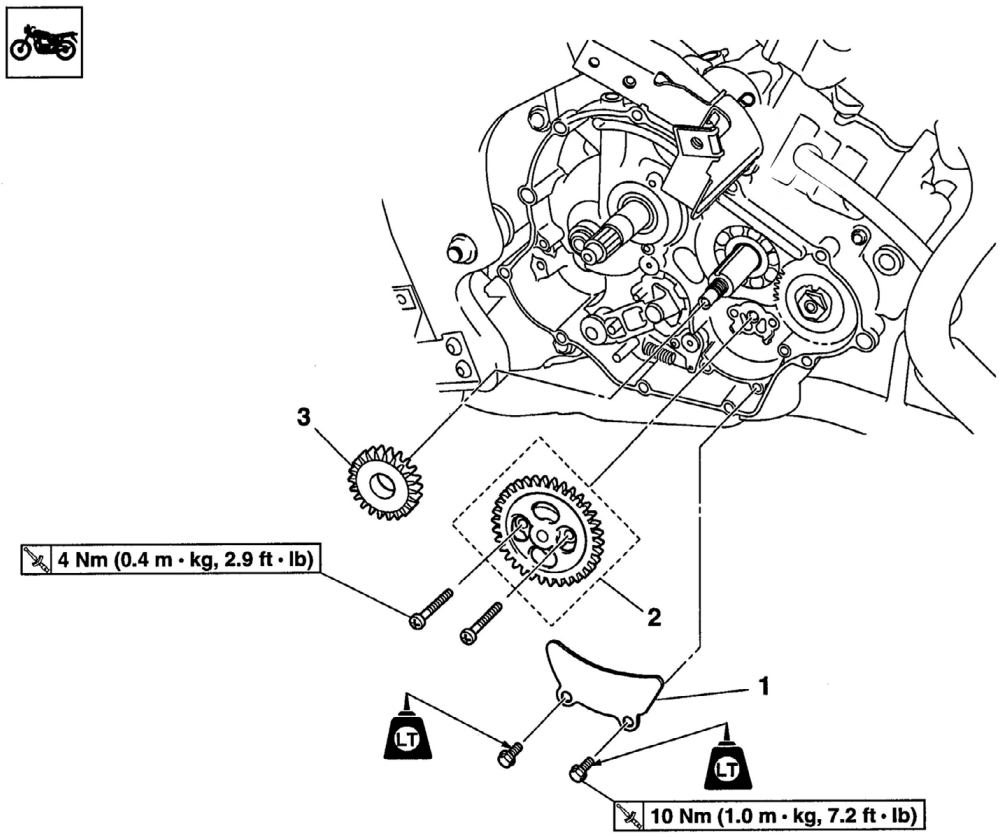
Nm	**• Clutch casing bolt 10 Nm (1.0 mkg, 7.2 ft-lb)**

• Tighten the clutch cover bolts in the correct sequence as shown in the figure.

12. Adjust:
- Clutch cable clearance
- Refer to "CLUTCH CABLE CLEARANCE ADJUSTMENT".

OIL PUMP

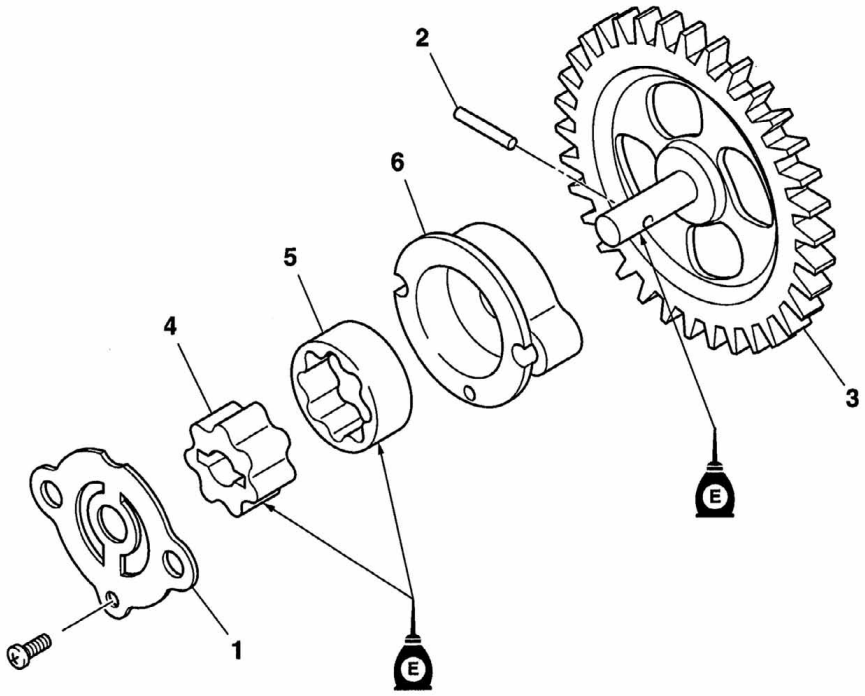
Oil pump removal



Se-quen-ce	Operation/Parts to remove	Quantity	Remarks
	Clutch housing		
	Balance shaft drive gear		
1	Oil baffle plate	1	
2	Oil pump unit	1	
3	Oil pump drive gear	1	
			Reverse removal procedure to install.

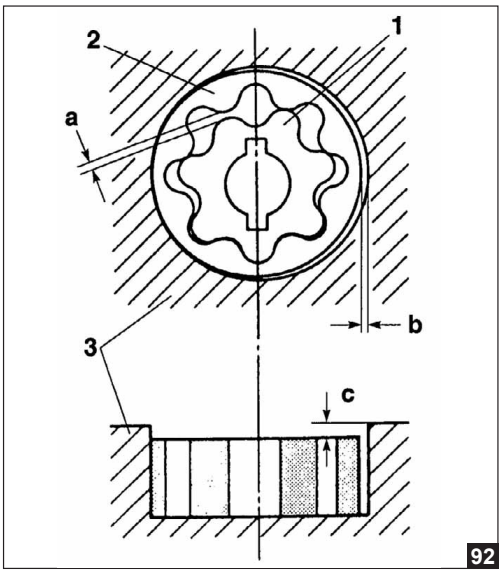
OIL PUMP DISASSEMBLY

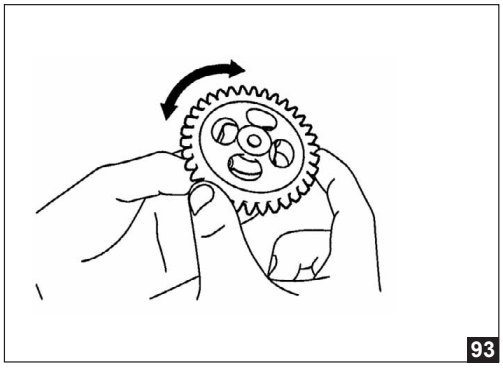
Oil pump disassembly



Se-quen-ce	Operation/Parts to remove	Quantity	Remarks
1	Oil pump housing cover	1	
2	Pin	1	
3	Oil pump driven gear	1	
4	Oil pump inside rotor	1	
5	Oil pump outside rotor	1	
6	Oil pump housing	1	
			Reverse removal procedure to install.

OIL PUMP CHECK





1. **Check:**
   - Oil pump drive gear
   - Oil pump driven gear
   - Oil pump housing
   - Oil pump housing cover

   Cracks/damage/wear → Replace faulty part(s).
2. **Measure:**
   - Inside rotor - outside rotor end "a" clearance
   - Outside rotor - oil pump housing "b" clearance
   - Oil pump housing - inside and outside rotor "c" clearance

   Not conforming to specifications → Replace oil pump. (see fig. 92)

	• Inside rotor-outside rotor end clearance **• Below 0.15 mm (0.0059 in)** **• Limit** **0.23 mm (0.0091 in)** **• Outside rotor-oil pump housing clearance** **0.13-0.18 mm (0.0051-0.0071 in)** **• Limit** **0.25 mm (0.0098 in)** **• Oil pump housing inside and outside rotor clearance** **0.06-0.11 mm (0.0024-0.0043 in)** **• Limit** **0.18 mm (0.0071 in)**

3. **Check:**
   - Oil pump operation

   Difficult movement → Repeat operations (1) and (2) or replace faulty part(s).

OIL PUMP ASSEMBLY

1. **Lubricate:**
   - Oil pump inside rotor
   - Oil pump outside rotor
   - Oil pump driven gear

   (with recommended lubricant)

	• Recommended lubricant **• Engine oil**

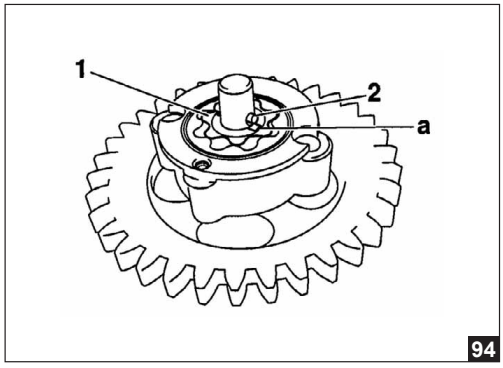
2. **Install:**
   - Oil pump outside rotor
   - Oil pump inside rotor "1"
   - Oil pump driven gear
   - Pin "2"

OIL PUMP ASSEMBLY

- **When installing inside rotor, align pin "2" of the oil pump shaft with groove "a" of inside rotor " 1" .**

3. **Check:**
   - Oil pump operation
   - Refer to "OIL PUMP CHECK".

OIL PUMP INSTALLATION



1. **Install:**
   - Oil pump assembly

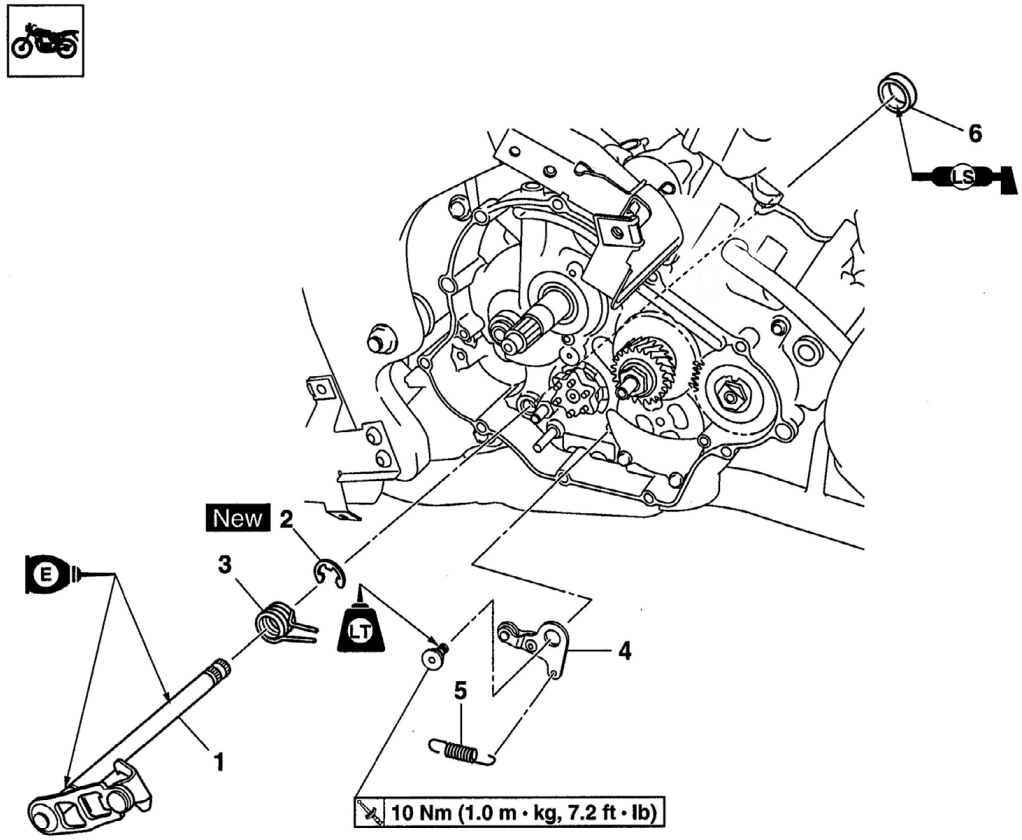
Nm	**• Oil pump unit screw** **4 Nm (0.4 mkg, 2.9 ft-lb)**

	WARNING! **• Tighten the screws then ensure the oil pump turns smoothly.**

GEARBOX SHAFT

Gearbox shaft and stop lever removal

New = part to be replaced upon reassembly



Se-quen-ce	Operation/Parts to remove	Quantity	Remarks
	Clutch housing		
	Gearbox transmission link		
1	Gearbox shaft	1	
2	Snap ring	1	
3	Gearbox shaft spring	1	
4	Stop lever	1	
5	Stop lever spring	1	
6	Oil seal	1	
			Reverse removal procedure to install.

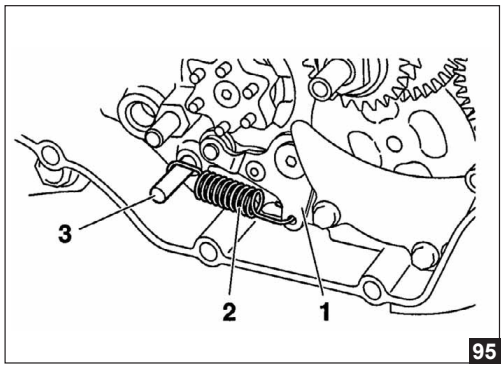
GEARBOX SHAFT CHECK

1. **Check:**
   - Gearbox shaft
     Bending/damage/wear → Replace.
   - Gearbox shaft spring
     Damage/wear → Replace.

STOP LEVER CHECK

1. **Check:**
   - Stop lever
     Bending/damage → Replace.
     Difficult roller rotation → Replace stop lever.
   - Stop lever spring
     Damage/wear → Replace.

