OWNER'S MANUAL

AIR-COOLED DIESEL ENGINE

170F / FE / FS / FSE
178F / FE / FS / FSE
186F / FE / FS / FSE

PREFACE

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 engine. The engine you have purchased is a complex piece of machinery. We recommend that that you consult with a dealer if you have doubts or concerns as to your experience or ability to properly maintain or repair your engine. 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.

Engine Features and Highlights

- Direct fuel injected intake system
- Recoil-type manual starter and or optional electric starter system
- Forced air convection cooling system
- Composite steel fan cover for minimum noise levels

Our four stroke diesel engines are air cooled with a direct fuel injected intake system. They offer maximum efficiency through the minimal conservation of energy and materials. These diesel engines are compact and lightweight. They are easily maintained and portable making it convenient to move. They are widely used as a source of mechanical power for industrial, agricultural, and machinery equipment. Some applications include irrigation equipment, diesel powered pressure sprayers, grass-cutting machines, and soil-sampling machines. Other applications include vibration rammers, shock rammers, marine engines, lightweight transport vehicles, portable compressors, and lightweight portable generators.

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

To ensure long engine life please follow the operating requirements listed in this manual.

If you have any questions or suggestions about this manual, please contact your local dealer or us. ***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. Eastern Tools and Equipment, Inc. reserves the right to make changes at any time without notice and without incurring any obligation.***

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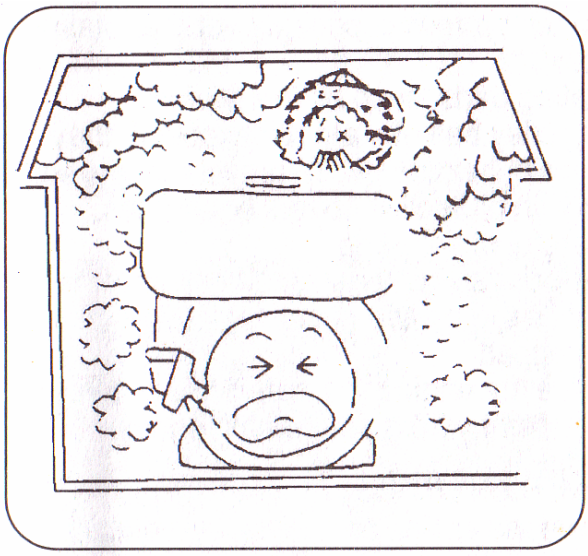
SAFETY PRECAUTIONS

Please be sure to follow each instruction carefully

EXHAUST PRECAUTIONS

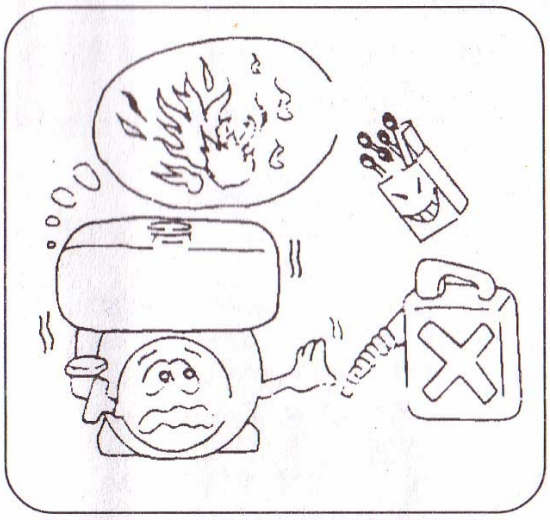
- Never inhale the exhaust gases, it contains carbon monoxide, a colorless, odorless and extremely dangerous gas which can cause unconsciousness or death
- Never operate the engine indoors or in a poorly ventilated area, such as a tunnel or cave, etc.
- Exercise extreme care when operating the engine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



REFUELING PRECAUTIONS

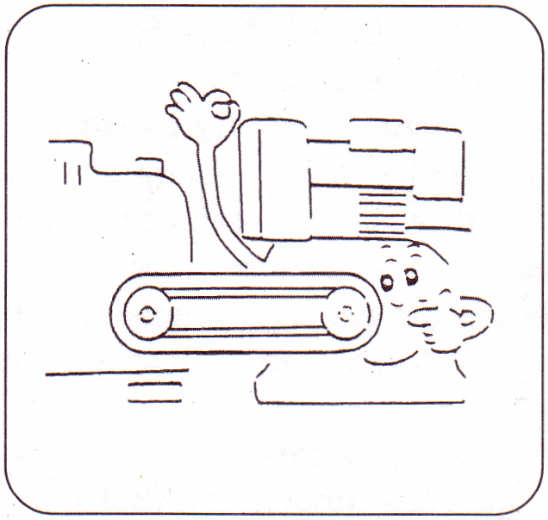
- Be sure to stop the engine before refueling.
- Do not overfill the fuel tank.
- If fuel is spilled, wipe it away carefully and wait until the fuel has dried before starting the engine again.
- When changing oil, make sure that the fuel cap is tightly secured to prevent fuel leakage.

FIRE PREVENTION



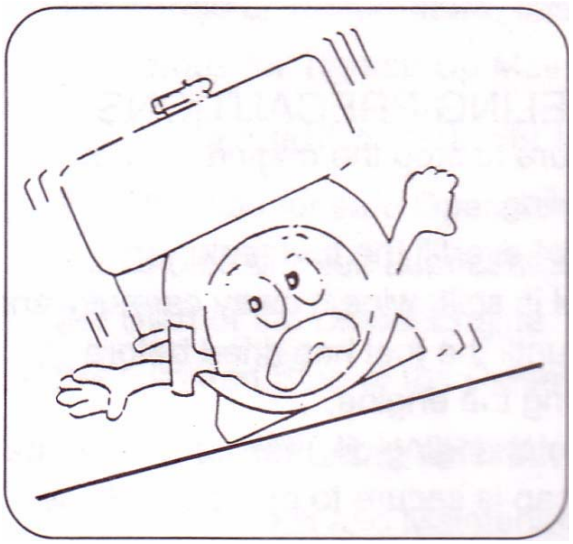
- Never operate the engine while smoking or near an open flame.
- Never use the engine around dry brush, twigs, cloth-rags, or other flammable materials.
- Keep the engine at least 3 feet (1 meter) away from buildings or other structures.
- Keep the engine away from flammables and other hazardous materials.

PROTECTIVE COVER



- Always place the protective covers over the rotating parts. If rotating parts such as the driving pulley, belts, and shafts are exposed, serious injuries can be caused. To prevent injury, please equip all rotating parts with protective covers.
- Be careful of hot parts. The muffler and other engine parts can become very hot while the engine is running or after the engine has been run. Always operate the engine in a safe area and keep children away from running engines.

SURROUNDINGS

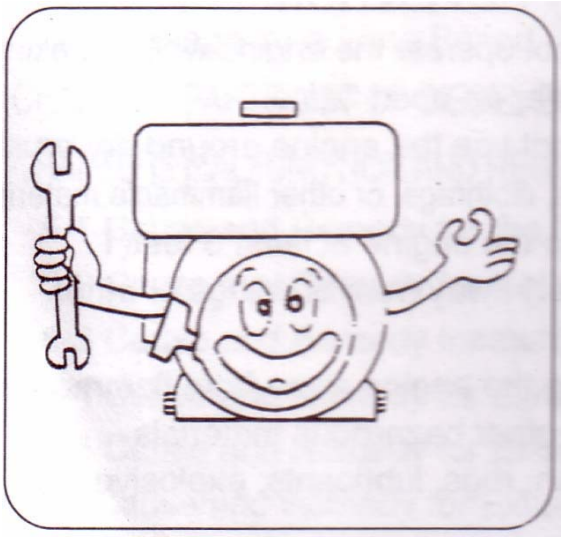


- Operate the engine on a table or level surface free of small rocks and loose gravel.
- Operate the engine on a level surface. If the engine is tilted, fuel may spill from the gas tank.

NOTE: Operating the engine at a steep incline may cause the engine to seize up due to improper lubrication even when the oil level is a maximum.

- Be careful of fuel spillage when transporting the engine. Always tighten the fuel cap and close the fuel strainer cock before moving the engine around.
- Never move the engine while it is in operation.
- If the engine will be transported over a long distance, drain all the fuel from the fuel tank to prevent fuel leakage.

PRE-OPERATION CHECKS



- Carefully check fuel pipes and fuel joints for fuel leakage. Leaked fuel creates a dangerous situation.
- Verify that all the nuts and bolts of the engine are tights. A loose nut or bolts may cause serious engine failure and could lead to serious injuries.
- Always check the engine oil and refill it if necessary.
- Always check the fuel level and refill it if necessary. **Never overfill the fuel tank**
- Avoid wearing dangling or long clothes such as loose aprons, towels, and waist belts, as these items may be caught in a rotating part of the engine.

Chapter 1 Technical Specifications and Data

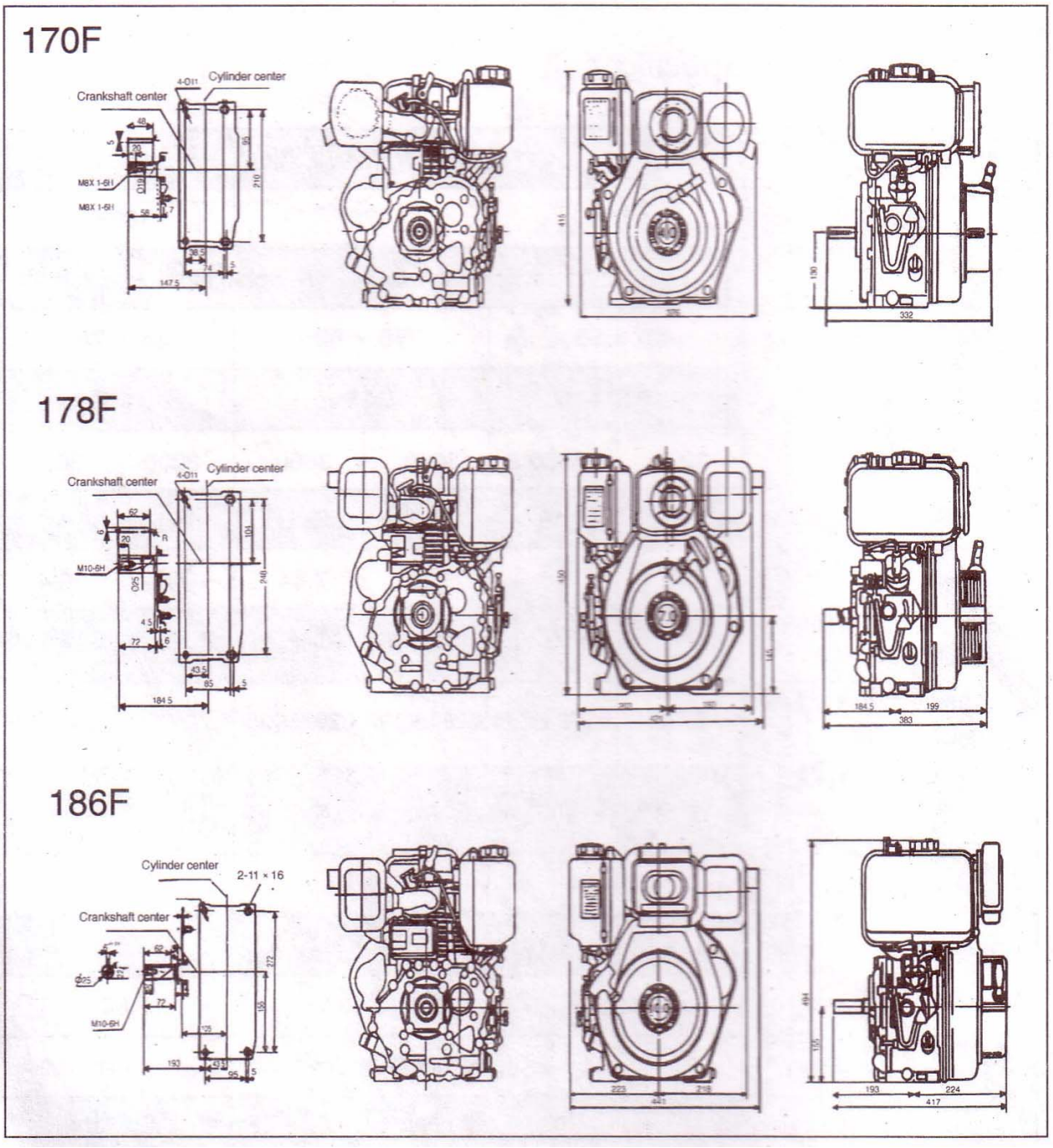
1-1 Technical specifications in English Units

Item \ Model		170F	178F	186F
Type		Single vertical cylinder, 4-stroke, air-cooled, direct injection		
Bore x Stroke (in.)		2.76 x 2.17	3.01 x 2.44	3.39 x 2.76
Displacement (cu. in.)		13.36	18.67	25.51
Speed (rpm)		3600	3600	3600
Output (HP)	Continuous	4.0	5.9	8.85
	Maximum	4.5	6.6	9.85
Fuel tank capacity (US gallons)		.66	.9	1.45
Lube-oil Capacity (oz)	Full	27.1	37.17	55.75
	Effective	8.45	13.51	20.27
Crankshaft direction		Clockwise from flywheel end		
Cooling type		Forced air cooled by flywheel fan		
Lubrication type		Pressure splash		
Starting system		Recoil manual start and or optional electric start		
Dry weight (recoil) (lbs)		60	73	106
Dry weight (elec.) (lbs)		68	84	117
Dimensions (LxWxH) (inch)		13.1 x 14.8 x 16.3	15.1 x 16.6 x 17.7	16.4 x 17.4 x 19.5

Technical specifications in SI units

Item \ Model		170F	178F	186F
Type		Single vertical cylinder, 4-stroke, air-cooled, direct injection		
Bore x Stroke (mm)		70 x 55	78 x 62	86 x 70
Displacement (cc)		211	296	406
Speed (rpm)		3600	3600	3600
Output (kw)	Continuous	2.98	4.4	6.6
	Maximum	3.36	4.92	7.3
Fuel tank capacity (Liters)		2.5	3.4	5.5
Lube-oil Capacity (L)	Full	.8	1.10	1.65
	Effective	.25	.40	.60
Crankshaft direction		Clockwise from flywheel end		
Cooling type		Forced air cooled by flywheel fan		
Lubrication type		Pressure splash		
Starting system		Recoil manual start and or optional electric start		
Dry weight (recoil) (kg)		27	33	48
Dry weight (elec.) (kg)		31	38	53
Dimensions (LxWxH) (mm)		332 x 376 x 415	383 x 421 x 450	417 x 441 x 494

1-2 Overall engine dimensions



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 the output shaft is properly aligned.

(3) Verify that the dimensions of the hole on the belt wheel and keyway shaft match or correspond with each other. Also make sure that the bolt of the engine shaft is tightened to the proper torque specifications.

(4) 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 wheel. If this is not properly calculated and matched, the desired speed on the driven wheel will be incorrect. A formula used to calculate the necessary diameters of the various wheels is provided below.

The diameter of driving wheel (belt wheel) can be calculates as follows:

Diameter of engine driving wheel (engine pulley) =

$$\frac{\text{Diameter of driven machine x speed of driven machine}}{\text{Diesel speed (engine speed)}}$$

(5) Make sure that the belt has a correct tension to it.

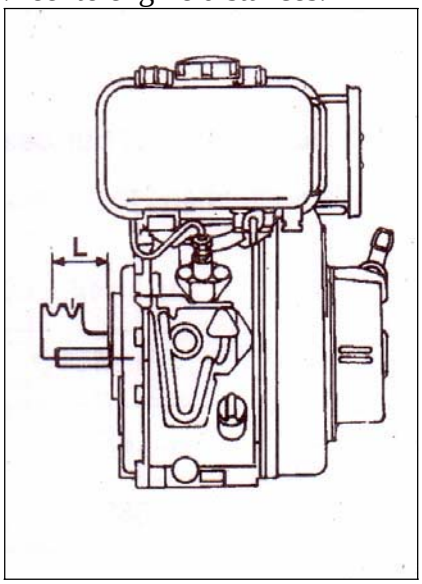
Note: If the belt is to tight, the engine bearings will wear at a high rate leading to engine failure. If the belt is to loose, the belt will slip at high speeds and high loads causing high pitch whistling noises.

1-2.1 Allowed clearance between belt wheel and engine

The belt pulley wheel should be as close to the engine as possible. The values of L are tabulated in table 1-1.

Table 1-1. Allowed belt pulley wheel to engine distances.

Item \ Model		170F	178F	186F
Belt	Type	A	B	C
	Qty.	2	2	2
Min.diameter of pulley		68	97	135
L		⩽ 80mm	⩽ 70mm	



1-2.2 Crankshaft driving angles must be less than 120^{o}, see Fig 1-1

The tilt must be kept within the allowed values shown in Fig 1-2

Fig 1-1. Allowed driving angles.

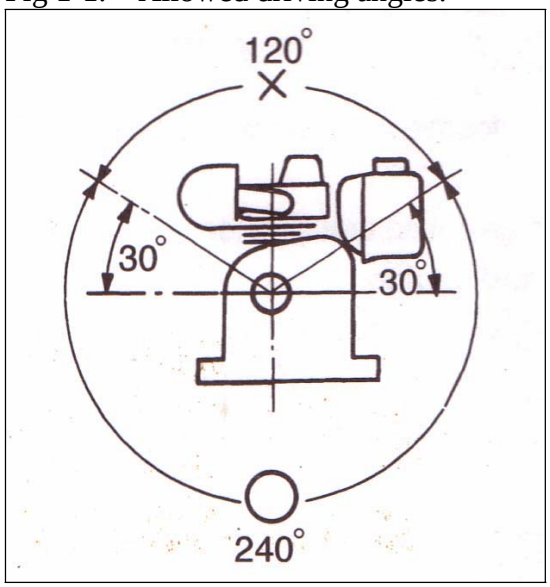
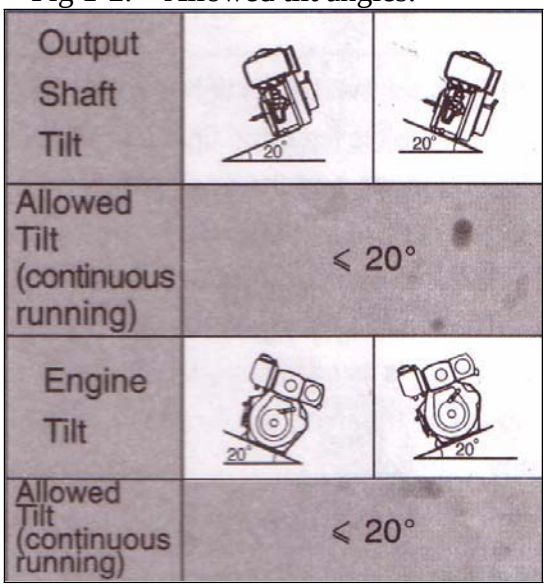


Fig 1-2. Allowed tilt angles.

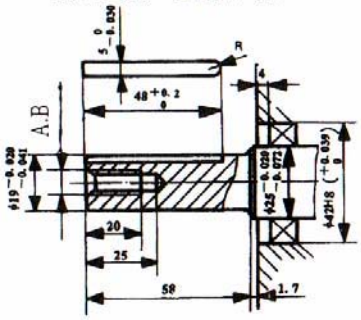
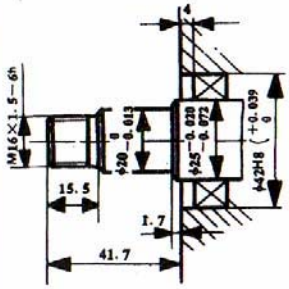
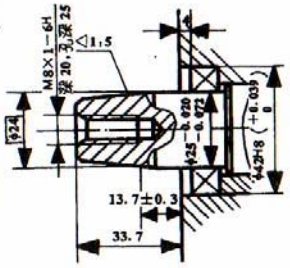
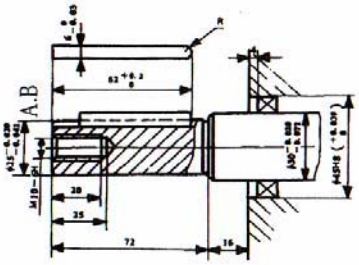
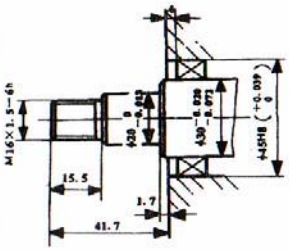
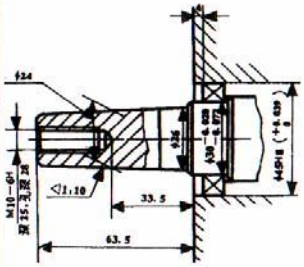
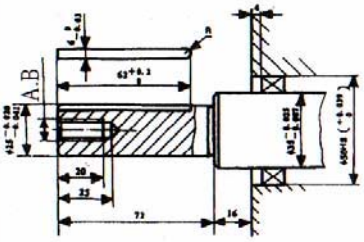
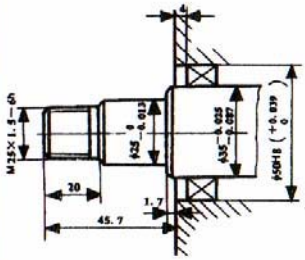
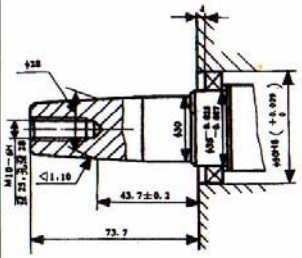


1-2.3 Please contact our dealers about the electric circuits involved with this engine. We recommend the use of accumulators rated at 20 hours shown in table 1-2.

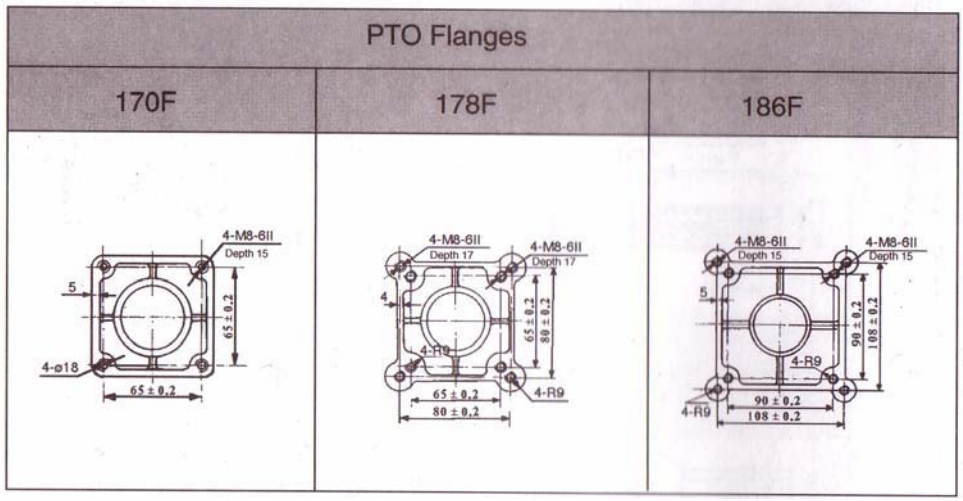
Table 1-2.

