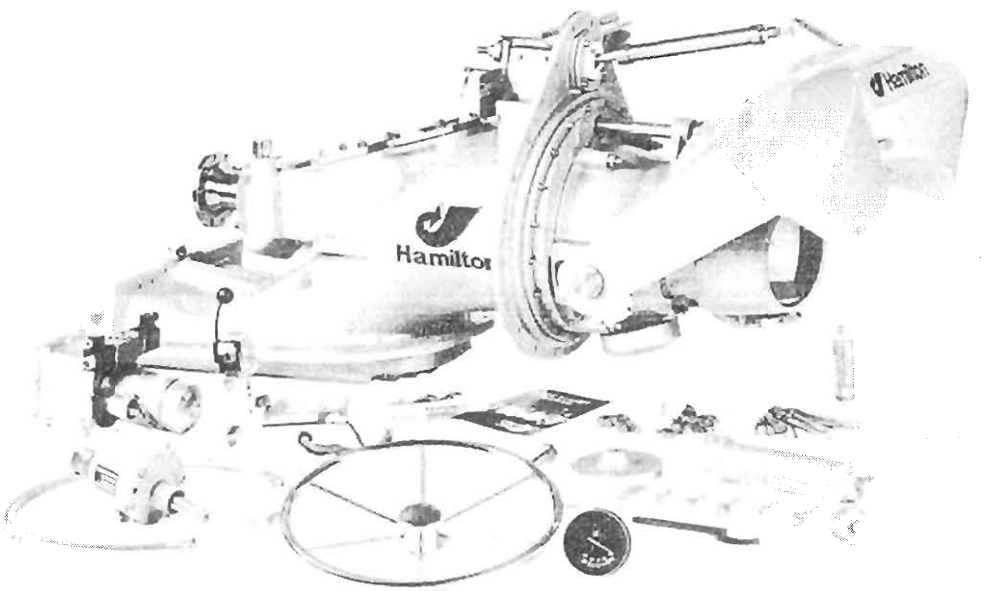
HamiltonJet

MARINE PROPULSION UNITS

MODEL 361



Part No. **98891** DECEMBER 1986—ECL 5M-1 -88

MODEL 361

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MODEL 361

GENERAL DESCRIPTION

A1-12-86

The Hamilton 361 Waterjet is a highly efficient, axial-flow pumping unit which provides propulsive thrust from the reaction of the water jetstream being ejected rearwards. Normally driven by a diesel or gas turbine marine engine, the unit can be used in planing and displacement craft or in a dual speed role as both loiter and high speed boost propulsion. Any number of waterjets can be employed without loss of propulsive efficiency.

The waterjet mounts inboard at the stern, drawing water through a reinforced opening in the hull bottom. Propulsive thrust generated is fully transferred through the jet intake to the hull - no thrust is transmitted through the driveshaft to the engine. The intake is protected by a highly developed screen which at planing speeds is largely self cleaning.

The pumping unit carries through the transom, where it is sealed with a compressed rubber seal, and discharges water directly aft through the outlet nozzle.

A single conical steering deflector aft of the nozzle deflects the water to port and starboard, giving powerful steering. The pivot axis of the steering deflector can be rotated 15° for port and starboard jets to give optimum steering thrust in hulls of up to 30° deadrise. Steering is manual hydraulic, activated via an inboard mounted tiller.

A hydraulically controlled thrust reversing deflector cuts the jetstream aft of the steering deflectors providing an infinite range of forward, zero or reverse manoeuvring speeds. Hamiltons Electronic Reverse Control (HERC) system gives fingertip reverse control. Full steerage is always available even at "zero speed".

By working the reverse and steering controls in unison a resultant thrust can be obtained in any direction giving 360 degree thrusting ability. In an emergency the reverse deflector can be lowered while underway acting as a powerful brake.

Designed and manufactured in corrosion resistant materials to international certifying authorities standards, the 361 is further protected by the fitting of large sacrifical anodes. The units are supplied as a complete package including steering and reverse systems with controls. A marine gearbox is not necessary, the waterjet matches a large range of common diesel engines and is normally directly driven by a short driveline connecting to the engine flywheel.

SPECIFICATIONS

Configuration .. Single stage axial flow.

Rotation ..... Left hand only (anti-clockwise looking at engine flywheel).

Casings ..... Cast LM6 aluminium alloy.

Mainshaft 70mm diam. SAF 2205 stainless steel.

Impeller ..... 4 bladed, cast.

Front Bearing .. Oil lubricated spherical roller.

Thrust Bearing . Oil lubricated spherical roller.

Tail Bearing ... Water lubricated cutless bearing.

Shaft Seal ..... Face type mechanical seal.

Transom Seal ... Compression rubber.

Classification . ABS, Lloyds & others available.

Corrosion Protection ..... Cathodic with anodes.

Std Coupling Flange ..... 140mm diam., 8 bolt.

Unit Weight Dry ..... 305 kg

Entrained Water Weight ... 70 kg

Weight of Intake Block :
- GRP ..... 26 kg
- Aluminium ..... 45 kg
- Steel ..... 42 kg

Steering System .. Manual hydraulic.

Reverse System ... HERC system - electronic control over power assisted hydraulics.

STANDARD EQUIPMENT :

Impeller and Nozzle to match engine.

Installation Kit to match hull material.

Single station HERC Reverse Control system with 12 or 24V DC electro-hydraulic power unit.

Single station Manual Hydraulic Steering System.

Transom Seal assembly.

Heavy duty aluminium bar Intake Screen.

Intake Raking Screen - kick down operated.

Cathodic Protection with anodes.

Inspection Hatch.

Outboard Inspection Hatch.

Outboard Water Offtake.

Special Tools Kit.

Jet and HERC System Manuals.

OPTIONAL EQUIPMENT :

Dual station steering and reverse controls.

Multiple jet Reverse Controls.

Kit for hydraulic operation of raking screen.

Inspection Hatch Overflow Preventer.

Universal and Torsionally Flexible driveshaft systems.

Flywheel or gearbox flange Adaptor Plates.

Certification (ABS, Lloyds etc).

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PLANING SPEED CRAFT (Over 20 knots)

- Plan for a minimum of 25 knots (laden speed) for good efficiency.
- Monohedron (constant deadrise) hull shape preferred (being directionally stable without the addition of appendages) with deadrise angles between 10^{o} and 30^{o}.

	Single Jet	Twin Jet	Triple Jet
Maximum recommended boat displacement ...	12 Tonnes	26 Tonnes	42 Tonnes
Minimum recommended power/weight ratio ::	35 kW/Tonne (45 hp/tonne)	30 kW/Tonne (40 hp/tonne)	25 kW/Tonne (35 hp/tonne)
Maximum power input (per jet) :::::::::	At 2300 rpm ..... 500 kW (670 hp)		

SEMI-PLANING SPEED CRAFT (10–20 knots)

- Hull resistance for some craft can be extremely high in this speed region and C.W.F. Hamilton should be consulted in all cases.
- Long harrow hulls are suitable including multi-hulls.
- Maximum power input (per jet) : 300 kW (400 hp)

DISPLACEMENT SPEED CRAFT (under 10 knots)

- A conventional vee'd stem bow with a minimum deadrise of 5^{o} is recommended to avoid air entry into the jet.
- Minimum jet immersion is with the waterline at the jet mainshaft.
- For displacement speed hulls, speed depends more on efficient hull shape than displacement or input power. The following displacements can be at least doubled for long narrow easily driven craft.
- Best efficiency will be obtained using low input power at, or below the crafts natural displacement speed.

	Single Jet	Twin Jet	Triple Jet
Recommended maximum displacement :::::::	20 Tonnes	45 Tonnes	90 Tonnes
Maximum recommended power input ::::::::	225 kW (300 hp) per jet		

MULTIPLE SPEED CRAFT

- Because engine overload does not occur and appendage drag is eliminated, 361 water jets are a simple solution to multiple speed capability whether mixed with water jets or other propulsors.
- Follow the guidelines for Planing and/or Displacement Speed Craft as appropriate.

N O T E :

The above Scope of Use is only a guide :-

If the application is outside any of the above limits, it is most important to seek the detailed advice of C.W.F. Hamilton & Co Ltd before proceeding. We will be happy to advise on the available options.

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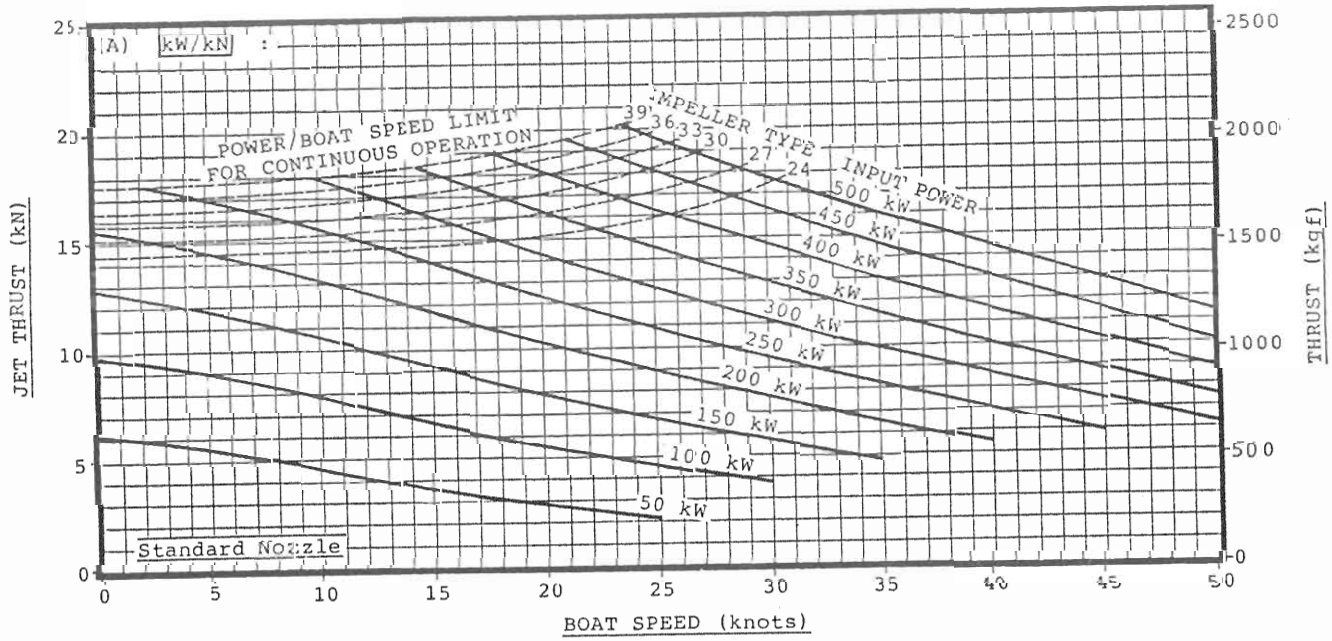
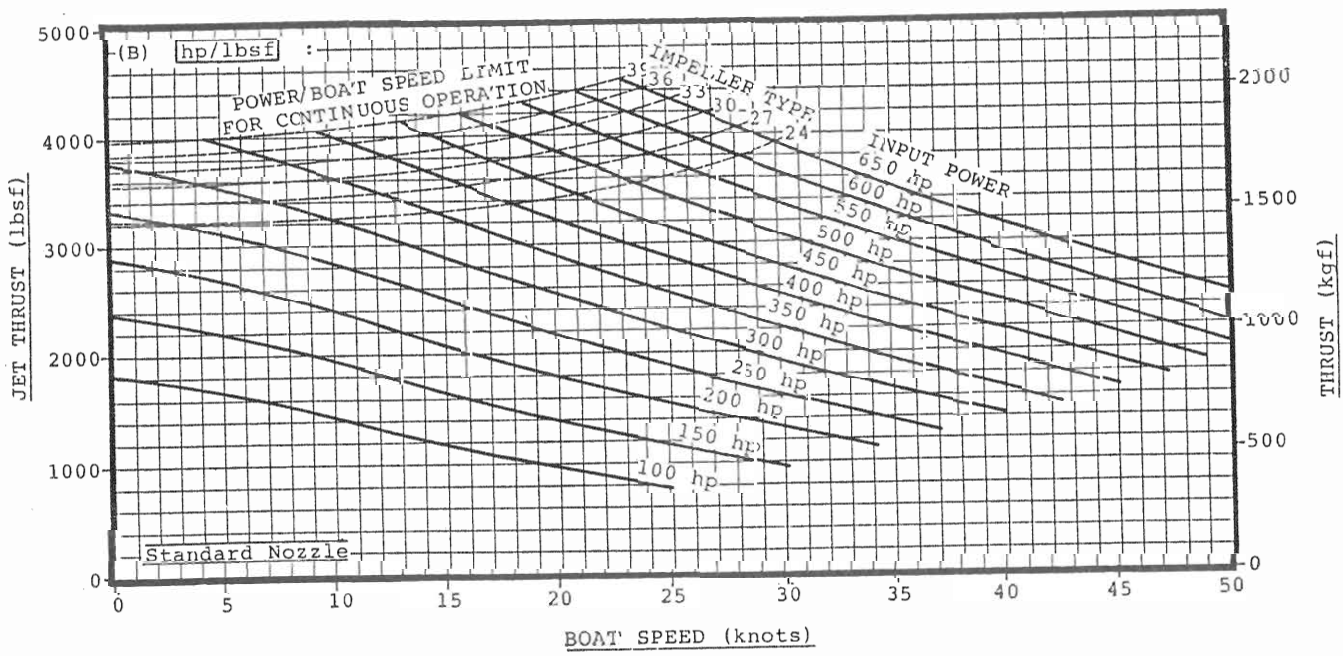
Where bare hull resistance (no appendages) is known this can be plotted directly against the jet thrust curves. (Divide the hull resistance by the number of jets before plotting).

Compare the inter-section of hull resistance and jet thrust curves with speed to estimate the unknown factor.

Note :-

If hull resistance is not known supply the following to C.W.F. Hamilton & Co Ltd for an estimate:
- displacement laden and unladen, LWL (water line length), maximum chine beam and the deadrise both amidships and at the transom.





Reverse thrust - is up to 55% of forward thrust.

Steering thrust - at right angles to the craft is up to 42% of forward thrust at full lock and is available at all speeds from full astern through to full ahead including at zero speed.

Power/Boat Speed Limit - the continuous (or cruising) Input Power versus Boat Speed point must lie to the right of the limit line of the impeller to be used. Intermittant operation to the left of the limit lines is allowable e.g. during acceleration up to planing speeds.

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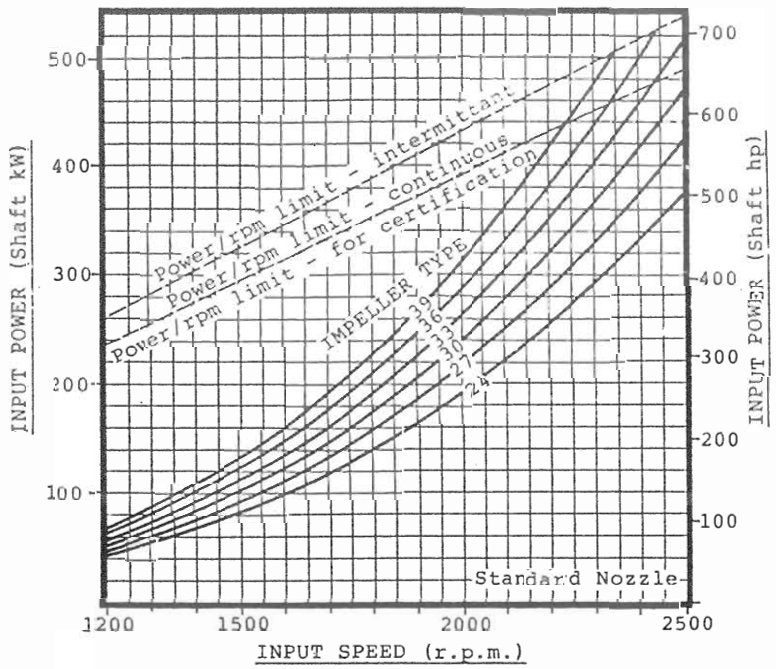
POWER REQUIREMENTS



The engines maximum flywheel power/rpm output (or shaft output if a gearbox is used) should lie within the area between the types 24 and 39 impellers. Where the engines maximun power/rpm does not coincide closely with one of the impeller types shown the jet can be fitted with a "large" or "small" nozzle to get a closer match.

TYPICAL MATCHING ENGINES:

These are direct drive matchings - a gearbox is not necessary. Many other matchings are possible both with and without use of a gearbox.

FOR PLANING CRAFT

Make	Model	Max. kW (hp)/rpm
CATERPILLAR	3406B	345(463)/2100
	3408B	375(503)/2100
FIAT	8281 SRM	405(550)/2400
G.M. DETROIT	6V--71 TA	325(435)/2300
	8V--71 TI	345(462)/2300
	6V--92 TA	354(475)/2300
	8V-92 TI	485(650)/2300
M.A.N.	D2866 LE (6)	300(408)/2300
	D2848 LE (8)	375(510)/2300
	D2840 LE (V10)	460(625)/2300
MERCEDES	OM422 IA	276(375)/2300
	OM423 IA	368(500)/2300
	OM424 IA	452(615)/2300
MWM	TBD 234 V6	360(489)/2300
	TBD 234 V8	480(652)/2300
NISSAN	RD8 TA	275(375)/2300
	RD10 TA	405(550)/2350
SCANIA	DSI 11	261(355)/2200
	DSI 14	331(450)/2100
VOLVO	TAMD 121 C	300(408)/2000

FOR DISPLACEMENT CRAFT

Make	Model	Max. kW (hp)/rpm
CATERPILLAR	3406B	186(250)/1800
CUMMINS	NT-855-M1	175(235)/1800
DETROIT	6V92	178(239)/1800
	8V71(2)	178(239)/1800
DEUTZ	S/A 6M 816	153(208)/1800
M.A.N.	D2866E	151(205)/1800
	D2866TE	194(264)/1800
	D2866LE	221(300)/1800
MERCEDES	OM421	135(184)/1800
	OM422	180(245)/1800
MITSUBISHI	8DC9	164(223)/1800
	8DC9T	224(304)/1800
MWM	D234 V8	164(223)/1800
	TBD 234 V8	227(308)/1800
SCANIA	DS 11	172(234)/1800
	DSI 11	202(275)/1800
VOLVO	TMD 121 C	221(300)/1800

GENERAL ARRANGEMENT:
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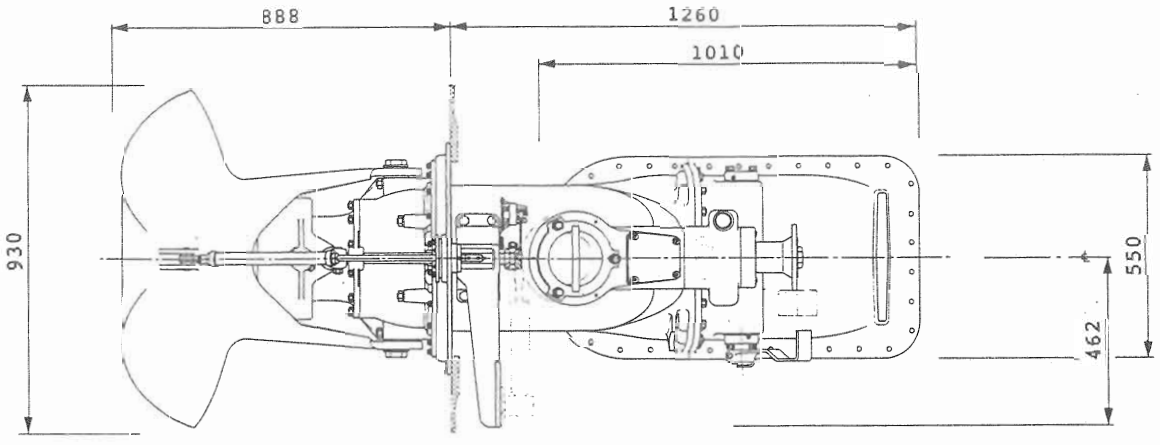

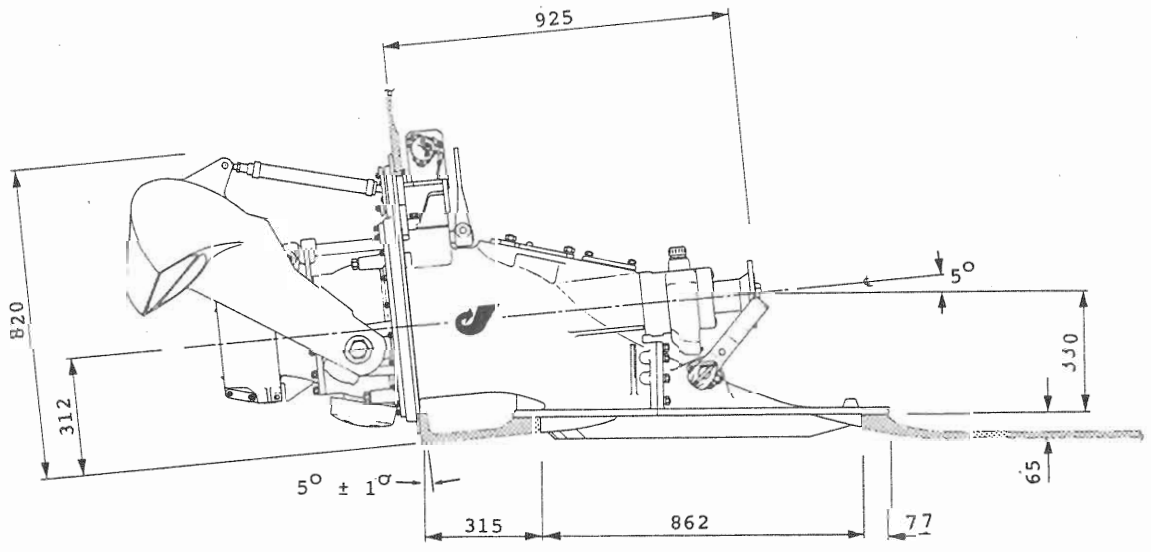

Scale 1:20

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PLANNING GUIDE (Planing Craft)

1. IS THE HULL SHAPE SUITABLE - refer "HULL SHAPE GUIDE" (Page F2).

2. DETERMINE REQUIRED POWER/WEIGHT RATIO - refer "SPEED GUIDE TABLE" (Page F3). Knowing the speed required and the approximate L.W.L. read off the required power/weight ratio.

3. ESTIMATE THE BOATS AUW (All Up or Laden Weight).

4. REQUIRED TOTAL HP = Power/Weight Ratio x AUW.

5. CHECK THAT 361 JET(S) ARE SUITABLE - The maximum AUW's for the 361 Jet(s) in planing craft are :-

Single 361 Jet	-	12 Tonnes max AUW
Twin 361 Jets	-	26 Tonnes max AUW
Triple 361 Jets	-	42 Tonnes max AUW

If the customers requirements give an AUW outside these limits then either :-

(a) a lightened boat AUW is necessary; or
(b) larger jet(s) are required.

6. DETERMINE SUITABLE ENGINE - refer engine selection table (Page D1). Divide the "Required total hp" by the number of engines to be used to determine required hp of each engine. From the Table of Matching engines for the choosen jet select an engine of hp equal to or greater than that required.

NOTE : It may be necessary to select a different model of jet than indicated by the above planning just to match the customers choice of engine. In this case re-check the AUW is within the capability of this jet or jets. If the desired engine does not appear in the table consult C.W.F. Hamilton & Co Ltd.

7. RE-CHECK SPEED - Re-estimate AUW knowing actual weights of the selected engine(s) and jet(s). Determine :-

$$\text{Power/weight ratio} = \frac{\text{Total input hp}}{\text{AUW}}$$

From Power/Weight ratio and boats L.W.L. check predicted speed on "SPEED GUIDE TABLE". This should exceed the desired speed to allow a performance margin.

8. MORE ACCURATE SPEED ESTIMATE - The above planning is a guide to performance. Having selected the engine and jet combination and finalised AUW etc, a more accurate speed estimate can be made by comparing the boats hull resistance with the jet thrust.

If hull resistance is not known supply the following information to C.W.F. Hamilton & Co Ltd for an estimate :-

- OAL
- LWL
- Max. Chine Beam
- Deadrise Amidships
- Deadrise at Transom

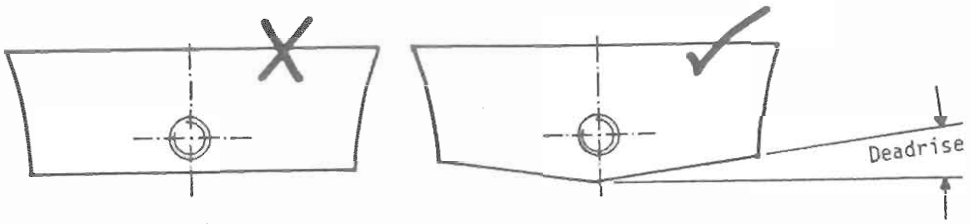
9. POWER/BOAT SPEED LIMIT - Noting the impeller type which matches the selected engine(s) check that the intersection of cruising speed and cruising power input lies to the right of (or below) the Power/Boat Speed Limit for that impeller. (Refer thrust curves Page C1).

10. INSTALLATION DATA - If the above planning gives a suitable solution consult :- Multiple Installations page F8; Performance Check and How to Order page F9; then Section G for hull preparation and installation data.

11. IF IN DOUBT - CONSULT C.W.F. HAMILTON & CO LTD.

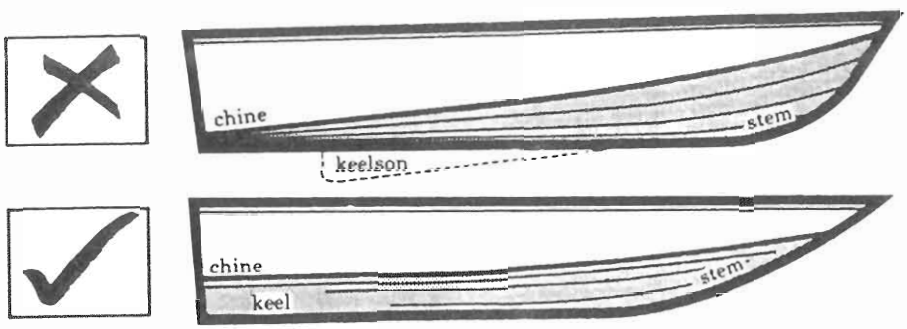
HULL SHAPES

Some DEADRISE angle in planing hulls is desirable. 10^{o} minimum is recommended.



This will ensure that aerated water from the bow wave will not enter the jet unit causing slip and loss of power.

Monohedron lines are recommended i.e. chine and keel parallel, at least over the planing area.



Monohedron - constant deadrise or vee angle.

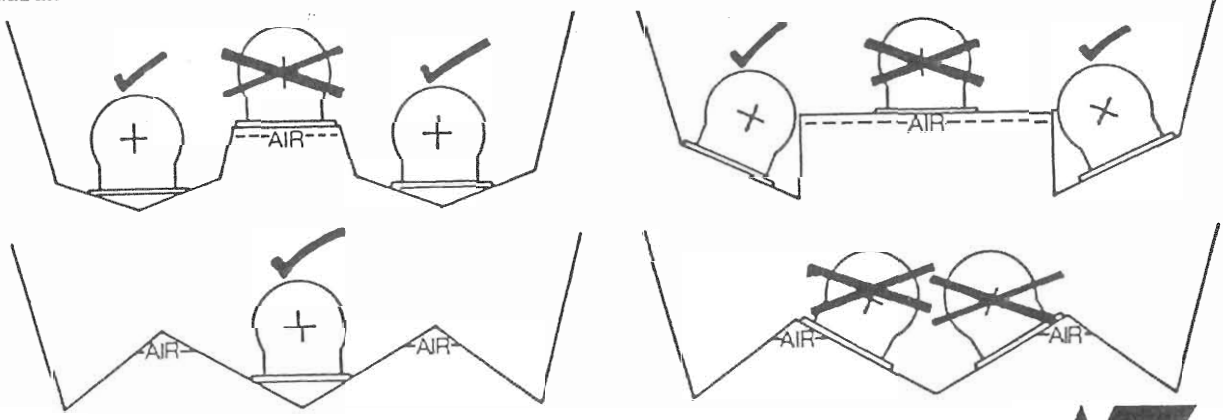
The STEM should be easy rising as a deep, fine forefoot can cause steering problems if the hull has any tendency to ride flat.

There must be NO KEEL, RUDDER, PLANING STRAKES OR ANY OTHER UNDERWATER APPENDAGES FOR AT LEAST 2m (7 ft) IN FRONT OF THE JET INTAKE. Such protrusions from the hull can interrupt water flow and divide water away from the intake. Strakes and/or keels outside the intake area are acceptable.

To ensure that the static draught is sufficient to PRIME THE JET UNIT, water must reach at least to the level of the main shaft when the boat is at rest.

MULTI-HULLS

Jets can be fitted in catamaran or trimaran hulls. Air entrainment between the hulls is part of the function of these craft in order to reduce hull resistance. Care must be taken that this entrained air does not enter the jet intake(s). This is alleviated if the hulls are deep in relation to the air tunnels so that the jet(s) when mounted in the hull(s) sit well down in the water. The reverse duct of the jet, when in the "up" (ahead) position must not project beyond the sidewalls of a catamaran or trimaran hull otherwise substantial drag may be caused.



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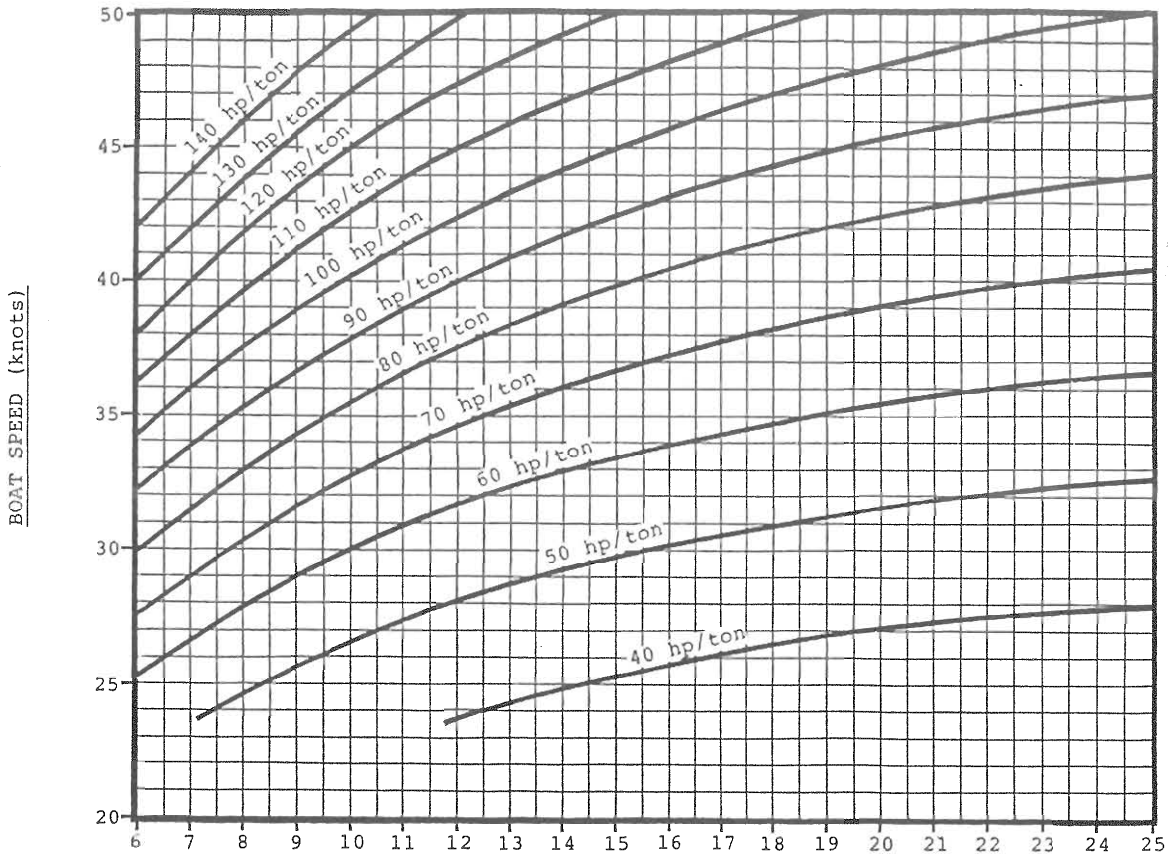
GUIDE TO PLANING SPEEDS:



NOTES :-

- This table should be used as a guide only for conventional monohedron planing hulls. For a more accurate speed estimate compare hull resistance with jet thrust.
- Water jet efficiency improves when craft displacement is less than the maximum recommended for each jet (or jets) - see Scope of Use page B1.
- Water jet efficiency improves with speed. Plan for a minimum speed of 25 knots with directly driven water jets.

To determine input power required :-

- Plot the point of intersection of the hulls LWL and the required speed.
- Read off the Power/displacement ratio at that point.
- The total input power required is then :- Power/displacement ratio x estimated displacement.
- To determine the number of jets refer to "Scope of Use", planing craft, recommended maximum displacements page B1.
- To determine engine power required : divide the total hp required by the number of jets.

(Alternatively with a given power input use the sequence in reverse to determine estimated speed).

Note :- Due to design differences other than the four factors considered this chartwill not provide a completely accurate speed estimate.

PLANNING GUIDE (Displacement Craft)

1. GENERAL - The 361 Jet will give acceptable propulsion efficiencies when used in displacement speed craft with easily driven fine lines (preferred length/beam ratio 5:1 or more) provided only moderate power input is used e.g. up to 150 kW (200 hp). However continuous inputs up to 215 kW (300 hp) can be used where shallow draft and/or very high degree of manoeuvrability are the prime requirements.

   Flat bottomed craft can be jet propelled at displacement speed but a vee'd bow and/or some deadrise is always preferable.

   Do not attempt to drive a displacement speed hull shape beyond natural displacement speed (refer Page F5) with directly driven jets - a semi-planing or planing hull should be used.

2. ESTIMATE LIKELY CRAFT SPEED - Refer to "SPEED GUIDE TABLE" Page F5. Plot L.W.L. against low, medium or high resistance and read off likely natural displacement speed.

3. DETERMINE THE POWER/WEIGHT RATIO - To reach the crafts natural displacement speed and obtain good manoeuvrability use between :-

   - 5 hp/ton - for low resistance full displacement shape designs, especially with length/beam ratios of 5:1 or more; and

   - 15 hp/ton - for high resistance hulls that are poorly shaped for displacement speeds.

