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OWNER'S MANUAL

AIR-COOLED DIESEL ENGINE

170F / FE / FS / FSE

178F / FE / FS / FSE

186F / FE / FS / FSE



PREFACE

Thank you for purchasing products from Eastern Tool & Equipment, INC. 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.



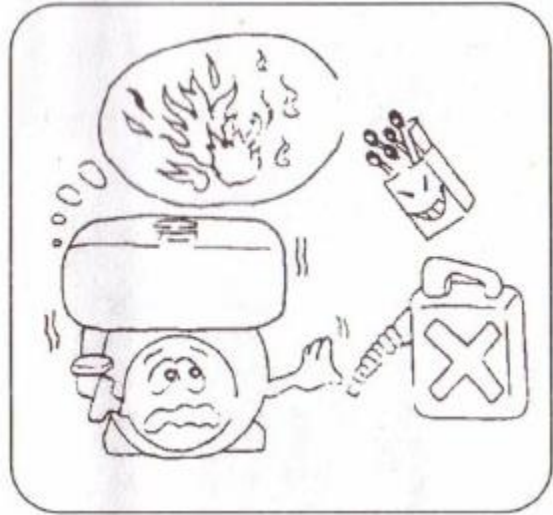
REFUELING PRECAUTIONS

- 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.



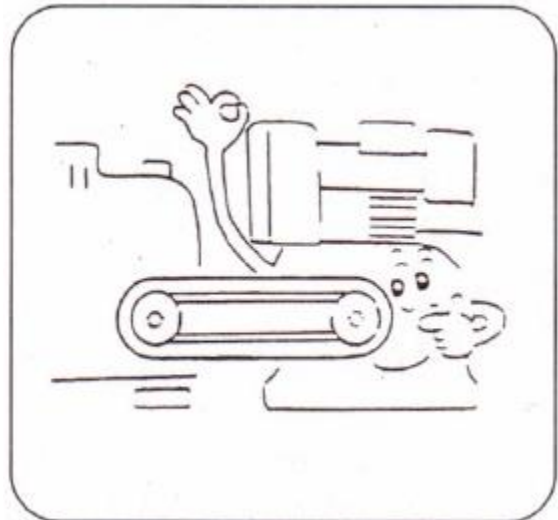
FIRE PREVENTION

- 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.

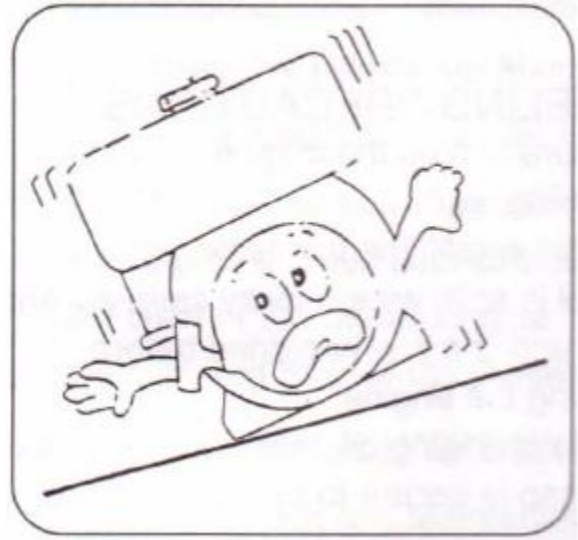


SURROUNDINGS

- 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.

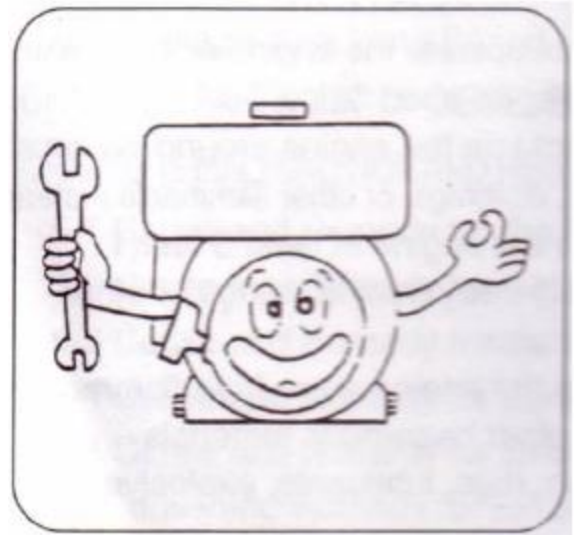
NOTE: Operating the engine at a steep incline may cause the engine to seize up due to improper lubrication even when the oil level is a maximum.

- 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 tight. 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

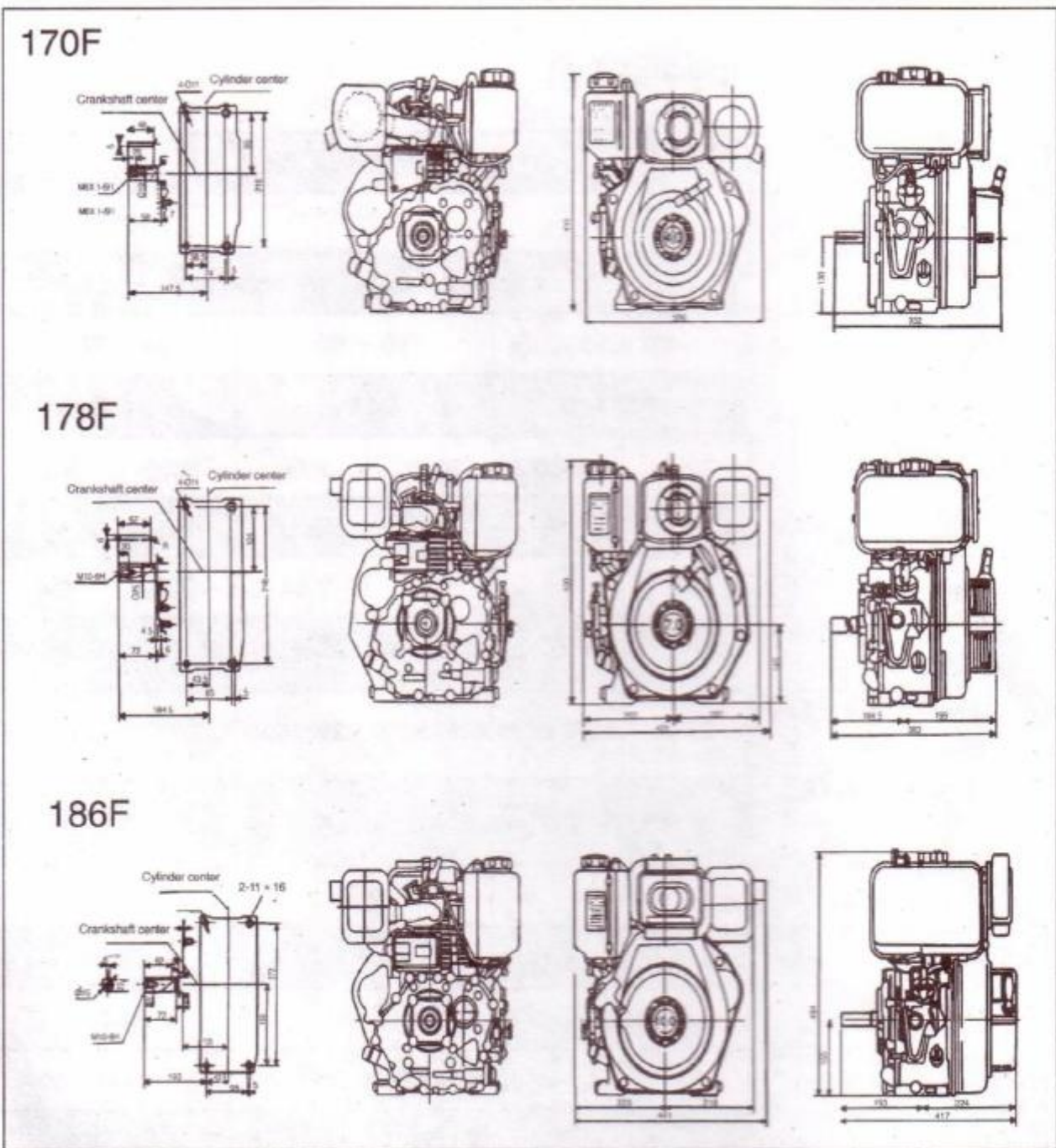
1-1 Technical specifications in English Units

Model		170F	178F	186F
Item				
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

Model		170F	178F	186F
Item				
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) =

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

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

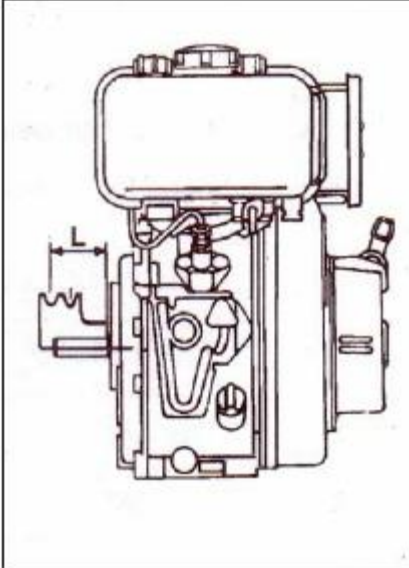
Note: If the belt is to tight, the engine bearings will wear at a high rate leading to engine failure. If the belt is to loose, the belt will slip at high speeds and high loads causing high pitch whistling noises.

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.

Model		170F	178F	186F
Item				
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°, see Fig 1-1

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

Fig 1-1. Allowed driving angles.

