

# **YANMAR**

# **SERVICE MANUAL**

## **MARINE DIESEL ENGINE**

### MODELS

**1GM (10L)**

**2GM (F)(L)**

**3GM (D)(F)(L)**

**3HM (F)(L)**

## — Contents —

1. Yanmar Marine Generator .....	2
2. Specifications .....	3
3. Performance Curves (DIN) .....	4
4. Specialized Parts for Marine Auxiliary Engines .....	8
4-1. Differences between the specialized parts of the GM(F)L/HM(F)L Series and the parts of the GM(F)/HM(F) Series .....	9
(1) Cover for starting shaft .....	9
(2) Lube oil pan and dipstick .....	9
(3) Flywheel housing .....	9
(4) Flywheel assembly .....	9
(5) Engine foot .....	9
(6) Water mixing elbow .....	9
(7) Pre-combustion chamber .....	9
(8) F.O. injection limiter .....	9
(9) F.O. injection pump assembly .....	9
(10) Regulator spring .....	10
(11) Bush for governor lever support .....	11
(12) Governor lever support .....	11
(13) Regulator lever .....	12
(14) Fuel cam .....	12
(15) Starter motor .....	12
(16) Bracket for F.O. strainer .....	22
(17) Engine lift hook .....	22
(18) Engine model name plate .....	22
5. Differences between the Yanmar Marine Generator Engines, and the GM(F)L/HM(F)L Engines .....	23
5-1. 2GM(F)L-YK and 3HM(F)L-YK .....	23

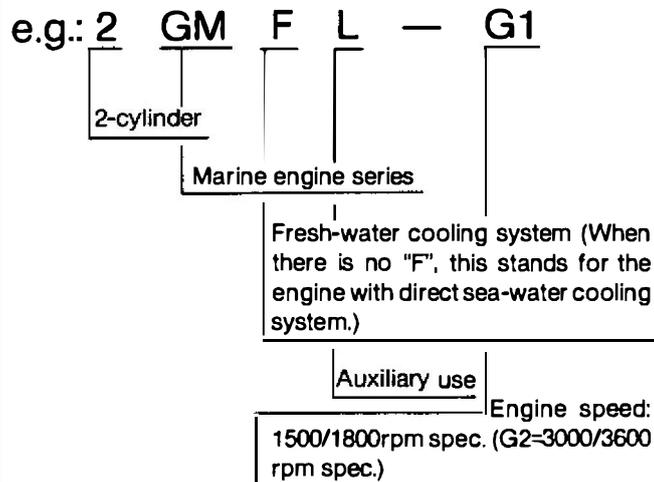
## Introduction

The models of the GM(F)L/HM(F)L series are small marine auxiliary engines based on Yanmar's GM(F)/HM(F) series, our pleasure boat use main propulsion engines.

Consequently, servicing instructions and information shared by the GM(F)L/HM(F)L and the GM(F)/HM(F) series have been omitted from this Service Manual. This Service Manual includes only the most necessary service instructions and information on parts not in common with the GM(F)/HM(F) series. Please note that constructions and specifications included herein are subject to change without notice in order to incorporate improvements in engine performance.

## Engine Model Name

The nomenclature of the GM(F) L/HM(F) L series follows the order shown below:



Every Yanmar engine comes with this Engine Model Name Plate. Always check the model name before making repairs and servicing.

## 1. Yanmar Marine Generator

Listed below are the model names of Yanmar Diesel Engine Marine Generator Sets and the diesel engine models for the generator sets.

Marine Gen Set Model	Output	Applicable Eng. Model
YMGA-40	4kW, 60Hz, 120/240V, 1 Phase, A.C.	△ 2GML-YK
YMGA-40F	4kW, 60Hz, 120/240V, 1 Phase, A.C.	* 2GMFL-YK
YMGA-80	8kW, 60Hz, 120/240V, 1 Phase, A.C.	△ 3HML-YK
YMGA-80F	8kW, 60Hz, 120/240V, 1 Phase, A.C.	* 3HMFL-YK

Note: △ shows direct sea-water cooling type engines  
\* shows fresh-water cooling type engines

### Important

When servicing Yanmar Marine Generators, refer to the "Yanmar Marine Generator Service Manual." This Service Manual is for marine auxiliary engines only.

## 2. Specifications

Series	Direct Sea-water Cooling Type Series								Fresh water Cooling Type Series					
Model	1GM10L-G2	2GML-YK 2GML-G1	2GML-G2	3GML-G1	3GML-G2	3HML-YK 3HML-G1	3HML-G2	2GMFL-YK 2GMFL-G1	2GMFL-G2	3GMFL-G1	3GMFL-G2	3HMFL-YK 3HMFL-G1	3HMFL-G2	
Type	Vertical, 4-cycle water cooled diesel engine													
Combustion system	Swirl pre-combustion chamber													
No. of cylinder	1	2		3				2		3				
Bore x stroke	mm	75 x 72	72 x 72				75 x 85		72 x 72				75 x 85	
Displacement	/	0.318	0.586		0.879		1.126		0.586		0.879		1.126	
Continuous rated output, HP (DIN6270A)	1500rpm	—	5.6	—	8.5	—	10.5	—	5.6	—	8.5	—	10.5	—
	1800rpm	—	6.8	—	10.0	—	13.5	—	6.8	—	10.0	—	13.5	—
	3000rpm	6.0	—	11.0	—	17.0	—	21.5	—	11.0	—	17.0	—	21.5
	3600rpm	7.0	—	13.0	—	20.0	—	25.5	—	13.0	—	20.0	—	25.5
One-hour rated output, HP (DIN6270B)	1500rpm	—	6.2	—	9.5	—	12.0	—	6.2	—	9.5	—	12.0	—
	1800rpm	—	7.5	—	11.5	—	15.0	—	7.5	—	11.5	—	15.0	—
	3000rpm	6.5	—	12.0	—	18.5	—	23.5	—	12.0	—	18.5	—	23.5
	3600rpm	7.8	—	14.5	—	22.0	—	28.0	—	14.5	—	22.0	—	28.0
Lubricating system	Forced lubrication with trochoid pump													
Starting system	Electric													
Cooling system	Direct sea-water cooling								Fresh water cooling					
Power take-off system	Flywheel	SAE, j620d												
	Flywheel housing	SAE, No. 5												
	Rotation	Counterclockwise, viewed from flywheel												
Fuel injection pressure	kg/cm <sup>2</sup>	170				160		170				160		
Fuel injection timing, (bTDC)	Degree	17±1	15±1	17±1	15±1	17±1	8±1	21±1	15±1	17±1	15±1	17±1	8±1	21±1
Lubricating oil capacity, Total (Effective)	/	1.3(0.6)	2.0(1.3)		2.6(1.8)		3.5(2.0)		2.0(1.3)		2.6(1.8)		3.5(2.0)	
Dry weight	kg	67	97		122		147		105		130		156	

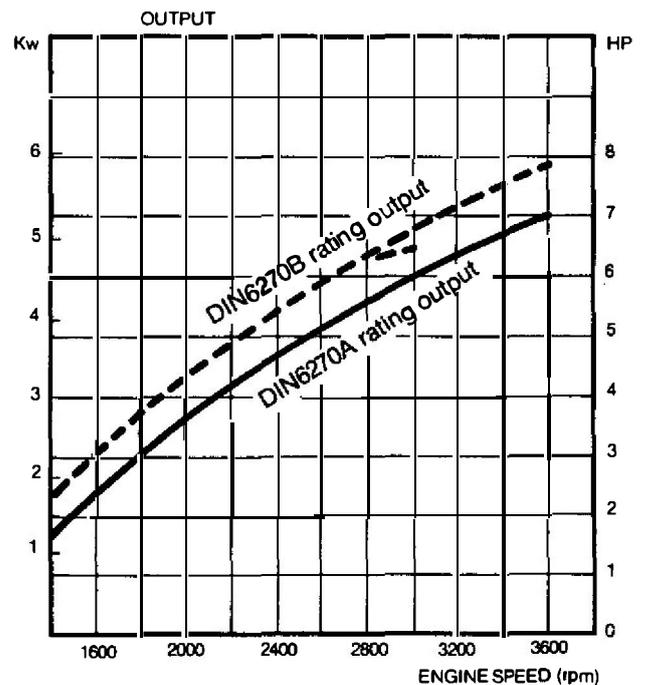
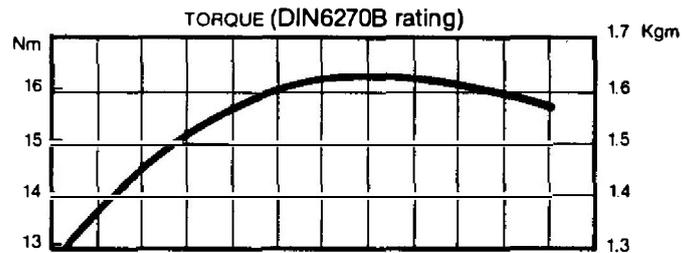
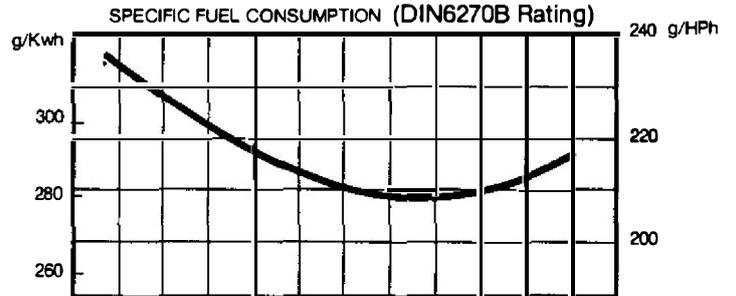
### 3. Performance Curves (DIN)

- Model: 1GM10L-G2
- Models: 2GM(F)L-G1, and 2GM(F)L-YK
- Model: 2GM(F)L-G2
- Model: 3GM(F)L-G1
- Model: 3GM(F)L-G2
- Models: 3HM(F)L-G1, and 3HM(F)L-YK
- Models: 3HM(F)L-G2

Remarks: 1) Output, engine torque and specific fuel consumption are measured at the flywheel.  
 2) These curves show the average performance of respective engines in test operation at our plant.

