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# KIPOR

## WUXI KIPOR POWER

### OPERATION MANUAL

PLEASE READ THIS MANUAL CAREFULLY.  
IT CONTAINS IMPORTANT SAFETY INFORMATION.

# KIPOR

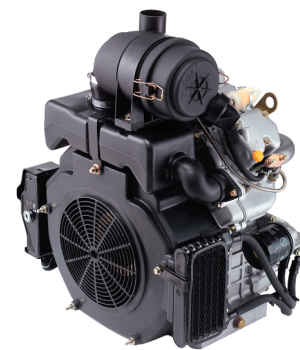
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## DIESEL ENGINE

**KD2V78F**

**KD2V86F**

Version 1, Printing date 25/01/2007



# PREFACE

Thank you for purchasing a KIPOR engine.

This manual covers operation and maintenance of the KD2V78F, KD2V86F engine.

Please read the manual carefully before using the engine to ensure the proper operation. If you have any comments or problems, please contact with our sales company or the authorized agent.

Follow the instructions to keep your engine in the best working condition and extend the life of it.

## 11. The engine power is insufficient

Reason	Troubleshooting
1) The fuel filter element is too dirty, oil supplying is not fluent	Clean or replace
2) The accelerator pulling rod works not well	Adjust the accelerator pulling rod
3) The fuel pipe is blocked, fuel supplying is not fluent	Check and clean
4) Fuel leaks or air mixed in the fuel system	Tighten, drain out the air in the fuel system
5) The oil supplying timing is wrong	Adjust
6) The fuel injector is faulty	Check the fuel injecting pressure and spray
7) The air filter is too dirty	Clean or replace the air filter element
8) The valve distribution phase is incorrect	Check and adjust
9) Insufficient cylinder compression pressure	
① Air leakage of valve	Grind the valve or replace the valve and valve seat ring
② Air leakage of cylinder gasket	Replace the cylinder gasket
③ Air leakage of fuel injector hole	Replace the sealing washer or heat insulation sheath of nozzle
④ The cylinder cover bolt looses	Tighten the bolt to the correct torque
⑤ Clearance between piston ring and piston ring groove is too big	Replace the piston ring, replace the piston if necessary
⑥ Clearance between piston and cylinder is too big	Replace the piston ring and piston

## 12. Smoke exhausting is excessive or smoke color is abnormal

Reason	Troubleshooting
1. Black smoke	
1) The fuel injector is blocked by carbon deposits; the needle valve is clipped	Check, repair or replace
2) The load is too heavy	Adjust the load
3) Fuel injection is late	Adjust the fuel injection timing
4) Fuel supplying of each cylinder is not uniform	Adjust the fuel supplying of each cylinder by professional
5) The inlet pipe and air filter are blocked	Disassemble and clean the air filter
2. White smoke	
1) Insufficient fuel supplying	Check
2) Start with low temperature and idle running	It is normal, reduce the idle time
3) The fuel quality is poor (water mixed in the fuel)	Replace for the qualified fuel
3. Blue smoke	
1) The piston ring is worn, or oil mixed in the cylinder combustion chamber (occurs in case of no load or low load)	Clean or replace the piston ring
2) The valve oil seal is damaged	Replace the valve oil seal

### 8. The oil consumption is too big

Reason	Troubleshooting
The oil viscosity is too low, incorrect type of oil	Use the correct type of oil
The piston cylinder clearance is too big, the oil return hole of piston ring groove is blocked	Replace or clean the oil hole
The piston ring is clipped; air ring is installed mistakenly; worn	Clean and replace
Oil leaks at the front /rear oil seal of crankshaft,crankcase and crankcase cover	Check and replace the damaged parts
The oil temperature and pressure is too high	Reduce the temperature, check and adjust the pressure limitation valve of oil pump
Oil leakage of valve oil seal	Replace the valve oil seal

### 9. Fuel consumption is too big

Reason	Troubleshooting
Fuel leaks	Replace the fuel pipe tighten to the correct torque
Fuel injection timing is abnormal	Adjust the fuel injection timing
The fuel injector or nozzle parts is abnormal	Clean and replace

### 10. Abnormal noise during running

Reason	Troubleshooting
Clearance between piston and cylinder is too big	Replace the piston ring or piston
Clearance between piston pin and connection rod small head bushing is too big	Replace the damaged parts and keep the correct clearance
Axial clearance between the main bushing and crankshaft and axial clearance between the connection rod bushing and crankshaft are too big	Replace the main bushing and connection rod bushing, keep the correct axial clearance
Clearance between piston ring and piston ring groove is too big	Replace the piston ring, replace the piston if necessary
Clearance between the crankshaft pushing side and thrust is too big	Replace the crankshaft thrust, keep the correct clearance
The gear is worn and clearance is too big, so crash will be caused if speed suddenly reduces	Replace the gear according to the wearing condition
The oil supplying timing is too early	Check and adjust the oil supplying timing
The fuel injector parts are seized	Clean or replace the nozzle parts

## Contents

### Instruction

1. Brief instruction .....	1
2. Model and its symbol .....	1
3. Engine configuration and installation dimension drawing .....	2
4. Installation dimension of engine crankshaft output end .....	3
5. Location of warning label .....	5
6. Load characteristic curve .....	6
7. Main technical specifications .....	7
8. Tighten torque of main bolts and nuts .....	8

### Usage

1.Safety .....	9
2.Load installation .....	10
3.Engine usage .....	11
4.Start the engine .....	13
5.Running .....	15
6.Stop the engine .....	15
7.Periodic check and maintenance .....	16
8.Long-term storage .....	19

### Troubleshooting

1.No fuel injection sound .....	20
2.Compression pressure is too low .....	21
3.The engine hard starting .....	22
4.Engine overspeed .....	23

5.Unstable engine speed.....	23
6.The engine stops suddenly.....	24
7.Abnormal oil pressure .....	25
8.The oil consumption is too big.....	26
9.Fuel consumption is too big.....	26
10.Abnormal noise during running.....	26
11.The engine power is insufficient.....	27
12.Smoke exhausting is excessive or smoke color is abnormal.....	27

