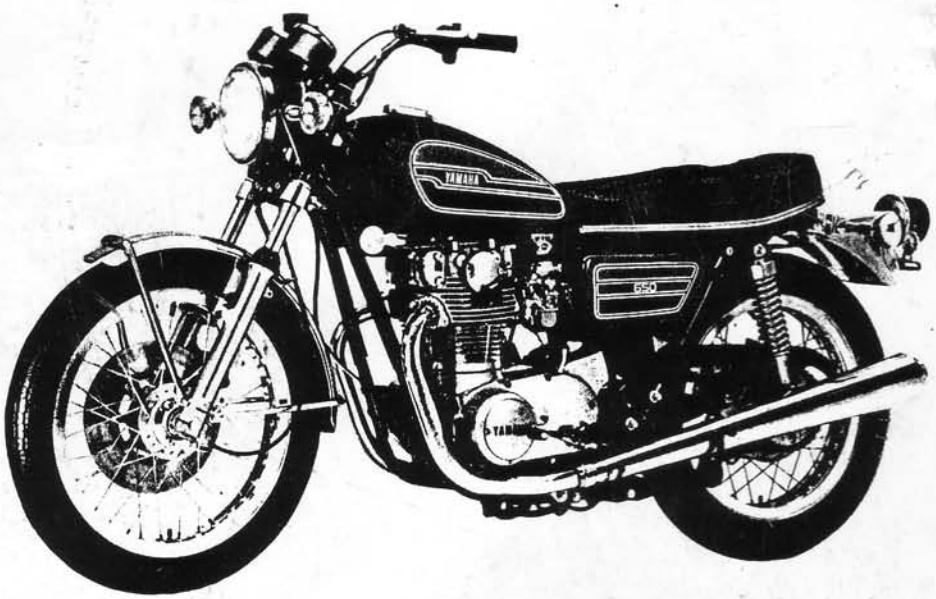
YAMAHA XS 650 (74-77)

GENUINE YAMAHA

Service Manual



LIT-11616-01-52

NOTICE

This manual has been written by Yamaha Motor Company for use by Authorized Yamaha Dealers and their qualified mechanics. In light of this purpose it has been assumed that certain basic mechanical precepts and procedures inherent to our product are already known and understood by the reader.

Without such basic knowledge, repairs or service to this model may render the machine unsafe, and for this reason we must advise that all repairs and/or service be performed by an Authorized Yamaha Dealer who is in possession of the requisite basic product knowledge.

Other information is produced by the U.S. distributor, Yamaha International Corporation, and is necessary to provide total technical coverage regarding the product.

The Research, Engineering, and Service Department of Yamaha are continually striving to further improve all models manufactured by the company. Modifications are therefore inevitable and changes in specifications or procedures will be forwarded to all Authorized Yamaha Dealers and will, where applicable, appear in future editions of this manual.

TX 650 A / XS 650 B / XS 650 C / XS 650 D
SERVICE MANUAL

1st Edition - October 1975
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LIT-11616-01-52

FOREWORD

This service manual has been designed to furnish all dealer and service personnel with specific information concerning this machine, including disassembly and assembly procedures, inspection and analysis of worn parts, and subsequent repair or adjustment procedures.

The manual should be thoroughly read. This will provide full familiarity with the design of this machine and all correct repair procedures.

Because Yamaha engineers are constantly searching for new and more efficient engine advancements, it is possible that some of this information may be modified in the future. Significant changes in design, adjustments or repair procedures will be immediately forwarded to all Authorized Yamaha Dealers through Technical Bulletins.

Information in this manual applies to TX650A, XS650B and XS650C models unless otherwise noted. Specifications for the XS650C model, if different than the ''B'' model, will generally be indicated in brackets [ ].

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CHAPTER 1. GENERAL

1-1 FEATURES

1. ENGINE

A. Valve and Camshaft Mechanism

The use of a single overhead camshaft is beneficial in two ways: First, it contacts the rocker arm in a more positive manner than standard push rod valve arrangements, which allows the engine to rev. higher. Secondly, there are fewer moving parts to wear. Also, the overhead camshaft is driven by a long-lasting single row endless chain that is directly connected to the crankshaft. An adjustable chain tensioner and several additional cushions keep chain noise at a minimum.

B. Twin, Constant Vacuum Carburetors

The throttle slide in this type carburetor is raised by engine vacuum, not a cable. The amount of vacuum to the carburetor is controlled by a butterfly valve in the carburetor venturi. The carburetor meters precisely the correct amount of fuel at all times because it is controlled by engine demand.

C. Trochoidal Oil Pump

The 650's have a rotary valve type oil pump. It is operated by a set of gears which connect the pump directly to the crankshaft. This means that oil is pumped under constant pressure to the engine at all times. It is an improvement over the standard reciprocating type oil pump.

D. Five Speed Transmission

The wide ratio five speed synchromesh transmission permits full usage of engine power under all conditions.

E. Miscellaneous

1. The crankshaft spins in three roller bearings and one ball bearing. This provides maximum support.
2. The unit construction engine splits horizontally into upper and lower cases. Engine repair procedures are easier to complete.
3. The first and third piston rings are chrome coated for extended durability.
4. An alternator/rectifier/regulator combination is in use to provide the continuous and controlled voltage output to the entire electrical system.

2. FRAME

A. Design

The frame incorporates the double down tube, full-cradle type design which provides strength for proper engine support and rigidity to prevent flexing.

B. Brakes

The large size disc brake has been adopted to ensure steady braking efficiency both at low and high speeds and in the rain.

1-2. SPECIFICATIONS

A. General Specifications

MODEL	TX650A/XS650B	XS650C (same unless noted)
Dimensions:		
Overall length	85.8 ins. (2,180 mm.)	
Overall width	35.4 ins. (907 mm.)	[32.9 in. (835 mm.)]
Overall height	45.7 ins. (1,162 mm.)	[44.9 in. (1140 mm.)]
Wheelbase	56.5 ins. (1,435 mm.)	
Min. ground clearance	5.5 ins. (140 mm.)	
Weight:		
Net	467 lbs. (212 kgs.)	
Performance:		
Max. speed	115 mph. (185 km/h)	
Fuel consumption (on paved level road)	70.6 mi./US gal (37 mph) (30 km/h at 60 km/h)	
Climbing ability	26 degrees	
Minimum turning radius	98.4 ins. (2,500 mm.)	
Braking distance (light load)	173 ft at 60 mph.	
Braking distance (Max. load)	178 ft at 60 mph.	
Acceleration performance (SS 1/4 mile)	13.0 sec.	
Engine:		
Type	Twin cylinder, Air-cooled, 4-stroke-S.O.H.C:	
Bore and stroke	2.953 x 2.913 ins. (75 x 74 mm.)	
Displacement	39.85 cu. ins. (653 cc.)	
Compression ratio	8.4:1	
Compression pressure	145 lbs./in.^{2} (9 – 11 kgs./cm.^{2}) at 500 rpm.	
Valve timing	Intake BTDC 36° (open) ABDC 36° (close) Exhaust BBDC 68° (open) ATDC 68° (close)	
Valve clearance (cold)	IN: 0.002 in. (0.05 mm.) EX: 0.004 in. (0.10 mm.)	[XS650C:0.15 mm(.006 in.)]
Lubrication:		
Lubrication system	Pressure lubricated, wet sump	
Delivery pump type	Trochoid pump	
Sump capacity (engine dry)	2,500 cc. (2.6 qt.)*	[XS650C:2,500 cc. (2.6 qt.)]
Recommended lubricant	SAE 20W/40, YAMALUBE	
Carburetor:		
Type	BS38 x 2	
Manufacturer	MIKUNI	
Main jet	# 127.5	# 122.5
Needle jet	Z – 6	Z – 8
Pilot jet	#45	# 25
Starter jet	0.7	(No. 1.) 80, (No. 2.) # 0.5
Jet needle & Clip position	4N08 4th stage	4 M1–3
Float level	24.0 ± 2.5 mm.	25.0 ± 2.5 mm
Pilot screw	3/4 ± 1/2 turns out	1½ ± ½ turns out
Air jet, Main	1.0 ϕ	1.0 ϕ
Air jet, Pilot	1.0 ϕ	1.4 ϕ
Throttle valve	#120	# 120

* indicates a change from original factory recommendation.

MODEL	TX650A/XS650B [XS650C (same unless noted)]
Air cleaner:	Oiled foam rubber [dry foam rubber]
Clutch:	
Type	Wet, multi-disc.
Primary Drive:	
Type	Spur gear
Reduction ratio	72/27 (2.666)
Transmission:	
Type	Constant mesh, five speed, wide ratio
Reduction ratio, 1st	32/13=2.461
2nd	27/17-1.588
3rd	26/20=1.300
4th	23/21=1.095
5th	22/23=0.956
Secondary Drive:	
Type	Single row chain
No. of links	103L
Size/Manufacturer	DID50HDS/DAIDO
Reduction ratio	34/17=2.000
Chassis:	
Frame type	Tubular steel double cradle type
Fuel tank capacity	4.0 US gals. (15 lit.)
Front suspension system	Telescopic fork
Fork travel	5.12 ins. (130 mm.)
Fork oil quantity	5.2 oz. (155 cc.)
Fork oil grade	SAE 10W/30
Fork dimensions, caster	63^{o}
trail	4.53 ins. (115 mm.)
Rear suspension system	Swing arm
Suspension travel	80 mm. (3.15 ins.)
Front wheel, rim size	1.85B x 19
tire size	3.50–19–4PR
inflation pressure	23 – 25 lbs./in.^{2} (1.6 kg/cm^2)
Rear wheel, rim size	2.15B x 18
tire size	4.00–18–4PR
inflation pressure	28 – 30 lbs./in.^{2} (2.0 kg/cm^2)
Braking system:	
Operation system, front	Right hand operation
Brake type, front	Hydraulic disc brake (fixed type)
Brake fluid quantity/Grade	1.68 oz. (50 cc.)/DOT #3 or #4
Operation system, rear	Right foot operation
Brake type, rear	Internal expansion, single leading shoe
Generator:	
Type	Alternator
Model	LD115 – 02
Manufacturer	HITACHI
Max. output	14V 11A/2,000 rpm.

