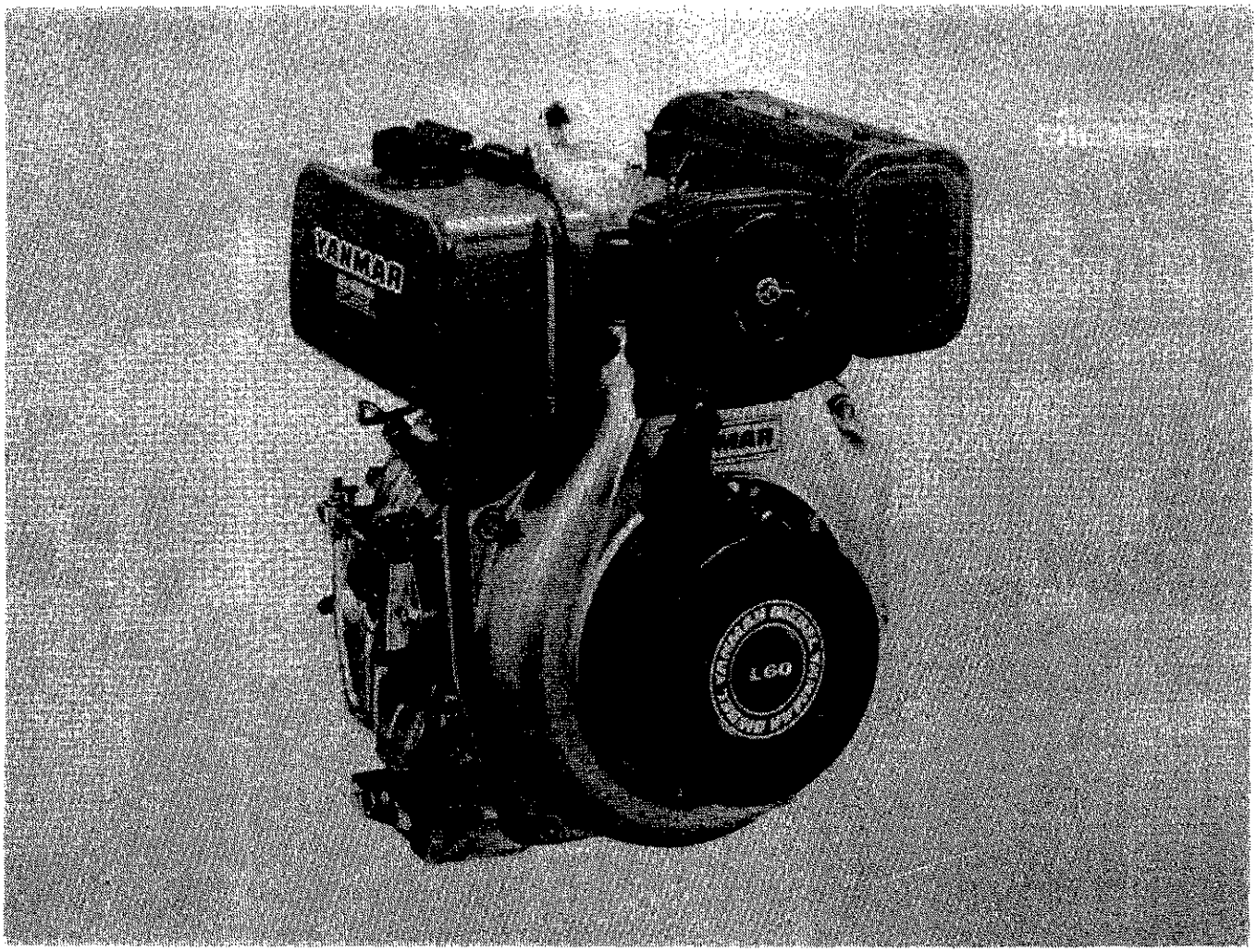
MENU

YANMAR

AIR COOLED DIESEL ENGINE

L-Series

MATCHING GUIDE



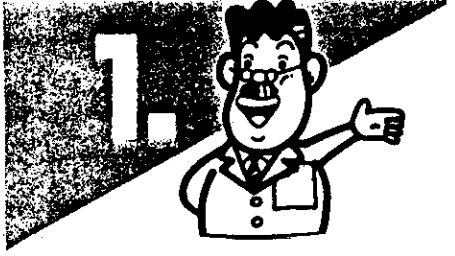
YANMAR DIESEL ENGINE CO.,LTD.

C O N T E N T S

I HOW TO COUPLE THE AIR-COOLED DIESEL ENGINE WITH A DRIVEN MACHINE AND CAUTIONS

Taking a power sprayer as an example, the selection of engine models and parts as well as the cautions for engine coupling are explained.

MEMO

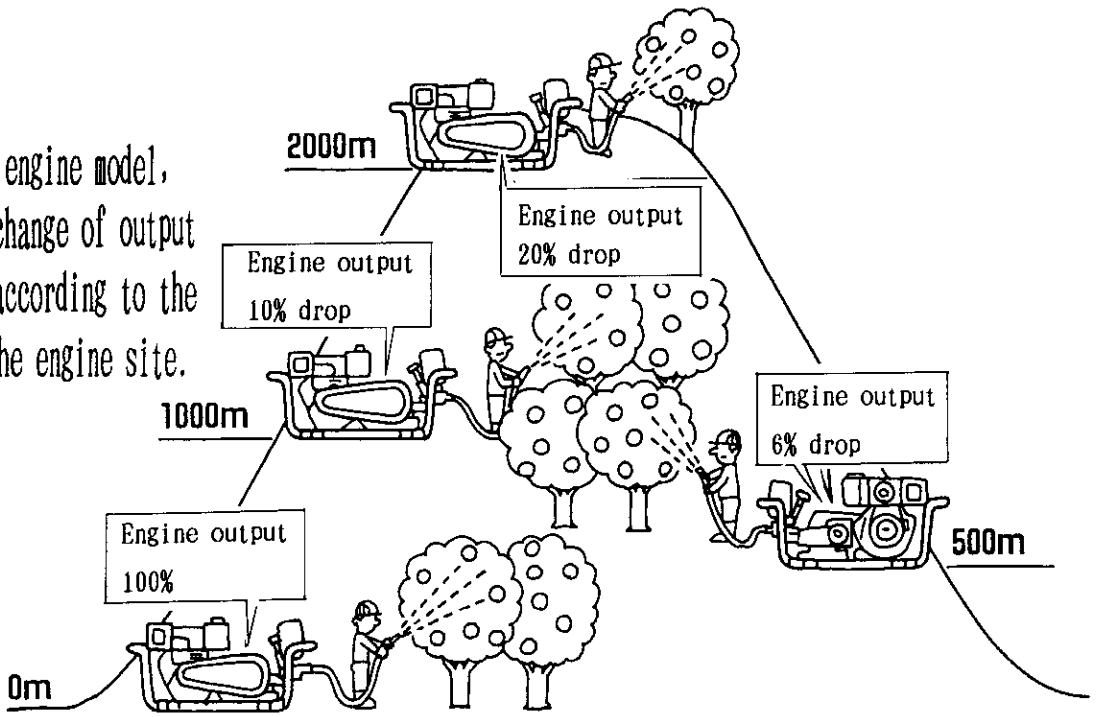


Check Points for Selecting Engine Models

Engine output drops by 10% at an altitude of 1000m!!

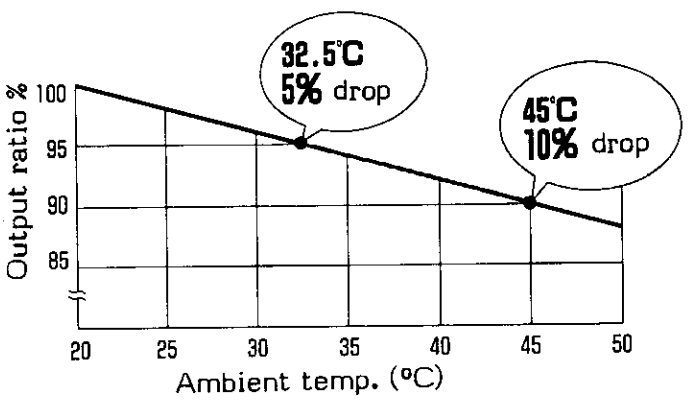
Engine output is affected by the atmospheric pressure and temperature.