## 7. Abnormal oil pressure

Reason	Troubleshooting
1. No oil pressure or low oil pressure	
1) Too littler oil	Refill in oil to a certain level
2) Oil dilutes	Replace for the correct type of oil
3)The oil pipe is broken; the pipe connector looses; oil leaks	Replace; tighten
4) The axial clearance of oil pump is too big	Replace
5) The pressure limitation valve of oil pump is not flexible; the spring distorts or brakes	Replace
6) The fitting clearance between main bearing and connection rod bearing is too big	Check, adjust or replace
7) The main oil duct is blocked	Check and clean
8) The oil filter is blocked	Check and clean the filter
9) The oil filter is too dirty	Clean or replace the filter element
10) The oil filter or oil cooler is short circuit	Check and replace
11) The oil pressure gauge is damaged	Replace
2. The oil pressure is too high	
1) The pressure limitation valve of oil pump is abnormal, oil return is not fluent	Check and adjust
2) The temperature is too low, and oil viscosity is too big	Use the correct type of oil, the viscosity will reduce when the engine warms

## 6. The engine stops suddenly

The sudden stopping is usually resulted by poor cooling, insufficient lubricating or not fluent oil supplying, and these conditions are mainly caused by incorrect maintenance. Maintenance will cost both money and time, so in order to avoid these problems, please take good care of your engine.

Reason	Troubleshooting	Remarks
No fuel in the fuel tank	Refill in fuel	Check the fuel tank periodically
The fuel is not qualified	Replace for the qualified fuel	Use the recommended fuel
Air sucked into the oil way	Drain out the air	Drain out the air in the oil way in case of long time no using
The fuel filter is blocked	Clean or replace the filter element	Clean or replace the filter element periodically
The fuel injection pump plug and oil exhausting ring are seized	Send to the oil pump maintaining station for maintenance	Send to the professional for maintenance
The fuel injection pump plug spring is broken	Send to the oil pump maintaining station for maintenance	
Electricity of fuel injection pump electromagnetic valve connector is disconnect	Check, replace or inspect the wiring line	
Scuffing or sticking of cylinder	Send to the maintenance station	
The oil pressure is too low or poor cooling or lubricating	Send to the maintenance station and check the lubricating system	Check and replace the lubrication periodically

## Instruction

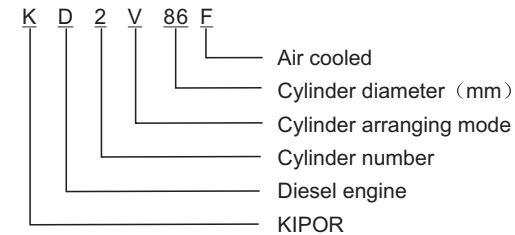
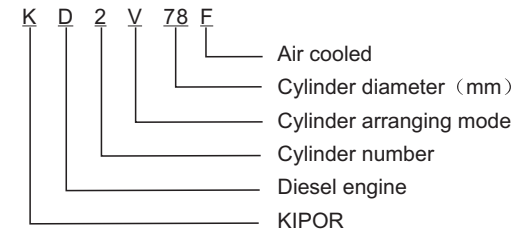
### 1. Brief instruction

This model of diesel engine is two cylinder, V-twin, OHV, four stroke and air cooled.

This model of diesel engine is multi-purpose with horizontal shaft output.

Thanks to the compact configuration, light weight, high rotation speed, low oil consumption, low noise, slight vibration, easy start, simple operation, convenience, safety, agility, good durability and reliability, the engine is applied very widely, such as supplying power to micro transporter, water pump, air compressor, agricultural tricycle and micro high-speed yacht, or assembled into light generator set and mobile power station.

### 2. Model and its symbol



### 3.Engine configuration and installation dimension drawing

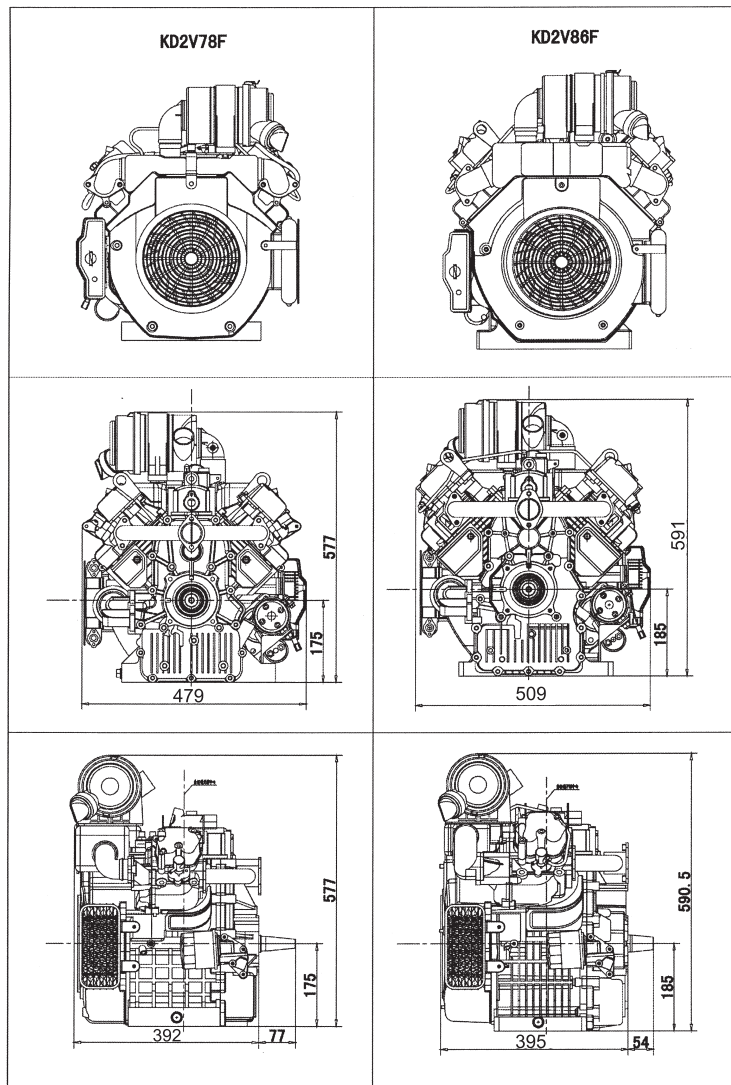


Figure 1 Engine configuration and installation dimension drawing

### 4. Engine overspeed

If the engine is overspeed during starting or running, please turn the engine starting switch to “O” to stop the engine. Long-time overspeed running will result in severe consequence.

