OptiGenerators International, Inc

Owner's Manual for

OPTI4000DE
OPTI6800DE
OPTI6800SDE

Opti Generators optimize your Life!

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PREFACE

We appreciate your business. The following manual is only a guide to assist you and is not a complete or comprehensive manual of all aspects of maintaining and repairing your generator. The equipment you have purchased is a complex piece of machinery. We recommend that you consult with a dealer if you have doubts or concerns as to your experience or ability to properly maintain or repair your equipment. You will save time and the inconvenience of having to go back to the store if you choose to write or call us concerning missing parts, service questions, operating advice, and/or assembly questions.

Our air-cooled diesel generators have some or all of the following features:

- Lightweight construction
- Air cooled
- Four-stroke diesel internal combustion engine
- Direct fuel injection system
- Electric, remote and recoil start(Open Frame Models only)
- Glow plug(also called preheater or cold starter)
- Large fuel tank
- Automatic voltage regulator
- NFB circuit protector
- AC and DC outputs
- Low oil pressure automatic shutoff sensor
- Heavy duty big solid wheels
- Sound-proof enclosure(silent model only)
- Specially designed exhaust system and power transfer box(trucking generator only)

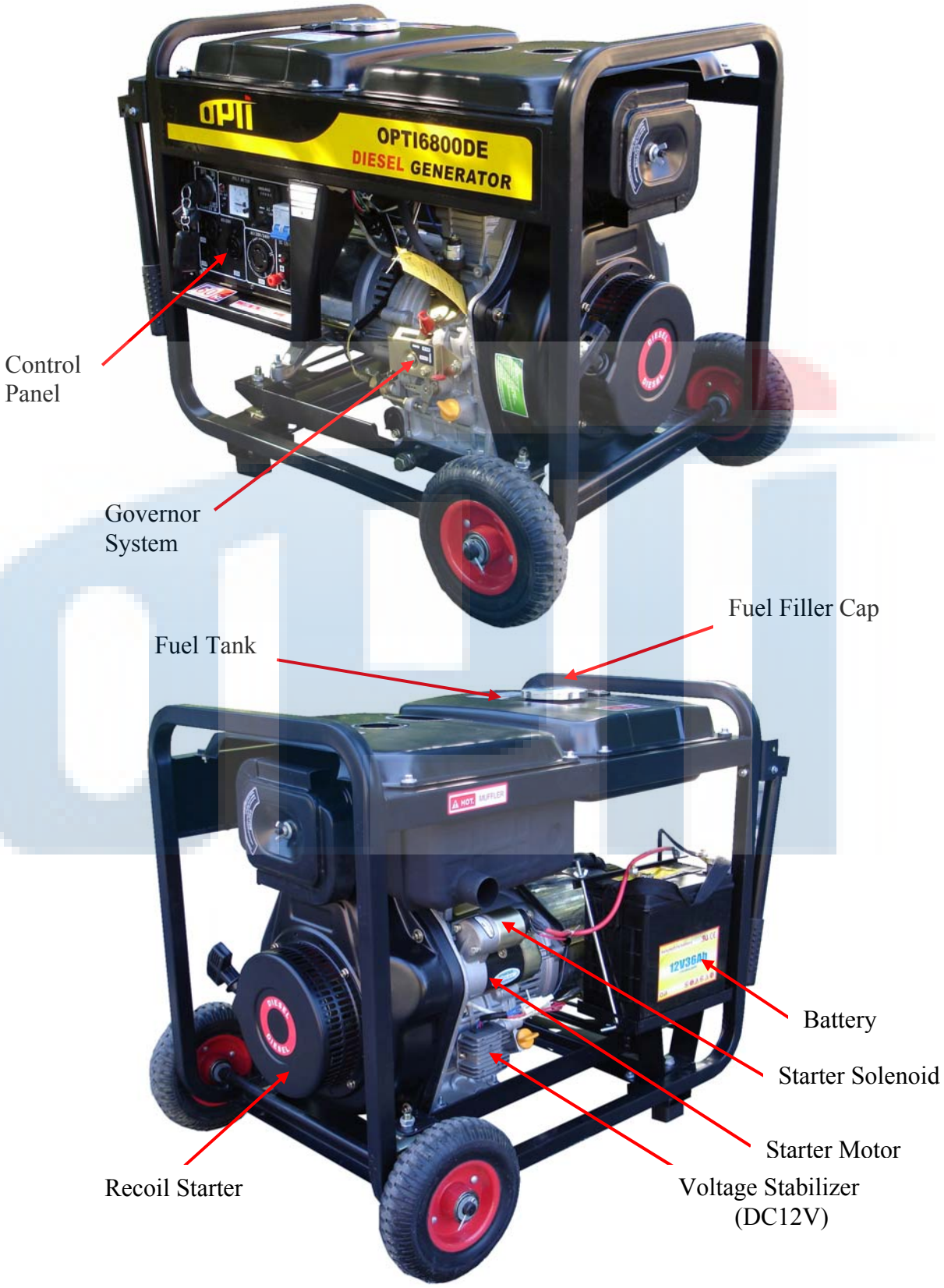
The KSD air-cooled diesel generators are widely used when electrical power is scarce. Our generators provide a portable mobile solution in supplying power for field operations during project construction. Some other known applications include pipeline construction and metal welding when electrical power is not available.

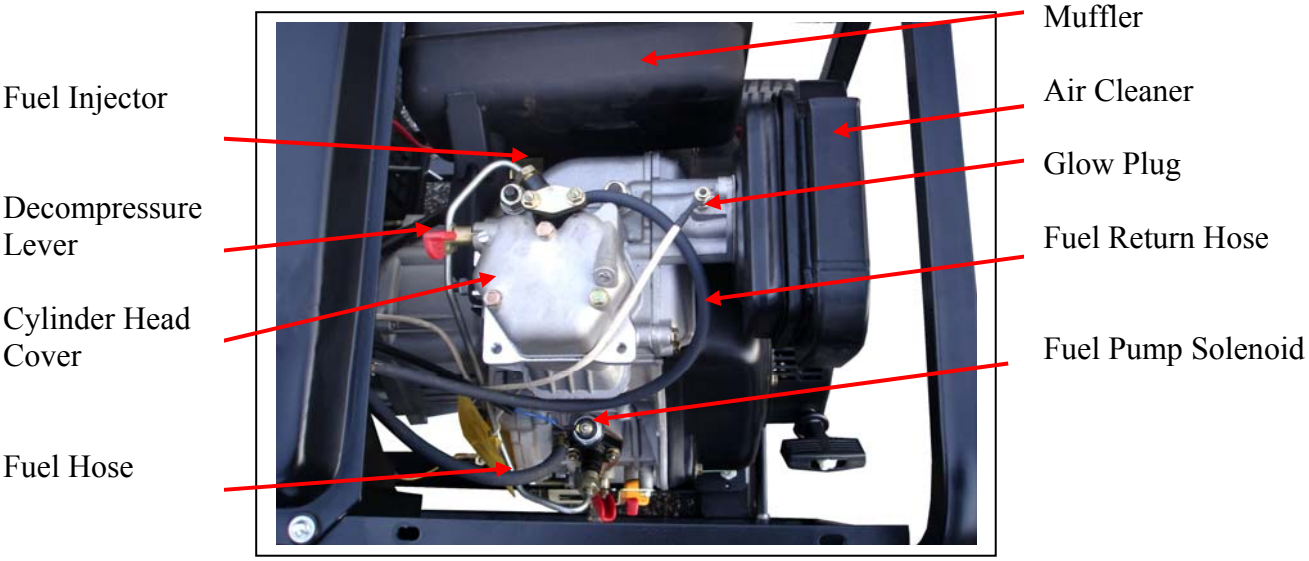
This manual will explain how to operate and service your generator set. If you have any questions or suggestions about this manual, please contact your local dealer or us directly.

Consumers should notice that this manual might differ slightly from the actual product as more improvements are made to our products. Some of the pictures in this manual may differ slightly from the actual product as well. Optigenerators International, Inc. reserves the right to make changes at any time without notice and without incurring any obligation.

Chapter 1 Overview of 4000 and 6800 Series

1.1 Open frame model





Top view of diesel engine

Silent model has the same configurations as open frame model except that silent model has specially designed muffler system and sound-proof enclosure.

1.2 Soundproof(silent) model

Chapter 2 Technical Specifications

2.1 Technical specifications

Table 1 Technical specifications in SI units

Item \ Model		4000 Series	6800 Series
Generator	Generator Type	Brushless, 2-pole, single phase	
	Excitation	Self-excitation voltage	
	Voltage regulator	Capacitor(brushless alternator) AVR(brush alternator)	
	Frequency	60Hz	
	Max Output	4000 Watts	6500 watt
	Rated Output	3500 Watts	5500 watt
	Rated Amps	29A@120V,14.5A@240V, 8.3A@12V	46A@120V,23A@240V,8.3A@ 12V
	Power factor (cos φ)	1.0	
	Operation Noise Level(dB @ 7m)	80	87 (open frame)/70 (silent)
	Insulation	B	
Engine	Engine Type	4-Stroke, air-cooled, single cylinder, OHV	
	Engine Model	KSD178FG	KSD186FAG
	Bore x Stroke (mm x mm)	78 x 62	86 x 72
	Displacement (cc)	296	418
	Rated Output(KW)	4.4	7
	Max Output(KW)	4.92	7.7
	Fuel Type	Diesel	
	Lube Oil Capacity(L)	0.8	1.15
	Fuel Tank Capacity(L)	12.5	12.5 (open frame)/14.7 (silent)
	Continuous Operation Hours	12 Hours @ half load	
	Ignition System	T.C.I.	
	Starting System	Recoil start(open frame only), electric startand remote start	
	Compression ratio	19:1	
	Lube type	SAE15W40 or 5W40 synthetic diesel engine oil	
	Dry Weight(kg)	38	53
	Dimension(LxWxH mm)	38.3 x 42.1 x 45	41.7 x 44.1 x 49.4
Electric Outlets	NEMA Rating	2 x NEMA 5-20R for 120V @ 20A 1 x NEMA L5-30R for 120A@ 30A 1 x NEMA L14-30R for 120/240V @ 30A 1 x DC12V @ 8.3A	
Weight	Net weight (kg)	96.2	119.4(open frame)/159.8 (silent)
Dimensions (L*W*H in cm)	Product	69.1 x 47 x 55.6	73.9 x 50 x 58.9 (open frame) 91.9 x 53.1 x 70.6 (silent)
	Carton	71.6 x 48.5 x 59.4	76.2 x 52.1 x 60.5 (open frame) 94.5 x 54.6 x 73.7 (silent)

Table 2 Technical specifications in British units

Item \ Model		4000 Series	6800 Series
Generator	Generator Type	Brushless, 2-pole, single phase	
	Excitation	Self-excitation voltage	
	Voltage regulator	Capacitor(brushless alternator) AVR(brush alternator)	
	Frequency	60Hz	
	Max Output	4000 Watts	6500 watt
	Rated Output	3500 Watts	5500 watt
	Rated Amps	29A@120V,14.5A@240 V, 8.3A@12V	46A@120V, 23A@240V, 8.3A@12V
	Power factor (cos φ)	1.0	
	Operation Noise Level(dB @ 23ft)	80	87 (open frame)/70 (silent)
	Insulation	B	
Engine	Engine Type	4-Stroke, air-cooled, single cylinder, OHV	
	Engine Model	KSD178FG	KSD186FAG
	Bore x Stroke (in x in)	3.07 x 2.44	3.39 x 2.83
	Displacement (in^3)	18.1	25.5
	Rated Output(HP)	5.9	9.3
	Max Output(HP)	6.6	10.3
	Fuel Type	Diesel	
	Lube Oil Capacity(oz)	27.1	38.9
	Fuel Tank Capacity(Gal)	3.3	3.3 (open frame)/3.9 (silent)
	Continuous Operation Hours	12 Hours @ half load	
	Ignition System	T.C.I.	
	Starting System	Recoil start(open frame only), electric startand remote start	
	Compression ratio	19:1	
	Lube type	SAE15W40 or 5W40 synthetic diesel engine oil	
	Dry Weight(lb)	84	117
	Dimension(LxWxH in)	15.1 x 16.6 x 17.7	16.4 x 17.4 x 19.5
Electric Outlets	NEMA Rating	2 x NEMA 5-20R for 120V @ 20A 1 x NEMA L5-30R for 120A@ 30A 1 x NEMA L14-30R for 120/240V @ 30A 1 x DC12V @ 8.3A	
Weight	Net weight (lb)	212	263(open frame)/352 (silent)
Dimensions (L*W*H in in)	Product	27.2 x 18.5 x 21.9	29.1 x 19.7 x 23.2 (open frame) 36.2 x 20.9 x 27.8 (silent)
	Carton	28.2 x 19.1 x 23.4	30 x 20.5 x 23.8 (open frame) 37.2 x 21.5 x 29 (silent)

2.2 Standard Features

*Electric start, Recoil start and Remote Control with Preheater(Cold Start)

*Large fuel tank with 12 hours continuous operating capability

*Automatic Voltage Regulator

*Automatic shutdown for low oil pressure

*Vibration isolation mounting between engine/alternator feet & base frame

*Reduced vibration and improving durability

*Non-fused breaker protects for AC

*Overload protection and convenience

*AC Voltmeter,120V/240V switch

*DC 12V charging system(car/boat batteries)

*Low fuel indicator, oil alert

*Ground fault interrupter

*Dependable, brush or brushless Alternator

*Advanced direct fuel injection system

*Provides low fuel consumption

*All American standard receptacles

*Vertical one-man mobile unit featuring

*Rugged construction

*Includes battery(truck generator excluded) and hour meter

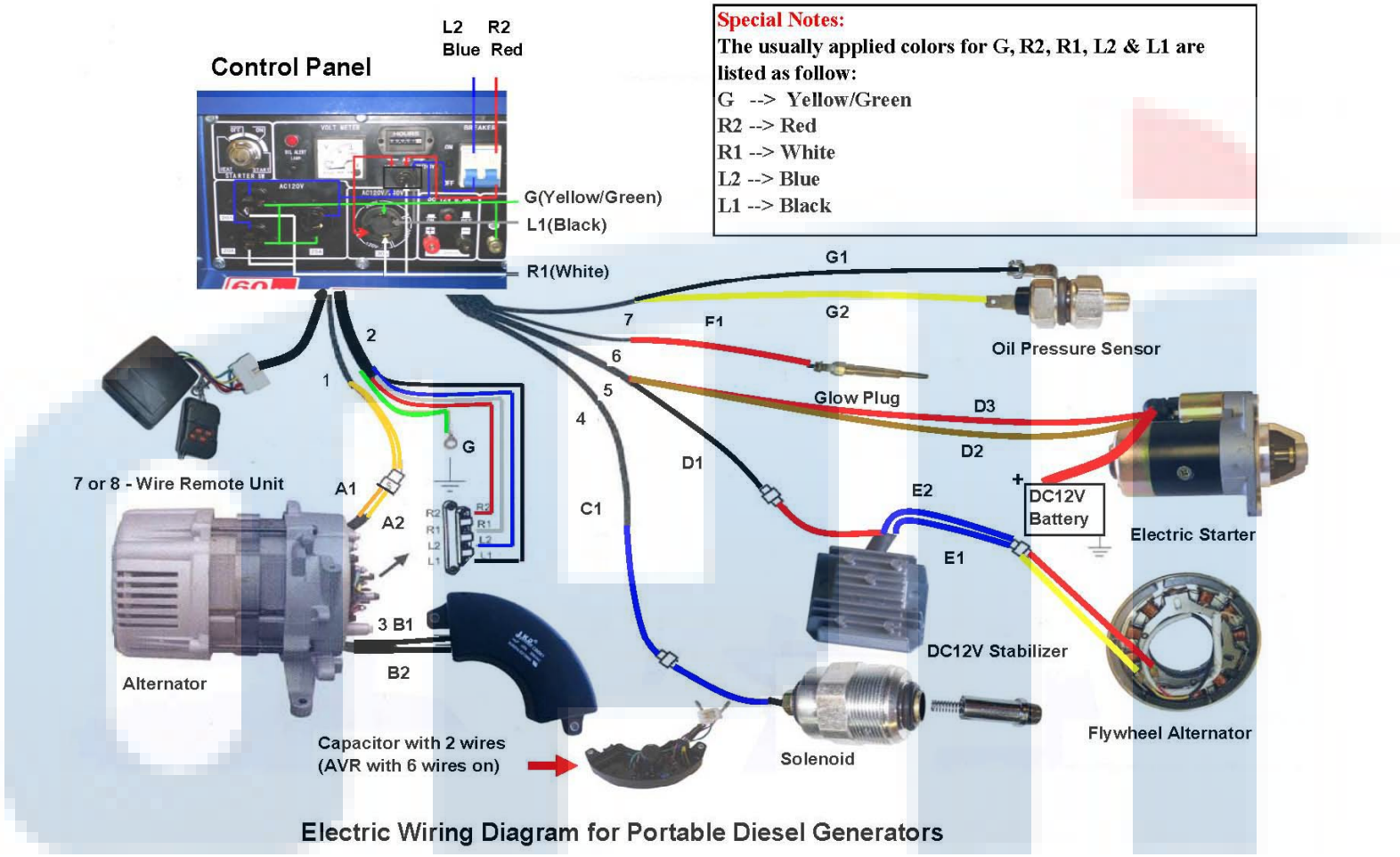
2.3 Basic operating parameters

Under the given conditions, the generator will output the specified power listed in the Table 3 below.

