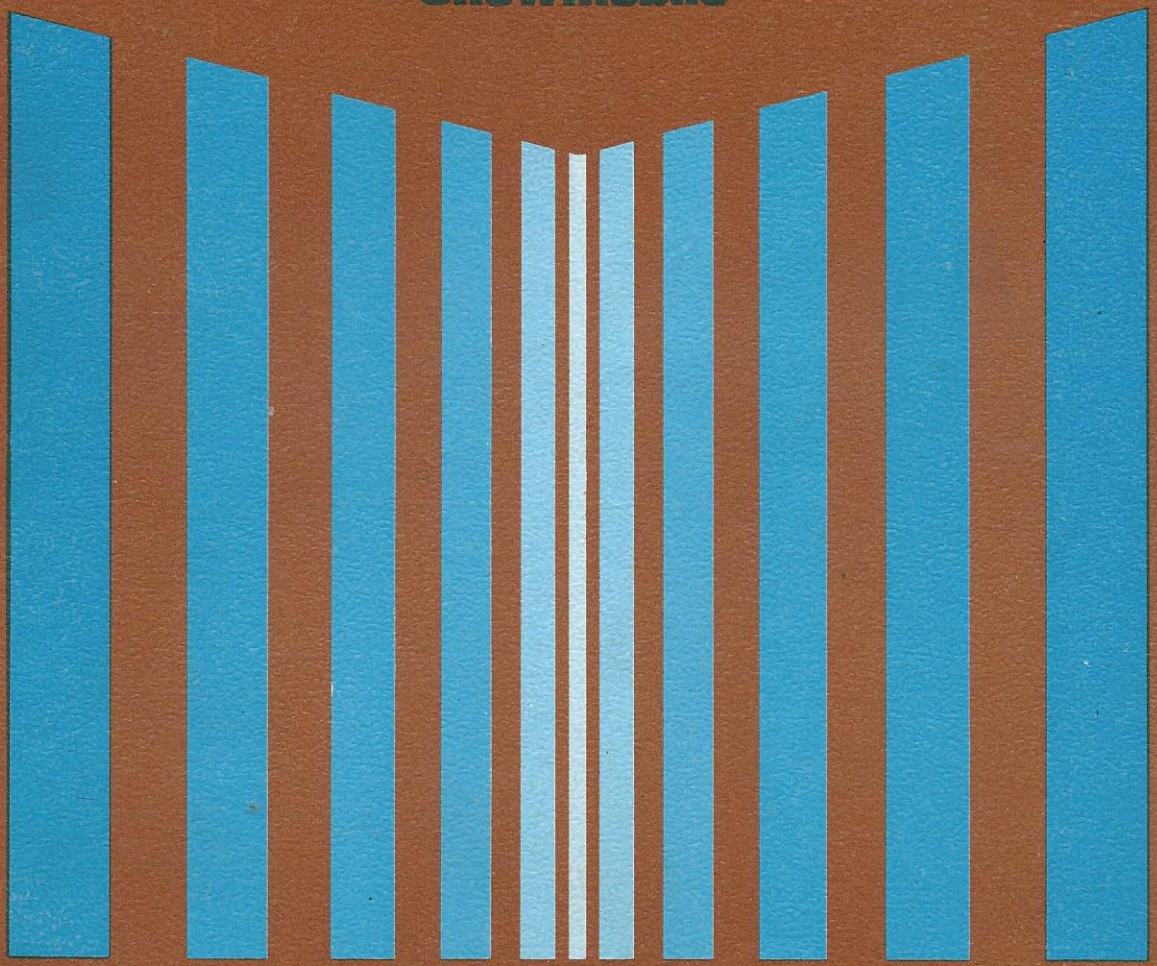
YAMAHA

SPECIAL TOOL and ELECTRO-TESTER

Motorcycle
Snowmobile



YAMAHA MOTOR CO., LTD.

USAGE OF YAMAHA SPECIAL TOOLS

FOREWORD

This Special Tool Manual is published to provide the technical instructions required for the correct use of special tools and measuring instruments in servicing Yamaha motorcycles and snowmobiles.

We hope that this manual will be of any help to you who are charged with giving the best possible service for the owners of Yamaha products.

Chapter 1, discusses the usage of special tools for motorcycles, and Chapter 2, the usage of the same for snowmobiles. In Chapter 3, is described the usage of Yamaha's electro-tester. Your through read would be highly appreciated.

YAMAHA MOTOR CO., LTD.
OVERSEAS ENGINEERING DIVISION

CONTENTS

CHAPTER 1.

HOW TO USE SPECIAL TOOLS FOR MOTORCYCLES,

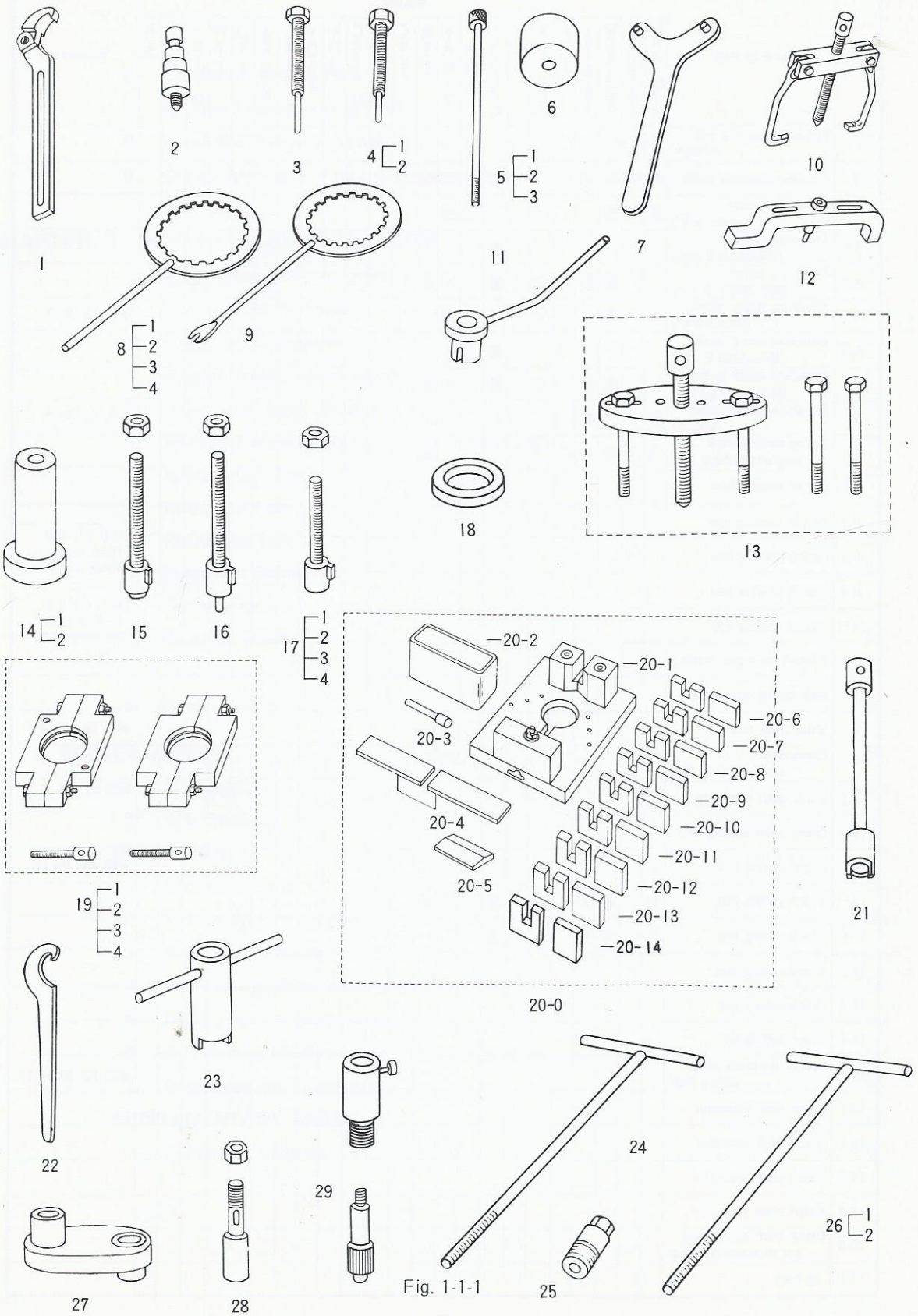

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Fig. 1-1-1

Fig.No.	Name of Part	Models																							Remarks
		MF2·MJ2	YF1·YJ1·YG1K	MF3D·U7(U5)	YF5·YJ5·YG5·6	FS1	YL1·YL3	YL5	YL2·YL2C	YA5	YA6·7	AT1	CT1	AS1·2	CS1·2	YD3	YDS2	YDS3·YDS3C·YM1	YDS5·YM2·YM2C	DT1	RT1	YR1·2	YR3	R5	
1	Exhaust pipe ring nut wrench	○	○	○	○	○	○	○	○	○	○			○	○	○	○	○	○						
2	Flywheel magneto puller	Ⓚ	Ⓚ	Ⓚ	Ⓚ	○			Ⓚ			Ⓜ	○							○					
3	Armature puller (Hitachi 3/8″)	Ⓔ		ⓀⒺ			⊗			○	⊗					○					○				
4-1	Armature puller (Mitsubishi 8 mm)								ⓀⒺ						⊗		○	○	⊗			⊗			
4-2	Armature puller (Mitsubishi 10 mm)			ⓀⒺ	Ⓔ		⊗	○	ⓀⒺ		⊗	Ⓔ		○	⊗				⊗			⊗	○	○	
5-1	Armature shock puller (Hitachi 3/8″)	Ⓔ		ⓀⒺ			⊗			○	⊗					○									with fig. No.7
5-2	Armature shock puller (Mitsubishi 8 mm)								ⓀⒺ						⊗		○	○	⊗			⊗			
5-3	Armature shock puller (Mitsubishi 10mm)			ⓀⒺ	Ⓔ		⊗		ⓀⒺ		⊗	Ⓔ		○	⊗				⊗			⊗	○		
6	Armature shock puller (Weight)	Ⓔ		Ⓔ	Ⓔ		○		Ⓔ	○	○	Ⓔ		○	○	○	○	○	○			○	○		with fig. No.5
7	Clutch and Flywheel magneto holding tool	○	○	Ⓚ	Ⓚ	○						Ⓜ	○												
8-1	Clutch holding tool									○															
8-2	Clutch holding tool						○				○	○	○	○	○										
8-3	Clutch holding tool		⊗		○	○			○																YF1. YJ1 and YG1K usable for minor model only
8-4	Clutch holding tool																		○	○	○	○	○	○	
9	Clutch holding tool		⊗																						YF1. YJ1 and YGIK unusable for minor model only
10	Primary drive gear puller															○	○	○							
11	Kick spring setting tool									○						○	○	○							
12	Valve cover tool									○															with fig. No.13
13	Crank case disassembling tool	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○				
14-1	Crank shaft setting tool	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			○	○				with fig. No. 15,16,17
14-2	Crank shaft setting tool																	○	○						
15	Crank setting bolt									○															with fig. No.14
16	Crank setting bolt	Ⓔ		Ⓔ	Ⓔ		○	○	Ⓔ		○	Ⓔ		○	○										
17-1	Crank setting bolt	Ⓚ	○	Ⓚ	Ⓚ				Ⓚ											○	○				
17-2	Crank setting bolt																	○							
17-3	Crank setting bolt																		○						
17-4	Crank setting bolt															○	○								
18	Spacer (for crank shaft setting tool)																			○	○				with fig. No.14,17
19-1	Crank shaft separator						○							○											
19-2	Crank shaft separator														○										
19-3	Crank shaft separator															○	○	○	○						
19-4	Crank shaft separator																					○	○	○	
20-0	Crank shaft assembling and disassembling jigs	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
20-1	Jig body	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	

Fig.No.	Name of Part	Models																						Remarks
		MF2·MJ2	YF1·YJ1·YG1K	MF3·DU7·U5	YF5·YJ5·YG5·6	FS1	YL1·YL3	YL5	YL2·YL2-1C	YA5	YA6·7	AT1	CT1	AS1·2	CS1·2	YD3	YDS2	YG5·YG5-1·CYM-1	YDS1·YM2·YM2C	DT1	RT1	YR1·2	YR3	R5	
20-2	Press metal	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
20-3	Push pin	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
20-4	Support plate	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
20-5	Wedge						○							○	○	○	○	○	○			○	○	○	
20-6	Crank width gauge (Stops) 38mm																								YF1,YJ1 and YG1K unusable for minor model only
20-7	Crank width gauge (Stops) 43 mm	⊗	⊗	○			○							○											
20-8	Crank width gauge (Stops) 45 mm		⊗		○																				YF1,YJ1 and YG1K usable for minor model only
20-9	Crank width gauge (Stops) 47 mm														○										
20-10	Crank width gauge (Stops) 50 mm							○	○	○	○	○	○			○	○								
20-11	Crank width gauge (Stops) 52 mm																	○	○						
20-12	Crank width gauge (Stops) 55.75 mm																					○	○	○	
20-13	Crank width gauge (Stops) 62 mm																			○	○				
20-14	Crank width gauge (Stops) 56mm											○	○												
21	Meter gear unit tool	○	○	○	○		○		○	○	○	○	○	○	○	○	○	○	○	○		○	○		
22	Steering nut wrench	○	○	○	○		○		○																
23	Slide metal locking tool									○															
24	Inner tube setting tool		○		○	○	○	○	○	○	○			○	○	○	○								
25	Attachment (Inner tube setting tool)															○	○							○	with fig. No.24
26-1	Inner tube setting tool																	⊗							
26-2	Inner tube setting tool																	⊗	○			○	○	○	
27	Dial gauge stand #1	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
28	Adapter (Dial gauge stand #1)																			○					with fig. No.27
29	Dial gauge stand #2	○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○	○			○	○		

Key to Symbol:

○ . . . . . Usable.

Ⓔ . . . . . Usable only for models equipped with electric starter or dynamo.

Ⓚ . . . . . Usable only for models equipped with kick starter or flywheel magneto.

⊗ . . . . . Usable or unusable due to design change. (Before the design change, it was unusable or usable.)

Ⓔ . . . . . Same as above, but applicable to models equipped with electric starter or dynamo.

HOW TO USE SPECIAL TOOLS

1. EXHAUST PIPE RING NUT WRENCH

The exhaust pipe ring nut wrench is designed to tightening and removing the exhaust pipe ring nut. It is usable for installing and removing the joint ring connecting the exhaust pipe to the muffler.

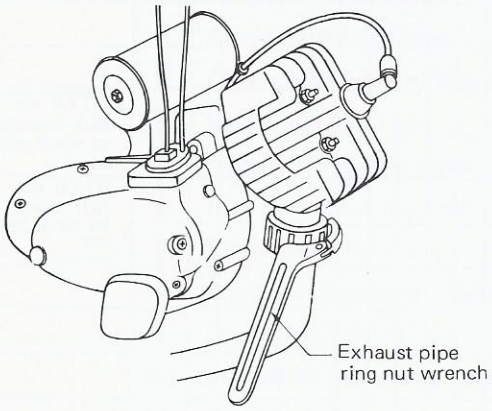


Fig. 1-1-2

2. FLYWHEEL MAGNETO PULLER

2–1 Removing the Flywheel Magneto

Procedure:

1) Insert the flywheel magneto puller into the tapped hole in the flywheel magneto.
2) Hold the puller with a wrench, and remove the flywheel by turning the handle of the puller.

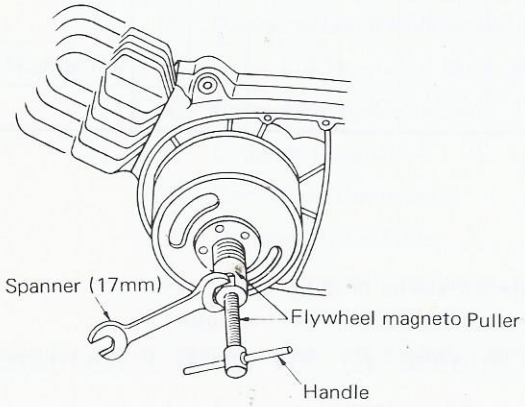


Fig. 1-2-1

3. ARMATURE PULLER BOLT

3–1 Removing the Armature

Procedure:

1) Insert the armature puller bolt into the armature.
2) Hold the armature with your hand.
   Remove the armature from the crankshaft by turning the armature puller bolt with a wrench.

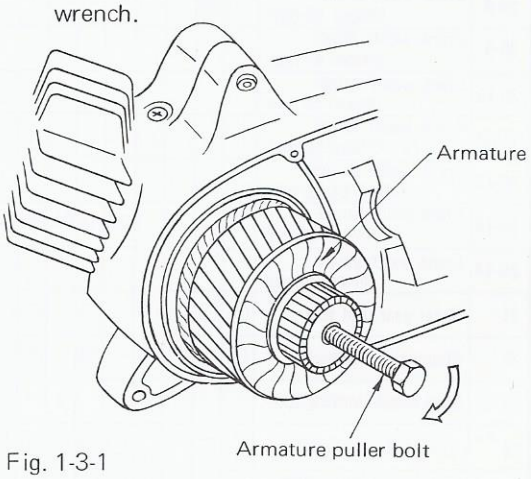


Fig. 1-3-1

4. ARMATURE SHOCK PULLER

Procedure:

1) Mount a weight on the shaft as shown in Fig. 4-1, and insert the shaft into the armature in screwing motion.
2) Strike the weight toward the shaft end with a steel hammer so that the armature will be removed.

Note:

This is a very effective method when the armature is stuck and difficult to be pulled off.

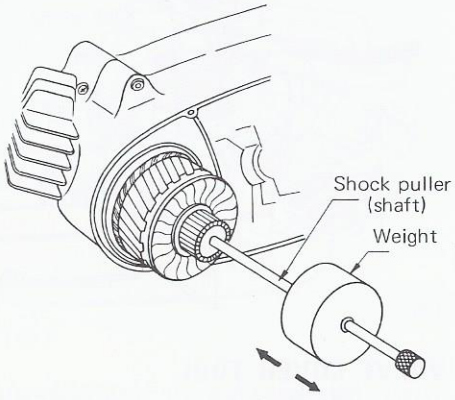


Fig. 1-4-1

5. CLUTCH AND FLYWHEEL MAGNETO HOLDING TOOL

5–1 Removing and Installing the Flywheel Magneto Lock Nut

Procedure:

1) Install the flywheel magneto holding tool (1) in the slots on the flywheel, and lock the flywheel magneto.
   Then remove or install the lock nut with a socket wrench.

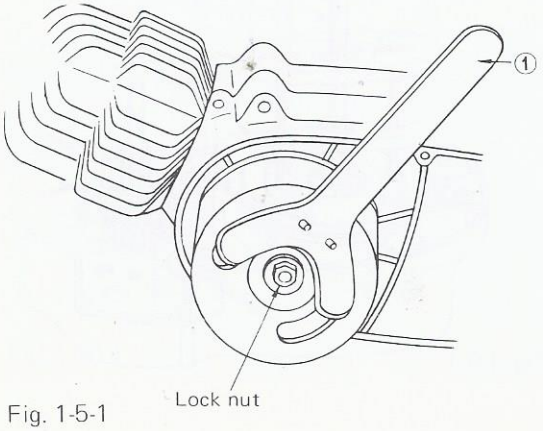


Fig. 1-5-1

5–2 Removing and Installing the Clutch Boss Lock Nut on the U5 and U7

Procedure:

1) As shown in Fig. 5-2, install this special tool on the clutch boss and lock the clutch. (In this case, the two protuberances of the tool are in two of the four holes of the clutch boss.)
2) Remove or install the lock nut by the use of a socket wrench.

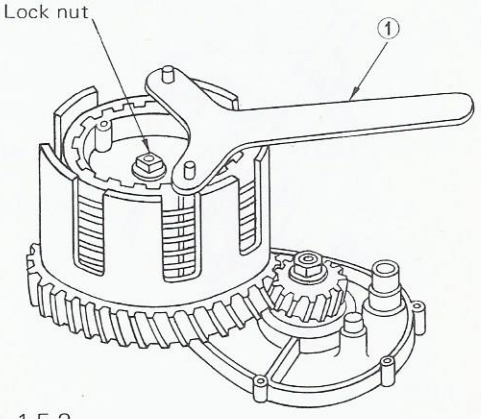


Fig. 1-5-2

6. CLUTCH HOLDING TOOL

6–1 Removing and Installing the Clutch Boss Lock Nut

Procedure:

1) Install the clutch holding tool (1) in the spline of the clutch boss as shown in Fig. 6-1.
2) Remove or install the lock nut by the use of a socket wrench (2).

* In addition, this special tool having Part No. 01-0403-00 is usable for removing and installing the shifter rod of the ball lock gear shifting mechanism employed for the Yamaha YG1 series.

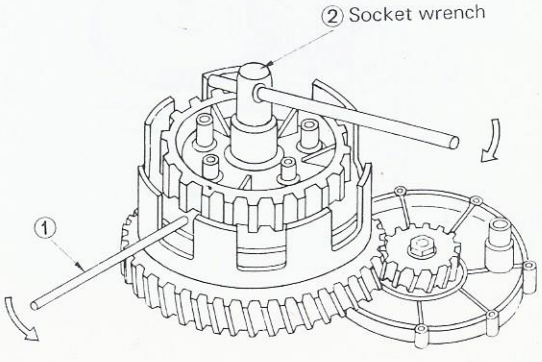


Fig. 1-6-1

6–2 Removing and Installing the Shifter Rod Lock Nut

Procedure:

1) As shown in Fig. 6-2, install the open-end of the clutch holding tool on the machined part of the shifter rod, and lock it. Then remove or install the lock nut.

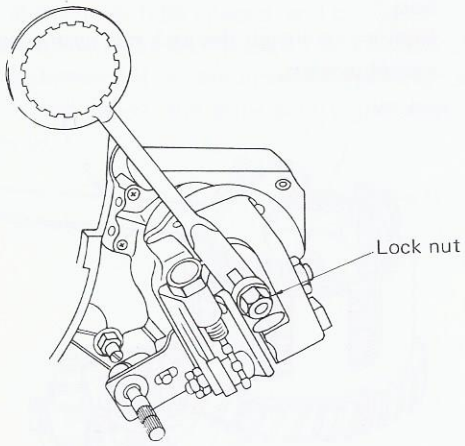


Fig. 1-6-2

7. PRIMARY DRIVE GEAR PULLER

Procedure:

1) Install the primary drive gear puller as shown in Fig. 7-1, and turn the handle.
   As the handle turns, the gear shaft moves downward and the gear can be removed.
2) This tool may be used for removal of other types of parts.

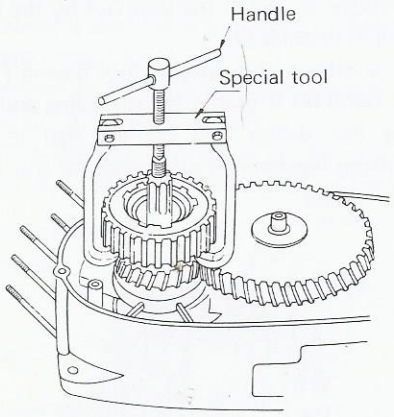


Fig. 1-7-1

8. KICK SPRING SETTING TOOL

Procedure:

1) Bring the tool so that the notch of the ring section of the tool is on the kick spring end.
2) Bring the spring bent end to the kick shaft hole.
3) Hold the spring with pliers, and insert the spring bent end into the kick shaft hole.

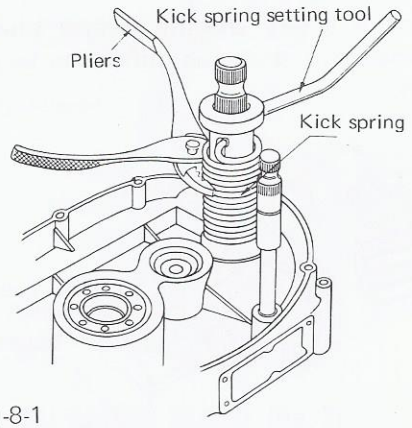


Fig. 1-8-1

9. VALVE COVER TOOL

9–1 Removing the Valve Cover (Usable for YA5 only)

Procedure:

1) When removing the valve cover, use the crankcase disassembling tool as well.

