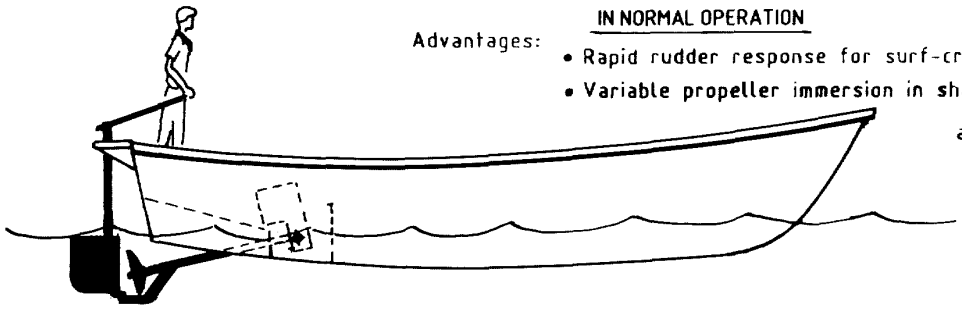
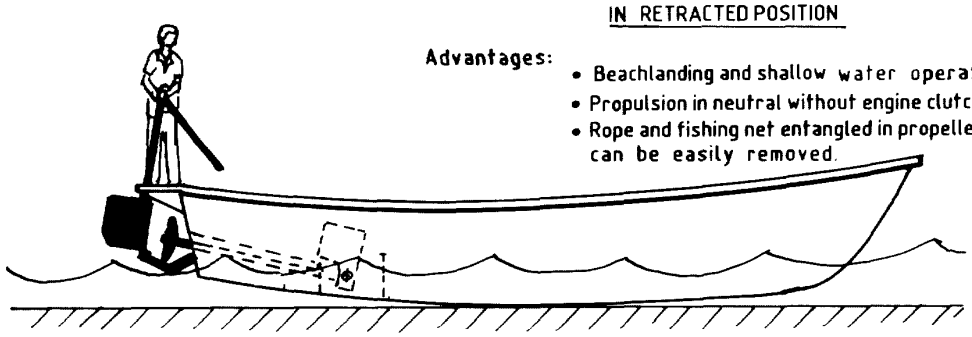
LIFTABLE PROPULSION SYSTEM - BOB DRIVE



IN NORMAL OPERATION

Advantages:

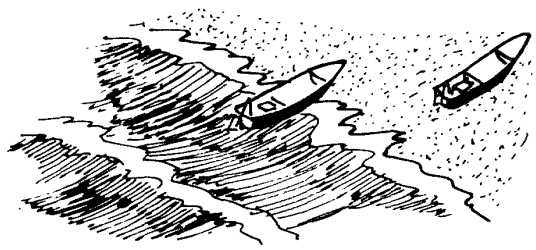
- Rapid rudder response for surf-crossing
- Variable propeller immersion in shallow areas.



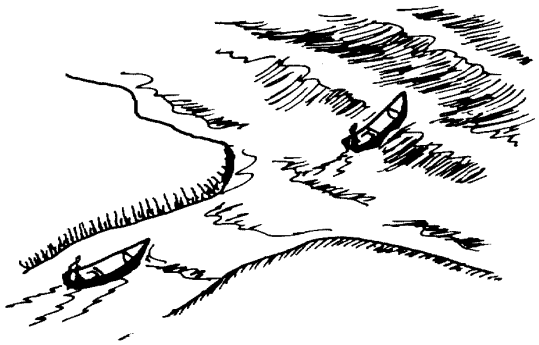
IN RETRACTED POSITION

Advantages:

- Beachlanding and shallow water operation
- Propulsion in neutral without engine clutch
- Rope and fishing net entangled in propeller can be easily removed.