4. ESTIMATE THE BOATS A.U.W. (All up or Laden Weight).

5. REQUIRED TOTAL HP = Power/Weight ratio x AUW.

6. CHECK THAT 361 JET(S) ARE SUITABLE - For reasonable efficiency and good manoeuvrability the following AUW limits are a guide for displacement speed craft :-

   Single 361 Jet - 20 Tonnes
   Twin 361 Jets - 45 Tonnes
   Triple 361 Jet - 90 Tonnes

   Note however that weight is not as critical for displacement speed craft, speed depending more on hull shape. Thus with easily driven long, narrow boats and barges the above weights can be doubled or even trebled.

   If the customers requirements give an AUW outside the above limits then either :-

   (a) a lighter and/or longer narrower boat is required to suit the 361 Jet(s); or
   (b) larger jet unit(s) are required.

7. DETERMINE SUITABLE ENGINE - Refer engine selection tables Page D1. Divide the "Required total hp" by the number of engines to be used to determine required hp of each engine. From the Table of Matching engines for the choosen jet select an engine of hp equal to or greater than required. Note power input recommendations in 1. above.

   NOTE : It may be necessary to select a different model of jet than indicated by the above planning just to match the customers choice of engine. In this case re-check the AUW is within the capability of this jet or jets.

   If the desired engine does not appear in any of the tables consult C.W.F. Hamilton & Co Ltd.

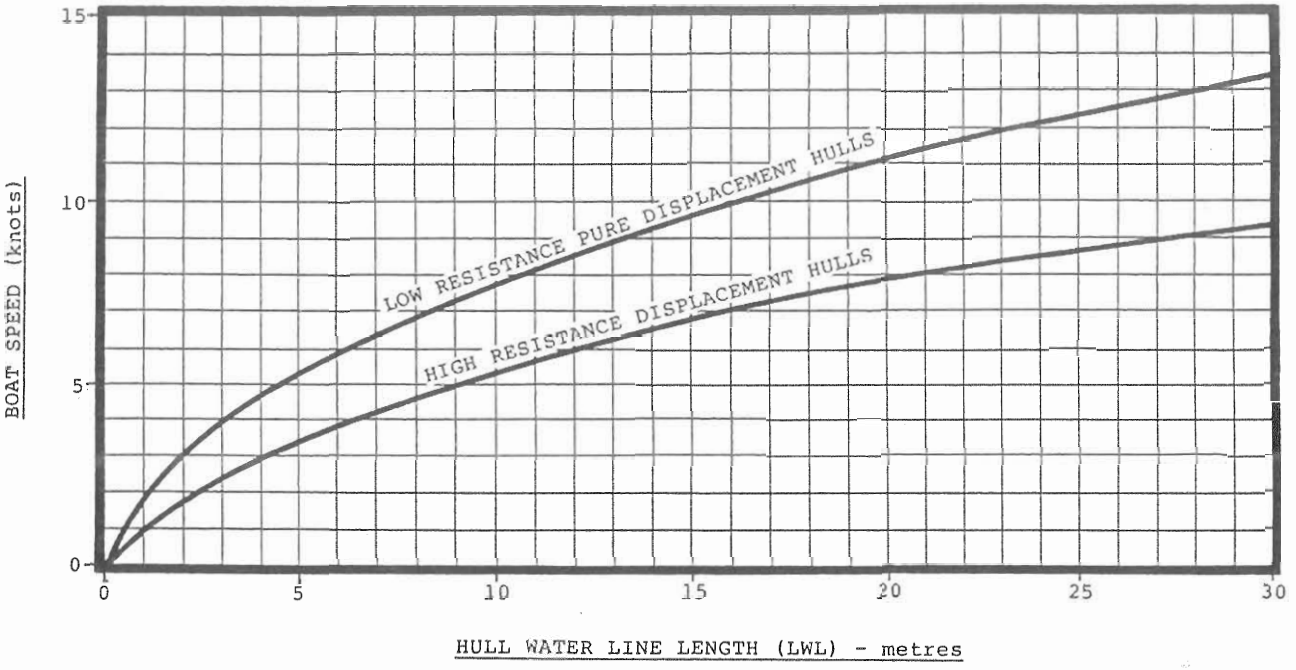
8. MORE ACCURATE SPEED ESTIMATE - The above planning is a guide to performance. Having selected the engine and jet combination and finalised AUW etc, a more accurate speed estimate can be made by comparing the boats hull resistance with jet thrust. (Refer to the Owner's Manual of selected jet model for thrust data). It may be necessary to consult a Naval Architect to estimate hull resistance for a displacement speed craft.

9. POWER/BOAT SPEED LIMIT : Refer Thrust Curves (page C1). Noting the impeller type which matches the selected engine(s) check that the intersection of cruising speed and cruising power input lies to the right of (or below) the Power/Boat Speed Limit for that impeller.

10. INSTALLATION DATA - If the above planning gives a suitable solution refer to "INSTALLATION" Page F6.

11. IF IN DOUBT - consult C.W.F. Hamilton & Co Ltd.

GUIDE TO NATURAL DISPLACEMENT SPEEDS:



INSTALLATION NOTES (Displacement Craft)

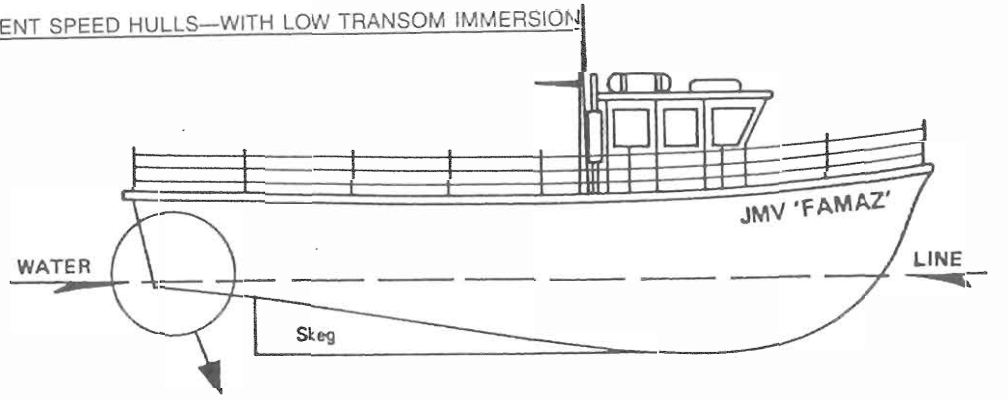
1. The jet unit is installed generally as for planing speed craft.

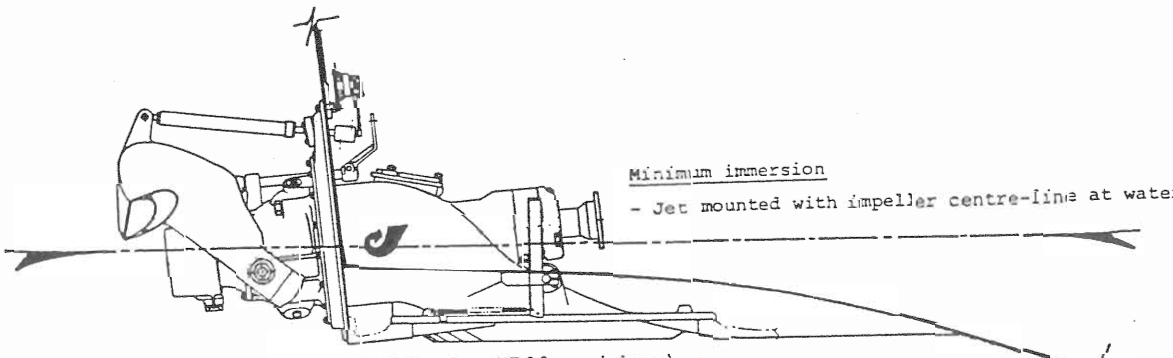
2. The jet can be installed completely submersed - it does not matter whether the jetstream exits into air or water.

3. There must not be any keel, rudder, strakes or other appendages for at least 2m (7') in front of the jet intake.

4. For hulls with low transom immersion hull modification may be necessary so that the jet can be immersed sufficiently to prime. Refer sketches below.

DISPLACEMENT SPEED HULLS—WITH LOW TRANSOM IMMERSION





Minimum immersion
- Jet mounted with impeller centre-line at waterline.

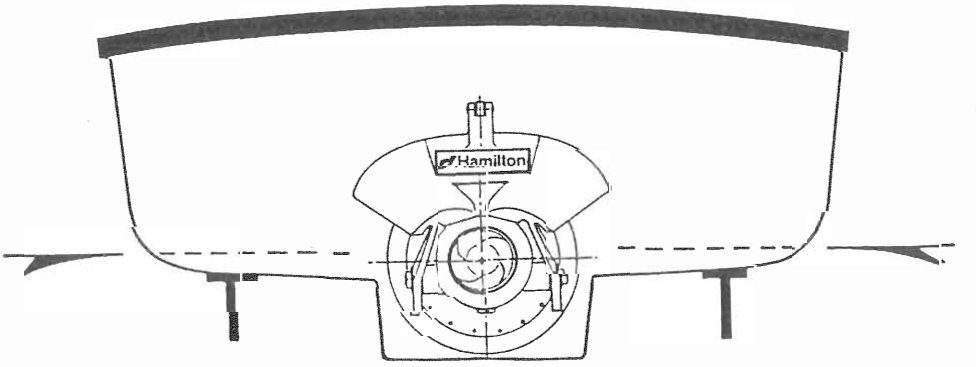
"Pod" added to hull to mount jet (width of pod 700mm minimum).

Remove skeg for at least 2m in front of jet intake.

NOTES :

- Engine should be installed in same position as it would be for a propeller installation or slightly aft of that position, which will improve priming of the jet.

- If more keeling is desired twin keels abeam of the intake is acceptable. (See sketch below).



TWIN BILGE KEELS (optional)

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SEMI-PLANING CRAFT

Semi planing craft generally operate in the 10-20 knot speed region where hull resistance can be very high - often higher than at 25 knots or more. A direct-drive jet or propeller installation will not develop sufficient thrust for optimum efficiency in this speed range.

With a large reduction ratio gearbox driving a large diameter propeller reasonable propulsion efficiency can be obtained at an acceptable cost.

While using a large diameter jet driven via a large reduction ratio gearbox would also give acceptable performance the cost is usually too high.

Generally therefore, jets should not be applied in the semi-planing speed region - either use a more powerful engine to achieve clean planing speeds or use much less power at displacement speeds. Should a customer insist on using a directly-driven jet in the semi-planing region consult C.W.F. Hamilton & Co Ltd with all the relevant data.

Exception

The exception to this rule is for very long and narrow craft (length/beam ratio over 5:1). These do not have high hull resistance in the transition from displacement to planing speeds and thus directly driven jets can be used in these craft in the 10-20 knot region - Catamarans are normally suitable.

MULTIPLE SPEED CRAFT

Referring to the Thrust Curves (Page C1).

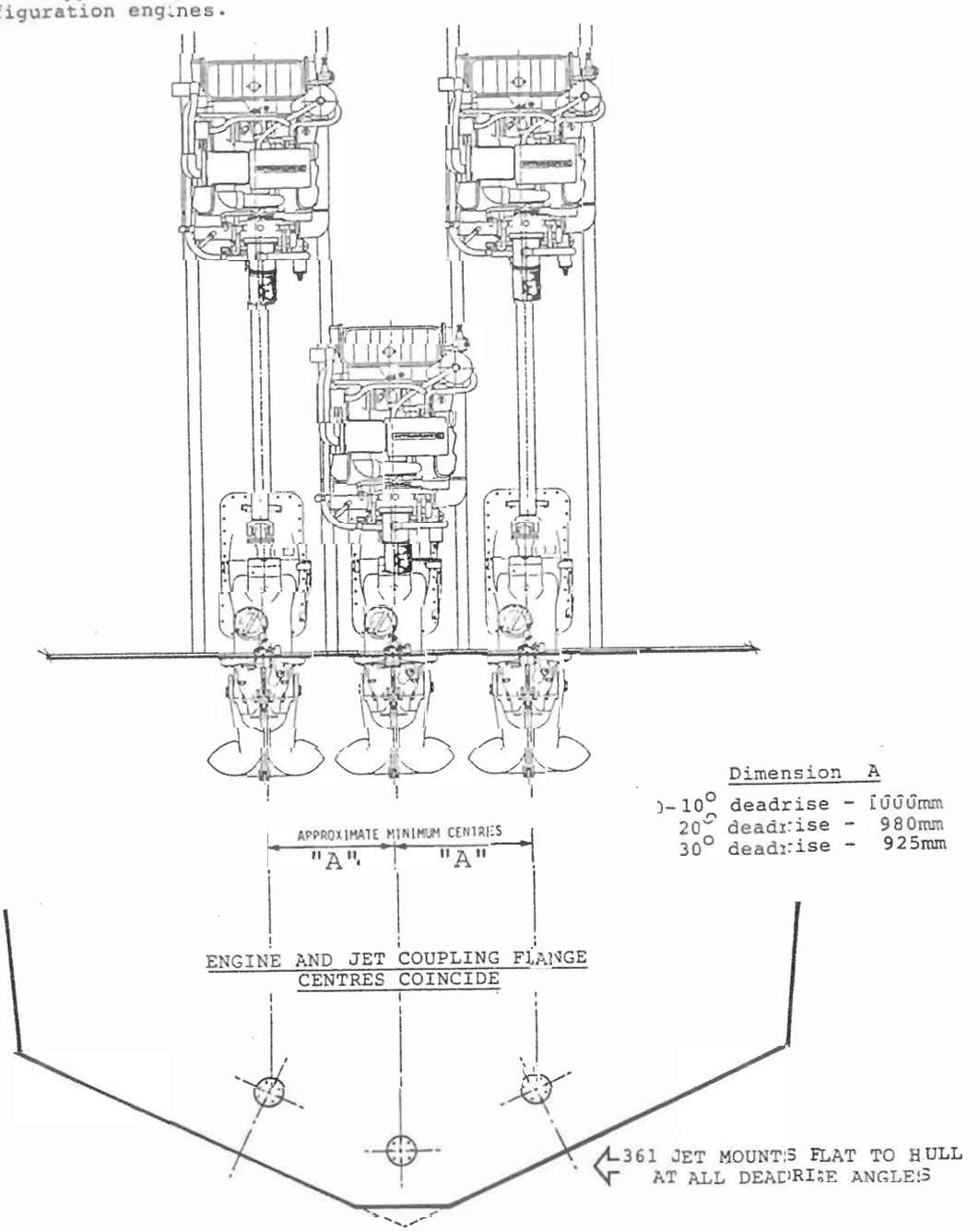
Ensure for all planned operating speeds the continuous (or cruising) Input Power versus Boat Speed point lies to right of (or below) the POWER/BOAT SPEED LIMIT line of the impeller to be used.

For example : A craft with triple equally powered engines is planned to achieve planing speed with all three engines running and displacement speed with only 1 engine running. A careful check should be made on the single engine Input Power versus Boat Speed - full throttle is likely to exceed the limit and an operating limit on power input (or rpm) should be imposed for displacement speed operation. Alternatively, a less powerful engine could be used for the third jet.

MULTIPLE INSTALLATIONS

The guidelines on planning hull shape, weight and speed prediction in the preceeding pages also apply. However, for multiple jet unit installations extra consideration must be given to the possibility of entrained air from the bow wave entering the jet (causing it to slip and loose thrust). This risk is minimised when the jets are mounted as close to the hull centre as possible.

The sketch shows a staggered engine arrangement which can be used for twin or triple installations of wide "Vee" configuration engines.



The advantages of this layout are :-

1. Keeps jets close to keel avoiding air from the bow wave entering the jet.
2. Keeps centre of gravity lowest in deep vee hulls.
3. Gives narrowest possible engine layout.
4. Gives better weight distribution fore and aft.
5. Gives improved engine access.

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PERFORMANCE CHECK

If the application is outside the limits outlined in this manual OR if a check on your design proposal is required, complete the following details and forward to C.W.F. Hamilton & Co Ltd.

Hull resistance curve attached : ☐Yes ☐No

Drawing and/or Photograph of hull attached : ☐Yes ☐No

If the hull resistance curve is not available, quote the following :

Max. Laden Displacement : .....

Waterline Length : .....

Max. Chine Beam : .....

Deadrise Angle Amidships : .....

Deadrise Angle at Transom : .....

Required Speed(s) : .....

Proposed Engine(s) : .....

Make and Model : .....

Number of Engines : .....

* Max. Intermittent Rating (kW/rpm) : .....

* Max. Continuous Rating (kW/rpm) : .....

* For engine ratings state nett output at flywheel, or if a gearbox is proposed, the shaft output kW/rpm.

TO ORDER:

Complete the above "Performance Check" details in full.

Certification required : ☐Yes ☐No

State Authority : .....

Hull Construction : ☐Wooden ☐GRP ☐Aluminium ☐Steel

State other : .....

☐Single Jet ☐Twin Jet ☐Triple Jet

Distance between jet centres : (multiple installations only) .....

Ships Voltage : ☐24V D.C ☐12V D.C.

Standard "HERC" Reverse Control required : (Refer pages I9, I10) ☐Yes ☐No

OR state option :

☐Twin jet controller

☐Triple jet controller

Dual station steering and reverse controls required : ☐Yes ☐No

Overflow preventer(s) required : ☐Yes ☐No

Flywheel adaptor(s) required to suit engine(s) listed above : ☐Yes ☐No

Driveshaft(s) required : (Indicate type below - refer to pages H2, H3) ☐Yes ☐No

☐Double Universal Driveshaft ☐Tortionally Flexible type

☐Tortionally Flexible Flywheel Coupling and Universal Driveshaft.

Distance between engine flywheel (or gearbox flange) and jet coupling : .....

On-board spares required : ☐Yes ☐No

HamiltonJet

BASIC INSTALLATION DATA AND DRAWING REFERENCES:

G.R.P. or Wooden Hulls:

A G.R.P. "Intake Moulding Block" (part number 104980) is supplied with the installation kit for fibreglass and wooden hulls. It can either be fitted in the hull mould prior to moulding the hull, or inserted into a prepared opening in an existing hull to mould the correct shape for mounting the jet unit intake through the hull bottom.

Refer to the following installation drawing at the rear of the manual :

- 104981 - Hull Preparation
- 104982 - Installation Information

Aluminium Hulls:

An "Intake Block" manufactured in marine grade aluminium is supplied ready to weld into a prepared opening in the hull bottom for port or starboard jets. For centrally mounted jets however the block must be machined to match the hull deadrise angle.

Refer to the following installation drawings at the rear of the manual :

- 104997Y - Intake Block
- 104978 - Hull Preparation
- 104979 - Installation Information

Steel Hulls:

A steel "Intake Block" is supplied (or can be built by the boat builder if desired) to weld into a prepared opening in the hull bottom. An insulation kit is supplied to totally insulate the jet unit from the hull.

Refer to the following installation drawings at the rear of the manual :

- 104971Y - Intake Block
- 104972 - Hull Preparation
- 104973 - Installation Information

MOUNTING THE JET UNIT:

After preparing the intake mounting block and transom hole in the hull, remove the reverse deflector and transom seal plate from the jet unit ready for installation. Lift the jet unit (complete with the intake screen) into the hull and position the unit so that the tailpipe passes out through the transom opening and the intake screen fits centrally in the rectangular intake hole. Check that the unit is correctly located in relation to the transom and proceed as follows :-

Fibreglass and Wooden Hulls: (Refer drawing 104982 at rear).

Using the jet flange as a template, drill 28 13.0mm dia. holes through the intake block.

There are 6 more holes at the rear of the unit which are obscured by the jet casing . Scribe through these holes to mark their position on the intake block. Remove the jet unit and drill the 6 13.0mm holes at 90° to the top face of the block.

From underneath the hull counter-sink the 32 holes 20.0mm dia x 2.0mm deep using a standard 20.mm dia. drill.

Aluminium Hulls: (Refer drawing 104979 at rear).

Screw in and tighten the studs provided into the tapped holes in the intake base. A convenient method of fitting studs is to tighten two nuts together on the top of the stud so a spanner can be engaged on the nuts to tighten the stud into the base. Use of thread locking fluid here is recommended.

Steel Hulls: (Refer drawing 104973 at rear).

Screw in and tighten the studs provided into the tapped holes in the intake base. Drill out the 34 13.0mm dia. holes in the intake flange to 16.0mm dia. to accept the insulating bushes. After apply R.T.V. silicone sealant as below. Place gasket over studs onto the intake base, install the jet unit in place over the studs and fit the insulating bushes.

BOLTING DOWN:

Liberally apply R.T.V. silicone sealant (supplied) to the top of the intake block, underside of the jet flange and to the bolt heads. Carefully position the jet unit flange on the intake base and bolt down as shown in the appropriate installation drawing.

Torque 34 nuts to 33 Nm (25 ft.lbs) and remove excess sealant from inside and outside the jet unit.

TRANSOM SEAL ASSEMBLY:

Place the transom seal assembly over the tailpipe, hold against the transom and centralise it in relation to the intake. Using a 9.5mm dia. drill bit drill through the holes to just dimple the transom for correct hole location.

Remove the transom seal assembly and proceed as follows :

Fibreglass, Wooden and Aluminium Hulls

Drill 22 holes 11mm dia. through the transom at the dimpled holes.

Steel Hulls

Drill 22 holes 8.5mm dia. x 28mm deep and tap M12 x 1.5-6H x 24mm deep. The transom seal plate must be totally insulated from the hull by a rubber gasket, insulating bushes and fibre washers fitted to the transom plate mounting blocks.

Drill out the 22 transom seal plate holes to 16.0mm dia. to accept the insulating bushes.

BOLTING UP:

Liberally apply R.T.V. silicone sealant (supplied) to the transom plate contact area on the hull, the joint face of the transom plate and bolt heads. Fit the transom seal assembly over the tailpipe and into place against the transom. Fit bolts, washers and nuts etc to secure the transom plate as per the appropriate installation drawing (at rear of manual) - in particular fit insulating gasket, bushes and washers as indicated for steel hulls. With through bolt systems install with bolt heads to the outside of the boat.

Torque the 22 M10 transom seal securing bolts up to 24 Nm (18 ft.lbs) and remove excess sealant.

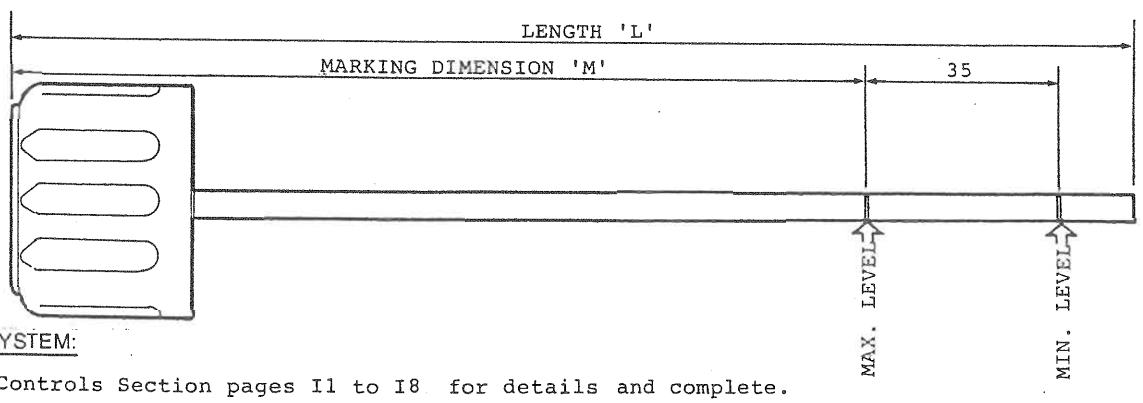
MAIN SEAL:

Work continually round the 20 M8 nuts until all are torques up to 12 Nm (9 ft. 1bs).

DIPSTICKS:

For single jet installations or for the centre jet of triple jets the dipstick is always part 104925. HOWEVER DIPSTICK LENGTH 'L' AND MARKING DIMENSION 'M' VARY TO ACCOMMODATE HULL DEADRISE ANGLES WITH PORT AND STARBOARD JETS. ENSURE THE CORRECT DIPSTICK IS FITTED AS FOLLOWS :

PART NUMBER	HULL DEADRISE RANGE	'L' mm (ins)	'M' mm (ins)
104925	10° port through 0° to 10° starboard	227 (8.94)	186 (7.32)
104926	10° to 20° Port Jet	192 (7.56)	151 (5.94)
104927	10° to 20° Starboard Jet	247 (9.72)	206 (8.11)
	20° to 30° Port Jet		
	20° to 30° Port Jet		



STEERING SYSTEM:

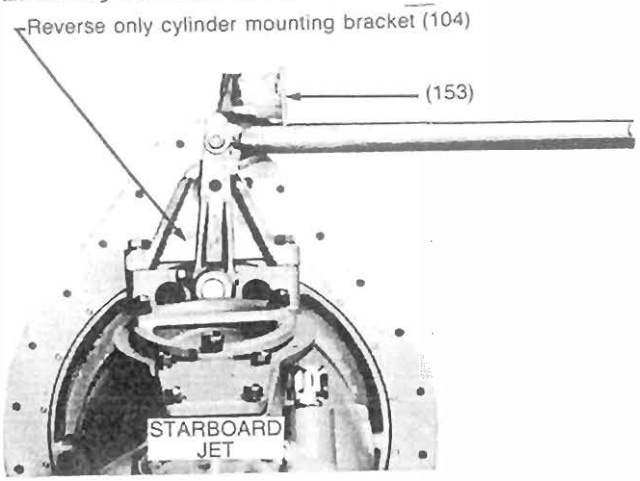
Refer to Controls Section pages I1 to I8 for details and complete.

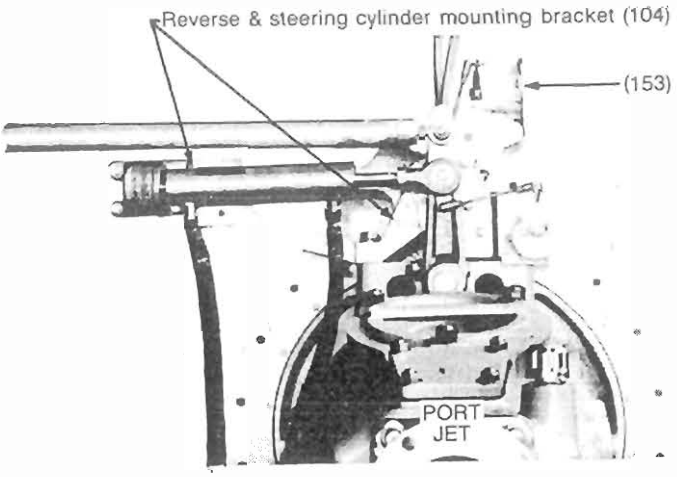
REVERSE DUCT : (Refer parts drawings pages S1 and S2 for identification of item numbers).

Ensure the mating thread and taper surfaces of the pivot pins (117) and threaded bush (84) are clean of paint etc. Coat thread and taper surfaces, bushes (115) and washers (116) with grease (refer recommended lubricants page M3). Fit flanged bushes (115), washers (116), reverse duct (114) and pivot pins (117). Using the mainshaft nut socket spanner (refer page N1) torque the pivot pins (117) to 650 Nm (490 lbs.ft).

MOUNTING THE REVERSE CYLINDER SENDER:

With multiple jet installations fit the reverse cylinder only or reverse and steering cylinder mounting bracket (104) to the intake.





Feed the hose port end of the reverse cylinder assembly (120) through the transom plate (107) mounting hole. Engage the hemi-spherical seats over the four M6 studs ensuring that the grease holes in the seats and cylinder mounting bracket (104) line up.

Fit four M6 washers (151) and nuts (152) and torque to 5 Nm (3.7 lbs.ft). Check the seal (112) and header (113) are correctly located, fit washers (46) and nuts (47) and torque to 12 Nm (9 lbs.ft).

Fit the reverse cylinder to reverse duct pin (118) and secure with split pin (119).

Bolt the reverse cylinder sender mounting plate (153) to the reverse (or reverse and steering) cylinder mounting bracket (104).

ADUSTING REVERSE CYLINDER AND SENDER:

The length of the Reverse Cylinder should then be adjusted (by the screw thread at the Reverse Duct end) so that the Reverse Duct is correctly located in the down position to receive all the water from the jet nozzle when the cylinder is fully extended.

The Reverse Duct hits the Steering Deflector if lowered too far. The 361 Duct should clear its Steering Deflector by approximately 5 to 10mm.

(If the Steering Controls of the 361 jet have been rotated to port or starboard a greater clearance will be required).

With the Duct in the down position work the steering from full lock to full lock and ensure the Steering Deflector does not hit the Reverse Duct at any lock. Reduce length of Cylinder further, if necessary. Fit sender linkages (items 160, 161, 162 and 163) and refer to the HERC Manual pages 9 and 10 to adjust the sender and complete installation of HERC System.

GENERAL

The engine(s) should be located in a position that will give the craft the most suitable fore and aft trim for the proposed boat speed. For semi-planing and moderate planing speed craft it is likely that the engine should be positioned well forward towards amidships for best trim and thus speed. For very high speed craft it is likely the engine should be positioned aft, close to the jet unit, to obtain best trim and speed. Follow the recommendations of the boat designer in this regard or consult C.W.F. Hamilton & Co Ltd.

MOUNTING

Mount the engine via mounting feet fixed to the engine bearers. The feet and bearers do not have to withstand the propulsion thrust load which is transmitted from the jet directly to the hull. Flexible engine mounts will reduce vibration and noise but these must be used in conjunction with a driveshaft system which does not cause a radial or side load at the jet coupling as the engine moves. Refer "DRIVESHAFTS" (Pages H1, H2) for recommended driveshafts and engine installation angles.

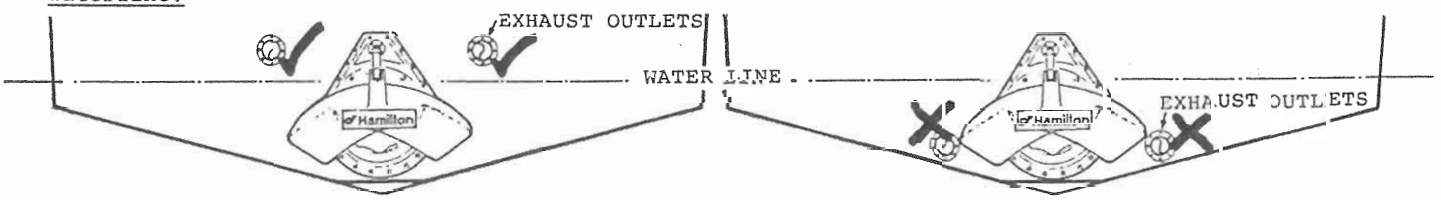
COOLING

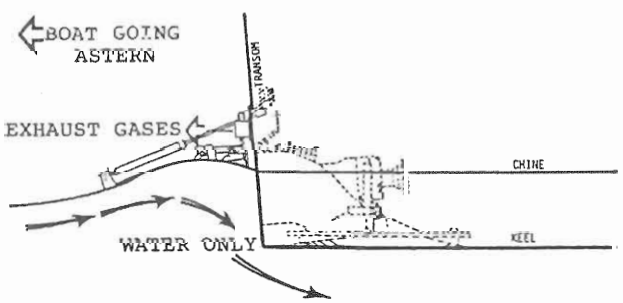
The 361 jet has a 1¼" BSP outboard water offtake which provides water at approximately 1 kN per sq.m. (1½ psi) at 600 rpm and 240 kW per sq.m. (35 psi) at full throttle - 670 hp (500 kW). The water may be fed directly to the engine without the need for a raw water pump, provided - (a) the pressure from the water offtake at idle is sufficient to cool the engine and (b) that the engine can withstand the full pressure from the jet offtake. To be sure of correct flow for engine cooling a conventional water pick up and the engine raw water pump should be used. The jet water offtake can be used for a deck cleaning hose but the pressure is not high enough for a fire hose.
CAUTION : If a gearbox or clutch are fitted to the engine a conventional hull water pick-up and engine raw water pump must be used.

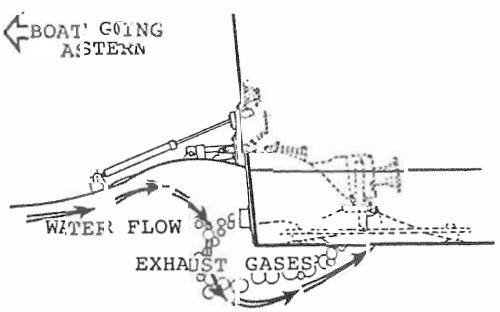
ENSURE THAT THE WATER PICK UP IS NOT DIRECTLY AHEAD OF THE JET INTAKE, BUT WELL TO THE SIDE TO AVOID TURBULENT WATER FLOW INTO THE JET.

EXHAUST SYSTEMS

The exhaust system can be any conventional system approved by the engine manufacturer, except that for the efficient operation of the jet in reverse, exhaust outlets are best sited above the waterline.







ENGINE SYSTEMS

Engine wiring, instrumentation and throttle systems are all conventional - follow the manufacturers recommendations. With the standard two lever control system (throttle reverse) Hamiltons supply the Herc Reverse Control Lever and the boat builder supplies the separate throttle control lever, cable and linkages.

GOVERNOR SETTINGS

The "no load" governor setting (or "high idle") on diesel engines should be set well clear of the full throttle R.P.M. achieved when driving the jet unit so that there is no chance of the governor reducing power (and performance) at full throttle.

MODEL 361

DRIVESHAFT OPTIONS

H2-12-86

Depending on the distance required between the engine and jet coupling flange, there are 3 recommended systems for coupling the engine to the jet. The main requirement of each system is that it must accommodate parallel and angular misalignment plus allow for axial movement.

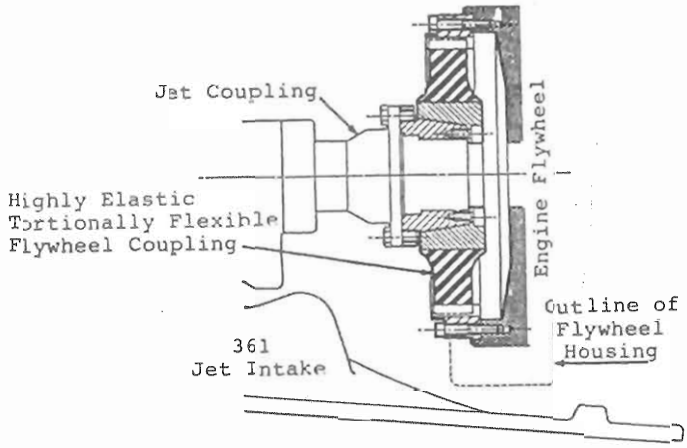
Thrust loads are absorbed by the jet - the engine and coupling are only subject to tortional loading.

SINGLE ELEMENT HIGHLY FLEXIBLE COUPLINGS—
100–150mm long.

Although there are very few suitable single element tortionally flexible couplings available (without a support bearing) two models can successfully be used to provide close coupling of the engine to the 361 jet, these are the "Centaflex" and "Centamax".

