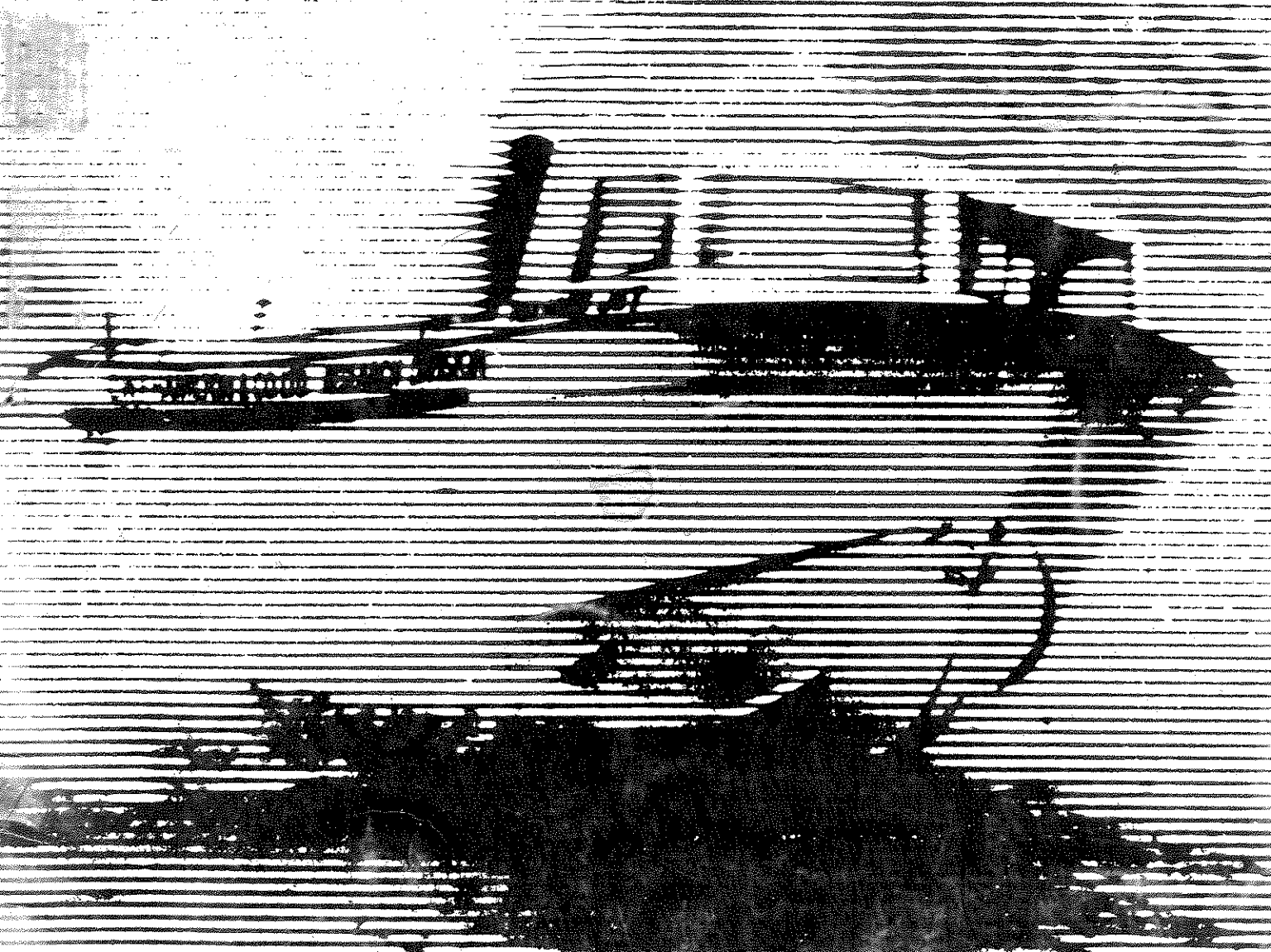




HamiltonJet

1300 Series Unit

Owner's Manual





HAMILTON MARINE JET UNITS

1300 SERIES

FOR DIESEL ENGINES

MODEL 1313

OWNER'S MANUAL

INDEX

	<u>SECTION</u>
DESCRIPTION, GENERAL INFORMATION	1.
STANDARD EQUIPMENT AND OPTIONS	2.
THRUST CURVES	3.
POWER CURVES	4.
DIMENSIONS	5.
INSTALLATION DETAILS	6.
OPERATION & MAINTENANCE	7.
GENERAL ARRANGEMENT DRAWING	8.
PARTS LIST	9.
DISMANTLING PROCEDURE	10.
PHOTOGRAPHS	11.

C. W. F. Hamilton & Co. Ltd,
Jet Propulsion Division.

May 1972.

GENERAL DESCRIPTION

The Hamilton Jet Unit is a device for propelling boats by harnessing the Reaction Force generated by expelling a column of water rearwards. This is achieved by drawing water in from under the hull, and pumping it at high pressure via a nozzle from the transom. It is immaterial whether the water jetstream goes into the air or the water - the reaction force is the same.

A prime mover, such as a conventional marine diesel engine, or gas turbine drives the unit through a short connecting shaft.

Efficiency is dependent on balancing the water flow and velocity, against the required boat displacement and speed. Hamilton jet units have comparable efficiency to propeller drive if applied as recommended - the first time this has been achieved in the history of marine propulsion.

The 1313 series units consist for four main parts:-

1. An Intake Duct - to convey water from the bottom of the boat to the pumping unit. This is made from corrosion resisting Silicon-Aluminium alloy, and contains a thrust bearing mounting, and an inspection hatch. A screen or grill is mounted across the intake opening to deflect debris from the interior of the unit.
2. The Thrust Bearing - is mounted on the front face of the intake duct, and carries a heavy duty duplex ball bearing with appropriate seals. The stainless steel mainshaft finishes with a flanged drive coupling at the front end, which is connected to the engine flywheel through a flexible connecting shaft. The bearing is cooled by the incoming water.
3. The Main Pumping Unit - is a single stage axial flow design mounted at the outlet end of the intake, and easily detachable for servicing. Axial-flow design is chosen since it ensures the highest possible flow rate to give the most efficient propulsion. The pump consists of a four-bladed impeller, with an associated set of guide vanes, all mounted in a stainless steel casing. The water is expelled from a large diameter nozzle, which handles about 23 tons of water per minute. This high flow capability is essential for efficient jet propulsion.
4. The Control Gear - consists of a pair of ganged deflectors for steering the jetstream left or right for quick and sensitive steering. Behind this again, is a large directional control deflector operated by a rod and lever system from inside the boat which can be lowered to slow, stop or reverse the craft as desired. Full steering is always available no matter what manoeuvre is undertaken. Hamilton Jet Control Systems give complete and fine control under all circumstances.

All parts of the 1313 unit are constructed of stainless steel or other corrosion-resisting materials.

They are designed expressly for DIESEL ENGINE DRIVE, and for the efficient propulsion of displacement launches and barges.

The units give the advantages of:-

- Extreme ease of fitting and removal
- Shallow draught
- Clean-bottomed hulls
- No propeller damage
- Greatly increased manoeuvrability
- Low maintenance
- High propulsive efficiency
- No marine transmission or reduction gear box required on engine

The following features are offered:-

1. R. P. M. range suitable for most popular diesel marine engines, driven direct off the flywheel.
2. Reverse control built-in to jet unit. No gearbox or reduction gear required on engine.
3. High degree of control at all speeds through powerful directed-jet steering, and reverse thrust deflector. Full steering response at all speeds and directions of travel, including the stationary position.
4. Manufactured from corrosion-resisting materials throughout. Main unit of stainless steel, mounted outboard of transom. Stainless steel impeller. Intake housing of cast Silicon-Aluminium alloy (LM6).
5. Anti-friction thrust bearing, grease lubricated. Water-lubricated fluted rear bearing for maximum reliability.
6. High efficiency Hamilton axial flow design giving optimum combination of jet velocity and mass flow. Hamilton Jets have highest mass flow for best boat performance.
7. Convenient design allowing dismantling of the main pumping unit without disturbing the watertight seal between the intake housing and the hull.
8. Inspection cover on intake housing enables access to the interior of the unit if necessary for weed clearance, or impeller inspection.

9. Outboard mounting on single angled hull surface with only one hole in the hull.
10. Two impeller pitches available for different engine characteristics.
11. Flange drive coupling supplied to suit 1350/1400 series Hardy Spicer universal drive shaft.
12. Manual operation of counter-balanced reverse deflector supplied with inboard lever.
13. Recommendations for hull modifications for mounting, engine coupling, and steering arrangements supplied with each unit.