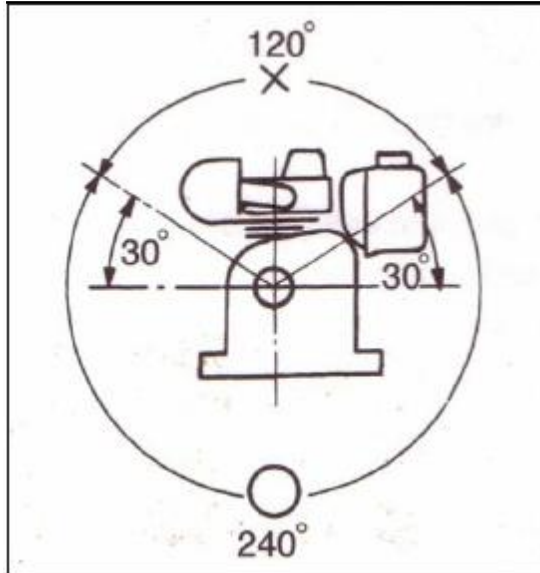






Fig 1-2. Allowed tilt angles.

Output Shaft Tilt		
Allowed Tilt (continuous running)	$< 20^\circ$	
Engine Tilt		
Allowed Tilt (continuous running)	$< 20^\circ$	

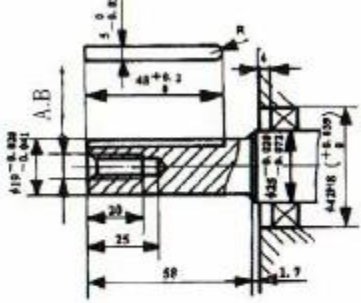
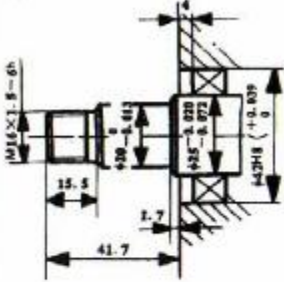
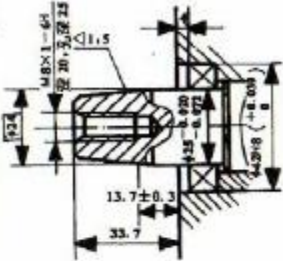
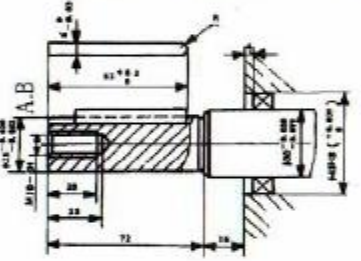
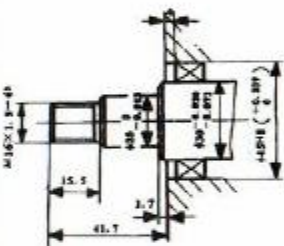
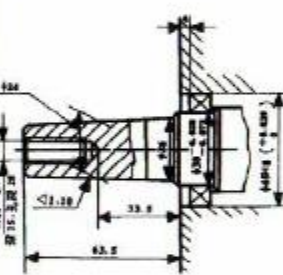
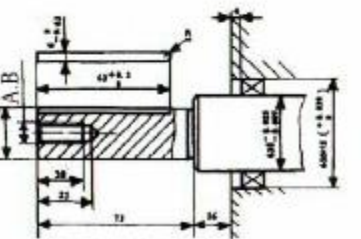
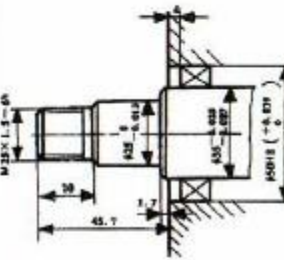
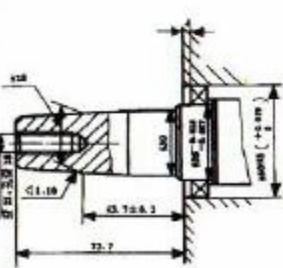
1-2.3 Please contact our dealers about the electric circuits involved with this engine. We recommend the use of accumulators rated at 20 hours shown in table 1-2.

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

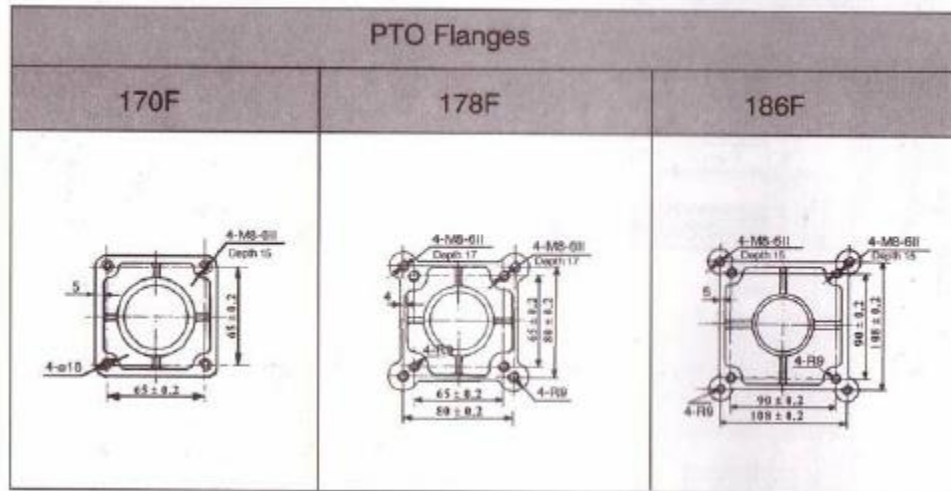
Table 1-2.

1-2 Diesel Engine shaft specifications

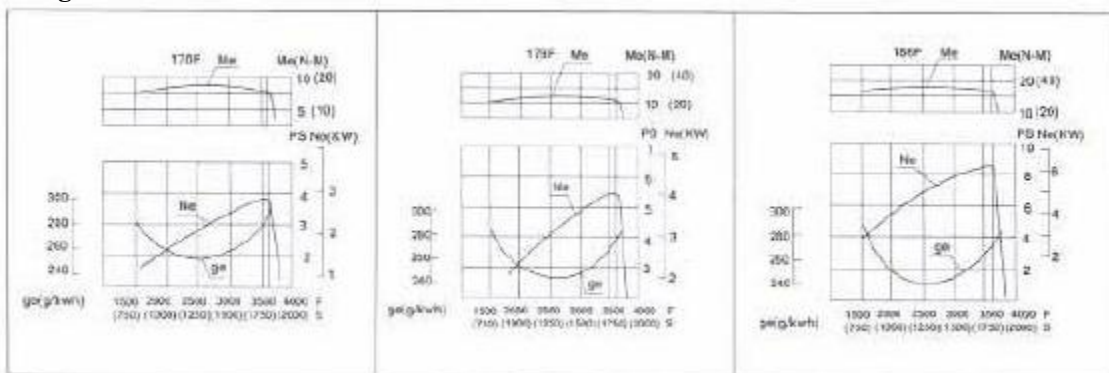
units: mm

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

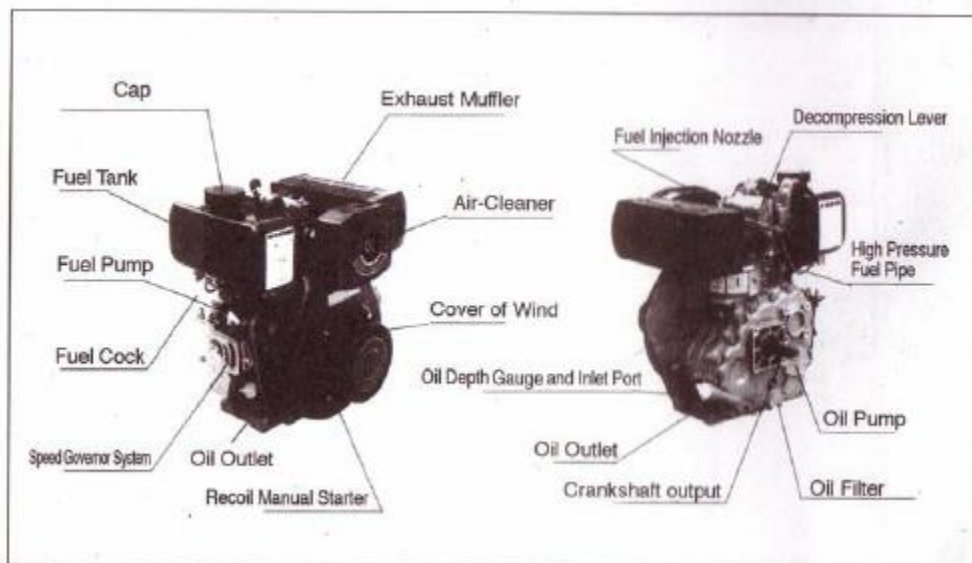
Sizes of PTO flanges



Diesel Engine Power Curves



1-4 Names of Diesel Engine Parts



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

Units: Degrees

ITEM \ MODEL	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
Table 1-4

Units: Degrees

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(°C)	< 480		
Machine oil temperature(°C)	< 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.

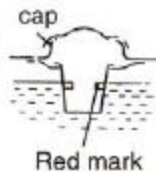
2-2 Fuel Choices

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.

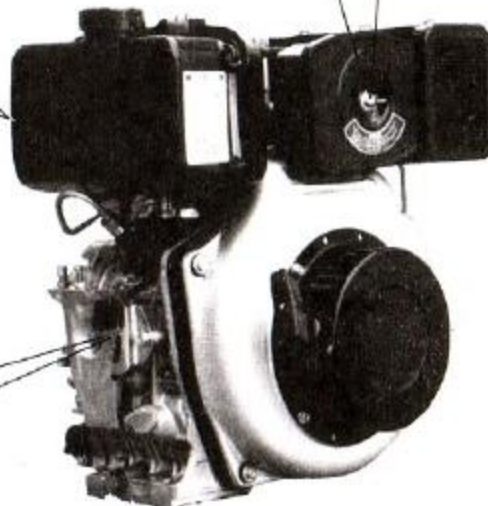
Model	170F	178F	186F
Capacity Liter	1.9	2.7	4.7
British Gal	(0.42)	(0.59)	(1.03)

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.



