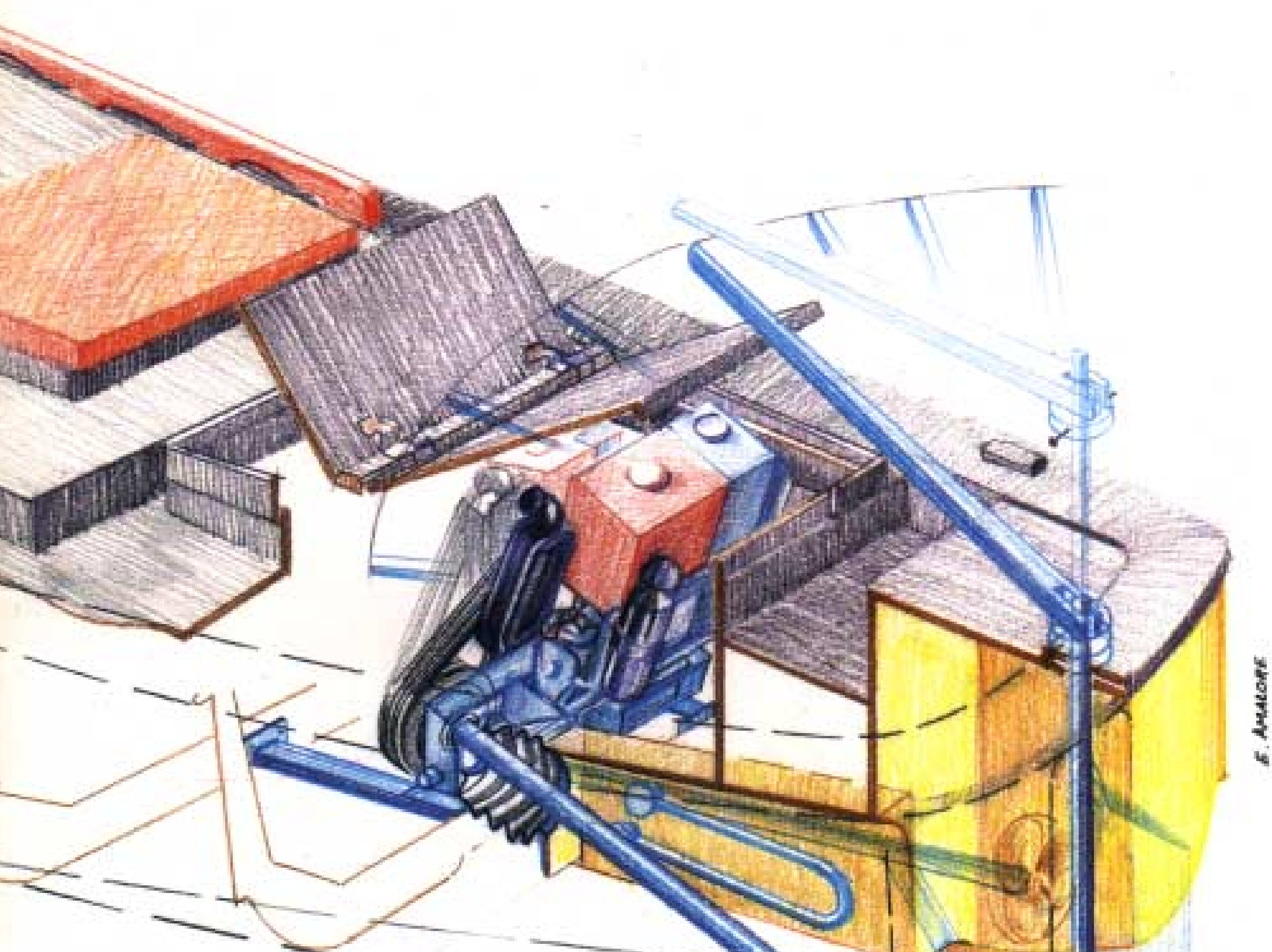
BOBP/MAG/14

Building A Liftable Propulsion System for Small Fishing Craft
THE BOB DRIVE



BOBP
For Fisheries Development
BAY OF BENGAL PROGRAMME

Building
A Liftable Propulsion System for Small Fishing Craft
THE BOB DRIVE

by

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and
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Small Craft Specialist (APO, BOBP)

Bay of Bengal Programme
Madras, India

1993

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INTRODUCTION

Motorization of small fishing craft has contributed considerably to fisheries development in the Bay of Bengal region over the last few decades. In Indonesia. Thailand and Bangladesh the most common engines by far for small fishing craft, are the 5 - 15 hp range of multipurpose diesel engines used for water pumps, generators, power tillers and small tractors. The advantages of this type of engine, compared with the specially marinized diesel engine, is the low cost and easy availability of both engines and spare paris.

Two methods for the installation of these engines have been developed and widely introduced.

The conventional inboard installation, where the propeller shall is fitted through the keel structure, is used in boats operating from harbours or sheltered beaches.

In the 'longtail' installation, the engine Sits on top of the transom and the propeller shaft goes through a long tube to the propeller.

These two methods of installations are, however, not suitable for boats that have to land on surf-beaten beaches.

The Bay of Bengal Programme (BOBP) undertook a project for development of beachlanding craft and their propulsion systems in India and Shri Lanka in 1979. The main challenge was to develop a propulsion system that could be fitted to a variety of air-cooled and water-cooled diesel engines that were available locally, provide good manoeuvrability when crossing the surf, permit rapid retraction of the propeller and the rudder and be strong enough to withstand both the impact when landing on the beach and the rough handling by users.

Only outboard motors had previously proved satisfactory for surf crossing, but, except in the case of small craft, this solution had economic limitations due to its high operating cost and the short service life of the motor Further, outboard motors have to be imported from Japan, Australia, Europe or the USA, while the multipurpose kerosene or diesel engines are now manufactured, or assembled, in many developing countries.

This manual describes the final version of the liftable propulsion system developed by BOBP and called the BOB DRIVE. The B0B Drive has undergone long-term trials in India and Shri Lanka and been found to be acceptable to fishermen operating from open surf beaches and from shallow water outlets. A variety of fishing craft, from FRP beachlanding craft and plywood canoes in India to narrow outrigger canoes in Shri Lanka, have been fitted with the BOB Drive and it has worked satisfactorily in all of them.

This manual is intended to be used by skilled mechanics in small workshops having a lathe and welding equipment It should also be of interest to engine manufacturers, boat builders, teachers in lisheries training institutes and extension workers in small-scale fisheries.

The projects for development of fishing craft, including liftable propulsion systems for beachlanding and negotiating shallow water outlets, were sponsored by the Bay of Bengal Programme's project "Small-Scale Fisherfolk Communities in the Bay of Bengal" (GCP/RASI118/MUL). They were executed by national fisheries institutions and BOBP in cooperation with engine manufacturers and dealers, boatyards, engineering workshops and fishedolk.

The Bay of Bengal Programme (BOBP) is a multiagency regional fisheries programme which covers seven countries around the Bay of Bengal - Bangladesh, India, Indonesia, Malaysia, Maldives, Shri Lanka and Thailand. The Programme plays a catalylic and consultative role: it develops, demonstrates and promotes new technologies, methodologies and ideas to help improve the conditions of small-scale lisherfolk communities in member countries. The BOBP is sponsored by the governments of Denmark, Sweden and the United Kingdom, and also by UNDP (United Nations Development Programme) and AGFUND (Arab Gulf Fund for United Nations Development Organizations). The main executing agency is the FAO (Food and Agriculture Organization of the United Nations).

This manual, prepared by O. Gulbrandsen, Naval Architect Consultani, and Mr M.R. Andersen, Small Craft Specialist, BOBP, is the result of the work done by BOBP staff, Varuna Construction & Design, Madras, fisheries officers and all those who were involved in the development and trials of the BOB Drive. It has not been cleared by the Governments concerned or the FAO.

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LIST OF MATERIALS
FOR SIDE OR TOP MOUNTED ENGINE

Does not include:

(a) Alternative large rudder, page 22

(b) Freshwater cooling system and cooling oil in tunnel, pages 29, 30

(c) Seawater cooling system, page 31

(d) Forward mounted engine, chassis, flexible stuffing box and tunnel, pages 34, 3536

(e) Tunnel, watertight bulkhead and rudder platform, pages 23, 24, 25, 26

NOTE: Unless otherwise stated, **all** dimensions are in mm. It metric sizes are not available, use nearest equivalent in inches.

Abbriviations : L = Length, D = Diameter, ID = Inner diameter, T = Thickness

	ITEM	OTY.	PAGE NOS.
MILD STEEL	Plate,T=6,400x 600	1	14,33
	Plate,T=8,75x130	1	8
	Flatiron, 6 x 40, L = 1200— See alternative	1	16
	Flatiron; 6 x 50, L = 2000	1	14
	Flatiron, 8 x 50, L = 600	1	15,27
	Flatiron, 15 x 100. L = 600	1	8,9
	Flat iron, 20 x 40, L = 1000, Top mounted L = 1200	1	17
	Rod,D=32,L=145	1	15
	Rod,D=45,L=105	1	15
	Rod,D=60,L=45	1	19
	Tube OD = 60.3, T = 6.3, ID 47.7, L = 1570	1	8
	TubeOD=13.5,ID=7.7,L=20	1	9
	Channeliron6x40x75,L=1000	1	27
	PlateT=4,65x170	1	20
STAINLESS STEEL 316	Strip2x25,L=320	1	21,22
	Strip 3 x 40, L =1200 — See alternative	1	16
	Rod D = 6, L = 1200 — See alternative	1	16
	RodD=10,L=330	1	20,21
	RodD=16,L=260	1	20
	Rod D = 35, L = 45 — Alternative tube ID = 24	1	10
	Propeller Shaft D = 25.4 or D + 28, L = 1470	1	10
	Tube 1 1/2” ASTM SCH 5S, OD =48.3, ID = 45, L = 70	1	10
	Tube 1/4” ASTM SCH 10S, OD = 13.7, ID 10.4, L = 60	1	9
BRONZE	Rod D = 65, L = 80 — Alternative tube ID = 24	1	9
	Rod D = 48, L 30 — Alternative tube ID = 24	1	10
	Propeller	1	5, 6

BOLTS, STEEL

ITEM	OTY.	PAGE NOS.
Hex Bolt M6x 75	2	26
Hex Bolt M 10 x 75	8	27
Hex BoltM 10x 100	6	25,26
Hex Bolt M 12 x 50	4	18
Hex Bolt M 12 x 120 – Alternative 12 x 200 for top mounted	2	17, 33
HexNutM6	2	
Hex Nut M 10	14	
Hex Nut M 12	10	
Washer M 6	2	
Washer M 10	14	
StudM10x50	2	12, 13
Hex Bolt M IOx 30	5	19,27
Hex Bolt M 10 x 60	2	20
Hex Bolt M 16x 60	2	19
Hex Nut M 10	14	
Hex Nut M 16	8	10, 19
Spherical roller bearing SKF 22205 CC or equivalent		9, 12
Oil Seal OD = 47, ID = 32, B = 7	3	8,9
Key, Stainless steel 316, 6 x 6 x 35		10, 12
Key, Stainless steel 316, 6 x 6 x 40		10, 12
Washer, Stainless steel 316, T 3, OD 32, ID = 17		12, 13
Quick coupling, hydraulic 1/4'		12,38
Grease gun with flexible hose and quick coupling		38
Grease cup No. 4, 1/4' BSP		15
Grease 2kg	1	12,38
V-belt pulley for engine, cast iron	1	5,11
V-belt pulley foL propeller shaft, cast iron	1	5, 11
V-belts	1 set	5, 18
Bellows, neoprene		28
Hoseclip, Stainless steel, D 190		28
Rod, Copper5x t60		21
Timber, heavy, sawn, 65 x 1400 (for 2		21
Timber, heavy, sawn, 40 x 200 x 1400 (for 2)		21
Timber, heavy, sawn, 32 x 200 x 450 (for 2)		21

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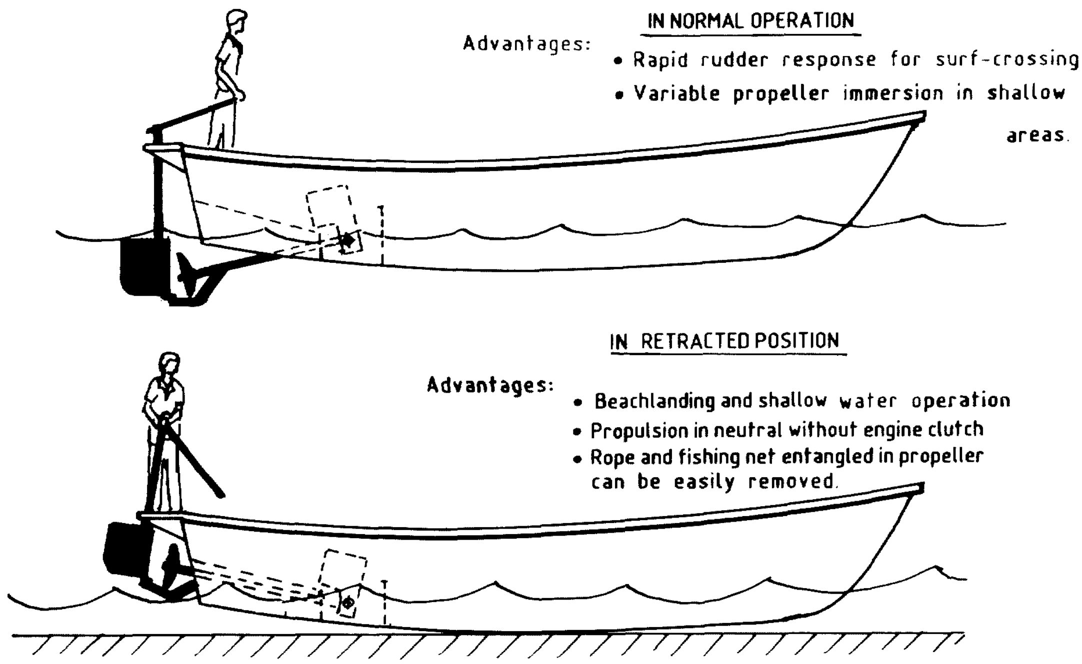
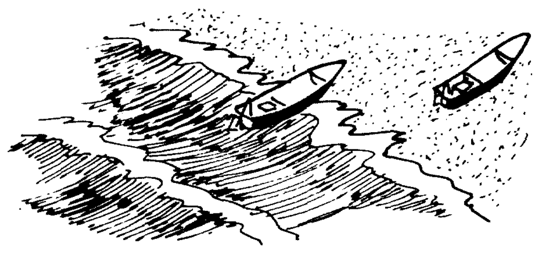
LIFTABLE PROPULSION SYSTEM - BOB DRIVE

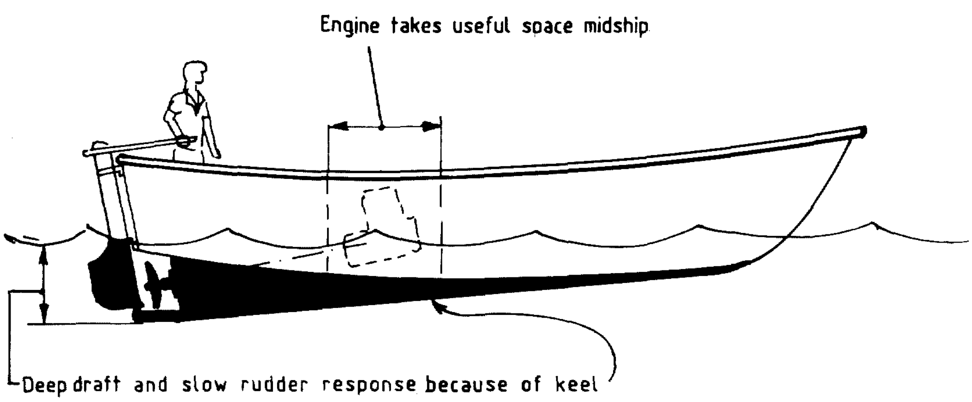




BEACHLANDING

RIVER OUTLET WITH SHALLOW WATER

CONVENTIONAL ENGINE INSTALLATION



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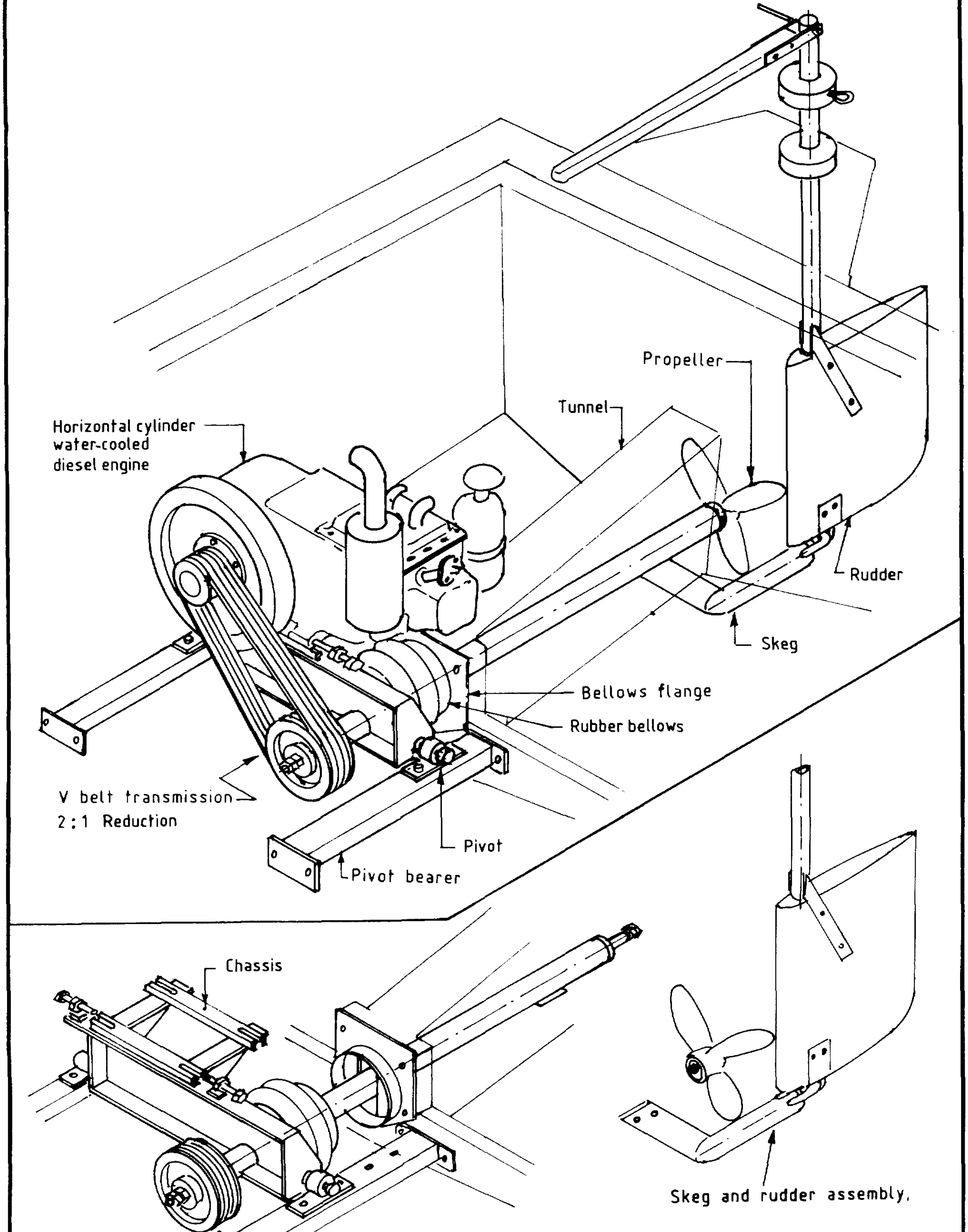
BOB DRIVE



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

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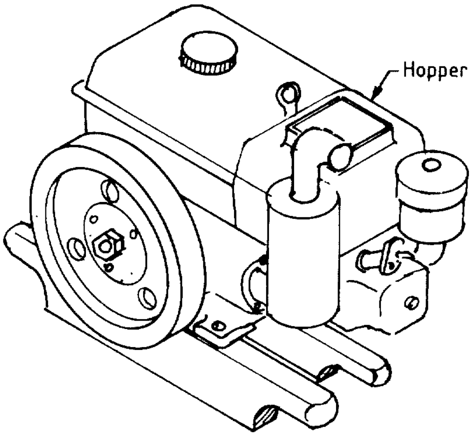
DIESEL ENGINES FOR THE BOB DRIVE

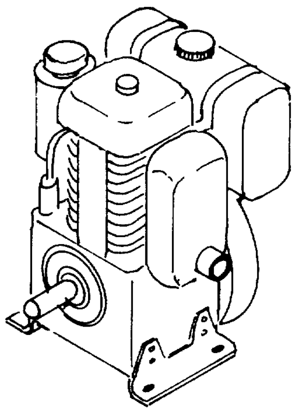
WATER-COOLED

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

Radiator cooling: Can be used after modifications



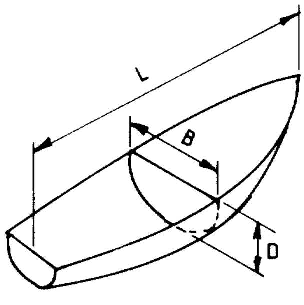
AIR-COOLED



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.

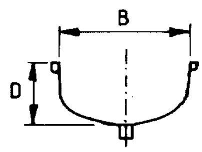
SELECTION OF ENGINE POWER

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.



