

# **AIR-COOLED DIESEL ENGINE**

**OPERATIONAL MANUAL**



**ORIGINAL INSTRUCTION**

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## INTRODUCTION

Thank you for purchasing products from  
FUJIAN EVERSTRONG LEGA POWER EQUIPMENTS CO., LTD.

- ★ Direct injection combustion chamber.
- ★ Recoil-type manual starter optional electric starter.
- ★ Force air cooling system.
- ★ Crankshaft case with side cover.
- ★ The fan cover made of low noise composite steel plate.

Our Series air cooled, direct injection, 4-stroke diesel engines are such a type engine of saving on material and energy. The series engines are small, light. They're easy to maintain, and convenient to move. They are used widely as a power for industrial, agricultural, machinery tools such as irrigation, spray, rice-transplanting, threshing, grasscutting, soilsampling, and also used in vibration rammer, shock rammer, marine engine, light-type transport vehicle, movable-type compressor, portable generation set, car washing machine, tillage machinery etc.

This operating manual will tell you how to operate and maintain your engines. Please read it before running the engine for correct operation.

Follow the operating requirement in the manual to keep the engine in best working condition and make the engine run longer.

If you have any questions or suggestions about this manual, please contact with us or your dealer. User should pay attention to that with the improvement of our products the description in this manual differs from practical products.

**★ Stating that tampering with the engine voids the EU type-approval of that particular engine.**

**Please make sure to follow each precaution carefully**



**EXHAUST PRECAUTIONS**

- Never inhales exhaust gases. They contain carbon monoxide, a type of colorless, odorless and extremely dangerous gas which can cause unconsciousness or death.
- Never operate the engine indoors or in a poorly ventilated area, such as a tunnel or cave, etc.
- Exercise extreme care when operating the engine near people or animals.
- Keep the exhaust pipe free of foreign objects.



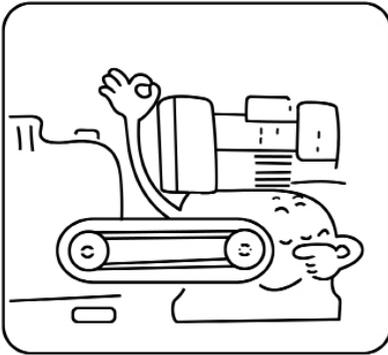
**REFUELING PRECAUTIONS**

- Be sure to stop the engine prior to refueling.
- Do not overfill the fuel tank.
- If fuel is spilt, wipe it away carefully and wait until the fuel has dried before starting the engine.
- When changing oil, make a sure that the fuel cap is secure to prevent spillage.



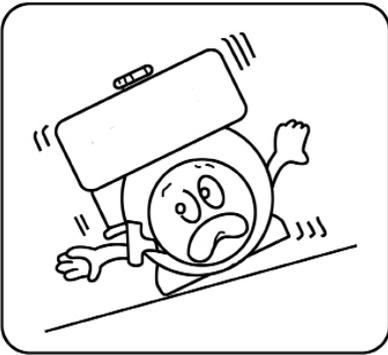
**FIRE PREVENTION**

- Do not operate while smoking or near an open flame.
- Do not use around dry brush, twigs, cloth rags, or other flammable materials.
- Keep the engine at least 3 feet (1 meter) away from buildings or other structures.
- Keep the engine away from flammable material and other hazardous materials (trash, rags lubricants, and explosives).



**PROTECTIVE COVER**

- Place the protective covers over the rotating parts. If rotating parts, such as the drive shaft, pulley, belt, etc, are left exposed, they are potentially hazardous. To prevent injury, equip them with protective covers or shrouds.
- Be careful of hot parts. The muffler and other engine parts become very hot while the engine is running or just after it has stopped. Operate the engine in a safe area and keep children away from the running engine.



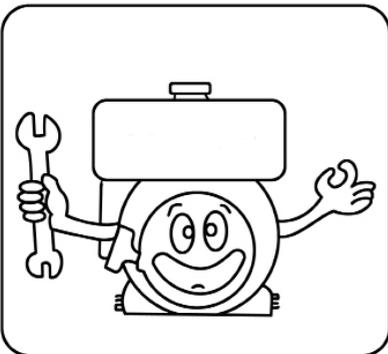
**SURROUNDINGS**

- Operate the engine on a table, level surface free of small rocks, loose gravel.
- Operate the engine on a level surface. If the engine is tilted, fuel spillage may result.

**NOTE:**

Operating the engine at a steep incline may cause seizure due to improper lubrication even with a maximum oil level.

- Be careful of fuel spillage when transporting the engine.
- Tighten the fuel tank cap securely and close the fuel strainer cock before transit. Do not move the engine while in operation.