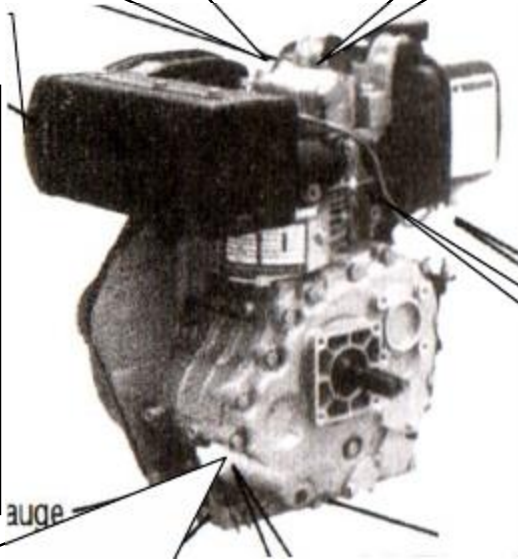
Oiling plug:

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

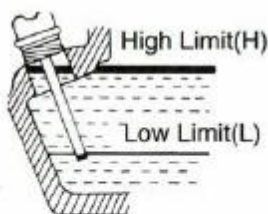
The factory has replaced the engine fuel and engine oil once already. To check the fuel pipeline, make sure the fuel line is completely drained. IF there is air in the pipeline, drain it out. To do this, loosen the nut between the injection pump and fuel pipe, then drain out the air until there are no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



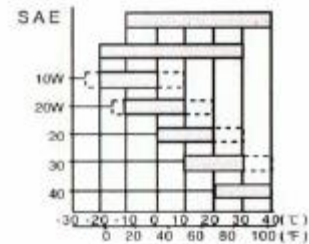
Fuel Cock lever
Stop
Start/Run

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

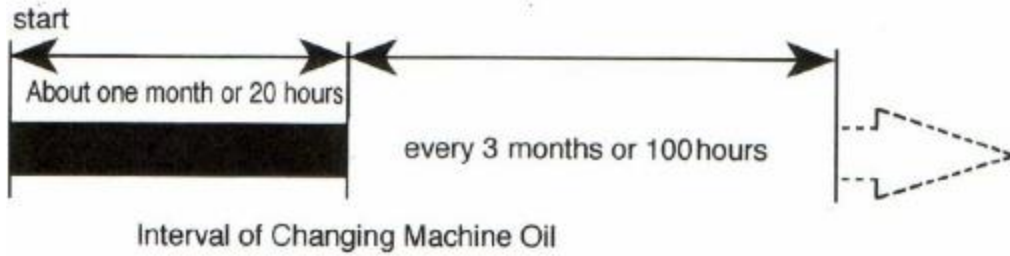


Be sure to use of GRADE CC or CD
A.P.I Diesel Engine Service.

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

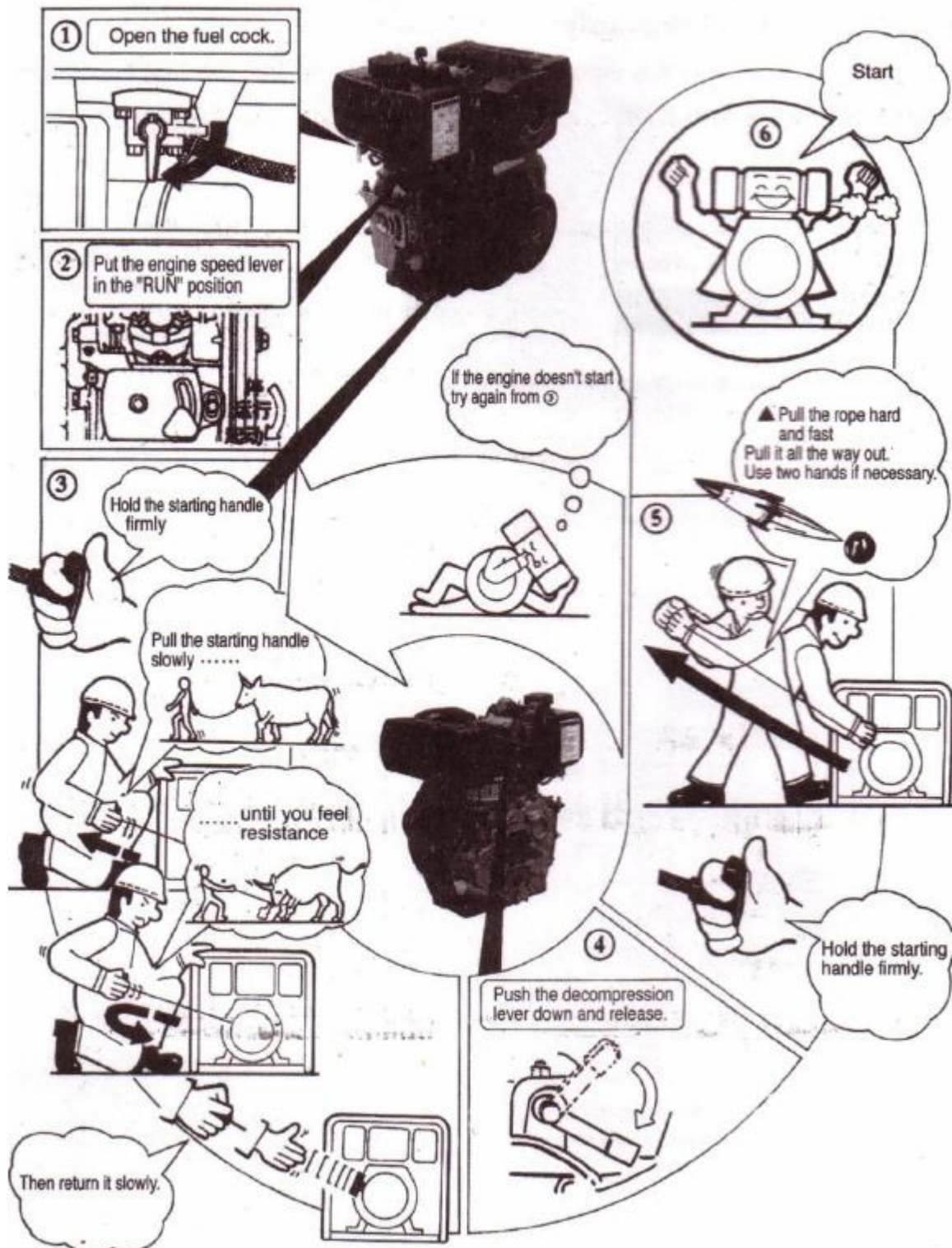
Change the engine oil regularly. Below a table for the interval of oil changes will be provided.

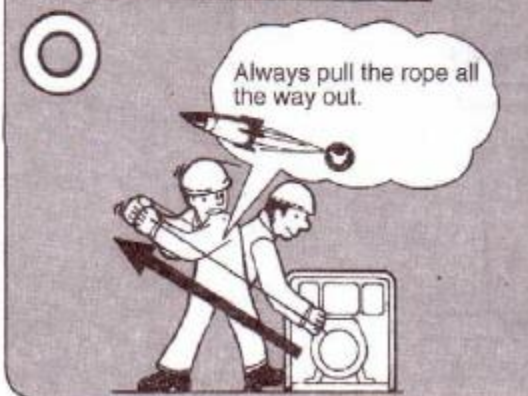
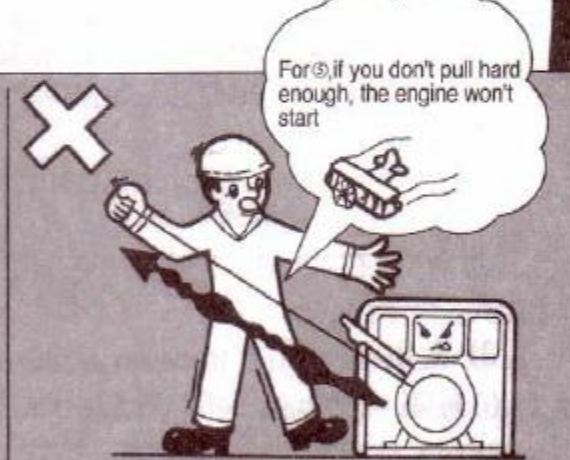
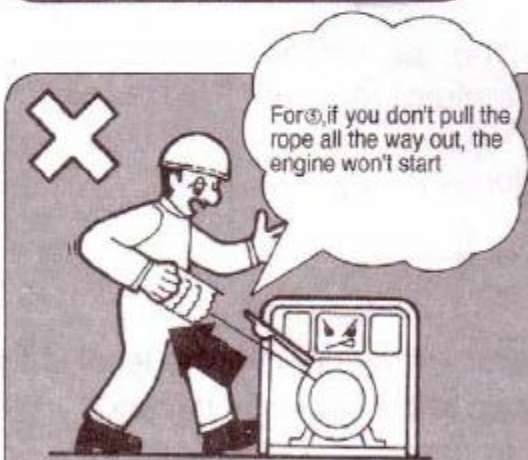


2-3 Starting the Diesel Engine

2-3.1 Recoil Starting

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



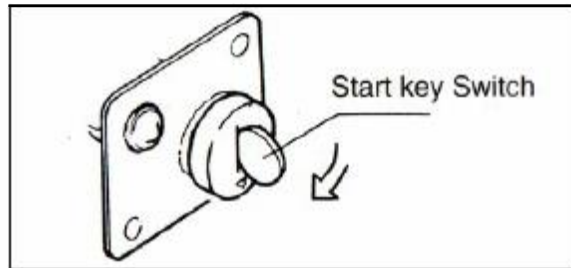


2-3.2 Diesel engine with electric starter system

(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.