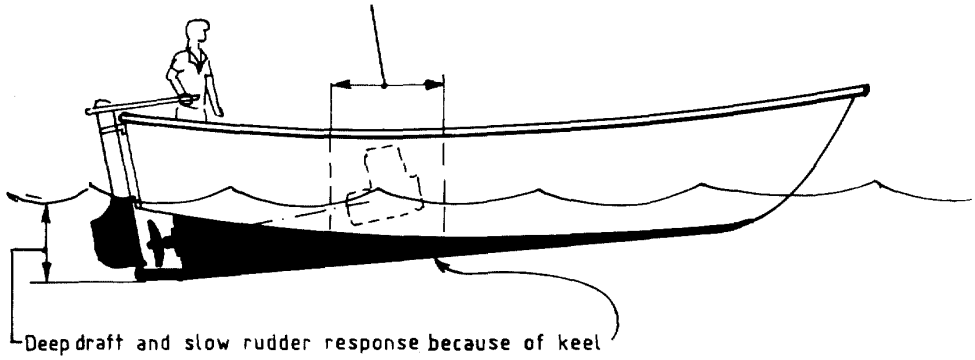
BEACHLANDING



RIVER OUTLET WITH SHALLOW WATER

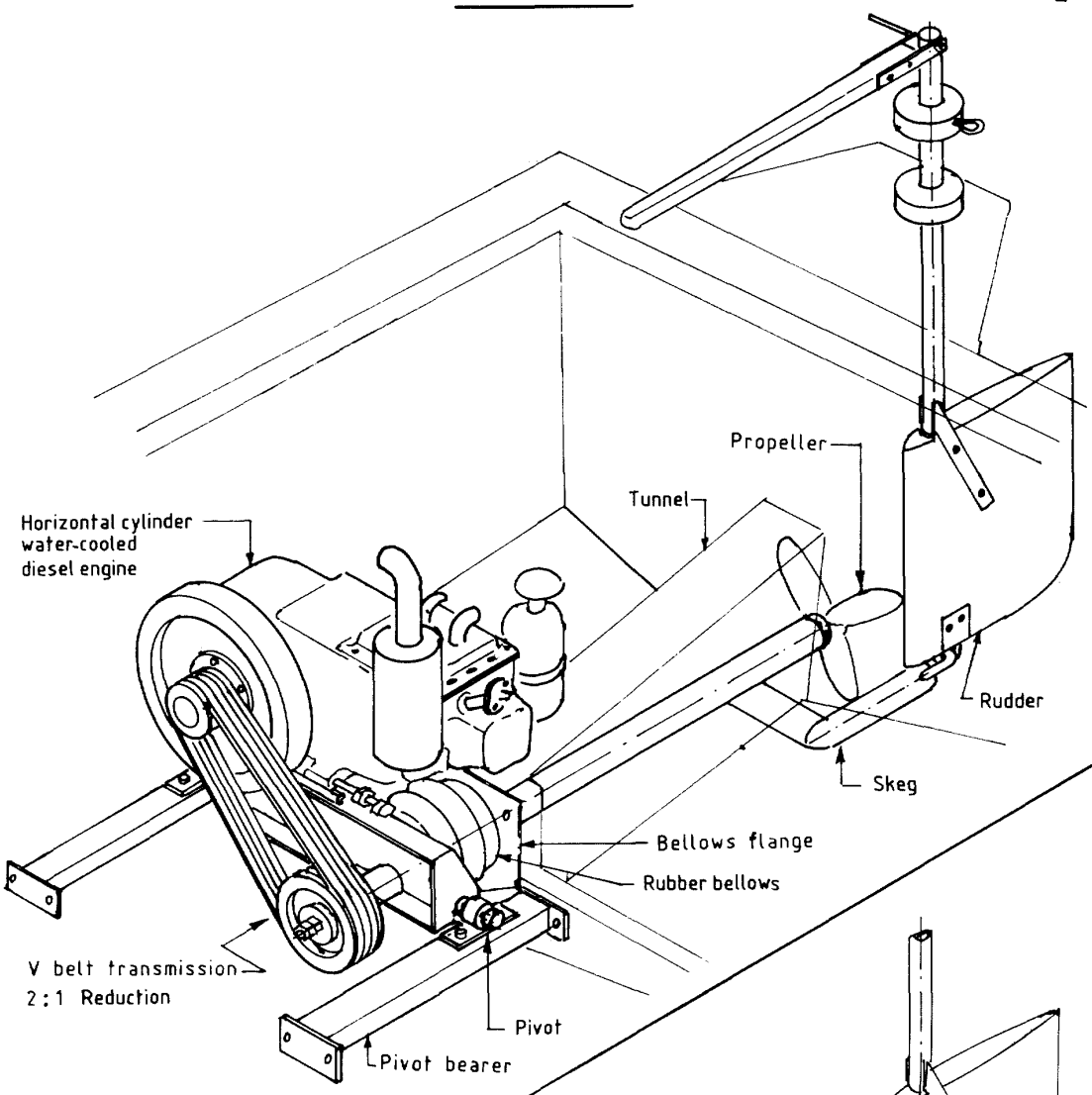
CONVENTIONAL ENGINE INSTALLATION

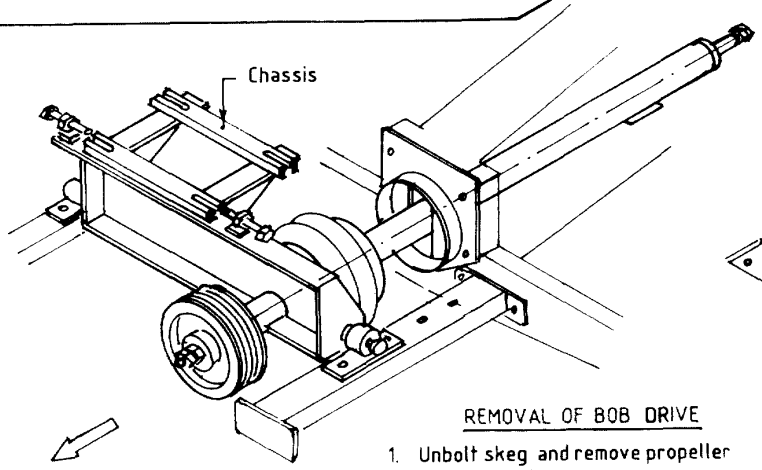
Engine takes useful space midship

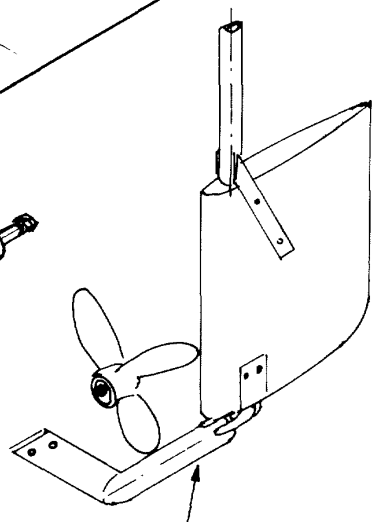


Deep draft and slow rudder response because of keel

BOB DRIVE







Skeg and rudder assembly.

REMOVAL OF BOB DRIVE

1. Unbolt skeg and remove propeller
2. Remove engine
3. Remove pivot bolts
4. Loosen bellows hose clips
5. Slide BOB Drive forward and up

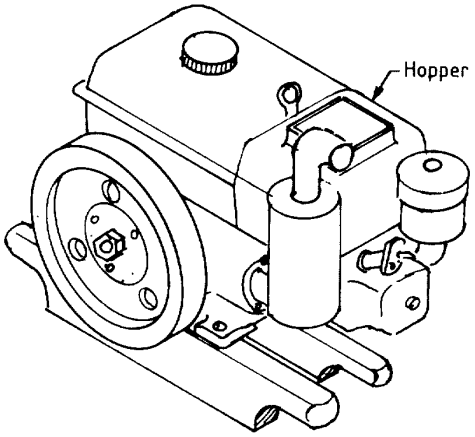
DIESEL ENGINES FOR THE BOB DRIVE

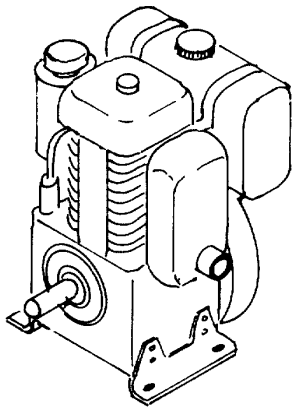
WATER-COOLED

Hopper cooling: Preferred for installation in boats, because of low cost.