Note:

a) Take care not to damage the O-ring of the valve cover, when removing and reinstalling the cover.
b) When removing the valve cover, be sure to loosen the valve cover set screws.

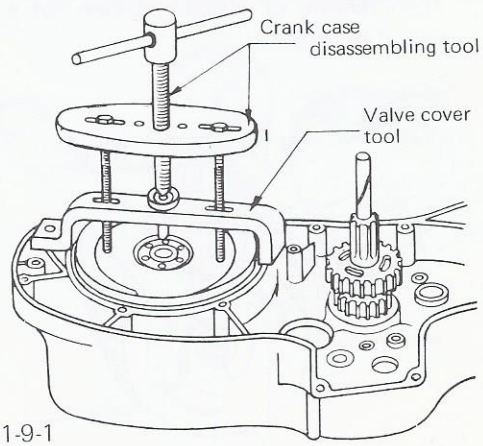


Fig. 1-9-1

9–2 Installing the Valve Cover (Usable for YA5 only)

Procedure:

1) Bring the tool so that the hole (a) is aligned with the knock pin of the crankcase.
2) Align the pin (b) with the valve cover locating hole.
3) Gently tap the valve cover with a plastic-tip hammer.

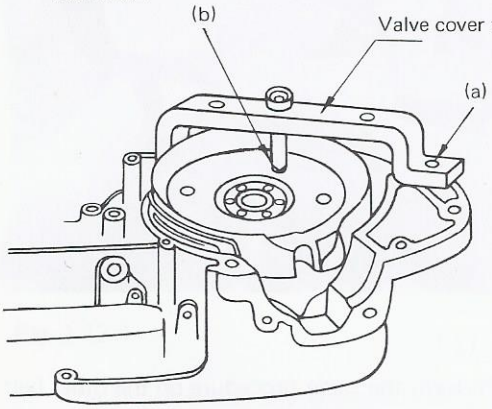


Fig. 1-9-2

10. CRANKCASE DISASSEMBLING TOOL

10–1 Dividing the Crankcase

Procedure:

1) Tightly fasten the 8 mm bolt (1), together with the tool body (2).
2) Alternately tap the crankcase sealing surface and main shaft with a plastic-tip hammer while turning the handle (4).
   Then push the crankshaft with the bolt (3), and the crankcase will be separated into the halves, right and left.

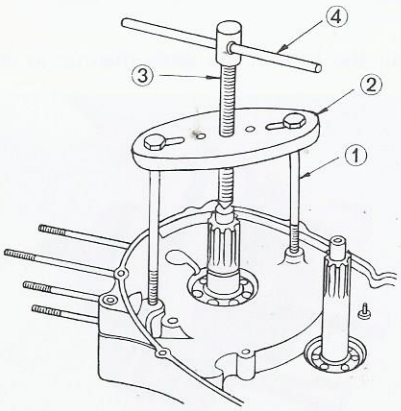


Fig. 1-10-1

10–2 Removing the Crankshaft Ass'y

1) As shown in Fig. 10-2, install the tool, and push out the crankshaft ass'y.

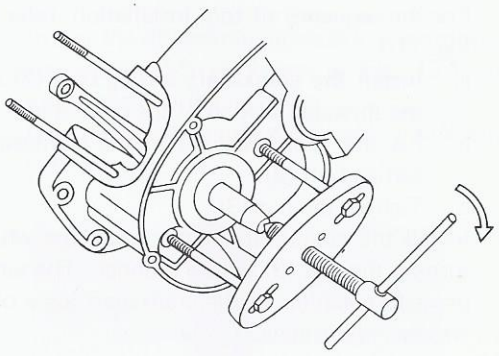


Fig. 1-10-2

11. CRANKSHAFT SETTING TOOL

11–1 Installing the Crankshaft Ass'y

Procedure:

1) For the sequence of tool installation, refer to Fig. 11-1.
   a. Install the crankshaft setting bolt (2) on the threaded section of the crankshaft.
   b. Fit the tool body (1) in the crankshaft setting bolt (2).
   c. Tighten the nut (3).
2) Install the crankshaft in the crankcase while turning the nut (3) with a spanner. The same procedure applies to the crankshaft ass'y of a two-cylinder engine.

Note:

On the DT-1, install the spacer (4) in tool body.

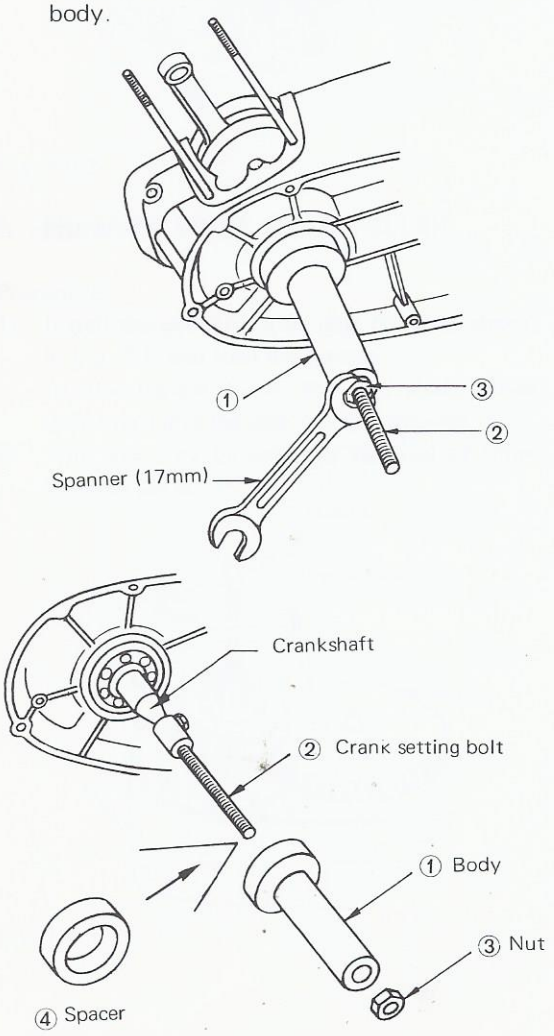


Fig. 1-11-1

12. CRANKSHAFT SEPARATING TOOL

12–1 Disassembling the Two-cylinder Crankshaft Ass'y

1) Insert the tool in the gap between the crank web and the crank cover.

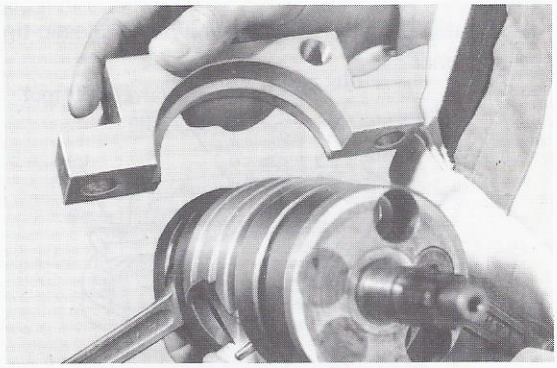


Fig. 1-12-1

2) Perform the same procedure on the other half of the crankshaft ass'y. Then tighten both halves.

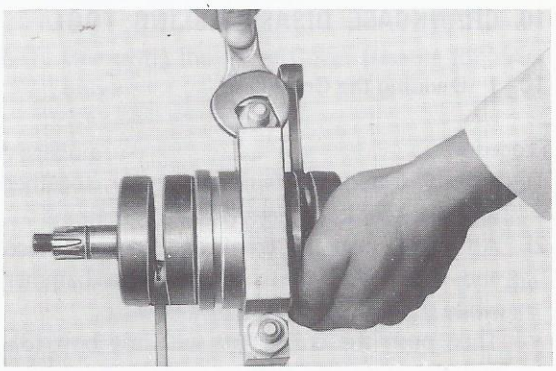


Fig. 1-12-2

3) Install the tool in the same manner as above.

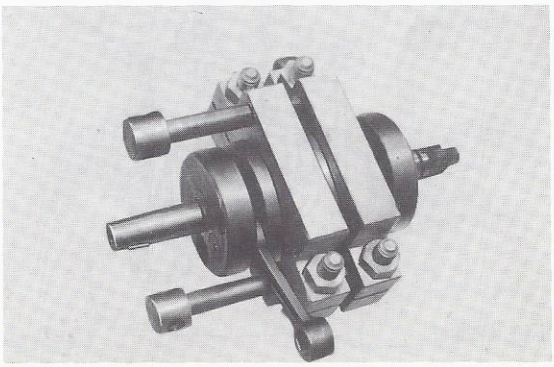


Fig. 1-12-3

4) Hold the installed tool with a vice. (You may continue the operation without the vice, but the sue of the vice will greatly facilitate the operation.)
Divide the crankshaft ass'y into the two halves, while alternately giving each bolt one turn.

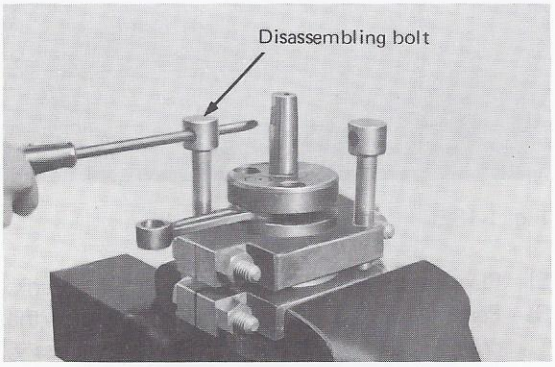


Fig. 1-12-4

5) The figure shows the crankshaft ass'y that is disassembled.

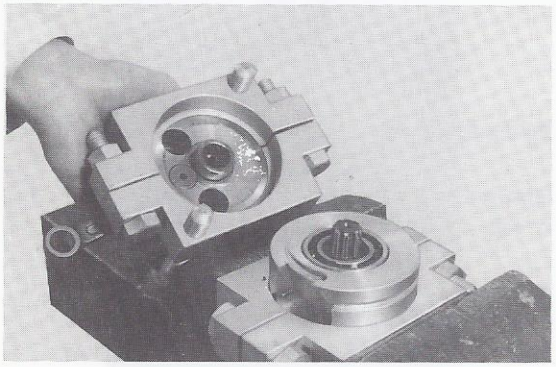


Fig. 1-12-5

13. CRANKSHAFT ASSEMBLING AND DISASSEMBLING JIGS

13–1 Removing the Crank Pin (For Both Single and Twin Cylinders)

1) Install the disassembling plate in the groove of the crank web as shown in Fig. 13-1, and install them in the jig body.
2) Disassemble the crankshaft ass'y by pushing it with the pin.

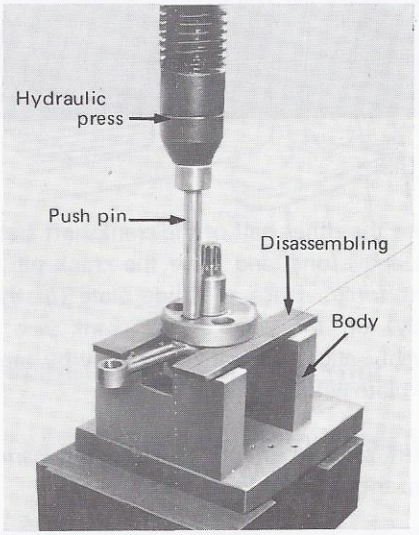


Fig. 1-13-1

13–2 Assembling the Crank Shaft Ass'y (Use a Hydraulic Press.)

1) Install the tool for determining the crankshaft ass'y width on the jig body.

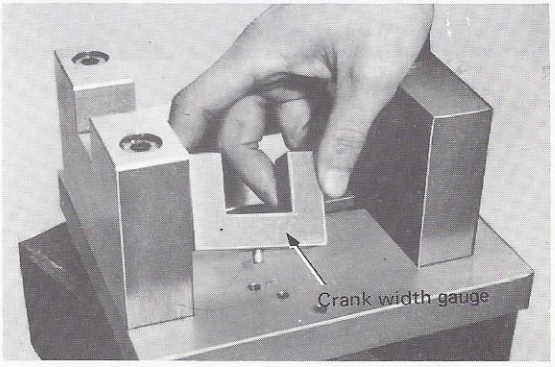


Fig. 1-13-2

2) Press-fit the crank pin in the crankshaft (one half of the ass'y), and install them on the jig body, then inserting the connecting rod into the jig body.

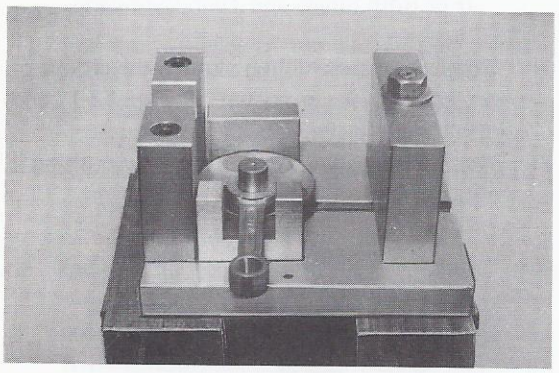


Fig. 1-13-3

3) Place the other half of the crankshaft ass'y on the above one, and drive the crank pin with light force. Place the slide plate (of the jig body) on the edge of the crank web, and roughly align the crankshaft ass'y by tapping the plate with a hammer lightly.

Note:

When striking the plate with the hammer, keep the lock nut loose tight.

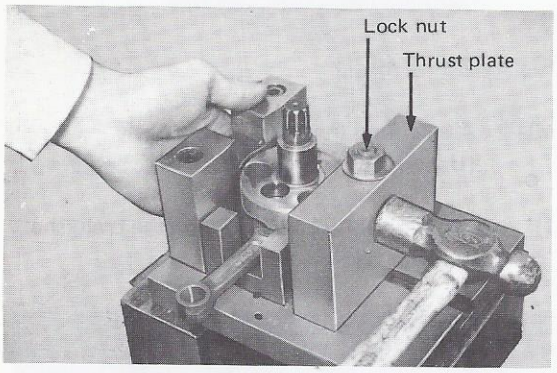


Fig. 1-13-4

4) Then fully tighten the lock nut.

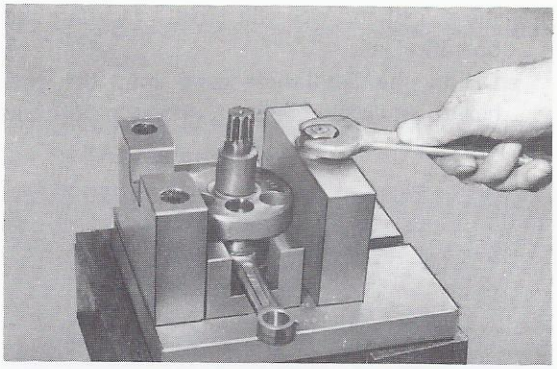
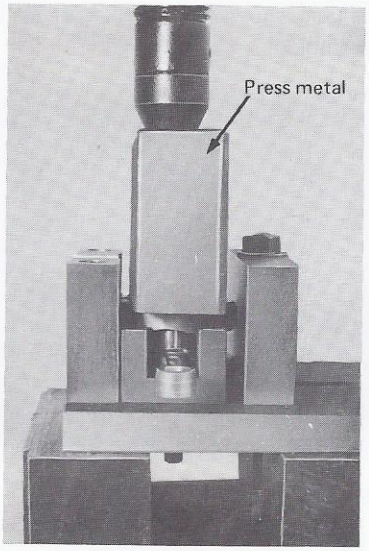


Fig. 1-13-5

5) Place the "press metal" on top of the crank.
6) Perform press right on the center line of the crank pin, and assemble the crankshaft ass'y. (Load: 5-8 tons)
7) Perform the alignment of the crankshaft ass'y.



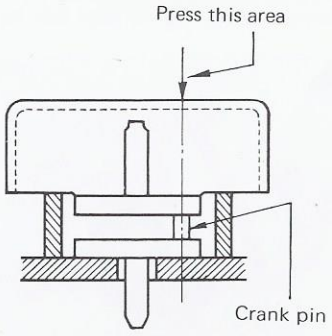


Fig. 1-13-6

8) When assembling the right and left sides of the crankshaft ass'y together, insert the support plate between them, and perform press operation.
9) Finally align the whole crankshaft ass'y.

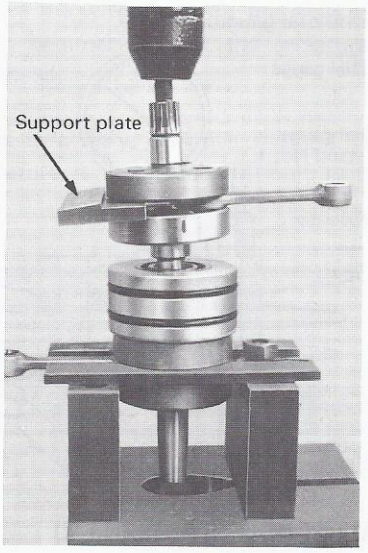


Fig. 1-13-7

14. METER GEAR UNIT TOOL

1) Remove the speedometer cable from the front hub.
2) Insert the tool into the hole where the cable was connected, and bring it into the slot of the meter gear unit.
3) Turn the handle, and remove the meter gear unit. (The same applies to the installation work.)

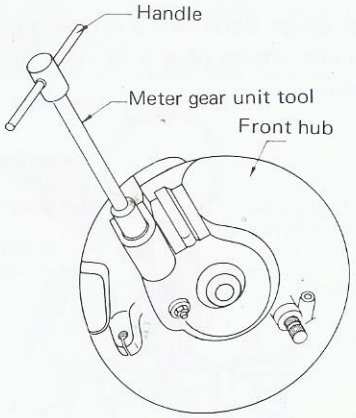


Fig. 1-14-1

15. STEERING NUT WRENCH

Procedure:
1) The tool is used for tightening and removing the steering nut.
2) This tool is also usable for tightening and removing the joint ring nut on the joint of the exhaust pipe and muffler.

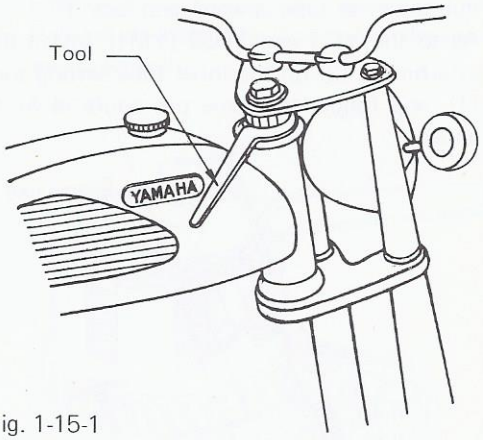


Fig. 1-15-1

16. SLIDE METAL LOCKING TOOL

16–1 Removing and Installing the Slide Metal (Usable for YA5 Only)

Procedure:
1) This tool is used for installing and removing the slide metal.

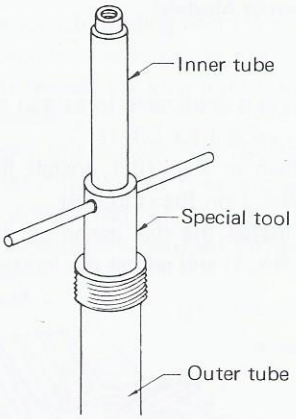


Fig. 1-16-1

17. INNER TUBE SETTING TOOL

17–1 Installing the Inner Tube

Procedure:

1) Insert the inner tube setting tool as shown in Fig. 17-1, and screw the inner tube end into the tapped hole.
   Pull the inner tube upward, and lock it.
2) As to the YD3 and YDS2 (YM1), install the attachment (2) on the inner tube setting tool (1), and follow the same procedure as in 1) above.

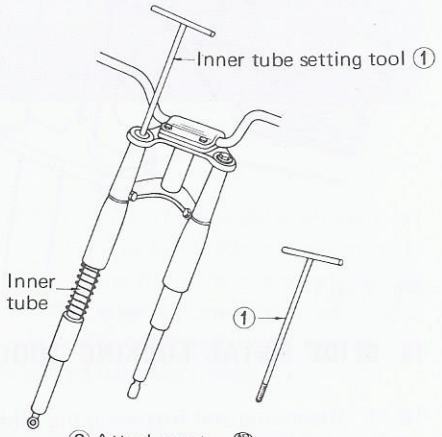


Fig. 1-17-1

18. DIAL GAUGE STAND (1) AND ADAPTER

18–1 For Ignition Timing Adjustment (Tourist Models)

Procedure:

The following is applicable to tourist models only. (All models except for DT-1)

1) As shown in Fig. 18-1, install the dial gauge stand No. 1 on the stud bolt.
2) Next, install the dial gauge on the dial gauge stand No. 1, and adjust the ignition timing.

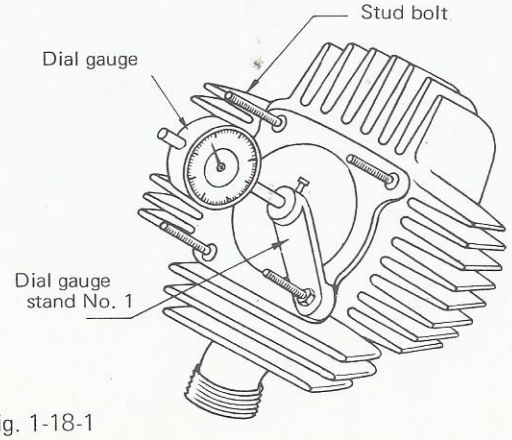


Fig. 1-18-1

18–2 For Ignition Timing Adjustment (DT-1)

Procedure:

1) As shown in Fig. 18-2, install the adapter (2), and then install the dial gauge stand No. 1 and the dial gauge.

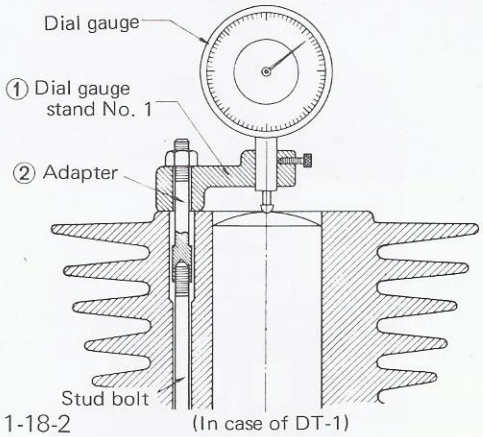


Fig. 1-18-2 (In case of DT-1)

19. DIAL GAUGE STAND (No. 2)

19–1 For Ignition Timing Adjustment

Procedure:

1) Screw dial gauge stand No. 2 into the cylinder head plug hole.
2) Remove the measuring needle from the dial gauge, and attach another measuring needle (of dial gauge stand No. 2) to the dial gauge.
3) As shown in Fig. 19-1, insert the dial gauge (attached to measuring needle) into the plug hole, and measure the ignition timing.

Note:

Dial gauge stand No. 2 is usable only for the cylinder whose plug is at right angles to the piston.