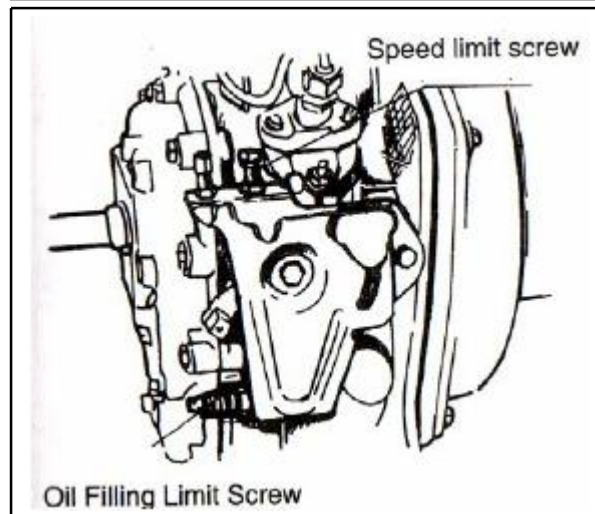


2-4 Running and stopping of the Diesel Engine

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



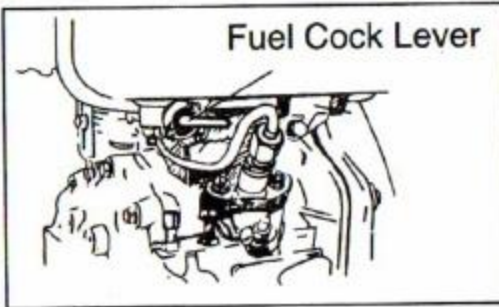
2-4.2 Checks on the engine while the engine is running.

- (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 too white or too 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. Set the fuel cock at "S" (stop position)



- (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.

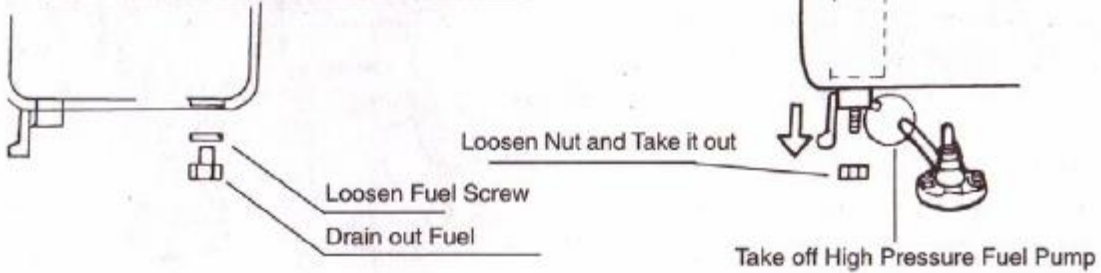
Item \ Time	Daily	After 20 hours or 1 month	100 Hours or Every 3 month	500 Hours Every 6 month	1000 Hours or Every year
Check and tighten the nut and screw	○				
Check and fill machine oil	○				
Change machine oil		○ (First time)	○ (Second time and later)		
Clean and change oil filter				○	● (Change)
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

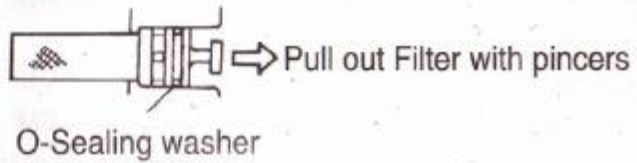
Take the filter out of fuel tank and clean it.

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



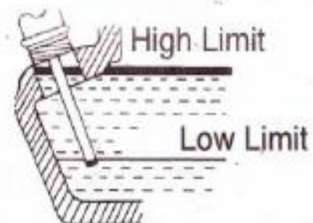
Change Lube oil filter

Clean	250 Hours
Change	500 Hours or when maintaining

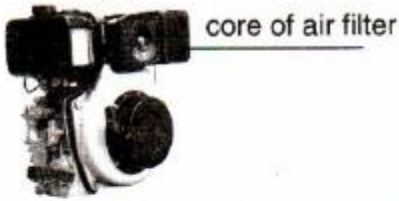


	168F (1D40)	178F (1D70)	186F (1D100)
Capacity(Liter)	0.75	1.10	1.65

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



Change the core of air filter



Change	Every 6 months or 500 hours (earlier if necessary)
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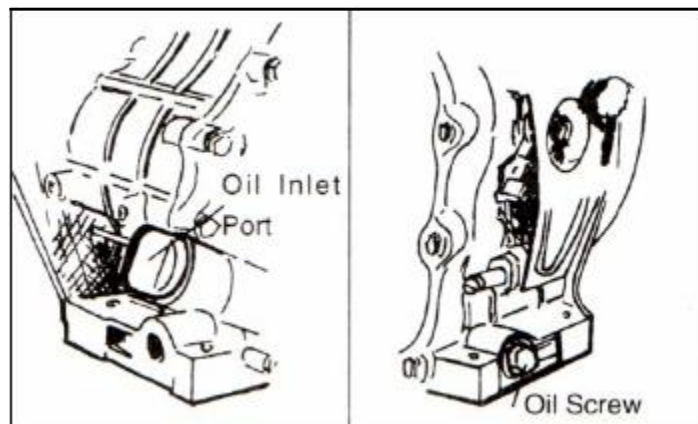
Do not use detergent to clean filter core. Use a soft brush instead.

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.

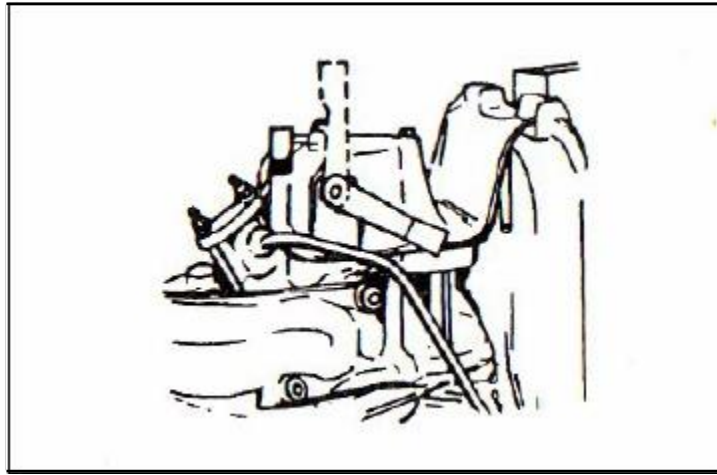
3-3 Storing the engine for long periods of time.

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 away the engine oil lubricant before the engine becomes cool and refill it with new oil. The figure below shows where the oil plugs are.



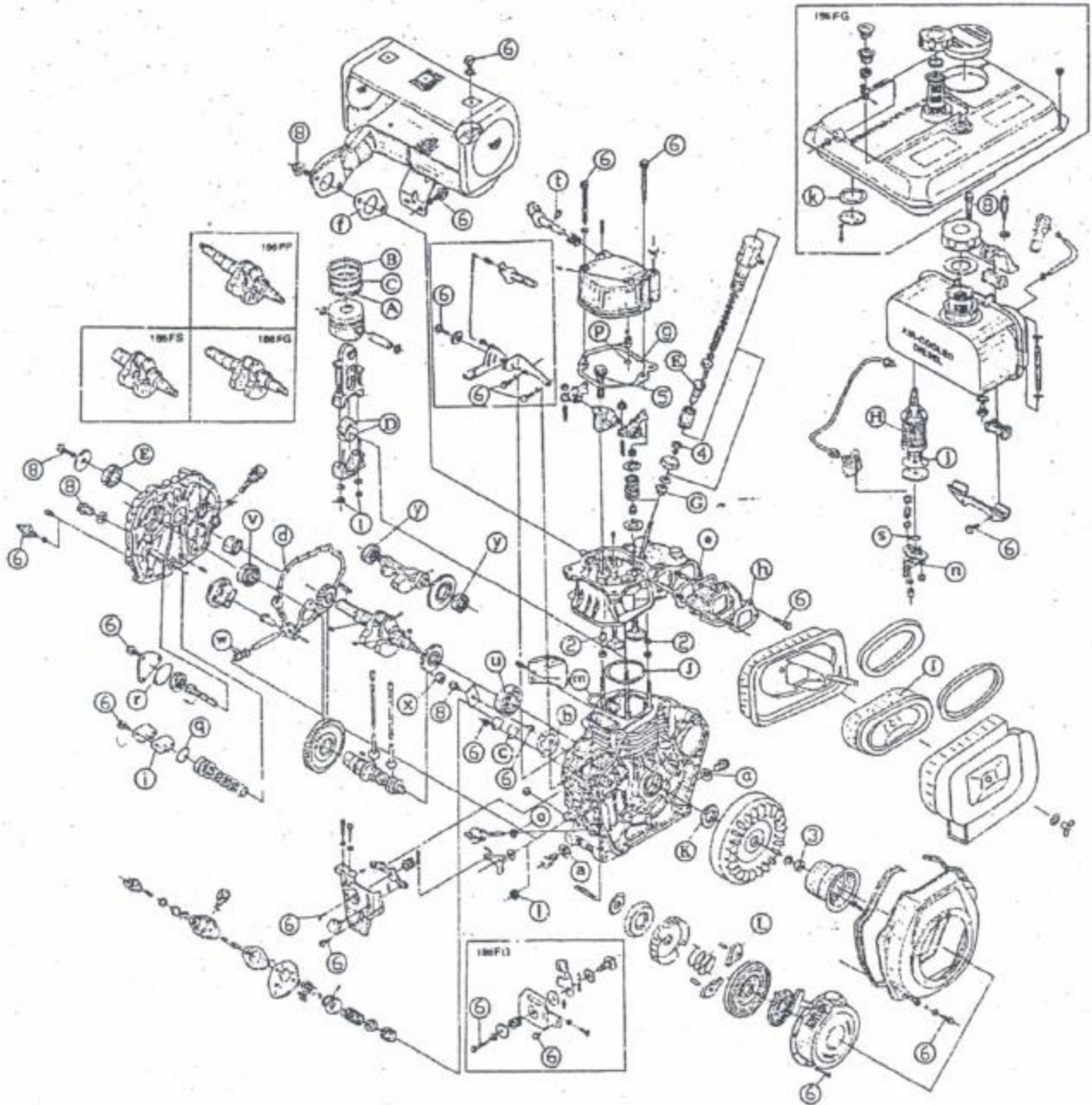
- (3) Take the rubber plug off the cover of the rocker shaft and put about 2cc of lubricant into it and put the plug back in place. The figure below shows where to access the plug.