**PRE-OPERATION CHECKS**

- Carefully check fuel pipes and joints for looseness and fuel leakage. Leaked fuel creates a potentially dangerous situation.
- Check bolts and nuts for looseness' loose bolt or nut may cause serious engine trouble.
- Check the engine oil and refill if necessary.
- Check the fuel level and refill if necessary. Take care not to over fill the tank.
- Wear snug fitting working clothes when operation the engine. Loose aprons, towels, belt, etc, may be caught in the engine or drive train causing a dangerous situation.



Front



Back

Overall Figure



Cross Section Figure

# CHAPTER 1 MAIN TECHNICAL SPECIFICATION AND DATA

## 1-1 Main Technical Specification

Item	Technical specification															
Model	170F (Add travel)/ 170FS		173F		178F (Add travel)/ 178FS		186F (Add travel)/ 186FS		EURO 5 : LA186F(G)/ LA186FA(G)		188F		EURO 5 : LA188F/ LA188FG		192F	
Type	Single-cylinder,vertical,4-stroke,air-cooled.direct-injection															
Bore x stroke (mm)	70x55 (70x57)		73x59		78x62 (78x64)		86x70 (86x72)				88x78			92x75		
Displacement (cc)	211(219)		247		296(306)		406(418)				474			499		
Engine speed (rpm)	3000/ 1500	3600/ 1800	3000/ 1500	3600/ 1800	3000/ 1500	3600/ 1800	3000/ 1500	3600/ 1800	3000	3600	3000/ 1500	3600/ 1800	3000	3600	3000/ 1500	3600/ 1800
Output kW	2.5	2.8	2.9	3.2	3.68	4.04	5.7	6.3	5.7	6.3	6.6	7.2	6.3	7.2	6.9	7.6
Consumption rate of fuel (g/kW.h)	≤280															
Consumption rate of oil (g/kW.h)	≤4.08		≤4.08		≤4.08		≤4.08				≤2.08			≤2.08		
Fuel tank capacity (L)	2.5		2.5		3.5		5.5				5.5			5.5		
Lub.oil Capacity	Full(L)	0.75	0.75	1.10	1.65				1.65			1.65				
	Effective (L)	0.25	0.25	0.40	0.60				0.60			0.60				
Rotary direction of crankshaft	Clock wise from fly wheel end															
Cooling type	Force air cooled system															
Lub.type	Pressure, splash															
Starting type	Recoil manual start and optional electric start															
Dry weight (Recoil)(kg)	26		27		32		44				45			47		
Dry weight (Electric)(kg)	31		32		37		49				50			52		

## 1-2 Overall Dimension and Installation

### 1-2.1 Overall and Installation Dimensions

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">173F/170F</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">178F</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">192F/188F/186F</p>	

## 1-2.2 Installation

- (1) There must be a tight stationary foundation for diesel engine to avoid vibration or movement when running.
- (2) Be sure that the center position of output axle is correct.
- (3) Check correct calibration between axle hole of belt wheel and key seat output shaft and whether the nut of output shaft is tighten up.
- (4) When driving other machine with belt the diameter of drive wheel must match with the speed of diesel engine and axle wheel of working machine, which directly influence working condition of diesel engine, the life of the engine and efficiency of working machine.

The diameter of drive wheel (belt wheel) can be calculated as follow.

Diameter of engine drive wheel= $\frac{\text{Diameter of axle Speed of wheel of working machine} \times \text{working machine}}{\text{Diesel speed}}$
-------------------------------------------------------------------------------------------------------------------------------------------------------

- (5) Be sure that belt be tightened properly.

If the belt is fixed too tight, the engine will be overloaded while starting, the belt will be drawn longer, and the engine may be damaged.

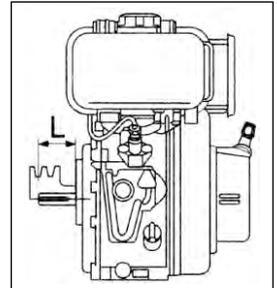
If the belt is fixed too loose, the belt will slip at high speed or when high load.

### 1-2.3 Allowed distance between belt wheel and engine

The distance should be as short as possible; the allowed value of L is listed in table 1-1

**NOTE:** The meaning of L is shown in figure above. Please contact with us or dealer if you have any questions. Table 1-1

Model		170F/173F	178F	186F/188F/192F
Belt	Type	A	B	C
	Qty	2	3	3
L		≤80mm	≤70mm	



1.2.4 Crank shaft(Original type)driving angle must be less than 120°,see Fig.1-1

### 1-2.5 Tilt

The tilt must be kept less than the allowed value shown in Fig.1-2.