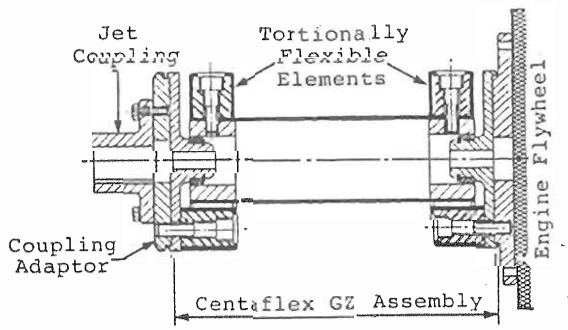
Both models bolt directly to the engine flywheel (or gearbox flange if used) and jet coupling flange via adaptor plates. The engine must remain in-line with the water jet mainshaft and rigid engine mounts are recommended.

In all cases, when using this system, supply full details of proposed coupling to C.W.F. Hamilton.



DOUBLE ELEMENT TORTIONALLY FLEXIBLE DRIVESHAFT—
300mm long or over.

Use a double element tortionally flexible driveshaft with support bearings such as the "Centaflex GZ" type illustrated. The engine is located in-line with the jet and can be flexibly mounted with this type of coupling.

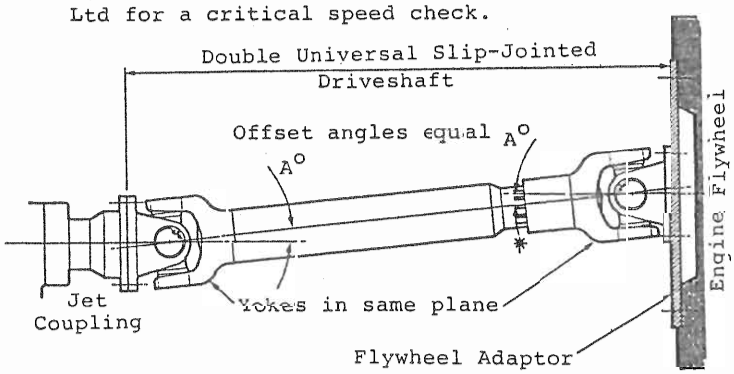


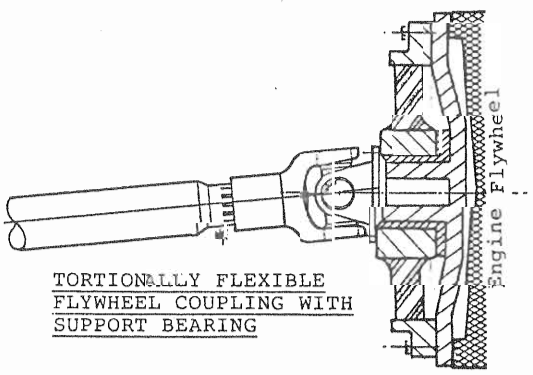
DOUBLE UNIVERSAL SLIP-JOINTED DRIVESHAFT
690–1500mm long.

The usual method of coupling the engine to the jet is the double universal slip-jointed driveshaft (Cardan Shaft). It bolts directly to the jet coupling flange and to the engine flywheel (via an adaptor plate) or alternatively a suitable tortionally flexible flywheel coupling can be used between the universal driveshaft and the engine flywheel. This coupling must be of the type with a support bearing to support the universal driveshaft. "Vulkardan" or "Centamax" have suitable couplings for use with universal driveshafts.

Notes :

- If a gearbox is used a tortionally flexible coupling will already be fitted between the engine and gearbox a universal driveshaft can therefore be bolted directly between the jet and gearbox (an adaptor will normally be required at the gearbox flange).
- The engine should be positioned so that the universal joints of the driveshaft each have equal offset angles of between 1.5 and 5 degrees - this is most important.
- Details of the driveshaft make, model and length should be supplied to C.W.F. Hamilton & Co Ltd for a critical speed check.



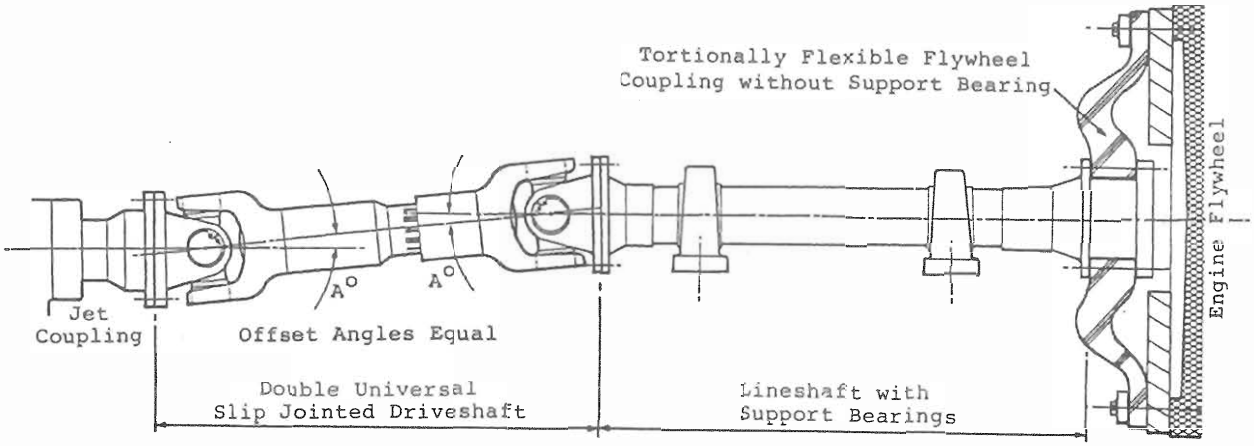


* Correct running length of shaft is with the shaft extended to half the total spline extension.

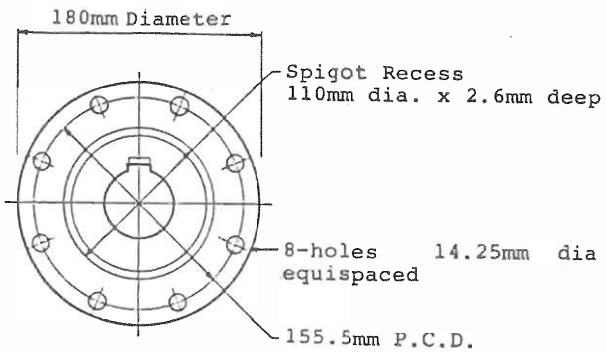
HamiltonJet

LONG DRIVESHAFTS—over 1500mm long.

Where the distance between the engine flywheel and jet coupling flange exceeds 1500mm, a fixed lineshaft supported in pedestal bearings should be used in conjunction with either universal driveshafts or tortionally flexible couplings between both (a) jet and lineshaft and (b) lineshaft and engine flywheel. If a gearbox is fitted the lineshaft can be directly attached to the gearbox flange using normal propeller shafting criteria i.e. gearbox should be rigidly mounted to avoid misalignment.



JET COUPLING FLANGE DETAILS



Standard 8-Hole Coupling Flange

MOMENTS OF INERTIA DATA:

It is advisable to have a tortional vibration analysis undertaken for the complete engine, driveshaft and jet rotating assembly, especially where a universal driveshaft is used without a tortionally resilient member or gearbox in the driveline. The engine is the most complex and therefore the analysis is normally done by the engine supplier.

Detail of the jet required for a tortional vibration analysis are listed below.

IMPELLER

Types 23-29 M = 17.65 Kg
Ip = .205 KgM^2

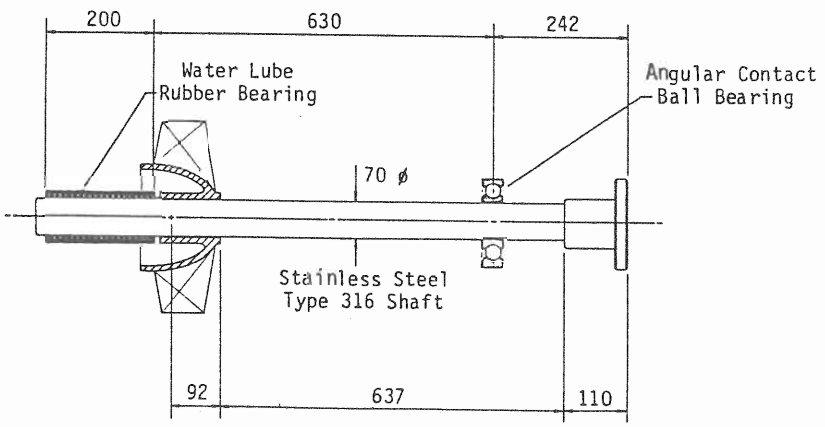
Types 30-37 M = 20.6 Kg
Ip = .24 KgM^2

SHAFT

M = 28.8 Kg
Ip = .0153 KgM^2

COUPLING

M = 5.3 Kg
Ip = .0153 KgM^2



HamiltonJet

DESCRIPTION:

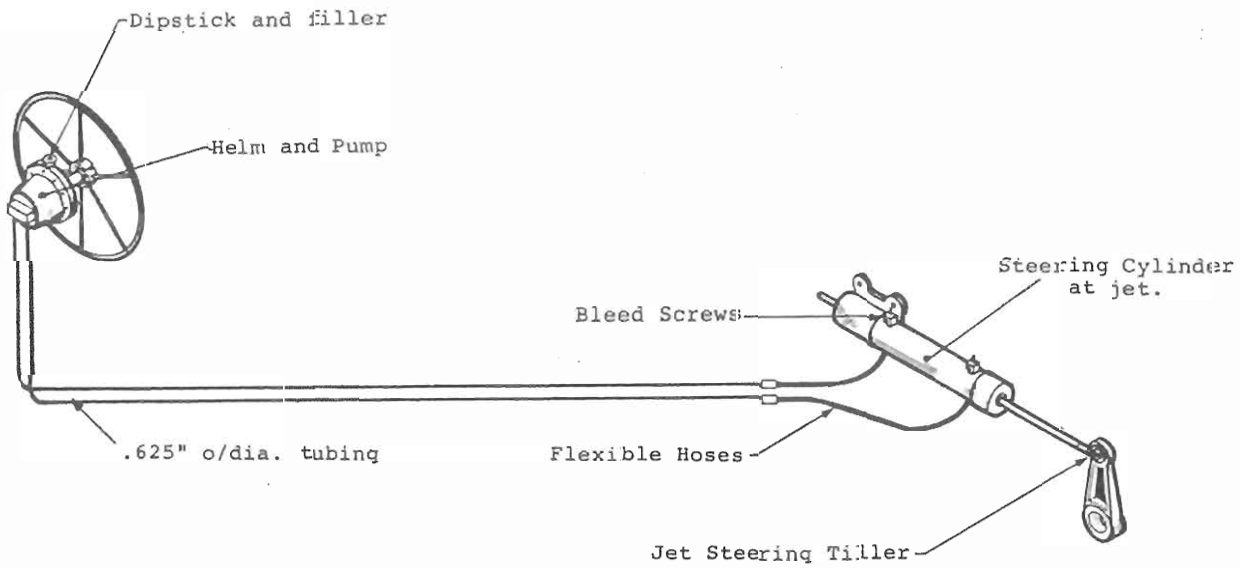
The steering system on the 361 jet is balanced so that power assisted controls are not necessary even for multiple jet units.

(The torque required on the steering shaft at 500 kW (650 hp) and full lock is approx 170 Nm (125 lbs.ft)).

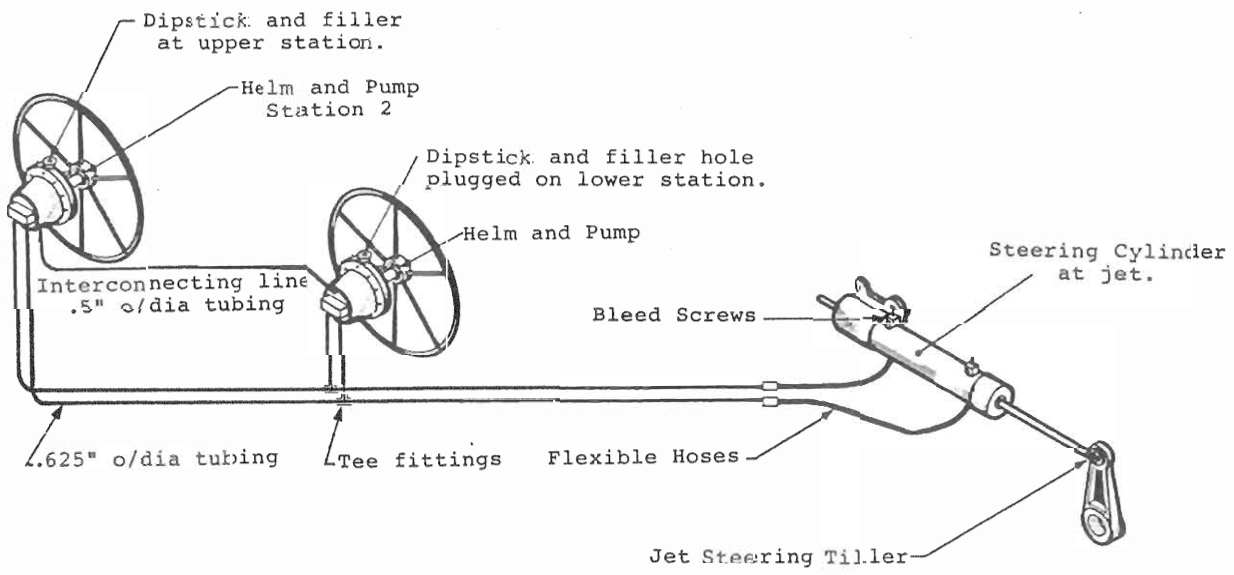
A manual hydraulic steering system is included with the jet which gives 1.9 turns of the helm from full lock to full lock. (A greater number of turns will reduce sensitivity of steering during low speed manoeuvring).

A steering position indicator system is standard equipment.

SINGLE STATION SYSTEM



DUAL STATION SYSTEM



SCOPE OF SUPPLY

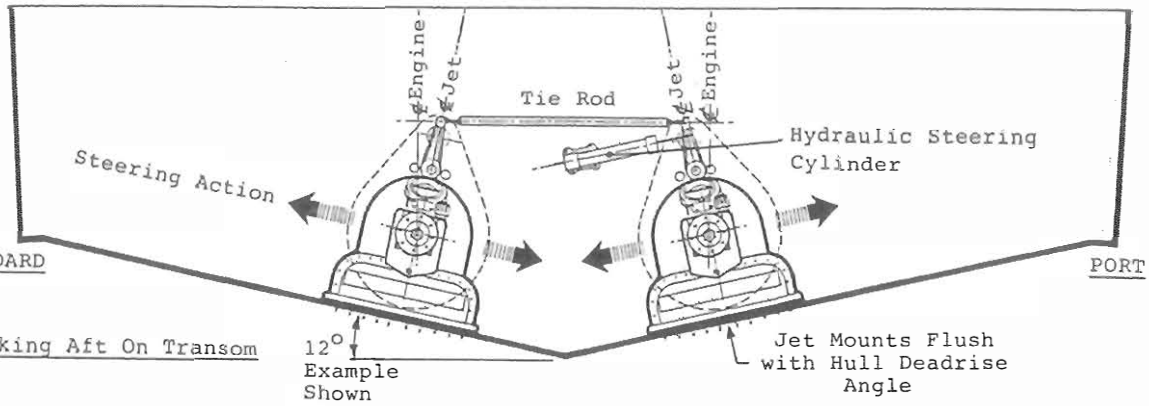
All equipment and fittings supplied except for .5" and .625" o/dia. tubing which boat builder supplies. The tubing should be suitable for 70 bar (1000 psi) working pressure. Single station system standard - Dual Station system optional at extra charge.

HamiltonJet

MULTIPLE JET INSTALLATIONS:

Ganged control of steering in multiple jet installations is achieved by swivel ended tie rod(s) interconnecting the jet tiller arms. An adjustable length tie rod is supplied to facilitate accurate centring of the jets.

FOR DEADRISE ANGLES UP TO 15°

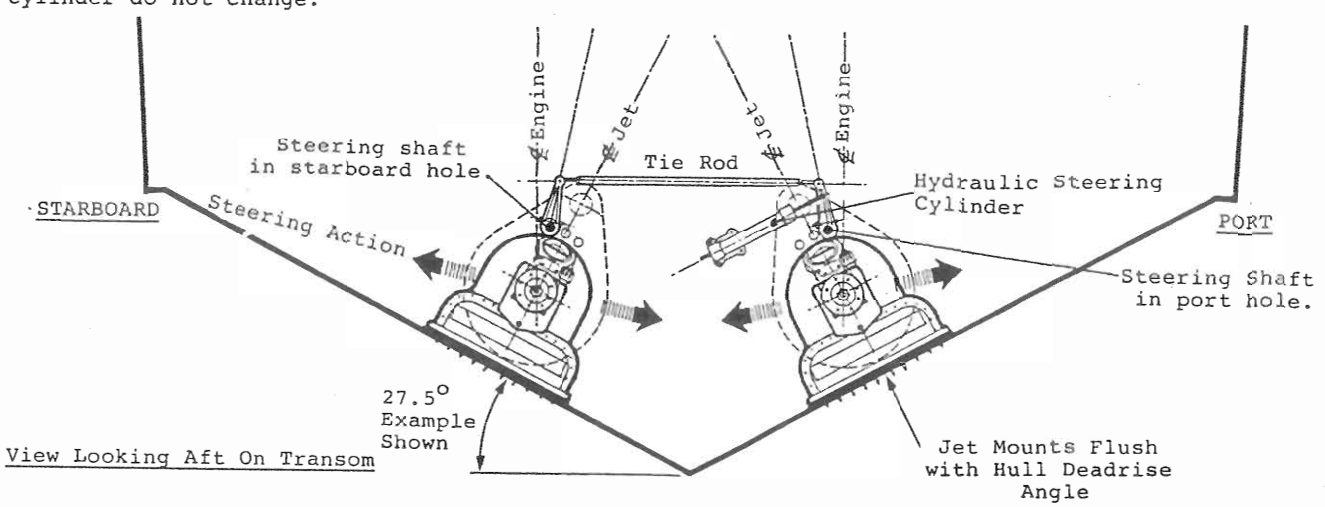


Notes (for deadrise angles up to 15°) :-

- The steering cylinder can mount on either port or starboard jet but always to the starboard side of the jet.
- The steering cylinder and the steering sender bracket both mount by the fixing holes which position them furthest to starboard - see illustration on Page I3 and above.

FOR DEADRISE ANGLES OF 15° OR MORE

The 361 jet steering assembly (tiller, shaft, nozzle and deflector) can be rotated 15° to port or starboard for maximum effectiveness. The mounting of the jet to the hull and of the reverse cylinder do not change.



Notes (for deadrise angles at 15° or more) :

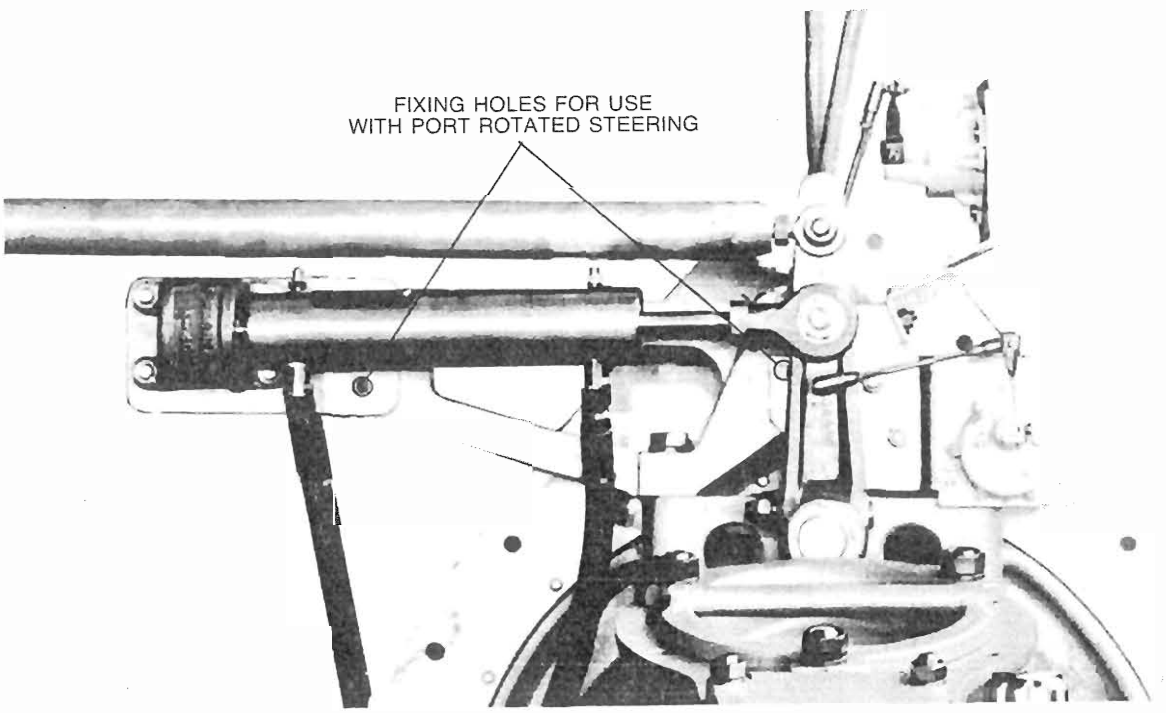
- The steering cylinder can only mount to the starboard side of the port jet unit.
- The steering cylinder and the steering sender bracket both mount by the fixing holes which position them furthest to port - see illustration above and illustration Page I3.
- Where a deadrise angle over 15° is quoted with the order for multiple jets C.W.F. Hamiltons will deliver the jets with the steering rotated. The steering can however, easily be rotated by the boat builder.

To Rotate Steering:

- Remove the cotter pin (102) and steering crank (100).
- Remove the 12 nuts and washers (18, 17) holding the nozzle (88). Remove the nozzle, with the steering deflector (90) still assembled to it, and rotate the nozzle in the required direction until the next set of 12 nozzle fixing holes line up. Reassemble nozzle to tailpipe and torque up the 12 M12 nuts and washers (17 and 18). (Refer torque table page M3).
- Knock the nylon bung (4) out of the intake hole, the steering shaft (99) now has to pass through. Clean off old thread locking fluid from the bung and the hole it was removed from.
- Carefully remove the scraper housing (5), scraper (6) and seal (7) from the centre steering shaft hole and refit in the hole the steering shaft will now pass through.
- Apply Loctite 601 or equivalent thread locking fluid to the bung (4) and refit in centre steering shaft hole.
- Refit steering tiller (101) and crank (100). Note the cotter pin in the crank is normally fitted from port to starboard side (i.e. not on starboard side) and the cotter pin in the crank is fitted from the opposite direction. Ensure cotter pins fit correctly and torque up M12 nuts. (Refer torque table page M3 and illustrations page I4).
- The steering cylinder and the steering sender bracket must be remounted by the fixing holes which position them furthest to port (see lower illustration - page I2 and illustration below).

TRIPLE 361 JETS:

- One steering cylinder only is required which can mount on the centre or port jets.
- Two swivel ended tie rods are used to interconnect the jet tillers : from starboard to centre jet and from centre to port jet. Bolt one tie rod aft and one ahead of centre jet tiller.
- The starboard and port jets can have steering rotated 15^{o} for deadrise angles of 15^{o} or more but the steering on the centre jet is not rotated.
- A sketch for triple steering arrangement can be supplied on request quoting the hull deadrise angle.



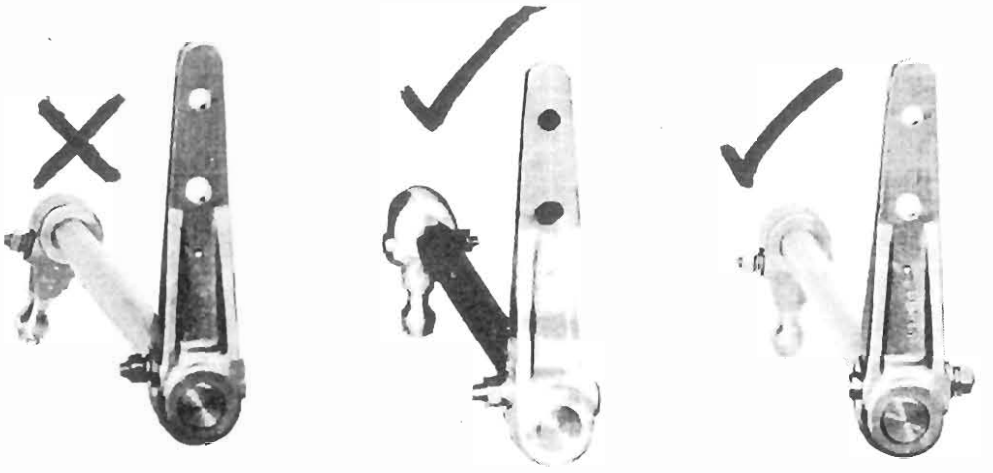
HamiltonJet

INSTALLATION NOTES

Jet Tiller (101):

The Cotter Pin in the steering crank (100) is normally fitted from port to starboard (i.e. washer and nut on the starboard side). The cotter on the steering tiller must be fitted from the opposite direction to the cotter in the steering crank i.e. normally from starboard to port, nut on the port side.

Ensure both cotters are fitting correctly and torque up M12 nuts (refer torque table page M3).



Repeat procedure for other jets if twin or triple jet craft.

Steering Cylinder (S4) and Sender Bracket (S6)

(refer illustrations page I3, 02, S6 and S7)

- Using 4 bolts (105) and washers (12) fix the combined steering and reverse cylinder mounting bracket (104) to the jet unit intake. (Fix to the port unit of twin jets).

- Mount the steering cylinder (S4) to the mounting bracket with 4 M10 studs, nuts and washers provided (items S1, S2, S3 of steering assembly - refer page I3 for details).

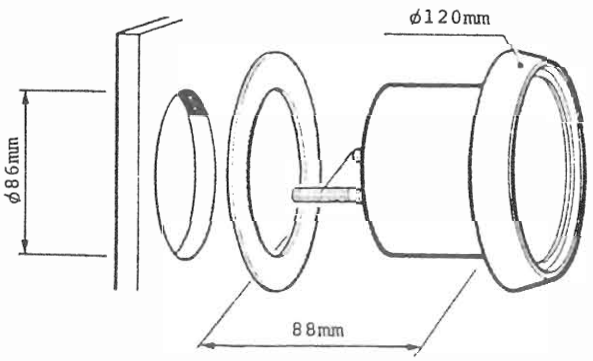
  NOTE : With the steering not rotated (steering shaft in centre intake hole) the cylinder(S4) and sender bracket (S6) are mounted by the fixing holes which position them farthest to starboard. Refer illustrations page I2, I3.

- With the steering rotated 15° to port (steering shaft in port intake hole) the cylinder and sender bracket (S6) are mounted by the fixing holes which position them farthest to port. See figure on pages I2,I3.Remove the plastic plugs from the cylinder hose ports.

  Fit the cylinder shaft end bolt from the transom side forward through the steering tiller and then through the cylinder shaft end eye. Place the washer S13 on first then tighten the first nut up firmly before tightening the second nut firmly to lock. (Refer illustrations page I3).

  NOTE : No adjustment of the cylinder positioning is provided for so the system may deflect slightly more one lock than to the other. This will not cause an operational problem.

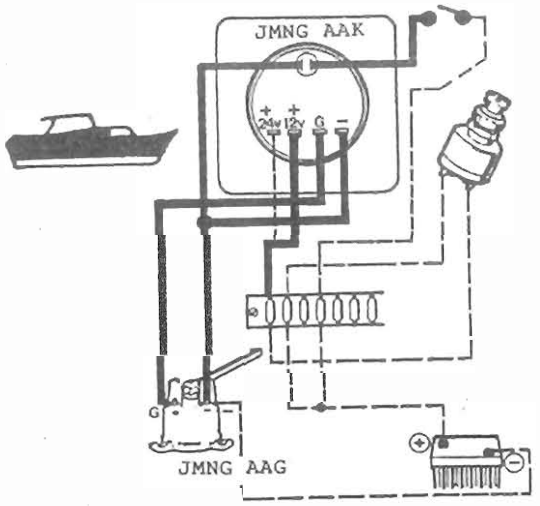
Mounting Indicator:



HamiltonJet

Wiring Diagram—Single Station:

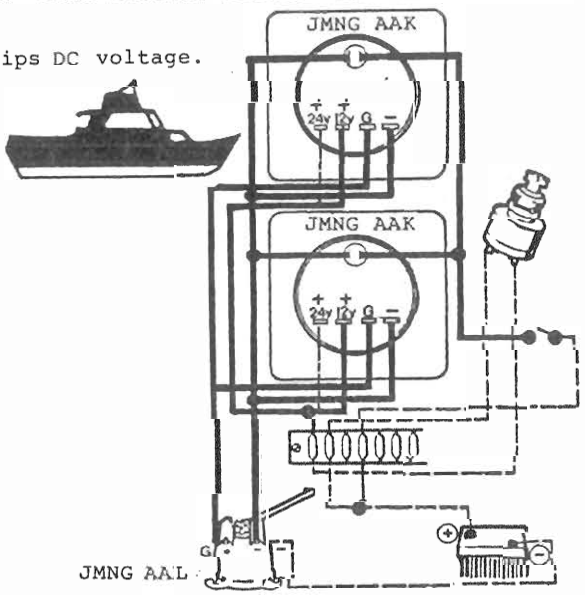
- With 12V DC system connect to 12V terminal on indicator.
- With 24V DC system connect to 24V terminal on indicator.



Wiring Diagram—Dual Station:

The sender must be changed to Hamilton part no. JMNG AAL "Dual Station Sender" and an additional Indicator JMNG AAK purchased.

Wire to 12V or 24V terminals of Indicators depending on ships DC voltage.



Sender Adjustment:

- Loosen the 3 M4 sender mounting screws (S20) and rotate the sender until the screws are central in the slotted holes in the sender. Temporarily retighten screws.
- Adjust length of sender link (S10) and sender arm (S16) so sender arm travels from stop to stop (or nearly so). Lock 2 nuts (S11) and screw (S18).
- Centralise steering deflector and temporarily clamp in this position. Loosen 3 M4 sender mounting screws (S20) and rotate the sender so the indicator gauge (at the helm position) registers zero helm deflection. Lock the 3 M4 screws (S20). With a single jet installation unclamp the steering deflector and proceed with helm pump installation. With twin or triple jets fit steering tie rod(s).

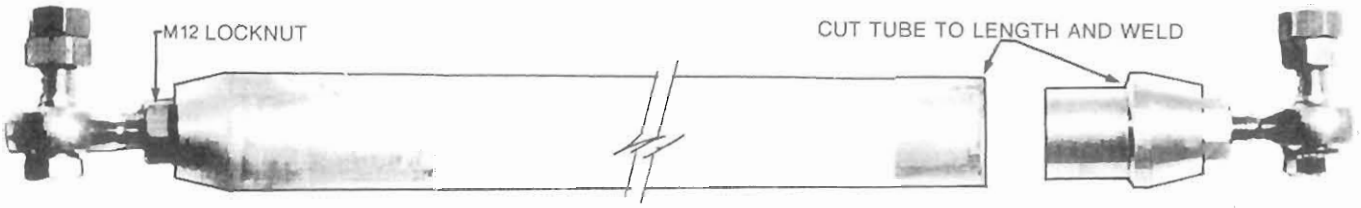
Steering Tie Rod Assembly: (Multiple jets only) (refer illustration page 16)

A tie rod kit is supplied with one end not welded so the rod tube can be cut to length required and welded.

With the steering deflector of the port jet (with steering cylinder) already clamped in the central or dead ahead position repeat procedure by clamping the starboard (and centre with triple jets) jet deflector in its central or dead ahead position.

Offer the tie rod up to the upper holes of the steering tillers and mark the length to cut the rod tube. Cut tube and weld to rod end. Bolt one end of tie rod onto forward side of tiller. Adjust thread lengths at ends until the hole at the unbolted end exactly lines up with the hole in the tiller (make sure the jet deflectors have not moved) and bolt up. Check the M12 locknut on the length adjustment are tight and unclamp the deflectors.

Steering Tie Rod Assembly—*cont.*

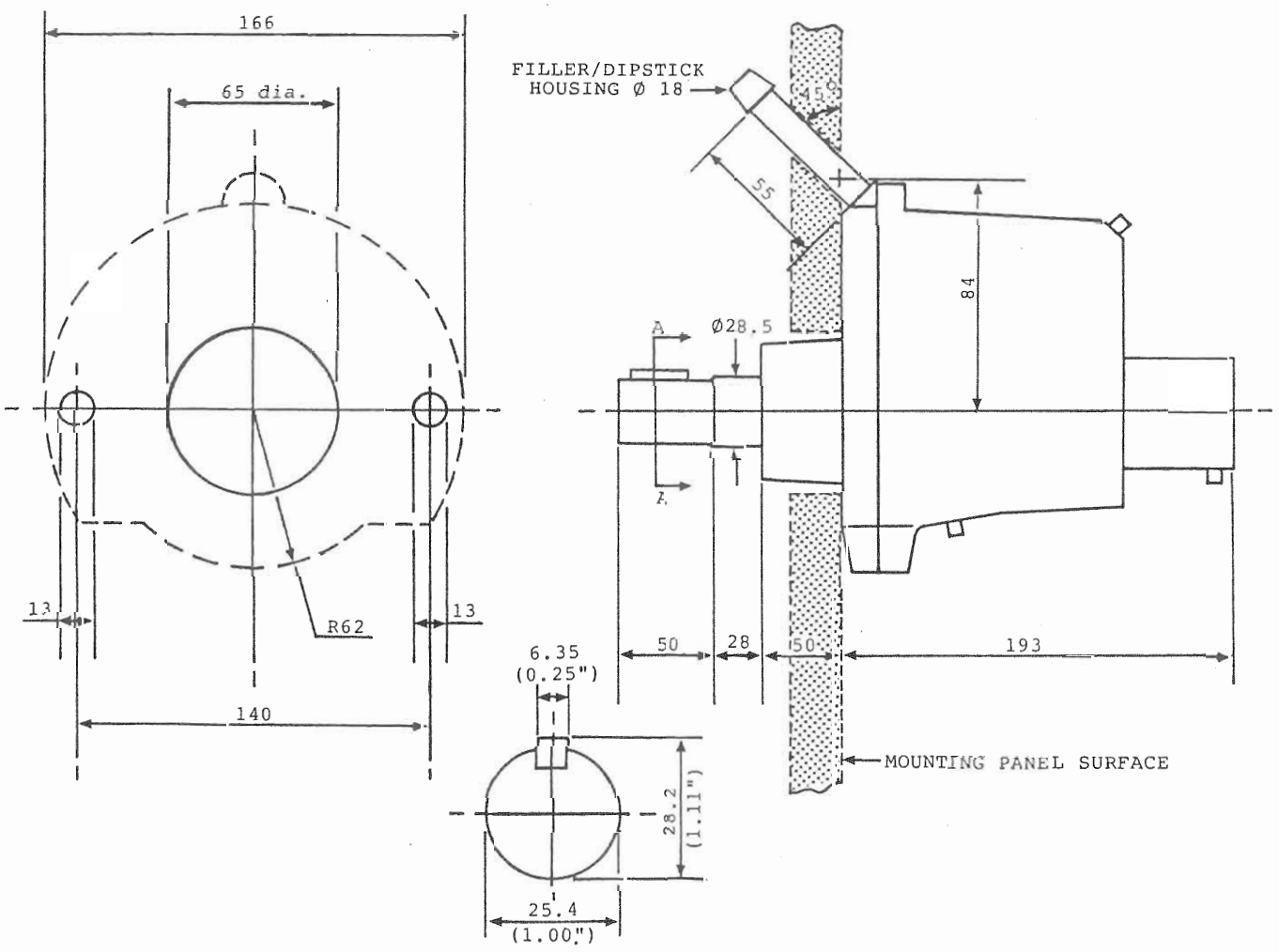


NOTE : Some steering "lock" (or motion) is lost through the imperfect geometry of this tie rod system. However, this can be ignored as the loss of steering thrust is small.