- (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

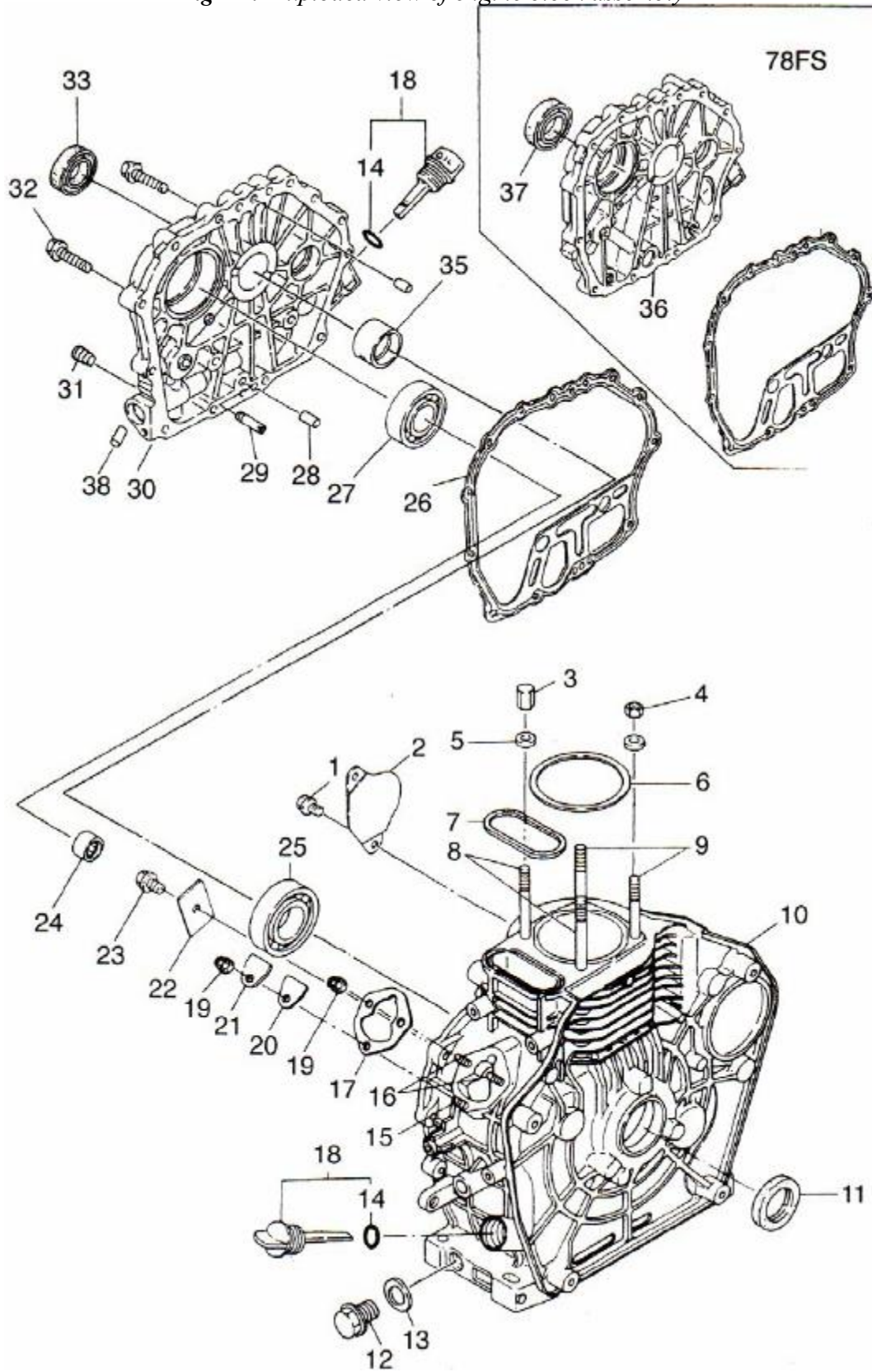
Table 4-1. Please refer to Fig 4-1 for illustration

Number	Part Number	Name of Part	Qty each set
1	ETQ1710626	Bolt M10 x 20 (GB5787-86)	2
2	ETQ 17138	Starter motor hole cover	2
	ETQ 70-1704901		2
3	ETQ 78-1704902	Cylinder head nuts (long)	2
	ETQ 86-1704903		2
	ETQ 70-1705001		2
4	ETQ 78-1705002	Cylinder head nuts (short)	2
	ETQ 86-1705003		2
	ETQ 70-1704801		2
5	ETQ 78-1704802	Cylinder head nut gasket	2
	ETQ 86-1704803		2
	ETQ 70-1719504		1
6	ETQ 78-1719704	Cylinder head gasket (0.4)	1
	ETQ 86-1706314		1
7	ETQ 70/78-17182	Oval ring gasket 5.1 x2.5	1
	ETQ 86-1720106	Oval ring gasket 5.1 x2.6	1
	ETQ 70-1700201		2
8	ETQ 78-1700202	Cylinder head bolts (long)	2
	ETQ 86-1700203		2
	ETQ 70-1700301		2
9	ETQ 78-1700302	Cylinder head bolts (short)	2
	ETQ 86-1700303		2
	ETQ 70-1700107		2
10	ETQ 78-1700103	Engine block	1
	ETQ 86-1700110		1
	ETQ 70-1711702		1
11	ETQ 78-1711702	Rear oil seal 30 x 45 x 8	1
	ETQ 86-1711704	Rear oil seal 35 x 50 x 8	1
12	ETQ 17121	Oil drain plug	1
13	ETQ 17120	Oil drain plug gasket	1
14	ETQ 1711324	O ring for oil dipstick	2
15	ETQ 17123	Fuel pump fastening bolt (short)	1
16	ETQ 17122	Fuel pump fastening bolt (long)	2
17	ETQ 1719605	Fuel injector gasket (0.5)	1
18	ETQ 70-1702001	Oil dipstick	2
	ETQ 78/86-1702002		2
19	ETQ 1710103	M6 nut	3
20	ETQ 17159	Sealing plate gasket	1
21	ETQ 17158	Sealing plate	1
22	ETQ 17195	Thrust piece	1
23	ETQ 1710636	Flange face with bolts (GB5789-86)	1

24	ETQ 1710010	Needle bearing 7941/15	1
	ETQ 70-1710006	Ball bearing 306 (GB/T276-94)	1
25	ETQ 78-1710007	Ball bearing 307 (GB/T276-94)	1
	ETQ 86-1710008	Ball bearing 308 (GB/T276-94)	1
	ETQ 70-1704601		1
26	ETQ 78-1704602	Crankcase cover gasket	1
	ETQ 86-1704603		1
	ETQ 70-1710002	Bearing 205 (GB/T276-94)	1
27	ETQ 78-1710003	Bearing 206 (GB/T276-94)	1
	ETQ 86-1710004	Bearing 207 (GB/T276-94)	1
28	ETQ 1711111	Retaining pin 8x12 (GB119-86)	2
29	ETQ 78/86-17080	Fuel Pipe	1
	ETQ 70-1701901		1
30	ETQ 78-1701902	Crankcase cover	1
	ETQ 86-1701904		1
31	ETQ 17133	Inner Hexagon Plug G1/8	1
	ETQ 70-1710083	M8 x 33.5 Bolt	1
	ETQ 70-1711062	M6 x 25	14
32	ETQ 78-1710083	M8 x 33.5 Bolt	15
	ETQ 86-1710083	M8 x 33.5 Bolt	16
	ETQ 70-1711701	Front oil seal 25 x 42 x 10	1
33	ETQ 78-1711703	Front oil seal 30x 45 x 10	1
	ETQ 86-1711705	Front oil seal 35 x 50 x 10	1
	ETQ 70-1701801		1
35	ETQ 78-1701802	Main Bushing	1
	ETQ 86-1701803		1
36	ETQ 78-1701903	Front side crankcase cover	1
37	ETQ 78-1711703	Front side oil seal	1
38	ETQ 70-1711602	Aluminum Plug Diameter 8 x 8	2
	ETQ 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	ETQ 70/78-1710755	M6 x 55 Flanged Bolt (GB5789-86)	2
	ETQ 86-1710730	M6 x 70 Flanged Bolt (GB5789-86)	2
2	ETQ 17142	Oiling hole plug	1
3	ETQ 17139	Decompression shaft	1
4	ETQ 1711310	O ring 10 x 1.9 (GB1235-76)	1
5	ETQ 17140	Decompression shaft spring	1
6	ETQ 1711103	Retaining pin 3 x 16 (GB119-86)	1
7	ETQ 70/78-17066	Cylinder head cover	1
	ETQ 86-1706603		1
8	ETQ 70/78-17170	Cylinder head cover gasket	1
	ETQ 86-1717001		1
9	ETQ 70/78-17168	Rocker arm	1
	ETQ 86-1716801		1
9A	ETQ 17165	Valve clearance adjusting screw	2
10	ETQ 70/78-1710745	Rocker arm shaft fastening bolt	1
	ETQ 86-1716901		1
11	ETQ 70-1705201	Adjusting valve spacer	2
	ETQ 78-1705202		2
	ETQ 86-1705203		2
12	ETQ 70-1702701	Valve clip	4
	ETQ 78-1702702		4
	ETQ 86-1702703		4
13	ETQ 70-1702801	Valve spring seat	2
	ETQ 78-1702802		2
	ETQ 86-1702803		2
14	ETQ 70-1702901	Valve spring	2
	ETQ 78-1702902		2
	ETQ 86-1702903		2
15	ETQ 70-1702003	Valve guide oil seal	2
	ETQ 78-1702004		2
	ETQ 86-1702100		2
16	ETQ 70/78-17136	Valve spring washer	2
	ETQ 86-1713601		2
17	ETQ 1711104	Pin 4 x 8 (GB119-86)	1
18	ETQ 1710920	Double ended stud AM8 x 20 (GB899-88)	2
19	ETQ 70-1702403	Cylinder Head	1
	ETQ 78-1702402		1
	ETQ 86-1702404		1
20	ETQ 70/78-1710955	Double ended bolt AM6 x 55 (GB900-88)	2
	ETQ 86-1710956	Double ended bolt AM6 x 75 (GB900-88)	2
21	ETQ 70-1702501	Intake valve	1
	ETQ 78-1702601		1