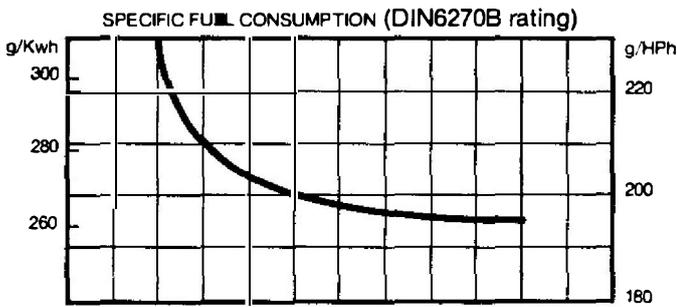
Performance Curves (DIN)

Model: 1GM10L-G2



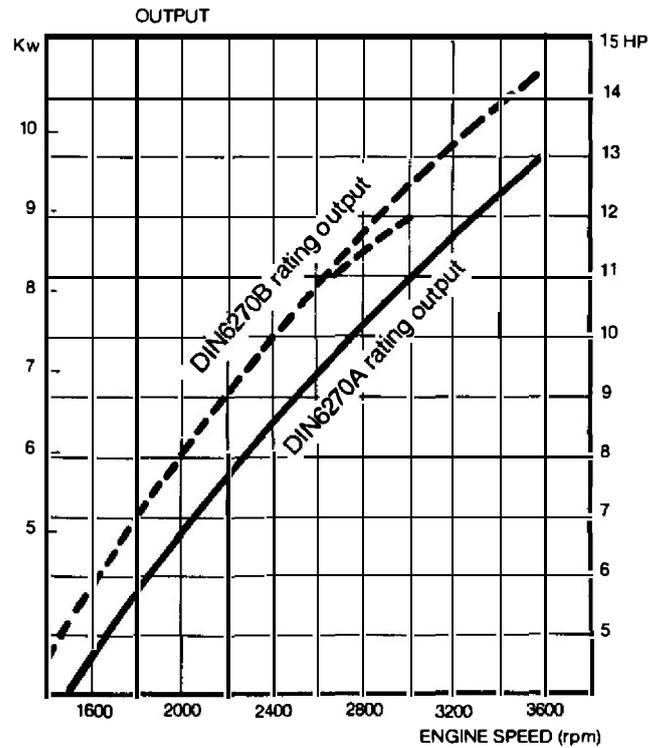
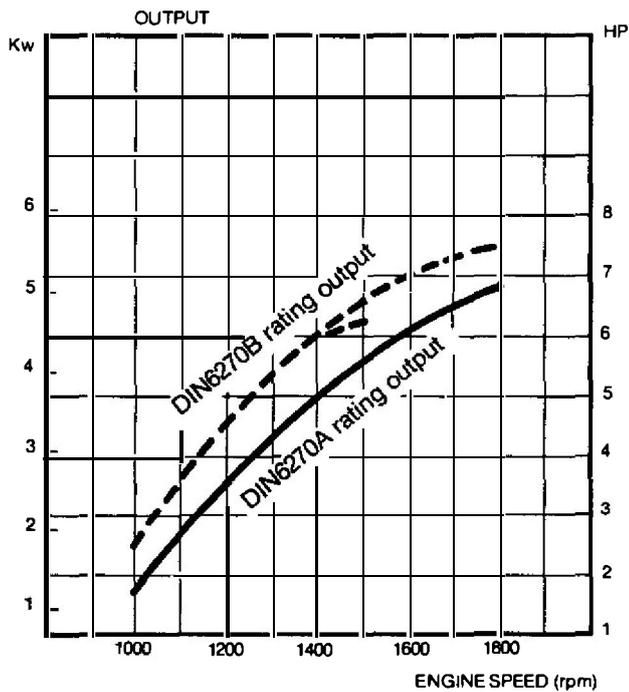
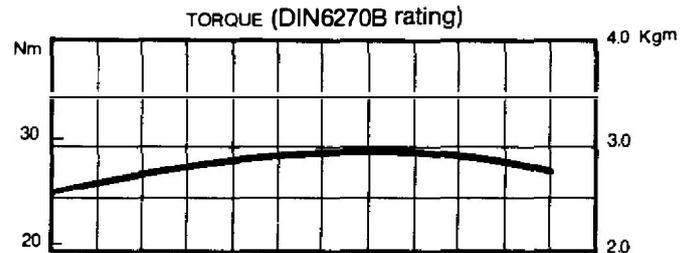
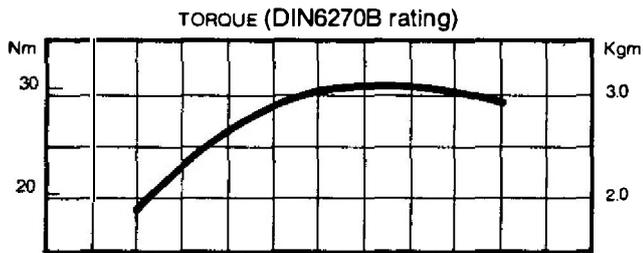
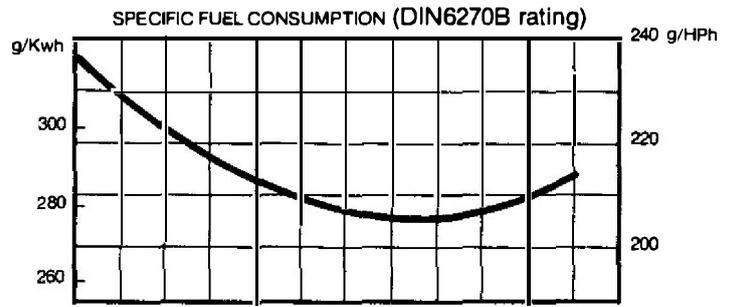
**Performance Curve (DIN)**

**Model: 2GM(F)L-G1**  
**Model: 2GM(F)L-YK**



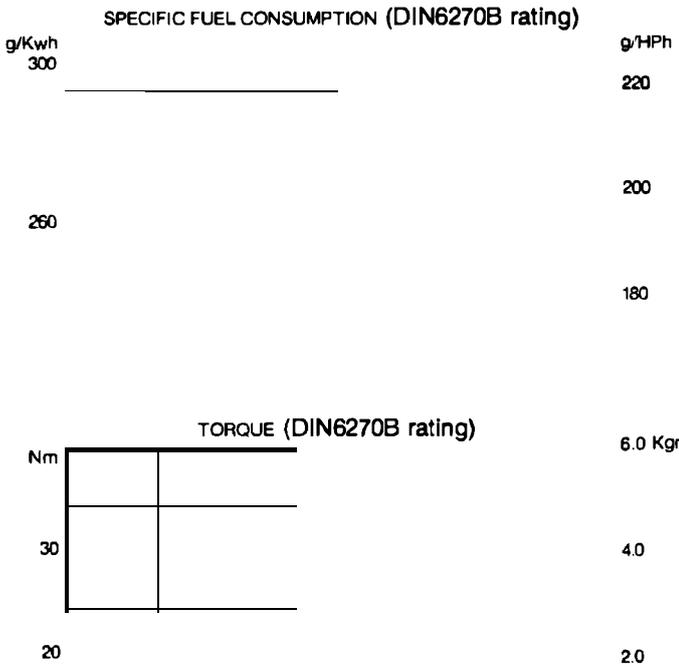
**Performance Curves (DIN)**

**Model: 2GM(F)L-G2**



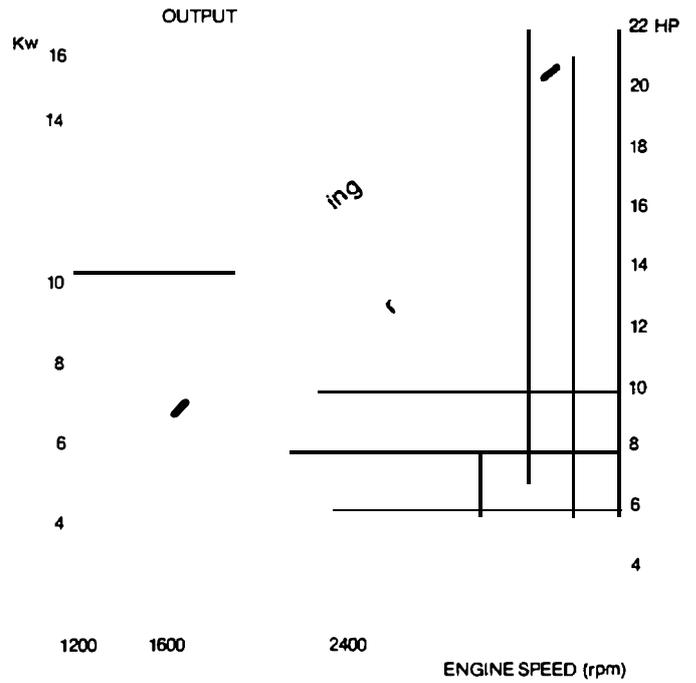
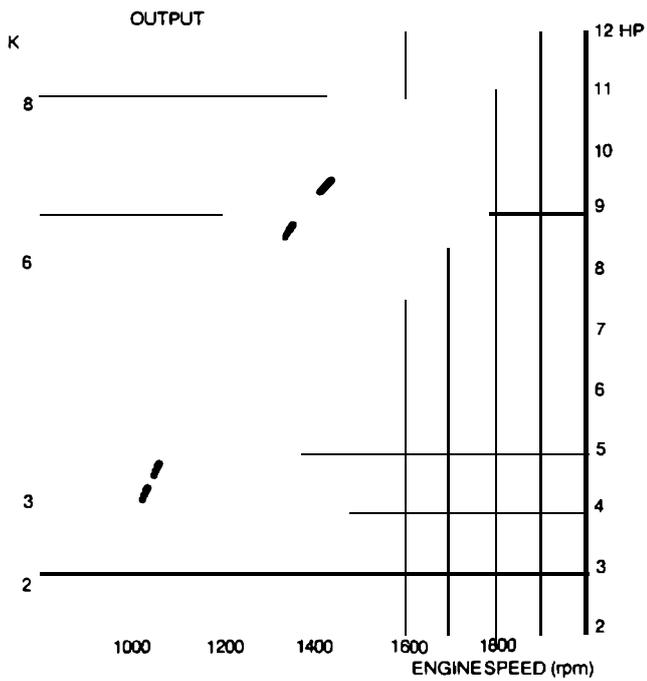
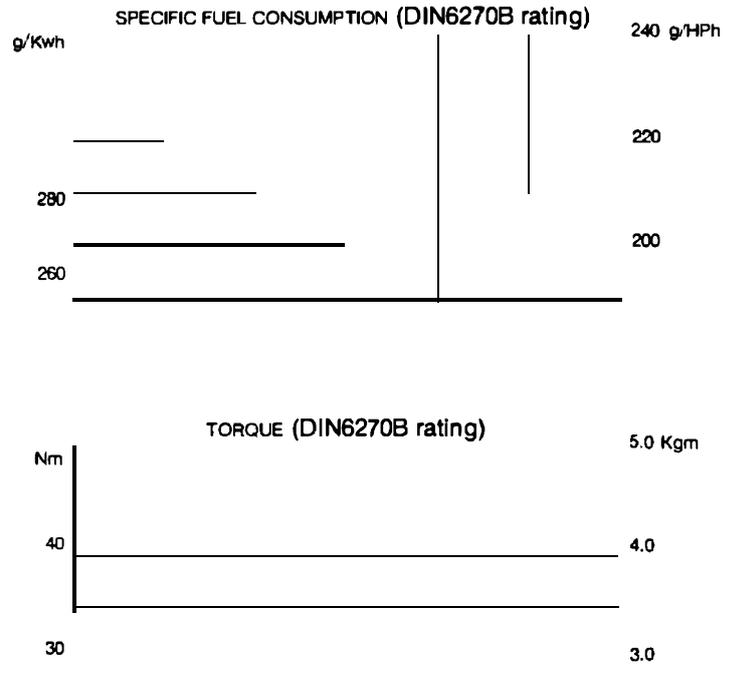
**Performance Curves (DIN)**