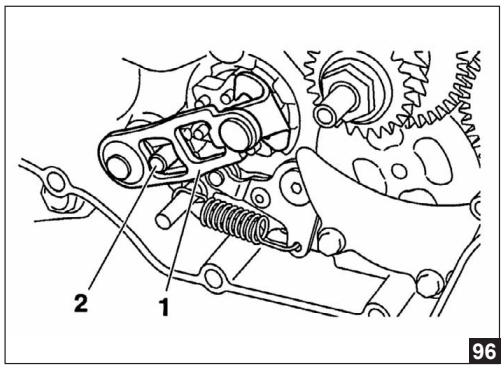
GEARBOX SHAFT INSTALLATION



95

1. **Install:**
   - Stop lever "1"
   - Stop lever spring "2"
     (see fig. 95)

- **Install stop lever spring as shown in the figure.**
- **Engage the ends of the stop lever spring to the stop lever and to the crankcase hub "3"**
- **Engage the stop lever with the gear selector drum section unit.**



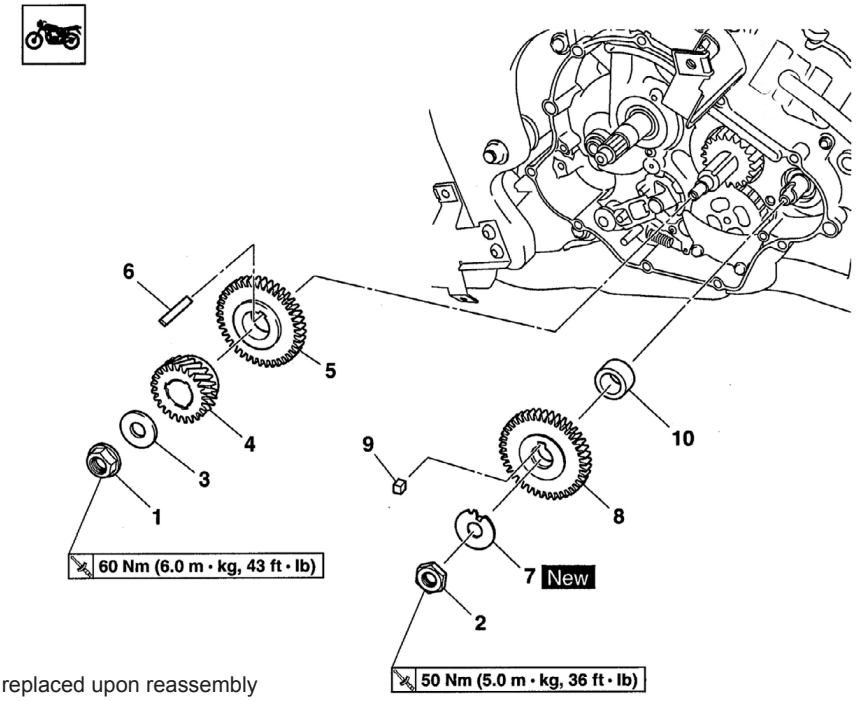
96

2. **Install:**
   - Gearbox shaft "1"

- **Hook the ends of the gearbox shaft spring to the gearbox shaft spring stop "2".**

BALANCE SHAFT GEAR

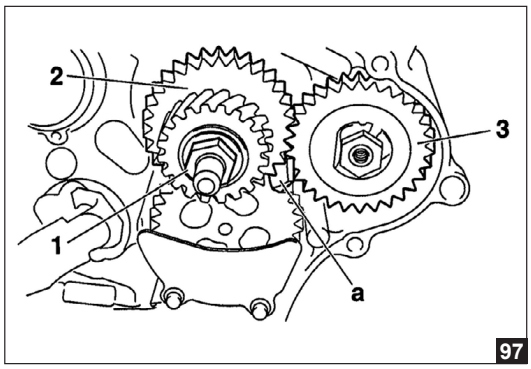
Primary drive gear and balance shaft gears removal



New = part to be replaced upon reassembly

Se-quen-ce	Operation/Parts to remove	Quantity	Remarks
	Clutch housing		
1	Primary drive gear nut	1	
2	Balance shaft driven gear nut	1	
3	Washer	1	
4	Primary drive gear	1	
5	Balance shaft drive gear	1	
6	Straight key	1	
7	Lock washer	1	
8	Balance shaft driven gear	1	
9	Straight key	1	
10	Spacer	1	
			Reverse removal procedure to install.

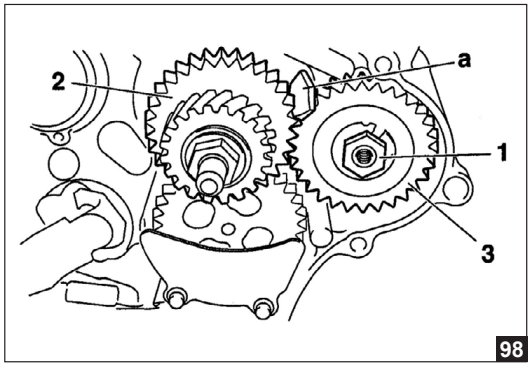
PRIMARY DRIVE GEAR AND BALANCE SHAFT GEARS REMOVAL



1. **Slacken:**
   • Primary drive gear nut "1"

• **Place the aluminium plate "a" between the balance shaft drive gear "2" and the balance shaft driven gear "3", then slacken the primary drive gear nut .**

2. **Unbend the lock washer tab.**
3. **Slacken:**
   • Balance shaft driven gear nut "1"

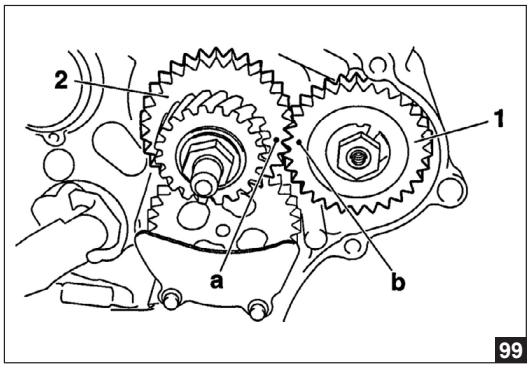


• **Place the aluminium plate "a" between the balance shaft drive gear "2" and the balance shaft driven gear "3", then slacken the balance shaft driven gear nut.**

PRIMARY DRIVE GEAR AND BALANCE SHAFT GEARS CHECK

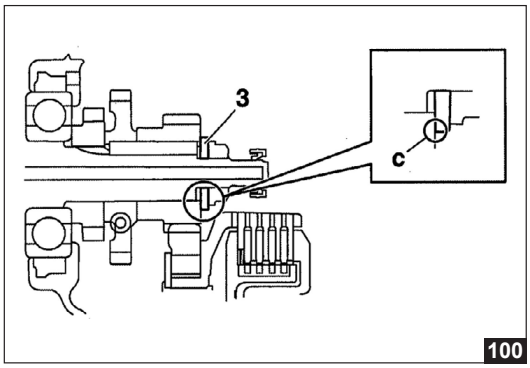
1. **Check:**
   • Balance shaft drive gear
   • Balance shaft driven gear
   Clefts/damage/wear → Replace.
2. **Check:**
   • Primary drive gear

PRIMARY DRIVE GEAR AND BALANCE SHAFT GEARS INSTALLATION



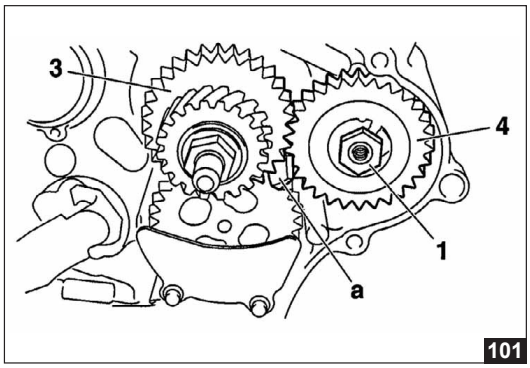
1. **Install:**
   - Balance shaft driven gear "1"
   - Lock washer
   - Balance shaft drive gear "2"
   - Primary drive gear
   - Washer "3"
   - Balance shaft driven gear nut
   - Primary drive gear nut

- **Align the punching "a" of the balance shaft drive gear "1" to the punching "b" of the balance shaft driven gear "2".**
- **Make sure of installing the washer so that the sharp side "c" is facing towards the primary drive gear.**

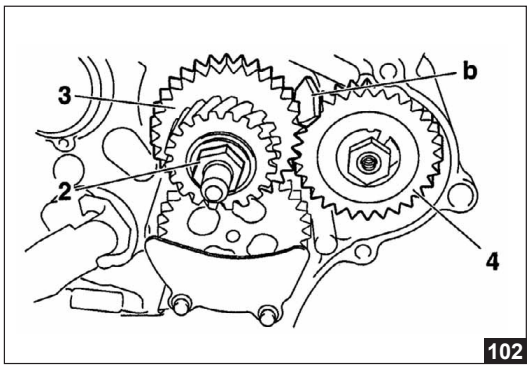


2. **Tighten:**
   - Balance shaft driven gear nut "1"
   - Primary drive gear nut "2"

Nm	**• Balance shaft driven gear nut** **50 Nm (5.0 mkg, 36 ft-lb)** **• Primary drive gear nut** **60 Nm (6.0 mkg, 43 ft-lb)**



- **Place the aluminium plate "a" between the balance shaft drive gear "3" and the balance shaft driven gear "4", then tighten the balance shaft driven gear nut.**
- **Place the aluminium plate "b" between the balance shaft drive gear "3" and the balance shaft driven gear "4", then tighten the primary drive gear nut.**

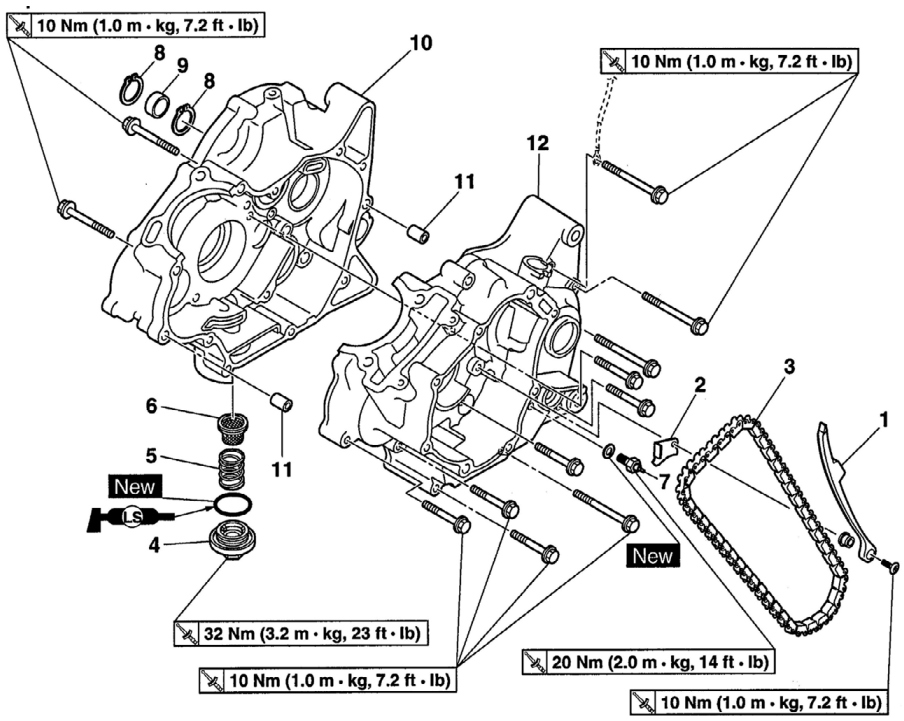


3. **Bend the lock washer tab on one of the flat sides of the nut.**

CRANKCASE

Crankcase separation

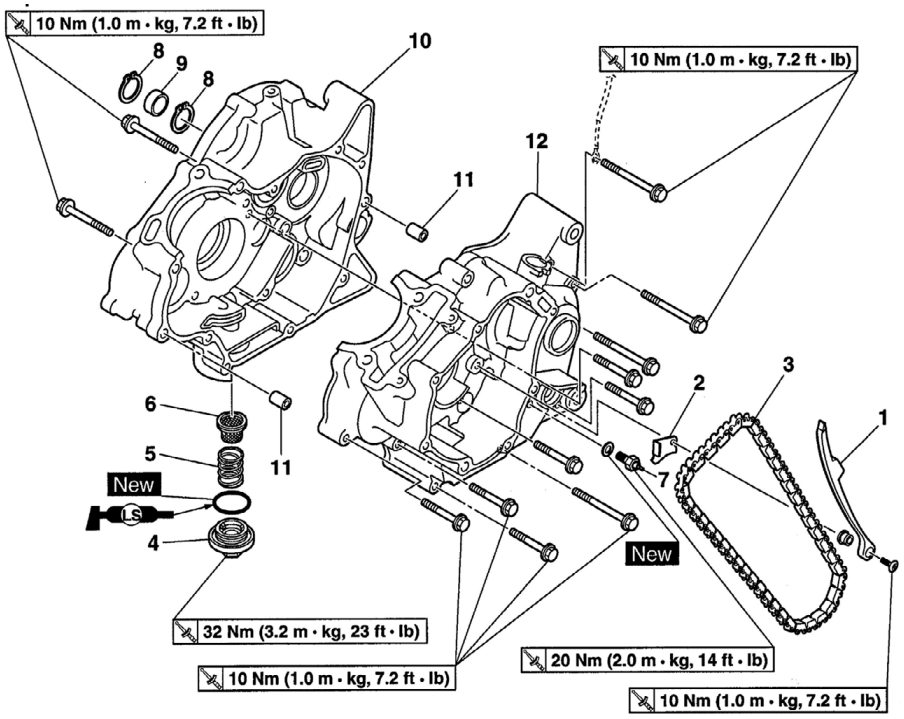
New = part to be replaced upon reassembly



Se-quen-ce	Operation/Parts to remove	Quantity	Remarks
	Engine		
	Cylinder head		
	Cylinder/Piston		
	Clutch housing		
	Oil pump unit		
	Gearbox shaft		
	Starter motor		
	Balance shaft gears		
1	Generator rotor	1	
			Reverse removal procedure to install.