Model	Units: (amp-hours)
170F	18~24
178F	24~26
186F	36~45

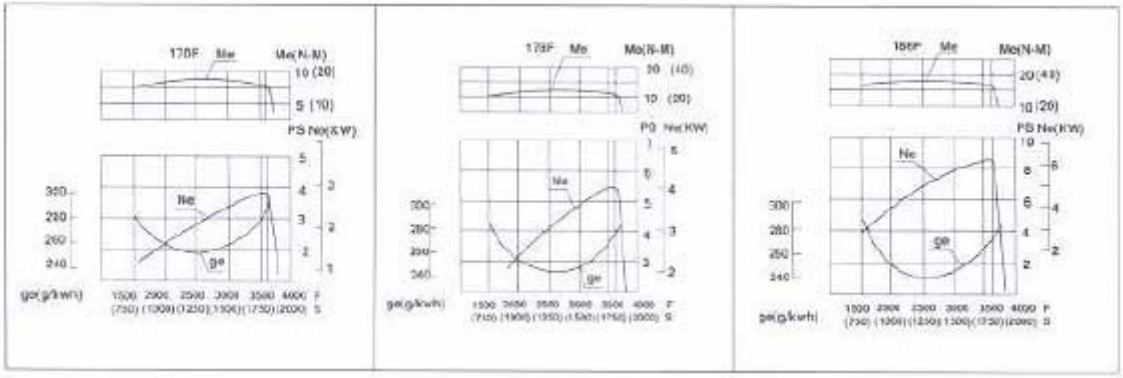
1-2 Diesel Engine shaft specifications units: mm

MODEL	Keyway shaft	Thread shaft	Taper shaft
170F	170FA-5/16 ″ -24NF-6H 170FB-M8 × 1-24NF-6H 		
178F	178FA-7/16 ″ -20UNF-6H 178FB-M10 × 1.25-20UNF-6H 		
186F	186FA-7/16 ″ -20UNF-6H 186FB-M10 × 1.25-20UNF-6H 		

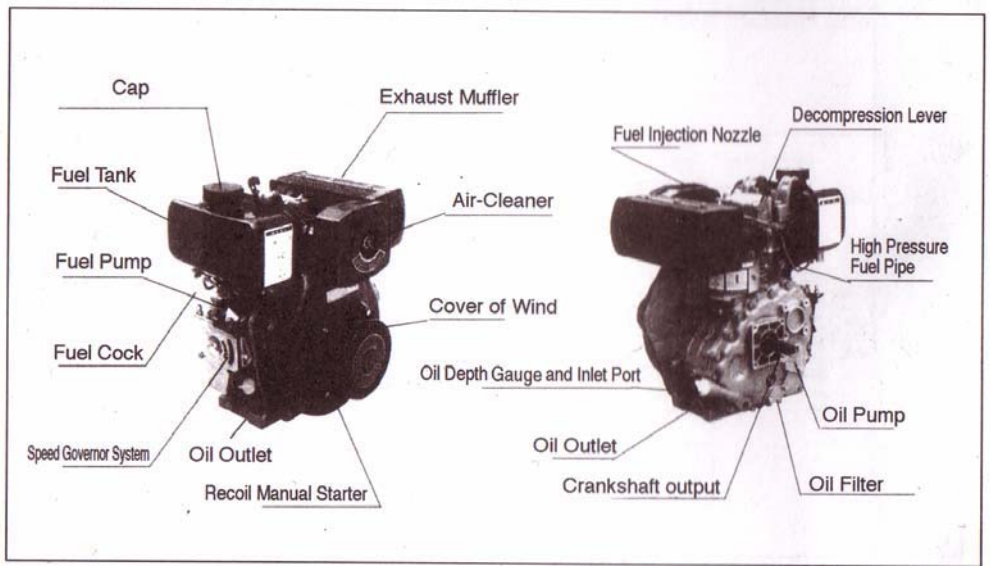
Sizes of PTO flanges



Diesel Engine Power Curves



1-4 Names of Diesel Engine Parts



1-5 **Valve timing, initial angle of fuel delivery and valve clearances.** Units: Degrees
Table 1-3.

MODEL / ITEM	PHASE		
	170F	178F	186F
Intake valve open	BTDC18° 30′	BTDC18°	BTDC13°
Intake valve close	ATDC45° 30′	ATDC46°	ATDC52°
Exhaust valve open	BBDC55° 30′	BBDC52°	BBDC57°
Exhaust valve close	ABDC8° 30′	ABDC12°	ABDC8.5°

1-5.2 Initial angle of fuel delivery Units: Degrees
Table 1-4

170F	178F	186F
21° ± 1°		22° ± 1°

1-5.3 Valve Clearances
Table 1-5

Description / Model	170F	178F	186F
Intake valve	0.10 ~ 0.15(Cold state)		
Exhaust valve	0.10 ~ 0.15(Cold state)		

1-6 Temperature ranges for exhaust and injection pressure specifications

Description / Model	170F	178F	186F
Exhaust temperature(℃)	⩽ 480		
Machine oil temperature(℃)	⩽ 95		
Smoke(Bosch)	⩽ 4		
Pressure of injection MPa(kgf/cm^2)	19.6 ± 0.49(200 ± 5)		

1-7 Torque specifications for various engine nuts and bolts

Table 1-7. Torque specifications in SI units Units: N m

Description \ Model	170F	178F	186F	Note
Connecting rod nut	25 ~ 30		40 ~ 45	Retighten up after test period
Cylinder head nut	35 ~ 40	42 ~ 43	55 ~ 60	
Flywheel nut	100 ~ 120		120 ~ 140	
Nozzle retainer nut	10 ~ 12			
Tighten bolt of rocker support	25 ~ 30			
Standard M8 bolt	20 ~ 30			
Standard M6 bolt	15 ~ 20			

CHAPTER 2 DIESEL ENGINE OPERATION

2-1 Please pay close attention for safe operation of the diesel engine.

1. The fuel used must be filtered by silk fabric or settled for 24 hours before it is used in the engine. Never add oil to the crankcase when the engine is running.
2. Keep flammable and combustible goods away from engine while engine is running. The engine should be placed in a simple ventilated place.
3. Do not touch the muffler when the engine is running or just after it has stopped.
4. The diesel engine should be operated at its rated power and rated speed. If abnormal operating conditions are detected, stop the engine immediately to check and fix the problem.
5. A new engine must be properly broken in. For the first 20 hours, run the engine at low speed and low loads. Do not allow engine to run at high speeds and high loads during the break in period.

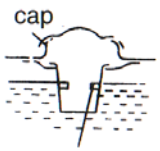
2-2 Fuel Choices

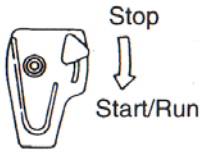
Choice of fuel:

Only use light diesel fuel for diesel engine. (No.0 in Summer No.-10 or No.-20 in winter.) Do not allow dust or water in the fuel and fuel tank.

Model	170F	178F	186F
Capacity Liter	1.9	2.7	4.7
British Gal	(0.42)	(0.59)	(1.03)

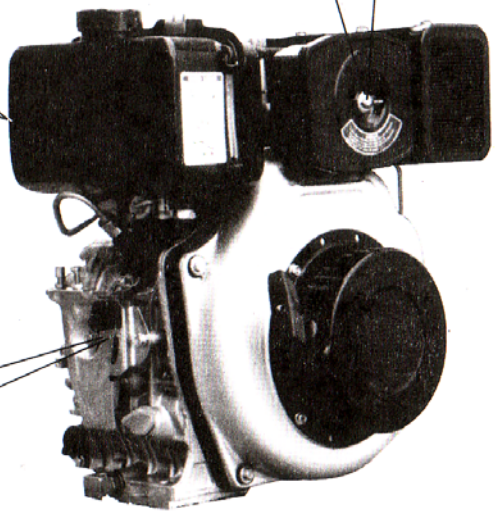
Caution:Do not let fuel level be higher than Red Mark





Core of air filter:

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



Oiling plug:

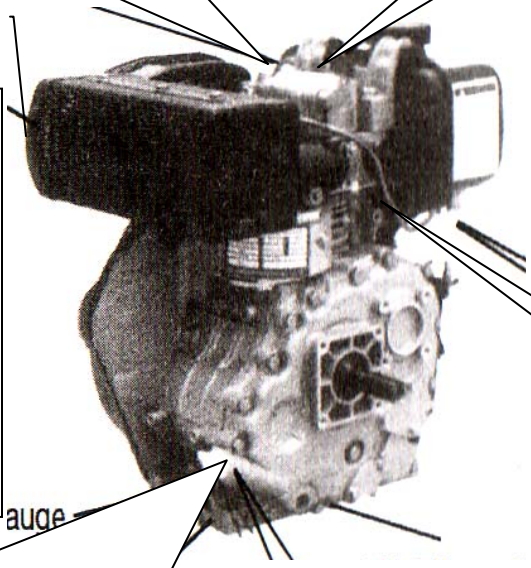
In winter, if it is difficult to start the engine, pull the plug out and fill 2cc of lube oil into the hole and then put the plug back in place. Make sure the plug is tight, if not, the engine can absorb dust into the combustion chamber and damage itself.

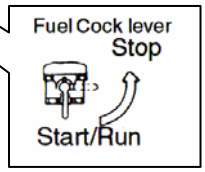
Compression release lever:

Push the lever down to start the engine

Muffler

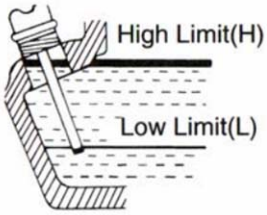
The factory has replaced the engine fuel and engine oil once already. To check the fuel pipeline, make sure the fuel line is completely drained. IF there is air in the pipeline, drain it out. To do this, loosen the nut between the injection pump and fuel pipe, then drain out the air until there are no bubbles left in fuel line.



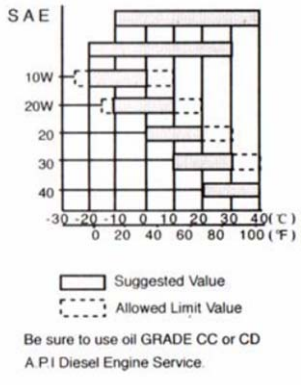


Oil Lubricant Inlet:

Place the engine on level ground and fill the lubricant into the inlet. When checking the oil level, gently place the dipstick into the oil. Do not turn the oil scale.

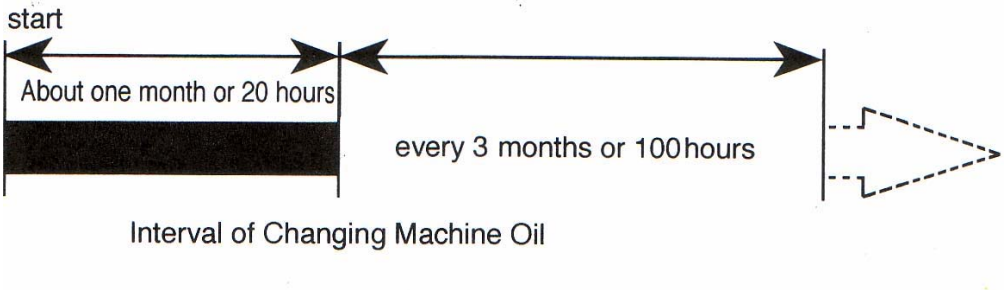


Model / Capacity	170F	178F	186F
Litre (British Gal)	0.75 (0.16)	1.1 (0.24)	1.65 (0.36)



If your engine is still relatively new, follow the break in procedure. The life of the engine will shorten if it is overloaded during its break in period. For the first 20 hours, the engine must be started and stopped according to the test run method.

Avoid overloading the engine
Change the engine oil regularly. Below a table for the interval of oil changes will be provided.

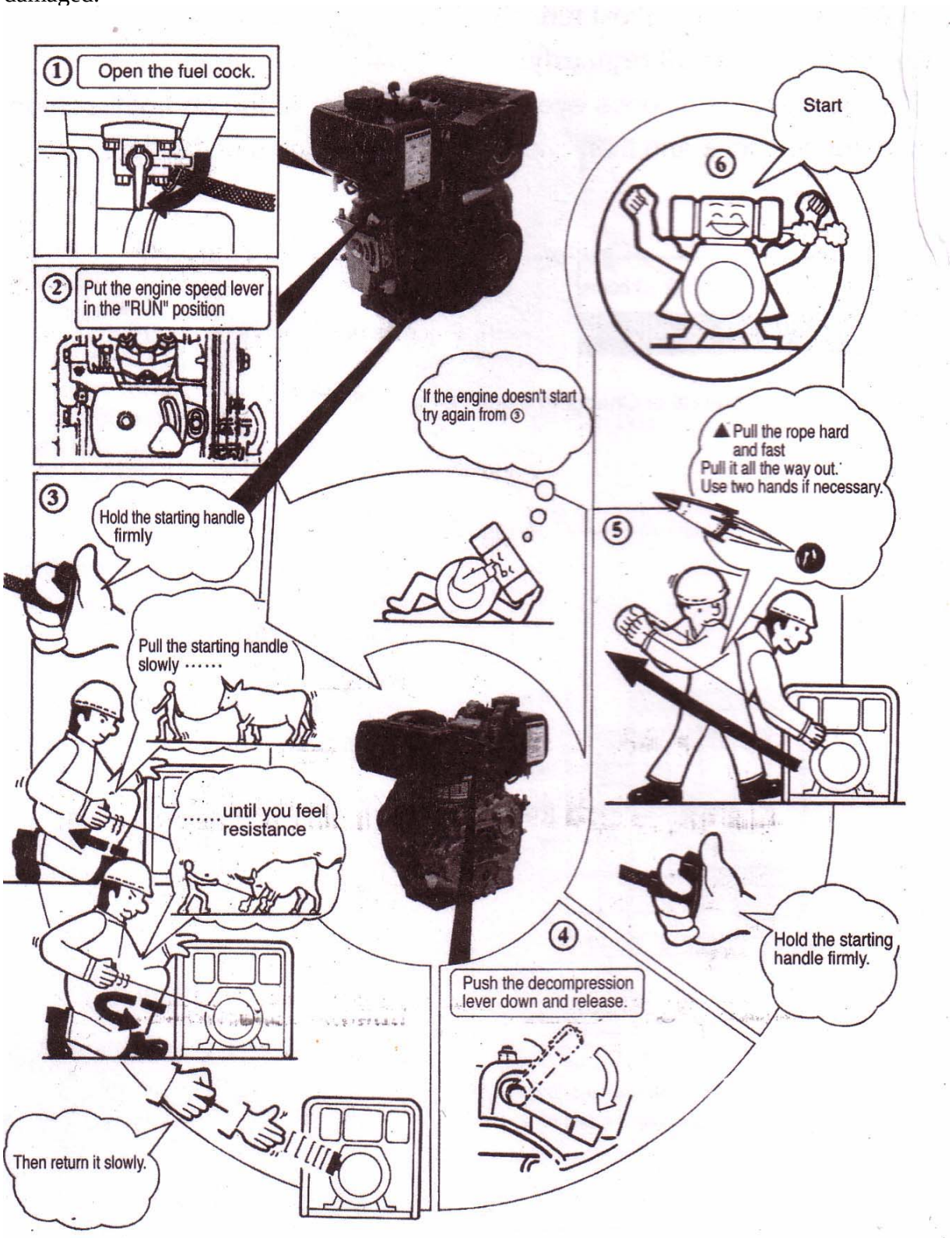


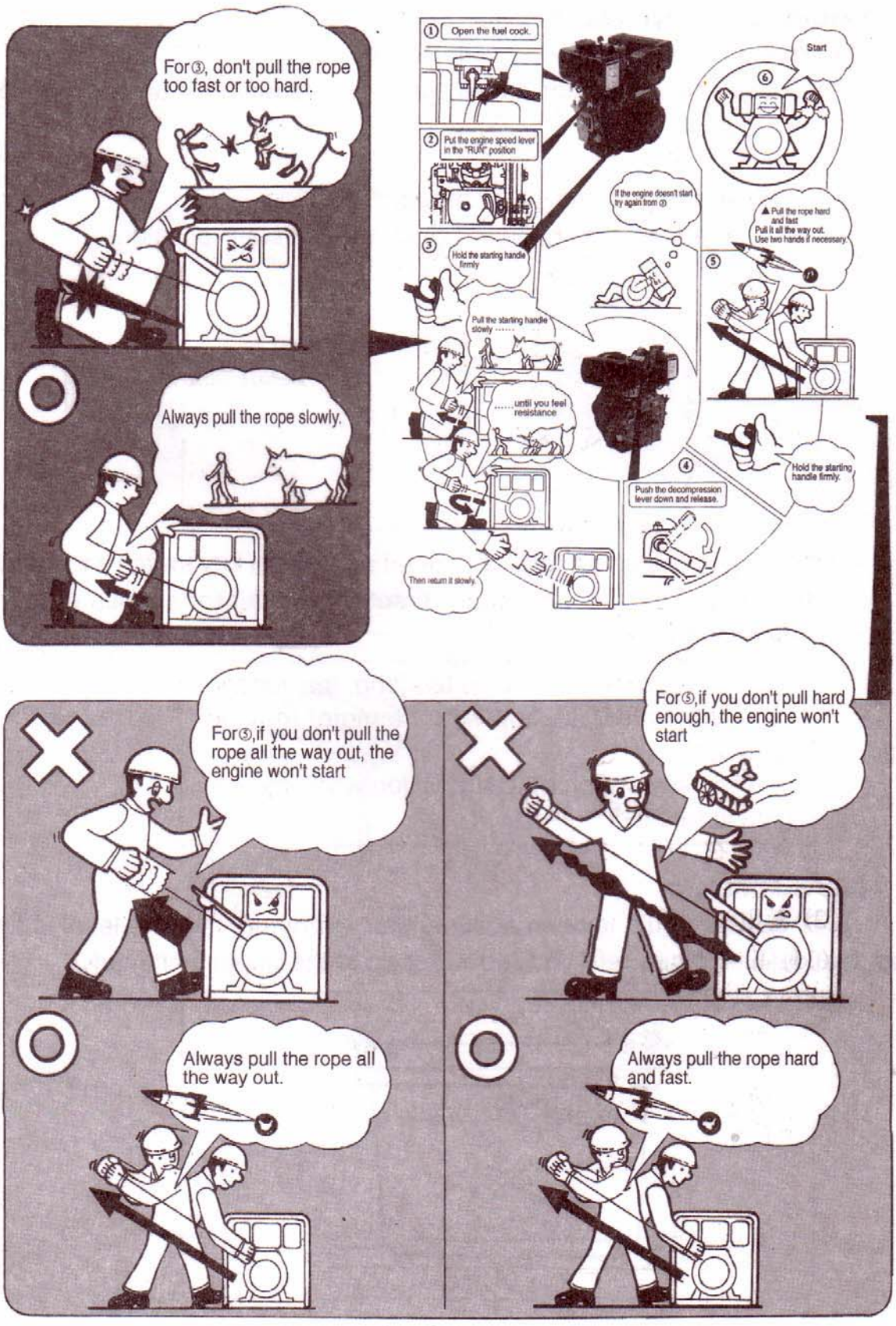
Interval of Changing Machine Oil

2-3 Starting the Diesel Engine

2-3.1 Recoil Starting

Note: When the engine is running, do not pull the recoil handle, otherwise the engine may be damaged.



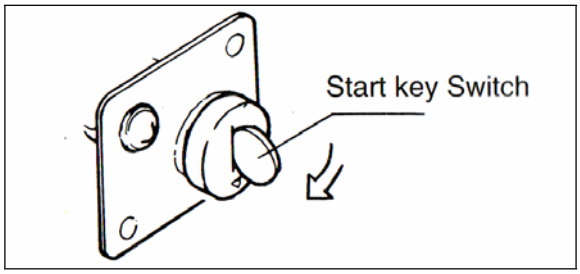

For③, don't pull the rope too fast or too hard.
Always pull the rope slowly.
① Open the fuel cock.
② Put the engine speed lever in the "RUN" position
③ Hold the starting handle firmly
Pull the starting handle slowly ·····
·····until you feel resistance
Then return it slowly.
④ Push the decompression lever down and release.
Hold the starting handle firmly.
⑤ ▲Pull the rope hard and fast
Pull it all the way out.
Use two hands if necessary.
⑥ Start
If the engine doesn't start try again from ②
For③,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.

2-3.2 Diesel engine with electric starter system

(1) Starting

The preparation of the diesel engine for the electric starting system is the same as the manual recoil type.

a. Open the fuel cock.
b. Set the speed governor lever to the start position.
c. Turn the start switch clockwise to the “Start” position.



d. If the engine is started, immediately remove your hand away from the key switch.
e. If the engine does not start after 10 seconds, wait awhile (about 15 seconds) before trying to start the engine again.

> If you run the starter motor to long, the voltage of the accumulator will drop and the motor may be damaged. Keep the key switch in the “ON” position

(2) Battery

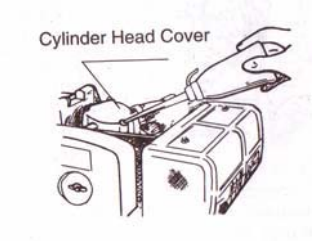
a. Always check the liquid level of the battery every month, if the level is lower than the low limit mark, refill the battery with distilled water till you reach the upper limit mark.

> If the liquid level in the battery is to low, the electric starter will not function to its best potential. Always keep the level of the liquid in the battery between the upper and lower limits. If there is too much liquid, the liquid will splash onto other nearby parts thereby ruining the battery.

2-3.3 Cold starting

If the engine is difficult to start in winter, take off the rubber seal plug and put 2cc of machine oil into the hole.

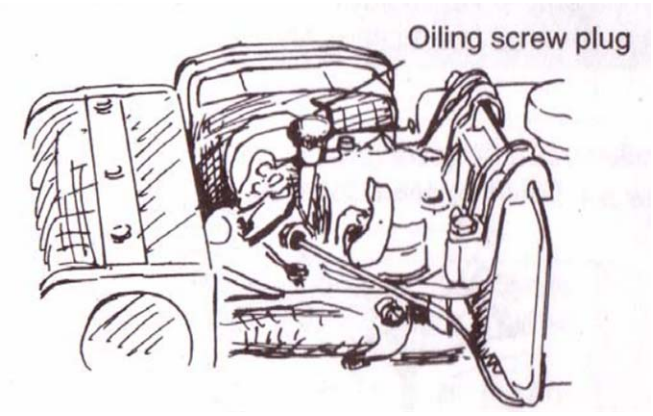
Notice: Engines supplied to the Torrid Zone will not contain the rubber plug. A solid plug is provided instead.



Warning:

Never use flammable liquids as fuel, such as gasoline etc. Also, never take away the air cleaner for easy starting of the engine, doing so may cause explosions from the intake gases.

Never take the oil plug unless you're planning on filling the oil. If the plug is not in place, rain, dust, and other impurities may be sucked into the engine causing serious damage to the engine parts.

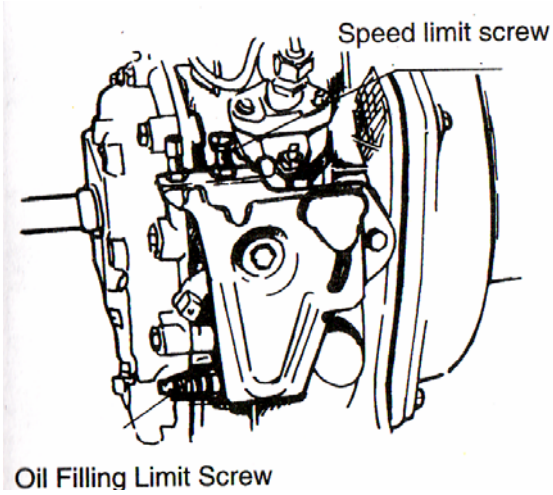


2-4 Running and stopping of the Diesel Engine

2-4.1 Running the Diesel engine

(1) Preheat the engine for three minutes at no load.
(2) Set the speed governor lever to the desired speed.

Use the speed governor lever to control the speed of the engine. Never loosen or readjust the speed limiting screw and the



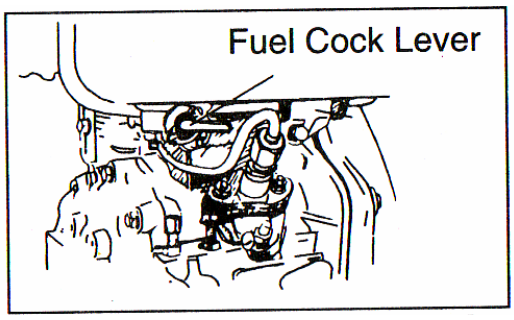
2-4.2 Checks on the engine while the engine is running.

(1) Check to see whether there are abnormal noises such as vibration.
(2) Check to make sure there is good combustion. (Extremely high speeds are not recommended for the engine, as that will decrease engine life.)
(3) Check to see the color of the exhaust gases to see if it is to white or to black.
(4) If any of these conditions are detected, stop the engine immediately and contact your nearest dealer for repair information.

2-4.3 Stopping the engine

(1) First, bring down the speed of the engine by using the speed governor. Let it run for 3 minutes at no load before stopping it.
(2) Then stop the engine.

Sudden stops to the engine will cause abnormal temperature increases in the block of the engine. Decrease the load gradually when stopping the engine. Also, never stop the engine with the decompression lever.



(4) If the engine comes with an electric starter, turn the starting switch to the “Off” position.

(5) Pull the recoil handle slowly until pressure is felt by your hand, this means the piston is on the compression stroke; where the intake and exhaust valves are closed and then let the handle recoil back into the engine. This natural position will prevent rust from occurring when the engine is being stored for long periods of time.

Note: Only perform step 5 when the engine is off. Doing so otherwise will damage the engine.

CHAPTER 3. TECHNICAL MAINTENANCE OF DIESEL ENGINE

3-1 Daily checks and maintenance

Check the oil level of the engine to see whether it is between the upper and lower limits.
Check to see whether there any oil leaks within the engine.
Keep the engine clean by cleaning up the dirt and other greasy deposits on the engine.

3-2 Regularly checks and maintenance

Regular checks and maintaining are very important for normal operation and engine life. The following table indicates what is necessary to be performed at specific time intervals. The marks signify that a special tool or technique is needed for maintenance. Please contact your local dealer for special maintenance.