IDENTIFICATION OF UNITS

The 1300 series units are identified as follows:-

<u>Impeller Dia.</u>	<u>No. of Stages</u>	<u>Model Type No.</u>
13"	1	Mark III

becomes: 1313 Model

SERIES 1313 JET UNIT

Length of boat	: 30-60 ft (9-20 metres)
Revolutions	: 1500-3000 r. p. m.
Approx. comparable propeller	: 16"-20" diameter
Weight of unit	: 435 lb. (200 kg)
Rotation	: L. H. only available (Clockwise looking at jet drive coupling)
Ratings:	Slow speed displacement boats, barges, etc. Rated up to 100 s. h. p.
Mounting:	This unit is designed for complete outboard mounting, against a single angled surface easily arranged on the hull, through which pass all the necessary shafts, controls, and other inboard items. The whole unit can be mounted in the prepared boat in minutes, and be detached completely if required for inspection, maintenance or over-haul just as simply. (This arrangement is subject to Prov. N. Z. Patent Application No. 166824).

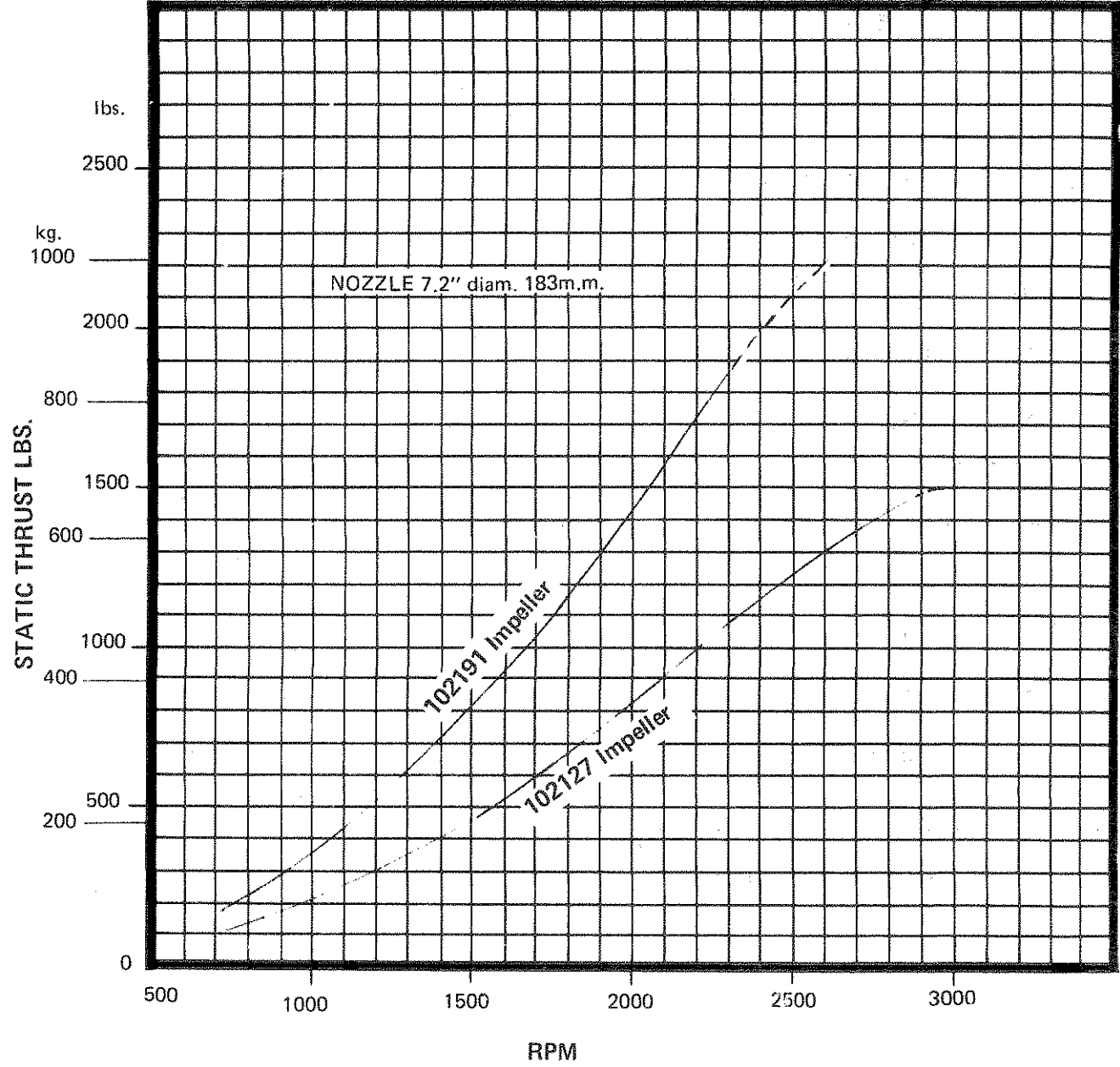
EQUIPMENT AND OPTIONS

ITEM		STANDARD EQUIPMENT
1.	Impeller diameter	13" (330 m. m.)
2.	Stages	1
3.	Impeller pitch	Fine : 102191 Extra Fine : 102127
4.	Nozzle diameter	7.2" (183 mm), 8" (203 mm)
5.	Mounting	Single 30° flat surface
6.	Screen Cleaning method	Inspection hatch
7.	Reverse operation	Manual lever
8.	Steering	Tiller arm, inboard
OPTIONAL AT EXTRA COST		
1.	Intake screen	Fixed bar (General use)
2.	Intake screen	Free finger (Weedfree) *
3.	Intake screen	Mechanical opening bars *
4.	Coupling shaft	Hardy Spicer 1350/1400 Series short shaft assembly.