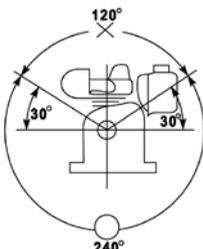


Fig.1-1

Output shaft Tilt	
Allowed Tilt (continuous running)	≤20°
Engine Tilt	
Allowed Tilt (continuous running)	≤20°

Fig.1-2

Table 1-2 unit: AH

170F/173F	17~24
178F	24~36
186/188F/192F	36~45

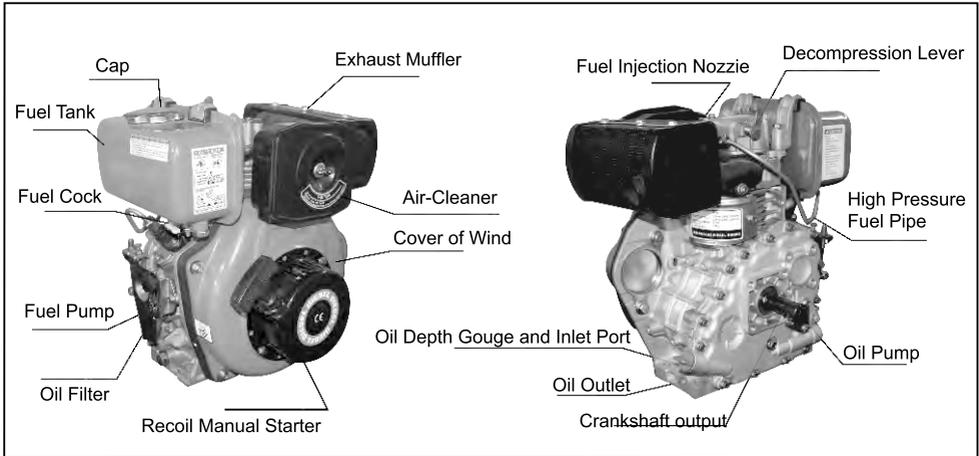
1-2.6 please contact with dealer about electric circuit.

We suggest to use accumulators (Rated 20 hours) shown in table 1-2.





## 1-4 Names of Diesel Engine Parts



## 1-5 Valve Open and Close Phase, Initial Angle of delivery and Valve Clearance

### 1-5.1 Value open and close phase(see table 1-3)

Table 1-3

Ltem \ Model	PHASE		
	170F/173F	178F	186F/188F/192F
Intake valve open	BTDC18° 30'	BTDC18°	BTDC14°
Intake valve close	ATDC45°30'	ATDC46°	ATDC50°
Exhaust valve open	BBDC55°30'	BBDC52°	BBDC54°
Exhaust valve close	ABDC8°30'	ABDC12°	ABDC10°

### 1-5.2 Initial angle of fuel delivery

Table 1-4

	3000rpm/3600rpm		3000rpm/3600rpm		3000rpm	3600rpm
170F/173F	16°±1°	186F	20°±1°	EURO 5 : LA186F		13°±1°
170F Add travel	20°±1°	186F Add travel	20°±1°	EURO 5 : LA186FG	13°±1°	
170F BOSCH	20°±1°	186F BOSCH	24°±1°	EURO 5 : LA186FA		13°±1°
178F	20°±1°	188F	18°±1°/21°±1°	EURO 5 : LA186FAG	13°±1°	
178F Add travel	21°±1°	192F	20°±1°	EURO 5 : LA188F		13°±1°
178F BOSCH	22°±1°			EURO 5 : LA188FG	13°±1°	

### 1-5.3 Valve clearance

Table 1-5

Model Description	170F/173F/178F/186F/188F/192F
Intake valve(mm)	0.15(Cold state)
Exhaust valve(mm)	0.15(Cold state)

### 1-6 Range of Temperature, Smoke and Pressure

Table 1-6

Model Description	170F/173F/178F/186F/188F/192F
Exhaust temperature(°C)	≤550
Machine oil temperature(°C)	≤120
Smoke(Bosch)	≤4
Pressure of injection MPa (kgf/cm <sup>2</sup> )	19.6±0.49(200±5)

### 1-7 Torque for Tighten Up Main Screw Bolt and Nut

Table 1-7

unit:N.m

Model Description	170F(Add travel) LA173F	178F(Add travel)	186F(Add travel)	188F	192F	Note
Connecting rod nut	29±1	33±1	45±1			Retighten up after test period
Cylinder head nut	33±1/35±1	45±1	63±1	75±1	75±1	
Fly wheel nut	140±5		180±5			
Nozzle retainer	10~12					
Tight screw bolt of rocket support	24±1 (10±1)		34±1 (24±1)	24±1		
Standard M8 bolt	18~22					
Standard M6 bolt	10~12					

## CHAPTER 2 OPERATION OF DIESEL ENGINE

### 2-1 Attention for Safe Operation

2-1.1 The fuel must be filtered by silk fabric or settled for 24 hours before use. Do not add oil into fuel tank or crank shaft case when the engine is running.