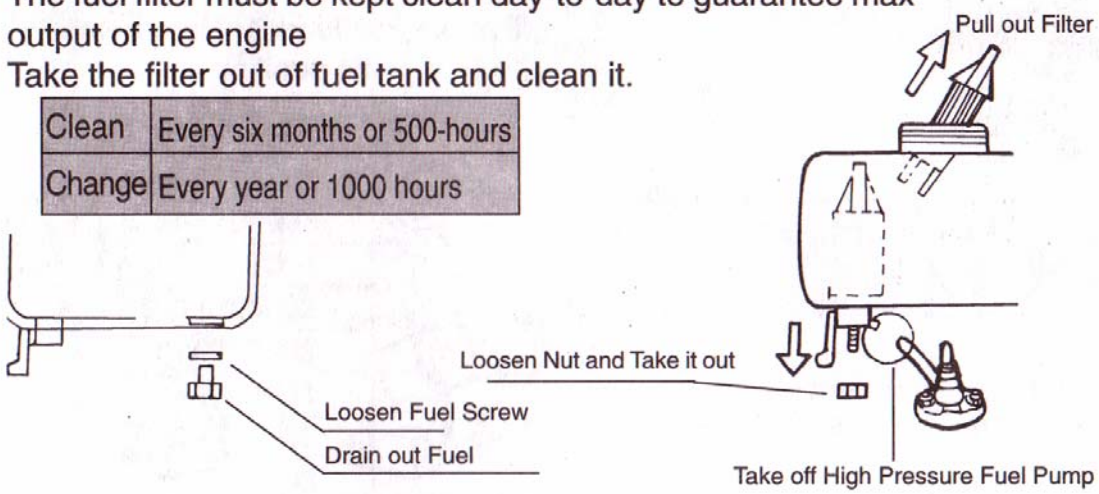
Item \ Time	Daily	After 20 hours or 1 month	100 Hours or Every 3 month	500 Hours Every 6 month	1000 Hours or Every year
Check and tighten the nut and screw	○				
Check and fill machine oil	○				
Change machine oil		○ (First time)	○ (Second time and later)		
Clean and change oil filter				○	● (Change)
Check oil-leakage	○				
Change the core of air filter		Cycle of check and main-tenance will be shortened at dusty place.		○	
Clean fuel tank	Every month				
Clean or change fuel filter				○ (Clean)	○ (Change)
Check nozzle				●	
Check injection pump				●	
Check pipeline of fuel				○ (Change if necessary)	
Adjust valve clearance of inlet and exhaust		● (First time)		●	
Grind valve holder of inlet and exhaust					●
Change piston ring					●
Check accumulator liquid	each month				
Clean the core of air filter		○ (Clean) every month or 50 hours			

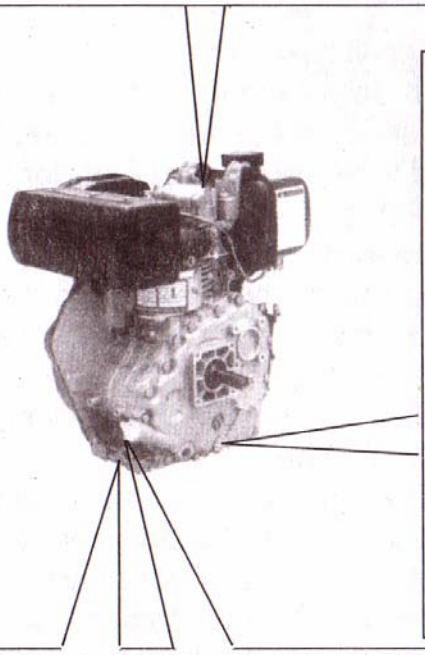
Clean and change fuel filter

The fuel filter must be kept clean day-to-day to guarantee max output of the engine

Take the filter out of fuel tank and clean it.

Clean	Every six months or 500-hours
Change	Every year or 1000 hours





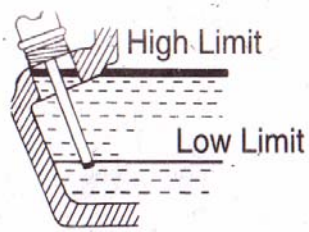
Change Lube oil filter

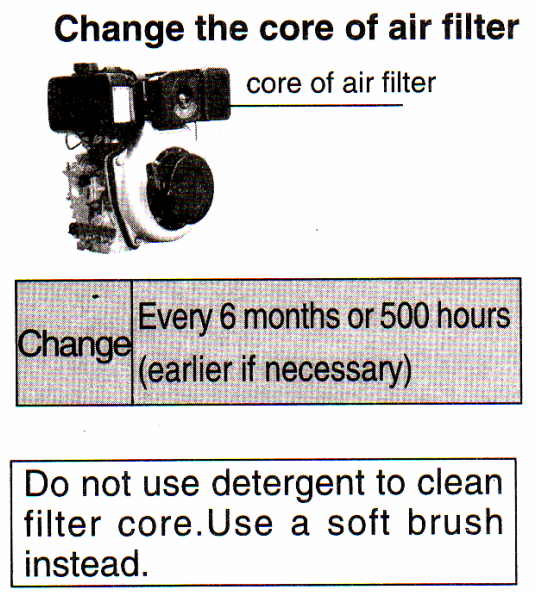
Clean	250 Hours
Change	500 Hours or when maintaining

O-Sealing washer

	168F (1D40)	178F (1D70)	186F (1D100)
Capacity(Liter)	0.75	1.10	1.65

Change	Operating period
First	First month or after 20 hours
Second and Later	Every 30 months or 1000 hours



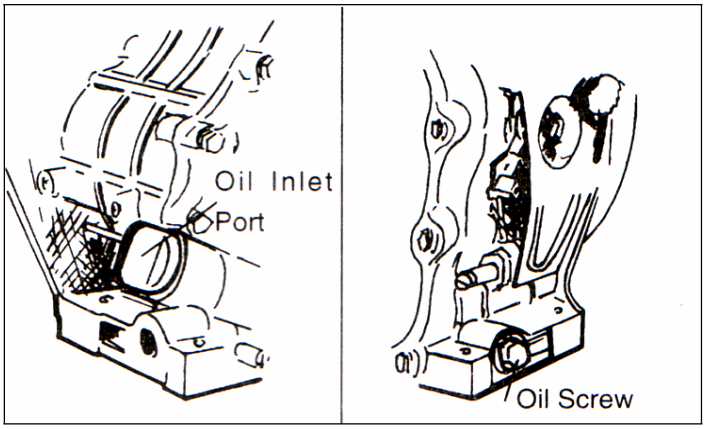


The core of the air filter may become dirty from various impurities. If this occurs, the performance of the engine will decrease because the amount of air entering the combustion chamber is incorrect. Also, because the amount of air is incorrect, the amount of fuel entering also becomes incorrect leading to an overall incorrect air/fuel mixture. This will lead to poor performance of the diesel engine. Always keep the air filter and air filter core clean.

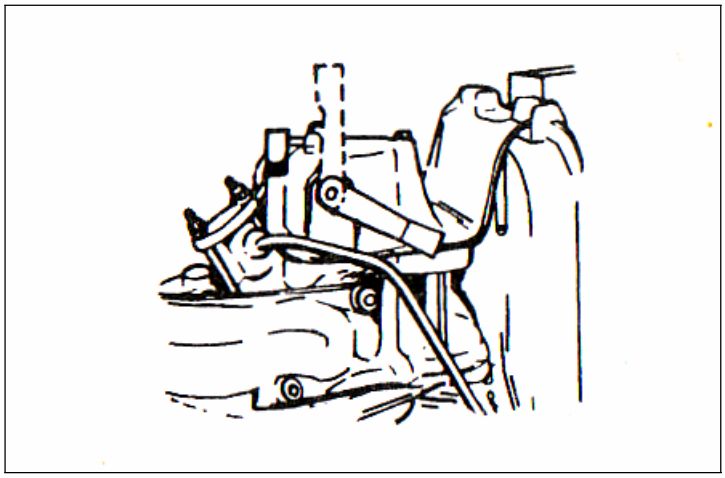
3-3 Storing the engine for long periods of time.

Please follow the instructions below if you plan on storing the engine for long periods of time.

(1) Run the engine for three minutes to burn out the excess fuel in the chamber.
(2) Quickly drain way the engine oil lubricant before the engine becomes cool and refill it with new oil. The figure below shows where the oil plugs are.



(3) Take the rubber plug off the cover of the rocker shaft and put about 2cc of lubricant into it and put the plug back in place. The figure below shows where to access the plug.



(4) **For recoil starting engines**, push the decompression lever down and pull the recoil starter two or three times. This pushes all the excess intake mixture out of the combustion chamber.

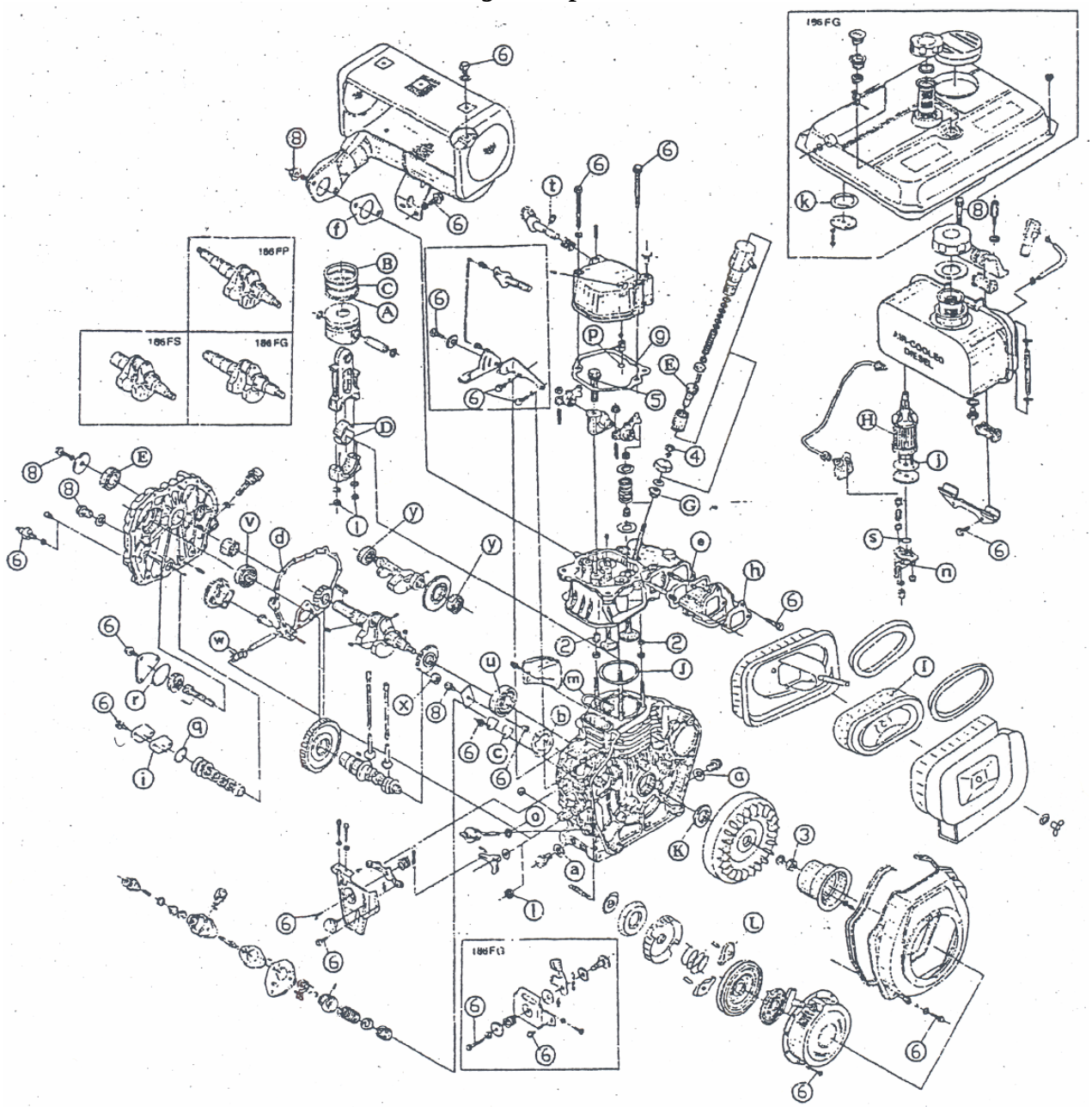
(5) **For engines that come with an electric starter**, hold down the decompression lever and turn the start key switch to the start position. Let the engine rotate for about two to three seconds. Once again, this pushes all the excess intake mixture out of the combustion chamber.

(6) Now pull the decompression lever up and pull on the recoil starter slowly until you feel resistance. The resistance point occurs on the compression stroke where the intake and exhaust valves are closed. It is also the point that will prevent moisture from entering the chamber to cause rust.

(7) Finally, clean excess oils from the engine and put the engine in a nice dry place.

CHAPTER 4 PART LISTINGS

Diesel Engine Exploded View



4-1 Engine Block

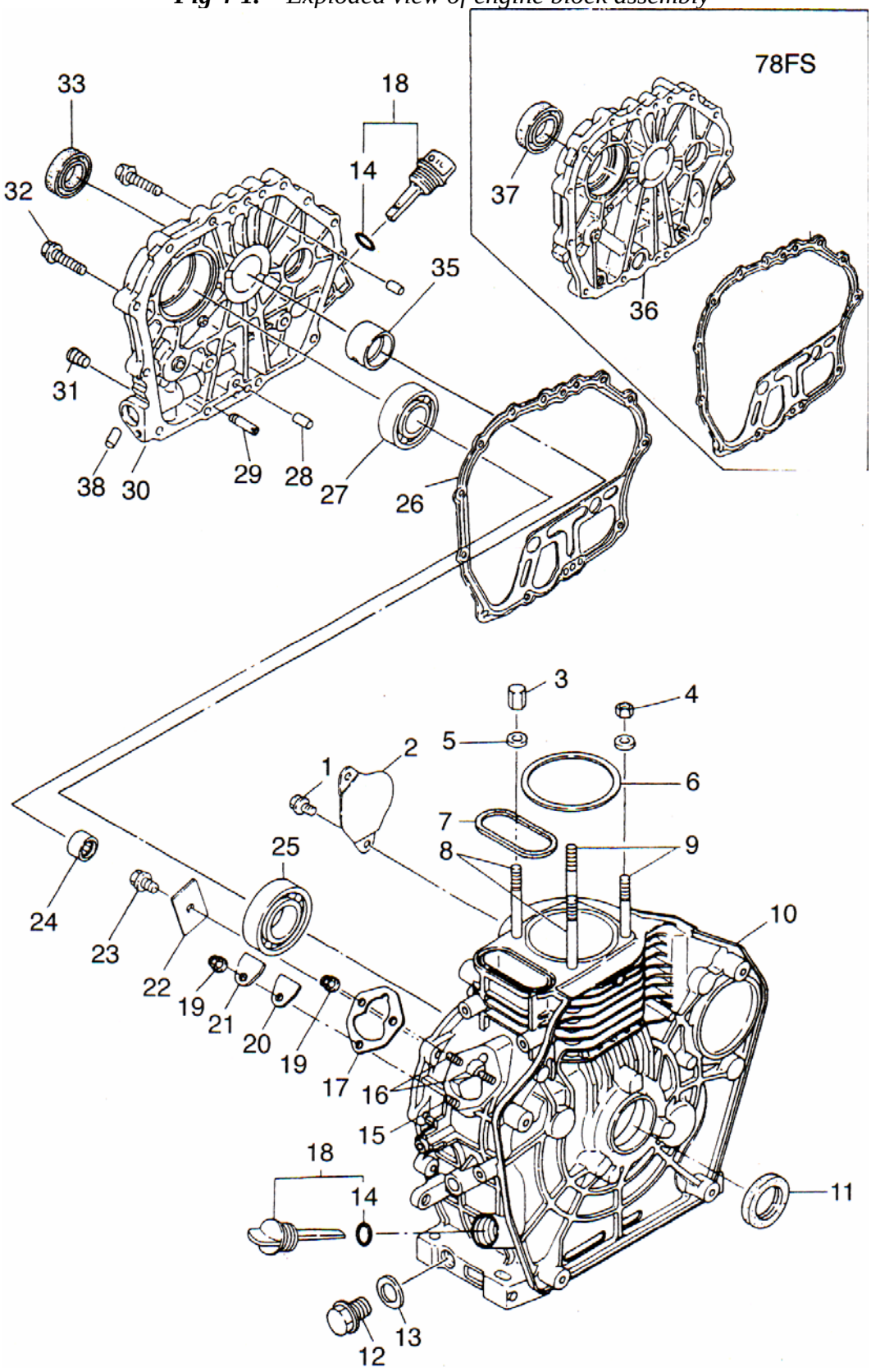
Table 4-1. *Please refer to Fig 4-1 for illustration*

Number	Part Number	Name of Part	Qty each set
1	KS1710626	Bolt M10 x 20 (GB5787-86)	2
2	KS 17138	Starter motor hole cover	2
	KS 70-1704901		2
3	KS 78-1704902	Cylinder head nuts (long)	2
	KS 86-1704903		2
	KS 70-1705001		2
4	KS 78-1705002	Cylinder head nuts (short)	2
	KS 86-1705003		2
	KS 70-1704801		2
5	KS 78-1704802	Cylinder head nut gasket	2
	KS 86-1704803		2
	KS 70-1719504		1
6	KS 78-1719704	Cylinder head gasket (0.4)	1
	KS 86-1706314		1
7	KS 70/78-17182	Oval ring gasket 5.1 x2.5	1
	KS 86-1720106	Oval ring gasket 5.1 x2.6	1
	KS 70-1700201		2
8	KS 78-1700202	Cylinder head bolts (long)	2
	KS 86-1700203		2
	KS 70-1700301		2
9	KS 78-1700302	Cylinder head bolts (short)	2
	KS 86-1700303		2
	KS 70-1700107		2
10	KS 78-1700103	Engine block	1
	KS 86-1700110		1
	KS 70-1711702		1
11	KS 78-1711702	Rear oil seal 30 x 45 x 8	1
	KS 86-1711704	Rear oil seal 35 x 50 x 8	1
12	KS 17121	Oil drain plug	1
13	KS 17120	Oil drain plug gasket	1
14	KS 1711324	O ring for oil dipstick	2
15	KS 17123	Fuel pump fastening bolt (short)	1
16	KS 17122	Fuel pump fastening bolt (long)	2
17	KS 1719605	Fuel injector gasket (0.5)	1
18	KS 70-1702001	Oil dipstick	2
	KS 78/86-1702002		2
19	KS 1710103	M6 nut	3
20	KS 17159	Sealing plate gasket	1
21	KS 17158	Sealing plate	1
22	KS 17195	Thrust piece	1
23	KS 1710636	Flange face with bolts (GB5789-86)	1

24	KS 1710010	Needle bearing 7941/15	1
	KS 70-1710006	Ball bearing 306 (GB/T276-94)	1
25	KS 78-1710007	Ball bearing 307 (GB/T276-94)	1
	KS 86-1710008	Ball bearing 308 (GB/T276-94)	1
	KS 70-1704601		1
26	KS 78-1704602	Crankcase cover gasket	1
	KS 86-1704603		1
	KS 70-1710002	Bearing 205 (GB/T276-94)	1
27	KS 78-1710003	Bearing 206 (GB/T276-94)	1
	KS 86-1710004	Bearing 207 (GB/T276-94)	1
28	KS 1711111	Retaining pin 8x12 (GB119-86)	2
29	KS 78/86-17080	Fuel Pipe	1
	KS 70-1701901		1
30	KS 78-1701902	Crankcase cover	1
	KS 86-1701904		1
31	KS 17133	Inner Hexagon Plug G1/8	1
	KS 70-1710083	M8 x 33.5 Bolt	1
	KS 70-1711062	M6 x 25	14
32	KS 78-1710083	M8 x 33.5 Bolt	15
	KS 86-1710083	M8 x 33.5 Bolt	16
	KS 70-1711701	Front oil seal 25 x 42 x 10	1
33	KS 78-1711703	Front oil seal 30x 45 x 10	1
	KS 86-1711705	Front oil seal 35 x 50 x 10	1
	KS 70-1701801		1
35	KS 78-1701802	Main Bushing	1
	KS 86-1701803		1
36	KS 78-1701903	Front side crankcase cover	1
37	KS 78-1711703	Front side oil seal	1
38	KS 70-1711602	Aluminum Plug Diameter 8 x 8	2
	KS 78/86-1711602		3

Note: If purchasing the engine cylinder block, the included parts are numbers 1, 2, 8, 9, 10, 12, 13, 14, 15, 16, 18 and 24. The parts of the crankcase cover include numbers 14, 18, 27, 28, 29, 30, 31, 35 and 38.

Fig 4-1. *Exploded view of engine block assembly*



4.2 Cylinder head Assembly

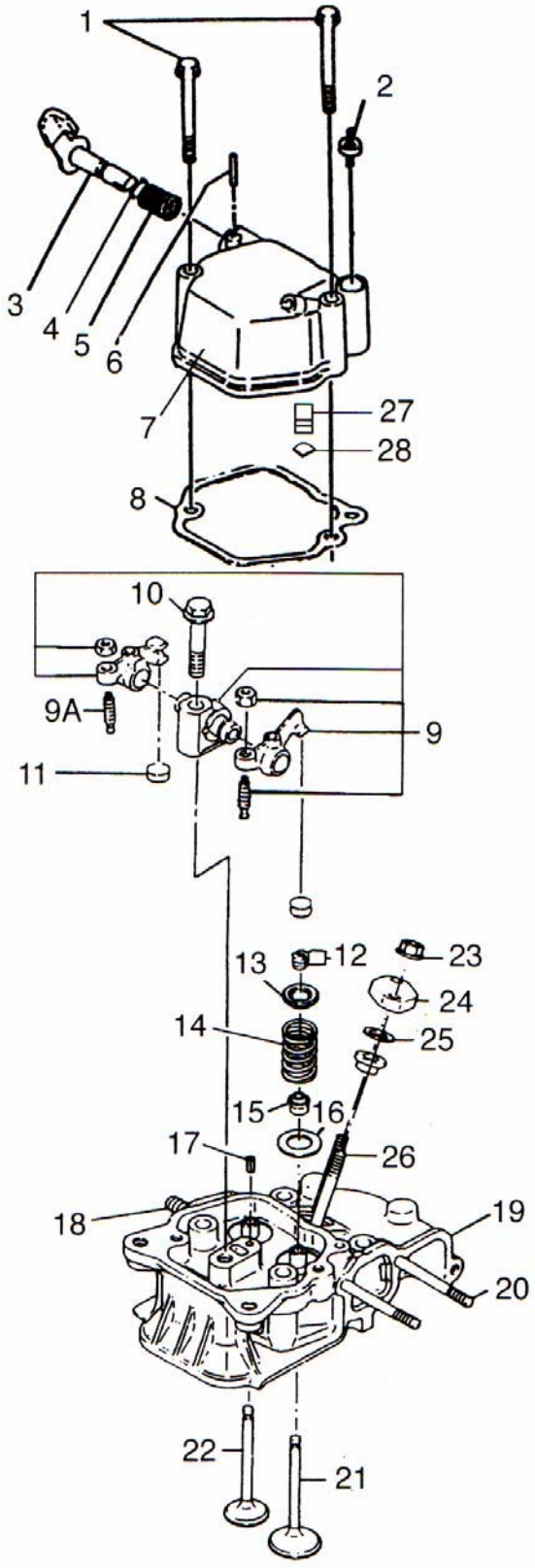
Table 4-2. *Part listing for cylinder head assembly. Please refer to Fig 4-2*

No.	Code	Names of Parts	Qty each set
1	KS 70/78-1710755	M6 x 55 Flanged Bolt (GB5789-86)	2
	KS 86-1710730	M6 x 70 Flanged Bolt (GB5789-86)	2
2	KS 17142	Oiling hole plug	1
3	KS 17139	Decompression shaft	1
4	KS 1711310	O ring 10 x 1.9 (GB1235-76)	1
5	KS 17140	Decompression shaft spring	1
6	KS 1711103	Retaining pin 3 x 16 (GB119-86)	1
7	KS 70/78-17066	Cylinder head cover	1
	KS 86-1706603		1
8	KS 70/78-17170	Cylinder head cover gasket	1
	KS 86-1717001		1
9	KS 70/78-17168	Rocker arm	1
	KS 86-1716801		1
9A	KS 17165	Valve clearance adjusting screw	2
10	KS 70/78-1710745	Rocker arm shaft fastening bolt	1
	KS 86-1716901		1
11	KS 70-1705201		2
	KS 78-1705202	Adjusting valve spacer	2
	KS 86-1705203		2
12	KS 70-1702701	Valve clip	4
	KS 78-1702702		4
	KS 86-1702703		4
13	KS 70-1702801	Valve spring seat	2
	KS 78-1702802		2
	KS 86-1702803		2
14	KS 70-1702901	Valve spring	2
	KS 78-1702902		2
	KS 86-1702903		2
15	KS 70-1702003	Valve guide oil seal	2
	KS 78-1702004		2
	KS 86-1702100		2
16	KS 70/78-17136	Valve spring washer	2
	KS 86-1713601		2
17	KS 1711104	Pin 4 x 8 (GB119-86)	1
18	KS 1710920	Double ended stud AM8 x 20 (GB899-88)	2
19	KS 70-1702403	Cylinder Head	1
	KS 78-1702402		1
	KS 86-1702404		1
20	KS 70/78-1710955	Double ended bolt AM6 x 55 (GB900-88)	2
	KS 86-1710956	Double ended bolt AM6 x 75 (GB900-88)	2
21	KS 70-1702501	Intake valve	1
	KS 78-1702601		1

	KS 86-1702503		1
22	KS 70-1702502	Exhaust valve	1
	KS 78-1702602		1
	KS 86-1702605		1
23	KS 1710103	M6 (GB6177-86) Nut	2
24	KS 1717302	Fuel injector pressure plate	1
25	KS 1724502	Fuel injector gasket	1
26	KS 70-1712201	AM 6 x 42 Fuel injector bolt	2
	KS 78-1712201	AM 6 x 42 Fuel injector bolt	2
	KS 86-17122	Fuel injector bolt (long)	2
27	KS 17141	Breather assembly	1
28	KS 1711312	O ring 12 x 1.9	1

Note: The parts of the cylinder head cover included are numbers 2, 3, 4, 5, 6, 7, 27, 28 and 29.
The parts of the rocker arm include 9 and 9a.
The parts of the cylinder head include 12, 13, 14, 15, 16, 17, 18, 19, 20, 22 and 26.