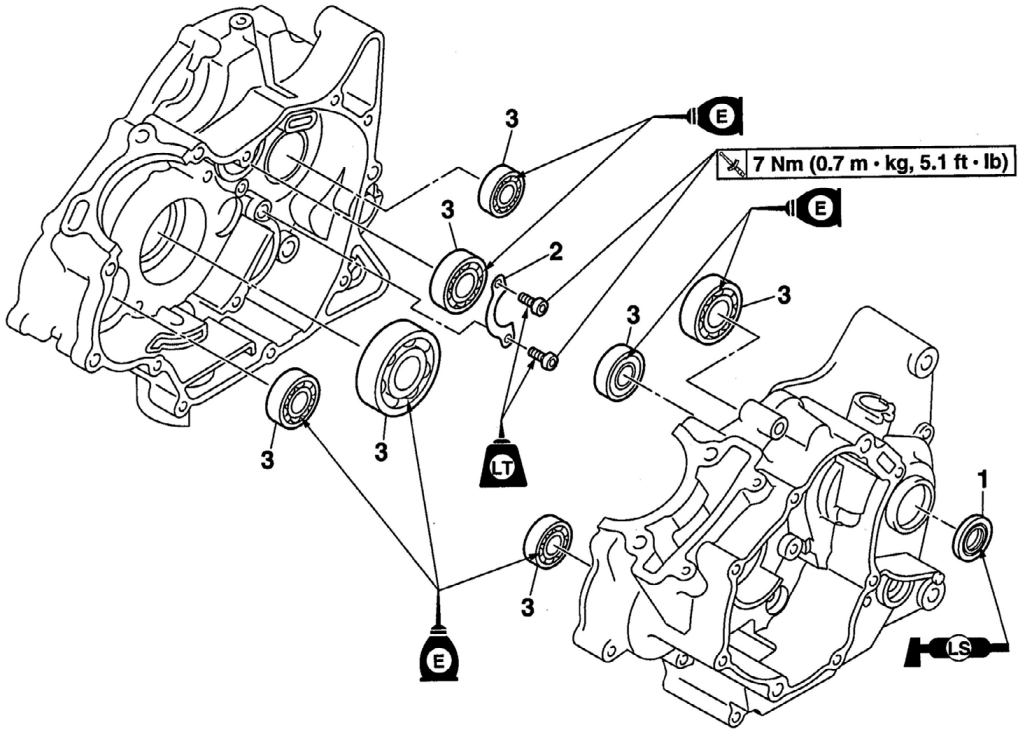
Crankcase separation

New = part to be replaced upon reassembly



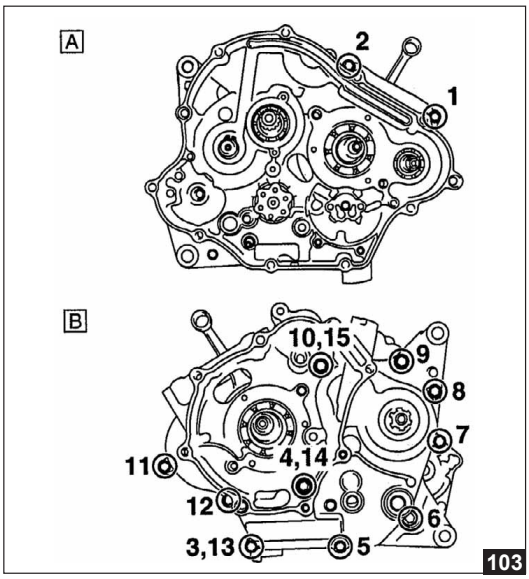
Se-quen-ce	Operation/Parts to remove	Quantity	Remarks
2	**Chain cover**	1	
3	**Timing chain**	1	
4	**Oil drain plug**	1	
5	**Spring**	1	
6	**Engine oil filter**	1	
7	**Neutral switch**	1	
8	**Snap ring**	2	
9	**Spacer**	1	
10	**Right crankcase**	1	
11	**Dowel pin**	2	
12	**Left crankcase**	1	
			Reverse removal procedure to install.

Bearings and oil seal removal

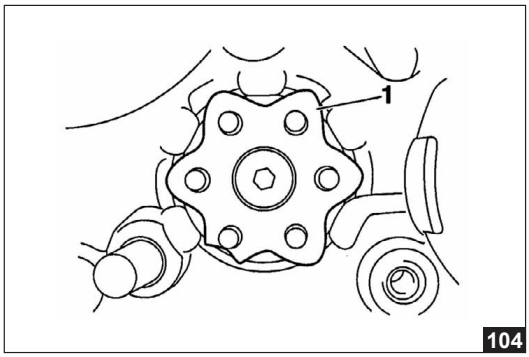


Sequence	Operation/Parts to remove	Quantity	Remarks
	Crankshaft/Balance shaft		
	Transmission		
1	**Oil seal**	1	
2	**Bearing stop**	1	
3	**Bearing**	7	
			Reverse removal procedure to install.

CRANKCASE SEPARATION



- **A. Right crankcase**
- **B. Left crankcase**



1. **Remove:**
   - Crankcase bolts

- **Gradually slacken each bolt of 1/4 turn at the time, as indicated in the sequence.**

2. **Rotate:**
   - Gear selector drum section

- **Rotate the gear selector drum section "1" to the position shown in the figure. In this position, the gear selector drum section teeth do not touch the crankcase during crankcase separation.**

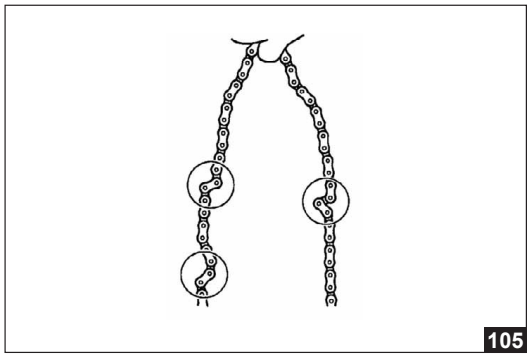
3. **Remove:**
   - Right crankcase

WARNING!
- **Tap with a mallet on crankcase side. Only tap on the crankcase reinforced parts, and not on crankcase mating surfaces. Proceed carefully and slowly, making sure the crankcases separate evenly.**

CRANKCASE CHECK

1. **Accurately wash the crankcase halves with a delicate solvent.**
2. **Accurately wash the gaskets surface and the crankcase mating surfaces.**
3. **Check:**
   - Crankcase
     Cracks/Damage → Replace.
   - Oil galleries
     Obstruction → Blow clean with a compressed air jet.

TIMING CHAIN AND TIMING CHAIN GUIDE CHECK



1. **Check:**
   • Timing chain
   Damage/stiffness → Replace the timing chain and the camshaft sprocket together.
2. **Check:**
   • Timing chain guide (intake side)
   Damage/wear → Replace.

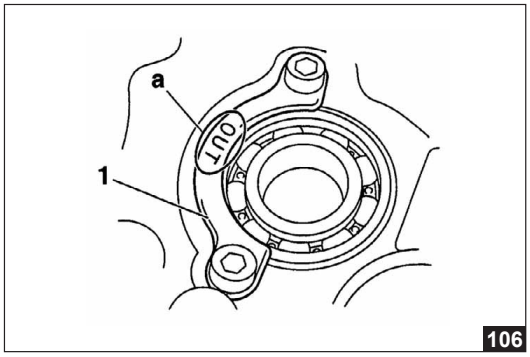
OIL FILTER CHECK

1. **Check:**
   • Oil filter
   Damage → Replace.
   Contamination → Clean with a solvent.

BEARINGS AND OIL SEAL CHECK

1. **Check:**
   • Bearings
   Clean and lubricate the bearings, then manually rotate the inner race.
   Hard movement → Replace.
   • Oil seal
   Damage/wear → Replace.

BEARING STOP INSTALLATION



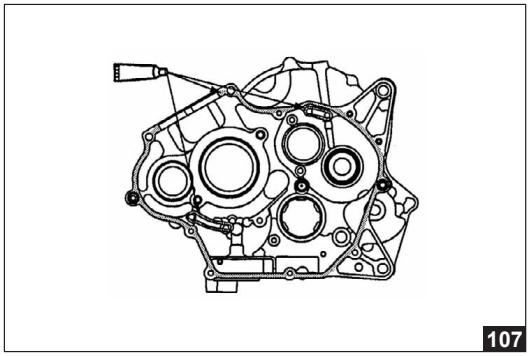
106

1. **Install:**
   • Bearing stop "1" (see fig. 106)

• Install the bearing stop "1" with the reference "OUT" "a" facing outside.
• Apply the threadlock (LOCTITE®) on the bearing stop bolt threadings.

Nm	**• Bearing stop bolt** **7 Nm (0.7 mkg, 5.1 ft-lb)** **LOCTITE®**

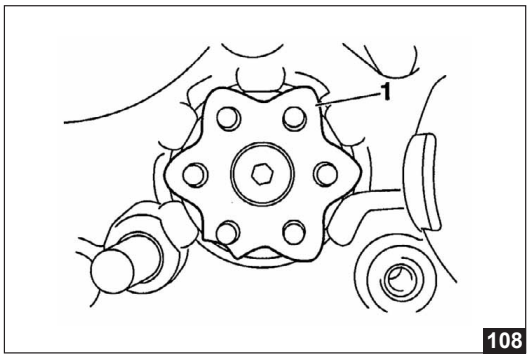
CRANKCASE ASSEMBLY


107

1. **Accurately wash all gaskets and crankcase mating surfaces.**
2. **Apply:**
   • Sealant
   (on crankcase mating surface)

	Sealant Three Bond No.1215®

• Avoid sealant from contacting oil channels.



108

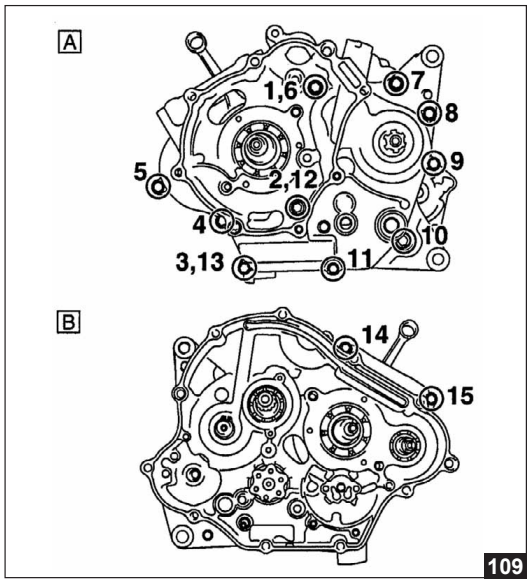
3. **Install:**
   • Right crankcase

• Rotate the gear selector drum section "1" to the position shown in the figure. In this position, the gear selector drum section teeth do not touch the crankcase during crankcase installation.

4. **Install:**
   • Crankcase bolts

Nm	**• Crankcase bolt** **10 Nm (1.0 mkg, 7.2 ft-lb)**

CRANKCASE ASSEMBLY



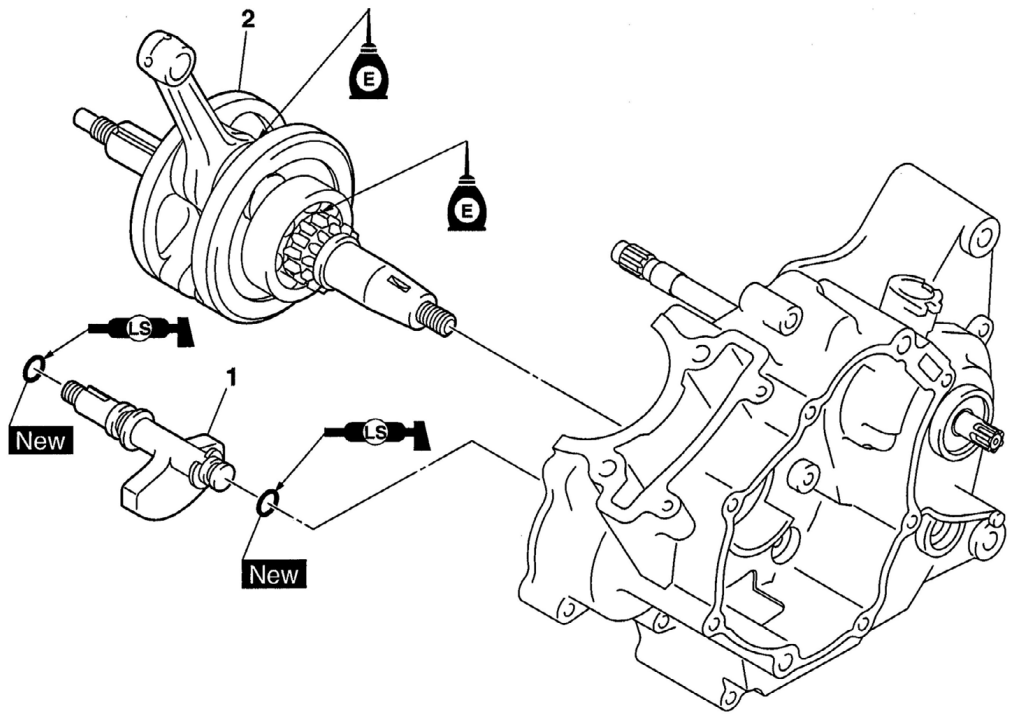
- **A. LEFT CRANKCASE**
- **B. RIGHT CRANKCASE**

- **Gradually tighten each bolt of 1/4 turn at the time, as indicated in the sequence.**

- M6X70 MM:"7-9", "11"
- M6X55 MM:"14","15"
- M6X45 MM:"1-5", "10"

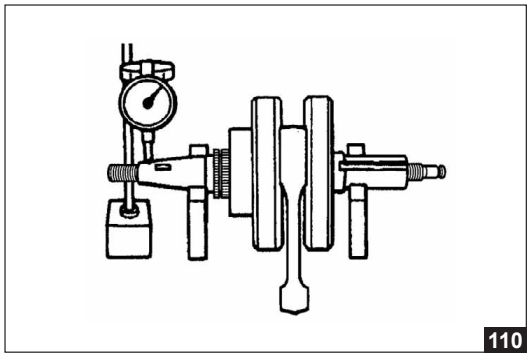
CRANKSHAFT

New = part to be replaced upon reassembly



Se-quen-ce	Operation/Parts to remove	Quantity	Remarks
	Crankcase		
1	**Balance shaft**	1	
2	**Crankshaft**	1	

CRANKSHAFT CHECK



1. **Measure:**
   - Crankshaft misalignment
     Not conforming to specifications → Replace crankshaft, the bearing or both.