**Model: 3GM(F)L-G1**



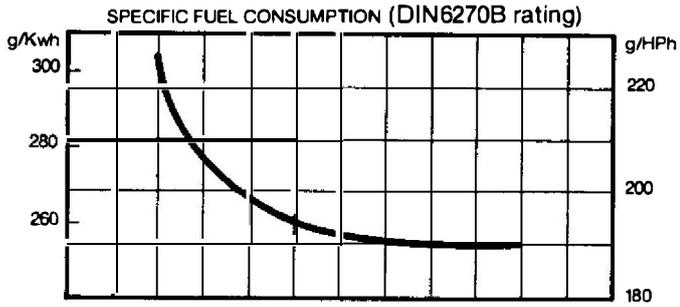
**Performance Curves (DIN)**

**Model: 3GM(F)L-G2**



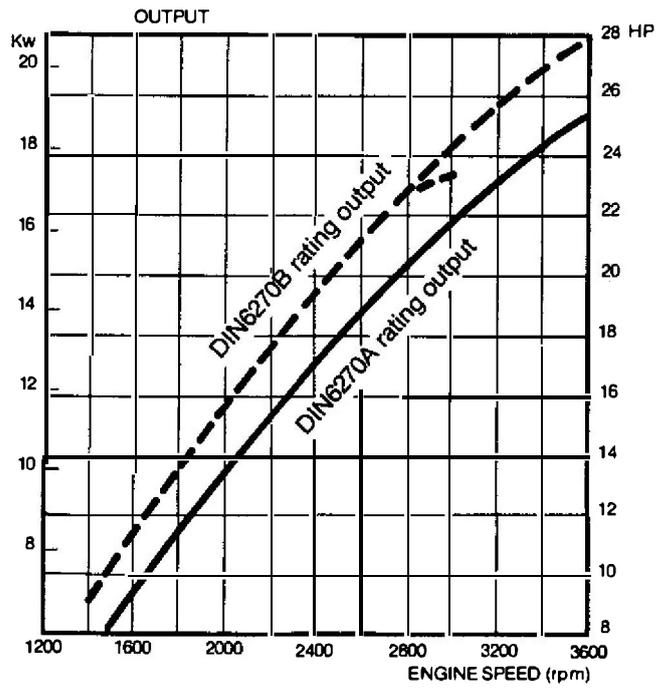
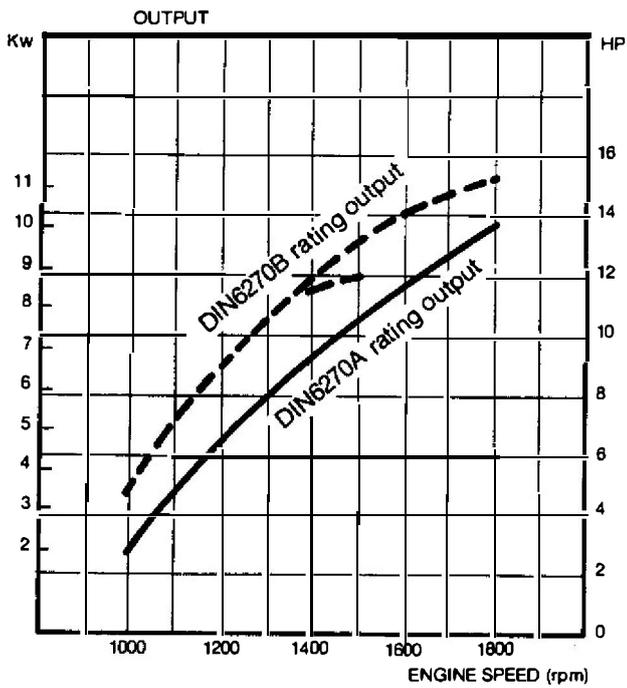
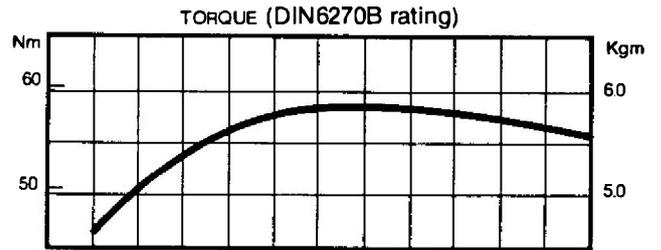
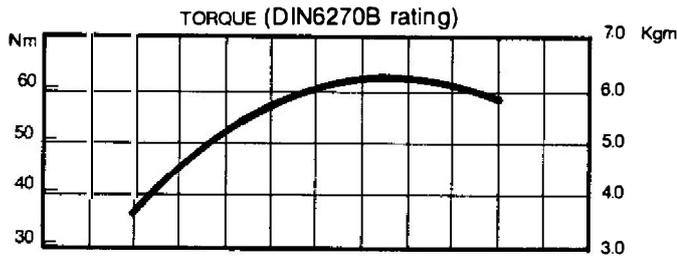
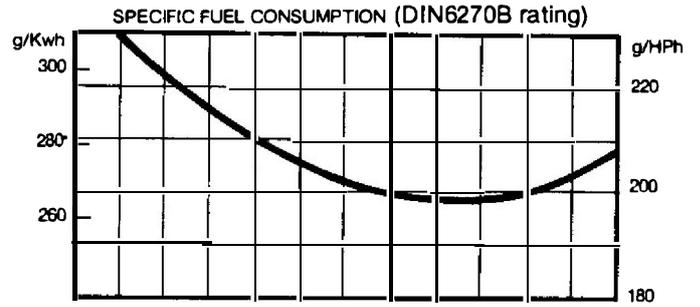
Performance Curves (DIN)

Model: 3HM(F)L-G1  
Model: 3HM(F)L-YK



Performance Curves (DIN)

Model: 3HM(F)L-G2



## 4. Specialized Parts for Marine Auxiliary Engines

Listed below are the specialized parts for the GM(F)L/HM(F)L series of marine auxiliary engines that are not in common with the parts for the GM(F)/HM(F) series of pleasure boat use marine propulsion engines. When replacing parts becomes necessary, make sure you use the correct parts by referring to the "Yanmar Parts Catalog" for your particular engine model.

No.	ENG. Model		1GM10L-		2GML-		2GMFL-		3GML-		3GMFL-		3HML-		3HMFL-		Remarks
			G2	G1 G2	G1 G2	G1 G2	G1 G2	G1 G2	G1 G2	G1 G2	G1 G2	G1 G2					
1	Cover for starting shaft			○	○	○	○	○									Blind cover type GM(F)/HM(F)  
2	Lube oil sump & dipstick												○	○			Total: 3.5/(GM(F)/HM(F): 5.5) Effective: 2.0/(GM(F)/HM(F): 3.0)
3	Flywheel housing		○	○	○	○	○	○	○	○	○	○	○	○	○	○	SAE No. 5
4	Flywheel Ass'y		○	○	○	○	○	○	○	○	○	○	○	○	○	○	SAE No. J620d
5	Engine foot	Gear case side, A	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Shape changed
		Gear case side, B	○ 1 pc	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	
		Flywheel side	○ 2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	2 pcs	
6	Water mixing elbow				○	○	○	○	○	○	○	○	○	○	○	○	Shape changed
7	Pre-combustion chamber	Front		○	○	○	○	○	○	○	○	○	○	○	○	○	Shape changed
		Rear		○	○	○	○	○	○	○	○	○	○	○	○	○	
8	F.O. injection limiter			○	○	○	○	○	○	○	○	○	○	○	○	○	F.O. injection limit changed
9	F.O. injection Pump Ass'y	1500/1800rpm		○	○	○	○	○	○	○	○	○	○	○	○	○	Plunger and delivery valve changed to comply with the F.O. injection limit change
		3000/3600rpm	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Plunger and delivery valve changed to comply with the F.O. injection limit change
10	Regulator spring	1500/1800rpm		○	○	○	○	○	○	○	○	○	○	○	○	○	I.D. color: Blue
		3000/3600rpm	○	○	○	○	○	○	○	○	○	○	○	○	○	○	I.D. color: White
11	Bush for governor lever support		○	○	○	○	○	○	○	○	○	○	○	○	○	○	Needle bearing changed to bushing
12	Governor lever support		○	○	○	○	○	○	○	○	○	○	○	○	○	○	Changed in accordance with the change in (11).
13	Regulator lever		○														Changed in accordance with the change in the regulator spring fixing length.
14	F.O. cam (F.O. injection pump drive)			○	○	○	○	○	○	○	○	○	○	○	○	○	Change in cam height
15	Starter motor		○	○	○	○	○	○	○	○	○	○	○	○	○	○	12V/1.3kW, Model: S114-244 GM(F) S114-303 12V/1.0kW
16	Bracket for F.O. strainer		○														Fixing position of F.O. strainer changed
17	Lifting hook for Engine			○	○	○	○	○	○	○	○	○	○	○	○	○	Engine's center of gravity changed
18	Engine model name plate		○	○	○	○	○	○	○	○	○	○	○	○	○	○	New engine model names

**Note:** ○—○ stands for the parts common to the models covered.  
○ stands for specialized parts for the relevant engine model.

#### 4-1. Differences between the specialized parts of the GM(F)L/HM(F)L Series and the parts of the GM(F)/HM(F) Series

##### (1) Cover for starting shaft

Since the starting system for all models of the GM(F)L/HM(F)L series is electric, a blind cover has been attached to prevent mis-use of the manual start handle.

Applicable Engine Models: 2GML-G1 and G2  
3GML-G1 and G2  
2GML-YK

##### (2) Lube oil pan and dipstick

A shallow type oil pan has been adopted to reduce the overall height of the engine. (The lube oil capacity has been changed accordingly.)

Applicable Engine Models: 3HML-G1 and G2  
3HMFL-G1 and G2  
3HML-YK

##### (3) Flywheel housing

SAE No. 5 has been adopted.

Applicable Engine Model: All models.

##### (4) Flywheel Assembly

SAE No. J620d has been adopted.

Applicable Engine Model: All models

##### (5) Engine Foot

The shape of the engine foot has been changed.

Applicable Engine Model: All models

##### (6) Water Mixing Elbow

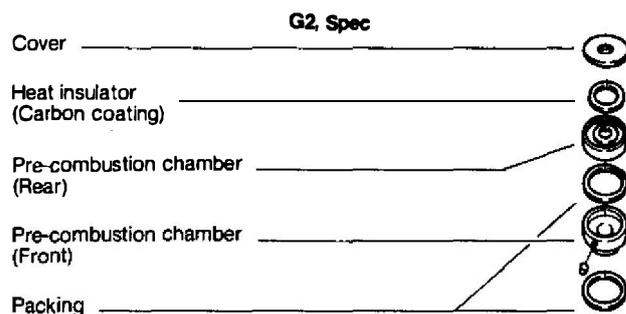
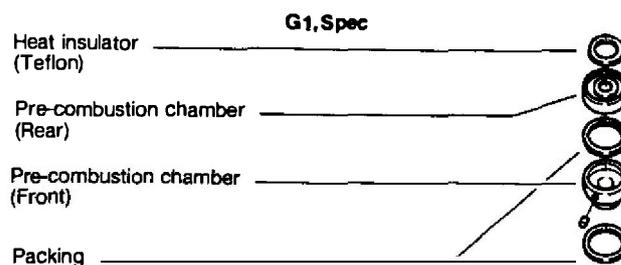
The shape has been changed to prevent it from coming into contact with the flywheel housing.

Applicable Engine Models: 2GMFL-G1 and G2  
3GML-G1 and G2  
3GMFL-G1 and G2  
3HML-G1 and G2  
3HMFL-G1 and G2  
2GMFL-YK  
3HML-YK  
3HMFL-YK

##### (7) Pre-combustion Chamber

The G1 spec. (1500/1800 rpm) models of the GM(F)L series have different pre-combustion chamber shapes (front and rear). Also, then heat insulators have been changed from carbon coating to Teflon. When replacing parts, make sure you use the correct G1 specification parts.

Applicable Engine Models: 2GML-G1  
2GMFL-G1  
3GML-G1  
3GMFL-G1  
2GML-YK  
2GMFL-YK



##### (8) F.O. Injection Limiter

Both the fuel injection limit shaft, which controls the amount of fuel injected in accordance with engine output, and the F.O. injection limiter spring, which adjusts engine torque, are specialized parts for all G1 spec. (1500/1800rpm) models. When replacing parts, make sure you use the correct G1 specification parts.