Fig 4-2. *Exploded view of cylinder head*



4-3 Piston connecting rod and crankshaft balancing mechanism

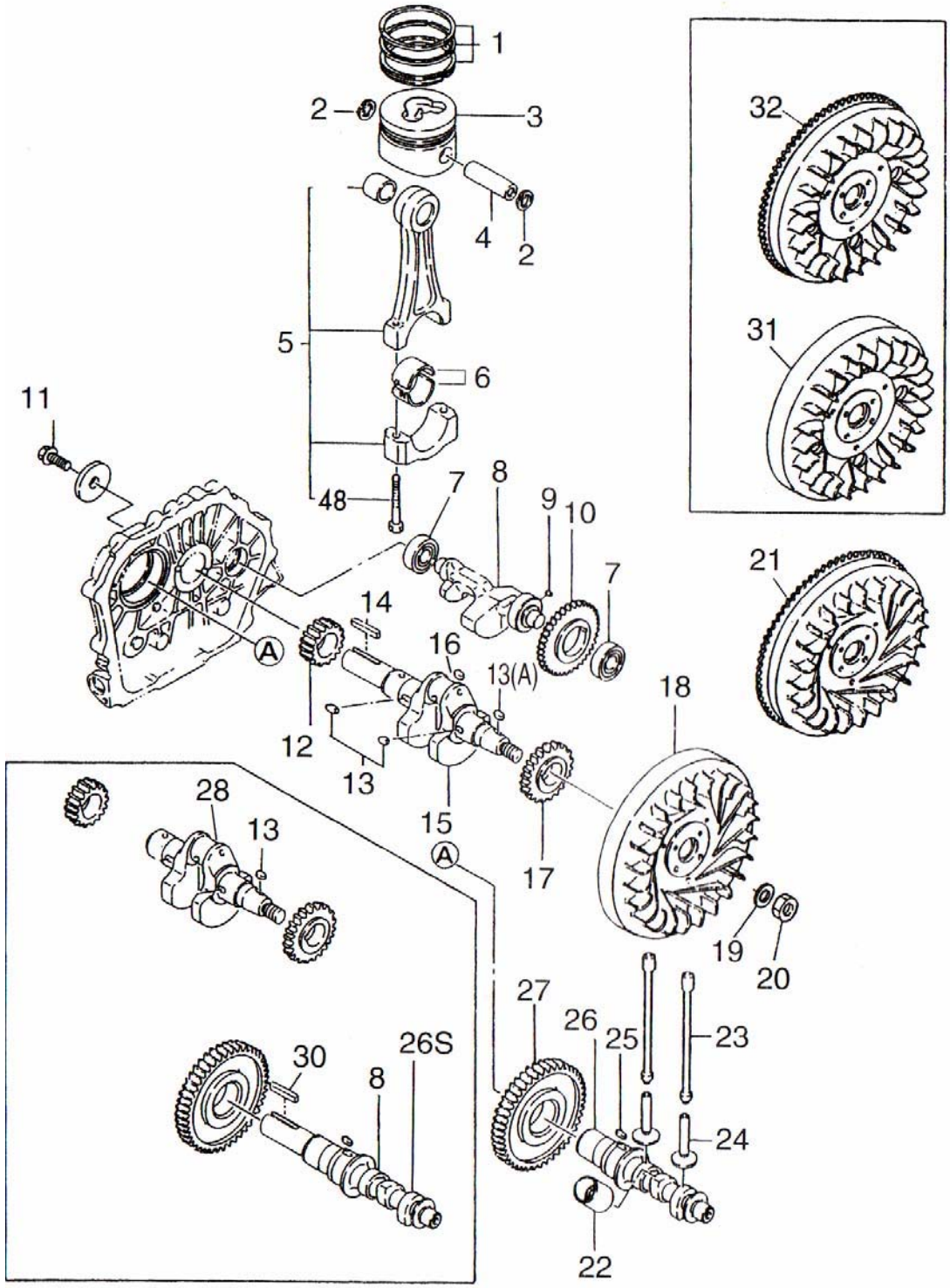
Table 4-3. *Please refer to Fig 4-3 for a complete illustration of the parts.*

No.	Code	Name of Part	Qty each set
1	KS70-1701403	Piston Rings	1
	KS 78-1701402		1
	KS 86-1701404		1
2	KS 70-1701601	Retainer clip of Piston pin Dia. 19mm	2
	KS 78-1701602	Retainer clip of Piston pin Dia. 21mm	2
	KS 86-1701603	Retainer clip of Piston pin Dia. 23mm	2
3	KS 70-1701200	Piston	1
	KS 78-1701202		1
	KS 86-1701204		1
	KS 78FS-1701203		1
4	KS 70-1701701	Piston pin	1
	KS 78-1701702		1
	KS 86-1701703		1
5	KS 70-1701301	Connecting rod	1
	KS 78-1701302		1
	KS 86-1701303		1
6	KS 70-1701501	Connecting rod journal bearing	1
	KS 78-1701502		1
	KS 86-1701503		1
7	KS 70-1710001	Bearing 202 (GB/T276-94)	2
	KS 78-1710001		2
	KS 86-1710000	Bearing 203 (GB/T276-94)	2
8	KS 70-1706501	Balancing Shaft	1
	KS 78-1706502		1
	KS 86-1706503		1
9	KS 1710507	Key 5 x 7 (GB1096-79)	2
10	KS 70-1707701	Balancing Shaft Timing Gear	1
	KS 78-1707702		1
	KS 86-1707703		1
11		Bolt (included with diesel engine)	1
12	KS 70-1700801	Crankshaft timing gear	1
	KS 78-1700802		1
	KS 86-1700803		1
13	KS 70/78-1710512	Key 5 x 12 (GB1096-79)	2
	KS 86-1710512	Key 5 x 12 (GB1096-79)	1
13A	KS 86-1710514	Key 5 x 14 (GB1096-79)	1
14	KS 70-1710530	Key 5 x 30 (GB1096-79)	1
	KS 78/86-1710563	Key 6 x 63 (GB1096-79)	1
15	KS 70-1700601	Crankshaft	1
	KS 78-1700701		1
	KS 86-1700708		1
16	KS 1711601	6 x 8 Plug	1

17	KS 70-1707801	Balancing Shaft Driving Gear	1
	KS 78-1707802		1
	KS 86-1707803		1
18	KS 70-1704400	Flywheel	1
	KS 78-1704404		1
	KS 86-1704409		1
19	KS 70/78-17156	Flywheel nut gasket	1
	KS 86-1715601		1
20	KS 70/78-17155	Flywheel nut	1
	KS 86-1715501		1
21	KS 70-1704501	Flywheel ring gear (for electric starter)	1
	KS 78-1704502		1
	KS 86-1705504		1
22	KS 1704705	Sleeve of fuel pump rod	1
23	KS 70-1705101	Push rod	2
	KS 78-1705102		2
	KS 86-1705103		2
24	KS 70-17157	Tappet	2
	KS 78-17157		2
	KS 86-1715701		2
25	KS 70/86-1710514	Key 5 x 14 (GB1096-79)	1
	KS 78-1710504	Key 4 x 12 (GB1096-79)	1
26	KS 70-1701001	Camshaft	1
	KS 78-1701002		1
	KS 86-1701000		1
26S	KS 78-1701003	Front Side Camshaft	1
27	KS 70-1701101	Camshaft timing gear	1
	KS 78-1701102		1
	KS 86-1701103		1
28	KS 78-1700702	FS crankshaft	1
30	KS 78-1710545	Key 8 x 45 (GB1096-79) camshaft key	1
31	KS 78-1704403	FS Flywheel	1
32	KS 78-1704503	FS flywheel ring gear	1

Note: The included parts with the piston connecting rod are numbers 1,2,3,4,5 and 6
The included parts with the balancing shaft are numbers 8, 9 and 10.
The included parts with the crankshaft are numbers 9, 12, 13, 15 and 17.

Fig 4-3. *Exploded view of Piston / Crank Assembly*



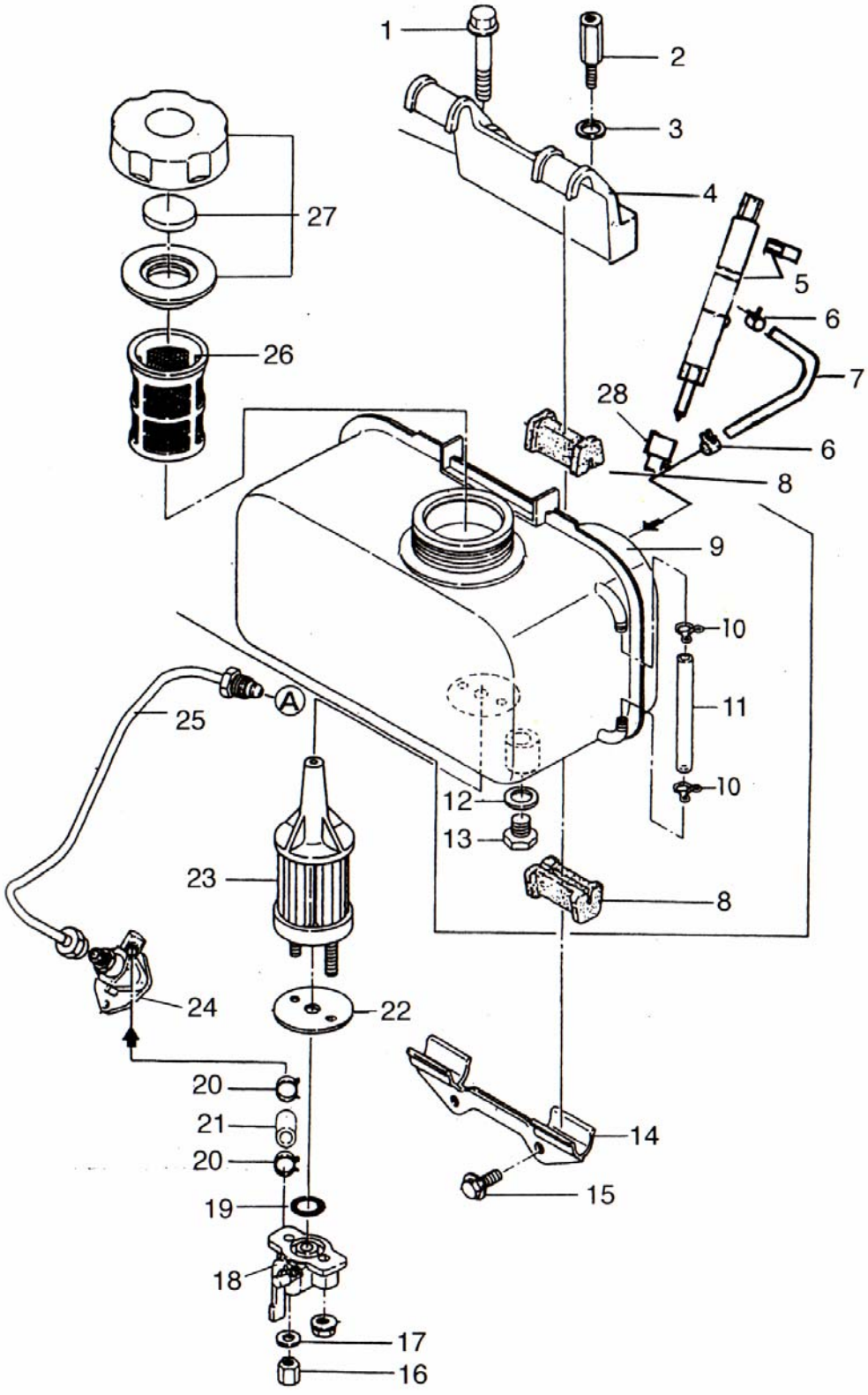
4-4 Fuel System Parts

Table 4-4. *Fuel system parts; please refer to Fig 4-4 for a complete illustration.*

No.	Code	Name of part	Qty each set
1	KS 1710745	M8 x 45 (GB5787-86) Bolt	1
2	KS 17185	Upper fuel tank bracket fastener	1
3	KS 1710208	Flat washer 8 (GB97.1-85)	1
4	KS 70-1705801	Upper fuel tank bracket	1
	KS 78-1705802		1
	KS 86-1705803		1
5	KS 1705301	Injector	1
6	KS 17212	Hose Clamp	2
7	KS 17192	Fuel Pipe	1
8	KS 17184	Rubber fuel tank mount	4
9	KS 70-1704201	Fuel Tank	1
	KS 78-1704202		1
	KS 86-1704203		1
10	KS 17212	Fuel Pipe connectors	2
11	KS 17147	Fuel Pipe	1
12	KS 17151	M6 (GB6177-86) Fuel drain gasket	1
13	KS 17152	Fuel drain plug	1
14	KS 17183	Lower fuel tank bracket	1
15	KS 1710714	M6 x 14 (GB5787-86) Bolt	2
16	KS 1710106	M6 (GB6177-86) Nut	2
17	KS 1710206	M6 (GB97.1-85) Flat washer	1
18	KS 17150	Fuel tank cock assembly	1
19	KS 17154	Flat washer	1
20	KS 1719403	Fuel pipe clamp	2
21	KS 17189	Fuel pipe	1
22	KS 17148	Fuel filter gasket	1
23	KS 70-1704301	Fuel filter assembly	1
	KS 78-1044302		1
	KS 86-1704303		1
24	KS 70-1704702	Fuel injector pump	1
	KS 78-1704702		1
	KS 86-1704700		1
25	KS 70-1705601	High pressure fuel pipe	1
	KS 78-1705602		1
	KS 86-1705603		1
26	KS 17146	Fuel cup filter	1
27	KS 17153	Fuel cap assembly	1
28	KS 1705302	Fuel injector cap	1

Note: The fuel tank assembly comes with numbers 9, 10, 11, 12, 13, 16, 17, 18, 19, 22, 23, 26 and 27.

Fig 4-4. *Exploded view of fuel tank parts*



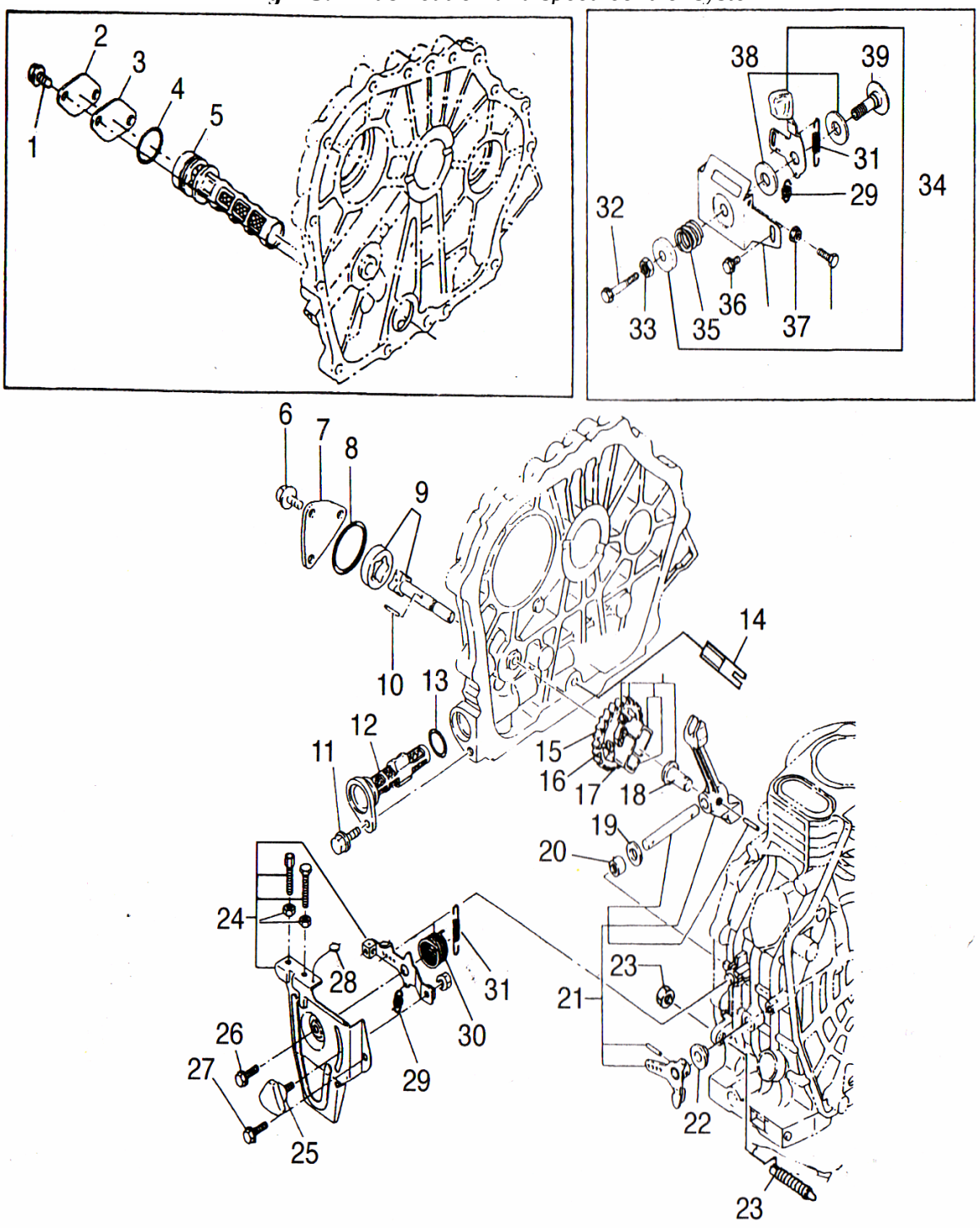
4-5 Oil and speed control system

Table 4-5. *Please refer to Fig 4-5 for a complete illustration.*

No.	Code	Name of part	Qty each set
1	KS 70-1710712	M6 x 12 (GB5787-86) Bolt	2
2	KS 70-17187	Oil filter cover	1
3	KS 70-17188	Oil filter cover gasket	1
4	KS 70-1711314	Sealing Ring 20 x 2.5	1
	KS 78/86-1711316	Sealing Ring 20X2.65	1
5	KS 70-1702101	Oil filter assembly	1
6	KS 1710712	M6 x 12 (GB5787-86) Bolt	3
7	KS 17022	Oil pump cover	1
8	KS 1711334	O ring 34.5 x 1.8 (GB3452.1-82)	1
9	KS 70-17135		1
	KS 78-17135	Oil Pump	1
	KS 86-1713501		1
10	KS 1711103	3 x 16 (GB119-82) pin	1
11	KS 78/86-1710714	M6 x 14 (GB5789-86)	1
12	KS 78/86-1702103	Oil filter cleaning element	1
13	KS 70-1711314	Sealing ring 20 x 2.5	1
	KS 78/86-1711316	Sealing ring 20 x 2.65	1
14	KS 78/86-17080	Oil Guide	1
15	KS 70-1702301	Oil pump driving gear	1
	KS 78-1702302		1
	KS 86-1702302		1
16	KS 17132	Fly block pin	1
17	KS 17131	Fly block	2
18	KS 17234	Governor fork tappet	2
19	KS 17125	Lever shaft gasket	1
20	KS 1710009	Bearing 7941/8 (GB290-64)	1
21	KS 70-1700501	Fork lever assembly	2
	KS 78-1700502		1
	KS 86-1700503		1
22	KS 17124	Washer	1
23	KS 70-17126	Fuel controller parts	1
	KS 78-17126		1
	KS 86-1712601		1
24	KS 17164	Handle bracket	1
25	KS 17167	Speed-control lever	1
26	KS 1710714	M6 x 14 (GB5787-86)	1
27	KS 1710714	M6 x 18 (GB5787-86)	1
28		Lead seal	1
29	KS 17162	Return spring 2	1
30	KS 17161	Return spring 1	1
	KS 70-17160		1

31	KS 78-17160	Speed-control spring	1
	KS 86-1716001		1
32	KS 1710645	M6 x 45 (GB6172-86) Bolt	1
33	KS 1710111	M10 x 1.25 Nut	1
34	KS 1706701	FG Lever	1
35	KS 1706901	FG governor spring	1
36	KS 1710714	M6 x 14 (GB5789-86) Bolt	1
37	KS 1710106	M6 (GB39-88) Nut	1
38	KS 1716801	Washer	2
39	KS 1730720	Shaft Handle	1

Fig 4-5. *Lubrication and speed control system*



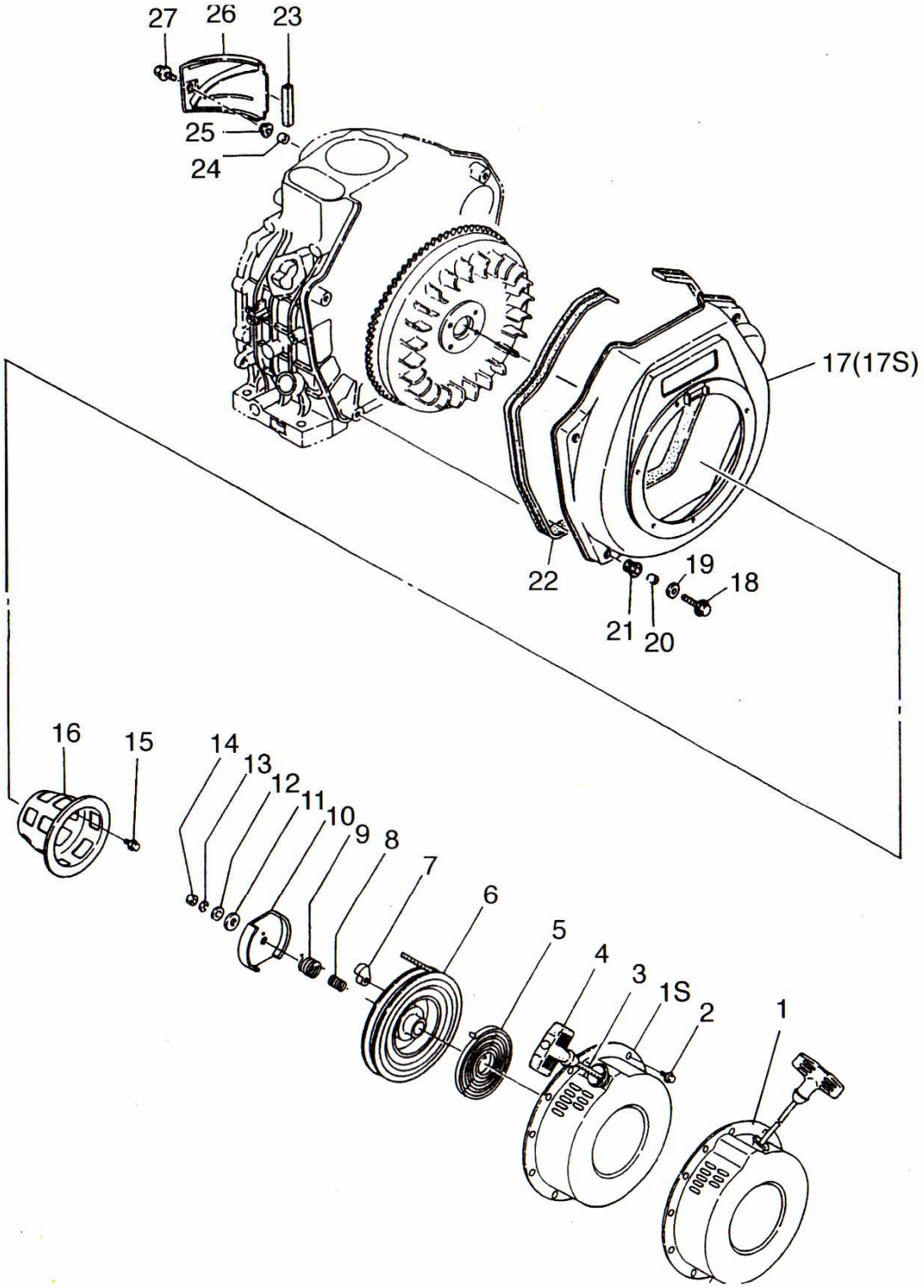
4-6 Cooling and recoil starting system

Table 4-6. *Please refer to Fig 4-6 for illustration.*

No.	Code	Name of part	Qty each set
1	KS 70-1703401	Recoil case assembly	1
	KS 78-1703402		1
	KS 86-1703404		1
1S	KS 78-1703404	178FS case assembly	1
2	KS 1710708	M6 x 8 (GB5787-86)	4
3	KS 70-1703501	Recoil starter rope	1
	KS 78-1703502		1
	KS 86-1703503		1
4	KS 70-1703801	Recoil starter handle	1
	KS 78-1703802		1
	KS 86-1703802		1
5	KS 70/78-1703301	Flat Torsional spring	1
	KS 86-1703303		1
6	KS 70-1703201	Recoil reel	1
	KS 78-1703202		1
	KS 86-1703203		1
7	KS 70-1704003	Starting claw	2
	KS 78/86-1704005		2
8	KS 70-17218	Helical spring	1
	KS 78/86-1721801		1
9	KS 70-17219	Torsional spring	1
	KS 78/86-1721901		1
10	KS 70-1704004	Starting claw plate	1
	KS 78/86-1704006		1
11	KS 70-17039	Friction plate	1
	KS 78/86-1703902		1
12	KS 70-1703903	Friction plate gasket	1
	KS 78/86-1703803		1
13	KS 1710306	Spring washer	1
14	KS 1710106	M6 (GB6170-86) Nut	1
15	KS 1710712	M6 x 12 (GB6170-86)	3 or 4
16	KS 70-1705701	Starter	1
	KS 78-1705702		1
	KS 86-1705703		1
17	KS 70-1704101	Recoil starter cover	1
	KS 78-1704102		1
	KS 86-1704105		1
17S	KS 78-1704106	Recoil starter cover assembly	1
18	KS 78-1710622	M6 x 22 (GB5787-86) Bolt	5
	KS 70/86-1710622		4
19	KS 78-1710207	M6 washer (GB90-85)	5
	KS 70/86-1710207		4