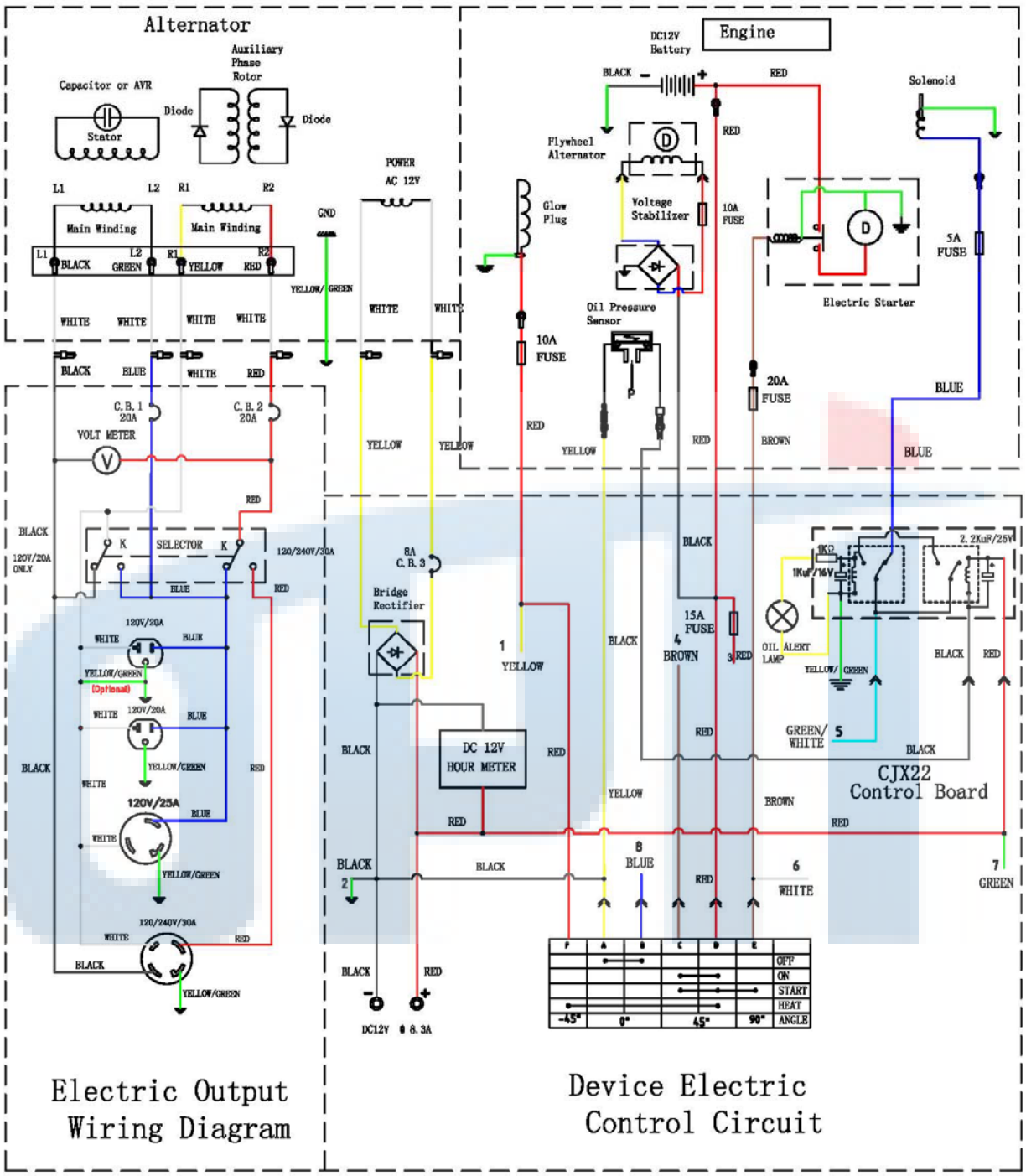
Table 3 Basic operating parameters

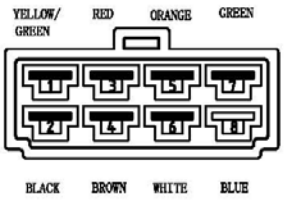
Height above sea level (ft)	Ambient temperature (°F)	Relative Humidity(RH)
0	+68 (+20 °C)	60%
<3280.8 (<1000 m)	41~104 (5~40 °C)	90%

2-4 Electric Diagrams for 4000 and 6800 Series



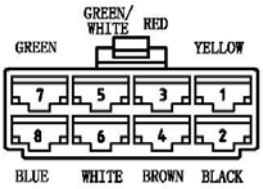
Wiring Diagram for generator with Electric Start ,Remote Start & Glow Plug





Remote Signal Receiver Plug(Male)

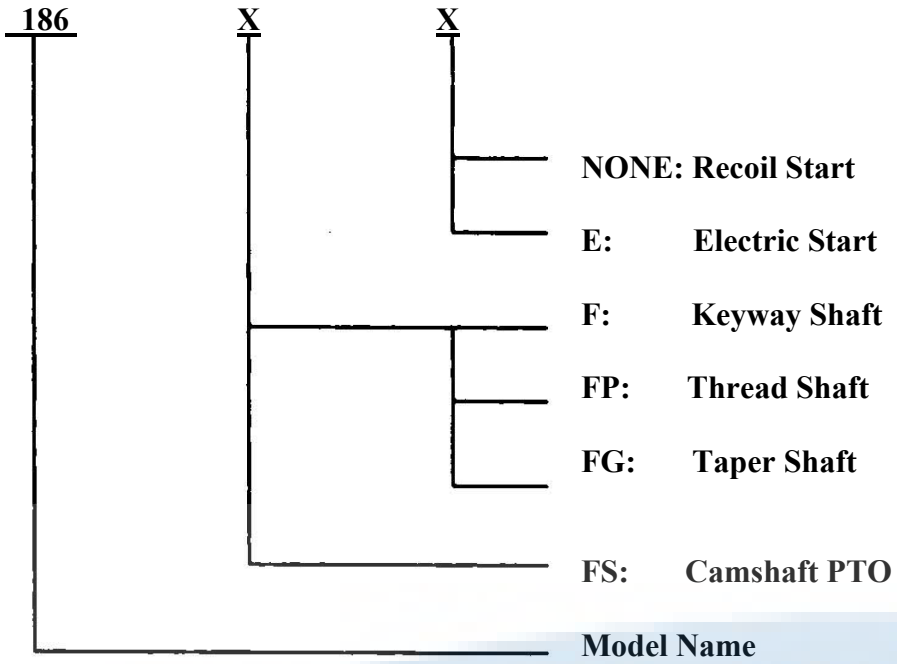
Ignition Key Switch Plug



Remote Signal Receiver Plug(Female)

2.5 Overall Dimensions of Diesel engine

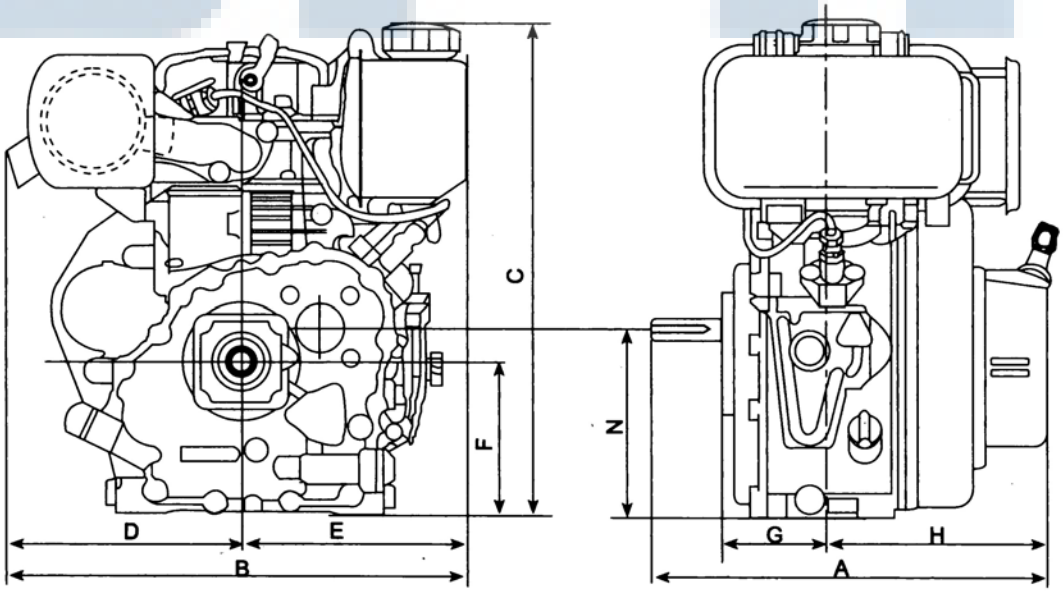
2.5.1 Diesel engine coding

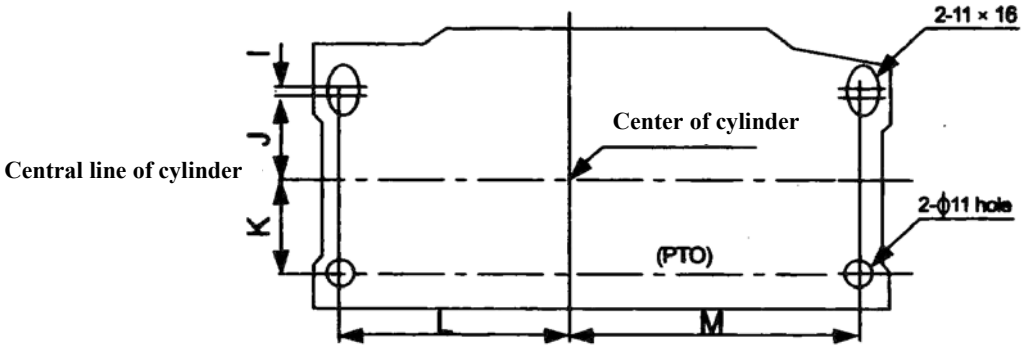


Diesel engine coding begins with 3 digits: the 1st digit stands for number of cylinder head and the last two digits for bore size in mm, e.g., 186 means one cylinder head and bore size is 86 mm. Three digits are followed by letter F and/or by another letter that stands for the type of output shaft. The letter F also means that an engine is air-cooled. If the coding ends up at a letter E, it means that an engine comes with electric start.

The default stroke of 186 series diesel engine is 70mm. However, the stroke of a diesel engine may be expanded from 70 mm to 72 mm. If it is true, a letter A will be used directly after letter F for telling whether an engine is expanded.

2.5.2 Overall engine dimensions (unit in mm)





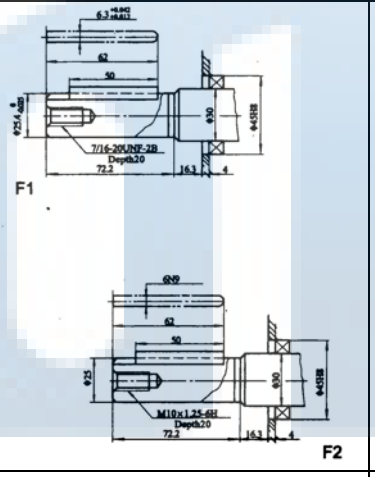
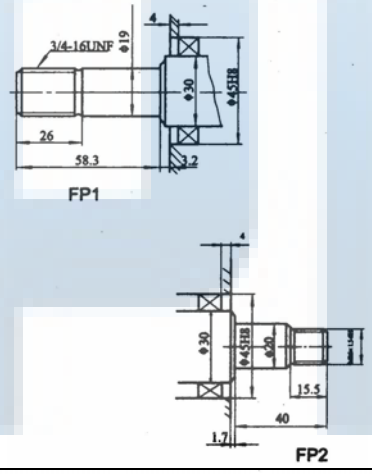
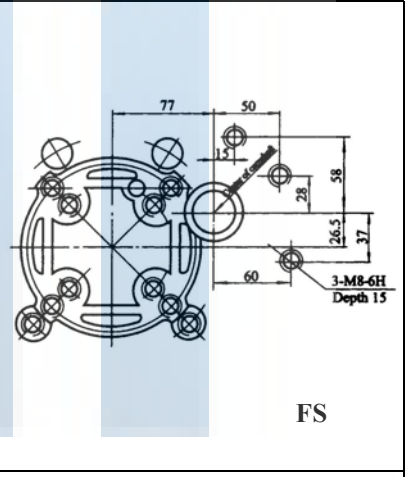
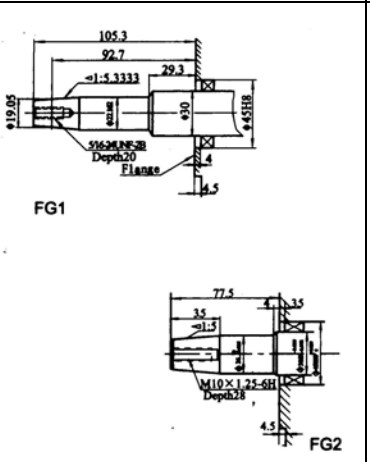
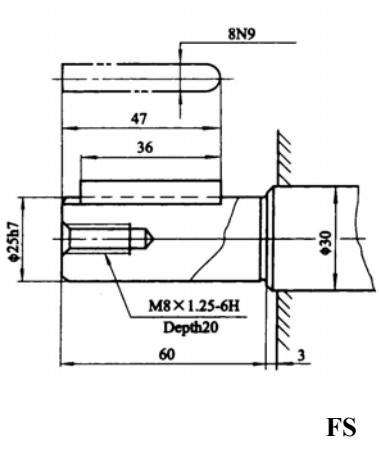
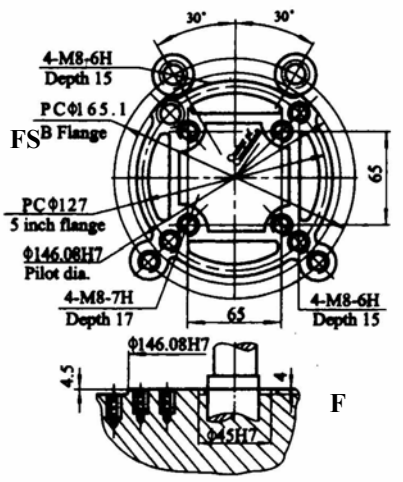
The values of letters in the above figures are tabulated in Table 2.3.

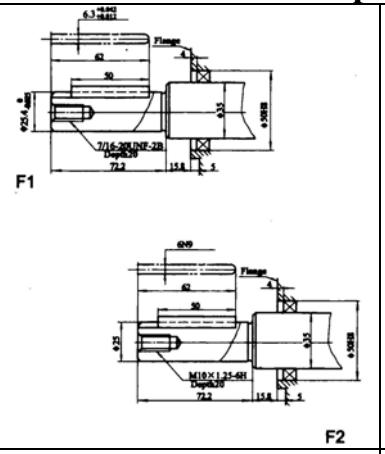
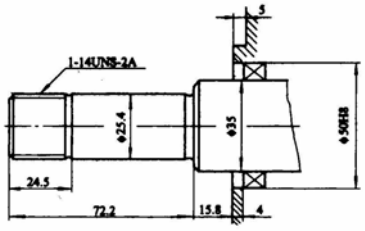
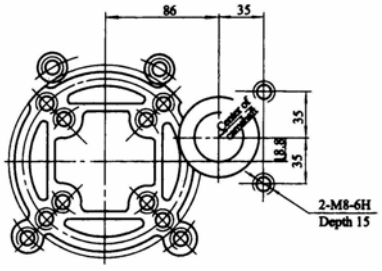
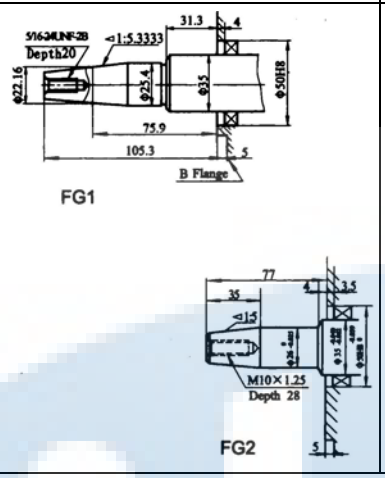
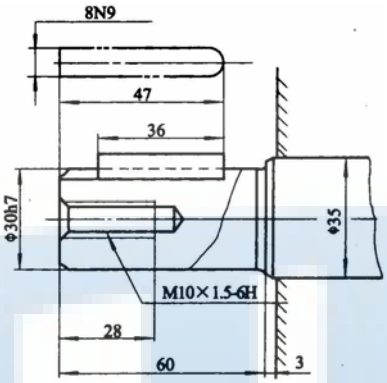
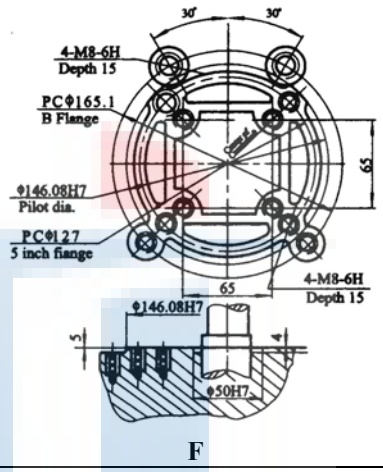
Table 2.3 Overall dimensions of diesel engine

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N
178	358	421	450	218	203	145	96	199	5	41.5	43.5	104	144	171.8
186	358	470	494	247	223	155	105	224	5	43.5	51.5	117	155	173.8

Note: All data subject to change without notice.

2.5.2 Connecting dimensions of output shafts and power-take off (PTO) flanges

Model	Output Shaft		PTO Flange
178			
			

Model	Output Shaft		PTO Flange
186			
			

2.6 Installation of diesel engine

2.6.1 Installation Conditions

(1) There must be a tight stationary foundation for the diesel engine to avoid vibrations or movement when the engine is running. For prolonged engine life, consider using some type of motor mount.

(2) Make sure that the centering position of output shaft is properly aligned.

(3) For diesel engine with thread shaft or taper shaft, make sure that matched machines must have the same thread size or coned angle as output shaft of engine.

(4) For diesel engine with keyway output shaft, check whether the bearing hole (installation hole) on the belt pulley and keyway output shaft are properly aligned and whether their dimensions match. Also make sure that the bolt of the engine shaft is tightened to the proper torque specifications.

(5) When the engine is matched with other belt driven machines, the total desired belt distance traveled by the driven wheel must equal the total distance traveled by the driver pulley. If this is not properly calculated and matched, the desired speed on the driven pulley will be incorrect. The diameter of driving belt pulley can be calculates as follows:

$$\text{Diameter of engine belt pulley} = \frac{\text{Diameter of driven machine x speed of driven machine}}{\text{Diesel engine speed}}$$

(6) Make sure that the belt is tightened properly.

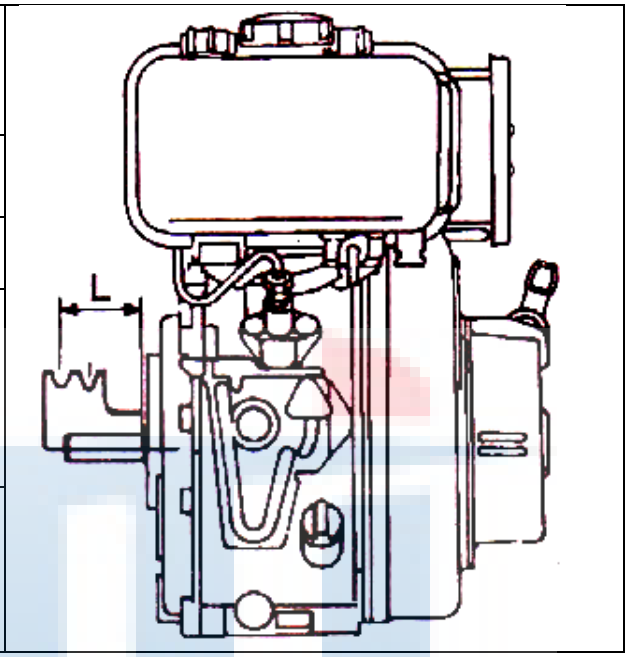
Note: If the belt is installed too tight, the engine will be overloaded and its bearings will wear at a high rate leading to engine failure; if the belt is too loose, the belt will slip at high speed and high load causing high pitch whistling noises.

2.6.2 Allowed clearance between belt wheel and engine

The belt pulley should be as close to the engine as possible. The values of L are tabulated in table 2.3.

Table 2.4 Allowed belt pulley to engine distances.

Item \ Model		178F	186F
Belt	Type	B	C
	Qty.	2	2
Min. Diameter of pulley (mm)		97	135
L* (mm)		≤ 70	



Note: * L means the distance between the crankshaft shoulder and the outer center of belt pulley groove.

2.6.3 Crankshaft driving and tilt angles

Crankshaft driving angles must be larger than 120° (see Fig. 2.1a). The tilt angles of engine must be kept within the allowed values shown in Fig. 2.1b.

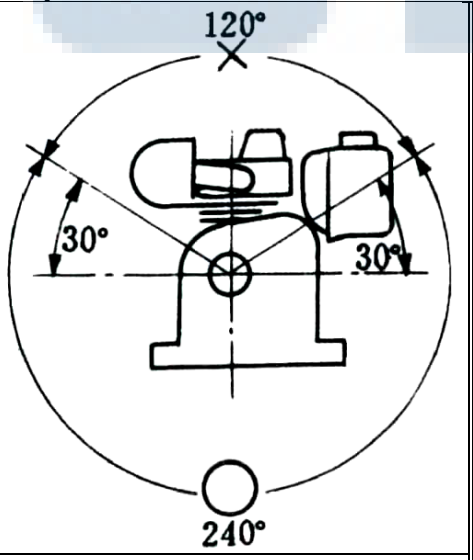


Fig. 2.1a Allowed driving angles.

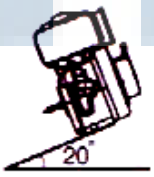
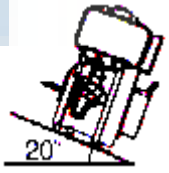
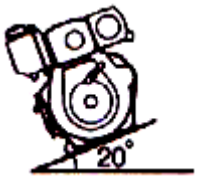
Output Shaft Tilt		
Allowed Tilt (continuous running)	≤ 20°	
Engine Tilt		
Allowed Tilt (continuous running)	≤ 20°	

Fig. 2.1b Allowed tilt angles.