- **Slowly rotate the crankshaft.**

	• Offset limit C **0.030 mm (0.0012 in)**

2. **Measure:**
   - Connecting rod big end side clearance
     Not conforming to specifications → Replace crankshaft.

	• Connecting rod big end side clearance D **0.110-0.410 mm (0.0043-0.0161 in)**

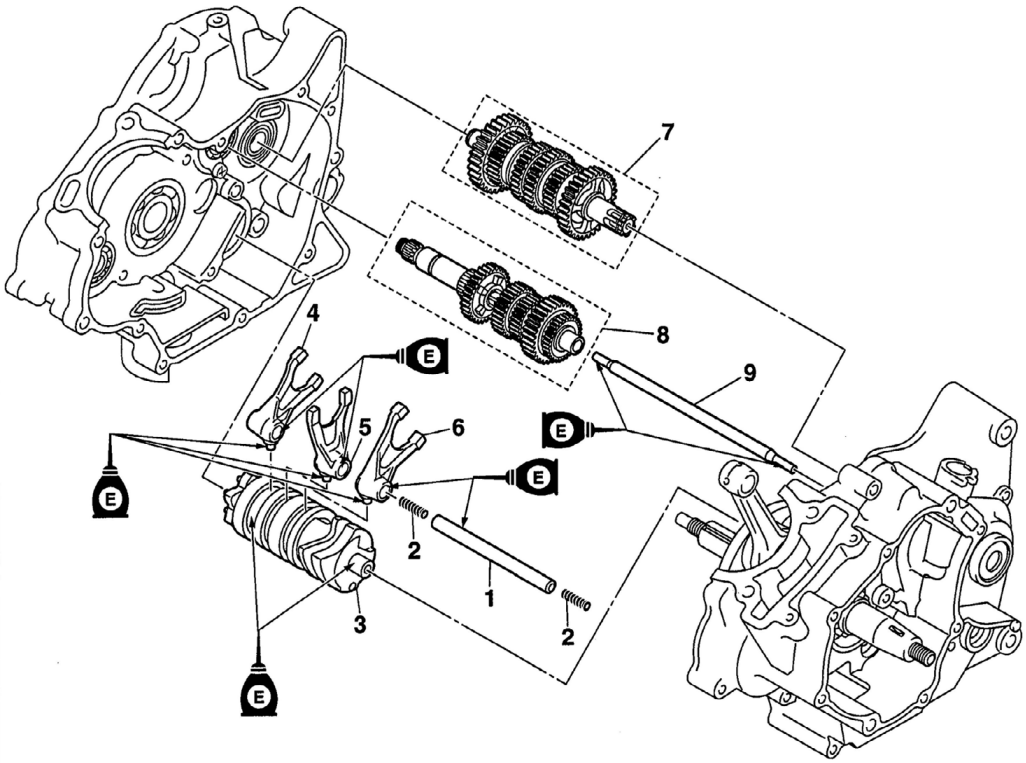
3. **Measure:**
   - Crankshaft width
     Not conforming to specifications → Replace crankshaft.

	• Width A **47.95-48.00 mm (1.888-1.890 in)**

4. **Check:**
   - Crankshaft sprocket
     Damage/wear → Replace the crankshaft.
   - Bearing
     Cracks/damage/wear → Replace the crankshaft.
5. **Check:**
   - Crankshaft pin
     Scratches/wear → Replace the crankshaft.
   - Crankshaft pin oil gallery
     Obstruction → Blow clean with a compressed air jet.

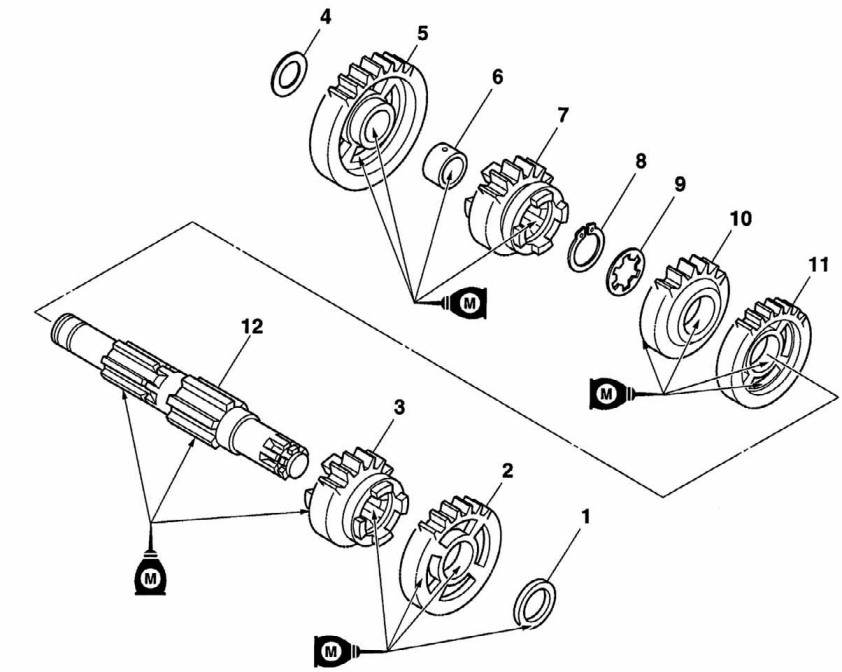
TRANSMISSION

Gear selector forks and drum assembly, transmission removal



Se-quen-ce	Operation/Parts to remove	Quantity	Remarks
	Crankcase		
1	**Gearbox fork shaft**	1	
2	**Spring**	2	
3	**Gear selector drum assembly**	1	
4	**Gear selector fork-R**	1	
5	**Gear selector fork-C**	1	
6	**Gear selector fork-L**	1	
7	**Output shaft assembly**	1	
8	**Complete input shaft**	1	
9	**Long clutch pushrod**	1	
			Reverse removal procedure to install.

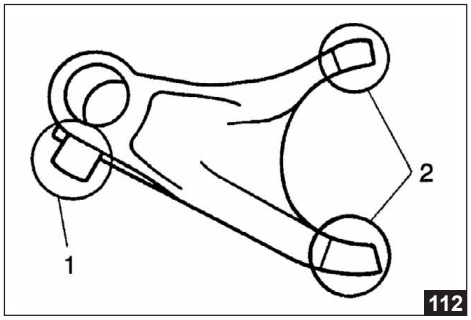
Output shaft disassembly



Se-quen-ce	Operation/Parts to remove	Quantity	Remarks
1	**Washer**	1	
2	**2nd speed gear**	1	
3	**6th speed gear**	1	
4	**Washer**	1	
5	**1st speed gear**	1	
6	**Spacer**	1	
7	**5th speed gear**	1	
8	**Snap ring**	1	
9	**Safety washer**	1	
10	**4th speed gear**	1	
11	**3rd speed gear**	1	
12	**Output shaft**	1	
			Reverse removal procedure to install.

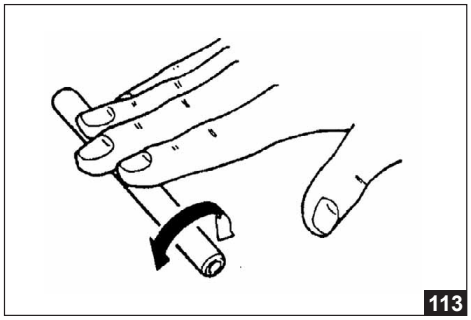
GEAR SELECTOR FORKS CHECK

- The following procedure is applied to all gear selector forks.

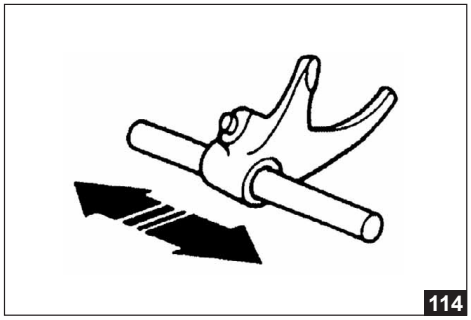


112

1. **Check:**
   - Gear selector fork cam roller "1"
   - Gear selector fork tooth "2"
     Deformation/damage/scoring/wear → Replace the gear selector fork. (see fig. 112)
2. **Check:**
   - Gearbox fork shaft
   - Roll the gearbox fork shaft on a flat surface.
   - Deformations → Replace.

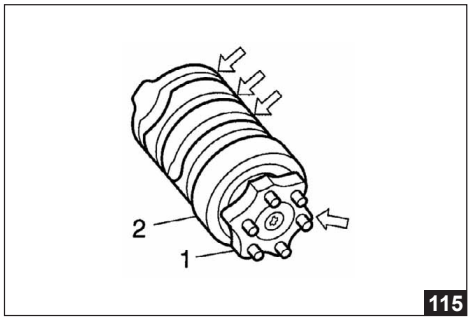

113

WARNING!
- **Do not try to straighten the gear selector fork shaft if deformed.**


114

3. **Check:**
   - Gear selector fork movement
     (on the gearbox fork shaft)
     Hard movement. Replace the gear selector forks and the gearbox fork shaft together.

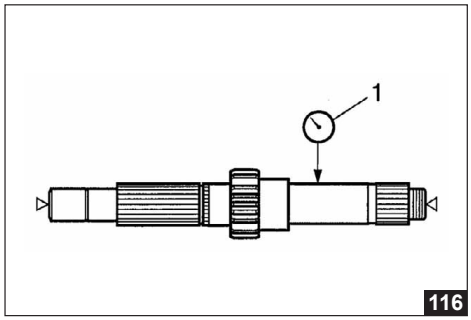
GEAR SELECTOR DRUM UNIT CHECK

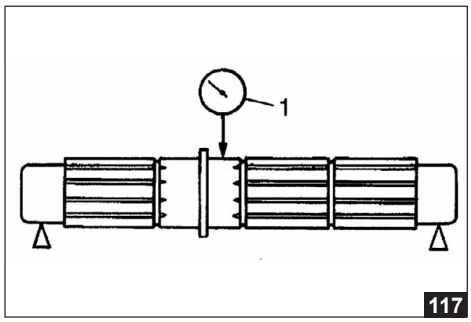


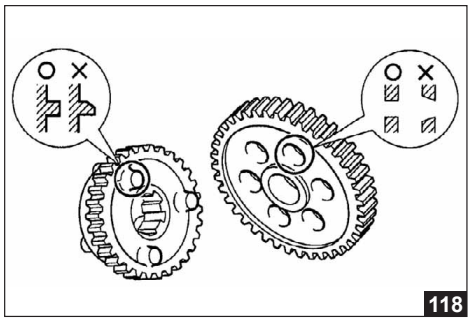
115

1. **Check:**
   - Gear selector drum groove
     Damage/scratches/wear → Replace the gear selector drum unit.
   - Gear selector drum section "1"
     Damage/wear → Replace the gear selector drum unit.
   - Gear selector drum bearing "2"
     Damage/pittings → Replace the gear selector drum unit.
     (see fig. 115)

TRANSMISSION CHECK







1. **Measure:**
   - Primary shaft misalignment
     (use a centre square and a dial gauge "1")
   - Not conforming to specifications → Replace the primary shaft.
     (see fig. 116)

	• **Input shaft offset limit** **0.08 mm (0.0032 in)**

2. **Measure:**
   - Output shaft misalignment
     (use a centre square and a dial gauge "1")
   - Not conforming to specifications → Replace the output shaft.
     (see fig. 117)

	• **Output shaft offset limit** **0.08 mm (0.0032 in)**

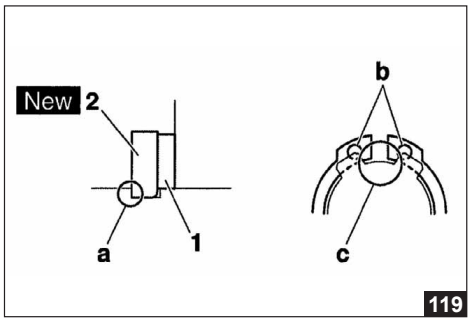
3. **Check:**
   - Transmission gears
   - Discoloured blue/pittings/wear → Replace faulty gear(s).
   - Transmission gears teeth
     Cracks/damage/rounded edges → Replace faulty gear(s).
4. **Check:**
   - Correct gear meshing
     (each sprocket with its gear)
     Not correct → Reassemble transmission shaft units.
5. **Check:**
   - Transmission gear movement
   - Hard movement → Replace faulty part(s).

CLUTCH PUSHROD CHECK

1. **Check:**
   - Long clutch pushrod
     Cleft/damage/wear → Replace the long clutch pushrod.
2. **Measure:**
   - Pushrod bending limit
     Not conforming to specifications → Replace long clutch pushrod.

