Product Manual Change Summary

Manual Type		HJ274
Part Number		089274
Revision	R1	30/11/03
Amendment	A70	10/09/14

Refer to ECN 23233 for amendments

B&W Manuals in Ring Binder Check List

One check list to be completed and returned with each order

- ❒ Print on Canon 100gsm A4 paper.
- ❒ Print A4 no scaling.
- ❒ Print double sided black and white.
- ❒ Punch 4 holes - ensure correctly spaced.
- ❒ 4 ring white binder.
- ❒ Hamilton indices as required.
- ❒ Hamilton Jet model front cover and spine insert (ensure correct jet model).
- ❒ Check jet model text on front cover is right aligned.
- ❒ Check for missing images - grey boxes (Contact Hamilton Jet).
- ❒ Check for colour consistency within a batch.
- ❒ Ensure manuals are packaged correctly to prevent damage or pages coming loose during transport.
- ❒ Check ring binders for quality i.e. rings close properly, no rips or defects in plastic etc.

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Installation and Service Manual

HJ274

Jet Unit Manual

R1A70

Manual Type		HJ274
Part Number		089274
Revision	R1	30/11/03
Amendment	A70	10/09/14

Contents

General Safety Notice

Warnings & Cautions

A Warning: is an operation or maintenance procedure, practice, condition or statement which, if not strictly observed, could result in injury or death to personnel.

This is indicated throughout the manual as below.

WARNING

A Caution: is an operation or maintenance procedure, practice condition or statement which, if not strictly observed, could result in damage to, or destruction of equipment .

This is indicated throughout the manual as below.

CAUTION

Limited Warranty

Limited Warranty

Terms of coverage

C.W.F. Hamilton & Co. Ltd. (Hamilton Jet) warrants to the original purchaser that each new Hamilton Jet product is free from defects in material and workmanship under normal use and service for the warranty period.

- In the event that a warranted defect in material or workmanship is disclosed to Hamilton Jet within the warranty period, Hamilton Jet's obligation is limited to, at its option, repairing or replacing the defective product, or component part at its factory or such other location as may be designated by Hamilton Jet.
- Defective products shall be returned to Hamilton Jet or its authorised service representative for inspection with transportation charges prepaid by the purchaser to the location specified by Hamilton Jet.
- This warranty only applies where the product is shown, to the satisfaction of Hamilton Jet, to be defective in material or workmanship during the warranty period.
- Hamilton Jet will supply parts required for warranty repairs free of charge and pay reasonable authorised labour costs.
- To the extent permitted by law, this warranty sets out the original purchaser's exclusive remedies with respect to the product covered by this warranty. In the event that Hamilton Jet determines it is unable to repair or replace any component part(s) found to be defective in materials and/or workmanship, Hamilton Jet's warranty liability shall be limited to payment by Hamilton Jet to the original purchaser of an amount not to exceed the value of the defective part(s), together with shipping charges, if any, incurred.
- All products removed or replaced under the warranty shall become the property of Hamilton Jet.
- All warranty claims shall be lodged with Hamilton Jet or its authorised distributor.

Warranty period

- The warranty period for Hamilton Jet products is limited to a period of twenty-four (24) months from the date of original shipment from the Hamilton Jet factory, or twelve (12) months from the vessel launch date, whichever occurs first.

Limitation of liability

- This warranty is extended only to the original purchaser, and is not transferable to or assignable to any other person or entity, and does not extend to future performance.
- In no event will Hamilton Jet, its distributors, or affiliates be liable for any incidental, punitive or consequential losses, inconveniences, damages or other costs resulting directly or indirectly from any defect in the product covered by this warranty, including, but not limited to, loss of use, revenue or profit.
- Hamilton Jet reserves the right to change its product through changes in design or materials without obligation to incorporate such changes in any products previously manufactured, but any improvement or changes may be incorporated in replacement product.

This warranty does not extend to failures, damages or defects resulting from the following:

- What Hamilton Jet determines to be, misuse, abuse, overloading, improper application, improper transportation or storage, abnormal wear and tear, negligence, carelessness, accident, natural calamity, vandalism, fouling caused by foreign material, peculiar water conditions or chemicals, or other circumstances over which Hamilton Jet has no control.
- Operation or maintenance in any way other than in accordance with the operating and maintenance instructions of Hamilton Jet.
- Vessel-to-shore electrical connections that change the corrosion potential of the vessel. For vessels equipped with shore power this warranty will not extend to the product unless an isolating transformer or galvanic isolator is fitted as described in the applicable HamiltonJet Product Manual.
- Incorrect installation, as per the applicable Hamilton Jet Product Manual and the applicable Hamilton Jet Designer's Manual. This warranty will not extend to the product unless a negative earth bonding system has been installed in the vessel as specified in the respective Hamilton Jet Product Manual, and a Jet Mainshaft critical speed check carried out to Hamilton Jet's written satisfaction.

This warranty does not cover or provide payment or reimbursement for the following:

- Any product which may have been serviced, repaired or altered in any way by anyone other than Hamilton Jet or a Hamilton Jet authorised facility.
- Any repairs or alterations carried out with the use of parts or accessories not manufactured by Hamilton Jet or its authorised representatives.
- Items incorporated in any Hamilton Jet product (other than by Hamilton Jet) when such items have been manufactured by others or are warranted by their respective manufacturers in favour of the purchaser.
- Used or reconditioned parts.
- The cost of transporting the vessel to a repair facility and for all related towing, harbour, docking, slippage, lifting, moorage, launching or retrieval charges.

No representations or express or implied warranty except as herein stated

- To the extent permitted by law, this limited warranty is the only warranty extended by Hamilton Jet and is in lieu of all other warranties, EXPRESSED or IMPLIED, oral or written and of all other obligations or liabilities, including without limitation any IMPLIED WARRANTIES of MERCHANTABILITY or FITNESS for a PARTICULAR PURPOSE. Except as provided in this warranty the product is sold as is, where is.
- No other person or agent or distributor is authorised to modify this warranty, give any other warranty on behalf of HamiltonJet or to assume for Hamilton Jet any other obligation or liability in connection with the sale of its products.
- In the United States and Canada, some states and provinces do not allow limitations on duration of an implied warranty, or the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. This limited warranty gives you specific legal rights and you may also have other rights, which vary from state to state.
- In other countries outside the United States and Canada, you may have statutory rights which cannot be affected or limited by the terms of this Warranty.

C.W.F. Hamilton & Co. Ltd. July 2005 [Rev H]

Warranty & Ownership Registration Form

C.W.F. Hamilton & Co Ltd.

To allow Hamilton jet to complete its records and in order to assist any claim under the attached Limited Warranty, please complete this Warranty and Ownership Registration Form in full and return as soon as possible by post or facsimile to:

The Marketing Department, C.W.F. Hamilton & Co Ltd, PO Box 709, Christchurch, New Zealand.
Fax +64 3 348 6969

Hamilton jet encourages the Distributor to take responsibility for ensuring the Purchaser and the Distributor complete this form at the time of sale and return it to Hamilton jet. Please complete one form per vessel only.

Hamilton jet Model		**Serial Number(s)**	
Delivery Date		**Commissioning / In Service Date**	
vessel / Project			
Purchaser			
Address			
Contact Name		**Signed**	
Distributor			
Address			
Contact Name		**Signed**	
Office Use Only	Logged by: **Date:**	**Proj. Code:**	

Part A

Operator Information

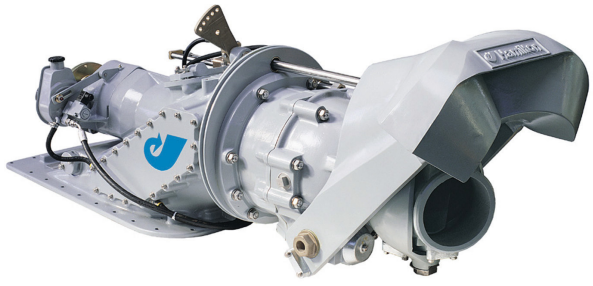
- Introduction and Product Description
- System Operation

Section 1
Introduction & Product Description

1.1 The Hamilton Water Jet System

1.1.1 Introduction

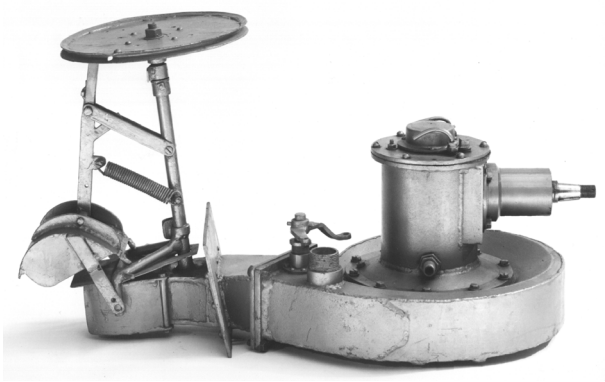
In the modern world, waterjets have rapidly gained acceptance as the leading means of propulsion for all types of high speed marine craft including ferries, work boats, patrol craft and pleasure boats. Recent advances in waterjet technology have put them ahead of conventional propeller systems in both high speed performance and also reliability. Modern waterjet powered vessels offer many advantages, such as high efficiency, rapid acceleration, shallow draft, unrivaled manoeuvrability and smooth, quiet operation. Whilst conventional propeller powered craft have several shortcomings, such as vibration, higher engine loading and susceptibility to damage from water borne debris, waterjets generally offer lower maintenance, longer engine life and simplified installation



Modern Hamilton Jet circa 2000

Hamilton Jet pioneered the commercial development of the modern waterjet system in the early 1950's and today have over 30,000 units installed worldwide. With a complete range of models suitable for power inputs of up to 3000 kW per unit, Hamilton waterjets are ideally suited to the efficient propulsion of a wide variety of high speed vessels, in either single or multiple configuration, typically from 5 to 50 meters in length.

Hamilton Jet is dedicated to the production of the highest quality waterjets and controls systems designed and manufactured to meet the requirements of the worlds leading certifying authorities. Full logistic support for projects is provided by the global Hamilton Jet organisation through factory support staff, regional offices and an extensive network of factory trained distributors in over 50 locations worldwide.



Hamilton Quinnat Jet Circa 1953

Equipment description:

The Hamilton HJ Series is a range of highly efficient single stage waterjets suitable for propelling craft typically up to 20 meters in length and 30 tonnes displacement, at speeds up to 50 knots. HJ Series waterjets are generally directly driven by high speed diesel engines. The HM Series are larger single stage waterjets suitable for vessels typically up to 50m in length and are generally driven by high speed diesel engines via a reduction gearbox.

Mounted partly inboard at the stern of the vessel, the Hamilton waterjet consists of a totally integrated package with steering and reverse mechanisms and jet mounted control system hydraulic equipment. Water is drawn into the waterjet through an intake screen at the base of the intake, which is mounted flush with the hull bottom. The pumping unit (impeller + stator) increases the pressure or "head" of the flow, which is then discharged at high velocity at the nozzle. The reaction to this high velocity jet stream provides the net thrust force, which is fully transmitted through the intake to the hull bottom.

A single piece balanced steering nozzle precisely directs the jet stream as commanded by the helm, providing high turning forces to either port or starboard. An independent split-duct type reverse deflector, usually hydraulically actuated, directs the jet stream back underneath the hull to provide powerful astern thrust. The reverse deflector may be set to a "zero speed" position (where the ahead and astern thrusts are balanced) at which point full steering is still available. Infinitely variable forward and reverse thrust may be selected by varying the position of the reverse duct and combined with the highly efficient steering, results in unparalleled vessel control and manoeuvrability.

A vessel fitted with a Hamilton waterjet has the minimum possible draft, with no protruding underwater appendages. This allows operation in shallow waters and in water with floating debris that may foul or damage a typical propeller driven vessel and also means increased safety for personnel working in the water near the vessel. The waterjet unit is an ideal form of propulsion for vessels working in a marine mammal environment.

1.1.2 Main Components

Intake and intake block

The intake represents the main structural body of the jet unit and is an integral part of the Hamilton Jet design. The intake is cast from high silicon aluminium alloy and is capable of transmitting the full net thrust force of the jet unit to the hull bottom, and not to the transom or to the engine via the drive shaft. The intake casting has a lower flange which mounts to an intake block, which is welded or bolted into the vessel hull. All Hamilton waterjets include an intake screen that is carefully engineered into the waterjet design so that operational parameters such as cavitation resistance are unaffected by its presence.

Oil cooler

The intake has an integrated oil cooler for the hydraulic control system. This is connected to a jet mounted hydraulic power unit (JHPU) via hoses.

Thrust bearing and waterseal

The thrust force generated by the pressure differential across the waterjet impeller is reacted on by a thrust bearing inside a bearing housing attached to the front of the intake. No additional external thrust bearing is required. Aft of the thrust bearing on the waterjet mainshaft is a mechanical face type waterseal which prevents water from entering the vessel and bearing housing.

Coupling and drive shaft

A coupling is mounted on the mainshaft forward of the bearing housing. A variety of couplings are available to suit the type of driveshaft flange used. The driveshaft to the waterjet must have axial and radial flexibility.

Impeller

The impeller design employed in all Hamilton waterjets is a highly refined mixed flow type capable of pumping large volumes of water at relatively low pressures, permitting high propulsive coefficients to be achieved at fast vessel speeds with outstanding resistance to cavitation. All impellers have been designed using sophisticated flow analysis software. The cast stainless steel impeller runs within a replaceable stainless steel wear ring located in the rear section of the intake or within an impeller housing attached to the rear face of the intake (on larger HM series jet units).

Tailpipe

Aft of the impeller is the tailpipe section containing a water lubricated marine bearing to support the rear of the mainshaft. The tailpipe contains a stator section that has vanes to remove the rotational direction of the flow so that a uniform axial flow is presented to the nozzle.

Nozzle

After the water flow passes the pump (impeller + stator), it is at a higher pressure and relatively low velocity. At the nozzle outlet, the pressure is at atmospheric. This difference in flow pressure is converted to flow velocity in the nozzle. The correct nozzle sizing is critical to the correct operation of the pump in a given application.

Steering (JT steering nozzle)

The steering assembly is attached to the rear of the tailpipe. It consists of a steering housing, nozzle insert and steering nozzle (which incorporates the nozzle described above). The steering nozzle is mounted inside the steering housing on vertical pivot pins and is rotated to port or starboard by linkages attached to an inboard steering cylinder. The Insert inside the steering housing ensures that the flow exiting the stator section reaches the final steering nozzle outlet without being disturbed by the steering mechanism, thus maximising steering efficiency.

Reverse duct

The reverse duct is attached by horizontal pivot pins to the tailpipe and can be positioned up or down by the inboard reverse cylinder. The ahead / astern function of the reverse duct is an integral part of the Hamilton Jet package. The split deflector type reverse duct is designed to provide maximum astern thrust under all conditions of vessel speed, water depth and throttle setting. A splitter is incorporated to divide the flow and angle the astern jet stream downwards and to the side, to clear the vessel transom and intake opening. This prevents recycling of flow through the jet unit (which may be aerated or contain sediment) and also excessive disturbance of the bottom of the waterway. The result is very high reverse efficiency that contributes to the excellent manoeuvrability afforded by a Hamilton waterjet.

Transom seal

The transom seal serves to seal the hole in the vessel transom through which the waterjet passes. It is bolted to the vessel transom and incorporates a flexible element which contacts and seals around the intake.

Screen rake

The HJ-213 to HJ-403 jet unit may be fitted with a screen rake as an accessory item. The screen rake is a foot operated rake mounted in the lower half of the intake, designed to clear any debris that may be caught by the intake screen. The spring return foot pedal for operating the screen rake is mounted on the port side of the intake casing.DRY RUN KIT (OPTIONAL EXTRA ON HJ-212 TO HJ-362 jet unitS)

Hamilton jet units are not fitted with the dry run kit as standard - this is an optional extra.

The dry run kit is a simple solution to the problem of starting the engine before putting the vessel in the water, where there is no gearbox fitted. It is particularly useful for man-overboard boats and lifeboats where it is important to ensure that the engine will start before the vessel is in the water. The dry run kit consists of a special bearing which can be run dry for short periods and run for long periods with water lubrication.

Overflow preventer or hatch extension (optional extra)

Hamilton jet units are not fitted with overflow preventers as standard - this is an optional extra.

The overflow preventer / hatch extension is used where the static waterline (vessel fully laden) is above the level of the inspection cover. It is attached to the top of the intake outside the inspection hatch.

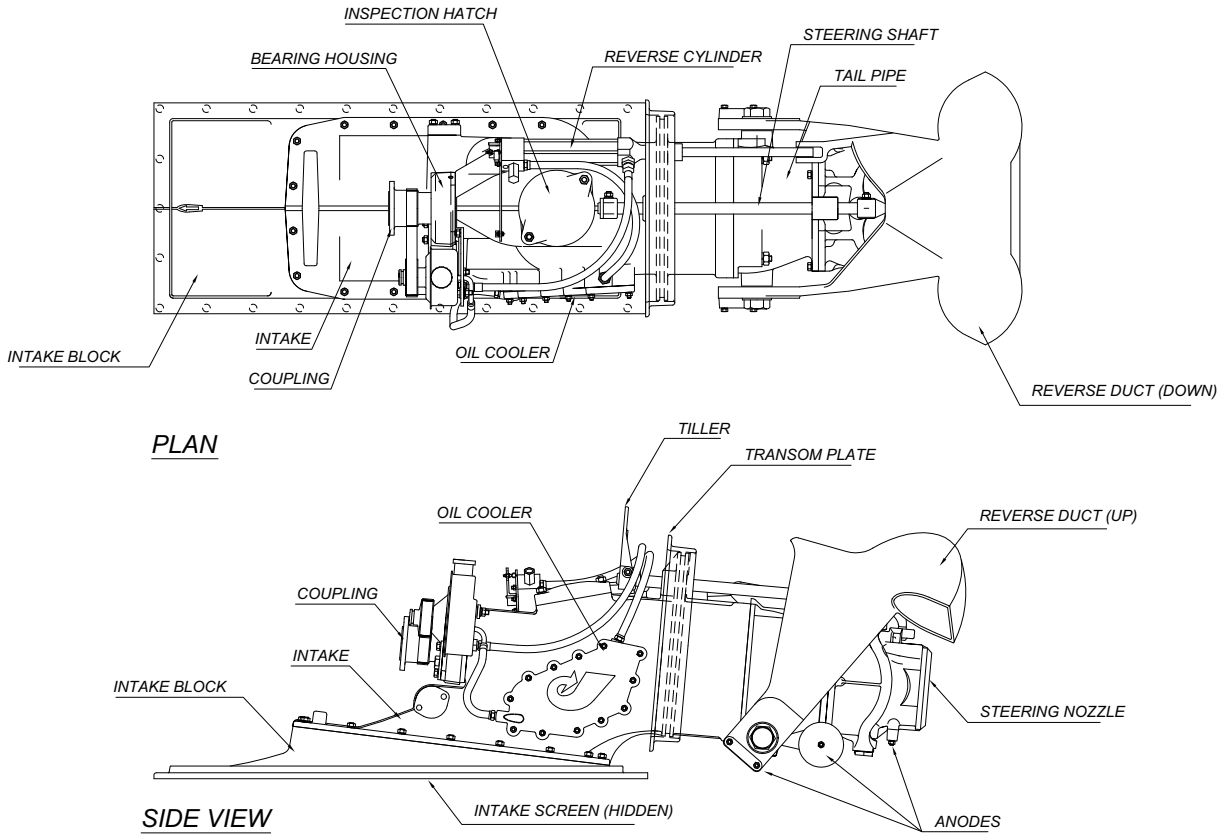


Figure 1: HJ-274 Jet Unit (5º Option Shown)

1.2 The Hamilton HSRX Reverse System

The Hamilton HSRX reverse system is a self contained hydraulic reverse actuation system.

The actuation is provided by a compact hydraulic reverse cylinder that uses a rotary valve inside the cylinder to give proportional positioning control. This allows fast control response where accurate posistioning is not required (from the fully up position to just prior to the reverse duct entering the waterjet) and fine control of the reverse cylinder position where it is needed (around the zero speed / reverse position).

With the piston restriction (A) fully open, equal pressure acts on both the rod end and cap end of the HSRX cylinder. As the cap end area is larger than the rod end area, the cylinder extends.

With the piston restriction (A) closed, the cylinder retracts. At full retraction, the bypass valve (B) opens, reducing the system pressure and power consumption of the pump.

The back pressure valve (3) Is factory preset at 3.45 MPa (500psi).

The pump assembly (1) is belt driven directly from the jet unit.

The pump assembly comprises, pump, an integral tank, flow control and pressure relief valves.

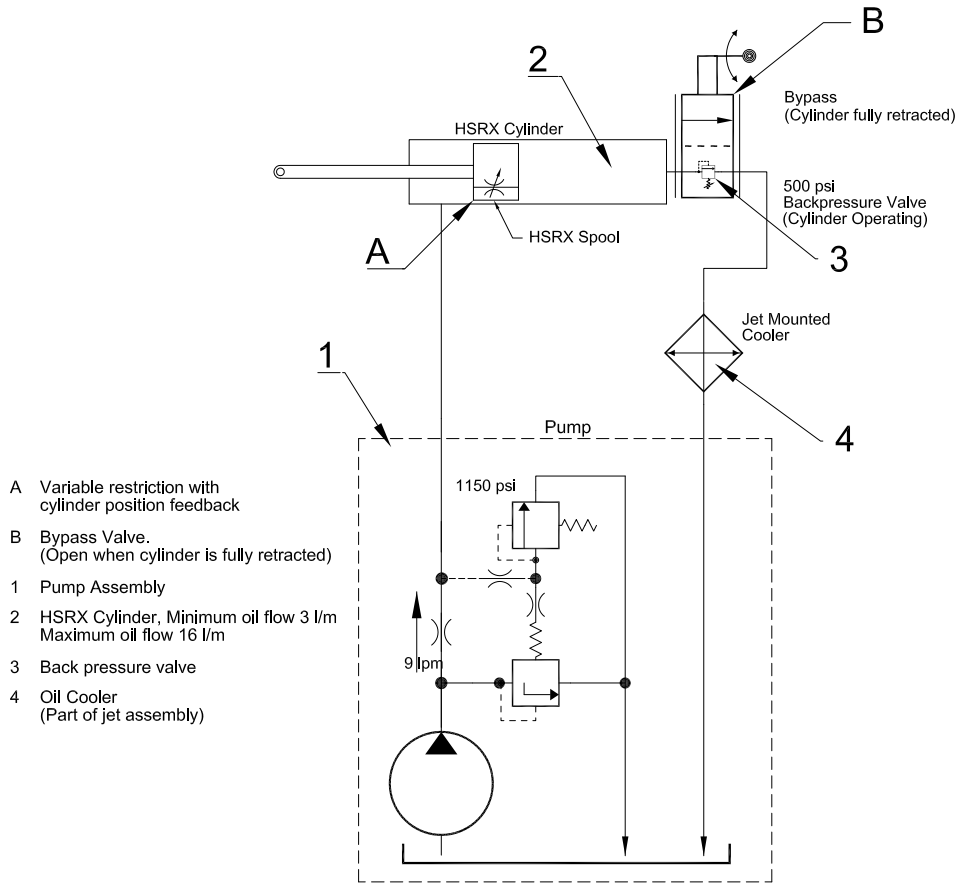


Figure 2: Basic Hydraulic Circuit Diagram

Section 2
System Operation

2.1 Starting Up

CAUTION

Never stop the engine(s), or disengage the drive to the jet unit, when approaching a mooring or at any time when control of the vessel may be required.

Note: With HSRX reverse control, the reverse duct may slowly drop to a full reverse position when the engine is not running.

At start up, the reverse duct may be in full reverse position, but will move to correspond with control lever position as soon as the JHPU (hydraulic pump unit) is running.

1. Before starting engine(s), the following checks should be carried out:
   a) The vessel is securely tied up or well clear of other objects.
   b) The helm is centred and the reverse controls are at zero speed.
   c) Clutches and gearboxes, if fitted, are in neutral position.
2. After starting engine(s) adjust the helm and reverse levers, to control vessel movement.

2.2 "Ahead" / "Zero Speed" / "Astern" Controls

WARNING

Selecting 'astern' (crash stop) while the vessel is moving ahead at high speed can produce very rapid deceleration. and should only be used in an emergency situation.
New operators should use the "crash stop" feature very carefully.
Do not use full helm control until the vessel has slowed.

"Astern" and "zero speed" are achieved by redirecting the jet stream. If the reverse duct is lowered fully, all of the jet stream is redirected back under the vessel giving "full astern thrust". If the reverse duct is lowered partially the jet stream is split giving some ahead and some astern thrust. At a certain reverse duct position the ahead and astern thrusts will be equal so the vessel will not move ahead or astern regardless of the throttle opening. **This position is given the technical term "zero speed"**. (This term 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.

“Crash” or “emergency stop”:
This procedure should only be used in an emergency.

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” can be very severe - even more so than full braking with a motor car.

To "brake" the vessel's forward motion :-

1. Close the throttle.
2. Select "astern".
3. Open the throttle, gently at first until the desired braking is achieved.
4. Close the throttle as soon as the vessel has slowed to a standstill.
5. Do not use full steering until the vessel has slowed.

2.3 Steering

The steering nozzle deflects the jet of water to port or starboard causing the vessel to steer to port or starboard respectively

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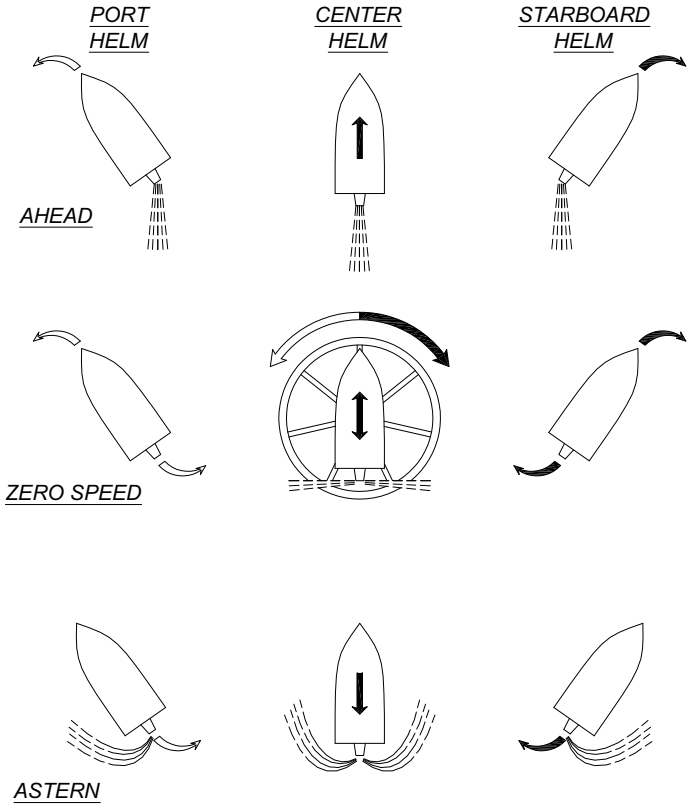


Figure 3: Steering Operation

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

1. If the engine is stopped there is no jet of water to deflect and so the vessel cannot be steered or stopped.
2. Never stop the engine or disengage the drive to the jet when approaching a mooring or at any time when steering will be required.
3. The more the throttle is opened the greater the steering effect - i.e. the sharper the turn.
4. Steering is available at "zero speed" as well as all ahead and astern speeds - a feature which gives the Hamilton Jet unrivalled manoeuvrability.

When moving ahead at **"zero speed"**, or astern, **the bow of the vessel will always turn the way the steering wheel is turned,** i.e. move the steering to port, the bow of the vessel will move to port and vice versa.

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

The following steering systems are suitable for this application:

a) A manual hydraulic steering system which gives approximately 1.3 turns of the helm from full lock to full lock is recommended. (A greater number of turns will reduce sensitivity of steering during low speed manoeuvring).

b) A high quality rotary, or rack and pinion, cable system is an alternative but for single jets only - the system must not allow more than 1.5 turns of the helm from full lock to full lock.

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

2.3.1 Total Hydraulic Failure

Emergency steering control
In the case of a complete manual hydraulic steering failure the Jet(s) may be steered by manually moving the jet tiller(s). Open the by-pass valve (or disconnect the hydraulic hoses at the steering cylinder if there is no valve). The nozzle position is indicated by the gauge at the helm. Steering may only be possible at low RPM unless an emergency tiller extension is used (not included in C.W.F Hamilton & Co Ltd standard supply).

Emergency manual reverse duct control
This may be carried out in case of failure of the reverse hydraulic controls system:

To raise the reverse duct:

1. Attach a rope to the reverse duct.
2. Take the weight of the reverse duct.
3. Disconnect the front hydraulic hose from the reverse cylinder.
4. Lift the reverse duct and tie off the rope so that the duct is raised out of the jet stream.

This will enable the vessel to proceed at speed and return to base to have the fault checked and rectified.

Emergency manoeuvring:

1. **With multiple jets**. Shut down the engine driving the jet without reverse and manoeuvre using the other jet(s).
2. **With a single jet.** The vessel can be partially manoeuvred by raising the reverse duct with a rope and lowering it under its own weight. The engine must be kept at idle RPM.

2.4 Manoeuvering and Docking

2.4.1 Low Speed Manoeuvring and Docking

The vessel is best manoeuvred as follows:-

1. Move the reverse control lever to the "zero speed" position.
2. Set the throttle to $^1/_3$ open - approximately 1,000 R.P.M. (In strong tide or wind conditions increase the throttle opening to obtain greater response as required to suit the conditions).
3. A slight movement either way from the "zero speed" position will be sufficient to move the vessel ahead or astern until the manoeuvre is complete.
4. Steering will be very responsive 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.
5. Manoeuvre at a fixed throttle opening, working the steering with one hand and the ahead/astern control lever with the other hand.

Note:

1. DO NOT WORK THE THROTTLES - Leave as set. With TWIN JETS manoeuvring is best carried out using the helm with one hand and both reverse levers with the other hand.
2. USE ONLY LOW ENGINE RPM - high RPM will give faster response but makes control more difficult.
3. If the bow is rotating to starboard, port lock must be used to stop the rotation (or vice versa) then the helm centred to hold the heading.
4. If the vessel is moving ahead then the reverse lever(s) must be moved astern to bring the vessel to rest (or vice versa) and then zero speed selected to hold the heading.

2.4.2 Moving Sideways

With twin jets:

Use the following procedure to move the vessel sideways away from the jetty. Initially both controls are at "ZERO SPEED" and the vessel is stationary.

Moving to port

1. Set both engine RPMs to just above idle with slightly higher RPM on the port side.
2. Set steering to ahead.
3. Move the port reverse lever to full astern and the starboard lever to full ahead.(A)
4. As the bow begins to swing to port, turn the helm to starboard to keep the vessel parallel to the jetty. (B)
5. The vessel will now move sideways to port.
6. Adjust the port engine RPM to prevent fore and aft movement. (Higher RPM moves vessel aft). This may also be done by bringing the starboard reverse control back towards the zero speed position.

Moving to starboard

7. Instructions 1 to 5 are the same but for port read starboard and vice versa. When the vessel is safely clear move both controls back to zero speed and centre the helm. Then move off in the required direction.

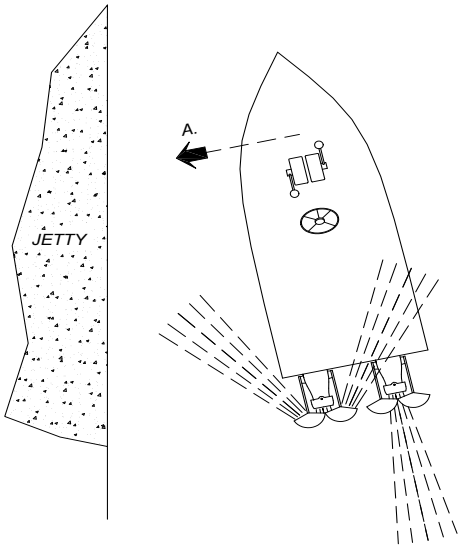


Figure 4: Moving to Port

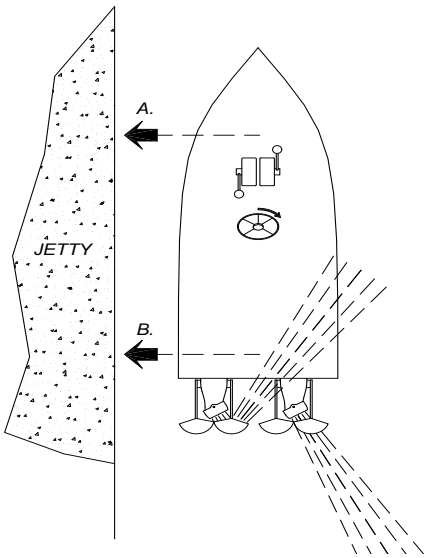


Figure 5: Docking

Docking.
Use the previous procedure when approaching or moving away from a jetty or another vessel.

Note: If the vessel is moving sideways too fast the controls should be set back to zero speed and the helm returned to centre. Alternatively set the controls for sideways movement in the opposite direction until the vessel stops moving sideways. The required control setting will vary according to wind and tide conditions.

With triple jets
Using all three jets to move sideways gives best results.

1. Set steering to dead ahead, all three reverse ducts to the "zero speed" position and RPM on all engines to the same value. (The RPM required for manoeuvring will depend on the prevailing sea conditions, higher RPM will improve response).
2. For sideways motion to port, set the port jet full astern and the starboard jet full ahead (this is reversed for sideways motion to starboard).
3. Use the centre jet reverse duct to control fore and aft movement (duct approximately 80% reversed).
4. Use the helm to control turning (rotation) moments, i.e. for sideways motion to port turn the helm to starboard to balance the turning moment of the port and starboard jets.

This method of sideways manoeuvring should result in 33% more side thrust than if only two jets were used. Once set up, only the centre jet reverse control and the helm need to be used for controlling the sideways movement.

Moving to starboard:
Follow instructions 1 to 4 as for moving to port, but for "port" read "starboard" and vice versa.

To stop sideways movement:

1. Set the helm to dead ahead, throttle RPM to idle and reverse to zero speed before the vessel reaches the required position.
2. Alternatively set controls to start sideways movement in the opposite direction until vessel stops sideways movement then set the controls to :-
   - Steering: Dead ahead.
   - Throttle: Idle.
   - Reverse: Zero speed.

2.5 Cruising

CAUTION

Running at speed with a partially blocked inlet grill or debris on the impeller will result in cavitation damage to the jet unit.

Care must be taken to prevent cavitation damage to the jet units, as described below:

1. Running at speed with a partially blocked inlet grill or debris on the impeller will result in cavitation damage to the jet unit. Therefore, before accelerating to full speed, all jet units should be cleared by BACKFLUSHING. **Refer to Section** 2.9"Blockages (Debris in the jet unit)". This should be done on every trip as soon as clear water is reached.
2. Acceleration should be carried out gradually. Full power cannot be used at low vessel speeds such as when operating on one engine only.
3. If there is any blockage of the jet unit, the engine will run at a higher than normal RPM and the vessel will accelerate slowly, and best speed will be reduced. If such symptoms are noticed, immediately slow the vessel and clear the blockage. **Refer to Section** 2.9"Blockages (Debris in the jet unit)".
4. In conditions of severe weather or overload, the engine speed should be reduced accordingly.

2.6 Shallow Water Operation

CAUTION

Do not run the jet unit if the vessel has run aground as damage may occur to the impellers and stator.

It is important to avoid pumping sand, stones, etc, through the jet unit as this will blunt and wear the impeller and may cause jamming of the steering. To prevent this happening, always ensure that the stern of the boat is in deep water before landing or pulling out from a beach and before accelerating to planing speed.

If the steering has become jammed, rock the helm wheel quickly from side to side until the steering becomes free.

Note: The use of excessive force at the helm could damage the steering components. In the case of a severe jam-up, this must be freed from the rear of the jet unit.

CAUTION

All parts of the steering system should be thoroughly examined for damage if excessive force has been used to free a severe jam-up. Refer to Section 8.5."Jet Unit Servicing Details".

The following diagrams illustrate good and bad practice:

A: At high planing speeds shallow water operation is not a problem until the vessel is nearly grounded.

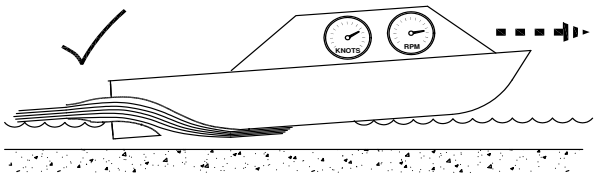


Figure 6: High Speed Planing in Shallow Water

B: At slow displacement speeds avoid using high R.P.M. in shallow water.

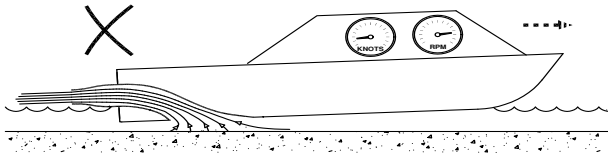


Figure 7: Shallow Water Operation Slow Speed

C: If it is not possible to pick a deep water area to start off and stop in, then "idle" over the shallow area into deep water before accelerating up to planing speed. If any debris has been picked up in the intake screen, momentarily stopping the engine should allow the debris to drop away from the screen.

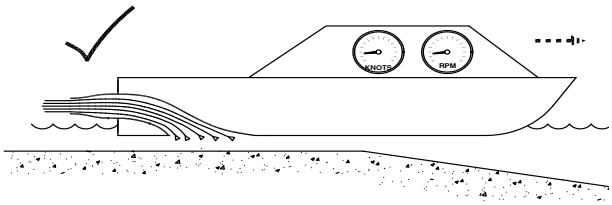


Figure 8: Shallow Water Operation Idle

2.7 Acceleration to High Speed

If leaving an area of shallows, or with debris in the water, ensure jets are clear of debris before accelerating to high speed. **Refer to Section** 2.9.3"Clearing Blockages". If there is any debris in the jet the engine will run at higher than normal RPM and the vessel will only accelerate only slowly, perhaps not reaching full (planing) speed. **Refer to Section** 2.9.2"Detecting Blockages".

Daily, prior to commencing operations, the inspection cover should be removed and any debris removed from around the impeller or intake screen. **Refer to Section** 8.5"Servicing Intervals".

CAUTION

Ensure that the water level is below the inspection cover level before removing the inspection cover.

CAUTION

Running at speed with a partially blocked inlet grill or debris on the impeller will result in cavitation damage to the jet unit.

2.8 Aerated Water

It is possible that some hulls may, under certain conditions, feed aerated water into the intake of the jet units.

When operating in areas where the water may be excessively aerated. (eg. fast flowing rapids or surf) the following points should be noted:

1. There may be a loss in thrust due to the unit pumping a significant amount of air instead of water.
2. The impeller may unload suddenly causing the engine RPM to fluctuate wildly.

When these symptoms occur, reduce engine RPM until the jet unit maintains a steady RPM and thrust.

2.9 Blockages (Debris in the jet unit)

2.9.1 Avoiding Blockages

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

2.9.2 Detecting Blockages

In debris laden waters it may be necessary to clear the intake screens and impellers before each run. In many cases the debris is picked up while the jet unit is moored, so it is advisable to clear the intake screen in open or clear waters.

Blockages of the jet unit are usually noticed by the following symptoms:

1. Engine unloading (RPM increases).
2. Lack of jet thrust (vessel speed drops).
3. Abnormal noise and vibration from the jet unit.

2.9.3 Clearing Blockages

WARNING

Extreme care is required whenever the inspection cover is removed as water may enter the vessel through this opening.

Never leave the inspection cover removed without constant monitoring of the water levels.

The following methods can be used to clear a blocked jet unit:

1. Slow or stop the engine driving the blocked jet unit. The blockage will often clear itself. This operation works best when the vessel is still moving forward at speed.
2. BACKFLUSH the blocked jet unit (only possible if a reversible gearbox is used) as below:
   a) Stop or slow the vessel to displacement speed.
   b) Move the reverse duct to the ZERO SPEED position.
   c) Reverse the rotation direction of the blocked jet unit by engaging reverse gear and opening the throttle slightly. This should clear the blockage. If this fails to work, repeat actions a to c several times.
3. Remove the inspection cover on the intake and manually clear the obstruction.

Refer to Section 2.9.4"Using the Inspection Cover".

Note:

1.Check that the static water level will be safely below the intake inspection cover lip.

2.If the static water level is too high, ballast should be placed on the bow to raise the stern high enough to allow the intake Inspection cover to be removed.

3.Alternatively, an optional extra overflow preventer can be fitted to the inspection point to allow inspection of the intake housing at higher water levels.

2.9.4 Using the Inspection Cover

WARNING

Extreme care is required whenever the inspection cover is removed as water may enter the vessel through this opening.

Never leave the inspection cover removed without constant monitoring of the water levels.

CAUTION

Before removing the inspection cover:-

a) Stop all engines.
b) Check that the static water level will be below the intake inspection cover lip.
c) If the static water level is too high, ballast should be placed on the bow to raise the stern high enough to allow the intake inspection cover to be removed.
d) Alternatively, an optional hatch extension/overflow preventor can be fitted to the Inspection hatch opening to allow inspection of the intake at higher water levels.

2.9.5 Inspection Hatch Extension (Optional Extra)

Note: Refer to Drawing "HJ27410004 Hatch Extension".

The inspection hatch extension is an optional extra for use with jet units where the water level is above the normal level of the inspection cover.

1. It is attached to the top of the intake casing in place of the inspection cover. The inspection cover is then fitted to the upper end of the inspection hatch extension.
2. It provides an increase of approximately 140 mm in allowable water level height.

2.10 Operating with an Engine and Jet Unit out of Service

If the vessel is operated with an engine and jet unit out of service, it is possible for the jet unit mainshaft to rotate due to water flowing through the jet unit. This is undesirable as it can lead to damage of the gearbox.

Use of shaft brake (if fitted) to stop mainshaft rotation

The shaft brake should be fitted to the output shaft of the gearbox. Apply the shaft brake to stop the jet unit mainshaft rotation in jet units not in service.

Use of engine to stop mainshaft rotation

If a shaft brake is not fitted, the jet unit mainshaft can be prevented from rotating by engaging the gearbox of the engine which is out of service.

Note: When using this method, it is possible for the jet unit to rotate the engine. If this occurs, disengage the gearbox and let the jet unit mainshaft rotate.

2.11 HSRX Reverse System

WARNING

Use of a waterjet steered vessel is different from a propeller driven vessel as the waterjet mainshaft must always be rotating whenever steering thrust is required.

Note: The following points should be noted when using the HSRX reverse system.

1. The HSRX reverse system does not have a mechanical connection between the reverse duct position and the control lever position. The control lever can be positioned before the reverse duct has reached the desired position (unlike previous HSRC systems, where the control lever followed the reverse duct position).
2. The HSRX reverse system has a bypass feature. When the control lever is touching the stop pin, the reverse duct will be in the fully raised position and a bypass valve opens. Oil is then passed directly to the tank rather than through the back pressure valve. The pump will now operate at considerably reduced pressure, which will minimise power consumption and maximise component life.
3. The by-pass port is only open when the reverse duct is in the fully raised position. At any position other than fully raised, the reverse system will operate at 500 psi back pressure. The maximum shaft speed for continuous operation of the reverse system, at any position other than fully raised, is 1000 RPM.
4. There is no flow control in the HSRX reverse system. The effect of this is, the higher the engine RPM, the faster the reverse duct will move. In the "crash stop" situation, (full reverse at full speed) the reverse can be actuated almost instantly, causing a very sudden and severe deceleration.
5. If a "neutral detent and engine start interlock" microswitch is fitted, refer to drawing "CTCLV01003 Reverse Controller" which is included in this manual.

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" can be very severe - even more so than full braking with a motor car.

CAUTION

Never stop the engine(s), or disengage the drive to the jet unit, when approaching a mooring or at any time when control of the vessel may be required.

CAUTION

If a problem is detected, return to the mooring immediately, at reduced power. DO NOT operate the jet unit until the fault has been repaired. refer to section 7 Fault Finding.

Part B

Design and Installation

- Design Basics
- Precautions Against Corrosion
- Installation
- Commissioning

Section 3
Design Basics

3.1 Propulsion System Design

Jet unit selection
Jet unit selection is a complex task. C.W.F. Hamilton should be consulted for advice in all cases.

3.2 Hull Design

CAUTION

Not all hull shapes are suitable for propulsion by water jets. guidelines on suitable hull shapes, performance and engine matching is provided in the designers manual.

3.2.1 Hull Loads

All loads produced by the jet unit result from the difference in momentum of the incoming and outgoing water. An exception is the torque load on the stator vanes as they remove the angular momentum of the waterjet which was input by the impeller.
The following four cases must be considered when calculating maximum loads:

- Full ahead.
- Full reverse.
- Full steering.
- Full reverse & full steering.

The load situations are described in Figure 1: Loads on the hull for HJ-274 jet unit .
While the jet unit loads can be readily calculated, the hull reaction loads are statically indeterminate. Being dependent on the stiffness and rigidity of both the jet unit and the hull structure.
All loads are transferred to the hull via the intake block. No significant loads are taken by the transom.
The table shows the maximum loads and moments applied at the centre of the jet base. (intake block).

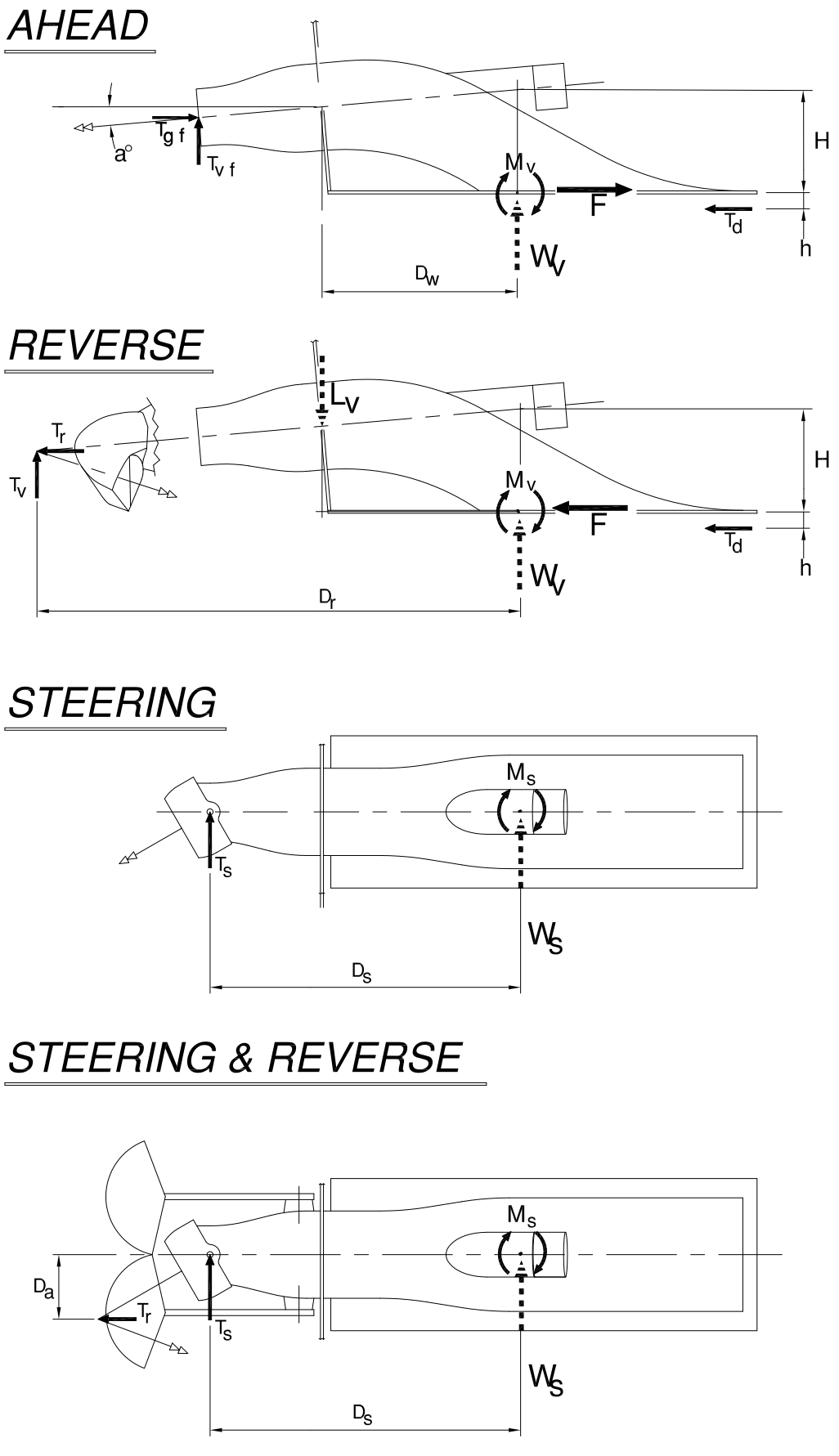


Figure 1: Loads on the hull for HJ-274 jet unit

Table 1: Table of Dimensions for HJ-274 - 0º Base Jet Unit

HJ-274 Jet - Relevant data			
Description	**Symbol**	**Units**	**Value**
Maximum power	P	Kw	330
Centreline height	H	m	0.27
Mean inlet depth	h	m	0.06
Steering to base centre	D_s	m	0.975
Reverse to base centre	D_r	m	1.38
Transom to base centre	D_w	m	0.50
Centre to reverse arm	D_a	m	0.18
Waterjet angle	a	degrees	0°

Table 2: Table of Hull Reaction Forces for HJ-274 Jet Unit

Hull reaction forces - HJ-274 Jet				
Description	**Symbol**	**Units**	**Ahead / steering**	**Reverse**
Axial load in hull bottom	F	kN	11.26	-17.64
Vertical load in base	Wv	kN	0	6.21
Side load in base	Ws	kN	8.90	7.98
Vertical moment	M	kN_m	6.27	6.09
Steering moment	Ms	kN_m	8.68	12.43

Adjustment of listed hull reaction forces to suit lower design powers.
For lower "design power" values, the hull reaction forces can be adjusted by using the following approximate equation:
"Your force" = K_{pr} x "listed force".
"Where: K_{pr}" = (your design power / listed design power) $^2/_3$rds.

3.2.2 Mono Hulled Vessel

1. Aerated water generated by the vessel's bow wave must not pass directly aft to the jet unit intake(s).
   a) A vee'd bow stem in conjunction with 10° minimum deadrise angle is recommended.
   b) Mount multiple jet units as close to the keel line as possible. ("staggered" engines can allow closer centres).
   c) Planing strakes, keelsons, "plank keels" and any other appendage that may create turbulent flow into the jet unit(s) must be removed from the hull bottom in front of and adjacent to the jet unit intakes. ***Refer to*** Figure 2: Mono Hull Design Recommendations**.**

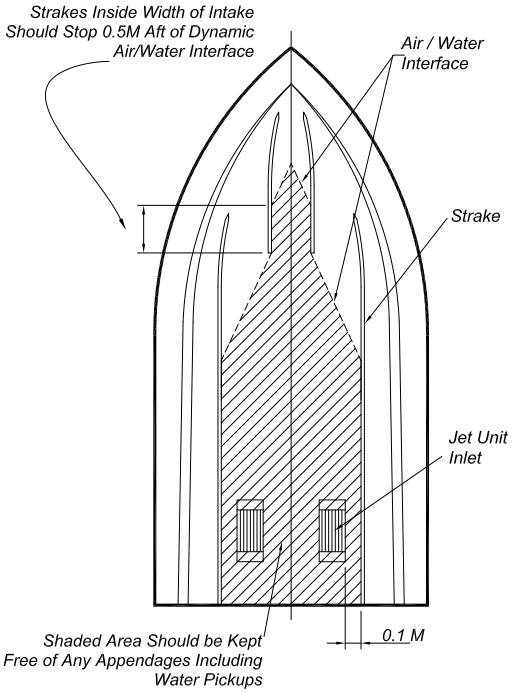


Figure 2: Mono Hull Design Recommendations

2. For speeds over 30 knots, monohedron (constant deadrise) hulls are recommended for directional stability without appendages.
3. Displacement speed and warped plane (reducing deadrise going aft) hulls may need additional directional stability. Twin "bilge keels" are normally sufficient and these do not increase draft or interfere with water flow into the jet intake.
4. Immersion. The jet unit must be immersed with the water line at least up to the underside of the mainshaft (at the impeller) in order to prime the unit when the engine is started.
5. Minimum distances between jets for multiple installations. ***Refer to*** Figure 3: Installation for Multiple Jets.
   a) For dimensions A and B shown in Figure 9, for twin and triple jet installations refer to installations drawings in section 5 of this manual.
   b) For applications using more than three jets consult C.W.F Hamilton & Co Ltd for distances between jets.

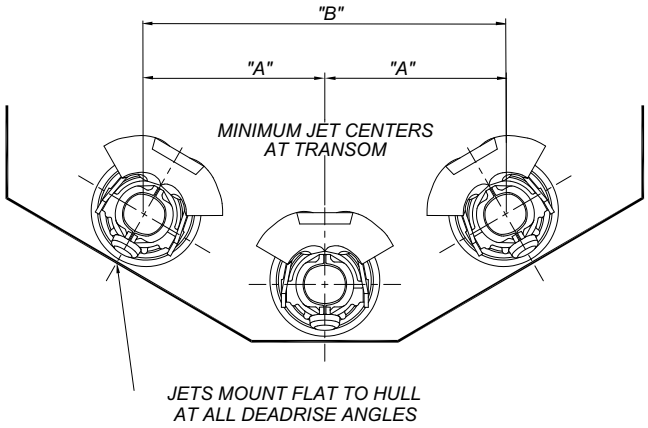


Figure 3: Installation for Multiple Jets

3.2.3 Multi Hulled Vessel

Jet units may be fitted in catamaran and **some** trimaran hulls. Air entrainment between the hulls occurs with these vessels and care must be taken to ensure that this entrained air does not enter the jet unit intakes(s). This is alleviated if the hulls are deep in relation to the air tunnels so that the jet unit sit well down in the water, as indicated on the following diagram. The reverse duct when in the "up" (ahead) position must not project beyond the sidewalls of a catamaran or trimaran hull or substantial drag may be caused.

Consult with C.W.F. Hamilton in all cases if jet units are proposed in these types of hull.

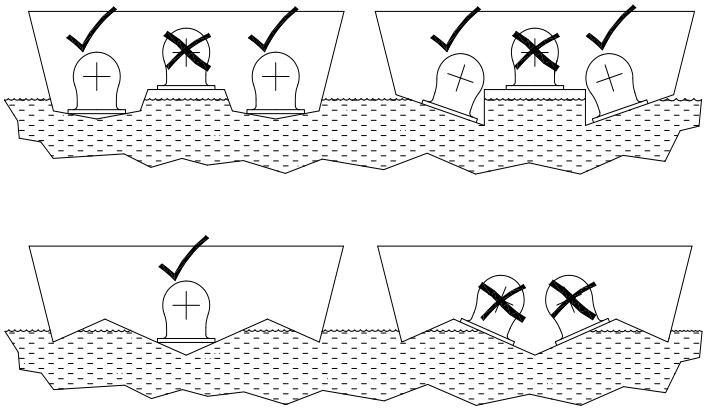


Figure 4: hull Design Recommendations for Multi Hull Vessels

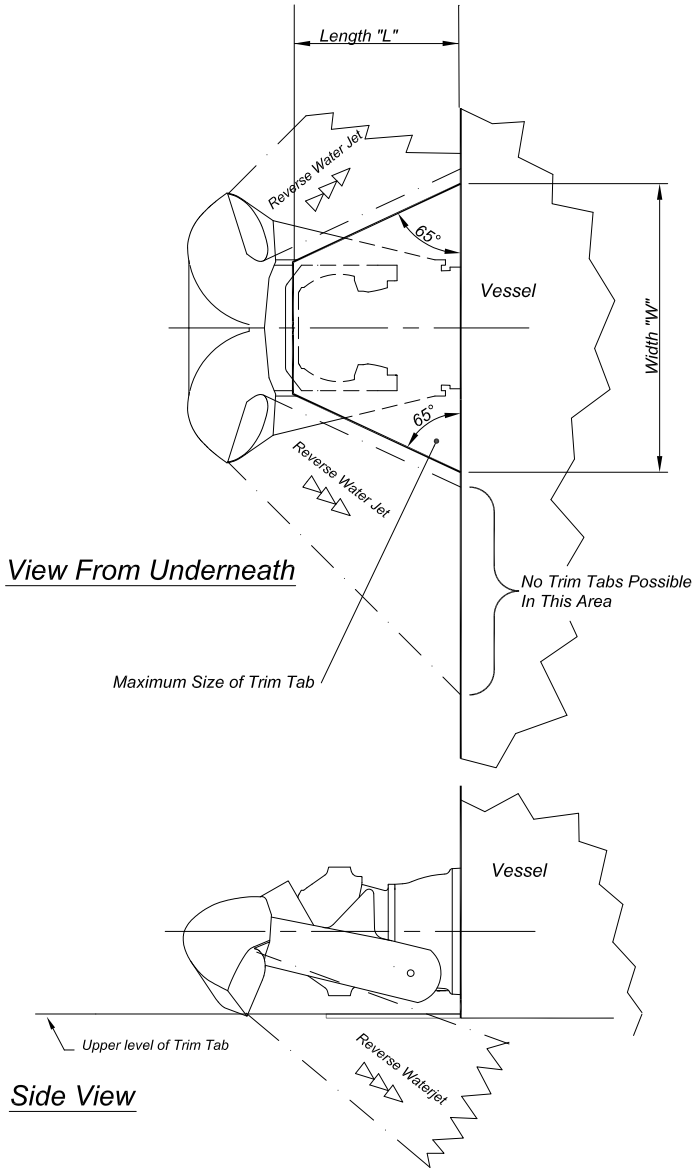
3.2.4 Trim Tabs

Note: Refer to "Precautions Against Corrosion Section 4.1.4" if fitting stainless steel trim tabs

Trim tabs cannot be mounted directly alongside the jet unit. This is because when moving astern, the reverse jet stream will hit them and reduce reverse thrust.

It is possible to mount trim tabs under the jet unit with any control equipment on either side of the jet unit. The adjacent diagram serves as a guide to the maximum size of trim tab that may be located under the jet unit. Contact Hamilton Jet if further details are required.

The diagram shows the area within which the trim tab must lie. From the maximum width "W" at the transom, the area tapers inwards at 25° per side until it reaches the same width as the reverse duct bottom corners.



JET	WIDTH "W"	LENGTH "L"
HM-811	2400	1500
HM-721	2130	1330
HM-651	1900	1180
HM-571	1880	1360
HM-521	1730	1250
HM-461	1540	1110
HM-422	1250	800
HJ-403	1250	800
HS-363	1270	950
HJ-364	1100	700
HJ-362	930	580
HJ-322	1030	740
HJ-292	950	640
HJ-274	950	640
HJ-241	850	650
HJ-213	850	550
HJ-212	850	550

Figure 5: Allowable Trim Tabs Location

3.3 Drivelines

CAUTION

Loads on jet unit thrust bearing

The jet unit thrust bearing accepts thrust loads from the jet unit to propel the craft. It should not be subjected to excessive loads from other sources as described below:

- The Jet thrust bearing will not stand excessive radial loads caused by adapters and belt pulleys overhanging the jet coupling flange.
- The Jet thrust bearing will not withstand excessive loads produced by rigid drivelines which do not accommodate misalignment resulting from engine movement.
- There is a limit to the driveshaft weight that can be supported at the jet unit.

3.3.1 Requirements of the Driveline

1. The driveline must accommodate parallel and angular misalignment plus allow axial movement.
2. The driveline must transmit the torque input to the jet unit with an acceptable life expectancy. It does not have to transmit thrust loads as these are absorbed by the jet unit.
3. Torsional flexibility will be required in the driveline. A torsional vibration analysis must always be carried out. The resultant torque on the jet unit must always be in the same direction. This should be carefully checked at engine idle speed.

3.3.2 Engineering Checks

All driveline component suppliers (including engine and jet suppliers) must be consulted with full driveline details to ensure suitability and compatibility of components.

Checks must include:

1. Critical speed check for whirling of the mainshaft: consult C.W.F. Hamilton & Co. Ltd.
2. Critical speed check for whirling of the driveshaft: consult driveline supplier.
3. Engine to jet alignment: consult C.W.F. Hamilton & Co. Ltd.
4. Torsional vibration analysis: consult engine or torsionally flexible coupling supplier.

Note: Critical speed checks should allow safe operation up to the engine's "no load" governor setting (or high idle).

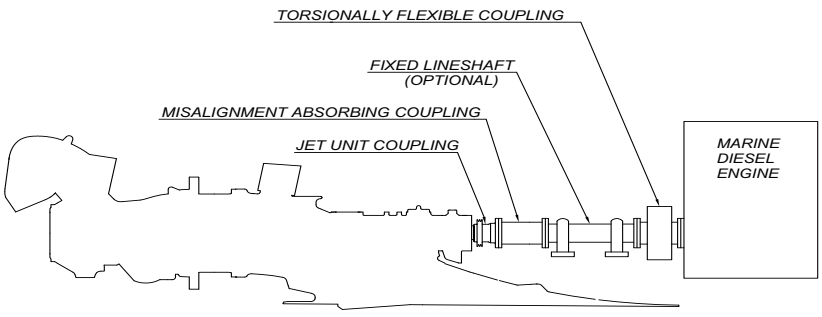


Figure 6: Drive Line Component Description

3.3.3 Driveshaft Options

The diagrams Figure 7: Double Universal Slip Jointed Driveshaft and Figure 8: Torsionally Flexible Flywheel Coupling show two common driveline components and their arrangments. These diagrams are a guide only. Always contact **C.W.F Hamilton & Co Ltd** before designing the driveline.

Universal driveshafts:

These are double universal slip-jointed driveshafts, also called cardan shafts. They bolt directly to the jet unit coupling.

Lengths range from approximately 900 mm to 3,000 mm. Lengths are limited by the weight which can be allowed at the jet unit coupling. **Refer to Section** 3.3.7 Critical Speed of Mainshaft **and Section** 3.3.2 Engineering Checks.

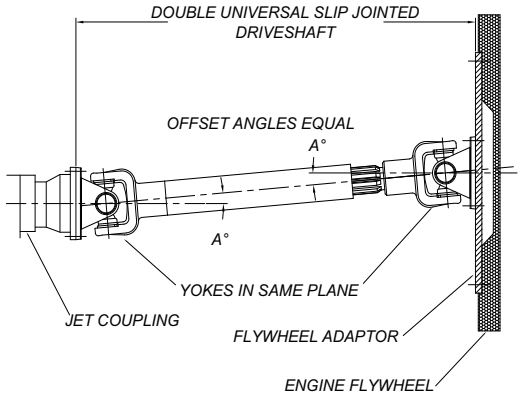


Figure 7: Double Universal Slip Jointed Driveshaft

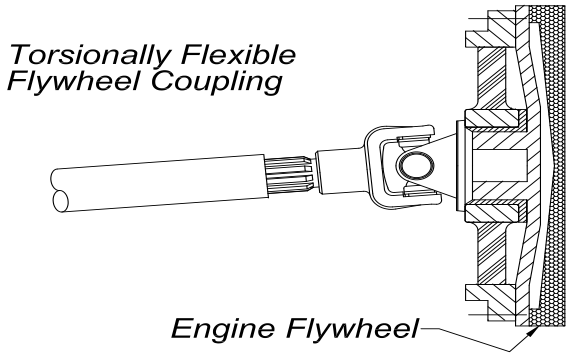


Figure 8: Torsionally Flexible Flywheel Coupling

Torsionally flexible coupling (TFC):

The torsional vibration analysis will determine how many TFCs are required and where they should be located. At least one TFC should be fitted either:

- Between the engine and the gearbox.
- Immediately between the gearbox and any shafting leading to the jet unit.

Double torsionally flexible couplings:

Examples of such couplings are "Centaflex" and "Megaflex".

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

Length - From approximately 200 mm (8") upwards, but limited by the weight which can be allowed at the jet unit coupling. **Refer to Section** 3.3.7 Critical Speed of Mainshaft.

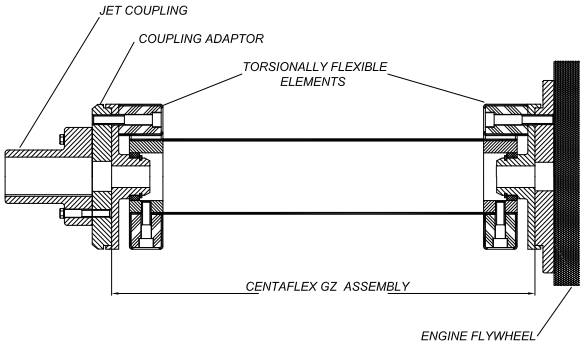


Figure 9: Central Universal Joint Shaft

Double element non torsionally flexible couplings:

An example of such a coupling is "Centalink".

Gear coupling:

This coupling is steel double -jointed coupling which is both flexible to allow for angular offset and also rigid to absorb torsional twisting.

The coupling is formed by two hubs which engage into a flanged sleeve with internal straight parallel teeth. Due to the design of the of the teeth curvature, if shaft misalignment occurs, the hub can oscillate in the flanged sleeve.

The curved face teeth couplings are flexible enough to compensate for misalignments and axial movements of coupled shafts. The same type of coupling also allows for greater shaft offset.

Manufacturers recommendations regarding installation and alignment should be followed.

Note: A double jointed coupling is required.

Long driveshafts:
Where the distance between the gearbox flange and the coupling flange exceeds that possible with a MAC, then a fixed lineshaft supported on pedestal bearings should be used in conjunction with either universal driveshafts or torsionally flexible couplings. **Refer to** Figure 10: Long Driveshafts.

Note: If a TFC is not required between the gearbox and the lineshaft, then the lineshaft can be directly attached to the gearbox flange using normal propeller shafting criteria. The gearbox should be mounted rigidly to avoid misalignment.

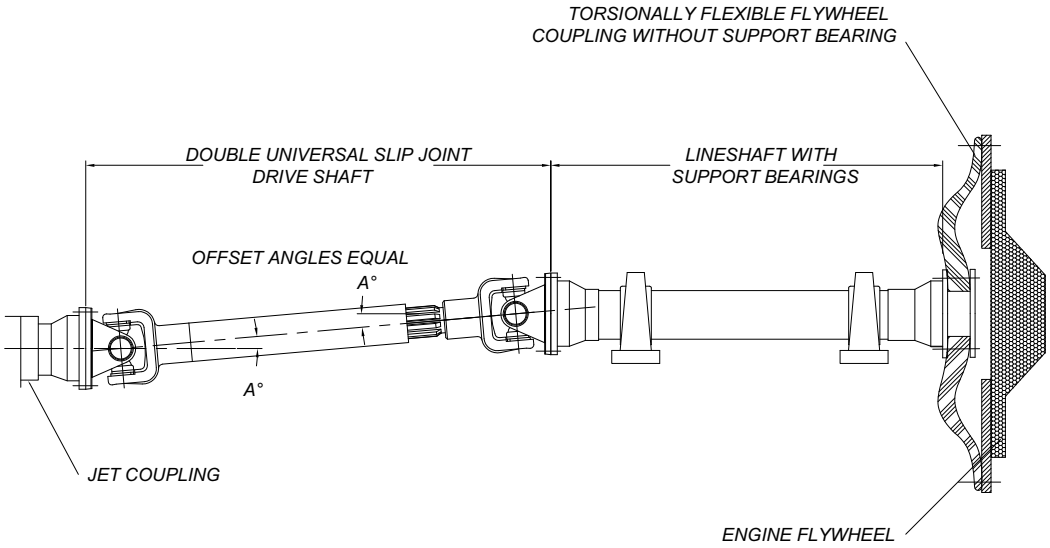
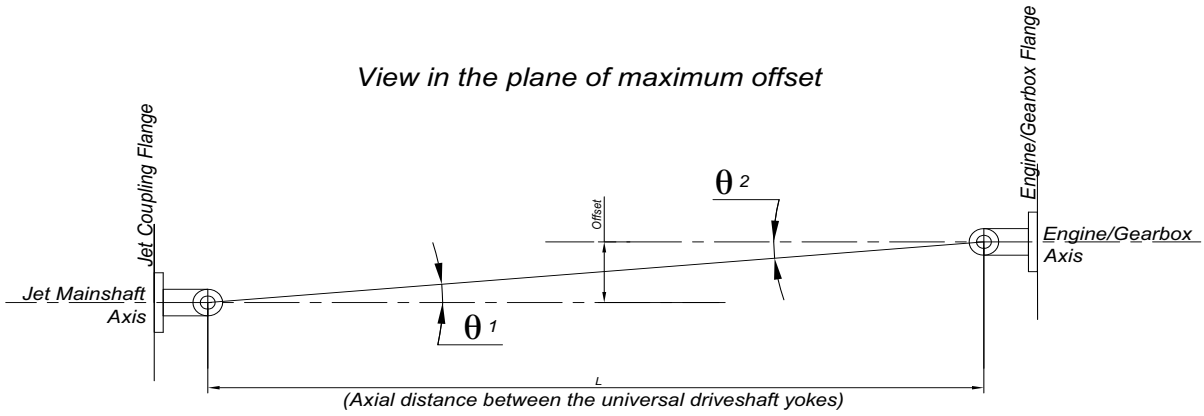


Figure 10: Long Driveshafts

3.3.4 Universal Driveshaft Alignment

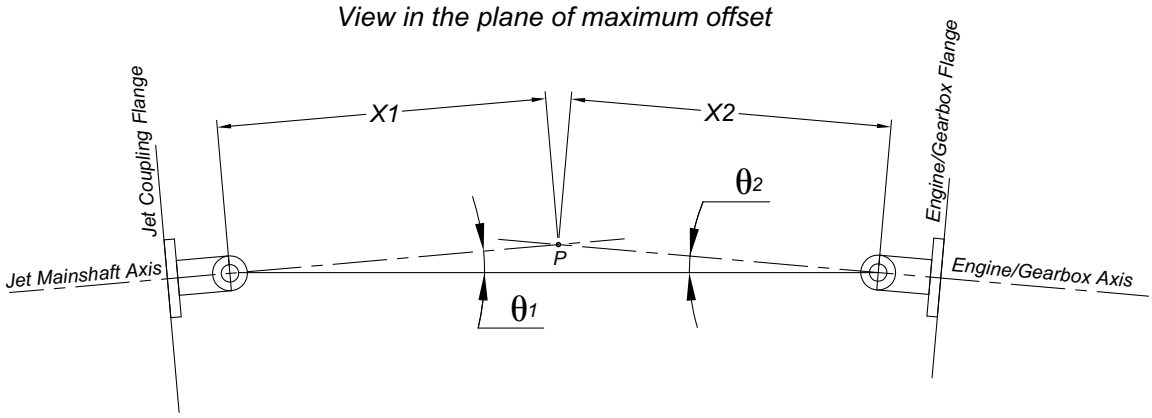
1. There are only two allowable configurations for location of centrelines for the jet unit and gearbox. These are shown in Figure 11: "Z" Configuration Coupling and "W" shown in Figure 12: "W" Configuration Coupling.
2. The universal driveshafts must be assembled with the yokes (forks) in the same plane.
3. Correct running length of the shaft is with the shaft extended to half the total spline extension length.
4. The splined end of the driveshaft is heavier and should be installed at the gearbox end of the driveline.
5. The engine must be positioned so that the universal joints of the driveshaft have equal offset angles. Refer to the driveshaft manufacturers recommendations for joint angles (typical range is between 1.5 and 5 degrees)



Note: θ_1 and θ_2 must be equal

Offset = L x tan θ

Figure 11: "Z" Configuration Coupling



Note: θ_1 and θ_2 must be equal.

If X1 = X2 and both input and ouput axes meet at point P then $\theta_1 = \theta_2$

The best method of alignment is to mount pointers on both the jet coupling (or output) flange and engine (or input) flange. The length of each pointer should be exactly the same and equal to half the nominal distance between the 2 flanges. Rotate the shafts to check that the pointers are straight

Figure 12: "W" Configuration Coupling

Note:

1. When the TFC couples directly to a universal driveshaft, the TFC must provide a bearing to support the universal driveshaft.
2. When the TFC couples directly to a Lineshaft supported on bearings, a support bearing is not required.

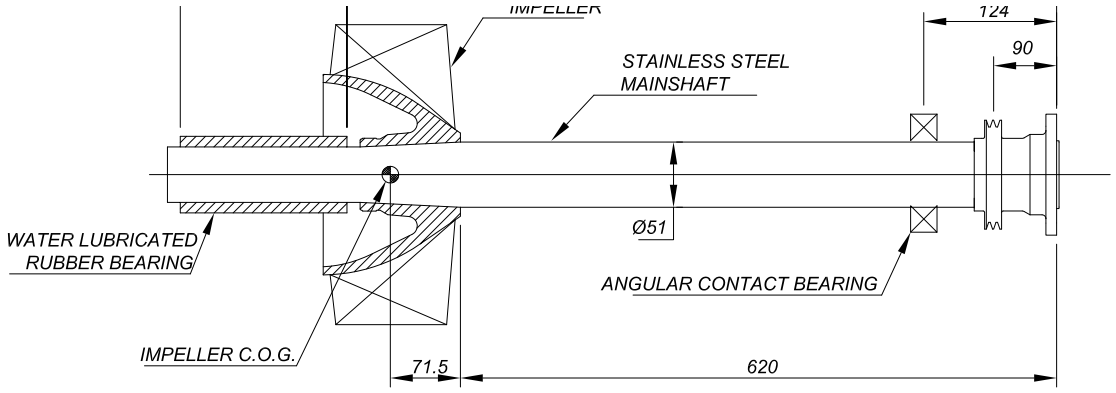
3.3.5 Jet Coupling Flange Details

Please refer Drawing HJ27402001 Couplings & Belts, for all relevant coupling details.

3.3.6 Moments of Inertia

A torsional vibration analysis must be carried out for the complete drive-train including engine flexible coupling, gearbox, driveshaft and jet rotational assembly, especially where a universal driveshaft is used without a torsionally resilient member or gearbox in the driveline. It is the responsibility of the vessel builder to see that this is carried out by either the engine manufacturer or the flexible coupling manufacturer.

The moment of inertia data for the jet unit is provided below, to enable a torsional vibration analysis to be carried out.



ITEM	TYPE	MASS (kg)	Ip (kg.m²)
MAINSHAFT	Ø51	11.1	0.0036
IMPELLERS	TYPE 6.5 TO 8.0 (4 BLADE)	8.0	0.055
	TYPE 8.5 TO 10.5 (5 BLADE)	7.5	0.047
	TYPE 10.6 TO 13 (6 BLADE)	8.5	0.053
COUPLINGS	120mm	2.2	0.0027
	1510	2.8	0.0056
	1410	2.6	0.0084

Figure 13: Drive Line Inertia Data Jet Mainshaft Dimensions

3.3.7 Critical Speed of Mainshaft

Note:

1. In all cases, for the calculation of the "critical speed of the jet mainshaft" consult C.W.F. Hamilton & Co Ltd.
2. The heavier splined end of the universal driveshaft should be located towards the engine.