2.7 Performance curves

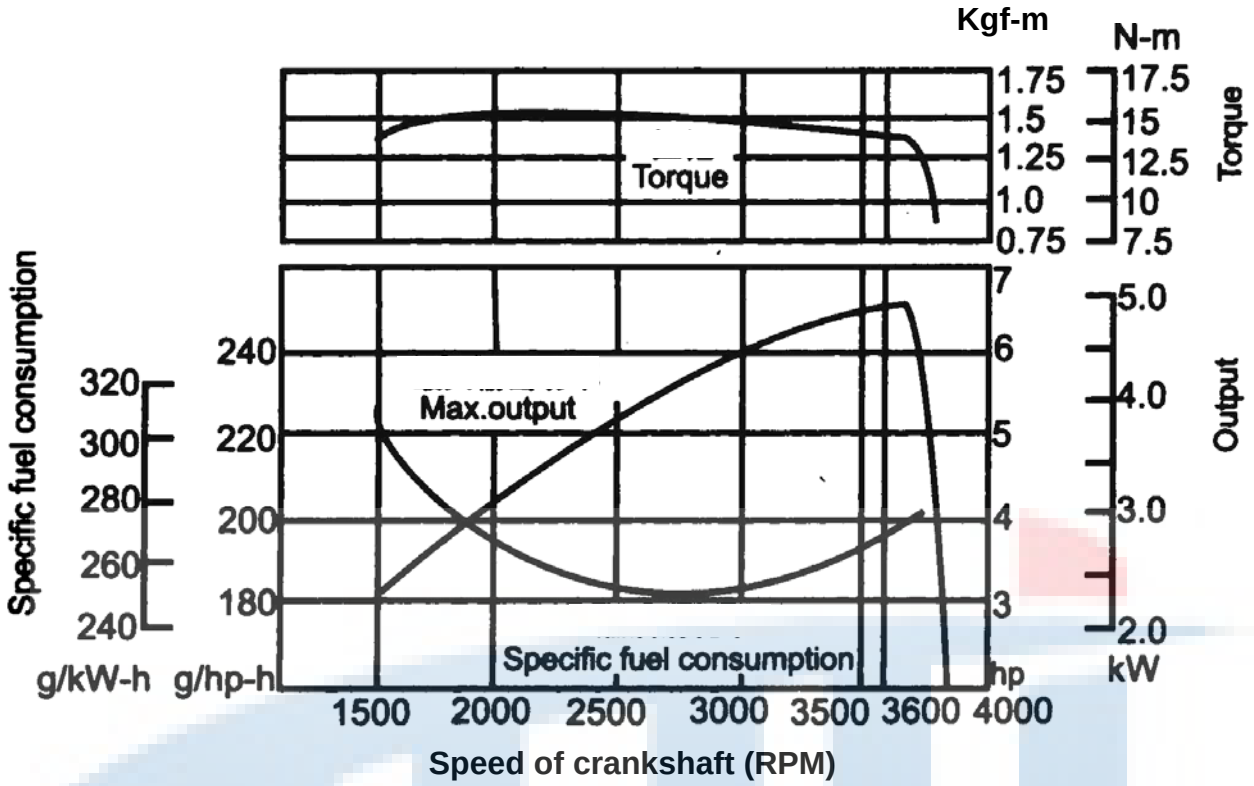


Fig. 2.2 a Performance curve for 178 diesel engine.

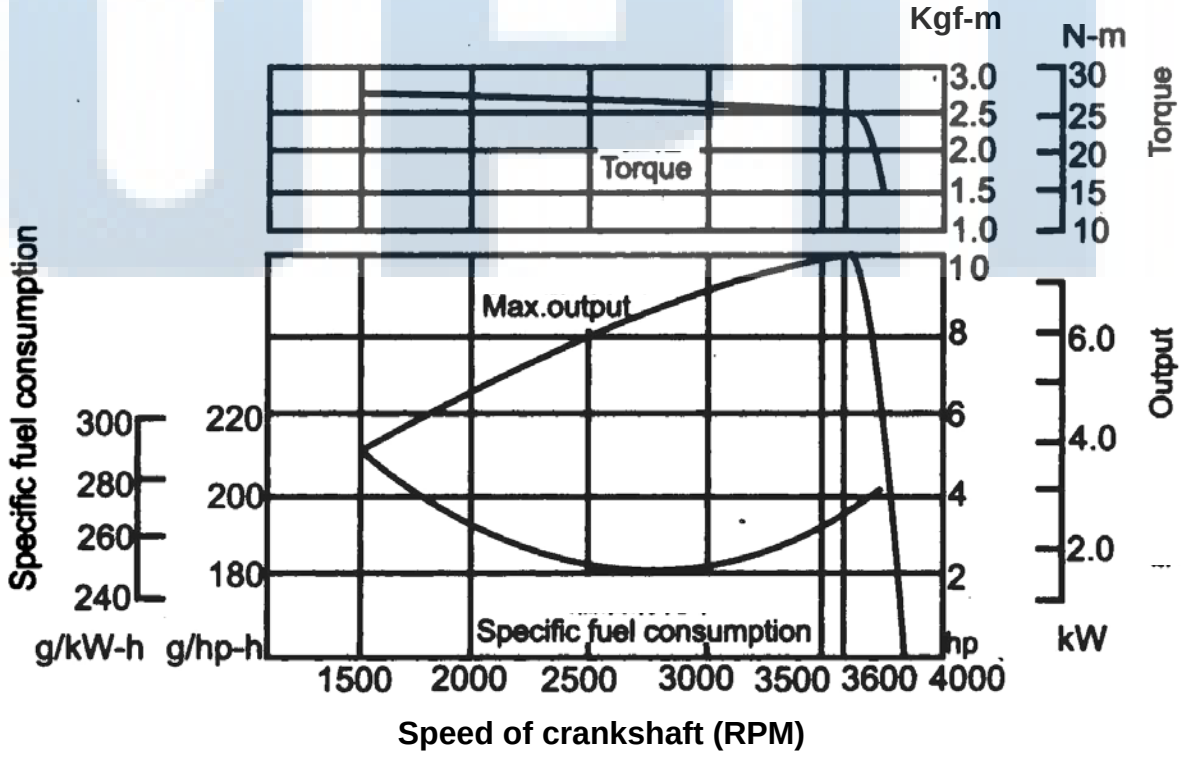


Fig. 2.2 b Performance curve for 186 diesel engine.

Performance is measured after 30 hours of running with air cleaner and exhaust silencer. Measurement conditions for performance curves are listed in Table 2.5.

Table 2.5 Measurement conditions for performance curves.

Item	Conditions	
Atmosperic condition	ISO 3046/I	
Intake air temperature	20°C	27 °C
Barometric pressure	760 mmHg	750 mmHg
Relative humidity	60%	60%

2.8 Valve timing, initial angle of fuel delivery and valve clearances.

Table 2.6 Valve timing.

Model / Item	Phase (Degrees)	
	178	186
Intake valve open	BTDC18°	BTDC13°
Intake valve close	ABDC46°	ABDC52°
Exhaust valve open	BBDC52°	BBDC57°
Exhaust valve close	ATDC12°	ATDC8°30’

Table 2.7 Initial angle of fuel delivery.

Model / Item	178		186	
Engine speed(RPM)	3000	3600	3000	3600
Initial angle of fuel delivery (Degrees)	19 ± 1	20 ± 1	21 ± 1	22 ± 1

Table 2.8 Valve clearance, unit in mm.

Model / Description	178	186
Intake valve	0.15 ~ 0.20 (cold state)	
Exhaust valve	0.15 ~ 0.20 (cold state)	

Table 2.9 Ranges of temperature, smoke and pressure.

Model / Description	178	186
Exhaust temperature(°C)	≤ 480	
Engine oil temperature(°C)	≤ 95	
Smoke(Bosch)	≤ 4	
Pressure of injection MPa(Kgf/cm^2)	19.6 ± 0.49 (200 ± 5)	

2.9 Torque specifications for various engine bolts and nuts

Table 2.10 Allowed torque for various engine bolts and nuts. Unit in N.m

Model / Description	178	186	Note
Connecting rod nut	25 ~ 30	40 ~ 45	Retighten up after break-in period
Cylinder head nut	42 ~ 46	54 ~ 58	
Flywheel nut	100 ~ 120	120 ~140	
Nozzle retainer nut	10 ~ 12		
Tightening screw bolt of rocker support	20 ~ 23		
Standard M8 bolt	18 ~ 22		
Standard M6 bolt	10 ~ 12		

CHAPTER 3 OPERATING THE DIESEL GENERATOR

3.1 General main points of safety during operation of the generator set.

In order to operate the generator set safely, please follow all the instructions provided in this manual carefully. Otherwise, it may lead to accidents or equipment damage.

3.1.1 Fire prevention

The proper fuel for the diesel generator set is light diesel fuel. Do not use gasoline, kerosene or other fuels other than light diesel fuel. Keep all flammable fuels away from the generator as it may spark and ignite these gases. In order to prevent fires from occurring and to provide enough ventilation for people and the machine, keep the diesel generator at least 1.5 meters away from buildings or other equipment. Always operate your diesel generator on a level site. If the generator is operated on an incline, the lubricating system within the engine will not perform well and may lead to engine failure.

3.1.2 Prevention from inhaling exhaust emissions

Diesel engine exhaust emissions have the potential to cause a range of health problems. Diesel engine exhaust emissions (commonly known as diesel fumes) are a mixture of gases, vapors, liquid aerosols and substances made up of particles. They contain the products of combustion including:

- carbon (soot);
- nitrogen;
- water;
- carbon monoxide;
- aldehydes;
- nitrogen dioxide;
- sulphur dioxide;
- polycyclic aromatic hydrocarbons.

The carbon particle or soot content varies from 60% to 80% depending on the fuel used and the type of engine. Most of the contaminants are adsorbed onto the soot. Petrol engines produce more carbon monoxide but much less soot than diesel engines.

Never inhale exhausts emitted by the engine. The exhaust emissions contain toxic carbon monoxide, nitrogen dioxide, sulphur dioxide and aldehydes. Never operate your generator in places with poor ventilation. In order to operate this machinery indoors, a suitable ventilation system for the building is required to draw the poisonous exhaust gases out.

3.1.3 Prevention from accidental burns

Never touch the muffler and its cover when the diesel engine is running. Never touch the muffler and its cover immediately after the diesel engine is shut off, as the muffler remains hot for some time.

3.1.4 Electric shock and short circuits

Never touch the generator if the generator is wet. Also never touch the generator if your hand is wet. Never operate your generator exposed to air in the field or outside buildings if the weather conditions call for any type of precipitation such as rain, snow or fog. To avoid electrical shocks, the generator should be grounded. Use a lead to connect the grounding terminal in the control panel of generator to the grounding surface of choice. Please refer to Fig. 3.1 before operating generator.

Note: When connecting devices to the generator, make sure that the power for all the devices is rated lower than generator output. Any of generator sockets should not be overloaded above its regulated limit.

Grounding terminal in the control panel

Fig. 3.1 Control Panel with Grounding Terminal

3.1.5 Other safety items

Before operating generator, all operators must be aware of put the **CIRCUIT BREAKER** to the **OFF** position if any accidents occur. Also, all operators should be familiar with all the switches and their functions of generator before using it. Wear safe shoes and suitable clothes during operation. Always keep generator **out of reach of children and animals.**

3.1.6 Battery

The electrolytic liquid of battery (known as battery acid) contains sulfuric acid. In order to protect your eyes, skin and clothing, wear protective glove and goggle when working with battery. If you contact with electrolytic liquid in your skin, wash it immediately with clean water and soap; if you contact with electrolytic liquid in your eyes, wash them immediately with distilled water, see a doctor as soon as you can.

3.2 Preparation before operation

3.2.1 Fuel choices and fuel treatment

Only use light diesel fuel. The fuel must be filtered clean. Never let dust and water mix with fuel in the fuel tank. Otherwise it will clog the fuel lines and oil nozzles. It may also damage your pressure pump. It is dangerous to overfill fuel tank. Never exceed 90% scale of fuel gauge.

Fresh diesel from gas station may contain water. Please put it in a diesel container and let it sit at least overnight, water and impurities will stay in the lower portion of container. Decant or suck top portion of diesel in the container into fuel tank of generator.

Caution:

Do not overfill tank. After filling, tighten the fuel cap. Never let fuel or fuel tank expose to sparks.
Be careful not to spill fuel when filling. If any fuel is spilled, make sure to clean up all the spilled fuel before starting engine.

3.2.2 Charging battery

We recommend the use of accumulators rated 20 hours shown in table 3.1.

Either deep-recycle maintenance free or dry battery (**white/red color**) comes with your generator (see Fig. 3.2). You should use a trickle charge to fully charge your battery before you crank your generator for the first time. If voltage level of battery is low, you may not start your generator. Long time cranking may damage electric starter and engine.

Table 3.1 Specifications of recommended accumulators for electric start

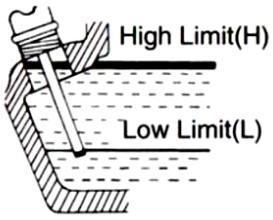
Model	Amps-hours
178F	24 ~ 26
186F	36 ~45

Fig. 3.2 Maintenance free battery (left) and dry battery (right), battery actual color is subject to change without notice.

If it is dry battery, the battery must be filled with battery acid to required level. Acid can be purchased at a local automotive supply store. To properly maintain your dry battery, check the height of the battery acid once a month. If the level of the liquid drops too low, fill it with distilled water until it reaches up to maximum level mark. If there is not enough battery acid, diesel engine cannot be started. It is important to keep the liquid level between the high and low limits. If the level in the battery is too high, the liquid may flow out and corrode surrounding parts.

3.2.3 Filling engine oil

Remove the dipstick from the engine, make sure the generator is on level ground and fill the engine with **SAE15W40 (warm weather) or SAE5W40 (cold weather) synthetic diesel engine oil**. Put the dipstick back into the hole to check the engine oil level (see Fig. 3.2).



Model / Capacity	178FG	186FAG
Liter(Oz)	0.8(27.1)	1.15(38.9)

Fig. 3.3 Schematic for filling engine oil.

The following procedures help you start our generator with ease:

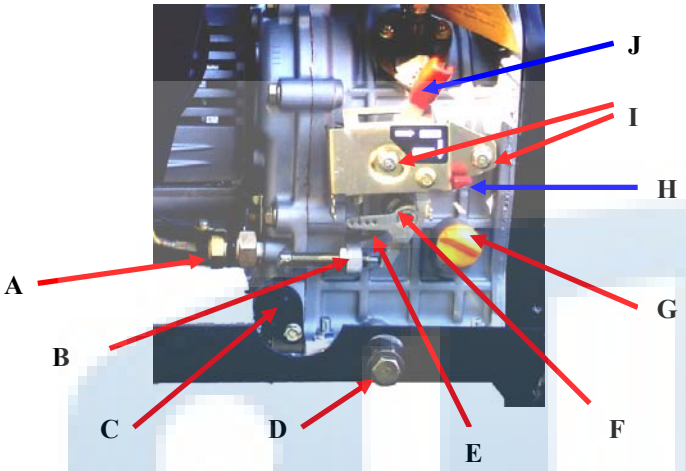
1. If dry battery(**WHITE/RED COLOR**) comes with your generator, please add enough acid to required level;
2. **FULLY CHARGE BATTERY** prior to cranking diesel engine;
3. Add engine oil to the required level (use oil plug to check); **Mobil Delvac SAE 15W40 (warm weather) or SAE 5W40 (cold weather) synthetic DIESEL ENGINE OIL** is recommended;
4. Add enough diesel in fuel tank, turn knob fuel Shutoff valve (Down) **ON** position. On open Frame this is under Fuel Tank, on enclosed Units this is on filter inside of the door;
5. Pull off the fuel hose connected to the fuel pump and **LET FUEL DRAIN OUT FREELY**, then replace the fuel hose;
6. Connect fully charged battery to generator;
7. **DO NOT** apply any load at this point and put the **CIRCUIT BREAKER** to the **OFF** position;
8. Push **RED** lever next to oil level check stick to the **RUN** position;
9. Turn on to the **START** position and release the key to the **ON** position;
10. In cold winter area please turn key counterclockwise to **HEAT** and hold about 20 seconds to preheat cold air, then turn clockwise to **START** engine, release the key to on position after engine starts; it helps start the engine in cold weather; if your remote control unit has remote preheater function, please see refer to operating procedures for remote start for your reference;
11. If the engine does not start, wait 1 to 3 minutes and repeat the 8 or 9;
12. Only try to use remote control after you successfully start the engine using a key switch.

Note: Open frame models usually come with recoil starter. If you want to pull start your generator, please refer to **Section 3.10 Procedures for recoil starting.**

3.4. Generator Break-in

A brand new engine must be properly broken in. The break-in period is about 20 hours. An oil change for a brand new engine is about 20 hours or one month. After break-in period, oil change shall be performed routinely every 100 hours or 3 months.

IMPORTANT: Do not apply high load during the **first 20 hours of break-in period**, change engine oil and check oil filter after first 20 hours of break-in running; if you find any dirty or metal scraps on the oil filter (please refer to Fig. 3.4), please use diesel to wash them away, otherwise, it may cause serious damage to your engine.



A: Oil Pressure Sensor
B: Factory Default Set Maximum Power Output Screw
C: Oil Filter
D: Oil Draining Bolt
E: Spring & 4 Holes for Frequency Adjustment
F: Governor
G: Oil Dipstick
H: Emergency Stop Lever
I: Frequency Adjustment Screws(2)
J: Speed Handle (Fuel Throttle Lever)

Fig. 3.4 Partial Front View of Diesel Engine

3.5 Applying Load to your Generator

After generator is started, push circuit breaker to ON position and you should read 120V in volt meter when voltage selector is set for 120V output or 240V in volt meter when voltage selector is set for 120V/240V output.

When applying loads to generator, make sure to apply loads in order. Apply larger load onto the generator first. If the generator labors great with applied load, smaller load can then be added. Never overload generator. Otherwise, generator will black smoke or circuit breaker will be stripped. In this event, decrease the number of small loads until generator labors normally. Please see Table 2-1 for technical specifications of generator for your reference. If the indication of the volt meter is too high or too low, adjust the engine speed (capacitor used for brushless alternator) or electric resistance of AVR used for brush alternator accordingly. Special skills are required to perform speed adjustment. An authorized professional is recommended to perform this work. If there are problems, stop the generator immediately and fix the issue.

Note: During operation, the generator should be put in a place with good ventilation. Never cover open frame generator using your own cage to solve a noisy problem, as this will cause overheating problem and then damage your generator. You must obtain our prior authorization for any change in our generator. Otherwise, the warranty for your generator will be voided.

Do not apply more than two loads simultaneously. Each load should be started one by one to avoid overloading generator. The generator should be running at 3600 revolutions per minute in order to achieve the frequency of 60Hz. The speed of the engine can be adjusted through speed governor.

CAUTION: A alternator consists of two sets of windings, namely R2 & R1 and L2 & L1 (see **Fig.3.5a**), each set of winding gives 120V output. A voltage selector is used to obtain 120V and/or 240V outputs (**see Fig. 3.5d**). Two sets of windings are in parallel when a selector is set at left while two sets of windings are in serial when a selector is set at right (**see Fig.3.5b & c**). If you push voltage selector left for only 120V output, you can apply full rated load at 120V outlets; if push selector right for both 120V & 240V outputs, you can apply full rated load at 240V outlet from four-prong socket; however, you can only apply HALF RATED LOAD at either 120V outlet (total two 120V outlets) from four-prong socket.