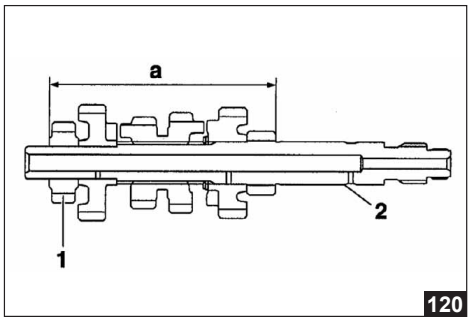
	• **Pushrod bending limit** **0.500 mm (0.0197 in)**

PRIMARY SHAFT AND OUTPUT SHAFT ASSEMBLY



1. **Install:**
   - Safety washer "1"
   - Snap ring "2"
     (see fig. 119)

- **Make sure of installing a snap ring with the sharp side "a" facing towards the opposite direction of the washer and gear.**
- **Make sure that the ends of the snap ring "b" correspond to the grooves of the splined shaft "c".**

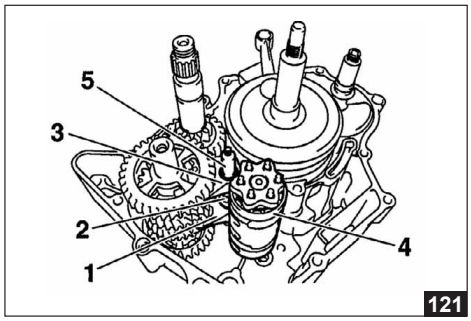


2. **Install:**
   - Sprocket of 2a "1"

- **Push the second sprocket inside the primary shaft "2", as shown in the figure.**

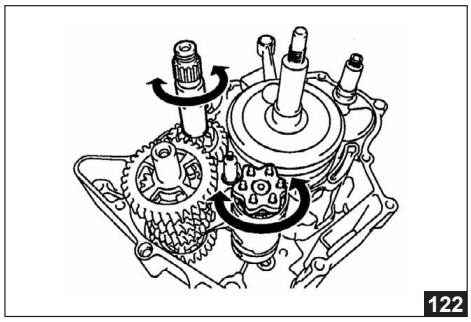
	• **Mounting depth "a"** **106.85-107.05 mm (4.207-4.215 in)**

GEAR SELECTOR FORKS AND GEAR SELECTOR DRUM UNIT INSTALLATION



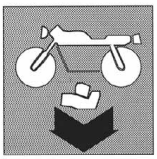
1. **Install:**
   - Gear selector fork-L "1"
   - Gear selector fork-C "2"
   - Gear selector fork-R "3"
   - Gear selector drum unit "4"
   - Springs
   - Gearbox fork shaft "5"
     (see fig. 121)

- **Reference protrusions on the gear selector forks must face towards the right side of the engine and be in the following sequence: "R", "C", "L".**

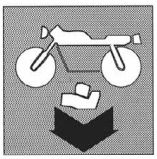


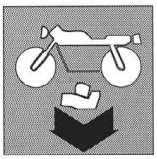
2. **Check:**
   - Transmission
     Irregular movement → Repair.

- **Thoroughly apply engine oil on each gear and bearing.**
- **Before assembling the crankcase, make sure the transmission is in neutral and that gears rotate freely.**



Section F2





INTRODUCTION

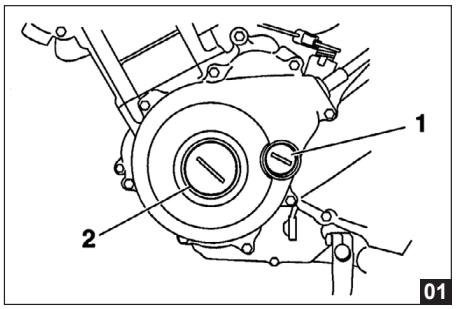
- This chapter includes all information necessary to perform recommended inspections and adjustments.
- Complying with these preventive maintenance procedures will ensure higher reliability and a long life of the vehicle while also minimising the need for costly overhaul interventions. This information applies to both vehicles in use or brand new ones being prepared for sale. All technicians in charge of maintenance must be familiar with the instructions herein.

SCHEDULED MAINTENANCE AND LUBRICATION

- **Yearly services shall be carried out every year, unless your maintenance schedule follows mileage intervals in kilometres or in miles, for the United Kingdom.**
- **From 30000 km (17500 mi), repeat maintenance intervals starting from operations scheduled for 6000 km (3500 mi).**
- **Positions highlighted with a star shall be entrusted to a Yamaha dealer, since they require special tools, specifications and technical skills.**

No.		Position	Check or Maintenance	Odometer reading					Yearly Inspection
				1000 km (600 mi)	6000 km (3500 mi)	12000 km (7000 mi)	18000 km (10500 mi)	24000 km (14000 mi)	
1	*	Fuel circuit	• Ensure that fuel hoses are not fissured or damaged.		■	■	■		■
2		Spark plug	• Check conditions. • Clean and restore electrode gap.		■				
			• Replace.					■	
3	*	Valves	• Check valve clearance. • Adjust.		■	■	■		
4		Clutch	• Check operation. • Adjust.		■	■		■	
5		Engine oil	• Change.	■	**2000 km (1200 mi) after the first 1000 km (600 mi) and every 3000 km (1800 mi) thereafter**				
			• Check oil level and for oil leaks on the vehicle.	**Every 3000 km (1800 mi)**					■
6		Oil filter element	• Replace.			■			

VALVE CLEARANCE ADJUSTMENT



- The following procedure applies to all valves.

- **Valve clearance shall be adjusted with cold engine, at ambient temperature.**
- **When measuring or adjusting valve clearance, the piston shall be set at Top Dead Centre (TDC) during the compression stroke.**

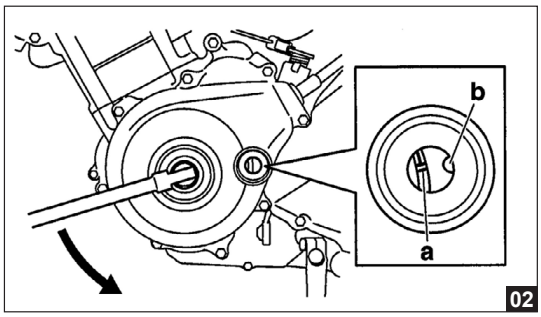
1. **Remove:**
   - Cylinder head cover
   - Cylinder head cover gasket.

Refer to "CYLINDER HEAD".

- **Remove the cylinder head cover by sliding it off the chassis tubes.**

2. **Remove:**
   - Timing mark access screw "**1**".
   - Crankshaft end access screw "**2**". (see fig.01)
3. **Measure:**
   - Valve clearance

	Valve clearance (with cold engine) • **Intake**.....**0.10-0.14 mm (0.0039-0.0055 in)** • **Exhaust**.....**0.20-0.24 mm (0.0079-0.0094 in)**

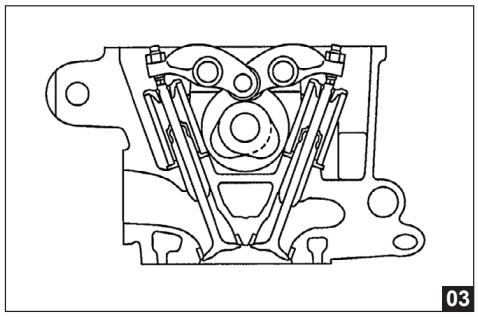


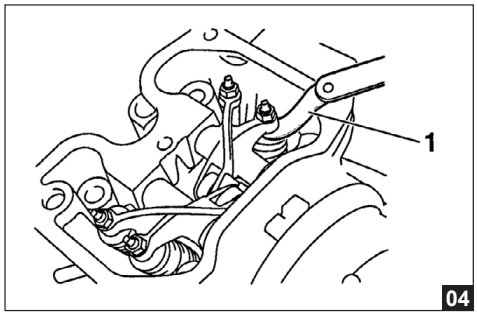
Not conforming to specs → Adjust.

a. Turn crankshaft counter clockwise.

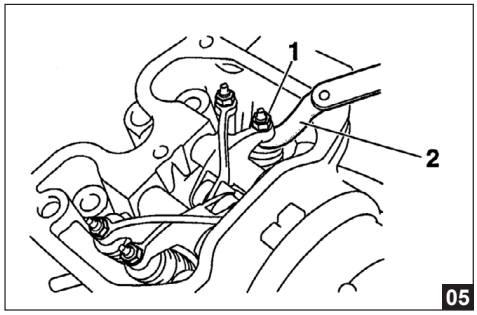
b. Align TDC reference "**a**" on generator rotor to fixed reference mark "**b**" onto generator cover. (see fig.02)

c. Ensure camshaft lobes are positioned as shown. (see fig.03)



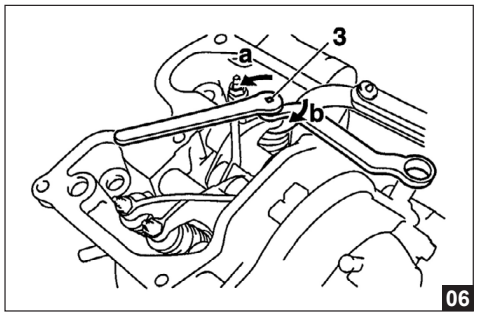


d. Measure valve clearance using a feeler gauge. (see fig.04)
Not conforming to specs → Adjust.



4. Adjust:
- Valve clearance

a. Loosen check nut " **1** " .
b. Fit the blade of a feeler gauge "**2**" in-between the adjuster screw end and the valve stem tip. (see fig. 05)



c. Turn adjuster screw "**3**" in direction "**a**" or "**b**" until obtaining the specified valve clearance. (see fig. 06)

	• **Direction "a": Valve clearance increases.** • **Direction "b": Valve clearance decreases.**

- Hold the adjuster screw in place and tighten the check nut as specified.

Nm	• **Valve adjuster screw check nut: 7 Nm (0.7 mkg, 5.1 ft-lb)**

d. Measure valve clearance again.
e. If valve clearance still does not meet the specifications, repeat all valve clearance adjustment steps until obtaining correct clearance.

5. Install:
- Crankshaft end access screw (together with O-ring)
- Timing mark access screw (together with O-ring)

6. Install:
- Cylinder head cover gasket.
- Cylinder head cover
- Spark plug

7. Install:
- Ignition coil "**4**"

Nm	• **Ignition coil bolt: 7 Nm (0.7 m·kg, 5.1 ft-lb)**

- Spark plug

Nm	• **Spark plug: 13 Nm (1.3 m·kg, 9.4 ft-lb)**

8. Disconnect:
- Spark plug cap.

9. Remove:
- Spark plug.

WARNING!
- **Before removing the spark plug, remove any impurities built up inside its seat with compressed air to avoid they enter the cylinder.**

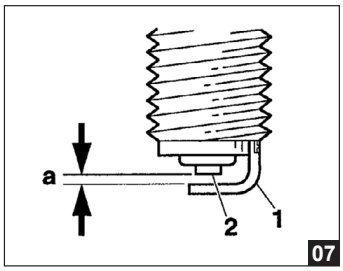
10. Check:
- Type of spark plug
  Incorrect → Change.

	• **Manufacturer/model NGK/CR8E**

11. Check:
- Electrode " **1** "
  Damage/wear → Change spark plug.
- Insulation "**2**"
  Strange colour → Change spark plug.
- Normal colour ranges from quite dark reddish brown to light reddish brown.

12. Clean:
- Spark plug
  (using a spark plug cleaner or a metal brush).

13. Measure:
- Electrode gap "**a**"
  (using a feeler gauge).
- Not conforming to specs → Restore correct gap.
  (see fig. 07)



	• **Electrode gap: 0.7-0.8 mm (0.028-0.031 in)**

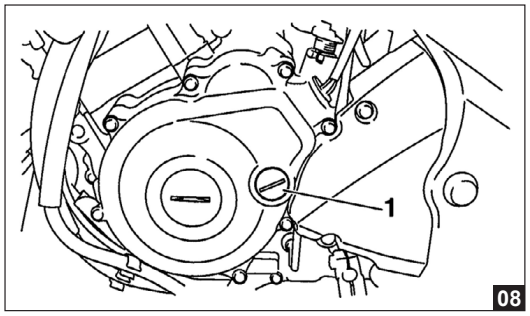
14. Install:
- Spark plug

Nm	• **Spark plug: 13 Nm (1.3 mkg, 9.4 ft-lb)**

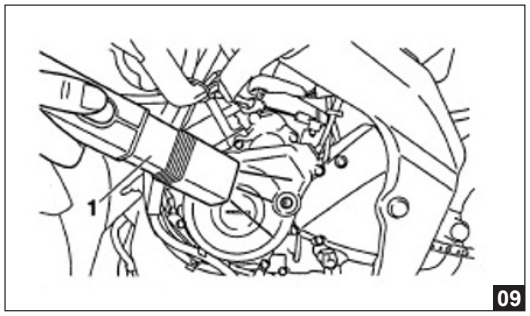
- **Before installing the spark plug, clean seal and spark plug mating surfaces.**

IGNITION ADVANCE CHECK

- **Before checking ignition advance, check electrical connections of the whole ignition system.**
- **Ensure all connections are secure and not corroded.**



1. Remove:
- Timing mark access screw "**1**". (see fig. 08)

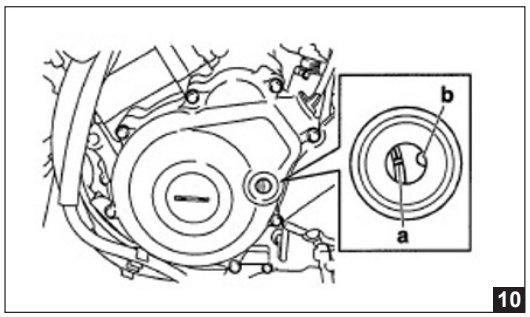


2. Connect:
- Stroboscopic lamp " **1** ";
- Digital rev meter. (see fig. 09)

3. Check:
- Ignition advance.

a. Start engine, warm up a few minutes, then let it idle at recommended speed.