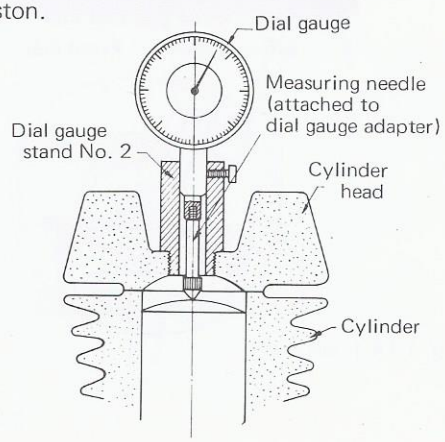
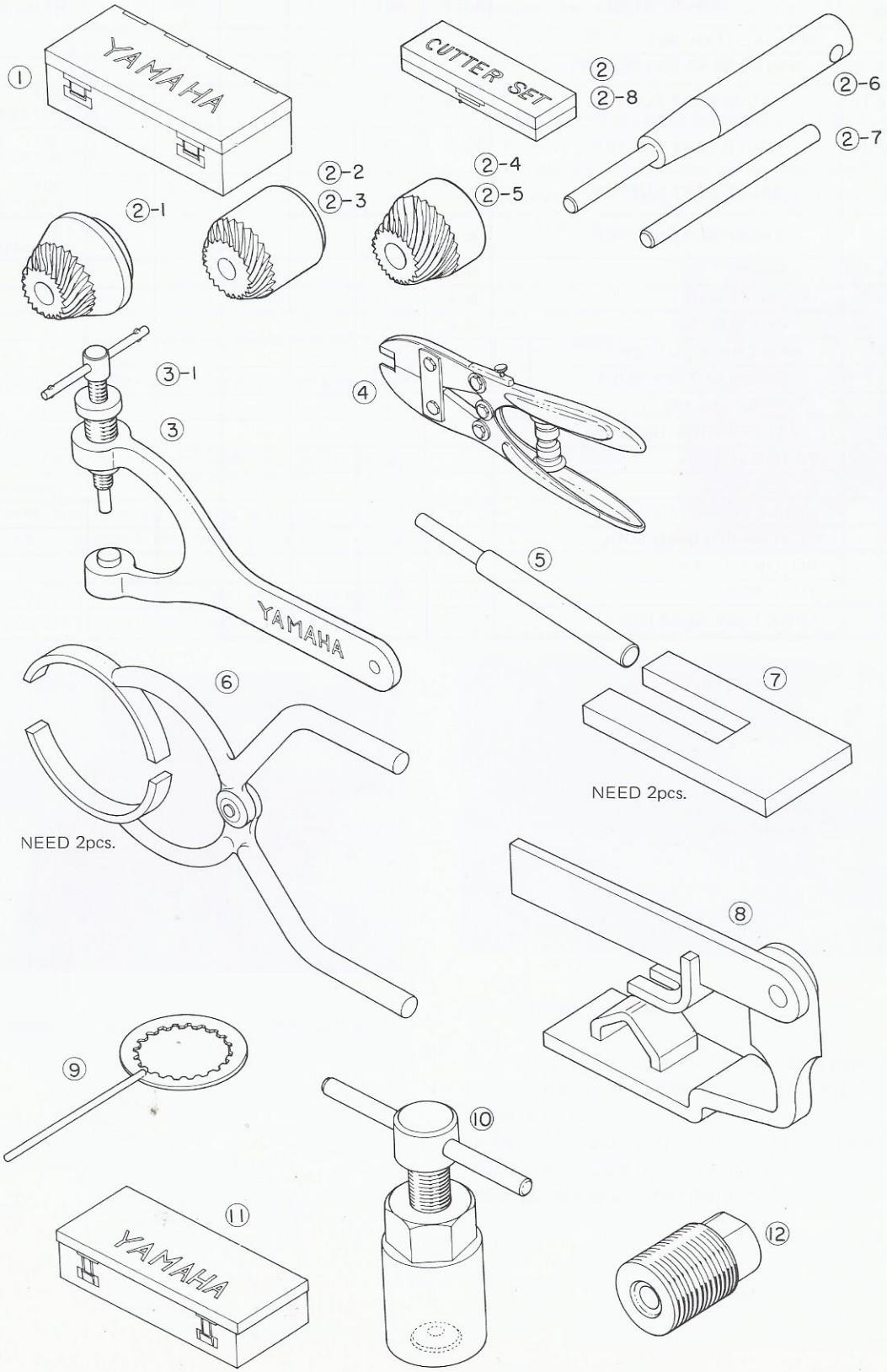


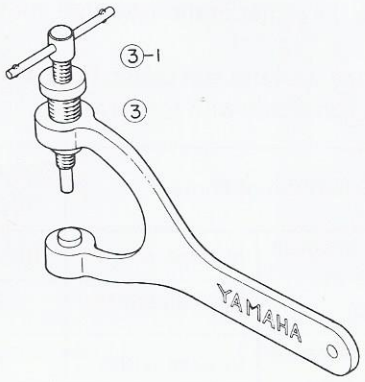
Fig. 1-19-1

XS650 How To Use Special Tool



REF. NO.	DESCRIPTION	S.R.P.	XS1					REMARKS
1	SPECIAL TOOL SET		○					
2	VALVE SEAT CUTTER SET		○					
2-1	VALVE SEAT CUTTER	N.A	○					65* INTAKE
2-2	VALVE SEAT CUTTER	N.A	○					45* INTAKE
2-3	VALVE SEAT CUTTER	N.A	○					45* EXHAUST
2-5	VALVE SEAT CUTTER	N.A	○					8R EXHAUST
2-6	PILOT	N.A	○					
2-7	CROSS BAR	N.A	○					
2-8	CUTTER BOX	N.A	○					
3	CAM CHAIN CUTTER		○					
3-1	CHAIN CUTTER BOLT		○					
4	CAM CHAIN JIG		○					
5	VALVE GUIDE TOOL		○					
6	PISTON SLIDER		○					
7	PISTON BASE		○					
8	VALVE SPRING TOOL		○					
9	CLUTCH HOLDING TOOL		○					
10	ROTOR PULLER		○					
11	TOOL BOX	N.A	○					
12	FORK TUBE ADAPTOR		○					

1. Cutting the Cam Chain



To cut the cam chain the following steps should be taken.

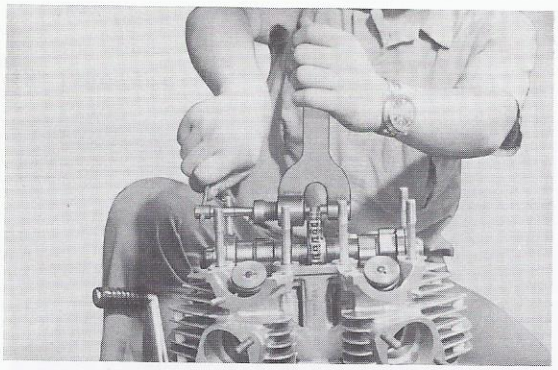
Procedures:

(1) Hold the cam chain with its joint facing upward.

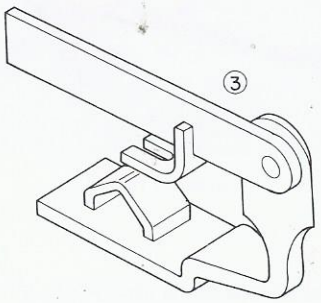
(2) Cover the opening of the crankcase with a cloth to prevent the chain joint from falling into it.

(3) Hold both ends of the chain with wires so that the chain will not fall into the crankcase.

(4) Cut the chain.



2. Disassembling the Valve and Valve Spring



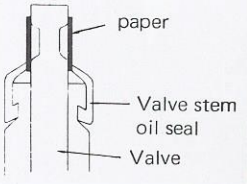
Check the valve and valve seat for wear. To measure the fatigue of the valve spring, use the valve compression.

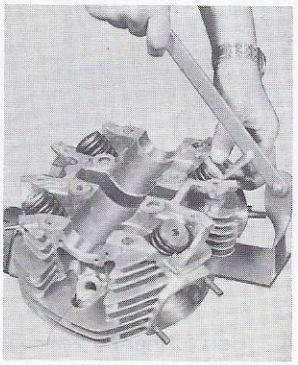
First compress the spring and remove the cotter pin.

Remove the valve, valve spring and spring retainer.

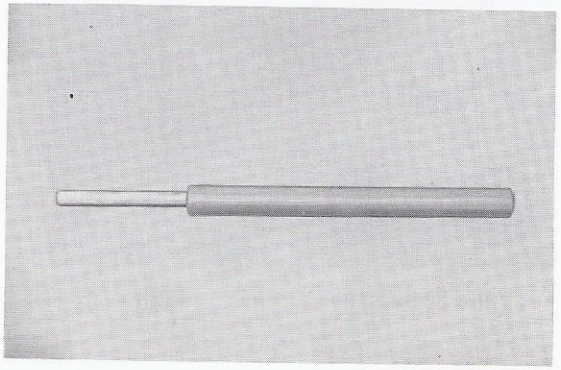
Note:

When pulling out the valve take care not to damage the lip of the oil seat fitted to the valve stem.





3. Valve Guide-removal and Installation



Valve Guide Remover

If a valve guide is found worn more than wear limit, it should be replaced. To remove it, use the guide remover.

(Keep in mind that valve guide replacement requires to replace the valve, too.)

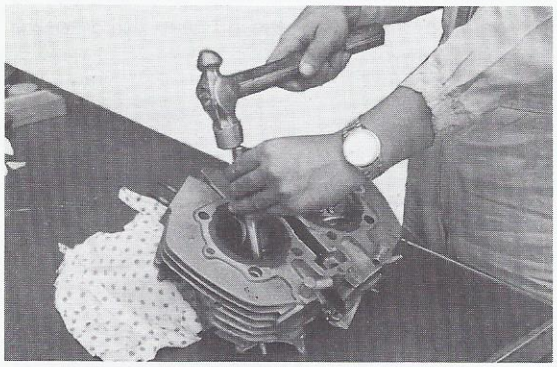
Valve guide inside — Normal diameter

Intake and exhaust:

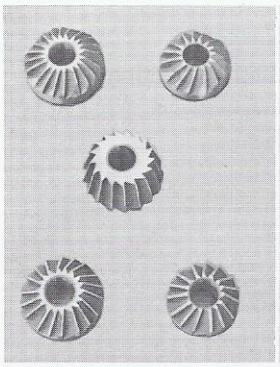
$$8\ \text{mm}\ ^{+0.019}_{-0.010}\ \text{mm}$$

Clearance limits:

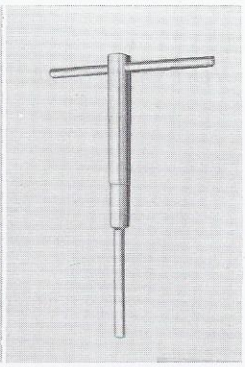
Intake:	0.08 mm
Exhaust:	0.10 mm



4. Correcting the Valve Seat



Valve Seat Cutter



Pilot

Check the valve seat and valve face for sealing. If sealing is found not good, correct the valve seat with the valve seat cutter.Three types of seat cutters are available.

Intake	8R	65°	45°
Exhaust	8R		45°

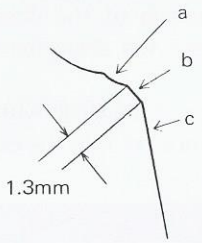
Procedures:

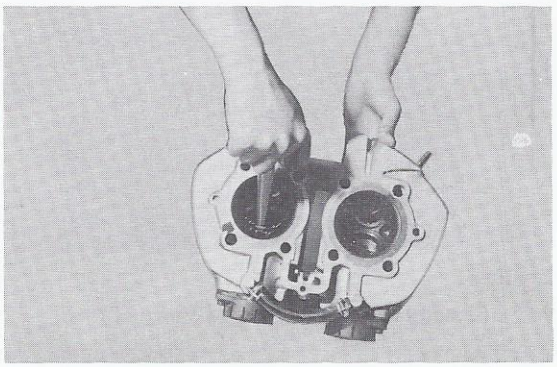
(1) To smooth out the "a" area, use an 8R cutter.
(2) For the "b" area, use a 45° cutter.
(3) For the "c" area, use a 65° cutter.
(The above (1), (2) and (3) are applicable to both intake and exhaust valves.)

* To check whether the valve is in good contact with the valve seat, coat the valve face with Prussian blue. Put the valve in position and rotate it with light pressure. If the Prussian blue transfers evenly to the center of the valve face, the seating is good.

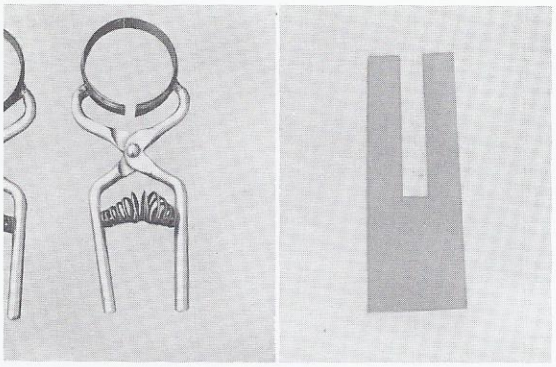
When using the valve seat cutter, hold it in place so that it is concentric with the valve seat.

Condition of contact		Order of use of cutters
Greater pressure at center of valve seat	In large width	8R → 65°
	In small width	45°
Greater pressure at outer edge of valve seat	In large width	8R
	In small width	8R → 45°
Greater pressure at inner edge of valve seat	In large width	65°
	In small edge	65° → 45°





5. Cylinder Installation



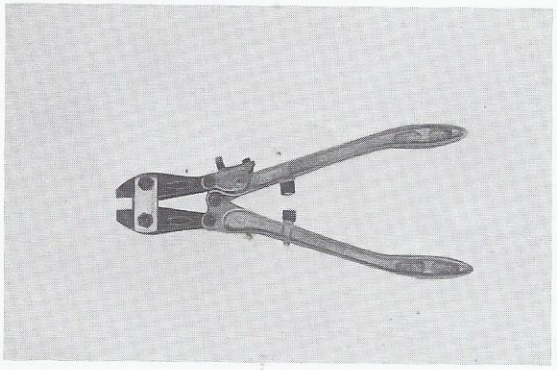
Piston Slider (1) Piston Base (2)

When installing the cylinder over the piston, the piston must be locked and the piston rings must be held tight against the piston. For this purpose, the piston slider and the piston base are used.
Before installing the cylinder over the piston, check for the following points.
Procedures:

(1) Facing of the piston
The arrow mark on the piston head must point to the exhaust valve side.
(2) Piston pin circlip ends
The piston pin circlip ends should not be in the notch.
(3) Piston ring ends
Piston ring ends should be positioned as shown below:

* Coat the piston and cylinder wall with oil, and install the cylinder over the piston with care.

6. Cam Chain Connection

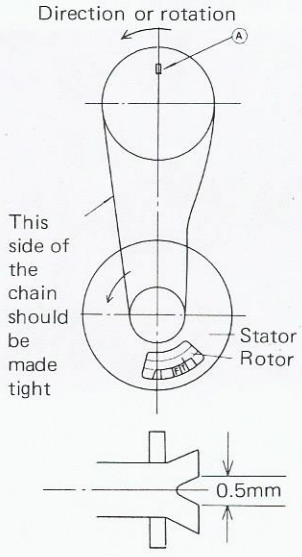


Chain Riveter

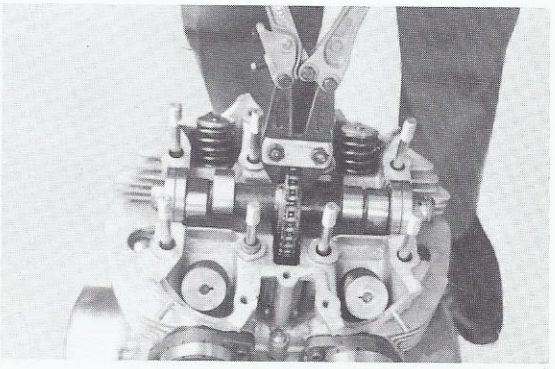
The riveting of the cam chain should be performed in the following order:

Procedures:

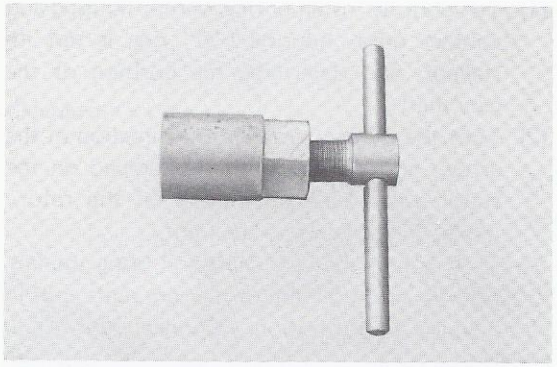
(1) Temporarily install both governor housing and contact point housing ("O" ring is not installed), and determine the position of the cam shaft.
(2) Turn the dynamo rotor in the direction of the arrow, and set the T mark stamped on the stator with the match mark on the rotor. (Refer to the figure to the right.)
(3) Then rotate the cam shaft and bring the key way (in the A section of the cam shaft end) in a horizontal position. Connect the chain ends.
(4) Always use a new chain joint pin. Joint should be caulked so that the joint head opens apart 0.5 mm as shown in the figure below.
(5) Adjust the chain tension with the chain tensioner.



Caulking



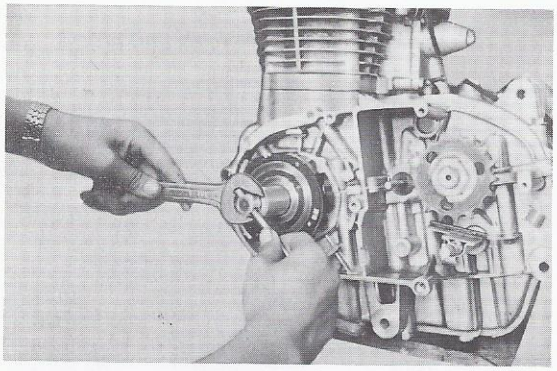
7. Dynamo Rotor Puller



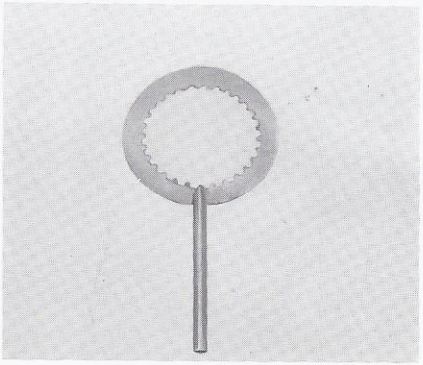
Dynamo Rotor Puller

After removing the stator assembly, install the rotor puller on the dynamo rotor and pull it out.

* When removing the rotor, take care not to mislocate the woodruff key.

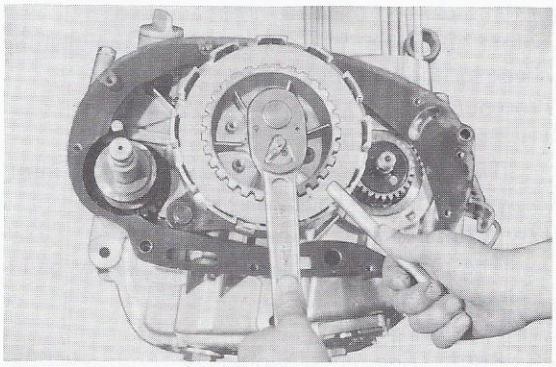


8. Clutch Housing – Installation and Removal



Clutch Locking Tool

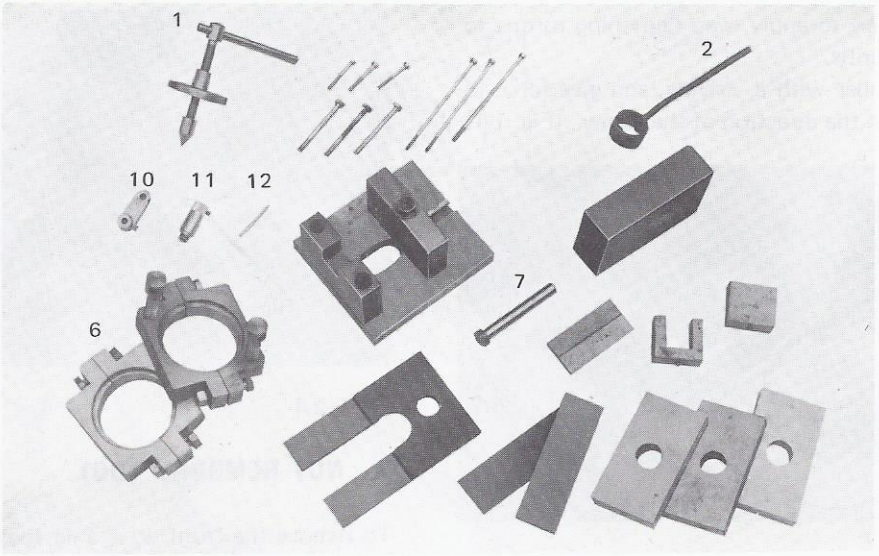
Install the clutch locking tool on the clutch housing to lock the clutch.

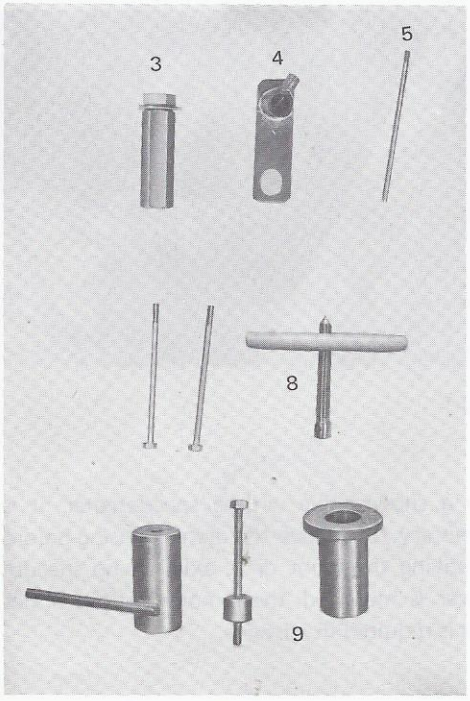


CHAPTER 2.

HOW TO USE SPECIAL TOOLS FOR SNOWMOBILES.

CHAPTER 2. SNOWMOBILES





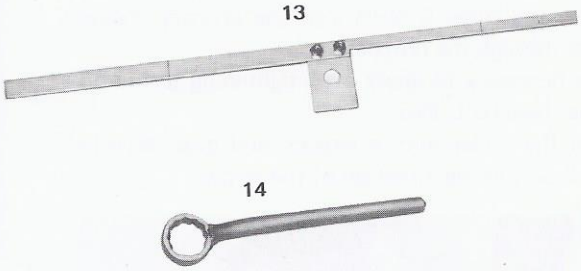


Fig. 2-1-1

1. Flywheel puller
2. Ring nut remover
3. Dial gauge stand No. 1 for single Engine
4. Dial gauge stand No. 2 for single Engine
5. Dial gauge adapter for single Engine
6. Crankshaft ass'y separater jig
7. Crankshaft ass'y disassembly and reassembly jigs
8. Crankcase disassembling tool
9. Crankshaft setting tool
10. Dial gauge stand No. 1 for twin Engine
11. Dial gauge stand No. 2 for twin Engine
12. Dial gauge adapter for twin Engine
13. Sheave gauge
14. Nut removal tool

1. FLYWHEEL MAGNETO PULLER

Position the magneto puller so that the A bolt end is on the crankshaft end. Screw the three B bolts into the flywheel magneto stater holes through the puller's holes.
It is necessary to apply even tightening torque to these three bolts.
Hold the puller with a wrench, and give force to these bolts in the direction of the arrow. (Fig. 1-1)

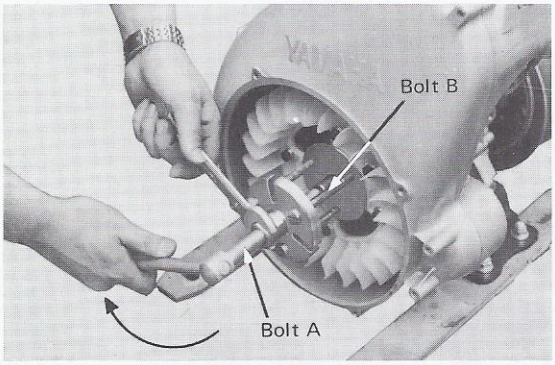


Fig. 2-1-2

In a similar manner, the primary sheave can be pulled out by using this puller. Position the puller so that the A bolt end is on the crankshaft end.
Screw the three C bolts into the primary sheave holes through the notches.
It is necessary to apply even tightening torque to these three bolts also.
Hold the puller with a wrench and give force to the A bolt in the direction of the arrow.