20	KS 78-17145	Collar	5
	KS 70/86-17145		4
21	KS 78-17143	Shock absorber	5
	KS 70/86-17143		4
22	KS 17144	Shock pads	1
23	KS 78/86-17127	Shock isolator	1
24	KS 78/86-17129	Collar	1
25	KS 78/86-17128	Pad	1
26	KS 70-1700401	Wind leading plate	1
	KS 78-1700402		1
	KS 86-1700403		1
27	KS 70-1710712	M6 x 12 (shaped piece) Bolt	1
	KS 78-1710718	M6 x 18 (shaped piece) Bolt	1
	KS 86-1710614	M6 x 22 (shaped piece) Bolt	1

Fig 4-6. *Exploded view of cooling and recoil starting system.*



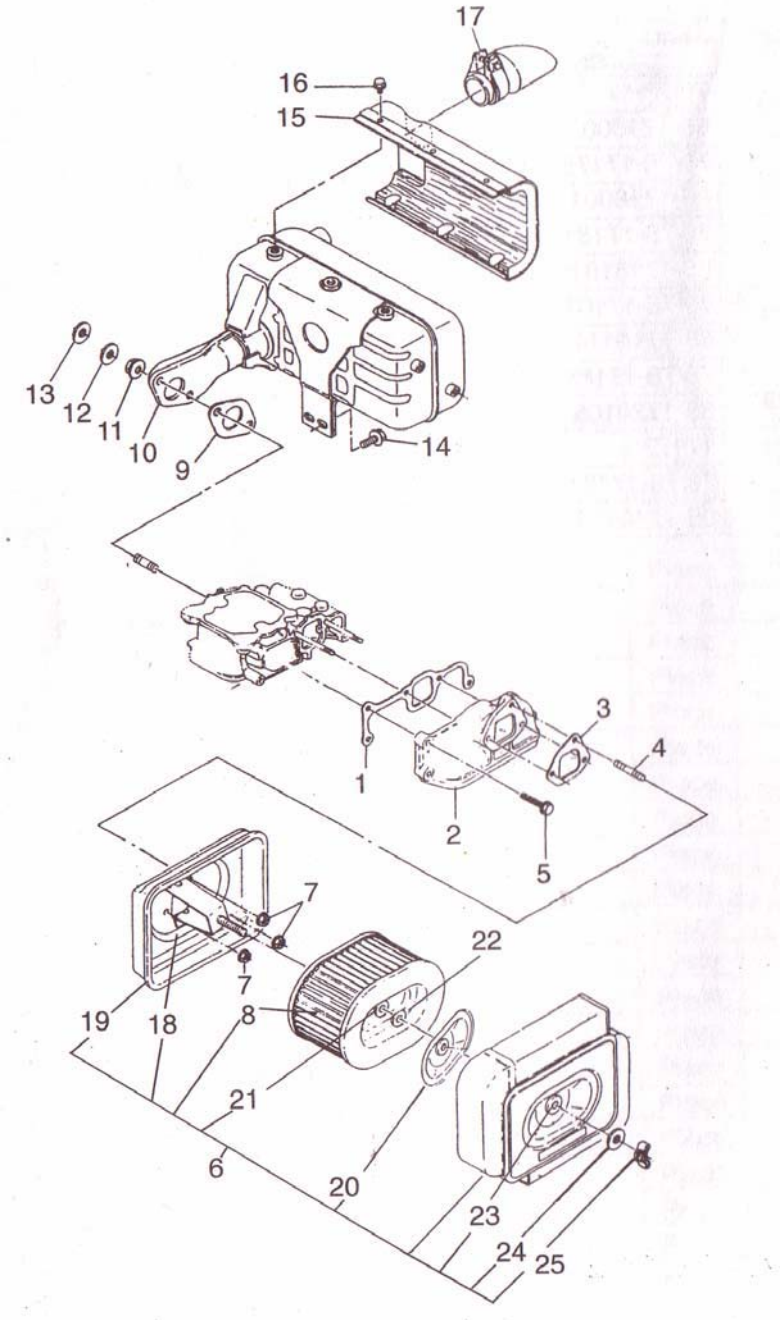
4-7 Air cleaner and silencer system

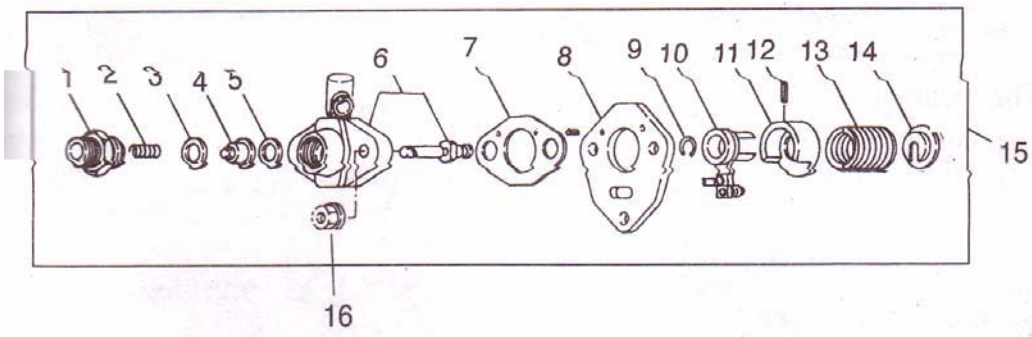
Table 4-7. *Please refer to Fig 4-7 for a complete illustration.*

No.	Code	Name of part	Qty each set
1	KS 70-1703101	Intake pipe gasket	2
	KS 78-1703102		1
	KS 86-1703103		1
2	KS 70-1703001	Intake pipe	1
	KS 78-1703002		1
	KS 86-1703003		1
3	KS 70/78-17175	Air cleaner gasket	3
	KS 86-1717501		1
4	KS 17137	Bolt	1
5			1
	KS 1710722	M6 x 22 (GB5789-86) Shaped bolt	1
			1
6	KS 70/78-17174		1
	KS 86-1717401	Air filter assembly	1
7	KS 1710103	M6 (GB6177-86) Nut	1
8	KS 70/78-1717602	Air filter element	1
	KS 86-1717601		1
9	KS 70/78-17186	Muffler gasket	1
	KS 86-1718601		1
10	KS 70-1705401	Muffler assembly	1
	KS 78-1705402		1
	KS 86-1705403		1
11	KS 1710208	Flat washer Dia. 8	2
12	KS 1710308	Spring washer Dia. 8	2
13	KS 1710108	M8 (GB6170-86) Nut	1
14	KS 70-1710714	M6 x 14 (GB5789-86) Bolt	2
	KS 78/86-1710757	M8 x 14 (GB5789-86) Bolt	2
15	KS 70-1705501	Muffler screen cover	1
	KS 78-1705502		1
	KS 86-1705503		1
16	KS 1710708	M6 x 14 (GB5789-86) Bolt	1
17	KS 70/78-1705404	Muffler tail pipe	1
	KS 86-1705406		1
18	KS 70/78-17179	Inner shock proof sealing ring	1
	KS 86-1718002		1
19	KS 70/78-17180	Bottom case assembly of Air Cleaner	1
	KS 86-1718003		1
20	KS 70/78-17178	Outer shock proof sealing ring	1
	KS 86-1718001		1
21	KS 70/78-17181	Air filter shock absorber	1
	KS 86-1718101		1
22	KS 70/78-1710103	Collar (GB6177-86)	1
	KS 86-1720106	Collar (GB6177-86)	1

23	KS 70/78-17182	Air filter shock absorber	1
	KS 86-1720106		1
24	KS 17177		1
25	KS 70/78-1710107	M6 butterfly nut	1
	KS 85-1710109	M8 butterfly nut	1

Fig 4-7. *Exploded view of muffler assembly*





1.Delivery holder
2.Delivery spring
3.Deliveny grasket
4.Delivey valve
6.Plunger
7.Adjusting gasket
8.Connecting plate of pump body
9.Circlip
10.Control lever Assem
11.Spring seat I
12.Pin of sleeve
13.Fuel injection pump
14.Fuel injection pump spring
15.Fuel pump assembly
16.Nut M6

CHAPTER 5 ENGINE TROUBLESHOOTING

5-1 Engine is not starting

Possible Cause	Remedy
Weather is cold. Engine oil may have become overly adhesive.	Put engine oil into crankcase after preheated. Put engine oil into the inlet manifold. Disconnect the belts to the engine and run engine under no load conditions until the engine becomes hot. Then connect the belts back and start the engine again.
Fuel system may be contaminated with water.	Clean the fuel filter and fuel pipe, and then replace the fuel with new fuel.
The fuel has thickened and does not permit easy flow.	Use the correct specific fuel.
There is air in the fuel system.	Drain out the air and fuel and tighten the connectors of the fuel pipe.
Very little fuel injected into cylinder or the injected spray is bad.	Check the position of the speed governor handle and clean the fuel injector spray nozzle. Check the fuel pump and change the pump or fuel nozzle if necessary.
Incomplete combustion	The spray nozzle may be bad, or the delivery angle may be incorrect. The gasket of the cylinder head may be leaking and the pressure of compression is not held. Fix each component that is necessary to achieve correct compression and a correct angle of spray.
Fuel delivery is not constant	Fuel level in fuel tank may be to low. Fill the fuel tank until it is full. Or the fuel pipe or fuel filter may be clogged, fix this by replacing them.
Low compression	Replace head gasket or tighten the cylinder head bolts in a diagonal line pattern. If changing the head gasket, tighten the cylinder head bolts once again after running the engine.
Piston rings worn leading to low compression	Change the piston rings.
Piston ring gaps may all be set up in a line	Make sure each piston ring gap is off by an angle of 120 degrees from each other.
Piston rings are stuck or broken	Clean the rings and cylinder with diesel fuel and or replace the rings if necessary.
Gas valves are leaking	Grind the gas valves, if the vestige is too deep, please send it to the factory for replacement
Incorrect valve clearance	Adjust the clearance as specified in the technical specifications chart.
The valve stem is clipped on the guide pipe	Disassemble the gas valve and clean the stem and guide pipe.

5-2 Diesel engine lacks power

Possible Cause	Remedy
Fuel system clogged. Clogged fuel line or clogged fuel filter.	Clean fuel filter and fuel pipe. Check the fuel switch, it should be opened fully.
Fuel pump is bad.	Service or change the damaged parts of the fuel pump.
Nozzle not operating correctly or incorrect injection pressure.	Adjust the injection pressure.
Carbon deposits in the spray hole.	Clean out the spray hole.
Adhered needle valve.	Clean or change needle valve.
Fitting between the needle valve and needle valve body is too loose.	Change the needle valve or needle valve body.
Air filter is dirty.	Disassemble the air filter assembly and clean the core and air filter.
Engine may be to slow.	Check the speed of the tachometer. Adjust the high speed limiting screw.

5-3 Engine stops automatically

Possible cause	Remedy
No fuel in system.	Add fuel to the fuel tank.
Fuel line is clogged.	Clean out fuel line.
There is air in fuel system.	Clean out the system and put new fuel in.
Needle valve of nozzle adhered.	Clean or grind the nozzle if necessary replace the nozzle.
Air filter is clogged.	Clean the air filter.
The load suddenly increases.	Decrease the load.

5-4 Engine exhaust very black

Possible cause	Remedy
Overloaded engine	Decrease the load. If driven machine is not properly fitted with proper engine, change the engine.
Bad fuel injection.	Check the fuel injection pressure and spraying conditions. Correct or replace the nozzle.
Not enough intake air or problems with leaking air.	Clean the air filter and check to see what the cause of the leak is and fix as necessary.

5-5 Engine exhaust very blue

Possible cause	Remedy
Engine oil in the cylinder.	Check the oil level and drain out unnecessary engine oil.
Piston ring worn or piston ring gaps are all aligned to permit oil to travel up into combustion chamber.	Check or change the piston rings and make sure the gaps are not all aligned.
Worn piston or worn cylinder.	Replace as necessary.
Valve and or valve guide worn.	Change the valve or valve guide as necessary.

ETQ

OWNER'S MANUAL

Air-cooled diesel engine generator set

DG4LE / DG6LE

PREFACE

Thank you for purchasing products from EASTERN TOOLS & EQUIPMENT, INC. 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 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 of the following features:

- Lightweight construction
- Air cooled
- Four-stroke diesel internal combustion engine
- Direct fuel injection system
- Recoil starter or an optional electric starter
- Large fuel tank
- Automatic voltage stabilizer
- NFB circuit protector
- AC and DC outputs
- Low oil pressure sensor

The ETQ 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. Eastern Tools and Equipment, Inc. reserves the right to make changes at any time without notice and without incurring any obligation.***

TABLE OF CONTENTS

1. Overall view of DG3LE series

2. Overall view of DG4LE series

3. Overall view of DG6LE series

4. Overall view of DG6LE-3P series

CHAPTER 1. TECHNICAL SPECIFICATIONS AND DATA

Technical specifications in SI units

Item \ Model			3LE Series	4LE Series	6LE Series	6LE-3P Series
Generator	Generator Type		Single phase AC generator			Three phase
	Frequency (Hz)		60	60	60	60
	Rated power (Kw)		2.8	4.0	6.0	5.0
	Cont. power (kW)		2.6	3.5	5.5	4.5
	Voltage (AC) (V)		120 / 240			
	Voltage (AC) (V)		12			420/240
	Current (DC) (A)		8.3			
	Speed (rpm)		3600	3600	3600	3600
	Power factor (cos φ)		1.0			0.8
	Phase type		Single-phase			
	Number of poles		2			
	Excitation		Self-excitation voltage			
	Insulation		B			
Diesel Engine	Engine model		ETQ170FG	ETQ178FG	ETQ186FG	ETQ186FG
	Type		Single-cylinder, vertical, 4-stroke, air-cooled, direct injection			
	Output	Continuous (kw)	2.98	4.40	6.6	6.6
		Maximum (kw)	3.36	4.9	7.34	7.34
	Bore x Stroke (mm)		70 x 55	78 x 62	86 x 70	86 x 70
	Displacement (cc)		219	306	418	418
	Cooling system		Forced air cooling by flywheel fan			
	Lubricating system		Pressure splash, duplex type lubrication			
	Lube-oil capacity		.75	1.1	1.65	1.65
	Starting system		Recoil manual start / Electric start (optional)			
	Fuel tank capacity (L)		15	15	15	15
	Dry weight		53	96	119	119
	Dimensions (LxWxH) (mm)		690x470x555	690x470x555	740x500x590	740x500x590

Technical specifications in English units

Item \ Model			3LE Series	4LE Series	6LE Series	6LE-3P Series
Generator	Generator Type		Single phase AC generator			Three phase
	Frequency (Hz)		60	60	60	60
	Rated power (HP)		3.75	5.36	8.04	6.7
	Cont. power (HP)		3.49	4.69	7.37	6.04
	Voltage (AC) (V)		120 / 240			
	Voltage (AC) (V)		12			420/240
	Current (DC) (A)		8.3			
	Speed (rpm)		3600	3600	3600	3600
	Power factor (cos φ)		1.0			0.8
	Phase type		Single-phase			
	Number of poles		2			
	Excitation		Self-excitation voltage			
	Insulation		B			
Diesel Engine	Engine model		ETQ170FG	ETQ178FG	ETQ186FG	ETQ186FG
	Type		Single-cylinder, vertical, 4-stroke, air-cooled, direct injection			
	Output	Continuous (HP)	4.0	5.9	8.85	8.85
		Maximum (HP)	4.5	6.6	9.85	9.85
	Bore x Stroke (in)		2.76 x 2.17	3.01 x 2.44	3.39 x 2.76	3.39 x 2.76
	Displacement (cu. in)		13.36	18.67	25.51	25.51
	Cooling system		Forced air cooling by flywheel fan			
	Lubricating system		Pressure splash, duplex type lubrication			
	Lube-oil capacity (oz)		25.34	37.17	55.75	55.75
	Starting system		Recoil manual start / Electric start (optional)			
	Fuel tank capacity (USgal)		3.96	3.96	3.96	3.96
	Dry weight (lb)		116	212	263	263
	Dimensions (LxWxH) (in)		27.2x18.5x21.9	27.2x18.5x21.9	29.1x19.7x23.2	29.1x19.7x23.2

1-2 Basic operating parameters

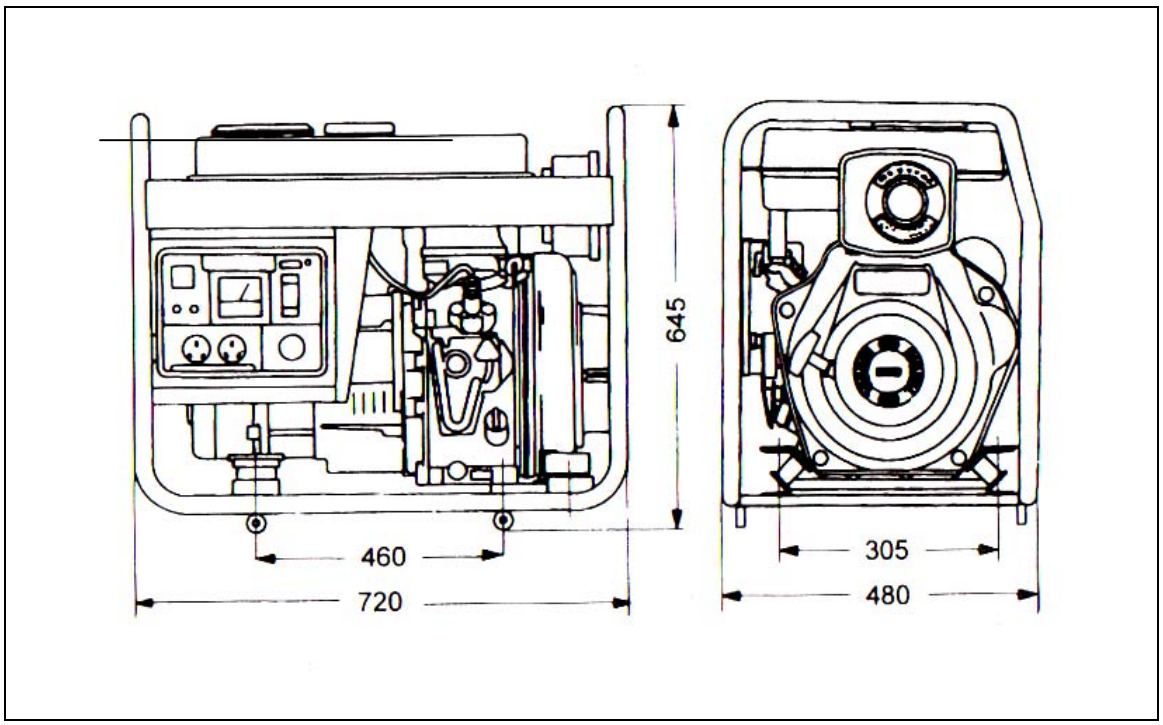
1-1.1 Under the given conditions, the generator will output the specified power in the table listed below.

Table 1.

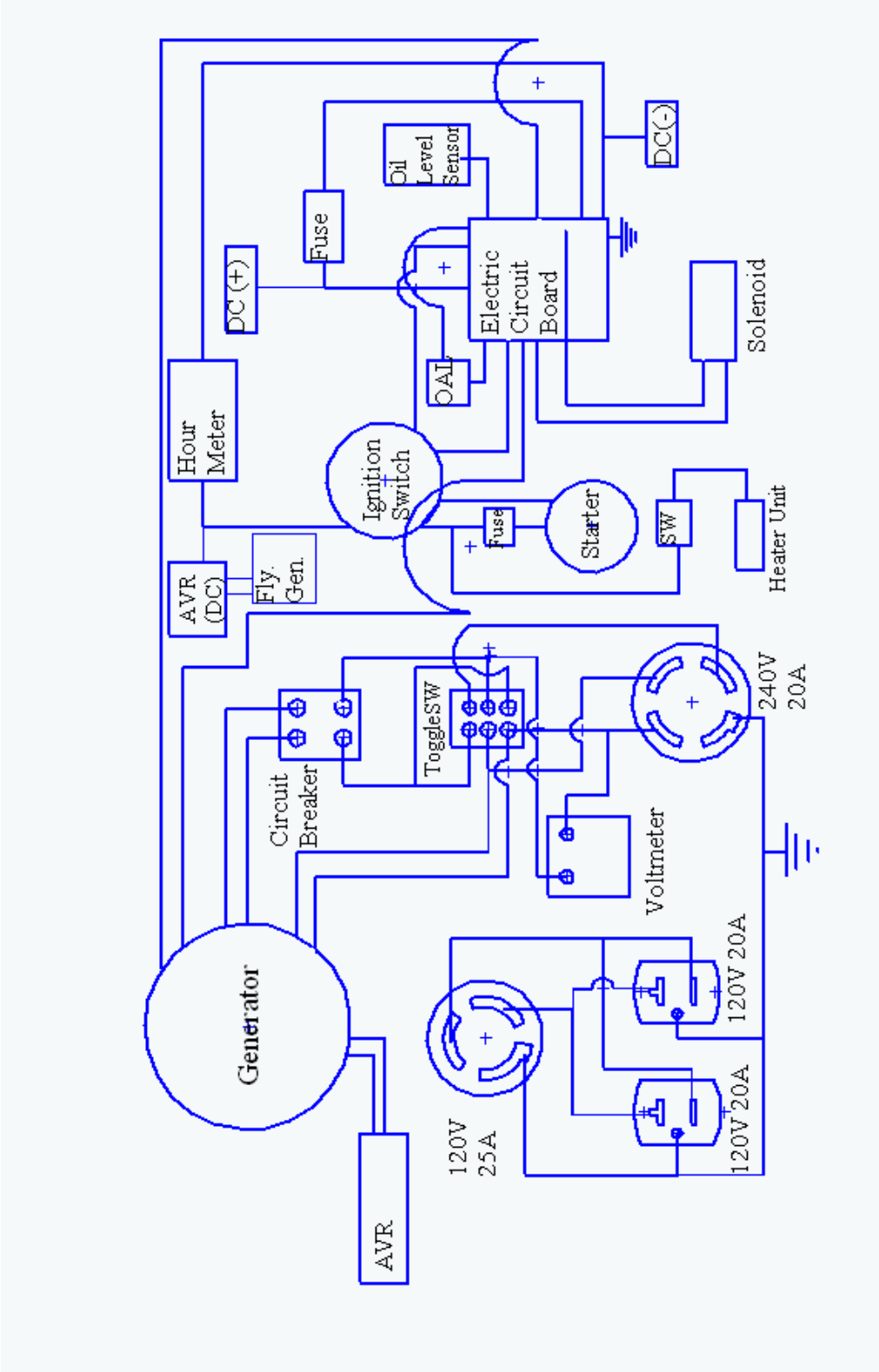
Height above sea level (ft)	Ambient temperature (^{o}F)	RH
0	+60 (+20 ^{o}C)	60%
<3280.8 (<1000 m)	41~104 (5-40 ^{o}C)	90%