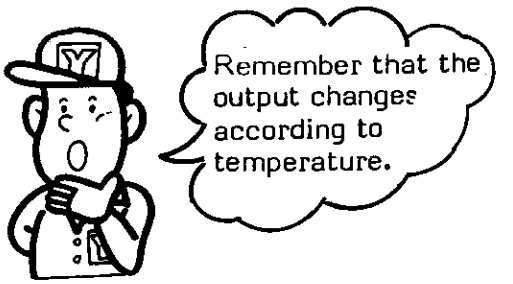
For selecting engine model, consider the change of output which varies according to the altitude of the engine site.



Engine output drops by 5% at temperature of 32.5℃, and 10% at temperature of 45℃.

The engine's rated output is designed to have 100% output at 20°C. Take the effects of engine site and the temperature into consideration.





MEMO

How to Select an Engine

Check the required horsepower for the driven machine in the catalog or operation manual of the machine, and select an engine which meets the required horsepower. Taking the Yanmar Power Sprayer TA Series as an example, the catalog specifications indicate that the required horsepower for model TA400 is 3.7 PS. So the engine to select is the L40 with an output of 3.8 PS.

Model		TA200	TA300	TA400	TA500
Dimensions	Overall length (mm)	371	398	398	493
	Overall width (mm)	252	293	293	331
	Overall height (mm)	276	304	305	370
Weight (kg)		10.0	12.8	13.0	18.4
Performance	Pressure (kg/cm^2)	50-20	50-10	50-10	50-10
	Revolution (rpm)	600-900	600-1400	700-1500	700-1300
	Discharge volume (ℓ/min)	7.9-11.9	15.0-35.1	24.5-52.5	32.3-60.0
Max. required output (PS)		1.2	2.3	3.7	4.8

Cautions

Most catalogs of power sprayers and pumps show the motor output (kW) or the motor horsepower (PS). Yanmar's catalog, however, shows the engine's horsepower. In this case, it is necessary to calculate the engine horsepower with the following conversion formula:

Motor output (kW) ÷ 0.75 = Motor horsepower (PS)
↑ Coefficient

Motor horsepower (PS) ÷ 0.8 = Engine horsepower (PS)
↑ 80% is the safety coefficient against the engine output change due to temperature, atmospheric pressure and other operational conditions

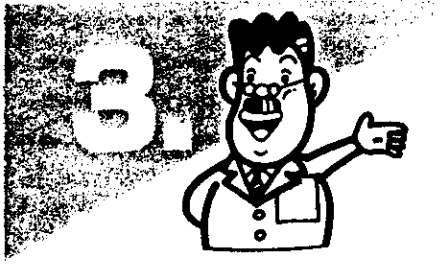
(Example)

A machine requires a motor output of 2.2 kW. What will the required rated output of the engine be ?

Motor output: 2.2 (kW) ÷ 0.75 (kW) = 2.9 PS
Engine horsepower: 2.9 (PS) ÷ 0.8 = 3.63 PS

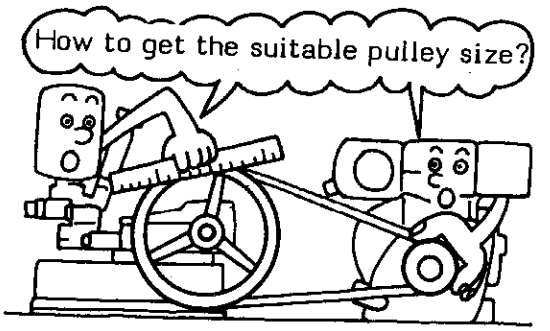
From the above calculation, the L40 (rated output 3.8 PS) is the appropriate engine to select.

MEMO



How to Select Pulleys for Engine and Driven Machine

Pulley sizes come in 12.5mm(0.5") increment. Select a pulley of suitable size by the following formula:



In case of power sprayers, check the water discharge quantity as follows:

Water spray Q'ty (liter/min.) per nozzle used
(shown in the nozzle catalog.)

x No. of nozzles in use ÷ 0.8 = Water discharge q'ty (liter/min.)
Allowance and surplus water

From the water discharge Q'ty obtained, select the required rev. speed of the driven machine listed in the catalog.

(Listed in catalogs or manuals)

Eng. pulley outside dia. (mm) = (Required rev. speed of driven machine (rpm) (ex. 800 rpm) x Driven machine pulley outside dia. (mm) (ex. ø8" = ø203 mm)) / 1800

= 3.55" (90 mm) ⇩ ø3-1/2"

L-engine rated output rev. peed (S-type)

Driven machine pulley outside dia. (mm) = 1800 x Eng. pulley outside dia. (mm) / Required rev. speed (rpm) of driven machine

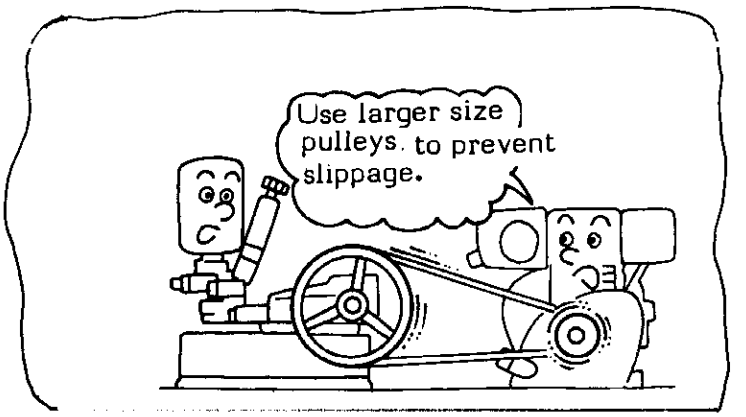
MEMO

Cautions

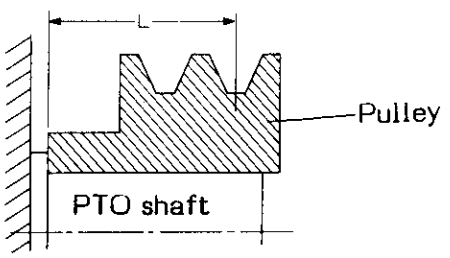
When the outside diameter of the engine's pulley is small, the belt tends to slip. So use a pulley with diameter larger than 65 mm for A-type V-belt and 115 mm for B-type V-belt. If the use of a small size pulley is unavoidable, use a large size pulley for the driven machine and make the engine's pulley as large as possible.

Belt type	Min. pulley dia. (mm)
V-belt A type	65
V-belt B type	115

When the overhang (L: distance between the PTO shaft stepped base and the outer V-belt center) is excessive, the PTO shaft may be damaged. Make sure that the overhang is within the range listed below.