Radiator cooling: Can be used after modifications

AIR-COOLED

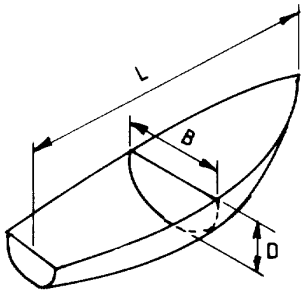




Multipurpose engines used for pumps, generators, power tillers and tractors have the advantage of low price and availability of spare parts
The engines are single cylinder and available in the range of 4 hp to 15 hp.
Kerosene engines can also be used. They are cheaper to buy, but have more operating problems because of electric ignition.
The selection of air-cooled or water-cooled engine will depend on what is available locally. Air-cooled engines are simpler, but the installation must permit a free flow of air.
Single cylinder engines have strong vibration. In some engines this is compensated for by a counter rotating balancer.

SELECTION OF ENGINE POWER

Engine power is mainly dependent on the displacement (weight of boat including the normal load.)



If the displacement is not known it can be estimated by using the CUBIC NUMBER = L × B × D

Measurements are in metres.

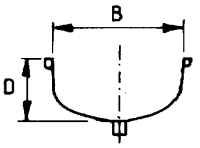


Table 1. Engine power

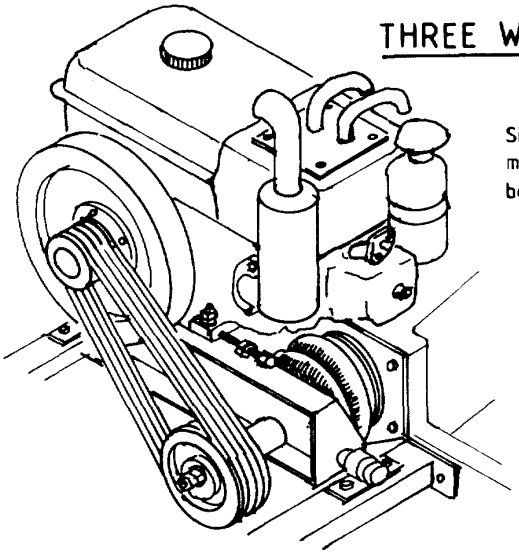
Cubic number L × B × D (m^3)	Displacement kg	Installed continuous hp.
5	500	3
10	1000	6
15	1500	9
20	2000	12
25	2500	15

Note ; Engine power (hp) is for continuous output.

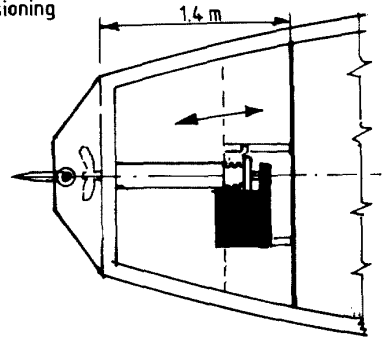
The speed obtained under normal wave conditions with the installed engine power shown to the left and assuming that the engine is operated at 3/4 power, will mainly be dependent on the length of the boat (L)

Length (L) metre	Speed in knots
6	5.2
7	5.6
8	6.0
9	6.3
10	6.7

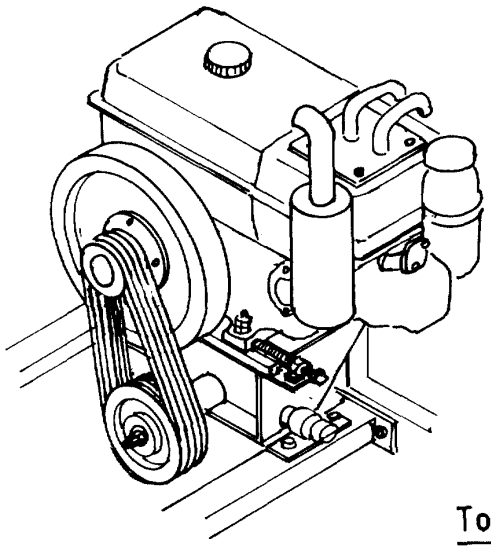
THREE WAYS OF MOUNTING THE ENGINE



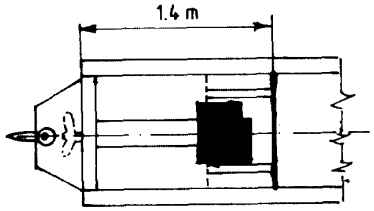
Side mounted engine is the best method. It gives more space for passage on one side and easy belt tensioning



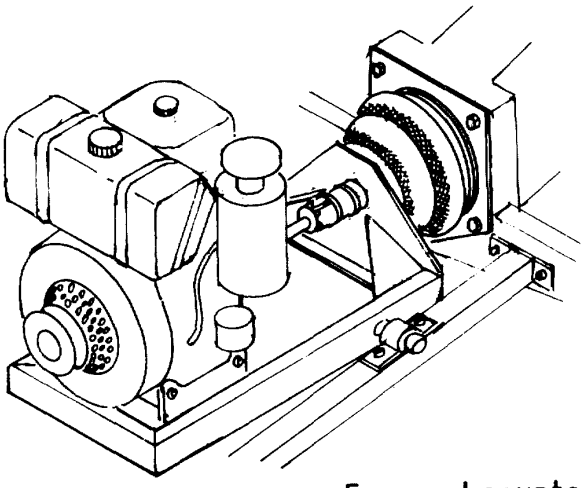
Side mounted engine



Top mounted engine is mainly used in narrow canoes

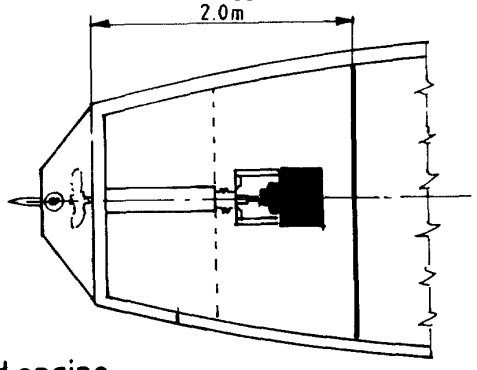


Top mounted engine



Forward mounted engine can be used when the engine has a reduction gear or a camshaft drive (2 : 1 reduction)