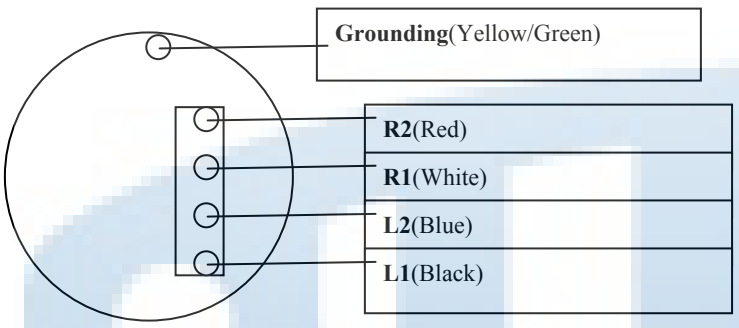


Fig.3.5a Wiring diagram for alternator

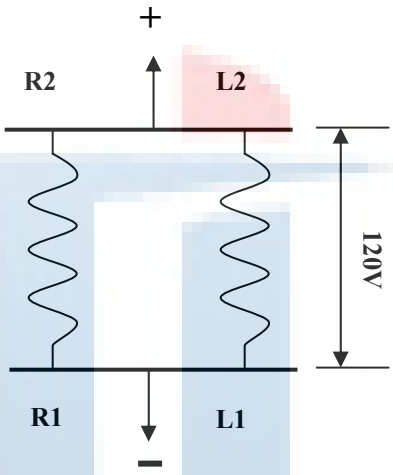
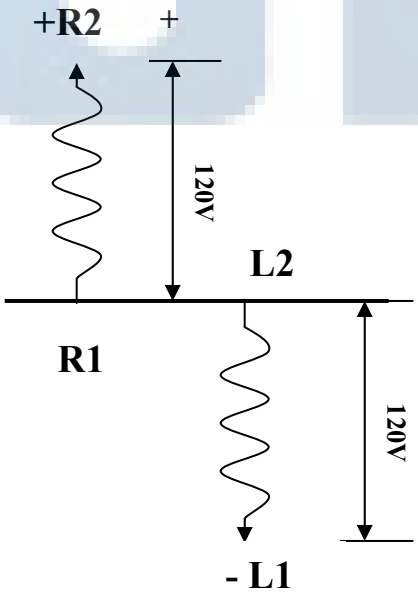
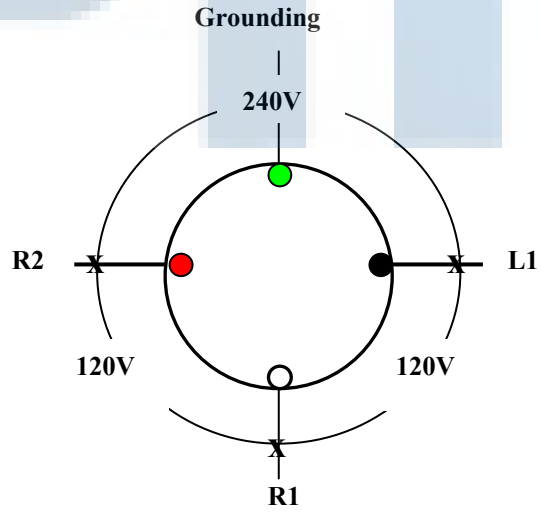


Fig.3.5b Parallel Connection





NEMA L14-30R for 120/240V @ 30A Four-Prong Socket

Fig.3.5c Serial Connection

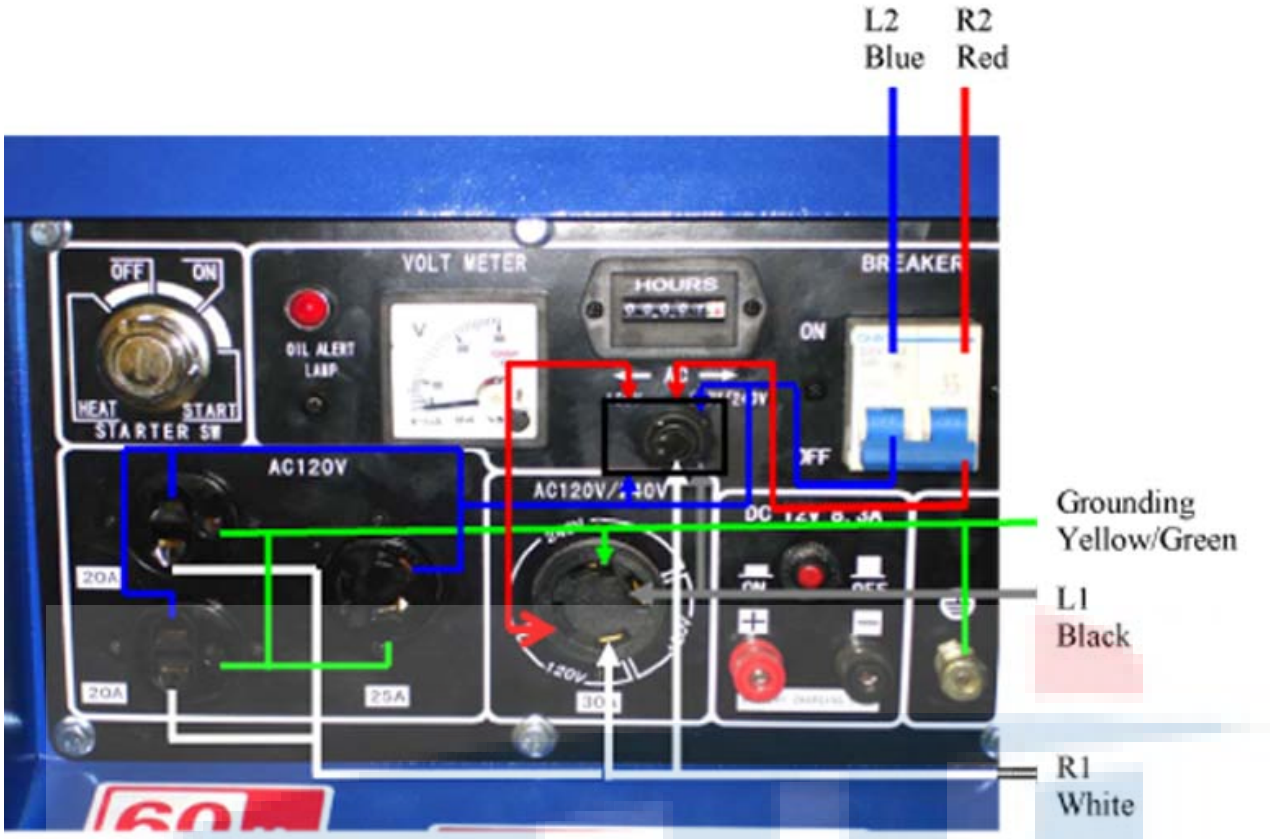


Fig. 3.5d Wiring Diagram of Electric Output for Control Panel

3.6. Operating Procedures for Remote Start

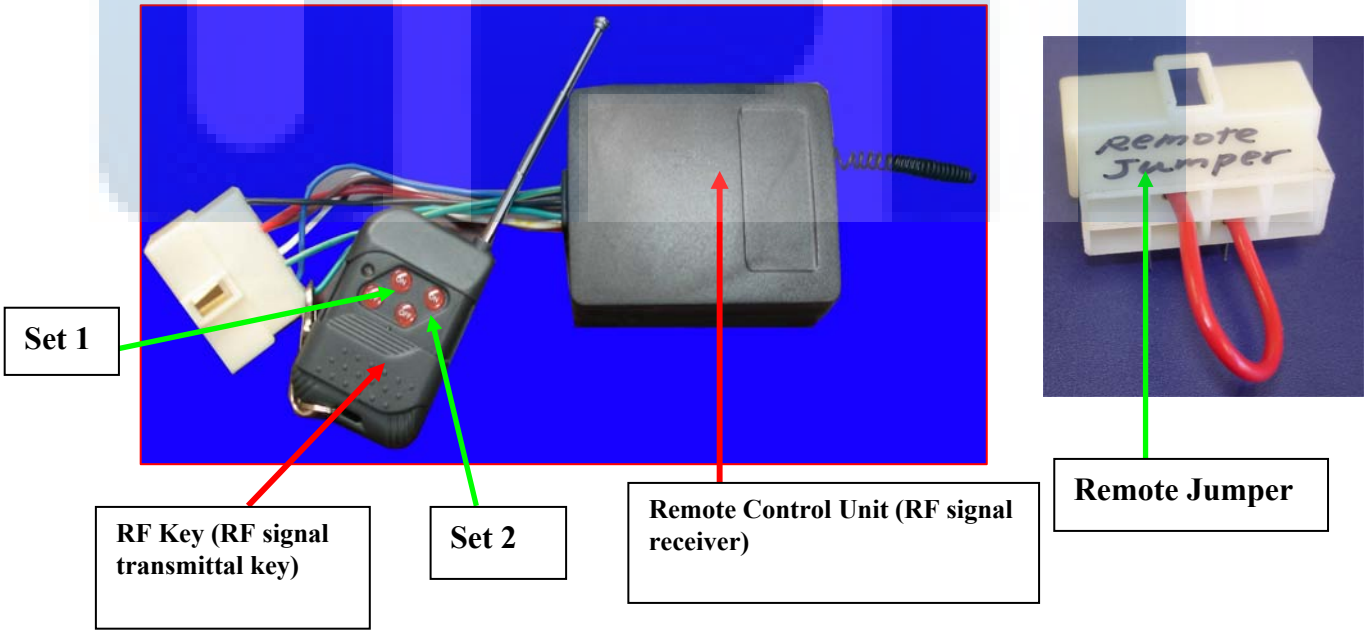


Fig. 3.6 Remote Control Unit (left) and Remote Jumper (right)

There are two sets of ON and OFF buttons in RF transmittal key. If your remote start unit (with 7 wires on) has no remote glow plug function, the operating procedures are as follows:

1. Please refer to above generator operation instruction for start using key switch;
2. If you want to use remote start, please make sure that your electronic key switch is either put on "OFF" position or taken away from the control panel;
3. There are two sets of ON and OFF buttons in RF key, you can depress either one of ON buttons to start the generator and either one of OFF buttons to shut down the generator respectively;
4. If you use key switch to start the generator and then use RF key to shut it down, make sure that you need turn electronic key switch to OFF position; otherwise, your generator battery will drain charge gradually;
5. In case your remote control unit fails and a remote jumper comes with your user's manual package, please unplug your remote control unit first, then plug the remote jumper; this will enable you to use key switch to start your generator; if there is no remote jumper with your package, please follow the order shown in the picture of remote jumper to electrically shorten the two corresponding wires coming out of your control unit(a small black box with either 7 or 8 wires on), then you shall use key switch to start your generator.

If your remote start unit (with 8 wires on) has remote glow plug function, the operating procedures are the same as the 7-wire remote control unit except the following:

There are two sets of ON and OFF buttons in RF key, you must depress ON button of set 1 to start the generator and OFF button of set 1 to shut down the generator respectively (**see Fig. 3.6**), also refer to **Section How to Use Glow Plug**;

3.7 How to Use Glow Plug

Fig. 3.7 Control Panel with Preheater Knob (left) and Preheater Button (right)

Diesel generator will be very hard to start in cold winter. However, glow plug will help start diesel generator much easier. There are two types of control panel used in our portable diesel generators: **Type A** control panel has heat knob (**see Fig.3.7 A**) and **Type B** has preheater button (**see Fig. 3.7 B**). For type A control panel, please turn key counterclockwise to **HEAT** position and hold about 20 seconds to preheat cold; for **Type B** control panel, please depress a small red button right above grounding terminal and hold about 20 seconds to preheat cold.

If your diesel generator comes with 8-wire remote control unit (it needs special order, extra charge applies), you can remote control glow plug. The operating procedures are as follows:

Two sets of ON and OFF buttons used for remote starting engine and turning on glow plug respectively (**see Fig. 3.6**), Set 1 for starting engine and Set 2 for controlling glow plug, Sets 1& 2 are interlocked each other and only one set of ON & OFF works at a time, Set 2 is programmed for powering on glow plug 25 Sec and glow plug will automatically power off after 25 Sec, you can also DEPRESS OFF button in SET 2 for power off earlier.

3.8 Charging battery

1. All 4000 and 6800 series diesel generators can automatically charge DC12V battery through voltage rectifier (voltage stabilizer) installed in the rear side of engine when they are running.
2. If generator is not used for a long time, the battery should be disconnected to avoid energy loss from the battery.
3. Do not connect the negative and positive terminals of the battery together at any time. Doing so will damage the battery and cause serious injuries.
4. Do not reverse the polarities when attaching battery cables to battery. Doing so will damage both battery and electric starter.
5. Battery will produce flammable gases during charging. Do not expose the battery to any flames and sparks during charging as this may cause a fire. To avoid sparking while connecting cables to battery, connect the cables to the battery then to electric starter. To disconnect battery cables, first disconnect the cable at the end of electric starter.

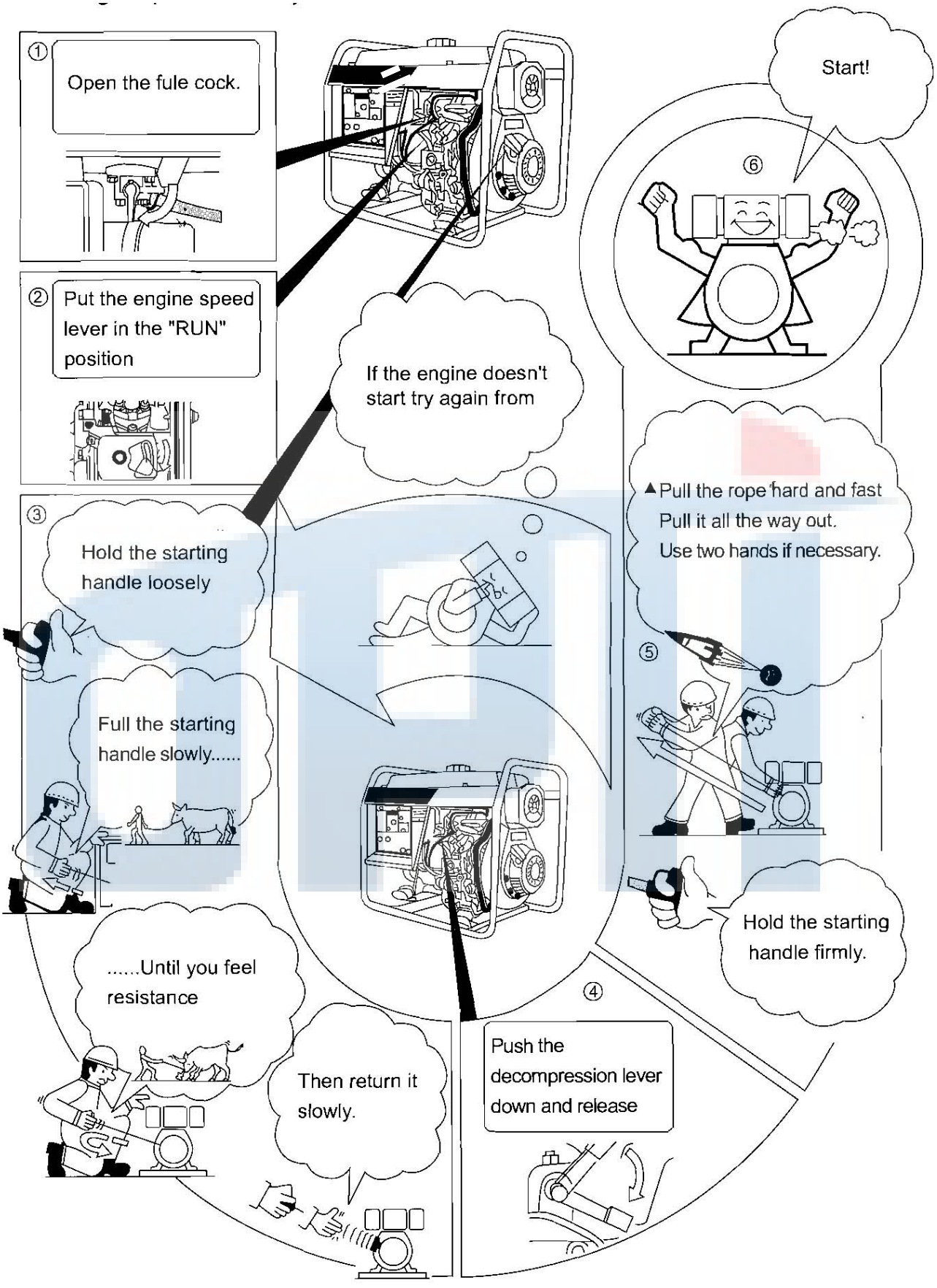
3.9 Stop generator

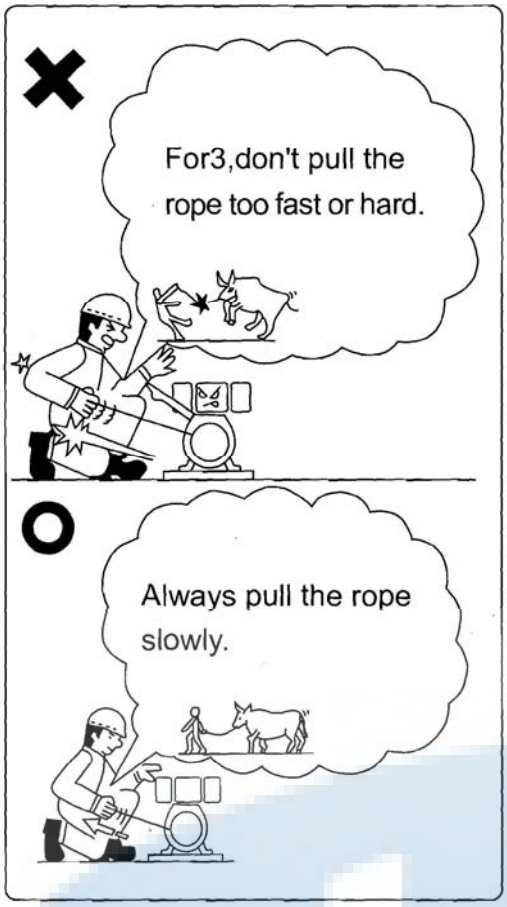
1. Remove the electrical load off the generator.
2. Let the engine idle for 3 minutes after unloading. Do not stop the diesel engine immediately. Stopping the diesel engine suddenly may raise the temperature of engine abnormally and lock the nozzle and damage the diesel engine.
3. Turn key to the “off” position or depress “off” button in RF key.
4. If do not use generator for a long time, please shut off fuel valve and then make sure that both intake and exhaust valves are closed for avoiding engine rusting. Pull slowly on the recoil handle (open frame models) or use one of your hands to manually rotate fly wheel (silent model) until you feel resistance when the piston of engine is in the compression stroke where both intake and exhaust valves are closed).