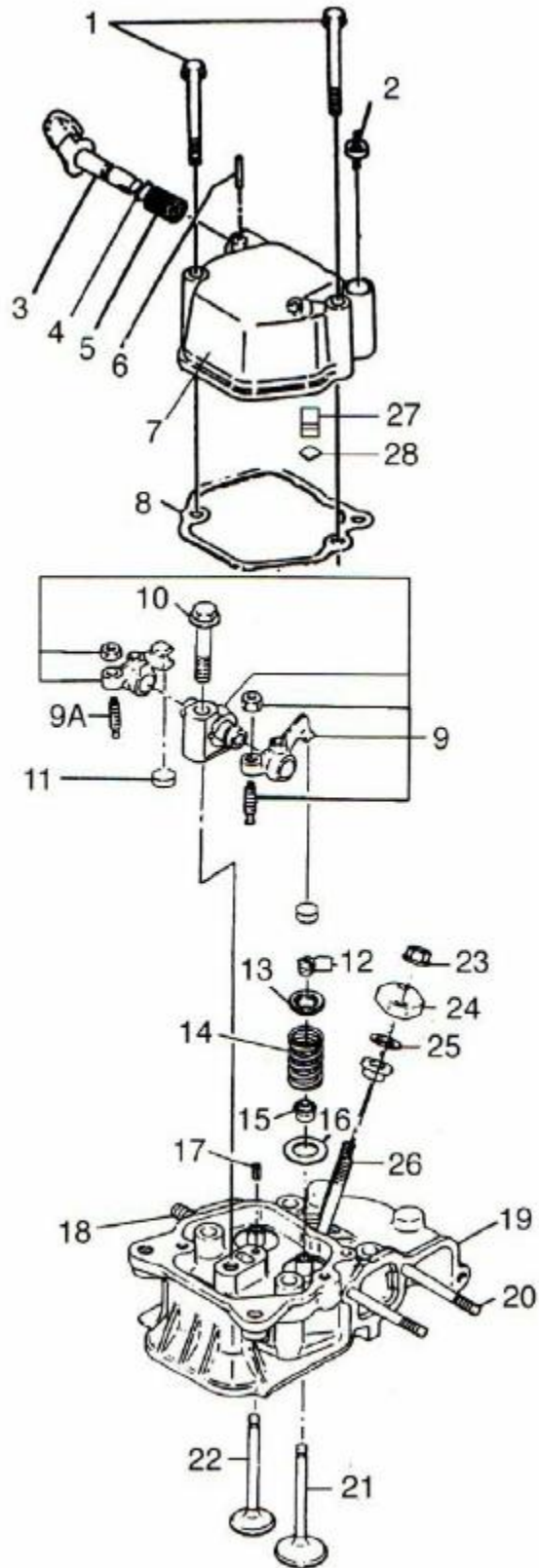
	ETQ 86-1702503		1
22	ETQ 70-1702502	Exhaust valve	1
	ETQ 78-1702602		1
	ETQ 86-1702605		1
23	ETQ 1710103	M6 (GB6177-86) Nut	2
24	ETQ 1717302	Fuel injector pressure plate	1
25	ETQ 1724502	Fuel injector gasket	1
26	ETQ 70-1712201	AM 6 x 42 Fuel injector bolt	2
	ETQ 78-1712201	AM 6 x 42 Fuel injector bolt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

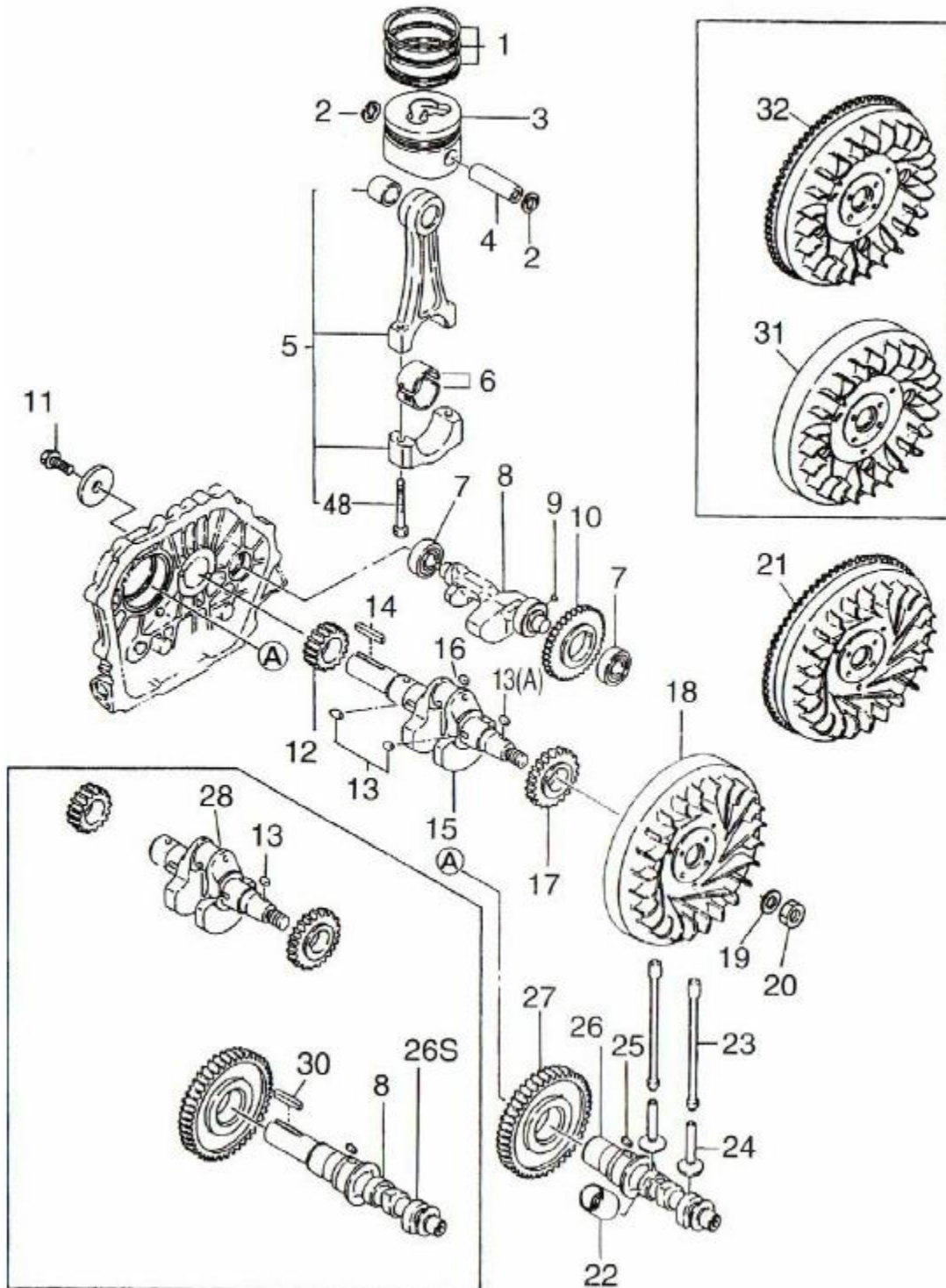
No.	Code	Name of Part	Qty each set
1	ETQ70-1701403	Piston Rings	1
	ETQ 78-1701402		1
	ETQ 86-1701404		1
2	ETQ 70-1701601	Retainer clip of Piston pin Dia. 19mm	2
	ETQ 78-1701602	Retainer clip of Piston pin Dia. 21mm	2
	ETQ 86-1701603	Retainer clip of Piston pin Dia. 23mm	2
3	ETQ 70-1701200	Piston	1
	ETQ 78-1701202		1
	ETQ 86-1701204		1
	ETQ 78FS-1701203		1
4	ETQ 70-1701701	Piston pin	1
	ETQ 78-1701702		1
	ETQ 86-1701703		1
5	ETQ 70-1701301	Connecting rod	1
	ETQ 78-1701302		1
	ETQ 86-1701303		1
6	ETQ 70-1701501	Connecting rod journal bearing	1
	ETQ 78-1701502		1
	ETQ 86-1701503		1
7	ETQ 70-1710001	Bearing 202 (GB/T276-94)	2
	ETQ 78-1710001		2
	ETQ 86-1710000	Bearing 203 (GB/T276-94)	2
8	ETQ 70-1706501	Balancing Shaft	1
	ETQ 78-1706502		1
	ETQ 86-1706503		1
9	ETQ 1710507	Key 5 x 7 (GB1096-79)	2
10	ETQ 70-1707701	Balancing Shaft Timing Gear	1
	ETQ 78-1707702		1
	ETQ 86-1707703		1
11		Bolt (included with diesel engine)	1
12	ETQ 70-1700801	Crankshaft timing gear	1
	ETQ 78-1700802		1
	ETQ 86-1700803		1
13	ETQ 70/78-1710512	Key 5 x 12 (GB1096-79)	2
	ETQ 86-1710512	Key 5 x 12 (GB1096-79)	1
13A	ETQ 86-1710514	Key 5 x 14 (GB1096-79)	1
14	ETQ 70-1710530	Key 5 x 30 (GB1096-79)	1
	ETQ 78/86-1710563	Key 6 x 63 (GB1096-79)	1
15	ETQ 70-1700601	Crankshaft	1
	ETQ 78-1700701		1
	ETQ 86-1700708		1
16	ETQ 1711601	6 x 8 Plug	1