Overhang



Type of belt	L40	L60	L75	L90
A-type x 2 pcs.	(Below 80 mm)	Below 160 mm	-	
B-type x 2 pcs.	Below 60 mm	(Below 95 mm)	(Below 70 mm)	

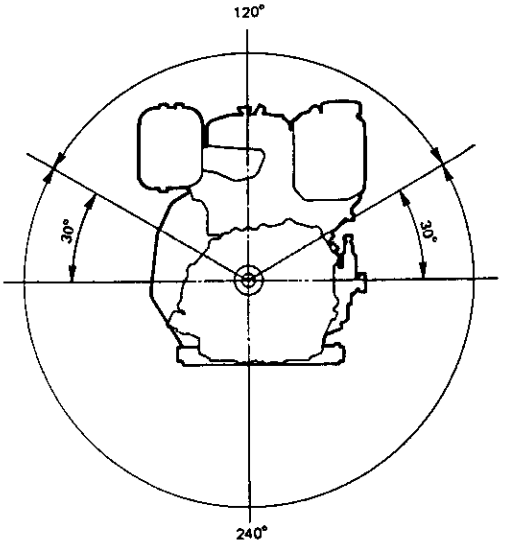
( ): Recommended belt type and overhang distance

MEMO

Note :

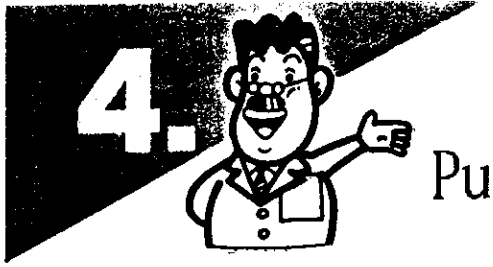
Direction of V-Belt Tension

For the V-belt drive engine, wherever possible use an engine which conforms to the camshaft PTO. Where a crankshaft PTO is used for V-belt drive, be sure to observe the following instructions on the direction of V-belt tension.



1. L40E-DT and L60E-DT
   (crankshaft PTO E-D type)
   Be sure to hang the V-belt within a downward angle of 240 degrees.
   Never pull the V-belt 120 degrees upwards at any time.

2. L40E-ST and L60E-ST
   (camshaft PTO E-ST type)
   These models allow V-belt tension in all direction.

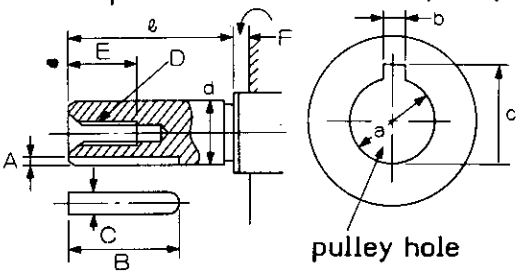


Pulley and Belt Installation

Pulley Hole Machining

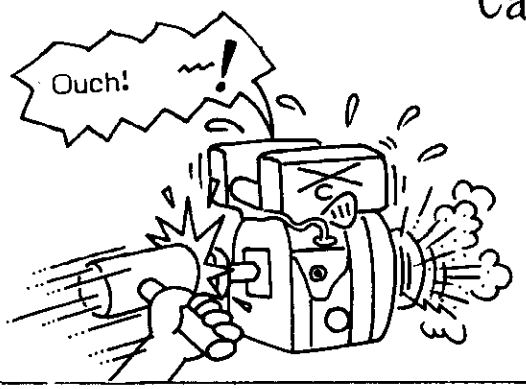
It is necessary to machine the pulley hole for matching it with the engine's output shaft. Show the following chart to a workshop.

S-Spec. P.T.O. Shaft & V-pulley



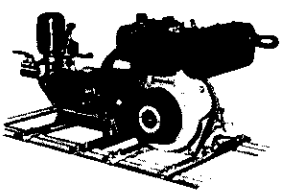
Part		Code	L40(S)	L40(D)	L60(S)	L60(D)	L75(S) L90(S)	L75(D) L90(D)
PTO shaft OD		d	ø20	ø19	ø25	ø25.4	ø25	ø25.4
PTO shaft length		ℓ	50	58.3	60	72.2	60	72.2
Key groove depth		A	3	3	4	3.4	4	3.4
Key groove length		B	32	47.6	40	62	42	62
Key groove width		C	$5^{+0.03}_{0}$	$4.7^{+0.054}_{+0.024}$	$7^{+0.03}_{0}$	$6.3^{+0.042}_{+0.012}$	$7^{+0.03}_{0}$	$6.3^{+0.042}_{+0.012}$
Shaft end screw dia (P : pitch)		D	M8xP1.25	5/16-24 UNF-2B	M8xP1.25	7/16-20 UNF-2B	M10xP1.5	7/16-20 UNF-2B
Shaft end screw depth		E	20	20	20	20	28	20
Protrusion from flange surface		F	3	3.2	3	16.3	3	15.8
V-pulley	Fitting hole dia	a	$ø20^{+0.04}_{+0.02}$	$ø19^{+0.04}_{+0.02}$	$ø25^{+0.04}_{+0.02}$	$ø25.4^{+0.04}_{+0.02}$	$ø25^{+0.04}_{+0.02}$	$ø25.4^{+0.04}_{+0.02}$
	Key groove width	b	$5^{+0.012}_{+0.004}$	$4.7^{+0.044}_{+0.032}$	$7^{+0.015}_{+0.006}$	$6.3^{+0.044}_{+0.032}$	$7^{+0.015}_{+0.006}$	$6.3^{+0.044}_{+0.032}$
	Key groove width	c	22	21.6	28	28.3	28	28.3

Caution

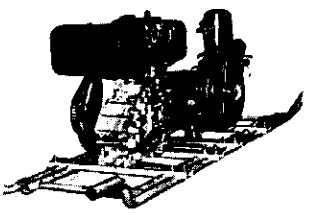


When the pulley is tapped lightly to the shaft by a plastic hammer, it should fit properly to the shaft.
Do not fit the pulley forcibly to the shaft, as this could damage the cylinder block.

Installation of Belt

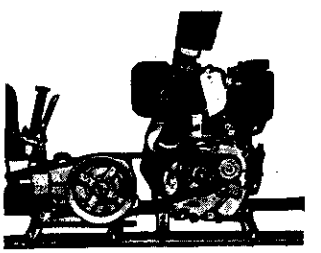


1. Set the engine to the driven machine. The setting arrangement should allow easy and periodical inspection and maintenance.
2. Install the belt. Adjust the engine position to align the pulley of the driven machine with the engine's pulley.
3. Move the engine position to obtain the proper belt tension. Check for proper belt tension by the procedure described on the next page.



Caution

It takes a few days for the belt to adjust to the pulleys. Re-tighten the belt tension after a few days operation.

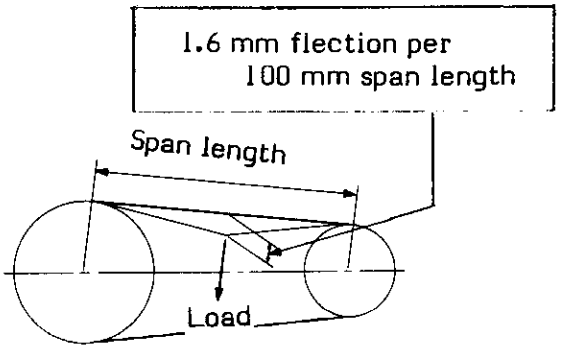


MEMO

MEMO

How to Measure the Belt Tension

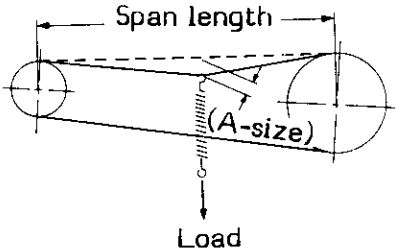
1. Measure the span length of the belt. (the distance between the two pulleys).
2. At the center of the belt span, apply a load with a spring scale hanging at a right angle.
   Measure the load with the spring scale



Measure the load with the spring scale

The flection of the belt should be 1.6mm per 100mm span length

For example, for a type a belt with a span length of 500 mm, the belt flection should be 1.6 x 5 = 8 mm. Measure the load when the belt flection (A-size) is 8 mm. When the flection load is within the flection load range listed below, belt tension is correct.