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

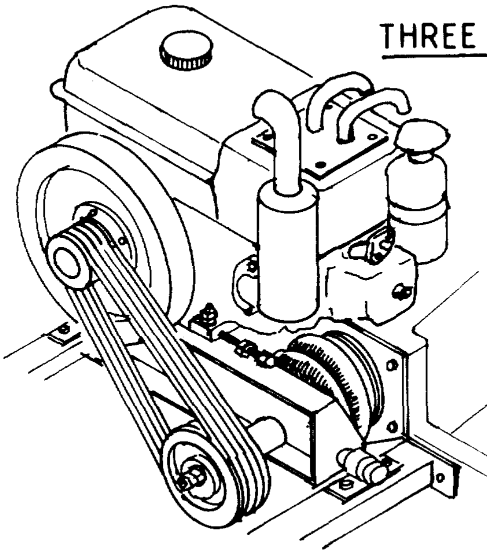
Table 1. Engine power

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

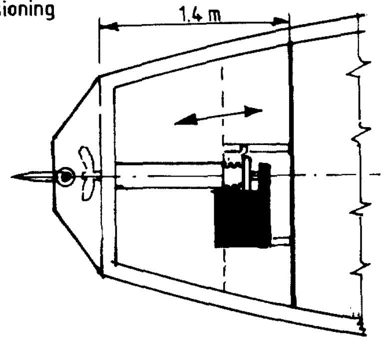
The speed obtained under normal wave conditions with the installed engine power shown to the left and assuming that the engine is operated at 3/4 power, will mainly be dependent on the length of the boat (L)

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

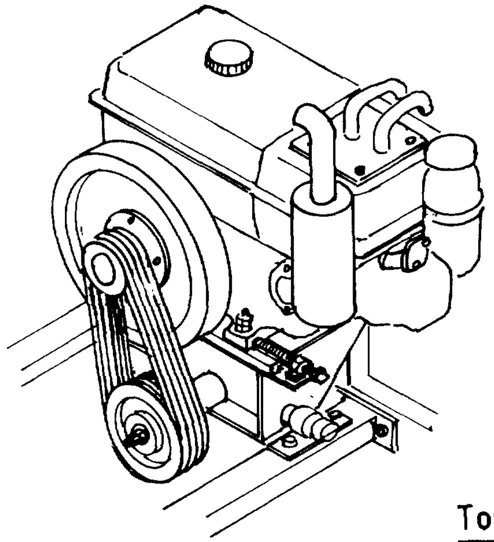
THREE WAYS OF MOUNTING THE ENGINE



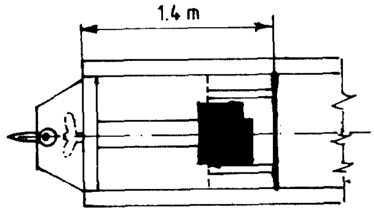
Side mounted engine is the best method. It gives more space for passage on one side and easy belt tensioning



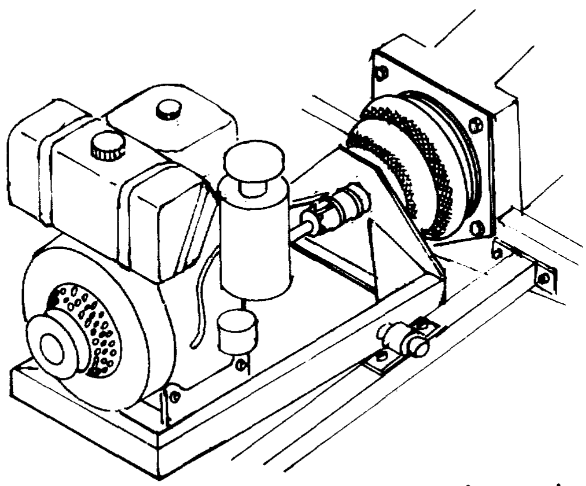
Side mounted engine



Top mounted engine is mainly used in narrow canoes

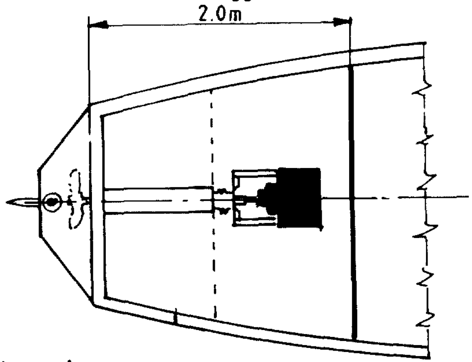


Top mounted engine



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



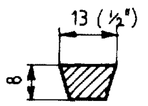
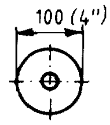
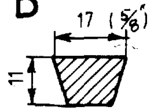
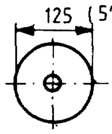
Forward mounted engine

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

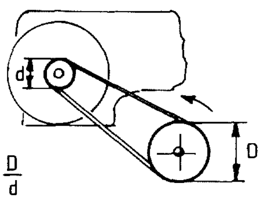
V-belt section mm	Engine pulley Pitch diameter mm	ENGINE POWER Continuous hp	NUMBER OF BELTS Engine RPM 2200	3000
A 		4	2 A	2 A
		5	2 A	2 A
		6	3 A	2 A
		7	3 A	3 A
		8	4 A	3 A
		9	4 A	3 A
		10	4 A	4 A
B 		11	3 B	4 A
		12	4 B	4 A
		13	4 B	4 B
		14	4 B	4 B

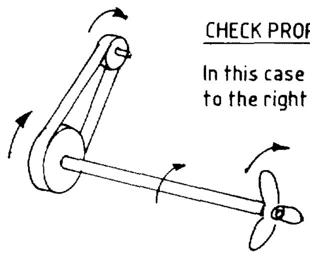
SELECTION OF PROPELLER

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

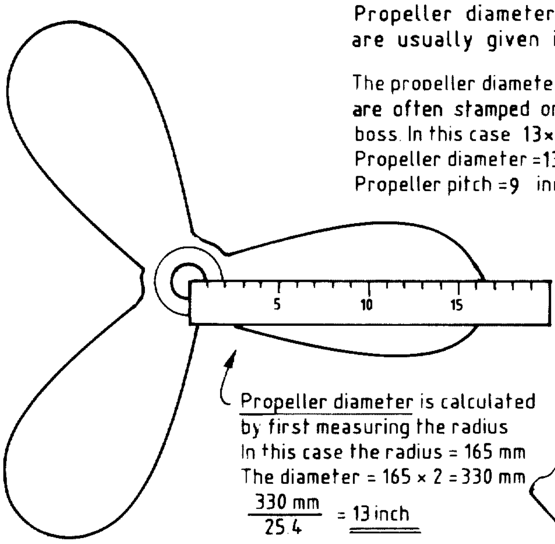
The propeller dimensions are for a three-bladed propeller with blade area ratio: 0.35–0.50 and a boatspeed = 5.5–6.5 knots

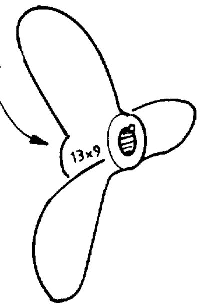
ENGINE CONTINUOUS POWER hp.	DIAMETER × PITCH (inches) versus PROPELLER RPM 1000	1100	1200	1300	1400	1500	1600	1700	1800
4	13 x 10½	13 × 9½	12 × 9	12 × 8½	11 × 8	11 × 7½	10 × 7	10 × 7	9 × 6½
6	14 × 10½	14 × 10	13 × 9½	12 × 9	12 × 8½	11 × 8	11 × 7½	11 × 7	10 × 7
8	16 × 11	15 × 10	14 × 9½	13 × 9	13 × 8½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

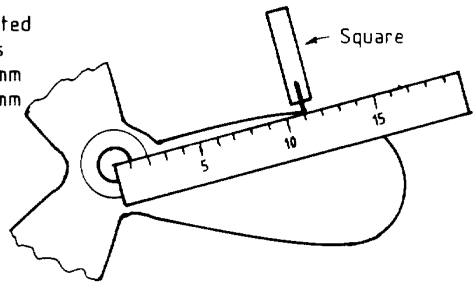
The propeller diameter and pitch are often stamped on the propeller boss. In this case 13×9 means;
Propeller diameter = 13 inches
Propeller pitch = 9 inches





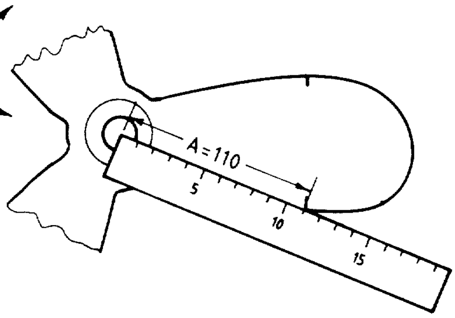
Propeller diameter is calculated by first measuring the radius
In this case the radius = 165 mm
The diameter = 165 × 2 = 330 mm

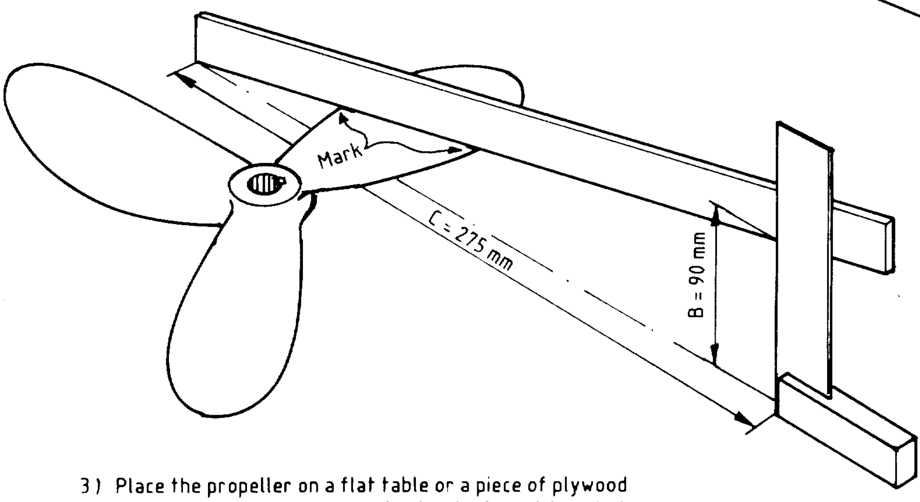
$$\frac{330\ \text{mm}}{25.4} = \underline{\underline{13\ \text{inch}}}$$



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.





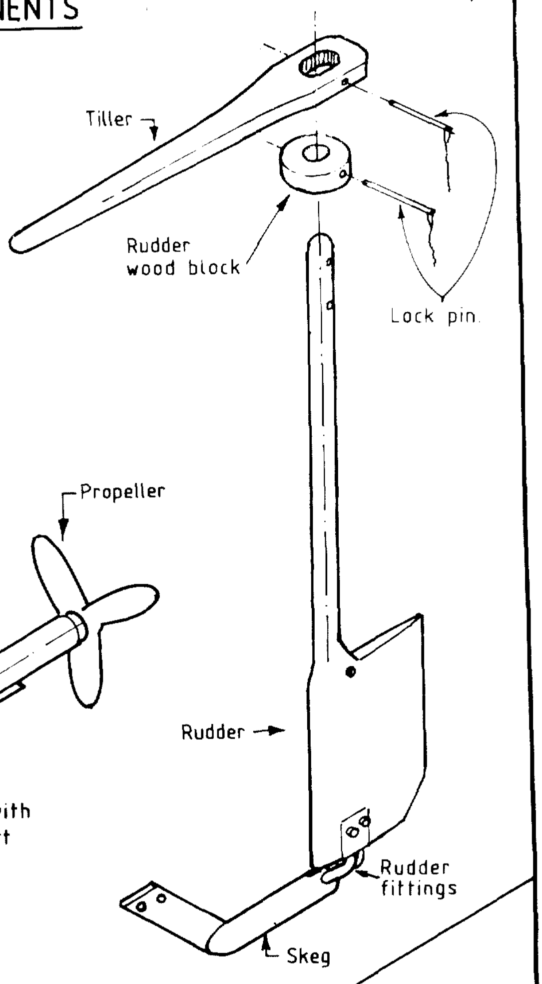
3) Place the propeller on a flat table or a piece of plywood with the propeller boss touching the table, not the blades.
4) Use a ruler or a straight edge minimum 30 cm long. Place it on top of the propeller blade alongside the two marks and with the corner of the ruler touching the table.
5) Measure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

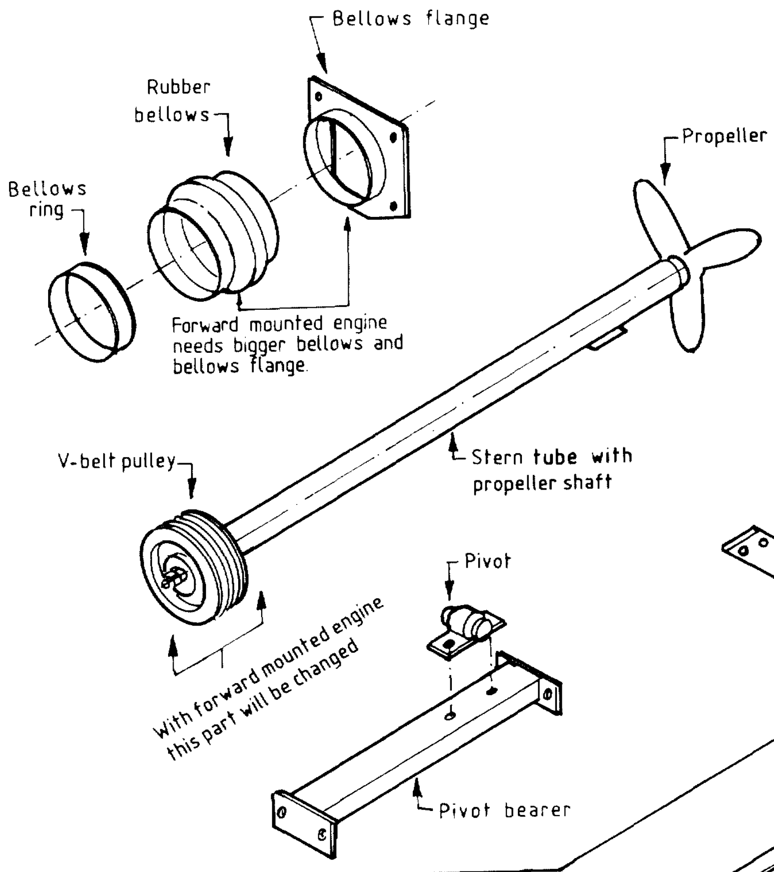
$$\text{PITCH} = \frac{A \times B}{4 \times C} = \frac{110 \times 90}{4 \times 275} = \underline{\underline{9\ \text{inch}}}$$

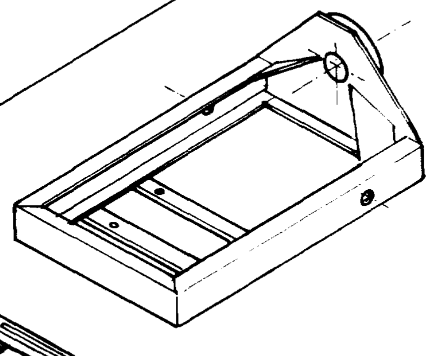
Note: A, B and C must be in mm.

BOB DRIVE COMPONENTS

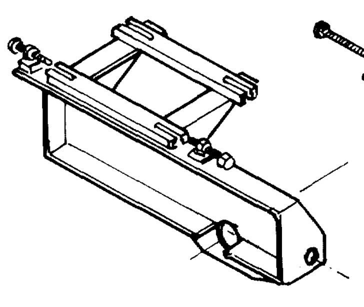
These components are common for all engine mountings



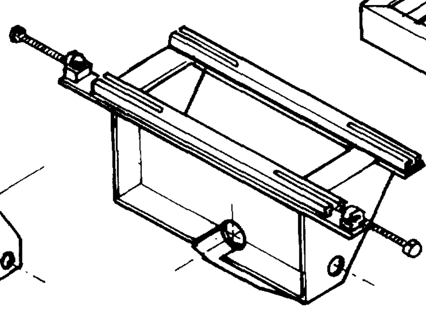




FORWARD MOUNTED ENGINE



SIDE MOUNTED ENGINE



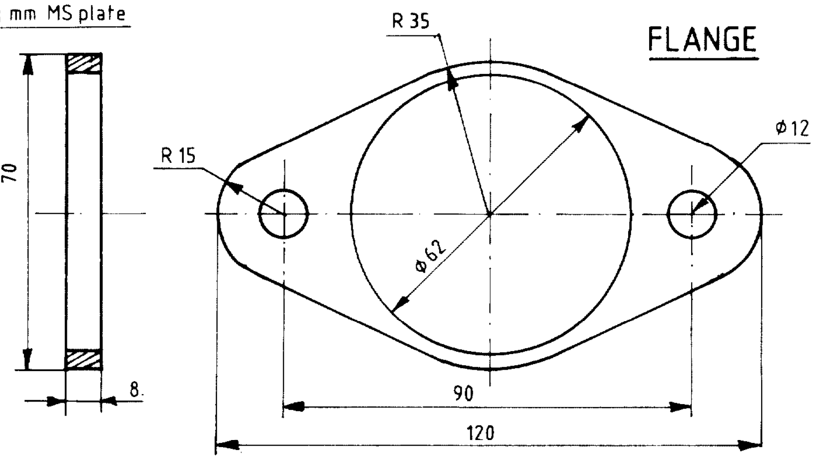
TOP MOUNTED ENGINE

The chassis are different

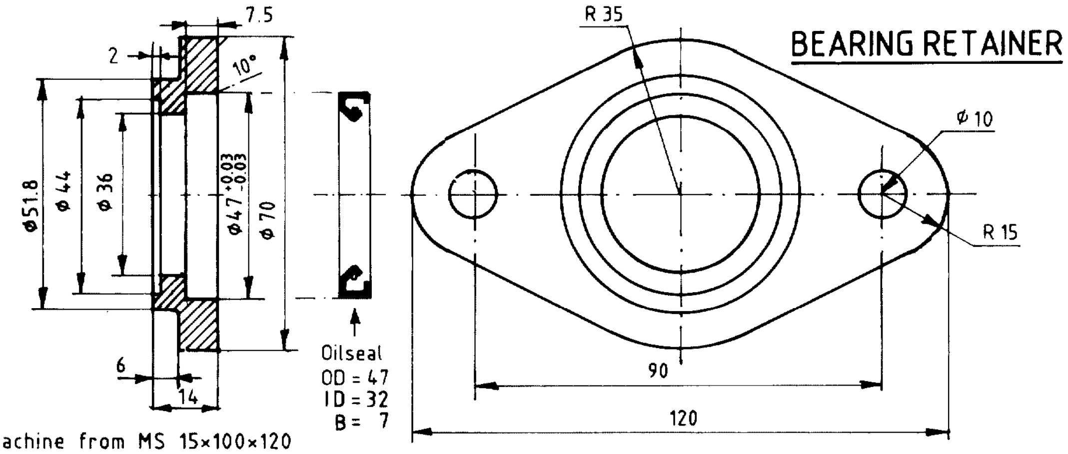
MANUFACTURE OF BOB DRIVE COMPONENTS

FLANGE

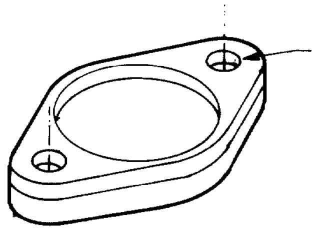
Cut from 8 mm MS plate



BEARING RETAINER

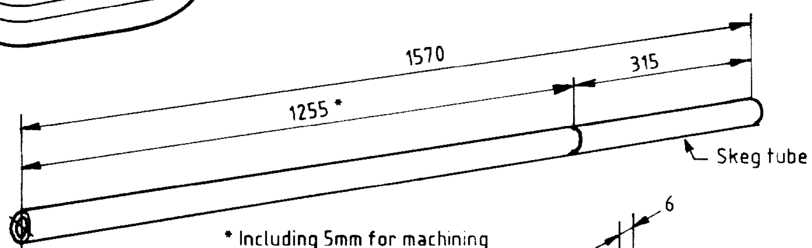


Machine from MS 15×100×120



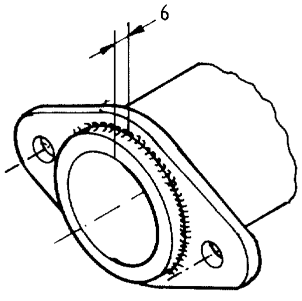
Drill holes Ø 10 in flange and bearing retainer at the same time. Then increase holes in flange to Ø 12.

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

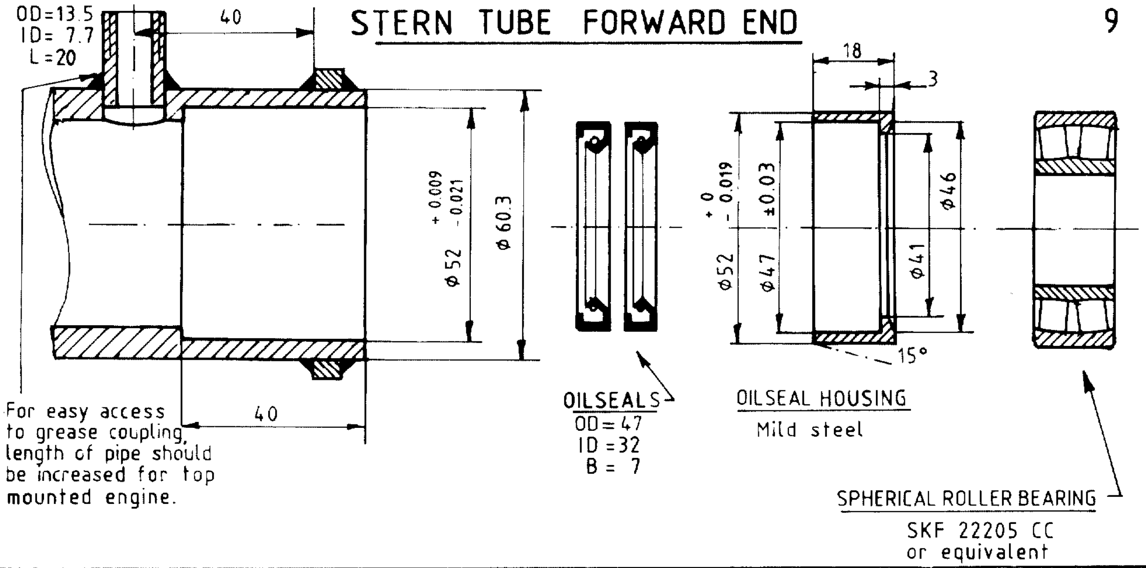
CUTTING STERN TUBE



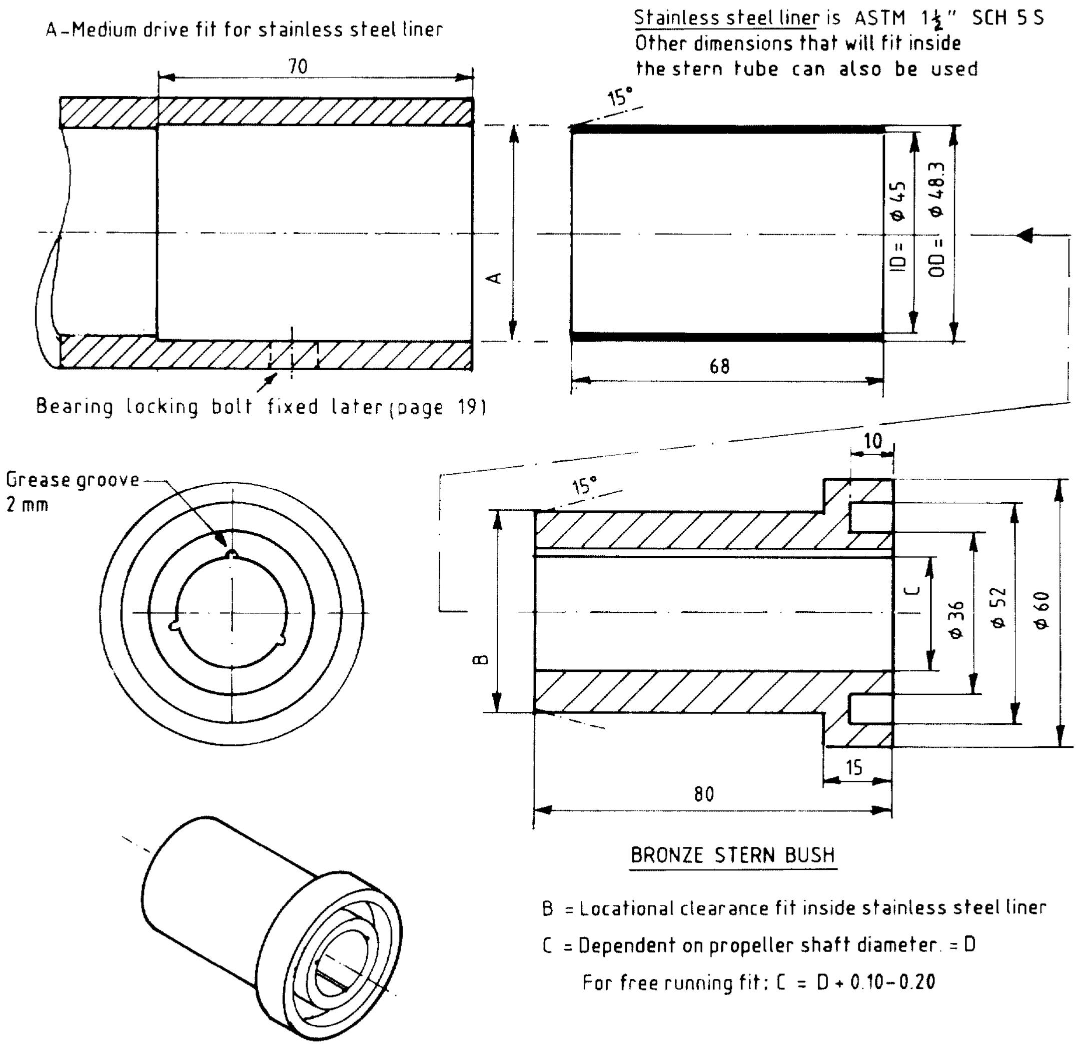
WELDING ON FLANGE

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

STERN TUBE FORWARD END



STERN TUBE AFT END



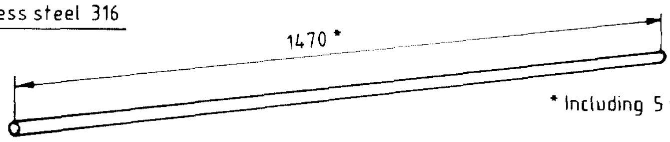
B = Locational clearance fit inside stainless steel liner