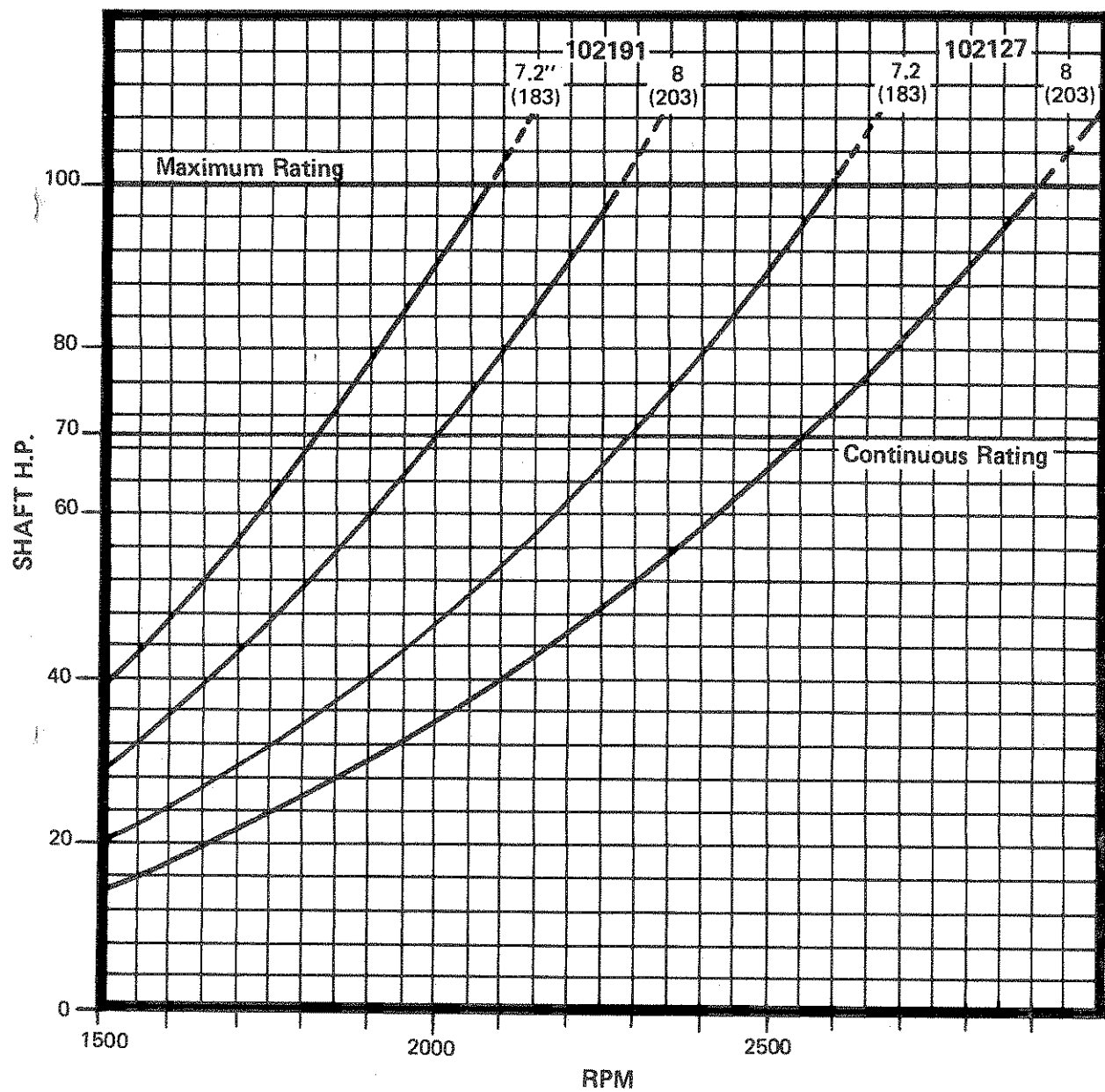
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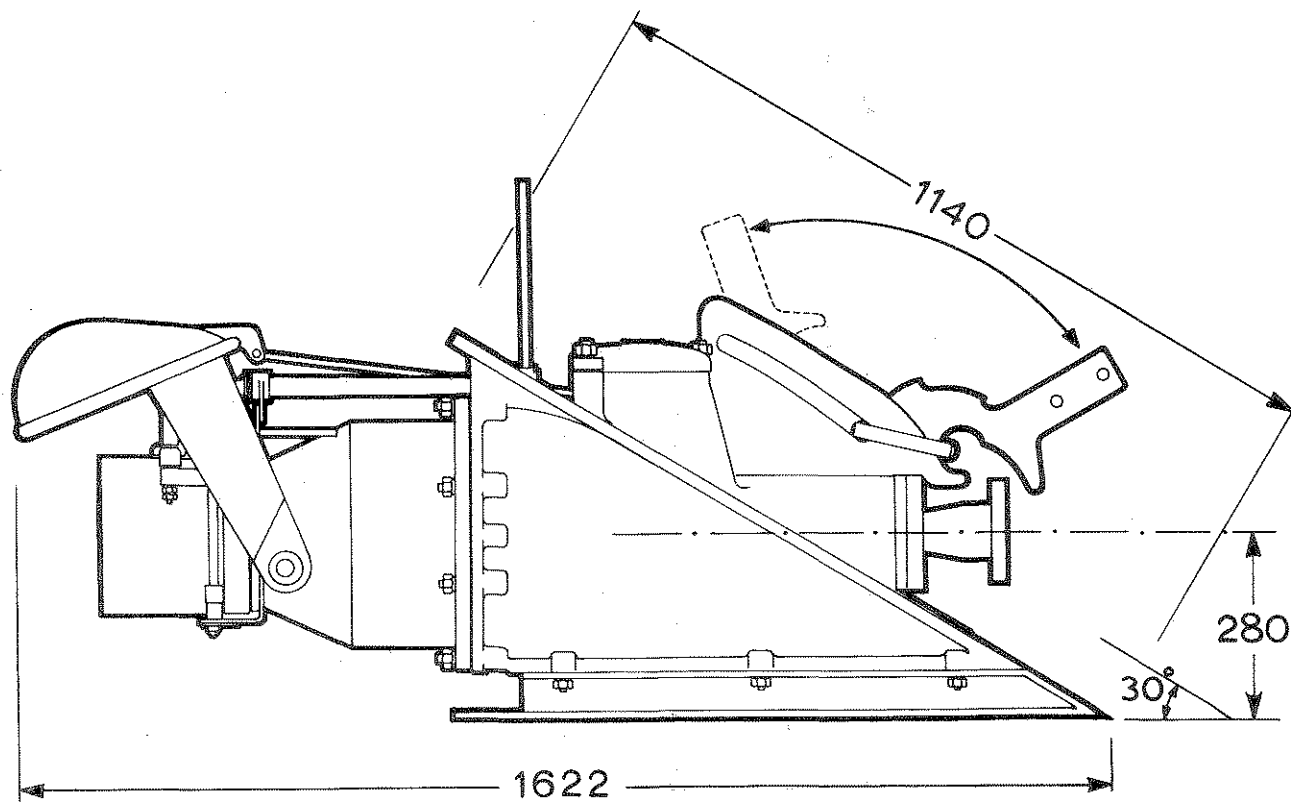
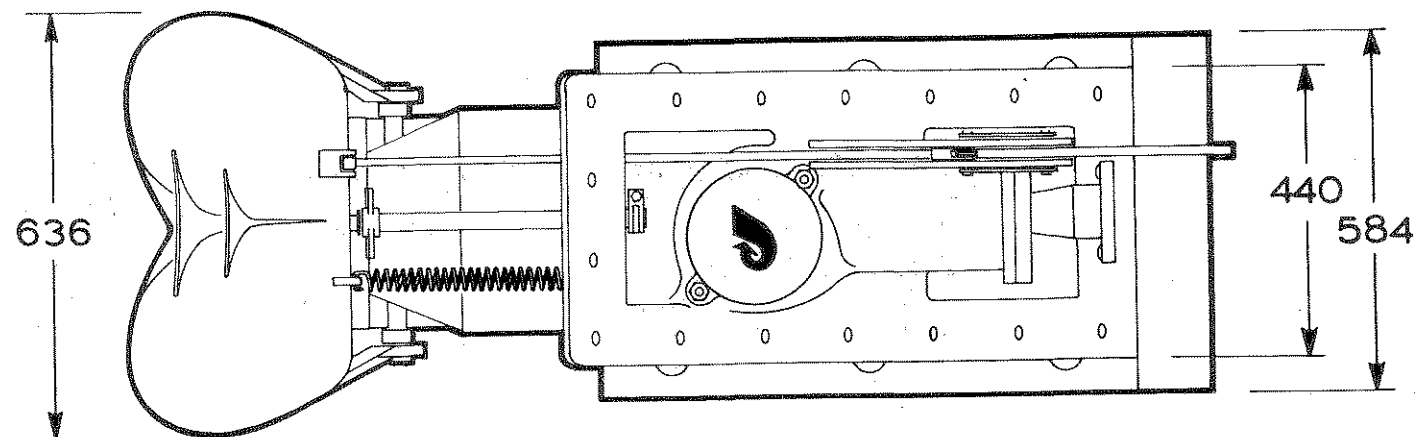
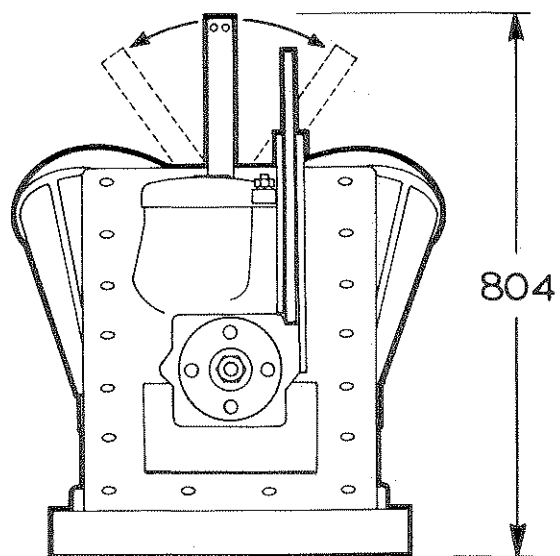
<p style="text-align: center;">ALL TECHNICAL INFORMATION CONTAINED IN THIS MANUAL IS SUBJECT TO CHANGE WITHOUT NOTICE</p>