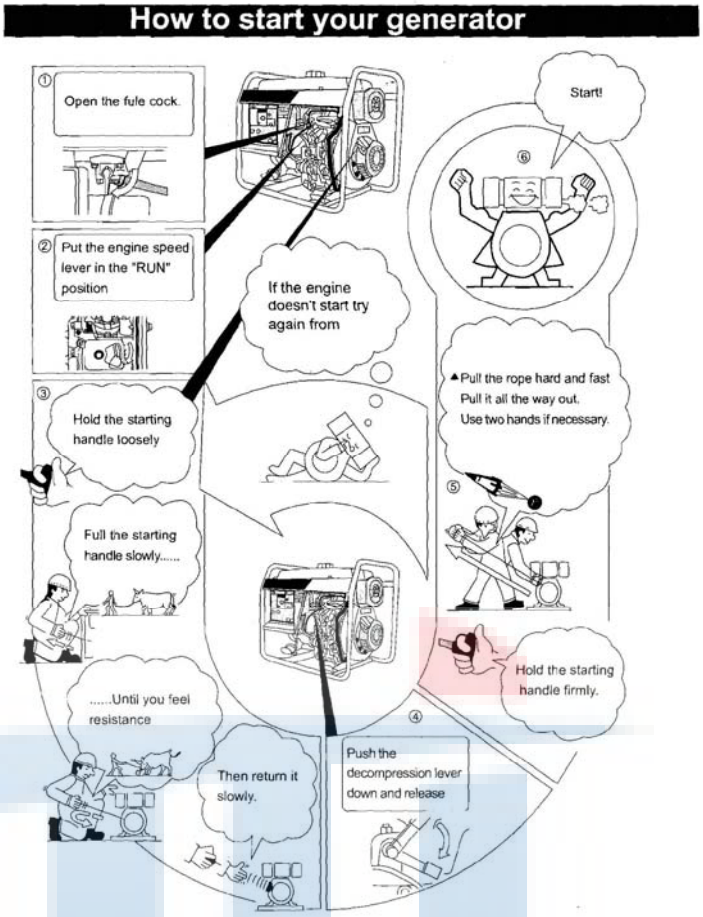
Emergency Stop:

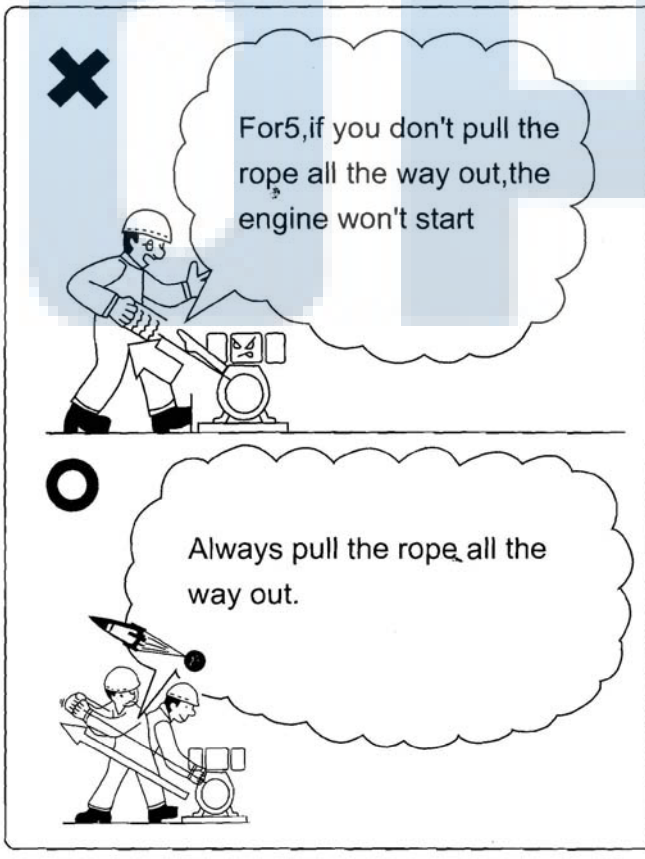
If you turn key to the “off” position or depress “off” button in RF key, the engine is still running, please depress emergency stop lever (see Fig. 3.4) to stop it manually. If emergency stop lever fails, please shut off fuel valve to stop it.

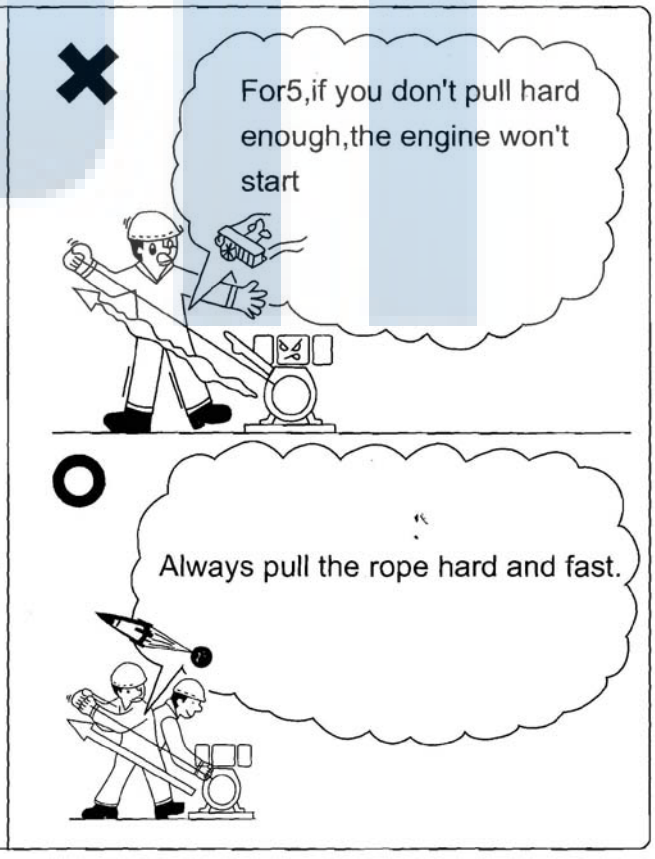
3.10 Procedures for recoil starting




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


How to start your generator
① Open the fule cock.
② Put the engine speed lever in the "RUN" position
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
If the engine doesn't start try again from
⑤ ▲Pull the rope hard and fast Pull it all the way out. Use two hands if necessary.
⑥ Start!
Hold the starting handle firmly.


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


For5,if you don't pull hard enough,the engine won't start
Always pull the rope hard and fast.

CHAPTER 4 MAINTENANCE

4.1 Maintenance schedules

Keeping your generator well maintained will prolong the life of your generator. Everything needs to be checked including the diesel engine, generator, control panel and frame. For overhauling procedures, please refer to the instruction manual of relative subassembly. If you need these manuals, please call our company and we will send you one.

Before starting the maintenance, make sure the diesel engine is off.

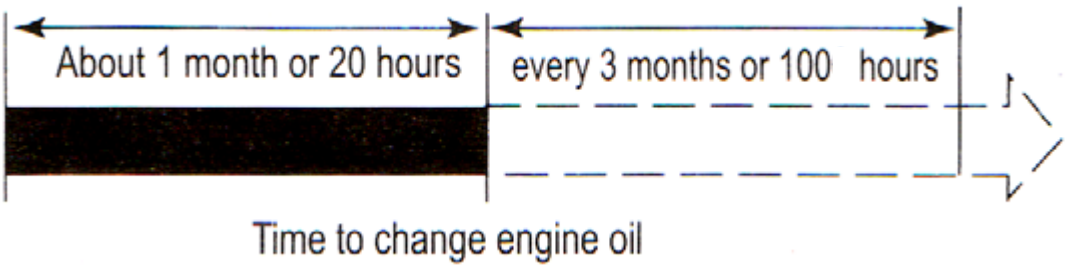
Please refer to the Table 4-1 below for the proper maintenance schedule.

Interval of maintenance / Item	Everyday	1st Month or 20hrs	Every 3 months or 100hrs	Every 6 months or 300hrs	Every year or 1000hrs
Check & fill enough fuel	○				
Drain fuel out of fuel tank		○			
Check & replenish engine oil	○				
Check oil leakage	○				
Check & tighten each engine part	○			● Tighten head bolts	
Change lube oil		○ (1st time)	○ (2nd time & thereafter)		
Clean oil filter				○ (replace)	
Replace air filter element	Service more frequently when used in dusty area			○ (replace)	
Clean fuel filter				○	● (replace)
Check fuel injection pump				●	
Check fuel injection nozzle				●	
Check fuel pipe				● (replace if necessary)	
Adjust the gaps of air intake & exhaust valves				●	
Grind air intake & exhaust valves					●
Replace piston rings					●
Check dry battery fluid	Monthly				
Check carbon brush & slide ring				●	
Check insulation resistance	○				

Note: "●" mark indicates that it needs special wrench, please contact with OPTI dealer.

4.2 Changing the engine oil (every 100 hours)

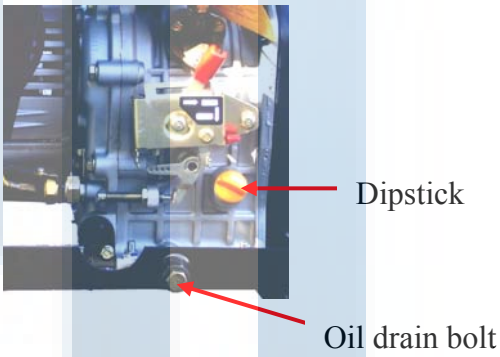
Engine oil is the most important factor in determining the life of your generator engine. If you use poor engine oil or if you do not change the oil regularly, the piston and cylinder will wear off easily or seize up. The life of the other engine parts such as bearings and rotating parts will be shortened considerably as well.



Time to change engine oil

All our portable diesel generators are installed low oil pressure automatic shut-off function. However, manual check of engine oil level using dipstick (oil filler cap) is strongly recommended prior to cranking engine. If the oil level is low, fill it up to required level. Oil is easily drained out of engine due to low viscosity and high fluidity when diesel engine is still hot. If the engine is fully cooled, the viscosity of oil turns higher and oil will be dense and sticky, especially in winter, it is more difficult to drain all the oil out or some impurities will remain in the engine.

Take the dipstick off. Remove the oil drain bolt when the diesel engine is still hot. Be careful of hot oil and hot engine as you may get burned. The bolt is located at the bottom of the cylinder. After draining the oil, put the bolt back and tighten it. Then fill with the proper engine oil to the proper level.



Warning: Do not fill engine oil when engine is running!

4.3 Air filter element replacement

Paper-based air filter element is used in diesel generators. It is non-reusable. So, do not try to wash the air filter for reuse purpose. Replace air-filter element every 6 months or 300 hours of regular operation. Never start the diesel engine without the air filter. Otherwise, it can cause serious damage to the engine if foreign objects enter the intake system. When the output of the diesel engine is reduced or the color of the exhaust emissions is abnormal, replace the air filter element on time. To replace an air filter element, first loosen the butterfly(wing) nut, take the cover of the air filter off and take the air filter element out, then after replacing the air filter element, replace the cover and tighten the butterfly nut firmly(**see Fig. 4.1**).

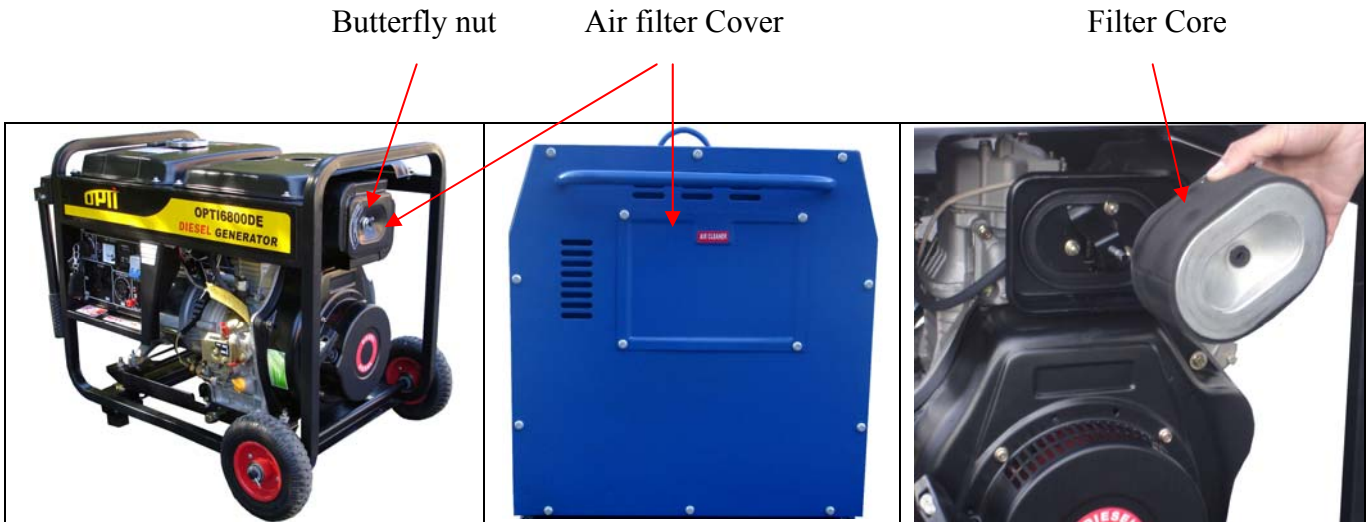


Fig. 4.1 Air filter element replacement

4.4 Fuel filter maintenance

The fuel filter should be cleaned often to keep the engine running at maximum performance. The recommended interval for cleaning or replacing fuel filter is 6 months or 500 hours of operation. Two types of fuel filter are used in our portable diesel generators: type A is solely used in open frame model; type B is mainly used in silent model and may be used in some open frame units. Fuel filter is either installed inside fuel tank (open frame model) or outside fuel tank in a fuel coke assembly (silent model). Please refer to Fig. 4.2 for your convenience.

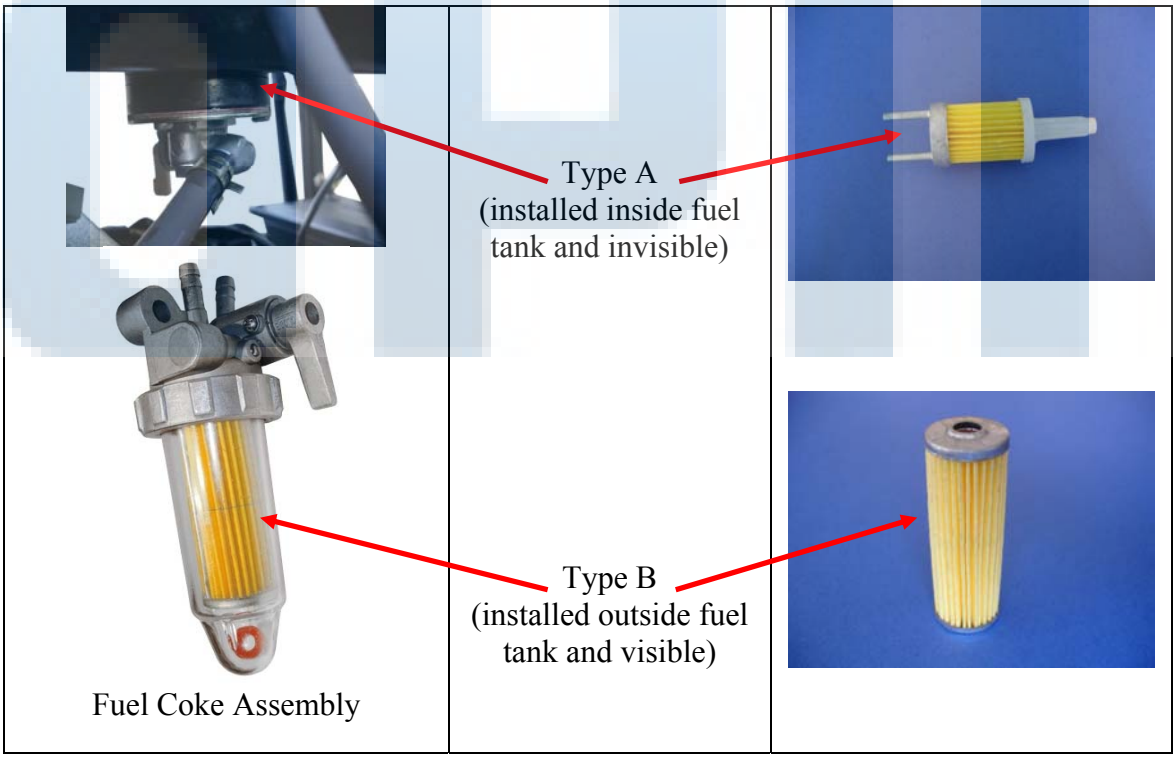


Fig. 4.2 Fuel Filters used with different fuel coke assemblies

How to replace fuel filter

a. Type A fuel filter:

1. Drain all the fuel out of fuel tank.
2. Keep fuel tank right up, loosen two hex nuts on a fuel coke assembly, then take off fuel coke assembly;
3. Loosen 3 small screws on a fuel gasket metal cover underneath fuel tank and remove metal plate cover.
4. Take used fuel filter out of fuel tank, remove circular rubber and O-ring seals and paper-based gasket(s) from the used filter and keep them for reuse if applicable and discard the used filter. You may use diesel fuel to clean up the used filter for reuse. However, the use of new filter is recommended.
5. Put circular rubber and O-ring seals and paper-based gasket(s), and then put gasket metal plate cover to the new filter.
6. Install new filter to fuel coke assembly and then manually slight tighten two hex nuts to the bolts of filter.
7. Place new filter inside fuel tank, align positions for three small screws. You can keep fuel tank upside down for your convenience.
8. Tighten three small screws and two hex nuts completely.

b. Type B fuel filter

Type B filter is very easy to replace: use one hand to hold the alumina head of fuel coke assembly and the other hand to hold thread flanged alumina ring, turn loose the ring counterclockwise, replace used filter with a new one and then tighten the ring completely.

4.5 Fuel injection nozzle

Check fuel injection nozzle every 6 months or 300 hours for possible blockage. Please clean up carbon deposit in fuel injector. Replace the used fuel injector if necessary.

4.6 Cylinder head bolt tensions

The cylinder head bolts should be tightened to specifications. Please refer to the diesel engine manual for specifications and the special tools are required to do this.

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4.7 Battery check

For dry battery, make sure that the battery acid is full. Electric starting system uses a DC12V battery. Due to numerous starting cycles, the battery acid may be used up. Also, before filling, verify that the battery is not damaged in any way. Add distilled water to the battery when filling. Perform checks on the battery once a month.

For maintenance free battery, please check the color of indicator: green means the battery is good, dark means recharging battery and Clear means replacing battery.

Caution: Color indicator is only used for reference, sometimes even though the indicator shows clear color, the battery itself may still work well.

4.8 Storage for a long period

If your generator needs to be stored for a long period, the following preparations should be made:

1. Start and run the engine for about 3 minutes, then stop.
2. Change the engine oil with new oil of proper grade when the engine is still hot.

3. Remove the screw plug out of the cylinder head cover and add 2CC of lubricating oil in plug hole, then replace the plug.
4. Recoil starting:
    a. Depress the decompression lever (non-compression position) and pull the recoil handle 2 or 3 times. This pushes the intake out. (Do not start the engine)
5. Electric starting:
    a. Depress the decompression lever, turn ignition key to “ON” position and crank the engine for 2-3 seconds. (Do not start the engine)
6. Pull the decompression lever up, pull the recoil starter **(open frame)** or manually rotate flywheel **(silent)** until you feel resistance; this is when the piston is on the compression stroke where both intake and exhaust valves are closed. Having intake and exhaust valves closed will keep moisture away from combustion chamber and prevent engine from rust.
7. Clean the engine and store in a dry place.

CHAPTER 5 TROUBLESHOOTING

5.1 Inspections before Operation and Maintenance

5.1.1 Inspection before operation

5.1.1.1 Check the insulated resistance

An insulated resistance usually results in the creepage of the alternator when it is below the regulated value and then brings on the security problems. The user should check the insulated resistance between the master and subordinate reels and the insulated resistance between the reels and the crust with 500V mega ohmmeter regularly. The value should not be under 2 M ohms at normal temperature; otherwise these parts should be dried. Use the electric cooker, infrared ray or big bulb or something else to heat them up outside until the insulated resistance reaches the regulated value.

5.1.1.2 Check the alternator assembly

Make sure all the firming components are tight and the rotor is easy to turn by hand without impacting, scrubbing and any abnormal noise. Do not let the rain or other liquid drop into the alternator.

5.1.2 Starting the generator

The end of voltage output should be on before running the machine. Generator should self excite, generate voltage in gear and reach the rated power when engine speed is accelerated to the rated value. Otherwise, stop the machine and check it.

5.1.3 Maintenance

Keep generator away from the oil, vapor, acidic/alkaline gas, saline brume and do not let any other solid matter fall into the generator. Keep drafty when the generator is running. Do not put anything on the surface of generator for baffling ventilation and heat dispersion. Do not operate under over-loading condition continuously and inspect bolts and mechanical firming components routinely.

5.2 Malfunction and Troubleshooting for Diesel Engine

5.2.1 Causes and Troubleshooting for the Engine Not Being Started

There are many factors causing non-starting issues. General causes for non-starting problem are summarized in Table 5.1.

For brand new diesel generator, if you can not start it, it is usually caused by entrapped air in the fuel hose. Please full off fuel hose from fuel injection pump and drain fuel freely to release all the entrapped air.

If you have used your generator for some time and find you can not start it or it shuts off automatically, it is usually caused by failure fuel system such as running out of fuel, non-energized solenoid, and burned solenoid or by failed remote control unit. **If there is no DC 12V power to solenoid, please troubleshoot as follows:**

1. Check whether solenoid fuse blows out or not. If it blows out, replace it.
2. If solenoid fuse is fine, please directly use a copper wire to feed 12V to solenoid (when disconnect blue wire to solenoid, make sure electrically insulate it for avoiding short circuit) and crank engine, see whether you can start it or not. If it works, solenoid control board or remote control unit fails.