C = Dependent on propeller shaft diameter = D

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

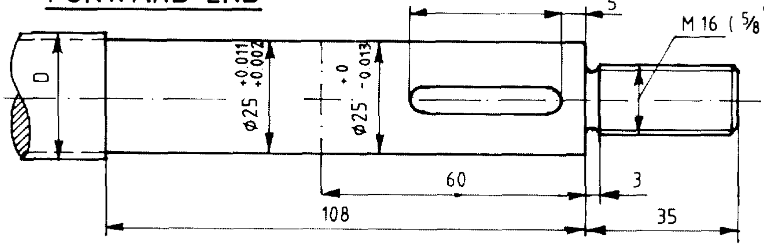
PROPELLER SHAFT

Material : Stainless steel 316



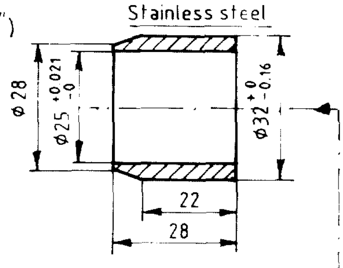
The diameter D of the propeller shaft is dependent on what is available. If 25mm diameter shafts are slightly undersize, the roller bearing will not fit. Shafts of D = 25.4 mm (1") or 28 mm are acceptable

FORWARD END

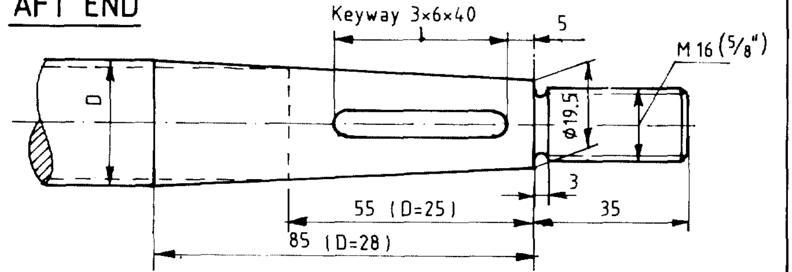


THRUST COLLAR

Stainless steel

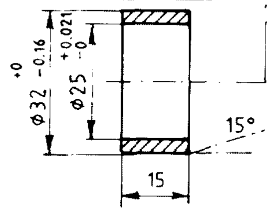


AFT END

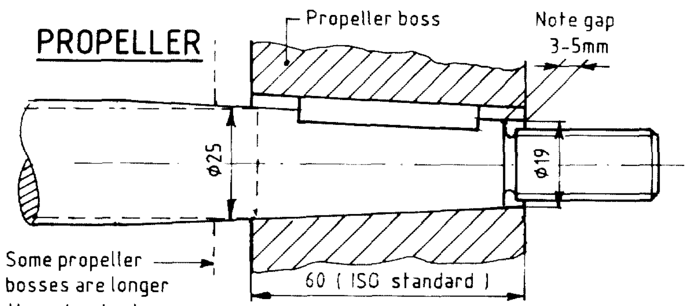


SPACER

Stainless steel



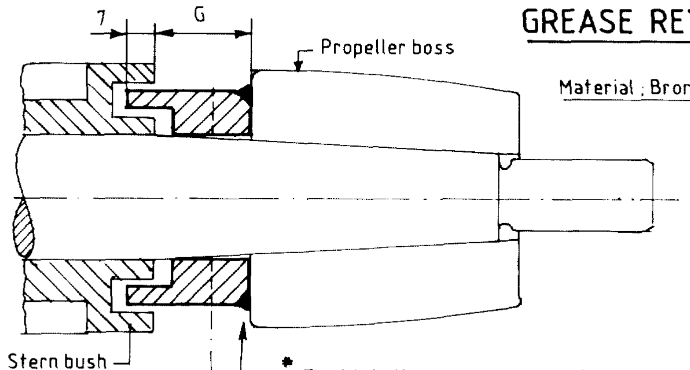
PROPELLER

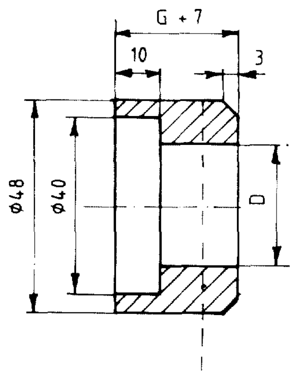


TAPER ON PROPELLER SHAFT
ISO STANDARD = 1 : 10

GREASE RETAINER

Material : Bronze



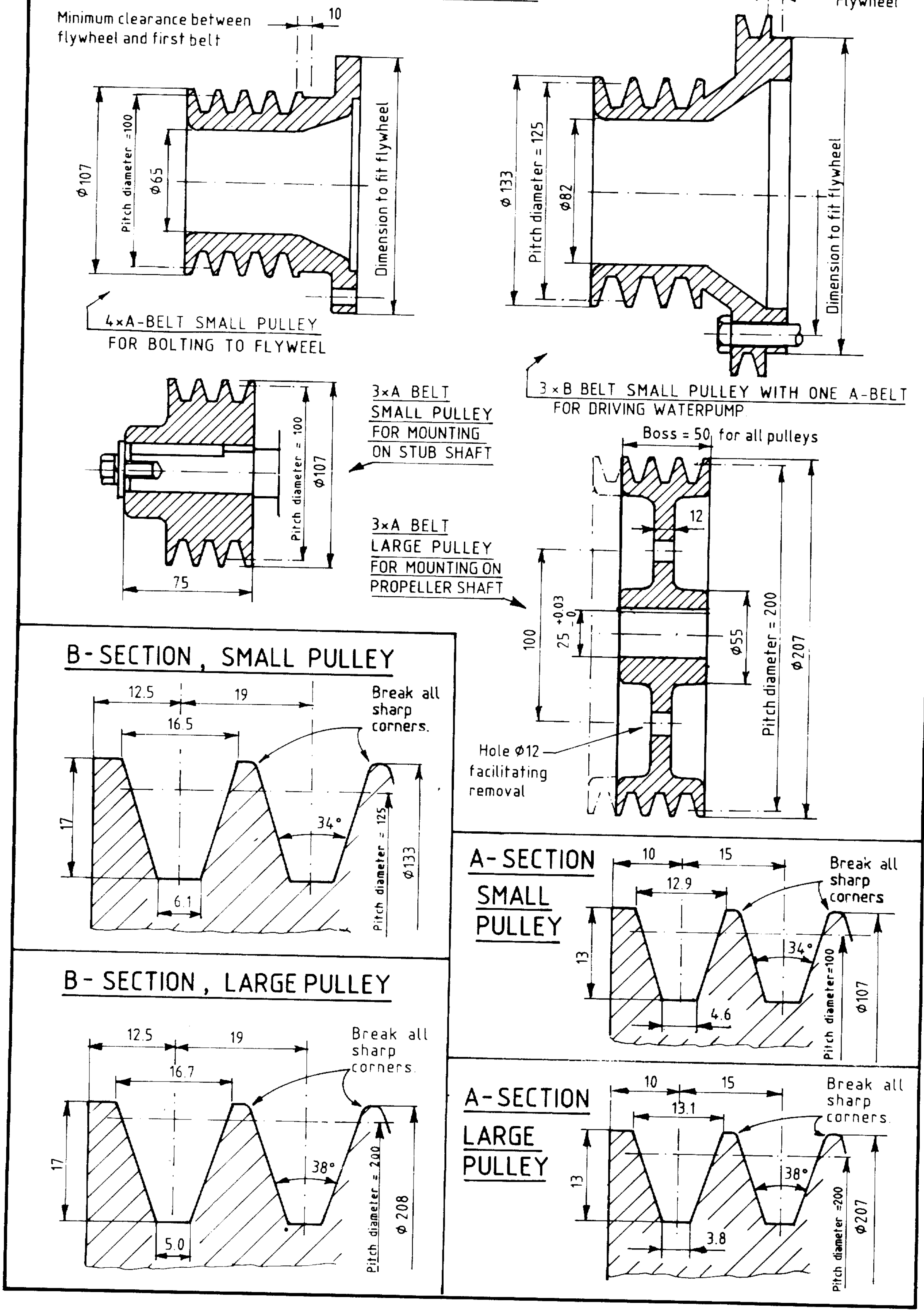


* To obtain the correct length of the grease retainer the stern gear must be assembled as shown on pages 12 and 13 The gap between the propeller and the stern bush is measured= G

MATERIAL CAST IRON

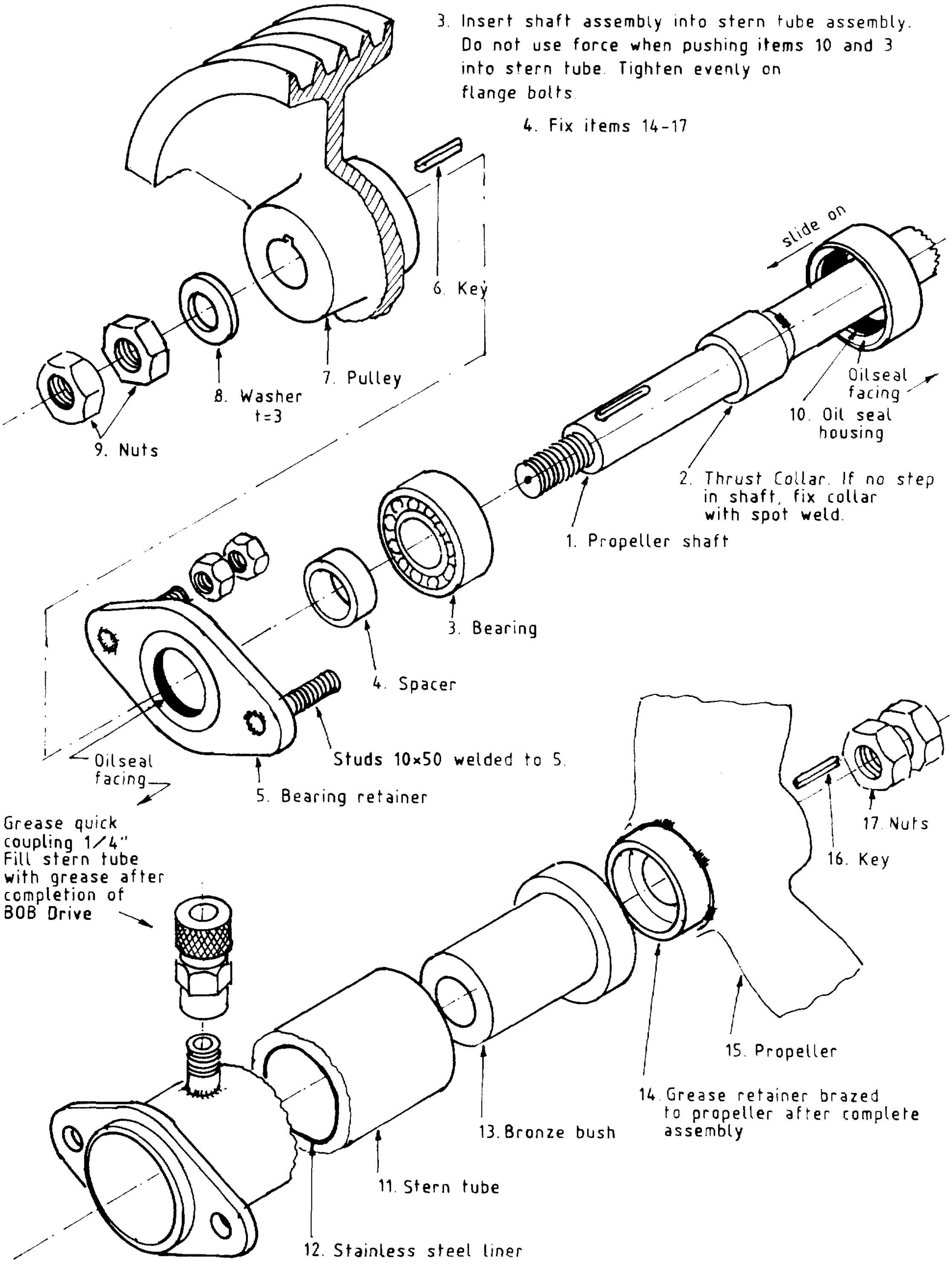
V-BELT PULLEYS

FOR SELECTION OF BELT TYPE AND PULLEYS-SEE PAGE 5.



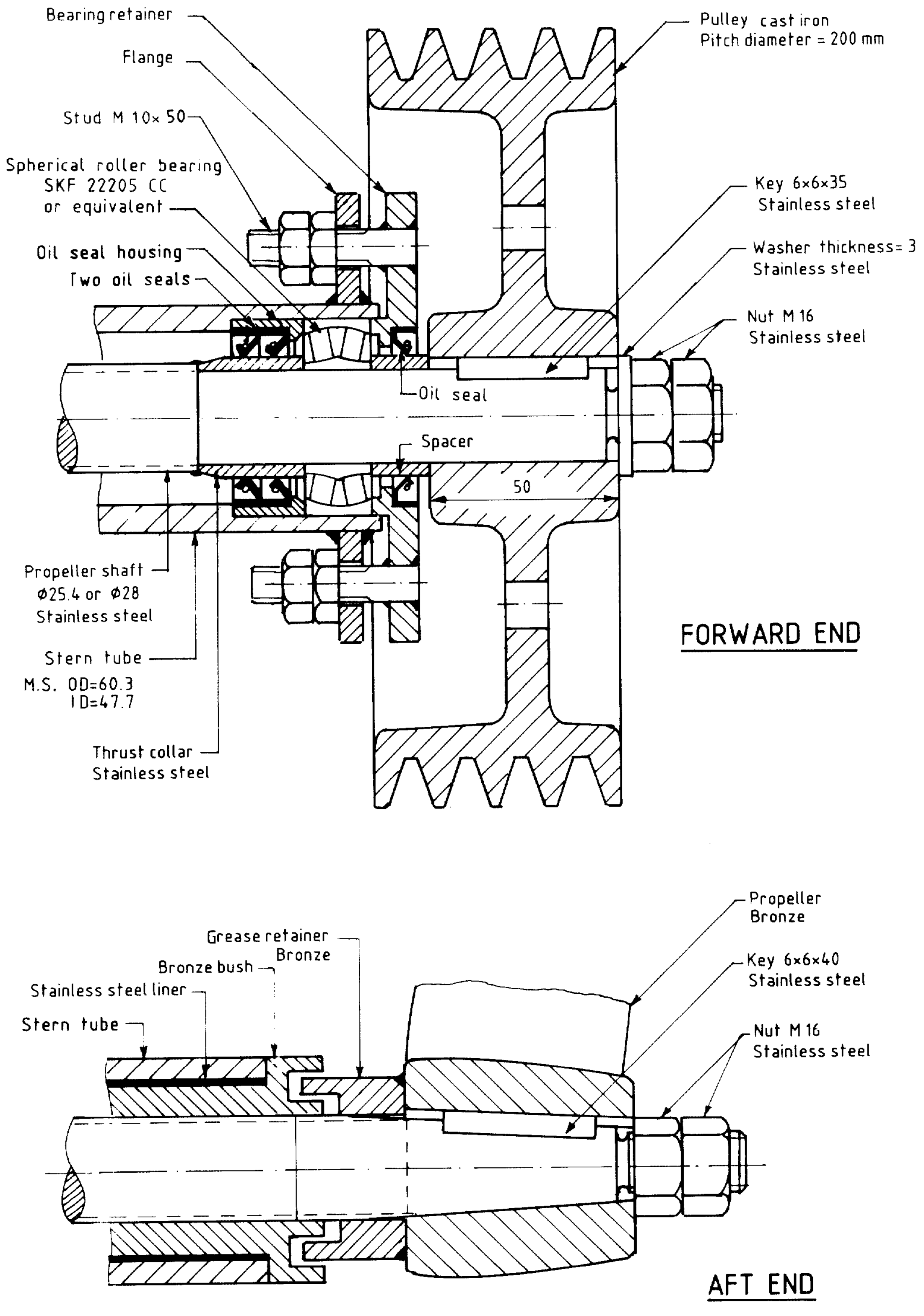
STERN GEAR ASSEMBLY

1. Shaft assembly - Items 1-10.
   Apply a lot of grease to the bearing
2. Stern tube assembly - Items 11-13
3. Insert shaft assembly into stern tube assembly. Do not use force when pushing items 10 and 3 into stern tube. Tighten evenly on flange bolts.
4. Fix items 14-17



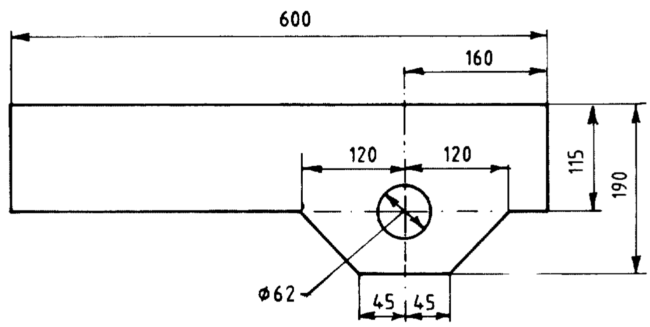
<<

STERN GEAR SECTION

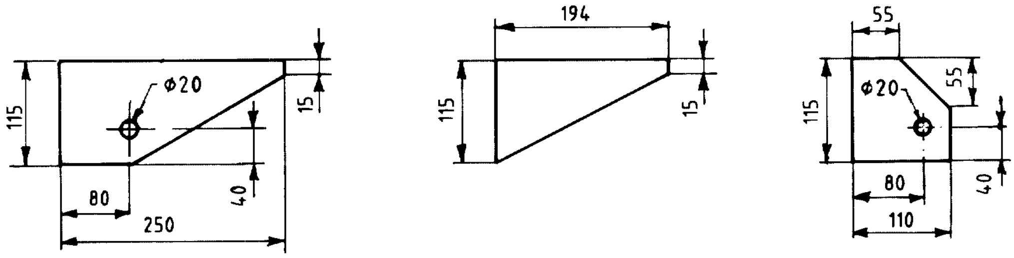


CHASSIS – SIDE MOUNTED ENGINE

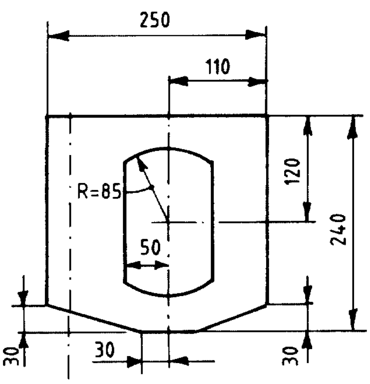
Steel plate 6 mm



FRONT PLATE

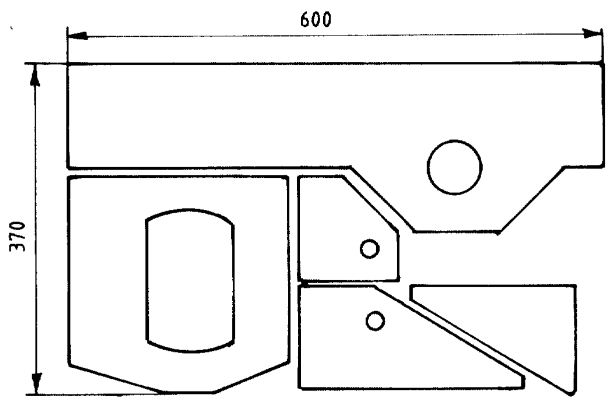


BRACKETS



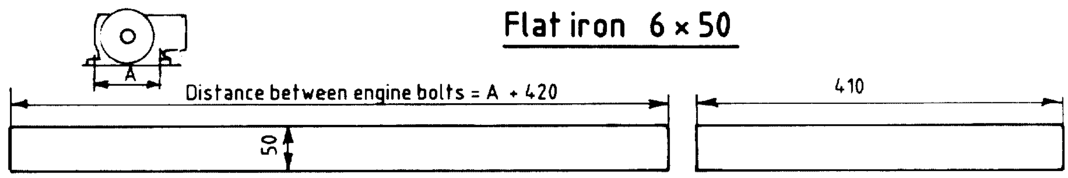
Without keel cooling coil in the tunnel, the bellows plate can be 220 wide.