MODEL	TX650A/XS650B [XS650C (same unless noted)]
Starter motor:	
Manufacturer	HITACHI
Type	S 108-35
Out put	0.5 KW
Out put characteristic, no load	12V 37A or less at 11,000 rpm. or more
with load	8.3V 100A 3,900 rpm. or more 0.105 kg-m. and better
Rectifier:	
Model	SD6D-9
Manufacturer	HITACHI
Regulator:	
Model	TLIZ-80
Manufacturer	HITACHI
No load voltage output	14.5 volts ± 0.5/3,000 rpm.
Ignition system:	
Type	Battery ignition
Ignition timing	13°BTDC (fully retarded) [15 ± 2° (fully retarded)]
Breaker point gap	0.012 – 0.016 in. (0.30 – 0.40 mm.)
Spark plug, Manufacturer	NGK
Heat range	B-8ES [BP–7ES]
Ignition coil, Manufacturer	HITACHI
Voltage output	10 KV @ 4,000 rpm.
Battery:	
Model	YB14L
Manufacturer	YUASA
Capacity	12V 14AH
Dimensions	134 x 166 x 89 mm.
Lights:	
Headlight	12V 50/40W
Taillight	12V 8W
Stoplight	12V 23W [12V 27W]
Neutral light	12V 3W
Flasher indicator lights	12V 3W x 2
Flasher lights	12V 27W x 4
High beam indicator light	12V 3W
Speedometer lights	12V 3W x 2
Tachometer light	12V 3W x 2
Rear brake lining warning light	12V 3W
Stoplight warning light	12V 3W
Parking light, Head	12V 5W
Tail	12V 8W

B. Maintenance specifications

Cylinder head bolt tightening torque:

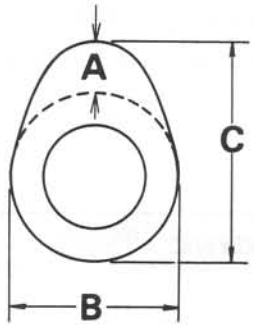
M 10	22.0 – 25.0 ft-lbs. (3.0 – 3.5 m-kgs.)
M 8	14.5 – 18.0 ft-lbs. (2.0 – 2.5 m-kgs.)
M 6	7.5 – 11.0 ft-lbs. (1.0 – 1.5 m-kgs.)

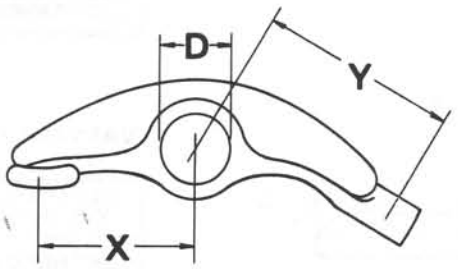
Camshaft:

Dimensions		Standard size	Wear limit
Intake	A	0.314 ins. (7.991 mm.)	
	B	1.269 ± 0.0019 ins. (32.24 ± 0.05 mm.)	1.298 ins. (32.04 mm.)
	C	1.574 ± 0.0019 ins. (39.99 ± 0.05 mm.)	1.571 ins. (39.88 mm.)
Exhaust	A	0.316 ins. (8.030 mm.)	
	B	1.271 ± 0.0019 ins. (32.30 ± 0.05 mm.)	1.267 ins. (32.15 mm.)
	C	1.576 ± 0.0019 ins. (40.03 ± 0.05 mm.)	1.571 ins. (39.88 mm.)

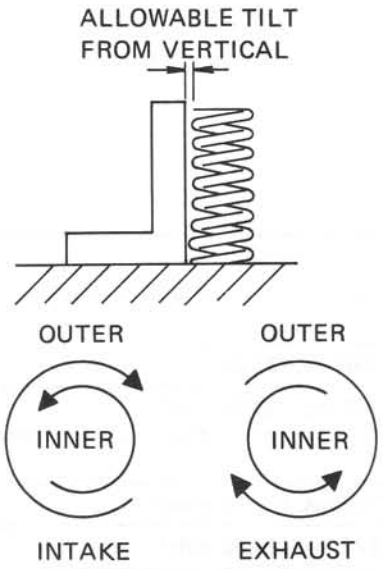
Rocker arms:

Dimensions	Standard size	Wear limit
D_1 : Amr I.D.	$0.590\ ^{+0.0007}_{-0}$ ins. ($15\ ^{+0.018}_{-0}$ mm.)	———
D_2 : Shaft I.D.	$0.590\ ^{-0.00035}_{-0.00059}$ ins. ($15\ ^{-0.009}_{-0.015}$ mm.)	———
Clearance	0.00035 in. (0.009 mm.) (Min.)	0.001 ins. (0.033 mm.) (Max.)
Lift ratio	X : Y = (40 : 48.31 mm.) = 1.576 : 1.903 ins.	





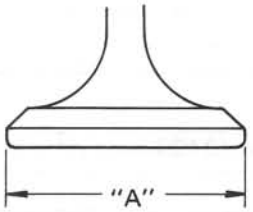
VALVE SPRINGS

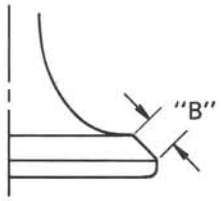


DIRECTION OF WINDINGS
(TOP TO BOTTOM)

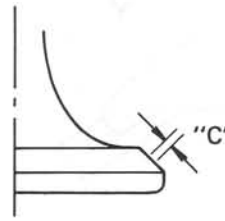
	INNER		OUTER	
	INTAKE	EXHAUST	INTAKE	EXHAUST
FREE LENGTH	1.654 in. (42.0 mm.)		1.676 ins. (42.55 mm.)	
SPRING RATE	k1=1.43 k2=1.81 (kgs./mm.)		k1=3.20 k2=4.18 (kgs./mm.)	
INSTALLED LENGTH (VALVE CLOSED)	1.379 ins. (35.0 mm.)		1.458 ins. (37.0 mm.)	
INSTALLED PRESSURE (VALVE CLOSED)	22.20 ± 2.05 lbs. (10 ± 0.7 kgs.)		39.03 ± 2.76 lbs. (17.7 ± 1.25 kgs.)	
COMPRESSED LENGTH (VALVE OPEN)	1.005 ins. (25.5 mm.)		1.084 ins. (27.5 mm.)	
COMPRESSED PRESSURE (VALVE OPEN)	59.97 ± 4.19 lbs. (27.2 ± 1.9 kgs.)		126.78 ± 8.82 lbs. (57.5 ± 4 kgs.)	
WIRE DIAMETER	0.114$^{\phi}$ in. (2.9$^{\phi}$ mm.)		.165$^{\phi}$ in. (4.2$^{\phi}$ mm.)	
NUMBER OF WINDINGS	6.0 turns		4.25 turns	
WINDING O.D.	0.764 in. (19.4ϕ mm.)		1.284 ins. (32.6ϕ mm.)	

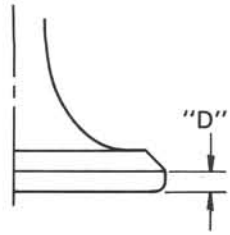
VALVES–INTAKE





	DIMENSIONS	
	STANDARD	WEAR LIMIT
CLEARANCE (COLD ENGINE)	0.002 in. (0.05 mm.)	———
"A" HEAD DIAMETER	1.614 in. (41ϕ mm.)	———
"B" FACE WIDTH	0.083 ins. (2.1 mm.)	———
"C" SEAT WIDTH	0.051 in. (1.3 mm.)	0.079 in. (2.0 mm.)
"D" MARGIN THICKNESS	0.051 in. (1.3 mm.)	0.0433 in. (1.1 mm.)
STEM DIAMETER (O.D.)	0.315 $^{-0.00039}_{-0.00098}$ in. ($8^{\phi}\,^{-0.010}_{-0.025}$ mm.)	
GUIDE DIAMETER (I.D.)	0.315 $^{+0.00074}_{+0.00039}$ in. ($8^{\phi}\,^{+0.019}_{+0.010}$ mm.)	
STEM-TO-GUIDE CLEARANCE	0.001 – 0.002 in. (0.029 – 0.044 mm.)	0.004 in. (0.10 mm.)





VALVES-EXHAUST

CLEARANCE (COLD ENGINE)	0.004 in. (0.10 mm.)[XS650C 0.006 in. (0.15 mm.)]	———
"A" HEAD DIAMETER	1.379 ins. (35ϕ mm.)	———
"B" FACE WIDTH	0.083 in. (2.1 mm.)	———
"C" SEAT WIDTH	0.051 in. (1.3 mm.)	0.079 in. (2.0 mm.)
"D" MARGIN THICKNESS	0.0512 in. (1.3 mm.)	0.0433 in. (1.1 mm.)
STEM DIAMETER (O.D.)	0.315 $^{+0.00098}_{+0.00157}$ in. ($8^{\phi}\,^{+0.025}_{+0.040}$ mm.)	
GUIDE DIAMETER (I.D.)	0.315 $^{-0.00074}_{-0.00010}$ in. ($8^{\phi}\,^{-0.019}_{-0.010}$ mm.)	
STEM-TO-GUIDE CLEARANCE	0.001 –0.002 in. (0.035 – 0.059 mm.)	0.005 in. (0.12 mm.)

Cylinder:	Standard bore size	$2.952\ ^{+0.00078}_{+0}$ ins. ($75\ ^{+0.020}_{+0}$ mm.)
	Wear limit	2.960 ins. (75.1 mm.)
	Taper limit	0.002 in. (0.05 mm.)
Piston:	Nominal clearance	0.00196 – 0.00216 in. (0.05 – 0.055 mm.)
	Wear Limit	0.004 in. (0.1 mm.)

Ring groove width

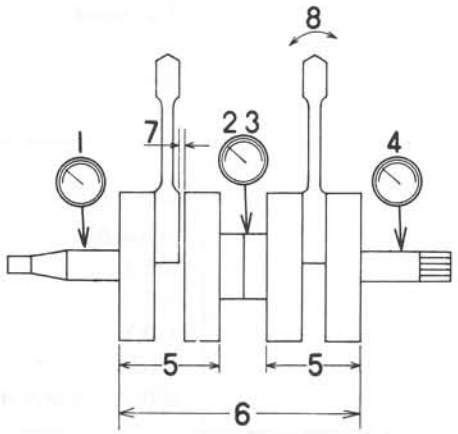
	1st	2nd	3rd
Nominal	0.047 in. (1.2 mm.)	0.059 in. (1.5 mm.)	0.110 in. (2.8 mm.)
Wear limit	0.05 in. (1.25 mm.)	0.06 in. (1.55 mm.)	0.112 in. (2.85 mm.)