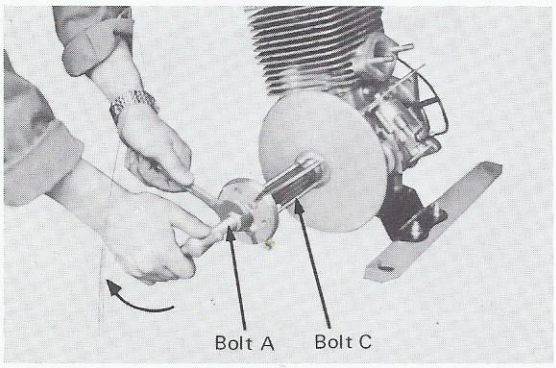


Fig. 2-1-3

2. RING NUT REMOVER

The ring nut wrench is used to loosen the ring nut fastening the primary sheave, bearing, and inner sheave together.

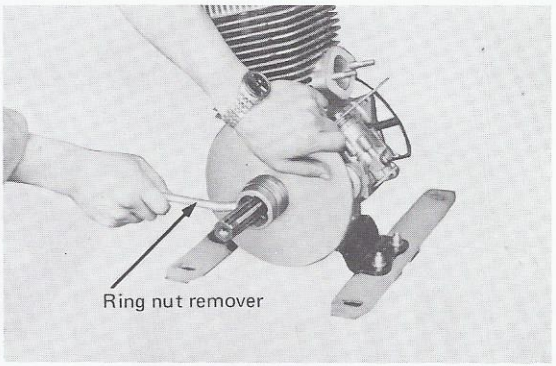


Fig. 2-2-1

3. NUT REMOVAL TOOL

To remove the front drive axle, loosen the 29 mm nut by using the nut removal tool.

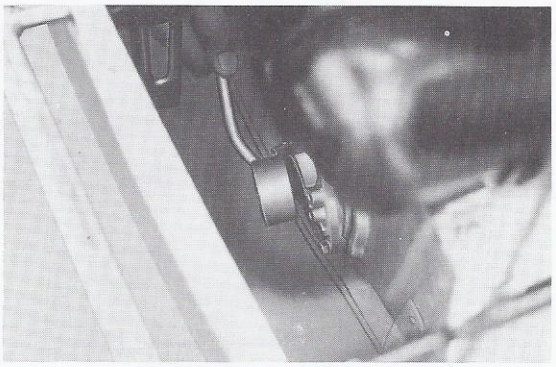


Fig. 2-3-1

Note:

On a snowmobile with a speedometer, it is necessary to remove the meter housing before removing the front drive axle. If no speedometer is mounted, the removal of the rubber cap is required in advance.

4. SHEAVE GAUGE

The sheave gauge is used to check the distance between the primary sheave and the secondary sheave or to correct the primary shaft and the secondary shaft if they are out of alignment.
To check the distance between the shafts, position the sheave gauge so that its holder is on the side opposite the sheave.
To correct shaft alignment, position the sheave gauge with the holder in contact with the inner side of each sheave.

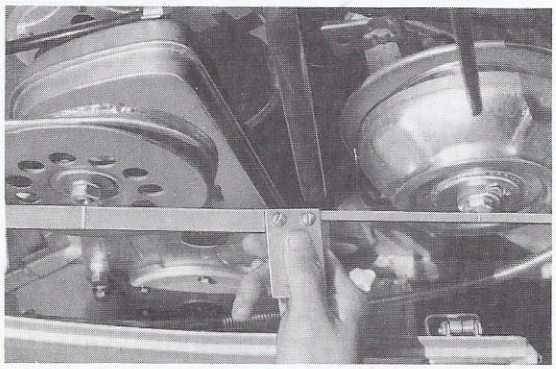


Fig. 2-4-1

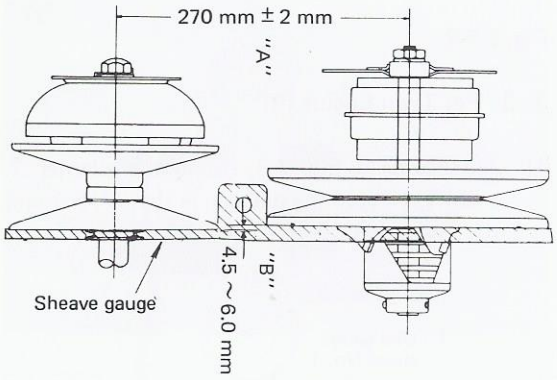


Fig. 2-4-2

5. CRANKCASE DISASSEMBLING TOOL

Position the tool so that the "A" bolt end is on the crankshaft end. Screw the two "B" bolts into the holes tapped in the crankcase right half.
It is necessary to tighten the bolts evenly. Next, give force to the "A" bolt head, and the crankcase can be disassembled.

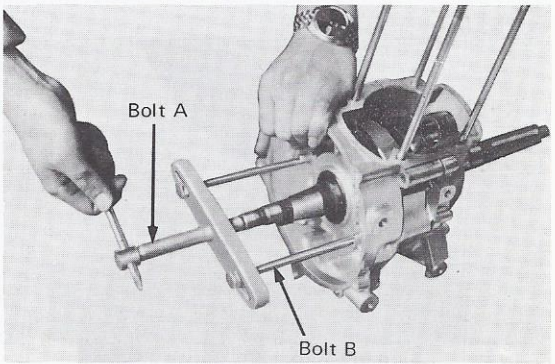


Fig. 2-5-1

In a similar manner, by using the crankcase disassembling tool from the crankshaft sheave side, the crankshaft ass'y can be separated from the crankcase left half.

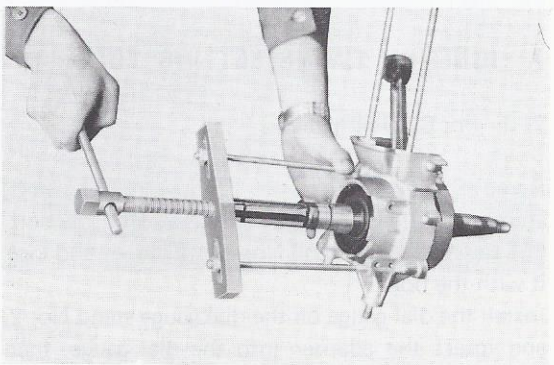


Fig. 2-5-2

6. CRANKSHAFT SETTING TOOL

Screw the crankshaft setting tool onto the crankshaft, and furthermore, put the bolt into the crankshaft setting tools B and A through the crankcase left half, then tighten with A lock nut. Hold the setting tool "A" holder so that it will not rotate, and turn the nut with a wrench in the direction of the arrow. The crankshaft will be pulled in.

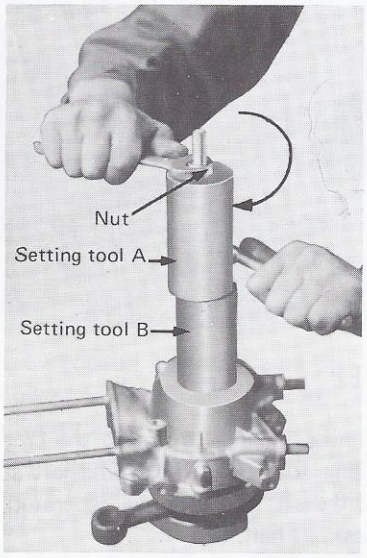


Fig. 2-6-1

7. IGNITION TIMING SETTING TOOL

7–1 For Single Engine

Remove the nut from the cylinder holding bolt, and install the dial gauge stand No. 1 on the bolt. Put the dial gauge stand No. 2 into No. 1, and lock it with the bolt.
Install the dial gauge on the dial gauge stand No. 2, and insert the adapter into the dial gauge, then adjust the ignition timing.

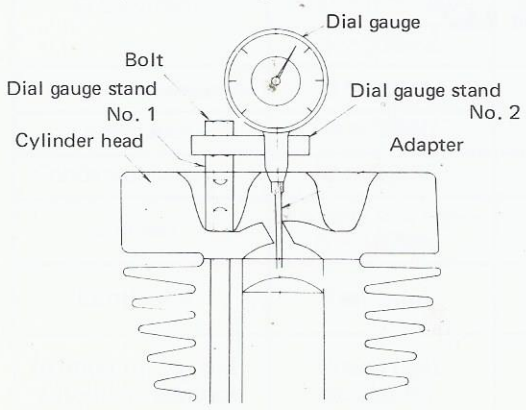


Fig. 2-7-1

7–2 For Twin Engine (A)

1) Screw dial gauge stand No. 2 into the cylinder head plug hole.
2) Remove the measuring needle from the dial gauge, and attach another measuring needle (of dial gauge stand No. 2) to the dial gauge.
3) As shown in Fig. 7-2, insert the dial gauge (attached to measuring needle) into the plug hole, and measure the ignition timing.

Note:
Dial gauge stand No. 2 is usable only for cylinders whose plug is in line with piston travel.

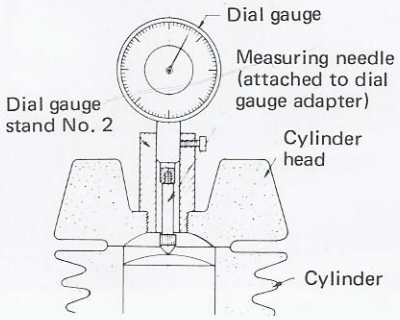


Fig. 2-7-2

7–3 For Twin Engine (B)

1) As shown in Fig. 7-3, install the adapter 2, and then install the dial gauge stand No. 1 and the dial gauge.

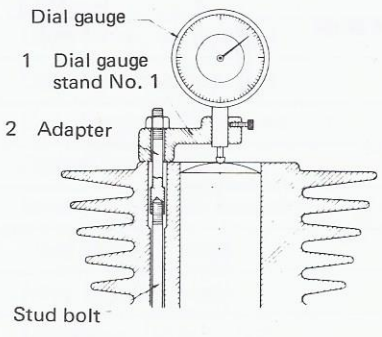


Fig. 2-7-3

8. CRANKSHAFT SEPARATOR TOOL

8–1 Disassembling the two-cylinder crankshaft ass'y

1) Insert the tool in the gap between the crank web and the crank cover.

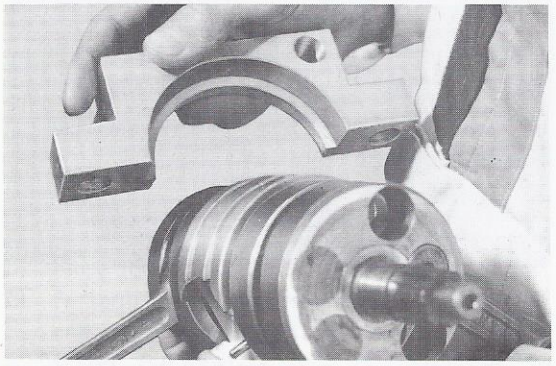


Fig. 2-8-1

2) Perform the same procedure on the other half of the crankshaft ass'y. Then tighten both halves.

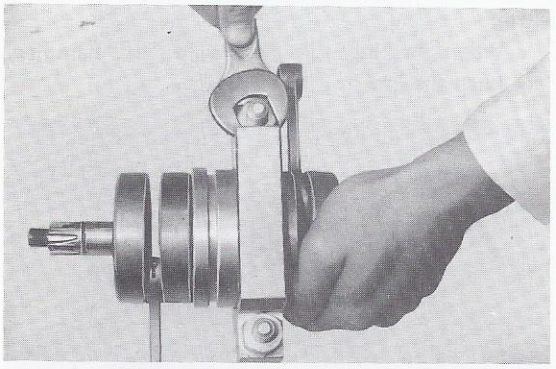


Fig. 2-8-2

3) Install the tool in the same manner as above.

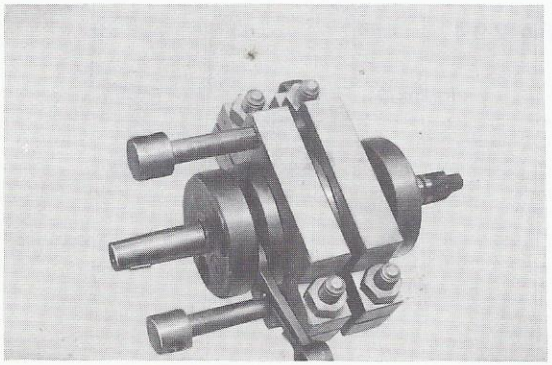


Fig. 2-8-3

4) Hold the installed tool with a vice. (You may continue the operation without the vice, but the sue of the vice will greatly facilitate the operation.)
Divide the crankshaft ass'y into the two halves, while alternately giving each bolt one turn.

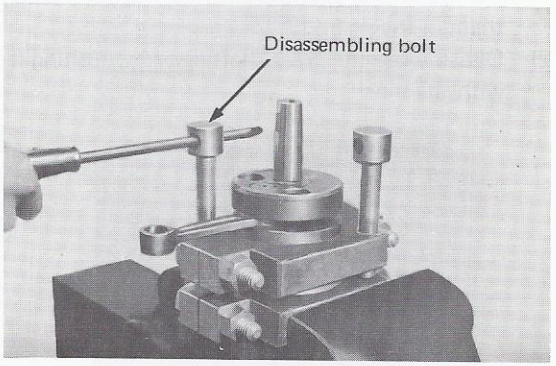


Fig. 2-8-4

5) The figure shows the crankshaft ass'y that is disassembled.

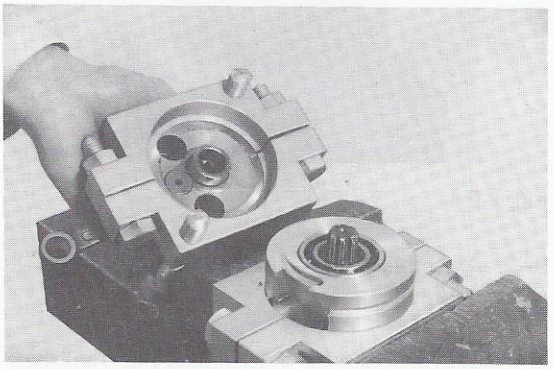


Fig. 2-8-5

9. CRANKSHAFT ASSEMBLING AND DISASSEMBLING JIGS

9–1 Removing the Crank Pin (For Both Single and Twin Cylinders)

1) Install the disassembling plate in the groove of the crank web as shown in Fig. 9-0, and install them in the jig body.
2) Disassemble the crankshaft ass'y by pushing it with the pin.

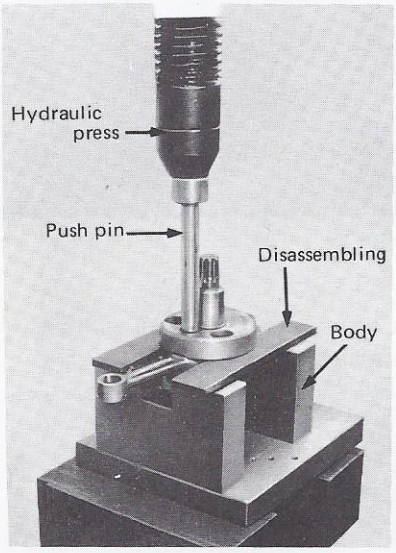


Fig. 2-9-1

9–2 Assembling the Crankshaft Ass'y (Use a hydraulic press.)

1) Install the tool for determining the crankshaft ass'y width on the jig body.

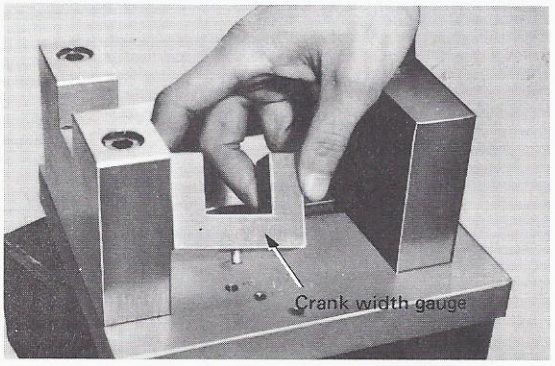


Fig. 2-9-2

2) Press-fit the crank pin in the crankshaft (one half of the ass'y), and install them on the jig body, then inserting the connecting rod into the jig body.

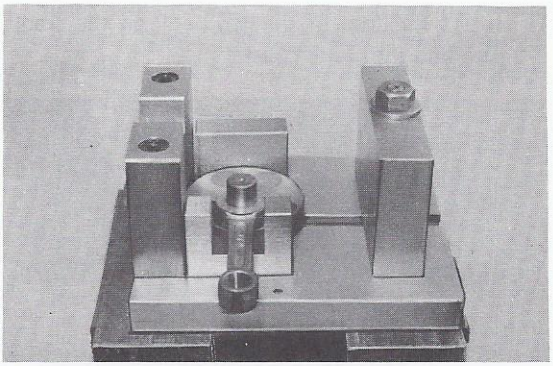


Fig. 2-9-3

3) Place the other half of the crankshaft ass'y on the above one, and drive the crank pin with light force. Place the slide plate (of the jig body) on the edge of the crank web, and roughly align the crankshaft ass'y by tapping the plate with a hammer lightly.

Note:

When striking the plate with the hammer, keep the lock nut loose tight.

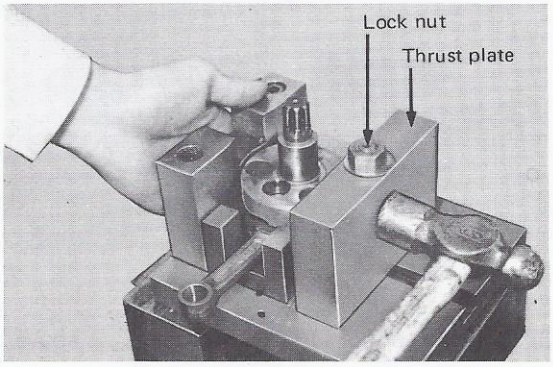


Fig. 2-9-4

4) Then fully tighten the lock nut.

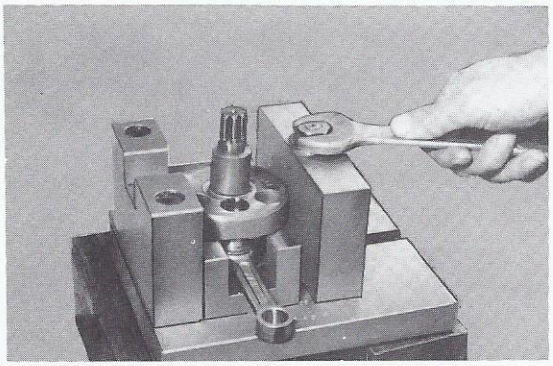
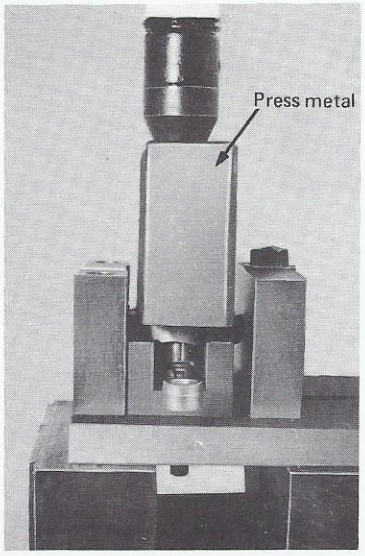


Fig. 2-9-5

5) Place the "press metal" on top of the crank.
6) Perform press right on the center line of the crank pin, and assemble the crankshaft ass'y. (Load: 5-8 tons)
7) Perform the alignment of the crankshaft ass'y.



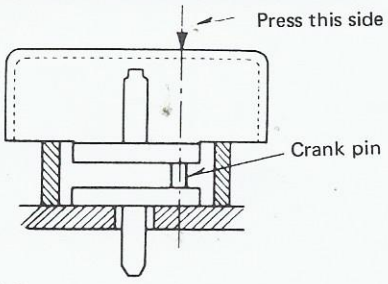


Fig. 2-9-6

8) When assembling the right and left sides of the crankshaft ass'y together, insert the support plate between them, and perform press operation.
9) Finally align the whole crankshaft ass'y.

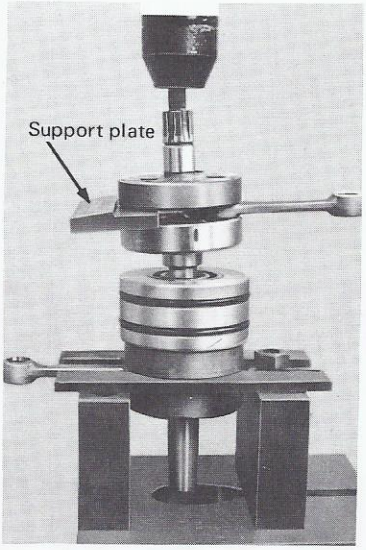


Fig. 2-9-7

CHAPTER 3

HOW TO USE ELECTRO-TESTER

CHAPTER 3. ELECTRO-TESTER

1. MAIN PARTS AND ACCESSORIES

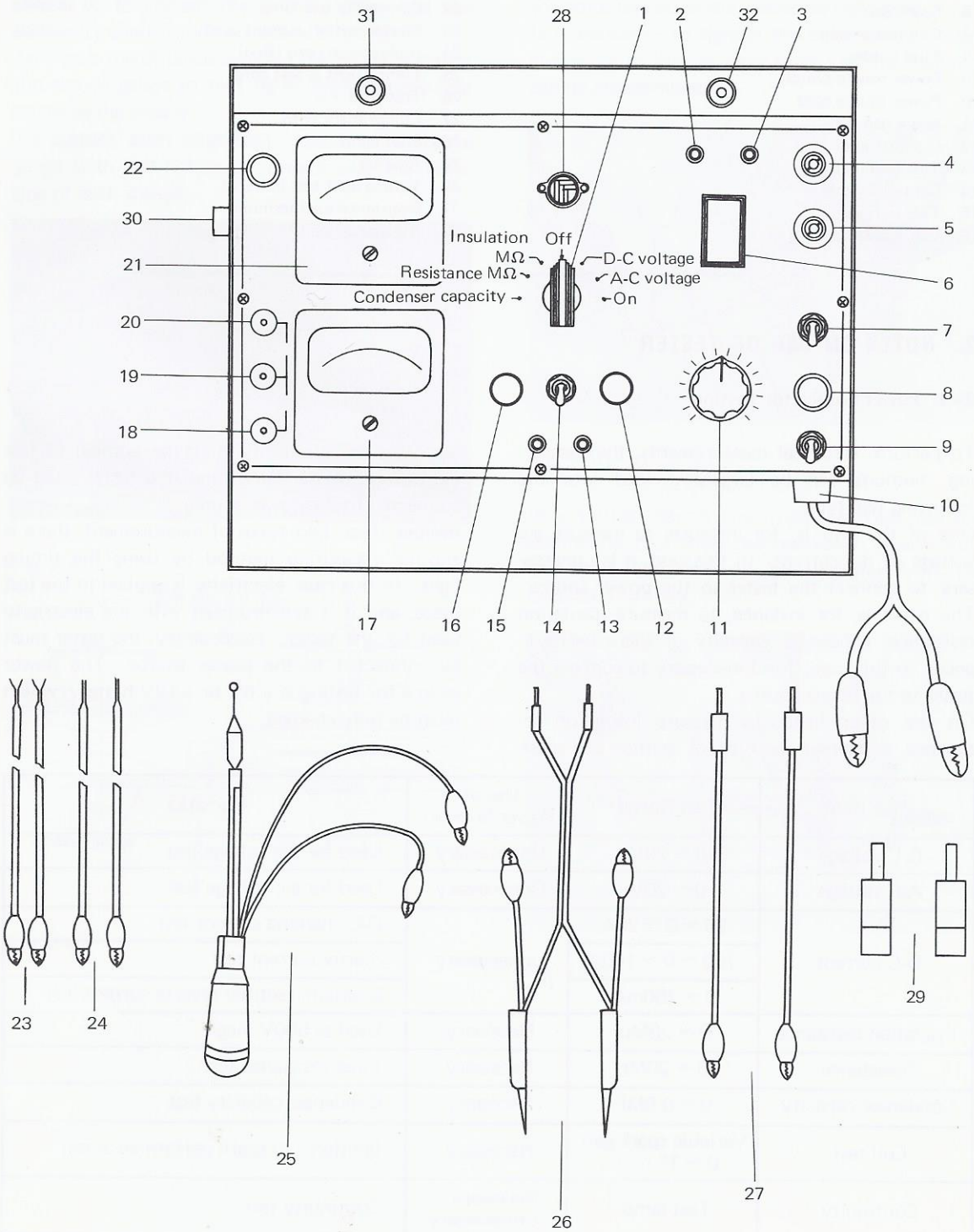


Fig. 3-1-1

1. Selector switch
2. Coil test PRIMARY negative terminal
3. Coil test PRIMARY positive terminal
4. Coil test SECONDARY negative terminal
5. Coil test SECONDARY positive terminal
6. Spark gap
7. Coil test switch
8. Fuse holder
9. Power source switch
10. Power source cord
11. Spark gap dial
12. O adjust knob
13. Test terminal +
14. Cal-test switch
15. Test terminal –
16. Cap. knob
17. Amp. meter
18. Starter amp. test terminal
19. Starter amp. test terminal or, amp. test terminal
20. Current terminal
21. Main meter
22. Continuity test lamp
23. Starter test or, current cord
24. Hightension cord (Red)
25. Timing light & test cord
26. Test cord + –
27. Coil primary cord
28. Pilot lamp
29. Adapter
30. Timing light test terminal
31. Resistance load terminal
32. Resistance load terminal

2. NOTES ON USE OF TESTER

2–1 Power Source for Testing

To perform electrical measurements, the measuring methods can be largely divided into the following two types:

One of the two is, for instance, to measure a-c voltage or d-c current. In this case, it is unnecessary to connect the tester to the power source.