Caution: there is a blue wire connected to the top of solenoid, NEVER touch the blue wire to engine case while with battery hooked up! Otherwise, a fuse (new 2008 or later model) or a control board for solenoid behind control panel will be burned!

Table 5.1 Causes and Troubleshooting for the Engine Not Being Started

CAUSES	TROUBLESHOOTING
Air exists in fuel system	Release trapped air in the fuel hose.
It is cold	Preheat cold air using glow plug first, then crank engine.
Engine oil is viscous	Fill machine oil into crankcase after warming-up. Fill machine oil into inlet pipe. Remove the connection belt from the machine (tapered shaft only), start the engine and then stop it. When it is warmed up, assemble the belt and then restart the engine.
Failure of fuel system	Check solenoid and see whether it is energized. Check fuel injection pump.
Water mixed in the fuel	Clean fuel tank, fuel filter and fuel pipe and change the fuel.
The fuel get thickening and can't flow easily	Use prescribed brand fuel
Injection fuel is little or the spray is not excellent	Check the position of governing handle or check and clean the fuel nozzle, change fuel injector if necessary.
Incomplete combustion	Mainly by ill spray Incorrect delivery angle Leakage in gasket of cylinder head Deficiency in pressure of compression
Interrupted of diesel fuel	Run out of fuel and get air in the fuel hose, should refill fuel into the fuel tank and drain fuel hose freely. Fuel pipe leaks or fuel filter is obstructed.
Deficiency in pressure of compression; Loosened nut of cylinder head; Damage or leakage in the gasket of cylinder	Tighten the nuts of cylinder head in the diagonal sequence; check the gasket of cylinder as per the standard requirement. When the engine with the new gasket is heating, tighten the nut of cylinder head again.
Big gap in the piston ring due to wear and tear	Change the piston ring
Leakage caused by each gap of piston ring lined in one direction	Make each gap of piston at angle of 120
Serious stickiness or breakage in piston ring	Clean it by diesel fuel or change the piston ring.
Leakage in valves	Skive the valves, or send it to repair factory if the vestige is too deep.
Incorrect valve clearance	Adjust the gap as specified (0.15~0.20 mm).
The valve stem is clipped in the guide pipe	Disassemble the valve, clean the stem and guide pipe with diesel fuel.

3. Use remote jumper to test, if it works, the remote control unit fails and needs replaced.

4. If remote jumper does not work, please turn Key Switch to "ON" position, use a multimeter (voltage tester) to measure the voltage on the solenoid, put positive polarity to the conjunction of blue wire and solenoid and negative polarity to engine case, you should read 12V in your meter. If the reading is ZERO, the solenoid control board (named CJX22 control board in green color behind control panel) fails and needs replaced.

If there is DC 12V power to solenoid, please troubleshoot as follows:

1. Take off solenoid from fuel pump using two wrenches. You should use one wrench to hold the solenoid firmly and turn counterclockwise to take it off fuel pump, at the same time, you must use the other wrench to hold metal pipe of fuel pump for avoiding its rotating. Take out a spring and a plunger in the solenoid, replace the solenoid (means bypassing solenoid) to fuel pump, crank the engine and see whether you can start or not; if works, solenoid is burned and needs replaced.

2. If you can not solve starting problem by bypassing solenoid, fuel pump or fuel injector may have failed.

How to test fuel pump or fuel injector?

a. Loosen the end of high pressure metal fuel pipe to fuel pump, crank engine and see whether you can see diesel popped out of fuel pump, if you can see diesel out of pump, the pump is fine. Otherwise, fuel pump needs replaced.

b. Take off fuel injector and test it: open the cover right on the top of enclosure (silent model) or muffler cover (open frame model), loosen two 10MM nuts, take out fuel injector with high pressure metal fuel pipe hooked up together, reconnect the other end of metal fuel pipe to fuel pump so that make sure you can observe the tip of fuel injector when cranking engine. if fuel injector is fine, you shall observe 4 well-sprayed diesel mists out of fuel injector tip; if not, try to use a piece of soft cloth to clean it and then try again; if you still can not see four mists, one or more tiny holes of fuel injector is/are bitted and fuel injector needs replaced.

c. Also, please check your battery voltage level, if it is below 12.5V, you probably can not start your engine; please fully charge your battery or try using your vehicle battery to crank.

d. If you can not hear cranking sound at all when you turn ignition key to start or use remote control unit to start, electronic key switch or the solenoid of electric starter is burnt and needs replaced. You can use a small copper wire to jump start your electric starter motor: jump start your electric starter and see whether your engine turns over; if it turns over, the starter is good and key switch needs replaced; otherwise, starter needs replaced.

Make sure you leave key in OFF position or simply remove key from control panel when you use remote start! Also, please depress OFF button after you remote shut down generator, otherwise, the battery will be gradually drained; it will also have a risk of burning solenoid.

Caution: please disconnect battery from your generator prior to conducting any maintenance or repair. Otherwise, some electronic parts will be burned with power operation.

If you perform all the above procedures and find fuel system is fine, please further check your diesel engine. Adjustment screw or tappet of your engine is probably snapped:

Remove fuel injector from your engine and take off cylinder cover, pull recoil handle or manually rotate flywheel, perceive whether you can see both intake and exhaust valves moves; if one of them does not move, please take a closer look at the cylinder head and make sure whether adjustment screw or tappet is snapped. If adjustment screw is snapped, try to take out the broken screw and replace it with a new one. Make sure you correctly adjust the gap of valves in the range of 0.15 ~ 0.20 mm. If tappet is snapped, you must remove alternator from diesel engine and then disassemble engine for replacement.

5.2.1.1 Instructions for disassembling alternator from engine

1. Drain out all the fluids from your generator including oil and fuel.
2. Remove generator frame (open frame) or soundproof enclosure (silent) from base pan.
3. Loosen four long bolts for holding alternator first and then remove stator from alternator.
   You should use two flat head screwdriver to warp up the stator out through two symmetrically distributed notches in the alternator cast case. It usually takes less than 10 seconds to remove stator from alternator.
4. Remove rotor from engine shaft.
   Completely loosen the long bolt with a 14MM hex head nut that is used to hold rotor to engine shaft so that you can take it out. However, you should not take out the long bolt, but to leave the loosened bolt in place, then use a **RUBBER HAMMER** hit heavily hit the 14MM hex head nut of long bolt about 10 times at the directions of left, right, back and forth, take out long bolt and then you shall pull out the rotor from engine shaft easily.

   Warning: Never use metal hammer rather than rubber hammer to hit the nut and avoid hitting in the bearing of rotor. Otherwise, the bearing will be broken.

5.2.1.2 Instructions for disassembling diesel engine

1. Loosen the end of high pressure metal fuel pipe to fuel injection pump and then remove the fuel injection pump from engine.
2. Remove fuel injection nozzle (injector) with high pressure fuel pipe from engine.
3. Remove cylinder gasket cover.
4. Remove rocker arm.
5. Remove two push rods.
6. Remove the half crankcase in alternator side (drive shaft side) from engine.
7. Remove cam shaft.
8. Replace the snapped tappet with a new one.

5.2.1.3 Instructions for setting valves and reassembling diesel engine

A. How to reassemble a diesel engine:

1. Suppose a diesel engine is disassembled at this step, e.g., fuel pump, fuel injector removed from, rocker arm and push rods taken off engine; **DO NOT REPLACE THEM NOW,**

OTHERWISE, YOU CAN'T PUT BACK THE HALF CASE OF ENGINE ON ALTERNATOR SIDE!

2. If tappets are snapped, please replace them and put the new ones in holes;
3. In case you pull off balance shaft during disassembling engine and need replace, please align balance gear and crank gear: there are TWO DOTS and ONE DOT in balance and crank gears respectively, you must align them at this step before aligning crank and cam gears;
4. Align crank gear(drive shaft) and cam gear(cam shaft): there are TWO DOTS and ONE DOT in crank and cam gears respectively, you must align them at this step;
5. Put case gasket and match two halves of engine together, tighten all bolts.
6. Put back push rods and rocker arm assembly, tighten two bolts for holding rocker arm, adjustment screws and nuts on rocker arm assembly and make sure adjustment screws touch push rods slightly so that you can lift up and down push rods. **DO NOT TIGHTEN ADJUSTMENT SCREWS FIRMLY AT THIS POINT, OTHERWISE, YOU CAN'T ADJUST VALVE GAP.**

B. How to set valve gaps:

The 4 strokes for engine are:

intake--->spray fuel, compress-->explode--->outtake exhaust.

When you spin flywheel, you can see push rods and rocker arms moving back and forth to make intake and exhaust valves open and/or close;

When both push rods move to their lowest positions, both intake and exhaust valves are close, then you can use your hand to move both rocker arms a little (both valves are close at this position);

This position is very important, you need adjust the valve gaps at this point: the gap between rocker arm and valve clip (a small round platform) for both sides (intake and exhaust valves) is 0.15 ~ 0.20mm (about 0.005906~0.007874 in). You can use a filler ruler of 0.15~0.20mm thickness to adjust.

C. Install fuel injector first, then install fuel pump.

You must install fuel pump correctly, otherwise you either can't start engine or overspeed engine. Below are brief procedures for reinstallment:

1. When you reinstall fuel pump, pull its needle half way in OBSERVATION WINDOW (bottom opening in fuel pump), push speed handle (fuel throttle lever) halfway. You can see a HOOD of speed handle when you move speed handle from left to right. The HOOD is used to hold fuel pump needle so that you can simultaneously move needle while push speed handle from left to right.
2. Use one hand to replace fuel pump while use the other hand to hold speed handle half way, let fuel pump needle right sit in the HOOD of speed handle, tighten upper two nuts first, then move fuel lever and see whether the needle moves with fuel throttle lever, otherwise, you need reinstall the fuel pump again.

IMPORTANT NOTES:

When you need use a hammer during disassembling or reassembling process whenever necessary, please NEVER USE METAL HAMMER to hit any parts, otherwise, you will deform or damage them.

5.2.2 Causes and Troubleshooting for Deficient Power of Diesel Engine

CAUSES	TROUBLESHOOTING
Malfunction of fuel system Parts obstruction in fuel filter and fuel pipe Inadequate fuel supplying	Check the fuel switch, they should be opened fully. Clean the fuel filter and fuel pipe.
Bad pressing of fuel pump	Check or change the damaged parts of fuel pump.
Malfunction of the fuel nozzle Incorrect injection pressure	Adjust the injection pressure
Carbon deposit in the nozzle hole	Clean
Needle was bit	Clean or change
Loose fit between needle and needle body	Change
Obstruction in air filter	Remove, clean or change the filter core.
Not fast enough of engine speed	Check the speed of engine with the tachometer, and then readjust the speed limit bolts.

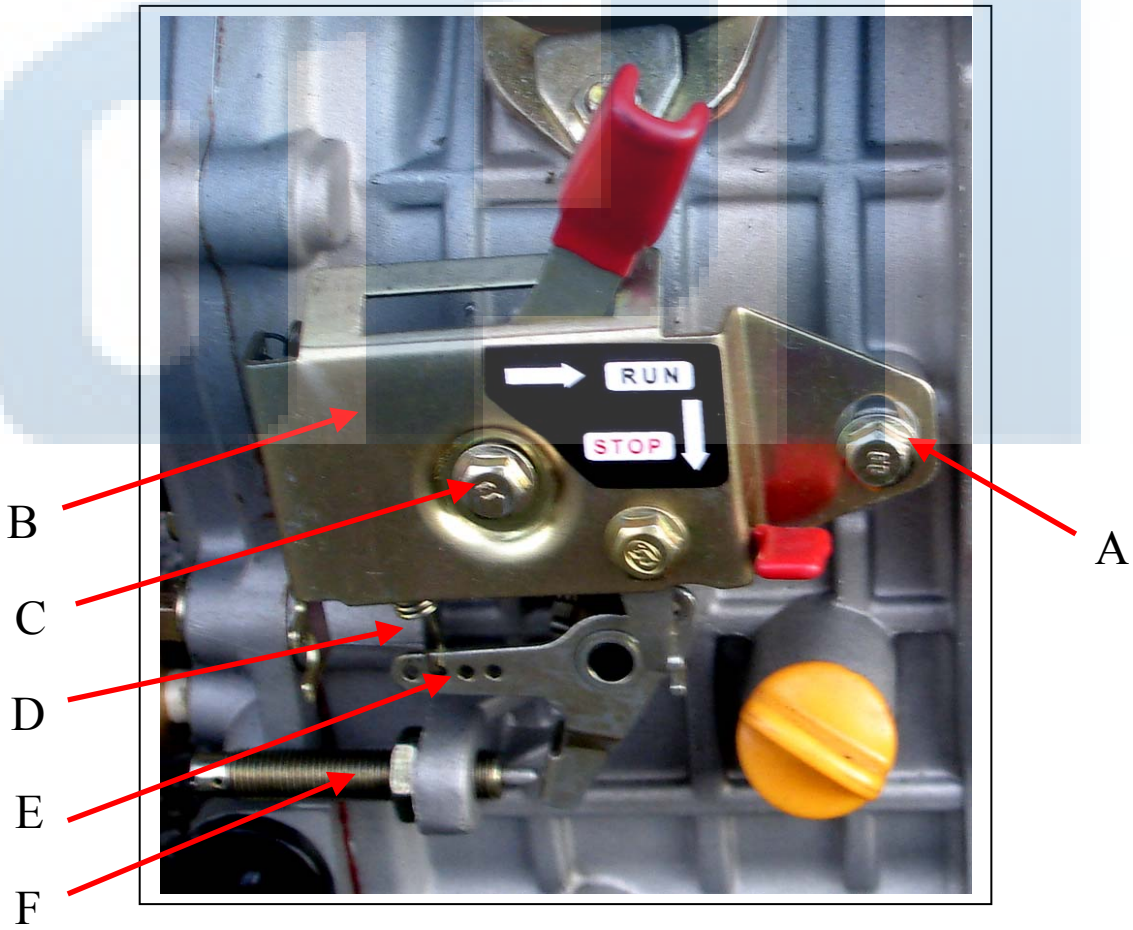

Fig. 5.1 Speed Governing System

5.2.2.1 Instructions for speed adjustment

There are three bolts used in the speed limit system (see Fig. 5.1): left (C), middle bottom and right (A) screws. Screws A & C are used for tightening metal plate B, A is also used for fine adjustment of speed and middle bottom screw for setting maximum fuel throttle. Please note that there is an oval-shaped hole in the metal plate B with A through.

Screw A is used for fine adjusting RPM (Frequency < 5 Hz), moving B up decreases RPM while moving B down increases RPM.

There are two rows of three small holes right behind the metal plate B (not shown in Fig. 5.1) and four large holes in location E. If the adjusted frequency > 10 Hz, the thick spring D is used for coarse tuning. Try to hook two ends of D in one of six small and four large holes E respectively for obtaining desired frequency, e.g., if we need change 60Hz to 50Hz, this method will be involved. Given position of hooked small hole, the obtained frequency decreases in the order from left to right holes of E; given position of hooked large hole, the obtained frequency decreases in the order from left to right small hole in the same row and upper to lower small holes. Frequency adjustment shall be conducted with a frequency meter.

Bolt F is preset for maximum power output position by manufacturer, it NEVER touches fuel lever unless the maximum power output is reached. So, NEVER adjust the position of threaded bolt.

Caution: If your generator runs unstable, e.g., runs at upper or lower speed and you excludes fuel system problem, you must try hooking the two end s of coarse spring D in different small and large holes to find out flexibly balanced position.

5.2.3 Causes and Troubleshooting for Engine Stopping Automatically

CAUSES	TROUBLESHOOTING
Malfunction of the fuel system Run out of fuel	Check solenoid, fuel pipe, fuel pump & fuel injector Fill fuel.
Low oil level or oil is too dirty	Check oil and change if necessary.
Air exists in fuel system	Release the air.
Nozzle needle was bitted	Clean, skive the nozzle or change it if necessary.
Obstruction in air filter	Check, clean or brush off, or change the filter element
Sudden increase of load	Lighten the load.
Remote control unit fails	Use remote jumper or replace with a new remote unit

5.2.4 Causes and Troubleshooting for Exhaust with Black Smoke

CAUSES	TROUBLESHOOTING
Overload	Lighten the load; change the unmatched loads if it does not comply with the requirements.
Bad spray	Faulty fuel injection system, change the nozzle if it is damaged.
Lack of air or leakage	Damaged or clogged air filter
Incomplete fuel combustion	Wrong grade of fuel Incorrect fuel injection pump timing Engine overheating Low compression ratio

5.2.5 Causes and Troubleshooting for Exhaust with Blue Smoke

CAUSES	TROUBLESHOOTING
Engine oil mixed in cylinder	Check the oil level, drain off the redundant engine oil
Piston ring is clipped, worn or lack of elasticity, hatch of each ring turned to the same direction and make engine oil up	Check and replace the piston ring and cross hatch of each ring
Big gap between piston and cylinder	Remedy or change
Worn and torn valve and guide	Change

5.2.6 Causes and Troubleshooting for Exhaust with White Smoke

CAUSES	TROUBLESHOOTING
Water mixed in diesel fuel	Clean the fuel tank and filter and change the diesel fuel.
Improper air/fuel mixture	Faulty fuel injection system Incorrect fuel injection and valve timing Engine overheating Faulty fuel pump and/or injection pump

5.2.7 Checking Methods for malfunctioned Engine

CAUSES	TROUBLESHOOTING
Speed sometimes fast, sometimes slow	Check if the speed governing system is flexible, and if air mixed in oil pipeline.
Abnormal noise suddenly sent out	Stop the engine and inspect each movable parts carefully
Exhaust with black suddenly	Check fuel system, especially the nozzle.
Rhythmically metal knocking sound in the cylinder	The fuel delivery angle is too big, should adjust the angle.

5.3 Overhaul and Troubleshooting for Diesel Generator

5.3.1 Causes and troubleshooting for the generator not being started

CAUSES	TROUBLESHOOTING
Lack of diesel fuel	Add diesel fuel
Fuel switch is not on the position of "ON" (start switch)	Turn fuel switch handle to the position of "ON"
Air entrapped in fuel system	Release air
No or little spray from injection pump and nozzle	Disassemble the nozzle and adjust it on the test table
The governor speed handle is not on the position of "RUN"	Turn the governor handle to the position of "RUN"
Oil lever is too low or oil is too dirty	The standard of lubricating oil is between upper line "H" and bottom line "L" Change oil if necessary
Recoil starter is not swift and powerful enough	Start the engine according to " Start Operation Procedure"
Dirty in the nozzle	Clean the nozzle
Ambient temperature is very low	Preheat cold air
No electricity of storage battery	Charge up or change the storage battery
Solenoid is not energized or stuck	Check fuse, CJX22 control board or replace solenoid
Ignition Key or remote control unit fails	Change if necessary
Electric starter fails	Change starter

5.3.2 Causes and troubleshooting for the generator not generating electricity

CAUSES	TROUBLESHOOTING
Power switch is on the position of "OFF"	Turn the switch handle to the position of "ON"
Bad contact of the socket	Adjust the socket pins
Burned AVR or capacitor	Change the AVR or capacitor
Nuts loosened in volt meter	Tighten loosened nuts
Voltage selector is burned	Replace voltage selector
Carbon brush is snapped or worn off	Check carbon brush
Stator is short-circuited	Change stator
Rotor Diode(s) is broken through	Change diode(s)
Rotor is burned	Change rotor

5.4 Damage Cause and Remedy of Brushless Alternator

Phenomena	Cause	Remedy
Can not generate	1. Switch is on the position of "OFF".	1. Turn the switch to the position "ON".
	2. Worse connection of the plug or the control panel.	2. Adjust the contactor of the plug or the wires inside the control panel.
	3. Circuit break of the stator coil or the capacitor overloads.	3.Check the stator at the point of the break; if it is the just reason that causes problem, change the stator; or check the capacitor with the multimeter, if the needle does not move, change the capacitor.
	4. Short circuit of the rectifier.	4. Check the rectifier by the Multimeter as the following steps: connect the pens to each two of the four contactors of the rectifiers both in the clock-wise way and in the counter-clock-wise way; if you find that both ways are electrically conducting or non-conducting, it needs replaced.
	5. Connection between the coil of the rotor and the rectifier is wrong, which can not make the different magnetic poles (N/S).	5. Check the reel and the rectifier by the Multimeter. Kindly note the current way while connecting.
Low Voltage	1. Low engine speed	1. Increase the engine speed.
	2. Short-circuit of the rotor reels.	2. Change the rotor.
	3. Short-circuit of the capacitor or the stator.	3. Chang the capacitor or stator.
Others	1. The rectifier of the rotor gets short circuit and the output voltage decreases suddenly after loading.	1. Check the rectifier as per the above instruction. Replace a new one.
	2. After loading, the Power take-off(PTO) drive shaft skids. This causes voltage to drop and alternator to overheat.	2. Disassemble the engine. Maintain the PTO shaft and the inside hole of the rotor until the conic degree reaches the reasonable level, then reassemble the engine.
	3.Short-circuit of the rotor or the stator makes the alternator overheat. The voltage drops.	3. Change the stator or the rotor.