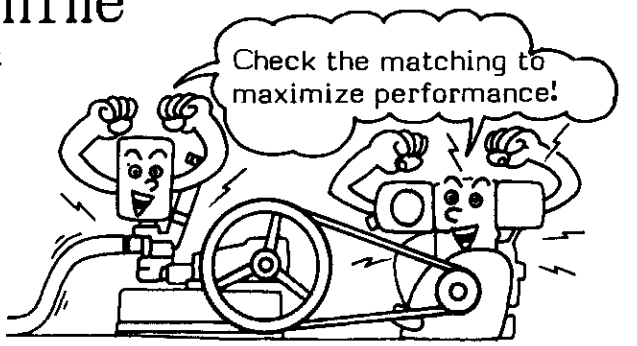


Flection load for proper belt tension, and the corresponding shaft load

Belt type	Small pulley dia. range(mm)	Min. flection load		New belt installation		Belt retensioning	
		Flection load (kg)	Shaft load (kg)	Flection load (kg)	Shaft load (kg)	Flection load (kg)	Shaft load (kg)
M	38~ 50	0.5	13	0.6	18	0.5	15
A	65~ 80	0.7	21	1.1	31	0.9	26
	81~ 90	0.8	23	1.3	35	1.1	31
	91~105	1.0	28	1.5	41	1.3	36
	106~	1.1	32	1.6	48	1.4	41
B	115~135	1.3	41	1.9	61	1.6	53
	136~160	1.6	49	2.4	73	2.1	63
	161~	1.7	53	2.6	77	2.3	68
C	175~205	2.5	76	3.8	113	3.2	98
	206~255	3.0	92	4.5	138	3.9	119
	256~	3.5	107	5.3	160	4.6	139

5. Matching Engine Output with Driven Machine

When coupling the L-engine with driven machine, it is necessary to match the engine output properly with the load of the driven machine to ensure the best performance of the machine.
Check the following points.



1) Example of Power Sprayer

(Check procedure)

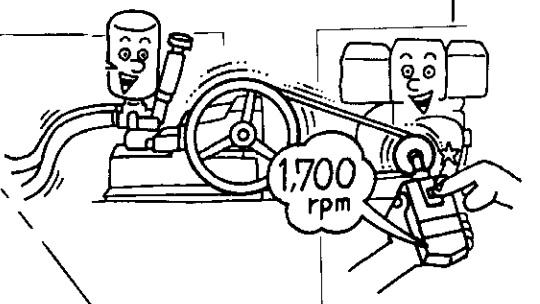
Set the pressure control valve to "open" position to make the pressure free with "full spill water".

Fully open the accel. lever to raise the engine speed.

1 Set the power sprayer at the desired service pressure. There should be no black smoke.
2 Measure the speed of the engine's output shaft. The speed should be over 1700 rpm.

When engine speed is 1500 rpm at the medium position of the accel. lever:

1. Set the power sprayer at the desired service pressure. There should be no black smoke.
2. Measure the speed of the engine's output shaft. The speed should be over 1400 rpm.



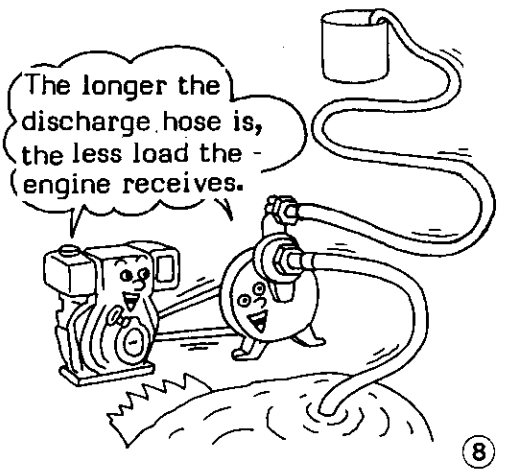
2) Example of Centrifugal Pump

(having a valve at the discharge port)

(Check procedure)

1. When there is a valve at the discharge port of the pump, fully close the valve after suction starts and then raise the engine speed to max.
2. Open the valve. The engine speed should be over 1700 rpm at this time.
   * Also check that there is no black smoke at this time.

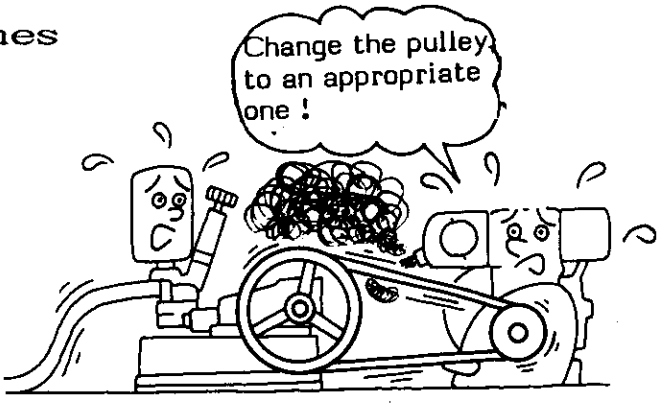
The max. horsepower is the horsepower at the max. flow discharged directly from the discharge port of the pump.
* When a long hose is installed at the discharge side, the engine load can be decreased.



MEMO

3) For other Types of Machines

Operate the machine while applying load at the max. speed position of the engine's speed control bracket. No black smoke should be emitted from the exhaust muffler. Measure the speed of the output shaft (or cam shaft).
The speed should be over 1,700 rpm at this time.



※ When engine conditions deviate from the standard:

Black smoke emission or low engine speed means that the load of the driven machine is too large. At this time, take the following corrective measures:

Either replace the engine's pulley with a smaller one, or change the driven machine pulley with a larger diameter pulley.

When the above is not enough, change both the engine and the driven machinery pulleys.

Caution

To obtain the correct matching of the engine and the driven machine for ensuring the best performance of the machine, the output matching test is necessary.

When necessary, consult with a Yanmar distributor.

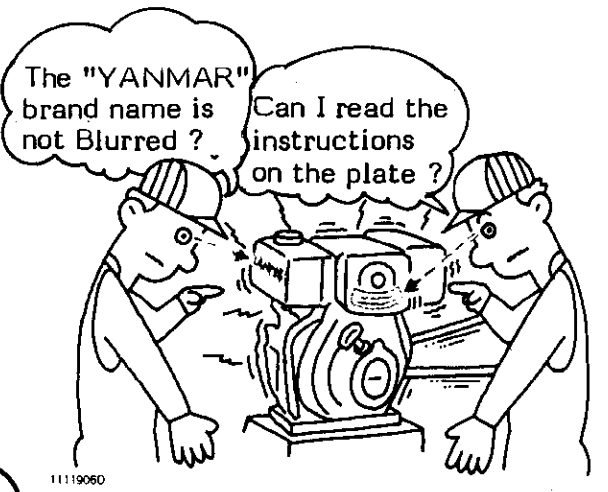
(For testing, engine speed, exhaust gas temp. and density, and lube oil temp.)

When in doubt, conduct a matching test.

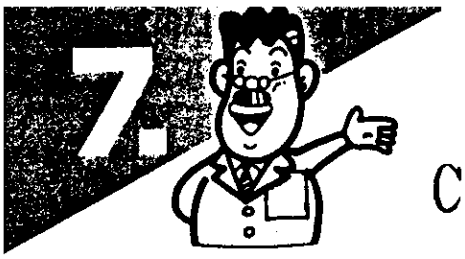
MEMO

How to Judge Vibration Level

If the letters of the instruction plate on the air cleaner can be read while the engine is operating, the engine vibration level is proper. Or if the "YANMAR" brand name on the fuel tank is not blurred while the engine is operating, the engine's vibration level is proper.
If vibration exceeds these levels, it is necessary to improve the installation.