Reason	Troubleshooting	Remarks
1.The speed adjusting handle operation is too not correct	Adjust the speed adjusting handle, check and adjust the installation position of speed adjusting spring	Use the speed adjusting handle correctly
2.The speed adjuster level is adjusted incorrectly 1)Incorrect adjusting 2)The tighten bolt adjusting the fork on the fuel injection pump looses	Adjust and fix the speed adjuster	

### 5. Unstable engine speed

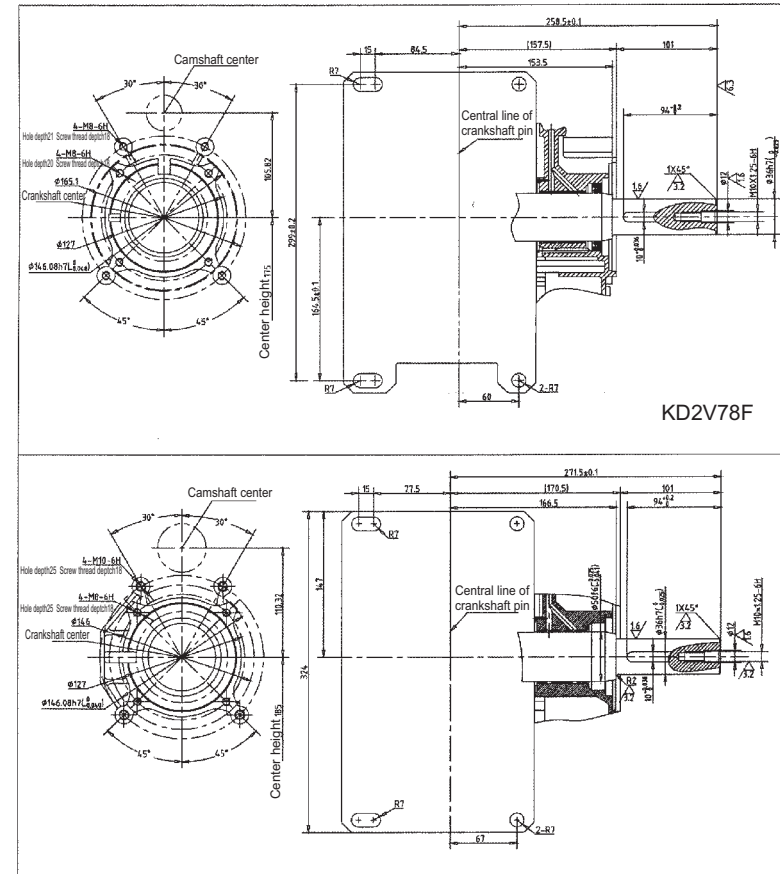
Reason	Troubleshooting	Remarks
Adjust the speed adjuster incorrectly	Adjust the speed adjuster	Pay attention to the adjusting way
The speed adjusting level shaft can't sliding normally	Lubricate or repair it	
The speed adjusting level interferes	Repair or replace it	
Poor fly ball action	Repair it	
The installation clearance of speed adjusting spring is too big	Adjust the installation clearance	
The installation location of speed adjusting spring is not correct	Adjust the installation location	
The fuel quality is poor or is polluted	Replace the fuel	
The fuel sprayer performance is poor		
One of the fuel injection nozzle is stuck	Grind or replace the fuel injection nozzle	
The needle valve is worn or damaged	Replace the fuel injector assembly	
The fuel injection timing is too late or too early	Adjust the fuel injection timing with adjusting gasket	
The camshaft end clearance is too big	Replace crankcase cover gasket	
The flywheel nut looses	Tighten the torque	Check the torque of the important bolt and nut periodically
Fuel supplying of the two cylinders of fuel injection pump is not balance	Send to the oil pump maintaining station for maintenance	



### 3. The engine hard starting

Fault reason	Troubleshooting	Remarks
1.The diesel quality is poor, or water mixed in the diesel	Replace the diesel	1)Use the recommended fuel 2)Obey the correct procedure of delivering, storing and discharging
2. Incorrect fuel injection timing 1)The thickness of the adjusting gasket is not suitable 2)Incorrect fuel injection pressure 3)The plug is worn	1)Adjust the thickness of the adjusting gasket 2)Adjust the fuel injection pressure 3)Replace the plug	1) Adjust the fuel injection timing 2) Pay attention to the way of adjusting the fuel injection pressure 3) Use the clean fuel
3.Poor pulverization of fuel injection 1) The fuel injection nozzle is stuck 2) The fuel injection nozzle is faulty 3) The fuel injection nozzle is worn 4)The fuel injection hole is blocked 5) The fuel injection pressure is too low	1)Clean or replace the fuel injection nozzle 2)Replace the fuel injection nozzle 3)Replace the fuel injection nozzle 4)Clean or replace the fuel injection nozzle 5)Adjust the fuel injection pressure	Use the clean fuel Pay attention to the way of adjusting the fuel injection pressure
4. The electric quantity of battery is insufficient or the connector looses	Charging; tighten the connector, repair the connection plug if necessary	
5. The starting motor gear can't be set into the flywheel gear ring	Rotate the flywheel, adjust the relative position between the small gear and gear ring	
6. Air mixed in the fuel injection pump	Drain out air, tighten the oil pipe connector	Drain out air in the fuel system before starting
7. The fuel filter element is blocked	Clean or replace the fuel filter element	Clean or replace the fuel filter element periodically
8. The starting switch is faulty	Check or replace the starting switch	
9. The fuel injection plug is broken or seized	Replace the fuel injection pump parts	