Applicable Engine Models: 2GML-G1  
2GMFL-G1  
3GML-G1  
3GMFL-G1  
3HML-G1  
3HMFL-G1  
2GML-YK  
2GMFL-YK  
3HML-YK  
3HMFL-YK

##### (9) F.O. Injection Pump Assembly

The F.O. injection volume as well as the plunger and the delivery valve have been changed. For models 3HM(F)L-G1 and G2, however, no change has been made in the plunger and the delivery valve.

### Standard F.O. Injection Amount

ENG. model	Camshaft speed (pump speed)	Amount of injection at rack mark position	F.O. injection pump ass'y. code No.
1GM10L-G2	1800 rpm	19±0.5cc/1000st	728173-51100
2GM(F)L-G1	900 rpm	17±0.5cc/1000st	724082-51100
2GM(F)L-YK	900 rpm	17±0.5cc/1000st	724082-51100
2GM(F)L-G2	1800 rpm	17±0.5cc/1000st	728272-51200
3GM(F)L-G1	900 rpm	17±0.5cc/1000st	728372-51100
3GM(F)L-G2	1800 rpm	17±0.5cc/1000st	728372-51200
3HM(F)L-G1	900 rpm	22±0.5cc/1000st	728672-51100
3HM(F)L-YK	900 rpm	22±0.5cc/1000st	728672-51100
3HM(F)L-G2	1800 rpm	22±0.5cc/1000st	728672-51200

Service standard values other than those listed above are the same as for main propulsion GM(F)/HM(F) series engines. See pages 3-1 ~ 3-28, Chapter 3, "Fuel System", of the "Service Manual" for GM(F)/HM(F) series.

### Plunger and Delivery Valve

Injection pump Ass'y code No.	Plunger with barrel code No.	Delivery valve with seat code No.	ENG. model
728173-51100	© 121454-51100	© 128170-51300	1GM10L-G2
724082-51100	124950-51100	128170-51300	2GM(F)L-G1 2GM(F)L-YK
728272-51200	124000-51100	124060-51300	2GM(F)L-G2
728372-51100	121550-51100	128170-51300	3GM(F)L-G1
728372-51200	121575-51100	124060-51300	3GM(F)L-G2
728672-51100	* 128696-51100	* 128696-51300	3HM(F)L-G1 3HM(F)L-YK
728672-51200	* 128696-51100	* 128696-51300	3HM(F)L-G2

Note 1: © stands for parts interchangeable with parts of model 1GM10(C).

\* stands for parts interchangeable with parts of model 3HM(F)(C).

2: A plate with an assembly code number stamped on its face is attached to the injection pump. When replacing the plunger and delivery valve, make sure you use parts that match this assembly code number.

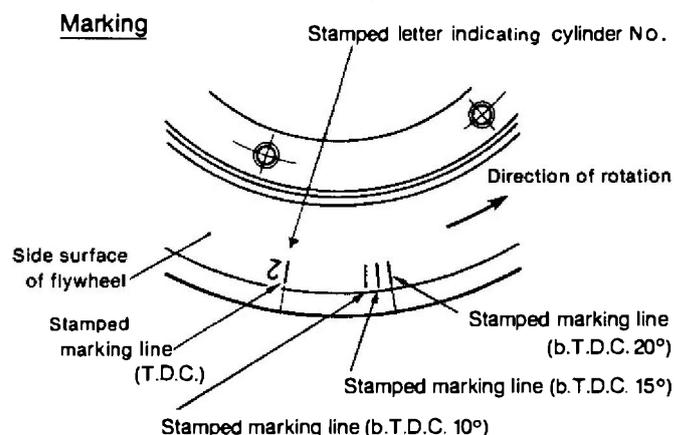
### Fuel Injection Timing

Fuel injection timing, bTDC	17°±1	15°±1	8°±1	21°±1
Engine model	1GM10L-G2 2GM(F)L-G2 3GM(F)L-G2	2GM(F)L-G1 2GM(F)L-YK 3GM(F)L-G1	3HM(F)L-G1 3HM(F)L-YK	3HM(F)L-G2

Note: Fuel Injection Timing Mark

On the side surface of flywheel lines and a figure have been stamped to indicate the position of T.D.C. and the number of cylinders. Other lines have been stamped to indicate where 10°, 15° and 20° from T.D.C. are located.

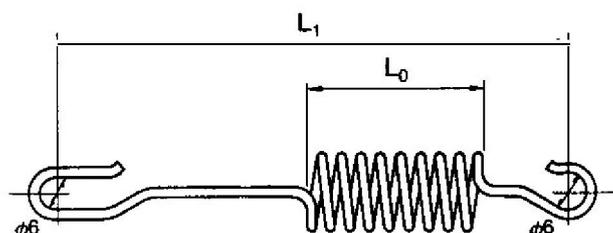
### Position of top dead center (Flywheel)



	1GM10L	2GM(F)L	3GM(F)L & 3HM(F)L
Stamped letter	1	1,2	1,2,3

### (10) Regulator Spring

Specifications



ENG. model	1GM10L-G2	2GM(F)L-G1 3GM(F)L-G1 3HM(F)L-G1	2GM(F)L-G2 3GM(F)L-G2 3HM(F)L-G2	2GM(F)L-YK 3HM(F)L-YK
Wire diameter, $\phi$ mm	2	1.6	2.3	1.4
Coil outside diameter, $\phi$ mm	16	15	16	13.4
No. of coil	10.5	10.5	9	7.5
Spring constant kg/mm	0.38	0.188	0.76	0.296
Free length	$L_0$ mm	27	20	28.5
	$L_1$ mm	63	66	74.7
Identification color	None	Blue	White	

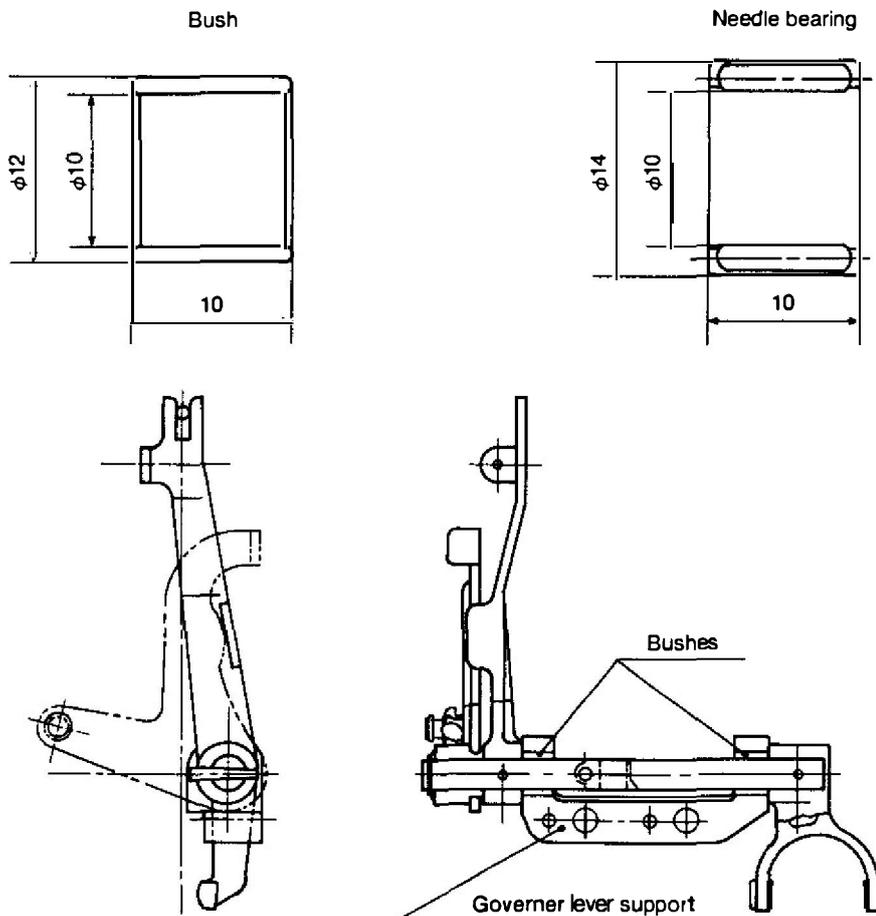
Note: The regulator spring (no I.D. color) for model 1GM10L-G2 is different in shape from the regulator spring for model 1GM10(C)

### (11) Bush for Governor Lever Support

### (12) Governor Lever Support

The needle bearings (Outer dia.  $\phi$ 14mm x Inner dia.  $\phi$ 10mm x L10mm) of the governor lever support have been changed to bushes (Outer dia.  $\phi$ 12mm x Inner dia.  $\phi$ 10mm x L10mm). Along with this change, the size of the press-in hole in the governor lever support has been changed to  $\phi$ 12mm from  $\phi$ 14mm.

Applicable Engine Model: All models

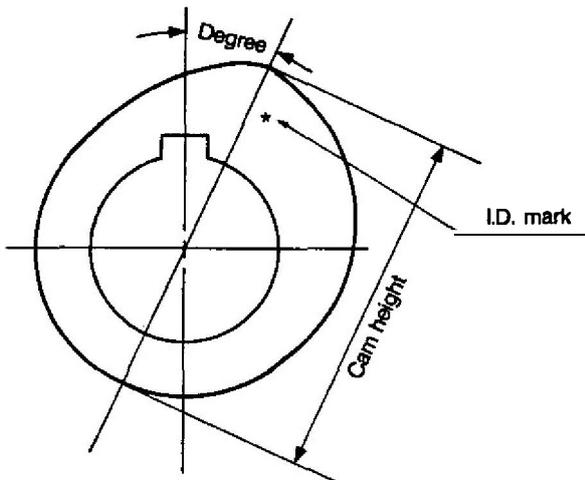


**(13) Regulator Lever**

Along with the change in the length of the regulator spring, the hook position of the lever has been changed.  
 Applicable Engine Model: 1GM10L-G2

**(14) Fuel Cam (F.O. Injection Pump Drive)**

The fuel injection timing (b.T.D.C.) for all G1 spec. (1500/1800rpm) models has been changed. Accordingly, the angle of the top line of the cam profile from the key groove center line has been changed. (See the sketch below.)



\*I.D. Mark: stands for the positioning mark for fixing the marked surface facing to the gear case side.

Applicable Engine Models:  
 2GM(F)L-G1, 2GM(F)L-YK  
 3GM(F)L-G1  
 3HM(F)L-G1, 3HM(F)L-YK

Note 1: For maintenance standards, and the wear limit of the fuel cam height, see the GM(F)/HM(F) Service Manual, Chapter 2, "Camshaft", pages 2-61.

2: I.D. marks are also provided for the marine propulsion engine models.

I.D. mark	Applicable engine model
O	1GM(C), 1GM10(C)(L-G2), 3GM(F)L-G1, 3HM(F)L-G1, 3HM(F)L-YK
E	2GM(F)L-G1, 2GM(F)L-YK
2	2GM(F)(C), 2GM(F)L-G2
Z	3GM(F)(C), 3HM(F)(C), 3GM(F)L-G2, 3HM(F)L-G2

**(15) Starter Motor**

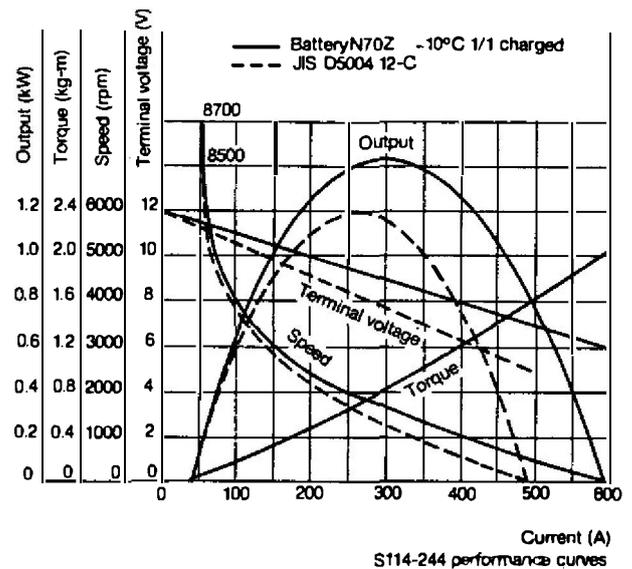
The capacity has been changed to 12V/1.3kw for all GML series engines.