MEMO



Cautions for a New Engine

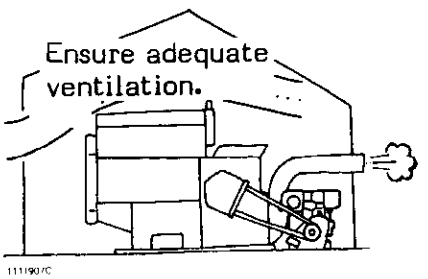
1) Temperature

- Lowest possible starting temp.
  - o Recoil starting ——— w/o starting aid agent ..... 0°C
    ——— w/starting aid agent ..... -5°C
  - o Electric starting ——— w/o starting aid agent ..... -10°C

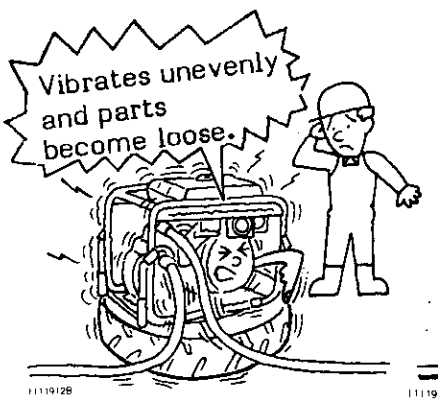
- Operation
  Below 40°C
  * When the engine is used under a temperature exceeding 40°C, de-rating of engine output, and the matching with the driven machine are necessary.

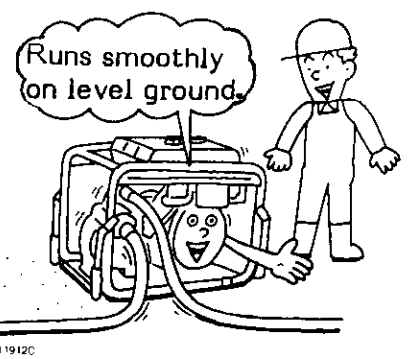
Note : 0°C starting (with recoil starter) is made easy by feeding oil warmed by the starting aid, pressing the decompression lever 2 or 3 times, and pulling the recoil starter.

2) Installation



o When using the engine indoors, be sure to provide adequate ventilation.



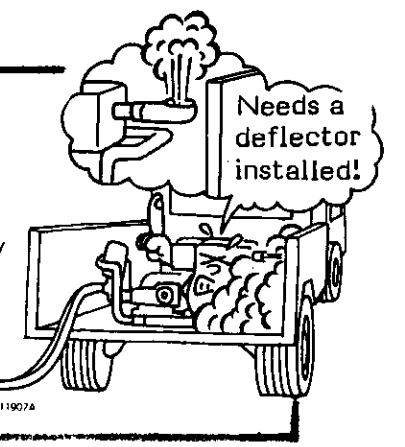


o Do not install the machine on a tire

o When using a power sprayer or other machine on the bed of a truck or other vehicle, open the tail gate or door so that exhaust gas does not blow back towards the engine.

Caution

When the tail gate can't be opened for some reason, install a deflector (accessory part) to the end of the muffler.



MEMO

3) Fuel

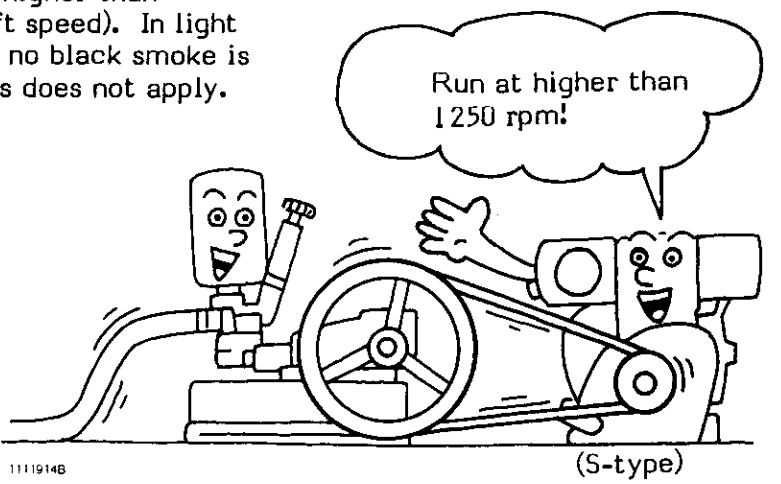
Use diesel light oil with a cetane value of over 45.
When a lower cetane value fuel is used, the engine will not start smoothly and will emit abnormally colored exhaust.

Fuel tank capacity and fuel supply interval (at rated output)

	L40	L60	L75	L90
Capacity (ℓ)	2.5	3.5	5.5	
Fuel supply interval (hr)	2.6	2.6	3.5	2.8

4) Engine's service speed range

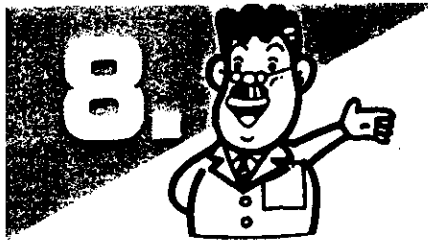
The L-engine is a high speed engine and is designed to produce optimum combustion at the high speed range. Accordingly, it is recommended to use the engine at a speed higher than 1250 rpm (output shaft speed). In light load conditions where no black smoke is emitted, however, this does not apply.



1111914B

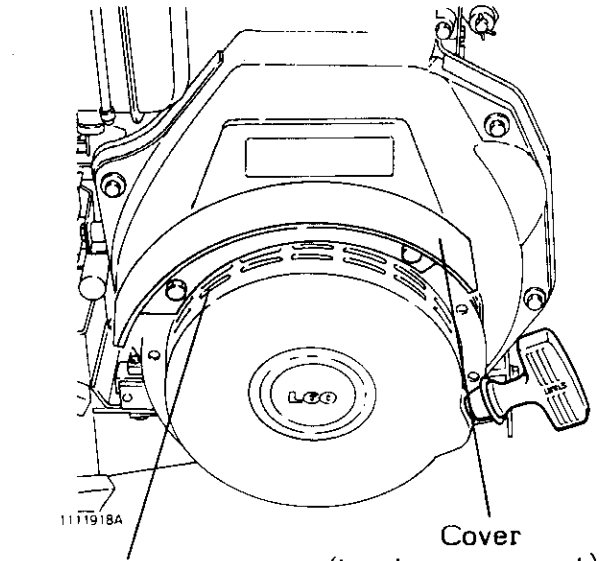
(S-type)

MEMO



Cautions for Coupling the Engine with Dust-Producing Machines

1) Straw cutters and other machines



Auto-clean device

Cover
(local procurement)
(Width: over 100 mm)

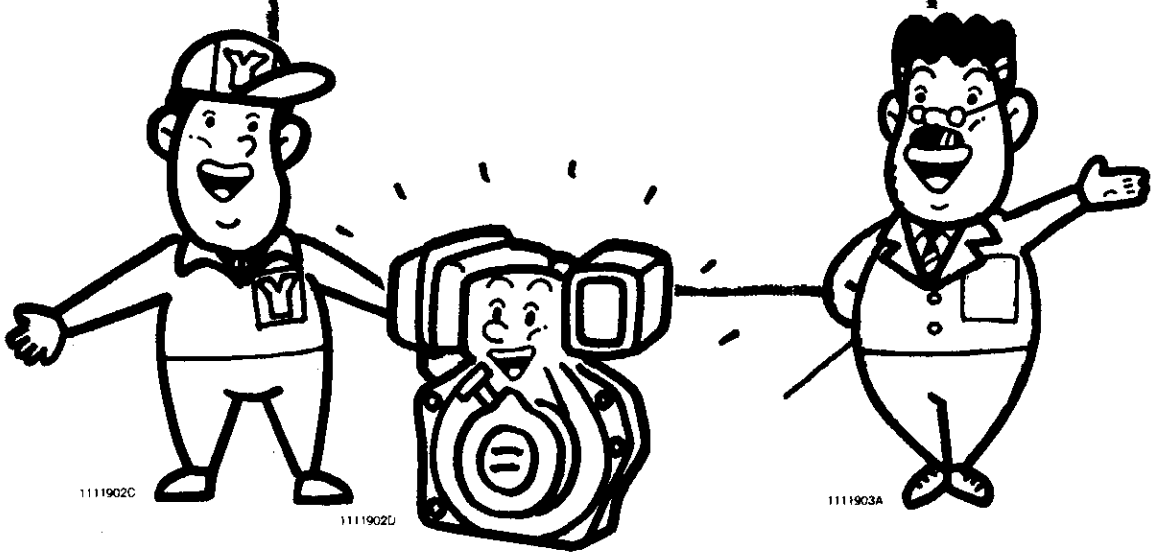
Installation of an "Auto-clean device" (optional part) to the cooling air inlet is recommended.