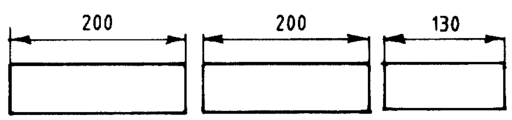
BELLOWS PLATE



MAKE PATTERNS FOR ALL PARTS FOR BETTER STEEL UTILIZATION

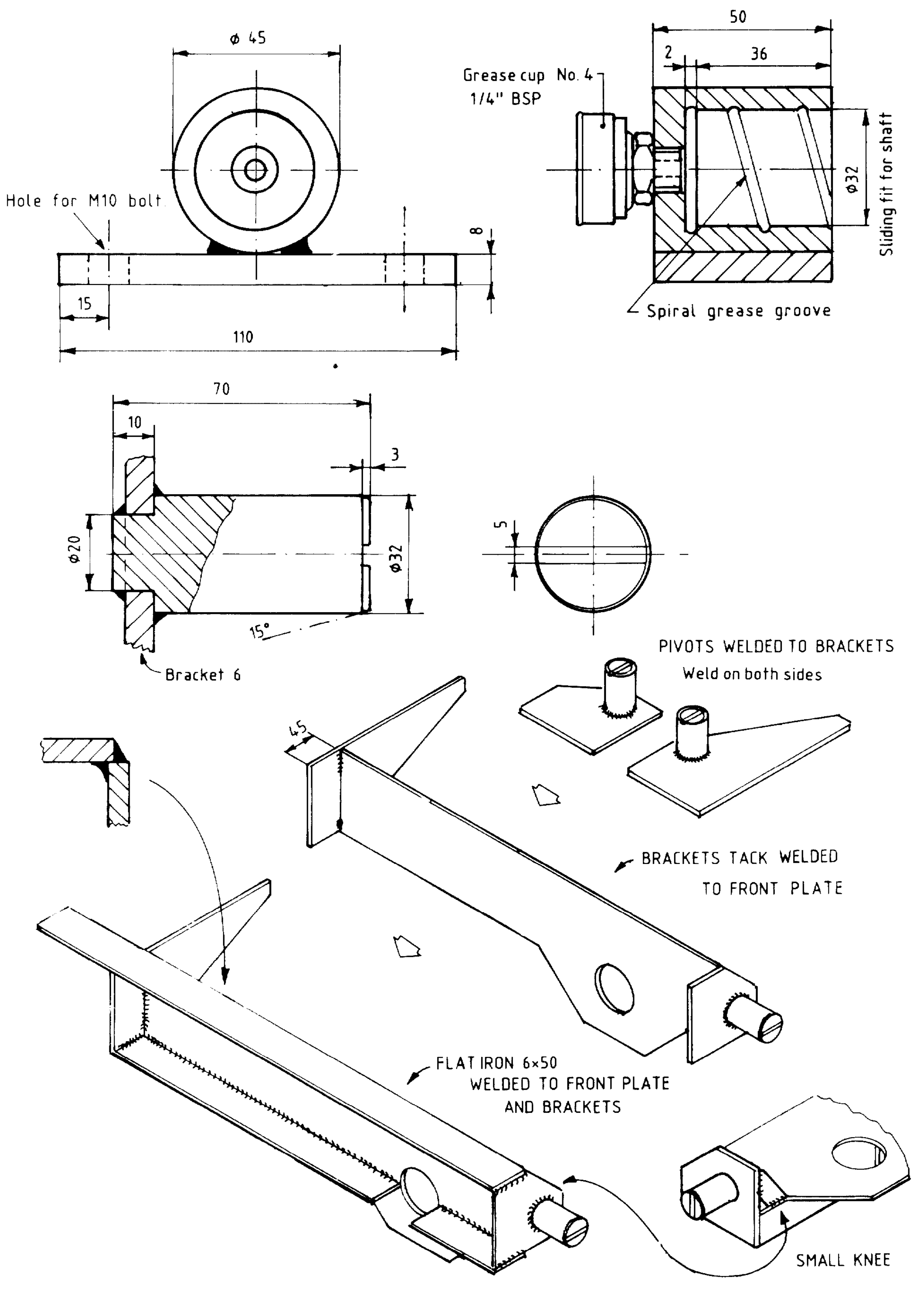
Flat iron 6 × 50





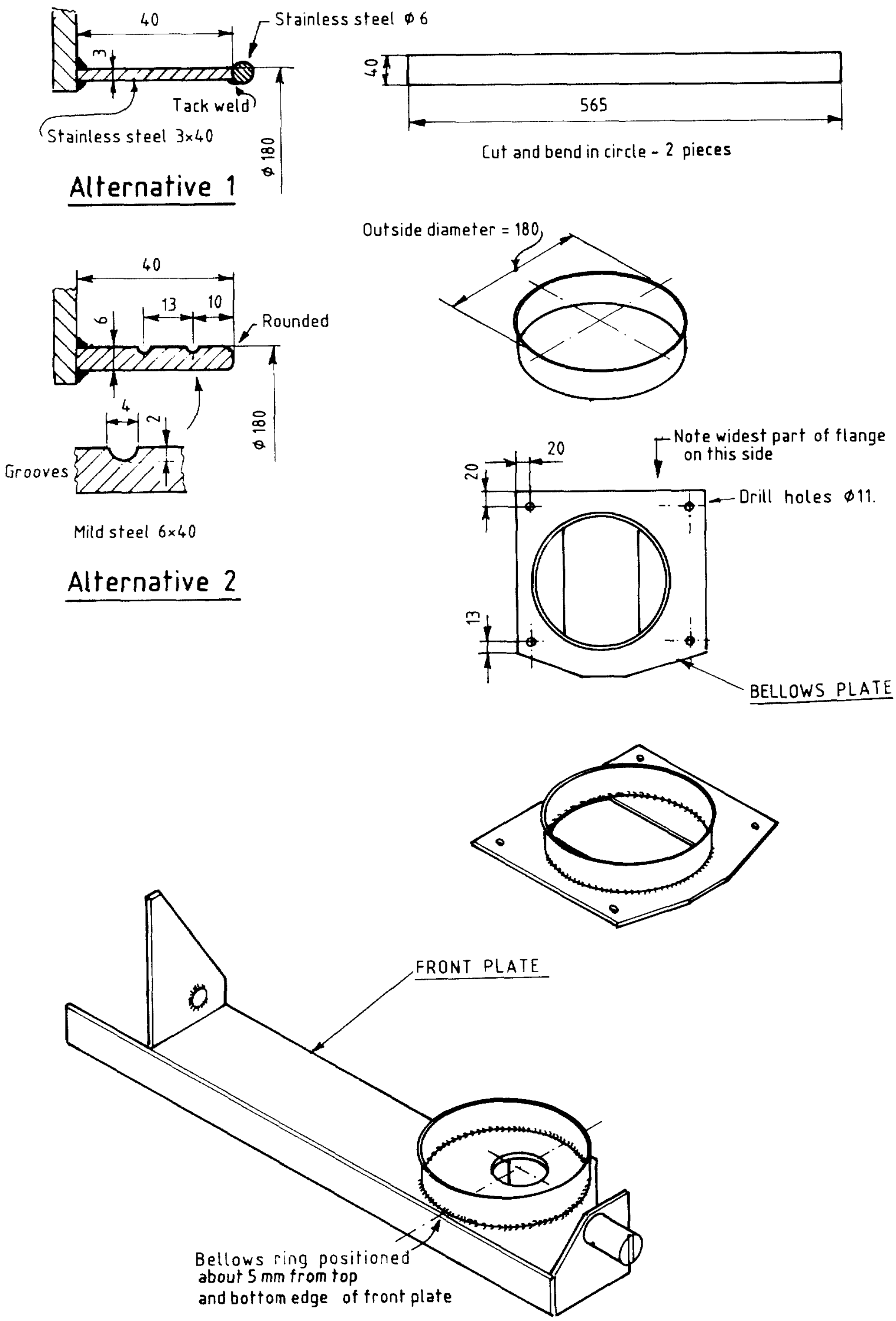
KNEE PLATES

PIVOTS


ϕ 45
Hole for M10 bolt
8
15
110
50
2
36
Grease cup No. 4
1/4" BSP
ϕ32
Sliding fit for shaft
Spiral grease groove
70
10
3
ϕ20
ϕ32
15°
Bracket 6
5
PIVOTS WELDED TO BRACKETS
Weld on both sides
45
BRACKETS TACK WELDED
TO FRONT PLATE
FLAT IRON 6×50
WELDED TO FRONT PLATE
AND BRACKETS
SMALL KNEE

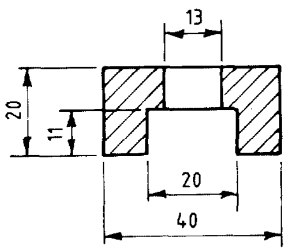
<<

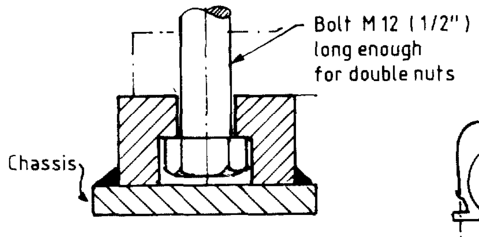
BELLOWS FLANGES



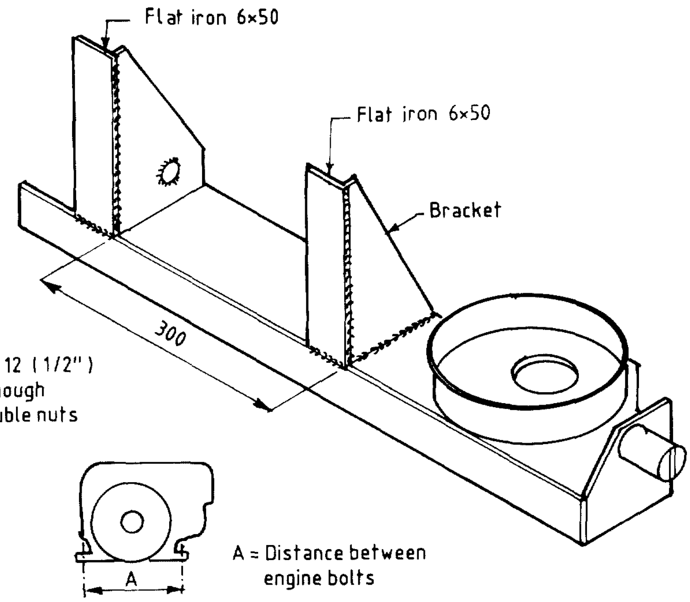
ENGINE MOUNTS

MILLED SLOT IN MOUNTS

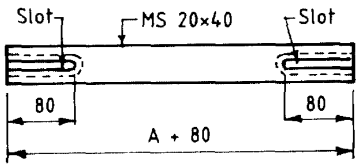




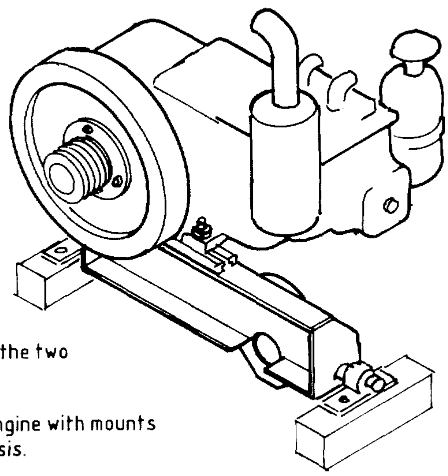
The slot must be wide enough
to permit sliding the bolt
but prevent the head turning



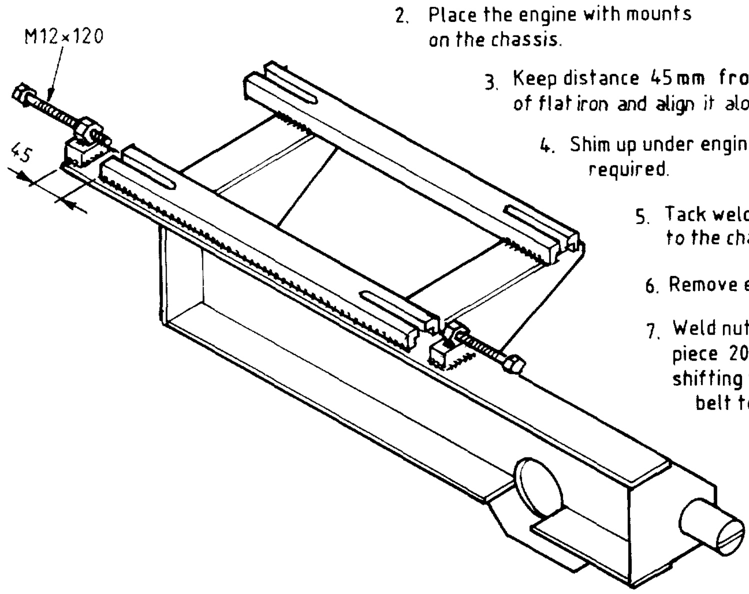
A = Distance between
engine bolts



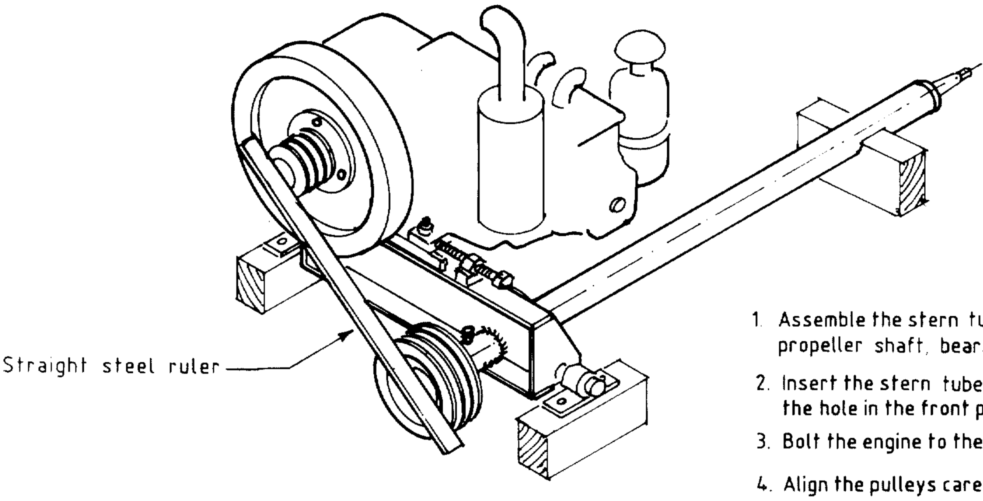
ENGINE MOUNTS (2)



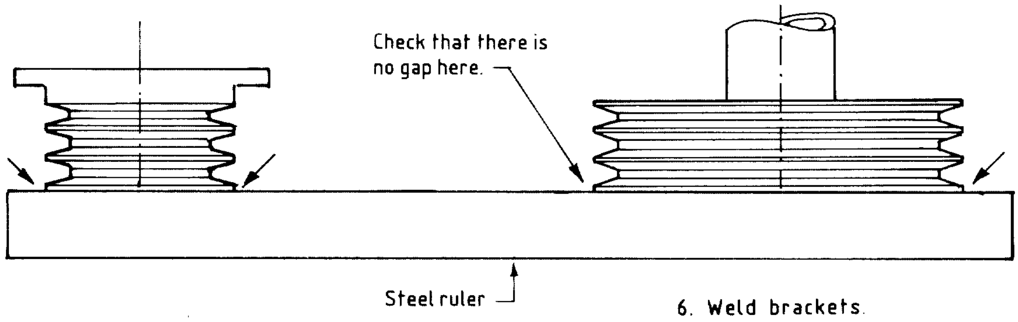
1. Bolt the engine to the two engine mounts
2. Place the engine with mounts on the chassis.
3. Keep distance 45 mm from end of flat iron and align it along the flat iron.
4. Shim up under engine mounts where required.
5. Tack weld the engine mounts to the chassis.
6. Remove engine and weld.
7. Weld nuts M 12 (1/2") on top of piece 20×20×40 to permit shifting the engine for belt tensioning. Bolts M 12×120



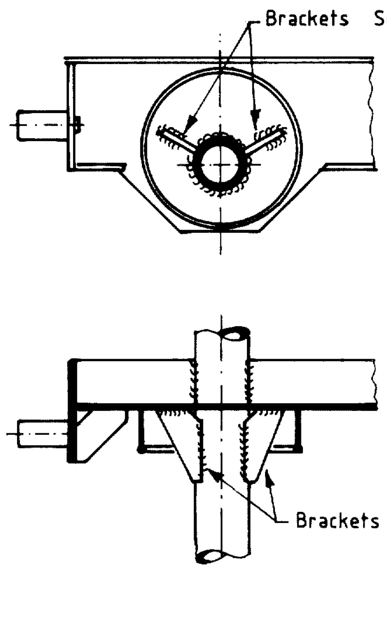
ALIGNMENT OF STERN TUBE



1. Assemble the stern tube with propeller shaft, bearings and pulley.
2. Insert the stern tube through the hole in the front plate.
3. Bolt the engine to the chassis.
4. Align the pulleys carefully
5. Support the stern tube and weld.

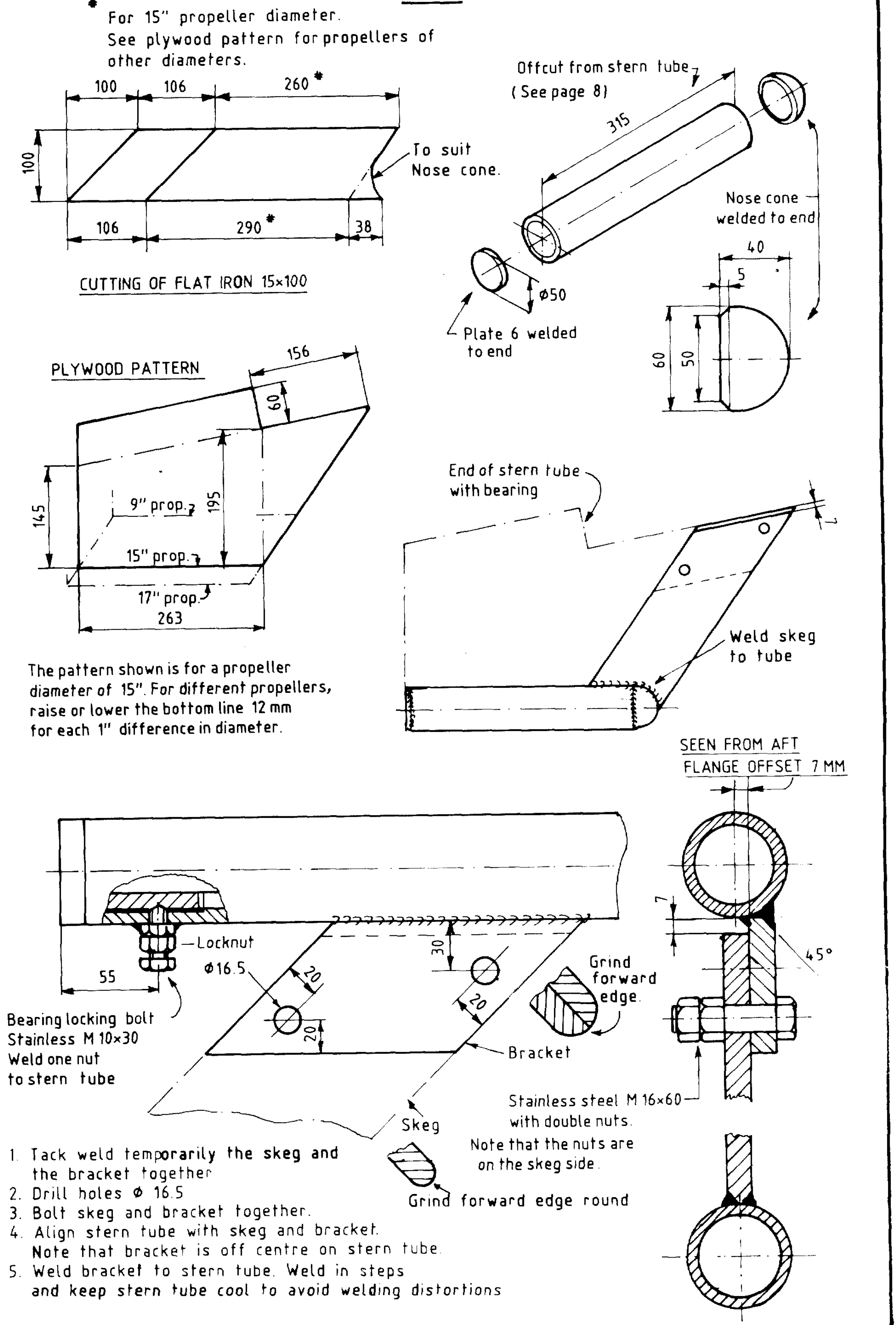


6. Weld brackets.



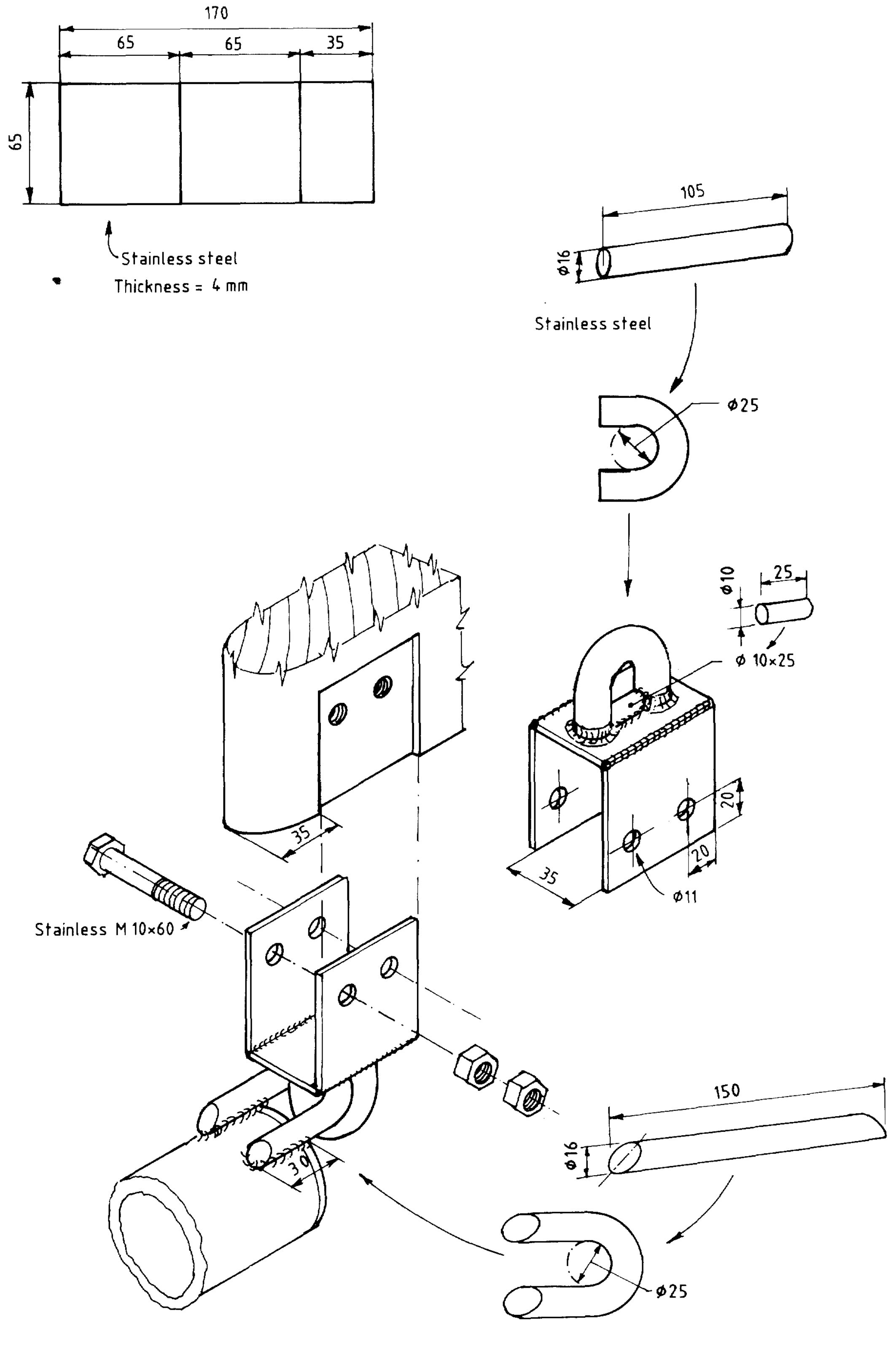
See page 14

SKEG

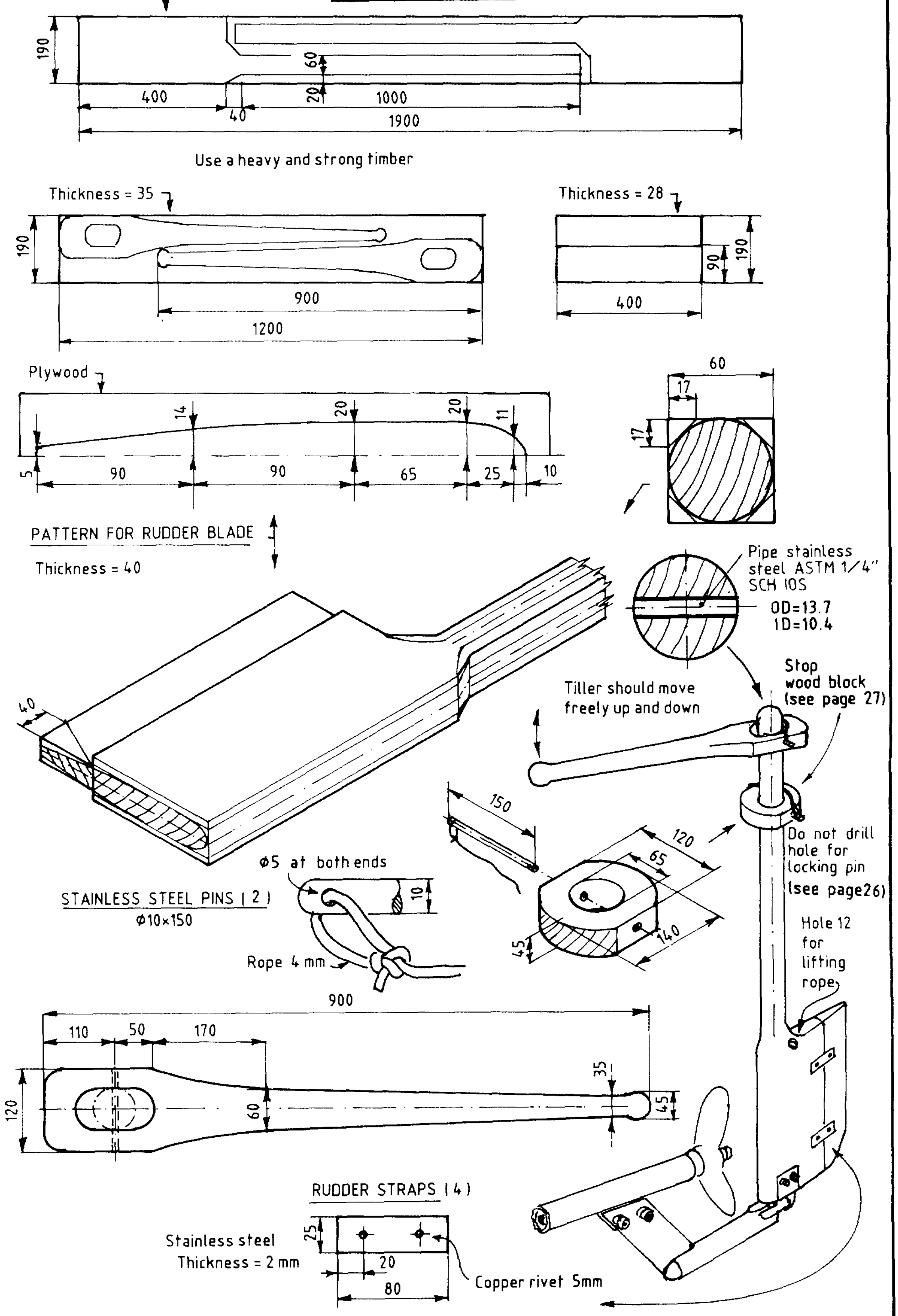


* For 15" propeller diameter.
See plywood pattern for propellers of other diameters.
100
106
260 *
100
To suit Nose cone.
106
290 *
38
CUTTING OF FLAT IRON 15×100
Offcut from stern tube
(See page 8)
315
Nose cone welded to end
40
5
Ø50
Plate 6 welded to end
60
50
PLYWOOD PATTERN
156
60
145
9" prop.
195
15" prop.
17" prop.
263
The pattern shown is for a propeller diameter of 15". For different propellers, raise or lower the bottom line 12 mm for each 1" difference in diameter.
End of stern tube with bearing
7
Weld skeg to tube
SEEN FROM AFT
FLANGE OFFSET 7 MM
7
45°
Locknut
Ø16.5
55
30
20
20
20
Grind forward edge.
Bearing locking bolt Stainless M 10×30 Weld one nut to stern tube
Bracket
Stainless steel M 16×60 with double nuts.
Note that the nuts are on the skeg side.
Skeg
Grind forward edge round
1. Tack weld temporarily the skeg and the bracket together
2. Drill holes Ø 16.5
3. Bolt skeg and bracket together.
4. Align stern tube with skeg and bracket. Note that bracket is off centre on stern tube.
5. Weld bracket to stern tube. Weld in steps and keep stern tube cool to avoid welding distortions