THRUST CURVES

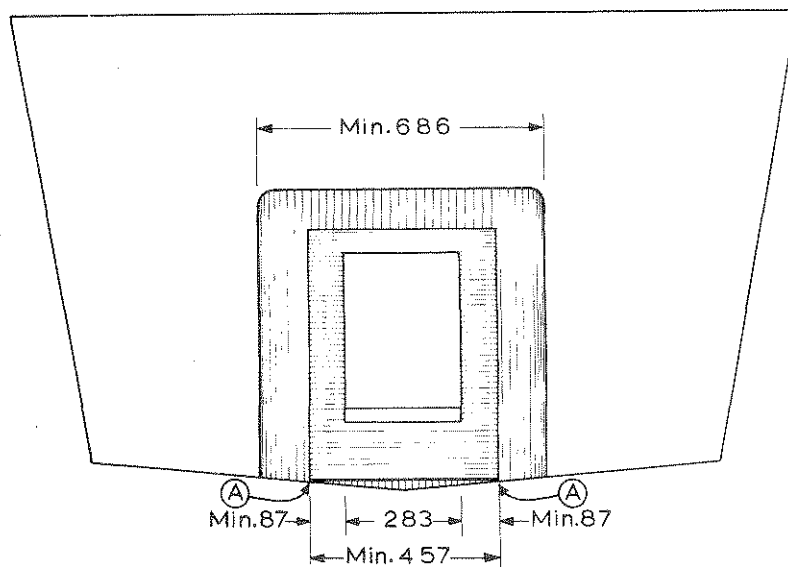
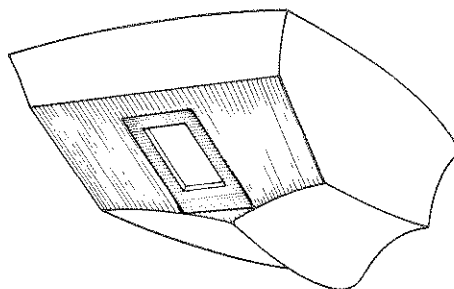
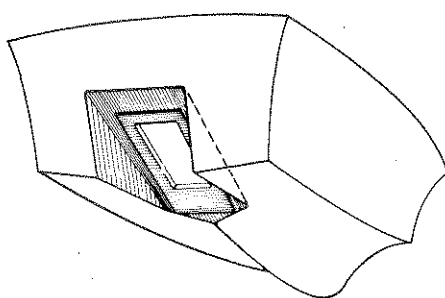
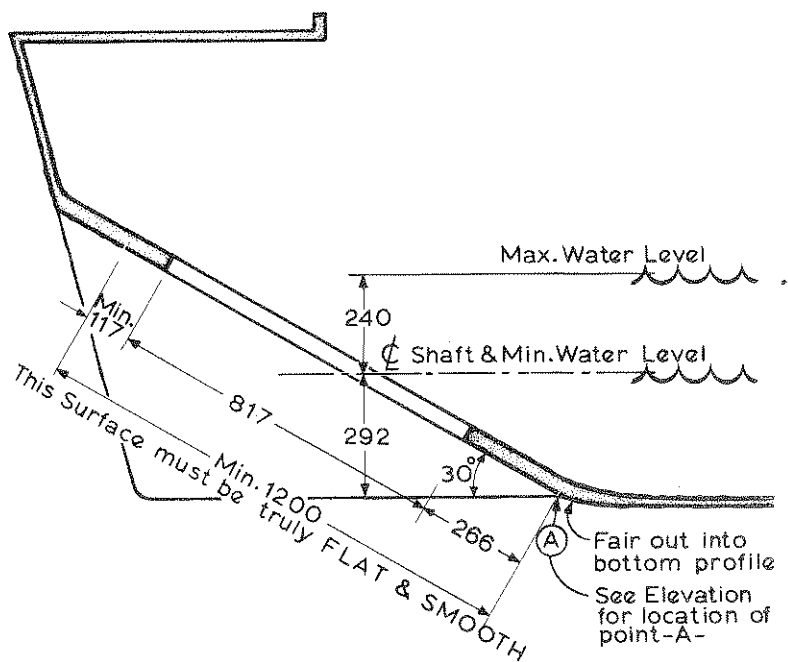


POWER CURVES





HULL PREPARATION FOR 1313 JET



INSTALLATION DETAILS

HULL PREPARATION

1. Prepare hull to accompanying installation drawings. Take care to arrange mounting in correct relation to the craft's minimum waterline, and to ensure a truly flat mounting surface at 30° to the waterline.
2. Cut hole through hull centrally in the mounting area, check its dimensions, and position in relation to the bottom edge of the 30° mounting face.
3. This angled face should be strong, rigid and securely attached to the hull and transom in such a way as to safely transfer the thrust of the unit to the hull proper.
4. Drill the 20, 20 m. m. holes through the hull to the pattern laid down on the template for the purpose.
5. Have a trial fitting of the unit to check hole centres.
6. Liberally smear both surfaces of the sealing gasket with a suitable sealing cement, fit over the studs on the unit and offer the unit up to the hull. (If desired the unit may be slung by a crane by the two inspection hatch bolts with a short crossbar, and pulled up with a sling descending from above and through the mounting hole).
7. Make sure the unit comes up neatly all around, put on washers and nuts and evenly tighten all round. Make sure the bottom sharp edge is practically flush with the bottom edge of the 30° angled mounting surface, but should NOT PROTRUDE below it.
8. The unit now installed, engine can be linked to the coupling, steering connected, and reverse control lever arranged.

GENERAL INSTALLATION DETAILS

1. ENGINE INSTALLATION

Position:

The engine should be mounted where recommended by the hull designer, or astern of this position. The latter may improve priming when starting, will give more forward cockpit space, and may improve top speed. The closest possible position to the jet unit will be determined by the length of the shortest possible drive shaft.

Level:

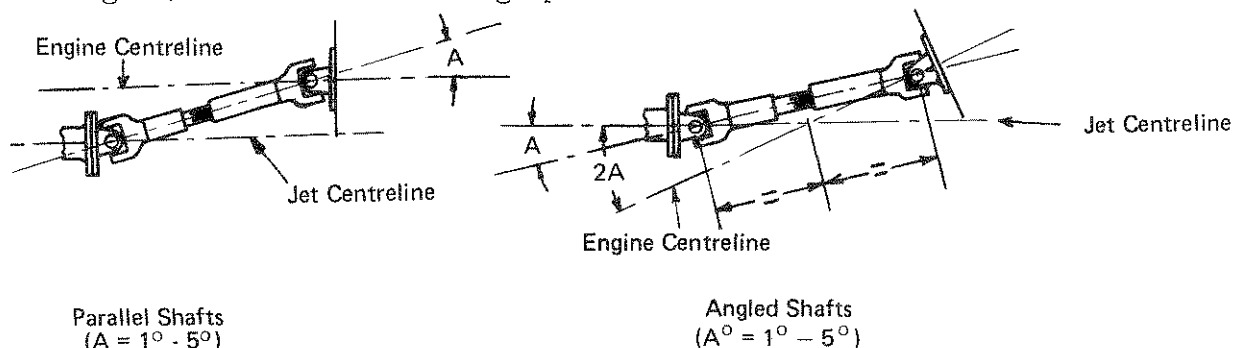
Mount the engine on longitudinal bearers so that the crankshaft line is preferably level and with a small clearance only under the oil sump.

Drive Shaft:

The drive coupling is made to match a Hardy Spicer 1350/1400 series universal joint. A double universal joint shaft should be used with a sliding spline of a length to suit the chosen engine position. An adaptor plate is required so that the universal joint can be coupled to the engine flywheel.

The universal should be run at a slight angle, to avoid vibration, but not too great an angle which would cause wear.

Make sure the two centre yokes are in the same plane to avoid torsional vibrations. No special care is required in lining up the engine, the universal taking up small differences.



IMPORTANT Limit universal angles to a maximum of 5° on each joint, which is about 1" offset on the usual short shaft.

GENERAL

In all other respects, e.g. cooling, the engine should be installed as for any conventional (i.e. propeller) drive marine engine installation. Follow the engine manufacturers installation instructions where applicable.

2. STEERING

This is effected by the pair of coupled deflectors arranged either side of the jet nozzle. Turning the steering wheel turns the deflectors which deflect the jet stream to the left or right giving powerful and accurate steering.

Good quality steering is of paramount importance in a jet boat. The most adaptable and lightest method of connecting the forward steering wheel to the aft steering arm is the cable and pulley system. It is almost completely frictionless, quite positive, and allows the normal self centering feature similar to an automobile.