The other is, for instance, to measure insulation resistance, condenser capacity or spark performance. In this case, it is unnecessary to connect the tester to the power source.

On the other hand, to measure insulation resistance, condenser capacity, or ignition coil spark performance, electricity must be applied to test pieces, and at the same time, the tester must be connected to the power source.

Besides these two types of measurement, there is another measuring method by using the timing light. In this case, electricity is applied to the test piece, and it is synchronized with the electricity used for the tester. Accordingly, the tester must be connected to the power source. The power source for testing is a 6V or a 12V battery, which must be fully charged.

Test Item	Test Range	Use of Power Source	Remarks
D-C voltage	0 ~ 20V	Unnecessary	Used for d-c voltage test
A-C voltage	0 ~ 20V	Unnecessary	Used for a-c voltage test
D-C current	20 ~ 0 ~ 20A	Unnecessary	D-C charging current test
	100 ~ 0 ~ 100A		Starter current test
	0 ~ 200mA		Selenium rectifier reverse current test
Insulation resistance	0 ~ 20MΩ	Necessary	Used as 500V mega
Resistance	0 ~ 20MΩ	Necessary	Inner resistance test
Condenser capacity	0 ~ 0.5MF	Necessary	Condenser capacity test
Coil test	Variable spark gap 0 ~ 15 mm	Necessary	Ignition coil spark performance test
Continuity	Test lamp	Necessary Unnecessary	Continuity test
Ignition timing and automatic advance	Timing light (accessory)	Necessary	Used to check ignition timing match marks while the engine runs, by use of the timing light.

2–2 Connecting Methods of Tester

1) The connection method differs between a voltmeter and an ammeter. Any incorrect connection will cause the meter to burn out. Voltage is likened to the water pressure caused by the difference of the water level between the A tank and the B tank as shown in Fig. 3-2-1. Accordingly, to determine the voltage, a voltmeter must be connected in parallel to the A and B terminals.

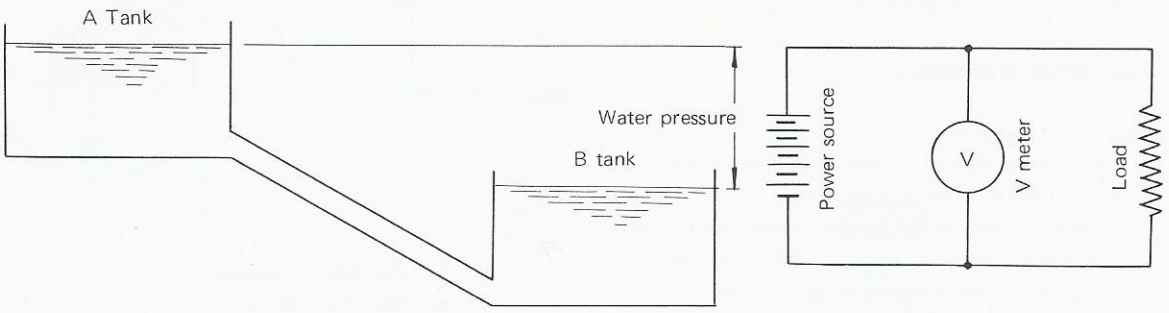


Fig. 3-2-2 Connection of V meter

2) Similarly, electric current is likened to the water current flowing from the A tank to the B tank. The flow rate can be measured by connecting a current meter (ammeter) between the A and B tanks. In this case, the meter is connected in series.

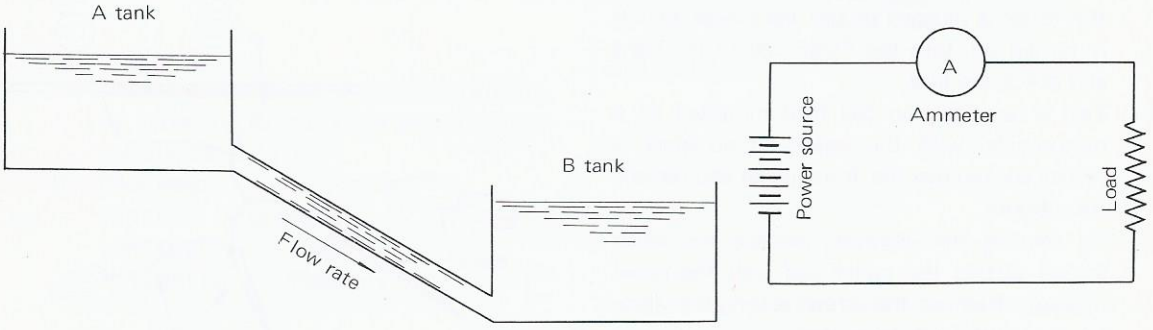


Fig. 3-2-1 Connection of Ammeter

2–3 Selection of Meter Range

To select the correct range from the meter, it is necessary to check for the ranges of current and voltage applied to the circuit which is to be tested, prior to starting the measurement.
If the reading is given with the pointer deflecting at around the center of the scale, the selection of range is ideal. If the pointer swings beyond the range of scale, the meter will be damaged. If the current or the voltage of the test piece is unknown, it is advisable to start at the highest range and switch down to lower ones until the correct one is reached.

2–4 After Using the Tester

After use of the tester, be sure to turn off the switches.

1) Power switch, Coil test switch, Selector switch — Should be set to "OFF".
2) Test switch — Should be set to "Test".
3) Spark gap dial, 0 adjust knob, Cap. knob — Should be turned fully to the left.

2–5 While being Carried

When the tester is being carried, care should be taken not to give it any strong shock, though it is given a special anti-shock design consideration. Otherwise, trouble may result.
In particular when it is carried on a motorcycle, it is advisable to use a cushion and secure the tester so that it will not shake severely.

2–6 While in Storage

Keep it off humidity:
The tester should be stored in a dry place.
Operate it once or twice a month:
Connect the tester to the power source and operate it once or twice a month to keep the vibrator contact points in good condition.
Keep it clean:
Keep the panel and cords free from oil and dust to maintain good continuity.

2–7 In Case of Malfunctions

- If the pilot lamp will not light up, even when the tester is plugged in and the power switch is turned on, turn the FUSE cap to the right and check the fuse.
- Test a new ignition coil (not mounted on a motorcycle) with the tester. If no spark is produced, remove the front panel and replace the vibrator.
  To remove the vibrator, remove the seven screws setting the panel and pull the panel upward. Remove the screws setting the vibrator, and pull it off the socket.

3. MEASURING PROCEDURES

3–1 Continuity Test

This test is used to check a circuit for continuity. The condition of a circuit, switch or wiring can be shown by the red lamp attached to the tester. If the lamp goes on, the circuit is in good condition.

1) Testing a dead circuit
   This includes, for instance, testing an ignition coil (removed from a motorcycle) for primary winding breaks and testing contact points for make-and-break operation.
   a) Connect the tester to the power source
      - Plug the power cord into the jacks in the bottom right of the tester and clip it to the battery terminals.
      - Be sure to connect the red test cord clip to the battery's positive terminal and the black cord clip to the negative.

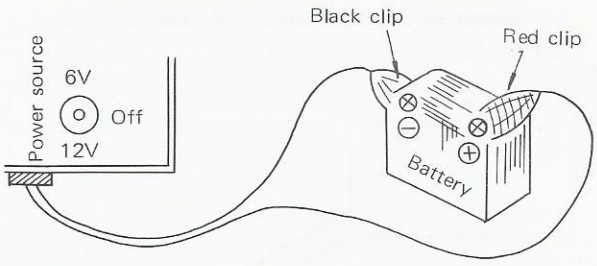


Fig. 3-3-1

   b) Set the selector switch knob to "ON".
      - Set the selector switch knob (in the center of the tester to "ON".
   c) Plug the test cord prods into the tester terminals.
      - Plug the No. 26 test cord prods into the tester terminals on the bottom center.

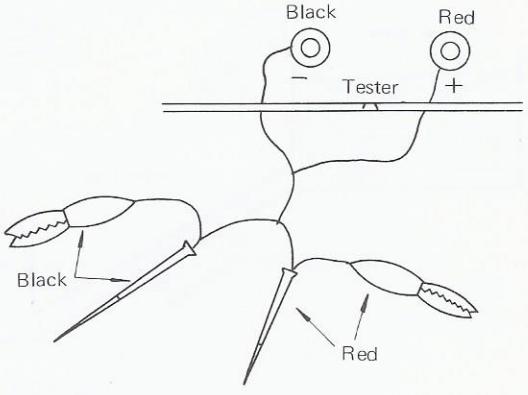


Fig. 3-3-2

   d) Clip the test leads to the terminals of the test piece.
   Example 1.
   Testing a starter coil for breaks (A-M)

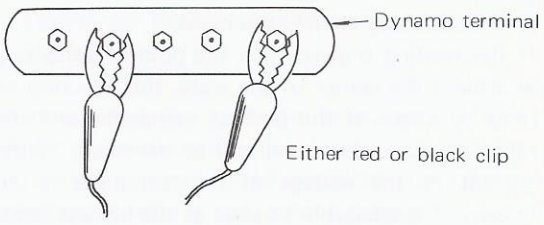


Fig. 3-3-3

Example 2.

Testing an ignition coil for primary winding breaks

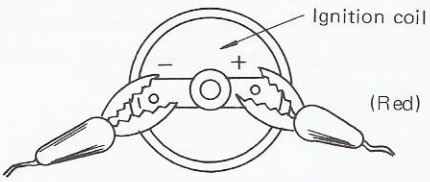


Fig. 3-3-4

Example 3.

Testing an ignition coil for secondary winding breaks

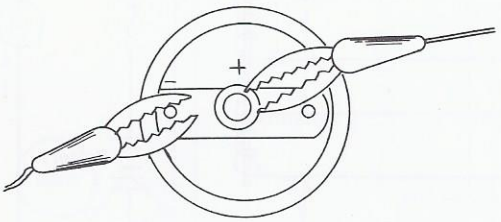


Fig. 3-3-5

e) Power switch
The power switch No. 9 must be correctly set according to the power source output voltage, 6V or 12V.

f) Pilot lamp
Pilot (red) lamp will:

Lights up	Good
Not light up	Defective

2) Testing a Live Circuit
This includes, for instance, testing the make-and-break timing with a voltmeter.

3–2 Measuring a-c Voltage

Measurement of a-c voltage can be conducted in the same manner as in the case of d-c voltage measurement. The selector switch must be set to "A-C Voltage".

3–3 Measuring d-c Voltage

1) No power source is needed.
2) Selector switch
   - Set the selector switch knob to "D-C Voltage."
3) Test cord
   - Plug the test cord prods (No. 26) into the tester's jacks in the bottom center of the tester.
4) Measurement
   - Connect the No. 26 test cord in series to the circuit (to be tested). The main meter's No. 21 needle pointer indicates voltage.

Note:

When measuring voltage, be sure to connect the tester in series with the circuit (to be tested).

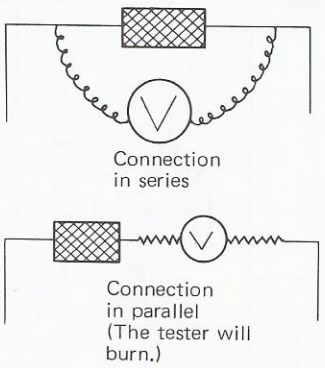


Fig. 3-3-6

4. OUTPUT VOLTAGE MEASUREMENT

4–1 Measuring Output Voltage at the Voltage Regulator's B Terminal (Measuring the voltage of the ignition coil while the engine runs)

This test is performed to measure the output voltage at the regulator's B terminal. In this test, the ignition coil alone is connected to the B terminal, and other loads (lamps and battery) are removed.

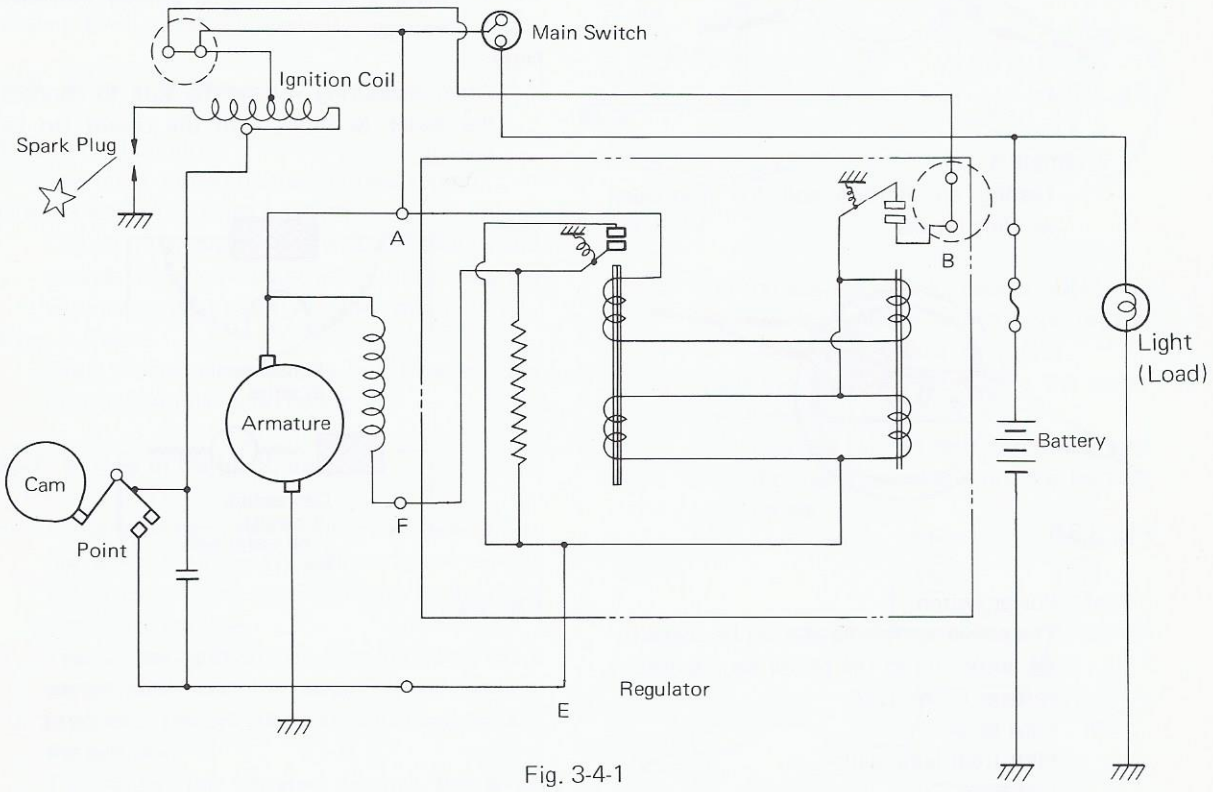


Fig. 3-4-1

1) Clip the red test cord to the regulator's B terminal (or the red lead). (If there are two B terminals, the smaller screw should be used.)

2) Connect the negative test cord to the chassis or to the engine for grounding.

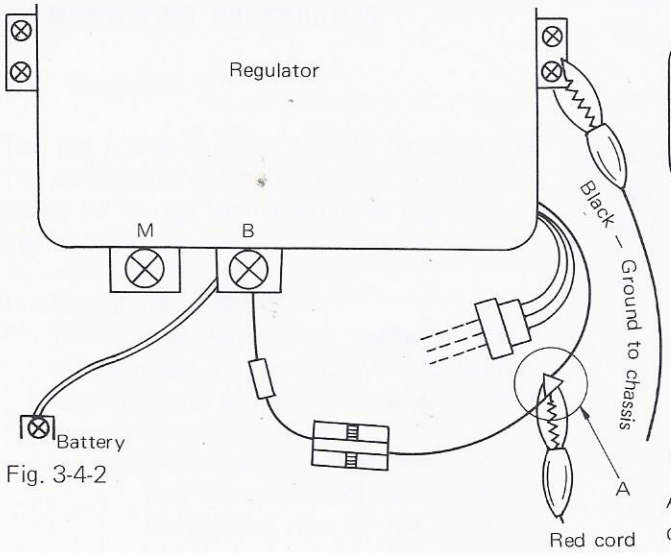


Fig. 3-4-2

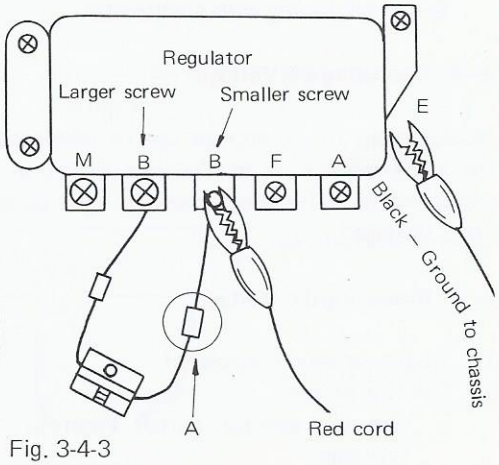


Fig. 3-4-3

As shown above, there are two ways of connection to the regulator.

3) Start the engine and increase the speed so that the tachometer shows specific RPM. Then, disconnect the fuse connector A.
4) Read the voltmeter when the generator turns at a specific speed.

4–2 Measuring Output Voltage at the Voltage Regulator's B Terminal

This test is performed to measure the output voltage at the regulator's B terminal with all loads (battery, ignition coil, etc.) disconnected from the B terminal.

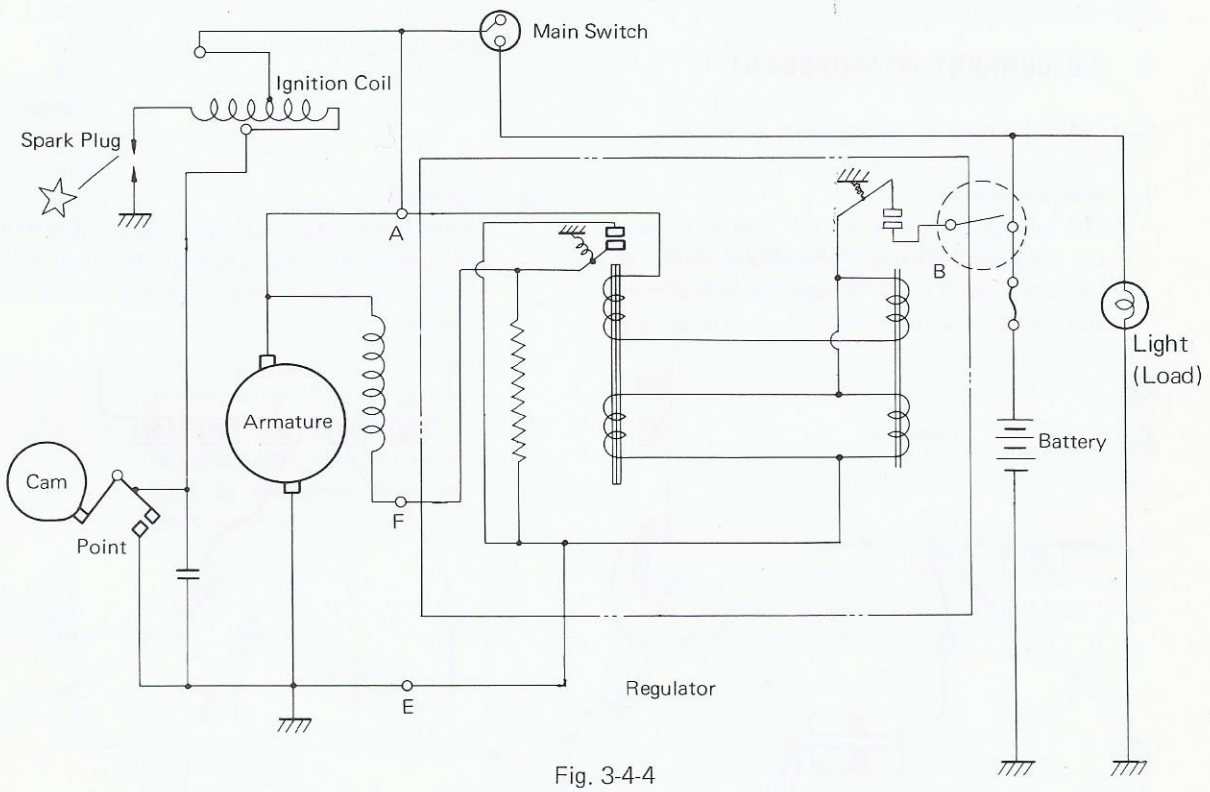


Fig. 3-4-4

1) Disconnect the red cord from the regulator's B terminal. (Or disconnect the red cord at the joint.)
(When there are two B terminals, disconnect the cord at the smaller screw.)
2) Connect the red test cord (+) to the B terminal.
3) Ground the black test cord (–) to the chassis or to the engine.

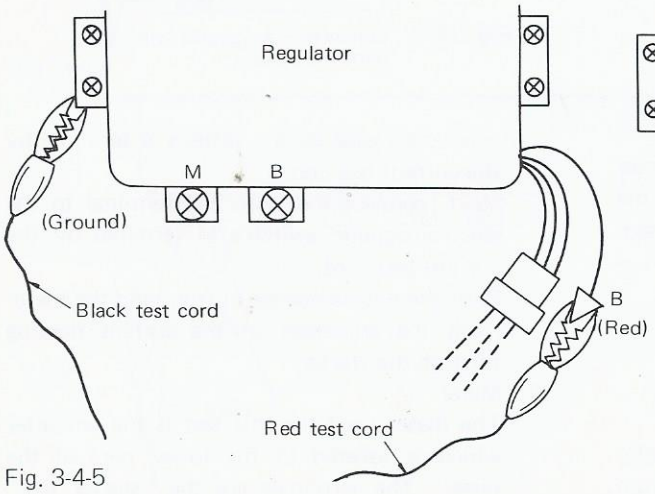


Fig. 3-4-5

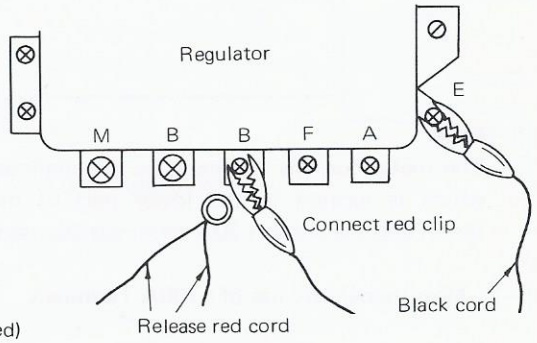


Fig. 3-4-6

4) Start the engine and keep it run at a specific speed.
Example:
On the DS6, if the meter reads 15.6 to 16.3 volts at 2,500 r.p.m., the output voltage is correct.

5) In this case, reduce the engine RPM so that the output voltage will decrease to 14 volts. In this way, the engine RPM for cut-in voltage can be found.