2-1.2 Burnable and explosive goods should not exist around the engine, and the place for installation should be plain and ventilate.

2-1.3 Do not touch muffler with you hand when the engine is running or after stop the engine when it is not cool enough.

2-1.4 The diesel engine must be run under rated power and rated speed. If you detect abnormal phenomenon, stop the engine immediately to check and remedy.

2-1.5 New engine or newly maintained one at first stage, run the engine at low speed and low load within test period, at first 20 hours, does not allow running it at high speed and full load.

2-1.6 When a peripheral device uses a flywheel generator power, do not disconnect the battery connections from the engine, or it may give the peripheral damage.

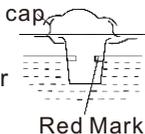
### 2-2 Choice of Fuel, Lubricant and Preparation before start

#### Choice of fuel:

To use light diesel fuel for diesel engine. Use light diesel fuel No.0 in Summer No.-10 or No.-20 in winter. Do not allow dust or water into fuel and fuel tank.

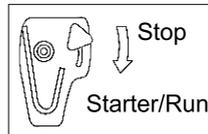
Model	170F/173F	178F	186F/188F /192F
Capacity Liter	2.5	3.5	5.5

Caution: Do not let fuel Level be higher than Red Mark



#### Core of filter:

Do not wash the core of air filter, because of this part is dry type. When power of engine is not good or the color of exhaust is abnormal, change the core. Do not operate the engine without the core of filter.



**Oil screw plug:**

In winter, if it is difficult to start the engine, pull out the plug and fill 2cc lube oil into the hole and then return the plug. Keep plug in tight condition. The engine can absorb dust and be damaged if the plug is taken away.

Do not use decompression lever to start the machine.

**Decompression lever:**

Do not use decompression lever to start the machine.

The fuel oil and machine oil in the engine are drained away before ex-factory. Check fuel pipeline before refilling fuel oil and starting the engine. If there is air in the pipeline, drain it out. The detail method is to loosen the nut of connection between injection pump and fuel pipe and drain out the air until there is no bubble in fuel.

Muffler

Oil Cap

Plug



Oil Filter Cap

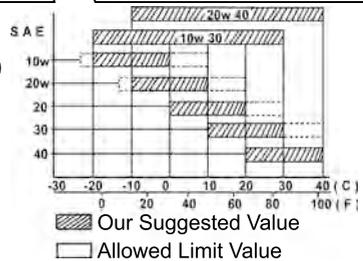
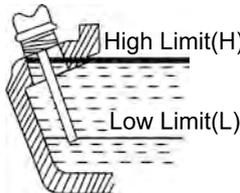
Fuel Cock Lever



Stop  
Starter/Run

**Lubricant inlet:**

Set the engine on plane ground and then fill lubricant into the inlet. When checking oil level, put the oil scale into the inlet lightly. Do not turn the oil scale.



Lube oil not be used GRADE CC or CD. A.P.L Diesel Engine Service.

Model	170F/173F	178F	186F/188F /192F
Capacity			
Liter(British Gal)	0.75 (0.16)	1.1 (0.24)	1.65 (0.35)

If your engine is still a newer one, its life would be shortened when over-loading. At first 20 hours the engine must be started and then stopped according to test method for running.

To avoid over-load:

Avoid over load during test engine.

To change machine oil regularly.

At first change machine oil once a twenty-hours or the end of first month at primary running time and then once every a three-months or 100-hour.