This installation requires more space in the boat and a bigger rubber bellows



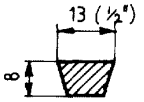
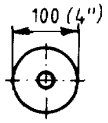
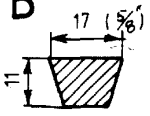
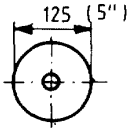
Forward mounted engine

SELECTION OF V-BELT TRANSMISSION.

The diameter of the V-belt pulley fixed to the propeller shaft is the same for all engines : D = 200 mm (8")

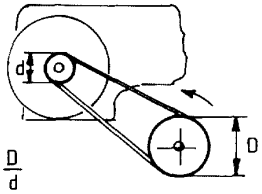
The diameter of the V-belt pulley fixed to the engine : A section belt D = 100 mm (4") Reduction ratio = 2 : 1
B section belt D = 125 mm (5") Reduction ratio = 1.6 : 1

Table 2. V-belt transmission

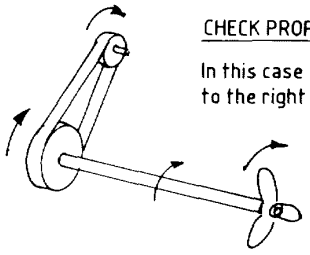
V-belt section mm	Engine pulley Pitch diameter mm	ENGINE POWER Continuous hp	NUMBER OF BELTS Engine RPM 2200	3000
A 		4	2 A	2 A
		5	2 A	2 A
		6	3 A	2 A
		7	3 A	3 A
		8	4 A	3 A
		9	4 A	3 A
		10	4 A	4 A
B 		11	3 B	4 A
		12	4 B	4 A
		13	4 B	4 B
		14	4 B	4 B

SELECTION OF PROPELLER

Engine turns to the left when seen from forward (anti clockwise)



Reduction ratio = $\frac{D}{d}$



CHECK PROPELLER ROTATION !

In this case the propeller turns to the right when seen from aft

The propeller is RIGHT HANDED (Turning clockwise)

EXAMPLE

ENGINE : Horizontal cylinder engine turning left when seen from the flywheel end (power take off).
ENGINE CONTINUOUS POWER : 9.0 hp at 2200 rpm.
V-BELT TYPE : A section V-belt. Number of belts ; 4 . Pulley diameter = 100 mm. (from Table 2) Reduction ratio = 2 : 1
PROPELLER RPM : Engine rpm / 2 = 2200 / 2 = 1100 rpm.
PROPELLER ROTATION: Right handed.
PROPELLER : Diameter = 15 inch. Pitch = 10 inch . Three-bladed. Blade area ratio = 0.35 – 0.50. (From Table 3)

Table 3. Propeller

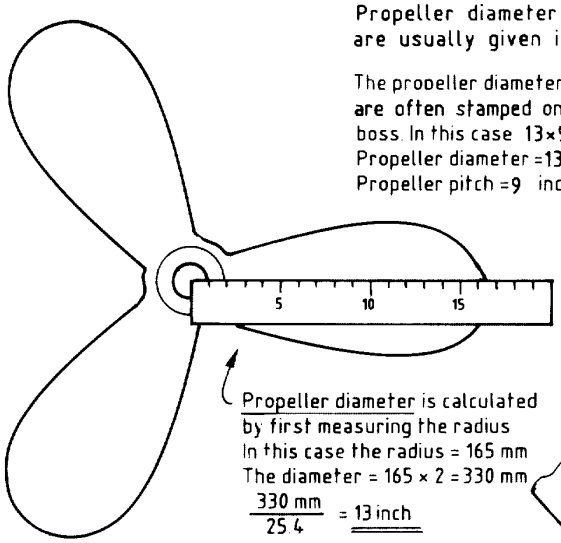
The propeller dimensions are for a three-bladed propeller with blade area ratio: 0.35–0.50 and a boatspeed = 5.5–6.5 knots

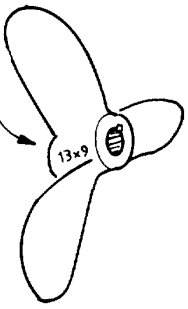
ENGINE CONTINUOUS POWER hp.	DIAMETER × PITCH (inches) versus PROPELLER RPM 1000	1100	1200	1300	1400	1500	1600	1700	1800
4	13 × 10½	13 × 9½	12 × 9	12 × 8½	11 × 8	11 × 7½	10 × 7	10 × 7	9 × 6½
6	14 × 10½	14 × 10	13 × 9½	12 × 9	12 × 8½	11 × 8	11 × 7½	11 × 7	10 × 7
8	16 × 11	15 × 10	14 × 9½	13 × 9	13 × 8½	12 × 8½	12 × 8	11 × 7½	11 × 7
10	16 × 11	15 × 10½	15 × 9½	14 × 9½	13 × 9	13 × 8½	12 × 8	12 × 7½	11 × 7½
12	17 × 11½	16 × 10½	15 × 10	14 × 9½	14 × 9	13 × 8½	13 × 8	12 × 8	12 × 7½
14	17 × 11½	16 × 11	15 × 10½	15 × 10	14 × 9½	14 × 9	13 × 8½	13 × 8	12 × 8