The starter motor is installed on the flywheel housing. When the starting button is pushed, the starter motor pinion flies out and engages the ring gear of the flywheel. Then the main contact is closed, current flows, and the engine is started.

After the engine starts, the pinion automatically returns to its initial position when the starting button is released. Once the engine starts, the starting button should be released immediately. Otherwise, the starter motor may be damaged or burned out.

**1 Specifications and Performance.**

Engine model		GML-series
Model		S114-244
Rating (sec)		30
Output (kW)		1.3
Clutch system		Overrunning
Engagement system		Magnetic shift
Pinion flyout voltage (V)		8 or less
No-load	Terminal voltage (V)	12
	Current (A)	60 or less
	Speed (rpm)	6000 or greater

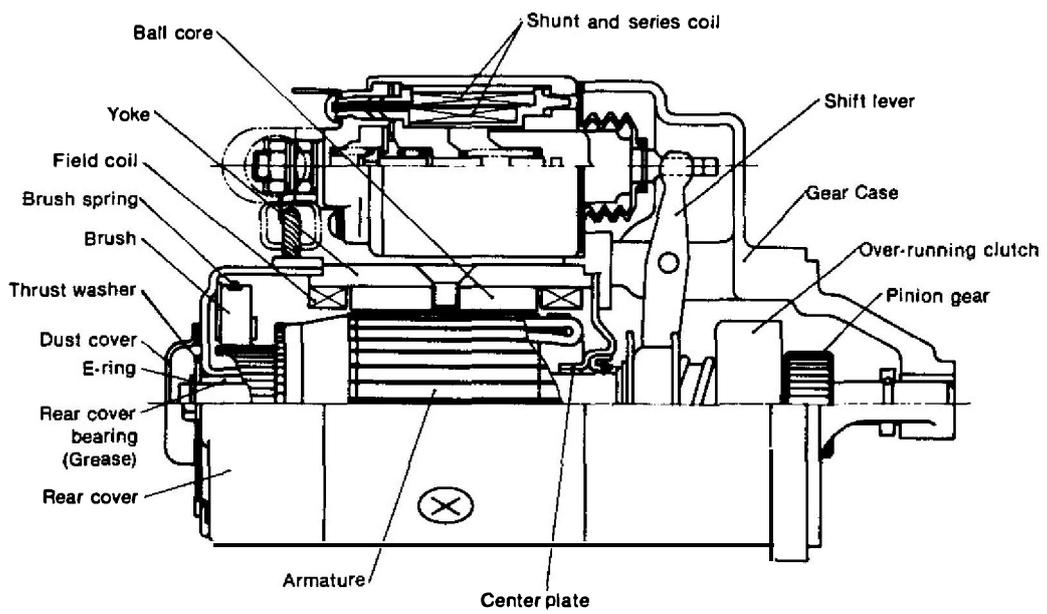
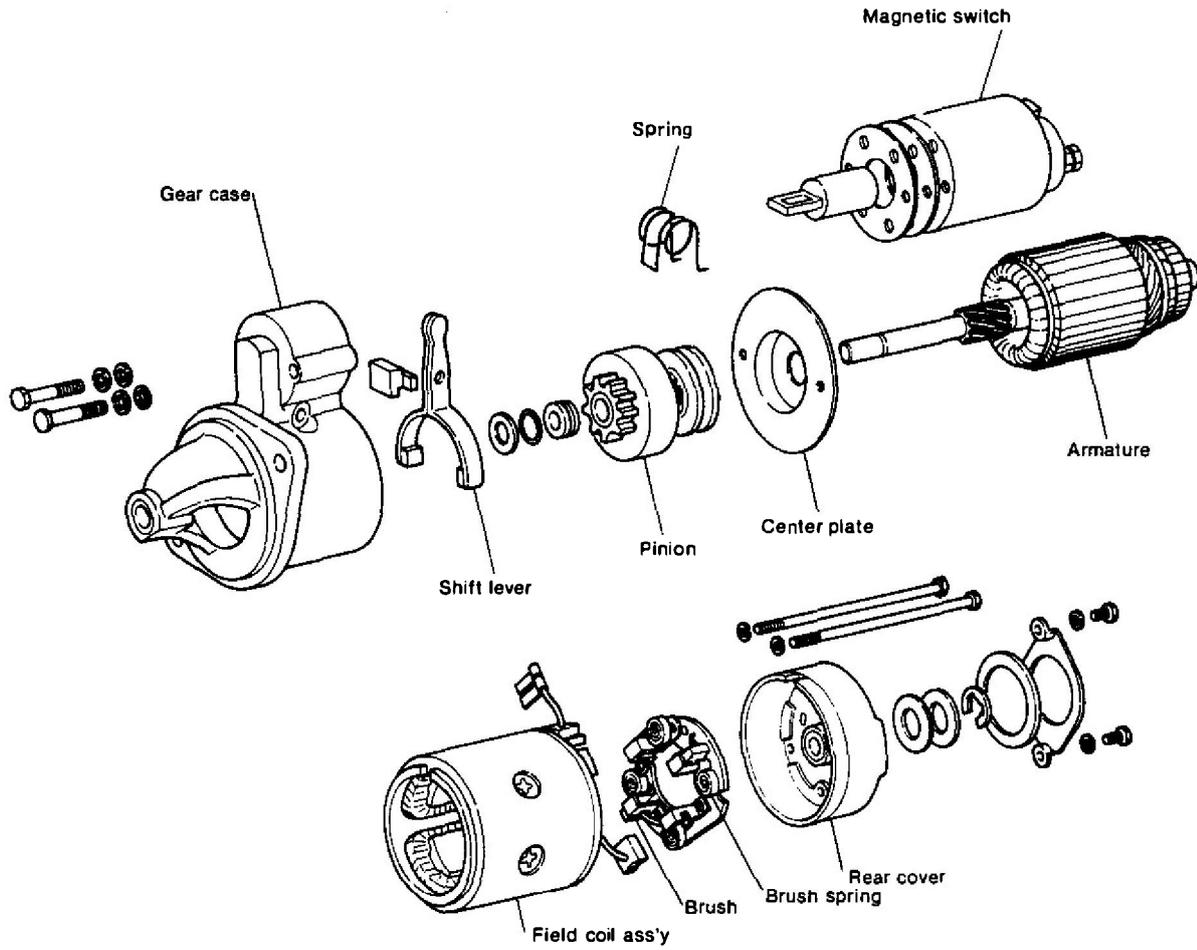


**2 Construction**

This starter motor described in this section is a conventional pre-engaged 4-brush 4-pole starter motor with a screw roller drive clutch.

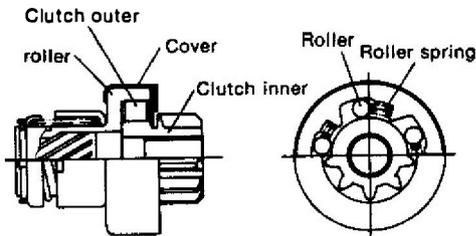
The starter motor is composed of three major parts, as follows:

- (1) Magnetic switch  
 Moves plunger to engage and disengage pinion, and through the engagement lever, opens and closes main contact (moving contact) to stop the starter motor.
- (2) Motor  
 A continuous current series motor which generates rotational drive power.
- (3) Pinion  
 Transfers driving power from motor to ring gear. An over-speed clutch is employed to prevent damage if the engine should run too fast.

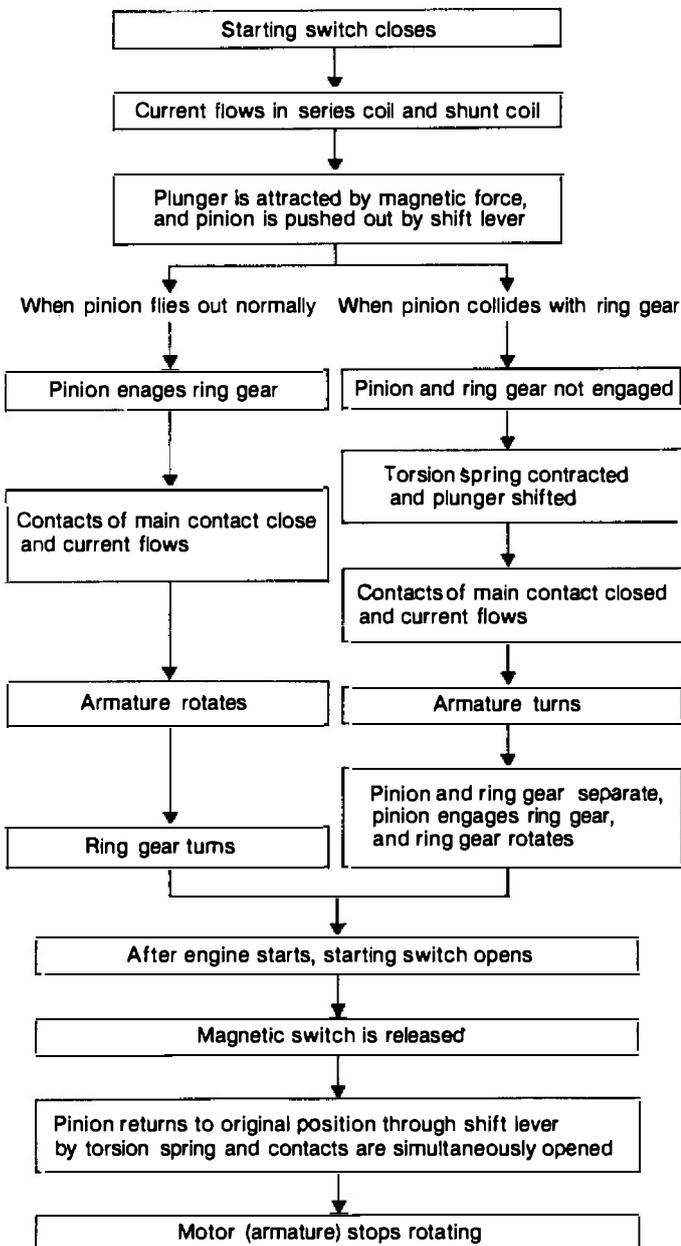


To prevent the motor receiving a shock which will occur as the engine starts and over-runs, this starter motor is installed with an over-running clutch.

**Over-running clutch**



**3 Operation**



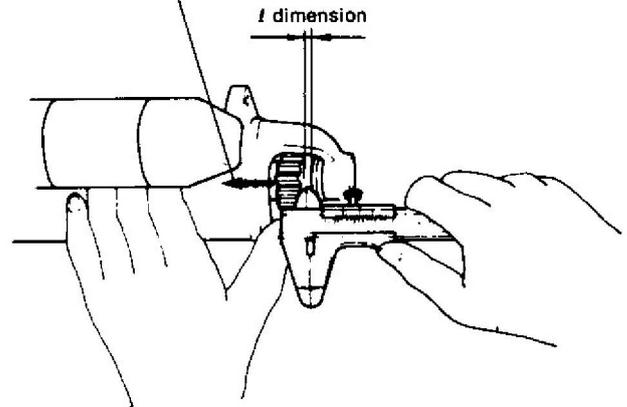
**4 Adjustment and performance test**

**4.1 L-size measurement (gap between pinion and pinion stopper)**

When the pinion is at the projected position, measure between pinion and pinion stopper. This check should be made with the pinion pressed back lightly to take up any play in the engagement linkage.