Mounting the Helm Pump:

The helm pump may be mounted with the shaft at any angle between horizontal and vertical. The pump has a lockvalve mounted on the rear with 3/8 NPT outlet ports.

With lockvalves the operator does not have to hold the helm against the loads caused by cross winds. However, the lockvalves thereby eliminate any self centring effect. If self centring is desired the lockvalves can be removed.



A - A

HamiltonJet

Piping the System:

Keep working conditions as clean as possible. Contamination of any form must be prevented from entering the system. It is essential that all hydraulic tubing is clean inside before starting the installation.

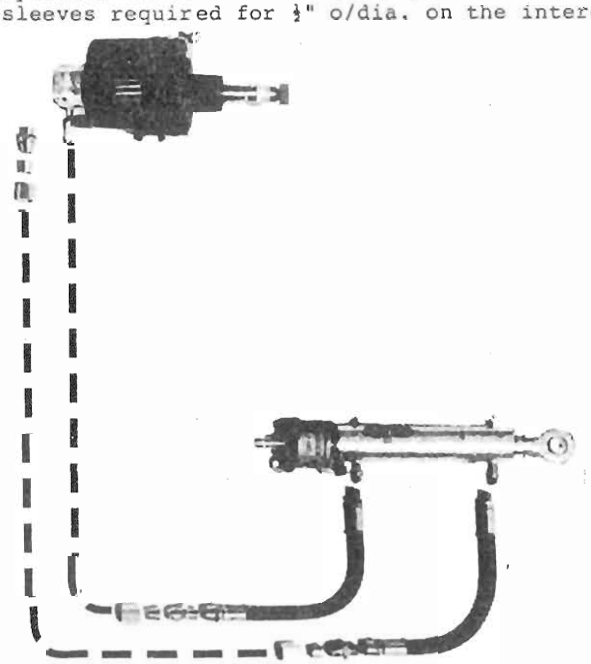
Teflon tape or pipe fitting compounds, commonly used to seal threaded joints, must be used sparingly and applied to the male threads only. The first two threads of the fitting should not be covered. If it is necessary to remove a fitting for any reason, the female thread must be cleaned before reinstalling the fitting.

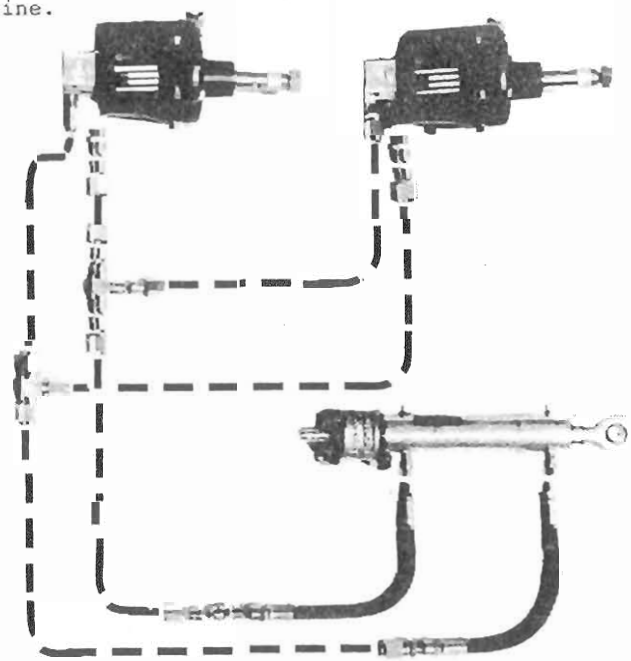
Steel or soft refrigeration-type tubing rated at a minimum working pressure of 7000 kPa (1000 psi) is recommended. Flexible hose must not be used in place of the recommended tubing (other than the two short lengths supplied) as it will adversely affect the performance of the system.

The tubing should be installed with lengths as straight as possible. Bends should be as gradual as possible. All lines should have a gradual rise toward the helm pump(s) to provide self-venting. Goosenecks (a vertical bend resembling an inverted letter "U") must be avoided if possible, otherwise vent plugs must be installed at the high point of the bend to provide a means for removing entrapped air.

The tubing must be held rigidly where it connects to the cylinder flex hose.

A complete kit of adaptors and sleeves etc. are provided to suit 5/8" o/dia. tubing for helm to cylinder lines and for dual station controls the kit includes tee fittings and the adaptors and sleeves required for ½" o/dia. on the interconnecting line.





In a multiple station system, all helm pumps are connected in an identical manner to the hydraulic lines leading to the steering cylinder. (Refer to the Piping drawings page I1). The pump reservoirs must be interconnected to create a continuous flow path. That is, connect the bottom of the highest pump to the top of the next highest, etc. This interconnection is required to fill and vent the system. All other connection ports on the pump housings must be plugged. The dipstick tube supplied must be installed in the top of the highest helm pump. The design of this dipstick fitting also allows the system to vent. DO NOT PLUG.

When connecting the steering lines to the cylinder, be certain that the tiller will move in the correct direction. (When standing in front of the wheel, turning a helm pump clockwise pumps oil out of the starboard side of the pump and should give starboard tiller).

If the vessel requires an "inspection approval", a bypass valve to allow emergency mechanical steering may have to be connected between the cylinder ports.

Recommended Oils:

The following oils are preferred due to their superior qualities.

Chevron	:	AW Machine 32, EP Hydraulic MV
Esso	:	Nuto H32
Gulf	:	Harmony AW32, Harmony HVI 36
Mobil	:	DTE 24, DTE 13
Shell	:	Tellus 32, Tellus T37
Texaco	:	Rando HD32, Rando HD AZ

DO NOT USE BRAKE FLUID or a heavier viscosity oil.

Filling and Bleeding the System:

Ensure that all fittings and plugs are tight as this filling procedure must develop a vacuum in the steering lines.

Connect the two identical lengths of clear plastic tubing to the bleed fittings on the steering cylinder. Place the free ends into a container (about one litre capacity) to catch any oil carried with the expelled air. Determine which steering line and bleed screw fitting will be pressurised when turning a steering wheel CLOCKWISE. Open the bleed screw at this fitting 2 turns. The other must remain tight. If a cylinder bypass valve is installed, it must be closed.

Next, fill all helm pump housings starting at the lowest and progressing to the highest. Plug each pump tightly after it is filled except the highest (or only) which is also the filler/vent for the system and it must be fitted with the dipstick tube.

Screw the plastic tubing assembled with a black plastic fitting into the end of the dipstick tube (where the dipstick is normally inserted) until it seats tightly against the O Ring on the fitting. This fitting will self-thread into the tube.

Place the free end of this (filling) tube into a container of oil and hold the container at, or above, the pump level. The end of the tube must continually remain below the oil level. THIS IS VERY IMPORTANT!

Turn the steering wheel CLOCKWISE on this pump only at about one revolution per second. Oil will be drawn into the pump after about 20 revolutions. A mixture of air and oil will be expelled from the bleed fitting on the cylinder. After most of the air is expelled, the system will begin to feel steady and solid. Close the bleed screw tightly and open the opposite bleed screw 2 turns.

Now turn the steering wheel COUNTER CLOCKWISE until most of the air is expelled. Close the bleed screw and apply light pressure at both hardover positions.

Remove the black plastic fitting and filling tube assembly. Ensure that the oil level in this pump just shows on the dipstick. Wrap a wiping rag around the dipstick tube. (It is advisable to keep this rag in place for the first week as any air remaining in the system may foam the oil as it naturally vents).

Starting at the lowest helm pump and progressing to the highest, apply first light, then heavier wheel pressure alternately at both hardover positions. The bleed screws at the alternately pressurised ends of the cylinder should be opened several times as each pump is pressurised. KEEP THE SYSTEM FULL OF OIL!

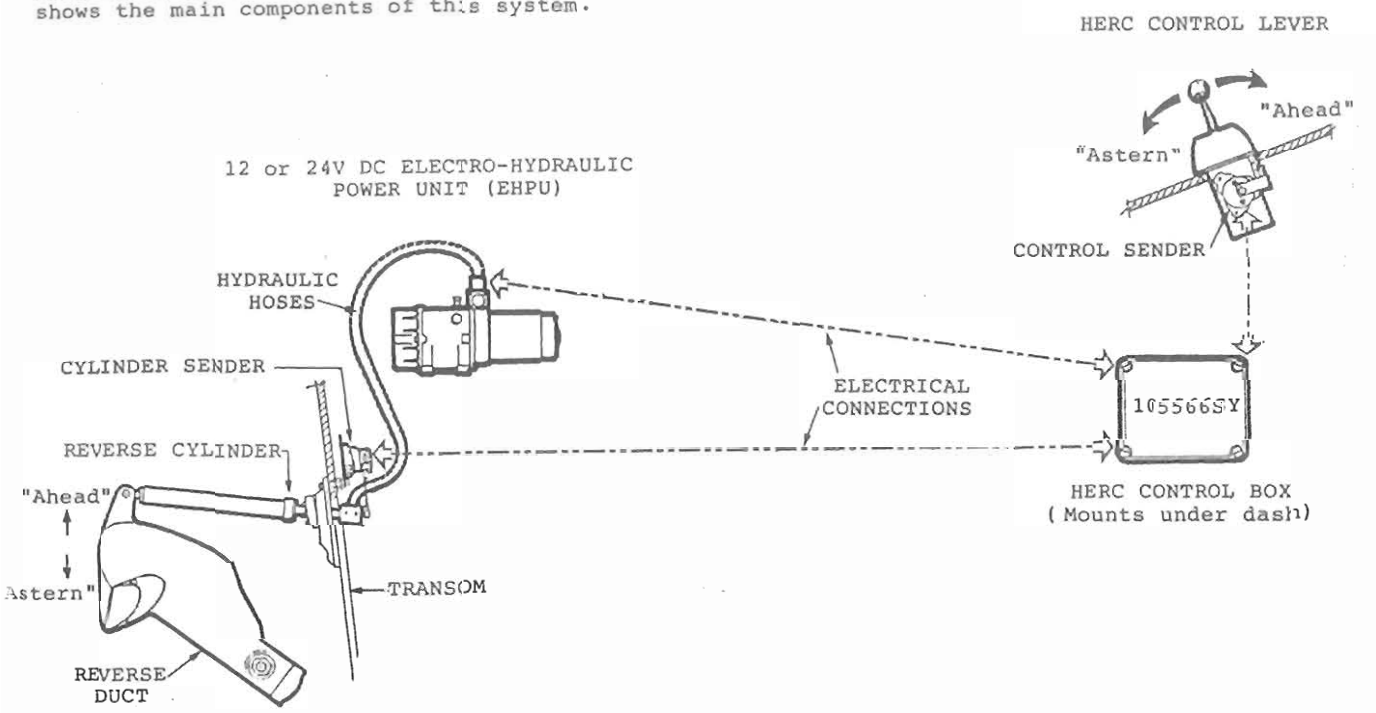
The system is now useable but it will not be smoothly responsive until the air is expelled. Air may continue to work out of the oil for some time so keep a regular check on the oil level for the first few days of operation.

If the plastic tubing assembled with a black plastic fitting is not available, the oil must be poured slowly into the dipstick tube. The rest of the procedure is the same, but the oil level in the highest (or only) helm pump must be maintained to prevent pumping air into the system.

AHEAD/ASTERN CONTROL

Description:

Control is by the "Hamilton Electronic Reverse Control" (HERC) system. The schematic diagram below shows the main components of this system.



The system is essentially an electronic "follow-up" system controlling power assisted hydraulics - the Reverse Cylinder following movement of the Control Lever.

The HERC Control Box *senses* the position of the HERC Control Lever and compares it with the position of the Reverse Cylinder. If the positions do not coincide the HERC Control Box starts the EHPU causing oil to flow and move the Reverse Cylinder. When the Cylinder position does coincide with the HERC Control Lever position the Control Box switches the EHPU off.

Full installation instructions are included in the separate "HERC System Manual" part number 82019. Note when ordering - the HERC Control Box can be connected to 12 or 24V D.C. supply without adjustment but the EHPU must be ordered 12 or 24V to suit voltage used on boat. All equipment for single station control, except external wiring, is included with the jet. See page I for dual station control.

The EHPU is best mounted horizontally just above the jet with the vent/filler upper-most. This way air in the system is automatically bled back to the reservoir and vented. Ensure the hydraulic hoses are loosely supported vertically above to one side of the Reverse Cylinder to avoid impact with the steering tiller.

The system has been thoroughly tested and refined giving unsurpassed manoeuvring control..

CONTROL LEVER OPTIONS

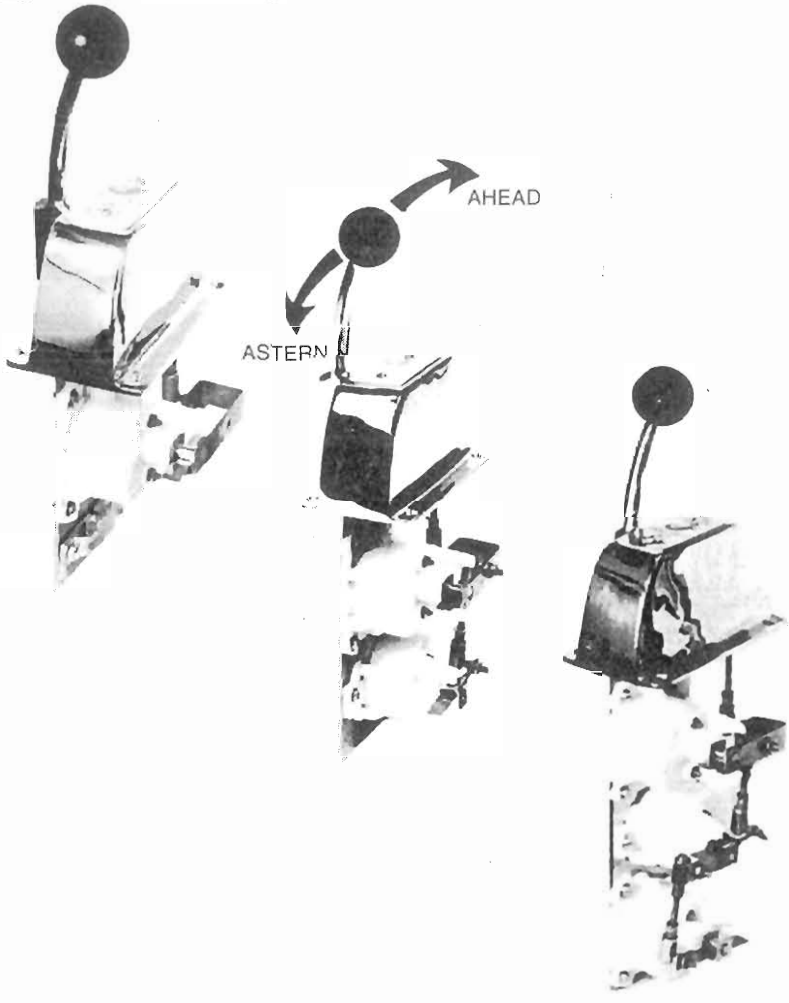
C.W.F. Hamilton & Co Ltd provide the Reverse Control Lever(s) but the boat builder (or C.W.F. Hamilton if desired) provides a separate and independant throttle system for the engine(s). This system is recommended for best manoeuvrability using the techniques described in Section K.

(A) Single Jet Reverse Controller:

Standard supply is one 104564SY with each jet unless optional controls are requested.

The controls can be mounted alongside one another for multiple jets but must all face the same direction.

Two 104564SY controllers with twin jets gives maximum manoeuvrability including the ability to move craft sideways.



(B) Twin Jet Reverse Controller:

(One control lever for twin jets) - Because full steering control is maintained at all positions of the reverse (including at zero speed) it is not necessary to have one control ahead and one control astern to turn on the spot. Merely turning the helm achieves the same manoeuvre. Thus the simple alternative of having one reverse lever controlling both jets in unison is possible with minimal loss of manoeuvring control.

(C) Triple: 105295SY

One control lever for triple jets.

Multiple Jets:

The complete HERC system is repeated for each jet with the exception that the control levers may be integrated as outlined earlier in this section.

Emergency Control:

A Joystick switch system is included which by-passes the HERC system allowing the HERC Control Box to be removed for checking while the boat is still operational. Alternatively a non-electric manual hydraulic emergency system is available.

Dual Station Control:

Equipment for single station control is included with the jet. However, the HERC Control Box accommodates single or dual station control.

Extra items required are (1 set per jet) :-

1. Dual Station Kit 105030

   This includes an illuminated push button for each station (operation of the button indicates selection of control at that station by illumination of the button) and an extra HERC operating lamp for the second station.

2. Repeat Reverse Control Lever(s) for the second station.

C.W.F. Hamilton & Co Ltd have taken precautions during manufacture and assembly of the jet unit, by using materials that are resistant to salt water corrosion and by placing anodes in the most effective places on the jet. The unit however, is still vulnerable to the actions of the person who fits the propulsion system into the hull and to the actions of his electrician.

One of the major causes of corrosion of metal parts in salt water, particularly impeller, is stray currents emanating from the vessel's electrical system. These currents can be very small, often defying detection, but acting over a considerable period can cause heavy corrosion. A protection method for the jet unit depends on the hull material of the boat. Therefore, BOATS USING HAMILTON JET UNITS AT SEA SHOULD BE BONDED AND WIRED AS FOLLOWS :-

(A) ALUMINIUM, GRP, WOOD HULLS (other than Steel):

1. Bonding System (refer diagram page J2)

The bond strip and connecting wires should be aluminium or copper of at least 14.5 sq.mm. cross section area (e.g. 5mm dia.) to give very low (e.g. 0.01 ohm) electrical resistance. All junctions should preferably be welded, but if bolted, should be clean, have a good contact, and be regularly inspected. The bond wire or strip which runs fore and aft down the hull, should be kept clear of bilge water where possible, and connected to :-

(a) The engine frame (the engine must have a negative earth).

(b) The jet unit casing.

(c) All anodes attached to the hull.

(d) The fuel tanks and any other major metal items.

(e) Casings of all major items of electrical equipment.

(f) In the case of a wood or fibreglass hull, to an external earth plate in the area of the hull bottom which is always under water.

(g) In the case of an aluminium hull, to a connection welded to the hull in an area where the hull is always touching water.

(h) Direct to the NEGATIVE pole of the battery.

2. Electrical Wiring System

Every part of the electrical system should use TWO wires, positive and negative, i.e. the negative must *not* run through the frame of any major unit, through the hull of the boat, or through the bonding system. That is to say, do not use an EARTH return system.

For example, the negative to the starter motor should be separate large section cable from the negative pole of the battery, to the holding bolt of the starter motor, and NOT to an engine bolt somewhere near the starter.

3. Radio, Transceivers, Depth Sounders and other electrical auxiliaries

Batteries, radio transmitter or other electrical equipment should NOT be earthed to the jet unit.

Be guided by your radio technician, but in general these systems should either be entirely insulated i.e. separate insulated alternator, separate batteries etc., or the system should be incorporated in the bonding system but with a separate earth plate well removed from the bonding earth strip and from the jet. The metal used for the separate earth plate must be compatible with the bonded earth strip metal and the hull material.

4. Zinc Anodes

The casing of the jet unit is electrically connected to the jet unit anodes. The anodes, which are zinc blocks, are fixed to various parts of the jet unit below the water line. If the anodes are being eaten away they are providing protection. They should be inspected and replaced when half consumed. Further anodes should be fitted on the hull, sufficient for hull protection, (see diagram page J2).

5. In-Service Checks

In service, two items should be inspected regularly :-

(a) The bonding system - for loose or corroded connections and test to ensure that electrical resistance is still low.

(b) All anodes - if any are more than half-eaten away replace them with a new anode.

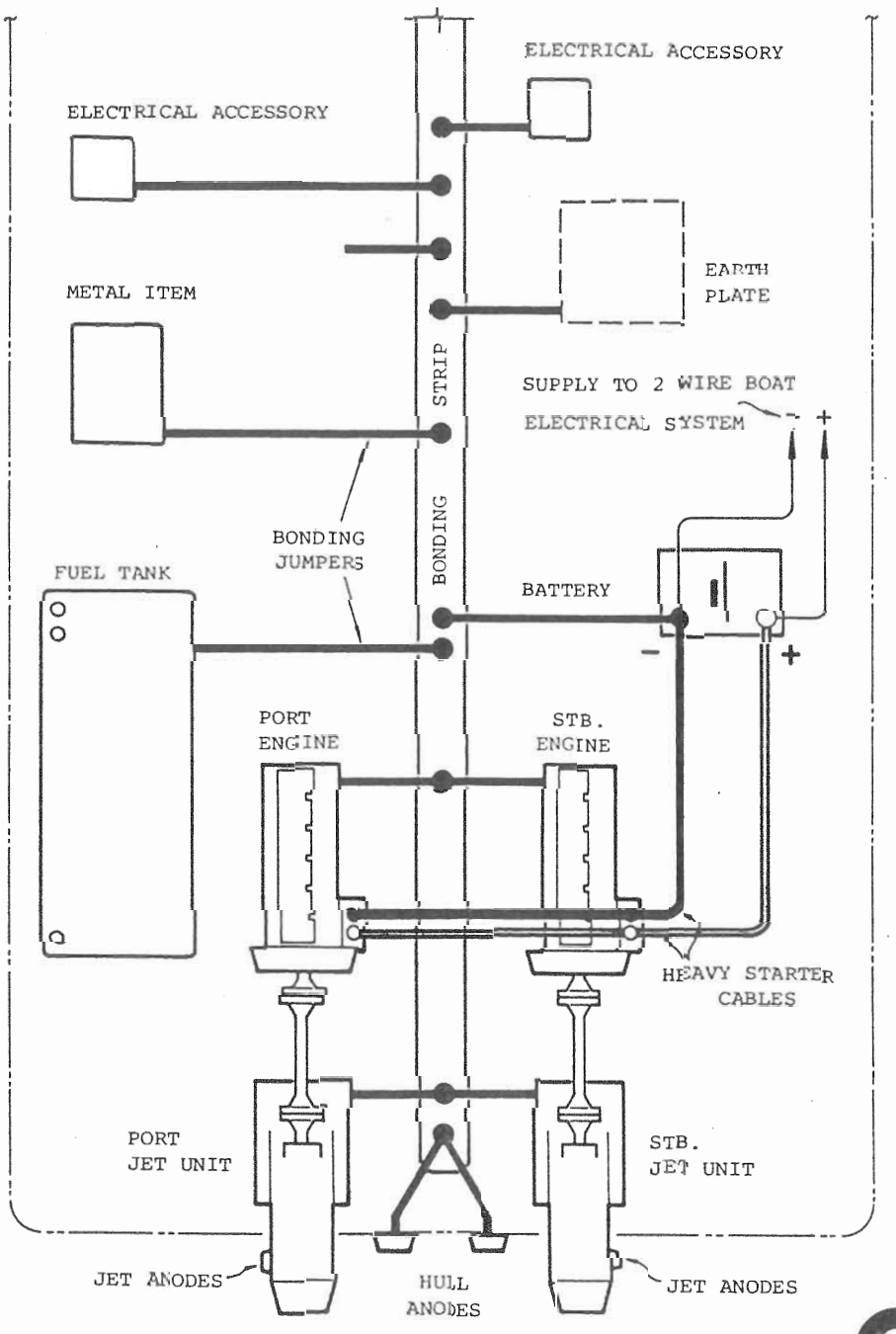
6. Anti-Fouling Paint

Keep stainless steel clean. Only use tin-based anti-fouling on the unit. Do not use any paint containing copper as this could cause corrosion of the jet unit.

7. Impressed Current Protection

Impressed current protection may be used if desired. Follow the Suppliers instructions.

EXAMPLE OF A BONDING LAYOUT (NOT STEEL HULLS)



HamiltonJet

B. STEEL HULLS:

The complete jet unit must be electrically isolated from the hull, engine etc. For the insulation instructions see the steel hull installation section for your jet unit, but specifically, insulation of the jet unit must be accomplished. The remainder of the boat should, in all respects, employ the Bonding System as described in A above.

Key areas for insulation of the jet unit are :-

(a) Base mounting flange and bolts.

(b) Transom seal to transom (sometimes by means of the rubber seal ring or gasket).

(c) Control connections such as steering and reverse cables, hydraulic hoses, etc. - (standard 361 reverse hoses are non wire wound - i.e. insulating) but the standard 361 steering hoses must be replaced with non wire wound type).

(d) Driveshaft. A coupling shaft using resilient rubber elements can provide the insulation most simply, or a flywheel plate insulated from engine flywheel by means of reinforced insulating sheet, bushes and washers (e.g. Tufnol).

The following are additional details :-

1. If a negative earth system is used on the boat it must not be connected to the jet unit casing or its anodes.

2. Every part of the boat electrical system should have TWO wires to it - a positive and a negative wire.

3. With electrical auxilliary equipment installation be guided by your electrician. Do not earth electrical equipment to the jet unit.

4. Separate zinc anodes are provided on the jet to protect the jet unit against corrosion.

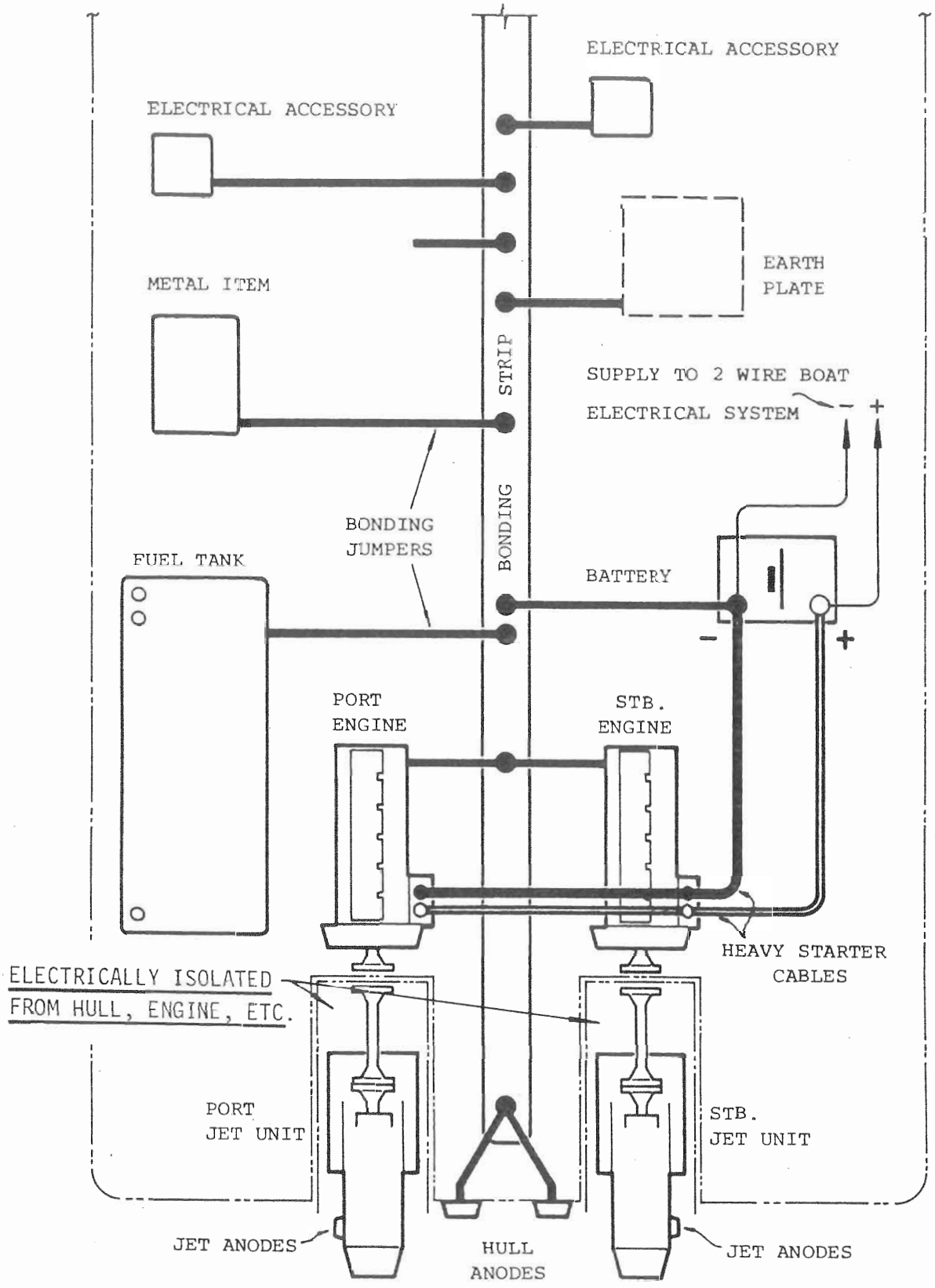
5. Regularly inspect all arodes and replace any that are more than half-eaten away.

6. Keep stainless steel clean.

7. If anti-fouling paint is used, use tin-based paint. Particularly do not use paints containing any copper at all.

8. A separate impressed current protection for the jet unit is also recommended if desired.

EXAMPLE OF A BONDING LAYOUT (STEEL HULLS ONLY)



HamiltonJet

STEERING:

The steering deflector deflects the jet of water to port or starboard causing the boat to steer to port or starboard respectively.

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

(a) If the engine is stopped there is no jet of water 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 at "zero speed" as well as all ahead and astern speeds - a feature which gives the Hamilton Jet unrivalled manoeuvrability.

Remember though that whether going ahead, at "zero speed", or astern the bow of the boat will always turn the way the steering wheel is turned, i.e. turn wheel to port, bow of boat will move to port and vice versa.

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

AHEAD/ZERO SPEED/ASTERN CONTROL:

Astern and "zero speed" are achieved by redirecting the jetstream. If the reverse duct is lowered fully all of the jetstream is redirected back under the boat giving full astern thrust. If the reverse duct is lowered partially the jetstream is split giving some ahead and some astern thrust. At one reverse duct position the ahead and astern thrusts will be equal so the boat will not move ahead or astern regardless of the throttle opening.

This position is referred to by Hamiltons as "zero speed". (It should not be confused with the neutral position of a gearbox when the driveline stops rotating).

When operating the Hamilton reverse control the jet unit is always rotating regardless of the position of the reverse duct. Any intermediate position between ahead and astern can be selected to give infinitely variable speeds when manoeuvring.

CAUTION

If in lightweight planing craft the astern or zero speed 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 an emergency.

EMERGENCY BRAKING:

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

(i) Close the throttle.

(ii) Select zero speed or astern.

(iii) Open the throttle, gently at first.

MANOEUVRING AND DOCKING:

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

(i) Move the reverse control lever to the "zero speed" position.

(ii) Set the throttle up to 1/3 open - say approx. 1,200 r.p.m. (In strong tide or wind conditions increase the throttle opening to obtain greater response as necessary).

(iii) A slight movement either way from the "zero speed" position will be sufficient to move the boat ahead or astern until the manoeuvre is complete.

(iv) Steering will be excellent also at this throttle opening. Full steering control is available at all Ahead/Astern control lever positions and there is no change of steering "sense" at any time.

Summary - manoeuvre at fixed throttle opening working the steering with one hand and the Ahead/Astern control lever with the other hand.

SHALLOW WATER OPERATION:

Avoid pumping stones, sand etc through the jet unit - this will blunt and wear the impeller.

(a) At high planing speeds this is not a problem until the boat is nearly aground.

(b) At slow displacement speeds avoid using large throttle openings in shallow water. If it is not possible to pick a deep water area to start off and stop in, "idle" over the shallow area into deep water before accelerating up to speed.

BLOCKAGES, DEBRIS, ETC, IN THE UNIT:

Small pieces of debris, water weed or large logs, etc will not normally block or harm the unit. However, it is good practice to steer around such debris if possible as any caught in the intake screen, impeller or tailpipe stator vanes can effect the jet unit's performance.

Blockages of the unit are usually noticed by :-

(a) The engine unloading (rpm increases).

(b) Lack of jet thrust (boat speed drops).

(c) Excessive noise and vibration from the unit.

If a blockage is indicated, close the throttle of the blocked unit, or stop the engine. Most times, especially if the boat is moving forwards, the obstruction will fall away.

If unsuccessful :-

(a) If a gearbox is fitted, momentarily reversing the jet unit rotation very effectively clears debris from the intake screen,

or, with the engine stopped :-

either -

(b) Operate the raking screen; or

(c) Remove the inspection cover (9) on the intake housing and clear the obstruction.

CAUTION : Before removing the inspection cover (9) :-

(i) Stop all engines.

(ii) Check that the static water level will be below the intake inspection cover lip.

If the static water level is too high, weight can be placed on the bow end to raiswe the stern end enough to allow the cover to be removed.

Alternatively, an optional extra overflow preventer (item 123) can be fitted to the inspection point to allow higher water levels.

A. STEERING:

Air continues to work its way out of manual hydraulic systems for some time. Regularly check the oil reservoir level for some weeks with a new boat and top up if necessary. With air in the system the steering will be soft - and not accurate. Ensure all air is bled from the system following the instructions on page I8. Ensure number of turns of the wheel is not more than 1.9 full lock to full lock otherwise steering will be insensitive.

With multiple jets ensure the steering tie rod length is adjusted so that all jets steer straight ahead at the same time (refer pages I5 and I6).

1. If the steering wheel is still difficult to turn, check the following :

(a) The jet tiller moves easily. Remove the cylinder rod end bolt and operate the wheel. If the cylinder operates easily, the jet tiller and steering assembly very likely has too much friction. Check the steering deflector and steering shaft rotate freely. If the cylinder does not move, and the wheel is still hard to turn, check :

(b) The system is free of entrapped air. (Refer "Bleeding" page I8).

(c) The system is piped using only the two short lengths of flex hose supplied for the cylinder connection.