If a heavy driveline is used then a transverse vibrational analysis of the jet mainshaft should be carried out.

3.4 Jet Mainshaft Alignment (For 5ºOption Only)

Port & starboard jets only

The HJ-274 waterjet mainshafts can be inclined at an angle of either 0º or 5º to the intake base.

For 5º offset jets when the port and starboard jets are mounted at the hull deadrise angle, the jet mainshafts are no longer parallel to the keel line in plan. The following table lists the angle deviation of the jet mainshaft when the jet base is mounted parallel to the keel line.

For intake base parallel to keel line:

B1 =Shaft angle in plan view.

B2 =Shaft slope in elevation.

Table 3: Angles (Relative to Keel Line in degrees)

Hull deadrise	B1	B2
0	0	5.0
5	0.4	5.0
10	0.9	4.9
15	1.3	4.8
20	1.7	4.7
25	2.1	4.5
30	2.5	4.3

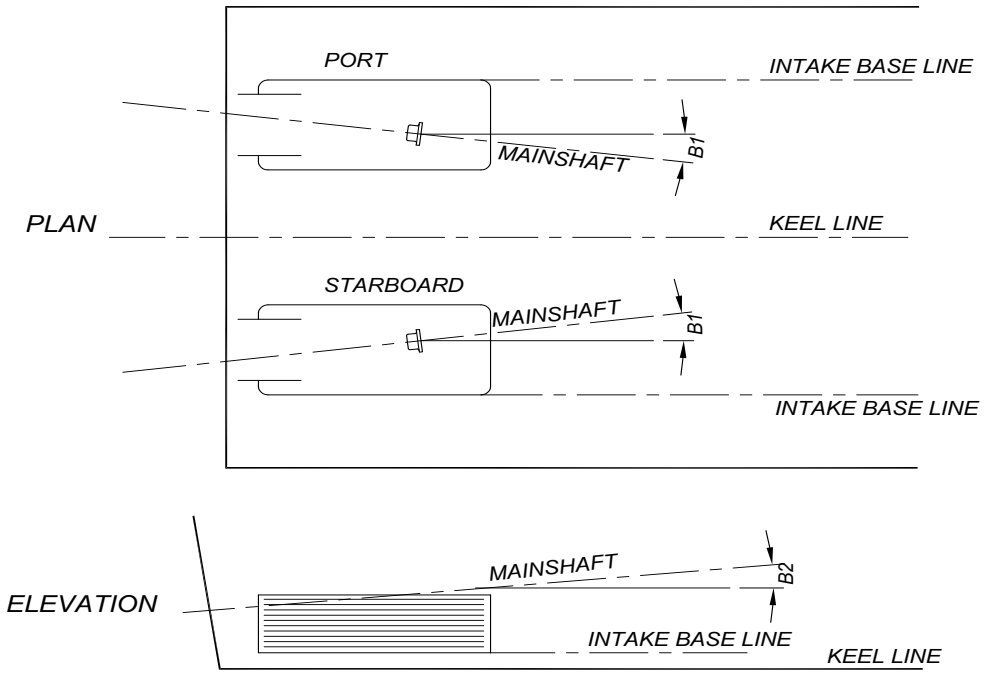


Figure 14: Jet Mainshaft Alignment

3.5 Water OffTake

CAUTION

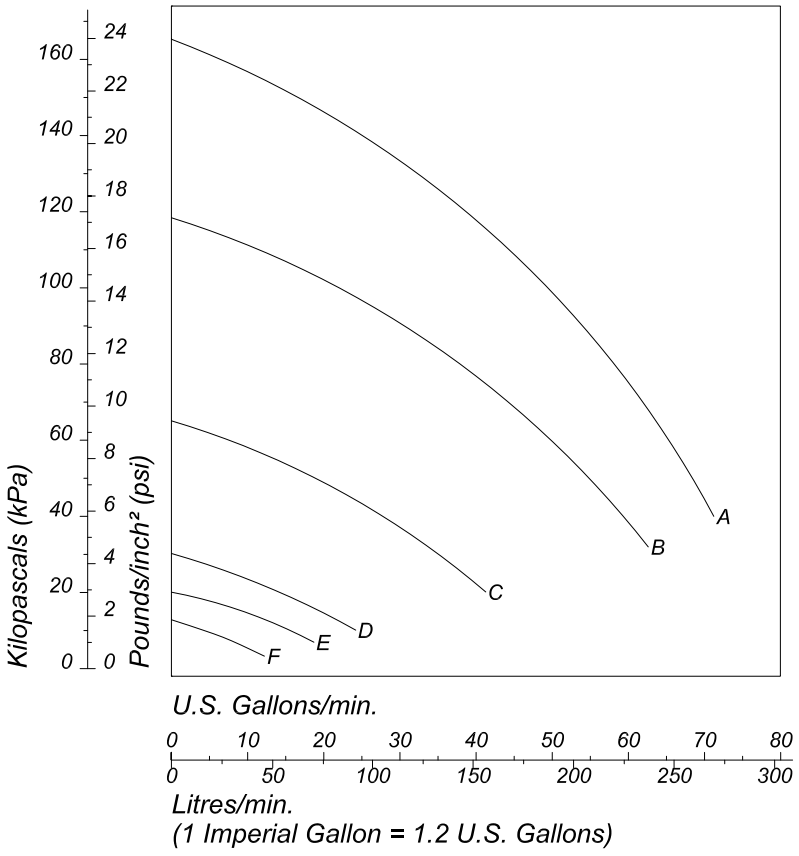
If a gearbox or clutch is fitted to the engine, a conventional hull water pick-up and engine raw water pump must be used.

The jet unit is fitted with a water offtake which may be used as a supplementary water supply (eg: for a deck wash). **If it is used as a part of the engine cooling circuit the designer / builder must satisfy themselves that the available flow is sufficient for the cooling requirements and the engine can withstand the full pressure from the water offtake.**

The following graph of flow rates is for the Jet at zero vessel speed. To determine RPM, refer to HP - RPM curves in the designers manual or, to calculate the RPM from horse power use the following formula:

$$RPM = 1000X\left[\frac{hpx0.746}{ImpellerRating}\right]^{(1/3)}$$

Note: Pressure increases with vessel speed. Pressures in excess of 30psi are likely at vessel speeds over 30 kts.



A = 161kW
B = 83kW
C = 35kW
D = 10kW
E = 5kW
F = 2.5kW

Figure 15: Water Offtake Pressure / Flow Graph.

3.6 Engine Location & Mounting

3.6.1 General

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

3.6.2 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 as this is transmitted for the jet unit 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 unit coupling as the engine moves.

For steel hulls

Ensure the driveline electrically insulates the engine from the jet unit.

3.6.3 Cooling

Jet unit water offtake.

The jet unit incorporates a 1¼″ BSP water offtake point on the starboard side of the intake. This is fitted with a plug. A 1¼″ BSP to 1¼″ BSP (32mm) hosetail, part number 201411, can be fitted in place of the plug. This provides water at pressures as follows:

Typical maximum pressure

310kPa (45 psi) at 330kW

The water may be fed directly to the engine for cooling without the need for a raw water pump, provided that:

- The flow from the water offtake at idle is sufficient to cool the engine.
- The engine can withstand the maximum pressure from the water offtake.

To be sure of correct flow for engine cooling a conventional water pick up and the engine raw water pump should be used.

CAUTION

If a gearbox or clutch is fitted to the engine, a conventional hull water pick-up and engine raw water pump must be used.

The jet unit water offtake can be used for a deck cleaning hose but the pressure is not high enough for a fire hose.

Conventional water pick-up.

CAUTION

Ensure that the engine cooling water pick up is not directly ahead of the jet unit intake, but well to the side to avoid turbulent water flow into the jet.

Alternatively a cooling system separate from the jet unit can be fitted to the engine maker's specifications. The water pick up points must NOT be directly ahead of the jet unit intakes and should be well to the side of the area forward and the same width as the intake opening.

3.6.4 Engine Systems

Engine wiring, instrumentation and throttle systems are all conventional. Follow the manufacturers recommendations.

With steel hulls.

Ensure the controls do not electrically connect the jet unit to the hull.

3.6.5 Engine Exhausts

Engine exhausts should not be located below the waterline near the jet units.

If engine exhausts are located in this area, water containing exhaust gases can be ingested by the jet unit when moving astern. This can cause loss of thrust and control of the jet unit.

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

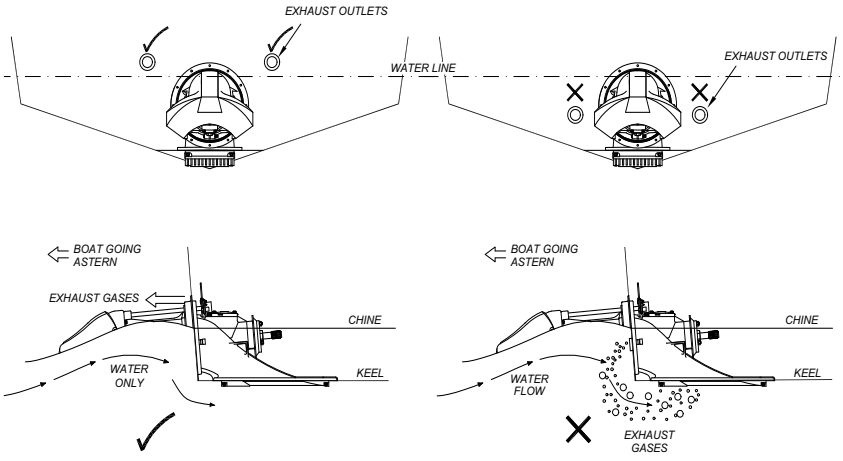


Figure 16: Exhaust System Layout

3.6.6 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.

3.7 HSRX Reverse System Description

The Hamilton HSRX reverse system is a self contained hydraulic reverse actuation system.

The actuation is provided by a hydraulic reverse cylinder that uses a rotary valve inside the cylinder to give variable progresssive positioning control. This allows fast control response where accurate posistioning is not required (from the fully up position to just prior to the reverse duct entering the waterjet) and fine control of the reverse cylinder position where it is needed (around the zero speed / reverse position).

With the piston restriction (A) fully open, equal pressure acts on both the rod end and cap end of the HSRX cylinder. As the cap end area is larger than the rod end area, the cylinder extends.

With the piston restriction (A) closed, the cylinder retracts. At full retraction, the bypass valve (B) opens, reducing the system pressure and power consumption of the pump.

The back pressure valve (3) Is factory preset at 3.45 MPa (500psi).

The pump assembly (1) is belt driven directly from the jet unit.

The pump assembly comprises, pump, an integral tank, flow control and pressure relief valves.

3.7.1 Basic Hydraulic Circuit

Refer to Drawing CTHSE12001 Hose Kits Stainless Steel Fittings Sht2 .

Table 4: Hydraulic Circuit Items

Item No.	Description
A	Variable restriction with cylinder posi-tion feedback.
B	Bypass valve. (open when cylinder is fully retracted).
1	Pump assembly.
2	HSRX cylinder. Minimum oil flow 3 litres per minute. Maximum oil flow 16 litres per minute.
3	Back pressure valve.
4	Oil cooler (part of jet assembly).

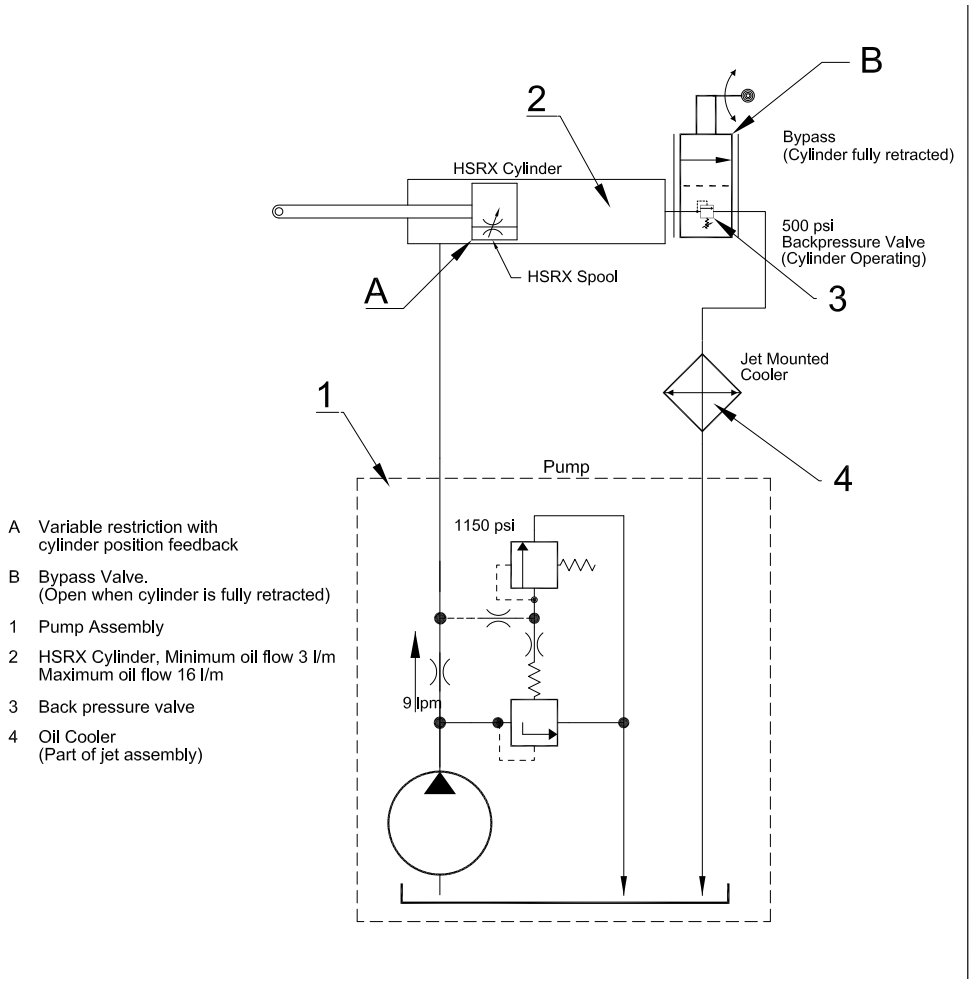


Figure 17: Hydraulic Circuit Diagram

3.7.2 Layout of Components

Refer to Drawing CTHPU01002 JHPU HSRX (Saginaw Pump) HJ-273 & HJ-274 Jets .

3.7.3 Scope of Supply

The following list of items are supplied with the HSRX reverse system.

1. HSRX reverse cylinder.
2. Pump assembly.
3. Cooler. (integral part of jet unit).
4. Hoses and fittings.
5. Belts for the pump.
6. Hydraulic oil.

These items are supplied factory assembled and mounted on the jet unit ready for use.

The following items are not supplied:

1. Cable or other actuating devices.

3.8 Description of the Dry Run System (Optional Extra)

Note: Hamilton jet units are not fitted with the dry run kit as a standard fit. The dry run kit is an optional extra which can be fitted to the jet unit at the customers request. Should the customer require a dry run system fitted, it can be purchased at additional cost and should be requested when the initial jet order is placed.

This dry run system is a simple solution to the problem of starting a boat engine before putting the vessel in the water. It is particularly useful for man-overboard boats and lifeboats where it is important to ensure that the engine will start before the vessel is in the water.

The dry run kit consists of a specially formulated marine bearing which can be run dry for short periods and run for long periods with water lubrication. **The standard rubber marine bearings are designed to run in a water immersed environment where the water acts as a coolant and lubricant for the bearing and waterseal. These cannot be run out of water.**

3.8.1 Installation

The dry run bearing components are a direct replacement for the standard marine bearing components, therefore there is no requirement for a special installation procedure for converting a jet unit to the dry run system. The dry run bearing components can be fitted as shown for the normal marine bearing replacement in the jet unit manual.

3.8.2 Corrosion

All the components of the dry run kit are made of high quality corrosion resistant materials.

3.8.3 Scope of Use

Because there is no cooling for the dry run system waterseal and marine bearing, if a jet unit is run without the vessel being immersed in water, the waterseal and the marine bearing will heat up rapidly in the absence of water to act as a coolant.

THE FOLLOWING LIMITS MUST BE ADHERED TO, to ensure good component life.

Maximum dry run time:	**3 minutes.**
Maximum dry run engine speed:	**1000 RPM.**
Minimum time between dry runs:	**1 Hour.**

The dry run bearing is a compromise for use in both dry and wet running conditions. The best wet running design solution is the rubber marine bearing which cannot be run dry. The dry run bearing will wear out more rapidly than a standard rubber marine bearing if the dry run system is used constantly in a dirty water environment. When used in silty water, life of the bearing and sleeve will be reduced, depending on the volume of grit in the water. **THIS SYSTEM SHOULD ONLY BE USED IN A CLEAN WATER ENVIRONMENT.** If extended use in a dirty water environment is expected, then regular monitoring of marine bearing wear is required

3.8.4 Fault Finding

Table 5: Fault Finding

Fault	Cause	Remedy
Dry run bearing jams up when dry running.	Excessive heat build-up. May have grit in bearing.	Run in water to cool. Leave overnight to cool. Flush out with clean water.
Clanging sound from the jet.	impeller hitting the wear ring or a worn dry run bearing	Replace worn dry run bearing and / or sleeve. Check the wear ring and replace if damaged.
Excessive scouring of shaft sleeve.	Running in dirty water and sucking sand or silt into jet.	Be careful not to suck sand or silt into jet, do not use high RPM in water when starting off.

3.8.5 Maintenance

Inspection

Inspect every 100 hours, 50 dry starts, or yearly, whichever is the soonest.

Remove the tailpipe and inspect.

If the wear on the bearing sleeve is greater than 0.2mm, replace the sleeve. Replace the plastic bearing when replacing the sleeve.

Note: As the dry run bearing runs on only one half of the bearing sleeve refer to Figure 19: Dry Run Bearing Assembly The bearing sleeve can be turned end for end when it shows signs of wear.

Assembly notes:

1. When changing the 'dry run bearing assembly', dismantle and reassemble the whole assembly (plastic and metal shell) to the tailpipe in the same manner as removing or replacing a standard rubber marine bearing. The plastic part of the bearing should be fitted so it sits closest to the impeller. The shell should sit flush with the tailpipe **refer to** Figure 19: Dry Run Bearing Assembly.
2. The bearing sleeve is the same as the bearing sleeve for the rubber marine bearing for fitting **refer to Section** Section 9 Overhaul of this manual.

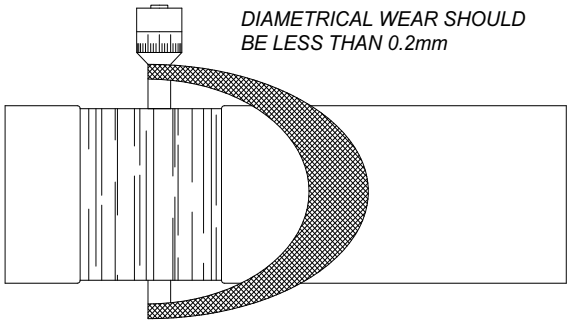


Figure 18: Bearing Sleeve Inspection

3.8.6 Parts List

Refer to Drawings HJ27401000 Basic Jet Assemblies Standard and Dry Run.

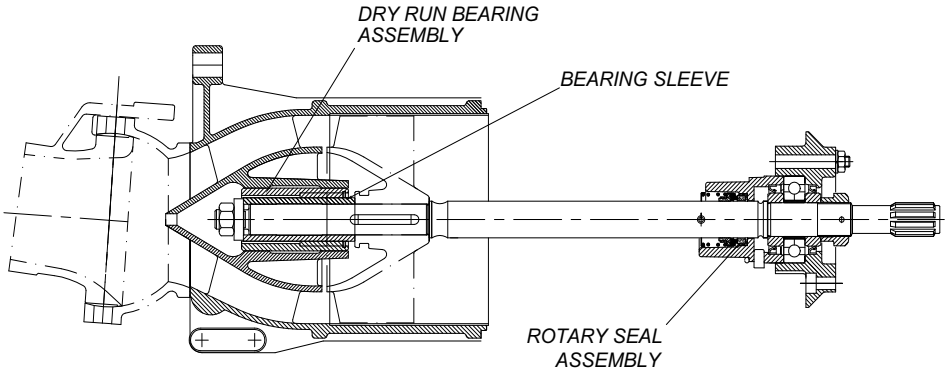


Figure 19: Dry Run Bearing Assembly

Section 4
Precautions Against Corrosion

4.1 General

4.1.1 Electrical Wiring System

CAUTION

An isolation transformer or a galvanic isolator must be correctly fitted to the vessel's electrical system if the vessel is to be connected to an external AC shore supply.

The guidance of the local inspecting authority rules should be sought, but in general note the following for:_

D.C. systems

Every part of the DC system should use **two** insulated "normally conducting" wires, a positive and a negative. The negative must not run through the frame of any unit, through the hull of the boat, or through the bonding system. **Do not use an earth return system**.

It is recommended that engine starter motors or other DC motors should be the two wire type with an insulated negative terminal rather than having the casing of the starter connected to the battery negative. This is to ensure starting currents do not pass through the earth bonding system.

In smaller vessels, it is common to use negative ground engine systems in which the starter motor, starter solenoid, and alternator are single pole devices using the engine block as the local return conductor. **In this situation, it is Important to connect the engine block to the battery negative with a heavy battery cable**.

In installations with two engines and two battery banks with cross-connect starting capability, there must be two heavy conductors between the engines. Local standards if appropriate should be complied with.

A.C. systems

For a vessel with both AC and DC circuits, it is essential for safety reasons that the AC system has a separate earth wire.

Dock potentials can be as positive as +350mV relative to a silver / silver chloride reference electrode. If a vessel with bonded aluminium Jets is connected to such a dock potential through the separate earth wire, without the protection of an **isolation transformer** or a **galvanic isolator**, the corrosion rate of the aluminium would increase to a value far greater than the normal sea water corrosion rate. This would occur regardless of whether the aluminium was protected by anodes or not.

A. Using an isolation transformer

If using AC shore supply, the recommended method of preventing potentially serious galvanic or stray current corrosion is to install an isolation transformer on board at the incoming line.

When an isolating transformer is used, there must be no connection between the shore supply earth and the vessels earth bonding system. The primary winding shield is earthed to shore while the secondary winding should be grounded on board the vessel. Only one side of the secondary winding is grounded on the secondary side of the transformer and the vessel's grounding circuit is tied in at this point. There must be no DC electrical connection between the shore supply and the on board AC circuit. Further information (including circuit diagrams) can be found in American Boat and Yacht Council (ABYC) publication E-11 *AC and DC Electrical Systems on Boats.*

B. Using a galvanic isolator

Alternatively with AC shore supply, a galvanic isolator can be installed on the AC earth wire just after the shore power inlet. This isolator isolates the vessel from low voltage D.C. galvanic currents, while allowing any short circuit to be safely conducted back to shore.

Isolators with capacitors are preferred over isolators with diodes only.The galvanic isolator must have an indicator or alarm that shows whether the earth current is being blocked or not. This indicator is required since the galvanic isolator only blocks low voltages (typically below 1.2V) and higher voltages will pass through the isolator and cause vessel corrosion damage. If the indicator was not present then the vessel operator would be unaware of the corrosion problem. Monitoring of the galvanic isolator is important to ensure proper operation of the isolator. The isolator must also have sufficient fault capacity to allow circuit breakers to trip under fault conditions. Galvanic isolators that comply with American Boat and Yacht Council recommendations (ABYC A-28, *Galvanic Isolators*) will meet the above requirements and are recommended by Hamilton Jet.

A correctly wired polarization transformer in conjunction with a galvanic isolator is acceptable for connecting to an AC shore power system.

4.1.2 Earth Bonding System

CAUTION

Prevention of Corrosion

Vessels using Hamilton Jet units, must be bonded and wired as described in Section 4 "Precautions Against Corrosion" section of the jet unit manual.

In aluminium and most GRP hulls, the jet unit, hull (if aluminium), all metal objects, electrical equipment casings and hull anodes should be connected with a low resistance bonding system (separate from normally current conducting 2 wire electric system).

The bonding strip and connecting wires should be aluminium or **insulated** copper of at least 14.5 sq.mm. cross section area (e.g. 5mm diameter.) to give very low (e.g. 0.01ohm) electrical resistance.

If a copper bonding strip is used, it should not be connected directly to the jet unit as galvanic corrosion will occur. The copper bonding strip should be connected to the jet unit via a stainless steel terminal connector.

The bonding wire or strip which runs the length of the hull, should be kept clear of bilge water.

The main function of the bonding system is to provide a path to battery negative, for stray currents.

An exception exists for steel and GRP hulls whose reinforcement is carbon fibre; the jet unit must be totally insulated from the hull and machinery thus relying totally on its own anodes for protection.

When a bonding system is used, it is essential that cathodic protection is provided. This cathodic protection can be in the form of **sacrificial anodes** or an **impressed current system**.

To minimise corrosion from stray current emanating from within the vessel, all power sources (battery and battery charger negatives, AC generator and the ship side of the shore supply earth) should be connected to the earth bonding system at a single common earth point. This will hold these circuits at a common voltage. Any stray currents will then have a direct path back to the battery negative or the AC source.

Alternatively, this connection to the battery negative can be deleted provided that the following are carried out:

1. There is a two wire normally current conducting electrical system which is isolated from the hull, jet unit and engine,
2. There is an effective leakage monitoring system, such as the "test light" system, which is used regularly and the results are recorded.

Without the bonding system to battery negative connection, stray current corrosion is possible and it is important to check for leakage:-

a) For every item of electrical equipment in operation.
b) When there is any alteration to the electrical system of the boat.
c) When any electrical connection is made to shore.

4.1.3 Corrosion Monitor

It is recommended that a corrosion monitor be fitted.

The corrosion monitor should be a high impedance device. There must be no possibility of an electrical connection between the jet units and the ships batteries.

If the jet units are isolated from the hull, corrosion monitoring of each jet unit external wetted surface and internal intake duct should be carried out.

If the jet units are electrically connected to the hull, corrosion monitoring of the hull only and each jet unit internal intake duct should be carried out.

4.1.4 Trim Tabs and Other Submerged Fittings

When 2 dissimilar metals are electrically connected and submerged in a seawater, then galvanic corrosion can occur.

If a large stainless steel fitting (such as a trim tab) is electrically connected to the jet, then the corrosion protection of the jet unit will be compromised. In order to ensure adequate corrosion protection for the jet, stainless steel trim tabs should be fully painted or electrically isolated from the jet unit, or preferably both. Normally an anode would be fitted to the trim tab to provide corrosion protection to the tab. Trim tabs made of aluminium will not affect the jet corrosion protection.

4.1.5 Earth Plate Connections for Electronic Transmitting Equipment

Radios, radar and other transmitting equipment **should NOT use the jet unit for an earth plate** but must have a separate earth plate.

Be guided by the installation instructions for the radio; radar equipment etc, but in general these systems should be electrically insulated from the jet unit **except that both the earth plate and the metal casings of the electrical transmitting equipment should be connected to the earth bonding system.**

1. An area of metal plate is required which is not painted and always immersed, even when at planing speeds. It is always in electrical contact with the sea water.
2. The area of metal plate is typically approximately 400 x 400 mm and should be located close to the equipment radiating electrical waves but well forward of the jet units.
3. For a metallic hull, the earth plate can be a thickened area of the hull, formed by welding additional plate inside the hull skin, up to 25 mm thick.
4. For a non metallic hull a separate metal earth plate must be fixed externally to the hull. It should be of material compatible with both the "bonding strip" and hull (stainless steel is likely to be the best option. It is not advisable to use copper as it can cause corrosion problems for other metals).
5. The "plate" should have a large stud welded to its centre and protruding inboard to which all the zero voltage wires from equipment can be connected to.
6. The earth plate should be connected by an insulated wire to the vessels "earth bonding system".

4.1.6 Anodes

The anodes fitted to the jet unit are made from aluminium alloy to MIL-A-24779 (SH) or zinc alloy to MIL-18001H

Anodes should not be painted over as they will not function as intended. If the anodes are being eaten away they are providing protection. They should be inspected and replaced when half consumed because the material that remains will not provide full protection. It is common for anodes to be partially covered with a very loose scale. The colour of the scale depends on local water conditions but can typically be creamy white, light brown or green. This scale, providing it is loose (i.e. easily scraped off with a fingernail), is normal.

If the anodes are not corroding when the vessel is in seawater, they are not functioning correctly and the cause should be investigated. One reason could be that the anode does not have good electrical contact between the component it is protecting and itself. The electrical resistance should be less than 0.2 ohms.

Poor quality anodes may contain too much iron impurity. Such anodes tend to form a dense non-conducting oxide film (usually charcoal grey in appearance). This condition usually occurs in fresh water. To confirm this condition, test for continuity between the anode and the jet unit using a multimeter set to ohms. If the anode has to be scraped with a knife to get a conductive reading, the anode is oxidized and must be replaced. Sanding the anode surface provides a temporary solution, but it will form the oxide again.

Jet unit anodes

These anodes are fitted to the reverse duct, steering deflector, reverse cylinder and the main body of the jet unit. Anodes are also fitted internally within the tailpipe and in most jet models, within the intake and under some inspection hatches.

Hull anodes

Further anodes should be fitted on the hull, sufficient for hull protection, as determined using a portable reference electrode and digital voltmeter and / or a corrosion monitor.

The hull anodes should remain immersed at all times.

Note: Anodes fitted on the transom of a planing speed craft will not be immersed when the craft is at speed and therefore will not be providing protection.

4.1.7 Anti Fouling Paint

CAUTION

Anti Fouling Paints

Do not use copper oxide based anti-fouling paints. Do not paint over the anodes.

4.1.8 Anti Seize Compound

CAUTION

ANTI-SEIZE COMPOUNDS

Do not use anti-seize compounds which are based on graphite, nickel or copper flakes - these will cause corrosion. Anti-seize compounds, usually containing zinc flakes, are available for aluminium.

4.1.9 Impressed Current Protection

Impressed current protection may be used if desired. Follow the supplier's instructions. Impressed current systems should have a "fail safe" feature which prevents the potential falling below -1100mV referenced to a silver / silver chloride reference electrode.

4.2 Aluminium, G.R.P. and Wood hulls (Other Than Steel or Carbon Fibre)

4.2.1 Earth Bonding System - (Not Normally Current Conducting)

Refer Drawing:
85114 Earth Bonding System Recommendations and Layout.

In the case of an aluminium hull, an engine stringer or any other continuous longitudinal member may be used as the bonding strip. All junctions should preferably be welded, but if bolted, should be clean, have a good contact and be regularly inspected and maintained.

4.3 Steel hulls and Carbon Fibre Reinforced F.R.P. hulls

CAUTION

For steel hulls and carbon fibre reinforced F.R.P hulls, the jet unit must be electrically insulated from the hull.

An insulating kit is supplied with the jet unit for steel installations.
For carbon fibre reinforced hulls, an alternative reinforcing fibre (such as glass) must be used in the area where the jet unit is mounted to ensure that carbon fibre does not contact the jet unit or fasteners.

4.3.1 Earth Bonding System (Not Normally Current Conducting)

Refer Drawing:
85114 Earth Bonding System Recommendations and Layout
If a negative earth system is used on the vessel, it **must not** be connected to the jet unit.

7. Every part of the vessel electrical system should have **two** wires to it, a positive and a negative wire.
8. With electrical auxiliary equipment installation be guided by your electrician. Do not earth electrical equipment to the jet unit, but to a separate earth.

4.3.2 Checking the Insulation

The insulation between the jet unit(s) and the steel hull should be regularly checked.

1. With the vessel out of the water
   Rinse the sea salt from the jet/hull area using fresh water.
   The resistance between the jet unit(s) and the hull should be 1000 ohms or greater. If the reading is below 1000 ohms, the fault should be investigated and rectified.
2. With the vessel in the water
   For steel hulls:
   a) Place a silver / silver chloride half cell in the seawater.
   b) With the silver / silver chloride half cell connected to the 'common' of a digital voltmeter (set to read 0 to 2000 mV).
   c) Connect the 'positive' terminal to the hull and note the reading.
   d) Repeat with the 'positive' terminal connected to the jet unit(s) body.
   e) Place a large anode in the seawater and electrically connect the hull to the anode.
   f) Repeat the digital voltmeter readings.
   g) If jet unit(s) is insulated from the hull, the mV readings for the jet unit(s) should not change.
   h) The mV readings for the hull should be more negative (eg: The reading could be -800mV without the large anode connected and -850mV with the large anode connected to the hull).
   i) This test can also be carried out with a corrosion monitor if fitted
3. In service
   The insulation between the jet unit(s) and the steel hull should be regularly checked.

4.4 The HSRX Reverse System

CAUTION

PREVENTION OF CORROSION
Vessels using Hamilton jet units, must be bonded and wired as described in Section 4 "Precautions Against Corrosion" section of the jet unit manual.

All C.W.F. Hamilton & Co Ltd manufactured components on the HSRX reverse system are manufactured from high quality materials, selected for their good corrosion resist properties. Some bought-in items are manufactured in plated steel. As these items are fitted inside the vessel, corrosion should be minimal. Should corrosion commence or if salt spray conditions are likely to be encountered, the following items may be painted to prevent the onset of corrsion:

1. The mounting bracket of the pump.
2. The pump
3. Pulleys (These are manufactured of zinc plated steel)

Section 5
Installation

5.1 Basic Installation Method

Ensure that the engine cooling water pick up is not directly ahead of the jet unit intake, but well to the side to avoid turbulent water flow into the jet.

For G.R.P. hulls:

Refer to Installation Drawing HJ27408001 Installation Details G.R.P hull With 5° Shaftline.

Refer to Installation Drawing HJ27408011 Installation Details G.R.P hull With o° Shaft Line.

An aluminium "intake block" is supplied with the installation kit for fibre glassing into G.R.P hulls.

"Intake block" for 0° Shaft Line. (Part No. 110339).

"Intake block" for 5° Shaft Line. (Part No. 110911).

The intake block is best fitted into the hull prior to moulding. After moulding into the hull the intake block is also bolted to the hull. For G.R.P hulls, refer to the installation drawings which can be found at the rear of this section.

For aluminium hulls:

Refer to Installation Drawing HJ27408002 Installation Details Aluminium hull with 5° Shaftline.

Refer to Installation Drawing HJ27408012 Installation Details Aluminum hull with 0° Shaftline.

An aluminium "intake block" is supplied ready to weld into a prepared opening in the hull bottom.

"Intake block" for 0° Shaft Line. (Part No. 110339).

"Intake block" for 5° Shaft Line. (Part No. 110911).

It is assumed that the aluminium plating of the hull is one of the following types 5083, 5086, 6061, 6063, 6101, 6202, 6151, or 6951. If not consult **C.W.F Hamilton & Co Ltd**. The intake block is LM6 grade aluminium. Weld the intake block into the hull using the weld procedure shown on **Drawing** 85080 Aluminium Weld Procedure. Ensure the contours between the hull and the intake block at front and rear are smooth to within 1mm.

For steel hulls:

Refer to Installation Drawing HJ27408003 Installation Details Steel hull with 5° Shaftline **and** HJ27408003 Installation Details Steel hull with 5° Shaftline Sht 2.

Refer to Installation Drawing HJ27408013 Installation Details Steel hull with 0° Shaftline **and** HJ27408013 Installation Details Steel hull with 0° Shaftline Sht 2.

"Intake block" for 0° Shaft Line. (Part No. 110339).

"Intake block" for 5° Shaft Line. (Part No. 110911).

Special installation is required to ensure that the jet unit is totally insulated from the hull.

An insulation kit is supplied to totally insulate the jet unit from the hull.

5.2 Hull Preparation

In multi jet unit installations, each jet unit may have been configured for port, starboard or centre mounting. Care should be taken to ensure that each jet is fitted in its correct position.

5.2.1 Fixing the Intake Block to the Hull

Note: The 5° GRP intake blocks are longer than the 0° intake blocks. Ensure that the correct installation drawings are referred to when cutting the intake block opening in the hull.

G.R.P. hulls:

Refer to Drawings HJ27408001 Installation Details G.R.P hull With 5° Shaftline **and** HJ27408011 Installation Details G.R.P hull With o° Shaft Line.

If possible, tape the intake block into the hull mould prior to moulding the hull. For centre-mounted jets and additional smooth surface will have to be taped to the mould in front of the intake block to mould over and form a fairing between the vee hull form and flat of intake block. For a wooden hull, or an existing GRP hull, cut a hole in the hull larger than the intake block base flange to allow a scarfed joint in GRP between the intake block and the hull, as shown on the installation drawing.

After moulding,

***For O° shaft line intake blocks,* drill 26 x 8.5 mm diameter holes** at the cast dimples in the bottom of the intake block up through the intake block flange and hull.

***For 5° shaft line intake blocks,* drill 28 x 8.5 mm diameter holes** at the cast dimples in the bottom of the intake block up through the intake block flange and hull. Countersink the holes to accept Screw [12]. Smear the shaft of screw [12] with silicone sealant [18] and fit with flat washers [6], spring washers [5] and nuts [4]. Torque load the nuts [4] to the recommended torque, **refer to Drawing** 85113 Threaded Fastener Tightening Torques.

Ensure that the contours between hull and intake block at the front and rear are smooth to within 1 mm.

Aluminium hulls:

Refer to Drawings HJ27408002 Installation Details Aluminium hull with 5° Shaftline **and** HJ27408012 Installation Details Aluminum hull with 0° Shaftline.

It is assumed that the aluminium plating of the hull is of one of the following types: 5083, 5086, 6061, 6063, 6101, 6202, 6151 or 6951. If not consult **C.W.F. Hamilton & Co Ltd.**

The intake block is LM6 grade aluminium. Weld the intake block into the hull in accordance with the information given in **Drawing** 85080 Aluminium Weld Procedure included in the jet drawings package. Ensure that the contours between hull and intake block, at front and rear, are smooth to within 1 mm. Grind flat where necessary, especially in front of the intake.

Steel hulls:

Refer to Drawings HJ27408003 Installation Details Steel hull with 5° Shaftline / HJ27408003 Installation Details Steel hull with 5° Shaftline Sht 2 / HJ27408013 Installation Details Steel hull with 0° Shaftline **and** HJ27408013 Installation Details Steel hull with 0° Shaftline Sht 2.

Electrical isolation

The intake block, jet unit and transom plate must be completely electrically isolated from the rest of the hull. This is achieved by the use of gaskets, bushes and studs, as shown on the hull installation drawings.

Installing the intake block

A steel recess must be built into the hull to accept the intake block, as shown on the Installation drawing.

Note: The prepared opening has sloping faces fore and aft to match the intake block. Use the following procedure to mount the intake block.

1. Once the prepared recess in the hull is completed, trial fit the intake block in place using 3mm spacers instead of the intake block gasket [17].
2. With the intake block in place,

Note: For O° shaft line intake blocks, drill 26 x 8.5 mm diameter holes at the cast dimples in the bottom of the intake block up through the intake block flange and hull.

Note: For 5° shaft line intake blocks, drill 28 x 8.5 mm diameter holes at the cast dimples in the bottom of the intake block up through the intake block flange and hull.

3. Drill through the countersunk points on the intake block from below, with an 8.5 mm dia drill. After piercing the intake block make a small marking cut in the steel hull with the drill.
4. Remove the intake block and clean off all burrs.
5. Drill out the marked positions in the steel edges of the prepared opening to 12 mm to accept the nylon insulating bushes [15]. Remove all burrs.
6. Fit the insulating bushes [15] and trim to the correct length. Remove the insulating bushes from the intake
7. Liberally smear both sides of the intake block gasket [17] with marine sealant [13] and fit the intake block gasket onto the intake block.

Note: The gasket is designed to fold down around the edges of the intake block.

8. Smear marine sealant [13] on top of the gasket [17] and run a bead of marine sealant around the internal corner of the prepared recess.
9. Ensure that all the bolts [12] are liberally smeared with marine sealant prior to fitting.
10. Install the intake block and secure in 3 positions with bolts [12], nylon Insulating bushes [15], flat washers [6], spring washers [5] and nuts [4]. Hand tighten.
11. Check for electrical isolation between the intake block and the vessel hull before fitting the remaining bolts.
12. Fit the remaining bolts [12], nylon insulating bushes [15], flat washers [6], spring washers [5] and nuts [4].
13. Torque load all the bolts and nuts to the recommended torque.
14. Once the intake block is installed, check again for electrical isolation and then fill any gap at the edges and corners with marine sealant. Clean off any excess sealant and trim off any protruding part of the intake block gasket [17].

5.2.2 Transom Preparation

An area at either 90º (for 0º shaft line) or 95º (for 5º shaft line) to the jet intake base, has to be prepared as shown on the appropriate installation drawings. Ideally this area is flush with the transom. For steel hulls cut, position and re-weld the required area if necessary.

For Oº shaft line: Transom angle should be at 90º to the intake base.

For 5º shaft line: Transom angle should be at 95º to the intake base.

For GRP and wooden hulls:

If the transom is not close to the angle required, an insert can be taped into the hull mould so the transom area, can be moulded with the hull at the angle required, . Alternatively,the required area can be cut from the transom and re fibre glassed back at the correct angle. One method to locate the cut-out transom at the correct angle is to install the jet unit, bolt the transom plate assembly and transom cut-out into position on the Jet and then to fibreglass the cut-out back into the transom.

For metal hulls:

If the transom is not close to the angle required, cut out the required area, reposition at the required angle and re-weld back to the transom with any necessary inserts at the sides and top.

5.3 Equipment Preparation

Do not unpack equipment until it is required for installation. This prevents mechanical damage and entry of foreign matter. Unpack carefully to prevent damage and loss of small items.

5.3.1 Steering Components

Refer to Drawing HJ27406000 Steering Assembly General Arrangement.

The jet unit is shipped complete with the steering components attached. It should not be necessary to remove any steering components prior to installation.

Note: For hydraulic steering options only, the steering cylinder will be supplied separate to the jet unit. The boat builder will be responsible for attaching the steering cylinder to the vessel on completion of the jet installation.

However, if problems with installation occur, refer to **Section** 9.4 Steering Assembly Removal and Overhaul **Section** 9.5 Steering Assembly Re-Fitting ***and Drawing*** CTSJK04010 tie rod Kit Twin & Triple Jets for removal and refitting instructions.

5.3.2 Reverse Components

Refer to Drawings HJ27407011 Reverse Assembly **and** HJ27407011 Reverse Assembly Sht 2.

Note: The jet unit is shipped complete with the reverse cylinder and reverse duct attached. The reverse duct complete with nozzle and steering assembly will require removal to install the transom plate,

To remove the reverse duct complete with nozzle and steering assembly, carry out the following actions:-

1. Disconnect any sensors attached to the reverse cylinder. Refer to the overhaul section in manual.
2. Whilst supporting the reverse duct with suitable approved lifting equipment and a lifting sling attached to the reverse duct, disconnect the reverse cylinder from the reverse duct [1] by removing the split pin [44] from the hydraulic cylinder connecting pin [43].
3. Withdraw the hydraulic cylinder connecting pin [43]. **Refer to Drawings** HJ27401000 Basic Jet Assemblies Standard and Dry Run and HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2.
4. Using suitable approved lifting equipment to support both the reverse duct / tailpipe and steering assembly, remove nuts [54] and special washers [59] from the upper studs [48] and lower studs [49] securing the tailpipe to the intake.
5. Carefully withdraw and remove the tailpipe complete with reverse duct and steering housing from the intake.

5.3.3 Removal of Other Parts

The jet unit is shipped with the controls system fitted. Should it be necessary to remove the controls system, refer to the controls manual supplied, for details on the fitting and removal procedures.

5.4 Mounting the jet unit

WARNING

All cylinder shafts are protected with spiral wrap during shipping.
Make sure the wrap is removed before first operation.

Refer to following installation drawings in the jet unit drawings package.

GRP hulls:

HJ27408001 Installation Details G.R.P hull With 5° Shaftline **and** HJ27408011 Installation Details G.R.P hull With o° Shaft Line.

Aluminium hulls:

HJ27408002 Installation Details Aluminium hull with 5° Shaftline **and** HJ27408012 Installation Details Aluminum hull with 0° Shaftline.

Steel hulls:

HJ27408003 Installation Details Steel hull with 5° Shaftline / HJ27408003 Installation Details Steel hull with 5° Shaftline Sht 2 **and** HJ27408013 Installation Details Steel hull with 0° Shaftline / HJ27408013 Installation Details Steel hull with 0° Shaftline Sht 2.

Preparation:

After mounting the intake block and making the transom hole in the hull, carry out the following actions:-

1. Ensure that the reverse duct, tailpipe complete and transom plate have been removed from the jet unit. **Refer to Section** 9.9 Transom Plate Assembly Overhaul **for removal procedures.**
2. To fit the jet unit complete with the intake screen attached, using approved lifting equipment, lift the jet unit with the intake screen attached, into the hull and position the jet unit so that the rear of the jet unit passes out through the transom opening and the intake screen fits centrally in the intake block hole. Should the screen required removal during installation refer to **Section** 9.9 Transom Plate Assembly Overhaul.
3. Check that the jet unit is correctly located in relation to the transom hole, and that the intake block mates neatly with the intake casting. Correct the hull preparation as necessary.
4. Check that the contours between the hull and the jet unit intake, at the front and rear are smooth to within 1mm ($^1/_{32}$"). There should be no steps.

If satisfactory, proceed as follows:-

5.4.1 Mounting the Jet Unit to the Hull

1. Using approved lifting equipment lift the jet unit off the hull and move it away from the intake block.
2. Screw in and tighten the studs provided, into the tapped holes in the intake block. A convenient method of fitting the studs is to tighten two nuts together on the top of the stud so that a spanner can be engaged on the nuts to tighten the studs into the base. Use of thread locking fluid such as Loctite 263 is recommended. Ensure threads are clean before applying Loctite.
3. Liberally apply neutral cure R.T.V. silicone sealant (supplied) to the top of the intake block, underside of the jet unit flange.
4. Carefully position the jet unit centrally over the intake base and carefully lower the jet unit flange onto the studs [8] on the intake block.
5. Ensure that studs fitted to the front of the jet intake, pass through the intake block. Secure the jet unit intake to the intake block with flat washers, spring washers and nuts. Torque load to the recommended torque.
6. Mount the screen rake spring anchor bracket Item [6] refer **Drawing** HJ27409002 Screen Rake Assy if fitted. This is attached to the 1st stud back from the front of the intake block on the starboard side of the jet.
7. Fit flat washers [11], spring washers [10] and nuts [9] as shown in **Installation Drawings.** HJ27408001 Installation Details G.R.P hull With 5° Shaftline / HJ27408011 Installation Details G.R.P hull With o° Shaft Line **(GRP hulls).** HJ27408002 Installation Details Aluminium hull with 5° Shaftline **and** HJ27408012 Installation Details Aluminum hull with 0° Shaftline **(Aluminium hulls).**
8. Torque load the 18 nuts [9] to the recommended torque.
9. Remove excess sealant from inside and outside the jet unit.

5.4.2 Assembly of the Transom Plate to the Hull

Ensure that the reverse duct complete with tailpipe and steering assembly has been removed from the jet unit.

1. Drill the dimples in the transom plate to 8.5mm.
2. Remove all burrs.
3. Place the transom plate [1] in over the rear of the jet unit and up against the transom.
4. Centralize the transom plate in relation to the intake and rotate to position the transom plate's vertical centerline square with the jet unit intake base. Ensure that the transom plate anodes are located at the bottom of the transom plate.

G.R.P hulls.

Refer to Drawings HJ27408001 Installation Details G.R.P hull With 5° Shaftline **and** HJ27408011 Installation Details G.R.P hull With o° Shaft Line.

Aluminium hulls.

Refer to Drawings HJ27408002 Installation Details Aluminium hull with 5° Shaftline **and** HJ27408012 Installation Details Aluminum hull with 0° Shaftline.

1. Using an 8.5 mm diameter drill bit, drill through the 16 holes in the transom plate to just dimple the transom for correct hole location.
2. Slide the transom plate back off the tailpipe.
3. Drill out the 16 holes in the transom using the 8.5 mm drill and remove all burrs.
4. Lubricate the transom plate o-ring [2] with multi-purpose grease. Fit in place in the seal groove on the jet unit intake. **Take care not to get any oil on the transom where sealant will be applied**.
5. Liberally apply marine sealant to the transom plate contact area on the hull, also the joint face of the transom plate and bolt heads.

6. Slide the transom plate [1] over the o-ring [2] and line up the transom plate with the holes in the transom.
7. Fit hex head screws [3], washers flat [6], spring washers [5] and nuts [4] to secure the transom plate [1] as per the appropriate installation drawing as shown above.

Note:

1. Ensure that the screw heads are fitted to the outside of the transom as shown on the installation drawings.
2. On the GRP hull, ensure that the continuity strap [20] is connected between the jet unit and the transom when fitting the transom plate , refer to Drawings HJ27408001 Installation Details G.R.P hull With 5º Shaftline and HJ27408011 Installation Details G.R.P hull With oº Shaft Line.

8. Tighten the screws [3] and nuts [4] to the recommended torque. Remove any excess sealant.
9. **On GRP hulls only:** Carry out an electrical continuity check between the jet unit and the transom plate.

Steel hulls.

Refer to Drawings: HJ27408003 Installation Details Steel hull with 5º Shaftline / HJ27408003 Installation Details Steel hull with 5º Shaftline Sht 2" **and** HJ27408013 Installation Details Steel hull with 0º Shaftline / HJ27408013 Installation Details Steel hull with 0º Shaftline Sht 2.

1. Using an 8.5 mm diameter drill bit, drill through the 16 holes in the transom plate to just dimple the transom for correct hole location.
2. Slide the transom plate back off the tailpipe.
3. Drill out the 16 holes in the transom using the 8.5 mm drill and remove all burrs.
4. Enlarge the 16 transom plate holes to 12 mm dia. to accept the insulating bushes [15] and remove all burrs.
5. Fit the insulating bushes to the transom plate and trim to the correct length.
6. Lubricate the transom plate o-ring [2] with multi-purpse grease. Fit in place in the seal groove on the jet unit intake. Take care not to get any oil on the transom where sealant will be applied.
7. Liberally apply neutral cure marine sealant [13] to the transom plate contact area on the hull, also the joint face of the transom plate and screw heads.
8. Ensure that the transom insulating gasket [16] is placed next to the transom.
9. Slide the transom plate [1] over the o-ring [2] and line up the transom plate with the holes in the transom.
10. The transom plate must be totally insulated from the hull by a rubber gasket [16] and Insulating bushes [15] fitted to the transom plate mounting screws.

Note: Ensure that the screw heads are fitted to the outside of the transom as shown on installation drawings.

11. With the insulating bushes [15] already fitted to the transom plate, fit screws [3], washers flat [6], washers spring [5] and nuts [4], to secure the transom plate to the transom as shown in the installation drawings.
12. Torque load to the recommended torque and remove any excess sealant.
13. Check for electrical isolation between the intake block and the vessel hull. **The resistance between the jet unit(s) and the steel hull should be 1000 ohms or greater.** If the reading is below 1000 ohms, the fault should be investigated and rectified.

5.5 Final Assembly

Refer to Drawings HJ27401000 Basic Jet Assemblies Standard and Dry Run **and** HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2.

The reverse duct and tailpipe should have been removed prior to the installation of the jet unit through the transom hole.

The reverse duct, tailpipe and steering assembly can now be refitted to the jet unit as shown in the following procedures:-

5.5.1 Re-Fitting the Reverse Components

Reverse duct and tailpipe re-fitting (complete):

1. Using the appropriate approved lifting equipment, lift the reverse duct complete with tailpipe and steering assembly attached and locate onto studs upper [48] and studs lower [49] fitted on the rear of the intake.
2. Secure in position with washer special [59] and nuts [54], using Loctite 242.

Note:

1. Torque load nuts [54] to the upper studs [48] to 16 Nm (45 lbs/ft).
2. Torque load nuts [54] to the lower studs [49] (SAF-2205) to 130 Nm (95 lbs/ft).

3. Reconnect the reverse duct to the reverse cylinder (if fitted) as shown in paragraphs 9 to 13 of ***Section*** 9.3.2 Reverse Duct: Refit to the Jet Unit.

Steering assembly re-fitting:

Refer to Section 9.5.2 Steering Shaft Refit**.**

Reverse duct re-fitting:

Using the appropriate lifting equipment, refit the reverse duct as shown in **Section** 9.3.2 Reverse Duct: Refit to the Jet Unit**.**

Reverse cylinder re-fitting:

Refer to Drawings HJ27407011 Reverse Assembly **and** HJ27407011 Reverse Assembly Sht 2.

The reverse cylinder may now be re-fitted to the jet unit in accordance with the instructions at **Section** 9.3.1 Reverse Cylinder: Refit to the Jet Unit.

5.5.2 Re-Fitting the Steering Components

Drawing HJ27406000 Steering Assembly General Arrangement ***refers.***

Steering cylinder re-fitting :

Refer to Drawing CTSJK02005 steering cylinder Mounting ***in this manual.***

The boat builder is to mount the steering cylinder to provide equal travel on either side of the centre position to ensure that the steering cylinder reaches the end of its stroke , in both directions, before the steering nozzle reaches the limit of its travel.

Refer to Section 9.5 Steering Assembly Re-Fitting ***for the re-fitting of steering components.***

Push pull cable system:

Refer to Drawing CTHLM06002 Cable Steering wheel & Cable Assembly 3″ Stroke**.**

Note: This is a steering option and is not "standard fit" for the HJ-274 jet unit.

If choosing a push-pull cable, use a heavy duty rotary system or a rack and pinion system such as those tabulated below. For lightest steering action, keep the number of bends in the cable to a minimum and ensure that bend radii are as large as possible. Make sure cables are well lubricated prior to installation.

The cable should be connected to the lower hole in the tiller arm for all single jet installations. In the case of multiple jet installations, the outer hole may be used to reduce the helm load if necessary.

5.5.3 Assembling of the Jet Steering Tillers

Refer to Drawings HJ27406000 Steering Assembly General Arrangement and CTSJK04010 tie rod Kit Twin & Triple Jets.

The jet tiller as supplied, is pre-drilled for the attachment of the tie rod bolts. The tiller has been drilled with a series of holes in the surface of the tiller. These holes are spaced at 6° intervals.

The position for attaching the tie rods to the tiller to suit the different deadrise angles is at an angle from the jet centreline which is equal to the deadrise angle. Attach the tie rod to the tiller at the nearest appropriate drilled hole on the tiller. ***Refer to Drawing*** CTSJK04010 tie rod Kit Twin & Triple Jets ***in this manual for correct fitting and positioning of the jet unit tillers and tie rods for twin jet applications.***

Note: The jet tillers and cotter pins must be fitted as shown in Figure 20: Jet Steering Tiller-Cotter Alignment.

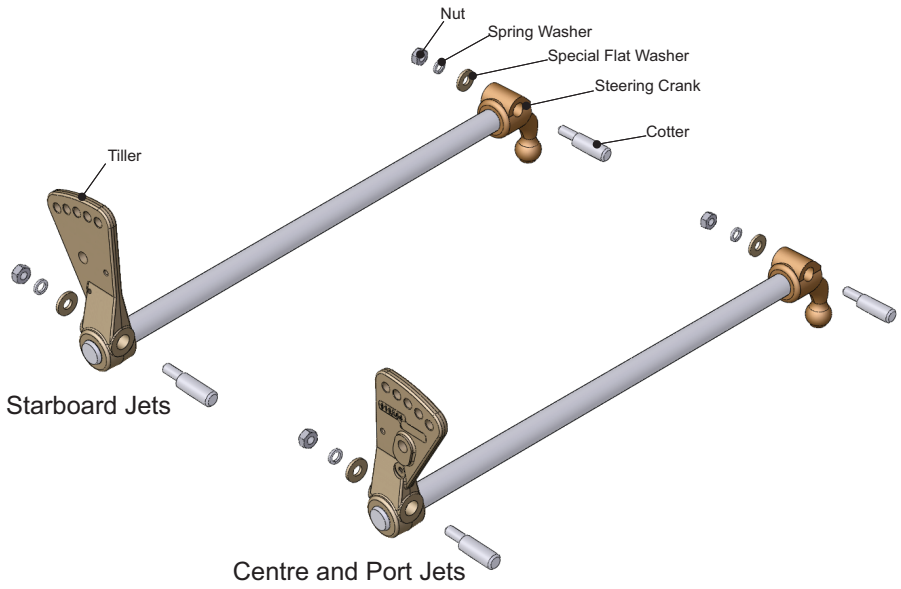


Figure 20: Jet Steering Tiller-Cotter Alignment

Twin jet installations:
One steering cylinder, port jet
One tie rod
Refer Figure 21: Twin Jet Arrangement

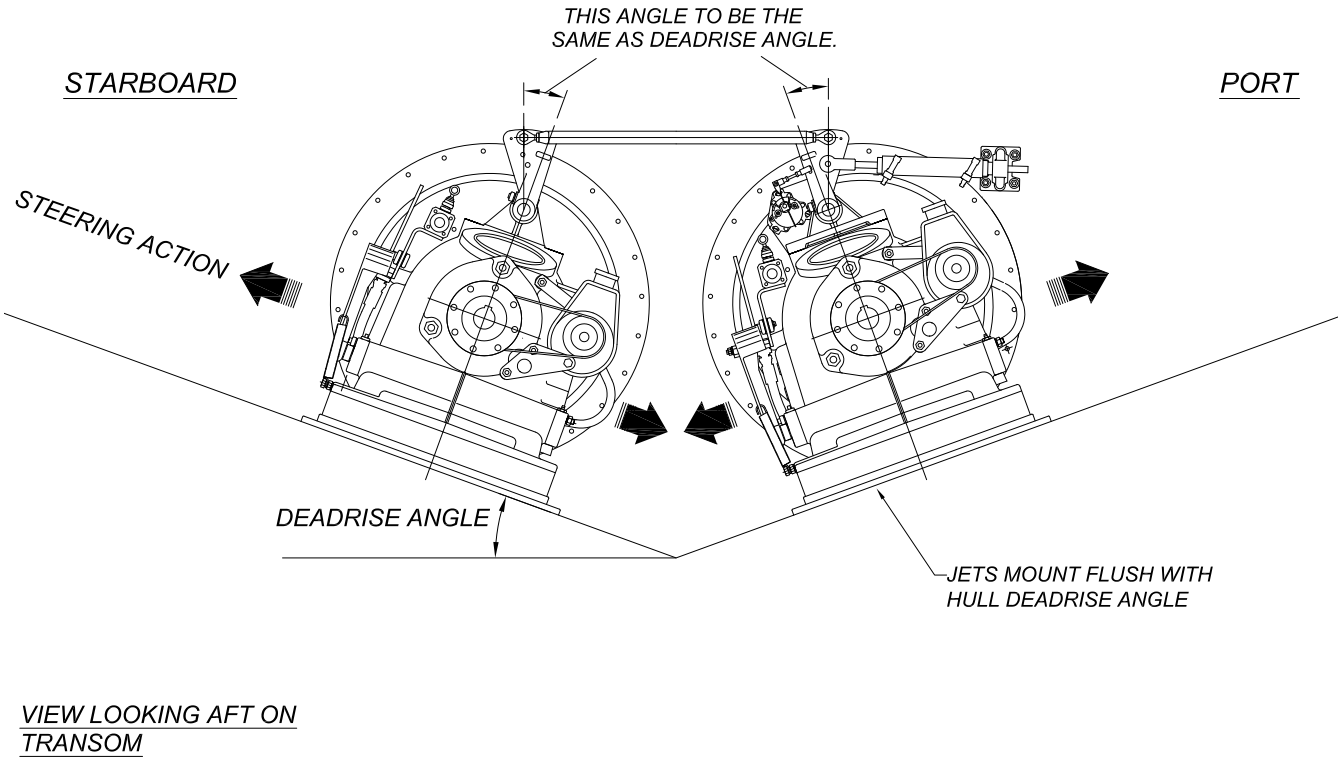


Figure 21: Twin Jet Arrangement

Triple jet installation:
One steering cylinder only is required which should mount on the center jet.
Two swivel ended tie rods are used to interconnect the jet tillers, from starboard to center jet and from center to port jet. ***Refer to Drawings*** CTSJK04010 tie rod Kit Twin & Triple Jets**.**

Tightening cotter (taper) pin nuts:-
Ensure that all the tillers are fitted the correct way as shown for single, twin or triple jets. Torque load all securing nuts to the recommended torque as shown in **Drawing** 85113 Threaded Fastener Tightening Torques.

5.5.4 Centering the Jet(s) Steering

Before fitting the steering tie rod(s) (for multiple jet applications), ensure that all nozzles are set to the "dead ahead" position and temporarily clamp the nozzles so that the tillers will not move from the dead ahead position.

Switch off the reverse control system (if operational) during steering adjustment so that the reverse duct cannot be accidentally lowered.

5.6 Driveline and Engine Installation

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

Driveshaft installation:
Use a double universal driveshaft with a slip joint (sliding spline). Any axial float will be taken up in the driveshaft. Flywheel adaptors may be used to match the driveshaft flange. Consult the sections on ***JET MAINSHAFT ALIGNMENT*** and ***DESIGN BASICS*** to get the engine location and shaft line angle correct. Consult C.W.F. Hamilton & Co. Ltd for an engineering check of driveline proposals.

Driveline components for diesel engines:
The driveline for a diesel engine installation will require a flexible coupling normally mounted on the engine flywheel. It is essential that the coupling is sufficiently flexible to ensure that the slow speed torsional vibration resonance point occurs below engine idle RPM. The engine manufacturer will be able to calculate the torsional coupling stiffness required to achieve this.

5.6.1 Mounting the Engine

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 to section** 3.4 Jet Mainshaft Alignment (For 5ºOption Only) **and also section** 3.3.3 Driveshaft Options, for recommended driveshaft and engine installation angles.

5.6.2 Engine Cooling

If a gearbox or clutch is fitted to the engine, a conventional hull water pick-up and engine raw water pump must be used.

Ensure that the engine cooling water pick up is not directly ahead of the jet unit intake, but well to the side to avoid turbulent water flow into the jet.

There is a 1¼" BSP outboard water offtake which provides water at approximately 10 kPa ($1^1/_2$ psi) at 600 RPM and up to 31kPa (45 psi) at - 260 Kw (350 hp) - ***refer to Section*** 3.5 Water OffTake. The water may be fed directly to the engine without the need for a raw water pump, provided that:

a) The pressure from the water offtake at idle is sufficient to cool the engine.
b) That the engine can withstand the full pressure from the water 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 unit water offtake can be used for a deck cleaning hose but the pressure is not high enough for a fire hose. The jet is supplied with the water offtake plugged. An 1¼ BSP to 1¼" (32mm) hose tail, supplied loose, can be fitted in place of the plug.

5.6.3 Engine Systems

Engine wiring, instrumentation and throttle systems are all conventional - follow the manufacturers recommendations.

With the standard HSRC reverse system, a two lever (separate) throttle and reverse controls MUST be used.

5.6.4 Exhaust Systems

Refer to Section 3.6.5 Engine Exhausts for further information on the exhaust system.

5.6.5 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.

To check, select neutral if clutch or gearbox fitted but without these unbolt the driveline at the engine flywheel and open the throttle fully. To accurately measure RPM, use a calibrated hand tachometer.

Example:

> ***If the maximum RPM for driving the jet unit is 2800 RPM, then the governor should not begin to operate until at least 2850 RPM. On most diesel engines this means the "no load governor setting" (or "high idle") should be at least 3050 RPM. (i.e. 250 RPM higher than the loaded maximum RPM).***

Ensure that the low idle RPM is set high enough to avoid any vibration in the driveline. Extensive idling with the driveline vibrating may damage the jet unit. **Refer to Section** 3.3 Drivelines.

5.7 Installation Checks for the Jet Unit

WARNING

All cylinder shafts are protected with spiral wrap during shipping.
Make sure the wrap is removed before first operation.

Jet unit: Mounting:

1. Check that the transition duct is faired to the hull bottom. Contours should be smooth with no steps or protrusions greater than 2mm.
2. Check that there are no flow obstructions forward of the intake (**Refer to hull details in the Jet Designers Manual and also *Section* 3.2 Hull Design and *Section* 5.2 Hull Preparation in this manual).**
3. Inspect the intake block for obvious distortion or gaps between the jet unit intake and the intake block.
4. **GRP and aluminium hulls only;** Check that the silicone sealant between the intake block and the jet unit intake has not squeezed out into the water passage. Trim off excess sealant if necessary.
5. **Steel hulls only;** Check that the sealant between the intake block and the jet intake has not squeezed out into the water passage. Check that the intake block gasket and sealant between the intake block and the hull flange has not squeezed out into the water passage. Check that the intake block gasket has been fitted properly, reposition if required and trim off any excess sealant if necessary.
6. Check the transom plate seal is correctly located and secured. ***(Do not over tighten)***. If two people are available and the vessel is indoors, a strong light may be used to check the fit of the transom cutout and transom seal.
7. **Steel hulls only;** Check that the jet unit is insulated from the hull **(Refer to *Section* 4.3.2 Checking the Insulation and the Installation Drawings contained in this manual)**.
8. Check that the engine exhausts are above the expected waterline or well clear of the water jets. **Refer to *Section* 3.6.5 Engine Exhausts in the "Design Basics" Section and *Section* 5.6.4 Exhaust Systems in the "Installation" Section of this manual.**
9. Check that the hull trim tabs (if fitted) will not interrupt reverse flow from the water jets. **Refer to Section 3.2.4 Trim Tabs and Figure 5: Allowable Trim Tabs Location in the "Design Basics" Section of this manual.**

Jet unit: General:

1. Ensure that the impeller is fitted to match the engine rating. The impeller part number ***(stamped on the impeller hub)*** can be viewed through the main inspection cover**.**
2. Check that the internal and external anodes are in place and have not been painted over. **(Refer to Drawing HJ27413002 anode Location).**
3. Check that the main inspection cover o-ring is correctly located and that the securing nuts are tightened to the recommended torque.
4. If antifouling has been applied to the jet unit casing, ensure that it is compatible with aluminium **(i.e. Not copper based)**.
5. Check that the bearing housing has been filled with the recommended grease prior to operating the jet unit for the first time. Refer: Section 9.6.4 Bearing Housing Re-Assembly item 20.
6. Check any water offtake connections (if fitted) for correct fitting and security. Check that any unused water offtakes are correctly plugged.

Anti-fouling Paints
Additional coats of Antifoul must be applied to the jet unit, typically within two weeks of the launch of the vessel.
The supplied Antifoul coating will require light abrasion and cleaning prior to further application of Antifoul.
Do not use Copper Oxide based anti-fouling paints. Do not paint over the anodes.

Application of Antifoul to new jets.

HJ274 to HJ364 jet models have an optional paint finish: Grey Gloss or Antifoul. HJ403 and larger are available with the Antifoul finish only.

The Grey Gloss finish is intended for vessels that are not continually afloat, for example trailered boats. It is not intended that Antifoul paint is applied directly over the Grey Gloss paint, since the Antifoul will not adhere.

For the Antifoul finish, the wetted surfaces of the jet unit, excluding the impeller, wear ring and mainshaft, are finished ex-factory with black coloured International Paints Trilux Antifoul. After a few weeks in air the Antifoul starts to oxidise and lose fouling prevention effectiveness. Prior to launch of the vessel one of the following processes should be followed:

1. Restore the Antifoul effectiveness by wet sanding or abrading the surface using abrasive hand pads (Scotch-Brite), or,
2. Apply additional coats of Antifoul:
   a) Degrease (with a water soluble degreaser) and
   b) Wet sand or abrade the Antifouled surface using abrasive hand pads (Scotch-Brite)
   c) Apply additional coats of Antifoul. Up to three layers of Trilux Antifoul may be applied; any further coats do not offer better Antifoul protection. Masking of the jet impeller and mainshaft is optional since it is OK for overspray to coat the mainshaft and impeller.

The factory application of Antifoul is a single coat. To provide optimal effectiveness and duration of antifouling, the application of additional coats is recommended.

Drive shaft:

1. Ensure that the driveline details have been checked and approved by CWF Hamilton & Co Ltd.
2. On universal joint drive shafts **(Refer to *Section* 3.3 Drivelines in the "Design Basics" Section of the Manual)** check the following:-
   - Yoke offset angles are in the same plane, are equal and less than 5°.
   - Yokes are in the same plane.
3. On line shafts supported by bearings (**Refer to *Section* 3.3 Drivelines in the "Design Basics" Section of the Manual)** check the following:-
   - Support bearings are aligned with the engine flywheel.
   - Outer support bearings are positioned close to the end couplings.
4. For steel hulls, ensure that the driveline electrically insulates the engine from the jet unit.

5.8 Installing the HSRX Reverse System

Refer to Drawings HJ27407011 Reverse Assembly **and** HJ27407011 Reverse Assembly Sht 2**.**

1. Prior to inserting the jet unit through the transom hole, remove the reverse duct as instructed in the overhaul section of the jet unit manual.
2. After the jet unit has been mounted in the vessel and the reverse duct has been re-fitted, connect the HSRX reverse cylinder to the reverse duct, ensuring that the reverse shaft assembly is orientated the same way as it was previously.
3. Ensure that the dot on the end of the reverse shaft assembly is positioned uppermost. If the shaft assembly is 180° out of position, with the cylinder correctly mounted, the HSRX reverse will not work properly. To correct a wrongly positioned shaft assembly, with the cylinder correctly mounted, remove the pin which connects the shaft assembly to the reverse duct and rotate the shaft assembly using an adjustable wrench on the shaft assembly end flats. Do not grip the shaft assembly itself as surface damage on the shaft assembly will damage the cylinder seals.

5.8.1 Remote Operating Systems

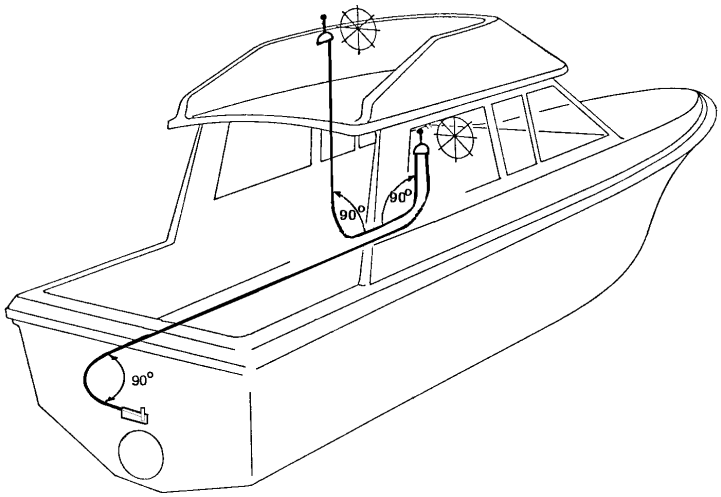


Figure 22: Remote Operating Systems

5.8.2 Cable Installation

The HSRX reverse system is supplied with a cable mounting plate (fitted to the end of the HSRX cylinder).

The recommended cable is the Morse 33c Supreme (low friction) cable. The cable mounting plate has been designed to suit this cable.

A suitable controller is the Morse "S" controller which can be fitted with a **"neutral detent and engine start interlock"** microswitch. This microswitch prevents the engine from being started with any other than the "neutral" position selected on the reverse controller. **Refer to Drawing** CTCLV01003 Reverse Controller.

CABLE RUNS SHOULD NOT EXCEED 12m. Cable runs above this length could result in a reduction in reverse duct control quality.

MINIMISE THE NUMBER OF BENDS. The diagram illustrates the ideal arrangement for a dual station system. Total bend angle per cable in this system is 180º. **Do not exceed 360º per total as this will result in excessive lost motion (backlash)**.

Cable "station exchanger" systems may allow reduced cable length and bends but tend to introduce excessive lost motion (backlash) themselves. For cable runs longer than 12m, refer to **Section** 5.8.4 Alternative Remote Operating Systems.

5.8.3 Reverse Control Lever Adjustment

Refer to Drawings HJ27407011 Reverse Assembly **and** HJ27407011 Reverse Assembly Sht 2**.**

1. With the reverse control lever in the full ahead position, the HSRX lever should be touching the stop pin. This ensures that the by-pass is operating in the full ahead position.
2. Adjust the reverse control lever full ahead stop screw to achieve this with no excess lever movement.
3. If the reverse control lever has no stops, it will be necessary to adjust the cable mounting position on the cable mounting plate and / or the actuation radius at the reverse control lever.
4. Check the oil tank level using the dipstick.
5. Check belt tension refer to **Drawing** CTHPU01002 JHPU HSRX (Saginaw Pump) HJ-273 & HJ-274 Jets **and Section** 8.6.2 Reverse Hydraulic Controls Servicing Details.

5.8.4 Alternative Remote Operating Systems

Pneumatic (Teletronic, MMC etc).
Electronic.

Consult **C.W.F Hamilton & Co Ltd** if proposing to use an alternative remote operating system.

Section 6
Commissioning

This information is intended for use by CWF Hamilton representatives. Refer to the controls system manual for details of commissioning checks specific to the controls system.

WARNING

Ensure that the vessel is securely moored, as during commissioning the jet unit may produce large thrust forces.

Do not proceed if any of the control systems fault alarms are still activated.

6.1 Pre-Launch checks

WARNING

All cylinder shafts are protected with spiral wrap during shipping.
Make sure the wrap is removed before first operation.

Carefully inspect all hydraulic cylinder shafts and pushrods for scratches, paint, weld splatter, dirt or any other contamination.
These shafts should be perfectly clean before the hydraulics are used to prevent damage to the seals.

Anti-fouling Paints

Additional coats of Antifoul must be applied to the jet unit, typically within two weeks of the launch of the vessel.
The supplied Antifoul coating will require light abrasion and cleaning prior to further application of Antifoul.
Do not use Copper Oxide based anti-fouling paints. Do not paint over the anodes.

1. Check all hydraulic shafts for damage and that they are free from contamination (weld splatter, grinding dust, fibreglass resin, etc).
2. Check that all inspection covers on all jet units are securely attached.
3. Ensure that the bearing housing is filled with the correct amount of grease prior to operating the jet unit for the first time Refer: Section 9.6.4“Bearing Housing Re-Assembly" item 20.
4. STEEL HULLS ONLY:Check that the insulation between the jet unit and the hull of the vessel measures NOT LESS THAN 1000 Ohms. Refer to **Section** 4.3.1“Checking the Insulation" for further details.

6.2 Post Launch Checks

Perform the following procedures before the engines are started.