5.5 Damage Cause and Remedy of Brush Alternator

Phenomena	Cause	Remedy
Can not generate	1. Switch is on the position of "OFF".	1. Turn the switch to the position "ON".
	2. Worse connection of the plug or the control panel.	2. Adjust the contactor of the plug or the wires inside the control panel.
	3. The connection of the AVR contact is bad or AVR burns.	3. Connect the contactor well or change AVR.
	4. The carbon brush wears out or its positive pole and its negative poles are connected crossly.	4. Change the carbon brush or make the wrong connection right.
	5. The second reel of the alternator has turnoff.	5. Check the reel by the Multimeter. And change the stator if it needs.
	6. The rotor has turnoff.	6. Check the reel by the Multimer and change the rotor if it needs.
Low Voltage	1. Low engine speed	1. Increase the engine speed.
	2. Short-circuit of the rotor reels. AVR burns.	2. Change AVR firstly. If the voltage is not high enough, change the rotor.
	3. Short-circuit of stator.	3. Chang the stator.
	4. The sample voltage has short circuit.	4. Adjust the resistance of AVR. If the voltage remains, change the stator of the alternator
Others	1. AVR burns after load. The voltage decreases, even disappear.	1. Change AVR.
	2. After loading, the PTO shaft skids, the voltage decreases, and the alternator overheats.	2. Disassemble the engine. Maintain the PTO shaft and the inside pole of the rotor until the conic degree reaches to the reasonable level. Then reassemble the engine.
	3. Short-circuit of the rotor or the stator makes the alternator overheat. The voltage decreases.	3. Change the stator or the rotor.

If you are still having trouble, please contact with your nearest dealer or with our company directly if necessary.

5.6 Questions and doubts

If you do not understand anything or have any questions, please feel free to contact your local dealer or with our company directly. Below is a list of some information you should have ready before contacting your local dealer or us.

1. Model of diesel engine generator and engine model number.
2. Purchase date and number of generator-operating hours along with the problem that occurred.
3. State of residency
4. A detailed serving condition and time when the problem occurred.

CHAPTER 6 GENERATOR PARTS DIAGRAMS AND LISTINGS

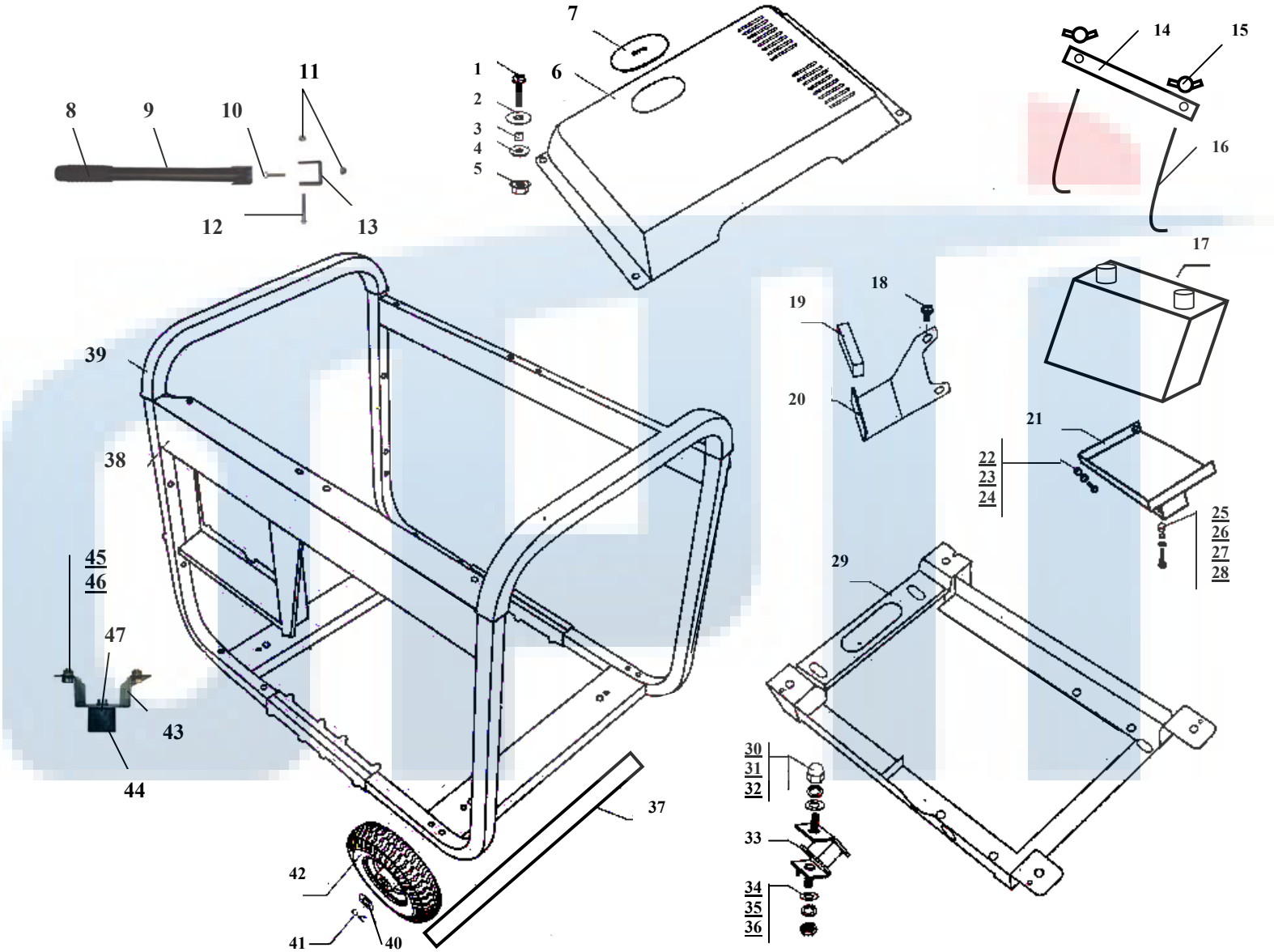

Fig. 6.1 Exploded view of frame assembly for 4000DE and 6800DE

Table 6.1 Parts list of frame assembly for 4000DE/6800DE(refer to Fig. 6.1)

Number Part	Description	Quantity	Part Number
1	M6 x 25 Bolt	4	1710625
2	M6 flat washer	4	1710206
3	Cylindrical washer(collar)	4	17145
4	Shock absorber	4	17143
5	M6 nut	4	1710106
6	Engine cover	1	6800422
7	Rubber cover	1	6800423
8	Handle rubber cover	2	6800424
9	Handle	2	6800425
10	M6 x 40 bolt	4	1710640
11	M6 nut	6	1710106
12	M6 x 60 bolt	2	1710660
13	Handle hinge	2	6800426
14	Battery retainer	1	6800s412
15	M6 wing nut	2	78-1710107
16	Tie hook bolt	2	6800s414
17	Battery	1	MF24AH/MF36AH
18	M8x12 bolts	2	1710812
19	Rubber absorber	1	4000427
20	Motor mount	1	4000428
21	Battery tray	1	6800415
22	M8 nut	1	1710108(also refer to 6800s224)
23	Spring washer 8	1	6800s222
24	M8 x 25 Bolt	1	1710825
25	M10 nut	1	171215
26	Spring washer 10	1	171214
27	Flat washer 10	1	1710210
28	M10 x 20 bolt	1	1711020
29	Vibration reducing Bracket	1	4000408/6800s408
30	M10 nut	4	171215
31	Spring washer 10	4	171214
32	Flat washer 10	4	1710210
33	Rubber mounts	4	6800s417
34	Flat washer 10	4	1710210
35	Spring washer 10	4	171214
36	M10 nut	4	171215
37	Axle	1	4000429/6800429
38	Bracket	1	4000430/6800430
39	Rubber insulator	2	4000431/6800431
40	Flat washer 20	4	1710220
41	Cotter pin 32 x 32	2	6800s419
42	Wheel	2	6800418
43	Rubber leg	2	6800432
44	Rubber cushion	2	6800433
45	M10 nut	10	171215
46	M10 x 15 bolt	8	1711015
47	M10 x 30 bolt	2	1711030

Fig. 6.2 Exploded view of parts list for alternator and engine assemblies of 4000 and 6800 series

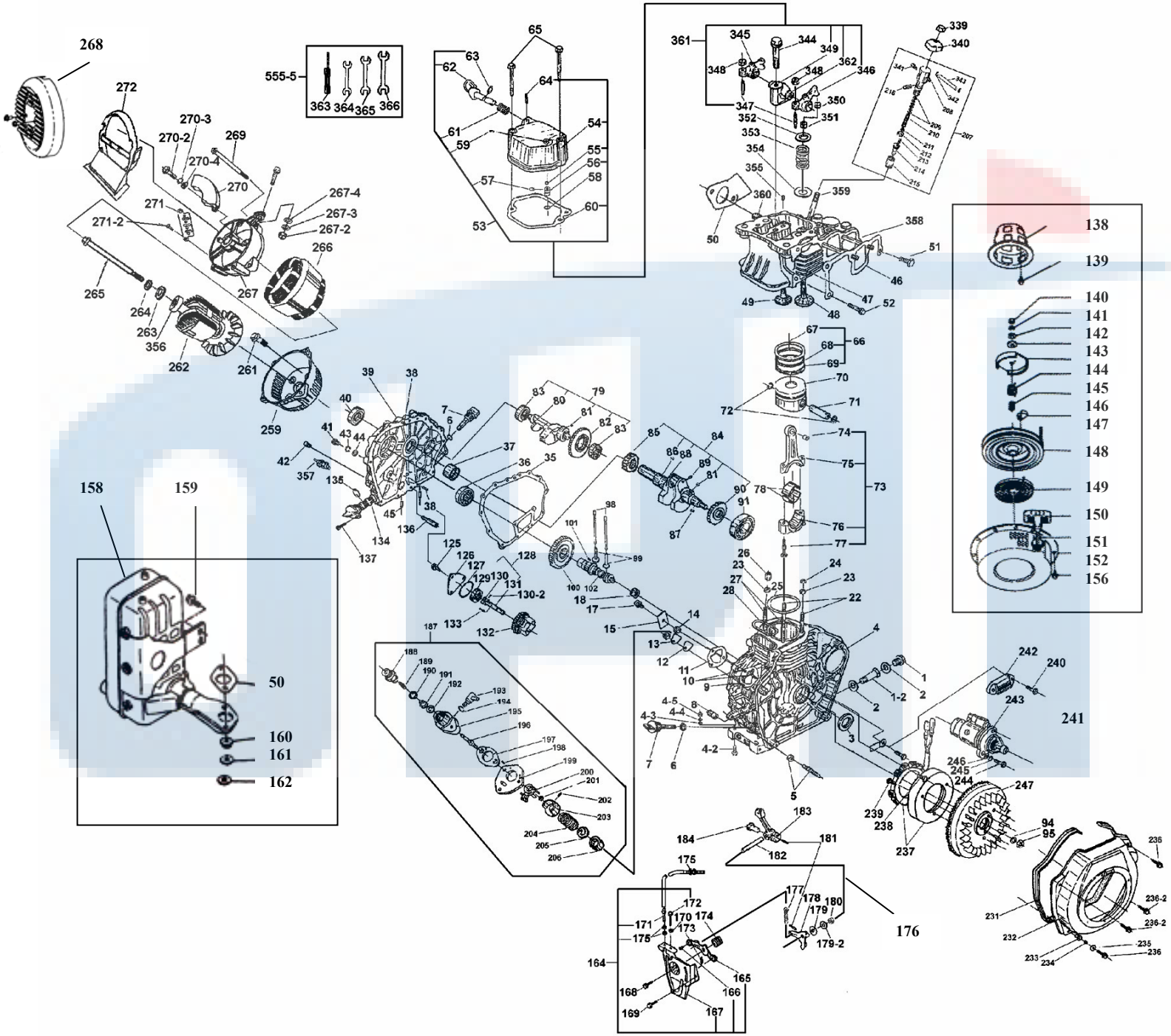

Fig. 6.3 Exploded view of muffler system and frame assembly for 6800SDE and of fuel tank and air cleaner assemblies for 4000 and 6800 series.

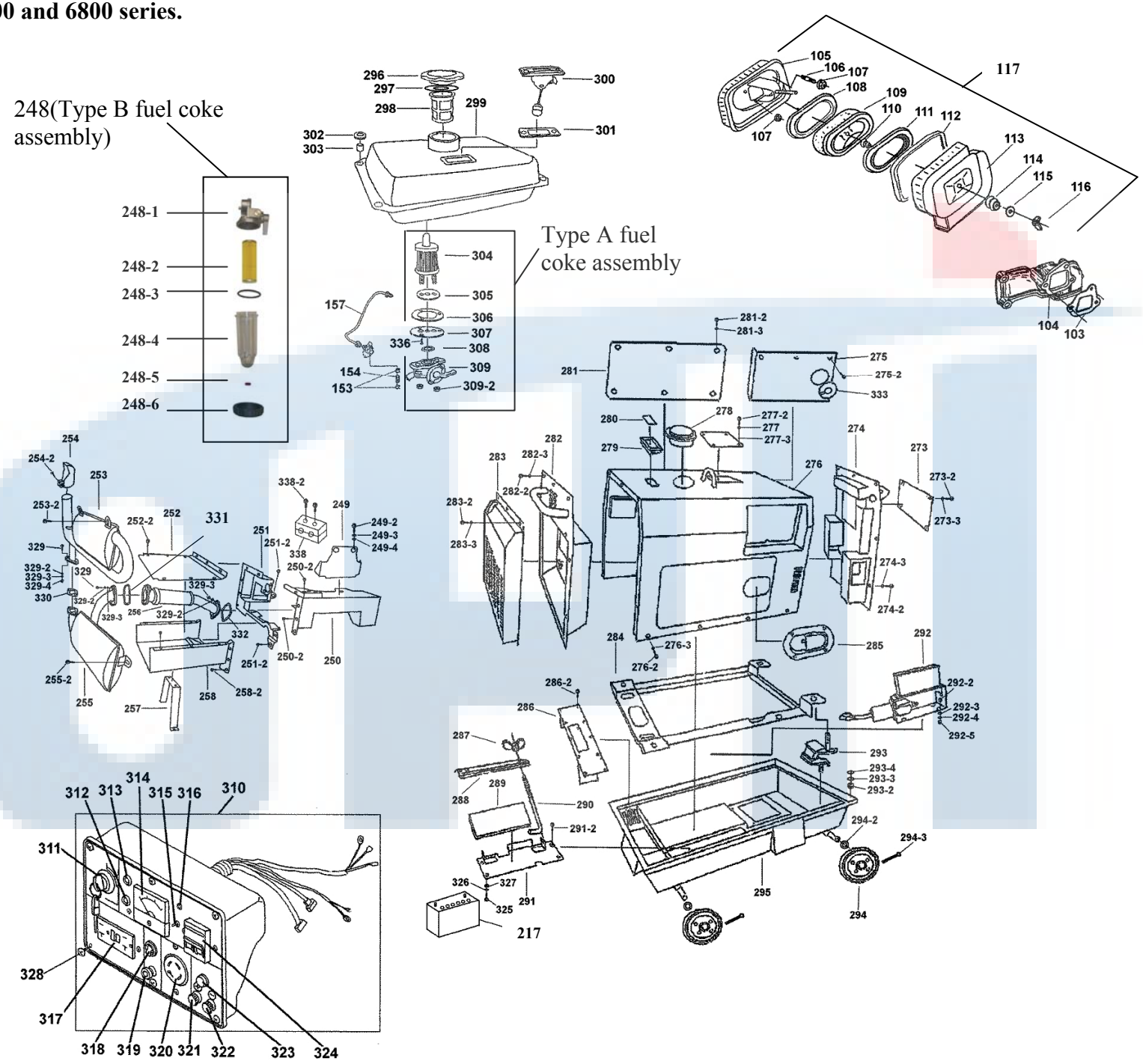

Table 6.2 Parts list of 4000DE, 6800DE and 6800SDE (refer to Figs. 6.2 & 6.3).

No.	Part No.	Part name	Qty.
1	17121	Drain plug	1
1-2	171211	Drain plug extension	1
2	17120	Drain plug gasket	2
3	78-1711702	Rear oil seal 30 x 45 x 8	1
	86-1711704	Rear oil seal 35 x 50 x 8	
4	78-1700103	Engine cylinder block	1
	86-1700110		
4-2	171212	M10 x 50 hexagon bolt	4
4-3	171213	Washer(also refer to 1710210)	4
4-4	171214	Spring washer	4
4-5	171215	M10 x 12 hexagon nut	4
5	78-17126	Fuel controller assembly	1
	86-1712601		
6	1711324	O ring for oil dipstick	2
7	86-1702002	Oil dipstick	2
8	171216	Oil pressure sensor	1
9	17123	Fuel pump fastening bolt (short)	1
10	17122	Fuel pump fastening bolt (long)	1
11	1719605	Fuel pump gasket(0.5)	1
12	17159	Sealing plate gasket	1
13	17158	Sealing plate	1
14	1710103	Flange head hexagon M6 nut	3
15	17195	Thrust piece	1
17	1710636	Flange head hexagon bolt(GB5789-86)	1
18	1710010	Needle bearing 7941/15	1
22	78-1700302	Cylinder head bolt (short)	2
	86-1700303		
23	78-1704802	Special washer	4
	86-1704803		
24	78-1705001	Cylinder head nut (short)	2
	86-1705003		
25	78-1719704	Cylinder head gasket(0.4)	1
	86-1706314		
26	78-1704902	Cylinder head nut (long)	2
	86-1704903		
27	78-1700202	Cylinder head bolt (long)	2
	86-1700203		
28	78-17182	Oval ring gasket 5.1 x 2.5	1
	86-1720106	Oval ring gasket 5.1 x 2.6	
35	78-1704602	Crankcase cover gasket	1
	86-1704603		
36	78-1710003	Ball bearing 206(GB/T276-94)	1
	86-1710004	Ball bearing 207(GB/T276-94)	

Table 6.2 continued to next page.

Table 6.2 Continued from previous page.

37	78-1701802 86-1701803	Main bushing	1
38	1711111	Retaining pin 8 x 12(GB118-86)	2
39	78-1701902 86-1701903	Crankcase cover	1
40	78-1711703 86-1711705	Front oil seal 30 x 45 x10 Front oil seal 35 x 50 x10	1
41	78-1710083 86-1710083	Flange head hexagon M8 x 33.5 bolt	15 16
42	1710083	Flange head hexagon M8 x 33.5 bolt	1
43	78-1710084 86-1710084	Spring washer	15 16
44	78-1710085 86-1710085	Washer	15 16
45	1711602	Aluminum plug 8 x 8	3
46	78-1703102 86-1703103	Air intake pipe gasket	1
47	78-1702402 86-1702404	Cylinder head	1
48	78-1702601 86-1702603	Intake valve	1
49	78-1702602 86-1702604	Exhaust valve	1
50	78-17186 86-1718601	Muffler gasket	1
51	78-1710955 86-1710956	Double ended bolt AM6 x 55(GB899-88) Double ended bolt AM6 x 75(GB899-88)	2 2
52	1710722	M6 x 22 bolt(GB5789-86)	1
53	78-17066 86-1706603	Cylinder head cover	1
54	17142	Oiling hole plug	1
55	17141	Plastic ball	1
56	17146	Breather	1
57	17147	Pin	1
58	171132	O ring 12 x 1.9	1
59	1701021	Plunger	1
60	78-17170 86-1717001	Cylinder head cover gasket	1
61	17140	Decompression lever spring	1
62	17139	Decompression lever	1
63	1711310	O ring 10 x 1.9(GB1235-76)	1
64	1711103	Retaining pin 3 x 16(GB119-86)	1
65	78-1710655 86-1710630	M6 x 55 flanged bolt(GB5789-86) M6 x 70 flanged bolt(GB5789-86)	2 3

Table 6.2 continued to next page.