### 4. Installation dimension of engine crankshaft output end



KD2V86F

Figure 2 Installation dimension of engine crankshaft output end

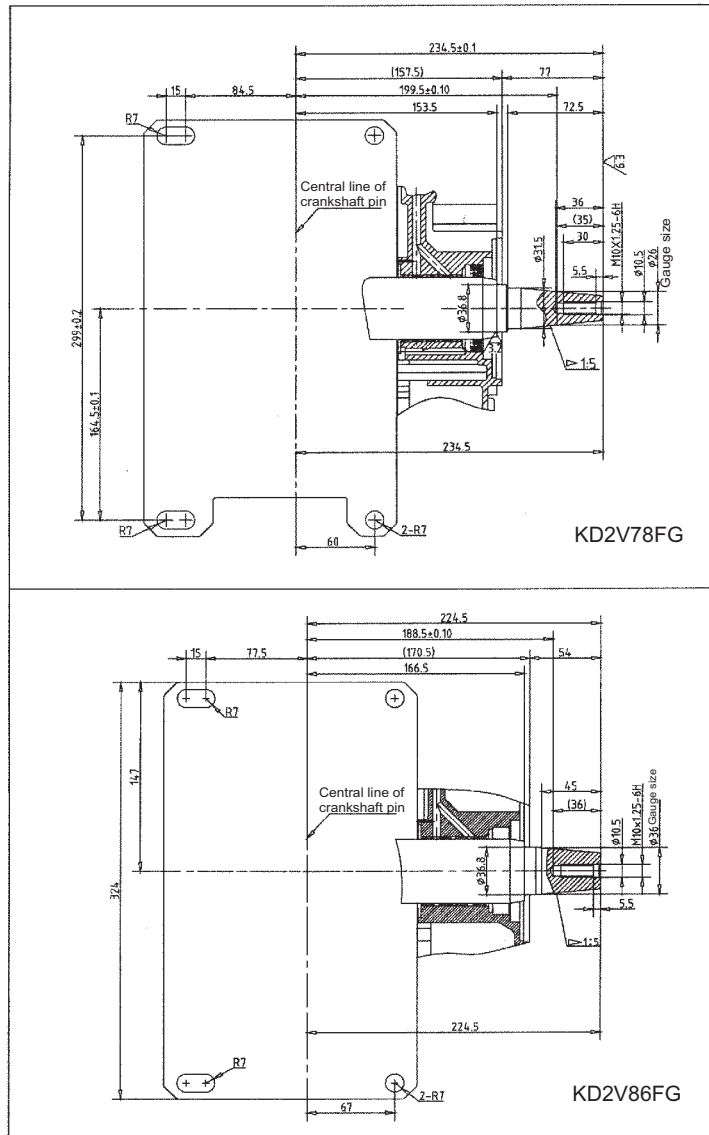


Figure 3 Installation dimension of engine crankshaft output end 2

## 2. Compression pressure is too low

Fault	Reason	Troubleshooting
1. Air leakage of inlet/exhaust valve	Incorrect valve clearance	Adjust to the correct inlet /exhaust valve clearance: rotate the flywheel, when the 1 <sup>st</sup> cylinder is at the compression upper dead point, align the upper dead point with the scale marks on the cylinder block and adjust the valve adjusting screw
	The inlet /exhaust valve seat is worn	Replace the inlet /exhaust valve seat
2. Air leaks around the fuel injection nozzle	Incorrect torque of fuel injection nozzle	Increase the torque
	The fuel injector washer is faulty	Replace the fuel injector washer
3. Air leakage if cylinder cover	Incorrect tighten torque of cylinder cover	Tighten to the correct torque
	The cylinder cover gasket is damaged	Replace the cylinder cover gasket
4. Air blowby of crankcase	The oil quality is poor: a. The oil goes bad b. The viscosity is too low	Replace the oil: apply the grade AEC or CD (API classification), or SAE 30# for warmness, 10W30# for coldness.
	The piston ring is stuck	Clean or replace the piston ring: a. clear off the deposit carbon in the ring groove. b. the factory label on the piston ring end should be lay upwards. c. don't mix the position of 1 <sup>st</sup> and 2 <sup>nd</sup> ring
	The piston ring is worn or broken	Replace the piston ring
	The piston ring groove is severely worn	Replace the piston

## Troubleshooting

### 1. No fuel injection sound

Fault	Reason	Troubleshooting
1. No fuel flows into fuel injection pump	The fuel tank is empty	Check the fuel level in the fuel tank, the fuel switch and the fuel filter
	The fuel switch is off	
	The fuel filter is blocked	
2.No fuel flows out from oil valve after high pressure pipe is disassembled	Air mixed in the fuel injection pump	Fill in oil and drain out air: a.Disassemble the high pressure oil pipe b.Loose the oil outlet valve seat c.Turn on the oil tank switch and discharge the oil (If no oil discharging, revolve the flywheel for half circle) d.Tighten and test the oil outlet valve Replace the oil outlet valve for couples
	The oil outlet valve seat is dirty or faulty	Clean the oil outlet valve
	The connector of speed adjustor is wrong	Adjust the speed adjusting connector
	The fuel injection plug is worn	Replace the fuel injection pump
3. Abnormal fuel injection	The fuel injection nozzle is stuck	Clean or replace it. The method for checking the fuel injection nozzle is that: clean it with light diesel, lean the needle valve in 45° if the needle valve could slide into needle valve hole in the action of gravity, it is normal.
	Incorrect fuel injection pressure	Adjust the fuel injection pressure with adjusting gasket
	The fuel injection nozzle is worn	Replace: clean the fuel filter and realign the location pin to replace the fuel injection nozzle
	Incorrect fuel injector assembly	Aligning and location: reassemble
	The injection hole of fuel injection nozzle is blocked	Clean or replace

### 5. Location of warning label

This label guides you how to operate the engine safely. Please keep the label clear and unbroken. If the label comes off or becomes hard to read, contact with your agent for replacement.