1. Check that there are no water leaks:
   a) At the transom seal.
   b) At the intake base.
   c) From under the bearing housing (water seal leak).
2. Check the JHPU oil level.
3. Check the oil level in the pump reservoir and refill as required. **See Section** 8.6.2"Reverse Hydraulic Controls Servicing Details", Item 3, "Filling the reverse system with Oil".
4. Ensure that the HSRX control lever is touching the stop pin when the reverse control is in the full ahead position.

CAUTION

If the HSRX control lever does not touch the stop pin when the reverse control is in the "full ahead" position then overheating of the HSRX system may occur.

5. Check that the waterline is up to at least the mainshaft centreline so that the jet unit will prime (pump water properly) when the engine is started.
6. Ensure that the vessel is securely moored fore and aft and is located in deep clean water.

6.3 Engine Running Checks (vessel Moored)

1. The water bearing (cutless bearing) must operate wet. ***Do Not operate the jet unit with the vessel out of the water, or with the vessel ballasted such that the jet unit does not prime (pump water properly) when the engine is started.***
2. Ensure that the vessel is securely moored fore and aft, in deep water.
3. With the reverse lever set to "zero speed", the engine(s) may be started and the engine supplier's representatives can carry out engine checks.
4. If the engine cooling water is taken from the jet unit water offtake, confirm that water is passing out of the engine exhaust outlets, where possible. Periodically check that the engine is running at the correct operating temperatureas this ensures that the engine is receiving sufficient water from the jet unit water offtake. Check that the cooling water hoses are secure.

CAUTION

Failure to check cooling water hoses may result in flooding of the vessel.

5. With the engines set to idle and the vessel securely moored in deep water, have someone monitoring the reservoir and refill as required.
6. Idle the engine at the lowest possible RPM.
7. Run the pump for 5 minutes approximately without moving the controls - this will purge air from the oil cooler. Refill the oil reservoir.
8. Start the engine, operate the controls to stroke each cylinder at least 10 times. This should purge any remaining air out of the system.
9. Top up the pump reservoir.
10. Check the system to ensure that it is not overheating. The bearing housing operating temperature at the bearing housing casing should maintain a temperature of 70° ±5°. A faulty bearing is likely to cause significant heat generation which will be quite noticeable and could even discolour the paint of the bearing housing.
11. Ensure the intake is under water - either with the boat trailer reversed into the water or with the boat moored securely.
12. Run the engine at idle, and recheck / refill the oil in the tank to the correct level shown on the dipstick.
13. Move the reverse control lever slowly to fully lower and raise the reverse duct several times. This will purge the hydraulic system of air.
14. The reverse control lever should now be moved to full astern position. There is no astern stop for the HSRX lever. The full astern reverse control lever stop should be adjusted so that the reverse duct travels fully down (cuts across the jetstream completely) with no surplus reverse control lever travel.
15. If more reverse control lever movement is required (for greater sensitivity) and spare cable movement is available, the cable actuation radius can be altered at the reverse control lever.

Note: Not all reverse control levers have an adjustable detent. C.W.F. Hamilton & Co. Ltd. recommend that any reverse control lever detent action is de-activated.(not used). The reason is that the zero speed position will vary with wind and tide and small movements either side of a detented position would become difficult to achieve.

Neutral detent and engine start interlock microswitch adjustment (if fitted).

If microswitch adjustment is required, the manufacturers instructions for the microswitch should be followed.

6.4 Vessel Speed and Handling Trials

CAUTION

If a problem is detected, return to the mooring immediately, at reduced power. DO NOT operate the jet unit until the fault has been repaired. refer to section 7 Fault Finding.

1. Leave the mooring and check that the steering is operating correctly at “forward speed”, at “zero speed” and at “astern”.
2. Observe the waterjet emerging from the steering nozzles when the vessel is going dead ahead at speed. The waterjet should be a relatively clean with an even shape.
3. Check that the jet unit and driveshaft are running smoothly (no vibration) over the entire engine operating speed range (i.e. from “zero speed” to “full ahead”).
4. Periodically check the surface temperature of the bearing housing and record the temperatures once it reaches a steady value. Due to friction caused by the seals, the bearing housing is likely to be warm. ***The bearing housing operating temperature should not exceed of 80º C.*** A faulty bearing will be heard and felt as a vibration through the bearing housing and is likely to cause significant heat build-up in the bearing housing.
5. If practical, check the coupling joint temperatures. Increased joint temperature may indicate driveshaft misalignment.
6. Periodically check the hydraulic oil temperature at the JHPU oil reservoir. Record the temperature reading after a sustained run at cruising speed and also after a period of vessel manoeuvering.
7. Record maximum speed (using GPS) and engine revolutions ***(Note that strong currents will result in inaccurate speed readings since the GPS only provides “speed over ground covered” readings).*** At maximum speed the jet unit revolutions should be verified with a hand held tachometer at the jet unit coupling.
8. Record vessel speed at varying engine revolutions if possible.
9. Record observations on vessel trim, loading etc.

6.5 After Initial Trials (After engine Shut Down)

1. **Refer to Section** 8.5“Servicing Intervals" for any after trials maintenance that may be required.
2. Ensure that all important information recorded during trials is stored for later reference.
3. Check for water leaks around the jet unit especially at the transom seal at the intake block and under the bearing housing (water seal leaks).
4. **STEEL HULLS ONLY**: Check that the insulation between the jet unit and the hull of the vessel measures no less than 1000 Ohms. Refer to **Section** 4.3.1“Checking the Insulation" for further details.

Part C
Servicing Information

- Fault Finding
- Maintenance
- Overhaul

Section 7
Fault Finding

How to use this fault finding table:

1. Look for a symptom similar to what you have noticed.
2. Try each solution until the fault is found and rectified.
3. Use the **"REFER"** column for more information on each solution.
4. Try the easiest (first) solution first.

7.1 Jet Unit Faults

Table 1: Jet Unit Faults

Symptom			
No	**Possible cause**	**Solution**	**Refer**
1	**The engine unloads (RPM increases).**		
	There is blockage of the jet unit.	The blockage must be removed.	Sect."2.9"
	Air is getting into the jet unit.	Check the inspection cover, hull design. Consult with C.W.F. Hamilton & Co Ltd.	Sect."2.9.4"
2	**A lack of jet thrust (boat speed drops).**		
	There is some blockage of the jet unit.	The blockage must be removed.	Sect."2.9"
	Air is getting into the jet unit.	Check the inspection cover, hull design. Consult with C.W.F. Hamilton & Co Ltd.	Sect."2.9.4"
3	**Excessive noise and vibration comes from the jet unit.**		
	There is blockage of the jet unit.	The blockage must be removed.	Sect."2.9"
	There is blockage of the impeller or stator.	Clear the impeller or stator.	Sect."2.9"

Table 1: Jet Unit Faults (Continued)

Symptom			
No	**Possible cause**	**Solution**	**Refer**
4	**Water leaking from under the bearing housing.**		
	Faulty water seal.	Inspect and replace the water seal.	Sect."9.6"
5	**Excessive high pitched rattling, or rattling whine coming from the jet unit.**		
	blockage in the jet unit.	The blockage must be removed	Sect."2.9.3"
	Faulty thrust bearing.	Inspect and repair the thrust bearing.	Sect."9.6"
	Cavitation is occurring.	Blocked screen intake. Check for blunt or damaged impeller. Excessive impeller tip clearance. Wrong type of impeller fitted. Vessel overloaded. Weight too far aft. Bad weather or sea conditions. Poor installation of the jet unit.	Sect."2.9.3" Sect."9.8.1" Sect."9.8.1" ***Refer to Drawing*** HJ27403001 impellers.
6	**Bad vibrations from the jet unit.**		
	There is some blockage of the jet unit. Worn marine bearing, or marine bearing water drain hole in the tailpipe cone is blocked. Something caught on the impeller.	The blockage must be removed. Inspect and repair the marine bearing. Clear the blockage in the tailpipe cone.	Sect."2.9" Sect."9.8.3" Sect."9.8.7"
	Worn driveshaft universal joints.	Inspect and repair the driveshaft as per manufacturer's recommendation's.	N./A.
7	**Engine revolutions gradually increasing over a period of time. Take off performance poor.**		
	There is some blockage of the jet unit.	The blockages must be removed.	Sect."2.9.3"
	Worn or blunt impellers.	Inspect and repair the impeller as well as the wear ring.	Sect."9.8.1" Sect."9.8.3"
	Excessive impeller tip clearance.	Inspect and repair the impeller as well as the wear ring.	Sect."9.8"
8	**Sudden increase in engine revolutions with no noticeable decrease in thrust.**		
	Faulty tachometer.	Repair tachometer.	N./A.

Table 1: Jet Unit Faults (Continued)

Symptom			
No	**Possible cause**	**Solution**	**Refer**
9	**Excessive engine revolutions, noisy jet unit with aerated water from nozzle.**		
	Screen blocked with wood or debris or rope through screen and wrapped around shaft.	The blockage must be removed.	Sect."2.9.3"
	Object jammed in stators and/or impeller.	The object must be removed.	Sect."2.9.3"
10	**Low engine RPM.**		
	Problem with engine.	Investigate operation of the engine.	Refer to engine manufacturers manual.
	Incorrect impeller and nozzle selection.	Contact C.W.F. Hamilton for a check to be made.	Refer to Drawings HJ27403001 impellers and HJ27406000 Steering Assembly General Arrangement.
11	**Main bearing housing excessively hot.**		
	Main bearing or seal failure.	The bearing housing operating temperature at the bearing housing Casing should maintain a temperature of 70° ±5°. A faulty bearing is likely to cause significant heat generation which will be quite noticeable and could even discolour the paint of the bearing housing. Overhaul the main bearing.	Sect."9.6"

7.2 Reverse System Faults

Table 2: Reverse System Faults

Symptom			
No	**Possible cause**	**Solution**	**Refer**
1	**Reverse duct is not moving.**		
	Reverse duct is jammed by debris.	Remove the debris and check for correct operation of the reverse duct.	Sect."9.2.2"
2	**Reverse duct does not go fully down or stay down.**		
	Back pressure too low.	If the back pressure valve is suspected of being faulty, it should be removed from the reverse cylinder and returned to a hydraulics facility where the valve can be checked. ***The pressure should be 500psi (34 Bar) at a flow of 9 litres per minute.***	Sect."9.2.4" and Drawing HJ27407011 Reverse Assembly
3	**Reverse duct is fully down unless control Lever is set to full ahead.**		
	Back pressure too high.	As Above.	As Above.
4	**Reverse duct not synchronised with the reverse lever.**		
	Cylinder rod 180° out of phase.	Rotate cylinder rod so that the dot on the rod end is uppermost. Also refer to the overhaul section in this manual.	Sect."5.8.2" Sect."9.2.4"
5	**Excessive heat build-up in the hydraulic system with reverse duct raised.**		
	HSRX control lever not against the stop pin in full ahead position.	Adjust the control cable.	Sect."5.8.3"

Table 2: Reverse System Faults (Continued)

Symptom			
No	**Possible cause**	**Solution**	**Refer**
6	**Reverse duct does not move.**		
	• Cannot move the controller. Jammed cable. • Controller moves freely. Broken cable. **Hydraulic failure:** **Can be caused by:** Broken pump belts. Belts slipping. blockage in the system. Run out of oil.(oil leak) **Jammed cylinder:** **can be caused by:** Bent reverse cylinder rod.	Free or replace the cable. Replace the cable. Replace belts. Adjust belt tension. Dismantle and clean the system. Refill the reservoir and purge the system. Replace the reverse cylinder rod.	Sect.“5.8” Sect.“5.8” Sect.“8.6.2”. HJ27402001 Couplings & Belts. CTHSE12001 Hose Kits Stainless Steel Fittings Sht2. Sect.“9.2”
7	**Reverse cylinder: Oil leaking from the shaft outside the transom.**		
	Reverse cylinder seal failure: Suspect seals are Wiper seal [35]. Oil seals [36].	Overhaul reverse cylinder.	Sect.“9.2.4”. HJ27407011 Reverse Assembly / HJ27407011 Reverse Assembly Sht 2
8	**Reverse cylinder: Oil Leaking out around the spool. Inside the vessel.**		
	Reverse cylinder seal failure. Suspect seals are: O-ring [37].	Overhaul the reverse cylinder.	Sect.“9.2.4”. HJ27407011 Reverse Assembly / HJ27407011 Reverse Assembly Sht 2
9	**Reverse cylinder: Oil Leaking around cylinder shaft to backhead interface.**		
	Reverse cylinder seal failure. Suspect seals are: O-ring [38].	Overhaul reverse cylinder.	Sect.“9.2.4”. HJ27407011 Reverse Assembly / HJ27407011 Reverse Assembly Sht 2
10	**System losing oil.**		
	Leak in the hydraulics system. Damaged cylinder rod. Leaky seals.	Replace or tighten. Can cause damage to seals, replace the rod and seals. Replace seals.	Sect.“9.2.4” HJ27407011 Reverse Assembly / HJ27407011 Reverse Assembly Sht 2

Table 2: Reverse System Faults (Continued)

Symptom			
No	**Possible cause**	**Solution**	**Refer**
11	**Reverse cylinder: Water Leaking in around the Fronthead [11].**		
	Reverse cylinder seal failure: Suspect seals are. Rubber boot [52].	Overhaul reverse cylinder.	Sect."9.2.4" HJ27407011 Reverse Assembly / HJ27407011 Reverse Assembly Sht 2
12	**Poor reverse thrust.**		
	Reverse duct flow is being ingested into the intake. Reverse flow hitting the trim tabs. Engine exhaust is being ingested into the intake.	Determine reason for limited travel and correct. Reposition trim tabs below jet centre Reposition engine exhausts to exhaust above the water line.	Sect."6.3" Sect."3.2.4" Sect."3.6.5"
13	**Poor forward thrust.**		
	Reverse duct not travelling fully up.	Determine reason for limited travel and correct.	Sect."6.3"
14	**Reverse control lever movement is stiff.**		
	Reverse control lever or cable is stiff.	Disconnect the reverse control cable at the lever. Check controller movement and cable movement. Lubricate as necessary. Check for bent or loose linkages. Check cable run from the control lever to the reverse cylinder lever to ensure that the cable is not being accidentally bent or crushed and restricting movement. Check that the cable type, length and route are as specified.	Sect."5.8"
15	**Reverse controller *(only for HSRX controls fitted with "neutral detent and engine start interlock")*.**		
	Engine can be started with either "forward" or "reverse" selected on the reverse controller.	Adjust the "neutral detent and engine start interlock" microswitch in accordance with the manufacturers instructions.	Refer to the manufacturers manual.
16	**No hydraulic pressure from the jet hydraulic pump unit (JHPU - saginaw pump).**		
	Reverse cylinder is not functioning due to little or no hydraulic pressure from the hydraulic pump.	Increase the engine (Jet) revolutions in quick bursts to about 1500 RPM until the vanes in the JHPU become free. This may assist.	N/A

7.3 Steering system Faults

Table 3: Steering System Faults

Symptom			
No	**Possible cause**	**Solution**	**Refer**
1	**Steering stiff at the helm.**		
	Grit jamming the nozzle.	Work the nozzle from side to side to release grit. Flush out the nozzle.	Sect.“9.4".
	Helm wheel stiff.	Check, rectify and lubricate as necessary.	
	Steering tiller shaft stiff.	Check movement of steering shaft and clearance on steering bushes. Rectify to a loose running fit.	Sect.“9.4".
	Grit between nozzle bushes [11], and nozzle.	Remove pivot pins [15] bushes [11], check bushes and pivot pins for wear. Replace with new parts as necessary.	Sect.“9.4.3". HJ27406000 Steering Assembly General Arrangement.
	Corrosion build-up under steering shaft or nozzle bushes.	Remove bushes, clean out bores and refit using Loctite.	Sect.“9.4".
2	**Steering jamming.**		
	Grit jamming nozzle.	Work nozzle from side to side to release grit. Flush out.	Sect.“9.4".
	Steering nozzle pivot bolts loose or bent.	Remove, check and replace bolts to the torque specified on the drawing.	HJ27406000 Steering Assembly General Arrangement.
	Steering nozzle and steering housing deformed by impact.	Remove, rebuild or replace as necessary.	

Section 8
Maintenance

8.1 General

This jet unit has been designed to require the absolute minimum of maintenance. However, it is recommended that the jet unit be regularly examined for the wear of the bearings, seals and bushes, etc and checked for corrosion annually as a minimum requirement.

Hydaulic equipment

When servicing hydraulic equipment, use the following general rules to ensure effective and trouble free servicing:

1. Minimise the loss of oil to surrounding areas by liberal use of oil absorbent cloth.
2. If disconnecting hydraulic connections to components which are not going to be serviced immediately, plug the connection to prevent loss of oil and entry of foreign particles.

8.2 Jet Surface Coating Procedure.

8.2.1 Introduction and Scope.

The purpose of this procedure is to outline the correct method for applying surface coatings to Hamilton waterjets. This procedure covers the following:

- Repairing/refurbishing paint on aluminium components.
- Repairing/refurbishing paint on steel and stainless steel components.

In all instances, it is necessary to read the paint manufacturers documentation regarding paint application. The paint manufacturer's documentation provides information such as paint compatibility, paint thickness/ coverage, drying times, recoat times, application method, and safety precautions.

8.2.2 Application of Antifoul Coatings

Application of Antifoul over Grey Gloss

Trilux Antifoul is not normally applied over Grey Gloss, since jets are available ex factory with the Antifoul applied to wetted surfaces. The Antifoul requires an epoxy tie coat, however it is not recommended to apply this tie coat on the Grey Gloss since the epoxy is not compatible with the polysiloxane based technology

used for Grey Gloss. It is therefore necessary to remove the Grey Gloss, which is a difficult process due to its high durability. If it is required to apply Antifoul over Grey Gloss then use the following process:

1. Sand to remove the Grey Gloss. If the surface is sanded through to bare metal then repair as per "Bare Metal Refurbishment".
2. Apply a tie coat of Interprotect, or alternatively Intergard 263 or Intercure 200 if Interprotect is unavailable. Masking of the jet impeller and mainshaft is optional since it is OK for overspray to coat the mainshaft and impeller.
3. Apply Antifoul. Up to three layers of Trilux Antifoul may be applied; any further coats do not offer better Antifoul protection.

Reapplication of Antifoul over existing Antifoul.

Trilux Antifoul may be applied directly over old Trilux in good condition. This can be done after thorough cleaning/degreasing and light abrading of the old Trilux. Abrasive hand pads (Scotch-Brite) or wet sanding is an acceptable way of hand abrading the old Trilux.

Use of alternative Antifoul.

Alternative Antifouls may be used provided the paint manufacturer has documented that the Antifoul is suitable for use on aluminium substrate. Foul release coatings (such as International Intersleek) have been successfully used on jet boats, however these need to be applied as a complete paint system.

Trilux can be over coated with most other makes of Antifoul, refer to the Antifoul/foul release manufacturer's specifications and recommendations for details.

ANTI FOULING PAINTS

Do not use copper oxide based anti-fouling paints. Do not paint over the anodes.

8.2.3 Maintenance of Jet Unit paint.

Recommended paint system

The aluminium components of Hamilton Jets are coated with a 3-coat paint system for both the Grey Gloss finish and the black Antifoul finish, as listed in the following table. The system consists of zinc chromate etch surface primer, epoxy primer, and top coat of either Grey Gloss or black Antifoul.

The painted steel and stainless steel components of Hamilton Jets are coated with a 3-coat paint system for both the Grey Gloss finish and the Black Antifoul finish, as listed in the following table. The system consists of surface primer, epoxy primer tie-coat, and top coat of either Grey Gloss or black Antifoul.

In October 2012 the Grey Gloss was changed from a polyester urethane based technology to a polysiloxane technology. The two products are not interchangeable and cannot be applied over each other. Refer to Product Bulletin PRB_08_2012 for details.

Any recoating or repair of the International Paints factory applied systems must be done with compatible products. Refer to the paint manufacturers TDS (technical data sheet) of the coating for compatibility, correct application thickness and minimum/ maximum recoat times.

System		Product	Regional Product Name				
			US/Canada	Europe/UK/Africa	Asia	South America	NZ/Australia
Cleaning		Work Preparation Wash	International 950 Cleaner	Super Cleaner	Super Cleaner	Super Cleaner	Awlgr Awlwash
		Bare metal Solvent Wash	Awlprep Plus Wax and Grease Remover T0115	Awlprep Plus Wax and Grease Remover T0115	Awlprep Plus Wax and Grease Remover T0115	Awlprep Plus Wax and Grease Remover T0115	Awlprep Plus Wax and Grease Remover T0115
Aluminium	Grey Gloss System	Aluminium Surface Primer	Viny-lux Primewash	Abrade, then immediately apply Epoxy Primer	Abrade, then immediately apply Epoxy Primer	Abrade, then immediately apply Epoxy Primer	Etch Primer for Aluminium Alloys
		Primer	Intercure 200	Intercure 200	Intercure 200	Intercure 200	Intercure 200
		Grey Gloss	Interfine 878	Interfine 878	Interfine 878	Interfine 878	Interfine 878
	Antifoul System	Aluminium Surface Primer	Viny-lux Primewash	Abrade, then immediately apply Epoxy Primer	Abrade, then immediately apply Epoxy Primer	Abrade, then immediately apply Epoxy Primer	Etch Primer for Aluminium Alloys
		Antifoul Primer	Interprotect, Intergard 263, or Intercure 200	Interprotect, Intergard 263, or Intercure 200	Interprotect, Intergard 263, or Intercure 200	Interprotect, Intergard 263, or Intercure 200	Interprotect, Intergard 263, or Intercure 200
		Antifoul	Trilux 33	Trilux 33	Trilux 33	Trilux 33	Trilux 33
Steel and Stainless Steel	Grey Gloss System	Surface Primer	Interprime 820	Interprime 820	Interprime 820	Interprime 820	Interprime 820
		Primer	Intercure 200	Intercure 200	Intercure 200	Intercure 200	Intercure 200
		Grey Gloss	Interfine 878	Interfine 878	Interfine 878	Interfine 878	Interfine 878
	Antifoul System	Surface Primer	Interprime 820	Interprime 820	Interprime 820	Interprime 820	Interprime 820
		Antifoul Primer	Interprotect, Intergard 263, or Intercure 200	Interprotect, Intergard 263, or Intercure 200	Interprotect, Intergard 263, or Intercure 200	Interprotect, Intergard 263, or Intercure 200	Interprotect, Intergard 263, or Intercure 200
		Antifoul	Trilux 33	Trilux 33	Trilux 33	Trilux 33	Trilux 33

Bare metal refurbishment - aluminium.

The aluminium castings used in the manufacture of Hamilton Jets require special attention when the coating has been damaged down to bare metal. The surface needs to be very clean and freshly abraded prior to the application of a suitable Primer to ensure a good bond is achieved. Masking of the jet impeller and mainshaft is optional, since it is OK for overspray to coat the mainshaft and impeller.

The area of refurbishment and immediate surroundings should be degreased with a water soluble degreaser and thoroughly rinsed off with clean water. The area should be sanded back to fresh bare metal with 80 to 120 grit aluminium oxide abrasive paper or sanding disc feathering the edges until a smooth surface is achieved. The affected area may be lightly sweep blast cleaned using non-metallic blast media. Appropriate masking is required to ensure that pushrods, bearings and seals are not blasted and that blast media does not contaminate bearings, bushes, and seals.

Heavy or medium abrasive sweep blasting of aluminium castings will cause excessive material loss from the casting. If sweep blasting is used it must be very light.

Warning

The surface should then be blown down or washed to remove sanding debris followed by a solvent wash to leave the surface dry and clean. For repairs to Grey Gloss, mask the Grey Gloss since applying epoxy primer over the Grey Gloss is not recommended. Within 30 minutes a coat of aluminium surface primer (Epoxy Primer or Zinc Chromate Etch primer) should be applied to seal the exposed aluminium surface. Using a Zinc Chromate Etch primer will provide optimum paint system performance in terms of corrosion protection. Etch primer shall only be applied to bare metal, and the coating thickness should be very thin since thick layers of etch primer lack strength; see the manufacturer's specifications and recommendations for application details.

Apply primer. Generally a total of 2 coats of epoxy primer are required to achieve an adequate film thickness.

If filling is required to repair the surfaces, use a suitable marine epoxy filler. The filler should be applied after application of the primer. Sand the filler as required then coat with epoxy primer.

Proceed with application of finish coats to primed surfaces

Bare metal refurbishment - steel and stainless steel.

The area of refurbishment and immediate surroundings should be degreased with a water soluble degreaser and thoroughly rinsed off with clean water.

Abrasive blast the surface clean to achieve a finish to Sa 2.5 (or to equivalents - AS1627.4 Class 2.5, NACE 2, SSPC - SP10). Feather the edges back 20-30mm onto sound substrate. Appropriate masking is required to ensure that aluminium castings pushrods, bearings and seals are not blasted and that blast media does not contaminate bearings, bushes, and seals.

Heavy or medium abrasive sweep blasting of aluminium castings will cause excessive material loss from the casting. If sweep blasting is used it must be very light.

Warning

The surface should then be blown down or washed to remove blasting debris followed by a solvent wash to leave the surface dry and clean. For repairs to Grey Gloss, mask the Grey Gloss since applying epoxy primer over the Grey Gloss is not recommended

Within 4 hours (steel) or 1 hour (stainless steel) of abrasive blasting, a coat of Steel Surface Primer should be applied to seal the surface. Apply the surface primer as per the manufacturer's recommendations.

If filling is required to repair the surface, apply a suitable marine epoxy filler. Sand filler to blend surfaces as required.

Apply primer coat to provide further corrosion protection and good adhesion of the top coat.

Proceed with Application of Finish Coats to Primed Surfaces

Application of topcoats to primed surfaces
Ensure the correct primer has been applied for the intended top coat. Refer "Recommended Paint System".

Ensure topcoat is applied within the minimum and maximum recoat times specified on the manufacturers technical date sheet (TDS). For example in order to achieve good adhesion to Interprotect it is necessary to apply Trilux Antifoul within 7 hours at 23°C. If the Epoxy Primer has been left too long prior to application of Antifoul, it will be necessary to abrade the Epoxy Primer and apply a further coat of Epoxy Primer.

If existing Grey Gloss areas had been masked for application of primer, then remove masking in preparation for over-coating with Grey Gloss.

When hard, the repaired area can be blended to the surrounding surfaces with 120 grit wet and dry sandpaper used wet. Once the surfaces are blended satisfactorily, wash area with clean water and allow to dry.

Apply topcoat of Grey Gloss or Antifoul.

ANTI FOULING PAINTS
Do not use copper oxide based anti-fouling paints. Do not paint over the anodes.

Application of Grey Gloss over existing Grey Gloss
The Grey Gloss is based on polysiloxane technology. When applying Grey Gloss over existing Grey Gloss (in sound condition), the existing Grey Gloss requires abrading to provide a key for the new Grey Gloss. A tie coat is not used, since an epoxy tie coat is not recommended on a polysiloxane coating.

For touch up repairs to Grey Gloss, Interfine 1080 or Interfine 878 may be used. Interfine 1080 is a single pack product, which makes application more convenient. Interfine 878 is a 2 pack product that results in a more durable finish than Interfine 1080. Interfine 878 is recommended where optimum paint durability is required, and particularly for Jet Unit internal water passages. Interfine 878 will provide faster drying times than 1080.

Interfine 878 can be overcoated with Interfine 878 or Interfine 1080, however Interfine 1080 should only be used for touch ups and Interfine 1080 can only be overcoated with Interfine 1080

8.3 Preservation: (Pre-Installation)

New jet preservation:

The following storage requirements must be provided to ensure that no damage or deterioration occurs to the jet unit :

1. Temperature must be between 10° C and 40° C and above the "dew point" (i.e. no condensation is allowed to form).
2. It is desirable to keep bearing housing components coated with grease; turn the mainshaft 180° once every month to achieve this.
3. All exposed steel parts (except for stainless steel parts) should be protected from corrosion. As a corrosion preventative treatment, coat all exposed steel parts with a thin layer of rust preventative oil.
4. To protect hydraulic fittings(except for stainless steel), either:
   a) Coat with oil impregnated corrosion protection tape.

OR

   b)Spray with a recognised corrosion protection treatment.
5. To prevent the hydraulic seals bonding to hydraulic shafts, move the steering and reverse cyclinders a small amount every 3 months. Loosen the by-pass valves (where fitted) to allow manual movement of the cylinders.

Preparation for use:

To prepare the jet unit for use:

6. Ensure that the bearing housing is greased via the nipple on the top of the bearing housing. **Refer to Section** 9.6.4 "Bearing Housing Re-Assembly" Item 20.

8.4 Preservation: (Post Installation)

Do not run the jet unit out of the water unless it is fitted with a dry run kit.

When the vessel is not operational for an extended period, the following procedures must be followed to prevent marine growth and corrosion problems.

If the jet unit is to be laid-up, carry out the following:-

1. Clean down the whole jet unit and wash inside and out with fresh water.
2. Hose the inside of the jet through the intake grill and the nozzle. Allow to dry completely.
3. Spray with a suitable corrosion protection oil such as Shell Ensis.
4. Oil and lubricate all moving parts.
5. **Carry out the following on a monthly basis**:-
   a) If the engine cannot be run, turn the mainshaft by 180°. This can be done manually.
   b) Stroke the reverse duct fully six times and leave in the raised position.
   c) Operate the steering from lock to lock fully six times.

If the jet is to remain moored, carry out the following:-

1. Actively prevent marine growth through the following procedures:
   a) Paint the inside and outside of the jet unit with antifouling paint. **Refer to Section** 4.1.7 "Anti Fouling Paint".
   b) Keep light away from the jet unit. Moor the vessel in deep water rather than shallow water.
   c) Place an opaque bag over the steering nozzle to prevent light entering the inside of the jet unit. In shallow water a similar cover should be tied over the intake screen.

Before moving any controls, ensure that any marine growth is removed from the steering and reverse linkage rods. This will prevent damage to the seals that these control rods pass through.

Perform the following procedures MONTHLY.

1. Run the jet unit for a short time.
2. Stroke the reverse duct and steering nozzle fully six times. Leave the reverse duct in the raised position and the steering pushrod fully retracted.
3. If the engine is not started, turn the mainshaft by 180° once per week. This can be done manually.

8.5 Servicing Intervals

Please note the following points:

1. Vessel usage is assumed to be 2000 operational hours per year. Adjust your schedule as necessary.
2. The frequency of the following service items may be varied to suit actual operating conditions. Refer to the appropriate section for details.
   - Jet unit examination every 5000 hours refer to **Section** 8.6 "Servicing Details".
3. Refer to the controls manual for the servicing of the controls system.

8.5.1 Servicing Intervals (Jet)

Table 4: Servicing Intervals (Jet)

Servicing intervals (jet)												
Item	**What to do**	**refer to**	**1st 5 hrs.**	**1 day**	**30 HRS**	**100 hrs.**	**500 hrs.**	**1 mth**	**3 mths**	**1000 hrs.**	**1st 2000 hrs.**	**5000 hrs.**
Intake flow path.	Check for blockage and clear.	8.6.1/1		•								
Thrust bearing.	Lubricate.	8.6.1/2			•			•				
Water seal.	Check for leaks.	8.6.1/4		•								
Anodes.	Check condition.	8.6.1/5										
Steering system	Check integrity.	8.6.1/6		•	•							
Steering crank cotter	Check integrity and lubricate.	8.6.1/6-4		•								
Steering crank	Grease	8.6.1/12							•			
Steering shaft & bushes	Check for wear. Grease.	8.6.1/8							•			
Steering cylinder & hoses	Check for leaks and condition	8.6.1/9	•			•		•				
Steering linkages.	Check integrity.	8.6.1/10	•	•								
Nozzle / nozzle housing.	Check “vertical end float”.	8.6.1/11							•			
Reverse cylinder shaft	Grease	8.6.1/12							•			
Screen rake and bearings.	Check/lubricate.	8.6.1/14							•			
Driveshaft universals.	Lubricate.	As recommended by the manufacturer										
Complete jet unit.	Examine / repair.	8.6.1/16									•	•
(Steel hull only).	Insulation check.	4.3.2						•				

8.5.2 Servicing Intervals (Hydraulic Reverse System)

Please note the following points:

The frequency of the servicing interval for the following items may be varied to suit actual operating conditions. For details, refer to the appropriate section referred to.

- Hydraulic oil change at 1000 hours may be varied to suit conditions.

Table 5: Hydraulic System Servicing Intervals

Servicing intervals (hydraulic system)						
Item	**What to do**	**refer to**	**1st 5 hrs.**	**Daily**	**1000 hrs.**	**Monthly**
Reverse pump oil	Check volume	8.6.2/1		●		
Reverse pump oil	Change	8.6.2/2	●		●	
Reverse cylinder and hoses	Check integrity	8.6.1/15		●		●
Pump-belts	Check belt tension	8.6.2/5	●			●
Pump-belts	Check belt condition	8.6.2/5		●		●
Cable linkages	Check attachment	8.6.1/16		●		
Reverse control lever	Check freedom of movement	5.8.3		●		
Reverse duct	Check that the reverse duct cuts the jet wash completely in the full astern position. Adjust if required.	6.3				●
Actuation lever	Check that the HSRX lever contacts the stop pin in the “full ahead” reverse control lever” position. Adjust if required.	5.8.3				●

Note:

1. If a new belt has been fitted, the belt tension should be checked and re-tensioned as required over a period of 24 to 48 hours "running-in" period to allow for belt settling. After the initial settling in period, the belt should be checked on a monthly basis and re-tensioned as required.
2. This maintenance schedule has been compiled for normal operating conditions. If the vessel is used in severe conditions where the oil is likely to become contaminated, the oil should be replaced at more frequent intervals.

8.5.3 Daily "Pre Use" Servicing Checks

The following areas should be checked on a daily basis if the vessel is in regular use.

Table 6: Daily Servicing Checks (Jet)

Daily servicing checks (jet)	
Area	**Operation**
Intake screen. **Impeller.** **Stator blades.**	**Ensure that the water level is below the hatch or overflow preventer before opening the inspection cover.** Check via the inspection hatch that the stator blades are clear of debris.
Reverse hydraulic cylinders and oil lines.	Check for oil leaks, especially if oil has been added to the reverse hydraulics system.
Steering system.	Check for oil leaks from the steering system, especially if oil has been added to the system. Check the freedom of movement of the steering cable. Check for security of attachment of the cable outer mount points.
Position indicator senders (transmitters).	Check for loose electrical connections and linkages if fitted on the system.
Thrust bearing housing.	Check for signs of water leaking from under the thrust bearing housing. (leaking water seal). If water seal is leaking it should be replaced as soon as possible otherwise water could contaminate the thrust bearing causing corrosion and failure of the thrust bearing.

8.6 Servicing Details

8.6.1 Jet Unit Servicing Details

Warning

Extreme care is required whenever the inspection cover is removed as water may enter the vessel through this opening.

Never leave the inspection cover removed without constant monitoring of the water levels.

Item no	Item	Operation
1	**Intake flow path.**	**Check for obstructions inside intake daily.** Remove inspection cover and check around the impeller and intake Screen for obstructions and debris. **Refer to Section** 2.9 "Blockages (Debris in the jet unit)".
2	**Thrust bearing.**	**Every 30 hours.** ***(or monthly if not run for 30 hours).*** Grease with a good quality lithium based ball bearing grease every 30 hours running. Refer: Drawing 85018 Recommendations for Lubricants and Oils Sht1  DO NOT OVER GREASE Use only 20ml grease Normal operating temperature is 50 - 55 ° C (120 - 130 ° F) but the bearing can operate up to 120 ºC satisfactorily, noting that most of the heat is generated by the seals. A faulty bearing will be indicated by noise and vibration rather than temperature.
3	**Marine water bearing.**	This is a water lubricated marine water bearing and requires no attention. **Do not run the jet unit out of water as this will damage the marine water bearing and the water seal**.
4	**Water seal.**	**Daily; Check for water leaks**. Visually check for water dripping from under the bearing housing. If water is found, the water seal is defective and should be replaced. ***The water seal should only be replaced if it is leaking, or there is insufficient material left to last to the next jet unit inspection.***

Item no	Item	Operation
5	**Anodes.**	Check the following: 1. **The bonding system:** For loose or corroded connections and test to ensure a low electrical resistance (Less than 0.2 Ohms). 2. **All sacrificial anodes:** Replace when 2/3 eroded. For vessels that are continually afloat, check the condition of external anodes every 3 months. Rapid anode consumption may indicate shore connection problems (see section 4-1 for more information on shore connections). The condition of the jet external anodes is indicative of the condition of the jet internal anodes (assuming anodes were all replaced at the same time) so if the external anodes require replacement (replace when or before they are 2/3 eroded) then the internal anodes should also be replaced. For trailer boats (and other vessels that are afloat only periodically) the anode consumption will be low because the anodes are immersed only periodically. For vessels operating in low salinity water (such as rivers and lakes) the anode consumption will be low due to the low electrical conductivity of the water. **Cleaning anodes** Anodes are typically all replaced at the vessels scheduled maintenance haul-out (typically annually). However if the vessel is only afloat periodically (e.g. trailer boats) or operates in low salinity water then anode consumption will be low. If it is expected that the anodes will be less than 2/3 eroded at the following maintenance haul-out, then the anodes may be cleaned rather than replaced. Clean the anodes as follows: Marine growth should be removed by water blasting. If a hard scale layer forms on the anodes then they should be cleaned using a coarse aluminium oxide sandpaper. Sand anodes by hand, orbital, or disc sander. Do not use a wire brush since this can cause metallic contamination of the anode, making it ineffective.

Item no	Item	Operation
6	**Steering system**	**Check integrity daily. A thorough check of the whole steering system is recommended every 30 hours of operation.** Check the whole steering system for freedom and range of movement. **If a severe jam-up or impact has occurred, all parts of the steering system should be examined for damage. This should include the following items on the jet unit.** 1. **Steering shaft:-** The steering shaft should be removed and checked for straightness, particularly at the crank end of the steering shaft. 2. **Tiller:-** Check that the tiller is not bent and that the steering shaft to tiller attachment bolts are secure. 3. **Steering crank and crank ball:-** Check that the crank is not bent or worn. Replace if damaged. The crank ball should be checked for excessive wear. 4. **Steering crank cotter:-** Check for security of attachment. Check that the tapered surface of the cotter has no indentations. Check for thread damage. Replace if deformed or damaged. 5. **Steering nozzle:-** Check that the steering arm on the top of the nozzle is not bent. ***Carry out a check of the " nozzle vertical end float adjustment", refer to Item 11, below.***
7	**Steering crank.**	**Grease every 3 months.** Check for security of attachment. Grease with water repellent grease.
8	**Steering shaft and bushes.**	**Grease every 3 months.** Lightly grease the steering shaft and bushes with a water repellent grease.Check the play in the steering shaft and bushes, it should be a running fit in the bushes with no binding.
9	**Steering cylinder and hoses.**	**Check after the first 5 hours and then monthly**. Check for leaks, damage or corrosion. Methodically check the steering cylinder and attached hoses for any signs of oil leaks, damage or corrosion of the fittings. Repair as necessary. ***Drawing*** "HJ27406000 Steering Assembly General Arrangement" ***refers.***
10	**Steering linkages.**	**Check integrity daily where possible**. ***(multi jet units only)***. Check that all linkages are secure and have a small amount of free play.
11	**Nozzle / nozzle housing.**	**Every 3 months.** Carry out a check of the "nozzle vertical end float adjustment". **Check and ensure that the end float between the nozzle and the nozzle housing is between 0.2 to 0.7 mm.** Measure between the outer shoulder of the steering pivot bush sleeve [11] and the inner face of the nozzle housing [9]. ***This should measure between 0.2 and 0.7 mm. Should the "nozzle vertical end float" require adjustment, refer to Section*** 9.5.1 "Nozzle Assembly Re-Fitting".
12	**Reverse cylinder shaft.**	**Grease the reverse cylinder shaft every 3 months.** Grease the reverse cylinder shaft with a water repellent grease through the nipple on the cylinder front head. ***Do Not pump if resistance is felt as this may force the wiper seal out of the cylinder retaining nut.*** **Refer to Section** 9.3.1 "Reverse Cylinder: Refit to the Jet Unit".

<table>
<tr><th>Item no</th><th>Item</th><th>Operation</th></tr>
<tr><td>14</td><td>Screen rake and bearings (if fitted).</td><td>Check for free operation every 3 months. Check the screen rake for security, damage or distortion and for freedom of operation. Check for any stiffness or binding which may be caused by seized bearings or debris caught in the screen. Grease bearings with water repellent grease.</td></tr>
<tr><td>15</td><td>Driveshaft universal joints.</td><td>Lubricate every 500 hrs. Or to suit the manufacturers recommendations.
Follow the manufacturers recommendations for type of driveshaft used.</td></tr>
<tr><td>16</td><td>Jet unit.</td><td>Carry out internal examination of the jet unit after the first 2000 hrs. operation and thereafter every 5000 hrs.
This examination should be carried out with the vessel out of the water.
The following checks should be carried out:-
a) Impeller blades - Check clearance.
• Remove the main inspection cover. Using feeler gauges, check the clearance between the tips of the impeller blades and the wear ring at each side of the impeller (not top and bottom).
<table><tr><th colspan="2">Impeller radial clearance</th><th></th></tr><tr><td>New min clearance</td><td>New max clearance</td><td>Max wear</td></tr><tr><td>0.45</td><td>0.80</td><td>1.12</td></tr></table>
b) Impeller - Check for wear and damage.
• Look for signs of corrosion and erosion damage on all surfaces of the impeller.
• Check the impeller leading and trailing edges for damage.</td></tr>
</table>

Item no	Item	Operation
16 (cont'd)	**Jet unit. (Cont'd)**	**c) Marine water bearing - Inspect.** • Inspect the marine water bearing for scoring or localised wear. • Replace if excessively worn. To check for wear, push the mainshaft hard from side to side. Check total sideways movement at impeller tips. This indicates the amount of wear in the rubber bearing and shaft sleeve. These items are to be removed in accordance with **Section** 9.8.8 "Tailpipe Area: Re-Assembly" of this manual.

Water bearing diametrical clearance		
New min clearance	New max clearance	Max wear limit
0.05	0.35	0.6

d) Check the water drain hole in the tailpipe cone for blockage. Ensure that the drain hole is not blocked.

e) Steering linkages - disconnect.

- These items are to be removed in accordance with **Section 9 Overhaul** of the controls manual.

f) Tailpipe, nozzle & nozzle housing - removal.

- These items are to be removed in accordance with **Section** 9.4 "Steering Assembly Removal and Overhaul" in this manual.

g)Jet unit paintwork.

- The main body of the jet unit is constructed from silicon-aluminium allow (LM6) which is resistant to corrosion from salt water.
- The castings are finished in a polyurethane paint. Periodic cleaning down, wire-brushing and repainting may be necessary depending on water conditions prevailing, and extent of use.
- When the vessel is on the slip, preferably annually, the complete jet unit should be inspected internally and externally for faults, corrosion, or breakage's. Clean down and repaint the castings where necessary.

h)Refit components.

- Refit components in accordance with the overhaul section of this manual. **Follow the recommendations on Drawing** "85018 Recommendations for Lubricants and Oils Sht1" **for bearing housing lubricants and hydraulic fluids. Refer to Drawing** "85113 Threaded Fastener Tightening Torques" **for thread tightening torques. Refer to Appendix** A-2 "Loctite Application Guide" **for information on thread and joint locking.**

i)Insulation checks (steel hulls only).

- Carry out insulation checks as per **Section** 4.3.2 "Checking the Insulation" on a monthly basis.

ANTI FOULING PAINTS

Do not use copper oxide based anti-fouling paints. Do not paint over the anodes.

ANTI-SEIZE COMPOUNDS

Do not use anti-seize compounds which are based on graphite, nickel or copper flakes - these will cause corrosion. Anti-seize compounds, usually containing zinc flakes, are available for aluminium.

If excessive wear or damage has been found, then undertake appropriate overhaul as described in **Section** Section 9 "Overhaul". Schedule the next maintenance period to suit the conditions found during this inspection, using the following guidelines:

1. Decrease the time between each maintenance interval the if amount of dirt and sand in the water increases.
2. Increase the time between each maintenance interval if amount of dirt and sand in water decreases.
3. Decrease interval if excessive wear was found in the jet unit internal inspection, refer to Section 8.6.1 "Jet Unit Servicing Details", **Item 16**.
4. Increase interval if minimal wear was found at the jet unit internal inspection, refer to Section 8.6.1 "Jet Unit Servicing Details", **Item 16**.

8.6.2 Reverse Hydraulic Controls Servicing Details

ITEM NO	ITEM	OPERATION
1	**Hydraulic oil pump check**	Daily; Unscrew the filler cap on the top of the pump reservoir (The filler cap is fitted with an integral dipstick) and check the oil level. Insert a funnel and top up the reservoir with oil to the 'MAX' dipstick mark, with an approved oil. Refer to Drawing "85018 Recommendations for Lubricants and Oils Sht1". Should the oil show signs of discoloration, contamination or degradation, the oil should be changed.
2	**Reverse system hydraulic oil replacement**	**Change the oil every 1000 hrs (oil changes may be varied to suit operating conditions).** **To change the oil, carry out the following procedure:** 1. Place a suitably sized container beneath the tank. 2. Disconnect the jubilee clip [H4] securing the hose [H3] from the Jet mounted oil cooler to the pump. 3. Remove the hose [H3] from the pump and allow the oil to drain from both the pump oil tank and the oil cooler, into the collection container. 4. Once the oil has drained out, refit the hose [H3] to the pump and tighten the jubilee clip [H4]. ***Refer to Section*** 8.6.2 "Reverse Hydraulic Controls Servicing Details" also r***efer to*** Figure 1: "Hose Connection Schematic"**.**

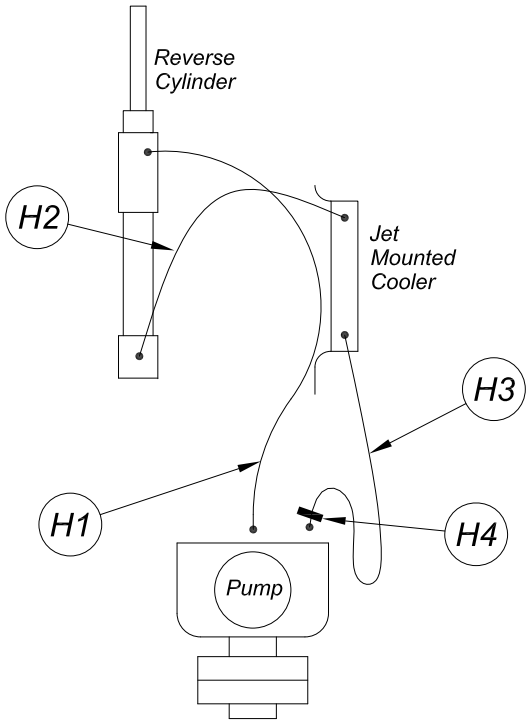


Figure 1: Hose Connection Schematic

ITEM NO	ITEM	OPERATION
3	**Filling the reverse system with oil**	**The reverse system is factory tested and delivered completely assembled and filled with oil. *The system oil capacity is approximately 0.9 litres of oil*.**

After completion of maintenance on the HSRX system and when the Jet and Pump are first run, the oil level will drop rapidly in the Reservoir. To avoid the Pump running dry the system should be filled as full as possible before the Jet and Pump are run.

1. Refer to Section 8.9 "Recommended Oils and Lubricants".
2. All oil should be filtered to prevent the ingress of contaminants.
3. When the jet and pump are first run the oil level will drop rapidly in the reservoir. To avoid the pump running dry, the system should be filled as full as possible before the jet and pump are run.

ITEM NO	ITEM	OPERATION
3 (Cont)	**Filling the reverse system with oil (Cont)**	**Fill the oil cooler:** **Refer to Hose Connection Schematic shown in *Section* 8.6.2 "Reverse Hydraulic Controls Servicing Details" and Figure 1: "Hose Connection Schematic".** Ensure that the pump is empty of oil. 1. Disconnect the reverse cylinder to cooler return Hose [H2] AT THE COOLER return port end. 2. Disconnect the feed hose [H3] to the oil cooler AT THE PUMP and ensure the free end remains higher than the cooler return port. 3. Place a funnel in the cooler return port and, ensuring air can escape, fill the cooler. 4. Reconnect the hoses [H2] and [H3] to the pump and cooler keeping the system as full of oil as possible. **Fill the oil pump reservoir:** Unscrew the filler cap on the top of the pump reservoir. (The filler cap is fitted with an integral dipstick). Insert a funnel and fill the reservoir with oil to the 'MAX' dipstick mark. The JHPU should now be run to purge air from the system. **It is important that this is carried out as shown in Section 8.6.2 "Reverse Hydraulic Controls Servicing Details".**
4	**Purging the reverse system**	**Whenever maintenance activities have been carried out on the reverse hydraulics, air will be trapped within the system, it is necessary to purge the system. It is important that the following actions are carried out to prevent running the oil pump dry:-** **On engine start-up::** With the engines set to idle and the vessel securely moored in deep water. 1. Have someone monitoring the reservoir and refill as required. 2. Idle the engine at the lowest possible RPM. 3. Run the pump for 5 minutes approximately without moving the controls - this will purge air from the oil cooler. Refill the oil reservoir. 4. Start the engine, operate the controls to stroke each cylinder at least 10 times. This should purge any remaining air out of the system. 5. Top up the pump reservoir. 6. Check the system to ensure that it is not overheating. It should be possible to hold your hand on any component for at least 2-3 seconds.

ITEM NO	ITEM	OPERATION
5	**Pump drive belts**	**Check the belt tension monthly.** **Refer to Drawing** "CTHPU01002 JHPU HSRX (Saginaw Pump) HJ-273 & HJ-274 Jets". .

Over tensioned v-belts will cause reduced pump and jet unit bearing life.

Note:

1. Belt adjustment should be carried out without the engines running.
2. If a new belt has been fitted, the belt tension should be checked and re-tensioned as required over a period of 24 to 48 hours "running-In" period to allow for belt settling.
3. After the initial settling in period, the belt should be checked on a monthly basis and re-tensioned as required.

To check the v-belt tension:

The belt tension is correct when a 2.4 mm deflection is achieved when a load of 580 to 870 gr (1.3 to 1.9 lbs) is applied to the centre of the belt.

To adjust the v-belt tension:

To adjust the belt tension carry out the following procedure:-

1. Slacken the nut [8] at the elongated slot end of the adjusting link [4].
2. Slacken the nut [8] at the opposite end of the adjusting link [4].
3. Slacken the screw [9] attaching the support bracket [3] to the base of the pump.
4. Tension the belt by levering the pump body away from the Intake to achieve the tension required above.
5. Tighten the nut [8] at the elongated slot end of the adjusting link [4], which secures the pump [1] to the adjusting link [4] and torque load.
6. Tighten the nut [8] at the opposite end of the adjusting link [4], which secures the adjusting link [4] to the bearing housing and torque load to the recommended torque.
7. Tighten the screw [9] attaching the support bracket [3] to the base of the pump and torque load to the recommended torque.

ITEM NO	ITEM	OPERATION
5 (cont)	**Pump drive belts (cont)**	**To check the v-belt condition:** Mark or note a point on the belt. Work your way around the belt, checking for cracks, frayed spots, cuts or unusual wear patterns. Check the belt for excessive heat. While the belt does get hot during operation, if it is too hot to touch, the cause of the overheating should be investigated. The hand can tolerate up to about 60°C (140°F), the maximum temperature at which a properly maintained belt should operate. The belt should be replaced if there are obvious signs of cracking, fraying or unusual wear.

If excessive wear or damage has been found in the controls system, undertake appropriate overhaul as described in *Section* Section 9 "Overhaul". Schedule the next maintenance period to suit the conditions found during this inspection, using the following guidelines:

- Decrease interval between maintenance periods if excessive wear was found during inspection of the controls system.
- Increase the interval between maintenance periods if minimal wear was found during inspection of the controls system.

8.7 Tools

8.7.1 Standard Recommended Tools

The following tools are required for normal maintenance activities:

1. Torque wrench. ¾"sq/dr.
2. Torque wrench. ½" sq/dr.
3. Ratchet, torque bar and short extn ½" sq/dr.
4. Sockets A/F ½" sq/dr, 13 mm, 19 mm, 24 mm.
5. Spanners A/F. 1 x 9 mm, 2 x 17 mm, 1 x 24 mm.
6. Allen Keys 1 x 6 mm and 1 x 8 mm.
7. Pliers long nose.
8. Screw driver large, flat blade.
9. Mallet, rubber.

8.7.2 Special Tools

Refer to Drawing "HJ27411000 Tool Kits".

8.8 Threaded Fasteners

Refer to Drawing "85113 Threaded Fastener Tightening Torques" and also Appendix A-2 "Loctite Application Guide" **for information on thread and joint locking.**

TIGHTENING TORQUES:
Ensure that all threaded fasteners are tightened to the correct torque as described in drawing 85113 or the relevant assembly drawings.

Tightening torques for threaded fasteners:

1. The tightening torques for standard fasteners are given on the drawing referenced at the start of this section.
2. The tightening torques for special fasteners are shown on the relevant drawings.
3. Ensure that recommended tightening torques are always used.

Thread locking agents

Most fasteners require thread locking agents to prevent loosening.

1. most applications are described in appendix A-2 "Loctite Application Guide".
2. Special applications will be shown on the relevant assembly drawing.

8.9 Recommended Oils and Lubricants

Recommended oils and lubricants required are specified on drawing "85018 Recommendations for Lubricants and Oils Sht1" in this manual.

Note: Do not use brake fluid or heavier viscosity oils.

Recommended hydraulic oils:
A mineral base hydraulic oil is recommended which contains anti-wear additives of a type that are active under boundary lubrication conditions at low temperatures. Oil viscosity should be 20cS approximately at 40°C and 4cS at 100°C. Normal operating temperature should lie between +30°C and +60°C.
For recommended oils, refer to the drawing referred to above:

Note: Any hydraulic fluids meeting "General Motors Power Steering Specifications" are suitable.

Table 7: Other Lubricants

Type	Equivalent
B.P. Energrease MM EP2.	or similar.
Anti Sieze Compound.	Rocl, YIGG, Jet-Lube, Nikal or similar.

ANTI-SEIZE COMPOUNDS
Do not use anti-seize compounds which are based on graphite, nickel or copper flakes - these will cause corrosion. Anti-seize compounds, usually containing zinc flakes, are available for aluminium.

Section 9
Overhaul

Note: The maintenance operations detailed in this section should be carried out when the vessel is on a slip or in dry dock.

Overhaul of the jet unit should only be carried out after an examination indicates the need for an overhaul. **Refer to Section** Section 8 "Maintenance" for details of how to examine the jet unit and controls system.

The following overhaul procedures can be carried out on this jet unit:

1. Reverse assembly overhaul. ***Sect "9.2"***.
2. Reverse cylinder overhaul. ***Sect "9.2.4".***
3. Steering assembly overhaul. ***Sect "9.4".***
4. Tailpipe area overhaul. ***Sect "9.7".***
5. Bearing housing area overhaul. ***Sect "9.6".***
6. HSRX hydraulic reverse system overhaul. ***Sect "9.11".***

Prior to commencement of overhaul:

Disconnect and remove all control equipment attached to components being overhauled. This prevents damage to the less robust control equipment.

Take care to identify electrical or hydraulic connectors so they can be correctly replaced.

Cover all connectors to prevent entry of dirt or loss of hydraulic oil.

Overhaul procedure:

The following procedure describes the main activities when carrying out a complete overhaul, but can be used to plan any other type of overhaul.

1. Overhaul the driveshaft (not described) (Refer to the manufacturers manual).
2. Overhaul the reverse assembly.
3. Overhaul the steering assembly.
4. Overhaul and refit the bearing housing area of jet unit.
5. Overhaul and refit the tailpipe area of jet unit.
6. Overhaul and refit the transom plate.
7. Refit the steering assembly.
8. Refit the reverse assembly.
9. Refit the driveshaft (not described).
10. Removal of the HSRX pump assembly from the jet unit.
11. Refit the HSRX pump assembly to the jet unit.

On completion of overhaul
Perform the appropriate commissioning of the jet unit as described in this jet unit manual **Section** Section 6 "Commissioning".

Commissioning the jet unit and controls system.
It is important that a commissioning of the vessel be carried out on completion of an overhaul activity as adjustments and connections may have been altered during the overhaul operation.

Tools
All tools required for the overhaul of the jet unit are shown on **Drawing** "HJ27411000 Tool Kits" and Section 8.7 "Tools" in this Manual.

9.1 General Information

Care of jet unit paintwork
All castings on the jet unit are of silicon-aluminium alloy (LM6) which exhibits good resistance to salt water corrosion.


CAUTION

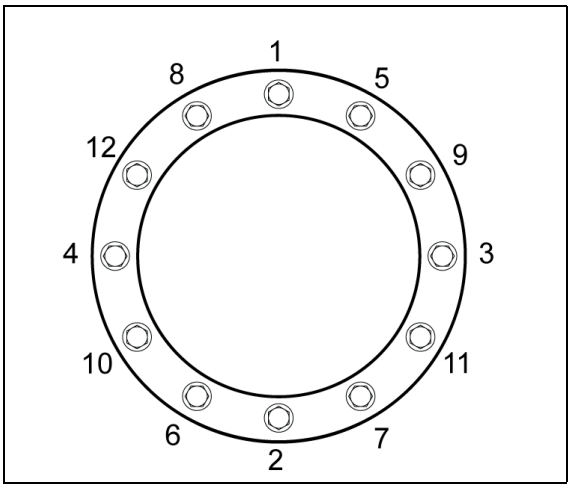
Anti Fouling Paints
Do not use copper oxide based anti-fouling paints. Do not paint over the anodes.


CAUTION

Anti-Seize compounds
Do not use anti-seize compounds which are based on graphite, nickel or copper flakes - these will cause corrosion. Anti-seize compounds, usually containing zinc flakes, are available for aluminium.

Anodes
Leave all anodes unpainted.

9.1.1 Torquing Sequence of Nuts



Flange nuts must be tightened in the correct sequence so that the flange pulls up square.
Where no specific sequence is given in the manual, do the following:

- Fit 4 nuts (top, bottom, left side, right side) and tighten each 1 turn at a time until the flanges pull together.
- Fit all remaining nuts and hand tighten only.
- Working around the flange, in a crosswise sequence as shown, Tighten nuts to the specified torque.
- Repeat the above torquing sequence until no further movement of the nut occurs.

9.2 Reverse Assembly Removal and Overhaul

Note: The maintenance operations detailed in this section should be carried out when the vessel is slipped.

For fault finding with the reverse system, refer to section 7.2 Reverse System Faults" in this manual.

For the overhaul of the reverse cylinders refer to section 9.2.4 "Reverse Cylinder Overhaul" in this manual.

9.2.1 Reverse Duct Removal

Refer to Drawing "HJ27407011 Reverse Assembly" / "HJ27407011 Reverse Assembly Sht 2".

1. Disconnect any sensors attached to the reverse cylinder. **Refer to the overhaul section of the controls manual supplied with this jet unit.**
2. If the reverse cylinder is to be removed, then slacken the retaining nut [12].
3. Whilst supporting the reverse duct with suitable approved lifting equipment and a lifting sling attached to the reverse duct, disconnect the reverse cylinder from the reverse duct [1] by removing the split pin [44] from the hydraulic cylinder connecting pin [43].
4. Take the weight of the reverse duct and withdraw the hydraulic cylinder connecting pin [43].
5. Move the reverse duct through its full range of movement to check for stiffness or wear in the reverse duct shouldered bushes [4].
6. Lower the reverse duct.
7. While supporting the reverse duct, remove the reverse duct pivot pins [3] and poly washers [5].
8. Remove the reverse duct, taking care not to damage the reverse duct shouldered bushes [4].

9.2.2 Reverse Duct Overhaul

Refer to Drawing "HJ27407011 Reverse Assembly" / "HJ27407011 Reverse Assembly Sht 2".

If the reverse duct shouldered bushes [4] and special poly washers [5], fitted in the reverse duct arms, are worn or damaged, these should be replaced.

Replacing the reverse duct shouldered bushes [4]:

1. Prior to re-fitting the reverse duct, the reverse duct shouldered bushes [4] and special poly washers [5] should be checked and replaced if required.
2. The shouldered bush [4] is normally a loose fit over the pivot pins [3] and should be round (not oval) to within approx 0.5 mm.
3. Check that the threads on the reverse duct pivot pins [3] are free from burrs.
4. If replacing the shouldered bushes [4] carry out the following actions:-
   a) The bore in the reverse duct arms must be cleaned of paint and corrosion deposits and painted with a vinyl etch primer.
   b) When the paint is dry, coat the bore of the reverse duct arms and the outer surfaces of the bushes [4] with a smear of marine grease.
   c) Press the new bushes into the reverse duct arms. Wipe off any surplus grease.
5. Should the reverse duct threaded bush [2] require replacement, **refer to section** 9.8.2 "Tailpipe Area - Dismantling".

Replacing the reverse cylinder attachment pin bushes [45]:

If replacing the shouldered bushes [45] carry out the following actions:-

1. With the reverse duct disconnected from the reverse cylinder piston shaft, press out the bushes [45] from the reverse duct. It may be necessary to apply light heat to the reverse duct arm in the area of the bushes [45] to break the loctite seal.
2. Clean out the bore in the reverse duct attachment point of old Loctite, paint and corrosion deposits and repair the paint finish as required.
3. Coat the outer surfaces of the bushes [45] with Loctite Activator 7075 and allow to dry. ***Do NOT apply Activator to the bore of the reverse duct attachment point.***

Note: Loctite Activator 7075 must be used to refit the shouldered bushes [45] otherwise the Loctite 325 will not cure and retain the bushes in position.

4. Apply Loctite 325 to the outer surfaces of the bushes [45] and the bore of the reverse duct attachment point.

Note: There are to be NO dry areas between the shouldered bush and the bore of the reverse duct attachment point once the shouldered bush is fitted.

5. From inside the attachment point, press the new bushes into the reverse duct arms and rotate to distribute the Loctite evenly over the surfaces.
6. Wipe off any excess loctite from around the shouldered bushes.

Replacing the reverse duct anodes [6]:

Refer to drawing "HJ27413002 anode Location". Visually check the 2 anodes [6] attached to the rear of the reverse duct arms. If these anodes are less than half of their original size, they should be replaced. To replace carry out the folowing actions :-

1. Remove the nuts [9] and spring washers [8] from studs [7] securing the anodes [6] to the to the reverse duct arms.
2. Remove anodes [6] from the reverse duct arms.
3. The mating surfaces of the anode / reverse duct arms should be scraped clean to ensure a good electrical contact.
4. Apply Loctite 263 to the threads of studs [7].
5. Fit new anodes [6] and attach to the studs [7] with nuts [9] and spring washers [8].
6. Torque load to the recommended torque.
7. Carry out Items 1 to 5 above for the second anode replacement.

9.2.3 Reverse Cylinder Removal

Refer to Drawing "HJ-274-07-011 Reverse Assembly. Sht 1" and "HJ-274-07-011 Reverse Assembly. Sht 2".

The reverse cylinder need only be dismantled if it is suspected that a seal has failed and hydraulic oil is found leaking from either end of the cylinder. This indicates that the piston rod or spool seals are defective and must be replaced.

1. With the reverse duct disconnected from the reverse cylinder, disconnect and fit blanking plugs to the hydraulic hoses attached to the reverse cylinder.
2. Disconnect the morse ball joint [42] from the HSRX handle [26].
3. Slacken the nuts [41] and screws [40] securing the morse cable to the cable clamp [49] and remove the morse cable from the clamp.
4. **From outside the vessel;** Unscrew and remove the reverse cylinder retaining nut [12] from the reverse cylinder fronthead extension [55] and remove off the reverse cylinder shaft [24].
5. Unscrew and remove the external hemispherical seat [51], rubber boot [52] and the hemispherical mount HSRX [53] from the reverse cylinder fronthead extension [55] and remove off the reverse cylinder shaft [24].
6. **From inside the vessel;** The reverse cylinder can now be removed from the transom by pushing the cylinder forwards into the vessel. Ensure that the Internal hemispherical mount HSRX [54] is removed from between the cylinder and the intake flange.
7. Refit the external hemispherical seat [51] with the rubber boot [52] and the hemispherical mount HSRX [53] and loosely secure to the reverse cylinder fronthead [11].
8. Refit the retaining nut [12] loosely to the reverse cylinder fronthead [11].
9. The reverse cylinder can now be removed from the vessel for further maintenance.

9.2.4 Reverse Cylinder Overhaul

Refer to Drawing "HJ-274-07-011 Reverse Assembly. Sht 1" and "HJ-274-07-011 Reverse Assembly. Sht 2".

Dismantling the reverse cylinder assembly:

The reverse cylinder need only be dismantled if it is suspected that a seal has failed and hydraulic oil is found leaking from either end of the cylinder. This indicates that the piston rod or spool seals are defective and must be replaced.

Note:

1. This operation should be carried out in a clean workshop environment where the cleanliness of components can be maintained.
2. All marine growth must be removed from the reverse cylinder shaft using Scotchbrite or 800 and 1200 Grit water paper prior to dismantling the reverse cylinder.

1. Slacken the set screw [27] securing the HSRX handle [26] in position and remove the handle from the spool.
2. Remove the v-ring [29] from the end of the spool. **Note the correct orientation of the v-ring [29] so that the v-ring is correctly re-fitted.**
3. Unscrew and remove the knurled nut from the top of the pressure relief valve and remove the pressure relief valve Cover [18] surrounding the pressure relief valve [20].
4. Unscrew and remove the pressure relief valve [20] from the reverse cylinder backhead [19].
5. The nipple [16] fitted to the reverse cylinder fronthead [11] and backhead [19] can be left fitted unless the bonded seals [17] are leaking or the hydraulic nipples [16] require replacing.
6. Remove the M6 nuts [33] and spring washers [32] securing the cable mount plate [39] to the backhead and remove the cable mount plate.
7. Withdraw the backhead [19] from the reverse cylinder [23]. The bearing [30] and spool [25] may also be withdrawn with the backhead.

8. The bearing [30] may be removed from the backhead [19].
9. Remove the cylinder [23] from the fronthead [11].
10. Withdraw the reverse cylinder shaft assembly [24] from the fronthead [11].

Note: The reverse cylinder shaft assembly is not to be dismantled further and should only be replaced as a complete item.

11. Slide the reverse cylinder fronthead [11] off the 4 x threaded reverse cylinder tie rods [31] fitted to the fronthead extension [55].
12. Check the stop pin [28] fitted to the backhead [19], for damage, wear and security of fitment. This pin does not need to be removed unless worn, loose or damaged.
13. Using a sharp spike or scriber, remove and discard all o-rings and seals. Take care not to damage the seal housing.
14. Thoroughly clean and inspect all components for wear and damage and replace as required.
    a) The spool shaft where the Viton shaft o-ring [24] contacts, should be free of any damage and measure no less than ø11.90 mm.
    b) The seal bore in the backhead [22] should measure no more than ø20.033 mm on MK2 cylinders.
    c) The shaft [10] should measure no less than ø19.93 mm.
    d) Cylinder bore should be no more than ø32.00 mm.

Note: Recommendations regarding use and fitting of seals:

- Ensure that all metallic particles and other contaminants have been removed from the component into which the seal is being fitted.
- Ensure that the hydraulic system to which components are fitted is free from metallic particles or other contaminants.
- Check that the seal housing is free from damage likely to harm the seal. Remove all sharp edges and burrs from metal parts paying particular attention to ports, grooves and threads over or through which the seal must pass during assembly.
- Clean all seal housing areas. Check that other surfaces adjacent to the passage of the seal on fitting are free of dirt, swarf or other contaminants.
- Where the difference between a thread diameter over which as seal must pass and the seal diameter is small, use some form of protection over the thread, such as a fitting sleeve made of hard plastic.
- Ensure that the seal has not been stored so that it has been distorted. Store seals in a cool, dry and dark place.
- Liberally smear the seal and metal component with a clean fluid of the appropriate type, or a compatible grease, before fitting the seal.
- Where seals, fitted to sub-assemblies such as pistons, are awaiting further fitting operations, ensure that the seals are not subjected to any misaligned or localised loading which will cause local deformation. Ensure sub-assemblies remain clean.
- The use of metal levers is not recommended, but should they be used, it is imperative that they are completely smooth and free from nicks and burrs. When using them, ensure that the metal surfaces adjacent to the seal are not damaged.

Re-assembly of the reverse cylinder:

Refer to Drawing "HJ-274-07-011 Reverse Assembly. Sht 1" and "HJ-274-07-011 Reverse Assembly. Sht 2".

Recommended oils and greases to be used for assembly of the H.S.R.X. reverse assembly.

- A. BP Energrease MM EP2 or equivalent.
- B. Mineral based oil such as recommended hydraulic oil. Refer to Drawing "85018 Recommendation for Lubricants & Oils".
- C. Non seize compound. (Rocl YIGG, Jet-Lube, Nikal, etc.).

1. Grease the new oil seals [36] and fit to the fronthead [11] and fronthead extension [55], ensuring that the seals are correctly orientated ***as shown in the*** Figure 1: "Fronthead/Extension Oil Seal [36] Fitting" ***below***.

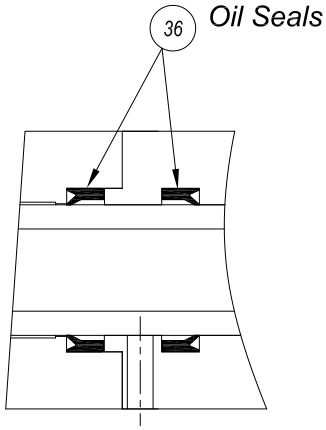


Figure 2: Fronthead/Extension Oil Seal [36] Fitting

2. If the stop pin [28] has been removed from the backhead [19], apply 7471 Primer T Activator to one end of the stop pin and allow to dry. Apply Loctite 680 to the same end of the stop pin and fit the stop pin to the backhead [19].
3. Grease and fit a new o-ring [56] to the o-ring groove on the front of the HSRX fronthead [11].
4. Fit the HSRX fronthead [11] onto the 4 x threaded reverse cylinder tie rods [31] fitted to the fronthead extension [55], ensuring that the hydraulic nipple [16] is correctly orientated to the anti-rotation slot in the fronhead [11], as shown in the Figure 2: "Fronthead Orientation".

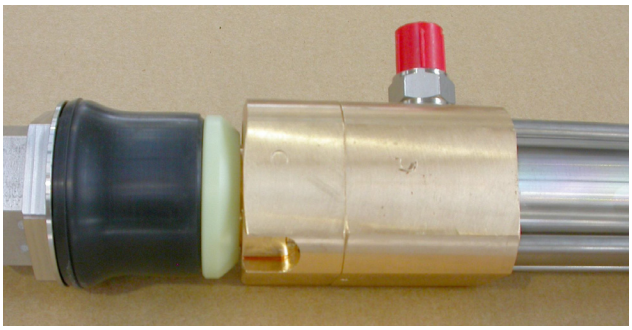


Figure 3: Fronthead Orientation

5. Grease and fit a new piston seal [34] to the reverse cylinder shaft assembl.

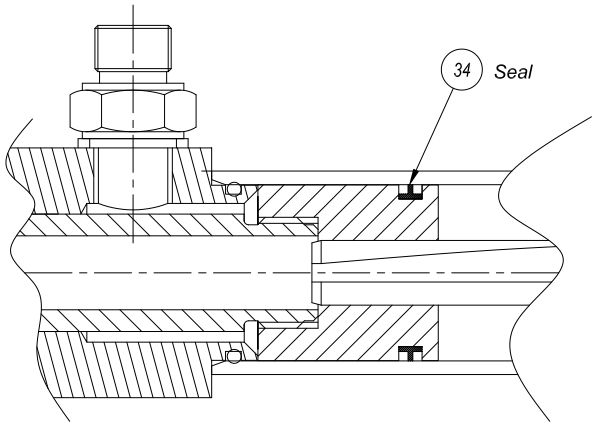
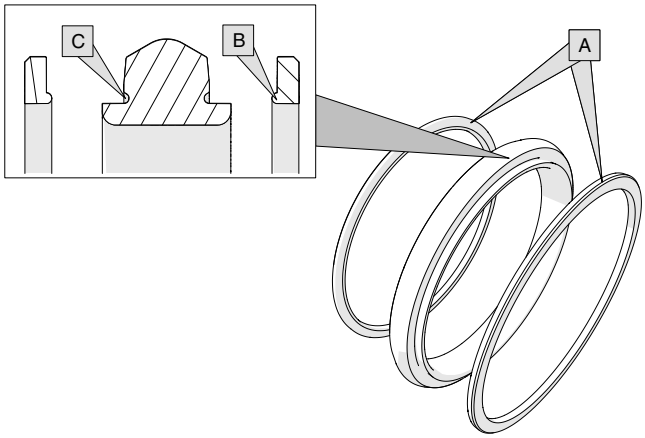


Figure 4: HSRX Piston Seal [34] Fitting



When fitting the three part piston seal, it is important that the two anti-extrusion rings [A] are fitted the correct way round.
The locating barb on the anti-extrusion ring [B] must fit into the groove on the sealing ring [C].

6. Lubricate the shaft assembly [24] using a mineral based oil such as the hydraulic oils shown in **Drawing** "85018 Recommendation for Lubricants & Oils" and carefully fit the shaft assembly through the fronthead [11] and fronthead extension [55].
7. Grease both outside ends of the cylinder [23].

Note: The cylinder [23] has a chamfered inner bore at one end of the cylinder and a seal recess at the other end. Note that it is critical that the chamfered end of the cylinder is fitted towards the fronthead [11] to prevent damage to o-ring [56] when fitting the cylinder [23] to the fronthead [11].

8. Push fit the chamfered end of the cylinder over the piston and into the fronthead [11].
9. Grease a new o-ring [37] and fit to the backhead [19] ***as shown in*** Figure 4: "Backhead Seal Fitting" ***on the following page***.
10. Grease a new o-ring [46] and o-ring [38] and fit to the backhead [19].
11. Lubricate the bearing [30] using a mineral based oil such as recommended in **Drawing** "85018 Recommendation for Lubricants & Oils" and fit to the spool [25].
12. Fit the bearing [30] with spool [25] to the backhead [19], taking care not to disturb or damage the o-ring [37] fitted to the backhead.
13. Whilst supporting the spool [25] already fitted to the backhead, fit the backhead and spool into the cylinder and over the 4 x threaded reverse cylinder tie rods [31], ensuring that the spool [25] passes through the centre of the reverse cylinder shaft [24]. Ensure that both hydraulic nipples [16] are aligned.
14. Assemble the cable mounting plate [39] to the tie rods [31] fitted to the backhead, ensuring that the cable mounting plate is correctly orientated for either left hand or right hand cable fit.
15. Secure hand tight to the studs [31] with spring washers [32] and nuts [33].