MEASURING PROPELLER DIAMETER AND PITCH

Propeller diameter and pitch are usually given in inches

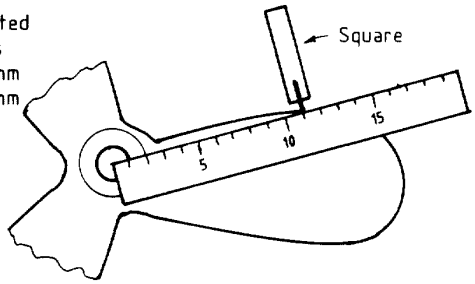
The propeller diameter and pitch are often stamped on the propeller boss. In this case 13×9 means;
Propeller diameter =13 inches
Propeller pitch =9 inches





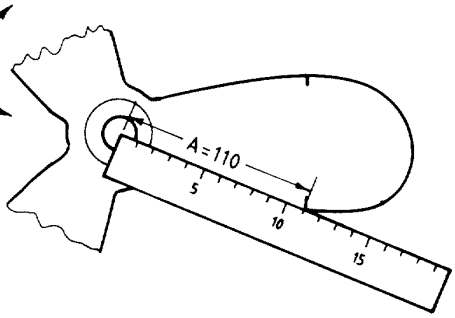
Propeller diameter is calculated by first measuring the radius
In this case the radius = 165 mm
The diameter = 165 × 2 = 330 mm

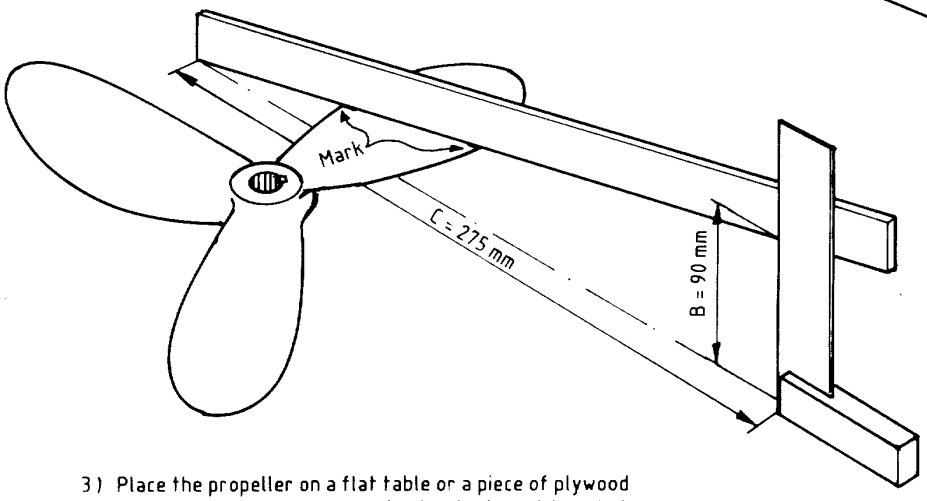
$$\frac{330\ mm}{25.4} = \underline{\underline{13\ inch}}$$



The propeller pitch is a measure for how far forward the propeller advances when making one turn.
The propeller pitch is measured as follows;

1) Measure the distance from the propeller centre to the widest part of the blade. Choose a round figure. In this case A = 110 mm
2) Make a mark at the edge of the propeller blade as shown. Use a square to get accurate marks on the lowest part of the blade as shown in top figure.





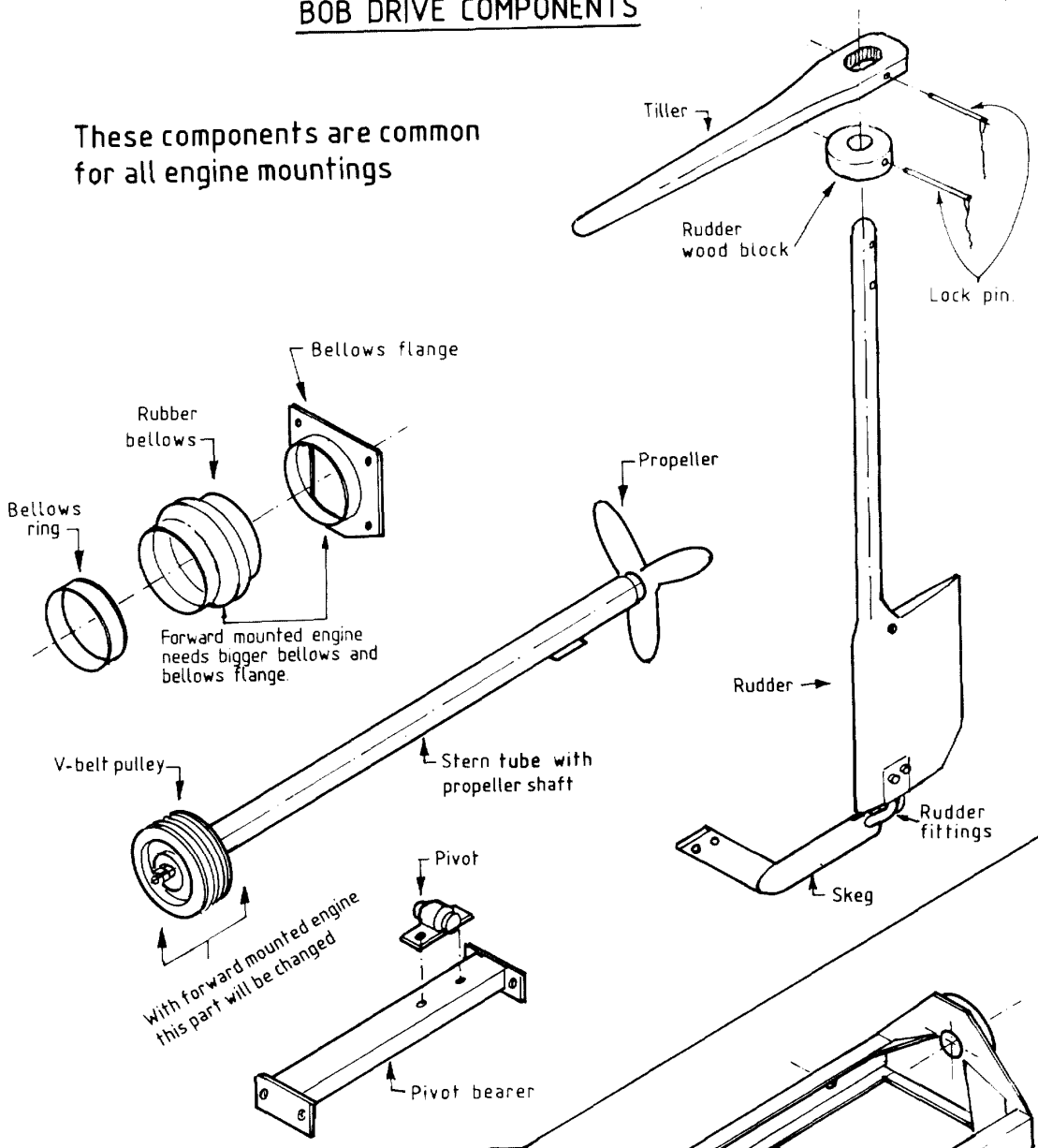
3) Place the propeller on a flat table or a piece of plywood with the propeller boss touching the table, not the blades.
4) Use a ruler or a straight edge minimum 30 cm long. Place it on top of the propeller blade alongside the two marks and with the corner of the ruler touching the table.
5) Measure distances B and C at any convenient point along the ruler. In this case B=90mm, C=275mm. Calculate the pitch:

$$\text{PITCH} = \frac{A \times B}{4 \times C} = \frac{110 \times 90}{4 \times 275} = \underline{\underline{9\ inch}}$$

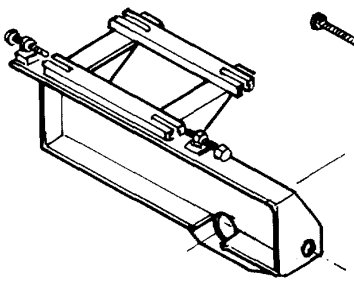
Note: A, B and C must be in mm.

BOB DRIVE COMPONENTS

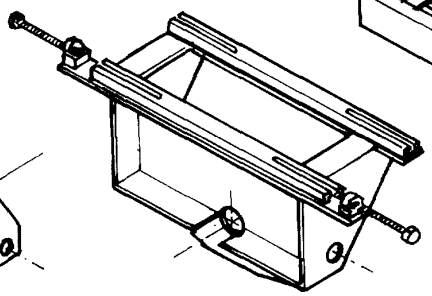
These components are common for all engine mountings



FORWARD MOUNTED ENGINE



SIDE MOUNTED ENGINE

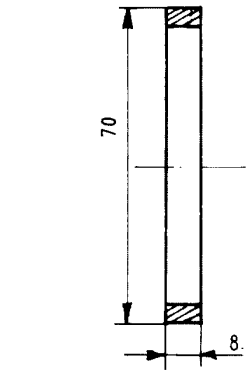


TOP MOUNTED ENGINE

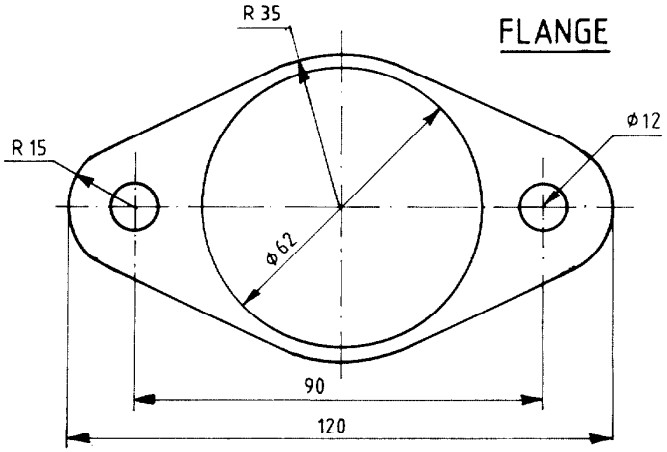
The chassis are different

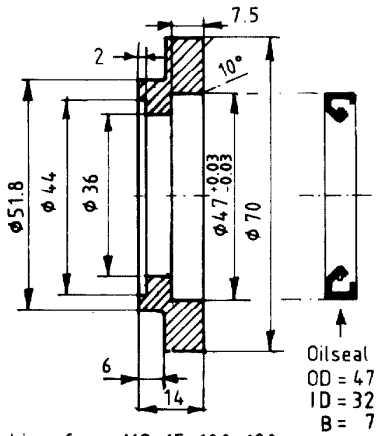
MANUFACTURE OF BOB DRIVE COMPONENTS

Cut from 8 mm MS plate



FLANGE

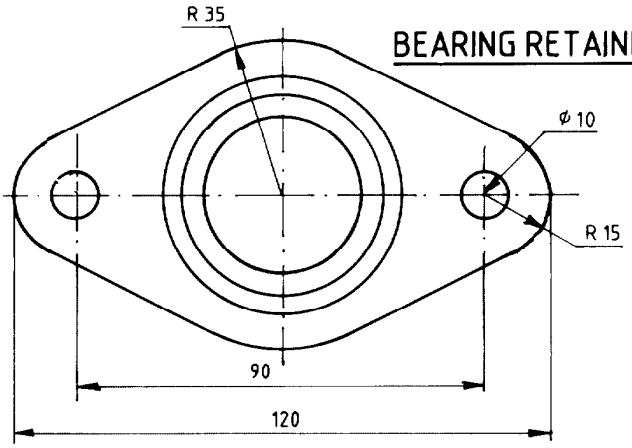


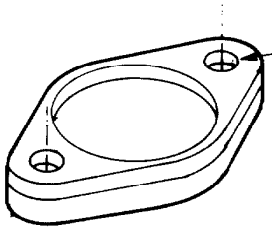


Machine from MS 15×100×120

Oilseal
OD = 47
ID = 32
B = 7

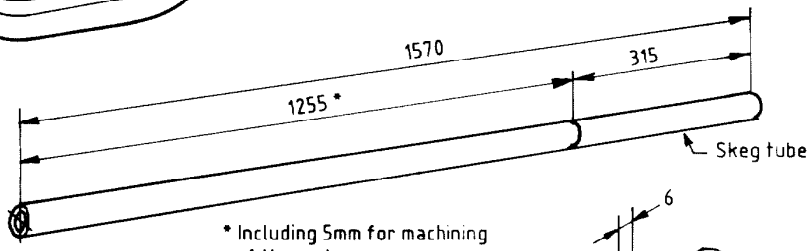
BEARING RETAINER





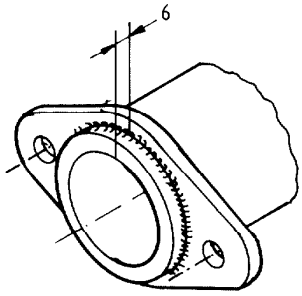