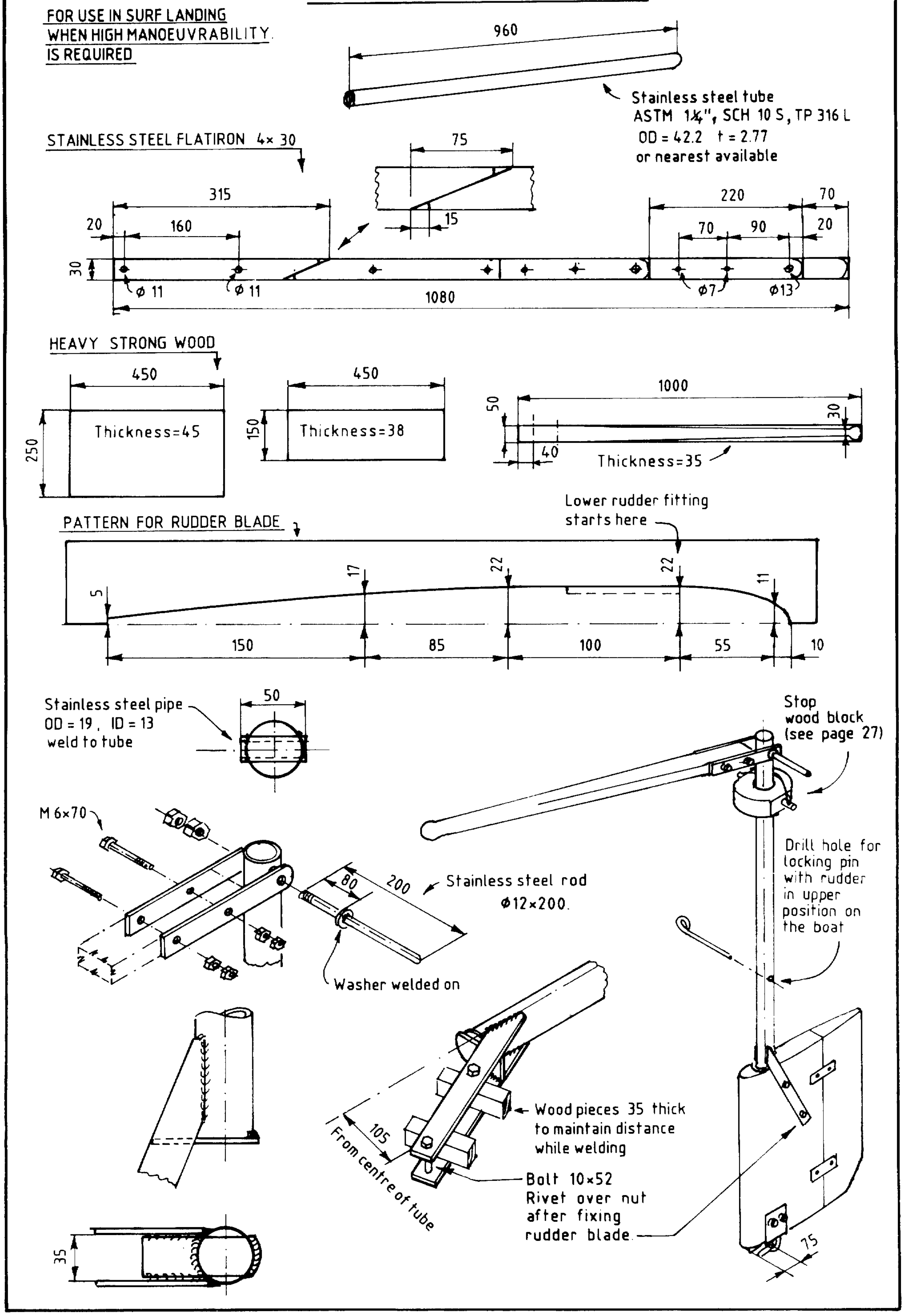
RUDDER FITTING



WOOD RUDDER


Thickness = 60
190
60
20
400
40
1000
1900
Use a heavy and strong timber
Thickness = 35
190
900
1200
Thickness = 28
90
190
400
Plywood
14
20
20
11
5
90
90
65
25
10
60
17
17
PATTERN FOR RUDDER BLADE
Thickness = 40
Pipe stainless steel ASTM 1/4" SCH 10S
OD=13.7
ID=10.4
Stop wood block (see page 27)
Tiller should move freely up and down
40
150
120
65
45
140
Do not drill hole for locking pin (see page26)
Hole 12 for lifting rope
Φ5 at both ends
10
STAINLESS STEEL PINS (2)
Φ10×150
Rope 4 mm
900
110
50
170
35
120
60
45
RUDDER STRAPS (4)
Stainless steel
Thickness = 2 mm
25
20
80
Copper rivet 5mm

ALTERNATIVE LARGE RUDDER



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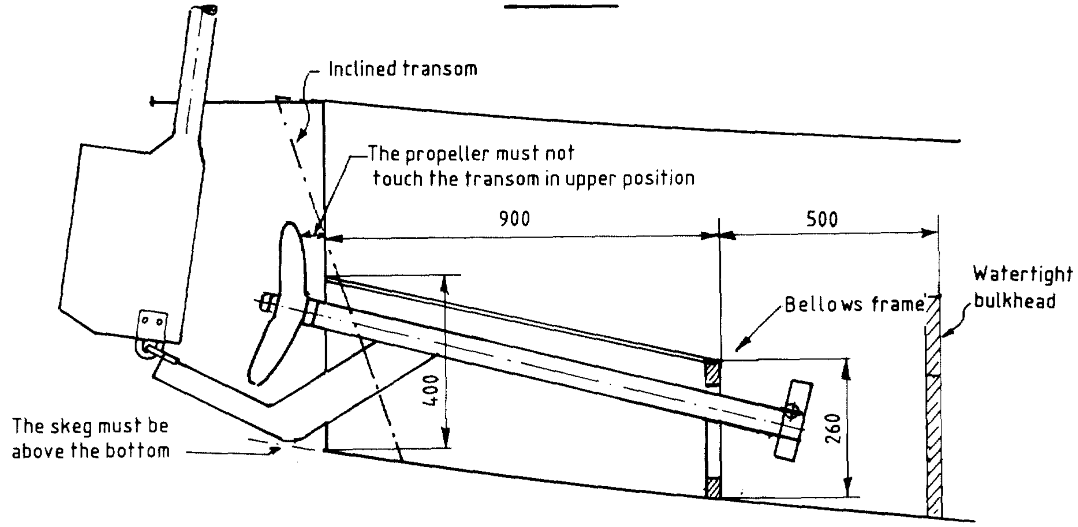
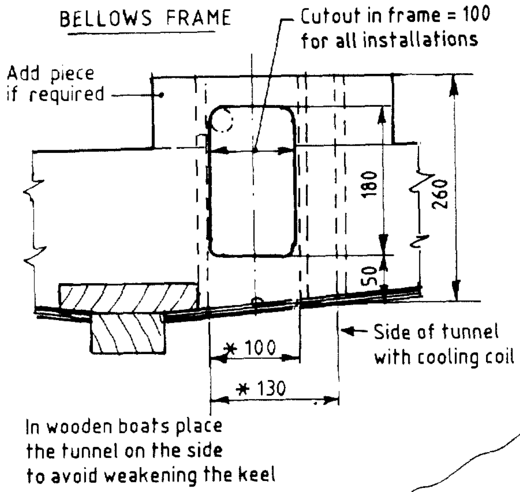
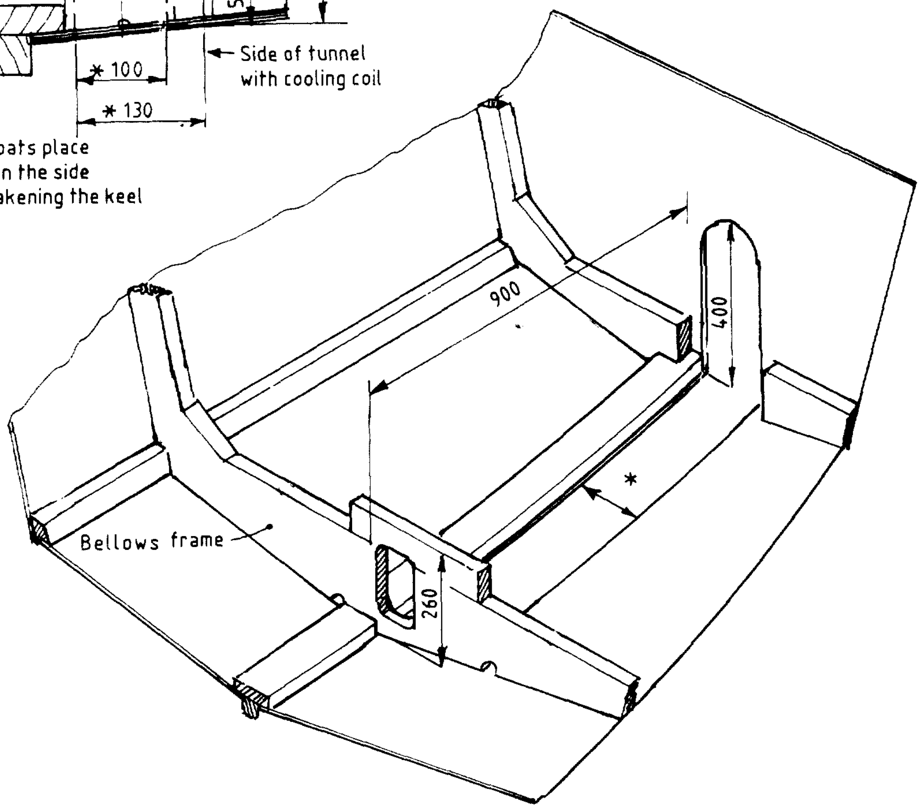
TUNNEL





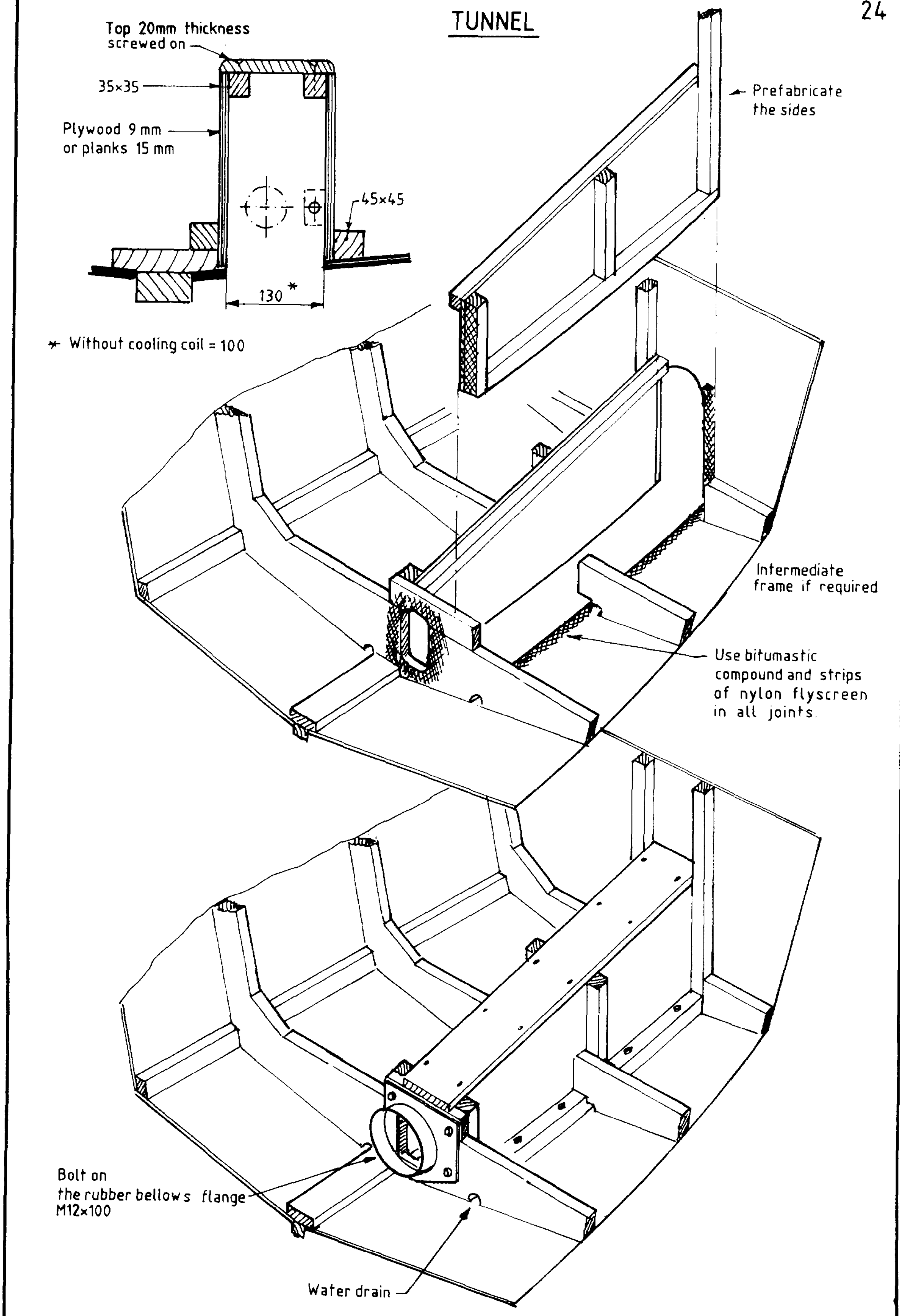
* The width of the tunnel measured on the inside will depend on whether cooling coil for the water cooling system is placed inside the tunnel.
The inside width of the tunnel :
With cooling coil =130mm
Without cooling coil =100mm



CONTINUED.

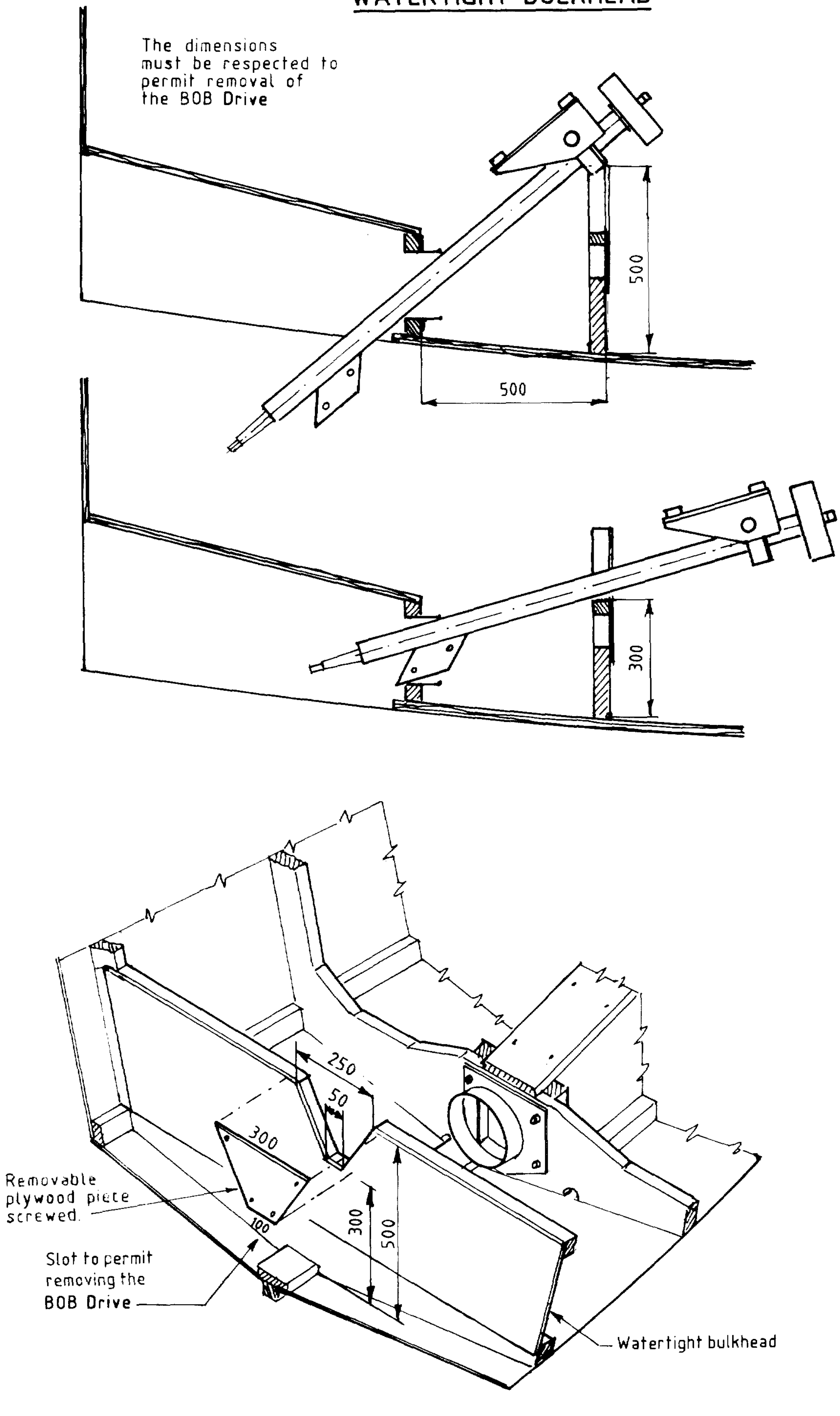
<<

TUNNEL

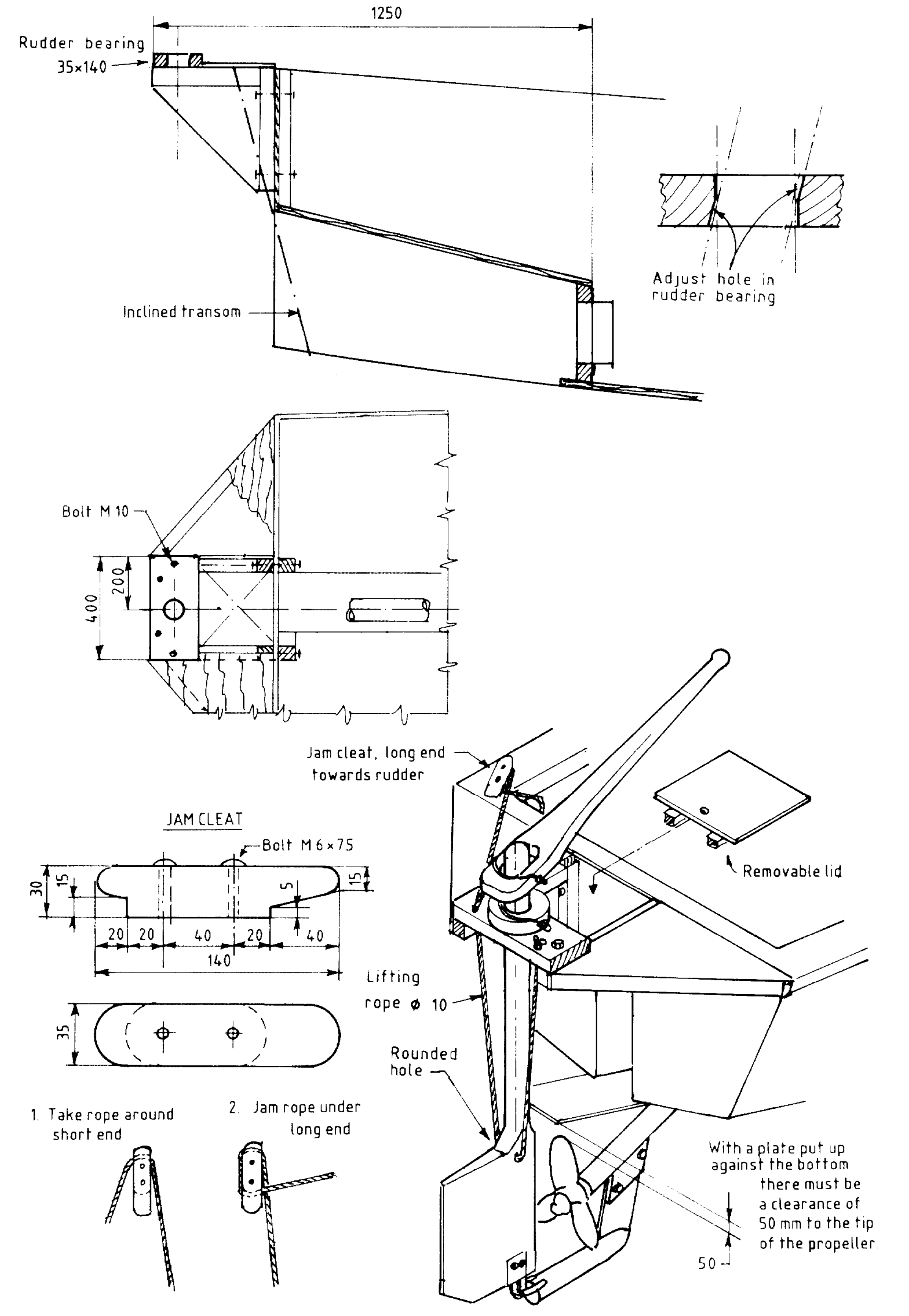

Top 20mm thickness
screwed on
35×35
Plywood 9 mm
or planks 15 mm
45×45
130 *
* Without cooling coil = 100
Prefabricate
the sides
Intermediate
frame if required
Use bitumastic
compound and strips
of nylon flyscreen
in all joints.
Bolt on
the rubber bellows flange
M12×100
Water drain