Note: Ensure that the cable mounting plate [39] is correctly orientated for either left hand or right hand cable fit. Refer to Section 0.1.2 "Reverse Duct: Refit to the Jet Unit" Sub-Section "Re-positioning the cable mount plate:".

16. Fit the washers [32] and nuts [33] to the tie rods [31]. Progressively torque load the nuts [33] to the recommended torque.
17. Fit the v-ring [29] to the spool at the backhead end of the reverse cylinder.

Note: Note the correct orientation of the v-ring [29] so that the v-ring is correctly re-fitted. as shown in the Figure 4: "Backhead Seal Fitting" below.

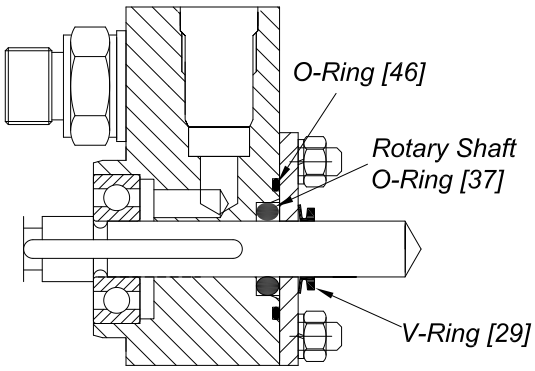


Figure 5: Backhead Seal Fitting

18. Fit the HSRX handle [26] to the outer end of the spool [25].
19. Fit the set screw [27] to the HSRX handle using Loctite 262 and tighten to secure the handle, ensuring that the set screw locates in the dimple in the spool [25].
20. Ensure that the spool rotates freely.
21. Fit the pressure relief valve [20] to the backhead [19] ensuring that the o-ring is fitted around the base of the relief valve.
22. Fit the protective cover over the relief valve ensuring that the base of the cover fits correctly over the o-ring at the base of the relief valve.
23. Fit the knurled nut to the top of the protective cover and screw the knurled nut onto the threaded part of the pressure relief valve until the o-ring on the underside of the knurled nut sits snugly inside the top of the protective cover.
24. If the hydraulic nipples [16] fitted to the fronthead [11] and backhead [19] have been removed during overhaul, refit with new bonded seals [17] and tighten.
25. Grease a new bearing ring [57] and fit to the retaining nut [12].
26. Grease a new wiper seal [35] and fit to the retaining nut [12] ***noting the orientation of the wiper seal as shown in the*** Figure 5: "Retaining Nut Wiper Seal [35] Fitting" ***below***.

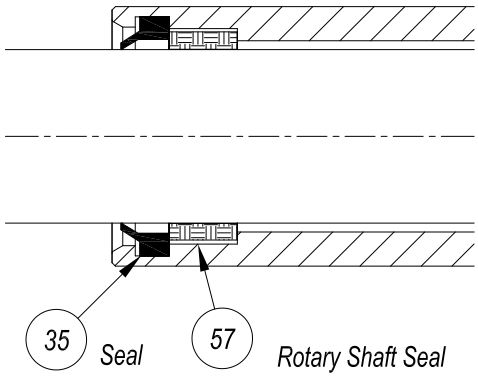


Figure 6: Retaining Nut Wiper Seal [35] Fitting

27.Lubricate the internal hemispherical mount [54] with silicone grease (e.g. Molycote Silicone o-ring lubricant) and refit to the backhead extension [55].

Note: Mineral oil based grease may damage the Neoprene rubber boot [52].

28.Lubricate the external hemispherical mount [53] with silicone grease (e.g. Molycote Silicone o-ring lubricant) and refit to the hemispherical seat [51].

29.Lubricate a new rubber boot [52] and fit over the hemispherical seat [51] and external hemispherical mount [53].

30.Refit the hemispherical seat [51] to the fronthead extension [55] with the external hemispherical mount [53] and rubber boot [52] fitted and tighten up far enough to allow the retaining nut [12] to be fitted.

31.Refit the retaining nut [12] to the fronthead extension [55] hand tight only.

32.The HSRX reverse cylinder can now be re-fitted to the jet unit.

Note: When re-fitting the reverse cylinder to the jet unit, the chamfer on the reverse shaft assembly should face downwards otherwise the reverse cylinder shaft will not connect to the reverse duct.

9.3 Reverse Assembly Re-Fitting

9.3.1 Reverse Cylinder: Refit to the Jet Unit

Refer to Drawing "HJ-274-07-011 Reverse Assembly. Sht 1" and "HJ-274-07-011 Reverse Assembly. Sht 2".

1. Remove the retaining nut [12] from the reverse cylinder fronthead [11].
2. Ensure that a new wiper seal [35] and wear ring [57] have been fitted to the retaining nut [12].
3. Remove the hemispherical seat [51] complete with rubber boot [52] and external hemispherical mount [53] from the reverse cylinder fronthead [11].
4. Ensure that a new rubber boot [52] has been fitted to the hemispherical seat [51].
5. Lightly smear the hemispherical mount [54] with silicone grease (e.g. Molycote Silicone o-ring lubricant) and fit into the cupped recess in the rear of the fronthead extension [55].
6. **From inside the vessel;** Pass the reverse cylinder through the intake flange (transom) until the flat side of the hemispherical mount [54] is firmly up against the shoulder on the intake flange and the slot in the fronthead locates around capscrew [10] fitted to the intake flange.
7. Remove the rubber boot [52] from the external hemispherical seat [51] and lightly smear the hemispherical mount [53] with silicone grease (e.g. Molycote Silicone o-ring lubricant) and fit into the cupped recess in the front of the hemispherical seat [51].
8. Refit the rubber boot [52] over the hemispherical mount [53] and onto the external hemispherical seat [51].
9. **From outside the vessel;** Fit the external hemispherical seat [51] complete with the external hemispherical seat [51] and rubber boot [52] over the reverse cylinder shaft [24].
10. Fit the retaining nut [12] over the reverse cylinder shaft [24].
11. Connect the reverse cylinder shaft [24] to the reverse cylinder using the connecting pin [43] in order to support the reverse cylinder then torque load the retaining nut as follows:-
12. Tighten the external hemispherical seat [51] onto the fronthead extension [55] **by hand to take up clearance in the spherical joint, then tighten a further 1/2 a turn.**

Note: Over torqueing of the external hemispherical seal [51] will cause damage to the rubber boot [52] and hemispherical mount [53].

13. Apply Loctite 243 to the threads of the fronthead extension [55].
14. ..Hold the hemispherical seat [51] using a suitable spanner and ***tighten the retaining nut [12] to 40Nm (30ft/lbs).***

15.Connect the hydraulic hoses to the reverse cylinder.

9.3.2 Reverse Duct: Refit to the Jet Unit

Refer to Drawing "HJ-274-07-011 Reverse Assembly. Sht 1" and "HJ-274-07-011 Reverse Assembly. Sht 2".

Reverse duct:

1. Examine the shouldered pivot bushes [4] and the threaded bushes [5] for wear and damage and replace if required.
2. Ensure that the thread and surfaces of the pivot pins [3] and the bushes [2] and [4] are clean.
3. Coat threads, bushes, and washers [3] with a recommended marine grease.
4. Ensure that the shouldered pivot pin bushes [4] in the reverse duct arms are secure and that the bushes are fitted with the shoulder on the inside of the reverse duct arm.
5. Position the reverse duct so that the pivot pin bushes [4] in the reverse duct arms are aligned with the threaded holes in the tailpipe.
6. Fit flat washers [5] to each of the pivot pins [3] prior to fitting the pins to reverse duct arms.
7. Insert the pivot pins [3] ensuring that the bushes [4] and washers [5] are correctly located.
8. Tighten the pivot pins [3] to the recommedned torque. **Torque load to 400 Nm (295 lbs/ft). Section** 8.7 "Threaded Fasteners" refers.
9. Raise and support the reverse duct and align the reverse shaft [24] with the attachment point on the reverse duct.

Note: The chamfer on the reverse shaft [24] should face downwards otherwise the reverse cylinder shaft will not connect to the reverse duct.

10. Fit the connecting pin [43] through the reverse duct attachment point and through the attachment hole in the end of the reverse shaft, ensuring that the bushes [45] in the reverse duct attachment point are secure and in their correct position.
11. Secure the pin [43] in position with split pin [44].
12. Carry out a full functional check of the reverse system to ensure correct operation and full range of movement.

Morse cable connect:

1. Ensure that the cable mount plate [39] is correctly orientated for either port or starboard positioned morse cable. This plate can be fitted to the reverse cylinder either facing to port or starboard. See Sub Heading **Re-positioning the cable mount plate**.
2. Slacken the 2 nuts [41] that clamp the morse cable to the cable mount plate [39] and refit the morse cable through the clamp.
3. Attach the morse cable ball joint [42] to the HSRX handle [26] located on the end of the reverse cylinder and tighten the attachment nut.
4. Retighten the 2 nyloc nuts [41] that attach the clamp bracket on the cable mount plate [39].

Re-positioning the cable mount plate:

Should the cable mount plate be wrongly orientated for the current fit of the reverse cable, carry out the following procedure to re-position the cable mount plate:-

1. Remove the 2 nuts [41] and cable clamp [49] that retain the morse cable to the cable mount plate [39] and remove the morse cable.
2. Slacken set screw [27] from the HSRX handle [26] and remove the handle from the spool [25].
3. Remove the v-ring [29] fitted between the HSRX handle [26] and the backhead.

4. Unscrew and remove the 4 nuts [33] and spring washers [32].
5. The cable mount plate [39] can now be removed from the backhead [19].
6. Ensure that the o-ring [46] fitted in the o-ring groove on the forward face of the backhead is not disturbed.
7. Refit the cable mount plate [39] 180° to the previous position, ensuring that the stop pin [28] in the backhead engages into the correct hole in the cable mount plate [39].
8. Refit the 4 nuts [33] and spring washers [32] that secure the cable mount plate to the backhead and progressively torque to the recomended torque. ***Refer to*** **Drawing** "85113 Recommendations for Nuts and Locking Screw Tightening Torques"**.**
9. Refit the v-ring [29] to the rear of the backhead. **Note the correct orientation of the v-ring [29].** ***(Refer to Drawing*** "HJ-274-07-011 Reverse Assembly. Sht 1").
10. Refit the HSRX handle [26] to the spool [25] and tighten the set screw [27], ensuring that the set screw locates into the dimple in the spool shaft.
11. Loosely refit cable clamp [49] to the cable mount plate [39].
12. Refit the morse cable through the cable clamp kitset.
13. Connect the morse cable to the HSRX handle [26] and tighten the morse ball joint [42] attachment nut.
14. Retighten the 2 nuts [41] that attach the cable clamp on the cable mount plate [39].

9.4 Steering Assembly Removal and Overhaul

Refer to Drawing "HJ27406000 Steering Assembly General Arrangement".

The steering assembly may use either a manual cable operating system or a Seastar hydraulic cylinder to operate the steering tiller.

If the jet unit is fitted with a Seastar steering cylinder, refer to the Seastar Maintenance Manual for any maintenance required.

If the jet unit uses a manual cable system, refer to the relevant controls manual supplied with the jet unit.

9.4.1 Steering Cylinder Removal

Refer to Drawing "HJ27406000 Steering Assembly General Arrangement".

The steering cylinder need only be dismantled if it is suspected that a seal has failed and hydraulic oil is found leaking along the piston rod assembly from either end of the cylinder. This indicates that the piston rod seals are defective and must be replaced. Refer to the Seastar Manual for information on seal replacement.

1. Disconnect any sensors attached to the tiller [6].
2. Disconnect the steering cylinder hose connections from the Seastar steering cylinder, ensuring that all connections are fitted with blanking plugs to prevent the ingress of moisture and dirt and the leaking of hydraulic oil.
3. Disconnect the steering cylinder rod end from the tiller [6]. Remove the 4 nuts securing the steering cylinder in position and remove the steering cylinder from the vessel.
4. Check all components for signs of corrosion, wear and damage and replace as required. **Refer to the Seastar Manual for information on seal replacement**.

9.4.2 Steering Shaft Removal

Refer to Drawing "HJ27406000 Steering Assembly General Arrangement".

Ensure that the steering tiller [6] has been disconnected from the steering control cable or steering cylinder (whichever fitted).

1. Check the steering shaft [14] for:-
   a) Freedom of movement.
   b) Excessive wear in the two bushes [8].
   c) Worn or damaged scraper [16] and seal [17] fitted to the steering bush and seal housing [28].
   d) Excessive wear in the ball end of the steering crank [12] and the steering crank bush [7].
2. Replace the steering bushes and seals if damaged or worn.
3. To remove the steering crank [12] from the steering shaft [14], remove nut [21], spring washer [23] and special washer [2] securing the cotter [1] to the steering crank.
4. Push the steering shaft [14] forwards into the vessel and slide the steering crank off the end of the steering shaft.
5. Remove the steering crank [12] from the steering crank bush [7].

9.4.3 Nozzle Assembly Removal

Refer to Drawing "HJ27406000 Steering Assembly General Arrangement".

1. Check the steering crank bush [7] for security and wear. Replace if loose or worn.
2. Rotate the nozzle [13] through its full arc of travel to check for stiffness or wear in the nozzle pivot bushes [30].

Note: The nozzle / nozzle housing should be removed as a complete assembly. To remove, carry out the following actions:-

3. To remove the nozzle housing, remove the nuts [21], spring washers [23] and flat washers [29] from the studs [19] securing the nozzle housing to the tailpipe.
4. Hit the nozzle housing sideways with a soft hammer and remove the nozzle housing off the studs [19].

Removing the nozzle from the nozzle housing

To remove the nozzle From the nozzle housing, carry out the following actions.

1. Loosen cap screws [25] securing the JT steering lip seals [24] to the inner face of the nozzle [13] and ensure that the lip seals are free to move.
2. Using a flat bladed screwdriver, flatten off the tab on the tab washer [5] retaining pivot pin [15] at the top and bottom of the nozzle [13].
3. Whilst supporting the nozzle, unscrew and remove the upper and lower pivot pins [15] and tab washers [5].

Note: When removing the lower pivot pin, take care not to lose the thrust washer [10] fitted inside the steering pivot bush [30].

4. Hook out thrust washer [10] fitted inside the upper steering pivot bush [30].
5. Rotate the nozzle to align the upper and lower nozzle pivot sleeves [11] with the cut outs in the nozzle housing [9].
6. Push the top of the nozzle upwards to release the lower nozzle pivot sleeve from the nozzle housing.
7. Pull the nozzle rearwards to remove the nozzle from the nozzle housing.
8. Clean all parts thoroughly and examine for wear and damage and replace as necessary.

Inspecting the steering nozzle[13] and nozzle housing [9]

Examine the following components for wear or damage and repair or replace as necessary:-

1. **nozzle pivot bush sleeves [11]**. Replace if worn or damaged.
2. **Pivot pins [15].** Replace if worn or damaged.
3. **Steering crank bush [7].** Check for wear or damage. Replace if worn.
4. **Steering pivot bush [30].** Check for wear and damage. Replace.
5. **Steering crank [12].** Check the condition of the Crank Ball, replace if excessively worn.
6. **Thrust washers [10]**. Check for wear or damage. Replace if worn.
7. **Lock washers [5]**. Discard and replace once removed. **Do not re-use**.
8. **Cotter [1].** Check the condition. Replace if damaged.
9. **JT Steering lip seals [24]**. Check the condition and security of the lip seals. Replace if damaged or worn.
10. **Anode [3].** Check the condition. Replace if more than 2/3 rds corroded.

9.4.4 Nozzle Assembly Overhaul

Refer to Drawing "HJ27406000 Steering Assembly General Arrangement".

Replacing the JT steering lip seals [24]

The JT steering lip seals can be replaced without separating the nozzle from the nozzle housing. The nozzle / nozzle housing must be removed from the tailpipe to carry out lip seal replacement.

To replace the JT steering lip seal [24], carry out the following actions:-

1. With the JT steering nozzle [13] and the nozzle housing [9] removed complete from the jet unit tailpipe and with the nozzle and nozzle housing placed face down on a work bench, unscrew and remove the 4 cap screws [25], spring washers [26] and flat washers [27] at the rear of the nozzle securing the 2 lip seals [24] to the rear face of the nozzle.
2. Carefully remove the 2 lip seals [24] from the rear of the nozzle housing and discard.
3. Replace with 2 new lip seals, ensuring that the JT steering lip seals [24] are fitted with the overhang of the seal facing outwards when the seal is fitted to the JT steering nozzle [13]. (Will be facing towards the front of the jet unit when completely assembled to the nozzle housing [9]).
4. Refit the 2 new lip seals [24] in position.

Note: There is some movement in the lip seals [24] when loosely secured with cap screws [25], this is to allow the lip seals to be adjusted to fit the inside of the nozzle housing [9].

5. Thoroughly clean the threads of the cap screws [25] and apply Loctite 222.
6. Secure the JT steering lip seals [24] using cap screws [25], flat washers [27] and spring washers [26].
7. ***Adjust the lip seal [24] to provide a 0.4 to 0.6mm gap to the spherical inner surface of the nozzle housing [9].*** Tightened cap screws [25] to the recommended torque.
8. Refit the JT steering nozzle [13] complete with the nozzle housing [9] to the tailpipe as shown in **section** 9.5.1 "Nozzle Assembly Re-Fitting".

Replacing the nozzle crank bush [7]

To replace the nozzle crank bush [7], carry out the following operation:-

1. With the nozzle removed from the nozzle housing and taken to a workshop facility.
2. Carefully cut and peel out the old nozzle crank bush [7] from the nozzle boss.
3. Clean out the bore of the nozzle boss.
4. Apply a thin coat of Loctite 7471 or Primer "T" to the outside surface of the bush [7] and allow to dry. **Do NOT apply Activator to the bore of the nozzle boss.**

Note: Loctite Activator 7471 must be used to refit the nozzle crank bush otherwise the Loctite 680 will not cure and retain the bush in position.

5. Apply Loctite 680 to the bore of the nozzle boss.
6. Carefully press the crank bush [7] into the nozzle boss ensuring that the bush is pressed in evenly and does not protrude above the sides of the nozzle boss.

Note: There are to be NO dry areas between the crank bush and the bore of the nozzle boss once the crank bush is fitted.

7. **Ensure that the crank bush [7] is firmly pushed fully into the nozzle boss until the crank bush bottoms out against the shoulder at the base of the nozzle boss**.
8. Clean off any surplus Loctite from around the replacement bush.

Replacing the rear steering shaft bush [8] and steering shaft bush sleeve [4]

1. Examine the steering shaft bush [8] and the steering shaft bush sleeve [4] located on the tailpipe.
2. **The steering shaft bush sleeve [4] should not require replacement.** Should it be necessary to replace the sleeve [4], the steering shaft should be removed from the jet unit as shown in the jet unit product manual at ***section*** 9.4.2 "Steering Shaft Removal"**.**
3. To replace the steering shaft bush sleeve [4], press out the steering shaft bush [8] from inside the steering shaft bush sleeve [4].
4. Press out the steering shaft bush [8] from the boss on the tailpipe.
5. Clean out the bore of old loctite and activator.
6. Remove all evidence of paint from inside the bore.

Note: The bore in the tailpipe is NOT to be painted.

7. Apply Loctite Activator 7075 to the outside of the steering shaft bush sleeve [4] and allow to dry. Ensure that the outside of the steering shaft bush sleeve is completely covered in Activator. **Do NOT apply Activator to the bore in the tailpipe.**

Note: Loctite Activator 7075 must be used to refit the steering bush and seal housing otherwise the Loctite 325 will not cure and retain the bush and seal housing in position.

8. Apply Loctite 325 to the outside of the steering shaft bush sleeve [4] and press the steering shaft bush sleeve into the bore on the tailpipe boss, in the direction of the arrow shown on the ***Drawing*** "HJ27406000 Steering Assembly General Arrangement" ensuring that the sleeve is fully home in the bore.
9. Rotate the steering shaft bush sleeve [4] when fitting to evenly distribute the loctite around the bore.
10. press in the steering shaft bush sleeve ensuring that it is fully home in the bore.
11. Wipe off any excess loctite from around the steering shaft bush sleeve.
12. Refit a new steering shaft bush [8] from the rear of the jet and press into the steering shaft bush sleeve [4]. Refer to ***Drawing*** "HJ27406000 Steering Assembly General Arrangement".

Replacing the forward steering shaft bush [8], steering bush and seal housing [28], scraper seal [16] and seal [17].

The steering bush and seal housing [28] should not require replacement: However, should it be necessary to replace the steering bush and seal housing, the steering shaft should be removed from the jet unit as shown in the jet unit product manual at **section 9.4.2. "Steering Assembly Removal".** The steering bush and seal housing should be pressed out forwards and a new steering bush and seal housing fitted.

1. To replace the steering bush and seal housing [28], remove the seal [17] from the forward end of the steering bush & seal housing [28].
2. Remove the scraper seal [16] from the rear end of the steering bush & seal housing.
3. Push the steering shaft bush [8] forwards out of the steering bush & seal housing.
4. Slacken off the grub screw [31] securing the steering bush & seal housing to the intake flange.
5. Press the steering bush and seal housing forwards out from the jet unit intake.
6. Clean out the bush bores of old loctite and loctite primer in the bore.
7. Remove all evidence of paint from inside the bore.

Note: The bore in the intake flange is NOT to be painted.

8. Apply Loctite Primer 7471 to the outside of the steering bush and seal housing [28] and allow to dry. Ensure that the outside of the steering bush & seal housing is completely covered in Activator. **Do NOT apply Primer to the bore of the intake flange.**

Note: Loctite Primer 7471 must be used to refit the steering bush and seal housing otherwise the Loctite 680 will not cure and retain the steering bush and seal housing [28] in position.

9. Apply Loctite 680 to the whole surface of the steering bush and seal housing bore and also to the front part of the steering bush & seal housing.

Note: There are to be NO dry areas between the steering bush & seal housing and the intake flange bore once the steering bush & seal housing is fitted.

10. Fit the steering bush & seal housing from inside the vessel, pushing the steering bush & seal housing rearwards.
11. Rotate the steering bush & seal housing when fitting to distribute the loctite evenly around the bore.
12. Press in the steering bush & seal housing [28] ensuring that it is fully home in the bore.
13. Apply Loctite 222 to the set screw [31] and tighten to secure the steering bush & seal housing in position.
14. Wipe off any excess Loctite from around the steering bush & seal housing and the intake flange bore.
15. Smear the the seal [17] with grease and refit to the recess in the forward end of the seal housing [28], ensuring that the seal is fitted correctly.
16. Smear the the steering shaft bush [8] with grease. Refit the steering shaft bush [8] from the rear, pushing the bush up against the rear of the seal [17] already fitted.
17. Smear the the scraper seal [16] with grease and refit to the recess in the rear of the steering bush and seal housing [28], ensuring that the seal is fitted correctly with the lip facing rearwards. **Refer to drawing "HJ27406000 Steering Assembly General Arrangement" for correct seal positioning.**
18. Refit the steering shaft as shown in **section 9.5.3. "Steering Assembly Refitting".**

Note: Ensure that the seal [17] and the scraper seal [16] are fitted correctly. Refer to drawing "HJ27406000 Steering Assembly General Arrangement".

Replacing the steering pivot pin bushes [30] and sleeves [11]

The nozzle is fitted with two pivot pin bushes [30] and sleeves [11] to accommodate the steering nozzle pivot pins [15].

Note: The sleeves [11] need only be replaced if the spherical surface shows signs of wear.

Inspect the steering pivot bushes [30] and sleeves [11] in the nozzle. These should be replaced if any signs of wear or damage is found.

1. The nozzle should be taken to a workshop facility and removed from the nozzle housing.
2. The steering pivot bushes [30] are a push fit into the sleeves [11]. These may need to be split and peeled out to remove from the steering pivot bush sleeves [11].
3. If the sleeves [11] require replacement, using a suitable press, carefully press out the old sleeves, It may be necessary to apply light heat to the nozzle in the area of the sleeves to break the Loctite seal.
4. Clean out the bore of old loctite and activator and repair the paint finish in the bores.
5. Apply Loctite Activator 7075 to the outside of the sleeves [11] and allow to dry.

Note: Loctite Activator 7075 must be used to refit the steering bush and seal housing otherwise the Loctite 325 will not cure and retain the steering bush and seal housing [28] in position.

6. Coat the primed surfaces of the sleeves with Loctite 325.
7. Press sleeves [11] fully home into the nozzle, ensuring that the sleeves are pressed in evenly and are fully home in the recess in the nozzle.
8. Clean off any surplus Loctite from around the replacement sleeves.
9. Fit new steering pivot bushes [30] and push fully home into the sleeves [11] already fitted to the steering nozzle [13].

Replacing the JT steering nozzle anode [3]

Refer to drawing "HJ27413002 anode Location".

1. Remove nuts [20] and spring washers [22] from studs [18] securing the anode [3] to the underside of nozzle [13].
2. Remove the anode [3] from the underside of the nozzle.
3. The mating surfaces of the anode / nozzle should be scraped clean to ensure a good electrical contact.
4. Apply Loctite 263 to studs [18].
5. Fit a new anode [3] and attach to the studs [18] on the underside of the nozzle with nuts [20] and spring washers [22]. Torque load to the recommended torque.

9.5 Steering Assembly Re-Fitting

9.5.1 Nozzle Assembly Re-Fitting

Refer to Drawing "HJ27406000 Steering Assembly General Arrangement".

With the nozzle / nozzle housing removed from the jet unit and placed on a suitable workbench.

1. Ensuring that the steering crank boss is uppermost, rotate the nozzle [13] to align with the cut outs in the nozzle housing.
2. With the nose of the nozzle tilted slightly upwards, feed the upper nozzle mounting point into the nozzle housing.
3. Push down on the nose of the nozzle ensuring that the lower nozzle mounting point passes into the nozzle housing.
4. Rotate the nozzle to align the upper and lower bushes [30] with the upper and lower openings in the nozzle housing.
5. Smear the threads of the pivot pins [15] with grease.
6. Fit a 2.5 mm thick thrust washer [10] into the lower steering pivot bush [30] and retain in position with marine grease.
7. Fit the lower pivot pin [15] fitted with a new tab washer [5] and tighten firmly to retain the nozzle in position. **Do not secure the tab washer [5] in position.**
8. Fit a 2.5 mm thick thrust washer [10] into the upper steering pivot bush [30] and retain in position with marine grease.
9. Fit the upper pivot pin [15] fitted with a new tab washer [5] and tighten firmly to retain the nozzle in position. **Do not secure the tab washer [5] in position.**

Note:

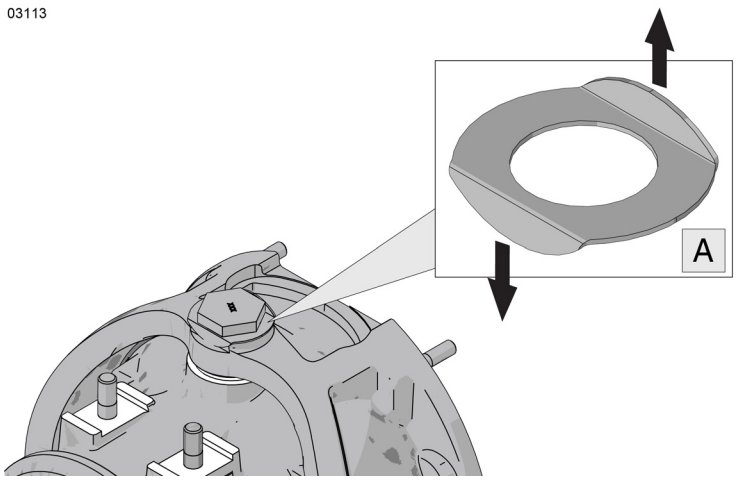
1. The nozzle “vertical end float adjustment” now has to be checked to achieve an end float of 0.5 to 1.0 Max, between the steering nozzle and the steering housing.
2. thrust washers [10] are available in variable thickness from 2.5mm to 4.0mm in 0.5mm size increase.

Nozzle vertical end float adjustment:

1. Check to ensure that the nozzle is centrally positioned in the nozzle housing.
2. Adjust the position of the nozzle by replacing the lower thrust washer [10] with a larger or smaller washer until the nozzle is located centrally within the steering housing.
3. With the nozzle located centrally in the nozzle housing, check the “vertical end float” between the nozzle and the nozzle housing. **This should be “between 0.5 to 1.0mm max”.**
4. Adjust the “vertical end float”, by replacing the upper thrust washer [10] with a larger or smaller Washer until the nozzle “vertical end float” is between 0.5 to 1.0mm max.
5. Once the nozzle “vertical end float” has been checked and adjusted, tighten both pivot pins [15] and torque load to 200 Nm (150 lbs/ft).

Note: If the JT steering lip seals are to be changed, they should be refitted at this point. Refer to "Replacing the JT steering lip seals [24]" on the previous pages.

6. Rotate the nozzle through its full arc of travel to ensure that there is no stiffness or binding of the nozzle.
7. Bend over the locking tabs on the tab washers [5] to secure the pivot pins in position.



Bend one side of the tab washer up and the other side down to lock the pivot pins in position.

8. Refit the nozzle complete with nozzle housing to the tailpipe of the jet unit and secure to studs [19] with spring washers [23], flat washers [29] and nuts [21]. Ensure that Loctite 243 is used on the threads of the studs [19] prior to fitting nuts [21.

9.5.2 Steering Shaft Refit

Refer to Drawing "HJ27406000 Steering Assembly General Arrangement".

1. Smear the ball of the steering crank [12] with grease and refit to the steering crank bush [7].
2. Pull the steering shaft [14] rearwards and slide the steering crank onto the end of the steering shaft.
3. Refit the cotter [1] to the steering crank [12] and secure with special washer [2], spring washer [23] and nut [21], torque load to the recommended torque.
4. Reconnect the steering tiller [6] to the steering control cable / steering cylinder, (whichever is fitted).

9.5.3 Steering Cylinder Re-Fitting

1. Refit the steering cylinder in the position prepared by the Boat Builder and secure as required.
2. Reconnect the cylinder rod end to the tiller [6].
3. Reconnect the steering cylinder hose connections to the steering cylinder. **Refer to the controls manual drawing package for correct hose connection layout**.
4. Re connect any sensors that were previously attached to the steering crank. **Refer to the overhaul section of the controls manual.**

9.5.4 Steering Linkages Adjustment

Refer to section 5.5.3 "Assembling of the Jet Steering Tillers" **and** 5.5.4 "Centering the Jet(s) Steering" for information on steering linkage and tiller adjustment for multiple jets.

9.6 Bearing Housing Assembly Overhaul

WARNING

Exercise extreme care if water seal replacement is to be carried out in the vessel as water may enter the vessel through the intake opening. Never leave the inspection cover removed.

WARNING

Exercise extreme care if overhauling the bearing housing with the vessel afloat as water may enter the vessel through the opening in the Intake.

9.6.1 Bearing Housing Dismantling

Refer to drawing "HJ27401000 Basic Jet Assemblies Standard and Dry Run" / "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2".

CAUTION

The water seal should not be removed unless it is being replaced. The water seal will not perform correctly if it is removed and then reinstalled.
The water seal need only be replaced if it is leaking.

Initial work:

1. Uncouple the driveshaft from the jet unit.
2. Remove the coupling grub screw [50].
3. Fit the torque arm [3] to prevent the coupling from turning **refer to Drawing** "HJ27411000 Tool Kits".
4. Unscrew the coupling nut [14].
5. Use a coupling puller [1] to draw the coupling free of the mainshaft refer to **Drawing** "HJ27411000 Tool Kits".
6. Remove the coupling key [11] from the mainshaft.
7. Unscrew the 3 bearing housing retainer nuts [54] from the studs [47] and remove special washers [59].
8. Slide bearing housing [21] off the mainshaft [8] (the bearing housing will still contain bearing [35], bearing carrier [10], oil inner seal sleeve [9] and oil seal [36]).
9. Withdraw the inner seal sleeve [9] and seal face holder [20] with oil seal [36] fitted.
10. Remove the bearing carrier [10] from the bearing housing.
11. Remove the bearing [35] from inside the bearing housing.
12. Press out the outer oil seal [36] from the bearing housing.
13. Remove o-ring [37] from the recess in the intake.

9.6.2 Water Seal Removal

Refer to Drawing "HJ27401000 Basic Jet Assemblies Standard and Dry Run", "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2".

1. Lubricate the mainshaft with with a 20:1 water and household detergent mix to help remove the water seal.

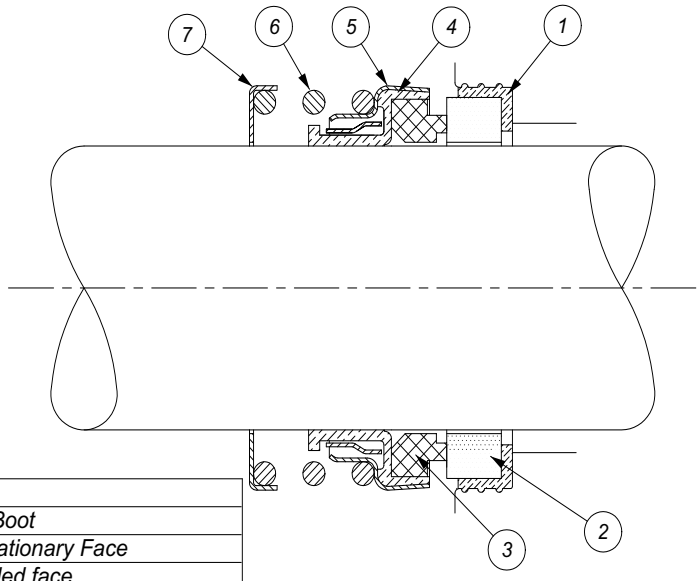
Note: The rubber bellows may adhere to the mainshaft and may require cutting to remove. Take care not to score the mainshaft if the rubber bellows has to be cut away.

2. Slide the water seal [25] and stationary counter face assembly forwards off the mainshaft and discard.

Checking for wear:

Check the following parts for wear and replace where necessary:-

1. **Oil seals [36] and seal sleeves [9]**. Check for cuts, wear and deformation. Replace as required.
2. **Bearing [35].** Check for wear or damage.
3. **Water seal [25] and stationary face assembly**. Check to see if mating faces are scored or chipped. Always replace both seal and Counter face even if one or other appears unworn.
4. **O-ring [37]**. Check for cuts or deformation.
5. **Split pin [33] located in the mainshaft**. Remove and discard. Always replace with a new split pin [33].
6. **Mainshaft.** Clean and inspect the mainshaft for scratches, burrs or frettin in the location of the water seal. These can be polished out using a fine emery paper.
7. **Thoroughly clean all parts**.



Item No	Description
1	Neoprene Boot
2	Ceramic Stationary Face
3	Resin Bonded face
4	Neoprene Bellows
5	Holder
6	Spring
7	Spring Cap

Figure 7: water seal

9.6.3 Water Seal Replacement and Re-Fitting

Refer to Drawing "HJ27401000 Basic Jet Assemblies Standard and Dry Run". "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2".

CAUTION

All Water seal faces must be clean and free of grease.

1. Replace the water seal retaining split pin [33] located in the mainshaft and ensure that it is correctly secured in place.
2. To allow the water seal to slide on the mainshaft, lubricate the mainshaft with a 20:1 water and household detergent mix.
3. Carefully replace the water seal parts onto the mainshaft in the following order :- spring cap [7], spring [6], Neoprene bellows [4] and rotating carbon face [3] as shown in Figure 7: "water seal".
4. Slide the water seal assembly down the mainshaft, through the hole in the intake until the spring cap rests against the split pin [33] fitted through the mainshaft.
5. Lubricate the seal face holder [20] and the stationary face rubber boot with with a 20:1 water and household detergent or liquid soap mix.
6. Fit a new neoprene boot [1] and ceramic face [2] **(Refer to** Figure 7: "water seal") to the rear of the seal face holder [20] and ensure that it is pushed fully home into the recess in the rear of the seal face holder.
7. The bearing housing can now be re-fitted.

9.6.4 Bearing Housing Re-Assembly

Refer to* section** 8.8 "Threaded Fasteners" ***and* section** 8.9 "Recommended Oils and Lubricants" ***Also refer to Figure 8: "Bearing Assembly" ***and*** Figure 7: "water seal".

1. Fit the o-ring [37] into the recess in the intake.
2. Press the inner oil seal [36] into the seal face holder [20] so that the lip faces towards the coupling flange. **Ensure that the seal lip faces towards the coupling flange. Refer to Drawings** "HJ27401000 Basic Jet Assemblies Standard and Dry Run" / "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2".
3. Apply marine grease to the o-ring [37] and to the seal face holder contact face with the intake.
4. Fit the seal face holder over the mainshaft and push into place against the intake face.
5. Grease the outside surface of the inner seal sleeve [9].
6. Slide the inner seal sleeve [9] over the mainshaft and push it through the inner oil seal [36] until the seal sleeve [9] rests firmly against the shoulder on the mainshaft [8].
7. Press the outer oil seal [36] into the bearing housing [21] until the outer oil seal is firmly up against the shoulder in the bearing housing. **Ensure that the seal lip faces towards the coupling flange. Refer to drawings** "HJ27401000 Basic Jet Assemblies Standard and Dry Run" / "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2"**.**
8. Pre-pack the bearing [35] with grease then press the bearing into the bearing housing [21].
9. Fit the bearing housing complete with bearing [35] over the mainshaft and locate onto studs [47].
10. Fit special washers [59] and nuts [54], using Loctite 242 to secure. Torque load to the recommended torque.

Note: studs [47] are SAF-2205. Torque load to 130 Nm (95 ft/lbs). Refer to "85113 Threaded Fastener Tightening Torques".

11. Smear the bearing carrier [10] with grease and gently slide the bearing carrier onto the mainshaft and into the bearing housing through the centre of the bearing [35].
12. Using a soft hammer, gently tap the inside of the bearing carrier [10] until it is level with the outside face of the bearing [35].
13. Apply grease to the outside surface of the outer seal sleeve [9] and slide the outer seal sleeve along mainshaft towards the bearing housing.
14. Carefully push the outer seal sleeve through the oil seal [36] fitted in the bearing housing until the seal sleeve rests firmly against the bearing [35].
15. Lightly grease the bore and key way of the coupling flange, the key way of the mainshaft and the face of the coupling nut [14].
16. Fit the coupling key [11] to the mainshaft and tap into position with a soft hammer.
17. Fit the coupling to the mainshaft, ensuring that the key way in the coupling aligns with the coupling key [11] fitted to the mainshaft.
18. Fit the coupling nut [14] to the mainshaft.
19. Fit the torque arm to the coupling to prevent the coupling from turning and torque load the coupling nut [14] to **230 Nm. (170 lbs/ft)**.
20. Tighten the coupling nut locking set screw (50) using Loctite 222
21. Whilst slowly rotating the mainshaft, lightly grease the bearing via the grease nipple [31] on the top of the bearing housing. Continue greasing until grease is just seen escaping between the seal [36] and seal sleeve [9] at the front of the bearing housing. (**Do not over grease**)
22. Turn the mainshaft by hand to ensure that it rotates freely before connecting the coupling to the driveshaft.

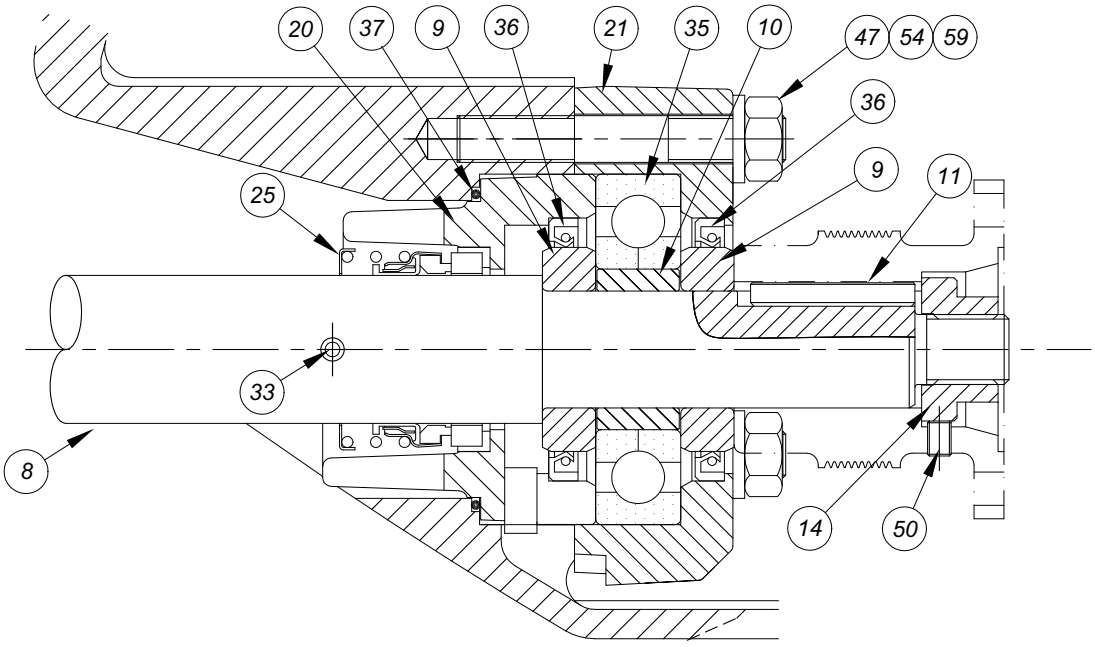


Figure 8: Bearing Assembly

9.7 Internal Anode Replacement

9.7.1 Intake Internal Anode

Refer to Drawing "HJ27413002 anode Location".

Note: The replacement of the intake internal anode should be carried out when the vessel is in dry dock.
To carry out this operation, refer to Drawings "HJ27401000 Basic Jet Assemblies Standard and Dry Run" / "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2".
The internal anode [61] can be removed through the inspection cover [19] on the jet intake.

1. Remove the inspection cover [19] and o-ring [40] from the inspection cover opening.
2. Inspect the anode [61] located on the starboard side of the intake. Replace the anode if it is more than half corroded, otherwise clean with a wire brush.
3. Should the anode require replacement, remove the securing nuts [52] , spring washers [55] and the anode [61].
4. The bolts [62] do not have to be removed from the intake.
5. If the bolts [62] need to be replaced, fit flat washer [60] to each of the bolts and apply Loctite 263 to the threads near the head of the bolts.
6. Screw the two bolts fully home through the location holes on the starboard side of the jet unit intake.
7. Fit a new anode [61] through the inspection hatch and onto the bolts [62] protruding into the intake. Ensure that the anode is fitted with curved side into the recess.
8. Add Loctite 243 to the threads of the two bolts [62].
9. Fit spring washers [55] and nuts [52] to the two bolts and tighten to the recommended torque.
10. Smear the o-ring [40] with grease and fit to the groove on the underside of the inspection cover.
11. Refit the inspection cover .

9.8 Tailpipe Area - Overhaul

If The reverse duct has not already been removed, it must be removed before proceeding. **Refer to section** 9.2.1 "Reverse Duct Removal".
If the steering linkages have not already been disconnected, they must be disconnected before proceeding. **Refer to section** 9.4.2 "Steering Shaft Removal".

9.8.1 Impeller - Checking for Wear

Checking for wear:
Refer to drawings "HJ27401000 Basic Jet Assemblies Standard and Dry Run" / "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2". Before dismantling the tailpipe end of the jet unit, remove the inspection cover [19] (or intake screen [7] if in dry dock) and carry out the following checks.

1. **Impeller tip wear check**:

Refer section 8.6.1 "Jet Unit Servicing Details" Item 16.

2. **Water bearing wear check**:

Refer section 8.6.1 "Jet Unit Servicing Details" Item 16.

9.8.2 Tailpipe Area - Dismantling

Refer to drawings "HJ27401000 Basic Jet Assemblies Standard and Dry Run" / "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2".

Dismantling:

Refer to drawing "HJ27406000 Steering Assembly General Arrangement".

If the tailpipe is being removed complete, proceed as follows, otherwise refer to **section** 9.4.3 "Nozzle Assembly Removal".

1. Disconnect the steering tiller [6] from the steering control cable or steering cylinder (If fitted).
2. Check the steering shaft for:-
   a) Freedom of movement.
   b) Excessive wear in bushes [4] and [8].
   c) Worn or damaged scraper [16] and seal [17].
   d) Excessive wear between the ball end of the steering crank [12] and the nozzle crank bush [7].
3. Replace steering bushes and seals if damaged or worn. See **section** 9.4.4 "Nozzle Assembly Overhaul" for details on nozzle bush replacement.
4. To remove the steering crank and steering linkages refer to **section** 9.4.2 "Steering Shaft Removal".
5. Should the nozzle require removal, refer to **section** 9.4.3 "Nozzle Assembly Removal".

Refer to Drawings "HJ27401000 Basic Jet Assemblies Standard and Dry Run" **and** "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2".

6. Remove the 4 x M16 nuts [54] and special washers [59] from the tailpipe upper studs [48] and lower studs [49].
7. Hit the tailpipe sideways with the heel of the hand or a rubber mallet to free the joint. Remove the tailpipe from the jet unit.

Impeller removal:

1. Prevent the coupling from turning by fitting the torque arm and unscrew the impeller nut [14].

Note: If the impeller nut is stiff to remove, apply gentle heat on the nut.

2. Withdraw the shaft sleeve [13] from between the impeller and the mainshaft.
3. Withdraw the impeller off the mainshaft.
4. Remove impeller key [12] from the mainshaft.
5. Examine the wear ring [3] for wear, pitting and score damage. In the unlikely event of this being very badly scored, or if the wear ring has swollen inwards, it should be replaced. If possible, request your local agent to carry out the replacement of the wear ring.

9.8.3 Inspection of the Tailpipe Marine Bearing and Wear Ring

With the tailpipe removed from the jet unit intake as shown in *section* 9.8.2 "Tailpipe Area - Dismantling", carry out the following actions:-

1. **Marine water bearing sleeve [17.1].** Check the condition of the marine bearing, if it is badly scored or worn, it will have to be extracted from the tailpipe and replaced. ***Refer to section*** 9.8.7 "Tailpipe Overhaul".
2. **Wear ring [3] and insulator [4].** Check for wear on the wear ring. This should be evident where the impeller has been running. If there is evidence of excessive wear by a 0.5mm lip, or signs of corrosion through or beneath the wear ring. The wear ring and insulator should be replaced. ***Refer to section*** 9.8.4 "Wear Ring and Insulator Removal and Replacement".
3. **Insulation.** Check the insulation between the wear ring and the tailpipe casing. Using a multimeter. check the insulation between the wear ring and the tailpipe casing. If the insulation has broken down, corrosion will occur beneath the wear ring. The wear ring and insulator should be replaced as shown in ***section*** 9.8.4 "Wear Ring and Insulator Removal and Replacement".
4. **Stator blades.** Check for signs of damage or erosion to the leading edges. Dress off any burrs.
5. **Plug [32] (on tailpipe).** Check the water-offtake screen by removing any stones from the filter holes. Ensure that the plug is securely fitted.

9.8.4 Wear Ring and Insulator Removal and Replacement

Refer to Drawings "HJ27401000 Basic Jet Assemblies Standard and Dry Run" / "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2".

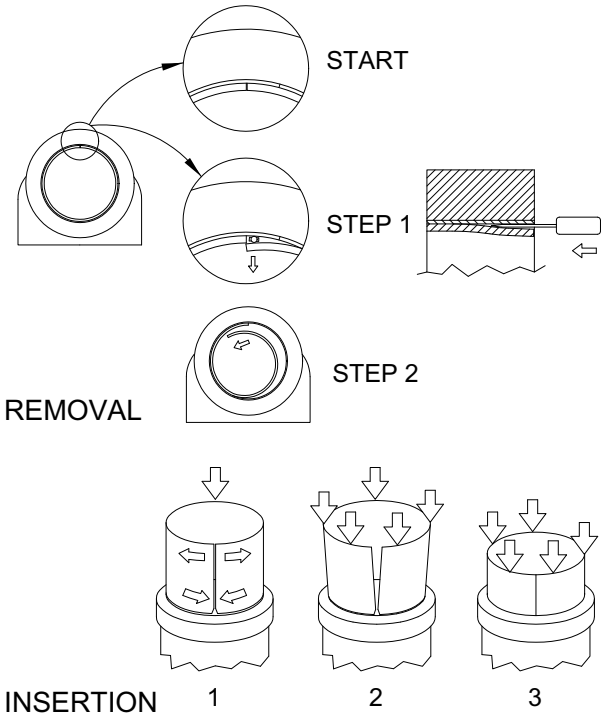


Figure 9: wear ring Inspection & Removal Instructions

Removing the old wear ring and insulator:

Step 1:

1. Find the joint in the wear ring [3] and force a long thin screw driver between the wear ring [3] and the Insulator [4], adjacent to the wear ring joint, until the end of the wear ring is free. ***See* Step 1** Figure 9: "wear ring Inspection & Removal Instructions".

Step 2:

2. Pull the free end of the wear ring inwards and remove it from the intake. ***See* Step 2** Figure 9: "wear ring Inspection & Removal Instructions",
3. Remove the wear ring insulator [4] and thoroughly clean and degrease the intake bore.

Preparing a new wear ring for fitting.

1. Before fitting a new wear ring, it should be trial fitted into the intake with ***no Insulator fitted***. There should be a gap of approximately 1mm between the mating ends of the wear ring with the wear ring completely fitted into the intake bore.
2. The wear ring may not fit without some “dress” filing of the mating ends to reduce the circumference slightly. ***DO NOT REMOVE TOO MUCH METAL FROM THE wear ring*** as the wear ring must be a tight fit in the intake once the insulator is fitted. This ensures that the wear ring remains in the correct position during operation.

Fitting a new insulator.

1. Paint the recess in the intake bore with a thin layer of two pot vinyl etch primer suitable for aluminium and allow to dry.
2. Apply a thin coat of zinc phosphate epoxy primer (such as International Paints Intercure 200 HS) and allow to dry.
3. Apply a second coat of zinc phosphate epoxy primer. ***While the primer is still wet***, fit a new insulator [38] to the intake, ensuring the insulator is in contact with the primer over the whole surface.
4. Smear the complete insulator surface with a thin layer of grease or oil.

Fitting a new wear ring:

Note: Because of variations in paint and grease thickness the wear ring may not fit without some "dress" filing of the mating ends to reduce the circumference slightly. DO NOT REMOVE TOO MUCH METAL from the wear ring as the wear ring must be a tight fit in the insulator to remain in the correct position.

1. Smear the whole insulator surface with a thin layer of grease or oil.

Step 1:

2. Take a new wear ring [3] and with the chamfer end leading, butt the strip at the chamfers by twisting slightly, (this reduces the lead in diameter) and gradually feed it inside the insulator [4] fitted in the intake until the wear ring butts fully.
3. Slide the wear ring in evenly as far as possible by hand.

Step 2:

4. Place a heavy steel plate against the edge of the wear ring (The plate is used to prevent damage to the end of the wear ring and should cover whole diameter of the wear ring).
5. Drive the wear ring evenly into the intake recess by hitting the plate with a large hammer.

6. Continue pushing the wear ring into the intake until the wear ring sits approximately **0.8 mm (1/32")** from the end of the recess in the intake. **Refer to** Figure 11: "Wear Ring Aft Position".
7. The wear ring must not touch any part of the jet unit except the insulator.
8. The wear ring is correctly fitted when it sits flush with the inner end of the intake flange.
9. On completion of the fitting of the wear ring, electrical insulation between the wear ring and the intake casting should be checked using a multimeter. **The resistance reading should be over 1000 ohms.**

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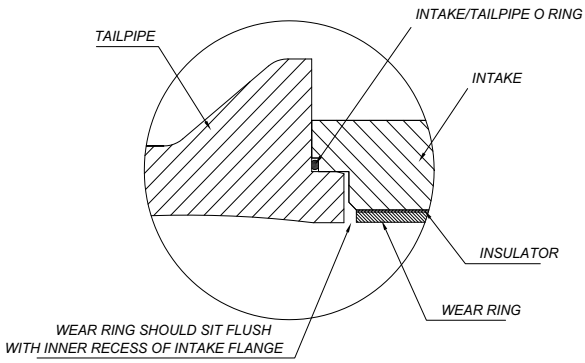

Figure 10: Forward Position of Wear Ring

Note: The wear ring is in the correct position when it is located approximately 0.8 mm (1/32") from the end of the recess in the intake. Refer to Figure 11: "Wear Ring Aft Position" and the wear ring sits flush with the inner recess of the intake flange. Figure 10: "Forward Position of Wear Ring". This gap must be maintained to prevent electrical contact between the wear ring and the tailpipe / intake of the jet unit.

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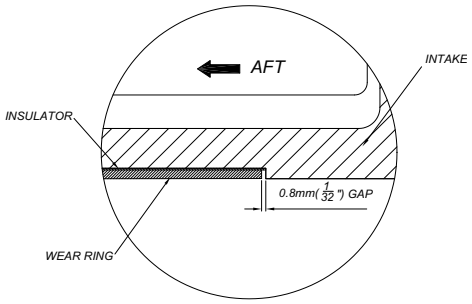


Figure 11: Wear Ring Aft Position

9.8.5 Impeller Area - Overhaul

Minor corrosion damage around the wear ring / impeller position such as pitting may be repaired by welding. Grind the welded surface flush with the original surface.

If the surface wear is more than 1mm deep, a new intake should be fitted.

9.8.6 Impeller Overhaul

Welding:

CAUTION

Avoid using excessive heat during welding.

Note: All welds must be passivated to prevent corrosion.
impellers are stainless steel type CF8M conforming to ASTM A 743 or 316 to BS 3100. Filler metal should have a chemical analysis similar to AISI 316L (Carbon content less than 3%). Post weld heat treatment is not required. Passivation is required after welding is completed.

Inspection:

1. Inspect all surfaces of the impeller for any sign of corrosion or erosion damage. Damaged areas should be weld repaired and dressed back to a smooth surface again.
2. Check the impeller leading and trailing edges for damage. In particular the outer corners of a blade may be bent if the impeller is dropped or mishandled. Bent or dented blades may be straightened using a large adjustable spanner or other suitable tool. Bring the blade back to its original smooth profile checking against other undamaged blades.
3. Inspect the leading edges, excessively worn or blunt leading edges may be built up by welding. Blunt impellers cause loss of performance and sometimes cavitation.
4. **Check the impeller O.D**.

Blade leading edge repair procedure:
Drawing "HJ27403001 impellers" **and Drawings** "82206 impeller Dressing Instruction Sht1" **show the desired blade profile. The following information should also be referred to:**

1. Dress the edge back to a smooth curve removing the minimum amount of metal.
2. Weld repair damaged edges if required.
3. Dress both faces of the blade taking slightly more metal off the rear side until the leading edge is the correct thickness all along.
4. Blend well back into the original blade surface.
5. Both front and rear surfaces are to be a smooth uniform curve with no sudden bumps or change in direction.
6. Grind or file a smooth radius along the leading edge.

Impeller outside diameter (O.D.) repair procedure:

1. If the impeller O.D. is excessively worn it may be built up by welding. After welding turn on a mandrel to the correct O.D. Use light cuts to avoid blade distortion. Dress the faces back flush with the original surfaces.
2. Turn the outside diameter making sure that it is concentric with the bore. (Light cuts should be taken when turning the outside diameter to avoid deformation of the impeller blades)

.

Impeller diameter

New max diameter	New min diameter	Worn min diameter
269.00	268.80	268.2

3. File and polish.

Balancing:

1. The impeller must be balanced if welding or grinding has been carried out on the impeller.
2. Balance the impeller statically, preferably on the mainshaft with the coupling and all keys in place. If this is not possible then balance the impeller statically on a suitable mandrel set on horizontal knife edges or bars to within the maximum out of balance specified.
3. ***Balance to within 45 gm-cm (0.63 oz/ins)***.
4. Balance weights of 316 SS may be welded to the inside of the hub and grinding is permitted.

Passivation:

Appropriate safety glasses, protective gloves and clothing must be worn to prevent skin exposure to nitric acid.

WARNING

1. If the impeller has been welded, passivation is required.
2. Immerse the impeller in hot 30% Nitric Acid for at least 2 hours.
3. Rinse in clean water.
4. If nitric acid immersion is not possible, a "brush on" pickling / passivation gel may be used on weld and heat affected areas.

9.8.7 Tailpipe Overhaul

Refer to "HJ27407011 Reverse Assembly" **and** "HJ27407011 Reverse Assembly".

Tailpipe:

1. Check that the drain hole in the tailpipe cone is not blocked. Clear any blockage.
2. Check the marine bearing [17] and water bearing sleeve [13] for wear or severe scoring and if necessary replace. **Refer to section** 8.6 "Servicing Details" **Item 13/3. Also** 9.8.7 "Tailpipe Overhaul". Replace if the impeller has just been built up and the wear ring has been replaced.
3. Use either an internal extractor to pull the water bearing [17] from the tailpipe, or place the tailpipe under a press and push out the water bearing [17] and tailpipe fairing [15] together.
4. When re-fitting the tailpipe fairing, use "Loctite 680" or equivalent.
5. Apply grease to the tailpipe bore before inserting a new water bearing but **ensure that grease is kept away from the rubber bearing surfaces of the water bearing**.
6. When pressing in the new water bearing, use a wooden block under the nose of the tailpipe fairing to take the load.

When shrink fitting of the marine bearing is required, chilling must be achieved by gradual cooling to not more than minus 20°F (-28°C) using a freezer or regular ice. DO NOT USE DRY ICE.

Note: Pounding or shocking the bearing while in a chilled state could cause the rubber to separate from the shell.

Replace the reverse duct pivot bushes [2]:

To replace the threaded reverse duct pivot bushes [2], carry out the following actions.

1. With the tailpipe removed from the intake, remove the threaded bush [2]. It may be necessary to apply light heat to the tailpipe in the area of the bush to break the loctite seal.
2. Clean out the bush bores in the tailpipe, ensuring that all old loctite is removed.

Note: The bores in the tailpipe are NOT to be painted.

3. Apply Loctite Activator 7471 to the outside of the pivot bush [2] and allow to dry. **Do NOT apply Activator to the bores in the tailpipe.**

Note: Loctite Activator 7471 must be used to refit the reverse duct pivot bushes otherwise the Loctite 680 will not cure and retain the pivot bush in position.

4. Apply Loctite 680 to the whole surface of the tailpipe bore and also to the front part of the reverse duct pivot bush.

Note: There are to be NO dry areas between the reverse duct pivot bush and the tailpipe bore once the reverse duct pivot bush is fitted.

5. Screw the bushes [2] fully into the tailpipe. Wipe off any excess Loctite.

Nozzle bushes - replacement:

Ensure that all worn or damaged steering and reverse system bushes, scrapers and seals have been replaced prior to re assembly of the tailpipe and nozzle. ***Refer to section*** 9.4.4 "Nozzle Assembly Overhaul" ***and section*** 9.8.7 "Tailpipe Overhaul".

External tailpipe anode replacement:

Refer to Drawing "HJ27407011 Reverse Assembly". Drawings "HJ27401000 Basic Jet Assemblies Standard and Dry Run" ***and*** "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2"**.**

1. Check the external tailpipe anodes [1] attached to the outside flanks of the tailpipe, if these are less than half of their original size, they should be replaced.
2. To replace the external tailpipe anodes, carry out the following operation:-
   a) Remove the nut [52] and spring washer [55] from stud [43].
   b) Remove the external anode [1].
   c) Ensure that the mating surfaces are scraped clean for a good electrical contact.
   d) Fit a new external anode [1].
   e) Attach with nut [52] and spring washers [55]. Torque load to the recommended torque.
   f) Repeat for the second external anode.
3. If the anode is still in good condition, ensure that it has not been painted over.
4. Scrub down with a wire brush if a coating has built up on the anode.

Internal tailpipe anodes [2] replacement:

Refer to Drawing "HJ27413002 anode Location". Drawings "HJ27401000 Basic Jet Assemblies Standard and Dry Run" ***and*** "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2"**.**

1. Check the 6 x internal tailpipe anodes [2] attached to the anode mounting plate [24] which is fitted to the forward face of the tailpipe. Should these be less than 2/3rds their original size, they should be replaced.
2. To replace the 6 x internal tailpipe anodes [2], carry out the following operation:-
   a) With the tailpipe removed from the intake [18], remove the nyloc nuts [51] and spring washers [55] from the studs [42] attaching the anode mounting plate [24] to the tailpipe.
   b) Remove the nyloc nuts [51] and spring washers [55] attaching each anode to the anode mount plate.
   c) Remove the 6 internal tailpipe anodes [2].
   d) Ensure that the mating surfaces between the anode and the anode mounting plate are scraped clean for a good electrical contact.
   e) Apply Loctite 243 to the threads of the anodes [2].
   f) Fit the new internal tailpipe anodes [2] to the anode mounting plate [24] and secure with nyloc nuts [51] and spring washer [55]. Torque load to the recommended torque.
   g) Apply Loctite 243 to the threads of studs [42] located on the inner face of the tailpipe.
   h) Refit the anode mounting plate [24] to the tailpipe and attach to studs [42] with nyloc nuts [51] and spring washers [55]. Torque load to the recommended torque.
3. If the anodes are still in good condition, ensure that the anodes are not painted over.
4. Scrub the anodes with a wire brush if a coating of corrosion has built up on the anodes.

9.8.8 Tailpipe Area: Re-Assembly

Refer to Drawings "HJ27406000 Steering Assembly General Arrangement", "HJ27401000 Basic Jet Assemblies Standard and Dry Run" and "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2".

Impeller re-assembly:

Refer to Drawing "HJ27401000 Basic Jet Assemblies Standard and Dry Run" and "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2".

Refer to specified minimum torque values shown in **section** 8.8 "Threaded Fasteners" and on **Drawing** "85113 Threaded Fastener Tightening Torques" when tightening all nuts.

1. Smear a light coating of grease over the mainshaft from the impeller keyway rearwards to the start of the impeller nut threads. **Do not grease the threads**.
2. Insert the impeller key [12] with chamfers facing down into the mainshaft keyway.
3. Slide the impeller onto the mainshaft [8] followed by the water bearing sleeve [13].
4. Clean the threads at the rear end of the mainshaft [8] (impeller nut end) and apply "Loctite 243" or equivalent to the threads.
5. **Fit the impeller nut [14] and torque load to 300 Nm (170 lbs/ft)**.

Tailpipe re-assembly:

1. Dust the water bearing [17] with talcum powder or french chalk.
2. Clean and grease the tailpipe / intake contact faces.
3. Refit the intake / tailpipe o-ring [16] to the recess in the intake.
4. Refit the tailpipe to the tailpipe upper studs [48] and lower studs [49], using special washers [59] and nuts [54]. Secure using Loctite 222.

Note: Because the lower studs [49] are SAF-2205 stainless steel and the upper studs [48] are 316 stainless steel, the attaching nuts [54] need different torque values. Refer Drawing "85113 Threaded Fastener Tightening Torques".

5. Torque load to the correct torque.
6. Turn the mainshaft to ensure that the assembly will rotate.

9.9 Transom Plate Assembly Overhaul

Should it be necessary to remove the transom seal assembly from the transom, for repair or replacement of damaged or worn components, carry out the following operation.
To replace the transom plate o-ring [2] or transom plate [1], the reverse duct and tailpipe must be removed complete, to access to the transom plate.

Note: The transom plate o-ring [2] and transom plate [1] should not be removed unless they are suspected of leaking or unless the transom plate [1] is corroded or damaged.

9.9.1 Transom Plate Removal

Note: The reverse duct and tailpipe should be removed complete to allow access to remove the transom plate.

To remove the reverse duct, tailpipe and steering components complete, **refer to section** 5.3.2 "Reverse Components".

G.R.P hulls:

Refer to Drawings "HJ27401000 Basic Jet Assemblies Standard and Dry Run" **and** "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2".

Aluminium hulls:

Refer to Drawings "HJ27408002 Installation Details Aluminium hull with 5° Shaftline" **and** "HJ27408012 Installation Details Aluminum hull with 0° Shaftline".

To remove the transom plate [1] and replace the transom plate *o-ring* [2], carry out the following operation:

1. Slacken and remove the screws [3], flat washers [6], spring washers [5] and nuts [4] securing the transom plate to the transom.
2. Remove the continuity strap [20] attached to the transom plate attachment screws [3].
3. Remove the transom plate off the jet unit intake.
4. Remove the transom plate o-ring [2] from around the jet unit and discard.
5. Clean off any old marine sealant from the transom plate [1] and the transom and examine for damage and corrosion. Replace or repair as required.

Steel hulls:

Refer to Drawings "HJ27408003 Installation Details Steel hull with 5° Shaftline" / "HJ27408003 Installation Details Steel hull with 5° Shaftline Sht 2" **and** "HJ27408013 Installation Details Steel hull with 0° Shaftline" / "HJ27408013 Installation Details Steel hull with 0° Shaftline Sht 2".

To remove the transom plate [1] and replace the transom seal [2], carry out the following operation:

1. Slacken and remove the screws [3], flat washers [6], spring washers [5] and nuts [4] securing the transom plate to the transom. Note that there are 2 flat washers [6] fitted to either side of the transom / transom plate.
2. Remove the nylon insulating bushes [15] from around the transom plate.
3. Remove the transom plate off the jet unit intake.
4. Remove the transom gasket [16] from the transom plate / transom interface and discard.
5. Remove the transom plate o-ring [2] from around the jet unit and discard.
6. Clean off any old marine sealant from the transom plate [1] and the transom and examine for damage and corrosion. Replace or repair as required.

9.9.2 Transom Plate Re-Fitting

Refer to section 5.4.2 "Assembly of the Transom Plate to the Hull" for information on how to refit the transom plate.

9.10 Hatch Extension (Optional Extra)

Refer to Drawing "HJ27410004 Hatch Extension".

C.W.F. Hamilton & Co Ltd can supply, as an optional extra, an inspection hatch extension [1]. This item enables work to be carried out on the jet unit where normally by removing the inspection cover may allow water to enter the vessel. The hatch extension raises the height of the inspection cover by approximately 140 mm.

WARNING

Extreme care is required whenever the inspection cover is removed as water may enter the vessel through this opening.

Never leave the inspection cover removed without constant monitoring of the water levels.

9.10.1 Hatch Extension Fitting

To fit the inspection hatch extension [1] carry out the following operation:-

1. Ensure that the water level is below the level of the inspection cover.
2. Ballast the bow end of the vessel to ensure that water does not enter the vessel through the inspection cover.

Refer to Drawing "HJ27401000 Basic Jet Assemblies Standard and Dry Run" **and** "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2"**.**

3. Remove nuts [53], flat washers [57] and spring washers [56] from the two studs [46] retaining the inspection cover [19].
4. Remove the inspection cover [19] and o-ring [40].
5. Check the o-ring [40] and replace if damaged or distorted.
6. Smear o-ring [40] with grease and refit to the o-ring groove in the inspection cover [19].

Refer to Drawing "HJ27410004 Hatch Extension".

7. Ensure that o-ring [5] on the base of the inspection hatch extension [1] is not damaged or distorted.
8. Smear the o-ring [5] with grease and refit to the base of the hatch extension [1] and fit hatch extension over the studs [46] shown on **Drawing** "HJ27401000 Basic Jet Assemblies Standard and Dry Run" ***and*** "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2".
9. Secure with flat washers [57], spring washers [56] and nuts [53] Shown on **Drawing** "HJ27401000 Basic Jet Assemblies Standard and Dry Run" ***and*** "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2" and torque load to the recommended torque.
10. Fit the inspection cover [19] shown on **Drawing** "HJ27401000 Basic Jet Assemblies Standard and Dry Run" ***and*** "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2" to studs [2] and secure with spring washer [4] and nut [3] shown in **Drawing** "HJ27410004 Hatch Extension" Torque load to the recommended torque.
11. Once the vessel is "in use", ensure that the hatch extension is not leaking water.

9.10.2 Hatch Extension Removal

WARNING

Extreme care is required whenever the inspection cover is removed as water may enter the vessel through this opening.

Never leave the inspection cover removed without constant monitoring of the water levels.

Refer to Drawings "HJ27401000 Basic Jet Assemblies Standard and Dry Run" **and** "HJ27410004 Hatch Extension".

To remove the hatch extension, carry out the following operations:-

1. Ensure that the water level is below the level of the intake Inspection opening. If necessary, ballast the bow end of the vessel to ensure that water does not enter the vessel through the Inspection opening when the inspection cover is removed.
2. Remove nuts [3] and spring washers [4] from studs [2] securing the inspection cover to the hatch extension.
3. Remove the inspection cover [19] and o-ring [40] from the top of the hatch extension. **Refer to Drawing** "HJ27410004 Hatch Extension".
4. To remove the hatch extension from the jet intake opening, remove nuts [53], spring washers [56] and flat washers [57] from the studs [46] securing the hatch extension to the intake opening.
5. Remove the hatch extension [1] and o-ring [5] from studs [46].
6. Ensure that the o-ring [40] fitted to the inspection cover [19] is not cut or perished.
7. Smear the o-ring [40] with marine grease and fit to the o-ring groove on the underside of the inspection cover.
8. Fit the inspection cover over studs [46] fitted around the inspection opening and secure in position with flat washers [57], spring washers [56] and nuts [53].
9. Torque load to the recommended torque.
10. Remove any ballast that may have been added to the bow of the vessel and check the inspection cover for leaks.

9.11 Screen Rake Assembly Overhaul (If Fitted)

Refer to Drawing "HJ27409002 Screen Rake Assy".

Before removing the screen rake, ensure that the screen has been removed, **refer to section** 9.12 "Intake Screen".

The screen rake need only be dismantled if it is suspected of being defective for the following reasons:-

a) The port [4] and starboard [3] screen rake bearings are worn.
b) O-rings [9] and [10] are leaking.
c) The screen rake [5] is damaged or bent.

9.11.1 Screen Rake Removal

Refer to Drawing "HJ27409002 Screen Rake Assy".

To remove the screen rake assembly, the vessel should be removed from the water to allow access to the underside of the vessel. To remove the screen rake, carry out the following:-

1. Support the screen rake beneath the vessel.
2. From inside the vessel, disconnect and remove the tension spring [1] from the rake actuator [8] and spring actuator bracket [6] on the starboard side of the intake, in the vicinity of the coupling flange.
3. Remove nut [12], spring washer [14], special washer [2] and the cotter pin [7] securing the rake actuator [8] to the screen rake [5].
4. Remove the rake actuator [8].
5. With the screen rake supported beneath the vessel. From inside the vessel, remove the screen rake bearing attachment nuts [13] and spring washers [15] from the starboard screen rake bearing [3].
6. Whilst ensuring that the screen rake is supported, withdraw the starboard screen rake bearing [3]. The starboard screen rake pivot point will now rest on the screen rake bearing housing in the intake.
7. From beneath the vessel, whilst supporting the screen rake move the screen rake fully to starboard to allow the port screen rake pivot point to clear the port screen rake bearing [4].
8. With the port screen rake pivot point clear of the port screen rake bearing [4], move the screen rake to starboard to allow the starboard screen rake pivot point to clear the starboard screen rake bearing housing in the intake.
9. Carefully lower the screen rake [5] from the underside of the intake.
10. Check the screen rake for distortion, damage and excessive wear at the screen rake bearing attachment points. Repair or replace as required.
11. Remove the screen rake bearing attachment nuts [13] and spring washers [15] from the port screen rake bearing [4] and withdraw the port screen rake bearing from the intake.
12. Check the o-rings [9] and [10] on the starboard screen rake bearing and replace if cut, damaged or distorted.
13. Check the starboard screen rake bearing for wear and damage. Replace as required.
14. Remove the grease nipple [11] from the starboard screen rake bearing [3] and ensure that the grease channels are not blocked.
15. Refit the grease nipple [11].
16. Check the o-ring [10] on the port screen rake bearing and replace if cut, damaged or distorted.
17. Remove the grease nipple [11] from the port screen rake bearing [4] and ensure that the grease channels are not blocked.
18. Refit the grease nipple [11].
19. Thoroughly clean all components and examine for wear, damage and distortion.

9.11.2 Screen Rake Re-Fitting

Refer to Drawing "HJ27409002 Screen Rake Assy".

1. Fit a new o-ring [10] on the port screen rake bearing and smear the shaft of the port screen rake bearing with grease.
2. **Refer to Drawing** "HJ27401000 Basic Jet Assemblies Standard and Dry Run" ***and*** "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2". Fit the port screen rake bearing [4] to the studs [44] on the port side of the intake. Secure with spring washer [15] and nuts [13], ensuring that the grease nipple [11] is positioned at the top of the bearing.
3. Torque load to the recommended torque.
4. From beneath the vessel, whilst supporting the screen rake and before fitting the starboard screen rake bearing, feed the starboard screen rake pivot point through the starboard screen rake mounting point in the intake.
5. Raise the port side of the screen rake and align the pivot point of the screen rake with the port screen rake bearing [4].
6. Push the screen rake into the port screen rake bearing [4].
7. Inside the vessel, fit new o-rings [9] and [10] to the starboard screen rake bearing [3] and smear the shaft of the starboard screen rake bearing with grease.
8. Fit the starboard screen rake bearing [3] over the starboard screen rake pivot point which is protruding through the intake.
9. **Refer to Drawing** "HJ27401000 Basic Jet Assemblies Standard and Dry Run" ***and*** "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2". Align the screen rake bearing [3] with the studs [44] on the intake, ensuring that the grease nipple [11] is positioned at the top of the bearing.
10. Secure with spring washer [15] and nuts [13]. Torque load to the recommended torque.
11. Fit the screen rake actuator [8] to the starboard screen rake pivot point and fit cotter pin [7] and secure with special washer [2], spring washer [14] and nut [12]. Torque load to the recommended torque.
12. Connect one end of the spring [1] to the spring anchor point [6] and connect the other end of the spring [1] to the screen rake actuator [8].
13. Grease the port and starboard screen rake bearings through the grease nipples [11] on the top of the screen rake bearings.
14. Remove the support from the screen rake beneath the vessel.
15. Carry out a functional check of the screen rake assembly. Have someone positioned beneath the vessel to observe that the screen rake operates without fouling on the intake screen.

9.11.3 Screen Rake Blanking Plugs

Refer to Drawing "HJ27409001 Screen Rake Blanking Plugs".

Should it be necessary to run the jet unit without a screen rake, blanking plugs [1] can be fitted in place of the port and starboard screen rake bearings.

To fit the blanking plugs, carry out the following procedure:

1. Remove the screen rake as shown in **section** 9.11.2 "Screen Rake Re-Fitting".
2. Ensure that o-ring [4] is not damaged, cut or distorted.
3. Liberally coat the shaft of the blanking plug with grease and fit onto studs [44], **refer to Drawing** "HJ27401000 Basic Jet Assemblies Standard and Dry Run" ***and*** "HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2".
4. Secure with spring washer [2] and nut [3]. Torque load to the recommended torque.
5. Repeat for the second blanking plug.