Start

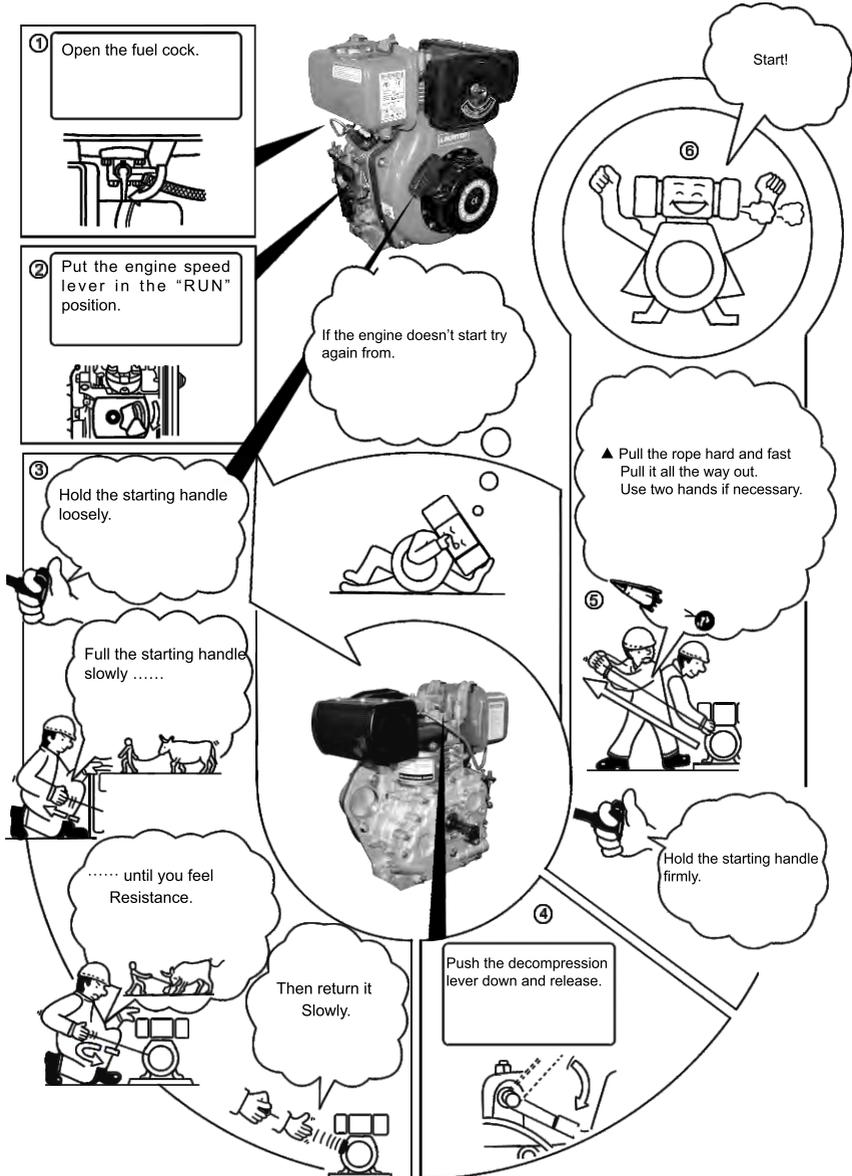


Interval of changing machine oil

## 2-3 Start of the Diesel Engine

### 2-3.1 Recoil type manual start

NOTE: WHEN THE ENGINE IS RUNNING, DO NOT PULL THE RECOIL HANDLE OTHERWISE THE ENGINE MAY BE DAMAGED



**1** Open the fuel cock.

**2** Put the engine speed lever in the "RUN" position.

If the engine doesn't start try again from.

**3** Hold the starting handle loosely.

Full the starting handle slowly .....

..... until you feel Resistance.

Then return it Slowly.

**4** Push the decompression lever down and release.

**5** Pull the rope hard and fast Pull it all the way out. Use two hands if necessary.

**6** Start!

**X**

For3, don't pull the rope too fast or hard.

**O**

Always pull the rope slowly.

1 Open the fuel cock.

2 Put the mower speed lever in the "STOP" position.

3 Hold the starting handle loosely.

4 Pull the starting handle slowly.

5 When you feel resistance, then return it slowly.

6 Push the decompression lever down and release.

7 Pull the rope back and hold. Pull it all the way out. Use two hands if necessary.

8 Push the starting handle firmly.

9 Start!

If the engine doesn't start try again later.

**X**

For5, if you don't pull the rope all the way out, the engine won't start.

**O**

Always pull the rope all the way out.

**X**

For5, if you don't pull hard enough, the engine won't start.

**O**

Always pull the rope hard and fast.

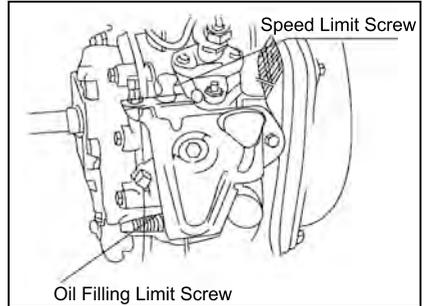
## 2-4 Run and stop of the Diesel Engine

### 2-4.1 Run of the engine

- (1) Preheat the machine for three minutes at no load.
- (2) Set the speed governor lever of the engine at necessary speed position.

It must use the speed governor lever to control the speed of engine.

Do not loosen or read just the limit screw of speed or oil-filling limit screw, otherwise the performance of the machine may be changed.