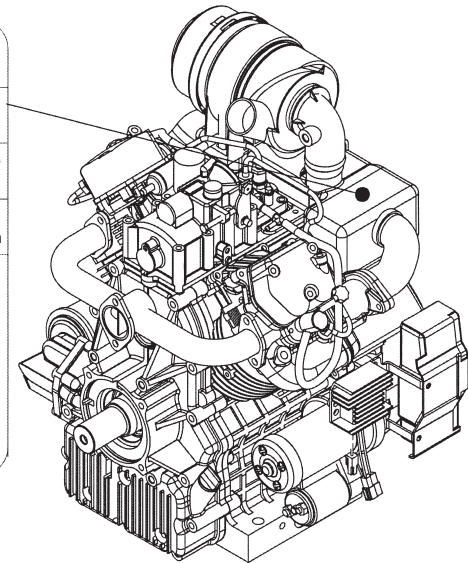
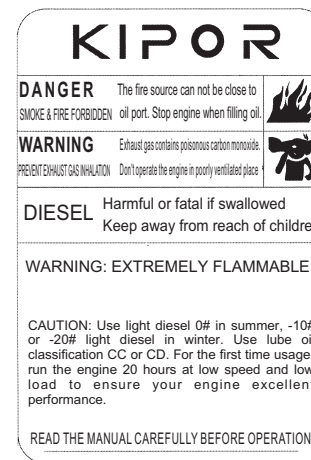


Figure 4 Location of warning label

6. Load characteristic curve

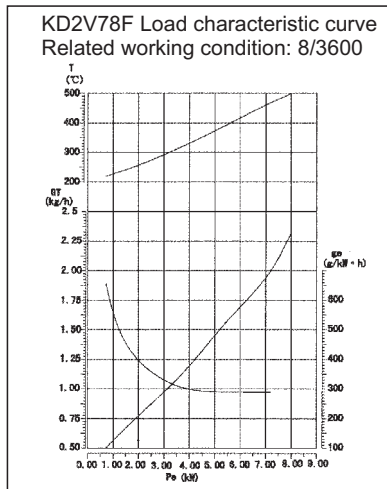


Figure 5 Load characteristic curve for KD2V78F engine

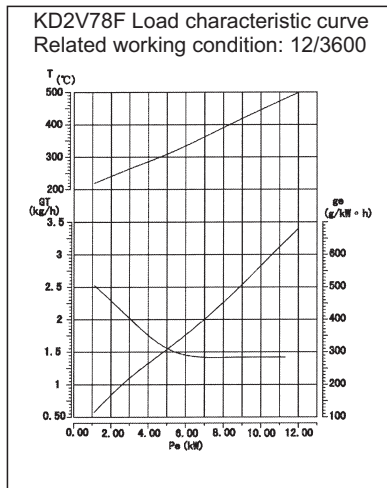
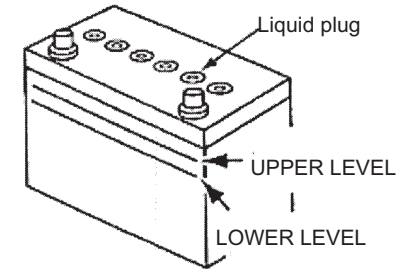


Figure 6 Load characteristic curve for KD2V86F engine

(b) Charge at well ventilated place. Fire is prohibited as hydrogen inside the battery is flammable.

(c) The electrolyte is dilute sulphuric acid, when touched on the eyes or skin, blindness or burnt will result. Be sure to put on glasses and rubber gloves during operation. Wash with water or refer to doctor for help if electrolyte is touched.

Notice: Continually use battery while the electrolyte is insufficient will cause battery damage, so please check the electrolyte level periodically. If the level is below the standard level, please refill electrolyte in time.



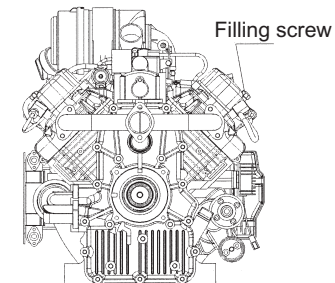
Picture 15 Battery electrolyte level

8. Long-term Storage

Prepare the following items before long-term storage:

- ① Run the engine 5 minutes at low speed.
- ② Drain out the engine oil while the engine is still warm and refill the fresh engine oil.
- ③ Disassemble the filling screw on the cylinder cover (refer to picture 16). Refill about 2ml engine oil and turn the engine for several circles.

Clean off the dirty on the engine surface, then store the engine at the dry place.



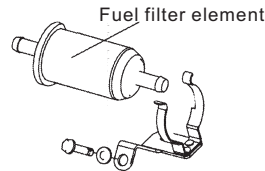
Picture 16

2) If the element is too dirty, the air flow will be blocked and starting will be hard, thus insufficient output and black exhausted smoke will result. Further more, it will cost both fuel oil and engine oil.

3) Running engine with worn element or without element is not allowed.

Table 11 Intervals for cleaning and replacing the air filter element

Clean	Every 500 h
Replace	Every 1000 h



a. Screw off the bolts on the fuel filter bracket, and take off the fuel filter and bracket.

Check whether there is deposited water or matter inside the fuel filter; reassemble the fuel filter if necessary.

b. Please replace the fuel filter if there is too much deposited water or matter on the filter.

(5) Screw on the bolts of the cylinder cover. This operation requires special tools, please contact with your agent.

(6) Adjust the nozzle and fuel injection pump, replace the valve seat and piston ring. These operations require special tools, please contact with your agent.

(7) Check and refill the electrolyte

The electrolyte will decrease after several times charging and discharging. (It will decrease more quickly in summer than in winter). Check the electrolyte level before starting the engine. Refill the distilled water until the upper level if necessary. Check the electrolyte level once every month, if the level is below the lower level, refill distilled water to the upper level. (Refer to picture 15).

Refer to table 13 for required battery capacity:

Table 13 Battery capacity

Model	Capacity
KD2V78F	≥ 12V60Ah
KD2V86F	

Warning:

(a) Turn off the battery switch and disassemble the grounding terminal when checking the electric circuit system. Otherwise, fire will result if short circuit occurs.

## 7. Main technical specifications

Table 1 Main technical specification table

Item	Technical specifications			
	KD2V78F		KD2V86F	
Engine model	KD2V78F		KD2V86F	
Engine type	Two cylinder, V-twin, air cooled, four stroke, OHV, direct injection			
Cylinder diameter x piston stroke mm	78 x 64		86 x 72	
Displacement L	0.610		0.836	
Compression ratio	20		19	
Related rotation speed r/min	3000	3600	3000	3600
Related power kW	7.2	8	11	12
Max. torque N · m	21.3/2500		33/2500	
Min. zero load stable rotation speed r/min	≤ 1300		≤ 1300	
Lubricating system	Pressure splashed			
Starting system	12V 1.4KW electric start			
Revolving direction of output terminal	Anticlockwise			
Fuel type	0# (summer), -10# or -20# (winter)			
Lubrication type	SAE10W-30			
Fuel consumption(g/kW.h)	3000	3600	3000	3600
	≤ 280.3	≤ 292.5	≤ 273.5	≤ 285.7
Overall dimension(LxWxH) mm	(392 + 77) x 479 x 577		(395+54) x 509 x 591	
Net weight kg	≤ 55		≤ 64	

■ This specification table is just for your reference, as it will change as the engine improved.