When using the engine with a machine such as straw cutters, where the engine is exposed to particles and dust, attach the proper cover (to be procured locally) over the "Auto-clean device".

Model	Necessary parts	
L40	Fan case	(114252-45100)
	Cover	(160730-76150)
	Spacer	(114352-76170)
	Recoil starter	(114252-76070)
	Bolt M6 x 45 (3 pcs.)	(26106-060452)
	Bolt M6 (4 pcs.)	(26106-060502)
L60	Fan case	(114352-45100)
	Cover	(160830-76150)
	Spacer	(114352-76170)
	Recoil starter	(114352-76070)
	Bolt M6 x 45 (3 pcs.)	(26106-060452)
	Bolt M6 (4 pcs.)	(26106-060602)

MEMO

II HANDLING INSTRUCTIONS

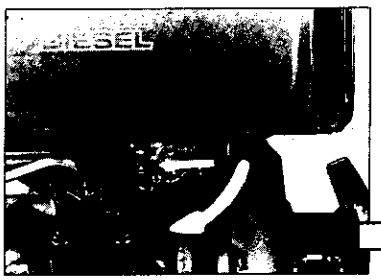


MEMO

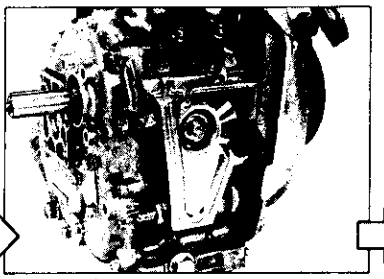
Recoil-Starting

Starting a diesel engine differs from starting a gasoline engine. See the starting instructions attached to the engine and start the engine correctly.

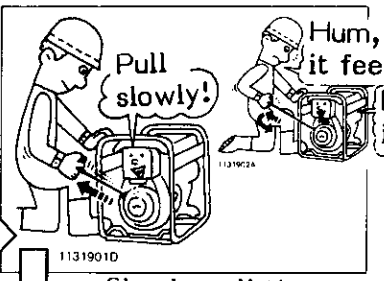
Starting procedures



① Turn the fuel valve to the "OPEN" position.

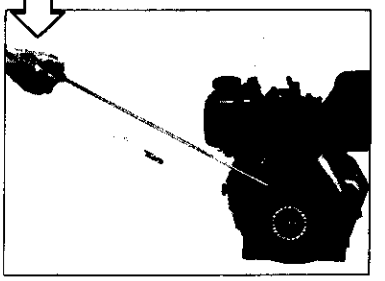


② Set the speed control lever to the "START" position. (Fully open the accel.)



③ Slowly pull the starter rope, and return it when it feel tight.

④ Press the decomp. lever and release.



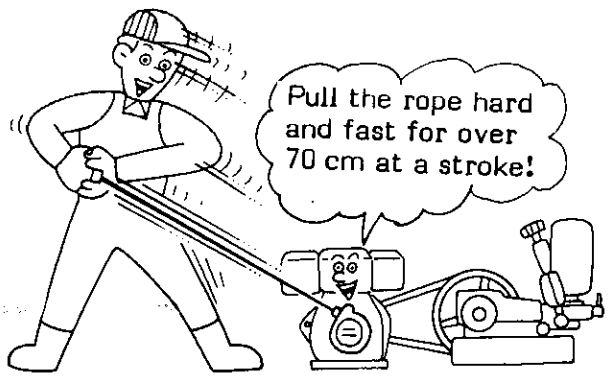
⑤ Pull the starter rope fast 70 cm.

When the engine does not start, repeat the procedures from step 3.

Auto-return decomp. device

When the recoil starter is pulled (Procedure 5), the decomp. lever automatically returns, and the engine is started.

Decompression of the engine starts when the starter rope is pulled 70 cm.



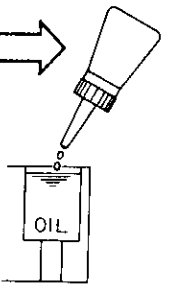
MEMO

Starting Aid Device

Feed oil to the oil port to make the engine start smoother under cold weather.

Handling procedures

Engine oil

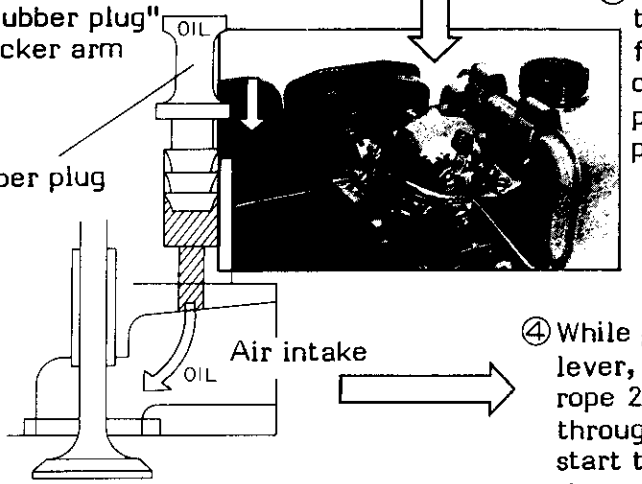


②Fill the port to the brim with engine oil(about 2 cc).

* Do not use gasoline.

③Push the rubber plug into the feeding port, which will feed engine oil into the cylinder. (Keep the rubber plug fitted into the feeding port.)

①Remove the "Rubber plug" on the valve rocker arm cover.

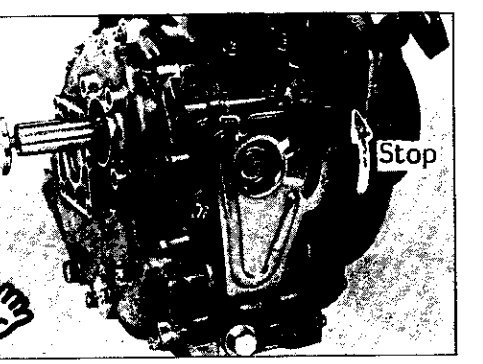


④While pressing the decomp. lever, pull the recoil starter rope 2 or 3 times to feed oil throughout the engine. Then, start the engine according to the procedures given on the previous page.

Stopping the Engine

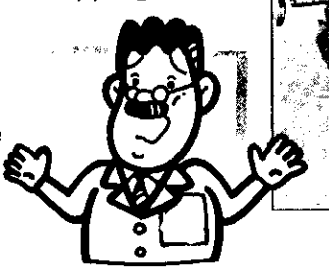
①Turn the speed control lever to the "STOP" position.

②For electric starting engines, turn the starter key to the "OFF" position after stopping the engine.



Caution

DO NOT stop the engine by the decomp. lever.