<<

WATERTIGHT BULKHEAD



RUDDER PLATFORM



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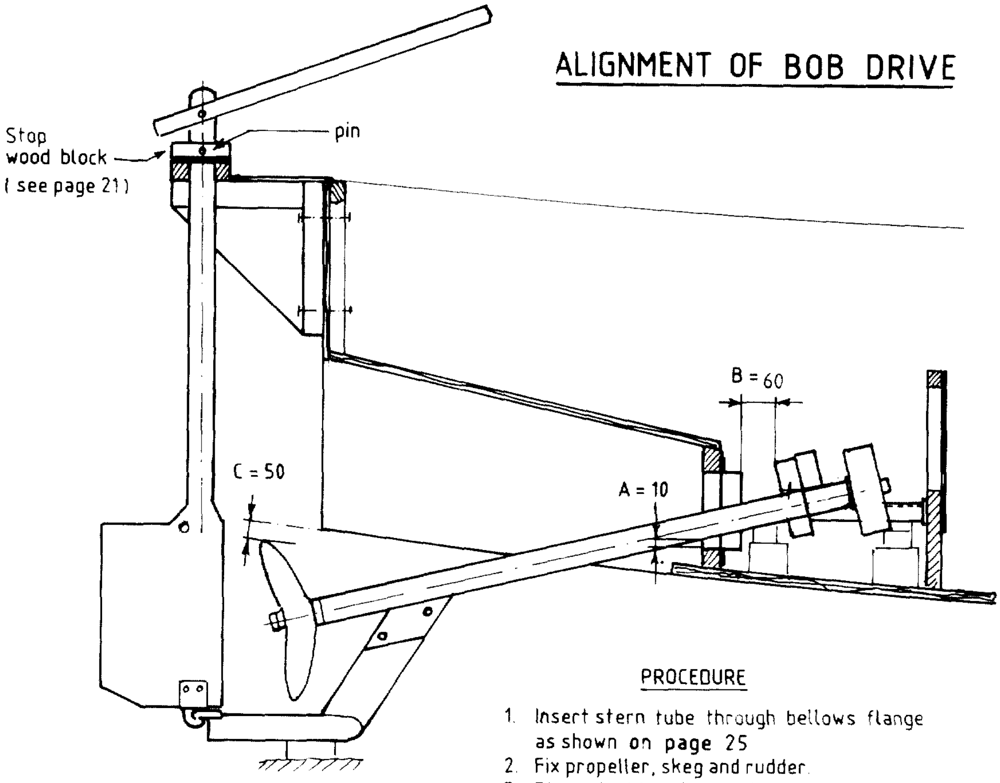
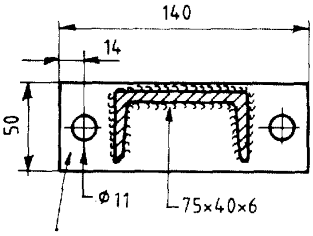
ALIGNMENT OF BOB DRIVE



LUGS FOR PIVOT BEARERS

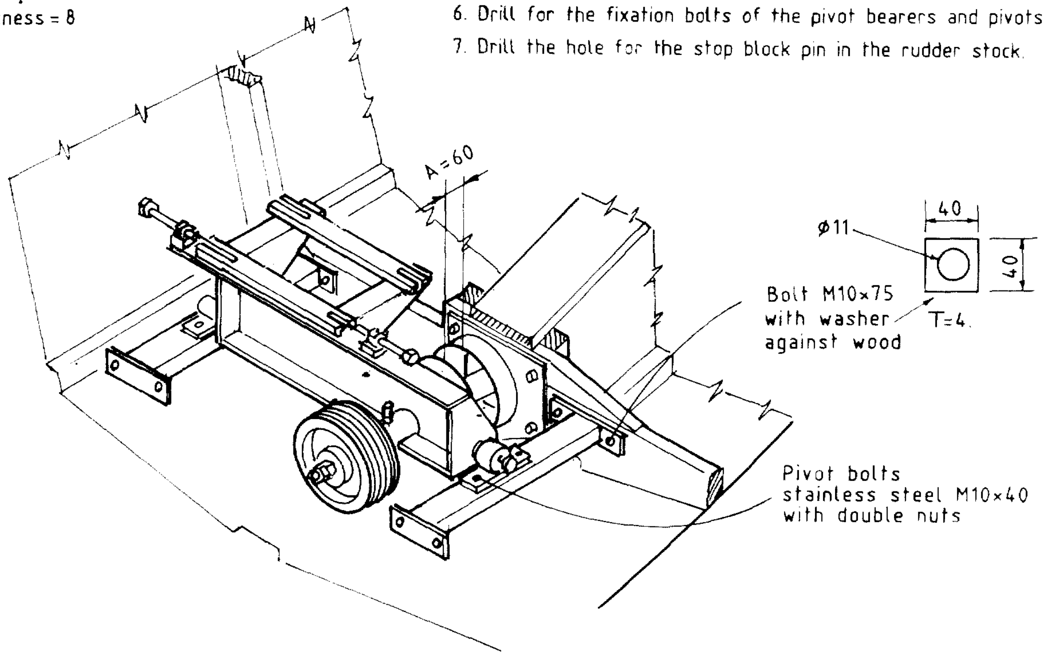


PROCEDURE

1. Insert stern tube through bellows flange as shown on page 25
2. Fix propeller, skeg and rudder.
3. Place pivot bearings on top of pivot bearers
4. Block up the pivot bearers and support the skeg so that the following measures are respected:

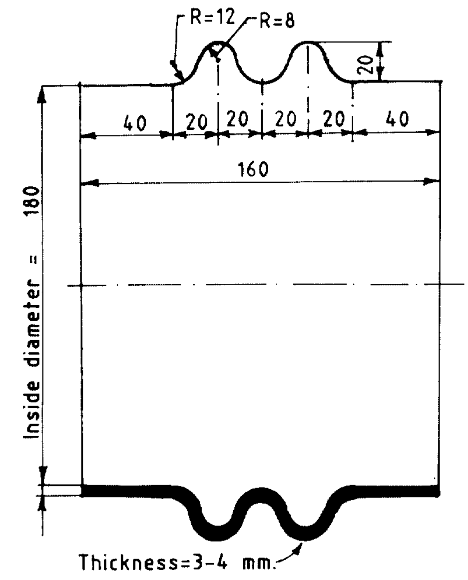
A. A gap of 10 mm between the stern tube and the bottom of the bellows flange hole
B. A distance of 60 mm between the bellows ring on top
C. A distance of 50 mm between the tip of the propeller and an extension of the bottom of the boat.(See page26)

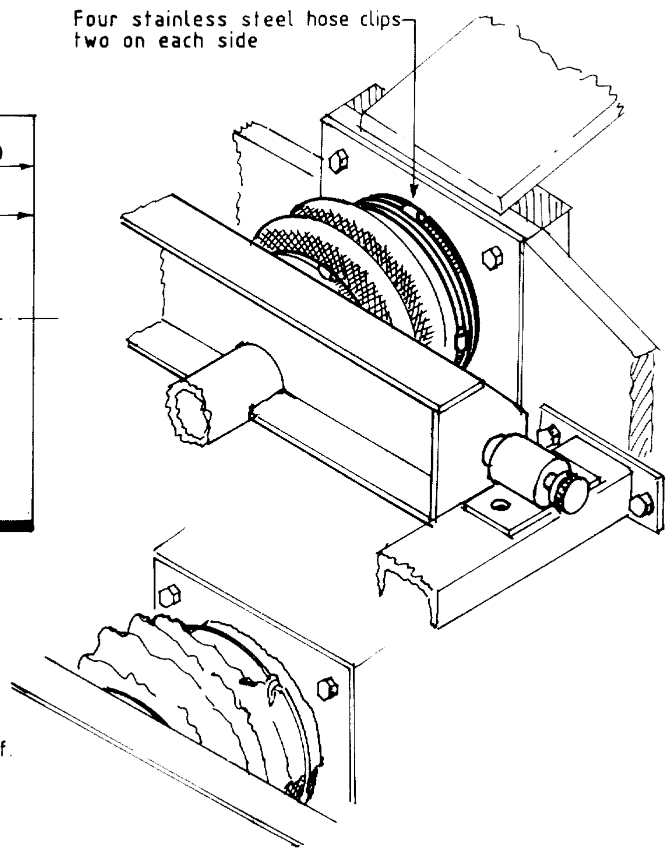
5. Raise the rudder and check that the stern tube has correct clearance to the tunnel sides in upper position.
6. Drill for the fixation bolts of the pivot bearers and pivots.
7. Drill the hole for the stop block pin in the rudder stock.



BELLOWS

MATERIAL : NEOPRENE





The bellows should be protected against direct contact with grease, oil and diesel by tying a sheet of plastic over the top half. This is especially important where the engine is mounted above the bellows.

ANTI-CORROSION TREATMENT

BEST PROTECTION RECOMMENDED WHEREVER POSSIBLE

1. Sand blasting
2. Zinc spraying
3. Two coats of enamel paint

For sand blasting and zinc spraying, plug ends of stern tube and pivot bearings.

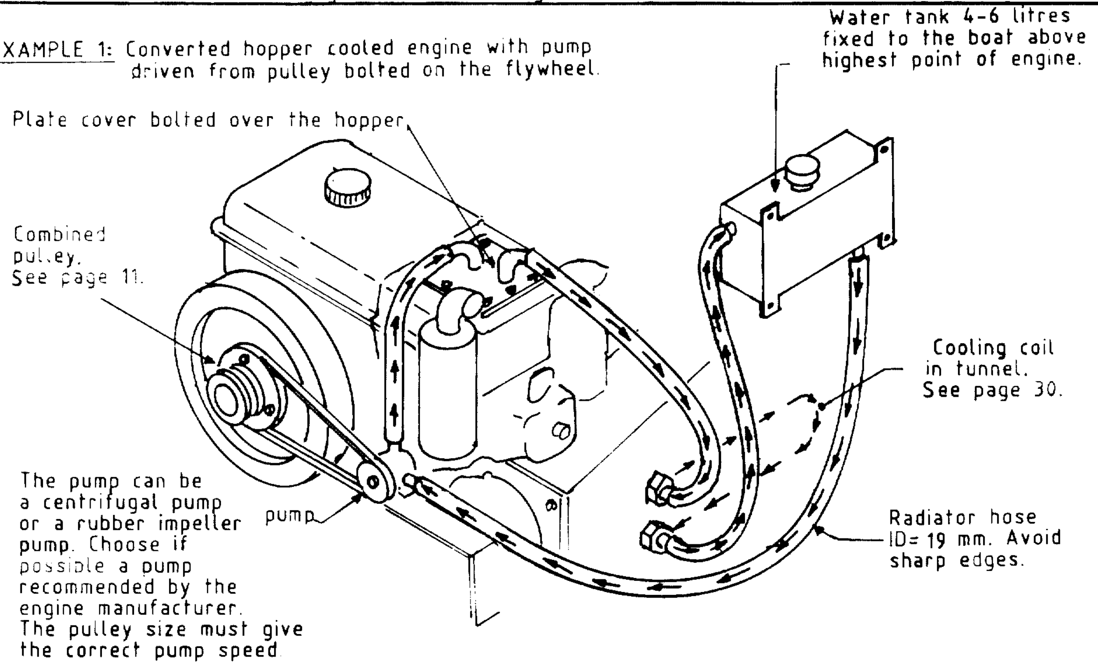
MINIMUM PROTECTION

1. Wire brushing to remove rust
2. Two coats of anti-corrosive primer
3. Two coats of enamel paint.

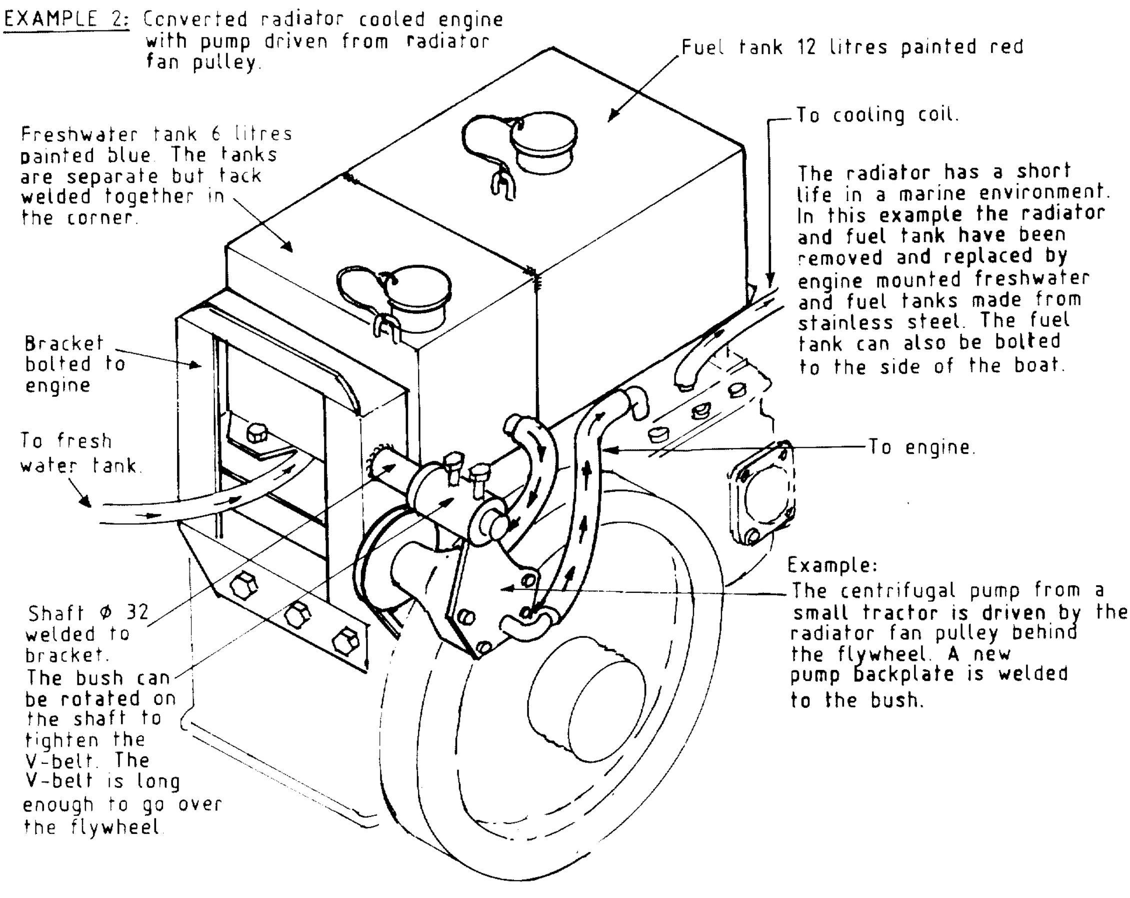
FRESHWATER COOLING SYSTEM

Freshwater cooling will give a longer life to the engine than seawater cooling, and will prevent problems due to sand getting into the engine when surf crossing and beach landing.

EXAMPLE 1: Converted hopper cooled engine with pump driven from pulley bolted on the flywheel.



EXAMPLE 2: Converted radiator cooled engine with pump driven from radiator fan pulley.



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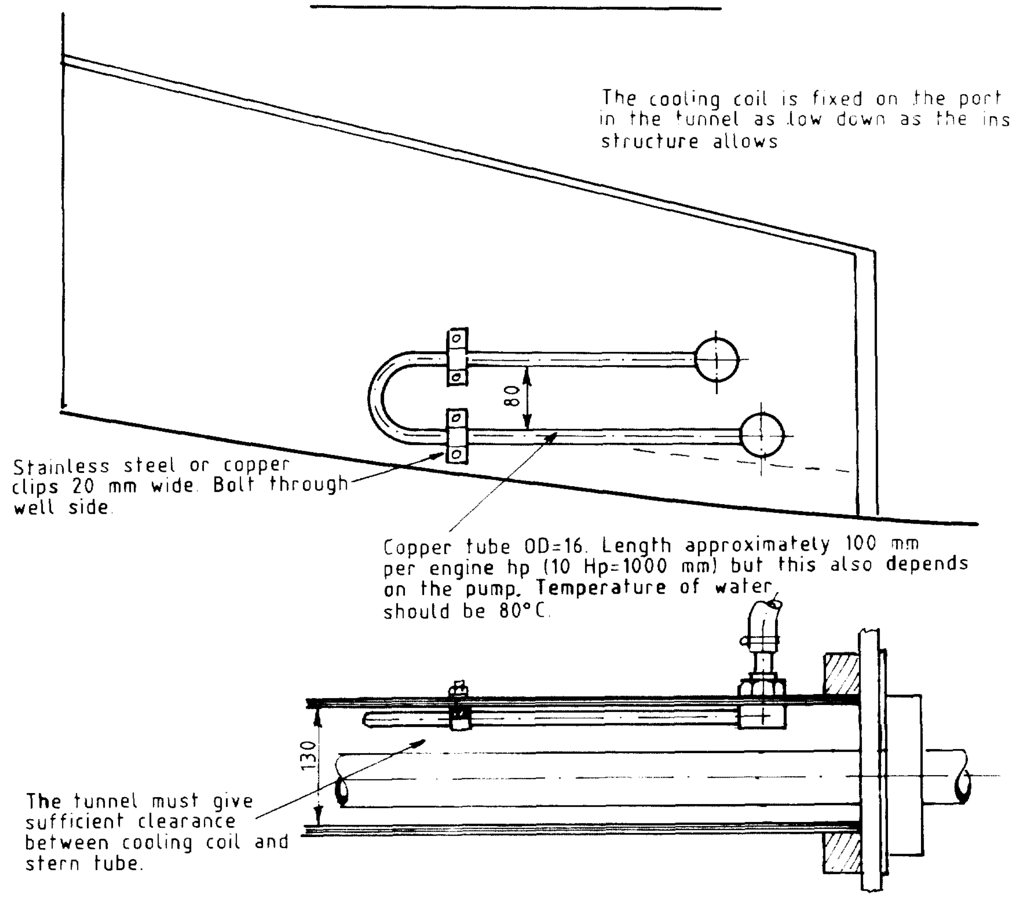
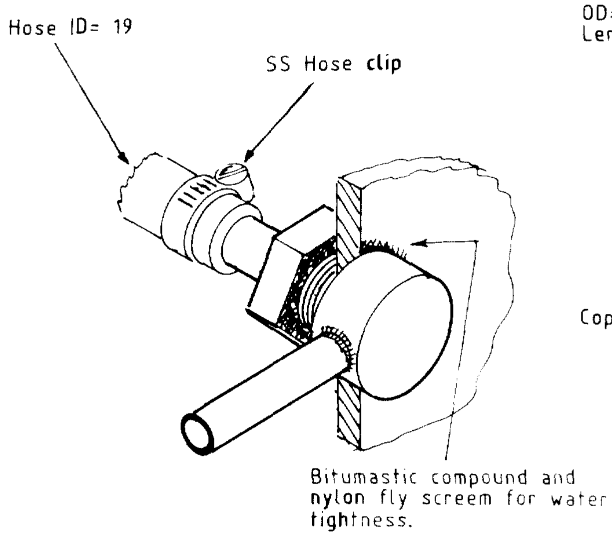
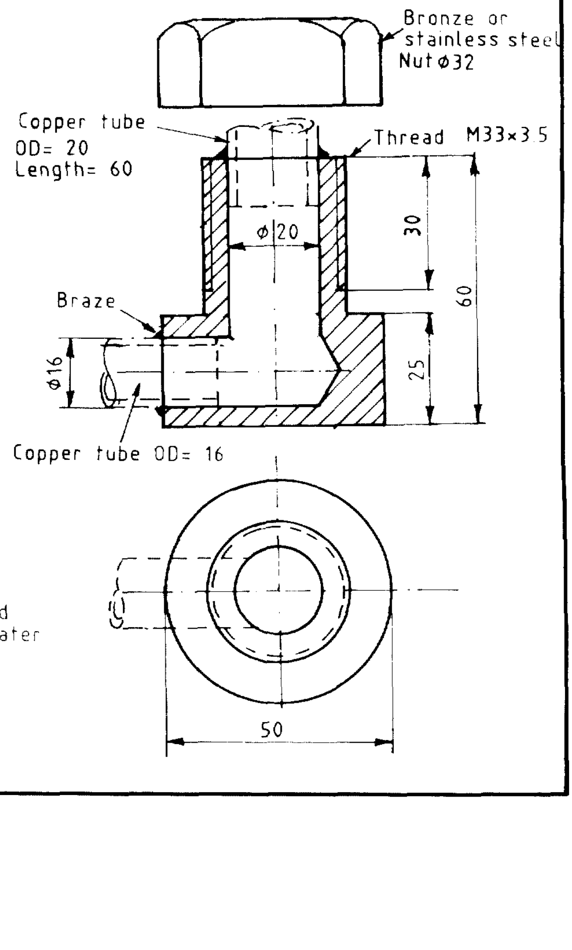
COOLING COIL IN TUNNEL