Piston ring:

		1st	2nd	3rd
Ring end gap, Installed	Nominal	0.008 – 0.016 in. (0.2 – 0.4 mm.)	0.008 – 0.016 in. (0.2 – 0.4 mm.)	0.012 – 0.035 in. (0.3 – 0.9 mm.)
	Wear limit	0.039 in. (1.0 mm.)	0.039 in. (1.0 mm.)	0.059 in. (1.5 mm.)
Ring end gap, Free	Nominal	0.335 in. (8.5 mm.)	0.433 in. (11.0 mm.)	0.0003 in. (0.01 mm.)
	Wear limit	–	–	–
Side clearance	Nominal	0.002 – 0.004 in. (0.04 – 0.08 mm.)	0.001 – 0.003 in. (0.03 – 0.07 mm.)	0.001 in. (0.03 mm.)
	Wear limit	0.006 in. (0.15 mm.)	0.006 in. (0.15 mm.)	0.0004 in. (0.01 mm.)

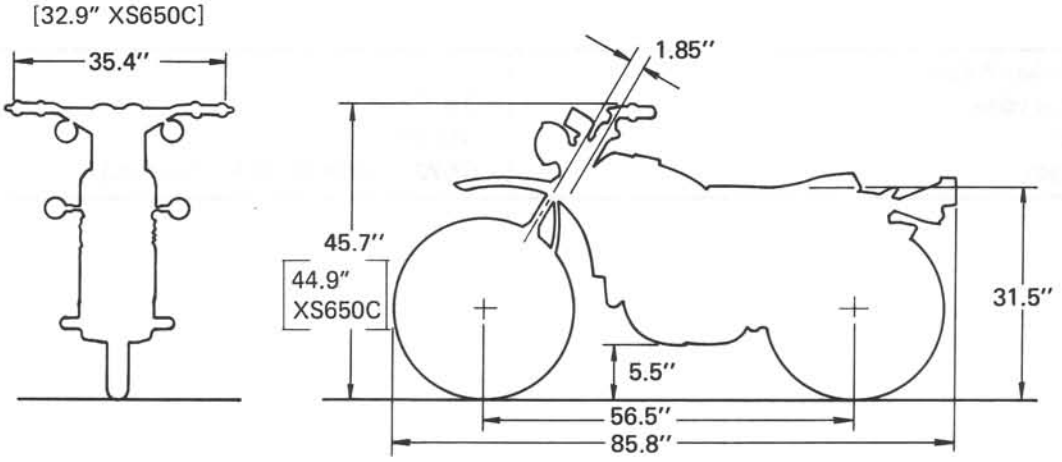
Crankshaft:

Deflection Tolerance				Flywheel width		Rod clearance			
						Axial		Side	
1.	2.	3.	4.	5.	6.	New	Max.	Max.	Min.
0.001 in. (0.03 mm.)	0.002 in. (0.05 mm.)	0.002 in. (0.05 mm.)	0.001 in. (0.03 mm.)	$2.598^{-0.00196}_{-0.00393}$ in. ($66^{-0.05}_{-0.10}$ mm.)	$7.322^{0}_{-0.001}$ in. ($186^{0}_{-0.03}$ mm.)	0.032 in. 0.039 (0.8 – 1.0 mm.)	0.079 in. (2.0 mm.)	0.024 in. (0.6 mm.)	0.012 in. (0.3 mm.)



Clutch:	
Clutch spring free length	1.363 ins. (34.6 mm.)
Wear limit	1.324 ins. (33.6 mm.)
Spring rate	145.592 lbs./in. (2.6 kgs./mm.)
Friction plate thickness	0.118 in. (3.0 mm.)
Wear limit	0.106 in. (2.7 mm.)
Warp. limit	0.002 in. (0.05 mm.)
Starter motor:	
Manufacturer	HITACHI
Type	S108-35
Field coil resistance	0.05 ohm ± 10% (20°C)
Armature winding resistance	0.055 ohm ± 10% (20°C)
Brush dimensions (WxHxL)	0.63 x 0.276 x 0.433 ins. (16 x 7 x 11 mm.)
Wear limit	0.177 in. (4.5 mm.)
Spring pressure	0.336 lb. (800 grs.)
Commutator Diameter	1.300 ins. (33 mm.)
Wear limit	1.261 ins. (32 mm.)
Mica undercut	0.020 – 0.032 in. (0.5 – 0.8 mm.)
Min. limit	0.008 in. (0.2 mm.)
Max. allowable run-out	0.006 in. (0.15 mm.)
Generator:	
Charging method	Regulator: A.C.Generator
Manufacturer	HITACHI
Model	LD115-02
Max. output	14V 11A/2,000 rpm.
Rotor coil resistance	5.15 ± 10%
Stator coil resistance	0.8 – 1.0 ohm each
Brush spring pressure	0.161 lbs. ± 15% (350 grs. ± 15%)
Brush dimensions (WxHxL)	0.177 x 0.177 x 0.571 in. (4.5 x 4.5 x 14.5 mm.)
Regulator:	
Manufacturer	HITACHI
Model	TL1Z-80
No-load voltage adjustment	14.5 ± 0.5V/3,000 rpm.
Yoke gap	0.035 in. (0.9 mm.)
Core gap	0.002 – 0.039 in. (0.6 – 1.0 mm.)
Point gap	0.012 – 0.016 in. (0.3 – 0.4 mm.)
Voltage coil resistance	10 ohm ± 10% at 20°C (68°F)
Rectifier:	
Manufacturer	HITACHI
Model	SB6B-17
Description (Type)	Full wave
Material	Silicon
Resistance	9 – 10 ohm
Reverse resistance	∞
Starter switch:	
Manufacturer	HITACHI
Model	A104-62
Winding resistance	3.5 ± 10% at 20°C (68°F)
Actuating voltage, ON	6.5V
OFF	4.0 V
Core gap	0.059 – 0.071 in. (1.5 – 1.8 mm.)
Point gap	0.035 – 0.044 in. (0.88 – 1.11 mm.)

Starter Safety Relay:	
Cut out voltage	2.5 V
Type	AS1-07
Core gap	0.020 – 0.024 in. (0.5 – 0.6 mm.)



SUSPENSION

	FRONT	REAR
Type	Telescopic Fork	Swing Arm
Travel	5.122 ins. (130 mm.)	3.152 ins. (80 mm.)
Spring Length Free	15.57 ins. (395.5 mm.)	8.235 ins. (209.0 mm.)
Spring Length Installed	14.98 ins. (380.5 mm.)	8.038 ins. (204.00 mm.)
Spring Constant	k=0.58 kgs/mm.	k=2.4 kgs/mm.
Spring Wear Limit (Free)	15.0 ins. (381 mm.)	8.0 ins. (203 mm.)
Number of Coils	58.25 turns	11.5 turns
Diameter of Coil	0.879ϕ in. (22.3ϕ mm.)	2.403ϕ ins. (61ϕ mm.)
Diameter of Wire	0.150ϕ in. (3.8ϕ mm.)	0.315ϕ in. (8ϕ mm.)
Caster	63° Trail	4.53 ins. (115 mm.)
Rear Swing Arm Nominal Length	18.163 ins. (461 mm.)	

WHEELS/TIRES

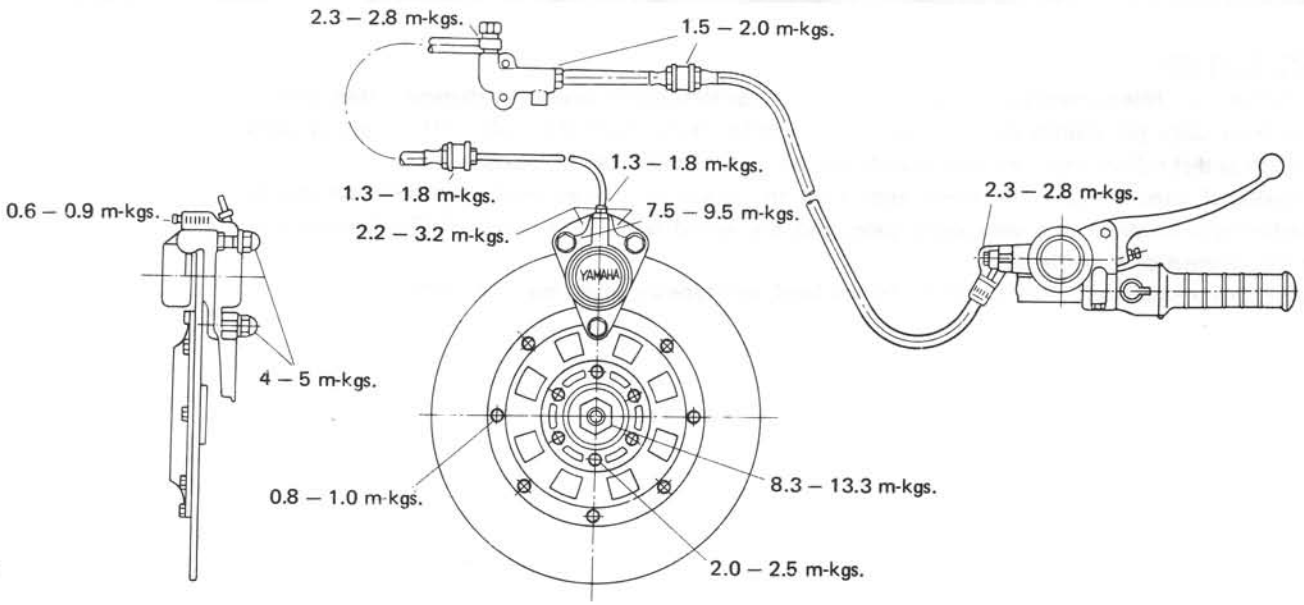
	FRONT	REAR
Mfr./Size/Tread Type	Yokohama/3.50 H-19.4 PR	Yokohama/4.00 H-18.4 PR
Tire Pressure	23 lbs/in.^{2} (1.6 kgs/cm^2)	28 lbs/in.^{2} (2.0 kgs/cm^2)
Rim Size/Material/Type	1.85B-19/Aluminum/H type	2.15B-18/Aluminum/H type
	—	—
Spoke Diameter	3.5ϕ mm. (Hub side: 4.0ϕ)	3.5ϕ (Hub side: 4.0ϕ)
Spoke Length (Inside)	7.368 ins. (187.0 mm.) 18 pcs.	5.92 ins. (150.5 mm.) 18 pcs.
Spoke Length (Outside)	7.148 ins. (186.5 mm.) 18 pcs.	5.91 ins. (150.5 mm.) 18 pcs.
Runout Limits (Vertical)	0.079 in. (2 mm.)	0.079 in. (2 mm.)
Runout Limits (Horizontal)	0.079 in. (2 mm.)	0.079 in. (2 mm.)