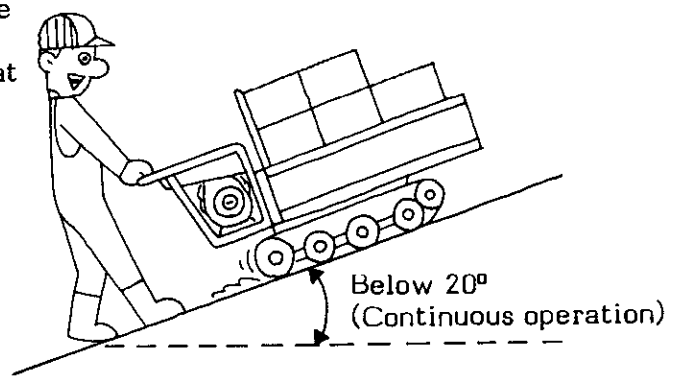


MEMO

Cautions for Inclined Operation

1. Inclined operation

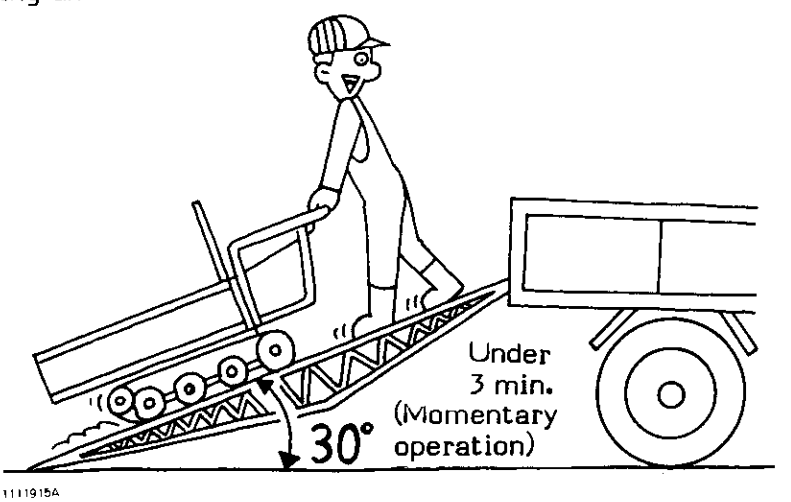
Do not continuously operate the engine in an inclined position of more than 20 degrees in any direction. If the engine is continuously operated at an inclination exceeding 20 degrees, engine parts will be damaged due to oil pressure drops.



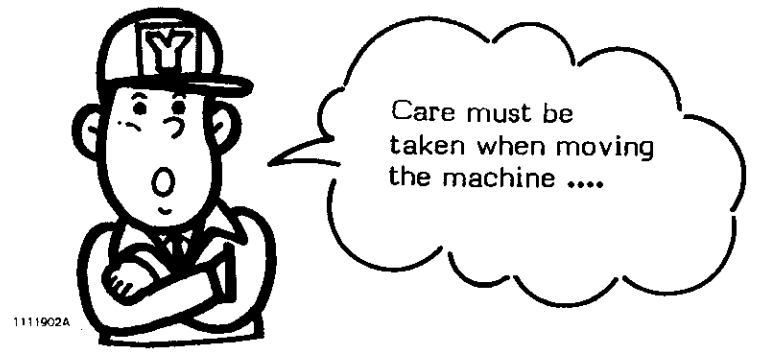
1111915C

2. Momentary inclined operation (less than 3 min.)

Max. 30 degree inclined operation of less than 3 minutes is allowed for turning the tillers or for loading and unloading.



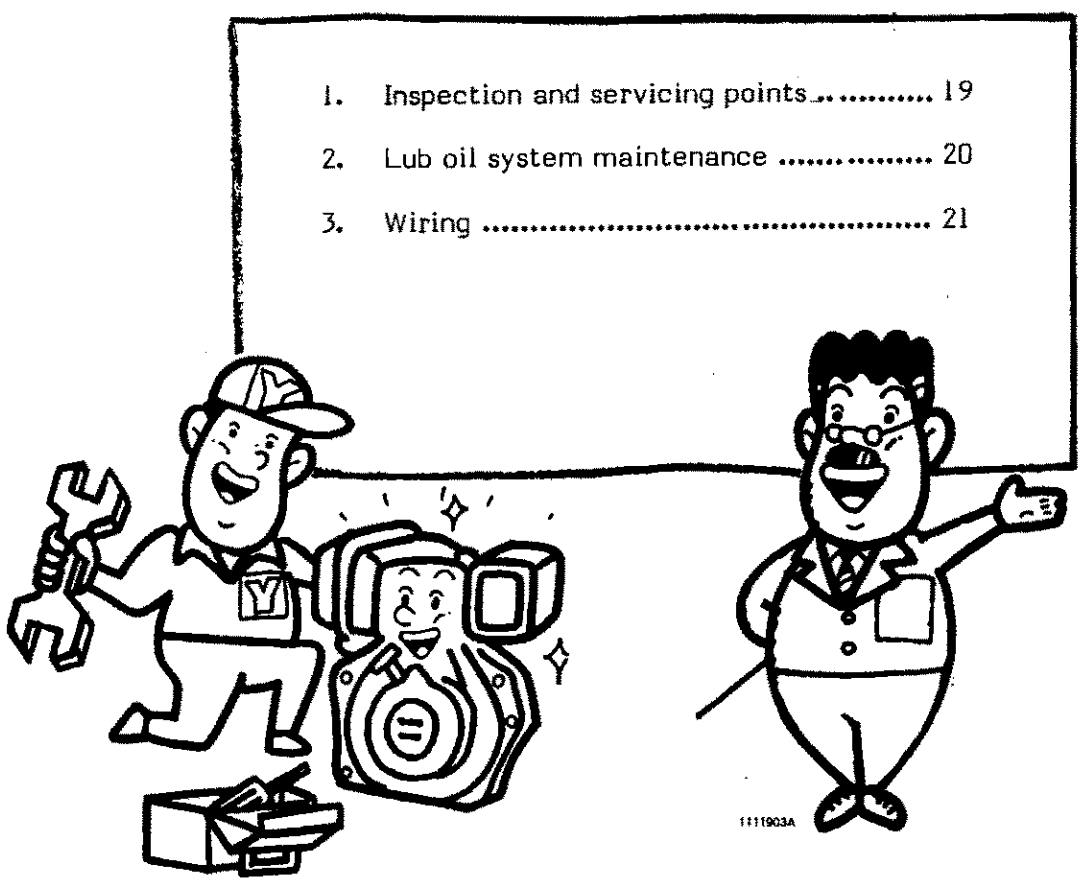
1111915A



1111902A

MEMO

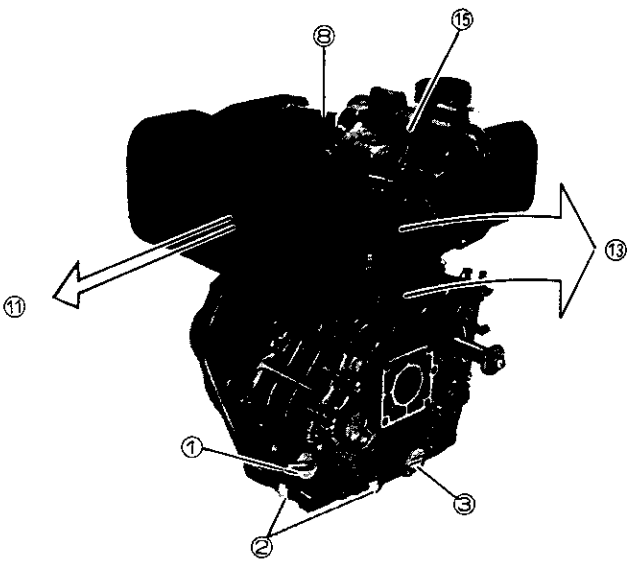
Ⅲ INSPECTION AND SERVICING INSTRUCTIONS

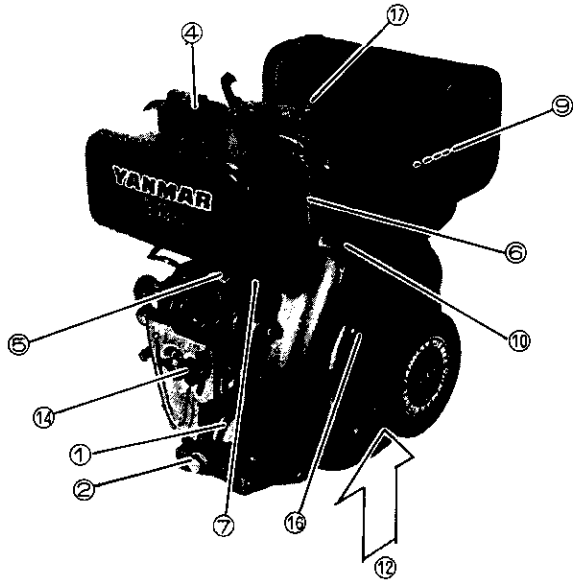


MEMO

1. Inspection and Servicing Points

When coupling the engine with driven machine, be sure to allow for easy servicing and inspection for the following engine points:





(A) Lub oil system

1 : Oil filler ports (2)
2 : Drain plugs (3)
3 : Oil strainer

(B) Fuel system

4 : Oil tank cap
5 : Fuel cock
6 : Oil level gauge
7 : Drain plug
8 : Fuel injection valve

(C) Air intake system

9 : Inspection and removal of filter element
(Replace every 500 hrs of operation)
10 : Do not block the air intake port

(D) Exhaust system

11 : Do not block the exhaust of the engine.
(Adjust the exhaust direction with an accessory deflector.)