	• **Idle speed**

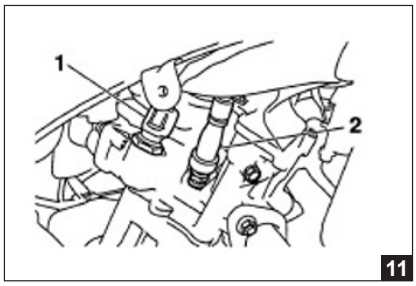


b. Check alignment of stationary reference mark "**a**" on generator cover with TDC reference "**b**" onto generator rotor.
Incorrect ignition → Check ignition system. (see fig.10)

- **Ignition advance can not be adjusted.**

4. **Remove:**
   - Digital rev meter
   - Stroboscopic lamp
5. **Install:**
   - Timing mark access screw (together with O-ring)

MEASURING COMPRESSION PRESSURE

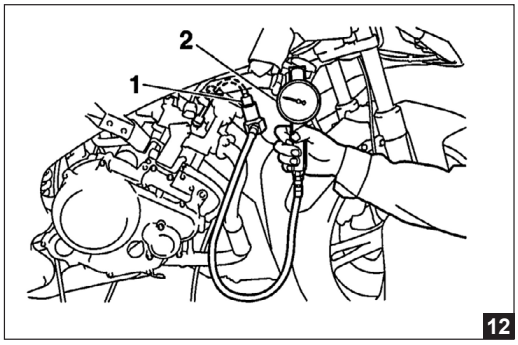


11

- **An insufficient compression pressure would negatively affect performance.**

1. **Measure:**
   - Valve clearance
   - Not conforming to specs → Adjust.
   - Refer to "**VALVE CLEARANCE ADJUSTMENT**" on page 3-4.
2. **Start engine,** warm it up a few minutes, then stop it.
3. **Disconnect:**
   - Coolant temperature sensor connector "**1**";
   - Spark plug cap "**2**".
     (see fig.11)
4. **Remove:**
   - Spark plug.

WARNING!
- **Before removing the spark plug, remove any impurities built up inside its seat with compressed air to avoid they enter the cylinder.**



12

5. **Install:**
   - Extension " **1** ";
   - Compression gauge "**2**".
     (see fig.12)

6. **Measure:**
   - Compression pressure.
     →Not conforming to specs Refer to operations (**c**) and (**d**).

- **Standard compression pressure (at sea level): 550 kPa/600 rpm (78.2 psi/600 rpm) (5.5 kgf/cm2/600 rpm)**
- **Minimum-maximum: 480-620 kPa (68.3-88.2 psi) (4.8-6.2 kgf/cm2)**

a. Take ignition switch to "ON".
b. With throttle fully open, start engine and allow pressure reading on compression gauge to stabilise.

c. If compression reading is higher than the maximum allowed value, ensure there is no scale on cylinder head, on valve surface and piston crown.
Scale → Remove.

d. If compression pressure is below minimum allowed value, pour one spoon of engine oil into spark plug bore and take measurement again.
Refer to the table below.

Compression pressure (applying oil to cylinder)	
Reading	Diagnosis
Value greater than the one measured with no oil	Worn or damaged piston ring(s) → Repair.
Value equal to the one measured with no oil	Piston ring, valves and cylinder head or piston probably faulty → Repair.

7. **Remove:**
   - Extension;
   - Compression gauge.
8. **Install:**
   - Spark plug.

Nm	**• Spark plug: 13 Nm (1.3 mkg, 9.4 ft-lb)**

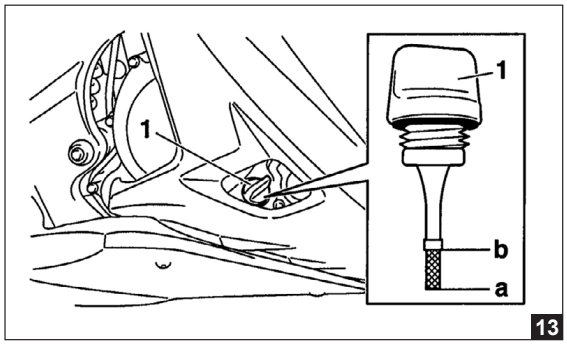
9. **Connect:**
   - Spark plug cap;
   - Coolant temperature sensor connector.

ENGINE OIL LEVEL CHECK

1. Set vehicle on a flat surface.

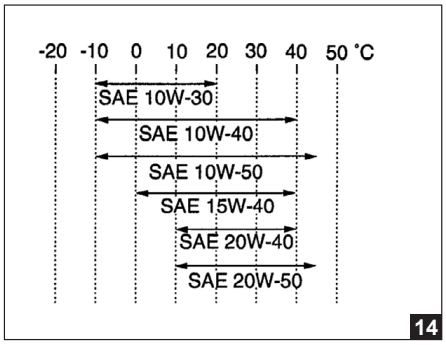
• Position the vehicle on a suitable support.
• Ensure vehicle is upright.

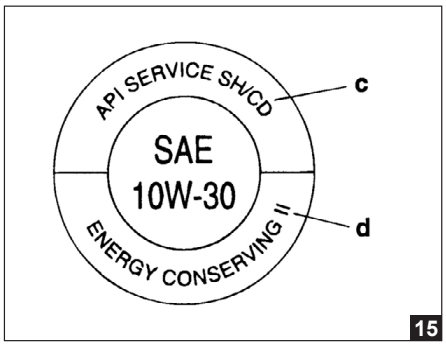
2. Start engine, warm it up a few minutes, then stop it.
3. Check:
- Engine oil level.
  Engine oil level should be between min. notch"**a**" and max. notch "**b**".
  Below min. level notch → Top up with recommended engine oil to correct level.



13

• Before checking engine oil level, allow a few minutes for oil to settle.
• Do not tighten the engine oil filler plug (dipstick) "1" when checking oil level.
(see fig.13)





(see fig.14)

	• **Type: SAE 10W-30, SAE 10W-40, SAE 15W-40, SAE 20W-40 or SAE 20W-50** • **Recommended engine oil grade: API service type SG or higher, JASO standard MA**

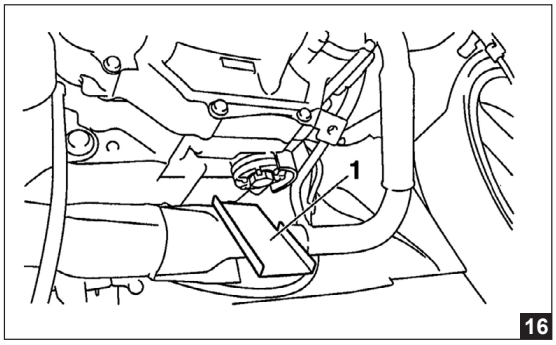
WARNING!
- **Engine oil also lubricates the clutch; a wrong type of oil or chemical additives could lead to clutch slipping. Therefore, do not add any chemical additives nor use engine oil with a "CD", "c" or higher grade and do not use oil labelled as "ENERGY CONSERVING II" "d".**
- **Do not let any foreign matter enter the crankcase.**

(see fig.15)

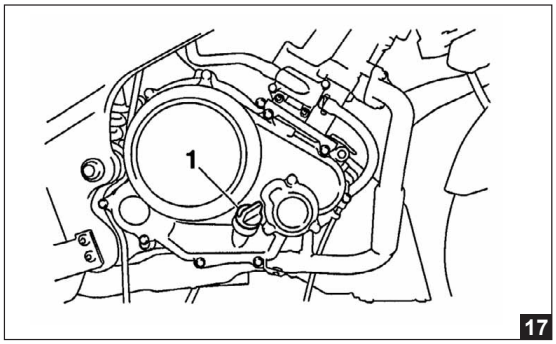
4. **Start engine, warm it up a few minutes, then stop it.**
5. **Check engine oil level again.**

- **Before checking engine oil level, allow a few minutes for oil to settle.**

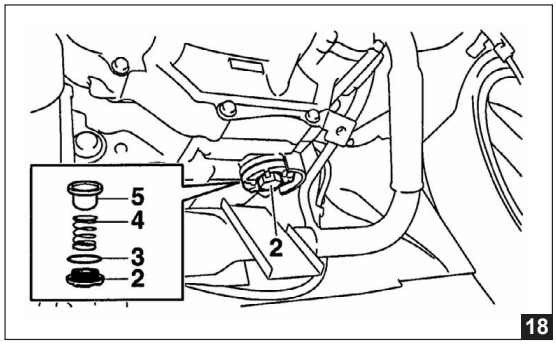
ENGINE OIL CHANGE



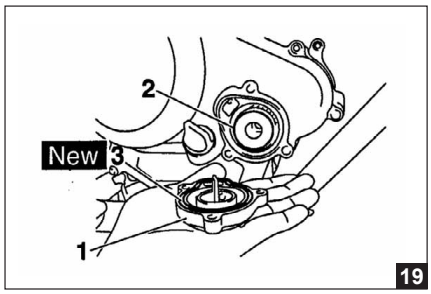
1. **Start engine, warm it up a few minutes, then stop it.**
2. **Set a collection tank under oil drain bolt.**
3. **Install:**
   - Engine oil drain adapter "**1**" (Placed under the rider saddle together with the owner's tool kit). (see fig.16)



4. **Remove:**
   - Engine oil filler plug (dipstick) "**1**" (see fig.17);



- Engine oil drain plug "**2**";
- O-ring "**3**";
- Spring "**4**";
- Engine oil filter "**5**".
  (see fig.18)



5. Drain:
- Engine oil (fully, from crankcase).

6. If the oil filter needs replacing, too, proceed as follows.

a. Remove oil filter element cover "1" and oil filter element "2".

b. Install a new O-ring "3".
(see fig.19)

c. Install the new oil filter element and oil filter element cover.

Nm	• **Oil filter element cover bolt: 10 Nm (1.0 mkg, 7.2 ft-lb)**

d. Check:
- Engine oil filter.
  Dirty → Clean.

7. Install:
- Engine oil filter;
- Spring
- O-ring;**New**
- Oil drain plug.

Nm	• **Oil filter element cover bolt: 10 Nm (1.0 mkg, 7.2 ft-lb)**

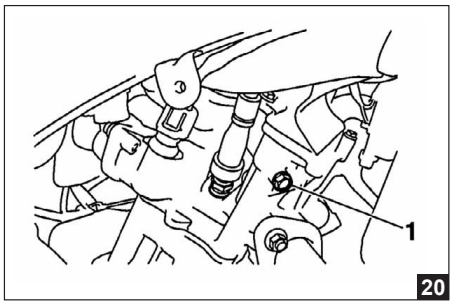
8. Fill:
- Crankcase (with the recommended quantity of specified engine oil).

Nm	**Engine oil capacity** **• Total quantity: 1.15 L (1.22 US qt) (1.01 Imp.qt)** **Without changing oil filter element** **• 0.95 L (1.00 US qt) (0.84 Imp.qt)** **When changing oil filter element** **• 1.00 L (1.06 US qt) (0.88 Imp.qt)**

9. Install:
- Engine oil filler plug

10. Start engine, warm it up a few minutes, then stop it.

11. Check:
- Engine (for engine oil leakage).



12. Check:
- Engine oil level;
- Refer to "**ENGINE OIL LEVEL CHECK**"
-

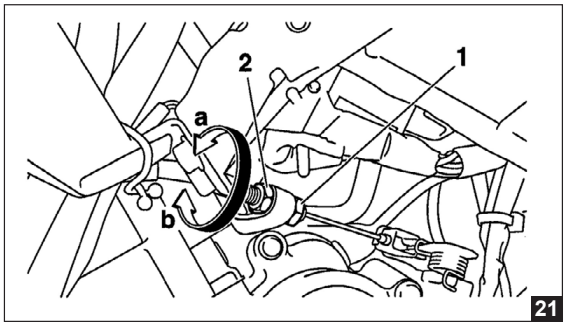
13. Check:
- Engine oil pressure.

a. Slightly loosen the oil level inspection plug "**1**". (see fig.20)

b. Start engine and let it idle until engine oil starts to filter through the oil level inspection plug. If engine oil does not come out after a minute, stop engine to avoid seizure.
c. Check engine oil channels, the oil filter element and oil pump for damage or leaks. Refer to "**OIL PUMP**".
d. Start engine after fixing the problem and check engine oil pressure again.
e. Tighten the oil level inspection plug as specified.

Nm	• **Oil level inspection plug: 7 Nm (0.7 mkg, 5.1 ft-lb)**

CLUTCH CABLE CLEARANCE ADJUSTMENT



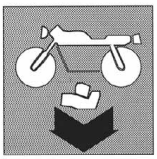
Engine side

a. Loosen check nut "**1**".
b. Turn adjuster bolt "**2**" towards "**a**" or "**b**" until obtaining the specified clutch cable clearance.

	• **Direction "a": Clutch cable clearance increases.** • **Direction "b": Clutch cable clearance decreases.**

(see fig.21)

c. Tighten the check nut.