(d) The hydraulic oil is one of the types recommended, that is, not more viscous (thicker) than automatic transmission fluid. (Refer recommended oils page I7).

(e) The tubing used is at least the size recommended. (Refer installation data page I7).

2. If the steering wheel continues to turn easily and the cylinder does not feel like it reaches hardover, check the following :

(a) The cylinder bypass valve (if installed) is in the closed (normal) position.

(b) All system fittings are tight.

(c) The system is free of entrapped air. If air is in the system, the wheel will spring back when turned and released. (Refer "Bleeding" page I8).

(d) A lockvalve on another helm pump is not contaminated. Contamination is indicated by the wheel turning at that station. That lockvalve must be disassembled and cleaned. When removing the slotted lockvalve inserts, take care not to lose the retained spring and steel ball or to damage the seals.

(e) The cylinder piston seals are not damaged. All of the above should be checked and determined to be satisfactory first. Remove the cylinder rod end bolt and attempt to stroke the cylinder rod fully back and forth by hand. If the rod moves, the piston seals must be replaced. Oil leaking along the cylinder rod from either end of the cylinder indicates the rod seals are defective and must be replaced. (Refer Maintenance Section page N6).

3. If the number of wheel turns is different when turning hardover to port and hardover to starboard, check the following :

(a) The system is free of entrapped air. (Refer "Bleeding" page I8).

(b) The system is piped using only the two short lengths of flex hose supplied for the connection of the cylinder.

B. AHEAD/ASTERN

- Refer to separate HERC Instruction Manual.
- Refer to Reverse Cylinder Maintenance page N6.
- Poor reverse thrust
  - Reverse duct not travelling fully down so whole jetstream enters it.
  - Reversed jetstream hitting hull or hull extension such as a trim plate.
  - Boat has insufficient immersion at transom and air being sucked from rear into jet intake.

Note effect of engine exhaust on jet reverse - page H1.

C. JET:

Note - assuming the correct impeller and nozzle combination are fitted then :-

High RPM - means jet is at fault.

Low RPM - means engine is at fault.

1.	Water leaking from under front bearing housing.	-	Faulty water seal or counter face.
2.	Excessive high pitched rattling whine.	-	Faulty thrust bearing.
3.	Bad vibrations.	-	Worn cutless bearing. Worn driveshaft universal joints.
4.	Engine revolutions gradually increasing over a period of time. Take off performance poor.	-	Worn or blunt impellers. Excessive impeller tip clearance.
5.	Sudden increase in engine revolutions, no noticeable decrease in jet thrust.	-	Fully tachometer.
6.	Excessive engine revolutions, noisy jet unit with aerated water from nozzle.	-	Screen blocked with weed, debris or rope through screen and wrapped around unit shaft or object jammed in stators and/or impeller.

N O T E : All the symptoms described in items 2, 3 and 4 may be caused by the same fault as in item 6.

GENERAL:

This unit has been designed to require the absolute minimum of maintenance. However, it is recommended that the unit be dismantled 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:-

THRUST BEARING:

Check oil level every 30 hours operation. Do not overfill. (See Recommended Lubricants page M3). Ensure correct dipstick is fitted - refer page G2.

REAR BEARING:

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

DO NOT RUN THE UNIT OUT OF WATER as this will damage the bearing and counterface. NOTE - Special cutless bearing (82) and waterseal counterface (41) are available at extra cost which enables the jet to be run dry.

To inspect the bearing see dismantling procedure section.

WATER SEAL:

This is a carbon face seal type with Ni *Resist* counterface and should require no attention. Any failure is detected by water leaking from a ¼" BSPP tapped hole under the bearing housing. A clear sight tube may be fitted into the tapped hole and run upwards to above water level. Any water leaking will be trapped in and easily seen in the sight tube.

To inspect seals see dismantling procedure section. Inspect at least every 500 hours.

DRIVESHAFT UNIVERSALS:

Every 30 hours sparingly grease the universal joints and sliding splines. Do not over grease.

SACRIFICIAL ANODES:

The unit is fitted with anodes on the tailpipe (85), steering deflector (97) and reverse bucket (122) which will waste away in sea or contaminated water. Regularly inspect these anodes and replace if half eroded away or more. If allowed to disappear, corrosion will start on the aluminium parts which could eventually damage the unit.

NOTE : The rate at which anodes erode away will vary considerably depending on the nature of the water. Check anodes monthly initially until a safe longer check interval can be established from experience.

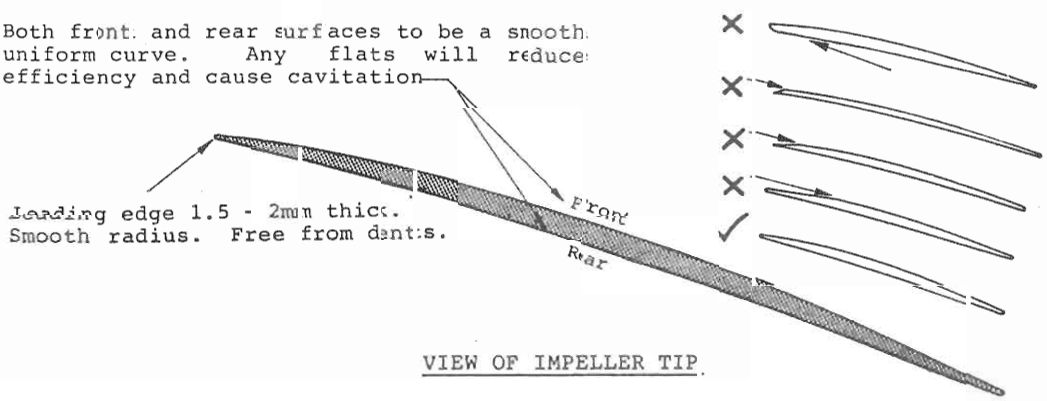
IMPELLER:

The leading edges of the impeller (70) 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 as a result.

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.

IMPELLER SHARPENING:

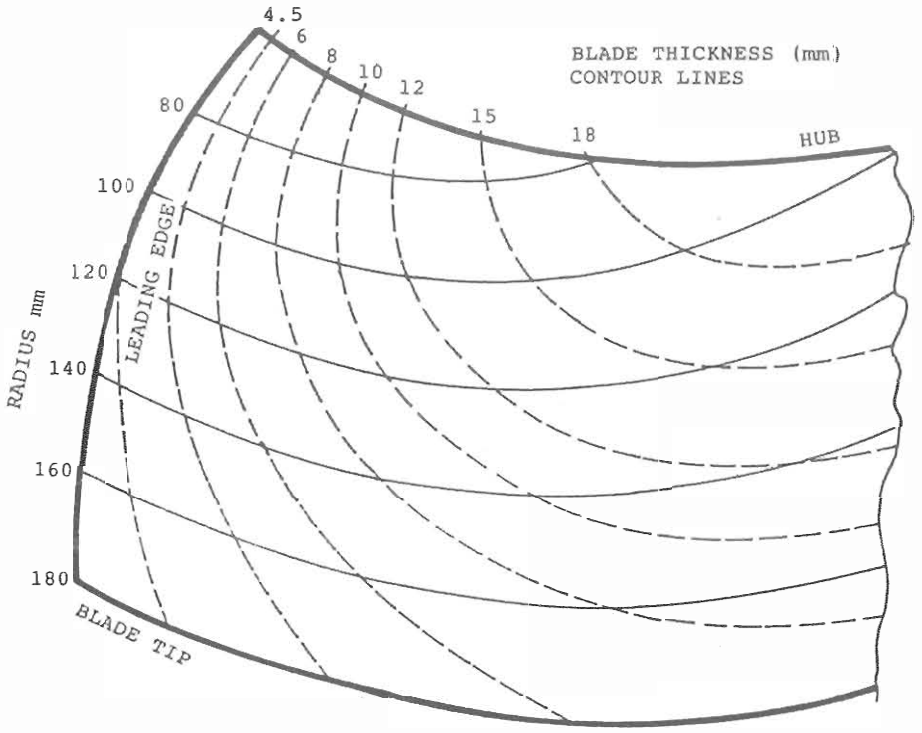
Both front and rear surfaces to be a smooth uniform curve. Any flats will reduce efficiency and cause cavitation



VIEW OF IMPELLER TIP

HamiltonJet

IMPELLER SHARPENING—CONTOUR LINES



FRONT VIEW OF IMPELLER BLADE

REVERSE AND STEERING HYDRAULICS:

Check oil levels daily and externally inspect all system components to ensure no oil leaks have developed. Top up reservoirs, if necessary. Refer HERC Manual for details on reverse system and pages and for steering system. Note that the steering system must use a "lighter" oil than the reverse system. Change oil annually or if contaminated in any way - see maintenance section.

REVERSE AND STEERING JOINTS:

All reverse bucket and steering joints outside the hull should be oiled and checked to see they are operating freely. Once in the water these joints will be water lubricated and will not normally require attention.

REVERSE CYLINDER TRANSOM PIVOT:

This spherical joint acts as both a water seal and a pivot for the reverse jack. Grease via Nipple (106) periodically. Use water repellent grease. (See Recommended Lubricants below).

RAKING SCREEN BEARINGS:

The screen rake should be checked at regular intervals for free operation. Stiffness or binding may be caused by debris caught in the screen or seized bearings. Grease bearings periodically. Use water repellent grease.

CARE OF JET UNIT PAINTWORK:

The main body of the unit is constructed from Silicon-Aluminium alloy (LM6) which best resists corrosion from salt water. These castings are finished in a Poly-urethane paint. Periodic cleaning down, wire-brushing, and re-painting may be necessary depending on water conditions prevailing, and extent of use.

When the craft is on the slip, or at least annually, the complete unit should be removed from the boat, and inspected internally and externally for faults, corrosions, or breakages (follow the maintenance instructions in Section N). Clean down and repaint the castings. DO NOT use copper-based antifouling paints. Tin base antifouling paints are suitable. Leave all stainless steel parts polished and unpainted.

RECOMMENDED LUBRICANTS:

For steering system use I.S.O. viscosity grade 32 oil such as Shell Tellus 32 or equivalent. For reverse hydraulic and oil filled bearing housing (48) use I.S.O. viscosity grade 46 oil; such as SHELL TELLUS 46 or equivalent. For all other applications (bearings, tapers, threads, mating joints and corrosion protection) - BP ENERGREASE MM - EP2 (Marine multi-purpose extreme pressure grease) or equivalent.

TIGHTENING TORQUES (for lubricated threads—see above):

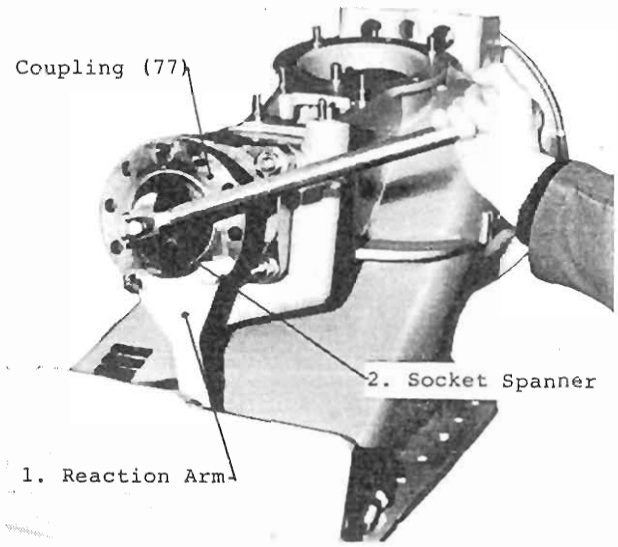
Thread Size	Description (Item No.)	Torque Nm	Torque lbs.ft.
M6	Nut	5	3.7
M8	Nut (47)	12	9
M10	Nut (96)	24	18
M12	Nut (18)	40	30
M16	Nut (13)	100	75
M20	Nut	200	145
-	Impeller Nut (75)	400	295
-	Bearing Locknut (69)	400	295
-	Coupling Nut (79)	400	295
-	Reverse Duct Pivot Pin (117)	600	450

SPECIAL TOOLS KIT—104933):

1.	Reaction Arm	104938
2.	Shaft Nut "Socket Spanner" (50mm A/F to 3/4" drive) (Also fits Reverse Duct Pivot Pin (117)).	JMNG AAP
3.	Coupling Puller	104936 Y
4.	Bearing Nut "Hook Spanner"	JNOD AFC
5.	Impeller "Puller"	104935 Y
6.	Puller Bolts (2 off)	104937
7.	Bolt M16 x 65 long (Zinc Plated) (5 off)	HYIX YDW
8.	Hex Nut M16 (5 off)	JDPV YAL

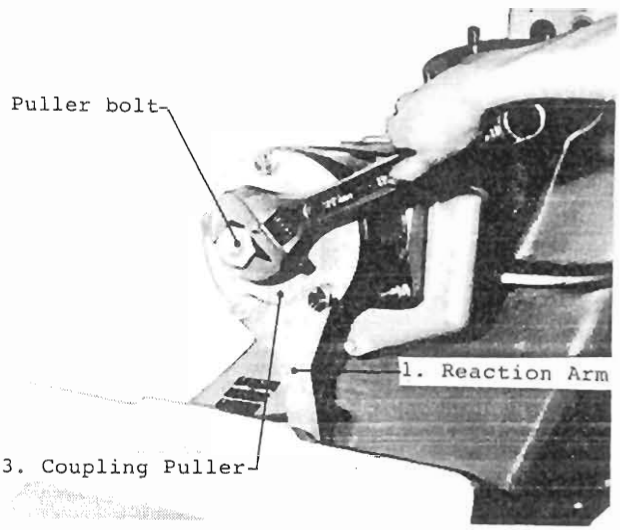
USE OF SPECIAL TOOLS:

To loosen coupling nut

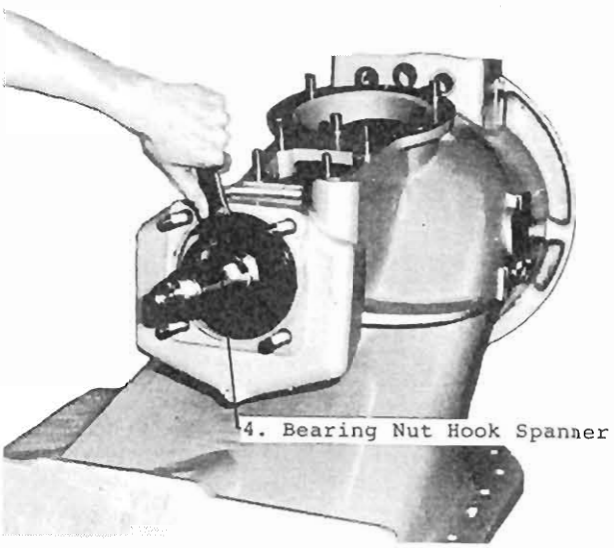


To pull coupling off taper

(also refer item 3 page N2).

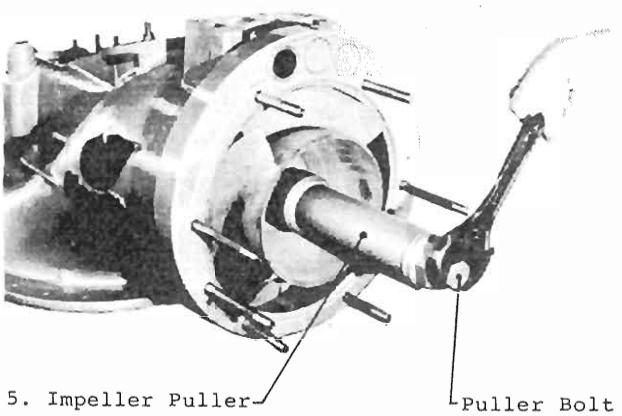


To unscrew Locknut (69)



To pull Impeller off taper

(also refer item 11 page N4).



HamiltonJet

A. THRUST BEARING ASSEMBLY AND WATER SEAL:

(Refer to illustrations page N1 for use of special tools).

Warning : If boat is afloat check that water level is below bearing housing before proceeding.

(i) Dismantling Thrust Bearing:

1. Uncouple the driveshaft from the jet unit.
2. Remove coupling flange grub screw (76), prevent coupling (77) from turning with 361 "Reaction Arm" and unscrew nut (79), two turns only, using 361 "Socket Spanner".
3. Fit 361 "Coupling Puller" to the coupling flange (77) and tighten the puller bolt firmly. Hit the puller bolt firmly with a hammer to free the coupling flange off its taper. Leave coupling flange as is with Reaction Arm and Puller attached - do not remove.
4. Unscrew bearing cap retainer nuts (13), withdraw bearing cap (57) (with oil seal (63), pre-load springs (58) and pressure plate (59)) carefully forward over the coupling flange body.
5. Disengage *tabs on lock* washer (68) from lock nut (69). Release bearing locknut (69) using 361 Hook Spanner.
6. Remove Reaction Arm and Puller. Remove coupling nut (79) and withdraw coupling flange (77) and key (78) plus items (57), (63), (58) and (59).
7. With draw seal sleeve (61), distance sleeve (67), bearing (66), bearing spacer (65).
8. Withdraw bearing housing (48) with bearing (64) and oil seal (62).
9. Withdraw seal sleeve (60).

(ii) Removing Water Seal:

10. Unscrew seal face retainer nuts (47) and withdraw retainer (45) and thrust collar (44).
11. Screw two M8 bolts into the tapped holes in the seal face holder (42) to remove it along with seal counterface (41).
12. Remove the seal inspection cover (14) and gasket (15). Release the two grub screws (40) and slide the spring retaining collar (39) aft. Slide the water seal assembly (41) forward off the mainshaft (38).

    NOTE : The mainshaft will rest on the fairing inside the intake casting.

(iii) Checking for Wear:

Check the following parts for wear and replace where necessary -

13. Oil seals (62 and 63) and their sleeves (60 and 61) (sleeves may be turned end for end instead of replacing).
14. Bearings (64 and 66).
15. Water seal and counterface assembly (41). Check to see if mating faces are scored or chipped. Always replace both seal and counterface even if one or other appears unworn.
16. "O" Rings (43, 55). Check for cuts or deformation.
17. The bearing retaining ring (49) is fitted into the bearing housing (48) with locking fluid. Unless bore is worn (bearing (64) is a loose fit) or ring is loose do not remove. If removal is required heat housing gently to break locking fluid.
18. Thoroughly clean all parts.

(iv) Re-assembly of Water Seal:

(Refer Recommended Lubricants and Tightening Torques - page M3).

1. With the seal inspection cover (14) removed, wet the mainshaft (with a 2 to 1 water to household detergent mix) and carefully replace in the following order :- seal retaining collar (39), spring, rubber drive ring and rotating parts of seal assembly (41).

   NOTES :- If a replacement seal has been supplied with a thin stainless steel spring retaining collar this should not be fitted but discarded.

   - Slide the whole assembly some 25mm aft of its final position.

2. Press seal counterface (41) into seal face holder (42).

3. Coat "O" Ring (43) and seal face holder (42) to intake (1) contact faces with marine grease.

4. Fix seal face holder (42) and "O" Ring (43) then thrust collar (44) and retainer (45). Torque up washers (46) and nuts (47).

WARNING - Water seal faces must remain free of grease.

(v) Re-assembly of Bearing Housing:

5. Lubricate seal sleeve (60) and slide into position.

6. Press seal (62) (with spring towards bearings) into bearing housing (48). If bearing ring (49) has been removed refit into bearing housing (48) using Loctite 601 or equivalent locking fluid.

7. Carefully assemble bearing housing (48) into position.

8. Assemble bearing spacer (65), bearing (66), distance sleeve (67) and lubricated seal sleeve (61) into position.

9. Grease lockwasher (68) and bearing lock nut (69) and assemble. Temporarily fit the coupling flange (77), key (78) and Reaction Arm to the mainshaft. Torque nut (69) to 400 Nm (295 lbs.ft) minimum. Note that a 1 metre long pipe extension placed on the 361 Hook Spanner will give approximately the required torque when the full force of 1 hand is applied to the end of the tube. Bend the lockwasher (68) tabs over the nut (69) to lock. Remove coupling flange key and Reaction Arm.

10. Press seal (63) with spring towards bearings, into bearing cap (57). Fit springs (58) using a smear of grease to hold them in position.

11. Coat "O" Ring (55) and bearing cap (57) to bearing housing (48) contact faces with grease.

12. Align the bearing outer race (66) and fit pressure plate (59) into bearing housing (48).

13. Initially refit shims (56) of the same total thickness as was previously used over the four studs (30) and slide up to bearing housing (48). Refit bearing cap complete with springs (58) into position. Screw on nuts (13) with spring washers (12) and torque to 100 Nm.

14. Check the mainshaft axial clearance is correct. Using a dial gauge on the mainshaft, move fore and aft and check that 0.13 - .18mm (.005-.007 ins.) movement is present. Alter shims (56) between bearing cap (57) and bearing housing (48) as necessary. Note - shims of 0.05, 0.13 and 0.25mm (0.002, 0.005 and 0.010 ins.) are available.

15. Lightly grease bore and keyway of coupling flange (77), taper and keyway on mainshaft (38) plus thread and face of coupling nut (79). Fit key (78), coupling (77) and coupling nut (79). Prevent coupling (77) from turning with 361 "Reaction Arm" and torque nut (79) using 361 "Socket Spanner" to 400 Nm (295 lbs.ft). Fit and tighten grub screw (76). Using the Reaction Arm as a handle check the mainshaft assembly will rotate.

16. Fill bearing housing (48) with oil until the dipstick (50) oil level reaches the full mark. Do not overfill. Use I.S.O. viscosity grade 46 oil such as Shell Tellus 46.

17. With seal inspection cover (14) removed and the mainshaft wetted (with 2 to 1 water to detergent mix), slide the shaft seal (41) into its correct position. Use either a simple "yoke" or two levers to do this and tighten each grub screw (40) into the recess holes provided in the mainshaft.

b. IMPELLER/WEAR RING:

(i) Checking for Wear:

Before dismantling the tailpipe end of the jet, remove the inspection cover (9) (or intake screen (34) if in dry dock) and carry out the following checks :

1. Using feeler gauges, check clearance between the tips of the impeller blades and wear ring (2) at each side of the unit (i.e. not top and bottom). Maximum recommended worn clearance is 1.5mm (.060 ins) per side.

2. Push the mainshaft (38) hard from side to side. Check total sideways movement at blade tips. Maximum recommended worn total movement is 0.6mm (.024 ins). This indicates the amount of wear in the rubber bearing (82) and shaft sleeve (74).

(ii) Dismantling:

3. Disconnect reverse jack (120) from duct (114) by removing pin (118). Move duct through full arc to check for stiffness or slack bushes.

4. Using the Shaft Nut "Socket Spanner" (refer illustration page N2) screw reverse bucket pivot pins (117) and remove reverse bucket (114).

5. Disconnect steering tiller (101) from steering cylinder. Check steering shaft (99) for :-

   (a) Free rotation and axial movement.

   (b) Undue wear in fore and aft bushes (8).

   (c) Undue wear in ball end of crank (100). (Check fit in deflector bush (91)).

6. Remove cotter (102) from steering crank (100) and ensure that crank rotates freely on shaft.

7. Rotate steering deflector (90) through full arc, to check for stiffness or slack bushes (89). If these seem to be in good condition the deflector can remain on the tailpipe/nozzle (81), (88) assembly.

8. Remove eight tailpipe nuts (13). Hit tailpipe sideways with the heel of the hand or a rubber mallet to free the joint and remove from the remainder of the jet unit, the steering crank (100) must be slipped off the shaft (99) at the same time.

9. Remove grub screw (76), lock coupling (77) with 361 "Reaction Arm" so that it cannot rotate and unscrew impeller nut (75) using Shaft Nut Socket Spanner.

10. Withdraw shaft sleeve (74).

11. Screw 361 "Impeller Puller" onto impeller hub and tighten the Puller Bolt firmly. Free inpeller (70) from mainshaft applying sharp blows with a hammer to the Puller Bolt. Withdraw impeller and puller.

12. Remove key (71) being careful not to lose locating dowel (72).

13. Examine wear ring (2). In the unlikely event of this being very badly scored, or if it has swollen inwards, it should be replaced. If possible, request your local agent to carry out the replacement.

(iii) Replacing the Wear Ring:

(a) Find the joint in the wear sleeve and force a fine screw driver between the sleeve and the intake casting adjacent to the joint until the end of the sleeve is free (fig. 1 and 2). Pull the end of the sleeve inwards and remove it from intake.

(b) Remove the insulating strip and thoroughly clean intake bore.

(c) Paint the intake bore with a thin layer of etch primer only.

(d) Put in a new insulating strip while etch primer is still wet then grease its inside diameter.

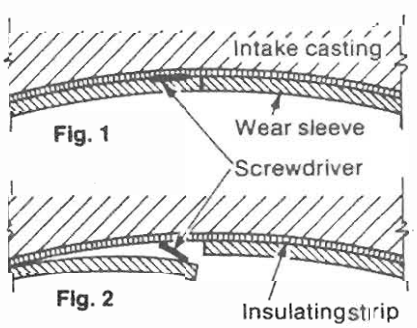


Fig. 1

Fig. 2

(e) Take a new wear strip and with chamfer end leading, butt the strip at the chamfers by twisting slightly, Fig 3, (this reduces the lead in diameter) and feed it inside the insulating strip, as it goes in straighten the strip gradually until it butts normally, Fig 4. Slide in as far as possible and complete assembly by tapping gently with a wood block round and round the outside edge. The wear strip is in the correct position when it is flush with the face of the bore, see Fig 5. the 0.8mm gap must be maintained to prevent electrical contact between the wear ring and the intake casting.

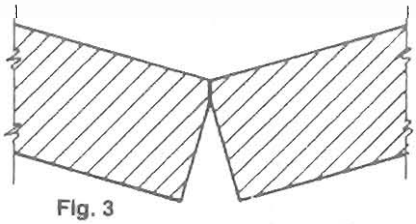


Fig. 3

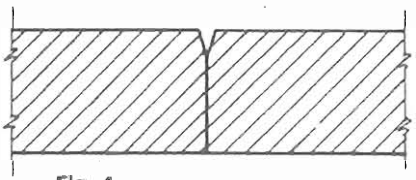


Fig. 4

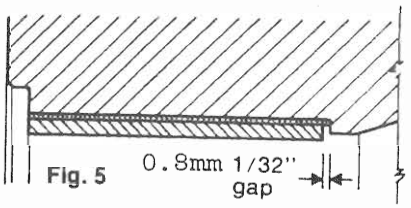


Fig. 5

(iv) Impeller Overhaul:

14. (a) Check the impeller leading edge, if blunt or dented file out the dents following the profile of the blade, and then sharpen in line with instruction on page M1.

(b) If you decided at point 1. in these assembly instructions that the outside diameter of the impeller was badly worn, check it again in the new wear ring, if the clearance is still too great proceed as follows -

- Build up impeller tips by welding.

  Aluminium Bronze Impellers : filler metal chemical analysis similar to BS1400 grade AB2. Post weld heat treat 650°C-670°C for 2 hours and cool in air.

  Stainless Steel : filler metal chemical analysis similar to ASIM 2769 316L (carbon content less than .03%). Post weld heat treatment not required.

- Turn the outside diameter to 360.0-359.9 (14.400-14.396 ins.) making sure that it is concentric with the bore. (Light cuts should be taken when turning outside diameter to avoid deformation of the impeller blades).

- File and polish.

- Balance the impeller statically, preferably on its main shaft (38) with the coupling (77) and all keys in place. Balance to within 120 gm-cm (1.67 oz.ins.)

(v) Re-assembly:

1. Check the cutless bearing (82) and its sleeve (74) for wear (refer item 2 page N4) or bad scoring and if necessary replace. Replace automatically if the impeller has just been built up and the wear sleeve replaced. Use either an internal extractor to pull bearing (82) from the tailpipe (81) or place tailpipe under a press and press bearing (82) and fairing (83) out together. Fix fairing back in with "Loctite 601" locking fluid or equivalent. Apply grease to tailpipe bore before inserting new bearing but keep grease away from rubber bearing surfaces. When pressing the new bearing in, use a wooden block under the nose of the tailpipe fairing to take the load.

2. Replace all worn bushes in the steering system.

3. Clean all parts thoroughly.

4. Smear a light coating of grease over complete mainshaft from in front of impeller seal position including impeller taper, and right aft including impeller nut thread.

5. Check impeller seal (73) for damage - replace if necessary. Fit onto shaft just ahead of impeller taper.

6. Insert impeller key (71) locating it with dowel (72).

7. Feed impeller onto shaft followed by the shaft sleeve (74).

8. Prevent shaft rotating by fitting Reaction Arm at coupling (77), screw on impeller nut (75) and torque to 400 Nm. (295 lbs.ft).

9. Redrill recess hole for grub screw (76) in mainshaft if necessary then fit and tighten grub screw (76).

10. Working through the intake inspection hatch remove surplus grease from the impeller seal recess (at front of impeller). Then feed the seal (73) back into the recess while rotating the mainshaft and impeller by hand.

11. Wipe shaft sleeve (74) clean to ensure rubber bearing (82) remains free of grease.

12. Dust rubber bearing (82) with talc or french chalk.

13. Clean and grease tailpipe/intake contact faces. Refit "O" Ring (87) and replace tailpipe, at the same time steering crank (100) onto shaft (99). Screw on nuts with spring washers (12), (13) - threads greased. Torque to 100 Nm. (75 lbs.ft).

14. Using the Reaction Arm fitted to the coupling flange (77) as a handle turn mainshaft to ensure assembly will rotate.

15. Replace and tighten cotter (102) in steering crank (100). Torque to 40 Nm. (30 lbs.ft). Ensure cotter fitted opposite way round to tiller cotter.

16. Replace reverse bucket pivot pins (117). Clean threads and taper seals then grease threads including bushes (115) and washers (116). Using Shaft Nut Socket Spanner torque pins to 650 Nm. (490 lbs.ft).

17. Check that steering control from helm to steering arm is free and then reconnect cylinder to arm (101). Refer to steering system installation and adjustment page I4.

C. STEERING SYSTEM:

The Steering Cylinder and helm pump parts lists and illustrationsare shown in Sections O, P and Q. For fault finding with Steering System refer to Fault Finding page L1.

The system oil should be changed annually or immediately if contaminated in anyway. If the oil has been contaminated in any way all components, including the helm pumps, must be disassembled, cleaned and the hydraulic lines flushed clean with kerosene, varsol or diesel oil. Check the condition of the cylinder seals carefully before reassembly and replace if necessary. Note - a cylinder seal kit part number 119-0082 is available. Refill system with oil and bleed as per instructions on pages I7 and I8.

D. REVERSE CYLINDER:

The Reverse Cylinder assembly is as Parts List page R1 and Drawing page R2.

For fault finding with the Reverse System refer to the HERC Manual.

Maintenance:

1. The Reverse Cylinder need only be dismantled if it is suspected that a seal has failed. Typical symptons of seal failure are :

Piston Seal (C8)	:	Reverse bucket creeping down from up position. (Can also be caused by a faulty solenoid valve on the EHPU - refer HERC Manual).
Front Head Seals (C10) & (C11)	:	Oil leaking from the Fronthead retainer (C12).

Dismantling:

2. Disconnect hydraulic hoses and sender linkage ball joint (161).

3. Remove Split Pin (119) and Cylinder Pin (118) at Reverse Duct (114).

4. Unscrew 4 nuts (47) and washers (46) and remove header (113) and seal (112). Unscrew 4 mounting nuts (152) and washers (151) and withdraw cylinder through hole in transom.

5. Hold the shaft with a spanner at point "A" and unscrew connector block (C16). Note - it may be necessary to apply heat to break the thread lock fluid used on this joint. Extend shaft fully and apply minimal heat at joint only.

6. Hold the backhead (C5) with a spanner and unscrew the Fronthead Retainer (C12). Note - if the joint between Backhead (C5) and Cylinder (C6) is undone it should be reassembled with thread lock fluid.

7. Withdraw the Shaft Assembly (C7) and Fronthead (C9) from the cylinder.

8. Remove end plug (C17) and "O" Ring (C18) from Connector (C16). Apply minimal heat if necessary to break thread lock fluid used on this joint.

9. Remove all other seals (C8, C10, C11, C13) and thoroughly clean all parts. Ensure threadlock fluid residue is removed from engaging threads between Shaft (C7) and Connector (C16), plus Connector (C16) and Plug (C17).

10. Check Cylinder (C6) bore and Shaft (C7) outside diameter. Replace if obviously worn or scored. Note - that these items must be replaced as a matched pair.

Re-assembly:

11. Fit new seals (C8), (C10), (C11), and (C13). Note - Cylinder Overhaul Kit part number 104913 is available. This includes all seals (C8), (C10), (C11), (C13) and (C18) plus a container of thread lock fluid "Loctite 569".

12. Oil Shaft Assembly (C7) and insert into Cylinder (C6).

13. Oil Fronthead (C9) inside and outside. Fit over shaft (C7) (taking care not to damage seal on threads) and insert into Cylinder (C6).

14. Grease the mating threads on Fronthead Retainer (C12) and Cylinder (C6) and screw together. (Do not apply thread lock fluid here). Torque to 40-50 Nm.

15. Slip the outer hemispherial seat (C15) onto the shaft assembly (C7). Clean the mating threads on Shaft Assembly (C7) and Connector (C16), apply thread lock fluid ("Loctite 569" or equivalent) to threads and screw together. Torque to 40-50 Nm with spanner on Shaft Assembly (C7) at point "A".

16. Carefully feed new "O" Ring (C18) into position between Shaft (C7) and Connector (C16).

17. Clean the mating threads of Plug (C17) and Connector (C16), apply thread lock fluid (Loctite 569 or equivalent) to threads and screw together.

18. If possible workshops test the cylinder before reinstalling in boat. The workshop test pressure for the cylinder is 210 bar (3050 psi) but for correct operation of the HERC system ensure that the setting of the relief valve of the hydraulic power unit in the boat is only 110 bar (1600 psi).

19. Feed assembly through transom hole. Slip hemispherical seats (C15) onto their studs. Checking that drilling for grease supply in hemispherical seat lines up with drilling in transom plate.

20. Screw on 4 nuts (152) and washers (151) and tighten.

21. Feed seal (112), header (113) into position and washers (46) and tighten nuts (47).

22. Reconnect : Cylinder to reverse duct with pin (118) and fit split pin (119); hydraulic hoses; and ball joint on link to sender.