	Starter motor	l dimension
GML-Series	S114-244	0.3 ~ 2.5

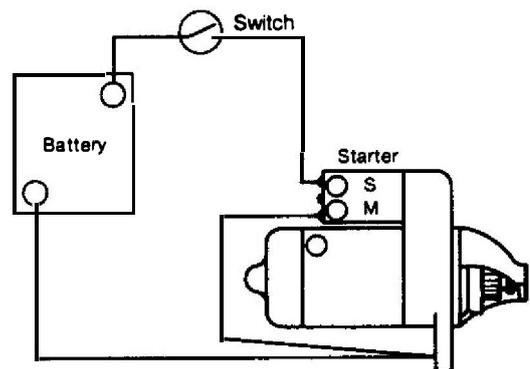
Pressing the pinion



Measuring of l dimension

**4.2 Pinion movement**

After complete assembly of the starter motor, connect up the motor as in Fig.



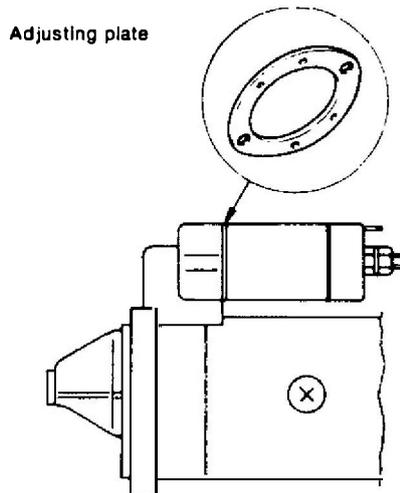
### 4.3 Plunger movement

Adjustment made by adjusting stroke of magnetic plunger to the prescribed value.

#### (1) Shim adjusting type

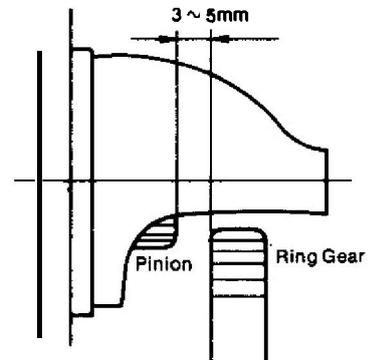
Adjust the  $l$ -dimension installing shim (Adjusting plate) at the magnetic switch attach section.

There are two kind of shim [Thickness 0.5mm (0.0197in.), 0.8mm (0.0315in.)]



### 4.5 Mesh clearance

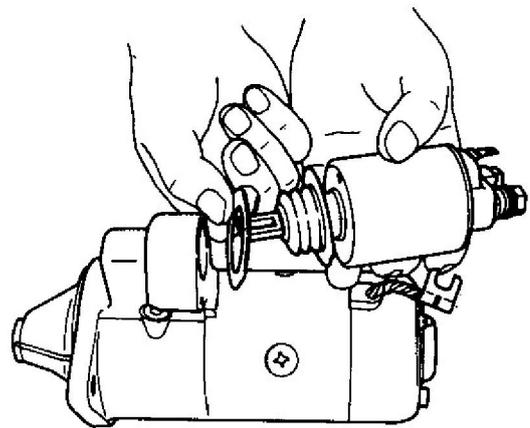
Mesh clearance is the distance between the flywheel ring gear and starter motor pinion in the rest position. This clearance should be between 3 mm to 5 mm.



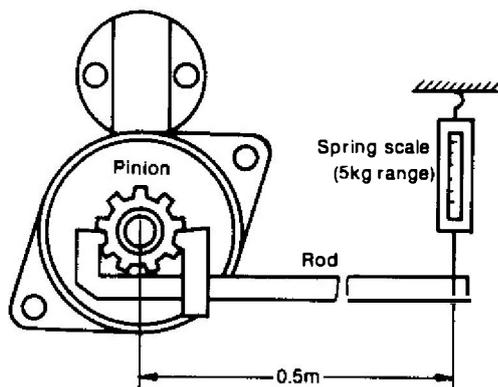
## 5 Disassembly

### 5.1 Magnetic switch

- (1) Disconnect magnetic switch wiring.
- (2) Remove through bolt mounting magnetic switch.
- (3) Remove magnetic switch.

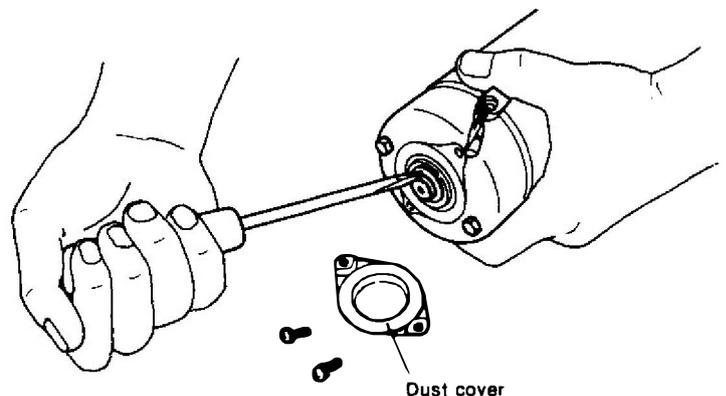


### 4.4 Pinion lock torque measurement

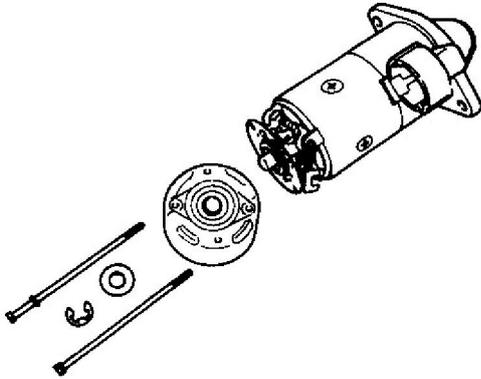


### 5.2 Rear cover

- (1) Remove dust cover.

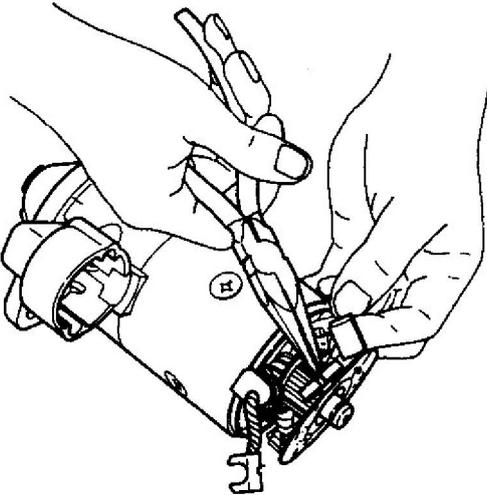


- (2) Remove E-ring, and remove thrust washer (be careful not to lose the washer and shim).
- (3) Remove the two through bolts holding the rear cover and the two screws holding the brush holder.
- (4) Remove rear cover.



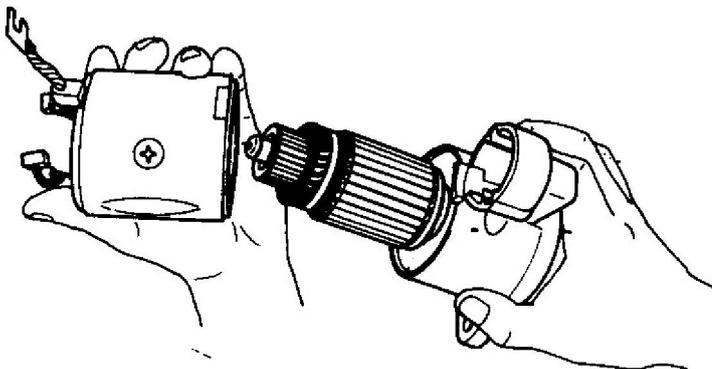
### 5.3 Brush holder

- (1) Float (-)brush from the commutator.
- (2) Remove (+)brush from the brush holder.
- (3) Remove brush holder.



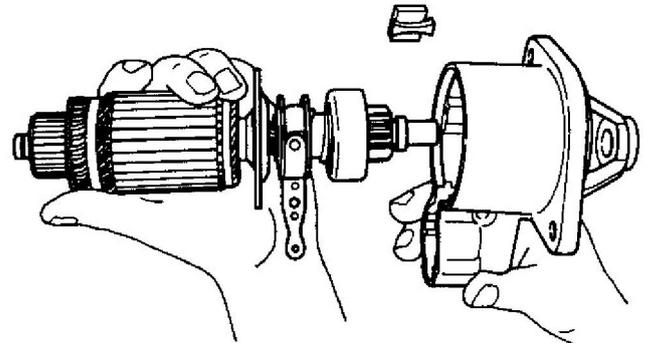
### 5.4 Yoke

- (1) Remove yoke. Pull it out slowly so that it does not strike against other parts.



### 5.5 Armature

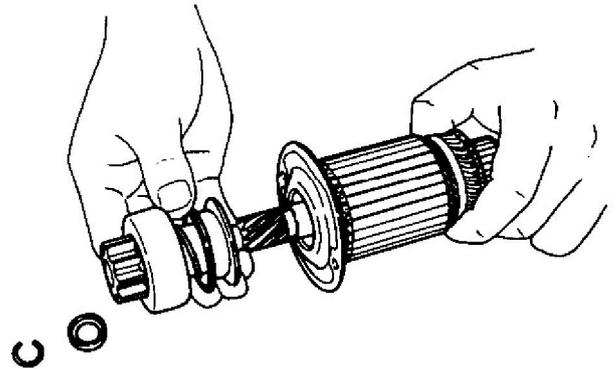
- (1) Slide pinion stopper to pinion side.



- (2) Remove the pinion stopper clip.

### 5.6 Pinion

- (1) Slide the pinion stopper to the pinion side.
- (2) Remove the pinion stopper clip.
- (3) Remove the pinion from the armature.

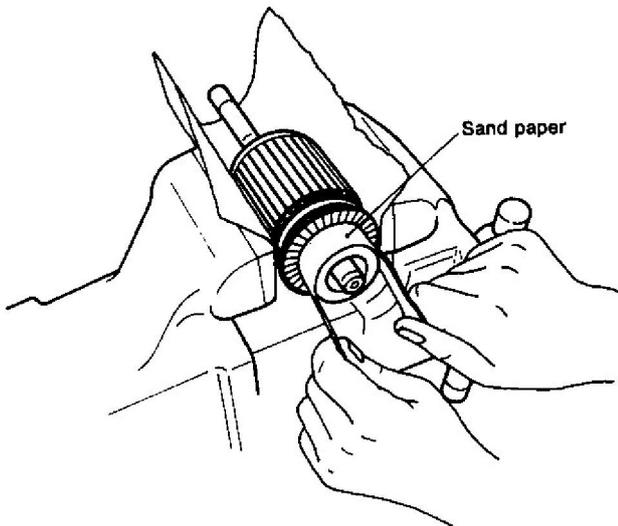


## 6 Inspection

### 6.1 Armature

#### (1) Commutator

Inspect the surface of the commutator. If corroded or pitted, sand with #500 ~ #600 sandpaper. If the commutator is severely pitted, grind it to within a surface roughness of at least 0.4 by turning it on a lathe. Replace the commutator if damage is irreparable.