SKIN FITTING FOR COOLING COIL

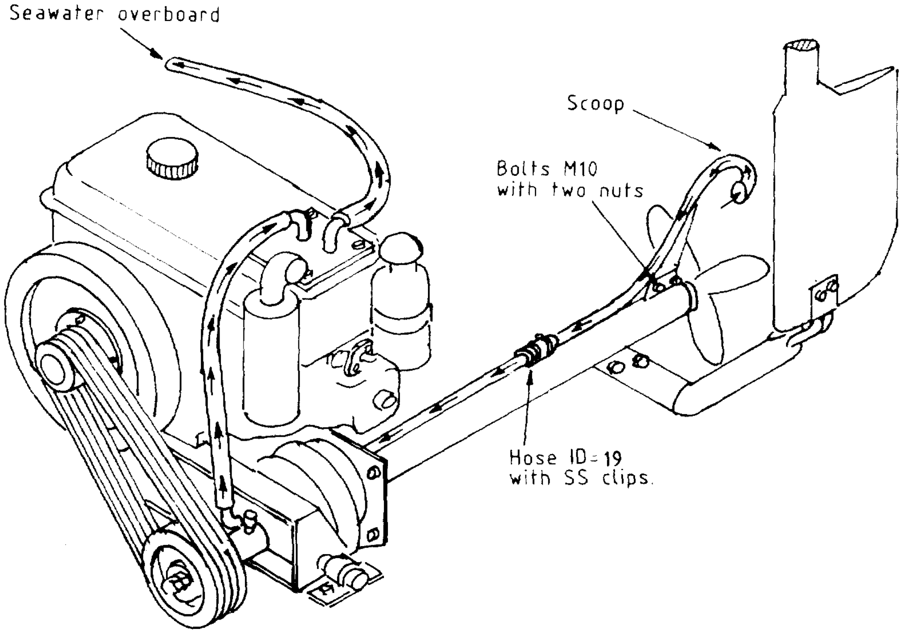
Material : Bronze



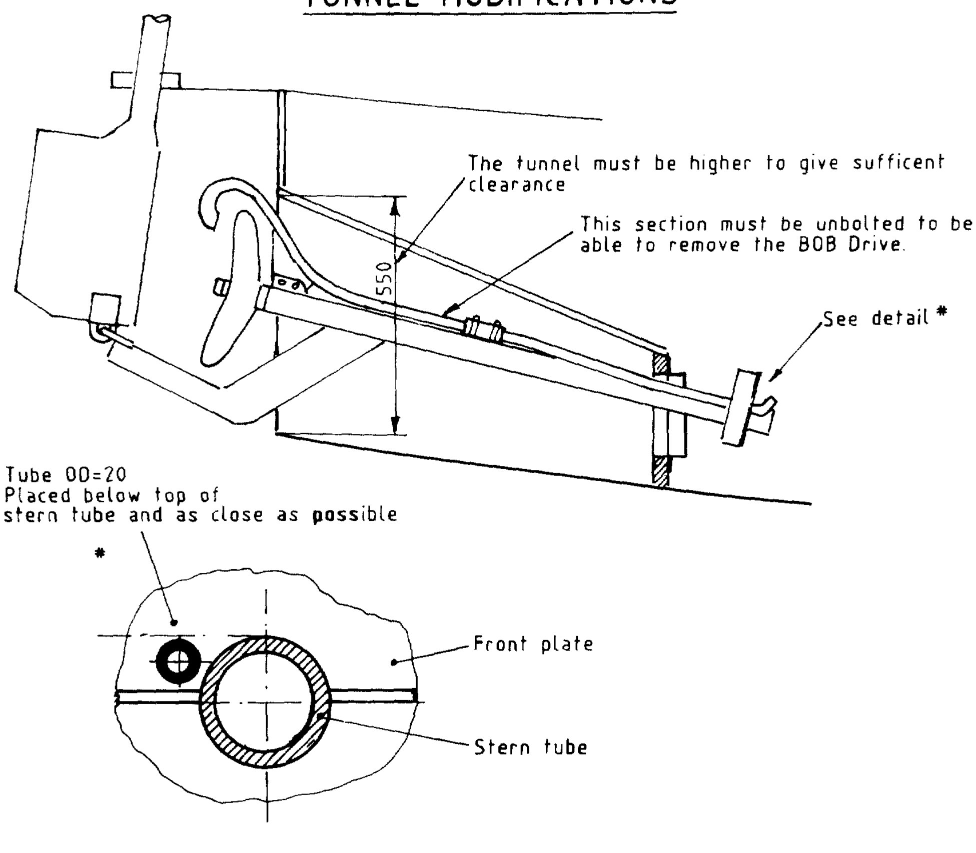


SEAWATER COOLING SYSTEM

This system is not suitable where there is sand mixed in the seawater (surf crossing and beach landing)



TUNNEL MODIFICATIONS



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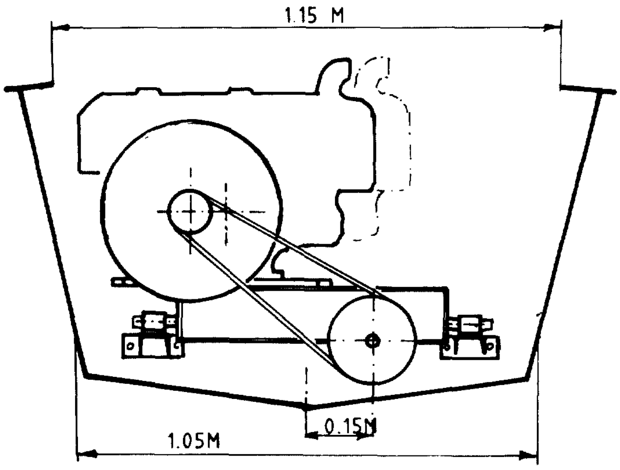
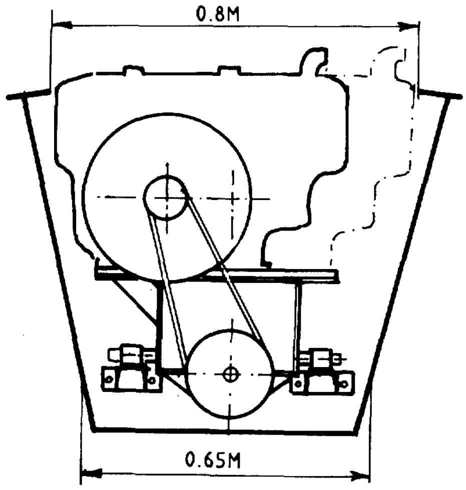
WIDTH REQUIREMENTS FOR INSTALLATION



SIDE MOUNTED ENGINE

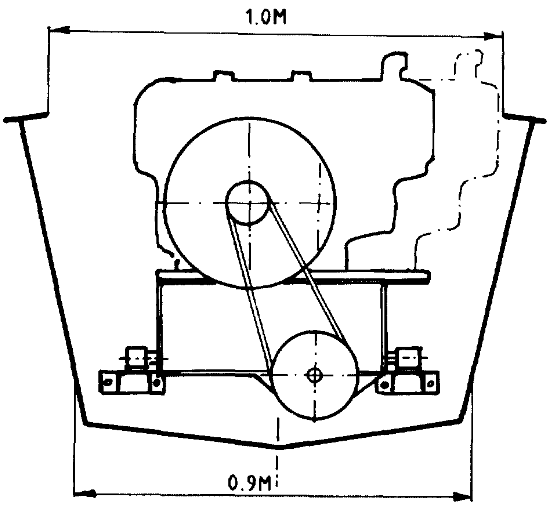
The side mounted engine gives a low installation with passage on one side.

Note that the tunnel is not on centre



TOP MOUNTED ENGINE WITH NARROW BASE

This is the only installation possible in a narrow canoe.



TOP MOUNTED ENGINE WITH A WIDE BASE

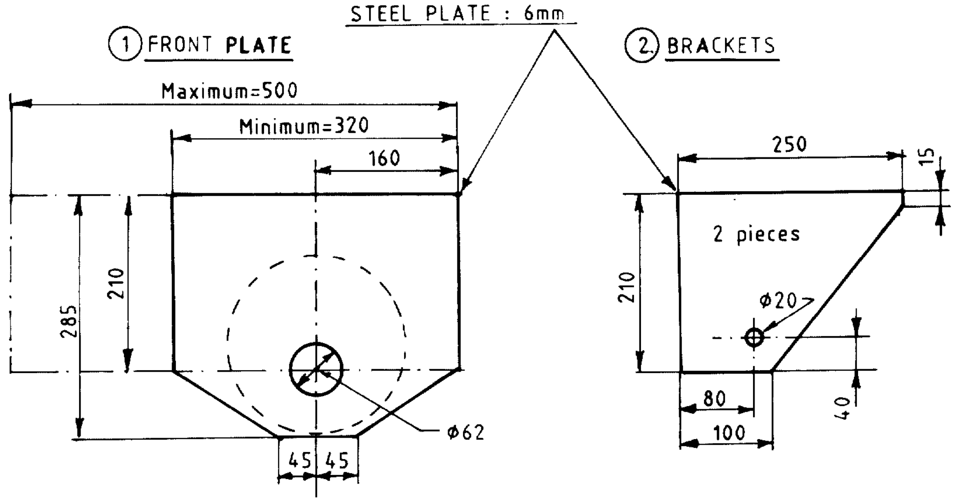
The wider base gives less force on the pivots and should be used whenever the width of the craft allows.

Note that the tunnel is not on centre.

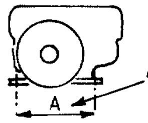
<<

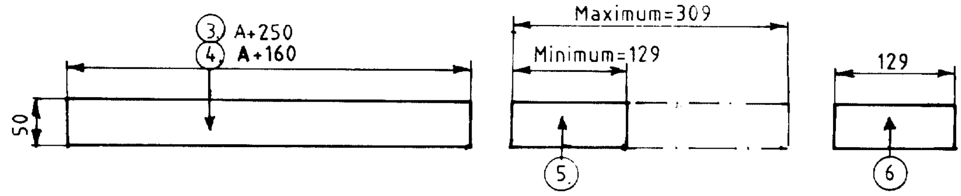
CHASSIS - TOP MOUNTED ENGINE

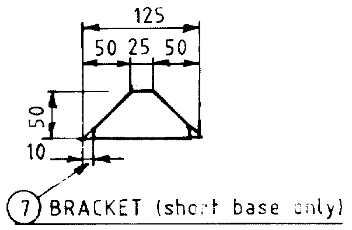
STEEL PLATE : 6mm

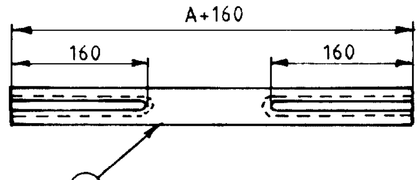


FLAT IRON : 6×50

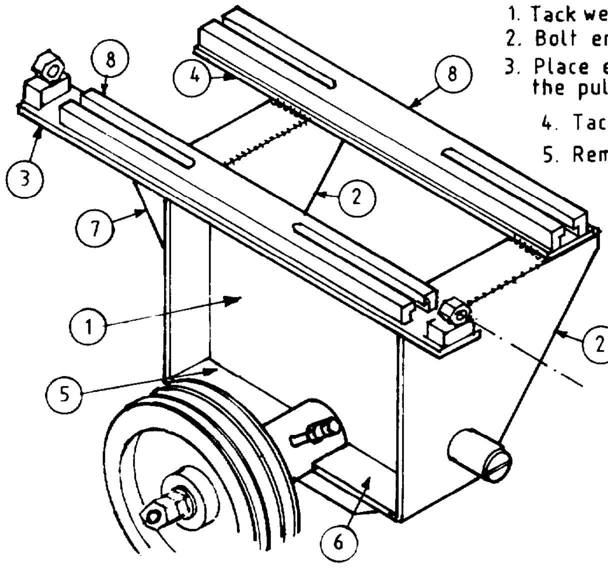






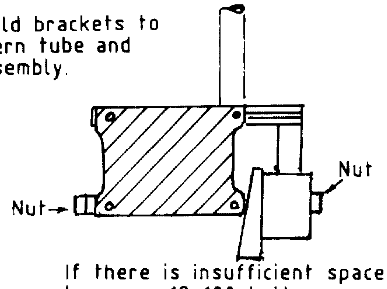


See page 17 for details on slot



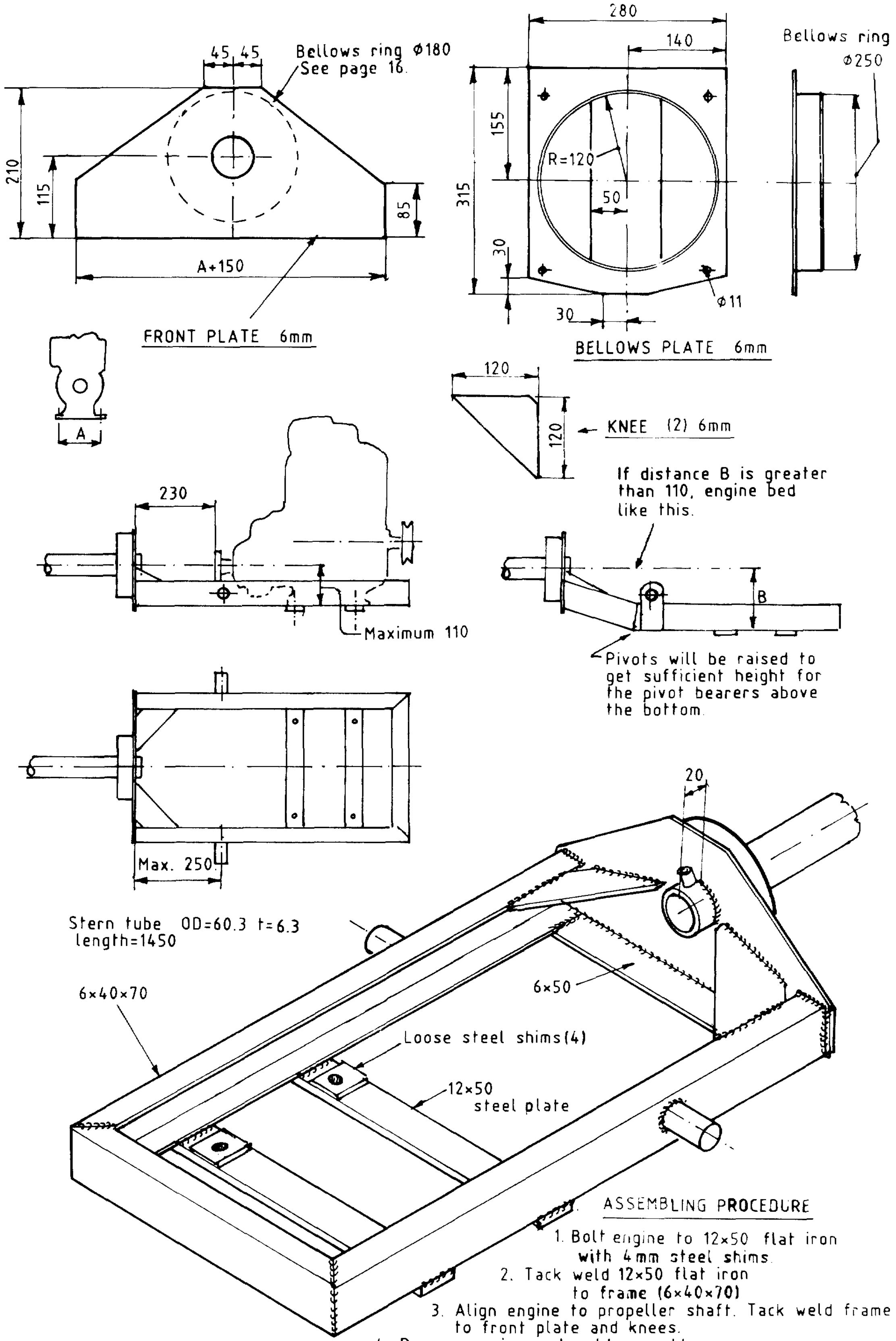
ASSEMBLY

1. Tack weld 8 to 3 and 4
2. Bolt engine to 8 in extreme right position
3. Place engine on chassis and move until the pulleys are in a vertical line
4. Tack weld 3 and 4 to 1 and 2 and stern tube
5. Remove engine.
6. Weld brackets to stern tube and assembly.



If there is insufficient space to use a 12×180 bolt, use a block of wood and a wedge to shift the engine.

CHASSIS - FORWARD MOUNTED ENGINE



ASSEMBLING PROCEDURE

1. Bolt engine to 12×50 flat iron with 4mm steel shims.
2. Tack weld 12×50 flat iron to frame (6×40×70)
3. Align engine to propeller shaft. Tack weld frame to front plate and knees.
4. Remove engine and weld assembly.

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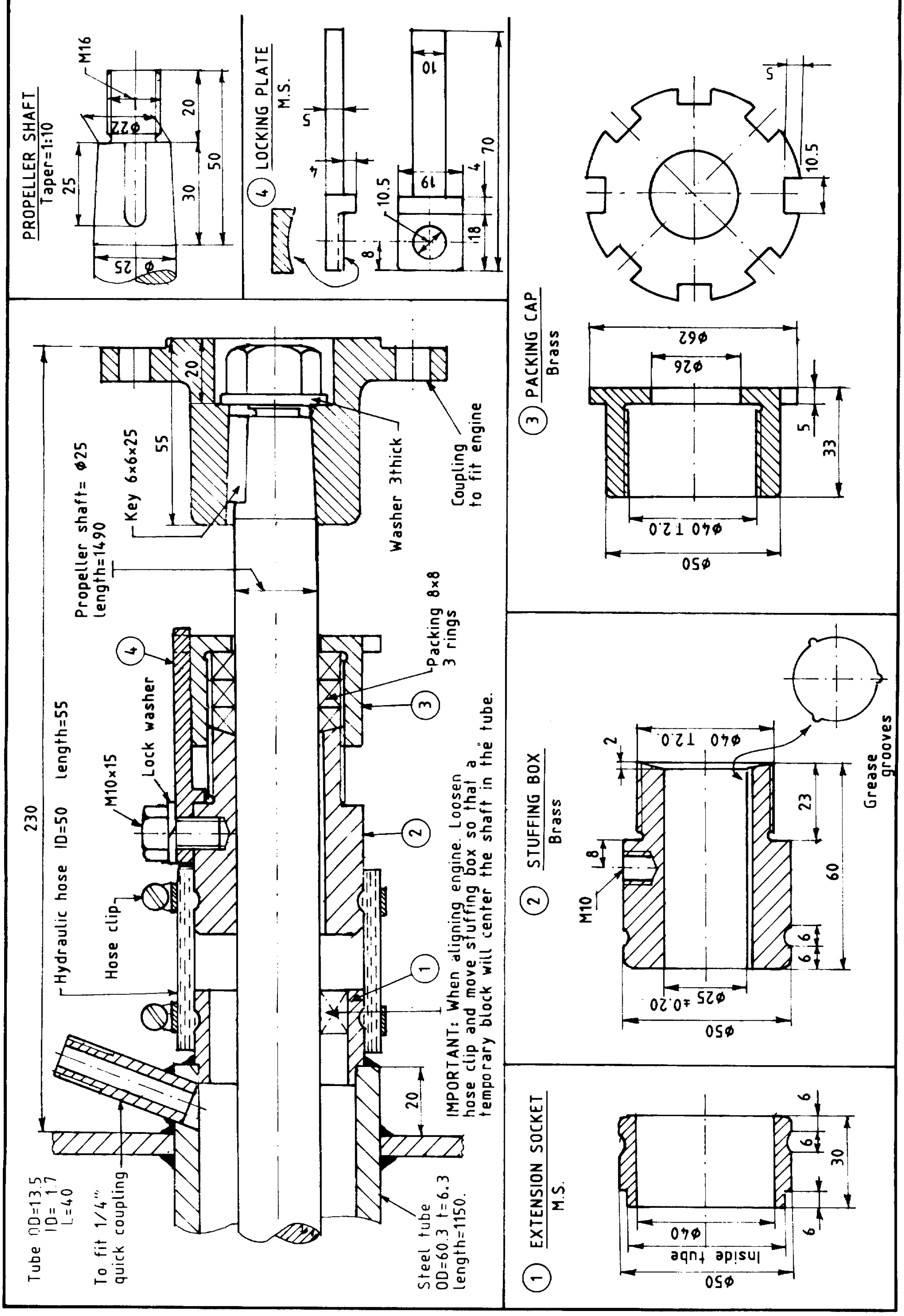
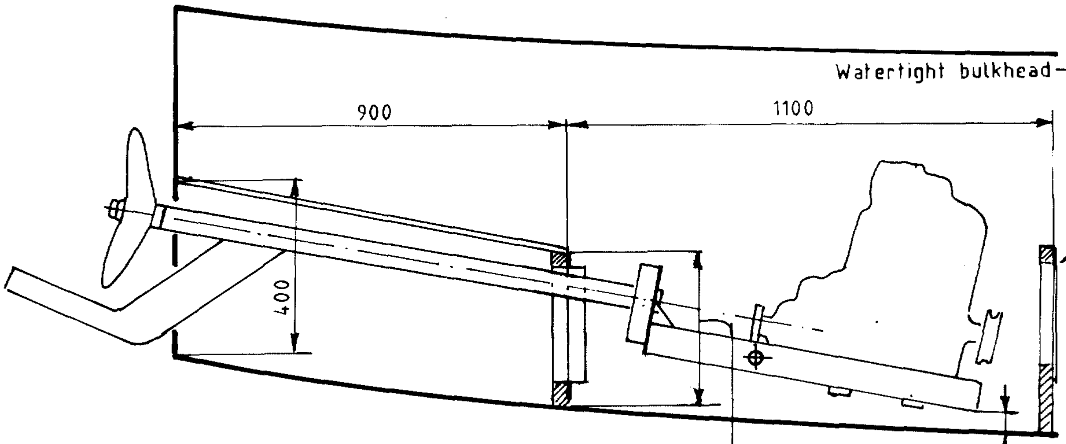
FORWARD MOUNTED ENGINE-FLEXIBLE STUFFING BOX

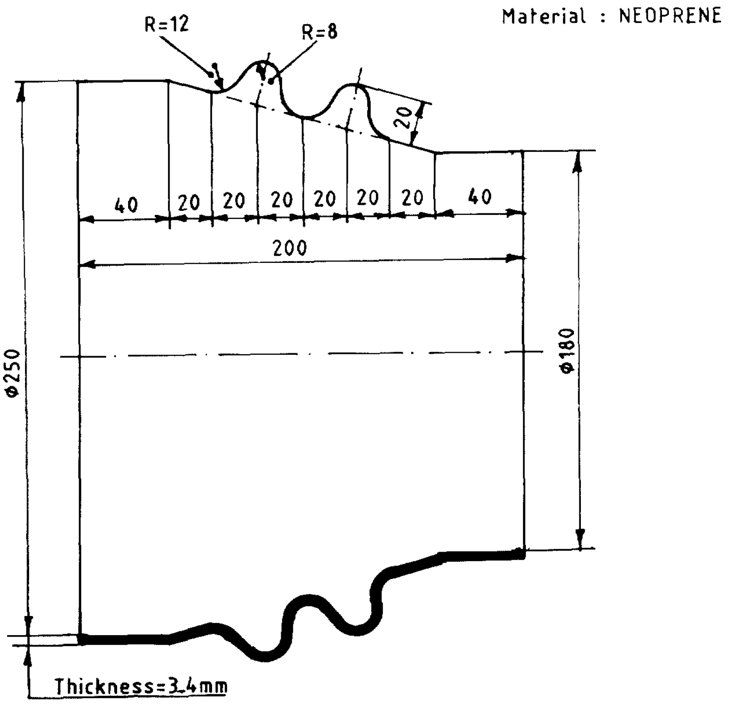


TUNNEL-FORWARD MOUNTED ENGINE



The minimum height of the tunnel is 340mm
but might have to be higher to obtain
sufficient clearance between chassis and bottom.
See page 23 for width of tunnel.
See page 27 for requirement in lower position.
Note however that due to the greater bellows,
the gap between the bellows rings should be B=90 on top

ALTERNATIVE BELLOWS



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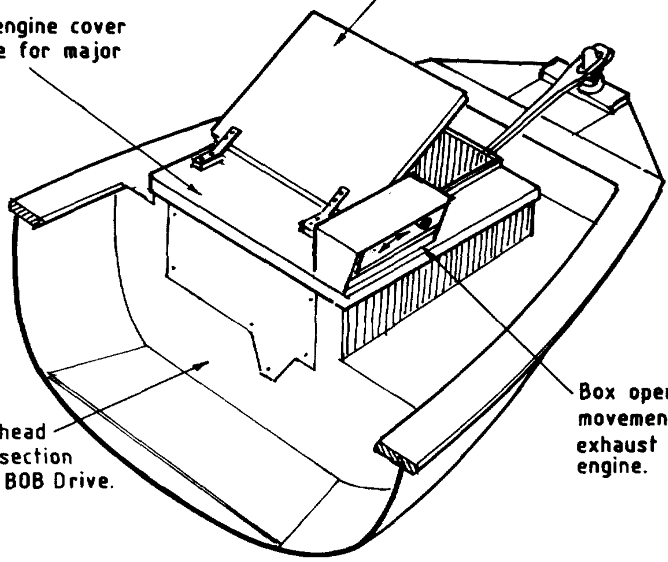
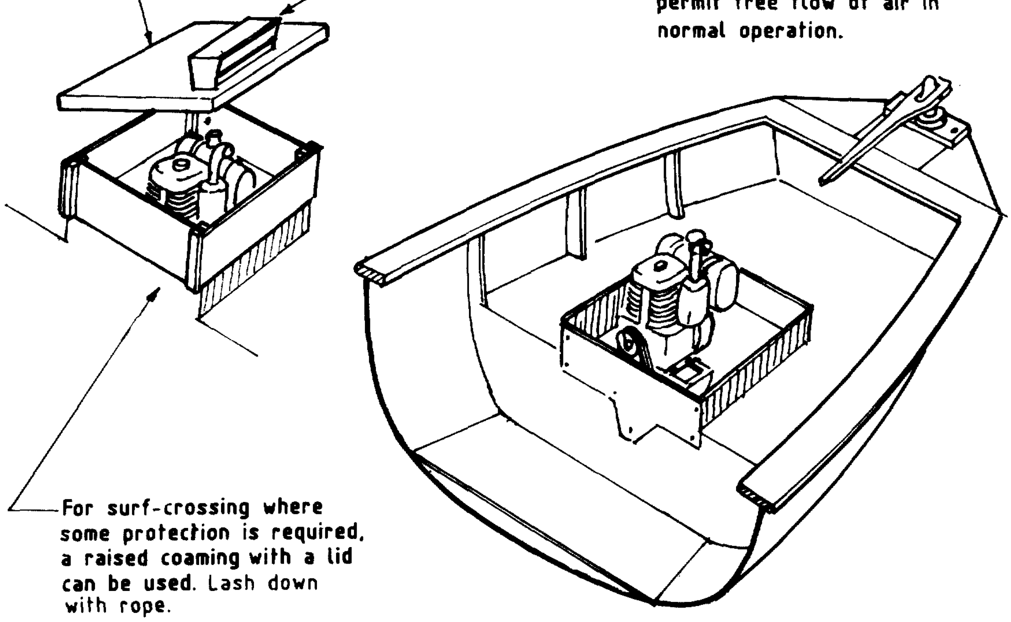
ENGINE PROTECTION

WATER-COOLED ENGINE

Below is shown an engine compartment for a side mounted engine.