23. Grease ball joint at (106).

24. Operate hydraulics, bleed system of air and check for leaks etc (refer HERC Manual).

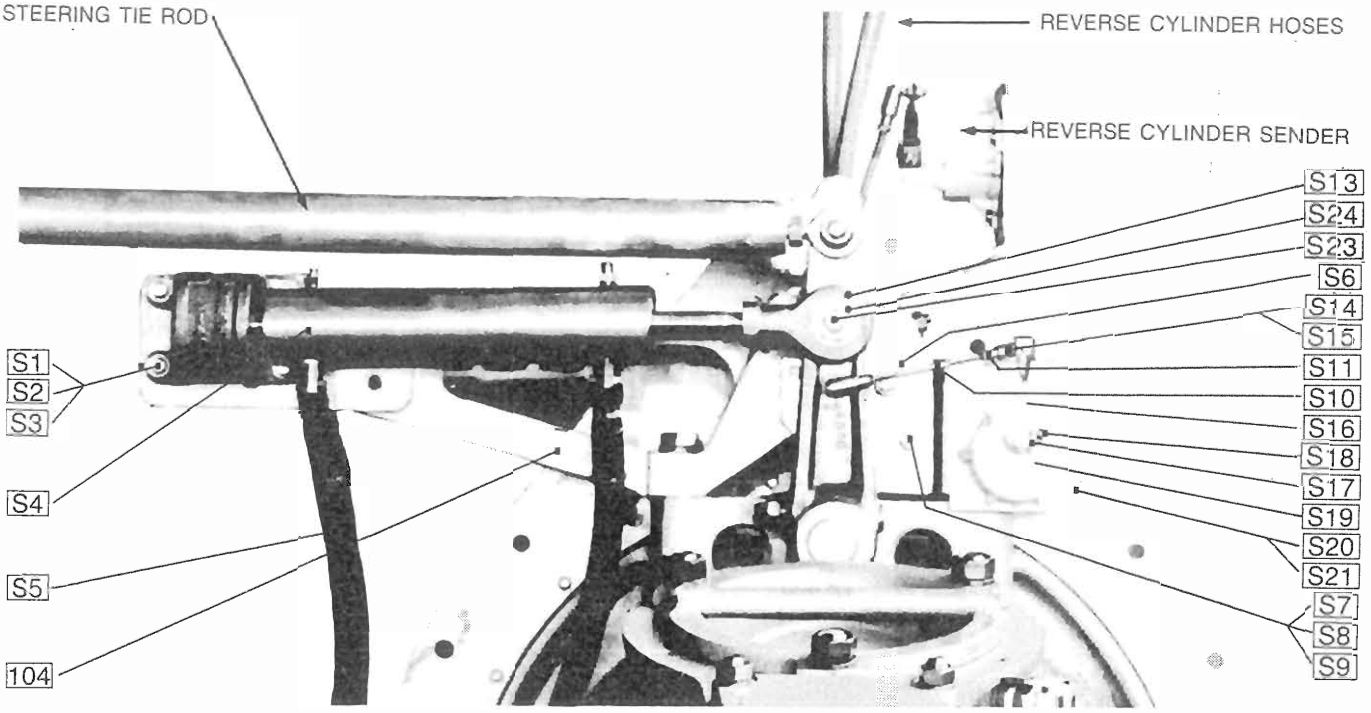
25. Refer to separate HERC INSTRUCTION booklet if Reverse Control not functioning properly.

STEERING CYLINDER AND SENDER ASSEMBLY (104889SY)

ITEM	PART NUMBER	REQ'D	DESCRIPTION
S1	30666	4	Stud M10
S2	JEQK XAE	4	Spring Washer M10
S3	JDQH XAE	4	Hex. Nut M10
S4	63571	1	Steering Cylinder Assembly
(See pages R1 R2 for internal details).			
S5	41-007025	2	Steering Cylinder Hose
S6	104892	1	Sender Mounting Bracket
S7	30665	2	Stud M8
S8	JEQK XAC	2	Spring Washer M8
S9	JDQH XAC	2	Hex. Nut M8
S10	104672	1	Sender Link
S11	JDKY ABQ	2	Hex. Nut 10-32 Brass
S12	JMNG AAK	1	Steering Indicator (not illustrated).
S13	JEOZ XAM	1	Flat Washer M16
S14	KYIN AAG	2	Ball Mount
S15	104671	2	Ball Cup
S16	104552-7	1	Sender Arm
S17	JMNG AAM	1	Sender Arm Bracket
S18	-	1	Sender Arm Locking Screw
S19	JMNG AAG	1	Sender
S20	HZMT XAD	3	Pan Head Screw M4 x 12
S21	JEPR AAN	3	Flat Washer 5/32"
S22	B2	1	Helm Steering Pump (not illustrated).
(Refer pages P1 P2 for detail).			
S23	HYQH XIO	1	Hex. Head bolt M16 x 60
S24	JDQK XAJ	2	Hex. Nut Thin M16

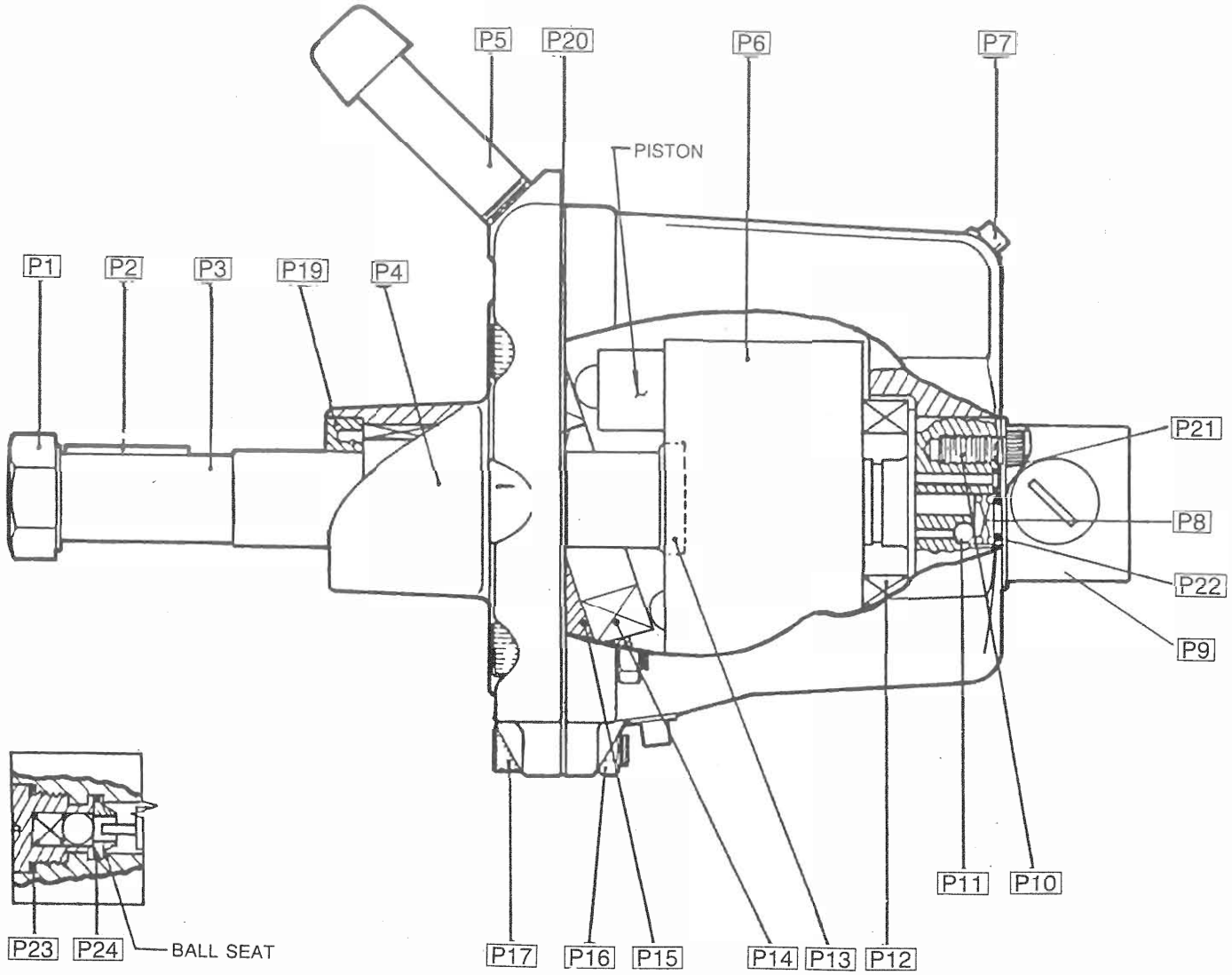
PARTS ILLUSTRATION
STEERING CYLINDER
AND SENDER ASSEMBLY

O2-12-86



HamiltonJet

ITEM	PART NUMBER	REQ'D	DESCRIPTION
P1	320-0063	1	Bolt
P2	51-102007	1	Key
P3	310-0003	1	Shaft Assembly
P4	320-0065	1	Front Plate
P5	111-0004	1	Dipstick Assembly
P6	310-0022	1	Housing Pintle & Rotor Assembly
P7	41-132002	2	Plugs
P8	31-100020	2	Springs
P9	400-0002	1	Lockvalve
P10	51-209002	2	Capscrews
P11	21-300002	2	Balls
P12	21-100006	1	Bearing
P13	320-0135	1	Key (Rotor)
P14	21-100002	1	Bearing
P15	91-990003	1	Bearing Cage
P16	51-509009	4	Nuts
P17	51-209003	4	Capscrews
P19) P20) P21) P22) P23) P24)	119-0085	1	Pump Seal Kit

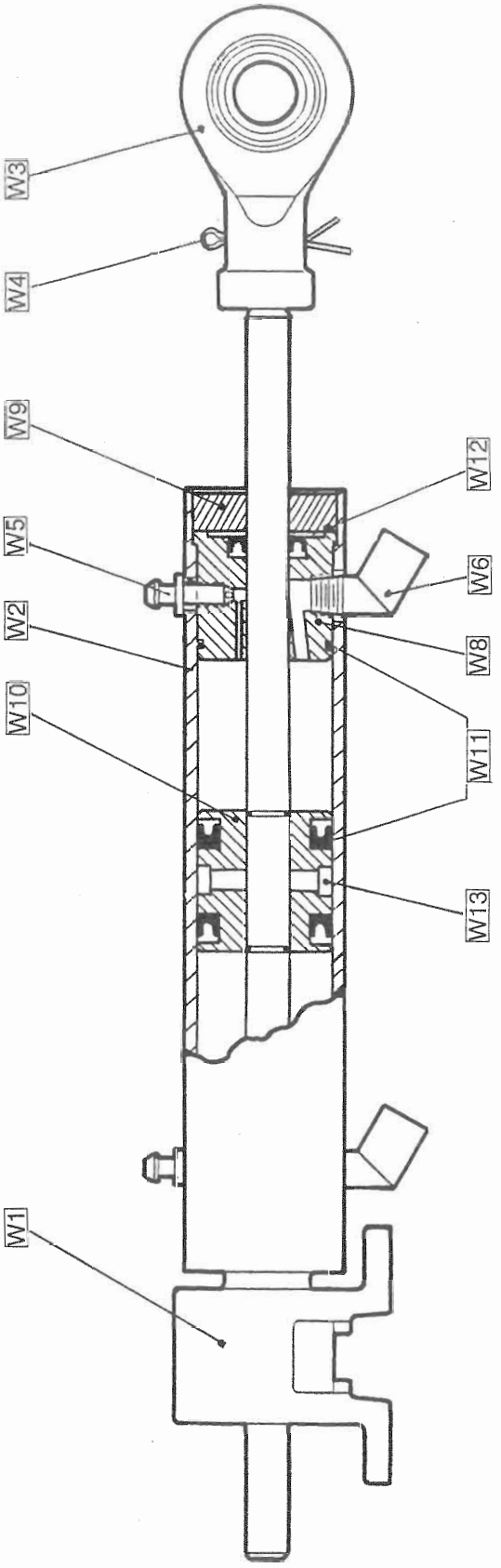


LOCK VALVE DETAIL

PARTS LIST
STEERING CYLINDER

Q1-12-86

ITEM	PART NUMBER	REQ'D	DESCRIPTION
W1	710-0002	1	Trunnion Assembly
W2	720-0006	1	Cylinder Barrel
W3	710-0003	1	Rod End Assembly
W4	51-182005	1	Cotter Pin
W5	720-0014	2	Bleed Fittings
W6	41-332038	2	45° Street Elbow
W8	720-0005	1	Cylinder End
W9	720-0003	1	Retainer
W10	710-0001	1	Piston Rod Assembly
W11	119-0082	1	Seal Kit
W12	91-992001	1	Washer
W13	720-0052	1	Piston Wear Ring



HamiltonJet

REVERSE CYLINDER:

Refer drawing 104871SY page R2.

When ordering specify jet serial number, part number and quantity required.

ITEM	PART NUMBER	REQ'D	DESCRIPTION
C 1	104653	1	Rod End
C 2	104654	1	Rod End Bush
C 3	104655	2	Rod End Washer
C 4	JDQK XAJ	1	M16 Hex. Locknut 316 S.S.
C 5	104772	1	Backhead
C 6	104773 +	1	Cylinder
C 7	104872SY +	1	Shaft Assembly
C 8	JWKZ ADD	1	Piston Seal
C 9	104777	1	Front Head
C10	HMHR AAS	1	"O" Ring .13" x 1" x 1.25"
C11	JWKZ ADE	1	Gland Seal
C12	104662	1	Fronthead Retainer
C13	JWOQ AAH	1	Rod Wiper
C14	HZMS XAH	1	M4 x 10 Screw Nylon
C15	104663	2	Hemispherical Seat
C16	104876	1	Connector
C17	105133	1	End Plug
C18	HMHR ADZ	1	"O" Ring .06" x .25" x .38"

SPARE PARTS KITS:

\+ Cylinder (C6) and Shaft Assembly (C7) must be replaced as a matched pair.

\- "Cylinder Overhaul Kit" 104913 contains all seals (items C8, C10, C11, C13, C18) plus a container of thread lock fluid.

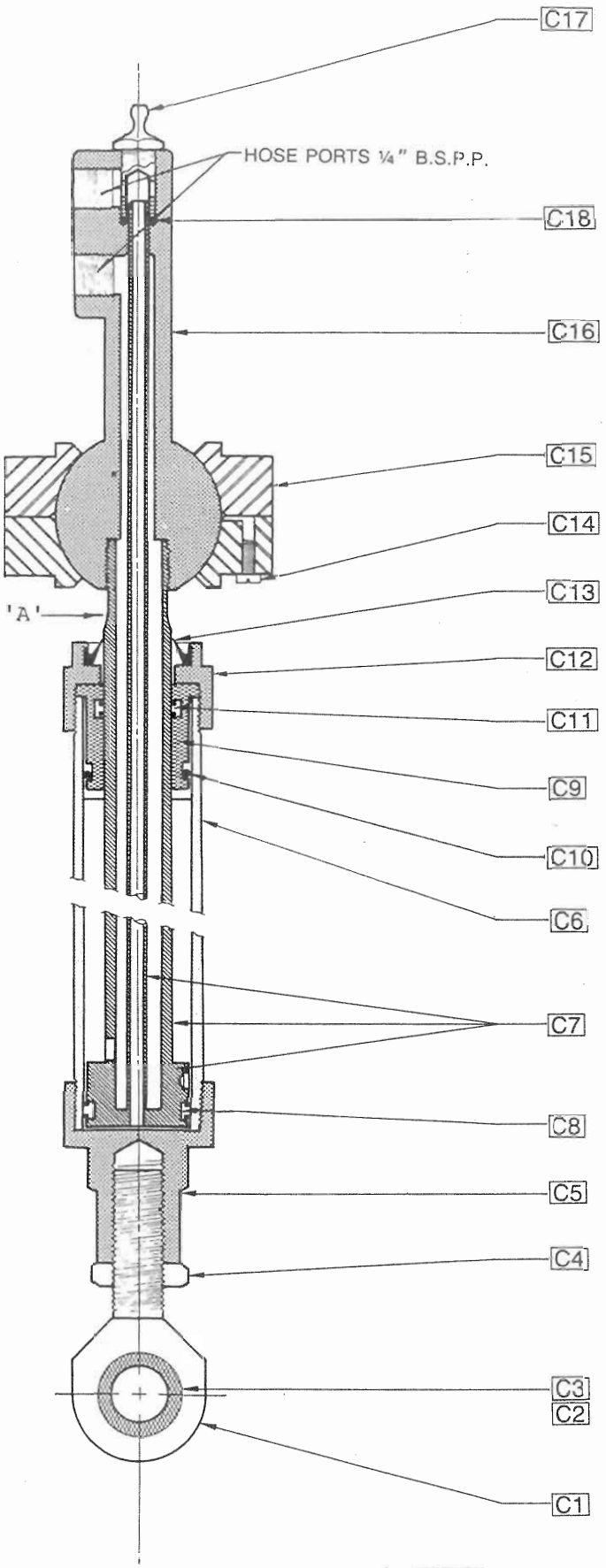
REVERSE CYLINDER ASSEMBLY 104871SY:

Specifications :-

DOUBLE ACTING

Bore	31.6mm (1.24")
Shaft dia.	20.57 to 20.52mm
Stroke	260mm (10.24")
Displacement	Closed 118cc Extended 204cc

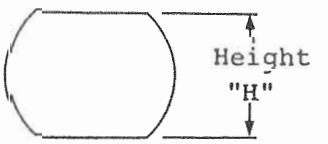
Relief Valve setting for 361 jet/HERC Control ..... 110 bar (1600 psi)



HamiltonJet

ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	104965	1	Intake - (available only as Intake "Spares Kit" Assembly part number - 105201SY and consists if items 1,2,3,4,5,6, 7,8,11,16,17,18,19,24,25,30,31,32,33 and 35).
2	104883	1	Wear Ring
3	104884	1	Insulator - Wear Ring
4	104858	2	Plug - Steering Shaft Hole
5	104838	1	Scraper Housing
6	61332	1	Scraper
7	61422	1	Seal
8	104837	2	Bush - Steering Shaft
9	104885Y	1	Inspection Cover
10	HMHR ACW	1	O Ring 0.25" x 6.5" x 7.0"
11	30657	3	Stud M16
12	JEQK XAJ	19	Spring Washer M16
13	JDQH XAL	15	Hex. Nut M16
14	104879	1	Inspection Cover - Water Seal
15	104880	1	Gasket - Seal Inspection Cover
16	30658	4	Stud M12
17	JEQK XAH	41	Spring Washer M12
18	JDQH XAH	43	Hex. Nut M12
19	30659	4	Stud M12
20			
21			
22	JEQK XAH	2	Spring Washer M12
23			
24	104966	1	Intake Extension - (available only as an assembly in Intake Spares Kit - see item 1. above).
25	102768	11	Stud M12
26	105389	1	Bearing - Port
27	105390	1	Bearing - Starboard
28			
29	30659	12	Stud M12
30	30656	4	Stud M16 - Intake/Bearing Housing
31	30661	6	Stud M8 - Intake/Seal Retainer
32	104848	4	Stud M16 - Intake/Tailpipe
33	30655	4	Stud M16 - Intake/Tailpipe
34	104967Y	1	Intake Screen
35	30668	8	Stud M12
36	63097	1	Name Plate
37	63135	1	Patent Plate
38	104827	1	Mainshaft
39	104842	1	Spring Retaining Collar
40	JAJY XCN	2	Socket Set Screw M10 x 12
41	61421	1	Water Seal and Face Assembly
42	104844	1	Seal Face Holder
43	HMHO ABD	1	O Ring 0.13" x 4.13" x 4.38"
44	104843	1	Thrust Collar
45	104841	1	Retainer - Seal Face Holder
46	JEQK XAC	36	Spring Washer M8
47	JDQH XAC	36	Hex. Nut M8
48	104812	1	Bearing Housing
49	104859-1	1	Bearing Ring

ITEM	PART NUMBER	REQ'D	DESCRIPTION
50	104925) or 104926) or 104927)	1	Filler Cap/Dipstick - up to 10° Deadrise Filler Cap/Dipstick - 10° to 20° Deadrise Port Filler Cap/Dipstick - 10° to 20° Deadrise Starboard Filler Cap/Dipstick - 20° to 30° Deadrise Port Filler Cap/Dipstick - 20° to 30° Deadrise Starboard (Refer sketch page G2 for identification).
51	104997	1	Gasket - Filler Base
52	104996	1	Filler Base
53	HZPR XBP	3	Round Head Screw M5 x 10
54	HIHK AAB	1	Plug 0.25 BSPT (Galv.)
55	HMHR ACD	1	O Ring 0.13" x 5.75" x 6.0"
56	104849-1) or 104849-2) or 104849-3)	As required	Shim 0.002") Shim 0.005") (refer page N3 items 13 & 14). Shim 0,010")
57	104822	1	Bearing Housing
58	60236	8	Pre-load Spring
59	104944	1	Pressure Plate
60	104823	1	Seal Sleeve - Aft
61	104943	1	Seal Sleeve - Front
62	JWKZ ACZ	1	Oil Seal - Aft
63	JWKZ ADO	1	Oil Seal - Front
64	JNOD AAL	1	Bearing SKF 22212C
65	104824	1	Bearing Spacer
66	JNOD AAV	1	Bearing SKF 29412E
67	104825	1	Distance Sleeve
68	104922	1	Lockwasher
69	104923	1	Lock Nut
70	104904) 105300) 105301) 104905) 105302) 105303)	1	Impeller Type 39 Impeller Type 36 Impeller Type 33 Impeller Type 30 Impeller Type 27 Impeller Type 24
71	104845	1	Impeller Key
72	104004	1	Dowel
73	104864	1	Impeller Seal
74	104865	1	Bearing Sleeve
75	104847	1	Impeller Nut
76	JAJM XBR	2	Socket Set Screw M8
77	105398	1	Coupling Flange - 8 x M14 Bolts
78	104846	1	Coupling Key
79	104924	1	Coupling Nut
80	103043) or JMNG AAO)	1	Plug 1.25 BSP - Water Offtake Hose Tail 1.25 BSP - Water Offtake
81	104810Y	1	Tailpipe (available only as a Tailpipe Spares Kit Assembly part number - 105202SY and consists of items 17,18,29,80, 81,82,83,85 and 86).
82	104866	1	Cutless Bearing
83	104811	1	Tailpipe Fairing
84	104867	2	Threaded Bush
85	103862	1	Anode - Tailpipe
86	103927	2	Stud M12
87	104986	1	O Ring - Intake/Tailpipe
88	104814) 104813)	1	Nozzle - Small H = 150mm Nozzle - Standard H = 171mm
89	104830	2	Bush - Deflector Pivot



Nozzle identification

ITEM	PART NUMBER	REQ'D	DESCRIPTION
90	105448	1	Steering Deflector Assembly - (Item 90 includes items 91 and 92. Items 91 and 92 are not available as spare parts).
93	104833	2	Pivot Pin
94	HYQH XEE	2	Hex. Head Bolt M10 x 80
95	JEQK XAE	3	Spring Washer M10
96	JDQH XAE	3	Hex. Nut M10
97	103359	2	Anode - Deflector
98	HYQH XCJ	2	Hex. Head - Bolt M8 x 80
99	104836	1	Steering Shaft
100	104834	1	Steering Crank
101	104840	1	Tiller
102	104835	2	Cotter
103	104908	2	Washer
104	104829) or 104828)	1	Steering and Reverse Mount Bracket Reverse Cylinder Only Mounting Bracket - not illustrated
105	HYQH XIO	4	Hex. Head Bolt M16 x 60
106			
107	104817	1	Transom Plate
108	104818	1	Transom Seal
109	104819	1	Header Ring
110	30633	20	Stud M8
111	30667	4	Stud M8
112	104820	1	Seal - Reverse Cylinder Mount
113	104821	1	Header - Reverse Cylinder Mount
114	104855Y	1	Reverse Duct
115	104869	2	Bush - Reverse Duct Pivot
116	104870	2	Washer - Reverse Duct Pivot
117	104868	2	Pivot Pin - Reverse Duct
118	104886	1	Pin - Reverse Cylinder/Duct
119	HUIL AAH	1	Split Pin Dia. 3 x 25
120	104871SY	1	Reverse Cylinder Assembly (Refer pages R1 and R2 for parts details of cylinder).
121	30632	4	Stud M8
122	104634	2	Anode - Reverse Duct
123	104940	1	Overflow Preventer Kit (optional extra)

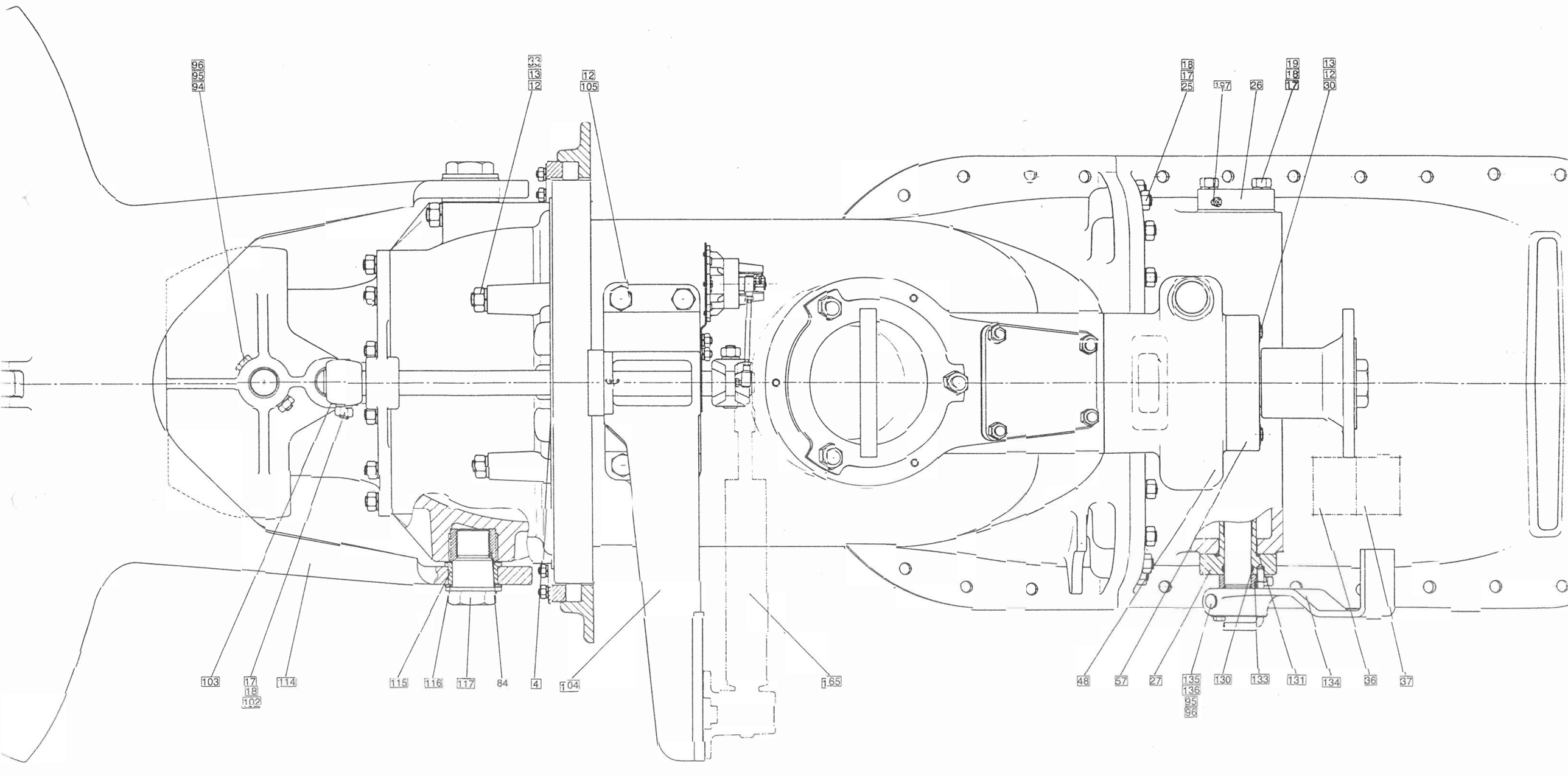
Overflow Preventer Kit consists of :-

123A	104942Y	1	Overflow Preventer
123B	HYQH XBY	3	Hex. Head Bolt M8 x 25
(46)	JEQK XAC	3	Spring Washer M8
123C	HIHK AAD	1	Plug 0.5 BSPT
123D	JMNG AAS	1	R.T.V. Sealant 120g
123E	LCIN ACD	1	Rubber Guard Strip - 1100mm
124			
125			
126			
127			
128			
129			
130	HMHR AAS	1	O Ring (for 1"-1.25" Shafts)
131	HMHR AAZ	2	O Ring (for 1.75"-2" Shafts)
132	105386Y	1	Screen Rake
133	105396	1	Spacer

ITEM	PART NUMBER	REQ'D	DESCRIPTION
134	105388SY	1	Rake Arm Assembly
Rake Arm Assembly consists of :-			
134A	105387Y	1	Actuating Arm
134B	105392	1	Locking Pin
134C	JMNG AAT	1	Locking Pin Retaining Ring
134D	105391	1	Flat Spring
134E	JEQK XAA	1	Spring Washer M6
134F	HZQH XAC	1	Hex. Head Screw M6 x 12
135	102834	1	Cotter
136	102993	1	Thick Washer
137	HEID AAA	2	Grease Nipple .125 BSP Straight
150	30636	4	Stud M6
151	JEQK XAA	4	Spring Washer M6
152	JDQH XAA	4	Hex Nut M6
153	104893	1	Mounting Plate - Reverse Sender
154	30665	2	Stud M8
155	HZMT XAD	3	Pan Head Screw M4 x 12 BRASS
156	JEPR AAN	3	Flat Washer .16" Brass
157	JMNG AAG	1	Sender
158	JMNG AAM	1	Sender Arm Bracket
159	104552-7	1	Sender Arm
160	KYIN AAG	1	Ball Mount
161	104671	2	Ball Cup
162	104672	1	Sender Link
163	JDKY ABQ	2	Hex Nut 10-32 Brass
164	-	1	Sender Arm Locking Screw
165	104889SY	1	Steering Cylinder and Sender Assy (Refer page S1 for parts deails of cylinder and sender assembly).