## 8. Tighten torque of main bolts and nuts

Table 2 Tighten torque of main bolts and nuts for KD2V78F

Name	Specification	Tighten torque
Connection rod bolt	M7	28 ± 2N · m
Tank cover locking bolt	M8	25 ~ 28 N · m
Cylinder cover locking nut	M9	42 ~ 46 N · m
Rocker arm seat bolt	M6	12 ~ 15 N · m
Cylinder cover locking bolt	M6	8 ~ 10N · m
Inlet pipe nut	M6	8 ~ 10N · m
Exhaust pipe nut	M8	20 ~ 24 N · m
Starting motor locking bolt	M10	55 ~ 65 N · m
Flywheel nut	M18	160 ~ 180 N · m
Fuel injector nut	M6	8 ~ 10N · m

Tighten torque of main bolts and nuts for KD2V86F

Name	Specification	Tighten torque
Connection rod bolt	M8	40 ~ 45N · m
Tank cover locking bolt	M8	25 ~ 28 N · m
Cylinder cover locking nut	M10	54 ~ 58 N · m
Rocker arm seat bolt	M8	17 ~ 23 N · m
Cylinder cover locking bolt	M6	8 ~ 10N · m
Inlet pipe nut	M6	8 ~ 10N · m
Exhaust pipe nut	M8	20 ~ 24 N · m
Starting motor locking bolt	M10	55 ~ 65 N · m
Flywheel nut	M18	160 ~ 180 N · m
Fuel injector nut	M6	8 ~ 10N · m

Table 9 Engine oil type for each season

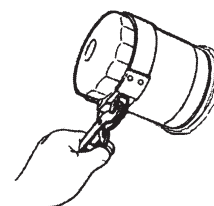
Temperature	Grade	Viscosity
Above 20°C (summer)	Above CC grade	SAE30
10 ~ 20°C (spring or autumn)		SAE20
Below 10°C (winter)		SAE10W ~ 30

(1) Replace the oil filter element (refer to picture 12). Refer to table 10 for intervals for cleaning and replacing the fuel filter element.

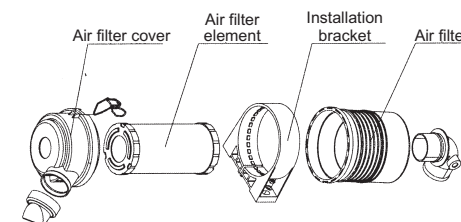
- 1) Drain out the engine oil and tighten the drain oil screw.
- 2) Disassemble the filter element by oil filter sleeve.
- 3) Check and clean the filter element.
- 4) Replace the filter element if it is damaged.
- 5) Clean the filter seat after installing the new filter element, clean the seal ring of oil filter with clean oil. Reassemble the filter assembly.

Table 10 Intervals for cleaning and replacing the oil filter element

Clean	Every 100 h
Replace	Every 500 h



Picture 12 Clean or replace the oil filter element



Picture 13 Clean and replace the air filter element

(3) Clean or replace the air filter element (refer to picture 13). If dust is sucked into and adhered on the air filter, the engine output will decrease, and the lube and fuel consumption will increase, furthermore, hard start will result. If dust is sucked into the combustion chamber, the moving parts will be damaged quickly and can not run normally. So please shorten your inspection time as short as possible when running the engine at dusty place. Refer to table 11 for intervals for cleaning and replacing the air filter element.

Notice: 1) Do not use detergent to clean the air filter element; you should use the soft brush instead.

## 7. Periodical check and maintenance

Periodical check and maintenance are very important for maintaining the performance and life of the engine. The following is the maintenance intervals and items table. The items with “○” indicate the maintenance item, and the items with “●” require technician or special tools, please contact with the agents.

Item	Interval				
	Each day	The 1 <sup>st</sup> month or 50 h	The 3 <sup>rd</sup> month or 100 h	The 6 <sup>th</sup> month or 500 h	Each year or 1000 h
Check and tighten all the bolts and nuts	○				
Check and refill engine oil	○				
Check for oil leakage	○				
Replace the engine oil		○	○		
Clean and replace the oil filter element			○(Clean)	●(Replace)	
Clean air filter element		○			
Replace air filter element				○	
Clean and replace fuel filter				○(Clean)	○(Replace)
Check nozzle				●	
Check oil pump				●	
Check fuel pipe				○	
Grind inlet/exhaust valve seat					●
Replace piston ring					●
Clean fuel tank	Each year				
Check the electrolyte	Each year				

### (1) Replace the engine oil

Drain out the exhausted oil when the engine is still warm and refill the recommended engine oil. Refer to picture 5. Refer to table 8 for oil replacement intervals.

Table 8 Intervals for oil replacement

Replace engine oil	Intervals
First time	Every 50h
Second time and after	Every 100h

Notice: Choose the oil type carefully according to different season and temperature. Refer to table 9.

## Usage

### 1. Safety

1.1 Never operate the engine in case of tired, drinking, or taking medicine. Unprofessional or unskillful worker can't operate the engine, to prevent accidental personal harm or machine fault happening. Put on the safe clothing and prepare the safety equipment.

1.2 In case of abnormal sound, vibration, smoke, oil leakage, or alarming light, please stop the engine immediately and report to the superintendent. Continuously using the engine only after the fault is resolved.

1.3 Hydrogen will be released out when charging and it is inflammable and explosive, so please use the engine at place with good ventilation and keep it away from fire.

1.4 Keep fuel or other inflammable things away from the engine, and use the correct type of light diesel. Use gasoline or other analog mistakenly will result in fire. Make sure you stop the engine before filling in fuel and wipe off the fuel if it overflows.

1.5 Poisonous gas is contained in the exhaust air and is harmful to the personal health, so make sure exhaust outside. Keep the equipment room well ventilated and don't shut off the window, intake or other ventilation apparatus. Never operate the engine in the narrow room, channel, cellar or cabin.