Drill holes ϕ10 in flange and bearing retainer at the same time. Then increase holes in flange to ϕ12.

Stern tube and skeg tube are made from the same tube:
OD = 60.3 , ID = 47.7 , Wall thickness = 6.3
Other tubes can be used provided inside diameter ID = maximum 48



* Including 5mm for machining of the ends

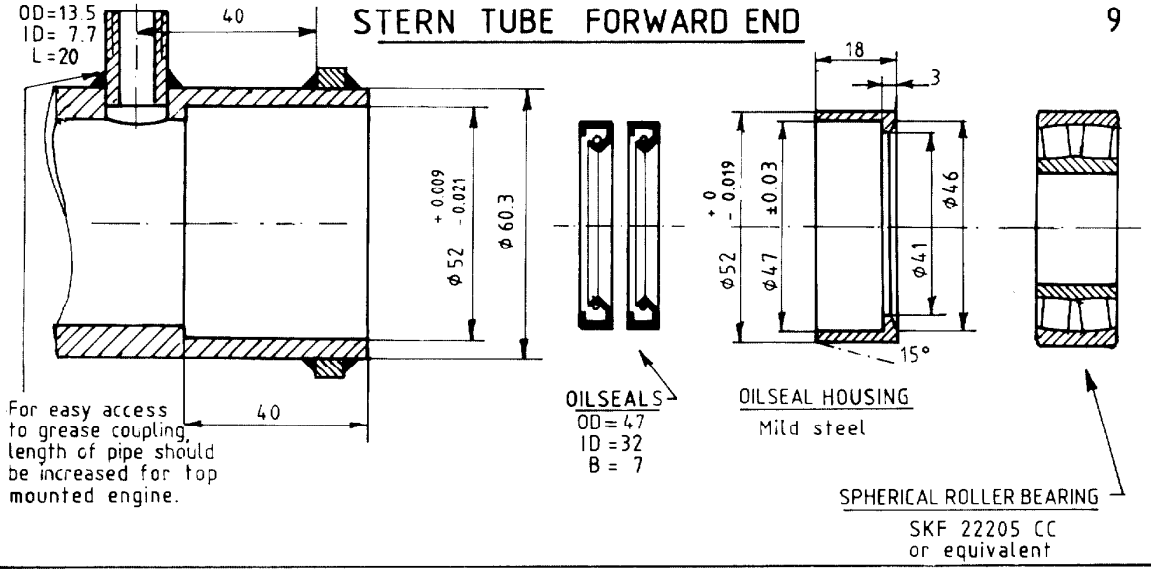
CUTTING STERN TUBE



WELDING ON FLANGE

The flange must be welded on the tube before machining the tube because of welding distortions

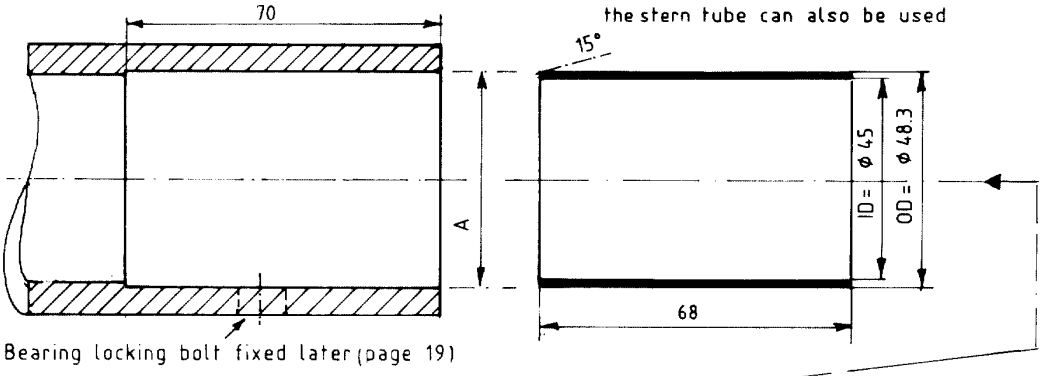
STERN TUBE FORWARD END

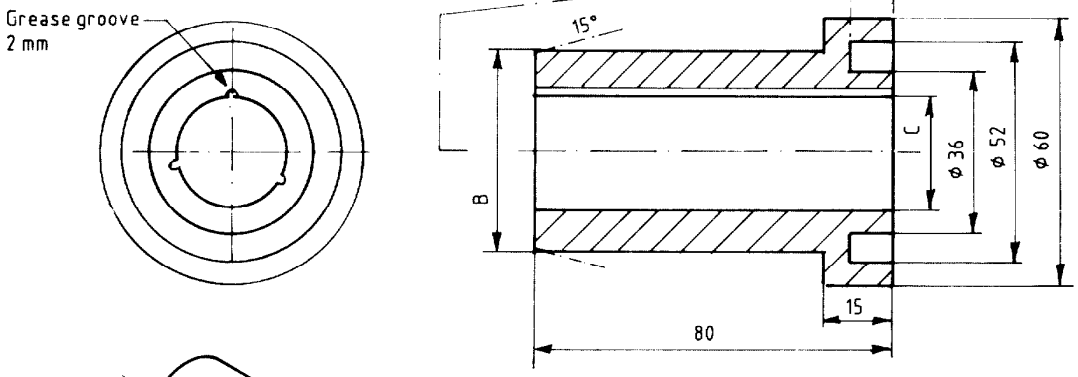


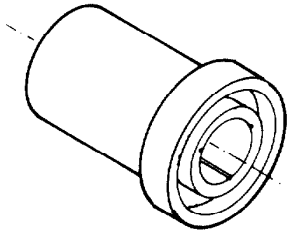
STERN TUBE AFT END

A-Medium drive fit for stainless steel liner

Stainless steel liner is ASTM 1½" SCH 5S
Other dimensions that will fit inside the stern tube can also be used