### 2-4.2 Check, when the machine is running

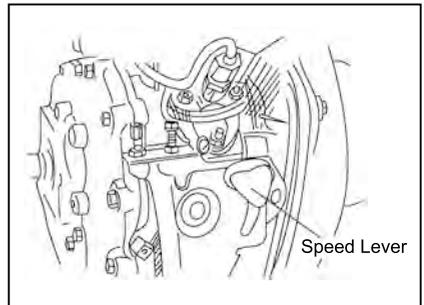
- (1) Whether there is abnormal sound and vibration?
- (2) Whether combustion is not good or over speed?
- (3) Whether the color of exhaust gas is normal (black or too white)?

If any of above phenomena is detected, stop the engine immediately and contact with local dealer.

### 2-4.3 stop of the engine

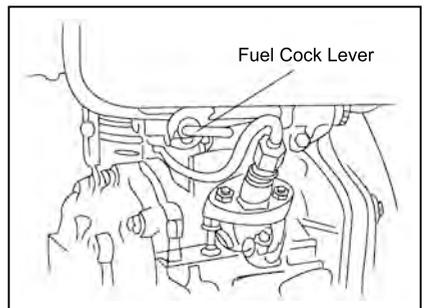
- (1) At first set the speed governor lever at low speed position before stop the engine, and then run the engine at no-load for three minutes.
- (2) Set the speed governor lever at "stop" position

Decrease the load gradually when stopping the engine. Sudden stopping of engine will cause abnormal incensement of temperature.  
Do not stop engine with decompression lever.



- (3) Set the fuel cock at "S"(stop position)
- (4) If the engine is motor type start, turn the start key switch to "OFF" position.
- (5) Pull out the recoil handle slowly until pressure is felt by your hand (that means at the point of compression stroke, where the intake and exhaust valves are closed) and then let the handle back to its natural position, so that it can prevent rust when the engine is not used.

Note: Only when stop the engine can you pull the recoil handle, otherwise the engine may be damaged.

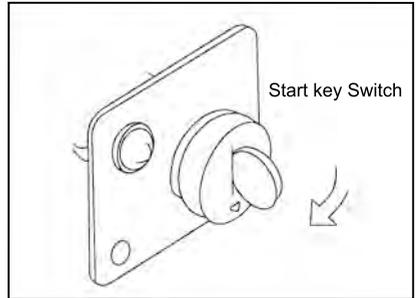


### 2-3.2 Motor-drive type start

#### (1) Start

The preparation of motor-drive start type is same as manual type (Recoil type).

1. Open the cock of fuel oil.
2. Set the speed governor lever at "start" position.
3. Turn on the start switch toward clockwise to "start" position.
4. If the engine is started, take your hand away from key switch immediately.
5. If the engine do not start after 10 seconds, wait for a while (about 15 seconds) then start again.

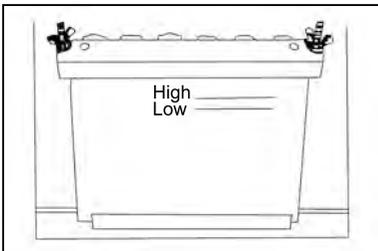


If the run time of motor is too long, the voltage of accumulator will be dropped and the motor may be damaged.

Keep key switch at "ON" position when the engine running.

#### (2) Accumulator

- 1 Check the liquid level in accumulator every month, if the level is lower than the low limit mark, refill distilled water until up to the upper limit mark.



If the liquid in the accumulator is not enough, the electric motor will not run for little electric current, so keep the liquid level between upper and lower limit marks.

The liquid will be splashed on near parts (which will be spoiled) if it is too much in the accumulator.

## CHAPTER 3 TECHNICAL MAINTENANCE OF DIESEL ENGINE

### 3-1 Check and Maintenance Daily

Check oil level of machine oil whether it is between high and low limit.

Check dust oil leakage phenomenon.

Clean up the dirt, greasy dust on the diesel engine and appendage, keep the engine clean.

Remove malfunction detected during operation.

### 3-2 Check and Maintenance Regularly

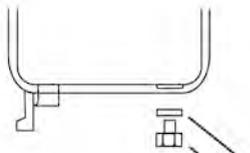
Check and maintenance regularly are very important for normal operation and durability of the engine. The following table indicates what is necessary and when to check the engine. Marks show special tool or technique needed for maintenance. Please contact with local dealer..