1.6 Don't touch the moving parts when engine is running, since it is dangerous and will cause personal damage even death. Never operate the engine if no protection shield installed to the moving parts. Check whether there are tools, clothes or other articles around the engine before starting the engine, in order to prevent injury. Stop the engine before maintaining, if you have to check the engine during it running, please pay special attention; don't touch your hands, skin or clothes with the moving parts to prevent personal damage.

1.7 The engine is very hot when it is running or just after stopping, as well as the high heat parts, such as muffler, exhaust pipe, cylinder and cylinder cover. Please be especially careful, and don't touch your body or hands with the hot parts to prevent scalding.

1.8 Pay sufficient attention to avoid your eyes, skin or clothes from being contacted with the fluid. The battery electrolyte is dilute sulfuric acid and causes burns. Wash it off immediately with a large amount of fresh water if you get any on you.

1.9 Make sure turn off the battery switch or disconnect the negative cable before inspection the electric system. Failure to do so will cause short circuit or fire.

1.10 If lube oil must be drained from the engine while it is still hot, take care not to let the oil splash on you to avoid scalding.

**Warning:** Modification not authorized! Never modify the engine or screw off the limit devices by yourself (such as the engine max speed limitation bolts, fuel quantity limitation device, etc). Such modification or screwing off will affect the engine performance, safety, reliability and shorten the engine life.

**Notice:** The waste oil should be collected in a container. Never dispose the waste oil directly to the outdoors, into a sewer, river, or the sea. Dispose the waste oil strictly observing the relevant regulations and laws. Ask a specialized waste recovery company for collection and disposal.

2. Load installation

- ①Fix the engine base tightly to prevent the engine moving or shocking.
- ②Be sure that the output shaft centers are in line.
- ③If the engine is on load, the pulley size must be in conformance with the engine rotation speed, load speed and load side pulley size.

The diameter of the pulley can be calculated by the following formal:

$$\text{The diameter of engine side pulley} = \frac{(\text{load side pulley diameter} \times \text{load speed})}{\text{engine rotation speed}(\text{rated speed})}$$

- ④Make sure the size of pulley shaft hole and key groove is conformance with the output end, otherwise accident will result. Correctly screw the output end bolts. Reselect the pulley for the appropriate size, if black smoke exhausted.
- ⑤Be sure that the tension of pulley is appropriate. If the pulley is too tight, hard starting will result, further more, the belt will worn quickly and the output shaft will be bent, so accident will result.
- ⑥ Specified triangle belt model is B (refer to table 4). The quantity of belt is decided by the load.

Table 4

Model	Belt model
KD2V78F	B
KD2V86F	B

Notice: If the engine runs with too much vibration, the engine and load will be damaged, so make sure fix the engine tightly. Accident will be caused if the belt is fixed too tightly, so please choose the correct size.

5. Running

- ①Warm up the engine for 5 minutes.
  - ②Set the speed governor level to the expected position, if the engine is still very hot.
  - ③If the engine continually exhausts black smoke during running, which indicates that the engine is running with overload, please do adjust the engine or the load.
- Warning: 1) The exhaust pipe is very hot during or just after running; do not touch the exhaust pipe.

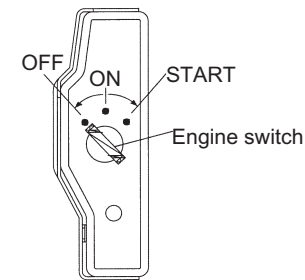
2) The air filter will suck the surrounding airflow during running, be sure that your hands, body and cloths do not approach this part to prevent injury. Adjust the engine speed by the speed governor level. Don't screw off the high speed limitation screw or fuel level controlling screw, otherwise, the engine speed or output will be abnormal.

3) Maintain the moving parts and the surrounding parts after engine stopped. Make sure that there is no tool or sundries inside the engine before starting the engine. Pay attention to the following items while running:

- ①Whether there is abnormal vibration or sound.
  - ②Whether the exhaust is normal.
  - ③Whether the engine continuously exhausts white, black or blue smoke.
- Remark: Be sure to shut off the engine when abnormal phenomenon occurs, and contact with the agent.

6. Stop the engine

- ①Directly turn off the electric switch to "OFF". (Refer to picture 11)



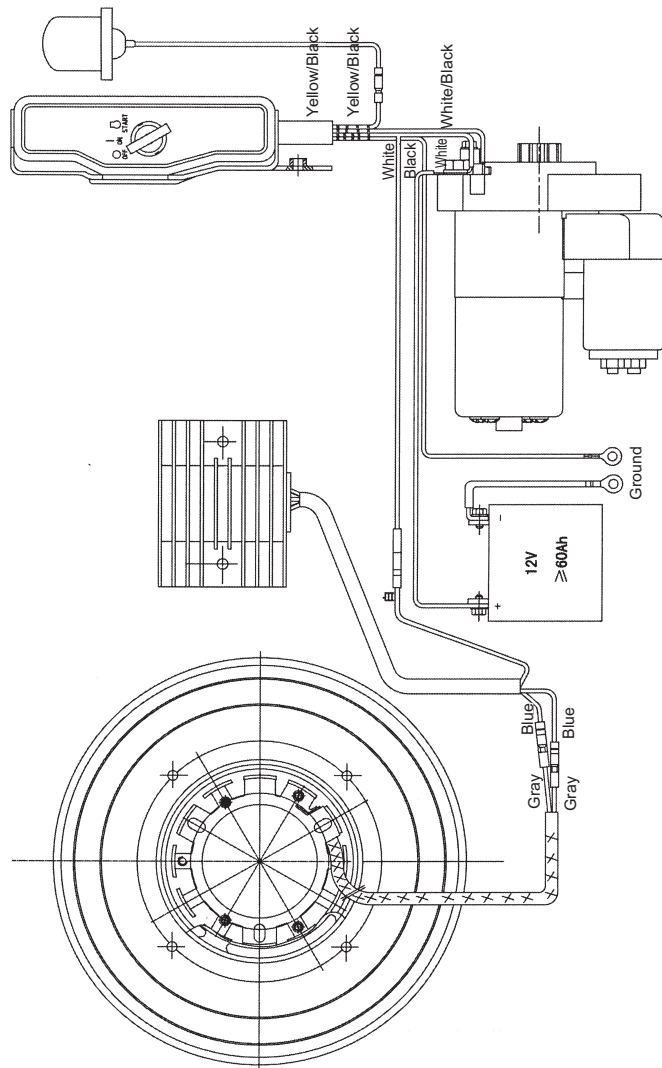
Picture 11 Stop the engine

\*.Prepare for the next operation:

- 1) Check whether there is oil or fuel leakage around or below the engine.
- 2) Check all the bolts and nuts. Screw them on if necessary.
- 3) Clean the dirty and dust on the surface of engine.
- 4) Check for the damage.