BRONZE STERN BUSH

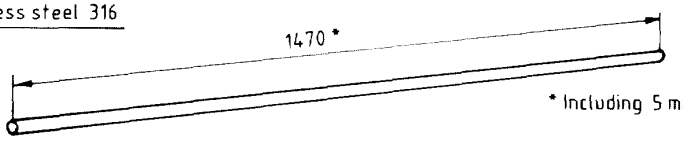
B = Locational clearance fit inside stainless steel liner

C = Dependent on propeller shaft diameter. = D

For free running fit: C = D + 0.10-0.20

PROPELLER SHAFT

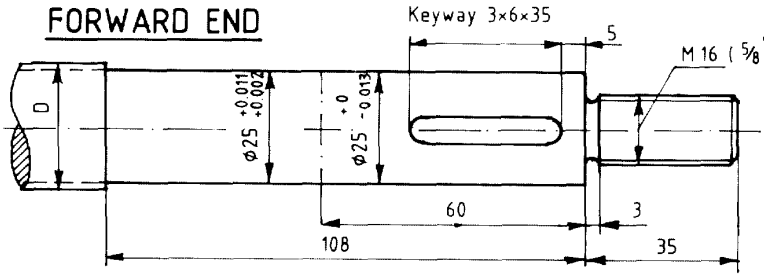
Material ; Stainless steel 316



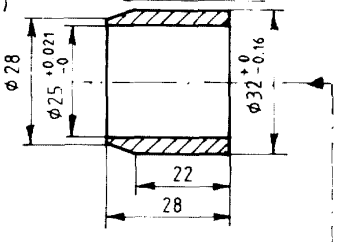
* Including 5 mm for turning ends

The diameter D of the propeller shaft is dependent on what is available. If 25mm diameter shafts are slightly undersize, the roller bearing will not fit. Shafts of D = 25.4 mm (1") or 28 mm are acceptable

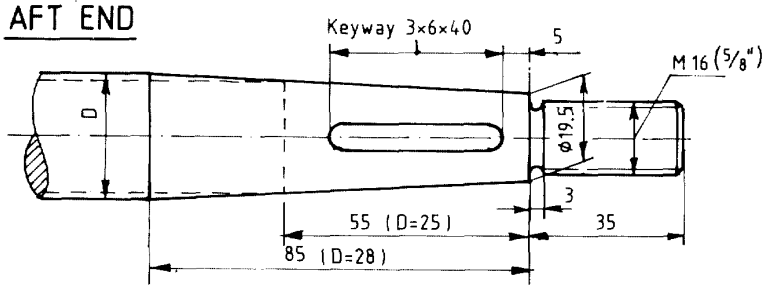
FORWARD END



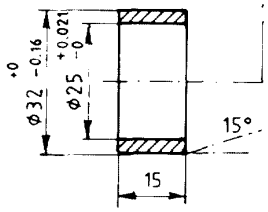
THRUST COLLAR
Stainless steel



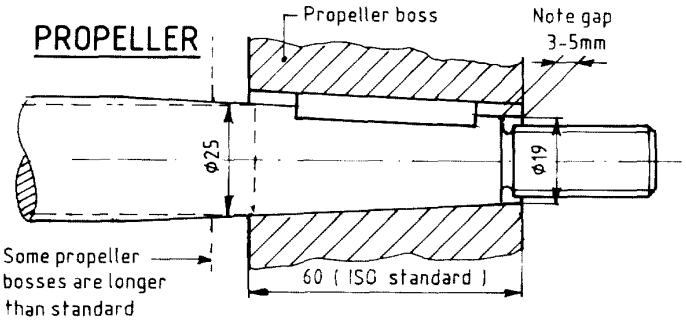
AFT END



SPACER
Stainless steel



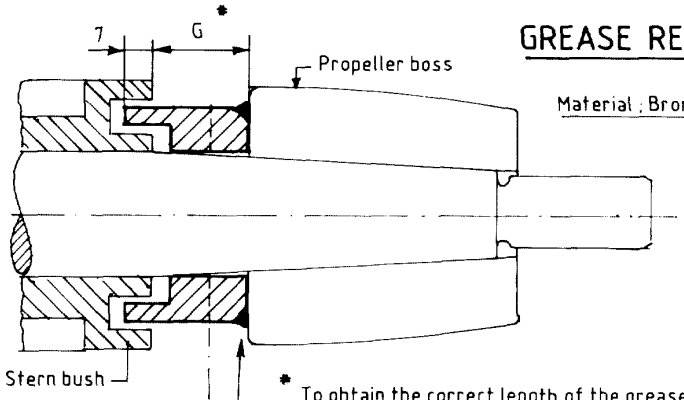
PROPELLER

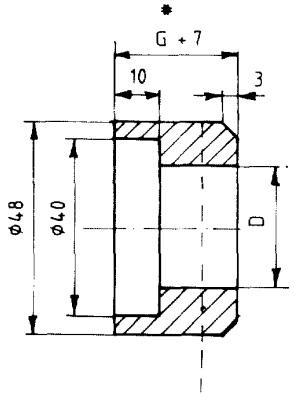


TAPER ON PROPELLER SHAFT
ISO STANDARD = 1 : 10

GREASE RETAINER

Material ; Bronze





* To obtain the correct length of the grease retainer the stern gear must be assembled as shown on pages 12 and 13
The gap between the propeller and the stern bush is measured= G