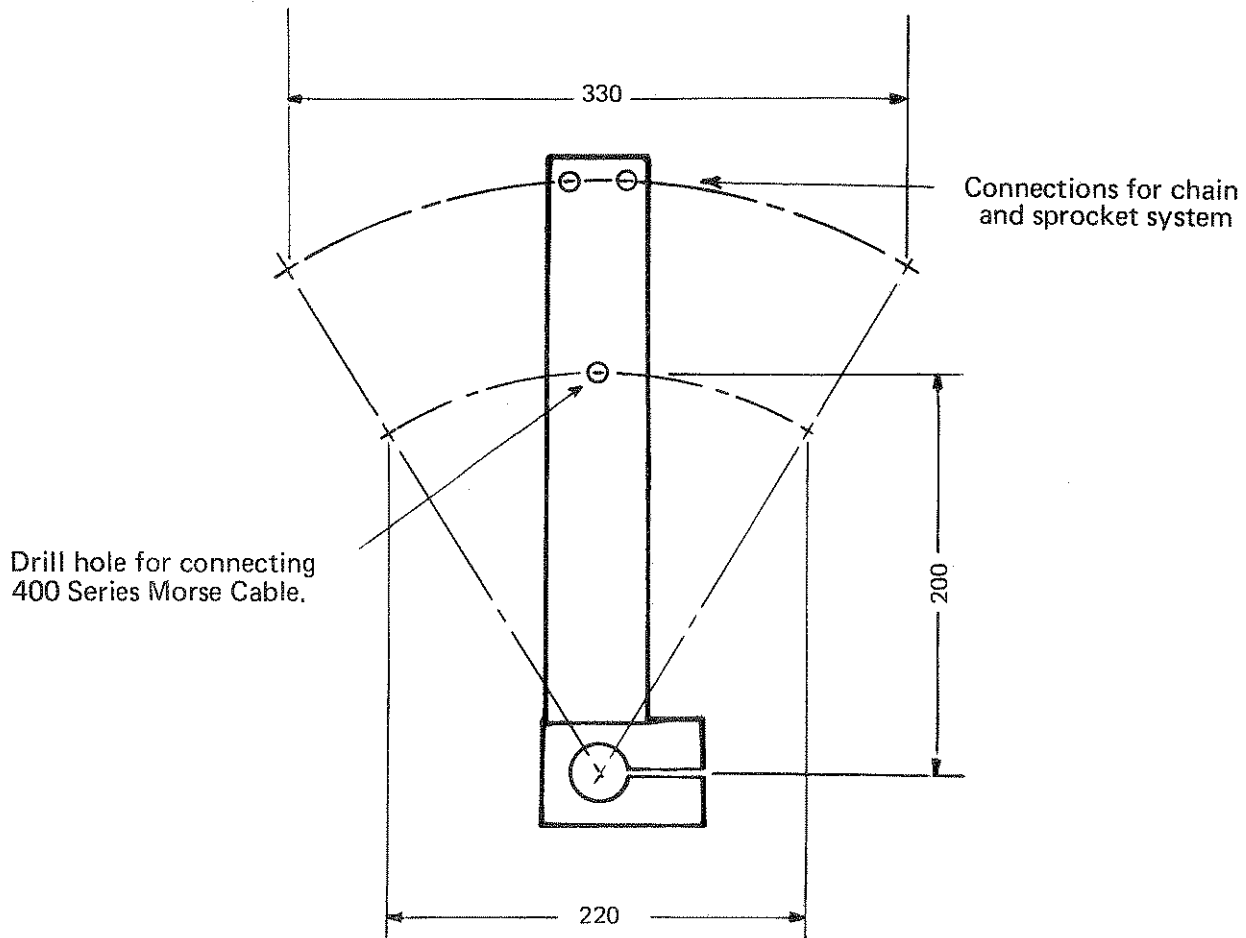
Chain & Sprocket System:

The layout for a chain and sprocket system is shown on drawing number 102186.

To retain sensitive manoeuvring at slow speeds there should be a maximum of two turns on the steering wheel to give full lock to full lock of the deflectors.

Cable Steering:

If a proprietary cable steering kit is desired the Morse 400 series is recommended - see sketches below.

CABLE CONNECTIONS ON STEERING ARM

3. FORWARD/NEUTRAL/REVERSE CONTROL

Principle of Operation:

The reverse bucket is the key to the forward, neutral and reverse control.

(a) Forward:

With the reverse bucket in the fully up position, the jet stream is able to pass out the back of the jet unit unimpeded. The resultant thrust on the boat is forwards.

(b) Reverse:

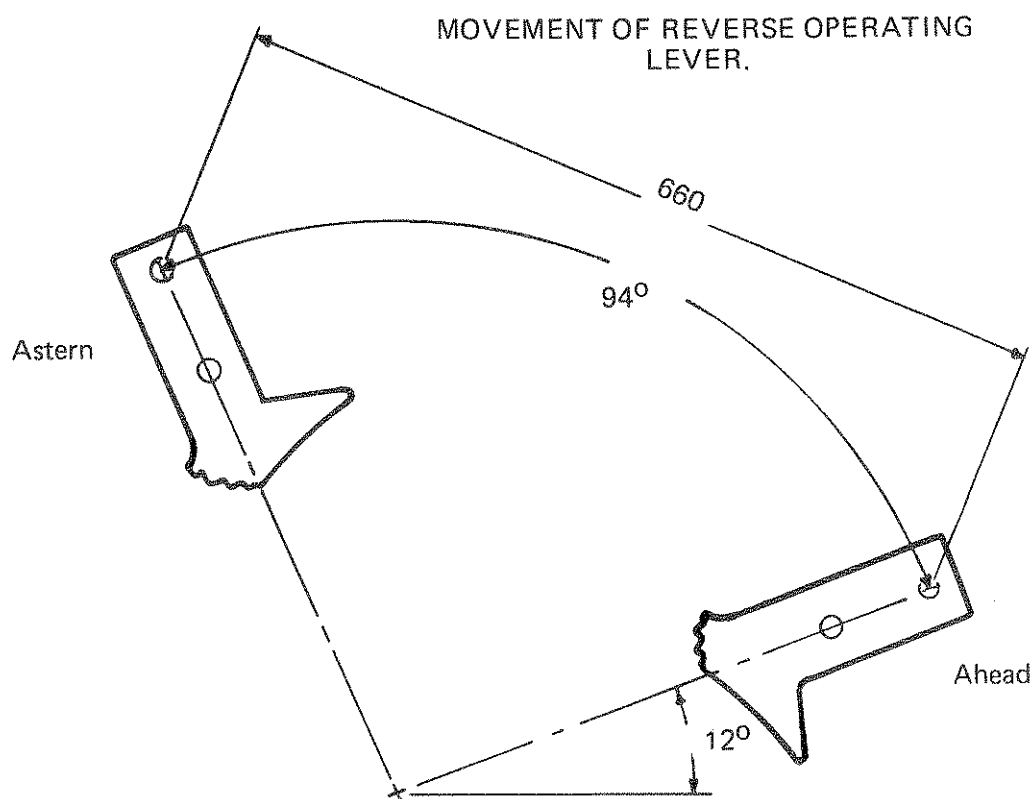
With the reverse bucket in the fully down position it cuts across the full jetstream, deflecting it down and forwards (relative to the boat). The resultant thrust on the boat is backwards.

(c) Neutral:

With the reverse bucket part way down, it is dispersing the water so the resultant thrust is nil, i. e. neutral.

(d) Braking:

If, while the boat is moving forwards, the neutral or reverse positions of the reverse bucket are engaged (remember the throttle should be closed before engaging these positions) and the throttle gently opened, the boat will very quickly come to rest. (One to two boat lengths from planing speeds with pleasure craft). This is a safety factor which only jet drives can give.



4. ELECTRICAL INSULATION

- (i) The engine must be insulated from a metal hull.
- (ii) The jet unit must also be insulated from a metal hull.
Note the following connections:-

Steering arm (70) to steering cable should be insulated,
or insulate the whole steering system from the hull.
- (iii) Use insulating bushes into the hull, and insulating washers
under each heavy washer, before bolting up.

OPERATION & MAINTENANCE

OPERATION OF THE JET UNIT

1. Steering:

The deflectors deflect the water jet to the left or right causing the boat to steer left and right respectively.

The following points should be remembered when operating a jet craft:-

- (a) If the engine is stopped there is no water jet for the deflectors to deflect and thus the craft cannot be steered.

Never stop the engine when approaching a mooring or at any time when steering will be required.

- (b) The wider the throttle is opened the greater the steering effect - i. e. the sharper the turn.
- (c) Steering is available in neutral and reverse as well as in forward control - a feature which gives the Hamilton Jet unrivalled manoeuvrability.

Remember though that whether going forwards, in neutral, or in reverse the bow of the boat will always turn the way the steering wheel is turned, i. e. turn wheel right, bow of boat will move right and vice versa.

This means that in reverse the boat has the opposite steering to a motor car, a feature which can be used to advantage when manoeuvring.