5. D-C CURRENT MEASUREMENT

5–1 Measurement by use of ±20A Terminals

1) Selector switch
The selector switch is in OFF position. As in the case of measuring "charging current" or "dynamo generating voltage," both current and voltage can be measured simultaneously.

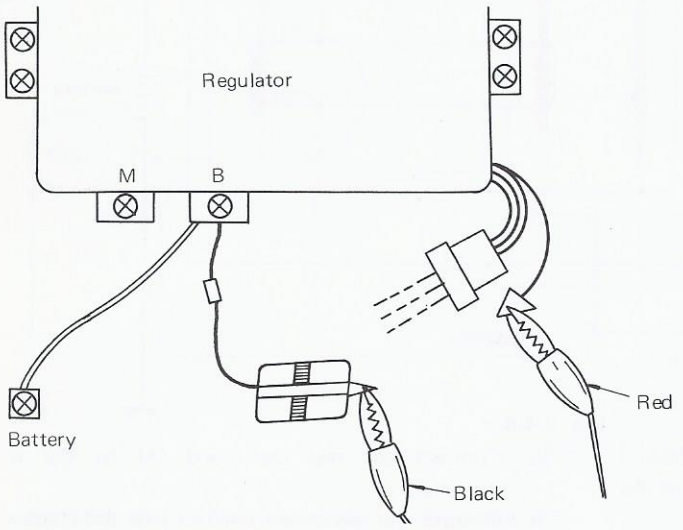


Fig. 3-5-1

2) Test leads
Connect the test cord (No. 23) to "Current 20A" terminals, and connect the other ends of the test cord in series with the circuit (to be tested).

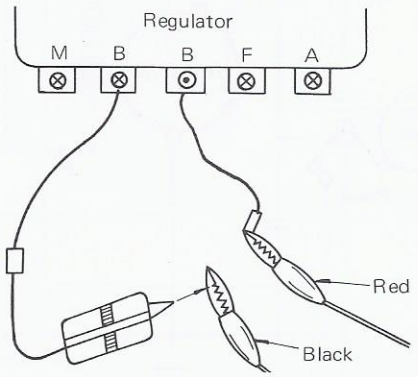


Fig. 3-5-2

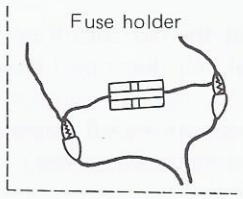


Fig. 3-5-3 Connection in parallel will burn the tester.

3) Meter
The meter for this test must be the ammeter which is located in the lower part of the tester, and the current 20A terminals are used.

5–2 Measurement by use of ±100A Terminals

1) Selector switch
The selector switch is set to OFF.
2) Test cord
Disconnect the wire from the electromagnetic switch's M terminal (to which the wire from the starter is connected). Connect the disconnected wire to the tester's S terminal by the current test cord.
Next, connect the tester's S terminal to the electromagnetic switch's M terminal by the current test cord.
Push the engine starter button, and the meter reads the amperage of the current flowing through the starter.
3) Meter
The meter used for this test is the ammeter which is located in the lower part of the tester. The terminals are the "starter test" terminals marked as "S" and "B". Amperage

is read by the red scale on the ammeter, and the selector switch position is not related to the meter reading.

Note:

The ±100A terminals are used for momentary measurement, and therefore, these terminals should not be used for starter test of any vehicles other than two-wheelers, three-wheelers and four-wheelers. Avoid using them for more than 10 seconds continuously.

Example:

Starter test

Starter trouble is in many cases judged by checking the amperage. In this case, the ±100A terminals are used.

a) Remove the spark plug high-tension cord. To avoid igniting the fuel.

b) Connect in series.

- Disconnect the green lead from the starter switch M terminal.
- Clip the positive test cord to the M terminal, and clip the negative test cord to the green lead which has been removed.

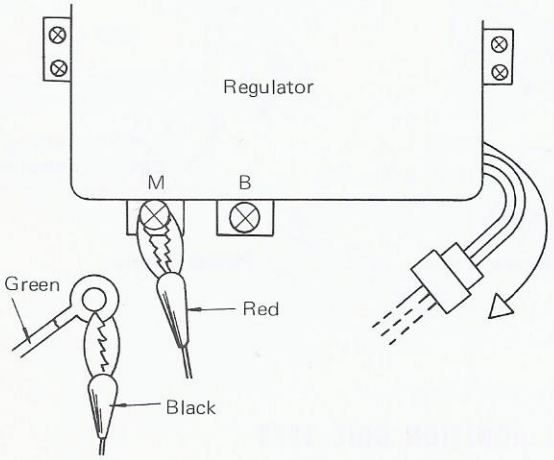


Fig. 3-5-4

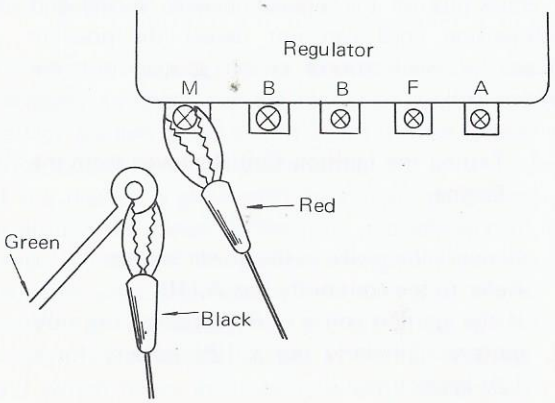


Fig. 3-5-5

On the regulator and the starting switch which are made into a one piece assembly, the green lead must be disconnected from the M terminal.

c) Measuring

Depress the starter button, and read the ammeter (No. 17) by the red scale when the starter turns.

d) Result

If the condition of the starter can be judged from the ammeter reading.

6. IGNITION TIMING CHECK-UP (Use of Timing Light)

Direct the timing light (which flashes with sparks) to the dynamo, and check for ignition timing.

1) Connect the timing light to the power source. Same manner as in the case of continuity test.

2) Install the adaptor.

Remove the high-tension cord from the spark plug, and install the No. 29 adapter in the spark plug hole. Then, connect the high-tension cord to the adapter.

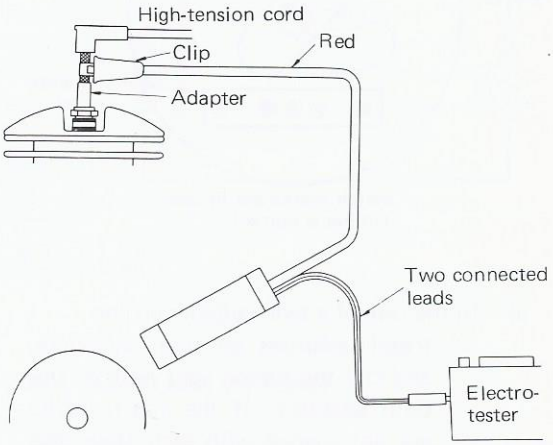


Fig. 3-6-1 Timing light

3) Install the timing light
Of the two leads connected the timing light, the lead prod should be plugged into the No. 30 terminal at the left side of the tester.

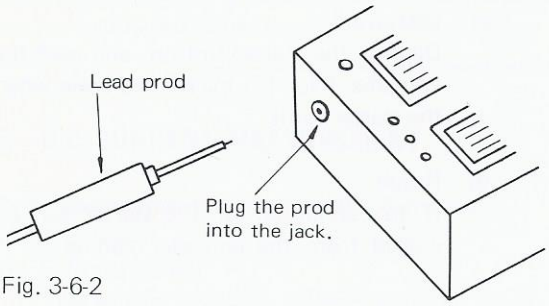


Fig. 3-6-2

Clip the red lead to the adapter.
(In case of a single cylinder engine, one of the red wires is not used.)

4) Power switch
Set the power switch correctly according to the output voltage of the power source, 6V or 12V.

5) Measuring
Remove the crankcase cover or the dynamo cover, and direct the light so that the dynamo can be seen. The cam appears standstill.
Check whether or not the match mark on the dynamo is in line with the match mark on the governor.

6) Judgement
If both match marks are in line:
Ignition timing is correct.
If the match mark on governor is found shifted in turning direction of governor:
Ignition timing is slow.
If the match mark on governor is found shifted the other way round:
Ignition timing is early.
If the match mark on governor is found moving back and forth:
The contact points may be loose or the cam shaft may be worn.

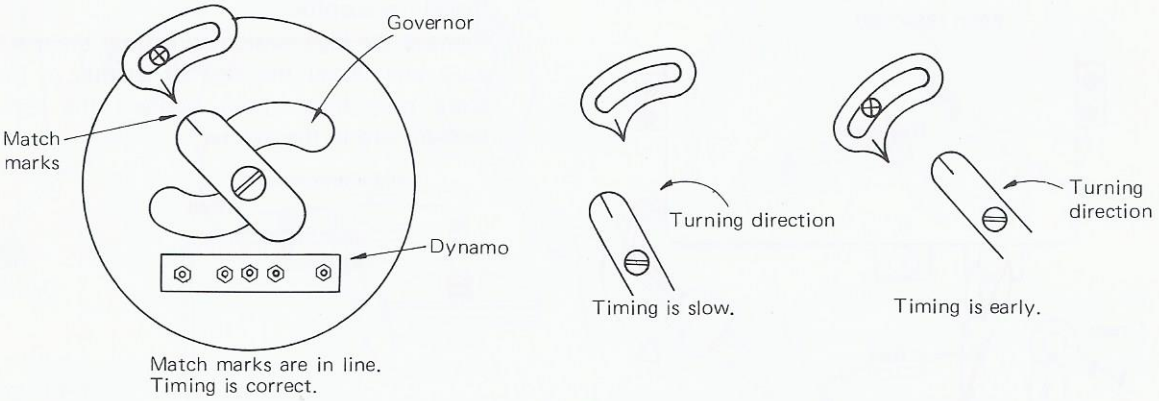


Fig. 3-6-3

a) In the case of a twin-cylinder engine
- Install adapters on both cylinders, and clip the timing light leads to the both adapters. If the match marks are not aligned with each other, the ignition is not timed correctly between the two cylinders.
- If a tachometer is used with the timing light for test
By comparing the governor points' opening with the engine RPM.
Engine RPM at both the biginning and the end of the automatic advance can be read.

7. IGNITION COIL TEST

If check-ups of the breaker points, wiring and high-tension cord can not detect the possible causes for weak sparks or no sparks, test the ignition coil.

7–1 Testing the Ignition Coil Removed from the Engine

1) Connect the tester to the power source
Refer to the continuity test A-(1).
If the ignition coil is of 6V capacity, use a 6V battery. Similarly use a 12V battery for a 12V ignition coil.

2) Connect the tester to the coil primary cord. Plug the coil primary cord (No. 27) into the jacks on the tester's coil primary side, and clip the other ends to both positive and negative terminals of the ignition coil.

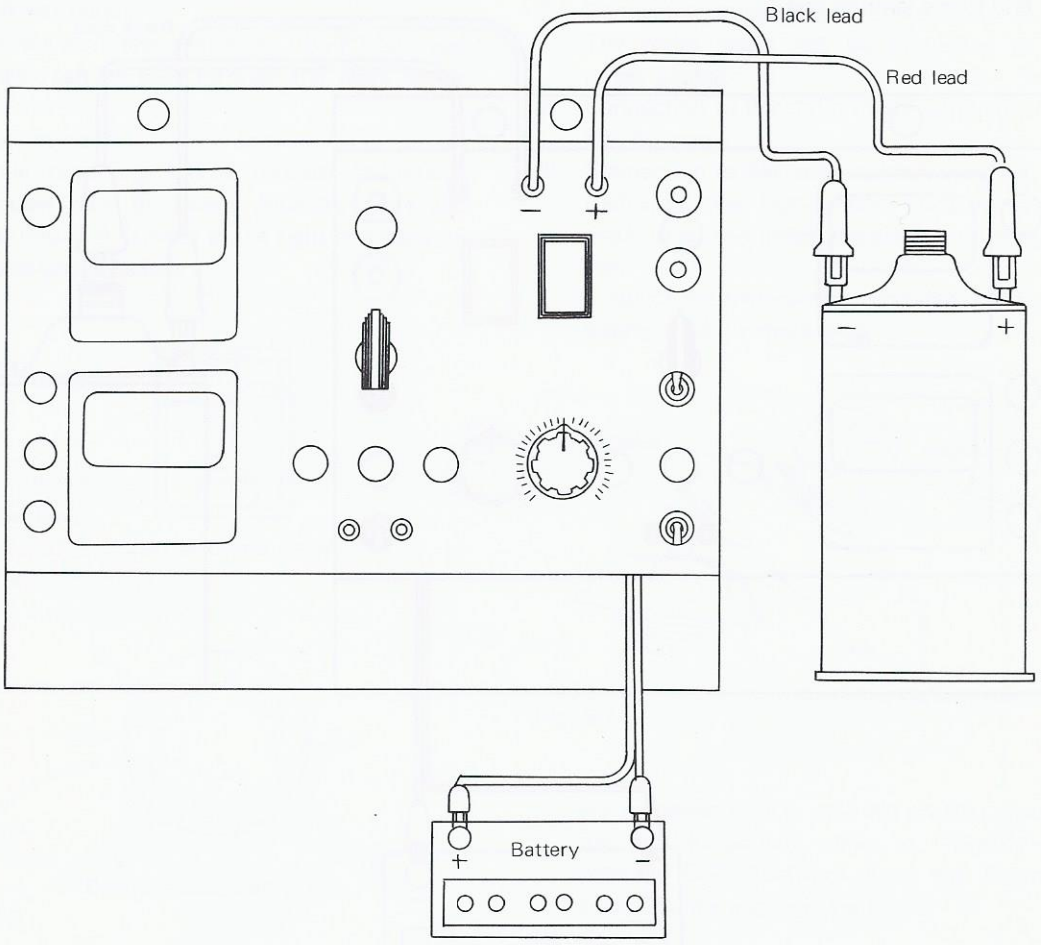


Fig. 3-7-1 Coil test

3) Connect the coil secondary winding
Plug the No. 24 high-tension cord (red) into the tester's secondary side, and clip the other end to the ignition coil.

Connect the positive lead to the ignition coil's center terminal, and connect the negative lead to the ignition coil's negative terminal.

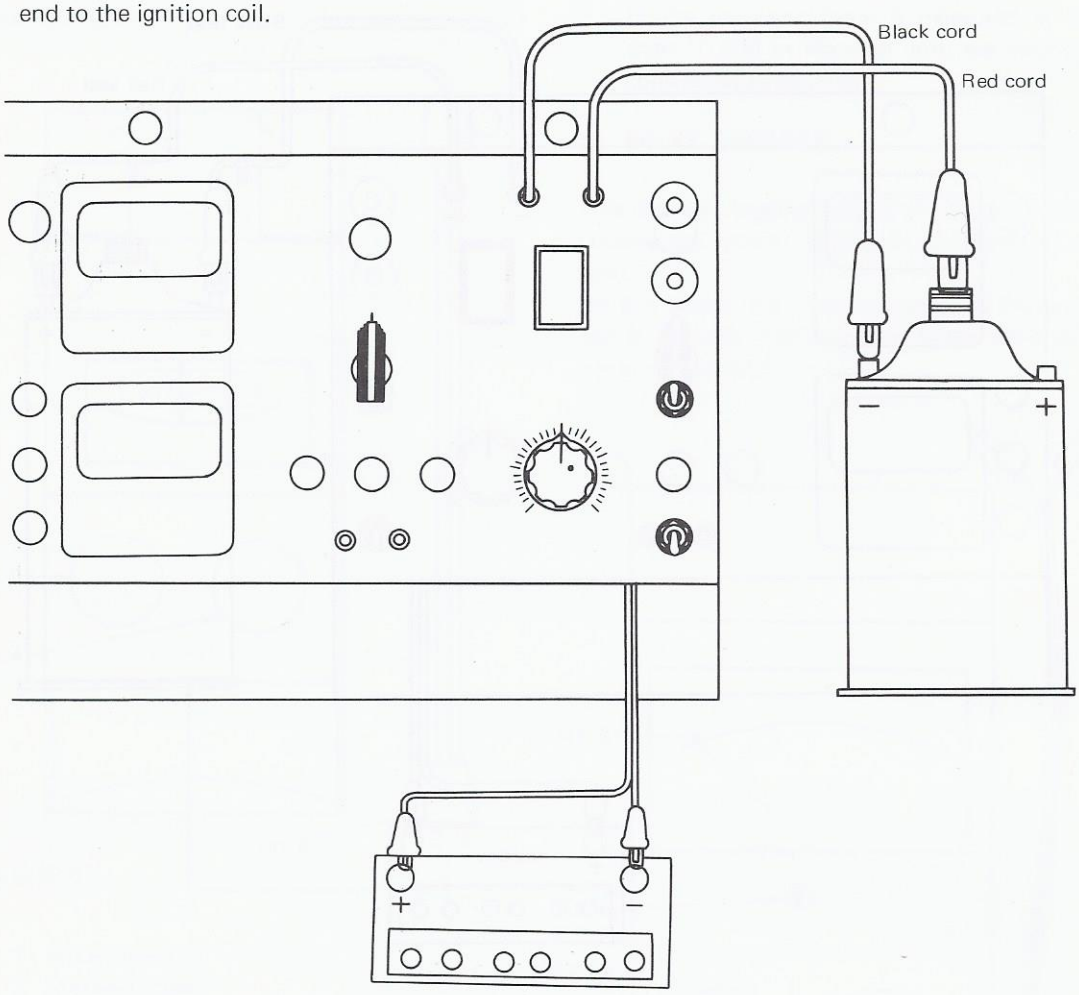


Fig. 3-7-2 Coil test

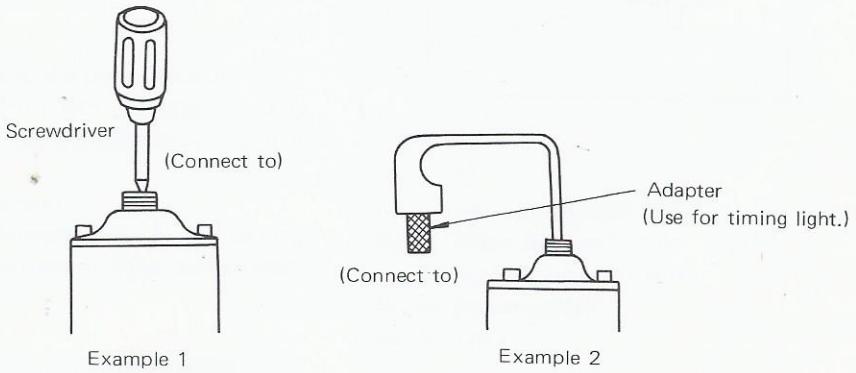


Fig. 3-7-3 Connection method on the positive side

4) Power switch
Set the power switch according to the power source.

5) Coil test switch
Set the coil test switch to "Coil Test" and sparks can be seen through the spark check window.

6) Measurement
While observing sparks through the check window (No. 6), slowly turn the spark gap dial (No. 11) from 0 to the right and measure the length of sparks.

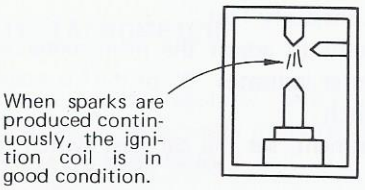


Fig. 3-7-4

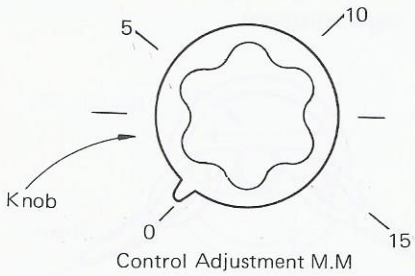


Fig. 3-7-5

7) Judgement
If the sparks are stable while the dial knob is turned from 0 to 7 or more, the ignition a coil is of good quality.

Notes:

1. In testing the ignition coil, the ammeter reads the amperage of the current flowing in the primary winding.
   This primary current is usually 1 to 2A.
   If the ammeter reads less than 1A and good sparks are produced, perform a re-test with a 12V battery.
2. In the case of testing a magnetor coil, do not allow it to produce sparks greater than the specified length and for many minutes.
3. The spark plug, once heated, tends to show low spark performance. If it is not heated to its working temperature, continue the test for 3 to 5 minutes with the dial set to 6 to 7 mm.

7–2 Testing an Ignition Coil Connected to the Engine

1) Connection to the power source.
The tester needs not be connected to the power source.

2) Connection to the coil primary winding.
Not necessary.

3) Connection to the coil secondary winding.
Removed the high-tension cord from the spark plug, and install the adapter on the plug cap.
Connect the high-tension cord (No. 24) to the adapter and the spark plug.

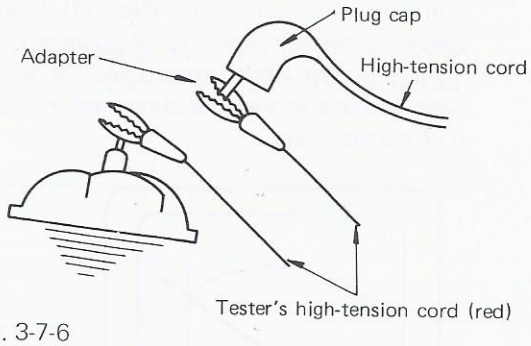


Fig. 3-7-6

As to power switch, coil test switch, measuring and judgement, refer to "Testing the Ignition Coil Removed from the Engine." (For test, the engine is kept run.)

Notes:

1. The above test is applicable to battery ignition, and will not be used for magneto ignition.
   An ignition coil connected to the engine is tested in the same manner as in the case of battery ignition.
2. Full care should be taken against shock hazards when testing the ignition coil, because a voltage of 10,000 volts or more is applied.
   In particular, avoid touching the ends of the test cord or any leaky area.
3. The ignition coil tends to show lower spark performance when it is heated. Taking this characteristic into consideration, test should preferably be conducted after running the engine for 3 to 5 minutes.

8. INSULATION TEST

Insulation test is conducted to check electric leakage and condition of insulation.

1) Connect the tester to the power source.
   Refer to "Continuity Test A-(1)."
2) Selector switch
   Set the selector switch to "Insulation MΩ".
3) Test switch
   Plug the cord prods into the tester's jacks.
   Refer to "Continuity Test A-(3)."
4) Power switch
   Refer to "Continuity Test A-(5)."
5) Zero adjustment
   Shift the cal. test switch (No. 14) located below the selector switch to "Adjustment."
   Turn the zero adjust knob (No. 13) to the right and left so that the ohmmeter indicates 0 of the MΩ scale.

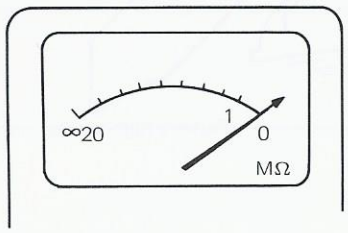


Fig. 3-8-1

6) Cal. test switch (No. 14)
   After zero adjustment, turn the zero adjust switch its home position. Now the test can be started.
7) Measurement
   Measure insulation resistance by connecting the other ends of the test cord to the component to be tested.
   Example:
   Condenser insulation test

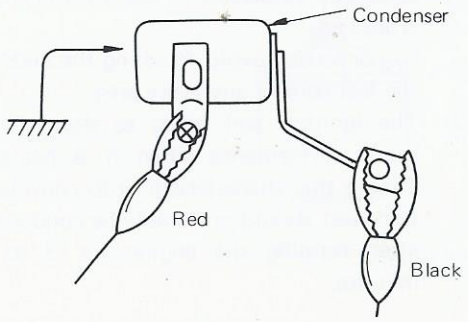


Fig. 3-8-2

Note:
After applying a d-c current to the condenser, be sure to ground it to discharge the electricity.

9. RESISTANCE TEST

1) Connect the tester to the power source.
   Refer to "Continuity Test."
2) Selector switch
   Set the selector switch to "Resistance MΩ."
3) Test cord
   Refer to "Continuity Test."
4) Power switch
   Refer to "Continuity Test."
   It is necessary to adjust the main meter so that its pointer indicates "0" of the kΩ scale.
5) Cal. test switch
   After adjustment, set the cal. test switch to "Test."
6) Measurement
   Example:
   Measuring the ignition coil primary winding's resistance.