1-3 General dimensions and overview of the generators

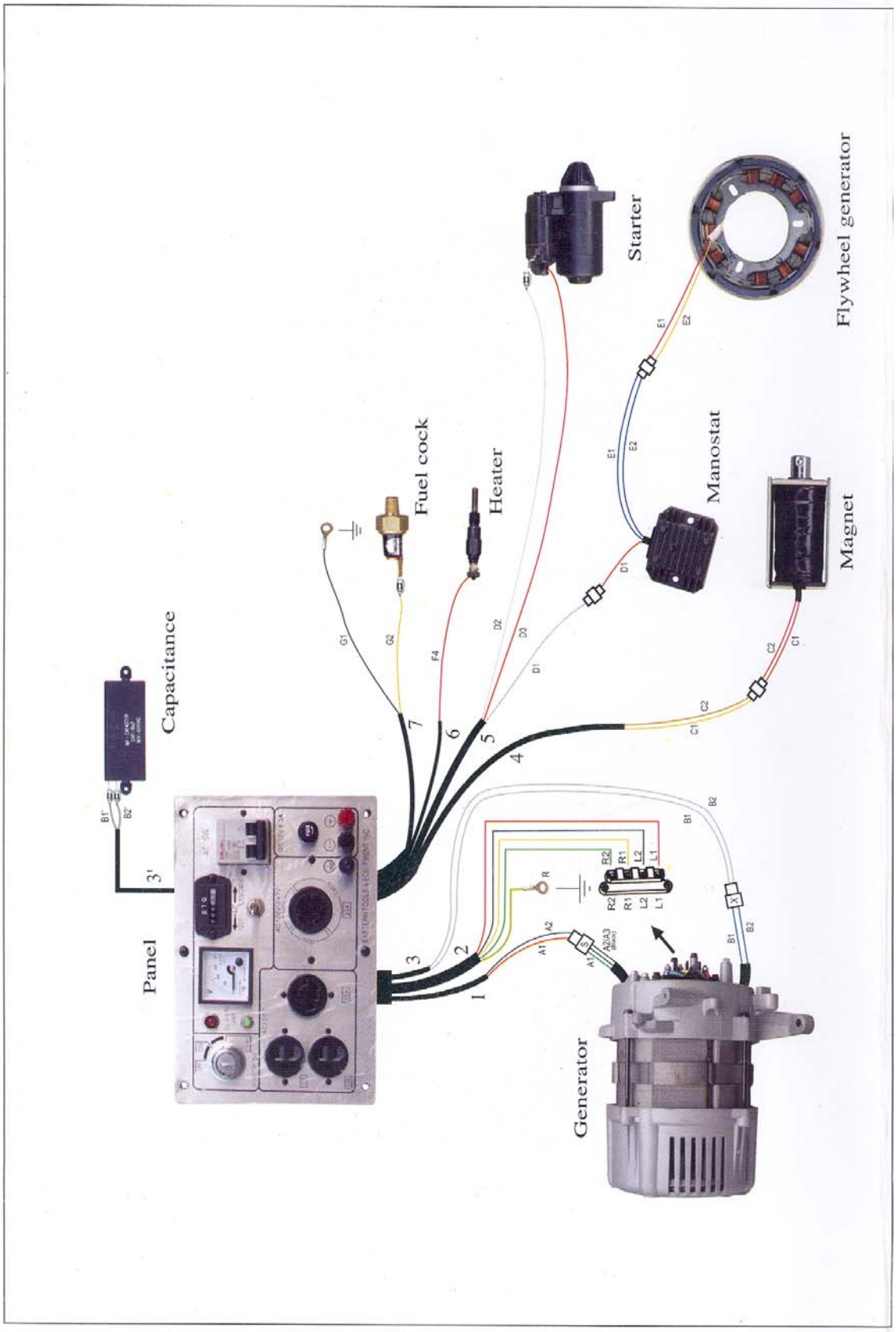
1-3.1 General dimensions of the LN series generators

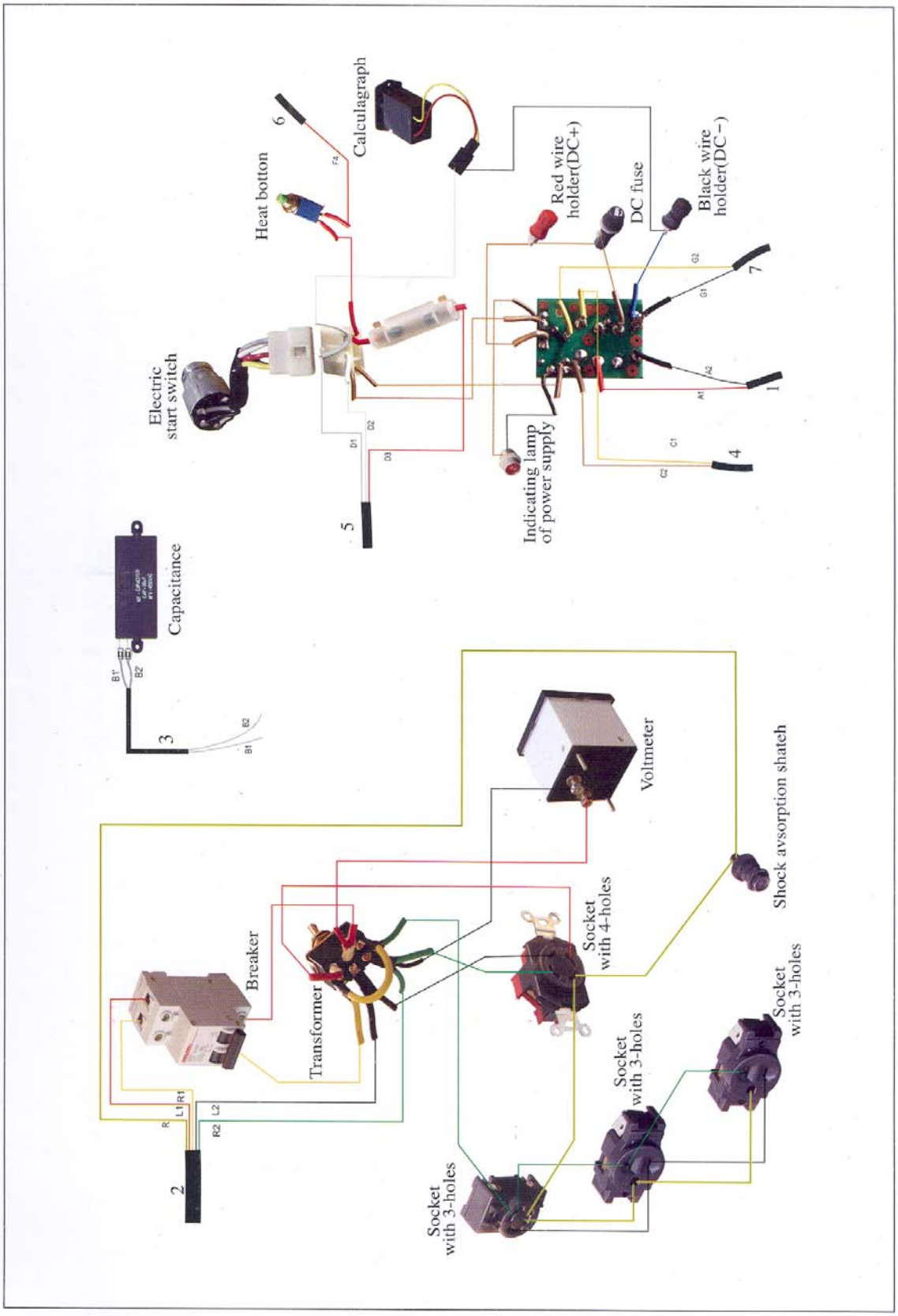


1-4 Electric wiring diagrams for various models of generators



Wiring diagrams for the LE models


Flywheel generator
Starter
Manostat
Magnet
Fuel cock
Heater
Capacitance
Panel
Generator


Calculagraph
Heat botton
Red wire holder(DC+)
DC fuse
Black wire holder(DC−)
Electric start switch
Indicating lamp of power supply
Capacitance
Voltmeter
Shock avsorption shateh
Breaker
Transformer
Socket with 4-holes
Socket with 3-holes
Socket with 3-holes
Socket with 3-holes

CHAPTER 2 OPERATING THE DIESEL GENERATOR

2-1 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. Doing so otherwise may lead to accidents and or equipment damage.

2-1.1 Fire prevention

The proper fuel for the diesel generator set is light diesel fuel. Do not use gasoline, kerosene and or other fuels other than light diesel fuel. Keep all flammable fuels away from the generator as the generator 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 and 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 failure of the engine.

2-1.2 Prevention from inhaling exhaust gases

Never inhale exhaust gases emitted by the engine. The exhaust gases contain toxic carbon monoxide. 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.

2-1.3 Prevention from accidental burns

Never touch the muffler and its cover when the diesel engine is running. Never touch the muffler and cover after the diesel engine has been used, as the muffler remains hot for a good period of time.

2-1.4 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 if the weather conditions call for any type of precipitation such as rain, snow, or fog. To prevent electrical shocks, the generator should be grounded. Use a lead to connect the grounding end of the generator to the grounding surface of choice. Please refer to Fig. 2-1 and Fig. 2-2 before beginning to use the electric generator.

Fig 2-1

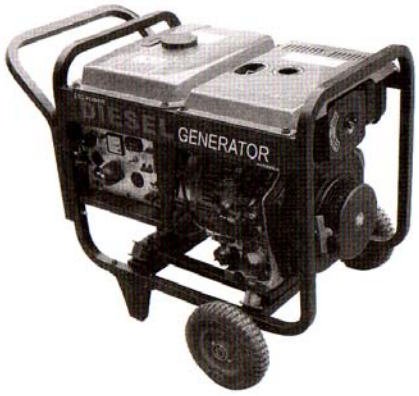
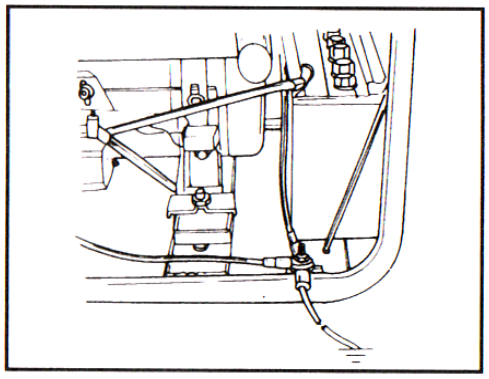


Fig 2-2



Note: When connecting devices to the generator, make sure all other devices are rated lower than the generators output. Any generator socket should not be overloaded over its regulated limit

2-1.5 Other safety points

Before operating this generator, all operators should have a good knowledge of how to break the circuit if any accidents occur. Also, all operators should be familiar with all the switches and functions of the generator before using this machine. While operating the generator, wear safe shoes and suitable clothes during operation. Always keep children and animals away from the generator.

2-1.6 Battery

The electrolytic liquid of the battery also known as battery acid contains sulfuric acid. In order to protect your eyes, skin, and clothing, wear protective gear when working with the battery. If you come in contact with the electrolytic liquid, wash it immediately with clean water. Also, if the electrolytic liquid comes in contact with your eyes, see a doctor immediately.

2-2 Preparation before operation

2-2.1 Fuel choices and fuel treatment

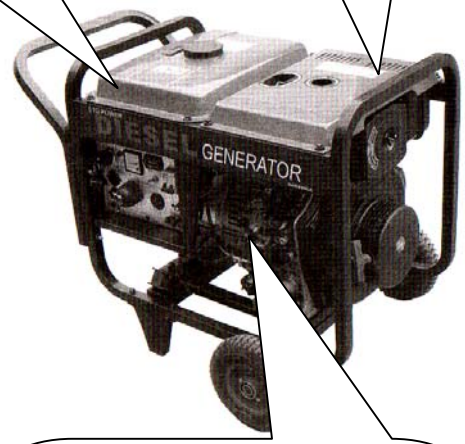
Fuel tank

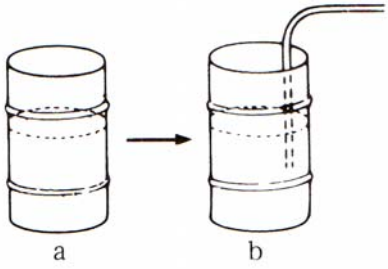
Use only light diesel fuel. The fuel should be filtered clean. Never let dust and water mix with fuel in the fuel tank. Otherwise it will clog the fuel lines and oil nozzles. It may also damage your pressure pump.

Note: It is dangerous to overfill the fuel tank. Never exceed the red piston in the filter.

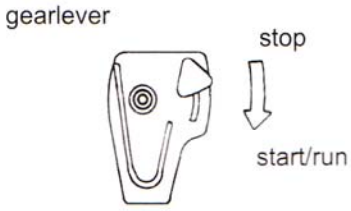
Air filter element

Do not wash the air filter. The element is made of dry material, which does not permit washing. When the output of the diesel engine is bad or the color of the exhaust gas is abnormal, replace the air filter element. Never start the diesel engine without the air filter.





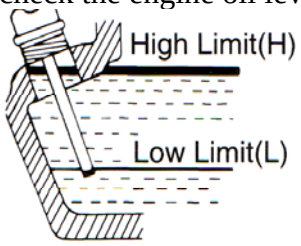
a. After purchasing fuel, put it into a drum and let it sit for 3-4 days.
b. 3-4 days later, insert half of the fuel sucker into the drum, (water and impurities stay in the lower portion of the drum)



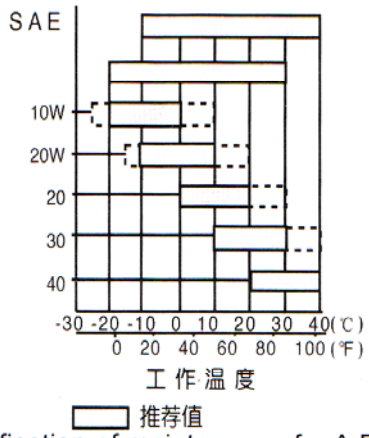
Note:
Never smoke near the opening of the fuel tank. Do not let sparks get near the fuel or fuel tank and do not overfill tank. After filling, tighten the fuel cap.

2-2.2 Filling engine oil

Remove the dipstick from the engine Make sure the generator is on level ground, and fill the engine with 15W40 engine oil. Put the dipstick back into the hole to check the engine oil level.

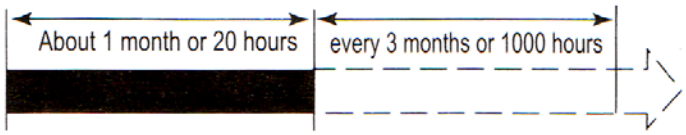


Capacity \ Model	186FG
Litre (British Gal)	1.65 (0.36)



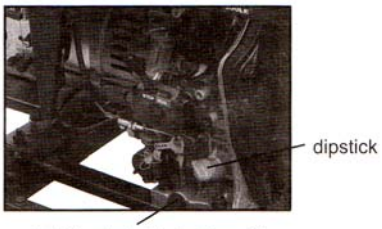
Classification of maintenance for A.P.I. diesel engine
The lubricating oil must be CC or CD grade.

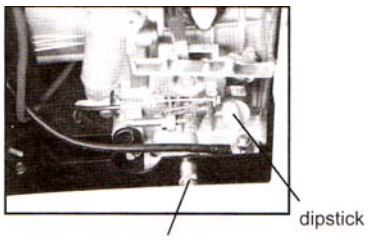
Engine oil is the most important factor in determining the life of your generator engine. If you use poor engine oil or if you don't change the oil regularly, the piston and cylinder will wear easily or seize up. Also, the life of the other parts in your engine such as bearings, and other rotating parts will shorten considerably.



Time to change engine oil

Although there is an alarm system to check for low oil pressure, it is always a good idea to check the amount of oil inside the engine. If the oil level is low, fill it before starting the engine. A good time to drain the oil from the engine is when the diesel engine is still hot. If the engine is fully cooled, it is more difficult to drain all the oil out or some impurities will remain in the engine.

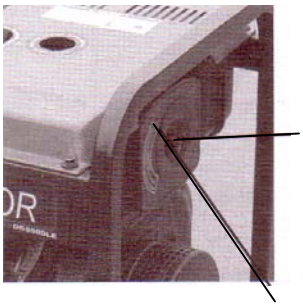




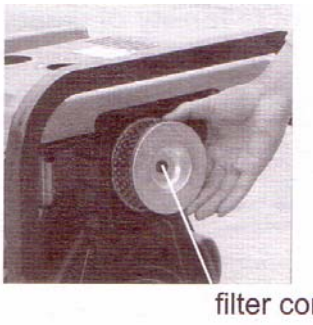
Warning: Don't fill engine oil when diesel is operating.

2-2.3 Checking the air filter

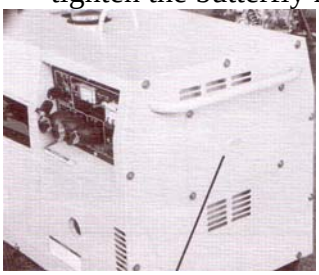
(1) Loosen the butterfly nut, take the cover of the air filter off and take the air filter element out.



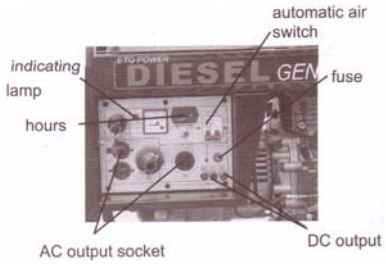
Do not use detergent to wash the air filter element. When the performance of the engine decreases or when the color of the exhaust gases is bad, exchange the filter element. Never start the engine without the air filter as foreign objects may enter the intake and damage the engine.



(2) After replacing the air filter element, replace the cover and tighten the butterfly nut firmly.



2-2.4 Checking the generator welder



(Note: Only certain welder generator sets have an electric fan incorporated on them.)

Before starting the generator, make sure the air switch is in the "Off" position. Starting the generator with the switch in the "On" switch is very dangerous.

The generator should be grounded in order to prevent electric shock.

Use dry compressed air (with pressure about 1.96 x 105 Pa) to blow the dust out in the electric control cabinet and at the surface of the generator. Check to see how clean the surface of the sliding ring is. Check the pressure of the carbon brush. Also, check whether the position of the carbon brush at the slide rig is correct and the fixture is reliable with a good contact.

According to the electric wiring diagram, check to see whether the connecting wire is correct and the connected place is firm.

Use a 500 M Ω meter to measure the insulation resistance of the electrical part. The resistance should be no less than 5M Ω. When measuring devices, make sure the AVR is turned off. Otherwise, it will burn the AVR. (For the low noise set, the inspection may not be performed).

2-2.5 The fuel and oil in a new engine is drained before sold.

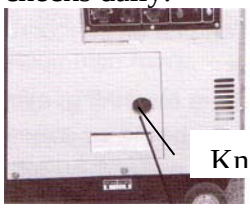
Before you start the engine, please fill the fuel tank and engine oil first. Then, check to see if there are air bubbles in the engine. If there are, follow these procedures. Loosen the connecting nut between the oil injection pump and oil pipe. Bleed the air from the system until there are no more bubbles. Then replace the connecting nut and tighten it.

2-3 Checking the operation of the diesel engine

2-3.1 Low-pressure alarm system. ETQ diesel engines have a low-pressure sensor system where if the oil pressure drops too low, the sensor will shut the engine off. The purpose of having this system is to ensure that the engine does not seize up. If there is not enough oil in the engine, the temperature of the oil will be raised too high. On the contrary, if there is too much oil in the engine, the engine oil can slow the engine down considerably.

2-3.2 How to open the case door/cover

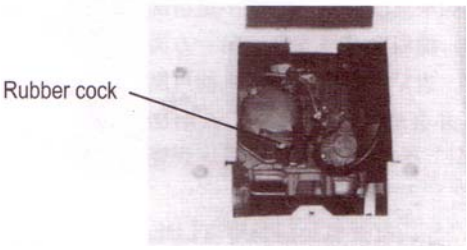
(1) Open the case door: turn the handle counterclockwise and open the door. Do these checks daily.



(2) Loosen the outer cover bolt of the air filter and outer cover of the oil nozzle, and then check the air filter.

(3) Check the outer cover of the oil nozzle. Loosen the butterfly nut and open the outer cover.

butterfly nut and open the outer cover.



2-3.3 Engine break in

When you purchase a brand new engine, the engine must be properly broken in. The break in period is about 20 hours.

(1) Avoid overloading the engine when brand new

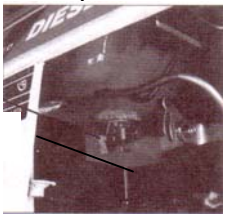
(2) Change the engine oil according to specifications. An oil change for a brand new engine is about 20 hours or every month, an older engine, the oil change is about 100 hours or three months.

2-4 Starting the generator set

2-4.1 Manual starting.

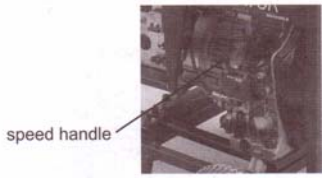
Start the engine in accordance with procedures below:

(1) Put the fuel switch in the "On" position.



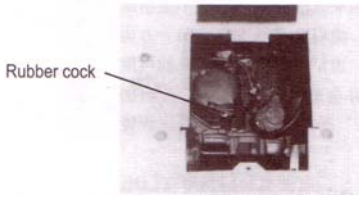
(2) Turn the handle of the engine to the "RUN"

position.



(3) Pull the recoil starter handle out until you feel resistance. It will reset to its original position automatically. The handle should be reset into its recoil device slowly to prolong the life of the engine starter.

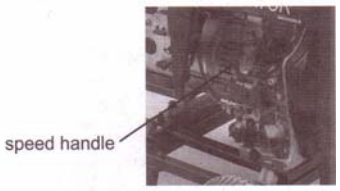
(4) In cold climate, it is difficult to start the engine. To remedy this, pull the rubber plug out from the rocker of the diesel engine and fill 2 ml of engine oil. Before starting, put the rubber plug back in place. If you don't put the rubber plug back in place, rain, dust and other dirt can enter into the diesel engine. It will cause the parts inside the diesel engine to wear quickly and lead to engine failure.



2-4.2 Electric starting

The procedures for preparing to start the engine are the same as the manual starting engine.

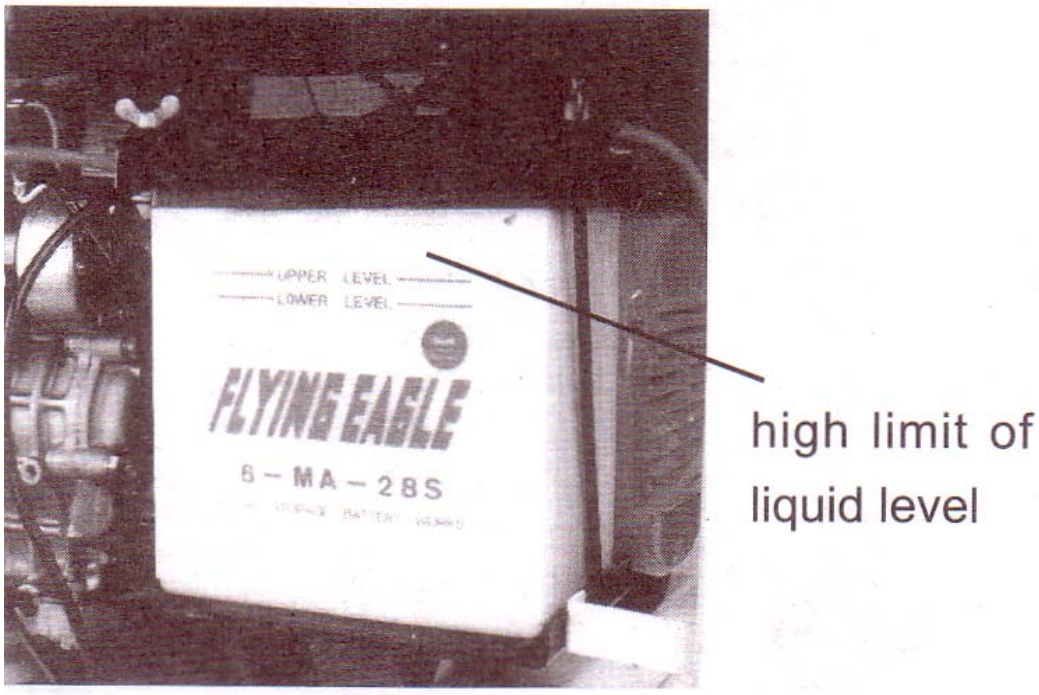
1. Insert key into ignition and put it in the "off" position.
2. Put the speed handle in the "Run" position.
3. Turn the start switch clockwise to the "START" position; (to set the silent type, first turn it clockwise to the "RUN" (ON) position for 1-2 seconds. The electromagnetic iron will be triggered, now turn it clockwise to the "START" position.
4. After the diesel engine is started, remove your hand from the switch handle; the switch will automatically reset itself to the "ON" position.
5. If the engine is not starting after 10 seconds of cranking, wait about 15 seconds before trying it again. If you crank to long, the voltage of the battery will drop. This can lead to improper ignition. When the diesel engine is operating, let the ignition retain on the "ON" position.



Note:
If you crank the starter to long, the battery may be drained too much to provide enough energy for proper engine ignition. Also, when the diesel engine is operating, let the key retain in the "ON" position.

2-4.3 Battery

Important Notice: All of our units come with a dry battery for shipping safety purposes. In order to get your generator started for the first time; the battery must be filled with battery acid which can be purchased at a local automotive supply store and slowly charged (trickle charged) for a day. After charging, the battery may be used. To properly maintain your 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 the high mark. If there is not enough battery acid, then the diesel engine cannot be started. It is important to keep the liquid level between the high and low limits.