4.2 Schematic diagram for electric starting engine (Refer to picture 10)



Schematic diagram for electric starting engine

Picture10 Schematic diagram for electric starting engine (Refer to picture 10)

3. Engine usage

Incorrect usage will shorten the life of engine. The first 20 hrs are the break-in period of the engine, the operator must obey to the following items:

(1) Warm up the engine 5 minutes after the initial starting.

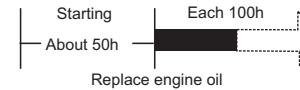
Run the engine at low speed and low load before the engine becomes warm. Do not run the engine at high speed and full load or low speed and zero load.

(2) Do not run the engine with overload

Do not run the engine with overload during break-in period, it is suggested to run the engine at 3000r/min, with 50% load.

(3) Replace the engine oil on time

Stop the engine and check the oil level after 0.5 hrs break-in, if the oil decreases, please refill in oil to the upper limitation level. Restart the engine, replace the oil while the engine is still warm after 50 hrs running, the old engine oil will be drained out completely.



3.1 Selection and usage of the fuel oil

(1) Use the light diesel most applicable for the performance of the engine.

a. Diesel usage:

b. If water or dirty mixed in the fuel, abnormal running will result. Seal the fuel in a clean container and store the container in a dry place away from the rain and dirty.

c. If diesel has been stored for several hours, the water and dirty will deposit at the bottom of the container. You can pump the upper clean diesel for usage.

(2) Refill the diesel.

Notice: 1) Don't loose the oil filler screw except for special usage, otherwise rain or dust will sunk into the air duct and cylinder, and the engine will wear quickly, so accident will result.

2) Don't fill in gasoline! It is very dangerous to fill in gasoline into the diesel engine. Do identify the fuel oil type and model before refilling.

3) Do stop the engine before refilling.

4) Wipe off the overflowed diesel.

3.2 Selection and usage of the engine oil

(1) Selection of the engine oil

It is very important to select the appropriate engine oil. If you use the improper diesel, the piston ring will adhere together, the piston will burn out, and the cylinder head gasket will wear out quickly, as well as bearings and other moving parts, so the engine life will be shorted. Table 5:

Table 5 Engine oil model

Temperature	Above 20°C (summer)	10~20°C (spring, autumn)	Below 10°C (winter)
Model	SAE30	SAE20	SAE10W-30

(2) Check the oil level and refill the engine oil

A. Do check the oil level before starting the engine. (Picture 7)

- ① Check whether the oil level is between the upper level and lower level with dipstick.
- ② Wipe off the overflow oil.
- ③ Tighten the dipstick after checking.

B. The engine oil level can not beyond the upper level.

C. Refer to the following table 6 for oil capacity:

Table 6 Oil capacity

Engine model	KD2V78F	KD2V86F
Oil capacity (L)	3.5	4

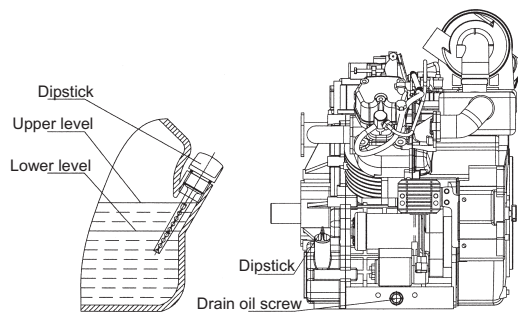


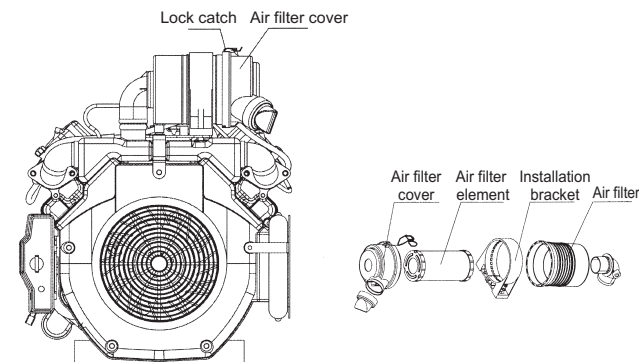
Figure 7 Check the engine oil level

Notice: 1) Check the oil level with the engine on a level surface. Refill oil if necessary.

2) Tighten the dipstick and check the oil level.

3.3 Replace the air filter element (Refer to picture 8)

- ① In case of insufficient engine output power and abnormal exhaust color, then it is necessary to replace the element. Screw off the lock catch, disassemble the air filter cover and remove the air filter.
- ② Replace the filter element, reassemble the air filter cover and screw on the lock catch.



Picture 8 Replace the air filter element

4. Start the engine

Engine switch:

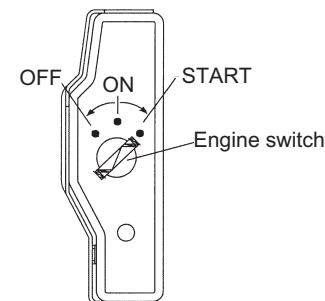
The engine switch is used to start and stop engine.

The engine switch should be at ON when engine started, and OFF when stopped. Turn on the engine switch to START to operate the starting motor and start the engine. The key will return to ON automatically.

4.1 Electric starting

4.1.1 Start the engine according to the following procedures: (Refer to picture 9)

- ① Turn the electric starting key clockwise to "START"
- ② Release the electric starting key after the engine is started.
- ③ If the engine could not start after starting the motor for 10 seconds, please wait for another 15 seconds and restart. Long term running will cost the battery power greatly and even burn out the motor.



Picture 9 Engine switch