2. Forward/Neutral/Reverse Control:

Caution

If the reverse or neutral positions are selected with the throttle left open and the boat moving forward at speed, the resultant "braking effect" is very severe - even more so than full braking with a motor car.

The above procedure should therefore be used only in emergency.

For normal operation to "brake" the boat's forward motion:-

- (i) Close the throttle
- (ii) Select reverse or neutral
- (iii) Open the throttle, gently at first.

3. Manoeuvring and Docking:

It has been found that the boat is best manoeuvred as follows:-

- (i) Set the throttle up to 1/3 open (say approx. 1,200 r. p. m. with high speed diesel engines).
- (ii) Move the lever control to the neutral position.
- (iii) A slight movement either way from this neutral position will be sufficient to move the boat forwards or backwards until the manoeuvre is complete.
- (iv) Steering will be excellent also at this throttle opening.

To summarise:

Manoeuvre at fixed throttle opening, one hand on the steering wheel and the other on the reverse lever. Move the reverse lever a little either side of the neutral position.

4. Shallow Water Operation:

Avoid using large throttle openings at slow speeds in shallow water as stones, sand, etc. will be sucked through the jet unit. Thus, when starting off and stopping, pick a deep water area and only travel over shallow water with small throttle opening.

MAINTENANCE

Note

This unit has been designed to require the absolute minimum of maintenance. However, it is recommended that the unit be dismantled (as in Steps 1 - 3 in Dismantling Procedure following), and inspected for wear on bearings, seals, etc. and corrosion annually as a minimum requirement.

Day to day maintenance should be negligible, but the following points and checks should be noted:-

1. Thrust Bearing:

Grease with a good quality Lithium-based ball bearing grease every 30 hours' operation. Do not overgrease.

2. Rear Bearing:

This is a water lubricated, cutless rubber bearing and requires no attention.

DO NOT RUN THE UNIT OUT OF WATER as this will damage the bearing. Application of a hose to the small hole at the back cone fairing of the tailpipe of single stage unit will wet the bearing sufficiently to allow the unit to run for a short time, but remember the engine will have no water circulation and prolonged running will cause damage.

To inspect the bearing see dismantling procedure section.

3. Gland Seal:

This is a carbon face seal type with bronze counterface and should require no attention.

To inspect seals see dismantling procedure section.

4. Drive Shaft Universals:

Every thirty hours sparingly grease the universal joints and sliding splines. Do not over grease.

5. Sacrificial Anodes:

The unit is fitted with anodes on the intake casting which will waste away in sea or contaminated water. Regularly inspect these anodes, and replace immediately they are reduced in size to a serious degree. If allowed to disappear, corrosion will start on the Aluminium parts which could eventually damage the unit.

6. Debris, Etc. in Unit

Any debris such as wood, water weed, etc, caught in the intake screen, impeller or tailpipe stator vanes will affect the jet unit's performance. The 1313 jet is provided with an inspection cover which readily gives access to the above blockages.

On most installations the static level of water inside the jet unit will be below the intake inspection cover lip and the cover can be removed provided the engine is stopped and the craft is stationary.

If the static water line is too high then often by moving the load to the bow of the boat or placing a heavy load on the bow end the stern is raised enough to allow the cover to be removed.

To remove the cover:-

Remove the two nuts and washers and draw the cover off.

Blockages of the unit are usually noticed by (a) the engine 'racing' and/or (b) lack of jet thrust or boat speed.

Great care should be taken to avoid ropes or vines as these, if caught around the impeller shaft, will be wound into the jet unit.

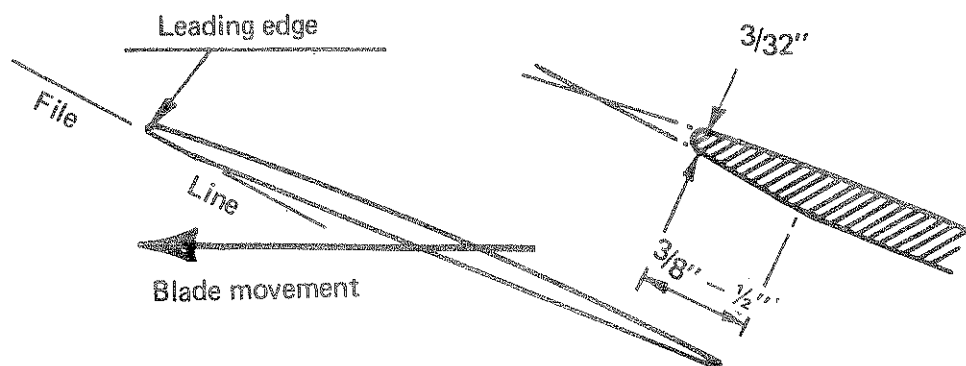
Recommended practice is to close the throttle or even stop the engine and coast over such bad debris if the boat cannot steer round it.

Smaller pieces of debris, water weed, etc, will not normally foul the unit.

7. Impeller:

The leading edges of the impeller may tend to become 'blunt' after a period of time with the action of small solid particles in the water. The performance of the impeller will drop with the blades blunt.

Anytime the inspection cover is removed (as above) the leading edge of the blades should be inspected for wear. If badly worn, remove impeller (see section on Dismantling Unit) and sharpen as shown below.



Details of Impeller Sharpening

8. Reverse and Steering Joints

The reverse bucket and steering joints which are outside the hull may tend to seize if the boat is laid up or stationary for some time.

These joints should be oiled after such periods and checked to see they are operating freely. Once in the water these joints will be water lubricated and will not normally require attention.

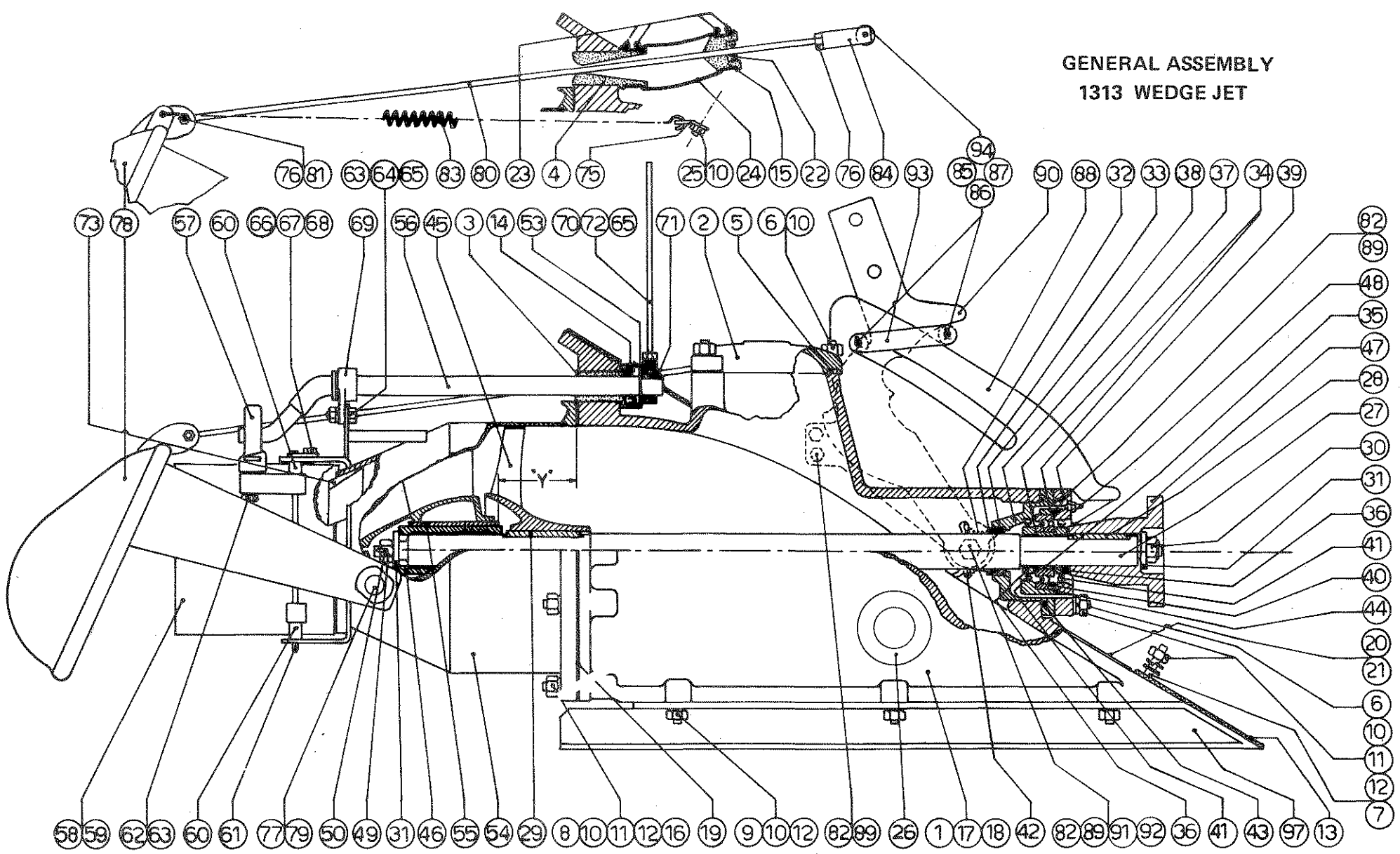
9. Care of Stainless Steel:

Stainless steel should not be painted, coated with anti-fouling or any similar treatment normally associated with mild steels. Stainless steel best resists rust and corrosion when the surface is clean and highly polished. The surfaces of the stainless steel components should be regularly inspected for signs of corrosion. Any areas of corrosion should be polished out with a fine emery cloth and the stainless steel brought back to a shiny surface finish.