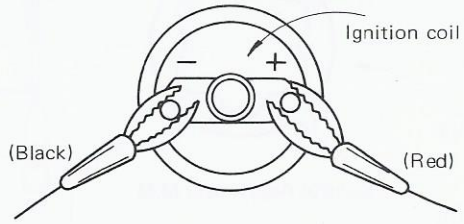


Fig. 3-9-1

10. CONDENSER CAPACITY

This test is made to measure the capacity of a condenser to store electric charges.

1) Connect the tester to the power source.
   Refer to "Continuity Test."
2) Selector switch
   Set the selector switch to "Condenser Capacity."
3) Test cord
   Refer to "Continuity Test."
4) Power switch
   Refer to "Continuity Test."
5) Capacity adjustment
   Set the cal. test switch (No. 14) to "Adjustment."
   Then, turn the cap. knob (No. 16) to the right

and left so that the main meter's pointer indicates 0.22 in the center of "Capacity μF" or indicates "Set."

6) Scale test switch
After capacity adjustment, turn the switch to "Test." Test is ready.

7) Measurement
As shown in the figure, clip the test cord to the condenser and measure the capacity.

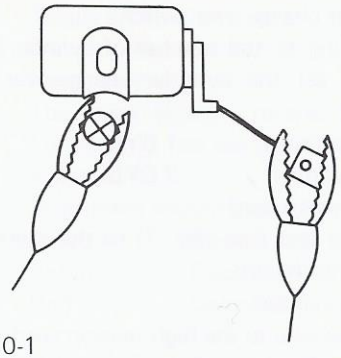


Fig. 3-10-1

11. TACHOMETER

To adjust the regulator, carburetor, ignition timing, etc., the accurate measurement of the engine RPM is a basic factor.

The tachometer reads the engine RPM from the number of sparks, by indicating it on the dial.

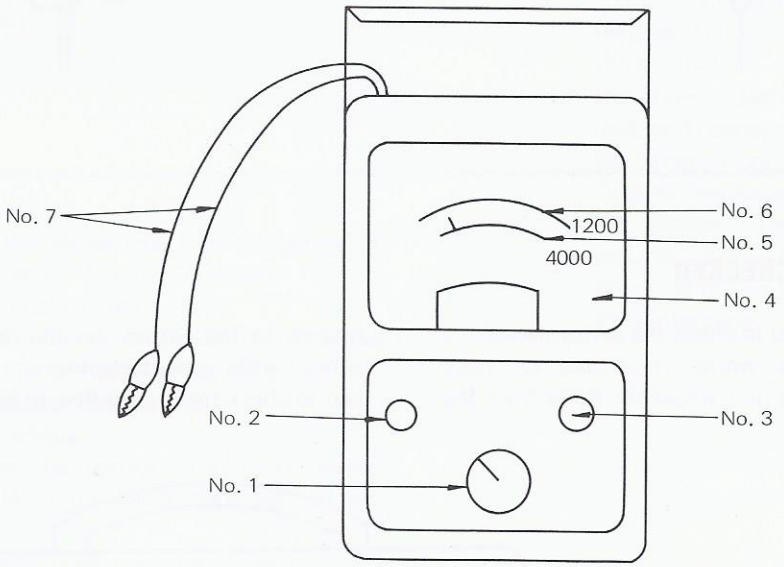


Fig. 3-10-2

No. 1 Selector switch
No. 2 Cylinder change-over switch
No. 3 Set adjustment knob
No. 4 Meter
No. 5 4,000 rpm scale
No. 6 12,000 rpm scale
No. 7 Test cord

1) Cylinder change-over switch
   According to the number of cylinders of the engine, set the cylinder change-over switch (No. 2).
   Single cylinder: 1 CYL
   Twin cylinder: 2 CYL
2) High-tension cord
   Clip the test lead (No. 7) to the spark plug's high-tension cord.
   Single cylinder:
   One wire to the high-tension cord.
   Another to ground.
   Twin cylinder:
   One wire to each high-tension cord.
   Grounding is unnecessary.

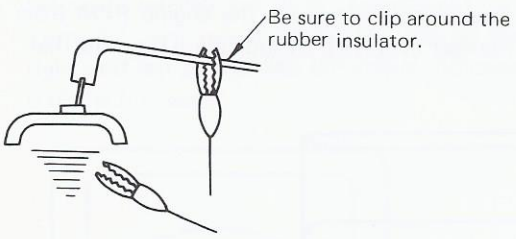


Fig. 3-10-3

3) Set adjustment
   Set the selector switch (No. 1) to "SET".
   Turn the SET adjustment switch (No. 3) to the right and left so that the pointer will indicate "SET" on the scale.
4) Measurement
   Start the engine, and measure the engine speed. If the engine speed is less than 4,000 rpm, set the selector switch to "4,000," and read the lower range of scale. If the engine speed exceeds 4,000, set the switch to "12,000," and read the upper range of scale.

Notes:

1. After the test, be sure to set the selector switch to "OFF." Otherwise, the dry battery will be discharged.
2. If the SET adjustment can not be done, it is considered that the dry battery is in a discharged state.
   Replace them with a new one.

12. RECTIFIER CHECKER

This checker is used to check the performance of a rectifier. In other words, it is used to check whether or not current smoothly flows from the dynamo to the battery (in the normal direction) without little loss of electricity. This test is also used to check for reverse flow of current.

No. 1 Current test knob
No. 2 Toggle switch
No. 3 Indicator lamp
No. 4 Voltage drop push button
No. 5 Meter
No. 6 Normal direction scale
No. 7 Reverse direction scale
No. 8 Test cord
No. 9 Battery leads

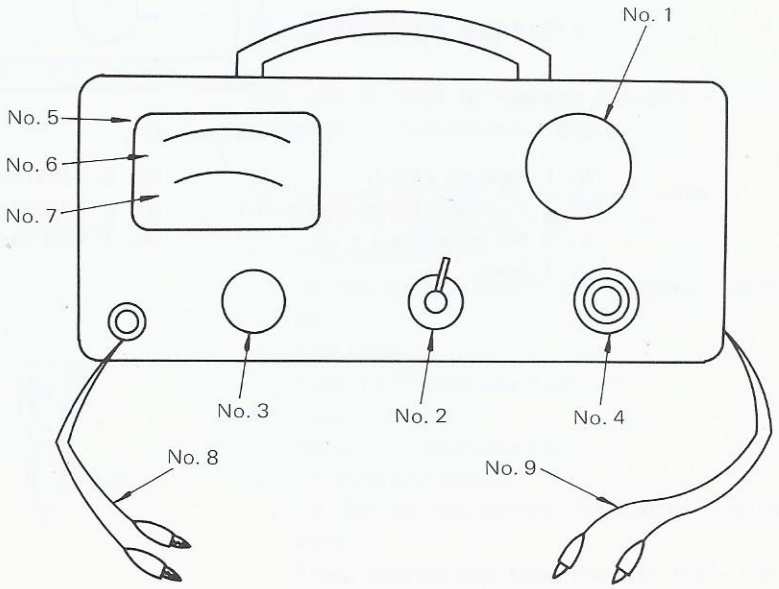


Fig. 3-10-4

1) Normal direction test
   a) Connect the tester to the power source.
   Connect the leads (No. 9) to the battery.
   The red lead is positive and the black is negative.
   b) Test cord
   Connect the test cord (No. 8) to the rectifier.
   (Connect the red cord to the red terminal, and the white one to the white terminal.)

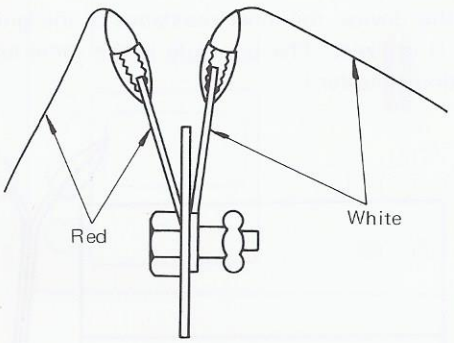


Fig. 3-10-5

   c) Toggle switch
   Turn the toggle switch in the center of the tester to "Normal Direction."
   d) Current adjustment
   Turn the current test knob (No. 1) to the right and left so that the meter pointer will indicate "5A" or "SET."
   e) Measurement
   Depress the voltage drop push button (No. 4) in the lower right part of the tester.
   The meter reads a voltage drop (according to the upper range of scale for normal direction).
   f) Judgement
   Judgement is made by color.

Green	Good
Yellow	Fair
Red	Defective

2) Reverse direction test
   a) Power source connection
   Same as in the case of normal direction test.
   b) Test cord
   Same as in the case of normal direction test.
   c) Toggle switch
   Turn to "Reverse."
   d) Measurement
   The meter shows a reverse flow in mA.
   For reading, use the lower range of scale.
   e) Judgement
   Judgement should be made by color.

Green	Good
Yellow	Fair
Red	Defective

Notes:

1. If overcurrent flows through the rectifier, the red pilot lamp lights up. It is considered that connection is wrong in polarity, or the rectifier is punctured. The meter is provided with a safety device, but it is advisable to disconnect the meter immediately.
2. To check the rectifier installed on a motorcycle.
   - Remove the white lead from the rectifier, and connect the test cord to the rectifier.
   - Disconnect the battery's positive lead, and connect the red test cord to the battery's positive terminal.
   - Ground the battery's black lead to the chassis. The subsequent procedures are the same as in the case of checking the rectifier removed from the motorcycle.

13. FLUX METER

This is used to measure the magnetic force of the flywheel magneto.

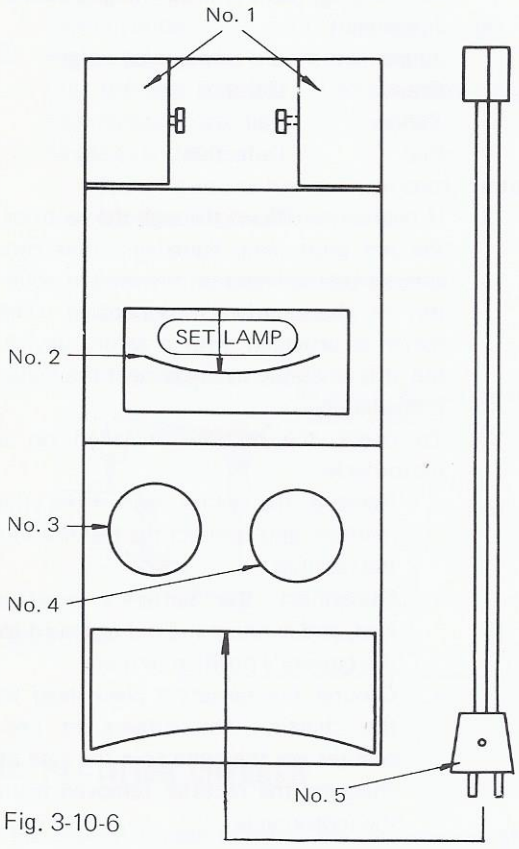


Fig. 3-10-6

No. 1 Attachment
No. 2 Maxwell scale
No. 3 Adjustment switch (Set Lamp)
No. 4 Change-over switch (Magnification)
No. 5 Power cord

1) Connect the tester to the power source.
   Plug the power cord (No. 5) into the A.C 100V outlet, and set the change-over switch (No. 4) to SET.
2) Attachment adjustment
   Adjust the attachments (No. 1) by turning screws so that they are in tight contact with the magneto.
3) Measurement
   a) Slowly turn the adjustment switch (No. 3) from left (On) to right (Off), and stop turning it when the SET-lamp goes off half.
   b) Place the attachments so that they are forced tightly against the magneto.
   c) Turn the change-over switch (No. 4) so that magnification will become proper.
4) Judgement
   If the magnetic force is measured at more than 10,000 in Maxwell unit, the magneto is considered to be good.

14. POINT CHECKER

This checker, together with a dial gauge, is used to observe the ignition timing of the flywheel magneto.
(In this device, the inner resistance of the ignition coil is utilized. The principle is the same as the continuity tester.)

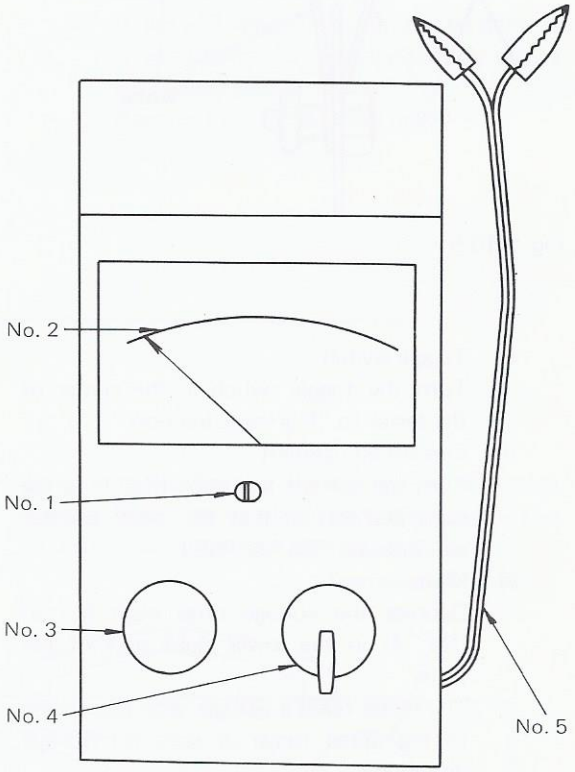


Fig. 3-10-7

No. 1 Zero adjustment screw
No. 2 Make and break scale
No. 3 Scale adjustment knob
No. 4 Power switch
No. 5 Cord

1) Usage
   a) Zero adjustment
      Set the meter pointer to 0 on the scale by turning the screw (No. 1).

b) Power source
Turn on the power switch (No. 4).

c) Tester adjustment
Set the pointer to the maximum value of scale by turning the scale adjustment knob.

d) Cord connection
Connect the red cord (No. 5) to the magneto's black cord, and ground the black cord (No. 5).

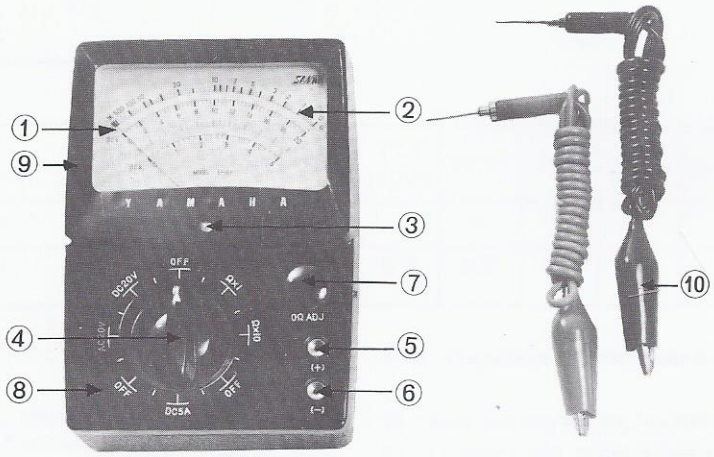
e) Measurement
- Install the dial gauge on the cylinder head (in the same manner as in the case of ignition timing adjustment).
- Measure the point gap, and then find the timing (what mm BTDC) when the points open, from the dial gauge reading.

f) Judgement
From the deflection of the pointer, determine the make and break of the points.

POCKET TESTER

1. INTRODUCTION

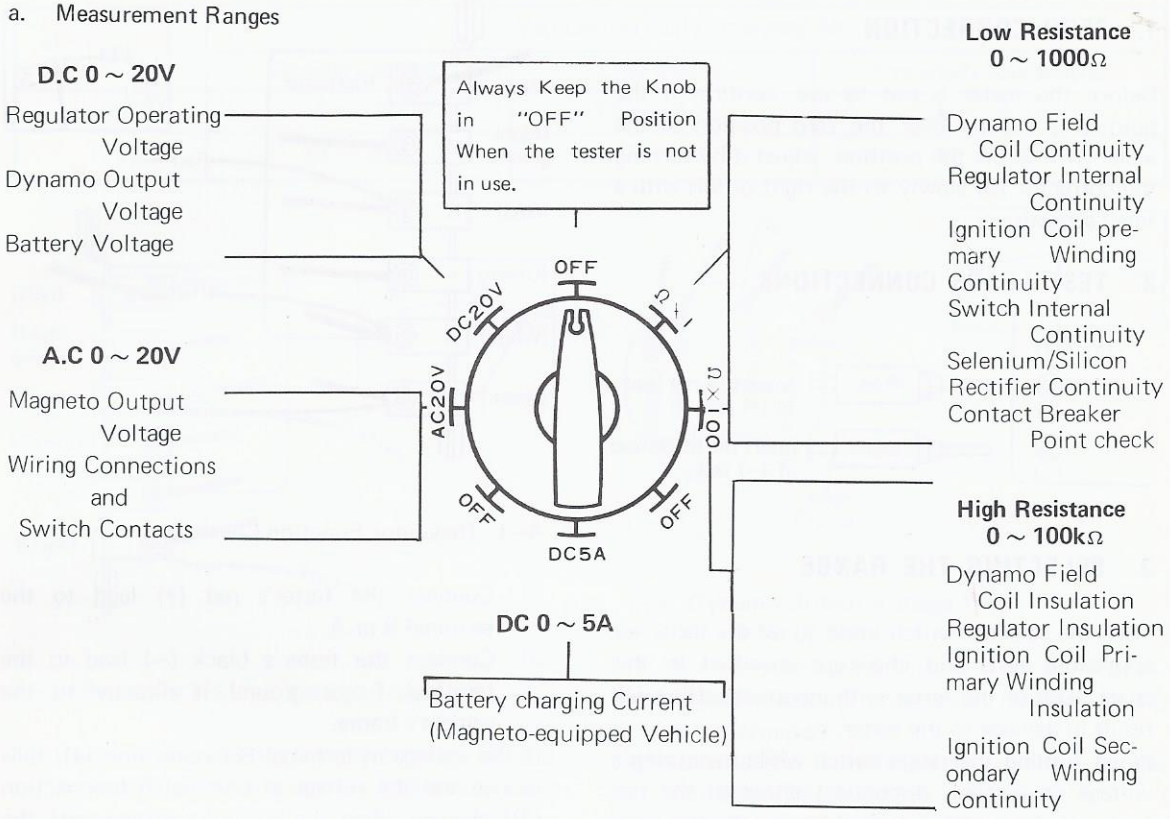
YOU ARE now the owner of the **New YAMAHA POCKET TESTER Model SP-6Y.** Built of choice materials, the meter, for its dependable performance, assures you of unfailing service for years to come in your engineering work.
It is made in such a compact type, you will find it most handy for your servicing no matter where you are.
"YAMAHA POCKET TESTER" will double its performance when used in combination with "YAMAHA ELECTRO TESTER".



1. Pointer
2. Scale dial
3. Zero corrector
4. Range selector switch knob
5. (+) Terminal jack
6. (—) Terminal jack
7. Zero ohm adjuster knob
8. Face panel
9. Iron case
10. Test leads

2. SPECIFICATIONS

a. Measurement Ranges



b. Meter Scale

Ω x 1 : The upper most scale gives ohm (Ω) readings in actual values.

Ω x 100 : The same scale as for the Ω x 1 setting is used. 100 times the numerals read on the scale represents the actual measured value (e.g. An ohm reading of 10 means 1000Ω, i.e. 10 x 100 = 1000).

DC20V : The black scale, second from the Top scale, gives DC voltage readings. It is graduated by thick lines at 2V intervals, with each 2V interval subdivided into 0.4V scale by fine lines.
(Caution: Be careful not to take "red (AC20V) scale" reading when the tester is used in the DC20V setting.)

AC20V : Red scale, third from the top scale, indicates AC voltage readings. It is graduated in the same manner as the DC20V scale.
(Caution: Be careful not to take "black (DC20V) scale" reading when the tester is used in the AC20V setting).

DC5A : The bottom scale gives ampere readings. It is graduated by thick lines at 1A intervals, with each 1A interval subdivided into 0.2A scale by fine lines.

c. Allowance

Ohms : ±3% of scale length
DC20V : ±3% at full scale deflection (0.6V)
DC5A : ±3% at full scale deflection (0.15A)
AC20V : ±4% at full scale deflection (0.8V)

d. Battery
a 1.5Volt dry cell. (UM-3 unequivalent)

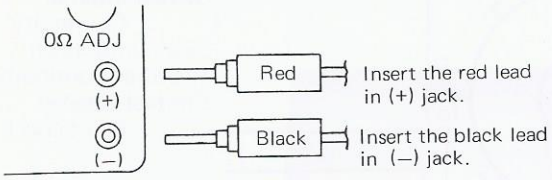
e. Size & Weight
133 x 92 x 40 mm 400 gr

OPERATION

1. ZERO CORRECTION

Before the meter is put to use, confirm if the pointer is exactly over the zero position of the scale. If it is off the position, adjust it by turning the corrector (3) slowly to the right or left with a small screwdriver.

2. TEST LEADS CONNECTIONS

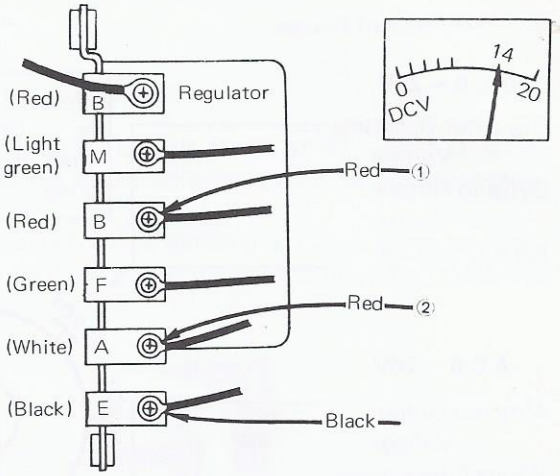


3. SELECTING THE RANGE

Turn the selector switch knob to set the tester for applicable tests and checkups specified in this chart. Use of the tester with incorrect setting will result in damage to the tester.
When turning the range switch while measuring a voltage or current, disconnect either of the test leads. If the switch is turned leaving the test leads connected to the matter, it can damage the meter. Always keep the selector switch in the "OFF" position when the tester is not in use.

4. D. C VOLTAGE MEASUREMENTS

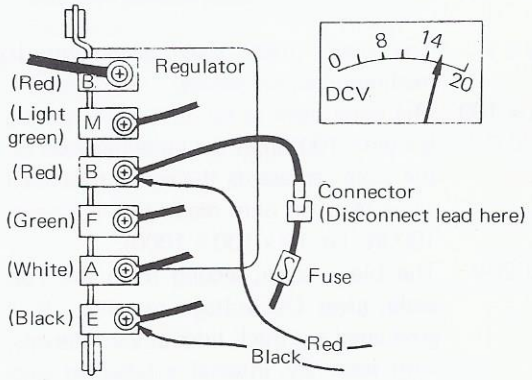
a. The selector switch is rotated to D. C 20V range.
b. Voltage is measured in parallel with the power. Taking note of the polarities of the voltage to be measured, the red test lead is applied to the positive side of the circuit and the black test lead to the negative side. Wrong connections deflect the pointer to the reverse direction across zero.
c. D. C 20V range are mostly used for measurements of . . . . . .
   4-1 Regulator Function checkup.
   4-2 Regulator Ignition Load Voltage Test.
   4-3 Regulator No-load Voltage Test.
   4-4 Dynamo Output Voltage Test.
   4-5 Battery Voltage Checkup.



4−1 Regulator Function Check up

1) Connect the tester's red (+) lead to the terminal B or A.
2) Connect the tester's black (−) lead to the terminal E, or ground it directly to the vehicle's frame.

If the voltage at terminal B (connection (1)) fails to rise and the voltage at terminal A (connection (2)) changes when the engine speed is raised, the regulator is not functioning properly.