Item \ Time	Daily	After 20 Hours or one month	100 Hours or each three month	500 Hours each six month	1000 Hours each year
Check and tighten the nut and screw	○				
Check and fill machine oil	○				
Change machine oil		○ (First time)	○ (First time and later)		
Clean and change oil filter				○	● (Change)
Check oil-leakage					
Change the core of air filter		It must shorten cycle of check and maintenance if at dusty		○	
Clean fuel tank	Each month				
Clean or change fuel filter				○ (Clean)	○ (Change)
Clean nozzle				●	
Check injection pump				●	
Check pipeline of fuel				○ (Change if necessary)	
Adjust valve clearance of inlet and exhaust		● (First time)			
Grind valve holder of inlet and exhaust					●
Change piston ring					●
Check accumulator liquid	○ each month				
Clean the core of air filter		○ (Clean) each month or each 50-hours			

### Clean and change fuel filter

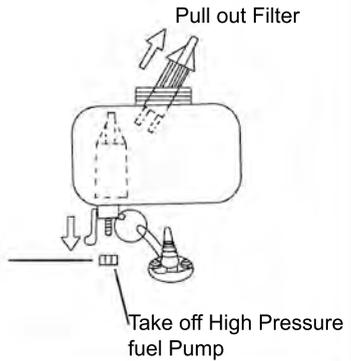
The fuel filter must be kept clean day-to-day to guarantee max output of the engine. To take the filter out of fuel tank and to clean it.

Clean	Each six-month or 300-hours
Change	Each year or 1000-hours



Loose Nut and Take it out

Drain out of Fuel



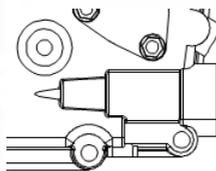
Pull out Filter

Take off High Pressure fuel Pump

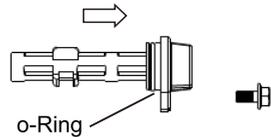


### Change Lube oil filter

Change	Lube oil filter
Clean	100 Hours
Change	300 Hours or when maintenance



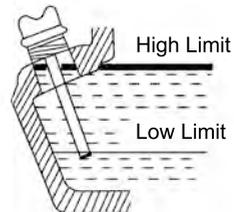
Pull out of Filter With Pincers



o-Ring

Model	170F/173F	178F	186F/188F/192F
Capacity(Liter)	0.75	1.10	1.65
Change	Operating period		
First	First month or after 20 hours		
Second and Later	Every 3-month or 100 hours		

### Change lubricant



High Limit

Low Limit

Change the core of air filter.

Change every 6-month or 300-hours (earlier if necessary)

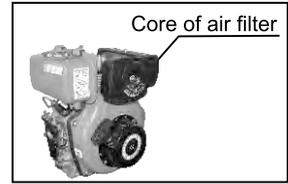
Do not use detergent to clean filter core.

Use a soft brush instead.

Do not operate the machine without core or use a bad core.

The core of filter obstruction means that the air in combustion chamber will be decreased, and consumption of fuel and lubricant increase. It is also difficult to start the engine.

Clean the core of filter regularly.



### 3-3 Storage for a Long Period.

Please do as follow if storage the engine for a long period.

(1) Run the machine for three minutes and then stop the machine.

(2) Drain away the lubricant before the engine to be cooled and then refill new machine oil.

(3) Disassemble the rubber plug on the cover of rocker shaft and then fill about 2cc lubricant into it and return the plug to its position.

(4) Recoil type start

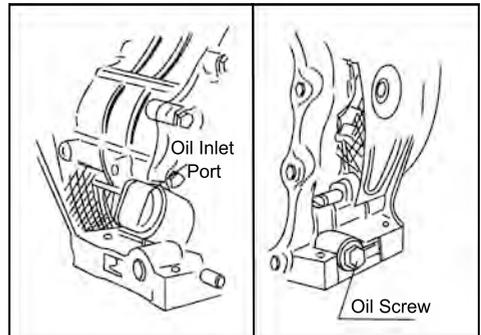
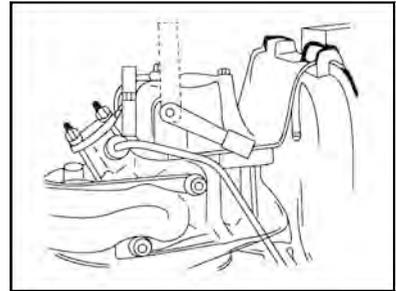
Put down and keep the decompression lever at the non-compression point and then pull the recoil starter for two or three times.

Motor-drive type start

Keep the decompression lever at non-compression point and let the engine rotate for two or three seconds, the start key switch on "start" position (Do not run the engine).

(5) Pull up the decompression lever and pull up recoil starter slowly until the resistance is felt by your hand (than is at the point of compression stroke, where the intake and exhaust valves are closed, which can prevent engine from rust).

(6) Clean out machine oil and dirt from the engine, and put the engine at a dry place.