BRAKES

Type	Disc Brake	Drum Brake
Actuating Method	Hydraulic	Link Rod
Brake Drum I.D.	—	(180ϕ mm.)
Lining Length x Width = Area Quant.		6.777 ins. x 1.182 ins. = 7.998 in^2 (172 mm. x 30 = 5,160 mm.^{2}) 2 pcs.
Pad Dia./Area/Quant.	47ϕmm./17.3cm.^{2}/2 pcs.	—
Pad (Lining) Thickness/Wear Limit	0.256/0.177 in. (6.5/4.5 mm.)	0.158/0.079 in. (4/2 mm.)
Disc Diameter/Thickness/Wear Limit	298ϕmm./7.0mm./6.5mm.	—

TORQUE SPECIFICATIONS

Valve clearance adjusting nut	8 mm.	11 – 18 ft-lbs. (1.5 – 2.5 m-kgs.)
Cylinder head tightening nut	10 mm.	22 – 25 ft-lbs. (3.0 – 3.5 m-kgs.)
bolt	8 mm.	15 – 18 ft-lbs. (2.1 – 2.5 m-kgs.)
bolt	6 mm.	7.5 – 11 ft-lbs. (1.0 – 1.5 m-kgs.)
stud bolt	10 mm.	11 – 14.5 ft-lbs. (1.5 – 2.0 m-kgs.)
Strainer cover tightening screw	6 mm.	6.0 – 7.2 ft-lbs. (0.8 – 1.0 m-kgs.)
Delivery pipe holding banjo bolt	10 mm.	14.5 – 16 ft-lbs. (2.0 – 2.2 m-kgs.)
	14 mm.	18 – 22 ft-lbs. (2.5 – 3.0 m-kgs.)
Drain plug	30 mm.	25 – 29 ft-lbs. (3.5 – 4.0 m-kgs.)
Pump cover tightening screw	6 mm.	5.0 – 6.5 ft-lbs. (0.7 – 0.9 m-kgs.)
Kick crank holding bolt	8 mm.	11 – 18 ft-lbs. (1.5 – 2.5 m-kgs.)
A.C. generator (Rotor) securing nut	12 mm.	50 – 54 ft-lbs. (7.0 – 7.5 m-kgs.)
A.C. generator (Stator) securing screw	6 mm.	5.0 – 6.5 ft-lbs. (0.7 – 0.9 m-kgs.)
Clutch boss securing nut	18 mm.	54 – 58 ft-lbs. (7.5 – 8.0 m-kgs.)
Drive sprocket securing nut	22 mm.	72 – 87 ft-lbs. (10.0 – 12.0 m-kgs.)
Crankcase tightening stud bolt	8 mm.	1st. 1.0, 2nd. 1.5, final 2.0 (m-kgs.)
Crankcase tightening stud nut	8 mm.	1st. 1.0, 2nd. 1.5, final 2.0 (m-kgs.)
Primary drive gear securing nut	14 mm.	51 – 72 ft-lbs. (7.0 – 10.0 m-kgs.)
Spark plug	14 mm.	19.5 – 21 ft-lbs. (2.7 – 2.9 m-kgs.)
Breaker shaft securing nut	6 mm.	5.8 – 7.2 ft-lbs. (0.8 – 1.0 m-kgs.)
Front wheel shaft securing nut	14 mm.	51 – 72 ft-lbs. (7.0 – 10.0 m-kgs.)
Front fork crown pinch bolt	8 mm.	5.8 – 8.6 ft-lbs. (0.8 – 1.2 m-kgs.)
Steering shaft securing bolt	14 mm.	30 – 45 ft-lbs. (4.2 – 6.2 m-kgs.)
Engine mounting nut	10 mm.	25 – 35 ft-lbs. (3.5 – 4.8 m-kgs.)
Pivot shaft-securing nut	14 mm.	36 – 58 ft-lbs. (5.0 – 8.0 m-kgs.)
Rear wheel shaft securing nut	18 mm.	87 – 130 ft-lbs. (12.0 – 18.0 m-kgs.)
Rear cushion holding nut	10 mm.	17 – 27 ft-lbs. (2.3 – 3.7 m-kgs.)



1-3. SERVICE CHART

A. Periodic maintenance intervals

Unit: miles

Page	Item	Remarks	Preoperational Check	Initial				Thereafter every		
				250	500	1,000	2,000	1,000	2,000	3,000
26,111	Brake System (Complete)	Chk/Adj as req'd, repair as req'd	O		O	O			O	
24	Clutch	Check/Adjust as required	O		O	O			O	
165	Battery	Top-Off/Ck spec. gr. as req'd —monthly— or	O	O	O	O		O		
160	Spark Plug(s)	Inspect/Clean or replace as req'd	O	O	O	O		O		
115,133	Wheels & Tires	Pressure/Spoke Tension/Runout	O	O	O	O		O		
—	Fittings & Fasteners	Tighten before each trip and/or	O	O	O	O		O		
132	Drive Chain	Tension/Alignment See Service Notes 3	O	O	O	O		O		
28	Engine Oil Level Check					O		O		
98	Air Filter	Foam Type-See Service Notes 1,3	O	O	O	O		O		
86	Fuel Petcock(s)	Clean/Flush tank as req'd	O	O	O	O			O	
18~21	Ignition Timing	Adjust/Clean or repl. pts. as req'd			O	O			O	
97~98	Carburetor Adjustment	Check Operation/Synch./Fittings			O	O			O	
95	Carburetor Overhaul	Clean/Repair as Req'd/Refit/Adjust					O			O
27	Cylinder Compression	Preventive Maintenance Check			O	O			O	
59	Decarbonize Engine	Includes Exhaust System				O	O		O	
21	Camshaft Drive Chain	Adjust Tension	O	O		O			O	
28	Primary Oil Filter	Clean			O					O
40	Oil Filter System	Clean All-Includes Traps, etc.				O	O			O
18	Valves	Adjust/Regrind per tests as req'd				O	O		O	

SERVICE NOTES:

1. Foam element air filters must be damp with oil at all times to function properly. Remove, clean, and oil filter at least once per month or every 500 - 1,000 miles; more often if possible. (If extremely hard usage, such as dirt riding, clean and lube daily). See lubrication chart for add'l details.
2. Pre-operational checks should be made each time the machine is used. Such an inspection can be thoroughly accomplished in a very short time; and the added safety it assures the rider is more than worth the minimal time involved.
3. For additional information, drive chain, engine oil level, wet-type air filter; see lube chart.

B. Lubrication Intervals

Unit: miles

Page	Item	Remarks	Preop ck	Type	Period							
					Initial				Thereafter every			
					250	500	1,000	2,000	1,000	2,000	4,000	8,000
28	Engine Oil	Warm engine before draining	O	#1	O		O	O	CHK	O		
132	Drive Chain	Lube/Adjust as req'd.	O	#2			See Service Notes					
133	Drive Chain	Remove/Clean/Lube/Adjust	O	#2				O		O		
98	Air Filter	Foam type	O	#9			See Service Notes					
–	Control & Meter Cables	All - Apply thoroughly		#3			O			O		
–	Throttle Grip & Housing	Light Application		#4			O			O		
–	Tach & Speedo Gear Hsgs.	Light Application		#4				O			O	
126	Rear Arm Pivot Shaft	Apply until shows		#5			O			O		
–	Brake Pedal Shaft	Light Application		#4			O			O		
–	Change Pedal Shaft	Light Application		#4			O			O		
–	Stand Shaft Pivot(s)	Light Application		#4			O			O		
122 ~ 124	Front Forks	Drain Completely - CK Specs		#2		CHK		O		CHK	O	
123	Steering Ball Races	Inspect thoroughly/Med.pack		#6				O			O	
157	Point Cam Lubr. Wick	Very Light Application		#7			O				O	
113	Hyd. Brake Fluid Res.	Use New Fluid Only-Yearly or:		#8	CHK		CHK		CHK			O
116	Wheel Bearings	Do Not Over-Pack		#6				O			O	

#1 At ambient temperatures of 45 - 90° use 20W-40 "SE".

#2 Use 10W-30 "SE" motor oil. (If desired, specialty type lubricants of quality manufacture may be used.) Add "DRIVE CHAINS" - Lube every 200 - 250 miles.

#3 Use graphite base type (specialty types available—use name-brand, quality manufacturer).

#4 Light duty: Smooth, light-weight, "white" grease. Heavy duty: Standard lube grease (do not use lube grease on throttle housing).

#5 Use standard lube grease – smooth, not coarse.

#6 Medium-weight wheel bearing grease of quality mfr.—preferably waterproof.

#7 Light-weight machine oil.

#8 Change yearly or 8,000 miles, whichever is first. Do not mix types. Use quality mfr. corresponding to SAE J1703B specifications. Keep clean. Do not allow water, etc., to contaminate.

#9 AIR FILTER – Foam element air filters must be damp with oil at all times to function properly. Clean and lube monthly or per mileage. If hard usage, clean and lube daily. Do not over-oil. Use SAE 10W/30 "SE".

PRE-OPERATION CHECK CHART

BRAKES	Check Operation/Adjustment/Hydraulic Reservoir
CLUTCH	Check Operation/Lever Adjustment
ENGINE OIL	Check Tank Level/Top-off as required
DRIVE CHAIN	Check Alignment/Adjustment/Lubrication
BATTERY	Check Electrolyte Level Weekly/Top-off Monthly
SPARK PLUG	After Break-in Check Color and Cond'n Weekly
AIR FILTER	Foam Type-Must be Clean and Damp W/Oil Always
WHEELS & TIRES	Check Pressure/Runout/Spoke Tightness/Axle Nuts
FITTINGS/FASTNERS	Check All-Tighten as required
LIGHTS/SIGNALS	Check headlight/tail-stop lights/turn sigs., etc.

Pre-operation checks should be made each time the machine is used. Such an inspection can be thoroughly accomplished in a very short time, and the added safety it assures the rider is more than worth the time involved.