9.12 Intake Screen

9.12.1 Intake Screen Removal

To remove the screen from the intake, carry out the following actions:-

G.R.P hulls (0º and 5º):

"HJ27408001 Installation Details G.R.P hull With 5º Shaftline" **and** "HJ27408011 Installation Details G.R.P hull With oº Shaft Line".

1. Whilst supporting the screen, remove 4 nuts [15], spring washers [16], flat washers [17] off studs [14].
2. Lower the screen off the 4 studs [14] and remove from the vessel for repair, refurbishment.

Aluminium hulls (0º and 5º):

"HJ27408002 Installation Details Aluminium hull with 5º Shaftline" **and** "HJ27408012 Installation Details Aluminum hull with 0º Shaftline".

1. Whilst supporting screen, remove 4 nuts [14], spring washers [15] and flat washers [16] off studs [13].
2. Lower the screen off the 4 studs [13] and remove from the vessel for repair, refurbishment.

Steel hulls (0º and 5º):

"HJ27408003 Installation Details Steel hull with 5º Shaftline", "HJ27408003 Installation Details Steel hull with 5º Shaftline Sht 2", "HJ27408013 Installation Details Steel hull with 0º Shaftline" **and** "HJ27408013 Installation Details Steel hull with 0º Shaftline Sht 2".

1. Whilst supporting the screen, remove 4 nuts [20], spring washers [21], flat washers [22] off studs [19].
2. Lower the screen off the 4 studs [19] and remove from the vessel for repair, refurbishment.

9.12.2 Intake Screen Re-Fitting

Ensure that the screen rake has been re-fitted. Refer to ***section*** 9.11.2 "Screen Rake Re-Fitting".

G.R.P hulls (0º and 5º):

1. Ensure the 4 studs [14] are securely fitted to the intake. If the studs are loose, refit using Loctite 263 [19].
2. Offer the screen up to the 4 studs [14] on the underside of the intake and secure in position with flat washers [17], spring washers [16] and nuts [15].
3. Tighten to the recommended torque.

Aluminium hulls (0º and 5º):

1. Ensure the 4 studs [13] are securely fitted to the intake. If the studs are loose, refit using Loctite 263 [18].
2. Offer the screen up to the 4 studs [13] on the underside of the intake and secure in position with flat washers [16], spring washers [15] and nuts [14].
3. Tighten to the recommended torque.

Steel hulls (0º and 5º):

1. Ensure the 4 studs [19] are securely fitted to the intake. If the studs are loose, refit using Loctite 263 [14].
2. Offer the screen up to the 4 studs [19] on the underside of the intake and secure in position with flat washers [22], spring washers [21] and nuts [20].
3. Tighten to the recommended torque.

9.13 HSRX Hydraulic Reverse System

9.13.1 Removal of the Pump Assembly from the Jet Unit

Refer to the following drawings:-
"CTHPU01002 JHPU HSRX (Saginaw Pump) HJ-273 & HJ-274 Jets".
"CTHSE12001 Hose Kits Stainless Steel Fittings Sht2".

To remove the pump assembly from the jet unit, carry out the following actions:-
Refer to drawing "CTHSE12001 Hose Kits Stainless Steel Fittings Sht2".

1. Drain the oil from the pump [1], jet mounted oil cooler and hose connections.
2. Disconnect the high pressure hose [H1] between the forward connection on the cylinder and the $^{3}/_{8}$" BSP adaptor on the rear of the pump.
3. Remove the $^{3}/_{8}$" push lock hose [H2] between the rear connection on the cylinder and the outlet on the top of the jet mounted oil cooler.
4. Remove the $^{3}/_{8}$" push lock hose [H3] from the lower connection on the jet mounted oil cooler.
5. Remove the hose clip [7] from the inlet to the pump and remove the hose.
6. Fit blanks to all the hydraulic connection points to prevent the ingress of moisture and dirt into the hydraulic system.

Refer to Drawings "CTHPU01002 JHPU HSRX (Saginaw Pump) HJ-273 & HJ-274 Jets".

7. To remove the belt from the pump, loosen nut [8] from the stud in the elongated slot in the support bracket [4] at the rear of the pump [1].
8. Slacken screw [9] securing the pump [1] to mount bracket [3] at the pump forward lower attachment point.
9. Slacken nut [8] securing the pump [1] to the intake casting at the rear lower attachment point of the pump.
10. Push the pump inboard towards the bearing housing. It should now be possible to remove the drive belt from the pump pulley.
11. Remove nut [8] and spring washer [7] from stud [5] at the inboard end of the adjusting link [4].
12. Remove nut [8], spring washer [7] and special washer [13] from the stud in the elongated slot in the adjusting link [4] at the rear of the pump [1].
13. Remove the support bracket [4] from the stud on the rear of the pump ensuring that the washer [13], fitted between the adjusting link [4] and the rear of the pump, is removed.
14. Remove screw [9] and spring washer [7] securing the pump [1] to mount bracket [3] at the pump forward lower attachment point.
15. Remove nut [8] and spring washer [7] securing the pump [1] to the intake casting at the rear lower attachment point of the pump.
16. The pump may now be removed from the jet unit.
17. Remove the nuts [8] and spring washers [7] from studs [5] attaching the support bracket [3] to the bearing housing of the jet unit.
18. Remove and retain the support bracket [3].

9.13.2 Re-Fitting the Pump Assembly to the Jet Unit

Refer to the following drawings:-

"CTHPU01002 JHPU HSRX (Saginaw Pump) HJ-273 & HJ-274 Jets".

"CTHSE12001 Hose Kits Stainless Steel Fittings Sht2".

Mount the pump assembly [1] onto the bearing housing using the following method:-

1. Attach the pump assembly [1] to the intake casting by the stud located at the rear lower attachment point of the pump and secure loosely in position with spring washer [7] and nut [8]. Do not torque load.
2. Attach the support bracket [3] to the 2 x studs [5] on the bearing housing and secure with spring washer [7] and nut [8]. Torque load to the recommended torque.
3. Secure the support bracket [3] to the forward lower attachment point of the pump assembly [1] with spring washer [7] and screw [9]. Tighten screw enough to allow slight movement of the pump.
4. Attach the adjusting link [4] to the stud [5] on the upper part of the bearing housing ensuring that the elongated slot in the adjusting link [4] is outboard of the Jet and is located over the stud on the rear of the pump. Ensure that special washer [13] is fitted to the stud on the rear of the pump before fitting the elongated slot in the adjusting link [4] over the stud.
5. Loosely secure the inboard end of the adjusting link, with spring washer [7] and nut [8].
6. Secure the outboard end of the adjusting link, loosely with special washer [13], spring washer [7] and nut [8]. Do not torque load.
7. Fit the pump drive belt and tension by levering the pump body away from the intake until the correct belt tension is achieved.

Note:

1. The belt tension is correct when a 2.4 mm deflection is achieved when a load of 580 to 870 gr (1.3 to 1.9 lbs) is applied to the centre of the belt.
2. If a new drive belt has been fitted, the belt should be re-tensioned after 30 minutes to 4 hours of running at full load, to compensate for initial belt stretch and "bedding" into the pulley grooves.

8. Tighten nut [8] on the inboard end of the adjusting link and torque load to the recommended torque.
9. Tighten the nut [8] at the elongated slot end of the adjusting link [4], which secures the pump [1] to the adjusting link [4]. Torque load the nut [8] to the recommended torque.
10. Tighten screw [9] securing the pump [1] to the support bracket [3] and torque load to the recommended torque.
11. Tighten the nut [8] located at the rear lower attachment point of the pump and torque load to the recommended torque.

Hose connections:

Refer to drawing:- "CTHSE12001 Hose Kits Stainless Steel Fittings Sht2".

Note:

1. Thread tape should be used on all BSPT to BSPP (parallel to taper) connections.
2. Push lock hoses should be renewed if disassembly is required.

1. Fit the high pressure hose [H1] between the forward connection on the cylinder and the 3/8" BSP adaptor on the pump, ensuring that the hose is routed forward of the inspection cover.
2. Fit 3/8" push lock hose [H2] between the rear connection on the cylinder and the outlet on the top of the jet mounted oil cooler.
3. Fit 3/8" push lock hose [H3] to the lower connection on the jet mounted oil cooler and the opposite hose end onto the inlet to the tank. Secure with hose clip [7].
4. Refill the reverse system with oil as described in ***section*** 8.6.2 "Reverse Hydraulic Controls Servicing Details", Item No.3 “Filling the HSRX system with Oil”.
5. Check the HSRX reverse system for oil leaks.

Appendix

- Supplementary Technical Information

A-1 Conversions

Torque

1 pound foot = 1.3558 newton metres
1 newton metre = 0.7375 pounds foot

Distance

1 inch = 2.54 centimetres
1 foot = 0.3048 metre
1 mile = 1.609 kilometres
1 nautical mile = 1.8532 kilometres
1 millimetre = 0.03937 inches
1 metre = 3.2808 feet
1 kilometre = 0.6214 mile
1 kilometre = 0.539 nautical mile

Area

1 inch^2 = 6.4516 centimetres^2
1 foot^2 = 929.03 centimetres^2
1 centimetre^2 = 0.1550 inch^2
1 metre^2 = 10.76 feet^2

Power

1 horsepower = 0.7457 kilowatts
1 horsepower (Metric) = 0.7355 kilowatts
1 kilowatt = 1.341 horsepower
1 kilowatt = 1.3596 metric horsepower

Force

1 kilonewton = 224.86 pounds force
1 pound force = 4.448 newtons

Weight

1 ounce = 28.35 grams
1 pound = 0.4536 kilograms
1 gram = 0.0353 ounce
1 kilogram = 2.205 pounds
1 tonne = 2205 pounds

Liquid Measure (Imperial)

1 Pint = 0.5506 litre
1 gallon =4.546 litres
1(UK) gallon = 1.201 (US) gallon
1 litre = 0.2199 (UK) gallons
To Convert Fahrenheit to Celsius, subtract 32 then multiply by 5/9
To convert Celsius to Fahrenheit, multiply by 9/5 then add 32.

Liquid Measure (U.S.)

1 pint = 0.473 litre
1 gallon = 3.785 litres

Speed

1 mile per hour = 0.8690 knots
1 kilometre per hour = 0.5396 knots
1 knot = 1.8532 kilometres per hour
1mile per hour = 1.609 kilometres per hour
1 kilometre per hour = 0.621 miles per hour
1 knot = 1.151 miles per hour

Pressure

1 pound/inch^2 = 0.0689 bar
1 pound/foot^2 = 4.8824 kilogram/metre^2
1 pound/inch^2 = 6.895 kilopascal
1 Newton/millimetre^2 = 145.04 pounds/inch^2
1 bar = 14.5038 pounds/inch^2
1 kilogram/metre^2 = 0.2048 pounds/foot^2
1 kilopascal = 0.145 pound/inch^2
1 bar = 100 kilopascal

Temperature

Fahrenheit	Celsius
248	120
212	100
176	80
140	60
104	40
95	35
86	30
77	25
68	20
59	15
50	10
41	5
32	0

A-2 Loctite Application Guide

85144 Issue F

General Practice

No smoking in the presence of Primer, Activator or Accelerator, as these products are highly flammable. Never mix Primer or Activator and Adhesive directly as liquids. For additional safe handling procedures refer to the product material safety data sheets (MSDS) and technical data sheets (TDS) available from www.loctite.com

- All parts must be free from oil and or grease. Do not use paint thinners for cleaning. Use solvent or degreaser such as Methylated spirits, Trichlorethylene or Acetone.
- All painted bores must be fully cured before the application of loctite.
- Fixing and full cure times for all loctite will be increased at reduced temperatures.
- To prevent the product from clogging in the nozzle, do not allow the tip to touch metal surfaces during application.
- In general, nuts that secure anodes use Loctite 243 and a spring washer. Anodes in internal water passages use nylocnuts, external anodes use plain nuts.

Primers, Activators and Accelerators

Primers are used when the surfaces to be threadlocked are not active enough to cause curing, or when the cure is required to be accelerated.

- Primers, Activators or Accelerators are not required on ‘active surfaces’, such as Bronze, Brass and Mild steel.
- For ‘Inactive surfaces’ (including Stainless steel or Aluminium) Primers, Activators or Accelerators are optional for threadlocking and are required for retaining.
- Primers, Activators or Accelerators are not to be applied to any painted surface.
- Allow sufficient time for Primers, Activators or Accelerators, where applied, to dry.

Equivalents

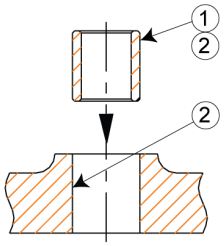
Loctite Grade		Equivalent
222	Purple	**Low Strength Threadlocker:** Loctite 221 (Compatible Primer is 7471) Loctite 225 (Compatible Primer is 7471)
243	Blue	**Medium Strength Threadlocker:** Loctite 242 (Compatible Primer is 7471) Loctite 245 (Compatible Primer is 7471) Loctite 248 (Compatible Primer is 7471)
263	Red	**High Strength Threadlocker:** Loctite 262 (Compatible Primer is 7471 or 7649) Loctite 268 (Compatible Primer is 7471 or 7649) Loctite 276 (No Primer Required) Loctite 277 if necessary (Compatible Primer is 7649)
680	Green	**High Strength Retainer:** Loctite 638 (Compatible Primer is 7471)
325	Amber	**Structural Adhesive:** Loctite 317 (Compatible Primer is 736)
542	Brown	**Hydraulic Thread Sealant:** Loctite 569 (Compatible Primer is 7471 or 7649) Loctite 561 (Compatible Primer is 7471 or 7649) Loctite 577 (Compatible Primer is 7471 or 7649)

Additional Notes for Equivalents

- Primer 7471 and Primer 7649 can be interchanged if necessary, however performance may be reduced
- Loctite 248, 268, 668 and 561 are in stick form.

Unpainted Bores, Stainless Bushes

Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed without Primer Activator, Accelerator		
680	*GREEN*	Type	Drying Time		Partial	Full
		n/a	n/a		30 Min	4-6Hrs

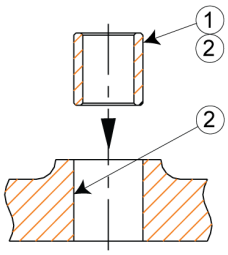


Bushes, sleeves, composite bush assemblies. (extra high strength retaining) primer will be used in all retaining applications.
1 - Apply primer to whole surface of bore and allow to dry before fitting.
2 - Apply Loctite to whole surface of bore and front of bush before fitting.
- There are to be no dry areas between the bush and the bore.

Rotate bush when fitting to distribute the Loctite evenly
For press fitted bushes, coat the entire bush and bore before pressing in the bush.

Unpainted Bores, LG2 Bushes

Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed without Primer Activator, Accelerator		
680	*GREEN*	Type	Drying Time		Partial	Full
		n/a	n/a		30 Min	4-6Hrs

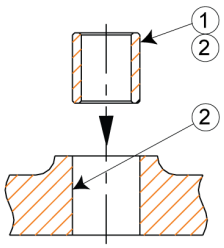


Bushes, sleeves, composite bush assemblies. (extra high strength retaining) primer will be used in all retaining applications.
Do not apply primer to LG2 Bushes
1 - Apply primer to whole surface of bore and allow to dry before fitting.
2 - Apply Loctite to whole surface of bore and front of bush before fitting.
- There are to be no dry areas between the bush and the bore.
- Rotate bush when fitting to distribute the Loctite evenly

For press fitted bushes, coat the entire bush and bore before pressing in the bush.

Painted Intercure Bores, Stainless Steel Bushes

Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed with Primer Activator, Accelerator		
325	*AMBER*	Type	Drying Time		Partial	Full
		Activator 7075	1-3Min		5Min	24Hrs

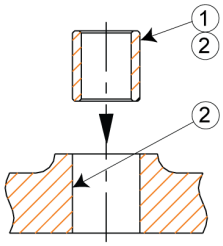


Bushes, sleeves, composite bush assemblies. (high strength adhesive) activator will be used in all retaining applications.
325 loctite will not cure without the activator. Do not apply activator to painted bore.
1 - Apply Activator to outside of bush and allow to dry.
2 - Apply Loctite to whole surface of bore and outside of bush before fitting bush.
- There are to be no dry areas between bush and bore.

Rotate bush when fitting to distribute the Loctite evenly

Painted Gloss Bores, Stainless Steel Bushes

Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed without Primer Activator, Accelerator		
680	*GREEN*	Type	Drying Time		Partial	Full
		n/a	n/a		30 Min	4-6Hrs

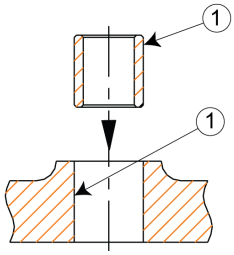


Bushes, sleeves, composite bush assemblies. (Extra high strength retaining)
Primer is used in all retaining applications.
Do not apply primer to painted bore.
1 - Apply primer to outside of outside of bush and allow to dry.
2 - Apply Loctite to whole surface of bore and outside of bush before fitting bush.
- There are to be no dry areas between bush and bore.

Rotate bush when fitting to distribute the Loctite evenly

Painted Gloss Bores, LG2 Bushes

Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed without Primer Activator, Accelerator		
680	*GREEN*	Type	Drying Time		Partial	Full
		n/a	n/a		30 Min	4-6Hrs

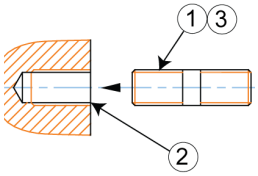


Bushes, sleeves, composite bush assemblies. (Extra high strength retaining)
1 - Apply Loctite to whole surface of bore and outside of bush before fitting bush.
- There are to be no dry areas between bush and bore.

Rotate bush when fitting to distribute the Loctite evenly

Studs M8 and Larger

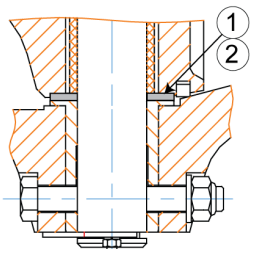
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed		
263	*RED*	Type	Drying Time		Partial	Full
		Primer 7649	30-705ec	With Primer	10Min	2Hrs
		(Optional)	n/a	Without Primer	20Min	6Hrs



Studs high strength locking
Primer is used to improve cure reliability, and reduce cure time.
1 - Apply optional primer to the thread of the stud and allow to dry.
2 - Apply several drops of thread locker down the sides of female thread.
3 - Apply Loctite to the thread engagement area of the stud in sufficient quantity to fill all engaged threads.
Assemble the stud to specifications.

D-Glide Thrust Washers

Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed with Primer Activator, Accelerator		
325	*AMBER*	Type	Drying Time		Partial	Full
		Activator 7075	1-3Min		5Min	24Hrs



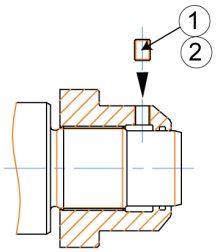
D-glide thrust washer retention (high strength adhesive)
Activator will be used in all retaining applications.
325 Loctite will not cure without the activator.
1 - Apply activator to one side of thrust washer and allow to dry.
2 - Apply Loctite evenly to housing recess.

- Press thrust washer into recess, activator side to adhesive.
- Remove any excess Loctite from the bush bore.

Hold the washer in place, for approx. 15 minutes, until the bond is firm.

Machine Set Screws, Set Screws, Grub Screws

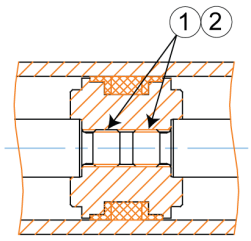
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed		
243	*BLUE*	Type	Drying Time		Partial	Full
		Primer 7471	30-70Sec	With Primer	10Min	2Hrs
		(Optional)	N/A	Without Primer	20Min	6Hrs
222	*PURPLE*	Primer 7471	30-70Sec	With Primer	10Min	2Hrs
		(Optional)	N/A	Without Primer	20Min	6Hrs



Machine screws, set screws, grub screws (low strength thread locking).
Primer is used to shorten the cure time when the temperature is below 15°.
1 - Apply optional primer to the thread of the screw and allow to dry. Screws fitted into Bronze do not require primer.
2 - Apply Loctite to the thread engagement area of the screw in sufficient quantity to fill all engaged threads.
3 Fit the Screw to the specified torque.

Cylinder Shafts, Compensator Shafts

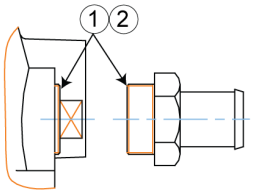
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed		
263	*RED*	Type	Drying Time		Partial	Full
		Primer 7649	30-70Sec	With Primer	10Min	2Hrs
		(Optional)	n/a	Without Primer	20Min	6Hrs



Cylinder shafts, compensator shafts (hydraulic, pneumatic thread sealant).
Primer is used to shorten the cure time when the temperature is below 15°.
1 - Apply optional primer to the threads of the shafts and allow to dry.
2 - Apply Loctite to the female threads in the piston and to the threads on the shafts in sufficient quantity to fill all the threads.
Assemble the shafts and piston as per the drawing specifications.

Water Offtake Bungs and Hose Tails

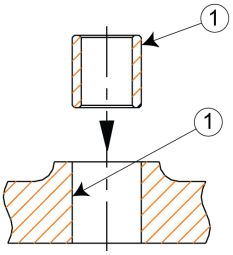
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed		
567	*White*	Type	Drying Time		Partial	Full
		Accelerator 7649 (Optional)	30-70Sec	With Primer	2Hrs	6Hrs
				Without Primer	12 Hrs	24Hrs



Water offtake bungs & hose tails (thread sealant)
Accelerator is used where cure speed is unacceptably long.
1 - Apply optional accelerator to thread of plug or hose tail and allow to dry.
2 - Do not apply accelerator to brass hose tails.
3 - Apply Loctite to thread engagement area of the plug or hose tail leaving the first thread Loctite free.
Screw plug or hose tail into tailpipe until plug or hose tail bottoms, and tighten firmly.

Unpainted Bores, D-Glide Bushes

Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed with Primer Activator, Accelerator		
325	*AMBER*	Type	Drying Time		Partial	Full
		Activator 7075	1-3Min		5Min	24Hrs

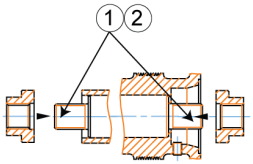


D-glide bush retention (high strength adhesive).
Activator will be used in all retaining applications.
325 Loctite will not cure without the activator.
1 - Apply activator to outside of bush and allow to dry.
2 - Apply adhesive to whole surface of bore.
- There are to be no dry areas between bush and bore.

Press bush into bore within 15 minutes.

Mainshaft Nuts Without Locking Devices

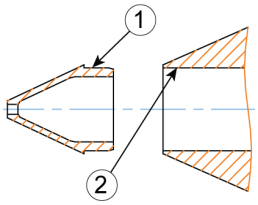
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed		
243	*BLUE*	Type	Drying Time		Partial	Full
		Primer 7471 (Optional)	30-70Sec N/A	With Primer	10Min	2Hrs
				Without Primer	20Min	6Hrs



Mainshaft nuts (medium strength thread locking)
Primer is used to shorten the cure time when the temperature is below 15°.
1 - Apply optional primer to the threads on the mainshaft and allow to dry.
2 - Apply Loctite to the thread engagement areas of the mainshaft in sufficient quantity to fill all engaged threads.
Assemble nuts to `jet specific' torque specifications.

Tailpipe Fairings Without Locking Devices

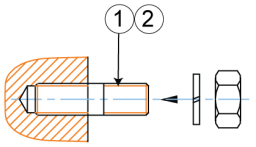
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed without Primer Activator, Accelerator		
680	*GREEN*	Type	Drying Time		Partial	Full
		n/a	n/a		30 Min	4-6Hrs



Tailpipe fairings without locking devices (extra high strength retaining).
1 - Apply primer to spigot of fairing and allow to dry.
2 - Apply Loctite to spigot bore of tailpipe.
Fit using normal methods.

Nuts on Studs and Bolts (Where Specified)

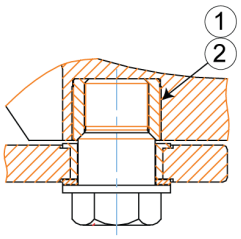
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed		
243	*BLUE*	Type	Drying Time		Partial	Full
		Primer 7471	30-70Sec	With Primer	10Min	2Hrs
		(Optional)	N/A	Without Primer	20Min	6Hrs
222	*PURPLE*	Primer 7471	30-70Sec	With Primer	10Min	2Hrs
		(Optional)	N/A	Without Primer	20Min	6Hrs



Nuts (low strength thread locking).
Primer is used to shorten the cure time when the temperature is below 15°.
1 - Apply optional primer to the thread of the stud or bolt and allow to dry.
2 - Apply Loctite to the thread engagement area of the stud or bolt in sufficient quantity to fill all engaged threads.
Tighten Nuts to specified torque.

Tailpipe Inserts (Where Fitted)

Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed		
263	*RED*	Type	Drying Time		Partial	Full
		Primer 7649	30-70Sec	With Primer	10Min	2Hrs
		(Optional)	n/a	Without Primer	20Min	6Hrs

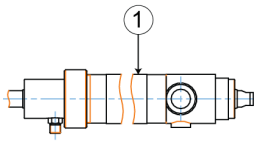


Tailpipe inserts (high strength thread locking).
Primer is used in all retaining applications.
1 - Apply primer to the thread of the insert and allow to dry.
2 - Apply Loctite to the female threads in the tailpipe and the threads of the insert in sufficient quantity to fill all the engaged threads.
- There are to be no dry areas between insert and tailpipe threads.

Screw insert into the tailpipe until it bottoms. Tighten firmly.

Steel Cylinders and AB2 Frontheads

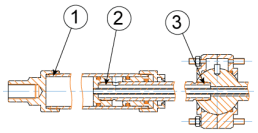
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed without Primer Activator, Accelerator		
542	*BROWN*	Type	Drying Time		Partial	Full
		N/A	N/A		45Min	24Hrs



Steel cylinders and AB2 frontheads (Med strength hydraulic thread sealant)
Leave the first thread free of sealant.
Force the sealant into the threads to thoroughly fill all threads.
1 - Apply Loctite to the leading threads of the cylinder (fronthead end only).
Assemble the fronthead to the cylinder and tighten firmly.

Stainless Steel Cylinders and Backheads

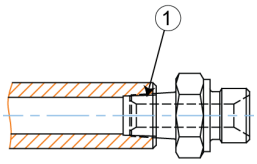
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed without Primer Activator, Accelerator		
542	*BROWN*	Type	Drying Time		Partial	Full
		N/A	N/A		45Min	24Hrs



Stainless steel cylinders & backheads (Med strength hydraulic thread sealant).
Leave the first thread free of sealant.
Force the sealant into the threads to thoroughly fill all threads.
1 - Apply Loctite to the leading threads of the cylinder (backhead end).
2 - Apply Loctite to the shaft threads (piston end).
3 - Apply Loctite to the shaft thread (connector end).
Fit the shaft into the piston and connector and tighten the backhead to the torque specified on the assembly drawing.

Tapered Male Nipples into Female Holes

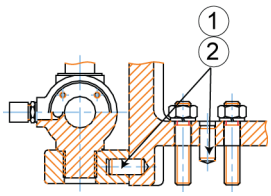
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed without Primer Activator, Accelerator		
542	*BROWN*	Type	Drying Time		Partial	Full
		N/A	N/A		45Min	24Hrs



Tapered Male Nipples in Female Holes (Medium Strength Hydraulic Thread Sealant).
1 - Apply Loctite to the thread engagement area of the nipple in sufficient quantity to fill all engaged threads.
Fit the nipple and tighten to the specified torque.

Dowel Retention

Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed without Primer Activator, Accelerator		
680	*GREEN*	Type	Drying Time		Partial	Full
		n/a	n/a		30 Min	4-6Hrs



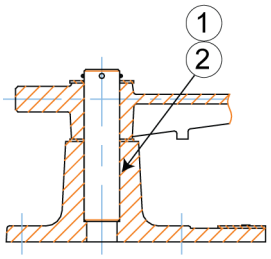
Dowel retention (extra high strength retaining).
Dowels are to be retained at one end only.
1 - Apply primer to one end of dowel and allow to dry.
2 - Apply Loctite to dowel hole in either casting or mounting plate, not both.

- Fit the end of the dowel with the primer into the hole that has the Loctite.

Remove excess Loctite from the dowel, before fitting the mounting plate over the dowel.

Steering Crank Shaft and Mounting Block

Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed without Primer Activator, Accelerator		
680	*GREEN*	Type	Drying Time		Partial	Full
		n/a	n/a		30 Min	4-6Hrs



Steering crankshaft to mounting block (Extra high strength retaining).
1 - Apply primer to bottom half of shaft and allow to dry.
2 - Apply Loctite to the bore of the mounting block and the bottom half of the shaft.
Heat the mounting block if required.
Press the shaft into the mounting block.
Remove excess Loctite from the top half of the shaft

A-3 Installation Checks

1. jet unit: mounting:

Item No.	Check to be carried out	Completed
1.1	Check the intake block is flush with the exterior of the hull bottom.	☐
1.2	Check that there are no flow obstructions forward of the intake (Refer to the hull details in jet Designers manual). Make a record of the size and position of any through hull penetrations or strakes around the jet area, for use when commissioning the jet unit.	☐
1.3	Inspect the intake base flange for obvious distortion or gaps between the intake base flange and the hull.	☐
1.4	Check the intake gasket (or sealant) between the base and the mounting surface has not squeezed out into the water passage. Trim off any excess gasket and sealant.	☐
1.5	Check the transom plate seal is correctly located and secured. (Do not overtighten). If two people are available and the boat is indoors, a strong light may be used to check the fit of the transom cut out and seal.	☐
1.6	For steel hulls check that the jet unit is insulated from the hull (Refer to the drawings and the “corrosion” section of the product manual).	☐
1.7	Check that engine exhaust outlets are above the expected waterline and well to the side of jet units (Refer to the design basics section in the jet unit product manual).	☐
1.8	Check that the hull trim tabs (if fitted) will not interrupt the reverse flow (Refer to the design basics section in the product manual).	☐
Remarks:		

2. jet unit: General:

Item No.	Check to be carried out	Completed
2.1	Ensure that the correct impeller is fitted to match engine duty. impeller part number (stamped on hub) can be seen through the jet unit inspection cover.	☐
2.2	Check that all anodes are in place and have not been painted over. (Refer to the anode location drawings shown in the product manual).	☐
2.4	Check that the inspection hatch seal is correctly located in the seal groove and that the inspection hatch securing bolts are tightened to the correct torque.	☐
2.5	Check that the correct dipstick is fitted to the bearing housings for the dead-rise of the jet (Refer to the dipstick drawings shown in the product manual) and that the oil level in the bearing housings are correct.	☐
2.6	Check that the water offtake hoses (when fitted) are appropriately and securely fitted.	☐
2.7	Check that any unused water offtakes are plugged.	☐
2.8	Check that the bearing housing has been filled with grease as shown in the Initial bearing housing re-assembly section.	☐

Anti-fouling Paints

Additional coats of antifoul must be applied to the jet unit, typically within two weeks of the launch of the vessel.
The supplied antifoul coating will require light abrasion and cleaning prior to further application of antifoul.

Do not use Copper Oxide based anti-fouling paints. Do not paint over the anodes.

3. jet systems: steering:

Item No.	Check to be Carried Out	Completed
3.1	For jet units with tiller type steering (e.g. HM-422) check that the cotter pins (tapered pins which locate the tiller arms on the steering shaft) are facing the correct direction for the deadrise angle and the number of jets (Refer to the steering drawings in the product manual).	☐
3.2	For manual hydraulic helms ensure that:- • Correct steering ratio (1 to 2 turns of helm from lock to lock). • Full lock travel is limited by the cylinder, not the steering linkage. • steering sense is correct (i.e. port helm provides port nozzle movement). • Ensure that all air has been bled from the steering system (feel at the wheel will be soft and spongy if there is still air in the steering system).	☐
Remarks:		

4. drive shaft:

Item No.	Check to be Carried Out	Completed
4.1	Ensure driveline details have been approved by CWF Hamilton & Co Ltd.	☐
4.2	On universal joint driveshafts (Refer to the design basics section in the product manual) check: • Yoke offset angles are in the same plane, are equal and are less than 5°. • Yokes are in the same plane.	☐
4.3	On bearing supported line shafts (Refer to the design basics section in the product manual) check: • The supportbearings are aligned with the engine flywheel. • Outer supportbearings are close to the end of the couplings.	☐
Remarks:		

A-4 Commissioning Checks

Refer to relevant controls product manual for commissioning of the controls system.

1 Pre launch checks

Item No.	Checks to be carried out	Completed
1.1	Check that the plastic spiral wrap protective cover (where fitted) has been removed from hydraulic shafts (HM-models only). Check all hydraulic shafts for damage and check that they are free from contamination (weld splatter, grinding dust, fibreglass resin, etc).	☐
1.2	Check that all the jet unit inspection covers are correctly fitted and secured.	☐
1.3	Check that all the anodes have been fitted and that they have not been painted over. Refer to anode location drawing.	☐
1.4	If the steering assembly, tailpipe or reverse duct have been removed during jet installation, check that all fasteners securing these items have been torqued correctly.	
Remarks:		

2 Post launch checks:

Item No.	Checks to be carried out	Completed
2.1	Check for water leaks at the transom seal, intake base, and from under the bearing housing (water seal leaking).	☐
2.2	For oil lubricated main bearings (HJ-362 and above), check that the correct dipstick is fitted and that oil level is correct (dipstick length is dependent on the deadrise angle of the jet unit). For HM-651 to HM-811, check that the dipsticks are on the correct side (Refer to the dipstick drawings in the product manual).	☐
2.3	For grease lubricated main bearings (HJ-322 and below), add grease until grease comes out of the front seal as shown in the "initial bearing housing reassembly" section.	☐
	⚠ Ensure that all bearing housings are correctly filled with the correct amount and grade of oil. If this is not done, then damage will occur to the Jet Unit.	
2.4	If a main bearing oil pump is fitted (HM-651 to HM-811) then check the oil pump operation by loosening the oil pipe fitting on top of the bearing housing and checking for oil flow.	☐
2.5	Check the JHPU oil level and replenish as required.	☐
2.6	If the vessel is fitted with shore power, then unplug the shore power and measure the electrical resistance between the hull and the earth pin of the vessel shore power plug. A correctly wired isolation transformer or galvanic isolator will result in high electrical resistance (greater than 1kohm) between the hull and the earth conductor. (Refer to "precautions against corrosion" section of the product manual).	Measured Resistance ☐ ohm
	⚠ Direct electrical connection of the hull to the earth conductor of a shore power supply can result in rapid jet corrosion. Refer to “Precautions Against Corrosion” section of the product manual.	

3 engine running checks (vessel moored):

Item No.	Checks to be carried out	Completed
3.1	The marine bearing must operate wet unless the optional dry run kit has been fitted (dry run kit available for HJ-212 to HJ-364 jet units only). For a jet unit fitted with a dry run kit, the following applies:- Maximum dry run time of 3 minutes with engine speed not exceeding 1000 RPM. Minimum time between dry runs of 1 hour. Do not operate the standard jet unit with the vessel out of the water, or with the vessel ballasted such that the jet unit does not prime (pump water properly) when the engine is started. For jets specified with a water feed system for the water seal and marine bearing (specified on jets where the mainshaft is above the static waterline, typically on multi-jet monohulls with high deadrise), check that water is being supplied to the water seal and marine bearing before running the jet unit	☐
3.2	Ensure the vessel is securely moored fore and aft and in deep clean water.	☐
3.3	With the reverse controls set to "zero speed", the engine(s) may be started and the engine supplier's representatives can carry out engine checks.	☐
3.4	If the engine cooling water is taken from the jet unit offtake, confirm that water is coming out of the engine exhaust outlets where possible. Periodically check that the engine is running at the correct operating temperature. Check that the cooling water hoses are secure.	☐
	⚠ Ensure that all bearing housings are correctly filled with the correct amount and grade of oil. If this is not done, then damage will occur to the jet unit.	
3.5	If the vessel is equipped with HSRC or HYRC and the pressure alarm sounds, immediately shut the engine off and refer to the controls product manual to check adjustments. Failure to immediately shut down the engine may result in serious damage to the hydraulic pump due to overheating.	☐
3.6	Check for water leaks around the jet unit while the engine is running particularly under the bearing housing (mainshaft water seal).	☐
3.7	Check that the jet unit and driveshaft are running smoothly (no vibration).	☐

3 engine running checks (vessel moored):

Item No.	Checks to be carried out	Completed
3.8	Periodically check the bearing housing temperature. The temperature should not exceed 80ºC. On multi-jet installations, all bearing housings should be at a similar temperature	☐
3.9	Check that the reverse controls are working by monitoring the reverse duct position while moving the reverse control lever(s).	☐
3.10	Check that the steering controls are working by monitoring steering nozzle position while moving the helm. *(Check that port helm gives port nozzle deflection, starboard helm gives starboard nozzle deflection and that all nozzles are steering in the same direction).*	☐
3.11	Check that steering travel is limited by the hydraulic steering cylinder and not the steering linkage. *(For jet units fitted with steering cylinders and linkages).*	☐
3.12	After stopping the engine, check that the main bearing and JHPU oil levels and replenish if required.	☐
Remarks:		

4 vessel trial:

Item No.	Checks to be carried out	Completed
4.1	Leave the mooring and check that the steering is operating correctly at "forward speed", at "zero speed" and going "astern".	☐
4.2	Observe the jet stream when going "dead ahead" at speed to ensure that it is relatively clean with an even shape.	☐
4.3	Check that the jet unit and driveshaft are running smoothly (no vibration) over the entire engine operating speed range (i.e. from "idle" to "full ahead").	☐
4.4	Periodically check the bearing housing temperature and record the temperature once it reaches a steady value. Due to friction caused by the seals, the bearing housing is likely to be warm. *The temperature should not exceed 80ºC.*	☐
4.5	If practical check the driveshaft coupling joint temperatures (if fitted). Increased joint temperature may indicate driveshaft misalignment.	☐
4.6	Periodically check the hydraulic oil temperature at the oil. Record the temperature reading after a sustained run at cruising speed and after a period of vessel manoeuvring.	☐
4.7	Record maximum speed (using GPS) and engine revolutions (strong currents will result in inaccurate speed readings since the GPS provides speed over ground). At maximum speed the jet revolutions should be verified with a hand held tachometer at the jet unit coupling.	☐
4.8	Record vessel speed at varying engine revolutions if possible.	☐
4.9	Record observations on vessel trim, loading, etc.	☐
Remarks:		

5. After initial trials:

Item No.	Checks to be carried out	Completed
5.1	Refer to the maintenance section of the product manual for any servicing that may be required on completion of trials.	☐
5.2	For steel hulls check that the jet unit is insulated from the hull. The resistance should be approximately 100 ohms but will vary depending on water salinity and hull characteristics. Refer to the precautions against corrosion section of the product manual.	☐
5.3	Check for water leaks at the transom seal, intake base, and from under the bearing housing (water seal leaking).	☐
Remarks:		

6 jet unit trials & commissioning data:

Commissioning engineer:		Commissioning date:	
vessel description:		Hamilton jet project number:	
vessel displacement:		jet units serial number(s):	
jet model(s):		gearbox ratio:	
impeller rating:		engine power & RPM:	
engine model:			

6.1. Temperature readings (driveshaft joints, bearing housing, hydraulics (If fitted)

Temperature:	Location and comments:

6.2. Speed trial readings:

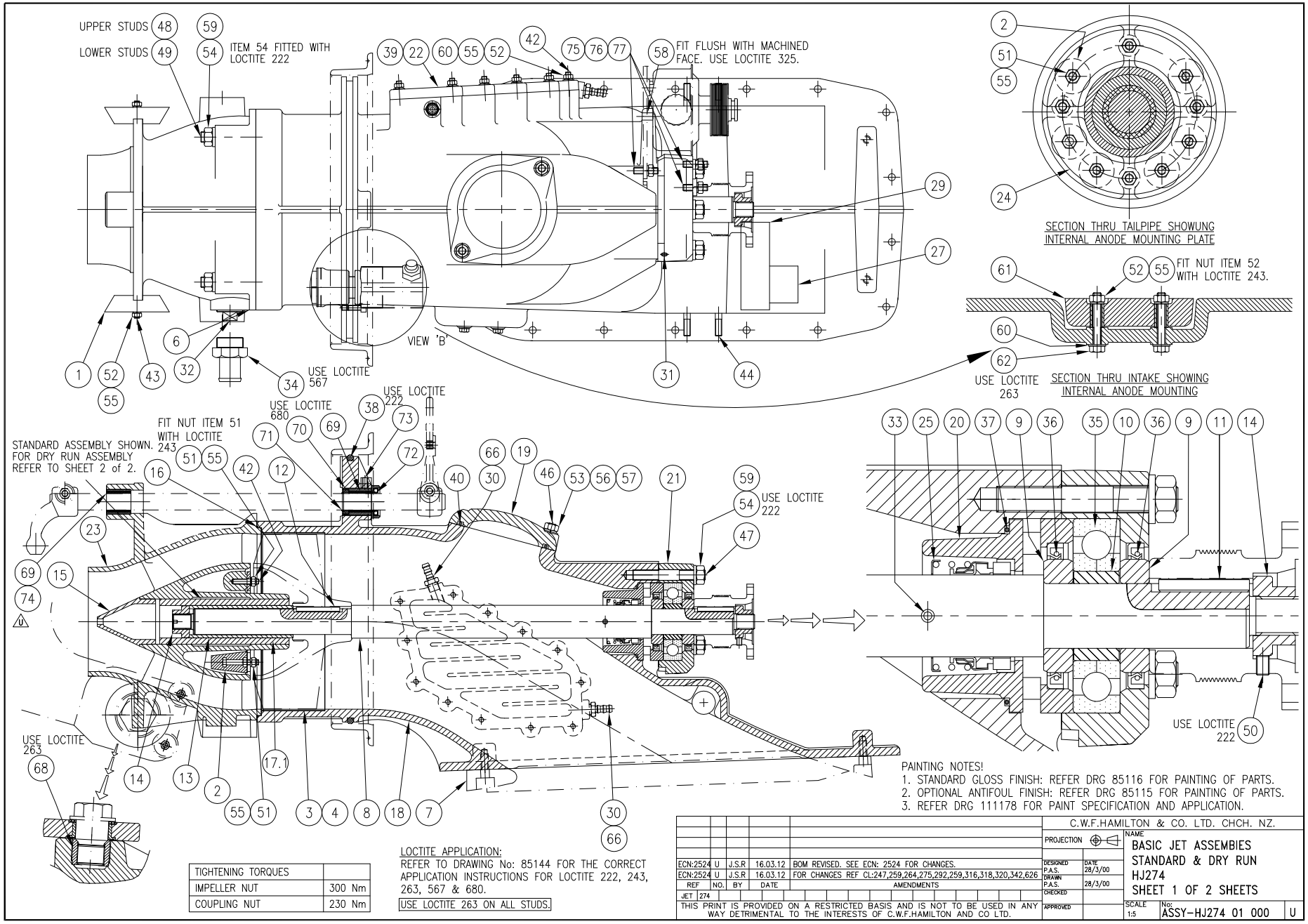
engine speed:	vessel speed:	Comments (loading, sea conditions etc):

Comments:

Drawings

- Technical Drawings

HJ27401000 Basic Jet Assemblies Standard and Dry Run



PAINTING NOTES!
1. STANDARD GLOSS FINISH: REFER DRG 85116 FOR PAINTING OF PARTS.
2. OPTIONAL ANTIFOUL FINISH: REFER DRG 85115 FOR PAINTING OF PARTS.
3. REFER DRG 111178 FOR PAINT SPECIFICATION AND APPLICATION.

TIGHTENING TORQUES	
IMPELLER NUT	300 Nm
COUPLING NUT	230 Nm

LOCTITE APPLICATION:
REFER TO DRAWING No: 85144 FOR THE CORRECT APPLICATION INSTRUCTIONS FOR LOCTITE 222, 243, 263, 567 & 680.

USE LOCTITE 263 ON ALL STUDS.

REF	NO.	BY	DATE	AMENDMENTS
ECN:2524	U	J.S.R	16.03.12	BOM REVISED. SEE ECN: 2524 FOR CHANGES.
ECN:2524	U	J.S.R	16.03.12	FOR CHANGES REF CL:247,259,264,275,292,259,316,318,320,342,626
JET	274			

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

		DATE
DESIGNED	P.A.S.	28/3/00
DRAWN	P.A.S.	28/3/00
CHECKED		
APPROVED		

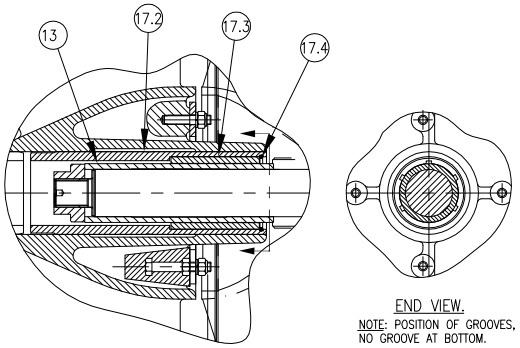
NAME
BASIC JET ASSEMBIES
STANDARD & DRY RUN
HJ274
SHEET 1 OF 2 SHEETS

SCALE 1:5 | No: ASSY-HJ274 01 000 | U

HJ27401000 Basic Jet Assemblies Standard and Dry Run Sht 2

A	B	C	D	E	F	G	H	Item	Kit	Part Number	Product Description	Drawing
									A	HJ27401001	BASIC JET ASSEMBLY	HJ2740100
									B	HJ27401004	BASIC JET DRY RUN ASSEMBLY	HJ2740100
									C	110809	INTAKE KIT	HJ2740100
									D	110810	TAILPIPE KIT	HJ2740100
									E	110732	TAILPIPE KIT (DRY RUN ASSEMBLY)	HJ2740100
									F	110811	BEARING HOUSING KIT	HJ2740100
									G	111654	ANODE KIT:- TAILPIPE INTERNAL	HJ3220100
									H	106626	DRY RUN BEARING ASSEMBLY	HJ2740100
	B1			E1					H	106626	DRY RUN BEARING ASSEMBLY	HJ2740100
A2	B2		D2	E2				1		102185	ANODE	102185
A6	B6		D6	E6		G6		2		111593	ANODE (INTERNAL) TAILPIPE	111593
A1	B1	C1						3		103362	WEAR RING	107266
A1	B1	C1						4		103363	INSULATOR (WEAR RING)	102727
A1	B1							5		105135	(Jet) Wood Transport Crate HJ 274	105135
A1	B1		D1	E1				6		105273-2	STONE BAR	105941
								7	REF	112395	SCREEN (0deg SHAFT LINE)	112395
								7	REF	112397	SCREEN (5deg SHAFT LINE)	112397
A1	B1							8		110417	MAINSHAFT	110417
A2	B2				F2			9		105279	SEAL SLEEVE	105279
A1	B1				F1			10		105280	BEARING CARRIER	105280
A1	B1							11		105283-1	COUPLING KEY	105283
A1	B1							12		105283-2	IMPELLER KEY	105283
A1	B1							13		111119	WATER BEARING SLEEVE	111119
A2	B2							14		112290	IMPELLER-COUPLING NUT AB2	112290
A1	B1		D1	E1				15		105287	TAILPIPE FAIRING	105287
A1	B1		D1	E1				16		105360	(O RING) 1.78mm(0.070")SECT - 0910mm CUT LENGTH - 289mm NOM. I.D.	113050
A1			D1					17.1		106264	MARINE WATER BEARING 70x50x200	106264
							H1	17.2		106626-1	BEARING SHELL	106626-1
							H1	17.3		106626-2	BEARING INNER	106626-2
							H1	17.4		111125	(GENERAL) ROUND CIRCLIP (DRY RUN BEARING)	104201
A1	B1	C1						18		110309	INTAKE	110309
A1	B1							19		106439	INSPECTION COVER	106439
A1	B1							20		111719	SEAL FACE HOLDER MK2 HJ274	111719
A1	B1				F1			21		110396	BEARING HOUSING C/W SAGINAW PUMP MOUNT HJ274	110396
A1	B1	C1						22		109194	OIL COOLER COVER PLATE	109194
A1	B1		D1	E1				23		111139	TAILPIPE	111139
A1	B1		D1	E1				24		111653	ANODE MOUNTING PLATE HJ274	111653
A1	B1							25		061527	(JET) ROTARY SEALS 2.0" (BR1-G2482CAN-X32)	61527
A1	B1	C1						27		063097	(LABELS) (MODEL & SERIAL No PLATE)	63097
A1	B1	C1						29		063610	(LABELS) (WARNING PLATE)	63610
A2	B2	C2						30		065234	HOSE TAIL 3/8" BSPP MALE PUSH LOC # 3D982-6-6C	115000
A1	B1				F1			31		200917	(GREASE) NIPPLES 1/8"BSP STAINLESS STEEL	N/A
A1	B1		D1	E1				32		200937	(PLUGS) B.S.P.P. PLUG 1-1/4" BSP SQ HD 316 S.S.	N/A

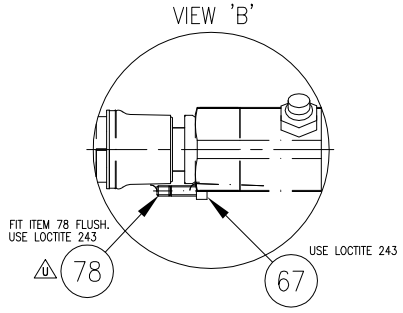
A	B	C	D	E	F	G	H	Item	Kit	Part Number	Product Description	Drawing
A1	B1							33		201074	(SPLIT PINS) ST ST 316 0.19"x2.50"	N/A
A1	B1		D1	E1				34		201411	(HOSE) TAILS 1-1/4" BSP (#BSP-6-HT-032) 316 STST	N/A
A1	B1				F1			35		201451	(SKF) BEARINGS ALL TYPES (SKF QJ311MA)	N/A
A2	B2				F2			36		065009	(OIL SEALS) NAK SCW10-70*90*10	N/A
A1	B1							37		064981	(O RINGS) IMPERIAL 0.13 X 4.0 X 4.25 (242N70)	N/A
								38	REF	110812	(JET) O RINGS SPECIAL TRANSOM PLATE	111183
A1	B1	C1						39		200998	(O RINGS) IMPERIAL 0.13x9.00x9.25 (270N70)	N/A
A1	B1							40		200991	(O RINGS) IMPERIAL 0.25x5.25x5.75 (431N70)	N/A
A16	B16	C12	D4	E4				42		201279	(STUDS) METRIC (316-STST) M8x40 (12/22)	30647
A2	B2		D2	E2				43		030661	(STUDS) METRIC (316-STST) M8x51 (16/16)	30647
A4	B4	C4						44		201281	(STUDS) METRIC (316-STST) M10x50 (15/26)	30637
A2	B2	C2						46		113343	(STUDS) METRIC (316 STST) M12 x 70 (24/24)	30639
A3	B3	C3						47		110423	(STUDS) METRIC (SAF-2205) M16x113 (40/40)	30700
A2	B2	C2						48		102286	(STUDS) METRIC (316-STST) M16x117 (32/32)	30634
A2	B2	C2						49		106364	(STUDS) METRIC (SAF-2205) M16x155 (32/32)	30700
A10	B10		D10	E10		G10		51		201330	NUT NYLOC M8 SS316	N/A
A16	B16	C12	D2	E2				52		201309	(NUTS) (METRIC ST ST 316) M8	N/A
A2	B2							53		201311	NUT HEX M12 SS316	N/A
A7	B7							54		201312	(NUTS) (METRIC ST ST 316) M16	N/A
A26	B26	C12	D12	E12		G10		55		201394	(WASHERS) (SPRING) METRIC ST ST 316 M8	N/A
A2	B2							56		201396	WASHER SPRING M12 SS316	N/A
A2	B2							57		201385	(WASHERS) (FLAT) METRIC ST ST 316 M12x24x1.6	N/A
A1	B1	C1						58		110806	SLEEVE FOR SAGINAW PUMP MOUNT	110806
A7	B7							59		103451	(WASHER) SPECIAL M16 316 STST	103451
A14	B14	C14						60		201383	WASHER FLAT M8x16x1.2 SS316	N/A
A1	B1	C1						61		111059	ANODE INTERNAL	111059
A2	B2	C2						62		201223	(SCREWS) (M/C SCREWS) METRIC ST ST 316 HEX HD M8x55	N/A
A1	B1							63		111426	274 LABELS KIT	111420
A1	B1							64		111201	PAINT APPLICATION 274 JET (STD) Gloss Finish.	111178
								65	REF	111179	PAINT APPLICATION 274 JET (OPTIONAL) Antifoul Preparation	111178
A2	B2	C2						66		201767	BONDED SEAL 3/8" BSP (400-823-4490-74)	115000
		C1						67		201261	(SCREWS) (CAPSCREWS) METRIC ST ST 316 SOCKET HD M8x20	N/A
			D2	E2				68		104608	THREADED BUSH (REV DUCT PIVOT PIN)	104608
		C1	D1	E1				69		111124	STEERING SHAFT BUSH (Orkot TL)	111124
		C1						70		111123	STEERING BUSH & SEAL HOUSING	111123
		C1						71		061353	(SEAL) SCRAPER RING-WYCLIP	N/A
		C1						72		061362	(OIL SEALS) 25x42x7 (GACO DPSM 25427) C/W SS SPRING	N/A
		C1						73		201246	(SCREWS) (SET SCREWS) METRIC ST ST 316 SOCKET M8x16	N/A
			D1	E1				74		111138	SLEEVE FOR STEERING SHAFT BUSH	111138
		C1			F2			75		201280	(STUDS) METRIC (316-STST) M10x40 (15/20)	30637
		C1			F2			76		201395	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A
		C1			F2			77		201310	(NUTS) (METRIC ST ST 316) M10	N/A
		C1						78		201245	SCREW SET SOCKET M8x10 SS316	N/A



DRY RUN ASSEMBLY

END VIEW.

NOTE: POSITION OF GROOVES, NO GROOVE AT BOTTOM.



REF	NO.	BY	DATE	AMENDMENTS
				SEE SHEET 1 FOR AMENDMENTS.

JET 274

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C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

NAME: BASIC JET ASSEMBLIES STANDARD & DRY RUN HJ274 SHEET 2 OF 2

DESIGNED P.A.S. DATE 28/3/00

DRAWN P.A.S. 28/3/00

CHECKED

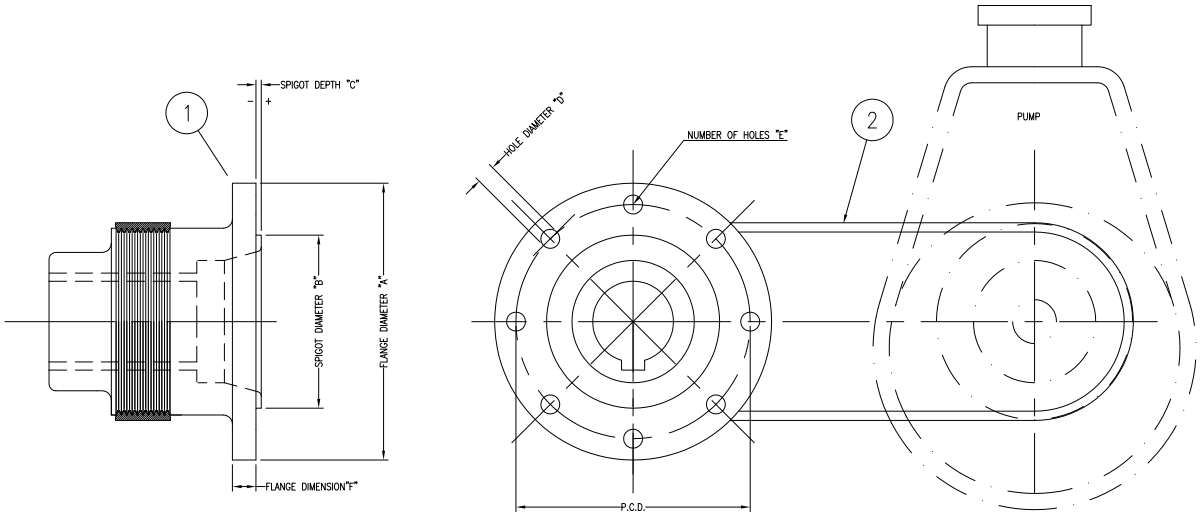
APPROVED

SCALE -

No: ASSY-HJ274 01 000 U

HJ27402001 Couplings & Belts

DO NOT SCALE THIS DRAWING | REMOVE ALL SHARP CORNERS | ALL DIMENSIONS IN mm. UNLESS OTHERWISE SHOWN | PROJECTION



A	B	C	D	E	F	G	H	Item	Kit	PartNumber	Qty	ProductDescription	DrawingNbr
									A	109285		COUPLING & V-BELT KIT (ELBE 0.112)	HJ27302001
									B	109216		COUPLING & V-BELT KIT (ELBE 0.113)	HJ27302001
									C	109217		COUPLING & V-BELT KIT (HARDY SPICER 1400)	HJ27302001
									D	109218		COUPLING & V-BELT KIT (HARDY SPICER 1510)	HJ27302001
									E	109219		COUPLING & V-BELT KIT (AQUADRIVE 14200)	HJ27302001
									F	110934		COUPLING & V-BELT KIT (AQUADRIVE 20400)	HJ27302001
									G	111253		COUPLING & V-BELT KIT (GWB 687.35 & .40)	HJ27402001
									H	111255		COUPLING & V-BELT KIT (HARDY SPICER 1610)	HJ27402001
A								1		108944	1	COUPLING WITH MICRO-V PULLEY (ELBE 0.112)	108944
	B							1		108945	1	COUPLING WITH MICRO-V PULLEY (ELBE 0.113)	108945
		C						1		108946	1	COUPLING WITH MICRO-V PULLEY (HARDY SPICER 1410)	108946
			D					1		108947	1	COUPLING WITH MICRO-V PULLEY (HARDY SPICER 1510 & 1550)	108947
				E				1		108948	1	COUPLING WITH MICRO-V PULLEY (AQUADRIVE 14200)	108948
					F			1		110933	1	COUPLING WITH MICRO-V PULLEY (AQUADRIVE 20400)	110933
						G		1		111254	1	COUPLING WITH MICRO-V PULLEY (GWB 687.35 & .40)	111254
							H	1		111256	1	COUPLING WITH MICRO-V PULLEY (HARDY SPICER 1610)	111256
A	B	C	D	E	F	G	H	2		64578	1	(VEE BELTS) Gates (PJ584 10 RIB) Micro Vee	N/A

COUPLING	DIA.A	DIA.B	DEPTH.C	DIA.D	PCD	HOLES.E	DIM.F
111256	175	168.32(recess)	(-1.4/1.2)	9.65	155.57	8	13
111254	150	90(spigot)	(+2.3/2.1)	12.1	130	8	10
110933	148	112(recess)	-7.0	M12x1.75-6H	128	6	25
108948	135	90(spigot)	-6.0	M12x1.75-6H	108	6	30
108947	146	95.29recees)	(-2.0/1.8)	11.5	120.6	4*	13
108946	116	69.9(recess)	(-2.0/1.8)	11.5	95.3	4*	10
108945	120	75(spigot)	(+2.3/2.1)	10.2	101.5	8	10
108944	120	75(spigot)	(+2.3/2.1)	8.2	101.5	8	10

*NOTE–HOLES NOT E/SPACED.SEE PART DRAWING

HJ27402001 D

REF	NO.	BY	DATE	AMENDMENTS
CL419	D	I.G.G	25.5.06	DIA. D NOW 12.1 WAS 10.2
CL413	C	SC	24.04.06	DIM F ADDED
CL115	B	R.J.L	2.11.99	KITS G–111253 & H–111255 ADDED.
CL85	A	P.S.	8.3.99	KIT F ADDED
				ISSUED FOR PRODUCTION.
JET	274			

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

MATERIAL

√ = N9 EXCEPT AS STATED

UNLIMITED DIMENSIONS TO BE ± 0.5

MAT'L CERT

DESIGNED P.A.S. DATE 18.11.98

DRAWN P.A.S. 18.11.98

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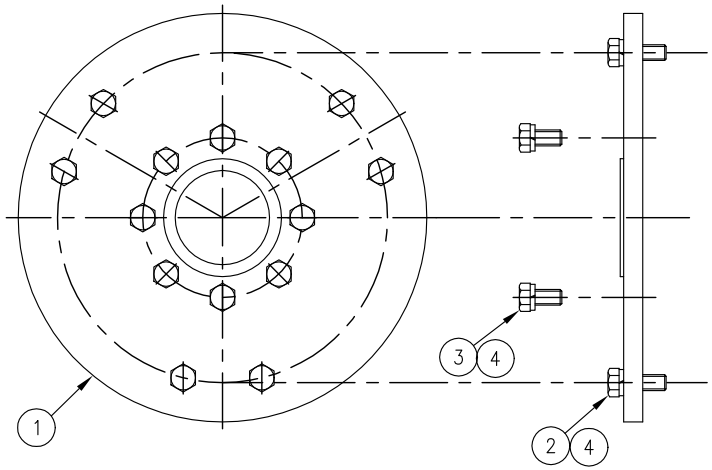
APPROVED K.V.E.

NAME COUPLINGS & BELTS HJ274

SCALE 1.5x | No: A3–HJ27402001 | D

HJ27402006 Fly Wheel Adapters



A	B	C	D	E	F	G	H	Code	Item	Kit	Part Nbr	Qty	ProductDescription	Drawing Nbr
										A	110408		ADAPTOR PLATE KIT for ISUZU UM4BCITC to 8 - dia10 HOLE X 120 FLANGE	HJ27302006
A								4	1		110407	1	ADAPTOR PLATE for ISUZU UM4BCITC to 8 - dia10 HOLE X 120 FLANGE	110407
A								4	2		HZQHXBU	6	HEX HEAD (M/C SCREW) M10x30	N/A
A								4	3		68005	8	M10 X 20 HEX MACHINE SCREW GR88 Z.P.	N/A
A								4	4		JEQKXAE	14	SPRING WASHER M10	N/A

CL74	0	P.S.		ISSUED FOR PRODUCTION.	
REF	NO.	BY	DATE	AMENDMENTS	
JET	274				

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PROJECTION

DESIGNED P.A.S. DATE 18/11/98

DRAWN P.A.S. 18/11/98

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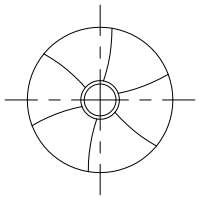
APPROVED

NAME: FLYWHEEL ADAPTORS FOR HJ274 JET

SCALE

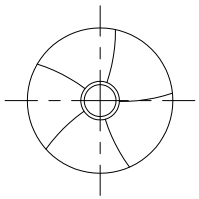
No: ASSY-HJ274 02 006 0

HJ27403001 impellers



6 BLADE

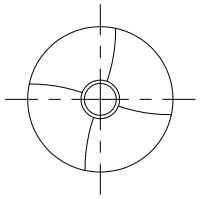
PartNumber	ProductDescription	DrawingNbr
107079	(JET) IMPELLERS TYPE (11.2) - (6 BLADE)	107082
107078	(JET) IMPELLERS TYPE (11.5) - (6 BLADE)	107082
107077	(JET) IMPELLERS TYPE (11.9) - (6 BLADE)	107082
107076	(JET) IMPELLERS TYPE (12.2) - (6 BLADE)	107082
107075	(JET) IMPELLERS TYPE (12.6) - (6 BLADE)	107082
107082	(JET) IMPELLERS TYPE (13.0) - (6 BLADE) As Cast	107082



5 BLADE

PartNumber	ProductDescription	DrawingNbr
112054	(JET) IMPELLERS TYPE (8.2) - (5 BLADE)	105380
105980	(JET) IMPELLERS TYPE (8.4) - (5 BLADE)	105380
105768	(JET) IMPELLERS TYPE (8.8) - (5 BLADE)	105380
105944	(JET) IMPELLERS TYPE (9.0) - (5 BLADE)	105380
111590	(JET) IMPELLERS TYPE (9.5) - (5 BLADE)	105380
105380	(JET) IMPELLERS TYPE (10.0) - (5 BLADE) As Cast	105380
110302	(JET) IMPELLERS TYPE (10.5) - (PITCHED 5 BLADE)	105846
105846	(JET) IMPELLERS TYPE (11.0) - (PITCHED 5 BLADE)	105846

△E



4 BLADE

PartNumber	ProductDescription	DrawingNbr
105870	(JET) IMPELLERS TYPE (6.5) - (4 BLADE)	105868
105869	(JET) IMPELLERS TYPE (7.0) - (4 BLADE)	105868
105381	(JET) IMPELLERS TYPE (7.5) - (4 BLADE)	105868
105868	(JET) IMPELLERS TYPE (8.0) - (4 BLADE) AS CAST	105868

△D NOTE:
REFER TO DRAWING 82206 FOR BLADE DRESSING INSTRUCTIONS AND BALANCING INFORMATION.

REF	NO.	BY	DATE	AMENDMENTS
CL421	E	I.G.G	16.06.06	DELETED 107080 & 107081. REINTRODUCED 105846
				FOR CHANGES REFER TO CL74, 154, 216, 217, 286

JET 274

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

DESIGNED P.A.S. DATE 18/11/98

DRAWN P.A.S. 18/11/98

CHECKED

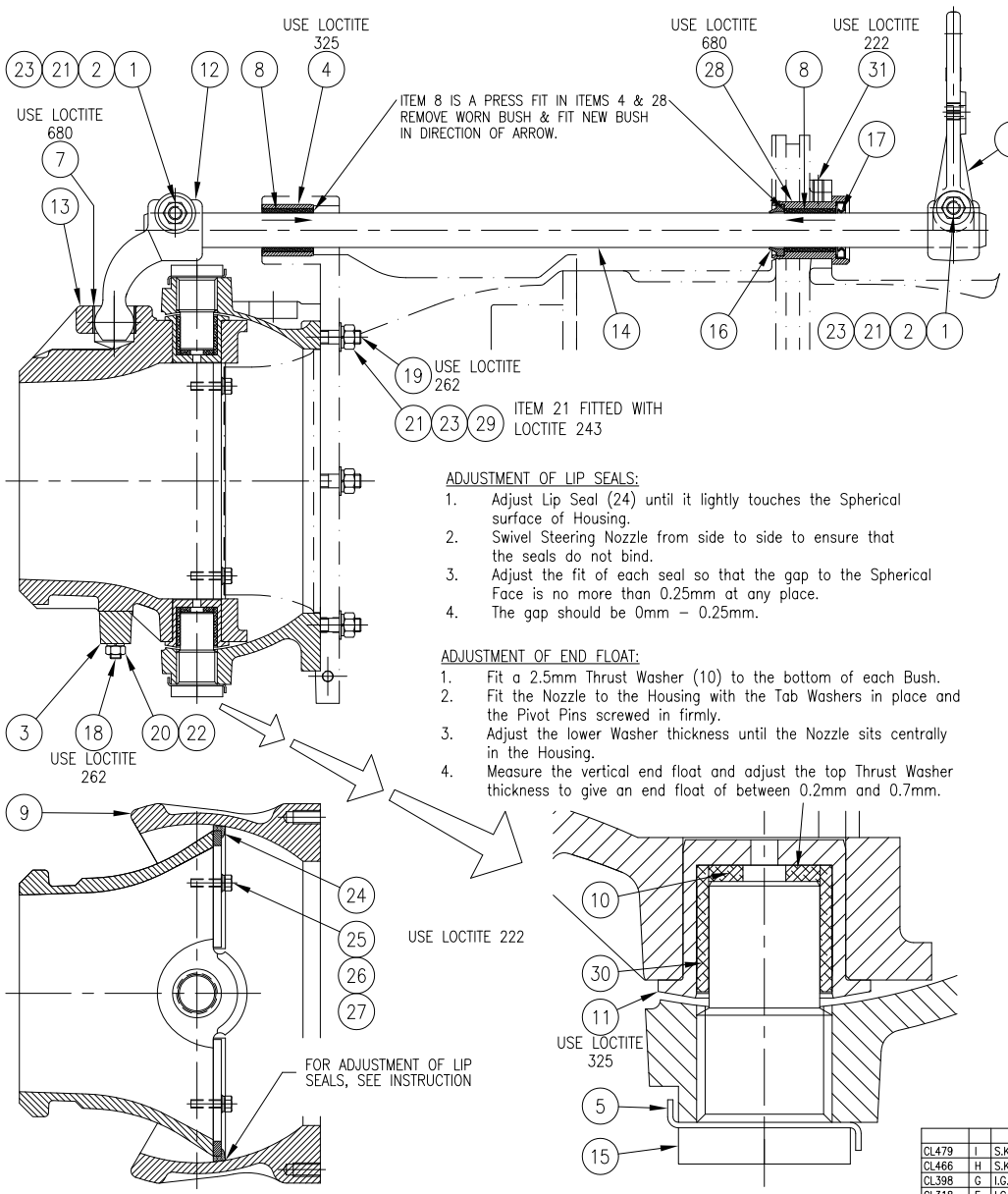
APPROVED

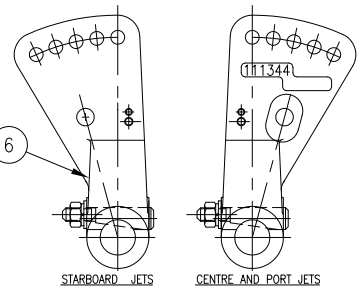
NAME HJ274 IMPELLERS

SCALE NTS

No: ASSY–HJ274 03 001 E

HJ27406000 Steering Assembly General Arrangement





STARBOARD JETS HJ274 06 025

CENTRE AND PORT JETS HJ274 06 005

LOCTITE APPLICATION:
REFER TO DWG No. 85144 FOR CORRECT APPLICATION INSTRUCTIONS FOR LOCTITE

PAINTING NOTES:
1). PAINT SPECS. AND APPLICATION: DWG No. 111178
2). STANDARD GLOSS FINISH: DWG No. 85116
3). OPTIONAL ANTIFOUL FINISH: DWG No. 85115

ADJUSTMENT OF LIP SEALS:
1. Adjust Lip Seal (24) until it lightly touches the Spherical surface of Housing.
2. Swivel Steering Nozzle from side to side to ensure that the seals do not bind.
3. Adjust the fit of each seal so that the gap to the Spherical Face is no more than 0.25mm at any place.
4. The gap should be 0mm – 0.25mm.

ADJUSTMENT OF END FLOAT:
1. Fit a 2.5mm Thrust Washer (10) to the bottom of each Bush.
2. Fit the Nozzle to the Housing with the Tab Washers in place and the Pivot Pins screwed in firmly.
3. Adjust the lower Washer thickness until the Nozzle sits centrally in the Housing.
4. Measure the vertical end float and adjust the top Thrust Washer thickness to give an end float of between 0.2mm and 0.7mm.

A	B	C	D	E	F	Item	Kit	PartNumber	Qty	ProductDescription	DrawingNbr
							A	HJ27406025		STEERING ASSEMBLY (STBD)	HJ27406000
							A	HJ27406005		STEERING ASSEMBLY (CENTER AND PORT)	HJ27406000
							B	111515		NOZZLE KIT	HJ27406000
							C	111516		HOUSING KIT	HJ27406000
							D	111511		NOZZLE PIVOT KIT	HJ27406000
							E	111343		STEERING SHAFT BUSH KIT	HJ32206000
							F	111525		STEERING KIT FOR HJ274	HJ27406000
A						1		102834	2	COTTER	102834
A						2		102993	2	(WASHER) SPECIAL 25mm ODx11mm IDx3mm thk	102993
A	B				F	3		103359	1	ANODE MK3	103359
A						4		111138	1	SLEEVE for STEERING SHAFT BUSH	111138
A		C	D		F	5		105139	2	(WASHER) SPECIAL 54mm OD x30.5mm ID x 1.2mm thk 316 STST	105139
A						6		111344	1	TILLER	111277
A	B				F	7		107156	1	DEFLECTOR CRANK BUSH	102961
A				E		8		111124	2	STEERING SHAFT BUSH (Orkot TL)	111124
A		C			F	9		109238	1	NOZZLE HOUSING (JT STEERING)	109238
A	B	C	D		F	10		111479-4	2	THRUST WASHER STEERING PIVOT (4.0mm)	111479
A	B	C	D		F	10		111479-1	2	THRUST WASHER STEERING PIVOT (2.5mm)	111479
A	B	C	D		F	10		111479-2	2	THRUST WASHER STEERING PIVOT (3.0mm)	111479
A	B	C	D		F	10		111479-3	2	THRUST WASHER STEERING PIVOT (3.5mm)	111479
A	B		D		F	11		111483	2	SLEEVE for STEERING PIVOT BUSH	111483
A						12		109703	1	STEERING CRANK (JT STEERING)	109703
A	B				F	13		111333	1	NOZZLE	111333
A						14		110416	1	SHAFT STEERING JT	109705
A			D		F	15		111481	2	PIVOT PIN JT STEERING	111481
A				E		16		061353	1	(SEAL) SCRAPER RING-WYCLIP	61332
A				E		17		061362	1	(OIL SEALS) 25x42x7 (Gaco DPSM 25427) C/W SS SPRING	N/A
A	B				F	18		030661	2	(STUDS) METRIC (316-STST) M8x51 (16/16)	30647
A		C			F	19		206680	6	(STUDS) METRIC (316-STST) M10x51 (22/22)	30637
A	B				F	20		201309	2	(NUTS) (METRIC ST ST 316) M8	N/A
A		C6			F6	21		201310	8	(NUTS) (METRIC ST ST 316) M10	N/A
A	B				F	22		201394	2	(WASHERS) (SPRING) METRIC ST ST 316 M8	N/A
A		C6			F6	23		201395	8	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A
A	B				F	24		111332	2	LIP SEAL	111332
A	B				F	25		201214	4	(SCREWS) (M/C SCREWS) METRIC ST ST 316 HEX HD M6x25	N/A
A	B				F	26		201392	4	WASHER SPRING M6 SS316	N/A
A	B				F	27		201382	4	WASHER FLAT M6x125x10 SS316	N/A
A						28		111123	1	STEERING BUSH & SEAL HOUSING	111123
A		C			F	29		201384	6	(WASHERS) (FLAT) METRIC ST ST 316 M10x21x1.2	N/A
A	B		D		F	30		111480	2	PIVOT BUSH for STEERING	111480
A						31		201246	1	(SCREWS) (SET SCREWS) METRIC ST ST 316 Socket M8x16	N/A

REF	NO.	BY	DATE	AMENDMENTS
CL479	I	S.K.	06.08.07	ITEM 19 WAS 201281 NOW 206680
CL466	H	S.K.	14.05.07	KIT 'F' ADDED TO ALLOW STEER ASSY W/O CRANK, SHAFT, TILLER ETC.
CL398	G	I.G.G	12.12.05	ITEM 25 WAS 30798, REVISED SEAL GAP SETTING PROCEDURE
CL318	F	I.G.G	29.03.04	ITEM 21 NOW FITTED WITH LOCTITE 243
CL176				FOR CHANGES SEE CL176, 193, 203, 229, 247, 302

JET 274

THIS PRINT IS PROVIDED ON A RESTRICTED BASIS AND IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO THE INTERESTS OF C.W.F.HAMILTON AND CO LTD.