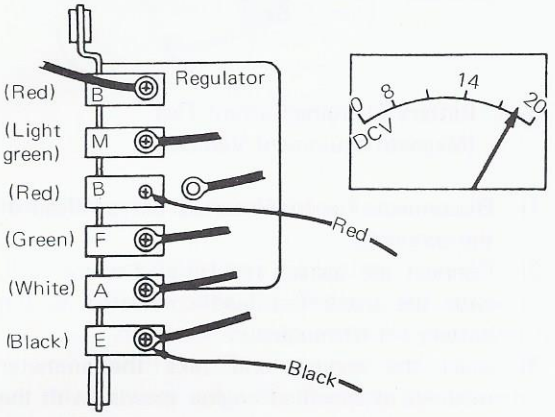


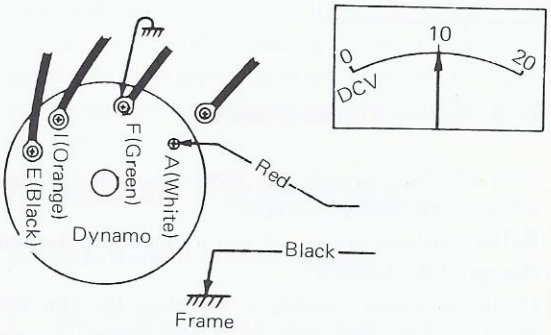
4−2 Regulator Ignition Load Voltage Test

1) Connect the tester's red (+) lead to terminal B.
2) Connect the tester's black (−) lead to terminal E, or ground it directly to the vehicle's frame.
3) Start the engine, and disconnect the regulator's red lead at the connector.
4) Take the voltmeter reading with the engine running at 3,000 rpm.

Standard Values (Operating Voltage Settings):

Type	Vehicle Normally Operated At:		
	Ordinary speeds	Low speeds	Extremely low speeds
6V	7 ~ 8V	7.5 ~ 8.25V	8 ~ 8.5V
12V	14 ~ 16V	15.0 ~ 16.5V	16 ~ 17V





4–3 Regulator No-load Voltage Test

1) Remove the red lead from terminal B, and connect the tester's red (+) lead to the same terminal.
2) Connect the tester's black (–) lead to the regulator's terminal E, or directly ground it on the vehicle's frame.
3) Start the engine, and take the voltmeter reading at 3,000 rpm.

Standard Values:

6V type (battery) 7.7 – 8.1V
12V type (battery) 15.6 – 16.5V

For proper adjustment of the regulator's operating voltage setting, refer to the standard values table under the heading "Ignition Load Voltage"

4–4 Dynamo Output Voltage Test

1) Remove the wiring harness from terminal A, and connect the tester's red (+) lead to the same terminal.
2) Ground the tester's black (–) lead to the vehicle's frame.
3) Run the engine at a constant speed slightly higher than the idling speed, and take the voltmeter reading. If the pointer does not oscillate, ground terminal F to the yoke.

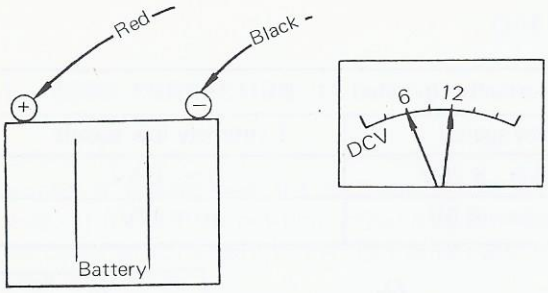
Note:

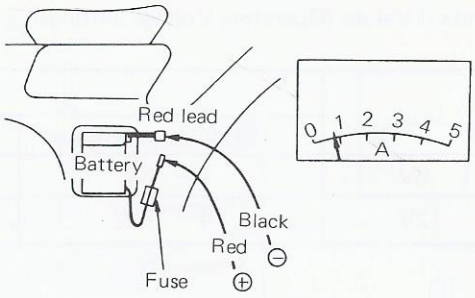
Do not increase the engine speed excessively, or the tester will be damaged.

Standard Values:

Dynamo is in proper condition if the voltmeter reading is as follows:

6V type Not less than 5V
12V type Not less than 10V





4–5 Battery Voltage Check Up

This checkup is only for determining the availability of the battery voltage.
Battery voltage alone will not indicate the state of charge of the battery.
If the voltmeter reading is less than 6V (for 6V type) or 12V (for 12V type), the battery is near "empty".

5. D. C CURRENT MEASUREMENTS

a. The Selector switch is rotated to D. C 5A range.
b. Different from D. C 20V measurements, the meter must be connected in series with the power.
c. D. C 5A range are mostly used for measurements of . . . . . .

5–1 Battery Charging Current Test (Magneto-equipment Vehicle)

1) Disconnect the fuse-inserted battery lead at the connector.
2) Connect the tester's red (+) lead to the fuse, with the black (–) lead connected to the battery (+) terminal.
3) Start the engine, and take the ammeter readings at specified engine speeds (with the main switch set in "Day" and "Night" positions in alternate sequence at each specified engine speed).

Note:
Make sure the transmission is in a position other than neutral when making these tests; otherwise the neutral lamp will operate causing the pointer to move toward the negative side when the engine is idling.

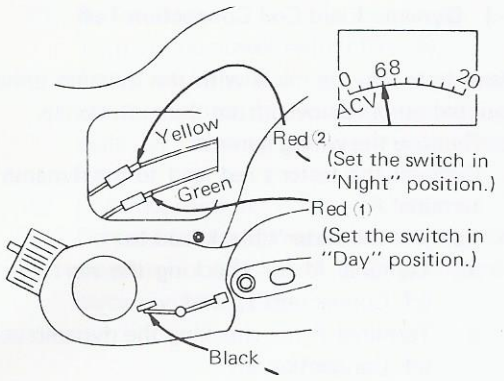
Standard Values:

	MF3D (U5D)	MF2K, YG1	YF1, YG1, YGS-1, YJ2
Daytime Charging	0.6A/3,000 rpm	0.6A/3,000 rpm	0.4A/2.500 rpm
Nighttime Charging	0.4A/3,000 rpm	0.6A/3,000 rpm	

cf. The test as in 6-1,2 applied in case the battery does not charge.

6. A. C VOLTAGE MEASUREMENTS

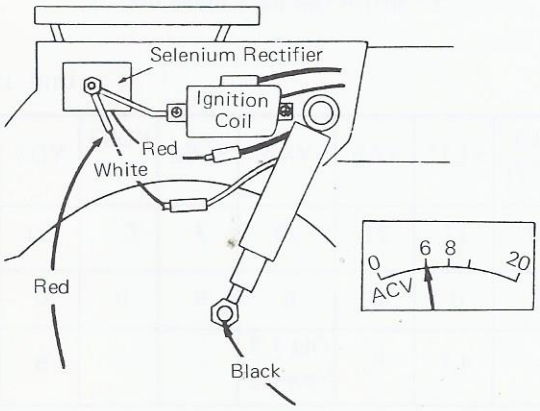
a. The Selector switch is rotated to A. C 20V range.
b. The connections of the test leads are same as in D. C voltage measurements – they are parallel with the power. Since alternating current is measured, readings are correct no matter which side of the voltage the test leads are connected.
c. A. C 20V range are mostly used for measurements of . . . . . .
6-1 Magneto Output Voltage test.
6-2 Wiring connections and switch contacts checkup.



6–1 Magneto Output Voltage Test

1) Connect the tester's red lead to:
   a. Green cable for checking the magneto's "daytime" output, with the main switch set in the "Day" position, and
   b. Yellow cable for checking the magneto's "nighttime" output, with the main switch set in the "Night" position.
2) Ground the tester's black lead to the vehicle's frame.

   A check under the "daytime" setting only indicates whether voltage output exists or not. If the tester (ACV) reading is more than 5.8V under the "nighttime" setting with the engine running at 2,500 rpm, the magneto is in proper working condition. Make sure all lamps necessary for nighttime operation are lit when making the magneto's "nighttime" voltage output check.



6–2 Wiring Connection and Switch Contracts Checkup.

Magneto-equipped Vehicle Only:

1) Connect the tester's red lead to the white terminal of the selenium (or silicon) rectifier.
2) Ground the tester's black lead to the vehicle's frame.
3) Start the engine, and keep it running at 2,500 rpm.

Note:

Take the tester (ACV) readings with the main switch set in "Day" and "Night" positions, respectively.

Standard Value:

If the tester (ACV) reading is more than 5.8V (with the main switch at both "Day" and "Night" positions), the electrical wirings and main switch are in proper condition.

7. RESISTANCE MEASUREMENTS

A. Low Resistance Measurements

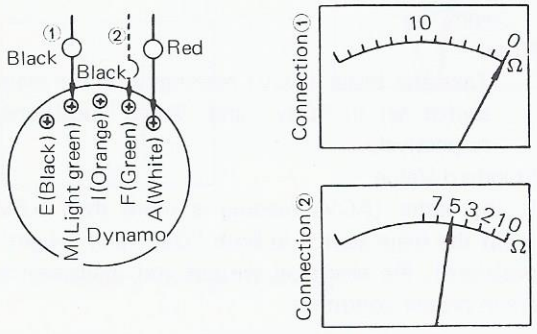
a. The Selector switch is rotated to Ω x 1 range.
b. Zero adjustment. Before taking a measurement, the test leads connected to the meter are shorted together. As the pointer deflects to the right, it is adjusted to be exactly on the zero position of the ohm scale by slowly rotating the "0Ω Adj" Knob. Do not force it beyond its stop position.

   The zero ohm adjustment is to avoid error caused by the wearing out of the internal batteries or change of the load current. The pointer must be adjusted from time to time when resistances are checked. It must also be adjusted as the switch is moved to Ω x 100 range.

   If zero adjustment is impossible when the adjusting Knob is turned full clockwise, the internal battery are exhausted and must be replaced immediately.
c. Replacement of the battery. Remove the case and put the meter face down on a soft cloth. Loosen the fixing bolt on the minus side and pull out the battery with its sheath and push it out.

   After the battery is replaced, do not tighten the fixing bolt too much, or the battery mount will be cracked.
d. Ω x 1 range are mostly used for measurements of . . . . . .
   7-1 Dynamo Field Coil Connection Test.
   7-2 Regulator Internal Connection Test.
   7-3 Ignition Coil Primary Winding Connection Test.
   7-4 Switch Internal Connection Test
   7-5 Selenium/Silicon Rectifier Connection Test

7-6 YAMAHA POCKET TESTER Used as a Contact Breaker Point Checker.



7–1 Dynamo Field Coil Connection Test

These tests may be made with the dynamo either mounted on or removed from the motorcycle.

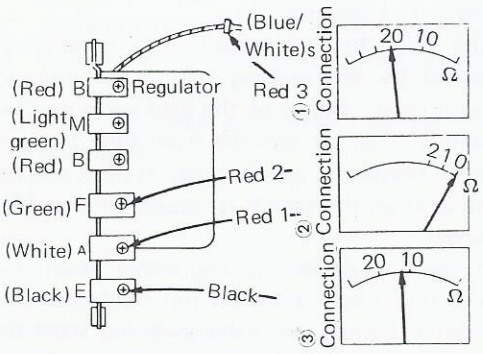
1) Remove the wiring harness.
2) Connect the tester's red lead to the dynamo's terminal A.
3) Connect the tester's black lead to:
   a. Terminal M for checking the starter coil (cf. Connection 1); and
   b. Terminal F for checking the dynamo coil (cf. Connection 2).

Standard Values:

Unit: Ω

	MF2	YG1D	H1	YL1 (12V)	YL1*	YA5	YA6	YDS2	YDS3 YM1	YD3
1 (A – M)	0	0	-	-	0	0	0	-	-	0
2 (A – F)	7.4	6.2	4.7	5.2	5.2	6.8	5.0	4.1	4.1	6.5

* with self-starter



7–2 Regulator Internal Connection Test

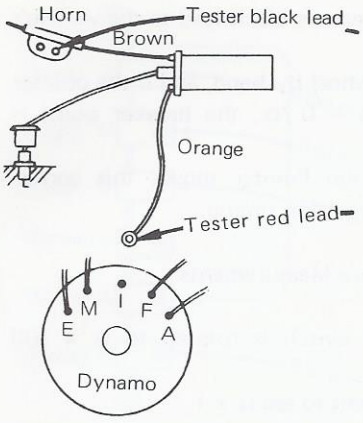
1) Remove the wiring harness.
2) Connect the tester's black lead to the regulator's terminal E.
3) Connect the tester's red lead to:
   a. Terminal A for checking coil and compensatory resistance (cf. Connection 1);
   b. Terminal F for checking the low-speed contact point (cf. Connection 2); and
   c. Blue/white lead for checking the magnetic switch coil (cf. Connection 3).

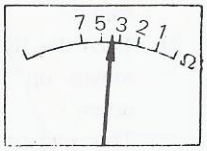
Standard Values:

Unit: Ω

	MF2	YG1D	H1	YL1 (12V)	YL1*	YA5	YA6	YDS2	YDS3 YM1	YD3
1 E – A	20	20	20	17	17	21	20	7	5.6	20
2 E – F	0	0	0	0	0	0	0	0	0	0
3 E – blue/white blue/white – brown	11	11	–	–	4.7	5	Old 1.7 New 5.2	–	–	5

* YL1 with self-starter





7–3 Ignition Coil Primary Winding Connection Test

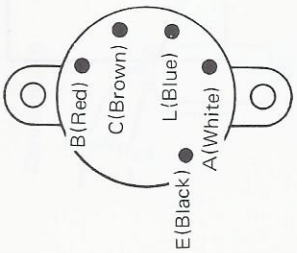
Make this test with the ignition coil mounted on the frame (cf. dynamo-equipped vehicles only).

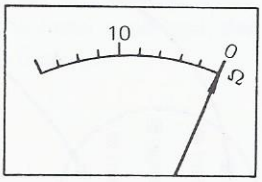
1) Disconnect the ignition coil's orange lead from the dynamo's terminal I and connect the tester's red lead to the orange lead.
2) Connect the tester's black lead to the brown lead (at the horn).

Standard Values:

Unit: Ω

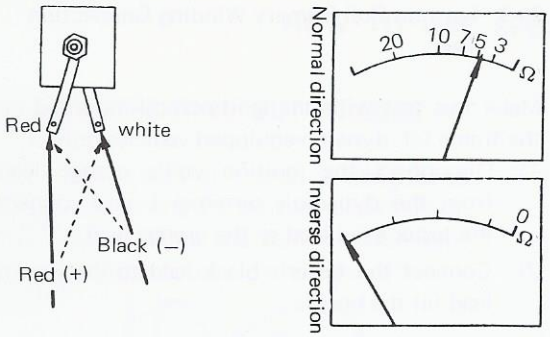
	MF2	YL1 (6V)	YL1 (12V) YA5, 6 YD2, 3	YDS2, 3 YM1	MF2 YG1	YF1, U5 YGS1
Ignition coil primary winding continuity	4.7	2.3	4.9	1.6	0.5 ~ 0.7	4.5





7–4 Switch Internal Connection Test

Type	Ignition key position	Tester leads-to-main switch connections	Test result
Battery– –ignition	"Day"	Red (B) – Brown (C)	If the Pointer remains at or close to 0Ω, the main switch is in proper condition.
	"Night"	Red (B) – Brown (C) Red (B) – Blue (L)	
	"OFF"	Black – Switch cover	
Magneto– –ignition	"Day"	Red – Brown White – Green	
	"Night"	Red – Brown White – Yellow White – Blue	



7–5 Selenium/silicon Rectifier Connection Test

Normal-direction Checkup:

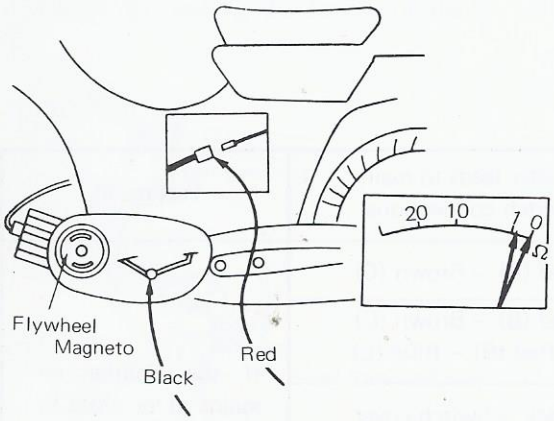
1) Connect the tester's red (+) lead to the red terminal piece of the selenium (or silicon) rectifier.
2) Connect the tester's black (–) lead to the white terminal piece of the selenium (or silicon) rectifier.

Standard Values: Silicon. . . . . 9 – 10Ω
Selenium . . . . . 4 – 5Ω

The rectifier is defective if the pointer does not move at all or moves to the extreme end.

Inverse-direction Checkup:

1) Reverse the above tester-to-rectifier connections.
   The rectifier is in proper condition if the pointer does not move at all. If defective, the pointer will move.

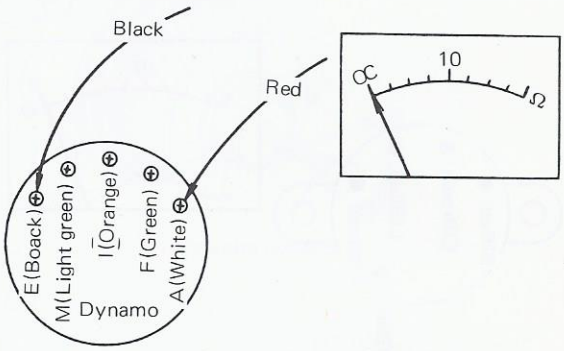


7–6 YAMAHA POCKET TESTER Used as a Contact Breaker Point Checker

1) Disconnect the black lead extending from the magneto at the connector, and connect the tester's red lead to that connector.
2) Ground the tester's black lead to the vehicle's frame.
3) Turn the flywheel by hand; and if the pointer moves up to = 0.7Ω, the breaker point is open.
   The instant the Pointer moves this corresponds to the ignition timing.

B. High Resistance Measurements

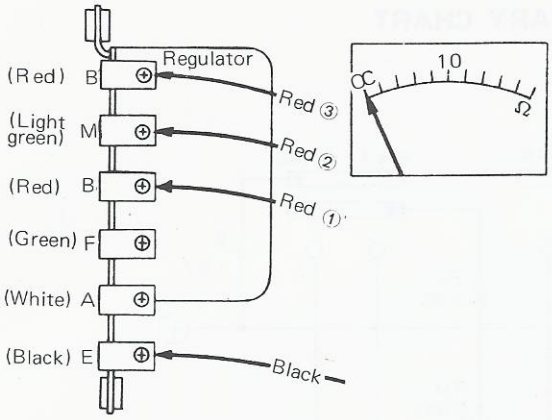
a. The Selector switch is rotated to Ω x 100 range.
b. Zero adjustment to see Ω x 1.
c. Ω x 100 range are mostly used for measurements of . . . . . .
   7-7 Dynamo Field Coil Insulation Test.
   7-8 Regulator Insulation Test.
   7-9 Ignition Coil Primary Winding Insulation Test.
   7-10 Ignition Coil Secondary Whinding Connection Test.



7–7 Dynamo Field Coil Insulation Test

1) Disconnect the wiring harness.
2) Raise the carbon brushes (out of contact with the commutator).
3) Connect the tester's red lead to the terminal A (white), and touch the terminal E (yoke) or the crankcase with the tester's black lead.

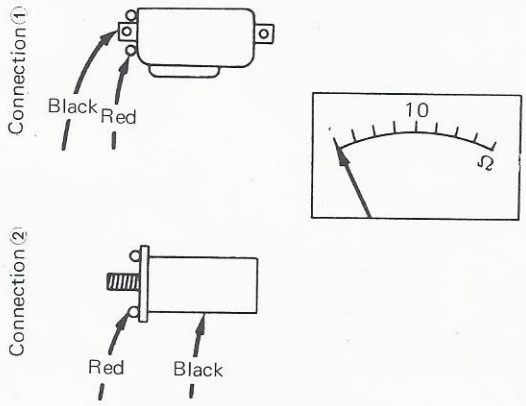
If the Pointer oscillates, the insulation of the dynamo field windings is defective.



7–8 Regulator Insulation Test

1) Disconnect the wiring harness.
2) Connect the tester's black lead to the regulator's terminal E.
3) Touch the regulator's terminals B1, M2, and B3 with the tester's red lead, one at a time.

If the Pointer oscillates when any of the three terminals is touched with the tester's red lead, the insulation of the regulator is defective.



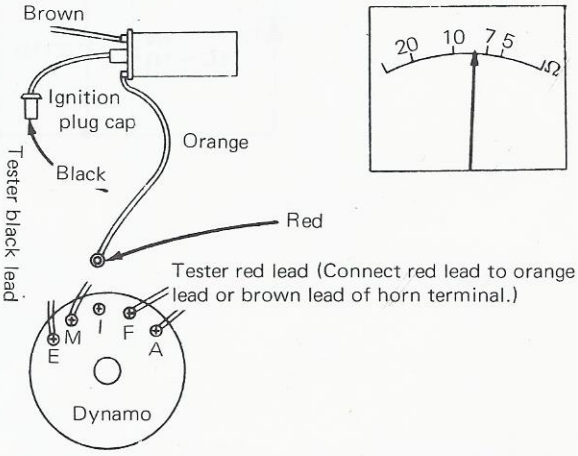
7–9 Ignition Coil Primary Winding Insulation Test Test

Make this check with the ignition coil removed from the frame.

1) Connect the tester's red lead to the primary terminal.
2) Connect the tester's black lead to the iron core (cf. Connection 1 applicable to MF2 YG1-D), or to the ignition coil case itself (cf. Connection 2 applicable to YA6, YDS3, YL1)

If the Pointer oscillates, the insulation of the ignition coil primary winding is defective.

cf. Insulation test applied only for two-terminals (+ , −) coil, not for single-terminal Coil used for magneto type.



7–10 Ignition Coil Secondary Winding Connection Test

Make this check with the ignition coil mounted on the frame (Dynamo-equipped vehicle).

1) Insert the tester's black lead in the ignition plug cap.
2) Disconnect the ignition coil's orange lead from the dynamo's terminal I, and connect the tester's red lead to the freed end of the orange lead.

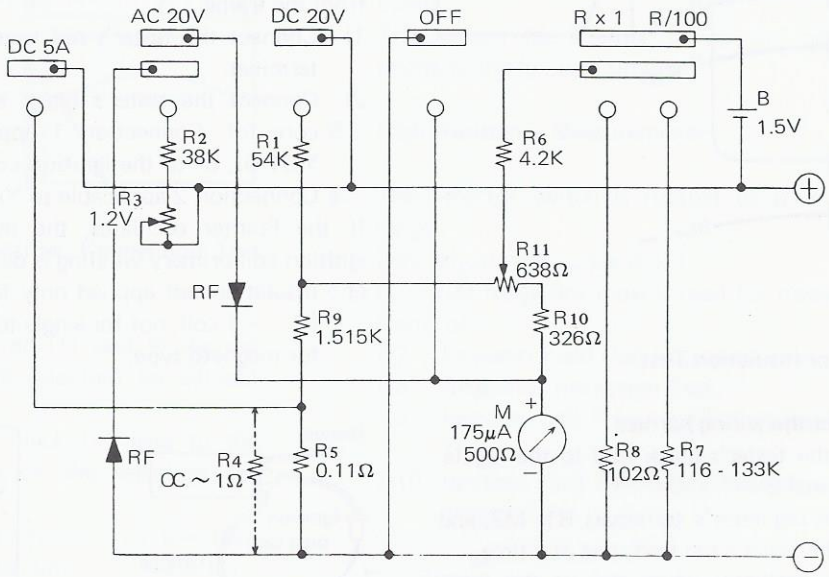
Standard Values: Unit: KΩ

	MF2 YG1D, H1	YL1 (6V)	YL1 (12V) YA5, 6 YD2, 3	YDS2, 3 YM1	MF2K, YG1	YF1, U5 YGS1, MF3D
Ignition coil secondary Winding continuity	8 ~ 9	10 ~ 11	5 ~ 6	5 ~ 6	2.5	Mitsubishi Hitachi 13

SUPPLEMENTARY CHART

1. Schematic diagram.

MODEL SP-6Y SCHEMATIC DIAGRAM



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