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

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



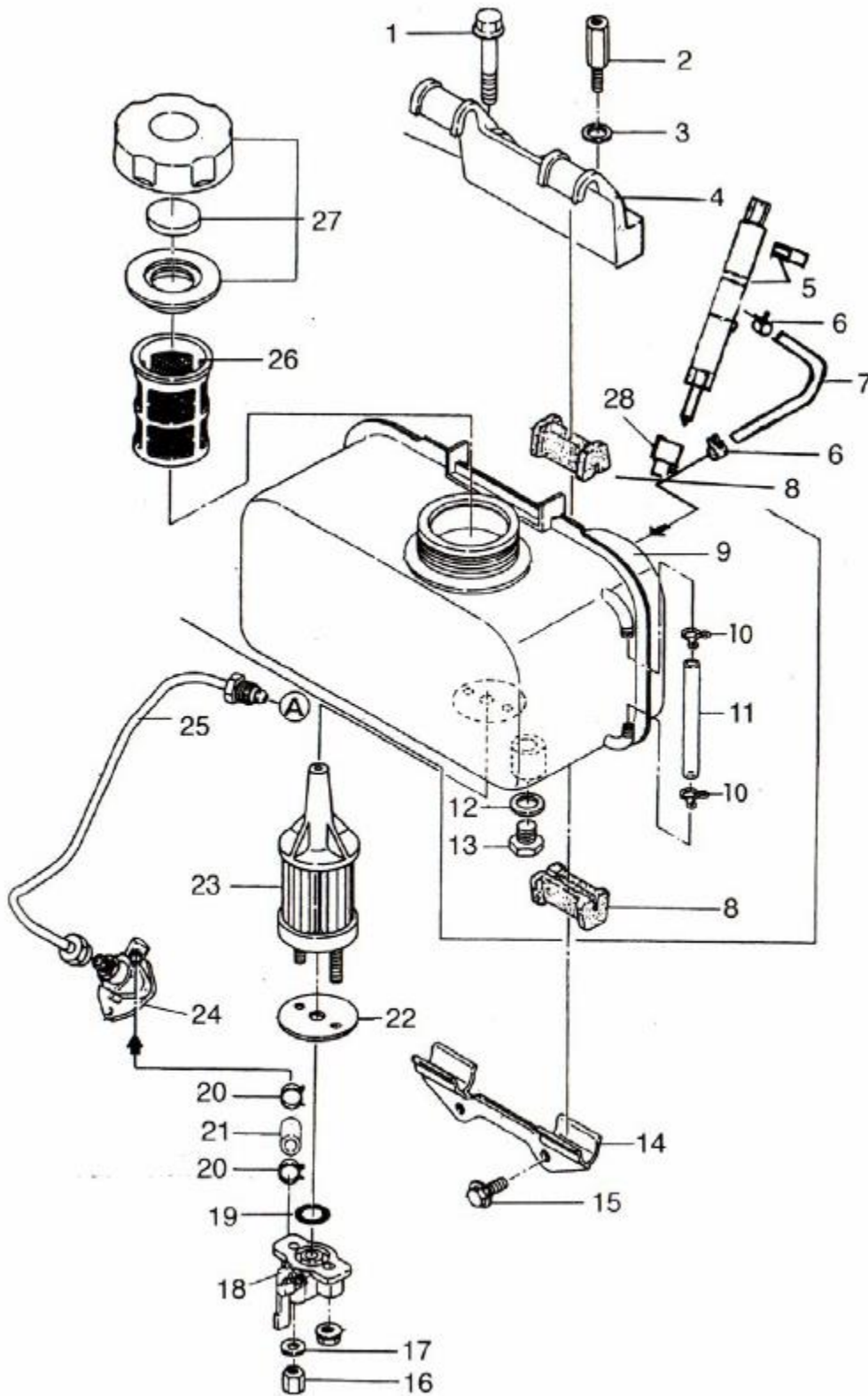
4-4 Fuel System Parts

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	ETQ 1710745	M8 x 45 (GB5787-86) Bolt	1
2	ETQ 17185	Upper fuel tank bracket fastener	1
3	ETQ 1710208	Flat washer 8 (GB97.1-85)	1
4	ETQ 70-1705801	Upper fuel tank bracket	1
	ETQ 78-1705802		1
	ETQ 86-1705803		1
5	ETQ 1705301	Injector	1
6	ETQ 17212	Hose Clamp	2
7	ETQ 17192	Fuel Pipe	1
8	ETQ 17184	Rubber fuel tank mount	4
9	ETQ 70-1704201	Fuel Tank	1
	ETQ 78-1704202		1
	ETQ 86-1704203		1
10	ETQ 17212	Fuel Pipe connectors	2
11	ETQ 17147	Fuel Pipe	1
12	ETQ 17151	M6 (GB6177-86) Fuel drain gasket	1
13	ETQ 17152	Fuel drain plug	1
14	ETQ 17183	Lower fuel tank bracket	1
15	ETQ 1710714	M6 x 14 (GB5787-86) Bolt	2
16	ETQ 1710106	M6 (GB6177-86) Nut	2
17	ETQ 1710206	M6 (GB97.1-85) Flat washer	1
18	ETQ 17150	Fuel tank cock assembly	1
19	ETQ 17154	Flat washer	1
20	ETQ 1719403	Fuel pipe clamp	2
21	ETQ 17189	Fuel pipe	1
22	ETQ 17148	Fuel filter gasket	1
23	ETQ 70-1704301	Fuel filter assembly	1
	ETQ 78-1044302		1
	ETQ 86-1704303		1
24	ETQ 70-1704702	Fuel injector pump	1
	ETQ 78-1704702		1
	ETQ 86-1704700		1
25	ETQ 70-1705601	High pressure fuel pipe	1
	ETQ 78-1705602		1
	ETQ 86-1705603		1
26	ETQ 17146	Fuel cup filter	1
27	ETQ 17153	Fuel cap assembly	1
28	ETQ 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