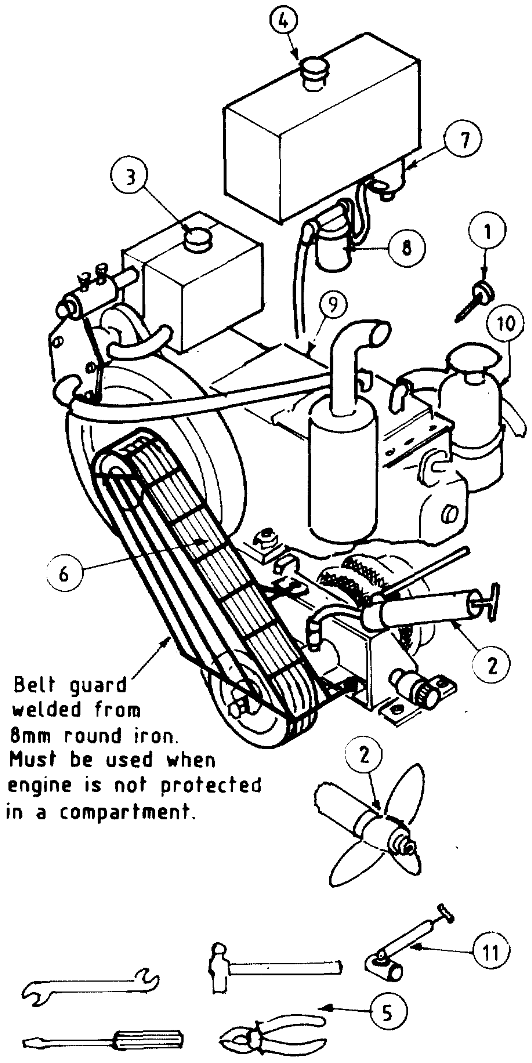


AIR-COOLED ENGINE



The engine installation must permit free flow of air in normal operation.

<<



MAINTENANCE

DAILY

1. Oil dipstick : check oil level and refill.
2. Grease gun with quick coupling. Check that grease is emerging at the propeller
3. Check freshwater level and carry spare can of freshwater for refilling.
4. Fuel level : Check level and carry extra fuel in spare can.
5. Tool kit : Always have it on board.

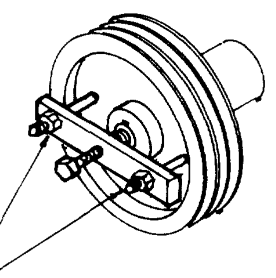
AT REGULAR INTERVALS

6. Belts : After tensioning if some belts are slack, change all belts at the same time. Never run with less belts than specified.
7. Sump in fuel tank : Drain dirty fuel.
8. Fuel filter and water separator : Cleaning and replacement as appropriate.
9. Engine oil : Change every 100 hours.
10. Air filter : Clean or change according to manufacturer's instructions.
11. Flit pump : Clean and spray engine with diesel, using it.

Note : Apply grease on to bolts and nuts and other parts subject to corrosion.

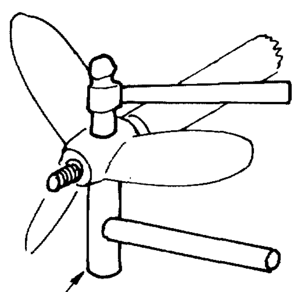
REMOVAL OF PULLEY.

Do not use a hammer.



Bolts M10 through holes in pulley (see page 11).

REMOVAL OF PROPELLER.



Use a heavy counterweight and strike the boss on top Do not hit the blades with a hammer.

INDEX

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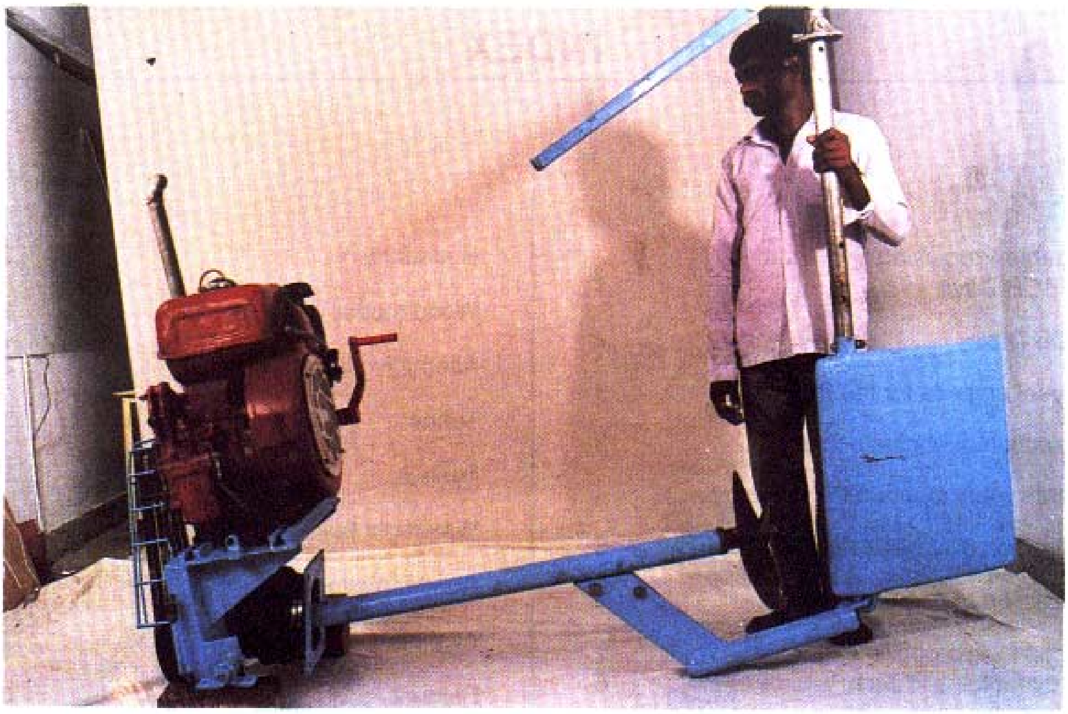
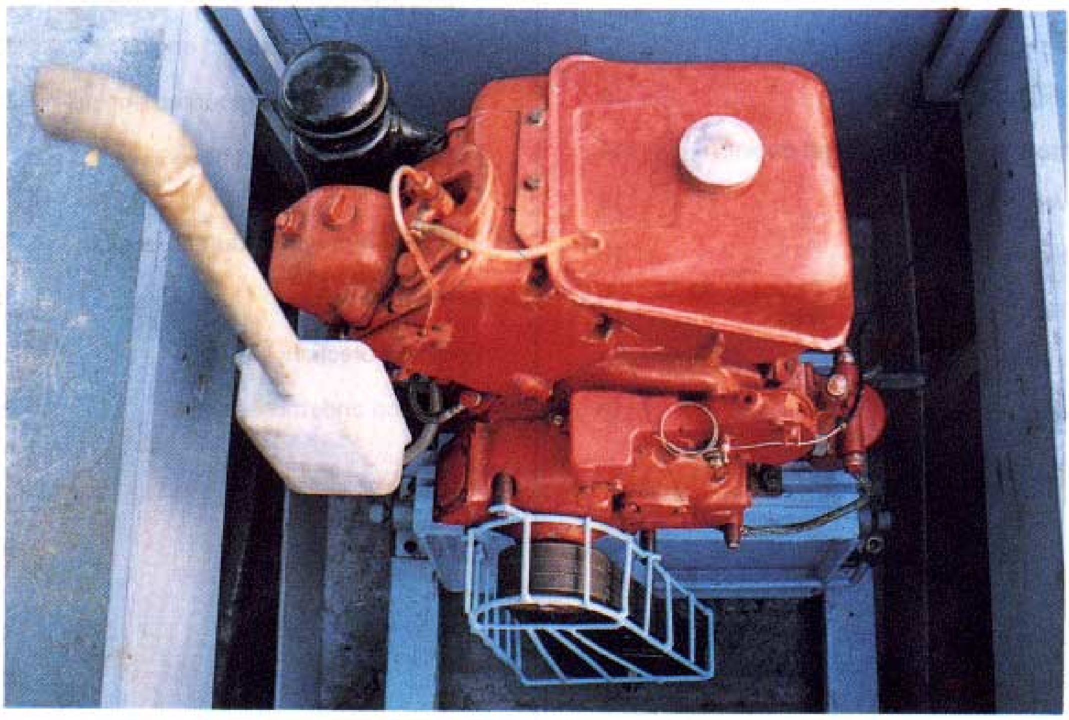


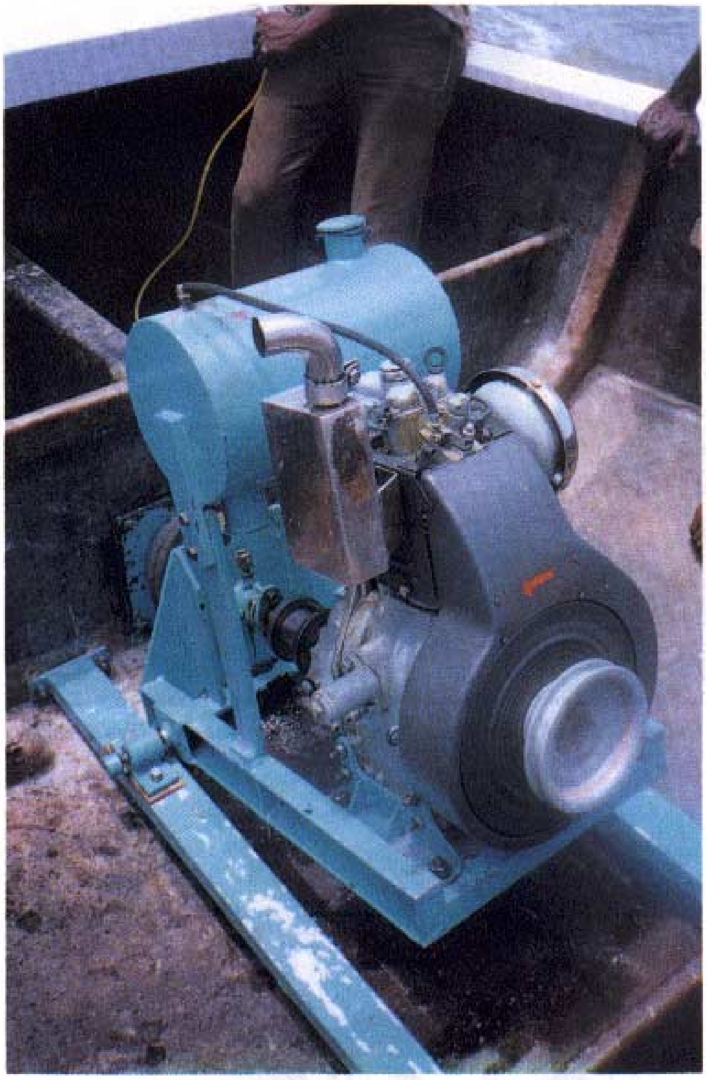
Top mounted VST air-cooled diesel engine BOB Drive



Top mounted VST air-cooled diesel engine BOB Drive installed in BLC IND-25

6.7 m FRP beachianding craft, IND-25, fitted with top mounted VST air-cooled diesel engine BOB Drive

8.5 m timber outrigger canoe, SRL-18A, fitted with top mounted Yanmar air-cooled diesel engine BOB Drive



Forward mounted Lombardini air-cooled diesel engine BOB Drive installed in FRP beach nava

9.1 m FRP beach nava *fitted with forward mounted Lombardini air-cooled diesel engine BOB Drive*

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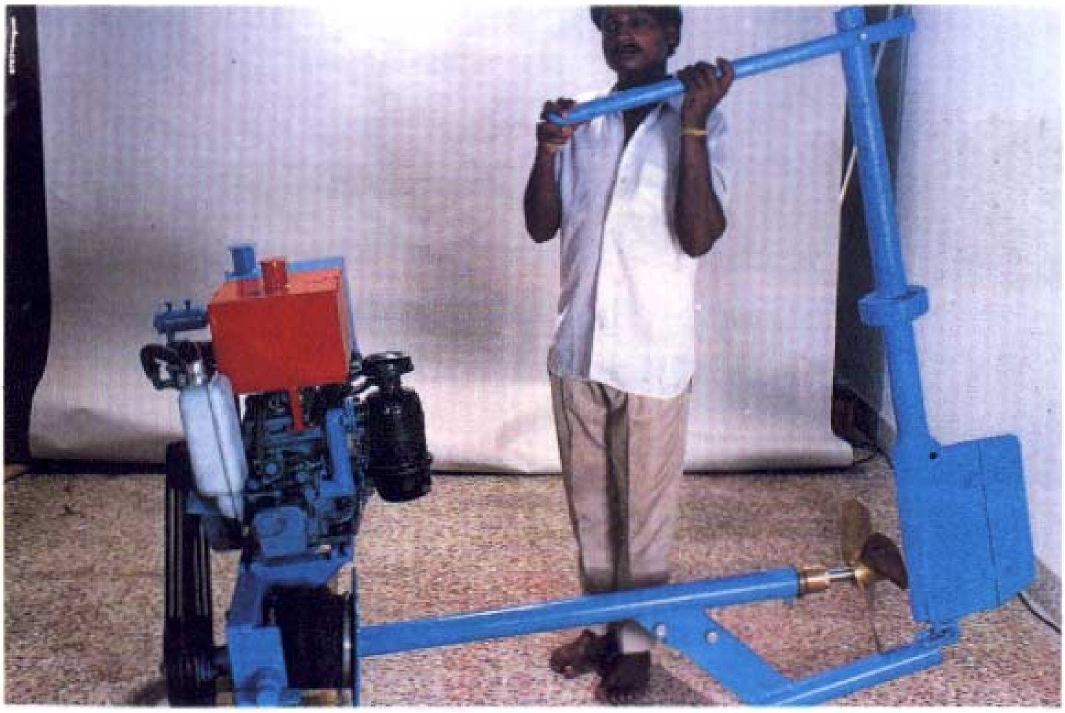
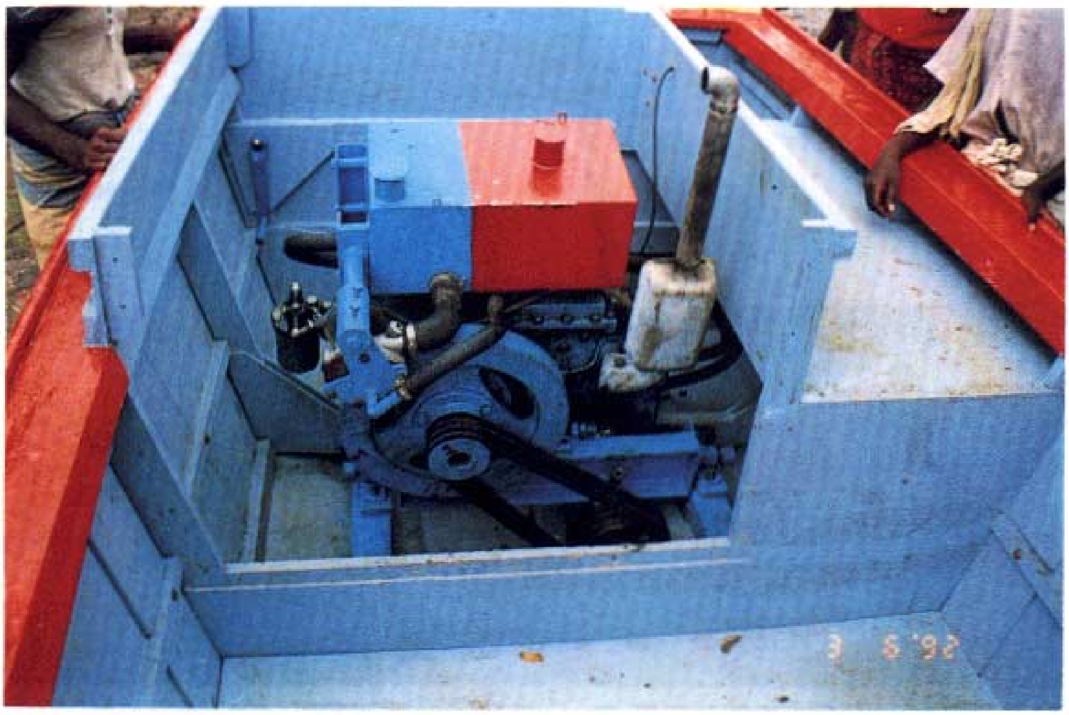


Side mounted VST water-cooled diesel engine BOB Drive

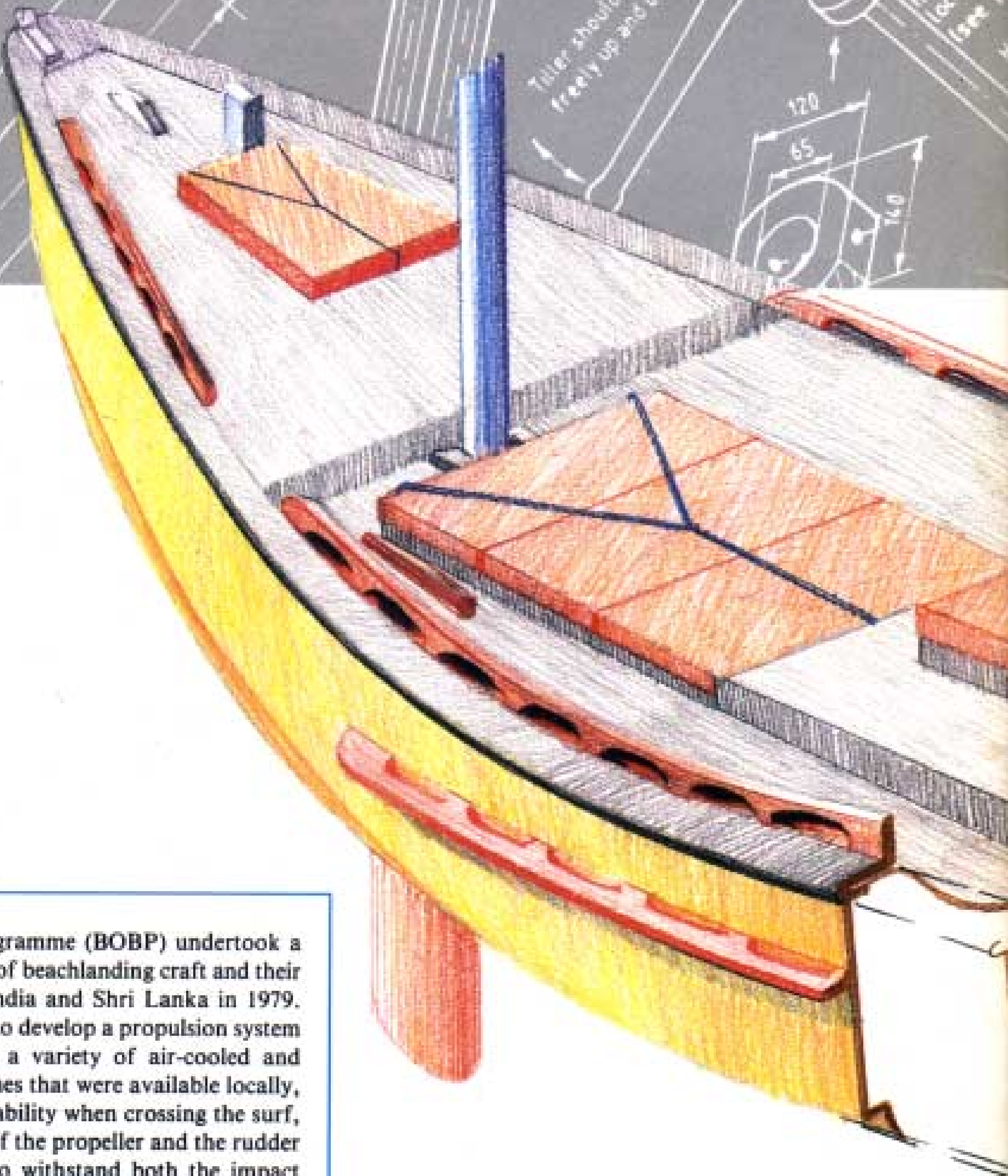


Side. mounted VST water-cooled diesel engine BOB Drive installed in plywood canoe

8.5 m plywood canoe, IND-28A, fitted with side mounted VST water-cooled diesel engine BOB Drive

8.5 m FRP beachianding craft, IND-20, fitted with side mounted VST water-cooled diesel engine BOB Drive

BOBP/MAG/14
Fishing Technology



The Bay of Bengal Programme (BOBP) undertook a project for development of beachlanding craft and their propulsion systems in India and Shri Lanka in 1979. The main challenge was to develop a propulsion system that could be fitted to a variety of air-cooled and water-cooled diesel engines that were available locally, provide good manoeuvrability when crossing the surf, permit rapid retraction of the propeller and the rudder and be strong enough to withstand both the impact when landing on the beach and the rough handling by users.

This manual describes the final version of the liftable propulsion system developed by BOBP and called the **BOB Drive.** It is intended to be used by skilled mechanics in small workshops having a lathe and welding equipment. It should also be of interest to engine manufacturers, boat-builders, teachers in fisheries training institutes and extension workers in small-scale fisheries.

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