MAINTENANCE & LUBRICATION CHARTS

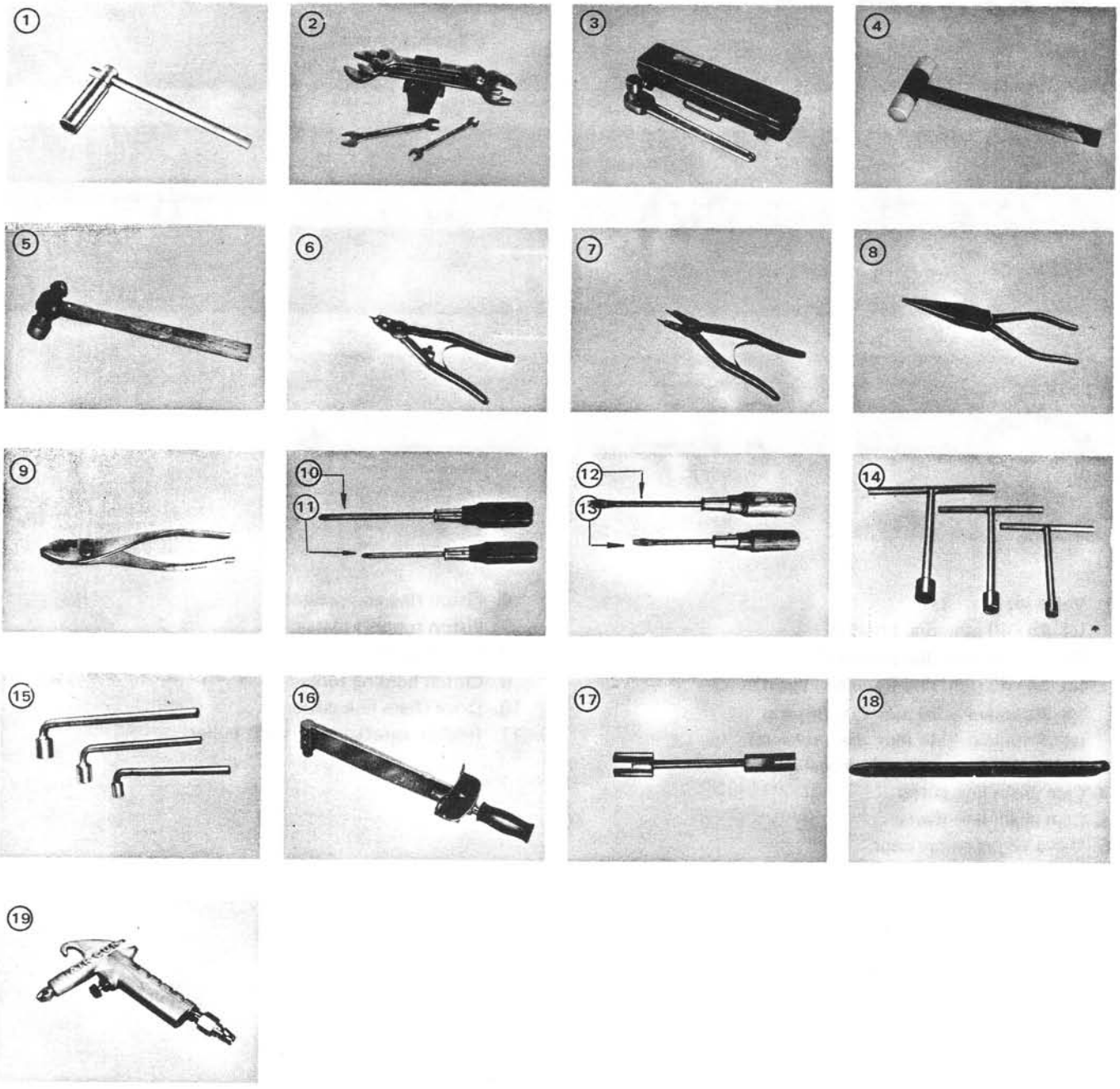
Interval recommendations and lubricant types listed in the Maintenance and Lubrication Charts are based upon general averages. Extremes in environment or usage may dictate shorter maintenance intervals, different lubricants or shorter lubrication intervals.

Therefore, all recommendations regarding types and intervals are to be considered a guide only. Intervals should not be exceeded but may be shortened as required. Lubricant types may be up-graded, but never down-graded.

1-4. SERVICE TOOLS

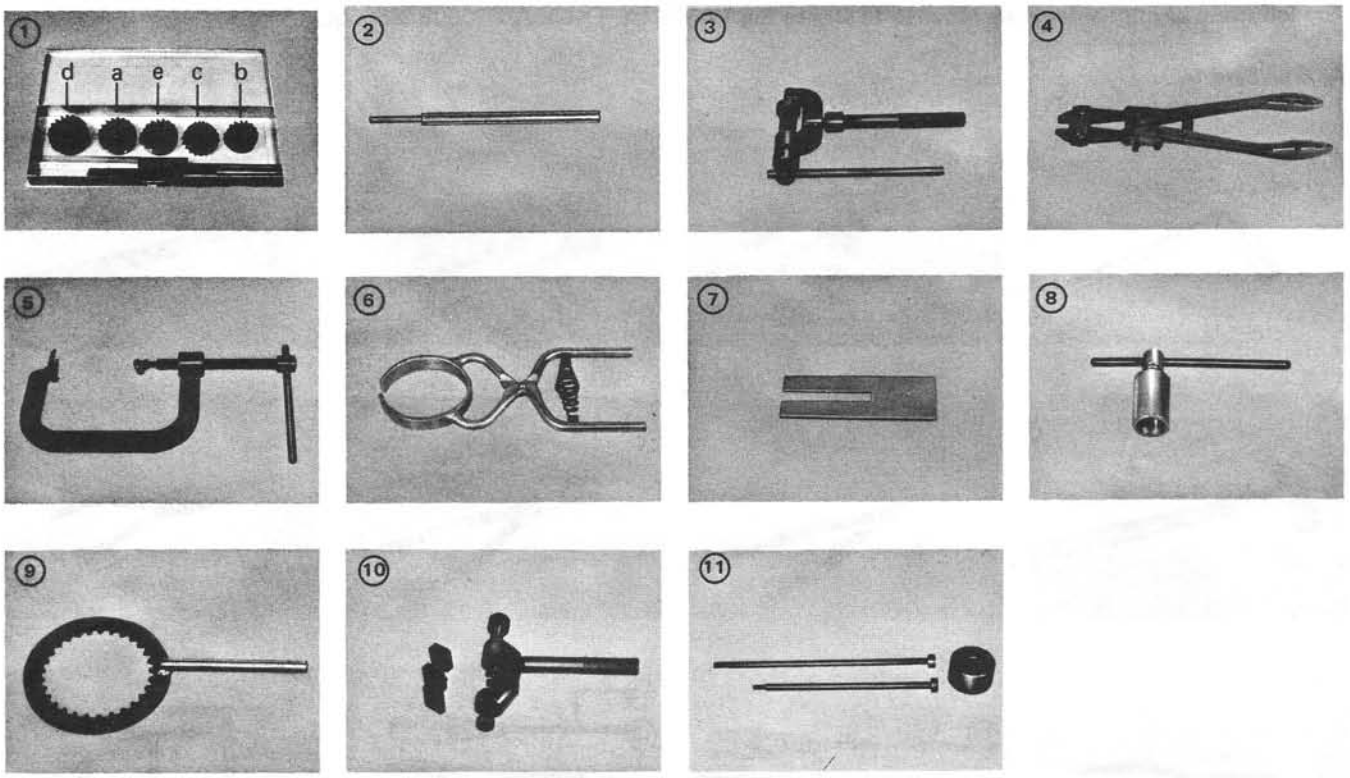
The following additional tools are required to service the YAMAHA TX650A/XS650B/XS650C

A. Standard tools



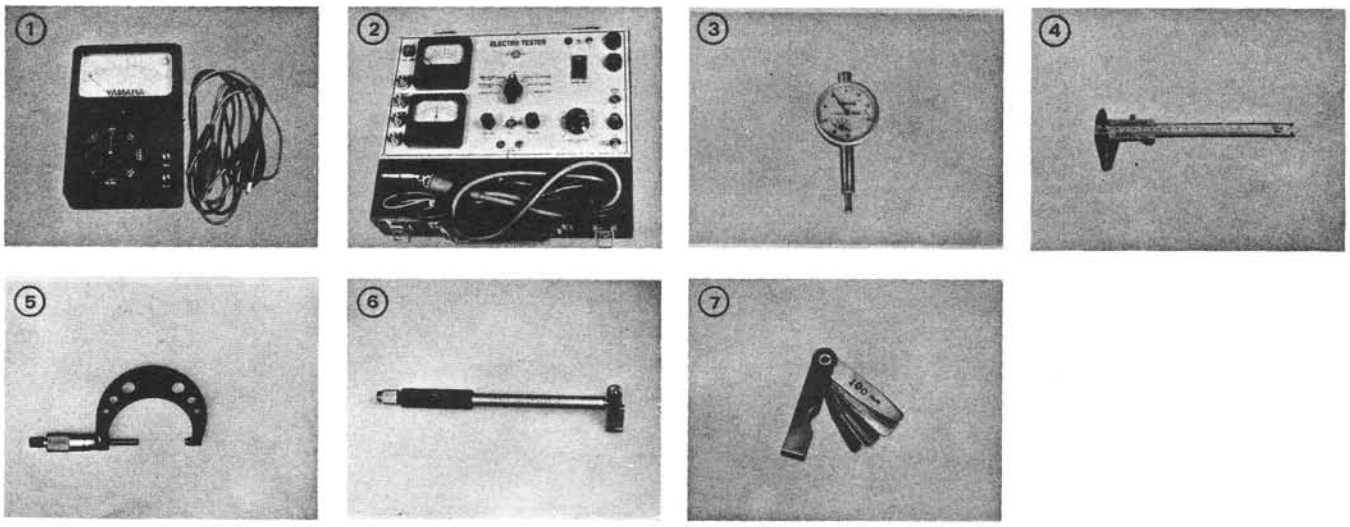
1. Plug wrench
2. Open-end wrenches
3. Socket wrenches
4. Soft-faced hammer
5. Steel hammer
6. Clip pliers (ST type)
7. Clip pliers (RT type)
8. Needle nose pliers
9. Combination pliers
10. Phillips-head screwdriver (Large)
11. Phillips-head screwdriver (Medium)
12. Slot-head screwdriver (Large)
13. Slot-head screwdriver (Medium)
14. T-type socket wrenches
15. L-type socket wrenches
16. Torque wrench
17. Nipple wrench
18. Iron levers
19. Air gun

D. Special tools



1. Valve seat cutters
   (a) 45 - 40 mm. dia. (intake)
   (b) 45 - 34 mm. dia. (exhaust)
   (c) 65 - 42 mm. dia. (intake/exhaust)
   (d) Rounded – 50 mm. dia. (intake)
   (e) Rounded – 44 mm. dia. (exhaust)
2. Valve guide installation/removal guide
3. Cam chain link cutter
4. Cam chain link riveter
5. Valve spring compressor
6. Piston ring compressors
7. Piston support plates
8. Rotor puller
9. Clutch holding tool
10. Drive chain link cutter
11. Rocker arm/Balancer shaft puller