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

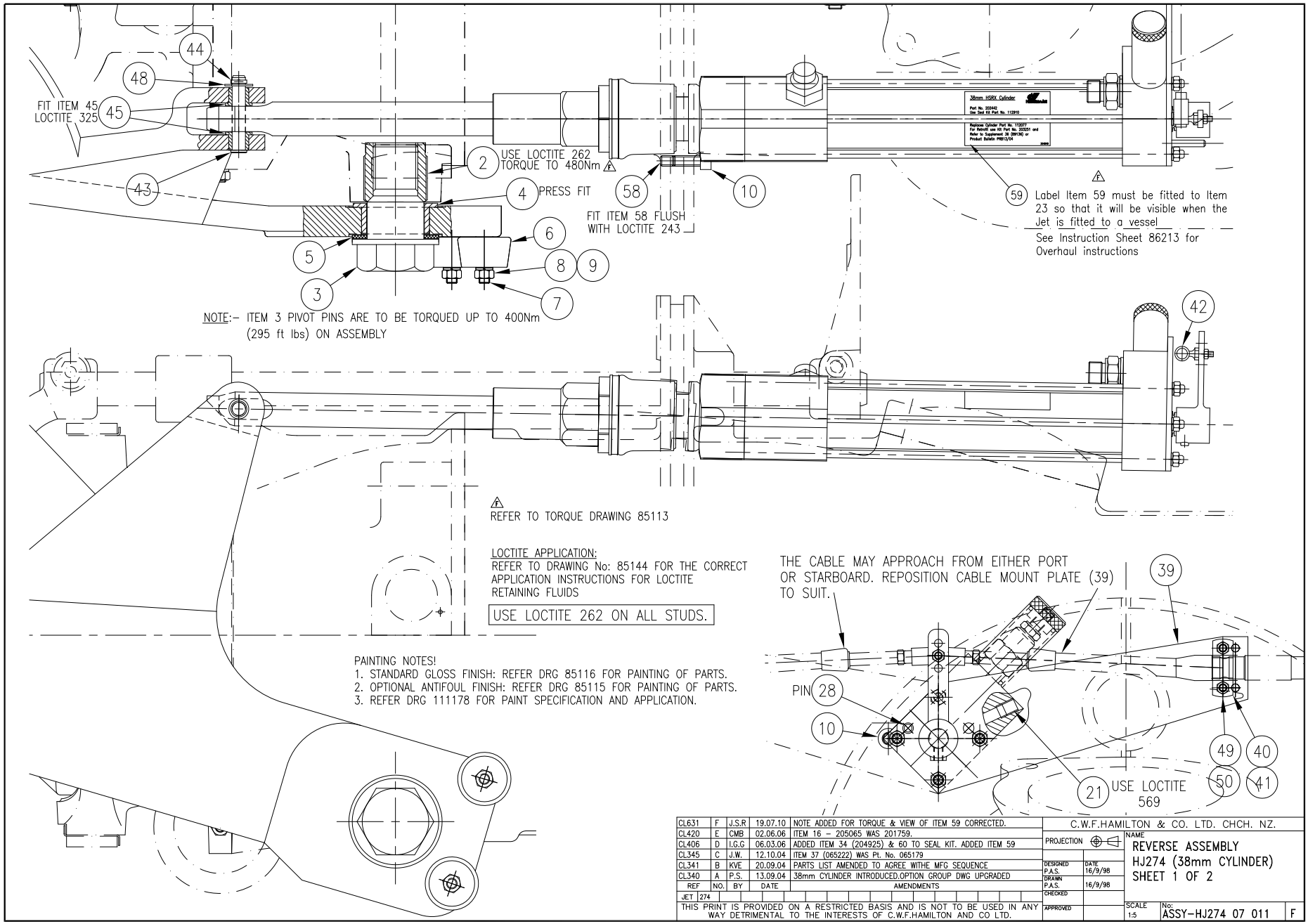
PROJECTION

DESIGNED P.A.S.	DATE 7/3/01
DRAWN P.A.S.	7/3/01
CHECKED	
APPROVED	

NAME
STEERING ASSEMBLY
GENERAL ARRANGEMENT
JT TYPE STEERING
HJ 274 JET

SCALE 1:3.33 | No. ASSY–HJ274 06 000 | I

HJ27407011 Reverse Assembly



REF	NO.	BY	DATE	AMENDMENTS
CL631	F	J.S.R	19.07.10	NOTE ADDED FOR TORQUE & VIEW OF ITEM 59 CORRECTED.
CL420	E	CMB	02.06.06	ITEM 16 – 205065 WAS 201759.
CL406	D	I.G.G	06.03.06	ADDED ITEM 34 (204925) & 60 TO SEAL KIT. ADDED ITEM 59
CL345	C	J.W.	12.10.04	ITEM 37 (065222) WAS Pt. No. 065179
CL341	B	KVE	20.09.04	PARTS LIST AMENDED TO AGREE WITHE MFG SEQUENCE
CL340	A	P.S.	13.09.04	38mm CYLINDER INTRODUCED.OPTION GROUP DWG UPGRADED

JET 274

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

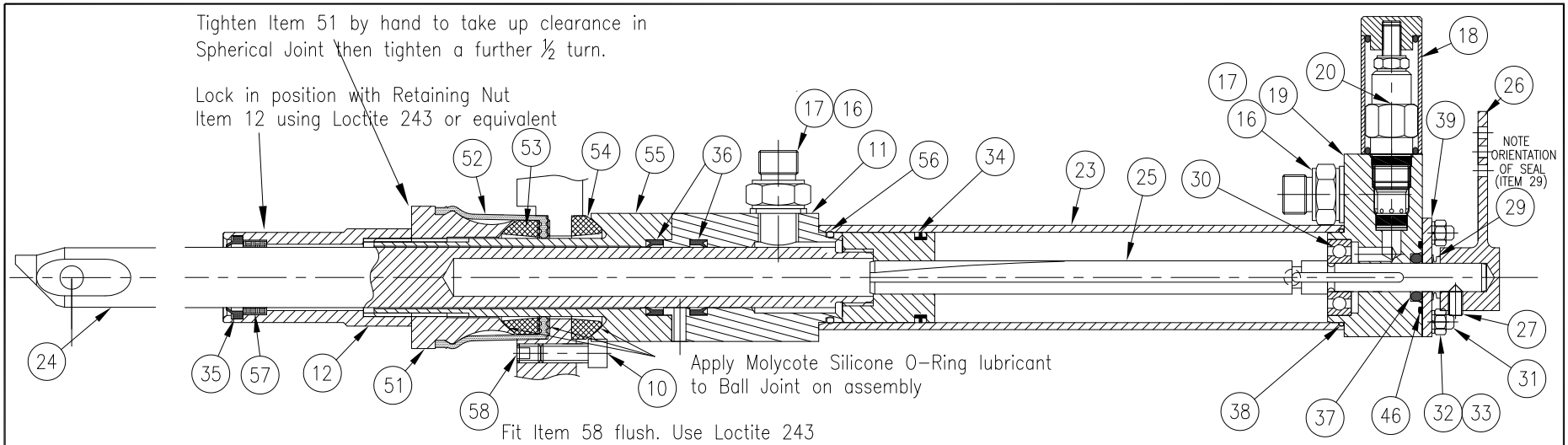
	DATE
DESIGNED P.A.S.	16/9/98
DRAWN P.A.S.	16/9/98
CHECKED	
APPROVED	

NAME
REVERSE ASSEMBLY
HJ274 (38mm CYLINDER)
SHEET 1 OF 2

SCALE 1:5

No: ASSY-HJ274 07 011 F

HJ27407011 Reverse Assembly Sht 2



A	B	C	D	E	F	G	Item	Kit	PartNumber	ProductDescription	DrawingNbr
								A	HJ27407011	REVERSE GROUP (HYDRAULIC) CONTROL 38mm Cylinder	HJ27407011
A1								B	202442	HSRX CYLINDER ASSY (38mm CYLINDER)	HJ27407011
								C	112910	SEAL KIT HSRX (38mm CYLINDER)	HJ27407011
								D	203028	HSRX BACKHEAD KIT (38mm CYLINDER)	HJ27407011
								E	112911	FRONT HEAD KIT HSRX (38mm CYLINDER)	HJ27407011
								F	112243	REVERSE DUCT KIT 274-292	HJ27407011
								G	080934	CABLE CLAMP KITSET	80934
A1					F1		1		110747	REVERSE DUCT	110747
A2							2		104608	THREADED BUSH (REV DUCT PIVOT PIN)	104608
A2							3		104609	REVERSE DUCT PIVOT PIN	104609
A2					F2		4		104610	SHOULDERED BUSH (acetal)	104610
A2							5		063955	(WASHER) SPECIAL POLYWASHER 65mm OD x 41mm ID x 2.5mm thk	N/A
A4					F4		6		112657	ANODE	112657
A4					F4		7		030661	(STUDS) METRIC (316-STST) M8x51 (16/16)	30647
A4					F4		8		201394	(WASHERS) (SPRING) METRIC ST ST 316 M8	N/A
A4					F4		9		201309	(NUTS) (METRIC ST ST 316) M8	N/A
A1							10		201261	(SCREWS) (CAPSCREWS) METRIC ST ST 316 Socket Hd M8x20	N/A
	B1			E1			11		112741	FRONTHEAD HSRX 38mm CYLINDER	112741
	B1			E1			12		112731	RETAINING NUT	112731
	B2		D1	E1			16		205065	NIPPLE 3/8" BSPP MALE x 3/8" BSPP MALE # Z101006	115000
	B2	C2	D1	E2			17		201767	BONDED SEAL 3/8" BSP (400-823-4490-74)	115000
	B1		D1				18		065185	COVER KIT (HCO 2240)	N/A
	B1		D1				19		112729	BACKHEAD HSRX 38mm CYLINDER	112729
	B1		D1				20		202986	PRESSURE RELIEF VALVE (RDBA-LDN) PRESSURE SET TO 34 BAR (500 psi)	N/A
							21	REF	065186	DRYSEAL PRESSURE PLUG 1/16" NPT	N/A
	B1						23		112742	CYLINDER HSRX 38mm CYLINDER	112742
	B1						24		112740	REVERSE CYLINDER SHAFT HSRX 38mm CYLINDER FINAL ASSEMBLY	112740
	B1						25		112743	SPOOL HSRX 38mm CYLINDER HJ274	112743
	B1						26		106561	HANDLE H.S.R.X	106561
	B1						27		201244	(SCREWS) (SET SCREWS) METRIC ST ST 316 Socket M6x10	N/A
	B1		D1				28		108927	PIN 3/16" dia x 40	108250

A	B	C	D	E	F	G	Item	Kit	PartNumber	ProductDescription	DrawingNbr
	B1	C1	D1				29		065187	V-RING (VA-12)	N/A
	B1		D1				30		203023	(SKF) BEARING 6201	N/A
	B4						31		111955	(STUDS) METRIC (316-STST) M6x342(12/12)	30635
	B4						32		201392	WASHER SPRING M6 SS316	N/A
	B4						33		201308	NUT HEX M6 SS316	N/A
		C1					34		204925	(SEAL) PISTON SEAL SMJ#5116	N/A
	B1	C1					34		203243	(SEAL) PISTON SEAL-GT 8069-173-HR	N/A
	B1	C1		E1			35		203024	(SEAL) WIPER SEAL HALLITE 8880610P 1x1.375x0.1875	N/A
	B2	C2		E2			36		203025	(OIL SEALS) HALLITE type 605 4345200 1x1.25x0.25	N/A
	B1	C1	D1				37		065222	12x4.5 Viton O ring	N/A
	B1	C1	D1	E1			38		203026	(O RINGS) IMPERIAL 0.07x1.5x1.625 (029N70)	N/A
	B1						39		108553	CABLE MOUNTING PLATE H.S.R.X	108553
	B2					G2	40		201183	SCREW RND 0.19UNCx1 SS316	N/A
	B2					G2	41		201326	NUT NYLOC 019UNC SS316	N/A
	B1						42		201553	BALL JOINT MORSE 30C CABLE 10-32 UNF S.S.	201553
A1							43		106503	CONNECTING PIN	106503
A1							44		201063	(SPLIT PINS) ST ST 316 3/32"x3/4"	N/A
A2					F2		45		111014	BUSH REVERSE CYLINDER PIN	111014
	B1	C1	D1				46		065183	(O RINGS) METRIC 25x2 N70	N/A
A1							48		201384	(WASHERS) (FLAT) METRIC ST ST 316 M10x21x1.2	N/A
	B1					G1	49		202544	MORSE CABLE CLAMP 30 S.S.	202544
	B1					G1	50		202543	SHIM - MORSE CABLE CLAMP	202543
	B1			E1			51		202439	HEMISPHERICAL SEAT (EXTERNAL) 38MM HSRX	202439
	B1	C1		E1			52		112863	RUBBER BOOT HSRX 38mm CYLINDER	112863
	B1			E1			53		112730	HEMISPHERICAL MOUNT HSRX	112730
	B1			E1			54		202441	HEMISPHERICAL MOUNT (INTERNAL) 38MM HSRX	202441
	B1			E1			55		112757	FRONTHEAD EXTENSION HSRX 38mm CYLINDER	112757
	B1	C1		E1			56		203027	(O RINGS) IMPERIAL 0.1x1.3125x1.5 (125N70)	N/A
	B1	C1		E1			57		061438	(WEAR RING) BEARING RING IPWR 1000 (POLYPAC)	N/A
A1							58		201245	SCREW SET SOCKET M8x10 SS316	N/A
	B1						59		204648	LABEL HJ274 38mm HSRX	204648
		C1					60		086213	INSTRUCTION SHEET, 38mm HSRX SEALS KIT	86213

ITEM 20:- PURCHASED AT PRE-SET PRESSURE OF 500 p.s.i.

REF	NO.	BY	DATE	AMENDMENTS
				SEE SHEET 1 FOR CHANGES

JET 274

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C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

DESIGNED P.A.S. DATE 16/9/98

DRAWN P.A.S. 16/9/98

CHECKED

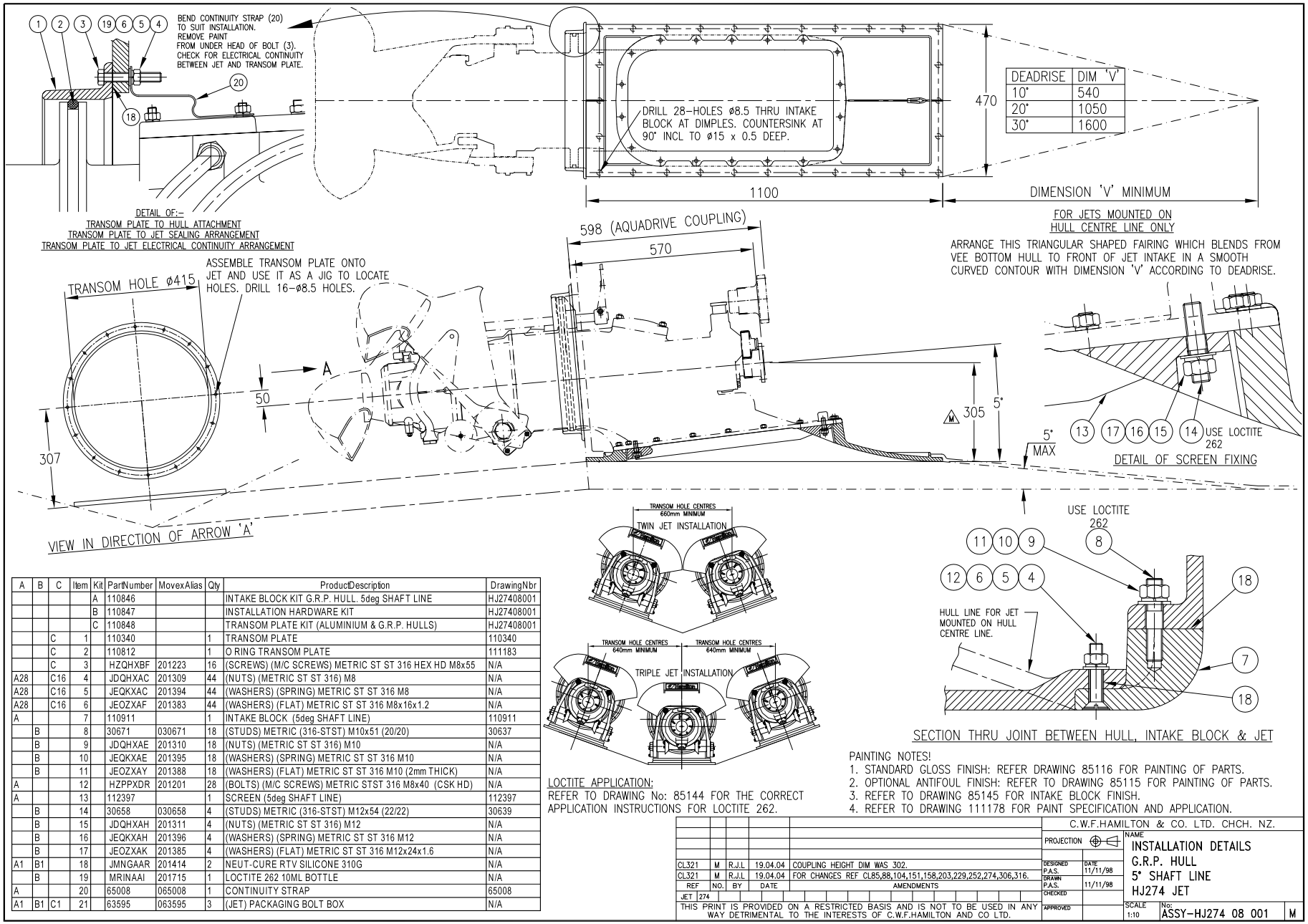
APPROVED

NAME
REVERSE ASSEMBLY
HJ274 (38mm CYLINDER)
SHEET 2 of 2 SHEETS

SCALE -

No: ASSY-HJ274 07 011 F

HJ27408001 Installation Details G.R.P hull With 5° Shaftline



DEADRISE	DIM 'V'
10°	540
20°	1050
30°	1600

A	B	C	Item	Kit	PartNumber	MovexAlias	Qty	ProductDescription	DrawingNbr
				A	110846			INTAKE BLOCK KIT G.R.P. HULL. 5deg SHAFT LINE	HJ27408001
				B	110847			INSTALLATION HARDWARE KIT	HJ27408001
				C	110848			TRANSOM PLATE KIT (ALUMINIUM & G.R.P. HULLS)	HJ27408001
		C	1		110340		1	TRANSOM PLATE	110340
		C	2		110812		1	O RING TRANSOM PLATE	111183
		C	3		HZQHXBF	201223	16	(SCREWS) (M/C SCREWS) METRIC ST ST 316 HEX HD M8x55	N/A
A28		C16	4		JDQHXAC	201309	44	(NUTS) (METRIC ST ST 316) M8	N/A
A28		C16	5		JEQKXAC	201394	44	(WASHERS) (SPRING) METRIC ST ST 316 M8	N/A
A28		C16	6		JEOZXAF	201383	44	(WASHERS) (FLAT) METRIC ST ST 316 M8x16x1.2	N/A
A			7		110911		1	INTAKE BLOCK (5deg SHAFT LINE)	110911
	B		8		30671	030671	18	(STUDS) METRIC (316-STST) M10x51 (20/20)	30637
	B		9		JDQHXAE	201310	18	(NUTS) (METRIC ST ST 316) M10	N/A
	B		10		JEQKXAE	201395	18	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A
	B		11		JEOZXAY	201388	18	(WASHERS) (FLAT) METRIC ST ST 316 M10 (2mm THICK)	N/A
A			12		HZPPXDR	201201	28	(BOLTS) (M/C SCREWS) METRIC STST 316 M8x40 (CSK HD)	N/A
A			13		112397		1	SCREEN (5deg SHAFT LINE)	112397
	B		14		30658	030658	4	(STUDS) METRIC (316-STST) M12x54 (22/22)	30639
	B		15		JDQHXAH	201311	4	(NUTS) (METRIC ST ST 316) M12	N/A
	B		16		JEQKXAH	201396	4	(WASHERS) (SPRING) METRIC ST ST 316 M12	N/A
	B		17		JEOZXAK	201385	4	(WASHERS) (FLAT) METRIC ST ST 316 M12x24x1.6	N/A
A1	B1		18		JMNGAAR	201414	2	NEUT-CURE RTV SILICONE 310G	N/A
	B		19		MRINAAI	201715	1	LOCTITE 262 10ML BOTTLE	N/A
A			20		65008	065008	1	CONTINUITY STRAP	65008
A1	B1	C1	21		63595	063595	3	(JET) PACKAGING BOLT BOX	N/A

LOCTITE APPLICATION:
REFER TO DRAWING No: 85144 FOR THE CORRECT APPLICATION INSTRUCTIONS FOR LOCTITE 262.

PAINTING NOTES!
1. STANDARD GLOSS FINISH: REFER DRAWING 85116 FOR PAINTING OF PARTS.
2. OPTIONAL ANTIFOUL FINISH: REFER TO DRAWING 85115 FOR PAINTING OF PARTS.
3. REFER TO DRAWING 85145 FOR INTAKE BLOCK FINISH.
4. REFER TO DRAWING 111178 FOR PAINT SPECIFICATION AND APPLICATION.

REF	NO.	BY	DATE	AMENDMENTS
CL321	M	R.J.L	19.04.04	COUPLING HEIGHT DIM WAS 302.
CL321	M	R.J.L	19.04.04	FOR CHANGES REF CL85,88,104,151,158,203,229,252,274,306,316.

JET 274

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C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

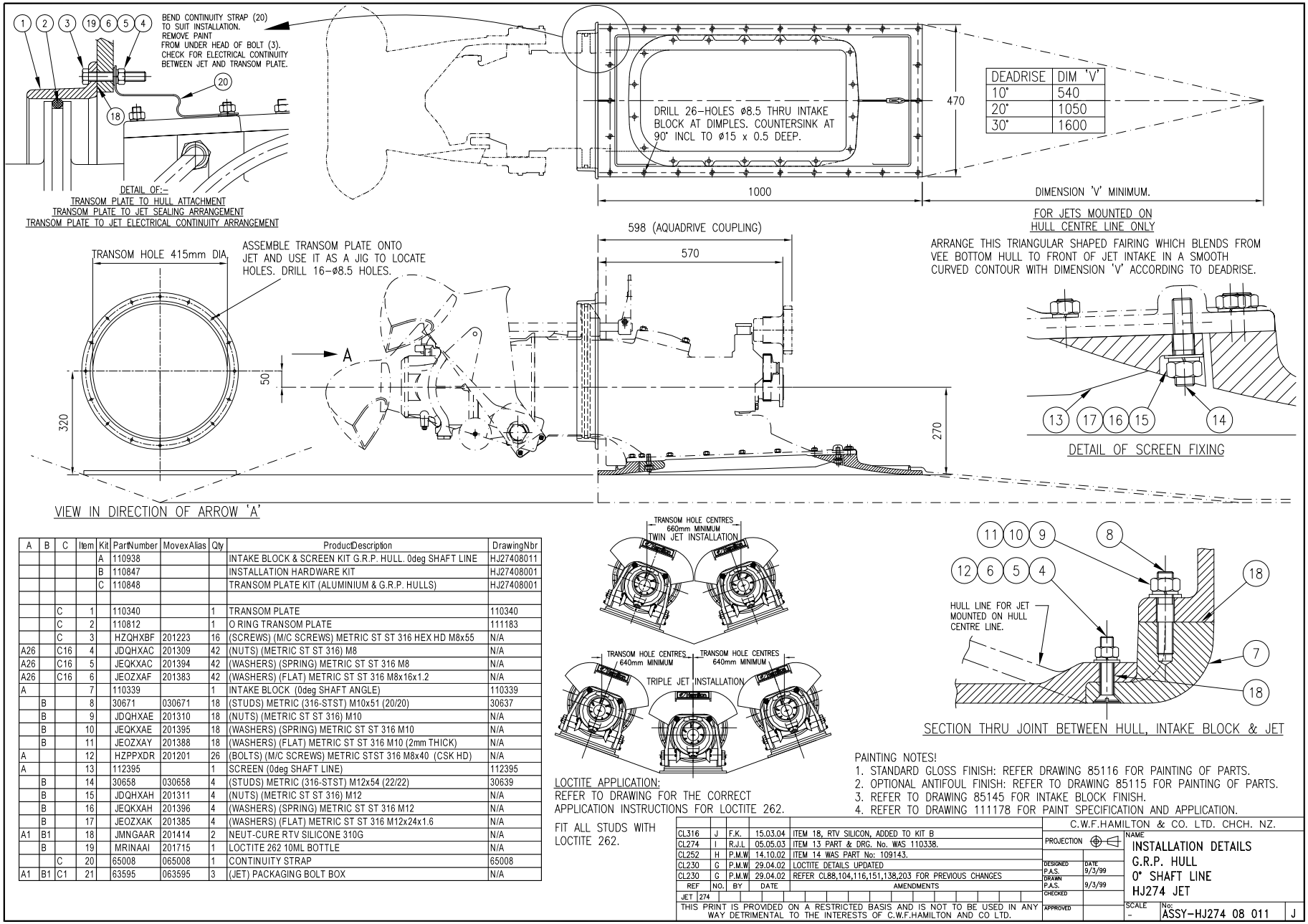
PROJECTION

NAME: INSTALLATION DETAILS G.R.P. HULL 5° SHAFT LINE HJ274 JET

DESIGNED P.A.S. DATE 11/11/98
DRAWN P.A.S. 11/11/98
CHECKED
APPROVED

SCALE 1:10 No: ASSY-HJ274 08 001 M

HJ27408011 Installation Details G.R.P hull With o° Shaft Line



A	B	C	Item	Kit	PartNumber	MovexAlias	Qty	ProductDescription	DrawingNbr
				A	110938			INTAKE BLOCK & SCREEN KIT G.R.P. HULL. 0deg SHAFT LINE	HJ27408011
				B	110847			INSTALLATION HARDWARE KIT	HJ27408001
				C	110848			TRANSOM PLATE KIT (ALUMINIUM & G.R.P. HULLS)	HJ27408001
		C	1		110340		1	TRANSOM PLATE	110340
		C	2		110812		1	O RING TRANSOM PLATE	111183
		C	3		HZQHXBF	201223	16	(SCREWS) (M/C SCREWS) METRIC ST ST 316 HEX HD M8x55	N/A
A26		C16	4		JDQHXAC	201309	42	(NUTS) (METRIC ST ST 316) M8	N/A
A26		C16	5		JEQKXAC	201394	42	(WASHERS) (SPRING) METRIC ST ST 316 M8	N/A
A26		C16	6		JEOZXAF	201383	42	(WASHERS) (FLAT) METRIC ST ST 316 M8x16x1.2	N/A
A			7		110339		1	INTAKE BLOCK (0deg SHAFT ANGLE)	110339
	B		8		30671	030671	18	(STUDS) METRIC (316-STST) M10x51 (20/20)	30637
	B		9		JDQHXAE	201310	18	(NUTS) (METRIC ST ST 316) M10	N/A
	B		10		JEQKXAE	201395	18	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A
	B		11		JEOZXAY	201388	18	(WASHERS) (FLAT) METRIC ST ST 316 M10 (2mm THICK)	N/A
A			12		HZPPXDR	201201	26	(BOLTS) (M/C SCREWS) METRIC STST 316 M8x40 (CSK HD)	N/A
A			13		112395		1	SCREEN (0deg SHAFT LINE)	112395
	B		14		30658	030658	4	(STUDS) METRIC (316-STST) M12x54 (22/22)	30639
	B		15		JDQHXAH	201311	4	(NUTS) (METRIC ST ST 316) M12	N/A
	B		16		JEQKXAH	201396	4	(WASHERS) (SPRING) METRIC ST ST 316 M12	N/A
	B		17		JEOZXAK	201385	4	(WASHERS) (FLAT) METRIC ST ST 316 M12x24x1.6	N/A
A1	B1		18		JMNGAAR	201414	2	NEUT-CURE RTV SILICONE 310G	N/A
	B		19		MRINAAI	201715	1	LOCTITE 262 10ML BOTTLE	N/A
		C	20		65008	065008	1	CONTINUITY STRAP	65008
A1	B1	C1	21		63595	063595	3	(JET) PACKAGING BOLT BOX	N/A

LOCTITE APPLICATION:
REFER TO DRAWING FOR THE CORRECT APPLICATION INSTRUCTIONS FOR LOCTITE 262.

FIT ALL STUDS WITH LOCTITE 262.

PAINTING NOTES!
1. STANDARD GLOSS FINISH: REFER DRAWING 85116 FOR PAINTING OF PARTS.
2. OPTIONAL ANTIFOUL FINISH: REFER TO DRAWING 85115 FOR PAINTING OF PARTS.
3. REFER TO DRAWING 85145 FOR INTAKE BLOCK FINISH.
4. REFER TO DRAWING 111178 FOR PAINT SPECIFICATION AND APPLICATION.

REF	NO.	BY	DATE	AMENDMENTS
CL316	J	F.K.	15.03.04	ITEM 18, RTV SILICON, ADDED TO KIT B
CL274	I	R.J.L	05.05.03	ITEM 13 PART & DRG. No. WAS 110338.
CL252	H	P.M.W	14.10.02	ITEM 14 WAS PART No: 109143.
CL230	G	P.M.W	29.04.02	LOCTITE DETAILS UPDATED
CL230	G	P.M.W	29.04.02	REFER CL88,104,116,151,138,203 FOR PREVIOUS CHANGES

JET 274

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

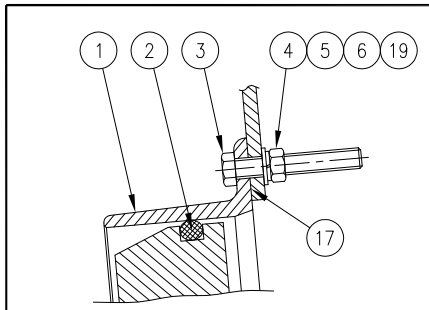
PROJECTION

NAME: INSTALLATION DETAILS G.R.P. HULL 0° SHAFT LINE HJ274 JET

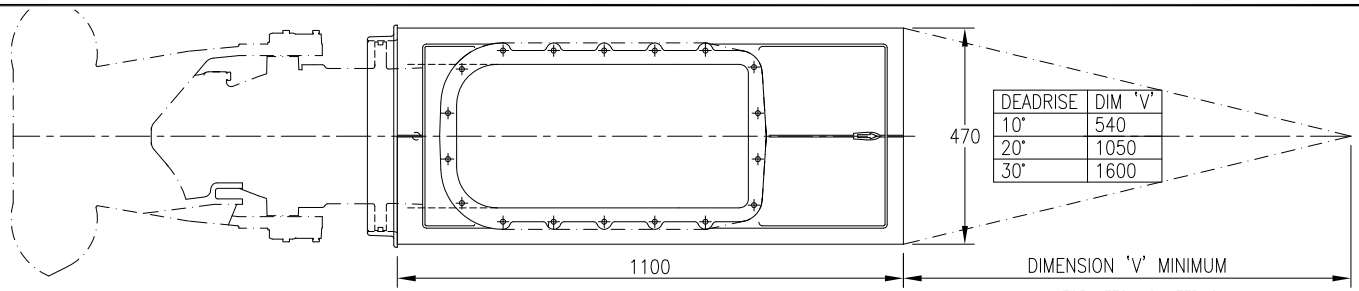
DESIGNED P.A.S. 9/3/99
DRAWN P.A.S. 9/3/99
CHECKED
APPROVED

SCALE -
No: ASSY-HJ274 08 011 J

HJ27408002 Installation Details Aluminium hull with 5° Shaftline



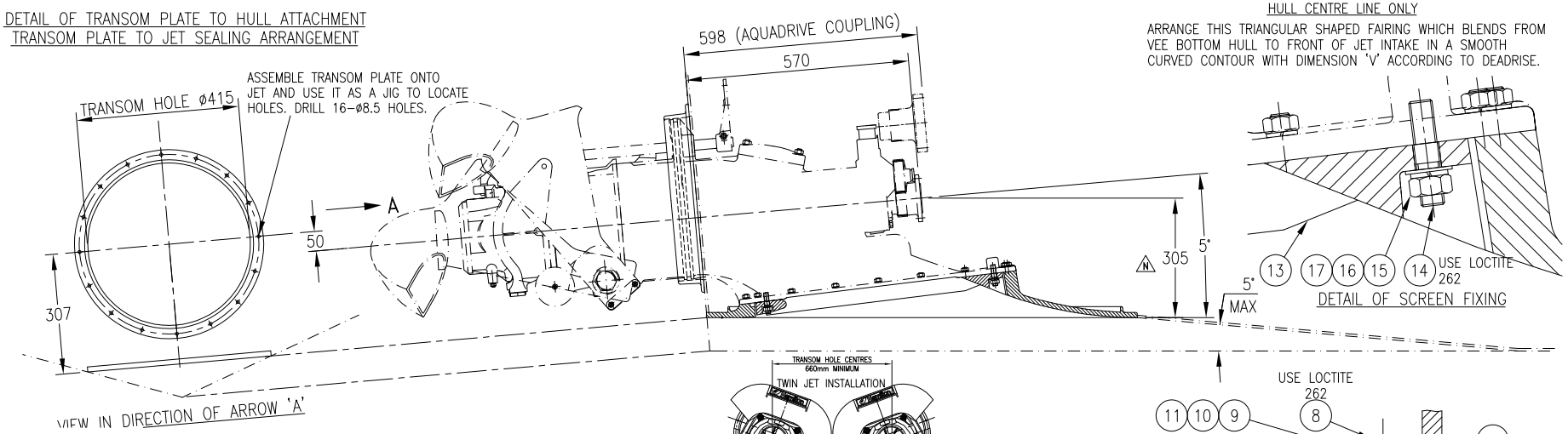
DETAIL OF TRANSOM PLATE TO HULL ATTACHMENT
TRANSOM PLATE TO JET SEALING ARRANGEMENT



DEADRISE	DIM 'V'
10°	540
20°	1050
30°	1600

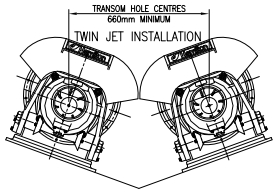
FOR JETS MOUNTED ON HULL CENTRE LINE ONLY

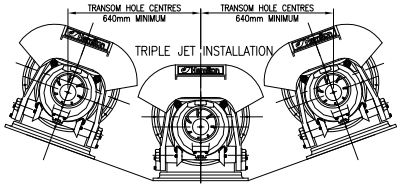
ARRANGE THIS TRIANGULAR SHAPED FAIRING WHICH BLENDS FROM VEE BOTTOM HULL TO FRONT OF JET INTAKE IN A SMOOTH CURVED CONTOUR WITH DIMENSION 'V' ACCORDING TO DEADRISE.

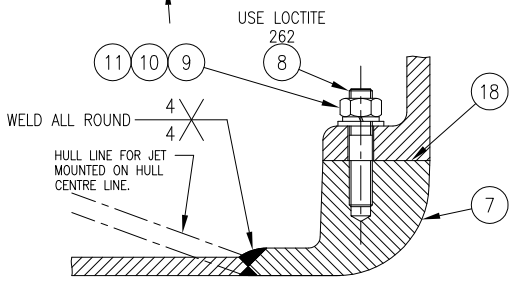


VIEW IN DIRECTION OF ARROW 'A'

DETAIL OF SCREEN FIXING







SECTION THRU JOINT BETWEEN HULL, INTAKE BLOCK & JET

A	B	C	Item	Kit	PartNumber	Qty	ProductDescription	DrawingNbr
				A	110936		INTAKE BLOCK & SCREEN KIT ALM. HULL. 5deg. SHAFT LINE	HJ27408002
				B	110847		INSTALLATION HARDWARE KIT	HJ27408001
				C	110848		TRANSOM PLATE KIT (ALUMINIUM & G.R.P. HULLS)	HJ27408001
		C	1		110340	1	TRANSOM PLATE	110340
		C	2		110812	1	O RING TRANSOM PLATE	111183
		C	3		HZQHXBF	16	(SCREWS) (M/C SCREWS) METRIC ST ST 316 HEX HD M8x55	N/A
		C	4		JDQHXAC	16	(NUTS) (METRIC ST ST 316) M8	N/A
		C	5		JEQKXAC	16	(WASHERS) (SPRING) METRIC ST ST 316 M8	N/A
		C	6		JEOZXAF	16	(WASHERS) (FLAT) METRIC ST ST 316 M8x16x1.2	N/A
A			7		110911	1	INTAKE BLOCK (5deg SHAFT LINE)	110911
	B		8		30671	18	(STUDS) METRIC (316-STST) M10x51 (20/20)	30637
	B		9		JDQHXAE	18	(NUTS) (METRIC ST ST 316) M10	N/A
	B		10		JEQKXAE	18	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A
	B		11		JEOZXAY	18	(WASHERS) (FLAT) METRIC ST ST 316 M10 (2mm THICK)	N/A
A			13		112397	1	SCREEN (5deg SHAFT LINE)	112397
	B		14		30658	4	(STUDS) METRIC (316-STST) M12x54 (22/22)	30639
	B		15		JDQHXAH	4	(NUTS) (METRIC ST ST 316) M12	N/A
	B		16		JEQKXAH	4	(WASHERS) (SPRING) METRIC ST ST 316 M12	N/A
	B		17		JEOZXAK	4	(WASHERS) (FLAT) METRIC ST ST 316 M12x24x1.6	N/A
A			18		JMNGAAR	1	NEUT-CURE RTV SILICONE 310G	N/A
	B		19		MRINAAI	1	LOCTITE 262 10ML BOTTLE	N/A
	B1	C1	21		63595	1	(JET) PACKAGING BOLT BOX	N/A

LOCTITE APPLICATION:
REFER TO DRAWING No: 85144 FOR THE CORRECT APPLICATION INSTRUCTIONS FOR LOCTITE 262.

PAINTING NOTES!
1. STANDARD GLOSS FINISH: REFER DRAWING 85116 FOR PAINTING OF PARTS.
2. OPTIONAL ANTIFOUL FINISH: REFER TO DRAWING 85115 FOR PAINTING OF PARTS.
3. REFER TO DRAWING 85145 FOR INTAKE BLOCK FINISH.
4. REFER TO DRAWING 111178 FOR PAINT SPECIFICATION AND APPLICATION.

REF	NO.	BY	DATE	AMENDMENTS
CL321	N	R.J.L	19.04.04	COUPLING HEIGHT DIM WAS 302.
CL306	M	I.G.G	15.12.03	TRANSOM HOLE HEIGHT 307mm WAS 301mm
CL274	L	R.J.L	15.05.03	ITEM 13 PART & DRG. No. WAS 110910.
CL274	L	R.J.L	05.05.03	FOR PAST CLs. REFER CL151, 158, 203, 229, 252.

JET 274

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

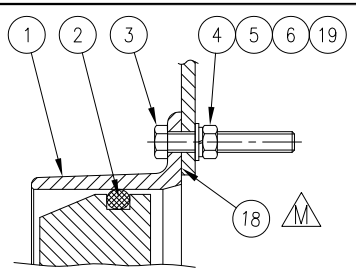
PROJECTION

NAME
INSTALLATION DETAILS
ALUMINIUM HULL
5° SHAFT LINE
HJ274 JET

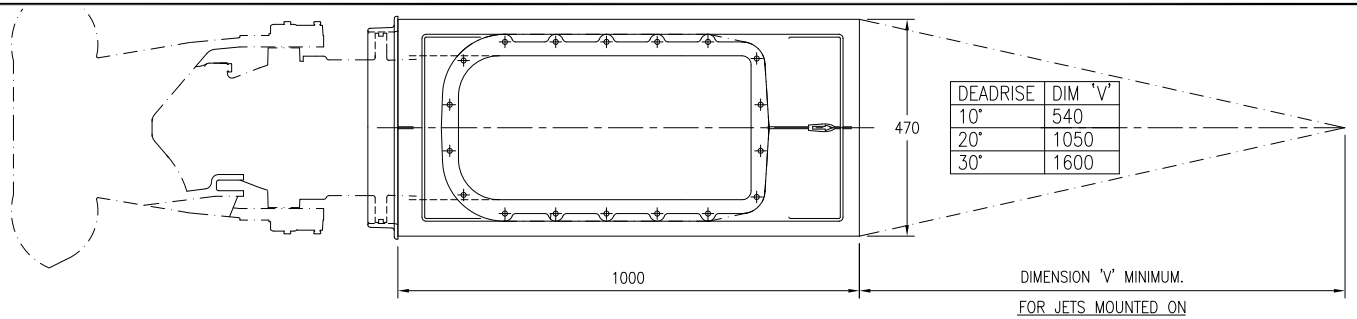
		DATE
DESIGNED	P.A.S.	11/11/98
DRAWN	P.A.S.	11/11/98
CHECKED		
APPROVED		

SCALE 1:10 | No: ASSY-HJ274 08 002 | N

HJ27408012 Installation Details Aluminum hull with 0° Shaftline



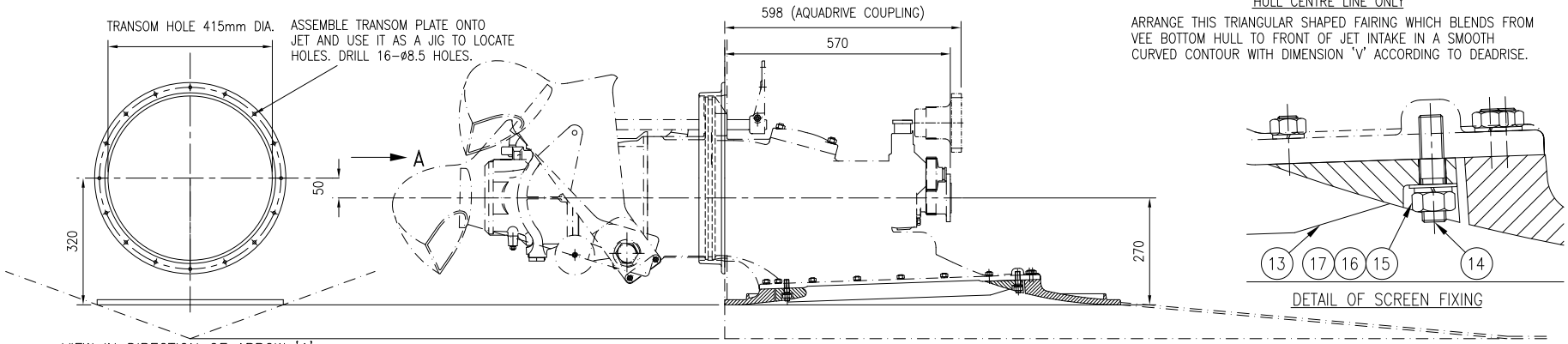
DETAIL OF TRANSOM PLATE TO HULL ATTACHMENT
TRANSOM PLATE TO JET SEALING ARRANGEMENT



DEADRISE	DIM 'V'
10°	540
20°	1050
30°	1600

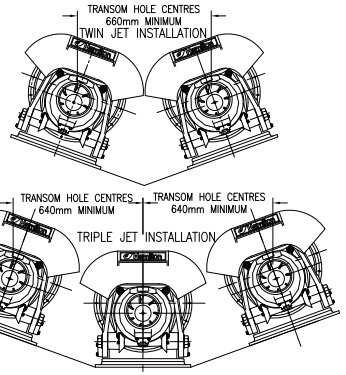
FOR JETS MOUNTED ON
HULL CENTRE LINE ONLY

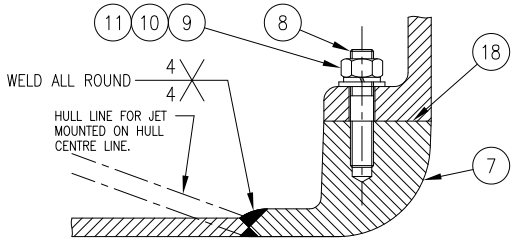
ARRANGE THIS TRIANGULAR SHAPED FAIRING WHICH BLENDS FROM VEE BOTTOM HULL TO FRONT OF JET INTAKE IN A SMOOTH CURVED CONTOUR WITH DIMENSION 'V' ACCORDING TO DEADRISE.



VIEW IN DIRECTION OF ARROW 'A'

DETAIL OF SCREEN FIXING





SECTION THRU JOINT BETWEEN HULL, INTAKE BLOCK & JET

A	B	C	Item	Kit	PartNumber	ProductDescription	DrawingNbr
				A	110937	INTAKE BLOCK & SCREEN KIT ALM. HULL. 0deg. SHAFT LINE	HJ2740801
				B	110847	INSTALLATION HARDWARE KIT	HJ2740800
				C	110848	TRANSOM PLATE KIT (ALUMINIUM & G.R.P. HULLS)	HJ2740800
		C1	1		110340	TRANSOM PLATE	110340
		C1	2		110812	(JET) O RINGS SPECIAL TRANSOM P_ATE	111183
		C16	3		201223	(SCREWS) (M/C SCREWS) METRIC ST ST 316 HEX HD M8x55	N/A
		C16	4		201309	(NUTS) (METRIC ST ST 316) M8	N/A
		C16	5		201394	(WASHERS) (SPRING) METRIC ST ST 316 M8	N/A
		C16	6		201383	WASHER FLAT M8x16x1.2 SS316	N/A
A1			7		110339	INTAKE BLOCK (0deg SHAFT ANGLE)	110339
	B18		8		030671	(STUDS) METRIC (316-STST) M10x51 (20/20)	30637
	B18		9		201310	(NUTS) (METRIC ST ST 316) M10	N/A
	B18		10		201395	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A
	B18		11		201388	(WASHERS) (FLAT) METRIC ST ST 316 M10 (2mm THICK)	N/A
A1			13		112395	SCREEN (0deg SHAFT LINE)	112395
	B4		14		030658	(STUDS) METRIC (316-STST) M12x54 (22/22)	30639
	B4		15		201311	NUT HEX M12 SS316	N/A
	B4		16		201396	WASHER SPRING M12 SS316	N/A
	B4		17		201385	(WASHERS) (FLAT) METRIC ST ST 316 M12x24x1.6	N/A
	B1		18		201414	MARINE SEALANT SIKAFLEX-291 LOT 310 ml	N/A
	B1		19		201715	LOCTITE 263 10ML BOTTLE	N/A
	B1	C1	21		063595	(JET) PACKAGING BOLT BOX	N/A

LOCTITE APPLICATION:
REFER TO DRAWING No: 85144 FOR THE CORRECT APPLICATION INSTRUCTIONS FOR LOCTITE 262.

FIT ALL STUDS WITH LOCTITE 262.

1. STANDARD GLOSS FINISH: REFER DRAWING 85116 FOR PAINTING OF PARTS.
2. OPTIONAL ANTIFOUL FINISH: REFER TO DRAWING 85115 FOR PAINTING OF PARTS.
3. REFER TO DRAWING 85145 FOR INTAKE BLOCK FINISH.
4. REFER TO DRAWING 111178 FOR PAINT SPECIFICATION AND APPLICATION.

REF	NO.	BY	DATE	AMENDMENTS
CL680	M	J.S.R	25.07.11	BALOON NO CORRECTED.
CL680	M	J.S.R	25.07.11	REFER CL85,88,104,116,117,151,158,203,230,252,274 FOR CHANGES

JET 274

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

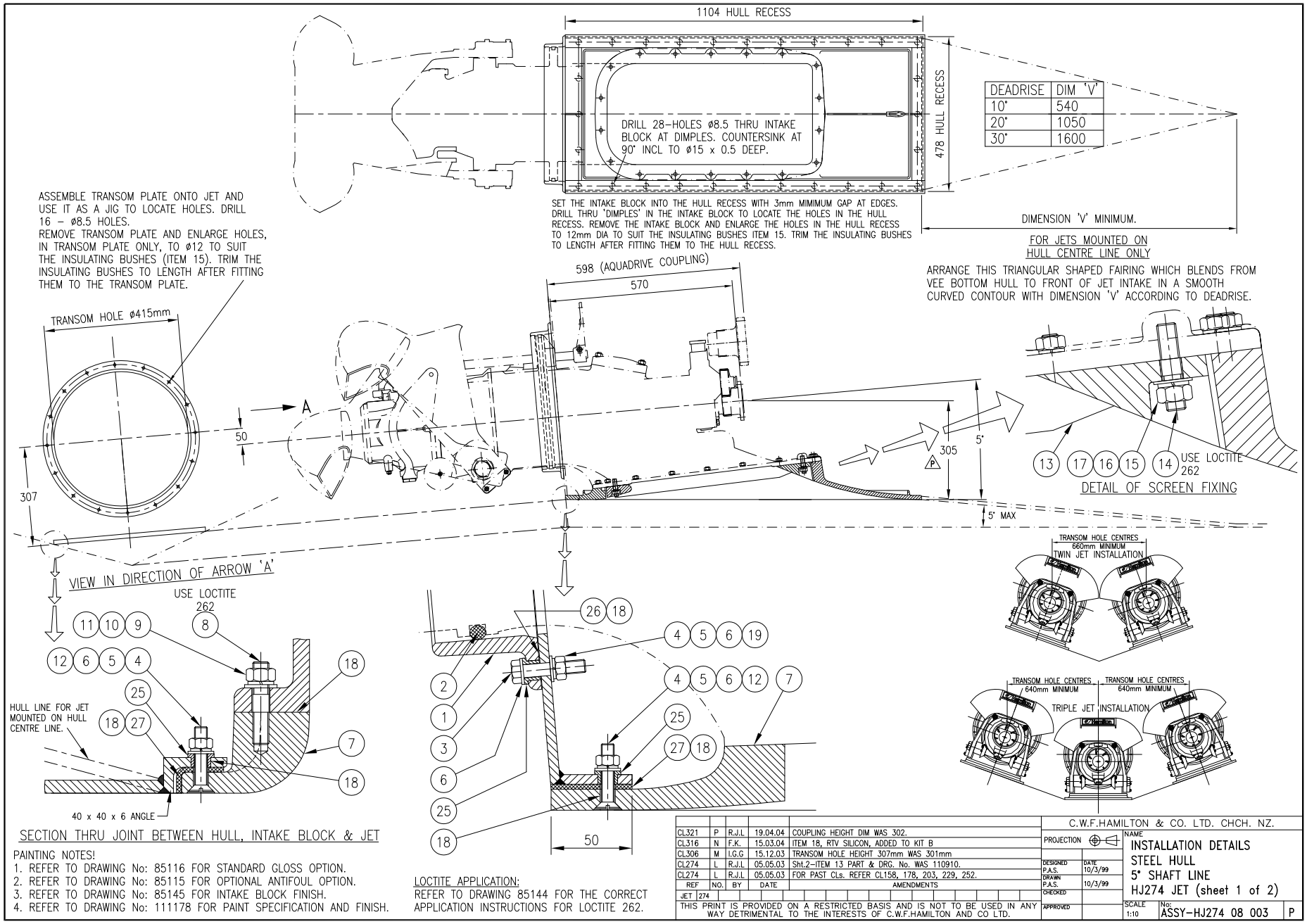
PROJECTION

DESIGNED P.A.S. 9/3/99
DRAWN P.A.S. 9/3/99
CHECKED
APPROVED

NAME
INSTALLATION DETAILS
ALUMINIUM HULL
0° SHAFT LINE
HJ274 JET

SCALE –
No: ASSY–HJ274 08 012 M

HJ27408003 Installation Details Steel hull with 5° Shaftline



SECTION THRU JOINT BETWEEN HULL, INTAKE BLOCK & JET

PAINTING NOTES!
1. REFER TO DRAWING No: 85116 FOR STANDARD GLOSS OPTION.
2. REFER TO DRAWING No: 85115 FOR OPTIONAL ANTIFOUL OPTION.
3. REFER TO DRAWING No: 85145 FOR INTAKE BLOCK FINISH.
4. REFER TO DRAWING No: 111178 FOR PAINT SPECIFICATION AND FINISH.

LOCTITE APPLICATION:
REFER TO DRAWING 85144 FOR THE CORRECT APPLICATION INSTRUCTIONS FOR LOCTITE 262.

REF	NO.	BY	DATE	AMENDMENTS
CL321	P	R.J.L	19.04.04	COUPLING HEIGHT DIM WAS 302.
CL316	N	F.K.	15.03.04	ITEM 18, RTV SILICON, ADDED TO KIT B
CL306	M	I.G.G	15.12.03	TRANSOM HOLE HEIGHT 307mm WAS 301mm
CL274	L	R.J.L	05.05.03	Sht.2–ITEM 13 PART & DRG. No. WAS 110910.
CL274	L	R.J.L	05.05.03	FOR PAST CLs. REFER CL158, 178, 203, 229, 252.

JET 274

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

NAME
INSTALLATION DETAILS
STEEL HULL
5° SHAFT LINE
HJ274 JET (sheet 1 of 2)

DESIGNED P.A.S. DATE 10/3/99
DRAWN P.A.S. 10/3/99
CHECKED
APPROVED

SCALE 1:10
No: ASSY–HJ274 08 003 P

HJ27408003 Installation Details Steel hull with 5° Shaftline Sht 2

A	B	C	Item	Kit	PartNumber	MovexAlias	Qty	ProductDescription	DrawingNbr
				A	110939			INTAKE BLOCK & SCREEN KIT STEEL HULL. 5deg SHAFT LINE	HJ27408003
				B	110847			INSTALLATION HARDWARE KIT	HJ27408001
				C	110850			TRANSOM PLATE KIT (STEEL HULL)	HJ27408003
		C	1		110340		1	TRANSOM PLATE	110340
		C	2		110812		1	O RING TRANSOM PLATE	111183
		C	3		HZQHXBF	201223	16	(SCREWS) (M/C SCREWS) METRIC ST ST 316 HEX HD M8x55	N/A
A28		C16	4		JDQHXAC	201309	44	(NUTS) (METRIC ST ST 316) M8	N/A
A28		C16	5		JEQKXAC	201394	44	(WASHERS) (SPRING) METRIC ST ST 316 M8	N/A
A28		C32	6		JEOZXAF	201383	60	(WASHERS) (FLAT) METRIC ST ST 316 M8x16x1.2	N/A
A			7		110911		1	INTAKE BLOCK (5deg SHAFT LINE)	110911
	B		8		30671	030671	18	(STUDS) METRIC (316-STST) M10x51 (20/20)	30637
	B		9		JDQHXAE	201310	18	(NUTS) (METRIC ST ST 316) M10	N/A
	B		10		JEQKXAE	201395	18	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A
	B		11		JEOZXAY	201388	18	(WASHERS) (FLAT) METRIC ST ST 316 M10 (2mm THICK)	N/A
A			12		HZPPXDR	201201	28	(BOLTS) (M/C SCREWS) METRIC STST 316 M8x40 (CSK HD)	N/A
A			13		112397		1	SCREEN (5deg SHAFT LINE)	112397
	B		14		30658	030658	4	(STUDS) METRIC (316-STST) M12x54 (22/22)	30639
	B		15		JDQHXAH	201311	4	(NUTS) (METRIC ST ST 316) M12	N/A
	B		16		JEQKXAH	201396	4	(WASHERS) (SPRING) METRIC ST ST 316 M12	N/A
	B		17		JEOZXAK	201385	4	(WASHERS) (FLAT) METRIC ST ST 316 M12x24x1.6	N/A
A1	B1		18		JMNGAAR	201414	2	NEUT-CURE RTV SILICONE 310G	N/A
	B		19		MRINAAI	201715	1	LOCTITE 262 10ML BOTTLE	N/A
A1	B1	C1	21		63595	063595	3	(JET) PACKAGING BOLT BOX	N/A
A28		C16	25		KHACXAF	201528	44	(BUSHES) NYLON FLANGED GS NYLATRON S48M	N/A
		C	26		110853		1	TRANSOM GASKET (STEEL HULL)	110853
A			27		111757		1	INTAKE BLOCK GASKET STEEL HULL (5deg INTAKE BLOCK)	111757

SEE SHEET 1 FOR AMENDMENTS.

REF | NO. | BY | DATE | AMENDMENTS

JET 274

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

DESIGNED P.A.S. DATE 18/11/98

DRAWN P.A.S. DATE 18/11/98

CHECKED

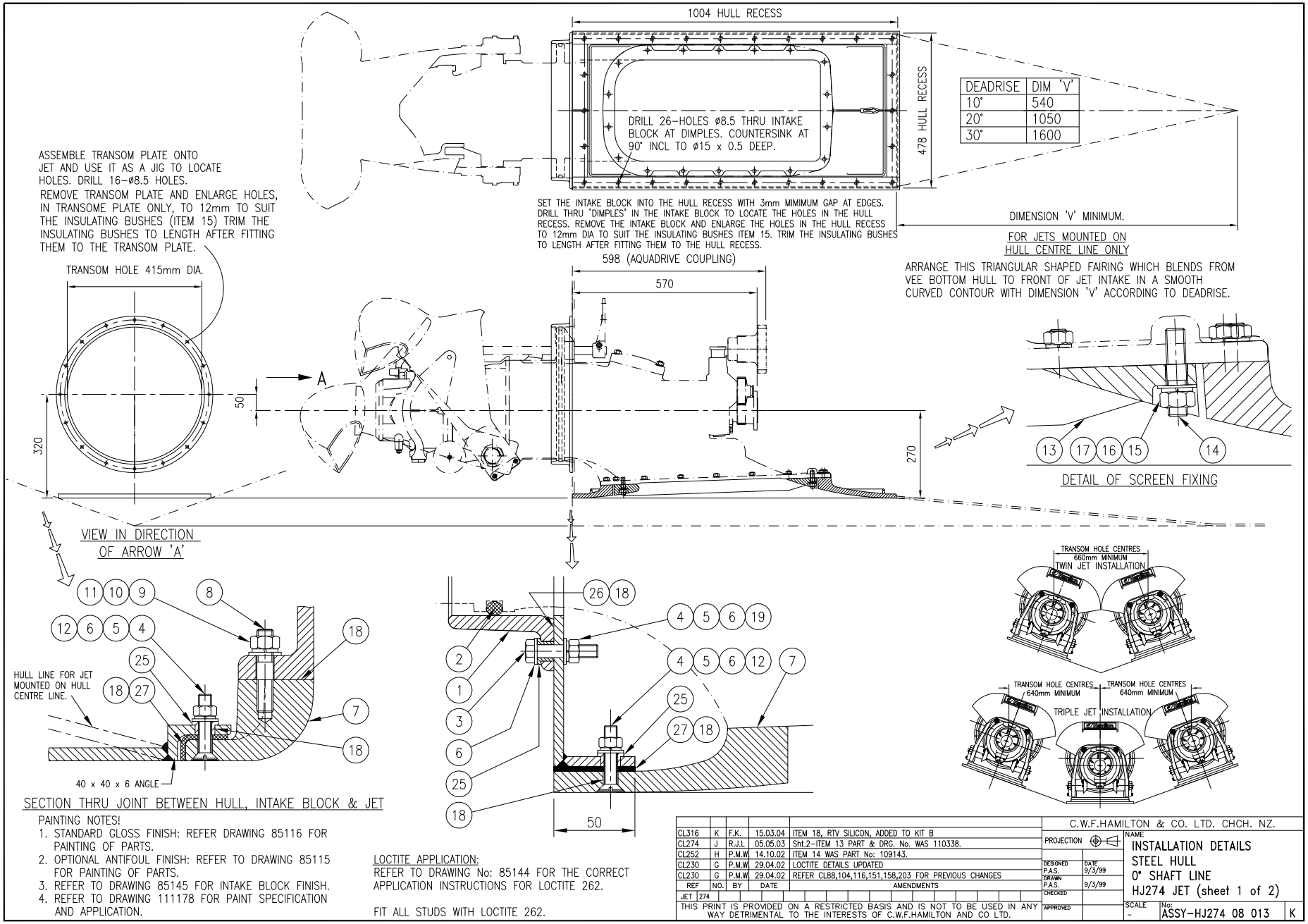
APPROVED

NAME
INSTALLATION DETAILS
STEEL HULL
5° SHAFT LINE
HJ274 JET (sheet 2 of 2)

SCALE -

No: ASSY-HJ274 08 003 P

HJ27408013 Installation Details Steel hull with 0° Shaftline



SECTION THRU JOINT BETWEEN HULL, INTAKE BLOCK & JET

PAINTING NOTES!
1. STANDARD GLOSS FINISH: REFER DRAWING 85116 FOR PAINTING OF PARTS.
2. OPTIONAL ANTIFOUL FINISH: REFER TO DRAWING 85115 FOR PAINTING OF PARTS.
3. REFER TO DRAWING 85145 FOR INTAKE BLOCK FINISH.
4. REFER TO DRAWING 111178 FOR PAINT SPECIFICATION AND APPLICATION.

LOCTITE APPLICATION:
REFER TO DRAWING No: 85144 FOR THE CORRECT APPLICATION INSTRUCTIONS FOR LOCTITE 262.

FIT ALL STUDS WITH LOCTITE 262.

REF	NO.	BY	DATE	AMENDMENTS
CL316	K	F.K.	15.03.04	ITEM 18, RTV SILICON, ADDED TO KIT B
CL274	J	R.J.L	05.05.03	Sht.2-ITEM 13 PART & DRG. No. WAS 110338.
CL252	H	P.M.W.	14.10.02	ITEM 14 WAS PART No: 109143.
CL230	G	P.M.W.	29.04.02	LOCTITE DETAILS UPDATED
CL230	G	P.M.W.	29.04.02	REFER CL88,104,116,151,158,203 FOR PREVIOUS CHANGES

JET 274

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

NAME
INSTALLATION DETAILS
STEEL HULL
0° SHAFT LINE
HJ274 JET (sheet 1 of 2)

DESIGNED P.A.S. DATE 9/3/99
DRAWN P.A.S. 9/3/99
CHECKED
APPROVED

SCALE -
No: ASSY-HJ274 08 013 K

HJ27408013 Installation Details Steel hull with 0° Shaftline Sht 2

A	B	C	Item	Kit	PartNumber	MovexAlias	Qty	ProductDescription	DrawingNbr
				A	110940			INTAKE BLOCK & SCREEN KIT STEEL HULL. 0deg SHAFT LINE	HJ27408013
				B	110847			INSTALLATION HARDWARE KIT	HJ27408001
				C	110850			TRANSOM PLATE KIT (STEEL HULL)	HJ27408003
		C	1		110340		1	TRANSOM PLATE	110340
		C	2		110812		1	O RING TRANSOM PLATE	111183
		C	3		HZQHXBF	201223	16	(SCREWS) (M/C SCREWS) METRIC ST ST 316 HEX HD M8x55	N/A
A26		C16	4		JDQHXAC	201309	42	(NUTS) (METRIC ST ST 316) M8	N/A
A26		C16	5		JEQKXAC	201394	42	(WASHERS) (SPRING) METRIC ST ST 316 M8	N/A
A26		C32	6		JEOZXAF	201383	58	(WASHERS) (FLAT) METRIC ST ST 316 M8x16x1.2	N/A
A			7		110339		1	INTAKE BLOCK (0deg SHAFT ANGLE)	110339
	B		8		30671	030671	18	(STUDS) METRIC (316-STST) M10x51 (20/20)	30637
	B		9		JDQHXAE	201310	18	(NUTS) (METRIC ST ST 316) M10	N/A
	B		10		JEQKXAE	201395	18	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A
	B		11		JEOZXAY	201388	18	(WASHERS) (FLAT) METRIC ST ST 316 M10 (2mm THICK)	N/A
A			12		HZPPXDR	201201	26	(BOLTS) (M/C SCREWS) METRIC STST 316 M8x40 (CSK HD)	N/A
A			13		112395		1	SCREEN (0deg SHAFT LINE)	112395
	B		14		30658	030658	4	(STUDS) METRIC (316-STST) M12x54 (22/22)	30639
	B		15		JDQHXAH	201311	4	(NUTS) (METRIC ST ST 316) M12	N/A
	B		16		JEQKXAH	201396	4	(WASHERS) (SPRING) METRIC ST ST 316 M12	N/A
	B		17		JEOZXAK	201385	4	(WASHERS) (FLAT) METRIC ST ST 316 M12x24x1.6	N/A
A1	B1		18		JMNGAAR	201414	2	NEUT-CURE RTV SILICONE 310G	N/A
	B		19		MRINAAI	201715	1	LOCTITE 262 10ML BOTTLE	N/A
A1	B1	C1	21		63595	063595	3	(JET) PACKAGING BOLT BOX	N/A
A26		C16	25		KHACXAF	201528	42	(BUSHES) NYLON FLANGED GS NYLATRON S48M	N/A
		C	26		110853		1	TRANSOM GASKET (STEEL HULL)	110853
A			27		110854		1	INTAKE BLOCK GASKET STEEL HULL HJ274 (0deg INTAKE BLOCK)	110854

SEE SHEET 1 FOR AMENDMENTS.

REF	NO.	BY	DATE	AMENDMENTS
JET 274				

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

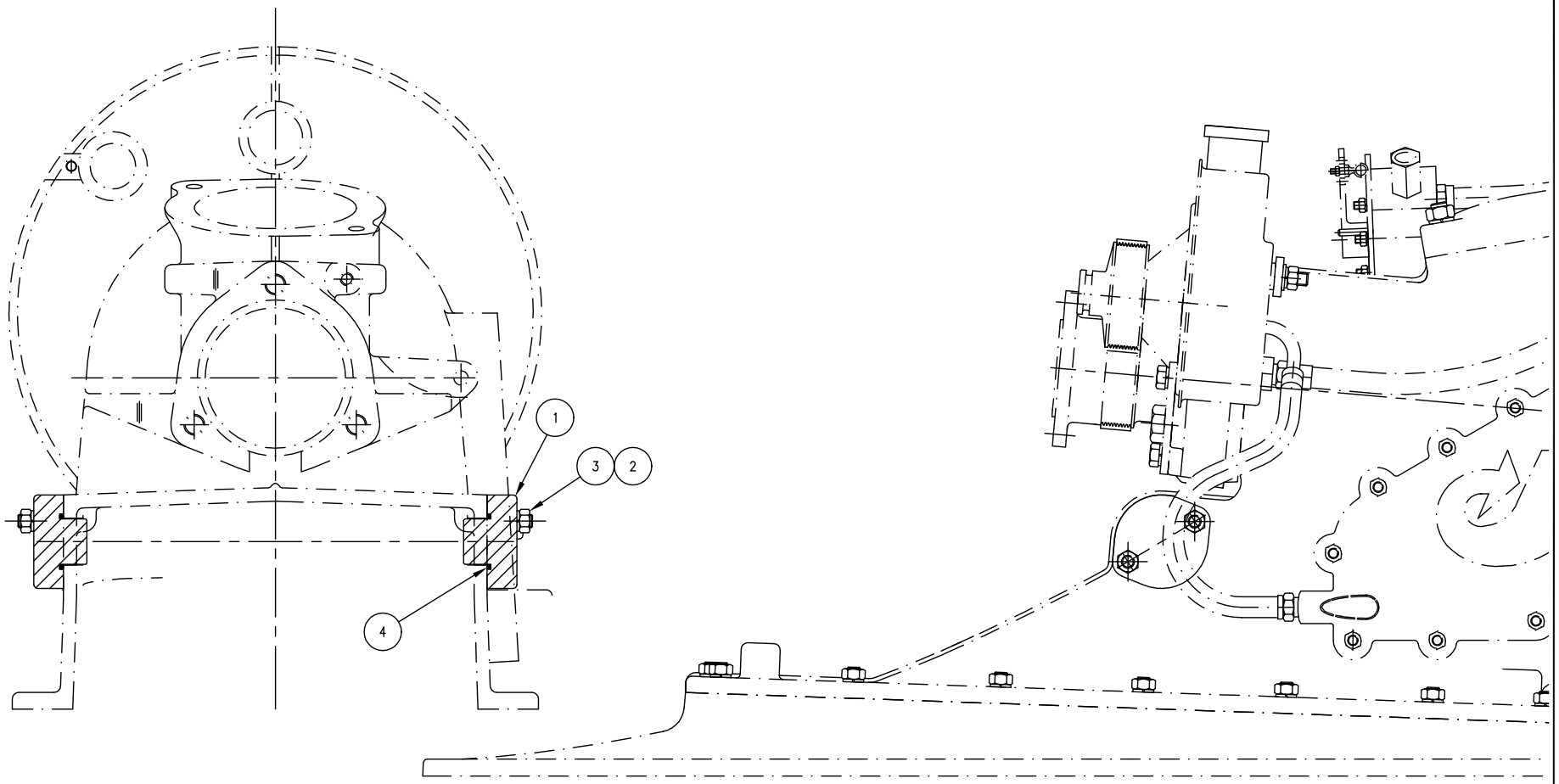
PROJECTION

DESIGNED	P.A.S.	DATE 10/3/99
DRAWN	P.A.S.	10/3/99
CHECKED		
APPROVED		

NAME
INSTALLATION DETAILS
STEEL HULL
0° SHAFT LINE
HJ274 JET (sheet 2 of 2)

SCALE –
No: ASSY–HJ274 08 013 K

HJ27409001 Screen Rake Blanking Plugs



Item	PartNumber	Qty	ProductDescription	DrawingNbr
1	105921	2	RAKE BLANKING PLUG	105921
2	JEQKXAE	4	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A
3	JDQHXAE	4	(NUTS) (METRIC ST ST 316) M10	N/A
4	HMHRAAW	2	(O RINGS) IMPERIAL 0.13x1.44x1.69 (221N70)	N/A

REF	NO.	BY	DATE	AMENDMENTS
CL108	A	P.S.	14/9/99	ITEM 1 WAS 1 OFF.
CL74	0	P.S.	18/11/98	ISSUED FOR PRODUCTION

JET 274

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

DESIGNED DATE

DRAWN P.A.S. 18/11/98

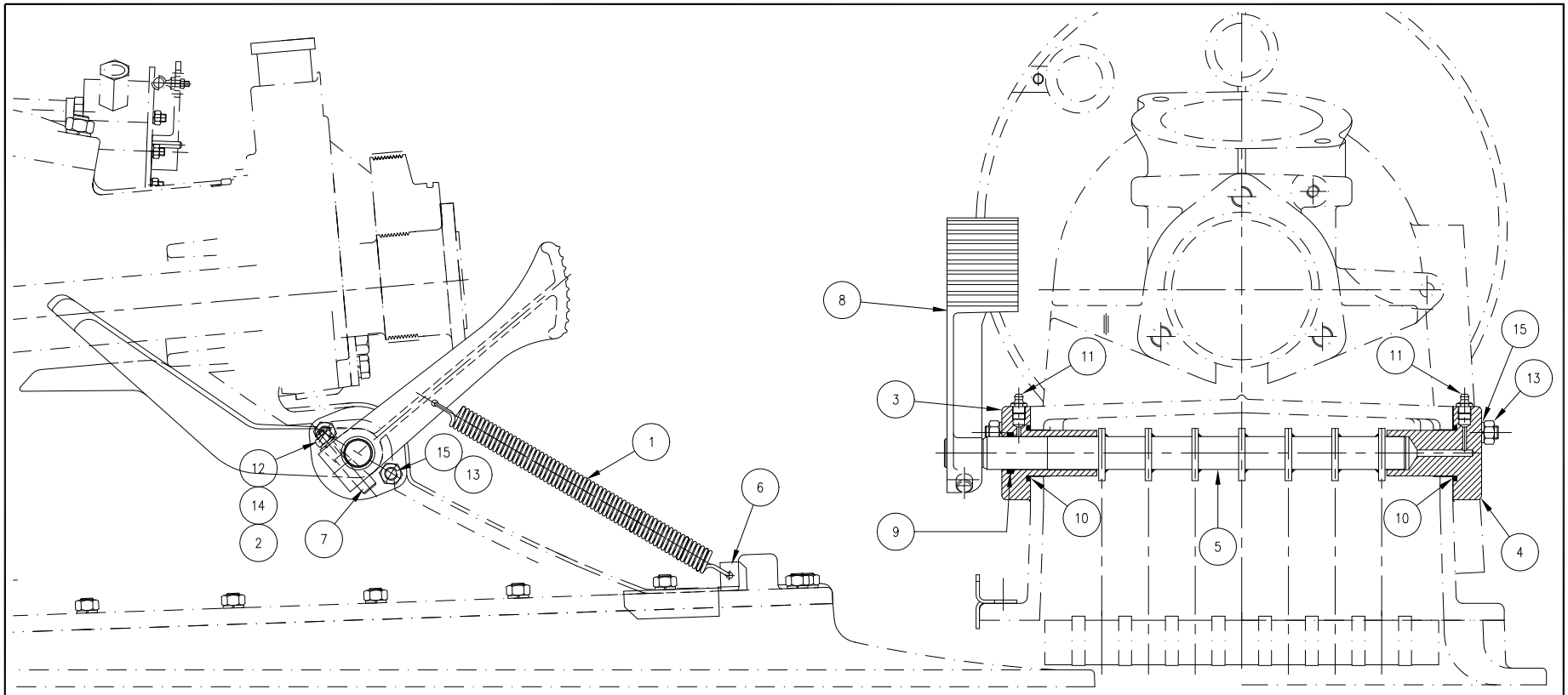
CHECKED

APPROVED

NAME SCREEN RAKE BLANKING PLUGS HJ 274 JET

SCALE No: ASSY-HJ274 09 001 A

HJ27409002 Screen Rake Assy



Item	PartNumber	Qty	ProductDescription	DrawingNbr
1	102364	1	TENSION SPRING 316 STST	102364
2	103637	1	(WASHER) SPECIAL 8mm (AB2)	103637
3	110861	1	BEARING STBD	110861
4	110860	1	BEARING PORT	110860
5	110859	1	SCREEN RAKE WELDED ASSEMBLY HJ274	110859
6	105359	1	SPRING ANCHOR BRACKET	105359
7	105931	1	COTTER	105931
8	106274	1	RAKE ACTUATOR	106274
9	HMHRAAS	1	(O RINGS) IMPERIAL 0.13"x1.0"x1-1/4" (214N70)	N/A
10	HMHRAAW	2	(O RINGS) IMPERIAL 0.13x1.44x1.69 (221N70)	N/A
11	HEIDAAA	2	(GREASE) NIPPLES (H29) 1/8"BSP	N/A
12	JDQHXAC	1	(NUTS) (METRIC ST ST 316) M8	N/A
13	JDQHXAE	4	(NUTS) (METRIC ST ST 316) M10	N/A
14	JEQKXAC	1	(WASHERS) (SPRING) METRIC ST ST 316 M8	N/A
15	JEQKXAE	4	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A

NO.	BY	DATE	AMENDMENTS
CL106	B	R.J.L	8.09.99	ITEM 3 WAS 105131 & ITEM 4 WAS 105130
CL084	A	P.S.	3/3/99	ITEM 3 WAS 110861 & ITEM 4 WAS 110860
CL76	0	P.S.		ISSUED FOR PRODUCTION.