## CHAPTER 4 MALFUNCTION REMEDY OF DIESEL ENGINE

### 4-1 The Cause and Remedy for the Engine Not Being Started

CAUSE	REMEDY
The weather is cold ,machine oil become more adhesive	Fill machine oil into crankshaft case after preheated. Fill machine oil into inlet manifold Disassemble the connection belt of match machine and then start the diesel engine, stop the engine When the engine is heating and reassembles the belt. Start the engine again.
Malfunction of fuel system. The fuel is mixed with water	Clean fuel tank filter and fuel pipe change fuel.
The fuel become thickening and not easy to flow	Use the fuel as specified
There is air in the fuel system	Drain out the air and tighten each connector or fuel pipe.
Injection fuel is little or no, the spray is not good	Check the position of speed governor handle, clean spray nozzle, fuel pump, maintain or change the pump or nozzle if necessary.
Combustion is not complete	The spray nozzle is not good, delivery angle is not correct, gasket of cylinder head is lack and the pressure of compression is not enough, remedy with its cause.
Diesel fuel delivery is interrupted	Diesel fuel is too little in the fuel tank fill the fuel into the fuel tank. If the fuel pipe and fuel filter are obstructed or leakage, remedy them
Compression pressure is not enough in the cylinder, The nut of cylinder head is not tighten or gasket of cylinder is damaged or leakage.	Tighten the nut of cylinder head, according, to diagonal line sequence and standard requirement, check gasket of cylinder, if change the gasket it must tighten the nut of cylinder head once again after pre-run the diesel engine.
The gap of piston ring is too big because of wearing	Change the piston ring
Each gap of piston rings line up, which cause leakage	Set each gap of piston at angle of 120°
The piston rings are stick. Seriously or broken	Clean with diesel fuel or change rings.
Gas calves leakage	Grind the gas valves, if the vestige is too deep, please send factory remedy
The valve clearance is not correct	Adjust the clearance as specified
The valve stem is clipped on guide pipe	Disassemble the gas valve and clean the stem and guide pipe.

#### 4-2 Cause and Remedy for Not Enough Power of Diesel Engine.

CAUSE	REMEDY
Malfunction of fuel system: parts obstruction of fuel pipeline and fuel filter	Check fuel switch, it must be opened fully, Clean fuel filter and fuel pipeline.
The pumping of fuel is not good	Maintain or change the damaged parts of fuel pump.
Malfunction of nozzle: injection pressure is not correct	Adjust the injection pressure
Spray bole carbon deposit	Clean
Needle valve adhered	Clean or change
Fitting is too loose between needle valve and needle valve body	Change
Air filter is obstructed	Disassemble or clean or change the core of filter
Speed is not high enough	Check the speed of diesel engine with tachometer Adjust the adjust high speed limit screw

#### 4-3 Cause and Remedy for Engine Stopping Auto matically

CAUSE	REMEDY
Malfunction of fuel system: No fuel	Add fuel
Fuel pipeline or filter is obstructed	Maintain or clean
There is air in fuel system	Drain out the air
Needle valve of nozzle adhered	Clean, grind the nozzle or change it if necessary
Air filter is obstructed	Maintain or clean or brush off.
The load increase suddenly	Decrease the load

#### 4-4 Cause and Remedy for Exhaust with Black Smoke

CAUSE	REMEDY
Over load	Decrease the load, if working machine is not properly matched, Change it.
Fuel Injection is not good	Check the injection pressure and spray condition and correct it , or change the nozzle if it is damaged.
Air is not enough or leakage	Clean the air filter, check the cause of leakage and remedy

#### 4-5 Cause and Remedy for Exhaust with Black Smoke

CAUSE	REMEDY
There is machine oil, in cylinder	Check oil level, drain away the unnecessary machine oil
Piston ring is clipped or worn, and its springiness is not enough or each. Gap of ring turn to same direction to make the machine oil go up.	Check, change the piston ring, and cross each gap position. Remedy or change
The gap is too big between piston and cylinder	Remedy or change
Valve and guide are worn	Change

#### 4-6 Cause and Remedy for Exhaust with White Smoke

CAUSE	REMEDY
There is water in diesel fuel	Clean the fuel tank and diesel filter, change diesel fuel.

#### 4-7 Methods and Positions of Stopping to Check When the Engine's malfunctioning

CAUSE	REMEDY
Speed is sometimes high, sometimes low	Check the speed governor system whether it is nimble Whether there is air in fuel pipeline.
Abnormal sound suddenly happen	Check each movement part carefully.
Exhaust with black smoke suddenly	Check fuel system specially nozzle.
There is metal knocking sound rhythmically in the cylinder	The fuel delivery angle is too big, adjust it.