PARTS NOT ILLUSTRATED:

PART NUMBER	REQ'D	DESCRIPTION
82019	1	HERC System Manual (The HERC System Manual contains details on all Ahead/Astern components except that the internal details of the reverse cylinder are shown on page R1 and R2).
104933	1	Special Tools Kit (Refer page N1 for details).
63503	2	Large "Hamilton Jet" Boat Decal
-	-	Installation Hardware (Studs, Bolts, Nuts, Washers, Gaskets etc) (For details refer to appropriate Instalation Drawing at rear i.e. 104982 - GRP or Wooden Hulls 104979 - Aluminium Hulls 104973 - Steel Hulls)
104941SY	-	Steering Tie Rod Kit (Illustrated in Controls Section page I6).
104889SY	1	Steering Cylinder and Sender Assembly (Refer pages O1, O2).
63571	-	Steering Cylinder Components (Refer pages Q1 and Q2).
B2	-	Steering Helm Pump Components (Refer pages P1 and P2).
104871SY	1	Reverse Cylinder Assembly (Refer pages R1 and R2).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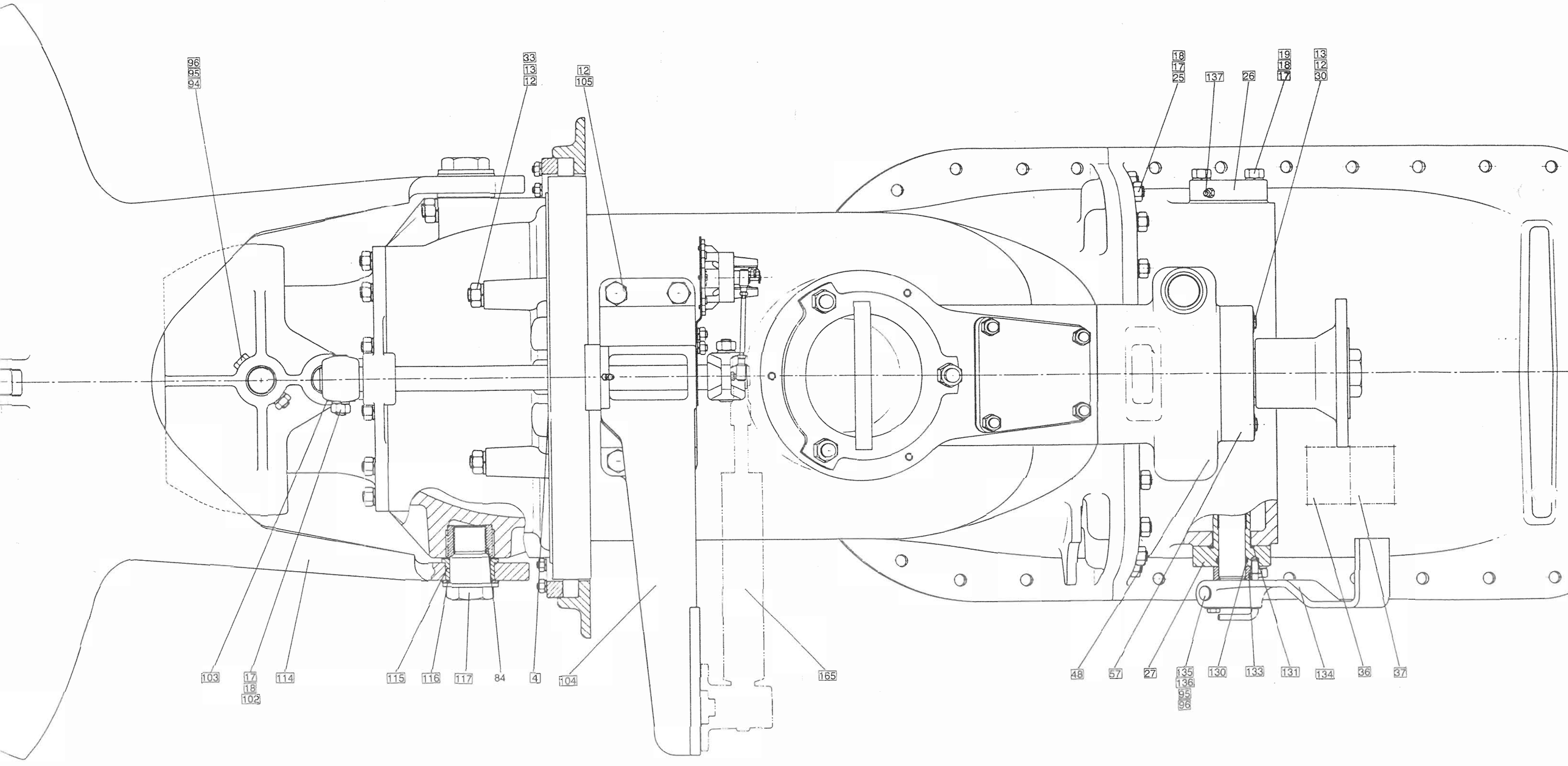
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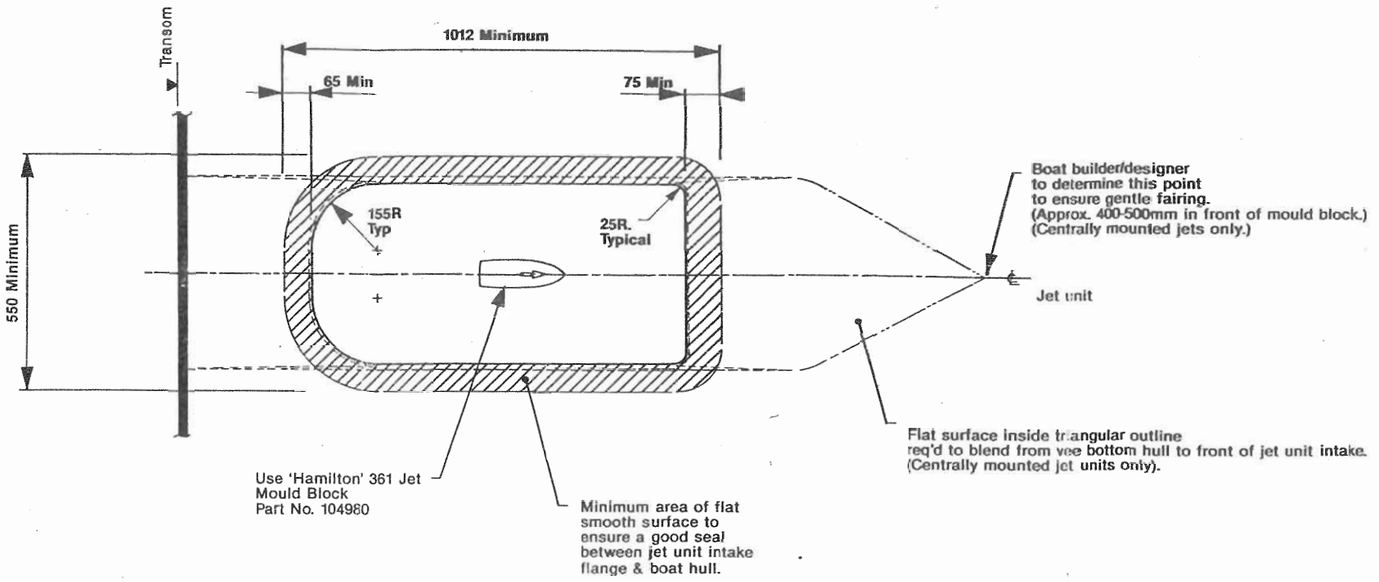
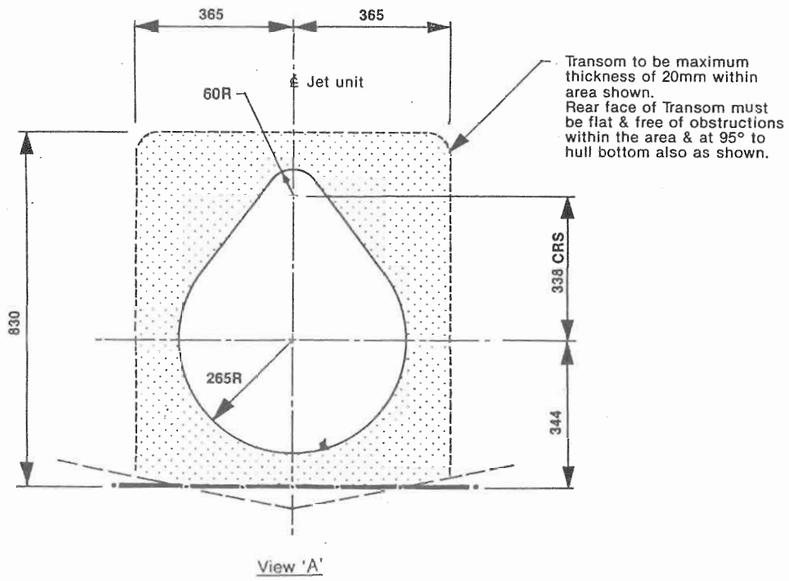
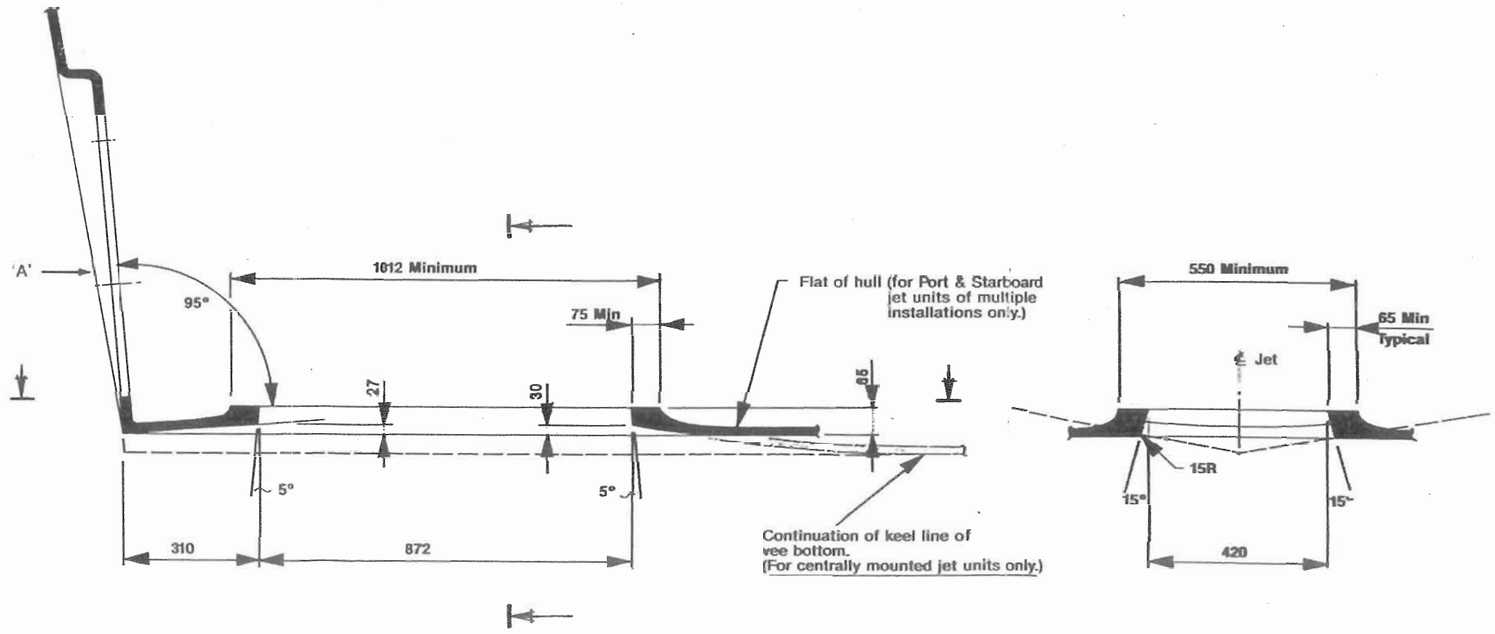
104981 | REMOVE SHARP CORNERS DO NOT SCALE DIMENSIONS IN MM/M.M. 3RD. ANGLE PROJECTION







NOTE

This drawing is to be read in close conjunction with:
DRG No. 104970 — GENERAL ARRANGEMENT
SALES INFORMATION —— (page E1).

104982 — INSTALLATION INFORMATION
PLANING CRAFT
FIBRE GLASS HULL

REF	NO.	BY	DATE	AMENDMENTS

C. W. F. HAMILTON & CO. LTD., CH.CH., N.Z.

MATERIAL

√-∇ EXCEPT AS STATED

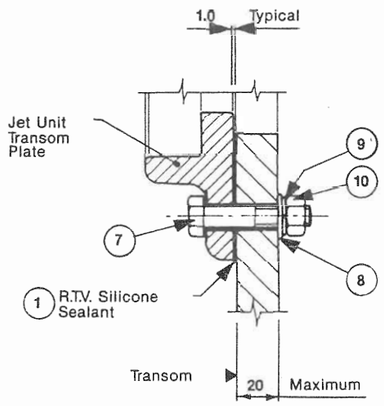
UNLIMITED DIMENSIONS TO BE ± 1.0 mm

NAME
361 JET
HULL PREPARATION
PLANING CRAFT
FIBRE GLASS HULL

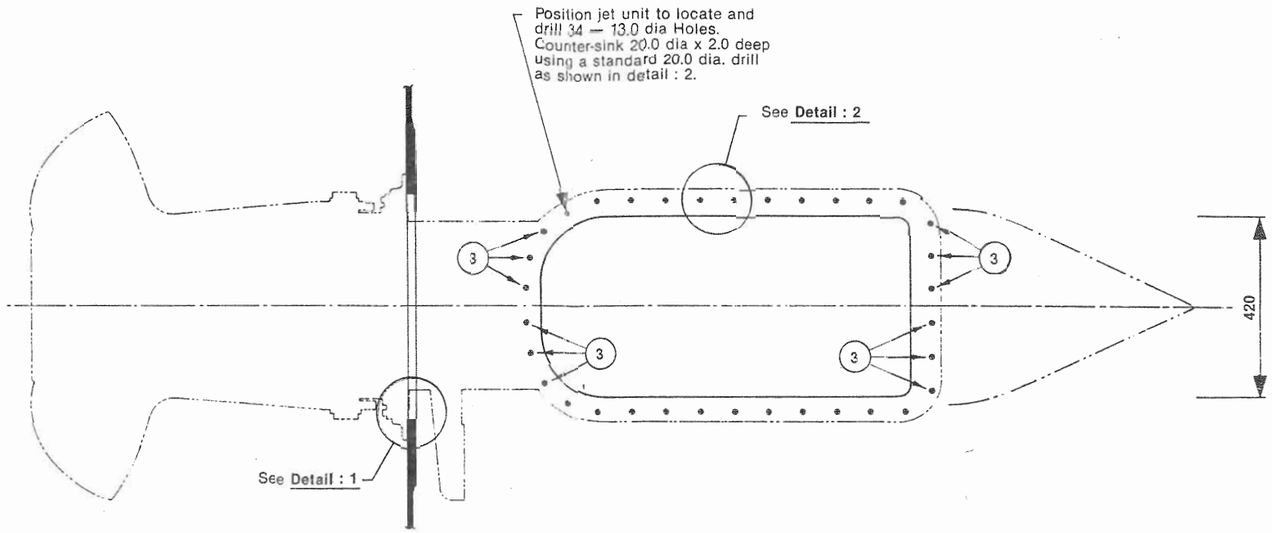
DRAWN RP
CHECKED
APPROVED
DATE 20 AUG. 85

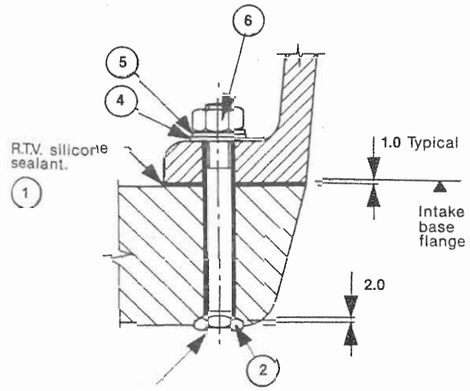
SCALE N.T.S.
NUMBER 104981

104982 | REMOVE SHARP CORNERS DO NOT SCALE DIMENSIONS IN ____/M.M. 3 RD. ANGLE PROJECTION



DETAIL : 1





NOTE:
Intake/hull bolts are lightly driven into hull until seating on countersunk face.
Seal head of bolts using R.T.V. silicone sealant provided.

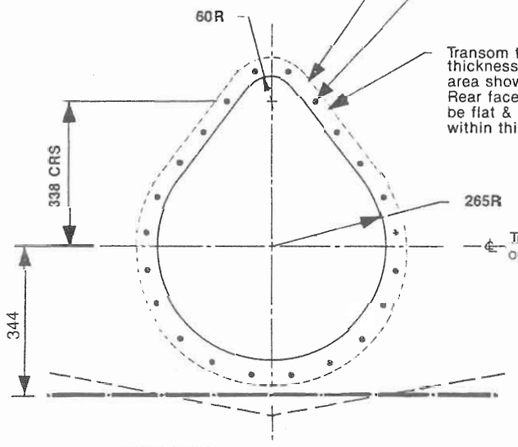
DETAIL : 2

Transom seal ass'y to be fastened on outside of transom by 22-M10 stainless steel bolts (supplied)

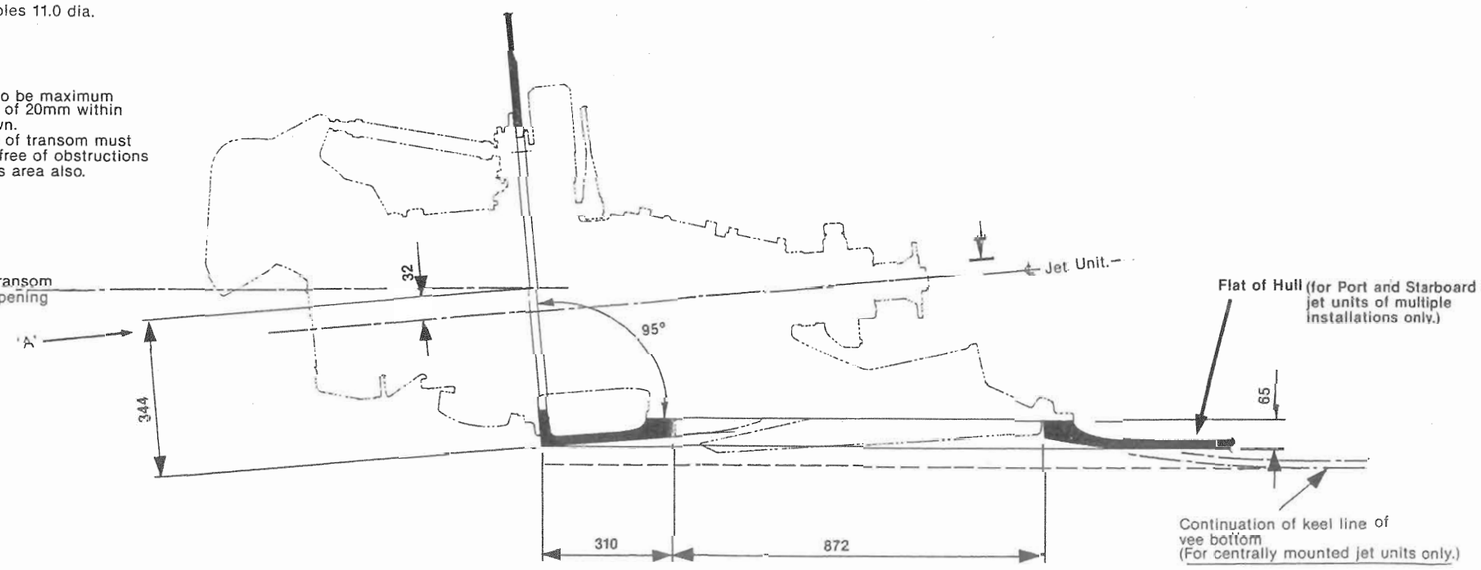
Assemble transom plate to jet unit & use as a jig to mark holes

Drill 22 holes 11.0 dia.

Transom to be maximum thickness of 20mm within area shown.
Rear face of transom must be flat & free of obstructions within this area also.



TRANSOM HOLE DETAILS View 'A'



ITEM	PART No.	REQ'D	DESCRIPTION	DRG No.
10	JDQHXAE	22	HEX NUT M10-1.5 316 s.s.	
9	JEQKXAE	22	SPRING WASHER Ø 10 316s.s.	
8	JEOZXAI	22	FLAT WASHER Ø 10 316 s.s.	
7	HYQHXDY	22	HEX.HD.BOLT M10-1.5 x 50 316 s.s.	
6	JDQHXAH	34	HEX.NUT M12-1.75 316 s.s.	
5	JEOZXAK	34	FLAT WASHER Ø 12 316 s.s.	
4	61427	34	FIBRE WASHER Ø 12	61000
3	104969	12	BOLT — SPECIAL M12-1.75 x 80 316 s.s.	104969
2	104968	22	BOLT — SPECIAL M12-1.75 x 100 316 s.s.	104968
1	JMNGAAR	2	TUBE — RTV SILICONE SEALANT	

NOTE

— This drawing is to be read in close conjunction with:
DRG No. 104970 — GENERAL ARRANGEMENT
SALES INFORMATION — (page E1)

104981 — HULL PREPARATION
PLANNING CRAFT
FIBRE GLASS HULL.

—Follow sequence outlined in Section G.

REF	NO	BY	DATE	AMENDMENTS
CL3404	O	[illegible]	19SEPT85	ISSUED FOR MANUFACTURE

C. W. F. HAMILTON & CO. LTD., CH.CH., N.Z.

MATERIAL

EXCEPT AS STATED

UNLIMITED DIMENSIONS TO BE ± 1·0 mm

DRAWN [illegible] DATE 15 AUG. 85

CHECKED

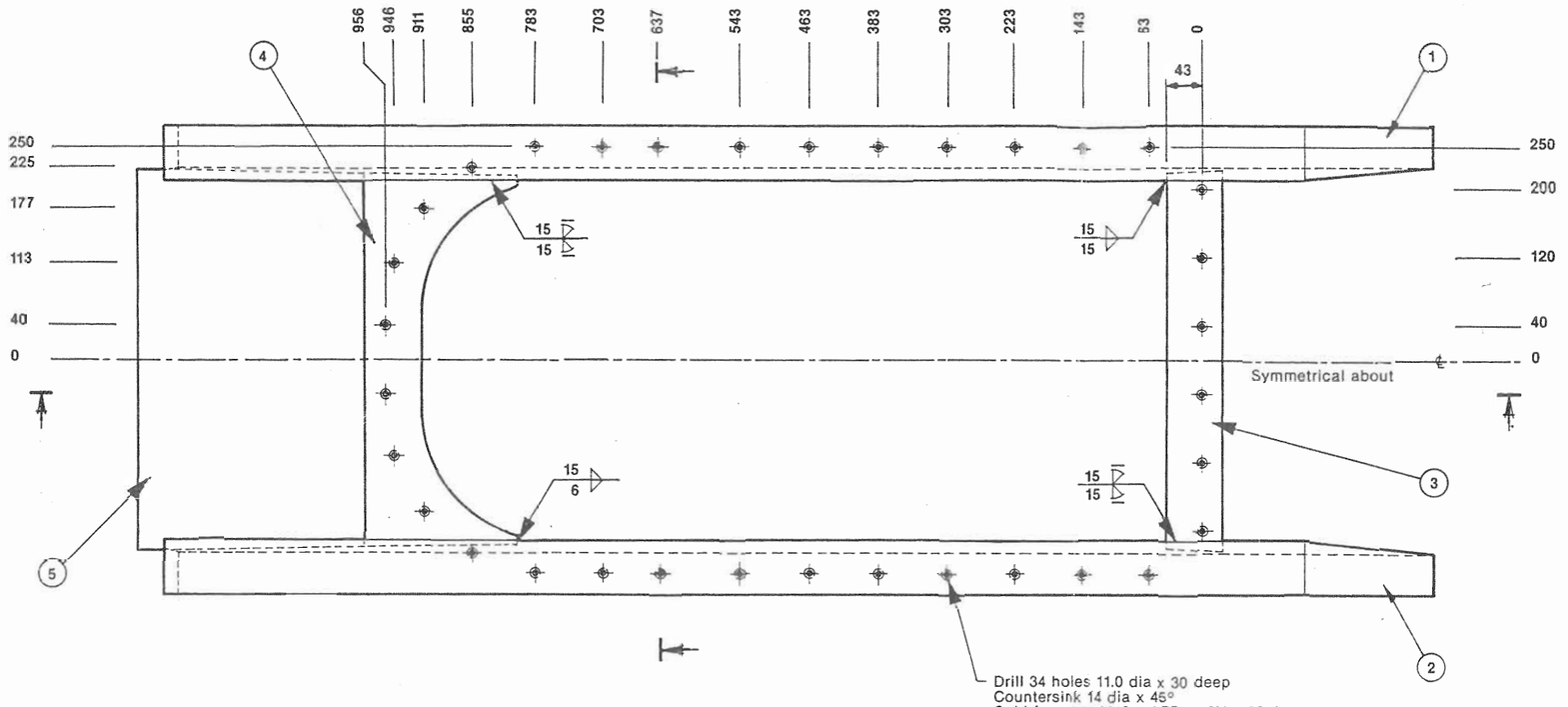
APPROVED

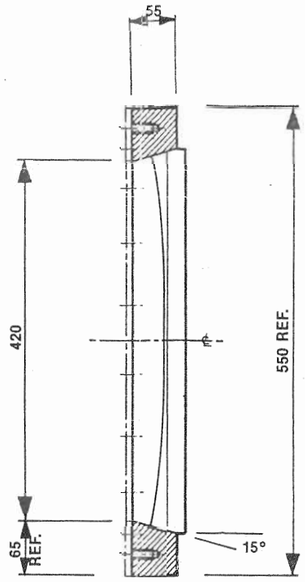
NAME
361 JET
INSTALLATION INFORMATION
PLANNING CRAFT
FIBRE GLASS HULL.

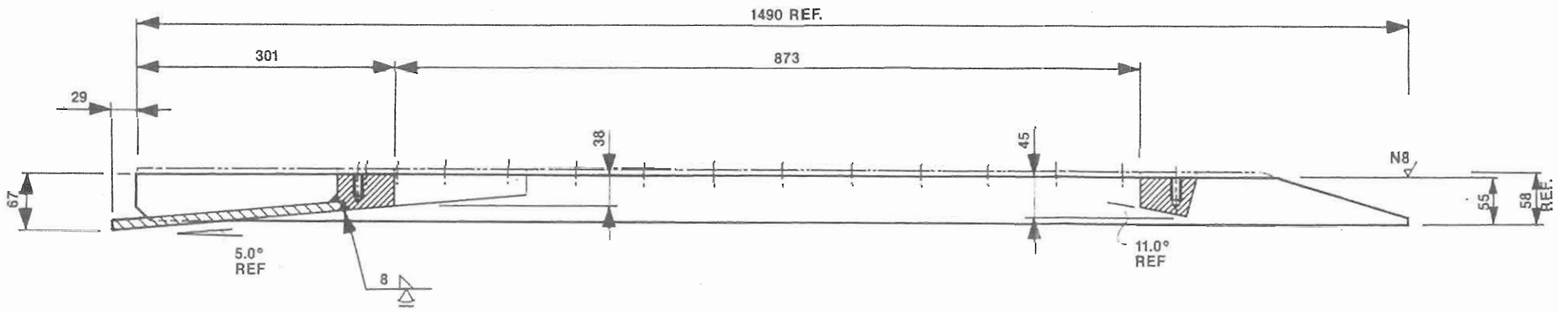
SCALE N.T.S.

NUMBER 104982

104977Y | ○ | REMOVE SHARP CORNERS DO NOT SCALE DIMENSIONS IN ▬/M.M. 3RD ANGLE PROJECTION







ITEM	PART No.	REQ'D	DESCRIPTION	DRG No.
5	104977-5	1	SLOPE SHEET	104977-5
4	104977-4	1	CROSS MEMBER — REAR	104977-4
3	104977-3	1	CROSS MEMBER — FRONT	104977-3
2	104977-2	1	SIDE MEMBER — STARBOARD	104977-2
1	104977-1	1	SIDE MEMBER — PORT	104977-1

REF	NO.	BY	DATE	AMENDMENTS
CL3396	0		20JUNE85	ISSUED FOR MANUFACTURE

C. W. F. HAMILTON & CO. LTD., CH.CH., N.Z.

MATERIAL

$\sqrt{}$ EXCEPT AS STATED

UNLIMITED DIMENSIONS TO BE ± 1·0 mm

NAME

361 JET
INTAKE BLOCK
PLANING CRAFT
ALUMINIUM HULL

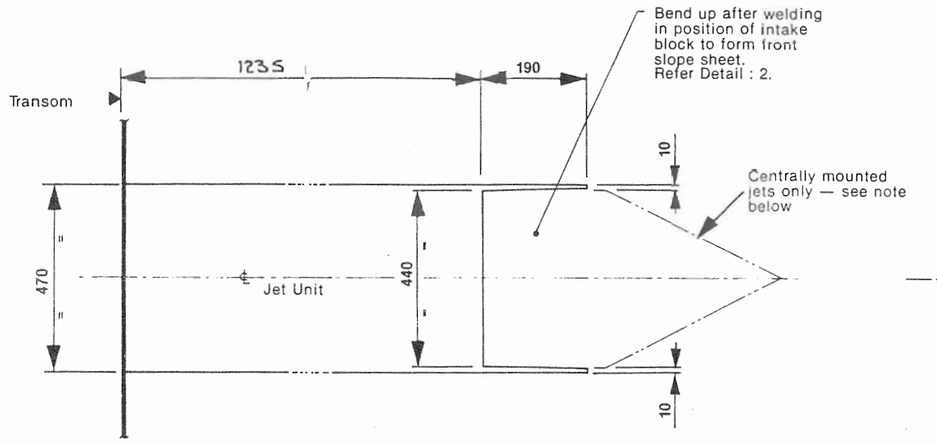
DRAWN | DATE 24 MAY 85

CHECKED

APPROVED

SCALE N.T.S. | NUMBER 104977Y ○

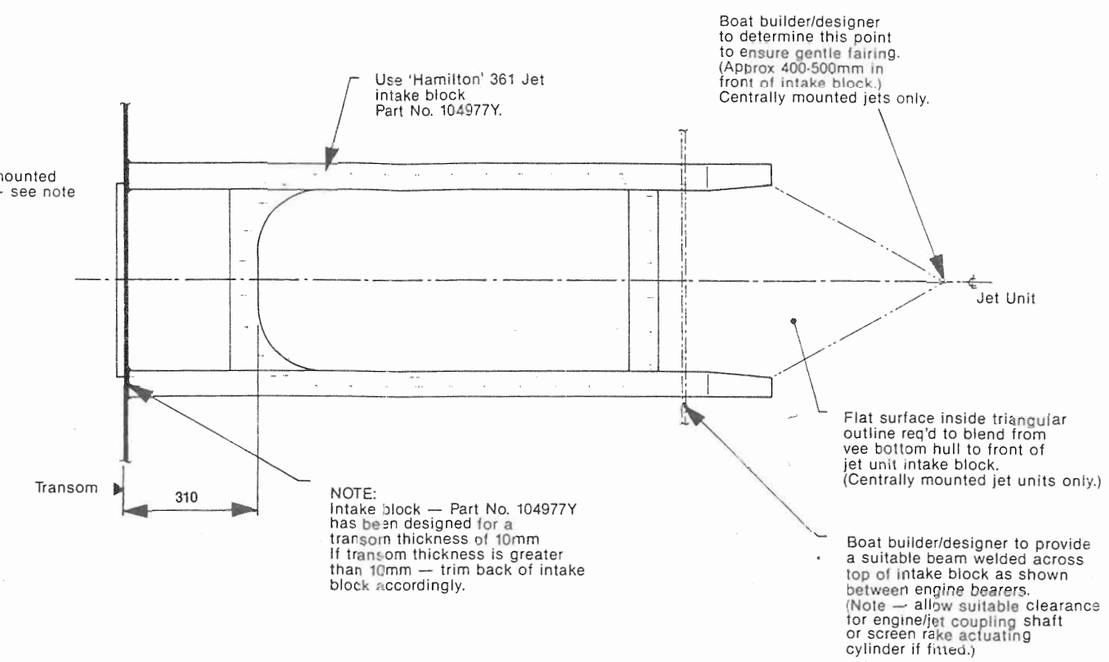
104978 | REMOVE SHARP CORNERS DO NOT SCALE DIMENSIONS IN MM 3RD ANGLE PROJECTION

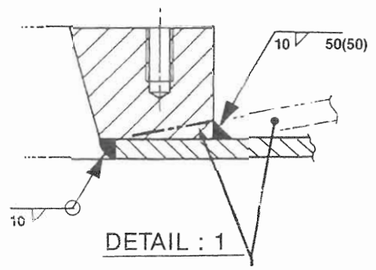


HULL BOTTOM OPENING DETAIL

Prior to welding in of intake block Part No. 104977Y.

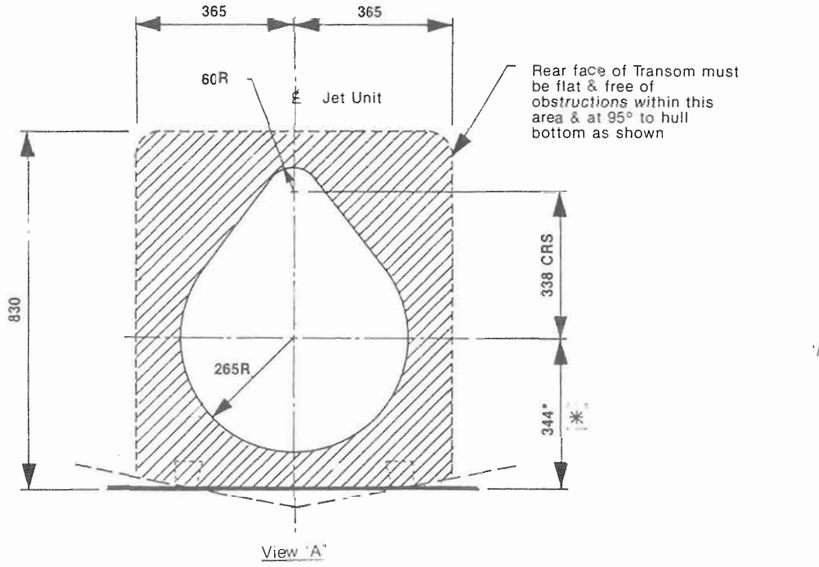
NOTE: Opening detail is for a port or starboard jet mounted to the flat hull surface. Additional material will be required to be removed inside triangular outline for centrally mounted jet units in a vee bottom hull & replaced with a triangular flat sheet to blend from vee bottom to front of intake block.





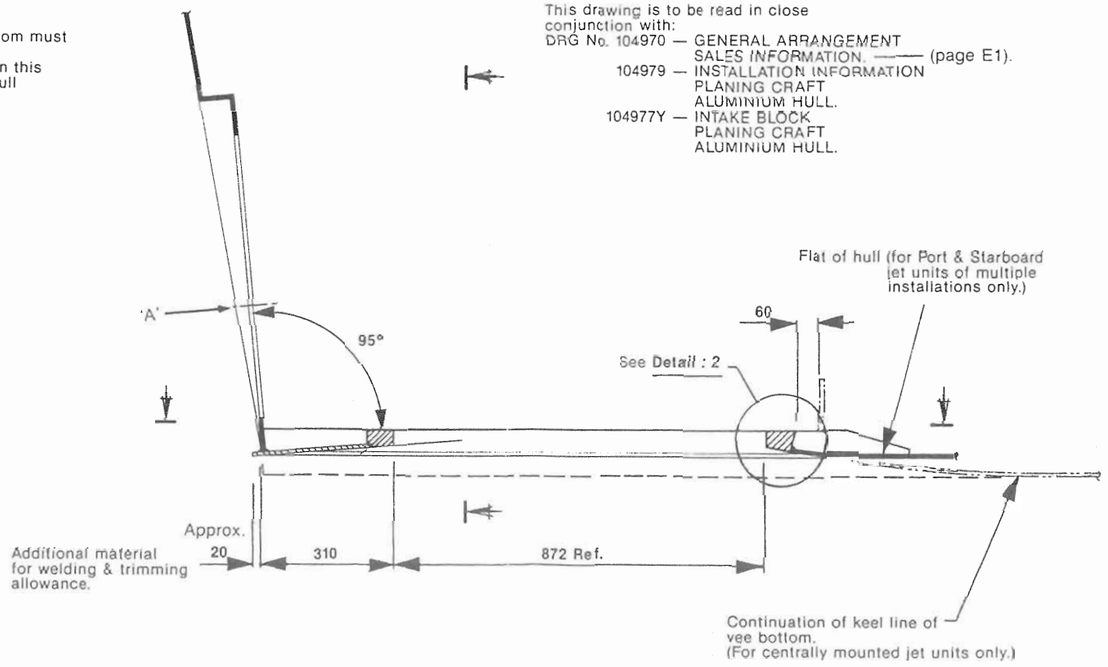
DETAIL : 1

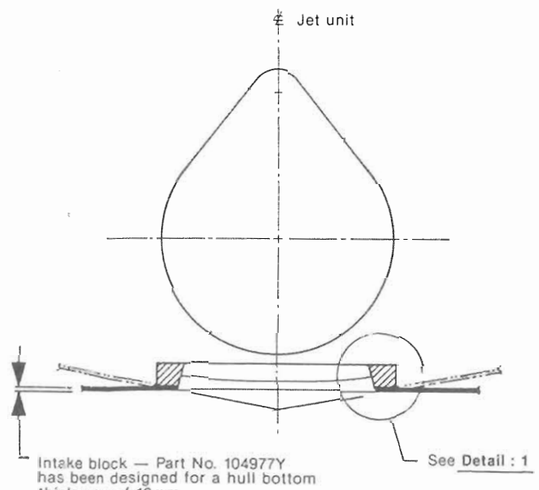
For centrally mounted jets the intake block must be machined to match the hull deadrise angle.

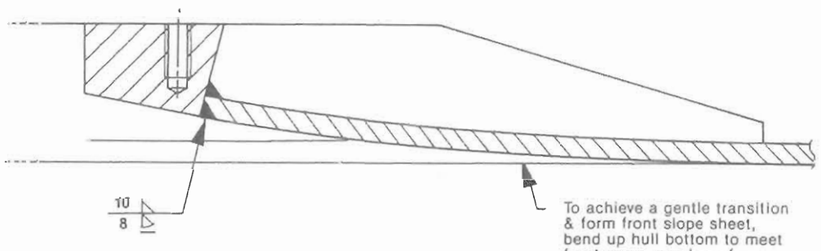


NOTE

This drawing is to be read in close conjunction with:
DRG No. 104970 — GENERAL ARRANGEMENT SALES INFORMATION. ——— (page E1).
104979 — INSTALLATION INFORMATION PLANING CRAFT ALUMINIUM HULL.
104977Y — INTAKE BLOCK PLANING CRAFT ALUMINIUM HULL.