(E) Cooling system

12 : Do not block the air intake flow from the recoil starter section.
13 : Do not block the cooling air exhaust.

(F) Starting and operation

14 : Speed control lever
15 : Decomp. lever
16 : Recoil starter
17 : Starting aid rubber plug
(Starting aid device)

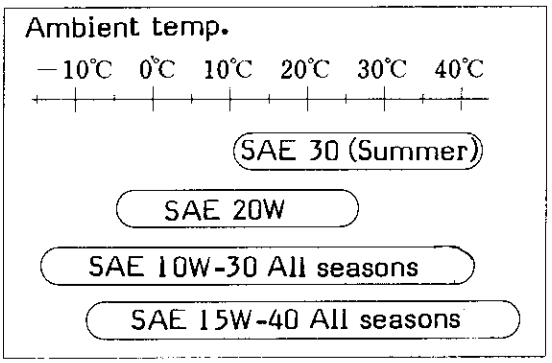
MEMO

Lub Oil System Maintenance

Engine oil

Recommended Lub oil

SAE 10W30 (Class CC or CD)



(Engine oil capacity and supply interval)

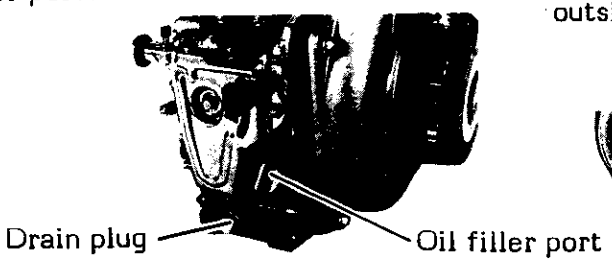
Model	L40	L60	L75	L90
Total capacity (ℓ)	0.75	1.1	1.65	1.65
Effective capacity (ℓ)	0.25	0.4	0.6	0.6
Supply interval (hr)	80	80	80	80

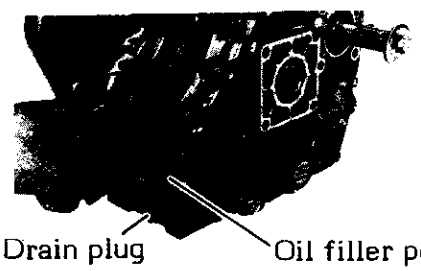
Supply interval

- o API grade Class CC or CD
  ..... Replace every 100 hrs.
- o Class CB (Not Recommended)
  ..... Replace every 50 hrs.
- o Class CA
  ..... Unsuitable for use

Positions of lub oil filler ports and drain plugs

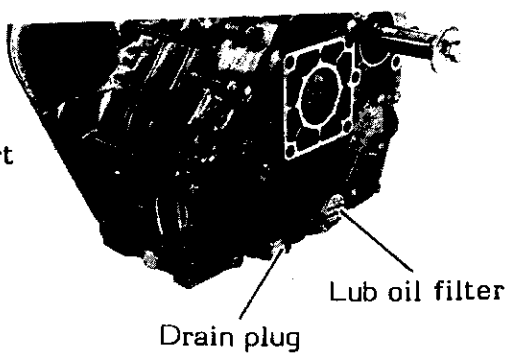
There are three oil drain ports and two oil filler ports.





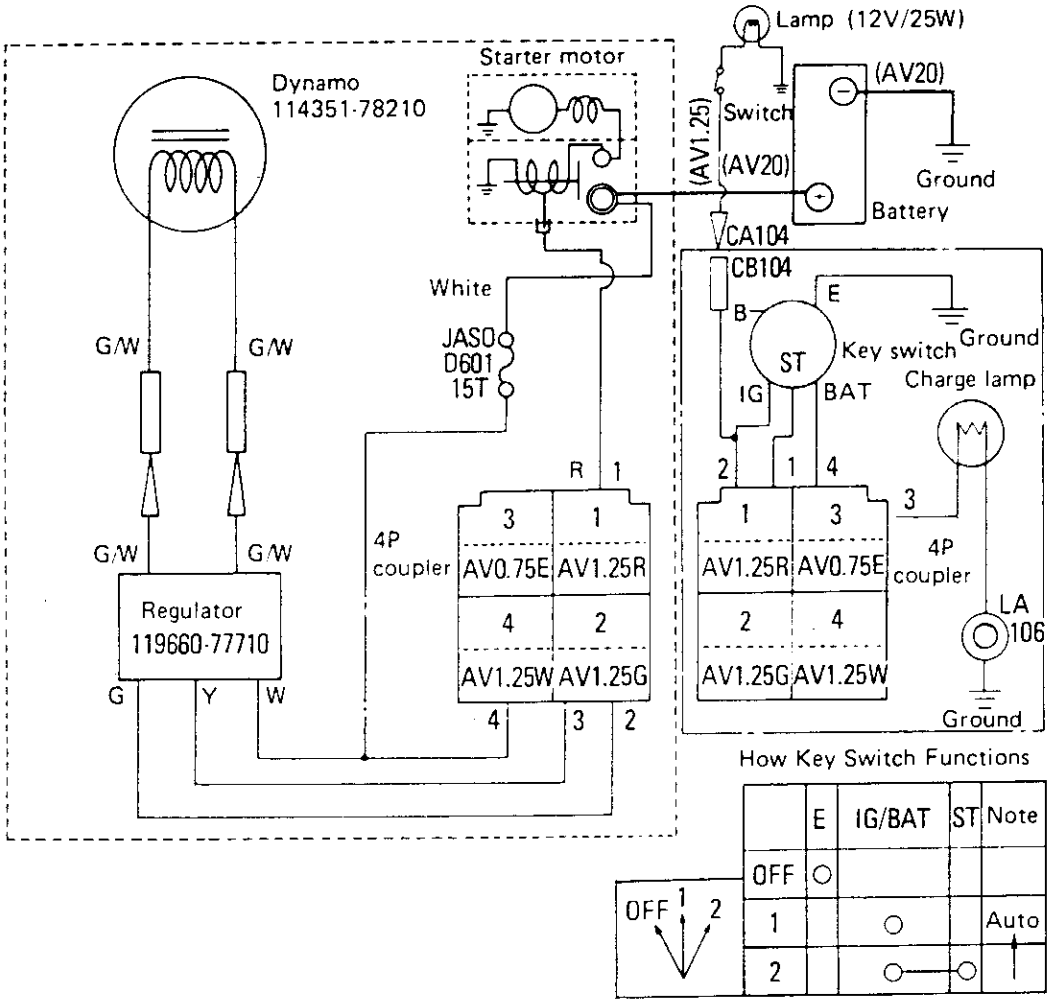
Lub oil filter

The lub oil filter is built in the crank case cover. It can be removed from the outside for inspection.



MEMO

3. Wiring



G: Green
W: White
R: Red
Y: Yellow

MEMO

YANMAR DIESEL ENGINE CO.,LTD.

OVERSEAS OPERATIONS DIVISION
1-1, 2-chome, Yaesu, Chuo-ku, Tokyo 104, Japan
Telex:0222-4733 Telephone:03-275-1111
Facsimile: 03-272-0687 Cable: YANMAR TOKYO

0000A0C0873 T 8906 Printed in Japan