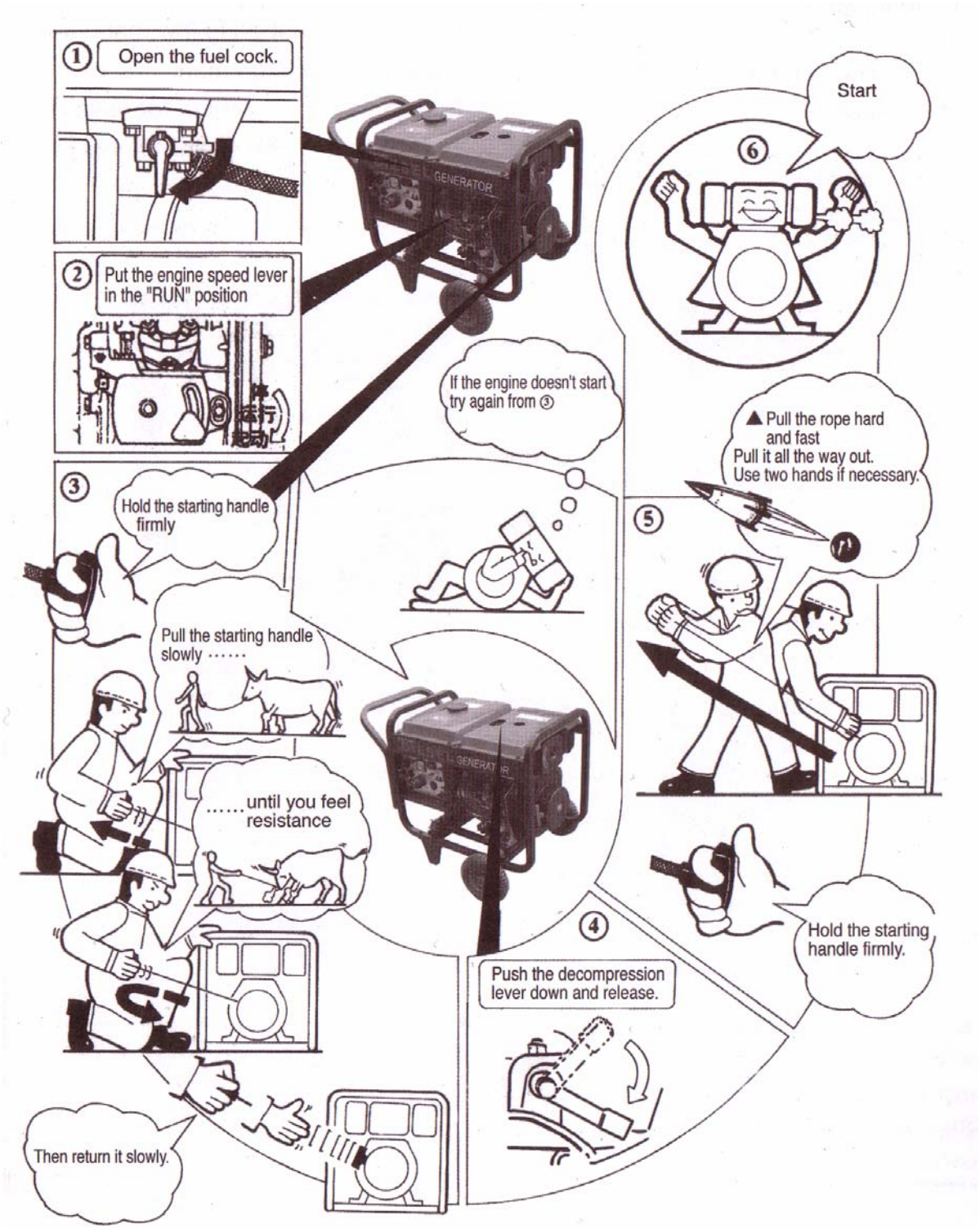


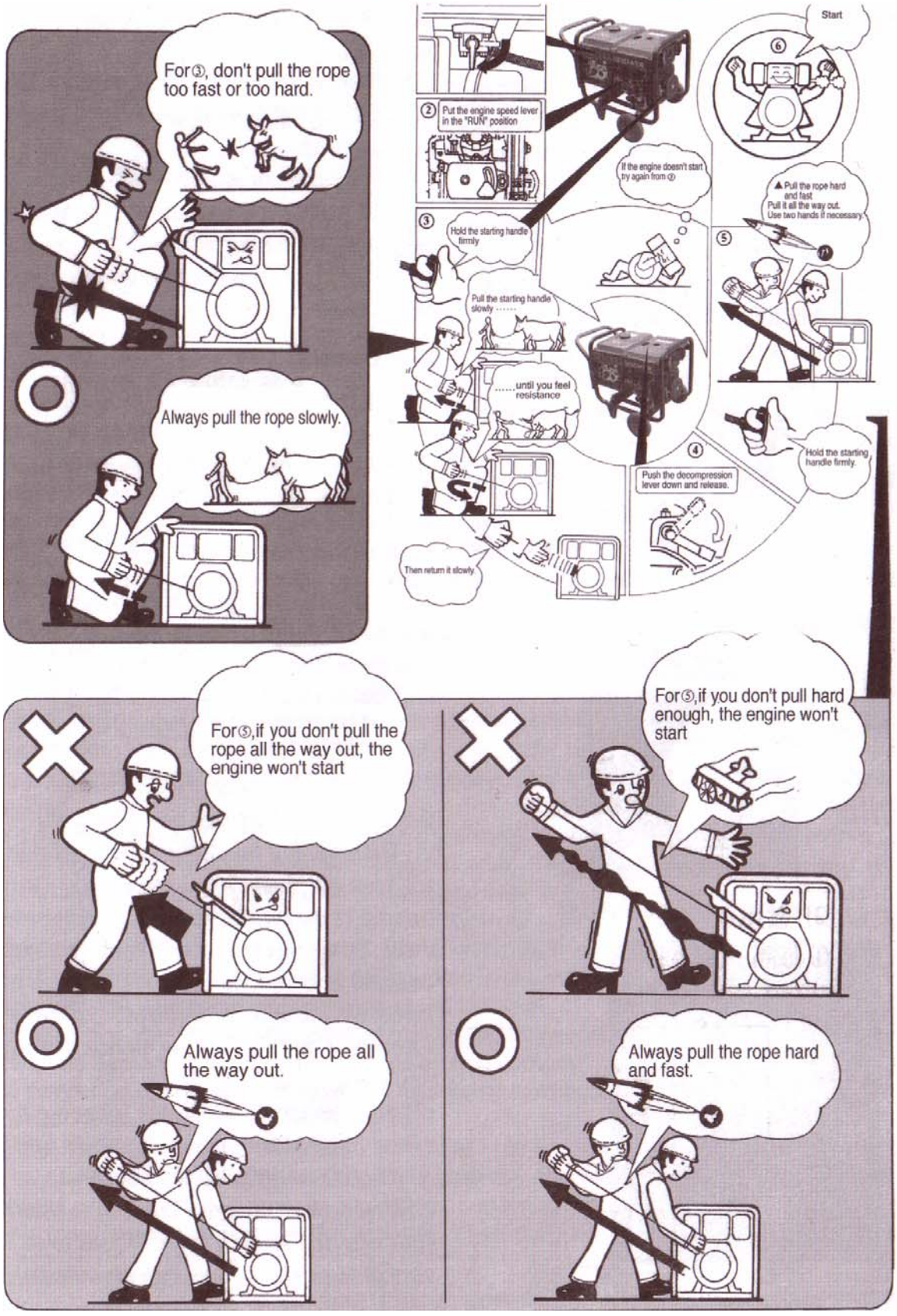
If the level in the battery is to high, the liquid may flow out and end up on surrounding parts resulting in corrosion of these parts.

Note: Avoid too much or too little of battery acid. Check and fill it once a month if necessary.

2-5 Procedures for starting the generator set

This procedure applies to the L series recoil starting style models.




For③, don't pull the rope too fast or too hard.
Always pull the rope slowly.
Start
⑥
② Put the engine speed lever in the "RUN" position
If the engine doesn't start try again from ②
▲ Pull the rope hard and fast Pull it all the way out. Use two hands if necessary.
③ Hold the starting handle firmly
Pull the starting handle slowly
.....until you feel resistance
⑤
④ Push the decompression lever down and release.
Hold the starting handle firmly.
Then return it slowly
For⑤,if you don't pull the rope all the way out, the engine won't start
For⑤,if you don't pull hard enough, the engine won't start
Always pull the rope all the way out.
Always pull the rope hard and fast.

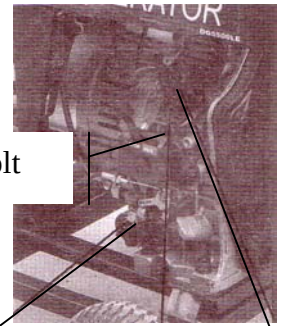
2-6 Proper operation of the generator set

2-6.1 Operating the diesel engine

1. Pre-heat the diesel engine for 3 minutes under no load conditions.
2. First check the height of the lubricating oil level, if it is low, refill it. Our diesel engines are equipped with an alarm system that will notify you if the oil pressure is too low. The alarm system will shut down the engine if the oil pressure is too low.
3. Do not adjust the speed limit regulation bolt or the fuel adjustment bolt. These bolts have been set by the factory already, changing them will affect the properties of the engine performance.

Fuel adjustment bolt

Speed limit bolt



Fuel adjustment bolt

High-pressure fuel pipe nut

Fuel adjustment bolt

2-6.2 Checks during engine operation

1. Check to see if there are abnormal noises.
2. Check to see if the performance is good or bad
3. Check the color of the exhaust gases (whether it is too black or too white). If any of these conditions exist, stop the engine and find the cause of the problem. If no problems are found, please contact your local dealer or our nearest company branch.

2-7 Loading

2-7.1 Load conditions

Exert loads in accordance with the specified parameters.

2-7.2 Output of electricity

1. Raise the revolutions per minute (turn the speed handle to the max setting) of the generator to get the maximum power out of the generator. If not, the automatic voltage regulator device will excite and doing this for long periods of time will cause the AVR to burn. For the rated speed of the generator, please refer to Chapter 1, item 1-1 technical specification and data.
2. Observe the pointer of the voltmeter, it should point to 230 V ± 5% (50Hz). (For 60 Hz set, it will be 240 V ± 5%). Meanwhile put the switch in the GEN (generator) position. The AC

voltage from the socket of the power supply can be output.

3. When connecting devices to the generator, make sure to connect these devices in order. Connect the large loads onto the generator first. If everything is functional, smaller loads can then be added. If the generator shuts off, it may be because the load being drawn by all the various devices are too high. In this event, decrease the number of small devices until everything is functional. The total drawn power should not exceed the maximum output power of the generator. Please see Table 1-1 for technical specifications of what the generator can output. In order to reset the generator after overdrawn power, let it sit for several minutes. If the indication of the voltmeter is too high or too low, adjust the speed accordingly. If there are problems, stop the generator immediately and fix the issue.
4. During operation, the generator should be in a place that has very good ventilation. Never cover the engine to solve a ventilation problem, as this will damage your equipment.

Table 2-1.

Note: Do not start more than two devices simultaneously. Each device should be started one by one to prevent overloading the generator.

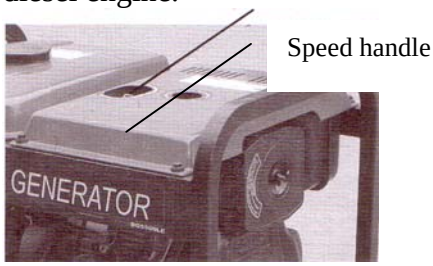
The generator should be running at 3600 revolutions per minute in order to achieve the (60 Hz) frequency. The speed of the engine can be adjusted from the speed governor.

2-7.3 Charging the battery

1. For the electric starter on the generator welder, the 12V battery is automatically charged through the regulator on the side of the engine when it is running.
2. If the generator is not used for long periods of 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 the battery cables to the battery. Doing so will damage both the battery and the electric starter.
5. When charging the battery, the battery produces flammable gases. Do not smoke, let flames, and sparks get near the battery while it is charging as this may cause a fire. To avoid sparking while connecting the cables to the battery, first, connect the cables to the battery then to the motor. To disconnect battery cables, first disconnect the motor end of the cable.

2-8 Stopping the generator

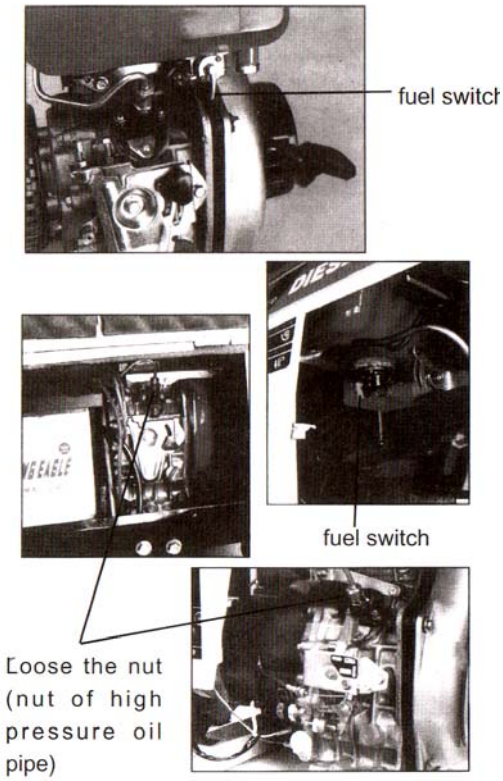
1. Take the electrical load off the generator.
2. Put the speed handle in the "RUN" position and let the engine run for 3 minutes after unloading. Do not stop the diesel engine immediately let it warm down. Stopping the diesel engine suddenly may raise the temperature of the engine abnormally and lock the nozzle and damage the diesel engine.



Note:

1. If the speed handle is in the "Stop position and the engine is still running, turn the fuel switch to the "OFF" position or loosen the high pressure oil pipe nut. The engine could be stopped more than one-way other than the speed handle way.
2. If you cannot stop the engine with a load on it, then remove the load first than stop the engine.

3. Press down on the brake handle
4. If equipped with an electric starter, turn the key to the "Off" position
5. Put the fuel handle to the "S" position
6. Finally, pull slowly on the recoil handle until you feel resistance (this is when the piston is on the compression stroke, where the intake and exhaust valves are closed). What this does is prevent the engine from rusting when not in use.



CHAPTER 3 MAINTENANCE

3-1 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 cabinet, and frame. For overhauling procedures, please refer to the instruction manual of the 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 3-1 for the proper maintenance schedule.

Table 3-1. *Maintenance schedule for diesel welder generator set*

Interval of / maintenanceItem	Everyday	1st month or after 20 hours	3rd month or 100 hours	6th month or 500 hours	Every year or 1000 hours
Check and fill enough fuel	○				
Discharge fuel		○			
Check and fill enough engine oil	○				
Check whether it leaks oil	○				
Check and screw each fastened part	○			● Screw the bolt of cylinder head firmly)	
Exchange engine oil		○ (1st time)	○ (2nd time late)		
Clean filter of engine oil				○ (Exchange)	
Exchange air filter element	If operated at dusty region, the period of maintenance should be shorten)			○ (Exchange)	
Clean filter of fuel				○	● (Exchange)
Check high pressure oil pump				●	
Check nozzle				●	
Check fuel pipe				● (If necessary, exchange it)	
Adjust the gaps of air intake and air exhausted gate		● (1st time)		●	
Grind air intake and air exhausted gate					●
Exchange piston ring					●
Check electrolytic solution of accumulator	(each month)				
Check electric brush and slide ring				●	
Check insulation resistance	The time of stop is over 10 days.			○	

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

3-1.1 Changing the engine oil (every 100 hours)

Take the oil cover off. Remove the oil drain plug 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.

3-1.2 Air filter maintenance schedule

1. Clean air-filter every 6 months or 500 hours of operation.
2. If necessary, exchange it.
3. Do not use detergent to clean air filter element.

Note:
Never start the engine without the air filter. This can cause serious damage to the engine if foreign objects enter the intake system. Always change the air filter on time.

3-1.3 Fuel filter maintenance

1. The fuel filter should be cleaned often to keep the engine running at maximum performance.
2. The recommended time period for cleaning the fuel filter is 6 months or 500 hours of operation.
   a. To do this, first drain the fuel from the fuel tank.
   b. Loosen the small screws on the fuel switch and remove the fuel filter form the port. Use diesel fuel to clean the fuel filter. Also, remove the fuel injector and clean the carbon deposit around it. The recommended time period for this is 3 months or 100 hours.

3-1.4 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 required to do this.

3-1.5 Battery check

Make sure the battery acid is full. The engine uses a 12V 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.

3-2 Storing for long periods of time

If your generator needs to be stored for long periods of time, the following preparations should be made.

1. Start the diesel engine for 3 minutes then stop it.
2. When the engine is still hot, change the engine oil with new engine oil of the proper grade.
3. Pull the rubber plug out of the cylinder head cover and put 2CC of lubricating oil in it, then cover the plughole up again.
4. For manual starting generator welders, press the decompression handle down and pull the recoil handle 2 or 3 times. This pushes the intake out. (Do not start the engine)
5. For electric started generator welders, press the decompression handle down and crank the engine for 2-3 seconds. To do this, put the starter switch in the “Start” position. (Do not start the diesel engine)
6. Finally, pull the recoil starter until you feel resistance; this is when the piston is on the compression stroke where the intake and exhaust valves are closed. Having the intake and exhaust valves closed will prevent rust, as moisture cannot get inside the combustion chamber.
7. Clean the engine and store it in a dry place.

CHAPTER 4 TROUBLESHOOTING

4-1 Troubleshooting procedures

	Causes of malfunction	Remedy
Diesel cannot be started.	Not enough fuel	Add enough fuel
	The switch of fuel is not at "OPEN"position	Turn the switch of fuel to"OPEN"position
	High-pressure pump and nozzle do not inject fuel or the injected amount is less.	Disassemble the nozzle and adjust it at test table.
	Speed control lever is not at "RUN" position.	Turn speed control lever to "RUN" position.
	Check level of lubrication oil.	The standard oil amount of lubricating oil should be between high graduation "H" and low graduation "L"
	It is not quick and powerful to pull reactive starter.	Start diesel engine in accordance with the requirements of "start operation procedures"
	Nozzle exists dirt.	Clean the nozzle.
	Accumulator has not electricity.	Charge the accumulator or exchange it.
Generator cannot generat electricity and has not welding voltage	Master switch (NFB) is not be switched on	Turn master switch handle to "ON" position.
	Carbon brush of generator was worn. The contact is bad.	Exchange the carbon brush.
	The contact of socket is bad.	Adjust the contact feet of socket.
	The rated revolution of engine cannot be reached.	Make it reach to the rated revolution in accordance with the requirements.
	AVR automatic governor is damaged.	Exchange it.
	The potentiometer of current regulation for electric welding is damaged.	Exchange it.

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

4-2 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. State of residency
3. Number of hours of operating equipment along with the problem that occurred.
4. A detailed condition and time when the problem occurred, in other words, climate and atmosphere

CHAPTER 5 GENERATOR PARTS DIAGRAMS AND LISTINGS

Figure 5-2. *Overall view of engine generator assembly*

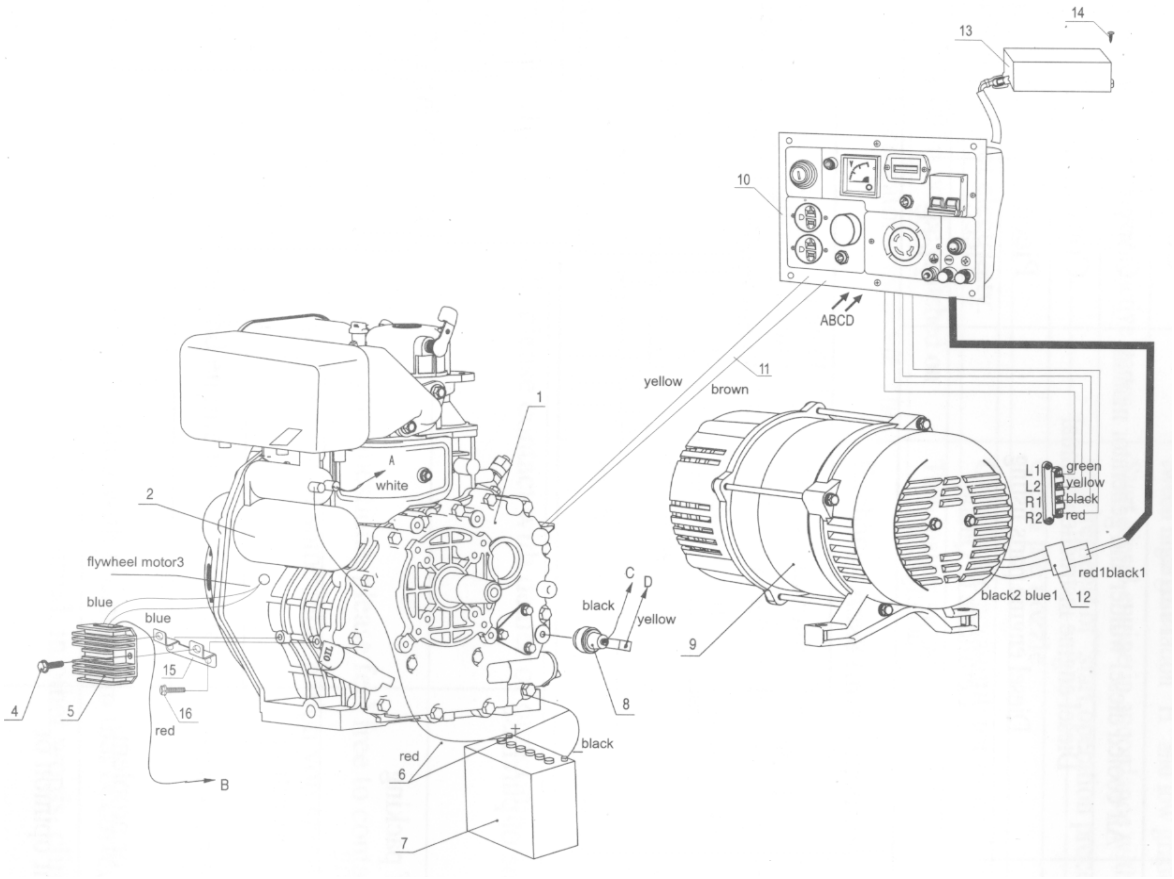


Table 5-1. *Please refer to figure 5-2 for illustration*

Number	Part Description	Quantity	Part Number (4LE / 6LE)
1	ETQ series diesel engine	1	ETQ4LE1 / ETQ6LE1
2	Starter Motor	1	ETQ4LE2 / ETQ6LE2
3	Flywheel generator	1	ETQ4LE3 / ETQ6LE3
4	Bolt	2	ETQ4LE4 / ETQ6LE4
5	Voltage Regulator	1	ETQ4LE5 / ETQ6LE5
6	Battery Cable (red)	1	ETQ4LE6 / ETQ6LE6
7	Battery Cable (black)	1	ETQ4LE7 / ETQ6LE7
8	Battery	1	ETQ4LE8 / ETQ6LE8
9	Oil level sensor	1	ETQ4LE9 / ETQ6LE9
10	Output panel assembly	1	ETQ4LE10 / ETQ6LE10
11	Throttle cable	2	ETQ4LE11 / ETQ6LE11
12	Connector assembly	1	ETQ4LE12 / ETQ6LE12
13	Capacitor	1	ETQ4LE13 / ETQ6LE13
14	Bolt	2	ETQ4LE14 / ETQ6LE14
15	Voltage Regulator Bracket	1	ETQ4LE15 / ETQ6LE15
16	Bolt	2	ETQ4LE16 / ETQ6LE16