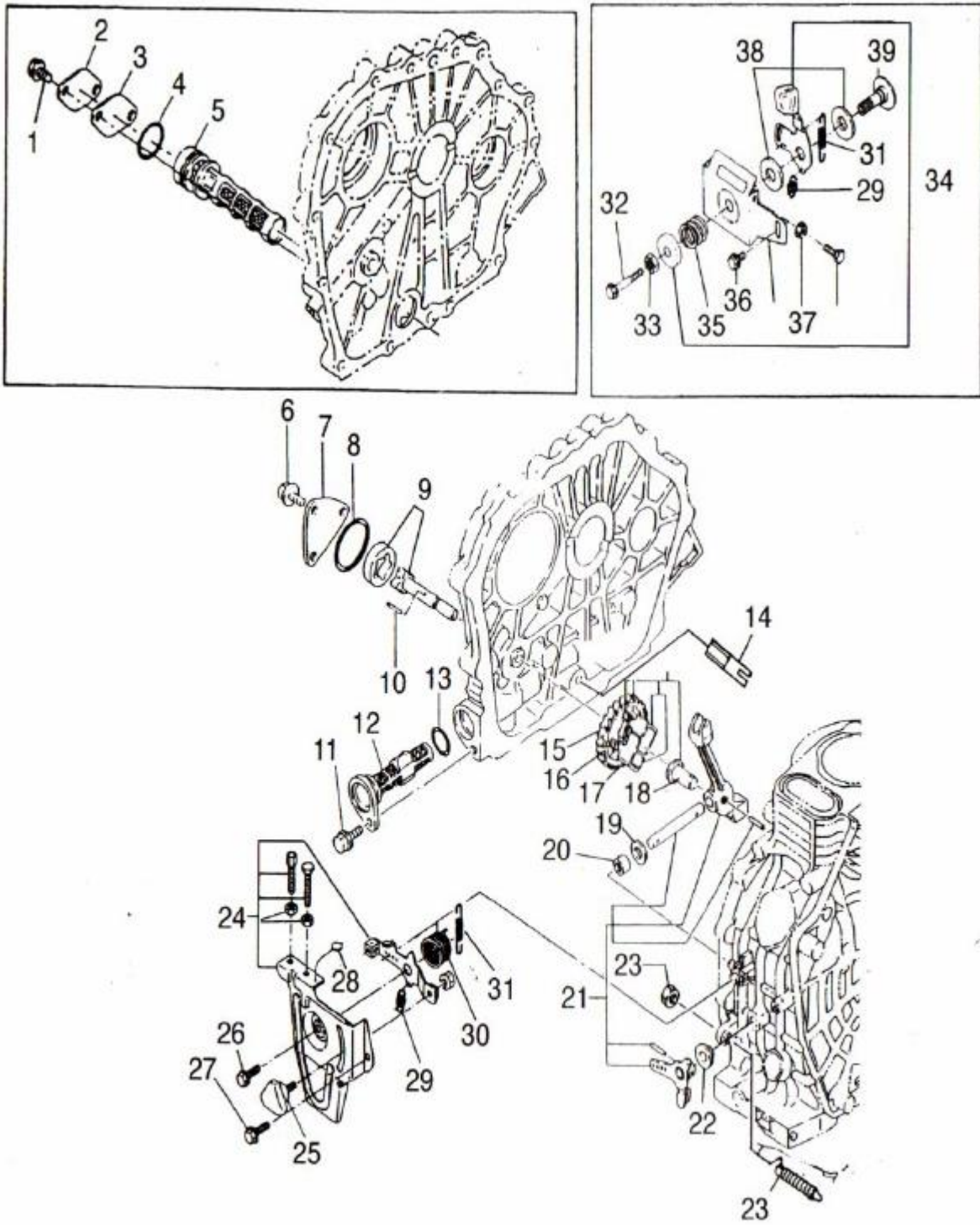
4-5 Oil and speed control system

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

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

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

Fig 4-5. Lubrication and speed control system



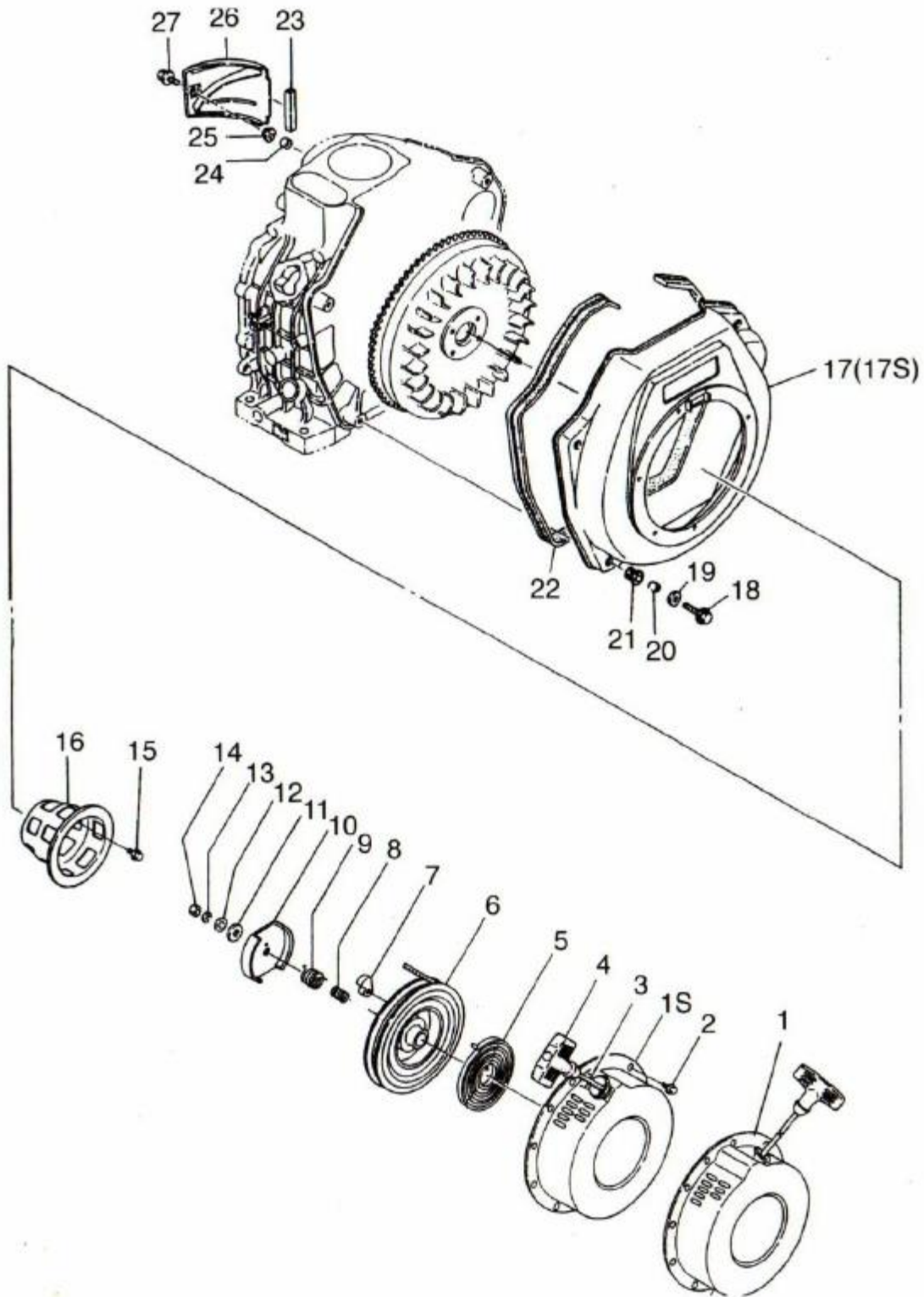
4-6 Cooling and recoil starting system

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

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

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

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



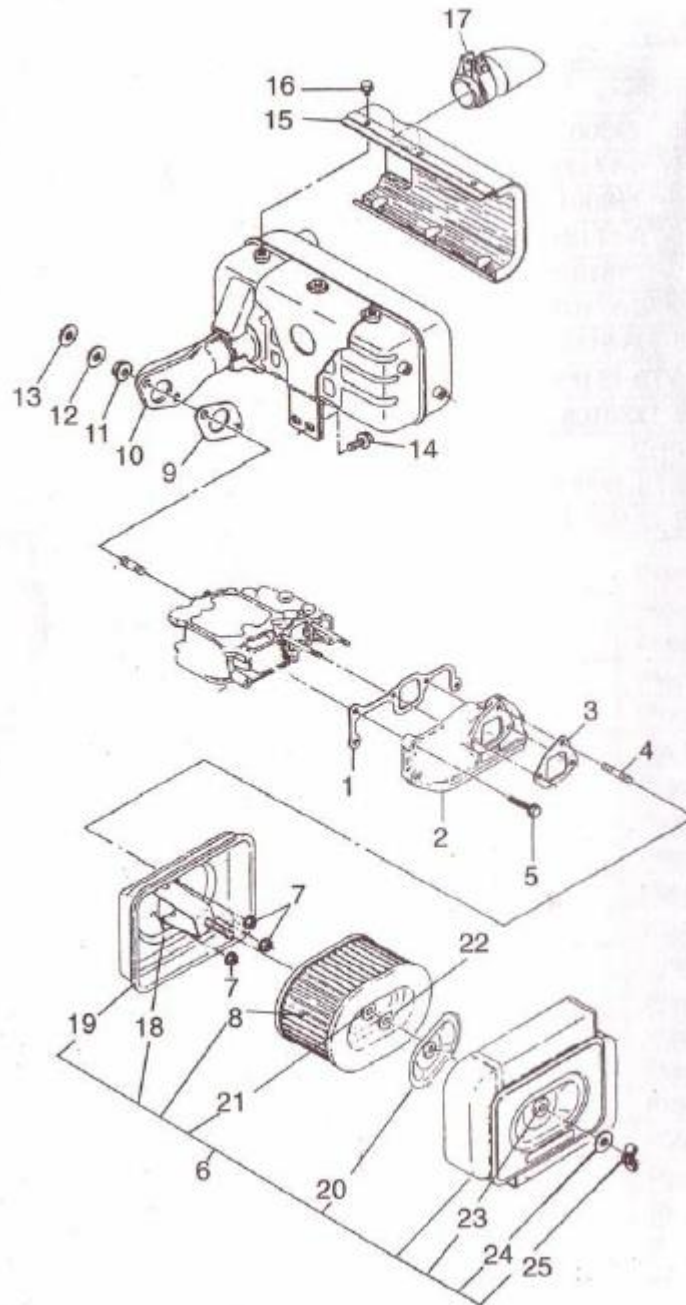
4-7 Air cleaner and silencer system

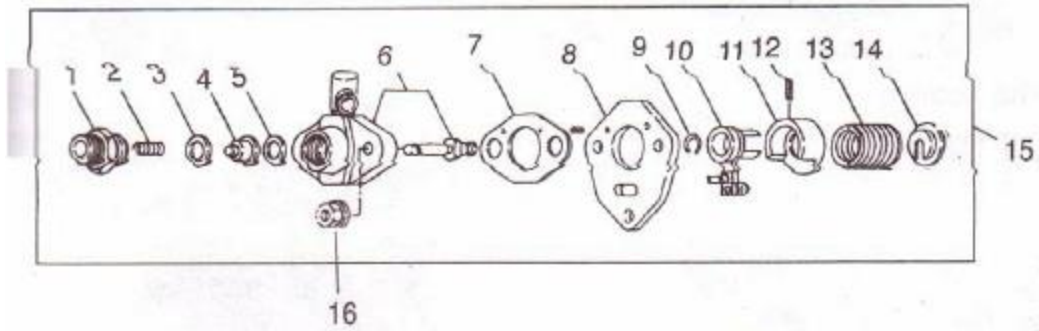
No.	Code	Name of part	Qty each set
1	ETQ 70-1703101	Intake pipe gasket	2
	ETQ 78-1703102		1
	ETQ 86-1703103		1
2	ETQ 70-1703001	Intake pipe	1
	ETQ 78-1703002		1
	ETQ 86-1703003		1
3	ETQ 70/78-17175	Air cleaner gasket	3
	ETQ 86-1717501		1
4	ETQ 17137	Bolt	1
5			1
	ETQ 1710722	M6 x 22 (GB5789-86) Shaped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

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

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

Fig 4-7. Exploded view of muffler assembly





- 1. Delivery holder
- 2. Delivery spring
- 3. Delivery gasket
- 4. Delivery valve
- 5. Delivery valve gasket
- 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 too 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 too 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.

5-6 Engine exhaust white

Possible cause	Remedy
There is water in the diesel fuel	Clean the fuel tank and diesel filter, replace the diesel fuel.

5-7 Various methods of checking to see if the engine is malfunctioning

Possible cause	Remedy
High and low speed fluctuation.	Check the speed governor system to see if it is loose. Also, check to make sure there is no air in the fuel system.
Abnormal sounds suddenly appear.	Check each rotating part carefully.
Sudden appearance of black smoke from exhaust.	Check the fuel system, especially the injection nozzle.
There are metal knocking sounds in the cylinder.	The fuel delivery angle is too large. Adjust it to the correct specifications.

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 PERMITTED 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 ENGINE	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 plug cleaning grit, or other abrasive material that has entered the engine because of improper maintenance 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.

Note: Please mail the above card to: *Eastern Tools & Equipment, Inc.*
4951 Commerce Dr.
Baldwin Park, CA 91706

www.tillers4africa.co.za

Email: sales@tillers4africa.co.za

Call Rodney for more info: 083 601 8321