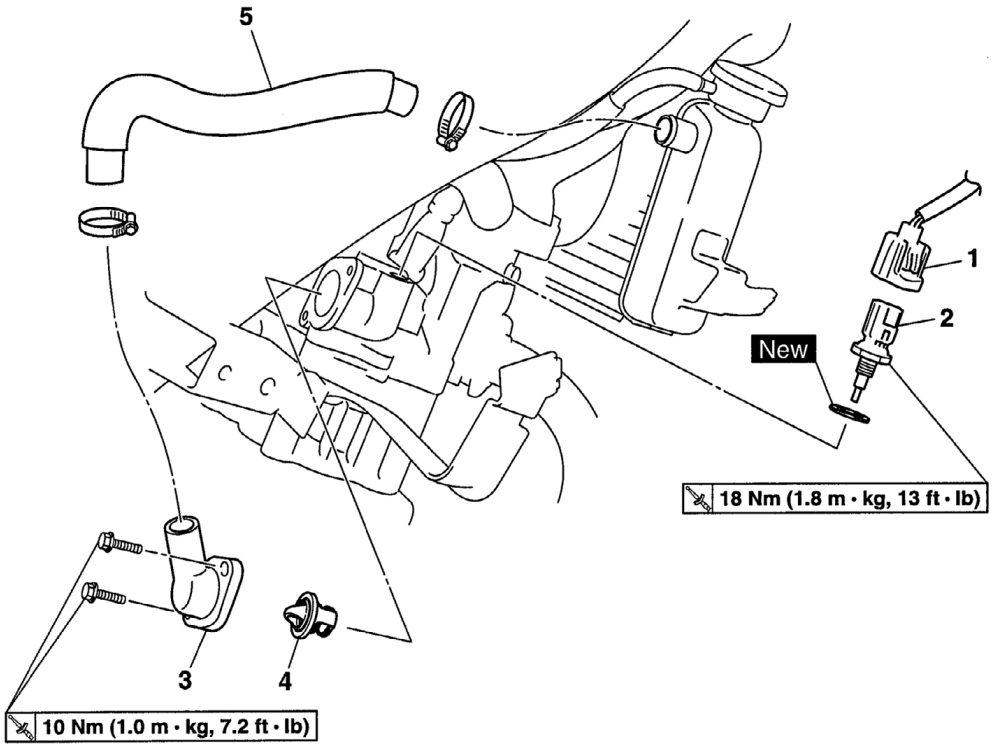


Section F3

THERMOSTAT

Thermostat removal

New = part to be replaced upon reassembly

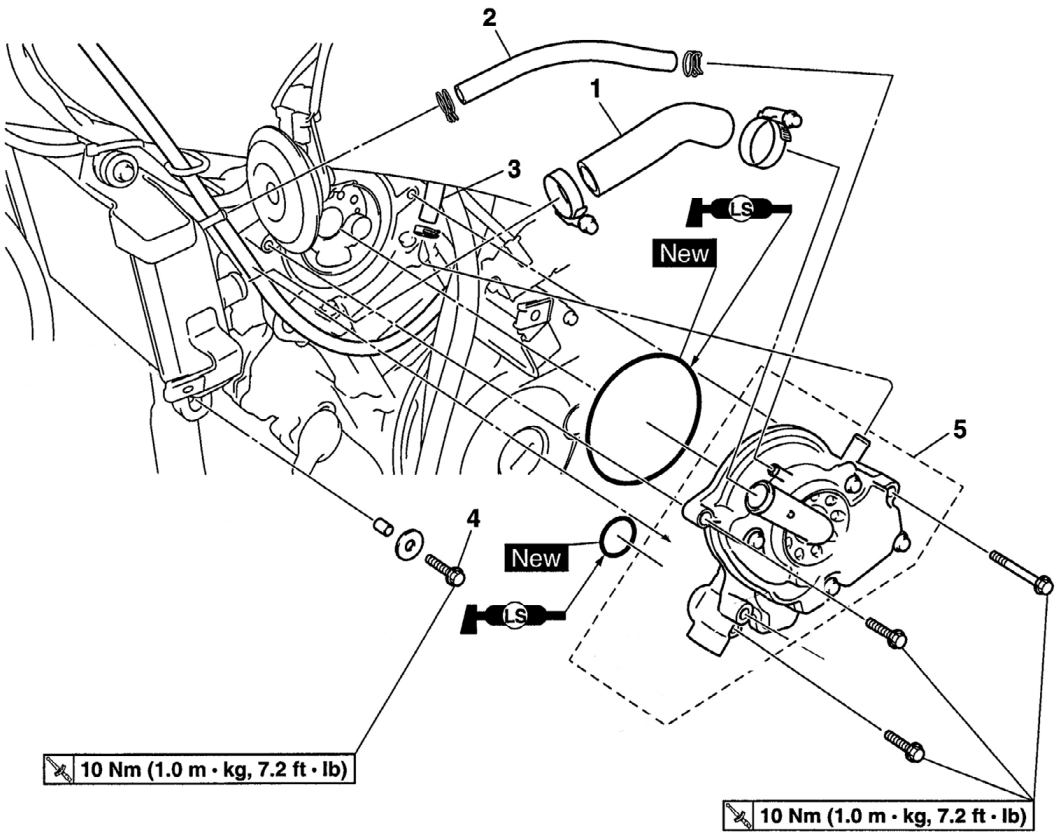


Se-quen-ce	Operation/Parts to remove	Quantity	Remarks
1	Coolant temperature sensor connector	1	
2	Coolant temperature sensor	1	
3	Thermostat cover	1	
4	Thermostat	1	
5	Radiator inlet hose	1	
		1	Reverse removal procedure to install.

WATER PUMP

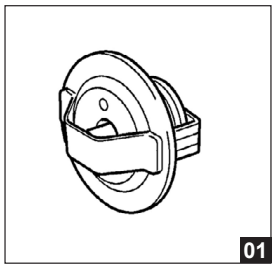
Water pump removal

New = part to be replaced upon reassembly



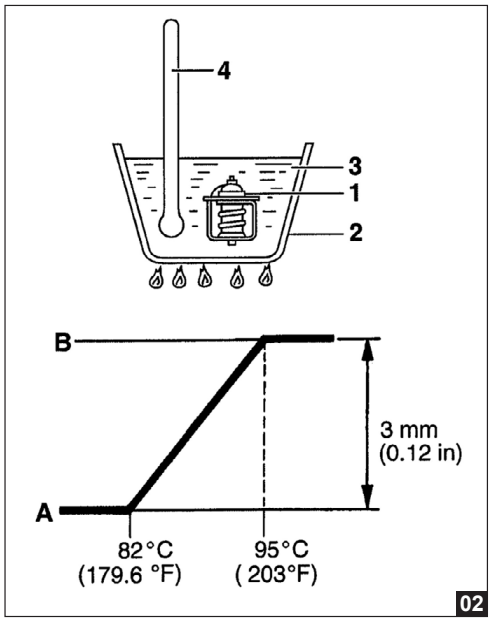
Se-quen-ce	Operation/Parts to remove	Quantity	Remarks
			It is not necessary to remove the water pump, unless coolant level is extremely low or coolant contains some engine oil.
1	Radiator outlet hose	1	
2	Water pump breather hose	1	
3	Cylinder head breather hose	1	Disconnect.
4	Radiator bolt	1	
5	Water pump assembly	1	
			Reverse removal procedure to install.

THERMOSTAT CHECK



1. **Check:**
   - Thermostat
     Does not open at 80.5-83.5 °C (176.9-182.3 °F) → Replace.
     (see fig.01)

a. Keep thermostat "**1**" in a vessel "**2**" containing water.
b. Slowly warm up the water "**3**".
c. Dip a thermometer "**4**" in water.
d. Stir water, then look at the thermostat and thermometer reading.
(see fig.02)

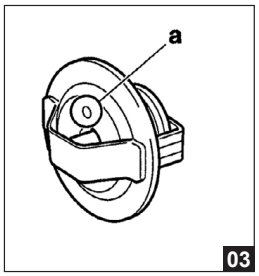


A. Fully closed
B. Fully open

- **If you have any doubts about thermostat accuracy, change it.**
- **A faulty thermostat could provoke a dangerous overheating or undercooling.**

2. **Check:**
   - Thermostat cover
   - Cracks/damage → Replace.
3. **Check:**
   - Radiator inlet hose
   - Cracks/damage → Replace.

THERMOSTAT INSTALLATION



1. **Install:**
   - Thermostat.
     Install the thermostat with breather hole "a" facing up. (see fig.03)

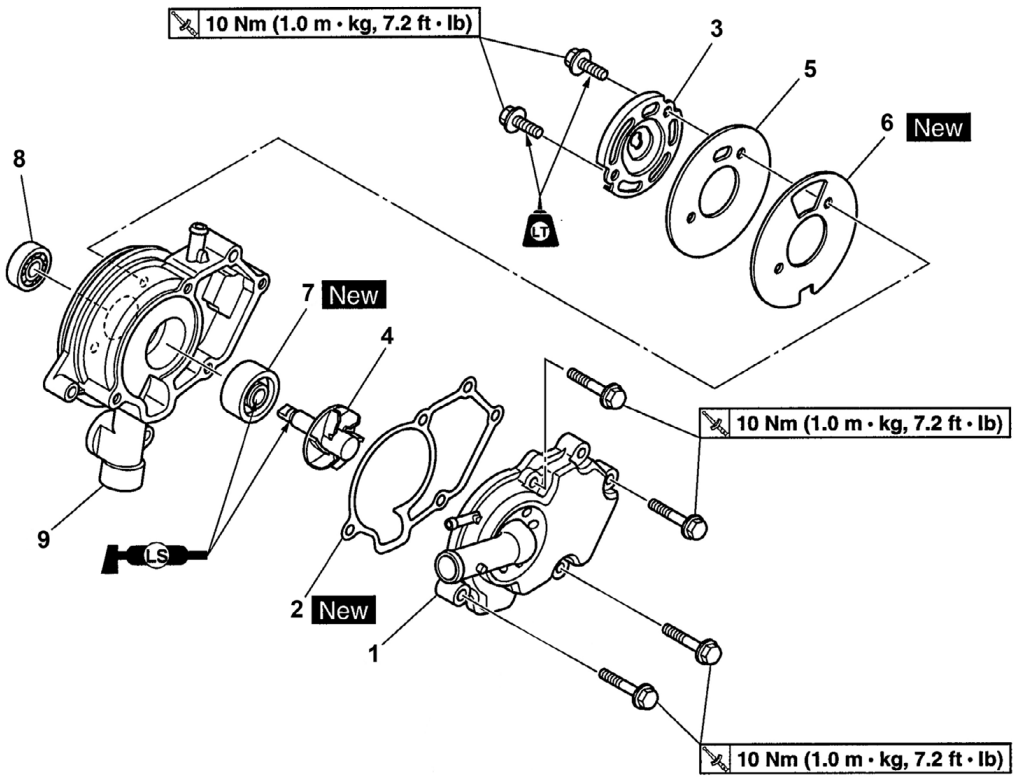
2. **Install;**
   - Copper washer.
   - Coolant temperature sensor.
   - **Coolant temperature sensor: 18 Nm (1.8 mkg, 13 ft-lb)**

WARNING!
- **Pay utmost attention when handling the coolant temperature sensor.**
- **Change any part that has fallen or suffered a strong impact.**

WATER PUMP DISASSEMBLY

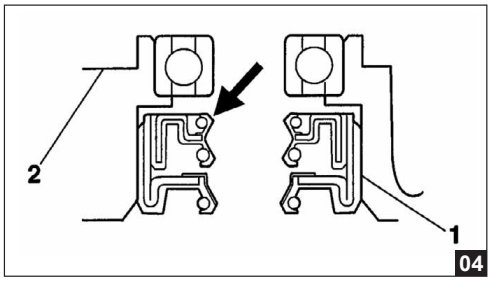
Water pump disassembly

New = part to be replaced upon reassembly



Sequence	Operation/Parts to remove	Quantity	Remarks
1	Water pump housing cover	1	
2	Water pump housing cover gasket	1	
3	Impeller shaft retainer	1	
4	Impeller shaft	1	
5	Water pump housing plate	1	
6	Water pump housing seal	1	
7	Water pump seal	1	
8	Bearing	1	
9	Water pump housing	1	
			Reverse removal procedure to install.

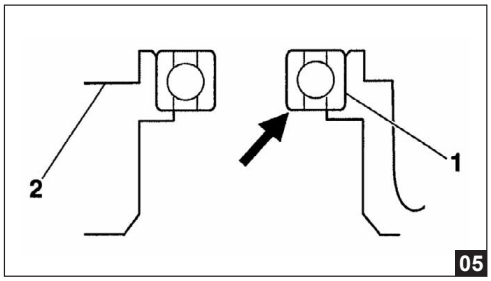
WATER PUMP DISASSEMBLY



1. **Remove:**
   - Water pump seal "**1**".

- **Remove the water pump seal from inside the water pump housing "2".**

(see fig.04)



2. **Remove:**
   - Bearing "1"

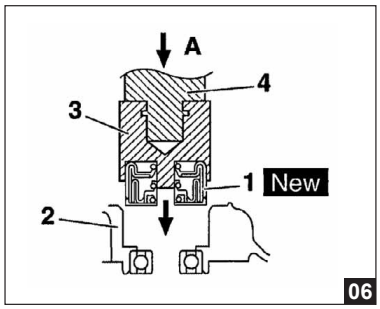
- **Remove the bearing from outside the water pump housing "2".**

(see fig. 05)

WATER PUMP CHECK

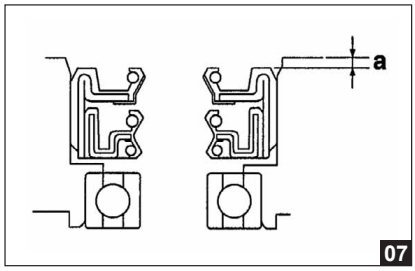
1. **Check:**
   - Water pump housing cover
   - Water pump housing
     Cracks/damage → Replace.
   - Impeller shaft
     Clefts/damage/wear → Change.
   - Bearing
     Hard movement → Replace.
   - Radiator outlet hose
     Cracks/damage → Replace.

WATER PUMP ASSEMBLY



New = part to be replaced upon reassembly

A. Push down.
3. Mechanical seal installing tool.
4. Centre duct shaft bearing installing tool.



1. **Install:**
   - Water pump seal "**1**" **UBI** (inside water pump housing "**2**")
- **Install water pump seal using the suitable tools.**

WARNING!
- **Never lubricate the water pump seal surface with oil or grease.**

- **Install water pump seal using the special tools and set it at the specified depth, as shown.**

(see fig. 06)

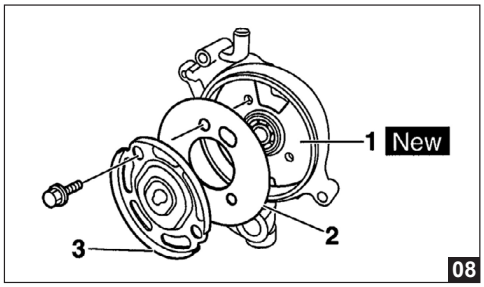
(see fig. 07)
a. 0-0.5 mm (0-0.02 in)

2. **Lubricate:**
   - Water pump seal lip.