B. Measuring instruments



1. Pocket tester
2. YAMAHA electrotester
3. Dial gauge
4. Vernier Cariper
5. Micro Meter
6. Cylinder gauge
7. Feeler gauge

C. Miscellaneous tools

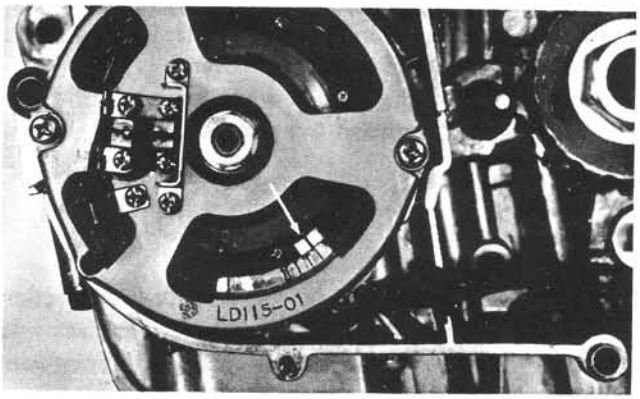
1. YAMAHA 4-stroke oil (or Motor oil 10W/30)
2. Oil jug
3. YAMAHA bond (No. 1)
4. Oiler
5. YAMAHA bond (No. 4)
6. Parts tray
7. Brake fluid
8. Overhauling stand
9. Bearing grease
10. Rags
11. Cotter pin
12. Vinyl tube (4mm)
13. Spring balance

CHAPTER 2. ADJUSTMENTS

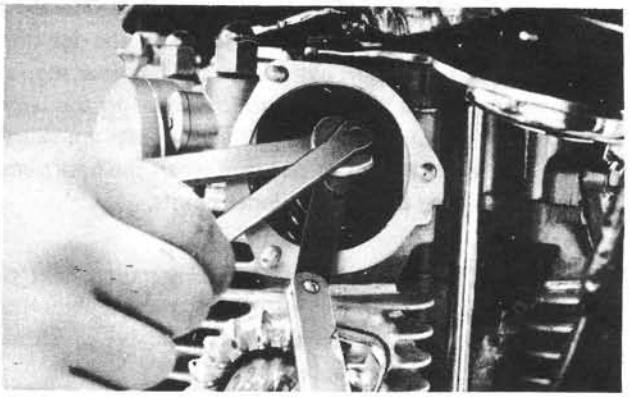
2-1. Valve Adjustment

A. Valve Adjustment

Improper valve clearance causes poor engine performance and possible engine damage. If there is too little clearance, the valve is held partially open. This permits blowby past the valve and a drop in compression. If there is too much clearance there will be excessive engine noise and the valve will not open fully which will create partial blockage of airflow at the port.



1. Remove all four tappet covers and the alternator cover.
2. Next, align the "T" mark on the stator with the timing mark on the rotor. This places the pistons at top dead center. One of the cylinders is now at the top of its compression stroke. The cylinder that is on the compression stroke has both valves shut. This can be noted by observing which cylinder has clearance at both valve adjustors.



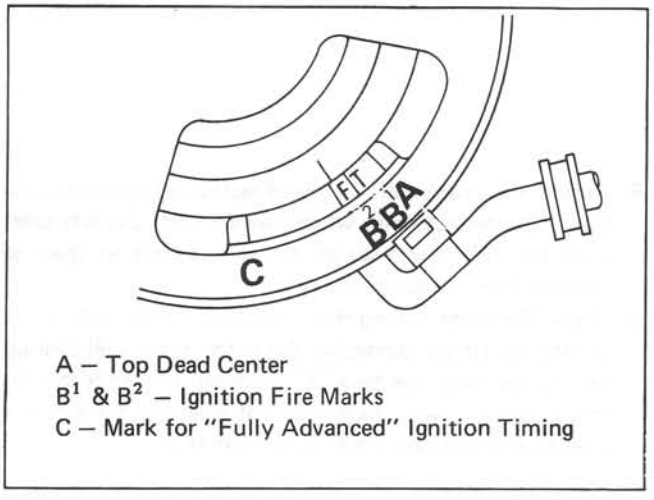
3. Use a feeler gauge to determine the existing clearance. The exhaust valve clearance should measure 0.004 in. (0.10 mm.); the intake clearance should measure 0.002 in. (0.05 mm.). (engine cold)
4. Loosen the lock nut and use the valve adjusting tool found in the Special Tool kit. Turn the adjustor in or out to obtain the correct clearance. Hold the adjustor solid to prevent it from moving and thoroughly tighten the lock nut. Recheck the clearance after tightening.
5. Rotate the crankshaft one complete revolution and once again line up the rotor and stator marks. The valve train of the other cylinder is now in position for adjustment.

Caution:
ADJUST VALVE CLEARANCE ONLY WHEN THE ENGINE IS COLD.

B. Setting Ignition Timing

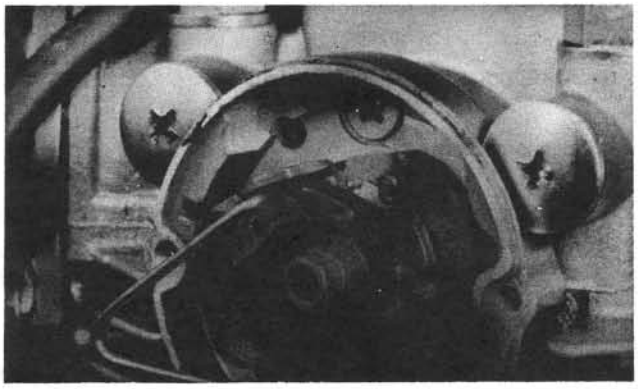
Caution:
In order to obtain accurate ignition timing, in relation to piston position, the cam chain must first be adjusted.

1. Ignition timing is checked observing the position of the timing marks on the rotor in relation to the timing marks on the stator.
2. The rotor has one timing mark. The stator has four timing marks. The first mark is identified by the letter "T". This means the piston is at "Top Dead Center". The next two marks, identified by the letter "F" stamped between them, are the point of proper ignition timing when fully retarded (engine stopped or idling). When setting ignition timing, set it so both cylinders fire between the marks (both ignition advance weights completely closed).



A – Top Dead Center
B^1 & B^2 – Ignition Fire Marks
C – Mark for "Fully Advanced" Ignition Timing

3. The fourth timing mark indicates 38° before TDC, the fully advanced ignition position.

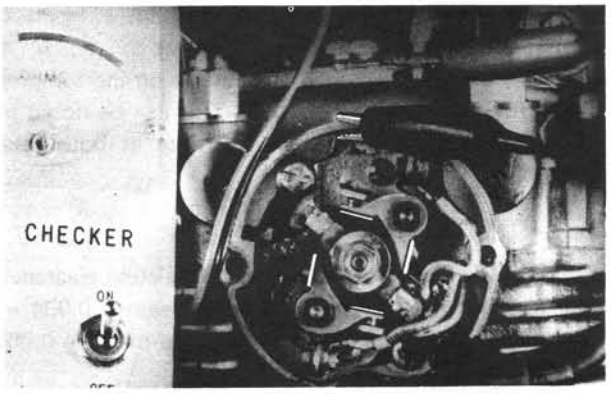


Note:

Each point gap should be checked first, and adjusted, if necessary. Then proceed with the timing adjustment.

4. Remove the alternator inspection plate, ignition points cover, and ignition advance unit cover.
5. Securely anchor the ignition advance weights into the "fully retarded" position (weights held inward).

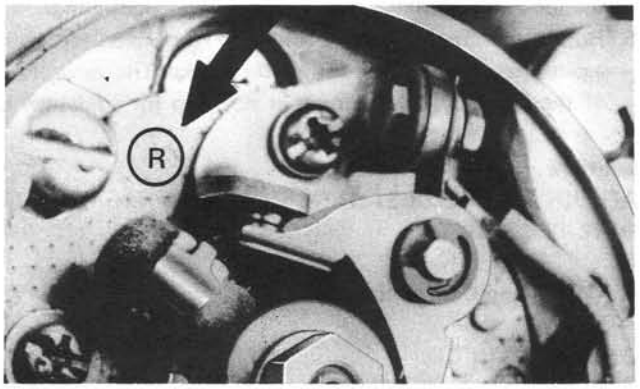
6. Check the point checker for full scale deflection (Infinity to Zero resistance), then hook the black lead to a good ground; the red lead to the grey point wire (right cylinder).



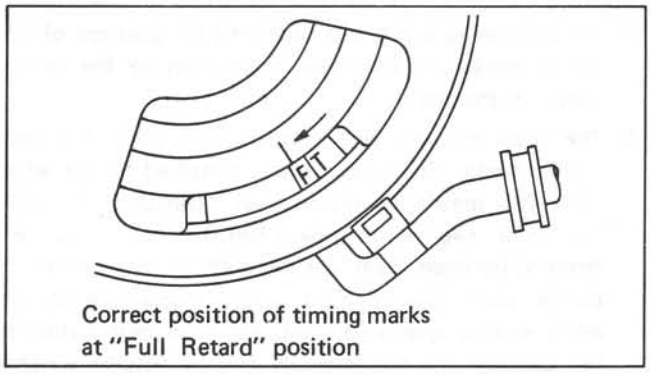
Caution:

Ignition timing for each cylinder is set separately. However, it is absolutely necessary that the right cylinder points are timed before the left cylinder points. The right cylinder points are mounted directly to the ignition point base plate. The left cylinder points, however, mount on a separate plate that is in turn mounted to the large ignition base plate. If the left cylinder points are timed first, they will shift out of position when the base plate is pivoted to time the right cylinder points.

7. The letter "L" (for left cylinder) is stamped next to one set of points, the letter "R" (for right cylinder) is stamped next to the other set. This indicates which set of points fires which cylinder.

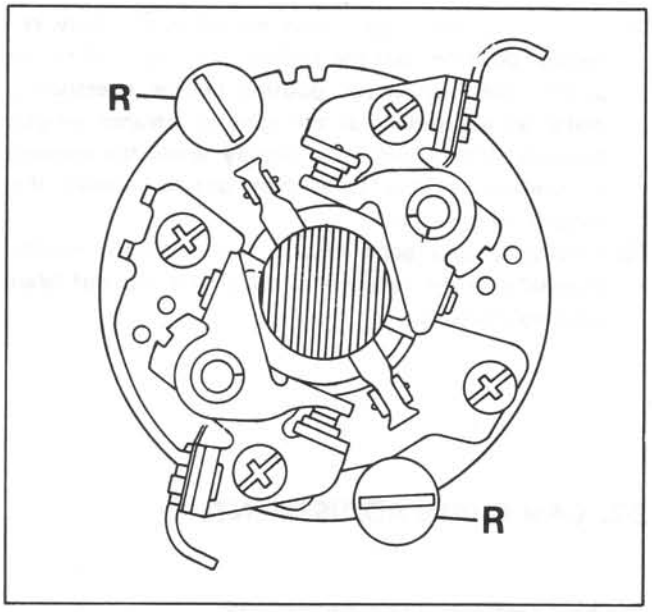


8. Rotate the crankshaft in the direction of running rotation (counterclockwise when viewed from the left side) until the right hand set of points just start to open, as indicated by the point checker.
9. Check the rotor timing mark position. If the right-hand points are timed correctly, the rotor mark will line up exactly between the two "F" stamped timing marks on the stator. If these marks do not line up, a corrective adjustment must be made to the points.