DETAIL : 2

REF	NO	BY	DATE	AMENDMENTS

C. W. F. HAMILTON & CO. LTD., CH.CH., N.Z.

MATERIAL

√ = 7/64 EXCEPT AS STATED

UNLIMITED DIMENSIONS TO BE ± 1·0 mm

NAME
361 JET
HULL PREPARATION
PLANING CRAFT
ALUMINIUM HULL

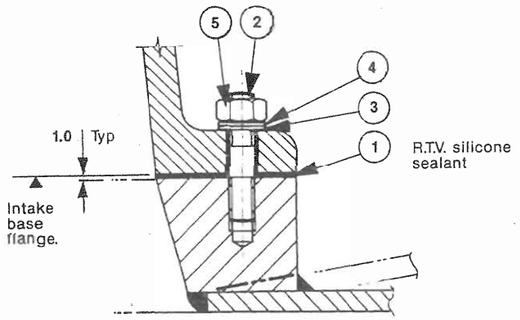
DRAWN | DATE 19 SEPT. 85

CHECKED

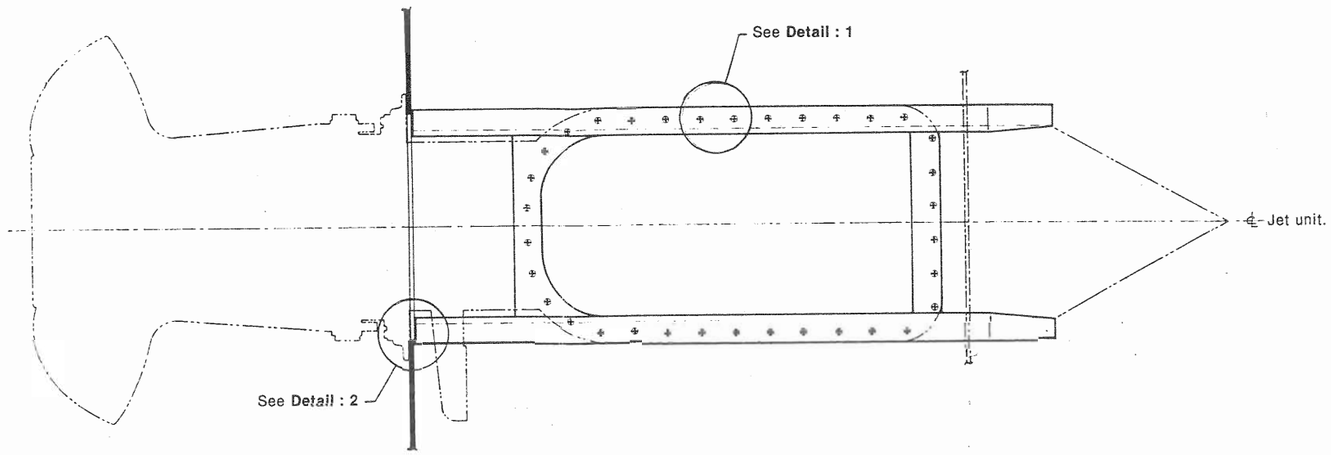
APPROVED

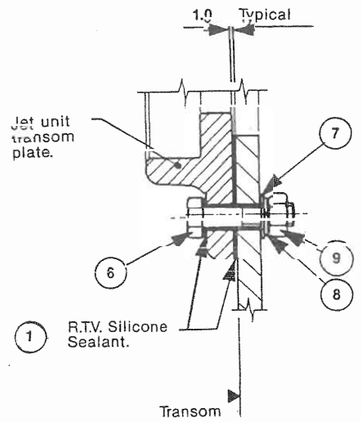
SCALE 1:2&1:10 | NUMBER 104978

104979 | REMOVE SHARP CORNERS DO NOT SCALE DIMENSIONS IN [redacted]/M.M. 3RD. ANGLE PROJECTION



DETAIL : 1





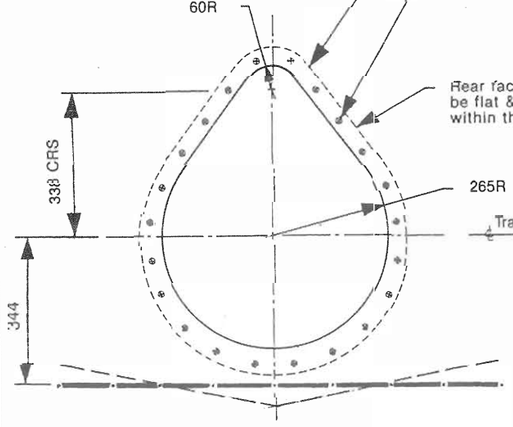
DETAIL : 2

NOTE:
For hulls undergoing survey.
Bolt holes through the transom may not be acceptable.
An alternative blind hole/stud system should be used.
Request 22 studs — Part No. 30671.

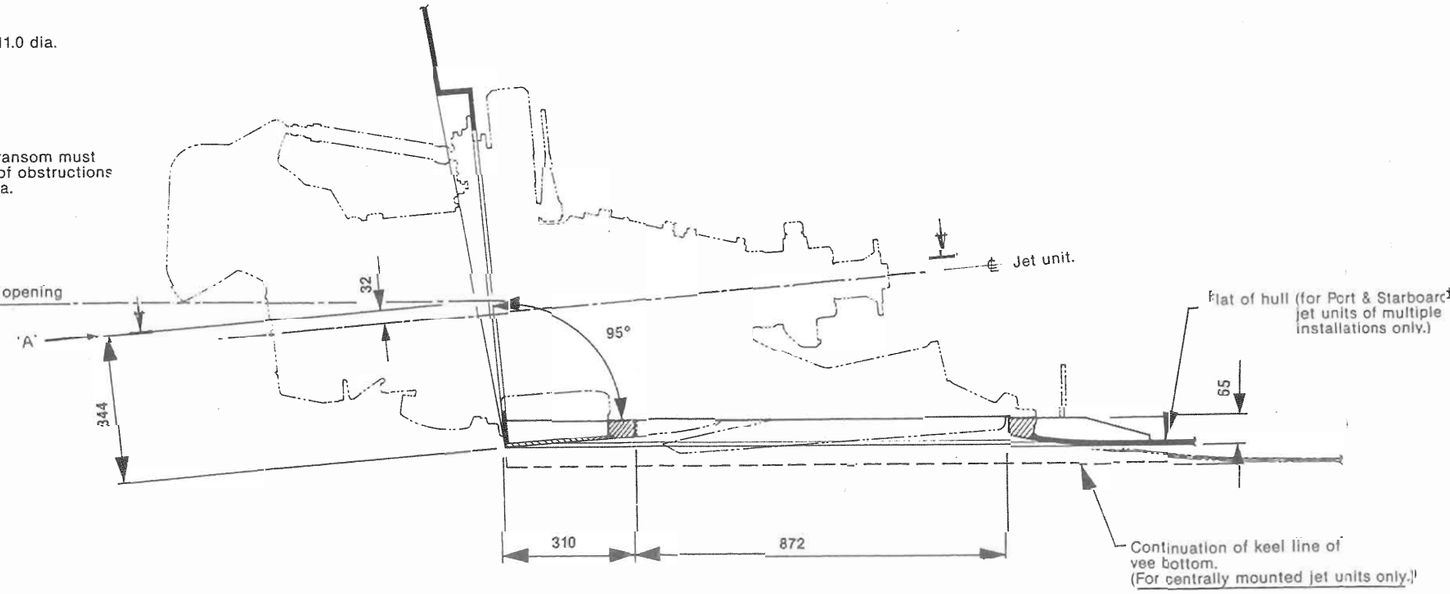
Transom seal ass'y to be fastened on outside of transom by 22 — M10 stainless steel bolts (supplied). Assemble transom plate to jet unit & use as a jig to mark holes.

Drill 22 holes 11.0 dia.

Rear face of transom must be flat & free of obstructions within this area.



TRANSOM HOLE DETAILS — View 'A'



NOTE

This drawing is to be read in close conjunction with:
DRG No. 104970 — GENERAL ARRANGEMENT SALES INFORMATION
104978 — HULL PREPARATION PLANING CRAFT ALUMINIUM HULL.

ITEM	PART No.	REQ'D	DESCRIPTION	DRG No.
9	JDQHXAE	22	HEX. NUT M10-1.5 316 s.s.	
8	JEQKXAE	22	SPRING WASHER Ø 10 316 s.s.	
7	JEOZXAI	22	FLAT WASHER Ø 10 316 s.s.	
6	HYQHXDX	22	HEX. HD BOLT M10-1.5 x 45 316 s.s.	
5	JDQHXAH	34	HEX. NUT M12-1.75 316 s.s.	
4	JEOZXAK	34	FLAT WASHER Ø 12 316 s.s.	
3	61427	34	FIBRE WASHER Ø 12	61000
2	103860	34	STUD M12-1.75 x 60 316 s.s.	30639
1	JMNGAAR	1	TUBE — RTV SILICONE SEALANT	

REF	NO	BY	DATE	AMENDMENTS
CL 3404	0	[redacted]	19 SEPT. 85	ISSUED FOR MANUFACTURE

C. W. F. HAMILTON & CO. LTD., CH.CH., N.Z.

MATERIAL

$\sqrt{}$ = 7.8 EXCEPT AS STATED

UNLIMITED DIMENSIONS TO BE ± 1.0 mm

NAME
36'1 JET
INSTALLATION INFORMATION
PLANNING CRAFT
ALUMINIUM HULL

DRAWN [redacted] DATE 18 SEPT. 85

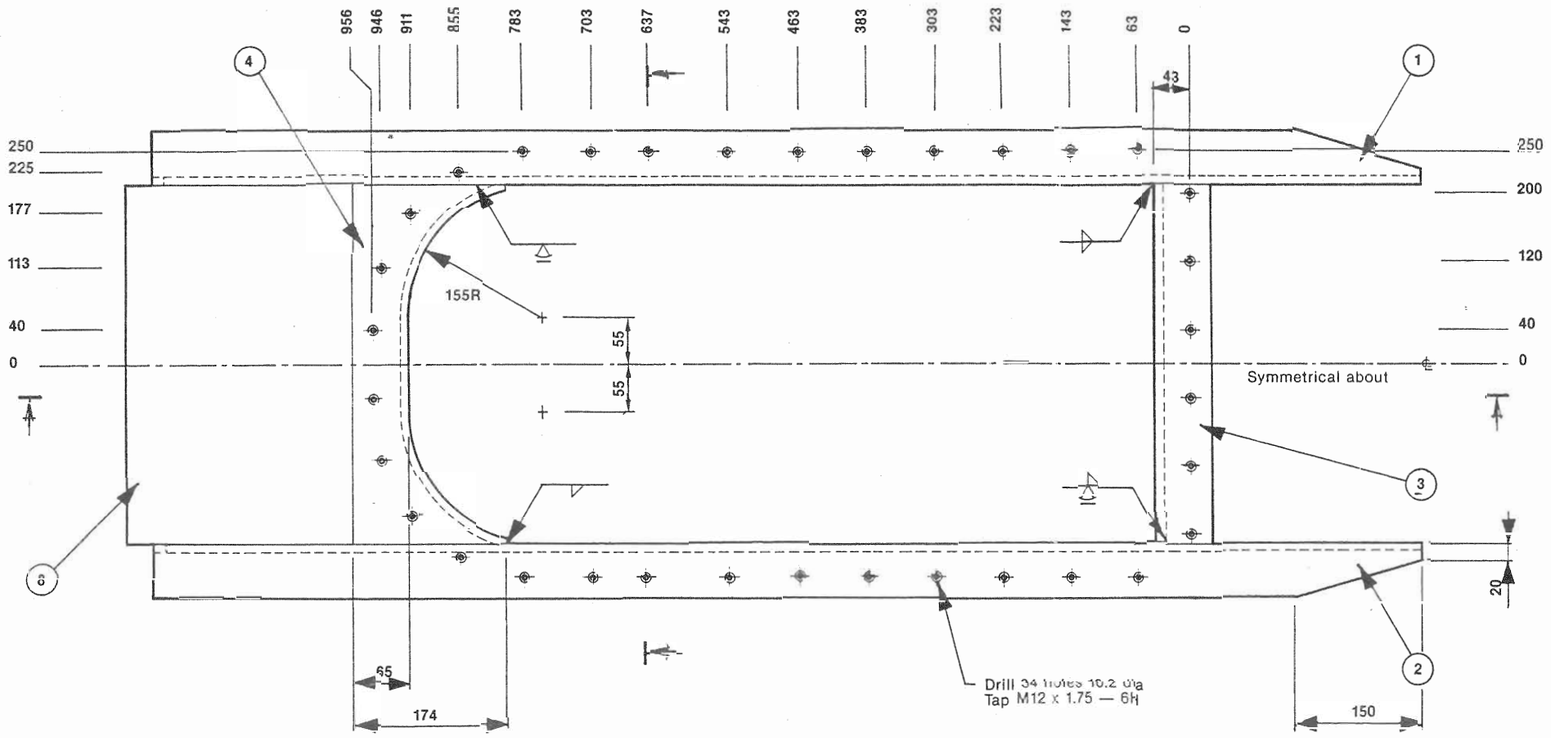
CHECKED

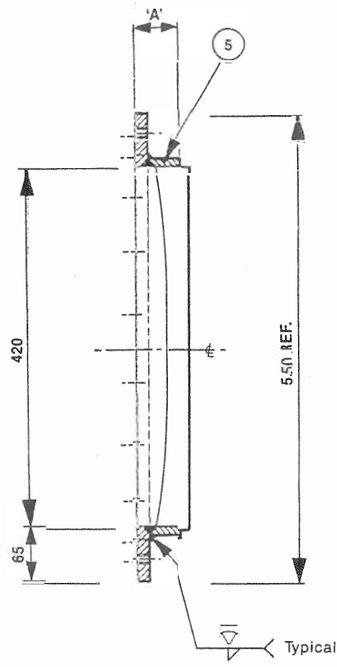
APPROVED

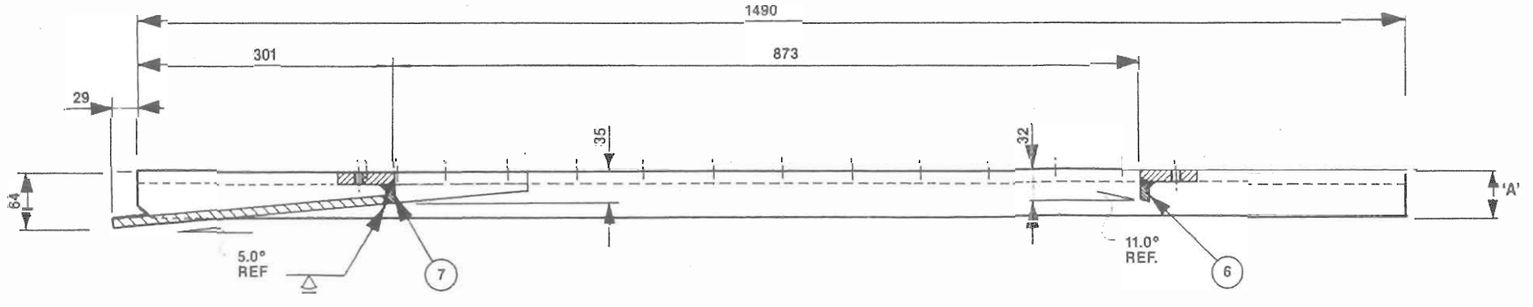
SCALE N.T.S.

NUMBER 104979

104971Y | REMOVE SHARP CORNERS DO NOT SCALE DIMENSIONS IN MM/M.M. 3 RD. ANGLE PROJECTION







ITEM	PART No.	REQ'D	DESCRIPTION	
8	104971-8	1	SLOPE SHEET	Ex 10mm MS plt.
7	104971-7	1	SIDE CROSS MEMBER — REAR	Ex 10mm MS plt.
6	104971-6	1	SIDE CROSS MEMBER — FRONT	Ex 10mm MS plt.
5	104971-5	2	SIDE MEMBER—PORT/STARBOARD	Ex 10mm MS plt.
4	104971-4	1	TOP CROSS MEMBER — REAR	Ex 16mm MS plt.
3	104971-3	1	TOP MEMBER — FRONT	Ex 16 x 65mm flt.
2	104971-2	1	TOP MEMBER — STARBOARD	Ex 16 x 65mm flt.
1	104971-1	1	TOP MEMBER — PORT	Ex 16 x 65mm flt.

NOTE:

Dimension 'A' equals 62mm minus hull thickness.

Top surface of intake frame is to be flat to ensure a good water seal with jet unit base flange.

REF	NO	BY	DATE	AMENDMENTS

C. W. F. HAMILTON & CO. LTD., CH.CH., N.Z.

MATERIAL: SEE ABOVE.

$\sqrt{}$ = 250 EXCEPT AS STATED

UNLIMITED DIMENSIONS TO BE ± 1·0 mm

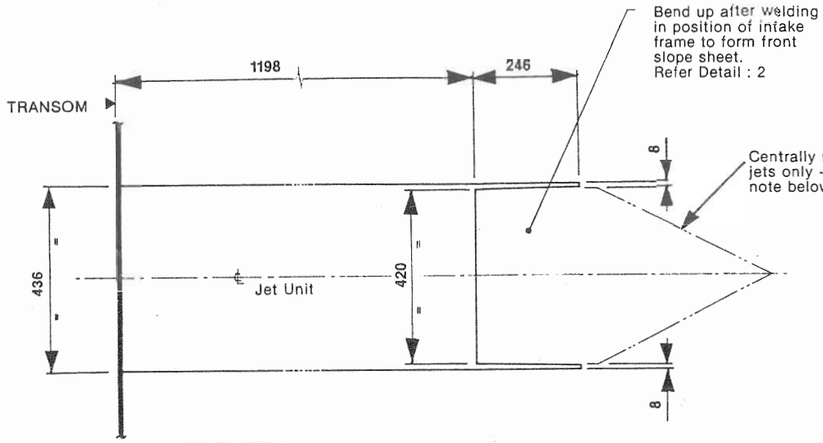
NAME: 361 JET
INTAKE FRAME
PLANING/DISPLACEMENT
CRAFT
STEEL HULL.

DRAWN | DATE: 9 SEPT. 85

CHECKED

APPROVED

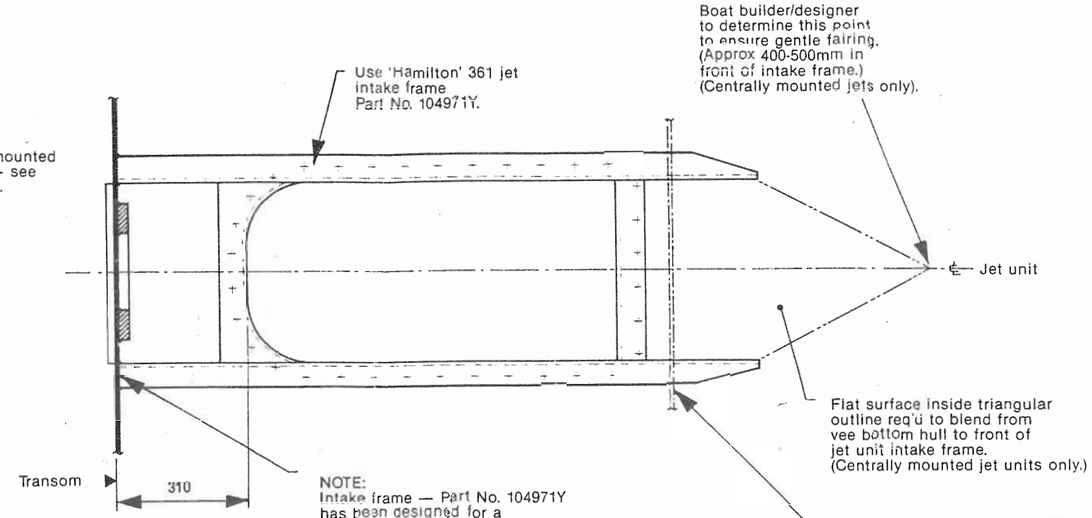
SCALE: N.T.S. | NUMBER: 104971Y

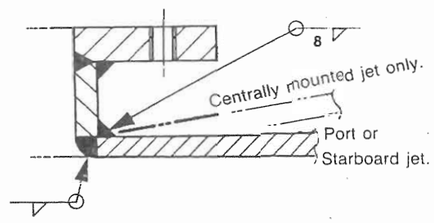


HULL BOTTOM OPENING DETAIL

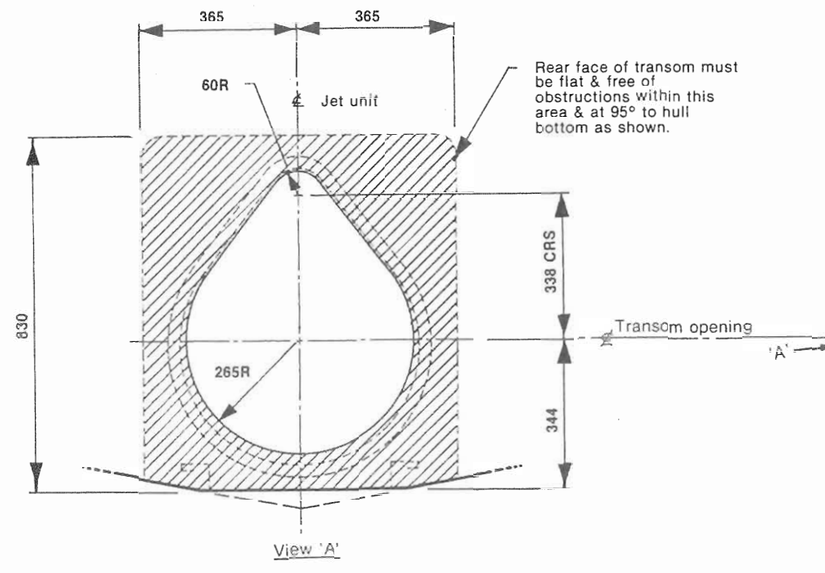
Prior to welding in of intake frame Part No. 104971Y.

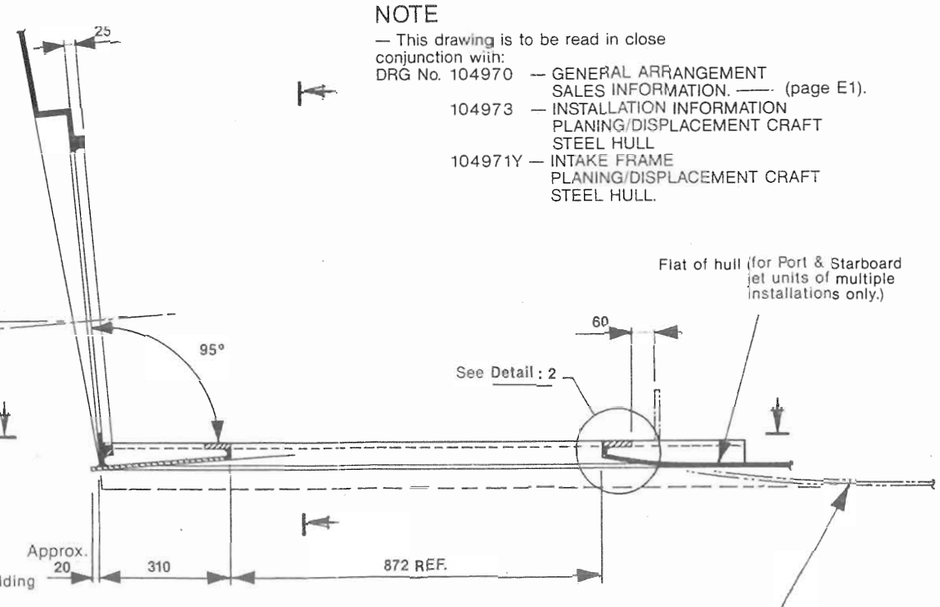
NOTE: Opening detail is for a port or starboard jet mounted to the flat hull surface. Additional material will be required to be removed inside triangular outline for centrally mounted jet units in a vee bottom hull & replaced with a triangular flat sheet to blend from vee bottom to front of intake frame.





DETAIL : 1

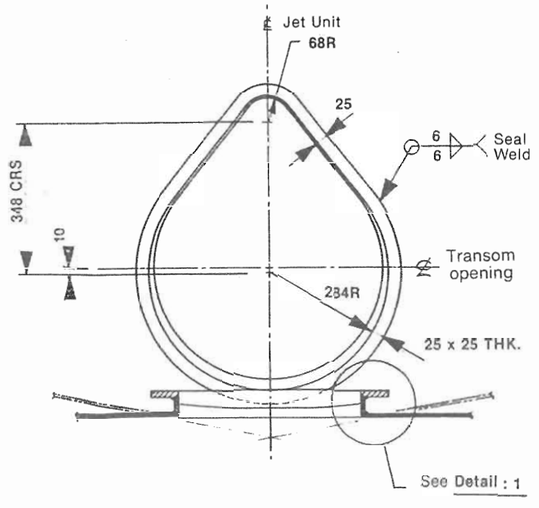


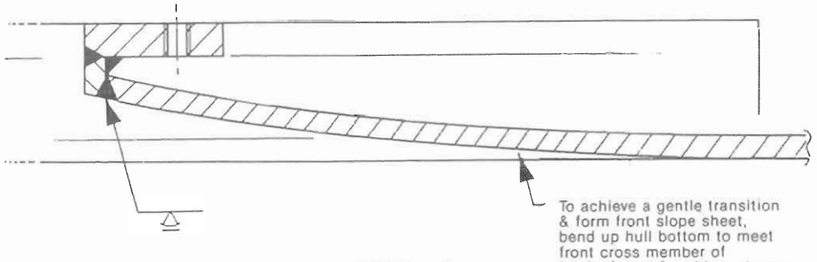


NOTE

— This drawing is to be read in close conjunction with:

DRG No. 104970 — GENERAL ARRANGEMENT SALES INFORMATION. —— (page E1).
104973 — INSTALLATION INFORMATION PLANING/DISPLACEMENT CRAFT STEEL HULL
104971Y — INTAKE FRAME PLANING/DISPLACEMENT CRAFT STEEL HULL.





DETAIL : 2

REF	NO	BY	DATE	AMENDMENTS

C. W. F. HAMILTON & CO. LTD., CH.CH., N.Z.

MATERIAL

√ = 3/64 EXCEPT AS STATED

UNLIMITED DIMENSIONS TO BE ± 1·0 mm

DRAWN KR. DATE 14 SEPT 85

CHECKED

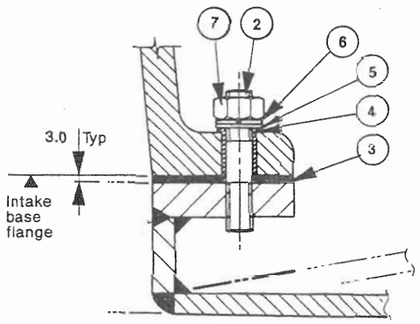
APPROVED

NAME: 361 JET
HULL PREPARATION
PLANING/DISPLACEMENT CRAFT
STEEL HULL.

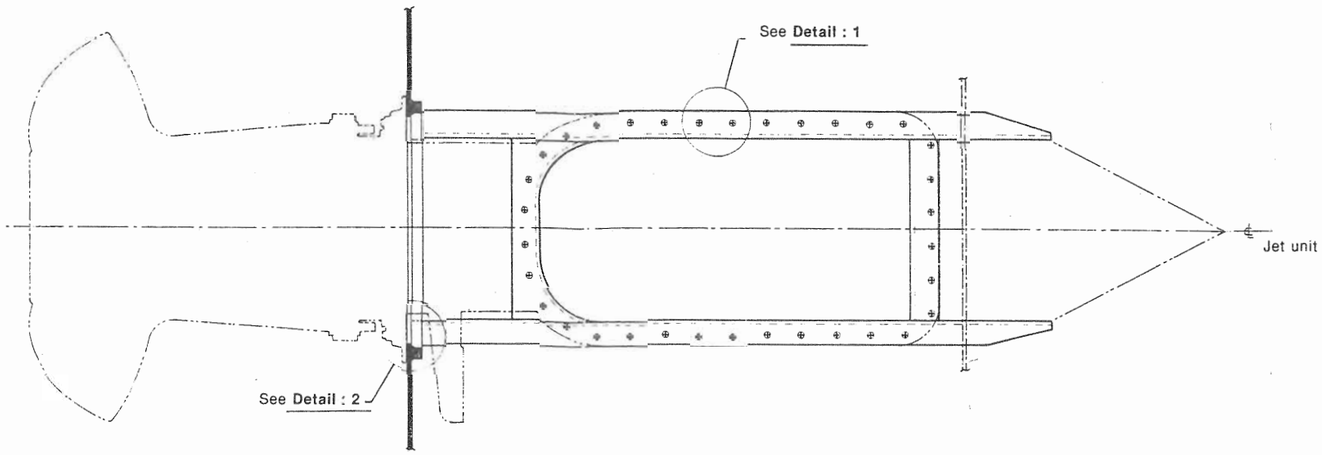
SCALE N.T.S. NUMBER 104972

104973 | REMOVE SHARP CORNERS DO NOT SCALE DIMENSIONS IN MM. 3 RD. ANGLE PROJECTION

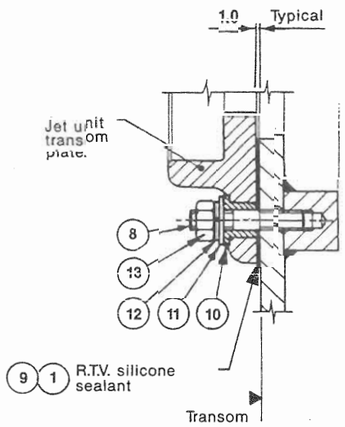
NOTE:
Open out standard intake base flange holes to 16.0 dia. to accept insulating bushes. (De-burr holes)



DETAIL : 1

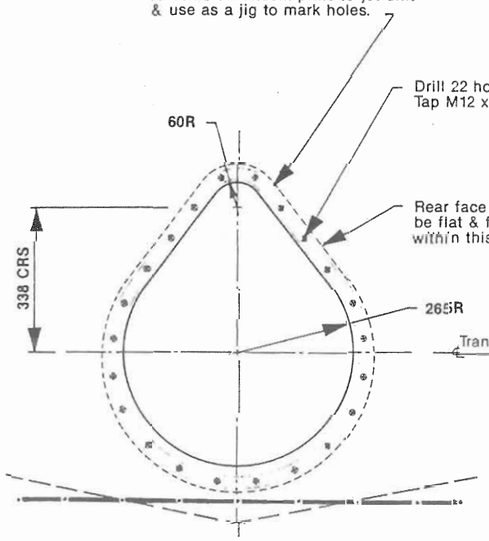


NOTE:
Open out standard transom plate mounting holes to 16.0 dia. to accept insulating bushes. (De-burr holes)

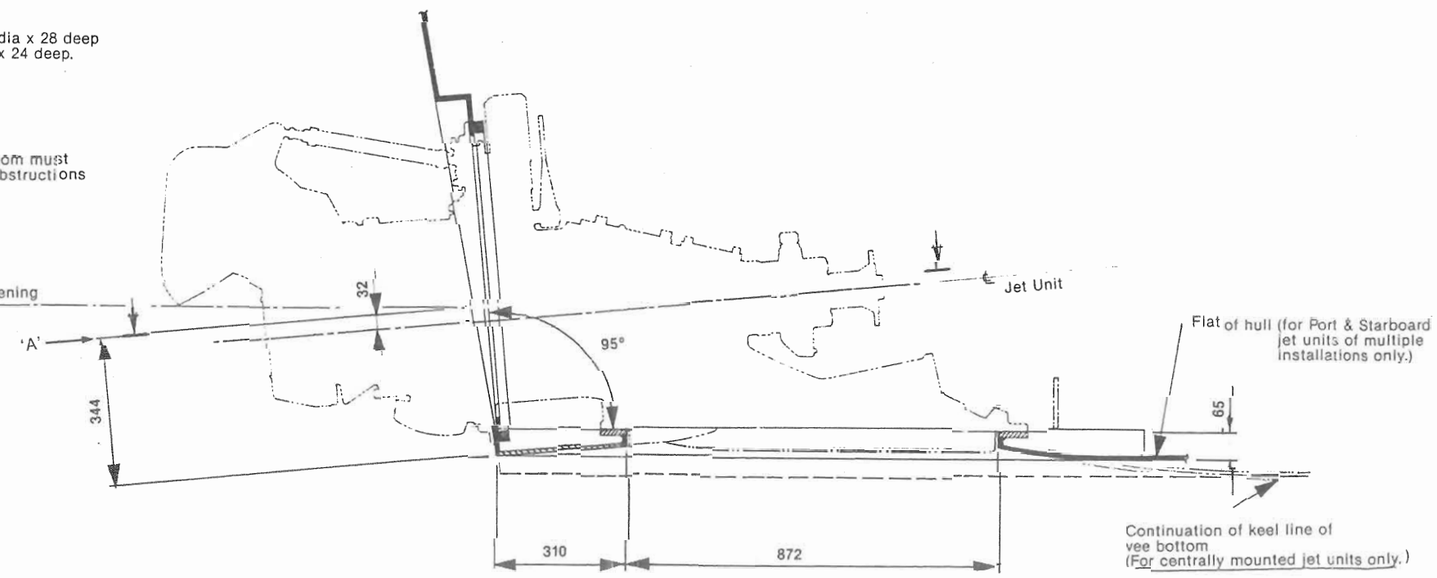


DETAIL : 2

Transom seal ass'y to be fastened on outside of transom by 22 - M10 stainless steel studs (supplied). Assemble transom plate to jet unit & use as a jig to mark holes.



TRANSOM HOLE DETAILS View 'A'



ITEM	PART No.	REQ'D	DESCRIPTION	DRG No.
13	JDQHXAE	22	HEX. NUT M10 — 1.5 316 s.s.	
12	JEQKXAE	22	SPRING WASHER Ø 10 316 s.s.	
11	JEOZXAY	22	LARGE FLAT WASHER Ø 10 316 s.s.	
10	KHACXAO	22	BUSH — ADDINGTON ENG. S 256 M.	
9	104839	1	INSULATOR — Ex 0.015"PLASTIC SHIM	104839
8	30671	22	STUD M10 — 1.5 x 51 316 s.s.	30637
7	JDQHXAH	34	HEX. NUT M12 — 1.75 316 s.s.	
6	JEQKXAH	34	SPRING WASHER Ø 12 316 s.s.	
5	JEOZXAK	34	FLAT WASHER Ø 12 316 s.s.	
4	KHACXAV	34	BUSH — ADDINGTON ENG. S 208 M	
3	104956	1	GASKET—Ex 3.0mm INSERTION RUBBER	104956
2	30672	34	STUD M12 — 1.75 x 67 316 s.s.	30639
1	JMNGAAR	1	TUBE — RTV SILICONE SEALANT	

NOTE:

This drawing is to be read in close conjunction with:
DRG No. 104970 —- GENERAL ARRANGEMENT & SALES INFORMATION
104972 —- HULL PREPARATION PLANING DISPLACEMENT CRAFT STEEL HULL

REF	NO	BY	DATE	AMENDMENTS
CL3404	0	RB	19SEPT85	ISSUED FOR MANUFACTURE

C. W. F. HAMILTON & CO. LTD., CH.CH., N.Z.

MATERIAL

DRAWN RB DATE 12 SEPT. 85

CHECKED

APPROVED

EXCEPT AS STATED

UNLIMITED DIMENSIONS TO BE ± 1.0 mm

NAME
361 JET
INSTALLATION INFORMATION
PLANING/DISPLACEMENT CRAFT
STEEL HULL.

SCALE N.T.S. NUMBER 104973