Table 6.2 Continued from previous page.

66	78-1701402 86-1701403	Piston ring set	1
67	17014100	First piston ring	1
68	17014101	Second piston ring	1
69	17014102	Oil ring complete	1
70	78-1701202 86-1701204	Piston	1
71	78-1701702 86-1701703	Piston pin	1
72	78-1701602 86-1701603	Retaining clip of piston pin Diameter 21mm Retaining clip of piston pin Diameter 23mm	2
73	78-1701302 86-1701303	Connecting rod assembly	1
74	17013100	Bushing	1
75	17013101	Connecting rod	1
76	17013102	Crank pin box	1
77	17013103	Rod bolt	2
78	78-1701502 86-1701503	Connecting rod journal bearing	1
79	78-1706500 86-1706500	Balancing shaft assembly	1
80	78-1706502 86-1706503	Balancing shaft	1
81	1710507	Key 5 x 7(GB1096-79)	2
82	78-1706602 86-1706603	Balancing shaft timing gear	1
83	78-1710001 86-1710000	Ball bearing 202(GB/T276-94) Ball bearing 203(GB/T276-94)	2
84	78-1707000 86-1707000	Crankshaft assembly	1
85	78-1707702 86-1707703	Crankshaft timing gear	1
86	1710512	Key 5 x 12(GB1096-79)	1
87	1710514	Key 5 x 14(GB1096-79)	1
88	78-1700701 86-1700708	Crankshaft	1
89	1711601	6 x 8 plunger	1
90	78-1707802 86-1707803	Balancing shaft driving gear	1
91	78-1710007 86-1710008	Ball bearing 307(GB/T276-94) Ball bearing 308(GB/T276-94)	1
94	1701304	Bushing	1
95	1701305	Flywheel nut	1

Table 6.2 continued to next page.

Table 6.2 Continued from previous page.

98	78-1705102 86-1705103	Push rod	2
99	78-17157 86-1715701	Valve tappet	2
100	78-1701102 86-1701103	Camshaft timing gear	1
101	78-1710504 86-1710514	Key 4 x 12(GB1096-79) Key 5 x 14(GB1096-79)	1
102	78-1701002 86-1701000	Camshaft	1
103	78-17175 86-1717501	Air cleaner gasket	1
104	78-1703002 86-1703003	Intake pipe	1
105	78-17180 86-1718003	Bottom case assembly of air cleaner	1
106	17137	Double ended bolt AM6 x 22(GB899-88)	1
107	1710103	Flange head hexagon M6 nut	3
108	78-17179 86-1718002	Inner shock proof sealing ring	1
109	78-1717602 86-1717601	Air filter element	1
110	78-17181 86-1718101	Air filter shock absorber	1
111	78-17178 86-1718001	Outer shock proof sealing ring	1
112	78-1718004 86-1718005	Air filter cover seal ring	1
113	78-1718006 86-1718007	Complete air filter cover	1
114	78-1718102 86-1718103	Cover shock absorber	1
115	78-17177 86-17177	Special washer	1
116	78-1710107 86-1710109	M6 wing nut M8 wing nut	1
117	78-17174 86-1717401	Air cleaner assembly	1
125	1710612	M6 x 12 bolt(GB5787-86)	3
126	17022	Oil pump cover	1
127	1711334	O ring 34.5 x 1.8(GB3452.1-82)	1
128	78-17135 86-1713501	Oil pump assembly	1
129	17135100	Outer rotator	1
130	17135101	Inner rotator	1

Table 6.2 continued to next page.

Table 6.2 Continued from previous page.

130-2	17135102	Pin	1
131	17135103	Oil pump shaft	1
132	78-1702302 86-1702302	Oil pump driving gear	1
133	1711103	3 x 16 pin(GB119-82)	1
134	1702103	Oil filter	1
135	1711316	O ring 20 x 2.65	1
136	17080	Oil guide	1
137	1710614	M6 x 14 bolt(GB5789-86)	1
138	78-1705702 86-1705703	Recoil starter	1
139	1710612	M6 x 12 bolt(GB6170-86)	3 or 4
140	1710106	M6 nut(GB6170-86)	1
141	1710306	Spring washer	1
142	78-1703903 86-1703803	Friction plate gasket	1
143	1703902	Friction plate	1
144	1704006	Starting claw plate	1
145	1721901	Torsional spring	1
146	1721801	Helical spring	1
147	1704005	Starting claw	2
148	78-1703202 86-1703203	Recoil reel	1
149	78-1703301 86-1703303	Flat torsional spring	1
150	78-1703802 86-1703802	Recoil starter handle	1
151	78-1703502 86-1703503	Recoil starter rope	1
152	78-1703402 86-1703404	Recoil case assembly	1
153	1719403	Fuel hose clamp	2
154	17189	Fuel hose	1
155	78-1704702 86-1704700	Fuel injector pump	1
156	1710608	M6 x 8(GB5787-86)	4
157	78-1705602 86-1705603	High pressure fuel pipe	1
158	78-1705402 86-1705403	Muffler assembly	1
159	1710814	M8 x 14 bolt(GB5789-86)	2
160	1710208	Flat washer 8	2
161	1710308	Spring washer 8	2

Table 6.2 continued to next page.

Table 6.2 Continued from previous page.

162	1710108	M8 nut(GB5789-86)	2
164	1711400	Speed control lever assembly	1
165	17167	Speed control lever	1
166	17168	Pan head screw	1
167	17164	Control system bracket	1
168	1710618	M6 x 18 bolt(GB5787-86)	1
169	1710614	M6 x 14 bolt(GB5787-86)	1
170	17163	Hexagon head nut	1
171	17165	Throttle cable	1
172	17166	Speed limit bolt	1
173	17162	Small return spring	1
174	78-17161 86-17161	Big return spring	1
175	17169	Thin hexagon nut	4
176	78-1700502 86-1700503	Fork lever assembly	1
177	78-17160 86-1716001	Governor spring	1
178	1711101	Governor lever	1
179	17124	Washer	1
179-2	1710009	Bearing 7941/8(GB290-64)	1
180	17125	Lever shaft gasket	1
181	1703022	3 x 22 pin	2
182	7011102	Lever shaft	1
183	8611601	Lever fork	1
184	17234	Governor fork tappet	1
187	78-1704702 86-1704700	Fuel injector pump assembly	1
188	1704710	Delivery holder	1
189	1704711	Delivery spring	1
190	1704712	Delivery gasket	1
191	1704713	Delivery valve	1
192	1704714	Delivery seat	1
193	1704715	Joint	1
194	1704716	O-ring	1
195	1704717	Pump body	1
196	1704718	Plunger	1
197	1704719	Shim set	1
198	1704720	Spring pin	2
199	1704721	Fuel pump plate	1
200	1704722	Control lever	1
201	1704723	Snap ring	1
202	1704724	Spring pin	1

Table 6.2 continued to next page.

Table 6.2 Continued from previous page.

203	1704725	Upper spring seat	1
204	1704726	Pump spring	1
205	1704727	Spring seat	1
206	1704728	Tappet	1
207	78-1705301 86-1705301	Fuel nozzle injector assembly	1
208	1705311	Nozzle body	1
209	1705321	Shim set	1
210	1705331	Nozzle spring	1
211	1705341	Spring retainer	1
212	1705351	Stop plate	1
213	1705361	Pin	2
214	1705371	Nozzle valve	1
215	78-1705302 86-1705302	Fuel injector cap	1
216	1705381	Spring pin	1
217	MF36AH MF24AH	battery	1
231	17144	Shock pad	1
232	78-1704102 86-1704105	Fan cover	1
233	17143	Fan cover bolt shock absorber	4
234	17145	Collar	4
235	1710206	M6 washer(GB90-85)	4
236	1710622	M6 x 22 bolt(GB5787-86)	2
236-2	1710622	M6 x 22 bolt(GB5787-86)	2
237	1716100	Flywheel alternator	1
238	1710620	M6 x 20 bolt(GB5787-86)	3
239	1710712	M6 x 12 countersunk hd screw	3
240	1716002	M6 spring washer	1
241	1710612	M6 x 12 pan head bolt	2
242	1716003	Regulator	1
243	1716004	Starting motor	1
244	1710035	M10 x 35 flange head hexagon bolt	2
245	171214	M10 spring washer	2
246	1710210	M10 washer	2
247	78-1704502 86-1705504	Flywheel with gear	1
248	6800s100	Type B fuel coke assembly	
248-1	6800s101	Fuel coke assembly head	
248-2	6800s102	Fuel filter(also refer to 1704303)	
248-3	6800s103	O-ring fuel gasket	
248-4	6800s104	Plastic tube	

Table 6.2 continued to next page.

Table 6.2 Continued from previous page.

248-5	6800s105	Water float	1
248-6	6800s106	Threaded annular locker	1
249	6800s200	Bracket for cover	1
249-2	6800s201	Flange head bolt	2
249-3	6800s202	Spring washer	2
249-4	6800s203	Washer	2
250	6800s204	Front fan hood	1
250-2	6800s205	Flange head bolt	2
251	6800s206	End fan hood	1
251-2	6800s207	Flange head bolt	2
252	6800s208	Guide bellows cover	1
252-2	6800s209	Flange head bolt	9
253	6800s210	Complete upper muffler	1
253-2	6800s211	Flange head bolt	2
254	6800s212	Muffler turning joint pipe	1
254-2	6800s213	Pan head screw	1
255	6800s214	Complete lower muffler	1
255-2	6800s215	Flange head bolt	2
256	6800s216	Muffler ripple pipe	1
257	6800s217	Guide bellows bracket	1
257-2	6800s218	Flange head bolt	2
258	6800s219	Guide bellows	1
258-2	6800s220	Flange head bolt	6
259	6800300	Front cover	1
	6800s300		
261	6800s302	M8 x 32 flange hexagon head bolt	4
262	6800s303	Rotor assembly	1
	4000303		
263	6800s304	Washer	1
264	6800s305	Spring washer	1
265	6800s306	M10 x 230 alternator bolt	1
	4000306	M10 x 210 alternator bolt	
266	6800s307	Stator assembly	1
	4000307		
267	6800s308	Rear cover	1
267-2	171215	M10 x 12 hexagon nut	2
267-3	171214	Spring washer	2
267-4	171213	Washer	2
267-5	171212	M10 x 50 hexagon bolt	2
268	6800309	End cover	1
269	6800s310	M6 x 160 flange hexagon head bolt	4
	4000310	M6 x 140 flange hexagon head bolt	

Table 6.2 continued to next page.

Table 6.2 Continued from previous page.

270	6800s311	Capacitor	1
	6800s312	AVR	
270-2	1710620	M6 x 20 bolt(GB5787-86)	2
270-3	1716002	M6 spring washer	2
270-4	1710206	M6 washer(GB90-85)	2
271	6800s313	Terminal block	1
271-2	1710620	M6 x 20 bolt(GB5787-86)	2
272	6800s314	End cover	1
273	6800s400	Air cleaner window cover	1
273-2	1710815	M8 x 15 bolt	4
273-3	1710804	M8 washer	4
274	6800s401	Engine front air cover	1
274-2	1710815	M8 x 15 bolt	10
274-3	1710804	M8 washer	10
275	6800s402	Air cleaner intake seat	1
275-2	1710815	M8 x 15 bolt	6
276	6800s403	Soundproof cover	1
276-2	1710815	M8 x 15 bolt	8
276-3	1710804	M8 washer	8
277	6800s404	Upper cover	1
277-2	1710815	M8 x 15 bolt	4
277-3	1710804	M8 washer	4
278	17153	Fuel filler cap	
279	17155	Fuel lever rubber seal	1
280	17156	Fuel level glass	1
281	6800s405	Left side cover	1
281-2	1710815	M8 x 15 bolt	6
281-3	1710804	M8 washer	6
282	6800s406	Muffler inner cover	1
282-2	1710815	M8 x 15 bolt	7
282-3	1710804	M8 washer	7
283	6800s407	Muffler outer cover	1
283-2	1710815	M8 x 15 bolt	6
283-3	1710804	M8 washer	6
284	6800s408	Commonality base	1
	4000408		
285	6800s409	Lever handle	1
286	6800s410	Under pan air cover	1
286-2	6800s411	Flange head bolt	10
287	78-1710107	M6 wing nut	2
288	6800s412	Battery retainer	1
289	6800s413	Battery pad	1
290	6800s414	Hook bolt	2

Table 6.2 continued to next page.

Table 6.2 Continued from previous page.

291	6800s415	Battery holder(silent model)	1
	6800415	Battery holder(open frame model)	
291-2	1710815	M8 x 15 bolt	4
292	6800s416	DC12V solenoid(used with cable)	1
		DC12V solenoid(installed in fuel pump)	
292-2	1710612	M6 x 12 bolt(GB5787-86)	2
292-3	1716002	M6 spring washer	2
292-4	1710206	M6 washer(GB90-85)	2
292-5	1710106	M6 nut(GB6177-86)	2
293	6800s417	Shock absorber	4
293-2	171215	M10 x 12 hexagon nut	4
293-3	171214	Spring washer	4
293-4	171213	Washer	4
294	6800s418	3.5" or 7.5" solid wheel	4
	6800418	8.5" solid wheel	2
294-2	1710210	Flat washer 10	8
	1710220	Flat washer 20	4
294-3	6800s419	Cotter pin	2 or 4
295	6800s420	Soundproof under pan	1
296	17153	Fuel tank cap	1
297		Fuel tank cap seal	1
298	17146	Fuel strainer	1
299	17157	Fuel tank(4000/6800 open frame)	1
	17158	Fuel tank(6800 silent)	
299-2	1710622	M6 x 22 bolt(GB5787-86)	4
299-3	1710206	M6 washer(GB90-85)	4
300	17152	Fuel level indicator	1
301	17155	Fuel lever indicator gasket	1
302	17143	Shock absorber for fuel tank	4
303	17145	Metal sleeve(collar)	4
304	1704302	Type A fuel filter	1
	1704303	Type B fuel filter(also refer to 6800s102)	
305	17148	Fuel filter gasket	1
306	17149	Fuel valve gasket	1
307	17151	Fuel valve plate	1
308	17154	O-ring fuel gasket	1
309	17150	Fuel coke assembly	1
309-2	1710106	M6 nut(GB6177-86)	2
310	6800s500	Control panel assembly(silent model)	1
	6800500	Control panel assembly(open frame model)	
311	6800s501	Starter switch with key	1
312	6800s502	Low oil warning indicator light	1
313	6800s502	Power indicator light	1

Table 6.2 continued to next page.

Table 6.2 Continued from previous page.

314	6800s503	Volt meter	1
315	6800s504	Glow plug button	1
316	6800s502	Glow plug indicator light	1
317	6800s505	120V outlet	2
	6800s506	Dual GFI 120V outlet	1
318	6800s507	Voltage switch (120v/240v)	1
319	6800s508	Ground terminal	1
320	6800s509	Four prong twist lock(120V/240V dual outlet)	1
	6800s510	Three prong twist lock(120V outlet)	1
321	6800s511	DC positive terminal	1
322	6800s512	DC negative terminal	1
323	6800s513	250V 10A fuse(3mm x 15mm)	1
	6800s514	250V 10A fuse(5mm x 30mm)	3 or 4
324	6800s515	Circuit breaker	1
325	1710815	M8 x 15 bolt	2
326	6800s222	Spring washer	2
327	6800s224	M8 nut(also refer to 1710108)	2
328	1710612	M6 x 12 bolt(GB5787-86)	6
329	6800s221	M8 x 40 bolt	4
329-2	6800s222	Spring washer	6
329-3	6800s223	Washer	6
329-4	6800s224	M8 nut(also refer to 1710108)	2
330	6800s225	Muffler connection gasket	1
331		Ripple pipe exit gasket	1
332		Ripple pipe inlet gasket	1
333	6800s421	Air filter inlet shock absorber	1
336	6800107	M6 screw	3
338	6800s232	Fuel line shock absorber	1
338-2	6800s233	M8 x 30 bolt	2
339	1710103	M6 nut(GB6177-86)	2
340	1717302	Fuel injector retaining plate	1
341	1717303	Fuel line fitting	1
342	17212	Fuel return hose clamp	2
343	17192	Fuel return hose	1
344	78-1710745	Rocker arm fastening bolt	1
	86-1716901		2
345	78-1702100	Exhaust rocker arm	1
	86-1702100		
346	78-1702102	Intake rocker arm	1
	86-1702102		
347	17165	Valve clearance adjusting screw	2
348	1706075	M6 x 75 special nut	2
349	78-1702101	Rocker arm support	1
	86-1702101		

Table 6.2 continued to next page.

Table 6.2 Continued from previous page.

350	78-1702106 86-1702106	Valve cap	2
351	78-1702702 86-1702703	Valve clip	2
352	78-1782802 86-1702803	Valve spring seat	2
353	78-1702902 86-1702903	Valve spring	2
354	78-17136 86-1713601	Valve spring washer	2
354-1	78-1702004 86-1702100	Valve guide oil seal(between 353 & 354)	2
355	1711104	Pin 4 x 8(GB119-86)	1
358	78-1710955	Double ended bolt AM6 x 55(GB899-88)	2
	86-1710956	Double ended bolt AM6 x 75(GB899-88)	2
359	78-1712201	AM 6 x 42 fuel injector bolt	2
	86-17122	AM 6 x 50 fuel injector bolt	
360	1710920	Double ended bolt AM8 x 20(GB899-88)	2
361	78-17168 86-1716801	Rocker arm assembly	1
362	78-1716802 86-1716802	Rocker arm shaft	1
363	6800s516	Flat head screwdriver	1
364	6800s517	Hexagon key (8/10mm)	1
365	6800s518	Hexagon key (12/14mm)	1
366	6800s519	Hexagon key (17/19mm)	1
555-5	6800s520	Tool bag(optional)	1

LIMITED WARRANTY

Optigenerators International, Inc ("OPTI") warrants its PRODUCTS against manufacturer defects in materials, workmanship and finish under normal use and service for twelve (12) months or one thousand hours whichever comes first from the original date of purchase. This warranty does not cover any damage due to impairments from accidents, damages caused by shipping company, product misuse, abuse, product modifications or product negligence, batteries and consuming parts such as automatic voltage regulator, carbon brush, filters, fuses, and gaskets. This 12-month or one thousand-hour warranty applies only to new products sold in the United States or Canada and is limited to the free parts replacement or defective unit replacement of OPTI products. Warranty does not include costs of removal, installation, labor, freight, inconvenience or consequential damages. To validate the warranty, Product Registration Card must be completed and mailed to Optigenerators International, Inc., 1256 Oakbrook Dr., Suite E, Norcross, GA 30093 or register on line at www.optigenerators.com/CustomerService.aspx within 30 days of original purchase.

Implied warranties of merchantability and fitness for a particular purpose on OPTI products are limited in duration to twelve (12) months or one thousand hours from the date of purchase. Some states/countries do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. Some states/countries do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. This warranty gives you specific legal rights, and you may also have other rights that vary from state to state and country to country.

The twelve-month warranty is solely applicable to OPTI dealers and distributors. All the terms to our dealers and distributors are also applicable to the end consumers of OPTI PRODUCTS except that the warranty period is six months for the end consumers of OPTI PRODUCTS.