JET 274

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

DESIGNED P.A.S. DATE 23/11/98

DRAWN P.A.S. 23/11/98

CHECKED

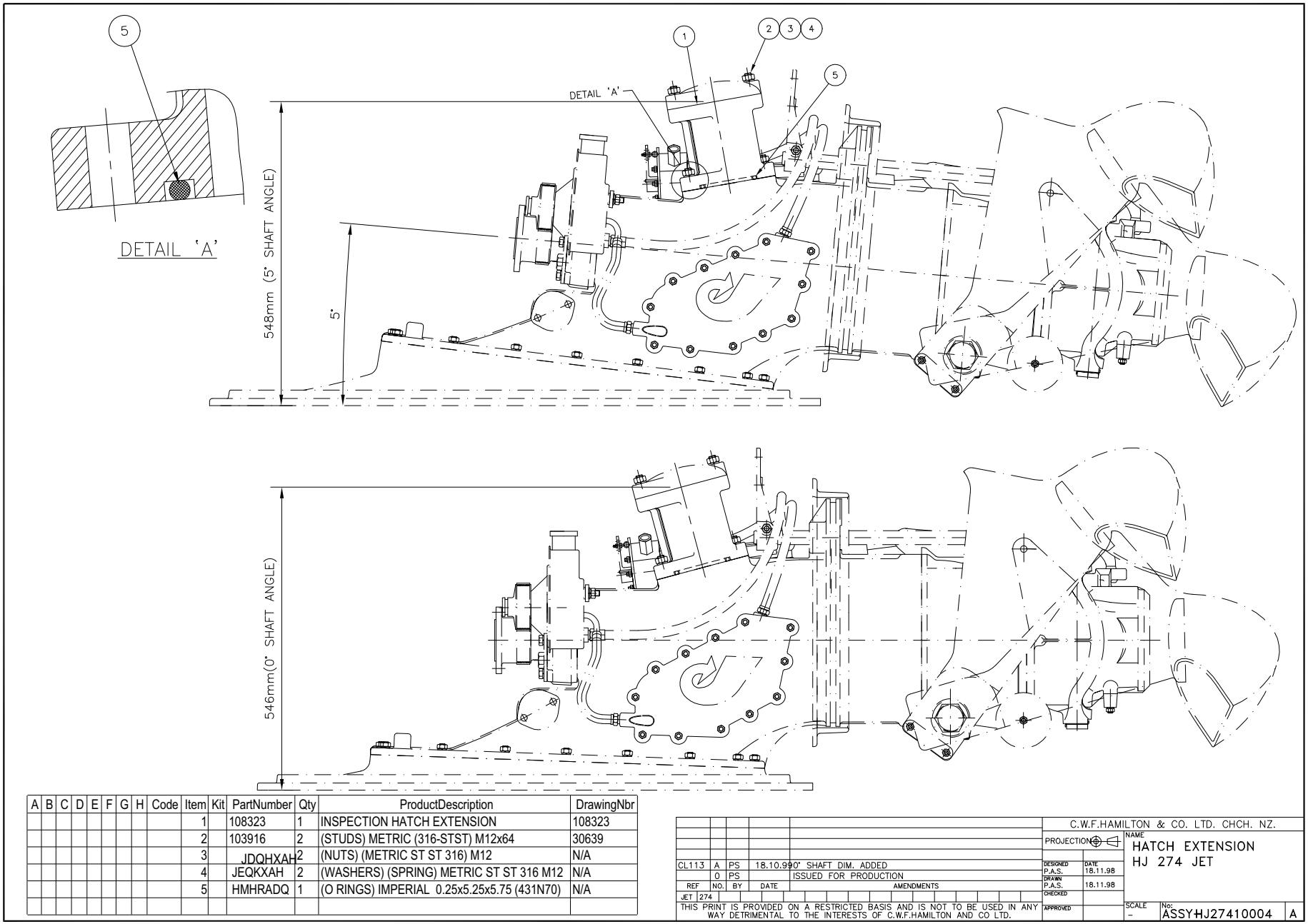
APPROVED

NAME
SCREEN RAKE ASSEMBLY
HJ274

SCALE -

No: ASSY-HJ274 09 002 B

HJ27410004 Hatch Extension



A	B	C	D	E	F	G	H	Code	Item	Kit	PartNumber	Qty	ProductDescription	DrawingNbr
									1		108323	1	INSPECTION HATCH EXTENSION	108323
									2		103916	2	(STUDS) METRIC (316-STST) M12x64	30639
									3		JDQHXAH	2	(NUTS) (METRIC ST ST 316) M12	N/A
									4		JEQKXAH	2	(WASHERS) (SPRING) METRIC ST ST 316 M12	N/A
									5		HMHRADQ	1	(O RINGS) IMPERIAL 0.25x5.25x5.75 (431N70)	N/A

REF	NO.	BY	DATE	AMENDMENTS
CL113	A	PS	18.10.990° SHAFT DIM. ADDED	
	0	PS	ISSUED FOR PRODUCTION	

JET 274

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C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

DESIGNED P.A.S. 18.11.98

DRAWN P.A.S. 18.11.98

CHECKED

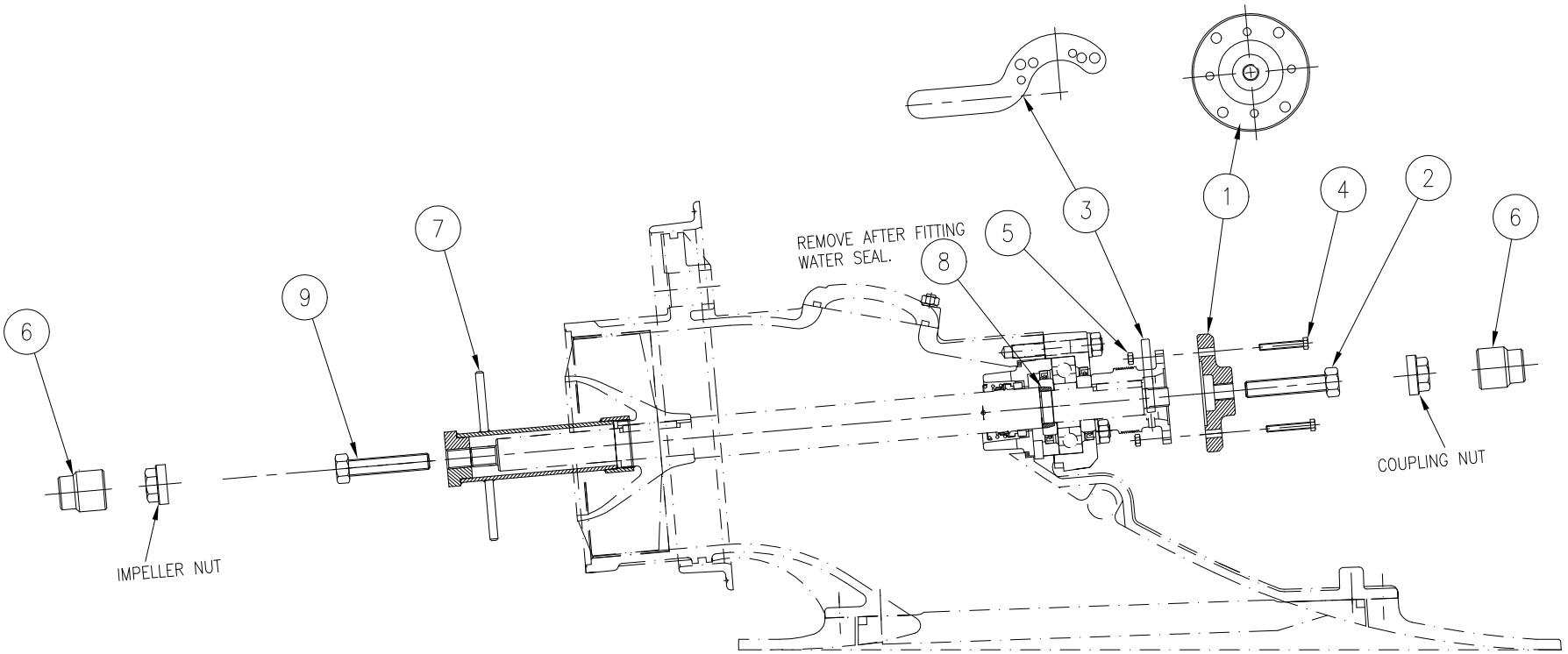
APPROVED

NAME
HATCH EXTENSION
HJ 274 JET

SCALE –

No: ASSY-HJ27410004 A

HJ27411000 Tool Kits



A	B	Item	Kit	PartNumber	Qty	ProductDescription	DrawingNbr
			A	HJ27411000		TOOL KIT	HJ27411000
			B	105950		IMPELLER PULLER KIT	HJ27411000
A		1		105795	1	COUPLING PULLER	105795
A		2		105796	1	FORCING SCREW M20	105796
A		3		105797	1	TORQUE ARM	105797
A		4		HYIXXBF	2	(BOLTS) (METRIC) MILD STEEL H/TENSILE GR88 (ZP) M8x55	N/A
A		5		JDPVYAC	2	(NUTS) (METRIC MILD STEEL) M8 (GR88) (ZP)	N/A
A		6		JMNGAAQ	1	(SOCKETS) TOOLS AF 3/4" SQ DRIVE 36mm (SOCKET)	N/A
A	B	7		105825	1	IMPELLER PULLER WELDED ASSEMBLY	105825
A		8		110276	1	ROTARY SEAL FITTING SLEEVE (nylon)	110276
A	B	9		105826	1	FORCING SCREW M24	105826

REF NO.	BY	DATE	AMENDMENTS
CL149	C	P.S.	KIT B ADDED
CL132	B	K.V.E.	21.03.00 ITEM 4 PART NUMBER ALTERED WAS HYIXYBF;;ITEM 9 WAS 2
CL91	A	P.S.	27/4/99 ITEM 2 WAS 105796-1. 7 WAS 105950. 105826-Y DELETED.
CL75	0	P.S.	22/12/98 ISSUED FOR PRODUCTION

JET 274

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

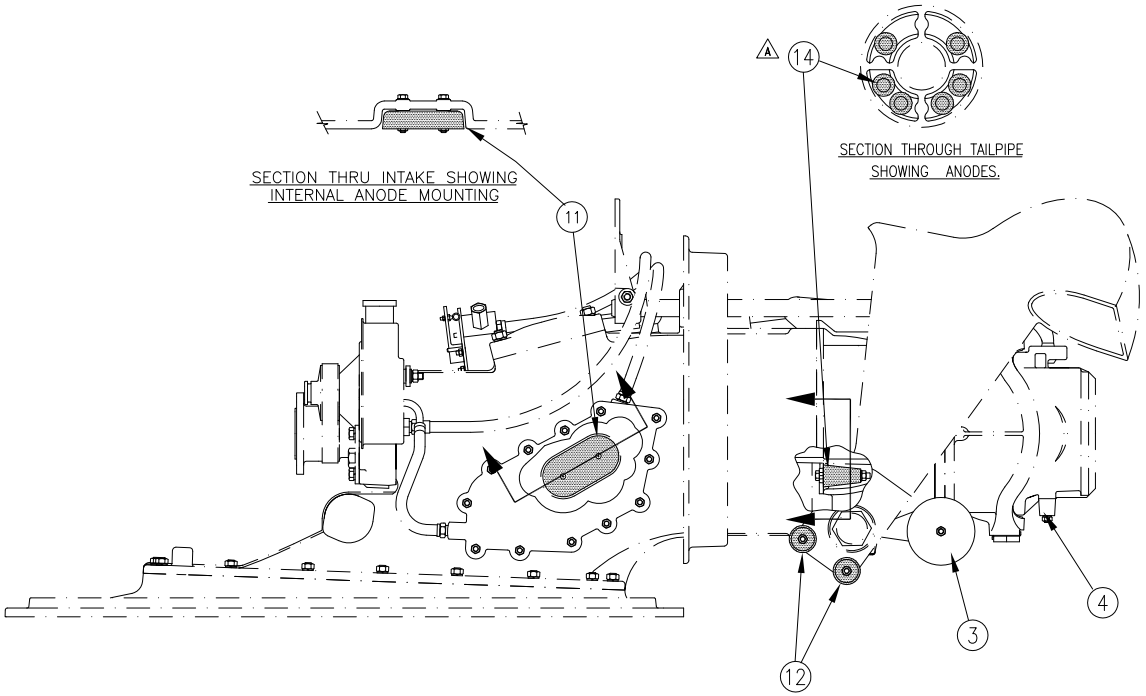
PROJECTION

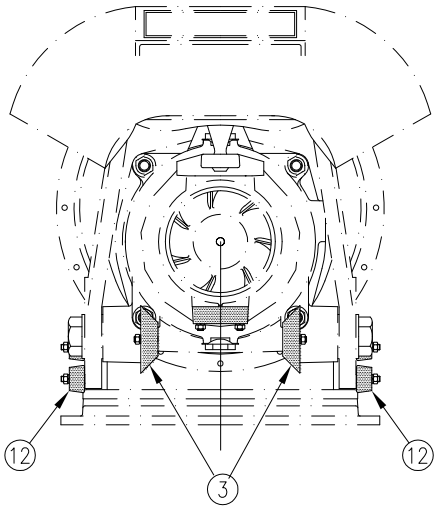
NAME
TOOL KIT
HJ274

DESIGNED P.A.S. DATE 20/11/98
DRAWN P.A.S. DATE 20/11/98
CHECKED
APPROVED

SCALE -
No: ASSY-HJ274 11 000 C

HJ27413002 anode Location





Item	PartNumber	Qty	ProductDescription	DrawingNbr
3	102185	2	ANODE	102185
4	103359	1	ANODE MK3	103359
11	111059	1	ANODE INTERNAL	111059
12	112657	4	ANODE	112657
14	111654	1	ANODE KIT:- TAILPIPE INTERNAL	HJ32201000

REF	NO.	BY	DATE	AMENDMENTS
CL316	C	I.G.G	15.03.04	111654 (ITEM 14) WAS 111593
CL299	B	P.M.W	20.10.03	ITEM 12 WAS PART No: 104634.
CL165	A	R.J.L	28.11.00	WAS 5 & ITEMS 12 & 14 NEW ANODE ADDED, ITEM 12 WAS ITEM 4
CL165	A	R.J.L	28.11.00	INTERNAL TAILPIPE ANODES WERE ITEM 4 NOW 14, ITEM 4 QTY
CL 147	0	R.J.L	19.07.00	ISSUED FOR PRODUCTION.

JET 274

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C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

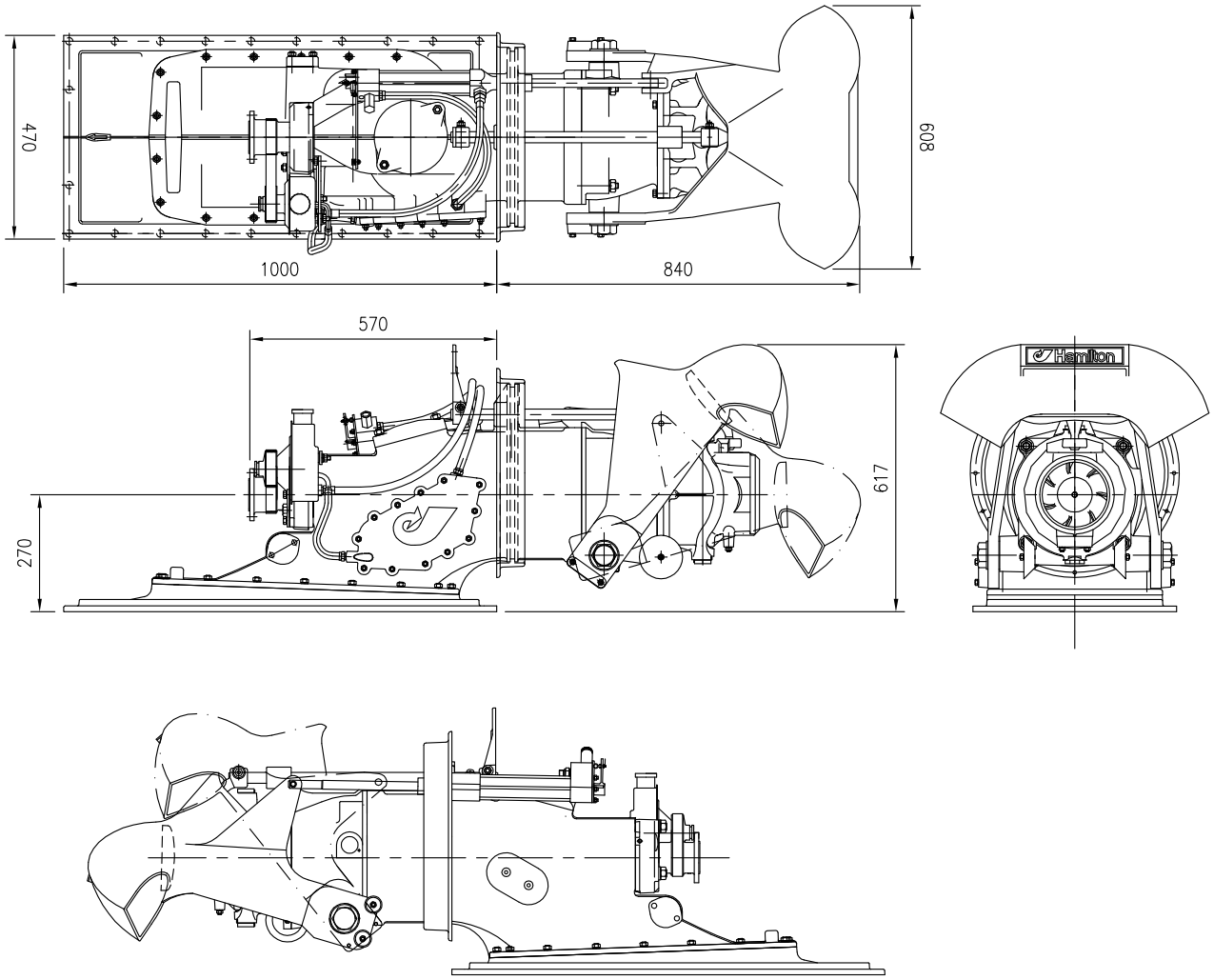
DESIGNED	R.J.L	DATE 11-07-00
DRAWN	R.J.L	11-07-00
CHECKED	D.B.	19-07-00
APPROVED	K.V.E	19-07-00

NAME
ANODE LOCATION
for
HJ274 JET

SCALE -

No: ASSY-HJ274 13 002 C

HJ27430001 General Assembly Drawing with 0° Shaftline



CL316	B	F.K.	15.03.04	RIGHT HAND VIEW SHOWN
CI 88	A	P.S.	14/12/98	WAS 5° SHAFT LINE. TRANSOM PLATE MOVED FORWARD 15mm
CL74	0	P.S.	11/10/98	ISSUED FOR PRODUCTION.
REF	NO.	BY	DATE	AMENDMENTS

JET 274

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

DESIGNED P.A.S. DATE 9/10/98

DRAWN P.A.S. 9/10/98

CHECKED

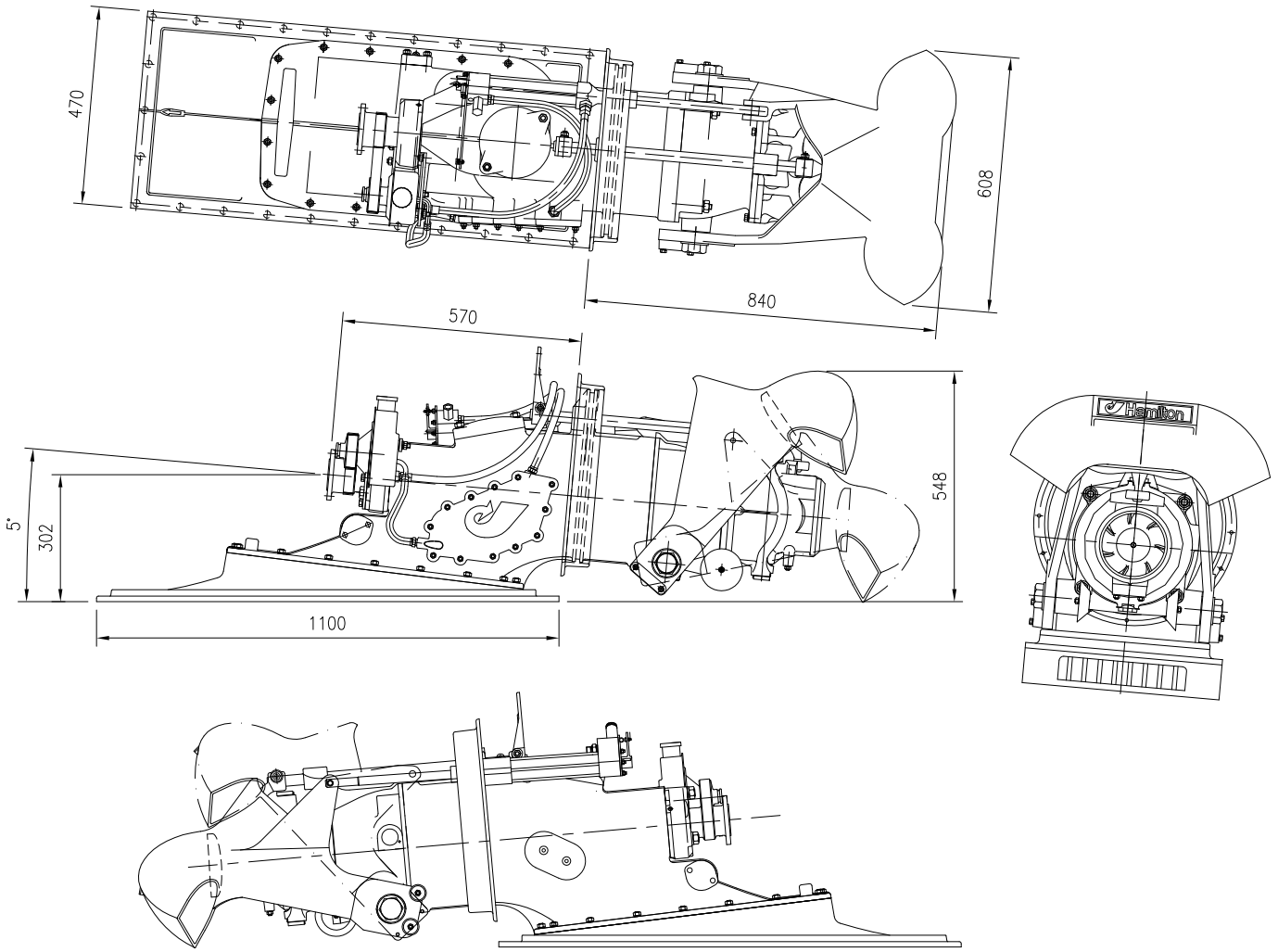
APPROVED

NAME
GENERAL ASSEMBLY
HJ274 JET
with 0° SHAFT LINE

SCALE 1:10

No: ASSY-HJ274 30 001 B

HJ27430002 General Assembly Drawing with 5° Shaftline

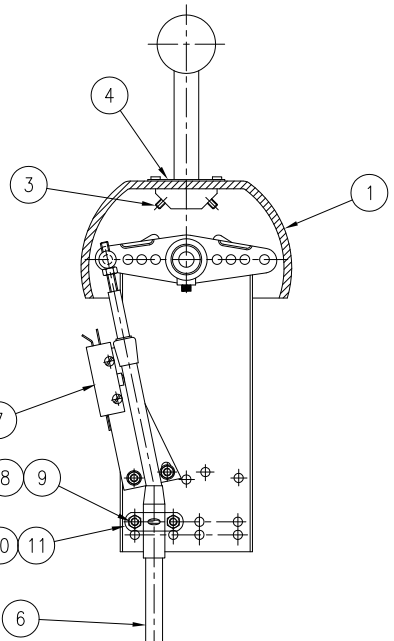


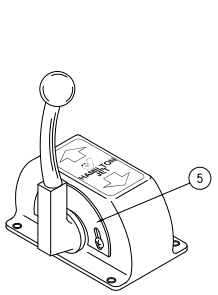
					C.W.F.HAMILTON & CO. LTD. CHCH. NZ.	
					PROJECTION	NAME: GENERAL ASSEMBLY HJ274 JET with 5° SHAFT LINE
CL316	A	F.K.	15.03.04	RIGHT HAND VIEW SHOWN	DESIGNED P.A.S. DATE 19/2/99	
CL88	0	P.S.	14/04/99	ISSUED FOR PRODUCTION.	DRAWN P.A.S. 19/2/99	
REF	NO.	BY	DATE	AMENDMENTS	CHECKED	
JET 274					APPROVED	SCALE 1:10 — No: ASSY–HJ274 30 002 — A

CTCLV01003 Reverse Controller

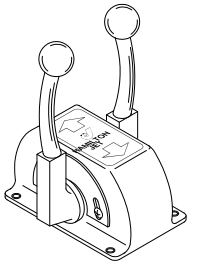
NEUTRAL DETENT AND ENGINE START INTERLOCK.

THE REVERSE DUCT CAN BE PLACED AT ANY POSITION BETWEEN FULL AHEAD AND FULL ASTERN, WITH THE "NEUTRAL" POINT (i.e. FORWARD AND REVERSE THRUSTS EQUAL) BEING APPROXIMATLEY 1/3 UP THROUGH THE JET STREAM FROM THE FULL ASTERN POSITION. THE EXACT POSITION BEING OBTAINED ON TRIALING THE BOAT.
THE DETENT PLATE MUST BE ADJUSTED TO CORRESPOND TO THIS NEUTRAL POSITION AND THE ENGINE START INTERLOCK SWITCH MUST BE ARRANGED TO ALLOW THE ENGINE TO START ONLY IN THIS SAME NEUTRAL POSITION.

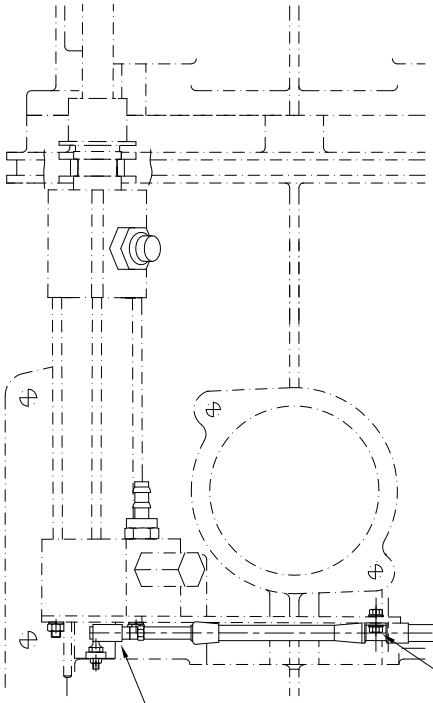




MODEL S



MODEL TWIN S



LENGTH OF CABLE MUST BE SPECIFIED BY CUSTOMER

8 9 10 11

(REF ONLY, SUPPLIED WITH REVERSE JACK)

(BALL JOINT SUPPLIED WITH REVERSE JACK)

A	B	C	Item	Kit	PartNumber	MovexAlias	Qty	ProductDescription	DrawingNbr
				A	110021			CLV SINGLE LEVER FOR SINGLE JET WITH NEUTRAL INTERLOCK	CTCLV01003
				B	110022			CLV TWIN LEVER FOR TWIN JETS WITH NEUTRAL INTERLOCK	CTCLV01003
				C	80934	080934		CABLE CLAMP KITSET	80934
	B		1		63566	063566	1	MORSE CONTROLLER TWIN 'S'	CTCLV01003
A			1		63526	063526	1	MORSE CONTROLLER SINGLE 'S'	CTCLV01003
A2	B4		3		203089		4	(SCREWS) (CAP SCREWS) IMPERIAL ST ST 304 3/16"UNFx3/4" (BUTTON HEAD)	N/A
A	B		4		63529	063529	1	(LABELS) "UP" (J)"DOWN"	CTCLV01003
A1	B2		5		104552-8		2	(LABELS) DETENT PLATE	CTCLV01003
A1	B2		7		64727	064727	1	NEUTRAL INTERLOCK SWITCH MORSE 047307	N/A
A2	B4	C2	8		HZJXAAD	201183	2	(SCREWS) (M/C SCREWS) IMPERIAL ST ST 316 3/16"UNCx1.0" (ROUND HEAD)	N/A
A2	B4	C2	9		JDQSAAA	201326	2	(NUTS) (IMPERIAL NYLOC ST ST 316) 3/16"UNC	N/A
A1	B2	C1	10		202543		1	SHIM - MORSE CABLE RETAINER.	202543
A1	B2	C1	11		202544		1	CLAMP - MORSE CABLE RETAINER.	202544

REF	NO.	BY	DATE	AMENDMENTS
CL346	E	I.G.G	19.10.04	CORRECTED QTYS ON 080934
CL330	D	I.G.G	05.07.04	203089 WAS HZJXAAC, DELETED ITEM 2 (106261)
CL307	C	I.G.G	22.12.03	ITEMISED CABLE CLAMP KITSET, UNC FASTENERS WERE M6
CL 31	B	P.S.	3/12/97	OPTION WITHOUT ENGINE INTERLOCK SWITCH DELETED.
CL3791	A	P.S.	13/6/97	PART No.110021, 110022 & ITEM 7 ADDED. NOTE ADDED
CL3732	0	L.C.	19/12/95	ISSUED FOR PRODUCTION

JET 213 241 273

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

DESIGNED K.V.A. DATE 10.95

DRAWN L COOPER 20.11.95

CHECKED K.V.A. 25/11/95

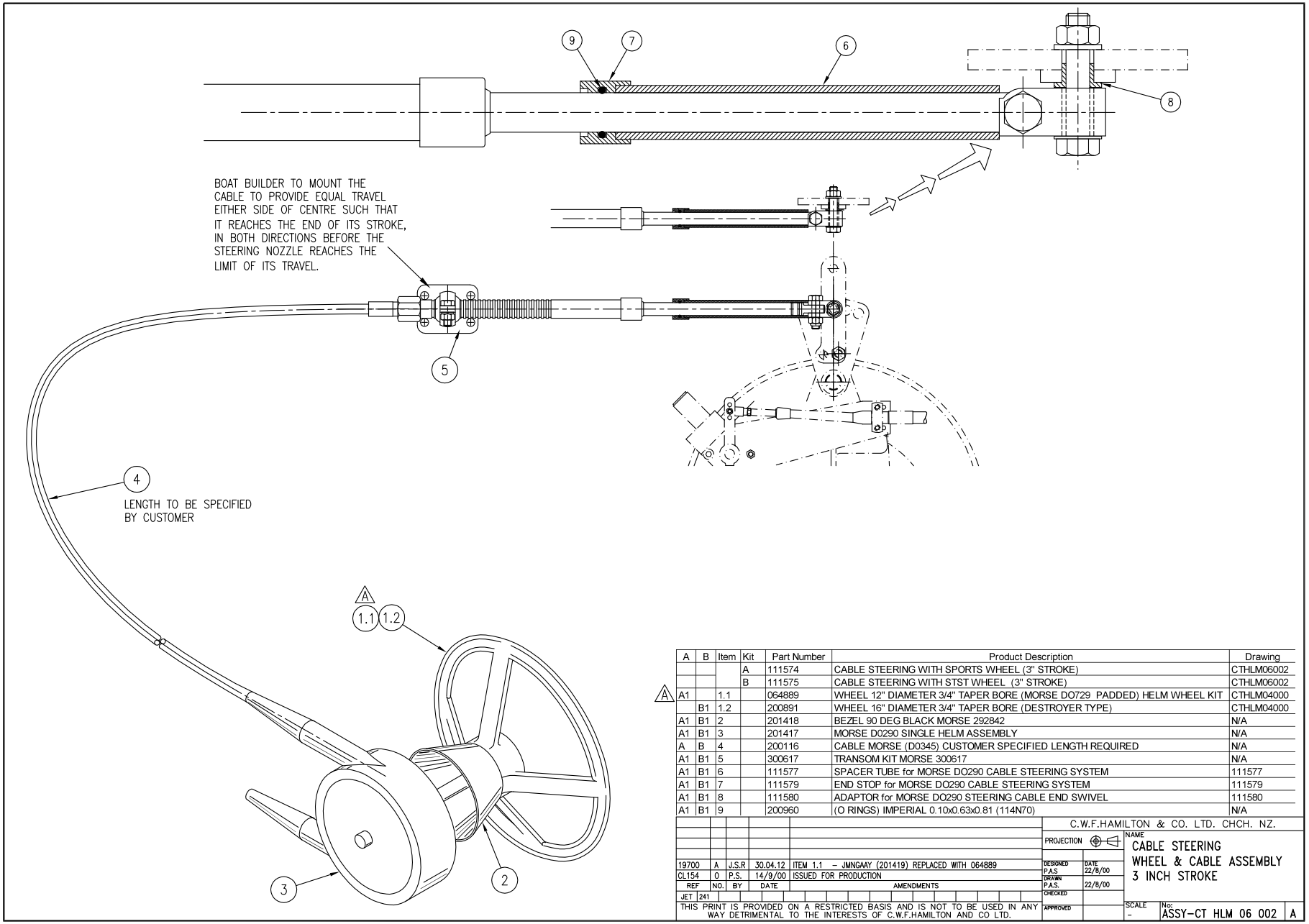
APPROVED K.V.E. 15/12/95

NAME
REVERSE CONTROLLER
MORSE S
WITH ENGINE START INTERLOCK
H.S.R.X. ONLY.

SCALE -

No: ASSY-CT CLV 01 003 E

CTHLM06002 Cable Steering wheel & Cable Assembly 3″ Stroke



A	B	Item	Kit	Part Number	Product Description	Drawing
			A	111574	CABLE STEERING WITH SPORTS WHEEL (3" STROKE)	CTHLM06002
			B	111575	CABLE STEERING WITH STST WHEEL (3" STROKE)	CTHLM06002
A1		1.1		064889	WHEEL 12" DIAMETER 3/4" TAPER BORE (MORSE DO729 PADDED) HELM WHEEL KIT	CTHLM04000
	B1	1.2		200891	WHEEL 16" DIAMETER 3/4" TAPER BORE (DESTROYER TYPE)	CTHLM04000
A1	B1	2		201418	BEZEL 90 DEG BLACK MORSE 292842	N/A
A1	B1	3		201417	MORSE D0290 SINGLE HELM ASSEMBLY	N/A
A	B	4		200116	CABLE MORSE (D0345) CUSTOMER SPECIFIED LENGTH REQUIRED	N/A
A1	B1	5		300617	TRANSOM KIT MORSE 300617	N/A
A1	B1	6		111577	SPACER TUBE for MORSE DO290 CABLE STEERING SYSTEM	111577
A1	B1	7		111579	END STOP for MORSE DO290 CABLE STEERING SYSTEM	111579
A1	B1	8		111580	ADAPTOR for MORSE DO290 STEERING CABLE END SWIVEL	111580
A1	B1	9		200960	(O RINGS) IMPERIAL 0.10x0.63x0.81 (114N70)	N/A

REF	NO.	BY	DATE	AMENDMENTS
19700	A	J.S.R	30.04.12	ITEM 1.1 – JMNGAAY (201419) REPLACED WITH 064889
CL154	0	P.S.	14/9/00	ISSUED FOR PRODUCTION
JET	241			

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

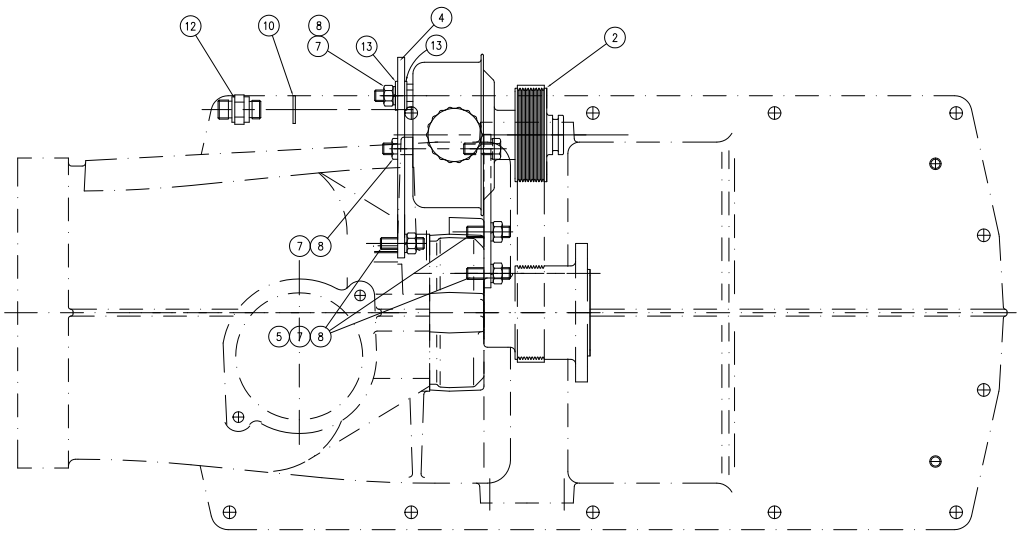
PROJECTION

DESIGNED P.A.S	DATE 22/8/00
DRAWN P.A.S.	22/8/00
CHECKED	
APPROVED	

NAME
CABLE STEERING
WHEEL & CABLE ASSEMBLY
3 INCH STROKE

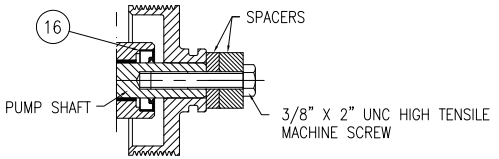
SCALE –
No: ASSY-CT HLM 06 002 A

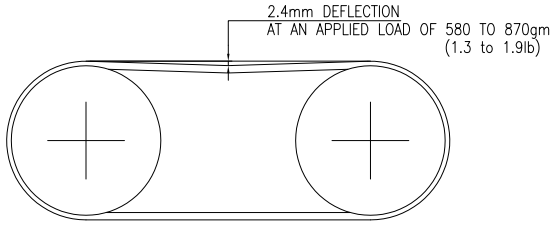
CTHPU01002 JHPU HSRX (Saginaw Pump) HJ-273 & HJ-274 Jets



FITTING PULLEY TO PUMP SHAFT

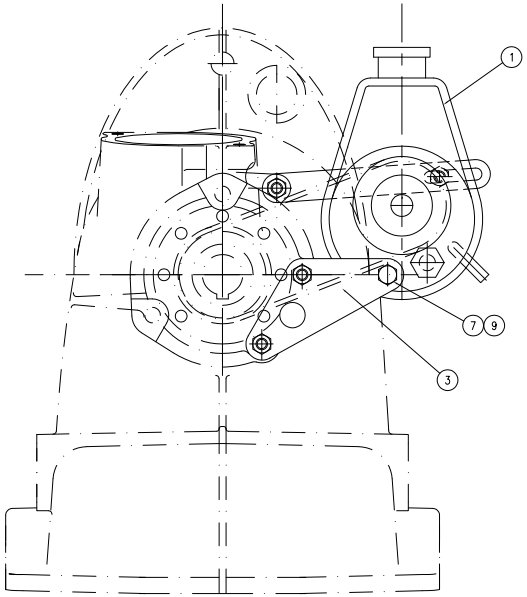
THE PULLEY IS AN INTERFERENCE FIT AND IS DRAWN ONTO THE PUMP SHAFT, IN 2 STAGES, WITH A HIGH TENSILE BOLT AND SUITABLE SPACERS UNTIL IT IS FLUSH WITH THE END OF THE SHAFT. SEE DETAIL BELOW.
REMOVE BOLT AND SPACERS AFTER INSTALLATION.





THE DRIVE SHOULD BE TENSIONED CORRECTLY AND RETENSIONED AFTER BETWEEN 30 MINUTES AND 4 HOURS AT FULL LOAD, TO COMPENSATE FOR THE SMALL INITIAL BELT STRETCH AND "BEDDING" INTO THE PULLEY GROOVES.

SETTING BELT TENSION



A	B	Item	Kit	PartNumber	ProductDescription	DrawingNbr
			A	CTHPU01002	JET HYDRAULIC POWER UNIT (SAGINAW) HSRX SYSTEM	CTHPU01002
			B	110857	SAGINAW PUMP & PULLEY ASSEMBLY	CTHPU01003
A1	B1	1		206264	SAGINAW PUMP	206264
A1	B1	2		108628	DRIVE PULLEY SAGINAW PUMP	108628
A1		3		109190	SAGINAW PUMP MOUNT BRACKET	109190
A1		4		109215	ADJUSTING LINK	109215
A3		5		201280	(STUDS) METRIC (316-STST) M10x40 (15/20)	30637
A6		7		201395	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A
A6		8		201310	(NUTS) (METRIC ST ST 316) M10	N/A
A1		9		201226	(SCREWS) (M/C SCREWS) METRIC ST ST 316 HEX HD M10x20	N/A
A1		10		064996	BONDED SEAL M16 (400-870-4490-74)	N/A
A1		12		068001	Adaptor 3/8 BSPP male X M16 x 1.5 metric male # SA10650616HJ	68001
A2		13		102993	(WASHER) SPECIAL 25mm ODx11mm IDx3mm thk	102993
A1		14		200120	OIL CASTROL DEXRON III 1 LITRE	N/A
A1		15		111614	PAINT APPLICATION JHPU'S With Saginaw Pump (Std) Gloss Finish	111178
		16	REF	203005	SEAL SAGINAW RSI 045131	N/A

PAINTING NOTES!
1. REFER TO DRG 85139 SHT 3 FOR PAINTING OF SAGINAW PUMP, SUPPORT BRACKET AND ADJUSTING LINK.
2. REFER TO DRG 111178 FOR PAINT SPECIFICATION AND APPLICATION.

REF	NO.	BY	DATE	AMENDMENTS
CL497	L	P.M.W	28.05.07	SAGINAW PUMP CHNGED TO KIT 206264
CL322	K	I.G.G	03.05.04	ADDED ITEM 16 AS SPARE PARTS
				SEE REV E AND CL74, 78, 118, 129, 159 FOR CHANGES

JET 273 274

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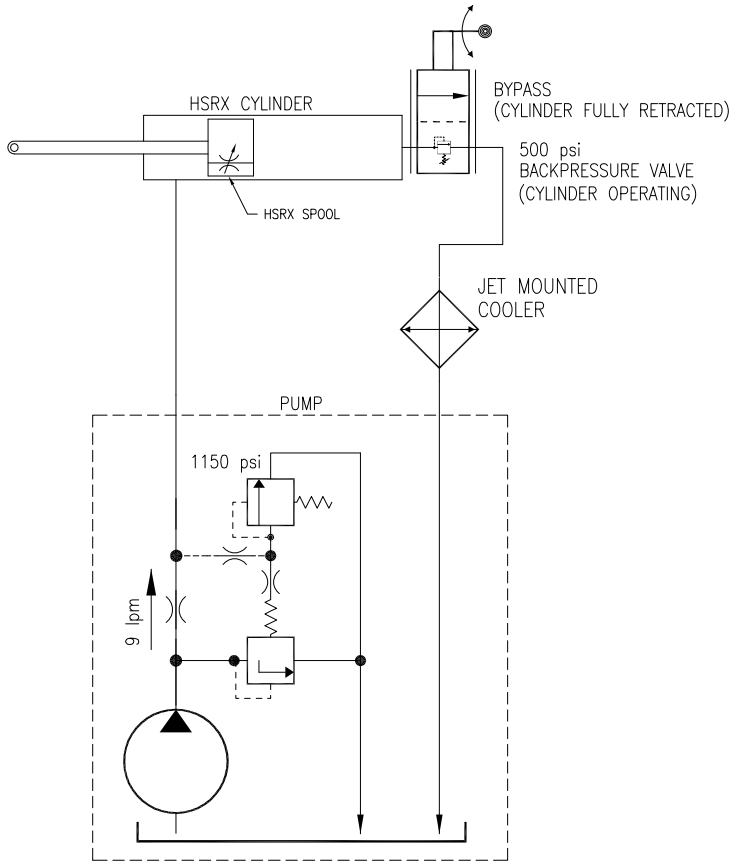
C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

DESIGNED	P.A.S.	7/8/96
DRAWN	P.A.S.	7/8/96
CHECKED		
APPROVED	K.V.E.	21/8/96

NAME
J.H.P.U.
H.S.R.X.
(SAGINAW PUMP)
HJ273 & 274 JETS

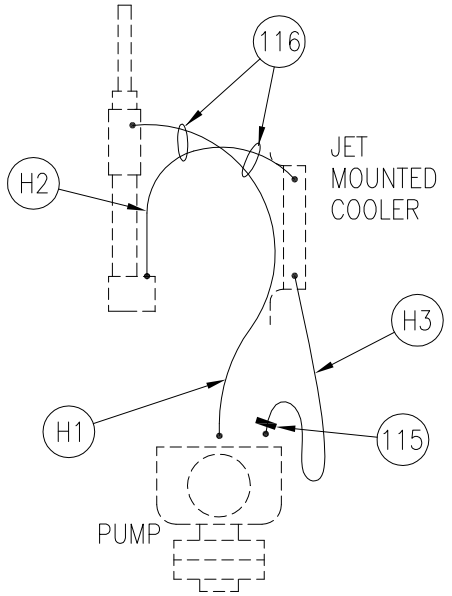
SCALE –
No: ASSY-CTHPU01002 L



HYDRAULIC CIRCUIT DIAGRAM

for

CT HPU 01 001 & 002



HOSE CONNECTION SCHEMATIC

CL697	D	J.S.R	10.11.11	NEW KIT D ADDED TO B.O.M
CL633	C	J.S.R	16.08.10	UPDATED BOM TO INCLUDE ITEM 7 & 8 IN THE LIST
CL467	B	S.K.	21.05.07	HOSE 115145 HAS HAD 15mm ADDED TO THE LENGTH
CL418	A	CMB	26.05.06	ISSUED FOR PRODUCTION
REF	NO.	BY	DATE	AMENDMENTS

JET 213 241 274 241A

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

DESIGNED J.W. DATE 08.10.02

DRAWN CMB 18.04.06

CHECKED

APPROVED

NAME
HOSE KITS
STAINLESS STEEL FITTINGS
HJ 213, 241 & 274
Sheet 1 of 2

SCALE -

No. ASSY-CT HSE 12 001 D

CTHSE12001 Hose Kits Stainless Steel Fittings Sht2

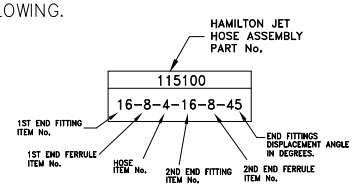
HAMILTON JET (HAM SPEC) HOSE KIT INSTRUCTIONS.

FOR A COMPLETE BREAKDOWN OF ALL PARTS NEEDED TO BUILD THESE KITS THIS DRAWING SHOULD BE USED IN CONJUNCTION WITH DRAWING 115000 Sheets 1 & 2.

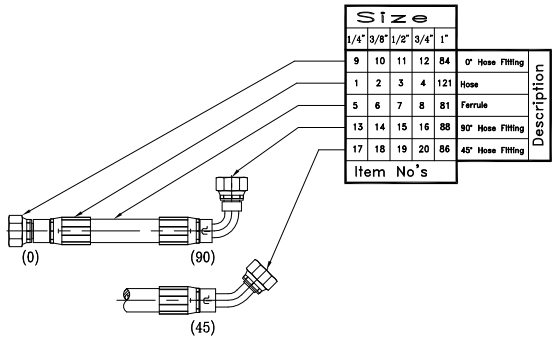
IN THE PARTS LIST ON THIS DRAWING, THE ITEMS REQUIRED TO BUILD EACH HOSE ASSEMBLY ARE LISTED IN EACH HOSE'S DESCRIPTION.

PartNumber	ProductDescription
115100	HOSE 3/4" L=0450mm 90-90 deg **16-8-4-16-8-45**

THE NUMBERS IN THE DESCRIPTION MEAN THE FOLLOWING.

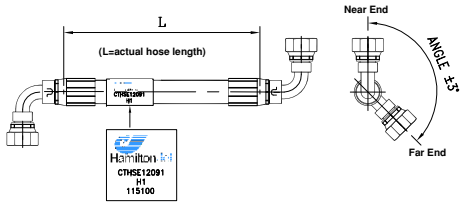


FOR GENERIC DESCRIPTIONS OF COMMON FITTINGS USE THE DIAGRAM BELOW. FOR COMPLETE DESCRIPTIONS OF ALL ITEM NUMBERS REFER TO DRAWING 115000 Sheets 1 & 2.



Notes:

(1) ALL FITTINGS TO BE STAINLESS STEEL
(2) THREAD FORM TO BE B.S.P.P.
(3) HOSE ASSEMBLIES TO BE ASSEMBLED BY TRAINED PERSONAL ONLY.
(4) HOSE ASSEMBLIES TO BE ASSEMBLED AS PER HOSE ASSEMBLY PROCEDURE MANUAL 85167.
(5) ALL HOSES TO BE CLEANED BY THE "AIR MATE" SYSTEM PRIOR TO THE INSERTION OF FITTINGS.



EACH HOSE MUST HAVE A HOSE LABEL SHOWING THE HOSE KIT NUMBER, 'H' NUMBER, AND HOSE PART NUMBER AS SHOWN ABOVE.

Displacement Angle

Specified only if two elbow fittings are used. Starting with either end as the near end, measure the angle clockwise to describe the displacement.

A	B	C	D	Item	Kit	PartNumber	ProductDescription	DrawingNbr
					A	CTHSE12002	HSRX HOSE KIT (SAGINAW pump) 213	CTHSE12001
					B	CTHSE12003	HSRX HOSE KIT (SAGINAW pump) 241	CTHSE12001
					C	CTHSE12004	HSRX HOSE KIT (SAGINAW pump) 274	CTHSE12001
△D					D	CTHSE12005	HINKLEY HOSE KIT (SAGINAW pump) 241A	CTHSE12001
A1	B1	C1	D1	115		201056	CLAMP HOSE 316SS 12-20 mm NORMA W5 #NHCSS012	N/A
A2	B2	C2		116		064500	CABLE TIE FARNELL PART # 149-327 150LG x 3.5 WIDE	115000
A1				213	H1	115142	HOSE 3/8" L=0350mm 45-00 deg 18-6-2-10-6-0	CTHSE12001
A1				213	H2	115143	HOSE 3/8" L=0300mm 90-00 deg 99-0-114-0-0	CTHSE12001
A1				213	H3	111211	HOSE 3/8" L=0300mm 00-00 deg 0-0-114-0-0-0	CTHSE12001
	B1			241	H1	115145	HOSE 3/8" L=0430mm 90-90 deg 14-6-2-117-6-315	CTHSE12001
	B1			241	H2	115146	HOSE 3/8" L=0395mm 00-00 deg 98-0-114-0-0	CTHSE12001
	B1		D1	241	H3	111213	HOSE 3/8" L=0300mm 00-00 deg 0-0-114-0-0-0	CTHSE12001
		C1		274	H1	115148	HOSE 3/8" L=0630mm 00-45 deg 10-6-2-18-6-0	CTHSE12001
		C1		274	H2	115149	HOSE 3/8" L=0585mm 00-00 deg 98-0-114-0-0	CTHSE12001
		C1		274	H3	111217	HOSE 3/8" L=0300mm 00-00 deg 0-0-114-0-0-0	CTHSE12001

REF	NO.	BY	DATE	AMENDMENTS
				REFER TO SHEET 1 FOR AMENDMENT

JET 213 241 274 241A

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

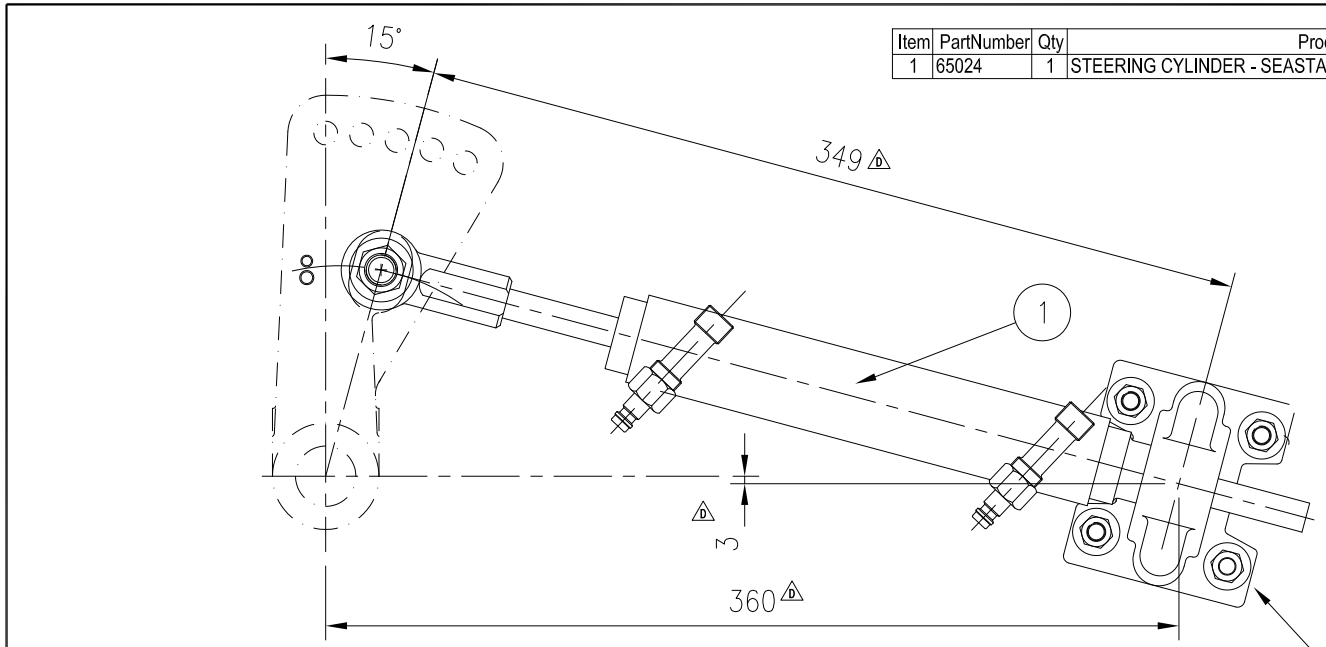
DESIGNED J.W. 08.10.02
DRAWN CMB 18.04.06
CHECKED
APPROVED

NAME
HOSE KITS
STAINLESS STEEL FITTINGS
HJ 213, 241 & 274
Sheet 2 of 2

SCALE -
No: ASSY-CT HSE 12 001 D

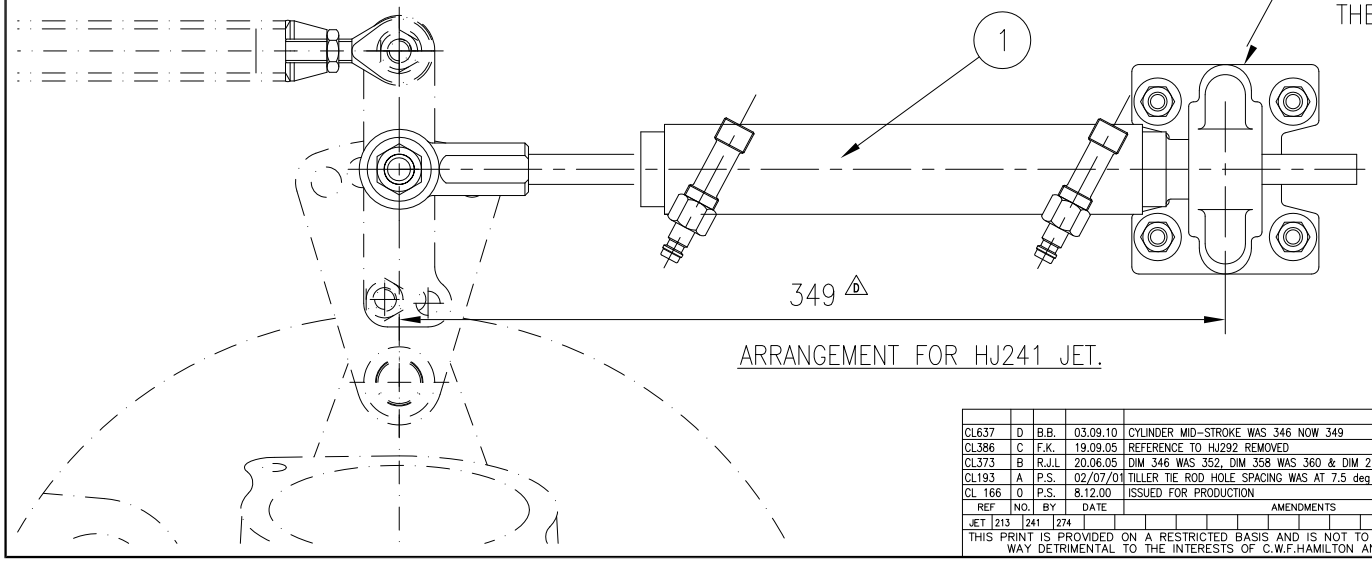
CTSJK02005 steering cylinder Mounting

Item	PartNumber	Qty	ProductDescription
1	65024	1	STEERING CYLINDER - SEASTAR MODEL HC5303 PART # BA125-3ATM



ARRANGEMENT FOR HJ274 JET

BOAT BUILDER TO MOUNT THE STEERING CYLINDER TO PROVIDE EQUAL TRAVEL EITHER SIDE OF CENTRE SUCH THAT IT REACHES THE END OF ITS STROKE, IN BOTH DIRECTIONS, BEFORE THE STEERING NOZZLE REACHES THE LIMIT OF ITS TRAVEL.



ARRANGEMENT FOR HJ241 JET.

REF	NO.	BY	DATE	AMENDMENTS
CL637	D	B.B.	03.09.10	CYLINDER MID-STROKE WAS 346 NOW 349
CL386	C	F.K.	19.09.05	REFERENCE TO HJ292 REMOVED
CL373	B	R.J.L.	20.06.05	DIM 346 WAS 352, DIM 358 WAS 360 & DIM 2 WAS 14.
CL193	A	P.S.	02/07/01	TILLER TIE ROD HOLE SPACING WAS AT 7.5 deg
CL 166	0	P.S.	8.12.00	ISSUED FOR PRODUCTION

JET 213 241 274

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

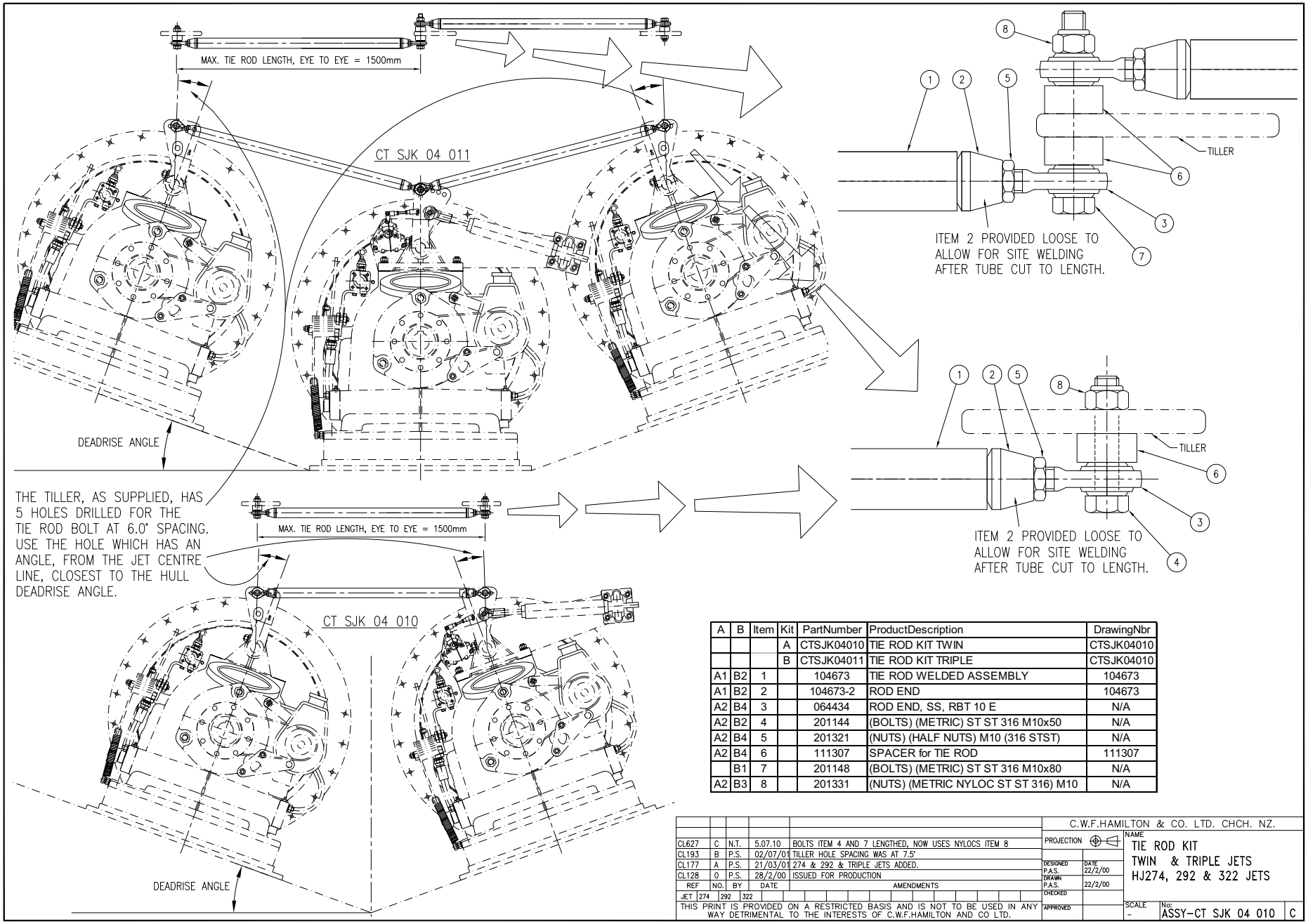
DESIGNED	P.A.S	21/2/00
DRAWN	P.A.S.	21/2/00
CHECKED	P.S	8.12.00
APPROVED	K.V.E.	8.12.00

NAME: STEERING CYLINDER MOUNTING HJ241 & 274

SCALE –

No: ASSY-CT SJK 02 005 D

CTSJK04010 tie rod Kit Twin & Triple Jets



A	B	Item	Kit	PartNumber	ProductDescription	DrawingNbr
			A	CTSJK04010	TIE ROD KIT TWIN	CTSJK04010
			B	CTSJK04011	TIE ROD KIT TRIPLE	CTSJK04010
A1	B2	1		104673	TIE ROD WELDED ASSEMBLY	104673
A1	B2	2		104673-2	ROD END	104673
A2	B4	3		064434	ROD END, SS, RBT 10 E	N/A
A2	B2	4		201144	(BOLTS) (METRIC) ST ST 316 M10x50	N/A
A2	B4	5		201321	(NUTS) (HALF NUTS) M10 (316 STST)	N/A
A2	B4	6		111307	SPACER for TIE ROD	111307
	B1	7		201148	(BOLTS) (METRIC) ST ST 316 M10x80	N/A
A2	B3	8		201331	(NUTS) (METRIC NYLOC ST ST 316) M10	N/A

REF	NO.	BY	DATE	AMENDMENTS
CL627	C	N.T.	5.07.10	BOLTS ITEM 4 AND 7 LENGTHED, NOW USES NYLOCS ITEM 8
CL193	B	P.S.	02/07/01	TILLER HOLE SPACING WAS AT 7.5"
CL177	A	P.S.	21/03/01	274 & 292 & TRIPLE JETS ADDED.
CL128	0	P.S.	28/2/00	ISSUED FOR PRODUCTION

JET 274 292 322

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

DESIGNED P.A.S. DATE 22/2/00

DRAWN P.A.S. 22/2/00

CHECKED

APPROVED

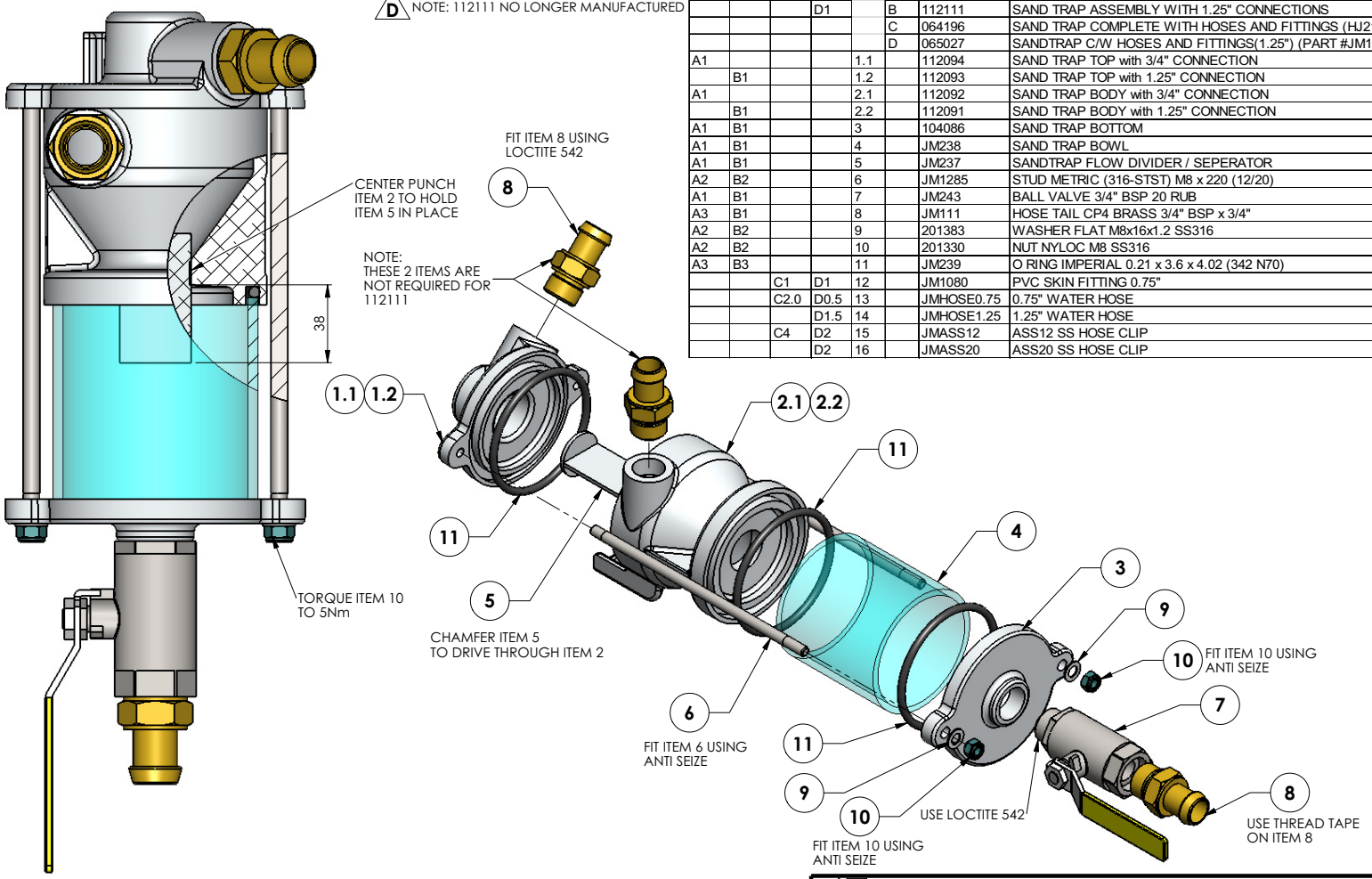
NAME
TIE ROD KIT
TWIN & TRIPLE JETS
HJ274, 292 & 322 JETS

SCALE -

No: ASSY-CT SJK 04 010 C

112110 Sand Trap Assembly

A	B	C	D	Item	Kit	PartNumber	ProductDescription	DrawingNbr
		C1			A	112110	SAND TRAP ASSEMBLY WITH 3/4" CONNECTIONS	112110
			D1		B	112111	SAND TRAP ASSEMBLY WITH 1.25" CONNECTIONS	112110
					C	064196	SAND TRAP COMPLETE WITH HOSES AND FITTINGS (HJ212 - HJ241)	64196
					D	065027	SANDTRAP C/W HOSES AND FITTINGS(1.25") (PART #JM1104-1031) (HJ274)	112110
A1				1.1		112094	SAND TRAP TOP with 3/4" CONNECTION	112093
	B1			1.2		112093	SAND TRAP TOP with 1.25" CONNECTION	112093
A1				2.1		112092	SAND TRAP BODY with 3/4" CONNECTION	112091
	B1			2.2		112091	SAND TRAP BODY with 1.25" CONNECTION	112091
A1	B1			3		104086	SAND TRAP BOTTOM	104086
A1	B1			4		JM238	SAND TRAP BOWL	N/A
A1	B1			5		JM237	SANDTRAP FLOW DIVIDER / SEPERATOR	N/A
A2	B2			6		JM1285	STUD METRIC (316-STST) M8 x 220 (12/20)	N/A
A1	B1			7		JM243	BALL VALVE 3/4" BSP 20 RUB	N/A
A3	B1			8		JM111	HOSE TAIL CP4 BRASS 3/4" BSP x 3/4"	N/A
A2	B2			9		201383	WASHER FLAT M8x16x1.2 SS316	N/A
A2	B2			10		201330	NUT NYLOC M8 SS316	N/A
A3	B3			11		JM239	O RING IMPERIAL 0.21 x 3.6 x 4.02 (342 N70)	N/A
		C1	D1	12		JM1080	PVC SKIN FITTING 0.75"	N/A
		C2.0	D0.5	13		JMHOSE0.75	0.75" WATER HOSE	N/A
			D1.5	14		JMHOSE1.25	1.25" WATER HOSE	N/A
		C4	D2	15		JMASS12	ASS12 SS HOSE CLIP	N/A
			D2	16		JMASS20	ASS20 SS HOSE CLIP	N/A



C. W. F. Hamilton & Co. Ltd

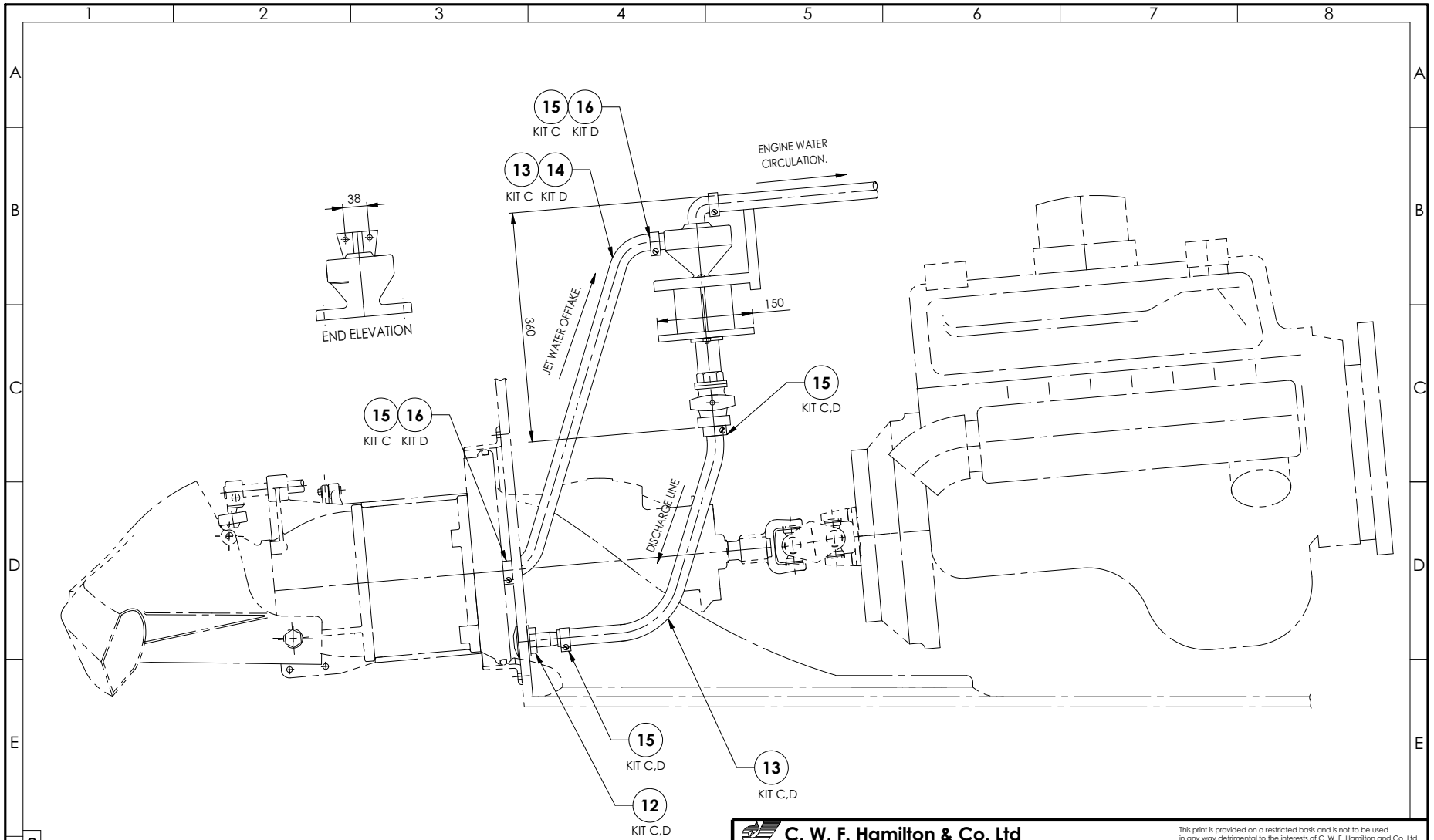
CHANGE HISTORY				
LATEST AMENDMENT: D - 112111 NO LONGER MANUFACTURED; C - KITS C AND D ADDED TO BOM; B - ITEM 10 WAS M8 NUT TORQUE SPEC ADDED				
AMENDED BY:	S.H.	12/03/12	ECN:	19614
AMENDMENT REVIEW:	D.B.	12/03/12		
DESIGNED BY:	P.A.S	15/03/02	ECN:	
DESIGN REVIEW:		01/01/01		

MANUFACTURING INFORMATION	
MATERIAL: N/A	
STANDARD:	
MAT. CERT REQ.: No	TRACEABILITY REQ.: No
WEIGHT: CAST [kg]:	MACHINED [kg]:
ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED	
UNTOLERANCED DIMENSIONS & SURFACE FINISH	
GENERAL: +/- 0.5 HOLES Ø: +/- 0.2 ANGULAR: +/- 0.5°	
MACHINED SURFACE FINISH: Ra 6.3 µm	

DRAWING INFORMATION			
SAND TRAP ASSEMBLY			
JET / CONTROL TYPE:			
DRAWN TO HAMJET 085195	PROJECTION:		
SCALE: 1:5	SHEET SIZE A3	Sheet1/2	
DWG No.: 112110		REV: D	

D | 112110 | DWG No

112110 Sand Trap Assembly Sht2



NOTE:
1. DRAWING IS A PICTORIAL REFERENCE ONLY
2. SHIPYARD TO SUPPLY BULKHEAD THROUGH FITTING FOR KIT D
3. KIT C SUITS JETS (HJ212-HJ241) AND KIT D SUITS JET HJ274

DWG No 112110 D

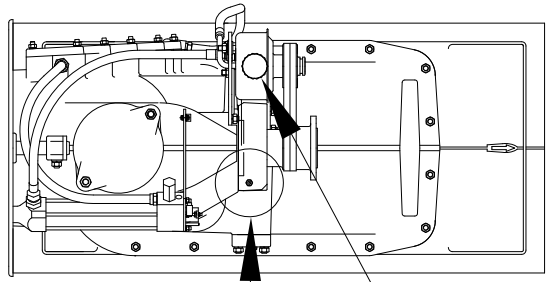
C. W. F. Hamilton & Co Ltd

CHANGE HISTORY				
LATEST AMENDMENT: D - 112111 NO LONGER MANUFACTURED; C - KITS C AND D ADDED TO BOM; B - ITEM 10 WAS M8 NUT TORQUE SPEC ADDED				
AMENDED BY:	S.H.	12/03/12	ECN:	19614
AMENDMENT REVIEW:	D.B.	12/03/12		
DESIGNED BY:	P.A.S	15/03/02	ECN:	
DESIGN REVIEW:		01/01/01		

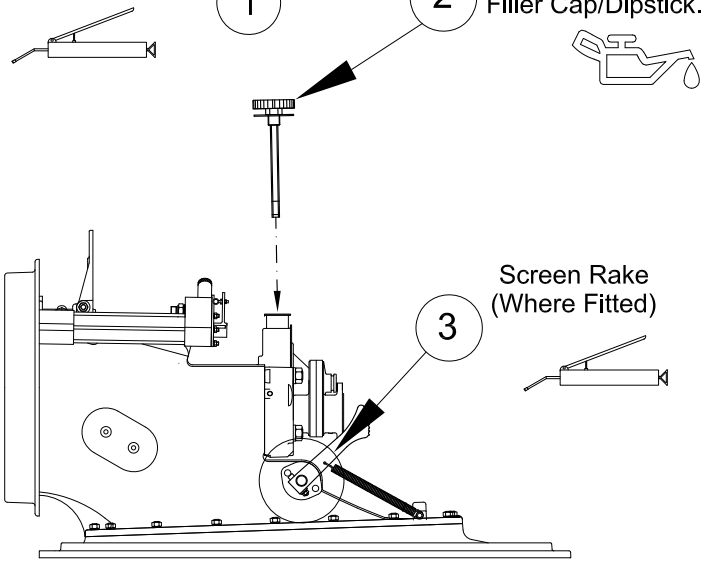
MANUFACTURING INFORMATION	
MATERIAL: N/A	
STANDARD:	
MAT. CERT REQ.: No	TRACEABILITY REQ.: No
WEIGHT; CAST [kg]:	MACHINED [kg]:
ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED	
UNTOLERANCED DIMENSIONS & SURFACE FINISH	
GENERAL: +/- 0.5 HOLES Ø: +/- 0.2 ANGULAR: +/- 0.5°	
MACHINED SURFACE FINISH: Ra 6.3 µm	

DRAWING INFORMATION			
SAND TRAP ASSEMBLY			
JET / CONTROL TYPE:			
DRAWN TO HAMJET 085195	PROJECTION:		
SCALE: 1:5	SHEET SIZE A3	Sheet2/2	
DWG No.: 112110		REV: D	

Hamilton Jet Regular Lubrication Chart



Plan View of Jet



Starboard View of Jet

Note:

1. Refer to drawing 85018 for lubricant specifications.
2. Refer to service manual for detailed service schedule, filter specifications and maintenance instructions.
3. Grease driveline as specified by driveline manufacturer.