- **Recommended lubricant**
- **Lithium soap-base grease**

3. **Install:**
   - Water pump housing seal "**1**".
   - Water pump housing plate "**2**".
   - Impeller shaft.
   - Impeller shaft retainer "**3**".

- **Impeller shaft retainer bolt: 10 Nm (1.0 mkg, 7.2 ft-lb) LOCTITE®**



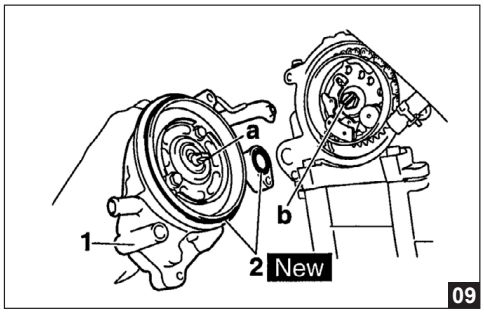
New = part to be replaced upon reassembly

- **Before installing the impeller shaft retainer, lubricate the slit on impeller shaft end with a thin layer of lithium soap-base grease.**
- **Install water pump housing seal, water pump housing plate and impeller shaft retainer as shown.**
- **After installation, ensure impeller shaft can turn smoothly.**
  (see fig. 08)

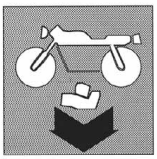
WATER PUMP INSTALLATION

1. Install:
- Water pump assembly "1".
- O-ring "2".

- **Align projecting part "a" on impeller shaft to slit "b" on camshaft sprocket bolt.**
- **Lubricate the O-rings with a thin layer of lithium soap-base grease.**
  (see fig. 09)

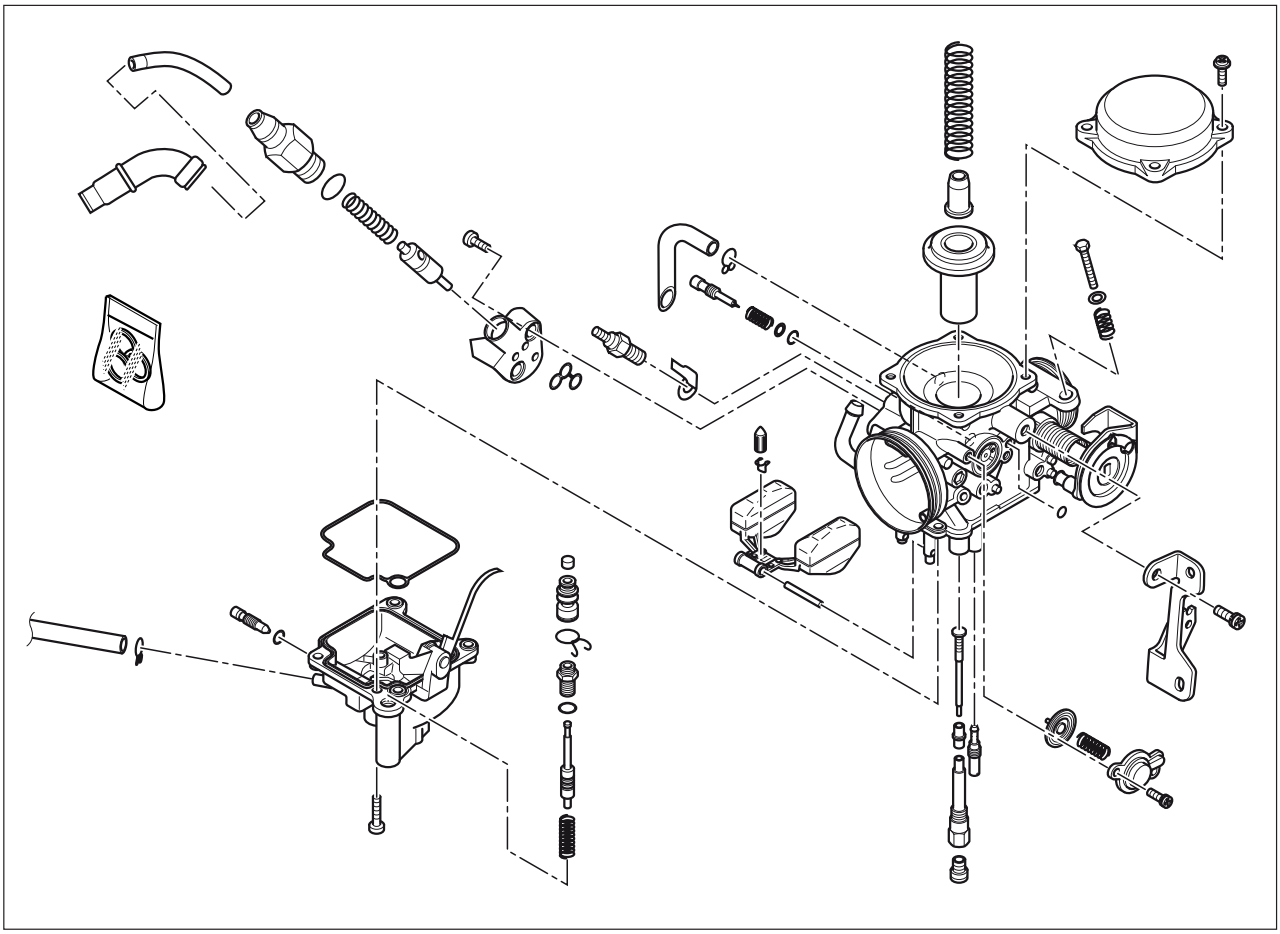


New = part to be replaced upon reassembly

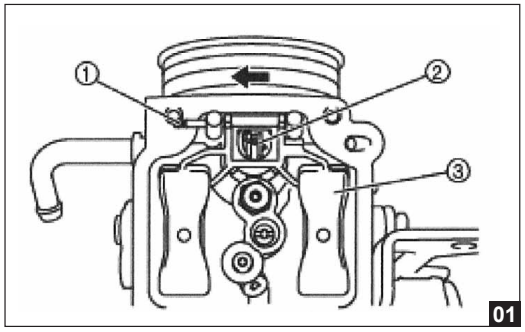


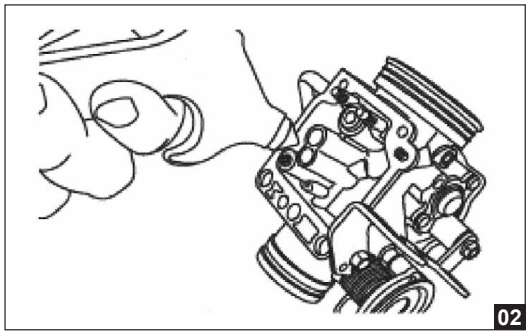
Section F4

CARBURETTOR



CARBURETTOR DISASSEMBLY





1. **Remove:**
   - floater pin "**1**"
   - needle valve "**2**"
   - floater "**3**"

   - **NOTE: Take out the floater pin in the direction shown by the arrow.**

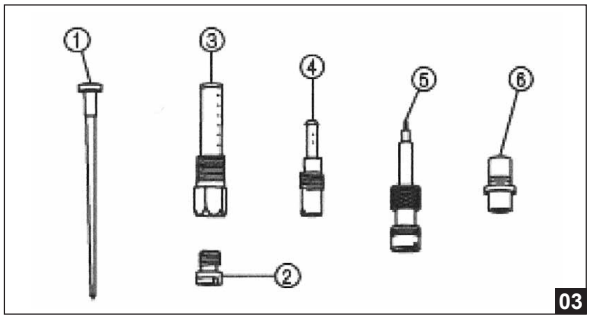
CARBURETTOR CHECK

1. **Check:**
   - carburettor body
   - float chamber
   - jet block
     Cracks/damage → Replace
2. **Check:**
   - fuel passages
   - Obstruction → Clean.

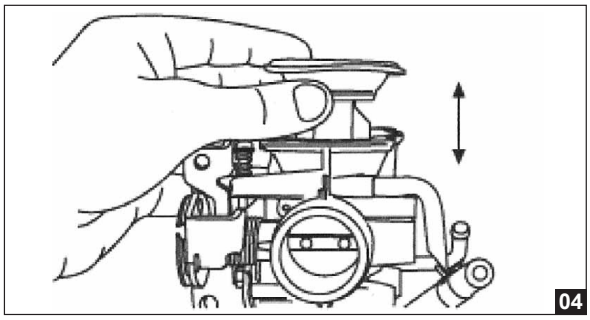
a. Flush carburettor with a petroleum-base solvent. Do not use corrosive detergent solutions.

b. Blow all passages and jets with compressed air.

3. **Check:**
   - float chamber body
     Dirty → Clean.
4. **Check:**
   - floater
     Damage → Replace
5. **Check:**
   - needle valve
     Damage/obstruction/wear → Change
6. **Check:**
   - piston valve
     Damage/scratches/wear → Change
   - piston valve diaphragm
   - enricher in release stage diaphragm
     Clefts/tears → Change
7. **Check:**
   - vacuum chamber cover
   - piston valve spring
     Cracks/damage → Replace



03


04

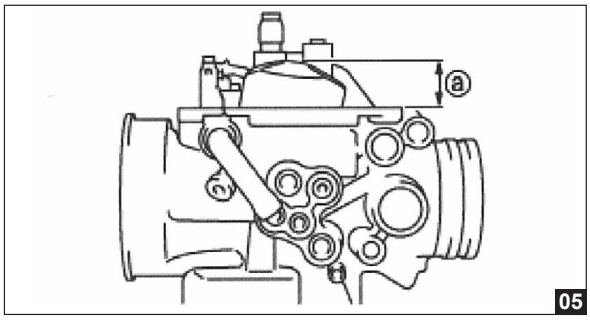
8. **Check:**
   - jet needle "**1**"
   - main jet "**2**"
   - needle jet support "**3**"
   - idle jet "**4**"
   - idle screw "**5**"
   - needle jet "**6**"

   Deformation/damage/wear → Change
   Obstruction → Clean
   Blow jets clean with compressed air.
9. **Check:**
   - piston valve movement

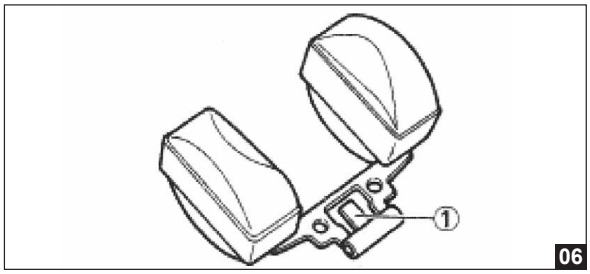
   Insert piston valve into carburettor body and move it up and down.
   Sealing → Change piston valve.
10. **Check:**
   - fuel hoses

   Cracks/damage/wear → Change.
   Obstruction → Clean.
   Blow hoses clean with compressed air.

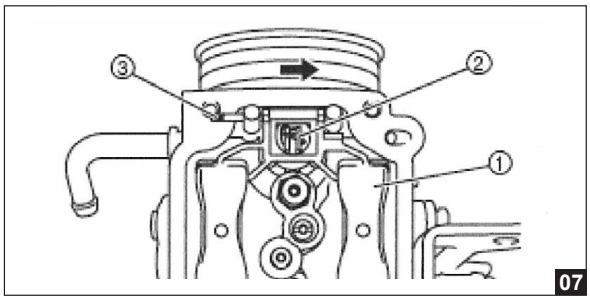
CARBURETTOR ASSEMBLY



05



06



07

WARNING!
- **Before assembling the carburettor, wash all parts with a petroleum-base solvent.**
- **Always use a new seal.**

1. **Measure:**
   - floater height "**a**"

   Not conforming to specs → Adjust.

	• **Floater height (A.G.) 17.5 mm (0.69 in)**

a. Hold carburettor upside-down.
b. Measure the distance from float chamber front mating surface (without seal) to floater top point.
- **NOTE: Floater arm should rest onto needle valve without shifting it down.**

c. If floater height does not comply with specifications, check the needle valve.
d. Replace, if worn out.
e. If in good conditions, adjust floater height by bending the floater tab "**1**" on floater.
f. Check floater height again.

2. **Install:**
   - floater "**1**"
   - needle valve "**2**"
   - floater pin "**3**"

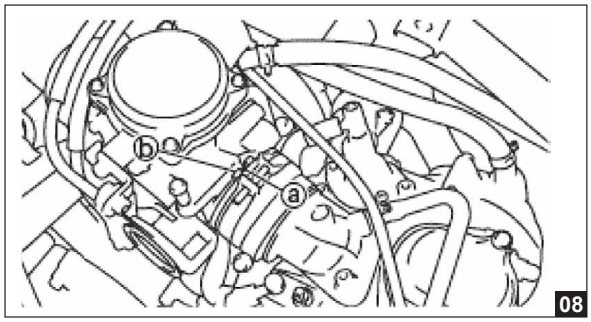
   NOTE: Install the floater pin in the direction shown by the arrow.

3. **Install:**
   - float chamber rubber seal **New**
   - float chamber
   - idle air screw

	• **Idle air screw loosened by ..... turns.**

4. **Install:**
   - accelerator pump assembly
5. **Install:**
   - enricher assembly in release stage

CARBURETTOR INSTALLATION



1. **Install:**
   - carburettor

   NOTE: Align protruding part "a" on carburettor to chamfer "b" on intake manifold.
2. **Adjust:**
   - idle speed

	• **Idle speed 1750 +/- 50 rpm.**

3. **Adjust:**
   - accelerator cable clearance