Figure 5-3. *Exploded view of frame assembly*

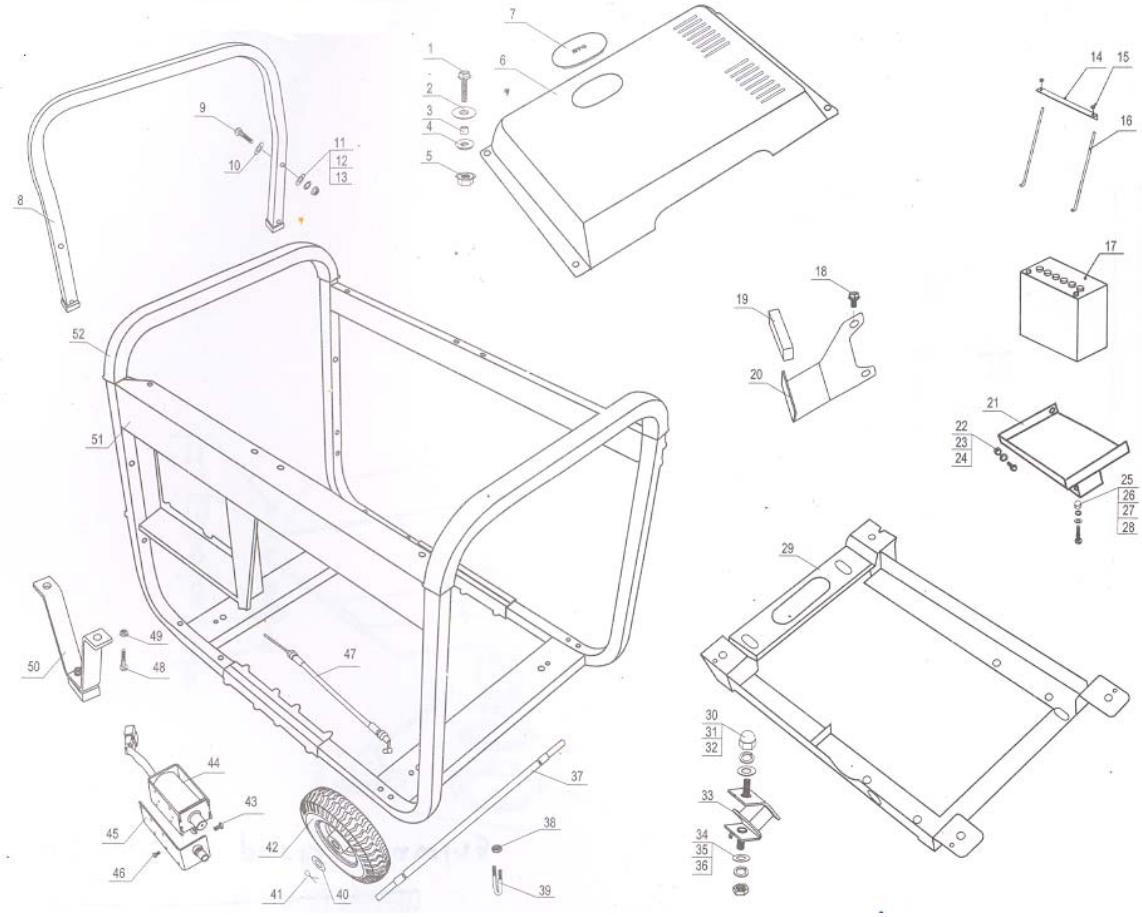


Table 5-2. *Please refer to figure 5-3.*

Number	Part Description	Quantity	Part Number (4LE / 6LE)
1	M6 x 25 Bolt	4	ETQ4LE17 / ETQ6LE17
2	M6 Flat washer	4	ETQ4LE18 / ETQ6LE18
3	Shock absorber	4	ETQ4LE19 / ETQ6LE19
4	Washer	4	ETQ4LE20 / ETQ6LE20
5	M6 Nut	4	ETQ4LE21 / ETQ6LE21
6	Engine cover	1	ETQ4LE22 / ETQ6LE22
7	Rubber cover	1	ETQ4LE23 / ETQ6LE23
8	Handrail	1	ETQ4LE24 / ETQ6LE24
9	M8 x 65 Bolt	4	ETQ4LE25 / ETQ6LE25
10	Plastic gasket	4	ETQ4LE26 / ETQ6LE26
11	Flat washer M8	4	ETQ4LE27 / ETQ6LE27
12	Spring washer	4	ETQ4LE28 / ETQ6LE28
13	M8 Nut	4	ETQ4LE29 / ETQ6LE29
14	Battery tie down	1	ETQ4LE30 / ETQ6LE30
15	M6 Nut	2	ETQ4LE31 / ETQ6LE31
16	Tie down hooks	2	ETQ4LE32 / ETQ6LE32
17	Battery	1	ETQ4LE33 / ETQ6LE33
18	M8x12 bolts	2	ETQ4LE34 / ETQ6LE34
19	Rubber absorber	1	ETQ4LE35 / ETQ6LE35
20	Motor mount	1	ETQ4LE36 / ETQ6LE36
21	Battery tray	1	ETQ4LE37 / ETQ6LE37
22	M6 Nut	1	ETQ4LE38 / ETQ6LE38
23	Spring washer 6	1	ETQ4LE39 / ETQ6LE39
24	M6 x 35 Bolt	1	ETQ4LE40 / ETQ6LE40
25	M10 Nut	2	ETQ4LE41 / ETQ6LE41
26	Spring washer 10	2	ETQ4LE42 / ETQ6LE42
27	Flat washer 10	2	ETQ4LE43 / ETQ6LE43
28	M10 x 20	2	ETQ4LE44 / ETQ6LE44
29	Bracket	1	ETQ4LE45 / ETQ6LE45
30	M10 Nut	4	ETQ4LE46 / ETQ6LE46
31	Spring washer 10	4	ETQ4LE47 / ETQ6LE47
32	Flat washer 10	4	ETQ4LE48 / ETQ6LE48
33	Rubber mounts	4	ETQ4LE49 / ETQ6LE49
34	Flat washer 10	4	ETQ4LE50 / ETQ6LE50
35	Spring washer 10	4	ETQ4LE51 / ETQ6LE51
36	M10 Nut	4	ETQ4LE52 / ETQ6LE52
37	Axle	1	ETQ4LE53 / ETQ6LE53
38	M6 Nut	4	ETQ4LE54 / ETQ6LE54
39	U bolt	2	ETQ4LE55 / ETQ6LE55
40	Flat washer 20	2	ETQ4LE56 / ETQ6LE56
41	Split pin 32 x 32	2	ETQ4LE57 / ETQ6LE57
42	Wheel	2	ETQ4LE58 / ETQ6LE58
43	Solenoid cable bolts	2	ETQ4LE59 / ETQ6LE59
44	Solenoid	1	ETQ4LE60 / ETQ6LE60
45	Solenoid bracket	1	ETQ4LE61 / ETQ6LE61
46	Bolts	4	ETQ4LE62 / ETQ6LE62
47	Throttle cable	1	ETQ4LE63 / ETQ6LE63
48	M8 x 40 Bolt	4	ETQ4LE64 / ETQ6LE64
49	M8 Nut	4	ETQ4LE65 / ETQ6LE65
50	Bracket	2	ETQ4LE66 / ETQ6LE66
51	Bracket	1	ETQ4LE67 / ETQ6LE67
52	Rubber insulator	2	ETQ4LE68 / ETQ6LE68

Figure 5-4. *Electric panel parts drawing*

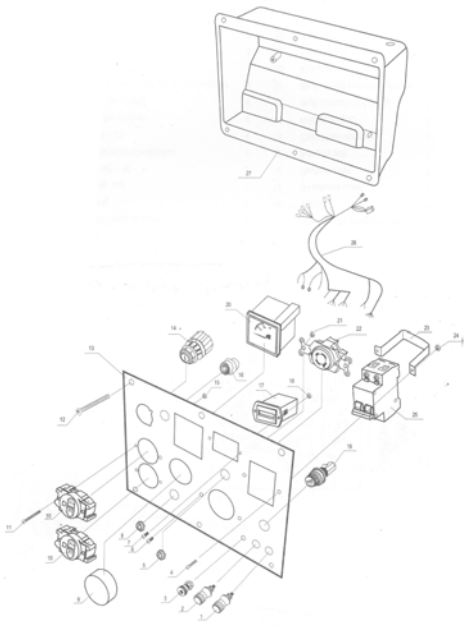


Table 5-3. *Please refer to Figure 5-4*

Number	Part Description	Quantity	Part Number (4LE /6LE)
1	Positive DC port	1	ETQ4LE69 / ETQ6LE69
2	Negative DC port	1	ETQ4LE70 / ETQ6LE70
3	Grounded bolt	1	ETQ4LE71 / ETQ6LE71
4	Bolt	2	ETQ4LE72 / ETQ6LE72
5	Large Nut	1	ETQ4LE73 / ETQ6LE73
6	Bolt	2	ETQ4LE74 / ETQ6LE74
7	Bolt	2	ETQ4LE75 / ETQ6LE75
8	Large Nut	1	ETQ4LE76 / ETQ6LE76
9	Current Adjusting Switch	1	ETQ4LE77 / ETQ6LE77
10	3 prong Socket	2	ETQ4LE78 / ETQ6LE78
11	Bolt	6	ETQ4LE79 / ETQ6LE79
12	Electric panel bolt	6	ETQ4LE80 / ETQ6LE80
13	Electric Panel	1	ETQ4LE81 / ETQ6LE81
14	Starter switch	1	ETQ4LE82 / ETQ6LE82
15	Large nut	6	ETQ4LE83 / ETQ6LE83
16	Oil alert lamp	1	ETQ4LE84 / ETQ6LE84
17	Hour meter	1	ETQ4LE85 / ETQ6LE85
18	Hour meter bolts	2	ETQ4LE86 / ETQ6LE86
19	DC Fuse	1	ETQ4LE87 / ETQ6LE87
20	Voltmeter	1	ETQ4LE88 / ETQ6LE88
21	Nut	2	ETQ4LE89 / ETQ6LE89
22	4 prong socket	1	ETQ4LE90 / ETQ6LE90
23	Breaker bracket	1	ETQ4LE91 / ETQ6LE91
24	Nut	2	ETQ4LE92 / ETQ6LE92
25	Breaker	1	ETQ4LE93 / ETQ6LE93
26	Wiring harness	1	ETQ4LE94 / ETQ6LE94
27	Electrical box	1	ETQ4LE95 / ETQ6LE95

Figure 5-5. *Generator head assembly*

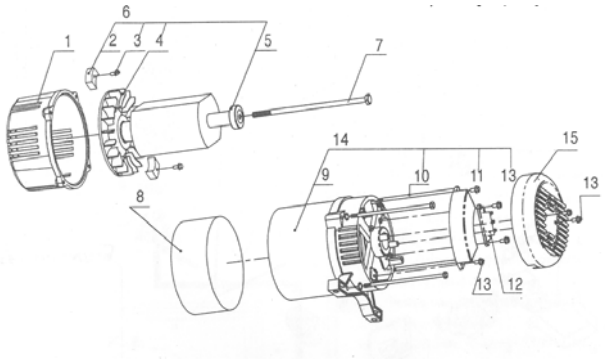


Table 5-4. *Please refer to figure 5-5*

Number	Part Description	Quantity	Part Number (4LE / 6LE)
1	Front end cover	1	ETQ4LE96 / ETQ6LE96
2	Diode	2	ETQ4LE97 / ETQ6LE97
3	M4 x 8 Bolt	2	ETQ4LE98 / ETQ6LE98
4	Fan Blade	1	ETQ4LE99 / ETQ6LE99
5	Bearing	1	ETQ4LE100 / ETQ6LE100
6	Rotor Unit	1	ETQ4LE101 / ETQ6LE101
7	Center bolt	1	ETQ4LE102 / ETQ6LE102
8	Motor cover	1	ETQ4LE103 / ETQ6LE103
9	Stator	1	ETQ4LE104 / ETQ6LE104
10	Long bolt	4	ETQ4LE105 / ETQ6LE105
11	Capacitor	1	ETQ4LE106 / ETQ6LE106
12	Wiring Seat	1	ETQ4LE107 / ETQ6LE107
13	M5 x 15 Bolt	6	ETQ4LE108 / ETQ6LE108
14	Stator Unit	1	ETQ4LE109 / ETQ6LE109
15	Dust Cover	1	ETQ4LE110 / ETQ6LE110

Figure 5-6. Fuel system components

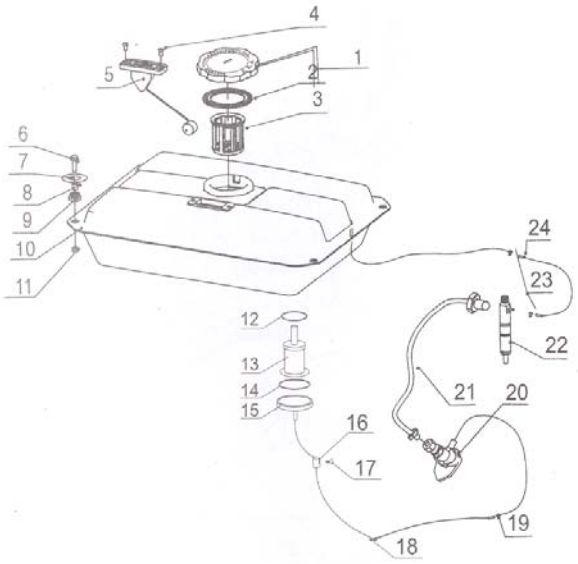


Table 5-5. *Please refer to figure 5-6.*

Number	Part Description	Quantity	Part Number (4LE / 6LE)
1	Fuel Cap	1	ETQ4LE111 / ETQ6LE111
2	Seal	1	ETQ4LE112 / ETQ6LE112
3	Filtering cup	1	ETQ4LE113 / ETQ6LE113
4	M5 x 10 screw	2	ETQ4LE114 / ETQ6LE114
5	Fuel lever indicator	1	ETQ4LE115 / ETQ6LE115
6	M6 x 25 Bolt	4	ETQ4LE116 / ETQ6LE116
7	Large flat washer 6	4	ETQ4LE117 / ETQ6LE117
8	Fuel tank lining	4	ETQ4LE118 / ETQ6LE118
9	Shock absorbing gasket	4	ETQ4LE119 / ETQ6LE119
10	Fuel tank	1	ETQ4LE120 / ETQ6LE120
11	M6 Nut	4	ETQ4LE121 / ETQ6LE121
12	O ring seal	1	ETQ4LE122 / ETQ6LE122
13	Fuel tank filter	1	ETQ4LE123 / ETQ6LE123
14	O ring gasket	1	ETQ4LE124 / ETQ6LE124
15	Fuel filter cover	1	ETQ4LE125 / ETQ6LE125
16	Cover	1	ETQ4LE126 / ETQ6LE126
17	Wing nut	1	ETQ4LE127 / ETQ6LE127
18	Fuel line	2	ETQ4LE128 / ETQ6LE128
19	Fuel inlet pipe	1	ETQ4LE129 / ETQ6LE129
20	High pressure fuel pump	1	ETQ4LE130 / ETQ6LE130
21	High pressure fuel pipe	1	ETQ4LE131 / ETQ6LE131
22	Fuel injector	1	ETQ4LE132 / ETQ6LE132
23	Overfill tube	2	ETQ4LE133 / ETQ6LE133
24	Fuel overfill pipe	1	ETQ4LE134 / ETQ6LE134

LIMITED WARRANTY

Eastern Tools & Equipment, Inc. will repair or replace, free of charge, any part or parts of the generator that are defective in material or workmanship or both. Transportation charges on parts submitted for repair or replacement under this Warranty must be borne by purchaser. This warranty is effective for the time period and subject to the conditions provided for in this policy. For warranty service, find the nearest Authorized Service Dealer by contacting the place of purchase or Eastern Tools & Equipment, Inc. THERE IS NO OTHER EXPRESSED WARRANTY. IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO ONE YEAR FROM PURCHASE, OR TO THE EXTENT PERMITED BY LAW ANY AND ALL IMPLIED WARRANTIES ARE EXCLUDED. LIABILITY FOR CONSEQUENTIAL DAMAGES UNDER ANY AND ALL WARRANTIES ARE EXCLUDED TO THE EXTENT EXCLUSION IS PERMITTED BY LAW. Some states do not allow limitations on how long an implied warranty lasts, and some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation and exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights, which vary from state to state.

Eastern Tools & Equipment, Inc.

WARRANTY PERIOD***

ENGINES	WITHIN U.S.A AND CANADA		OUTSIDE U.S.A. AND CANADA	
	CONSUMER USE	COMMERCIAL USA	CONSUMER USE	COMMERCIAL USE
DIESEL GENERATOR	1 year or 1000 hours	1 year or 1000 hours	1 year or 1000 hours	1 year or 1000 hours

* The warranty period begins on the date of purchase by the first retail consumer or commercial end user, and continues for the period of time stated in the table above. "Consumer use" means personal residential household use by a retail consumer. "Commercial use" means all other uses, including use for commercial, income producing or rental purposes. Once the engine has experienced commercial use, it shall thereafter be considered as a commercial use engine for purposes of this warranty. **Engines used in competitive racing or on commercial or rental tracks are not warranted.**

*** A two-year or 1,500 hour warranty applies to the emission control system on engines certified by EPA and CARB

IMPORTANT
"WARRANTY REGISTRATION IS NECESSARY TO OBTAIN LIMITED WARRANTY ON EASTERN TOOLS & EQUIPMENT, INC., ENGINES. THE WARRANTY REGISTRATION CARD MUST BE RETURNED WITHIN 15 DAYS OF ORIGINAL PURCHASE FOR LIMITED WARRANTY TO BE VALID."

About Your Product Warranty

Eastern Tools & Equipment, Inc. welcomes warranty repair and apologizes to you for being inconvenienced. Any Authorized Service Dealer may perform warranty repairs. Most warranty repairs are handled routinely, but sometimes warranty service may be inappropriate. For example, warranty would not apply if an engine is damaged because of misuse, lack of routine maintenance, shipping, handling, warehousing and improper installation. Similarly, warranty is void if the serial number on the engine has been removed or if the engine has been altered or modified. If a customer differs with the decision of the Service Dealer, an investigation will be made to determine whether the warranty applies. Ask the Service Dealer to submit all supporting facts to his Distributor or the factory for review. If the distributor or the factory decides that the claim is justified, the customer will be fully reimbursed for those items that are defective. To avoid misunderstanding, which might occur between the customer and the dealer, listed below are some of the causes of engine failure that the warranty does not cover.

Normal wear:

Engines and generators, like all mechanical devices, need periodic parts service and replacement to perform well. Warranty will not cover repair when normal use has exhausted the life of a part of an engine.

Improper maintenance:

The life of an engine or your equipment depends upon the conditions under which it operates, and the care it receives. Some applications, such as tillers, pumps, and rotary movers, are very often used in dusty or dirty conditions, which can cause what appears to be premature, wear. Such wear, when caused by dirt, dust, spark pug cleaning grit, or other abrasive material that has entered the engine because of improper maintenance is is not covered by warranty.

This warranty covers engine related defective material and/or workmanship only, and not replacement or refund of the equipment to which the engine may be mounted. Nor does the warranty extend to repairs required because of:

1. PROBLEMS CAUSED BY PARTS THAT ARE NOT ORIGINAL EASTERN TOOLS & EQUIPMENT, INC., PARTS.
2. Equipment controls or installations that prevent starting, cause unsatisfactory engine performance, or shorten engine life. (Contact equipment manufacturer.)
3. Leaking carburetors, clogged fuel pipes, sticking valves, or other damage, caused by using contaminated or stale fuel. (Use clean, fresh, lead-free gasoline.)
4. Parts which are scored or broken because an engine was operated with insufficient or contaminated lubricating oil, or an incorrect grade of lubricating oil (check oil level daily or after every 8 hours of operation. Refill when necessary and change at recommended intervals.) Engine damage may occur if oil level is not properly maintained. Read Operating & Maintenance Instructions.
5. Repair or adjustment of associated parts or assemblies such as clutches, transmissions, remote controls, etc., which are not manufactured by Eastern Tools & Equipment, Inc.
6. Damage or wear to parts caused by dirt, which entered the engine because of improper air cleaner maintenance, re-assembly, or use of a non-original air cleaner element or cartridge. Read Operating & Maintenance Instructions.
7. Parts damaged by over-speeding, or overheating caused by grass, debris, or dirt, which plugs or clogs the cooling fins, or flywheel area, or damage caused by operating the engine in a confined area without sufficient ventilation.
8. Engine or equipment parts broken by excessive vibration caused by a loose cutter blades unbalanced blades or loose or unbalanced impellers, improper attachment of equipment to engine crankshaft, over-speeding or other abuse in operation.
9. A bent or broken crankshaft, caused by striking a solid object with the cutter blade of a rotary lawn mower, or excessive v-belt tightness.
10. Routine tune-up or adjustment of the engine.
11. Engine or engine component failure, i.e., combustion chamber, valves, valve seats, valve guides, or burned starter motor winding, caused by the use of alternate fuels such as, liquefied petroleum, natural gas, altered gasoline's, etc.

Warranty is available only through service dealers, which have been authorized by Eastern Tools & Equipment, Inc. Contact place of purchase or Eastern Tools & Equipment, Inc. for Service Dealer near you.

CALIFORNIA & USEPA EMISSION CONTROL WARRANTY STATEMENT

The U.S. Environmental Protection Agency (EPA), the California Air Resources Board (CARB) and Eastern Tools & Equipment, Inc. are pleased to explain the Federal and California Emission Control System Warranty on your 2003 small off-road engine. In California, new small off-road engines must be designed, built and equipped to meet the State's stringent anti-smog standards. Eastern Tools & Equipment, Inc. must warrant the emission control system on your small off-road engine for the periods of time listed above provided there has been no abuse, neglect or improper maintenance of your small off-road engine.

Your emission control system may include parts such as the carburetor, or fuel-injection system, the ignition system and catalytic converter. Also included may be hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, Eastern Tools & Equipment, Inc. will repair your small off-road engine at no cost to you including diagnosis, parts and labor.

PRODUCT REGISTRATION CARD

For more efficient customer service, please fill out the information below and mail to Eastern Tools & Equipment, Inc. Product Warranty and Registration Division, 12220 Rivera Rd, suite B; Whittier, CA 90606

Model No._____ Engine Serial No._____ Purchase Date _____/_____/_____

Purchased from: [ ] Retail location [ ] Private Consumer [ ] Other_____
Name_____
Location Address_____
Telephone w/ area code_____ Purchase Price_____

Purchased: [ ] NEW or [ ] USED

Consumer information:
Name_____ Telephone w/ area code _____
Street Address_____ Suite or Apt No. _____
City_____ State_____ Zip Code_____
Province or Country_____
Are you a: [ ] Business or [ ] Residence

Product Usage Information:
How often will you use this product? [ ] Everyday [ ] Periodically [ ] Emergency use only
[ ] Other_____

What type of application will you use this product in?
[ ] Heavy Commercial [ ] Moderate Commercial [ ] Light Commercial [ ] Tradeshows
[ ] Heavy Residential [ ] Moderate Residential [ ] Light Residential [ ] Camping, backpacking
[ ] Other_____

IMPORTANT INFORMATION:
It is critical to your warranty that the original point of sales receipt be retained by current consumer, and in order to comply with Eastern Tools & Equipment Product Warranty Statement you must return this registration card within 15 days of original purchase. Product warranty is valid from original date of purchase.

OWNER'S WARRANTY RESPONSIBILITIES

As the small off-road engine owner, you are responsible for the performance of the required maintenance listed in your Owner's Manual. Eastern Tools & Equipment, Inc. recommends that you retain all receipts covering maintenance on your small off-road engine, but Eastern Tools & Equipment, Inc. cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

As the small off-road engine owner, you should, however, be aware that Eastern Tools & Equipment, Inc. may deny you warranty coverage if your small off-road engine or a part thereof has failed due to abuse, neglect, improper maintenance or unapproved modifications.

You are responsible for presenting your small off-road engine to Eastern Tools & Equipment, Inc. distribution center as soon as a problem exists. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days.

If you have any questions regarding your warranty rights and responsibilities or to request warranty service you should contact either the place of purchase or Eastern Tools & Equipment, Inc., c/o Service Manager, Engine and Equipment Service Division, 12220 Rivera Road, Suite-B; Whittier, California 90606. Telephone 1-562-698-7500, or contact Eastern Tools & Equipment, Inc. through the Internet at http://www.easterntools.com

IMPORTANT NOTE:

This warranty statement explains your rights and obligations under the Emission Control System Warranty (ECS Warranty), which is provided to you by Eastern Tools & Equipment, Inc. pursuant to California law. Eastern Tools & Equipment, Inc. also provides to original purchasers of new Eastern Tools & Equipment, Inc engines. Eastern Tools & Equipment, Inc. Limited Warranties for New engines & other Equipment associated with the engine (Eastern Tools & Equipment, Inc. Products Warranty), which is enclosed with all New Eastern Tools & Equipment, Inc. engines and products on a separate sheet. The ECS Warranty applies only to the emission control system of your new engine. To the extent that there is any conflict in terms between the ECS Warranty and the Eastern Tools & Equipment, Inc., Warranty, the ECS Warranty shall apply except in any circumstances in which the Eastern Tools & Equipment, Inc. Product Warranty may provide a longer warranty period. Both the ECS Warranty and the Eastern Tools & Equipment, Inc. product Warranty describe important rights and obligations with respect to your new engine.

Eastern Tools & Equipment, Inc. at its location in Whittier, California can perform warranty service or any authorized service dealer near you. At the time of requesting warranty service, evidence must be presented of the date of sale to the original purchaser. The purchaser shall pay any charges for transporting the products to and from the place where the inspection and/or warranty work is performed. The purchaser shall be responsible for any damage or loss incurred in connection with the transportation of any engine or any part(s) thereof submitted for inspection and/or warranty work.

If you have any questions regarding your warranty rights and responsibilities, you should contact eastern Tools & Equipment, Inc. at 1-562-320-0231.

List for comments from users

		Date of Manufacture	
Name of user		Model Number	
Address of user		Occupation	
Place of purchase			
Packaging conditions			
Operating conditions			
Parts Conditions			
Malfunction problem			
Opinions or suggestions			

Note: Please mail the above card to: ***Eastern Tools & Equipment, Inc.***
12220 Rivera Rd, Suite B
Whittier, CA 90606

Appendix:

1. Attached list of tools, fittings, and subassemblies

Order No.	Name	Qty	Remarks
1	Air-cooled diesel welder and generator set	1	
2	Kit	1	
3	Plastic cover	1	
4	Plug and power supply	1	

2. Attached technical documents

Order No.	Name	Qty	Remarks
1	Air cooled diesel welder and generator manual	1	
2	Diesel engine instruction manual	1	
3	Diesel engine parts listing	1	
4	Certificate of Quality	1	
5	Packing List	1	

EASTERN TOOLS & EQUIPMENT, INC.

TEL: 1-626-960-6299

FAX: 1-626-960-6244

WEB SITE.http://easterntools.com