In general, clean off oil slicks, chemical depositis, etc, daily, as stainless steel may corrode under such a deposit.

10. Periodically when the craft is on the slip, or at least an annual survey, the complete unit should be removed from the boat, and inspected internally and externally for faults, corrosions, or breakages. Clean down and repaint the intake castings. (Do not use copper-based paints).

GENERAL ASSEMBLY 1313 WEDGE JET



MODEL 1313PARTS LISTINTAKE ASSEMBLY

<u>Item</u>	<u>Part No.</u>	<u>Description</u>	<u>Quantity</u>
1	102114	Intake	1
2	102115	Inspection Cover	1
3	102143	Steering Shaft Bush	1
4	102141	Reverse Shaft Bush	1
5	102170	Inspection Cover Seal 171 ID x 10 dia.	1
6	102175	16 mm Stud (Inspection cover & bearing housing) SS	6
7	102176	16 mm Stud (Intake to hull)	17
8	102177	16 mm Stud (Tailpipe)	8
9	102178	16 mm Stud (Base)	6
10		M 16 Hex Nut 18-8 SS	38
11	102153	Washer	30
12		16 mm Spring Washer SS	38
13	102144	Gasket (Jet Unit to Hull)	1
14	61348	Steering Shaft Seal 1 1/8 x 1 5/8 x 3/8 (Repco Type A. B. 01 Rustless Spring)	1
15	102142	Seal Bush	1
16	102154	Tailpipe Insulating Washer	8
17	102169	Tailpipe Dowel	2
18	102147	Bearing Housing Dowel	2
19	102158	Tailpipe Gasket	1
20	63135	Patent Plate	1
21	63097	Name Plate	1
22	61349	Oil Seal 5/8 x 1 1/8 x 1/4 Rustless Spring (Repco Type A. B. 01)	1
23		Hose Clip "Rex No. 2" SS	4
24		Radiator Hose 64 ID 2 ply x 150 long	1
25	102181	16 mm Stud (Intake to hull)	1
26	102185	Anode	2

INTAKE SCREEN

(A variety of options are available)

97	102139	Intake Screen W. A. (fixed bar)	1
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BEARING & SHAFT ASSEMBLY

<u>Item</u>	<u>Part No.</u>	<u>Description</u>	<u>Quantity</u>
27	102118	Mainshaft	1
28	102157	Coupling Key	1
29	102132	Impeller Key	1
30		M20 Self Locking Nut Cad. plated	1
31	102155	Shaft Washer	2
32	61351	Romet Seal SCR 666/175	1
33	102120	Seal Insulator	1
34	102121	Bearing Insulator Washer	2
35	102122	Bearing Insulating Sleeve	1
36	102119	Seal Sleeve	2
37	102116	Bearing Housing	1
38	102137	Seal Counterface	1
39	102138	Bearing Retainer	1
40		Bearing SKF QJ309 or equivalent	1
41	61350	Type 231 Rubber covered seal 60 x 75 x 8 Rustless spring. Flaseal 16991	2
42		Split Pin 7 x 50 SS	1
43		O Ring 5 3/8 x 5 5/8 x 1/8 GS	1
44		O Ring 4 x 4 1/4 x 1/8 GS	1
45	102127	Impeller 90 HP @ 2500 RPM	1
46	102134	Bearing Sleeve	1
47	102123	Coupling Flange	1
48		Grease Nipple 1/8 BSP x 45	1
49		Slotted Nut M20 SS	1
50		Split Pin 3 x 38 SS	

TAILPIPE & STEERING ASSEMBLY

<u>Item</u>	<u>Part No.</u>	<u>Description</u>	<u>Quantity</u>
53	102183	3.1 x 28.5 Washer SS	1
54	102126	Tailpipe W. A.	1
55	80682-446	Cutless Bearing	1
56	102133	Steering Shaft	1
57	102117	Tie Bar	1
58	102124	L. H Deflector	1
59	102125	R. H Deflector	1
60	102131	Deflector Pivot Bush	4
61	102129	Hinge Pin W. A.	2
62	102130	Tie Bar Pivot	2
63		M 16 Hex Nut 18-8 SS	4
64		M 16 Hex Bolt x 40 18-8 SS	2
65		16 mm Spring Washer SS	4
66		M10 Hex Bolt x 20 18-8 SS	2
67		M10 Hex Nut 18-8 SS	2
68		10 mm Spring Washer SS	2
69	102136	Steering Shaft Support Bearing	1
70	102135	Steering Arm W. A.	1
71	102168	Steering Shaft Key	1
72		M16 Hex bolt x 65 18-8 SS	1
73	102179	Nozzle	1
74	102187	6 x 20 mm Csk screw, nut, lockwasher SS	5

REVERSE ASSEMBLY

75	102180	Reverse Spring Lug	1
76		M16 Hex. Nut 18-8 SS	2
77		Split Pin 8 x 65 SS	2
78	102128	Reverse Bucket W. A.	1
79	102140	Reverse Bucket pivot bush	2
80	102159	Reverse Push Rod	1
81		M16 Hex Bolt x 90 (Max. thread 38) SS	1
82		M16 Hex Bolt x 40 18-8 SS	4
83	102161	Reverse Bucket Spring	1
84	102164	Clevis	1
85	102160	Clevis Pin	2
86	102165	Roller	3
87		Split Pin 5 x 25 SS	4
88	102166	Guide	1
89		16 mm Spring Washer SS	4
90	102167	Reverse Lever	1
91	102171	Reverse Lever Bush	1
92	102173	Reverse Lever Spacer	1
93	102172	Link	2
94	102182	Roller	4

DISMANTLING PROCEDURE

(Note: It is assumed that the boat is slipped for work in this section).

1. TO CHECK CARBON SEAL AND BEARING ASSEMBLY

- (a) Unfasten the rear end of the universal driveshaft.
- (b) Using a pin spanner on coupling holes (47), undo coupling end nut (30) and remove coupling washer (31).
- (c) Draw off coupling (47) and remove the key (28).
- (d) Remove bolt (82) and spring washer (89) that holds the reverse lever guide (88) to the bearing retainer (39). Loosen the other nuts holding this plate.
- (e) Remove the four bearing retainer nuts (10), spring washer (12) and flat washers (11).
- (f) It may be necessary to hold the mainshaft rearwards from the very front of it, along its axis while sliding the seal sleeves and bearing housing forward. This is so the shaft will not pull out of the rear bearing. Pull the retainer plate (39) forward and free from the shaft, taking care not to damage the oil seal. Slide off the seal sleeve (36) and insulating washer (34). Take care not to damage the chromed surface on the outside of the sleeve.
- (g) Slide the bearing housing (37) with bearing (40) off the shaft. The rear seal sleeve (36) and insulating sleeve (35) will come off at the same time.
- (h) With the mainshaft supported by the rear bearing, slide the Romet seal (32) forward off the shaft.

(Take care not to damage the face of the carbon seal or its counter-face (38) which is in the rear of the bearing housing).
- (i) Thoroughly clean all components in a grease solvent.
- (j) Examine all parts for wear, damage, etc, and replace if necessary. The surface finish of the carbon seal (32) and counterface (38) is most important to obtain a satisfactory seal, the seal faces having a lapped finish.