Item No	Item Discription	Task
1	Thrust Bearing	Grease every 100 hours. It is preferable that mainshaft is turning when adding grease
2	Hydraulic Power Unit Oil Level	Check oil level Daily. Change after first 10 to 50 hrs then every 1000 hrs of running
3	Screen Rake	Grease every 3 months

REF	NO.	BY	DATE	AMENDMENTS
CL463	A	SK	23.04.07	ISSUED FOR INFORMATION
JET	274	241	213	

THIS PRINT IS PROVIDED ON A RESTRICTED BASIS AND IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO THE INTERESTS OF C.W.F.HAMILTON AND CO LTD.

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

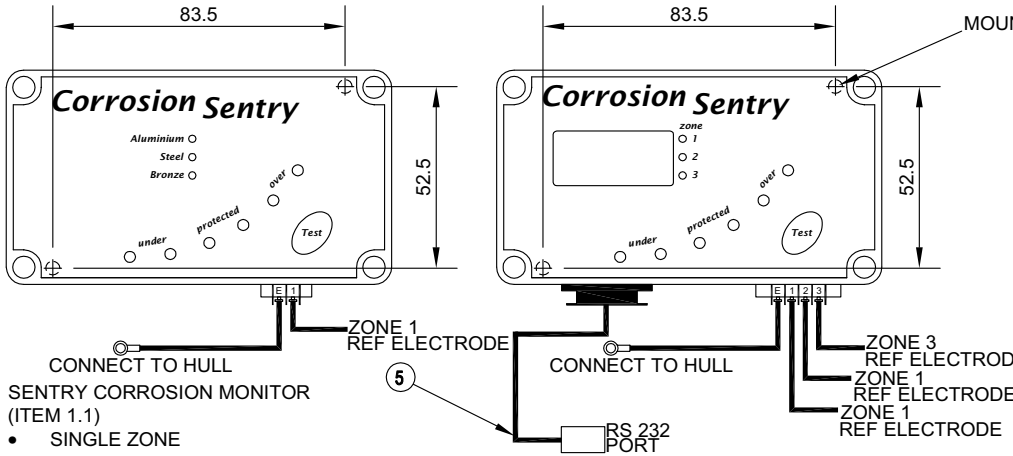
	DATE
DESIGNED SK	23.10.06
DRAWN SK	23.10.06
CHECKED N.T.	13.04.07
APPROVED	

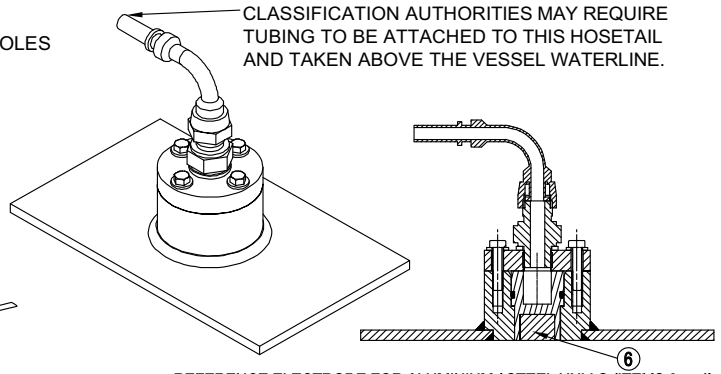
NAME

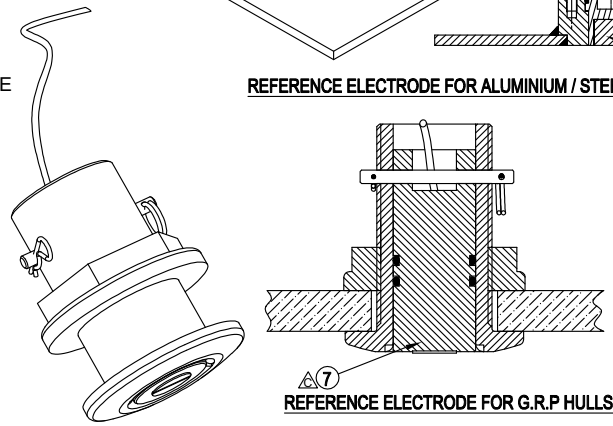
REGULAR LUBRICATION CHART for HJ274, 241 & 213 JETS.

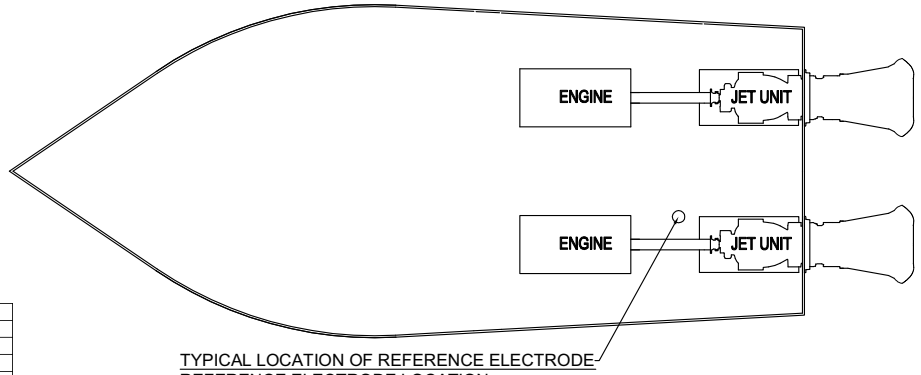
SCALE NTS | No: ASSY-205754 | A

HM00013001 anode Condition Monitor









FOR CORRECT INSTALLATION OF CORROSION MONITOR AND REFERENCE ELECTRODES, REFER TO THE INFORMATION SUPPLIED WITH THE "CORROSION SENTRY". TYPICALLY THE REFERENCE ELECTRODE IS INSTALLED NEAR THE FORWARD END AND INBOARD OF THE WATERJETS (REFER TO ILLUSTRATION). THE REFERENCE ELECTRODE SHOULD BE INSTALLED AT LEAST 1M (3FT) FROM ANY HULL ANODES. THE DISPLAY UNIT IS TYPICALLY MOUNTED ON A BULKHEAD WHERE ACCESS IS CONVENIENT FOR MONITORING, OR IN THE WHEELHOUSE. THE UNIT IS BATTERY OPERATED SO DOES NOT REQUIRE EXTERNAL POWER.

A	B	C	D	E	F	Item	Kit	Part Number	Product Description	Drawing
							A	065153	SENTRY CORROSION MONITOR KIT (SINGLE ZONE GRP HULL)	HM00013001
							B	065316	SENTRY CORROSION MONITOR KIT (SINGLE ZONE ALUMINIUM HULL)	HM00013001
							C	065317	SENTRY CORROSION MONITOR KIT (SINGLE ZONE STEEL HULL)	HM00013001
							D	209812	SENTRY CORROSION MONITOR KIT LOGGING VERSION FOR GRP HULLS	HM00013001
							E	209811	SENTRY CORROSION MONITOR KIT LOGGING VERSION FOR ALUMINUM HULLS	HM00013001
							F	209813	SENTRY CORROSION MONITOR KIT LOGGING VERSION FOR STEEL HULLS	HM00013001
A1	B1	C1				1.1		065154	SENTRY CORROSION MONITOR 1 ZONE (SN-01)	HM00013001
			D1	E1	F1	1.2		209815	SENTRY CORROSION MONITOR LOGGING VERSION (SN-03L-K2000)	HM00013001
A1			D1			2		065155	REFERENCE ELECTRODE GRP (REF-SKN-ZNK)	HM00013001
	B1			E1		3		065318	REFERENCE ELECTRODE ALUMINUIM HULL (REF-COM-AL-ZN)	HM00013001
		C1			F1	4		065319	REFERENCE ELECTRODE STEEL HULL (REF-COM-ST-ZN)	HM00013001
			D	E	F	5	REF	210814	CORROSION LOGGER CABLE	HM00013001
	B	C		E	F	6	REF	210823	REFERENCE ELECTRODE (SPARE ZINC ELECTRODE WITH WIRE) FOR AL OR STEEL HULL	HM00013001
A			D			7	REF	210926	REFERENCE ELECTRODE (SPARE ZINC ELECTRODE WITH WIRE) FOR GRP HULL	HM00013001

REF	NO.	BY	DATE	AMENDMENTS
19958	C	J.S.R	04.07.12	ADDED ITEM 7 TO BOM
19547	B	J.S.R	15.03.12	ITEM 5 AND 6 ADDED TO KIT.
CL621	A	N.T.	24.05.10	ISSUED FOR PRODUCTION

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

NAME: ANODE CONDITION MONITOR

DESIGNED | DATE

DRAWN N.T. 12.05.10

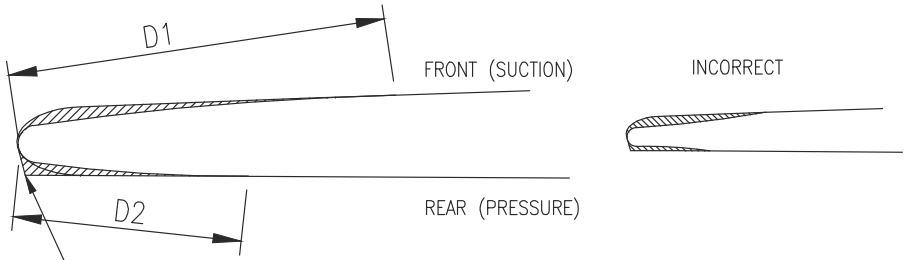
CHECKED

APPROVED

SCALE -

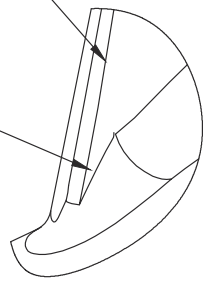
No: ASSY-HM000 13 001 C

FACTORY IMPELLER LEADING EDGE DRESSING



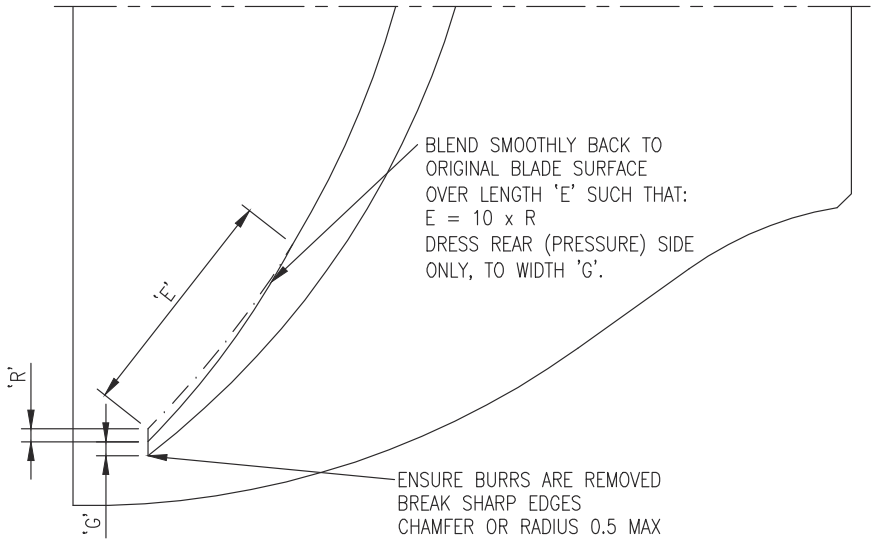
DRESS THE SQUARE EDGE OF THE IMPELLER BLADE LEADING EDGE BACK, AND SHARPEN BLADE AS SHOWN, TO RADIUS GIVEN BELOW IN TABLE 1.

AT THE BLADE–HUB INTERFACE, BLEND THE LE RADIUS INTO THE BLADE–HUB RADIUS.



IMPELLER TRAILING EDGE DRESSING

NOTE: ONLY REQUIRED FOR TRIMMED IMPELLERS



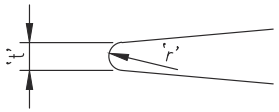
T.E. WIDTH 'G' mm	JET MODELS
2	212 213
2.5	241
3	274 292 322 362 364
4	391 403
4	FIRST TRIM IMPELLERS IF 'G' LESS THAN 5

NOTE: AFTER SHARPENING & DRESSING BLADES IMPELLER MUST BE BALANCED.

REFER TO DRAWING 82207 FOR HM AND HT JETS

TABLE 1: LEADING EDGE RADIUS

DRESS TO THICKNESS 't'.
SMOOTH TO RADIUS 'r' AT LEADING EDGE, FROM MID–BLADE HEIGHT TO OD.



THICKNESS 't' MAX	RADIUS 'r' MAX	D1 (MIN)		D2 (MIN)		JET MODELS
		OD	HUB	OD	HUB	
1.7	0.85	25	15	20	10	212–322
2.0	1.0	35	20	25	12.5	364–403

HamiltonJet

CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS

REVISION: L ECN: 23199

ADDED SHEET 5 ON STAMPING

DESIGN CHECK:	IH	26.08.14	SIGN.
DRAWING REVISION:	SH	26.08.14	SIGN.
DOCUMENT CHECK:	IH	26.08.14	SIGN.
ORIGINAL DESIGN:	MJH	26.06.03	SIGN.

MANUFACTURING INFORMATION

MATERIAL:

STANDARD:

MAT CERT REQ: TRACEABILITY REQ:

FINISHED WEIGHT:

ALL DIMENSIONS IN (mm) UNLESS OTHERWISE SPECIFIED

REMOVE ALL SHARP EDGES AND BURRS

UNTOLERANCED DIMENSIONS & SURFACE FINISH
GENERAL: ±0.5 HOLES: Ø0.2 ANGULAR: ± 0.5°
MACHINED SURFACE FINISH: Ra 6.3 µm

DRAWING INFORMATION

HJ IMPELLER BLADE DRESSING INSTRUCTIONS AND BALANCING INFORMATION

JET / CONTROL TYPE HJ

DRAWN TO HAMJET 085195 PROJECTION:

SCALE: SHEET SIZE: A3 Sht 1 of 5

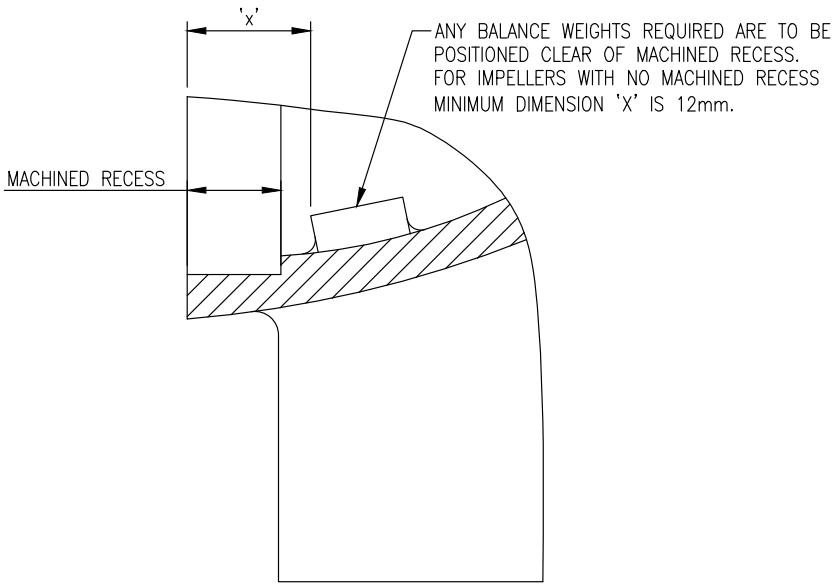
DWG No: 082206 REV: L

82206 impeller Dressing Instruction Sht2

JET MODEL	BALANCE LIMIT (g.cm)	MAX WEIGHT @ OD (g)
212 TURBO	11	2.0
212	22	2.0
213	22	2.0
241 TURBO	24	2.0
241	24	2.0
273	46	3.4
274	46	3.4
291	50	3.4
292	50	3.4
322	96	6.0
362/364	110	6.0
391/403	220	11.0

BALANCE LIMIT TABLE

REFER TO 85182 FOR BALANCING PROCEDURE



BALANCE WEIGHT POSITION

HamiltonJet

CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS	MANUFACTURING INFORMATION	DRAWING INFORMATION
REVISION: ECN: REFER TO SHEET 1 FOR AMENDMENTS	MATERIAL: STANDARD: MAT CERT REQ: TRACEABILITY REQ: FINISHED WEIGHT:	HJ IMPELLER BLADE DRESSING INSTRUCTIONS AND BALANCING INFORMATION
DESIGN CHECK: SIGN.	ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED	JET / CONTROL TYPE HJ
DRAWING REVISION: SIGN.	REMOVE ALL SHARP EDGES AND BURRS	DRAWN TO HAMJET 085195 PROJECTION:
DOCUMENT CHECK: SIGN.	UNTOLERANCED DIMENSIONS & SURFACE FINISH GENERAL: ±0.5 HOLES: Ø0.2 ANGULAR: ± 0.5°	SCALE: SHEET SIZE: A3 Sht 2 of 5
ORIGINAL DESIGN: SIGN.	MACHINED SURFACE FINISH: Ra 6.3 µm	DWG No: 082206 REV: L

82206 impeller Dressing Instruction Sht3

REPAIR OF SURFACE DEFECTS ON STAINLESS STEEL IMPELLERS.

1. SURFACE DEFECTS IN BLADES.

(A) SHALLOW PITS UP TO A MAXIMUM DEPTH OF 0.5mm ARE TO BE WELD REPAIRED AND GROUND BACK FLUSH TO ADJACENT SURFACE.

(B) BLADE THICKNESS MAY BE REDUCED LOCALLY BY UP TO 0.5mm FOR THE PURPOSE OF GRINDING OUT INCLUSIONS OR OTHER SURFACE FLAWS.

(C) WHERE THE SURFACE DEFECT IS GREATER THAN 0.5mm DEEP, THE DEFECT IS TO BE GROUND OUT TO CLEAN METAL, AS SHOWN, REPAIRED BY WELDING AND GROUND BACK FLUSH TO ADJACENT SURFACE.

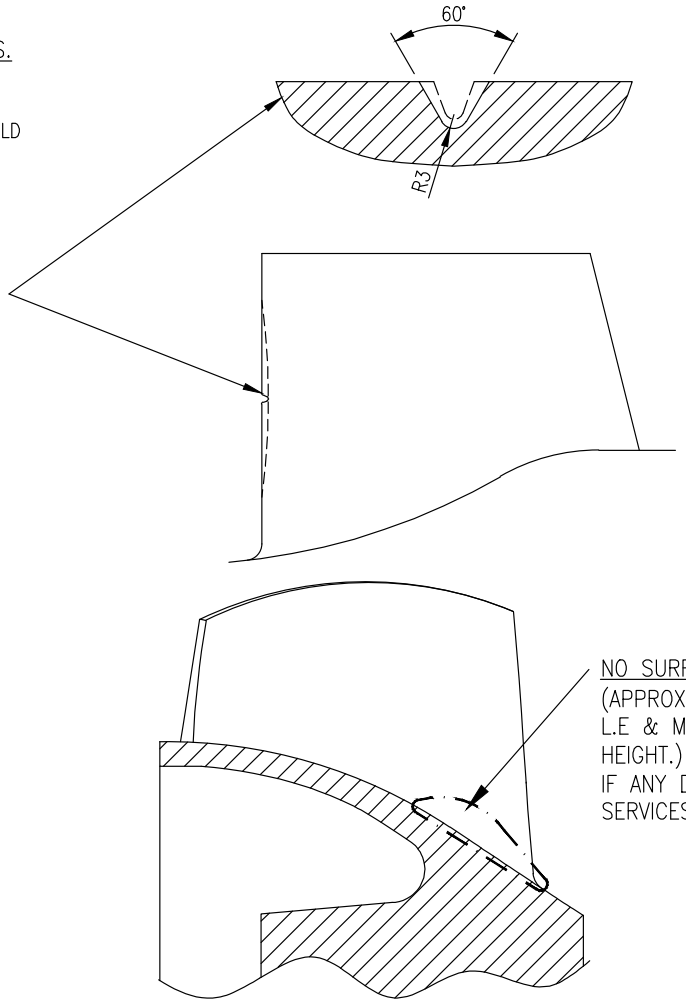
(D) THE SURFACE ROUGHNESS IS TO BE Ra 3.2um (N8) OR BETTER AFTER FETTLING.

(E) THE FILLET IS DEFINED AS PART OF BLADE.

2. SURFACE DEFECTS IN THE HUB.

THESE ARE TO BE TREATED THE SAME AS BLADE DEFECTS EXCEPT THAT FOR INSTRUCTIONS (A), (B) AND (C) A MAXIMUM DEPTH OF 1mm IS ALLOWED INSTEAD OF 0.5mm.

THE SURFACE ROUGHNESS IS TO BE Ra 6.3um (N9) OR BETTER AFTER FETTLING.



NO SURFACE DEFECTS ALLOWED
(APPROX ½ OF ROOT LENGTH FROM L.E & MAXIMUM DOUBLE THE FILLET HEIGHT.) ON SIDE.
IF ANY DOUBT CONTACT TECHNICAL SERVICES.

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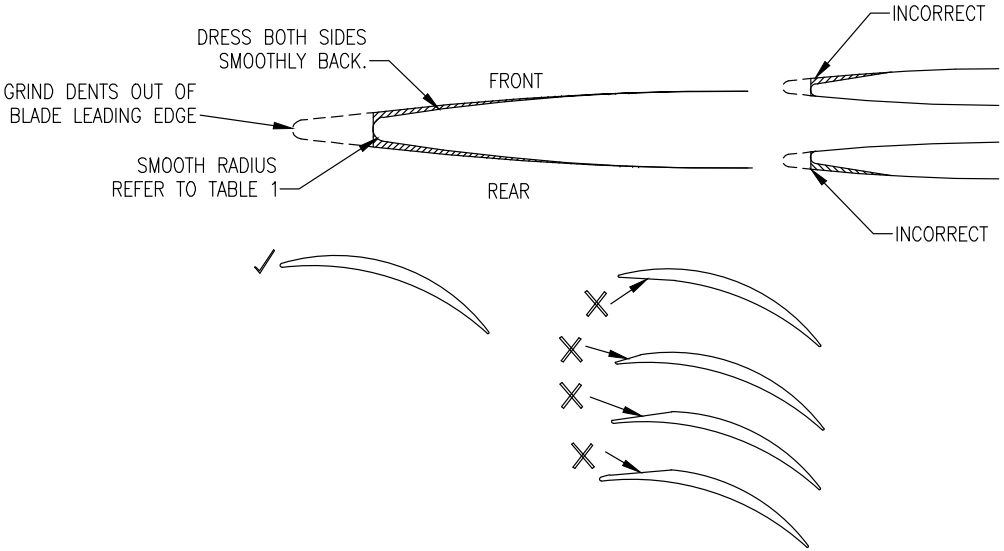
CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS	MANUFACTURING INFORMATION	DRAWING INFORMATION
REVISION: ECN: REFER TO SHEET 1 FOR AMENDMENTS	MATERIAL: STANDARD: MAT CERT REQ: TRACEABILITY REQ: FINISHED WEIGHT:	HJ IMPELLER BLADE DRESSING INSTRUCTIONS AND BALANCING INFORMATION
DESIGN CHECK: SIGN.	ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED	JET / CONTROL TYPE HJ
DRAWING REVISION: SIGN.	REMOVE ALL SHARP EDGES AND BURRS	DRAWN TO HAMJET 085195 PROJECTION:
DOCUMENT CHECK: SIGN.	UNTOLERANCED DIMENSIONS & SURFACE FINISH GENERAL: ±0.5 HOLES: Ø0.2 ANGULAR: ± 0.5°	SCALE: SHEET SIZE: A3 Sht 3 of 5
ORIGINAL DESIGN: SIGN.	MACHINED SURFACE FINISH: Ra 6.3 µm	DWG No: 082206 REV: L

CUSTOMER IMPELLER LEADING EDGE DRESSING



IMPELLER SHARPENING

THE LEADING EDGES OF THE IMPELLER MAY TEND TO BECOME "BLUNT" AFTER A PERIOD OF TIME WITH THE ACTION OF SMALL SOLID PARTICLES IN THE WATER. THE PERFORMANCE OF THE IMPELLER MAY DROP AS A RESULT.

ANY TIME THE INSPECTION COVER IS REMOVED, THE LEADING EDGE OF THE BLADES SHOULD BE INSPECTED FOR WEAR. IF BADLY WORN, REMOVE THE IMPELLER (SEE MANUAL ON DISMANTLING JET UNIT) AND SHARPEN AS SHOWN ABOVE.

BOTH FRONT AND REAR SURFACES TO BE SMOOTH UNIFORM CURVES. ANY FLAT AREAS WILL REDUCE EFFICIENCY AND CAUSE CAVITATION.

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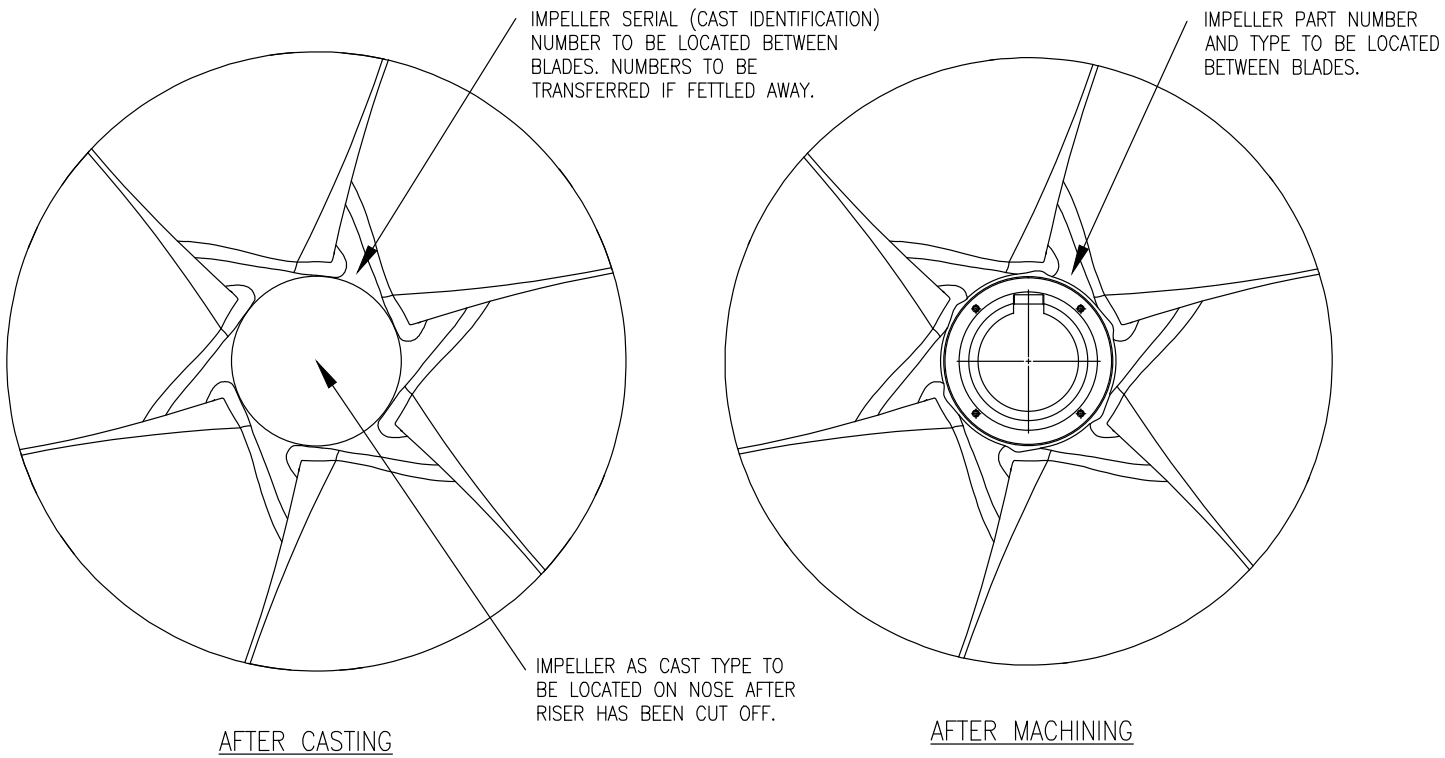
CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS	MANUFACTURING INFORMATION	DRAWING INFORMATION
REVISION: ECN: **REFER TO SHEET 1 FOR AMENDMENTS**	MATERIAL: STANDARD: MAT CERT REQ: TRACEABILITY REQ: FINISHED WEIGHT:	**HJ IMPELLER BLADE DRESSING INSTRUCTIONS AND BALANCING INFORMATION**
DESIGN CHECK: SIGN.	ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED	JET / CONTROL TYPE HJ
DRAWING REVISION: SIGN.	REMOVE ALL SHARP EDGES AND BURRS	DRAWN TO HAMJET 085195 PROJECTION:
DOCUMENT CHECK: SIGN.	UNTOLERANCED DIMENSIONS & SURFACE FINISH GENERAL: ±0.5 HOLES: Ø0.2 ANGULAR: ± 0.5°	SCALE: SHEET SIZE: A3 Sht 4 of 5
ORIGINAL DESIGN: SIGN.	MACHINED SURFACE FINISH: Ra 6.3 µm	DWG No: 082206 REV: L

IDENTIFICATION PROCESS ⚠L



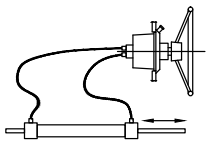
HamiltonJet

CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS	MANUFACTURING INFORMATION	DRAWING INFORMATION
REVISION: ECN: **REFER TO SHEET 1 FOR AMENDMENTS**	MATERIAL: STANDARD: MAT CERT REQ: TRACEABILITY REQ: FINISHED WEIGHT:	**HJ IMPELLER BLADE DRESSING INSTRUCTIONS AND BALANCING INFORMATION**
DESIGN CHECK: SIGN.	**ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED**	JET / CONTROL TYPE **HJ**
DRAWING REVISION: SIGN.	**REMOVE ALL SHARP EDGES AND BURRS**	DRAWN TO HAMJET 085195 PROJECTION:
DOCUMENT CHECK: SIGN.	**UNTOLERANCED DIMENSIONS & SURFACE FINISH** GENERAL: **±0.5** HOLES: **Ø0.2** ANGULAR: **± 0.5°**	SCALE: SHEET SIZE: **A3** **Sht 5 of 5**
ORIGINAL DESIGN: SIGN.	MACHINED SURFACE FINISH: **Ra 6.3 µm**	DWG No: **082206** REV: **L**

85018 Recommendations for Lubricants and Oils Sht1

HYDRAULIC FLUIDS	JET	VOLUME (L)

JASTRAM MANUAL HYDRAULIC STEERING



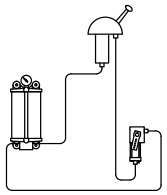
FLUID
ISO VG32 HYDRAULIC OIL

EXAMPLES

CASTROL:	HYSPIN AW32
SHELL:	TELLUS 32
ESSO/EXON/MOBIL:	NUTO H32/DTE EXCEL 32
TEXACO/CHEVRON/CALTEX:	RANDO HD32/AW32
GULF:	HARMONY AW32

JET	VOLUME (L)
HJ364	REFER TO JET MANUAL

HYNAUTIC REMOTE CONTROL SYSTEMS



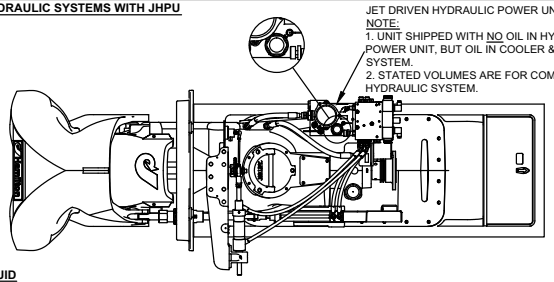
FLUID
50/50 MIXTURE BY VOLUME OF DISTILLED WATER AND ETHYLENE-GLYCOL (ANTI-FREEZE). ETHYLENE-GLYCOL SHOULD BE AS PURE AS POSSIBLE (NO ADDITIVES).

EXAMPLES
MCO-03 HYNAUTIC

DO NOT USE
BRAKE FLUID OR OIL

JET	VOLUME (L)
HJ364	REFER TO JET MANUAL
HJ403	
HM422	
HM461	
HM521	
HM571	

HYDRAULIC SYSTEMS WITH JHPU



JET DRIVEN HYDRAULIC POWER UNIT
NOTE:
1. UNIT SHIPPED WITH NO OIL IN HYDRAULIC POWER UNIT, BUT OIL IN COOLER & CONTROL SYSTEM.
2. STATED VOLUMES ARE FOR COMPLETE HYDRAULIC SYSTEM.

FLUID
USE MINERAL OR SYNTHETIC BASED HYDRAULIC FLUID CONFORMING TO ISO 11158, DIN 51524-2/DIN 51524-3 STANDARDS. THE HYDRAULIC FLUID SELECTED SHOULD BE WITHIN THE OPERATING TEMPERATURE RANGE. THE OPERATING VISCOSITY FOR HAMILTON JET HYDRAULIC SYSTEMS IS WITHIN THE VISCOSITY RANGE OF 16-36 CST.

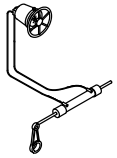
EXAMPLES

SHELL:	TELLUS 46
CASTROL:	HYSPIN AWS M46
ESSO/EXON/MOBIL:	DTE 10 EXCEL 46
B.P:	BARTRAN® HV46
GULF:	HARMONY AW46

JET	VOLUME (L)
HJ364	5.25
HJ403	7.5
HM422	7.5
HM461	7.5
HM521	7.5
HM571	7.5
HM651	21
HM721	21
HM811	21
HT810	21
HT900	60
HT1000	80

HYDRAULIC FLUIDS	JET	VOLUME (L)

SEASTAR MANUAL HYDRAULIC STEERING



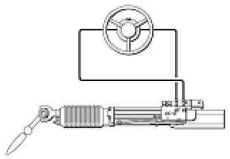
FLUID
FLUIDS MEETING MIL H5606C SPECIFICATIONS

EXAMPLES

SEASTAR:	HA5430 (1 QT), HA5440 (1 US GAL.)
SHELL:	SHELL AERO FLUID 41 OR 4
ESSO/MOBIL:	UNIVIS N15 OR J13/ MOBIL AERO HFA
TEXACO/CHEVRON:	HO15/ AVIATION HYDRAULIC FLUID A
PETRO CANADA:	HARMONY HV115

JET	VOLUME (L)
HJ213	REFER TO JET MANUAL
HJ241	
HJ274	
HJ292	
HJ322	
HJ364	
HJ403	

SEASTAR POWERED HYDRAULIC STEERING



FLUID
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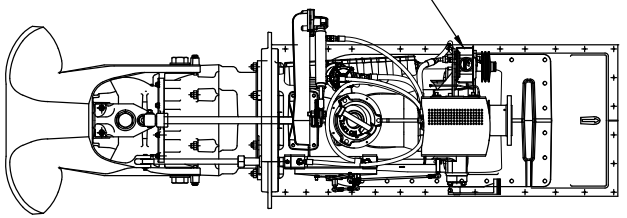
ESSO/MOBIL:	UNIVIS N15 OR J13/ MOBIL AERO HFA
TEXACO/CHEVRON:	HO15/ AVIATION HYDRAULIC FLUID A
PETRO CANADA:	HARMONY HV115

JET	VOLUME (L)
HJ403	REFER TO JET MANUAL
HM461	
HM521	
HM571	

HYDRAULIC SYSTEMS WITH SAGINAW HPU

JET DRIVEN HYDRAULIC POWER UNIT
NOTE: UNIT SHIPPED FILLED WITH OIL.



FLUID
FLUIDS MEETING GM SPECIFICATION NO. 9985010

EXAMPLES

SHELL:	DONAX TF / SPIRAX
ESSO/MOBIL:	DEXRON ®/ ATF
CASTROL:	TRANSMAX DEX 111
TEXACO/CHEVRON:	TEXAMATIC 7045E/ HD-389
GULF:	DEXRON VI

DO NOT USE
HYDRAULIC OIL

JET	HSRX / HSRC	BLUE ARROW
HJ213	1.0	N/A
HJ241	1.0	N/A
HJ274	1.2	N/A
HJ292	1.2	1.8
HJ322	1.7	2.3

HamiltonJet

CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS			
REVISION: V	ECN: 20317		
BEARING HOUSING GREASE INFORMATION UPDATED			
SHEET 2 - BALL JOINT GREASE REQUIREMENT ADDED			
SHEET 2 - IMPELLER SEAL GREASE REQUIREMENT ADDED			
DESIGN CHECK:	N.T	04.06.13	SIGN
DRAWING REVISION:	J.S.R	31.05.13	SIGN
DOCUMENT CHECK:	S.K	04.06.13	SIGN
ORIGINAL DESIGN:	RJL	21.12.93	SIGN

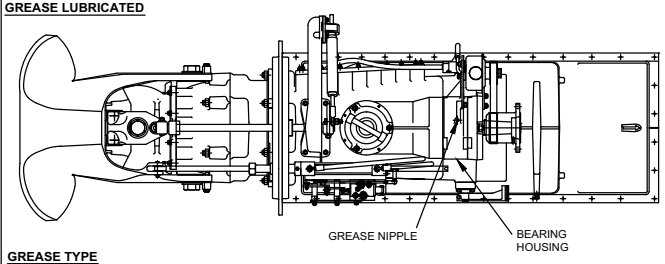
MANUFACTURING INFORMATION
MATERIAL:
STANDARD:
MAT CERT REQ: TRACEABILITY REQ:
FINISHED WEIGHT:
ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED
REMOVE ALL SHARP EDGES AND BURRS
UNTOLERANCED DIMENSIONS & SURFACE FINISH
GENERAL: HOLES: ANGULAR:
MACHINED SURFACE FINISH:

DRAWING INFORMATION		
RECOMMENDATIONS FOR LUBRICANTS AND OILS		
JET / CONTROL TYPE		
DRAWN TO HAMJET 085195	PROJECTION:	
SCALE:	SHEET SIZE: A3	SHT 1 / 3
DWG No: 85018	REV: V	

85018 Recommendations for Lubricants and Oils Sht2

BEARING HOUSING LUBRICATION

GREASE LUBRICATED



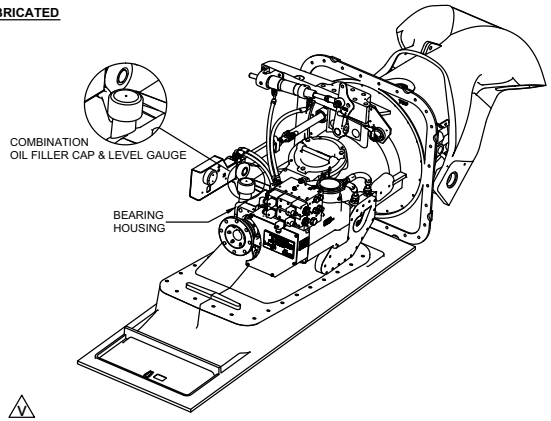
GREASE TYPE
MULTI PURPOSE EXTREME PRESSURE (EP) CALCIUM SULPHONATE COMPLEX OR LITHIUM HYDROXYSTEARATE. TO ENSURE GREASE COMPATIBILITY, PURGE THE HOUSING INLINE WITH GREASE MANUFACTURERS GUIDELINES IF GREASE TYPE IS CHANGED. EX-FACTORY GREASE IS CALCIUM SULPHONATE BASED.

EXAMPLES
BP: ENERGREASE MP-MG2
CASTROL: MOLUB-ALLOY 6040/150
MOBIL: MOBILUX EP 2
SHELL: GADUS S2 V100

DO NOT USE
CALCIUM COMPLEX
BENTONITE CLAY
POLYUREA

JET	VOLUME (L)
HJ212	REFER TO JET MANUAL
HJ213	
HJ241	
HJ274	
HJ292	
HJ322	

OIL LUBRICATED



FLUID
MINERAL OR SYNTHETIC BASED HYDRAULIC OIL TO ISO 11158 OR DIN 51524-2/ DIN 51524-3. STRAIGHT MINERAL OILS WITH EP ADDITIVES ARE RECOMMENDED FOR ROLLING BEARING LUBRICATION. RECOMMENDED MINIMUM OIL VISCOSITY INDEX IS 95. THE OPERATING VISCOSITY FOR HAMILTON JET SYSTEMS IS WITHIN THE VISCOSITY RANGE OF 16-36 CST.

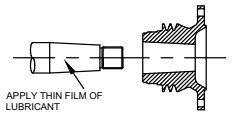
EXAMPLES
SHELL: TELLUS 46
CASTROL: HYSPIN AWS M46
ESSO/EXON/MOBIL: DTE 10 EXCEL 46
B.P: BARTRAN® HV46
GULF: HARMONY AW46

NOTES:
1. JET UNIT OIL LEVELS WILL VARY DEPENDING ON DEADRISE OF HULL.
2. OIL VOLUMES SHOWN ARE FOR CENTRALLY MOUNTED UNITS WITH NO DEADRISE.
3. OIL LEVELS MUST BE WITHIN THE MARKS SHOWN ON THE DIPSTICK.
4. ALL VOLUMES SHOWN ARE IN LITRES (LT).

	BEARING	COOLER
HJ364	1.1	N/A
HJ403	3.6	N/A
HM422	3.6	N/A
HM461	3.6	N/A
HM521	3.7	N/A
HM571	3.7	N/A
HM651	6.2	2.6
HM721	7.0	5.0
HM811	9.3	5.0
HT810	9.3	5.0
HT900	14	6.0
HT1000	31.2	1.0

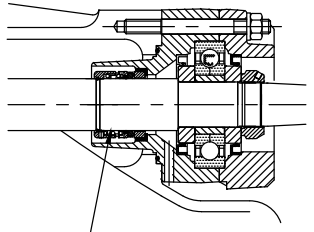
JOINT LUBRICATION

TAPERS (IMPELLERS & COUPLINGS)



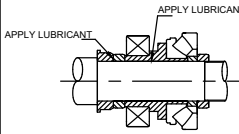
GREASE
MULTIPURPOSE LITHIUM BASE.
OR CALCIUM SULPHATE BASED.
EXAMPLES
BP: ENERGREASE MP-MG2
CASTROL: MOLUB-ALLOY 6040/150
MOBIL: MOBILUX EP 2
SHELL: GADUS S2 V100

FITTING OF ROTARY SEAL



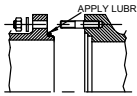
USE ONLY P-80® TEMPORARY RUBBER ASSEMBLY LUBRICANT (P/N 902021). OR
DETERGENT: WATER (20:1)
DO NOT LUBRICATE SEAL FACES
DO NOT USE GREASE OR OIL

STEEL TO STEEL



GREASE
MULTIPURPOSE LITHIUM BASE.
OR CALCIUM SULPHATE BASED.
EXAMPLES
BP: ENERGREASE MP-MG2
CASTROL: MOLUB-ALLOY 6040/150
MOBIL: MOBILUX EP 2
SHELL: GADUS S2 V100

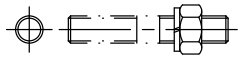
O-RINGS (NITRILE RUBBER ONLY)



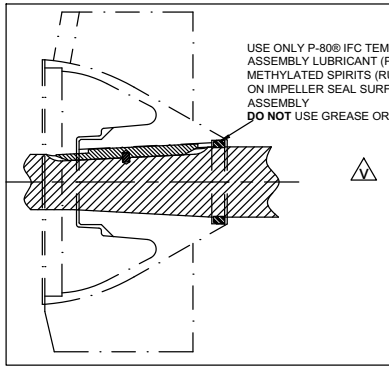
NOTE: DO NOT GREASE BARRIER CORD O-RINGS

GREASE
MULTIPURPOSE LITHIUM BASE.
OR CALCIUM SULPHATE BASED.
EXAMPLES
BP: ENERGREASE MP-MG2
CASTROL: MOLUB-ALLOY 6040/150
MOBIL: MOBILUX EP 2
SHELL: GADUS S2 V100

THREADS



REFER TO DRAWING NUMBER: 85113



USE ONLY P-80® IFC TEMPORARY RUBBER ASSEMBLY LUBRICANT (P/N 902021) OR METHYLATED SPIRITS (RUBBING ALCOHOL) ON IMPELLER SEAL SURFACE TO AID ASSEMBLY
DO NOT USE GREASE OR OIL

BALL JOINT

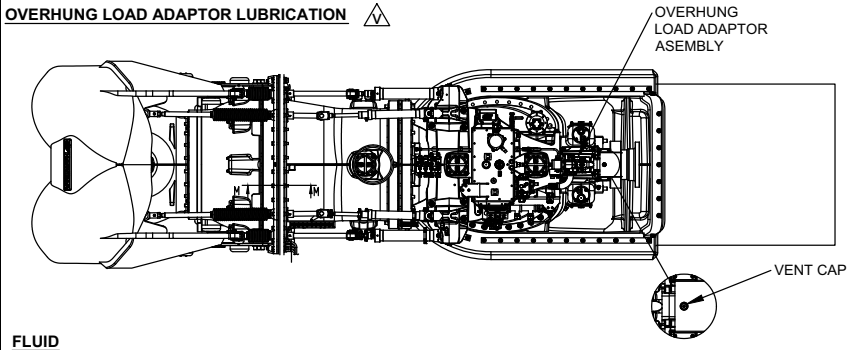
GREASE
MULTIPURPOSE LITHIUM BASE.
OR CALCIUM SULPHATE BASED.
EXAMPLES
BP: ENERGREASE MP-MG2
CASTROL: MOLUB-ALLOY 6040/150
MOBIL: MOBILUX EP 2
SHELL: GADUS S2 V100

HamiltonJet

CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS	MANUFACTURING INFORMATION	DRAWING INFORMATION
REVISION: ECN: SEE SHEET 1 FOR DETAILS	MATERIAL: STANDARD: MAT CERT REQ: TRACEABILITY REQ: FINISHED WEIGHT:	RECOMMENDATIONS FOR LUBRICANTS AND OILS
DESIGN CHECK: SIGN.	ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED	JET / CONTROL TYPE
DRAWING REVISION: SIGN.	REMOVE ALL SHARP EDGES AND BURRS	DRAWN TO HAMJET 085195 PROJECTION:
DOCUMENT CHECK: SIGN.	UNTOLERANCED DIMENSIONS & SURFACE FINISH GENERAL: HOLES: ANGULAR: MACHINED SURFACE FINISH:	SCALE: SHEET SIZE: A3 SHT 2 / 3
ORIGINAL DESIGN: SIGN.		DWG No: 85018 REV: V

85018 Recommendations for Lubricants and Oils Sht3

OVERHUNG LOAD ADAPTOR LUBRICATION



FLUID

USE MINERAL OR SYNTHETIC BASED HYDRAULIC FLUID CONFORMING TO ISO 11158, DIN 51524-2/DIN 51524-3 STANDARDS. THE HYDRAULIC FLUID SELECTED SHOULD BE WITHIN THE OPERATING TEMPERATURE RANGE. THE OPERATING VISCOSITY FOR HAMILTON JET HYDRAULIC SYSTEMS IS WITHIN THE VISCOSITY RANGE OF 16-36 CST.

EXAMPLES

SHELL:	TELLUS 46
CASTROL:	HYSPIN AWS M46
ESSO/EXON/MOBIL:	DTE 10 EXCEL 46
B.P:	BARTRAN® HV46
GULF:	HARMONY AW46

JET	VOLUME (L)
HT900 HT1000	REFER TO JET MANUAL FOR INSTRUCTIONS ON ACHIEVING CORRECT OIL LEVEL

CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS	MANUFACTURING INFORMATION	DRAWING INFORMATION
REVISION: ECN: SEE SHEET 1 FOR DETAILS	MATERIAL: STANDARD: MAT CERT REQ: TRACEABILITY REQ: FINISHED WEIGHT:	RECOMMENDATIONS FOR LUBRICANTS AND OILS
DESIGN CHECK: SIGN.	ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED	JET / CONTROL TYPE
DRAWING REVISION: SIGN.	REMOVE ALL SHARP EDGES AND BURRS	DRAWN TO HAMJET 085195 PROJECTION:
DOCUMENT CHECK: SIGN.	UNTOLERANCED DIMENSIONS & SURFACE FINISH GENERAL: HOLES: ANGULAR:	SCALE: SHEET SIZE: A3 SHT 3 / 3
ORIGINAL DESIGN: SIGN.	MACHINED SURFACE FINISH:	DWG No: 85018 REV: V

PROJECTION

Aluminium Weld Procedure for Hamilton Jet Installation or Repair

1. Welds

To be full penetration and conform to relevant Classification Society requirements (e.g. ABS, Lloyds Register, DNV).

2. Welder Qualifications

Properly qualified welder to relevant Classification Society requirements, in downhand or overhead as required.

3. Inspection

Inspection to be done by a welding inspector qualified to relevant Classification Society requirements.

4. Site

The site must be:
Dry and free from steel dust or any other contaminates that could effect the finished weld condition.
Sheltered from draughts to prevent disturbance to shielding gas.

5. Welding Process

M.I.G.

6. Welding Wire

Plate (5086 or 5083) to Plate (5086 or 5083), use 5356 Filler Wire
Casting (EN AC 44100) to Casting (EN AC 44100), use 4043 Filler Wire

Casting (EN AC 44100) to Plate (5086 or 5083), use 4043 Filler Wire. 5356 filler wire may be used if the local process/conditions show superior weld quality to 4043, however adequate inspection shall be performed as per paragraph 15.

7. Shield Gas

Argon or helium.

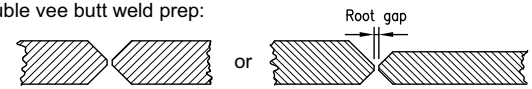
8. Weld Position

Weld position options are:
Flat downhand. Turn hull over to do the other side flat downhand. Requires double vee prep.
Single vee prep. Use backing strip. Weld flat downhand one side only, then grind off backing strip.
Double vee prep. Flat downhand one side. Overhead other side.

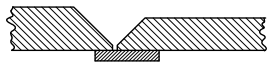
9. Weld Prep

Minimise root gap on weld preps. Recommended maximum gap 1.5mm ($\frac{1}{16}$") for welds to cast material.

Double vee butt weld prep:



Single vee butt weld prep with backing strip:



10. Cleanliness

Dress all surfaces to be welded just prior to welding to remove surface oxides. Cast aluminium that has been submerged in salt water must be thoroughly rinsed in fresh water then dried, prior to final dressing.

11. Preheat

Remove chill 50° - 60° C (120° - 140° F) to ensure weld prep area is dry.

12. Support

A rigid strong back should be clamped or tacked to intake blocks during welding to prevent distortion of the block.

13. Weld Runs

Multipass runs may be necessary depending on plate and casting thickness. Stitch 75mm with 75mm gaps for first 2 runs to minimise distortion. Stitch sequence for intake blocks to be a star sequence, rather than proceeding linearly around the block circumference.
Grind stop starts before filling in.
Subsequent runs may be full length runs.

14. Back Gouging

Chipping, Routing, Milling, grinding or other suitable methods are to be employed at the root or under side of the weld to obtain sound metal before applying subsequent beads.
Grind stop/start craters.

15. Inspection of Welds

No cracks, porosity, lack of fusion, cold laps or undercut. Use dye penetrant to check outer surface of welds and intermediate weld passes, such as root passes, and also to check back-chipped, ground or gouged joints prior to depositing subsequent passes. Any die penetrant used is to be thoroughly removed from area before rewelding.
Dye penetrant is not to be used where complete removal of the dye penetrant material cannot be assured.

REF	NO.	BY	DATE	AMENDMENTS
CL660	D	N.T.	02.03.11	PARAGRAPHS 6 AND 13 AMMENDED
CL460	C	N.T.	02.04.07	BASE METAL OPTIONS ADDED, NOW SUPERSEDES 85103
CL3765	B	P.S.	24.09.96	REDRAWN ON CAD.OVERHEAD OPTION ADDED.
CL3607	A	P.S.	06.06.95	
CL3620	0	PS		ISSUED FOR PRODUCTION.

JET ALL 272 291 321 363 391

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

MATERIAL

√ = N9 EXCEPT AS STATED

UNLIMITED DIMENSIONS TO BE ±

MAT'L CERT

DESIGNED DATE

DRAWN P.A.S. 06.06.95

CHECKED

APPROVED K.V.E 30.10.96

NAME: ALUMINIUM WELD PROCEDURE for JET INSTALLATION or REPAIR

SCALE

No: A3–85080 D

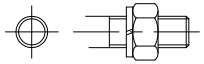
D 85080

85113 Threaded Fastener Tightening Torques

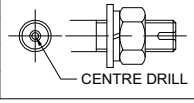
DO NOT SCALE THIS DRAWING REMOVE ALL SHARP CORNERS ALL DIMENSIONS IN mm. UNLESS OTHERWISE SHOWN PROJECTION

NUT TIGHTENING TORQUES

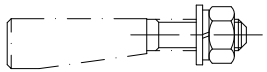
SIZE	N.m	lbs.ft	NUTS ON 316 ST. STL STUDS
M6	5	4	(NON MAGNETIC)
M8	12	9	
M10	24	18	
M12	45	33	
M16	75	55	
M20	120	90	



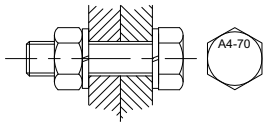
SIZE	GREASED		ANTISEIZED		NUTS ON 2205 ST. STL STUDS
	N.m	lbs.ft	N.m	lbs.ft	
M12	60	44	45	33	(MAGNETIC)
M16	150	110	110	80	
M20	270	200	210	155	
M24	470	345	350	260	
M30	900	660	650	480	CENTRE DRILL



SIZE	N.m	lbs.ft	NUTS ON 316 ST. STL COTTER PINS
M6	5	4	
M8	12	9	
M10	24	18	
M12	45	33	

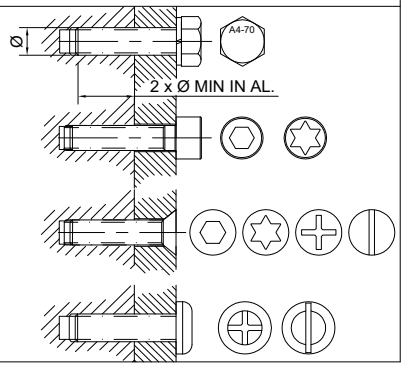


SIZE	N.m	lbs.ft	NUTS ON BOLTS / SCREWS
METRIC			
M3	0.8	0.6	
M4	2	1.5	
M5	4	3	
M6	7	5	
M8	16.5	12	
M10	33	24	
M12	60	44	
M16	140	103	
M20	260	190	
M24	410	300	
IMPERIAL			
1/4" UNC	7.5	5.5	
5/16" UNC	15.3	11.3	
3/8" UNC	27	20	
1/2" UNC	65	48	
5/8" UNC	130	96	
3/4" UNC	230	170	



SCREW TIGHTENING TORQUES

SIZE	N.m	lbs.ft	BOLTS & SCREWS IN ALL METALS
METRIC			NOTE: 2 x DIAMETER MIN THREAD LENGTH REQUIRED IN ALUMINIUM CASTINGS
M2	0.2	0.15	
M2.5	0.35	0.25	
M3	0.6	0.4	
M4	1.5	1.1	
M5	3	2.2	
M6	5	4	
M8	12	9	
M10	24	18	
M12	45	33	
M16	95	70	
M20	180	133	
IMPERIAL			
1/4" UNC	5	4	
5/16" UNC	11	8	
3/8" UNC	19	14	
1/2" UNC	45	31	
5/8" UNC	89	66	
3/4" UNC	160	120	

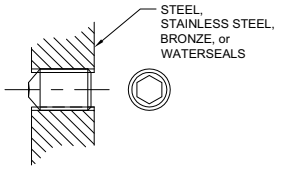


Notes:

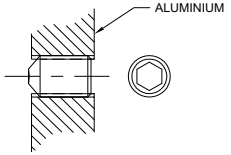
1. Ensure all threads are clean.
2. Where the assembly drawing does not specify Loctite or thread lubricant, use the thread lubricant specified on sheet 2 of this drawing.
3. Where Loctite is specified, refer to Loctite Application Guide drawing 85144.
4. For specific instructions on tightening torques for impeller nuts, coupling nuts, and bearing lock nuts refer to the relevant jet assembly drawing.
5. Torques specified in assembly drawings take precedence over this drawing. Use this drawing when the assembly drawing does not specify torque for the fastener.

SET SCREW TIGHTENING TORQUES

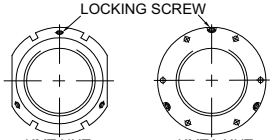
SIZE	N.m	lbs.ft	SET SCREWS EXCEPT IN ALUMINIUM
M3	0.6	0.4	
M4	1.5	1.1	
M5	3	2.2	
M6	5	4	
M8	12	9	
M10	24	9	
M12	45	33	



SIZE	N.m	lbs.ft	SET SCREWS IN ALUMINIUM
M3	0.4	0.3	
M4	1.0	0.7	
M5	2.0	1.5	
M6	3.3	2.5	
M8	8	6	
M10	16	12	
M12	30	22	



SIZE	N.m	lbs.ft	SET SCREWS ON KMT OR KMTA NUTS
M6	8	6	LOCKING SCREW
M8	18	13	
M10	35	26	
			KMT NUT KMTA NUT



REF	NO.	BY	DATE	AMENDMENTS
CL707	T	S.H.	20.02.12	ADDED HOSE CLAMP TORQUES. HYDRAULIC FITTINGS IN CASTINGS CHANGED
CL686	S	S.K.	01.09.11	M2 & M2.5 TORQUE ADDED. TORX, FLATHEAD & POZI/PHILLIPS IMAGES ADDED.
CL676	R	N.T.	20.06.11	ANTISEIZE TORQUES ADDED FOR 2205 STUDS, M24 NUT ON BOLT ADDED

JET ALL

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

MATERIAL N/A

√ = N9 EXCEPT AS STATED

UNLIMITED DIMENSIONS TO BE ± N/A

MAT'L CERT

DESIGNED R.J.L. DATE

DRAWN R.J.L. 16.08.99

CHECKED

APPROVED

NAME THREADED FASTENER TIGHTENING TORQUES Sheet 1 of 2.

SCALE N/A No: A3-85113 T

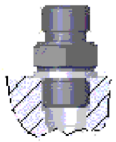
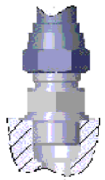
T

85113

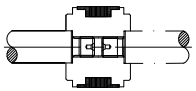
85113 Threaded Fastener Tightening Torques Sht2

DO NOT SCALE THIS DRAWING REMOVE ALL SHARP CORNERS ALL DIMENSIONS IN mm. UNLESS OTHERWISE SHOWN PROJECTION

HYDRAULIC FITTING TORQUES

BSPP HYDRAULIC FITTINGS						
	FITTINGS EXCEPT IN JET CASTINGS		FITTINGS IN JET CASTINGS		HOSES	
						
SIZE	N.m	lbs.ft	N.m	lbs.ft	N.m	lbs.ft
1/8	9	7	4	3	7	5
1/4	35	26	10	7	20	15
3/8	45	33	20	15	35	26
1/2	65	48	40	30	60	44
3/4	130	96	63	46	115	85
1	160	118	105	77	140	103
1-1/4	240	177	142	105	210	155
1-1/2	320	240	320	240	290	214
2	500	370	500	370	400	300

HYDRAULIC CYLINDER PISTON TORQUE

SIZE	N.m	lbs.ft	STAINLESS THREADS ON MILD STEEL
M16 X 2	75	55	
M24 X 3	250	184	

HOSE CLAMP TIGHTENING TORQUES

PART	SIZE	N.m	lbs.ft
201056	12-20	2.3	1.6
201057	14-32	4	2.9
201058	30-45	5	3.6
201059	40-60	5	3.6
205780	50-70	5	3.6

PART	SIZE	N.m	lbs.ft
201060	60-80	5	3.6
206094	80-100	5	3.6
064924	51-55	15	11
209872	59-63	15	11

THREAD LUBRICANTS

THREAD TYPE	DESCRIPTION OF LUBRICANT
316 STAINLESS STUDS	MULTIPURPOSE MARINE GRADE GREASE.
2205 STAINLESS STUDS	MULTIPURPOSE MARINE GRADE GREASE OR MARINE GRADE ANTI SEIZE. ANTI SEIZE WILL REDUCE THE RISK OF THREAD GALLING SO IS RECOMMENDED ON M20 AND LARGER
OTHER METRIC FASTENERS	MULTIPURPOSE MARINE GRADE GREASE.
1/4" UNC - 1/8" UNC	MULTIPURPOSE MARINE GRADE GREASE.
3/4" UNC	MARINE GRADE ANTI SEIZE.
BRONZE IMPELLER OR COUPLING NUTS	MULTIPURPOSE MARINE GRADE GREASE.
HYDRAULIC FITTINGS	GENERAL PURPOSE GREASE OR HYDRAULIC OIL. EXAMPLE: ACCROLUBE

MULTIPURPOSE MARINE GRADE LITHIUM OR CALCIUM SULPHATE BASED GREASE

Examples:
Shell: Shell Alvania RL2
Mobile: Mobilux 2, Mobilux EP 2
Castrol: Molub - Alloy 6040
BP: Engergrease MP-MG 2

MARINE GRADE ANTI SEIZE

Use Only:
LOCTITE MARINE GRADE ANTI SEIZE

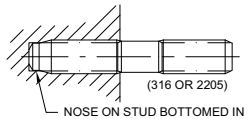
DO NOT USE ANTISEIZES CONTAINING COPPER,NICKEL,GRAPHITE OR METAL FLAKE

ONLY USE LOCTITE MARINE GRADE ANTI SEIZE WHEN USING ANTI SEIZE ON NUTS FITTED TO 2205 STUDS, IN ORDER TO ACHIEVE CORRECT STUD PRELOAD

STUD INSTALLATION

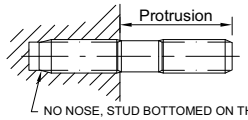
SIZE	N.m	lbs.ft
M12	18	13
M16	30	22
M20	48	35
M24	180	130
M30	370	270

ROLL FORMED STUDS WITH NOSE



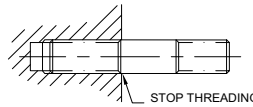
Thread stud into casting until thread bottoms. Confirm protrusion is equal to stud length minus thread length as per stud description

ROLL FORMED STUDS WITHOUT NOSE



Thread stud into casting until thread dissappears. Do not thread past this point.

CUT THREAD STUDS



REFER TO SHEET 1 FOR AMENDMENTS.

REF	NO.	BY	DATE	AMENDMENTS
JET	ALL			

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

MATERIAL N/A
MAT'L CERT
DESIGNED R.J.L. DATE
DRAWN R.J.L. 18.08.99
CHECKED
APPROVED

√ = N9 EXCEPT AS STATED
UNLIMITED DIMENSIONS TO BE ± N/A

NAME THREADED FASTENER TIGHTENING TORQUES Sheet 2 of 2.

SCALE N/A No: A3-85113 T

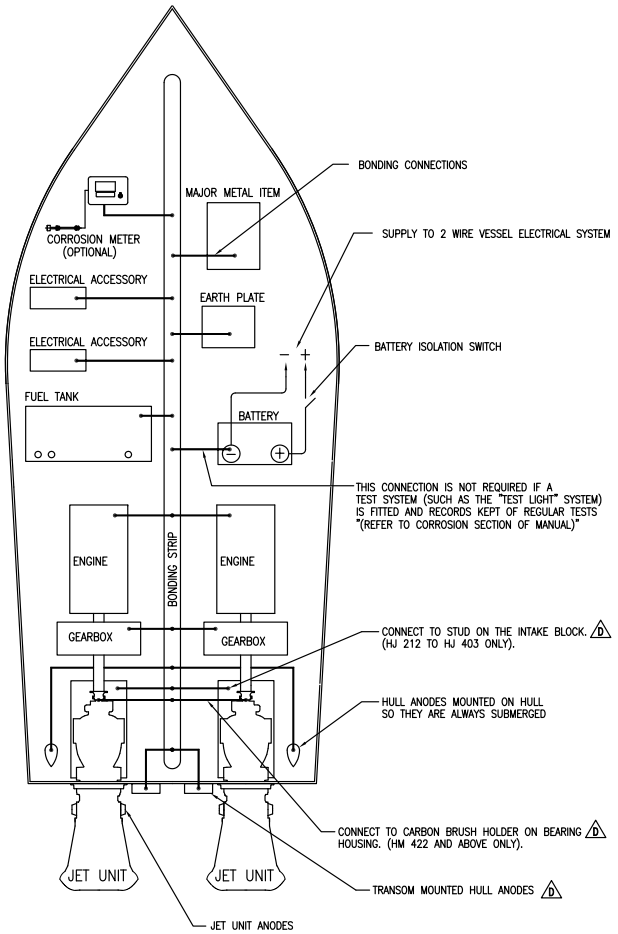
T 85113

85114 Earth Bonding system

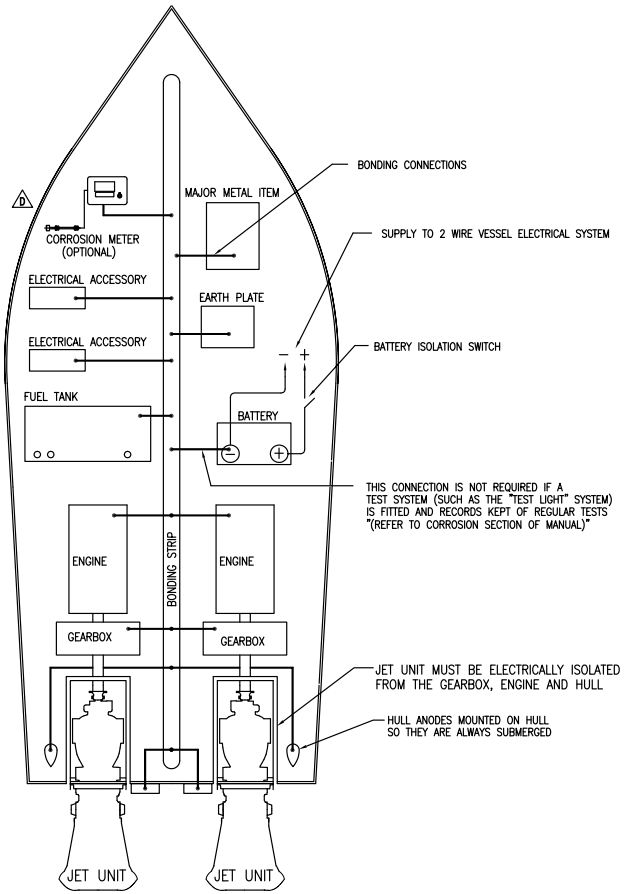
DO NOT SCALE THIS DRAWING.

PROJECTION

ALL DIMENSIONS IN mm. UNLESS OTHERWISE SHOWN.



EARTH BONDING SYSTEM FOR ALUMINIUM AND G.R.P. HULLS



EARTH BONDING SYSTEM FOR STEEL AND CARBON FIBRE HULLS

NOTE: APPLYING TO BOTH DIAGRAMS ABOVE

ANODES PLACED ON THE CRAFT TRANSOM WILL BE "DRY" AND THUS NOT ACTIVE WHEN THE CRAFT IS AT PLANING SPEEDS THEREFORE ADDITIONAL ANODES SHOULD BE PLACED UNDER THE HULL WHERE THEY WILL BE "WET" AT ALL TIMES.
THESE ANODES SHOULD BE UNIFORMLY SPACED OVER THE WETTED HULL LINES. THEY SHOULD BE RECESSED INTO THE HULL OR STREAMLINED IN SHAPE TO MINIMISE DRAG.
THEY SHOULD NOT BE LOCATED DIRECTLY AHEAD OF THE JET UNIT INTAKE AS THEY MAY DISTURB THE INLET FLOW.

REF	NO.	BY	DATE	AMENDMENTS
CL532	D	N.T.	12.05.03	TRANSOM ANODES ADDED. CORROSION MONITOR ON STEEL HULL
CL275	C	P.M.W.	12.05.03	NOTES RE STUD ON INTAKE & CARBON BRUSH HOLDER ADDED
CL275	C	P.M.W.	12.05.03	'WOODEN' REMOVED FROM L.H. SIDE TITLE.
CL118	B	R.J.L	23.11.99	SHAFT BONDING NOTE CLARIFIED.
CL108	A	R.J.L	16.09.99	SPELLING CORRECTED.
CL104	0	R.J.L	18.08.99	ISSUED FOR PRODUCTION.
JET	ALL			

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

MATERIAL N/A

√ = N9 EXCEPT AS STATED

UNLIMITED DIMENSIONS TO BE ±

MATL CERT

DESIGNED DATE

DRAWN R.J.L 18-08-99

CHECKED L.E.A 18.08.99

APPROVED K.V.E

NAME EARTH BONDING SYSTEM RECOMMENDATIONS AND LAYOUT

SCALE - No: A2-85114 D

Notes

Hamilton jet is an international company committed to meeting their customer's needs through the production of waterjet propulsion systems of the highest standards. Dedicated to waterjet propulsion. Hamilton jet is globally represented by an extensive supportnetwork.

World Headquarters
C.W.F. Hamilton & Co Ltd
P.O. Box 709 Christchurch
New Zealand
Phone: +64 3 962 0530
Fax +64 3 348 6969
E-Mail: marketing@hamjet.co.nz
Web: www.hamiltonjet.co.nz

American Office
Hamilton jet Inc.
1111 N.W. ballard Way
Seattle, WA 98107
Phone: +1 206 784 8400
Fax: +1 206 783 7323
E-Mail: marketing@hamiltonjet.com
Web: www.hamiltonjet.com

European Office
Hamilton jet (U.K.) Ltd
unit 4a
The Birches Industrial Estate
East Grinstead West Sussex
RH19.1XZ united Kingdom
Phone +44 1342 313 437
Fax +44 1342 313 438
E-Mail: info@hamjetuk.com

Hamiltonjet Asia
Hamiltonjet Pte Ltd
30 Toh Guan Road
#80-08B ODC Building
Singapore 608840
Phone: +65 656 72202
Fax: +65 656 74788
Email hamiltonjet.asia@hamjet.co.nz

MEMBER OF THE C.W.F. HAMILTON GROUP