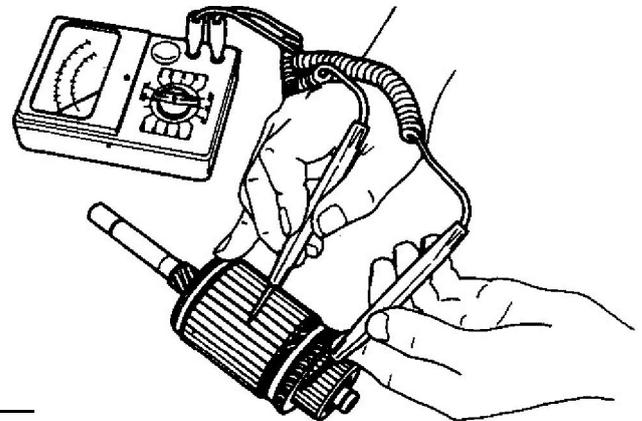
	Maintenance standard	Repair limit
Mica undercut	0.2 (0.0079)	0.5 ~ 0.8 (0.0197 ~ 0.0315)

#### (3) Armature coil ground test

Using a tester, check for continuity between the commutator and the shaft (or armature core). Continuity indicates that these points are grounded and that the armature must be replaced.

- 1) Short test...existence of broken or disconnected coil.
- 2) Insulation test...between commutator and armature core or distortion shaft.

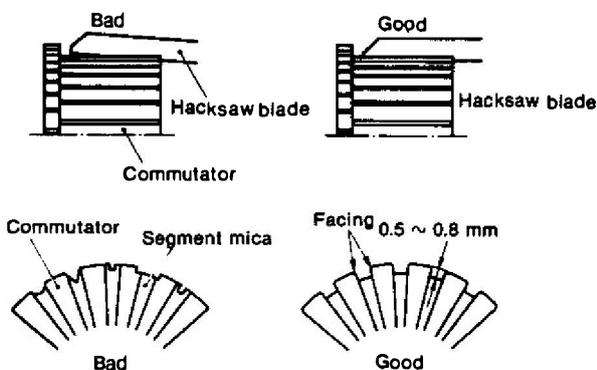
Checking commutator for Insulation defects.



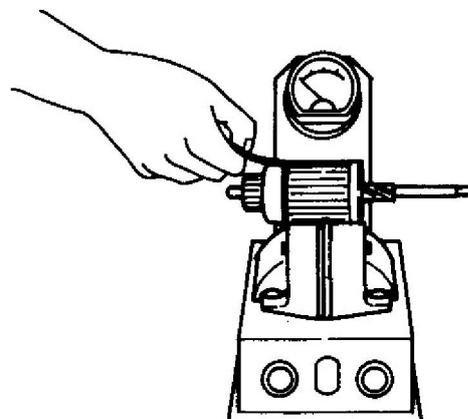
	Maintenance standard	Wear limit
Commutator outside diameter	φ40(1.5748)	φ38(1.496)
Commutator run-out	Within 0.04 (0.0016)	0.2(0.0079)
Difference between maximum diameter and minimum diameter	Repair limit 0.4(0.0157)	Repair accuracy 0.05(0.002)

#### (2) Mica undercut

Check the mica undercut, correct with a hacksaw blade when the undercut is too shallow.

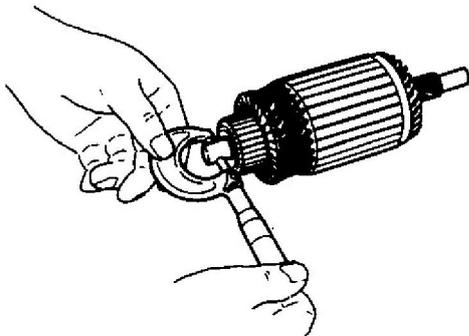


Checking armature windings for insulation faults.



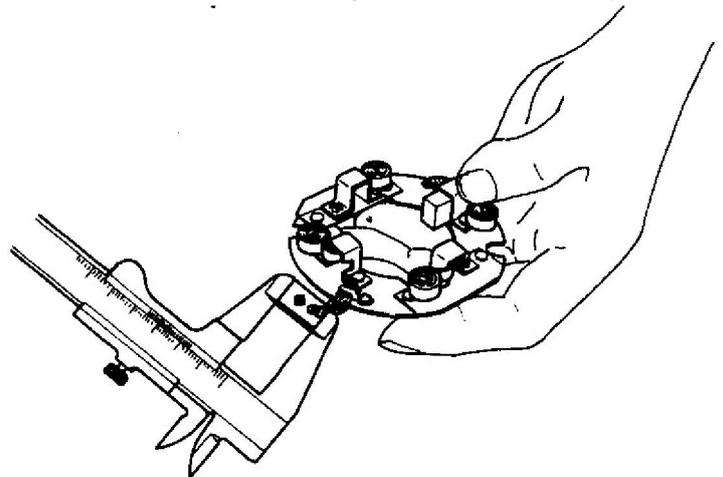
**(4) Armature shaft outside diameter**

Measure the outside diameter of the armature shaft at four locations: front, center, end, and pinion. Replace the armature if the shaft is excessively worn. Check the bend of the shaft; replace the armature if the bend exceeds 0.08mm (0.0031in.)



**6.3 Brush**

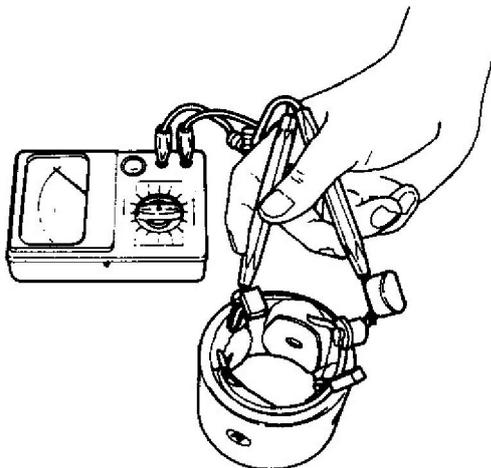
The brushes are quickly worn down by the motor. When the brushes are defective, the output of the motor will drop.



**6.2 Field coil**

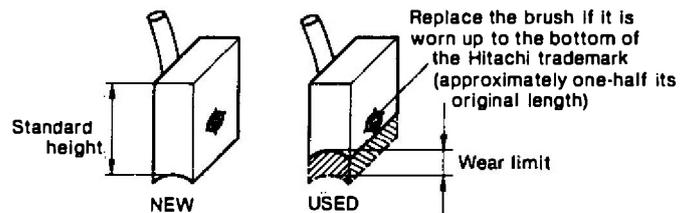
**(1) Open test**

Check for continuity between the terminals connecting the field coil brushes. Continuity indicates that the coil is open and that the coil must be replaced.



**(1) Brush dimensions**

Replace brushes which have been worn beyond the specified wear limit.



	S114-244
Brush standard height	16(0.6299)
Wear limit	4(0.1575)

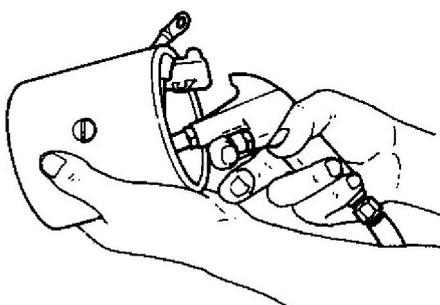
**(2) Short test**

Check for continuity between the yoke and any field coil terminal. Continuity indicates that the coil is shorted and that it must be replaced.

**(3) Cleaning the Inside of the yoke**

If any carbon powder or rust has collected on the inside of the yoke, blow the yoke out with dry compressed air.

\* Do not remove the field coil from the yoke.

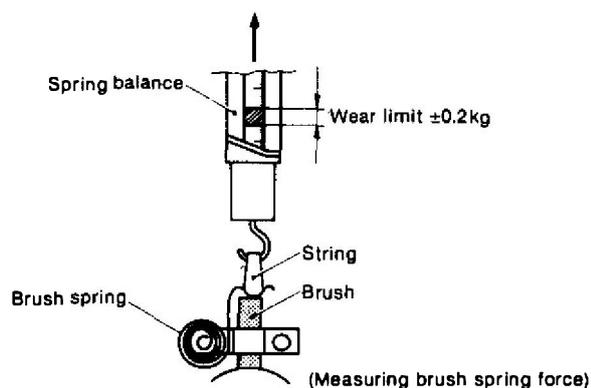


(2) Brush appearance and movement in brush holder.

If the outside of the brush is damaged, replace it. If the movement of the brushes in the brush holder is hampered because the holder is rusted, repair or replace the holder.

(3) Brush spring

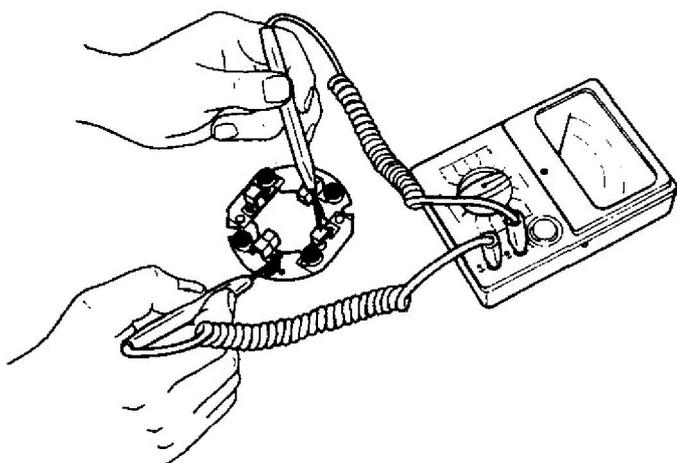
Since the brush spring pushes the brush against the commutator while the motor is running, a weak or defective spring will cause excessive brush wear, resulting in sparking between the brush and the commutator during operation. Measure the spring force with a spring balance; replace the spring when the difference between the standard value and the measured value exceeds  $\pm 0.2\text{kg}$ .



	S114-244
Standard spring load	1.6kg(3.527 lb)

(4) Brush holder ground test

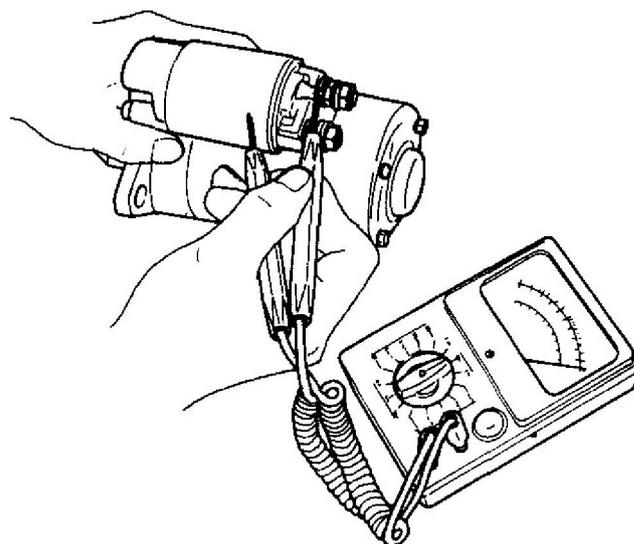
Check for continuity between the insulated brush holder and the base of the brush holder assembly. Continuity indicates that these two points are grounded and that the holder must be replaced.