If the surface of the seal sleeves (36) is pitted or scratched where the seals run, they should be replaced. The seals (41) should be tight when assembled on the sleeves, and when held up to the light, no light should pass between the sleeve and the seal lip. If it is a loose fit and light passes through the gap, replace the seals. Examine the running surfaces of the bearing for pitting and/or wear and also the cages to ensure it is still intact. Examine the "O" Rings for cuts or deformities and replace if necessary.

1. Reassembly

Avoid dirt and grit at all times.

- (k) Replace carbon seal (32) with insulator (33) between the spring and "O" Ring.
- (l) Smear the "O" Ring (43) and the mating faces of the intake (1) and bearing housing (37) with lanoline. Slide the bearing housing (37) with seal (41) and counterface (38) installed, but without the bearing over the shaft and into position, taking care not to damage the seal counterface (38).
- (m) Slide on to the shaft the rear seal sleeve (36), bearing insulating washer (34), and bearing insulating sleeve (35).
- (n) Slide over the insulating sleeve, one half of the split inner race of the bearing, making sure the ball track is facing forward. Insert the outer race of the bearing with balls and cage into the recess in the bearing housing making sure the inner races are to the same side before being split up. Push the other inner bearing race over the insulating sleeve to finish assembling the bearing.
- (o) Replace the insulating washer (34) and front seal sleeve (36).
- (p) Smear mating faces of the retainer plate (39) bearing housing and "O" Ring (44) with lanoline. Slide into position and replace flat washers (11), spring washer (12) and nuts (10) on the four studs and tighten to 80 ft lb or 11 kg metre.
- (q) Replace bolt (82) and spring washer (89) and retighten this and the other bolts holding the reverse guide plate to 80 ft lb or 11 kg metres.

2. TO CHECK REAR (CUTLESS) BEARING

- (a) Remove reverse spring anchor (75), reverse bucket spring (83), reverse push rod nut (76) and bolt (81), split pin (77) and reverse bucket pivot bush (79). Slide the bucket arms off their pivots and withdraw the reverse bucket (78).
- (b) Remove the two nuts (63), tie bar pivots (62) on each end of the tie bar (57) and then remove the tie bar.
- (c) Loosen the steering arm clamping bolt (72) and withdraw the steering arm (70) from the steering shaft (56). Remove the key (71) and withdraw the steering shaft (58) from the rear of the unit.
- (d) Remove the eight nuts (10), spring washers (12) and flat washers (11) that hold the tailpipe to the intake.
- (e) As the only support for the mainshaft and impeller is from the front bearing assembly with the tailpipe removed, extreme care must be taken when the tailpipe (54) is withdrawn from the intake (1) and the weight is taken off the two tailpipe dowels (17). The tailpipe must be completely axially removed from the rear bearing (55) and impeller so as to avoid excess weight on the rear of the mainshaft.

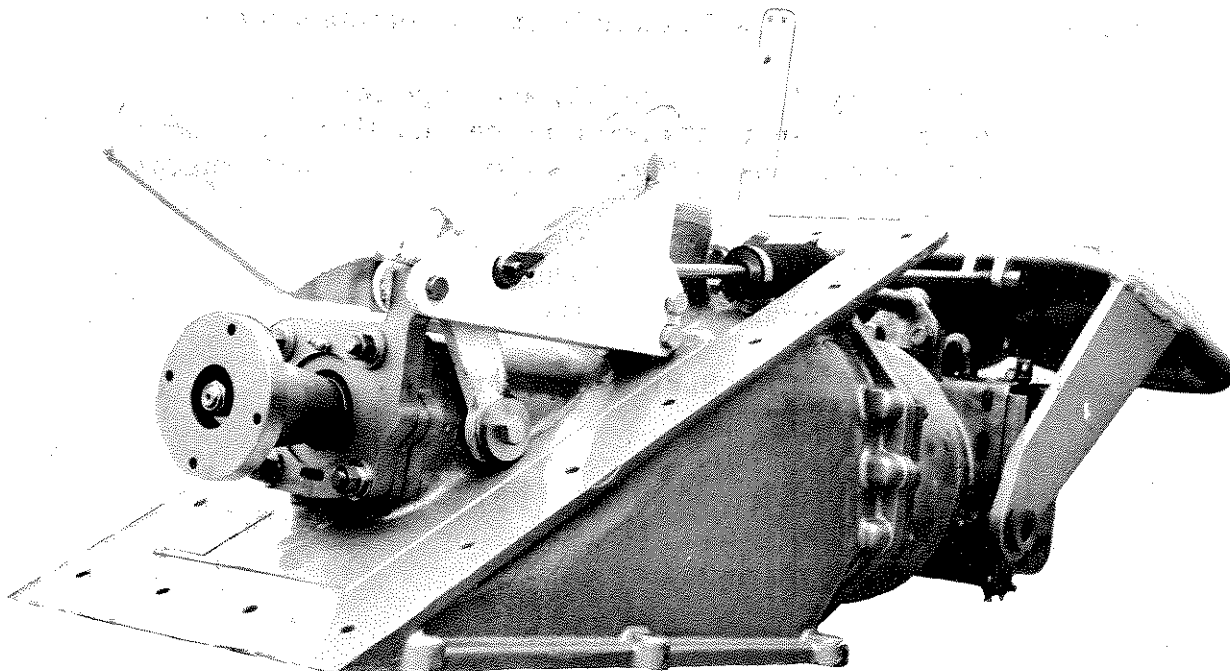
- (f) Examine the running surface of the rubber cutless bearing (55). If badly worn or scored, the bearing should be replaced. Use an internal puller to remove worn bearing from the tailpipe (54). Fitting the new bearing should be done with a press. If this is not possible, the bearing can be driven in with a suitable mandrel but the bearing itself should never be struck with a hammer or similar. Press or drive the bearing in till dimension "Y" equals 4 inches or 102 mm from the front face of the tailpipe flange (that which contacts the intake face on assembly) to the front end of the cutless bearing. It is best measured by placing a straight edge across the tailpipe flange and measuring down to the cutless bearing.
- (g) Examine the impeller leading edges for damage and for blunt edges. If the impeller requires attention proceed with Section 3, "To Remove Impeller". If the impeller is satisfactory reassemble using the reverse of the procedure above, "To Dismantle". The following should however, be noted:-
 - (i) Coat the bearing sleeve (46) with french chalk so that the cutless bearing (55) is not damaged on reassembly.
 - (ii) Tailpipe stud nuts (10) should be torqued to 80 ft lb or 11 kg metres.

3. TO REMOVE THE IMPELLER

(First refer to Part 7 of the Maintenance Section for details of inspecting impeller and sharpening blades. Proceed as in Part 2. "Rear (Cutless) Bearing" from Steps (a) to (e).

- (a) Examine the cutless bearing as in (f) of the previous section and replace if necessary. The shaft and impeller are now accessible from outside the boat. Lock the mainshaft to stop it turning. (It is recommended that a pin spanner be applied to the front coupling (47) to do this).
- (b) Remove the split pin (50), undo the rear shaft nut (49) and remove the washer (31). When undoing the shaft nut, support the impeller by placing a piece of wood under the impeller and into the intake to minimise the downward leverage transmitted to the front bearing.
- (c) Slide off the bearing sleeve (46) and take care not to damage the outside bearing surface.
- (d) The impeller (45) can now be drawn off and the key (29) removed. Should the impeller be difficult to remove from this position, dismantle the coupling end of the shaft assembly as in Section 1. "Carbon Seal and Bearing Assembly" from Steps (a) to (g), and slide the impeller (45) and shaft (27) out from the rear of the intake (1).
- (e) When the impeller and key are removed from the shaft, clean shaft and keyway thoroughly. Polish lightly with fine emery cloth if necessary to remove any scale, etc.

- (f) If the shaft has been removed, reassemble the coupling end back in the unit as for Section 1 from Steps (k) to (q).
- (g) Overhaul the impeller as outlined in Part 7 of Maintenance Section.
- (h) Smear shaft (27), key (29), sleeve (46) and impeller bore with lanoline. Replace key in shaft and slide the impeller and bearing sleeve on to the shaft, making sure the slot in the sleeve engages with the key.
- (i) Replace washer (31) and do up rear shaft nut and torque to 160 ft lb or 22 kg metres. Replace split pin (50).
- (j) Reassemble tailpipe as for Section 2, Part (g).



1313 jet unit showing 'wedge' mount arrangement.



The 1313 assembly line.

EXAMPLES OF SUITABLE APPLICATIONS



27ft. aluminium barge.



36ft. fibreglass fishing boat operating in Japan.