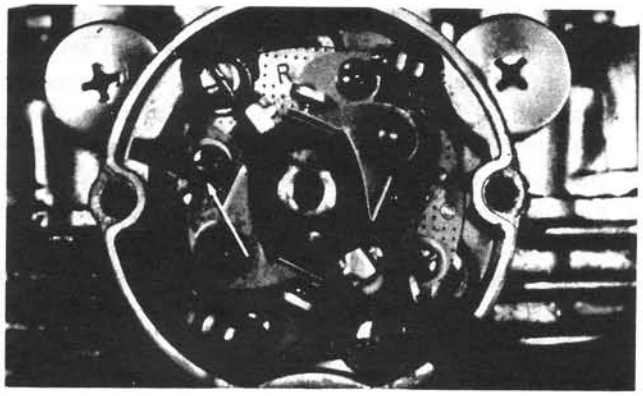
Correct position of timing marks at "Full Retard" position

10. With the timing marks lined up correctly, loosen both base plate lock screws. Pivot the entire plate until the right cylinder points just start to open, (as indicated by the point checker).

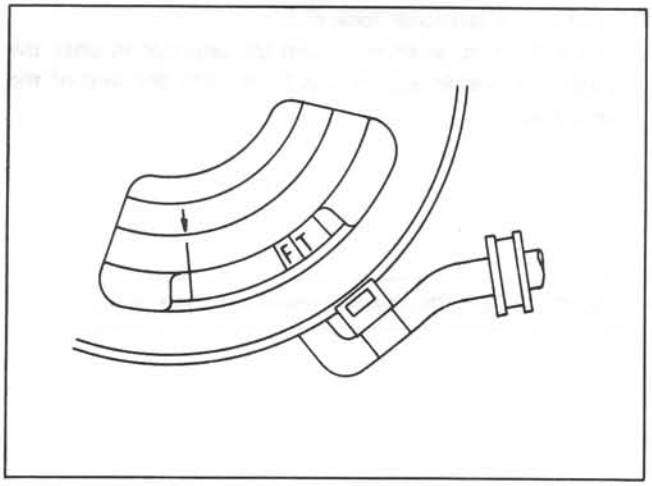


Base plate set screws

11. Tighten down both lock screws and check the timing again to make sure the base plate has not moved.
12. To set left cylinder timing, repeat steps 6 thru 10, except to switch the point checker probe from the grey wire to the orange wire. The left cylinder points are held in place on the base plate by two different lock screws. Loosen both lock screws as shown in the accompanying figure and make the necessary adjustments.

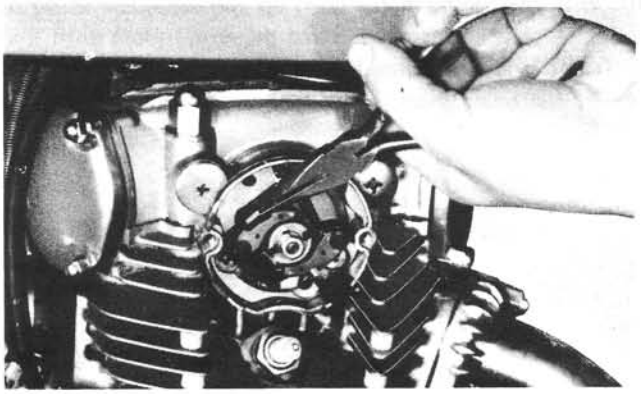


13. Ignition timing of both cylinders must be checked at the "fully advanced" position. Wedge both ignition advance weights fully open. With the point checker hooked up to the orange wire, rotate the crankshaft. The left-hand points must now open when the rotor mark lines up with the stator full advance mark. (A tolerance of 3 mm. is allowed in either direction of the stator mark.) Switch the point checker lead to the right-hand cylinder and re-check.



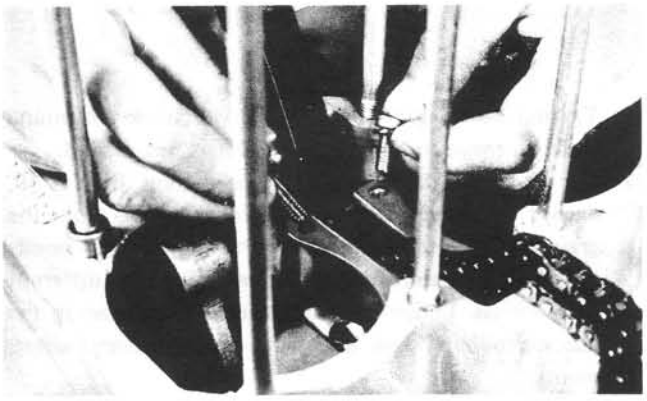
Proper timing mark position at "full advance"

14. If both cylinders are timed correctly at "fully retarded" position, but the timing marks do not line up at the "fully advanced" position (within tolerances), make an adjustment at the ignition advance weight stoppers. Bend them in to slightly lessen the amount of ignition advance, bend them out to increase the amount of advance.
15. Finally, it is a good idea to re-check your results, especially in the case where the engine has not been running correctly.



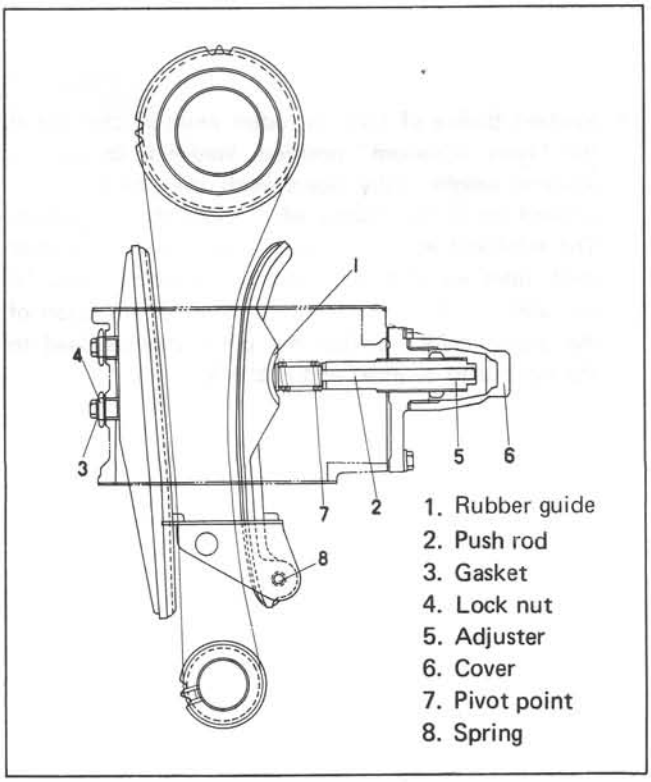
2-2. CAM CHAIN ADJUSTMENT

A. Chain Tensioner (TX650A/XS650B)

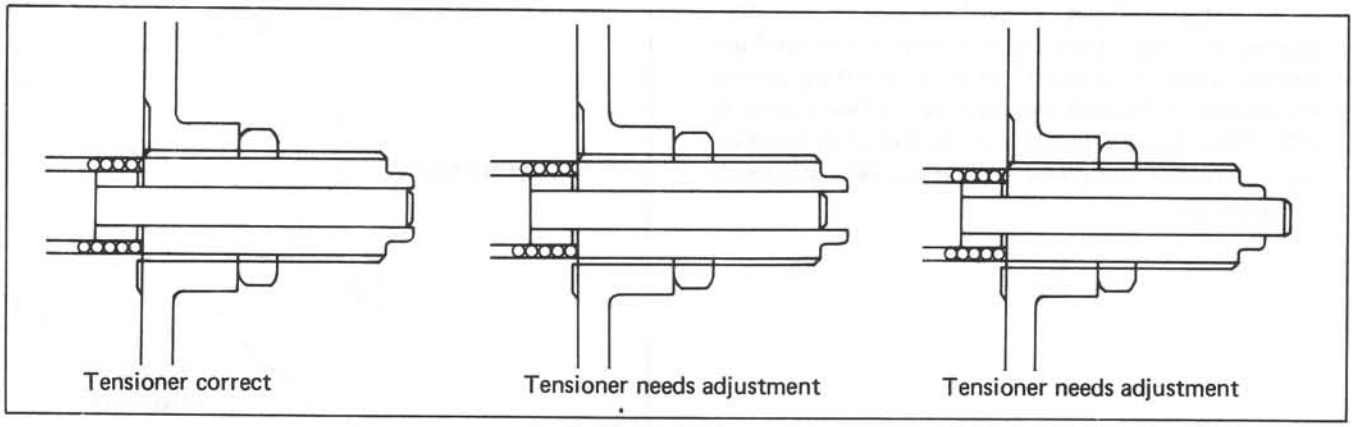


1. The chain tensioner consists of a steel and rubber guide that is held against the cam chain by a spring and a locked in-place push rod. This slider takes up any free play in the chain. In addition, a rubber dampener solidly mounted to the tensioner arm, just below the tensioner base, helps to guide the cam chain. Because of gradual chain wear, an adjustment is required periodically.
2. Four 6 mm. bolts hold the tensioner housing in place. Remove these and pull the unit out of the cylinder.
3. Reverse this procedure to install the unit. During installation, install a new gasket coated on both sides with Yamaha Bond #4.
4. Rotate crankshaft in a counterclockwise direction (viewed from the left side of the engine) to place all slack in the area of the chain tensioner.
5. Remove the metal case protective cover.
6. Loosen the tensioner lock nut.
7. Use a 22 mm. wrench to turn the adjustor in until the push rod (inside adjuster) is flush with the end of the adjustor.

XS650C Cam Chain Adjustment See Page 64.