6.4 Magnetic switch

(1) Shunt coil continuity test

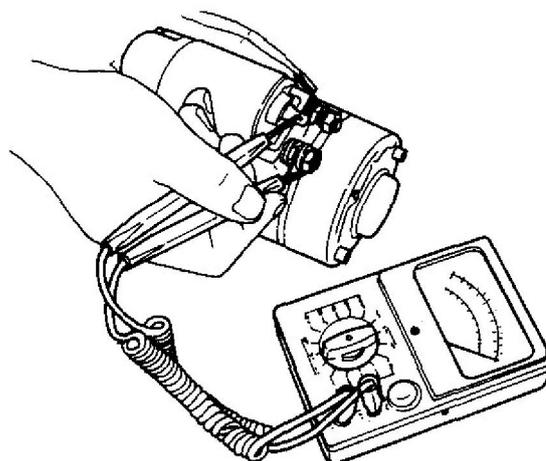
Check for continuity between the S terminal and the magnetic switch body (metal part). Continuity indicates that the coil is open and that the switch must be replaced.



	S114-244
Coil resistance (at 20°C)	0.695Ω

(2) Series coil continuity test

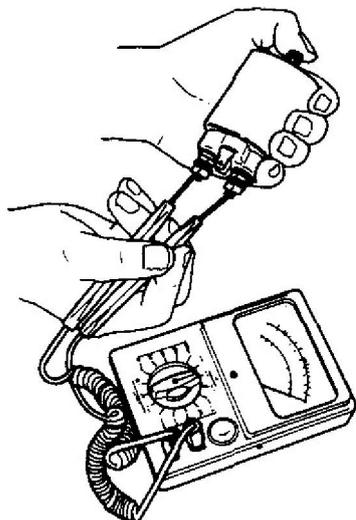
Check for continuity between the S terminal and M terminal. Continuity indicates that the coil is open and that it must be replaced.



	S114-206
Resistance value (at 20°)	0.325Ω

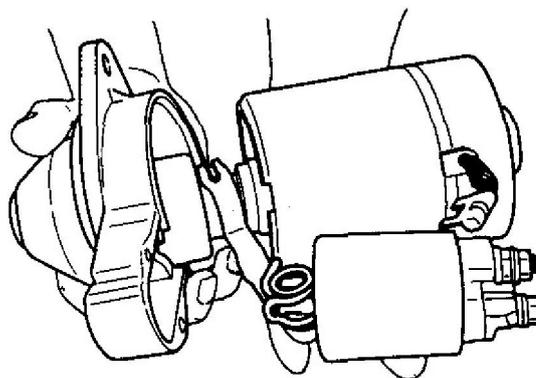
**(3) Contactor contact test**

Push the plunger with your finger and check for continuity between the M terminal and B terminal. Continuity indicates that the contact is faulty and that the contactor must be replaced.



**(2) Mounting the magnetic switch**

Attach the shift lever to the pinion; assemble the gear case as shown below. Do not forget to install the dust cover before assembling the gear case. After reassembly, check by conducting no-load operation.



**6.5 Pinion**

- (1) Inspect the pinion teeth and replace the pinion if the teeth are excessively worn or damaged.
- (2) Check if the pinion slides smoothly; replace the pinion if faulty.
- (3) Inspect the springs and replace if faulty.
- (4) Replace the clutch if it slips or seizes.

**(3) Lubrication**

Lubricate each bearing and spline (points indicated in the figure below) with high quality "Hitachi Electrical Equipment Grease A". The following lubricants may be used in place of Hitachi Electrical Equipment Grease A.

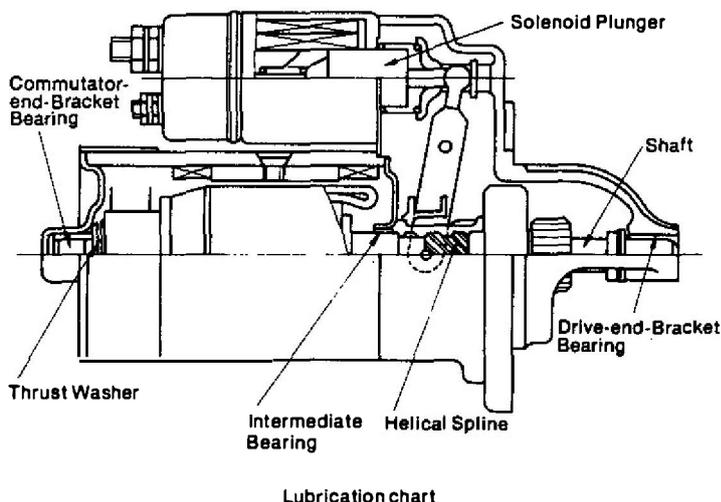
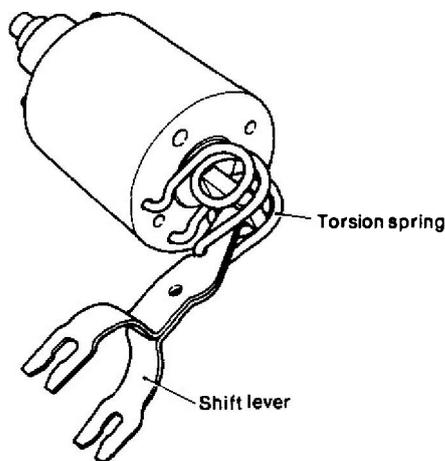
Magnetic switch plunger	Shell	Aeroshell No. 7
Bearing and spline	Shell	Albania Grease No. 2

**7 Reassembly precautions**

Reassemble the starter motor in the reverse order of disassembly, paying particular attention to the following:

**(1) Torsion spring and shift lever**

Hook the torsion spring into the hole in the magnetic switch and insert the shift lever into the notch in the plunger of the magnetic switch through the torsion spring.

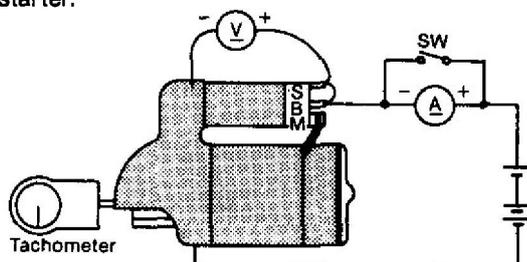


## 8 Testing

### 8.1 No load test

#### Test procedure

- (1) Connect the positive side of the ammeter (A) to the positive terminal of the battery, and connect the negative side of the ammeter to the B terminal of the starter.



- (2) Connect the negative terminal of the battery to the body of the starter.
  - (3) Connect the positive side of the voltmeter (V) to the B terminal of the starter, and connect the negative side of the voltmeter to the body of the starter.
  - (4) Attach the tachometer.
  - (5) Connect the B terminal of the starter to the S terminal of the magnetic switch.
- The magnetic switch should begin operating, and the speed, current, and voltage should be the prescribed values.
  - A fully charged battery must be used.
  - Since a large current flows when the starter is operated, close the protection circuit switch before initial operation, then open the switch and measure the current after the starter reaches a constant speed.

## 9 Maintenance standard

			S114-244	
Brush	Standard spring load	kg (lb)	1.6 (3.527)	
	Standard height	mm (in.)	16 (0.6299)	
	Wear limit	mm (in.)	12 (0.472)	
Magnetic switch	Series coil resistance	$\Omega$	0.325	
	Shunt coil resistance	$\Omega$	0.695	
Commutator	Outside diameter	Maintenance standard	mm (in.)	$\phi 40$ (1.5748)
		Wear limit	mm (in.)	$\phi 38$ (1.4961)
	Difference between maximum diameter and maximum diameter	Repair limit	mm (in.)	0.4 (0.0157)
		Repair accuracy	mm (in.)	0.05 (0.002)
	Mica undercut	Maintenance standard	mm (in.)	0.2 (0.079)
		Repair limit	mm (in.)	0.5--0.8 (0.0197--0.0315)
Standard dimension	Brush side bearing	Shaft diameter	mm (in.)	$\phi 12.45$ -- $\phi 12.47$ (0.4902--0.4909)
		Bearing inside diameter	mm (in.)	$\phi 12.53$ (0.4930)
	Intermediate bearing	Shaft diameter	mm (in.)	—
		Bearing inside diameter	mm (in.)	—
	Pinion sliding section	Shaft diameter	mm (in.)	$\phi 11.95$ -- $\phi 11.97$ (0.4704--0.4713)
		Pinion inside diameter	mm (in.)	$\phi 12.059$ -- $\phi 12.06$ (0.47476--0.47480)
	Pinion side bearing	Shaft diameter	mm (in.)	$\phi 12.45$ -- $\phi 12.47$ (0.4902--0.4909)
		Bearing inside diameter	mm (in.)	$\phi 12.521$ (0.4930)

**10 Various problems and their remedies****(1) Pinion fails to advance when the starting switch is closed**

Problem	Cause	Corrective action
Wiring	Open or loose battery or switch terminal	Repair or retighten
Starting switch	Threaded part connected to pinion section of armature shaft is damaged, and the pinion does not move	Repair contacts, or replace switch
Starter motor	Threaded part connected to pinion section of armature shaft is damaged, and the pinion does not move	Replace
Magnetic switch	Plunger of magnetic switch malfunctioning or coil shorted	Repair or replace

**(2) Pinion is engaged and motor rotates, but rotation is not transmitted to the engine**

Problem	Cause	Corrective action
Starting motor	Overrunning clutch faulty	Replace

**(3) Motor rotates at full power before pinion engages ring gear**

Problem	Cause	Corrective action
Starter motor	Torsion spring permanently strained	Replace

**(4) Pinion engages ring gear, but starter motor fails to rotate**

Problem	Cause	Corrective action
Wiring	Wires connecting battery and magnetic switch open or wire connecting ground, magnetic switch and motor terminals loose	Repair, retighten, or replace wire
Starter motor	Pinion and ring gear engagement faulty Motor mounting faulty Brush worn or contacting brush spring faulty Commutator dirty Armature, field coil faulty Field coil and brush connection loose	Replace Remount Replace Repair Repair or replace Retighten
Magnetic switch	Contactors contact faulty Contactors contacts pitted	Replace Replace

**(5) Motor fails to stop when starting switch is opened after engine starts**

Problem	Cause	Corrective action
Starting switch	Switch faulty	Replace
Magnetic switch	Switch faulty	Replace

**(16) Bracket for F.O. Strainer**

To prevent the flywheel housing (SAE No.5) from coming into contact with the bottom of F.O. strainer, the position of the bracket fixing holes has been changed.

Applicable Engine Model: 1GM10L-G2

**(17) Engine Lift Hook**

Along with the change in the engines' center of gravity, the positions of the engine lift hook and engine mounts have been changed.

Applicable Engine Model: All models (except 1GM10L---G2)

**(18) Engine Model Name Plate**

Changed to comply with the new engine model names.

## 5. Differences between the Yanmar Marine Generator Set Engines, and the GM(F)L/HM(F)L Engines

### 5-1. 2GM(F)L-YK and 3HM(F)L-YK

(1) The L.O. strainer has been moved to the regulator handle side.

(2) A fixed type regulator handle has been adopted (at 1800rpm position).

These are the major differences between the generator engines and the marine auxiliary engines. The engine performance levels between the 2GM(F)L-G1 and 2GM(F)L-YK, and between the 3HM(F)L-G1 and 3HM(F)L-YK are identical.

Since several different parts are used, check the engine model name on the name plate, and look up the correct parts in your Yanmar Parts Catalog when replacing parts.



# **YANMAR DIESEL ENGINE CO., LTD.**

**OVERSEAS OPERATIONS DIVISION**  
Telex: 0222-4733 Telephone: 03-3275-1111

1-1, 2-chome, Yaesu, Chuo-ku, Tokyo 104, Japan  
Facsimile: 03-3272-0687 Cable: YANMAR TOKYO

*Printed in Japan*  
0000A0A10259101