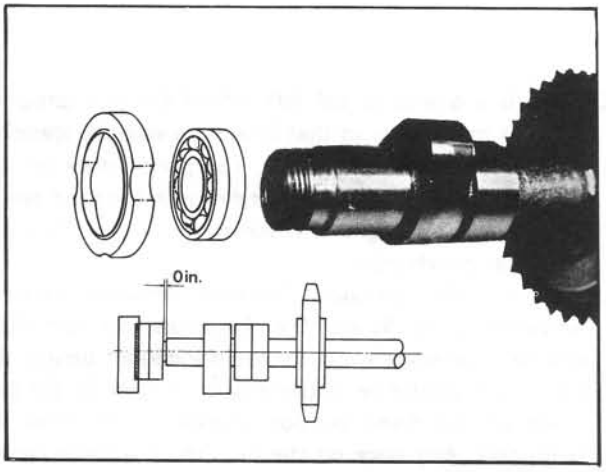


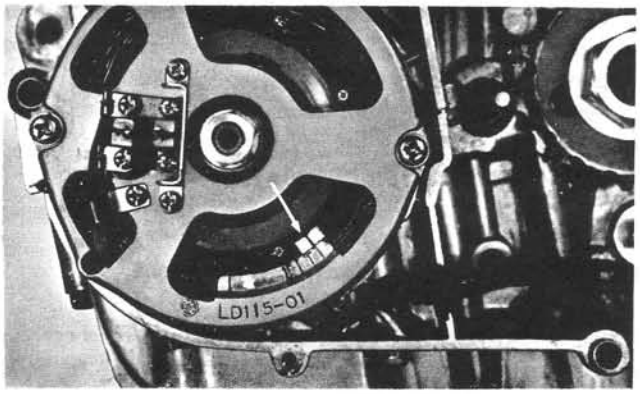
8. Tighten the lock nut and install the cover.
   Check this adjustment every 2,000 miles.



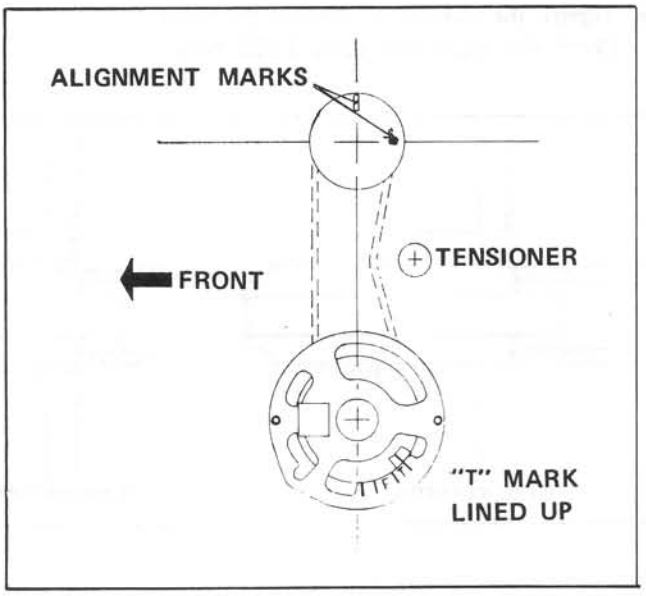
B. Timing the Camshaft

1. Slide all cam bearings in toward the center of the camshaft as far as possible. Place the camshaft into position with the camshaft threaded end on the right-hand side. Holding both cam bearings in toward the cam sprocket, move the cam back and forth until the cam chain driven sprocket is aligned with the crankshaft drive sprocket. This can be determined by observing the position of each cam bearing in its bearing boss. Both bearings must be positioned at equal distance in the cam bearing bosses.

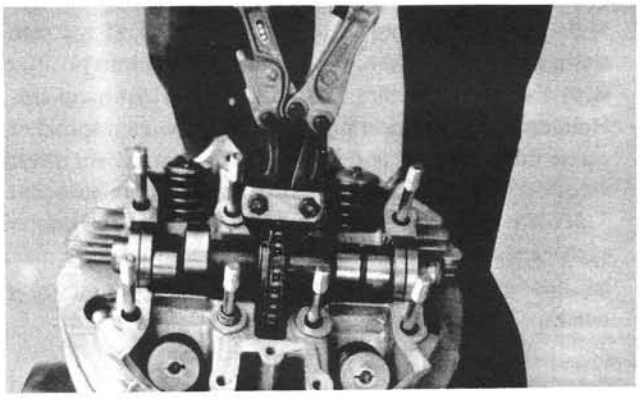




2. Next, rotate the pistons to TDC, as verified by lining up the rotor timing mark with the "T" (top) mark on the stator.
   If the stator has been removed, use the "dowel pin" process described in the Valve Timing section carefully equalizing the "dead point" of piston travel by turning the crankshaft forward and backward a few degrees at TDC. Make sure the piston is at the top of its compression stroke first. Otherwise, an opening valve may catch the dowel pin.



3. There is a groove in the left side of the cam sprocket. Position this groove so that it lines up with the sprocket centers. This can be checked. The punch mark on the camshaft sprocket must be parallel with the head gasket surface. Lay a straight edge across the head surface and check the punch mark.
4. Reconnect the cam chain. The chain tensioner has been loosened during disassembly. Therefore, the cam chain will have excessive slack. To avoid incorrect timing, the cam chain should be installed with no slack in the cam chain on the front portion (opposite side from the tensioner). Any slack on the back chain portion can be taken up with the tensioner.
5. Join the chain together by installing and riveting a new chain link. Always use a new link each time the chain is reconnected. (Use a chain riveter, not a hammer and punch, to mushroom the rivet ends). The Parts Book lists the replacement link to use.



Important:
Make the proper chain tension adjustment.

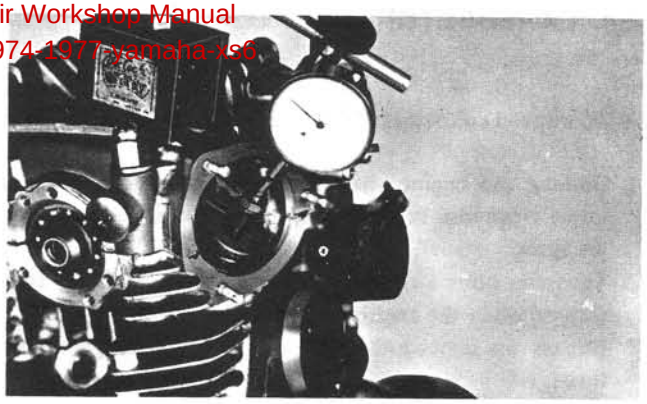
C. Checking Valve Timing with a Degree Wheel

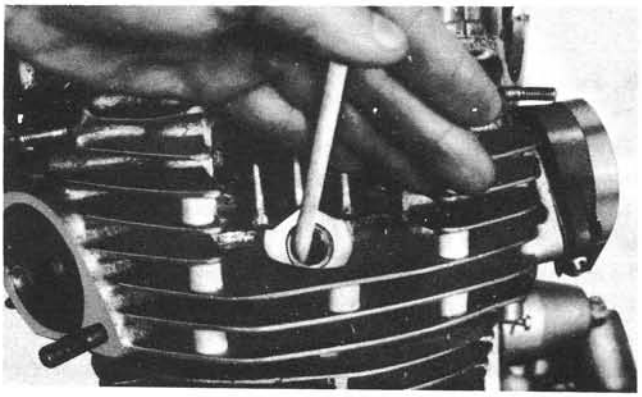
If the camshaft is not timed to open the valves in correct relation to crankshaft rotation, performance will be poor and engine misfire can occur.

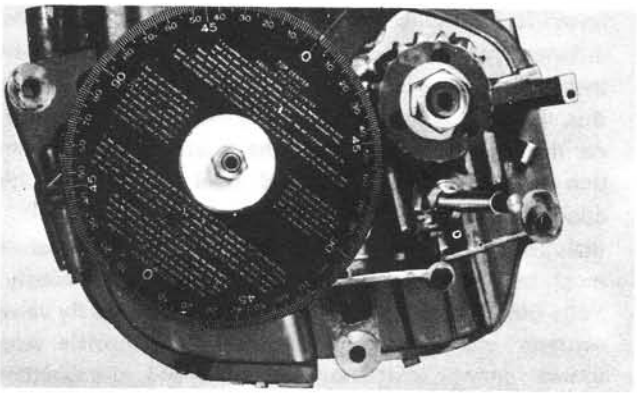
1. Important. Make sure the cam chain tensioner has been properly adjusted.
2. Adjust all vlaves to correct clearances. (0.002" intake, 0.004" exhaust engine COLD.)
3. Remove the left-hand case cover and stator. Mount the degree wheel (found in Special Tool Kit) to the rotor lock bolt.

4. Remove the spark plug and a place wooden dowel pin in the hole. Rotate the engine in a counter-clockwise direction (from left side) and find Top Dead Center on the compression stroke (valves are both closed) by watching the piston rise and fall as indicated by dowel pin position.
   Mount a pointer at the degree wheel so that it points to "O" on the wheel with the engine at TDC.
5. Mount the dial indicator over an intake valve tappet adjustor.
6. Rotate the crankshaft in a counter-clockwise direction (from left side). Watch the mounted dial indicator. Note when all clearance is taken up and the valve just starts to open.
7. Check the pointer position (in degrees on the wheel). The dial indicator should show the valve open 36° before top dead center after all valve tappet clearance has been taken up. Remember, "O" on the degree wheel is at Top Dead Center. The intake valve must close at 68° after bottom dead center; a total of 284°.
8. If the valve starts to open 26° or 46° before top dead center, the camshaft sprocket is one tooth off in its alignment with the crankshaft sprocket. The cam chain must be loosened and the camshaft rotated to its correct position.

Note:
Valve timing is off by approximately 10° for every tooth the camshaft sprocket is misaligned.







2-3. CLUTCH ADJUSTMENT

If the clutch lever lash is too small, the clutch tends to slip during engagement. If too large, it tends to drag. This causes fast wear to friction plates and results in poor gear shifting.

To adjust the clutch, proceed as follows:

1. Remove the adjusting screw cap, and loosen the adjusting screw lock nut.
2. Screw in the clutch cable adjusting screw (on the clutch lever holder) until tight, and screw in the clutch adjusting screw until it contacts the push rod. (If the clutch adjusting screw is further screwed in, the clutch springs will be contracted, and the clutch adjusting screw will also become tight.) Back out the clutch adjusting screw 1/4 turn.
3. Tighten the clutch adjusting screw lock nut.
4. Finally, adjust the play of clutch lever holder by turning the clutch cable adjusting screw.

Amount of play: 0.8 - 1.1 in. (20 - 30 mm.)